# DRAINAGE ANALYSIS

## Prepared for V.M.D Companies, LLC
## Proposed Industrial Warehouse Development

**Innovation Way**
**Fall River - Assessors Map W-19 Lots 185 & 189**
**Freetown – Parcel ID 236-006.01**
**Fall River/Freetown, Massachusetts 02720**

**July 25, 2022**
**Revised November 21, 2022**


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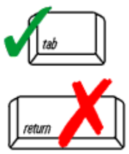
**Massachusetts Department of Environmental Protection**
Bureau of Resource Protection - Wetlands Program

# Checklist for Stormwater Report

## A. Introduction

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




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

The Stormwater Report must include:

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

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

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

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

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

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

# Checklist for Stormwater Report

## B. Stormwater Checklist and Certification

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

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

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

## Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

COMMONWEALTH OF MASSACHUSETTS
TRACY L.
DUARTE
CIVIL
NO. 48660
REGISTERED
PROFESSIONAL ENGINEER

Tracy L. Duarte

Tracy L. Duarte
Signature and Date

## Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

## **Checklist** (continued)

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

☒ No disturbance to any Wetland Resource Areas

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

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

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

☒ Use of “country drainage” versus curb and gutter conveyance and pipe

☒ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): ____________________

**Standard 1: No New Untreated Discharges**

☒ No new untreated discharges

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

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

## **Checklist** (continued)

**Standard 2: Peak Rate Attenuation**

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

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

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

**Standard 3: Recharge**

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

## Checklist (continued)

**Standard 3: Recharge** (continued)

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

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

**Standard 4: Water Quality**

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

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

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

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

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

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

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

## **Checklist** (continued)

**Standard 4: Water Quality** (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

**Standard 6: Critical Areas**

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

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

## **Checklist** (continued)

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

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

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

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

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

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

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

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

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

# Checklist 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.

# 1. INTRODUCTION

MBL Land Development and Permitting Corporation (MBL) has prepared this Drainage Analysis for the proposed development of the project site along Innovation Way with land located within both Fall River and Freetown, Massachusetts. The purpose of the analysis is to quantitatively understand the impacts of the Proposed Industrial Warehouse Development on the existing hydrologic conditions and to mitigate these impacts through the implementation of a proposed stormwater management system that utilizes best management practices (BMPs) and is supported by an Operations & Maintenance Plan as well as a Long-Term Pollution Prevention Plan.

# 2. SITE DESCRIPTION

## 2.1 EXISTING CONDITIONS

The property is located along the eastern side of Innovation Way in Freetown and Fall River, Massachusetts and is referenced as Freetown Assessors ID 236-006.01 and Lots 185 and 189 on Assessors Map W-19 in Fall River. The site contains a total of area of 122.37 acres. The existing site consists of woods and bordering vegetated wetlands present throughout the site.

This lot lies within a "Zone X", an area of minimal flood hazard, as shown on FEMA F.I.R.M. Map 2005C0263G having an effective date of July 16, 2014 and FEMA F.I.R.M Map 25005C0264F having an effective date of July 7, 2009.

The site is located within a NHESP Priority Habitat of Rare Species (PH 478) as well as an Estimated Habitat of Rare Wildlife (EH 415). The site is not located near a Certified Vernal Pool according to the Massachusetts Natural Heritage Atlas, 15th Edition effective August 1, 2021. The site is also not located within an ACEC, Outstanding Resource Water nor any other Critical Area.

## 2.2 PROPOSED CONDITIONS

The proposed site development consists of the construction of four industrial warehouse buildings with associated site access, parking, loading, utilities and a stormwater management system. Three of the proposed buildings, referenced as Buildings 1, 2 and 4, are located within the City of Fall River and one building, referenced as Building 3, is located within the Town of Freetown. In total 598 parking spaces and 130 loading spaces are proposed in Fall River and 168 parking spaces and 38 loading docks are proposed in Freetown.

## 2.3 SOILS

The Soil Conservation Survey for Bristol County indicates that the site is located within the following Soil Map Units; 71A – Ridgebury Fine Sandy Loam, 0-3% slopes; 71B – Ridgebury Fine Sandy Loam, 3-8% slopes; 73A – Whitman Fine Sandy Loam, 0 to 3 % slopes; 307B – Paxton Fine Sandy Loam, 0-8% slopes; 307C – Paxton Fine Sandy Loam, 8-15% slopes; 705C Charlton-Paxton Complex, 8-15%; & 706E Charlton-Rock outcrop-Paxton complex, 15-35% slopes. These soil types have respective Hydrologic Soil Groups of B. C, & D.

## 2.4 SITE TOPOGRAPHY

The existing site topography ranges from elevation 230 at the high point on the northern side of the site to elevation 160 at the southern side of the site. The site slopes are generally between 5-10%.

# 3. DRAINAGE CALCULATIONS

To mitigate the quality and quantity of stormwater runoff discharging from the site, a stormwater management system has been designed to collect, treat, and control flows leaving the site. The proposed stormwater management system consists of curbing, deep sump hooded catch basins, drain manholes, and water quality units which will convey stormwater runoff to subsurface recharge chambers systems, and infiltration basins. The proposed stormwater systems have been designed to hold the required water quality and recharge volumes, while containing flows from various storm events.

Building 1 stormwater management system consists of curbing, deep sump hooded catch basins, drain manholes, Pretx Curb Inlet Pretreatment unit, and water quality units that convey water to two different treatment systems. Part of the site flows to a non-infiltrating Focal Point Bioretention system that will allow for further treatment of stormwater runoff. Stormwater treated by this bioretention system will discharge through piping underneath each system, with outlet control structures will be utilized to control flows for larger storm events. Additional stormwater runoff from the site travels to a separate subsurface recharge chamber system has been designed to hold and treat the required recharge and water quality volumes, while allowing the excess flows from storms greater than the 25-year storm event to pass to discharge through overflow pipes.

Building 2 stormwater management system consists of curbing, deep sump hooded catch basins, drain manholes, and water quality units that convey water to two different subsurface recharge chambers systems. The front parking lot of the building is designed to flow towards a Cultec R-902HD subsurface chambers system has been designed to hold the water quality and required recharge volume and contain flows up to the 100-year storm event. Meanwhile the rest of the site and the roof of the building is designed to flow towards a subsurface recharge chamber system has been designed to hold and treat the required recharge and water quality volumes, while allowing the excess flows from storms greater than the 25-year storm event to pass to discharge through overflow pipes.

Building 3 stormwater management system consists of curbing, deep sump hooded catch basins, drain manholes, and water quality units that convey water to two separate infiltration basins. The infiltration basin have been designed to hold and treat the required recharge and water quality volumes, each basin also has a riprap overflow spillway which will allow flows from larger storm events to pass, after proper treatment.

Building 4 stormwater management system consists of curbing, deep sump hooded catch basins, drain manholes, and water quality units that convey water to two different stormwater recharge systems. The associated driveway and parking areas for building 4 are designed to flow towards an infiltration basin system has been designed to hold the water quality and required recharge volume and contain flows up to the 100-year storm event. Meanwhile the roof of the building is designed to flow towards a subsurface recharge chamber system has been designed to contain flows up to the 100-year storm event.

The stormwater management system has been designed to reduce peak flows from existing conditions to the proposed conditions for all storm events. From an environmentally sensitive perspective, the aforementioned measures result in a low impact design that promotes on-site groundwater recharge while preserving the natural hydrologic conditions.

A detailed hydrologic and hydraulic analysis of the stormwater management system was completed to evaluate its performance and document compliance with the Massachusetts Stormwater Standards for a redevelopment project. MBL has prepared the following drainage system calculations for the proposed site development. These calculations are broken into two main sections; Hydrologic and Hydraulic Analysis.

## 3.1 HYDROLOGIC ANALYSIS

The Soil Conservation Service (SCS) Unit Hydrograph methodology was utilized to develop a hydrologic model of the site. MBL utilized HydroCAD Version 10.1 software, developed by HydroCAD Software Solutions, LLC to analyze the site hydrology. The program calculates peak rates of runoff and runoff volume based on selected rainfall events. Contributing watershed areas were identified and soils, surface cover, watershed slope, and flow paths were evaluated to develop the necessary HydroCAD model input parameters. A minimum Time of Concentration (Tc) of six (6) minutes was used in the calculations.

Drainage calculations were performed for the Existing and Proposed Conditions for the 24-hour 2, 10, 25 and 100-year Type III storm events. The total rainfall for each of the storm events was based upon data published by the Northeast Regional Climate Center (NRCC). The total rainfall values used in the hydrologic modeling are shown in the following table:

**Table 1: Table Design Rainfall Data**

| 2-year, 24-hour storm | 10-year, 24-hour storm | 25-year, 24-hour storm | 100-year, 24-hour storm |
|---|---|---|---|
| 3.30 inches | 4.88 inches | 6.10 inches | 8.56 inches |

### 3.1.1 Design Points

To compare the difference between the existing and proposed peak flow rates, the existing and proposed watershed areas were delineated. The design point for each watershed areas is determined by flow paths from the hydraulically most distance point of the watershed. These parameters were utilized to calculate the times of concentration which were modeled. The same Design Point was analyzed for both the existing and proposed conditions. For this project, four design points were identified, which is as follows:

- Wetlands Center
- Innovation Way (2009 City Layout)
- Innovation Way (2009 SHLO)
- Offsite South
- Offsite East

### 3.1.2 Existing Hydrology

The existing site was analyzed using 5 watershed areas discharging to the design points above. The existing watershed areas are shown on the attached Figure 7 titled, “Existing Conditions Drainage Map”. The hydrographs for the watershed areas were generated to develop the peak discharge rates for the 24-hour, 2, 10, 25, and 100-year storm events for the existing site conditions.

### 3.1.3 Proposed Hydrology

The proposed site was analyzed using 36 watershed areas discharging to the design points above. The proposed watershed areas are shown on the attached Figure 8 entitled "Proposed Conditions Drainage Map". The hydrographs for the watershed areas were generated and routed through the proposed BMPs to develop the peak discharge rates for the 24-hour 2, 10, 25 and 100-year storm events for the proposed site conditions.

### 3.1.4 Peak Discharge Rates

Table 2 below summarizes the existing and proposed peak discharge rates for each Design Point. As depicted in the table, the proposed peak rate of discharge does not increase over existing rate for all storm events analyzed.

**Table 2: Pre and Post Development Peak Discharge Rates**

| Storm Frequency | Existing Peak Runoff (cfs) | Proposed Peak Runoff (cfs) | Existing Peak Runoff (cfs) | Proposed Peak Runoff (cfs) | Existing Peak Runoff (cfs) | Proposed Peak Runoff (cfs) | Existing Peak Runoff (cfs) | Proposed Peak Runoff (cfs) | Existing Peak Runoff (cfs) | Proposed Peak Runoff (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Wetlands Center | | Innovation Way (2009 City Layout) | | Innovation Way (2009 SHLO) | | Offsite South | | Offsite East | |
| 2 | 12.15 | 11.20 | 2.63 | 1.10 | 4.17 | 1.24 | 1.07 | 0.18 | 7.64 | 3.79 |
| 10 | 34.86 | 30.20 | 6.64 | 2.30 | 10.52 | 2.65 | 2.56 | 0.40 | 29.62 | 14.73 |
| 25 | 55.70 | 47.00 | 10.19 | 3.31 | 16.15 | 3.85 | 3.86 | 0.59 | 51.13 | 25.21 |
| 100 | 102.39 | 94.51 | 17.95 | 5.42 | 28.43 | 6.40 | 6.69 | 0.98 | 100.80 | 92.11 |

## 3.2 HYDRAULIC ANALYSIS

The stormwater closed (underground piping) drainage system discharging to the BMPs were designed to convey the 25-year storm event. Pipe capacity and peak discharge rates for the closed drainage system were calculated using a Manning's Formula.

The closed drainage system, as designed, is capable of conveying the design flow as calculated, as well as maintaining a design velocity under 10.0 feet per second (fps) for pipe capacity full conditions. The closed drainage system analysis for the proposed system is depicted in Appendix B.

# 4. BEST MANAGEMENT PRACTICES

The Massachusetts Stormwater Standards requires 80% removal rate over an average annual basis, for Total Suspended Solids (TSS) contained in stormwater runoff. Additionally, the Fall River Redevelopment Authority Deed restrictions on the Site through Agreement with MEPA requires a 90% reduction in TSS. The water quality volume or “first flush” is defined as the volume obtained by multiplying one inch (1”) times the impervious surface area of the contributing drainage area. Water quality volume calculations are provided in Appendix D. When this volume is incorporated into properly designed BMPs an 80% reduction of average annual TSS loading will result. The following Best Management Practices will be employed for the project.

## 4.1 DEEP SUMP HOODED CATCH BASINS

Deep sump hooded catch basins are proposed for pretreatment. 25% TSS pretreatment credit has been taken for the deep sump hooded catch basins.

## 4.2 PRETEX CURB INLET

A Pretex Curb Inlet Pretreatment unit is proposed for pretreatment to the Bioretention System. 44% TSS pretreatment credit has been taken for the Pretx unit.

## 4.3 WATER QUALITY UNITS

Contech Cascade Separator, Contech Continuous Deflective Separator (CDS), and Stormceptor Water Quality Units are proposed for TSS removal. Please see Appendix D for the corresponding manufacturer’s TSS removal calculations for the proposed water quality units.

## 4.4 BIORETENTION SYSTEM

The proposed FocalPoint Bioretention systems will achieve a TSS removal rate of 90% when receiving water from pretreatment methods. stormwater will be discharging to the existing wetlands after treatment.

## 4.5 SUBSURFACE STORMTRAP RECHARGE SYSTEMS

StormTrap Subsurface Recharge System are proposed to recharge from the building roof and paved areas. Subsurface recharge chambers have a TSS removal rate of 80%.

## 4.6 INFILTRATION BASINS

The proposed infiltration basins will achieve a TSS removal rate of 80% while promoting groundwater recharge on-site.

## 4.7 CULTEC RECHARGE CHAMBERS

Cultec Recharger 902HD Subsurface Recharge Chambers are proposed to recharge stormwater runoff. Recharge chambers have a TSS removal rate of 80%.

# 5. STORMWATER MANAGEMENT STANDARDS COMPLIANCE

The proposed best management practices (BMPs) selection and their placement within the treatment train of the stormwater management system has been strategically planned and designed as prescribed by the Massachusetts Stormwater Management Handbook. The following addresses how the project complies with Standards 1-10 as set forth in the Massachusetts Stormwater Handbook:

Standard 1

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

There are no new untreated discharges to or that will cause erosion in wetlands or waters of the Commonwealth. All stormwater runoff from impervious surfaces is designed to be collected, conveyed and treated prior to discharging to the existing wetlands.

Standard 2

*Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates.*

The stormwater management system has been designed so that the proposed peak discharge rates are less than the existing peak discharge rates for the 2-year, 10-year, 25-year and 100-year 24-hour storm events (see Table 2 of this report). Supporting documentation such as HydroCAD computer model output, required computations, and tables are located in Appendix A.

Standard 3

*Loss of annual recharge to groundwater shall be eliminated or minimized with environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance.*

The proposed stormwater management system has been designed to collect stormwater runoff and recharge it back into the ground on-site. Supporting documentation such as Required Recharge Volume Calculations can be found in Appendix C.

Standard 4

*Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).*

The required removal of 90% TSS has been achieved by a series of BMP's including deep sump hooded catch basins, water quality units, Pretx pretreatment units, subsurface recharge chambers, infiltration basins and a bioretention system. Computations and documentation are provided in Appendix D.

Standard 5

*For land uses with higher potential loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.*

The site is not a land use with higher potential pollutant load, per the regulations.

Standard 6

*Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.*

The site is located within both an Estimated and Priority Habitat of Endangered Species. A 1" runoff depth has been utilized to account for this in the Water Quality Volume calculations provided in Appendix D.

Standard 7

*A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural 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.*

The project is not considered a redevelopment project per the regulations.

Standard 8

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

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is located in Appendix E.

Standard 9

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

A Long-Term Operation and Maintenance Plan (O&M Plan) for the site stormwater management facilities can be found in Appendix G and a Long-Term Pollution Prevention Plan (LPPP) is located in Appendix F.

Standard 10

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

An Illicit Discharge Compliance Statement has been provided in Appendix H.

# 6. CONCLUSION

The proposed project will not increase the peak rate of runoff for all modeled storm events for this site over existing conditions. This has been accomplished by implementing BMPs that will enhance the quality of stormwater runoff including deep sump hooded catch basins, water quality units, Pretx pretreatment units, vegetated filter strips, subsurface recharge chamber systems, infiltration basin and bioretention systems. The proposed stormwater management system has been designed to the meet all 10 of the Massachusetts Stormwater Management System Standards.

## Figure 1: Aerial Map


NOTE: INFORMATION ON THIS PLAN OBTAINED FROM MASSGIS USGS COLOR ORTHO IMAGERY 2019.

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WEB: www.MBLLand Development.com

AERIAL MAP

INNOVATION WAY

ASSESSORS MAP W-19, LOT 185 & 189
PARCEL ID 236-006.01

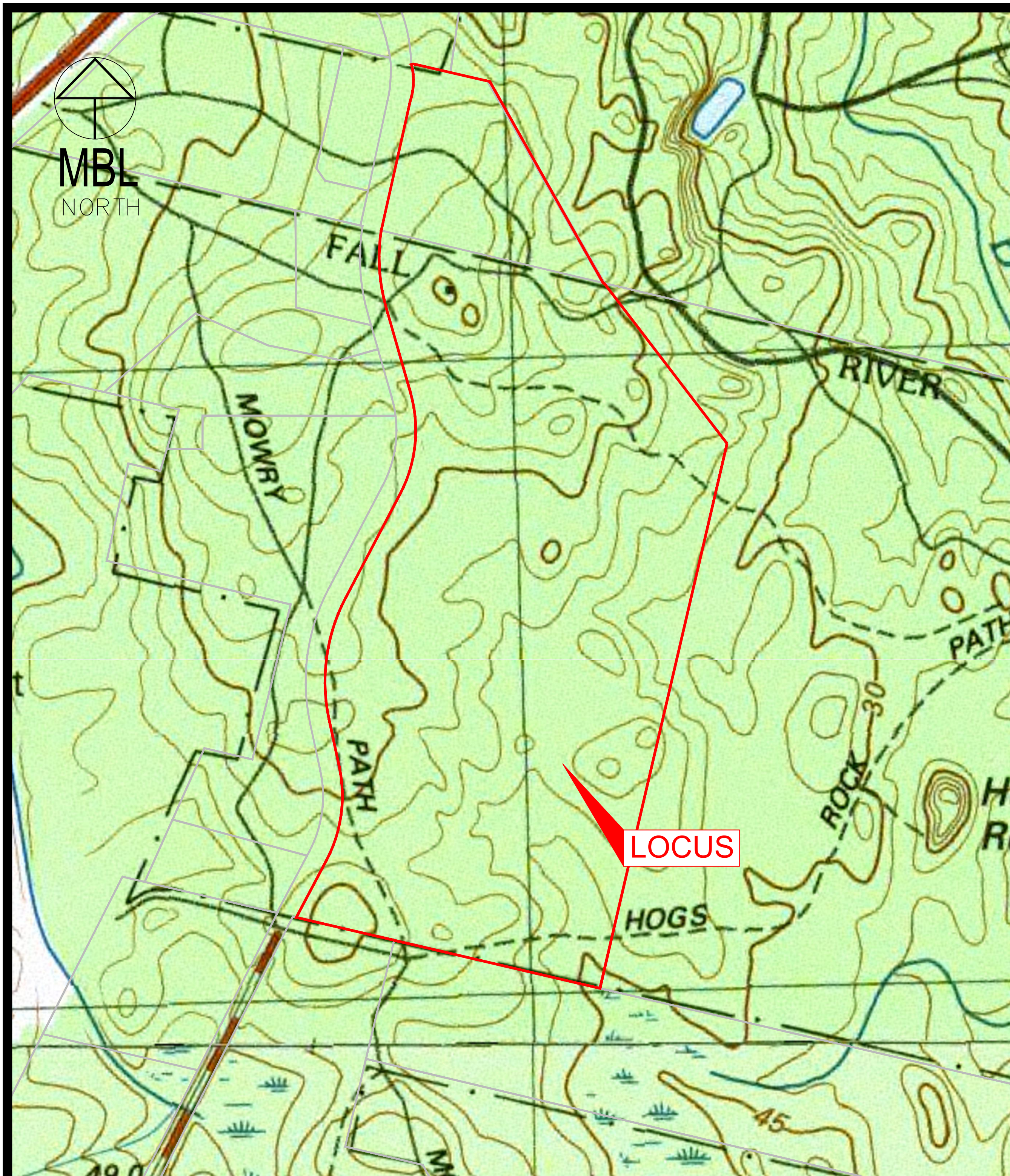
FALL RIVER/FREETOWN MASSACHUSETTS

| | |
|---|---|
| PROJ. No: | 2021-036 |
| DATE: | 07/25/2022 |
| SCALE: | 1"=750' |

FIGURE 1

X:\2021\2021-036\ADMIN\REPORTS\NOI\FIGURES\2021-036 FIGURES.DWG

## Figure 2: USGS Topographic Map




NOTE: INFORMATION ON THIS PLAN OBTAINED FROM MASSGIS SCANNED 1:25,000 USGS TOPOGRAPHIC QUAD IMAGES, JUNE 2001.

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USGS TOPOGRAPHIC MAP

INNOVATION WAY

ASSESSORS MAP W-19, LOT 185 & 189
PARCEL ID 236-006.01

FALL RIVER/FREETOWN MASSACHUSETTS

| | |
|---|---|
| PROJ. No: | 2021-036 |
| DATE: | 07/25/2022 |
| SCALE: | 1"=750' |

FIGURE 2

X:\2021\2021-036\ADMIN\REPORTS\NOI\FIGURES\2021-036 FIGURES.DWG

# Figure 3: Flood Insurance Rate Map


ZONE A, 1% ANNUAL CHANCE OF FLOODING, NO BFE

ZONE X, 0.2% ANNUAL CHANCE OF FLOODING

FLOODWAY AREAS IN ZONE AE

NOTE: FLOOD BOUNDARY INFORMATION SHOWN OBTAINED FROM FEMA FIRM MAP FOR COMMUNITY PANEL NO. 25005C0263G HAVING AN EFFECTIVE DATE OF JULY 16, 2014.


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FLOOD INSURANCE MAP

INNOVATION WAY

ASSESSORS MAP W-19, LOT 185 & 189
PARCEL ID 236-006.01

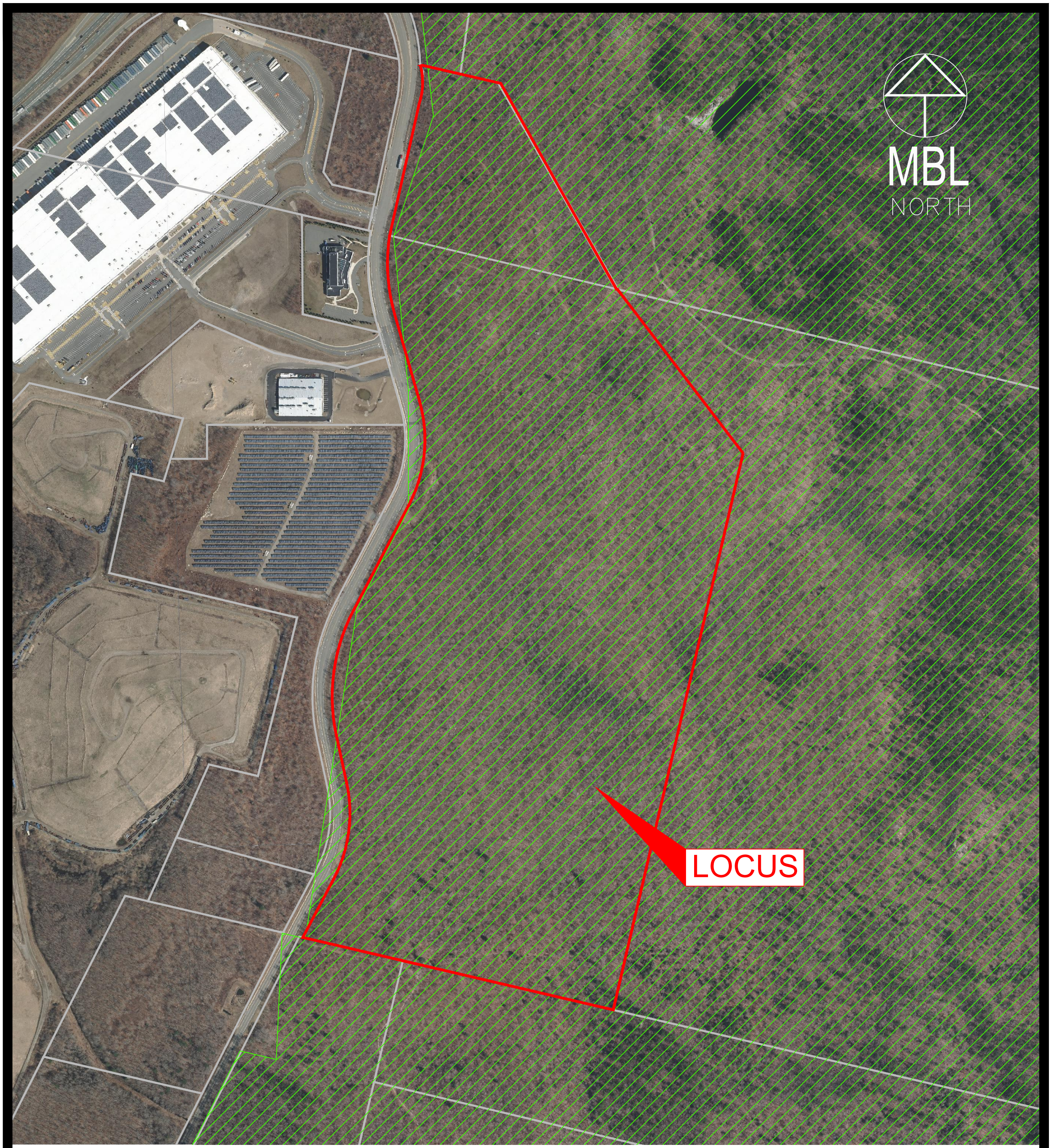
FALL RIVER/FREETOWN MASSACHUSETTS

| | |
|---|---|
| PROJ. No: | 2021-036 |
| DATE: | 07/25/2022 |
| SCALE: | 1"=750' |

FIGURE 3

X:\2021\2021-036\ADMIN\REPORTS\NOI\FIGURES\2021-036 FIGURES.DWG

# Figure 4: Natural Heritage Map




ESTIMATED HABITATS OF RARE WILDLIFE

PRIORITY HABITATS OF RARE SPECIES

CERTIFIED VERNAL POOL

NOTE: INFORMATION ON THIS PLAN OBTAINED FROM THE 15TH EDITION OF THE MASSACHUSETTS NATURAL HERITAGE ATLAS DATED AUGUST 1, 2021.

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NATURAL HERITAGE MAP
INNOVATION WAY

ASSESSORS MAP W-19, LOT 185 & 189
PARCEL ID 236-006.01
FALL RIVER/FREETOWN MASSACHUSETTS

| | |
|---|---|
| PROJ. No: | 2021-036 |
| DATE: | 07/25/2022 |
| SCALE: | 1"=750' |

FIGURE 4

X:\2021\2021-036\ADMIN\REPORTS\NOI\FIGURES\2021-036 FIGURES.DWG

# Figure 5: Critical Areas


AREAS OF CRITICAL ENVIRONMENTAL CONCERN

WELLHEAD PROTECTION AREAS

OUTSTANDING RESOURCE WATERS

NOTE: INFORMATION ON THIS PLAN OBTAINED FROM MASS GIS DATABASE ACEC, IPWA, ZONE II AND OUTSTANDING RESOURCE WATERS DATA LAYER. THE LOCUS IS NOT LOCATED WITHIN A CRITICAL AREA.


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CRITICAL AREAS MAP

INNOVATION WAY

ASSESSORS MAP W-19, LOT 185 & 189
PARCEL ID 236-006.01

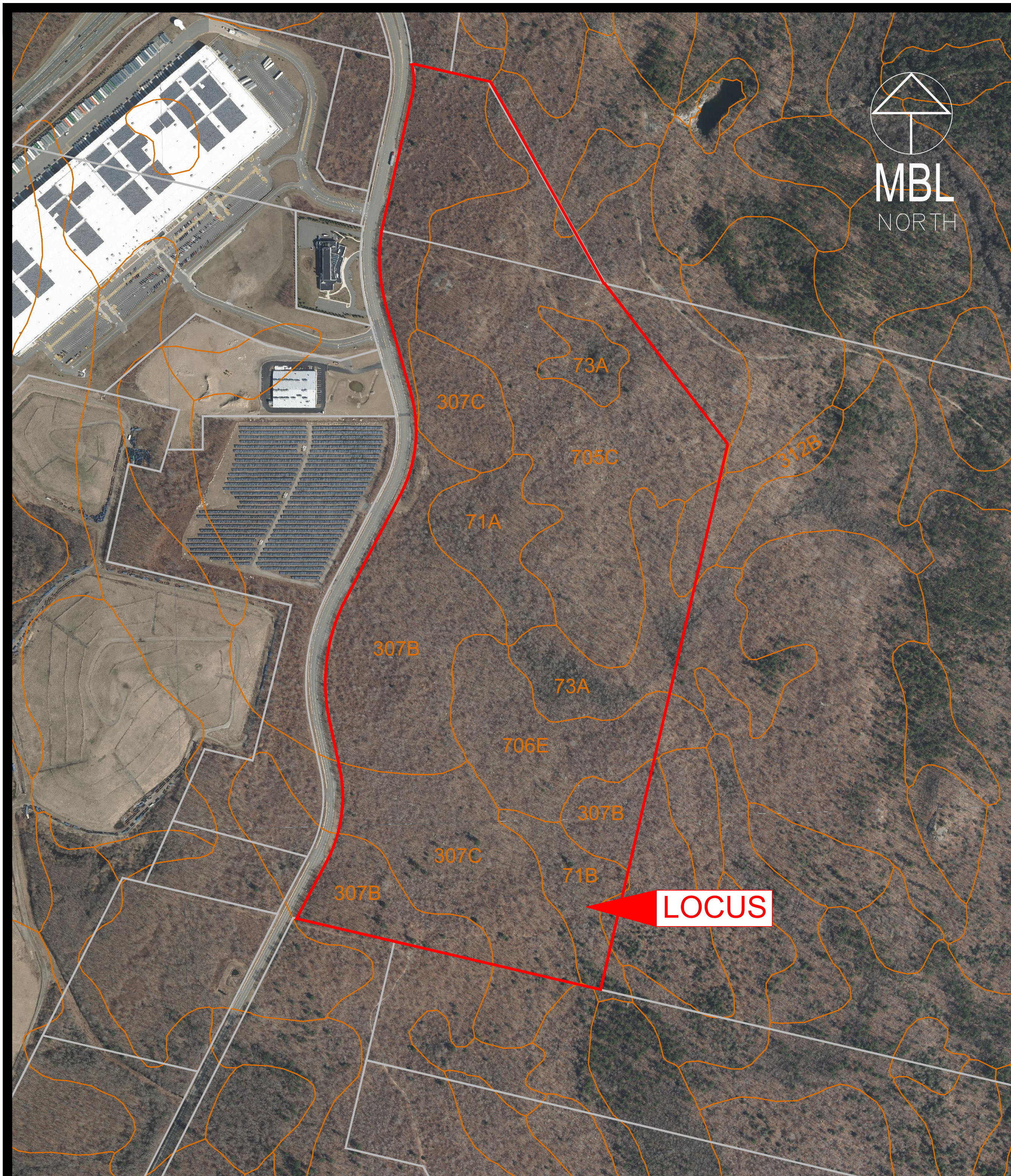
FALL RIVER/FREETOWN MASSACHUSETTS

| | |
|---|---|
| PROJ. No: | 2021-036 |
| DATE: | 07/25/2022 |
| SCALE: | 1"=750' |

FIGURE 5

X:\2021\2021-036\ADMIN\REPORTS\NOI\FIGURES\2021-036 FIGURES.DWG

## Figure 6: Soils Map




NOTE: INFORMATION ON THIS PLAN OBTAINED FROM MASS GIS NRCS SSURGO-CERTIFIED SOILS DATA LAYER.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SOILS MAP

INNOVATION WAY

ASSESSORS MAP W-19, LOT 185 & 189
PARCEL ID 236-006.01

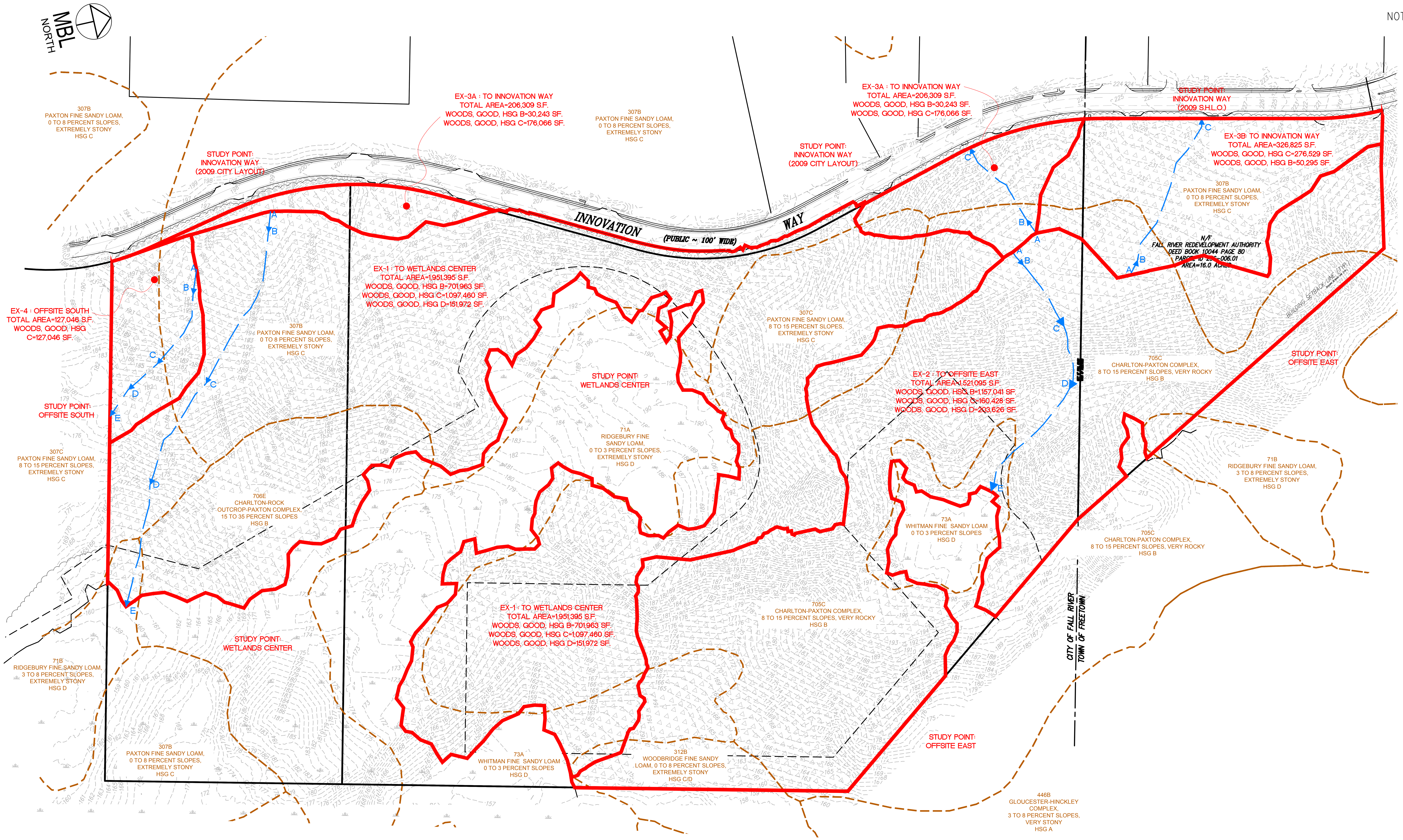
FALL RIVER/FREETOWN MASSACHUSETTS

| | |
|---|---|
| PROJ. No: | 2021-036 |
| DATE: | 07/25/2022 |
| SCALE: | 1"=750' |

FIGURE 6

X:\2021\2021-036\ADMIN\REPORTS\NOI\FIGURES\2021-036 FIGURES.DWG

## Figure 7: Existing Conditions Drainage Map




## LEGEND

- SOILS BOUNDARY
- WATERSHED BOUNDARY
- DRAINAGE FLOWPATH
- WOODS

NOTE: WHERE NO FLOWPATH IS SHOWN, A TIME OF CONCENTRATION OF 6 MINUTES WAS USED.

| No. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 4 | 11/21/2022 | REVISION PER COMMENTS | JAW |
| 3 | 11/10/2022 | REVISION PER MASSDOT COMMENTS | JAW |
| 2 | 10/12/2022 | REVISION PER MASSDOT COMMENTS | JAW |
| 1 | 09/08/2022 | REVISION PER COMMENT FROM CITY OF FALL RIVER | JAW |

REVISIONS

PROJ. MANAGER: MBL
CHIEF DESIGNER: MBL
REVIEWED BY: DATE

SEAL

SEAL

PREPARED FOR

V.M.D. COMPANIES, LLC
733 TURNPIKE STREET, ROUTE 114
NORTH ANDOVER MASSACHUSETTS

SCALE:
HORZ.: 1"=100'
VERT.:
DATUM:
HORZ.: NAD83
VERT.: NAVD88
100 50 0 100
GRAPHIC SCALE

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PROPOSED WAREHOUSE DEVELOPMENT

# EXISTING CONDITIONS DRAINAGE MAP
0 INNOVATION WAY
FALL RIVER- MAP W-19 LOTS 185 & 189
FREETOWN - PARCEL ID 236-006.01
FALL RIVER/FREETOWN MASSACHUSETTS

PROJ. No.: 2021-036
DATE: JULY 25, 2022

FIGURE 7

X:\2021\2021-036\CIVIL\Design\Drainage\2021-036 Figure 7 - Pre Dev Map.dwg, 11/17/2022 10:50:55 AM, DWG To PDF.pc3

## Figure 8: Proposed Conditions Drainage Map


X:\2021\2021-036\CIVIL\Design\Drainage\2021-036 Figure 8 - Post Dev Map-MASTER.dwg, 11/21/2022 10:49:29 AM, DWG To PDF.pc3

UCS: | MS VIEW: | LMAN: | CTB:

| No. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 4 | 11/21/2022 | REVISION PER COMMENTS | JAW |
| 3 | 11/10/2022 | REVISION PER MASSDOT COMMENTS | JAW |
| 2 | 10/12/2022 | REVISION PER MASSDOT COMMENTS | JAW |
| 1 | 09/08/2022 | REVISION PER COMMENT FROM CITY OF FALL RIVER | JAW |

REVISIONS

PROJ. MANAGER: MBL
CHIEF DESIGNER: MBL
REVIEWED BY: | DATE

SEAL

SEAL

PREPARED FOR

V.M.D. COMPANIES, LLC
733 TURNPIKE STREET, ROUTE 114
NORTH ANDOVER MASSACHUSETTS

SCALE:
HORZ.: 1"=100'
VERT.:
DATUM:
HORZ.: NAD83
VERT.: NAVD88
100 50 0 100
GRAPHIC SCALE

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PROPOSED WAREHOUSE DEVELOPMENT

# POST DEVELOPMENT DRAINAGE MAP

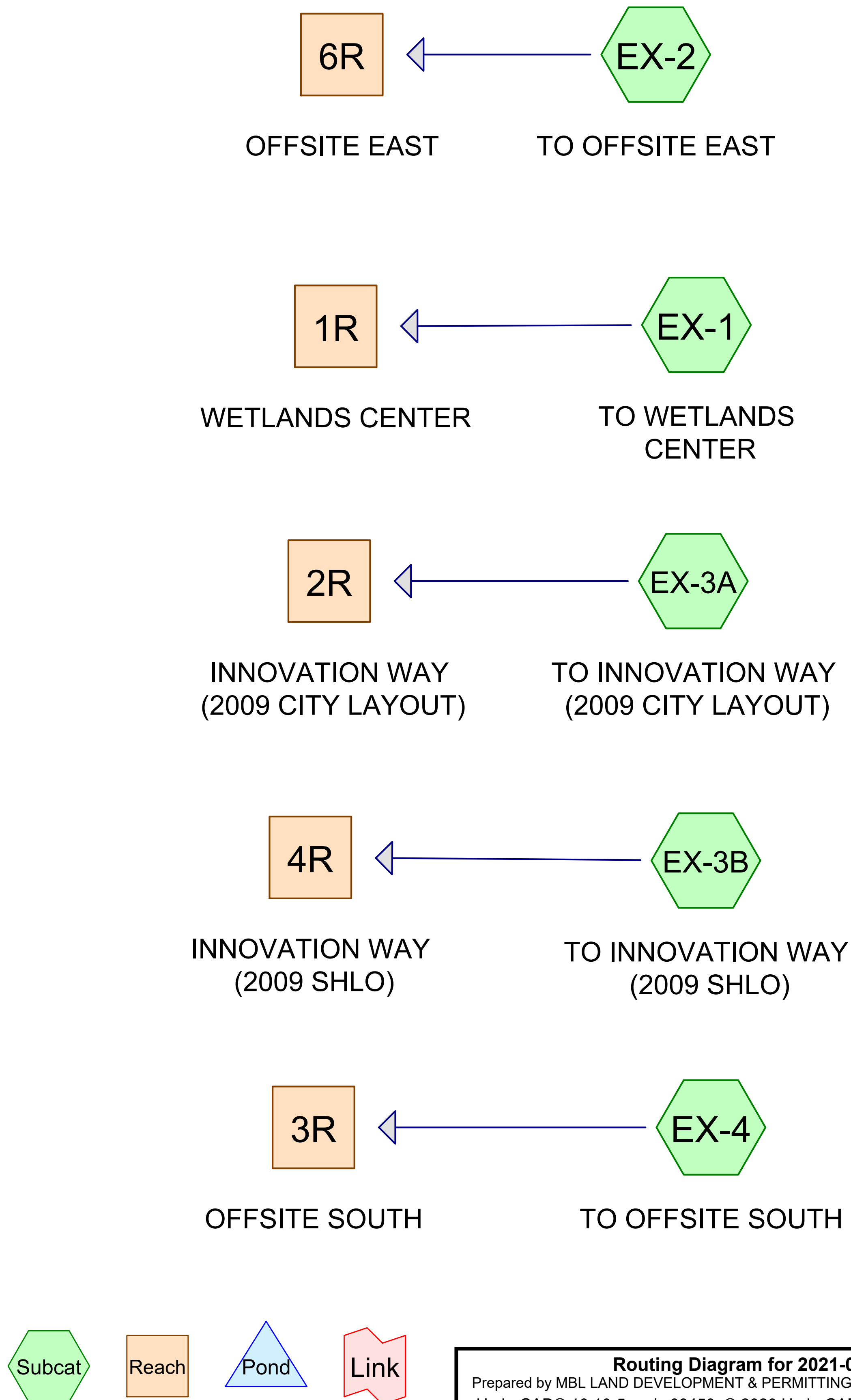
0 INNOVATION WAY
FALL RIVER- MAP W-19 LOTS 185 & 189
FREETOWN - PARCEL ID 236-006.01
FALL RIVER/FREETOWN MASSACHUSETTS

PROJ. No.: 2021-036
DATE: JULY 25, 2022

FIGURE 8

# APPENDIX A: HYDROLOGIC ANALYSIS

# Pre-Development HydroCAD Analysis




**Routing Diagram for 2021-036 EX**
Prepared by MBL LAND DEVELOPMENT & PERMITTING CORP., Printed 11/17/2022

## Area Listing (all nodes)

| Area (sq-ft) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 1,939,543 | 55 | Woods, Good, HSG B (EX-1, EX-2, EX-3A, EX-3B) |
| 1,837,529 | 70 | Woods, Good, HSG C (EX-1, EX-2, EX-3A, EX-3B, EX-4) |
| 355,598 | 77 | Woods, Good, HSG D (EX-1, EX-2) |
| **4,132,670** | **64** | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (sq-ft) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0 | HSG A | |
| 1,939,543 | HSG B | EX-1, EX-2, EX-3A, EX-3B |
| 1,837,529 | HSG C | EX-1, EX-2, EX-3A, EX-3B, EX-4 |
| 355,598 | HSG D | EX-1, EX-2 |
| 0 | Other | |
| **4,132,670** | | **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 | Subcatchment Numbers |
|---|---|---|---|---|---|---|---|
| 0 | 1,939,543 | 1,837,529 | 355,598 | 0 | 4,132,670 | Woods, Good | EX-1, EX-2, EX-3A, EX-3B, EX-4 |
| **0** | **1,939,543** | **1,837,529** | **355,598** | **0** | **4,132,670** | **TOTAL AREA** | |

## Summary for Subcatchment EX-1: TO WETLANDS CENTER

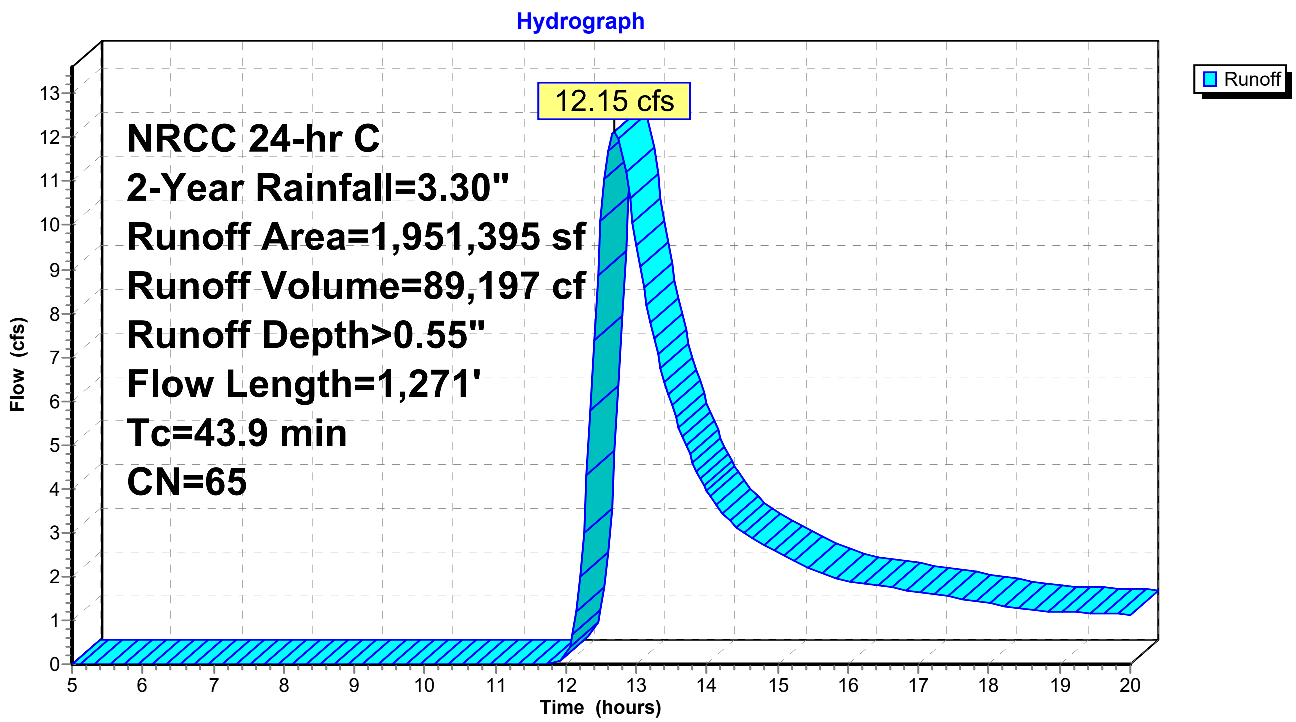
Runoff = 12.15 cfs @ 12.69 hrs, Volume= 89,197 cf, Depth> 0.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| Area (sf) | CN | Description |
|---|---|---|
| 701,963 | 55 | Woods, Good, HSG B |
| 1,097,460 | 70 | Woods, Good, HSG C |
| 151,972 | 77 | Woods, Good, HSG D |
| 1,951,395 | 65 | Weighted Average |
| 1,951,395 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 22.2 | 50 | 0.0050 | 0.04 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 9.4 | 505 | 0.0322 | 0.90 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 4.8 | 348 | 0.0575 | 1.20 | | **Shallow Concentrated Flow, CD**<br>Woodland Kv= 5.0 fps |
| 7.5 | 368 | 0.0266 | 0.82 | | **Shallow Concentrated Flow, DE**<br>Woodland Kv= 5.0 fps |
| 43.9 | 1,271 | Total | | | |

### Subcatchment EX-1: TO WETLANDS CENTER



## Summary for Subcatchment EX-2: TO OFFSITE EAST

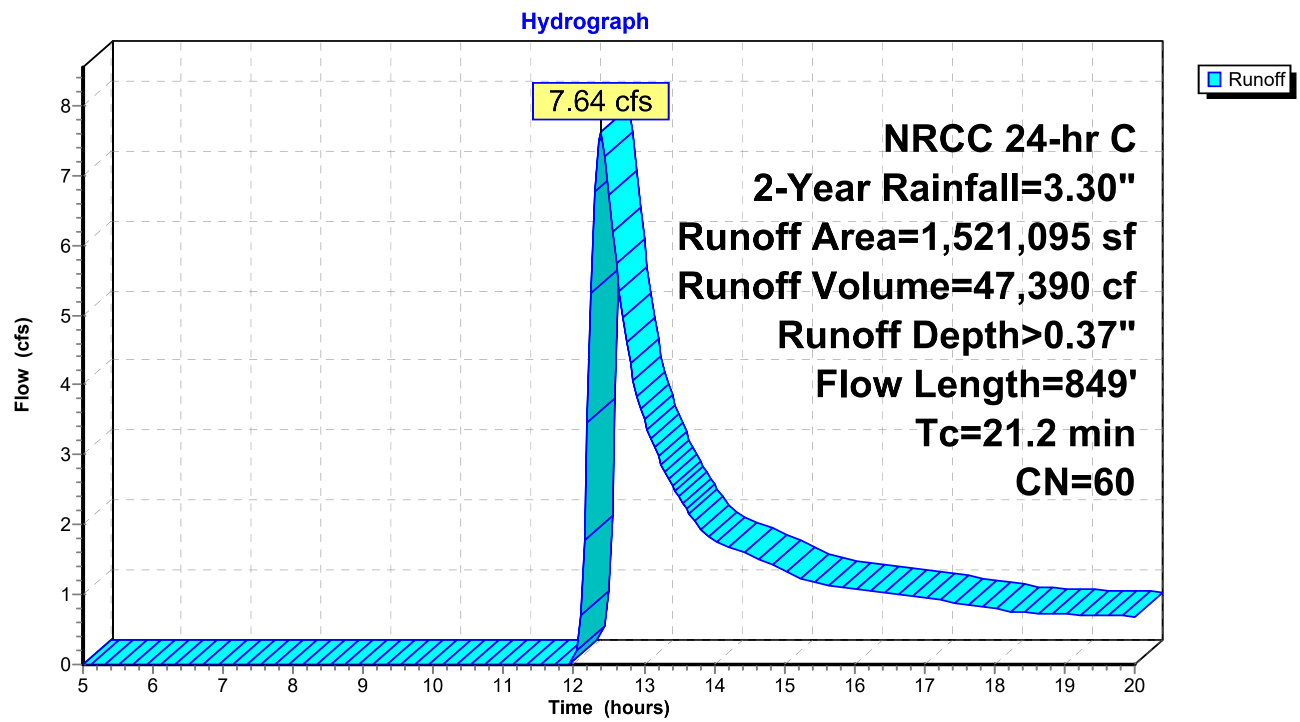
Runoff = 7.64 cfs @ 12.39 hrs, Volume= 47,390 cf, Depth> 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C  2-Year Rainfall=3.30"

| Area (sf) | CN | Description |
|---|---|---|
| 1,157,041 | 55 | Woods, Good, HSG B |
| 160,428 | 70 | Woods, Good, HSG C |
| 203,626 | 77 | Woods, Good, HSG D |
| 1,521,095 | 60 | Weighted Average |
| 1,521,095 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 9.1 | 50 | 0.0468 | 0.09 | | **Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.00" |
| 3.3 | 217 | 0.0469 | 1.08 | | **Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps |
| 2.1 | 194 | 0.0937 | 1.53 | | **Shallow Concentrated Flow, CD** Woodland Kv= 5.0 fps |
| 6.7 | 388 | 0.0370 | 0.96 | | **Shallow Concentrated Flow, DE** Woodland Kv= 5.0 fps |
| 21.2 | 849 | Total | | | |

### Subcatchment EX-2: TO OFFSITE EAST



## Summary for Subcatchment EX-3A: TO INNOVATION WAY (2009 CITY LAYOUT)

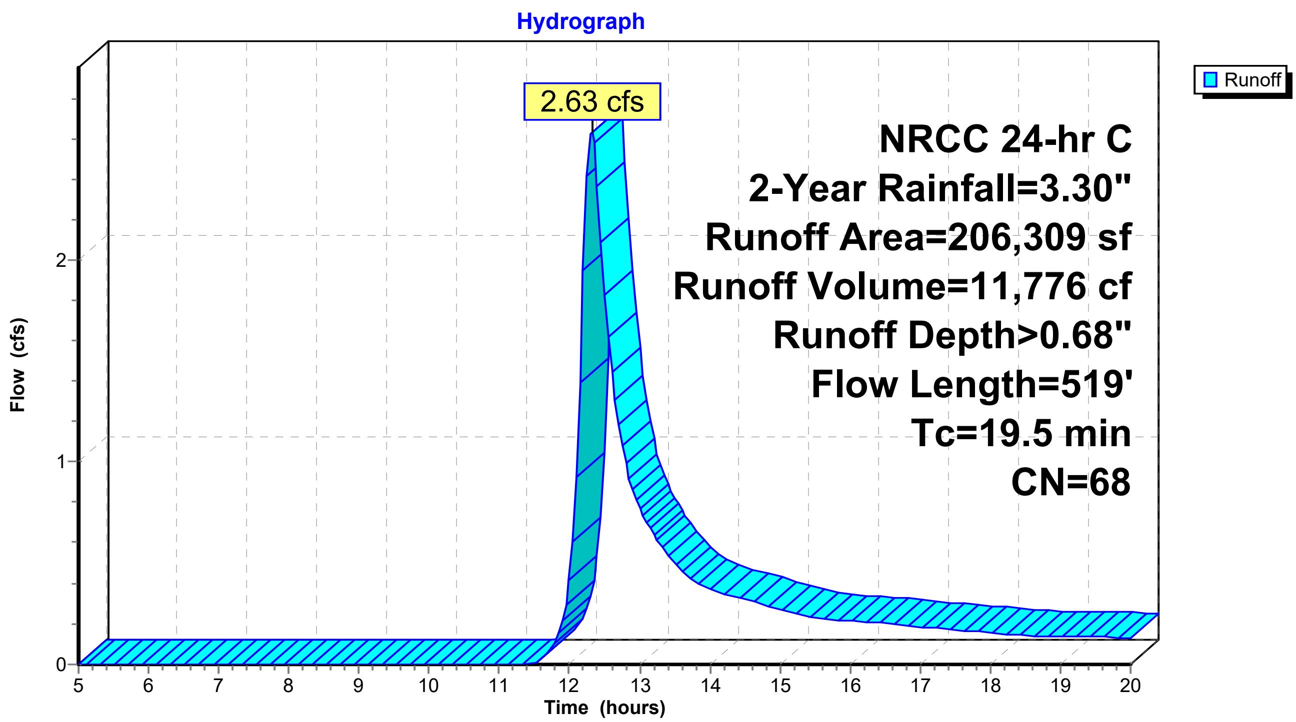
Runoff = 2.63 cfs @ 12.32 hrs, Volume= 11,776 cf, Depth> 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| Area (sf) | CN | Description |
|---|---|---|
| 176,066 | 70 | Woods, Good, HSG C |
| 30,243 | 55 | Woods, Good, HSG B |
| 206,309 | 68 | Weighted Average |
| 206,309 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.6 | 50 | 0.0314 | 0.08 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 8.9 | 469 | 0.0307 | 0.88 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 19.5 | 519 | Total | | | |

### Subcatchment EX-3A: TO INNOVATION WAY (2009 CITY LAYOUT)



## Summary for Subcatchment EX-3B: TO INNOVATION WAY (2009 SHLO)

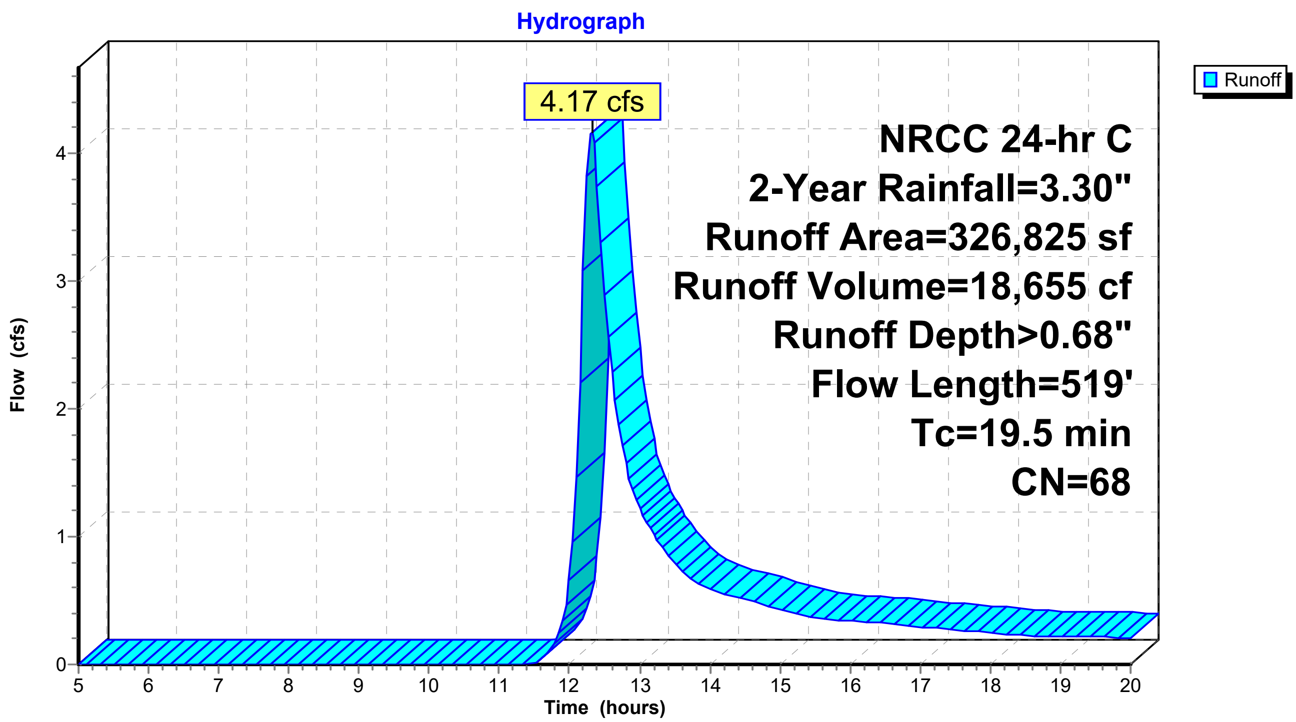
Runoff = 4.17 cfs @ 12.32 hrs, Volume= 18,655 cf, Depth> 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| Area (sf) | CN | Description |
|---|---|---|
| 276,529 | 70 | Woods, Good, HSG C |
| 50,296 | 55 | Woods, Good, HSG B |
| 326,825 | 68 | Weighted Average |
| 326,825 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.6 | 50 | 0.0314 | 0.08 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 8.9 | 469 | 0.0307 | 0.88 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 19.5 | 519 | Total | | | |

## Subcatchment EX-3B: TO INNOVATION WAY (2009 SHLO)



## Summary for Subcatchment EX-4: TO OFFSITE SOUTH

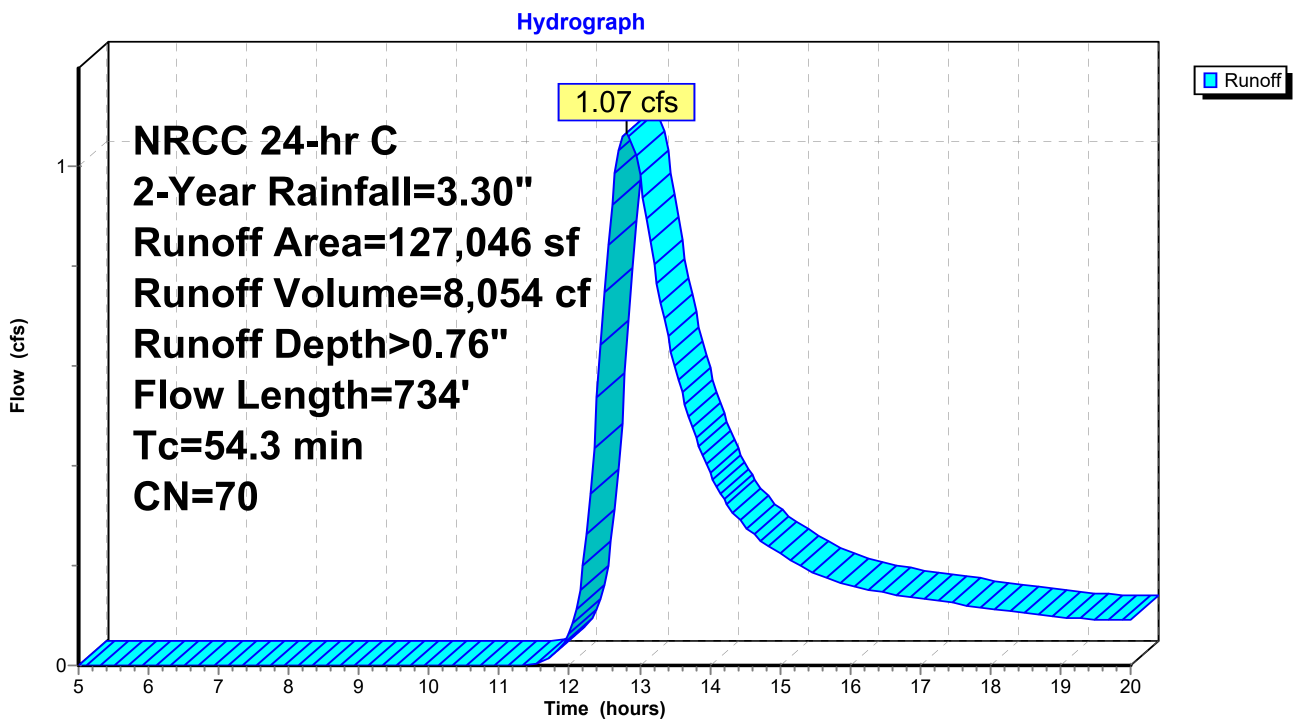
Runoff = 1.07 cfs @ 12.82 hrs, Volume= 8,054 cf, Depth> 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| Area (sf) | CN | Description |
|---|---|---|
| 127,046 | 70 | Woods, Good, HSG C |
| 127,046 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 39.3 | 50 | 0.0012 | 0.02 | | **Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.00" |
| 11.8 | 475 | 0.0180 | 0.67 | | **Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps |
| 1.4 | 114 | 0.0705 | 1.33 | | **Shallow Concentrated Flow, CD** Woodland Kv= 5.0 fps |
| 1.8 | 95 | 0.0317 | 0.89 | | **Shallow Concentrated Flow, DE** Woodland Kv= 5.0 fps |
| 54.3 | 734 | Total | | | |

## Subcatchment EX-4: TO OFFSITE SOUTH

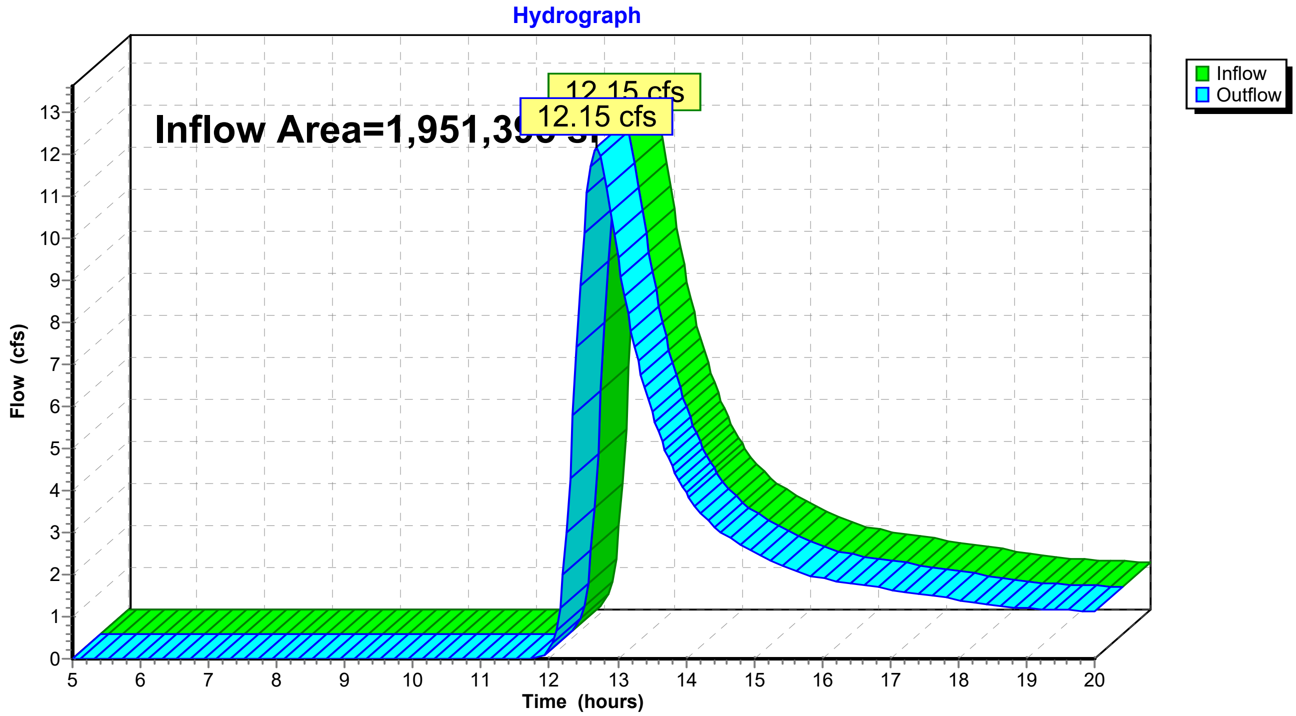


## Summary for Reach 1R: WETLANDS CENTER

Inflow Area = 1,951,395 sf, 0.00% Impervious, Inflow Depth > 0.55" for 2-Year event
Inflow = 12.15 cfs @ 12.69 hrs, Volume= 89,197 cf
Outflow = 12.15 cfs @ 12.69 hrs, Volume= 89,197 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 1R: WETLANDS CENTER

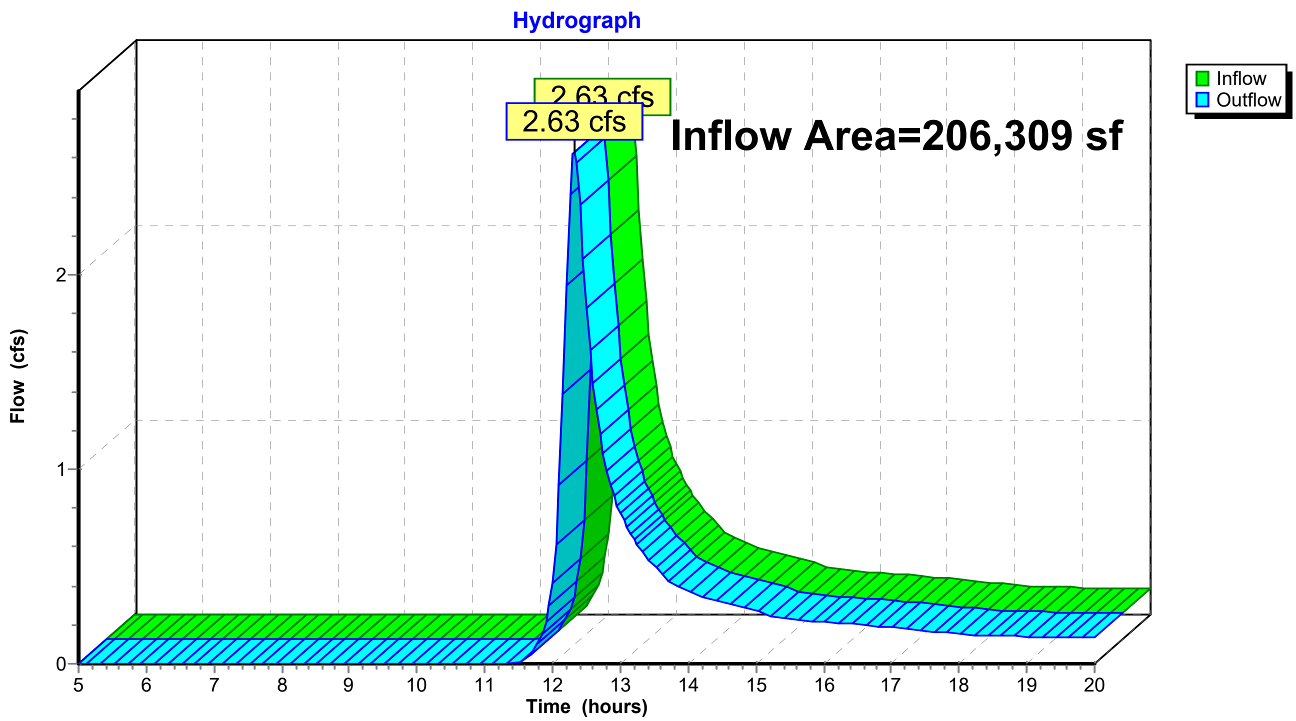


## Summary for Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 206,309 sf, | 0.00% Impervious, | Inflow Depth > 0.68" | for 2-Year event |
| Inflow = | 2.63 cfs @ | 12.32 hrs, Volume= | 11,776 cf | |
| Outflow = | 2.63 cfs @ | 12.32 hrs, Volume= | 11,776 cf, Atten= 0%, Lag= 0.0 min | |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

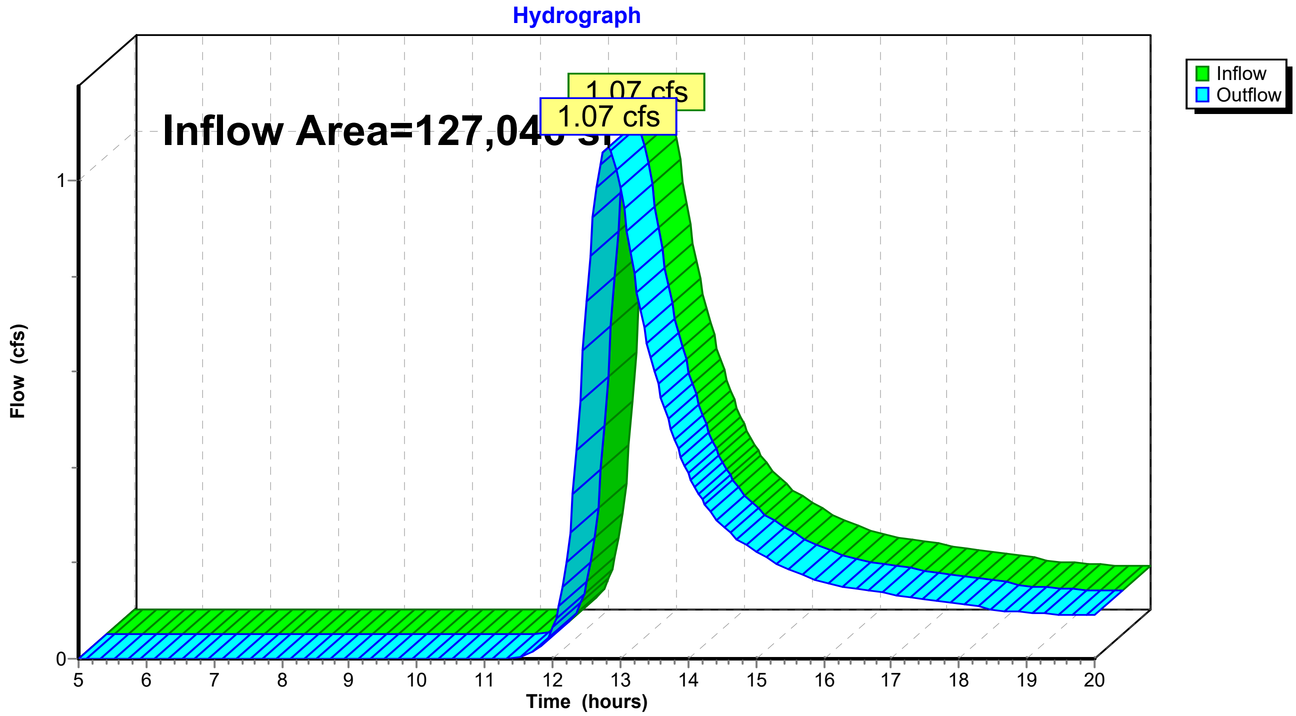


## Summary for Reach 3R: OFFSITE SOUTH

| | | | |
|---|---|---|---|
| Inflow Area = | 127,046 sf, 0.00% Impervious, | Inflow Depth > 0.76" | for 2-Year event |
| Inflow = | 1.07 cfs @ 12.82 hrs, Volume= | 8,054 cf | |
| Outflow = | 1.07 cfs @ 12.82 hrs, Volume= | 8,054 cf, Atten= 0%, Lag= 0.0 min | |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

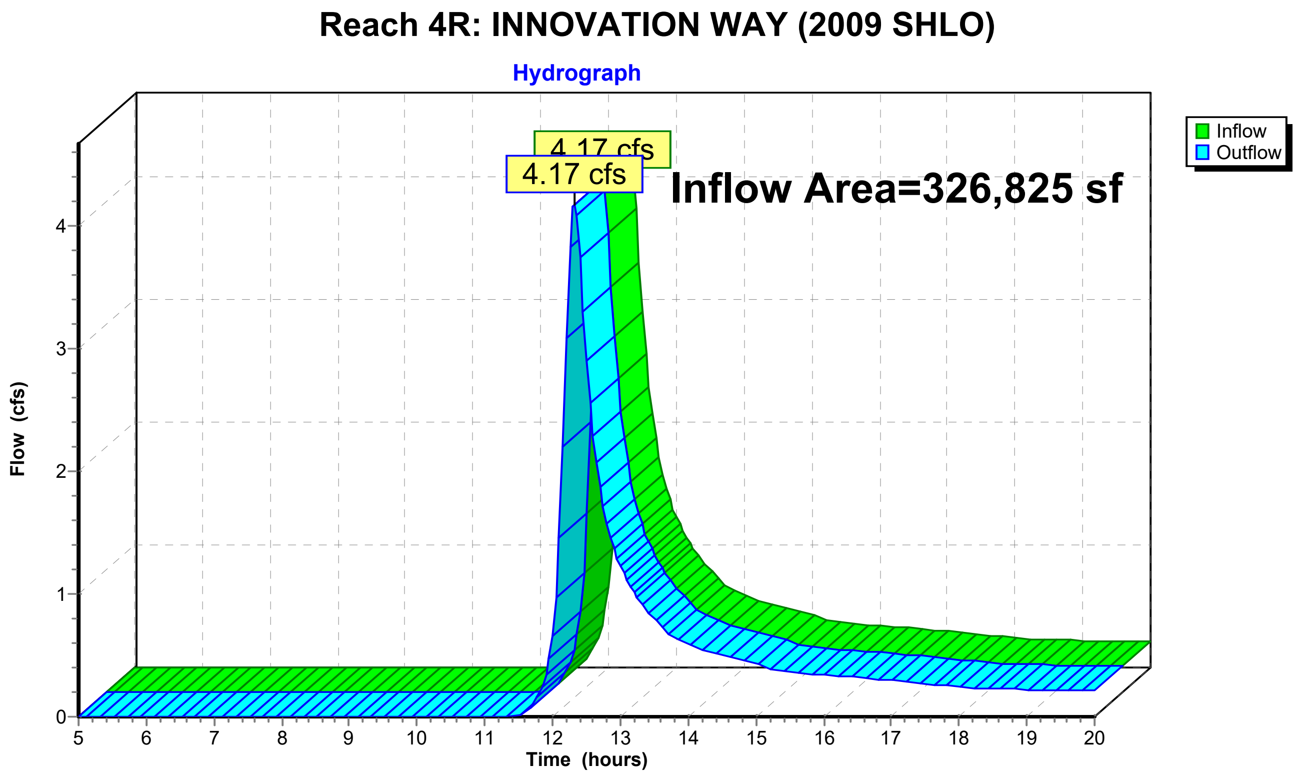
### Reach 3R: OFFSITE SOUTH



## Summary for Reach 4R: INNOVATION WAY (2009 SHLO)

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 326,825 sf, | 0.00% Impervious, | Inflow Depth > 0.68" | for 2-Year event |
| Inflow = | 4.17 cfs @ | 12.32 hrs, Volume= | 18,655 cf | |
| Outflow = | 4.17 cfs @ | 12.32 hrs, Volume= | 18,655 cf, Atten= 0%, Lag= 0.0 min | |

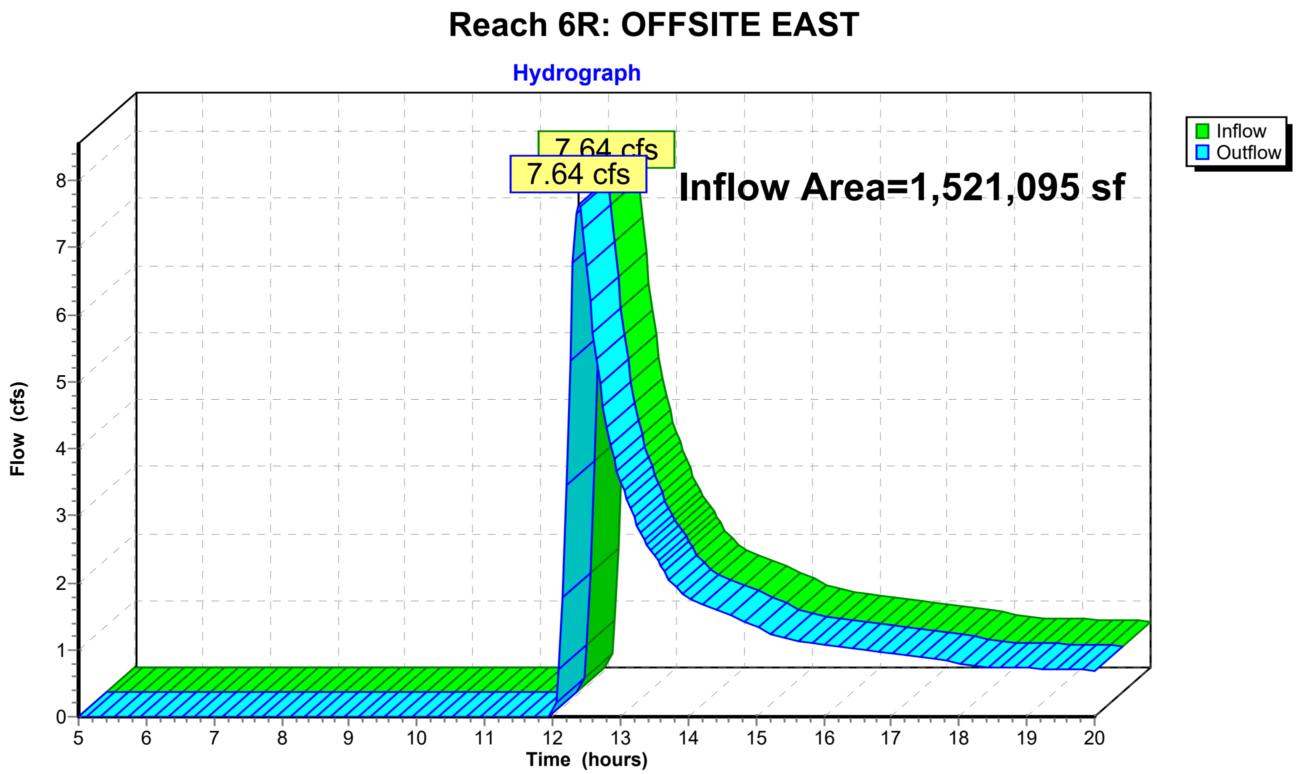
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



## Summary for Reach 6R: OFFSITE EAST

Inflow Area = 1,521,095 sf, 0.00% Impervious, Inflow Depth > 0.37" for 2-Year event
Inflow = 7.64 cfs @ 12.39 hrs, Volume= 47,390 cf
Outflow = 7.64 cfs @ 12.39 hrs, Volume= 47,390 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



## Summary for Subcatchment EX-1: TO WETLANDS CENTER

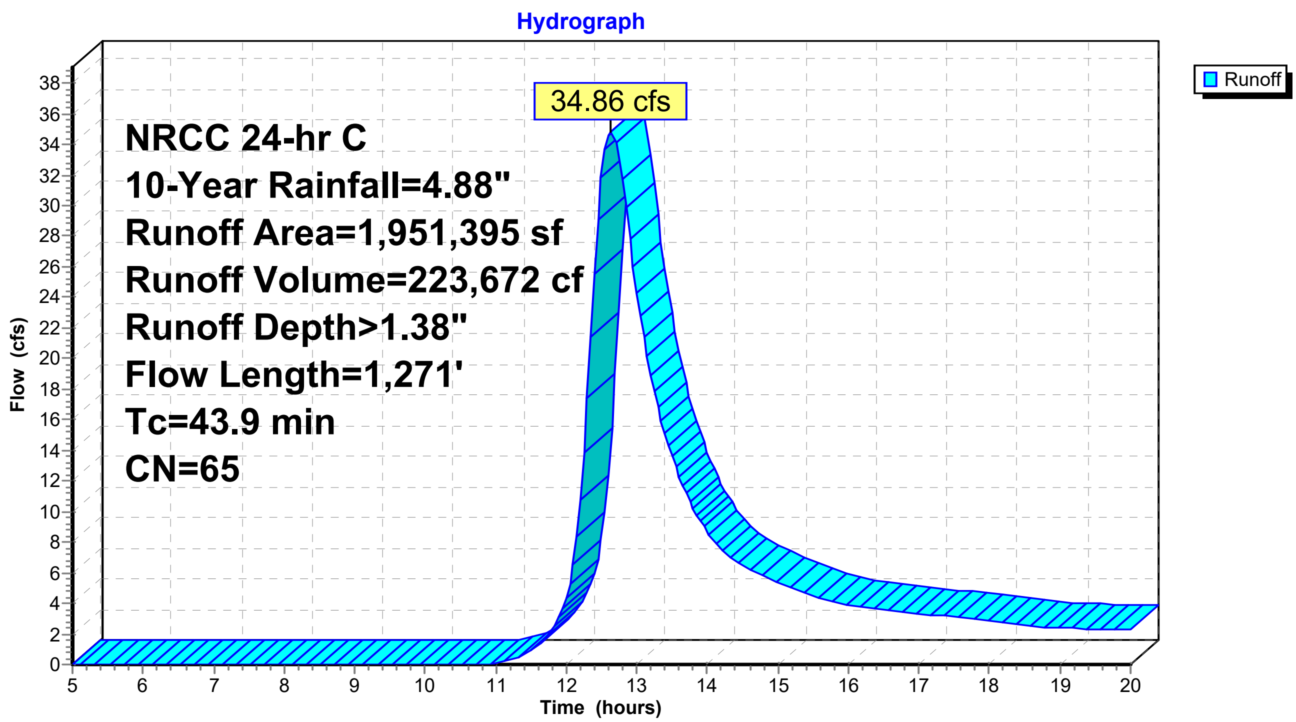
Runoff = 34.86 cfs @ 12.64 hrs, Volume= 223,672 cf, Depth> 1.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| Area (sf) | CN | Description |
|---|---|---|
| 701,963 | 55 | Woods, Good, HSG B |
| 1,097,460 | 70 | Woods, Good, HSG C |
| 151,972 | 77 | Woods, Good, HSG D |
| 1,951,395 | 65 | Weighted Average |
| 1,951,395 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 22.2 | 50 | 0.0050 | 0.04 | | **Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.00" |
| 9.4 | 505 | 0.0322 | 0.90 | | **Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps |
| 4.8 | 348 | 0.0575 | 1.20 | | **Shallow Concentrated Flow, CD** Woodland Kv= 5.0 fps |
| 7.5 | 368 | 0.0266 | 0.82 | | **Shallow Concentrated Flow, DE** Woodland Kv= 5.0 fps |
| 43.9 | 1,271 | Total | | | |

## Subcatchment EX-1: TO WETLANDS CENTER



## Summary for Subcatchment EX-2: TO OFFSITE EAST

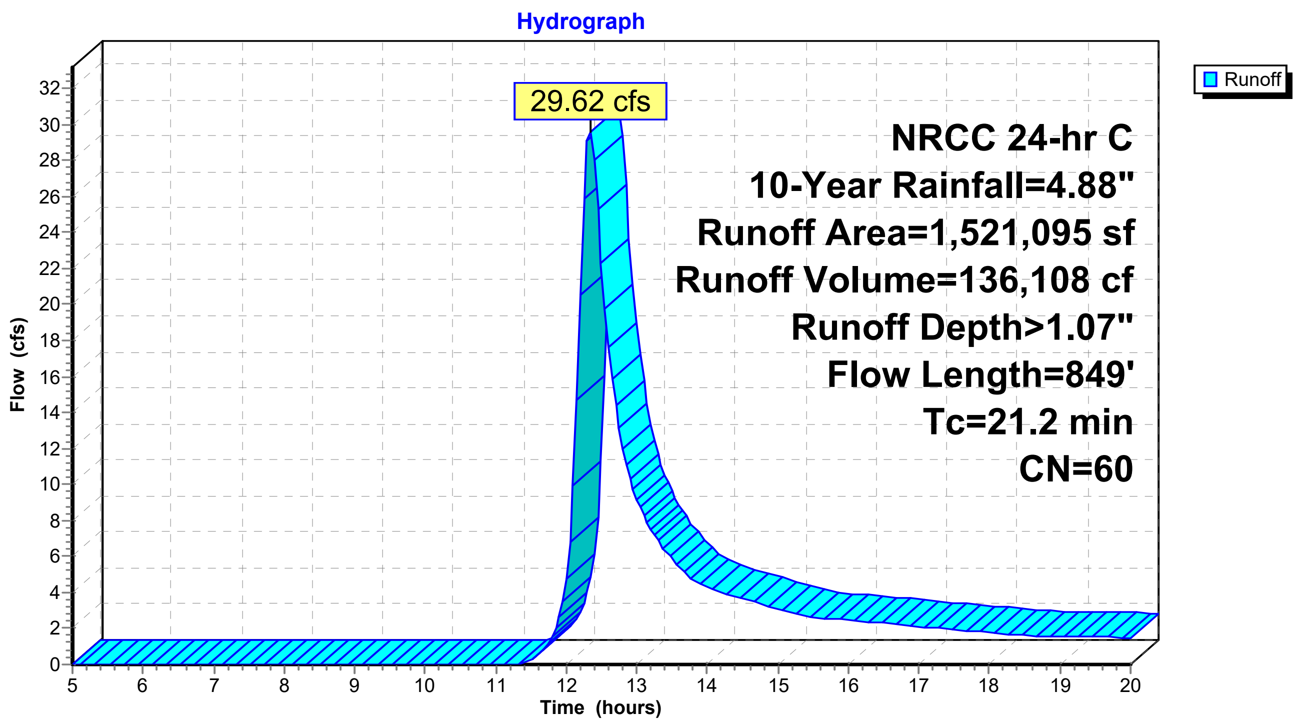
Runoff = 29.62 cfs @ 12.34 hrs, Volume= 136,108 cf, Depth> 1.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| Area (sf) | CN | Description |
|---|---|---|
| 1,157,041 | 55 | Woods, Good, HSG B |
| 160,428 | 70 | Woods, Good, HSG C |
| 203,626 | 77 | Woods, Good, HSG D |
| 1,521,095 | 60 | Weighted Average |
| 1,521,095 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 9.1 | 50 | 0.0468 | 0.09 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 3.3 | 217 | 0.0469 | 1.08 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 2.1 | 194 | 0.0937 | 1.53 | | **Shallow Concentrated Flow, CD**<br>Woodland Kv= 5.0 fps |
| 6.7 | 388 | 0.0370 | 0.96 | | **Shallow Concentrated Flow, DE**<br>Woodland Kv= 5.0 fps |
| 21.2 | 849 | Total | | | |

### Subcatchment EX-2: TO OFFSITE EAST



## Summary for Subcatchment EX-3A: TO INNOVATION WAY (2009 CITY LAYOUT)

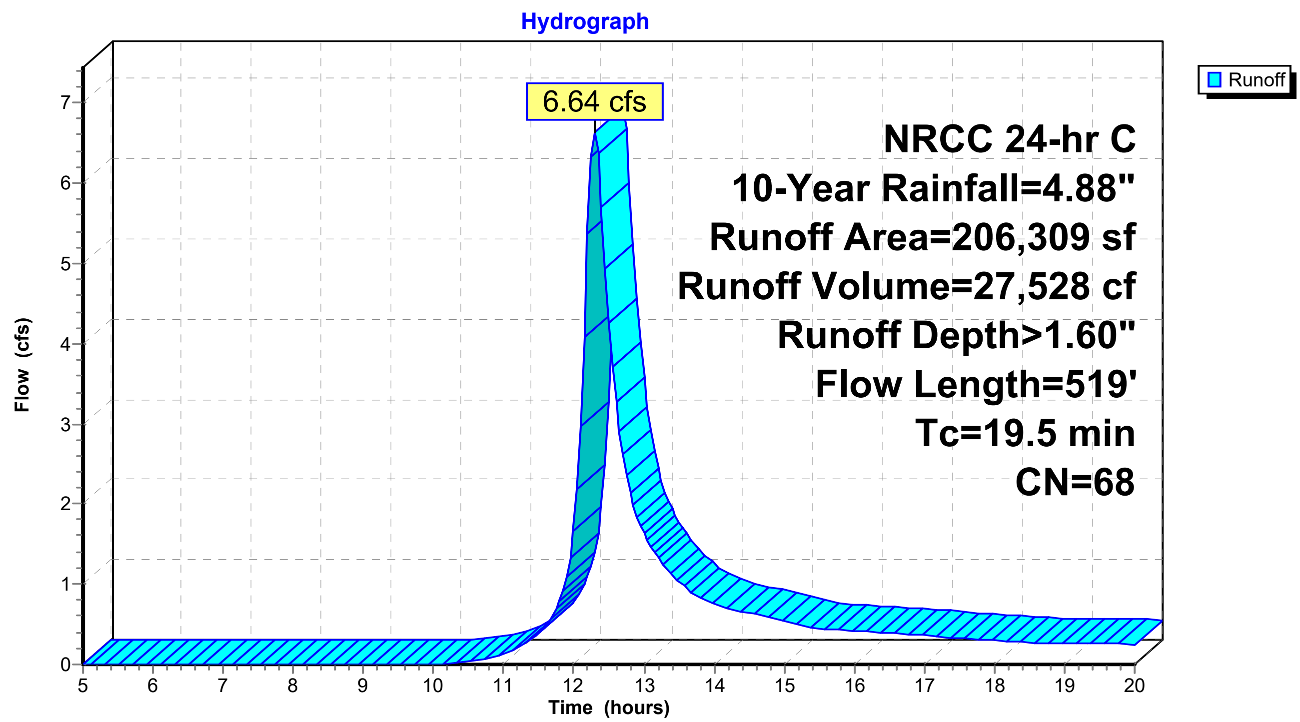
Runoff = 6.64 cfs @ 12.30 hrs, Volume= 27,528 cf, Depth> 1.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| Area (sf) | CN | Description |
|---|---|---|
| 176,066 | 70 | Woods, Good, HSG C |
| 30,243 | 55 | Woods, Good, HSG B |
| 206,309 | 68 | Weighted Average |
| 206,309 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.6 | 50 | 0.0314 | 0.08 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 8.9 | 469 | 0.0307 | 0.88 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 19.5 | 519 | Total | | | |

### Subcatchment EX-3A: TO INNOVATION WAY (2009 CITY LAYOUT)



## Summary for Subcatchment EX-3B: TO INNOVATION WAY (2009 SHLO)

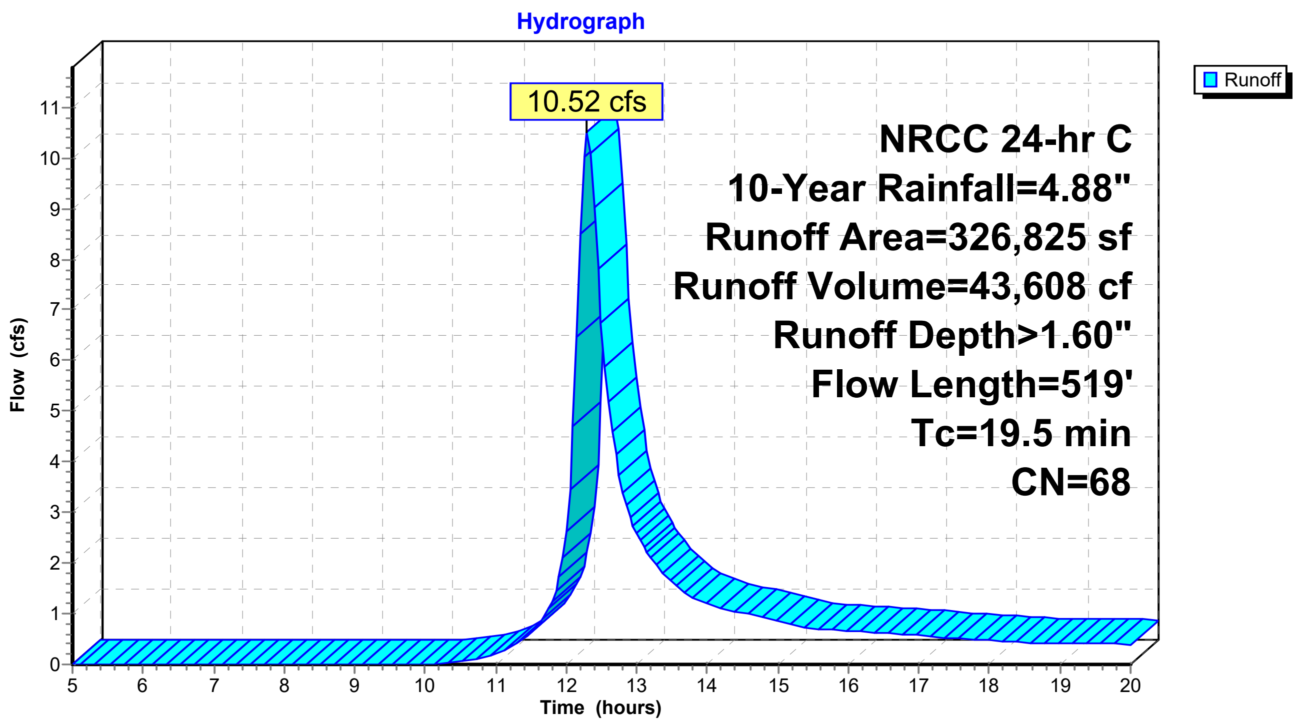
Runoff = 10.52 cfs @ 12.30 hrs, Volume= 43,608 cf, Depth> 1.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| Area (sf) | CN | Description |
|---|---|---|
| 276,529 | 70 | Woods, Good, HSG C |
| 50,296 | 55 | Woods, Good, HSG B |
| 326,825 | 68 | Weighted Average |
| 326,825 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.6 | 50 | 0.0314 | 0.08 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 8.9 | 469 | 0.0307 | 0.88 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 19.5 | 519 | Total | | | |

### Subcatchment EX-3B: TO INNOVATION WAY (2009 SHLO)



## Summary for Subcatchment EX-4: TO OFFSITE SOUTH

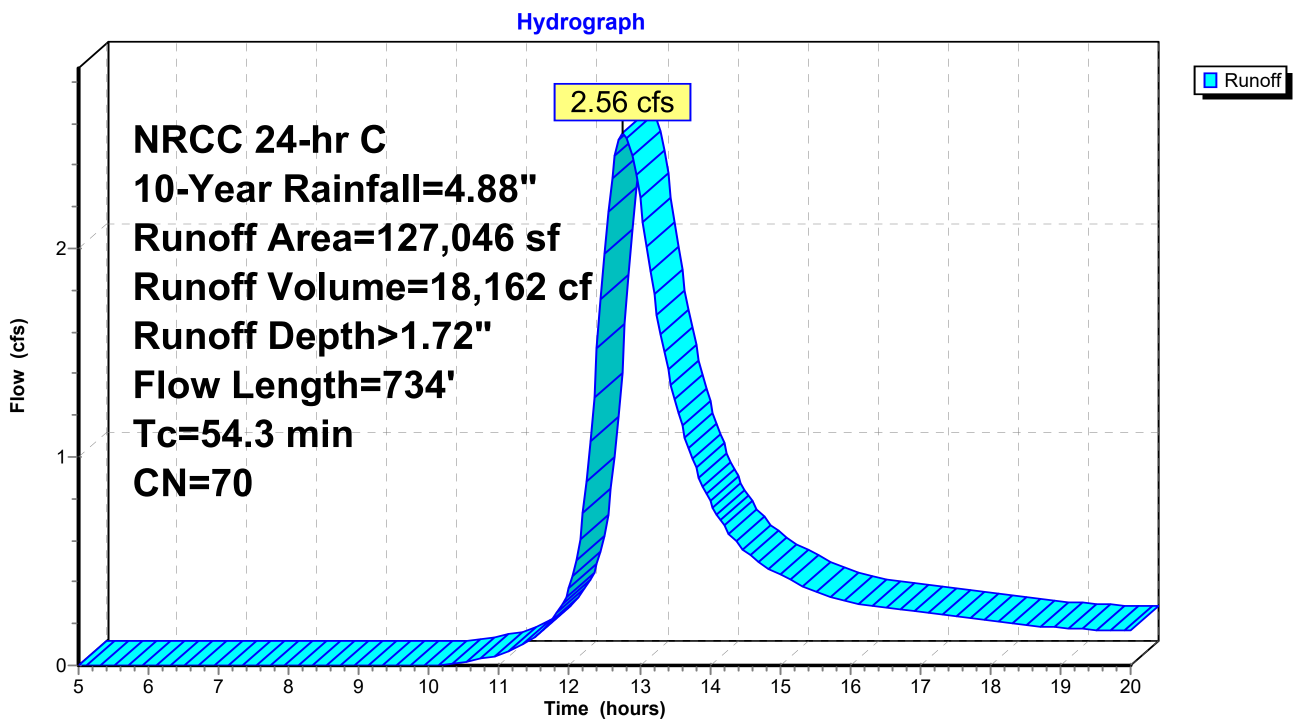
Runoff = 2.56 cfs @ 12.76 hrs, Volume= 18,162 cf, Depth> 1.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| Area (sf) | CN | Description |
|---|---|---|
| 127,046 | 70 | Woods, Good, HSG C |
| 127,046 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 39.3 | 50 | 0.0012 | 0.02 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 11.8 | 475 | 0.0180 | 0.67 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 1.4 | 114 | 0.0705 | 1.33 | | **Shallow Concentrated Flow, CD**<br>Woodland Kv= 5.0 fps |
| 1.8 | 95 | 0.0317 | 0.89 | | **Shallow Concentrated Flow, DE**<br>Woodland Kv= 5.0 fps |
| 54.3 | 734 | Total | | | |

## Subcatchment EX-4: TO OFFSITE SOUTH

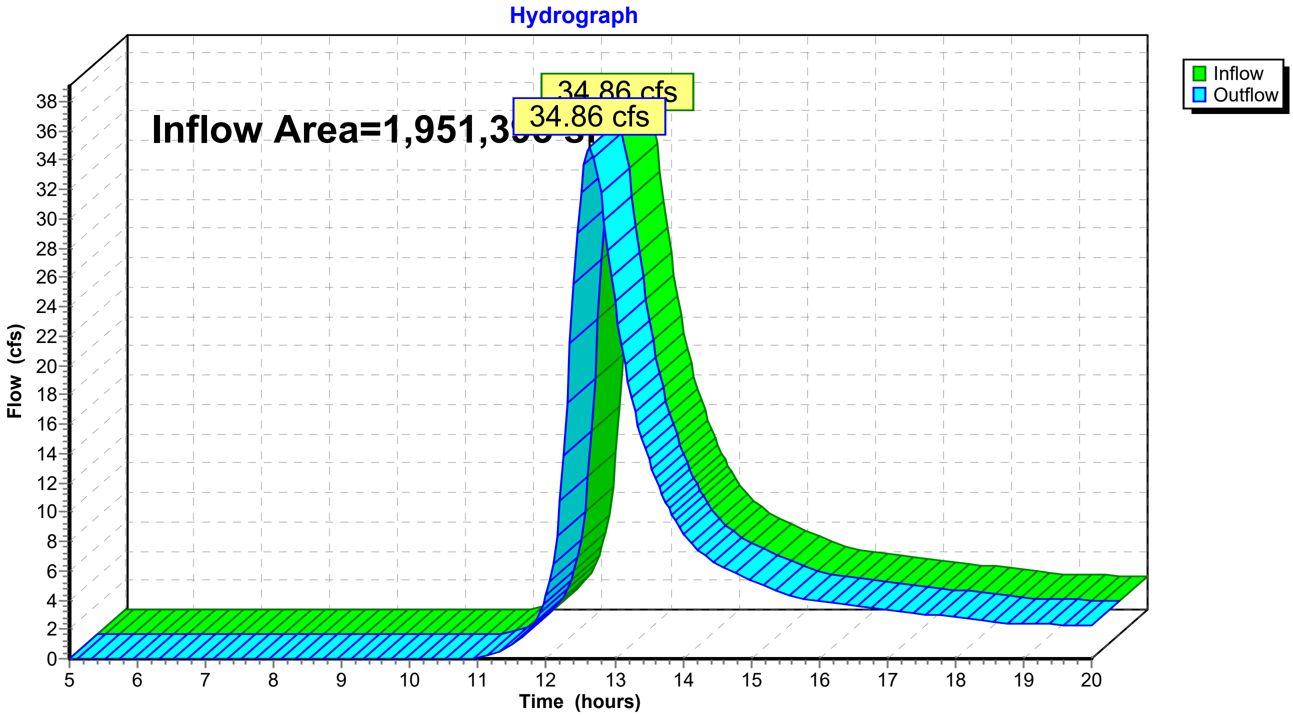


## Summary for Reach 1R: WETLANDS CENTER

Inflow Area = 1,951,395 sf, 0.00% Impervious, Inflow Depth > 1.38" for 10-Year event
Inflow = 34.86 cfs @ 12.64 hrs, Volume= 223,672 cf
Outflow = 34.86 cfs @ 12.64 hrs, Volume= 223,672 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 1R: WETLANDS CENTER

