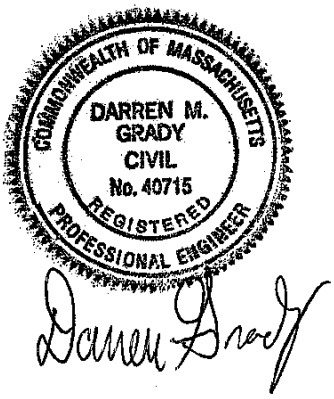
GRADY CONSULTING, L.L.C.
Civil Engineers ♦ Land Surveyors ♦ Landscape Architects

STORMWATER REPORT

171 Mattakeesett Street
Pembroke, Massachusetts



Prepared for:

171 Mattakeesett Street LLC
283 Sawyer Street
New Bedford, MA 02746

December 17, 2018

Revised
April 2, 2019
September 26, 2019

71 Evergreen Street, Suite 1 ♦ Kingston, MA 02364 ♦ Tel (781) 585-2300 ♦ Fax (781) 585-2378

SUMMARY

This Stormwater Report has been prepared to document compliance with Stormwater Management Standards. The applicant is proposing to expand the existing warehouse/storage/industrial use by constructing an additional (3) three proposed garage buildings, each 7,000 square feet. **The revised plans show a revised building layout and provide a vegetative buffer to the rear of the property. The buildings have been revised from 70'x 100' to 60'x120', 7,200 sqaure feet. The fire access and boat storage areas have been modified to pavement. The basin and underground chamber system has been increased in size. A 50-foot vegetative buffer is provided between the basin and rear property. The fire access and boat storage areas have been revised as proposed paved areas.**

The property is located in a Flood Plain Zone X as shown on Flood Insurance Rate Map Community Panel Number 25023C0204J C dated July 17, 2012 and not in a Zone II Aquifier Protection Zone. There are no wetland resource areas on the site.

The property is located at 171 Mattakeesett Street, Pembroke. The property is currently used for the construction and maintenance of boats. The property is approximately 34 percent developed. The developed area consists of a driveway with parking areas and three buildings. The undeveloped area consists of gravel area used for boat storage.. Soils on the site are classified as Udorthents soils, hydrologic soils group B, which are well drained soils with groundwater greater than 80 inches below the surface. The existing drainage system consists of catch basins, manholes, stormceptor unit, and infiltration basins. Their designs are based on a hydrologic soil group A with an infiltration rate of 8.27 inches per hour. **The proposed drainage system will utilize catch basins, drain manholes, Cascade Seperators, concrete chambers and an infiltration basin. The existing catch basins collecting runoff from the southerly side of the existing developed site shall be utilized. Stormwater will be routed from the existing catch basins to an existing Cascade Seperator unit, then to the proposed subsurface chambers system and infiltration basin. The expanded driveway and parking areas will drain to a catch basin, then to a Cascade Seperator unit before entering into the proposed infiltration basin. Roof drains are proposed for the proposed buildings with discharges to the infiltration basin.**

The analysis was prepared to demonstrate that the proposed development complies with Stormwater Management Requirements and Town of Pembroke Planning Board Rules and Regulations. This includes removal of at least 80% of Total Suspended Solids and attenuation of stormwater flows for the proposed development. The attenuation of stormwater flows has been achieved by routing runoff from the proposed development to the subsurface chamber system and an infiltration basin.

This analysis is divided into the following sections:
Section I Compliance with Massachusetts Stormwater Management Regulations
Section II Overall Site Analysis

The calculations have been performed for the 2, 10, and 25, 100-year 24 hour storm event, using the HydroCAD 10.0.

The following table summarizes runoff for the pre and post-development conditions.

SUMMARY OF STORMWATER FLOWS
(CFS)

		Flow towards northeast side of the site	
Design Storm		Existing Condition (Pre 1)	Proposed Condition (Link 14L)
2-year	3.4”	8.53	0.00
10-year	4.7”	13.94	0.00
25-year	5.6”	17.77	5.43
100-year	7.0”	23.76	16.18
		(Pre 3)	(Post 3)
2-year	3.4”	0.04	0.00
10-year	4.7”	0.20	0.01
25-year	5.6”	0.35	0.03
100-year	7.0”	0.62	0.11

Section I

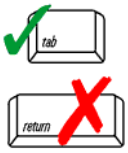
Compliance with Massachusetts Stormwater Management Regulations

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

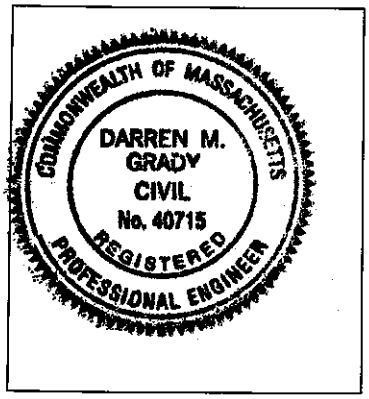
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Darren Grady 9/26/19
Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

- [X] 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
- [X] Use of "country drainage" versus curb and gutter conveyance and pipe
- [ ] Bioretention Cells (includes Rain Gardens)
- [ ] Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- [ ] Treebox Filter
- [ ] Water Quality Swale
- [ ] Grass Channel
- [ ] Green Roof
- [ ] Other (describe): _____

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

STANDARD 1. NO UNTREATED DISCHARGES OR EROSION TO WETLANDS
Applicants must demonstrate that there are no new untreated discharges. To demonstrate that all new discharges are adequately treated, applicants may rely on the computations required to demonstrate compliance with Standards 4 through 6. No additional computations are required.

All proposed developed areas of the lot are routed through the infiltration basin and galley infiltration systems prior to discharge.

STANDARD 2. PEAK RATE ATTENUATION
"Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates."

No increases in post development peak discharge rates are proposed. Calculations demonstrating this are located in Section II.

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

Based on Plymouth County Soil Survey, the site consists of Hydrologic Soils Group "Type B". The previous Drainage Calculations and Stormwater Management Plan shows a soil with a Hydrologic Soils Group "Type A" with and infiltration rate of 8.27 inches per hour. An infiltration rate of 8.27 inches was utilized for the design.

Sample Calculation Post 1A-1E

Impervious Area = 141,953 SF
Target Depth Factor (F) = 0.6"

Rv = F x impervious area = 0.6"x 141,953 SF x 1'/12"= 7,098 CF

<u>Sizing Storage Volume</u>

Using the "static method", the proposed infiltration device must provide sufficient storage capacity to hold the Required Recharge Volume without taking any infiltration into account. The volumes below are listed in the Hydroflow calculations.

Proposed storage volume infiltration basin 1=21,548 (below the outlet),

Drawdown Within 72 Hours

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

Where:
Rv = Storage Volume
K = Saturated Hydraulic Conductivity For "Static" and "Simple Dynamic" Methods, use Rawls Rate (see Table 2.3.3). For "Dynamic Field" Method, use 50% of the in-situ saturated hydraulic conductivity.
Bottom Area = Bottom Area of Recharge Structure

$$\text{Time} = \frac{26{,}479\ \text{CF}}{(8.27")(1'/12")(6{,}204\ \text{SF})} = 6.19\ \text{hours} < 72\ \text{hours}$$

Mounding Analysis

"Mounding analysis is required when the vertical separation from the bottom of an exfiltration system to seasonal high groundwater is less than four (4) feet and the recharge system is proposed to attenuate the peak discharge from a 10-year or higher 24-hour storm (e.g., 10-year, 25-year, 50-year, or 100-year 24-hour storm). In such cases, the mounding analysis must demonstrate that the Required Recharge Volume (e.g., infiltration basin storage) is fully dewatered within 72 hours (so the next storm can be stored for exfiltration). The mounding analysis must also show that the groundwater mound that forms under the recharge system will not break out above the land or water surface of a wetland (e.g., it doesn't increase the water sheet elevation in a Bordering Vegetated Wetland, Salt Marsh, or Land Under Water within the 72-hour evaluation period)."

"The Hantush[1] or other equivalent method may be used to conduct the mounding analysis. The Hantush method predicts the maximum height of the groundwater mound beneath a rectangular or circular recharge area. It assumes unconfined groundwater flow, and that a linear relation exists between the water table elevation and water table decline rate. It results in a water table recession hydrograph depicting exponential decline. The Hantush method is available in proprietary software and free on-line calculators on the Web in automated format. If the analysis indicates the mound will prevent the infiltration BMP from fully draining within the 72-hour period, an iterative process must be employed to determine an alternative design that drains within the 72-hour period."

Groundwater is greater than 4 feet below the bottom of the basin and a mounding calculation is not required..

[1] Hantush 1967 – See Reference for Standard 3.

STANDARD 4. WATER QUALITY

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

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

This standard applies after the site is stabilized.[2] *Since removal efficiency may vary with each storm, 80% TSS removal is not required for each storm. It is the average removal over the year that is required to meet the standard. The required water quality volume, the runoff volume requiring TSS treatment, is calculated as follows:*

The required water quality volume equals 1.0 inch of runoff times the total impervious area of the post-development project site for a discharge

- *from a land use with a higher potential pollutant load;*
- *within an area with a rapid infiltration rate (greater than 2.4 inches per hour);*
- *within a Zone II or Interim Wellhead Protection Area;*
- *near or to the following critical areas:*
    - *Outstanding Resource Waters,*
    - *Special Resource Waters,*
    - *bathing beaches,*
    - *shellfish growing areas,*
    - *cold-water fisheries.*

The required water quality volume equals 0.5 inches of runoff times the total impervious area of the post-development site for all other discharges."

The proposed work meets the requirement for removal of total suspended solids (TSS).

Standard 4 requires the development and implementation of suitable practices for source control and pollution prevention. These measures must be identified in a long-term pollution prevention plan. The long-term pollution prevention plan shall include the proper procedures for the following:

- *good housekeeping;*
- *storing materials and waste products inside or under cover;*

- *vehicle washing;*
- *routine inspections and maintenance of stormwater BMPs;*
- *spill prevention and response;*
- *maintenance of lawns, gardens, and other landscaped areas;*
- *storage and use of fertilizers, herbicides, and pesticides;*
- *pet waste management;*
- *operation and management of septic systems; and*
  proper management of deicing chemicals and snow.

The long-term pollution prevention plan shall provide that sand piles be contained and stabilized to prevent the discharge of sand to wetlands or water bodies, and, where feasible, covered. If a Total Maximum Daily Load (TMDL) has been developed that indicates that use of fertilizers containing nutrients must be reduced, the long-term pollution prevention plan shall also include a nutrient management plan. The long-term pollution prevention plan may be prepared as a separate document or combined with the Operation and Maintenance Plan required by Standard 9.

The long-term pollution prevention plan will be combined with the Operation and Maintenance Plan required by Standard 9.

WATER QUALITY TREATMENT VOLUME

V_{WQ} = (D_{WQ}/12 inches/foot) * (A_{IMP} * 43,560 square feet/acre)

V_{WQ} = *Required Water Quality Volume* (in cubic feet)
D_{WQ} = Water Quality Depth: one-inch for discharges within a Zone II or Interim Wellhead Protection Area, to or near another critical area, runoff from a LUHPPL, or exfiltration to soils with infiltration rate greater than 2.4 inches/hour or greater; ½-inch for discharges near or to other areas.
A_{IMP} = Impervious Area (in acres)

The site is located in soils with an infiltration rate greater than 2.4 inches/hour so a Water Quality Depth of one-inch is required.

V_{WQ} = (1 inch/12 inches/foot) * (141,953 square feet) = 11,829 CF

21,548 CF storage volume provided in the infiltration basin below the outlet

TSS REMOVAL PERCENTAGE COMPUTATIONS

The following calculation demonstrates the required 80% removal of total solids (TSS).

INSTRUCTIONS:
1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: 171 Mattakeesett Street CS-4 #1

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Cascade Seperator	0.80	0.75	0.60	0.15
Subsurface Infiltration/ Infiltration Basin	0.80	0.15	0.12	0.03

Total TSS Removal = 97%

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

Project: 171 Mattakeeset St
Prepared By: Darren Grady, P.E.
Date: September 26, 2019

*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

Mass. Dept. of Environmental Protection

INSTRUCTIONS:
1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: 171 Mattakeesett Street CS-4 #2

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Cascade Seperator	0.80	0.75	0.60	0.15
Subsurface Infiltration/ Infiltration Basin	0.80	0.15	0.12	0.03

Total TSS Removal = 97%

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

Project: 171 Mattakeeset St
Prepared By: Darren Grady, P.E.
Date: September 26, 2019

*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

Mass. Dept. of Environmental Protection

STANDARD 5 LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS

The land use is considered a higher potential pollutant load. The owner currently employs measures including storing paints and oils used indoors for protection from exposure to rain, snow, snow melt, and stormwater run-off. These are summarized in the Operation and Maintenance Plan.

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STANDARD 6. CRITICAL AREAS

The land use is not located within a critical area.

STANDARD 7. REDEVELOPMENT PROJECT

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

The project is partially a redevelopment project. The design is in full compliance with the regulations.

STANDARD 8. CONSTRUCTION PERIOD CONTROLS

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

The proposed project will not disturb more than one acre of land and is eligible to obtain coverage under the NPDES Construction General Permit issued by EPA without the preparation of a Stormwater Pollution Plan.

STANDARD 9. LONG-TERM OPERATION AND MAINTENANCE (O&M) PLAN

A Long -Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.

The Long-Term Operation and Maintenance Plan shall at a minimum include:

1. *Stormwater management system(s) owners;*
2. *The party or parties responsible for operation and maintenance, including how future property owners will be notified of the presence of the stormwater management system and the requirement for proper operation and maintenance;*
3. *The routine and non-routine maintenance tasks to be undertaken after construction is complete and a schedule for implementing those tasks;*
4. *A plan that is drawn to scale and shows the location of all stormwater BMPs in each treatment train along with the discharge point;*
5. *A description and delineation of public safety features; and*
6. *An estimated operations and maintenance budget.*

STANDARD 10. ILLICIT DISCHARGES PROHIBITED

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

This statement is intended to meet Standard #10 of the Stormwater Management requirements

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater.

Except for the potential for deliberate criminal act of discharge by an unauthorized entity for which the property owner has no control, there are to be no illicit discharges into the stormwater system.

Applicant\Owner

OVERFLOW SPILLWAY DESIGN - INFILTRATION BASIN

Job No.: 18-181
Location: 171 Mattakeesett Street

- Design Spillway for Q_{100} into Basin

Q_{100} = 29.06 cfs

- Length of Spillway = 22 ft

- Set Spillway Elevation 0.5 Above 100 Year Level of Basin

100 Year Level = 88.78
Feet above 100 Year Level= 0.5
89.28
Use Spillway Elevation = 89.28

- Set Top of Berm 0.50 feet Above 100 Year Spillway Surface

$Q = CLH^{3/2}$

Q = Discharge Over Broad Crested Weir
C = 2.7 Handbook of Hydraulics p. 5-40, King & Brater
L = Length of Weir
H = Head on Weir

$H = (Q/CL)^{2/3}$

$H = 29.06 / (2.7*22)^{2/3}$ = 0.62

Top of Berm Elevation = 89.28 + 0.62 + 0.50 = 90.4

Use 90.40

Pipe Capacity

BLD 1 Roof Drains + Crushed Stone Trench

Q=CiA

A (pave + Bld)	51162	0.9	46045.8
A (grass)	0	0.5	0
A (trees)	0	0.2	0
A_{Total}	51162	0.90	46046

C=	0.90	
A=	51,162	(square feet)
A=	1.17	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)
Q_{25}=	6.44	cfs
Q_{100}=	7.74	cfs

Pipe Capacity

$Q=1.486/n\ (A)\ (R^{2/3})\ (S^{1/2})\ (7.48)\ (60)$

Pipe Dia=	18	Inches
n=	0.013	
S=	0.006	ft/ft
A= $\prod r^2$	1.767	sf

Q = 1.486 /(0.013) (1.767) (0.375 ^2/3) (0.006 ^1/2)

Q=	8.16	cfs

Pipe Capacity

BLD 1 + 2 Roof Drains

Q=CiA

A (pave + Bld)	7200	0.9	6480
A (grass)	0	0.5	0
A (trees)	0	0.2	0
A_{Total}	7200	0.90	6480

C=	0.90	
A=	7,200	(square feet)
A=	0.17	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)
Q_{25}=	0.91	cfs
Q_{100}=	1.09	cfs

Pipe Capacity

Q=1.486/n (A) ($R^{2/3}$) ($S^{1/2}$) (7.48) (60)

Pipe Dia=	8	Inches
n=	0.013	
S=	0.012	ft/ft
A= ∏ r^2	0.349	sf

Q = 1.486 /(0.013) (0.349) (0.166666666666667 ^2/3) (0.

Q= 1.33 cfs

Pipe Capacity

BLD 3 Roof Drain + Overland flow

Q=CiA

A (pave + Bld)	19523	0.9	17570.7
A (grass)	0	0.5	0
A (trees)	21250	0.2	4250
A_{Total}	40773	0.54	21821

C=	0.54	
A=	40,773	(square feet)
A=	0.94	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)
Q_{25}=	3.05	cfs
Q_{100}=	3.67	cfs

Pipe Capacity

Q=1.486/n (A) ($R^{2/3}$) ($S^{1/2}$) (7.48) (60)

Pipe Dia=	15	Inches
n=	0.013	
S=	0.006	ft/ft
A= ∏ r^2	1.227	sf

Q = 1.486 /(0.013) (1.227) (0.3125 ^2/3) (0.006 ^1/2)

Q= 5.02 cfs

Pipe Capacity

CB#A

Q=CiA

A (pavement)	24328	0.9	21895.2
A (grass)	0	0.5	0
A (trees)	11746	0.2	2349.2
A_{Total}	36074	0.67	24244

C=	0.67	
A=	36,074	(square feet)
A=	0.83	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)

Q_{25}=	3.39	cfs
Q_{100}=	4.07	cfs

Pipe Capacity

$Q=1.486/n\ (A)\ (R^{2/3})\ (S^{1/2})\ (7.48)\ (60)$

Pipe Dia=	15	Inches
n=	0.013	
S=	0.008	ft/ft
A= $\prod r^2$	1.227	sf

Q = 1.486 /(0.013) (1.227) (0.3125 ^2/3) (0.008 ^1/2)

Q=	5.79	cfs

Pipe Capacity

CB#B

Q=CiA

A (pavement)	7415	0.9	6673.5
A (grass)	0	0.5	0
A (trees)	0	0.2	0
A_{Total}	7415	0.90	6674

C=	0.90	
A=	7,415	(square feet)
A=	0.17	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)

Q_{25}=	0.93	cfs
Q_{100}=	1.12	cfs

Pipe Capacity

$Q=1.486/n\ (A)\ (R^{2/3})\ (S^{1/2})\ (7.48)\ (60)$

Pipe Dia=	12	Inches
n=	0.013	
S=	0.005	ft/ft
$A= \prod r^2$	0.785	sf

Q = 1.486 /(0.013) (0.785) (0.25 ^2/3) (0.005 ^1/2)

Q=	2.52	cfs

Pipe Capacity

CB#C

Q=CiA

A (pavement)	13070	0.9	11763
A (grass)	0	0.5	0
A (trees)	0	0.2	0
A_{Total}	13070	0.90	11763

C=	0.90	
A=	13,070	(square feet)
A=	0.30	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)
Q_{25}=	1.64	cfs
Q_{100}=	1.98	cfs

Pipe Capacity

$Q=1.486/n\ (A)\ (R^{2/3})\ (S^{1/2})\ (7.48)\ (60)$

Pipe Dia=	12	Inches
n=	0.013	
S=	0.089	ft/ft
A= $\prod r^2$	0.785	sf

Q = 1.486 /(0.013) (0.785) (0.25 ^2/3) (0.089 ^1/2)

Q=	10.65	cfs

Pipe Capacity

CB#D

Q=CiA

A (pavement)	11467	0.9	10320.3
A (grass)	0	0.5	0
A (trees)	0	0.2	0
A_{Total}	11467	0.90	10320

C=	0.90	
A=	11,467	(square feet)
A=	0.26	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)

Q_{25}=	1.44	cfs
Q_{100}=	1.73	cfs

Pipe Capacity

$Q=1.486/n\ (A)\ (R^{2/3})\ (S^{1/2})\ (7.48)\ (60)$

Pipe Dia=	12	Inches
n=	0.013	
S=	0.010	ft/ft
A= $\prod r^2$	0.785	sf

Q = 1.486 /(0.013) (0.785) (0.25 ^2/3) (0.01 ^1/2)

Q=	3.57	cfs

Pipe Capacity

CB#E

Q=CiA

A (pavement)	4705	0.9	4234.5
A (grass)	0	0.5	0
A (trees)	0	0.2	0
A_{Total}	4705	0.90	4235

C=	0.90	
A=	4,705	(square feet)
A=	0.11	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)
Q_{25}=	0.59	cfs
Q_{100}=	0.71	cfs

Pipe Capacity

$Q=1.486/n\ (A)\ (R^{2/3})\ (S^{1/2})\ (7.48)\ (60)$

Pipe Dia=	12	Inches
n=	0.013	
S=	0.001	ft/ft
A= $\prod r^2$	0.785	sf

Q = 1.486 /(0.013) (0.785) (0.25 ^2/3) (0.001 ^1/2)

Q=	1.13	cfs

Pipe Capacity

DMH A

Q=CiA

A (pavement)	16172	0.9	14554.8
A (grass)	0	0.5	0
A (trees)	0	0.2	0
A_{Total}	16172	0.90	14555

C=	0.90	
A=	16,172	(square feet)
A=	0.37	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)
Q_{25}=	2.03	cfs
Q_{100}=	2.45	cfs

Pipe Capacity

$Q=1.486/n\ (A)\ (R^{2/3})\ (S^{1/2})\ (7.48)\ (60)$

Pipe Dia=	12	Inches
n=	0.013	
S=	0.010	ft/ft
A= $\prod r^2$	0.785	sf

Q = 1.486 /(0.013) (0.785) (0.25 ^2/3) (0.01 ^1/2)

Q=	3.57	cfs

Pipe Capacity

DMH B TO CS-4

Q=CiA

A (pavement)	20485	0.9	18436.5
A (grass)	0	0.5	0
A (trees)	0	0.2	0
A_{Total}	20485	0.90	18437

C=	0.90	
A=	20,485	(square feet)
A=	0.47	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)

Q_{25}=	2.58	cfs
Q_{100}=	3.10	cfs

Pipe Capacity

Q=1.486/n (A) ($R^{2/3}$) ($S^{1/2}$) (7.48) (60)

Pipe Dia=	12	Inches
n=	0.013	
S=	0.017	ft/ft
A= ∏ r^2	0.785	sf

Q = 1.486 /(0.013) (0.785) (0.25 ^2/3) (0.017 ^1/2)

Q=	4.66	cfs

Pipe Capacity

CS-4 to UC system

Q=CiA

A (pavement)	36657	0.9	32991.3
A (grass)	0	0.5	0
A (trees)	0	0.2	0
A_{Total}	36657	0.90	32991

C=	0.90	
A=	36,657	(square feet)
A=	0.84	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)

Q_{25}=	4.61	cfs
Q_{100}=	5.54	cfs

Pipe Capacity

$Q=1.486/n\ (A)\ (R^{2/3})\ (S^{1/2})\ (7.48)\ (60)$

Pipe Dia=	12	Inches
n=	0.013	
S=	0.031	ft/ft
A= $\prod r^2$	0.785	sf

Q = 1.486 /(0.013) (0.785) (0.25 ^2/3) (0.031 ^1/2)

Q=	6.29	cfs

Pipe Capacity

CB#1

Q=CiA

A (pavement)	37602	0.9	33841.8
A (grass)	0	0.5	0
A (trees)	0	0.2	0
A_{Total}	37602	0.90	33842

C=	0.90	
A=	37,602	(square feet)
A=	0.86	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)
Q_{25}=	4.73	cfs
Q_{100}=	5.69	cfs

Pipe Capacity

$Q=1.486/n\ (A)\ (R^{2/3})\ (S^{1/2})\ (7.48)\ (60)$

Pipe Dia=	15	Inches
n=	0.013	
S=	0.025	ft/ft
A= $\prod r^2$	1.227	sf

Q = 1.486 /(0.013) (1.227) (0.3125 ^2/3) (0.025 ^1/2)

Q=	10.24	cfs

Pipe Capacity

CB#2

Q=CiA

A (pavement)	8107	0.9	7296.3
A (grass)	0	0.5	0
A (trees)	0	0.2	0
A_{Total}	8107	0.90	7296

C=	0.90	
A=	8,107	(square feet)
A=	0.19	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)

Q_{25}=	1.02	cfs
Q_{100}=	1.23	cfs

Pipe Capacity

$Q=1.486/n\ (A)\ (R^{2/3})\ (S^{1/2})\ (7.48)\ (60)$

Pipe Dia=	12	Inches
n=	0.013	
S=	0.040	ft/ft
$A= \prod r^2$	0.785	sf

Q = 1.486 /(0.013) (0.785) (0.25 ^2/3) (0.04 ^1/2)

Q=	7.14	cfs

Pipe Capacity

CB#3

Q=CiA

A (pavement)	33328	0.9	29995.2
A (grass)	0	0.5	0
A (trees)	11746	0.2	2349.2
A_{Total}	45074	0.72	32344

C=	0.72	
A=	45,074	(square feet)
A=	1.03	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)
Q_{25}=	4.52	cfs
Q_{100}=	5.44	cfs

Pipe Capacity

$Q=1.486/n\ (A)\ (R^{2/3})\ (S^{1/2})\ (7.48)\ (60)$

Pipe Dia=	15	Inches
n=	0.013	
S=	0.010	ft/ft
A= $\prod r^2$	1.227	sf

Q = 1.486 /(0.013) (1.227) (0.3125 ^2/3) (0.01 ^1/2)

Q=	6.48	cfs

Pipe Capacity

Existing DMH to CS-4 and UC system

Q=CiA

A (pavement)	79037	0.9	71133.3
A (grass)	0	0.5	0
A (trees)	11746	0.2	2349.2
A_{Total}	90783	0.81	73483

C=	0.81	
A=	90,783	(square feet)
A=	2.08	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)

Q_{25}=	10.27	cfs
Q_{100}=	12.35	cfs

Pipe Capacity

Q=1.486/n (A) ($R^{2/3}$) ($S^{1/2}$) (7.48) (60)

Pipe Dia=	21	Inches
n=	0.013	
S=	0.007	ft/ft
A= ∏ r^2	2.405	sf

Q = 1.486 /(0.013) (2.405) (0.4375 ^2/3) (0.007 ^1/2)

Q=	13.29	cfs

Pipe Capacity

Stormceptor to Flared End

Q=CiA

A (pavement)	25605	0.9	23044.5
A (grass)	0	0.5	0
A (trees)	0	0.2	0
A_{Total}	25605	0.90	23045

C=	0.90	
A=	25,605	(square feet)
A=	0.59	(acres)
i_{25}	6.09	(25 yr-5min)
i_{100}	7.32	(100 yr-5min)
Q_{25}=	3.22	cfs
Q_{100}=	3.87	cfs

Pipe Capacity

$Q=1.486/n\ (A)\ (R^{2/3})\ (S^{1/2})\ (7.48)\ (60)$

Pipe Dia=	12	Inches
n=	0.013	
S=	0.014	ft/ft
A= $\prod r^2$	0.785	sf

Q = 1.486 /(0.013) (0.785) (0.25 ^2/3) (0.014 ^1/2)

Q=	4.22	cfs

National Flood Hazard Layer FIRMette

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/19/2018 at 7:25:48 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

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 Plymouth County, Massachusetts

171 Mattakeeset Street, Pembroke

July 19, 2018

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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Contents

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.

