MILLENNIUM ENGINEERING, INC.

Land Surveyors and Civil Engineers

STORMWATER MANAGEMENT REPORT

FOR THE

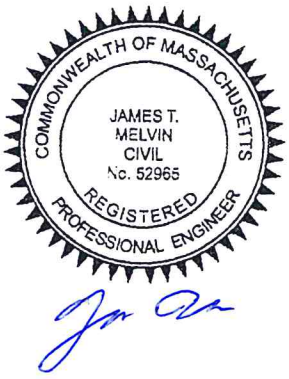
DEFINITIVE SUBDIVISION PLAN

AT

23 HAMPSTEAD STREET
METHUEN, MA

PREPARED FOR:

JR BUILDERS, INC.
599 CANAL STREET
LAWRENCE, MA



3-1-22

DATE: OCTOBER 4, 2021
REVISED: NOVEMBER 23, 2021
REVISED: JANUARY 24, 2022
REVISED: MARCH 1, 2022

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23 Hampstead Street Methuen, MA

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I. Introduction

Introduction

The subject parcel is described as Tax Map 808, Block 75, Lot 4 on the City of Methuen, MA Assessor's Map. The project parcel is 4.87 acres in size. Elevations on the site range from 198.00' to the south end of the parcel to 176.00' at the north end of the site. These elevations are based upon 1988 NAV datum.

The Definitive subdivision at 23 Hampstead Street proposes to create 4 lots to be located on approximately 4.87 acres in Methuen, Massachusetts. The project will consist of the construction of a new residential road, a garage addition to the existing dwelling, and the construction of 3 single-family dwellings. A 311' roadway will provide frontage for the 4 residential lots. The proposed stormwater management system for the project includes catch basins, sediment forebay, subsurface infiltration structures, and an infiltration basin. The catch basins and sediment forebay will remove suspended solids prior to discharging to the infiltration areas. The infiltration areas will provide stormwater recharge to the groundwater and mitigate peak runoff rates so the post-development runoff rates will be less than or equal to the pre-development rates.

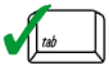
II. Stormwater Management Checklist

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

[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.

B. Stormwater Checklist and Certification

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

Checklist for Stormwater Report

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.

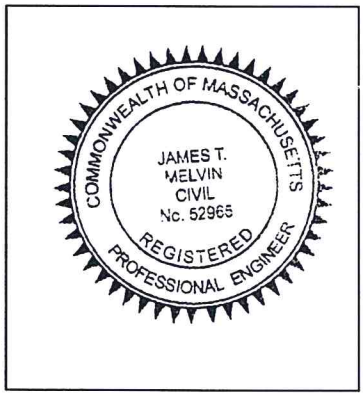
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



3-1-22
Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist (continued)

Checklist for Stormwater Report

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): Subsurface infiltration Structures

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

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

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

Checklist (continued)

Checklist for Stormwater Report

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist (continued)

Checklist for Stormwater Report

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist (continued)

Checklist for Stormwater Report

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist (continued)

Checklist for Stormwater Report

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

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

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

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

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

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

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

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

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

Checklist (continued)

Checklist for Stormwater Report

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.

III. Hydrologic Analysis

Existing Site Characteristics

In general, the property is irregular in shape and fronts Hampstead Street. The entire property is upland with no resource areas located on-site. An existing single-family dwelling with associated garage, pool, driveway, patio, decks and utilities is located on-site. See the accompanying plan for a more detailed description of the existing site conditions and topography.

The lot consists of three soil groups: Montauk fine sandy loam, 301B (Hydrologic Soil Group C); Scituate fine sandy loam, 316B (Hydrologic Soil Group C); and Leicester fine sandy loam, 67A (Hydrologic Soil Group A/D). 9 test pits were performed onsite in September 2021. The test pits indicated fill material along Hampstead Street and C soils being present throughout the site. See Appendix E for the NRCS soil map.

Proposed Site Features

The Applicant proposes to construct a 311' residential roadway to create frontage for 4 residential lots. Access to the property will be via Hampstead Street. Single-family dwellings are proposed on 3 lots and the existing single-family dwelling is to stay on the remaining lot. Underground electrical and telecommunications service will also be provided. Sewer and water services are proposed to be connected to the City of Methuen's 8" sewer main and 12" water main located in the Hampstead Street Right of Way.

In order to address stormwater management regulations, catch basins, Cotech Water Quality Units, subsurface infiltration areas, and roof drywells are proposed to treat, store, and infiltrate runoff.

WATERSHED ANALYSIS AND METHODOLOGY

The stormwater runoff management system was analyzed using the storm events of the 2-year, 10-year and 100-year frequency. The analysis was performed using HydroCAD, version 10.00. Using USDA NRCS TR-20 and TR-55 methods of estimating runoff, the program uses the measured characteristics of the site and computes runoff produced by simulated rainfall events. The results are then used to design runoff control structures.

Existing drainage area boundaries were developed using an onsite topographic survey performed by Millennium Engineering, Inc. Proposed site development boundaries were developed from proposed grades and ground cover designed to minimize site storm water management structure requirements.

Hydrologic soil groups and curve numbers were estimated for existing and proposed developed conditions using available NRCS Soil Maps, current vegetation, and terrain.

DRAINAGE ANALYSIS

The purpose of the drainage analysis is two-fold. The first is to analyze and quantify the pre-development runoff flows through the site. The second purpose is to evaluate the impact of the proposed development on drainage patterns and flows, both within and outside the site, and to design a stormwater management system to adequately convey post-development runoff.

The design of the stormwater management system has the following goals:

1.) Minimize or eliminate erosion and sedimentation during construction as well as after development.

2.) To ensure that post-development flows do not have an adverse effect on downstream drainage structures and landowners.

3.) To design a stormwater and treatment system which will carry the surface runoff and satisfy goals one and two.

To determine the hydrological effect of the proposed development on the watershed, the existing conditions must first be analyzed.

WATERSHED DESCRIPTION: EXISTING CONDITIONS

Depending on the soil classification, type of ground cover present and the direction of the flow of runoff, the existing site is divided into watershed areas. Watershed area E1 consists of the front of the site and drains off to the south west towards Hampstead street. Area E2 consists of most of the site that flows towards directly north to the abutting property. Area E3 consists of a very small portion of the site that flows to the abutting property to the North East. See the attached plans (Watersheds and HydroCad Data, sheet 1 of 2) for the watershed area boundaries and the pre-development time of concentration flow paths.

WATERSHED ANALYSIS: EXISTING CONDITIONS

The existing conditions were modeled using the tabular hydrograph method with a Type III synthetic storm distribution for the 2, 10 and 100-year storm recurrence intervals. Runoff hydrographs were produced to estimate existing peak discharge.

Flows for the three storm simulations are as follows:

Existing (Pre-development) Peak Runoff Rates (c.f.s.)

Subcatchment	Size	2 Yr	10 Yr	100 Yr
	(Acres)	Storm	Storm	Storm
E1	1.35	1.01	2.30	5.83
E2	3.41	1.85	4.87	13.69
E3	0.10	0.08	0.20	0.55

The pre-development drainage calculations can be found in Appendix A.

WATERSHED DESCRIPTION: POST-DEVELOPMENT CONDITIONS

To determine the post development runoff, new watersheds, runoff curve numbers and times of concentration were generated reflecting the changes in the topography and surface cover. The post-development watersheds are shown on the attached plans (Watersheds and HydroCad Data, sheet 2 of 2). Watershed area P1A consists of the lawn, pavement, and roof areas of the front of Lots 1 and 4 abutting Hampstead Street. The runoff flows over land towards Hampstead Street. Watershed Area P1B and P1C consist of the proposed roadway and lawn areas that flow into catchbasins and ultimately into the City's drainage system. P1D consists of the roof area from Lot 4 that drains into a subsurface infiltration system. Watershed areas P2B and P2C consist of proposed roadway, driveways, and some lawn area. These areas are directed into catch basins, into the sediment forebay, into the infiltration basin, and ultimately discharged to the north of the site. Area P2D consist of the proposed roofs and lawn areas. These areas are directed towards the infiltration basin to the back of lots 2 and 3 , and ultimately discharged towards the abutting lot to the north. Area P2A consist mainly of woods and some grass area. The runoff flows over land towards the abutting lot to the north of the parcel. Area P3 is a small portion of the site consisting of woods that flows overland to the abutting property to the north east.

WATERSHED ANALYSIS: POST-DEVELOPMENT CONDITIONS

The proposed developed conditions were modeled using the tabular hydrograph method with a Type III synthetic storm distribution for the 2, 10 and 100-year storm recurrence intervals. Runoff hydrographs were produced to estimate the post-development peak discharge.

Flows for the three storm simulations are as follows:

Post-Developed Peak Runoff Rates (c.f.s.)

Subcatchment	Size (Acres)	2 Yr Storm	10 Yr Storm	100 Yr Storm
Total P1	0.83	0.98	2.13	5.23
Total P2	3.88	1.15	4.67	13.08
Total P3	0.10	0.08	0.20	0.55

The post-development drainage calculations can be found in Appendix B.

IV. Stormwater Recharge Calculations

Stormwater Recharge Calculations

Calculations were performed to ensure that the proposed project will comply with the groundwater recharge requirements of the Mass **DEP** Stormwater Management Standards. The required recharge volume was calculated as follows:

The Required Recharge Volume equals a depth of runoff corresponding to the soil type times the impervious areas located on site.

Rv = Fx Impervious area Where:

Rv = Required Recharge Volume, expressed in cubic feet

F = Target Depth Factor associated with each Hydrologic Soil

Group Impervious Area = pavement and rooftop area on site

For the proposed project:

Required Recharge volume, Rv (C soil) = F * impervious area
= 0.25 in * 26,528 s.f.
= 553 c.f.

Total Required Recharge Volume = 553 c.f.

Total Recharge provided = 3,981 c.f.
Inf. Basin 1= 3,216 c.f.
Roof Drywell 1= 765 c.f.

Adjusted Required Recharge Volume

Since only a portion of the new impervious areas are to be directed into the infiltration BMP, it is necessary to calculate an Adjusted Required Recharge Volume:

1. The Required Recharge Volume = 553 cubic feet
2. The total proposed impervious area is 26,528 s.f.
3. The proposed impervious area draining to all infiltration areas is 23,450 s.f.

4. The ratio of total site impervious area to impervious are draining to the infiltration BMP is 26,528 / 23,450= 1.14
5. The Adjusted Required Recharge Volume = 1.14 x 553 cubic feet = 631 cubic feet.

Stormwater recharge will be accomplished on the site through the infiltration areas to be constructed.

Total Recharge provided = 3,981 c.f.

Drawdown Calculation

Infiltration Basin 1

$$\text{Drawdown Time} = \frac{Rv}{(K)\,(\text{Bottom Area})}$$

Rv=Storage Volume= 3,216 c.f.
K=Saturated Hydraulic Conductivity=1.02 in./hr
Bottom Area=1,109 s.f.

$$\text{Drawdown Time} = \frac{3216\ \text{c.f.}}{(1.02\ \text{in/hr})(1\text{ft}/12\text{in})(1109\ \text{s.f.})}$$

Drawdown Time = 34.17 hours

Roof Drywell 1

$$\text{Drawdown Time} = \frac{Rv}{(K)\,(\text{Bottom Area})}$$

Rv=Storage Volume= 765 c.f.
K=Saturated Hydraulic Conductivity=1.02 in./hr

Bottom Area=842 s.f.

Drawdown Time = $\frac{765 \text{ c.f.}}{(1.02 \text{ in/hr})(1\text{ft}/12\text{in})(506 \text{ s.f.})}$

Drawdown Time = 17.78 hours

V. TSS Removal Calculations

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Infiltration Basin 1

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Basin	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = **80%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: M213934
Prepared By: JTM
Date: 11/23/2021

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

VI. Water Quality Calculations

Water Quality Calculations

The Massachusetts DEP requires water quality calculations based on 1/2 inch of runoff for the total impervious area associated with the proposed development. The following calculation identifies the water quality volume required.

Infiltration Area 1

Total Impervious Area contributing to Infiltration Area 1 = 17,729 s.f.
17,729 s.f. * 1/2" / 12 (to convert to ft) = 739 c.f. of runoff to be treated for water quality.

Volume of infiltration area 1 below the lowest outlet = 3,216 c.f.

VII. Soils Analysis

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Essex County, Massachusetts, Northern Part

August 18, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (23 Hampstead Street)

Map Scale: 1:2,020 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

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

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

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

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 16, Jun 9, 2020

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

Date(s) aerial images were photographed: Aug 13, 2020—Sep 15, 2020

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

Map Unit Legend (23 Hampstead Street)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
67A	Leicester fine sandy loam, 0 to 3 percent slopes	2.1	19.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	1.3	12.2%
301B	Montauk fine sandy loam, 0 to 8 percent slopes, very stony	4.0	37.2%
316B	Scituate fine sandy loam, 3 to 8 percent slopes, very stony	1.9	18.0%
410A	Sutton fine sandy loam, 0 to 3 percent slopes	1.4	12.7%
420B	Canton fine sandy loam, 3 to 8 percent slopes	0.1	0.6%
Totals for Area of Interest		**10.7**	**100.0%**

Map Unit Descriptions (23 Hampstead Street)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor

components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Essex County, Massachusetts, Northern Part

67A—Leicester fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vjh4
Elevation: 30 to 280 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Leicester and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Leicester

Setting

Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Friable coarse-loamy eolian deposits over friable coarse-loamy basal till derived from granite and gneiss

Typical profile

O - 0 to 3 inches: muck
H2 - 3 to 8 inches: fine sandy loam
H3 - 8 to 31 inches: fine sandy loam
H4 - 31 to 60 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Whitman

Percent of map unit: 8 percent

Landform: Depressions
Hydric soil rating: Yes

Woodbridge
Percent of map unit: 7 percent
Hydric soil rating: No

253B—Hinckley loamy sand, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2svm8
Elevation: 0 to 1,430 feet
Mean annual precipitation: 36 to 53 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting
Landform: Moraines, kame terraces, kames, outwash terraces, outwash deltas, outwash plains, eskers
Landform position (two-dimensional): Summit, backslope, footslope, shoulder
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, tread, riser
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile
Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities
Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 8 percent
Landform: Outwash plains, kames, eskers, moraines, outwash terraces, outwash deltas, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, tread, riser
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Moraines, outwash terraces, outwash deltas, kame terraces, outwash plains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope, head slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Eskers, moraines, outwash terraces, outwash deltas, kame terraces, outwash plains, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

301B—Montauk fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w80v
Elevation: 0 to 1,070 feet

Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Montauk, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Montauk, Very Stony

Setting

Landform: Hills, ground moraines, recessionial moraines, drumlins
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 6 inches: fine sandy loam
Bw1 - 6 to 28 inches: fine sandy loam
Bw2 - 28 to 36 inches: sandy loam
2Cd - 36 to 74 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Scituate, very stony

Percent of map unit: 6 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, footslope, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex

Across-slope shape: Convex
Hydric soil rating: No

Canton, very stony

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury, very stony

Percent of map unit: 4 percent
Landform: Drainageways, hills, ground moraines, depressions
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

316B—Scituate fine sandy loam, 3 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: vjs9
Elevation: 50 to 340 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Scituate and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scituate

Setting

Landform: Drumlins
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable coarse-loamy eolian deposits over dense coarse-loamy lodgment till derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: fine sandy loam
H2 - 5 to 27 inches: fine sandy loam
H3 - 27 to 60 inches: loamy sand

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 18 to 30 inches to densic material
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Ridgebury

Percent of map unit: 20 percent
Landform: Depressions
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

410A—Sutton fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xffg
Elevation: 0 to 1,240 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sutton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sutton

Setting

Landform: Hills, ridges, ground moraines

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 5 inches: fine sandy loam
Bw1 - 5 to 17 inches: fine sandy loam
Bw2 - 17 to 25 inches: sandy loam
C1 - 25 to 39 inches: gravelly sandy loam
C2 - 39 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 12 to 27 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F144AY008CT - Moist Till Uplands
Hydric soil rating: No

Minor Components

Leicester

Percent of map unit: 5 percent
Landform: Ground moraines, depressions, drainageways, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Charlton

Percent of map unit: 5 percent
Landform: Ground moraines, hills, ridges
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Canton

Percent of map unit: 4 percent
Landform: Ridges, moraines, hills

Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Whitman

Percent of map unit: 1 percent
Landform: Depressions, drainageways, hills, drumlins, ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

420B—Canton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2w81b
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Canton

Setting

Landform: Ridges, moraines, hills
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification

Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 10 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Montauk

Percent of map unit: 5 percent
Landform: Hills, ground moraines, moraines, drumlins
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Charlton

Percent of map unit: 4 percent
Landform: Hills, ground moraines, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 1 percent
Landform: Depressions, marshes, kettles, swamps, bogs
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

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SOIL SUITABILITY ASSESSMENT REPORT

COMMONWEALTH OF MASSACHUSETTS

METHUEN, MASSACHUSETTS

SOIL EVALUATION FOR DETERMINATION OF SOIL TYPE AND GROUNDWATER TABLE ELEVATIONS

SITE INFORMATION

Street Address: 23 Hampstead Street Town: Methuen State: Massachusetts Zip Code: 01844 County: Essex
Land Use: Residential Latitude: ~42° 45' 41.22" N Longitude: ~71° 10' 21.73" W

PUBLISHED SOIL DATA AND MAP UNIT DESCRIPTION

Physiographic Division: Appalachian Highlands Province: New England Section: Seaboard lowland section
Soil survey area: Essex County, Massachusetts, Northern Part Series name: 301B – Montauk FSL, 00-08% slopes
Soil Order: Inceptisol Soil Suborder: Ochrepts Soil Family: Coarse-loamy, mixed, mesic, Typic Dystrochrepts
Soil moisture regime: Udic Soil temperature regime: Mesic Land Cover: Meadow grass Runoff class: Low
Soil hydric or upland: Upland Average depth to water table: 18" to 37" Depth to restrictive feature: Variable to densic soil
Frequency of flooding: None Frequency of ponding: None Available water capacity: Low (~5.6")
Drainage Class: Well drained Hydrologic Soil Group: C Ksat: Very low to moderately high (0.00 – 1.42 in/hr)
Ecological site: Well drained dense till uplands

WETLAND AREA & USGS WELL MEASUREMENTS

National Wetland Inventory Map: NA Wetlands Conservancy Program: NA Bordering vegetative wetland: NA
Current Water Resource Condition (USGS): Well Site # 424841071004101- MA-HLW 23 Haverhill, MA.,
Well depth: 15.10 feet Land surface altitude: 100.00 feet above NGVD29 Latitude: ~42°48'41.8" N Longitude: ~71°00'41.7"
Most recent data value: ' on 07/13/21 (depth to water level in feet below land surface) Range: Above normal

SURFICIAL GEOLOGY

Surficial Geology: Qgm: Ground moraine
Geologic parent material: Coarse-loamy over sandy lodgment till Geomorphic landform: ground moraine
Slope aspect: Westerly Landform position (2D): Backslope Landform position (3D): Side slope
Slope gradient: ~0-3% Down slope shape: Linear Across slope shape: Linear Slope complexity: Simple
Bedrock outcropping in vicinity: None observed Glacial erratics in vicinity: None observed
Bedrock Type: Berwick Formation – Silurian (440 – 420 Ma): Gray to gray green phyllite and calcareous quartzite and quartz-mica schist and well bedded calc-silicates.

TP 21-1 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

Date: September 17, 2021 Time: 09:02 Weather: clear, ~65-70ºF, breezy and dry

Landscape: Upland Landform: Ground moraine controlled by shallow bedrock structure Position on landscape: Side slope

Slope aspect: Westerly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Stripped land surface

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ► TP 21-1

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 62"	C^	Sharp, angular, blasted rock fragments		none observed	Human transported material; Anthropic layer; non-deleterious material; loose, very angular, blasted, cobble to boulder sized rock content. No soil present within the rocky matrix.
62" → 67"	A_b	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
67" → 77"	B_W	Sandy Loam	10YR 5/8 yellowish brown	66" (m,2-3,p) 2.5YR 4/6 10YR 7/1	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few relict medium roots; ~05% rounded to sub-rounded gravel content of mixed lithology; bedrock refusal at depth.
R @ 77"					Bedrock refusal at 77"

Depth to bedrock: @ 77" Seasonal High Groundwater Table: 66" Apparent water table: Not observed

TP 21-1 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE None Observed

Apparent water seeping from pit face:___ (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Slightly damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

Depth below grade to observed Estimated Seasonal High Groundwater Table: 66”

Kind: Iron concentrations; iron coating on sand grains Location: B_W matrix Shape: Amorphous

Hardness: Soft Boundary: Diffuse Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 2.5YR 4/6 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 66” inches below grade

Observed water weeping from side of deep hole: ___ inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 0.83 feet

Depth of naturally occurring pervious material in TP 21-1 Upper boundary: 67”
Lower boundary: 77”

Certification

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

Alexander F. Parker *#1848* — June 1998

Massachusetts Evaluator & Certification number — Date of Soil Evaluator Certification

Unofficial testing for on-site drainage — 09/17/21

Witness — Date of soil testing

TP 21-2 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

Date: September 17, 2021 Time: 09:26 Weather: clear, ~65-70°F, breezy and dry

Landscape: Upland Landform: Ground moraine controlled by shallow bedrock structure Position on landscape: Side slope

Slope aspect: Westerly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Stripped land surface

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ► TP 21-2

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 73"	C^	Sharp, angular, blasted rock fragments		none observed	Human transported material; Anthropic layer; non-deleterious material; loose, very angular, blasted, cobble to boulder sized rock content. No soil present within the rocky matrix.
73" → 87"	B_W	Sandy Loam	10YR 5/8 yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few relict medium roots; ~05% rounded to sub-rounded gravel content of mixed lithology; bedrock refusal at depth.
87"→ 120"	$2C_d$	Sandy Loam	10YR 4/4 dark yellowish brown	90" (m,2-3,p) 2.5YR 4/6 10YR 7/1	Friable to slightly firm; compact, massive structure; mixed fine-to-medium grained mineral content; damp matrix; non-sticky; non-plastic; poorly sorted; dense, tight matrix in-situ; approximately 05-10% sub-angular to sub-rounded gravel, ~05-10% sub-rounded to angular cobble content of mixed lithology; high and low chroma colors dispersed within matrix at 90"; no apparent water observed; bedrock refusal at test hole depth.
R @ 120"					Bedrock refusal at 120"

Depth to bedrock: @ 120" Seasonal High Groundwater Table: 90" Apparent water table: Not observed

TP 21-2 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE None Observed

Apparent water seeping from pit face:___ (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Slightly damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

Depth below grade to observed Estimated Seasonal High Groundwater Table: 90”

Kind: Iron concentrations; iron coating on sand grains Location: 2Cd matrix Shape: Amorphous

Hardness: Soft Boundary: Diffuse Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 2.5YR 4/6 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 90” inches below grade

Observed water weeping from side of deep hole: ___ inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 2.75 feet

Depth of naturally occurring pervious material in TP 21-2 Upper boundary: 87”
Lower boundary: 120”

Certification

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

Alexander F. Parker *#1848*	June 1998
Massachusetts Evaluator & Certification number	Date of Soil Evaluator Certification
Unofficial testing for on-site drainage	09/17/21
Witness	Date of soil testing

TP 21-3 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

Date: September 17, 2021 Time: 09:59 Weather: clear, ~65-70ºF, breezy and dry

Landscape: Upland Landform: Ground moraine controlled by shallow bedrock structure Position on landscape: Side slope

Slope aspect: Westerly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Stripped land surface

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ► TP 21-3

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00” → 110”	C^	Sharp, angular, blasted rock fragments		none observed	Human transported material; Anthropic layer; non-deleterious material; loose, very angular, blasted, cobble to boulder sized rock content. No soil present within the rocky matrix.
R @ 110”					Bedrock refusal at 110”

Depth to bedrock: @ 110” Seasonal High Groundwater Table: Undetermined Apparent water table: Not observed

TP 21-3 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE — NONE OBSERVED

Apparent water seeping from pit face:___ (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Slightly damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE — UNDETERMINED

Depth below grade to observed Estimated Seasonal High Groundwater Table:___

Kind: _____ Location: _____ Shape: _____

Hardness: _____ Boundary: _____ Abundance: _____ Size: _____ Contrast: _____

Concentration color: _____ Reduction color: _____ Moisture state: _____

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: ___ inches below grade

Observed water weeping from side of deep hole: ___ inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 0.00 feet

Depth of naturally occurring pervious material in TP 21-3 Upper boundary: 00”
Lower boundary: 00”

Certification

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

Alexander F. Parker *#1848*	June 1998
Massachusetts Evaluator & Certification number	Date of Soil Evaluator Certification
Unofficial testing for on-site drainage	09/17/21
Witness	Date of soil testing

TP 21-4 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

Date: September 17, 2021 Time: 10:28 Weather: Clear, ~65-70ºF, breezy and dry

Landscape: Upland Landform: Ground moraine controlled by shallow bedrock structure Position on landscape: Side slope

Slope aspect: Westerly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Stripped land surface

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ► TP 21-4

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 12"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
12" → 28"	B_W	Sandy Loam	10YR 5/8 yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few relict medium roots; ~05% rounded to sub-rounded gravel content of mixed lithology; bedrock refusal at depth.
28" → 90"	$2C_d$	Sandy Loam	10YR 4/4 dark yellowish brown	67" (m,2-3,p) 2.5YR 4/6 10YR 7/1	Friable to slightly firm; compact, massive structure; mixed fine-to-medium grained mineral content; damp matrix; non-sticky; non-plastic; poorly sorted; dense, tight matrix in-situ; approximately 05-10% sub-angular to sub-rounded gravel, ~05-10% sub-rounded to angular cobble content of mixed lithology; high and low chroma colors dispersed within matrix at 67"; no apparent water observed; no bedrock refusal at test hole depth.

Depth to bedrock: > 90" Seasonal High Groundwater Table: 67" Apparent water table: Not observed

TP 21-4 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE None Observed

Apparent water seeping from pit face:___ (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Slightly damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

Depth below grade to observed Estimated Seasonal High Groundwater Table: 67”

Kind: Iron concentrations; iron coating on sand grains Location: 2Cd matrix Shape: Amorphous

Hardness: Soft Boundary: Diffuse Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 2.5YR 4/6 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 67” inches below grade

Observed water weeping from side of deep hole: ___ inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 6.50 feet

Depth of naturally occurring pervious material in TP 21-4 Upper boundary: 12”
Lower boundary: 90”

Certification

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

Alexander F. Parker *#1848*	June 1998
Massachusetts Evaluator & Certification number	Date of Soil Evaluator Certification
Unofficial testing for on-site drainage	09/17/21
Witness	Date of soil testing

TP 21-5 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

Date: September 17, 2021 Time: 10:49 Weather: Clear, ~65-70ºF, breezy and dry

Landscape: Upland Landform: Ground moraine controlled by shallow bedrock structure Position on landscape: Side slope

Slope aspect: Westerly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Stripped land surface

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ► TP 21-5

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 12"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
R @ 12"					Bedrock refusal at 12"

Depth to bedrock: @ 12" Seasonal High Groundwater Table: Undetermined Apparent water table: Not observed

TP 21-5 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE None Observed

Apparent water seeping from pit face:___ (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Slightly damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE UNDETERMINED

Depth below grade to observed Estimated Seasonal High Groundwater Table:___

Kind: _____ Location: _____ Shape: _____

Hardness: _____ Boundary: _____ Abundance: _____ Size: _____ Contrast: _____

Concentration color: _____ Reduction color: _____ Moisture state: _____

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: ___ inches below grade

Observed water weeping from side of deep hole: ___ inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 0.00 feet

Depth of naturally occurring pervious material in TP 21-5 Upper boundary: 00”
Lower boundary: 00”

Certification

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

Alexander F. Parker *#1848* — June 1998

Massachusetts Evaluator & Certification number — Date of Soil Evaluator Certification

Unofficial testing for on-site drainage — 09/17/21

Witness — Date of soil testing

TP 21-6 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

Date: September 17, 2021 Time: 11:22 Weather: Clear, ~65-70°F, breezy and dry

Landscape: Upland Landform: Ground moraine controlled by shallow bedrock structure Position on landscape: Side slope

Slope aspect: Westerly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Stripped land surface

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ► TP 21-6

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 08"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
08" → 19"	B_W	Sandy Loam	10YR 5/8 yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few relict medium roots; ~05% rounded to sub-rounded gravel content of mixed lithology; bedrock refusal at depth.
19" → 60"	$2C_d$	Sandy Loam	10YR 4/4 dark yellowish brown	46" (m,2-3,p) 2.5YR 4/6 10YR 7/1	Friable to slightly firm; compact, massive structure; mixed fine-to-medium grained mineral content; damp matrix; non-sticky; non-plastic; poorly sorted; dense, tight matrix in-situ; approximately 05-10% angular to sub-rounded gravel, ~05-10% sub-angular to very angular cobble content of mixed lithology; high and low chroma colors dispersed within matrix at 46"; no apparent water observed; bedrock refusal at test hole depth.
R @ 60"					Bedrock refusal at 60"

Depth to bedrock: @ 60" Seasonal High Groundwater Table: 46" Apparent water table: Not observed

TP 21-6 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE None Observed

Apparent water seeping from pit face:___ (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Slightly damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

Depth below grade to observed Estimated Seasonal High Groundwater Table: 46”

Kind: Iron concentrations; iron coating on sand grains Location: 2Cd matrix Shape: Amorphous

Hardness: Soft Boundary: Diffuse Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 2.5YR 4/6 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 46” inches below grade

Observed water weeping from side of deep hole: ___ inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 6.50 feet

Depth of naturally occurring pervious material in TP 21-6 Upper boundary: 12”
Lower boundary: 90”

Certification

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

Alexander F. Parker *#1848*	June 1998
Massachusetts Evaluator & Certification number	Date of Soil Evaluator Certification
Unofficial testing for on-site drainage	09/17/21
Witness	Date of soil testing

TP 21-7 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

Date: September 17, 2021 Time: 11:48 Weather: Clear, ~65-70ºF, breezy and dry

Landscape: Upland Landform: Ground moraine controlled by shallow bedrock structure Position on landscape: Side slope

Slope aspect: Westerly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Stripped land surface

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ► TP 21-7

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 12"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
12" → 22"	B_W	Sandy Loam	10YR 5/8 yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few relict medium roots; ~05% rounded to sub-rounded gravel content of mixed lithology; bedrock refusal at depth.
22" → 72"	$2C_d$	Sandy Loam	10YR 4/4 dark yellowish brown	48" (m,2-3,p) 2.5YR 4/6 10YR 7/1	Friable to slightly firm; compact, massive structure; mixed fine-to-medium grained mineral content; damp matrix; non-sticky; non-plastic; poorly sorted; dense, tight matrix in-situ; approximately 05-10% angular to sub-rounded gravel, ~05-10% sub-angular to very angular cobble content of mixed lithology; high and low chroma colors dispersed within matrix at 48"; no apparent water observed; bedrock refusal at test hole depth.
R @ 72"					Bedrock refusal at 72"

Depth to bedrock: @ 72" Seasonal High Groundwater Table: 48" Apparent water table: Not observed

TP 21-7 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE None Observed

Apparent water seeping from pit face:___ (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Slightly damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

Depth below grade to observed Estimated Seasonal High Groundwater Table: 48”

Kind: Iron concentrations; iron coating on sand grains Location: 2Cd matrix Shape: Amorphous

Hardness: Soft Boundary: Diffuse Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 2.5YR 4/6 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 48” inches below grade

Observed water weeping from side of deep hole: ___ inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 5.00 feet

Depth of naturally occurring pervious material in TP 21-7 Upper boundary: 12”
Lower boundary: 72”

Certification

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

Alexander F. Parker *#1848*	June 1998
Massachusetts Evaluator & Certification number	Date of Soil Evaluator Certification
Unofficial testing for on-site drainage	09/17/21
Witness	Date of soil testing

TP 21-8 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

Date: September 17, 2021 Time: 12:28 Weather: Clear, ~65-70ºF, breezy and dry

Landscape: Upland Landform: Ground moraine controlled by shallow bedrock structure Position on landscape: Side slope

Slope aspect: Westerly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Stripped land surface

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ► TP 21-8

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 10"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
10" → 22"	B_W	Sandy Loam	10YR 5/8 yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few relict medium roots; ~05% rounded to sub-rounded gravel content of mixed lithology; bedrock refusal at depth.
22" → 78"	$2C_d$	Sandy Loam	10YR 4/4 dark yellowish brown	49" (m,2-3,p) 2.5YR 4/6 10YR 7/1	Friable to slightly firm; compact, massive structure; mixed fine-to-medium grained mineral content; damp matrix; non-sticky; non-plastic; poorly sorted; dense, tight matrix in-situ; approximately 05-10% angular to sub-rounded gravel, ~05-10% sub-angular to very angular cobble content of mixed lithology; high and low chroma colors dispersed within matrix at 49"; no apparent water observed; bedrock refusal at test hole depth.
R @ 78"					Bedrock refusal at 78"

Depth to bedrock: @ 78" Seasonal High Groundwater Table: 49" Apparent water table: Not observed

TP 21-8 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE None Observed

Apparent water seeping from pit face:___ (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Slightly damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

Depth below grade to observed Estimated Seasonal High Groundwater Table: 49”

Kind: Iron concentrations; iron coating on sand grains Location: 2Cd matrix Shape: Amorphous

Hardness: Soft Boundary: Diffuse Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 2.5YR 4/6 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 49” inches below grade

Observed water weeping from side of deep hole: ___ inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 5.66 feet

Depth of naturally occurring pervious material in TP 21-8 Upper boundary: 10”
Lower boundary: 78”

Certification

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

Alexander F. Parker *#1848*	June 1998
Massachusetts Evaluator & Certification number	Date of Soil Evaluator Certification
Unofficial testing for on-site drainage	09/17/21
Witness	Date of soil testing

TP 21-9 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

Date: September 17, 2021 Time: 12:58 Weather: Clear, ~65-70ºF, breezy and dry

Landscape: Upland Landform: Ground moraine controlled by shallow bedrock structure Position on landscape: Side slope

Slope aspect: Westerly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Stripped land surface

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ► TP 21-9

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 11"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; clear wavy boundary.
11" → 19"	B_W	Sandy Loam	10YR 5/8 yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few relict medium roots; ~05% rounded to sub-rounded gravel content of mixed lithology; bedrock refusal at depth.
19" → 76"	$2C_d$	Sandy Loam	10YR 4/4 dark yellowish brown	45" (m,2-3,p) 2.5YR 4/6 10YR 7/1	Friable to slightly firm; compact, massive structure; mixed fine-to-medium grained mineral content; damp matrix; non-sticky; non-plastic; poorly sorted; dense, tight matrix in-situ; approximately 05-10% angular to sub-rounded gravel, ~05-10% sub-angular to very angular cobble content of mixed lithology; high and low chroma colors dispersed within matrix at 45"; no apparent water observed; bedrock refusal at test hole depth.
R @ 76"					Bedrock refusal at 76"

Depth to bedrock: @ 76" Seasonal High Groundwater Table: 45" Apparent water table: Not observed

TP 21-9 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE None Observed

Apparent water seeping from pit face:___ (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Slightly damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

Depth below grade to observed Estimated Seasonal High Groundwater Table: 45”

Kind: Iron concentrations; iron coating on sand grains Location: 2Cd matrix Shape: Amorphous

Hardness: Soft Boundary: Diffuse Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 2.5YR 4/6 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 45” inches below grade

Observed water weeping from side of deep hole: ___ inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 5.42 feet

Depth of naturally occurring pervious material in TP 21-9 Upper boundary: 11”
Lower boundary: 76”

Certification

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

Alexander F. Parker *#1848*	June 1998
Massachusetts Evaluator & Certification number	Date of Soil Evaluator Certification
Unofficial testing for on-site drainage	09/17/21
Witness	Date of soil testing

TP 22-10 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

Date: March 01, 2022 Time: 11:30 Weather: Overcast, ~25-30°F, breezy and dry

Landscape: Upland Landform: Ground moraine controlled by shallow bedrock structure Position on landscape: Side slope

Slope aspect: Westerly Slope (%): 00- 03% Slope complexity: Simple Land Cover: Stripped land surface

Property line: 10^{+} feet Drainage way: 50^{+} feet Drinking water well: 100^{+} feet Abutting septic system: 50^{+} feet

Wetlands: 100^{+} feet Public water supply reservoir: 400^{+} feet Tributary to reservoir: 200^{+} feet

SOIL PROFILE ▶ TP 22-10

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 11"	A_P	Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Very friable; moderate-grade; fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; slightly damp; non-sticky; non-plastic; many fine grass roots; free of clasts; approximately 6" of frost; clear wavy boundary.
11" → 21"	B_W	Sandy Loam	10YR 5/8 yellowish brown	none observed	Very friable; moderate-grade, fine, sub-angular blocky structure; non-cohesive; mixed medium to mostly fine-grained mineral content; slightly damp; non-sticky; non-plastic; few medium roots; ~05% rounded to sub-rounded gravel content of mixed lithology; diffuse wavy boundary.
21" → 110"	$2C_d$	Sandy Loam	10YR 4/4 dark yellowish brown	40" (m,2-3,p) 2.5YR 4/6 10YR 7/1	Friable to slightly firm; compact, massive structure; mixed fine-to-medium grained mineral content; damp matrix; non-sticky; non-plastic; poorly sorted; dense, tight matrix in-situ; approximately 05-10% angular to sub-rounded gravel, ~05-10% sub-angular to very angular cobble content of mixed lithology; high and low chroma colors dispersed within matrix at 40"; no apparent water observed; no bedrock refusal at test hole depth.

Depth to bedrock: > 110" Seasonal High Groundwater Table: 40" Apparent water table: Not observed

TP 22-10 DEEP OBSERVATION HOLE

23 Hampstead Street, Methuen, Massachusetts

FOR DRAINAGE BASIN

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE None Observed

Apparent water seeping from pit face:___ (below land surface) Depth to stabilized apparent water: ___ (below land surface)

Soil moisture state: Damp

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

Depth below grade to observed Estimated Seasonal High Groundwater Table: 40"

Kind: Iron concentrations; iron coating on sand grains Location: 2Cd matrix Shape: Amorphous

Hardness: Soft Boundary: Diffuse Abundance: Many Size: Medium to coarse Contrast: Prominent

Concentration color: 2.5YR 4/6 red Reduction color: 10YR 7/1 light gray Moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: 40" inches below grade

Observed water weeping from side of deep hole: ___ inches below grade

Observed depth to stabilized phreatic water: ___ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 8.25 feet

Depth of naturally occurring pervious material in TP 22-10 Upper boundary: 11"
Lower boundary: 110"

Certification

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

Alexander F. Parker *#1848*
Massachusetts Evaluator & Certification number

June 1998
Date of Soil Evaluator Certification

Unofficial testing for on-site drainage
Witness

03/01/22
Date of soil testing

M213934

VIII. Long Term Pollution Prevention and Operations and Maintenance Plan

This long-term Stormwater Management System Operations and Maintenance (O&M) Plan, filed with the City of Methuen, shall be implemented for the proposed development at 23 Hampstead street to ensure that the stormwater management system functions as designed. The Owner holds the primary responsibility for overseeing and implementing the O&M Plan and assigning a Property Manager who will be responsible for the proper operation and maintenance of the stormwater structures. In case of transfer of property ownership, future property owners shall be notified of the presence of the stormwater management system and the requirements for proper implementation of the O&M Plan. Included in the manual is a Stormwater Management O&M Plan identifying the key components of the stormwater system and a log for tracking inspections and maintenance.

The stormwater management system protects and enhances the stormwater runoff water quality through the removal of sediment and pollutants, and source control significantly reduces the amount of pollutants entering the system. Preventive maintenance of the system will include a comprehensive source reduction program of regular vacuuming and litter removal, and prohibitions on the use of pesticides.

The purpose of the Stormwater Operations and Maintenance (O&M) plan is to ensure inspection of the system, removal of accumulated sediments, oils, and debris, and implementation of corrective action and record keeping activities.

The ongoing responsibility is the Owner, its successors and assigns. Adequate maintenance is defined in this document as good working condition.

Contact information is provided below:

Responsibility for Operations and Maintenance
JR Builders, Inc.
599 Canal Street
Lawrence, MA

Illicit Discharge Compliance Statement

I, _____, verify that all illicit discharges to the stormwater management system are prohibited and no illicit discharges exist on the site.

EROSION AND SEDIMENT CONTROL BMPs

Minimize Disturbed Area and Protect Natural Features and Soil

Topsoil

Topsoil stripped from the immediate construction area can be temporarily stockpiled on site providing that the perimeter of the stockpiles is properly staked with silt fence at the toe of slope. The stockpiles shall be in areas that will not interfere with construction and at least 15 feet away from areas of concentrated flows or pavement. The area shall be inspected weekly for erosion and immediately after storm events. Areas on or around the stockpile that have eroded shall be stabilized immediately with erosion controls.

Stabilize Soils

Temporary Stabilization

- All vegetated areas which do not exhibit a minimum of 85% vegetative growth by Oct. 15th, or which are disturbed after Oct. 15th, shall be stabilized by seeding and installing erosion control blankets on slopes greater than 3:1, and seeding and placing 3 to 4 tons of mulch per acre, secured with anchored netting, elsewhere. The placement of erosion control blankets or mulch and netting shall not occur over accumulated snow or on frozen ground and shall be completed in advance of thaw or spring melt events.
- All ditches or swales which do not exhibit a minimum of 85% vegetative growth by Oct. 15th, or which are disturbed after Oct. 15th, shall be stabilized with stone or erosion control blankets appropriate for the design flow conditions.
- After November 15th, incomplete road surfaces, where work has stopped for the winter season, shall be protected with a minimum of 3 inches of crushed gravel.

Protect Slopes

Geotextile erosion control blankets shall be used to provide stabilization for slopes exceeding 3:1. Prepare soil before installing erosion control blanket, including any necessary application of lime, fertilizer, and seed. Begin at the top of the slope by anchoring the blanket in a 6" deep x 6" wide trench with approximately 12" extended beyond the upslope portion of the trench. Anchor the blanket with a row of staples/stakes approximately 12" apart in the bottom of the trench. Backfill and compact the trench after stapling. Apply seed to compacted soil and fold remaining 12" portion of back over seed and compacted soil. Secure over compacted soil with a row of staples/stakes spaced approximately 12" apart across the width of the blanket. Roll erosion control blanket either down or horizontally across the slope. Blanket will unroll with appropriate side against the soil surface. All blankets must be securely fastened to soil surface by placing staples/stakes in appropriate locations as shown in the staple pattern guide. When using the dot system, staples/stakes should be placed through each of the colored dots corresponding to the appropriate staple pattern. The edges of parallel blankets must be stapled with approximately

2"-5" overlap. Consecutive blankets spliced down the slope must be placed end over end (shingle style) with an approximate 3" overlap. Staple through overlapped area, approximately 12" apart across entire blanket's width. In loose soil conditions, the use of staple or stake lengths greater than 6" may be necessary to properly anchor the blanket.

Establish Perimeter Controls and Sediment Barriers

Silt fence shall be installed along the edge of the limit of work. The silt fence shall be installed before construction begins. Wooden posts shall be doubled and coupled at filter cloth seams. Filter cloth shall be fastened securely to support netting with ties spaced every 24" at top, midsection, and bottom. When two sections of filter cloth adjoin each other, they shall be overlapped by 6 inches, folded and stapled. Silt fence shall be removed upon completion of the project and stabilization of all soil.

Maintenance:
1. Silt fence shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any repairs that are required shall be made immediately.
2. If the fabric on the silt fence shall decompose or become ineffective during the expected life of the fence, the fabric shall be replaced promptly.
3. Sediment deposits shall be inspected after every storm event. The deposits shall be removed when they reach approximately one-half the height of the barrier.
4. Sediment deposits that are removed or left in place after the fabric has been removed shall be graded to conform with the existing topography and vegetated.

Establish Stabilized Construction Entrance

A stabilized construction entrance shall be installed before construction begins on the site. The stone anti-tracking pad shall remain in place until the subgrade of pavement is installed.

1. Stone shall be 1-2" stone, reclaimed stone, or recycled concrete equivalent.
2. The length of the stabilized entrance shall not be less than 50'.
3. The thickness of the stone for the stabilized entrance shall not be less than 6".
4. Geotextile filter cloth shall be placed over the entire area prior to placing the stone.
5. All surface water that is flowing to or diverted toward the construction entrance shall be piped beneath the entrance. If piping is impractical, a berm with 5:1 slope that can be crossed by vehicles may be substituted for the pipe.
6. The entrance shall be maintained in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top-dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spilled, washed, or tracked onto public rights-of-way must be removed promptly.
7. Wheels shall be cleaned to remove mud prior to entrance onto public rights-of way. When washing is required, it shall be done on an area stabilized with stone which drains into an approved sediment trapping device.

Catch Basin Inlet Protection

Inlet protection devices intercept and/or filter sediment before it can be transported from a site into the storm drain system and discharged into a lake, river, stream, wetland, or other waterbody. These devices also keep sediment from filling or clogging storm drain pipes, ditches, and downgradient sediment traps or ponds. A siltsack or approved equal shall be used for catch basin inlet protection. It should be inspected weekly. When the restraint cord is no longer visible, siltsack is full and shall be emptied.

POST-CONSTRUCTION BMPs

Snow and Snow Melt Management

Proper management of snow and snow melt, snow removal and storage, use of deicing compounds, and other practices can minimize major runoff and pollutant loading impacts. Snow will be stored in areas adjacent to the edge of the roadway. Use of alternative deicing compounds, such as calcium chloride and calcium magnesium acetate, will be investigated for use. Professional services will be used for snow management.

Deep Sump/Hooded Catch Basins

Deep sump/hooded catch basins are incorporated in the proposed development's stormwater management plan as pre-treatment for the proposed drainage system. The sump provides for settlement of suspended solids and a hood is provided to remove floatables and trapped hydrocarbons. It is not anticipated that the proposed roadway will become an area of high sediment loading. The sump should be inspected and cleaned at least four times per year; the more frequent the cleaning, the less likely sediment will be resuspended and subsequently discharged. Catch basin sediments and debris shall be disposed of at an approved DEP landfill. The owner shall be responsible for the catch basin cleaning operations.

Infiltration Basin

An infiltration basin is included in the stormwater management plan design for the proposed development. The applicant of the project, through his contractor, will incorporate this sediment control feature into the project during construction activities. Upon completion of the development, the Owner will be responsible for proper maintenance of the basin. To ensure proper performance and system longevity, the following maintenance schedule is recommended:

a. Mowing: Basin should be mowed periodically; at least once per month in the spring, summer and fall. The vegetation must not be cut shorter than four inches. All grass clippings should be removed and properly disposed of;
b. Sediment and debris removal: Basin should be inspected at least twice annually and following any rainfall event exceeding 2.5 inches over a 24-hour period. Any sediment and debris should be removed manually before the vegetation is adversely impacted. At a minimum, accumulated debris should be removed at least once per year to ensure sediments are not re-suspended.
c. Basin protection: Efforts should be made, through snow and snow melt management, local bylaws and public education, to protect the basin from damages of snow removal and off-street parking.

Infiltration Chamber

Infiltration chambers are incorporated into the site design for infiltration. The chambers shall be inspected after every major storm event in the first 4 months after construction to ensure proper function. Inspection ports shall be utilized for access and assessment. After the four-month period, the chambers shall be inspected a minimum of twice per year. Any grit or sediment found within the chambers impacting infiltration shall be removed by manual or mechanical methods, such as a vacuum truck. The homeowner will be responsible for proper maintenance of the subsurface systems.

Sediment Forebay

Sediment forebays are included in the stormwater management plan as pretreatment for the proposed infiltration basins. The forebays will be portioned from the basins by use of a stone filter berm. The forebays and riprap shall be inspected monthly during construction and cleaned upon completion of the project. The forebays shall be inspected monthly and cleaned twice per year by a landscaping contractor hired by the Owner. Sediments removed during cleaning shall be disposed of at an approved DEP landfill.

Rip Rap

Inspect the rip rap outlets regularly, especially after major storm events. Notation of any low spots or erosion should be made.

<u>FINAL STABILIZATION</u>

<u>Permanent Seeding</u>

Loam and hydroseed any disturbed surfaces after the final design grades have been achieved. A minimum of 6" of loam shall be installed. Seed mix shall be a maximum of 10% rye grass and

a minimum of 90% permanent bluegrass and/or fescue. Lime shall be applied at a rate of 2 tons/acre.

Construction debris, trash and temporary BMPs (including silt fences, material storage areas, and inlet protection) will also be removed and any areas disturbed during removal will be seeded immediately.