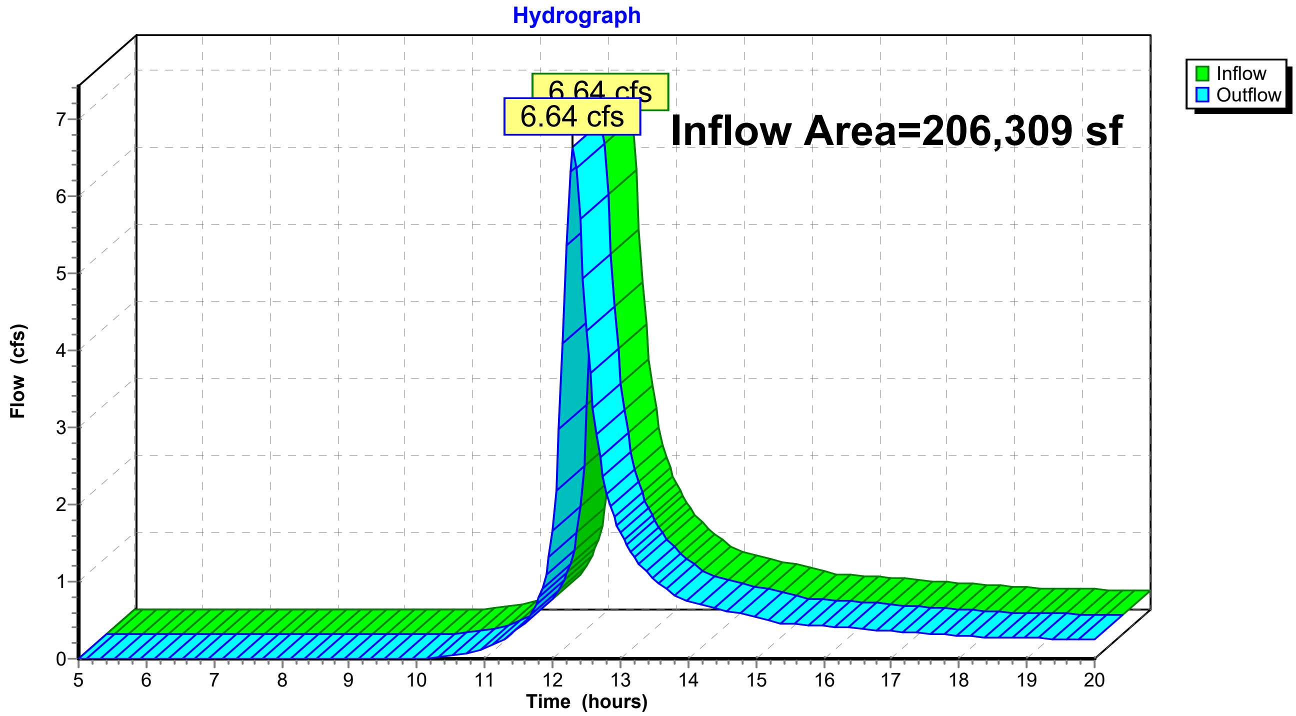


## Summary for Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

| | | | |
|---|---|---|---|
| Inflow Area = | 206,309 sf, 0.00% Impervious, | Inflow Depth > 1.60" | for 10-Year event |
| Inflow = | 6.64 cfs @ 12.30 hrs, Volume= | 27,528 cf | |
| Outflow = | 6.64 cfs @ 12.30 hrs, Volume= | 27,528 cf, Atten= 0%, Lag= 0.0 min | |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

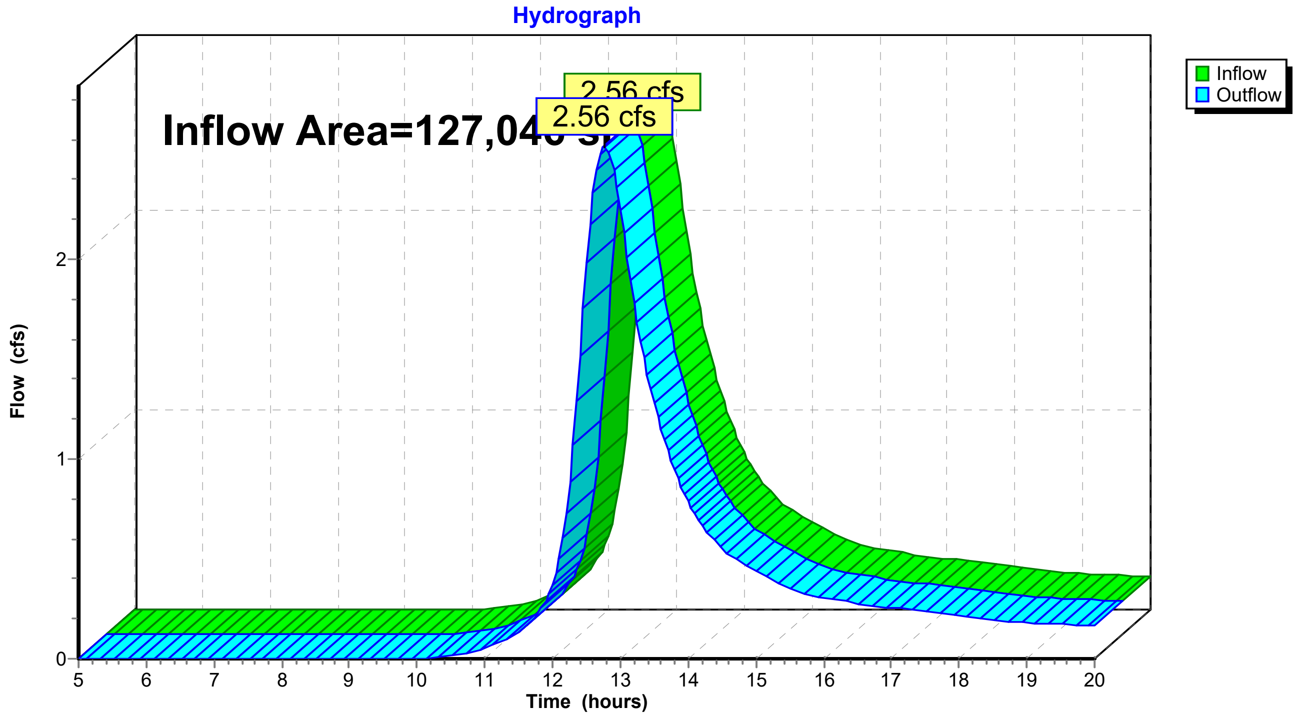


## Summary for Reach 3R: OFFSITE SOUTH

Inflow Area = 127,046 sf, 0.00% Impervious, Inflow Depth > 1.72" for 10-Year event
Inflow = 2.56 cfs @ 12.76 hrs, Volume= 18,162 cf
Outflow = 2.56 cfs @ 12.76 hrs, Volume= 18,162 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

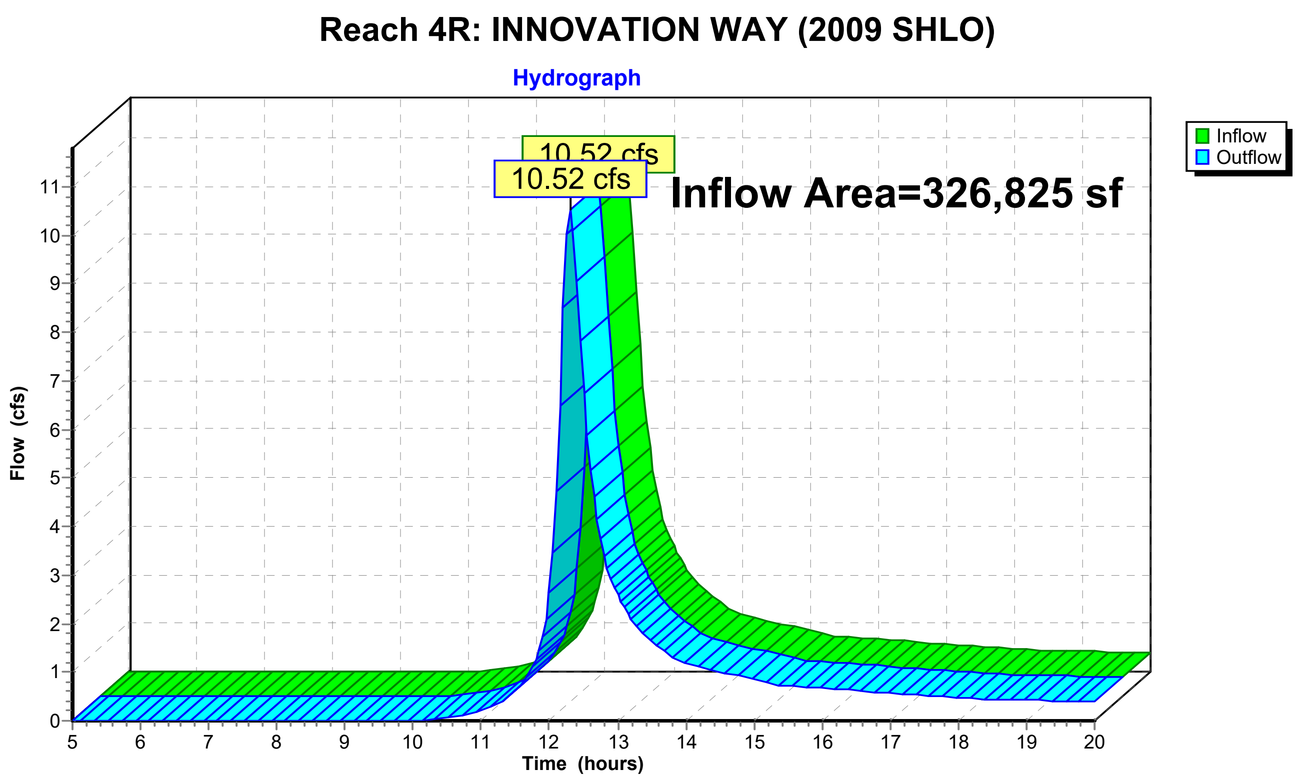
### Reach 3R: OFFSITE SOUTH



## Summary for Reach 4R: INNOVATION WAY (2009 SHLO)

Inflow Area = 326,825 sf, 0.00% Impervious, Inflow Depth > 1.60" for 10-Year event
Inflow = 10.52 cfs @ 12.30 hrs, Volume= 43,608 cf
Outflow = 10.52 cfs @ 12.30 hrs, Volume= 43,608 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

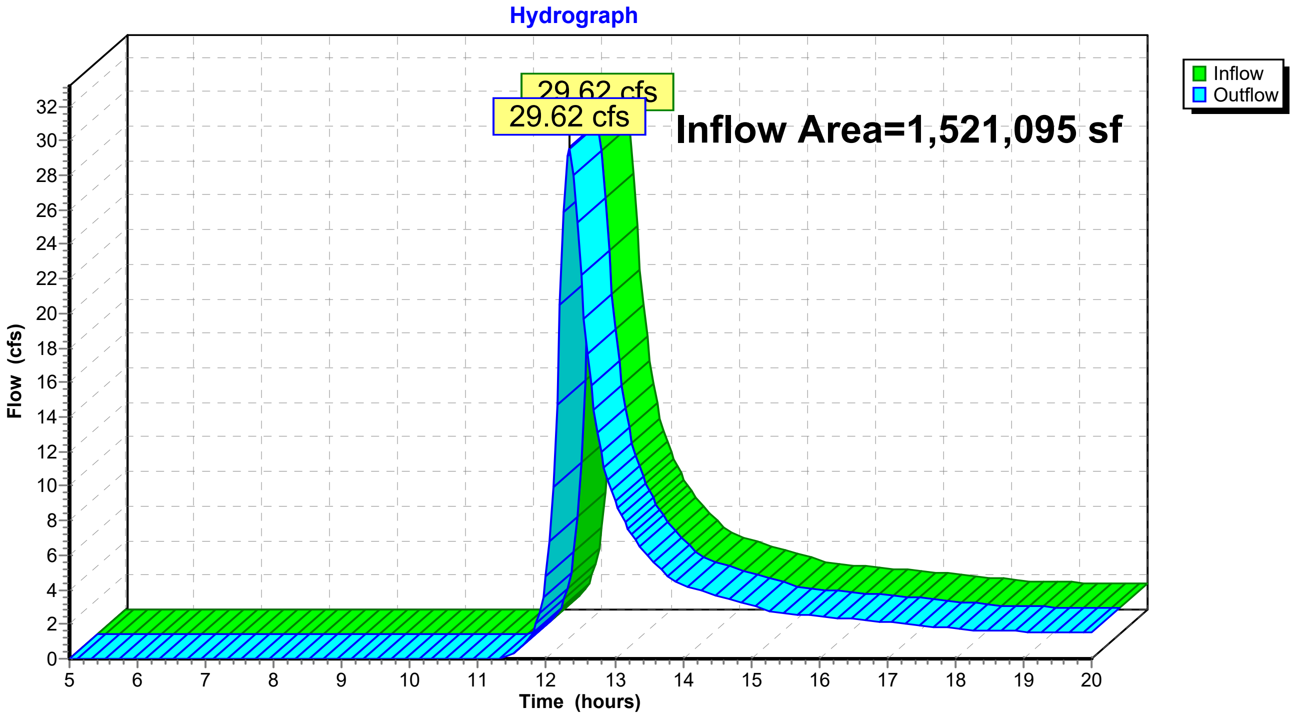


## Summary for Reach 6R: OFFSITE EAST

Inflow Area = 1,521,095 sf, 0.00% Impervious, Inflow Depth > 1.07" for 10-Year event
Inflow = 29.62 cfs @ 12.34 hrs, Volume= 136,108 cf
Outflow = 29.62 cfs @ 12.34 hrs, Volume= 136,108 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 6R: OFFSITE EAST



## Summary for Subcatchment EX-1: TO WETLANDS CENTER

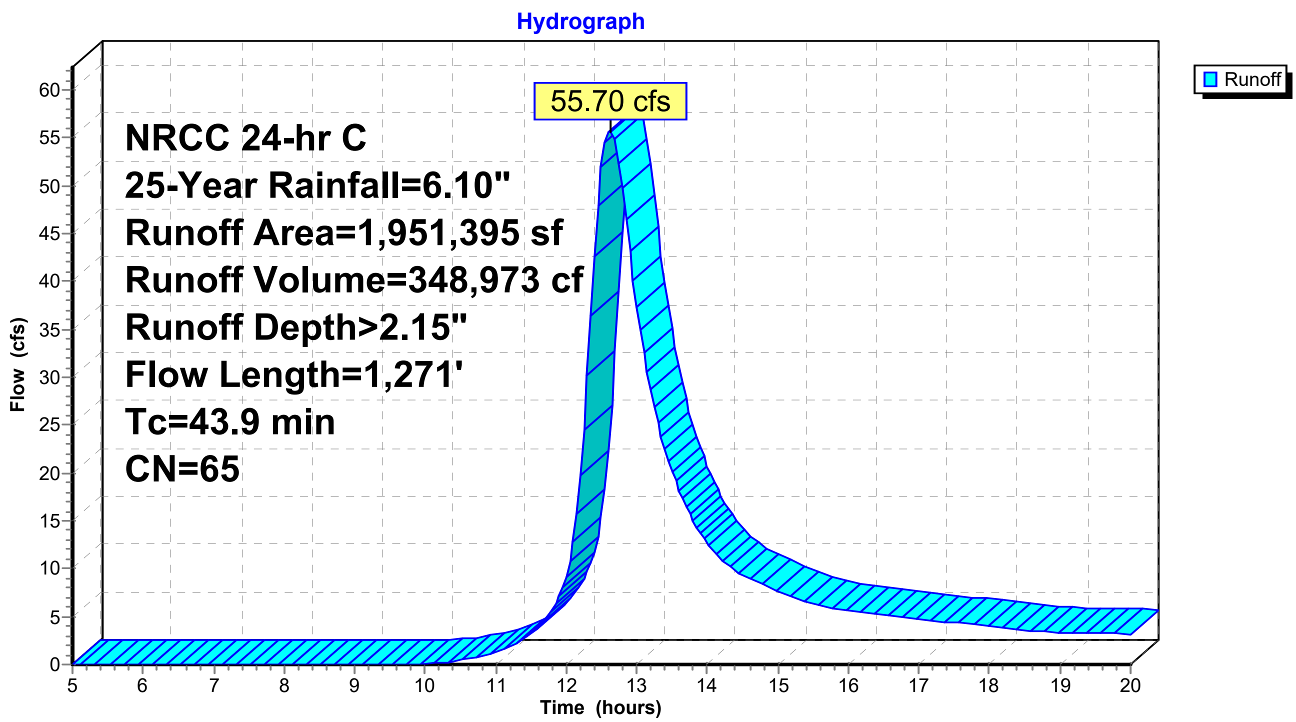
Runoff = 55.70 cfs @ 12.62 hrs, Volume= 348,973 cf, Depth> 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| Area (sf) | CN | Description |
|---|---|---|
| 701,963 | 55 | Woods, Good, HSG B |
| 1,097,460 | 70 | Woods, Good, HSG C |
| 151,972 | 77 | Woods, Good, HSG D |
| 1,951,395 | 65 | Weighted Average |
| 1,951,395 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 22.2 | 50 | 0.0050 | 0.04 | | **Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.00" |
| 9.4 | 505 | 0.0322 | 0.90 | | **Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps |
| 4.8 | 348 | 0.0575 | 1.20 | | **Shallow Concentrated Flow, CD** Woodland Kv= 5.0 fps |
| 7.5 | 368 | 0.0266 | 0.82 | | **Shallow Concentrated Flow, DE** Woodland Kv= 5.0 fps |
| 43.9 | 1,271 | Total | | | |

## Subcatchment EX-1: TO WETLANDS CENTER



## Summary for Subcatchment EX-2: TO OFFSITE EAST

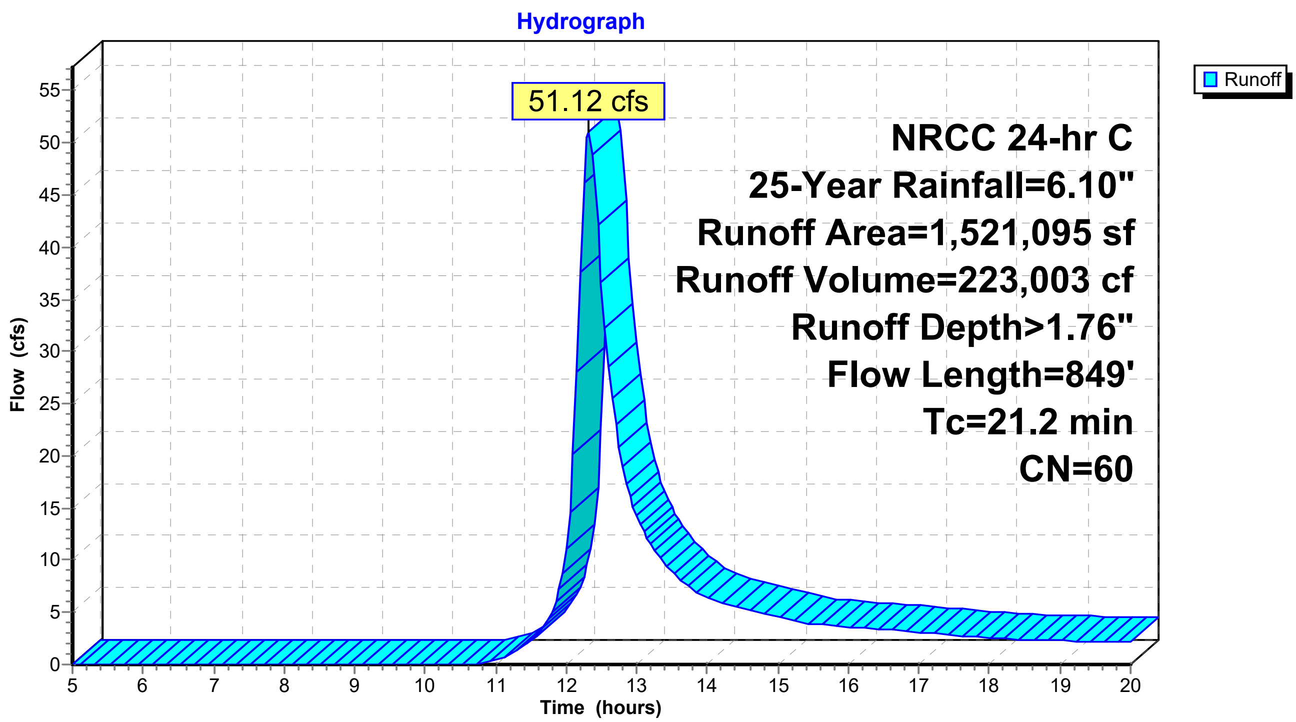
Runoff = 51.12 cfs @ 12.32 hrs, Volume= 223,003 cf, Depth> 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| Area (sf) | CN | Description |
|---|---|---|
| 1,157,041 | 55 | Woods, Good, HSG B |
| 160,428 | 70 | Woods, Good, HSG C |
| 203,626 | 77 | Woods, Good, HSG D |
| 1,521,095 | 60 | Weighted Average |
| 1,521,095 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 9.1 | 50 | 0.0468 | 0.09 | | **Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.00" |
| 3.3 | 217 | 0.0469 | 1.08 | | **Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps |
| 2.1 | 194 | 0.0937 | 1.53 | | **Shallow Concentrated Flow, CD** Woodland Kv= 5.0 fps |
| 6.7 | 388 | 0.0370 | 0.96 | | **Shallow Concentrated Flow, DE** Woodland Kv= 5.0 fps |
| 21.2 | 849 | Total | | | |

## Subcatchment EX-2: TO OFFSITE EAST



## Summary for Subcatchment EX-3A: TO INNOVATION WAY (2009 CITY LAYOUT)

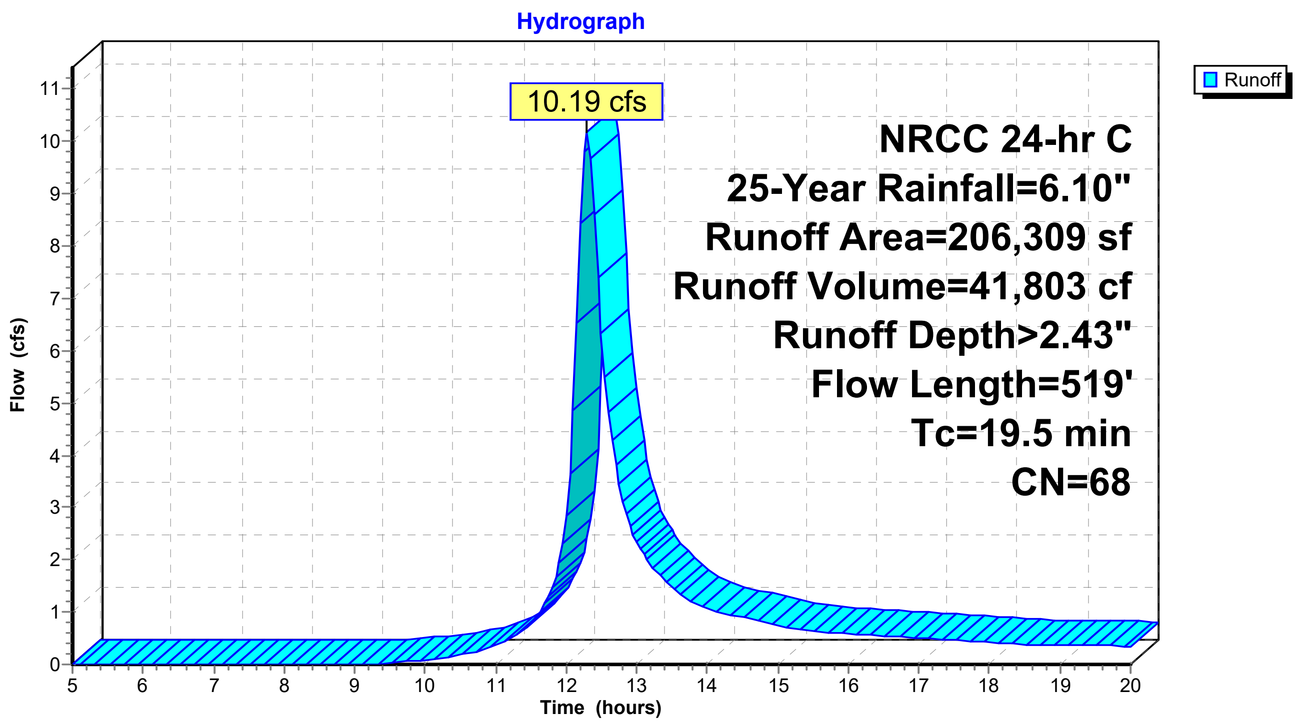
Runoff = 10.19 cfs @ 12.30 hrs, Volume= 41,803 cf, Depth> 2.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| Area (sf) | CN | Description |
|---|---|---|
| 176,066 | 70 | Woods, Good, HSG C |
| 30,243 | 55 | Woods, Good, HSG B |
| 206,309 | 68 | Weighted Average |
| 206,309 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.6 | 50 | 0.0314 | 0.08 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 8.9 | 469 | 0.0307 | 0.88 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 19.5 | 519 | Total | | | |

### Subcatchment EX-3A: TO INNOVATION WAY (2009 CITY LAYOUT)



## Summary for Subcatchment EX-3B: TO INNOVATION WAY (2009 SHLO)

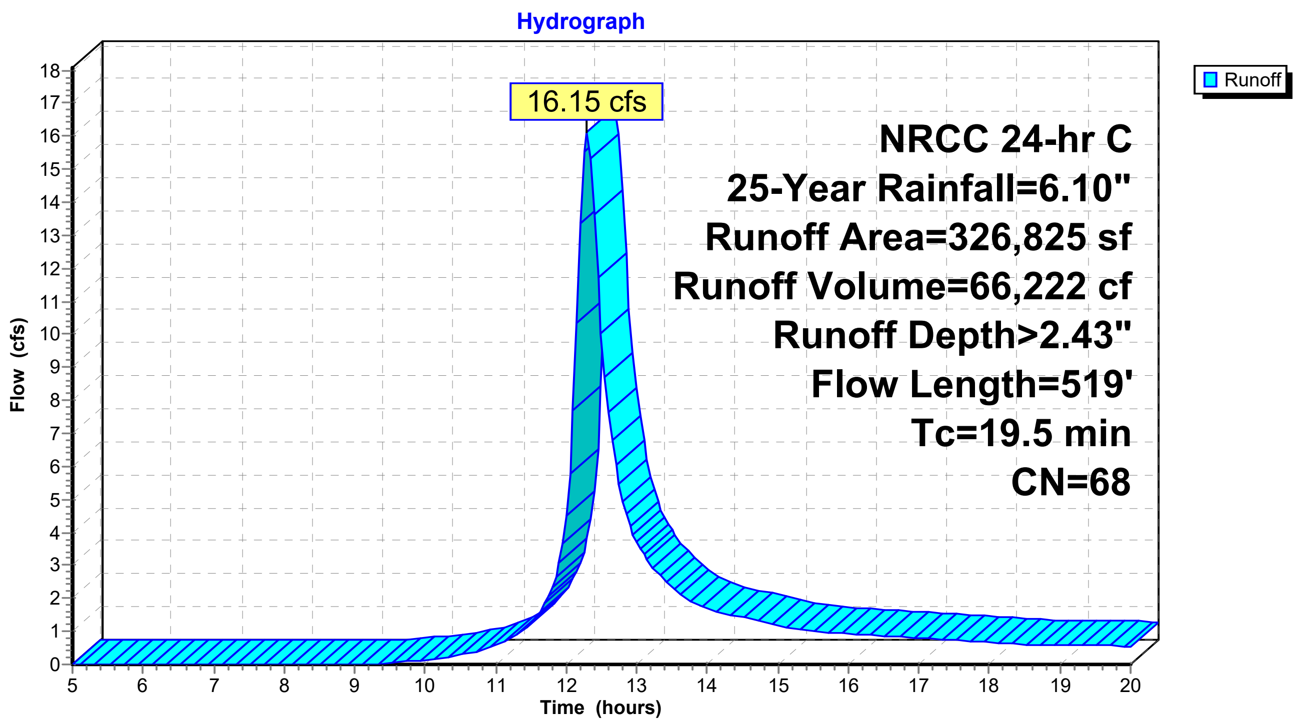
Runoff = 16.15 cfs @ 12.30 hrs, Volume= 66,222 cf, Depth> 2.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| Area (sf) | CN | Description |
|---|---|---|
| 276,529 | 70 | Woods, Good, HSG C |
| 50,296 | 55 | Woods, Good, HSG B |
| 326,825 | 68 | Weighted Average |
| 326,825 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.6 | 50 | 0.0314 | 0.08 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 8.9 | 469 | 0.0307 | 0.88 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 19.5 | 519 | Total | | | |

### Subcatchment EX-3B: TO INNOVATION WAY (2009 SHLO)



## Summary for Subcatchment EX-4: TO OFFSITE SOUTH

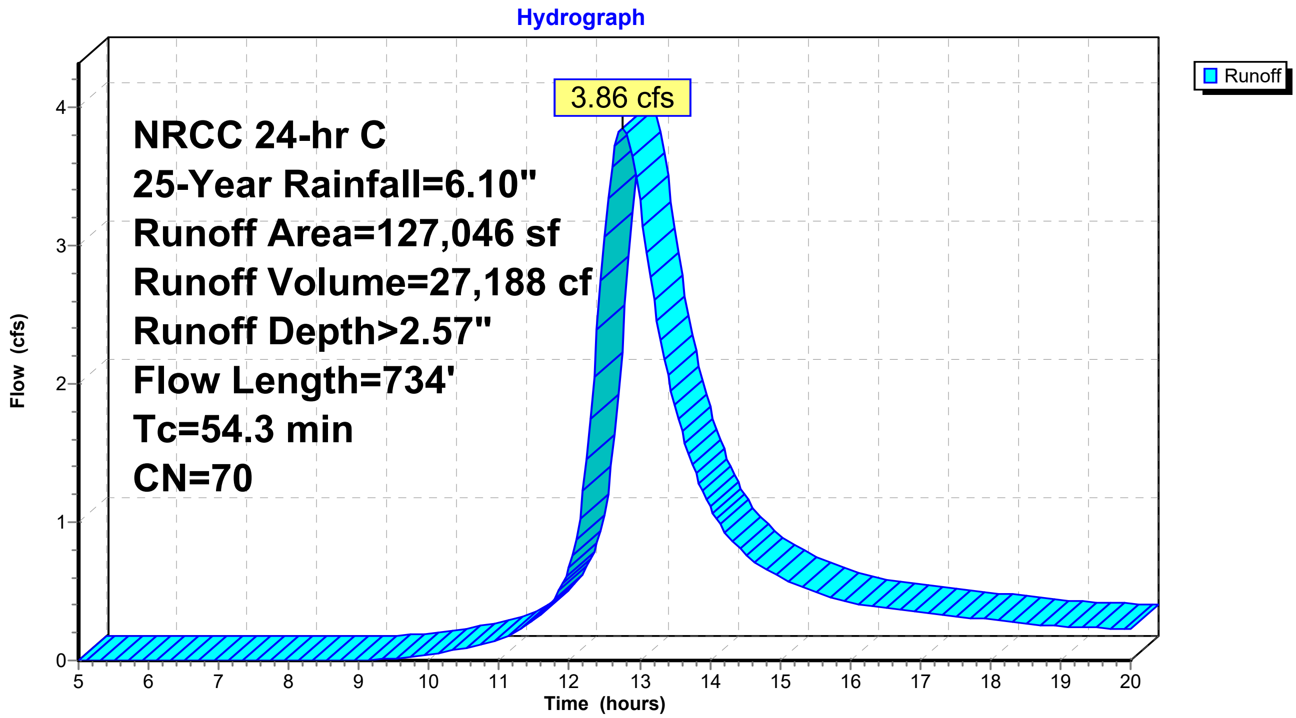
Runoff = 3.86 cfs @ 12.75 hrs, Volume= 27,188 cf, Depth> 2.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| Area (sf) | CN | Description |
|---|---|---|
| 127,046 | 70 | Woods, Good, HSG C |
| 127,046 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 39.3 | 50 | 0.0012 | 0.02 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 11.8 | 475 | 0.0180 | 0.67 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 1.4 | 114 | 0.0705 | 1.33 | | **Shallow Concentrated Flow, CD**<br>Woodland Kv= 5.0 fps |
| 1.8 | 95 | 0.0317 | 0.89 | | **Shallow Concentrated Flow, DE**<br>Woodland Kv= 5.0 fps |
| 54.3 | 734 | Total | | | |

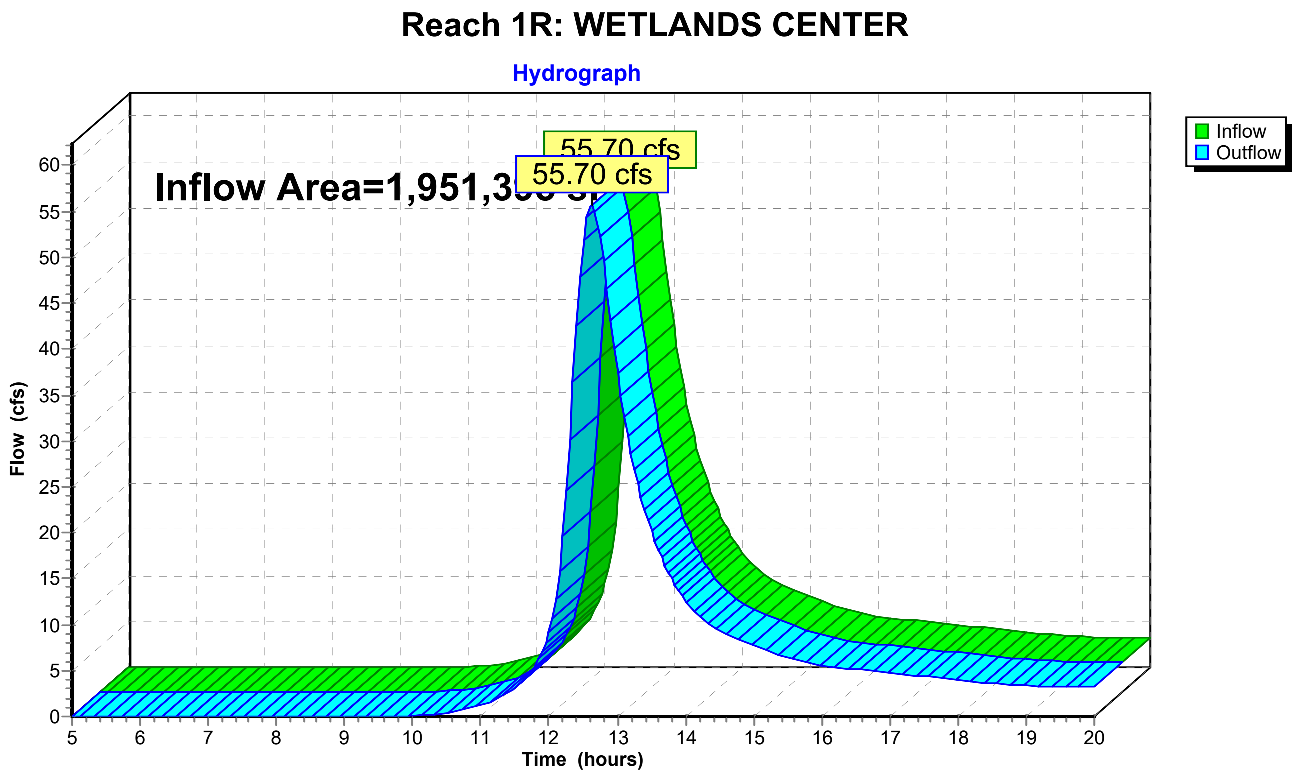
## Subcatchment EX-4: TO OFFSITE SOUTH



## Summary for Reach 1R: WETLANDS CENTER

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 1,951,395 sf, | 0.00% Impervious, | Inflow Depth > 2.15" | for 25-Year event |
| Inflow = | 55.70 cfs @ | 12.62 hrs, Volume= | 348,973 cf | |
| Outflow = | 55.70 cfs @ | 12.62 hrs, Volume= | 348,973 cf, Atten= 0%, Lag= 0.0 min | |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

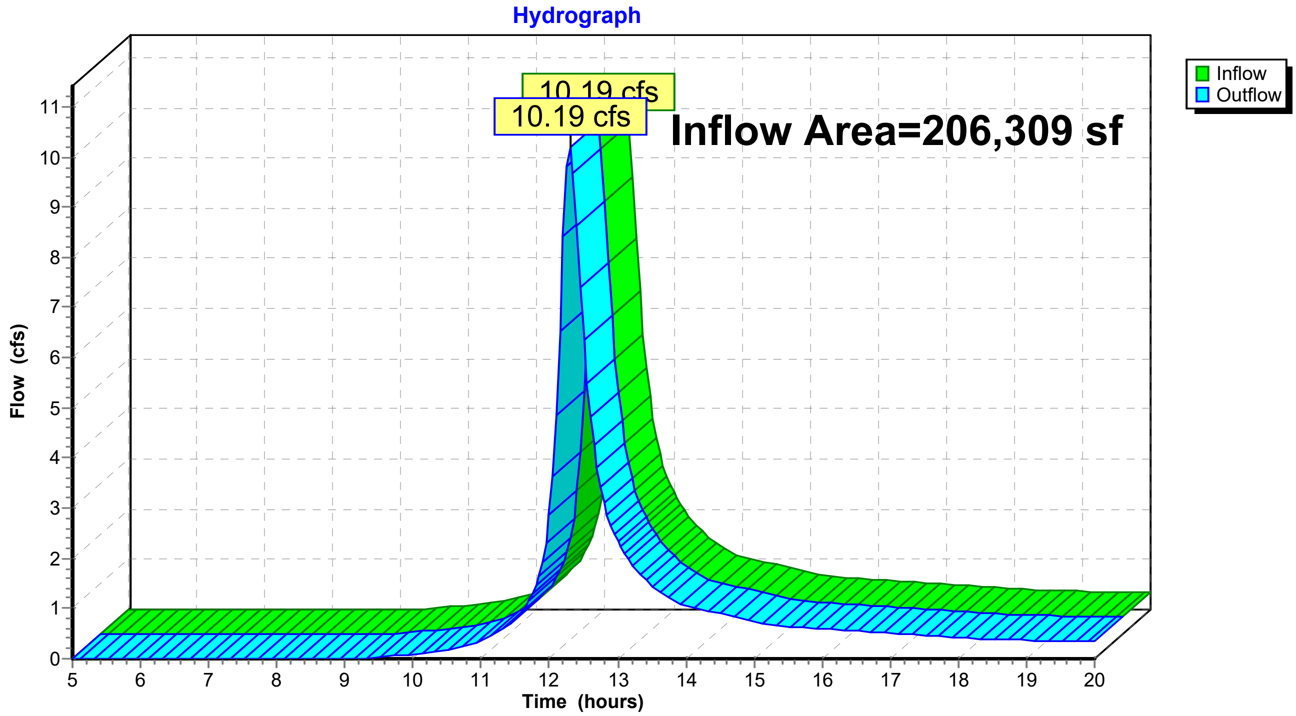


## Summary for Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

Inflow Area = 206,309 sf, 0.00% Impervious, Inflow Depth > 2.43" for 25-Year event
Inflow = 10.19 cfs @ 12.30 hrs, Volume= 41,803 cf
Outflow = 10.19 cfs @ 12.30 hrs, Volume= 41,803 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

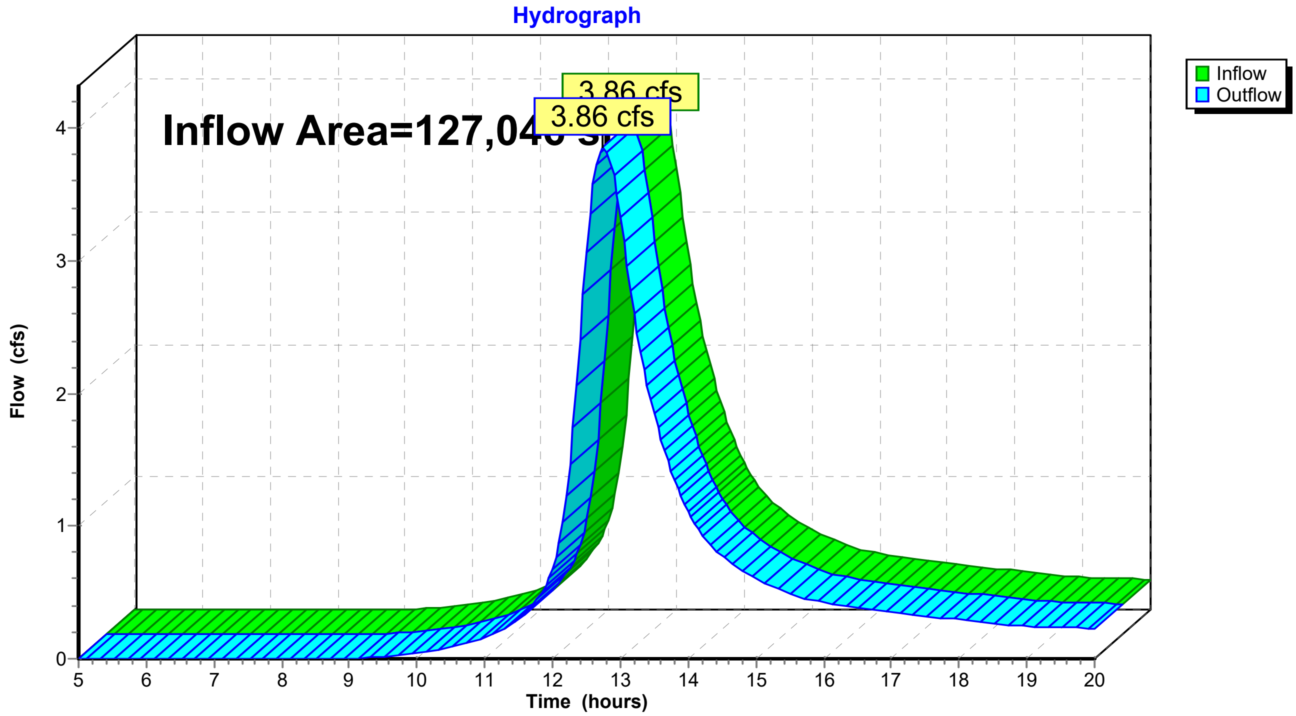


## Summary for Reach 3R: OFFSITE SOUTH

Inflow Area = 127,046 sf, 0.00% Impervious, Inflow Depth > 2.57" for 25-Year event
Inflow = 3.86 cfs @ 12.75 hrs, Volume= 27,188 cf
Outflow = 3.86 cfs @ 12.75 hrs, Volume= 27,188 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

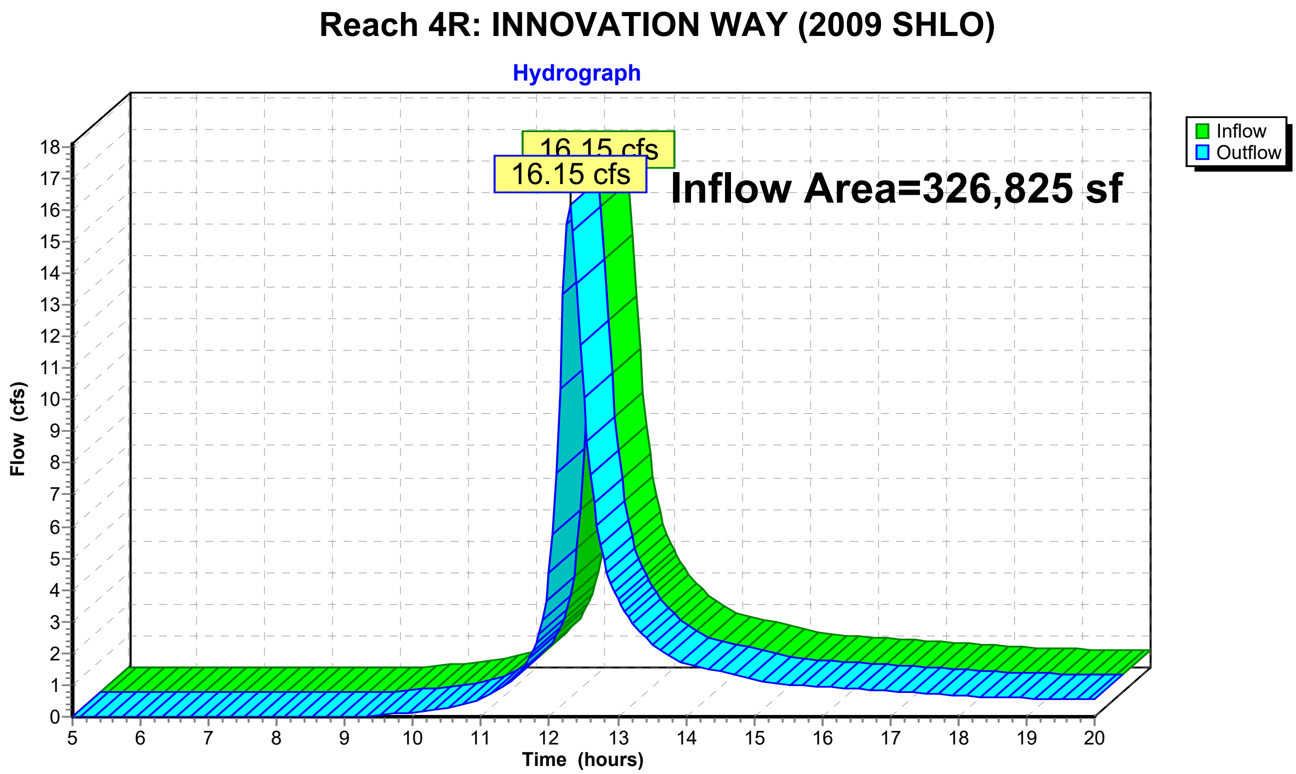
### Reach 3R: OFFSITE SOUTH



## Summary for Reach 4R: INNOVATION WAY (2009 SHLO)

Inflow Area = 326,825 sf, 0.00% Impervious, Inflow Depth > 2.43" for 25-Year event
Inflow = 16.15 cfs @ 12.30 hrs, Volume= 66,222 cf
Outflow = 16.15 cfs @ 12.30 hrs, Volume= 66,222 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

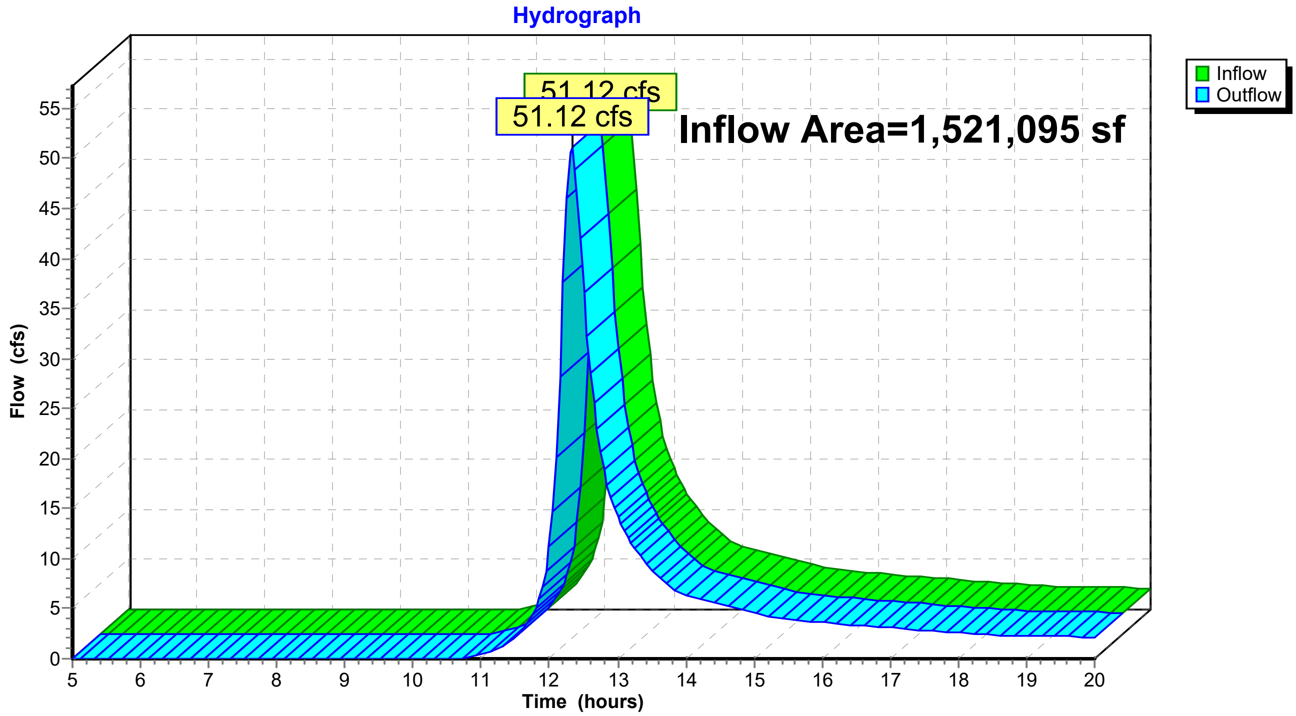


## Summary for Reach 6R: OFFSITE EAST

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 1,521,095 sf, | 0.00% Impervious, | Inflow Depth > 1.76" | for 25-Year event | |
| Inflow = | 51.12 cfs @ | 12.32 hrs, | Volume= | 223,003 cf | |
| Outflow = | 51.12 cfs @ | 12.32 hrs, | Volume= | 223,003 cf, | Atten= 0%, Lag= 0.0 min |

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 6R: OFFSITE EAST



## Summary for Subcatchment EX-1: TO WETLANDS CENTER

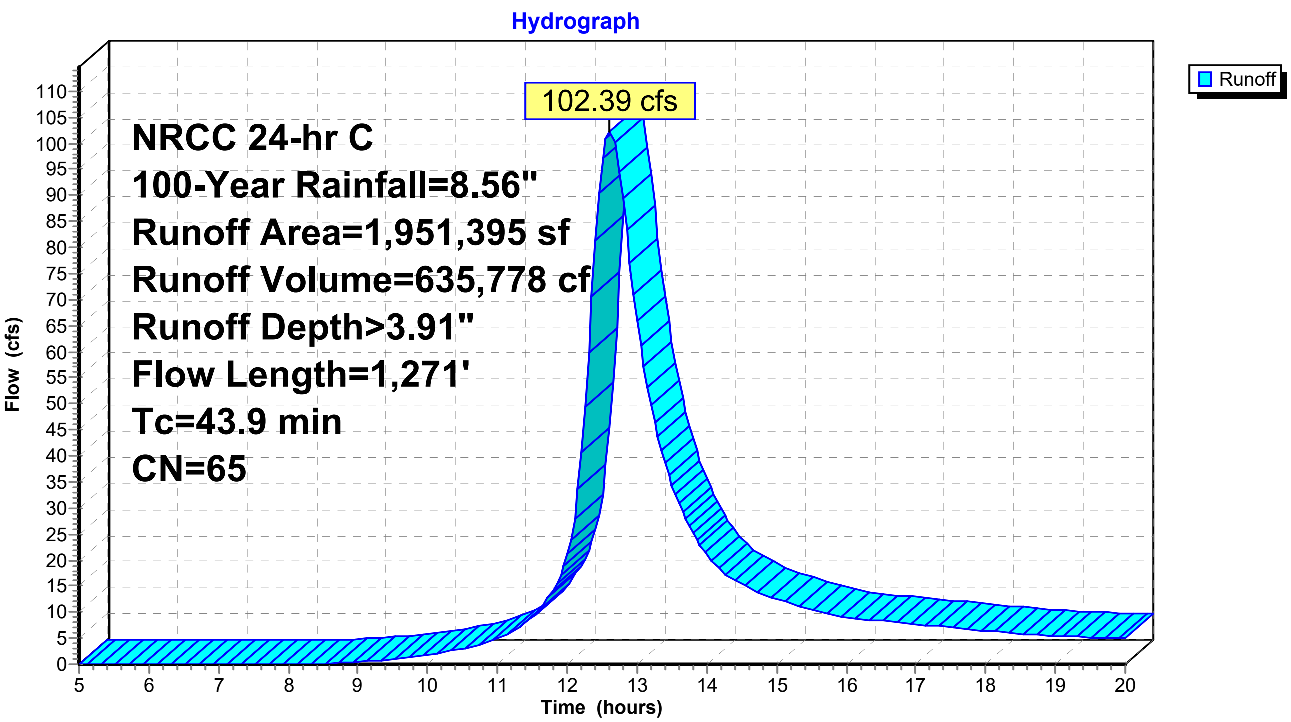
Runoff = 102.39 cfs @ 12.61 hrs, Volume= 635,778 cf, Depth> 3.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| Area (sf) | CN | Description |
|---|---|---|
| 701,963 | 55 | Woods, Good, HSG B |
| 1,097,460 | 70 | Woods, Good, HSG C |
| 151,972 | 77 | Woods, Good, HSG D |
| 1,951,395 | 65 | Weighted Average |
| 1,951,395 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 22.2 | 50 | 0.0050 | 0.04 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 9.4 | 505 | 0.0322 | 0.90 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 4.8 | 348 | 0.0575 | 1.20 | | **Shallow Concentrated Flow, CD**<br>Woodland Kv= 5.0 fps |
| 7.5 | 368 | 0.0266 | 0.82 | | **Shallow Concentrated Flow, DE**<br>Woodland Kv= 5.0 fps |
| 43.9 | 1,271 | Total | | | |

## Subcatchment EX-1: TO WETLANDS CENTER



## Summary for Subcatchment EX-2: TO OFFSITE EAST

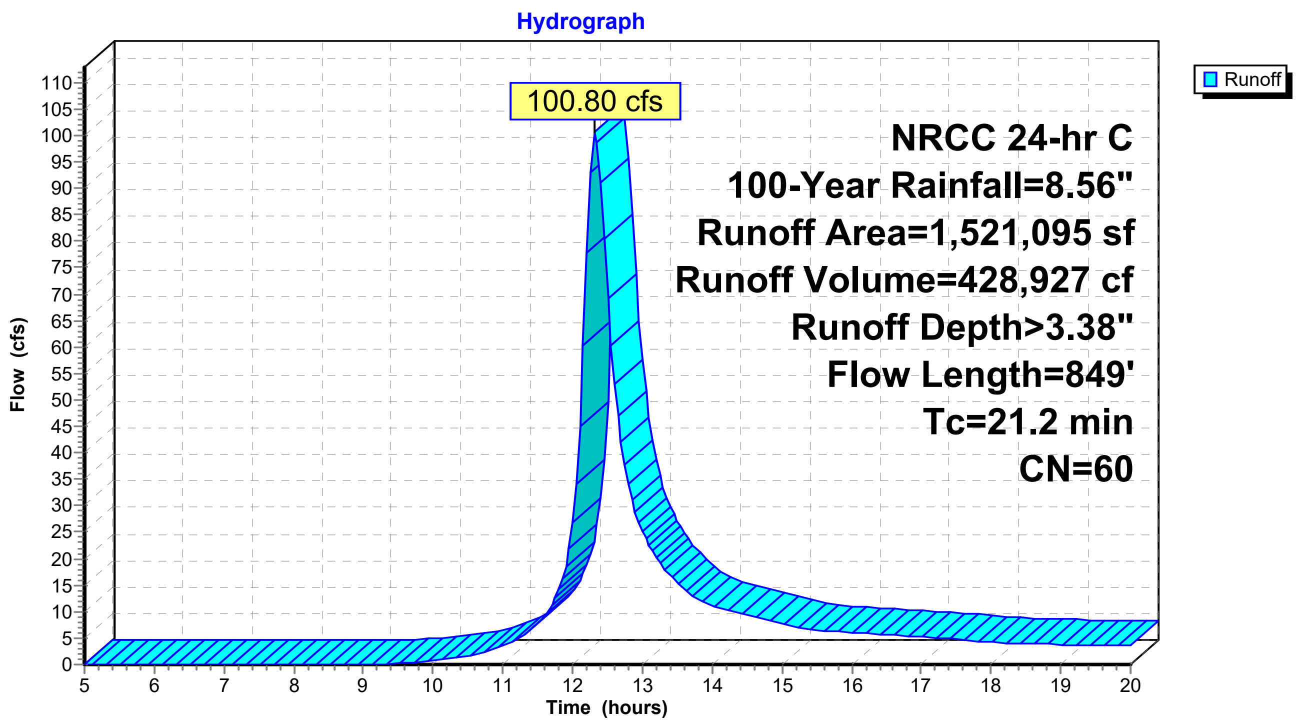
Runoff = 100.80 cfs @ 12.32 hrs, Volume= 428,927 cf, Depth> 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| Area (sf) | CN | Description |
|---|---|---|
| 1,157,041 | 55 | Woods, Good, HSG B |
| 160,428 | 70 | Woods, Good, HSG C |
| 203,626 | 77 | Woods, Good, HSG D |
| 1,521,095 | 60 | Weighted Average |
| 1,521,095 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 9.1 | 50 | 0.0468 | 0.09 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 3.3 | 217 | 0.0469 | 1.08 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 2.1 | 194 | 0.0937 | 1.53 | | **Shallow Concentrated Flow, CD**<br>Woodland Kv= 5.0 fps |
| 6.7 | 388 | 0.0370 | 0.96 | | **Shallow Concentrated Flow, DE**<br>Woodland Kv= 5.0 fps |
| 21.2 | 849 | Total | | | |

## Subcatchment EX-2: TO OFFSITE EAST



## Summary for Subcatchment EX-3A: TO INNOVATION WAY (2009 CITY LAYOUT)

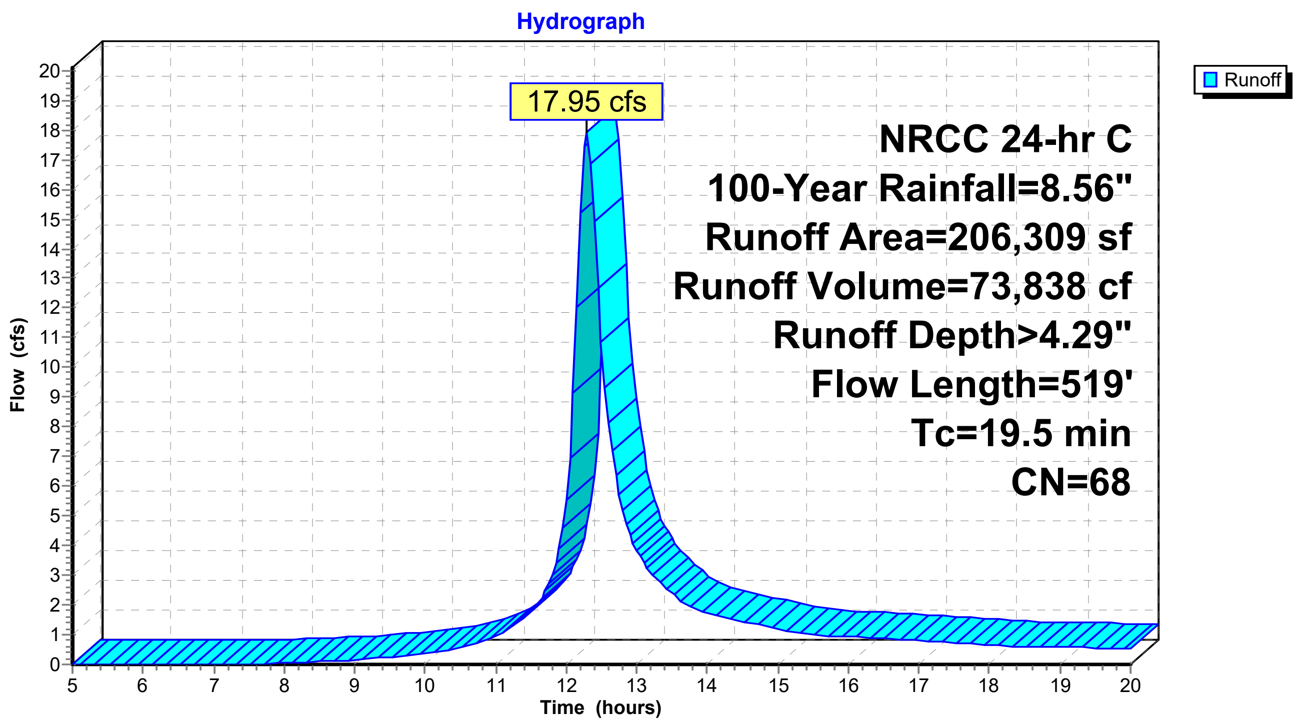
Runoff = 17.95 cfs @ 12.29 hrs, Volume= 73,838 cf, Depth> 4.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| Area (sf) | CN | Description |
|---|---|---|
| 176,066 | 70 | Woods, Good, HSG C |
| 30,243 | 55 | Woods, Good, HSG B |
| 206,309 | 68 | Weighted Average |
| 206,309 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.6 | 50 | 0.0314 | 0.08 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 8.9 | 469 | 0.0307 | 0.88 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 19.5 | 519 | Total | | | |

### Subcatchment EX-3A: TO INNOVATION WAY (2009 CITY LAYOUT)



## Summary for Subcatchment EX-3B: TO INNOVATION WAY (2009 SHLO)

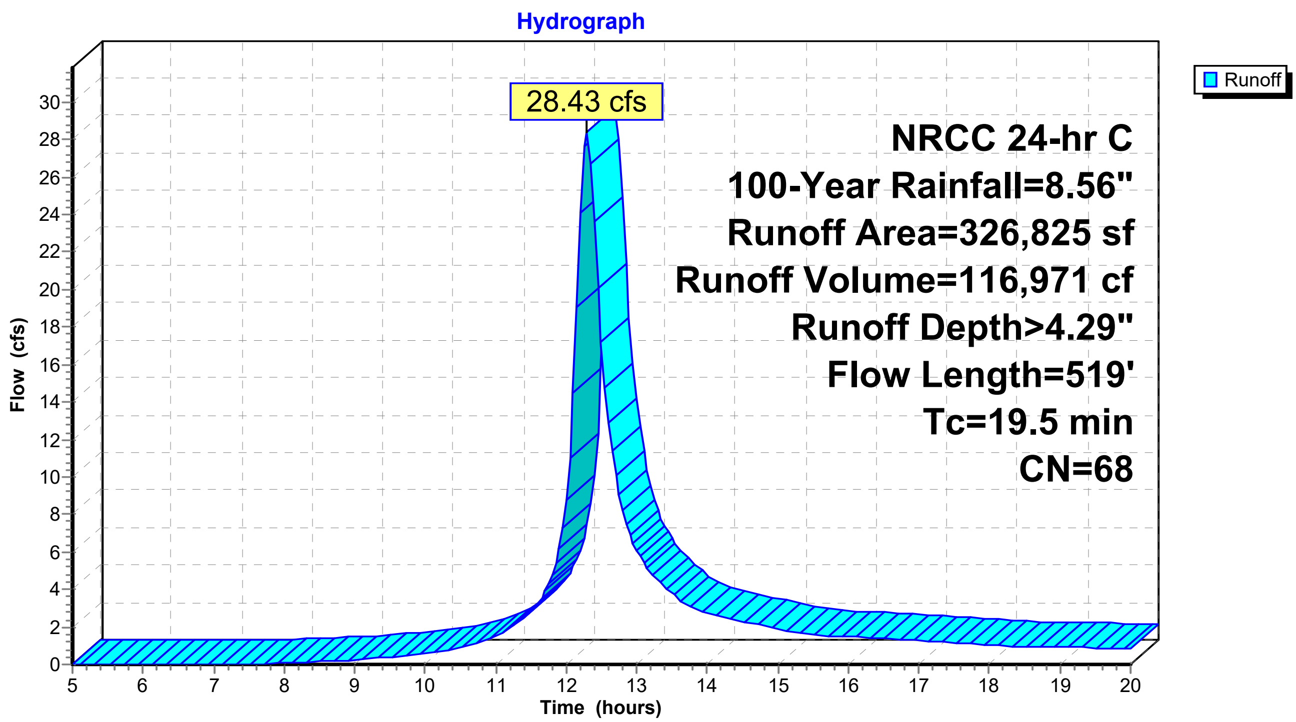
Runoff = 28.43 cfs @ 12.29 hrs, Volume= 116,971 cf, Depth> 4.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| Area (sf) | CN | Description |
|---|---|---|
| 276,529 | 70 | Woods, Good, HSG C |
| 50,296 | 55 | Woods, Good, HSG B |
| 326,825 | 68 | Weighted Average |
| 326,825 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 10.6 | 50 | 0.0314 | 0.08 | | **Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.00" |
| 8.9 | 469 | 0.0307 | 0.88 | | **Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps |
| 19.5 | 519 | Total | | | |

## Subcatchment EX-3B: TO INNOVATION WAY (2009 SHLO)



## Summary for Subcatchment EX-4: TO OFFSITE SOUTH

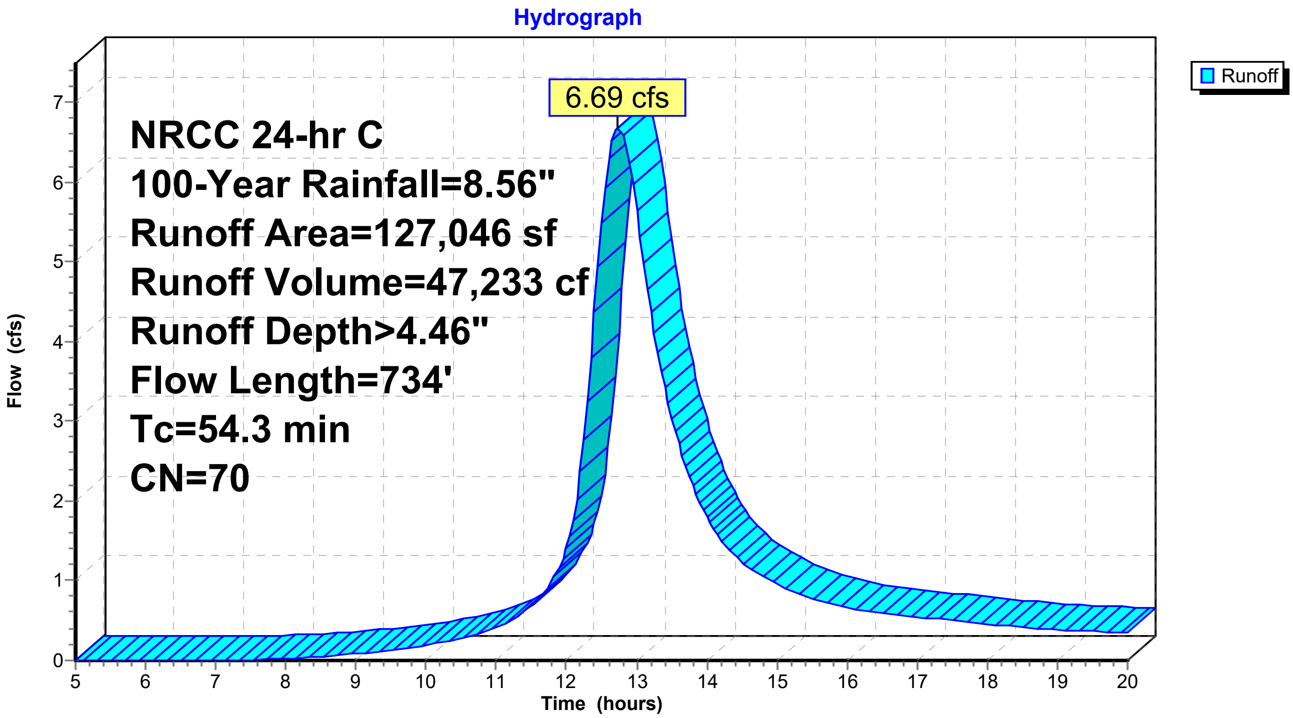
Runoff = 6.69 cfs @ 12.74 hrs, Volume= 47,233 cf, Depth> 4.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| Area (sf) | CN | Description |
|---|---|---|
| 127,046 | 70 | Woods, Good, HSG C |
| 127,046 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 39.3 | 50 | 0.0012 | 0.02 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 11.8 | 475 | 0.0180 | 0.67 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 1.4 | 114 | 0.0705 | 1.33 | | **Shallow Concentrated Flow, CD**<br>Woodland Kv= 5.0 fps |
| 1.8 | 95 | 0.0317 | 0.89 | | **Shallow Concentrated Flow, DE**<br>Woodland Kv= 5.0 fps |
| 54.3 | 734 | Total | | | |

## Subcatchment EX-4: TO OFFSITE SOUTH

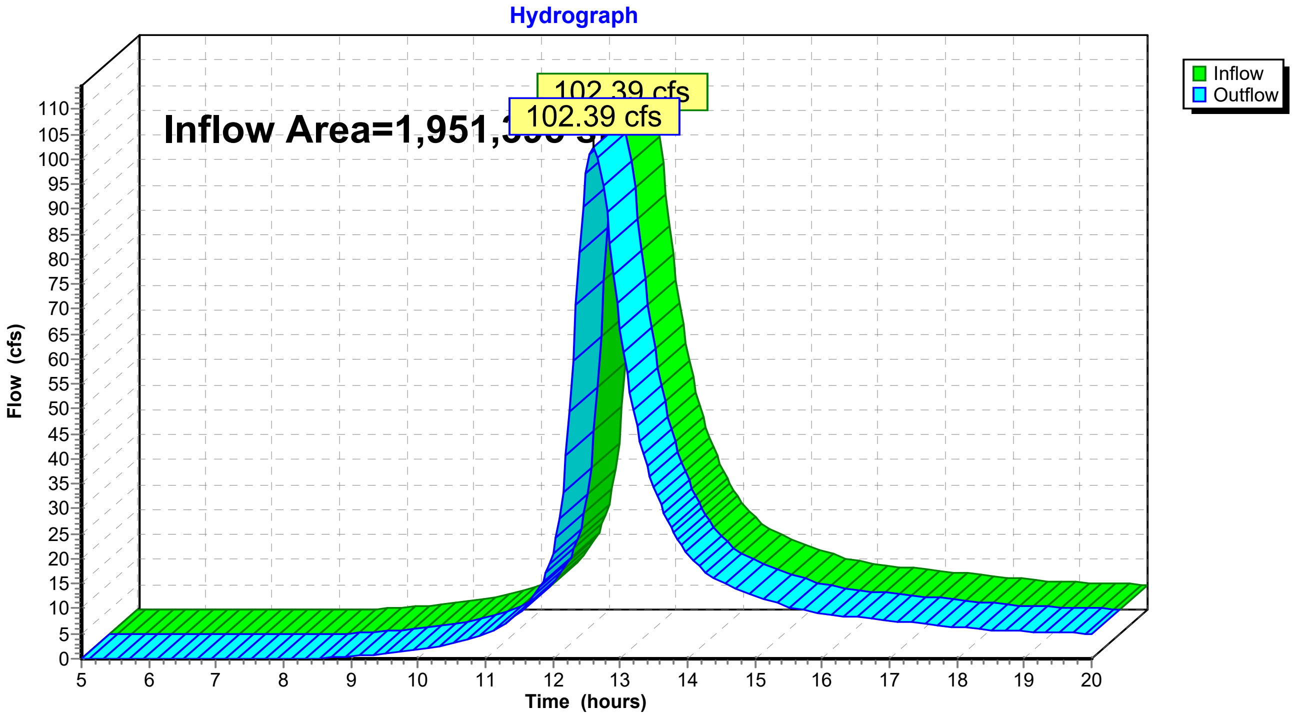


## Summary for Reach 1R: WETLANDS CENTER

Inflow Area = 1,951,395 sf, 0.00% Impervious, Inflow Depth > 3.91" for 100-Year event
Inflow = 102.39 cfs @ 12.61 hrs, Volume= 635,778 cf
Outflow = 102.39 cfs @ 12.61 hrs, Volume= 635,778 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

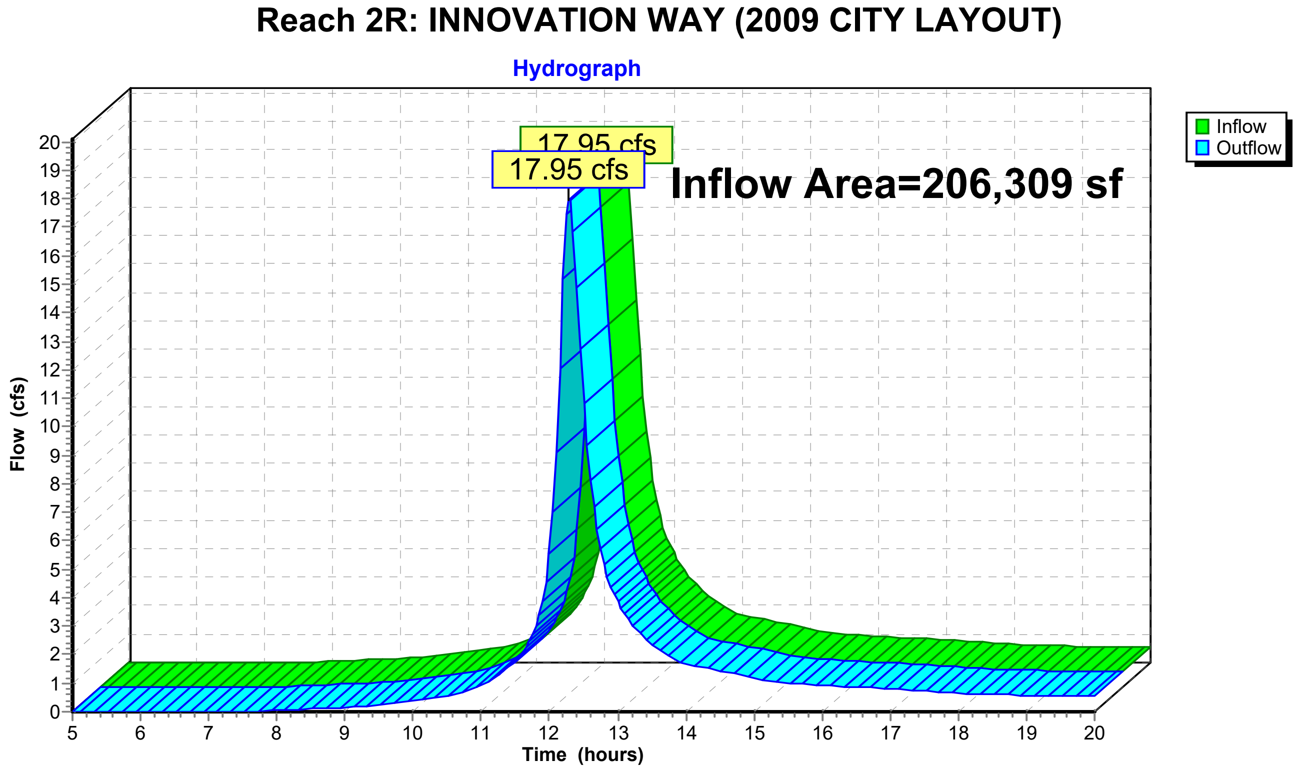
### Reach 1R: WETLANDS CENTER



## Summary for Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

Inflow Area = 206,309 sf, 0.00% Impervious, Inflow Depth > 4.29" for 100-Year event
Inflow = 17.95 cfs @ 12.29 hrs, Volume= 73,838 cf
Outflow = 17.95 cfs @ 12.29 hrs, Volume= 73,838 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

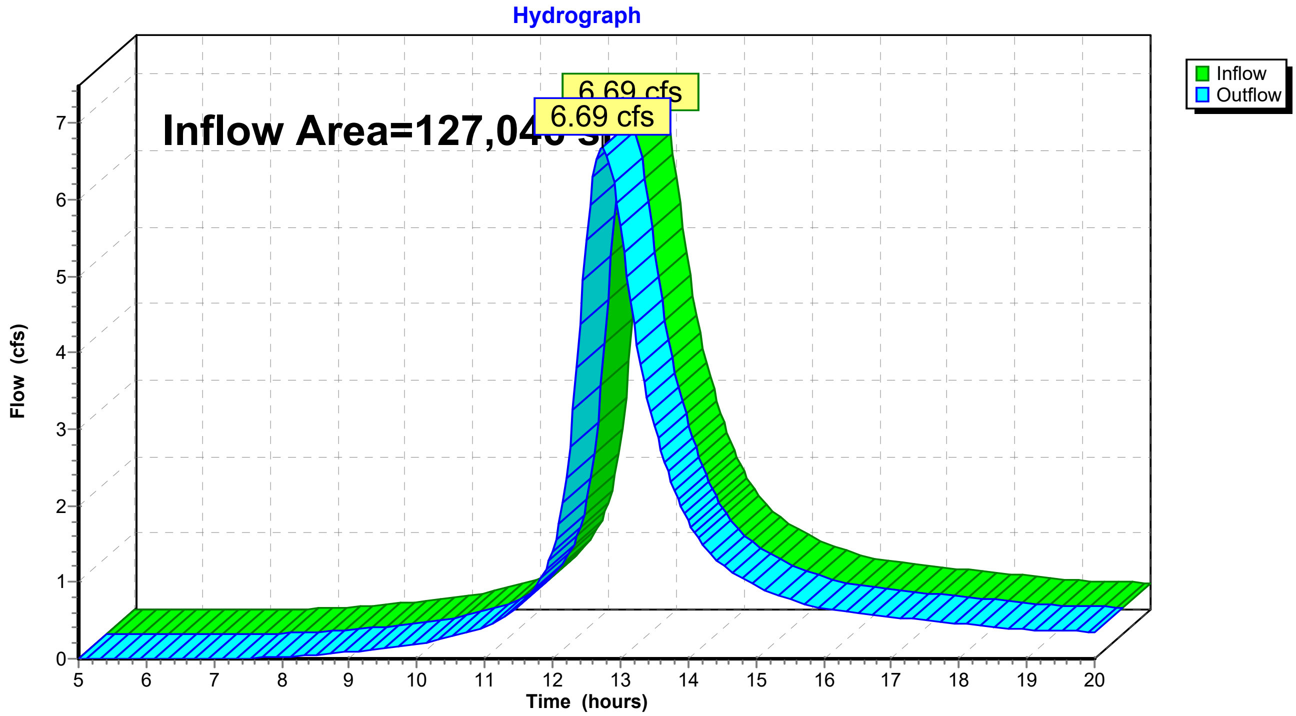


## Summary for Reach 3R: OFFSITE SOUTH

Inflow Area = 127,046 sf, 0.00% Impervious, Inflow Depth > 4.46" for 100-Year event
Inflow = 6.69 cfs @ 12.74 hrs, Volume= 47,233 cf
Outflow = 6.69 cfs @ 12.74 hrs, Volume= 47,233 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Reach 3R: OFFSITE SOUTH

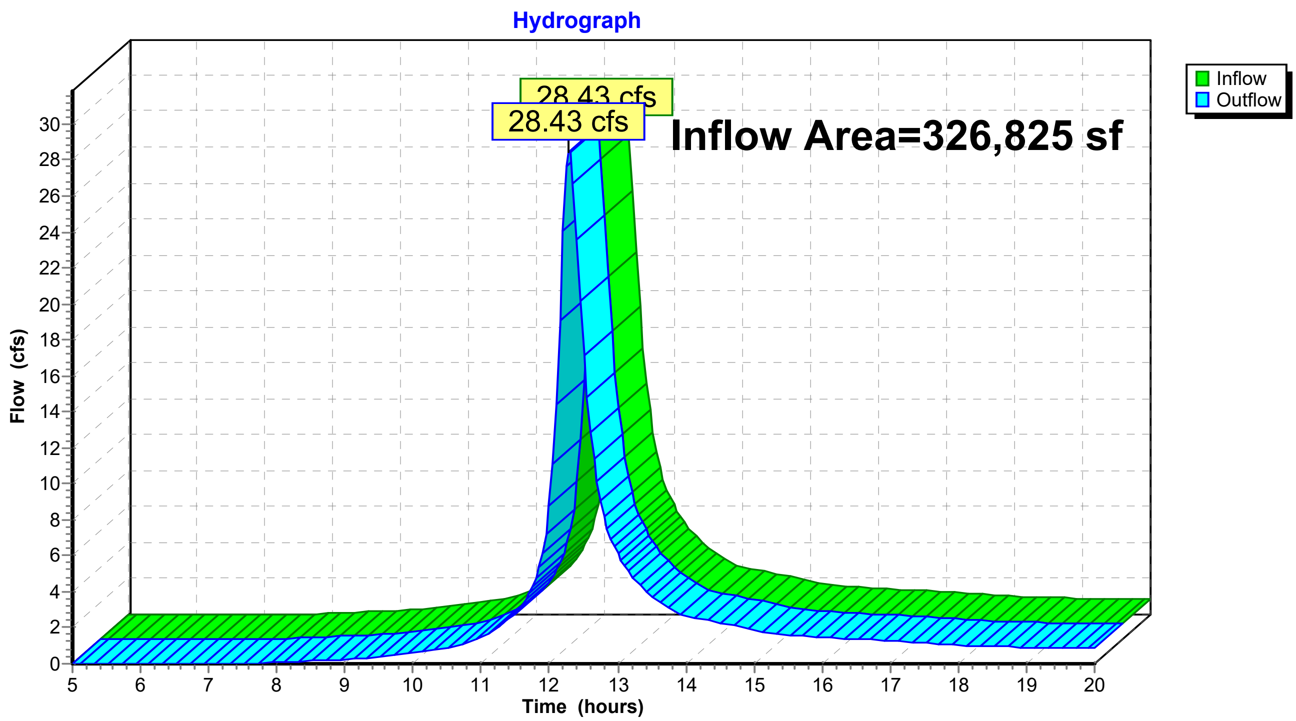


## Summary for Reach 4R: INNOVATION WAY (2009 SHLO)

Inflow Area = 326,825 sf, 0.00% Impervious, Inflow Depth > 4.29" for 100-Year event
Inflow = 28.43 cfs @ 12.29 hrs, Volume= 116,971 cf
Outflow = 28.43 cfs @ 12.29 hrs, Volume= 116,971 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

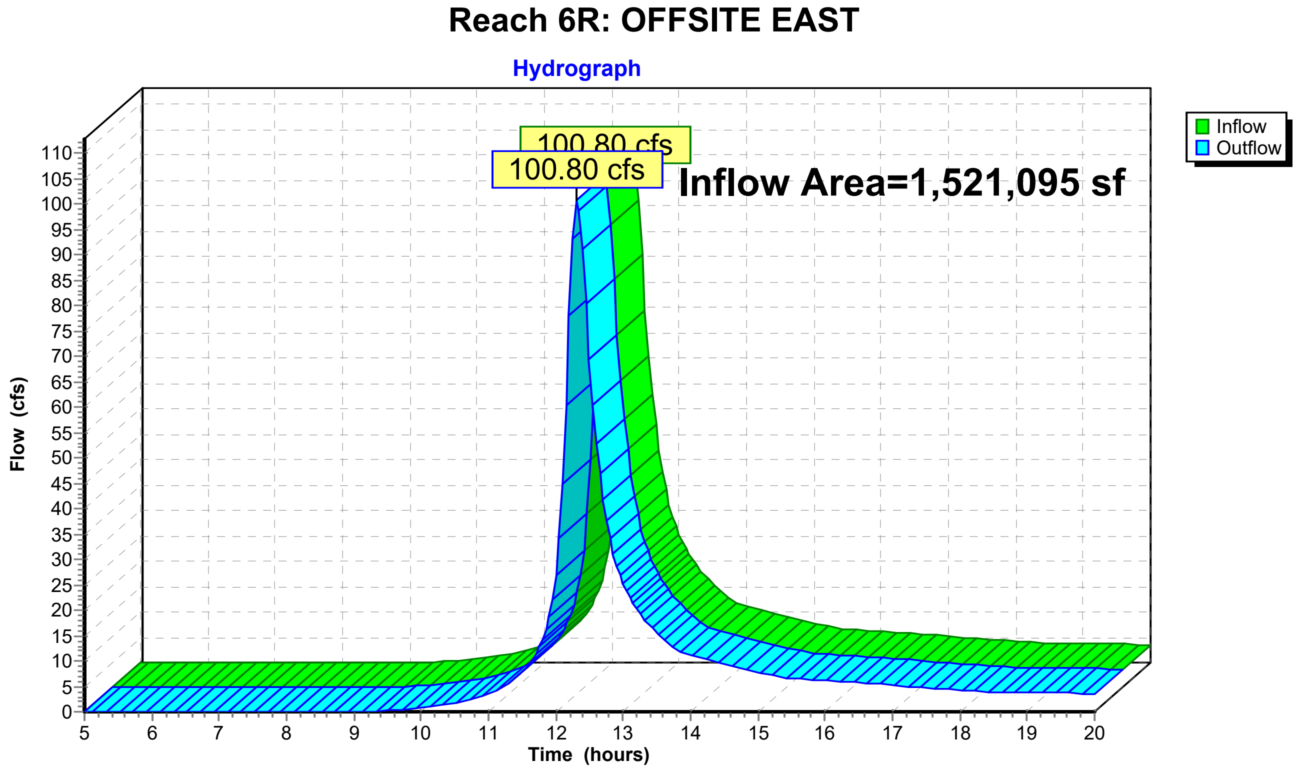
### Reach 4R: INNOVATION WAY (2009 SHLO)



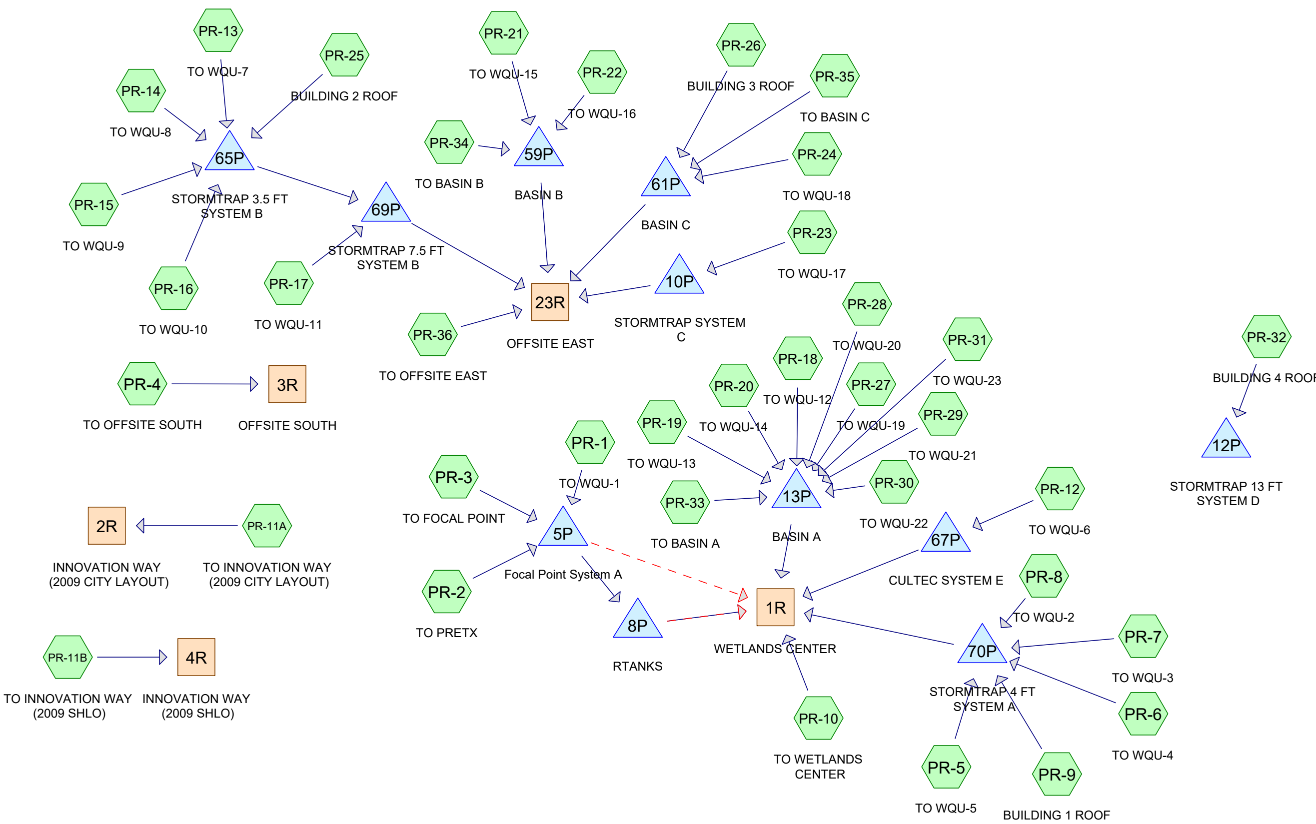
## Summary for Reach 6R: OFFSITE EAST

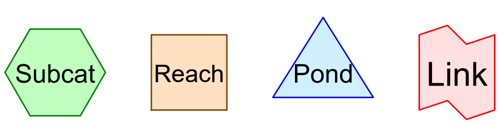
Inflow Area = 1,521,095 sf, 0.00% Impervious, Inflow Depth > 3.38" for 100-Year event
Inflow = 100.80 cfs @ 12.32 hrs, Volume= 428,927 cf
Outflow = 100.80 cfs @ 12.32 hrs, Volume= 428,927 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



# Post-Development HydroCAD Analysis




**Routing Diagram for 2021-036 POST-MASTER-REV2**
Prepared by MBL LAND DEVELOPMENT & PERMITTING CORP., Printed 11/22/2022
HydroCAD® 10.10-5a s/n 09450 © 2020 HydroCAD Software Solutions LLC

## Area Listing (all nodes)

| Area (sq-ft) | CN | Description (subcatchment-numbers) |
|---:|---:|---|
| 384,179 | 61 | >75% Grass cover, Good, HSG B (PR-10, PR-13, PR-14, PR-15, PR-16, PR-27, PR-28, PR-33, PR-34, PR-35, PR-36) |
| 423,241 | 74 | >75% Grass cover, Good, HSG C (PR-1, PR-10, PR-11A, PR-11B, PR-12, PR-17, PR-18, PR-19, PR-2, PR-20, PR-21, PR-22, PR-23, PR-24, PR-3, PR-35, PR-36, PR-4, PR-5, PR-6, PR-8) |
| 21,174 | 80 | >75% Grass cover, Good, HSG D (PR-28, PR-29, PR-30, PR-31, PR-36) |
| 1,922,940 | 98 | IMPERVIOUS (PR-1, PR-12, PR-13, PR-14, PR-15, PR-16, PR-17, PR-18, PR-19, PR-2, PR-20, PR-21, PR-22, PR-23, PR-24, PR-25, PR-26, PR-27, PR-28, PR-29, PR-3, PR-30, PR-31, PR-32, PR-5, PR-6, PR-7, PR-8, PR-9) |
| 741 | 70 | IMPERVIOUS (PR-11A) |
| 845,063 | 55 | Woods, Good, HSG B (PR-10, PR-28, PR-34, PR-36) |
| 293,905 | 70 | Woods, Good, HSG C (PR-10, PR-11B, PR-36, PR-4) |
| 241,427 | 77 | Woods, Good, HSG D (PR-10, PR-36) |
| **4,132,670** | **80** | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (sq-ft) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0 | HSG A | |
| 1,229,242 | HSG B | PR-10, PR-13, PR-14, PR-15, PR-16, PR-27, PR-28, PR-33, PR-34, PR-35, PR-36 |
| 717,146 | HSG C | PR-1, PR-10, PR-11A, PR-11B, PR-12, PR-17, PR-18, PR-19, PR-2, PR-20, PR-21, PR-22, PR-23, PR-24, PR-3, PR-35, PR-36, PR-4, PR-5, PR-6, PR-8 |
| 262,601 | HSG D | PR-10, PR-28, PR-29, PR-30, PR-31, PR-36 |
| 1,923,681 | Other | PR-1, PR-11A, PR-12, PR-13, PR-14, PR-15, PR-16, PR-17, PR-18, PR-19, PR-2, PR-20, PR-21, PR-22, PR-23, PR-24, PR-25, PR-26, PR-27, PR-28, PR-29, PR-3, PR-30, PR-31, PR-32, PR-5, PR-6, PR-7, PR-8, PR-9 |
| **4,132,670** | | **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 Num |
|---|---|---|---|---|---|---|---|
| 0 | 384,179 | 423,241 | 21,174 | 0 | 828,594 | >75% Grass cover, Good | |
| 0 | 0 | 0 | 0 | 1,923,681 | 1,923,681 | IMPERVIOUS | |
| 0 | 845,063 | 293,905 | 241,427 | 0 | 1,380,395 | Woods, Good | |
| **0** | **1,229,242** | **717,146** | **262,601** | **1,923,681** | **4,132,670** | **TOTAL AREA** | |

## Summary for Subcatchment PR-1: TO WQU-1

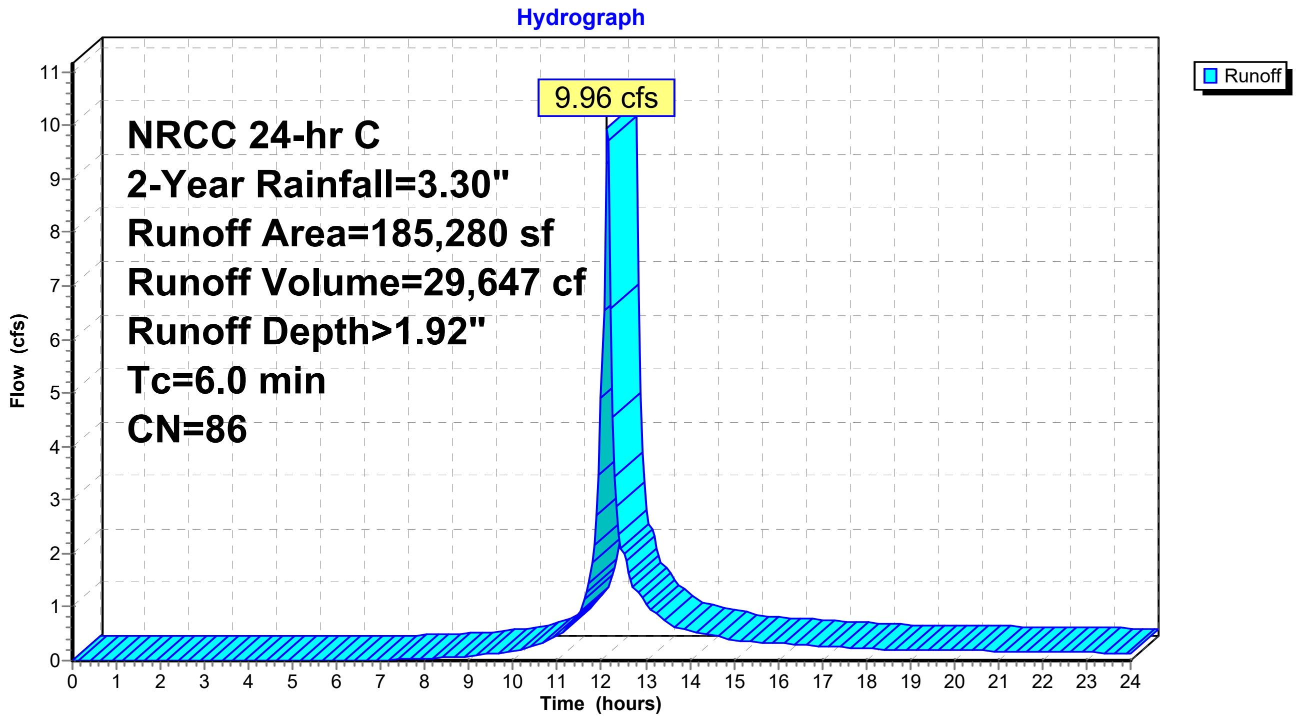
Runoff = 9.96 cfs @ 12.13 hrs, Volume= 29,647 cf, Depth> 1.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 96,140 | 98 | IMPERVIOUS |
| | 89,140 | 74 | >75% Grass cover, Good, HSG C |
| | 185,280 | 86 | Weighted Average |
| | 89,140 | | 48.11% Pervious Area |
| | 96,140 | | 51.89% Impervious Area |

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

### Subcatchment PR-1: TO WQU-1



## Summary for Subcatchment PR-10: TO WETLANDS CENTER

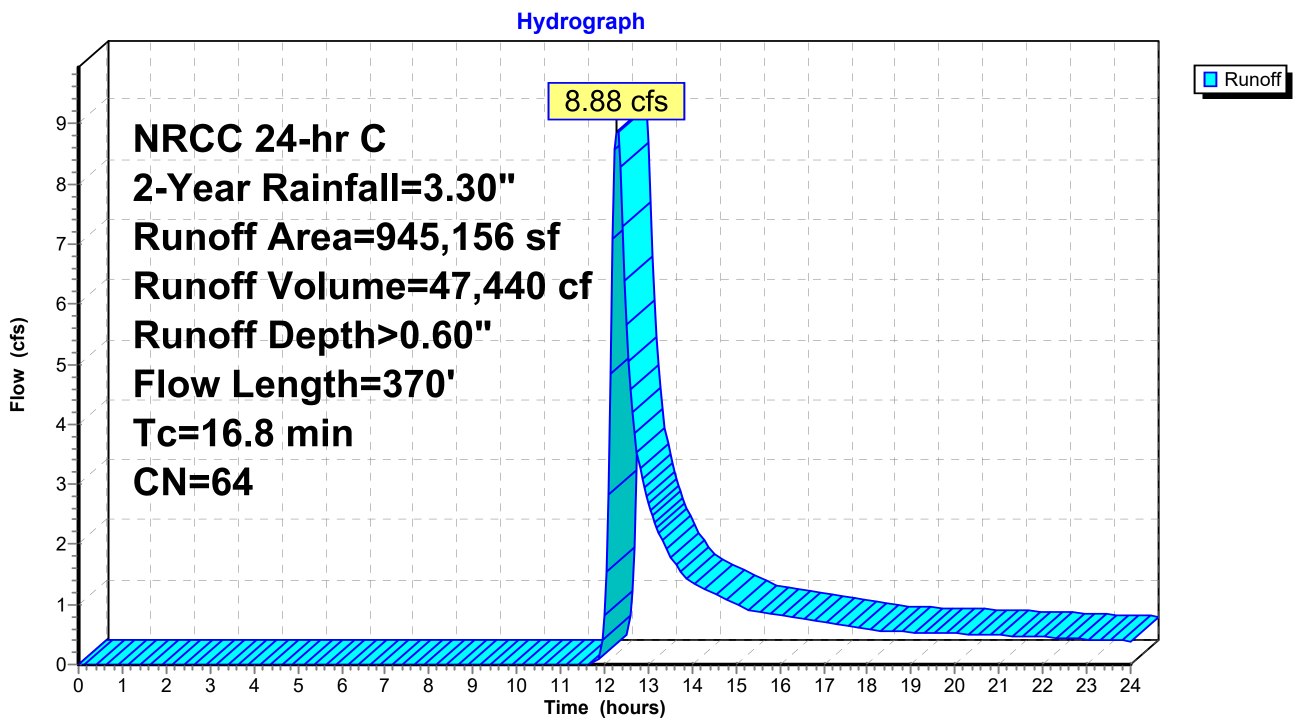
Runoff = 8.88 cfs @ 12.29 hrs, Volume= 47,440 cf, Depth> 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| Area (sf) | CN | Description |
|---|---|---|
| 409,457 | 55 | Woods, Good, HSG B |
| 277,625 | 70 | Woods, Good, HSG C |
| 128,687 | 77 | Woods, Good, HSG D |
| 75,015 | 61 | >75% Grass cover, Good, HSG B |
| 54,372 | 74 | >75% Grass cover, Good, HSG C |
| 945,156 | 64 | Weighted Average |
| 945,156 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.8 | 50 | 0.0500 | 0.09 | | **Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.00" |
| 0.7 | 45 | 0.0444 | 1.05 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 7.3 | 275 | 0.0156 | 0.62 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 16.8 | 370 | Total | | | |

### Subcatchment PR-10: TO WETLANDS CENTER



## Summary for Subcatchment PR-11A: TO INNOVATION WAY (2009 CITY LAYOUT)

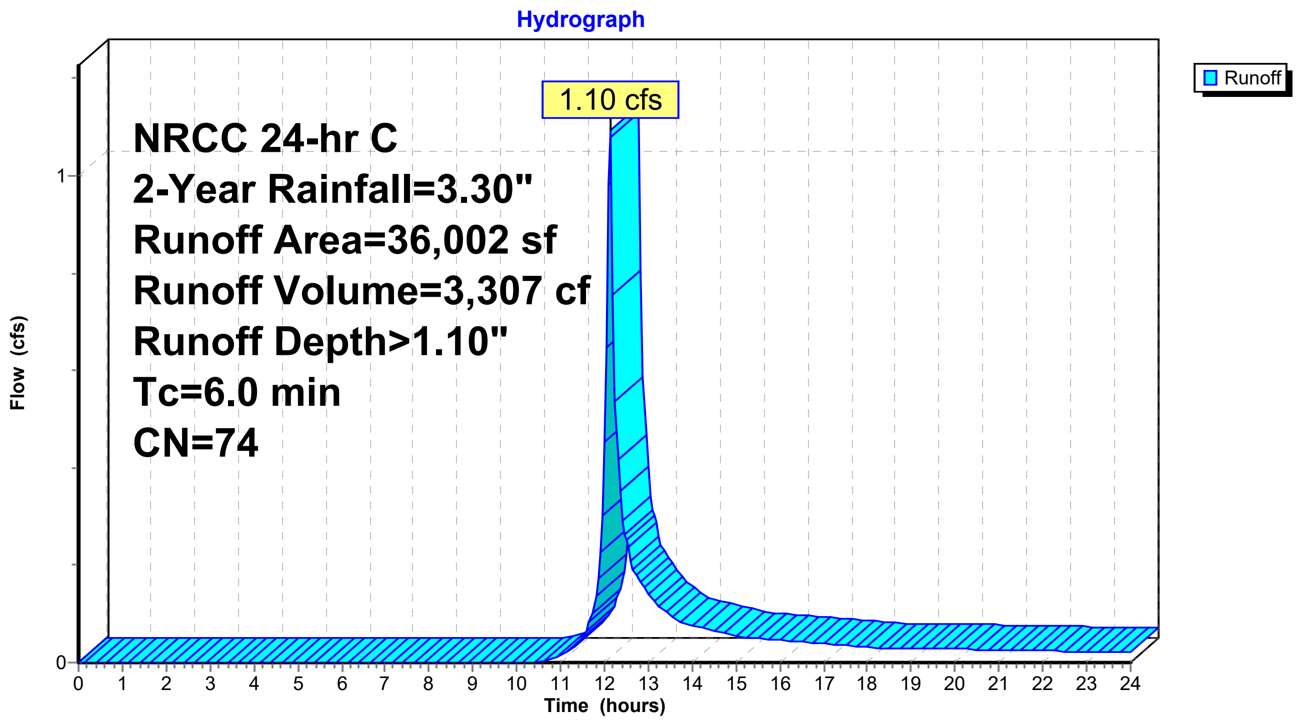
Runoff = 1.10 cfs @ 12.14 hrs, Volume= 3,307 cf, Depth> 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 35,261 | 74 | >75% Grass cover, Good, HSG C |
| * | 741 | 70 | IMPERVIOUS |
| | 36,002 | 74 | Weighted Average |
| | 36,002 | | 100.00% Pervious Area |