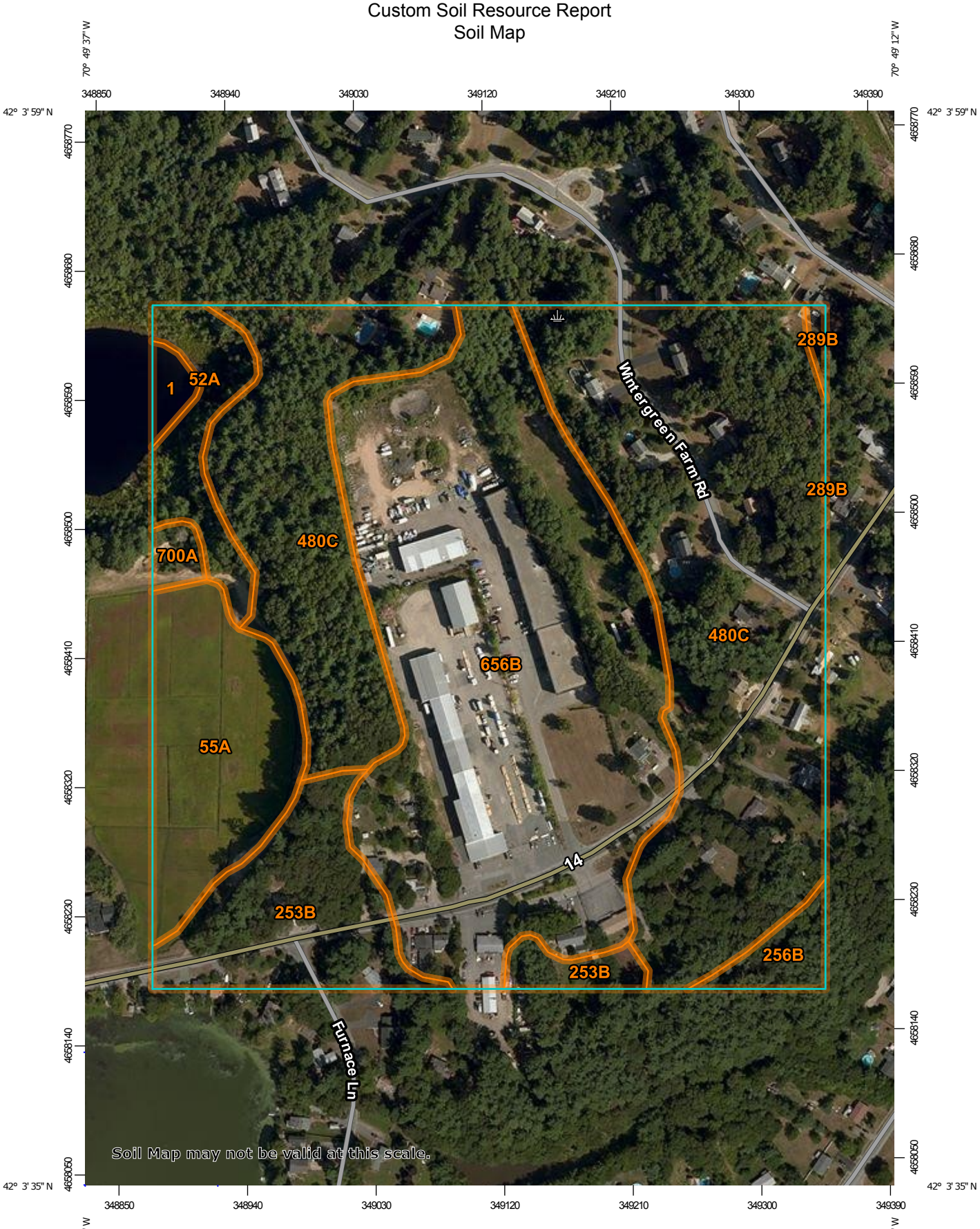
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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



Map Scale: 1:3,650 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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 1:12,000.

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

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

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

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

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

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

Soil Survey Area: Plymouth County, Massachusetts
Survey Area Data: Version 10, Oct 6, 2017

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

Date(s) aerial images were photographed: Aug 26, 2014—Sep 4, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	0.4	0.7%
52A	Freetown muck, 0 to 1 percent slopes	2.0	3.6%
55A	Freetown coarse sand, 0 to 3 percent slopes, sanded surface	4.7	8.4%
253B	Hinckley loamy sand, 3 to 8 percent slopes	4.7	8.5%
256B	Deerfield fine sand, 3 to 8 percent slopes	0.8	1.4%
289B	Hinckley gravelly sandy loam, 3 to 8 percent slopes, bouldery	0.1	0.3%
480C	Plymouth - Carver complex, 8 to 15 percent slopes	22.9	41.1%
656B	Udorthents - Urban land complex, 0 to 8 percent slopes	19.7	35.4%
700A	Udipsamments, wet substratum, 0 to 3 percent slopes	0.4	0.7%
Totals for Area of Interest		**55.7**	**100.0%**

Map Unit Descriptions

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.

Plymouth County, Massachusetts

1—Water

Map Unit Setting

National map unit symbol: bd0b
Elevation: 0 to 330 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days

Map Unit Composition

Water: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Minor Components

Freetown

Percent of map unit: 1 percent
Landform: Bogs, depressions, kettles, marshes, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 1 percent
Landform: Bogs, depressions, kettles, marshes, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 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: Not prime farmland

Map Unit Composition

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

Description of Freetown

Setting

Landform: Bogs, depressions, depressions, kettles, marshes, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Percent of area covered with surface fragments: 0.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
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 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 5 percent
Landform: Bogs, depressions, depressions, kettles, marshes, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

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

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

55A—Freetown coarse sand, 0 to 3 percent slopes, sanded surface

Map Unit Setting

National map unit symbol: 2t2qj
Elevation: 0 to 180 feet
Mean annual precipitation: 40 to 52 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 190 to 250 days
Farmland classification: Farmland of unique importance

Map Unit Composition

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

Description of Freetown, Sanded Surface

Setting

Landform: Bogs, depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy human-transported material over highly decomposed organic material

Typical profile

^Ap - 0 to 15 inches: coarse sand
2Oa - 15 to 79 inches: muck

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
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 0 to 6 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Very high (about 20.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D

Hydric soil rating: Yes

Minor Components

Swansea, sanded surface, inactive
Percent of map unit: 5 percent
Landform: Bogs, depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Rainberry, sanded surface
Percent of map unit: 4 percent
Landform: Depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

Tihonet
Percent of map unit: 3 percent
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Udipsamments, wet substratum
Percent of map unit: 3 percent
Landform: Dikes on bogs
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave, convex
Across-slope shape: Concave, linear
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: Eskers, kames, kame terraces, outwash plains, outwash terraces, moraines, outwash deltas
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
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
Natural 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
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 8 percent
Landform: Eskers, kames, kame terraces, outwash plains, outwash terraces, moraines, outwash deltas
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: Kame terraces, outwash plains, outwash terraces, moraines, outwash deltas
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, kames, kame terraces, outwash plains, outwash terraces, moraines, outwash deltas
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

256B—Deerfield fine sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: bcwx
Elevation: 0 to 400 feet
Mean annual precipitation: 41 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

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

Description of Deerfield

Setting

Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Footslope, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oe - 1 to 2 inches: moderately decomposed plant material
Oa - 2 to 3 inches: highly decomposed plant material

E1 - 3 to 5 inches: fine sand
E2 - 5 to 8 inches: fine sand
Bs - 8 to 11 inches: fine sand
Bw1 - 11 to 15 inches: fine sand
Bw2 - 15 to 20 inches: fine sand
BC - 20 to 26 inches: fine sand
C1 - 26 to 39 inches: fine sand
C2 - 39 to 61 inches: fine sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 14.17 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 4 percent
Landform: Kames, outwash plains, terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Carver

Percent of map unit: 4 percent
Landform: Outwash plains, moraines, pitted outwash plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Mashpee

Percent of map unit: 4 percent
Landform: Depressions, terraces, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Massasoit

Percent of map unit: 4 percent
Landform: Depressions, terraces, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Sudbury

Percent of map unit: 4 percent
Landform: Depressions, outwash plains, terraces
Landform position (two-dimensional): Footslope, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

289B—Hinckley gravelly sandy loam, 3 to 8 percent slopes, bouldery

Map Unit Setting

National map unit symbol: bd1g
Elevation: 0 to 400 feet
Mean annual precipitation: 41 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

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

Description of Hinckley, Bouldery

Setting

Landform: Eskers, kames, terraces, outwash deltas
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glaciofluvial deposits

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 3 inches: gravelly sandy loam
Bw - 3 to 19 inches: very gravelly loamy coarse sand
C1 - 19 to 33 inches: very gravelly coarse sand
C2 - 33 to 60 inches: very gravelly coarse sand

Properties and qualities

Slope: 3 to 8 percent
Percent of area covered with surface fragments: 0.1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 28.34 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 10 percent
Landform: Kames, outwash plains, terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Gloucester, bouldery

Percent of map unit: 7 percent
Landform: Ground moraines, hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Barnstable, bouldery

Percent of map unit: 3 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

480C—Plymouth - Carver complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: bcyy
Elevation: 0 to 400 feet
Mean annual precipitation: 41 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

Plymouth and similar soils: 45 percent
Carver and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plymouth

Setting

Landform: Outwash plains, moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Sandy and gravelly supraglacial meltout till over sandy and gravelly glaciofluvial deposits

Typical profile

Oi - 0 to 4 inches: slightly decomposed plant material
Oe - 4 to 6 inches: moderately decomposed plant material
A - 6 to 7 inches: loamy coarse sand
E - 7 to 11 inches: coarse sand
Bs - 11 to 15 inches: loamy coarse sand
Bw - 15 to 20 inches: coarse sand
BC - 20 to 29 inches: coarse sand
C - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Carver

Setting

Landform: Outwash plains, moraines, pitted outwash plains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Sandy glaciofluvial deposits

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 3 inches: moderately decomposed plant material
A - 3 to 7 inches: coarse sand
E - 7 to 10 inches: coarse sand
Bw1 - 10 to 15 inches: coarse sand
Bw2 - 15 to 28 inches: coarse sand
BC - 28 to 32 inches: coarse sand
C - 32 to 67 inches: coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural 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 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Barnstable

Percent of map unit: 10 percent
Landform: Moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent

Landform: Kames, outwash plains, terraces
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

656B—Udorthents - Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: bd08
Elevation: 0 to 390 feet
Mean annual precipitation: 41 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

Udorthents, loamy, and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Loamy

Setting

Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy human transported material

Typical profile

^A - 0 to 5 inches: loam
^C1 - 5 to 21 inches: gravelly loam
^C2 - 21 to 80 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.01 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Udipsamments, wet substratum

Percent of map unit: 5 percent
Landform: Dikes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Linear
Hydric soil rating: No

Udorthents, wet substratum

Percent of map unit: 5 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Udipsamments

Percent of map unit: 5 percent
Landform: Dikes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Linear
Hydric soil rating: No

700A—Udipsamments, wet substratum, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: bd02
Elevation: 0 to 390 feet
Mean annual precipitation: 41 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

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

Description of Udipsamments, Wet Substratum

Setting

Landform: Dikes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Linear
Parent material: Sandy human transported material over sandy and gravelly glaciofluvial deposits

Typical profile

^Ap - 0 to 3 inches: loamy fine sand
^C1 - 3 to 20 inches: fine sand
Ab - 20 to 24 inches: loamy fine sand
Bwb - 24 to 31 inches: fine sand
BC - 31 to 44 inches: fine sand
C2 - 44 to 51 inches: fine sand
C3 - 51 to 72 inches: very fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 14.17 in/hr)
Depth to water table: About 20 to 48 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A/D
Hydric soil rating: No

Minor Components

Tihonet

Percent of map unit: 10 percent
Landform: Bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Udipsamments

Percent of map unit: 5 percent
Landform: Dikes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Linear

Hydric soil rating: No

Udorthents, wet substratum

Percent of map unit: 5 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

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OPERATION AND MAINTENANCE PLAN
PROPOSED DRAINAGE SYSTEM – DURING CONSTRUCTION
171 Mattakeesett Street
Pembroke, MA 02359

Owner:

171 Mattakeesett Street LLC
283 Sawyer Street
New Bedford, MA 02746
Contact: Kevin Welch (508) 999-7363

Party Responsible for Operation and Maintenance:

171 Mattakeesett Street LLC
283 Sawyer Street
New Bedford, MA 02746
Contact: Kevin Welch (508) 999-7363

Source of Funding:

Operation and Maintenance of this stormwater management system will be the responsibility of the property owner to include its successor and/or assigns, as the same may appear on record with the appropriate register of deeds.

During Construction:

Construction activities shall follow the Construction Sequence shown on the approved plan. During periods of active construction the stormwater management system shall be inspected on a weekly basis and within 24 hours of a storm event of greater than ½". Maintenance tasks shall be performed monthly or after significant rainfall events of 1" of rain or greater. During construction, silt-laden runoff shall be prevented from entering the drainage system and off-site properties. Temporary swales shall be constructed as needed during construction to direct runoff to sediment traps. Infiltration systems shall not be placed in service until after the installation of base course pavement and vegetative stabilization of the areas contributing to the systems.

During dewatering operations, all water pumped from the dewatering shall be directed to a "dirt bag" pumped sediment removal system (or approved equal) as manufactured by ACF Environmental. The unit shall be placed on a crushed stone blanket. Disposal of such "dirt bag" shall occur when the device is full and can no longer effectively filter sediment or allow water to pass at a reasonable flow rate. Disposal of this unit shall be the responsibility of the contractor and shall be as directed by the owner in accordance with applicable local, state, and federal guidelines and regulations.

Stabilized construction entrances shall be placed at the entrances and shall consist of 1½" to 2" stone and be constructed as shown on the approved plans.

All erosion and sedimentation control measures shall be in place prior to the commencement of any site work or earthwork operations, shall be maintained during construction, and shall remain in place until all site work is complete and ground cover is established.

Heavy equipment shall not be used on basin bottoms.

All exposed soils not to be paved shall be stabilized as soon as practical. Seed mixes shall only be applied during appropriate periods as recommended by the seed supplier, typically May 1 to October 15. Any exposed soils that can not be stabilized by vegetation during these dates shall be stabilized with hay bales, hay mulch, check dams, jute netting or other acceptable means.

Once each structure is in place, it should be maintained in accordance with the procedures described in the post-construction Operations and Maintenance Plan.

During dry periods where dust is created by construction activities the following control measures should be implemented.

- Sprinkling – The contractor may sprinkle the ground along haul roads and traffic areas until moist.
- Vegetative cover – Areas that are not expected to be disturbed regularly may be stabilized with vegetative cover.
- Mulch – Mulching can be used as a quick and effective means of dust control in recently disturbed areas.
- Spray on chemical soil treatments may be utilized. Application rates shall conform to manufacturers recommendations.

Inspections

The Owner shall be responsible to secure the services of a Professional Engineer to perform inspections as required. Inspections during periods of active construction shall be weekly and within 24 hours of a storm event of greater than ½ “. The Professional Engineer shall perform inspections to insure that the approved plan is being followed with particular attention to the Planning Board Approval and the Construction Sequencing. The Engineer shall be responsible for inspecting the roadway construction and the construction of the stormwater management system. The Engineer shall prepare and submit to the Planning Board, the Inspection Schedule and Evaluation Checklist (see attached) and, if necessary, request the required maintenance and/or repair of the necessary items. This form shall be stamped by the Engineer and the Owner shall be notified that specific changes and/or repairs are necessary.

For additional information, refer to Performance, Standards and Guidelines for Stormwater Management in Massachusetts, published by the Department of Environmental Protection.

STORMWATER MANAGEMENT
BEST MANAGEMENT PRACTICES
INSPECTION SCHEDULE AND EVALUATION CHECKLIST – CONSTRUCTION PHASE

PROJECT LOCATION: 171 Mattakeesett Street – Pembroke, MA Latest Revision: 9/26/19

Stormwater Control Manager: _____ **Stamp**

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/ Repair Needed yes/no List items	Date of Cleaning/Repair	Performed By	Water Level in Detention System
Silt fence & swales and silt traps	After every major storm event							
Deep Sump Catch Basins	Weekly or after major storm event.							
Cascade Seperator(s)	Weekly or after major storm event.							
Infiltration Basins	After every major storm event							
Dewatering Operations	Daily-during actual dewatering							
Temporary Construction Entrance	Daily or as needed.							

(1) Refer to the Massachusetts Stormwater Management, Volume Two: Stormwater Technical Handbook for recommendations regarding frequency for inspection and maintenance of specific BMPs.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended. Slow release fertilizer recommended.
Other notes:(Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan)

OPERATION AND MAINTENANCE PLAN
PROPOSED DRAINAGE SYSTEM – POST CONSTRUCTION
171 Mattakeeset Street
Pembroke, MA 02359

Owner:

171 Mattakeeset Street LLC
283 Sawyer Street
New Bedford, MA 02746
Contact: Kevin Welch (508) 999-7363

Party Responsible for Operation and Maintenance:

171 Mattakeeset Street LLC
283 Sawyer Street
New Bedford, MA 02746
Contact: Kevin Welch (508) 999-7363

Source of Funding:
Operation and Maintenance of this stormwater management system will be the responsibility of the owners until the road and drainage system are accepted by Town Meeting and conveyed to the Town of Pembroke. Once accepted by the Town, funding for operation and maintenance of the stormwater management system will be the responsibility of the Department of Public Works.

Post Construction Inspection and Maintenance:

Street Sweeping

Streets shall be swept at least twice per year. Sweeping shall be completed during the early spring, no later than May 1st, before sediment from winter sanding operations is washed into the drainage system. Disposal of the accumulated sediment shall be in accordance with applicable local, state, and federal guidelines and regulations.

Deep Sump Catch Basins

Deep sump catch basins shall become part of the roadway system and shall be inspected after every major storm event during construction and cleaned when sediment exceeds 18" depth. After construction when all slopes have been stabilized, basins shall be cleaned a minimum of twice per year. Disposal of the accumulated sediment shall be in accordance with applicable local, state, and federal guidelines and regulations.

Cascade Seperator Unit(s)

New Installations
The condition of each unit shall be checked after every runoff event for the first 30 days. The visual inspection shall ascertain that the unit is functioning properly (weir structure is not blocked) and shall measure the amount of sediment that has accumulated in the sump and floating trash and debris in the separation chamber. This can be done with a calibrated "dip stick" so that the depth of deposition can be tracked. Schedules for inspections and cleanout shall be based on storm events and pollutant accumulation.

Ongoing Operation
During the rainfall season, the unit shall be inspected at least once every 30 days. The floatables shall be removed and the sump cleaned when the sump is 85% full. If floatables accumulate more rapidly than the settleable solids, the floatables shall be removed using a vactor truck or dip net when the layer is two feet thick.

Cleanout of the units shall be performed no later than May 1st because of the nature of pollutants collected and the potential for odor generation from the decomposition of material collected and retained. This end of season cleanout will assist in preventing the discharge of pore water for the units during periods of low rainfall. The unit shall be cleaned at least twice yearly.

Cleanout and Disposal
Standard vactoring operations shall be employed in the cleanout of the units. Disposal of material from the units shall be in accordance with applicable local, state, and federal guidelines and regulations. Disposal of the decant material to a POTW is recommended. Field decanting to the storm drainage system shall not be permitted. Solids can be disposed similar to normal practices for materials collected from catch basin cleaning.

Infiltration Galley System(s)

The Infiltration System should be inspected at least once per year to ensure that the subsurface system is operating as intended. If accumulated sediment is observed within the galley it should be removed from the galley as necessary.

Infiltration Basin(s)

After construction, the infiltration basins should be inspected for standing water 1-2 days after any significant rainfall exceeding 1" of rainfall in 24 hours. If the infiltration basin is continuing to hold standing water after 2 days the owner should have outlet structure inspected and repaired. The basin should also be inspected to verify whether infiltration function has been lost. If infiltration capacity has become degraded, it should be restored under the direction of a qualified professional.

The infiltration basins should be inspected quarterly and at least once per year to ensure that the system is operating as intended. If accumulated sediment is observed within the basin it should be removed from the basin as necessary. Any sediment removed from the infiltration systems should be disposed of in accordance with Town, State and Federal Regulations. The system including the stormwater discharge locations should also be inspected for growth of any invasive species and removed if found.

The embankments of the basin shall be mowed periodically, to prevent the establishment of woody vegetation on the berms. Embankments and spillways shall be inspected annually for general structural integrity, with immediate corrective action as warranted by inspection.

Land Uses with Higher Potential Pollutant Loads (LUHPPL)

The proposed buildings are a capital improvement designed to protect LUHPPL from the exposure to rain, snow, snow melt, and stormwater run-off. The building will provide additional workspace used for the maintaining boats.

The owner shall maintain pollution prevention measures currently being used at the site including covered maintenance processes and covered, indoor, storage locations for lubricants, oils, and paints.

Lawn Fertilization

Lawn fertilizer shall be slow release and limited to 3 lbs per 1000 s.f. per year.

Estimated Annual Budget

The estimated annual budget for performance of the above is $1,100-$1,600.

Spill Containment and Management Plan

April 28, 2006

Initial Notification

In the event of a spill, the facility manager will be notified immediately.

Facility Managers (name) Mr. Sergio Gioioso, FPG Gioioso Realty Trust

Facility Manager (phone) (781) 831-7809

Assessment - Initial Containment

The supervisor will assess the incident and initiate containment control measures with the appropriate spill containment equipment included in the spill kit kept on-site. The supervisor will first contact the Fire Department and then notify the Police Department, Department of Public Works, Board of Health and Conservation Commission. The fire department is ultimately responsible for matters of public health and safety and should be notified immediately.

Contact: Phone Number:

Fire Department: 911

Police Department: 911

Department of Public Works: (781) 293-5620

Board of Health Phone: (781) 293-2718

Conservation Commission Phone: (781) 293-7735

Further Notification

Based on the assessment from the Fire Chief, additional notification to a cleanup contractor may be made. The Massachusetts Department of Environmental Protection (DEP) and the EPA may be notified depending upon the nature and severity of the spill. The Fire Chief will be responsible for determining the level of cleanup and notification required. The attached list of emergency phone numbers shall be posted in the facility office and readily accessible to all employees.

HAZARDOUS WASTE / OIL SPILL REPORT

Date___/___/___ Time_____ AM / PM

Exact location (Transformer #)_____

Type of equipment_____ Make_____ Size_____

S / N_____ Weather Conditions_____

On or near water ☐ Yes If yes, name of body of water_____
☐ No

Type of chemical / oil spilled_____

Amount of chemical / oil spilled_____

Cause of spill_____

Measures taken to contain or clean up spill_____

Amount of chemical / oil recovered_____ Method_____

Material collected as a result of clean up

_____ drums containing_____

_____ drums containing_____

_____ drums containing_____

Location and method of debris disposal_____

Name and address of any person, firm, or corporation suffering damages_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring____

Spill reported to General Office by_____ Time_____ AM / PM

Spill reported to DEP / National Response Center by_____

DEP Date___/___/___ Time_____ AM / PM Inspector_____

NRC Date___/___/___ Time_____ AM / PM Inspector_____

Additional comments_____

EMERGENCY RESPONSE EQUIPMENT INVENTORY

The following equipment and materials shall be maintained at all times and stored in a secure area for long-term emergency response need.