IIX. **Appendix**

a. Rip Rap Sizing Calculations

Rockingham County Conservation District

PIPE OUTLET PROTECTION APRON DESIGN
And
d_{50} RIPRAP SIZING

PROJECT NAME :	23 Hampstead Street				
PROJECT # :	Infiltration Area 1 Outlet				
BY :	SRC			CHECKED BY :	
DATE :	11/23/21	STORM:	10-Yr	DATE :	

DOWNSTREAM PIPE HYDRAULICS

Peak Discharge Required =	2.53	cfs
Depth of Flow* =	0.23	Feet

La AND W CALCULATIONS:

Culvert Diameter (Do) =	12.0	Inches
Tail Water Depth (TW)* =	0.23	Feet
Width of Apron @ U.S End (W) =	3.0	Feet
Length of Apron (La) =	12	Feet
Width of Apron @ D.S End (W) =	15	Feet

***If outletting to Flat Area use TW depth = 0.2 x Do**

ROCK RIPRAP SIZE

d_{50} = 0.30 Feet or 3.60 Inches

$d_{50} = (0.02 \times Q^{4/3})/(Tw \times Do)$

ROCK RIPRAP GRADATION (TABLE 7-24 OF NHDES HANDBOOK)

% of Weight Smaller Than The Given Size	Size of Stone in Inches		
100	5.4	to	7.2
85	4.7	to	6.5
50	3.6	to	5.4
15	1.1	to	1.8

Minimum Rock Riprap Blanket Thickness = 10.8 Inches

Minimum Six inch Sand/Gravel Bedding or Geotextile Fabric Required Under All Rock Riprap

FORMULAS USED (Reference NHDES HANDBOOK, Pages 7-114, 7-115)

Manning's Uniform Channel Flow -	Q = (A x 1.486 x R^(2/3) x S^(1/2))/"n"
Length of Apron (La) TW< Do/2 -	La = (1.8 x Q/Do^1.5) + 7 x Do
Length of Apron (La) TW>= Do/2 -	La = 3.0 x Q/Do^1.5 + 7 x Do
Width of Apron @ D.S End TW < Do/2 -	W = 3 x Do + La
Width of Apron @ D.S End TW >= Do/2 -	W = 3 x Do + 0.4 x La
Width of D.S. Apron if in Channel -	Ch. BW +Sum of Side Slopes x Flow Depth
Width of Apron @ Culvert -	Wc = 3 x Do

b. Pipe Sizing Calculations

PIPE VELOCITY CALCULATIONS-10 YEAR STORM

Millennium Engineering, Inc.

Pipe Sizing Calculation Spreadsheet:

Name: Geramat Way
Location: 23 Hampstead Street
Methuen, MA

Job No.: M213934
Date: 11/23/2021
Revised:

Design Parameters:

IDF Curve

25 Year Storm Boston, MA

k_e= 0.2

DESCRIPTION	LOCATION		AREA (AC.)	C	C x A	SUM C x A	FLOW TIME (MIN)		i*	DESIGN					CAPACITY		PIPE PROFILE				
	FROM	TO					PIPE	CONC. TIME		Q cfs	V fps	n	PIPE SIZE	SLOPE	Q full ft^3/s	V full ft/s	LENGTH ft	FALL ft	RIM	INV UPPER	INV LOWER
CB-1	CB-1	DMH-1	0.38	0.53	0.20	0.20	0.08	2.0	6.2	1.3	3.0	0.013	12	0.007	2.9	3.7	15	0.10	182.86	179.86	179.76
CB-2	CB-2	DMH-1	0.96	0.47	0.45	0.45	0.06	2.1	6.2	2.7	3.9	0.013	12	0.007	2.9	3.7	15	0.10	182.86	179.86	179.76
DMH-1	DMH-1	DMH-2			0.00	0.65	1.11	2.2	6.1	4.0	3.3	0.013	12	0.005	2.5	3.2	222	1.11	183.37	179.66	178.55
DMH-2	DMH-2	FES			0.00	0.65	0.47	3.3	5.8	3.7	4.2	0.013	12	0.008	3.2	4.1	119	0.95	184.55	178.45	177.50
CB-3	CB-3	DMH -3	0.17	0.50	0.09	0.09	0.19	1.9	6.2	0.5	2.1	0.013	12	0.005	2.5	3.2	24	0.12	181.00	177.00	176.88
CB-4	CB-4	DMH-3	0.11	0.47	0.05	0.05	0.16	8.0	4.6	0.2	1.8	0.013	12	0.007	3.0	3.8	17	0.12	181.00	177.00	176.88

MEI

Weighted Runoff Coefficients "C" for Rational Method

C'- Coefficients

Pervious Soil	0.35
Impervious	0.9

Description of Area CB-1	Area (acres)	Runoff Coefficient	A x C
Pervious	0.253	0.35	0.09
Impervious	0.126	0.90	0.11
Totals =	**0.379**		0.20

Weighted Runoff Coefficient = **S(AxC) / SA = 0.53**

Description of Area CB-2	Area (acres)	Runoff Coefficient	A x C
Pervious	0.752	0.35	0.26
Impervious	0.203	0.90	0.18
Totals =	**0.955**		0.45

Weighted Runoff Coefficient = **S(AxC) / SA = 0.47**

Description of Area CB-3	Area (acres)	Runoff Coefficient	A x C
Pervious	0.127	0.35	0.04
Impervious	0.046	0.90	0.04
Totals =	**0.173**		0.09

Weighted Runoff Coefficient = **S(AxC) / SA = 0.50**

Description of Area CB-4	Area (acres)	Runoff Coefficient	A x C
Pervious	0.090	0.35	0.03
Impervious	0.024	0.90	0.02
Totals =	**0.114**		0.05

Weighted Runoff Coefficient = **S(AxC) / SA = 0.47**

Description of Area	Area (acres)	Runoff Coefficient	A x C
Pervious		0.35	0.00
Impervious		0.90	0.00
Totals =	**0.000**		0.00

Weighted Runoff Coefficient = **S(AxC) / SA = #DIV/0!**

Description of Area	Area (acres)	Runoff Coefficient	A x C
Pervious		0.35	0.00
Impervious		0.90	0.00
Totals =	**0.000**		0.00

Weighted Runoff Coefficient = **S(AxC) / SA = #DIV/0!**

Description of Area	Area (acres)	Runoff Coefficient	A x C
Pervious		0.35	0.00
Impervious		0.90	0.00
Totals =	**0.000**		0.00

Weighted Runoff Coefficient = **S(AxC) / SA = #DIV/0!**

Description of Area	Area (acres)	Runoff Coefficient	A x C
Pervious		0.35	0.00
Impervious		0.90	0.00
Totals =	**0.000**		0.00

Weighted Runoff Coefficient = **S(AxC) / SA = #DIV/0!**

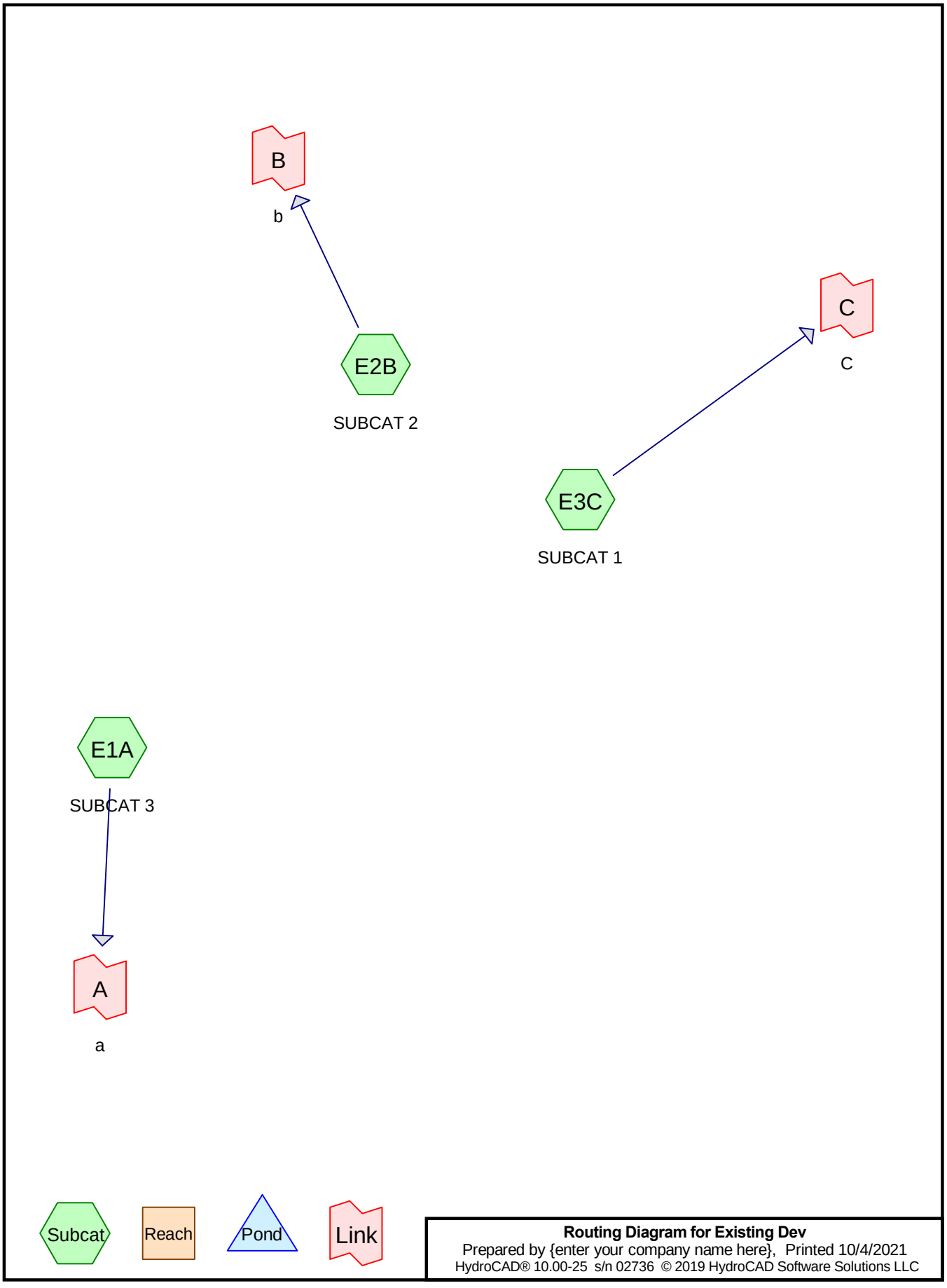
Description of Area	Area (acres)	Runoff Coefficient	A x C
Pervious		0.35	0.00
Impervious		0.90	0.00
Totals =	**0.000**		0.00

Weighted Runoff Coefficient = **S(AxC) / SA = #DIV/0!**

Description of Area	Area (acres)	Runoff Coefficient	A x C
Pervious		0.35	0.00
Impervious		0.90	0.00
Totals =	**0.000**		0.00

Weighted Runoff Coefficient = **S(AxC) / SA = #DIV/0!**

c. Existing Conditions HydroCAD Report



Routing Diagram for Existing Dev

Prepared by {enter your company name here}, Printed 10/4/2021

Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 4104 MA Georgetown Essex County
Rainfall events imported from "NRCS-Rain.txt" for 4180 MA Methuen Essex County

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.584	74	>75% Grass cover, Good, HSG C (E1A, E2B)
0.134	98	Paved parking, HSG C (E1A)
0.054	98	Unconnected roofs, HSG C (E1A)
0.016	98	Water Surface, HSG C (E1A)
4.084	70	Woods, Good, HSG C (E1A, E2B, E3C)
4.872	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
4.872	HSG C	E1A, E2B, E3C
0.000	HSG D	
0.000	Other	
4.872		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.584	0.000	0.000	0.584	>75% Grass cover, Good	E1A, E2B
0.000	0.000	0.134	0.000	0.000	0.134	Paved parking	E1A
0.000	0.000	0.054	0.000	0.000	0.054	Unconnected roofs	E1A
0.000	0.000	0.016	0.000	0.000	0.016	Water Surface	E1A
0.000	0.000	4.084	0.000	0.000	4.084	Woods, Good	E1A, E2B, E3C
0.000	**0.000**	**4.872**	**0.000**	**0.000**	**4.872**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1A: SUBCAT 3 Runoff Area=58,856 sf 15.08% Impervious Runoff Depth>0.92"
Flow Length=301' Tc=18.0 min CN=75 Runoff=1.01 cfs 0.103 af

Subcatchment E2B: SUBCAT 2 Runoff Area=148,707 sf 0.00% Impervious Runoff Depth>0.68"
Flow Length=525' Tc=16.9 min CN=70 Runoff=1.85 cfs 0.193 af

Subcatchment E3C: SUBCAT 1 Runoff Area=4,653 sf 0.00% Impervious Runoff Depth>0.68"
Flow Length=174' Slope=0.0570 '/' Tc=8.7 min CN=70 Runoff=0.08 cfs 0.006 af

Link A: a Inflow=1.01 cfs 0.103 af
Primary=1.01 cfs 0.103 af

Link B: b Inflow=1.85 cfs 0.193 af
Primary=1.85 cfs 0.193 af

Link C: C Inflow=0.08 cfs 0.006 af
Primary=0.08 cfs 0.006 af

Total Runoff Area = 4.872 ac Runoff Volume = 0.302 af Average Runoff Depth = 0.74"
95.82% Pervious = 4.668 ac 4.18% Impervious = 0.204 ac

Summary for Subcatchment E1A: SUBCAT 3

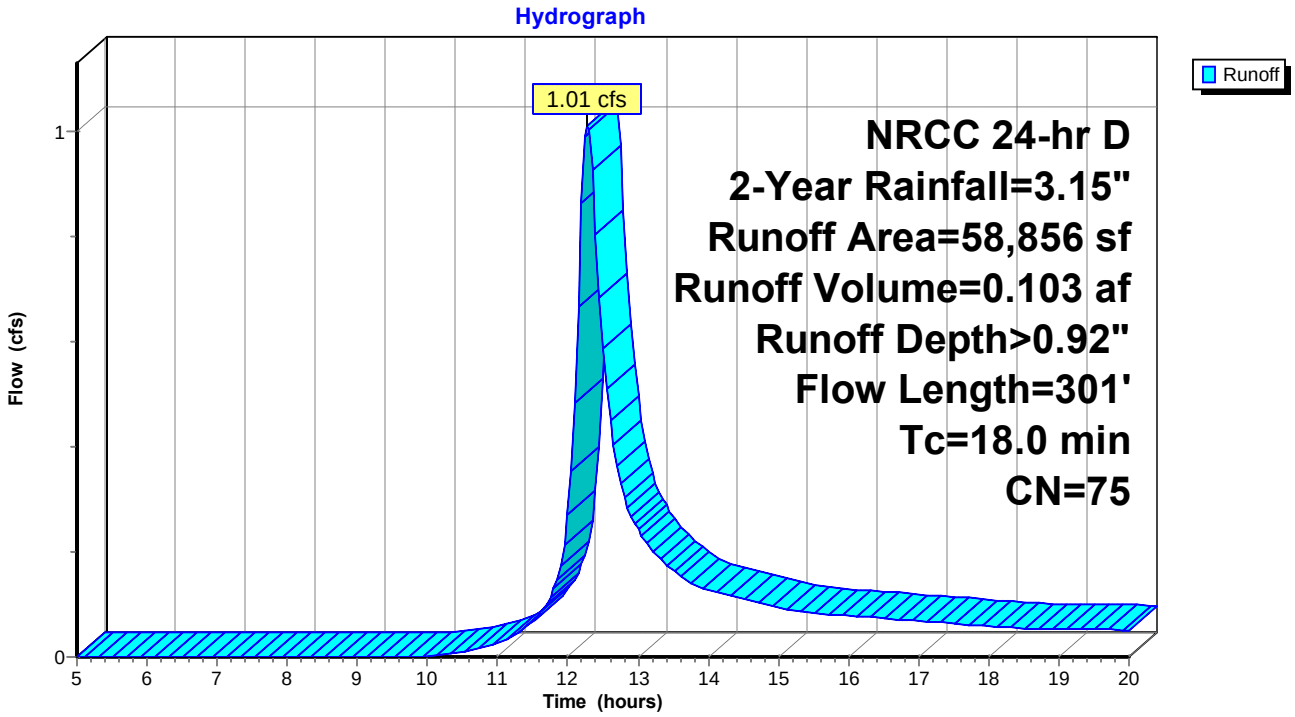
Runoff = 1.01 cfs @ 12.28 hrs, Volume= 0.103 af, Depth> 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
37,045	70	Woods, Good, HSG C
2,360	98	Unconnected roofs, HSG C
5,820	98	Paved parking, HSG C
698	98	Water Surface, HSG C
12,933	74	>75% Grass cover, Good, HSG C
58,856	75	Weighted Average
49,978		84.92% Pervious Area
8,878		15.08% Impervious Area
2,360		26.58% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.0	93	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	20	0.4500	3.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	58	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	80	0.0800	5.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
18.0	301	Total			

Subcatchment E1A: SUBCAT 3



Summary for Subcatchment E2B: SUBCAT 2

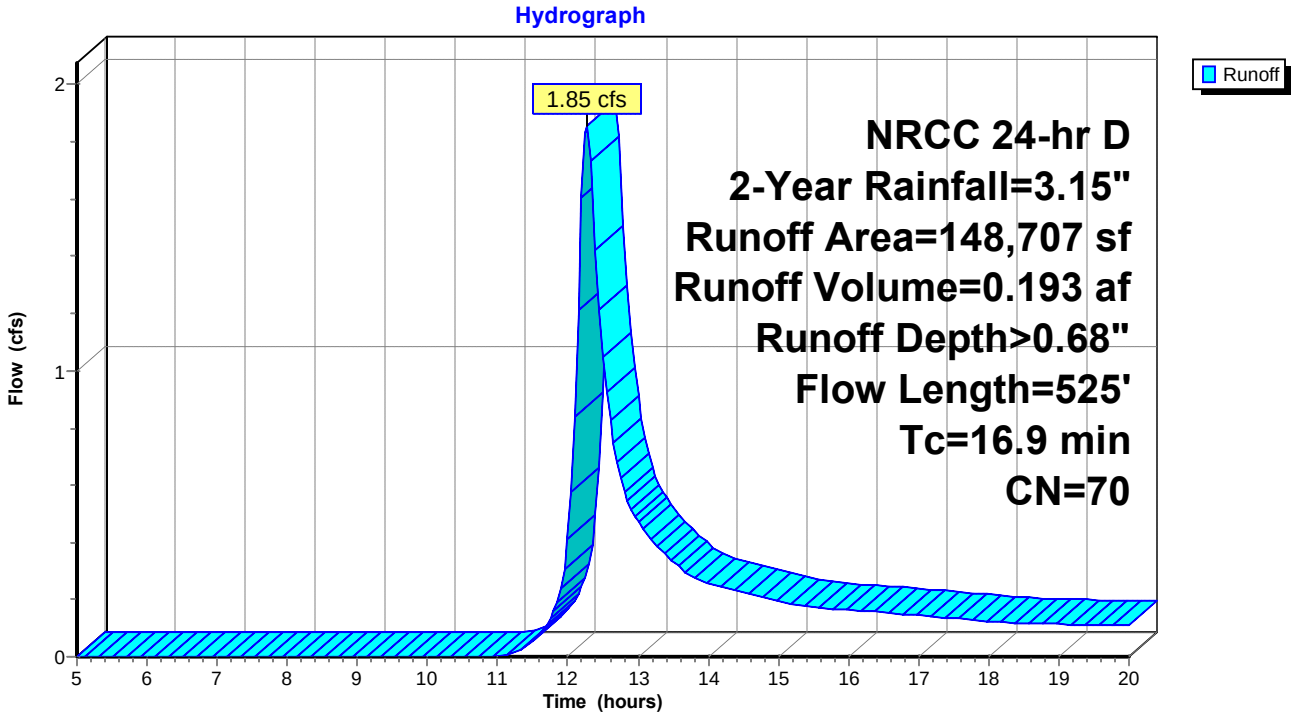
Runoff = 1.85 cfs @ 12.27 hrs, Volume= 0.193 af, Depth> 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
12,509	74	>75% Grass cover, Good, HSG C
136,198	70	Woods, Good, HSG C
148,707	70	Weighted Average
148,707		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
3.8	258	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.3	155	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.3	62	0.0250	0.79		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.9	525	Total			

Subcatchment E2B: SUBCAT 2



Summary for Subcatchment E3C: SUBCAT 1

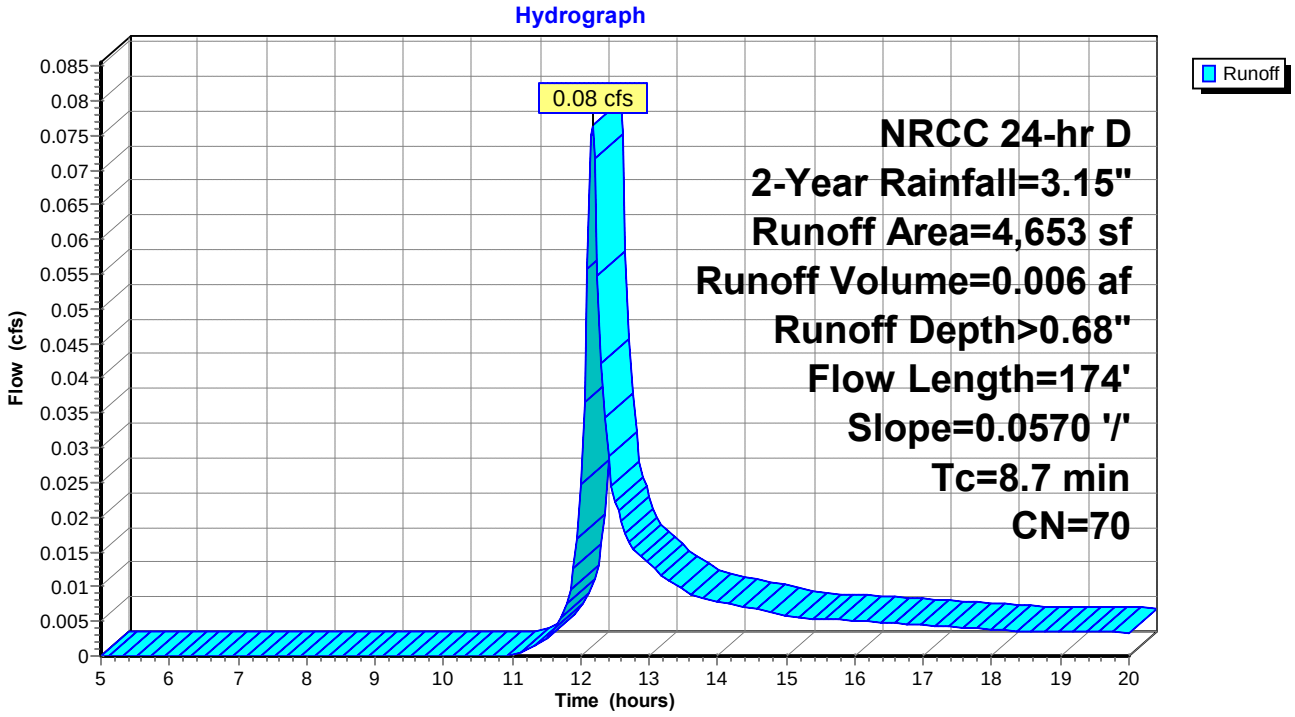
Runoff = 0.08 cfs @ 12.17 hrs, Volume= 0.006 af, Depth> 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
4,653	70	Woods, Good, HSG C
4,653		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	124	0.0570	3.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	174	Total			

Subcatchment E3C: SUBCAT 1

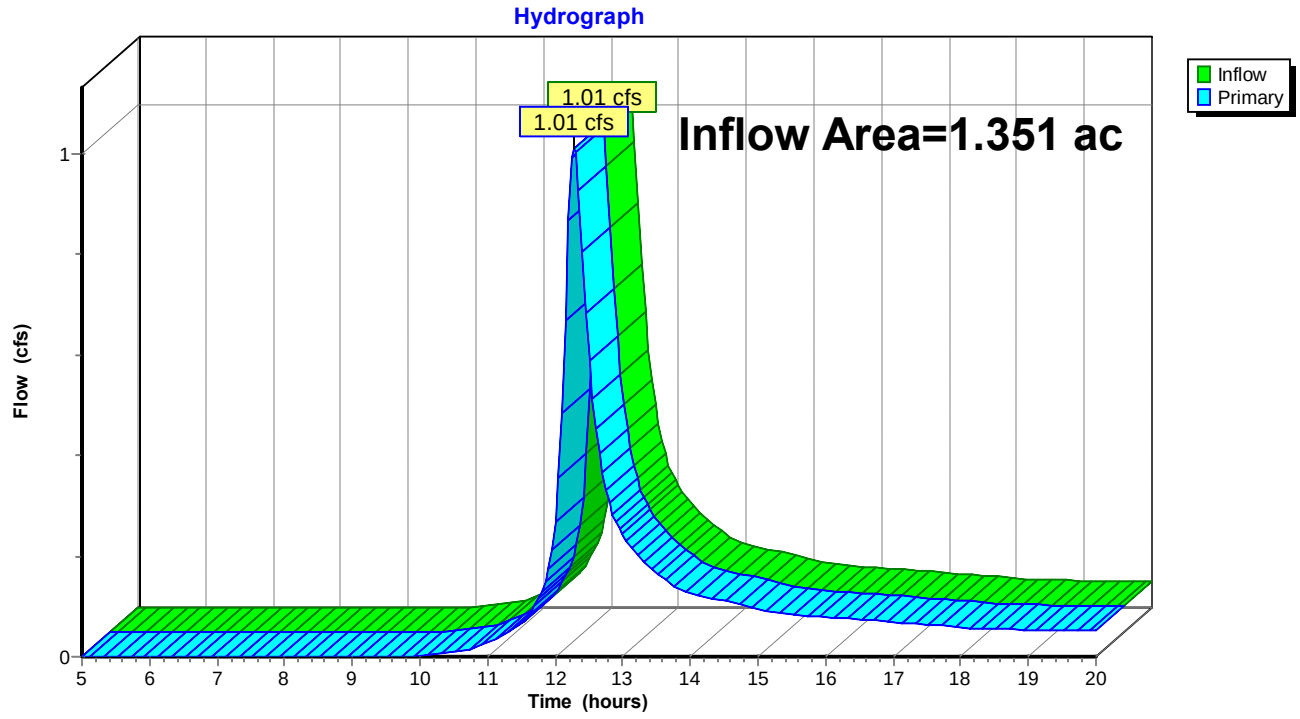


Summary for Link A: a

Inflow Area = 1.351 ac, 15.08% Impervious, Inflow Depth > 0.92" for 2-Year event
Inflow = 1.01 cfs @ 12.28 hrs, Volume= 0.103 af
Primary = 1.01 cfs @ 12.28 hrs, Volume= 0.103 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link A: a

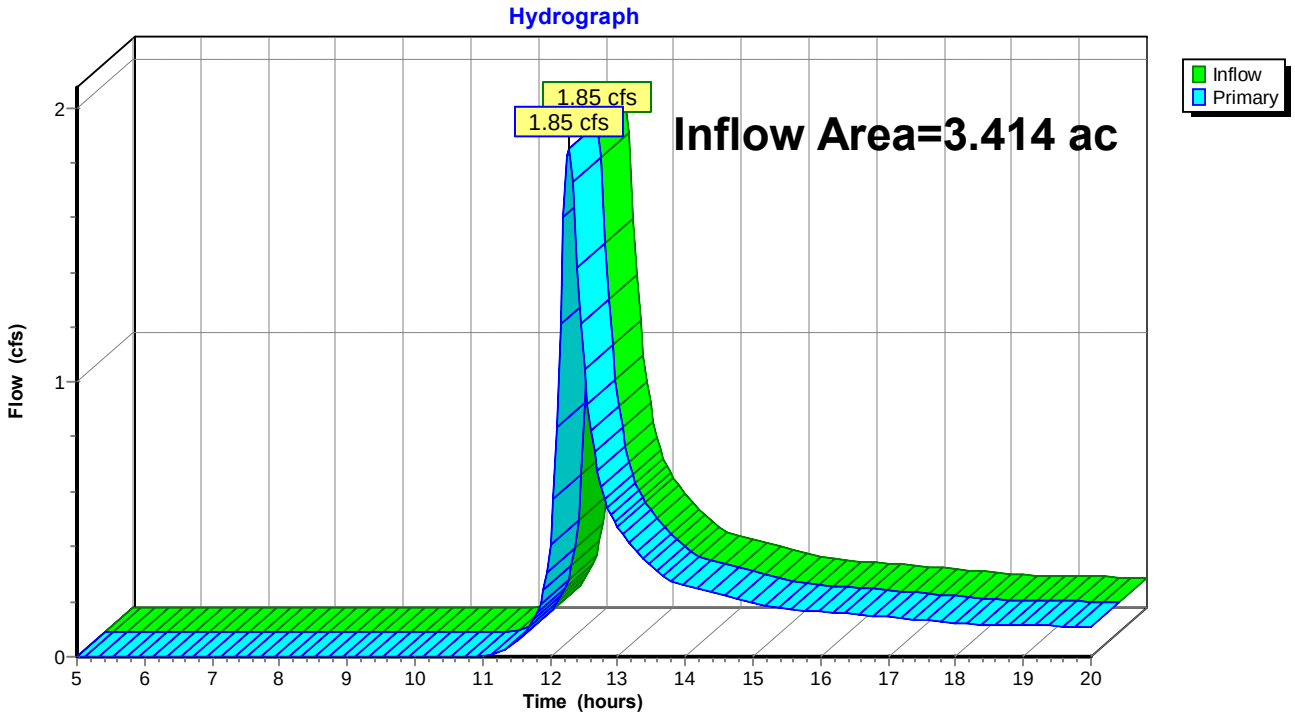


Summary for Link B: b

Inflow Area = 3.414 ac, 0.00% Impervious, Inflow Depth > 0.68" for 2-Year event
Inflow = 1.85 cfs @ 12.27 hrs, Volume= 0.193 af
Primary = 1.85 cfs @ 12.27 hrs, Volume= 0.193 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link B: b

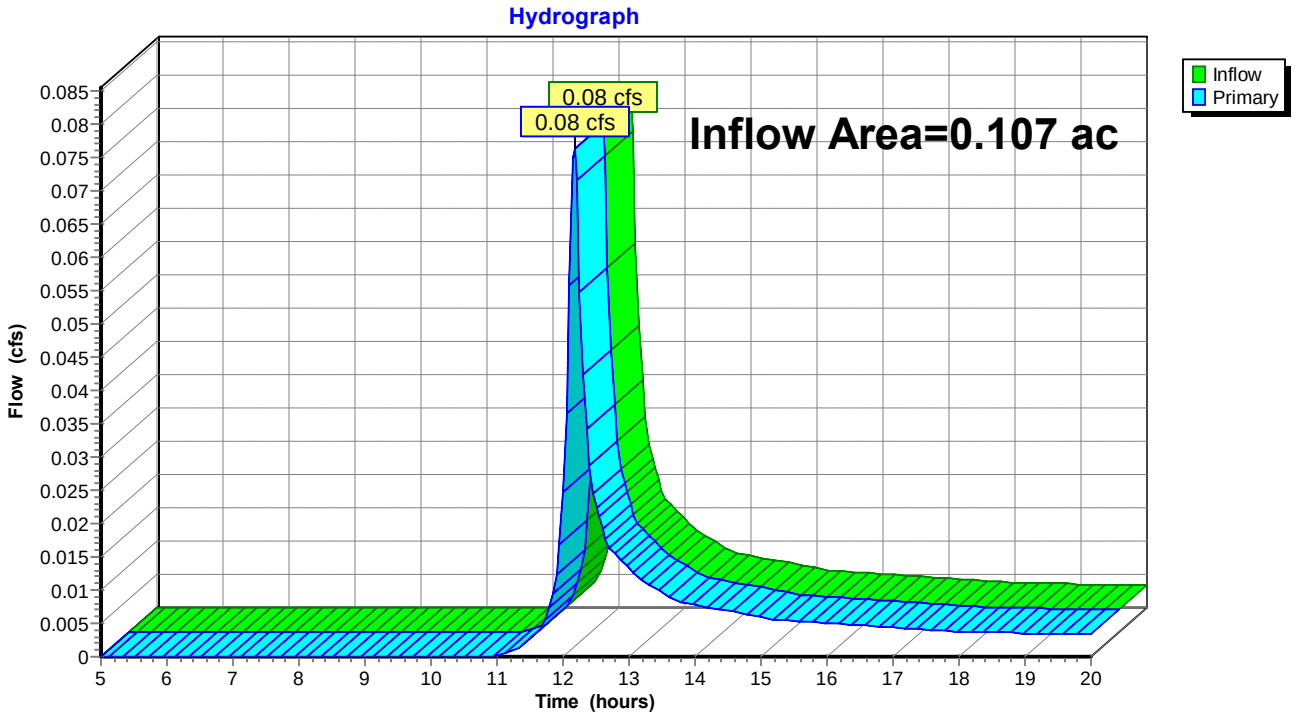


Summary for Link C: C

Inflow Area = 0.107 ac, 0.00% Impervious, Inflow Depth > 0.68" for 2-Year event
Inflow = 0.08 cfs @ 12.17 hrs, Volume= 0.006 af
Primary = 0.08 cfs @ 12.17 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link C: C



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1A: SUBCAT 3 Runoff Area=58,856 sf 15.08% Impervious Runoff Depth>2.05"
Flow Length=301' Tc=18.0 min CN=75 Runoff=2.30 cfs 0.231 af

Subcatchment E2B: SUBCAT 2 Runoff Area=148,707 sf 0.00% Impervious Runoff Depth>1.67"
Flow Length=525' Tc=16.9 min CN=70 Runoff=4.87 cfs 0.476 af

Subcatchment E3C: SUBCAT 1 Runoff Area=4,653 sf 0.00% Impervious Runoff Depth>1.68"
Flow Length=174' Slope=0.0570 '/' Tc=8.7 min CN=70 Runoff=0.20 cfs 0.015 af

Link A: a Inflow=2.30 cfs 0.231 af
Primary=2.30 cfs 0.231 af

Link B: b Inflow=4.87 cfs 0.476 af
Primary=4.87 cfs 0.476 af

Link C: C Inflow=0.20 cfs 0.015 af
Primary=0.20 cfs 0.015 af

Total Runoff Area = 4.872 ac Runoff Volume = 0.721 af Average Runoff Depth = 1.78"
95.82% Pervious = 4.668 ac 4.18% Impervious = 0.204 ac

Summary for Subcatchment E1A: SUBCAT 3

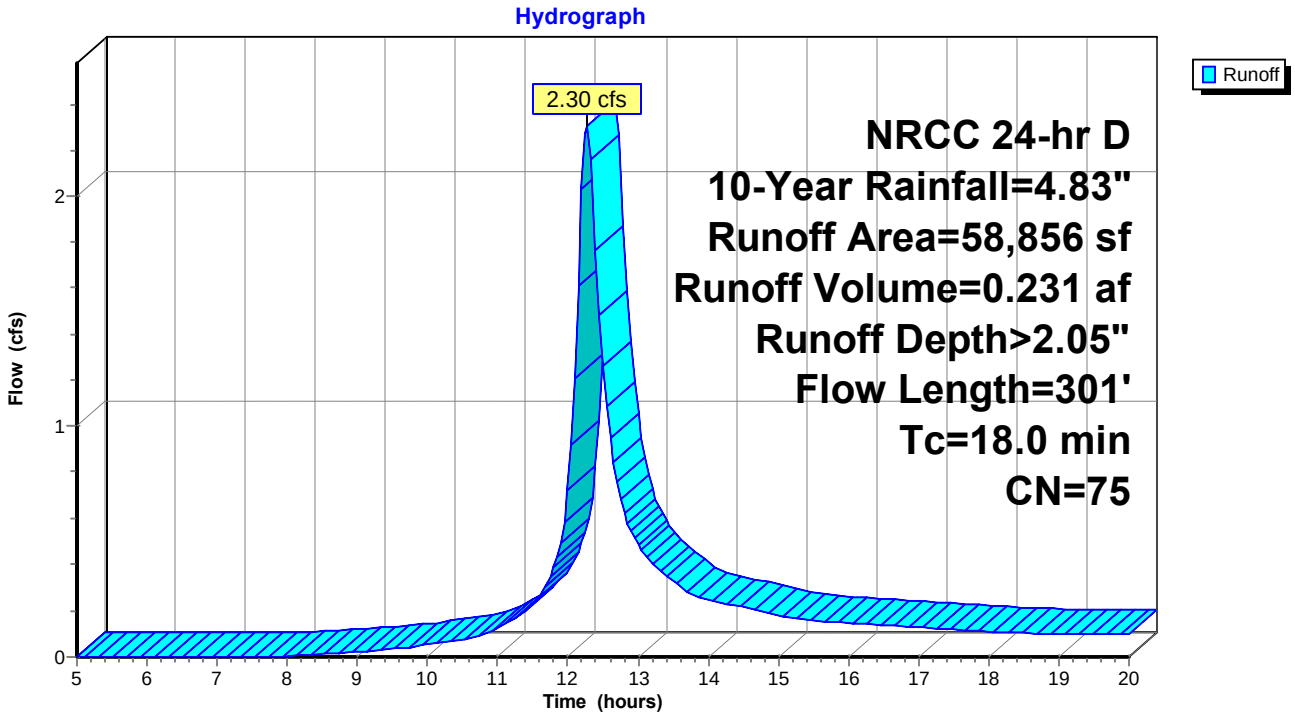
Runoff = 2.30 cfs @ 12.27 hrs, Volume= 0.231 af, Depth> 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
37,045	70	Woods, Good, HSG C
2,360	98	Unconnected roofs, HSG C
5,820	98	Paved parking, HSG C
698	98	Water Surface, HSG C
12,933	74	>75% Grass cover, Good, HSG C
58,856	75	Weighted Average
49,978		84.92% Pervious Area
8,878		15.08% Impervious Area
2,360		26.58% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.0	93	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	20	0.4500	3.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	58	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	80	0.0800	5.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
18.0	301	Total			

Subcatchment E1A: SUBCAT 3



Summary for Subcatchment E2B: SUBCAT 2

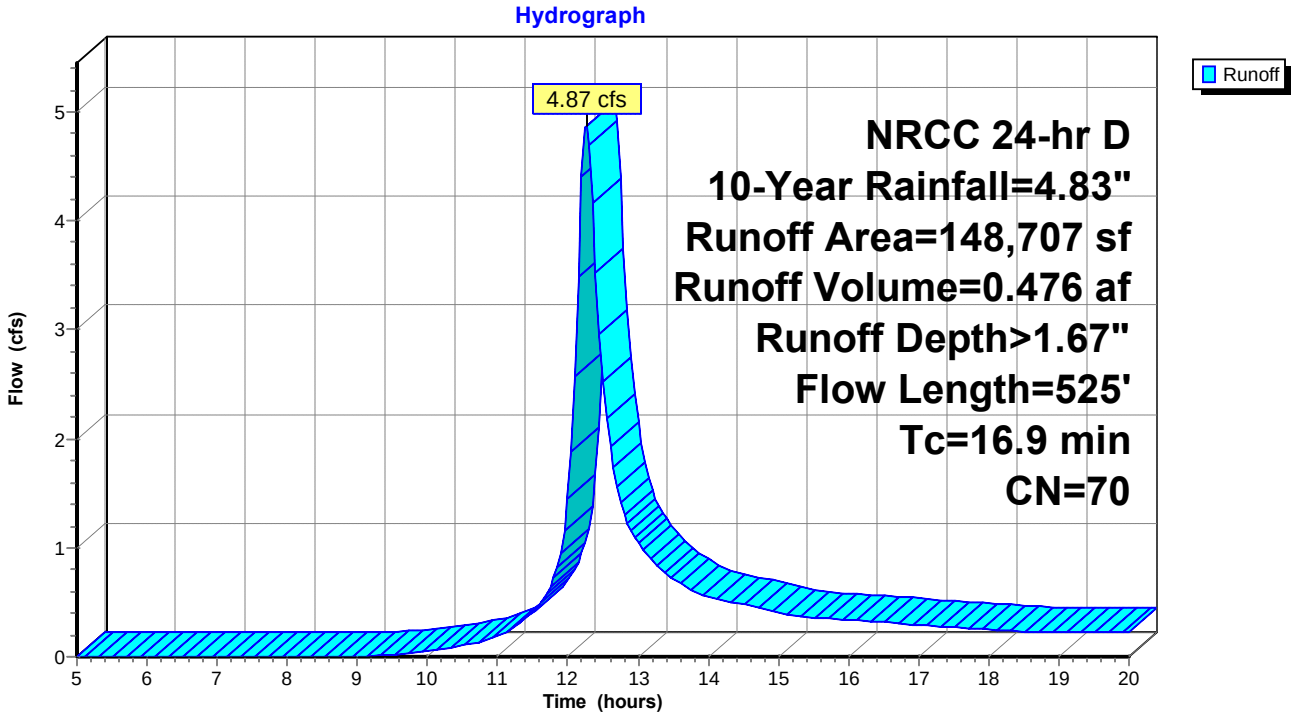
Runoff = 4.87 cfs @ 12.26 hrs, Volume= 0.476 af, Depth> 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
12,509	74	>75% Grass cover, Good, HSG C
136,198	70	Woods, Good, HSG C
148,707	70	Weighted Average
148,707		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
3.8	258	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.3	155	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.3	62	0.0250	0.79		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.9	525	Total			

Subcatchment E2B: SUBCAT 2



Summary for Subcatchment E3C: SUBCAT 1

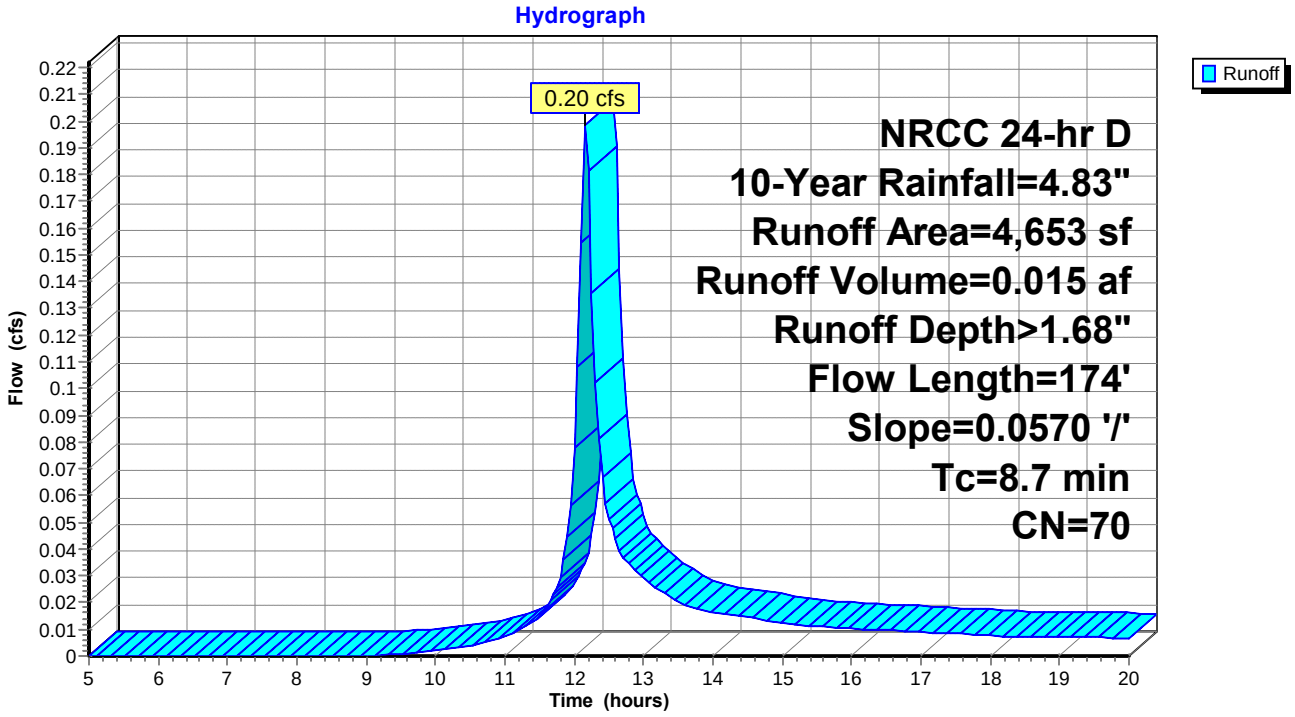
Runoff = 0.20 cfs @ 12.16 hrs, Volume= 0.015 af, Depth> 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
4,653	70	Woods, Good, HSG C
4,653		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	124	0.0570	3.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	174	Total			

Subcatchment E3C: SUBCAT 1

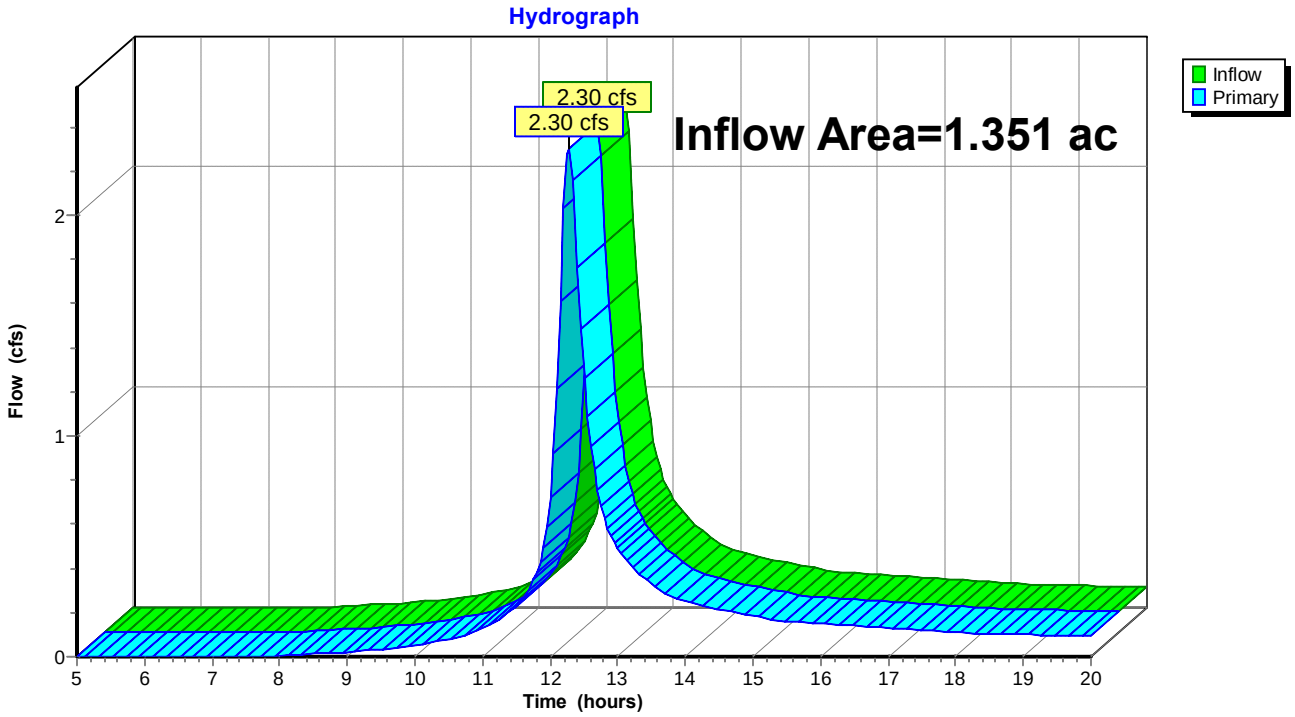


Summary for Link A: a

Inflow Area = 1.351 ac, 15.08% Impervious, Inflow Depth > 2.05" for 10-Year event
Inflow = 2.30 cfs @ 12.27 hrs, Volume= 0.231 af
Primary = 2.30 cfs @ 12.27 hrs, Volume= 0.231 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link A: a