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

### Subcatchment PR-11A: TO INNOVATION WAY (2009 CITY LAYOUT)



## Summary for Subcatchment PR-11B: TO INNOVATION WAY (2009 SHLO)

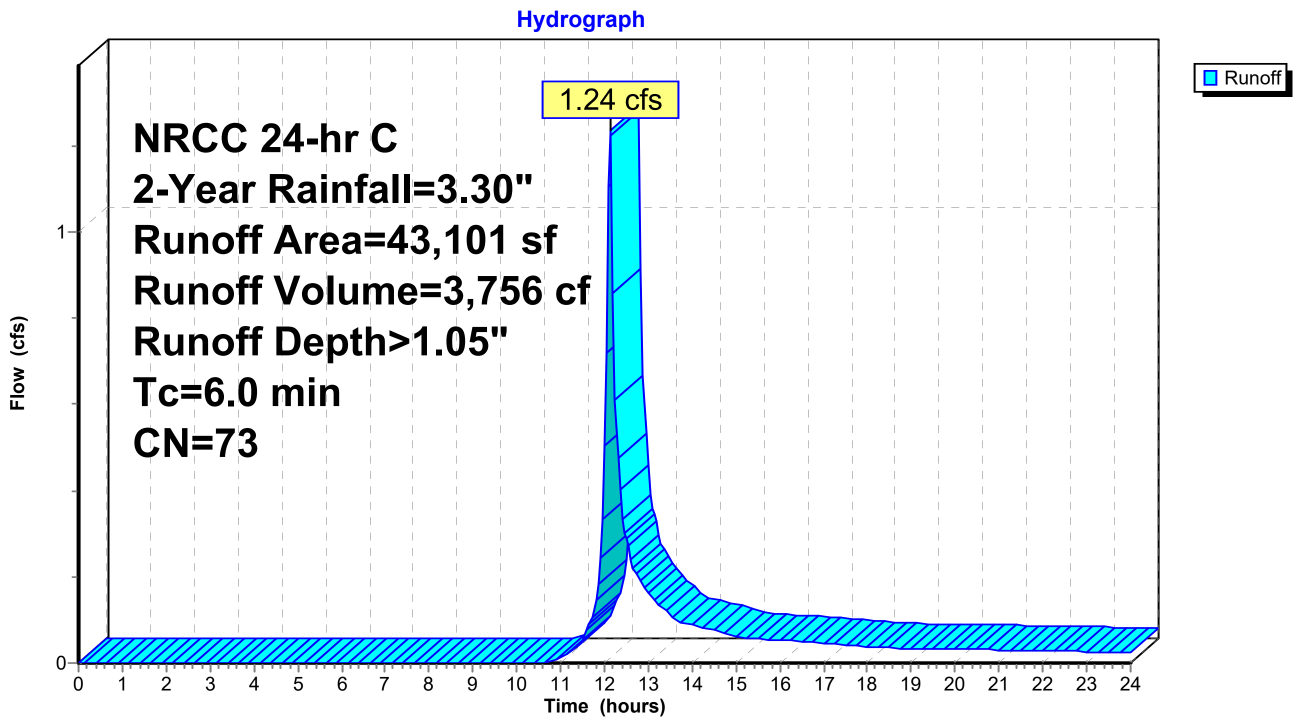
Runoff = 1.24 cfs @ 12.14 hrs, Volume= 3,756 cf, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| Area (sf) | CN | Description |
|---|---|---|
| 37,380 | 74 | >75% Grass cover, Good, HSG C |
| 5,721 | 70 | Woods, Good, HSG C |
| 43,101 | 73 | Weighted Average |
| 43,101 | | 100.00% Pervious Area |

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

## Subcatchment PR-11B: TO INNOVATION WAY (2009 SHLO)



## Summary for Subcatchment PR-12: TO WQU-6

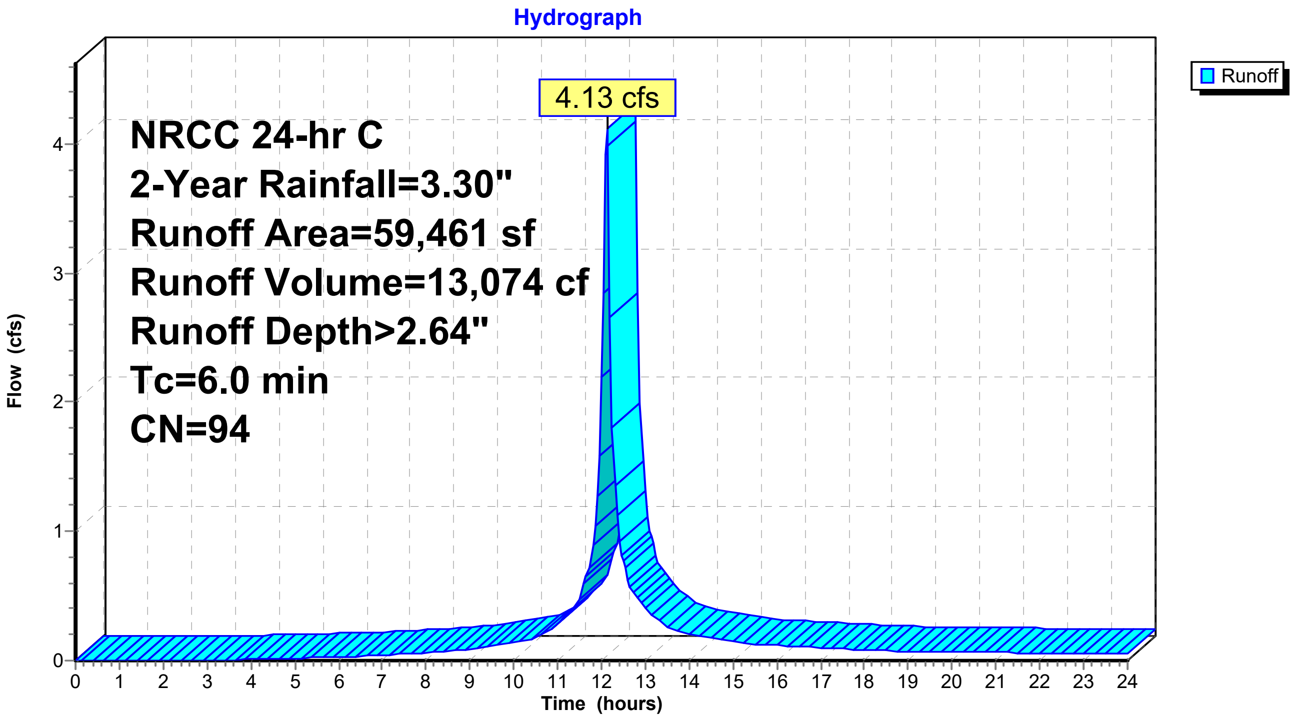
Runoff = 4.13 cfs @ 12.13 hrs, Volume= 13,074 cf, Depth> 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 50,470 | 98 | IMPERVIOUS |
| | 8,991 | 74 | >75% Grass cover, Good, HSG C |
| | 59,461 | 94 | Weighted Average |
| | 8,991 | | 15.12% Pervious Area |
| | 50,470 | | 84.88% Impervious Area |

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

## Subcatchment PR-12: TO WQU-6



## Summary for Subcatchment PR-13: TO WQU-7

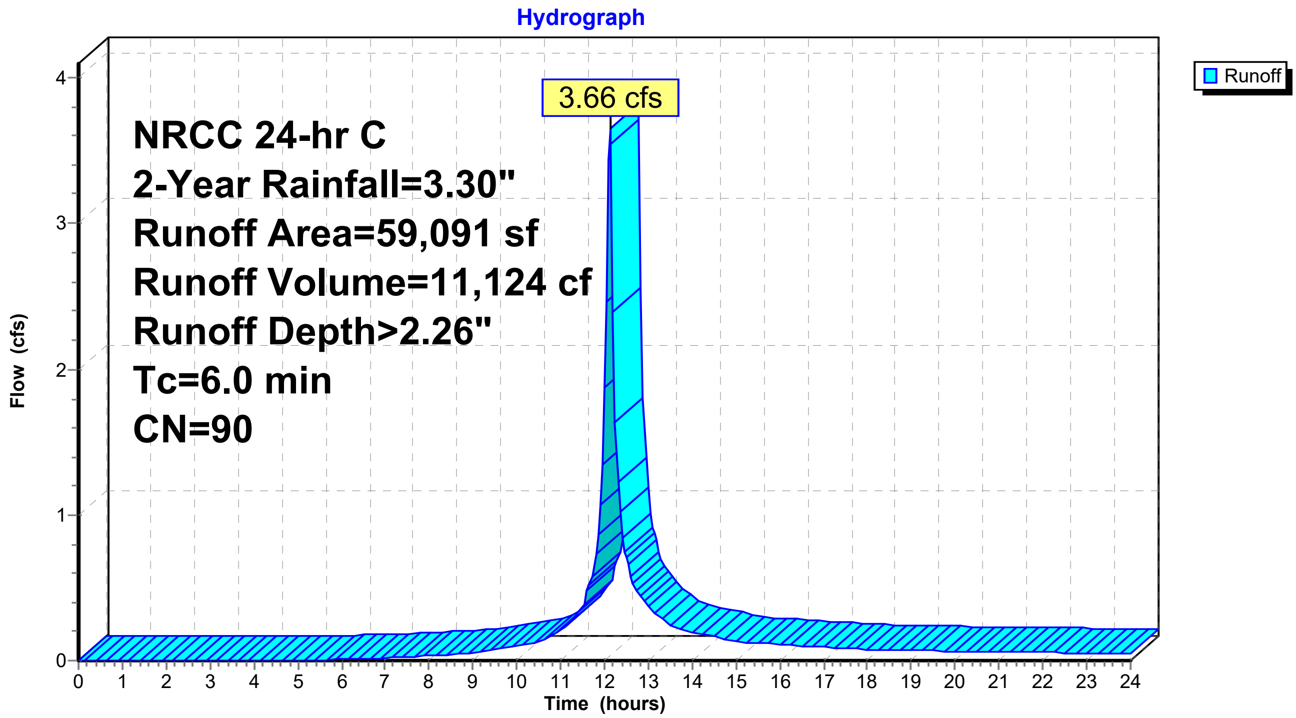
Runoff = 3.66 cfs @ 12.13 hrs, Volume= 11,124 cf, Depth> 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 46,105 | 98 | IMPERVIOUS |
| | 12,986 | 61 | >75% Grass cover, Good, HSG B |
| | 59,091 | 90 | Weighted Average |
| | 12,986 | | 21.98% Pervious Area |
| | 46,105 | | 78.02% Impervious Area |

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

### Subcatchment PR-13: TO WQU-7



## Summary for Subcatchment PR-14: TO WQU-8

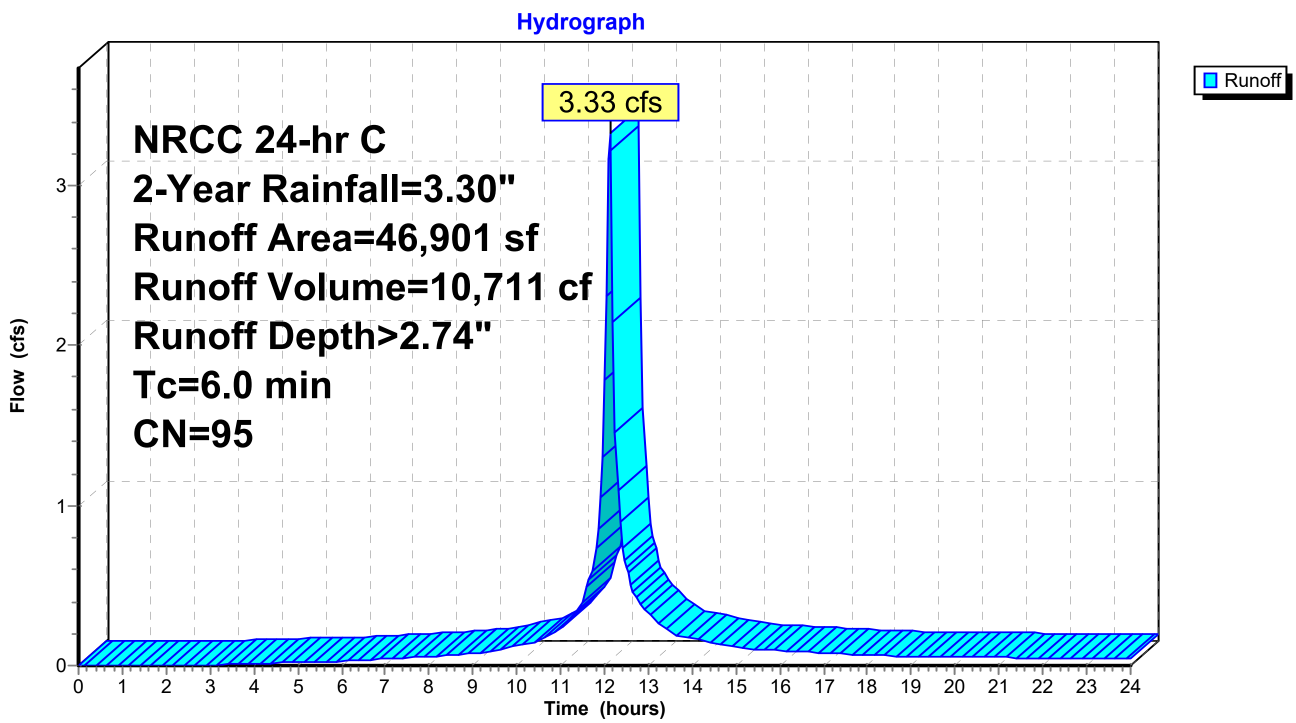
Runoff = 3.33 cfs @ 12.13 hrs, Volume= 10,711 cf, Depth> 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 42,641 | 98 | IMPERVIOUS |
| | 4,260 | 61 | >75% Grass cover, Good, HSG B |
| | 46,901 | 95 | Weighted Average |
| | 4,260 | | 9.08% Pervious Area |
| | 42,641 | | 90.92% Impervious Area |

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

### Subcatchment PR-14: TO WQU-8



## Summary for Subcatchment PR-15: TO WQU-9

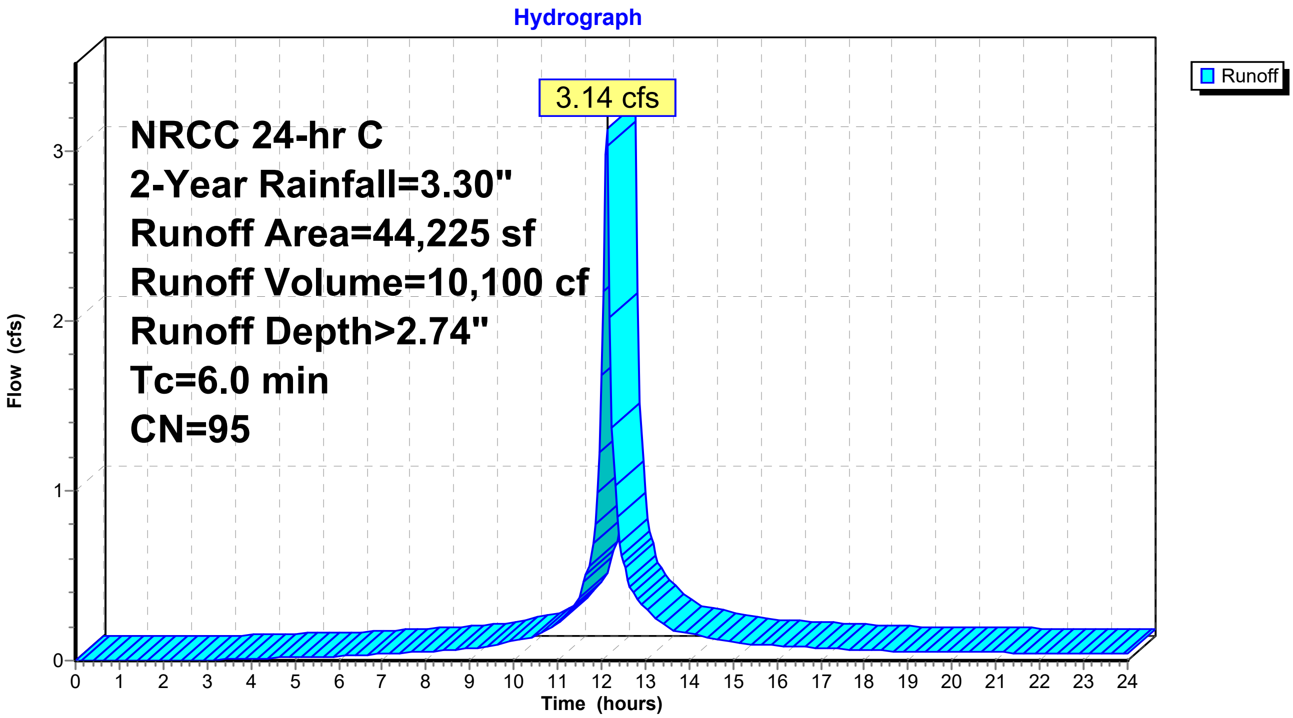
Runoff = 3.14 cfs @ 12.13 hrs, Volume= 10,100 cf, Depth> 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 40,778 | 98 | IMPERVIOUS |
| | 3,447 | 61 | >75% Grass cover, Good, HSG B |
| | 44,225 | 95 | Weighted Average |
| | 3,447 | | 7.79% Pervious Area |
| | 40,778 | | 92.21% Impervious Area |

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

### Subcatchment PR-15: TO WQU-9



## Summary for Subcatchment PR-16: TO WQU-10

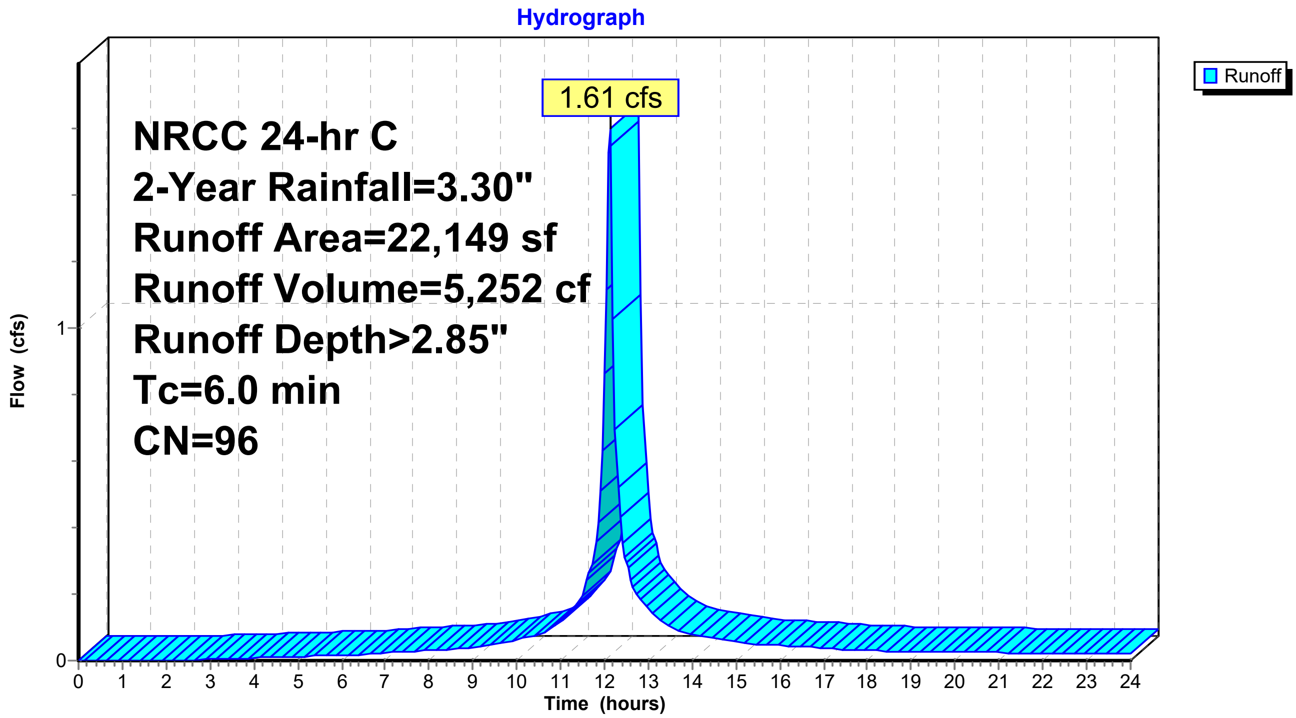
Runoff = 1.61 cfs @ 12.13 hrs, Volume= 5,252 cf, Depth> 2.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 21,009 | 98 | IMPERVIOUS |
| | 1,140 | 61 | >75% Grass cover, Good, HSG B |
| | 22,149 | 96 | Weighted Average |
| | 1,140 | | 5.15% Pervious Area |
| | 21,009 | | 94.85% Impervious Area |

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

## Subcatchment PR-16: TO WQU-10



## Summary for Subcatchment PR-17: TO WQU-11

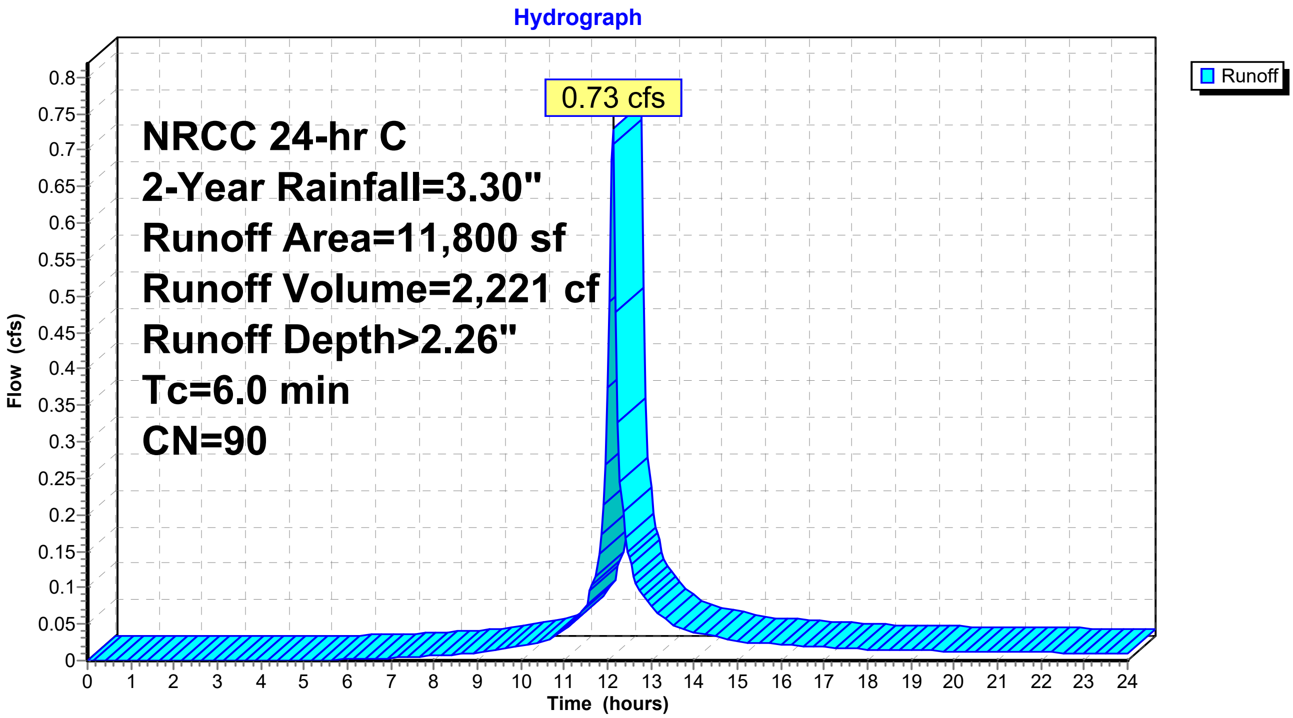
Runoff = 0.73 cfs @ 12.13 hrs, Volume= 2,221 cf, Depth> 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 7,968 | 98 | IMPERVIOUS |
| | 3,832 | 74 | >75% Grass cover, Good, HSG C |
| | 11,800 | 90 | Weighted Average |
| | 3,832 | | 32.47% Pervious Area |
| | 7,968 | | 67.53% Impervious Area |

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

### Subcatchment PR-17: TO WQU-11



## Summary for Subcatchment PR-18: TO WQU-12

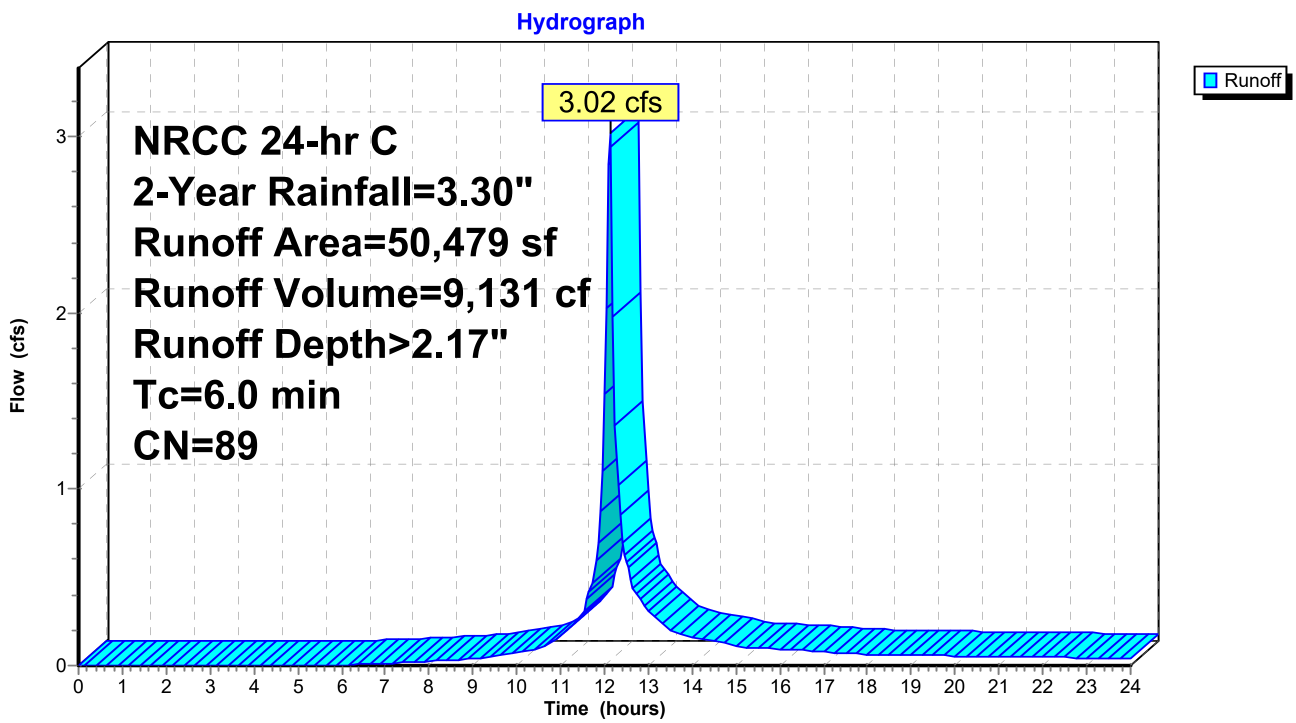
Runoff = 3.02 cfs @ 12.13 hrs, Volume= 9,131 cf, Depth> 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 31,033 | 98 | IMPERVIOUS |
| | 19,446 | 74 | >75% Grass cover, Good, HSG C |
| | 50,479 | 89 | Weighted Average |
| | 19,446 | | 38.52% Pervious Area |
| | 31,033 | | 61.48% Impervious Area |

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

### Subcatchment PR-18: TO WQU-12



## Summary for Subcatchment PR-19: TO WQU-13

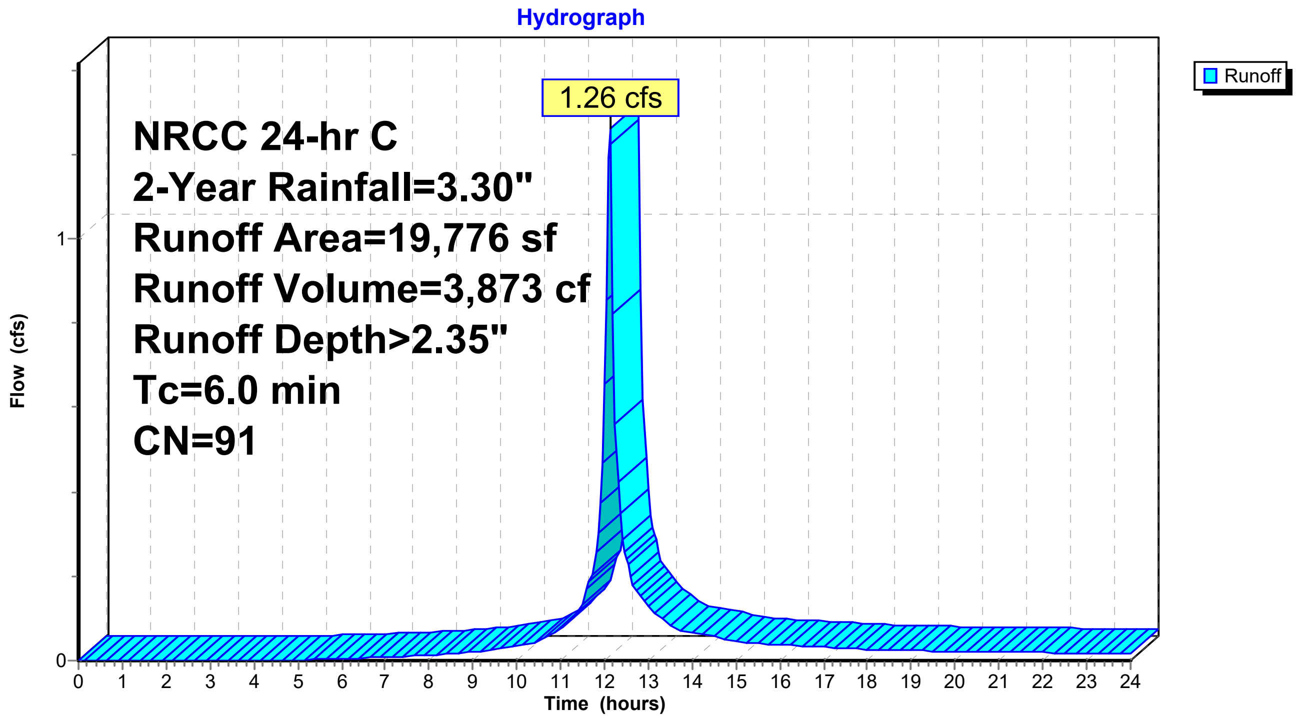
Runoff = 1.26 cfs @ 12.13 hrs, Volume= 3,873 cf, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 14,228 | 98 | IMPERVIOUS |
| | 5,548 | 74 | >75% Grass cover, Good, HSG C |
| | 19,776 | 91 | Weighted Average |
| | 5,548 | | 28.05% Pervious Area |
| | 14,228 | | 71.95% Impervious Area |

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

## Subcatchment PR-19: TO WQU-13



## Summary for Subcatchment PR-2: TO PRETX

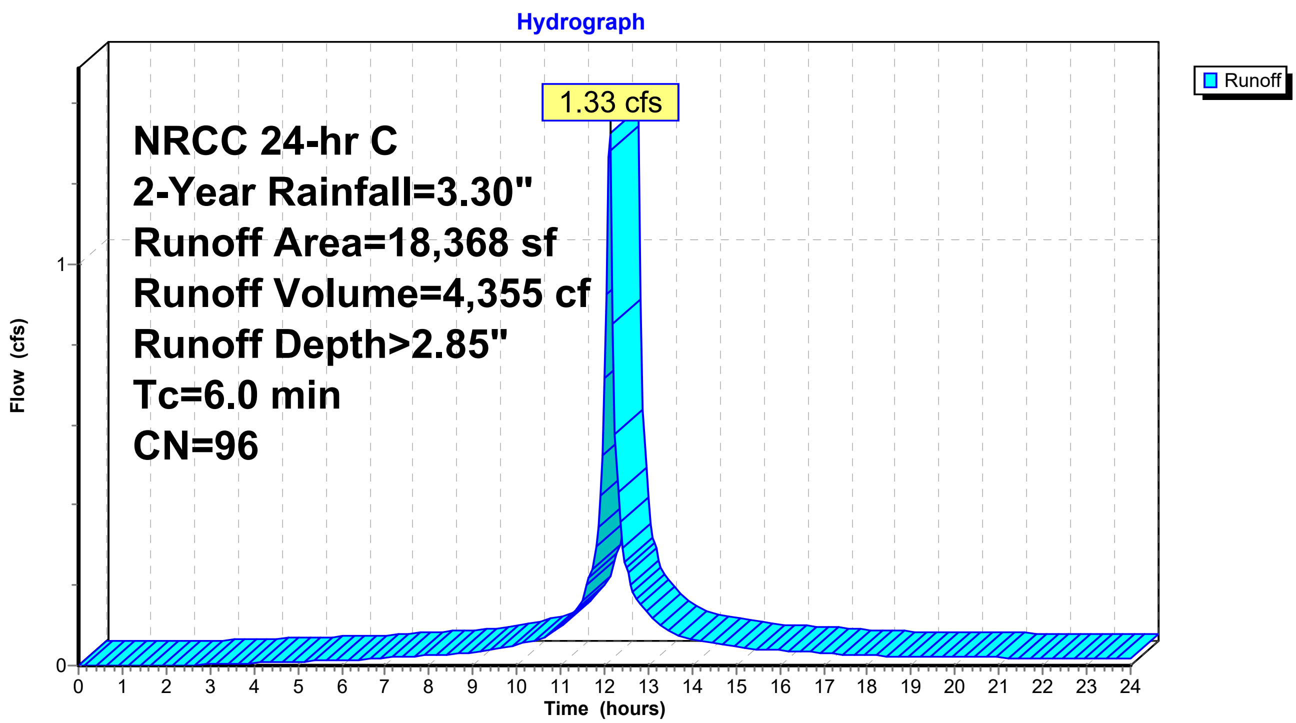
Runoff = 1.33 cfs @ 12.13 hrs, Volume= 4,355 cf, Depth> 2.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 16,637 | 98 | IMPERVIOUS |
| | 1,731 | 74 | >75% Grass cover, Good, HSG C |
| | 18,368 | 96 | Weighted Average |
| | 1,731 | | 9.42% Pervious Area |
| | 16,637 | | 90.58% Impervious Area |

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

## Subcatchment PR-2: TO PRETX



## Summary for Subcatchment PR-20: TO WQU-14

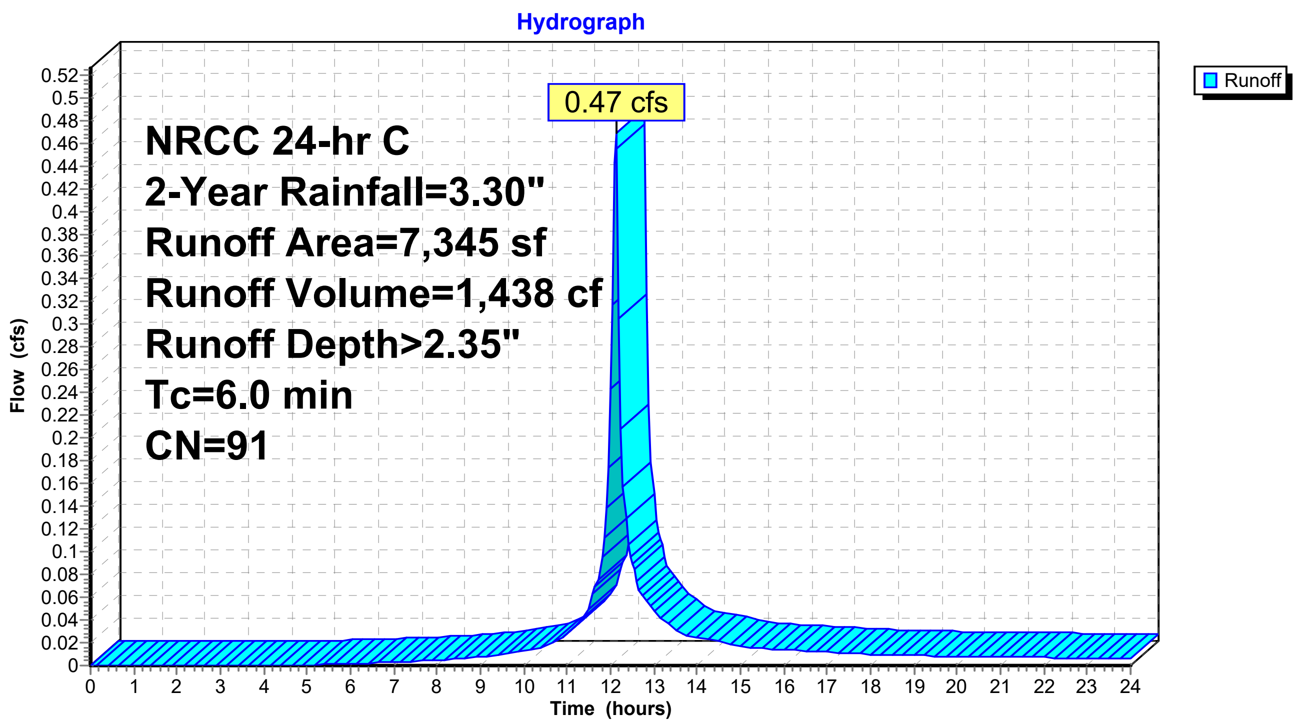
Runoff = 0.47 cfs @ 12.13 hrs, Volume= 1,438 cf, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 5,138 | 98 | IMPERVIOUS |
| | 2,207 | 74 | >75% Grass cover, Good, HSG C |
| | 7,345 | 91 | Weighted Average |
| | 2,207 | | 30.05% Pervious Area |
| | 5,138 | | 69.95% Impervious Area |

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

## Subcatchment PR-20: TO WQU-14



## Summary for Subcatchment PR-21: TO WQU-15

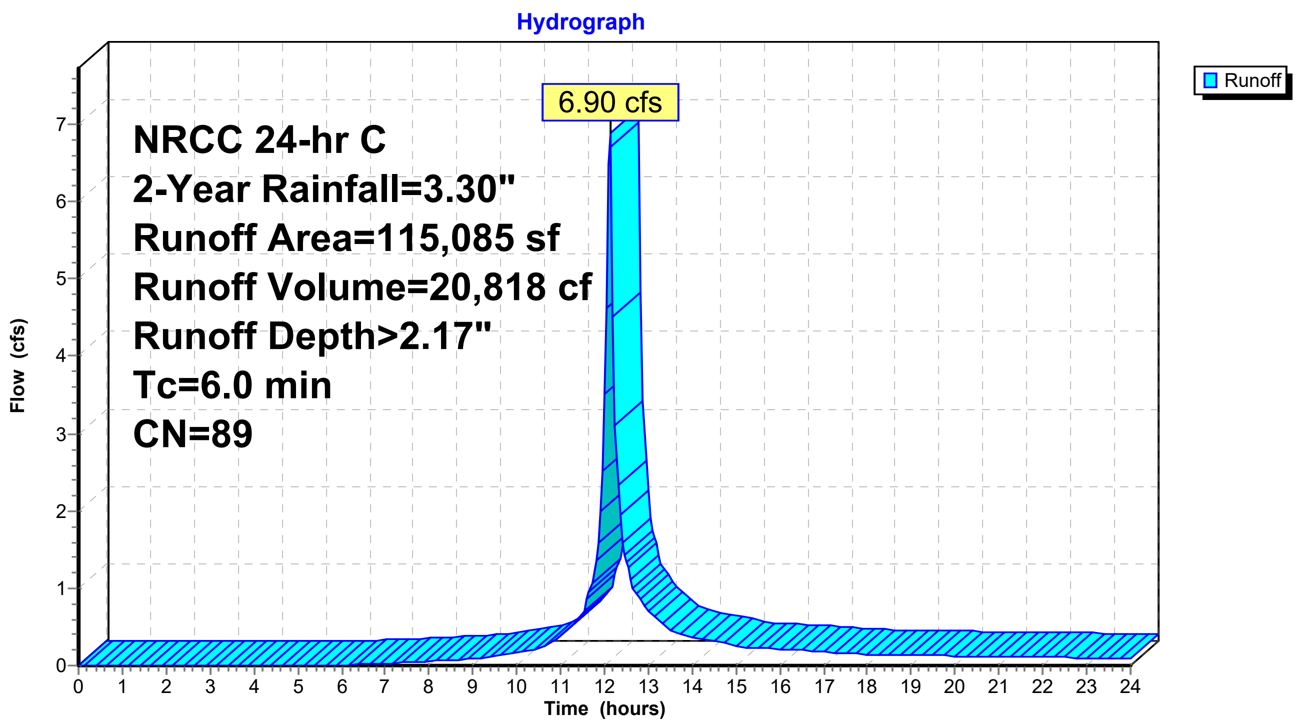
Runoff = 6.90 cfs @ 12.13 hrs, Volume= 20,818 cf, Depth> 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 71,553 | 98 | IMPERVIOUS |
| | 43,532 | 74 | >75% Grass cover, Good, HSG C |
| | 115,085 | 89 | Weighted Average |
| | 43,532 | | 37.83% Pervious Area |
| | 71,553 | | 62.17% Impervious Area |

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

## Subcatchment PR-21: TO WQU-15



## Summary for Subcatchment PR-22: TO WQU-16

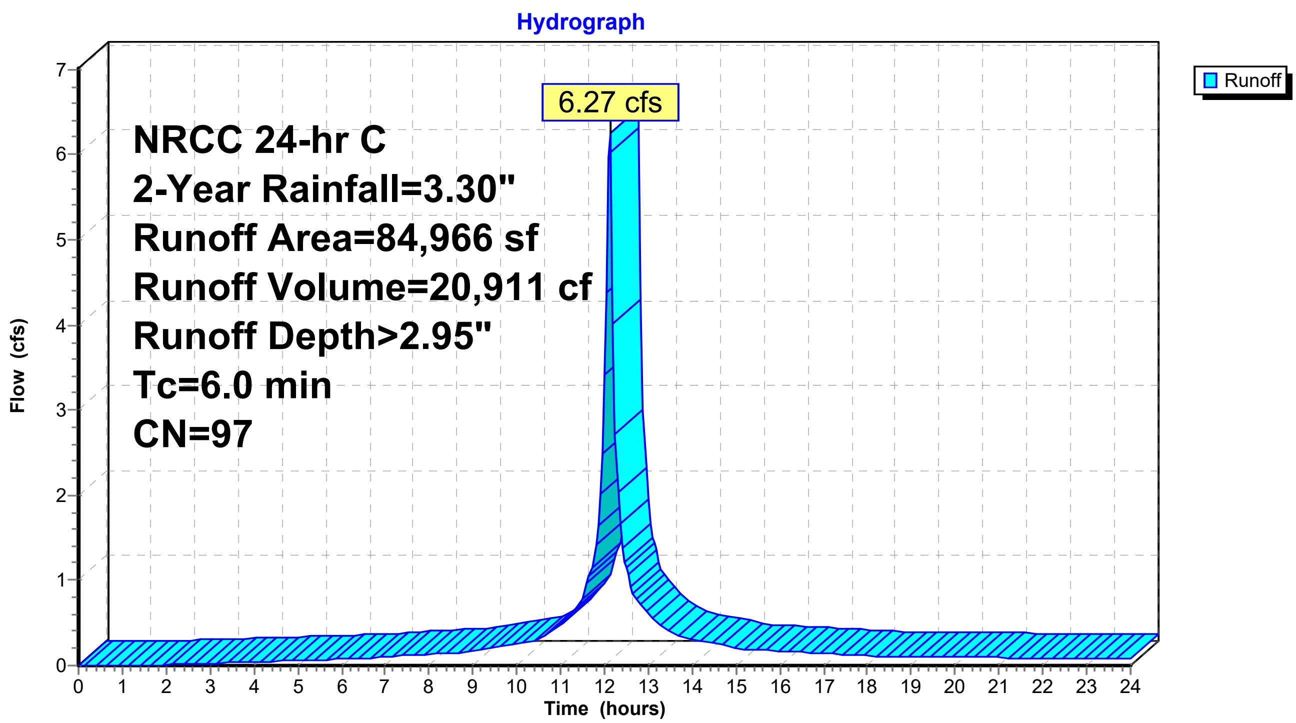
Runoff = 6.27 cfs @ 12.13 hrs, Volume= 20,911 cf, Depth> 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 2,771 | 74 | >75% Grass cover, Good, HSG C |
| * | 82,195 | 98 | IMPERVIOUS |
| | 84,966 | 97 | Weighted Average |
| | 2,771 | | 3.26% Pervious Area |
| | 82,195 | | 96.74% Impervious Area |

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

### Subcatchment PR-22: TO WQU-16



## Summary for Subcatchment PR-23: TO WQU-17

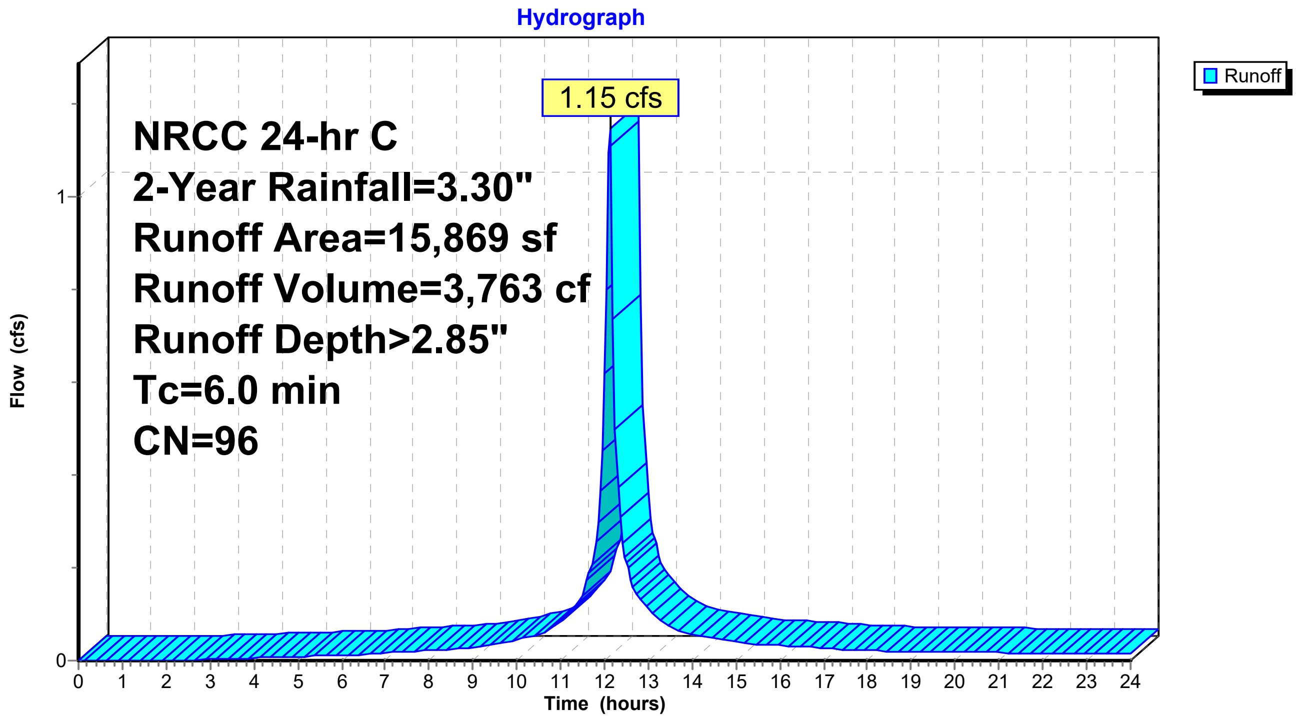
Runoff = 1.15 cfs @ 12.13 hrs, Volume= 3,763 cf, Depth> 2.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 14,403 | 98 | IMPERVIOUS |
| | 1,466 | 74 | >75% Grass cover, Good, HSG C |
| | 15,869 | 96 | Weighted Average |
| | 1,466 | | 9.24% Pervious Area |
| | 14,403 | | 90.76% Impervious Area |

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

## Subcatchment PR-23: TO WQU-17



## Summary for Subcatchment PR-24: TO WQU-18

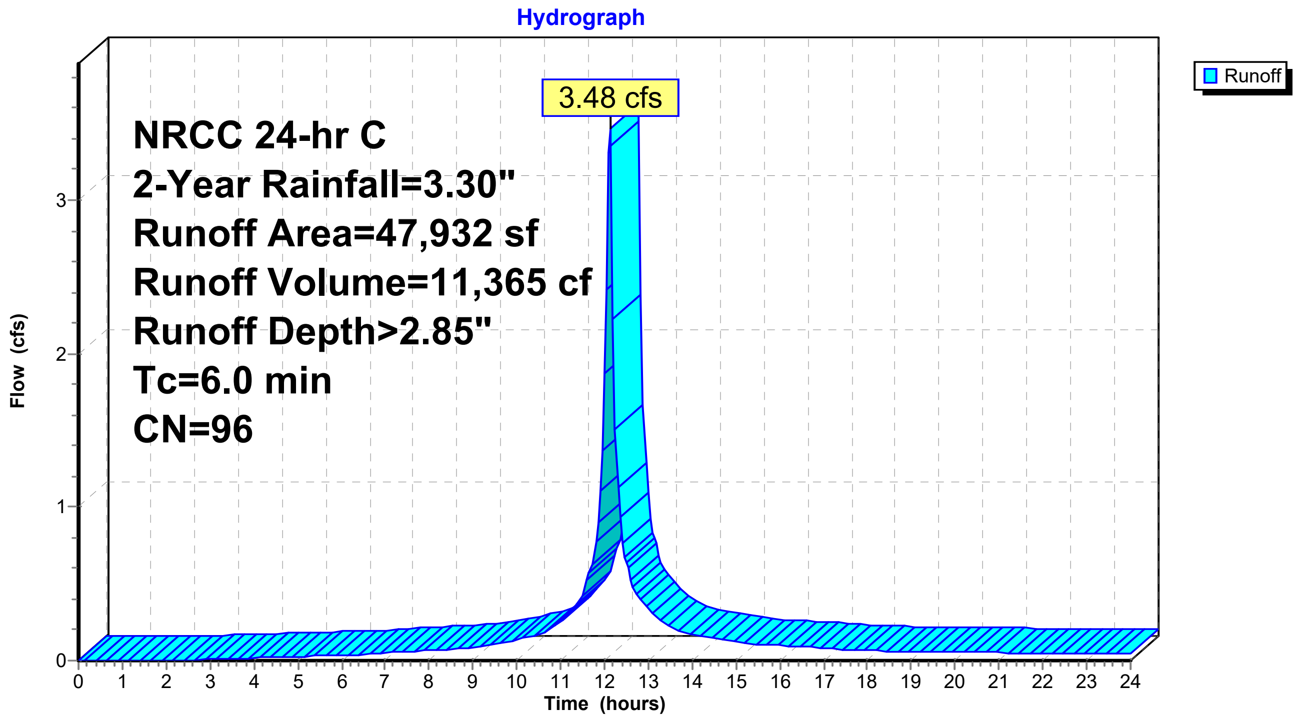
Runoff = 3.48 cfs @ 12.13 hrs, Volume= 11,365 cf, Depth> 2.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 4,668 | 74 | >75% Grass cover, Good, HSG C |
| * | 43,264 | 98 | IMPERVIOUS |
| | 47,932 | 96 | Weighted Average |
| | 4,668 | | 9.74% Pervious Area |
| | 43,264 | | 90.26% Impervious Area |

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

## Subcatchment PR-24: TO WQU-18



## Summary for Subcatchment PR-25: BUILDING 2 ROOF

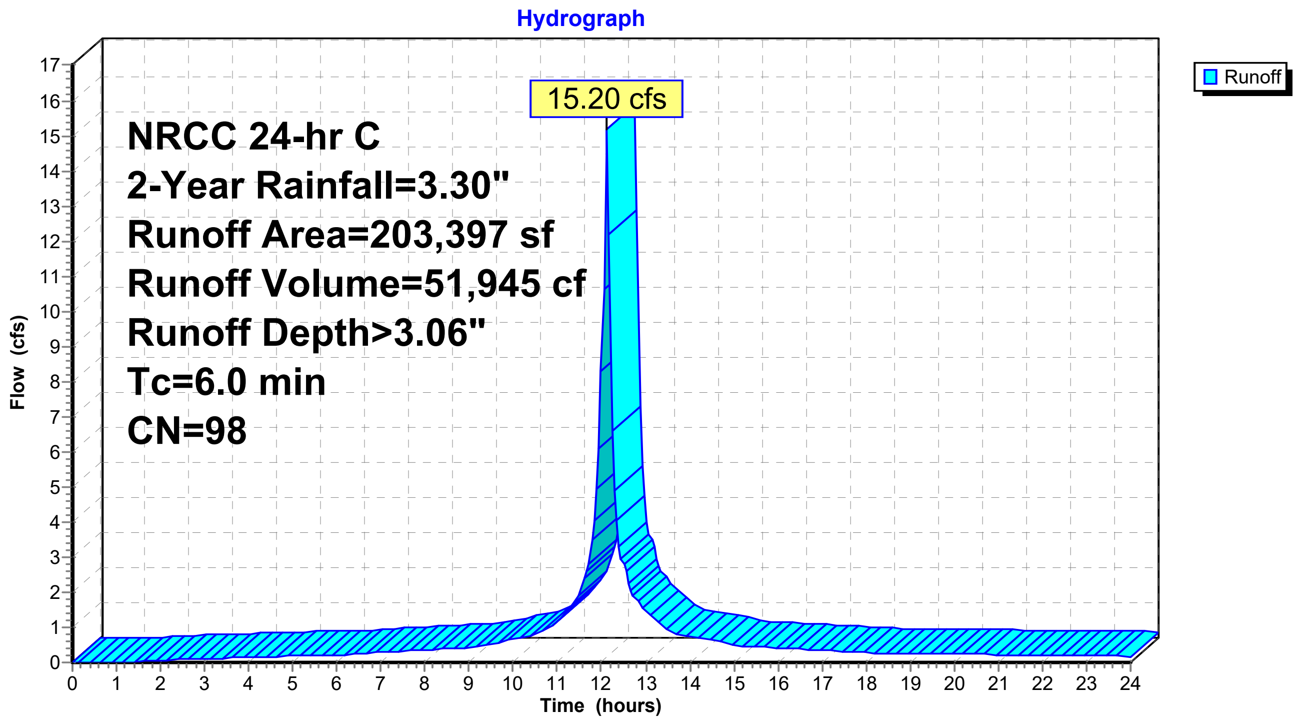
Runoff = 15.20 cfs @ 12.13 hrs, Volume= 51,945 cf, Depth> 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 203,397 | 98 | IMPERVIOUS |
| | 203,397 | | 100.00% Impervious Area |

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

## Subcatchment PR-25: BUILDING 2 ROOF



## Summary for Subcatchment PR-26: BUILDING 3 ROOF

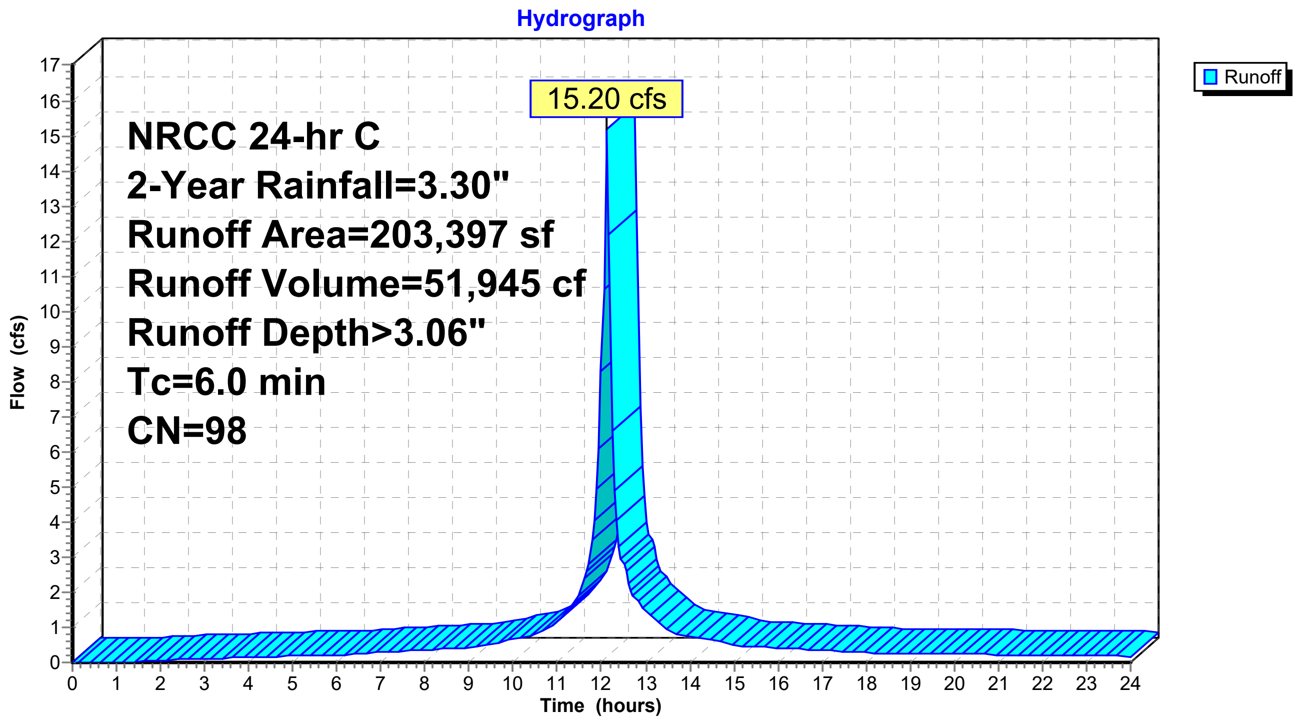
Runoff = 15.20 cfs @ 12.13 hrs, Volume= 51,945 cf, Depth> 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 203,397 | 98 | IMPERVIOUS |
| | 203,397 | | 100.00% Impervious Area |

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

### Subcatchment PR-26: BUILDING 3 ROOF



## Summary for Subcatchment PR-27: TO WQU-19

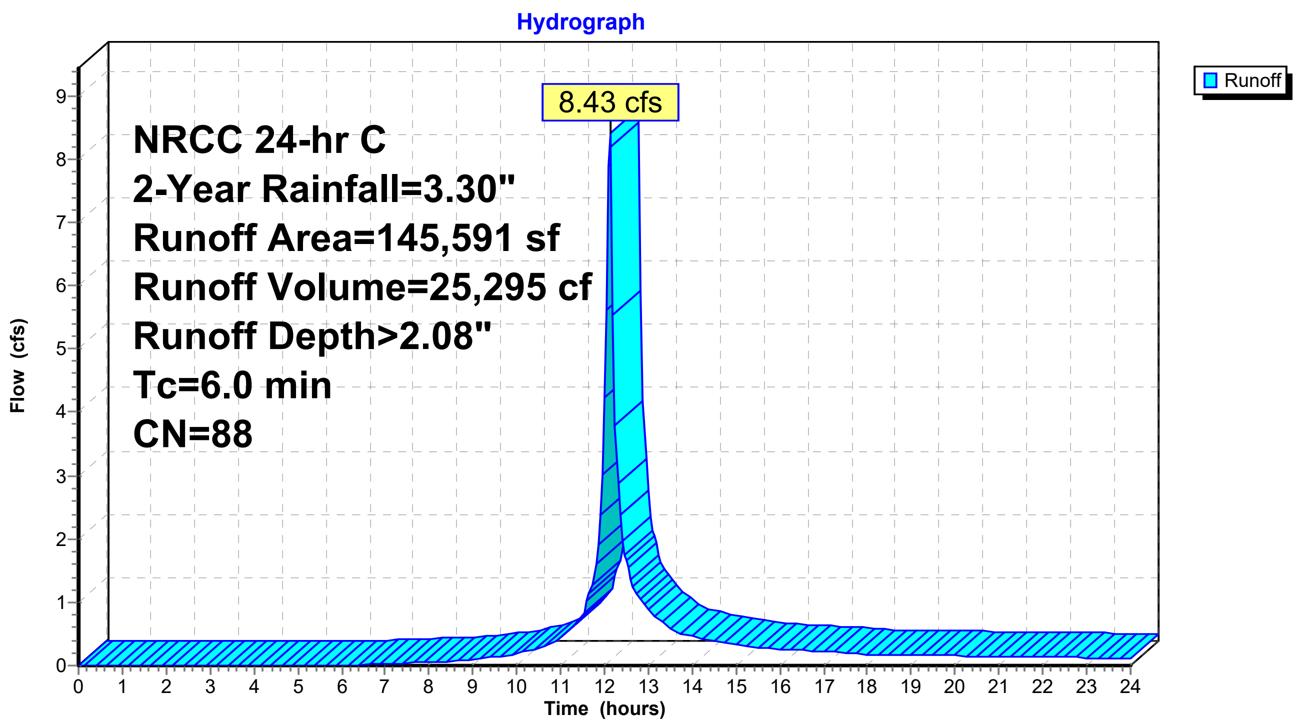
Runoff = 8.43 cfs @ 12.13 hrs, Volume= 25,295 cf, Depth> 2.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 105,426 | 98 | IMPERVIOUS |
| | 40,165 | 61 | >75% Grass cover, Good, HSG B |
| | 145,591 | 88 | Weighted Average |
| | 40,165 | | 27.59% Pervious Area |
| | 105,426 | | 72.41% Impervious Area |

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

### Subcatchment PR-27: TO WQU-19



## Summary for Subcatchment PR-28: TO WQU-20

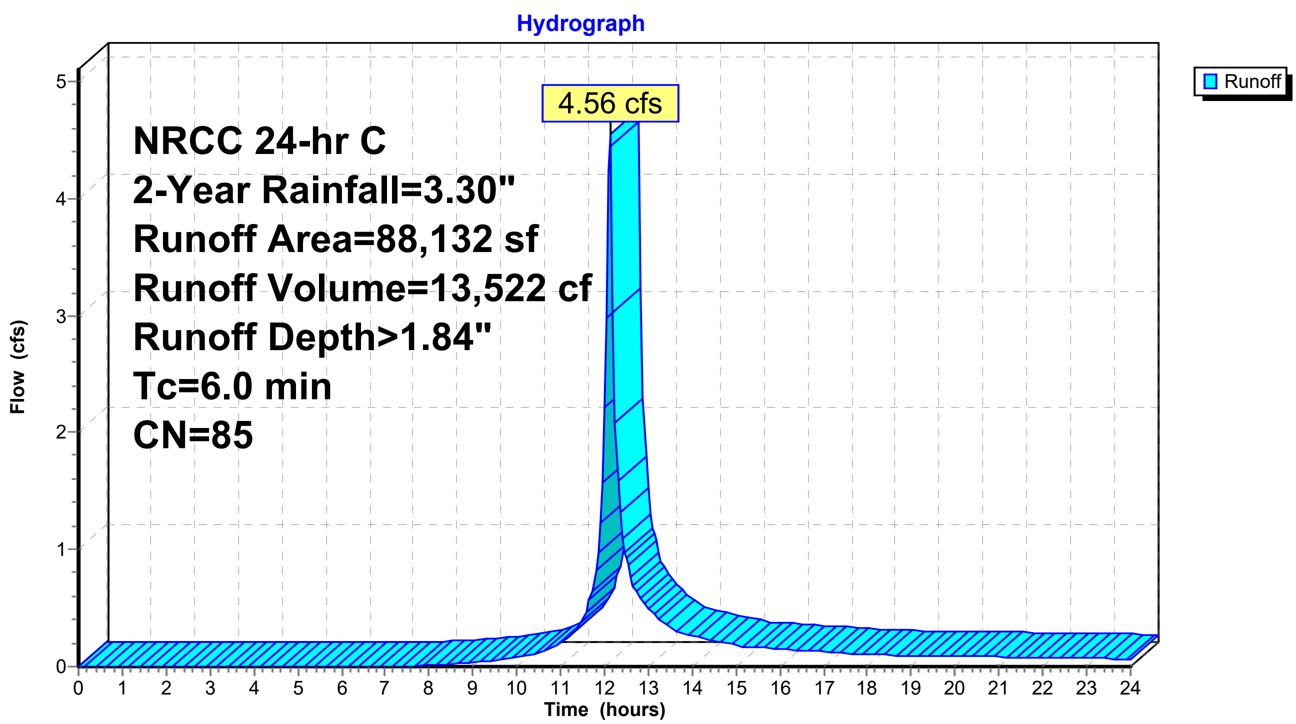
Runoff = 4.56 cfs @ 12.13 hrs, Volume= 13,522 cf, Depth> 1.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 55,365 | 98 | IMPERVIOUS |
| | 7,996 | 55 | Woods, Good, HSG B |
| | 5,832 | 80 | >75% Grass cover, Good, HSG D |
| | 18,939 | 61 | >75% Grass cover, Good, HSG B |
| | 88,132 | 85 | Weighted Average |
| | 32,767 | | 37.18% Pervious Area |
| | 55,365 | | 62.82% Impervious Area |

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

### Subcatchment PR-28: TO WQU-20



## Summary for Subcatchment PR-29: TO WQU-21

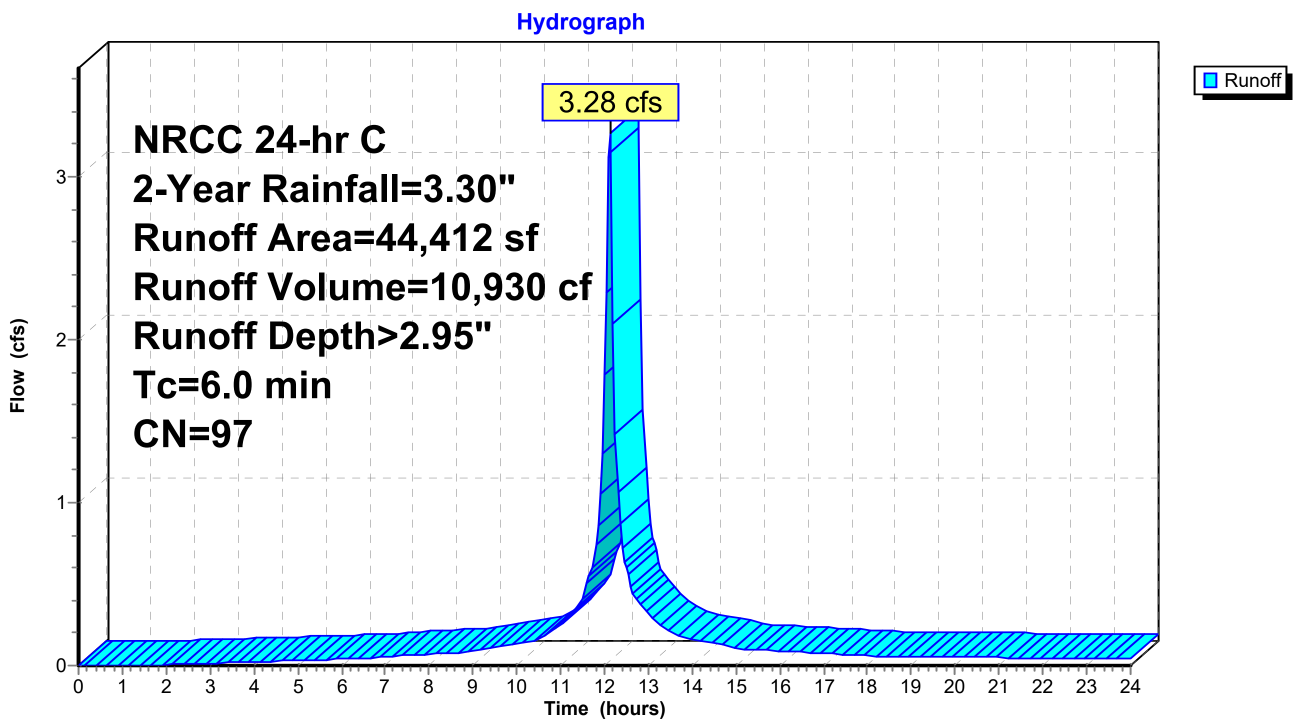
Runoff = 3.28 cfs @ 12.13 hrs, Volume= 10,930 cf, Depth> 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 41,857 | 98 | IMPERVIOUS |
| | 2,555 | 80 | >75% Grass cover, Good, HSG D |
| | 44,412 | 97 | Weighted Average |
| | 2,555 | | 5.75% Pervious Area |
| | 41,857 | | 94.25% Impervious Area |

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

## Subcatchment PR-29: TO WQU-21



## Summary for Subcatchment PR-3: TO FOCAL POINT

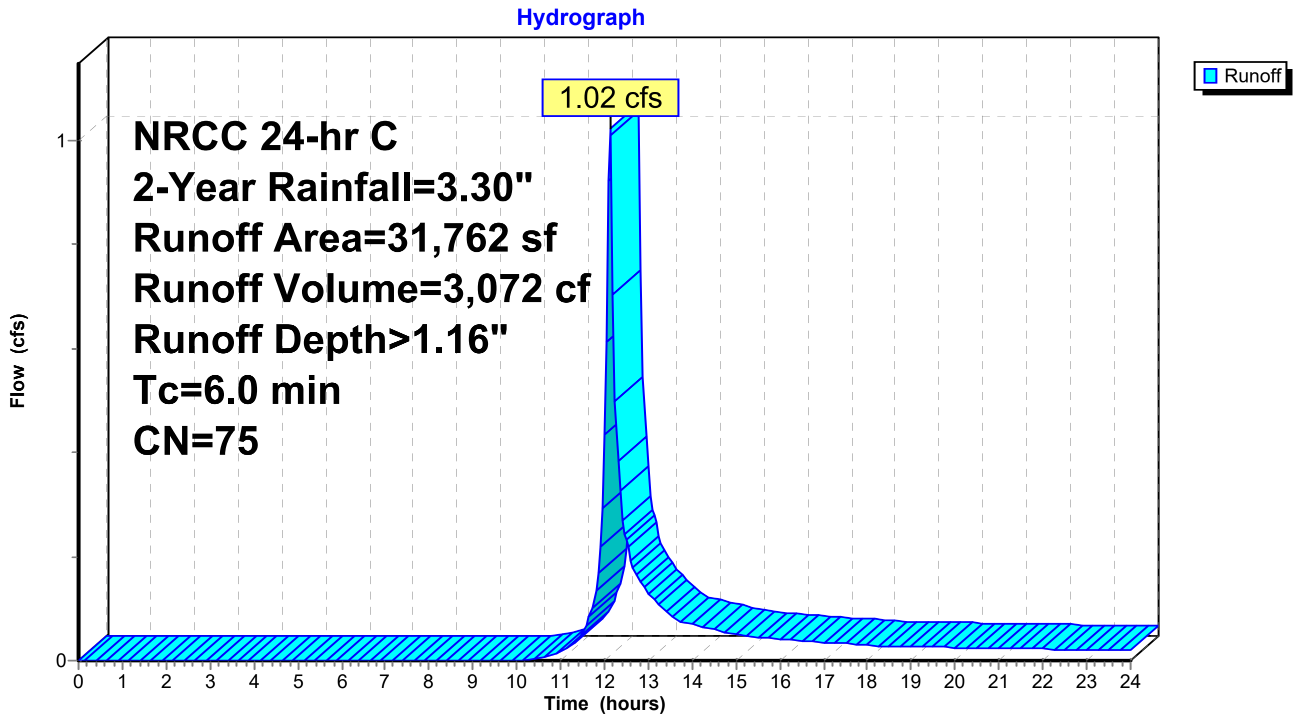
Runoff = 1.02 cfs @ 12.14 hrs, Volume= 3,072 cf, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 1,048 | 98 | IMPERVIOUS |
| | 30,714 | 74 | >75% Grass cover, Good, HSG C |
| | 31,762 | 75 | Weighted Average |
| | 30,714 | | 96.70% Pervious Area |
| | 1,048 | | 3.30% Impervious Area |

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

### Subcatchment PR-3: TO FOCAL POINT



## Summary for Subcatchment PR-30: TO WQU-22

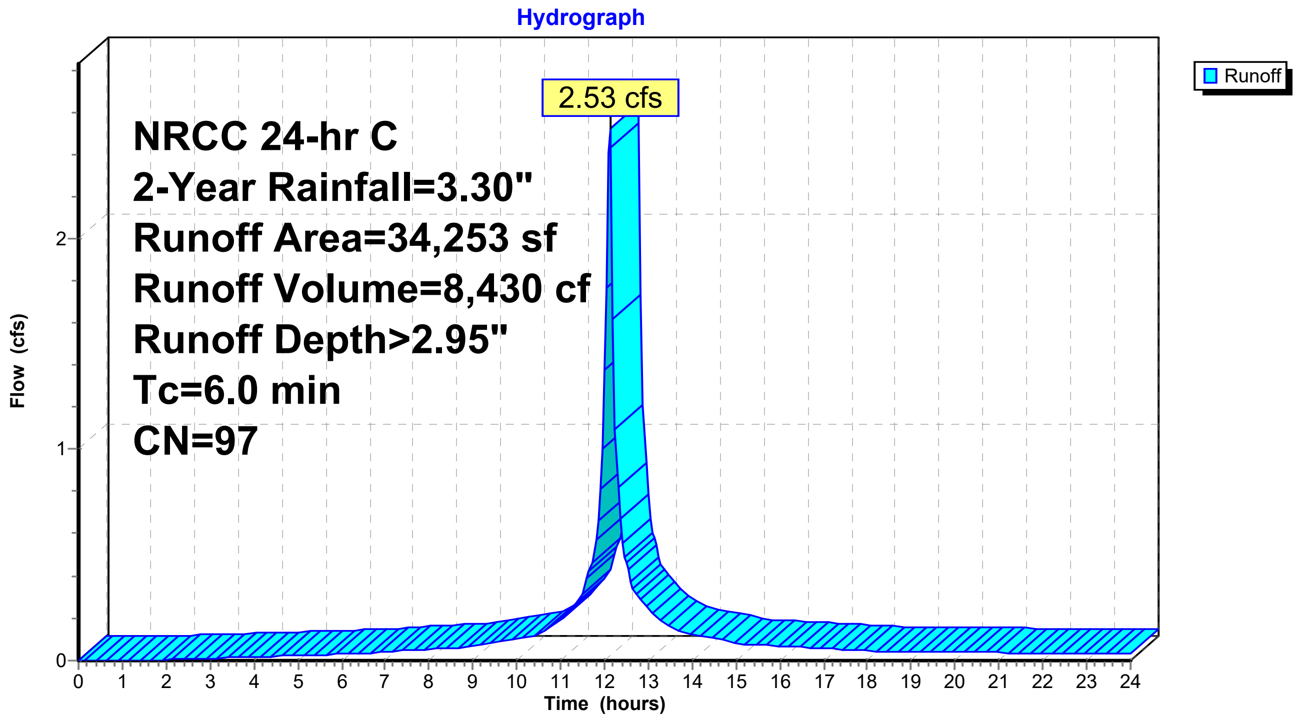
Runoff = 2.53 cfs @ 12.13 hrs, Volume= 8,430 cf, Depth> 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 31,439 | 98 | IMPERVIOUS |
| | 2,814 | 80 | >75% Grass cover, Good, HSG D |
| | 34,253 | 97 | Weighted Average |
| | 2,814 | | 8.22% Pervious Area |
| | 31,439 | | 91.78% Impervious Area |

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

### Subcatchment PR-30: TO WQU-22



## Summary for Subcatchment PR-31: TO WQU-23

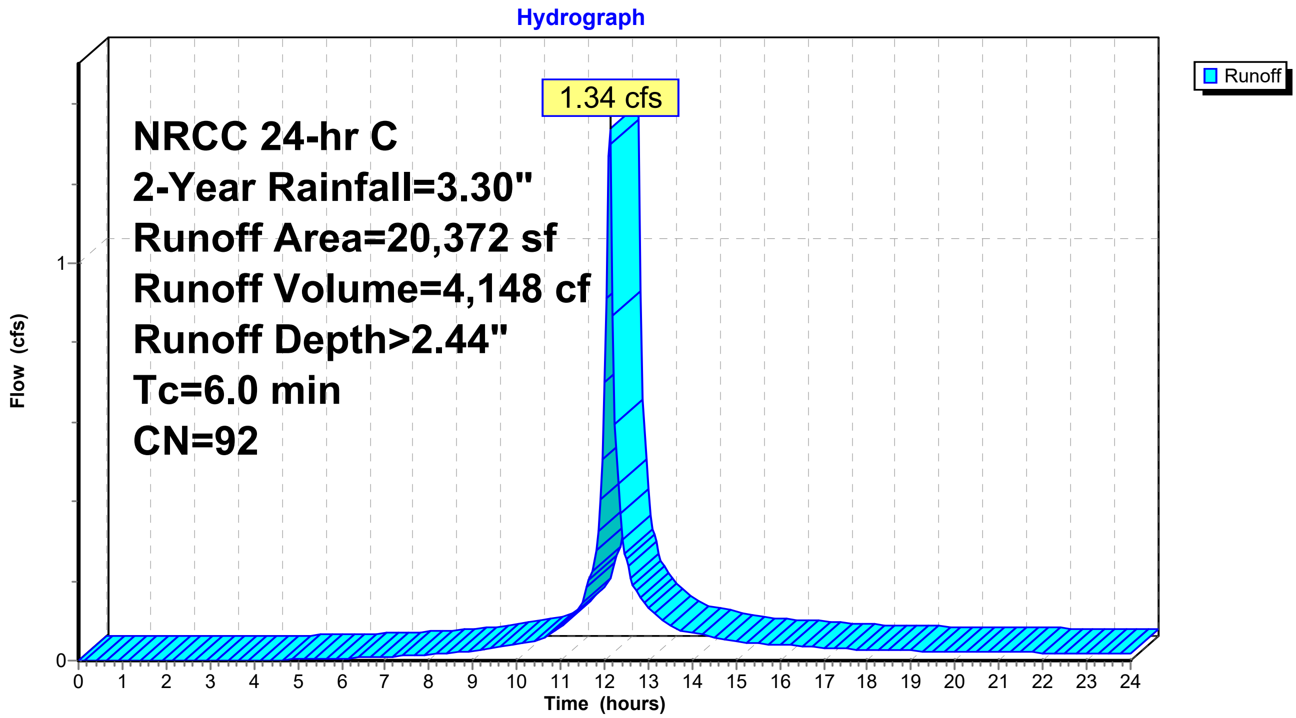
Runoff = 1.34 cfs @ 12.13 hrs, Volume= 4,148 cf, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 13,946 | 98 | IMPERVIOUS |
| | 6,426 | 80 | >75% Grass cover, Good, HSG D |
| | 20,372 | 92 | Weighted Average |
| | 6,426 | | 31.54% Pervious Area |
| | 13,946 | | 68.46% Impervious Area |

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

## Subcatchment PR-31: TO WQU-23



## Summary for Subcatchment PR-32: BUILDING 4 ROOF

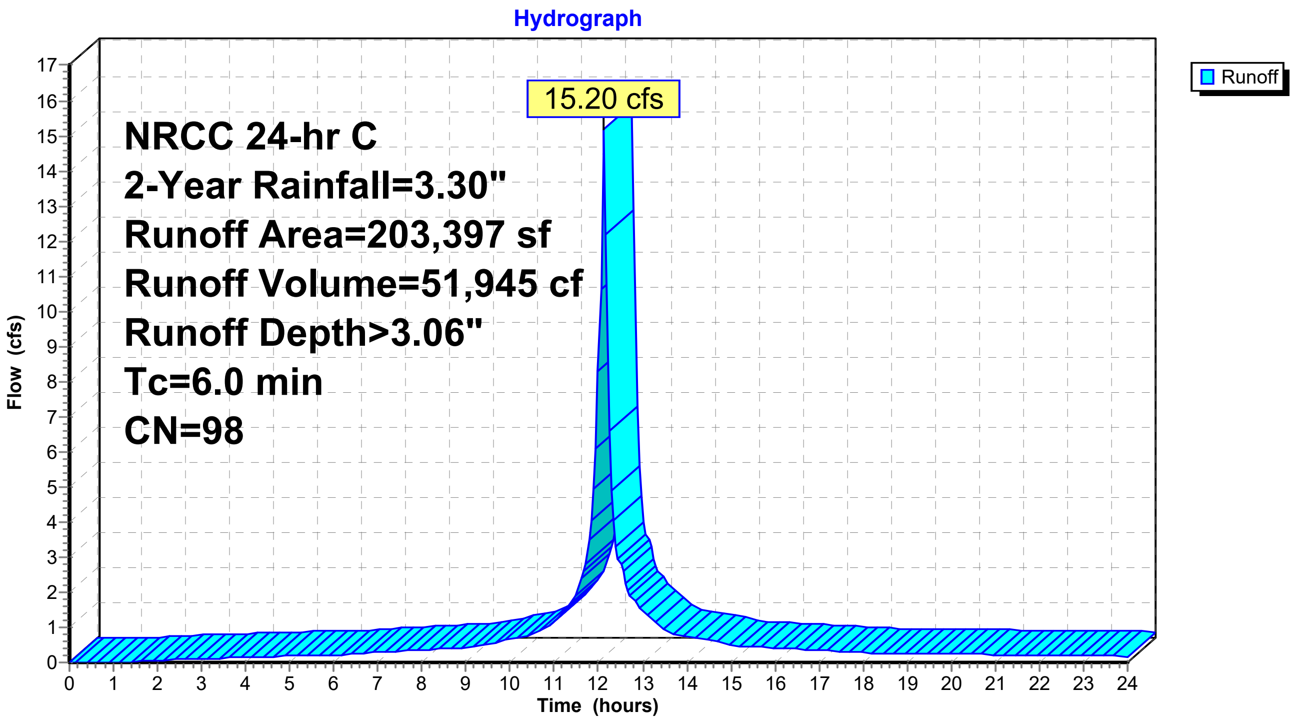
Runoff = 15.20 cfs @ 12.13 hrs, Volume= 51,945 cf, Depth> 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 203,397 | 98 | IMPERVIOUS |
| | 203,397 | | 100.00% Impervious Area |

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

## Subcatchment PR-32: BUILDING 4 ROOF



## Summary for Subcatchment PR-33: TO BASIN A

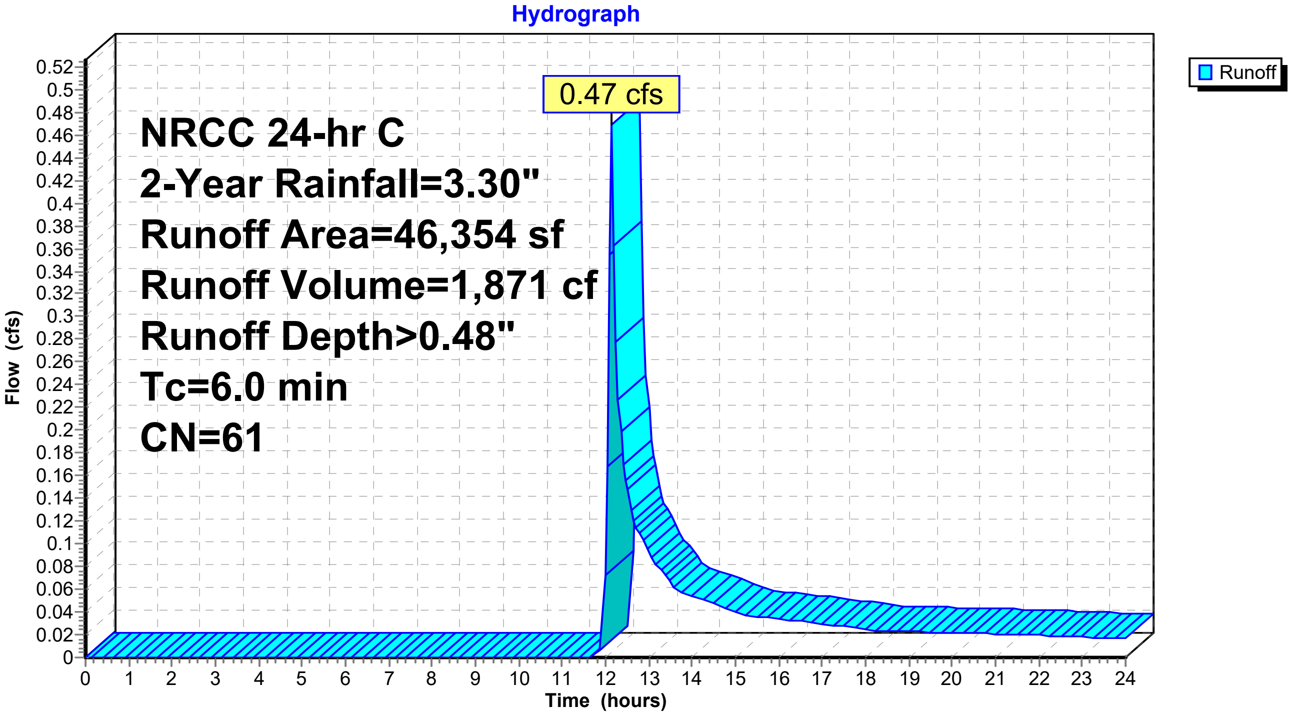
Runoff = 0.47 cfs @ 12.15 hrs, Volume= 1,871 cf, Depth> 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| Area (sf) | CN | Description |
|---|---|---|
| 46,354 | 61 | >75% Grass cover, Good, HSG B |
| 46,354 | | 100.00% Pervious Area |

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

## Subcatchment PR-33: TO BASIN A



## Summary for Subcatchment PR-34: TO BASIN B

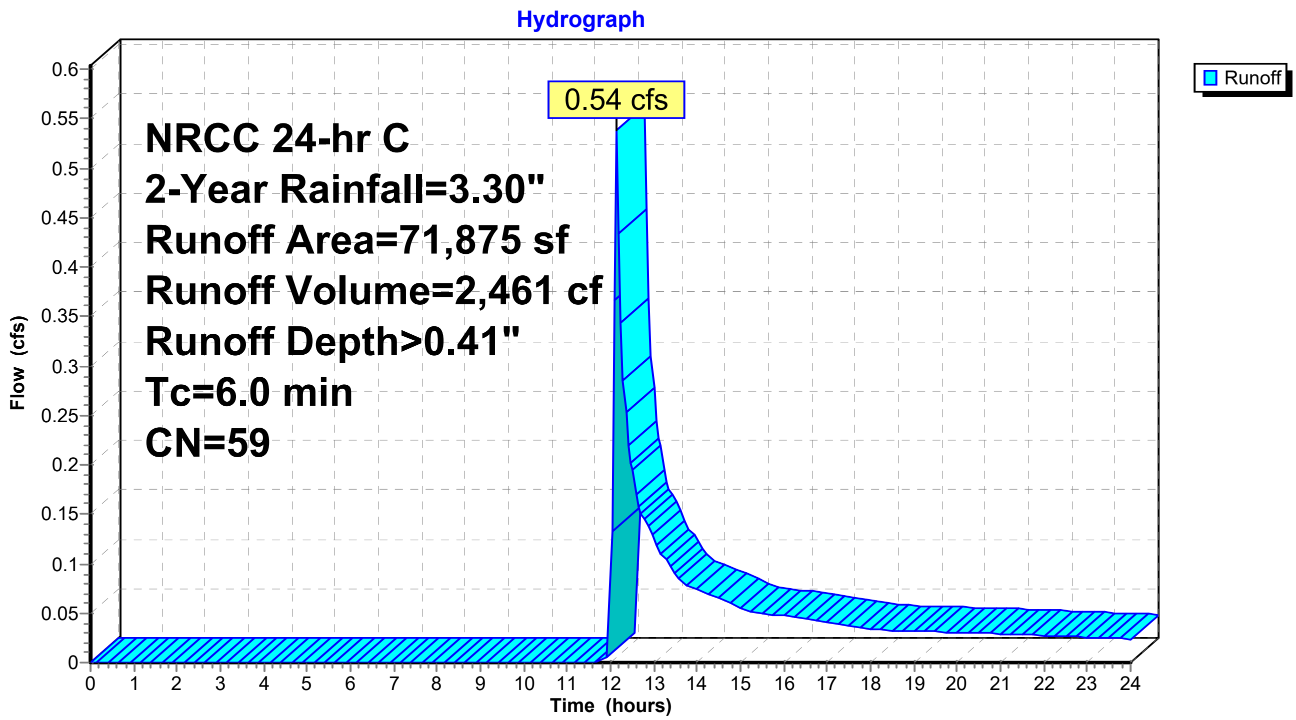
Runoff = 0.54 cfs @ 12.16 hrs, Volume= 2,461 cf, Depth> 0.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| Area (sf) | CN | Description |
|---|---|---|
| 24,851 | 55 | Woods, Good, HSG B |
| 47,024 | 61 | >75% Grass cover, Good, HSG B |
| 71,875 | 59 | Weighted Average |
| 71,875 | | 100.00% Pervious Area |

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

## Subcatchment PR-34: TO BASIN B



## Summary for Subcatchment PR-35: TO BASIN C

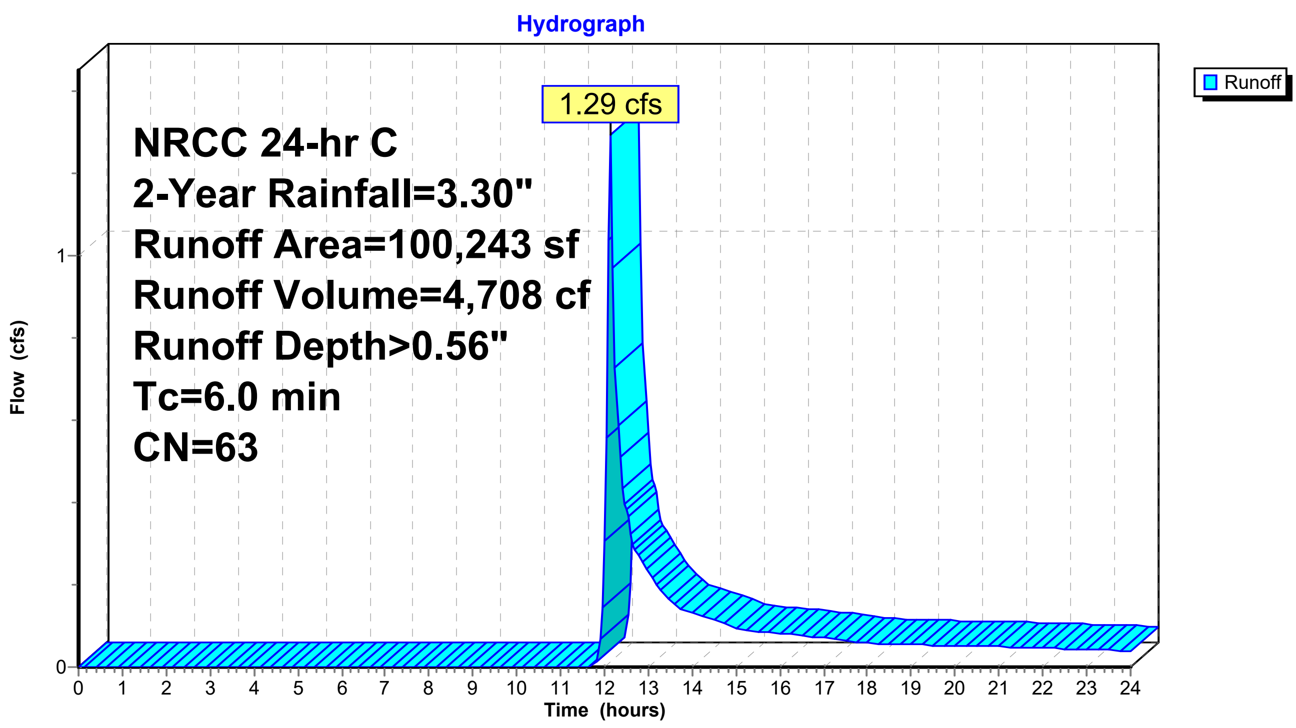
Runoff = 1.29 cfs @ 12.15 hrs, Volume= 4,708 cf, Depth> 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| Area (sf) | CN | Description |
|---|---|---|
| 17,490 | 74 | >75% Grass cover, Good, HSG C |
| 82,753 | 61 | >75% Grass cover, Good, HSG B |
| 100,243 | 63 | Weighted Average |
| 100,243 | | 100.00% Pervious Area |

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

## Subcatchment PR-35: TO BASIN C



## Summary for Subcatchment PR-36: TO OFFSITE EAST

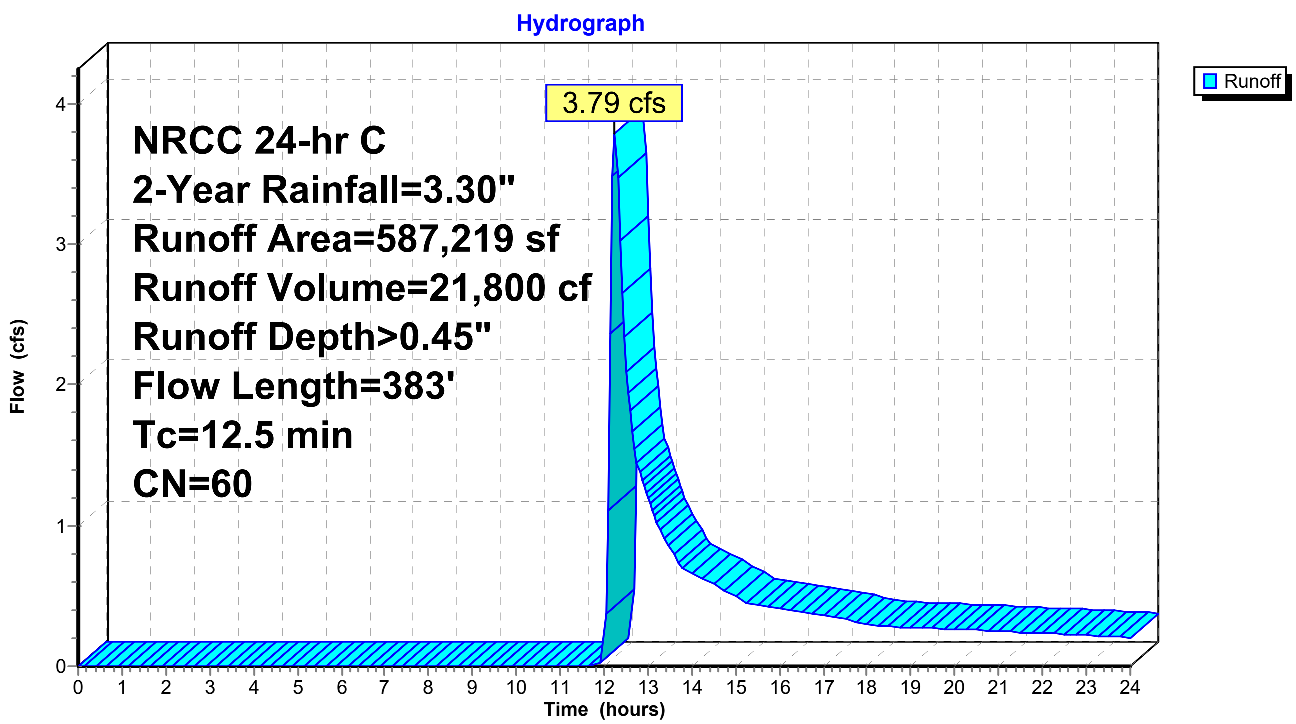
Runoff = 3.79 cfs @ 12.25 hrs, Volume= 21,800 cf, Depth> 0.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| Area (sf) | CN | Description |
|---|---|---|
| 402,759 | 55 | Woods, Good, HSG B |
| 6,465 | 70 | Woods, Good, HSG C |
| 112,740 | 77 | Woods, Good, HSG D |
| 52,096 | 61 | >75% Grass cover, Good, HSG B |
| 9,612 | 74 | >75% Grass cover, Good, HSG C |
| 3,547 | 80 | >75% Grass cover, Good, HSG D |
| 587,219 | 60 | Weighted Average |
| 587,219 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.0 | 50 | 0.0640 | 0.10 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 4.5 | 333 | 0.0604 | 1.23 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 12.5 | 383 | Total | | | |

### Subcatchment PR-36: TO OFFSITE EAST



## Summary for Subcatchment PR-4: TO OFFSITE SOUTH

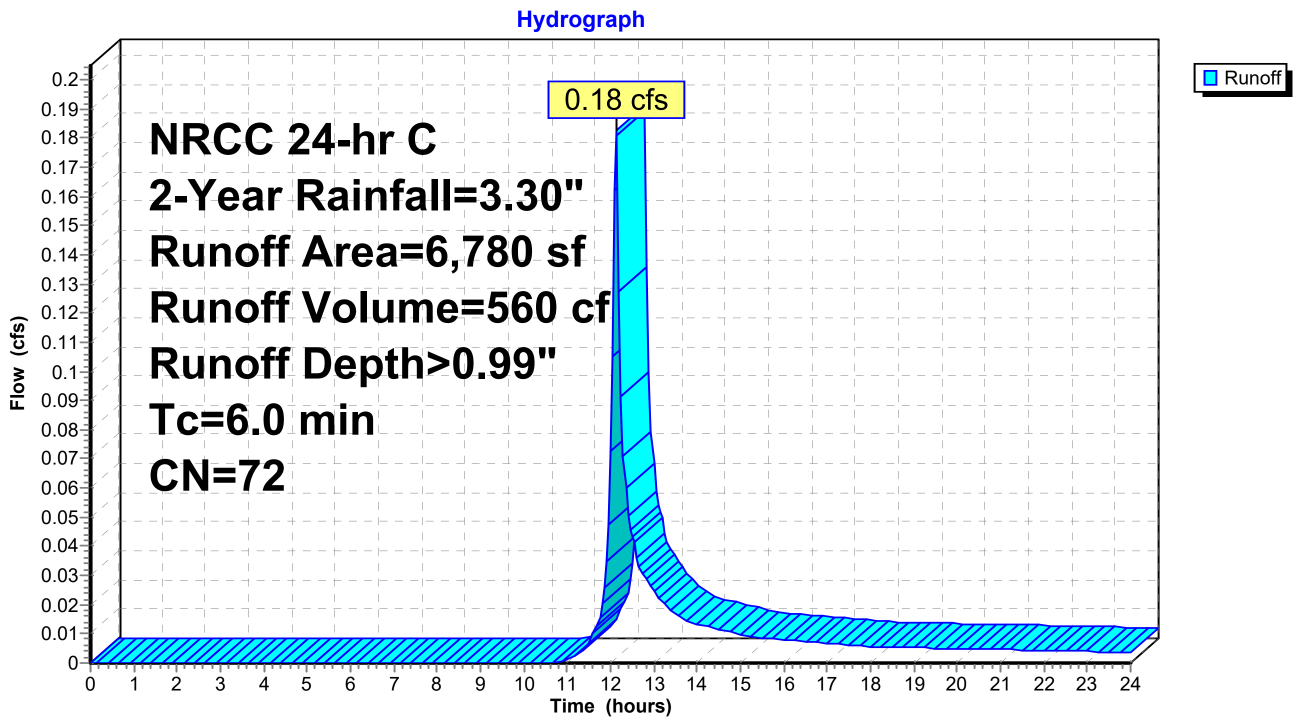
Runoff = 0.18 cfs @ 12.14 hrs, Volume= 560 cf, Depth> 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| Area (sf) | CN | Description |
|---|---|---|
| 2,686 | 74 | >75% Grass cover, Good, HSG C |
| 4,094 | 70 | Woods, Good, HSG C |
| 6,780 | 72 | Weighted Average |
| 6,780 | | 100.00% Pervious Area |