--	SORBENT PADS	1 BALE
--	SAND BAGS (empty)	10
--	SPEEDI-DRI ABSORBENT	2 – 40LB BAGS
--	21" INFLATABLE PIPE PLUG	1
--	SQUARE END SHOVELS	2
--	PRY BAR	1
--	CATCH BASIN COVER	1

STORMWATER MANAGEMENT
BEST MANAGEMENT PRACTICES

INSPECTION SCHEDULE AND EVALUATION CHECKLIST – POST CONSTRUCTION PHASE

PROJECT LOCATION: 171 Mattakeesett Street – Pembroke, MA Latest Revision: 9/26/19

Best Management Practice	Inspection Frequency (1)	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning/ Repair Needed yes/no List items	Date of Cleaning/Repair	Performed By	Water Level in Detention System
Deep Sump Catch Basins	Twice per year							
Cascade Seperators(s)	Twice per year							
Subsurface Galley System	Twice per year							
Infiltration Basin	Once per year							

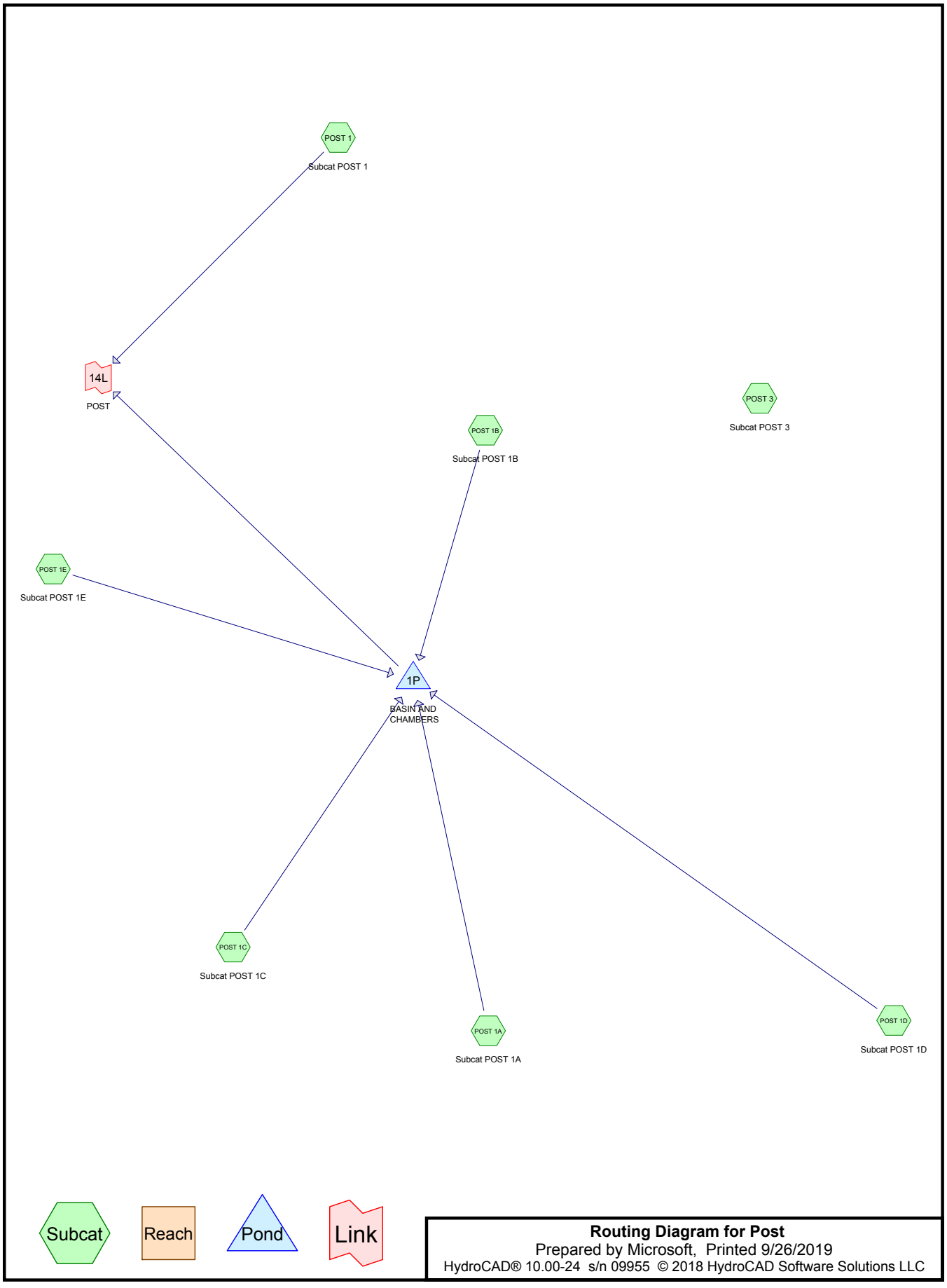
(1) Refer to the Massachusetts Stormwater Management, Volume Two: Stormwater Technical Handbook for recommendations regarding frequency for inspection and maintenance of specific BMPs.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended. Slow release fertilizer recommended.
Other notes:(Include deviations from: Con Com Order of Conditions, PB Approval, Construction Sequence and Approved Plan)

Stormwater Control Manager: _____ **Stamp**

Section II

Overall Site Analysis



Routing Diagram for Post
Prepared by Microsoft, Printed 9/26/2019
HydroCAD® 10.00-24 s/n 09955 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
15,401	49	50-75% Grass cover, Fair, HSG A (POST 1B, POST 1E, POST 3)
45,788	76	Gravel roads, HSG A (POST 1, POST 1A, POST 1B, POST 1C, POST 1D, POST 1E, POST 3)
89,666	98	Paved parking, HSG A (POST 1A, POST 1B, POST 1E)
52,296	98	Roofs, HSG A (POST 1A, POST 1B, POST 1C, POST 1D, POST 1E)
52,251	36	Woods, Fair, HSG A (POST 1, POST 1C, POST 1E, POST 3)
255,402	**78**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
255,402	HSG A	POST 1, POST 1A, POST 1B, POST 1C, POST 1D, POST 1E, POST 3
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
255,402		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Nur
15,401	0	0	0	0	15,401	50-75% Grass cover, Fair	
45,788	0	0	0	0	45,788	Gravel roads	
89,666	0	0	0	0	89,666	Paved parking	
52,296	0	0	0	0	52,296	Roofs	
52,251	0	0	0	0	52,251	Woods, Fair	
255,402	**0**	**0**	**0**	**0**	**255,402**	**TOTAL AREA**	

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

Subcatchment POST 1: Subcat POST 1 Runoff Area=12,865 sf 0.00% Impervious Runoff Depth>0.05"
Tc=6.0 min CN=44 Runoff=0.00 cfs 57 cf

Subcatchment POST 1A: Subcat POST 1A Runoff Area=56,315 sf 91.37% Impervious Runoff Depth>2.94"
Tc=6.0 min CN=96 Runoff=4.14 cfs 13,816 cf

Subcatchment POST 1B: Subcat POST 1B Runoff Area=66,819 sf 78.05% Impervious Runoff Depth>2.09"
Tc=6.0 min CN=87 Runoff=3.76 cfs 11,640 cf

Subcatchment POST 1C: Subcat POST 1C Runoff Area=43,157 sf 21.01% Impervious Runoff Depth>0.95"
Tc=6.0 min CN=70 Runoff=1.01 cfs 3,400 cf

Subcatchment POST 1D: Subcat POST 1D Runoff Area=34,081 sf 63.52% Impervious Runoff Depth>2.35"
Tc=6.0 min CN=90 Runoff=2.13 cfs 6,680 cf

Subcatchment POST 1E: Subcat POST 1E Runoff Area=30,935 sf 24.69% Impervious Runoff Depth>0.28"
Tc=6.0 min CN=54 Runoff=0.09 cfs 724 cf

Subcatchment POST 3: Subcat POST 3 Runoff Area=11,230 sf 0.00% Impervious Runoff Depth>0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 4 cf

Pond 1P: BASIN AND CHAMBERS Peak Elev=86.67' Storage=12,301 cf Inflow=11.04 cfs 36,261 cf
Discarded=1.72 cfs 36,243 cf Primary=0.00 cfs 0 cf Outflow=1.72 cfs 36,243 cf

Link 14L: POST Inflow=0.00 cfs 57 cf
Primary=0.00 cfs 57 cf

Total Runoff Area = 255,402 sf Runoff Volume = 36,322 cf Average Runoff Depth = 1.71"
44.42% Pervious = 113,440 sf 55.58% Impervious = 141,962 sf

Summary for Subcatchment POST 1: Subcat POST 1

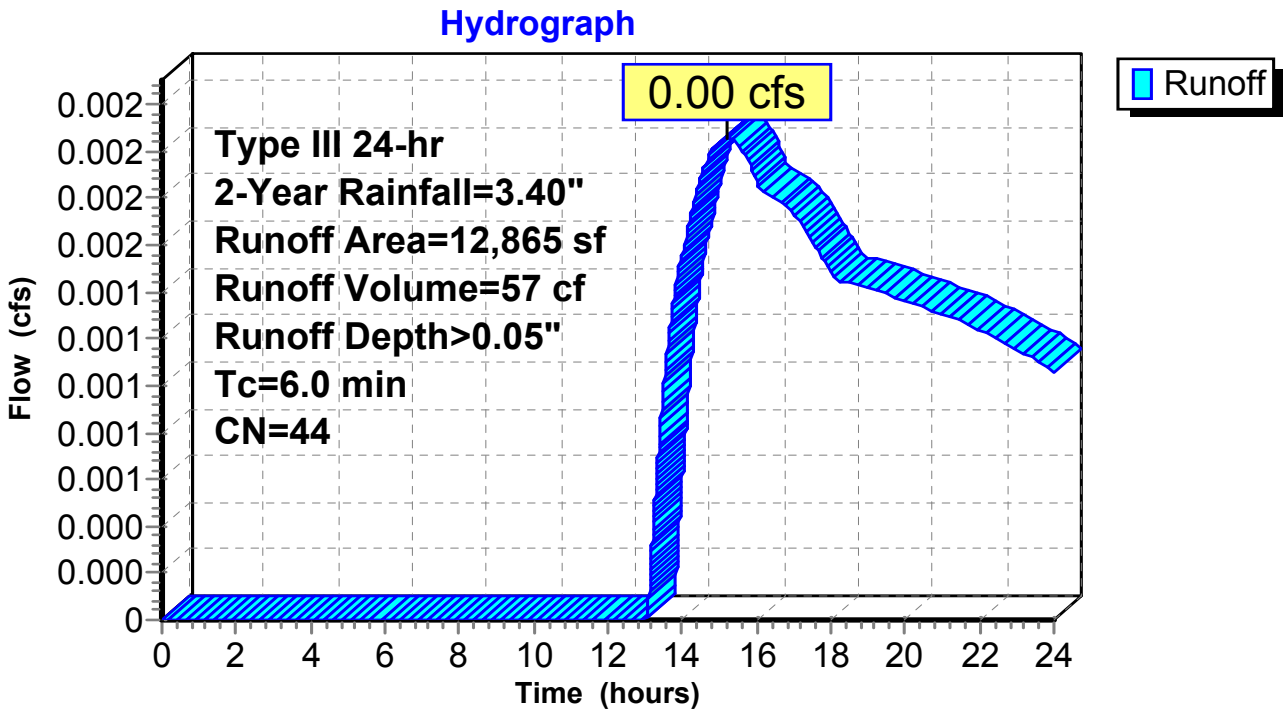
Runoff = 0.00 cfs @ 15.22 hrs, Volume= 57 cf, Depth> 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (sf)	CN	Description
2,675	76	Gravel roads, HSG A
10,190	36	Woods, Fair, HSG A
12,865	44	Weighted Average
12,865		100.00% Pervious Area

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

Subcatchment POST 1: Subcat POST 1



Summary for Subcatchment POST 1A: Subcat POST 1A

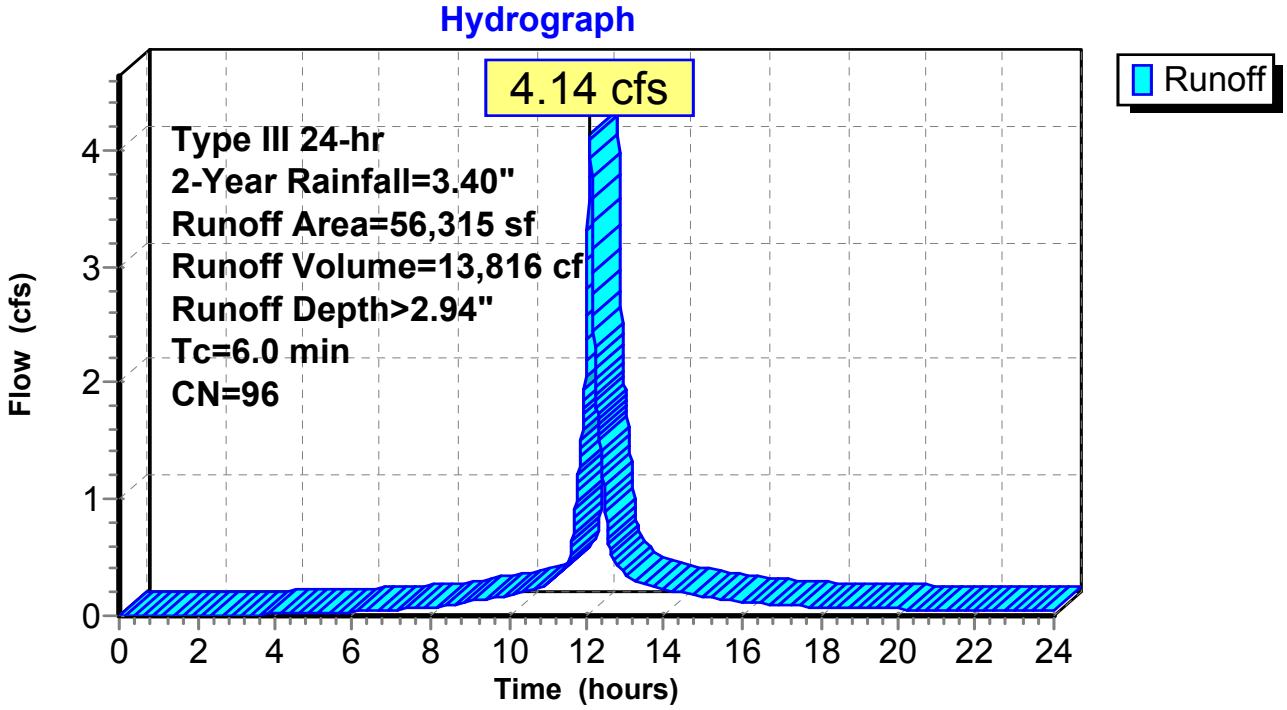
Runoff = 4.14 cfs @ 12.08 hrs, Volume= 13,816 cf, Depth> 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (sf)	CN	Description
4,861	76	Gravel roads, HSG A
51,445	98	Paved parking, HSG A
8	98	Roofs, HSG A
56,315	96	Weighted Average
4,861		8.63% Pervious Area
51,454		91.37% Impervious Area

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

Subcatchment POST 1A: Subcat POST 1A



Summary for Subcatchment POST 1B: Subcat POST 1B

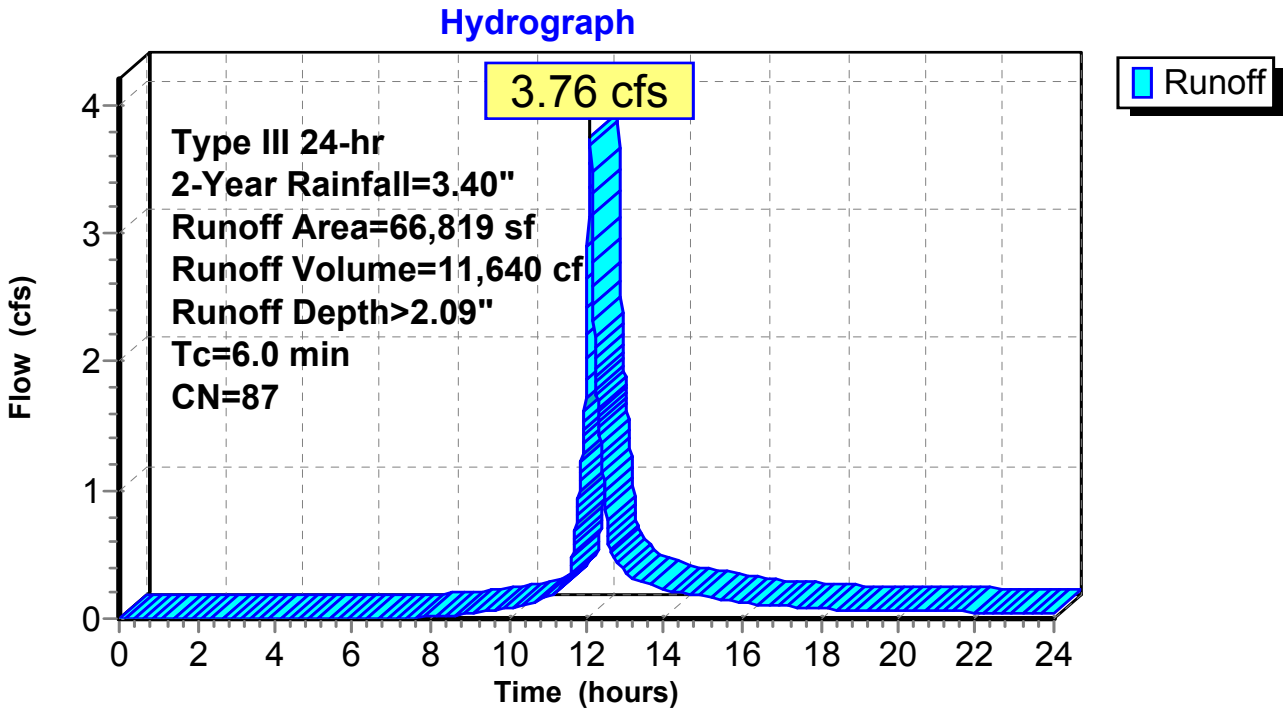
Runoff = 3.76 cfs @ 12.09 hrs, Volume= 11,640 cf, Depth> 2.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (sf)	CN	Description
14,136	49	50-75% Grass cover, Fair, HSG A
531	76	Gravel roads, HSG A
37,767	98	Paved parking, HSG A
14,386	98	Roofs, HSG A
66,819	87	Weighted Average
14,667		21.95% Pervious Area
52,153		78.05% Impervious Area

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

Subcatchment POST 1B: Subcat POST 1B



Summary for Subcatchment POST 1C: Subcat POST 1C

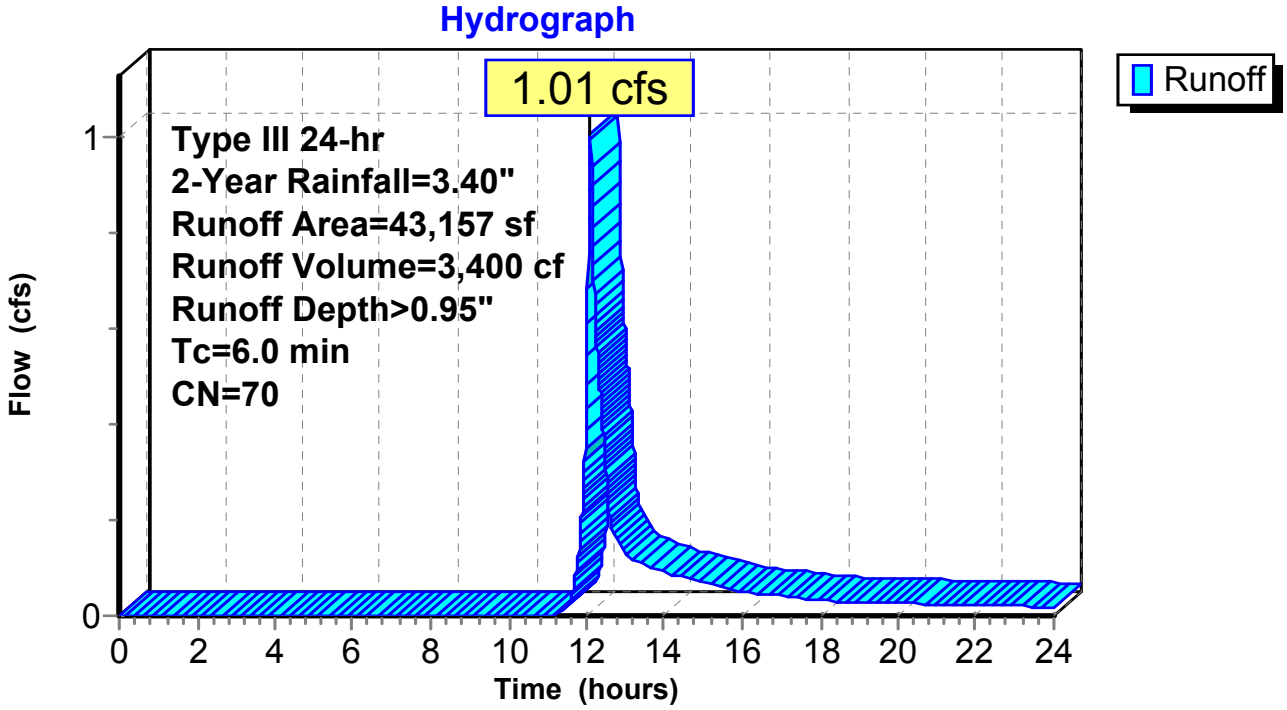
Runoff = 1.01 cfs @ 12.10 hrs, Volume= 3,400 cf, Depth> 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (sf)	CN	Description
22,583	76	Gravel roads, HSG A
9,068	98	Roofs, HSG A
11,506	36	Woods, Fair, HSG A
43,157	70	Weighted Average
34,089		78.99% Pervious Area
9,068		21.01% Impervious Area

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

Subcatchment POST 1C: Subcat POST 1C



Summary for Subcatchment POST 1D: Subcat POST 1D

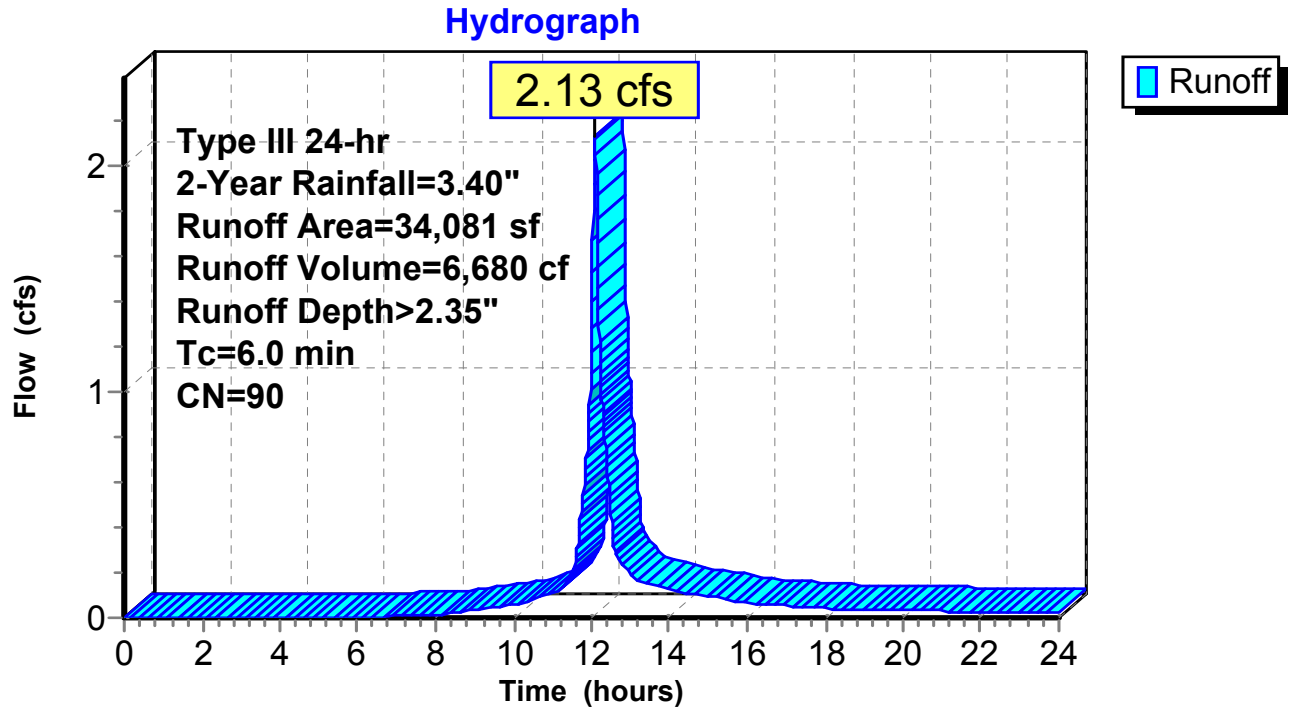
Runoff = 2.13 cfs @ 12.09 hrs, Volume= 6,680 cf, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (sf)	CN	Description
12,432	76	Gravel roads, HSG A
21,649	98	Roofs, HSG A
34,081	90	Weighted Average
12,432		36.48% Pervious Area
21,649		63.52% Impervious Area

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

Subcatchment POST 1D: Subcat POST 1D



Summary for Subcatchment POST 1E: Subcat POST 1E

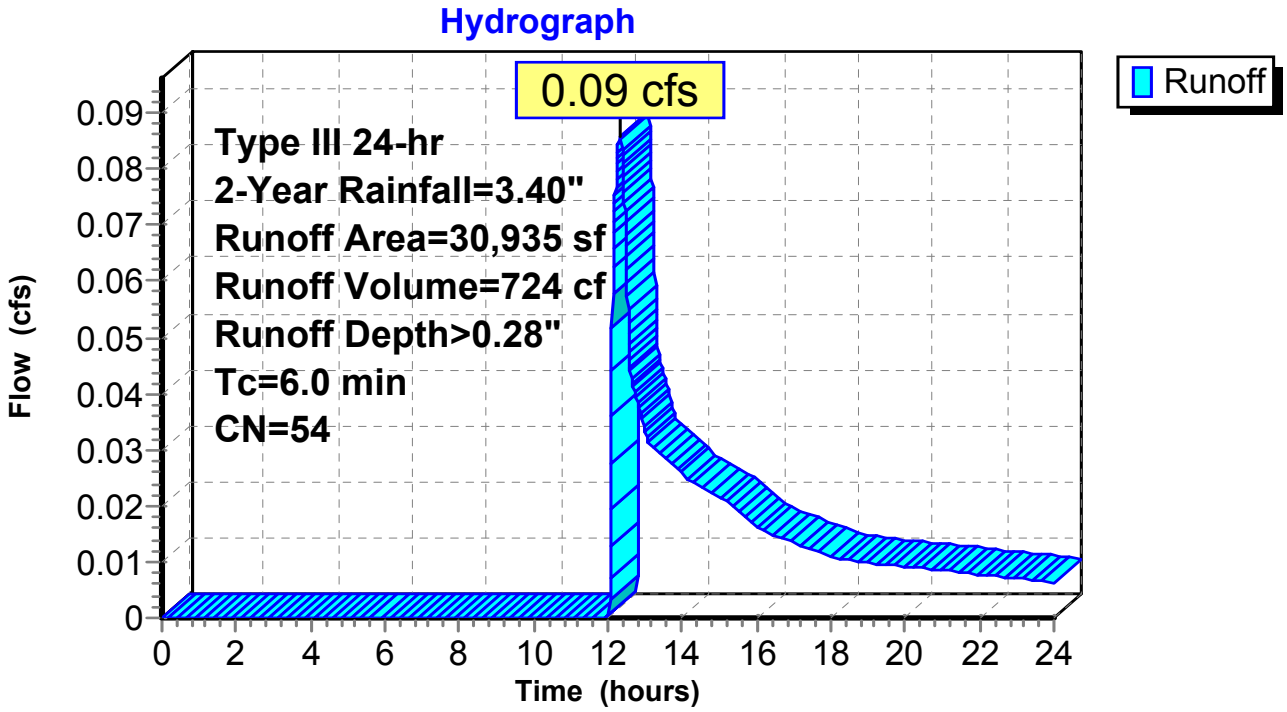
Runoff = 0.09 cfs @ 12.32 hrs, Volume= 724 cf, Depth> 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (sf)	CN	Description
89	49	50-75% Grass cover, Fair, HSG A
2,136	76	Gravel roads, HSG A
454	98	Paved parking, HSG A
7,185	98	Roofs, HSG A
21,071	36	Woods, Fair, HSG A
30,935	54	Weighted Average
23,296		75.31% Pervious Area
7,639		24.69% Impervious Area

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

Subcatchment POST 1E: Subcat POST 1E



Summary for Subcatchment POST 3: Subcat POST 3

[73] Warning: Peak may fall outside time span

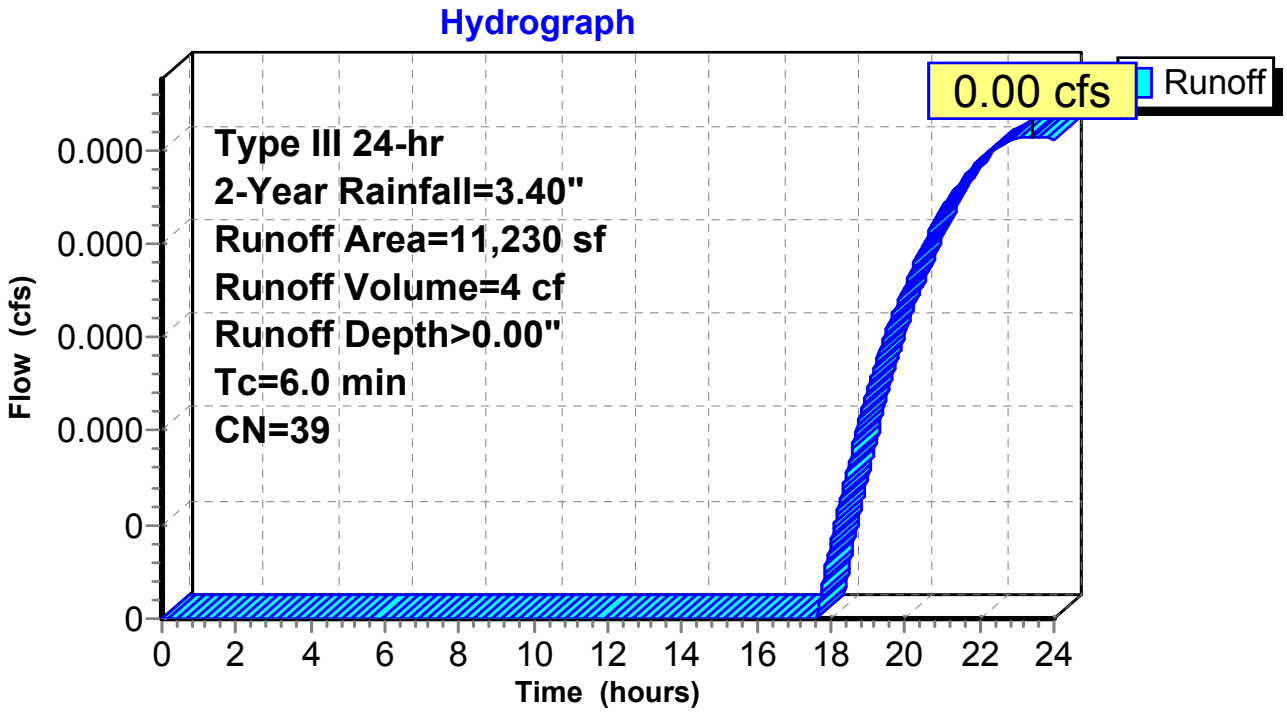
Runoff = 0.00 cfs @ 23.42 hrs, Volume= 4 cf, Depth> 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (sf)	CN	Description
1,176	49	50-75% Grass cover, Fair, HSG A
571	76	Gravel roads, HSG A
9,484	36	Woods, Fair, HSG A
11,230	39	Weighted Average
11,230		100.00% Pervious Area