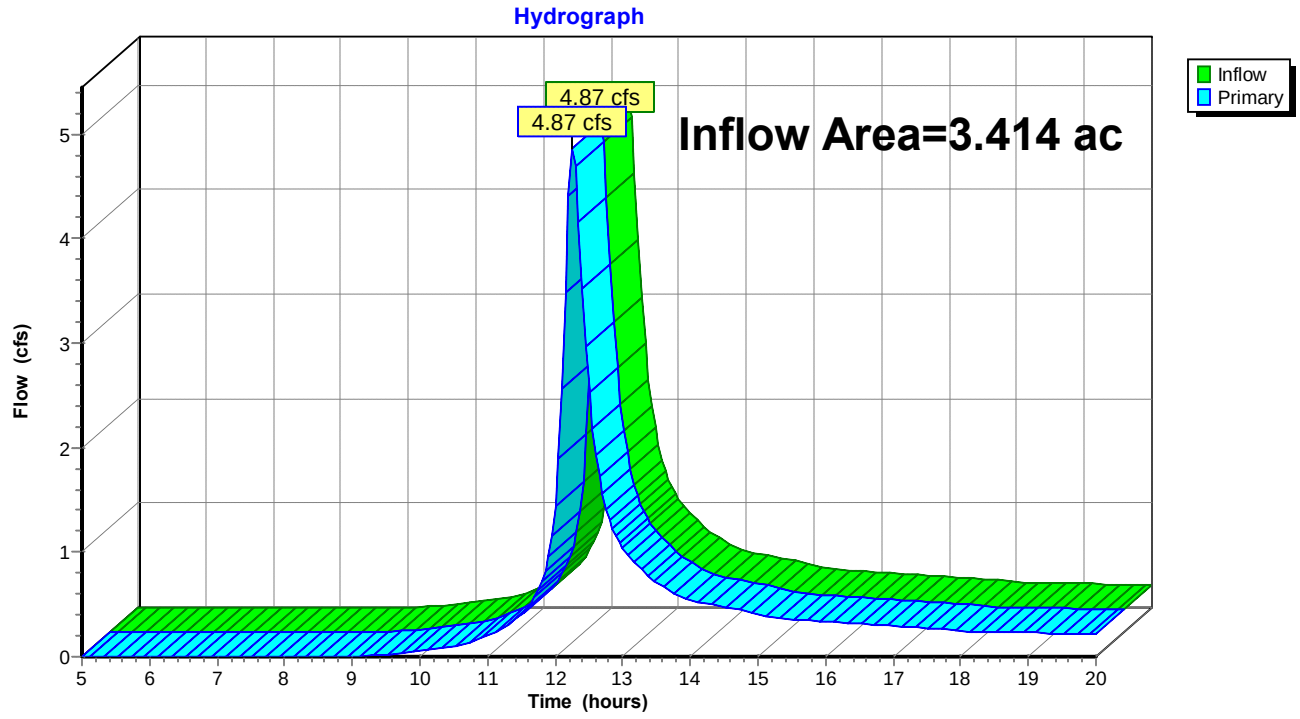


Summary for Link B: b

Inflow Area = 3.414 ac, 0.00% Impervious, Inflow Depth > 1.67" for 10-Year event
Inflow = 4.87 cfs @ 12.26 hrs, Volume= 0.476 af
Primary = 4.87 cfs @ 12.26 hrs, Volume= 0.476 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link B: b

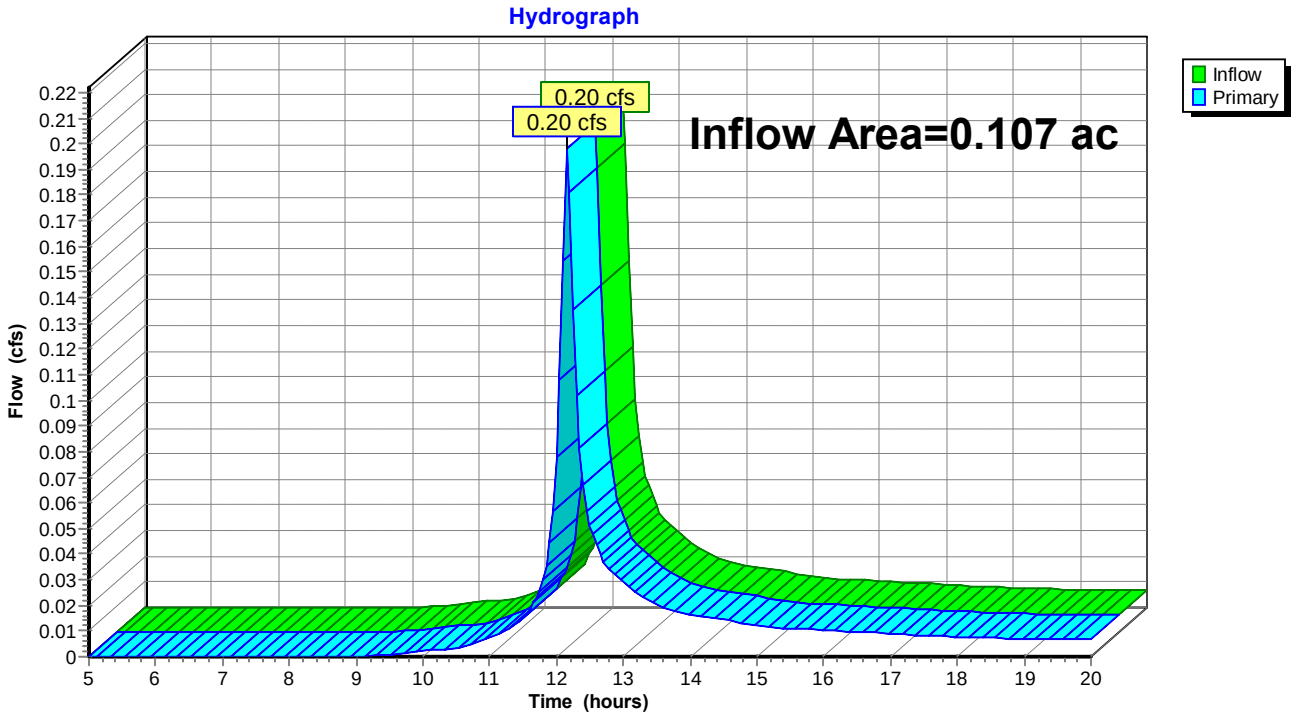


Summary for Link C: C

Inflow Area = 0.107 ac, 0.00% Impervious, Inflow Depth > 1.68" for 10-Year event
Inflow = 0.20 cfs @ 12.16 hrs, Volume= 0.015 af
Primary = 0.20 cfs @ 12.16 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link C: C



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1A: SUBCAT 3 Runoff Area=58,856 sf 15.08% Impervious Runoff Depth>5.33"
Flow Length=301' Tc=18.0 min CN=75 Runoff=5.83 cfs 0.600 af

Subcatchment E2B: SUBCAT 2 Runoff Area=148,707 sf 0.00% Impervious Runoff Depth>4.74"
Flow Length=525' Tc=16.9 min CN=70 Runoff=13.69 cfs 1.350 af

Subcatchment E3C: SUBCAT 1 Runoff Area=4,653 sf 0.00% Impervious Runoff Depth>4.76"
Flow Length=174' Slope=0.0570 '/' Tc=8.7 min CN=70 Runoff=0.55 cfs 0.042 af

Link A: a Inflow=5.83 cfs 0.600 af
Primary=5.83 cfs 0.600 af

Link B: b Inflow=13.69 cfs 1.350 af
Primary=13.69 cfs 1.350 af

Link C: C Inflow=0.55 cfs 0.042 af
Primary=0.55 cfs 0.042 af

Total Runoff Area = 4.872 ac Runoff Volume = 1.993 af Average Runoff Depth = 4.91"
95.82% Pervious = 4.668 ac 4.18% Impervious = 0.204 ac

Summary for Subcatchment E1A: SUBCAT 3

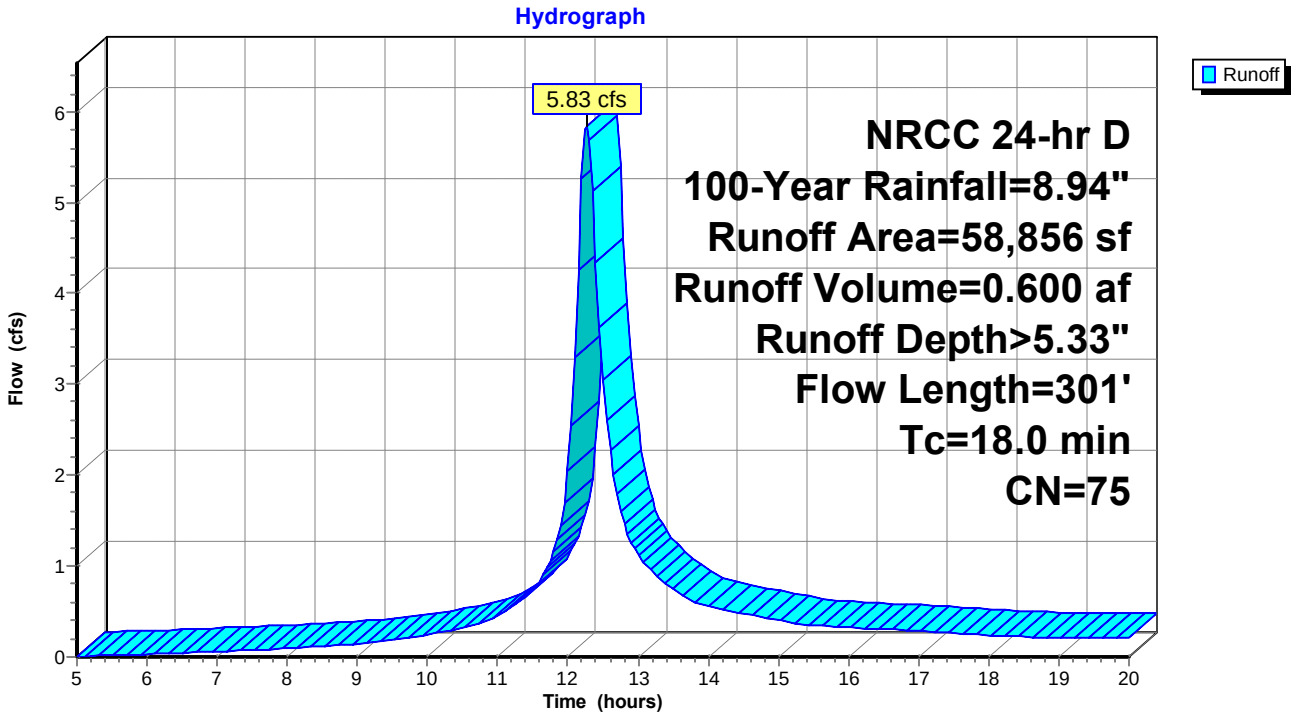
Runoff = 5.83 cfs @ 12.27 hrs, Volume= 0.600 af, Depth> 5.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
37,045	70	Woods, Good, HSG C
2,360	98	Unconnected roofs, HSG C
5,820	98	Paved parking, HSG C
698	98	Water Surface, HSG C
12,933	74	>75% Grass cover, Good, HSG C
58,856	75	Weighted Average
49,978		84.92% Pervious Area
8,878		15.08% Impervious Area
2,360		26.58% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.5	50	0.0100	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.0	93	0.1000	1.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	20	0.4500	3.35		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	58	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	80	0.0800	5.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
18.0	301	Total			

Subcatchment E1A: SUBCAT 3



Summary for Subcatchment E2B: SUBCAT 2

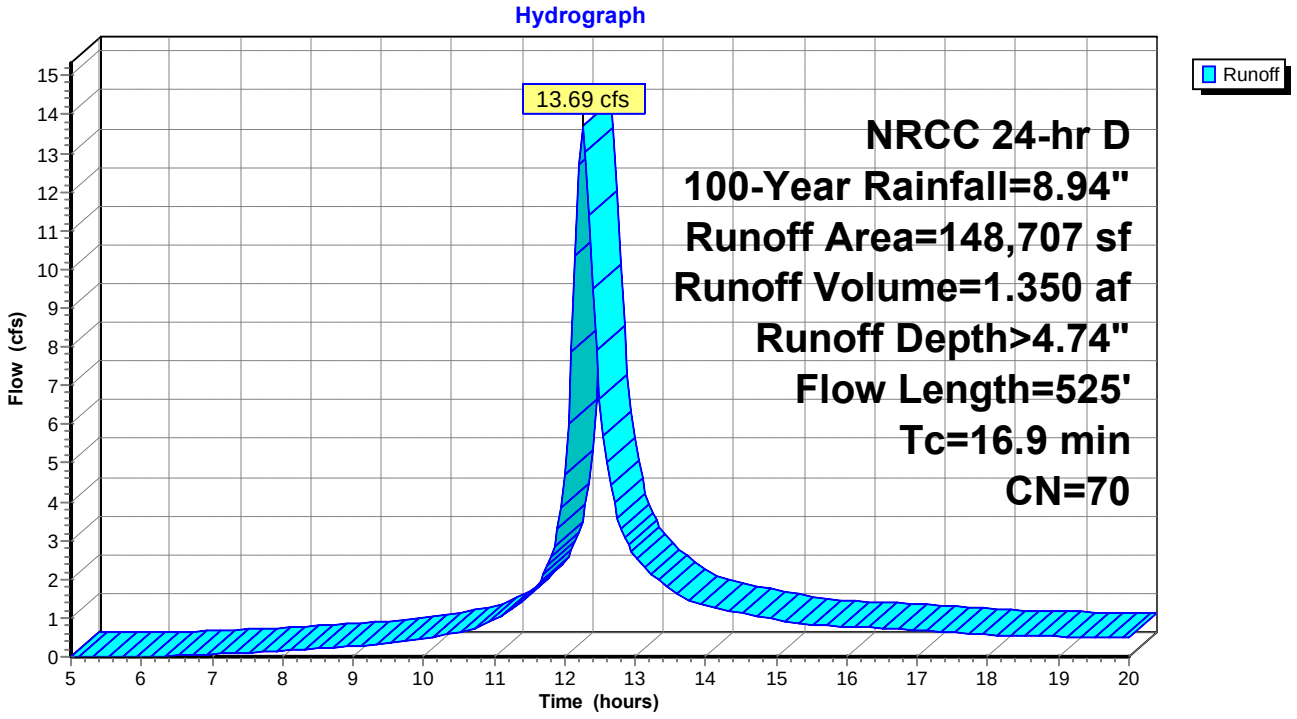
Runoff = 13.69 cfs @ 12.26 hrs, Volume= 1.350 af, Depth> 4.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
12,509	74	>75% Grass cover, Good, HSG C
136,198	70	Woods, Good, HSG C
148,707	70	Weighted Average
148,707		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
3.8	258	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.3	155	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.3	62	0.0250	0.79		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
16.9	525	Total			

Subcatchment E2B: SUBCAT 2



Summary for Subcatchment E3C: SUBCAT 1

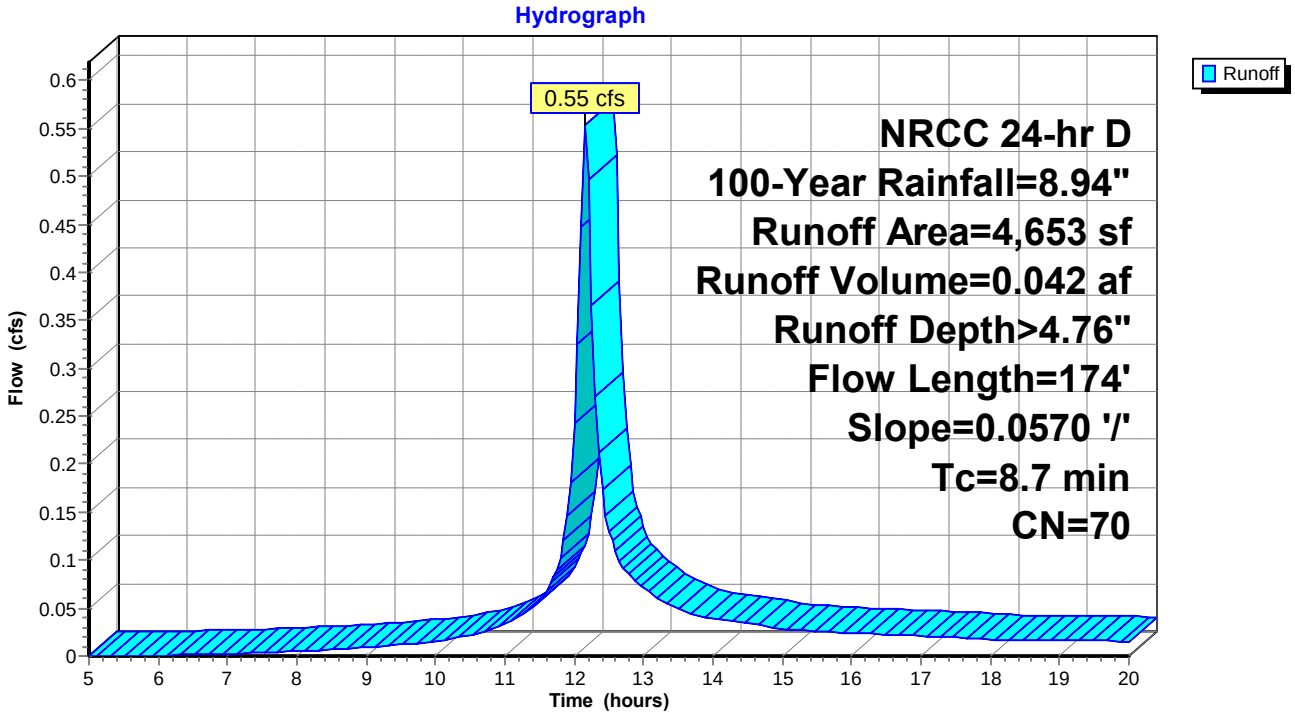
Runoff = 0.55 cfs @ 12.16 hrs, Volume= 0.042 af, Depth> 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
4,653	70	Woods, Good, HSG C
4,653		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	124	0.0570	3.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	174	Total			

Subcatchment E3C: SUBCAT 1

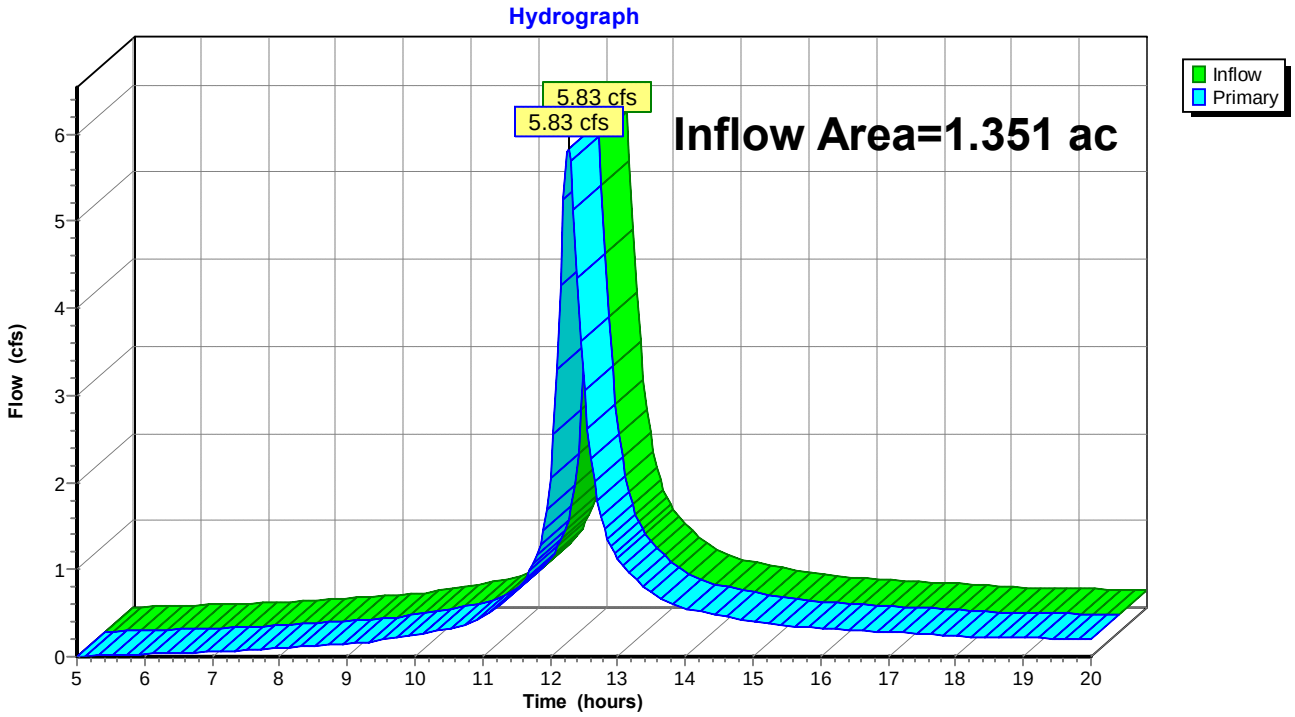


Summary for Link A: a

Inflow Area = 1.351 ac, 15.08% Impervious, Inflow Depth > 5.33" for 100-Year event
Inflow = 5.83 cfs @ 12.27 hrs, Volume= 0.600 af
Primary = 5.83 cfs @ 12.27 hrs, Volume= 0.600 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link A: a

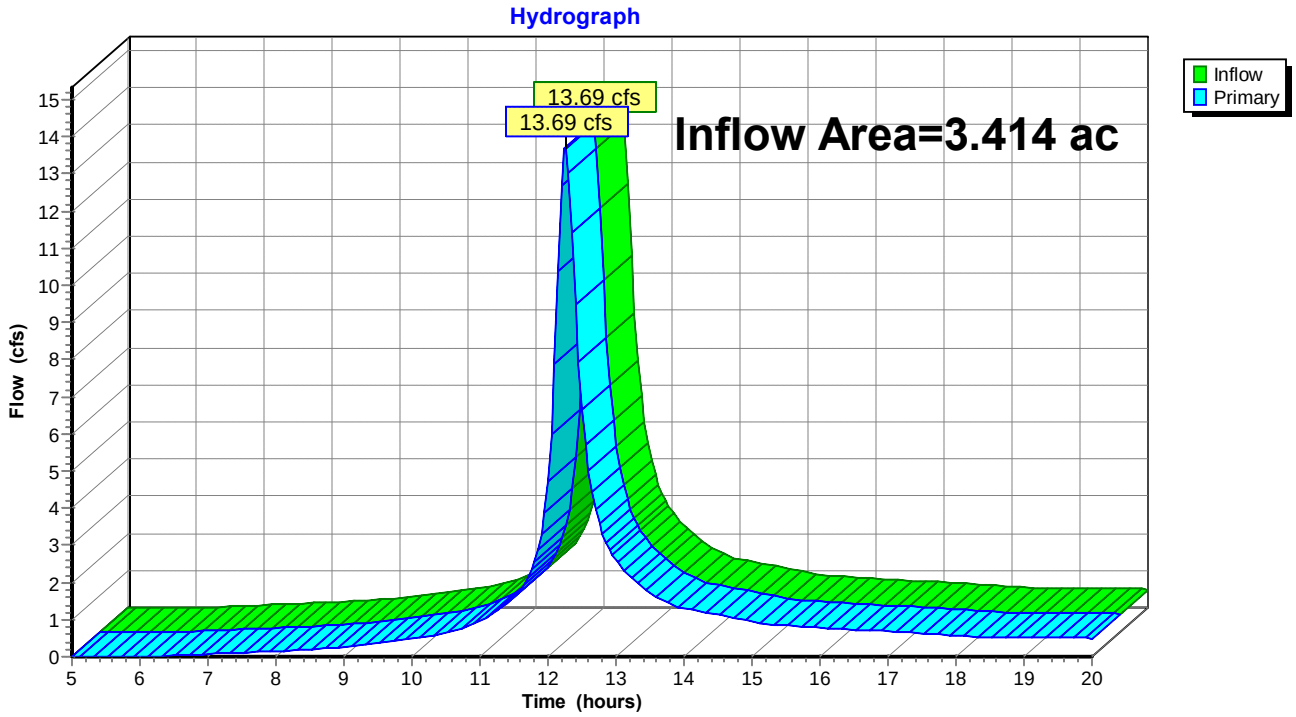


Summary for Link B: b

Inflow Area = 3.414 ac, 0.00% Impervious, Inflow Depth > 4.74" for 100-Year event
Inflow = 13.69 cfs @ 12.26 hrs, Volume= 1.350 af
Primary = 13.69 cfs @ 12.26 hrs, Volume= 1.350 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link B: b

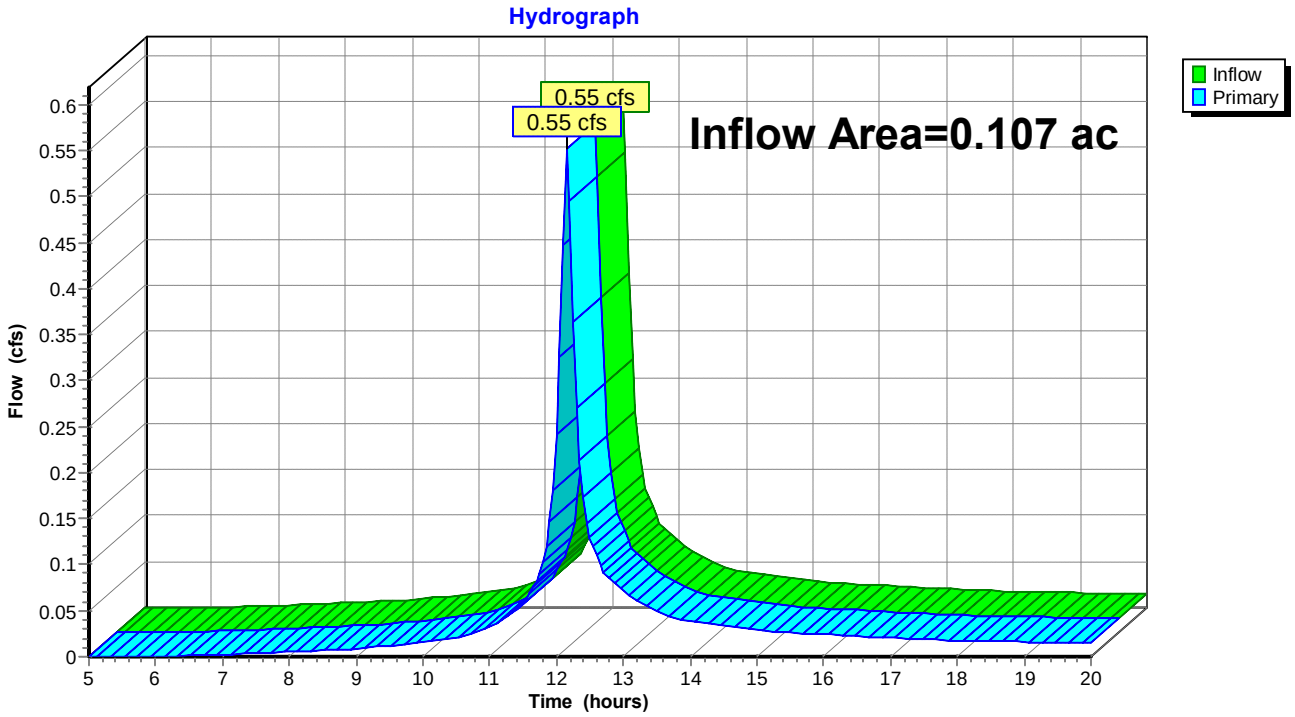


Summary for Link C: C

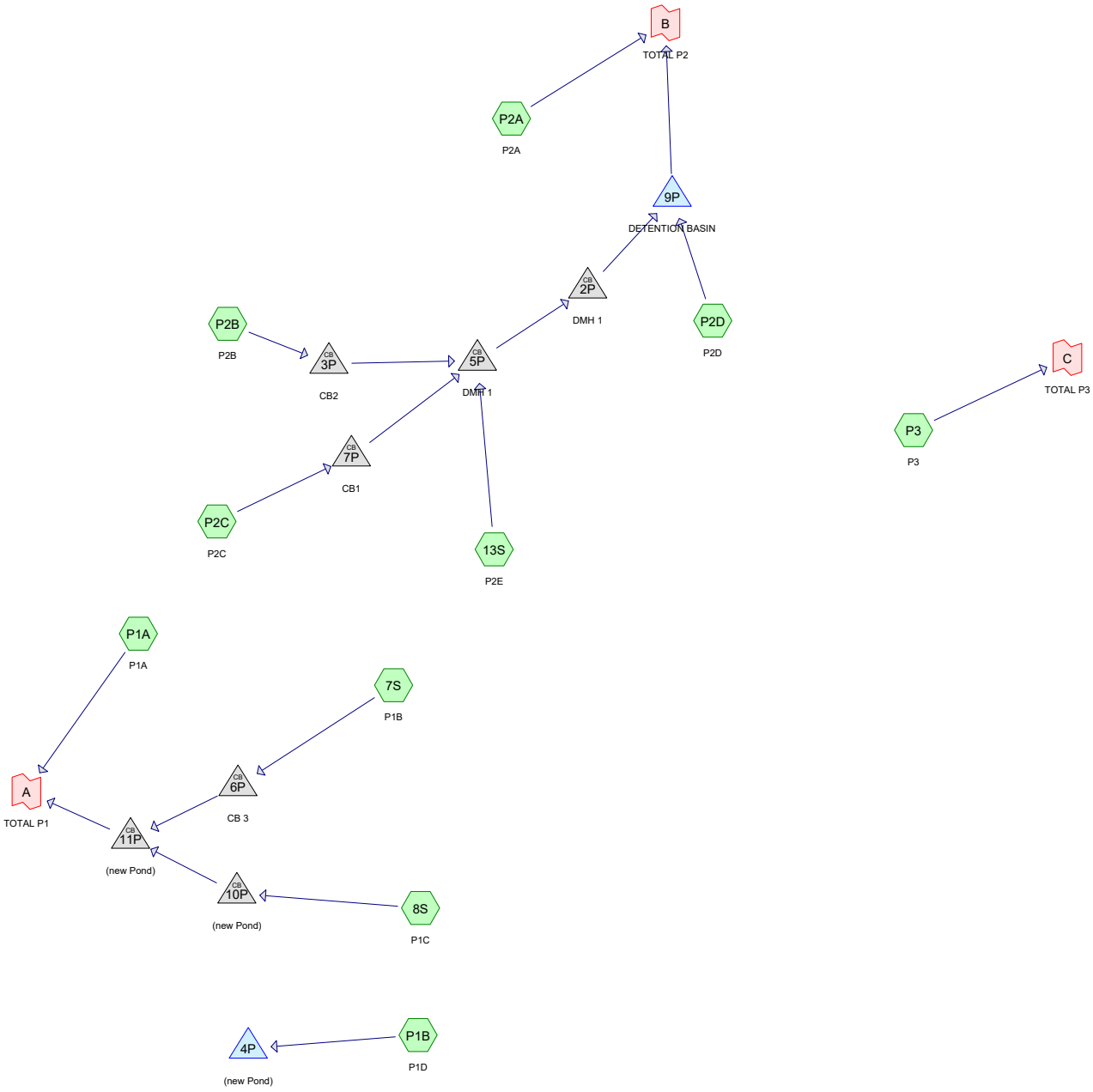
Inflow Area = 0.107 ac, 0.00% Impervious, Inflow Depth > 4.76" for 100-Year event
Inflow = 0.55 cfs @ 12.16 hrs, Volume= 0.042 af
Primary = 0.55 cfs @ 12.16 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link C: C



d. Proposed Conditions HydroCAD Report



Routing Diagram for POST Dev 2-9-22
Prepared by Millennium Engineering, Inc., Printed 3/2/2022

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.883	74	>75% Grass cover, Good, HSG C (7S, 8S, P1A, P2A, P2B, P2C, P2D)
0.407	98	Paved parking, HSG C (7S, 8S, P1A, P2B, P2C)
0.202	98	Roofs, HSG C (13S, P1B, P2D)
1.381	70	Woods, Good, HSG C (P1A, P2A, P2C, P2D, P3)
4.872	**76**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
4.872	HSG C	7S, 8S, 13S, P1A, P1B, P2A, P2B, P2C, P2D, P3
0.000	HSG D	
0.000	Other	
4.872		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	2.883	0.000	0.000	2.883	>75% Grass cover, Good	7S, 8S, P1A, P2A, P2B, P2C, P2D
0.000	0.000	0.407	0.000	0.000	0.407	Paved parking	7S, 8S, P1A, P2B, P2C
0.000	0.000	0.202	0.000	0.000	0.202	Roofs	13S, P1B, P2D
0.000	0.000	1.381	0.000	0.000	1.381	Woods, Good	P1A, P2A, P2C, P2D, P3
0.000	**0.000**	**4.872**	**0.000**	**0.000**	**4.872**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 7S: P1B Runoff Area=7,552 sf 26.68% Impervious Runoff Depth>1.21"
Tc=6.0 min CN=80 Runoff=0.25 cfs 0.017 af

Subcatchment 8S: P1C Runoff Area=5,004 sf 21.24% Impervious Runoff Depth>1.15"
Tc=6.0 min CN=79 Runoff=0.16 cfs 0.011 af

Subcatchment 13S: P2E Runoff Area=1,614 sf 100.00% Impervious Runoff Depth>2.60"
Tc=0.0 min CN=98 Runoff=0.12 cfs 0.008 af

Subcatchment P1A: P1A Runoff Area=23,438 sf 1.11% Impervious Runoff Depth>0.87"
Tc=6.0 min CN=74 Runoff=0.57 cfs 0.039 af

Subcatchment P1B: P1D Runoff Area=2,400 sf 100.00% Impervious Runoff Depth>2.60"
Tc=6.0 min CN=98 Runoff=0.15 cfs 0.012 af

Subcatchment P2A: P2A Runoff Area=63,576 sf 0.00% Impervious Runoff Depth>0.73"
Flow Length=469' Tc=9.4 min CN=71 Runoff=1.08 cfs 0.088 af

Subcatchment P2B: P2B Runoff Area=16,517 sf 33.23% Impervious Runoff Depth>1.33"
Tc=6.0 min CN=82 Runoff=0.61 cfs 0.042 af

Subcatchment P2C: P2C Runoff Area=41,666 sf 21.32% Impervious Runoff Depth>1.15"
Tc=6.0 min CN=79 Runoff=1.33 cfs 0.091 af

Subcatchment P2D: P2D Runoff Area=45,818 sf 10.48% Impervious Runoff Depth>0.98"
Flow Length=174' Slope=0.0570 '/' Tc=8.7 min CN=76 Runoff=1.13 cfs 0.085 af

Subcatchment P3: P3 Runoff Area=4,653 sf 0.00% Impervious Runoff Depth>0.68"
Flow Length=174' Slope=0.0570 '/' Tc=8.7 min CN=70 Runoff=0.08 cfs 0.006 af

Pond 2P: DMH 1 Peak Elev=179.23' Inflow=1.99 cfs 0.142 af
12.0" Round Culvert n=0.011 L=118.3' S=0.0080 '/' Outflow=1.99 cfs 0.142 af

Pond 3P: CB2 Peak Elev=180.33' Inflow=0.61 cfs 0.042 af
12.0" Round Culvert n=0.010 L=13.5' S=0.0074 '/' Outflow=0.61 cfs 0.042 af

Pond 4P: (new Pond) Peak Elev=183.19' Storage=176 cf Inflow=0.15 cfs 0.012 af
Outflow=0.02 cfs 0.012 af

Pond 5P: DMH 1 Peak Elev=180.53' Inflow=1.99 cfs 0.142 af
12.0" Round Culvert n=0.012 L=222.0' S=0.0050 '/' Outflow=1.99 cfs 0.142 af

Pond 6P: CB 3 Peak Elev=178.27' Inflow=0.25 cfs 0.017 af
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=0.25 cfs 0.017 af

Pond 7P: CB1 Peak Elev=180.61' Inflow=1.33 cfs 0.091 af
12.0" Round Culvert n=0.010 L=13.5' S=0.0074 '/' Outflow=1.33 cfs 0.091 af

Pond 9P: DETENTION BASIN Peak Elev=179.18' Storage=4,090 cf Inflow=3.07 cfs 0.227 af
Discarded=0.12 cfs 0.071 af Primary=0.49 cfs 0.089 af Outflow=0.62 cfs 0.160 af

Pond 10P: (new Pond) Peak Elev=178.21' Inflow=0.16 cfs 0.011 af
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=0.16 cfs 0.011 af

Pond 11P: (new Pond) Peak Elev=178.12' Inflow=0.41 cfs 0.028 af
12.0" Round Culvert n=0.011 L=10.0' S=0.0300 '/' Outflow=0.41 cfs 0.028 af

Link A: TOTAL P1 Inflow=0.98 cfs 0.068 af
Primary=0.98 cfs 0.068 af

Link B: TOTAL P2 Inflow=1.15 cfs 0.177 af
Primary=1.15 cfs 0.177 af

Link C: TOTAL P3 Inflow=0.08 cfs 0.006 af
Primary=0.08 cfs 0.006 af

Total Runoff Area = 4.872 ac Runoff Volume = 0.401 af Average Runoff Depth = 0.99"
87.50% Pervious = 4.263 ac 12.50% Impervious = 0.609 ac

Summary for Subcatchment 7S: P1B

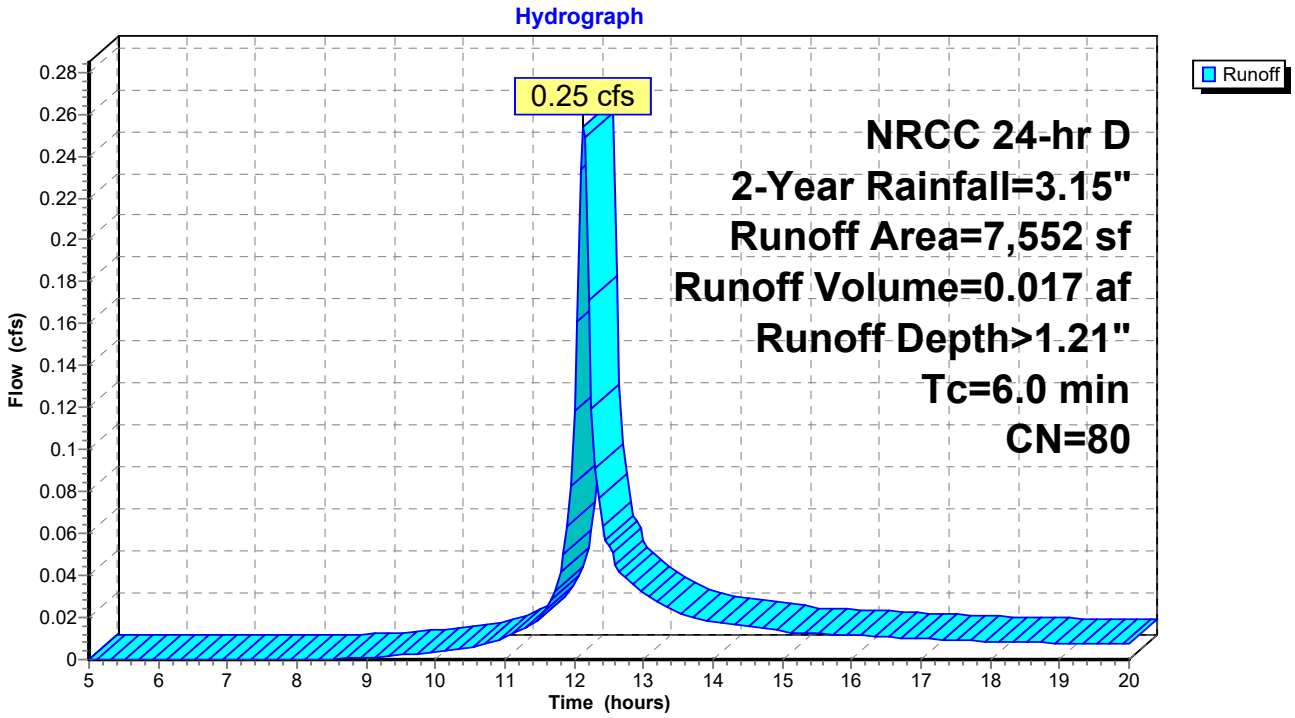
Runoff = 0.25 cfs @ 12.13 hrs, Volume= 0.017 af, Depth> 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
2,015	98	Paved parking, HSG C
5,537	74	>75% Grass cover, Good, HSG C
7,552	80	Weighted Average
5,537		73.32% Pervious Area
2,015		26.68% Impervious Area

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

Subcatchment 7S: P1B



Summary for Subcatchment 8S: P1C

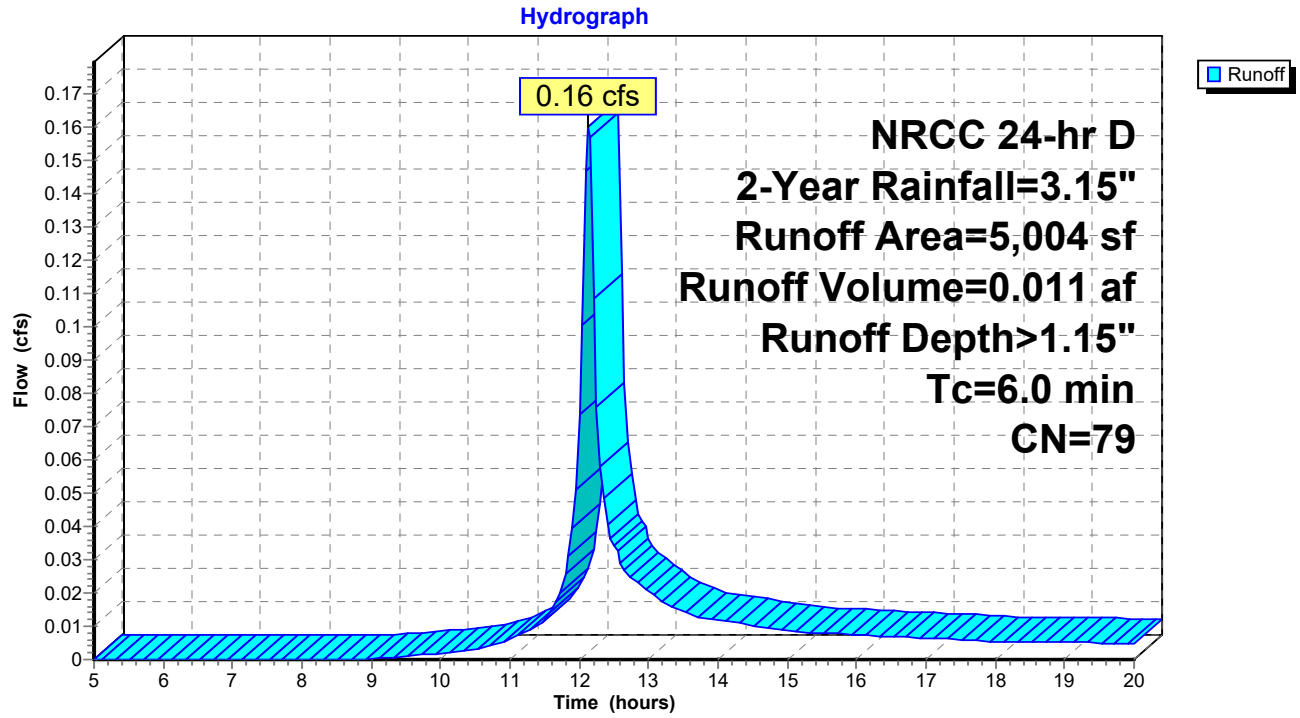
Runoff = 0.16 cfs @ 12.13 hrs, Volume= 0.011 af, Depth> 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
1,063	98	Paved parking, HSG C
3,941	74	>75% Grass cover, Good, HSG C
5,004	79	Weighted Average
3,941		78.76% Pervious Area
1,063		21.24% Impervious Area

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

Subcatchment 8S: P1C



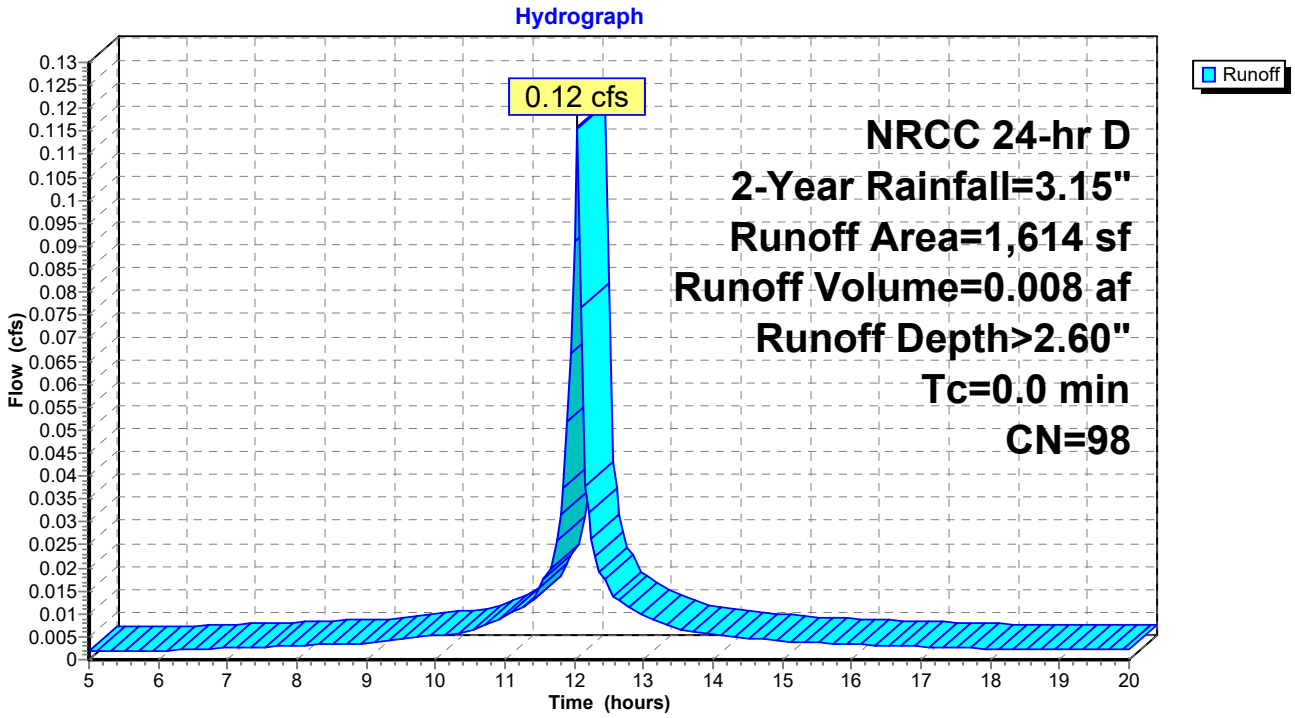
Summary for Subcatchment 13S: P2E

Runoff = 0.12 cfs @ 12.04 hrs, Volume= 0.008 af, Depth> 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
1,614	98	Roofs, HSG C
1,614		100.00% Impervious Area

Subcatchment 13S: P2E



Summary for Subcatchment P1A: P1A

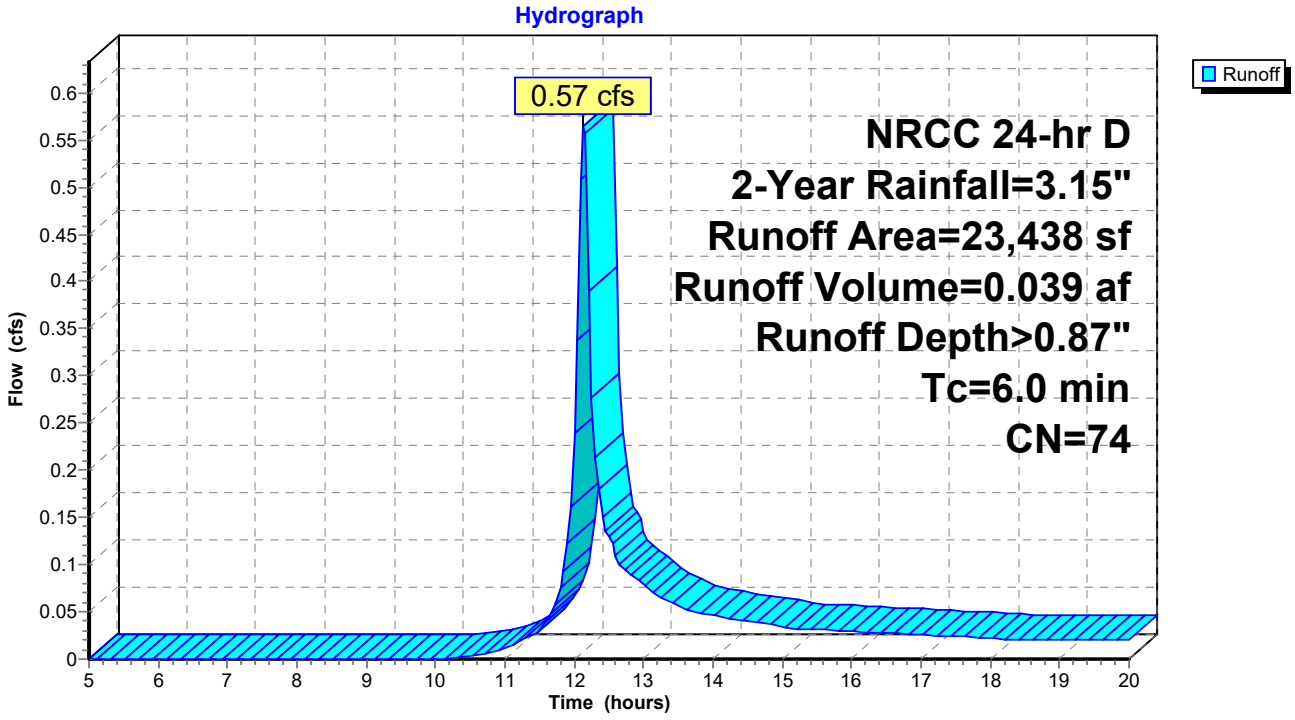
Runoff = 0.57 cfs @ 12.14 hrs, Volume= 0.039 af, Depth> 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
22,750	74	>75% Grass cover, Good, HSG C
261	98	Paved parking, HSG C
427	70	Woods, Good, HSG C
23,438	74	Weighted Average
23,177		98.89% Pervious Area
261		1.11% Impervious Area