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

### Subcatchment PR-4: TO OFFSITE SOUTH



## Summary for Subcatchment PR-5: TO WQU-5

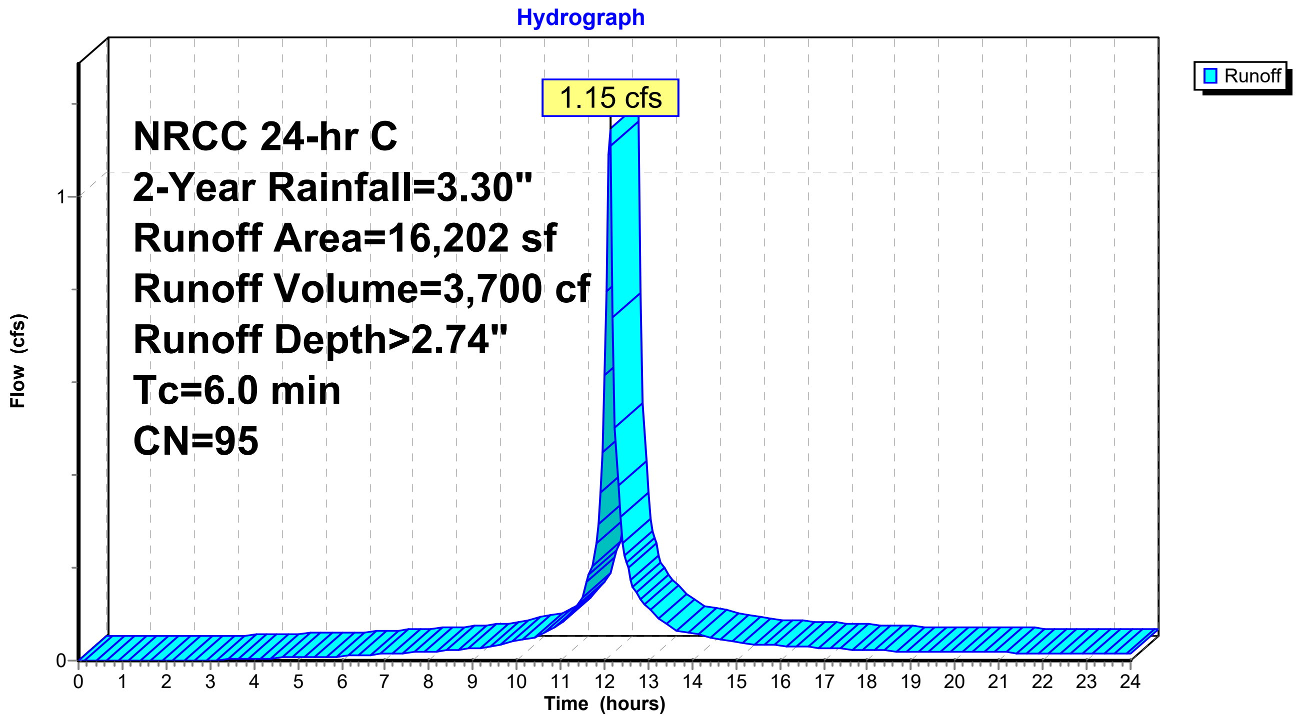
Runoff = 1.15 cfs @ 12.13 hrs, Volume= 3,700 cf, Depth> 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 14,419 | 98 | IMPERVIOUS |
| | 1,783 | 74 | >75% Grass cover, Good, HSG C |
| | 16,202 | 95 | Weighted Average |
| | 1,783 | | 11.00% Pervious Area |
| | 14,419 | | 89.00% Impervious Area |

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

### Subcatchment PR-5: TO WQU-5



## Summary for Subcatchment PR-6: TO WQU-4

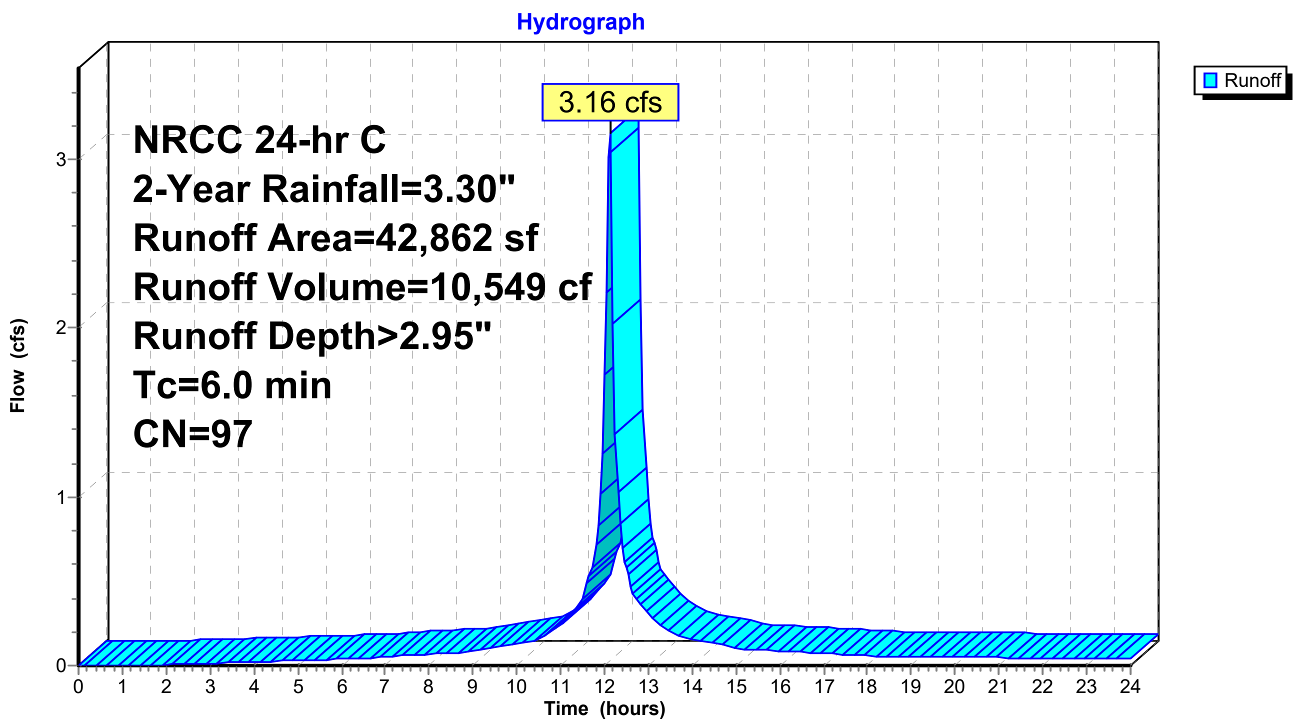
Runoff = 3.16 cfs @ 12.13 hrs, Volume= 10,549 cf, Depth> 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 41,625 | 98 | IMPERVIOUS |
| | 1,237 | 74 | >75% Grass cover, Good, HSG C |
| | 42,862 | 97 | Weighted Average |
| | 1,237 | | 2.89% Pervious Area |
| | 41,625 | | 97.11% Impervious Area |

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

### Subcatchment PR-6: TO WQU-4



## Summary for Subcatchment PR-7: TO WQU-3

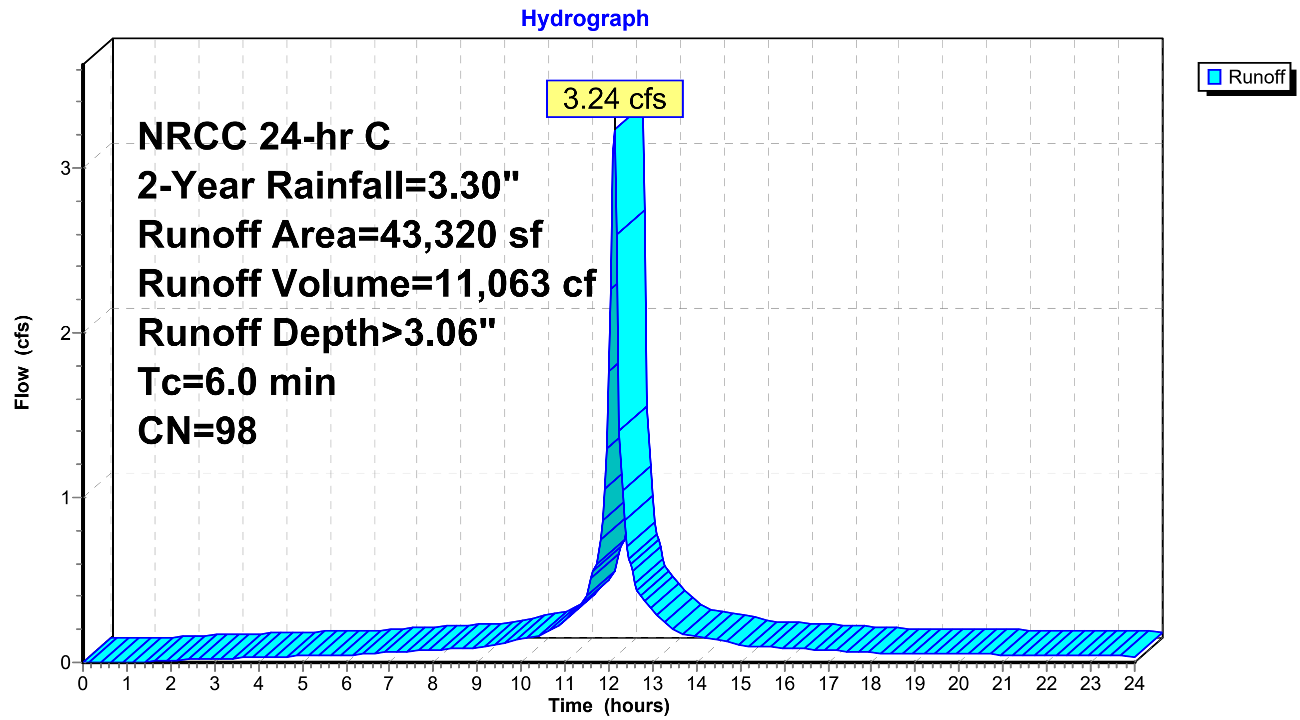
Runoff = 3.24 cfs @ 12.13 hrs, Volume= 11,063 cf, Depth> 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 43,320 | 98 | IMPERVIOUS |
| | 43,320 | | 100.00% Impervious Area |

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

## Subcatchment PR-7: TO WQU-3



## Summary for Subcatchment PR-8: TO WQU-2

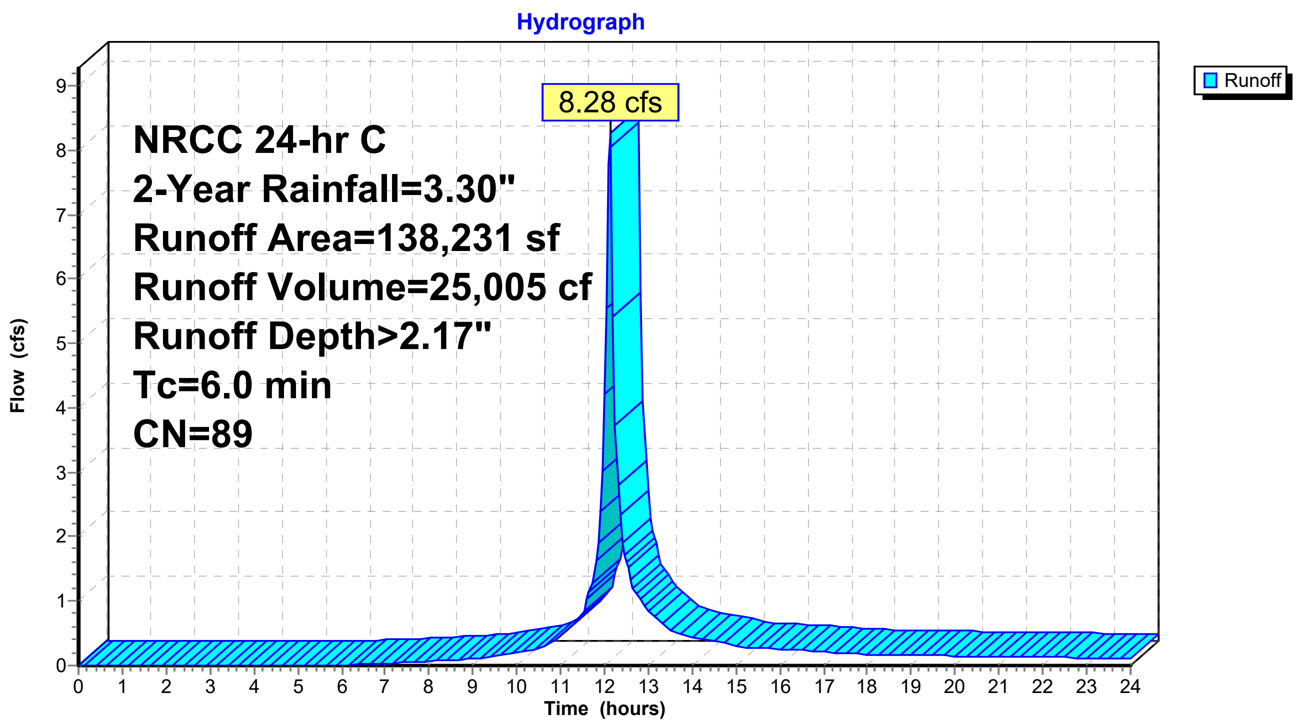
Runoff = 8.28 cfs @ 12.13 hrs, Volume= 25,005 cf, Depth> 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 88,857 | 98 | IMPERVIOUS |
| | 49,374 | 74 | >75% Grass cover, Good, HSG C |
| | 138,231 | 89 | Weighted Average |
| | 49,374 | | 35.72% Pervious Area |
| | 88,857 | | 64.28% Impervious Area |

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

### Subcatchment PR-8: TO WQU-2



## Summary for Subcatchment PR-9: BUILDING 1 ROOF

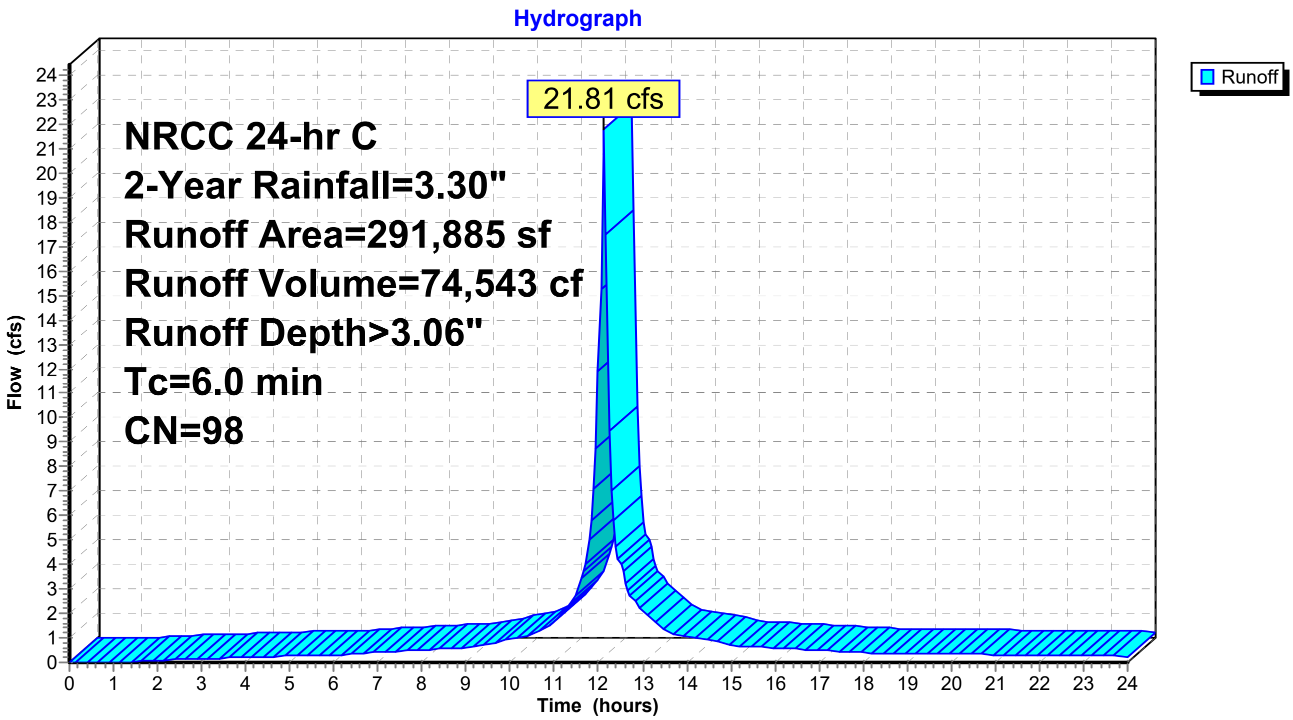
Runoff = 21.81 cfs @ 12.13 hrs, Volume= 74,543 cf, Depth> 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.30"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 291,885 | 98 | IMPERVIOUS |
| | 291,885 | | 100.00% Impervious Area |

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

### Subcatchment PR-9: BUILDING 1 ROOF

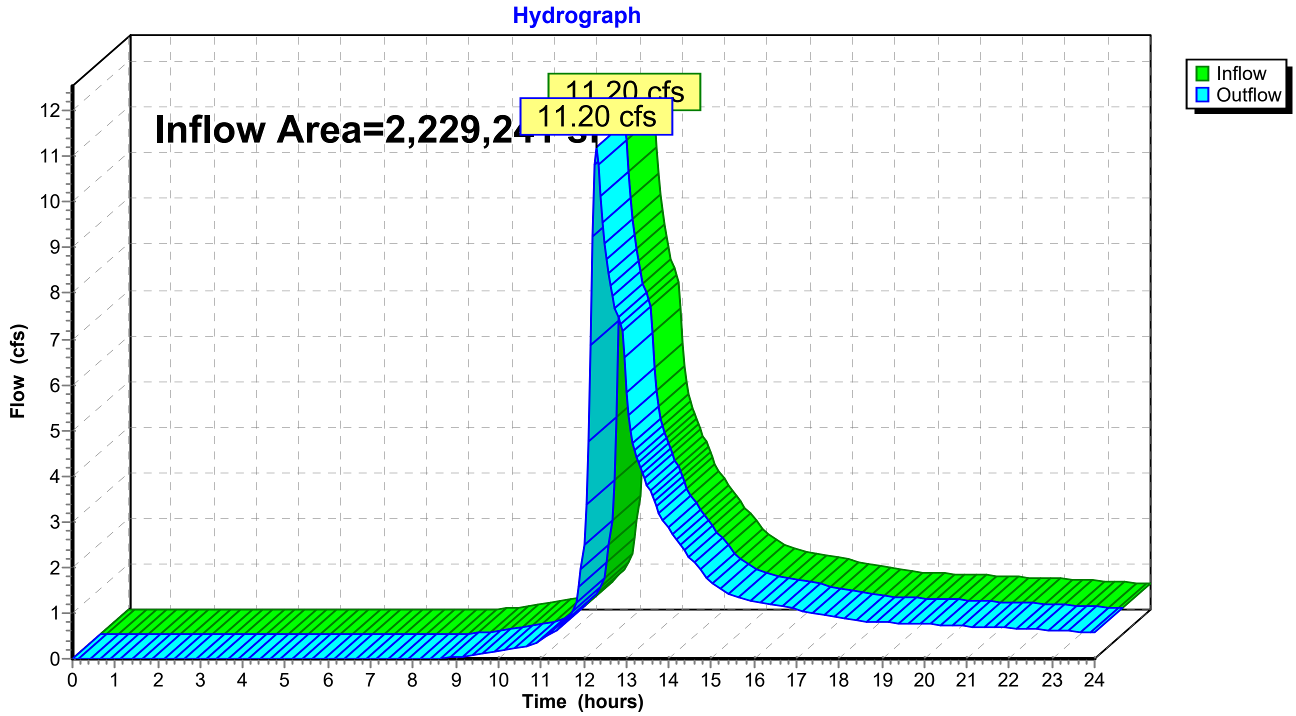


## Summary for Reach 1R: WETLANDS CENTER

Inflow Area = 2,229,241 sf, 42.29% Impervious, Inflow Depth > 0.45" for 2-Year event
Inflow = 11.20 cfs @ 12.30 hrs, Volume= 83,527 cf
Outflow = 11.20 cfs @ 12.30 hrs, Volume= 83,527 cf, Atten= 0%, Lag= 0.0 min

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

### Reach 1R: WETLANDS CENTER

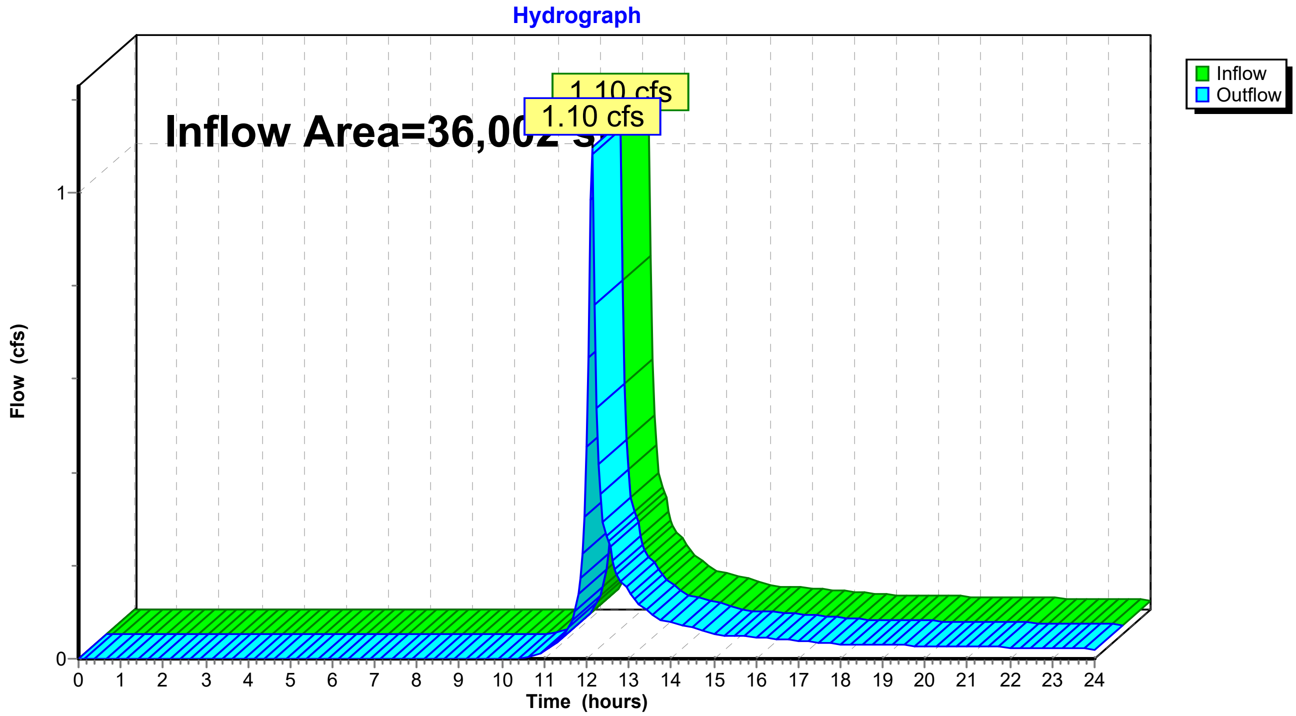


## Summary for Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

Inflow Area = 36,002 sf, 0.00% Impervious, Inflow Depth > 1.10" for 2-Year event
Inflow = 1.10 cfs @ 12.14 hrs, Volume= 3,307 cf
Outflow = 1.10 cfs @ 12.14 hrs, Volume= 3,307 cf, Atten= 0%, Lag= 0.0 min

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

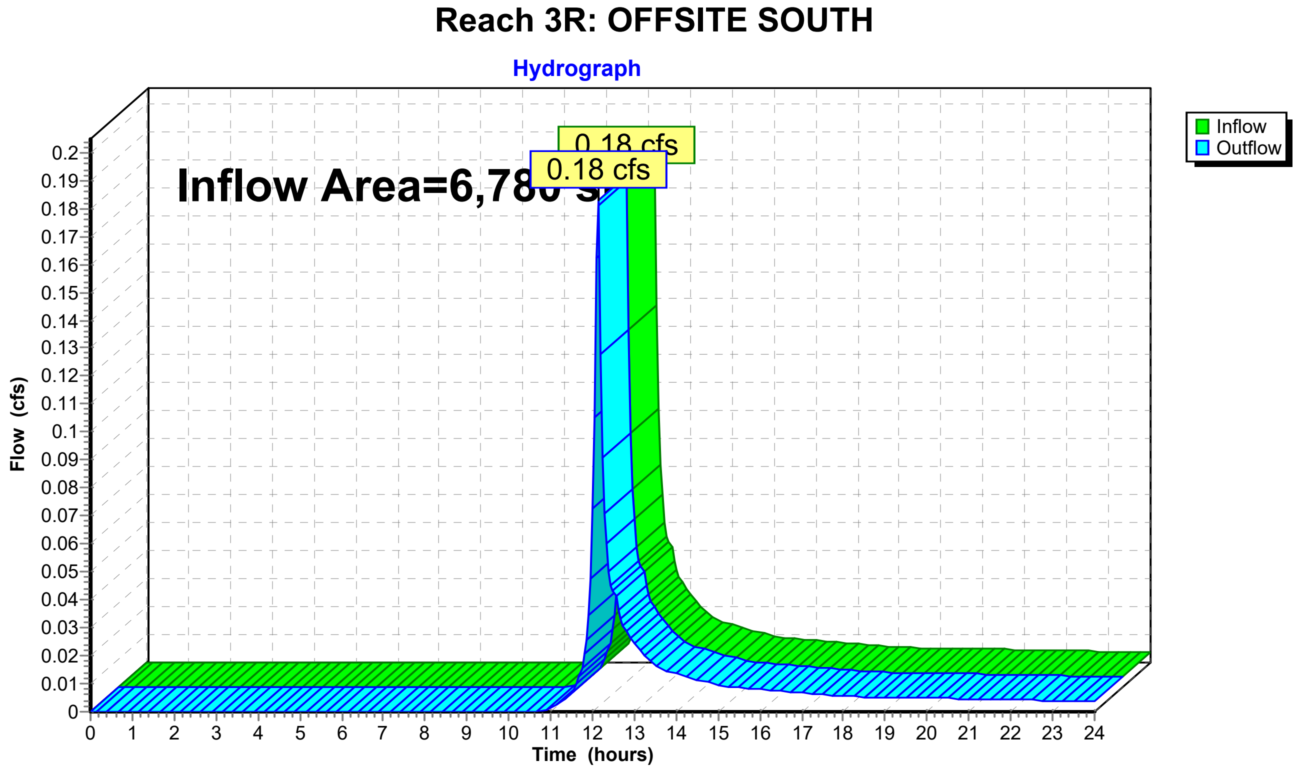
### Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)



## Summary for Reach 3R: OFFSITE SOUTH

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 6,780 sf, | 0.00% Impervious, | Inflow Depth > 0.99" | for 2-Year event | |
| Inflow = | 0.18 cfs @ | 12.14 hrs, | Volume= | 560 cf | |
| Outflow = | 0.18 cfs @ | 12.14 hrs, | Volume= | 560 cf, | Atten= 0%, Lag= 0.0 min |

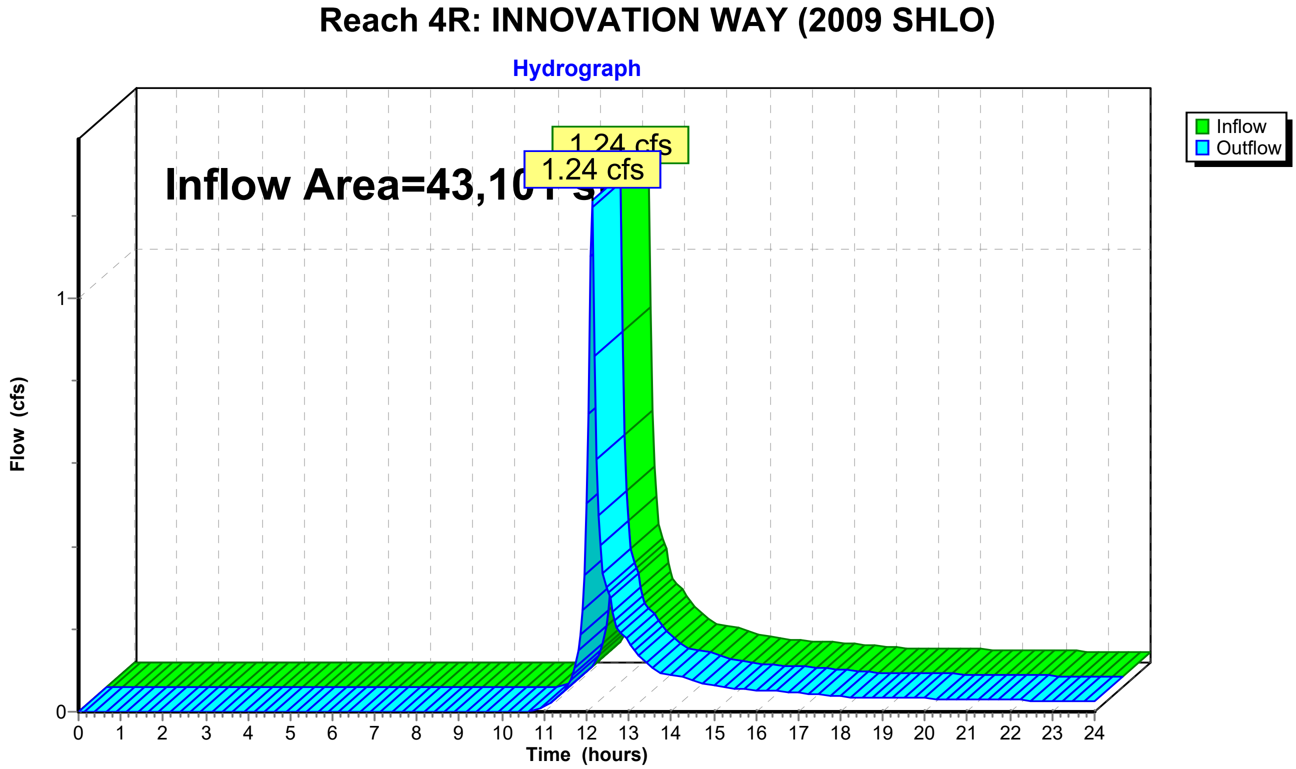
Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs



## Summary for Reach 4R: INNOVATION WAY (2009 SHLO)

Inflow Area = 43,101 sf, 0.00% Impervious, Inflow Depth > 1.05" for 2-Year event
Inflow = 1.24 cfs @ 12.14 hrs, Volume= 3,756 cf
Outflow = 1.24 cfs @ 12.14 hrs, Volume= 3,756 cf, Atten= 0%, Lag= 0.0 min

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

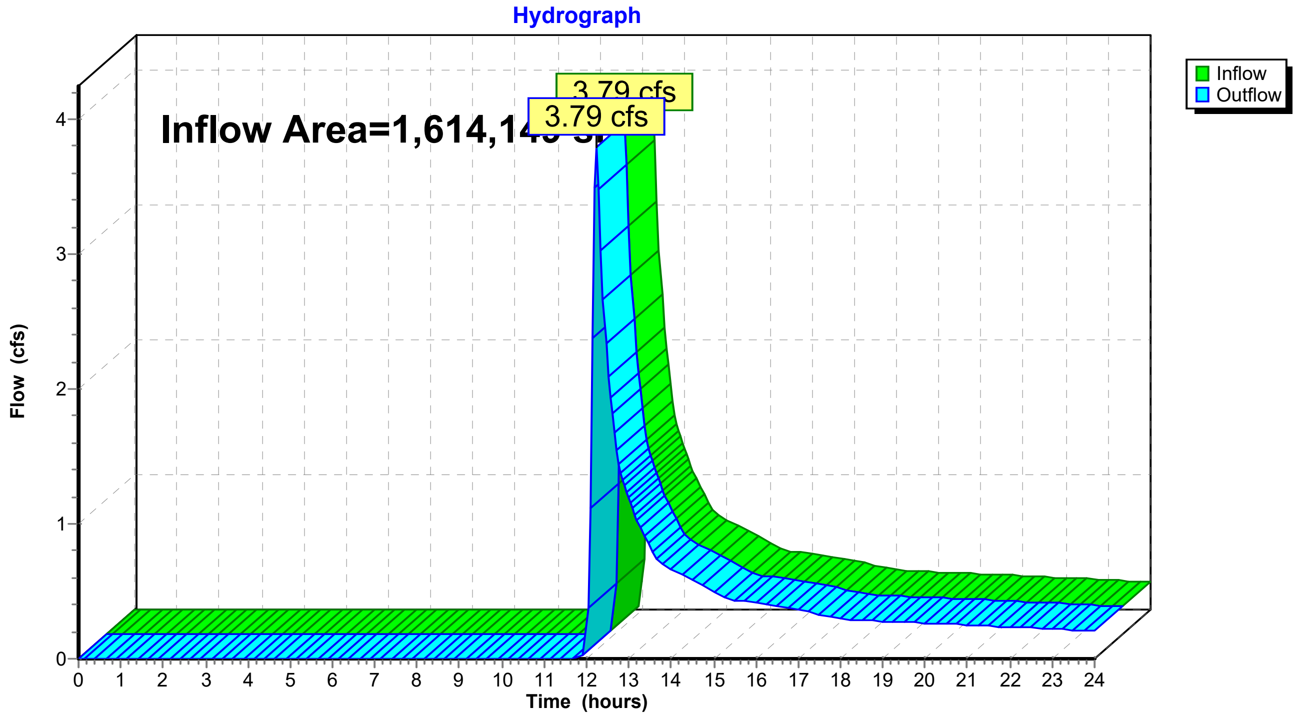


## Summary for Reach 23R: OFFSITE EAST

Inflow Area = 1,614,149 sf, 48.12% Impervious, Inflow Depth > 0.16" for 2-Year event
Inflow = 3.79 cfs @ 12.25 hrs, Volume= 21,800 cf
Outflow = 3.79 cfs @ 12.25 hrs, Volume= 21,800 cf, Atten= 0%, Lag= 0.0 min

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

### Reach 23R: OFFSITE EAST



## Summary for Pond 5P: Focal Point System A

Inflow Area = 235,410 sf, 48.35% Impervious, Inflow Depth > 1.89" for 2-Year event
Inflow = 12.31 cfs @ 12.13 hrs, Volume= 37,074 cf
Outflow = 4.31 cfs @ 12.00 hrs, Volume= 37,072 cf, Atten= 65%, Lag= 0.0 min
Primary = 4.31 cfs @ 12.00 hrs, Volume= 37,072 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 187.02' @ 12.31 hrs Surf.Area= 1,860 sf Storage= 4,632 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.2 min ( 830.7 - 826.5 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 184.25' | 837 cf | **40.00'W x 46.50'L x 2.25'H FOCIAL POINT**<br>4,185 cf Overall x 20.0% Voids |
| #2 | 186.50' | 45,685 cf | **Custom Stage Data (Prismatic)**Listed below (Recalc) -Impervious |
| | | 46,522 cf | Total Available Storage |

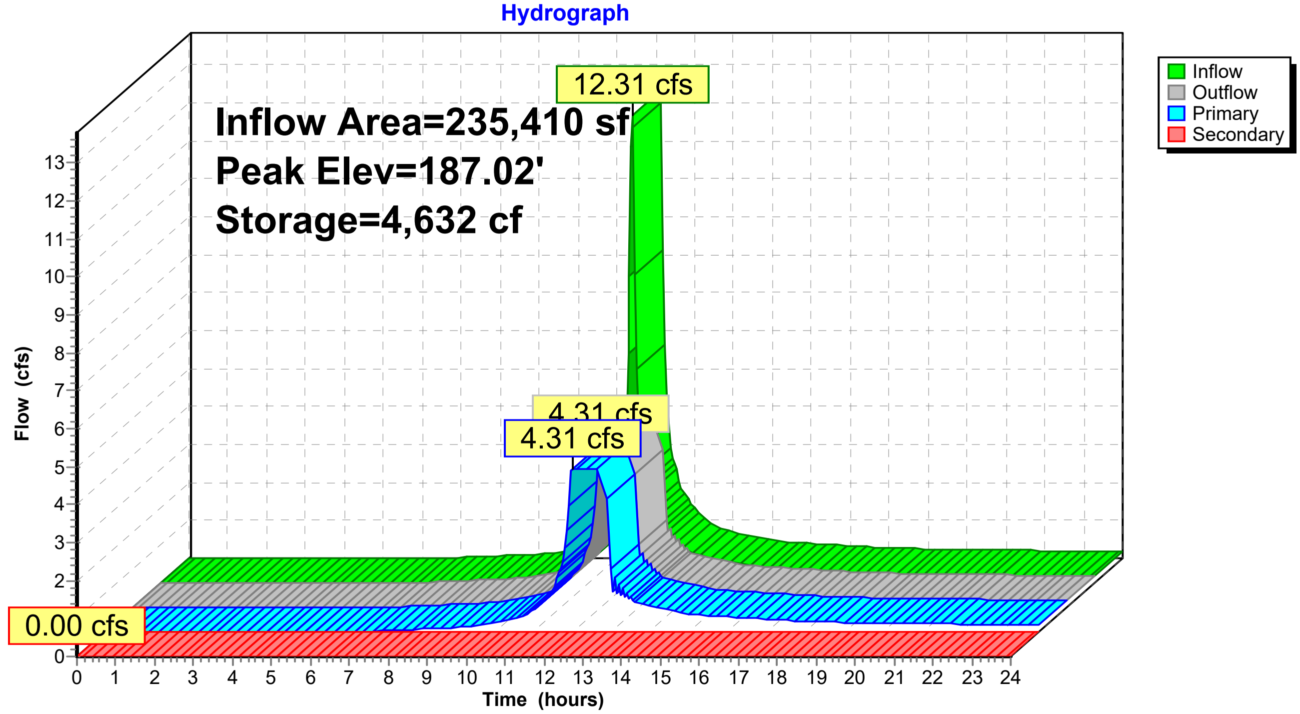
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 186.50 | 3,206 | 0 | 0 |
| 187.00 | 11,178 | 3,596 | 3,596 |
| 188.00 | 13,067 | 12,123 | 15,719 |
| 189.00 | 14,971 | 14,019 | 29,738 |
| 190.00 | 16,924 | 15,948 | 45,685 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 184.25' | **100.000 in/hr Exfiltration over Surface area** Phase-In= 0.10' |
| #2 | Secondary | 188.70' | **48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 2 | 185.00' | **12.0" Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=4.31 cfs @ 12.00 hrs HW=184.78' TW=182.47' (Dynamic Tailwater)
└─**1=Exfiltration** (Exfiltration Controls 4.31 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=184.25' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** ( Controls 0.00 cfs)
  └─**3=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 5P: Focal Point System A



## Summary for Pond 8P: RTANKS

Inflow Area = 235,410 sf, 48.35% Impervious, Inflow Depth > 1.89" for 2-Year event
Inflow = 4.31 cfs @ 12.00 hrs, Volume= 37,072 cf
Outflow = 4.26 cfs @ 12.90 hrs, Volume= 36,087 cf, Atten= 1%, Lag= 54.0 min
Primary = 2.64 cfs @ 12.90 hrs, Volume= 33,232 cf
Secondary = 1.62 cfs @ 12.90 hrs, Volume= 2,855 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 183.63' @ 12.90 hrs Surf.Area= 3,844 sf Storage= 7,814 cf

Plug-Flow detention time= 47.2 min calculated for 36,087 cf (97% of inflow)
Center-of-Mass det. time= 32.1 min ( 862.8 - 830.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 181.18' | 943 cf | **48.62'W x 79.07'L x 3.07'H Field A**<br>11,807 cf Overall - 9,450 cf Embedded = 2,357 cf x 40.0% Voids |
| #2A | 181.43' | 8,978 cf | **ACF R-Tank HD 2** x 1088 Inside #1<br>Inside= 15.7"W x 33.9"H => 3.52 sf x 2.35'L = 8.3 cf<br>Outside= 15.7"W x 33.9"H => 3.70 sf x 2.35'L = 8.7 cf<br>1088 Chambers in 34 Rows |
| | | 9,921 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 181.43' | **6.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Secondary | 183.17' | **12.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=2.64 cfs @ 12.90 hrs HW=183.63' TW=0.00' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Orifice Controls 2.64 cfs @ 6.72 fps)

**Secondary OutFlow** Max=1.62 cfs @ 12.90 hrs HW=183.63' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Orifice Controls 1.62 cfs @ 2.30 fps)

## Pond 8P: RTANKS - Chamber Wizard Field A

**Chamber Model = ACF R-Tank HD 2 (ACF Environmental R-Tank HD)**
Inside= 15.7"W x 33.9"H => 3.52 sf x 2.35'L = 8.3 cf
Outside= 15.7"W x 33.9"H => 3.70 sf x 2.35'L = 8.7 cf

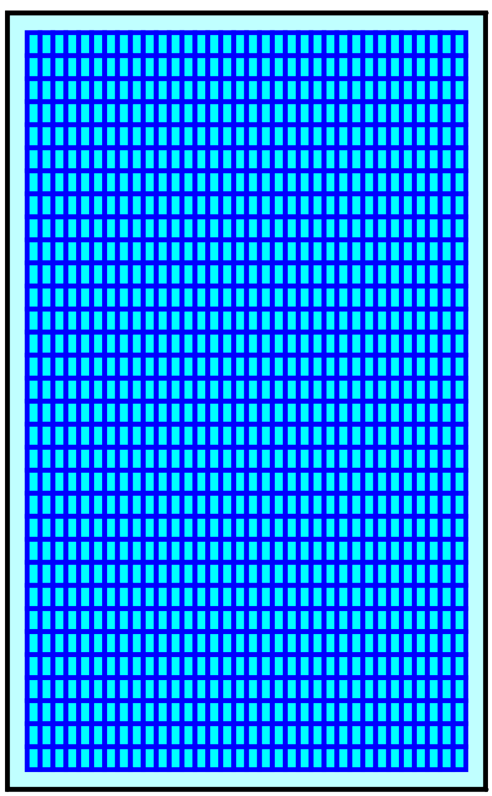
32 Chambers/Row x 2.35' Long = 75.07' Row Length +24.0" End Stone x 2 = 79.07' Base Length
34 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 48.62' Base Width
3.0" Stone Base + 33.9" Chamber Height = 3.07' Field Height

1,088 Chambers x 8.3 cf = 8,977.8 cf Chamber Storage
1,088 Chambers x 8.7 cf = 9,450.4 cf Displacement

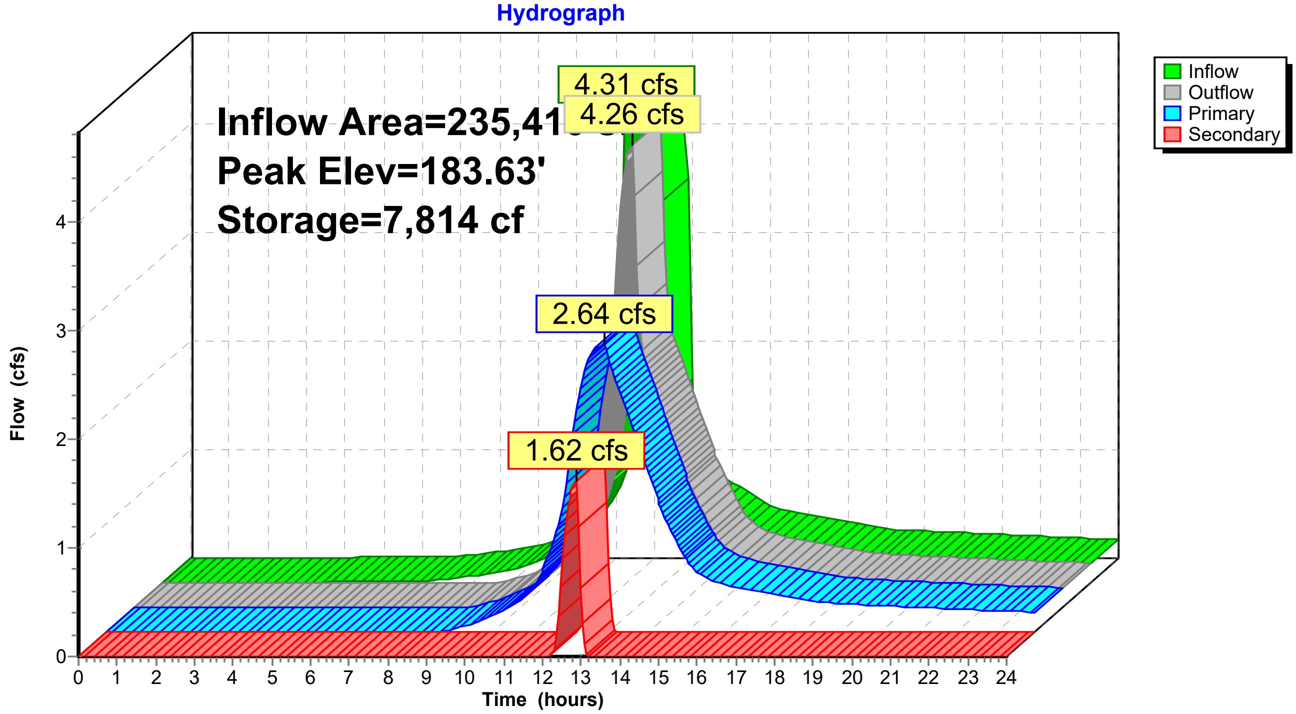
11,807.3 cf Field - 9,450.4 cf Chambers = 2,357.0 cf Stone x 40.0% Voids = 942.8 cf Stone Storage

Chamber Storage + Stone Storage = 9,920.6 cf = 0.228 af
Overall Storage Efficiency = 84.0%
Overall System Size = 79.07' x 48.62' x 3.07'

1,088 Chambers
437.3 cy Field
87.3 cy Stone



## Pond 8P: RTANKS



## Summary for Pond 10P: STORMTRAP SYSTEM C

Inflow Area = 15,869 sf, 90.76% Impervious, Inflow Depth > 2.85" for 2-Year event
Inflow = 1.15 cfs @ 12.13 hrs, Volume= 3,763 cf
Outflow = 0.14 cfs @ 11.90 hrs, Volume= 3,767 cf, Atten= 88%, Lag= 0.0 min
Discarded = 0.14 cfs @ 11.90 hrs, Volume= 3,767 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 219.66' @ 12.74 hrs Surf.Area= 2,561 sf Storage= 1,041 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 43.6 min ( 819.9 - 776.3 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 219.25' | 1 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc)<br>7,683 cf Overall - 7,682 cf Embedded = 1 cf |
| #2 | 219.25' | 7,682 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 7,683 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 219.25 | 2,561 | 0 | 0 |
| 219.75 | 2,561 | 1,281 | 1,281 |
| 220.25 | 2,561 | 1,281 | 2,561 |
| 220.75 | 2,561 | 1,281 | 3,842 |
| 221.25 | 2,561 | 1,281 | 5,122 |
| 221.75 | 2,561 | 1,281 | 6,403 |
| 222.25 | 2,561 | 1,281 | 7,683 |

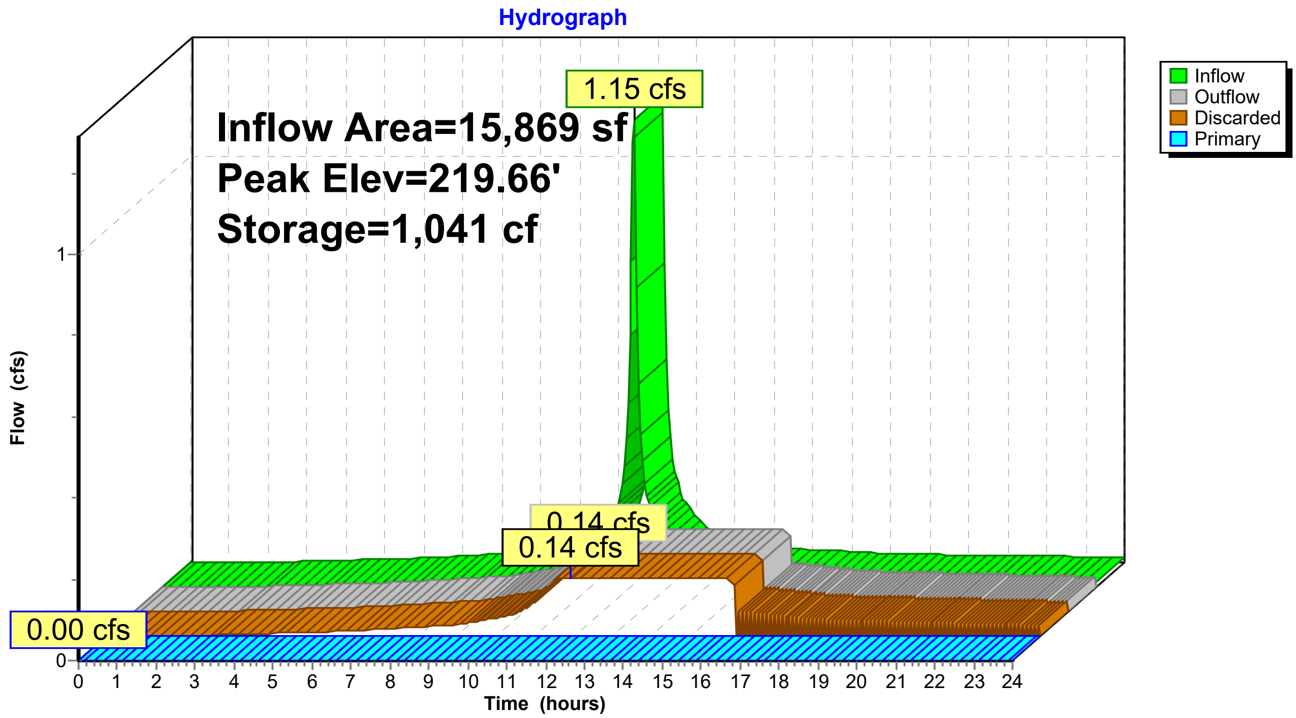
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 219.25 | 0 |
| 219.75 | 1,280 |
| 220.25 | 2,561 |
| 220.75 | 3,841 |
| 221.25 | 5,121 |
| 221.75 | 6,401 |
| 222.25 | 7,682 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 219.25' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 220.75' | **12.0" Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.14 cfs @ 11.90 hrs HW=219.29' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=219.25' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 10P: STORMTRAP SYSTEM C



## Summary for Pond 12P: STORMTRAP 13 FT SYSTEM D

Inflow Area = 203,397 sf,100.00% Impervious, Inflow Depth > 3.06" for 2-Year event
Inflow = 15.20 cfs @ 12.13 hrs, Volume= 51,945 cf
Outflow = 0.25 cfs @ 6.65 hrs, Volume= 18,562 cf, Atten= 98%, Lag= 0.0 min
Discarded = 0.25 cfs @ 6.65 hrs, Volume= 18,562 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 174.78' @ 19.23 hrs Surf.Area= 10,737 sf Storage= 34,094 cf

Plug-Flow detention time= 249.3 min calculated for 18,562 cf (36% of inflow)
Center-of-Mass det. time= 69.8 min ( 827.0 - 757.2 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 170.75' | 0 cf | **64.19'W x 167.27'L x 14.00'H Field A**<br>150,314 cf Overall - 150,314 cf Embedded = 0 cf x 40.0% Voids |
| #2A | 170.75' | 125,597 cf | **StormTrap ST2 DoubleTrap 13-0** x 60 Inside #1<br>Inside= 101.7"W x 156.0"H => 101.45 sf x 15.40'L = 1,561.9 cf<br>Outside= 101.7"W x 168.0"H => 118.71 sf x 15.40'L = 1,827.6 cf<br>60 Chambers in 6 Rows<br>50.88' x 153.96' Core + 6.66' Border = 64.19' x 167.27' System |
| | | 125,597 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 170.75' | **1.020 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.25 cfs @ 6.65 hrs HW=171.25' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.25 cfs)

## Pond 12P: STORMTRAP 13 FT SYSTEM D - Chamber Wizard Field A

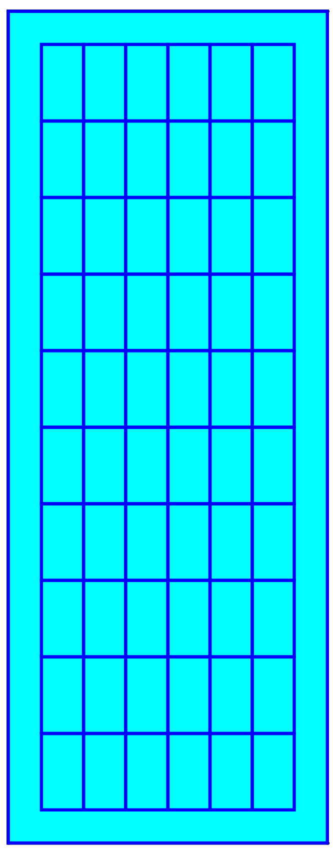
**Chamber Model = StormTrap ST2 DoubleTrap 13-0 (StormTrap ST2 DoubleTrap® Type I+III)**
Inside= 101.7"W x 156.0"H => 101.45 sf x 15.40'L = 1,561.9 cf
Outside= 101.7"W x 168.0"H => 118.71 sf x 15.40'L = 1,827.6 cf

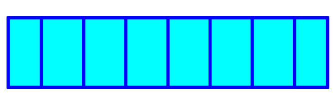
10 Chambers/Row x 15.40' Long = 153.96' Row Length +79.9" Border x 2 = 167.27' Base Length
6 Rows x 101.7" Wide + 79.9" Side Border x 2 = 64.19' Base Width
168.0" Chamber Height = 14.00' Field Height

60 Chambers x 1,561.9 cf + 31,885.6 cf Border = 125,597.4 cf Chamber Storage
60 Chambers x 1,827.6 cf + 40,656.9 cf Border = 150,313.8 cf Displacement

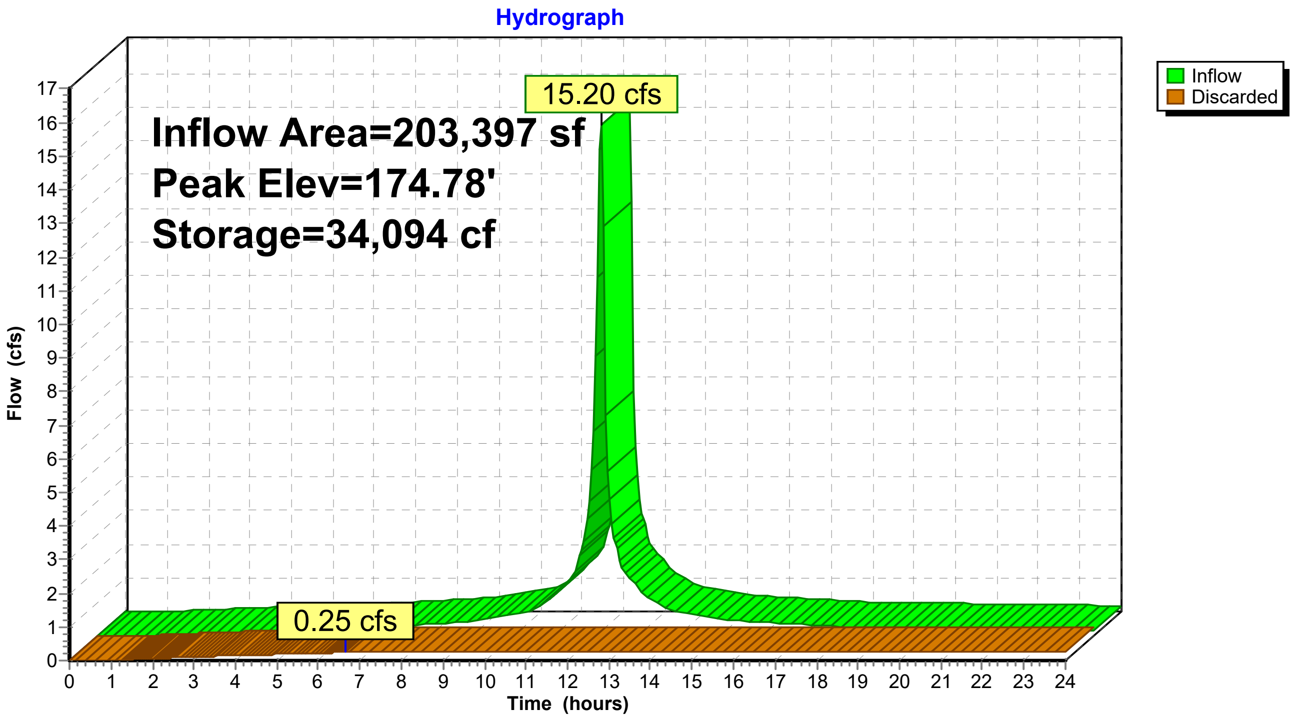
Chamber Storage = 125,597.4 cf = 2.883 af
Overall Storage Efficiency = 83.6%
Overall System Size = 167.27' x 64.19' x 14.00'

60 Chambers (plus border)
5,567.2 cy Field





## Pond 12P: STORMTRAP 13 FT SYSTEM D



## Summary for Pond 13P: BASIN A

Inflow Area = 456,714 sf, 65.34% Impervious, Inflow Depth > 2.07" for 2-Year event
Inflow = 25.33 cfs @ 12.13 hrs, Volume= 78,639 cf
Outflow = 0.99 cfs @ 14.92 hrs, Volume= 52,231 cf, Atten= 96%, Lag= 167.2 min
Discarded = 0.99 cfs @ 14.92 hrs, Volume= 52,231 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 171.54' @ 14.92 hrs Surf.Area= 17,832 sf Storage= 40,572 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 169.6 min ( 979.9 - 810.3 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 169.00' | 214,942 cf | **Custom Stage Data (Prismatic)**Listed below (Recalc) |

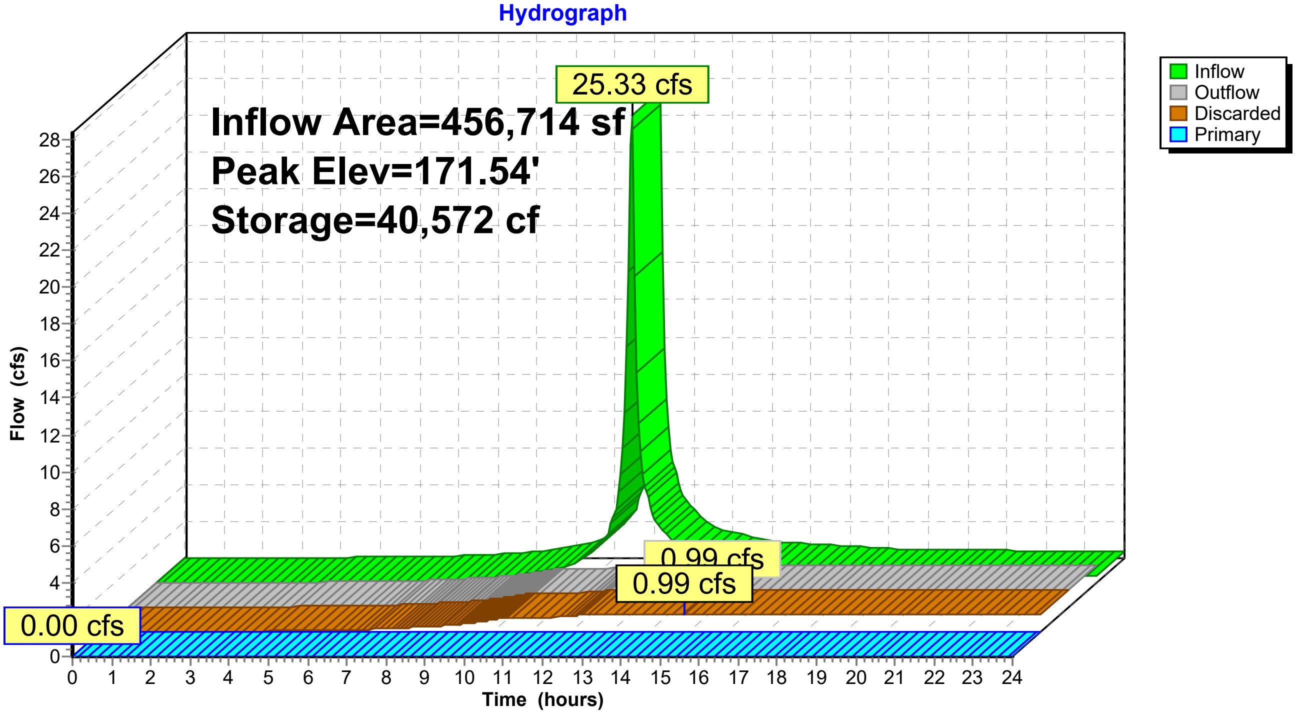
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 169.00 | 14,114 | 0 | 0 |
| 170.00 | 15,529 | 14,822 | 14,822 |
| 171.00 | 17,000 | 16,265 | 31,086 |
| 172.00 | 18,527 | 17,764 | 48,850 |
| 173.00 | 20,111 | 19,319 | 68,169 |
| 174.00 | 21,751 | 20,931 | 89,100 |
| 175.00 | 23,448 | 22,600 | 111,699 |
| 176.00 | 25,345 | 24,397 | 136,096 |
| 177.00 | 27,180 | 26,263 | 162,358 |
| 178.00 | 29,071 | 28,126 | 190,484 |
| 178.80 | 32,074 | 24,458 | 214,942 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 169.00' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 177.80' | **20.0' long x 15.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63 |

**Discarded OutFlow** Max=0.99 cfs @ 14.92 hrs HW=171.54' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.99 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=169.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond 13P: BASIN A



## Summary for Pond 59P: BASIN B

Inflow Area = 271,926 sf, 56.54% Impervious, Inflow Depth > 1.95" for 2-Year event
Inflow = 13.66 cfs @ 12.13 hrs, Volume= 44,191 cf
Outflow = 0.76 cfs @ 13.99 hrs, Volume= 36,360 cf, Atten= 94%, Lag= 111.5 min
Discarded = 0.76 cfs @ 13.99 hrs, Volume= 36,360 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 211.86' @ 13.99 hrs Surf.Area= 13,591 sf Storage= 20,067 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 164.1 min ( 964.4 - 800.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 210.00' | 77,098 cf | **Custom Stage Data (Irregular)**Listed below (Recalc) |

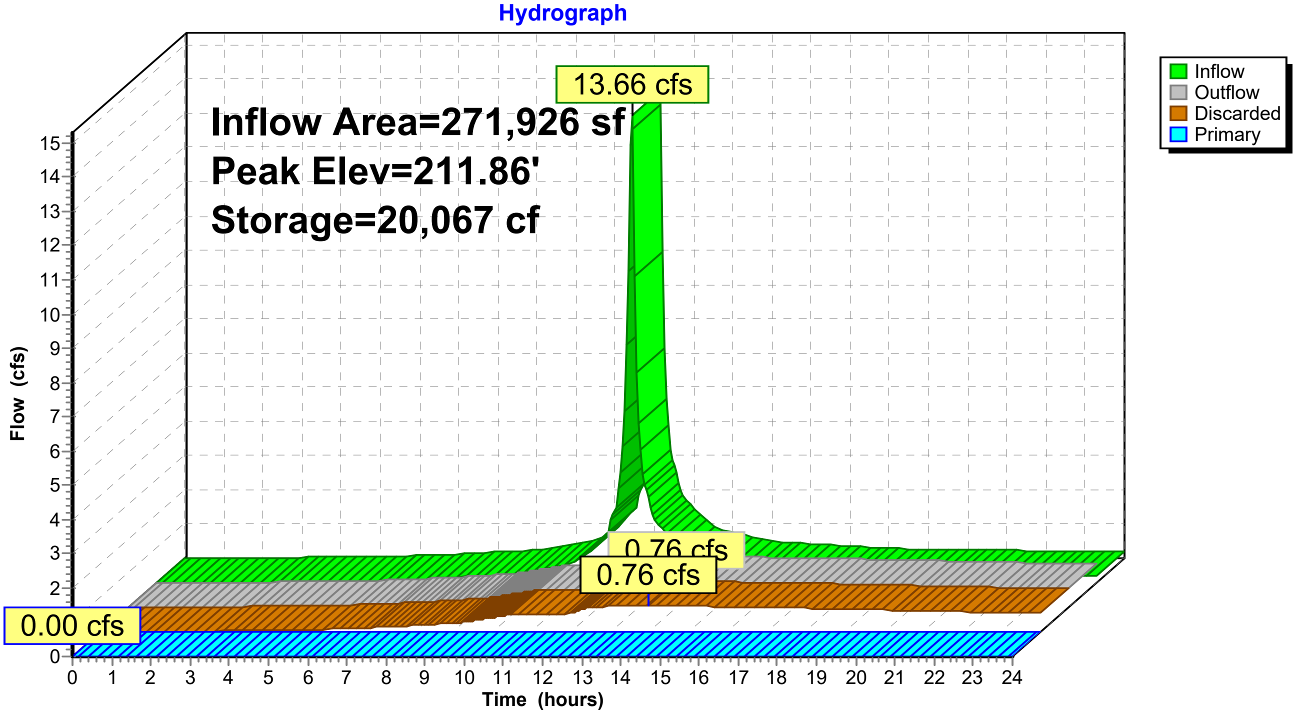
| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|---|---|---|---|---|---|
| 210.00 | 9,182 | 374.9 | 0 | 0 | 9,182 |
| 211.00 | 10,335 | 393.7 | 9,753 | 9,753 | 10,394 |
| 212.00 | 14,140 | 565.6 | 12,188 | 21,941 | 23,526 |
| 213.00 | 15,865 | 584.4 | 14,994 | 36,935 | 25,340 |
| 214.00 | 20,870 | 647.8 | 18,310 | 55,245 | 31,587 |
| 215.00 | 22,851 | 666.2 | 21,853 | 77,098 | 33,620 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 210.00' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 214.00' | **30.0' long x 15.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63 |

**Discarded OutFlow** Max=0.76 cfs @ 13.99 hrs HW=211.86' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.76 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=210.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond 59P: BASIN B



## Summary for Pond 61P: BASIN C

Inflow Area = 351,572 sf, 70.16% Impervious, Inflow Depth > 2.32" for 2-Year event
Inflow = 19.92 cfs @ 12.13 hrs, Volume= 68,018 cf
Outflow = 0.84 cfs @ 14.62 hrs, Volume= 47,841 cf, Atten= 96%, Lag= 149.7 min
Discarded = 0.84 cfs @ 14.62 hrs, Volume= 47,841 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 213.62' @ 14.62 hrs Surf.Area= 15,126 sf Storage= 33,412 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 151.1 min ( 922.5 - 771.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 211.00' | 91,926 cf | **Custom Stage Data (Irregular)** Listed below (Recalc) |

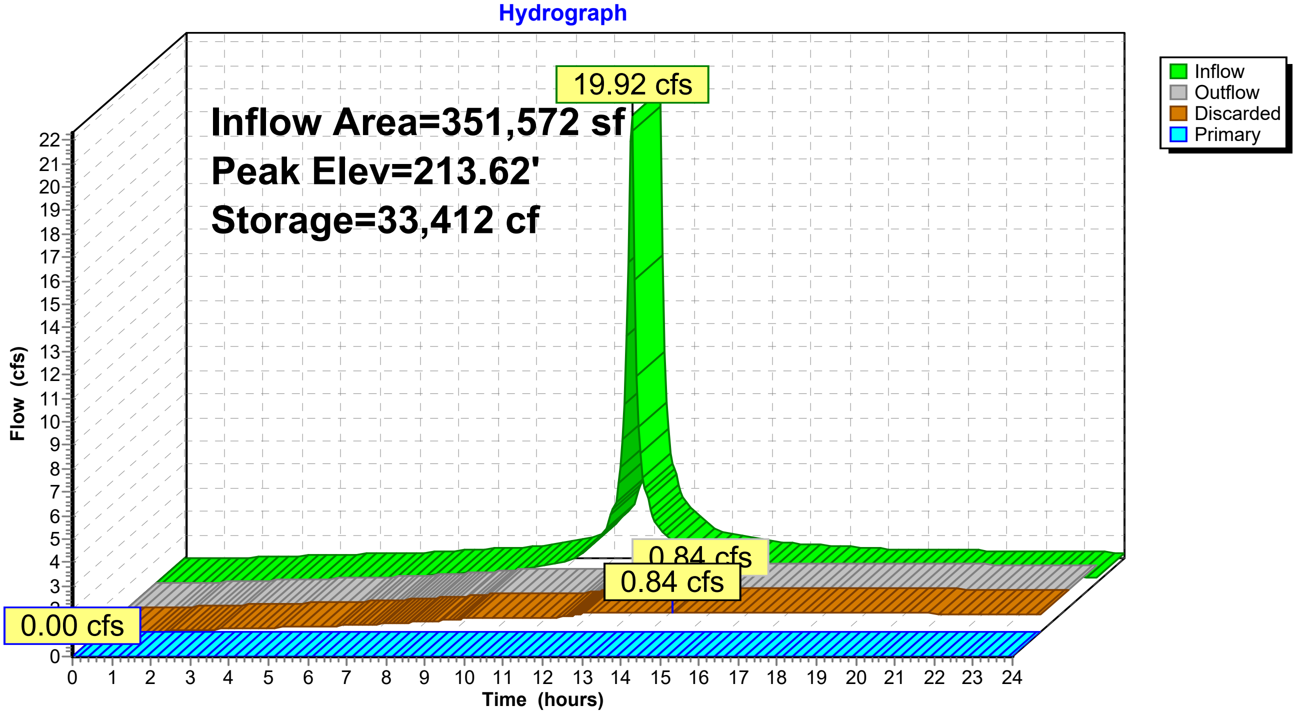
| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|---|---|---|---|---|---|
| 211.00 | 10,407 | 575.7 | 0 | 0 | 10,407 |
| 212.00 | 12,162 | 594.5 | 11,273 | 11,273 | 12,253 |
| 213.00 | 13,974 | 613.4 | 13,058 | 24,331 | 14,167 |
| 214.00 | 15,842 | 632.2 | 14,898 | 39,229 | 16,132 |
| 215.00 | 17,767 | 651.1 | 16,795 | 56,024 | 18,166 |
| 216.00 | 19,749 | 669.9 | 18,749 | 74,773 | 20,250 |
| 216.80 | 23,177 | 701.3 | 17,152 | 91,926 | 23,720 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 211.00' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 215.80' | **20.0' long x 10.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64 |

**Discarded OutFlow** Max=0.84 cfs @ 14.62 hrs HW=213.62' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.84 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=211.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond 61P: BASIN C



## Summary for Pond 65P: STORMTRAP 3.5 FT SYSTEM B

Inflow Area = 375,763 sf, 94.19% Impervious, Inflow Depth > 2.85" for 2-Year event
Inflow = 26.94 cfs @ 12.13 hrs, Volume= 89,131 cf
Outflow = 20.81 cfs @ 12.19 hrs, Volume= 89,110 cf, Atten= 23%, Lag= 3.6 min
Discarded = 0.96 cfs @ 10.65 hrs, Volume= 53,358 cf
Primary = 19.85 cfs @ 12.19 hrs, Volume= 35,753 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 214.22' @ 12.19 hrs Surf.Area= 17,139 sf Storage= 18,578 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 51.8 min ( 823.2 - 771.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 213.14' | 2 cf | **Custom Stage Data (Prismatic)** Listed below<br>59,987 cf Overall - 59,985 cf Embedded = 2 cf |
| #2 | 213.14' | 59,985 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 59,987 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 213.14 | 17,139 | 0 | 0 |
| 213.39 | 17,139 | 4,285 | 4,285 |
| 214.14 | 17,139 | 12,854 | 17,139 |
| 214.64 | 17,139 | 8,570 | 25,709 |
| 215.14 | 17,139 | 8,570 | 34,278 |
| 215.64 | 17,139 | 8,570 | 42,848 |
| 216.14 | 17,139 | 8,570 | 51,417 |
| 216.64 | 17,139 | 8,570 | 59,987 |

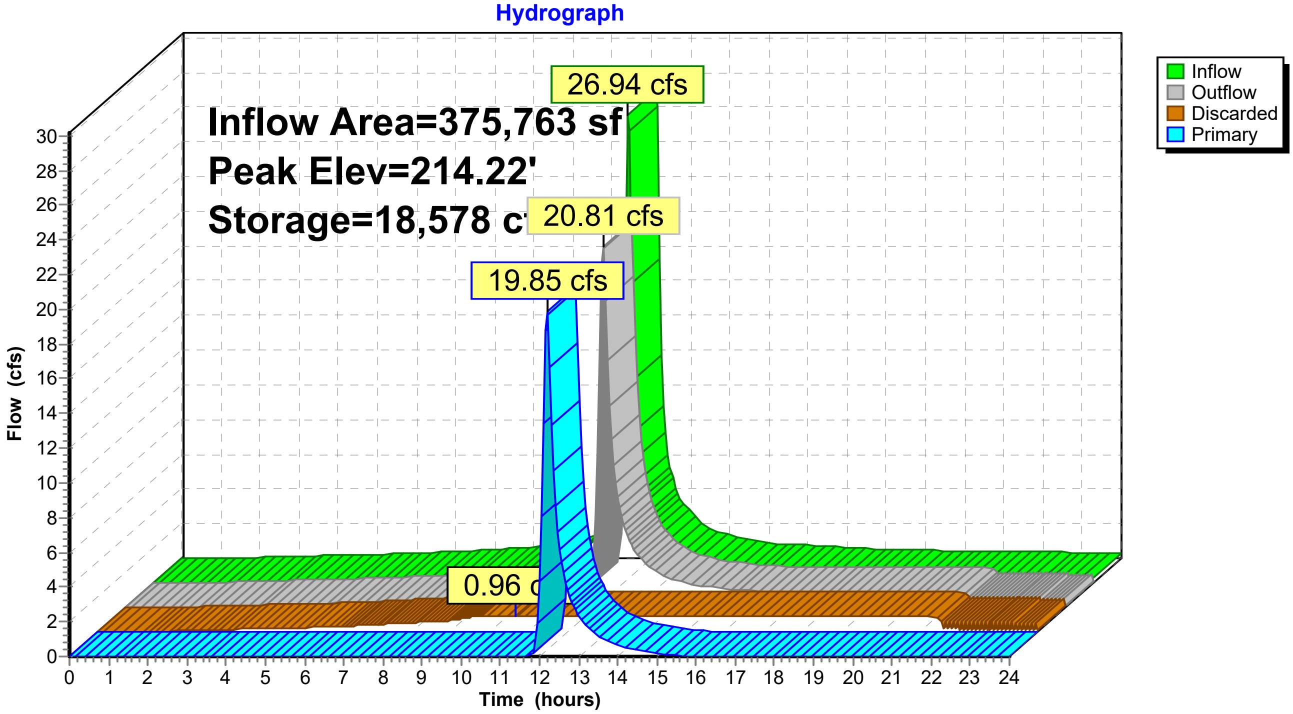
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 213.14 | 0 |
| 213.64 | 8,569 |
| 214.14 | 17,138 |
| 214.64 | 25,708 |
| 215.14 | 34,277 |
| 215.64 | 42,846 |
| 216.14 | 51,416 |
| 216.64 | 59,985 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 213.14' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 213.64' | **24.0" Vert. Orifice/Grate X 10.00** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.96 cfs @ 10.65 hrs HW=213.18' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.96 cfs)

**Primary OutFlow** Max=19.47 cfs @ 12.19 hrs HW=214.22' TW=209.96' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Orifice Controls 19.47 cfs @ 2.59 fps)

## Pond 65P: STORMTRAP 3.5 FT SYSTEM B



## Summary for Pond 67P: CULTEC SYSTEM E

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 59,461 sf, 84.88% Impervious, | Inflow Depth > 2.64" | for 2-Year event | |
| Inflow = | 4.13 cfs @ 12.13 hrs, | Volume= | 13,074 cf | |
| Outflow = | 0.33 cfs @ 11.60 hrs, | Volume= | 13,073 cf, | Atten= 92%, Lag= 0.0 min |
| Discarded = | 0.33 cfs @ 11.60 hrs, | Volume= | 13,073 cf | |
| Primary = | 0.00 cfs @ 0.00 hrs, | Volume= | 0 cf | |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 211.71' @ 13.24 hrs Surf.Area= 5,889 sf Storage= 4,764 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 106.5 min ( 897.1 - 790.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 210.36' | 8,095 cf | **37.50'W x 157.03'L x 5.75'H Field A** |
| | | | 33,860 cf Overall - 13,622 cf Embedded = 20,238 cf x 40.0% Voids |
| #2A | 211.11' | 13,622 cf | **Cultec R-902HD** x 210 Inside #1 |
| | | | Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf |
| | | | Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap |
| | | | 210 Chambers in 5 Rows |
| | | | Cap Storage= +2.8 cf x 2 x 5 rows = 27.6 cf |
| | | 21,717 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 210.36' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 213.56' | **12.0" Vert. Orifice/Grate** C= 0.600 |
| | | | Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.33 cfs @ 11.60 hrs HW=210.43' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.33 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=210.36' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 67P: CULTEC SYSTEM E - Chamber Wizard Field A

**Chamber Model = Cultec R-902HD (Cultec Recharger® 902HD)**
Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= +2.8 cf x 2 x 5 rows = 27.6 cf

78.0" Wide + 9.0" Spacing = 87.0" C-C Row Spacing

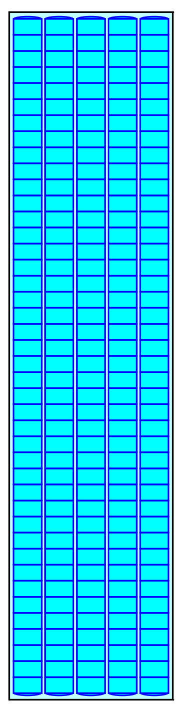
42 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 155.03' Row Length +12.0" End Stone x 2 = 157.03' Base Length
5 Rows x 78.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.50' Base Width
9.0" Stone Base + 48.0" Chamber Height + 12.0" Stone Cover = 5.75' Field Height

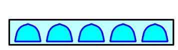
210 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 5 Rows = 13,622.0 cf Chamber Storage

33,860.3 cf Field - 13,622.0 cf Chambers = 20,238.4 cf Stone x 40.0% Voids = 8,095.3 cf Stone Storage

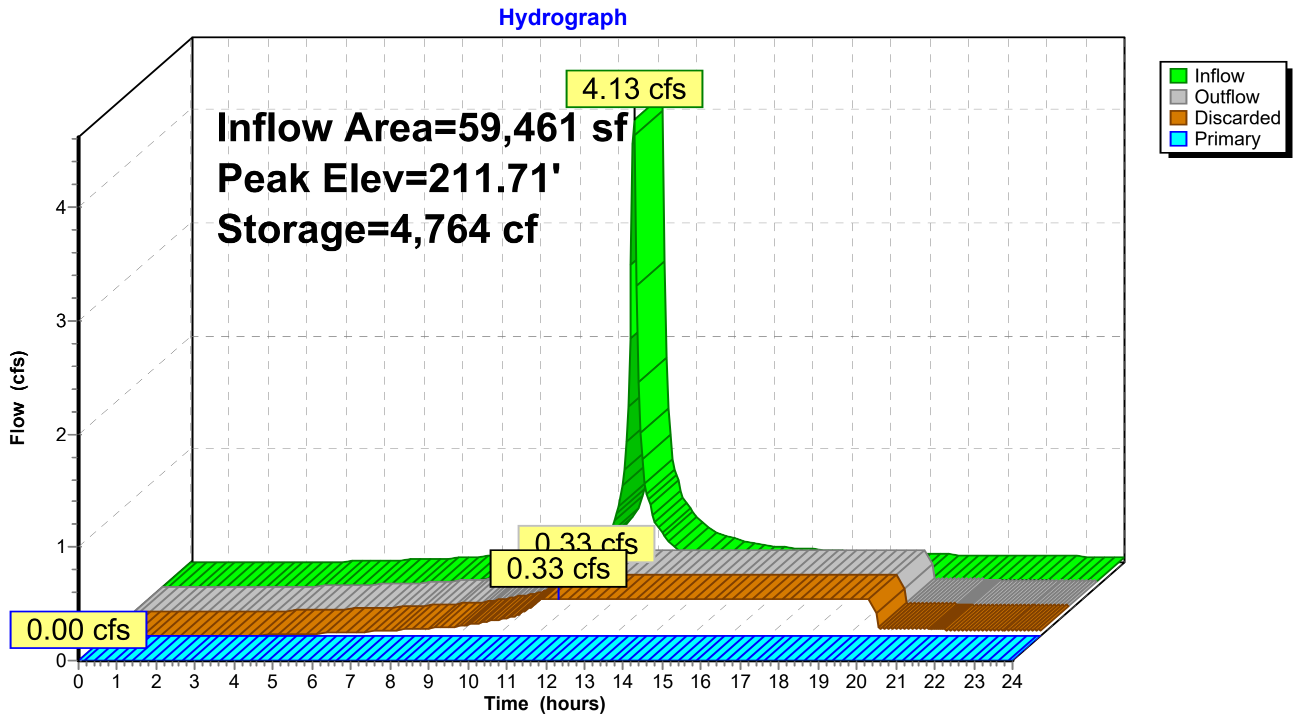
Chamber Storage + Stone Storage = 21,717.3 cf = 0.499 af
Overall Storage Efficiency = 64.1%
Overall System Size = 157.03' x 37.50' x 5.75'

210 Chambers
1,254.1 cy Field
749.6 cy Stone





## Pond 67P: CULTEC SYSTEM E



## Summary for Pond 69P: STORMTRAP 7.5 FT SYSTEM B

Inflow Area = 387,563 sf, 93.38% Impervious, Inflow Depth > 1.18" for 2-Year event
Inflow = 20.39 cfs @ 12.18 hrs, Volume= 37,974 cf
Outflow = 0.62 cfs @ 12.05 hrs, Volume= 27,670 cf, Atten= 97%, Lag= 0.0 min
Discarded = 0.62 cfs @ 12.05 hrs, Volume= 27,670 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 211.87' @ 14.09 hrs Surf.Area= 11,144 sf Storage= 30,477 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 311.5 min ( 1,069.5 - 757.9 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 209.14' | 5 cf | **Custom Stage Data (Prismatic)**Listed below<br>83,580 cf Overall - 83,575 cf Embedded = 5 cf |
| #2 | 209.14' | 83,575 cf | **Custom Stage Data**Listed below Inside #1 |
| | | 83,580 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 209.14 | 11,144 | 0 | 0 |
| 209.64 | 11,144 | 5,572 | 5,572 |
| 210.14 | 11,144 | 5,572 | 11,144 |
| 210.64 | 11,144 | 5,572 | 16,716 |
| 211.14 | 11,144 | 5,572 | 22,288 |
| 211.64 | 11,144 | 5,572 | 27,860 |
| 212.14 | 11,144 | 5,572 | 33,432 |
| 212.64 | 11,144 | 5,572 | 39,004 |
| 213.14 | 11,144 | 5,572 | 44,576 |
| 213.64 | 11,144 | 5,572 | 50,148 |
| 214.14 | 11,144 | 5,572 | 55,720 |
| 214.64 | 11,144 | 5,572 | 61,292 |
| 215.14 | 11,144 | 5,572 | 66,864 |
| 215.64 | 11,144 | 5,572 | 72,436 |
| 216.14 | 11,144 | 5,572 | 78,008 |
| 216.64 | 11,144 | 5,572 | 83,580 |

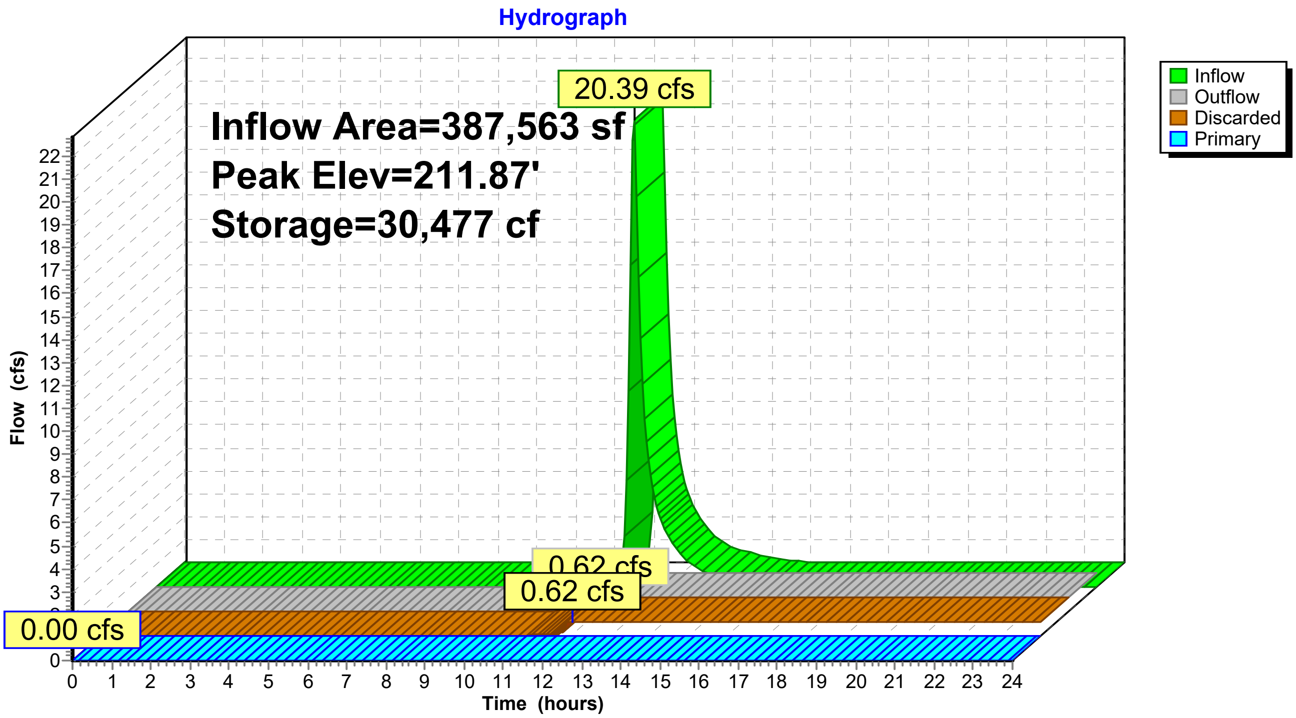
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 209.14 | 0 |
| 209.64 | 5,572 |
| 210.14 | 11,144 |
| 210.64 | 16,715 |
| 211.14 | 22,287 |
| 211.64 | 27,858 |
| 212.14 | 33,430 |
| 212.64 | 39,002 |
| 213.14 | 44,573 |
| 213.64 | 50,145 |
| 214.14 | 55,717 |
| 214.64 | 61,289 |
| 215.14 | 66,860 |
| 215.64 | 72,432 |
| 216.14 | 78,004 |
| 216.64 | 83,575 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 209.14' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 214.64' | **15.0" Round Culvert X 4.00**<br>L= 12.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 214.64' / 214.40' S= 0.0200 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf |

**Discarded OutFlow** Max=0.62 cfs @ 12.05 hrs HW=209.30' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.62 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=209.14' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** ( Controls 0.00 cfs)

## Pond 69P: STORMTRAP 7.5 FT SYSTEM B



## Summary for Pond 70P: STORMTRAP 4 FT SYSTEM A

Inflow Area = 532,500 sf, 90.16% Impervious, Inflow Depth > 2.81" for 2-Year event
Inflow = 37.64 cfs @ 12.13 hrs, Volume= 124,861 cf
Outflow = 2.56 cfs @ 11.55 hrs, Volume= 124,895 cf, Atten= 93%, Lag= 0.0 min
Discarded = 2.56 cfs @ 11.55 hrs, Volume= 124,895 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 185.87' @ 13.43 hrs Surf.Area= 45,880 sf Storage= 47,525 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 138.6 min ( 909.4 - 770.8 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 184.83' | 0 cf | **Custom Stage Data (Prismatic)** Listed below<br>183,520 cf Overall - 183,520 cf Embedded = 0 cf |
| #2 | 184.83' | 183,520 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 183,520 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 184.83 | 45,880 | 0 | 0 |
| 185.33 | 45,880 | 22,940 | 22,940 |
| 185.83 | 45,880 | 22,940 | 45,880 |
| 186.33 | 45,880 | 22,940 | 68,820 |
| 186.83 | 45,880 | 22,940 | 91,760 |
| 187.33 | 45,880 | 22,940 | 114,700 |
| 187.83 | 45,880 | 22,940 | 137,640 |
| 188.33 | 45,880 | 22,940 | 160,580 |
| 188.83 | 45,880 | 22,940 | 183,520 |

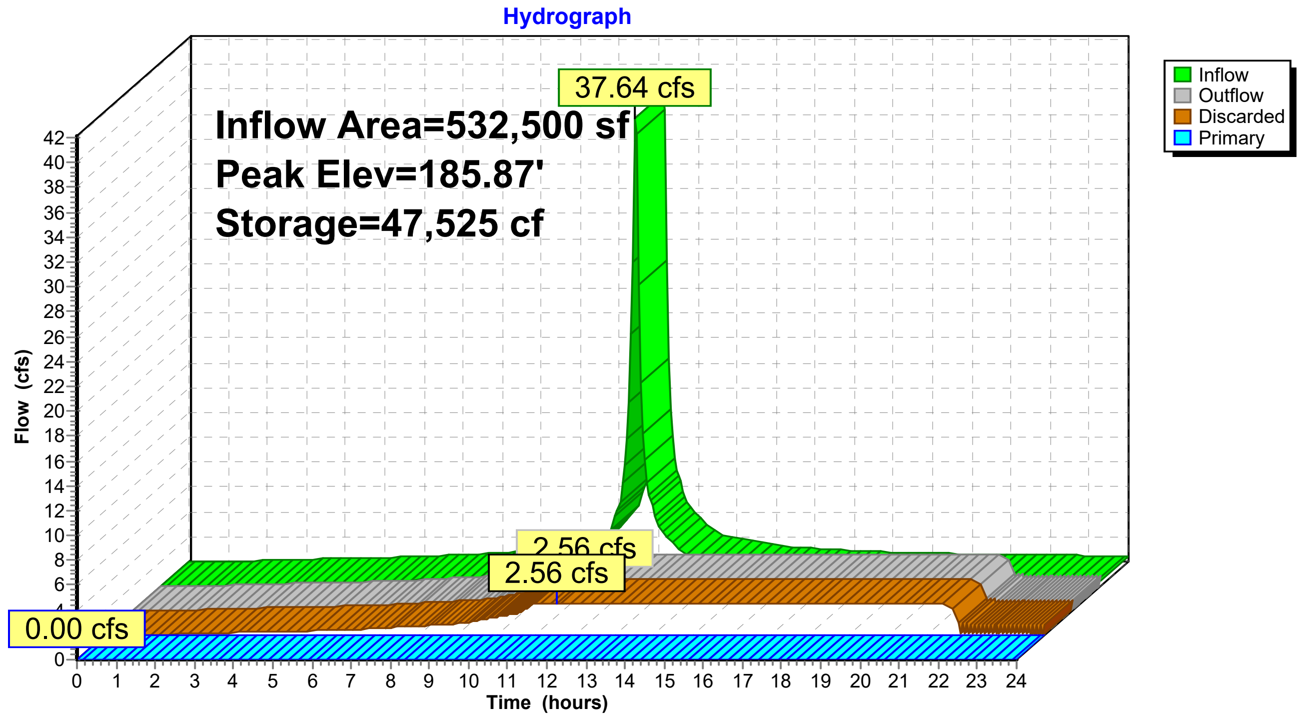
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 184.83 | 0 |
| 185.33 | 22,940 |
| 185.83 | 45,880 |
| 186.33 | 68,820 |
| 186.83 | 91,760 |
| 187.33 | 114,700 |
| 187.83 | 137,640 |
| 188.33 | 160,580 |
| 188.83 | 183,520 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 184.83' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 186.80' | **15.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=2.56 cfs @ 11.55 hrs HW=184.88' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 2.56 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=184.83' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** ( Controls 0.00 cfs)

**Pond 70P: STORMTRAP 4 FT SYSTEM A**



## Summary for Subcatchment PR-1: TO WQU-1

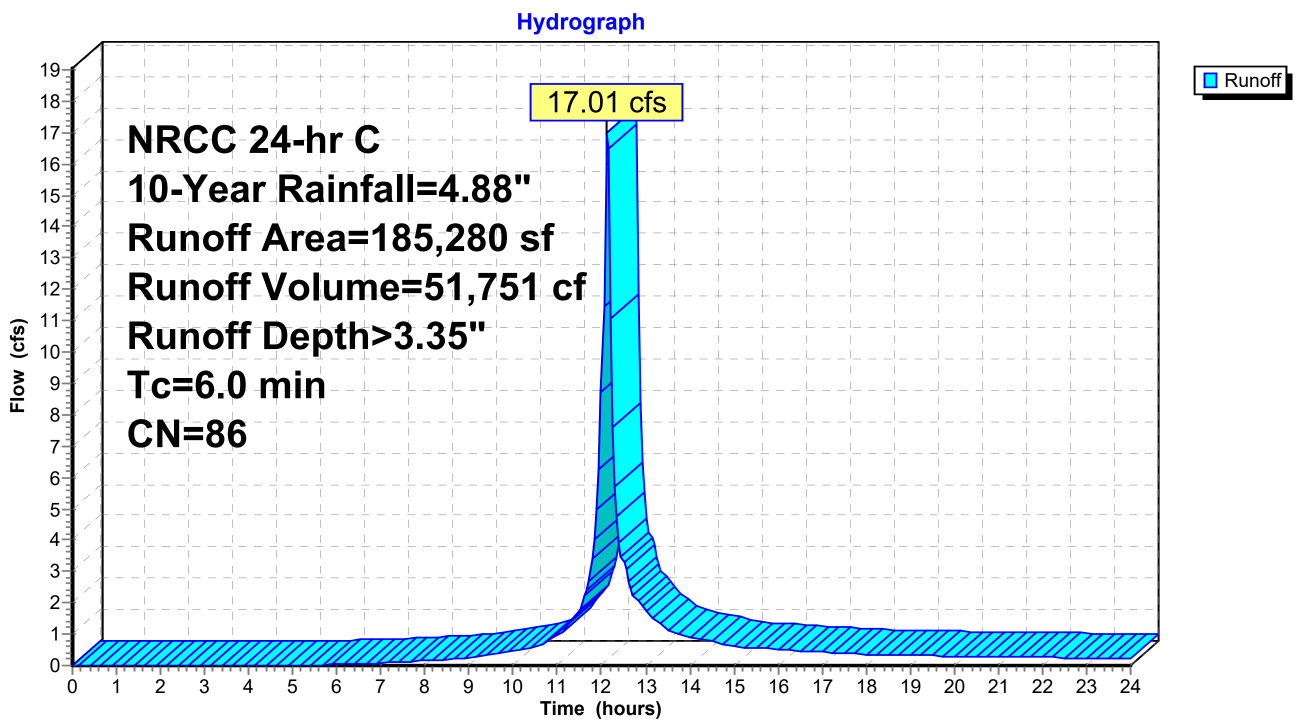
Runoff = 17.01 cfs @ 12.13 hrs, Volume= 51,751 cf, Depth> 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 96,140 | 98 | IMPERVIOUS |
| | 89,140 | 74 | >75% Grass cover, Good, HSG C |
| | 185,280 | 86 | Weighted Average |
| | 89,140 | | 48.11% Pervious Area |
| | 96,140 | | 51.89% Impervious Area |

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

## Subcatchment PR-1: TO WQU-1



## Summary for Subcatchment PR-10: TO WETLANDS CENTER

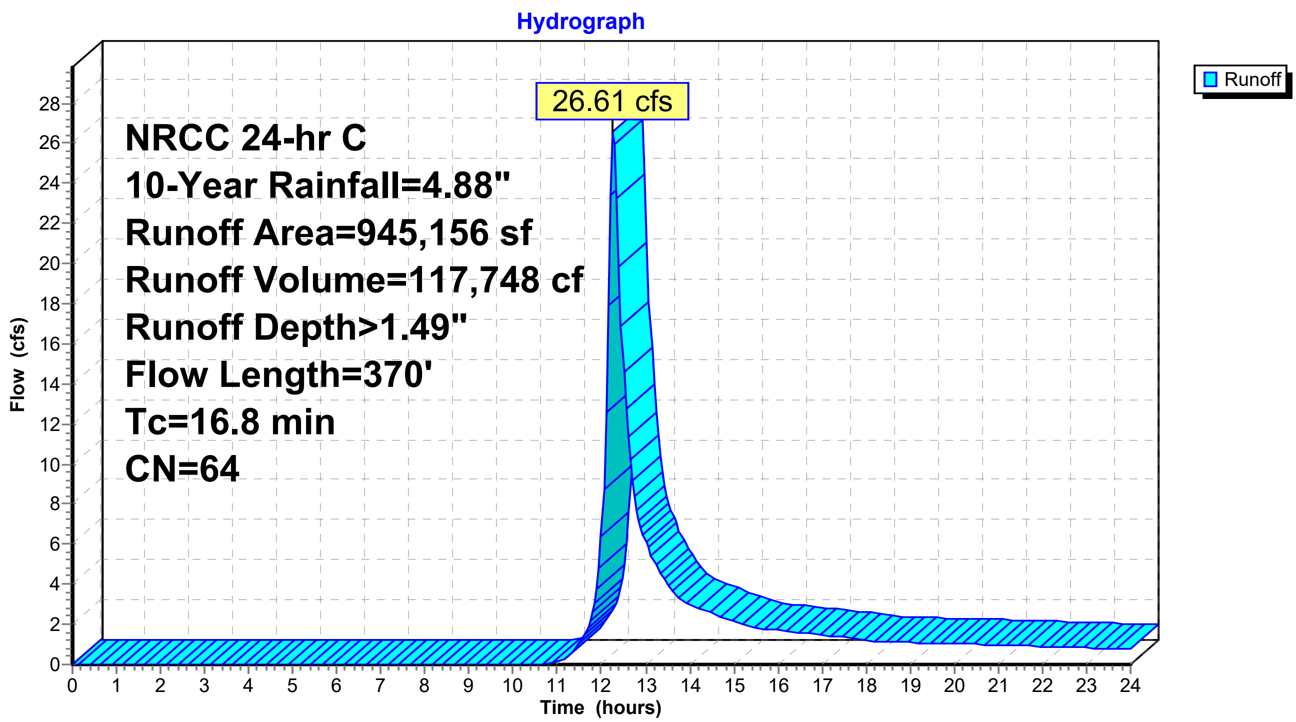
Runoff = 26.61 cfs @ 12.27 hrs, Volume= 117,748 cf, Depth> 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| Area (sf) | CN | Description |
|---|---|---|
| 409,457 | 55 | Woods, Good, HSG B |
| 277,625 | 70 | Woods, Good, HSG C |
| 128,687 | 77 | Woods, Good, HSG D |
| 75,015 | 61 | >75% Grass cover, Good, HSG B |
| 54,372 | 74 | >75% Grass cover, Good, HSG C |
| 945,156 | 64 | Weighted Average |
| 945,156 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.8 | 50 | 0.0500 | 0.09 | | **Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.00" |
| 0.7 | 45 | 0.0444 | 1.05 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 7.3 | 275 | 0.0156 | 0.62 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 16.8 | 370 | Total | | | |

### Subcatchment PR-10: TO WETLANDS CENTER



## Summary for Subcatchment PR-11A: TO INNOVATION WAY (2009 CITY LAYOUT)

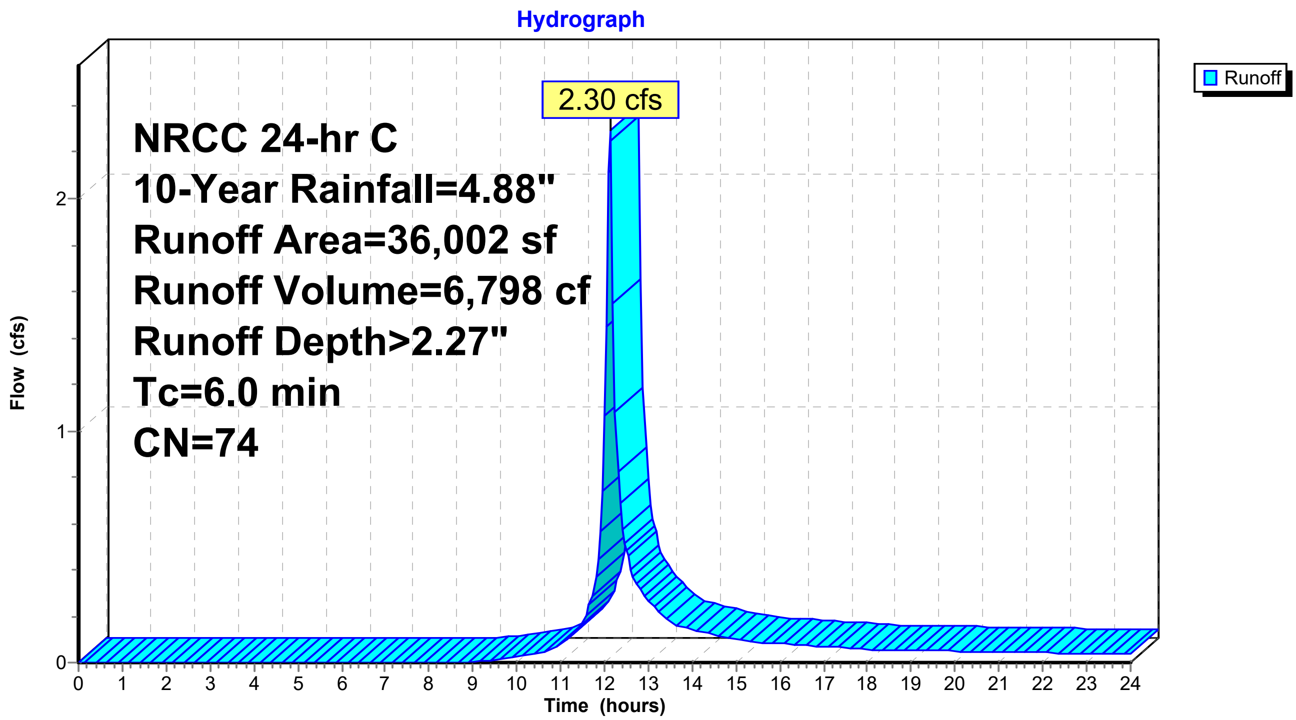
Runoff = 2.30 cfs @ 12.13 hrs, Volume= 6,798 cf, Depth> 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 35,261 | 74 | >75% Grass cover, Good, HSG C |
| * | 741 | 70 | IMPERVIOUS |
| | 36,002 | 74 | Weighted Average |
| | 36,002 | | 100.00% Pervious Area |