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

Subcatchment POST 3: Subcat POST 3



Summary for Pond 1P: BASIN AND CHAMBERS

Inflow Area = 231,307 sf, 61.37% Impervious, Inflow Depth > 1.88" for 2-Year event
Inflow = 11.04 cfs @ 12.09 hrs, Volume= 36,261 cf
Outflow = 1.72 cfs @ 12.59 hrs, Volume= 36,243 cf, Atten= 84%, Lag= 30.2 min
Discarded = 1.72 cfs @ 12.59 hrs, Volume= 36,243 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 86.67' @ 12.59 hrs Surf.Area= 7,969 sf Storage= 12,301 cf

Plug-Flow detention time= 73.9 min calculated for 36,243 cf (100% of inflow)
Center-of-Mass det. time= 73.6 min (878.2 - 804.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	83.00'	2,879 cf	**37.20'W x 102.00'L x 5.00'H Field A** 18,972 cf Overall - 11,775 cf Embedded = 7,197 cf x 40.0% Voids
#2A	83.50'	8,869 cf	**Concrete Galley 4x4x4** x 200 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf 200 Chambers in 8 Rows
#3	86.00'	24,916 cf	**Custom Stage Data (Conic)**Listed below
		36,663 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	3,183	0	0	3,183
87.00	4,664	3,900	3,900	4,680
88.00	6,205	5,416	9,316	6,243
89.00	7,800	6,987	16,304	7,866
90.00	9,451	8,612	24,916	9,549

Device	Routing	Invert	Outlet Devices
#1	Discarded	83.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	88.10'	**10.0' long x 0.8' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32

Discarded OutFlow Max=1.72 cfs @ 12.59 hrs HW=86.67' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 1.72 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=83.00' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: BASIN AND CHAMBERS - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4 (Concrete Galley, UCPI 4x4x4 Galley or equivalent)
Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf
Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf

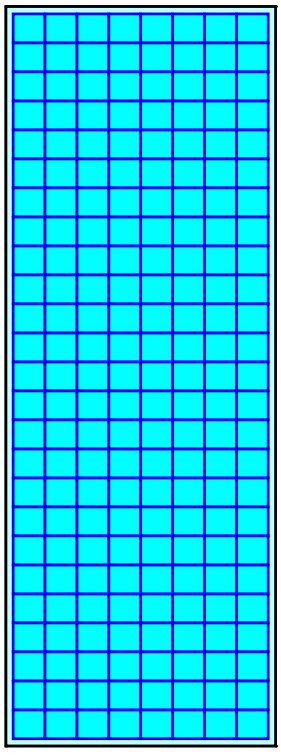
25 Chambers/Row x 4.00' Long = 100.00' Row Length +12.0" End Stone x 2 = 102.00' Base Length
8 Rows x 52.8" Wide + 12.0" Side Stone x 2 = 37.20' Base Width
6.0" Base + 48.0" Chamber Height + 6.0" Cover = 5.00' Field Height

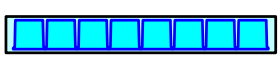
200 Chambers x 44.3 cf = 8,868.9 cf Chamber Storage
200 Chambers x 58.9 cf = 11,775.3 cf Displacement

18,972.0 cf Field - 11,775.3 cf Chambers = 7,196.7 cf Stone x 40.0% Voids = 2,878.7 cf Stone Storage

Chamber Storage + Stone Storage = 11,747.6 cf = 0.270 af
Overall Storage Efficiency = 61.9%
Overall System Size = 102.00' x 37.20' x 5.00'

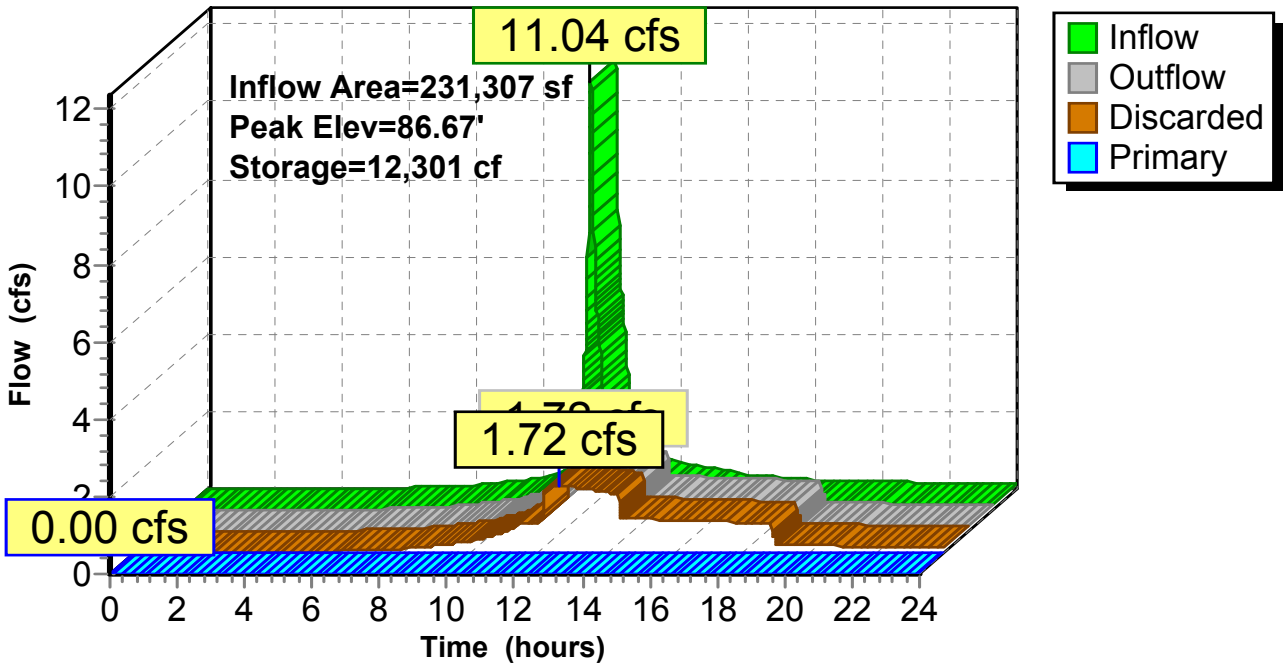
200 Chambers @ $ 300.00 /ea = $ 60,000.00
702.7 cy Field Excavation @ $ 10.00 /cy = $ 7,026.67
266.5 cy Stone @ $ 30.00 /cy = $ 7,996.37
Total Cost = $ 75,023.04





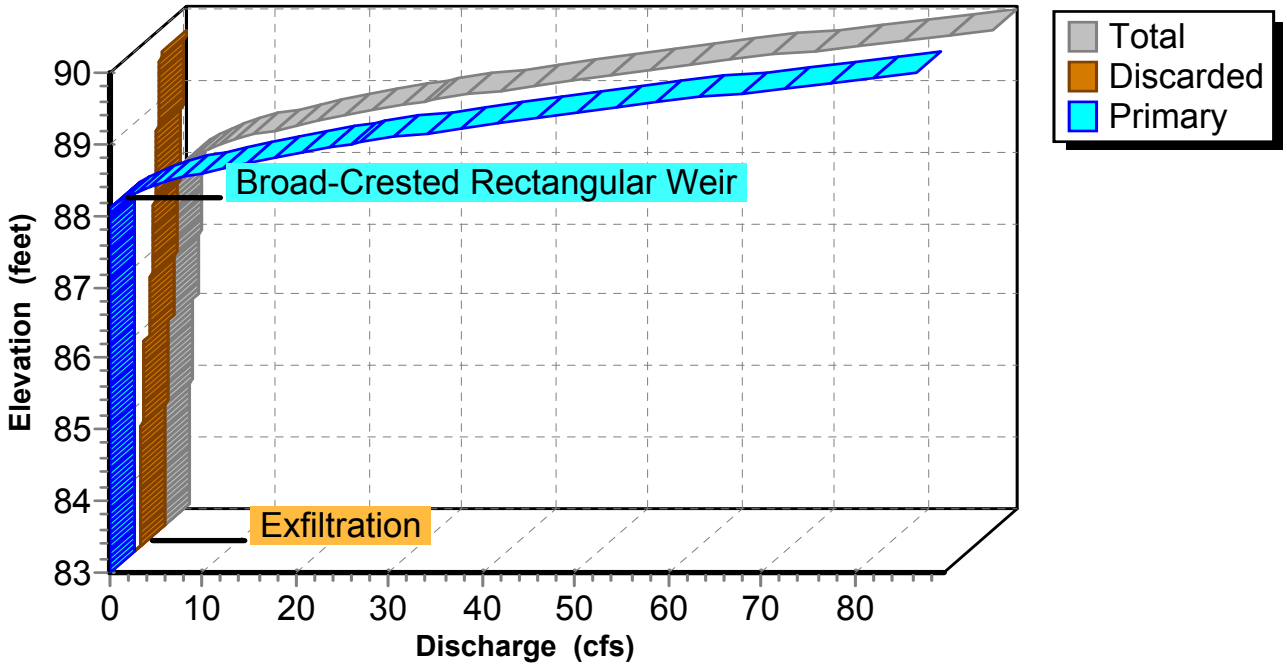
Pond 1P: BASIN AND CHAMBERS

Hydrograph

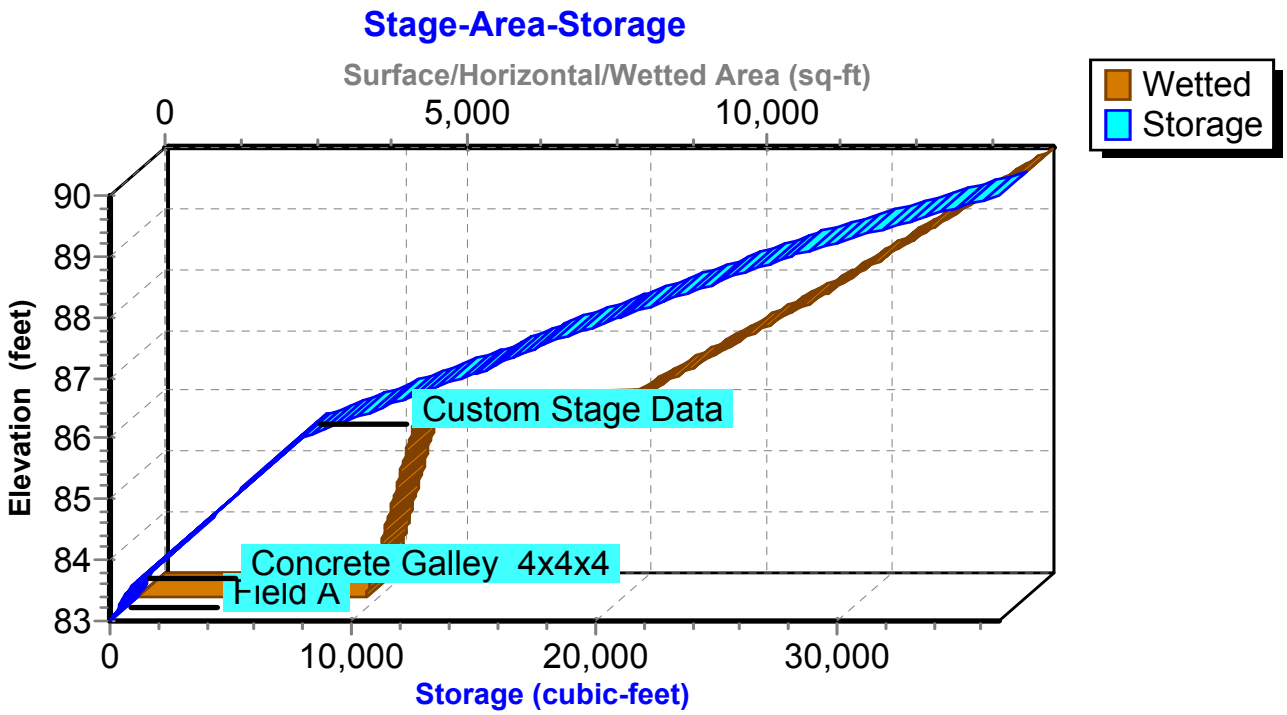


Pond 1P: BASIN AND CHAMBERS

Stage-Discharge



Pond 1P: BASIN AND CHAMBERS

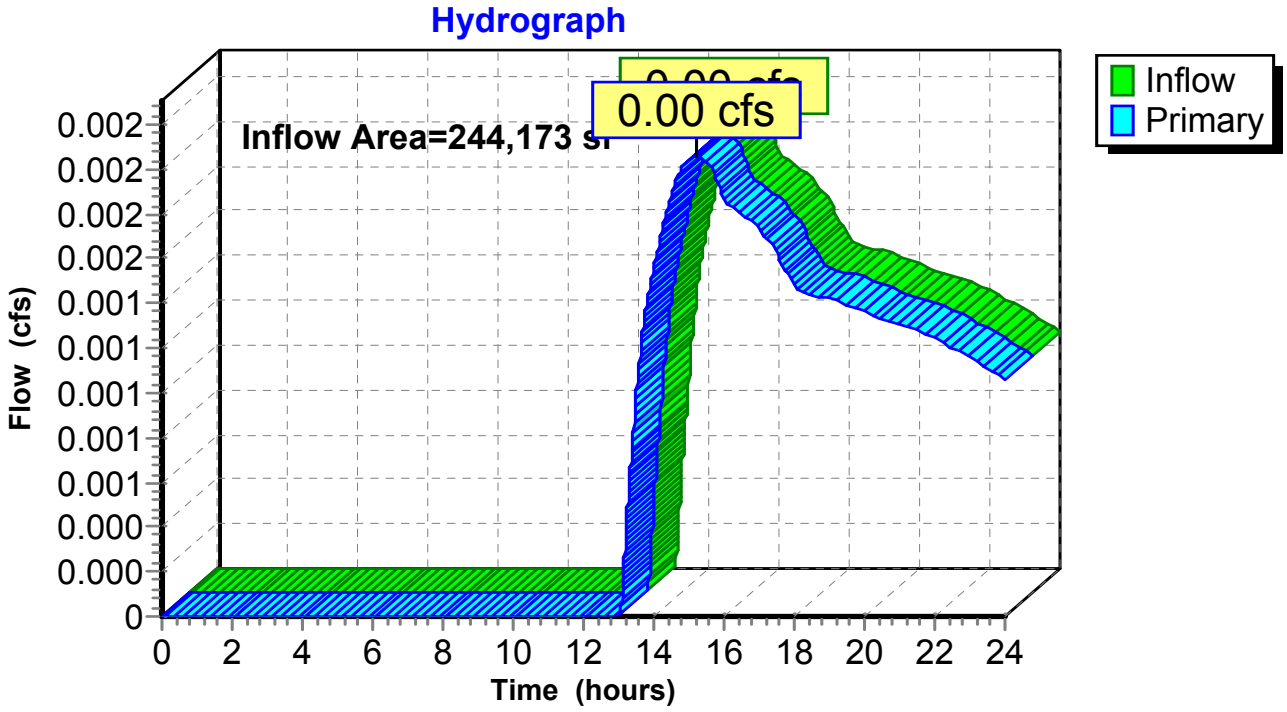


Summary for Link 14L: POST

Inflow Area = 244,173 sf, 58.14% Impervious, Inflow Depth > 0.00" for 2-Year event
Inflow = 0.00 cfs @ 15.22 hrs, Volume= 57 cf
Primary = 0.00 cfs @ 15.22 hrs, Volume= 57 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 14L: POST



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

Subcatchment POST 1: Subcat POST 1 Runoff Area=12,865 sf 0.00% Impervious Runoff Depth>0.31"
Tc=6.0 min CN=44 Runoff=0.03 cfs 333 cf

Subcatchment POST 1A: Subcat POST 1A Runoff Area=56,315 sf 91.37% Impervious Runoff Depth>4.23"
Tc=6.0 min CN=96 Runoff=5.83 cfs 19,856 cf

Subcatchment POST 1B: Subcat POST 1B Runoff Area=66,819 sf 78.05% Impervious Runoff Depth>3.28"
Tc=6.0 min CN=87 Runoff=5.82 cfs 18,277 cf

Subcatchment POST 1C: Subcat POST 1C Runoff Area=43,157 sf 21.01% Impervious Runoff Depth>1.81"
Tc=6.0 min CN=70 Runoff=2.06 cfs 6,525 cf

Subcatchment POST 1D: Subcat POST 1D Runoff Area=34,081 sf 63.52% Impervious Runoff Depth>3.58"
Tc=6.0 min CN=90 Runoff=3.19 cfs 10,179 cf

Subcatchment POST 1E: Subcat POST 1E Runoff Area=30,935 sf 24.69% Impervious Runoff Depth>0.78"
Tc=6.0 min CN=54 Runoff=0.47 cfs 2,006 cf

Subcatchment POST 3: Subcat POST 3 Runoff Area=11,230 sf 0.00% Impervious Runoff Depth>0.14"
Tc=6.0 min CN=39 Runoff=0.01 cfs 134 cf

Pond 1P: BASIN AND CHAMBERS Peak Elev=88.07' Storage=21,548 cf Inflow=17.33 cfs 56,842 cf
Discarded=2.21 cfs 56,815 cf Primary=0.00 cfs 0 cf Outflow=2.21 cfs 56,815 cf

Link 14L: POST Inflow=0.03 cfs 333 cf
Primary=0.03 cfs 333 cf

Total Runoff Area = 255,402 sf Runoff Volume = 57,309 cf Average Runoff Depth = 2.69"
44.42% Pervious = 113,440 sf 55.58% Impervious = 141,962 sf

Summary for Subcatchment POST 1: Subcat POST 1

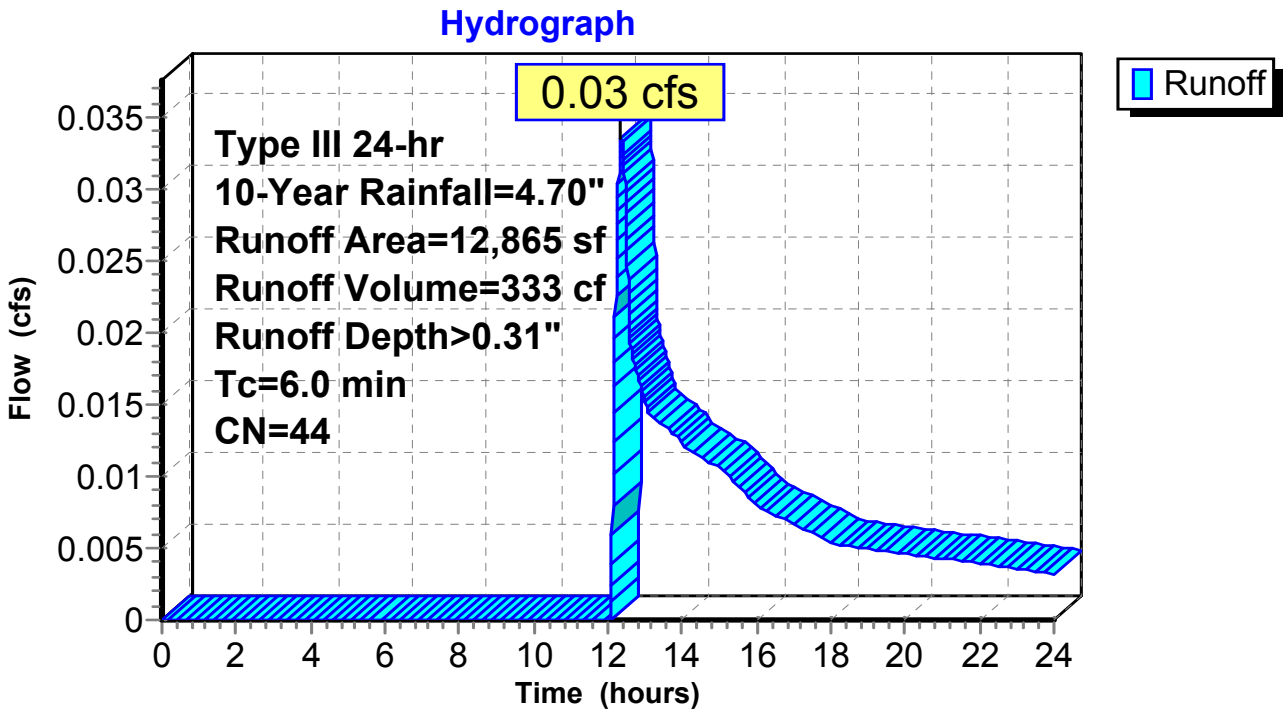
Runoff = 0.03 cfs @ 12.37 hrs, Volume= 333 cf, Depth> 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
2,675	76	Gravel roads, HSG A
10,190	36	Woods, Fair, HSG A
12,865	44	Weighted Average
12,865		100.00% Pervious Area

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

Subcatchment POST 1: Subcat POST 1



Summary for Subcatchment POST 1A: Subcat POST 1A

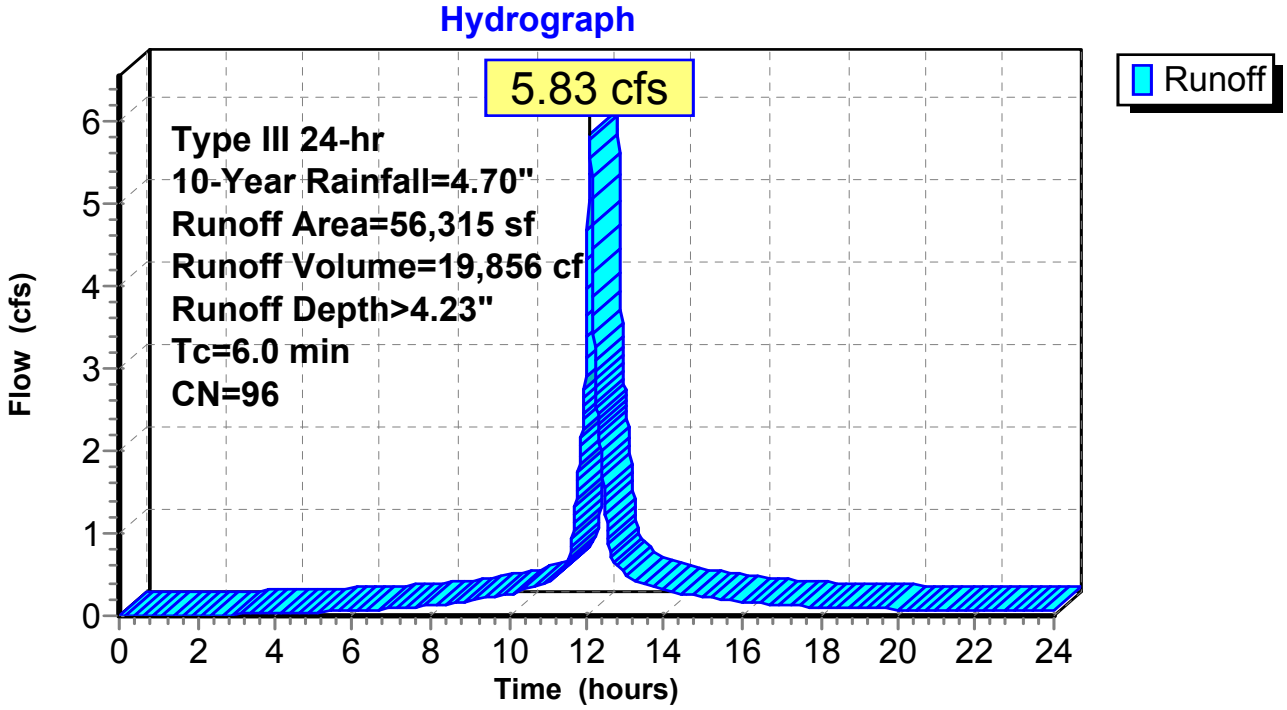
Runoff = 5.83 cfs @ 12.08 hrs, Volume= 19,856 cf, Depth> 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
4,861	76	Gravel roads, HSG A
51,445	98	Paved parking, HSG A
8	98	Roofs, HSG A
56,315	96	Weighted Average
4,861		8.63% Pervious Area
51,454		91.37% Impervious Area

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

Subcatchment POST 1A: Subcat POST 1A



Summary for Subcatchment POST 1B: Subcat POST 1B

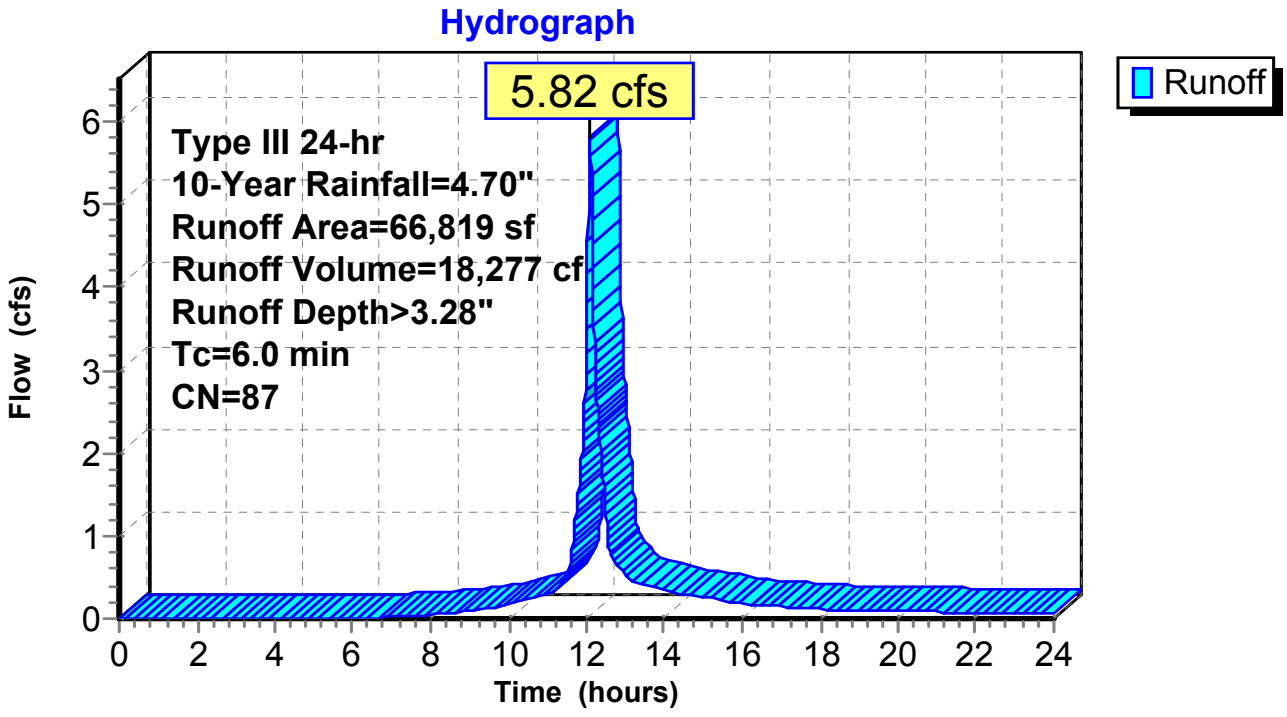
Runoff = 5.82 cfs @ 12.09 hrs, Volume= 18,277 cf, Depth> 3.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
14,136	49	50-75% Grass cover, Fair, HSG A
531	76	Gravel roads, HSG A
37,767	98	Paved parking, HSG A
14,386	98	Roofs, HSG A
66,819	87	Weighted Average
14,667		21.95% Pervious Area
52,153		78.05% Impervious Area