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

Subcatchment P1A: P1A



Summary for Subcatchment P1B: P1D

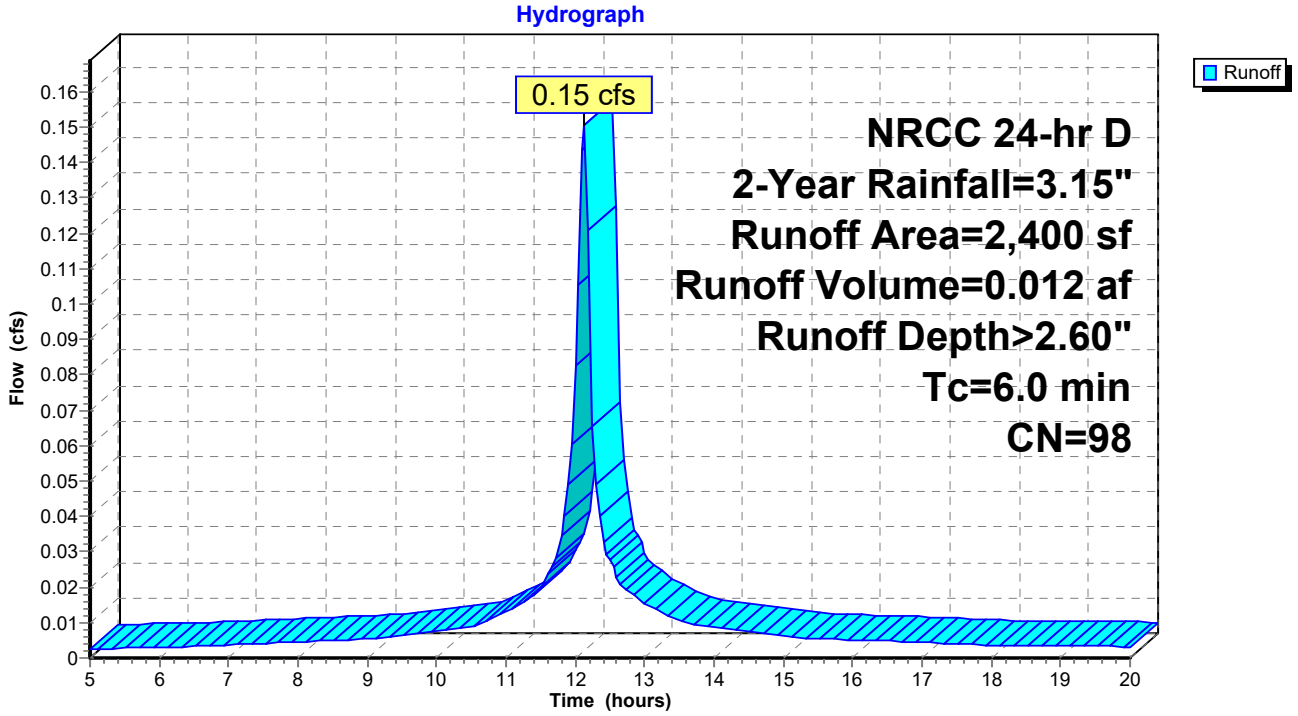
Runoff = 0.15 cfs @ 12.13 hrs, Volume= 0.012 af, Depth> 2.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
2,400	98	Roofs, HSG C
2,400		100.00% Impervious Area

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

Subcatchment P1B: P1D



Summary for Subcatchment P2A: P2A

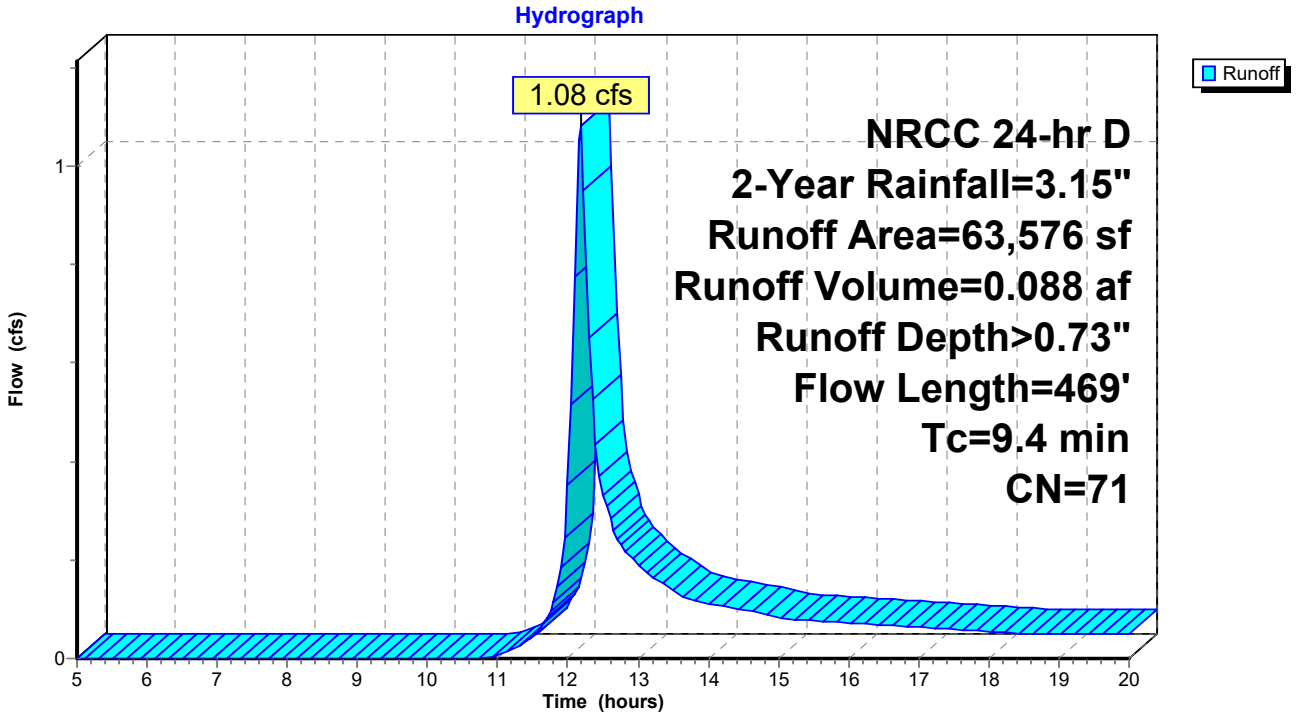
Runoff = 1.08 cfs @ 12.18 hrs, Volume= 0.088 af, Depth> 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
41,098	70	Woods, Good, HSG C
22,478	74	>75% Grass cover, Good, HSG C
63,576	71	Weighted Average
63,576		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.1	66	0.0430	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	85	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.7	87	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	44	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.3	137	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.4	469	Total			

Subcatchment P2A: P2A



Summary for Subcatchment P2B: P2B

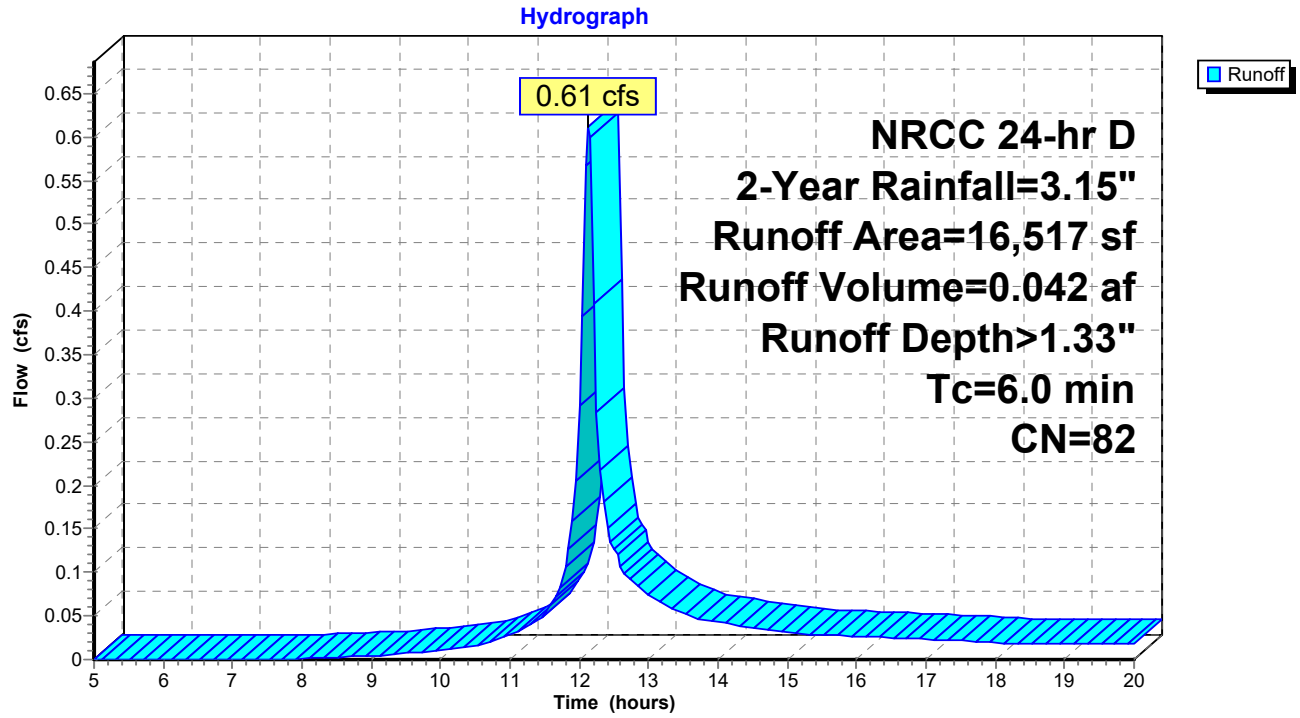
Runoff = 0.61 cfs @ 12.13 hrs, Volume= 0.042 af, Depth> 1.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
5,489	98	Paved parking, HSG C
11,028	74	>75% Grass cover, Good, HSG C
16,517	82	Weighted Average
11,028		66.77% Pervious Area
5,489		33.23% Impervious Area

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

Subcatchment P2B: P2B



Summary for Subcatchment P2C: P2C

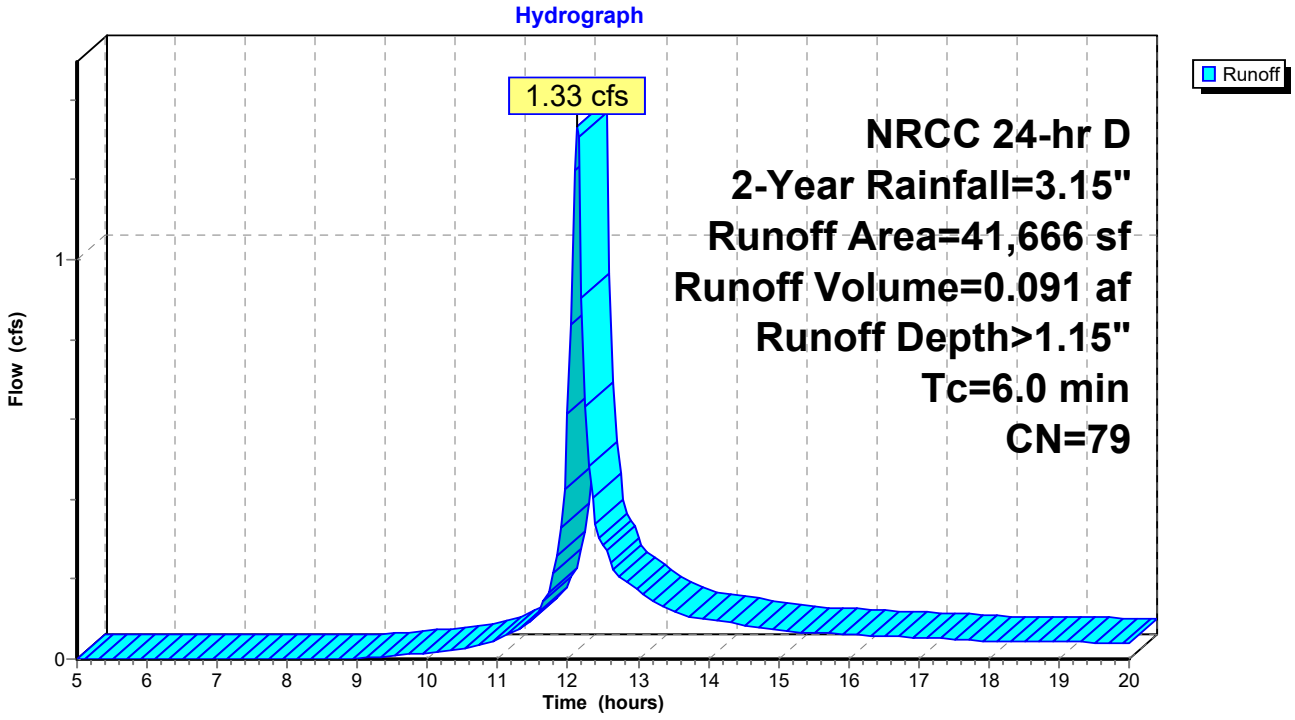
Runoff = 1.33 cfs @ 12.13 hrs, Volume= 0.091 af, Depth> 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
8,883	98	Paved parking, HSG C
29,830	74	>75% Grass cover, Good, HSG C
2,953	70	Woods, Good, HSG C
41,666	79	Weighted Average
32,783		78.68% Pervious Area
8,883		21.32% Impervious Area

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

Subcatchment P2C: P2C



Summary for Subcatchment P2D: P2D

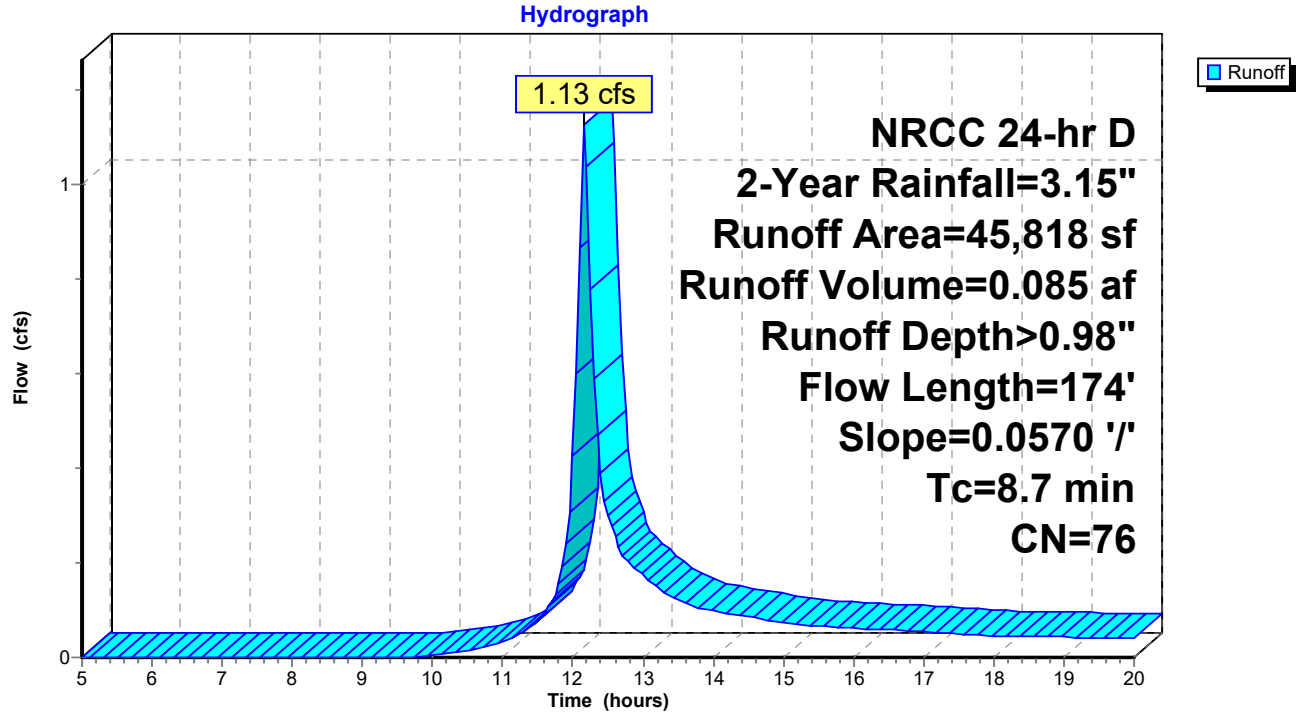
Runoff = 1.13 cfs @ 12.16 hrs, Volume= 0.085 af, Depth> 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
4,800	98	Roofs, HSG C
30,008	74	>75% Grass cover, Good, HSG C
11,010	70	Woods, Good, HSG C
45,818	76	Weighted Average
41,018		89.52% Pervious Area
4,800		10.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	124	0.0570	3.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	174	Total			

Subcatchment P2D: P2D



Summary for Subcatchment P3: P3

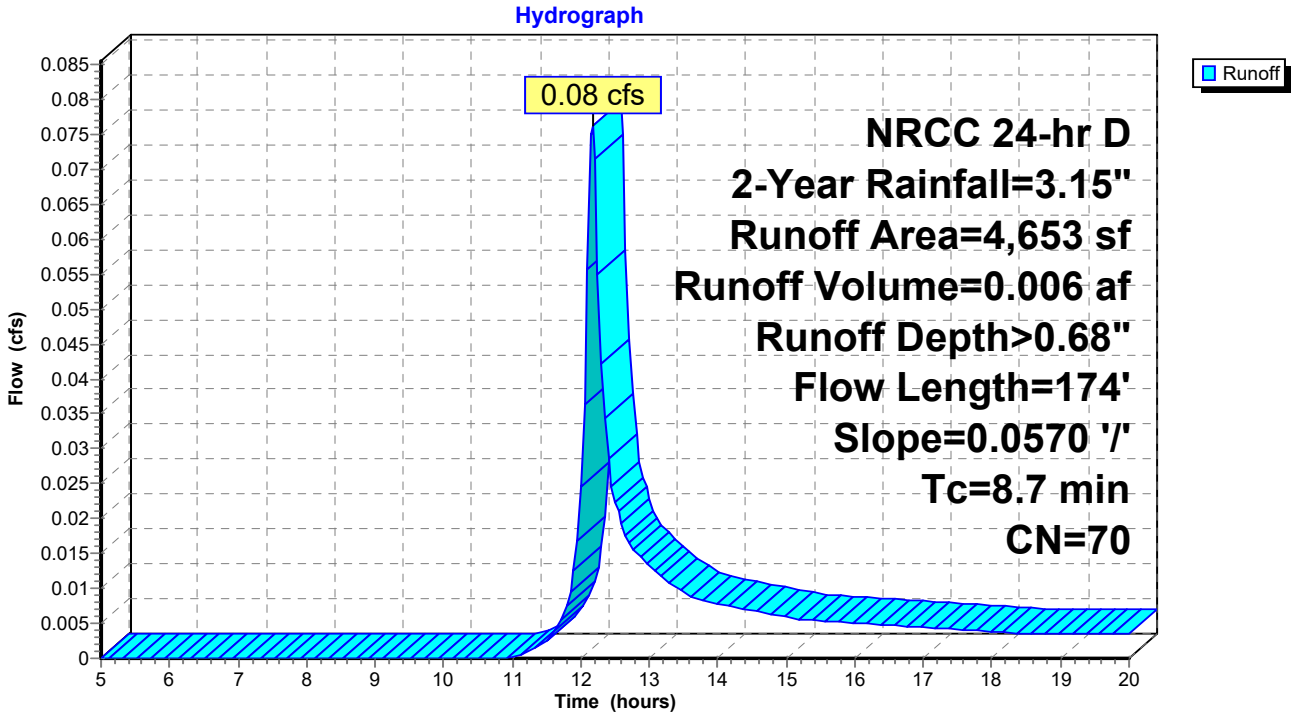
Runoff = 0.08 cfs @ 12.17 hrs, Volume= 0.006 af, Depth> 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
4,653	70	Woods, Good, HSG C
4,653		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	124	0.0570	3.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	174	Total			

Subcatchment P3: P3



Summary for Pond 2P: DMH 1

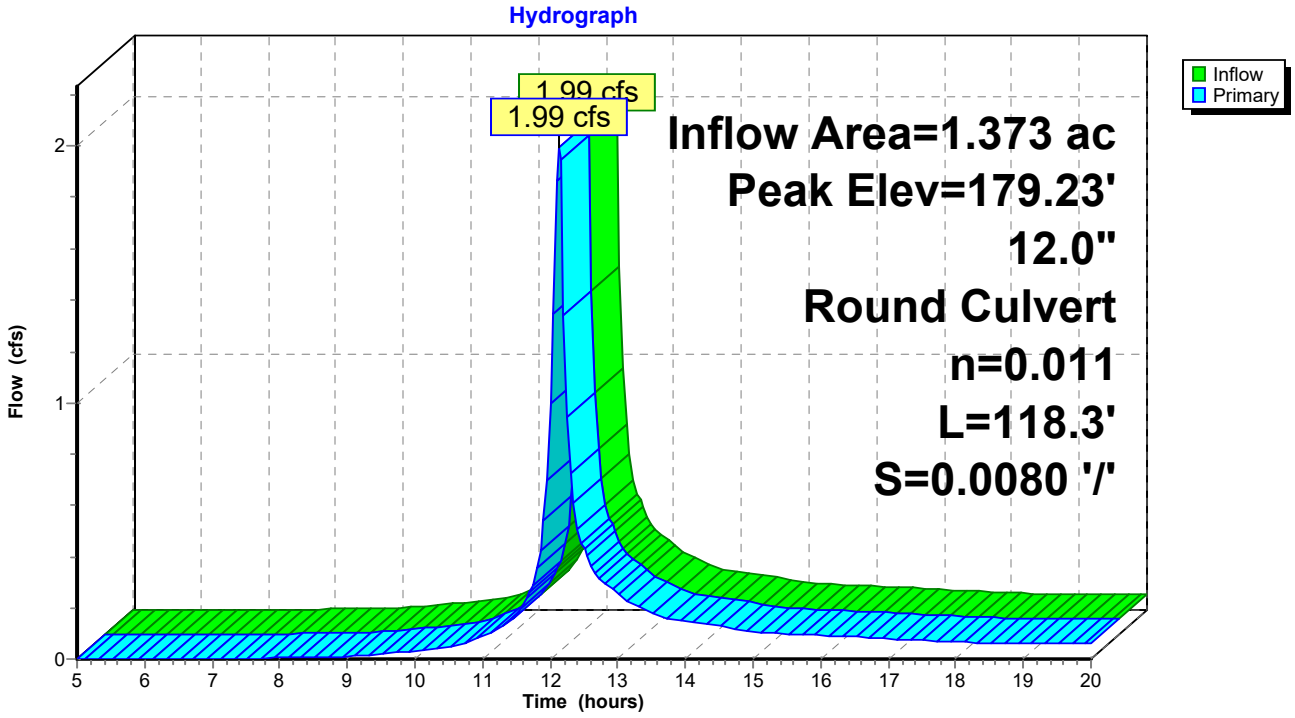
Inflow Area = 1.373 ac, 26.73% Impervious, Inflow Depth > 1.24" for 2-Year event
Inflow = 1.99 cfs @ 12.13 hrs, Volume= 0.142 af
Outflow = 1.99 cfs @ 12.13 hrs, Volume= 0.142 af, Atten= 0%, Lag= 0.0 min
Primary = 1.99 cfs @ 12.13 hrs, Volume= 0.142 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 179.23' @ 12.13 hrs
Flood Elev= 182.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	178.45'	**12.0" Round Culvert** L= 118.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 178.45' / 177.50' S= 0.0080 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=1.91 cfs @ 12.13 hrs HW=179.21' (Free Discharge)
1=Culvert (Inlet Controls 1.91 cfs @ 2.97 fps)

Pond 2P: DMH 1



Summary for Pond 3P: CB2

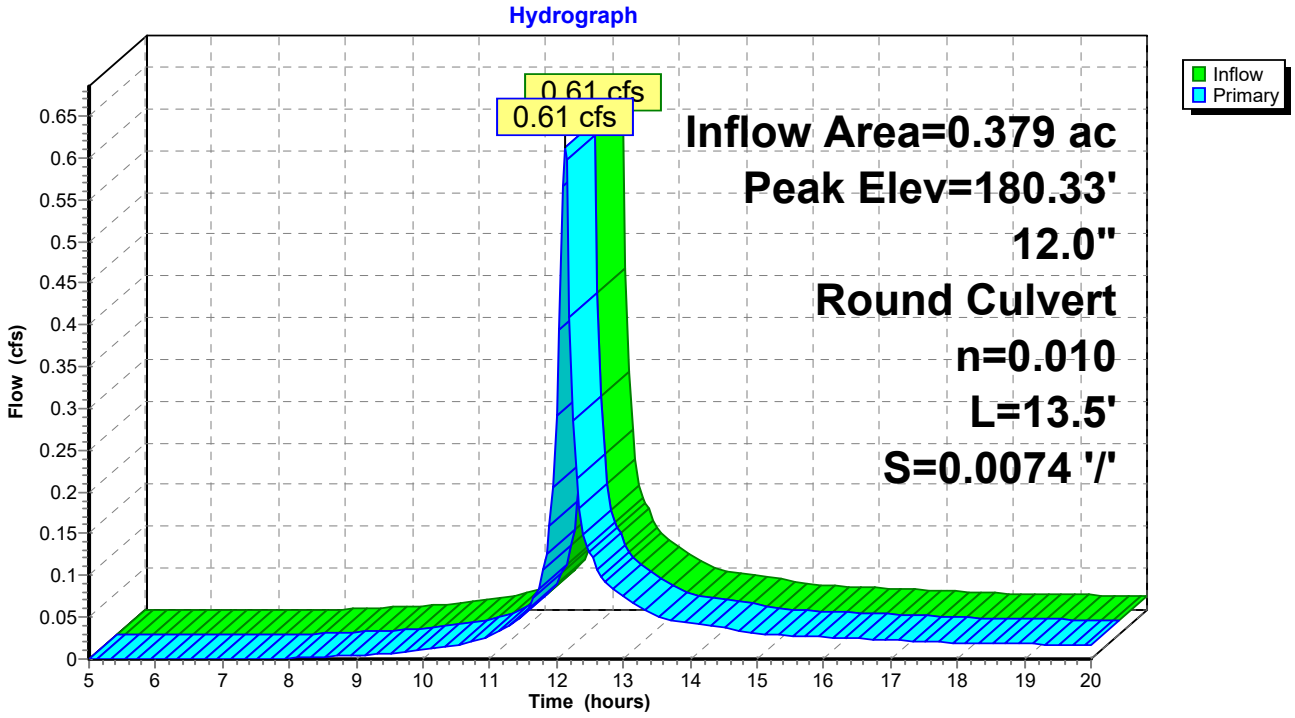
Inflow Area = 0.379 ac, 33.23% Impervious, Inflow Depth > 1.33" for 2-Year event
Inflow = 0.61 cfs @ 12.13 hrs, Volume= 0.042 af
Outflow = 0.61 cfs @ 12.13 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min
Primary = 0.61 cfs @ 12.13 hrs, Volume= 0.042 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 180.33' @ 12.13 hrs
Flood Elev= 182.86'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.86'	**12.0" Round Culvert** L= 13.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 179.86' / 179.76' S= 0.0074 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.59 cfs @ 12.13 hrs HW=180.32' (Free Discharge)
1=Culvert (Barrel Controls 0.59 cfs @ 2.47 fps)

Pond 3P: CB2



Summary for Pond 4P: (new Pond)

Inflow Area = 0.055 ac,100.00% Impervious, Inflow Depth > 2.60" for 2-Year event
Inflow = 0.15 cfs @ 12.13 hrs, Volume= 0.012 af
Outflow = 0.02 cfs @ 13.02 hrs, Volume= 0.012 af, Atten= 90%, Lag= 53.9 min
Discarded = 0.02 cfs @ 13.02 hrs, Volume= 0.012 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 183.19' @ 13.02 hrs Surf.Area= 506 sf Storage= 176 cf

Plug-Flow detention time= 90.5 min calculated for 0.012 af (100% of inflow)
Center-of-Mass det. time= 88.5 min (828.3 - 739.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	182.50'	487 cf	**15.75'W x 32.10'L x 3.50'H Field A** 1,769 cf Overall - 551 cf Embedded = 1,218 cf x 40.0% Voids
#2A	183.00'	551 cf	**ADS_StormTech SC-740 +Cap** x 12 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 12 Chambers in 3 Rows
		1,038 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	182.50'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 180.00'

Discarded OutFlow Max=0.02 cfs @ 13.02 hrs HW=183.19' (Free Discharge)
↑**1=Exfiltration** (Controls 0.02 cfs)

Pond 4P: (new Pond) - Chamber Wizard Field A

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

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

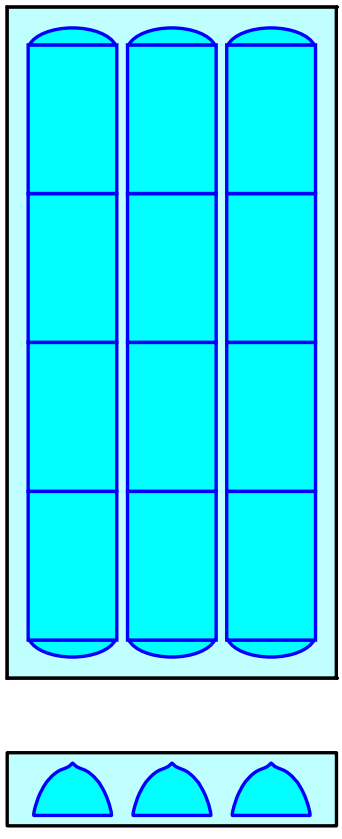
4 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 30.10' Row Length +12.0" End Stone x 2 = 32.10' Base Length
3 Rows x 51.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

12 Chambers x 45.9 cf = 551.3 cf Chamber Storage

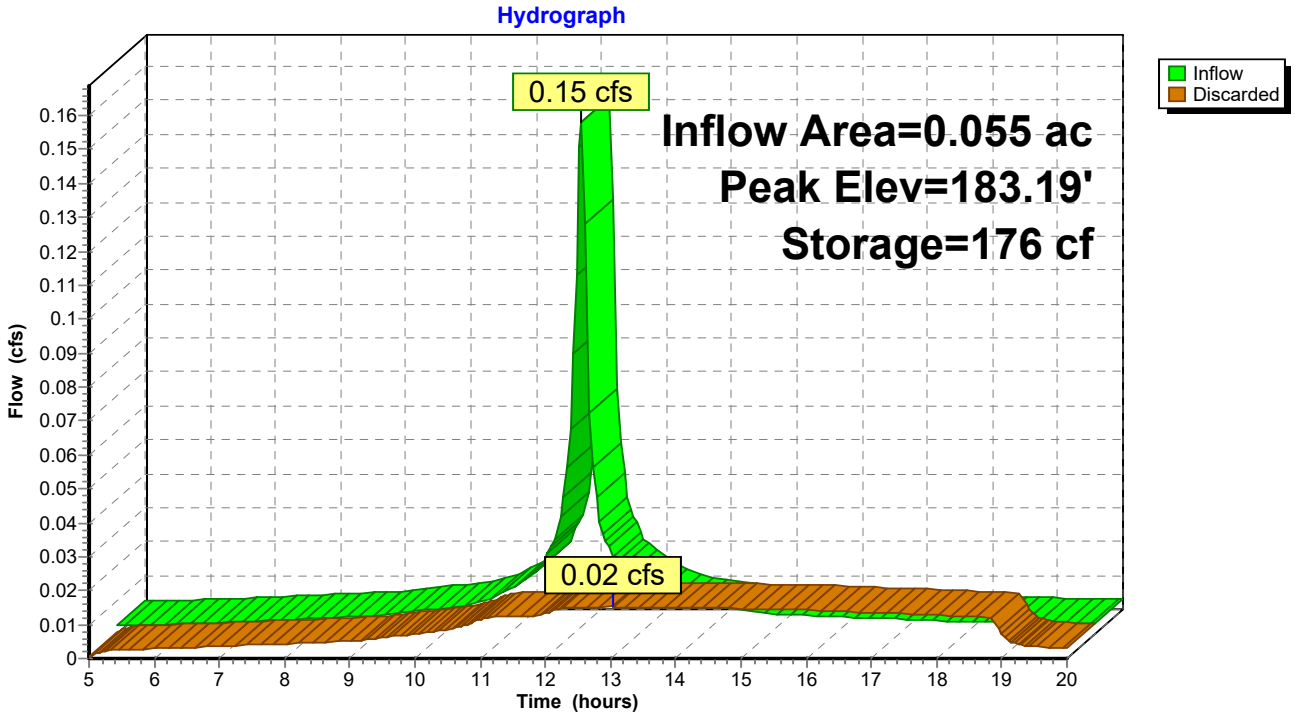
1,769.3 cf Field - 551.3 cf Chambers = 1,218.0 cf Stone x 40.0% Voids = 487.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,038.5 cf = 0.024 af
Overall Storage Efficiency = 58.7%
Overall System Size = 32.10' x 15.75' x 3.50'

12 Chambers
65.5 cy Field
45.1 cy Stone



Pond 4P: (new Pond)



Summary for Pond 5P: DMH 1

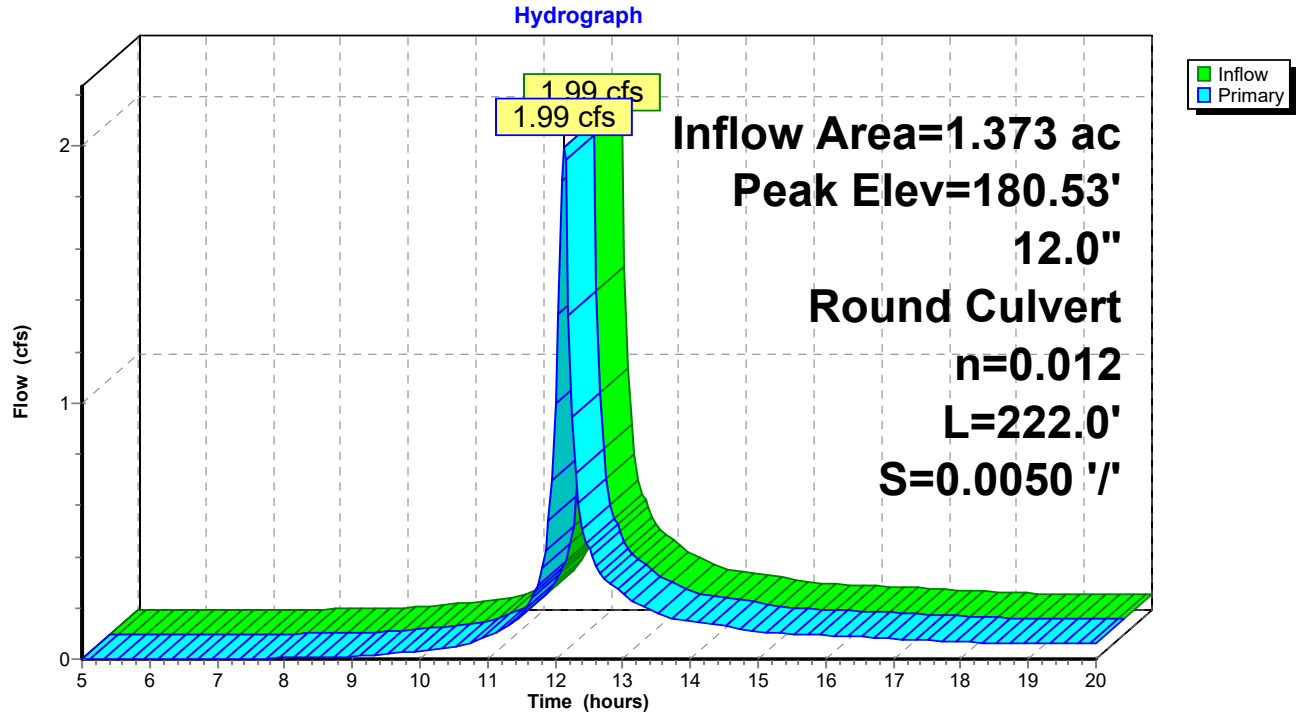
Inflow Area = 1.373 ac, 26.73% Impervious, Inflow Depth > 1.24" for 2-Year event
Inflow = 1.99 cfs @ 12.13 hrs, Volume= 0.142 af
Outflow = 1.99 cfs @ 12.13 hrs, Volume= 0.142 af, Atten= 0%, Lag= 0.0 min
Primary = 1.99 cfs @ 12.13 hrs, Volume= 0.142 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 180.53' @ 12.13 hrs
Flood Elev= 185.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.66'	**12.0" Round Culvert** L= 222.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 179.66' / 178.55' S= 0.0050 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary OutFlow Max=1.91 cfs @ 12.13 hrs HW=180.51' (Free Discharge)
1=Culvert (Barrel Controls 1.91 cfs @ 3.63 fps)

Pond 5P: DMH 1



Summary for Pond 6P: CB 3

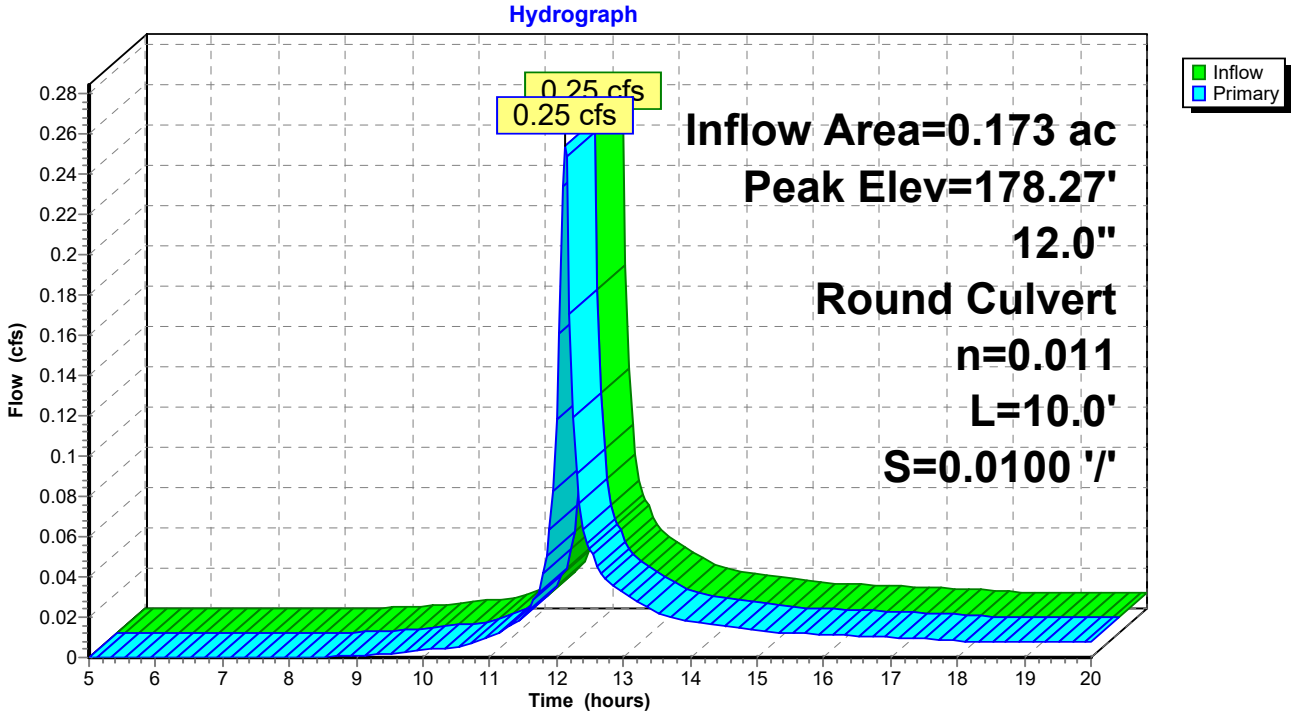
Inflow Area = 0.173 ac, 26.68% Impervious, Inflow Depth > 1.21" for 2-Year event
Inflow = 0.25 cfs @ 12.13 hrs, Volume= 0.017 af
Outflow = 0.25 cfs @ 12.13 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min
Primary = 0.25 cfs @ 12.13 hrs, Volume= 0.017 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 178.27' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	178.00'	**12.0" Round Culvert** L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 178.00' / 177.90' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.24 cfs @ 12.13 hrs HW=178.26' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.24 cfs @ 2.25 fps)

Pond 6P: CB 3



Summary for Pond 7P: CB1

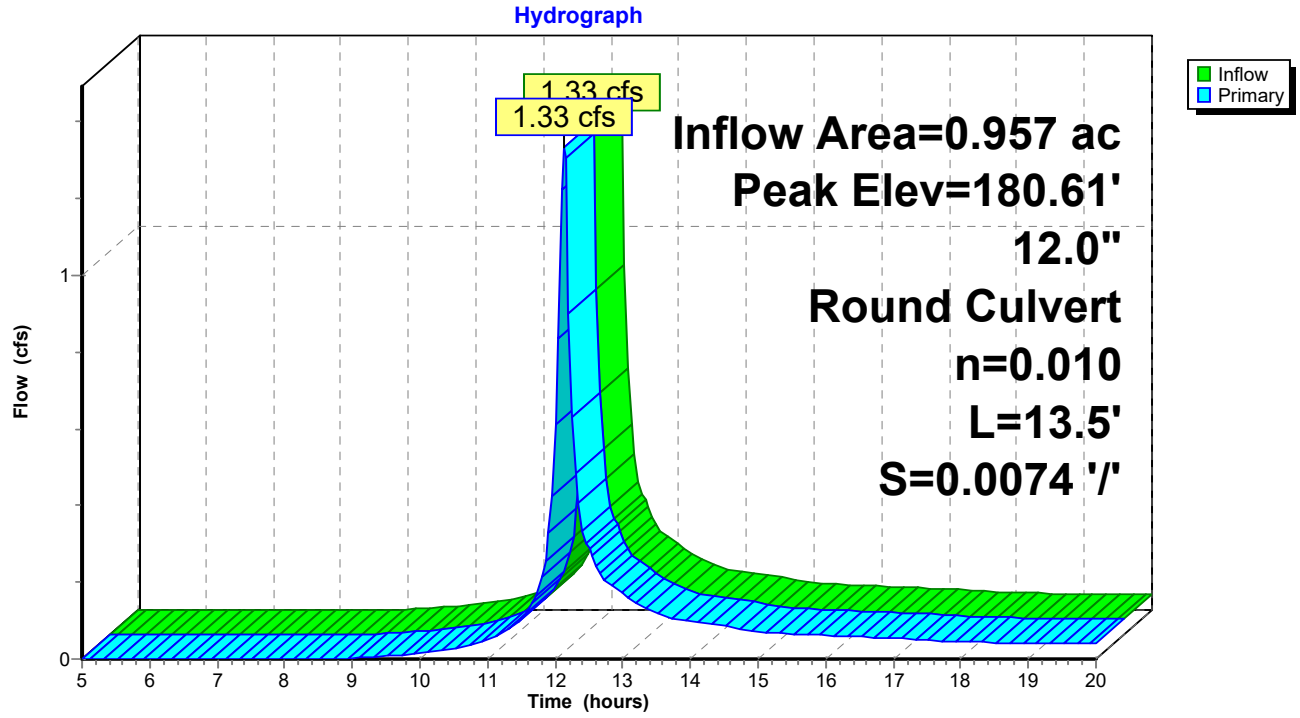
Inflow Area = 0.957 ac, 21.32% Impervious, Inflow Depth > 1.15" for 2-Year event
Inflow = 1.33 cfs @ 12.13 hrs, Volume= 0.091 af
Outflow = 1.33 cfs @ 12.13 hrs, Volume= 0.091 af, Atten= 0%, Lag= 0.0 min
Primary = 1.33 cfs @ 12.13 hrs, Volume= 0.091 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 180.61' @ 12.13 hrs
Flood Elev= 182.86'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.86'	**12.0" Round Culvert** L= 13.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 179.86' / 179.76' S= 0.0074 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.28 cfs @ 12.13 hrs HW=180.59' (Free Discharge)
1=Culvert (Barrel Controls 1.28 cfs @ 2.92 fps)

Pond 7P: CB1



Summary for Pond 9P: DETENTION BASIN

Inflow Area = 2.425 ac, 19.68% Impervious, Inflow Depth > 1.12" for 2-Year event
Inflow = 3.07 cfs @ 12.14 hrs, Volume= 0.227 af
Outflow = 0.62 cfs @ 12.60 hrs, Volume= 0.160 af, Atten= 80%, Lag= 27.7 min
Discarded = 0.12 cfs @ 12.60 hrs, Volume= 0.071 af
Primary = 0.49 cfs @ 12.60 hrs, Volume= 0.089 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 179.18' @ 12.60 hrs Surf.Area= 5,391 sf Storage= 4,090 cf

Plug-Flow detention time= 152.5 min calculated for 0.159 af (70% of inflow)
Center-of-Mass det. time= 74.8 min (891.1 - 816.4)

Volume	Invert	Avail.Storage	Storage Description
#1	177.50'	24,911 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

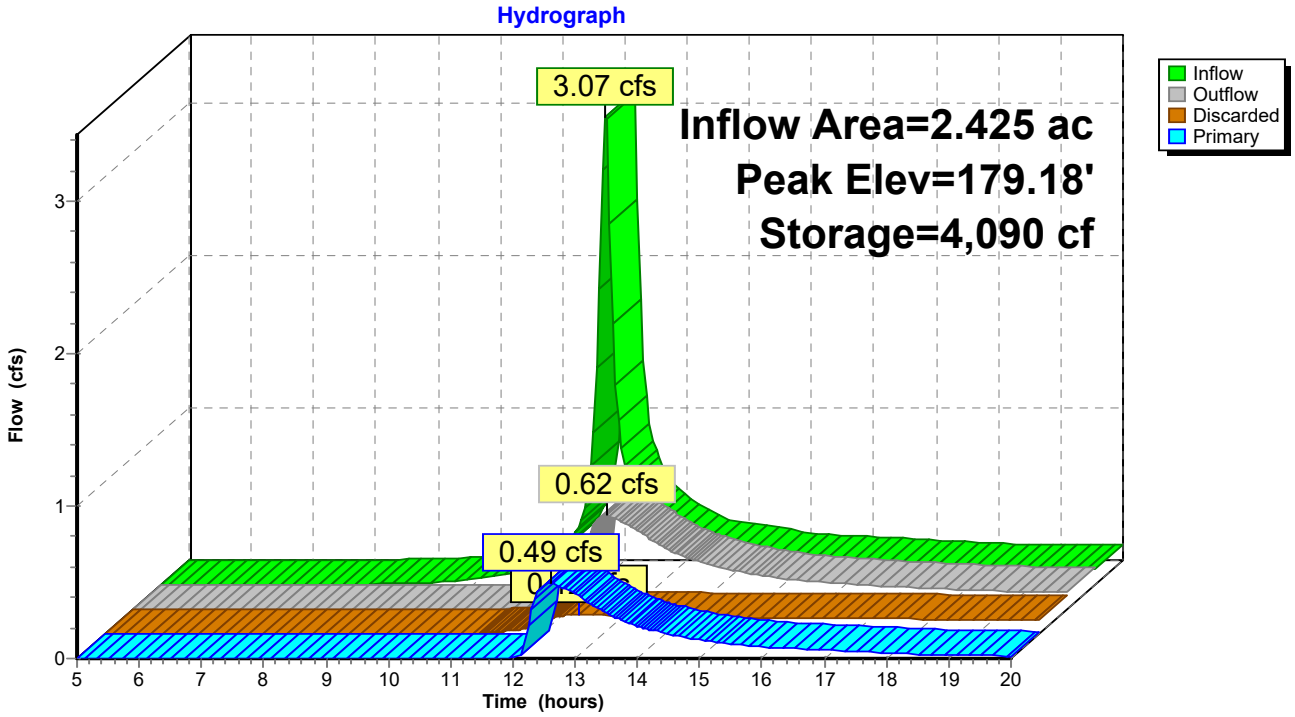
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
177.50	203	0	0
178.00	1,073	319	319
179.00	4,680	2,877	3,196
180.00	8,686	6,683	9,879
181.00	10,008	9,347	19,226
181.50	12,732	5,685	24,911

Device	Routing	Invert	Outlet Devices
#1	Primary	178.00'	**18.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 178.00' / 176.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Primary	181.00'	**6.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Device 1	178.90'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	178.90'	**8.0" Vert. Orifice/Grate** C= 0.600
#5	Device 1	179.90'	**24.0" W x 24.0" H Vert. Orifice/Grate** C= 0.600
#6	Discarded	178.00'	**1.020 in/hr Exfiltration over Surface area above 178.00'** Conductivity to Groundwater Elevation = 175.80' Excluded Surface area = 1,073 sf