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

### Subcatchment PR-11A: TO INNOVATION WAY (2009 CITY LAYOUT)



## Summary for Subcatchment PR-11B: TO INNOVATION WAY (2009 SHLO)

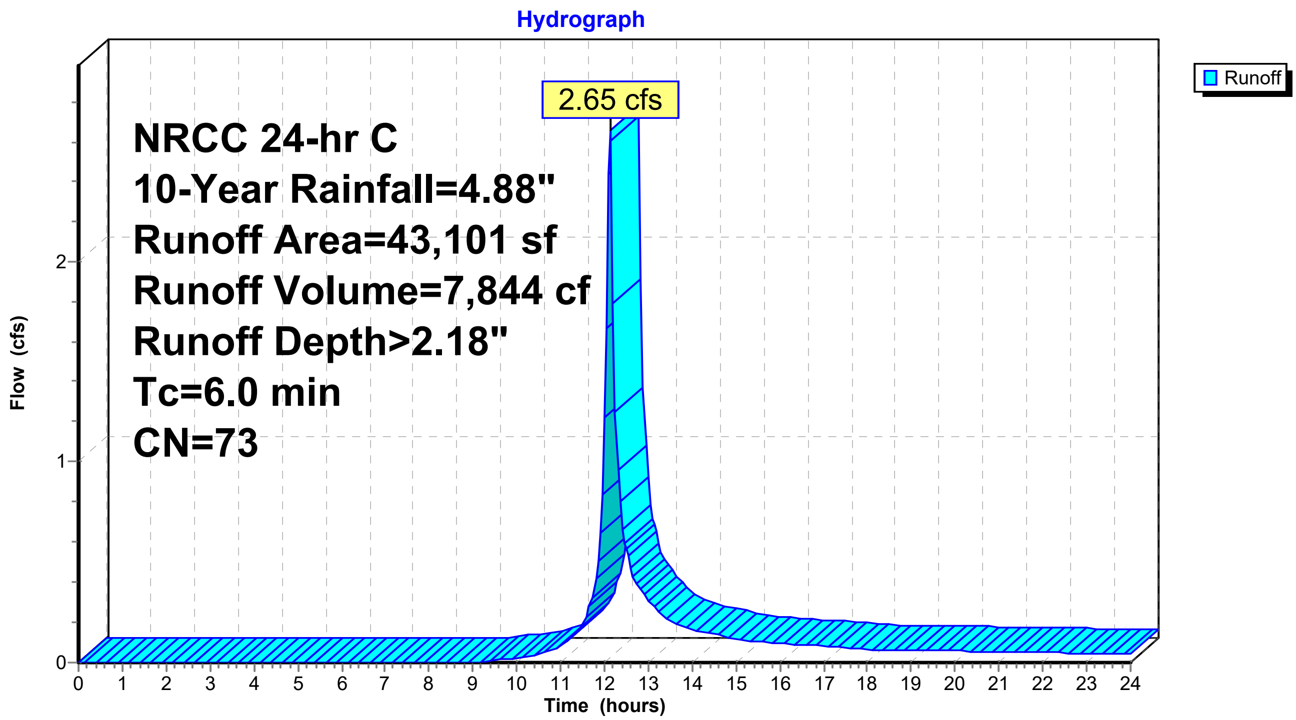
Runoff = 2.65 cfs @ 12.13 hrs, Volume= 7,844 cf, Depth> 2.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| Area (sf) | CN | Description |
|---|---|---|
| 37,380 | 74 | >75% Grass cover, Good, HSG C |
| 5,721 | 70 | Woods, Good, HSG C |
| 43,101 | 73 | Weighted Average |
| 43,101 | | 100.00% Pervious Area |

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

### Subcatchment PR-11B: TO INNOVATION WAY (2009 SHLO)



## Summary for Subcatchment PR-12: TO WQU-6

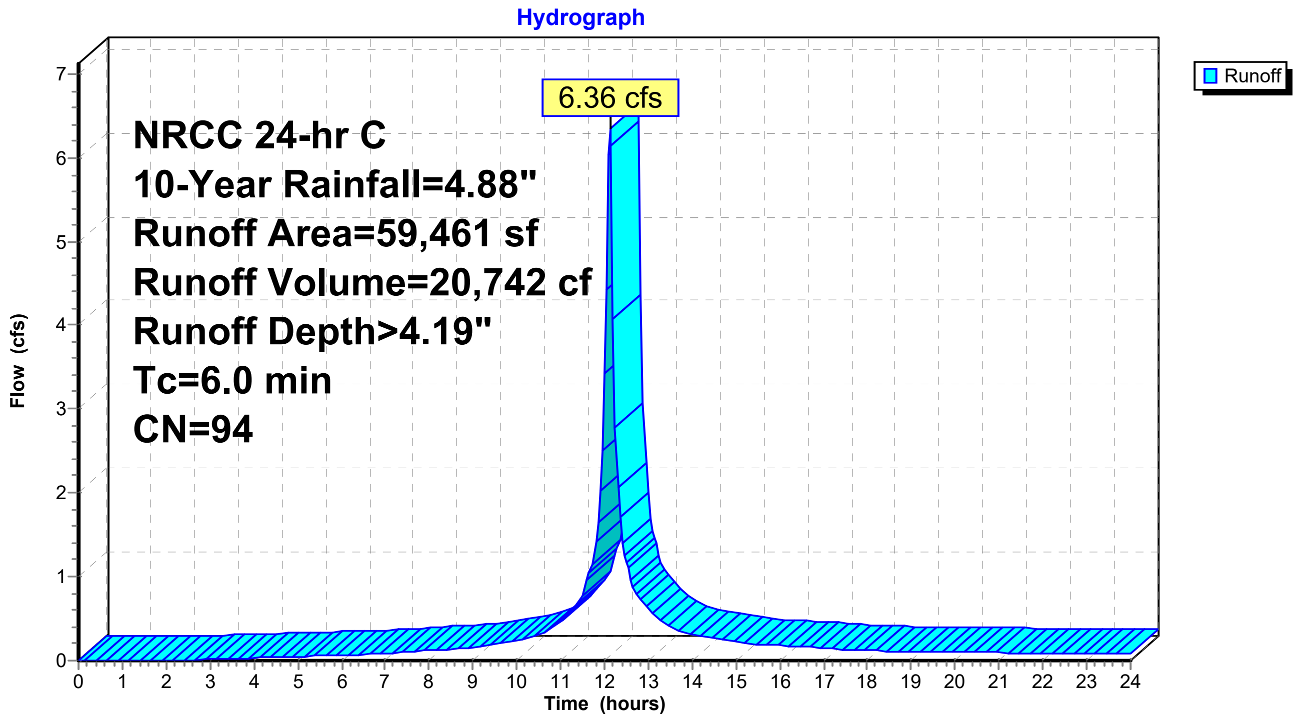
Runoff = 6.36 cfs @ 12.13 hrs, Volume= 20,742 cf, Depth> 4.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 50,470 | 98 | IMPERVIOUS |
| | 8,991 | 74 | >75% Grass cover, Good, HSG C |
| | 59,461 | 94 | Weighted Average |
| | 8,991 | | 15.12% Pervious Area |
| | 50,470 | | 84.88% Impervious Area |

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

### Subcatchment PR-12: TO WQU-6



## Summary for Subcatchment PR-13: TO WQU-7

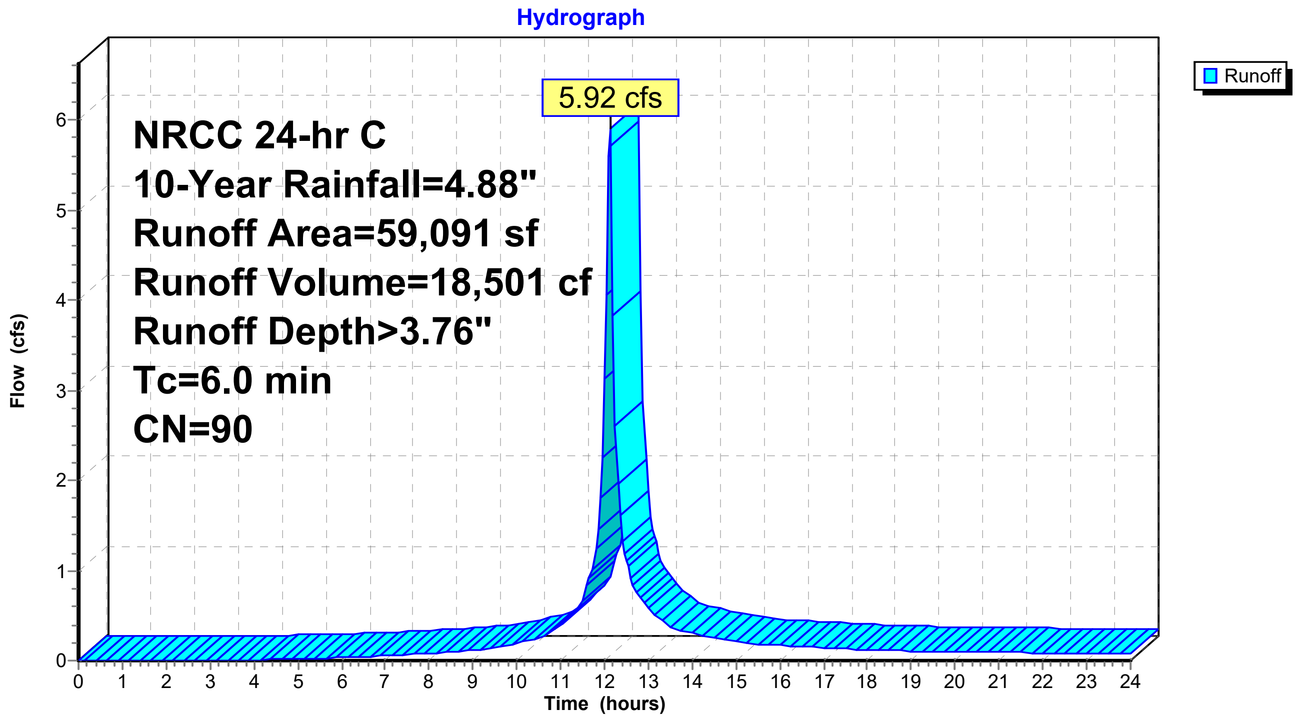
Runoff = 5.92 cfs @ 12.13 hrs, Volume= 18,501 cf, Depth> 3.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 46,105 | 98 | IMPERVIOUS |
| | 12,986 | 61 | >75% Grass cover, Good, HSG B |
| | 59,091 | 90 | Weighted Average |
| | 12,986 | | 21.98% Pervious Area |
| | 46,105 | | 78.02% Impervious Area |

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

### Subcatchment PR-13: TO WQU-7



## Summary for Subcatchment PR-14: TO WQU-8

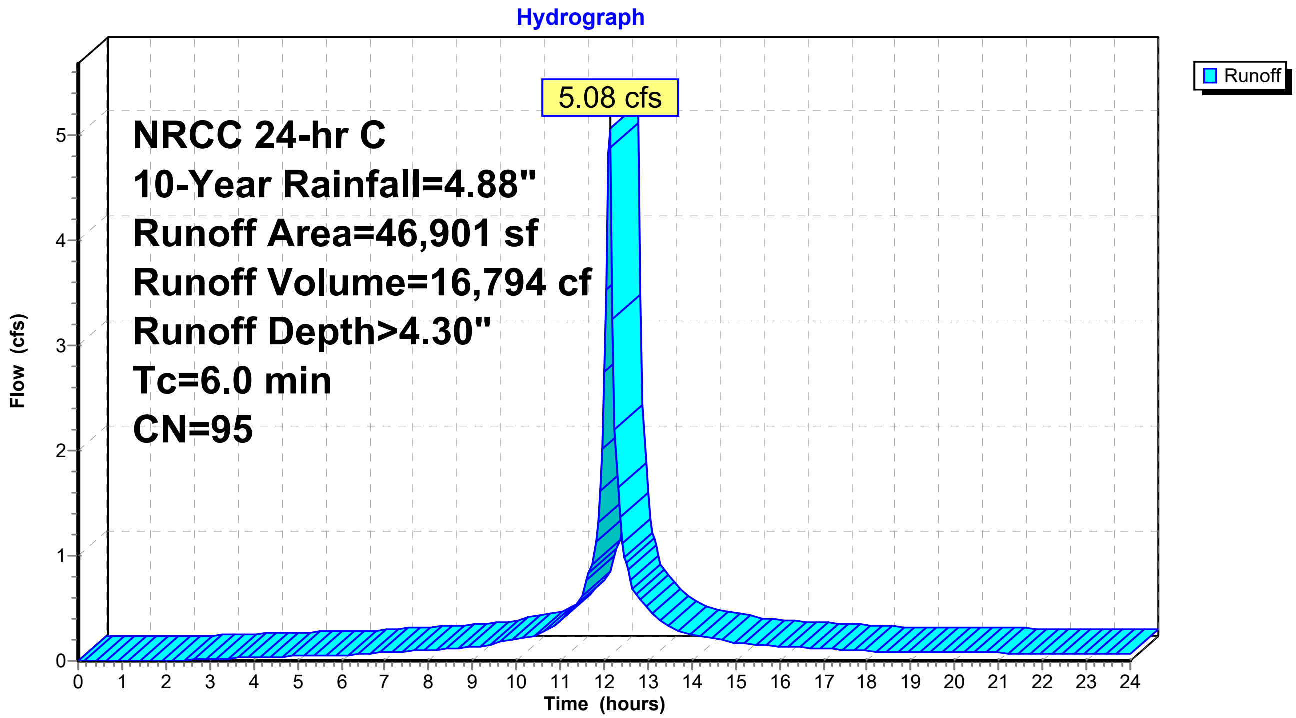
Runoff = 5.08 cfs @ 12.13 hrs, Volume= 16,794 cf, Depth> 4.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 42,641 | 98 | IMPERVIOUS |
| | 4,260 | 61 | >75% Grass cover, Good, HSG B |
| | 46,901 | 95 | Weighted Average |
| | 4,260 | | 9.08% Pervious Area |
| | 42,641 | | 90.92% Impervious Area |

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

### Subcatchment PR-14: TO WQU-8



## Summary for Subcatchment PR-15: TO WQU-9

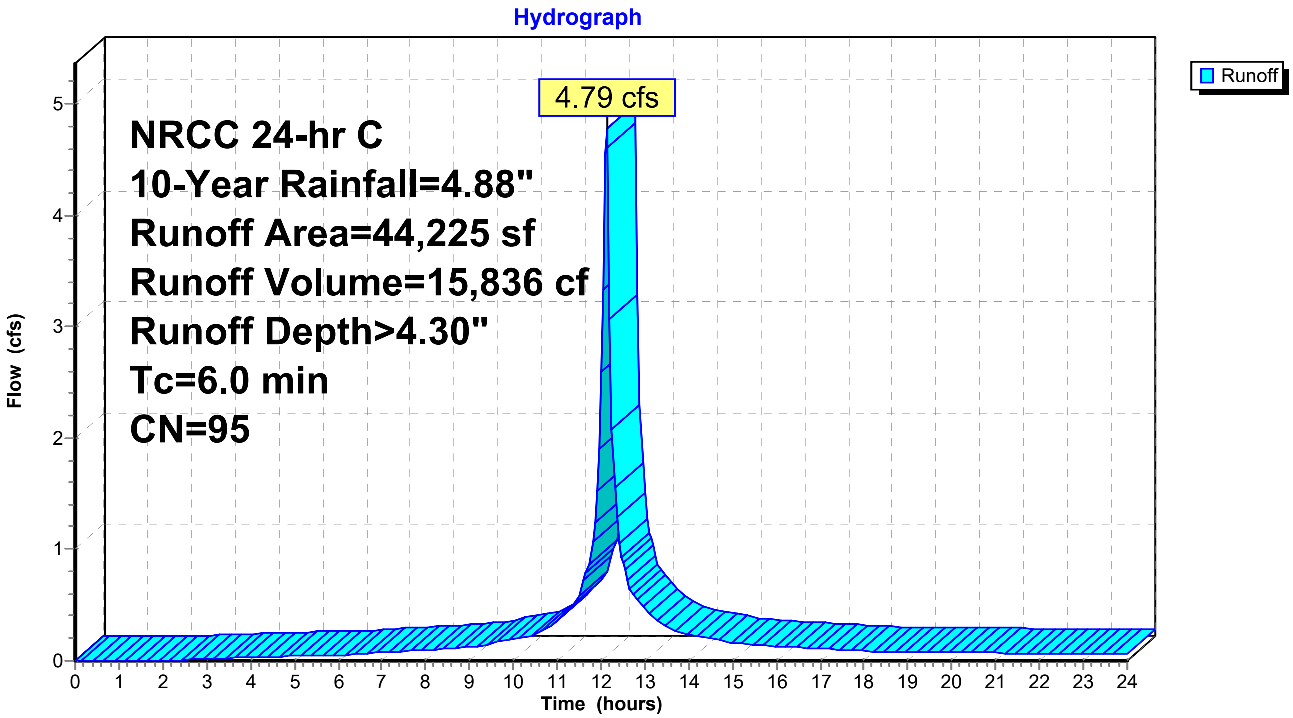
Runoff = 4.79 cfs @ 12.13 hrs, Volume= 15,836 cf, Depth> 4.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 40,778 | 98 | IMPERVIOUS |
| | 3,447 | 61 | >75% Grass cover, Good, HSG B |
| | 44,225 | 95 | Weighted Average |
| | 3,447 | | 7.79% Pervious Area |
| | 40,778 | | 92.21% Impervious Area |

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

### Subcatchment PR-15: TO WQU-9



## Summary for Subcatchment PR-16: TO WQU-10

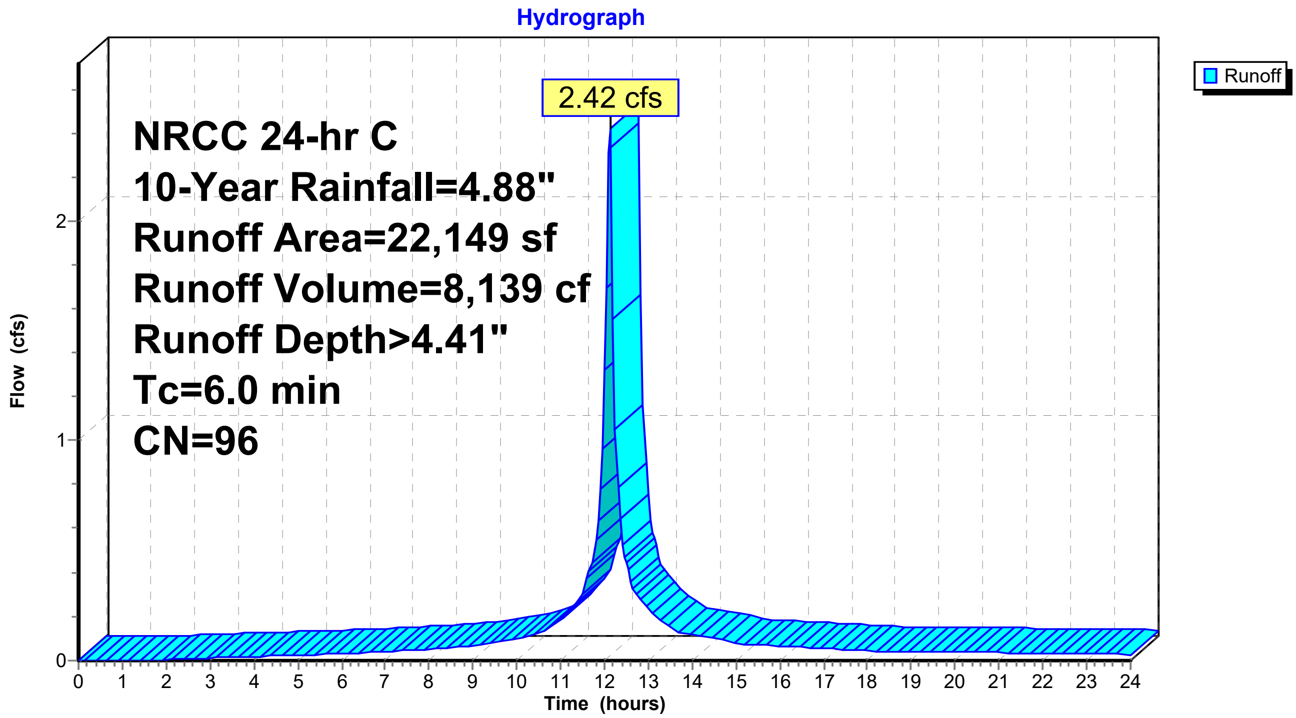
Runoff = 2.42 cfs @ 12.13 hrs, Volume= 8,139 cf, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 21,009 | 98 | IMPERVIOUS |
| | 1,140 | 61 | >75% Grass cover, Good, HSG B |
| | 22,149 | 96 | Weighted Average |
| | 1,140 | | 5.15% Pervious Area |
| | 21,009 | | 94.85% Impervious Area |

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

### Subcatchment PR-16: TO WQU-10



## Summary for Subcatchment PR-17: TO WQU-11

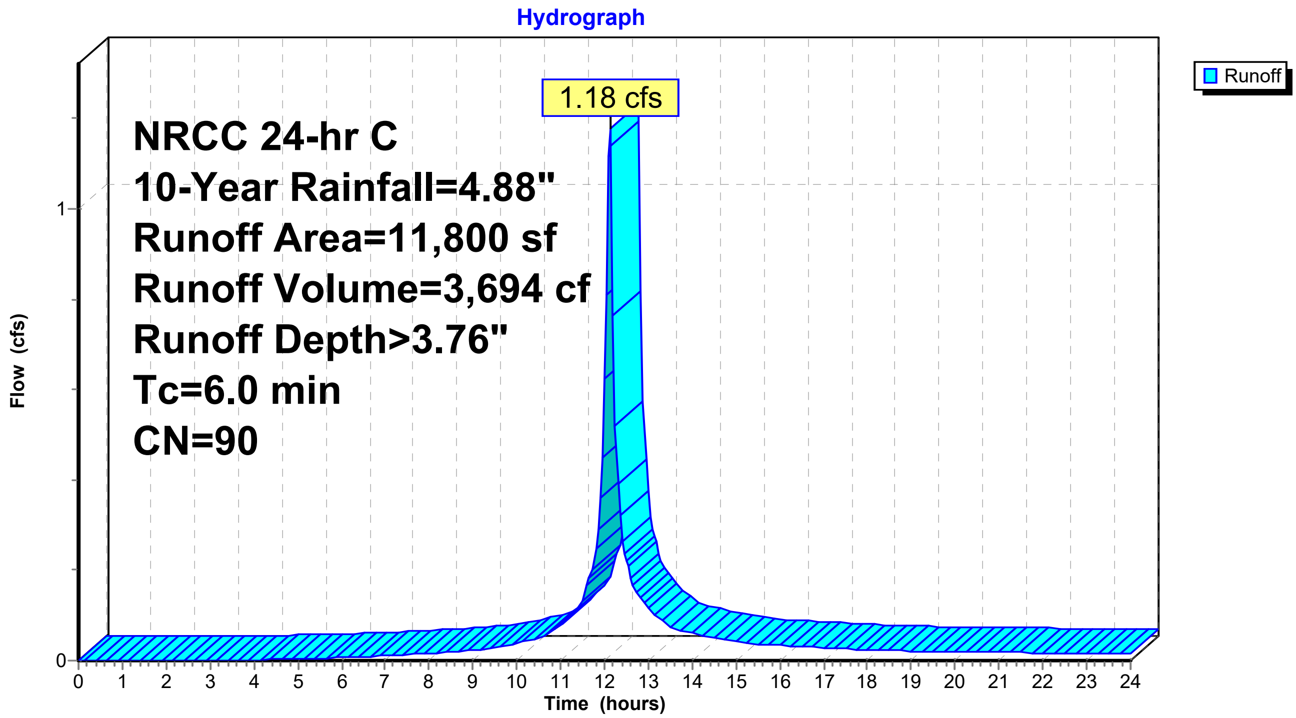
Runoff = 1.18 cfs @ 12.13 hrs, Volume= 3,694 cf, Depth> 3.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 7,968 | 98 | IMPERVIOUS |
| | 3,832 | 74 | >75% Grass cover, Good, HSG C |
| | 11,800 | 90 | Weighted Average |
| | 3,832 | | 32.47% Pervious Area |
| | 7,968 | | 67.53% Impervious Area |

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

### Subcatchment PR-17: TO WQU-11



## Summary for Subcatchment PR-18: TO WQU-12

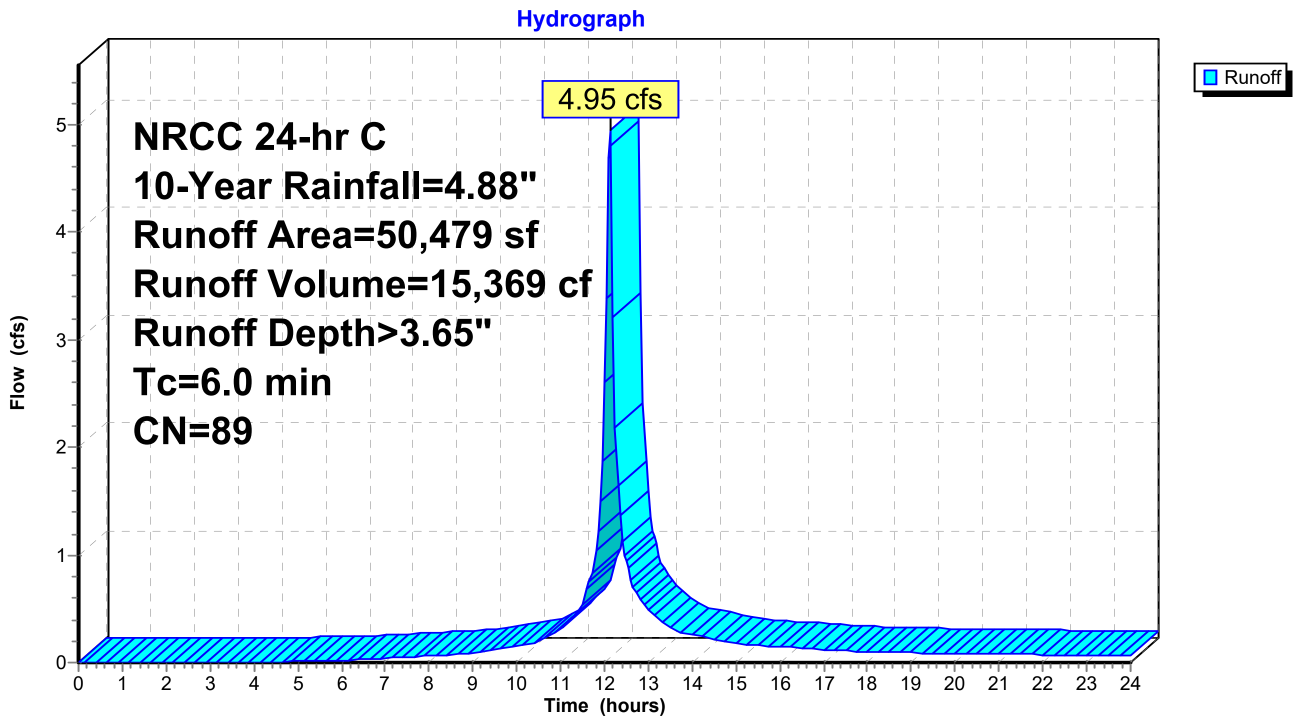
Runoff = 4.95 cfs @ 12.13 hrs, Volume= 15,369 cf, Depth> 3.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 31,033 | 98 | IMPERVIOUS |
| | 19,446 | 74 | >75% Grass cover, Good, HSG C |
| | 50,479 | 89 | Weighted Average |
| | 19,446 | | 38.52% Pervious Area |
| | 31,033 | | 61.48% Impervious Area |

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

## Subcatchment PR-18: TO WQU-12



## Summary for Subcatchment PR-19: TO WQU-13

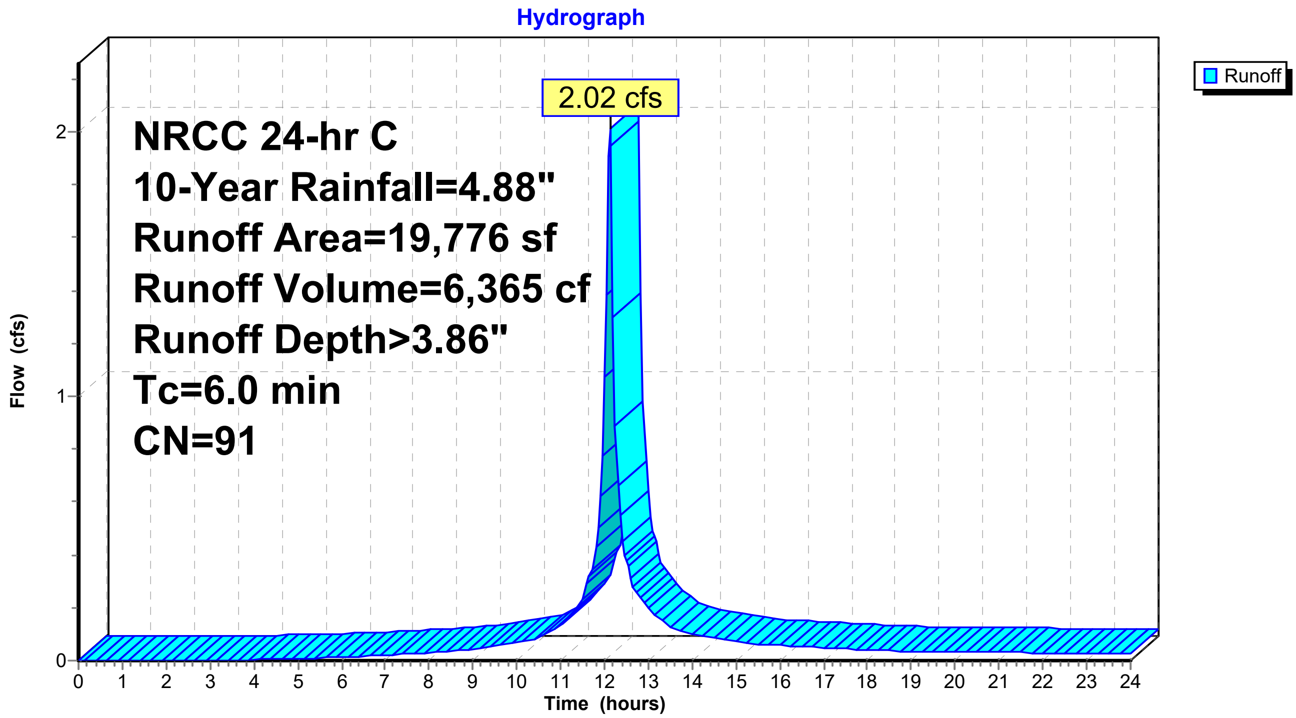
Runoff = 2.02 cfs @ 12.13 hrs, Volume= 6,365 cf, Depth> 3.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 14,228 | 98 | IMPERVIOUS |
| | 5,548 | 74 | >75% Grass cover, Good, HSG C |
| | 19,776 | 91 | Weighted Average |
| | 5,548 | | 28.05% Pervious Area |
| | 14,228 | | 71.95% Impervious Area |

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

## Subcatchment PR-19: TO WQU-13



## Summary for Subcatchment PR-2: TO PRETX

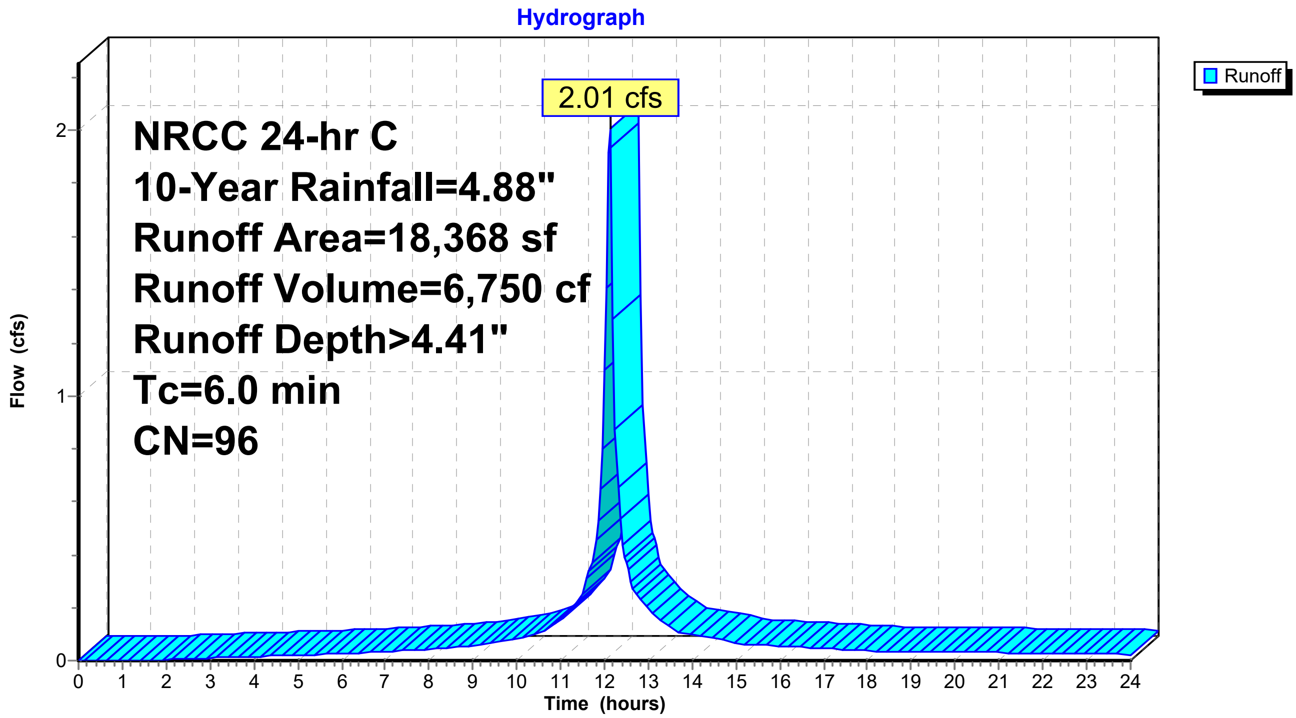
Runoff = 2.01 cfs @ 12.13 hrs, Volume= 6,750 cf, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 16,637 | 98 | IMPERVIOUS |
| | 1,731 | 74 | >75% Grass cover, Good, HSG C |
| | 18,368 | 96 | Weighted Average |
| | 1,731 | | 9.42% Pervious Area |
| | 16,637 | | 90.58% Impervious Area |

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

## Subcatchment PR-2: TO PRETX



## Summary for Subcatchment PR-20: TO WQU-14

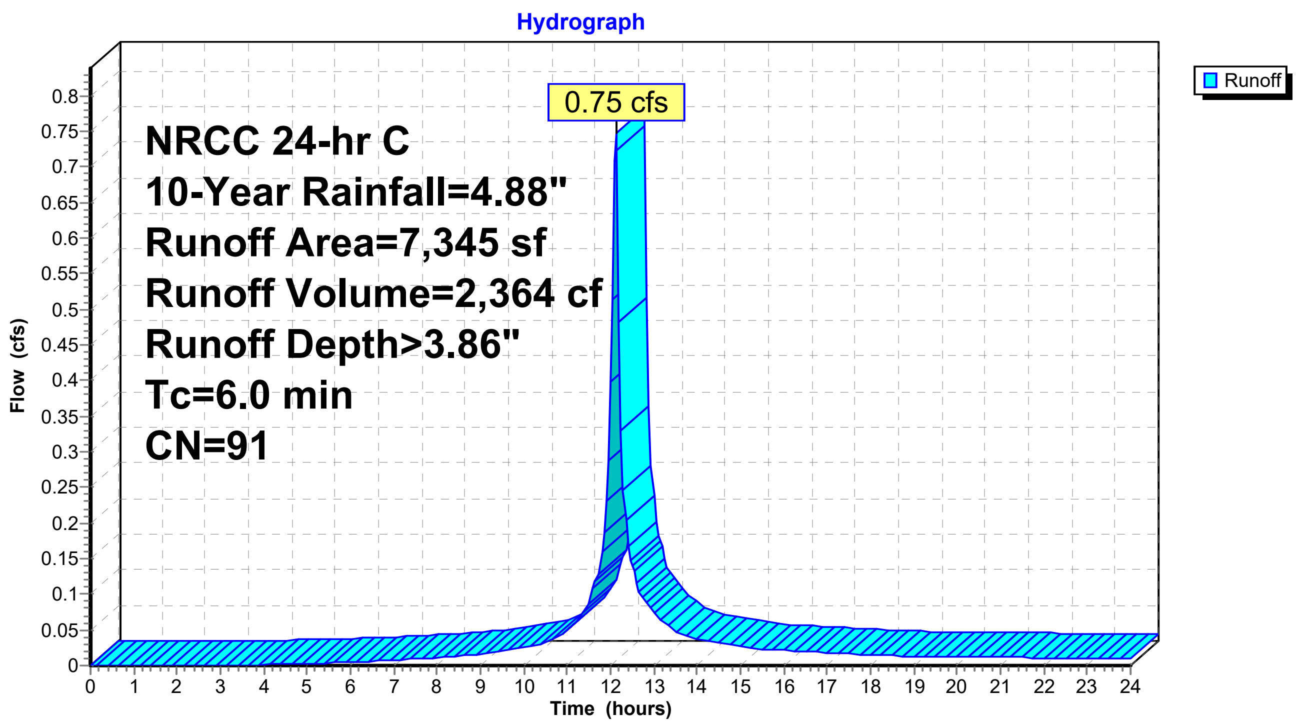
Runoff = 0.75 cfs @ 12.13 hrs, Volume= 2,364 cf, Depth> 3.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 5,138 | 98 | IMPERVIOUS |
| | 2,207 | 74 | >75% Grass cover, Good, HSG C |
| | 7,345 | 91 | Weighted Average |
| | 2,207 | | 30.05% Pervious Area |
| | 5,138 | | 69.95% Impervious Area |

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

### Subcatchment PR-20: TO WQU-14



## Summary for Subcatchment PR-21: TO WQU-15

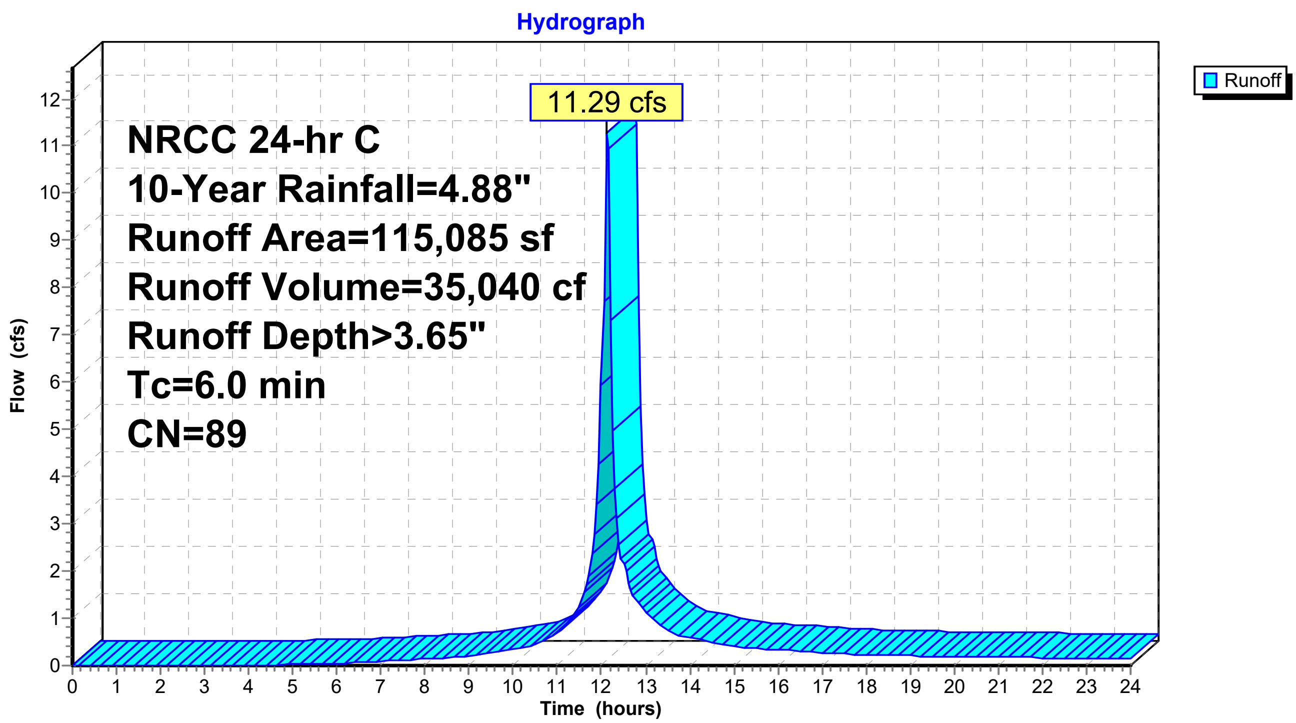
Runoff = 11.29 cfs @ 12.13 hrs, Volume= 35,040 cf, Depth> 3.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 71,553 | 98 | IMPERVIOUS |
| | 43,532 | 74 | >75% Grass cover, Good, HSG C |
| | 115,085 | 89 | Weighted Average |
| | 43,532 | | 37.83% Pervious Area |
| | 71,553 | | 62.17% Impervious Area |

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

### Subcatchment PR-21: TO WQU-15



## Summary for Subcatchment PR-22: TO WQU-16

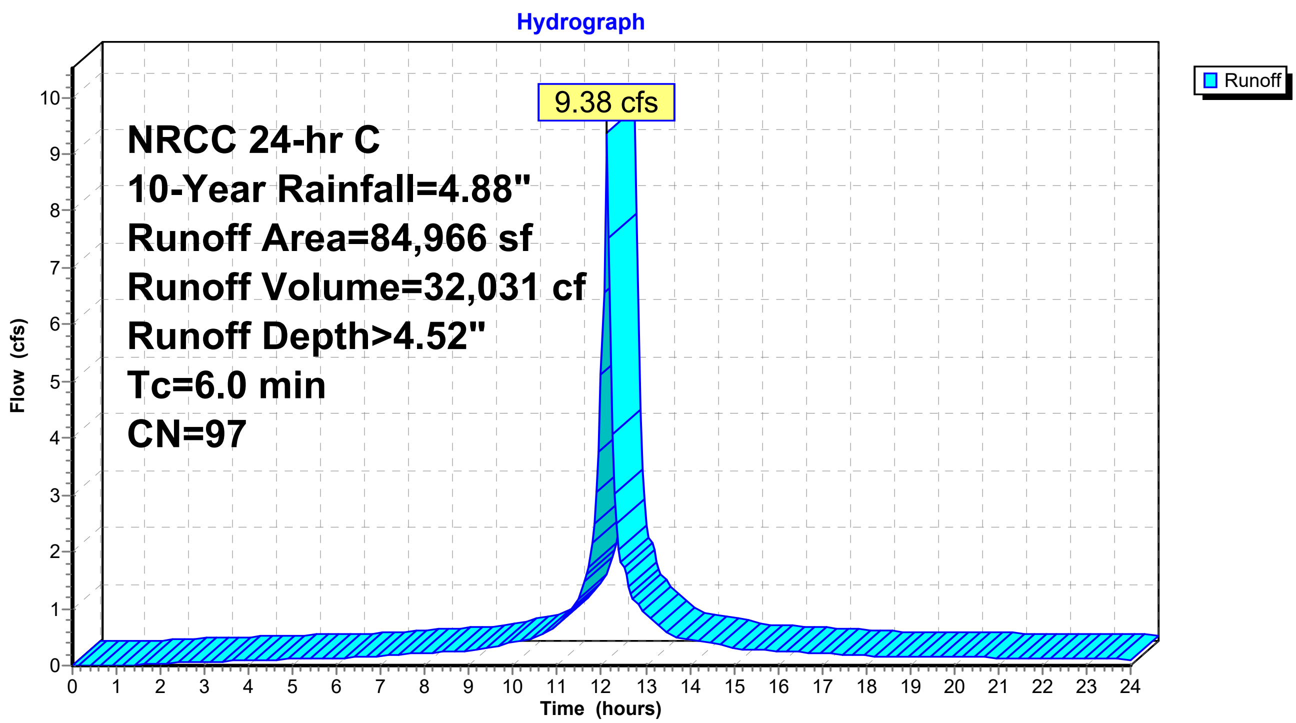
Runoff = 9.38 cfs @ 12.13 hrs, Volume= 32,031 cf, Depth> 4.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 2,771 | 74 | >75% Grass cover, Good, HSG C |
| * | 82,195 | 98 | IMPERVIOUS |
| | 84,966 | 97 | Weighted Average |
| | 2,771 | | 3.26% Pervious Area |
| | 82,195 | | 96.74% Impervious Area |

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

## Subcatchment PR-22: TO WQU-16



## Summary for Subcatchment PR-23: TO WQU-17

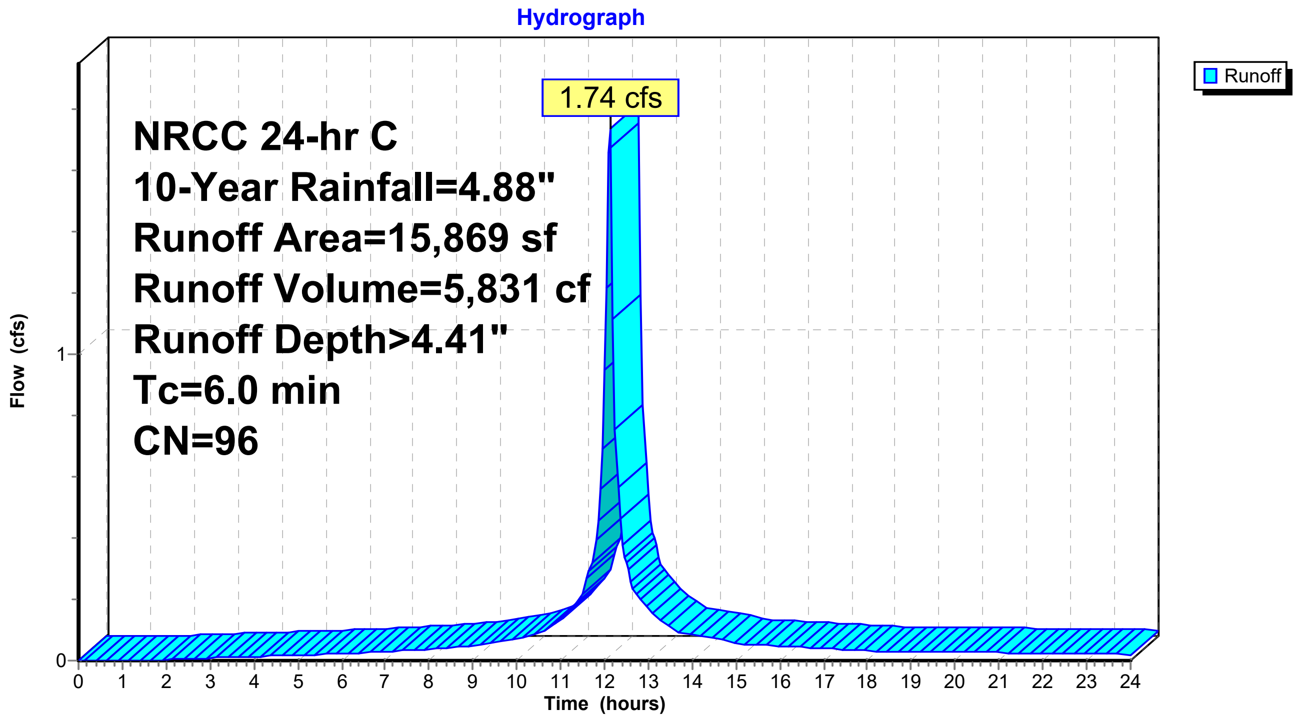
Runoff = 1.74 cfs @ 12.13 hrs, Volume= 5,831 cf, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 14,403 | 98 | IMPERVIOUS |
| | 1,466 | 74 | >75% Grass cover, Good, HSG C |
| | 15,869 | 96 | Weighted Average |
| | 1,466 | | 9.24% Pervious Area |
| | 14,403 | | 90.76% Impervious Area |

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

### Subcatchment PR-23: TO WQU-17



## Summary for Subcatchment PR-24: TO WQU-18

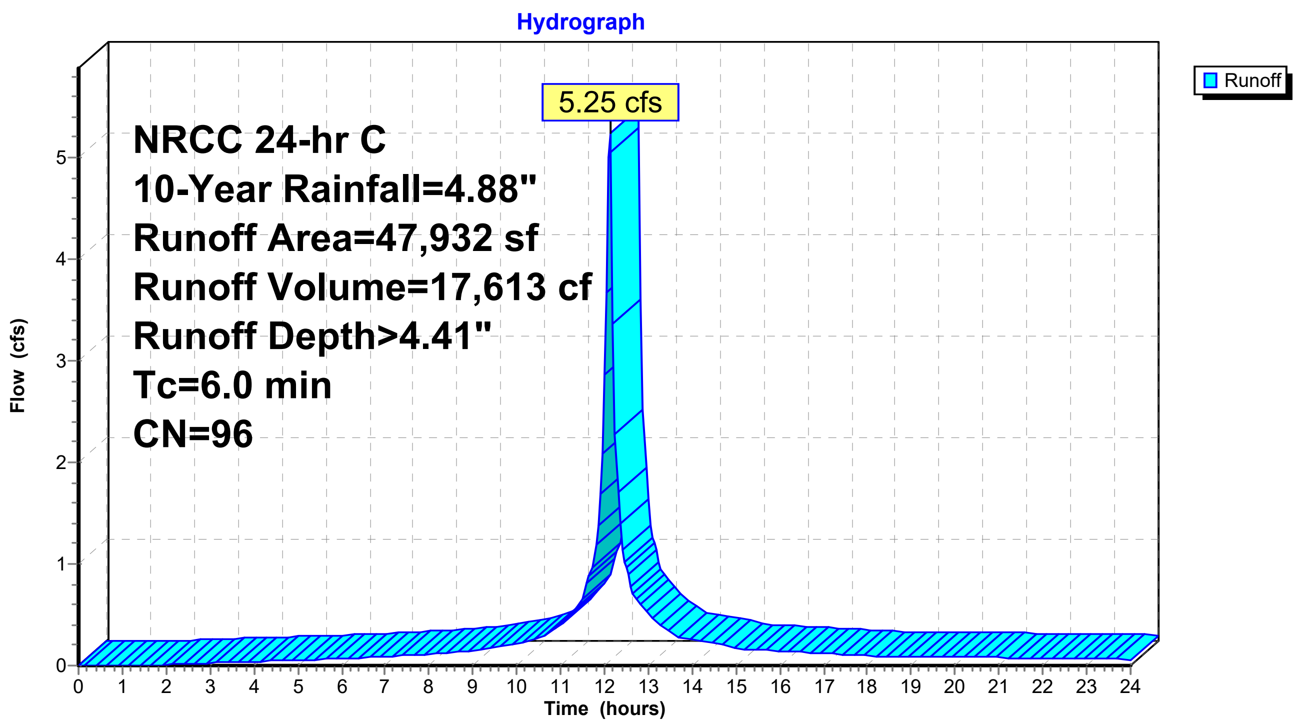
Runoff = 5.25 cfs @ 12.13 hrs, Volume= 17,613 cf, Depth> 4.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 4,668 | 74 | >75% Grass cover, Good, HSG C |
| * | 43,264 | 98 | IMPERVIOUS |
| | 47,932 | 96 | Weighted Average |
| | 4,668 | | 9.74% Pervious Area |
| | 43,264 | | 90.26% Impervious Area |

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

### Subcatchment PR-24: TO WQU-18



## Summary for Subcatchment PR-25: BUILDING 2 ROOF

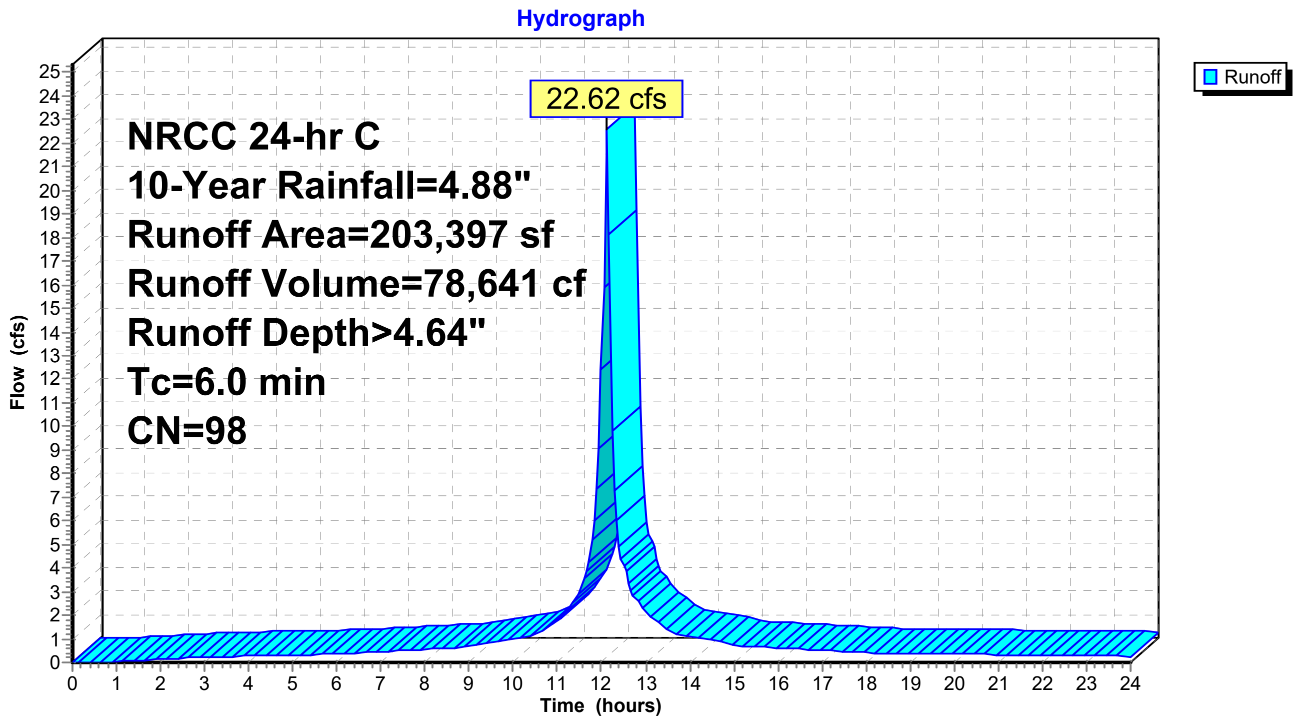
Runoff = 22.62 cfs @ 12.13 hrs, Volume= 78,641 cf, Depth> 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 203,397 | 98 | IMPERVIOUS |
| | 203,397 | | 100.00% Impervious Area |

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

## Subcatchment PR-25: BUILDING 2 ROOF



## Summary for Subcatchment PR-26: BUILDING 3 ROOF

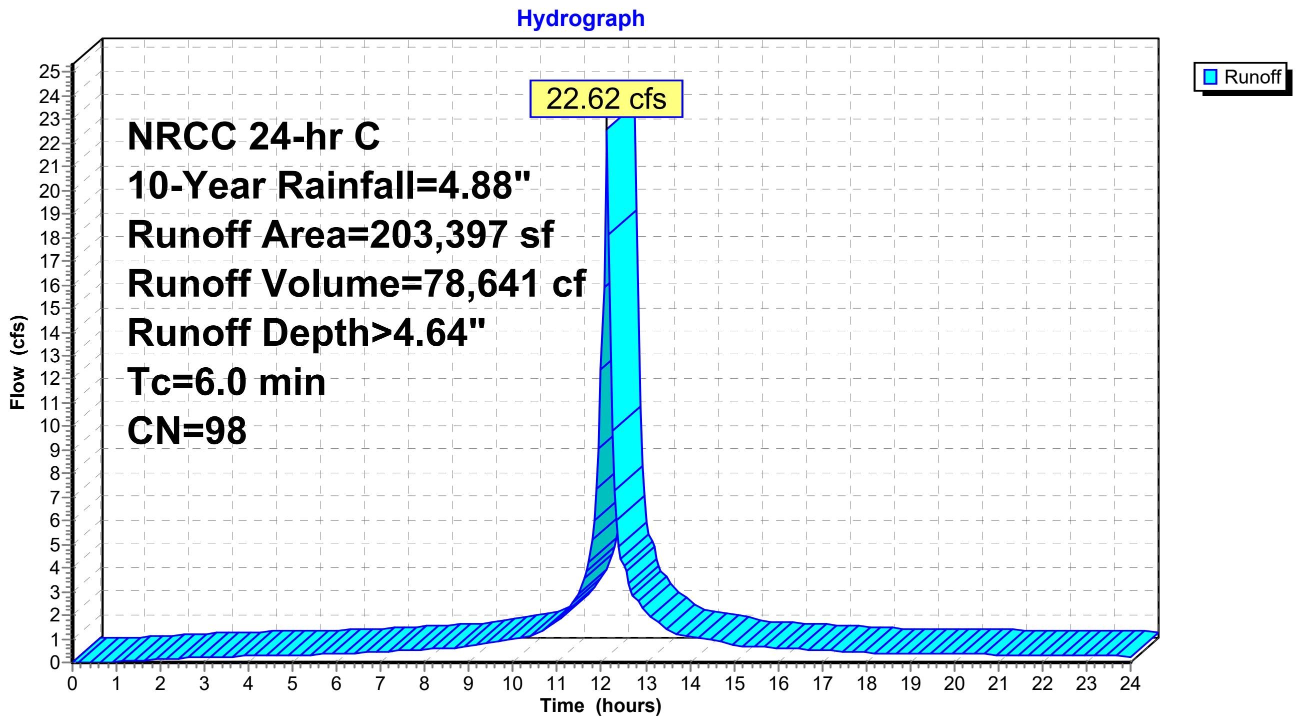
Runoff = 22.62 cfs @ 12.13 hrs, Volume= 78,641 cf, Depth> 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 203,397 | 98 | IMPERVIOUS |
| | 203,397 | | 100.00% Impervious Area |

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

### Subcatchment PR-26: BUILDING 3 ROOF



## Summary for Subcatchment PR-27: TO WQU-19

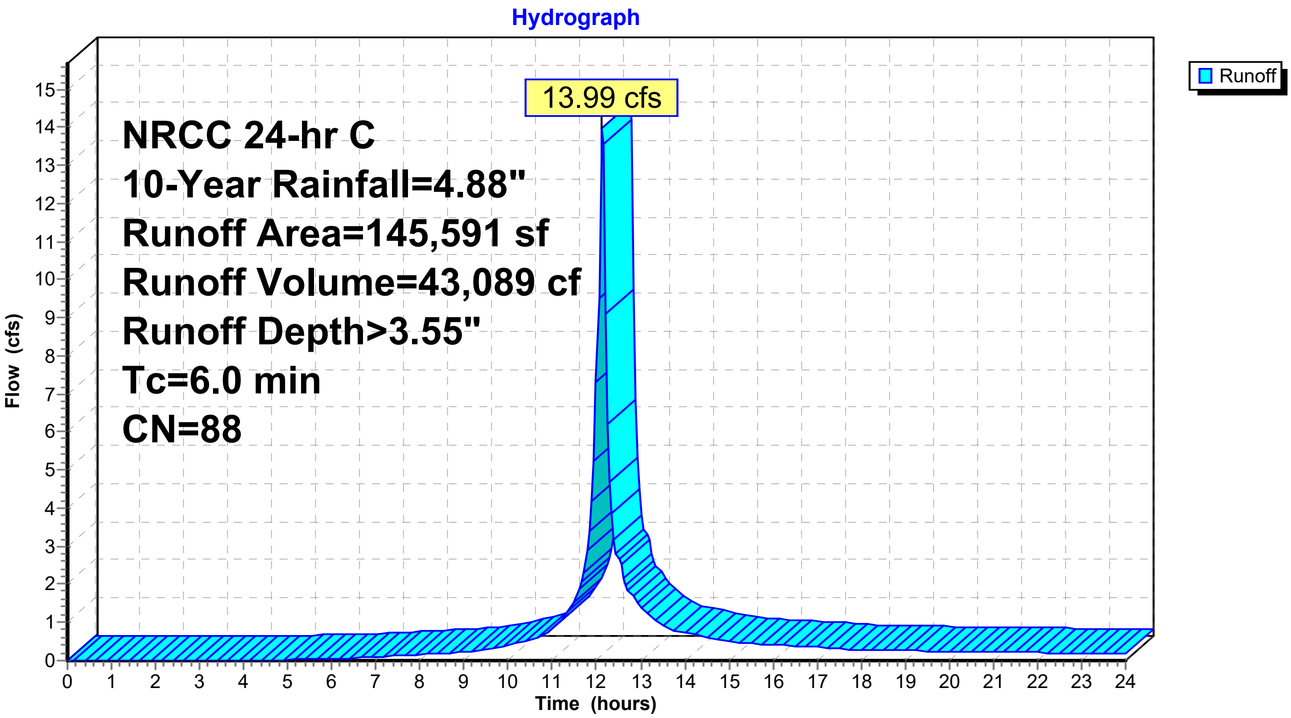
Runoff = 13.99 cfs @ 12.13 hrs, Volume= 43,089 cf, Depth> 3.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 105,426 | 98 | IMPERVIOUS |
| | 40,165 | 61 | >75% Grass cover, Good, HSG B |
| | 145,591 | 88 | Weighted Average |
| | 40,165 | | 27.59% Pervious Area |
| | 105,426 | | 72.41% Impervious Area |

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

## Subcatchment PR-27: TO WQU-19



## Summary for Subcatchment PR-28: TO WQU-20

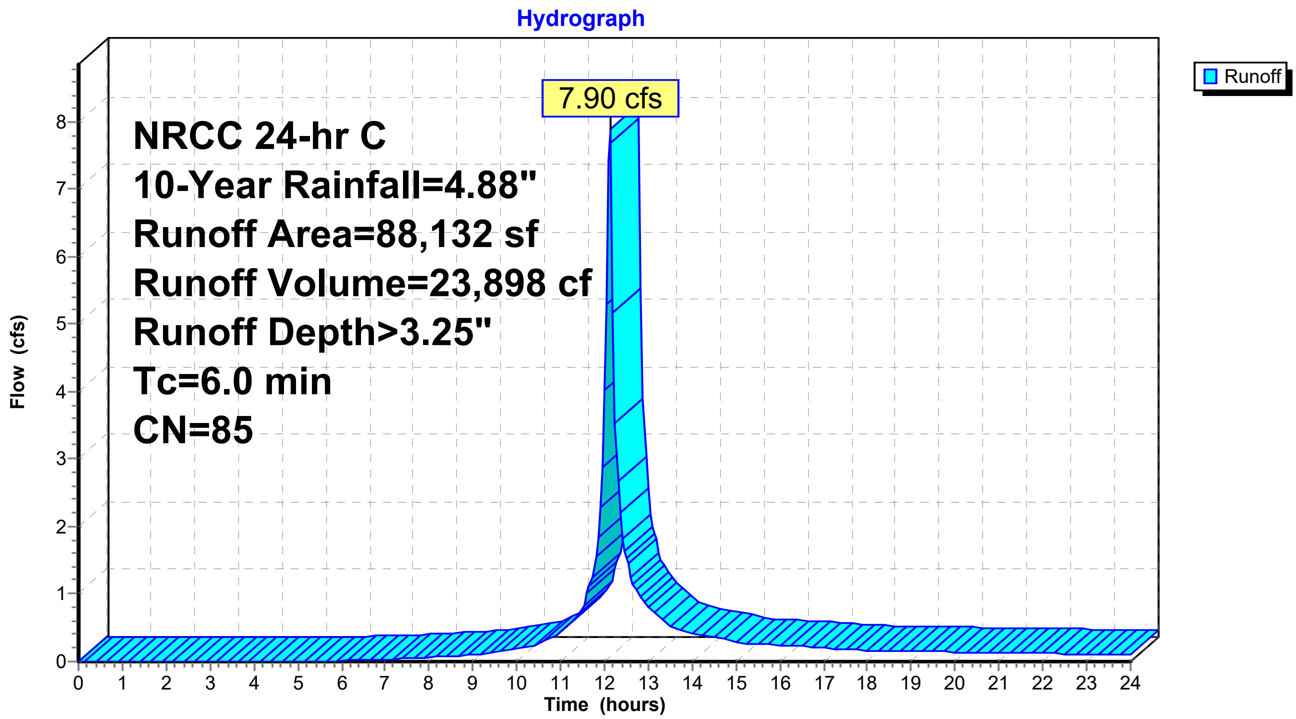
Runoff = 7.90 cfs @ 12.13 hrs, Volume= 23,898 cf, Depth> 3.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 55,365 | 98 | IMPERVIOUS |
| | 7,996 | 55 | Woods, Good, HSG B |
| | 5,832 | 80 | >75% Grass cover, Good, HSG D |
| | 18,939 | 61 | >75% Grass cover, Good, HSG B |
| | 88,132 | 85 | Weighted Average |
| | 32,767 | | 37.18% Pervious Area |
| | 55,365 | | 62.82% Impervious Area |

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

### Subcatchment PR-28: TO WQU-20



## Summary for Subcatchment PR-29: TO WQU-21

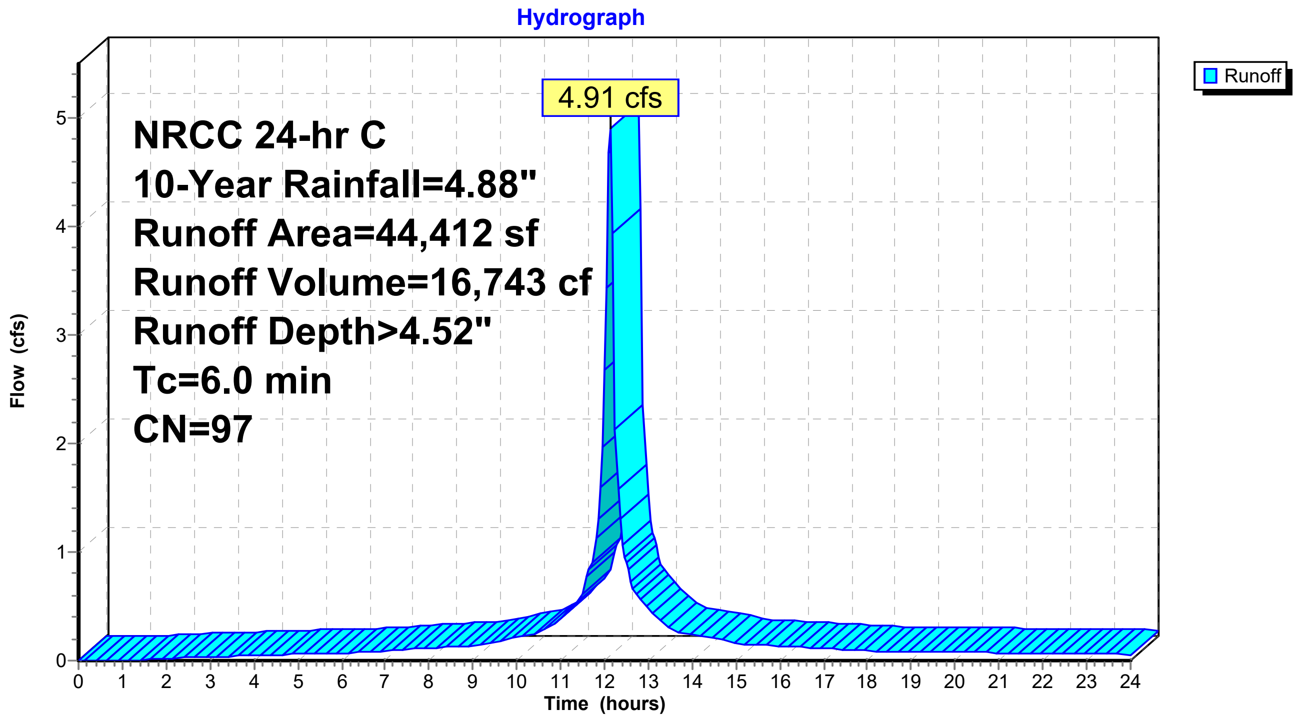
Runoff = 4.91 cfs @ 12.13 hrs, Volume= 16,743 cf, Depth> 4.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 41,857 | 98 | IMPERVIOUS |
| | 2,555 | 80 | >75% Grass cover, Good, HSG D |
| | 44,412 | 97 | Weighted Average |
| | 2,555 | | 5.75% Pervious Area |
| | 41,857 | | 94.25% Impervious Area |

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

### Subcatchment PR-29: TO WQU-21



## Summary for Subcatchment PR-3: TO FOCAL POINT

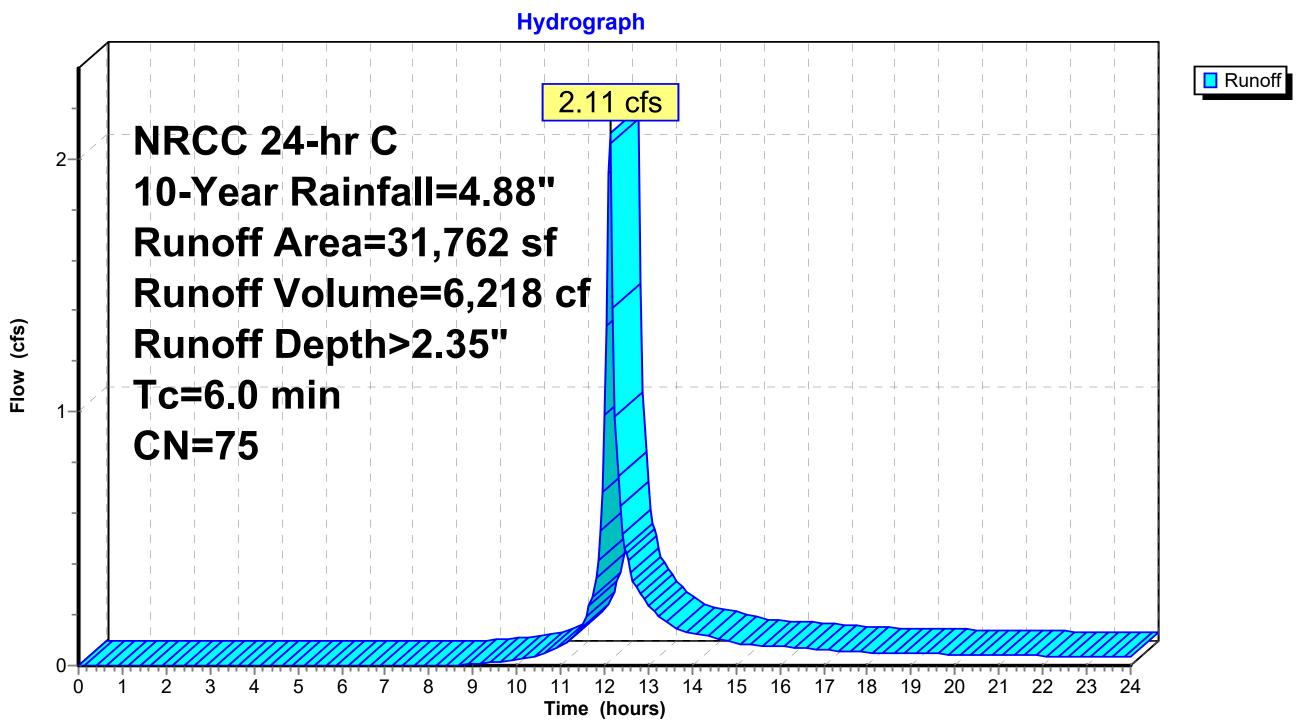
Runoff = 2.11 cfs @ 12.13 hrs, Volume= 6,218 cf, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 1,048 | 98 | IMPERVIOUS |
| | 30,714 | 74 | >75% Grass cover, Good, HSG C |
| | 31,762 | 75 | Weighted Average |
| | 30,714 | | 96.70% Pervious Area |
| | 1,048 | | 3.30% Impervious Area |

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

### Subcatchment PR-3: TO FOCAL POINT



## Summary for Subcatchment PR-30: TO WQU-22

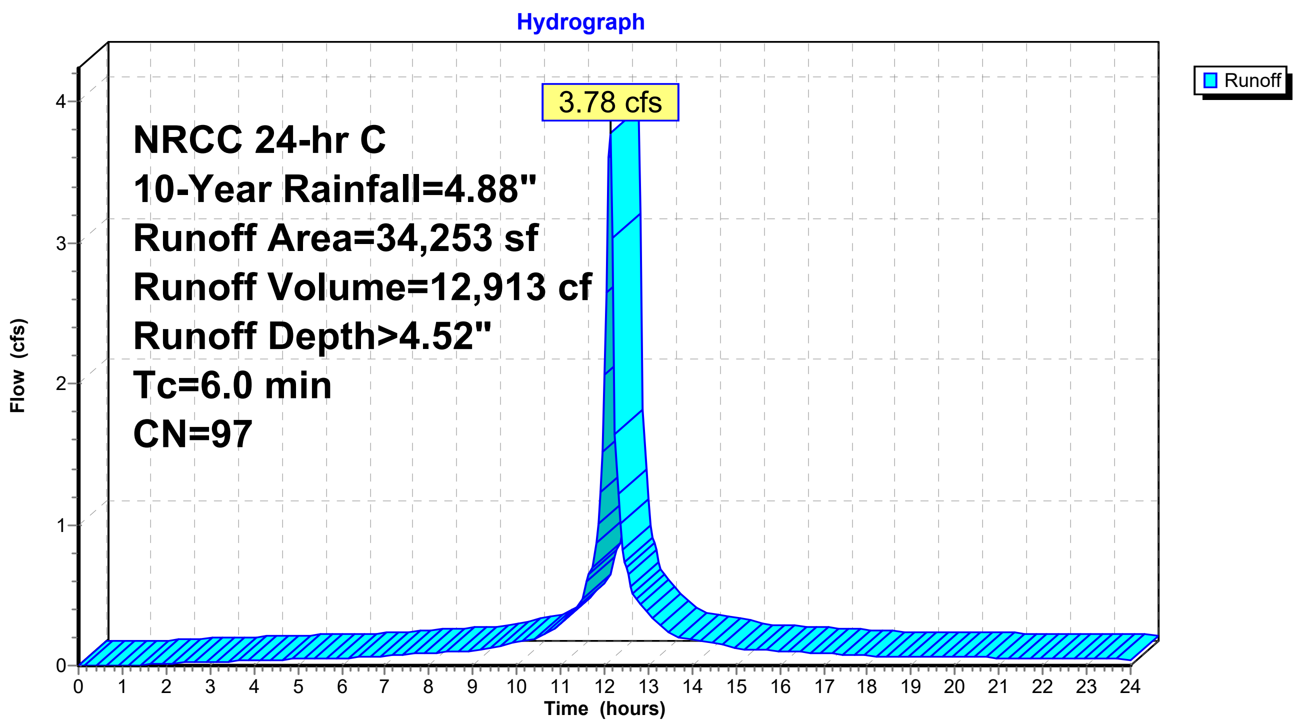
Runoff = 3.78 cfs @ 12.13 hrs, Volume= 12,913 cf, Depth> 4.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 31,439 | 98 | IMPERVIOUS |
| | 2,814 | 80 | >75% Grass cover, Good, HSG D |
| | 34,253 | 97 | Weighted Average |
| | 2,814 | | 8.22% Pervious Area |
| | 31,439 | | 91.78% Impervious Area |

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

## Subcatchment PR-30: TO WQU-22



## Summary for Subcatchment PR-31: TO WQU-23

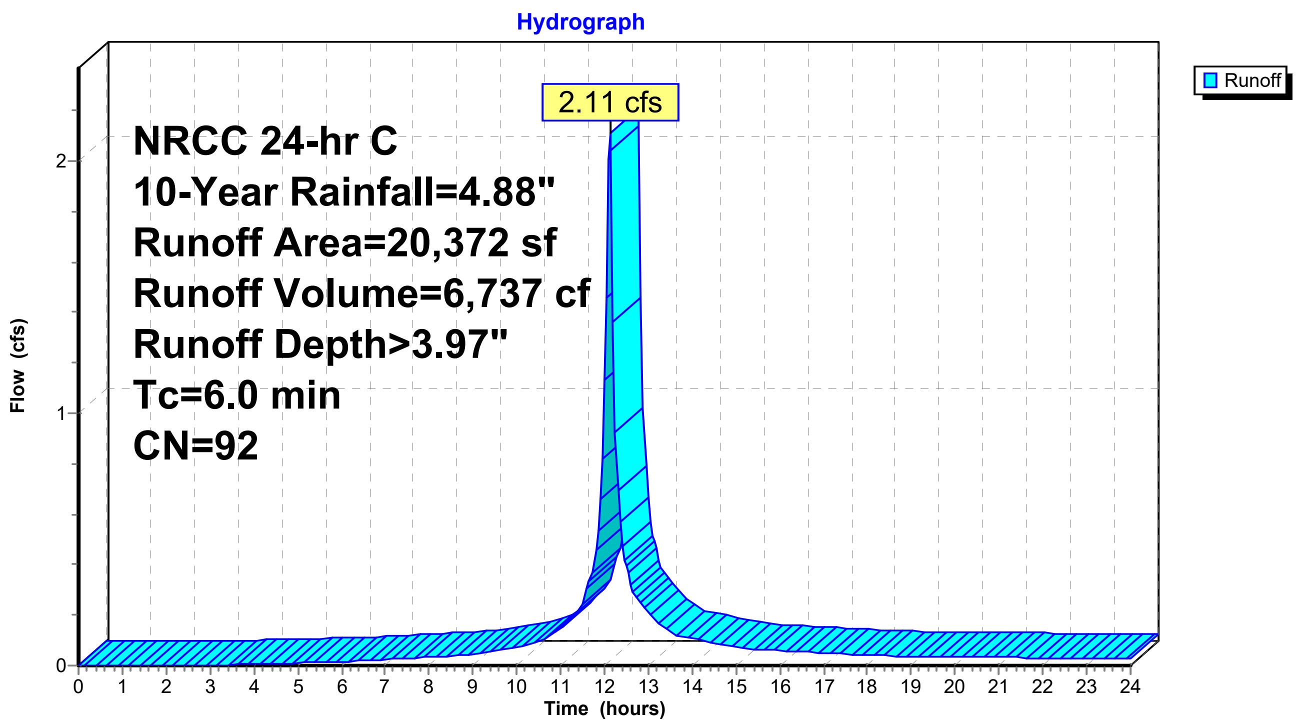
Runoff = 2.11 cfs @ 12.13 hrs, Volume= 6,737 cf, Depth> 3.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 13,946 | 98 | IMPERVIOUS |
| | 6,426 | 80 | >75% Grass cover, Good, HSG D |
| | 20,372 | 92 | Weighted Average |
| | 6,426 | | 31.54% Pervious Area |
| | 13,946 | | 68.46% Impervious Area |

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

### Subcatchment PR-31: TO WQU-23



## Summary for Subcatchment PR-32: BUILDING 4 ROOF

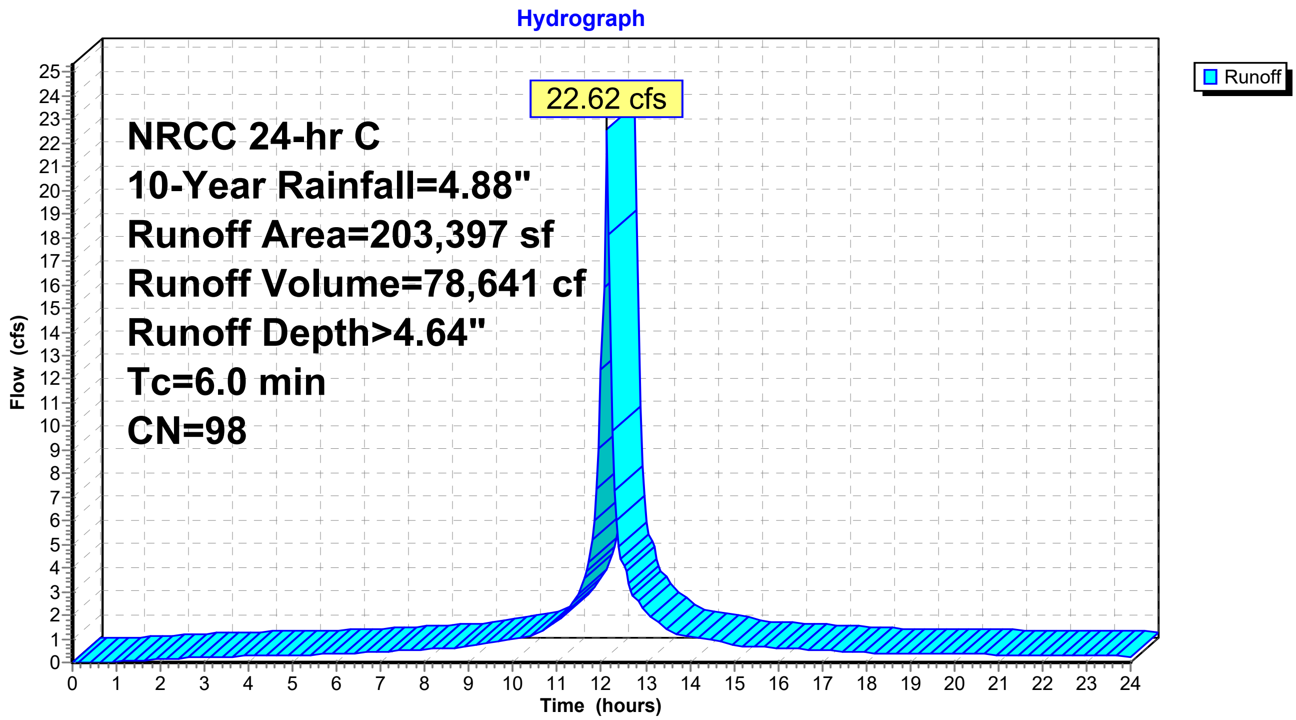
Runoff = 22.62 cfs @ 12.13 hrs, Volume= 78,641 cf, Depth> 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 203,397 | 98 | IMPERVIOUS |
| | 203,397 | | 100.00% Impervious Area |

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

## Subcatchment PR-32: BUILDING 4 ROOF



## Summary for Subcatchment PR-33: TO BASIN A

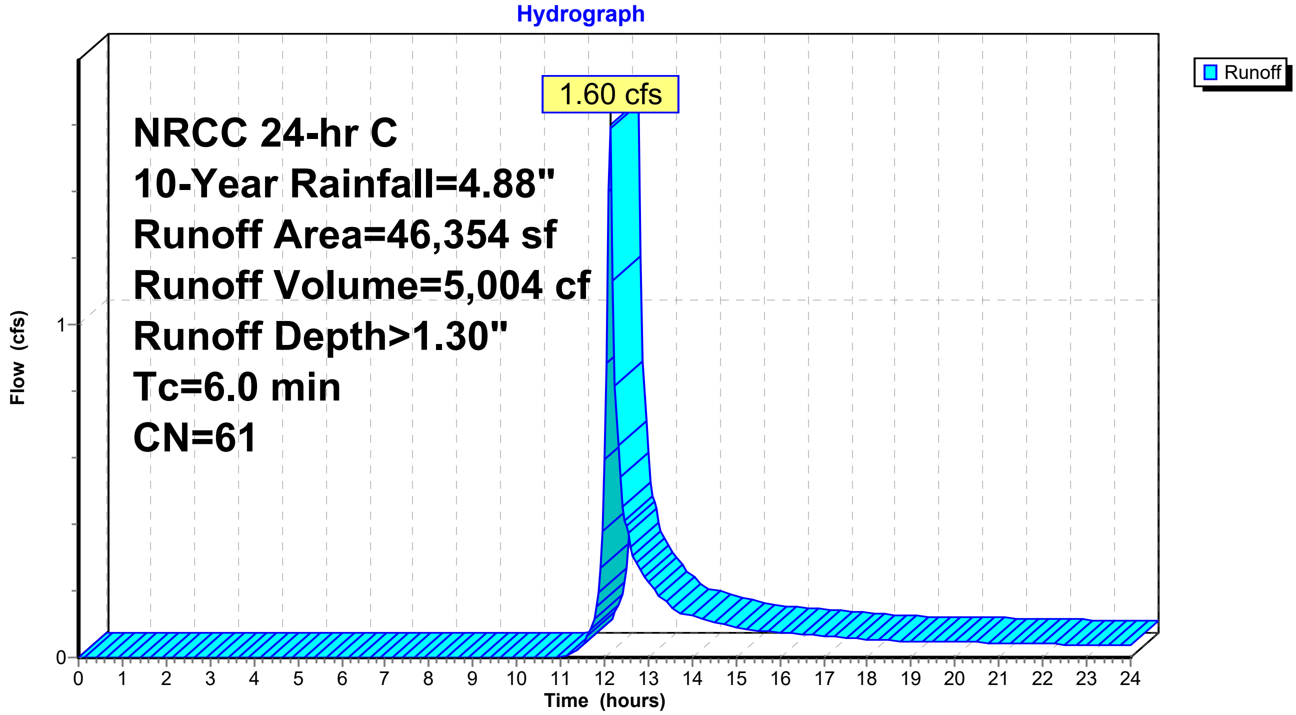
Runoff = 1.60 cfs @ 12.14 hrs, Volume= 5,004 cf, Depth> 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| Area (sf) | CN | Description |
|---|---|---|
| 46,354 | 61 | >75% Grass cover, Good, HSG B |
| 46,354 | | 100.00% Pervious Area |

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

## Subcatchment PR-33: TO BASIN A



## Summary for Subcatchment PR-34: TO BASIN B

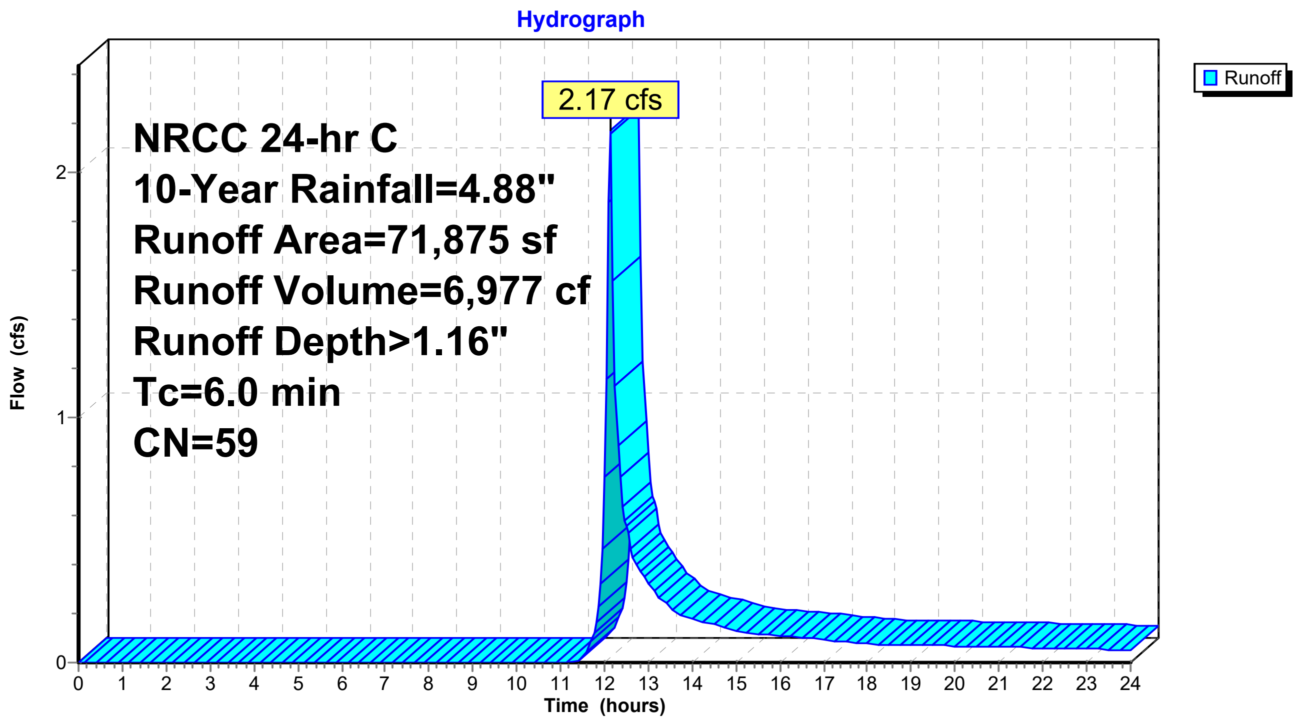
Runoff = 2.17 cfs @ 12.14 hrs, Volume= 6,977 cf, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| Area (sf) | CN | Description |
|---|---|---|
| 24,851 | 55 | Woods, Good, HSG B |
| 47,024 | 61 | >75% Grass cover, Good, HSG B |
| 71,875 | 59 | Weighted Average |
| 71,875 | | 100.00% Pervious Area |

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

## Subcatchment PR-34: TO BASIN B



## Summary for Subcatchment PR-35: TO BASIN C

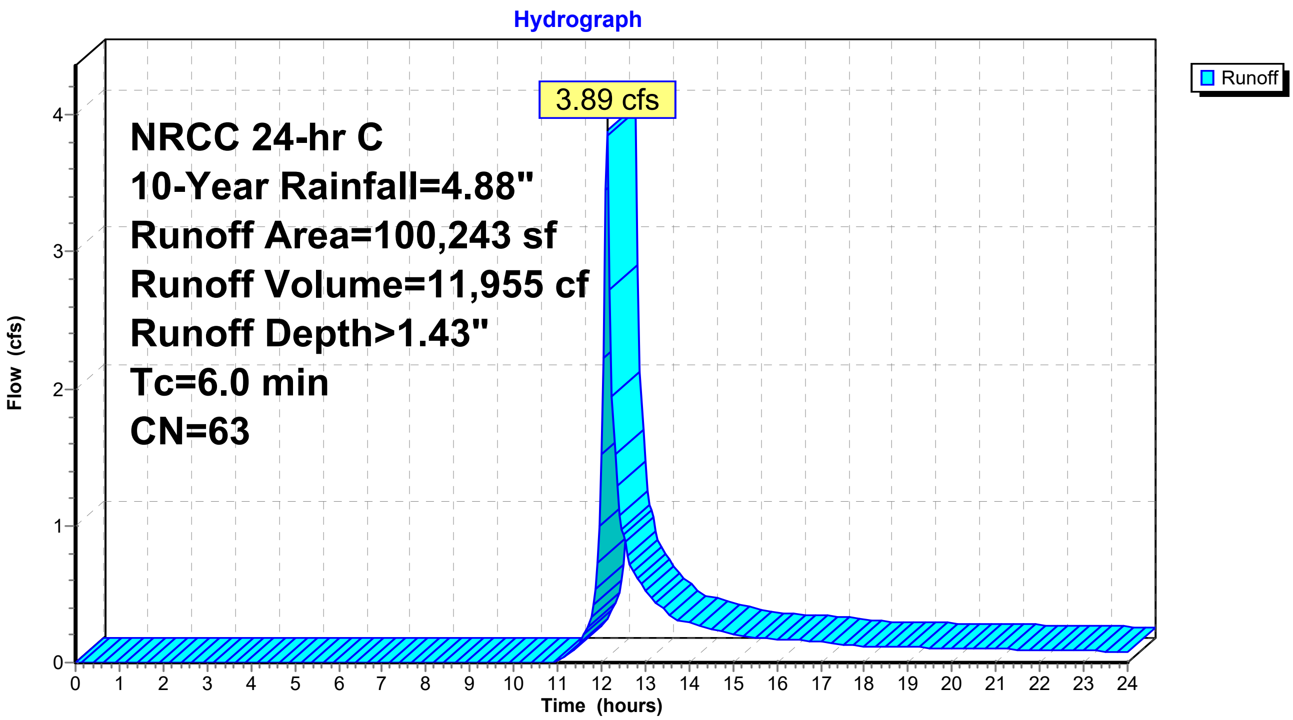
Runoff = 3.89 cfs @ 12.14 hrs, Volume= 11,955 cf, Depth> 1.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| Area (sf) | CN | Description |
|---|---|---|
| 17,490 | 74 | >75% Grass cover, Good, HSG C |
| 82,753 | 61 | >75% Grass cover, Good, HSG B |
| 100,243 | 63 | Weighted Average |
| 100,243 | | 100.00% Pervious Area |

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

## Subcatchment PR-35: TO BASIN C



## Summary for Subcatchment PR-36: TO OFFSITE EAST

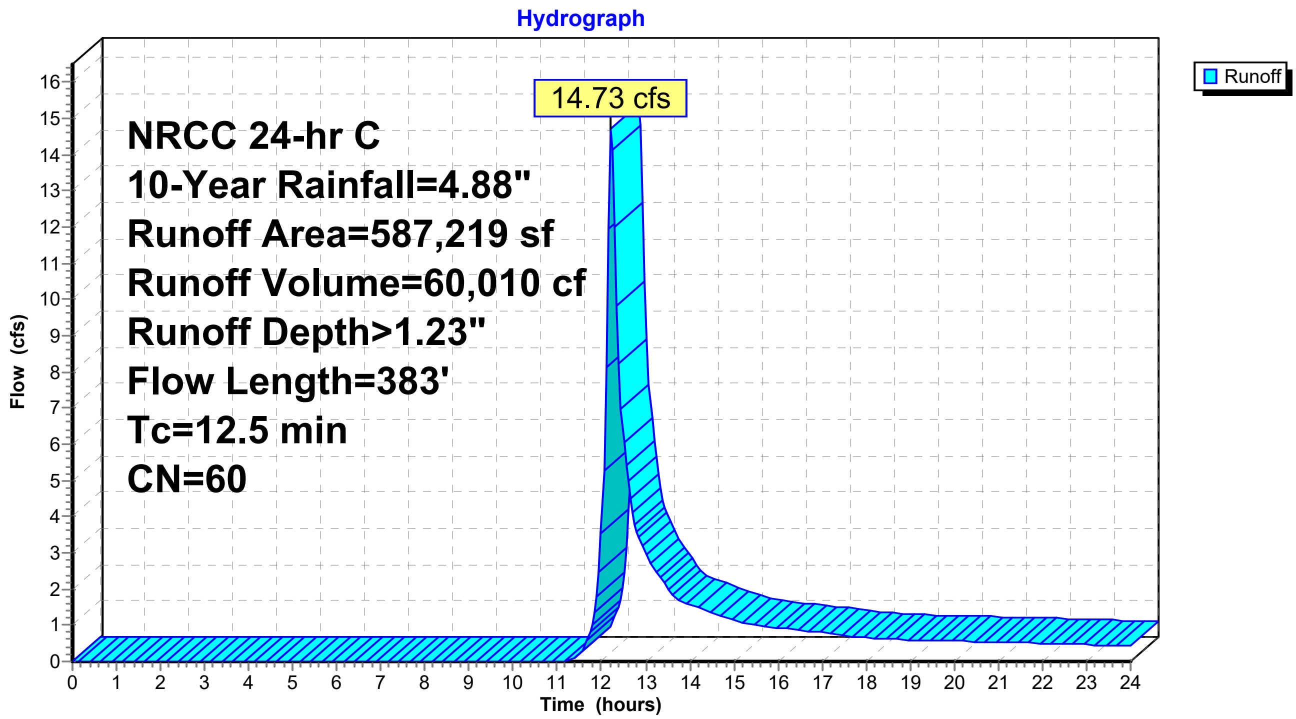
Runoff = 14.73 cfs @ 12.22 hrs, Volume= 60,010 cf, Depth> 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| Area (sf) | CN | Description |
|---|---|---|
| 402,759 | 55 | Woods, Good, HSG B |
| 6,465 | 70 | Woods, Good, HSG C |
| 112,740 | 77 | Woods, Good, HSG D |
| 52,096 | 61 | >75% Grass cover, Good, HSG B |
| 9,612 | 74 | >75% Grass cover, Good, HSG C |
| 3,547 | 80 | >75% Grass cover, Good, HSG D |
| 587,219 | 60 | Weighted Average |
| 587,219 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.0 | 50 | 0.0640 | 0.10 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 4.5 | 333 | 0.0604 | 1.23 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 12.5 | 383 | Total | | | |

### Subcatchment PR-36: TO OFFSITE EAST



## Summary for Subcatchment PR-4: TO OFFSITE SOUTH

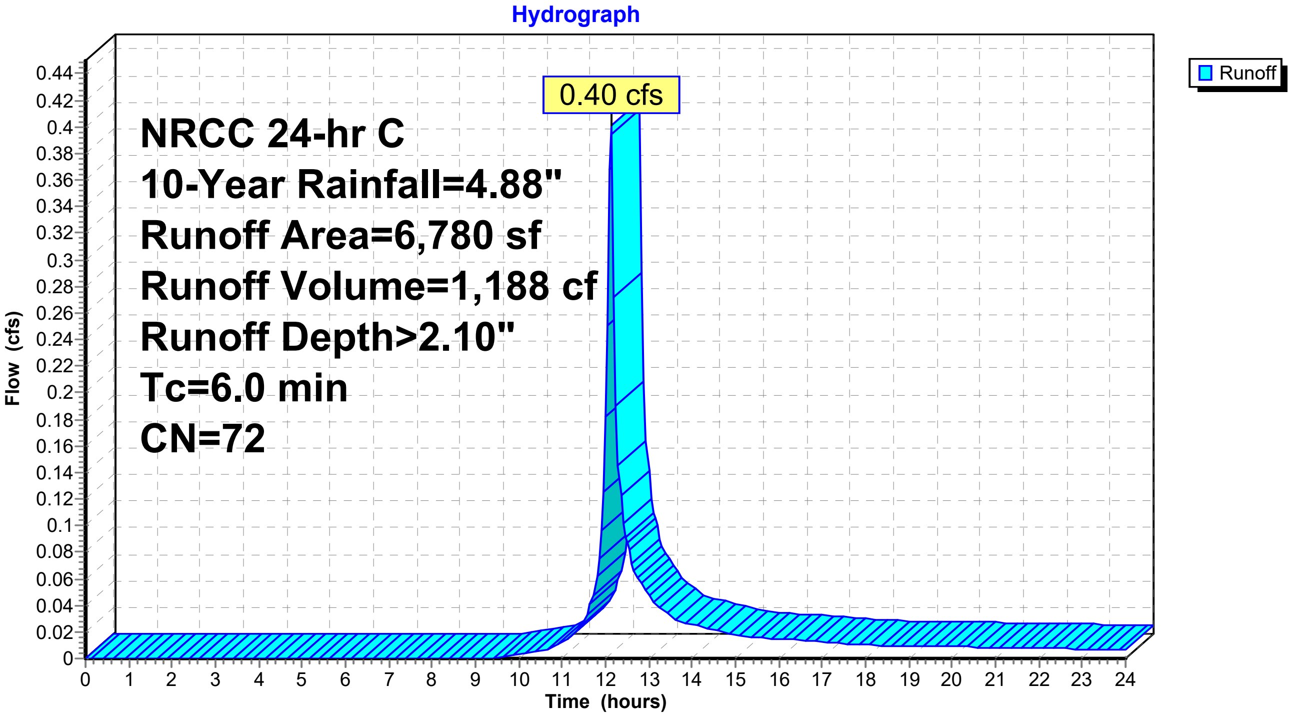
Runoff = 0.40 cfs @ 12.13 hrs, Volume= 1,188 cf, Depth> 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| Area (sf) | CN | Description |
|---|---|---|
| 2,686 | 74 | >75% Grass cover, Good, HSG C |
| 4,094 | 70 | Woods, Good, HSG C |
| 6,780 | 72 | Weighted Average |
| 6,780 | | 100.00% Pervious Area |

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

## Subcatchment PR-4: TO OFFSITE SOUTH



## Summary for Subcatchment PR-5: TO WQU-5

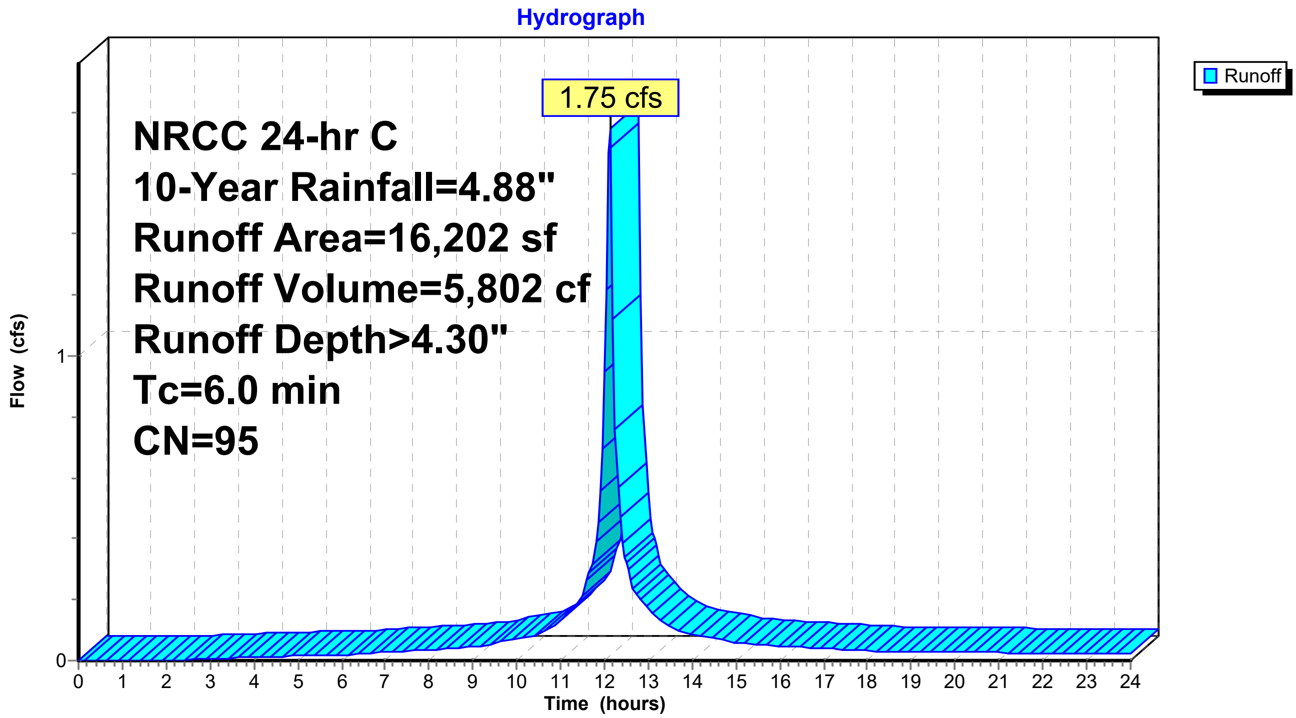
Runoff = 1.75 cfs @ 12.13 hrs, Volume= 5,802 cf, Depth> 4.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 14,419 | 98 | IMPERVIOUS |
| | 1,783 | 74 | >75% Grass cover, Good, HSG C |
| | 16,202 | 95 | Weighted Average |
| | 1,783 | | 11.00% Pervious Area |
| | 14,419 | | 89.00% Impervious Area |