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

Subcatchment POST 1B: Subcat POST 1B



Summary for Subcatchment POST 1C: Subcat POST 1C

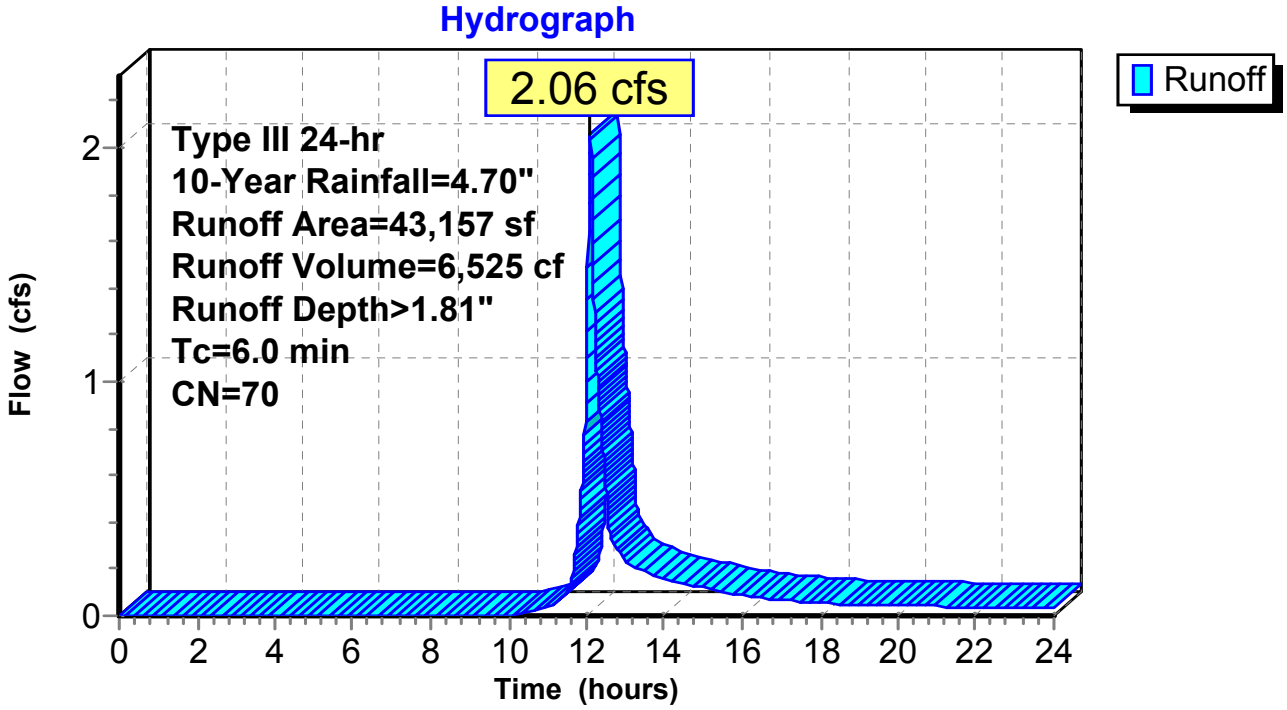
Runoff = 2.06 cfs @ 12.09 hrs, Volume= 6,525 cf, Depth> 1.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
22,583	76	Gravel roads, HSG A
9,068	98	Roofs, HSG A
11,506	36	Woods, Fair, HSG A
43,157	70	Weighted Average
34,089		78.99% Pervious Area
9,068		21.01% Impervious Area

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

Subcatchment POST 1C: Subcat POST 1C



Summary for Subcatchment POST 1D: Subcat POST 1D

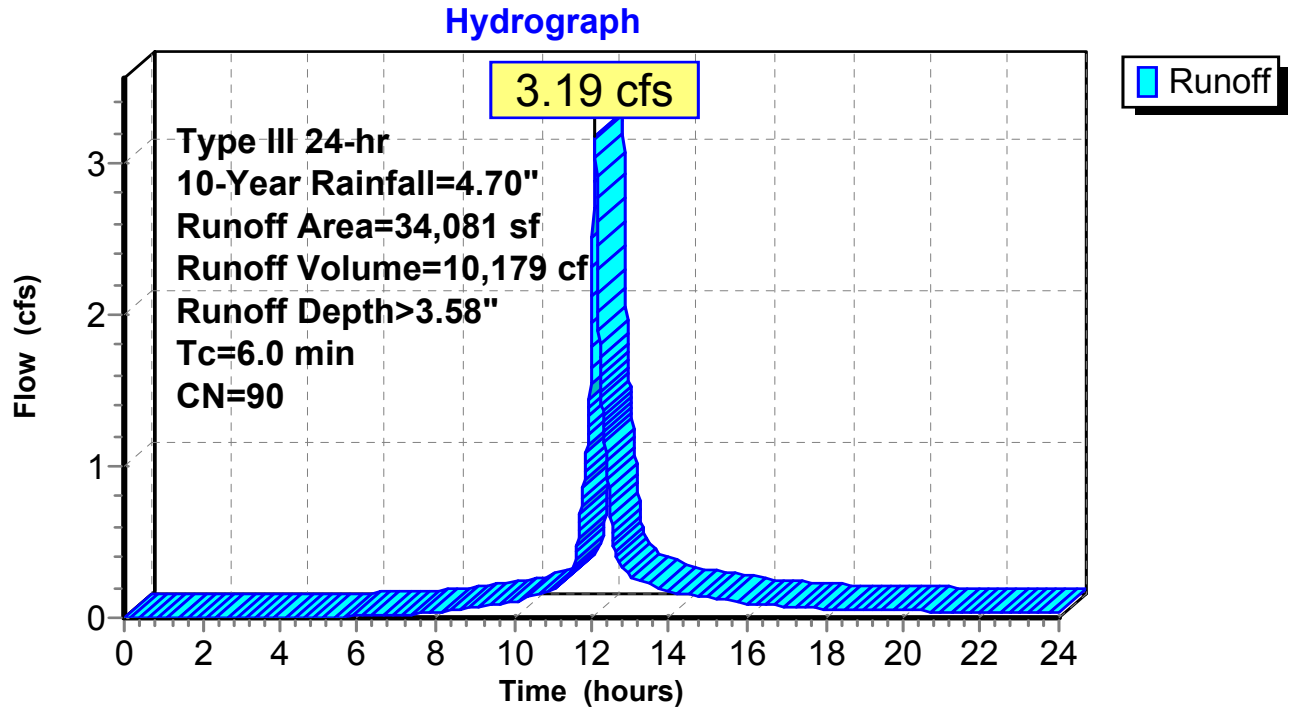
Runoff = 3.19 cfs @ 12.09 hrs, Volume= 10,179 cf, Depth> 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
12,432	76	Gravel roads, HSG A
21,649	98	Roofs, HSG A
34,081	90	Weighted Average
12,432		36.48% Pervious Area
21,649		63.52% Impervious Area

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

Subcatchment POST 1D: Subcat POST 1D



Summary for Subcatchment POST 1E: Subcat POST 1E

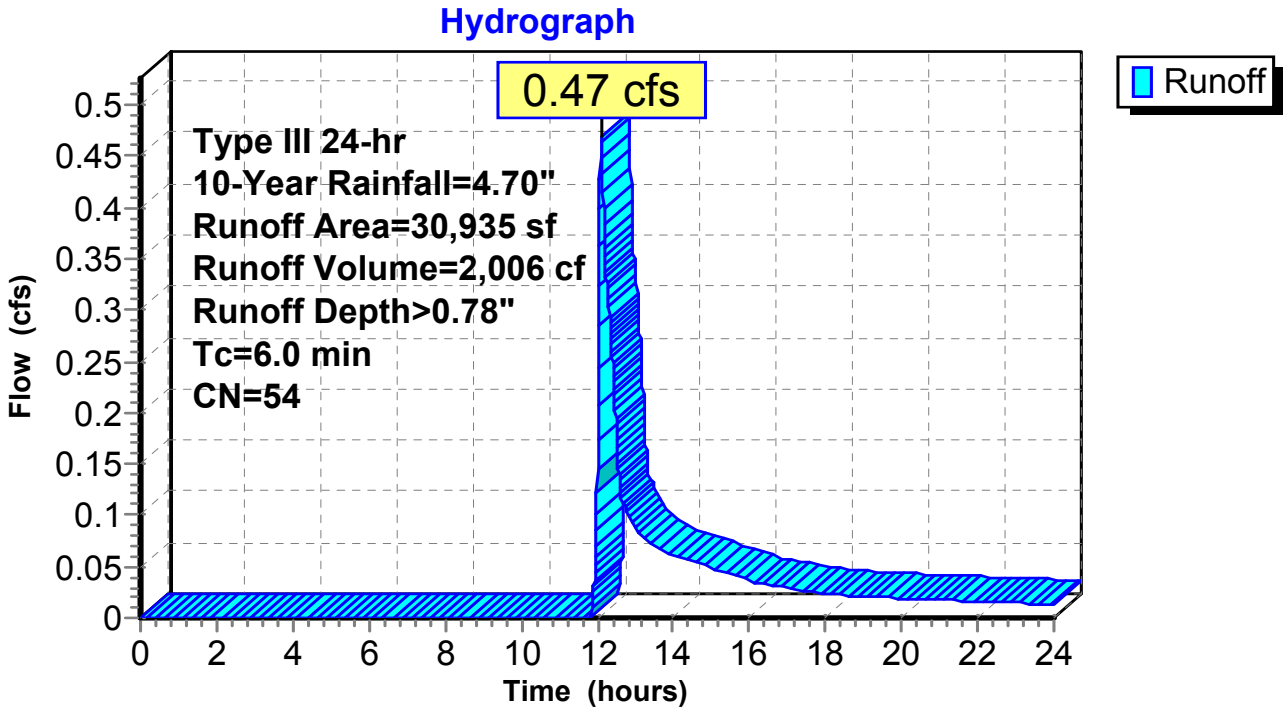
Runoff = 0.47 cfs @ 12.11 hrs, Volume= 2,006 cf, Depth> 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
89	49	50-75% Grass cover, Fair, HSG A
2,136	76	Gravel roads, HSG A
454	98	Paved parking, HSG A
7,185	98	Roofs, HSG A
21,071	36	Woods, Fair, HSG A
30,935	54	Weighted Average
23,296		75.31% Pervious Area
7,639		24.69% Impervious Area

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

Subcatchment POST 1E: Subcat POST 1E



Summary for Subcatchment POST 3: Subcat POST 3

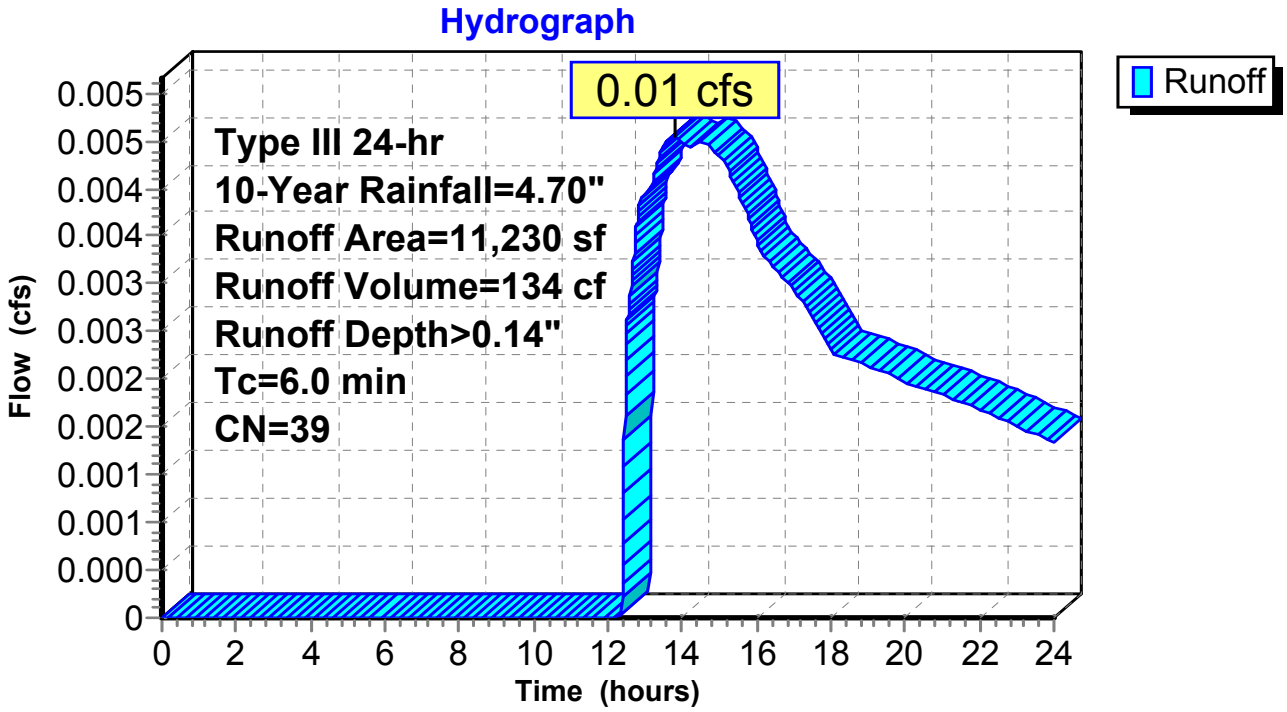
Runoff = 0.01 cfs @ 13.78 hrs, Volume= 134 cf, Depth> 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
1,176	49	50-75% Grass cover, Fair, HSG A
571	76	Gravel roads, HSG A
9,484	36	Woods, Fair, HSG A
11,230	39	Weighted Average
11,230		100.00% Pervious Area

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

Subcatchment POST 3: Subcat POST 3



Summary for Pond 1P: BASIN AND CHAMBERS

Inflow Area = 231,307 sf, 61.37% Impervious, Inflow Depth > 2.95" for 10-Year event
Inflow = 17.33 cfs @ 12.09 hrs, Volume= 56,842 cf
Outflow = 2.21 cfs @ 12.69 hrs, Volume= 56,815 cf, Atten= 87%, Lag= 36.0 min
Discarded = 2.21 cfs @ 12.69 hrs, Volume= 56,815 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 88.07' @ 12.69 hrs Surf.Area= 10,110 sf Storage= 21,548 cf

Plug-Flow detention time= 99.6 min calculated for 56,815 cf (100% of inflow)
Center-of-Mass det. time= 99.3 min (895.4 - 796.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	83.00'	2,879 cf	**37.20'W x 102.00'L x 5.00'H Field A** 18,972 cf Overall - 11,775 cf Embedded = 7,197 cf x 40.0% Voids
#2A	83.50'	8,869 cf	**Concrete Galley 4x4x4** x 200 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf 200 Chambers in 8 Rows
#3	86.00'	24,916 cf	**Custom Stage Data (Conic)**Listed below
		36,663 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	3,183	0	0	3,183
87.00	4,664	3,900	3,900	4,680
88.00	6,205	5,416	9,316	6,243
89.00	7,800	6,987	16,304	7,866
90.00	9,451	8,612	24,916	9,549

Device	Routing	Invert	Outlet Devices
#1	Discarded	83.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	88.10'	**10.0' long x 0.8' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32

Discarded OutFlow Max=2.21 cfs @ 12.69 hrs HW=88.07' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 2.21 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=83.00' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: BASIN AND CHAMBERS - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4 (Concrete Galley, UCPI 4x4x4 Galley or equivalent)
Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf
Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf

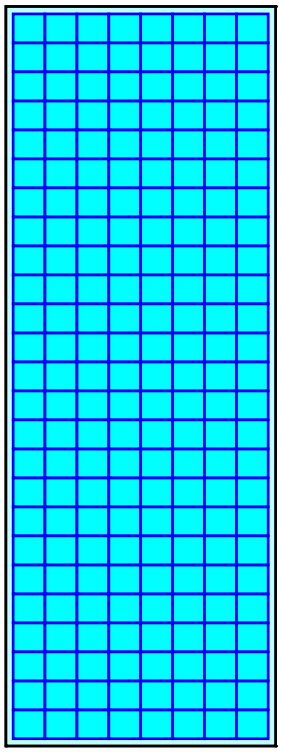
25 Chambers/Row x 4.00' Long = 100.00' Row Length +12.0" End Stone x 2 = 102.00' Base Length
8 Rows x 52.8" Wide + 12.0" Side Stone x 2 = 37.20' Base Width
6.0" Base + 48.0" Chamber Height + 6.0" Cover = 5.00' Field Height

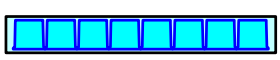
200 Chambers x 44.3 cf = 8,868.9 cf Chamber Storage
200 Chambers x 58.9 cf = 11,775.3 cf Displacement

18,972.0 cf Field - 11,775.3 cf Chambers = 7,196.7 cf Stone x 40.0% Voids = 2,878.7 cf Stone Storage

Chamber Storage + Stone Storage = 11,747.6 cf = 0.270 af
Overall Storage Efficiency = 61.9%
Overall System Size = 102.00' x 37.20' x 5.00'

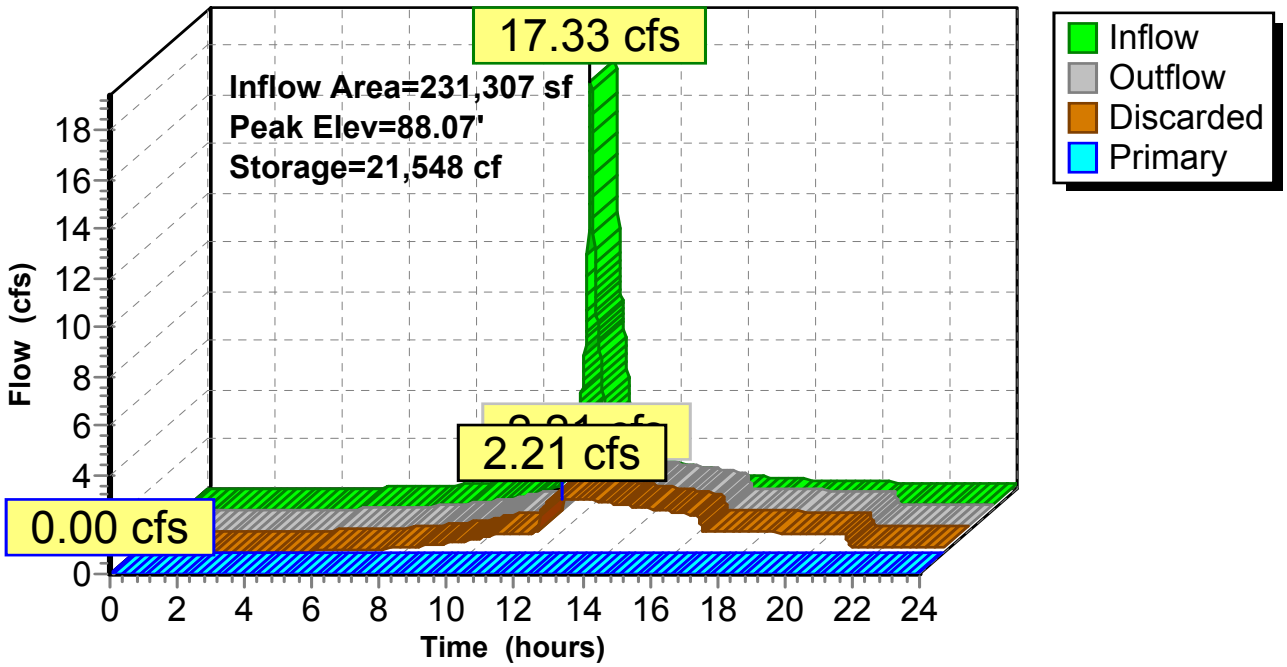
200 Chambers @ $ 300.00 /ea = $ 60,000.00
702.7 cy Field Excavation @ $ 10.00 /cy = $ 7,026.67
266.5 cy Stone @ $ 30.00 /cy = $ 7,996.37
Total Cost = $ 75,023.04





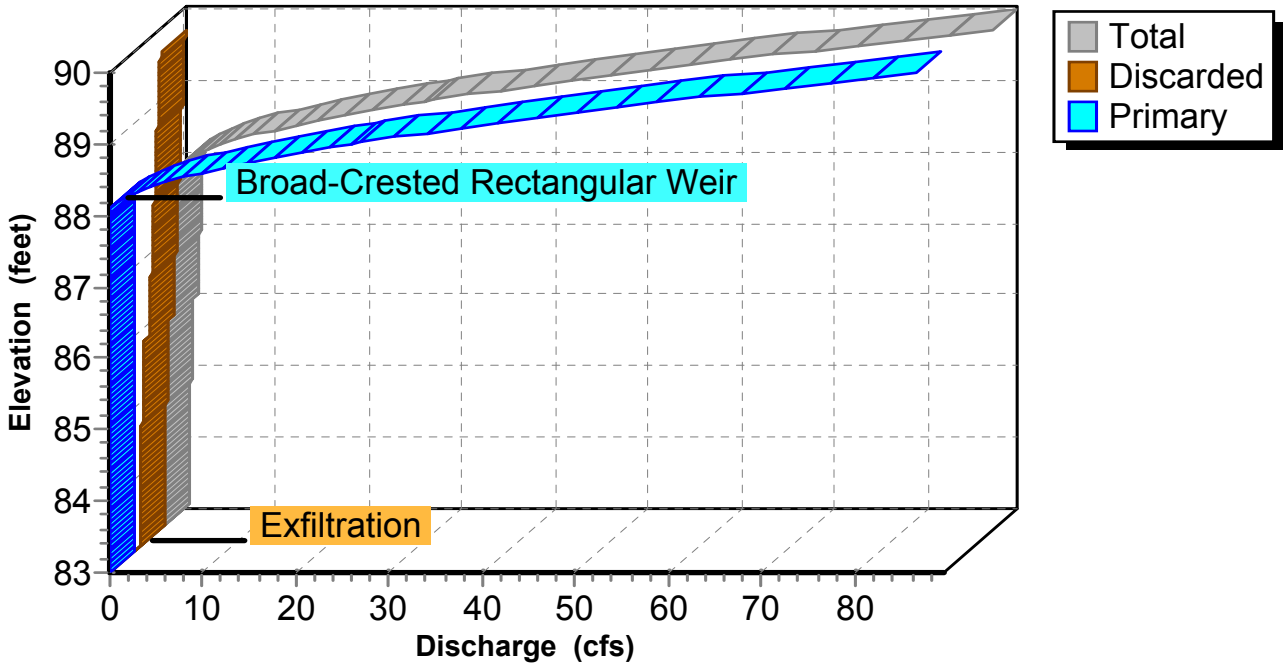
Pond 1P: BASIN AND CHAMBERS

Hydrograph

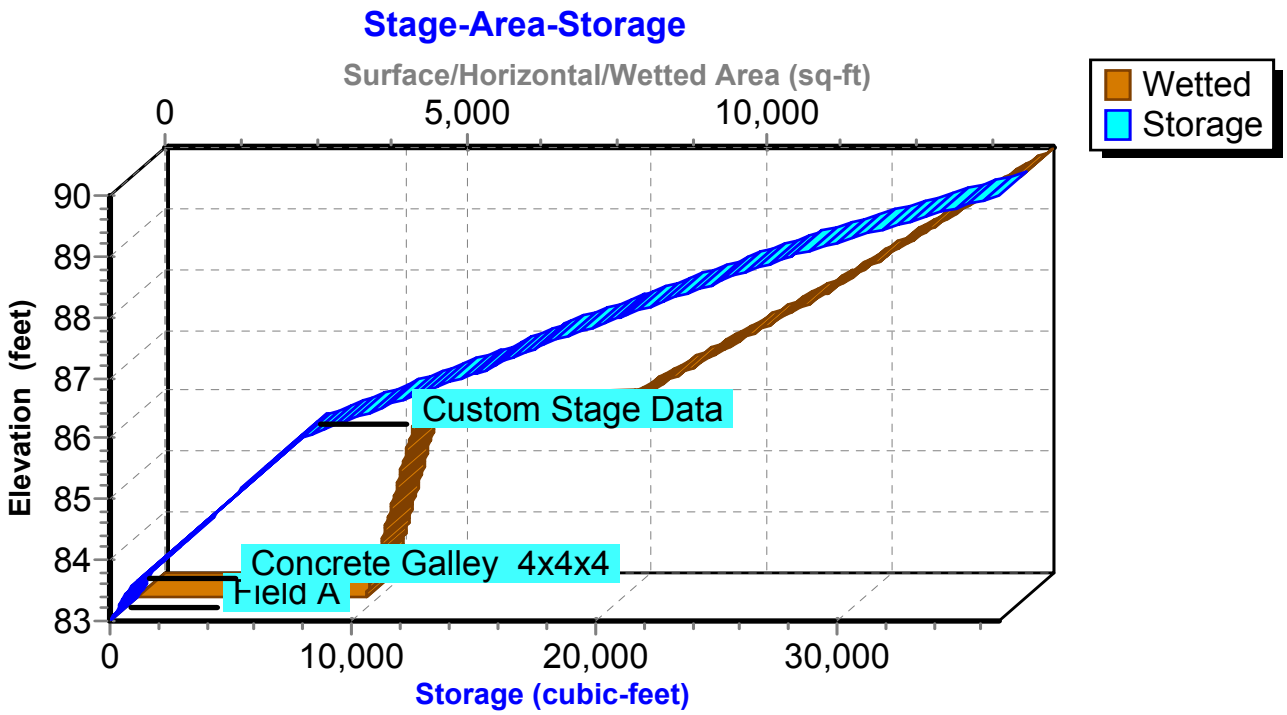


Pond 1P: BASIN AND CHAMBERS

Stage-Discharge



Pond 1P: BASIN AND CHAMBERS

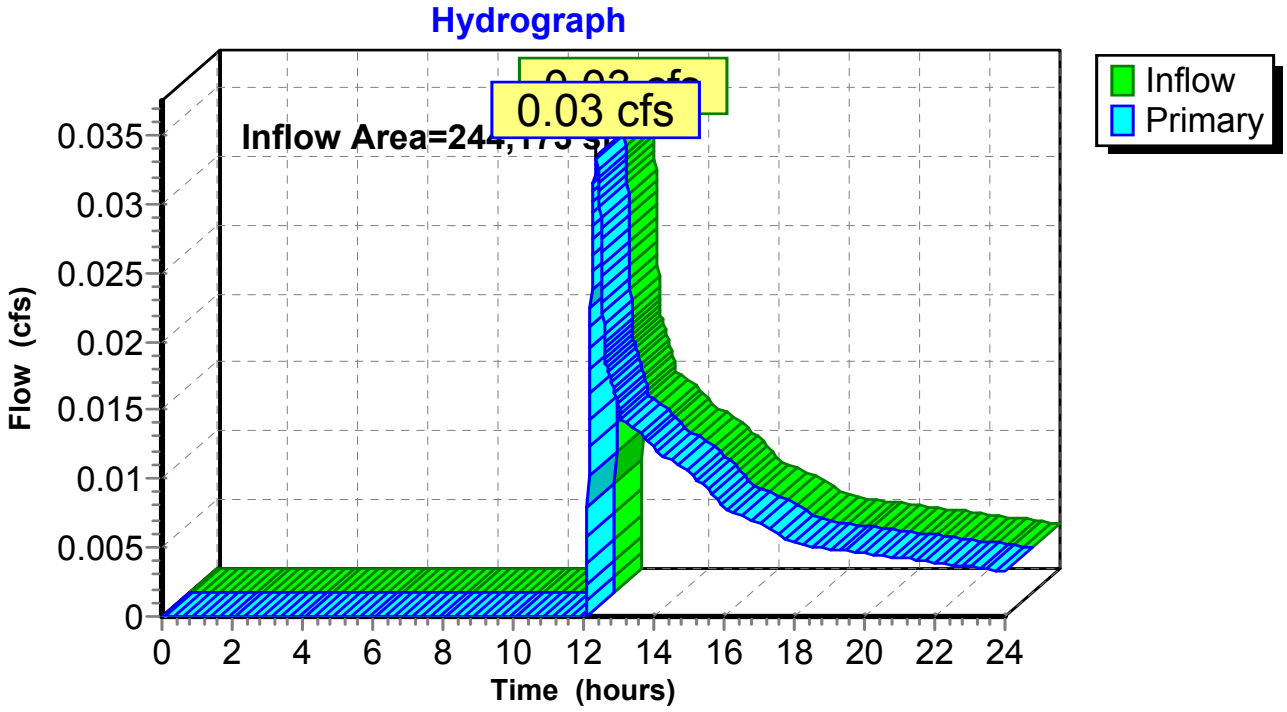


Summary for Link 14L: POST

Inflow Area = 244,173 sf, 58.14% Impervious, Inflow Depth > 0.02" for 10-Year event
Inflow = 0.03 cfs @ 12.37 hrs, Volume= 333 cf
Primary = 0.03 cfs @ 12.37 hrs, Volume= 333 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 14L: POST