Discarded OutFlow Max=0.12 cfs @ 12.60 hrs HW=179.18' (Free Discharge)
└**6=Exfiltration** (Controls 0.12 cfs)

Primary OutFlow Max=0.49 cfs @ 12.60 hrs HW=179.18' (Free Discharge)
└**1=Culvert** (Passes 0.49 cfs of 4.34 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 0.25 cfs @ 1.79 fps)
  └**4=Orifice/Grate** (Orifice Controls 0.25 cfs @ 1.79 fps)
  └**5=Orifice/Grate** (Controls 0.00 cfs)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 9P: DETENTION BASIN



Summary for Pond 10P: (new Pond)

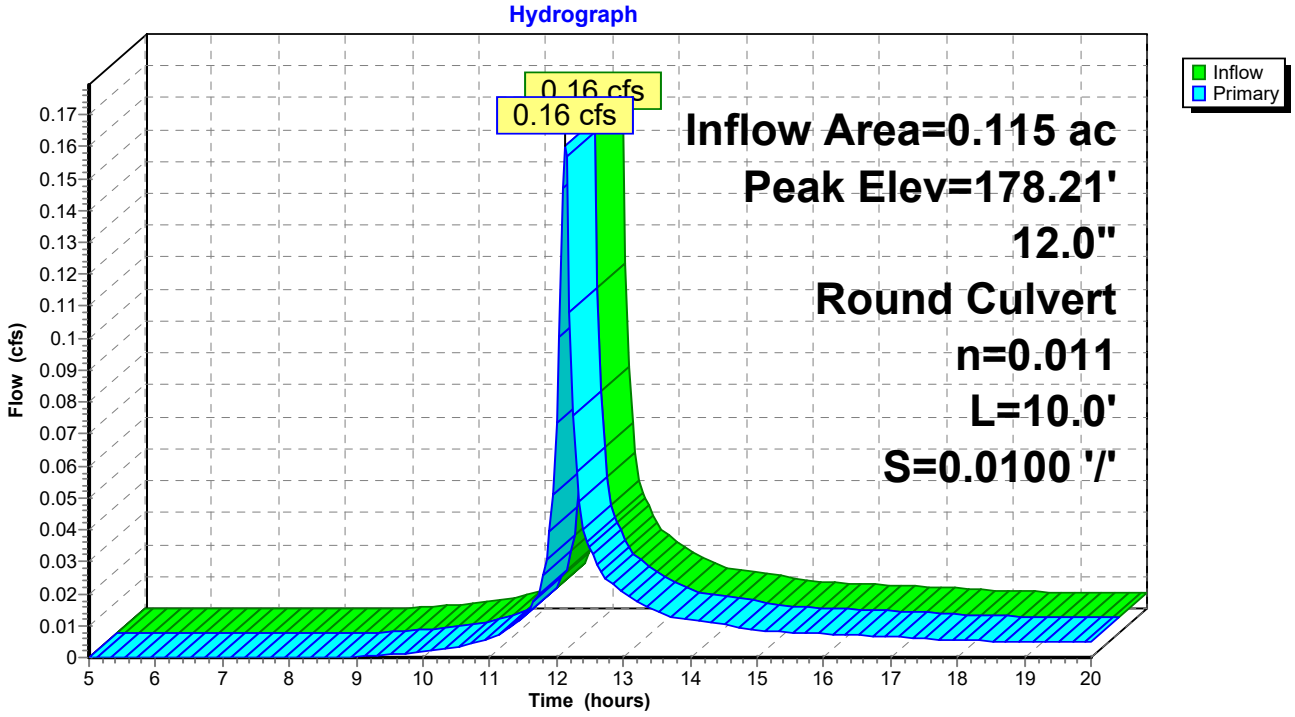
Inflow Area = 0.115 ac, 21.24% Impervious, Inflow Depth > 1.15" for 2-Year event
Inflow = 0.16 cfs @ 12.13 hrs, Volume= 0.011 af
Outflow = 0.16 cfs @ 12.13 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min
Primary = 0.16 cfs @ 12.13 hrs, Volume= 0.011 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 178.21' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	178.00'	**12.0" Round Culvert** L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 178.00' / 177.90' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.15 cfs @ 12.13 hrs HW=178.20' (Free Discharge)
1=Culvert (Barrel Controls 0.15 cfs @ 2.04 fps)

Pond 10P: (new Pond)



Summary for Pond 11P: (new Pond)

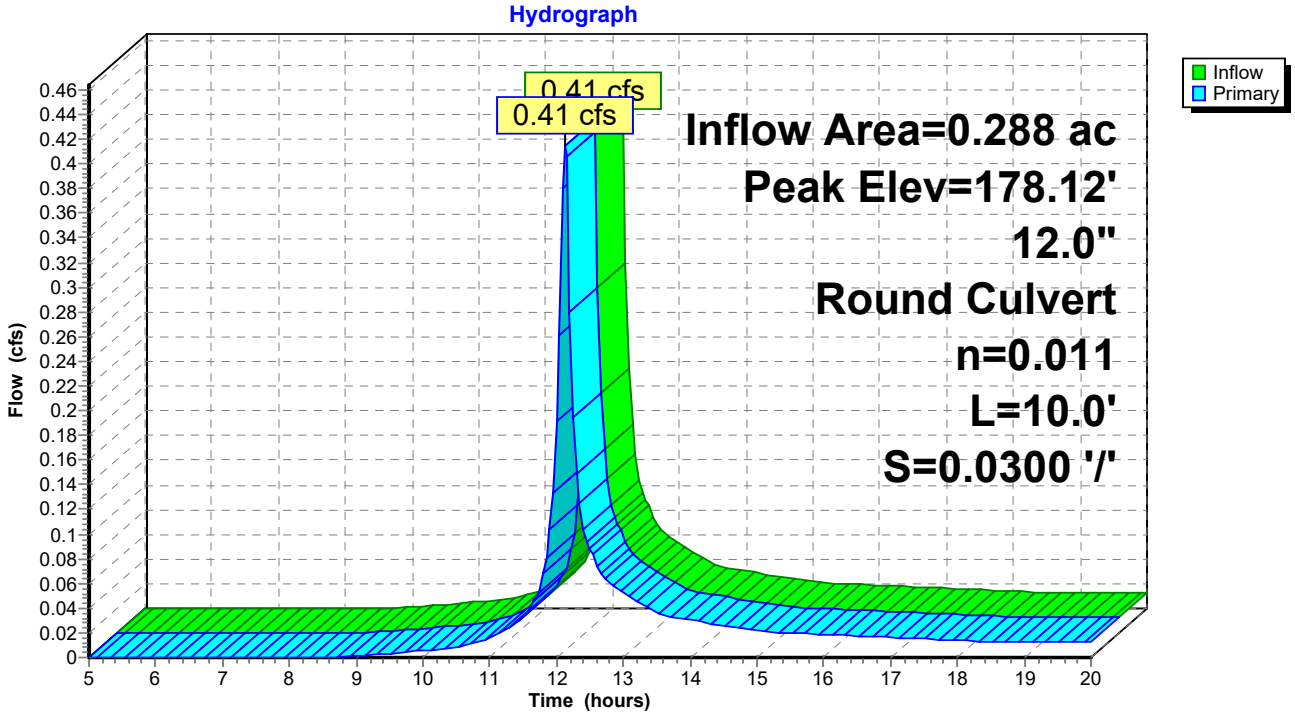
Inflow Area = 0.288 ac, 24.51% Impervious, Inflow Depth > 1.18" for 2-Year event
Inflow = 0.41 cfs @ 12.13 hrs, Volume= 0.028 af
Outflow = 0.41 cfs @ 12.13 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min
Primary = 0.41 cfs @ 12.13 hrs, Volume= 0.028 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 178.12' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	177.80'	**12.0" Round Culvert** L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 177.80' / 177.50' S= 0.0300 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.40 cfs @ 12.13 hrs HW=178.11' (Free Discharge)
1=Culvert (Inlet Controls 0.40 cfs @ 1.90 fps)

Pond 11P: (new Pond)

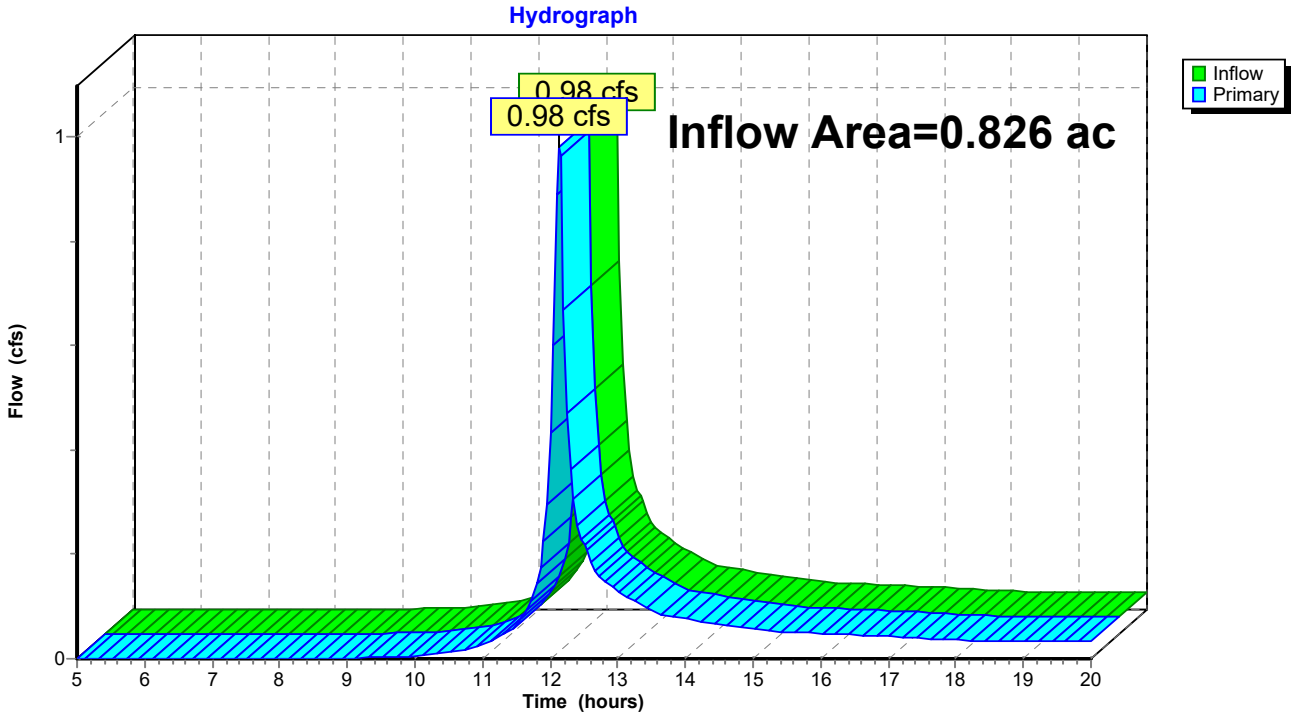


Summary for Link A: TOTAL P1

Inflow Area = 0.826 ac, 9.28% Impervious, Inflow Depth > 0.98" for 2-Year event
Inflow = 0.98 cfs @ 12.13 hrs, Volume= 0.068 af
Primary = 0.98 cfs @ 12.13 hrs, Volume= 0.068 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link A: TOTAL P1

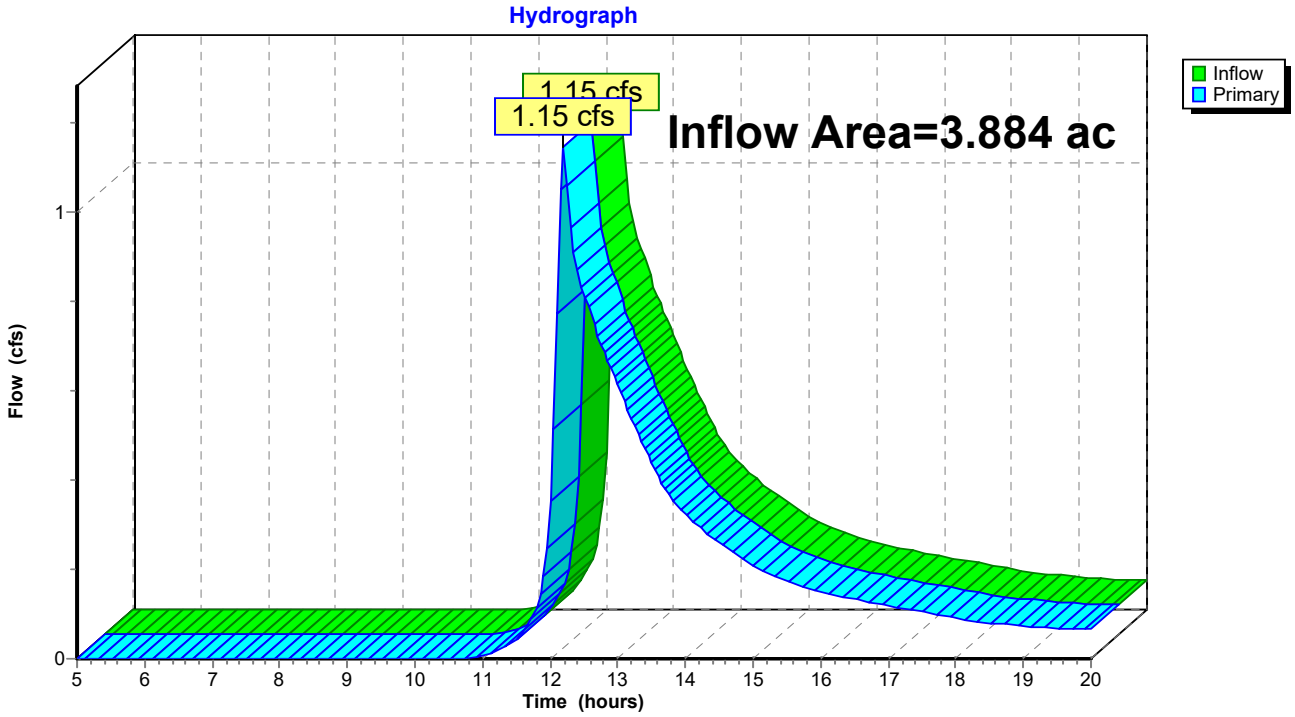


Summary for Link B: TOTAL P2

Inflow Area = 3.884 ac, 12.29% Impervious, Inflow Depth > 0.55" for 2-Year event
Inflow = 1.15 cfs @ 12.20 hrs, Volume= 0.177 af
Primary = 1.15 cfs @ 12.20 hrs, Volume= 0.177 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link B: TOTAL P2

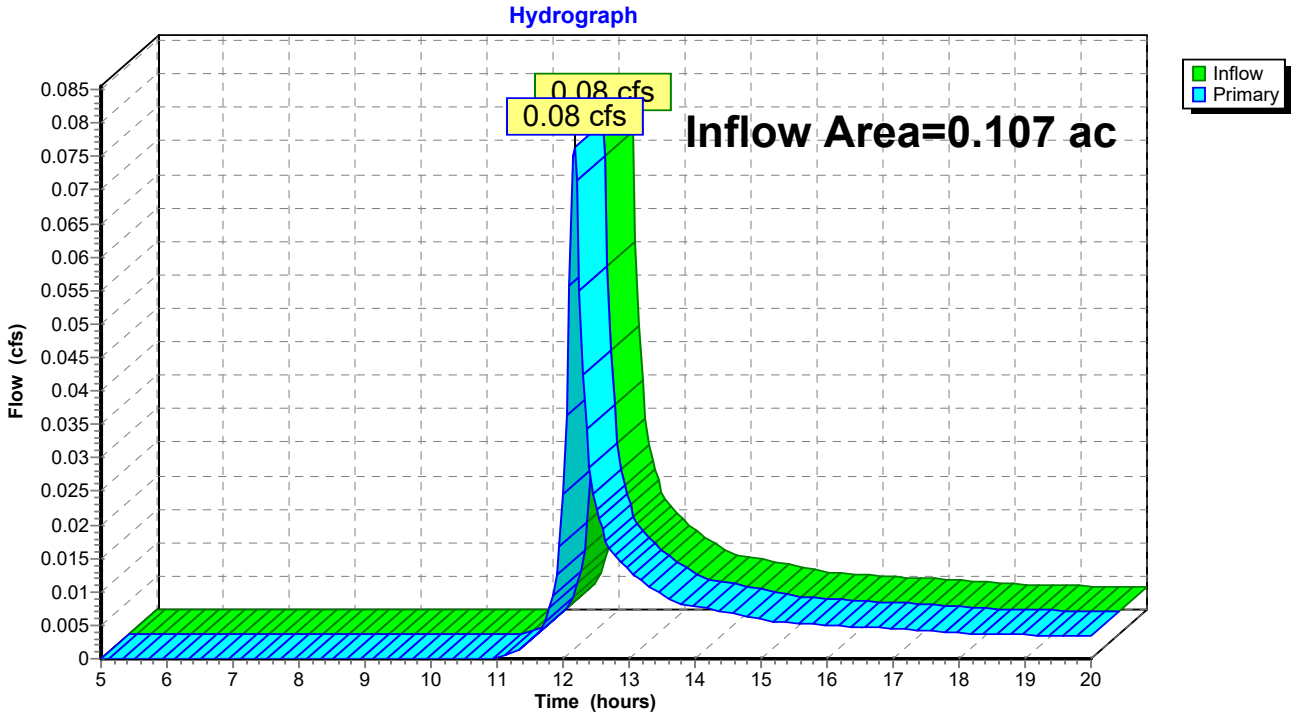


Summary for Link C: TOTAL P3

Inflow Area = 0.107 ac, 0.00% Impervious, Inflow Depth > 0.68" for 2-Year event
Inflow = 0.08 cfs @ 12.17 hrs, Volume= 0.006 af
Primary = 0.08 cfs @ 12.17 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link C: TOTAL P3



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 7S: P1B Runoff Area=7,552 sf 26.68% Impervious Runoff Depth>2.47"
Tc=6.0 min CN=80 Runoff=0.51 cfs 0.036 af

Subcatchment 8S: P1C Runoff Area=5,004 sf 21.24% Impervious Runoff Depth>2.39"
Tc=6.0 min CN=79 Runoff=0.33 cfs 0.023 af

Subcatchment 13S: P2E Runoff Area=1,614 sf 100.00% Impervious Runoff Depth>4.06"
Tc=0.0 min CN=98 Runoff=0.18 cfs 0.013 af

Subcatchment P1A: P1A Runoff Area=23,438 sf 1.11% Impervious Runoff Depth>1.98"
Tc=6.0 min CN=74 Runoff=1.29 cfs 0.089 af

Subcatchment P1B: P1D Runoff Area=2,400 sf 100.00% Impervious Runoff Depth>4.06"
Tc=6.0 min CN=98 Runoff=0.23 cfs 0.019 af

Subcatchment P2A: P2A Runoff Area=63,576 sf 0.00% Impervious Runoff Depth>1.75"
Flow Length=469' Tc=9.4 min CN=71 Runoff=2.74 cfs 0.213 af

Subcatchment P2B: P2B Runoff Area=16,517 sf 33.23% Impervious Runoff Depth>2.65"
Tc=6.0 min CN=82 Runoff=1.19 cfs 0.084 af

Subcatchment P2C: P2C Runoff Area=41,666 sf 21.32% Impervious Runoff Depth>2.39"
Tc=6.0 min CN=79 Runoff=2.73 cfs 0.190 af

Subcatchment P2D: P2D Runoff Area=45,818 sf 10.48% Impervious Runoff Depth>2.14"
Flow Length=174' Slope=0.0570 '/' Tc=8.7 min CN=76 Runoff=2.48 cfs 0.187 af

Subcatchment P3: P3 Runoff Area=4,653 sf 0.00% Impervious Runoff Depth>1.68"
Flow Length=174' Slope=0.0570 '/' Tc=8.7 min CN=70 Runoff=0.20 cfs 0.015 af

Pond 2P: DMH 1 Peak Elev=180.12' Inflow=3.99 cfs 0.286 af
12.0" Round Culvert n=0.011 L=118.3' S=0.0080 '/' Outflow=3.99 cfs 0.286 af

Pond 3P: CB2 Peak Elev=180.56' Inflow=1.19 cfs 0.084 af
12.0" Round Culvert n=0.010 L=13.5' S=0.0074 '/' Outflow=1.19 cfs 0.084 af

Pond 4P: (new Pond) Peak Elev=183.59' Storage=329 cf Inflow=0.23 cfs 0.019 af
Outflow=0.02 cfs 0.016 af

Pond 5P: DMH 1 Peak Elev=182.51' Inflow=3.99 cfs 0.286 af
12.0" Round Culvert n=0.012 L=222.0' S=0.0050 '/' Outflow=3.99 cfs 0.286 af

Pond 6P: CB 3 Peak Elev=178.40' Inflow=0.51 cfs 0.036 af
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=0.51 cfs 0.036 af

Pond 7P: CB1 Peak Elev=181.18' Inflow=2.73 cfs 0.190 af
12.0" Round Culvert n=0.010 L=13.5' S=0.0074 '/' Outflow=2.73 cfs 0.190 af

Pond 9P: DETENTION BASIN Peak Elev=179.67' Storage=7,223 cf Inflow=6.38 cfs 0.474 af
Discarded=0.19 cfs 0.090 af Primary=2.22 cfs 0.309 af Outflow=2.41 cfs 0.399 af

Pond 10P: (new Pond) Peak Elev=178.31' Inflow=0.33 cfs 0.023 af
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=0.33 cfs 0.023 af

Pond 11P: (new Pond) Peak Elev=178.27' Inflow=0.84 cfs 0.059 af
12.0" Round Culvert n=0.011 L=10.0' S=0.0300 '/' Outflow=0.84 cfs 0.059 af

Link A: TOTAL P1 Inflow=2.13 cfs 0.147 af
Primary=2.13 cfs 0.147 af

Link B: TOTAL P2 Inflow=4.67 cfs 0.522 af
Primary=4.67 cfs 0.522 af

Link C: TOTAL P3 Inflow=0.20 cfs 0.015 af
Primary=0.20 cfs 0.015 af

Total Runoff Area = 4.872 ac Runoff Volume = 0.868 af Average Runoff Depth = 2.14"
87.50% Pervious = 4.263 ac 12.50% Impervious = 0.609 ac

Summary for Subcatchment 7S: P1B

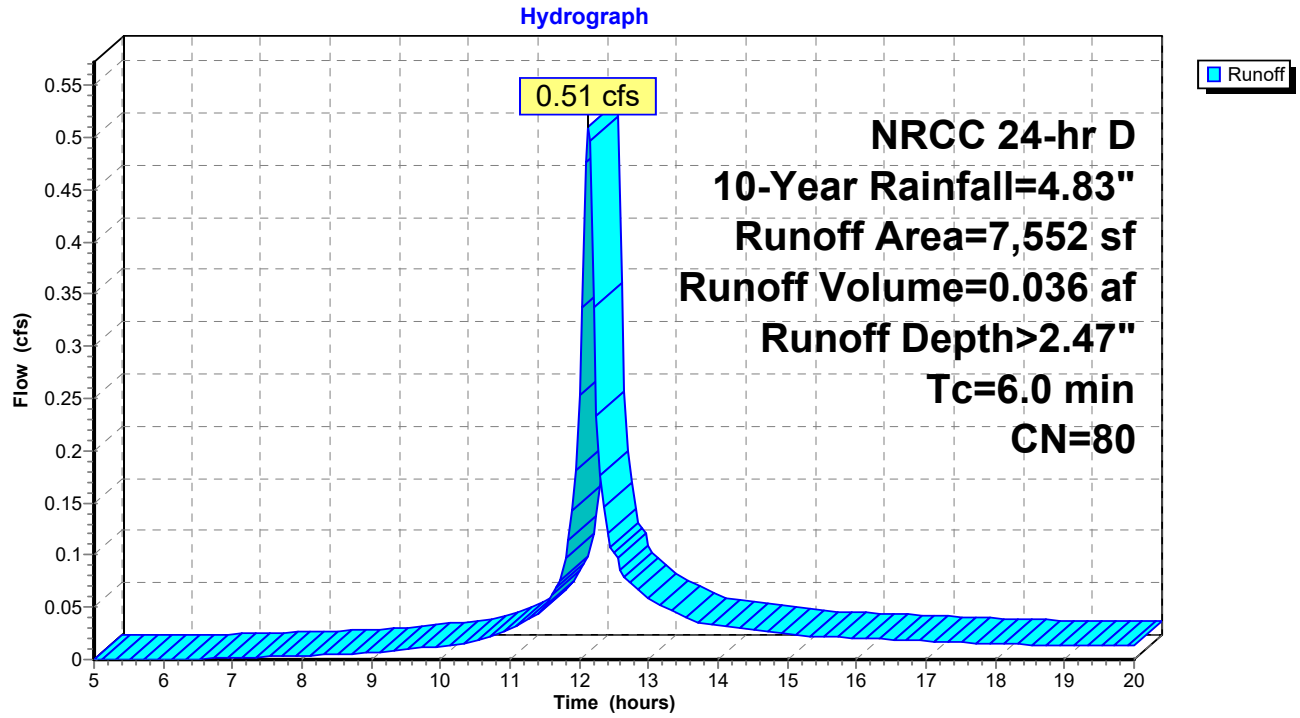
Runoff = 0.51 cfs @ 12.13 hrs, Volume= 0.036 af, Depth> 2.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
2,015	98	Paved parking, HSG C
5,537	74	>75% Grass cover, Good, HSG C
7,552	80	Weighted Average
5,537		73.32% Pervious Area
2,015		26.68% Impervious Area

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

Subcatchment 7S: P1B



Summary for Subcatchment 8S: P1C

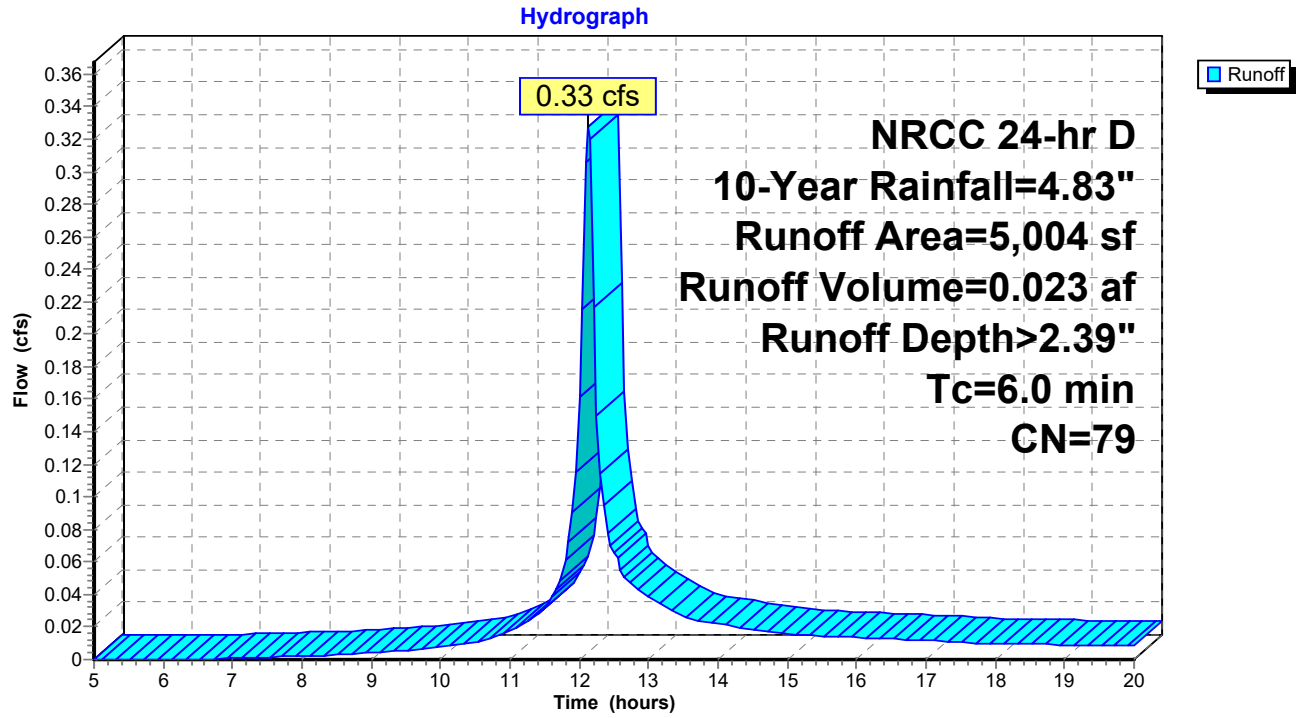
Runoff = 0.33 cfs @ 12.13 hrs, Volume= 0.023 af, Depth> 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
1,063	98	Paved parking, HSG C
3,941	74	>75% Grass cover, Good, HSG C
5,004	79	Weighted Average
3,941		78.76% Pervious Area
1,063		21.24% Impervious Area

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

Subcatchment 8S: P1C



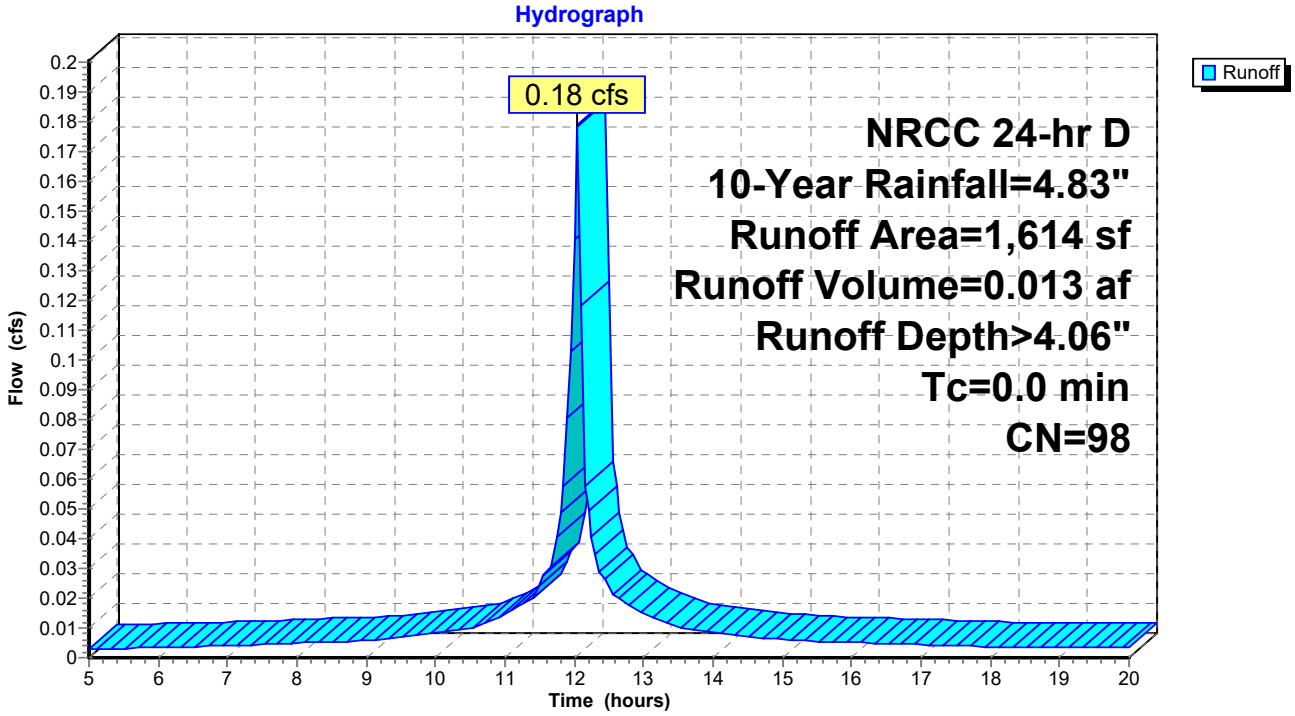
Summary for Subcatchment 13S: P2E

Runoff = 0.18 cfs @ 12.04 hrs, Volume= 0.013 af, Depth> 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
1,614	98	Roofs, HSG C
1,614		100.00% Impervious Area

Subcatchment 13S: P2E



Summary for Subcatchment P1A: P1A

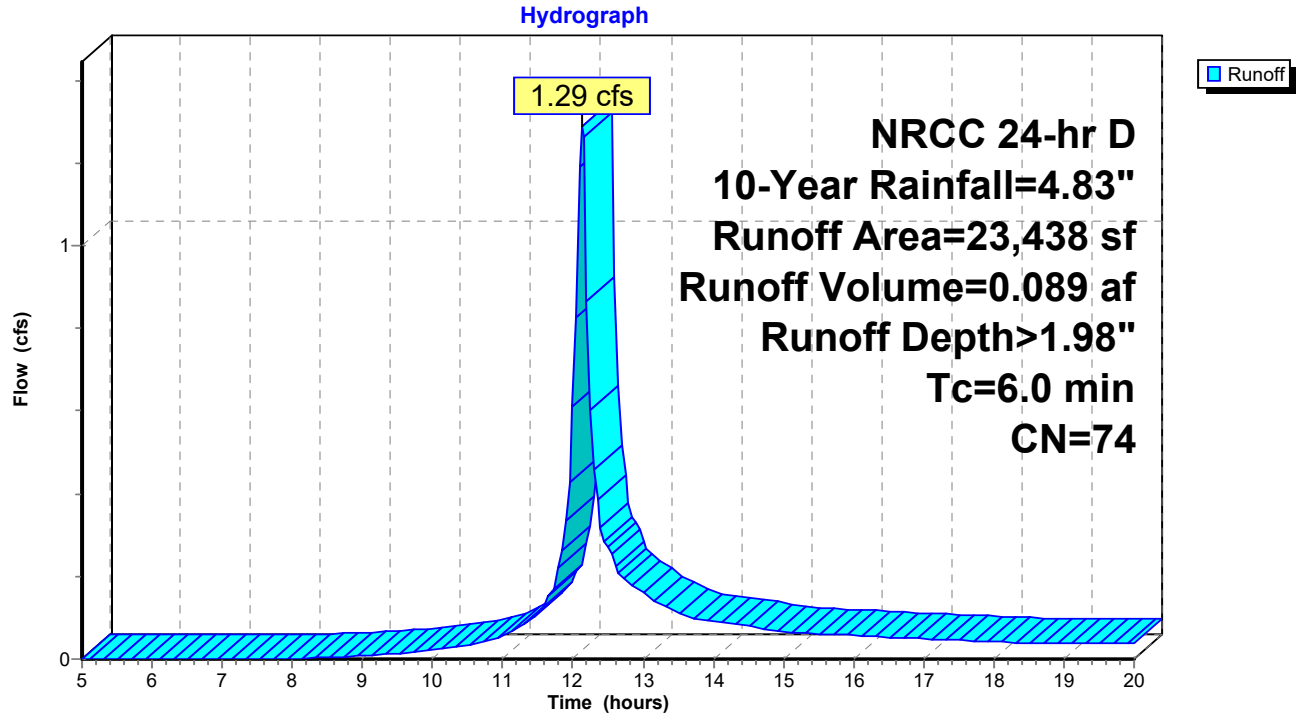
Runoff = 1.29 cfs @ 12.13 hrs, Volume= 0.089 af, Depth> 1.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
22,750	74	>75% Grass cover, Good, HSG C
261	98	Paved parking, HSG C
427	70	Woods, Good, HSG C
23,438	74	Weighted Average
23,177		98.89% Pervious Area
261		1.11% Impervious Area

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

Subcatchment P1A: P1A



Summary for Subcatchment P1B: P1D

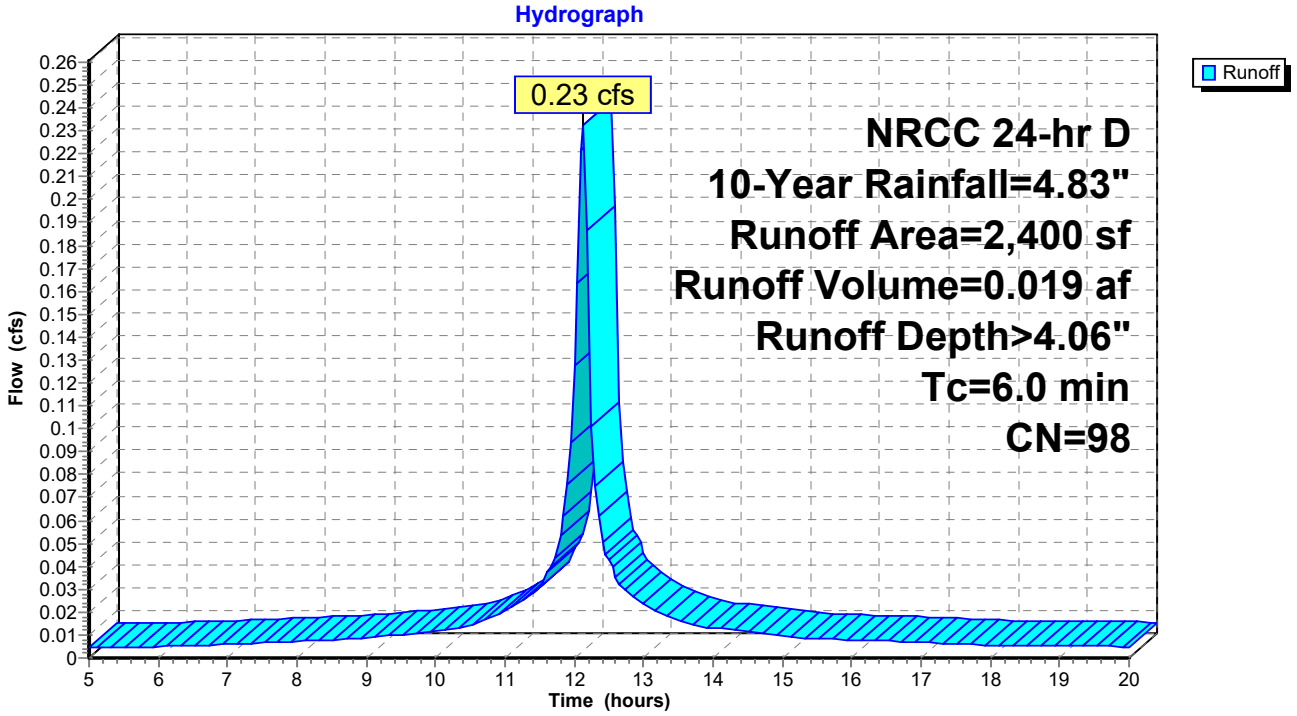
Runoff = 0.23 cfs @ 12.13 hrs, Volume= 0.019 af, Depth> 4.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
2,400	98	Roofs, HSG C
2,400		100.00% Impervious Area

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

Subcatchment P1B: P1D



Summary for Subcatchment P2A: P2A

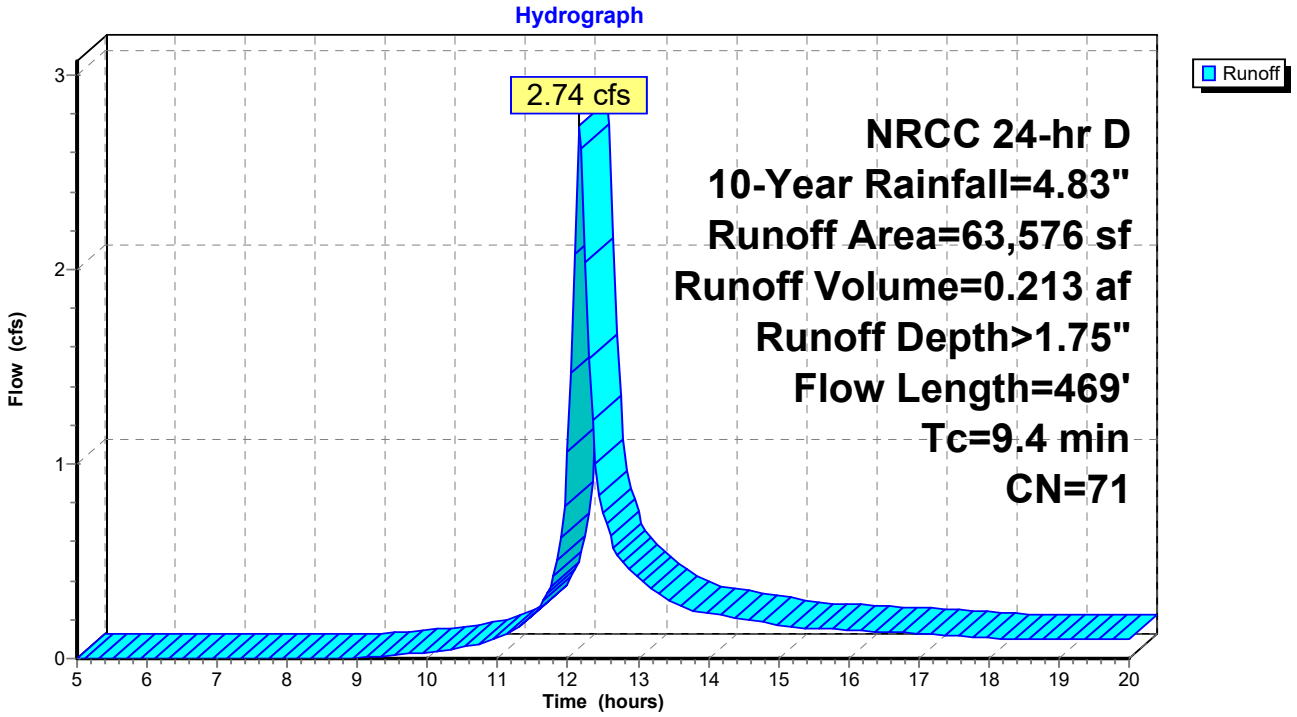
Runoff = 2.74 cfs @ 12.17 hrs, Volume= 0.213 af, Depth> 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
41,098	70	Woods, Good, HSG C
22,478	74	>75% Grass cover, Good, HSG C
63,576	71	Weighted Average
63,576		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.1	66	0.0430	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	85	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.7	87	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	44	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.3	137	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.4	469	Total			

Subcatchment P2A: P2A



Summary for Subcatchment P2B: P2B

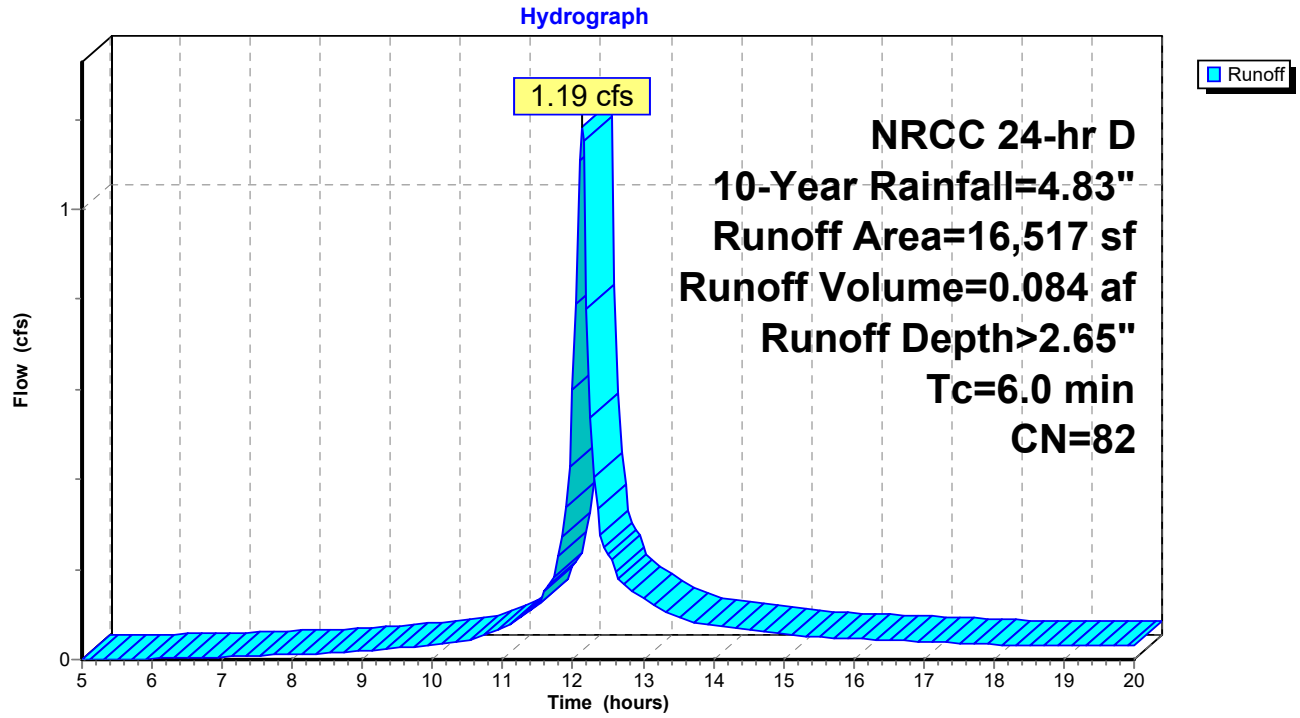
Runoff = 1.19 cfs @ 12.13 hrs, Volume= 0.084 af, Depth> 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
5,489	98	Paved parking, HSG C
11,028	74	>75% Grass cover, Good, HSG C
16,517	82	Weighted Average
11,028		66.77% Pervious Area
5,489		33.23% Impervious Area

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

Subcatchment P2B: P2B



Summary for Subcatchment P2C: P2C

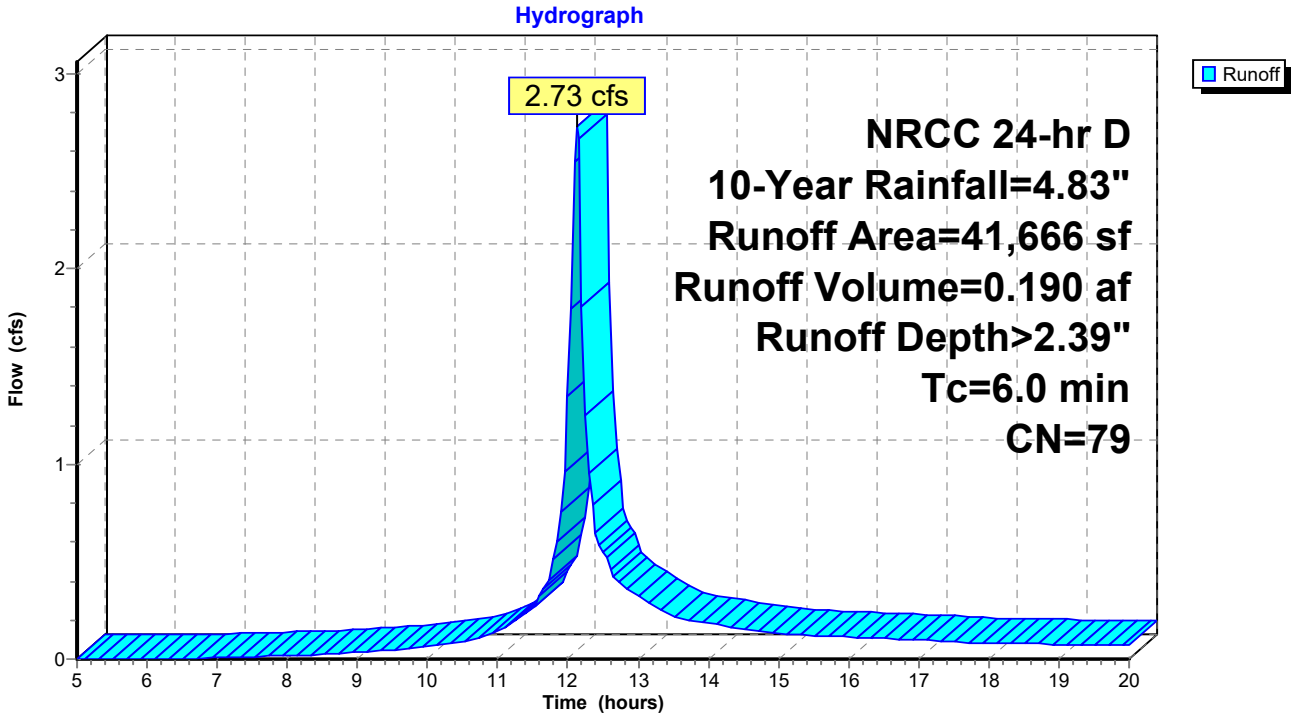
Runoff = 2.73 cfs @ 12.13 hrs, Volume= 0.190 af, Depth> 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
8,883	98	Paved parking, HSG C
29,830	74	>75% Grass cover, Good, HSG C
2,953	70	Woods, Good, HSG C
41,666	79	Weighted Average
32,783		78.68% Pervious Area
8,883		21.32% Impervious Area