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

### Subcatchment PR-5: TO WQU-5



## Summary for Subcatchment PR-6: TO WQU-4

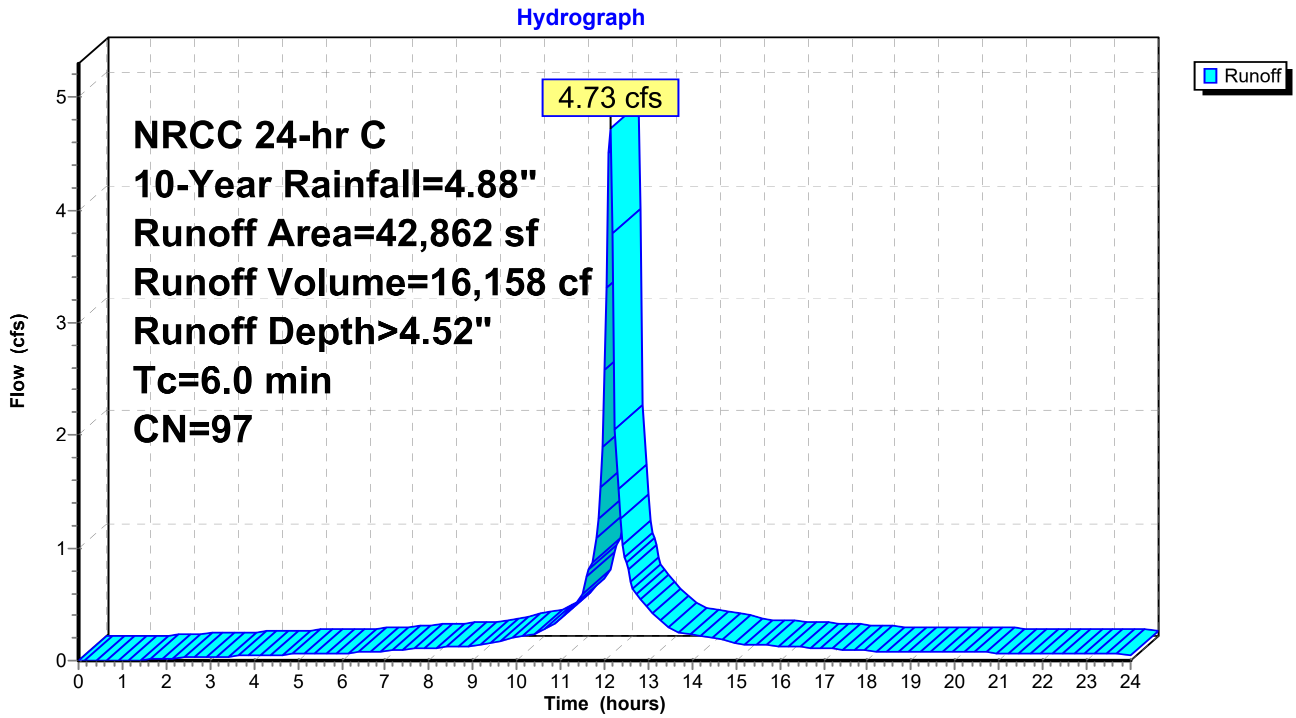
Runoff = 4.73 cfs @ 12.13 hrs, Volume= 16,158 cf, Depth> 4.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 41,625 | 98 | IMPERVIOUS |
| | 1,237 | 74 | >75% Grass cover, Good, HSG C |
| | 42,862 | 97 | Weighted Average |
| | 1,237 | | 2.89% Pervious Area |
| | 41,625 | | 97.11% Impervious Area |

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

## Subcatchment PR-6: TO WQU-4



## Summary for Subcatchment PR-7: TO WQU-3

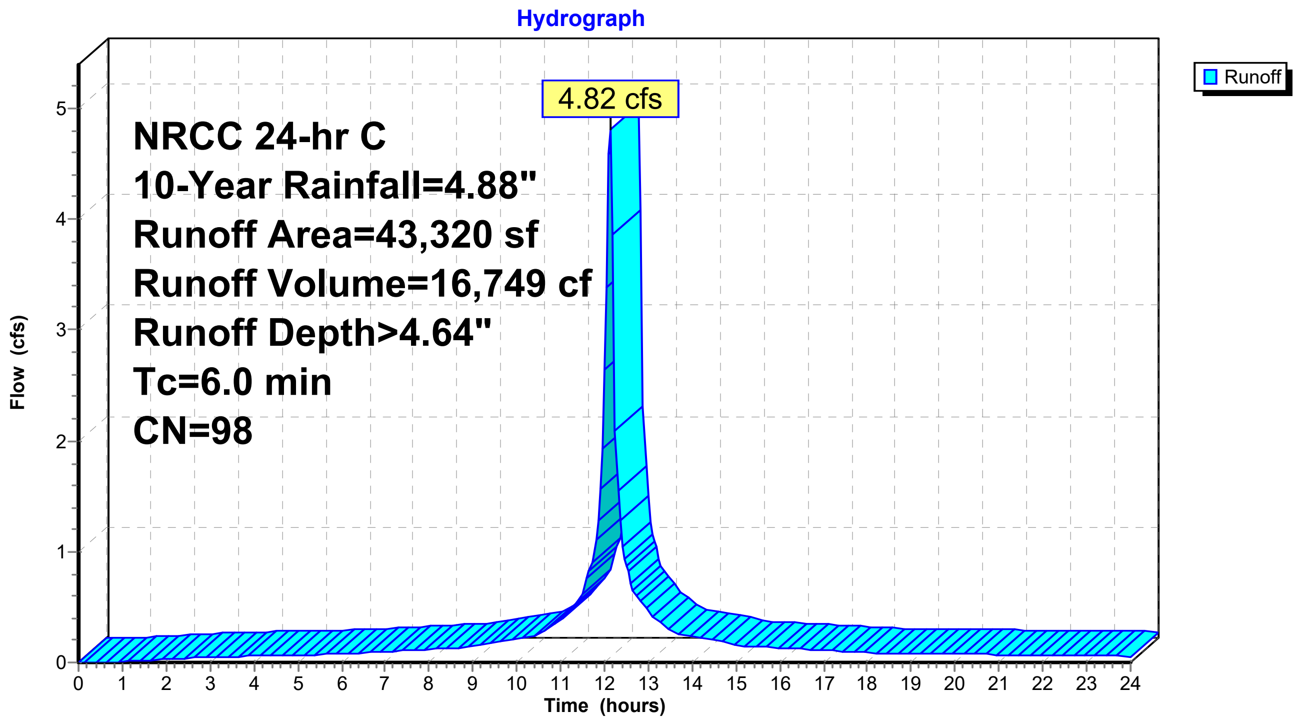
Runoff = 4.82 cfs @ 12.13 hrs, Volume= 16,749 cf, Depth> 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 43,320 | 98 | IMPERVIOUS |
| | 43,320 | | 100.00% Impervious Area |

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

## Subcatchment PR-7: TO WQU-3



## Summary for Subcatchment PR-8: TO WQU-2

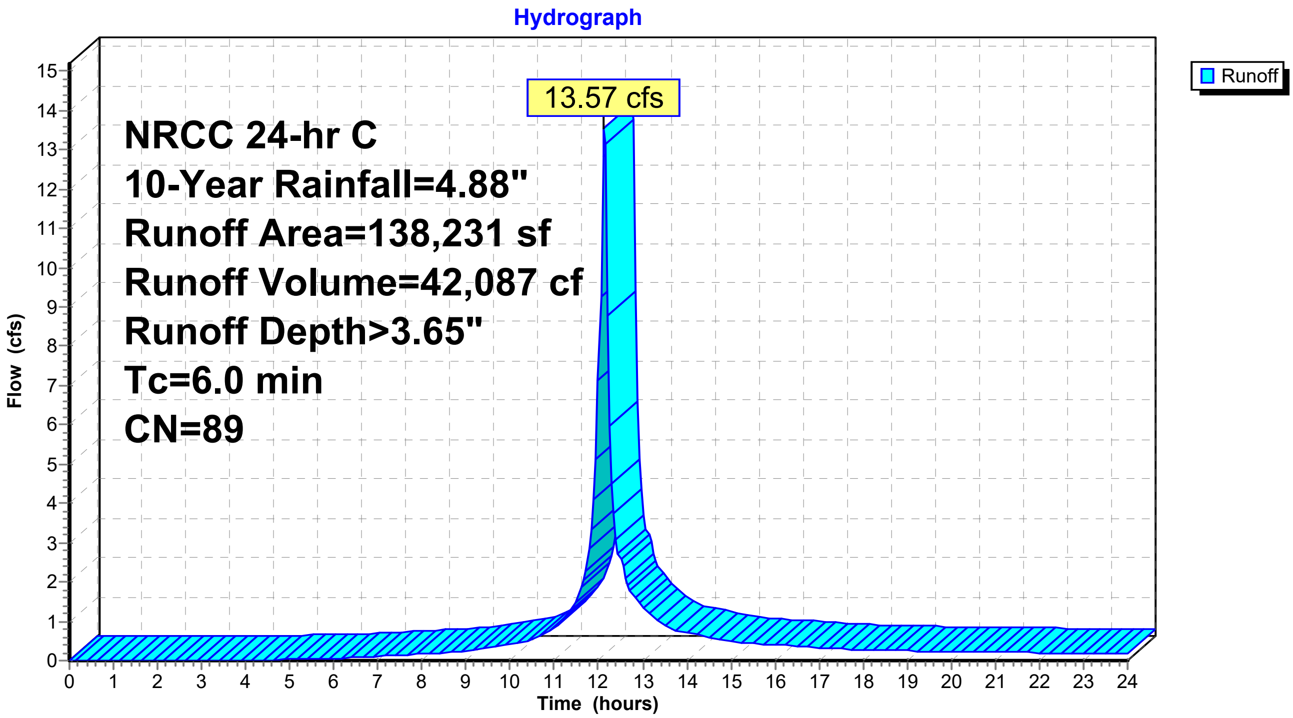
Runoff = 13.57 cfs @ 12.13 hrs, Volume= 42,087 cf, Depth> 3.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 88,857 | 98 | IMPERVIOUS |
| | 49,374 | 74 | >75% Grass cover, Good, HSG C |
| | 138,231 | 89 | Weighted Average |
| | 49,374 | | 35.72% Pervious Area |
| | 88,857 | | 64.28% Impervious Area |

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

### Subcatchment PR-8: TO WQU-2



## Summary for Subcatchment PR-9: BUILDING 1 ROOF

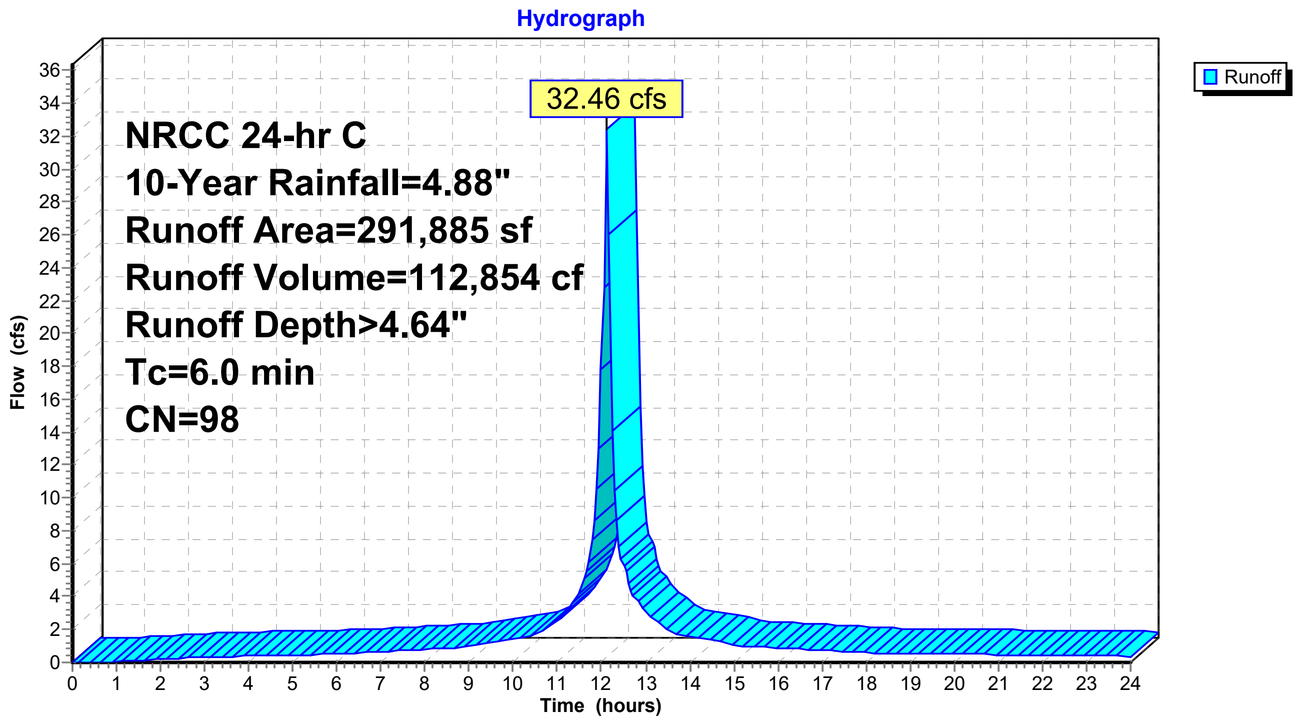
Runoff = 32.46 cfs @ 12.13 hrs, Volume= 112,854 cf, Depth> 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.88"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 291,885 | 98 | IMPERVIOUS |
| | 291,885 | | 100.00% Impervious Area |

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

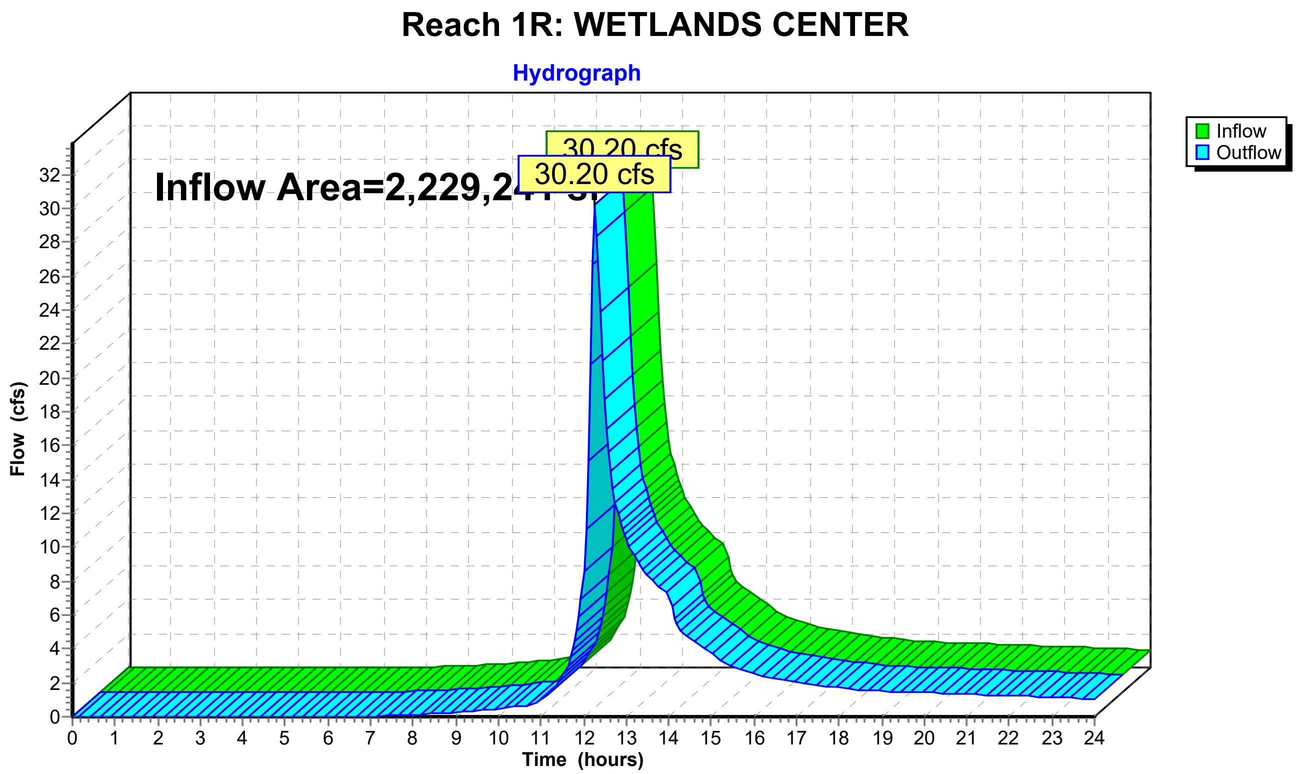
## Subcatchment PR-9: BUILDING 1 ROOF



## Summary for Reach 1R: WETLANDS CENTER

| | | | |
|---|---|---|---|
| Inflow Area = | 2,229,241 sf, 42.29% Impervious, | Inflow Depth > 0.98" | for 10-Year event |
| Inflow = | 30.20 cfs @ 12.27 hrs, Volume= | 181,379 cf | |
| Outflow = | 30.20 cfs @ 12.27 hrs, Volume= | 181,379 cf, Atten= 0%, Lag= 0.0 min | |

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

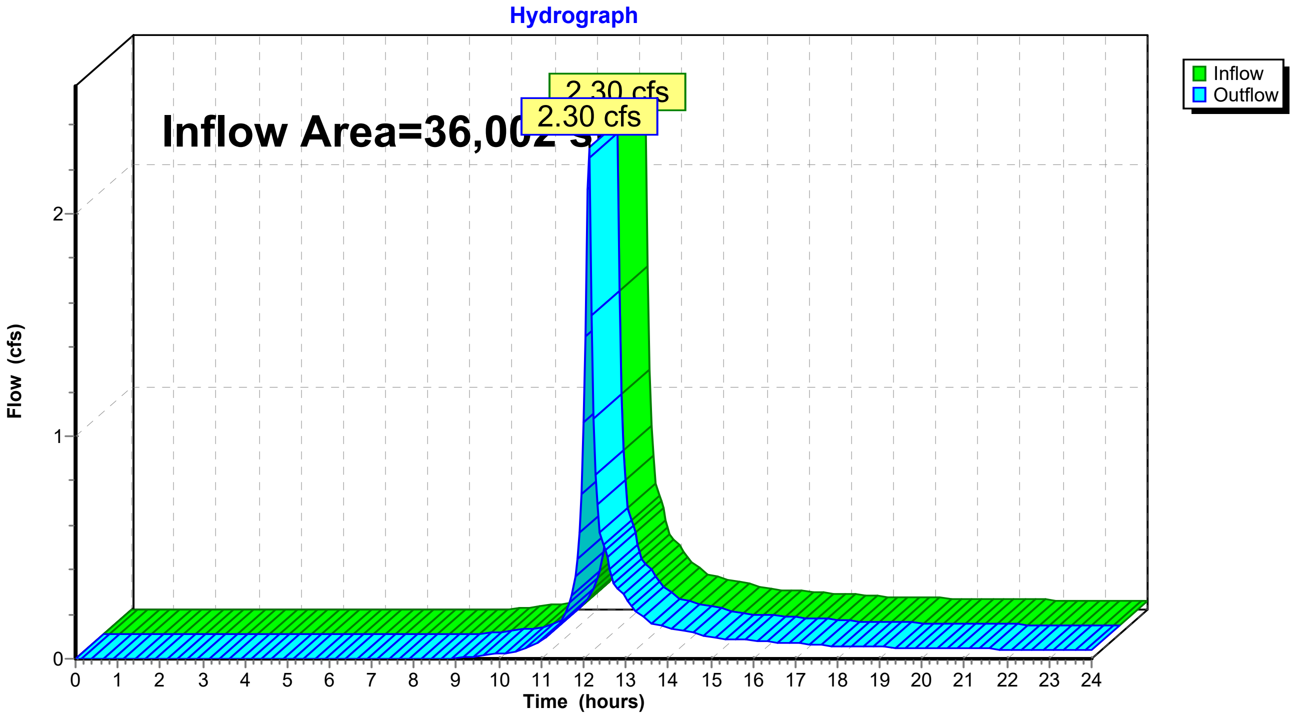


## Summary for Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

| | | | |
|---|---|---|---|
| Inflow Area = | 36,002 sf, | 0.00% Impervious, Inflow Depth > 2.27" | for 10-Year event |
| Inflow = | 2.30 cfs @ | 12.13 hrs, Volume= | 6,798 cf |
| Outflow = | 2.30 cfs @ | 12.13 hrs, Volume= | 6,798 cf, Atten= 0%, Lag= 0.0 min |

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

### Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

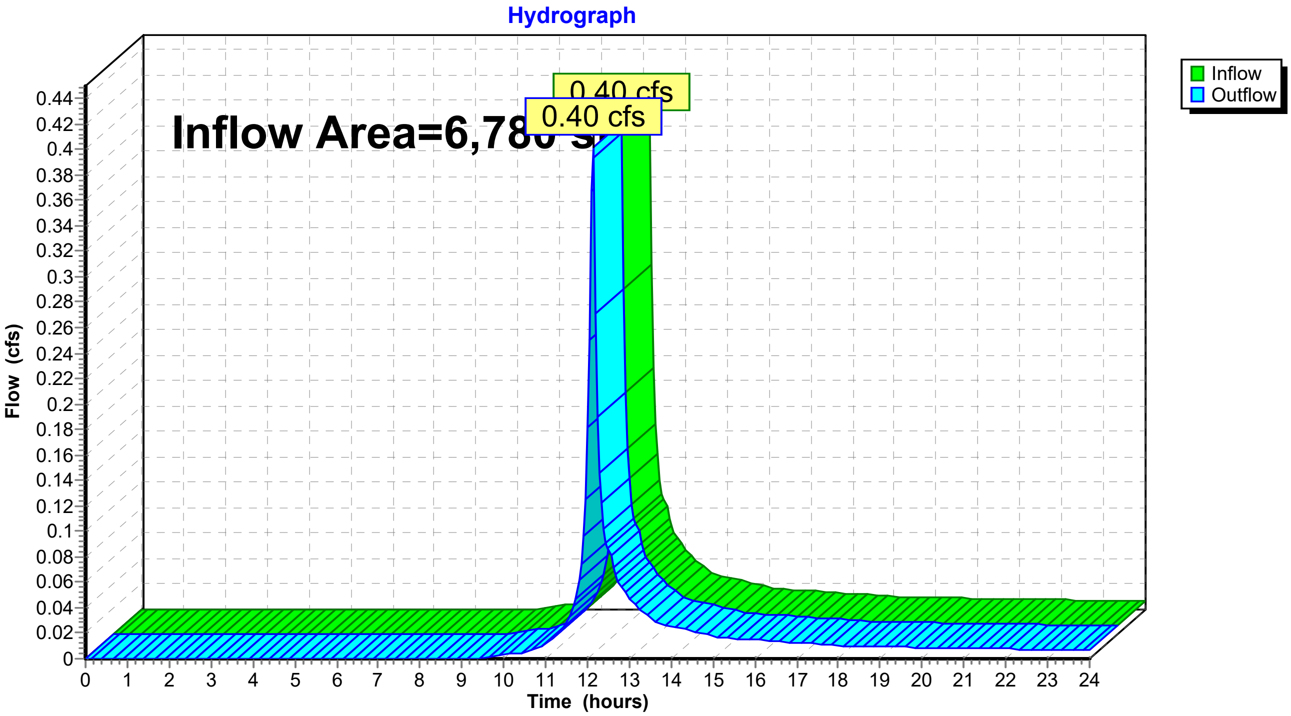


## Summary for Reach 3R: OFFSITE SOUTH

Inflow Area = 6,780 sf, 0.00% Impervious, Inflow Depth > 2.10" for 10-Year event
Inflow = 0.40 cfs @ 12.13 hrs, Volume= 1,188 cf
Outflow = 0.40 cfs @ 12.13 hrs, Volume= 1,188 cf, Atten= 0%, Lag= 0.0 min

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

### Reach 3R: OFFSITE SOUTH

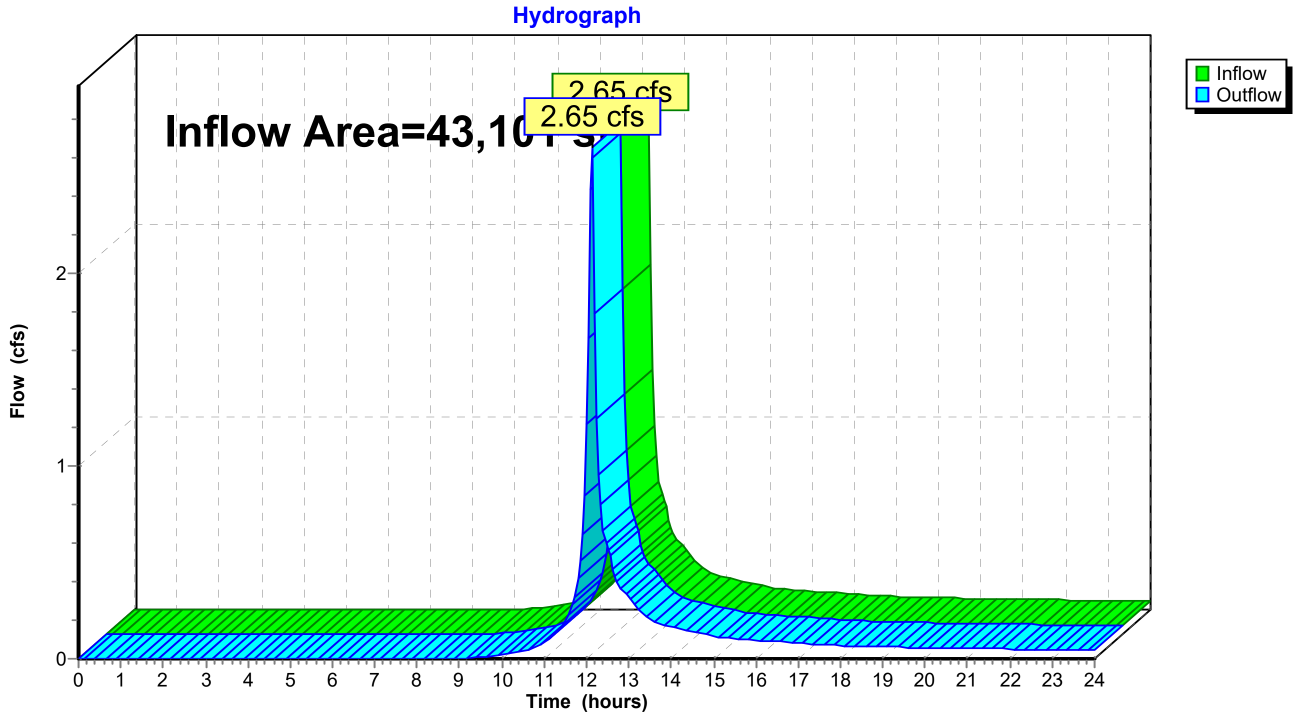


## Summary for Reach 4R: INNOVATION WAY (2009 SHLO)

Inflow Area = 43,101 sf, 0.00% Impervious, Inflow Depth > 2.18" for 10-Year event
Inflow = 2.65 cfs @ 12.13 hrs, Volume= 7,844 cf
Outflow = 2.65 cfs @ 12.13 hrs, Volume= 7,844 cf, Atten= 0%, Lag= 0.0 min

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

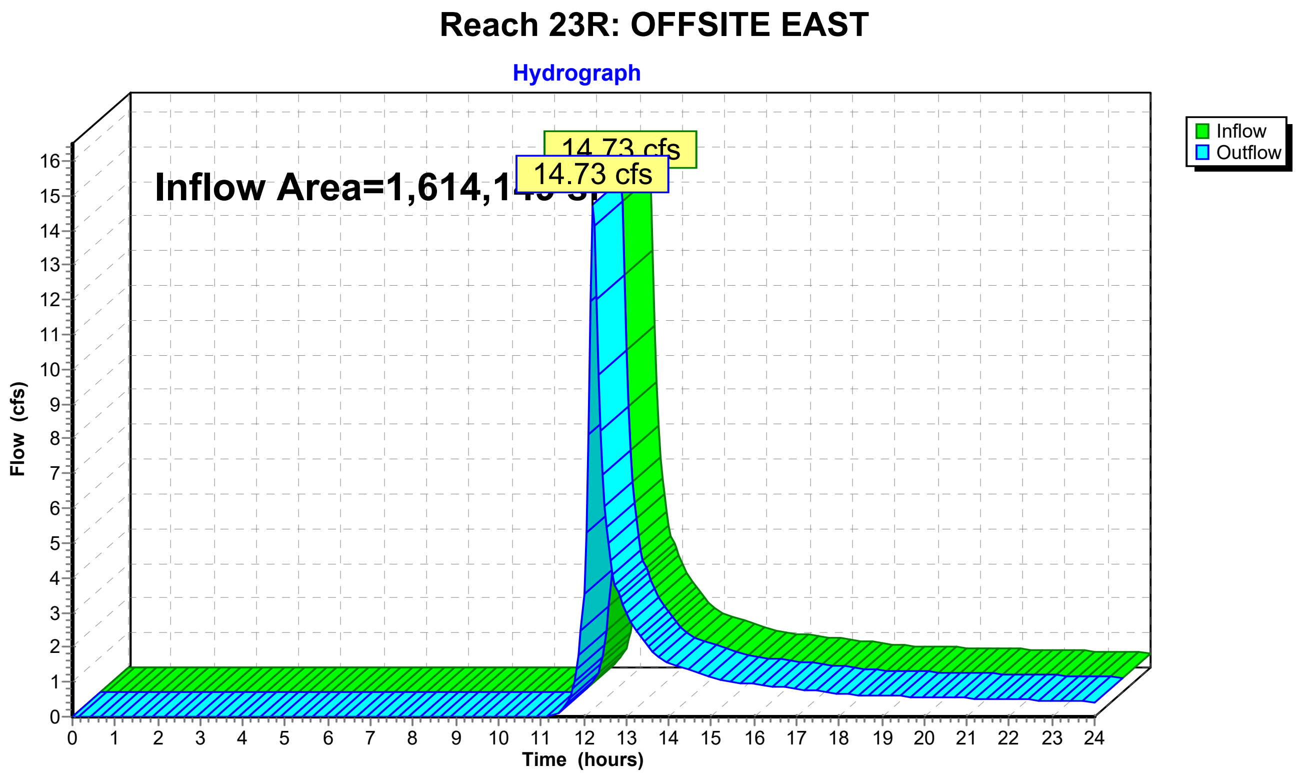
### Reach 4R: INNOVATION WAY (2009 SHLO)



## Summary for Reach 23R: OFFSITE EAST

| | | | |
|---|---|---|---|
| Inflow Area = | 1,614,149 sf, 48.12% Impervious, | Inflow Depth > 0.45" | for 10-Year event |
| Inflow = | 14.73 cfs @ 12.22 hrs, | Volume= | 60,010 cf |
| Outflow = | 14.73 cfs @ 12.22 hrs, | Volume= | 60,010 cf, Atten= 0%, Lag= 0.0 min |

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



## Summary for Pond 5P: Focal Point System A

Inflow Area = 235,410 sf, 48.35% Impervious, Inflow Depth > 3.30" for 10-Year event
Inflow = 21.13 cfs @ 12.13 hrs, Volume= 64,718 cf
Outflow = 4.31 cfs @ 11.85 hrs, Volume= 64,784 cf, Atten= 80%, Lag= 0.0 min
Primary = 4.31 cfs @ 11.85 hrs, Volume= 64,784 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 187.75' @ 12.46 hrs Surf.Area= 1,860 sf Storage= 13,311 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 16.1 min ( 826.4 - 810.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 184.25' | 837 cf | **40.00'W x 46.50'L x 2.25'H FOCIAL POINT**<br>4,185 cf Overall x 20.0% Voids |
| #2 | 186.50' | 45,685 cf | **Custom Stage Data (Prismatic)**Listed below (Recalc) -Impervious |
| | | 46,522 cf | Total Available Storage |

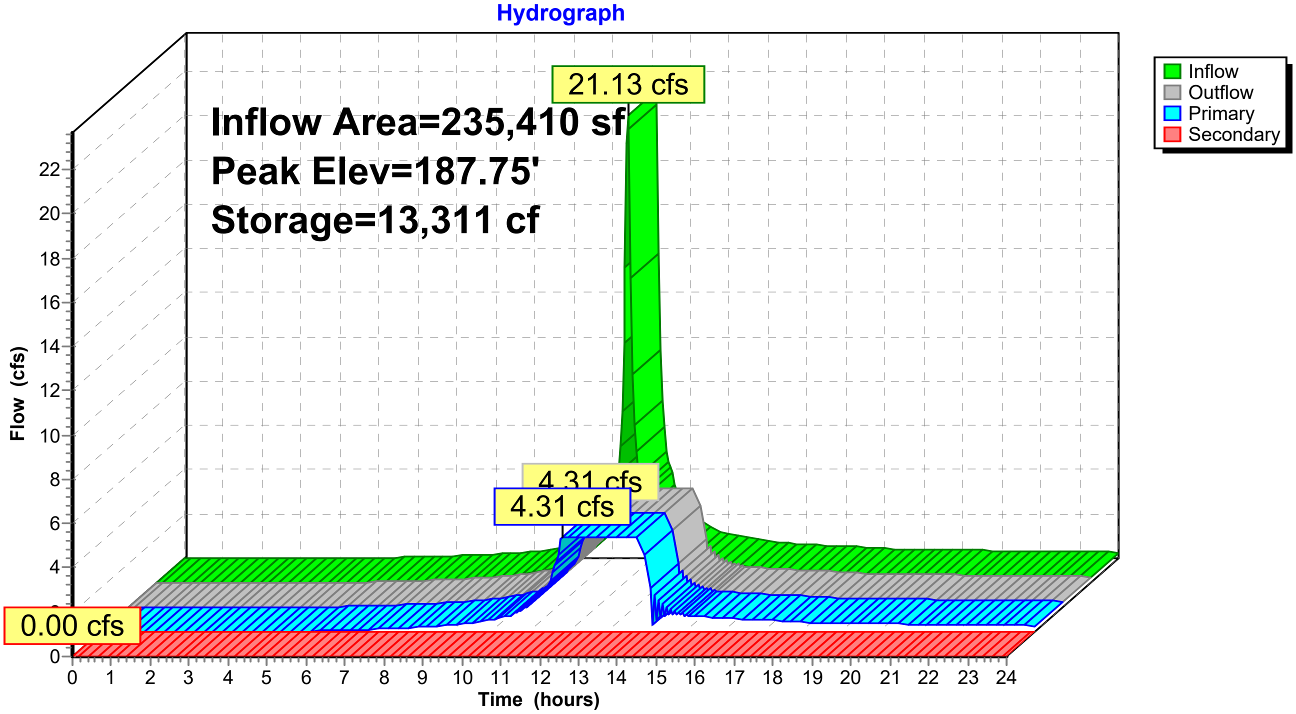
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 186.50 | 3,206 | 0 | 0 |
| 187.00 | 11,178 | 3,596 | 3,596 |
| 188.00 | 13,067 | 12,123 | 15,719 |
| 189.00 | 14,971 | 14,019 | 29,738 |
| 190.00 | 16,924 | 15,948 | 45,685 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 184.25' | **100.000 in/hr Exfiltration over Surface area** Phase-In= 0.10' |
| #2 | Secondary | 188.70' | **48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 2 | 185.00' | **12.0" Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=4.31 cfs @ 11.85 hrs HW=184.52' TW=182.75' (Dynamic Tailwater)
└─**1=Exfiltration** (Exfiltration Controls 4.31 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=184.25' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** ( Controls 0.00 cfs)
  └─**3=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 5P: Focal Point System A



## Summary for Pond 8P: RTANKS

Inflow Area = 235,410 sf, 48.35% Impervious, Inflow Depth > 3.30" for 10-Year event
Inflow = 4.31 cfs @ 11.85 hrs, Volume= 64,784 cf
Outflow = 4.31 cfs @ 14.05 hrs, Volume= 63,631 cf, Atten= 0%, Lag= 132.0 min
Primary = 2.64 cfs @ 14.05 hrs, Volume= 52,446 cf
Secondary = 1.66 cfs @ 14.05 hrs, Volume= 11,185 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 183.64' @ 14.05 hrs Surf.Area= 3,844 sf Storage= 7,837 cf

Plug-Flow detention time= 39.7 min calculated for 63,631 cf (98% of inflow)
Center-of-Mass det. time= 29.4 min ( 855.8 - 826.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 181.18' | 943 cf | **48.62'W x 79.07'L x 3.07'H Field A** |
| | | | 11,807 cf Overall - 9,450 cf Embedded = 2,357 cf x 40.0% Voids |
| #2A | 181.43' | 8,978 cf | **ACF R-Tank HD 2** x 1088 Inside #1 |
| | | | Inside= 15.7"W x 33.9"H => 3.52 sf x 2.35'L = 8.3 cf |
| | | | Outside= 15.7"W x 33.9"H => 3.70 sf x 2.35'L = 8.7 cf |
| | | | 1088 Chambers in 34 Rows |
| | | 9,921 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 181.43' | **6.0" Vert. Orifice/Grate X 2.00** C= 0.600 |
| | | | Limited to weir flow at low heads |
| #2 | Secondary | 183.17' | **12.0" Vert. Orifice/Grate X 2.00** C= 0.600 |
| | | | Limited to weir flow at low heads |

**Primary OutFlow** Max=2.64 cfs @ 14.05 hrs HW=183.64' TW=0.00' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Orifice Controls 2.64 cfs @ 6.73 fps)

**Secondary OutFlow** Max=1.66 cfs @ 14.05 hrs HW=183.64' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Orifice Controls 1.66 cfs @ 2.32 fps)

## Pond 8P: RTANKS - Chamber Wizard Field A

**Chamber Model = ACF R-Tank HD 2 (ACF Environmental R-Tank HD)**
Inside= 15.7"W x 33.9"H => 3.52 sf x 2.35'L = 8.3 cf
Outside= 15.7"W x 33.9"H => 3.70 sf x 2.35'L = 8.7 cf

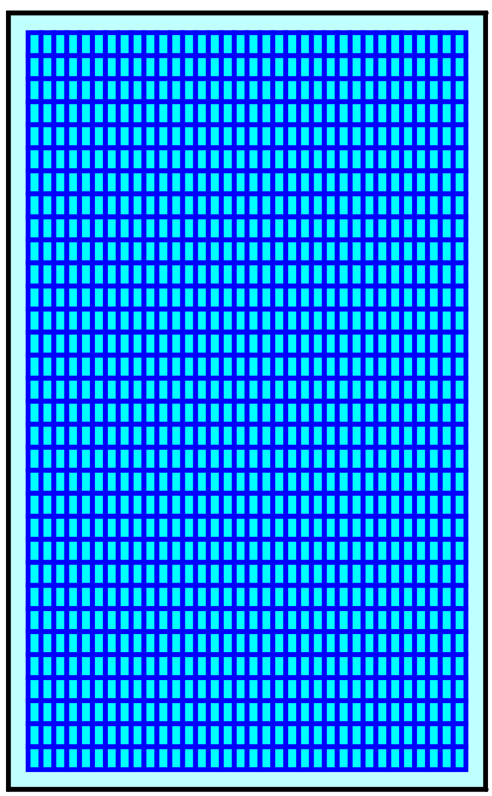
32 Chambers/Row x 2.35' Long = 75.07' Row Length +24.0" End Stone x 2 = 79.07' Base Length
34 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 48.62' Base Width
3.0" Stone Base + 33.9" Chamber Height = 3.07' Field Height

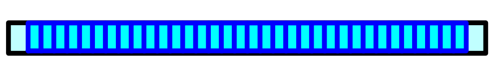
1,088 Chambers x 8.3 cf = 8,977.8 cf Chamber Storage
1,088 Chambers x 8.7 cf = 9,450.4 cf Displacement

11,807.3 cf Field - 9,450.4 cf Chambers = 2,357.0 cf Stone x 40.0% Voids = 942.8 cf Stone Storage

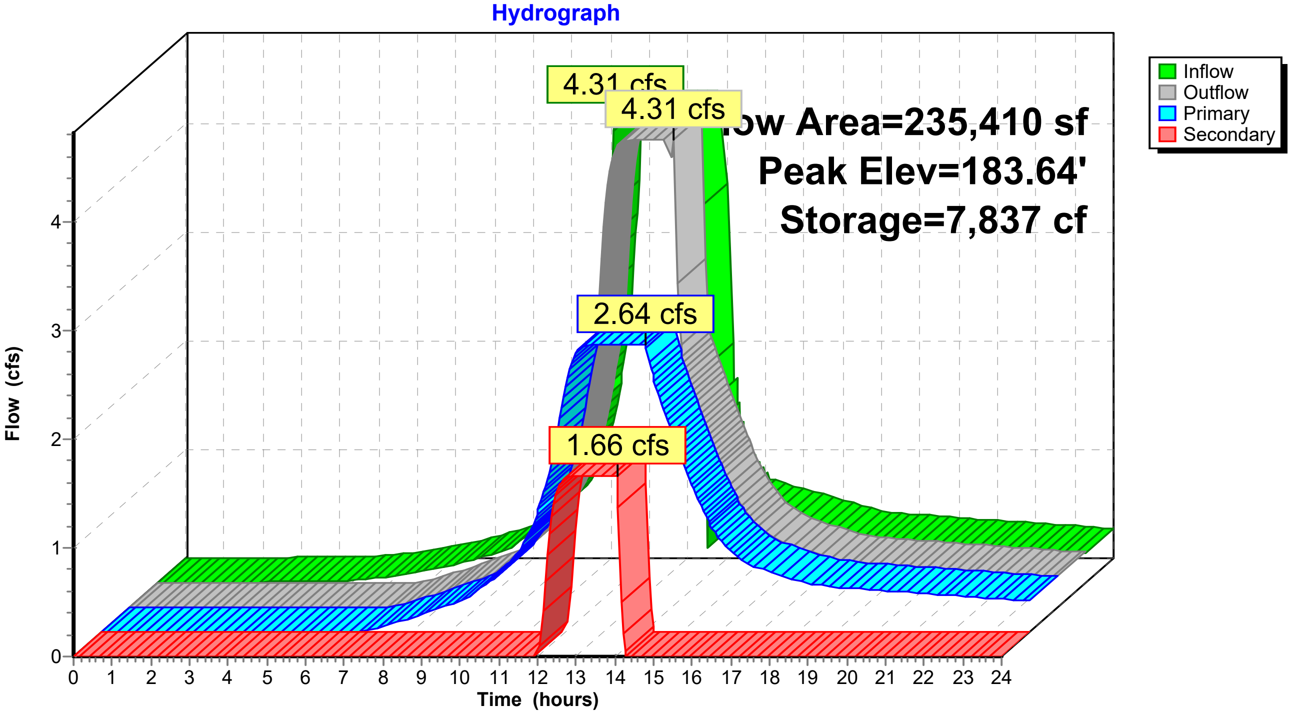
Chamber Storage + Stone Storage = 9,920.6 cf = 0.228 af
Overall Storage Efficiency = 84.0%
Overall System Size = 79.07' x 48.62' x 3.07'

1,088 Chambers
437.3 cy Field
87.3 cy Stone





## Pond 8P: RTANKS



## Summary for Pond 10P: STORMTRAP SYSTEM C

Inflow Area = 15,869 sf, 90.76% Impervious, Inflow Depth > 4.41" for 10-Year event
Inflow = 1.74 cfs @ 12.13 hrs, Volume= 5,831 cf
Outflow = 0.14 cfs @ 11.60 hrs, Volume= 5,834 cf, Atten= 92%, Lag= 0.0 min
Discarded = 0.14 cfs @ 11.60 hrs, Volume= 5,834 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 220.04' @ 13.16 hrs Surf.Area= 2,561 sf Storage= 2,010 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 96.5 min ( 861.5 - 765.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 219.25' | 1 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc)<br>7,683 cf Overall - 7,682 cf Embedded = 1 cf |
| #2 | 219.25' | 7,682 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 7,683 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 219.25 | 2,561 | 0 | 0 |
| 219.75 | 2,561 | 1,281 | 1,281 |
| 220.25 | 2,561 | 1,281 | 2,561 |
| 220.75 | 2,561 | 1,281 | 3,842 |
| 221.25 | 2,561 | 1,281 | 5,122 |
| 221.75 | 2,561 | 1,281 | 6,403 |
| 222.25 | 2,561 | 1,281 | 7,683 |

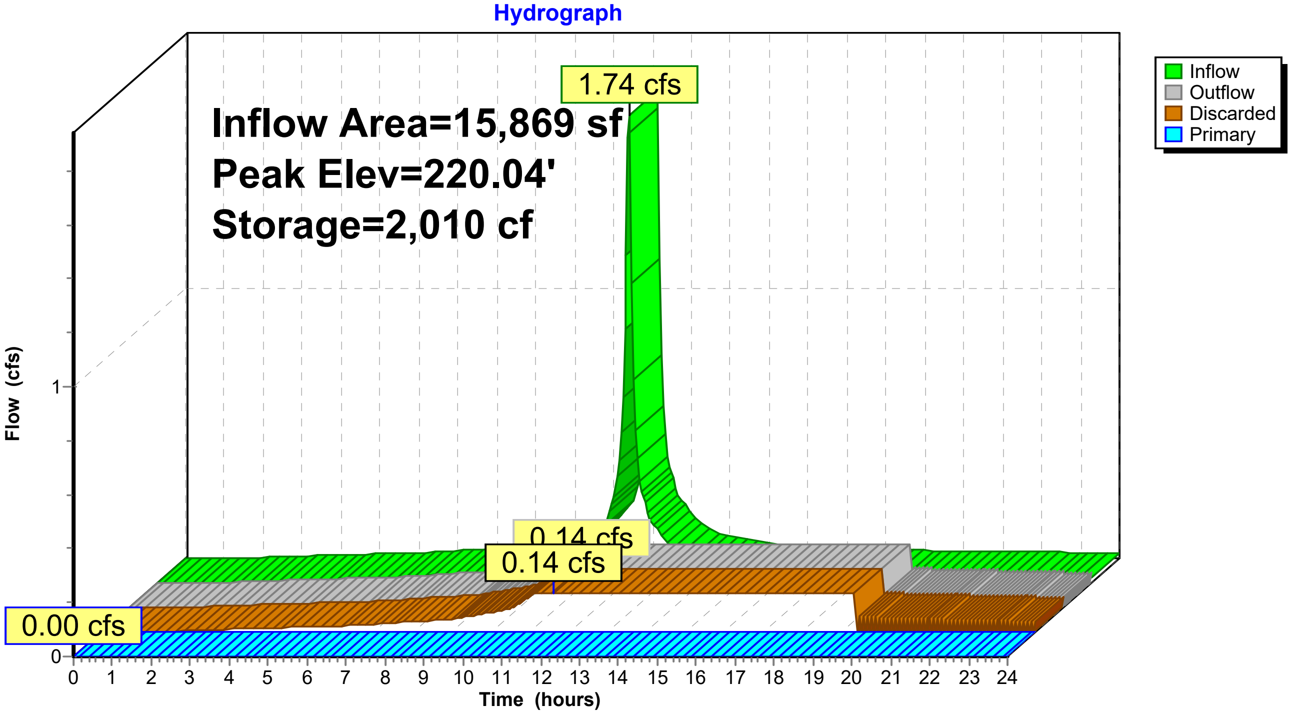
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 219.25 | 0 |
| 219.75 | 1,280 |
| 220.25 | 2,561 |
| 220.75 | 3,841 |
| 221.25 | 5,121 |
| 221.75 | 6,401 |
| 222.25 | 7,682 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 219.25' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 220.75' | **12.0" Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.14 cfs @ 11.60 hrs HW=219.28' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=219.25' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 10P: STORMTRAP SYSTEM C



## Summary for Pond 12P: STORMTRAP 13 FT SYSTEM D

Inflow Area = 203,397 sf,100.00% Impervious, Inflow Depth > 4.64" for 10-Year event
Inflow = 22.62 cfs @ 12.13 hrs, Volume= 78,641 cf
Outflow = 0.25 cfs @ 3.80 hrs, Volume= 20,077 cf, Atten= 99%, Lag= 0.0 min
Discarded = 0.25 cfs @ 3.80 hrs, Volume= 20,077 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 177.31' @ 24.00 hrs Surf.Area= 10,737 sf Storage= 58,564 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 31.3 min ( 780.6 - 749.2 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 170.75' | 0 cf | **64.19'W x 167.27'L x 14.00'H Field A**<br>150,314 cf Overall - 150,314 cf Embedded = 0 cf x 40.0% Voids |
| #2A | 170.75' | 125,597 cf | **StormTrap ST2 DoubleTrap 13-0** x 60 Inside #1<br>Inside= 101.7"W x 156.0"H => 101.45 sf x 15.40'L = 1,561.9 cf<br>Outside= 101.7"W x 168.0"H => 118.71 sf x 15.40'L = 1,827.6 cf<br>60 Chambers in 6 Rows<br>50.88' x 153.96' Core + 6.66' Border = 64.19' x 167.27' System |
| | | 125,597 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 170.75' | **1.020 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.25 cfs @ 3.80 hrs HW=171.25' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.25 cfs)

## Pond 12P: STORMTRAP 13 FT SYSTEM D - Chamber Wizard Field A

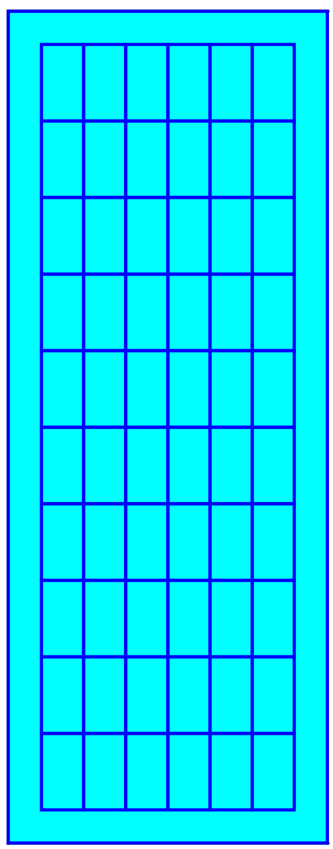
**Chamber Model = StormTrap ST2 DoubleTrap 13-0 (StormTrap ST2 DoubleTrap® Type I+III)**
Inside= 101.7"W x 156.0"H => 101.45 sf x 15.40'L = 1,561.9 cf
Outside= 101.7"W x 168.0"H => 118.71 sf x 15.40'L = 1,827.6 cf

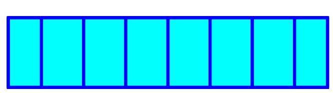
10 Chambers/Row x 15.40' Long = 153.96' Row Length +79.9" Border x 2 = 167.27' Base Length
6 Rows x 101.7" Wide + 79.9" Side Border x 2 = 64.19' Base Width
168.0" Chamber Height = 14.00' Field Height

60 Chambers x 1,561.9 cf + 31,885.6 cf Border = 125,597.4 cf Chamber Storage
60 Chambers x 1,827.6 cf + 40,656.9 cf Border = 150,313.8 cf Displacement

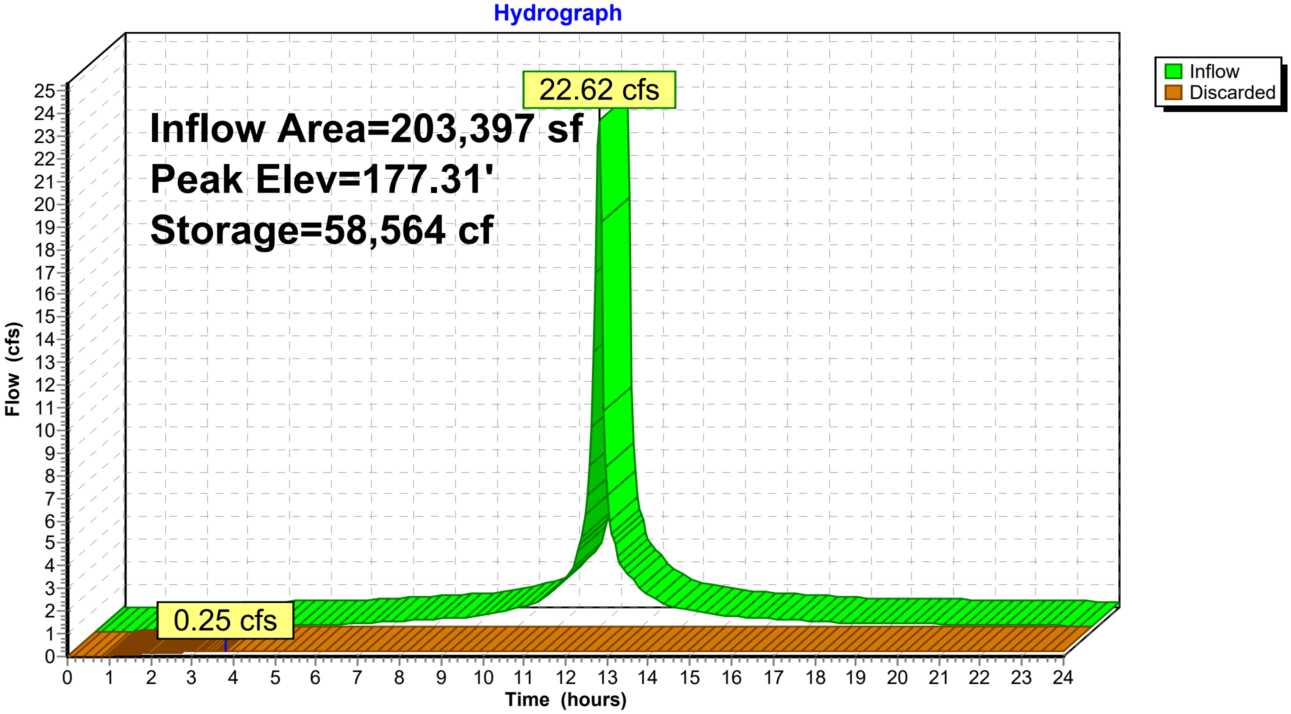
Chamber Storage = 125,597.4 cf = 2.883 af
Overall Storage Efficiency = 83.6%
Overall System Size = 167.27' x 64.19' x 14.00'

60 Chambers (plus border)
5,567.2 cy Field





## Pond 12P: STORMTRAP 13 FT SYSTEM D



## Summary for Pond 13P: BASIN A

Inflow Area = 456,714 sf, 65.34% Impervious, Inflow Depth > 3.48" for 10-Year event
Inflow = 41.99 cfs @ 12.13 hrs, Volume= 132,482 cf
Outflow = 1.17 cfs @ 16.41 hrs, Volume= 65,048 cf, Atten= 97%, Lag= 256.7 min
Discarded = 1.17 cfs @ 16.41 hrs, Volume= 65,048 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 173.50' @ 16.41 hrs Surf.Area= 20,931 sf Storage= 78,428 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 154.9 min ( 952.0 - 797.1 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 169.00' | 214,942 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

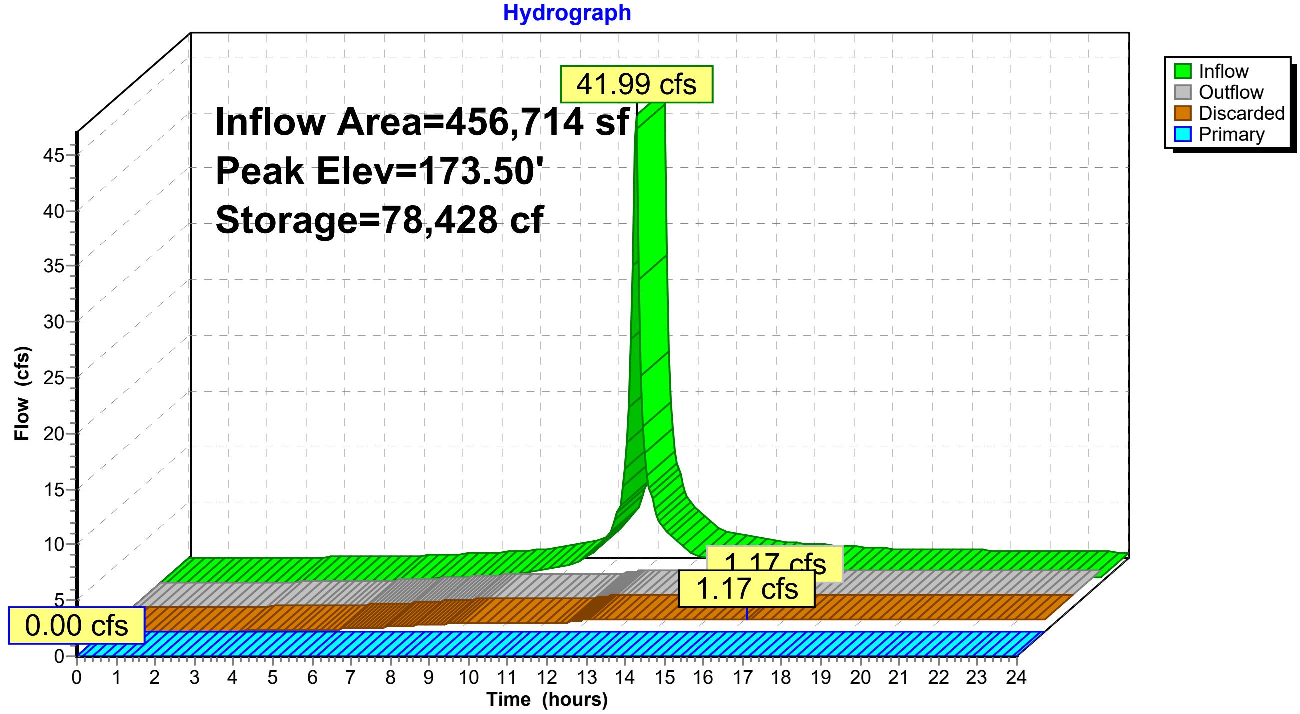
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 169.00 | 14,114 | 0 | 0 |
| 170.00 | 15,529 | 14,822 | 14,822 |
| 171.00 | 17,000 | 16,265 | 31,086 |
| 172.00 | 18,527 | 17,764 | 48,850 |
| 173.00 | 20,111 | 19,319 | 68,169 |
| 174.00 | 21,751 | 20,931 | 89,100 |
| 175.00 | 23,448 | 22,600 | 111,699 |
| 176.00 | 25,345 | 24,397 | 136,096 |
| 177.00 | 27,180 | 26,263 | 162,358 |
| 178.00 | 29,071 | 28,126 | 190,484 |
| 178.80 | 32,074 | 24,458 | 214,942 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 169.00' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 177.80' | **20.0' long x 15.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63 |

**Discarded OutFlow** Max=1.17 cfs @ 16.41 hrs HW=173.50' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.17 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=169.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond 13P: BASIN A



## Summary for Pond 59P: BASIN B

Inflow Area = 271,926 sf, 56.54% Impervious, Inflow Depth > 3.27" for 10-Year event
Inflow = 22.82 cfs @ 12.13 hrs, Volume= 74,047 cf
Outflow = 0.92 cfs @ 14.80 hrs, Volume= 48,153 cf, Atten= 96%, Lag= 160.4 min
Discarded = 0.92 cfs @ 14.80 hrs, Volume= 48,153 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 213.12' @ 14.80 hrs Surf.Area= 16,444 sf Storage= 38,924 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 165.0 min ( 955.9 - 790.9 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 210.00' | 77,098 cf | **Custom Stage Data (Irregular)** Listed below (Recalc) |

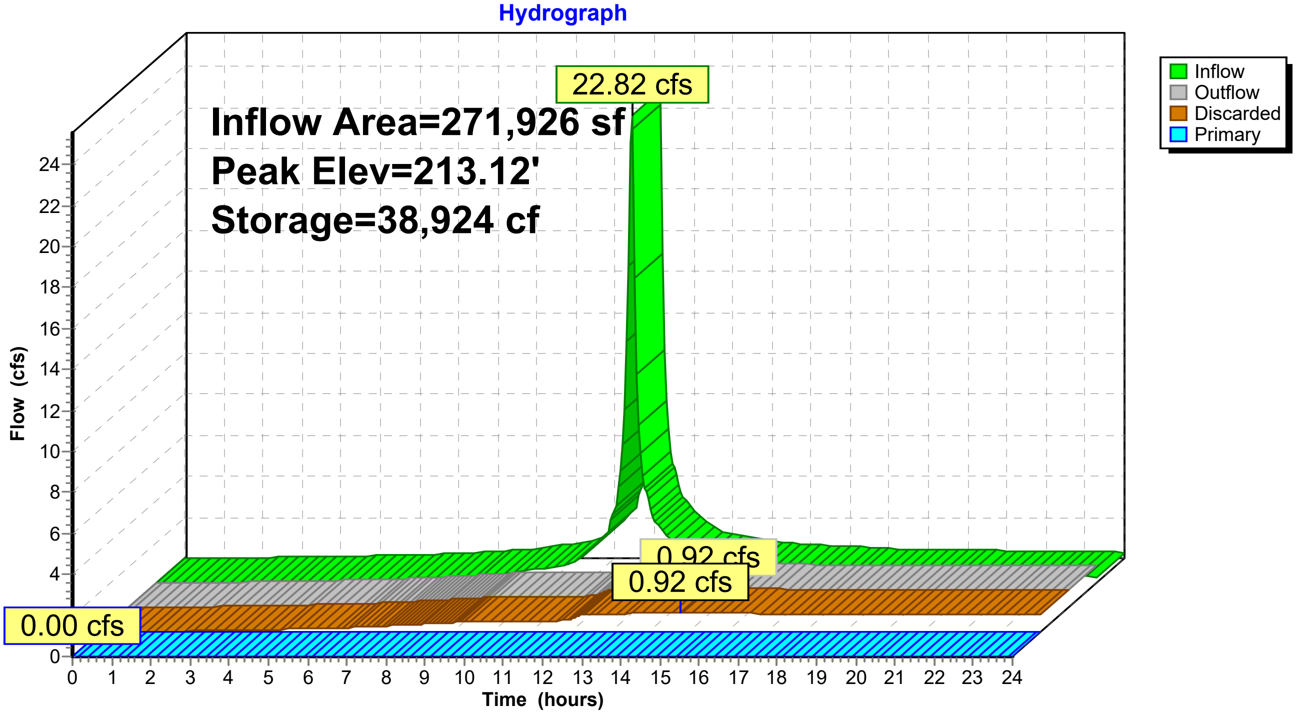
| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|---|---|---|---|---|---|
| 210.00 | 9,182 | 374.9 | 0 | 0 | 9,182 |
| 211.00 | 10,335 | 393.7 | 9,753 | 9,753 | 10,394 |
| 212.00 | 14,140 | 565.6 | 12,188 | 21,941 | 23,526 |
| 213.00 | 15,865 | 584.4 | 14,994 | 36,935 | 25,340 |
| 214.00 | 20,870 | 647.8 | 18,310 | 55,245 | 31,587 |
| 215.00 | 22,851 | 666.2 | 21,853 | 77,098 | 33,620 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 210.00' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 214.00' | **30.0' long x 15.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63 |

**Discarded OutFlow** Max=0.92 cfs @ 14.80 hrs HW=213.12' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.92 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=210.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond 59P: BASIN B



## Summary for Pond 61P: BASIN C

Inflow Area = 351,572 sf, 70.16% Impervious, Inflow Depth > 3.69" for 10-Year event
Inflow = 31.72 cfs @ 12.13 hrs, Volume= 108,210 cf
Outflow = 1.02 cfs @ 15.42 hrs, Volume= 59,928 cf, Atten= 97%, Lag= 197.2 min
Discarded = 1.02 cfs @ 15.42 hrs, Volume= 59,928 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 215.23' @ 15.42 hrs Surf.Area= 18,219 sf Storage= 60,213 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 137.3 min ( 903.6 - 766.3 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 211.00' | 91,926 cf | **Custom Stage Data (Irregular)**Listed below (Recalc) |

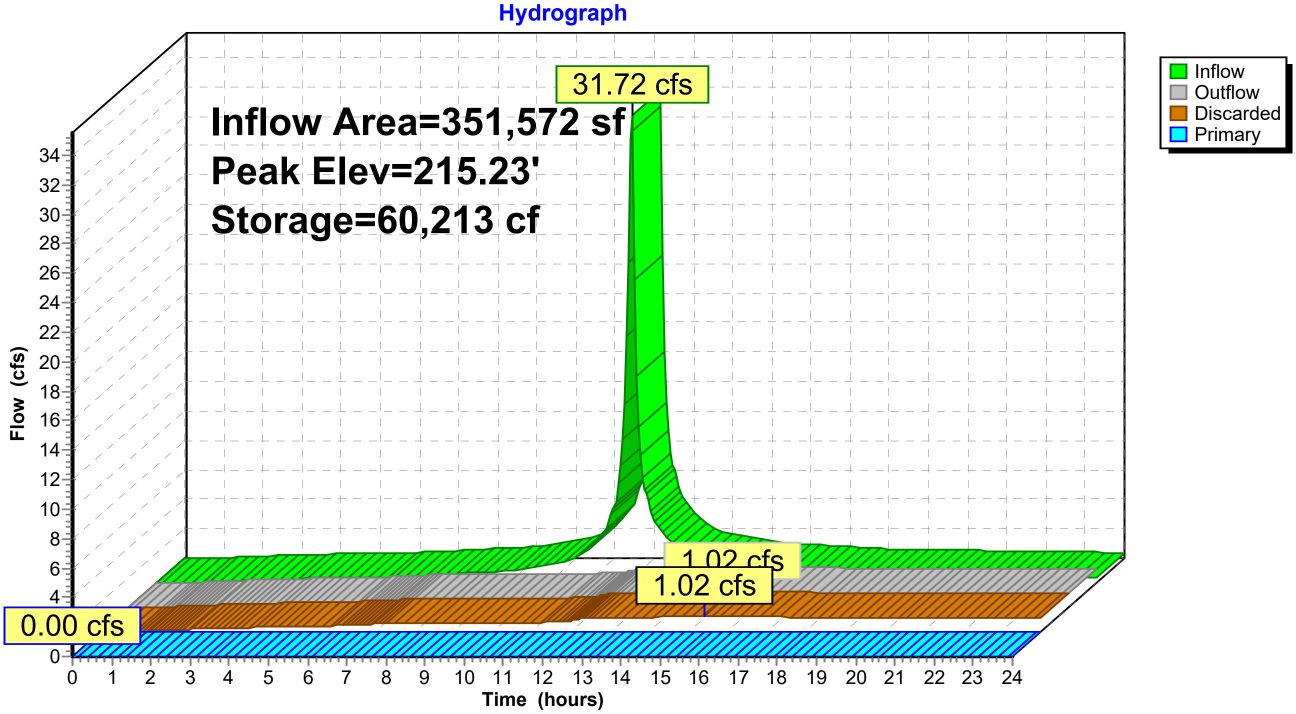
| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|---|---|---|---|---|---|
| 211.00 | 10,407 | 575.7 | 0 | 0 | 10,407 |
| 212.00 | 12,162 | 594.5 | 11,273 | 11,273 | 12,253 |
| 213.00 | 13,974 | 613.4 | 13,058 | 24,331 | 14,167 |
| 214.00 | 15,842 | 632.2 | 14,898 | 39,229 | 16,132 |
| 215.00 | 17,767 | 651.1 | 16,795 | 56,024 | 18,166 |
| 216.00 | 19,749 | 669.9 | 18,749 | 74,773 | 20,250 |
| 216.80 | 23,177 | 701.3 | 17,152 | 91,926 | 23,720 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 211.00' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 215.80' | **20.0' long x 10.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64 |

**Discarded OutFlow** Max=1.02 cfs @ 15.42 hrs HW=215.23' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=211.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond 61P: BASIN C



## Summary for Pond 65P: STORMTRAP 3.5 FT SYSTEM B

Inflow Area = 375,763 sf, 94.19% Impervious, Inflow Depth > 4.40" for 10-Year event
Inflow = 40.82 cfs @ 12.13 hrs, Volume= 137,912 cf
Outflow = 34.54 cfs @ 12.17 hrs, Volume= 133,686 cf, Atten= 15%, Lag= 2.6 min
Discarded = 0.96 cfs @ 9.50 hrs, Volume= 65,434 cf
Primary = 33.59 cfs @ 12.17 hrs, Volume= 68,252 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 214.41' @ 12.17 hrs Surf.Area= 17,139 sf Storage= 21,835 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 53.9 min ( 815.7 - 761.8 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 213.14' | 2 cf | **Custom Stage Data (Prismatic)** Listed below<br>59,987 cf Overall - 59,985 cf Embedded = 2 cf |
| #2 | 213.14' | 59,985 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 59,987 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 213.14 | 17,139 | 0 | 0 |
| 213.39 | 17,139 | 4,285 | 4,285 |
| 214.14 | 17,139 | 12,854 | 17,139 |
| 214.64 | 17,139 | 8,570 | 25,709 |
| 215.14 | 17,139 | 8,570 | 34,278 |
| 215.64 | 17,139 | 8,570 | 42,848 |
| 216.14 | 17,139 | 8,570 | 51,417 |
| 216.64 | 17,139 | 8,570 | 59,987 |

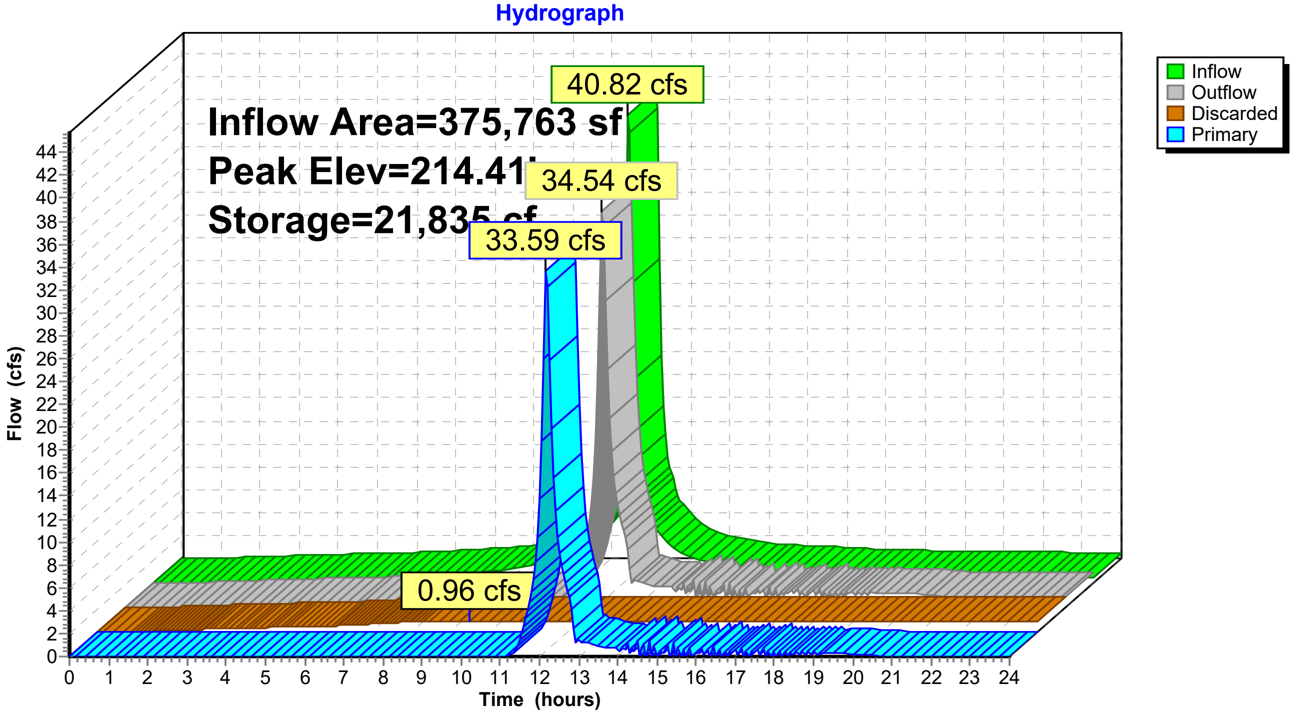
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 213.14 | 0 |
| 213.64 | 8,569 |
| 214.14 | 17,138 |
| 214.64 | 25,708 |
| 215.14 | 34,277 |
| 215.64 | 42,846 |
| 216.14 | 51,416 |
| 216.64 | 59,985 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 213.14' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 213.64' | **24.0" Vert. Orifice/Grate X 10.00** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.96 cfs @ 9.50 hrs HW=213.18' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.96 cfs)

**Primary OutFlow** Max=32.67 cfs @ 12.17 hrs HW=214.40' TW=211.32' (Dynamic Tailwater)
↑—**2=Orifice/Grate** (Orifice Controls 32.67 cfs @ 2.97 fps)

## Pond 65P: STORMTRAP 3.5 FT SYSTEM B



## Summary for Pond 67P: CULTEC SYSTEM E

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 59,461 sf, | 84.88% Impervious, | Inflow Depth > 4.19" | for 10-Year event |
| Inflow = | 6.36 cfs @ | 12.13 hrs, Volume= | 20,742 cf | |
| Outflow = | 0.33 cfs @ | 11.10 hrs, Volume= | 18,739 cf, | Atten= 95%, Lag= 0.0 min |
| Discarded = | 0.33 cfs @ | 11.10 hrs, Volume= | 18,739 cf | |
| Primary = | 0.00 cfs @ | 0.00 hrs, Volume= | 0 cf | |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 212.59' @ 13.87 hrs Surf.Area= 5,889 sf Storage= 9,081 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 178.4 min ( 955.8 - 777.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 210.36' | 8,095 cf | **37.50'W x 157.03'L x 5.75'H Field A**<br>33,860 cf Overall - 13,622 cf Embedded = 20,238 cf x 40.0% Voids |
| #2A | 211.11' | 13,622 cf | **Cultec R-902HD** x 210 Inside #1<br>Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf<br>Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap<br>210 Chambers in 5 Rows<br>Cap Storage= +2.8 cf x 2 x 5 rows = 27.6 cf |
| | | 21,717 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 210.36' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 213.56' | **12.0" Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.33 cfs @ 11.10 hrs HW=210.42' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.33 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=210.36' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 67P: CULTEC SYSTEM E - Chamber Wizard Field A

**Chamber Model = Cultec R-902HD (Cultec Recharger® 902HD)**
Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= +2.8 cf x 2 x 5 rows = 27.6 cf

78.0" Wide + 9.0" Spacing = 87.0" C-C Row Spacing

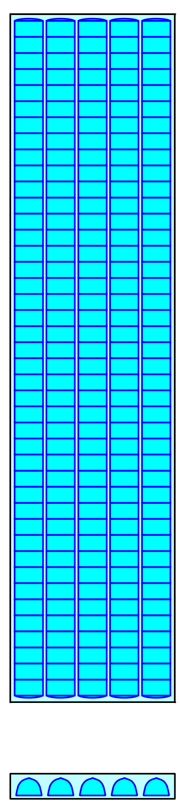
42 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 155.03' Row Length +12.0" End Stone x 2 = 157.03' Base Length
5 Rows x 78.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.50' Base Width
9.0" Stone Base + 48.0" Chamber Height + 12.0" Stone Cover = 5.75' Field Height

210 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 5 Rows = 13,622.0 cf Chamber Storage

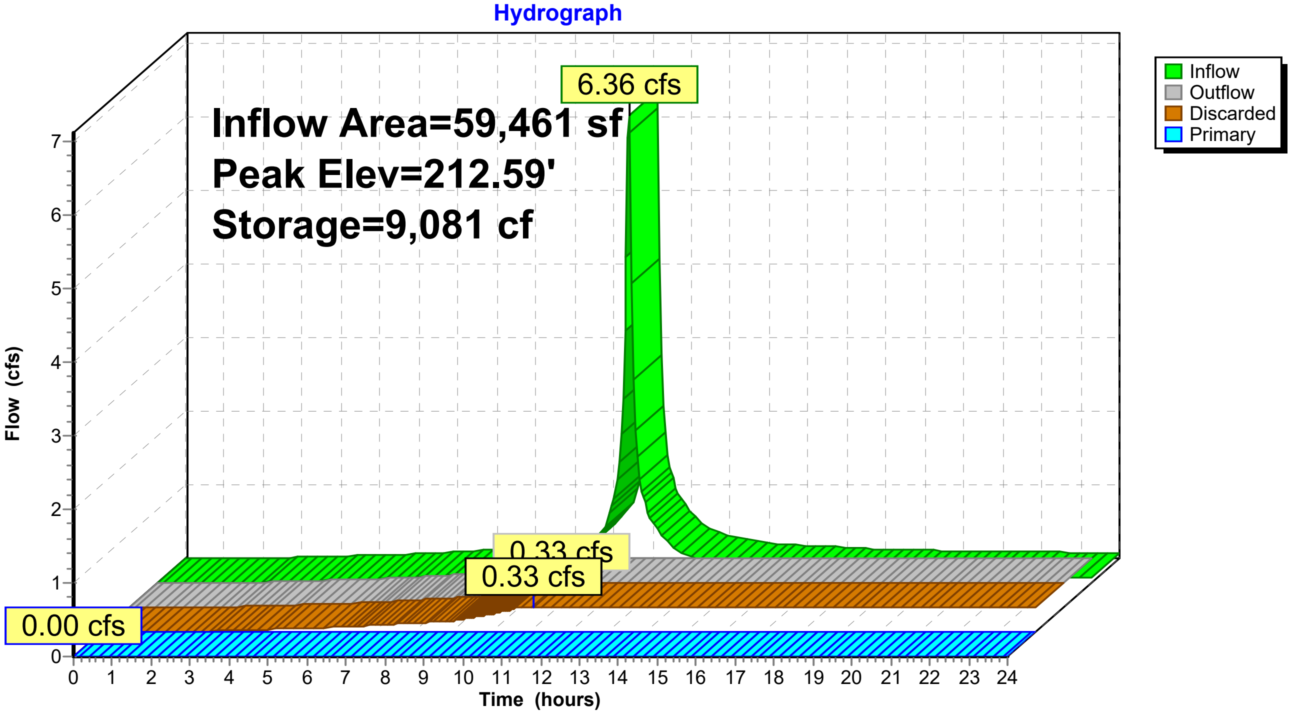
33,860.3 cf Field - 13,622.0 cf Chambers = 20,238.4 cf Stone x 40.0% Voids = 8,095.3 cf Stone Storage

Chamber Storage + Stone Storage = 21,717.3 cf = 0.499 af
Overall Storage Efficiency = 64.1%
Overall System Size = 157.03' x 37.50' x 5.75'

210 Chambers
1,254.1 cy Field
749.6 cy Stone



## Pond 67P: CULTEC SYSTEM E



## Summary for Pond 69P: STORMTRAP 7.5 FT SYSTEM B

Inflow Area = 387,563 sf, 93.38% Impervious, Inflow Depth > 2.23" for 10-Year event
Inflow = 34.63 cfs @ 12.17 hrs, Volume= 71,947 cf
Outflow = 0.62 cfs @ 11.65 hrs, Volume= 28,943 cf, Atten= 98%, Lag= 0.0 min
Discarded = 0.62 cfs @ 11.65 hrs, Volume= 28,943 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 214.17' @ 14.99 hrs Surf.Area= 11,144 sf Storage= 56,043 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 279.3 min ( 1,051.5 - 772.2 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 209.14' | 5 cf | **Custom Stage Data (Prismatic)**Listed below<br>83,580 cf Overall - 83,575 cf Embedded = 5 cf |
| #2 | 209.14' | 83,575 cf | **Custom Stage Data**Listed below Inside #1 |
| | | 83,580 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 209.14 | 11,144 | 0 | 0 |
| 209.64 | 11,144 | 5,572 | 5,572 |
| 210.14 | 11,144 | 5,572 | 11,144 |
| 210.64 | 11,144 | 5,572 | 16,716 |
| 211.14 | 11,144 | 5,572 | 22,288 |
| 211.64 | 11,144 | 5,572 | 27,860 |
| 212.14 | 11,144 | 5,572 | 33,432 |
| 212.64 | 11,144 | 5,572 | 39,004 |
| 213.14 | 11,144 | 5,572 | 44,576 |
| 213.64 | 11,144 | 5,572 | 50,148 |
| 214.14 | 11,144 | 5,572 | 55,720 |
| 214.64 | 11,144 | 5,572 | 61,292 |
| 215.14 | 11,144 | 5,572 | 66,864 |
| 215.64 | 11,144 | 5,572 | 72,436 |
| 216.14 | 11,144 | 5,572 | 78,008 |
| 216.64 | 11,144 | 5,572 | 83,580 |

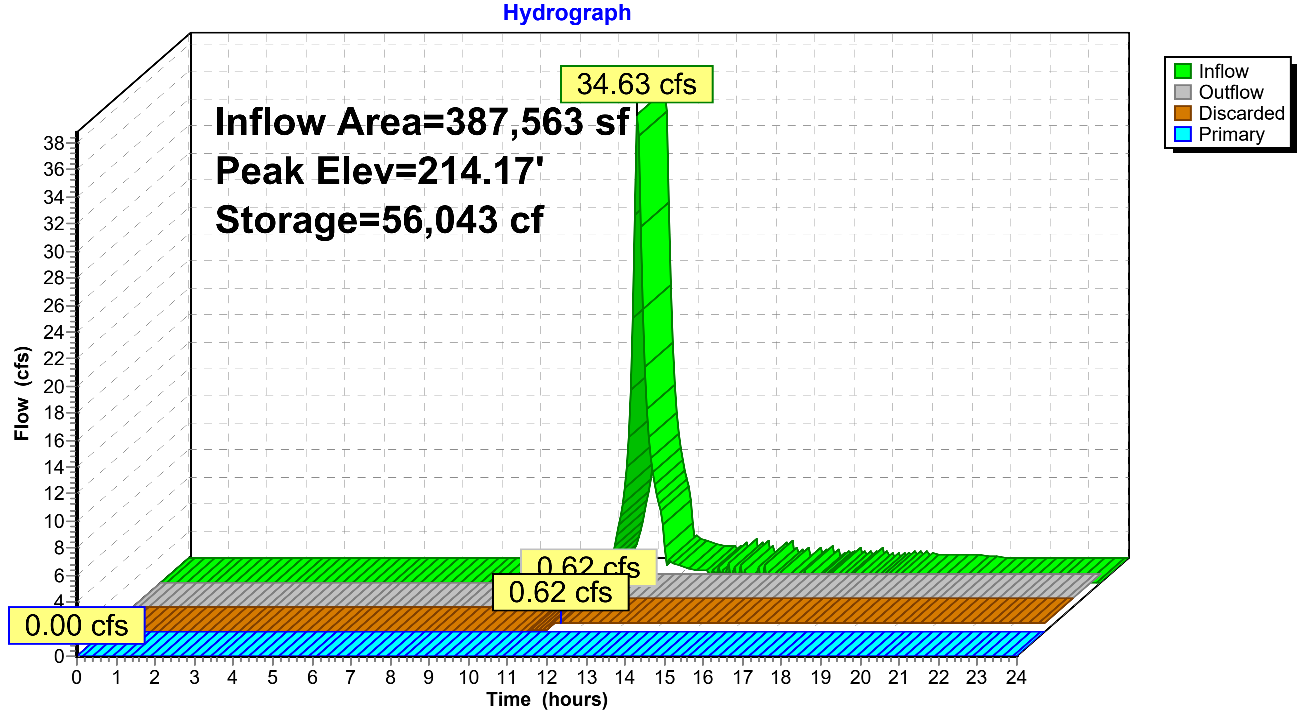
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 209.14 | 0 |
| 209.64 | 5,572 |
| 210.14 | 11,144 |
| 210.64 | 16,715 |
| 211.14 | 22,287 |
| 211.64 | 27,858 |
| 212.14 | 33,430 |
| 212.64 | 39,002 |
| 213.14 | 44,573 |
| 213.64 | 50,145 |
| 214.14 | 55,717 |
| 214.64 | 61,289 |
| 215.14 | 66,860 |
| 215.64 | 72,432 |
| 216.14 | 78,004 |
| 216.64 | 83,575 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 209.14' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 214.64' | **15.0" Round Culvert X 4.00**<br>L= 12.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 214.64' / 214.40' S= 0.0200 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf |

**Discarded OutFlow** Max=0.62 cfs @ 11.65 hrs HW=209.24' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.62 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=209.14' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** ( Controls 0.00 cfs)

## Pond 69P: STORMTRAP 7.5 FT SYSTEM B



## Summary for Pond 70P: STORMTRAP 4 FT SYSTEM A

Inflow Area = 532,500 sf, 90.16% Impervious, Inflow Depth > 4.36" for 10-Year event
Inflow = 57.32 cfs @ 12.13 hrs, Volume= 193,650 cf
Outflow = 2.56 cfs @ 11.05 hrs, Volume= 155,587 cf, Atten= 96%, Lag= 0.0 min
Discarded = 2.56 cfs @ 11.05 hrs, Volume= 155,587 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 186.74' @ 14.31 hrs Surf.Area= 45,880 sf Storage= 87,713 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 158.4 min ( 920.2 - 761.8 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 184.83' | 0 cf | **Custom Stage Data (Prismatic)** Listed below<br>183,520 cf Overall - 183,520 cf Embedded = 0 cf |
| #2 | 184.83' | 183,520 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 183,520 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 184.83 | 45,880 | 0 | 0 |
| 185.33 | 45,880 | 22,940 | 22,940 |
| 185.83 | 45,880 | 22,940 | 45,880 |
| 186.33 | 45,880 | 22,940 | 68,820 |
| 186.83 | 45,880 | 22,940 | 91,760 |
| 187.33 | 45,880 | 22,940 | 114,700 |
| 187.83 | 45,880 | 22,940 | 137,640 |
| 188.33 | 45,880 | 22,940 | 160,580 |
| 188.83 | 45,880 | 22,940 | 183,520 |

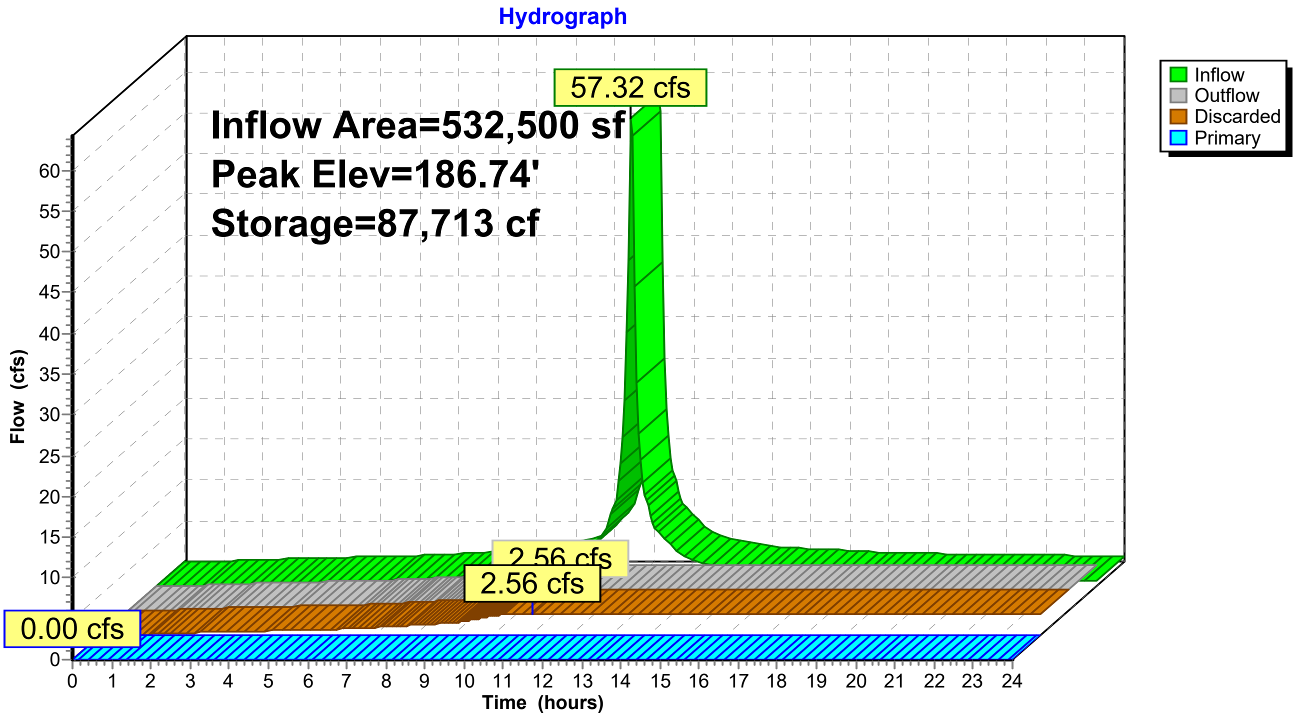
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 184.83 | 0 |
| 185.33 | 22,940 |
| 185.83 | 45,880 |
| 186.33 | 68,820 |
| 186.83 | 91,760 |
| 187.33 | 114,700 |
| 187.83 | 137,640 |
| 188.33 | 160,580 |
| 188.83 | 183,520 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 184.83' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 186.80' | **15.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=2.56 cfs @ 11.05 hrs HW=184.88' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 2.56 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=184.83' TW=0.00' (Dynamic Tailwater)
└**2=Orifice/Grate** ( Controls 0.00 cfs)

**Pond 70P: STORMTRAP 4 FT SYSTEM A**



## Summary for Subcatchment PR-1: TO WQU-1

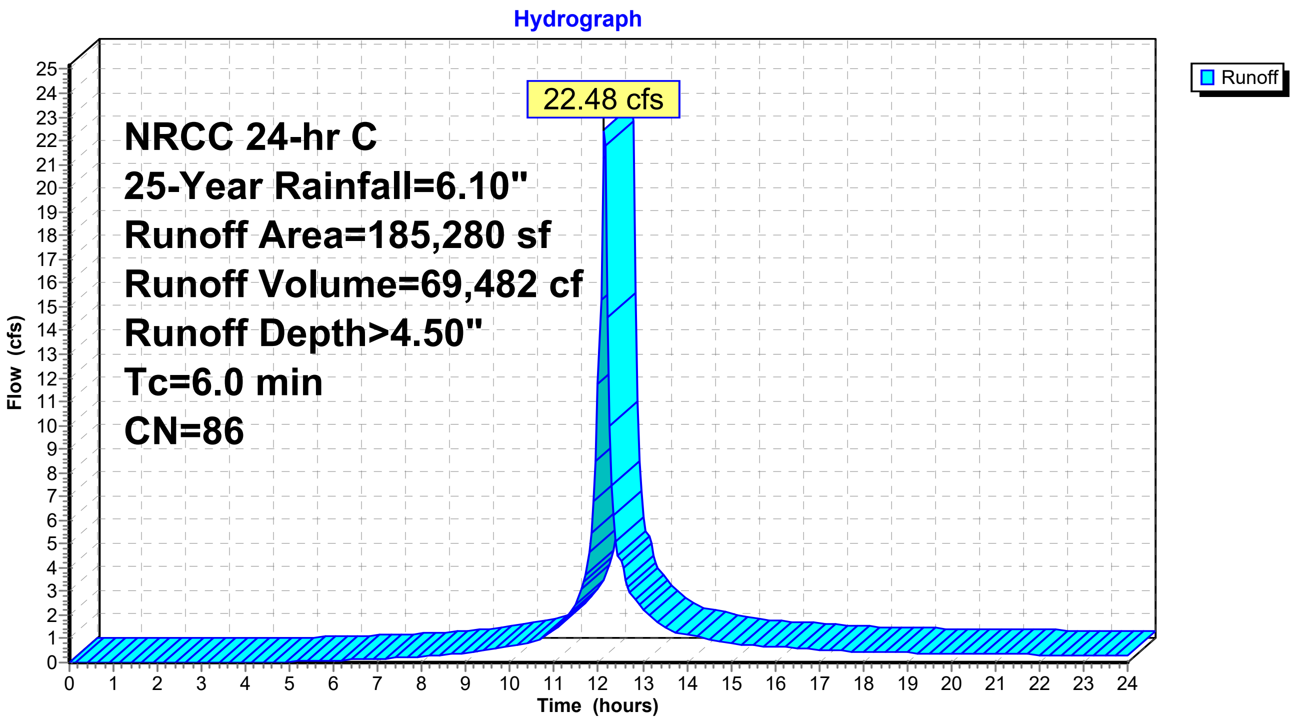
Runoff = 22.48 cfs @ 12.13 hrs, Volume= 69,482 cf, Depth> 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 96,140 | 98 | IMPERVIOUS |
| | 89,140 | 74 | >75% Grass cover, Good, HSG C |
| | 185,280 | 86 | Weighted Average |
| | 89,140 | | 48.11% Pervious Area |
| | 96,140 | | 51.89% Impervious Area |

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

## Subcatchment PR-1: TO WQU-1



## Summary for Subcatchment PR-10: TO WETLANDS CENTER

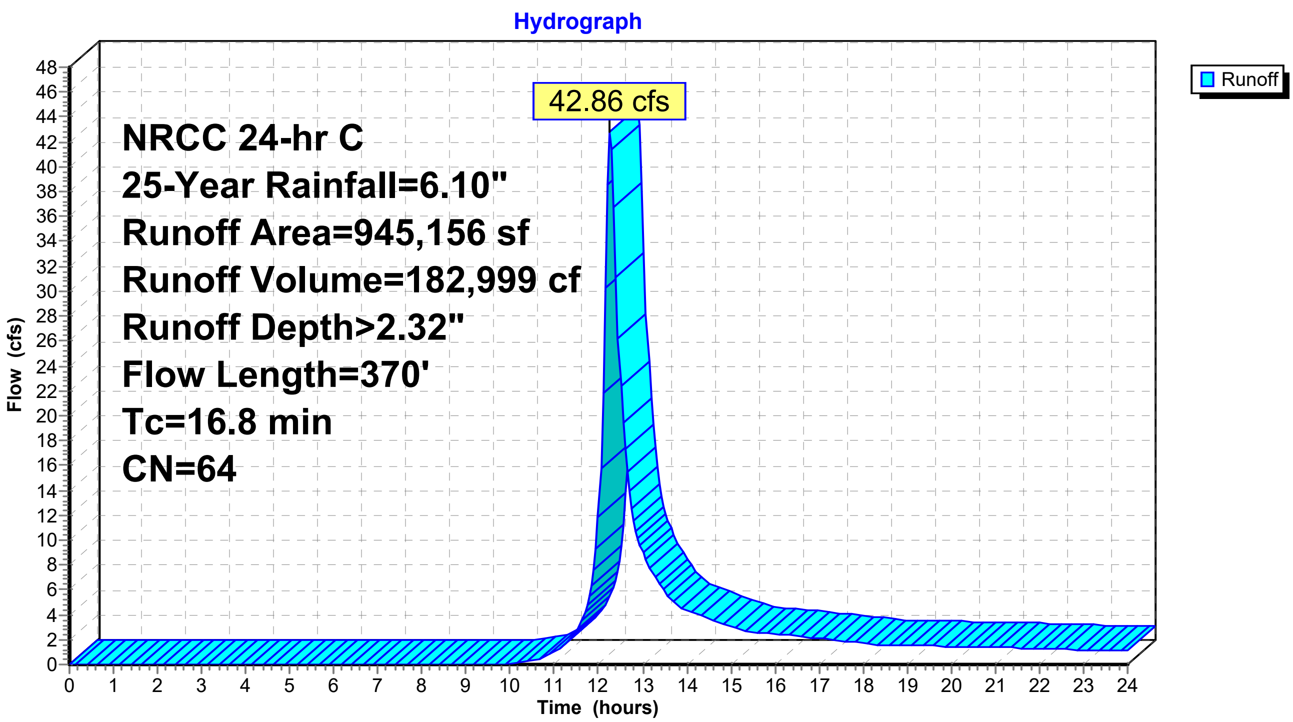
Runoff = 42.86 cfs @ 12.26 hrs, Volume= 182,999 cf, Depth> 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| Area (sf) | CN | Description |
|---|---|---|
| 409,457 | 55 | Woods, Good, HSG B |
| 277,625 | 70 | Woods, Good, HSG C |
| 128,687 | 77 | Woods, Good, HSG D |
| 75,015 | 61 | >75% Grass cover, Good, HSG B |
| 54,372 | 74 | >75% Grass cover, Good, HSG C |
| 945,156 | 64 | Weighted Average |
| 945,156 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.8 | 50 | 0.0500 | 0.09 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 0.7 | 45 | 0.0444 | 1.05 | | **Shallow Concentrated Flow,**<br>Woodland Kv= 5.0 fps |
| 7.3 | 275 | 0.0156 | 0.62 | | **Shallow Concentrated Flow,**<br>Woodland Kv= 5.0 fps |
| 16.8 | 370 | Total | | | |

### Subcatchment PR-10: TO WETLANDS CENTER



## Summary for Subcatchment PR-11A: TO INNOVATION WAY (2009 CITY LAYOUT)

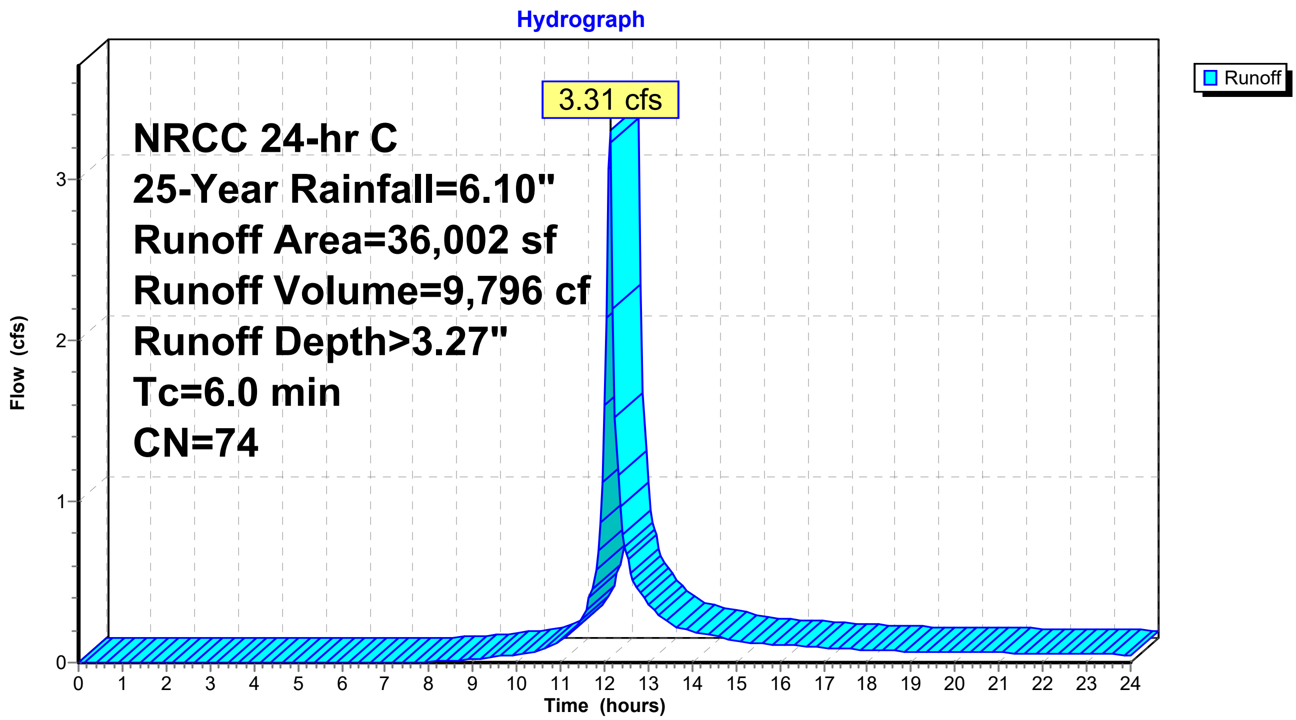
Runoff = 3.31 cfs @ 12.13 hrs, Volume= 9,796 cf, Depth> 3.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 35,261 | 74 | >75% Grass cover, Good, HSG C |
| * | 741 | 70 | IMPERVIOUS |
| | 36,002 | 74 | Weighted Average |
| | 36,002 | | 100.00% Pervious Area |

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

### Subcatchment PR-11A: TO INNOVATION WAY (2009 CITY LAYOUT)



## Summary for Subcatchment PR-11B: TO INNOVATION WAY (2009 SHLO)

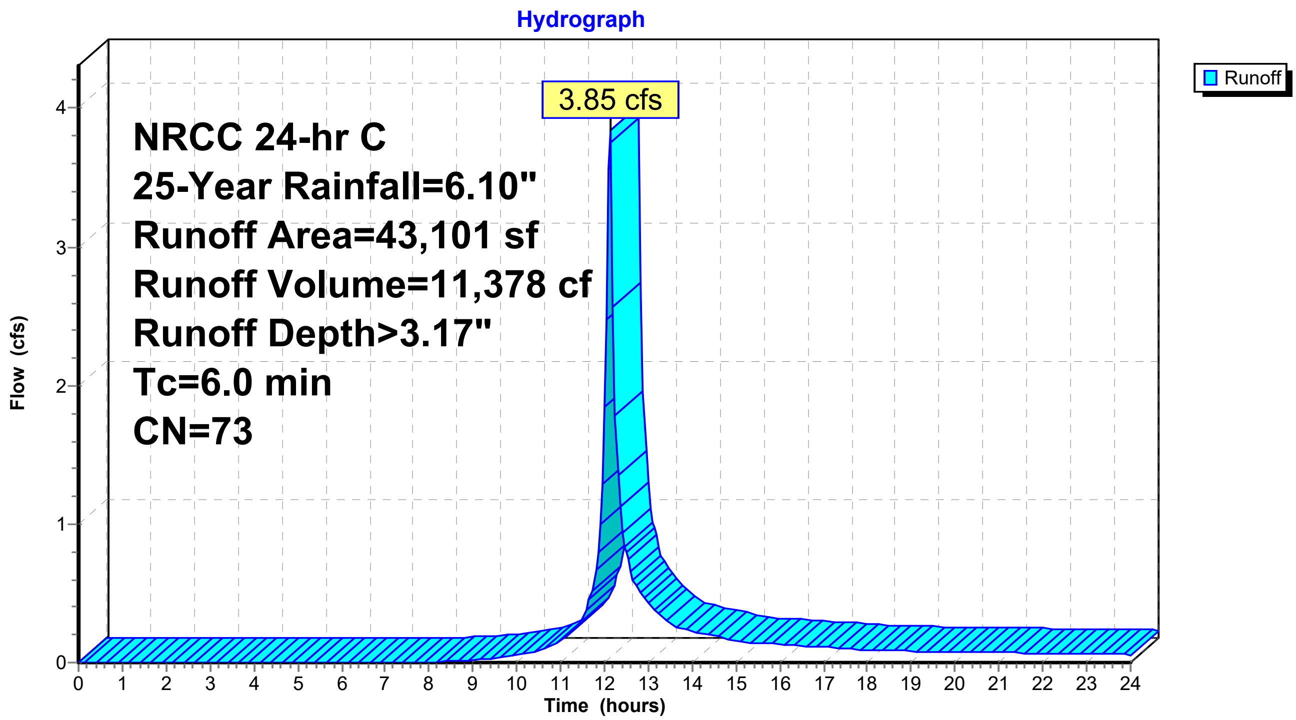
Runoff = 3.85 cfs @ 12.13 hrs, Volume= 11,378 cf, Depth> 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| Area (sf) | CN | Description |
|---|---|---|
| 37,380 | 74 | >75% Grass cover, Good, HSG C |
| 5,721 | 70 | Woods, Good, HSG C |
| 43,101 | 73 | Weighted Average |
| 43,101 | | 100.00% Pervious Area |