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

Subcatchment POST 1: Subcat POST 1 Runoff Area=12,865 sf 0.00% Impervious Runoff Depth>0.59"
Tc=6.0 min CN=44 Runoff=0.09 cfs 632 cf

Subcatchment POST 1A: Subcat POST 1A Runoff Area=56,315 sf 91.37% Impervious Runoff Depth>5.13"
Tc=6.0 min CN=96 Runoff=7.00 cfs 24,051 cf

Subcatchment POST 1B: Subcat POST 1B Runoff Area=66,819 sf 78.05% Impervious Runoff Depth>4.13"
Tc=6.0 min CN=87 Runoff=7.26 cfs 23,005 cf

Subcatchment POST 1C: Subcat POST 1C Runoff Area=43,157 sf 21.01% Impervious Runoff Depth>2.49"
Tc=6.0 min CN=70 Runoff=2.87 cfs 8,949 cf

Subcatchment POST 1D: Subcat POST 1D Runoff Area=34,081 sf 63.52% Impervious Runoff Depth>4.45"
Tc=6.0 min CN=90 Runoff=3.91 cfs 12,646 cf

Subcatchment POST 1E: Subcat POST 1E Runoff Area=30,935 sf 24.69% Impervious Runoff Depth>1.22"
Tc=6.0 min CN=54 Runoff=0.86 cfs 3,147 cf

Subcatchment POST 3: Subcat POST 3 Runoff Area=11,230 sf 0.00% Impervious Runoff Depth>0.34"
Tc=6.0 min CN=39 Runoff=0.03 cfs 315 cf

Pond 1P: BASIN AND CHAMBERS Peak Elev=88.44' Storage=24,116 cf Inflow=21.86 cfs 71,798 cf
Discarded=2.32 cfs 64,602 cf Primary=5.43 cfs 7,164 cf Outflow=7.75 cfs 71,765 cf

Link 14L: POST Inflow=5.51 cfs 7,796 cf
Primary=5.51 cfs 7,796 cf

Total Runoff Area = 255,402 sf Runoff Volume = 72,745 cf Average Runoff Depth = 3.42"
44.42% Pervious = 113,440 sf 55.58% Impervious = 141,962 sf

Summary for Subcatchment POST 1: Subcat POST 1

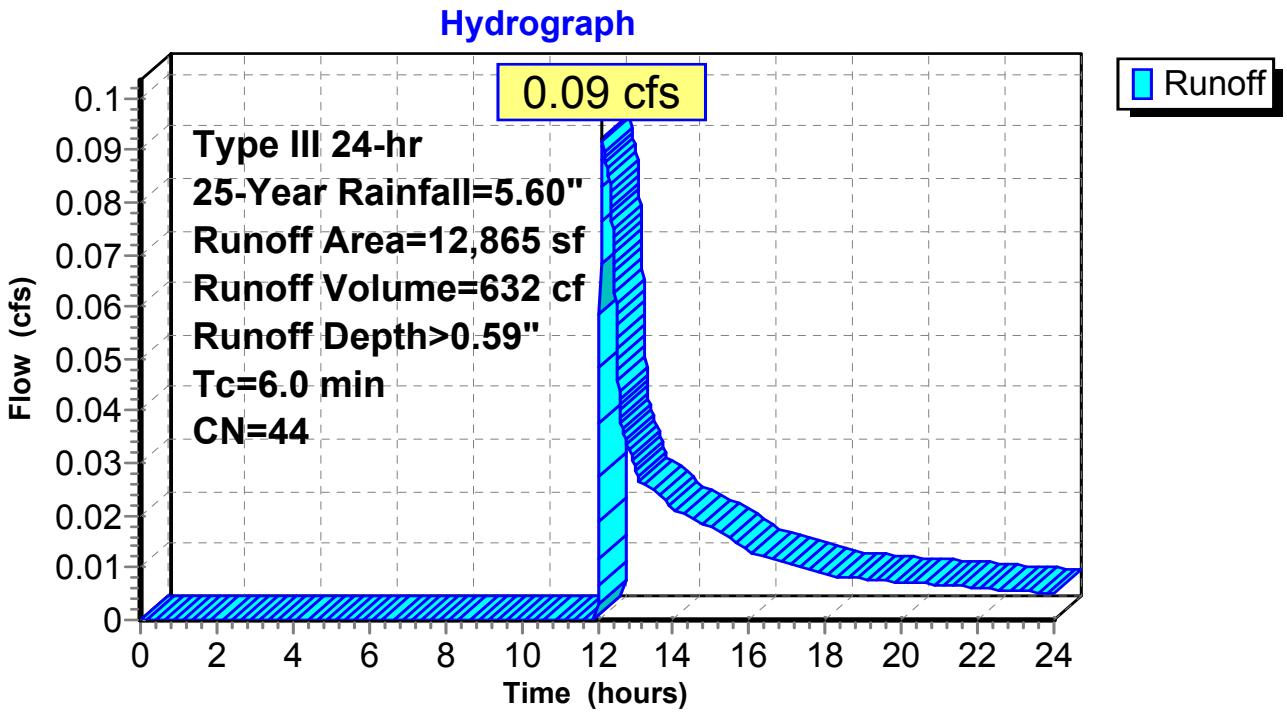
Runoff = 0.09 cfs @ 12.15 hrs, Volume= 632 cf, Depth> 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
2,675	76	Gravel roads, HSG A
10,190	36	Woods, Fair, HSG A
12,865	44	Weighted Average
12,865		100.00% Pervious Area

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

Subcatchment POST 1: Subcat POST 1



Summary for Subcatchment POST 1A: Subcat POST 1A

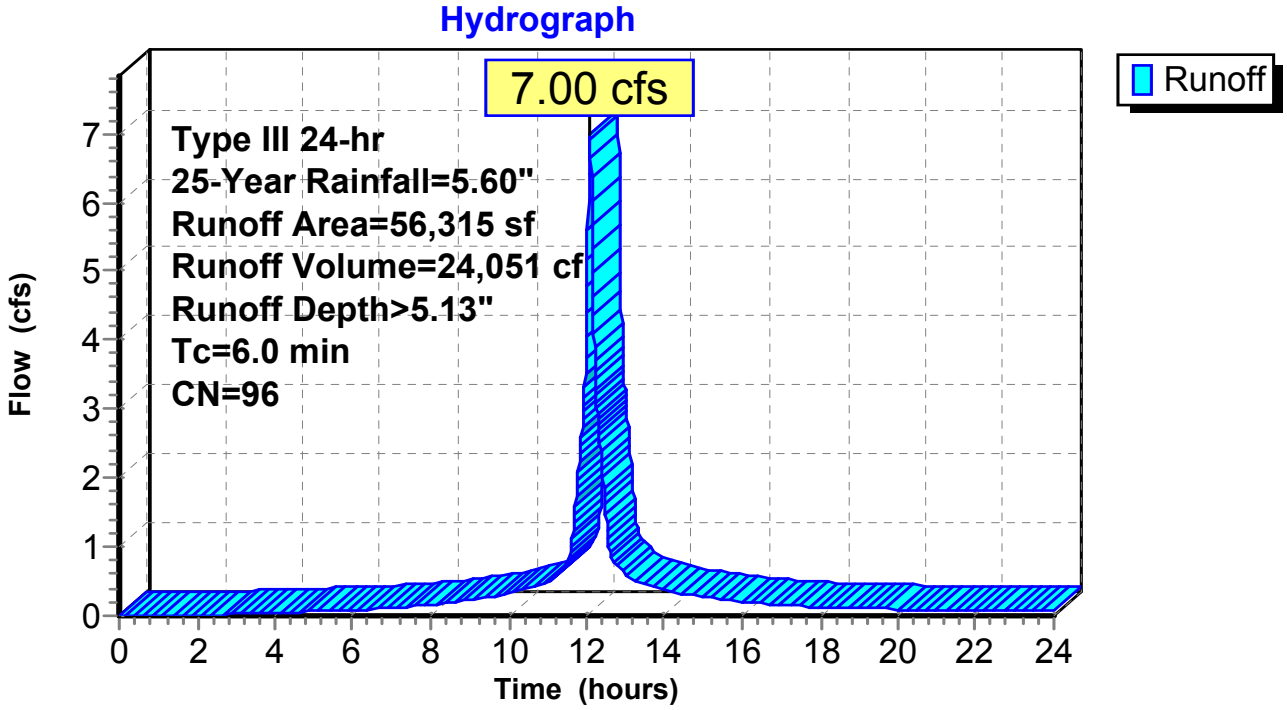
Runoff = 7.00 cfs @ 12.08 hrs, Volume= 24,051 cf, Depth> 5.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
4,861	76	Gravel roads, HSG A
51,445	98	Paved parking, HSG A
8	98	Roofs, HSG A
56,315	96	Weighted Average
4,861		8.63% Pervious Area
51,454		91.37% Impervious Area

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

Subcatchment POST 1A: Subcat POST 1A



Summary for Subcatchment POST 1B: Subcat POST 1B

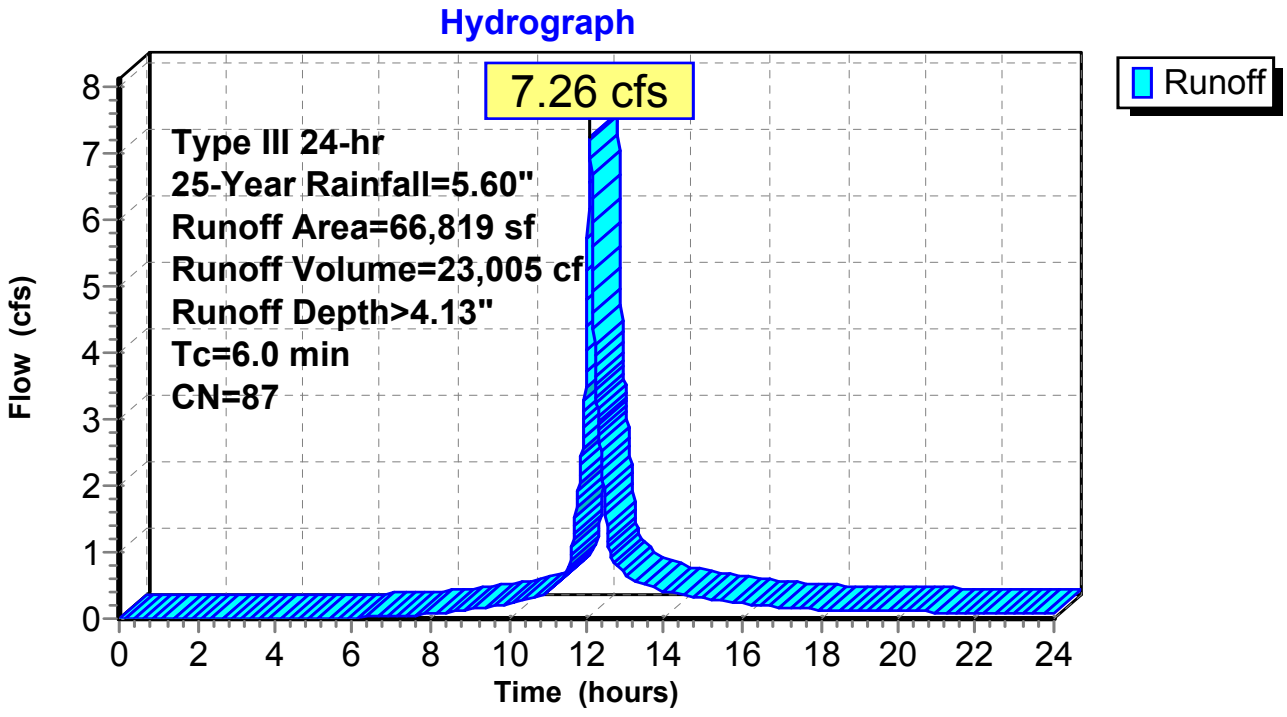
Runoff = 7.26 cfs @ 12.09 hrs, Volume= 23,005 cf, Depth> 4.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
14,136	49	50-75% Grass cover, Fair, HSG A
531	76	Gravel roads, HSG A
37,767	98	Paved parking, HSG A
14,386	98	Roofs, HSG A
66,819	87	Weighted Average
14,667		21.95% Pervious Area
52,153		78.05% Impervious Area

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

Subcatchment POST 1B: Subcat POST 1B



Summary for Subcatchment POST 1C: Subcat POST 1C

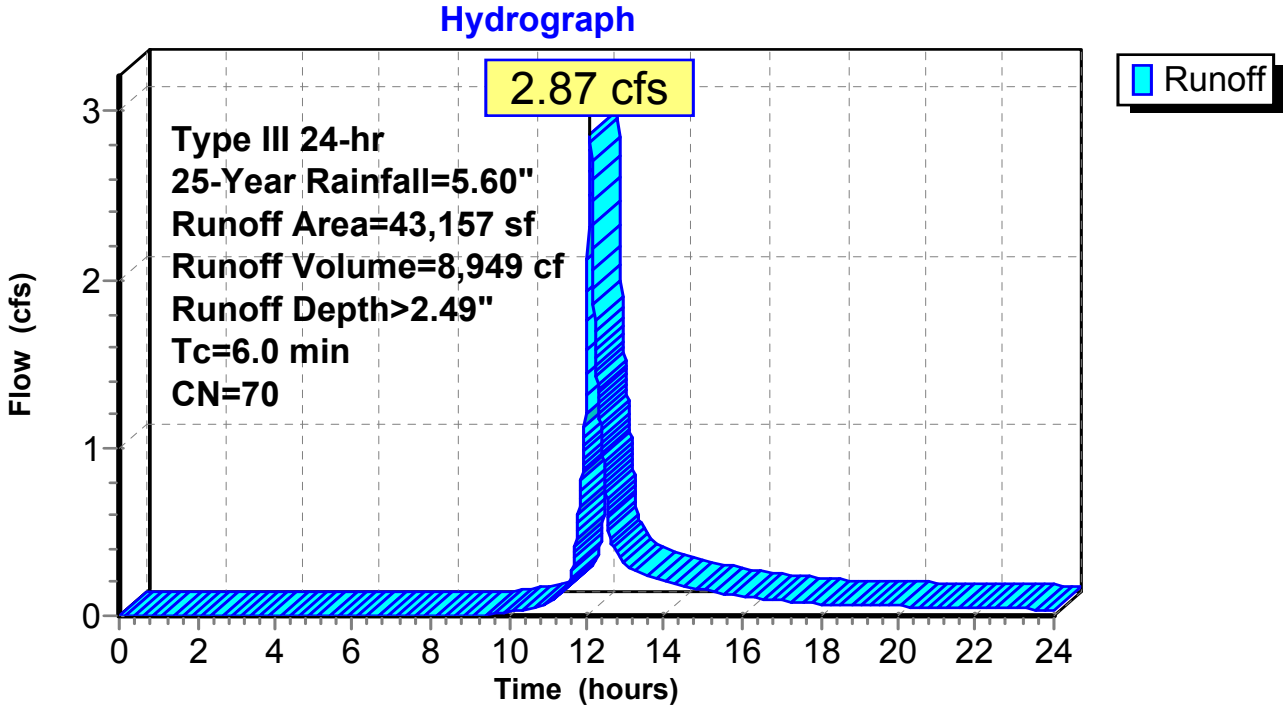
Runoff = 2.87 cfs @ 12.09 hrs, Volume= 8,949 cf, Depth> 2.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
22,583	76	Gravel roads, HSG A
9,068	98	Roofs, HSG A
11,506	36	Woods, Fair, HSG A
43,157	70	Weighted Average
34,089		78.99% Pervious Area
9,068		21.01% Impervious Area

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

Subcatchment POST 1C: Subcat POST 1C



Summary for Subcatchment POST 1D: Subcat POST 1D

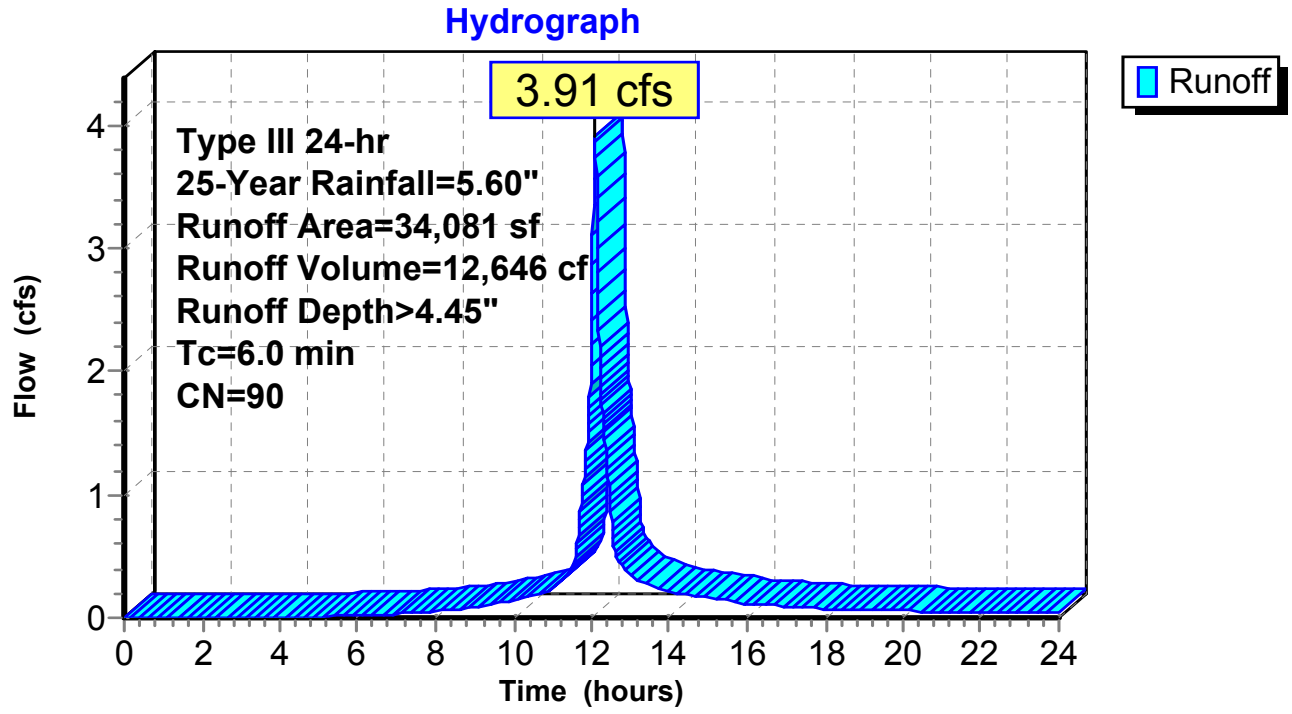
Runoff = 3.91 cfs @ 12.08 hrs, Volume= 12,646 cf, Depth> 4.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
12,432	76	Gravel roads, HSG A
21,649	98	Roofs, HSG A
34,081	90	Weighted Average
12,432		36.48% Pervious Area
21,649		63.52% Impervious Area

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

Subcatchment POST 1D: Subcat POST 1D



Summary for Subcatchment POST 1E: Subcat POST 1E

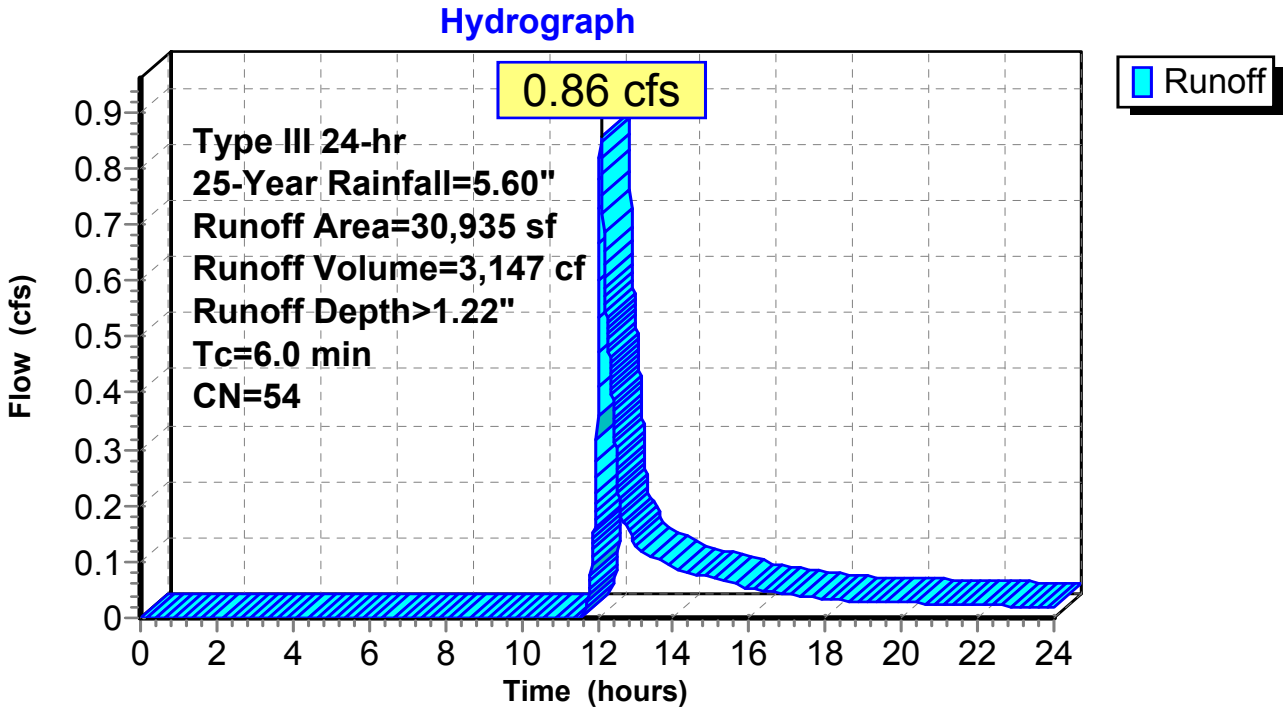
Runoff = 0.86 cfs @ 12.10 hrs, Volume= 3,147 cf, Depth> 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
89	49	50-75% Grass cover, Fair, HSG A
2,136	76	Gravel roads, HSG A
454	98	Paved parking, HSG A
7,185	98	Roofs, HSG A
21,071	36	Woods, Fair, HSG A
30,935	54	Weighted Average
23,296		75.31% Pervious Area
7,639		24.69% Impervious Area

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

Subcatchment POST 1E: Subcat POST 1E



Summary for Subcatchment POST 3: Subcat POST 3

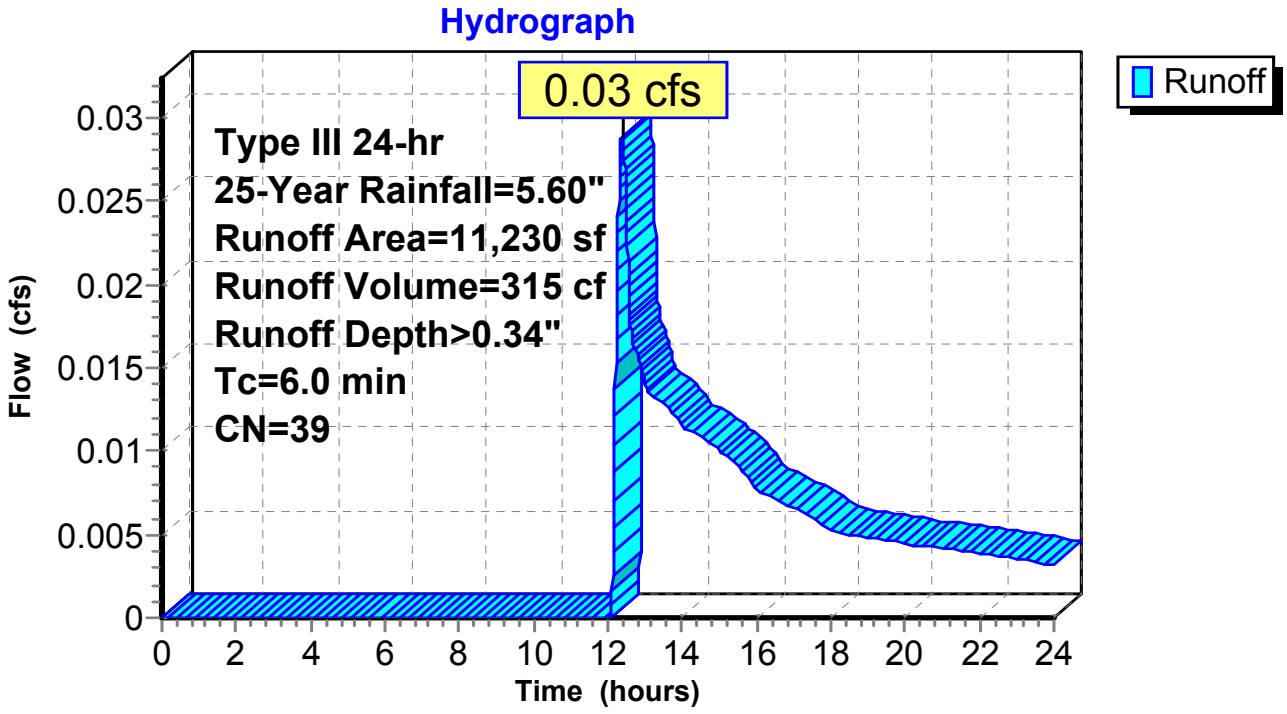
Runoff = 0.03 cfs @ 12.39 hrs, Volume= 315 cf, Depth> 0.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (sf)	CN	Description
1,176	49	50-75% Grass cover, Fair, HSG A
571	76	Gravel roads, HSG A
9,484	36	Woods, Fair, HSG A
11,230	39	Weighted Average
11,230		100.00% Pervious Area