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

Subcatchment P2C: P2C



Summary for Subcatchment P2D: P2D

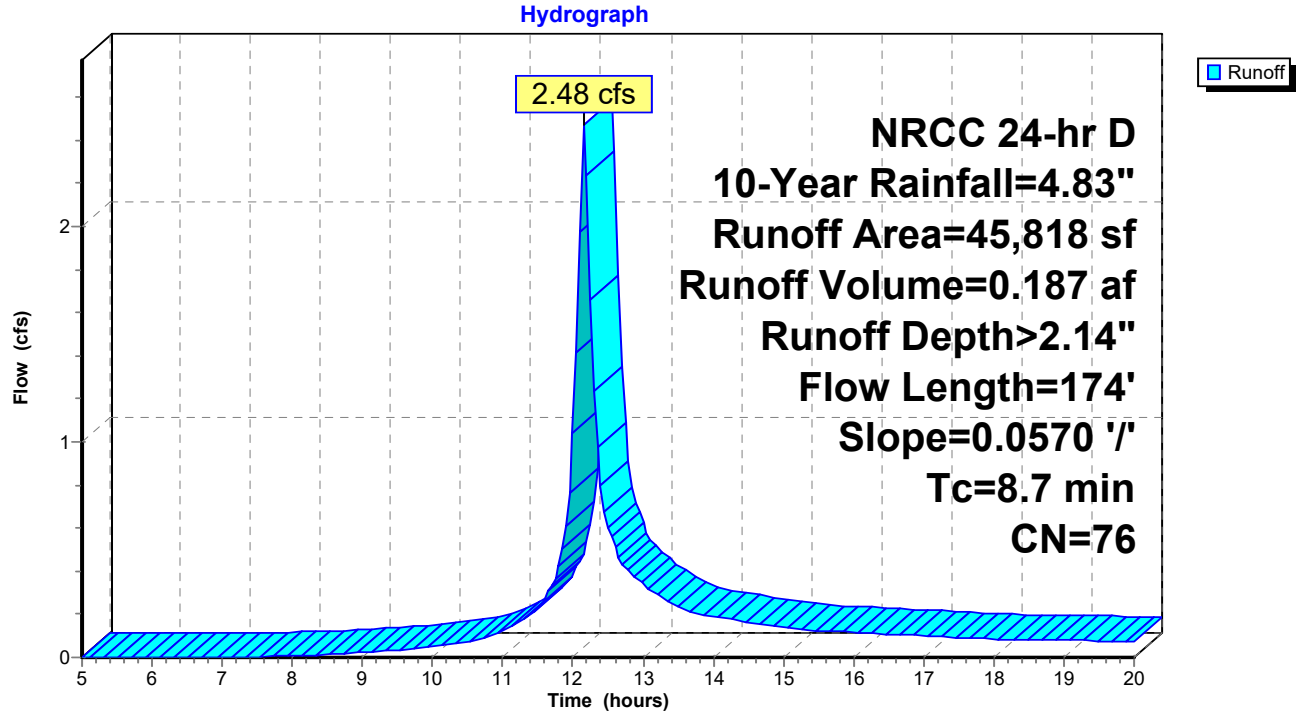
Runoff = 2.48 cfs @ 12.16 hrs, Volume= 0.187 af, Depth> 2.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
4,800	98	Roofs, HSG C
30,008	74	>75% Grass cover, Good, HSG C
11,010	70	Woods, Good, HSG C
45,818	76	Weighted Average
41,018		89.52% Pervious Area
4,800		10.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	124	0.0570	3.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	174	Total			

Subcatchment P2D: P2D



Summary for Subcatchment P3: P3

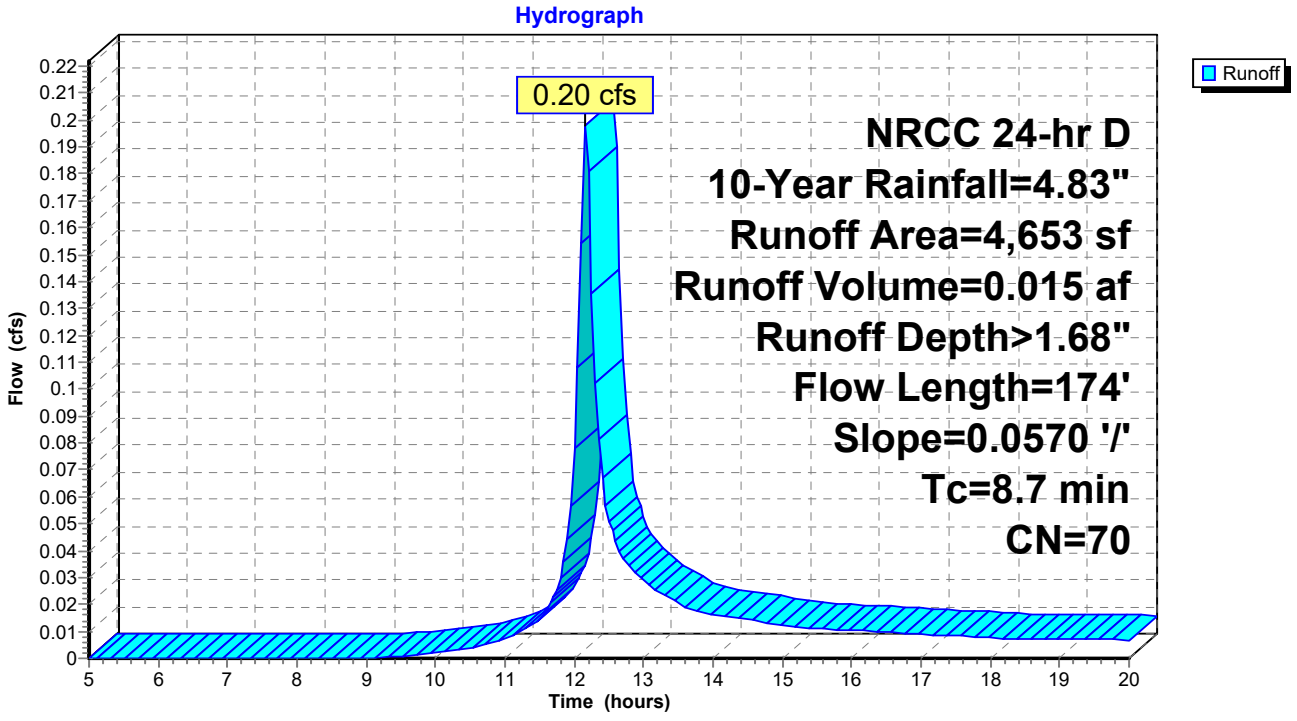
Runoff = 0.20 cfs @ 12.16 hrs, Volume= 0.015 af, Depth> 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
4,653	70	Woods, Good, HSG C
4,653		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	124	0.0570	3.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	174	Total			

Subcatchment P3: P3



Summary for Pond 2P: DMH 1

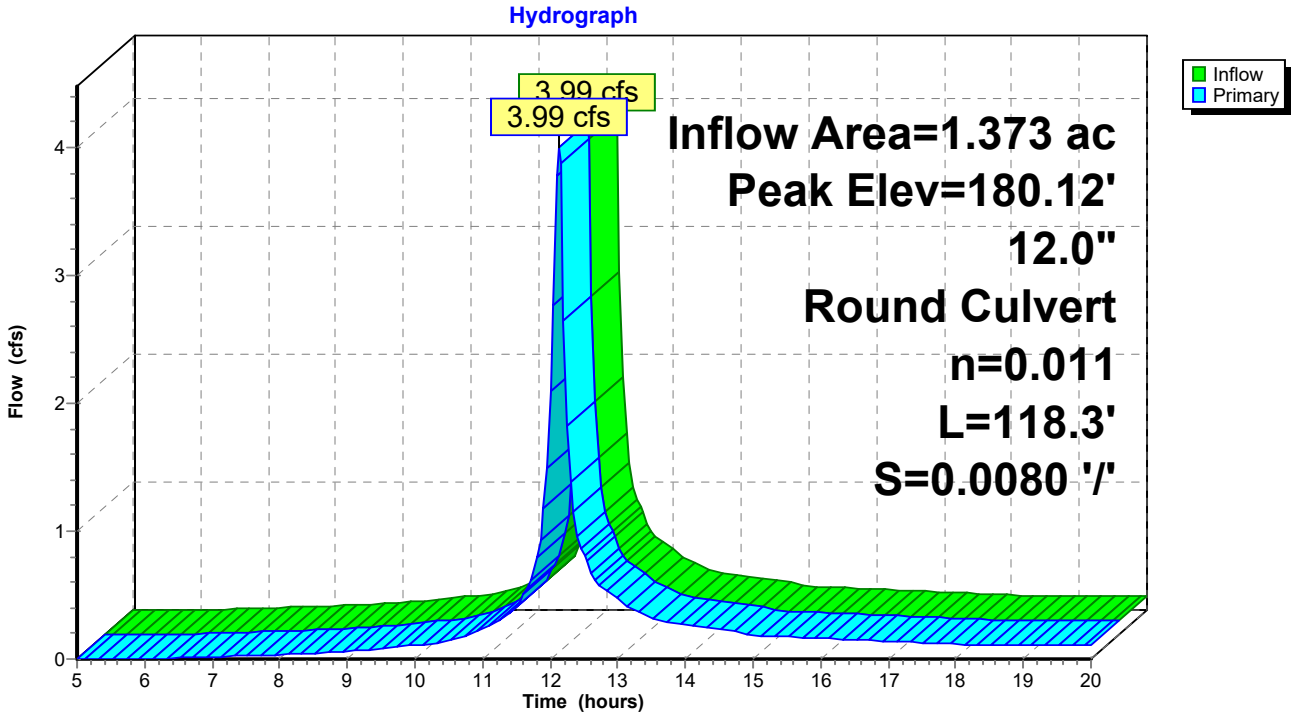
Inflow Area = 1.373 ac, 26.73% Impervious, Inflow Depth > 2.50" for 10-Year event
Inflow = 3.99 cfs @ 12.13 hrs, Volume= 0.286 af
Outflow = 3.99 cfs @ 12.13 hrs, Volume= 0.286 af, Atten= 0%, Lag= 0.0 min
Primary = 3.99 cfs @ 12.13 hrs, Volume= 0.286 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 180.12' @ 12.13 hrs
Flood Elev= 182.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	178.45'	**12.0" Round Culvert** L= 118.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 178.45' / 177.50' S= 0.0080 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=3.83 cfs @ 12.13 hrs HW=180.04' (Free Discharge)
1=Culvert (Barrel Controls 3.83 cfs @ 4.88 fps)

Pond 2P: DMH 1



Summary for Pond 3P: CB2

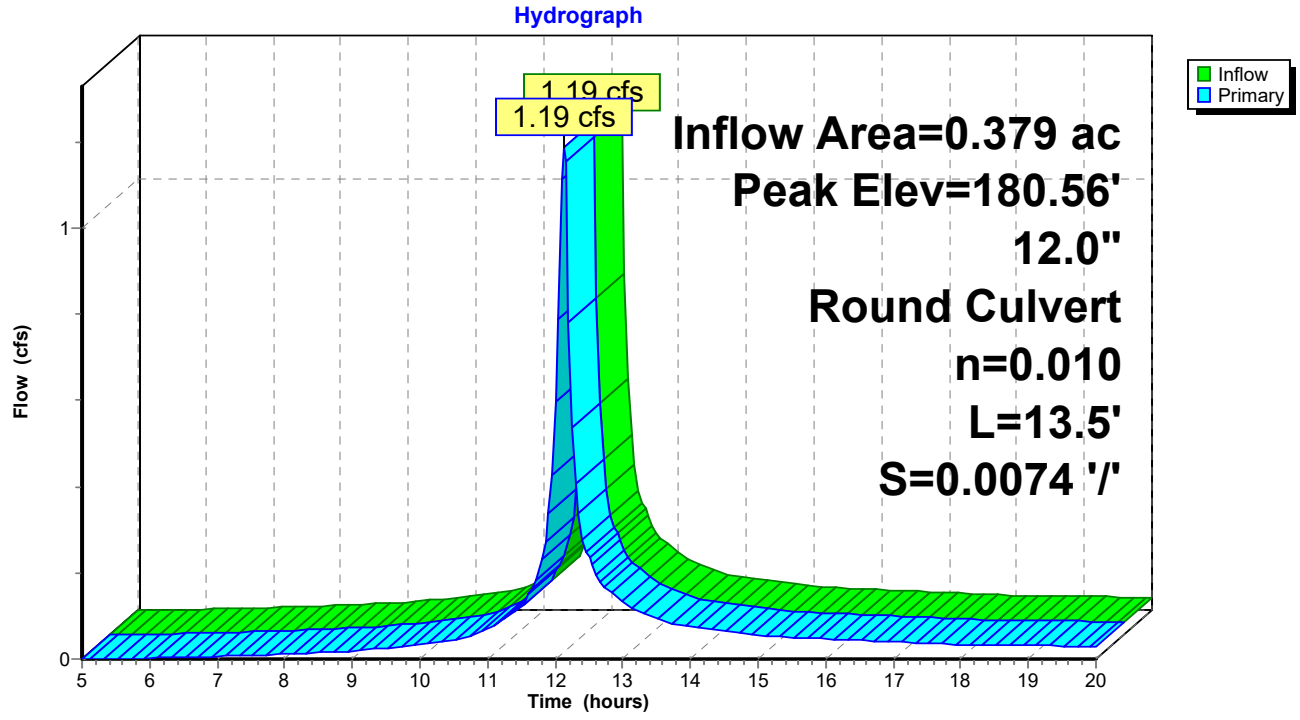
Inflow Area = 0.379 ac, 33.23% Impervious, Inflow Depth > 2.65" for 10-Year event
Inflow = 1.19 cfs @ 12.13 hrs, Volume= 0.084 af
Outflow = 1.19 cfs @ 12.13 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.0 min
Primary = 1.19 cfs @ 12.13 hrs, Volume= 0.084 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 180.56' @ 12.13 hrs
Flood Elev= 182.86'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.86'	**12.0" Round Culvert** L= 13.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 179.86' / 179.76' S= 0.0074 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.14 cfs @ 12.13 hrs HW=180.54' (Free Discharge)
1=Culvert (Barrel Controls 1.14 cfs @ 2.84 fps)

Pond 3P: CB2



Summary for Pond 4P: (new Pond)

Inflow Area = 0.055 ac,100.00% Impervious, Inflow Depth > 4.06" for 10-Year event
Inflow = 0.23 cfs @ 12.13 hrs, Volume= 0.019 af
Outflow = 0.02 cfs @ 13.44 hrs, Volume= 0.016 af, Atten= 93%, Lag= 78.6 min
Discarded = 0.02 cfs @ 13.44 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 183.59' @ 13.44 hrs Surf.Area= 506 sf Storage= 329 cf

Plug-Flow detention time= 150.0 min calculated for 0.016 af (83% of inflow)
Center-of-Mass det. time= 94.8 min (831.8 - 737.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	182.50'	487 cf	**15.75'W x 32.10'L x 3.50'H Field A** 1,769 cf Overall - 551 cf Embedded = 1,218 cf x 40.0% Voids
#2A	183.00'	551 cf	**ADS_StormTech SC-740 +Cap** x 12 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 12 Chambers in 3 Rows
		1,038 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	182.50'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 180.00'

Discarded OutFlow Max=0.02 cfs @ 13.44 hrs HW=183.59' (Free Discharge)
↑**1=Exfiltration** (Controls 0.02 cfs)

Pond 4P: (new Pond) - Chamber Wizard Field A

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

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

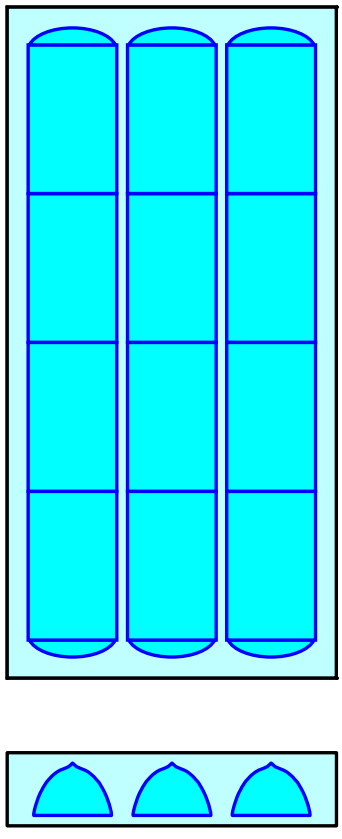
4 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 30.10' Row Length +12.0" End Stone x 2 = 32.10' Base Length
3 Rows x 51.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

12 Chambers x 45.9 cf = 551.3 cf Chamber Storage

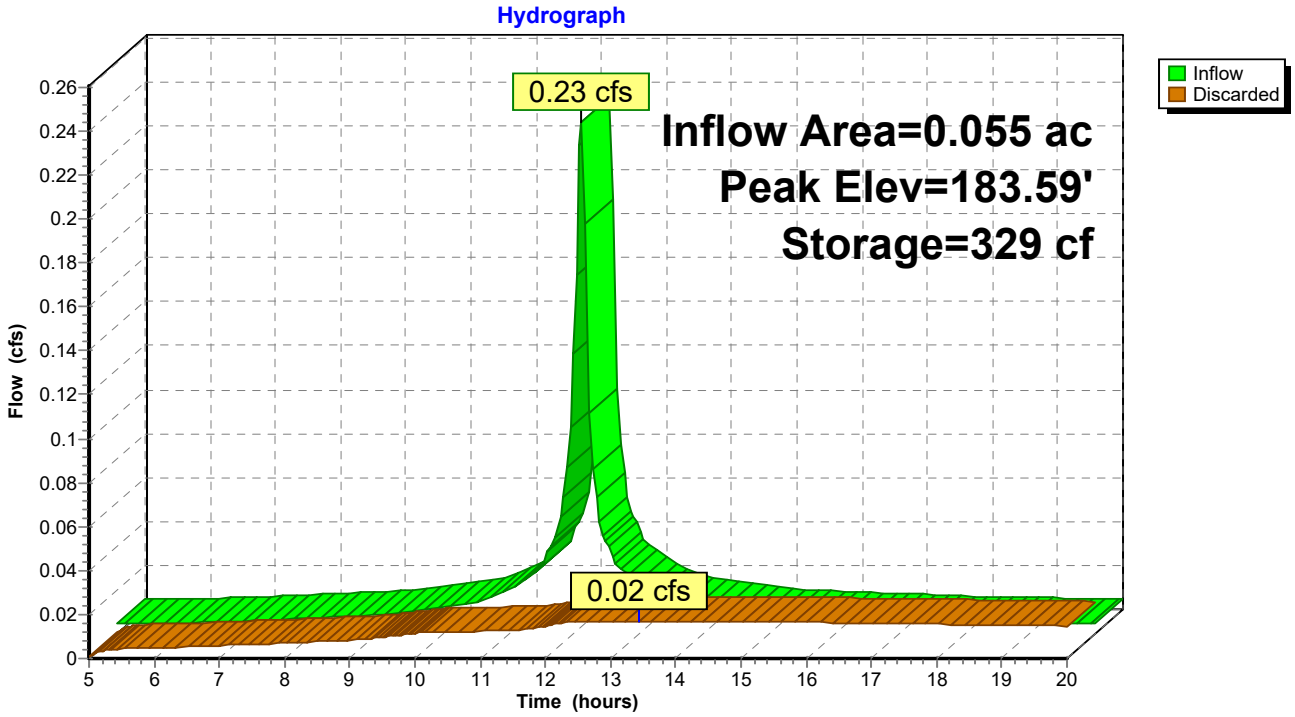
1,769.3 cf Field - 551.3 cf Chambers = 1,218.0 cf Stone x 40.0% Voids = 487.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,038.5 cf = 0.024 af
Overall Storage Efficiency = 58.7%
Overall System Size = 32.10' x 15.75' x 3.50'

12 Chambers
65.5 cy Field
45.1 cy Stone



Pond 4P: (new Pond)



Summary for Pond 5P: DMH 1

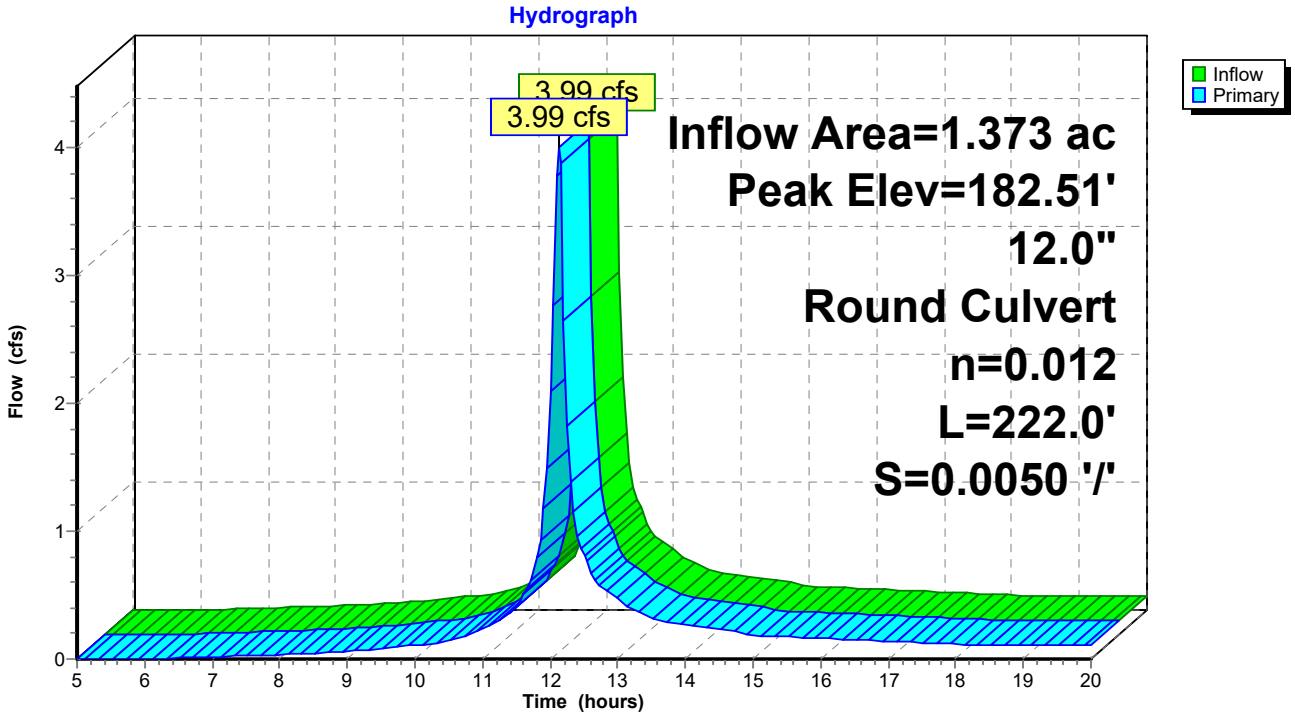
Inflow Area = 1.373 ac, 26.73% Impervious, Inflow Depth > 2.50" for 10-Year event
Inflow = 3.99 cfs @ 12.13 hrs, Volume= 0.286 af
Outflow = 3.99 cfs @ 12.13 hrs, Volume= 0.286 af, Atten= 0%, Lag= 0.0 min
Primary = 3.99 cfs @ 12.13 hrs, Volume= 0.286 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 182.51' @ 12.13 hrs
Flood Elev= 185.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.66'	**12.0" Round Culvert** L= 222.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 179.66' / 178.55' S= 0.0050 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary OutFlow Max=3.83 cfs @ 12.13 hrs HW=182.30' (Free Discharge)
1=Culvert (Barrel Controls 3.83 cfs @ 4.88 fps)

Pond 5P: DMH 1



Summary for Pond 6P: CB 3

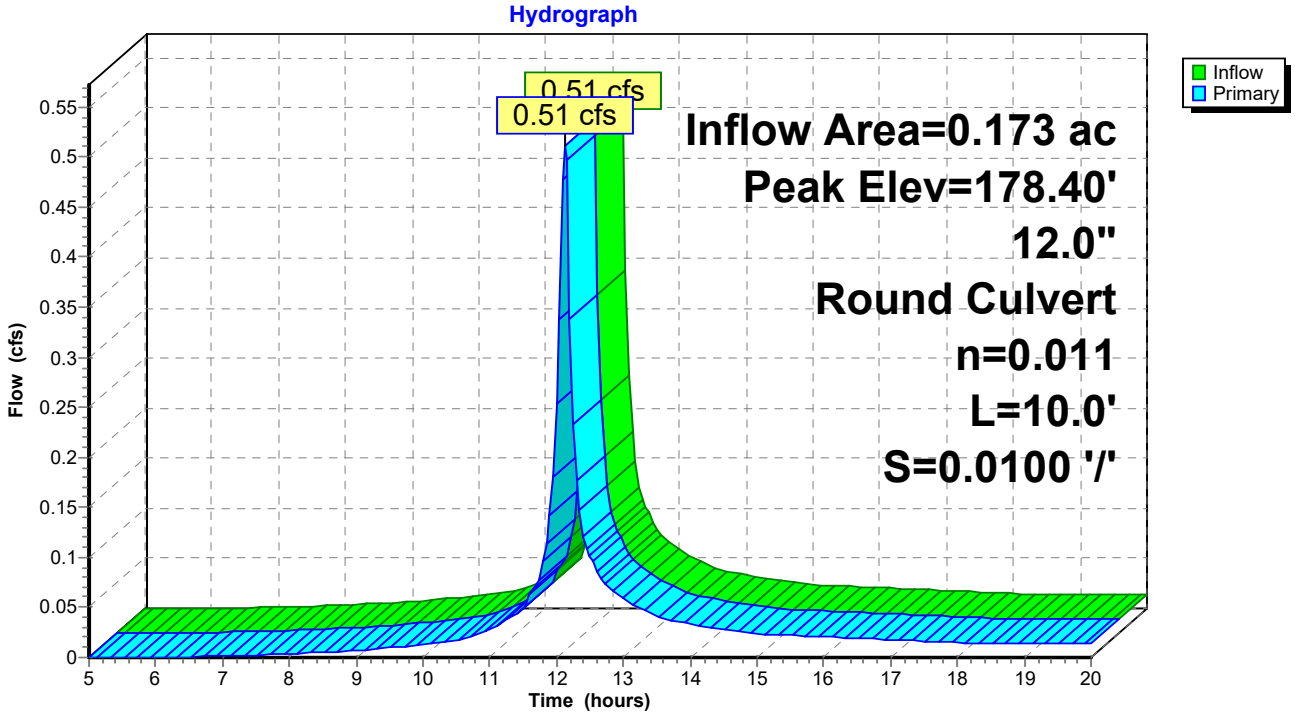
Inflow Area = 0.173 ac, 26.68% Impervious, Inflow Depth > 2.47" for 10-Year event
Inflow = 0.51 cfs @ 12.13 hrs, Volume= 0.036 af
Outflow = 0.51 cfs @ 12.13 hrs, Volume= 0.036 af, Atten= 0%, Lag= 0.0 min
Primary = 0.51 cfs @ 12.13 hrs, Volume= 0.036 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 178.40' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	178.00'	**12.0" Round Culvert** L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 178.00' / 177.90' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.49 cfs @ 12.13 hrs HW=178.39' (Free Discharge)
1=Culvert (Barrel Controls 0.49 cfs @ 2.59 fps)

Pond 6P: CB 3



Summary for Pond 7P: CB1

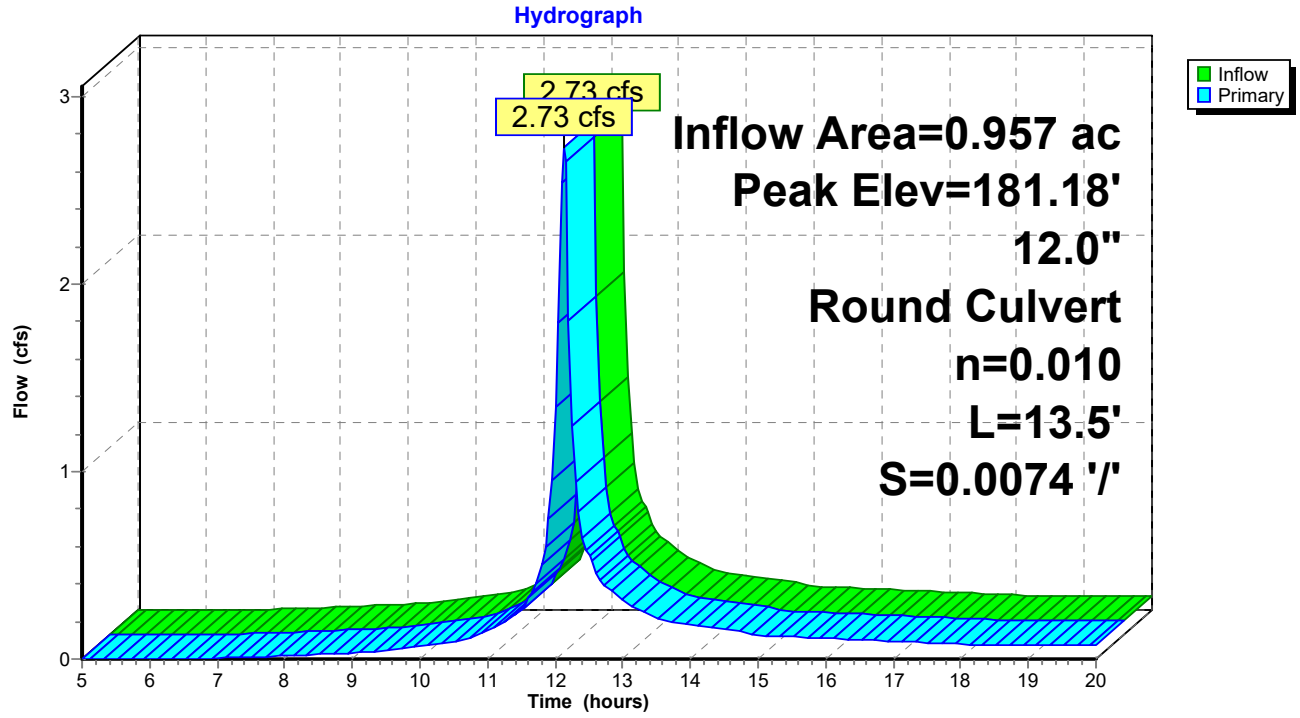
Inflow Area = 0.957 ac, 21.32% Impervious, Inflow Depth > 2.39" for 10-Year event
Inflow = 2.73 cfs @ 12.13 hrs, Volume= 0.190 af
Outflow = 2.73 cfs @ 12.13 hrs, Volume= 0.190 af, Atten= 0%, Lag= 0.0 min
Primary = 2.73 cfs @ 12.13 hrs, Volume= 0.190 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 181.18' @ 12.13 hrs
Flood Elev= 182.86'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.86'	**12.0" Round Culvert** L= 13.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 179.86' / 179.76' S= 0.0074 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.62 cfs @ 12.13 hrs HW=181.13' (Free Discharge)
1=Culvert (Inlet Controls 2.62 cfs @ 3.33 fps)

Pond 7P: CB1



Summary for Pond 9P: DETENTION BASIN

Inflow Area = 2.425 ac, 19.68% Impervious, Inflow Depth > 2.34" for 10-Year event
Inflow = 6.38 cfs @ 12.14 hrs, Volume= 0.474 af
Outflow = 2.41 cfs @ 12.32 hrs, Volume= 0.399 af, Atten= 62%, Lag= 11.0 min
Discarded = 0.19 cfs @ 12.32 hrs, Volume= 0.090 af
Primary = 2.22 cfs @ 12.32 hrs, Volume= 0.309 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 179.67' @ 12.32 hrs Surf.Area= 7,360 sf Storage= 7,223 cf

Plug-Flow detention time= 99.4 min calculated for 0.399 af (84% of inflow)
Center-of-Mass det. time= 49.0 min (846.0 - 796.9)

Volume	Invert	Avail.Storage	Storage Description
#1	177.50'	24,911 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

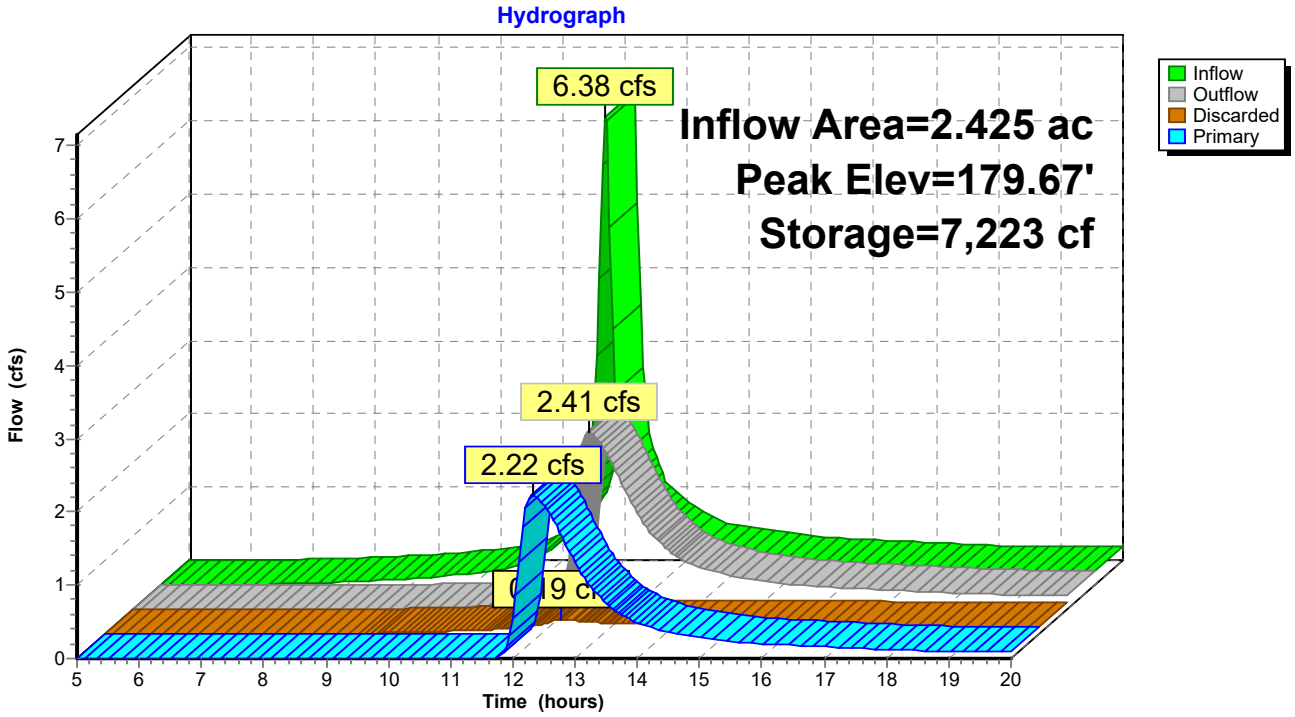
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
177.50	203	0	0
178.00	1,073	319	319
179.00	4,680	2,877	3,196
180.00	8,686	6,683	9,879
181.00	10,008	9,347	19,226
181.50	12,732	5,685	24,911

Device	Routing	Invert	Outlet Devices
#1	Primary	178.00'	**18.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 178.00' / 176.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Primary	181.00'	**6.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Device 1	178.90'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	178.90'	**8.0" Vert. Orifice/Grate** C= 0.600
#5	Device 1	179.90'	**24.0" W x 24.0" H Vert. Orifice/Grate** C= 0.600
#6	Discarded	178.00'	**1.020 in/hr Exfiltration over Surface area above 178.00'** Conductivity to Groundwater Elevation = 175.80' Excluded Surface area = 1,073 sf

Discarded OutFlow Max=0.19 cfs @ 12.32 hrs HW=179.67' (Free Discharge)
└**6=Exfiltration** (Controls 0.19 cfs)

Primary OutFlow Max=2.21 cfs @ 12.32 hrs HW=179.67' (Free Discharge)
└**1=Culvert** (Passes 2.21 cfs of 6.43 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 1.11 cfs @ 3.17 fps)
  └**4=Orifice/Grate** (Orifice Controls 1.11 cfs @ 3.17 fps)
  └**5=Orifice/Grate** (Controls 0.00 cfs)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 9P: DETENTION BASIN



Summary for Pond 10P: (new Pond)

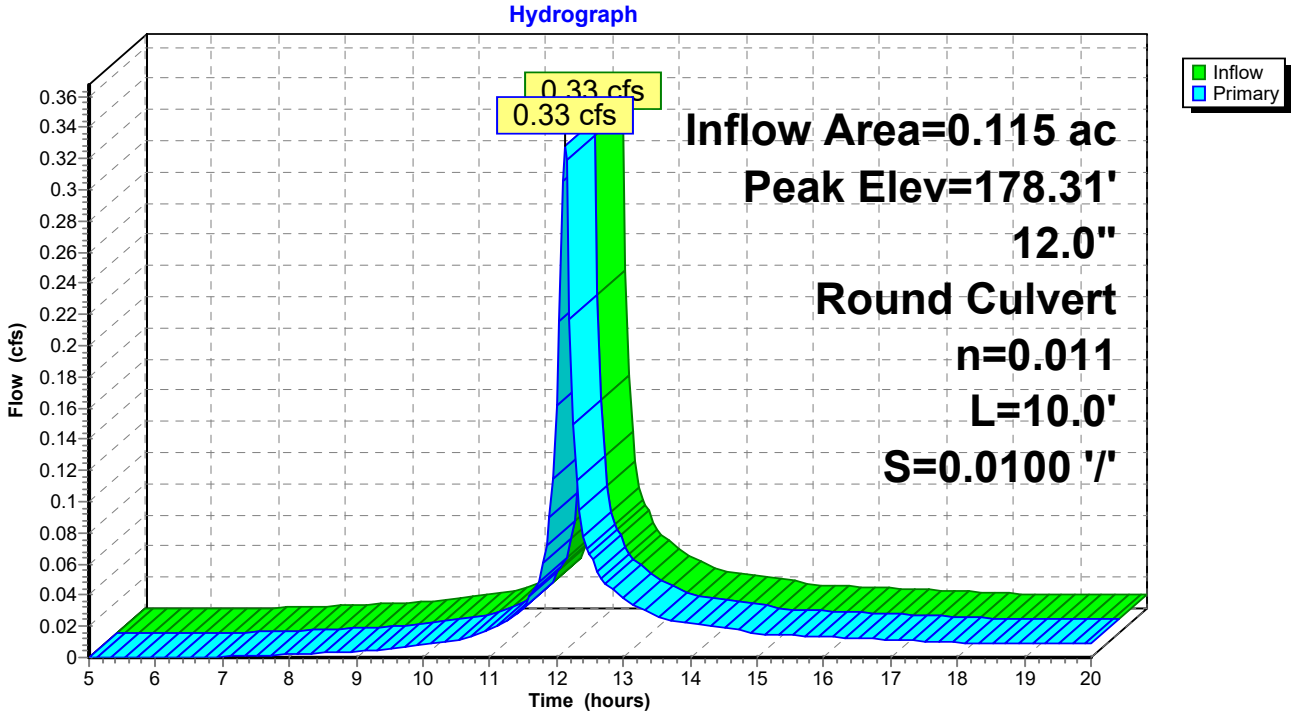
Inflow Area = 0.115 ac, 21.24% Impervious, Inflow Depth > 2.39" for 10-Year event
Inflow = 0.33 cfs @ 12.13 hrs, Volume= 0.023 af
Outflow = 0.33 cfs @ 12.13 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min
Primary = 0.33 cfs @ 12.13 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 178.31' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	178.00'	**12.0" Round Culvert** L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 178.00' / 177.90' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.31 cfs @ 12.13 hrs HW=178.30' (Free Discharge)
1=Culvert (Barrel Controls 0.31 cfs @ 2.37 fps)

Pond 10P: (new Pond)



Summary for Pond 11P: (new Pond)

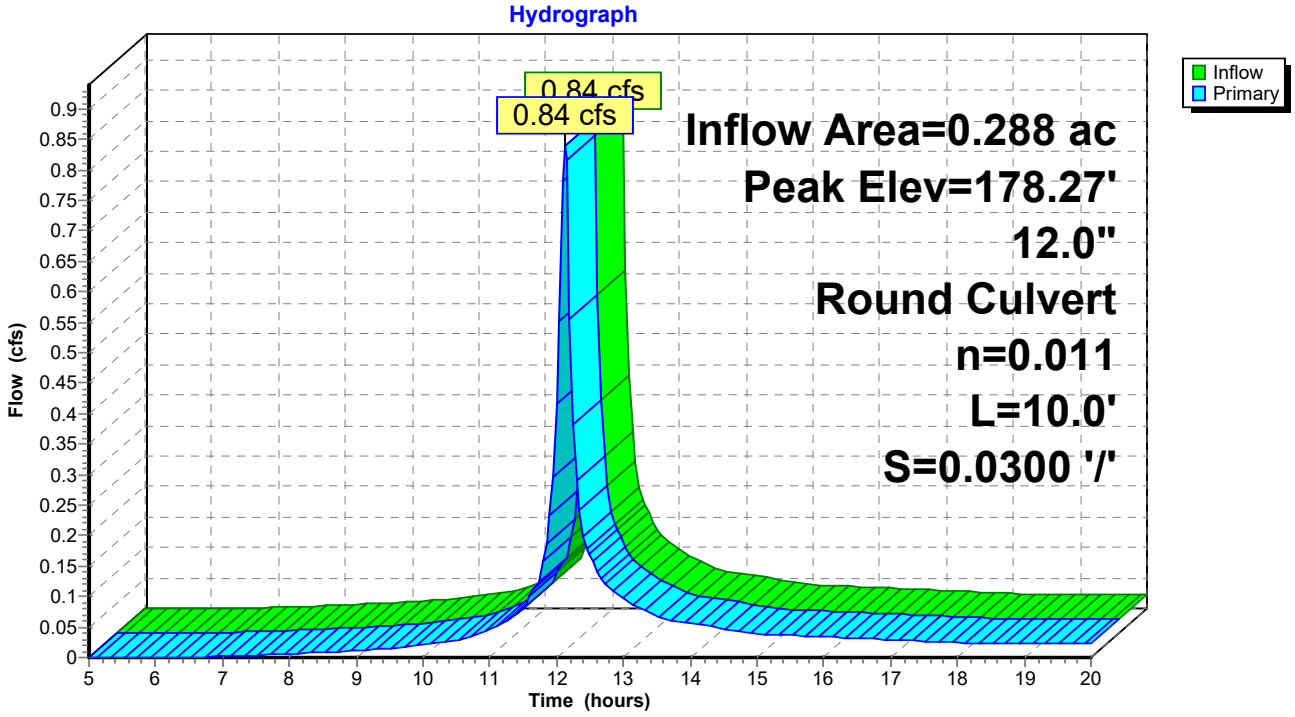
Inflow Area = 0.288 ac, 24.51% Impervious, Inflow Depth > 2.44" for 10-Year event
Inflow = 0.84 cfs @ 12.13 hrs, Volume= 0.059 af
Outflow = 0.84 cfs @ 12.13 hrs, Volume= 0.059 af, Atten= 0%, Lag= 0.0 min
Primary = 0.84 cfs @ 12.13 hrs, Volume= 0.059 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 178.27' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	177.80'	**12.0" Round Culvert** L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 177.80' / 177.50' S= 0.0300 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.80 cfs @ 12.13 hrs HW=178.26' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.80 cfs @ 2.30 fps)

Pond 11P: (new Pond)

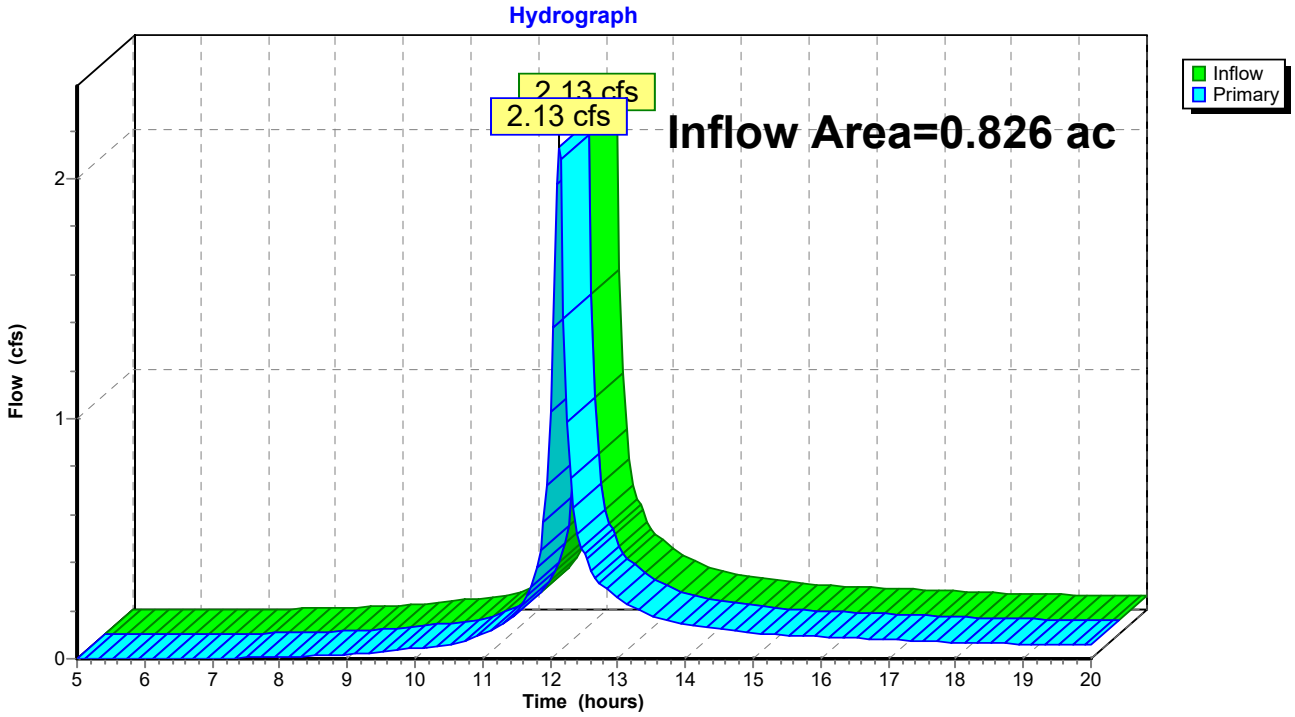


Summary for Link A: TOTAL P1

Inflow Area = 0.826 ac, 9.28% Impervious, Inflow Depth > 2.14" for 10-Year event
Inflow = 2.13 cfs @ 12.13 hrs, Volume= 0.147 af
Primary = 2.13 cfs @ 12.13 hrs, Volume= 0.147 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link A: TOTAL P1

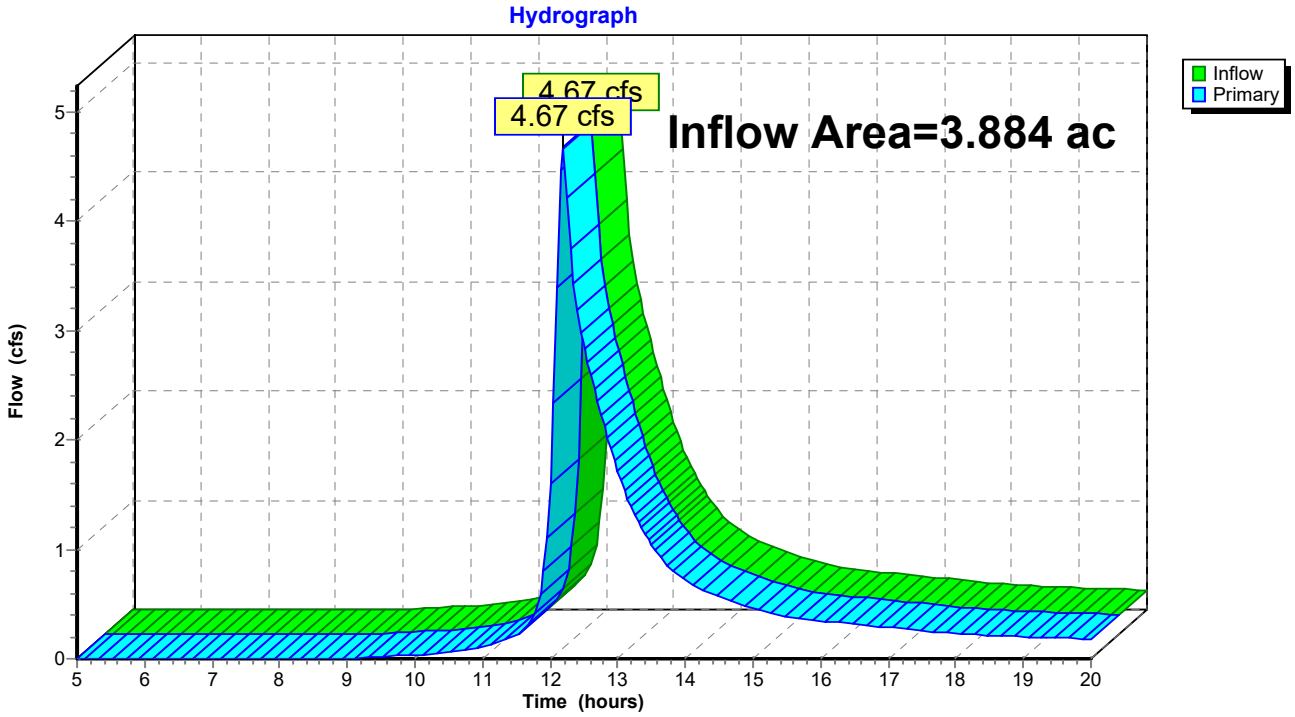


Summary for Link B: TOTAL P2

Inflow Area = 3.884 ac, 12.29% Impervious, Inflow Depth > 1.61" for 10-Year event
Inflow = 4.67 cfs @ 12.19 hrs, Volume= 0.522 af
Primary = 4.67 cfs @ 12.19 hrs, Volume= 0.522 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link B: TOTAL P2