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

### Subcatchment PR-11B: TO INNOVATION WAY (2009 SHLO)



## Summary for Subcatchment PR-12: TO WQU-6

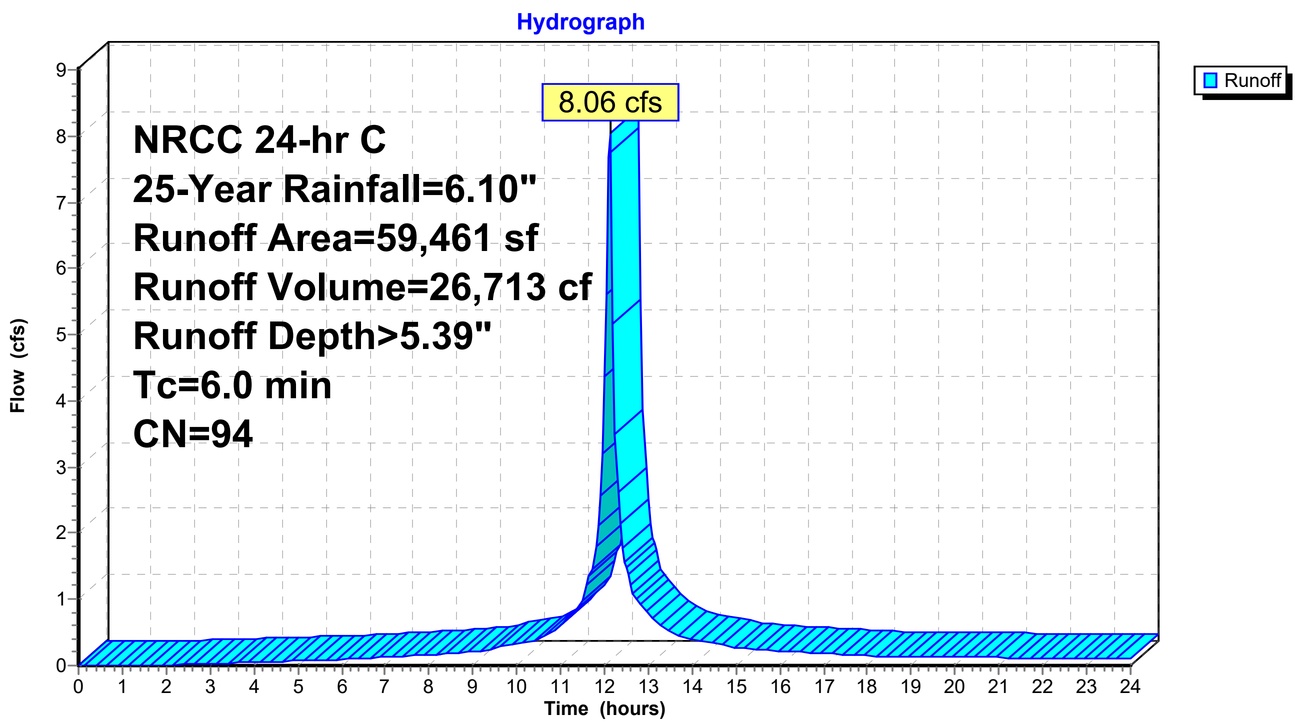
Runoff = 8.06 cfs @ 12.13 hrs, Volume= 26,713 cf, Depth> 5.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 50,470 | 98 | IMPERVIOUS |
| | 8,991 | 74 | >75% Grass cover, Good, HSG C |
| | 59,461 | 94 | Weighted Average |
| | 8,991 | | 15.12% Pervious Area |
| | 50,470 | | 84.88% Impervious Area |

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

### Subcatchment PR-12: TO WQU-6



## Summary for Subcatchment PR-13: TO WQU-7

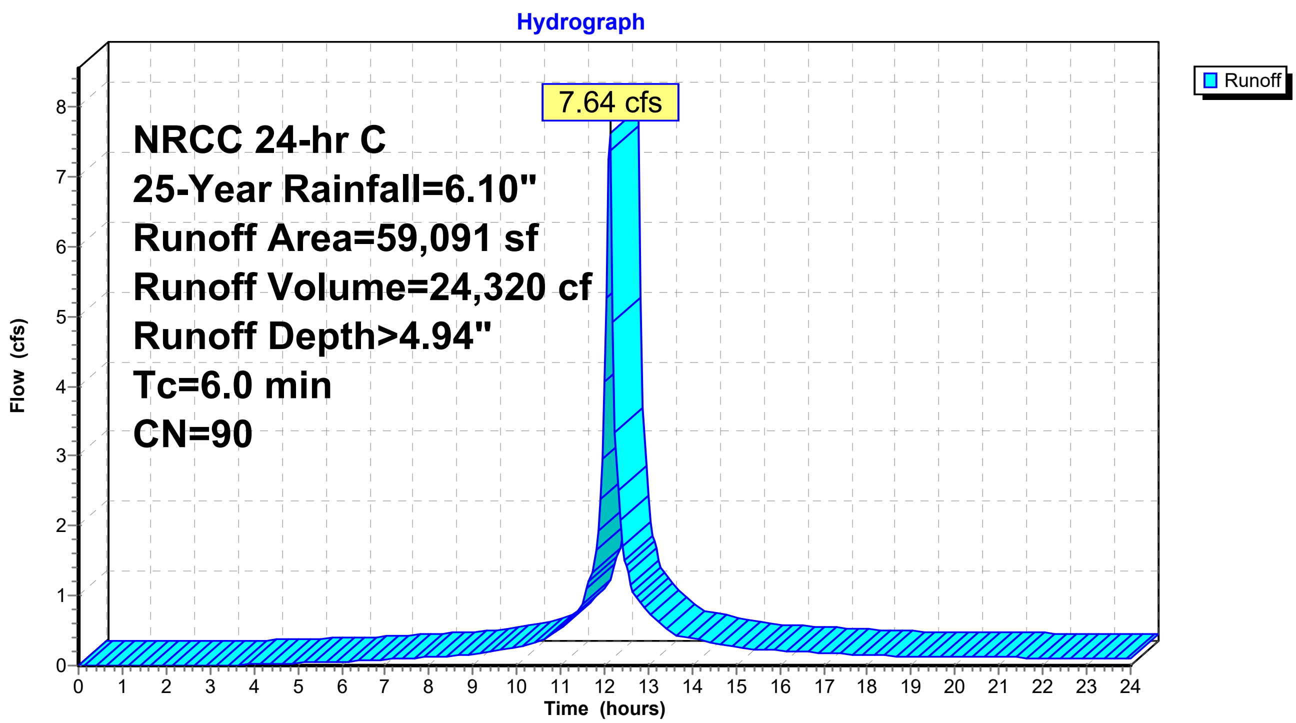
Runoff = 7.64 cfs @ 12.13 hrs, Volume= 24,320 cf, Depth> 4.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 46,105 | 98 | IMPERVIOUS |
| | 12,986 | 61 | >75% Grass cover, Good, HSG B |
| | 59,091 | 90 | Weighted Average |
| | 12,986 | | 21.98% Pervious Area |
| | 46,105 | | 78.02% Impervious Area |

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

### Subcatchment PR-13: TO WQU-7



## Summary for Subcatchment PR-14: TO WQU-8

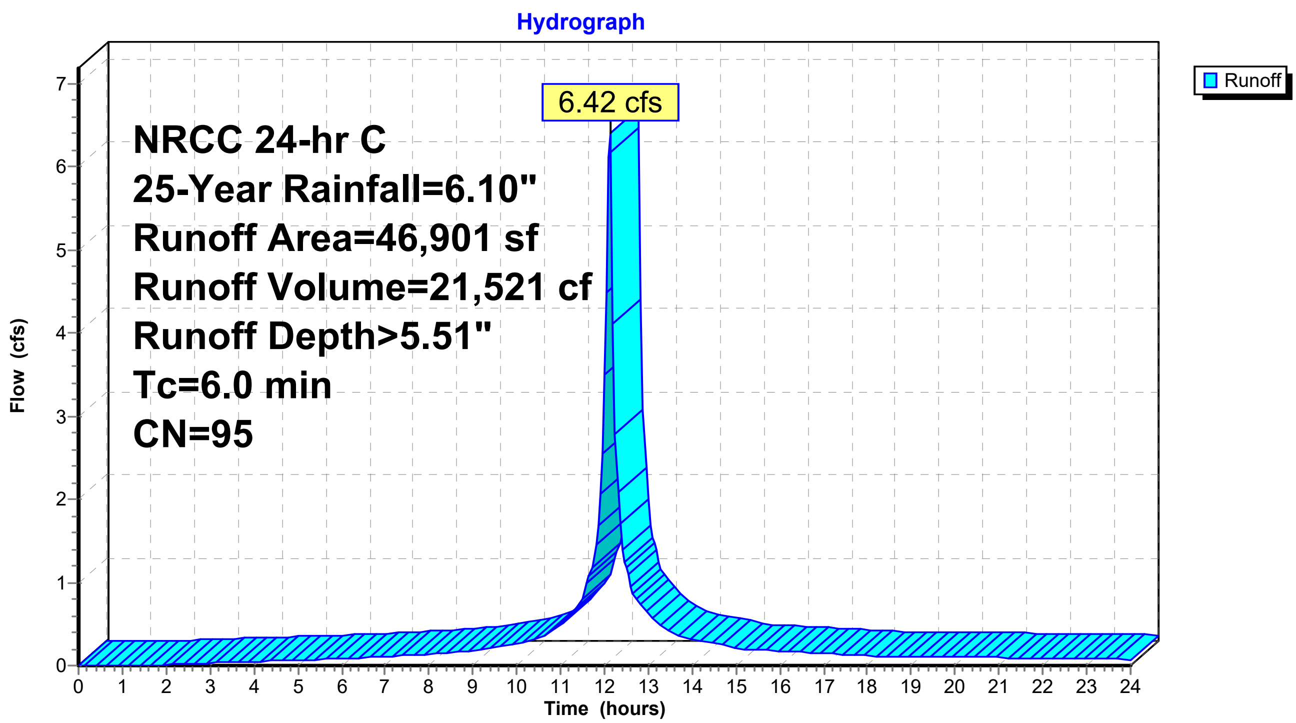
Runoff = 6.42 cfs @ 12.13 hrs, Volume= 21,521 cf, Depth> 5.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 42,641 | 98 | IMPERVIOUS |
| | 4,260 | 61 | >75% Grass cover, Good, HSG B |
| | 46,901 | 95 | Weighted Average |
| | 4,260 | | 9.08% Pervious Area |
| | 42,641 | | 90.92% Impervious Area |

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

### Subcatchment PR-14: TO WQU-8



## Summary for Subcatchment PR-15: TO WQU-9

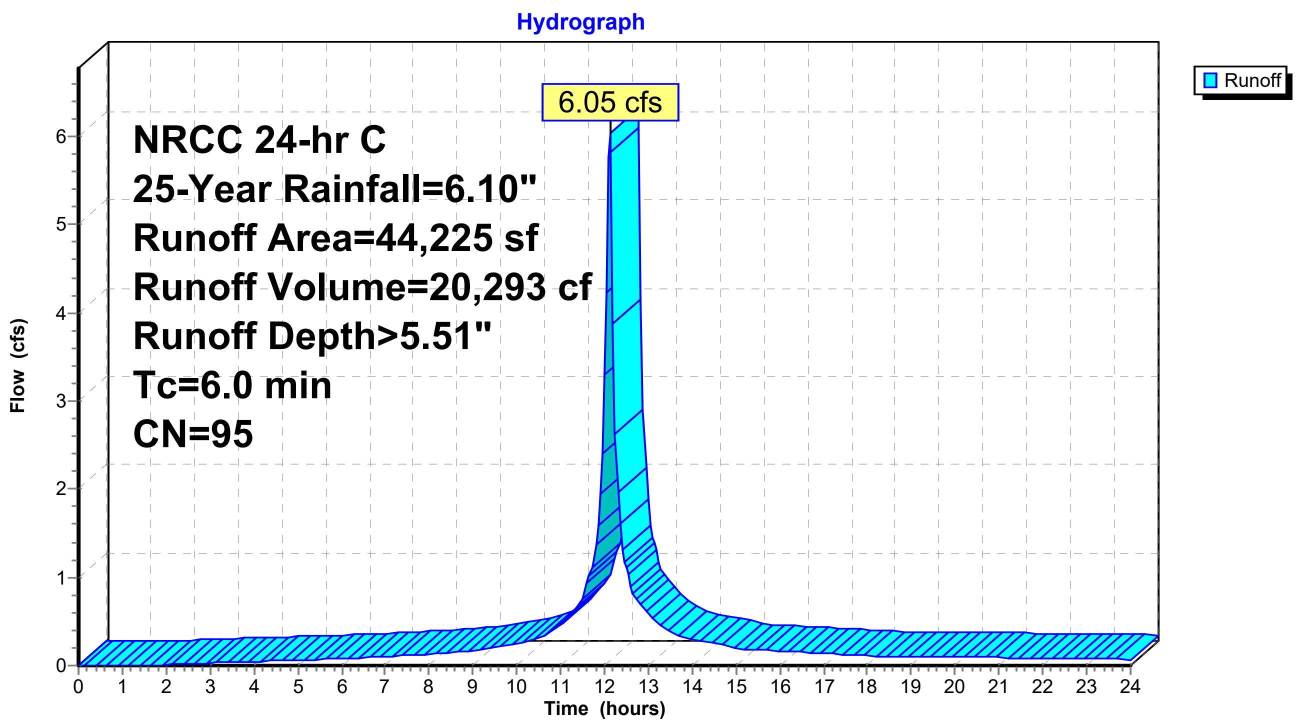
Runoff = 6.05 cfs @ 12.13 hrs, Volume= 20,293 cf, Depth> 5.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 40,778 | 98 | IMPERVIOUS |
| | 3,447 | 61 | >75% Grass cover, Good, HSG B |
| | 44,225 | 95 | Weighted Average |
| | 3,447 | | 7.79% Pervious Area |
| | 40,778 | | 92.21% Impervious Area |

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

## Subcatchment PR-15: TO WQU-9



## Summary for Subcatchment PR-16: TO WQU-10

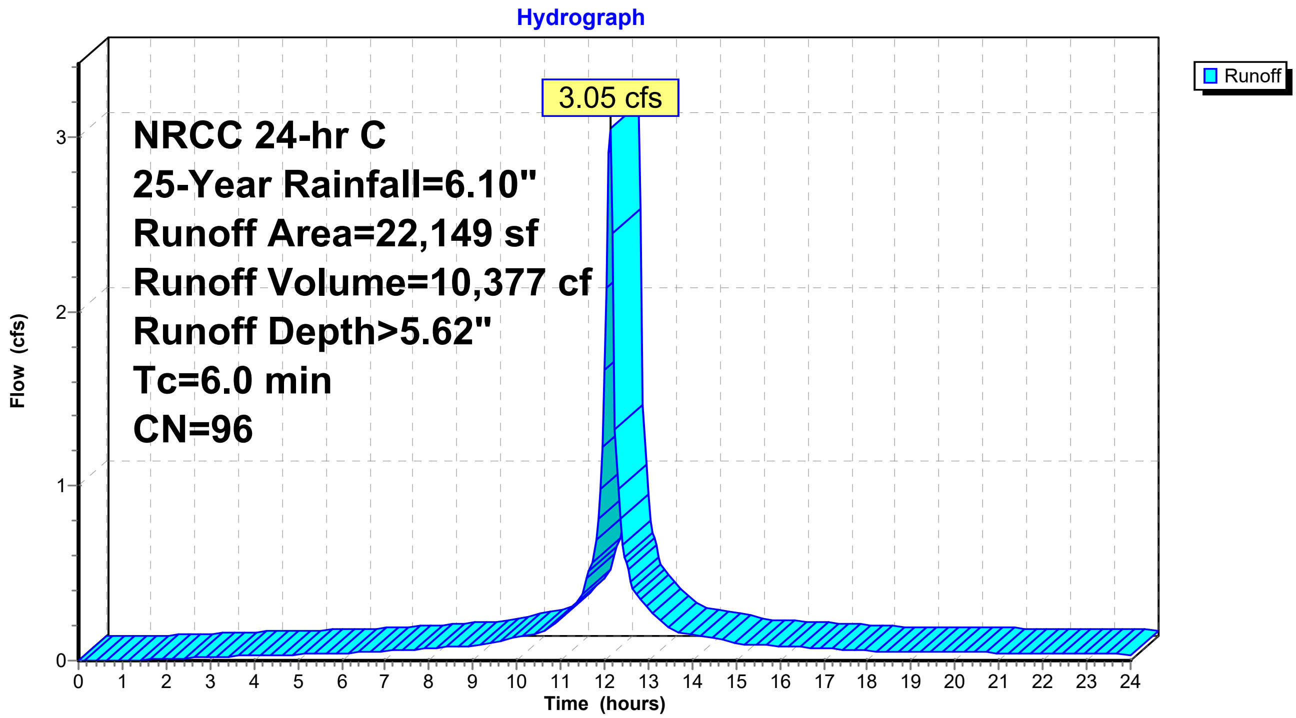
Runoff = 3.05 cfs @ 12.13 hrs, Volume= 10,377 cf, Depth> 5.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 21,009 | 98 | IMPERVIOUS |
| | 1,140 | 61 | >75% Grass cover, Good, HSG B |
| | 22,149 | 96 | Weighted Average |
| | 1,140 | | 5.15% Pervious Area |
| | 21,009 | | 94.85% Impervious Area |

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

## Subcatchment PR-16: TO WQU-10



## Summary for Subcatchment PR-17: TO WQU-11

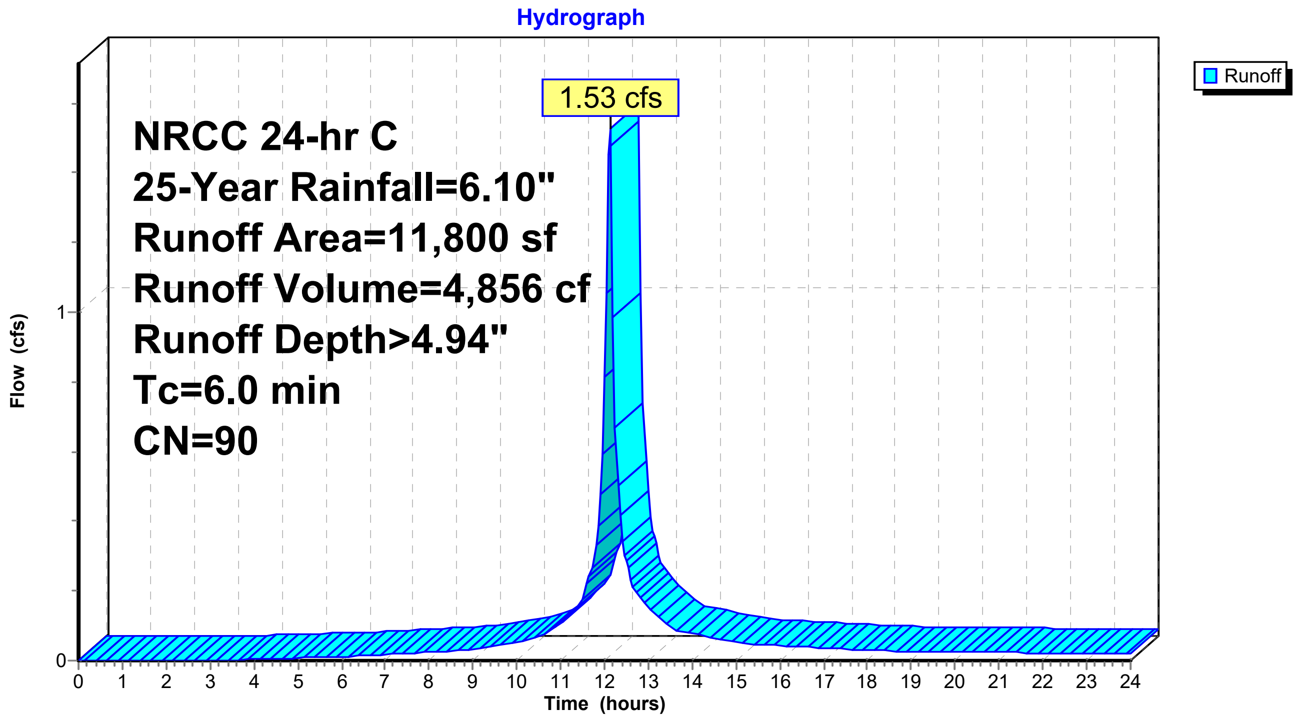
Runoff = 1.53 cfs @ 12.13 hrs, Volume= 4,856 cf, Depth> 4.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 7,968 | 98 | IMPERVIOUS |
| | 3,832 | 74 | >75% Grass cover, Good, HSG C |
| | 11,800 | 90 | Weighted Average |
| | 3,832 | | 32.47% Pervious Area |
| | 7,968 | | 67.53% Impervious Area |

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

### Subcatchment PR-17: TO WQU-11



## Summary for Subcatchment PR-18: TO WQU-12

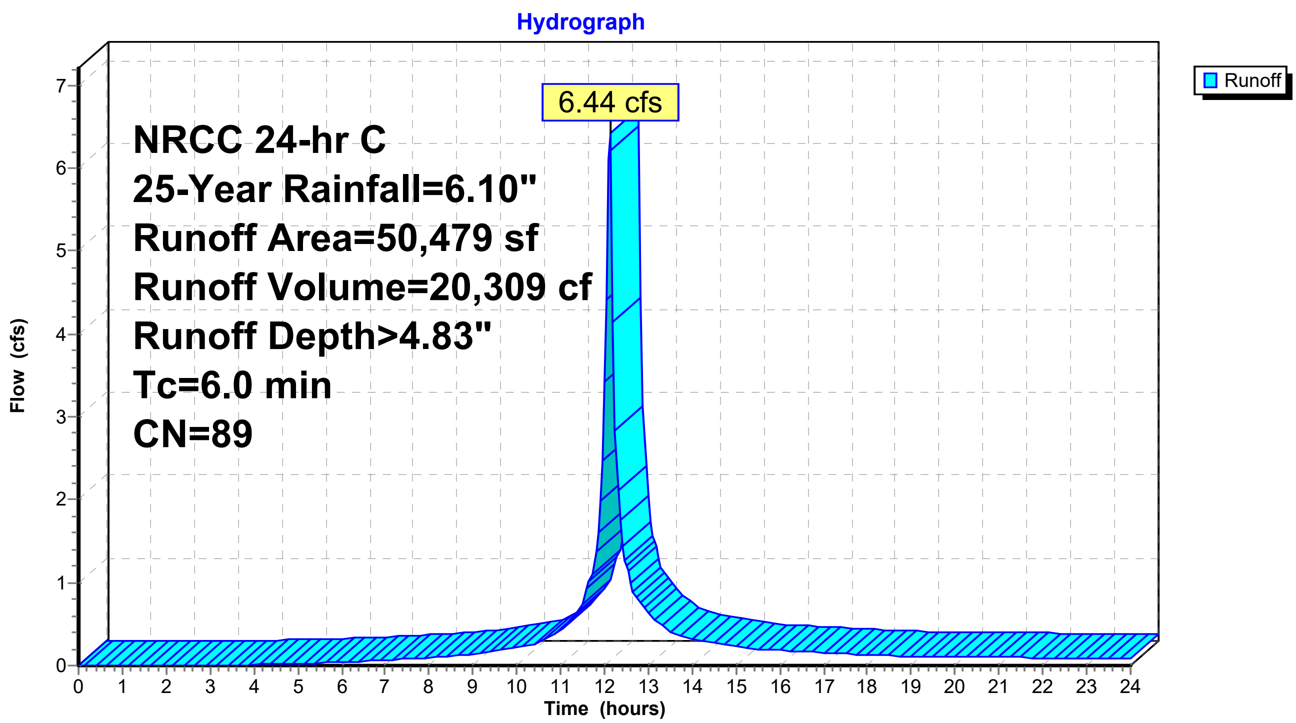
Runoff = 6.44 cfs @ 12.13 hrs, Volume= 20,309 cf, Depth> 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 31,033 | 98 | IMPERVIOUS |
| | 19,446 | 74 | >75% Grass cover, Good, HSG C |
| | 50,479 | 89 | Weighted Average |
| | 19,446 | | 38.52% Pervious Area |
| | 31,033 | | 61.48% Impervious Area |

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

## Subcatchment PR-18: TO WQU-12



## Summary for Subcatchment PR-19: TO WQU-13

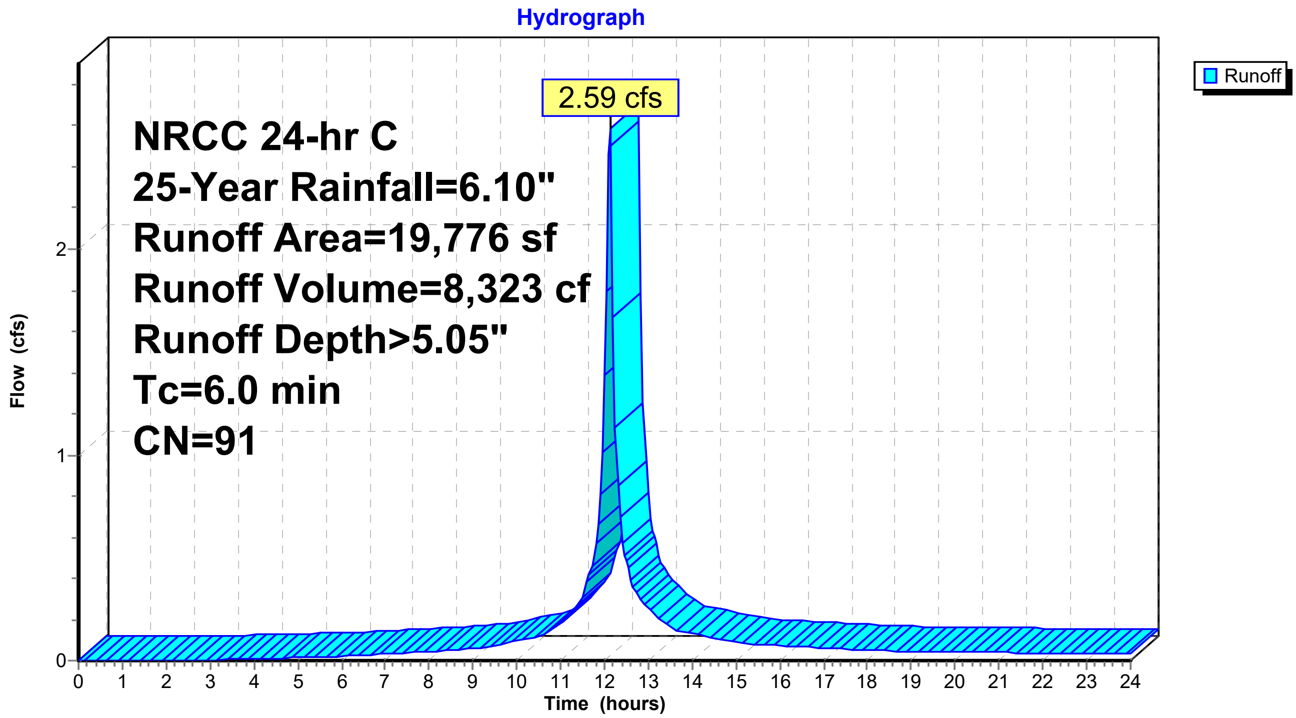
Runoff = 2.59 cfs @ 12.13 hrs, Volume= 8,323 cf, Depth> 5.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 14,228 | 98 | IMPERVIOUS |
| | 5,548 | 74 | >75% Grass cover, Good, HSG C |
| | 19,776 | 91 | Weighted Average |
| | 5,548 | | 28.05% Pervious Area |
| | 14,228 | | 71.95% Impervious Area |

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

## Subcatchment PR-19: TO WQU-13



## Summary for Subcatchment PR-2: TO PRETX

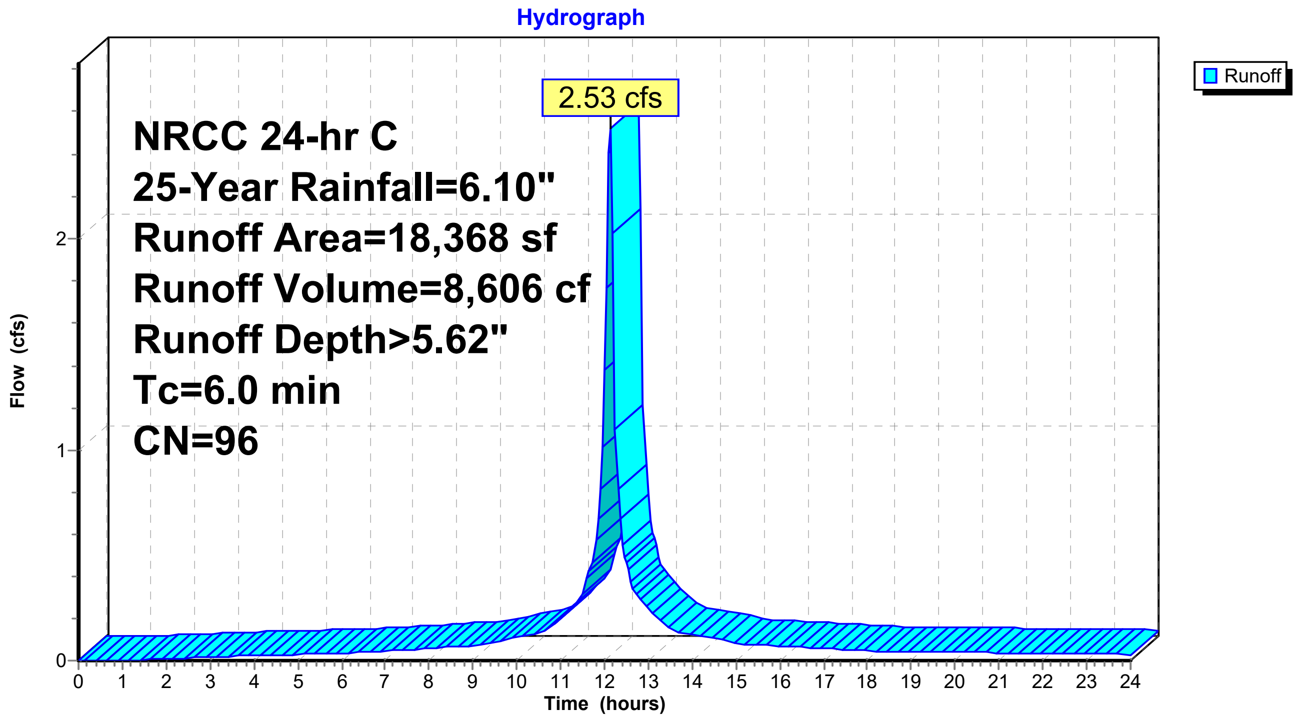
Runoff = 2.53 cfs @ 12.13 hrs, Volume= 8,606 cf, Depth> 5.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 16,637 | 98 | IMPERVIOUS |
| | 1,731 | 74 | >75% Grass cover, Good, HSG C |
| | 18,368 | 96 | Weighted Average |
| | 1,731 | | 9.42% Pervious Area |
| | 16,637 | | 90.58% Impervious Area |

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

## Subcatchment PR-2: TO PRETX



## Summary for Subcatchment PR-20: TO WQU-14

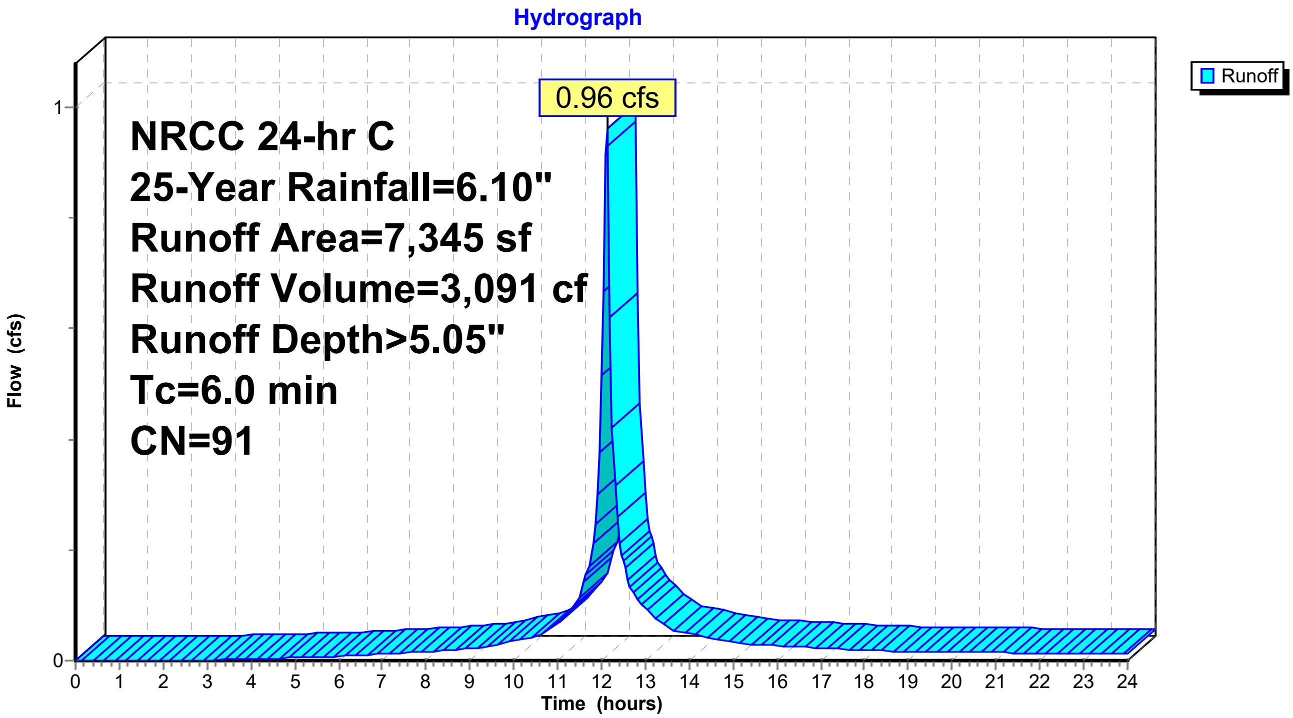
Runoff = 0.96 cfs @ 12.13 hrs, Volume= 3,091 cf, Depth> 5.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 5,138 | 98 | IMPERVIOUS |
| | 2,207 | 74 | >75% Grass cover, Good, HSG C |
| | 7,345 | 91 | Weighted Average |
| | 2,207 | | 30.05% Pervious Area |
| | 5,138 | | 69.95% Impervious Area |

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

## Subcatchment PR-20: TO WQU-14



## Summary for Subcatchment PR-21: TO WQU-15

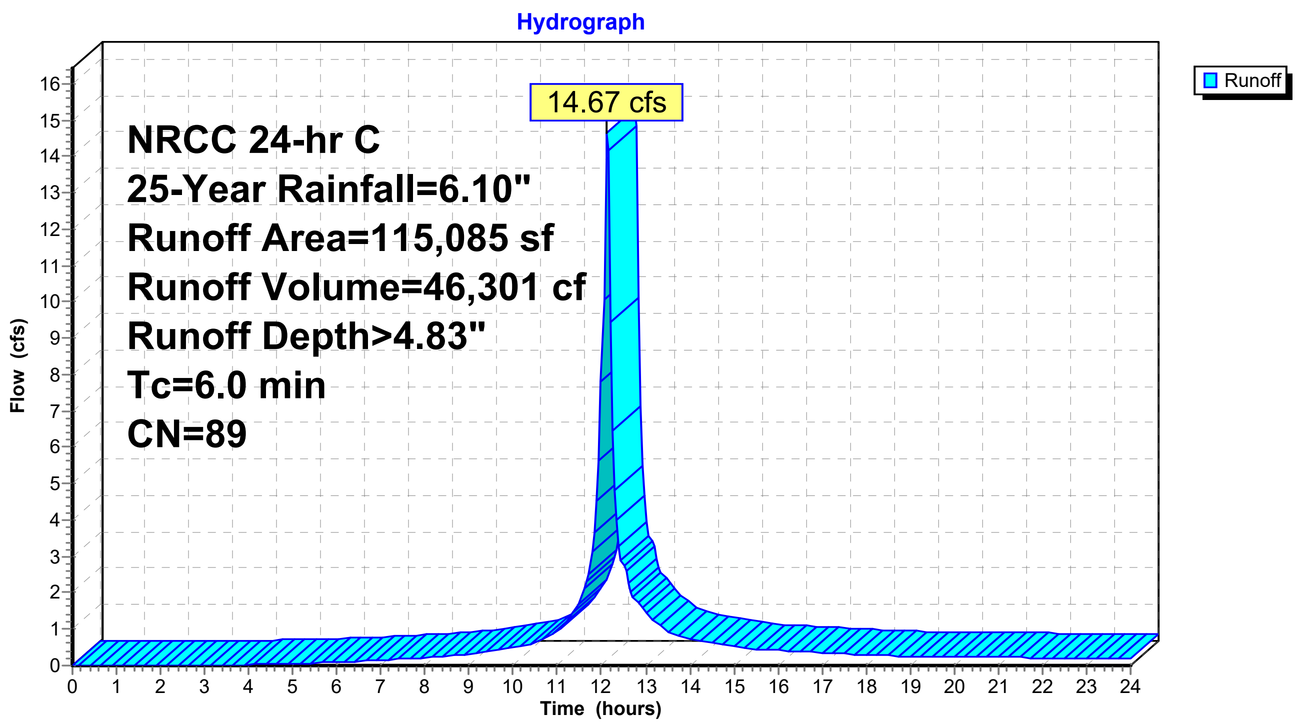
Runoff = 14.67 cfs @ 12.13 hrs, Volume= 46,301 cf, Depth> 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 71,553 | 98 | IMPERVIOUS |
| | 43,532 | 74 | >75% Grass cover, Good, HSG C |
| | 115,085 | 89 | Weighted Average |
| | 43,532 | | 37.83% Pervious Area |
| | 71,553 | | 62.17% Impervious Area |

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

### Subcatchment PR-21: TO WQU-15



## Summary for Subcatchment PR-22: TO WQU-16

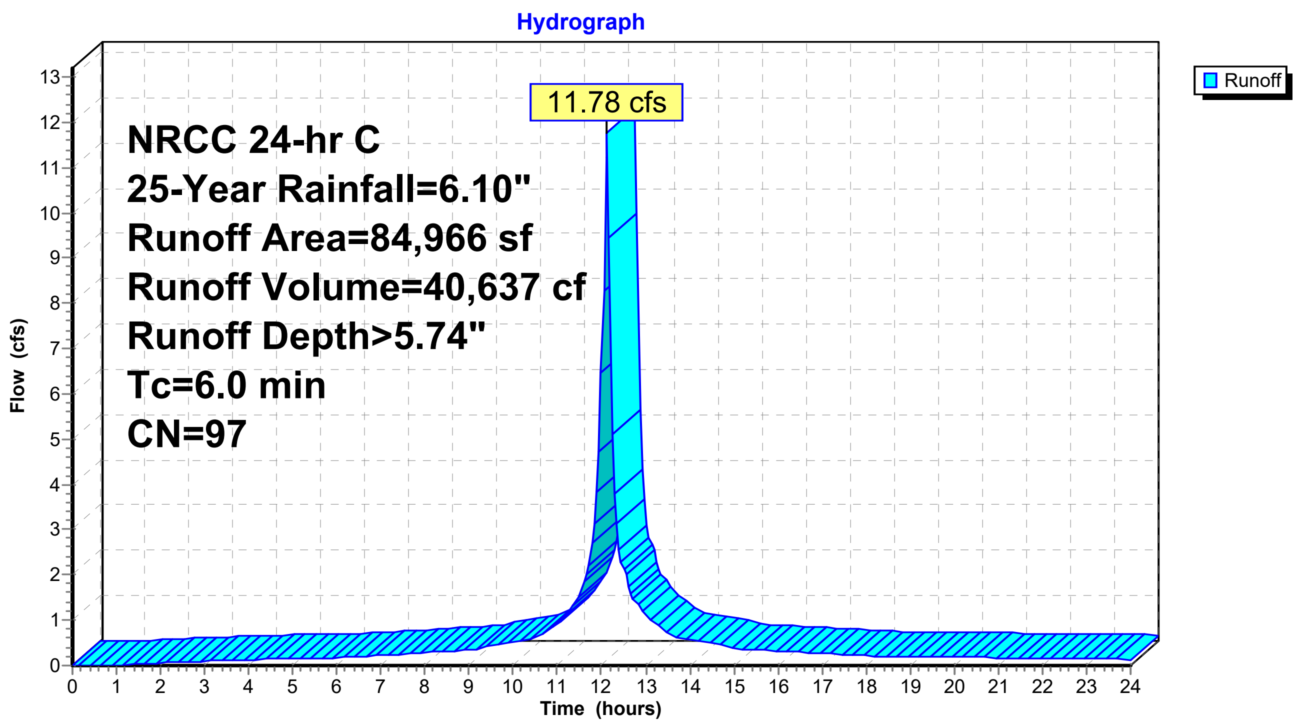
Runoff = 11.78 cfs @ 12.13 hrs, Volume= 40,637 cf, Depth> 5.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 2,771 | 74 | >75% Grass cover, Good, HSG C |
| * | 82,195 | 98 | IMPERVIOUS |
| | 84,966 | 97 | Weighted Average |
| | 2,771 | | 3.26% Pervious Area |
| | 82,195 | | 96.74% Impervious Area |

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

## Subcatchment PR-22: TO WQU-16



## Summary for Subcatchment PR-23: TO WQU-17

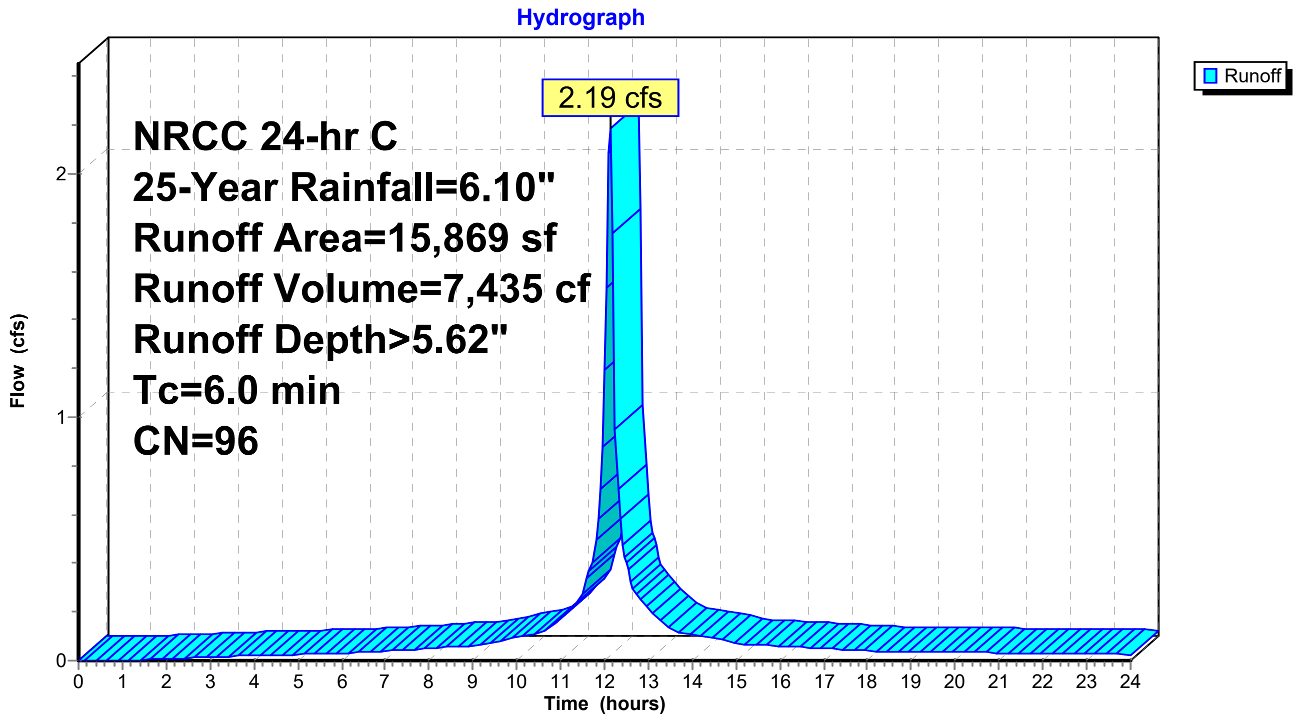
Runoff = 2.19 cfs @ 12.13 hrs, Volume= 7,435 cf, Depth> 5.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 14,403 | 98 | IMPERVIOUS |
| | 1,466 | 74 | >75% Grass cover, Good, HSG C |
| | 15,869 | 96 | Weighted Average |
| | 1,466 | | 9.24% Pervious Area |
| | 14,403 | | 90.76% Impervious Area |

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

### Subcatchment PR-23: TO WQU-17



## Summary for Subcatchment PR-24: TO WQU-18

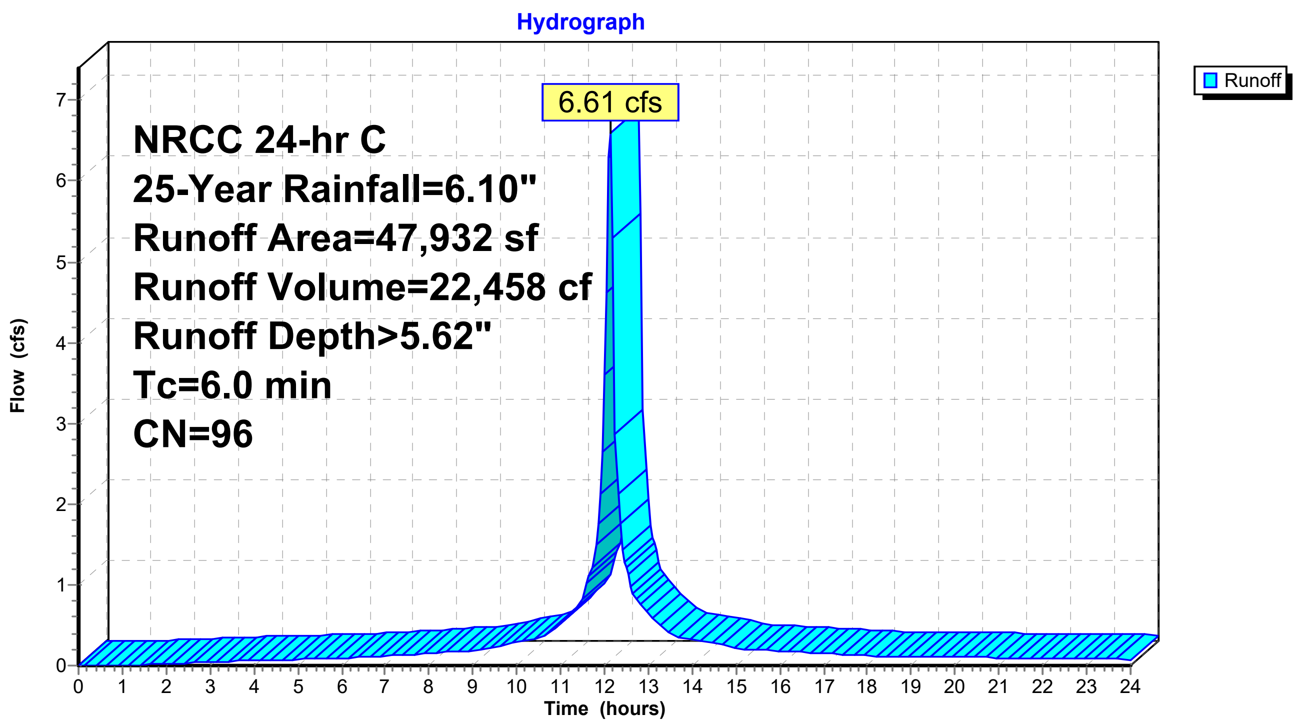
Runoff = 6.61 cfs @ 12.13 hrs, Volume= 22,458 cf, Depth> 5.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 4,668 | 74 | >75% Grass cover, Good, HSG C |
| * | 43,264 | 98 | IMPERVIOUS |
| | 47,932 | 96 | Weighted Average |
| | 4,668 | | 9.74% Pervious Area |
| | 43,264 | | 90.26% Impervious Area |

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

### Subcatchment PR-24: TO WQU-18



## Summary for Subcatchment PR-25: BUILDING 2 ROOF

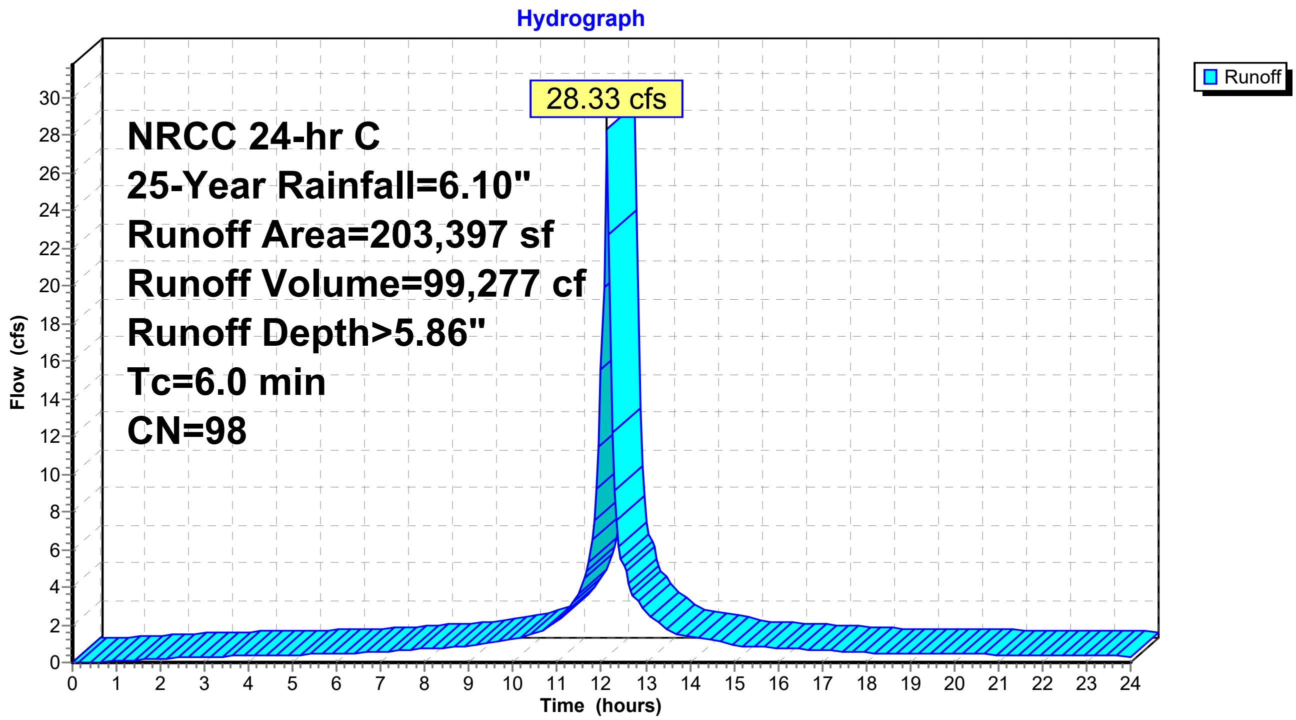
Runoff = 28.33 cfs @ 12.13 hrs, Volume= 99,277 cf, Depth> 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 203,397 | 98 | IMPERVIOUS |
| | 203,397 | | 100.00% Impervious Area |

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

## Subcatchment PR-25: BUILDING 2 ROOF



## Summary for Subcatchment PR-26: BUILDING 3 ROOF

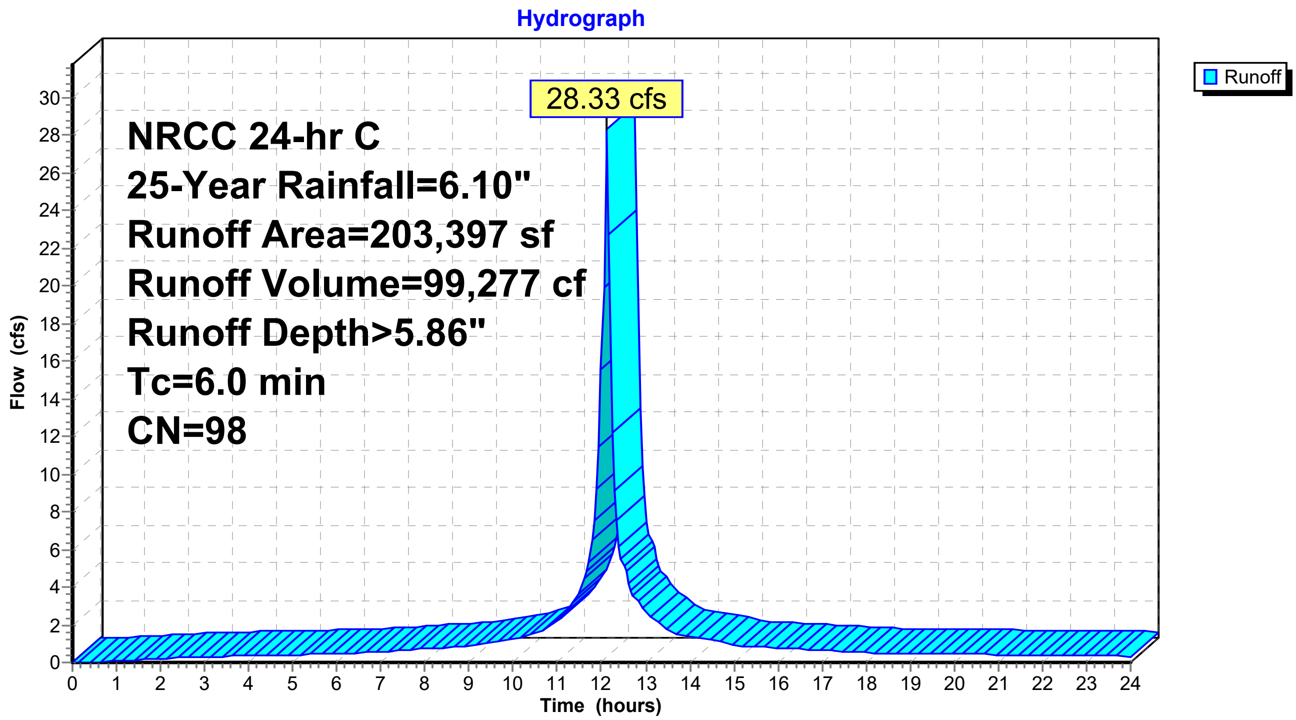
Runoff = 28.33 cfs @ 12.13 hrs, Volume= 99,277 cf, Depth> 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 203,397 | 98 | IMPERVIOUS |
| | 203,397 | | 100.00% Impervious Area |

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

### Subcatchment PR-26: BUILDING 3 ROOF



## Summary for Subcatchment PR-27: TO WQU-19

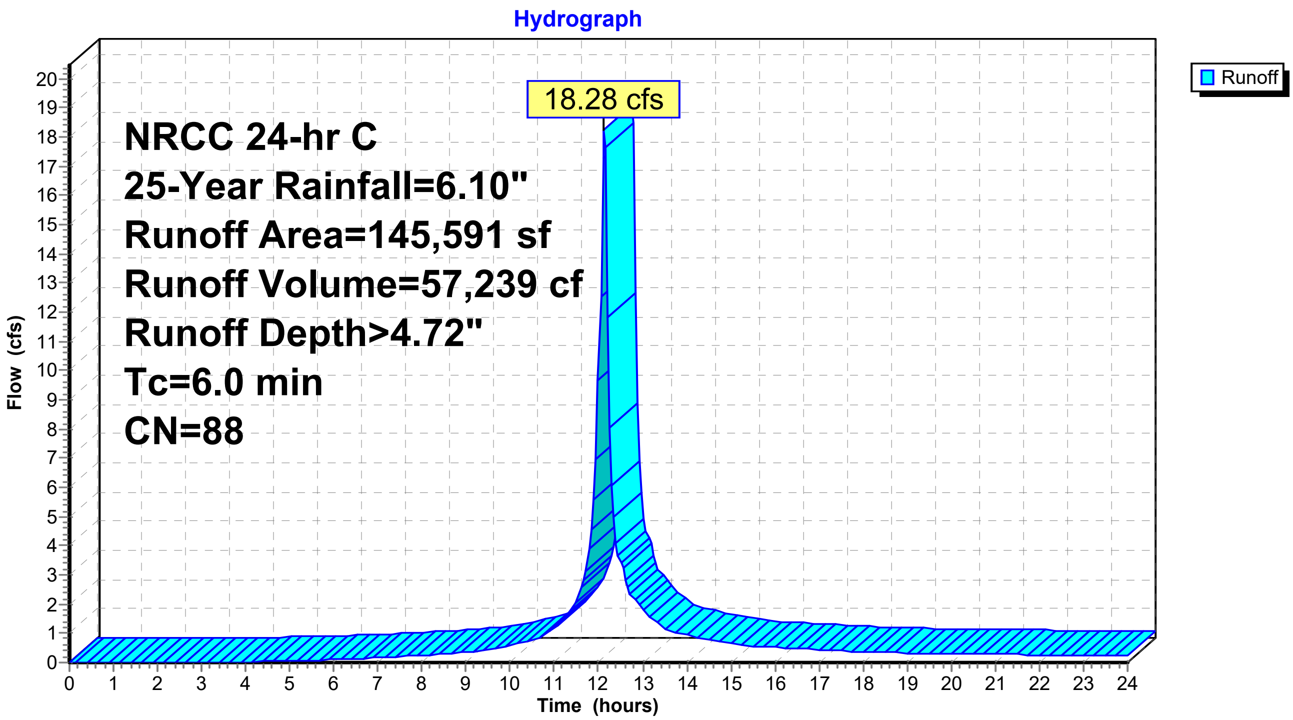
Runoff = 18.28 cfs @ 12.13 hrs, Volume= 57,239 cf, Depth> 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 105,426 | 98 | IMPERVIOUS |
| | 40,165 | 61 | >75% Grass cover, Good, HSG B |
| | 145,591 | 88 | Weighted Average |
| | 40,165 | | 27.59% Pervious Area |
| | 105,426 | | 72.41% Impervious Area |

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

### Subcatchment PR-27: TO WQU-19



## Summary for Subcatchment PR-28: TO WQU-20

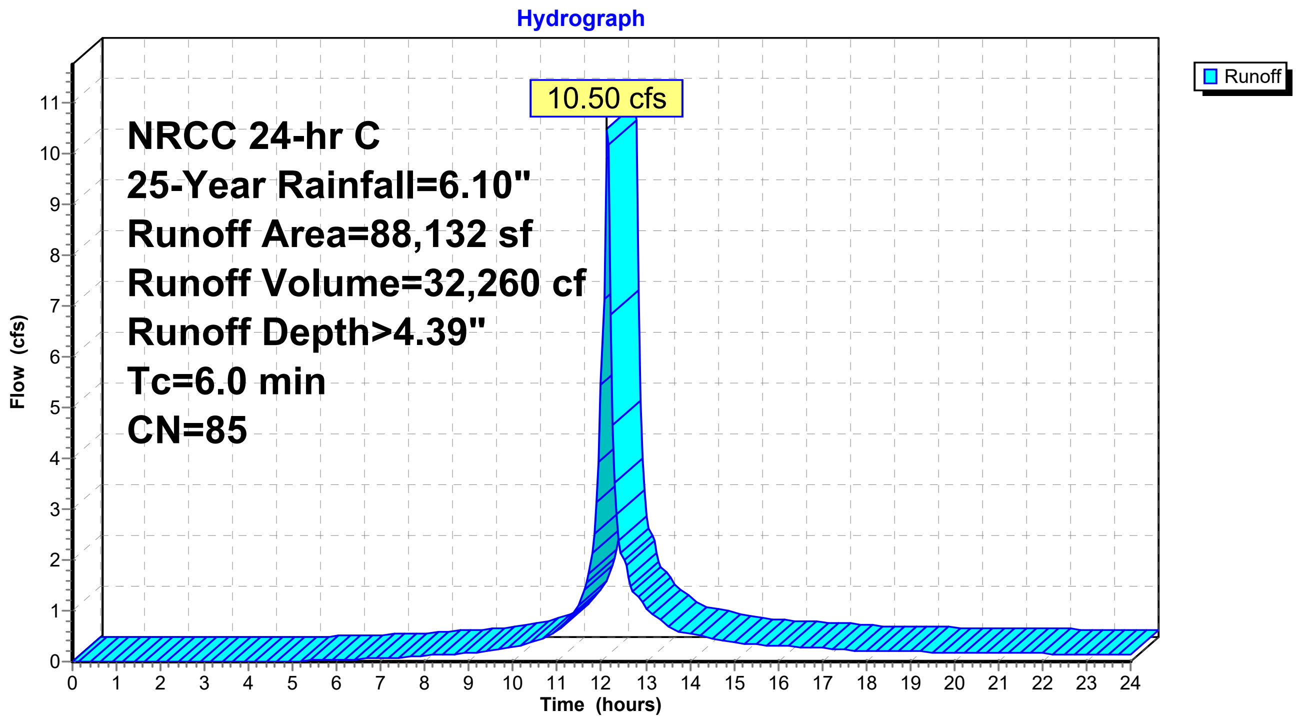
Runoff = 10.50 cfs @ 12.13 hrs, Volume= 32,260 cf, Depth> 4.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 55,365 | 98 | IMPERVIOUS |
| | 7,996 | 55 | Woods, Good, HSG B |
| | 5,832 | 80 | >75% Grass cover, Good, HSG D |
| | 18,939 | 61 | >75% Grass cover, Good, HSG B |
| | 88,132 | 85 | Weighted Average |
| | 32,767 | | 37.18% Pervious Area |
| | 55,365 | | 62.82% Impervious Area |

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

### Subcatchment PR-28: TO WQU-20



## Summary for Subcatchment PR-29: TO WQU-21

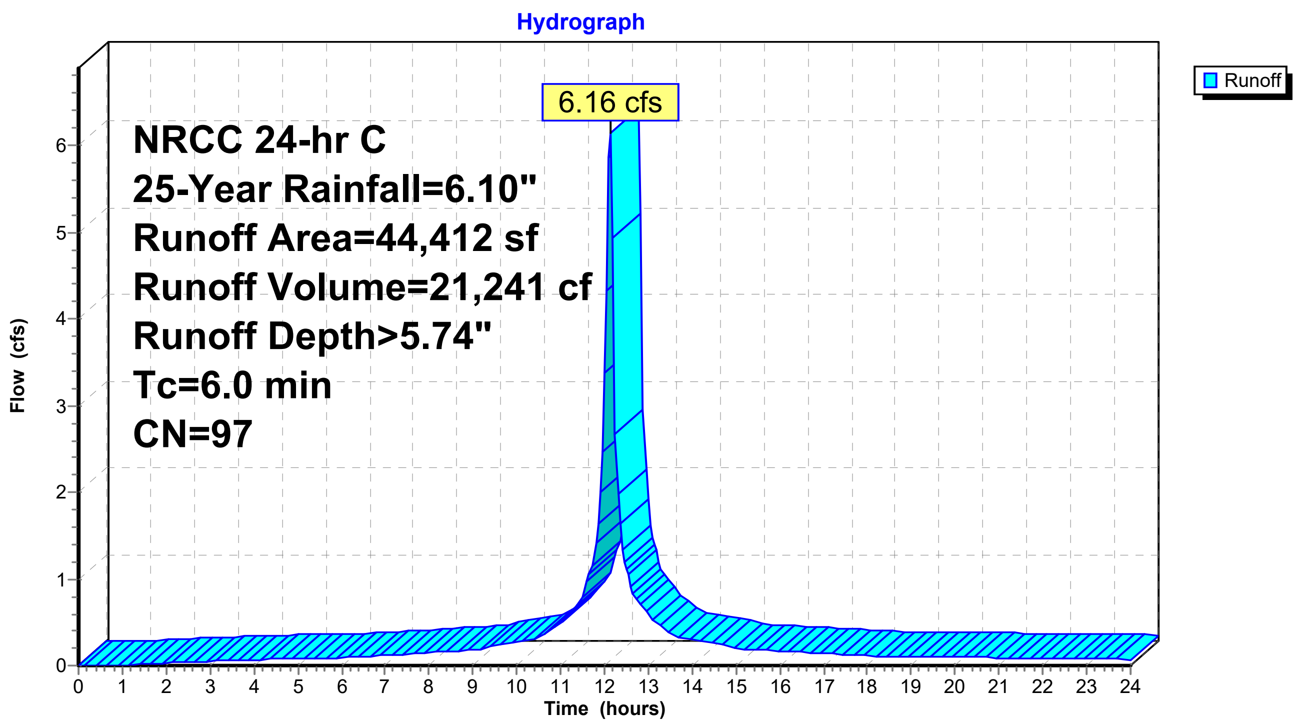
Runoff = 6.16 cfs @ 12.13 hrs, Volume= 21,241 cf, Depth> 5.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 41,857 | 98 | IMPERVIOUS |
| | 2,555 | 80 | >75% Grass cover, Good, HSG D |
| | 44,412 | 97 | Weighted Average |
| | 2,555 | | 5.75% Pervious Area |
| | 41,857 | | 94.25% Impervious Area |

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

## Subcatchment PR-29: TO WQU-21



## Summary for Subcatchment PR-3: TO FOCAL POINT

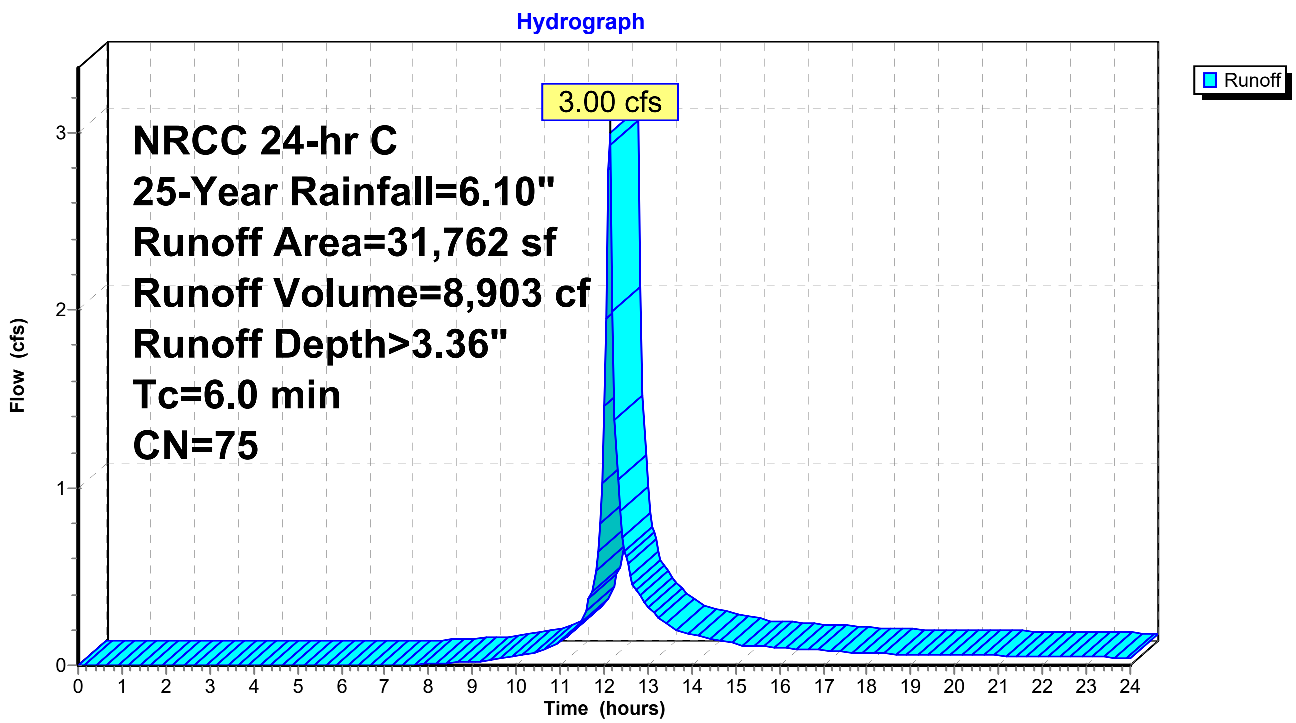
Runoff = 3.00 cfs @ 12.13 hrs, Volume= 8,903 cf, Depth> 3.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 1,048 | 98 | IMPERVIOUS |
| | 30,714 | 74 | >75% Grass cover, Good, HSG C |
| | 31,762 | 75 | Weighted Average |
| | 30,714 | | 96.70% Pervious Area |
| | 1,048 | | 3.30% Impervious Area |

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

### Subcatchment PR-3: TO FOCAL POINT



## Summary for Subcatchment PR-30: TO WQU-22

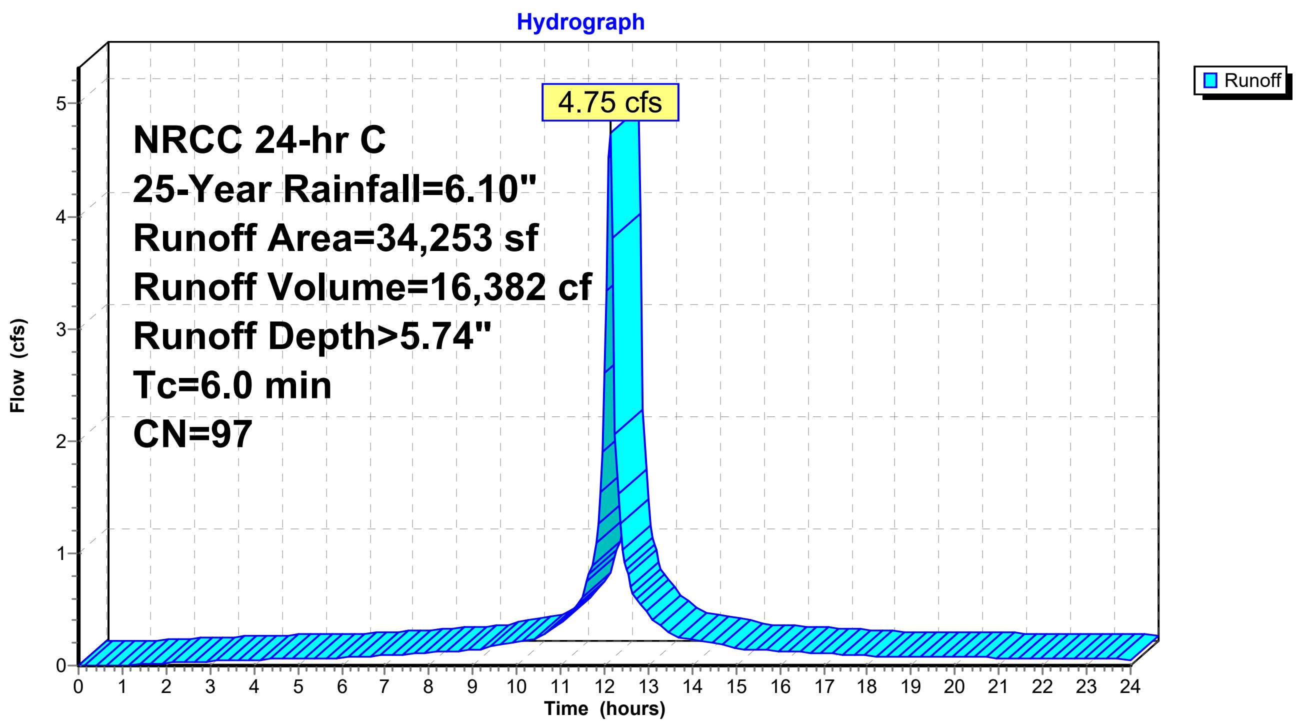
Runoff = 4.75 cfs @ 12.13 hrs, Volume= 16,382 cf, Depth> 5.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 31,439 | 98 | IMPERVIOUS |
| | 2,814 | 80 | >75% Grass cover, Good, HSG D |
| | 34,253 | 97 | Weighted Average |
| | 2,814 | | 8.22% Pervious Area |
| | 31,439 | | 91.78% Impervious Area |

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

## Subcatchment PR-30: TO WQU-22



## Summary for Subcatchment PR-31: TO WQU-23

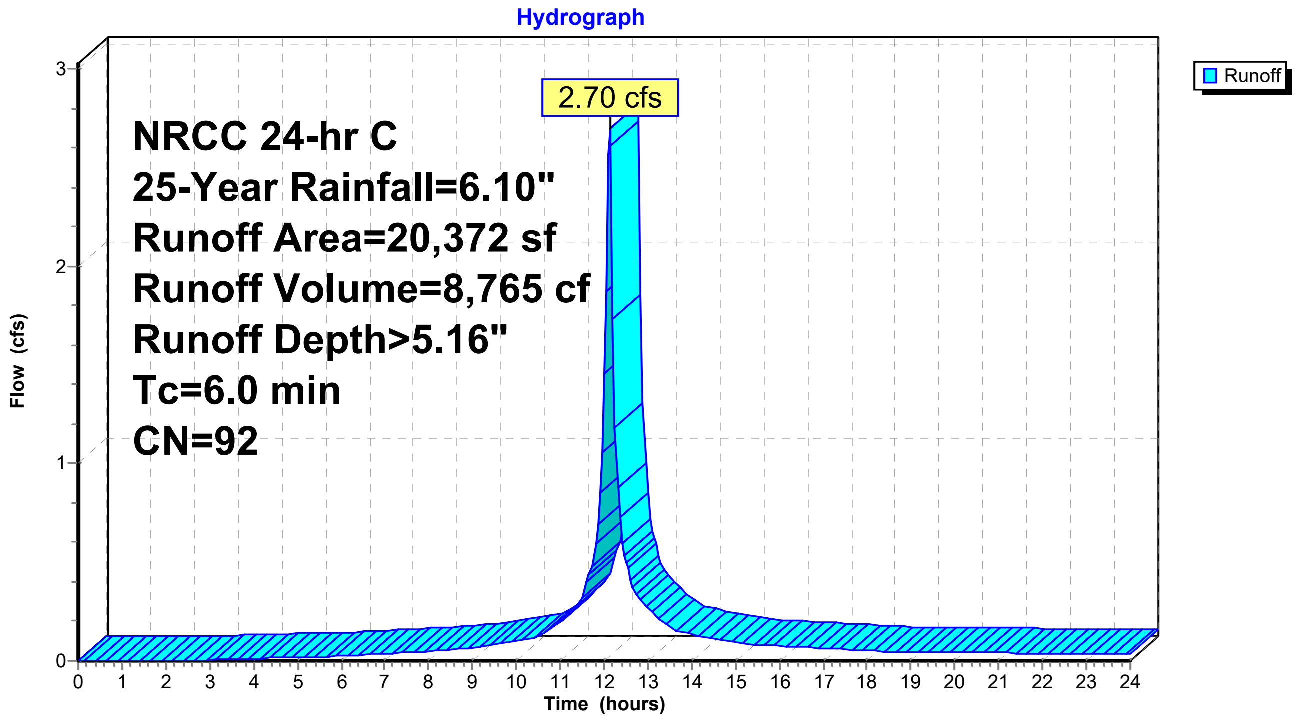
Runoff = 2.70 cfs @ 12.13 hrs, Volume= 8,765 cf, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 13,946 | 98 | IMPERVIOUS |
| | 6,426 | 80 | >75% Grass cover, Good, HSG D |
| | 20,372 | 92 | Weighted Average |
| | 6,426 | | 31.54% Pervious Area |
| | 13,946 | | 68.46% Impervious Area |

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

## Subcatchment PR-31: TO WQU-23



## Summary for Subcatchment PR-32: BUILDING 4 ROOF

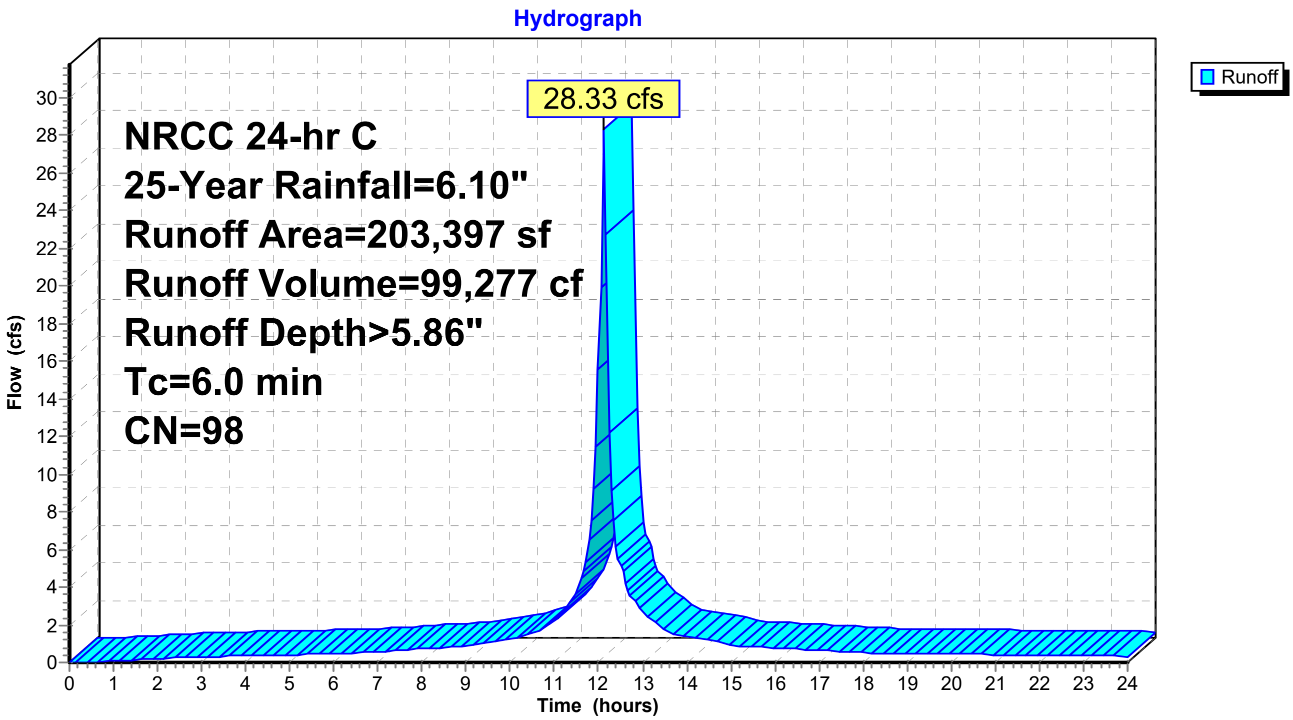
Runoff = 28.33 cfs @ 12.13 hrs, Volume= 99,277 cf, Depth> 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 203,397 | 98 | IMPERVIOUS |
| | 203,397 | | 100.00% Impervious Area |

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

## Subcatchment PR-32: BUILDING 4 ROOF



## Summary for Subcatchment PR-33: TO BASIN A

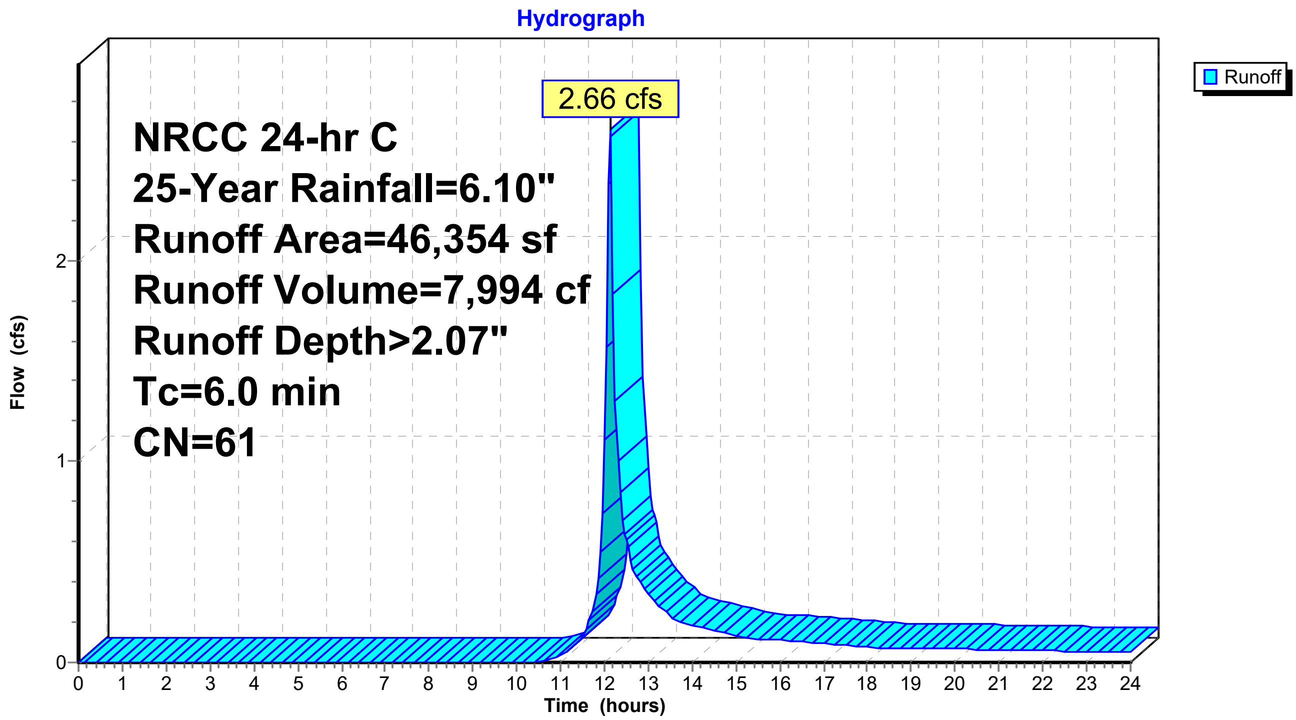
Runoff = 2.66 cfs @ 12.14 hrs, Volume= 7,994 cf, Depth> 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| Area (sf) | CN | Description |
|---|---|---|
| 46,354 | 61 | >75% Grass cover, Good, HSG B |
| 46,354 | | 100.00% Pervious Area |

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

## Subcatchment PR-33: TO BASIN A



## Summary for Subcatchment PR-34: TO BASIN B

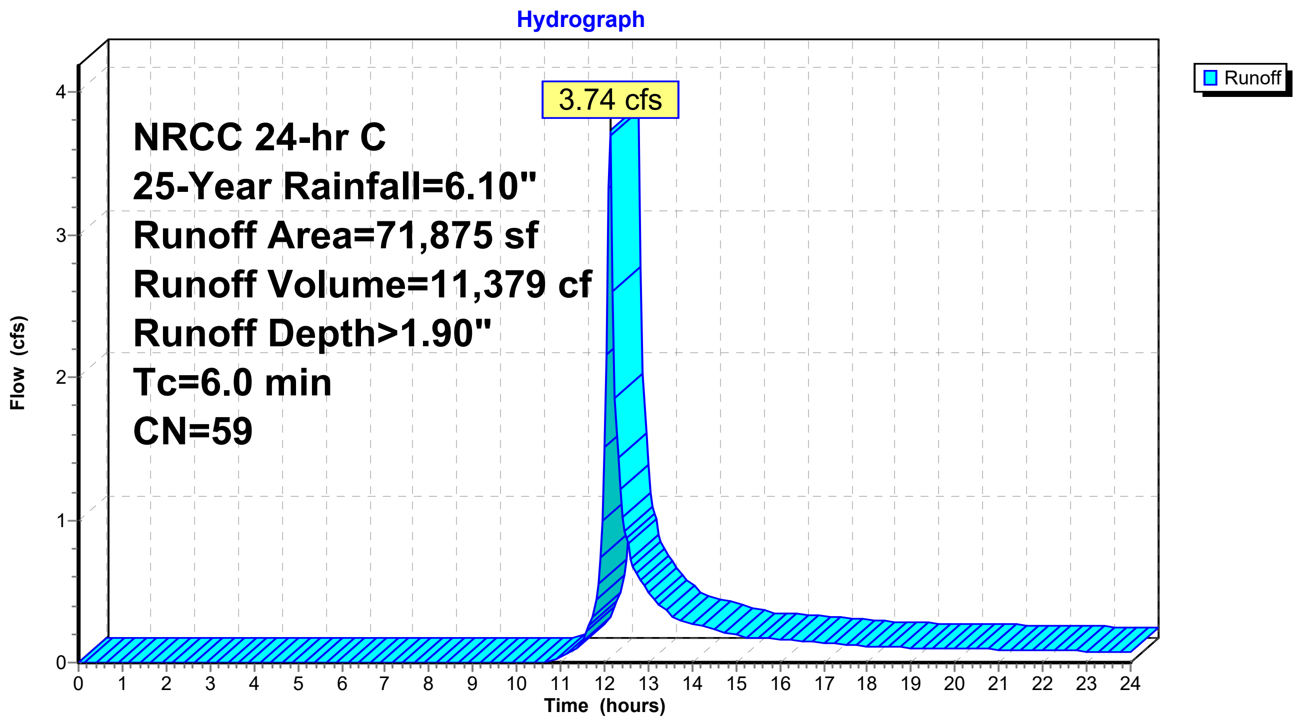
Runoff = 3.74 cfs @ 12.14 hrs, Volume= 11,379 cf, Depth> 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| Area (sf) | CN | Description |
|---|---|---|
| 24,851 | 55 | Woods, Good, HSG B |
| 47,024 | 61 | >75% Grass cover, Good, HSG B |
| 71,875 | 59 | Weighted Average |
| 71,875 | | 100.00% Pervious Area |

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

## Subcatchment PR-34: TO BASIN B



## Summary for Subcatchment PR-35: TO BASIN C

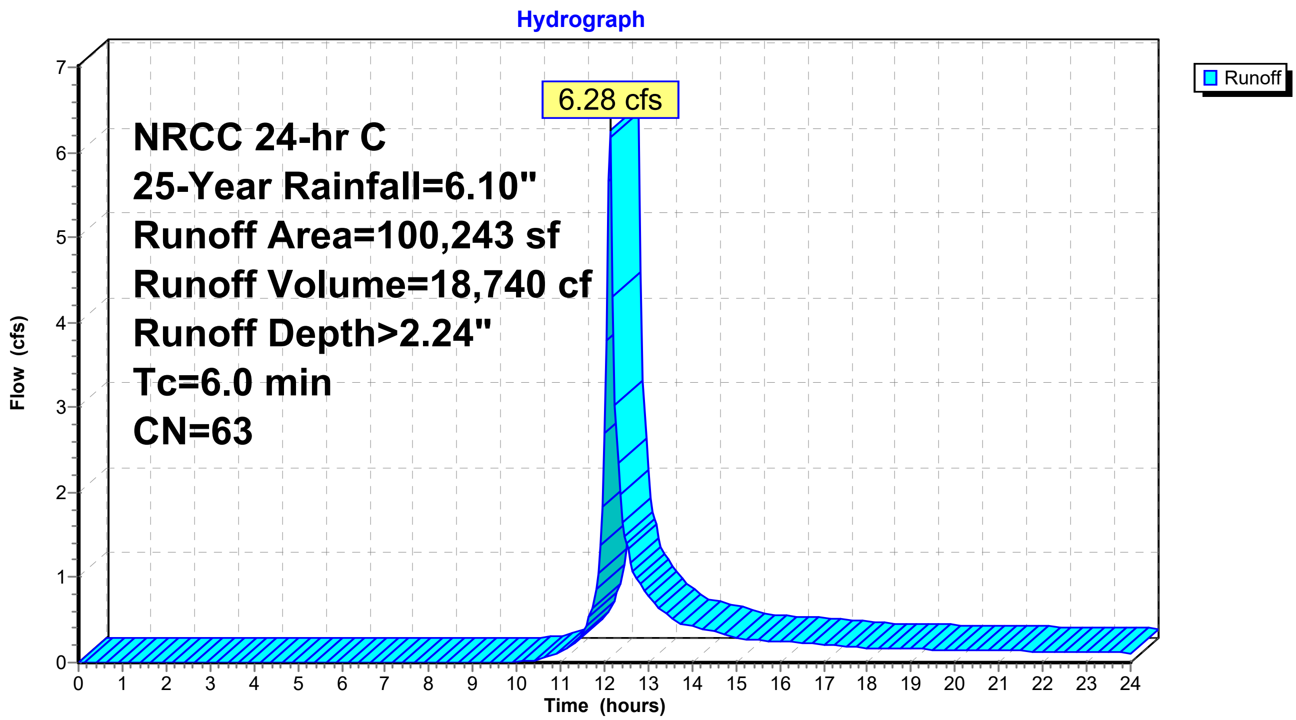
Runoff = 6.28 cfs @ 12.14 hrs, Volume= 18,740 cf, Depth> 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| Area (sf) | CN | Description |
|---|---|---|
| 17,490 | 74 | >75% Grass cover, Good, HSG C |
| 82,753 | 61 | >75% Grass cover, Good, HSG B |
| 100,243 | 63 | Weighted Average |
| 100,243 | | 100.00% Pervious Area |

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

## Subcatchment PR-35: TO BASIN C



## Summary for Subcatchment PR-36: TO OFFSITE EAST

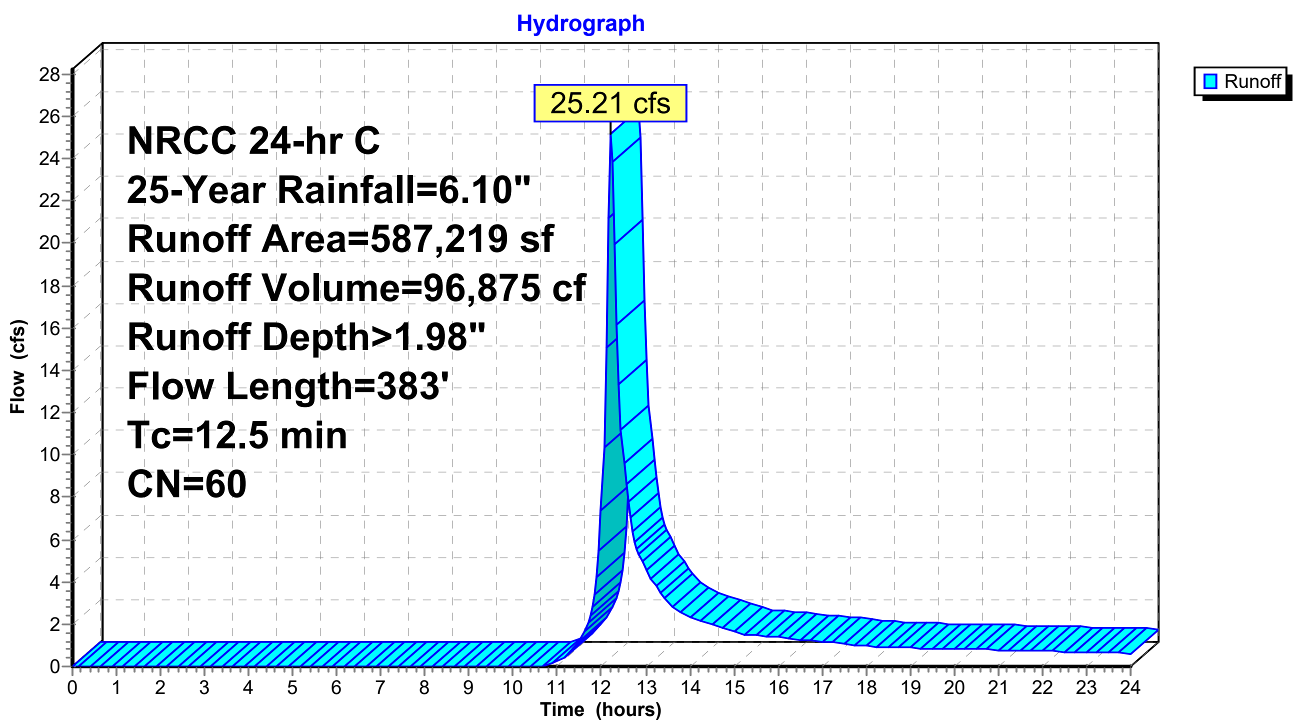
Runoff = 25.21 cfs @ 12.21 hrs, Volume= 96,875 cf, Depth> 1.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| Area (sf) | CN | Description |
|---|---|---|
| 402,759 | 55 | Woods, Good, HSG B |
| 6,465 | 70 | Woods, Good, HSG C |
| 112,740 | 77 | Woods, Good, HSG D |
| 52,096 | 61 | >75% Grass cover, Good, HSG B |
| 9,612 | 74 | >75% Grass cover, Good, HSG C |
| 3,547 | 80 | >75% Grass cover, Good, HSG D |
| 587,219 | 60 | Weighted Average |
| 587,219 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.0 | 50 | 0.0640 | 0.10 | | **Sheet Flow, AB**<br>Woods: Light underbrush n= 0.400 P2= 3.00" |
| 4.5 | 333 | 0.0604 | 1.23 | | **Shallow Concentrated Flow, BC**<br>Woodland Kv= 5.0 fps |
| 12.5 | 383 | Total | | | |

### Subcatchment PR-36: TO OFFSITE EAST



## Summary for Subcatchment PR-4: TO OFFSITE SOUTH

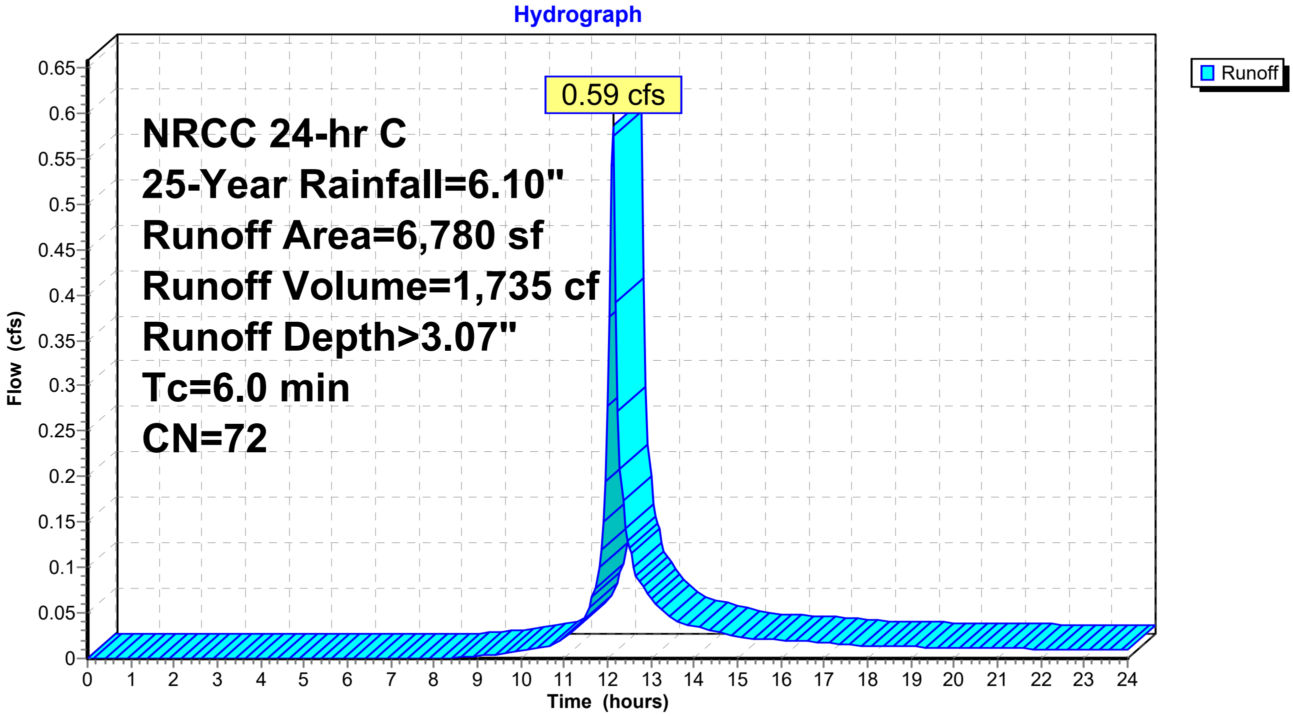
Runoff = 0.59 cfs @ 12.13 hrs, Volume= 1,735 cf, Depth> 3.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| Area (sf) | CN | Description |
|---|---|---|
| 2,686 | 74 | >75% Grass cover, Good, HSG C |
| 4,094 | 70 | Woods, Good, HSG C |
| 6,780 | 72 | Weighted Average |
| 6,780 | | 100.00% Pervious Area |

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

### Subcatchment PR-4: TO OFFSITE SOUTH



## Summary for Subcatchment PR-5: TO WQU-5

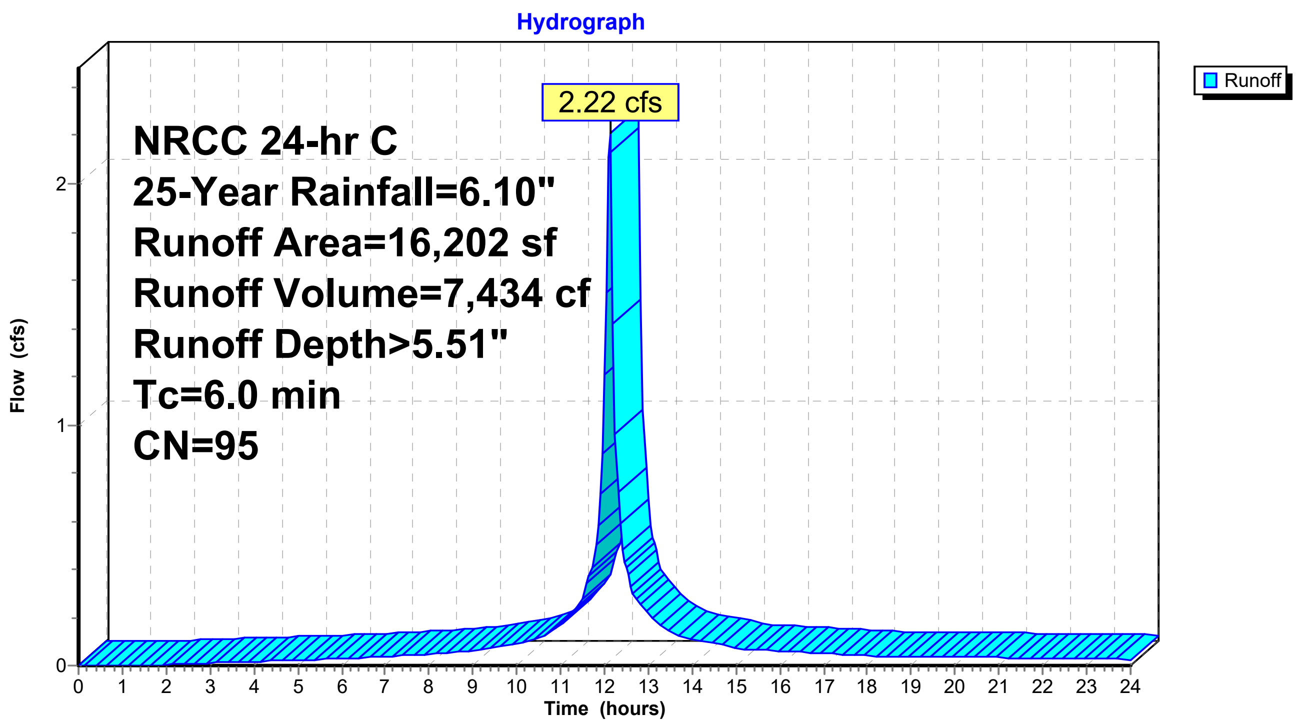
Runoff = 2.22 cfs @ 12.13 hrs, Volume= 7,434 cf, Depth> 5.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 14,419 | 98 | IMPERVIOUS |
| | 1,783 | 74 | >75% Grass cover, Good, HSG C |
| | 16,202 | 95 | Weighted Average |
| | 1,783 | | 11.00% Pervious Area |
| | 14,419 | | 89.00% Impervious Area |