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

Subcatchment POST 3: Subcat POST 3



Summary for Pond 1P: BASIN AND CHAMBERS

Inflow Area = 231,307 sf, 61.37% Impervious, Inflow Depth > 3.72" for 25-Year event
Inflow = 21.86 cfs @ 12.09 hrs, Volume= 71,798 cf
Outflow = 7.75 cfs @ 12.36 hrs, Volume= 71,765 cf, Atten= 65%, Lag= 16.6 min
Discarded = 2.32 cfs @ 12.36 hrs, Volume= 64,602 cf
Primary = 5.43 cfs @ 12.36 hrs, Volume= 7,164 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 88.44' @ 12.36 hrs Surf.Area= 10,696 sf Storage= 24,116 cf

Plug-Flow detention time= 94.1 min calculated for 71,736 cf (100% of inflow)
Center-of-Mass det. time= 93.8 min (885.4 - 791.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	83.00'	2,879 cf	**37.20'W x 102.00'L x 5.00'H Field A** 18,972 cf Overall - 11,775 cf Embedded = 7,197 cf x 40.0% Voids
#2A	83.50'	8,869 cf	**Concrete Galley 4x4x4** x 200 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf 200 Chambers in 8 Rows
#3	86.00'	24,916 cf	**Custom Stage Data (Conic)**Listed below
		36,663 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	3,183	0	0	3,183
87.00	4,664	3,900	3,900	4,680
88.00	6,205	5,416	9,316	6,243
89.00	7,800	6,987	16,304	7,866
90.00	9,451	8,612	24,916	9,549

Device	Routing	Invert	Outlet Devices
#1	Discarded	83.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	88.10'	**10.0' long x 0.8' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32

Discarded OutFlow Max=2.32 cfs @ 12.36 hrs HW=88.44' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 2.32 cfs)

Primary OutFlow Max=5.41 cfs @ 12.36 hrs HW=88.44' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 5.41 cfs @ 1.61 fps)

Pond 1P: BASIN AND CHAMBERS - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4 (Concrete Galley, UCPI 4x4x4 Galley or equivalent)
Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf
Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf

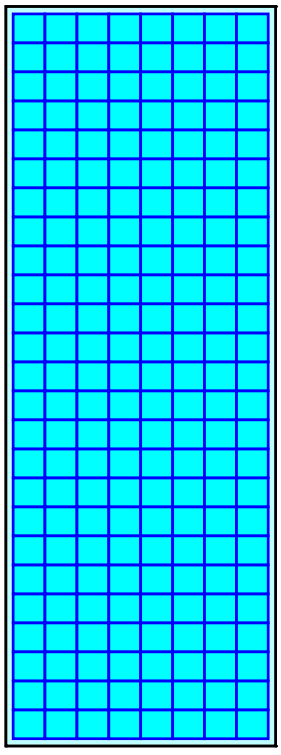
25 Chambers/Row x 4.00' Long = 100.00' Row Length +12.0" End Stone x 2 = 102.00' Base Length
8 Rows x 52.8" Wide + 12.0" Side Stone x 2 = 37.20' Base Width
6.0" Base + 48.0" Chamber Height + 6.0" Cover = 5.00' Field Height

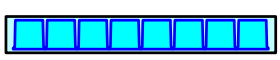
200 Chambers x 44.3 cf = 8,868.9 cf Chamber Storage
200 Chambers x 58.9 cf = 11,775.3 cf Displacement

18,972.0 cf Field - 11,775.3 cf Chambers = 7,196.7 cf Stone x 40.0% Voids = 2,878.7 cf Stone Storage

Chamber Storage + Stone Storage = 11,747.6 cf = 0.270 af
Overall Storage Efficiency = 61.9%
Overall System Size = 102.00' x 37.20' x 5.00'

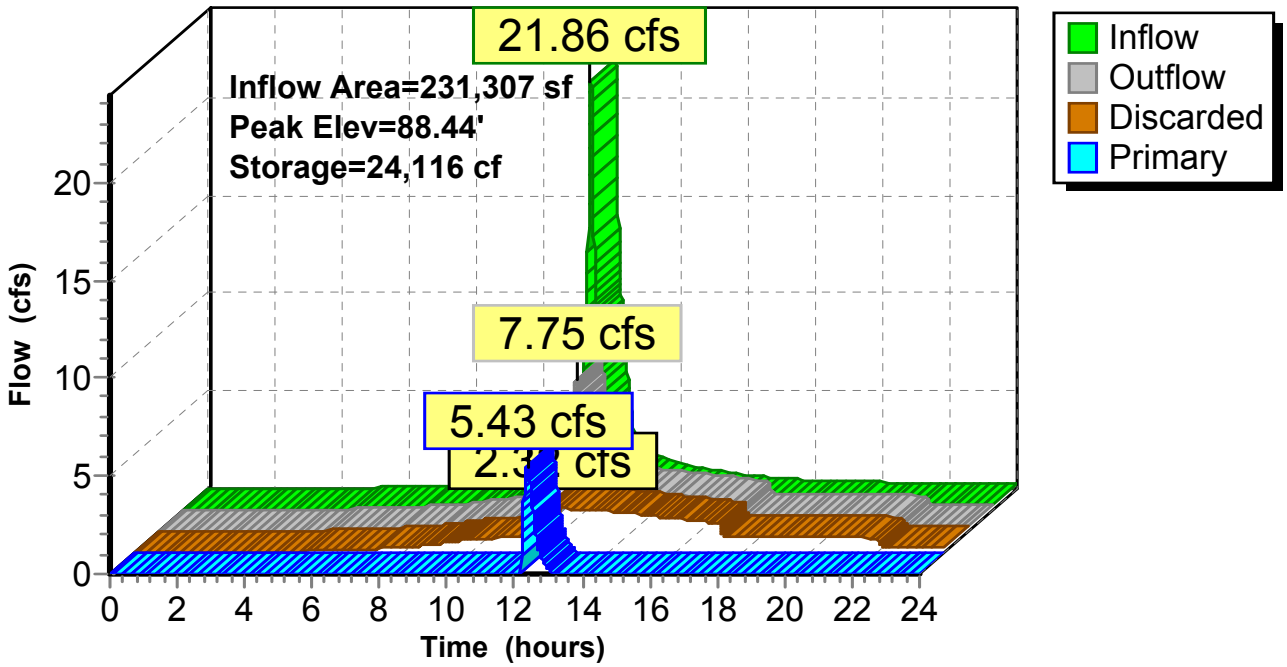
200 Chambers @ $ 300.00 /ea = $ 60,000.00
702.7 cy Field Excavation @ $ 10.00 /cy = $ 7,026.67
266.5 cy Stone @ $ 30.00 /cy = $ 7,996.37
Total Cost = $ 75,023.04





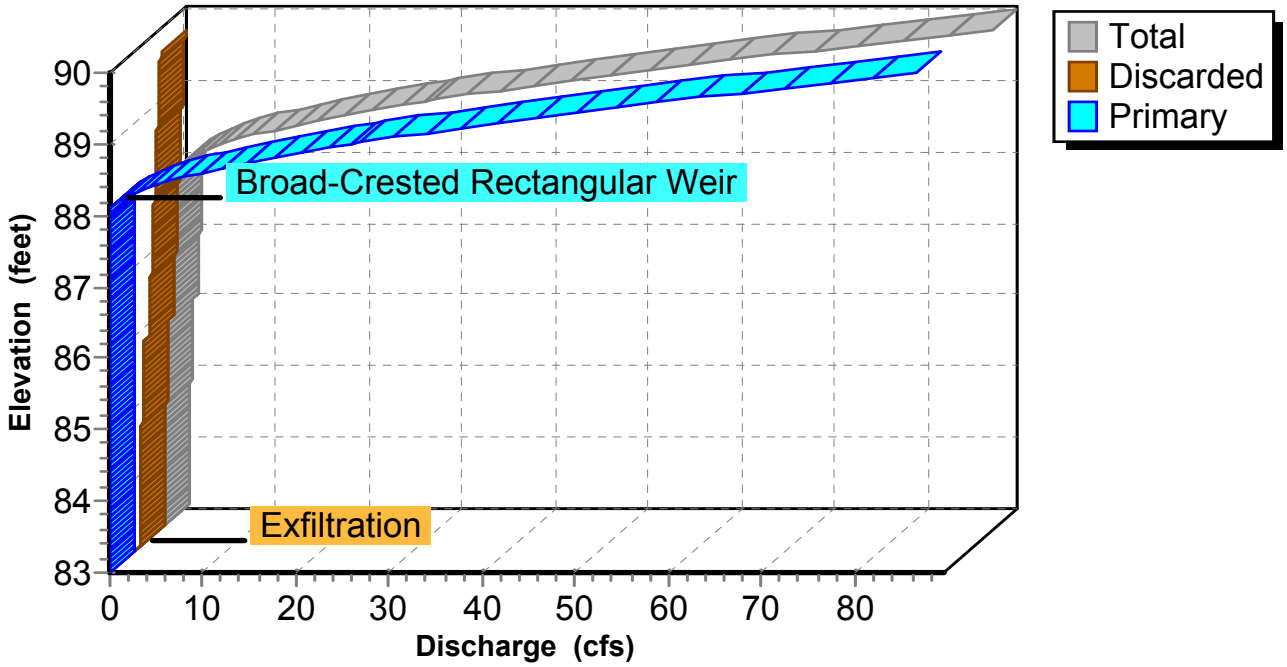
Pond 1P: BASIN AND CHAMBERS

Hydrograph

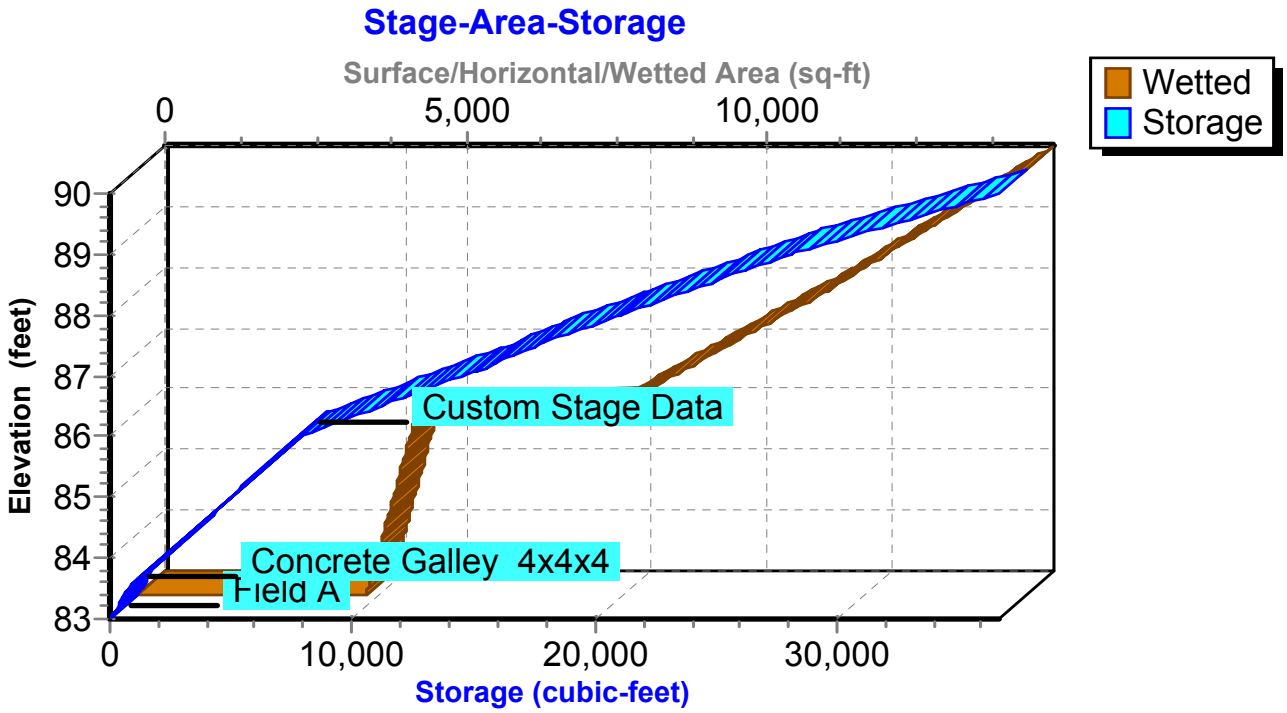


Pond 1P: BASIN AND CHAMBERS

Stage-Discharge



Pond 1P: BASIN AND CHAMBERS

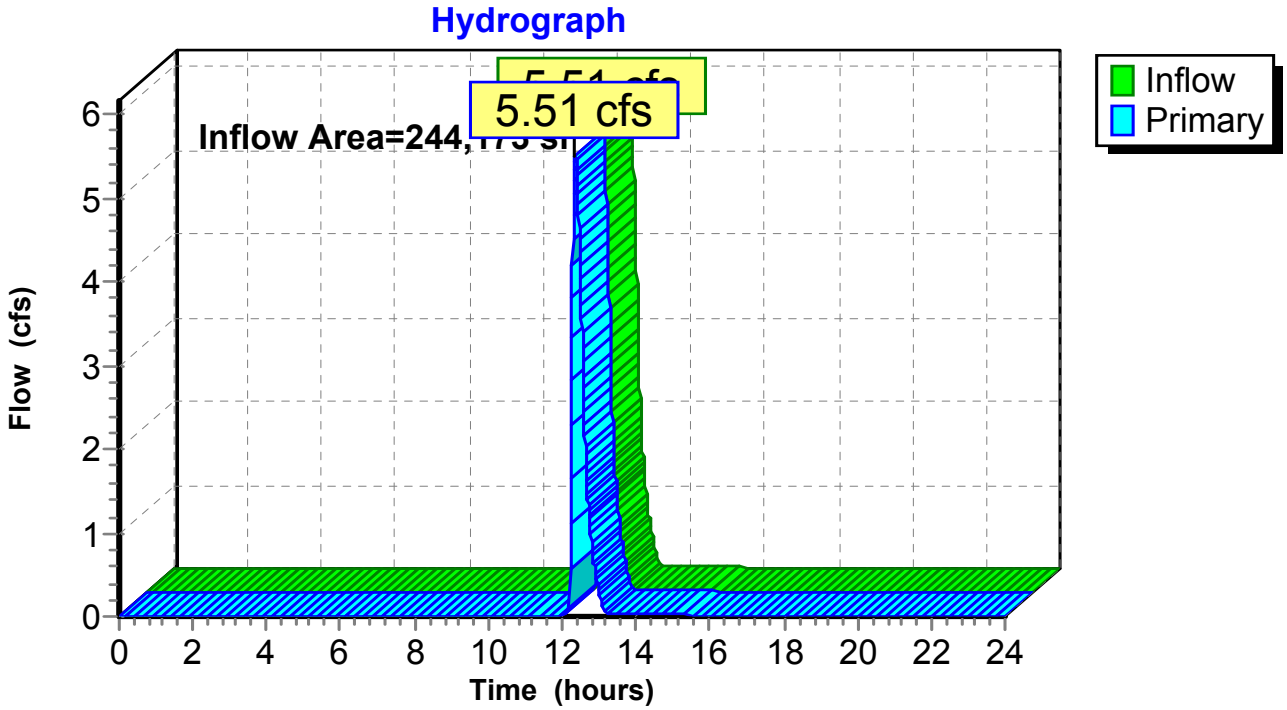


Summary for Link 14L: POST

Inflow Area = 244,173 sf, 58.14% Impervious, Inflow Depth > 0.38" for 25-Year event
Inflow = 5.51 cfs @ 12.36 hrs, Volume= 7,796 cf
Primary = 5.51 cfs @ 12.36 hrs, Volume= 7,796 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 14L: POST



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

Subcatchment POST 1: Subcat POST 1 Runoff Area=12,865 sf 0.00% Impervious Runoff Depth>1.15"
Tc=6.0 min CN=44 Runoff=0.29 cfs 1,236 cf

Subcatchment POST 1A: Subcat POST 1A Runoff Area=56,315 sf 91.37% Impervious Runoff Depth>6.52"
Tc=6.0 min CN=96 Runoff=8.80 cfs 30,590 cf

Subcatchment POST 1B: Subcat POST 1B Runoff Area=66,819 sf 78.05% Impervious Runoff Depth>5.47"
Tc=6.0 min CN=87 Runoff=9.48 cfs 30,482 cf

Subcatchment POST 1C: Subcat POST 1C Runoff Area=43,157 sf 21.01% Impervious Runoff Depth>3.61"
Tc=6.0 min CN=70 Runoff=4.20 cfs 12,998 cf

Subcatchment POST 1D: Subcat POST 1D Runoff Area=34,081 sf 63.52% Impervious Runoff Depth>5.82"
Tc=6.0 min CN=90 Runoff=5.04 cfs 16,524 cf

Subcatchment POST 1E: Subcat POST 1E Runoff Area=30,935 sf 24.69% Impervious Runoff Depth>2.03"
Tc=6.0 min CN=54 Runoff=1.56 cfs 5,226 cf

Subcatchment POST 3: Subcat POST 3 Runoff Area=11,230 sf 0.00% Impervious Runoff Depth>0.77"
Tc=6.0 min CN=39 Runoff=0.11 cfs 717 cf

Pond 1P: BASIN AND CHAMBERS Peak Elev=88.78' Storage=26,479 cf Inflow=29.06 cfs 95,820 cf
Discarded=2.43 cfs 74,754 cf Primary=16.18 cfs 21,023 cf Outflow=18.61 cfs 95,777 cf

Link 14L: POST Inflow=16.42 cfs 22,258 cf
Primary=16.42 cfs 22,258 cf

Total Runoff Area = 255,402 sf Runoff Volume = 97,773 cf Average Runoff Depth = 4.59"
44.42% Pervious = 113,440 sf 55.58% Impervious = 141,962 sf

Summary for Subcatchment POST 1: Subcat POST 1

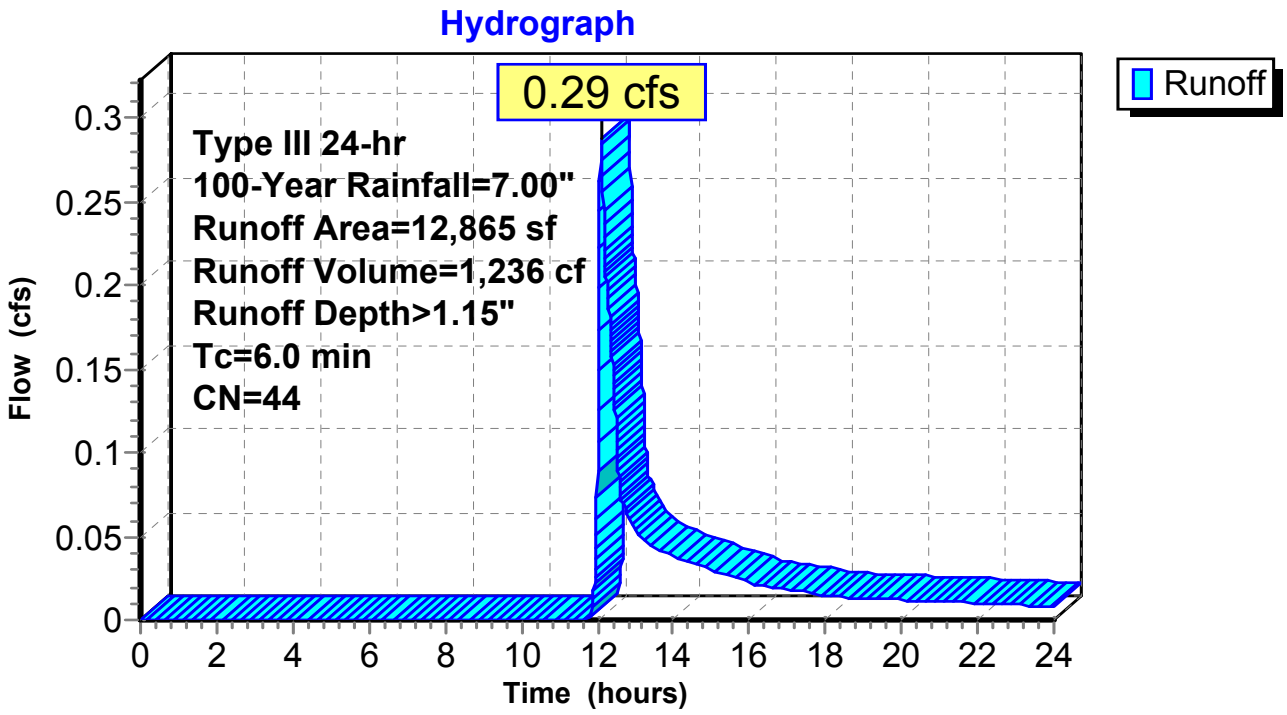
Runoff = 0.29 cfs @ 12.11 hrs, Volume= 1,236 cf, Depth> 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
2,675	76	Gravel roads, HSG A
10,190	36	Woods, Fair, HSG A
12,865	44	Weighted Average
12,865		100.00% Pervious Area

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

Subcatchment POST 1: Subcat POST 1



Summary for Subcatchment POST 1A: Subcat POST 1A

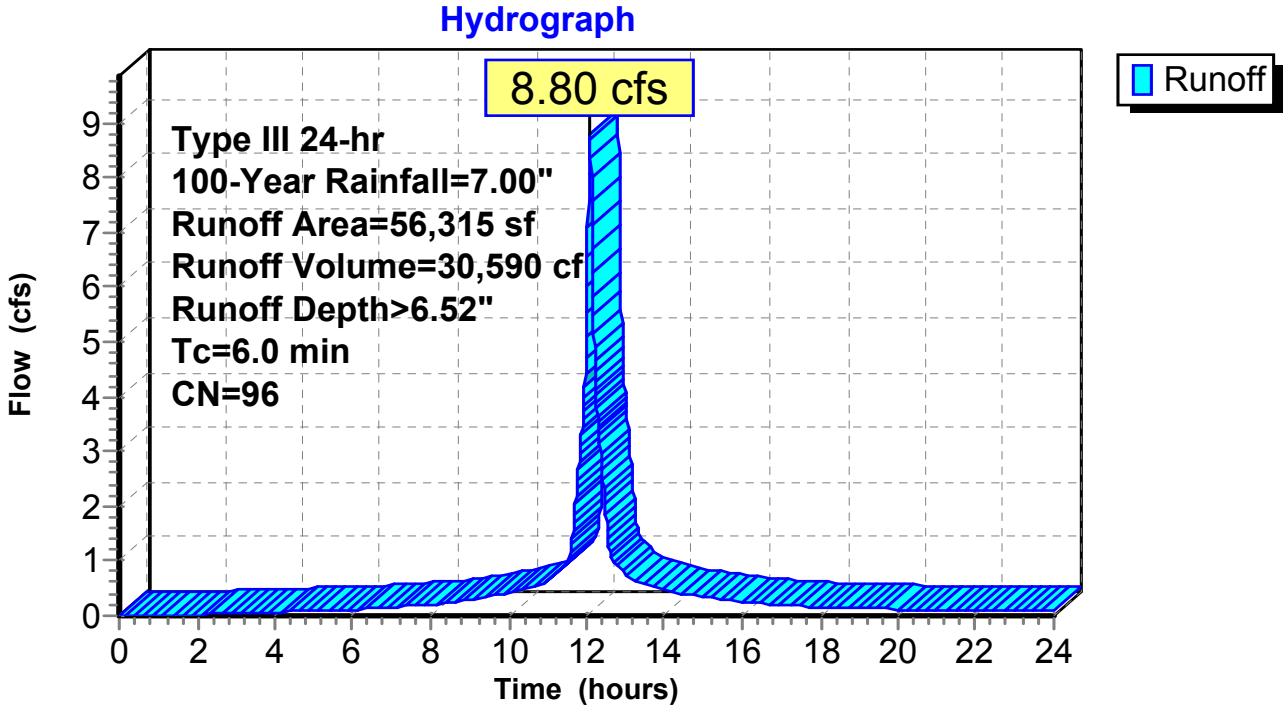
Runoff = 8.80 cfs @ 12.08 hrs, Volume= 30,590 cf, Depth> 6.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
4,861	76	Gravel roads, HSG A
51,445	98	Paved parking, HSG A
8	98	Roofs, HSG A
56,315	96	Weighted Average
4,861		8.63% Pervious Area
51,454		91.37% Impervious Area

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

Subcatchment POST 1A: Subcat POST 1A



Summary for Subcatchment POST 1B: Subcat POST 1B

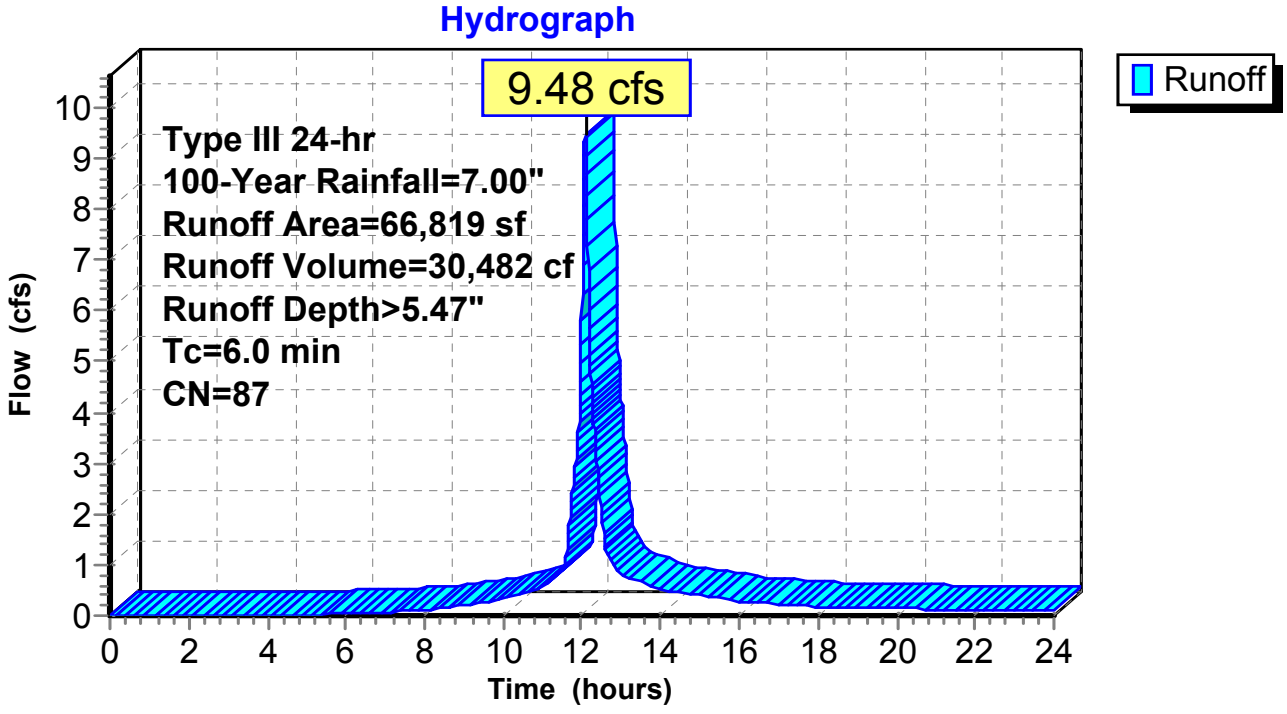
Runoff = 9.48 cfs @ 12.08 hrs, Volume= 30,482 cf, Depth> 5.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
14,136	49	50-75% Grass cover, Fair, HSG A
531	76	Gravel roads, HSG A
37,767	98	Paved parking, HSG A
14,386	98	Roofs, HSG A
66,819	87	Weighted Average
14,667		21.95% Pervious Area
52,153		78.05% Impervious Area