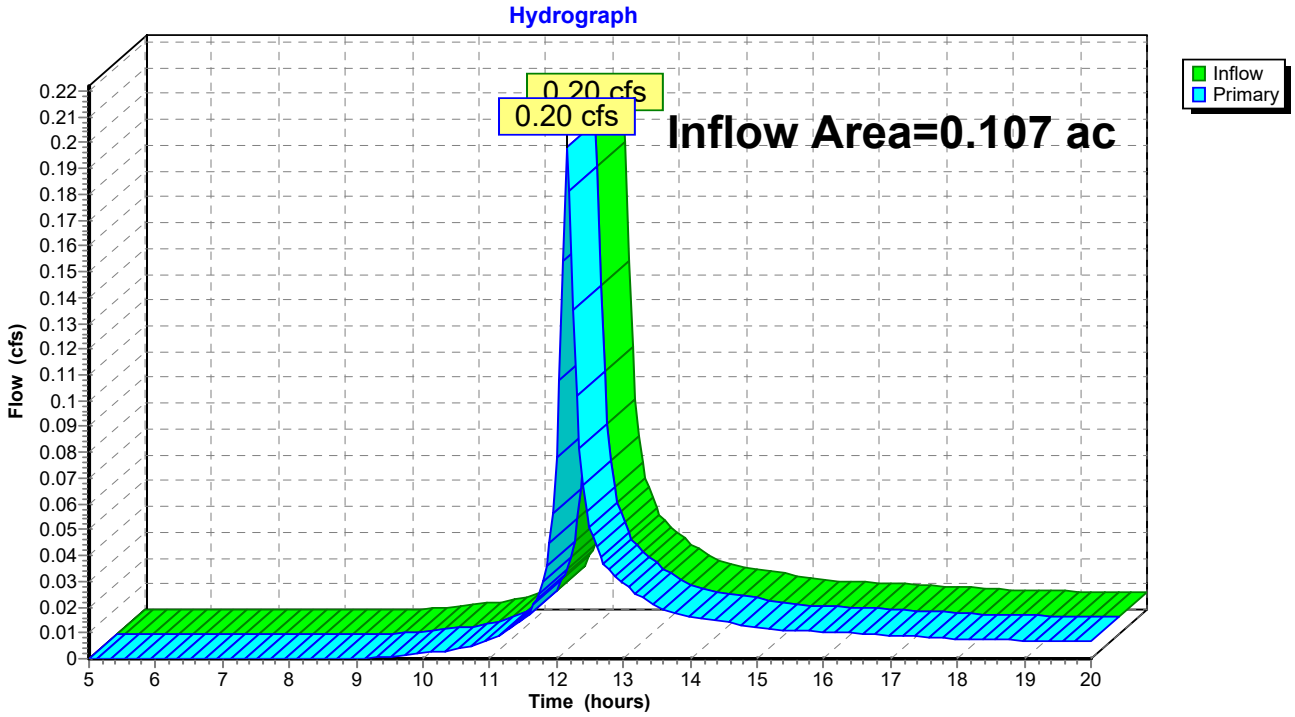


Summary for Link C: TOTAL P3

Inflow Area = 0.107 ac, 0.00% Impervious, Inflow Depth > 1.68" for 10-Year event
Inflow = 0.20 cfs @ 12.16 hrs, Volume= 0.015 af
Primary = 0.20 cfs @ 12.16 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link C: TOTAL P3



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 7S: P1B Runoff Area=7,552 sf 26.68% Impervious Runoff Depth>5.94"
Tc=6.0 min CN=80 Runoff=1.17 cfs 0.086 af

Subcatchment 8S: P1C Runoff Area=5,004 sf 21.24% Impervious Runoff Depth>5.82"
Tc=6.0 min CN=79 Runoff=0.76 cfs 0.056 af

Subcatchment 13S: P2E Runoff Area=1,614 sf 100.00% Impervious Runoff Depth>7.59"
Tc=0.0 min CN=98 Runoff=0.33 cfs 0.023 af

Subcatchment P1A: P1A Runoff Area=23,438 sf 1.11% Impervious Runoff Depth>5.24"
Tc=6.0 min CN=74 Runoff=3.29 cfs 0.235 af

Subcatchment P1B: P1D Runoff Area=2,400 sf 100.00% Impervious Runoff Depth>7.59"
Tc=6.0 min CN=98 Runoff=0.43 cfs 0.035 af

Subcatchment P2A: P2A Runoff Area=63,576 sf 0.00% Impervious Runoff Depth>4.88"
Flow Length=469' Tc=9.4 min CN=71 Runoff=7.48 cfs 0.593 af

Subcatchment P2B: P2B Runoff Area=16,517 sf 33.23% Impervious Runoff Depth>6.16"
Tc=6.0 min CN=82 Runoff=2.63 cfs 0.195 af

Subcatchment P2C: P2C Runoff Area=41,666 sf 21.32% Impervious Runoff Depth>5.82"
Tc=6.0 min CN=79 Runoff=6.36 cfs 0.464 af

Subcatchment P2D: P2D Runoff Area=45,818 sf 10.48% Impervious Runoff Depth>5.47"
Flow Length=174' Slope=0.0570 '/' Tc=8.7 min CN=76 Runoff=6.12 cfs 0.480 af

Subcatchment P3: P3 Runoff Area=4,653 sf 0.00% Impervious Runoff Depth>4.76"
Flow Length=174' Slope=0.0570 '/' Tc=8.7 min CN=70 Runoff=0.55 cfs 0.042 af

Pond 2P: DMH 1 Peak Elev=187.13' Inflow=9.14 cfs 0.682 af
12.0" Round Culvert n=0.011 L=118.3' S=0.0080 '/' Outflow=9.14 cfs 0.682 af

Pond 3P: CB2 Peak Elev=181.12' Inflow=2.63 cfs 0.195 af
12.0" Round Culvert n=0.010 L=13.5' S=0.0074 '/' Outflow=2.63 cfs 0.195 af

Pond 4P: (new Pond) Peak Elev=184.83' Storage=766 cf Inflow=0.43 cfs 0.035 af
Outflow=0.02 cfs 0.022 af

Pond 5P: DMH 1 Peak Elev=194.98' Inflow=9.14 cfs 0.682 af
12.0" Round Culvert n=0.012 L=222.0' S=0.0050 '/' Outflow=9.14 cfs 0.682 af

Pond 6P: CB 3 Peak Elev=178.64' Inflow=1.17 cfs 0.086 af
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=1.17 cfs 0.086 af

Pond 7P: CB1 Peak Elev=184.84' Inflow=6.36 cfs 0.464 af
12.0" Round Culvert n=0.010 L=13.5' S=0.0074 '/' Outflow=6.36 cfs 0.464 af

Pond 9P: DETENTION BASIN Peak Elev=180.48' Storage=14,225 cf Inflow=15.06 cfs 1.162 af
Discarded=0.28 cfs 0.137 af Primary=6.61 cfs 0.940 af Outflow=6.90 cfs 1.077 af

Pond 10P: (new Pond) Peak Elev=178.50' Inflow=0.76 cfs 0.056 af
12.0" Round Culvert n=0.011 L=10.0' S=0.0100 '/' Outflow=0.76 cfs 0.056 af

Pond 11P: (new Pond) Peak Elev=178.57' Inflow=1.93 cfs 0.142 af
12.0" Round Culvert n=0.011 L=10.0' S=0.0300 '/' Outflow=1.93 cfs 0.142 af

Link A: TOTAL P1 Inflow=5.23 cfs 0.377 af
Primary=5.23 cfs 0.377 af

Link B: TOTAL P2 Inflow=13.08 cfs 1.534 af
Primary=13.08 cfs 1.534 af

Link C: TOTAL P3 Inflow=0.55 cfs 0.042 af
Primary=0.55 cfs 0.042 af

Total Runoff Area = 4.872 ac Runoff Volume = 2.209 af Average Runoff Depth = 5.44"
87.50% Pervious = 4.263 ac 12.50% Impervious = 0.609 ac

Summary for Subcatchment 7S: P1B

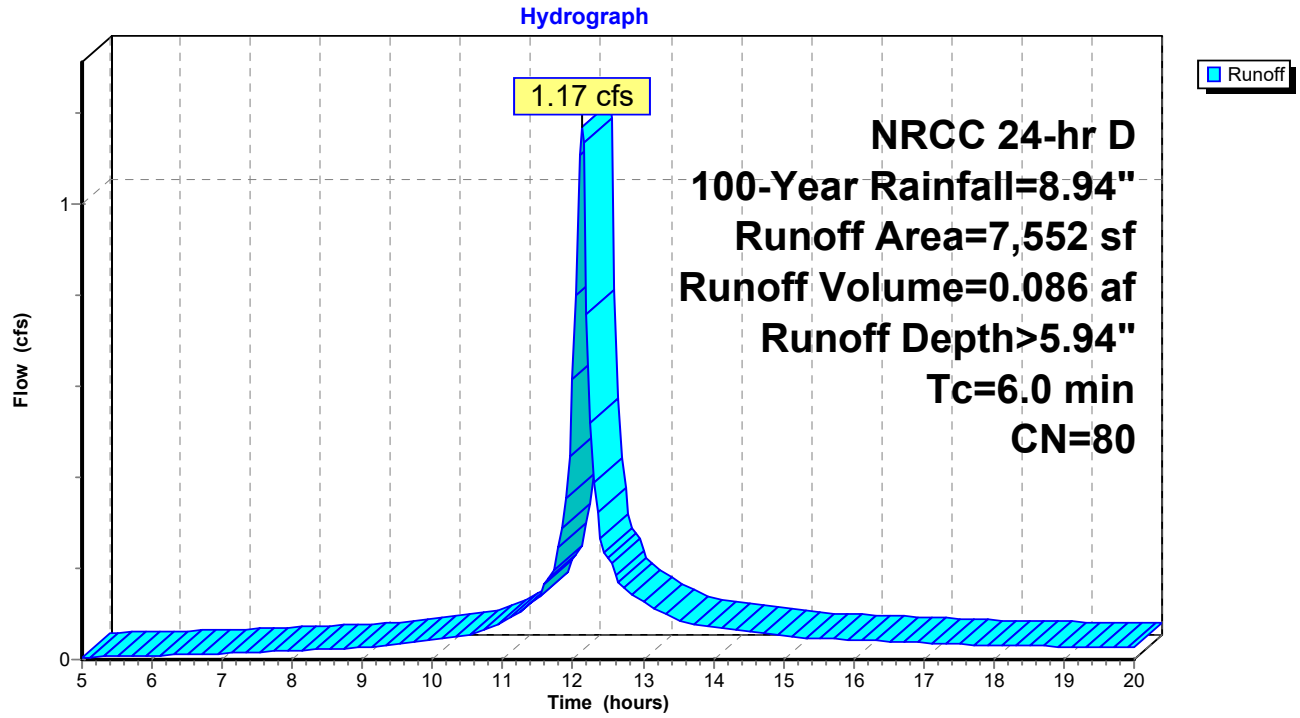
Runoff = 1.17 cfs @ 12.13 hrs, Volume= 0.086 af, Depth> 5.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
2,015	98	Paved parking, HSG C
5,537	74	>75% Grass cover, Good, HSG C
7,552	80	Weighted Average
5,537		73.32% Pervious Area
2,015		26.68% Impervious Area

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

Subcatchment 7S: P1B



Summary for Subcatchment 8S: P1C

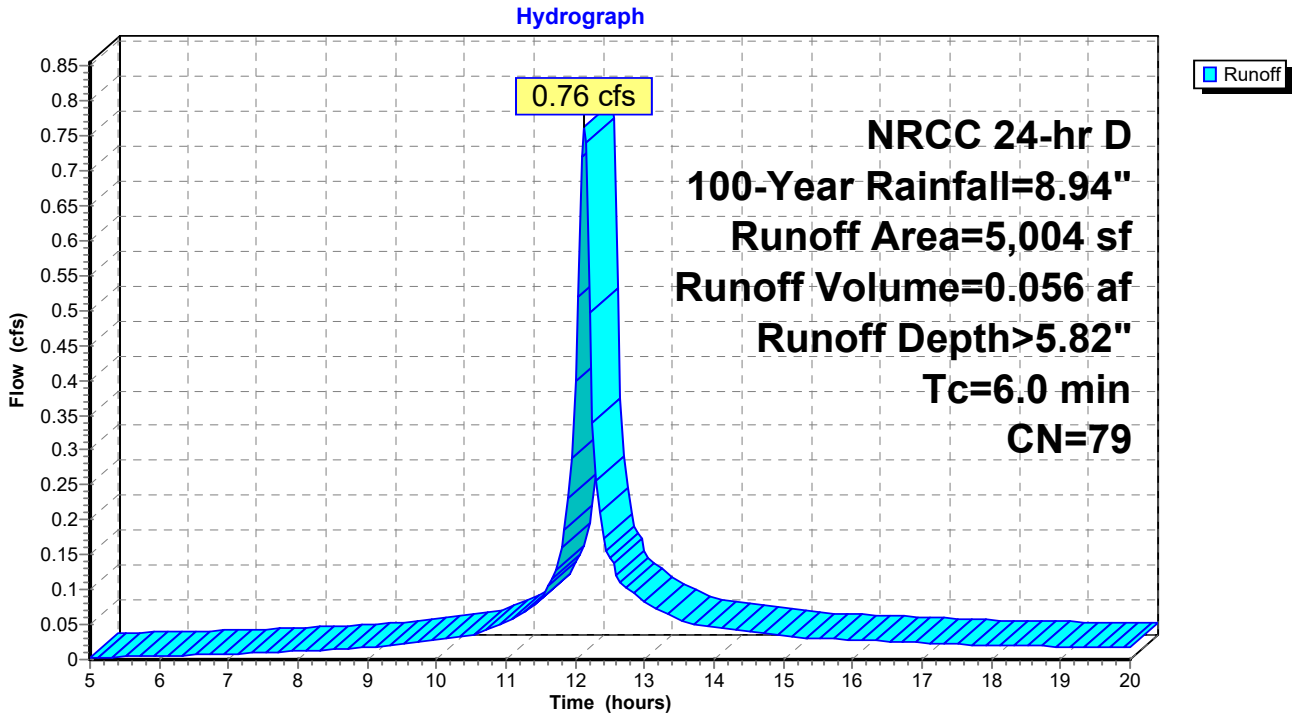
Runoff = 0.76 cfs @ 12.13 hrs, Volume= 0.056 af, Depth> 5.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
1,063	98	Paved parking, HSG C
3,941	74	>75% Grass cover, Good, HSG C
5,004	79	Weighted Average
3,941		78.76% Pervious Area
1,063		21.24% Impervious Area

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

Subcatchment 8S: P1C



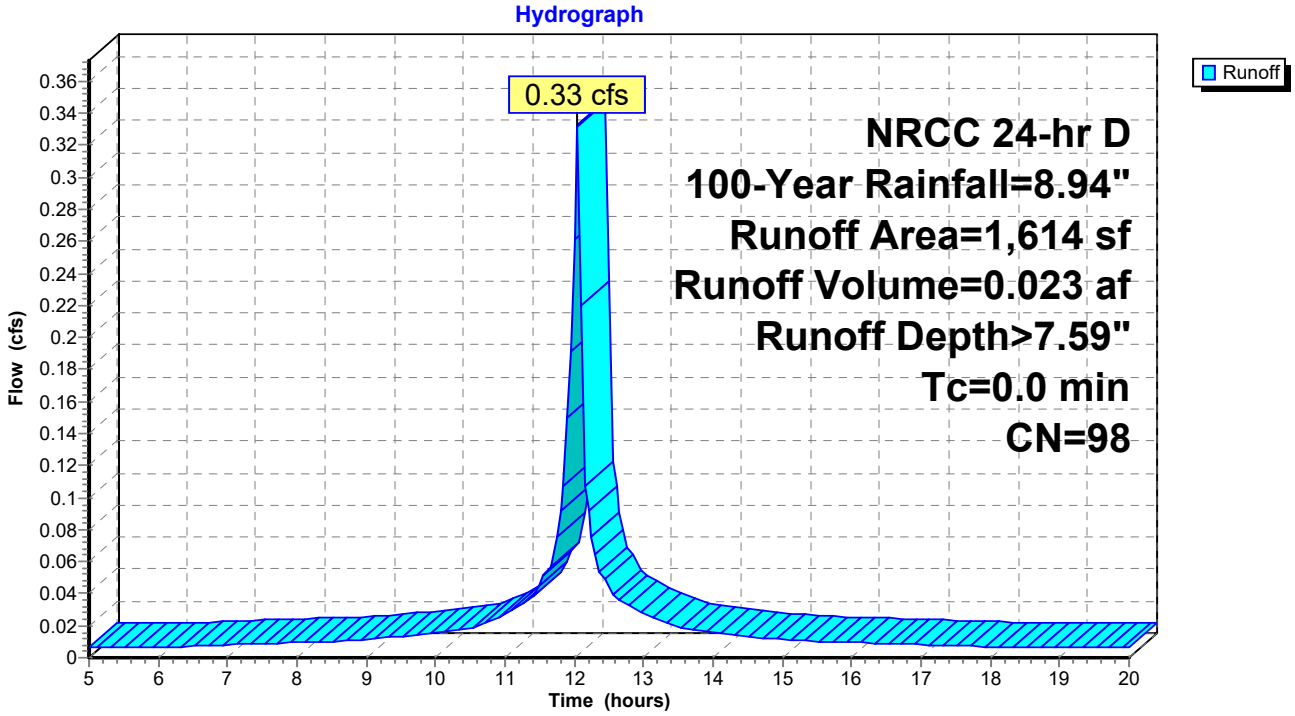
Summary for Subcatchment 13S: P2E

Runoff = 0.33 cfs @ 12.04 hrs, Volume= 0.023 af, Depth> 7.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
1,614	98	Roofs, HSG C
1,614		100.00% Impervious Area

Subcatchment 13S: P2E



Summary for Subcatchment P1A: P1A

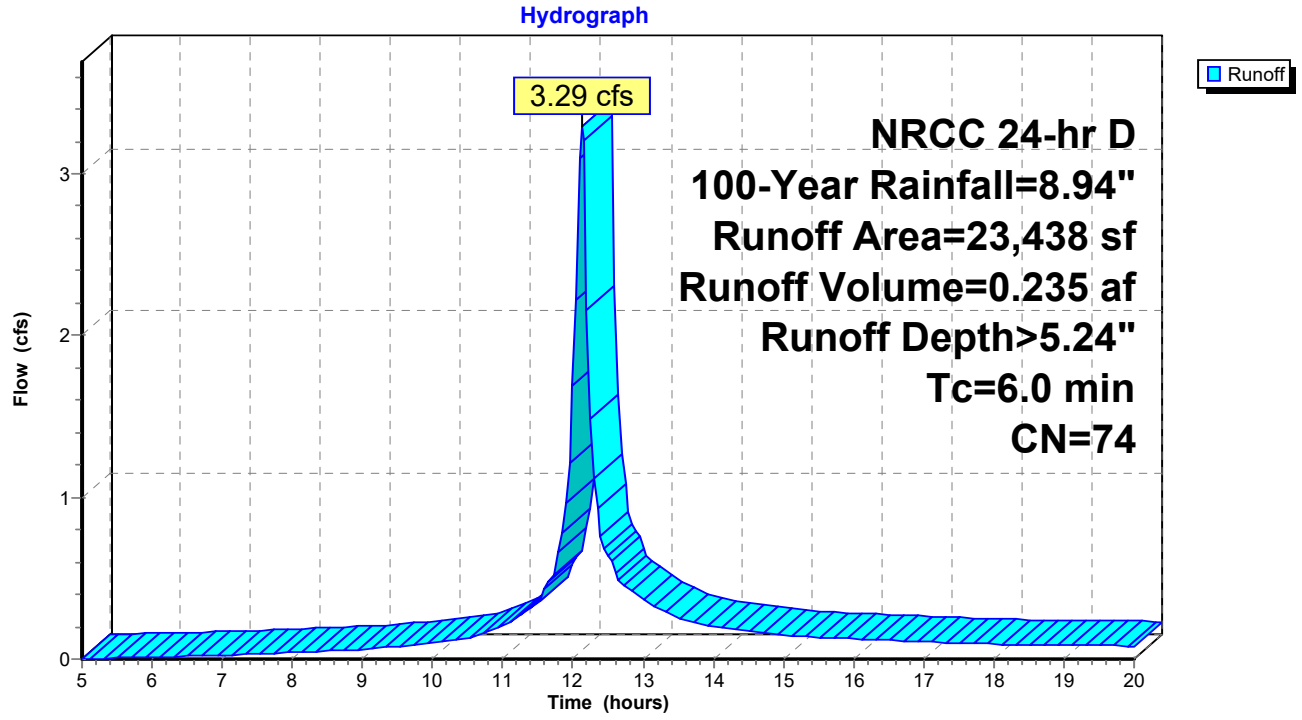
Runoff = 3.29 cfs @ 12.13 hrs, Volume= 0.235 af, Depth> 5.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
22,750	74	>75% Grass cover, Good, HSG C
261	98	Paved parking, HSG C
427	70	Woods, Good, HSG C
23,438	74	Weighted Average
23,177		98.89% Pervious Area
261		1.11% Impervious Area

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

Subcatchment P1A: P1A



Summary for Subcatchment P1B: P1D

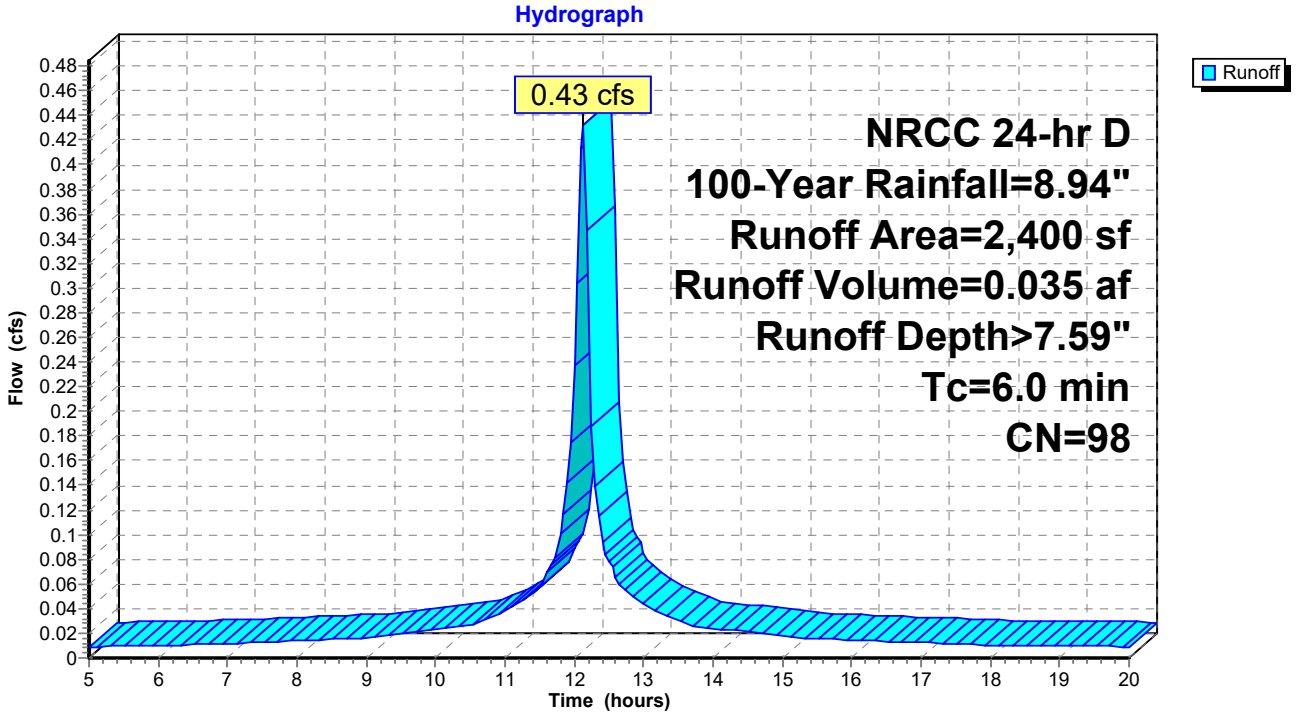
Runoff = 0.43 cfs @ 12.13 hrs, Volume= 0.035 af, Depth> 7.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
2,400	98	Roofs, HSG C
2,400		100.00% Impervious Area

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

Subcatchment P1B: P1D



Summary for Subcatchment P2A: P2A

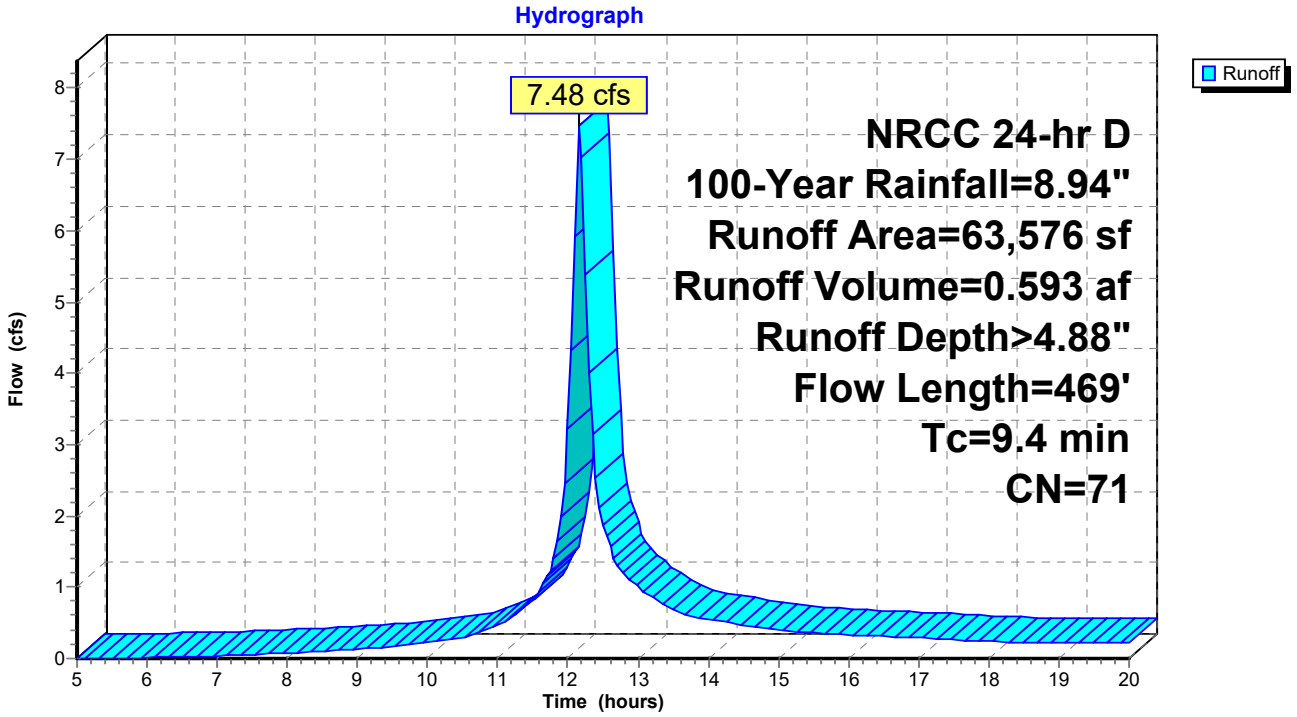
Runoff = 7.48 cfs @ 12.17 hrs, Volume= 0.593 af, Depth> 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
41,098	70	Woods, Good, HSG C
22,478	74	>75% Grass cover, Good, HSG C
63,576	71	Weighted Average
63,576		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	50	0.0600	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.1	66	0.0430	1.04		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	85	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.7	87	0.0300	0.87		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	44	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.3	137	0.0400	1.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
9.4	469	Total			

Subcatchment P2A: P2A



Summary for Subcatchment P2B: P2B

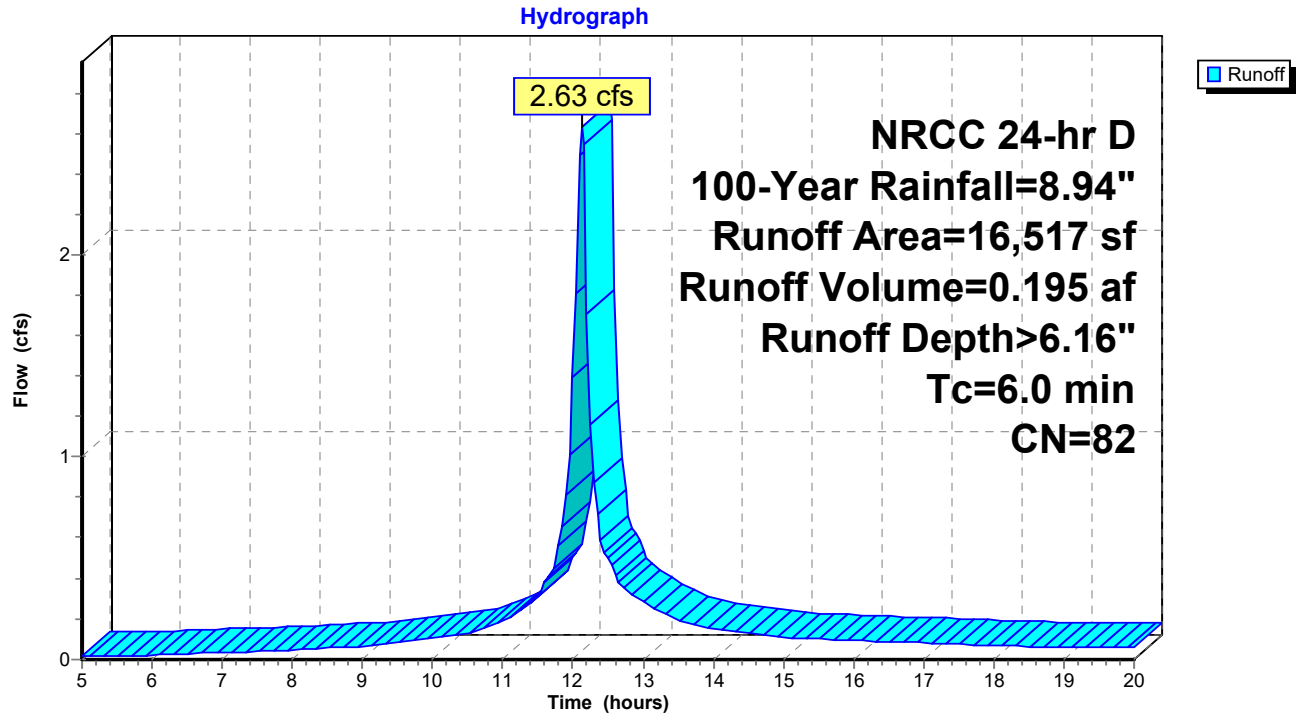
Runoff = 2.63 cfs @ 12.13 hrs, Volume= 0.195 af, Depth> 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
5,489	98	Paved parking, HSG C
11,028	74	>75% Grass cover, Good, HSG C
16,517	82	Weighted Average
11,028		66.77% Pervious Area
5,489		33.23% Impervious Area

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

Subcatchment P2B: P2B



Summary for Subcatchment P2C: P2C

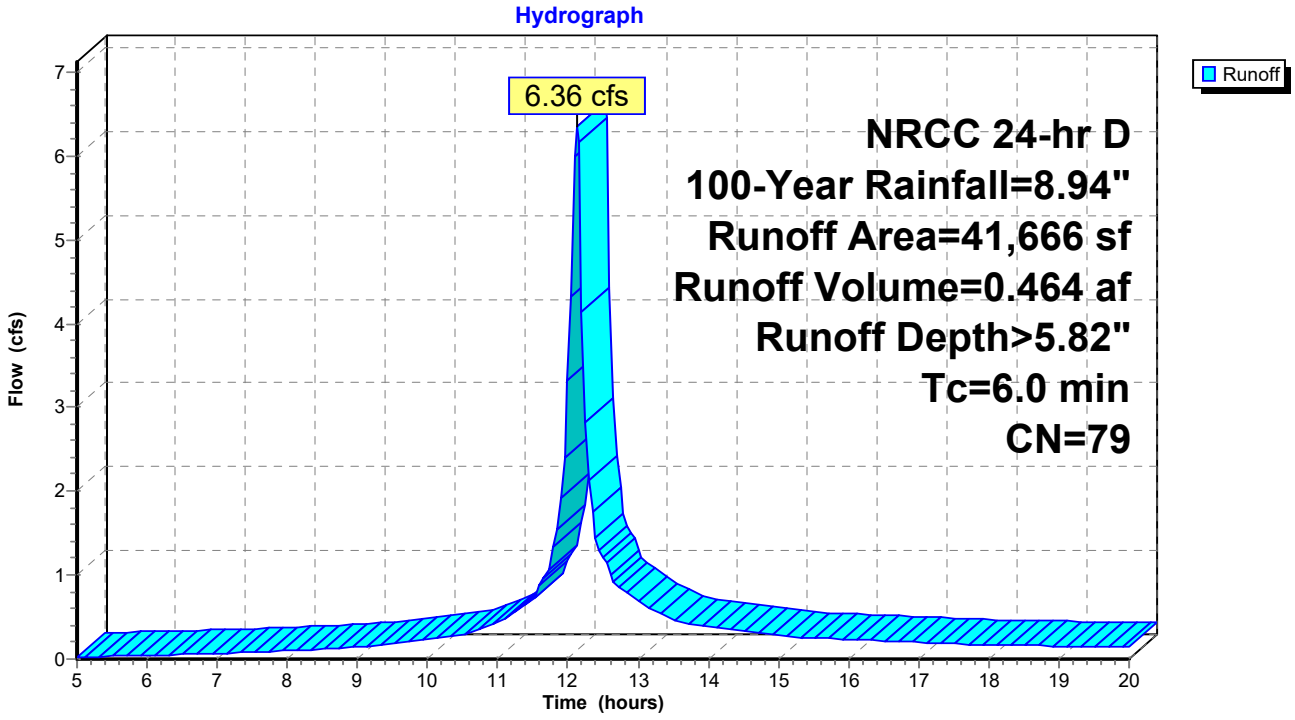
Runoff = 6.36 cfs @ 12.13 hrs, Volume= 0.464 af, Depth> 5.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
8,883	98	Paved parking, HSG C
29,830	74	>75% Grass cover, Good, HSG C
2,953	70	Woods, Good, HSG C
41,666	79	Weighted Average
32,783		78.68% Pervious Area
8,883		21.32% Impervious Area

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

Subcatchment P2C: P2C



Summary for Subcatchment P2D: P2D

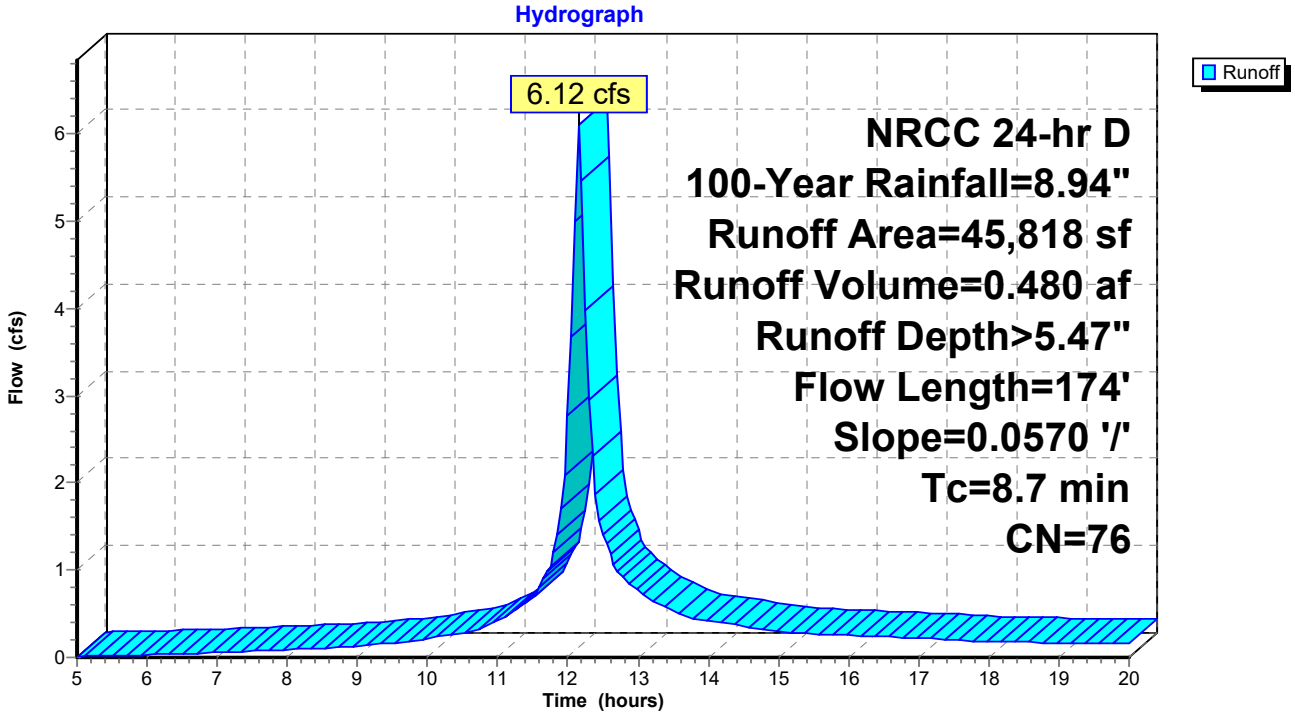
Runoff = 6.12 cfs @ 12.16 hrs, Volume= 0.480 af, Depth> 5.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
4,800	98	Roofs, HSG C
30,008	74	>75% Grass cover, Good, HSG C
11,010	70	Woods, Good, HSG C
45,818	76	Weighted Average
41,018		89.52% Pervious Area
4,800		10.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	124	0.0570	3.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	174	Total			

Subcatchment P2D: P2D



Summary for Subcatchment P3: P3

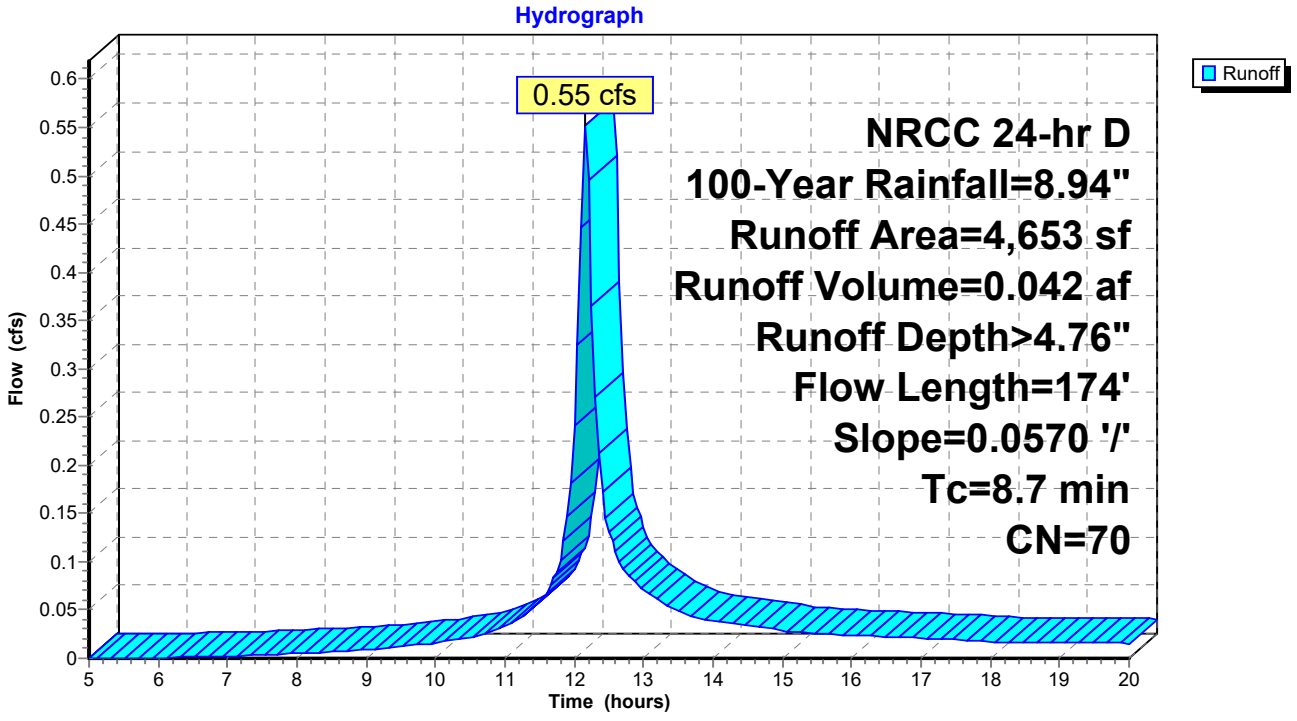
Runoff = 0.55 cfs @ 12.16 hrs, Volume= 0.042 af, Depth> 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
4,653	70	Woods, Good, HSG C
4,653		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	124	0.0570	3.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
8.7	174	Total			

Subcatchment P3: P3



Summary for Pond 2P: DMH 1

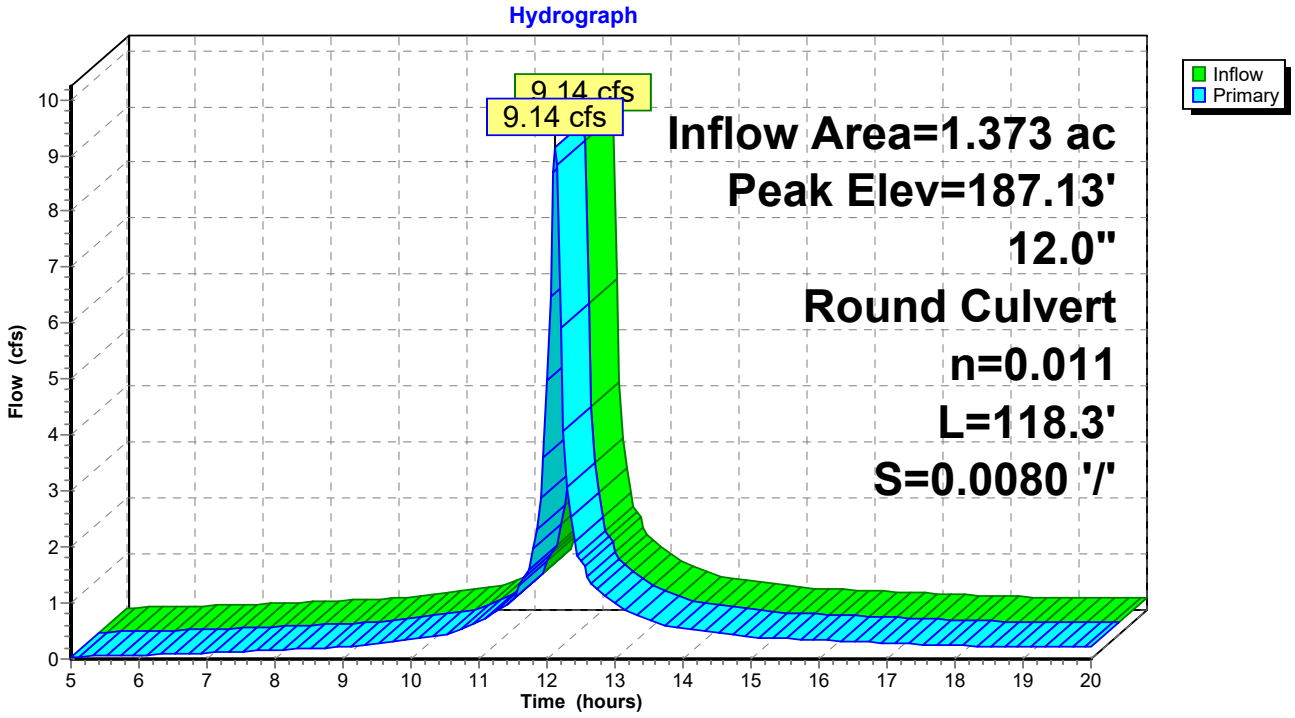
Inflow Area = 1.373 ac, 26.73% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 9.14 cfs @ 12.13 hrs, Volume= 0.682 af
Outflow = 9.14 cfs @ 12.13 hrs, Volume= 0.682 af, Atten= 0%, Lag= 0.0 min
Primary = 9.14 cfs @ 12.13 hrs, Volume= 0.682 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 187.13' @ 12.13 hrs
Flood Elev= 182.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	178.45'	**12.0" Round Culvert** L= 118.3' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 178.45' / 177.50' S= 0.0080 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=8.77 cfs @ 12.13 hrs HW=186.55' (Free Discharge)
1=Culvert (Barrel Controls 8.77 cfs @ 11.17 fps)

Pond 2P: DMH 1



Summary for Pond 3P: CB2

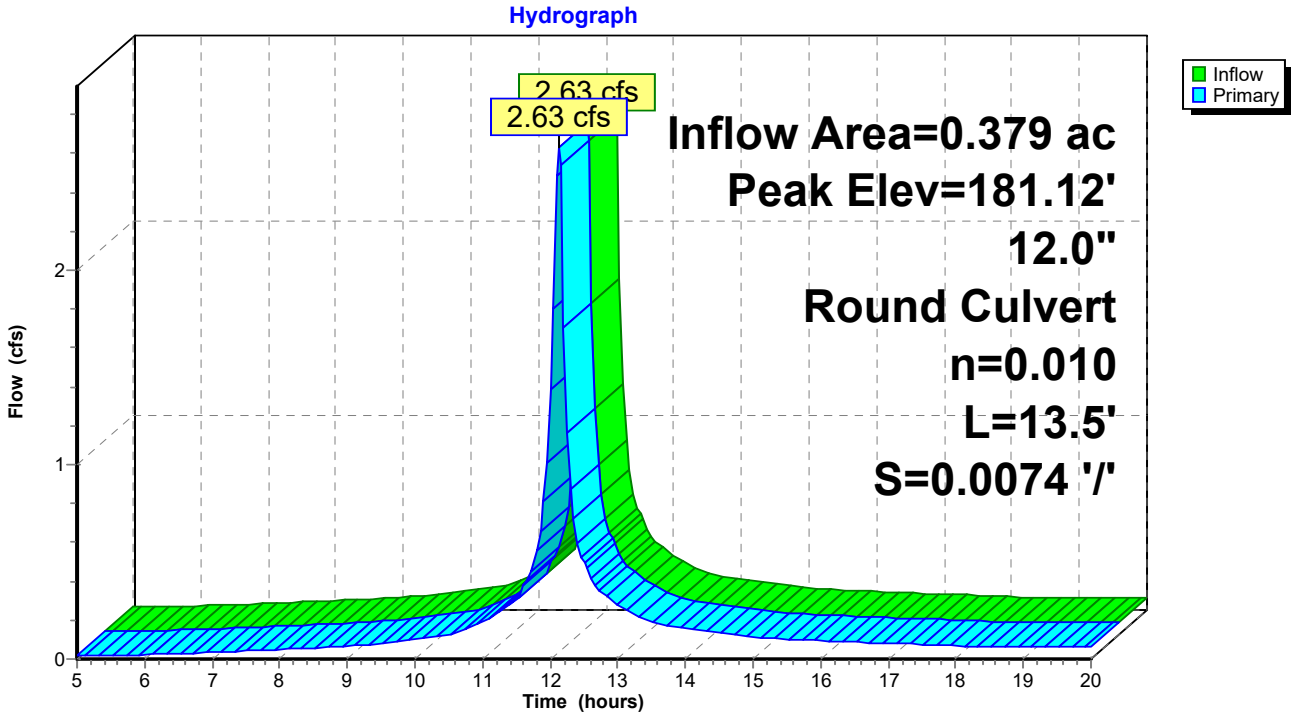
Inflow Area = 0.379 ac, 33.23% Impervious, Inflow Depth > 6.16" for 100-Year event
Inflow = 2.63 cfs @ 12.13 hrs, Volume= 0.195 af
Outflow = 2.63 cfs @ 12.13 hrs, Volume= 0.195 af, Atten= 0%, Lag= 0.0 min
Primary = 2.63 cfs @ 12.13 hrs, Volume= 0.195 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 181.12' @ 12.13 hrs
Flood Elev= 182.86'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.86'	**12.0" Round Culvert** L= 13.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 179.86' / 179.76' S= 0.0074 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.52 cfs @ 12.13 hrs HW=181.07' (Free Discharge)
1=Culvert (Inlet Controls 2.52 cfs @ 3.21 fps)

Pond 3P: CB2



Summary for Pond 4P: (new Pond)

Inflow Area = 0.055 ac,100.00% Impervious, Inflow Depth > 7.59" for 100-Year event
Inflow = 0.43 cfs @ 12.13 hrs, Volume= 0.035 af
Outflow = 0.02 cfs @ 14.18 hrs, Volume= 0.022 af, Atten= 95%, Lag= 123.1 min
Discarded = 0.02 cfs @ 14.18 hrs, Volume= 0.022 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 184.83' @ 14.18 hrs Surf.Area= 506 sf Storage= 766 cf

Plug-Flow detention time= 178.0 min calculated for 0.022 af (62% of inflow)
Center-of-Mass det. time= 85.5 min (820.4 - 734.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	182.50'	487 cf	**15.75'W x 32.10'L x 3.50'H Field A** 1,769 cf Overall - 551 cf Embedded = 1,218 cf x 40.0% Voids
#2A	183.00'	551 cf	**ADS_StormTech SC-740 +Cap** x 12 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 12 Chambers in 3 Rows
		1,038 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	182.50'	**1.020 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 180.00'

Discarded OutFlow Max=0.02 cfs @ 14.18 hrs HW=184.83' (Free Discharge)
↑**1=Exfiltration** (Controls 0.02 cfs)

Pond 4P: (new Pond) - Chamber Wizard Field A

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

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

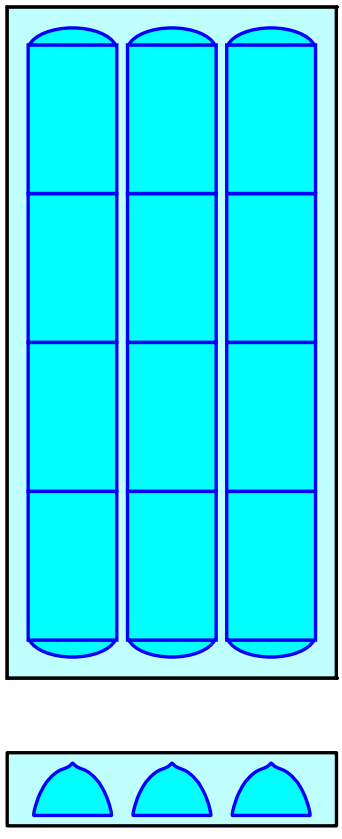
4 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 30.10' Row Length +12.0" End Stone x 2 = 32.10' Base Length
3 Rows x 51.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

12 Chambers x 45.9 cf = 551.3 cf Chamber Storage

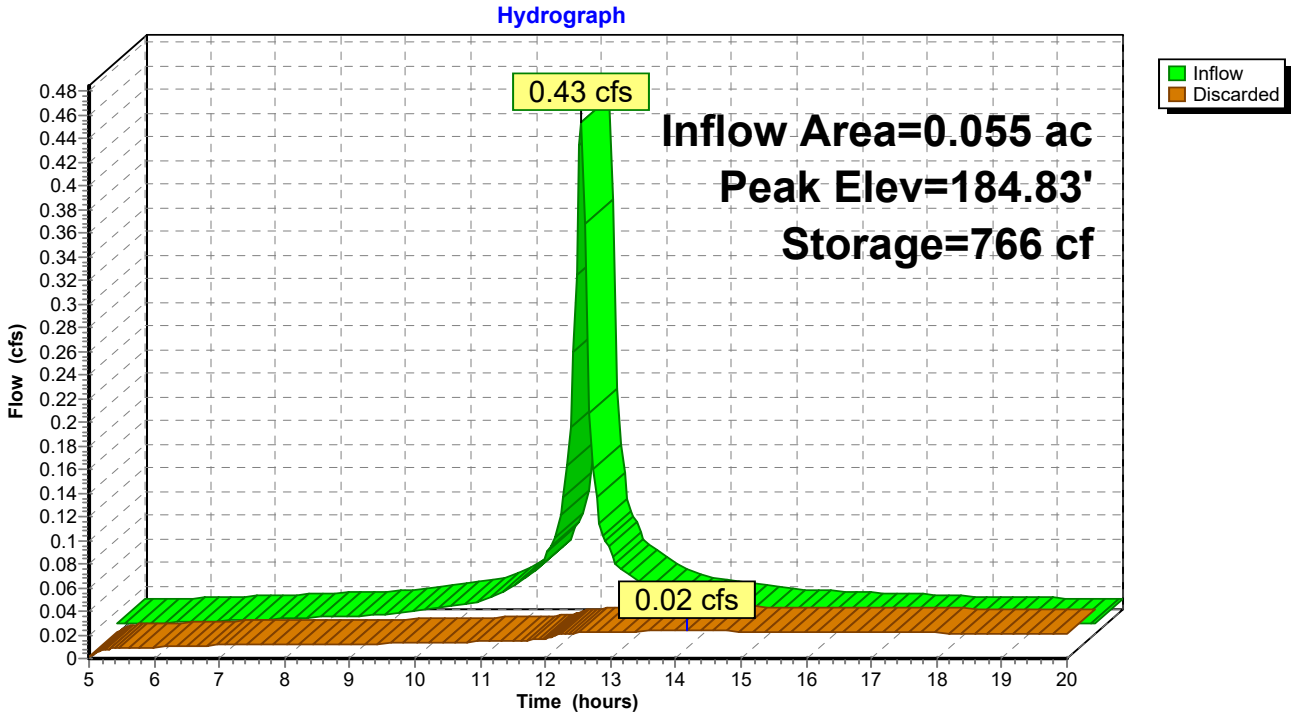
1,769.3 cf Field - 551.3 cf Chambers = 1,218.0 cf Stone x 40.0% Voids = 487.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,038.5 cf = 0.024 af
Overall Storage Efficiency = 58.7%
Overall System Size = 32.10' x 15.75' x 3.50'

12 Chambers
65.5 cy Field
45.1 cy Stone



Pond 4P: (new Pond)



Summary for Pond 5P: DMH 1

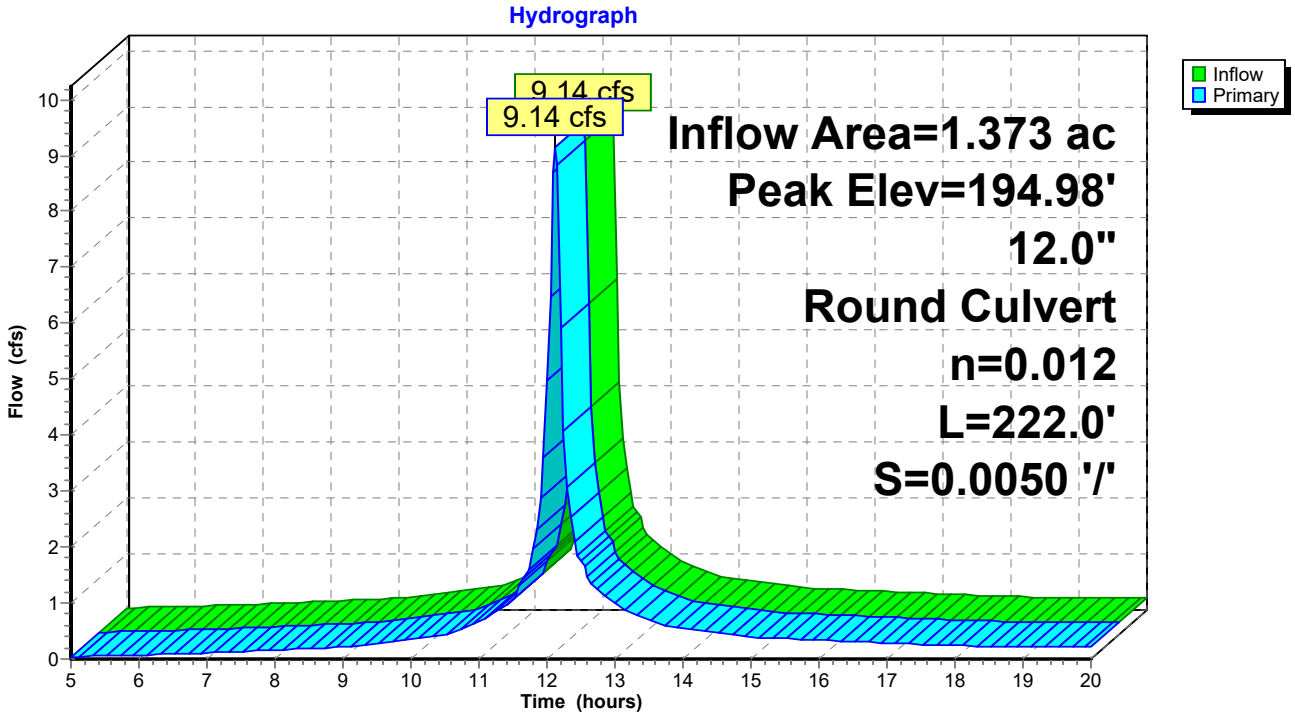
Inflow Area = 1.373 ac, 26.73% Impervious, Inflow Depth > 5.97" for 100-Year event
Inflow = 9.14 cfs @ 12.13 hrs, Volume= 0.682 af
Outflow = 9.14 cfs @ 12.13 hrs, Volume= 0.682 af, Atten= 0%, Lag= 0.0 min
Primary = 9.14 cfs @ 12.13 hrs, Volume= 0.682 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 194.98' @ 12.13 hrs
Flood Elev= 185.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.66'	**12.0" Round Culvert** L= 222.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 179.66' / 178.55' S= 0.0050 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

Primary OutFlow Max=8.77 cfs @ 12.13 hrs HW=193.95' (Free Discharge)
1=Culvert (Barrel Controls 8.77 cfs @ 11.17 fps)

Pond 5P: DMH 1



Summary for Pond 6P: CB 3

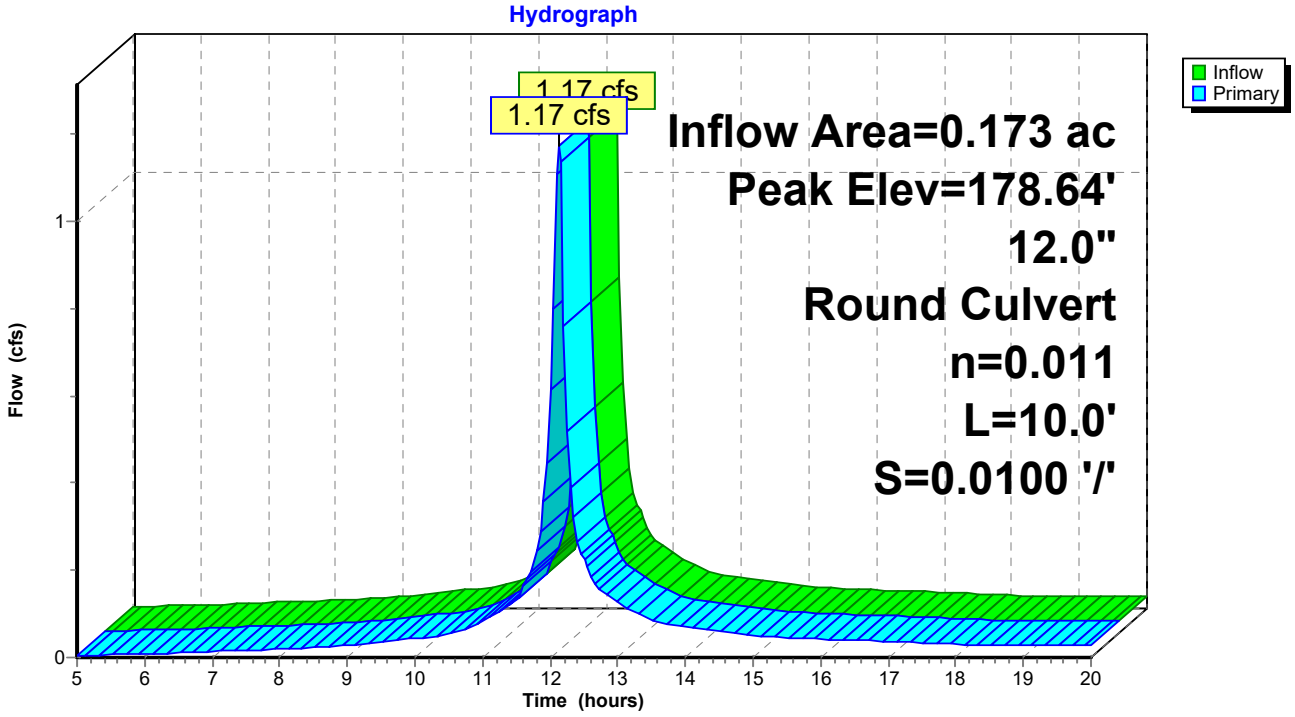
Inflow Area = 0.173 ac, 26.68% Impervious, Inflow Depth > 5.94" for 100-Year event
Inflow = 1.17 cfs @ 12.13 hrs, Volume= 0.086 af
Outflow = 1.17 cfs @ 12.13 hrs, Volume= 0.086 af, Atten= 0%, Lag= 0.0 min
Primary = 1.17 cfs @ 12.13 hrs, Volume= 0.086 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 178.64' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	178.00'	**12.0" Round Culvert** L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 178.00' / 177.90' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=1.12 cfs @ 12.13 hrs HW=178.63' (Free Discharge)
└**1=Culvert** (Barrel Controls 1.12 cfs @ 3.09 fps)

Pond 6P: CB 3



Summary for Pond 7P: CB1

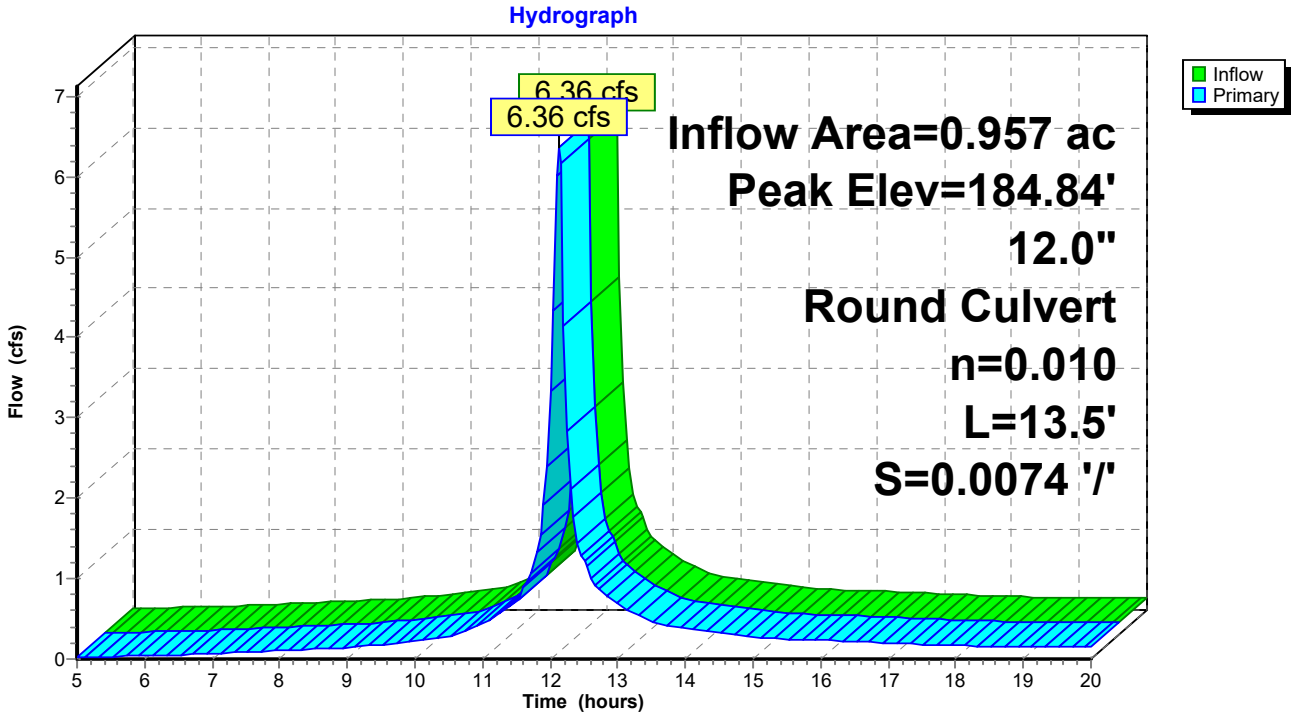
Inflow Area = 0.957 ac, 21.32% Impervious, Inflow Depth > 5.82" for 100-Year event
Inflow = 6.36 cfs @ 12.13 hrs, Volume= 0.464 af
Outflow = 6.36 cfs @ 12.13 hrs, Volume= 0.464 af, Atten= 0%, Lag= 0.0 min
Primary = 6.36 cfs @ 12.13 hrs, Volume= 0.464 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 184.84' @ 12.13 hrs
Flood Elev= 182.86'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.86'	**12.0" Round Culvert** L= 13.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 179.86' / 179.76' S= 0.0074 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=6.10 cfs @ 12.13 hrs HW=184.53' (Free Discharge)
1=Culvert (Inlet Controls 6.10 cfs @ 7.76 fps)

Pond 7P: CB1



Summary for Pond 9P: DETENTION BASIN

Inflow Area = 2.425 ac, 19.68% Impervious, Inflow Depth > 5.75" for 100-Year event
Inflow = 15.06 cfs @ 12.14 hrs, Volume= 1.162 af
Outflow = 6.90 cfs @ 12.28 hrs, Volume= 1.077 af, Atten= 54%, Lag= 8.6 min
Discarded = 0.28 cfs @ 12.28 hrs, Volume= 0.137 af
Primary = 6.61 cfs @ 12.28 hrs, Volume= 0.940 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 180.48' @ 12.28 hrs Surf.Area= 9,324 sf Storage= 14,225 cf

Plug-Flow detention time= 68.7 min calculated for 1.074 af (92% of inflow)
Center-of-Mass det. time= 41.4 min (813.3 - 772.0)

Volume	Invert	Avail.Storage	Storage Description
#1	177.50'	24,911 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

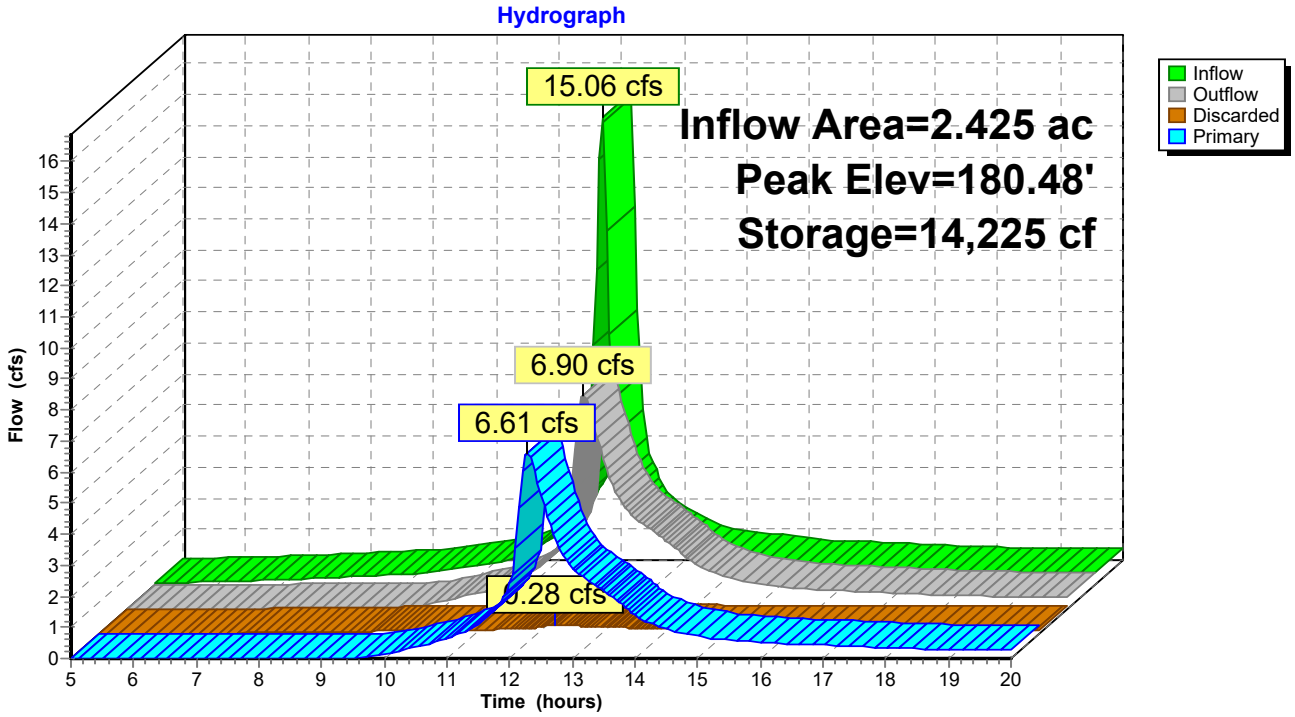
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
177.50	203	0	0
178.00	1,073	319	319
179.00	4,680	2,877	3,196
180.00	8,686	6,683	9,879
181.00	10,008	9,347	19,226
181.50	12,732	5,685	24,911

Device	Routing	Invert	Outlet Devices
#1	Primary	178.00'	**18.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 178.00' / 176.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Primary	181.00'	**6.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Device 1	178.90'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	178.90'	**8.0" Vert. Orifice/Grate** C= 0.600
#5	Device 1	179.90'	**24.0" W x 24.0" H Vert. Orifice/Grate** C= 0.600
#6	Discarded	178.00'	**1.020 in/hr Exfiltration over Surface area above 178.00'** Conductivity to Groundwater Elevation = 175.80' Excluded Surface area = 1,073 sf

Discarded OutFlow Max=0.28 cfs @ 12.28 hrs HW=180.48' (Free Discharge)
└**6=Exfiltration** (Controls 0.28 cfs)

Primary OutFlow Max=6.58 cfs @ 12.28 hrs HW=180.48' (Free Discharge)
└**1=Culvert** (Passes 6.58 cfs of 8.83 cfs potential flow)
  └**3=Orifice/Grate** (Orifice Controls 1.88 cfs @ 5.37 fps)
  └**4=Orifice/Grate** (Orifice Controls 1.88 cfs @ 5.37 fps)
  └**5=Orifice/Grate** (Orifice Controls 2.83 cfs @ 2.44 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 9P: DETENTION BASIN



Summary for Pond 10P: (new Pond)

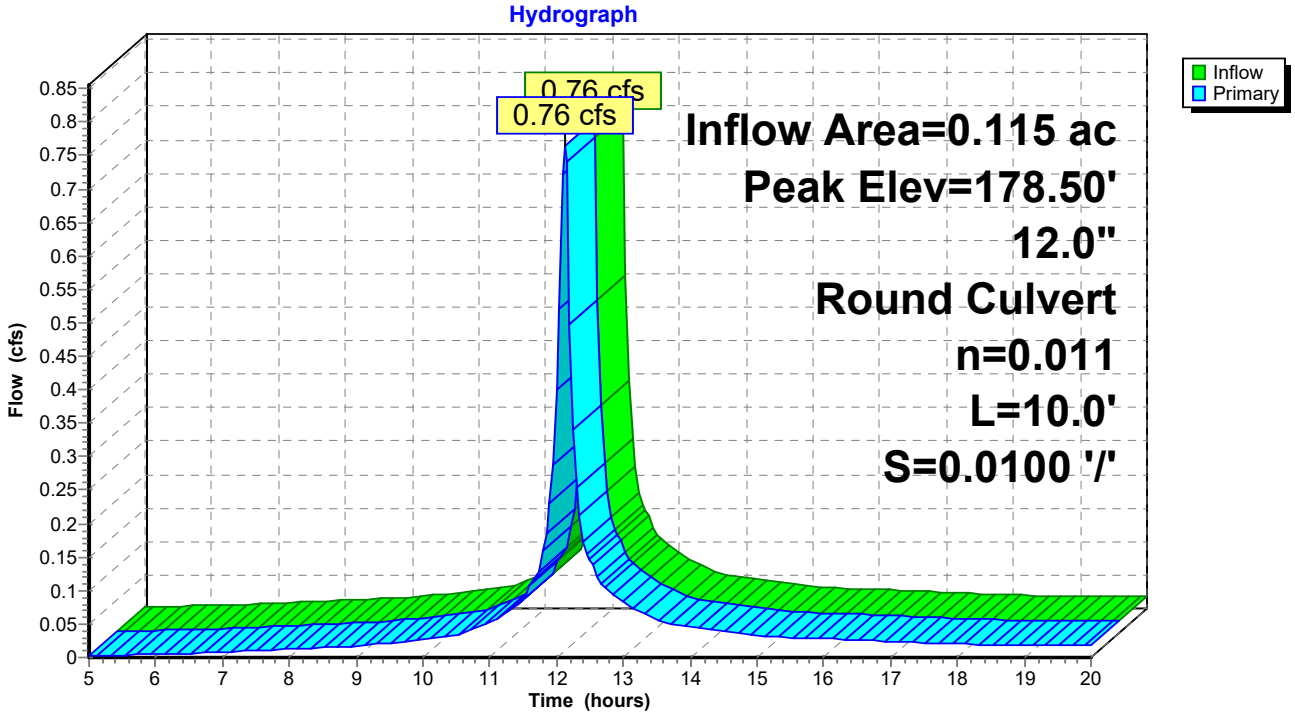
Inflow Area = 0.115 ac, 21.24% Impervious, Inflow Depth > 5.82" for 100-Year event
Inflow = 0.76 cfs @ 12.13 hrs, Volume= 0.056 af
Outflow = 0.76 cfs @ 12.13 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min
Primary = 0.76 cfs @ 12.13 hrs, Volume= 0.056 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 178.50' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	178.00'	**12.0" Round Culvert** L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 178.00' / 177.90' S= 0.0100 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=0.73 cfs @ 12.13 hrs HW=178.49' (Free Discharge)
└**1=Culvert** (Barrel Controls 0.73 cfs @ 2.82 fps)

Pond 10P: (new Pond)



Summary for Pond 11P: (new Pond)

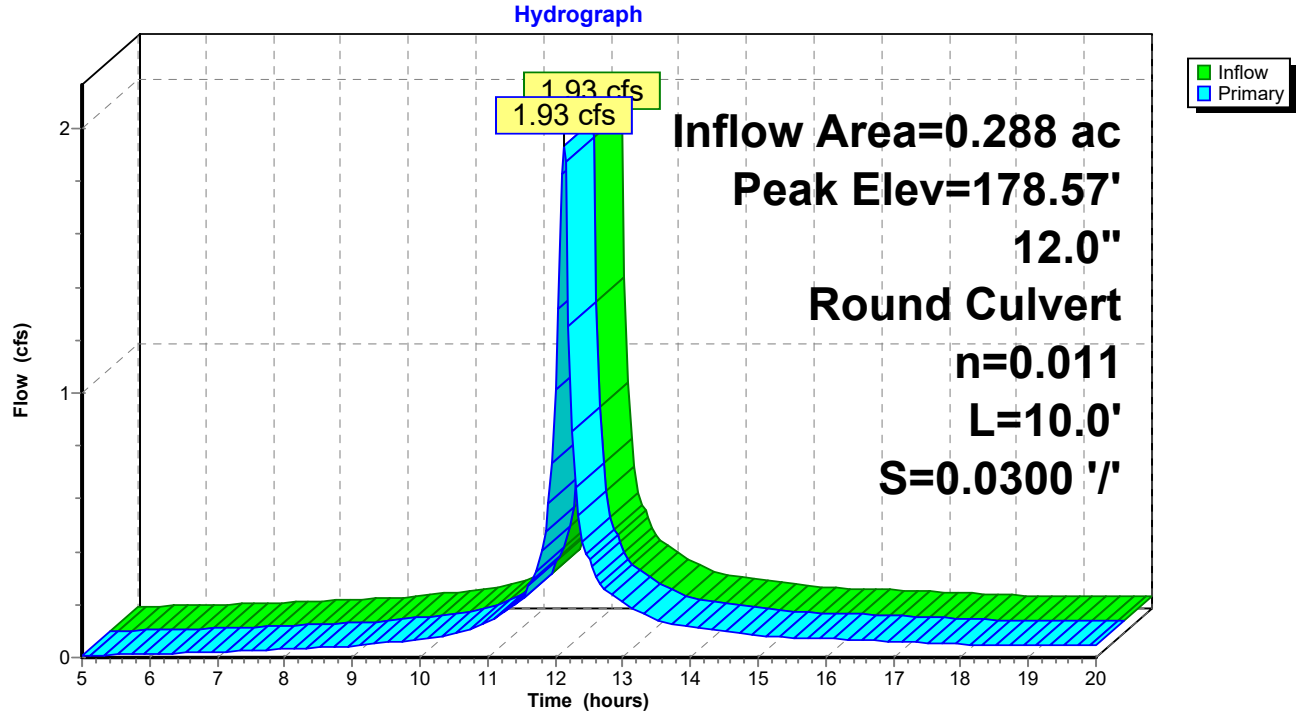
Inflow Area = 0.288 ac, 24.51% Impervious, Inflow Depth > 5.89" for 100-Year event
Inflow = 1.93 cfs @ 12.13 hrs, Volume= 0.142 af
Outflow = 1.93 cfs @ 12.13 hrs, Volume= 0.142 af, Atten= 0%, Lag= 0.0 min
Primary = 1.93 cfs @ 12.13 hrs, Volume= 0.142 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 178.57' @ 12.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	177.80'	**12.0" Round Culvert** L= 10.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 177.80' / 177.50' S= 0.0300 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=1.85 cfs @ 12.13 hrs HW=178.55' (Free Discharge)
1=Culvert (Inlet Controls 1.85 cfs @ 2.94 fps)

Pond 11P: (new Pond)

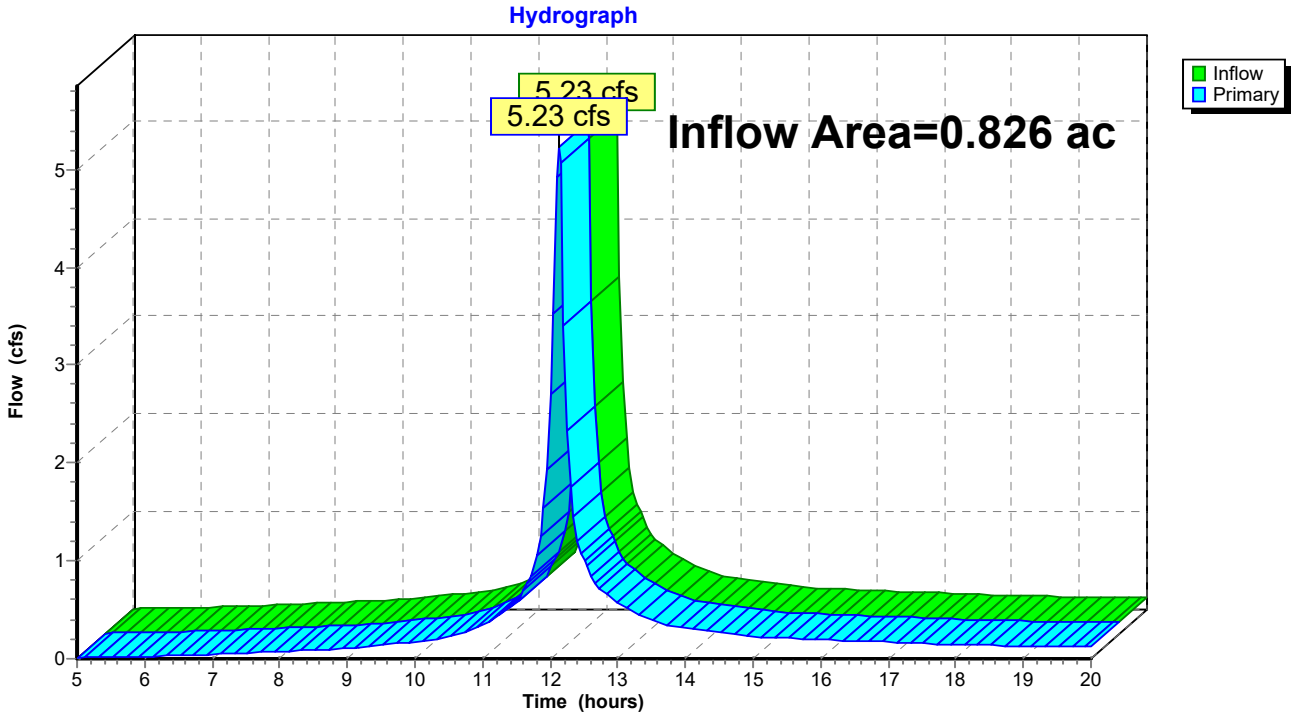


Summary for Link A: TOTAL P1

Inflow Area = 0.826 ac, 9.28% Impervious, Inflow Depth > 5.47" for 100-Year event
Inflow = 5.23 cfs @ 12.13 hrs, Volume= 0.377 af
Primary = 5.23 cfs @ 12.13 hrs, Volume= 0.377 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link A: TOTAL P1

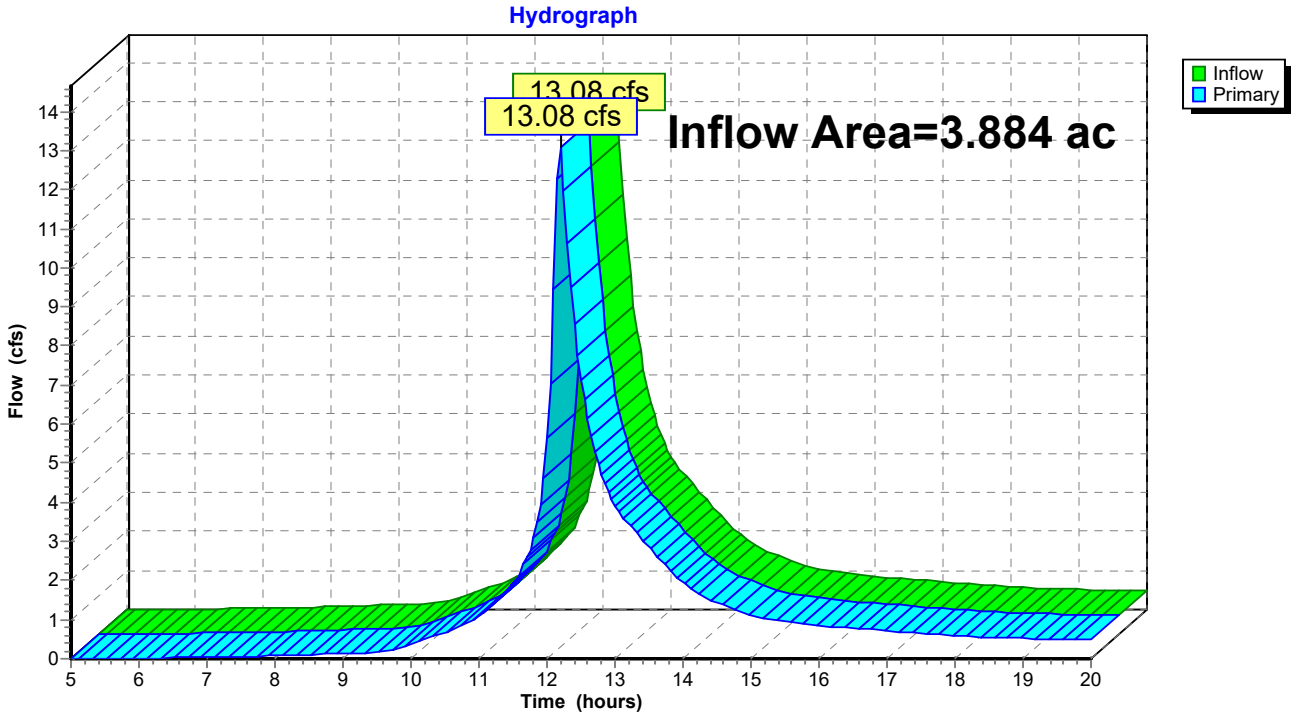


Summary for Link B: TOTAL P2

Inflow Area = 3.884 ac, 12.29% Impervious, Inflow Depth > 4.74" for 100-Year event
Inflow = 13.08 cfs @ 12.20 hrs, Volume= 1.534 af
Primary = 13.08 cfs @ 12.20 hrs, Volume= 1.534 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link B: TOTAL P2

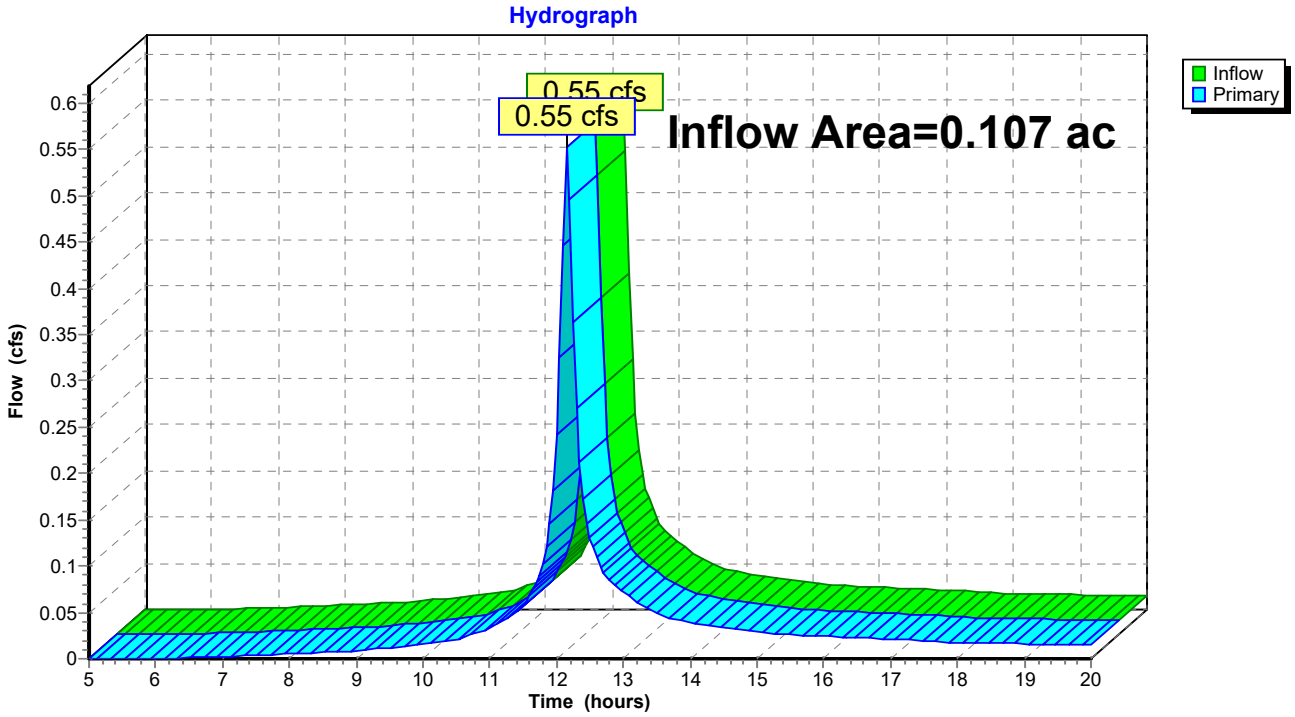


Summary for Link C: TOTAL P3

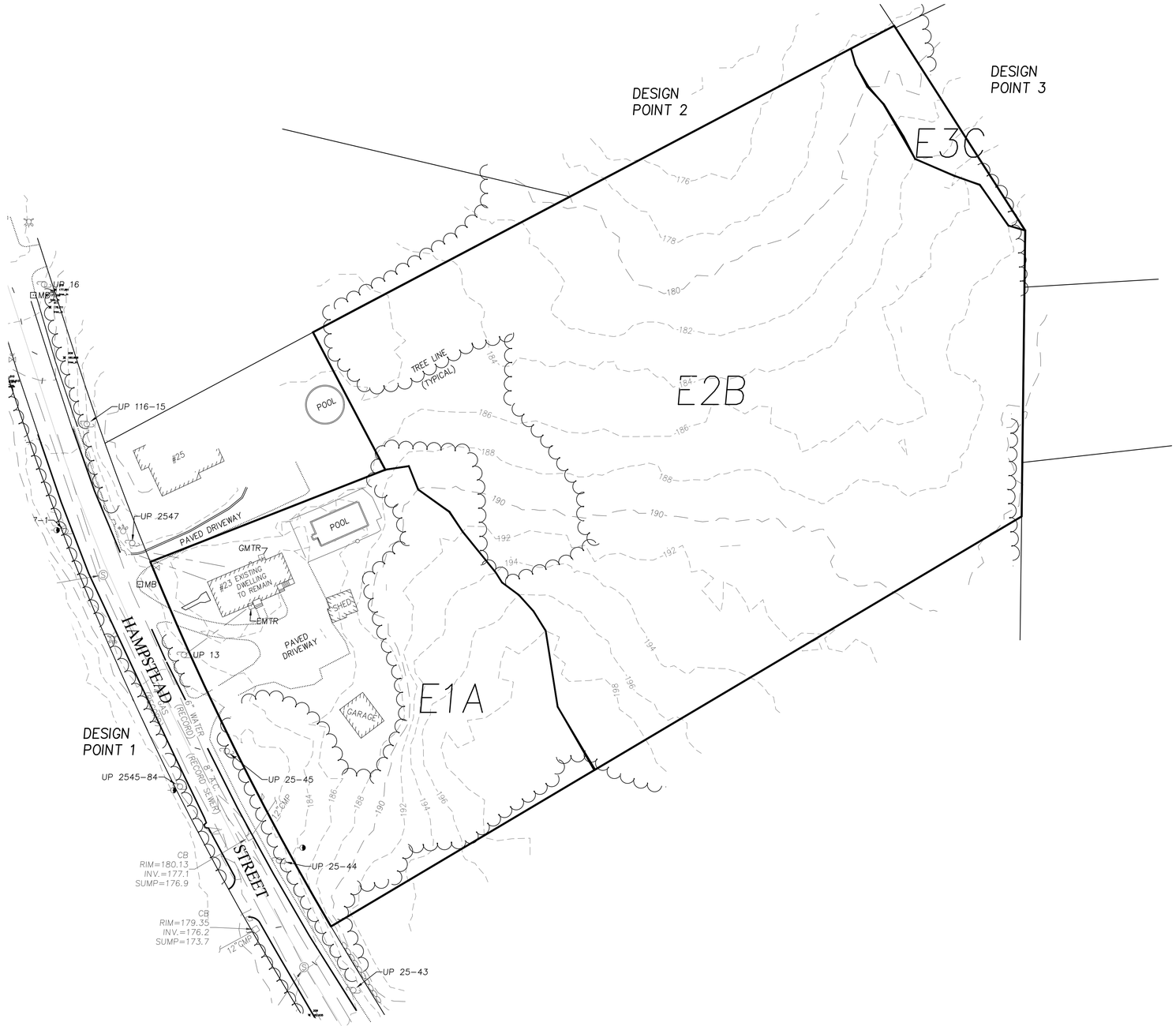
Inflow Area = 0.107 ac, 0.00% Impervious, Inflow Depth > 4.76" for 100-Year event
Inflow = 0.55 cfs @ 12.16 hrs, Volume= 0.042 af
Primary = 0.55 cfs @ 12.16 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link C: TOTAL P3



e. Watershed Maps



GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)

1 inch = 40'

PREPARED FOR

JR BUILDERS, INC.

16 INDUSTRIAL WAY

SALEM, NH

NO.	DATE	DESCRIPTION	BY

MEI

MILLENNIUM ENGINEERING, INC.

ENGINEERING AND LAND SURVEYING

62 ELM ST. SALISBURY, MA 01952 (978) 463-8980

13 HAMPTON RD. EXETER, NH 03833 (603) 778-0528

SCALE: 1"=40' | CALC. BY: S.R.C.

DATE: OCT. 5, 2021 | CHKD. BY: J.T.M. | PROJECT: M213934

DEFINITIVE SUBDIVISON PLAN

IN

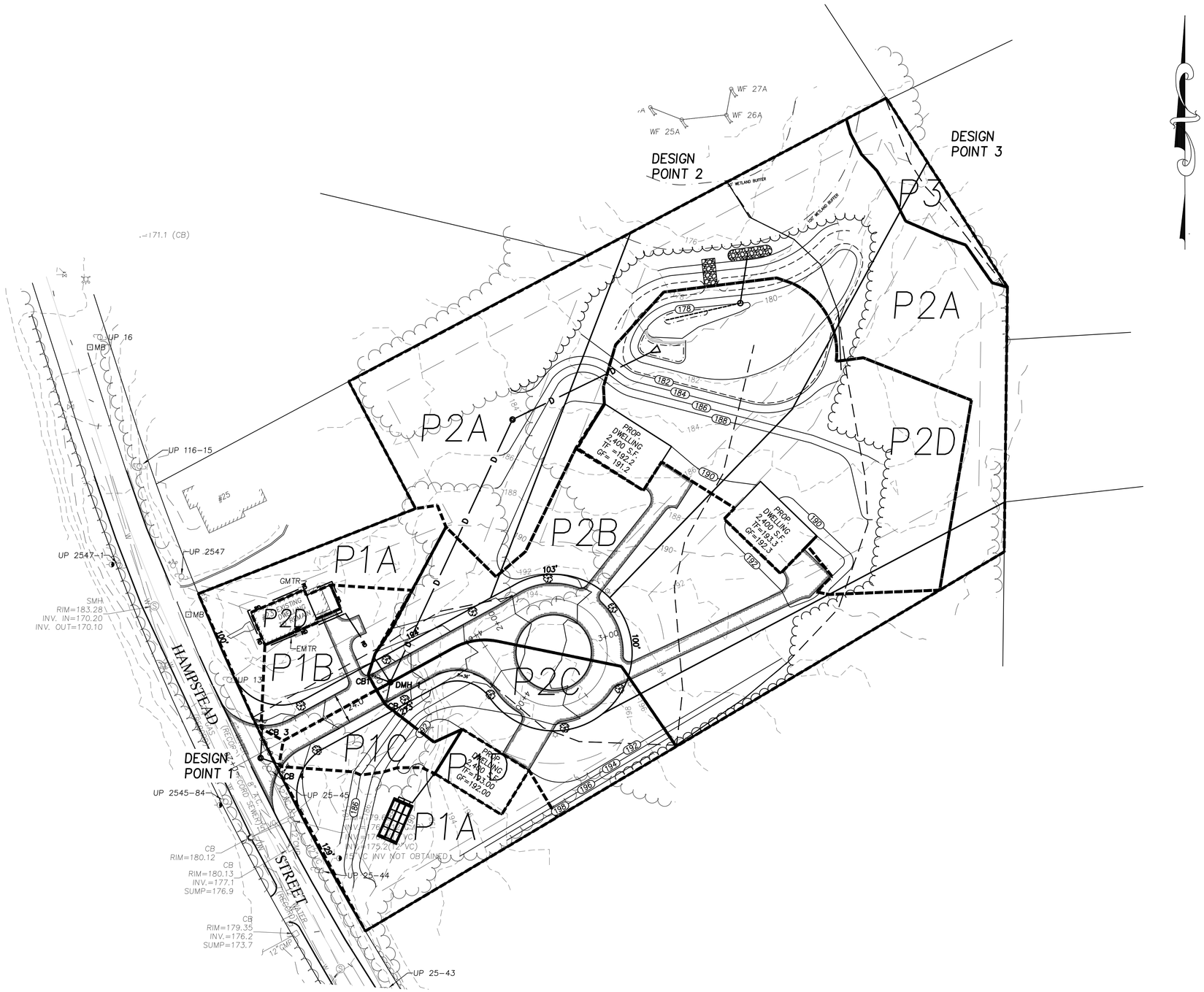
METHUEN, MA

AT

23 HAMPSTEAD ST

PRE-DEVELOPMENT WATERSHED MAP

SHEET: 1 OF 1



PREPARED FOR

JR BUILDERS, INC.
16 INDUSTRIAL WAY
SALEM, NH

NO.	DATE	DESCRIPTION	BY
3	3/1/22	RESPONSE TO PEER REVIEW	S.R.C.
2	1/24/22	RESPONSE TO PEER REVIEW	J.T.M.
1	11/23/21	RESPONSE TO PEER REVIEW	J.T.M.

MEI
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ENGINEERING AND LAND SURVEYING
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SCALE: 1"=40' | CALC. BY: J.T.M.
DATE: OCT. 5, 2021 | CHKD. BY: E.W.B.
PROJECT: M213934

DEFINITIVE SUBDIVISON PLAN

IN
METHUEN, MA
AT
23 HAMPSTEAD ST

POST-DEVELOPMENT WATERSHED MAP

SHEET: 1 OF 1