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

Subcatchment POST 1B: Subcat POST 1B



Summary for Subcatchment POST 1C: Subcat POST 1C

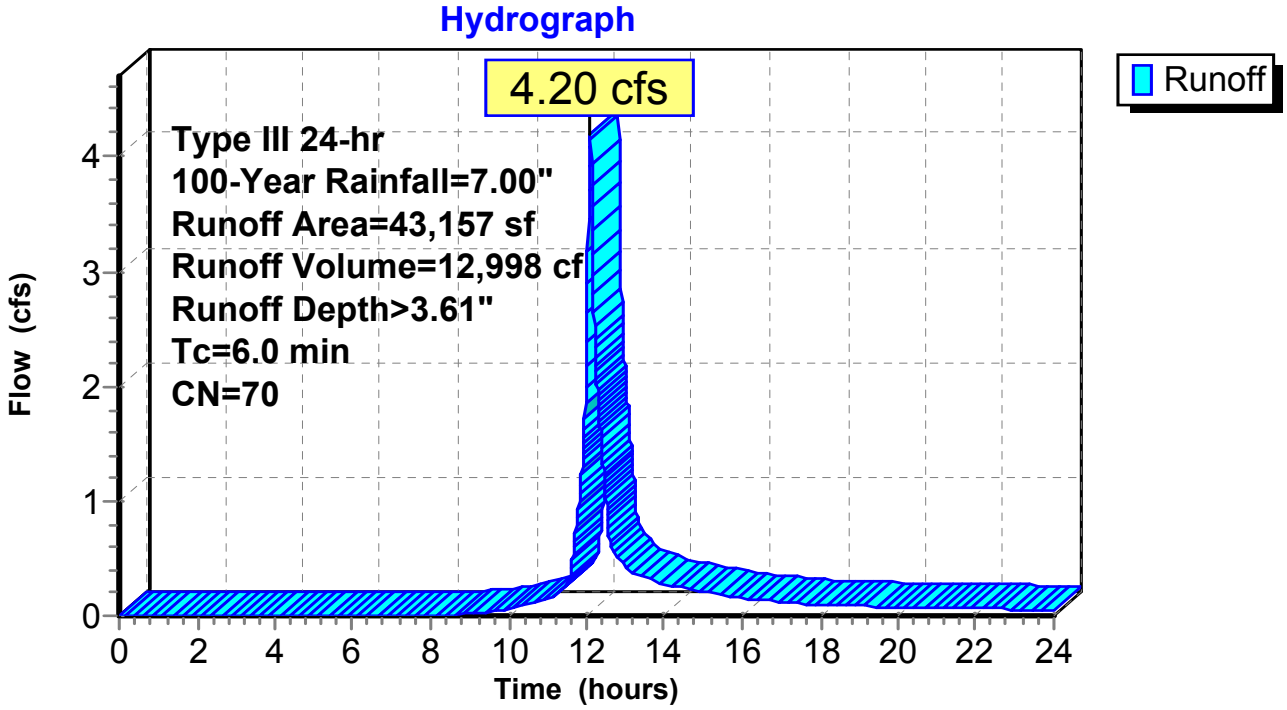
Runoff = 4.20 cfs @ 12.09 hrs, Volume= 12,998 cf, Depth> 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
22,583	76	Gravel roads, HSG A
9,068	98	Roofs, HSG A
11,506	36	Woods, Fair, HSG A
43,157	70	Weighted Average
34,089		78.99% Pervious Area
9,068		21.01% Impervious Area

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

Subcatchment POST 1C: Subcat POST 1C



Summary for Subcatchment POST 1D: Subcat POST 1D

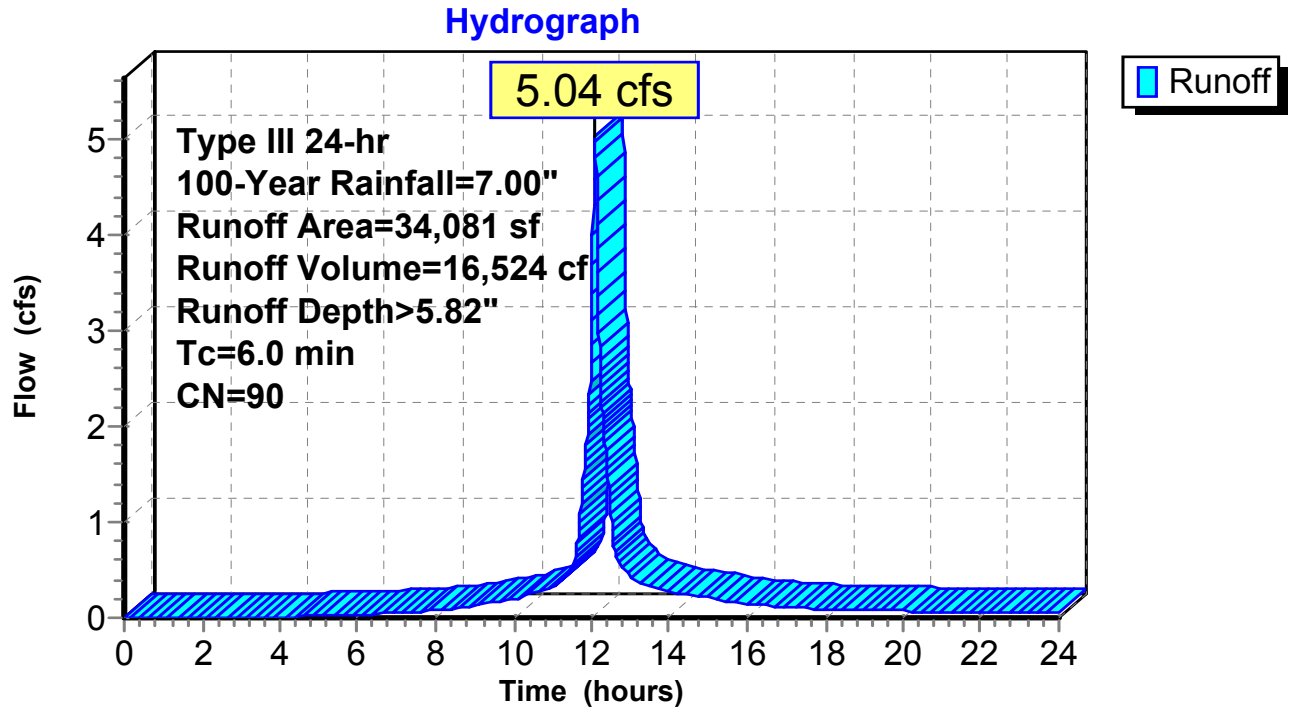
Runoff = 5.04 cfs @ 12.08 hrs, Volume= 16,524 cf, Depth> 5.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
12,432	76	Gravel roads, HSG A
21,649	98	Roofs, HSG A
34,081	90	Weighted Average
12,432		36.48% Pervious Area
21,649		63.52% Impervious Area

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

Subcatchment POST 1D: Subcat POST 1D



Summary for Subcatchment POST 1E: Subcat POST 1E

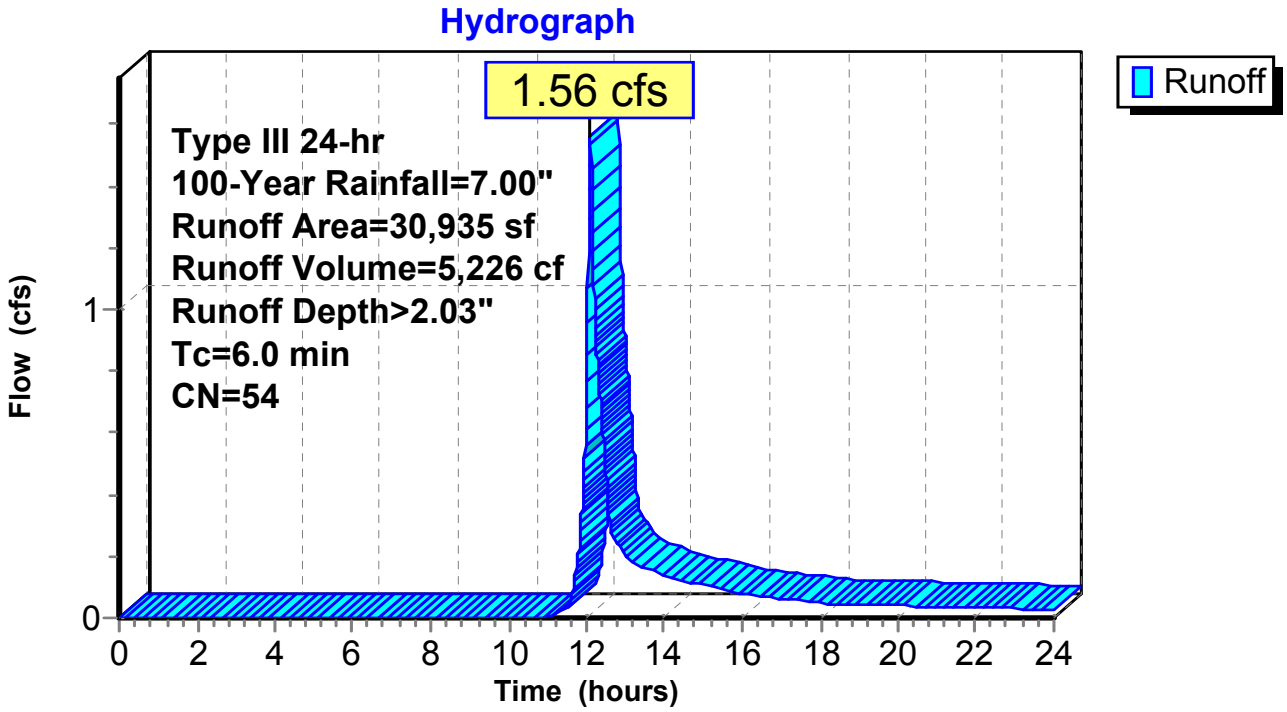
Runoff = 1.56 cfs @ 12.10 hrs, Volume= 5,226 cf, Depth> 2.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
89	49	50-75% Grass cover, Fair, HSG A
2,136	76	Gravel roads, HSG A
454	98	Paved parking, HSG A
7,185	98	Roofs, HSG A
21,071	36	Woods, Fair, HSG A
30,935	54	Weighted Average
23,296		75.31% Pervious Area
7,639		24.69% Impervious Area

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

Subcatchment POST 1E: Subcat POST 1E



Summary for Subcatchment POST 3: Subcat POST 3

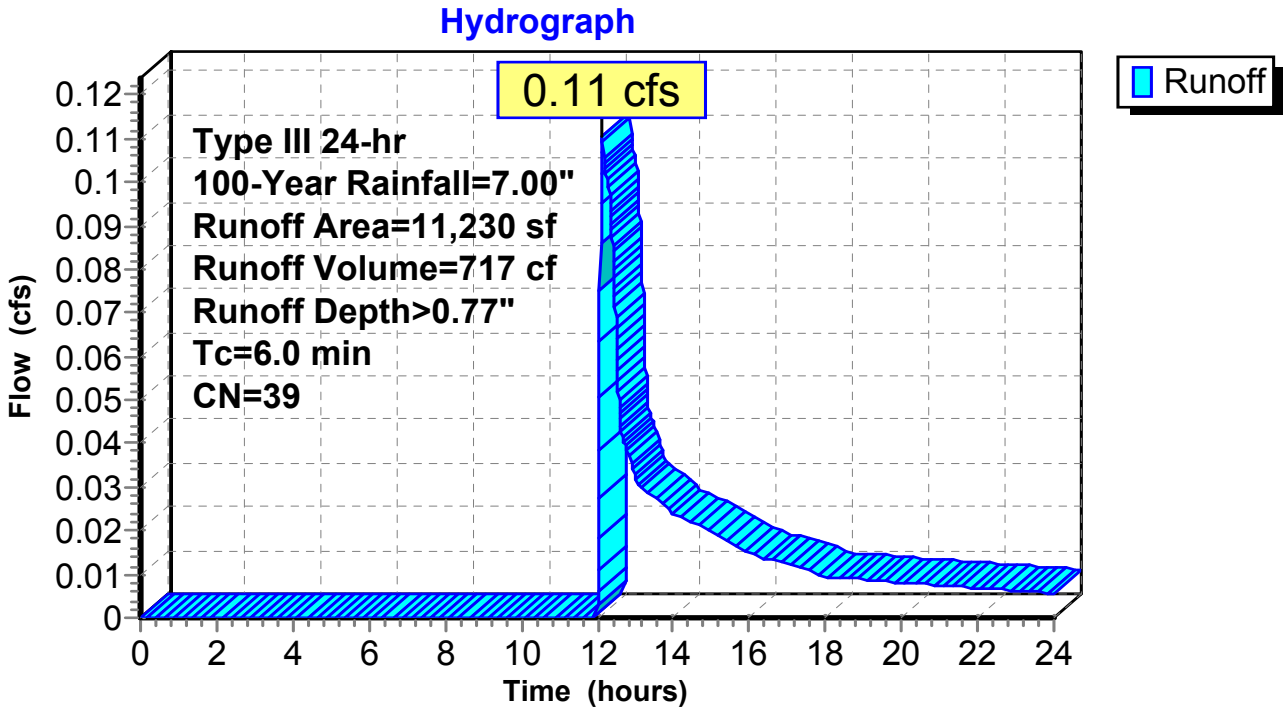
Runoff = 0.11 cfs @ 12.14 hrs, Volume= 717 cf, Depth> 0.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
1,176	49	50-75% Grass cover, Fair, HSG A
571	76	Gravel roads, HSG A
9,484	36	Woods, Fair, HSG A
11,230	39	Weighted Average
11,230		100.00% Pervious Area

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

Subcatchment POST 3: Subcat POST 3



Summary for Pond 1P: BASIN AND CHAMBERS

Inflow Area = 231,307 sf, 61.37% Impervious, Inflow Depth > 4.97" for 100-Year event
Inflow = 29.06 cfs @ 12.09 hrs, Volume= 95,820 cf
Outflow = 18.61 cfs @ 12.18 hrs, Volume= 95,777 cf, Atten= 36%, Lag= 5.7 min
Discarded = 2.43 cfs @ 12.18 hrs, Volume= 74,754 cf
Primary = 16.18 cfs @ 12.18 hrs, Volume= 21,023 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 88.78' @ 12.18 hrs Surf.Area= 11,236 sf Storage= 26,479 cf

Plug-Flow detention time= 86.1 min calculated for 95,737 cf (100% of inflow)
Center-of-Mass det. time= 85.8 min (871.9 - 786.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	83.00'	2,879 cf	**37.20'W x 102.00'L x 5.00'H Field A** 18,972 cf Overall - 11,775 cf Embedded = 7,197 cf x 40.0% Voids
#2A	83.50'	8,869 cf	**Concrete Galley 4x4x4** x 200 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf 200 Chambers in 8 Rows
#3	86.00'	24,916 cf	**Custom Stage Data (Conic)**Listed below
		36,663 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
86.00	3,183	0	0	3,183
87.00	4,664	3,900	3,900	4,680
88.00	6,205	5,416	9,316	6,243
89.00	7,800	6,987	16,304	7,866
90.00	9,451	8,612	24,916	9,549

Device	Routing	Invert	Outlet Devices
#1	Discarded	83.00'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	88.10'	**10.0' long x 0.8' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.74 2.78 2.86 3.00 3.11 3.18 3.25 3.29 3.32 3.31 3.32

Discarded OutFlow Max=2.43 cfs @ 12.18 hrs HW=88.77' (Free Discharge)
1=Exfiltration (Exfiltration Controls 2.43 cfs)

Primary OutFlow Max=16.15 cfs @ 12.18 hrs HW=88.77' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 16.15 cfs @ 2.39 fps)

Pond 1P: BASIN AND CHAMBERS - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4 (Concrete Galley, UCPI 4x4x4 Galley or equivalent)
Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf
Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf

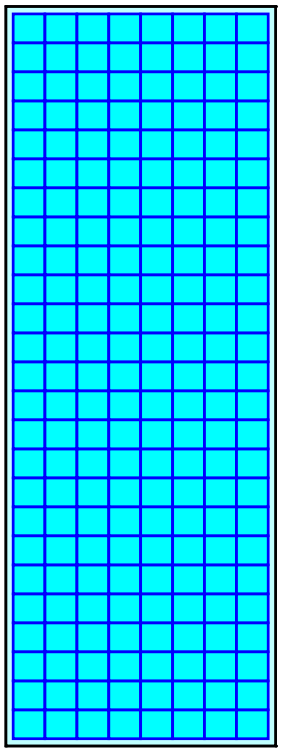
25 Chambers/Row x 4.00' Long = 100.00' Row Length +12.0" End Stone x 2 = 102.00' Base Length
8 Rows x 52.8" Wide + 12.0" Side Stone x 2 = 37.20' Base Width
6.0" Base + 48.0" Chamber Height + 6.0" Cover = 5.00' Field Height

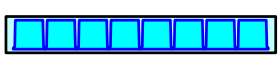
200 Chambers x 44.3 cf = 8,868.9 cf Chamber Storage
200 Chambers x 58.9 cf = 11,775.3 cf Displacement

18,972.0 cf Field - 11,775.3 cf Chambers = 7,196.7 cf Stone x 40.0% Voids = 2,878.7 cf Stone Storage

Chamber Storage + Stone Storage = 11,747.6 cf = 0.270 af
Overall Storage Efficiency = 61.9%
Overall System Size = 102.00' x 37.20' x 5.00'

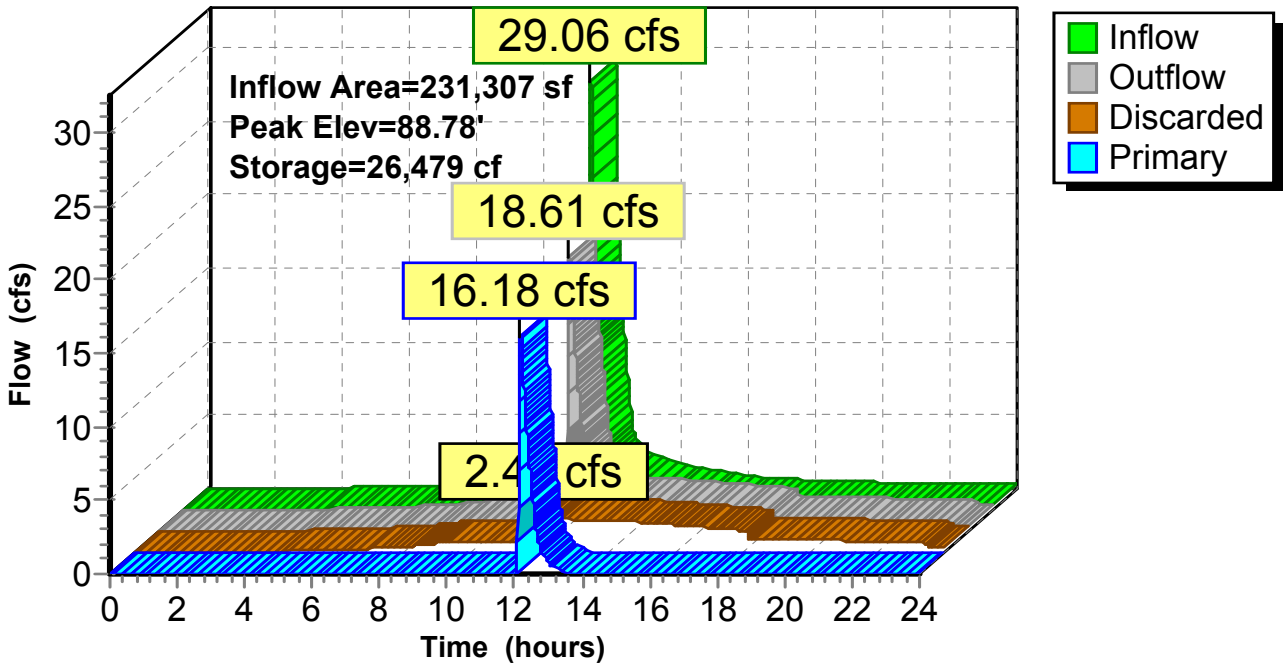
200 Chambers @ $ 300.00 /ea = $ 60,000.00
702.7 cy Field Excavation @ $ 10.00 /cy = $ 7,026.67
266.5 cy Stone @ $ 30.00 /cy = $ 7,996.37
Total Cost = $ 75,023.04





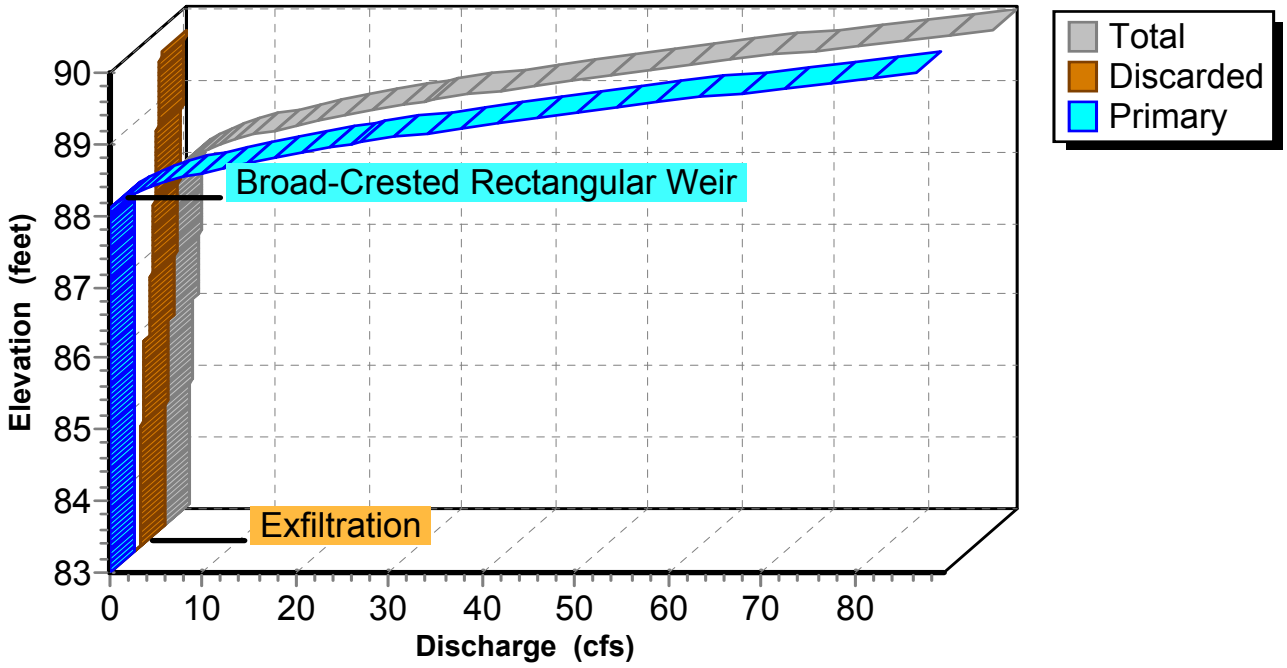
Pond 1P: BASIN AND CHAMBERS

Hydrograph

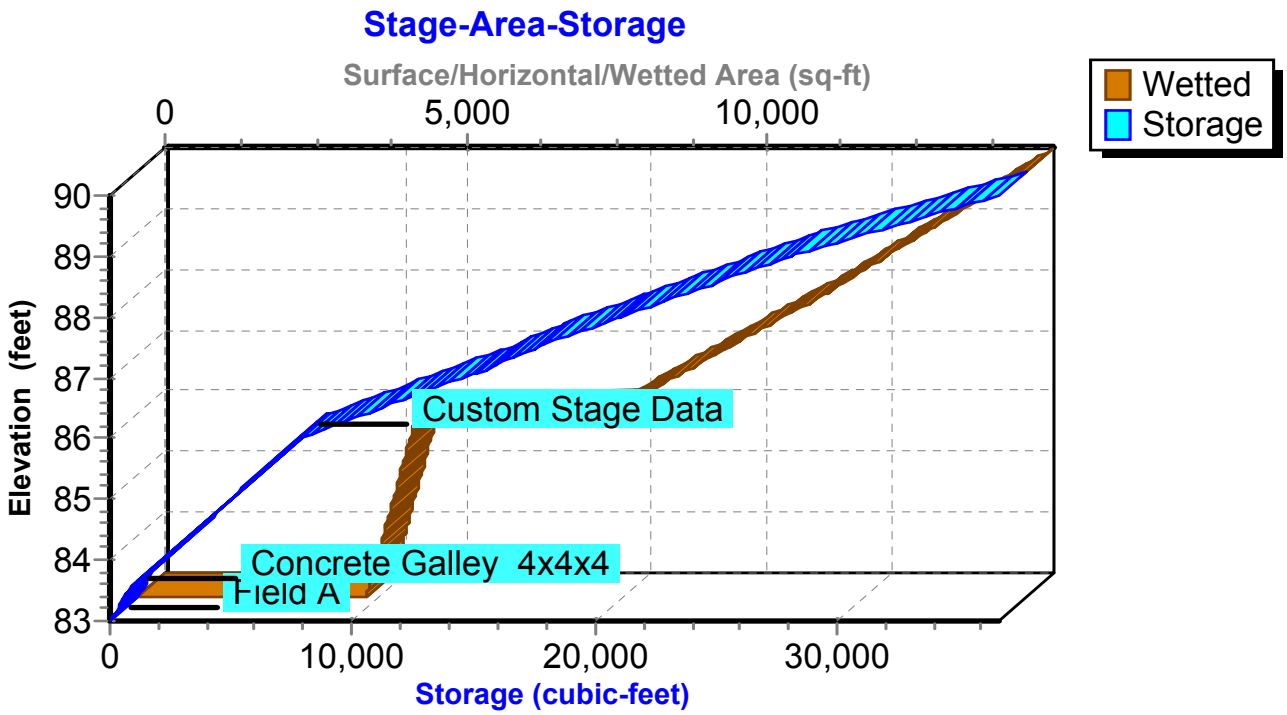


Pond 1P: BASIN AND CHAMBERS

Stage-Discharge



Pond 1P: BASIN AND CHAMBERS



Summary for Link 14L: POST

Inflow Area = 244,173 sf, 58.14% Impervious, Inflow Depth > 1.09" for 100-Year event
Inflow = 16.42 cfs @ 12.18 hrs, Volume= 22,258 cf
Primary = 16.42 cfs @ 12.18 hrs, Volume= 22,258 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 14L: POST