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

### Subcatchment PR-5: TO WQU-5



## Summary for Subcatchment PR-6: TO WQU-4

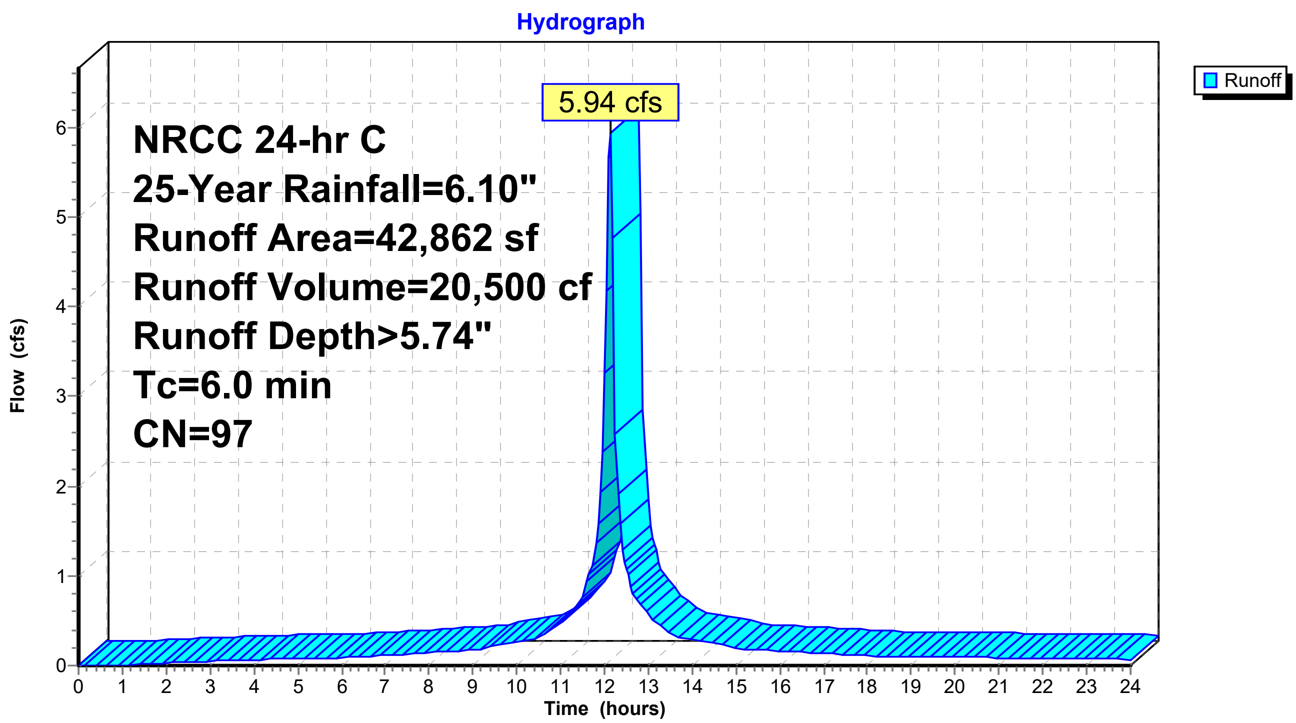
Runoff = 5.94 cfs @ 12.13 hrs, Volume= 20,500 cf, Depth> 5.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 41,625 | 98 | IMPERVIOUS |
| | 1,237 | 74 | >75% Grass cover, Good, HSG C |
| | 42,862 | 97 | Weighted Average |
| | 1,237 | | 2.89% Pervious Area |
| | 41,625 | | 97.11% Impervious Area |

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

## Subcatchment PR-6: TO WQU-4



## Summary for Subcatchment PR-7: TO WQU-3

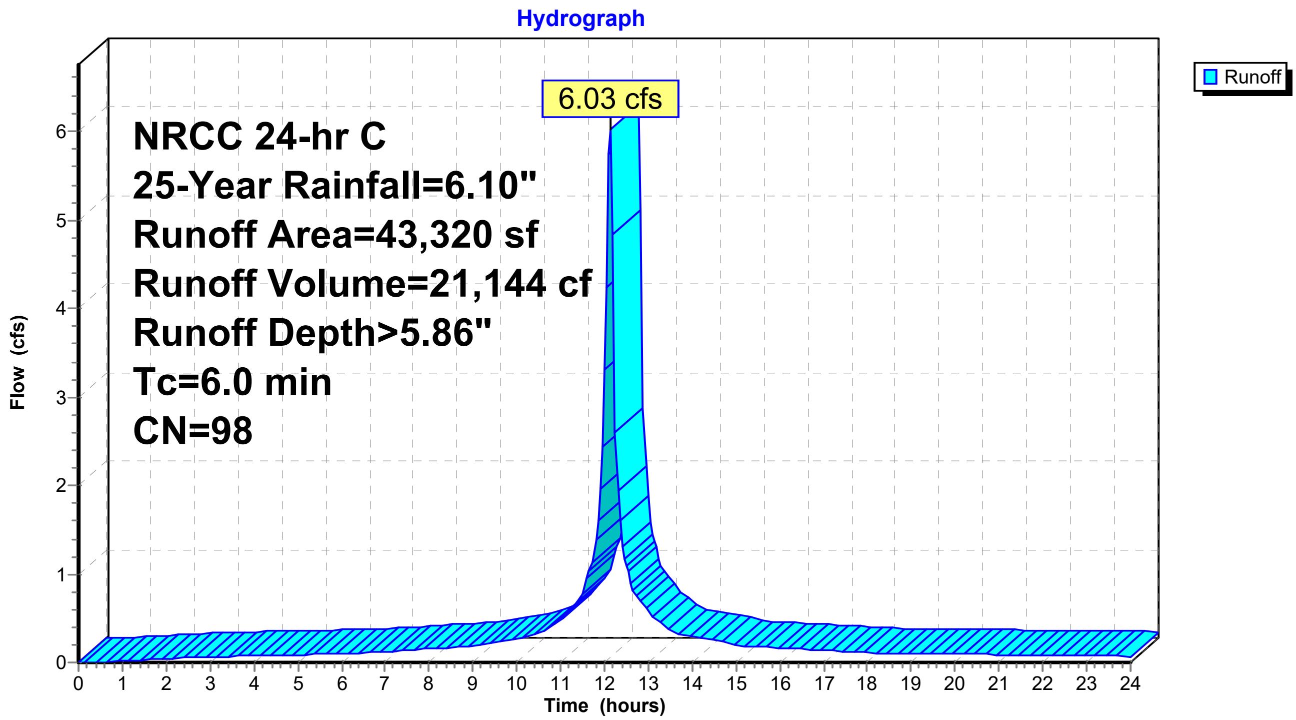
Runoff = 6.03 cfs @ 12.13 hrs, Volume= 21,144 cf, Depth> 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 43,320 | 98 | IMPERVIOUS |
| | 43,320 | | 100.00% Impervious Area |

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

## Subcatchment PR-7: TO WQU-3



## Summary for Subcatchment PR-8: TO WQU-2

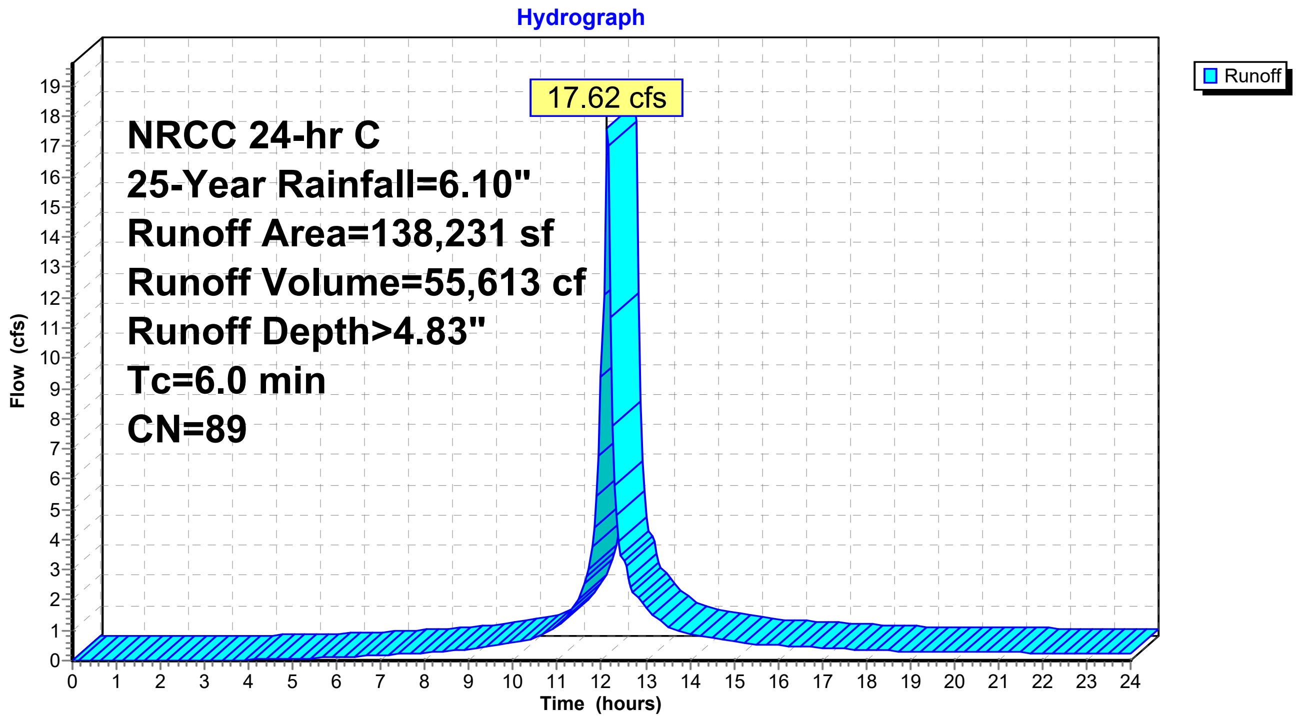
Runoff = 17.62 cfs @ 12.13 hrs, Volume= 55,613 cf, Depth> 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 88,857 | 98 | IMPERVIOUS |
| | 49,374 | 74 | >75% Grass cover, Good, HSG C |
| | 138,231 | 89 | Weighted Average |
| | 49,374 | | 35.72% Pervious Area |
| | 88,857 | | 64.28% Impervious Area |

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

### Subcatchment PR-8: TO WQU-2



## Summary for Subcatchment PR-9: BUILDING 1 ROOF

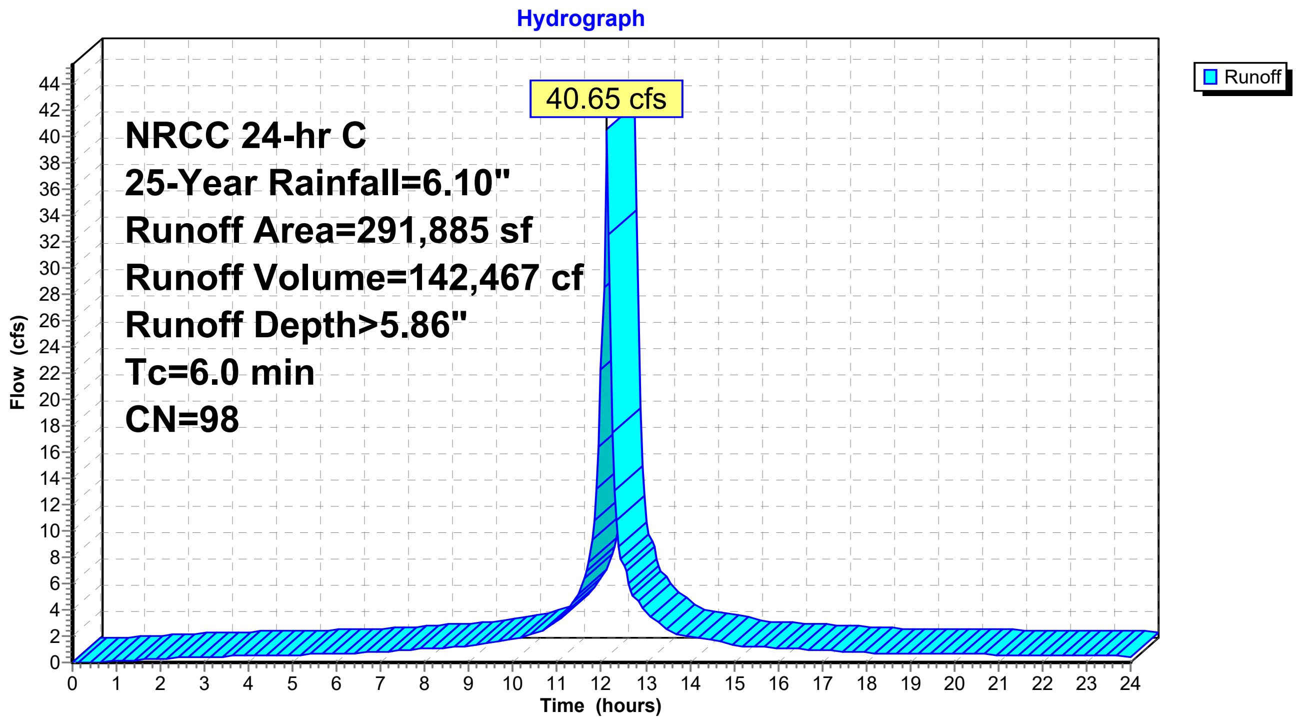
Runoff = 40.65 cfs @ 12.13 hrs, Volume= 142,467 cf, Depth> 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.10"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 291,885 | 98 | IMPERVIOUS |
| | 291,885 | | 100.00% Impervious Area |

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

## Subcatchment PR-9: BUILDING 1 ROOF

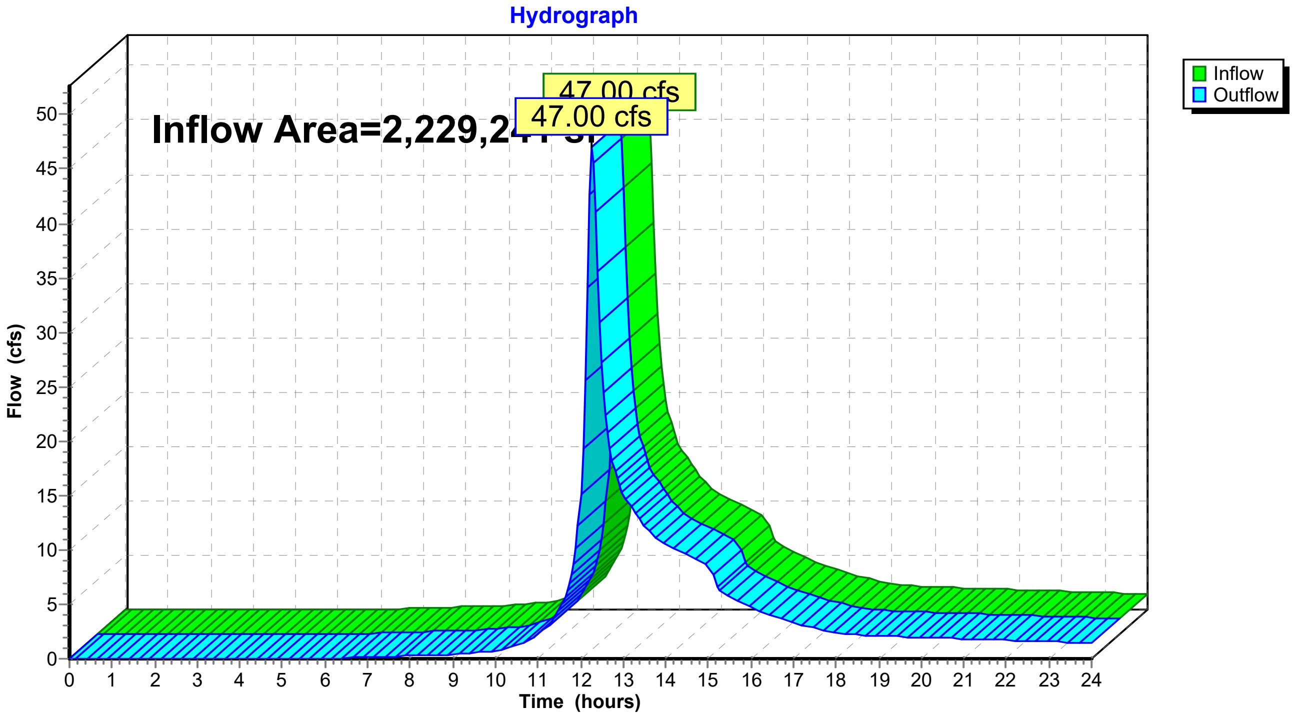


## Summary for Reach 1R: WETLANDS CENTER

Inflow Area = 2,229,241 sf, 42.29% Impervious, Inflow Depth > 1.56" for 25-Year event
Inflow = 47.00 cfs @ 12.26 hrs, Volume= 289,780 cf
Outflow = 47.00 cfs @ 12.26 hrs, Volume= 289,780 cf, Atten= 0%, Lag= 0.0 min

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

### Reach 1R: WETLANDS CENTER

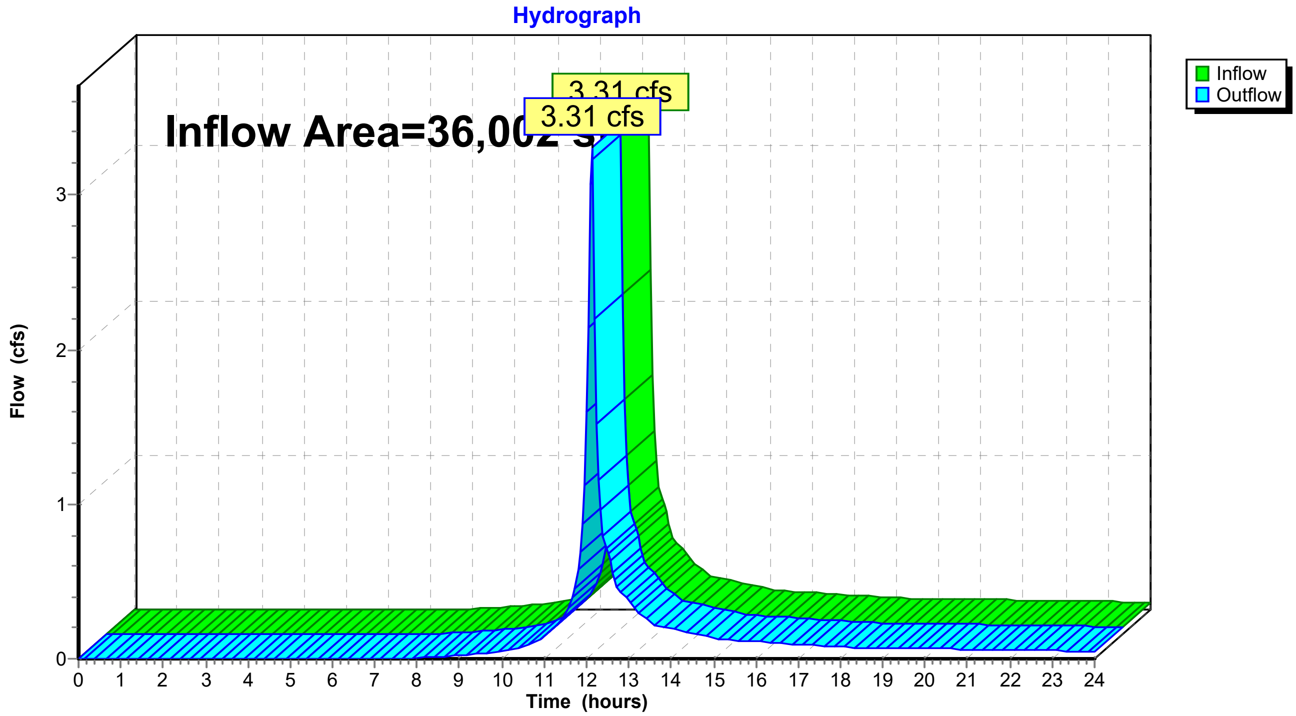


## Summary for Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

Inflow Area = 36,002 sf, 0.00% Impervious, Inflow Depth > 3.27" for 25-Year event
Inflow = 3.31 cfs @ 12.13 hrs, Volume= 9,796 cf
Outflow = 3.31 cfs @ 12.13 hrs, Volume= 9,796 cf, Atten= 0%, Lag= 0.0 min

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

### Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

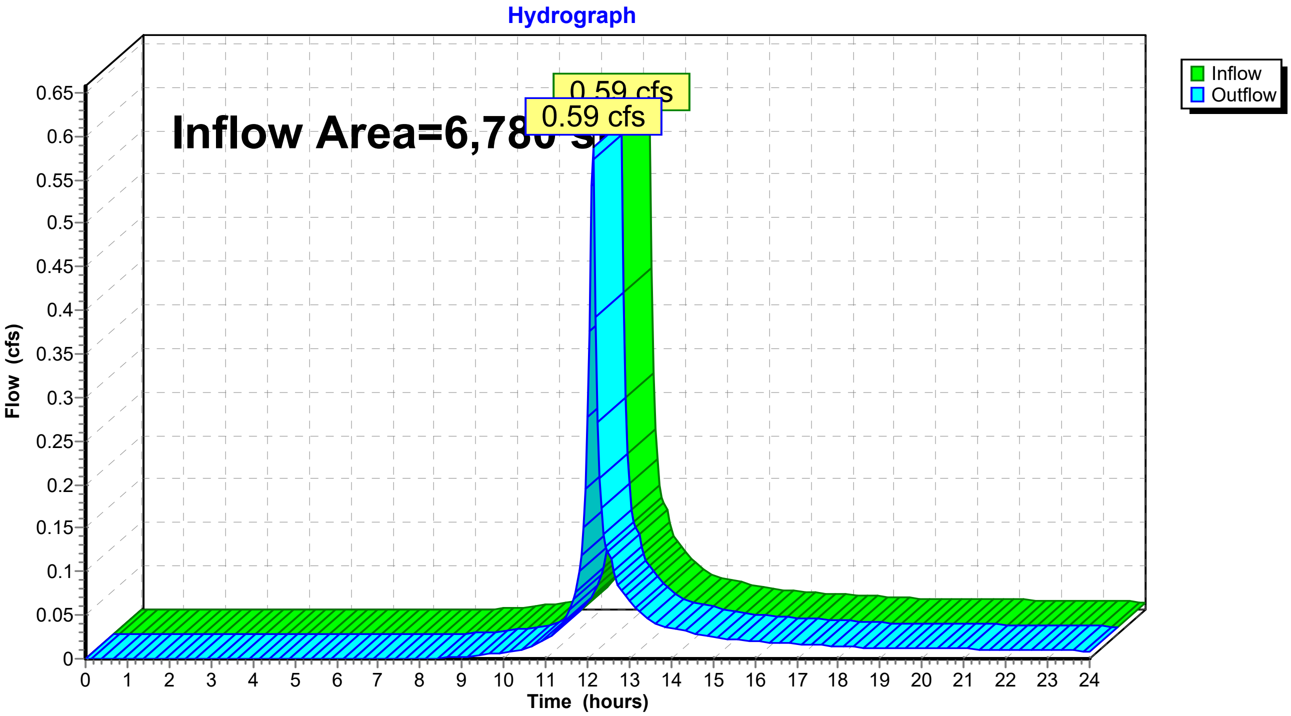


## Summary for Reach 3R: OFFSITE SOUTH

Inflow Area = 6,780 sf, 0.00% Impervious, Inflow Depth > 3.07" for 25-Year event
Inflow = 0.59 cfs @ 12.13 hrs, Volume= 1,735 cf
Outflow = 0.59 cfs @ 12.13 hrs, Volume= 1,735 cf, Atten= 0%, Lag= 0.0 min

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

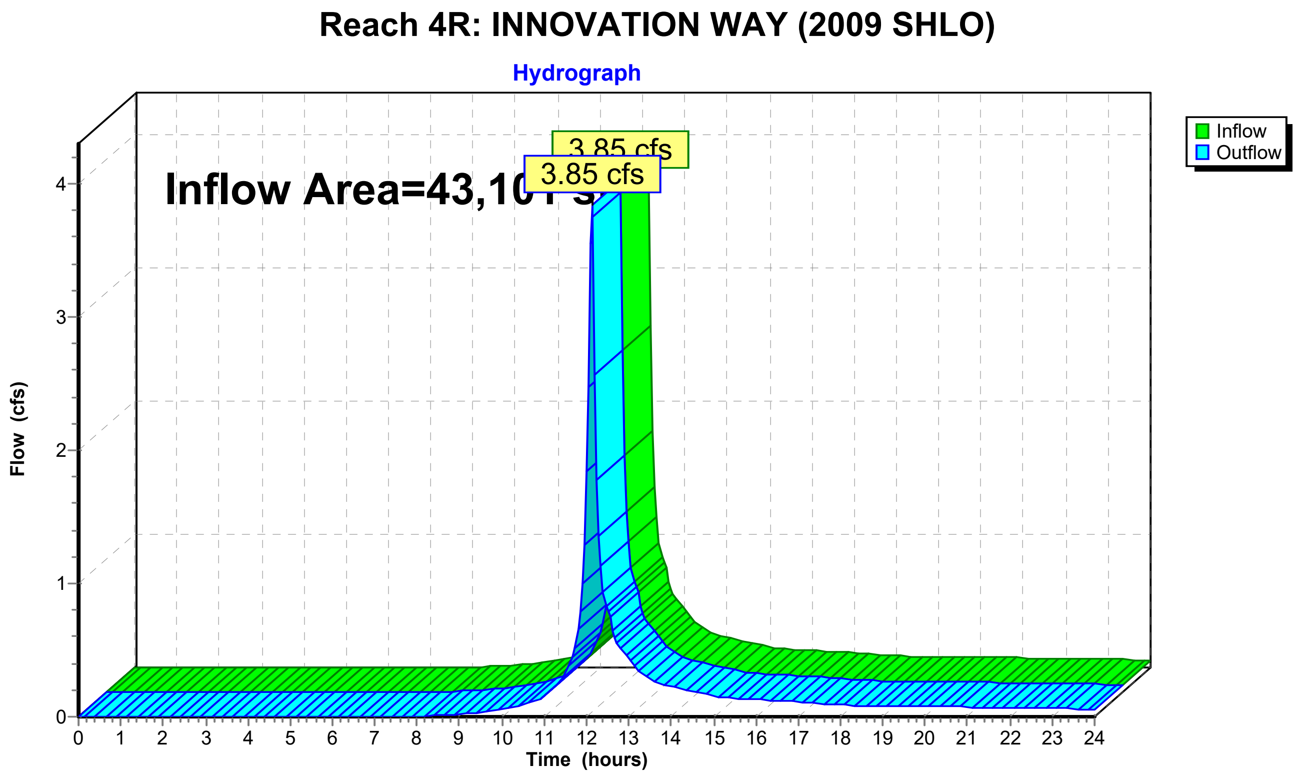
### Reach 3R: OFFSITE SOUTH



## Summary for Reach 4R: INNOVATION WAY (2009 SHLO)

Inflow Area = 43,101 sf, 0.00% Impervious, Inflow Depth > 3.17" for 25-Year event
Inflow = 3.85 cfs @ 12.13 hrs, Volume= 11,378 cf
Outflow = 3.85 cfs @ 12.13 hrs, Volume= 11,378 cf, Atten= 0%, Lag= 0.0 min

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

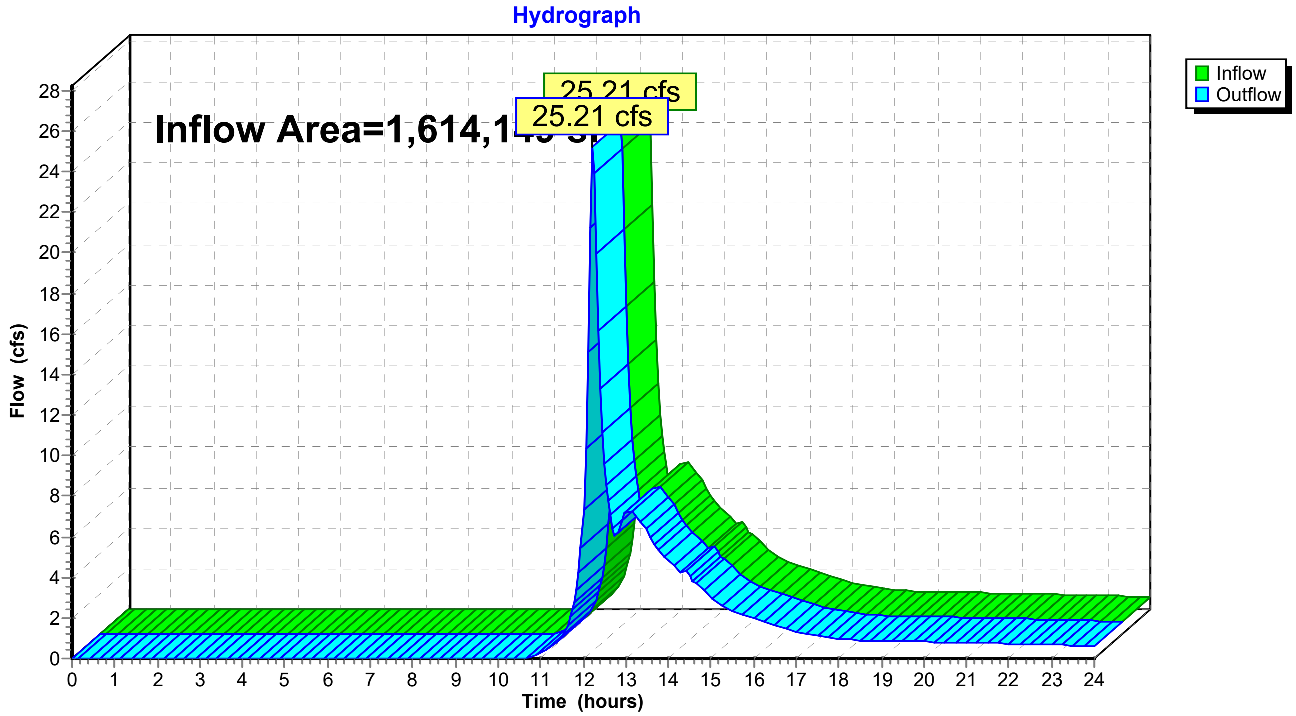


## Summary for Reach 23R: OFFSITE EAST

Inflow Area = 1,614,149 sf, 48.12% Impervious, Inflow Depth > 0.90" for 25-Year event
Inflow = 25.21 cfs @ 12.21 hrs, Volume= 120,724 cf
Outflow = 25.21 cfs @ 12.21 hrs, Volume= 120,724 cf, Atten= 0%, Lag= 0.0 min

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

### Reach 23R: OFFSITE EAST



## Summary for Pond 5P: Focal Point System A

Inflow Area = 235,410 sf, 48.35% Impervious, Inflow Depth > 4.43" for 25-Year event
Inflow = 28.02 cfs @ 12.13 hrs, Volume= 86,990 cf
Outflow = 4.31 cfs @ 11.70 hrs, Volume= 86,998 cf, Atten= 85%, Lag= 0.0 min
Primary = 4.31 cfs @ 11.70 hrs, Volume= 86,998 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 188.38' @ 12.61 hrs Surf.Area= 1,860 sf Storage= 21,720 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 29.3 min ( 831.0 - 801.8 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 184.25' | 837 cf | **40.00'W x 46.50'L x 2.25'H FOCIAL POINT**<br>4,185 cf Overall x 20.0% Voids |
| #2 | 186.50' | 45,685 cf | **Custom Stage Data (Prismatic)**Listed below (Recalc) -Impervious |
| | | 46,522 cf | Total Available Storage |

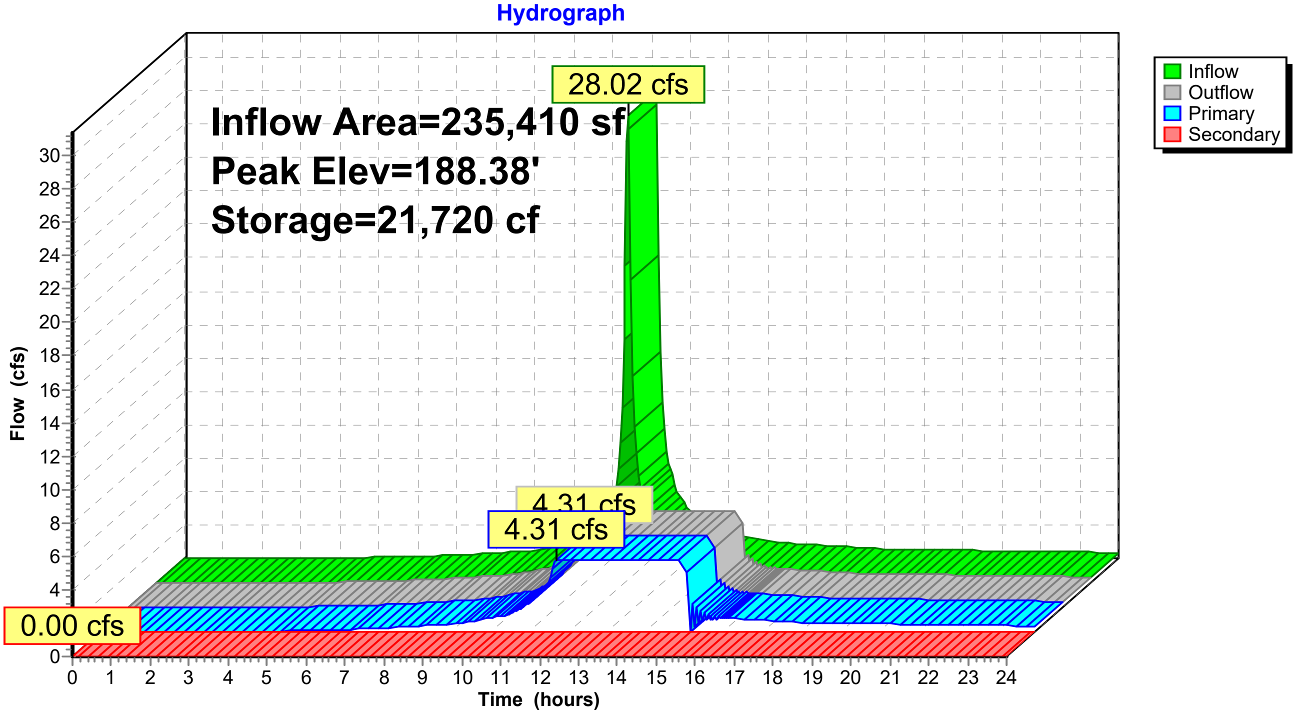
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 186.50 | 3,206 | 0 | 0 |
| 187.00 | 11,178 | 3,596 | 3,596 |
| 188.00 | 13,067 | 12,123 | 15,719 |
| 189.00 | 14,971 | 14,019 | 29,738 |
| 190.00 | 16,924 | 15,948 | 45,685 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 184.25' | **100.000 in/hr Exfiltration over Surface area** Phase-In= 0.10' |
| #2 | Secondary | 188.70' | **48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 2 | 185.00' | **12.0" Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=4.31 cfs @ 11.70 hrs HW=184.37' TW=182.91' (Dynamic Tailwater)
└─**1=Exfiltration** (Exfiltration Controls 4.31 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=184.25' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** ( Controls 0.00 cfs)
  └─**3=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 5P: Focal Point System A



## Summary for Pond 8P: RTANKS

Inflow Area = 235,410 sf, 48.35% Impervious, Inflow Depth > 4.43" for 25-Year event
Inflow = 4.31 cfs @ 11.70 hrs, Volume= 86,998 cf
Outflow = 4.31 cfs @ 15.05 hrs, Volume= 85,731 cf, Atten= 0%, Lag= 201.0 min
Primary = 2.64 cfs @ 15.05 hrs, Volume= 67,180 cf
Secondary = 1.66 cfs @ 15.05 hrs, Volume= 18,550 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 183.64' @ 15.05 hrs Surf.Area= 3,844 sf Storage= 7,837 cf

Plug-Flow detention time= 36.8 min calculated for 85,552 cf (98% of inflow)
Center-of-Mass det. time= 28.5 min ( 859.6 - 831.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 181.18' | 943 cf | **48.62'W x 79.07'L x 3.07'H Field A**<br>11,807 cf Overall - 9,450 cf Embedded = 2,357 cf x 40.0% Voids |
| #2A | 181.43' | 8,978 cf | **ACF R-Tank HD 2** x 1088 Inside #1<br>Inside= 15.7"W x 33.9"H => 3.52 sf x 2.35'L = 8.3 cf<br>Outside= 15.7"W x 33.9"H => 3.70 sf x 2.35'L = 8.7 cf<br>1088 Chambers in 34 Rows |
| | | 9,921 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 181.43' | **6.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Secondary | 183.17' | **12.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=2.64 cfs @ 15.05 hrs HW=183.64' TW=0.00' (Dynamic Tailwater)
└—**1=Orifice/Grate** (Orifice Controls 2.64 cfs @ 6.73 fps)

**Secondary OutFlow** Max=1.66 cfs @ 15.05 hrs HW=183.64' TW=0.00' (Dynamic Tailwater)
└—**2=Orifice/Grate** (Orifice Controls 1.66 cfs @ 2.32 fps)

## Pond 8P: RTANKS - Chamber Wizard Field A

**Chamber Model = ACF R-Tank HD 2 (ACF Environmental R-Tank HD)**
Inside= 15.7"W x 33.9"H => 3.52 sf x 2.35'L = 8.3 cf
Outside= 15.7"W x 33.9"H => 3.70 sf x 2.35'L = 8.7 cf

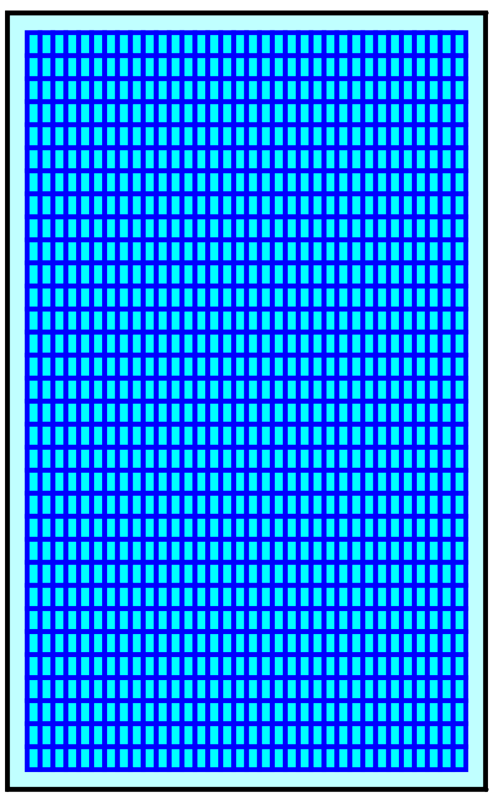
32 Chambers/Row x 2.35' Long = 75.07' Row Length +24.0" End Stone x 2 = 79.07' Base Length
34 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 48.62' Base Width
3.0" Stone Base + 33.9" Chamber Height = 3.07' Field Height

1,088 Chambers x 8.3 cf = 8,977.8 cf Chamber Storage
1,088 Chambers x 8.7 cf = 9,450.4 cf Displacement

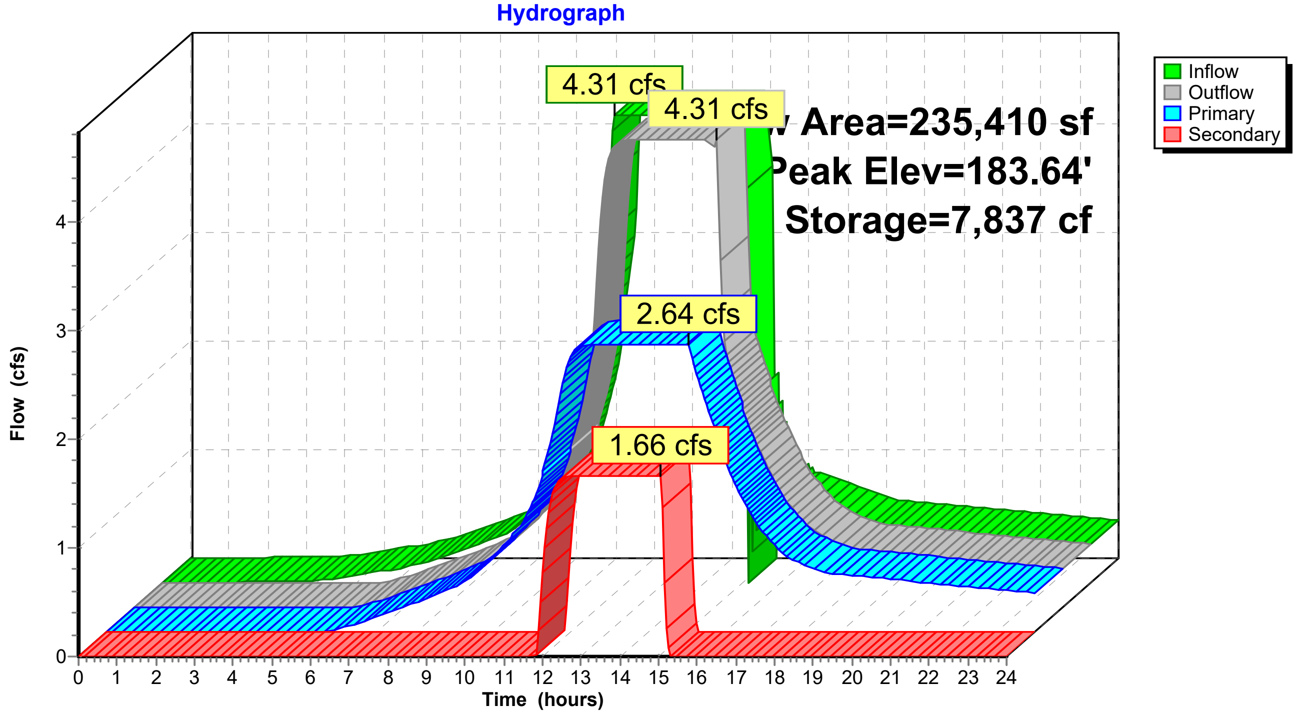
11,807.3 cf Field - 9,450.4 cf Chambers = 2,357.0 cf Stone x 40.0% Voids = 942.8 cf Stone Storage

Chamber Storage + Stone Storage = 9,920.6 cf = 0.228 af
Overall Storage Efficiency = 84.0%
Overall System Size = 79.07' x 48.62' x 3.07'

1,088 Chambers
437.3 cy Field
87.3 cy Stone



## Pond 8P: RTANKS



## Summary for Pond 10P: STORMTRAP SYSTEM C

Inflow Area = 15,869 sf, 90.76% Impervious, Inflow Depth > 5.62" for 25-Year event
Inflow = 2.19 cfs @ 12.13 hrs, Volume= 7,435 cf
Outflow = 0.14 cfs @ 11.35 hrs, Volume= 7,436 cf, Atten= 93%, Lag= 0.0 min
Discarded = 0.14 cfs @ 11.35 hrs, Volume= 7,436 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 220.36' @ 13.45 hrs Surf.Area= 2,561 sf Storage= 2,852 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 147.1 min ( 906.5 - 759.5 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 219.25' | 1 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc)<br>7,683 cf Overall - 7,682 cf Embedded = 1 cf |
| #2 | 219.25' | 7,682 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 7,683 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 219.25 | 2,561 | 0 | 0 |
| 219.75 | 2,561 | 1,281 | 1,281 |
| 220.25 | 2,561 | 1,281 | 2,561 |
| 220.75 | 2,561 | 1,281 | 3,842 |
| 221.25 | 2,561 | 1,281 | 5,122 |
| 221.75 | 2,561 | 1,281 | 6,403 |
| 222.25 | 2,561 | 1,281 | 7,683 |

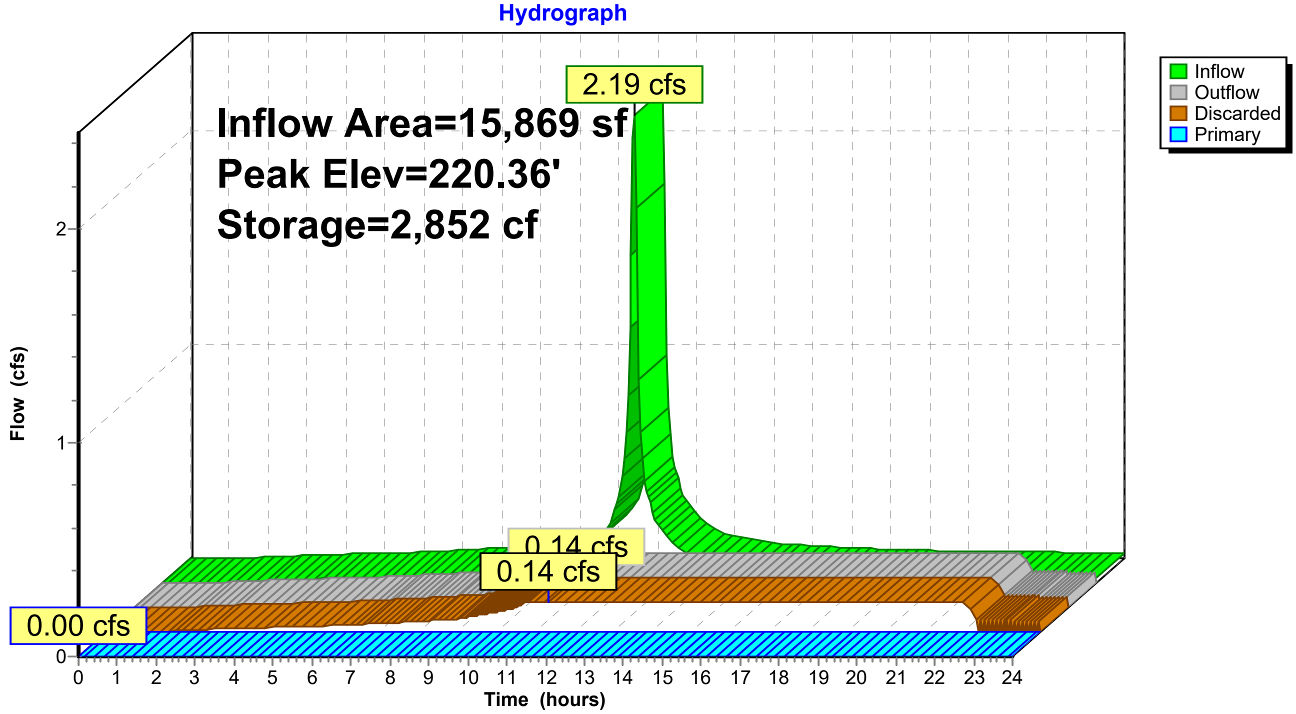
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 219.25 | 0 |
| 219.75 | 1,280 |
| 220.25 | 2,561 |
| 220.75 | 3,841 |
| 221.25 | 5,121 |
| 221.75 | 6,401 |
| 222.25 | 7,682 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 219.25' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 220.75' | **12.0" Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.14 cfs @ 11.35 hrs HW=219.28' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=219.25' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 10P: STORMTRAP SYSTEM C



## Summary for Pond 12P: STORMTRAP 13 FT SYSTEM D

Inflow Area = 203,397 sf,100.00% Impervious, Inflow Depth > 5.86" for 25-Year event
Inflow = 28.33 cfs @ 12.13 hrs, Volume= 99,277 cf
Outflow = 0.25 cfs @ 2.50 hrs, Volume= 20,616 cf, Atten= 99%, Lag= 0.0 min
Discarded = 0.25 cfs @ 2.50 hrs, Volume= 20,616 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 179.39' @ 24.00 hrs Surf.Area= 10,737 sf Storage= 78,655 cf

Plug-Flow detention time= 309.4 min calculated for 20,616 cf (21% of inflow)
Center-of-Mass det. time= 18.0 min ( 763.5 - 745.4 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 170.75' | 0 cf | **64.19'W x 167.27'L x 14.00'H Field A**<br>150,314 cf Overall - 150,314 cf Embedded = 0 cf x 40.0% Voids |
| #2A | 170.75' | 125,597 cf | **StormTrap ST2 DoubleTrap 13-0** x 60 Inside #1<br>Inside= 101.7"W x 156.0"H => 101.45 sf x 15.40'L = 1,561.9 cf<br>Outside= 101.7"W x 168.0"H => 118.71 sf x 15.40'L = 1,827.6 cf<br>60 Chambers in 6 Rows<br>50.88' x 153.96' Core + 6.66' Border = 64.19' x 167.27' System |
| | | 125,597 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 170.75' | **1.020 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.25 cfs @ 2.50 hrs HW=171.25' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.25 cfs)

## Pond 12P: STORMTRAP 13 FT SYSTEM D - Chamber Wizard Field A

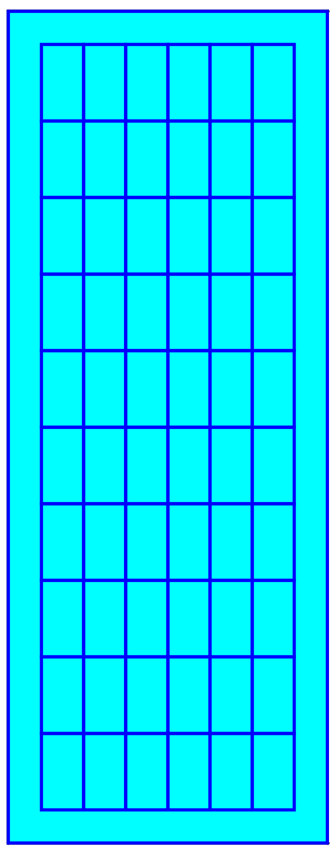
**Chamber Model = StormTrap ST2 DoubleTrap 13-0 (StormTrap ST2 DoubleTrap® Type I+III)**
Inside= 101.7"W x 156.0"H => 101.45 sf x 15.40'L = 1,561.9 cf
Outside= 101.7"W x 168.0"H => 118.71 sf x 15.40'L = 1,827.6 cf

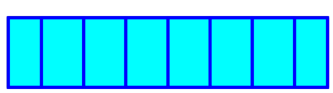
10 Chambers/Row x 15.40' Long = 153.96' Row Length +79.9" Border x 2 = 167.27' Base Length
6 Rows x 101.7" Wide + 79.9" Side Border x 2 = 64.19' Base Width
168.0" Chamber Height = 14.00' Field Height

60 Chambers x 1,561.9 cf + 31,885.6 cf Border = 125,597.4 cf Chamber Storage
60 Chambers x 1,827.6 cf + 40,656.9 cf Border = 150,313.8 cf Displacement

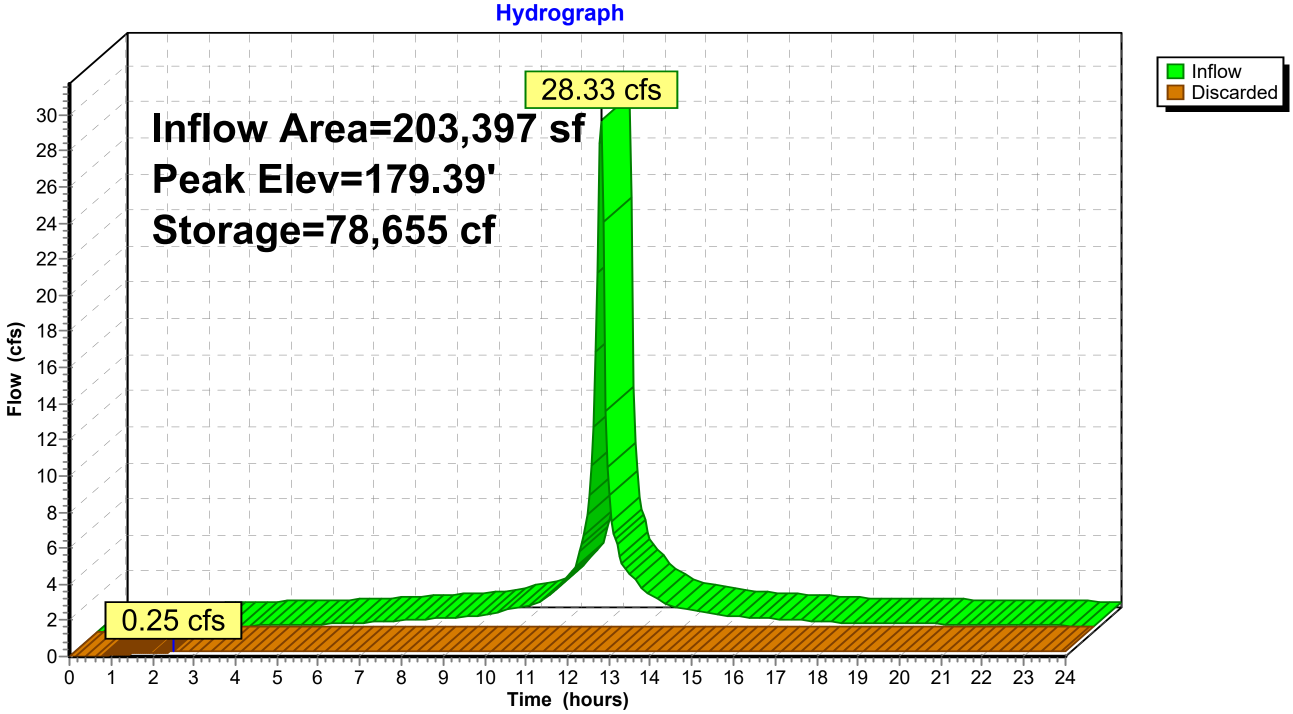
Chamber Storage = 125,597.4 cf = 2.883 af
Overall Storage Efficiency = 83.6%
Overall System Size = 167.27' x 64.19' x 14.00'

60 Chambers (plus border)
5,567.2 cy Field





## Pond 12P: STORMTRAP 13 FT SYSTEM D



## Summary for Pond 13P: BASIN A

Inflow Area = 456,714 sf, 65.34% Impervious, Inflow Depth > 4.61" for 25-Year event
Inflow = 55.02 cfs @ 12.13 hrs, Volume= 175,606 cf
Outflow = 1.30 cfs @ 17.16 hrs, Volume= 74,276 cf, Atten= 98%, Lag= 302.2 min
Discarded = 1.30 cfs @ 17.16 hrs, Volume= 74,276 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 174.96' @ 17.16 hrs Surf.Area= 23,378 sf Storage= 110,738 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 148.0 min ( 938.1 - 790.1 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 169.00' | 214,942 cf | **Custom Stage Data (Prismatic)**Listed below (Recalc) |

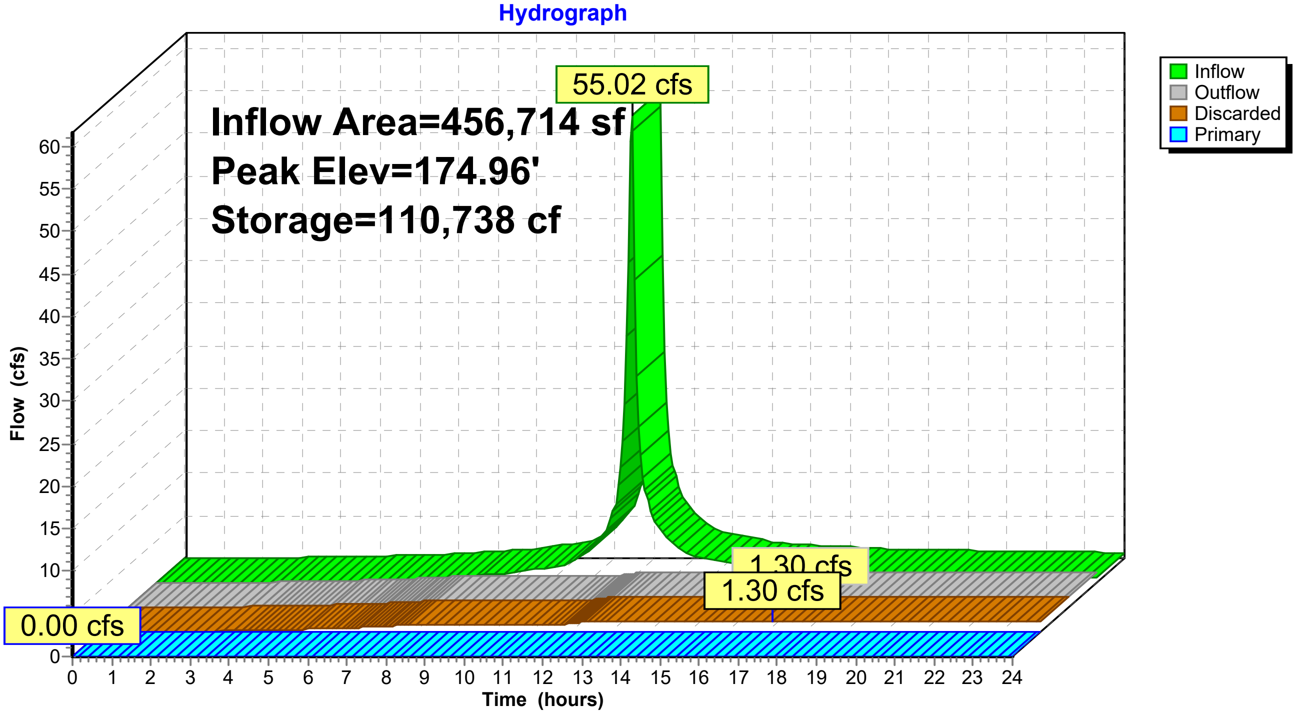
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 169.00 | 14,114 | 0 | 0 |
| 170.00 | 15,529 | 14,822 | 14,822 |
| 171.00 | 17,000 | 16,265 | 31,086 |
| 172.00 | 18,527 | 17,764 | 48,850 |
| 173.00 | 20,111 | 19,319 | 68,169 |
| 174.00 | 21,751 | 20,931 | 89,100 |
| 175.00 | 23,448 | 22,600 | 111,699 |
| 176.00 | 25,345 | 24,397 | 136,096 |
| 177.00 | 27,180 | 26,263 | 162,358 |
| 178.00 | 29,071 | 28,126 | 190,484 |
| 178.80 | 32,074 | 24,458 | 214,942 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 169.00' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 177.80' | **20.0' long x 15.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63 |

**Discarded OutFlow** Max=1.30 cfs @ 17.16 hrs HW=174.96' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.30 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=169.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond 13P: BASIN A



## Summary for Pond 59P: BASIN B

Inflow Area = 271,926 sf, 56.54% Impervious, Inflow Depth > 4.34" for 25-Year event
Inflow = 30.16 cfs @ 12.13 hrs, Volume= 98,318 cf
Outflow = 1.15 cfs @ 14.89 hrs, Volume= 58,746 cf, Atten= 96%, Lag= 165.5 min
Discarded = 1.15 cfs @ 14.89 hrs, Volume= 58,746 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 213.95' @ 14.89 hrs Surf.Area= 20,625 sf Storage= 54,292 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 162.9 min ( 948.7 - 785.8 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 210.00' | 77,098 cf | **Custom Stage Data (Irregular)** Listed below (Recalc) |

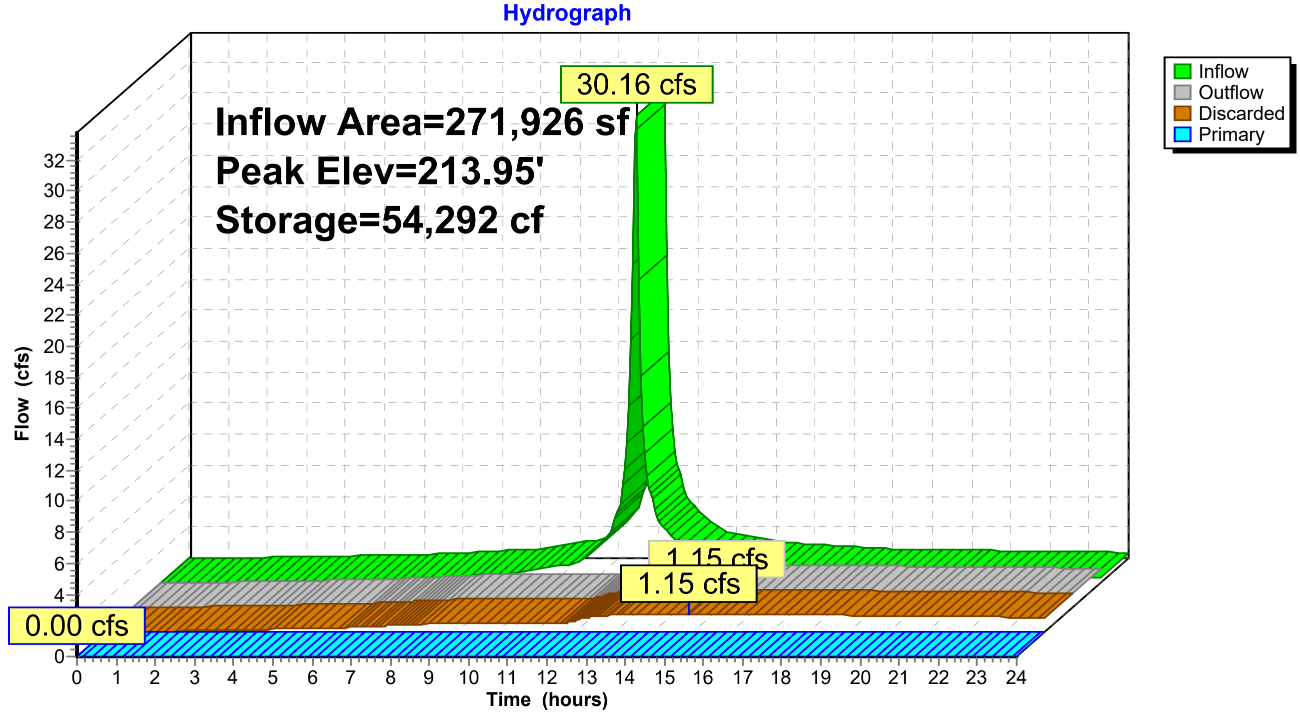
| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|---|---|---|---|---|---|
| 210.00 | 9,182 | 374.9 | 0 | 0 | 9,182 |
| 211.00 | 10,335 | 393.7 | 9,753 | 9,753 | 10,394 |
| 212.00 | 14,140 | 565.6 | 12,188 | 21,941 | 23,526 |
| 213.00 | 15,865 | 584.4 | 14,994 | 36,935 | 25,340 |
| 214.00 | 20,870 | 647.8 | 18,310 | 55,245 | 31,587 |
| 215.00 | 22,851 | 666.2 | 21,853 | 77,098 | 33,620 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 210.00' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 214.00' | **30.0' long x 15.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63 |

**Discarded OutFlow** Max=1.15 cfs @ 14.89 hrs HW=213.95' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.15 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=210.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond 59P: BASIN B



## Summary for Pond 61P: BASIN C

Inflow Area = 351,572 sf, 70.16% Impervious, Inflow Depth > 4.79" for 25-Year event
Inflow = 41.17 cfs @ 12.13 hrs, Volume= 140,474 cf
Outflow = 3.52 cfs @ 13.17 hrs, Volume= 78,821 cf, Atten= 91%, Lag= 62.6 min
Discarded = 1.09 cfs @ 13.17 hrs, Volume= 65,915 cf
Primary = 2.43 cfs @ 13.17 hrs, Volume= 12,906 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 215.93' @ 13.17 hrs Surf.Area= 19,614 sf Storage= 73,462 cf

Plug-Flow detention time= 246.6 min calculated for 78,657 cf (56% of inflow)
Center-of-Mass det. time= 116.4 min ( 880.1 - 763.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 211.00' | 91,926 cf | **Custom Stage Data (Irregular)**Listed below (Recalc) |

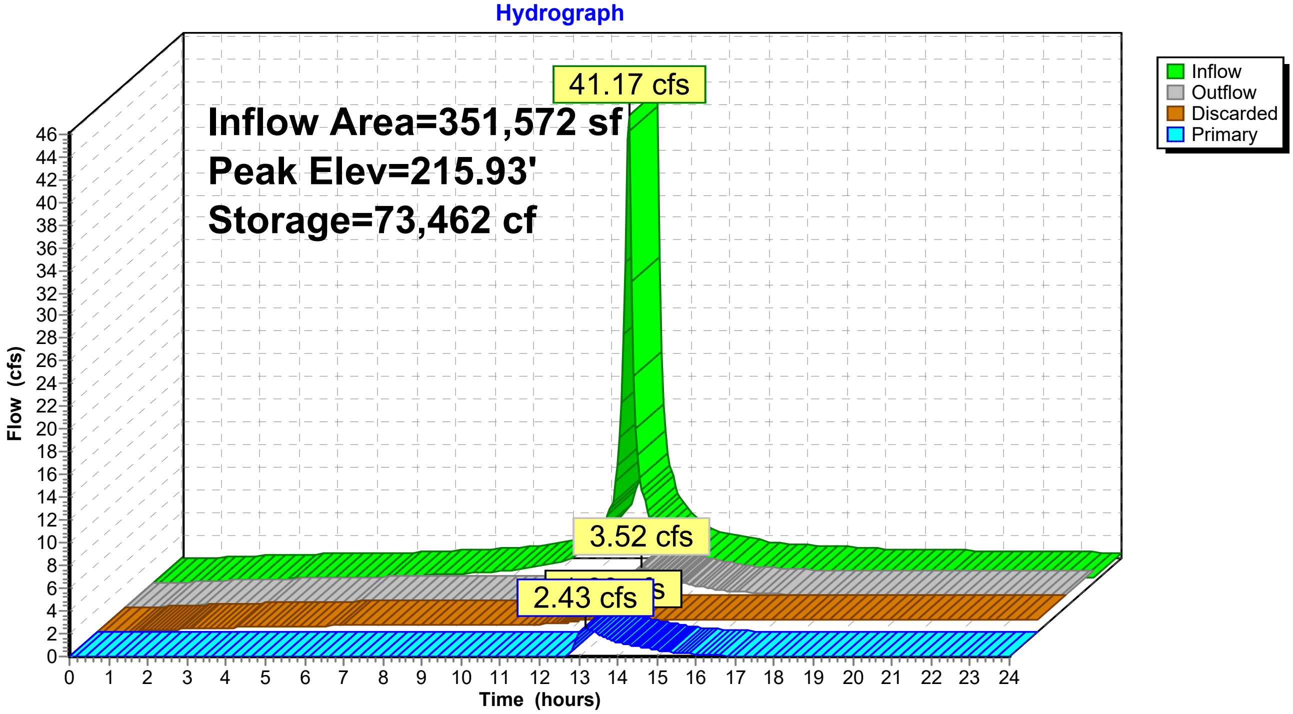
| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|---|---|---|---|---|---|
| 211.00 | 10,407 | 575.7 | 0 | 0 | 10,407 |
| 212.00 | 12,162 | 594.5 | 11,273 | 11,273 | 12,253 |
| 213.00 | 13,974 | 613.4 | 13,058 | 24,331 | 14,167 |
| 214.00 | 15,842 | 632.2 | 14,898 | 39,229 | 16,132 |
| 215.00 | 17,767 | 651.1 | 16,795 | 56,024 | 18,166 |
| 216.00 | 19,749 | 669.9 | 18,749 | 74,773 | 20,250 |
| 216.80 | 23,177 | 701.3 | 17,152 | 91,926 | 23,720 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 211.00' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 215.80' | **20.0' long x 10.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64 |

**Discarded OutFlow** Max=1.09 cfs @ 13.17 hrs HW=215.93' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.09 cfs)

**Primary OutFlow** Max=2.42 cfs @ 13.17 hrs HW=215.93' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 2.42 cfs @ 0.91 fps)

# Pond 61P: BASIN C



## Summary for Pond 65P: STORMTRAP 3.5 FT SYSTEM B

Inflow Area = 375,763 sf, 94.19% Impervious, Inflow Depth > 5.61" for 25-Year event
Inflow = 51.49 cfs @ 12.13 hrs, Volume= 175,788 cf
Outflow = 44.54 cfs @ 12.17 hrs, Volume= 160,164 cf, Atten= 13%, Lag= 2.4 min
Discarded = 0.96 cfs @ 8.30 hrs, Volume= 69,167 cf
Primary = 43.58 cfs @ 12.17 hrs, Volume= 90,997 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 214.93' @ 13.80 hrs Surf.Area= 17,139 sf Storage= 30,683 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 53.1 min ( 810.1 - 757.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 213.14' | 2 cf | **Custom Stage Data (Prismatic)** Listed below<br>59,987 cf Overall - 59,985 cf Embedded = 2 cf |
| #2 | 213.14' | 59,985 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 59,987 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 213.14 | 17,139 | 0 | 0 |
| 213.39 | 17,139 | 4,285 | 4,285 |
| 214.14 | 17,139 | 12,854 | 17,139 |
| 214.64 | 17,139 | 8,570 | 25,709 |
| 215.14 | 17,139 | 8,570 | 34,278 |
| 215.64 | 17,139 | 8,570 | 42,848 |
| 216.14 | 17,139 | 8,570 | 51,417 |
| 216.64 | 17,139 | 8,570 | 59,987 |

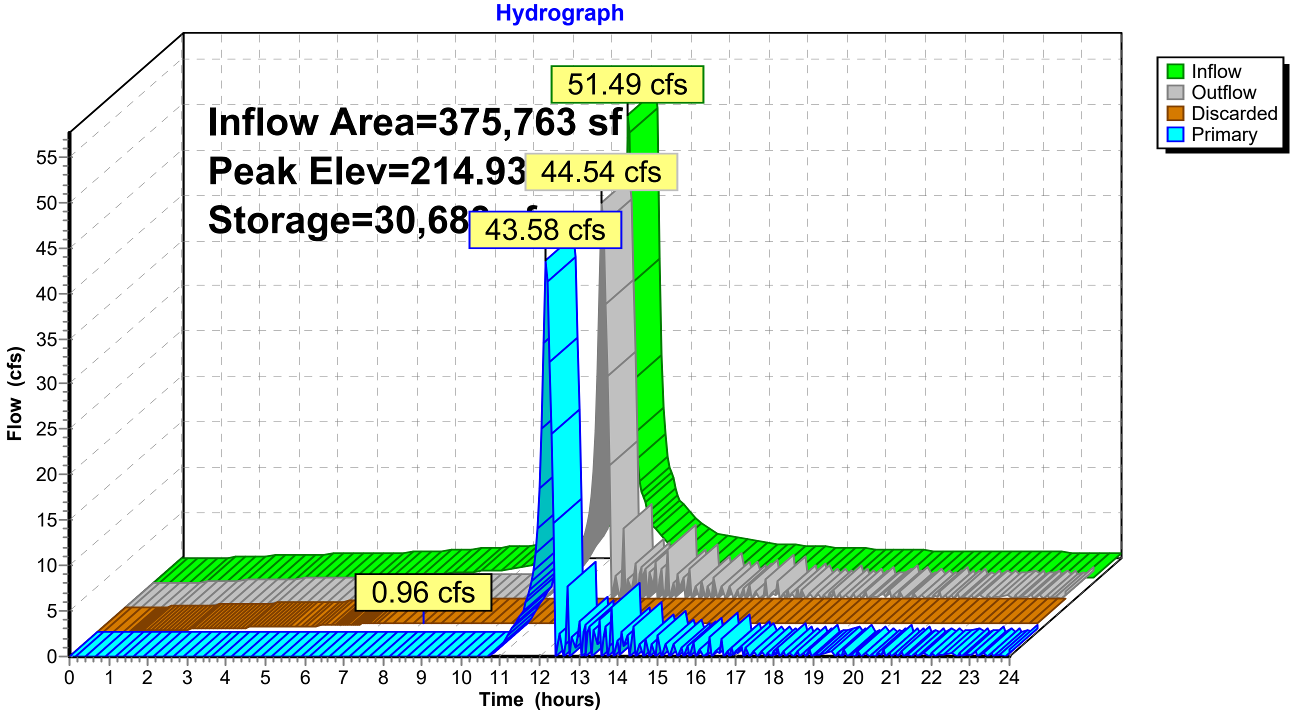
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 213.14 | 0 |
| 213.64 | 8,569 |
| 214.14 | 17,138 |
| 214.64 | 25,708 |
| 215.14 | 34,277 |
| 215.64 | 42,846 |
| 216.14 | 51,416 |
| 216.64 | 59,985 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 213.14' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 213.64' | **24.0" Vert. Orifice/Grate X 10.00** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.96 cfs @ 8.30 hrs HW=213.18' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.96 cfs)

**Primary OutFlow** Max=42.44 cfs @ 12.17 hrs HW=214.52' TW=212.57' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Orifice Controls 42.44 cfs @ 3.19 fps)

## Pond 65P: STORMTRAP 3.5 FT SYSTEM B



## Summary for Pond 67P: CULTEC SYSTEM E

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 59,461 sf, 84.88% Impervious, | Inflow Depth > 5.39" for 25-Year event | | |
| Inflow = | 8.06 cfs @ 12.13 hrs, | Volume= | 26,713 cf | |
| Outflow = | 0.33 cfs @ 10.75 hrs, | Volume= | 19,825 cf, | Atten= 96%, Lag= 0.0 min |
| Discarded = | 0.33 cfs @ 10.75 hrs, | Volume= | 19,825 cf | |
| Primary = | 0.00 cfs @ 0.00 hrs, | Volume= | 0 cf | |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 213.39' @ 14.55 hrs Surf.Area= 5,889 sf Storage= 12,801 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 157.2 min ( 927.9 - 770.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 210.36' | 8,095 cf | **37.50'W x 157.03'L x 5.75'H Field A** |
| | | | 33,860 cf Overall - 13,622 cf Embedded = 20,238 cf x 40.0% Voids |
| #2A | 211.11' | 13,622 cf | **Cultec R-902HD** x 210 Inside #1 |
| | | | Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf |
| | | | Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap |
| | | | 210 Chambers in 5 Rows |
| | | | Cap Storage= +2.8 cf x 2 x 5 rows = 27.6 cf |
| | | 21,717 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 210.36' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 213.56' | **12.0" Vert. Orifice/Grate** C= 0.600 |
| | | | Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.33 cfs @ 10.75 hrs HW=210.42' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.33 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=210.36' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 67P: CULTEC SYSTEM E - Chamber Wizard Field A

**Chamber Model = Cultec R-902HD (Cultec Recharger® 902HD)**
Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= +2.8 cf x 2 x 5 rows = 27.6 cf

78.0" Wide + 9.0" Spacing = 87.0" C-C Row Spacing

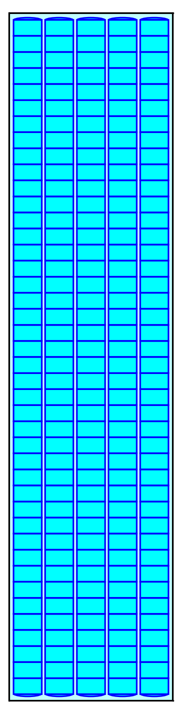
42 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 155.03' Row Length +12.0" End Stone x 2 = 157.03' Base Length
5 Rows x 78.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.50' Base Width
9.0" Stone Base + 48.0" Chamber Height + 12.0" Stone Cover = 5.75' Field Height

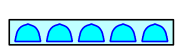
210 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 5 Rows = 13,622.0 cf Chamber Storage

33,860.3 cf Field - 13,622.0 cf Chambers = 20,238.4 cf Stone x 40.0% Voids = 8,095.3 cf Stone Storage

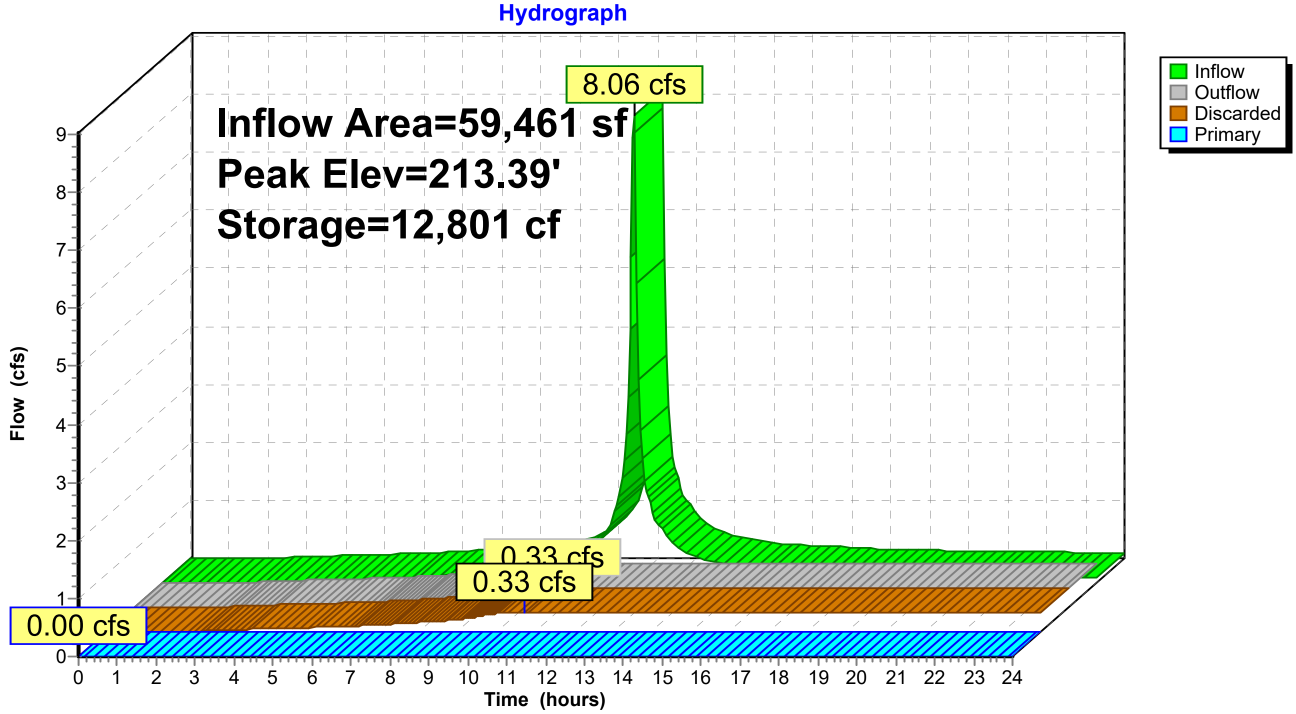
Chamber Storage + Stone Storage = 21,717.3 cf = 0.499 af
Overall Storage Efficiency = 64.1%
Overall System Size = 157.03' x 37.50' x 5.75'

210 Chambers
1,254.1 cy Field
749.6 cy Stone





## Pond 67P: CULTEC SYSTEM E



## Summary for Pond 69P: STORMTRAP 7.5 FT SYSTEM B

Inflow Area = 387,563 sf, 93.38% Impervious, Inflow Depth > 2.97" for 25-Year event
Inflow = 44.96 cfs @ 12.16 hrs, Volume= 95,854 cf
Outflow = 2.03 cfs @ 13.89 hrs, Volume= 41,091 cf, Atten= 95%, Lag= 103.5 min
Discarded = 0.62 cfs @ 11.20 hrs, Volume= 30,149 cf
Primary = 1.41 cfs @ 13.89 hrs, Volume= 10,942 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 214.95' @ 13.89 hrs Surf.Area= 11,144 sf Storage= 64,738 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 198.2 min ( 991.1 - 792.9 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 209.14' | 5 cf | **Custom Stage Data (Prismatic)** Listed below<br>83,580 cf Overall - 83,575 cf Embedded = 5 cf |
| #2 | 209.14' | 83,575 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 83,580 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 209.14 | 11,144 | 0 | 0 |
| 209.64 | 11,144 | 5,572 | 5,572 |
| 210.14 | 11,144 | 5,572 | 11,144 |
| 210.64 | 11,144 | 5,572 | 16,716 |
| 211.14 | 11,144 | 5,572 | 22,288 |
| 211.64 | 11,144 | 5,572 | 27,860 |
| 212.14 | 11,144 | 5,572 | 33,432 |
| 212.64 | 11,144 | 5,572 | 39,004 |
| 213.14 | 11,144 | 5,572 | 44,576 |
| 213.64 | 11,144 | 5,572 | 50,148 |
| 214.14 | 11,144 | 5,572 | 55,720 |
| 214.64 | 11,144 | 5,572 | 61,292 |
| 215.14 | 11,144 | 5,572 | 66,864 |
| 215.64 | 11,144 | 5,572 | 72,436 |
| 216.14 | 11,144 | 5,572 | 78,008 |
| 216.64 | 11,144 | 5,572 | 83,580 |

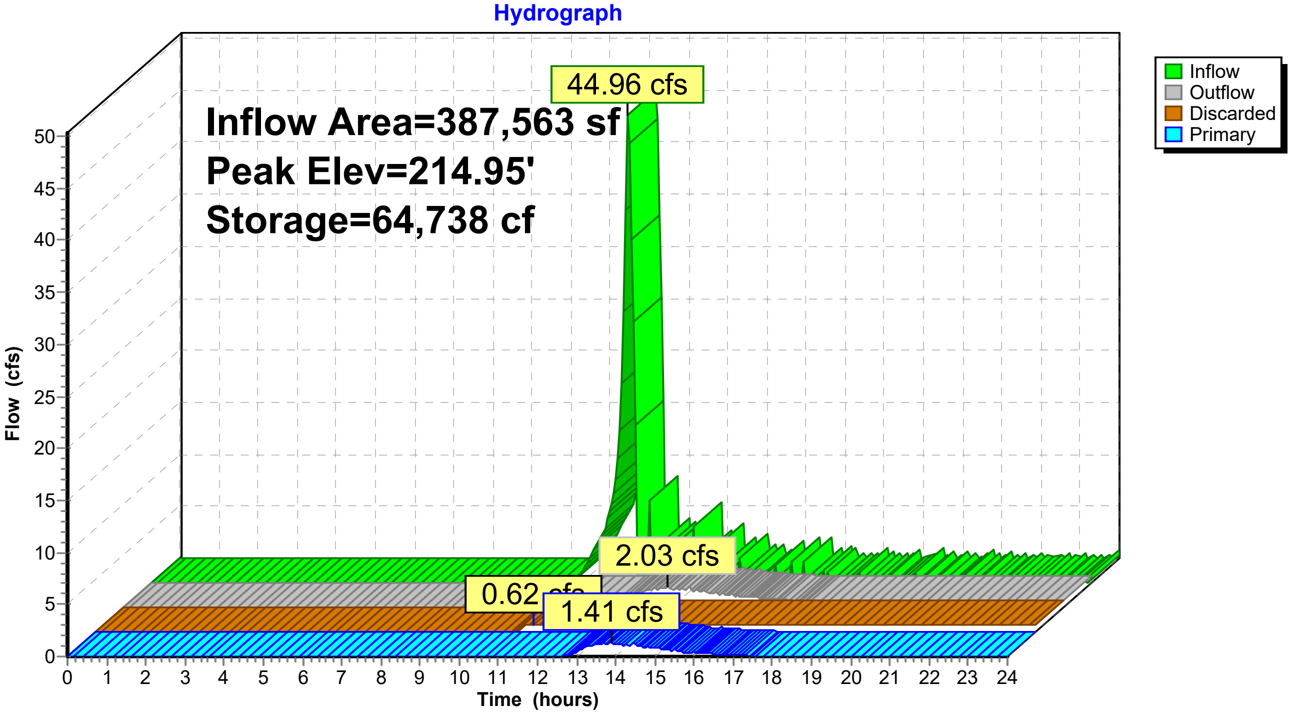
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 209.14 | 0 |
| 209.64 | 5,572 |
| 210.14 | 11,144 |
| 210.64 | 16,715 |
| 211.14 | 22,287 |
| 211.64 | 27,858 |
| 212.14 | 33,430 |
| 212.64 | 39,002 |
| 213.14 | 44,573 |
| 213.64 | 50,145 |
| 214.14 | 55,717 |
| 214.64 | 61,289 |
| 215.14 | 66,860 |
| 215.64 | 72,432 |
| 216.14 | 78,004 |
| 216.64 | 83,575 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 209.14' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 214.64' | **15.0" Round Culvert X 4.00**<br>L= 12.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 214.64' / 214.40' S= 0.0200 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf |

**Discarded OutFlow** Max=0.62 cfs @ 11.20 hrs HW=209.23' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.62 cfs)

**Primary OutFlow** Max=1.38 cfs @ 13.89 hrs HW=214.95' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Inlet Controls 1.38 cfs @ 1.49 fps)

## Pond 69P: STORMTRAP 7.5 FT SYSTEM B



## Summary for Pond 70P: STORMTRAP 4 FT SYSTEM A

Inflow Area = 532,500 sf, 90.16% Impervious, Inflow Depth > 5.57" for 25-Year event
Inflow = 72.46 cfs @ 12.13 hrs, Volume= 247,159 cf
Outflow = 4.67 cfs @ 13.47 hrs, Volume= 185,565 cf, Atten= 94%, Lag= 80.8 min
Discarded = 2.56 cfs @ 10.55 hrs, Volume= 164,514 cf
Primary = 2.11 cfs @ 13.47 hrs, Volume= 21,051 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 187.29' @ 13.47 hrs Surf.Area= 45,880 sf Storage= 112,762 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 131.1 min ( 888.3 - 757.2 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 184.83' | 0 cf | **Custom Stage Data (Prismatic)** Listed below<br>183,520 cf Overall - 183,520 cf Embedded = 0 cf |
| #2 | 184.83' | 183,520 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 183,520 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 184.83 | 45,880 | 0 | 0 |
| 185.33 | 45,880 | 22,940 | 22,940 |
| 185.83 | 45,880 | 22,940 | 45,880 |
| 186.33 | 45,880 | 22,940 | 68,820 |
| 186.83 | 45,880 | 22,940 | 91,760 |
| 187.33 | 45,880 | 22,940 | 114,700 |
| 187.83 | 45,880 | 22,940 | 137,640 |
| 188.33 | 45,880 | 22,940 | 160,580 |
| 188.83 | 45,880 | 22,940 | 183,520 |

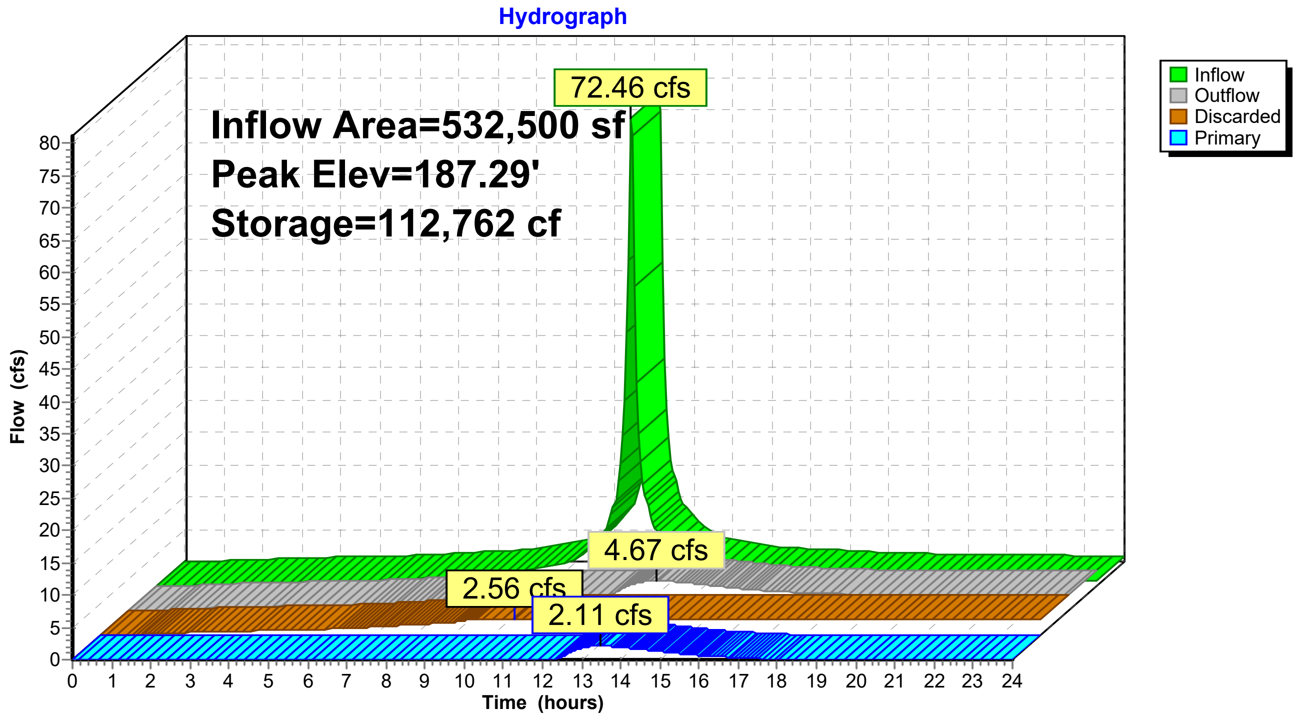
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 184.83 | 0 |
| 185.33 | 22,940 |
| 185.83 | 45,880 |
| 186.33 | 68,820 |
| 186.83 | 91,760 |
| 187.33 | 114,700 |
| 187.83 | 137,640 |
| 188.33 | 160,580 |
| 188.83 | 183,520 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 184.83' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 186.80' | **15.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=2.56 cfs @ 10.55 hrs HW=184.87' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 2.56 cfs)

**Primary OutFlow** Max=2.11 cfs @ 13.47 hrs HW=187.29' TW=0.00' (Dynamic Tailwater)
↑—**2=Orifice/Grate** (Orifice Controls 2.11 cfs @ 2.38 fps)

## Pond 70P: STORMTRAP 4 FT SYSTEM A



## Summary for Subcatchment PR-1: TO WQU-1

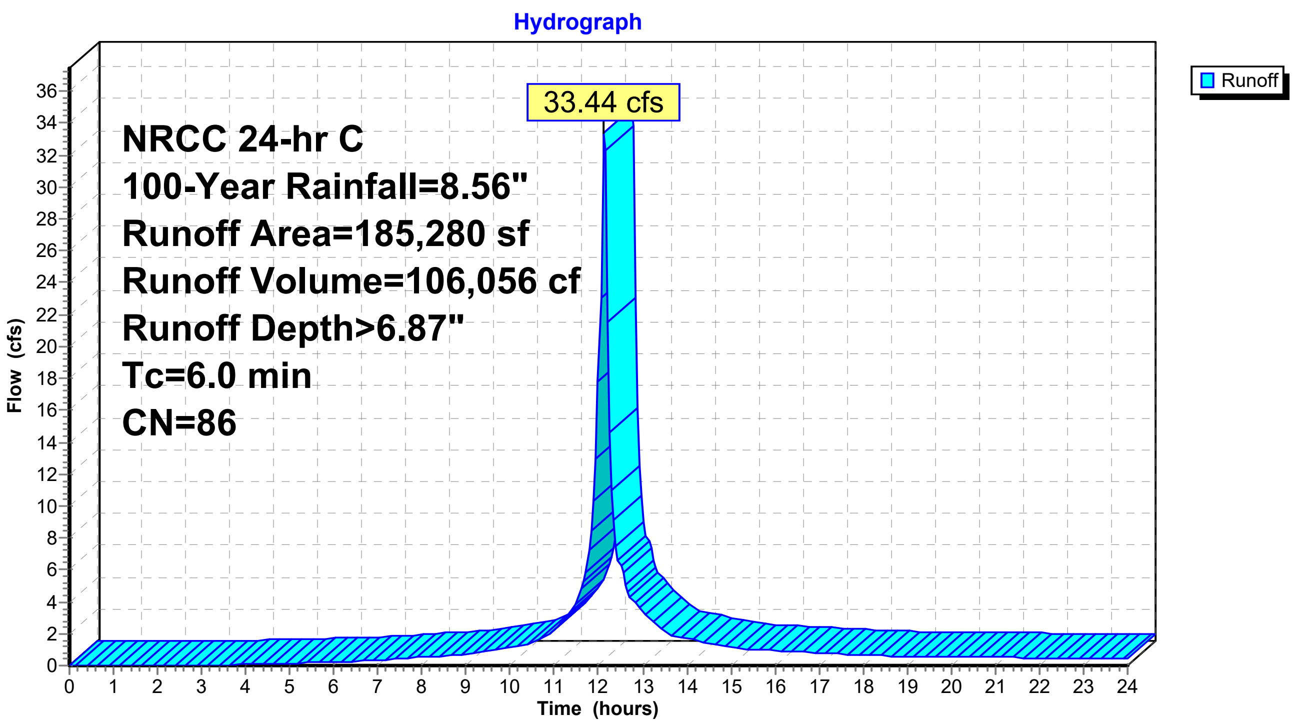
Runoff = 33.44 cfs @ 12.13 hrs, Volume= 106,056 cf, Depth> 6.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 96,140 | 98 | IMPERVIOUS |
| | 89,140 | 74 | >75% Grass cover, Good, HSG C |
| | 185,280 | 86 | Weighted Average |
| | 89,140 | | 48.11% Pervious Area |
| | 96,140 | | 51.89% Impervious Area |

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

## Subcatchment PR-1: TO WQU-1



## Summary for Subcatchment PR-10: TO WETLANDS CENTER

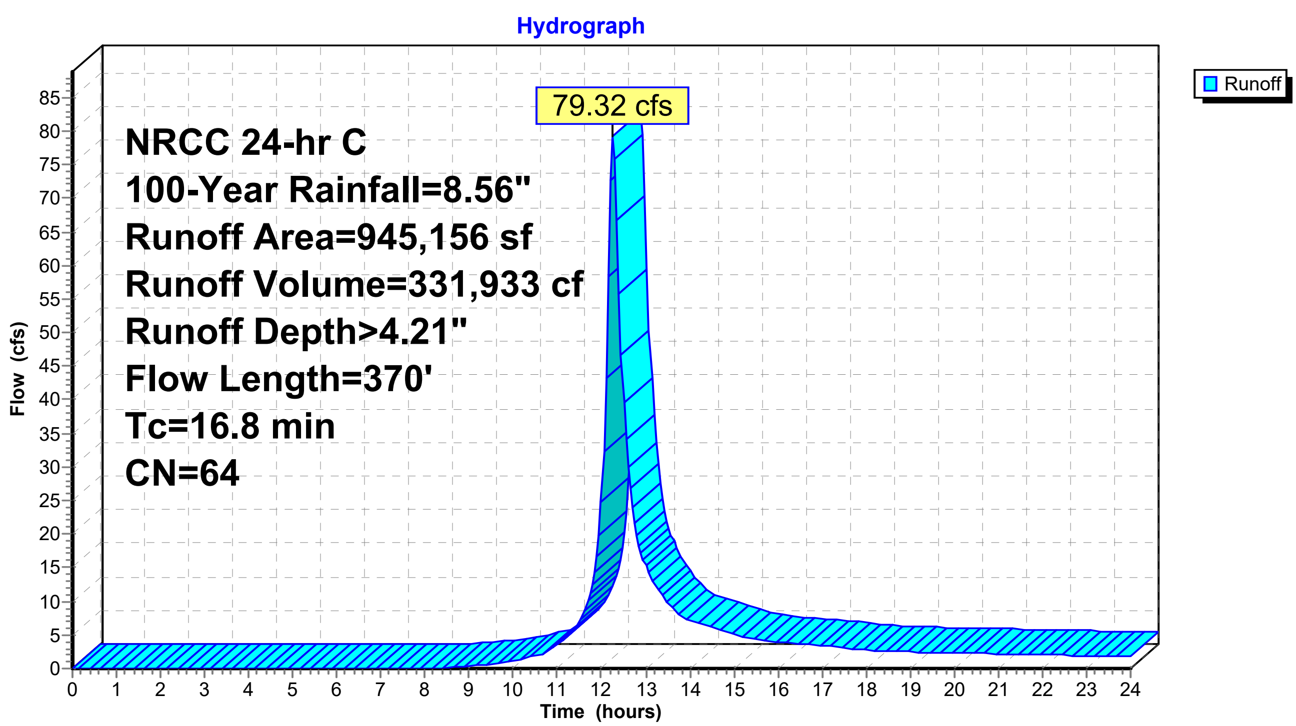
Runoff = 79.32 cfs @ 12.26 hrs, Volume= 331,933 cf, Depth> 4.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| Area (sf) | CN | Description |
|---|---|---|
| 409,457 | 55 | Woods, Good, HSG B |
| 277,625 | 70 | Woods, Good, HSG C |
| 128,687 | 77 | Woods, Good, HSG D |
| 75,015 | 61 | >75% Grass cover, Good, HSG B |
| 54,372 | 74 | >75% Grass cover, Good, HSG C |
| 945,156 | 64 | Weighted Average |
| 945,156 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.8 | 50 | 0.0500 | 0.09 | | **Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.00" |
| 0.7 | 45 | 0.0444 | 1.05 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 7.3 | 275 | 0.0156 | 0.62 | | **Shallow Concentrated Flow,** Woodland Kv= 5.0 fps |
| 16.8 | 370 | Total | | | |

## Subcatchment PR-10: TO WETLANDS CENTER



## Summary for Subcatchment PR-11A: TO INNOVATION WAY (2009 CITY LAYOUT)

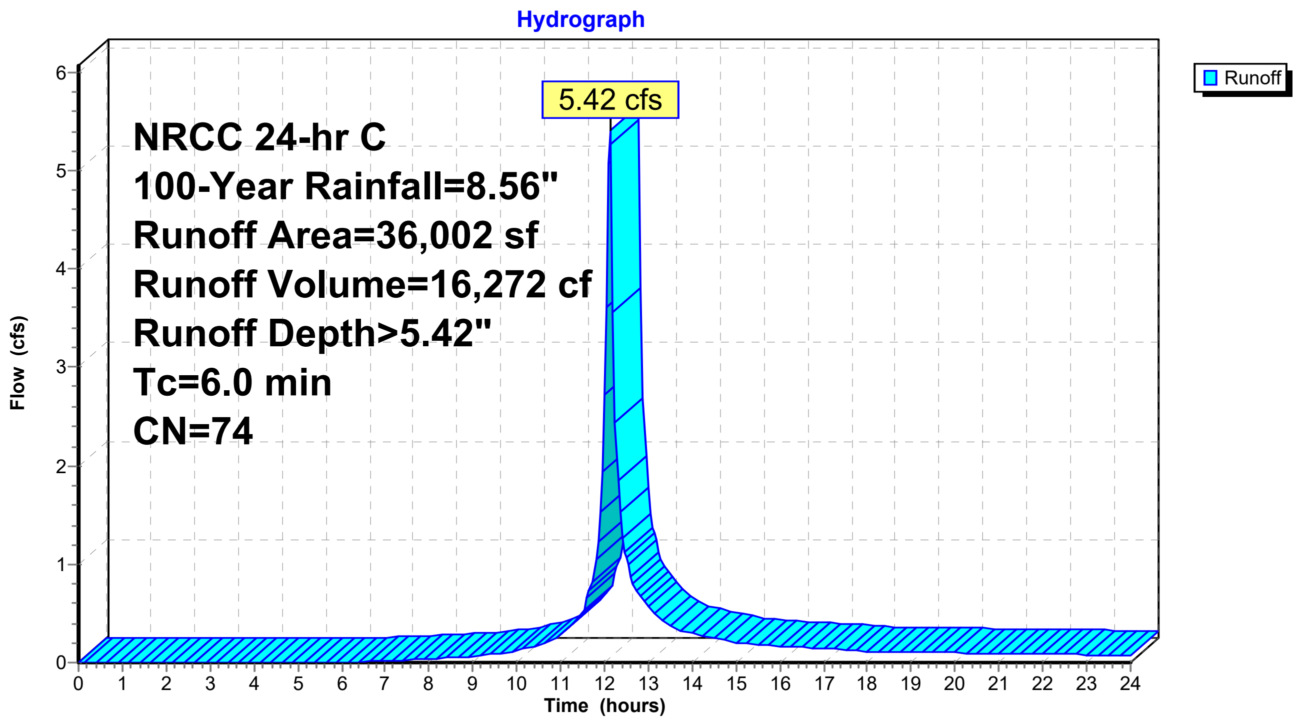
Runoff = 5.42 cfs @ 12.13 hrs, Volume= 16,272 cf, Depth> 5.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 35,261 | 74 | >75% Grass cover, Good, HSG C |
| * | 741 | 70 | IMPERVIOUS |
| | 36,002 | 74 | Weighted Average |
| | 36,002 | | 100.00% Pervious Area |

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

### Subcatchment PR-11A: TO INNOVATION WAY (2009 CITY LAYOUT)



## Summary for Subcatchment PR-11B: TO INNOVATION WAY (2009 SHLO)

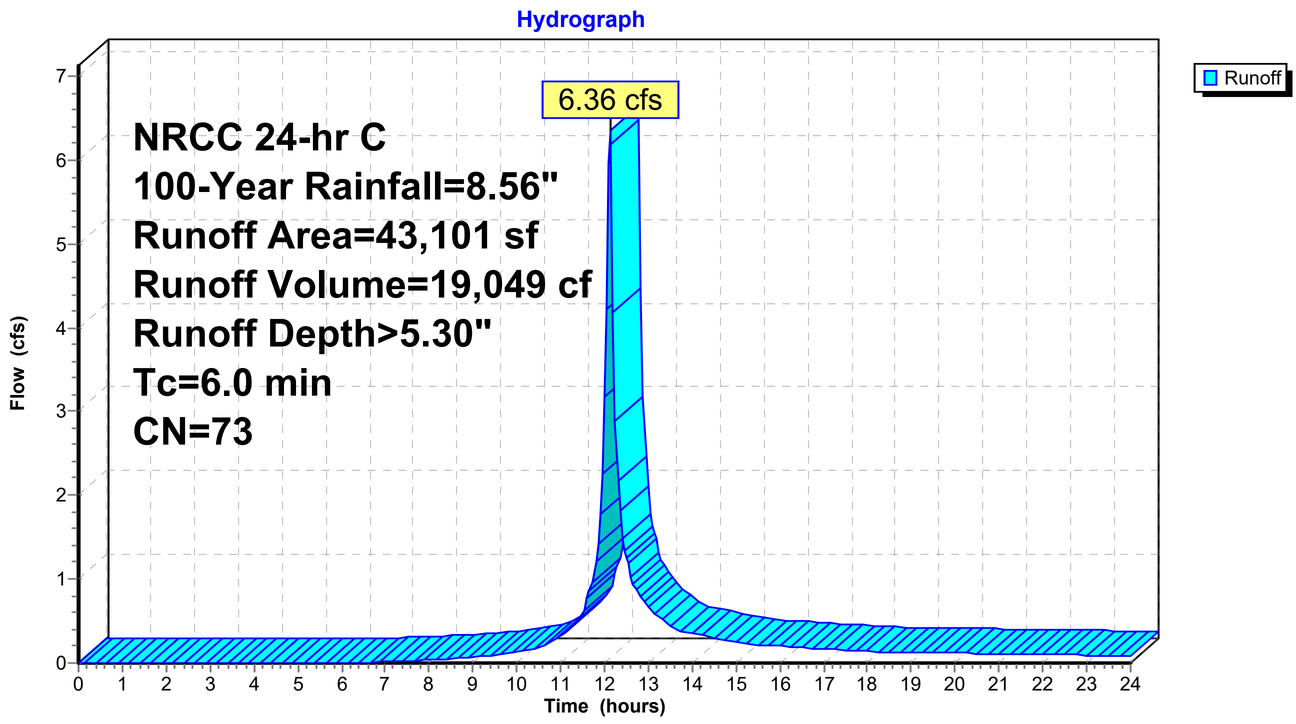
Runoff = 6.36 cfs @ 12.13 hrs, Volume= 19,049 cf, Depth> 5.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| Area (sf) | CN | Description |
|---|---|---|
| 37,380 | 74 | >75% Grass cover, Good, HSG C |
| 5,721 | 70 | Woods, Good, HSG C |
| 43,101 | 73 | Weighted Average |
| 43,101 | | 100.00% Pervious Area |

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

## Subcatchment PR-11B: TO INNOVATION WAY (2009 SHLO)



## Summary for Subcatchment PR-12: TO WQU-6

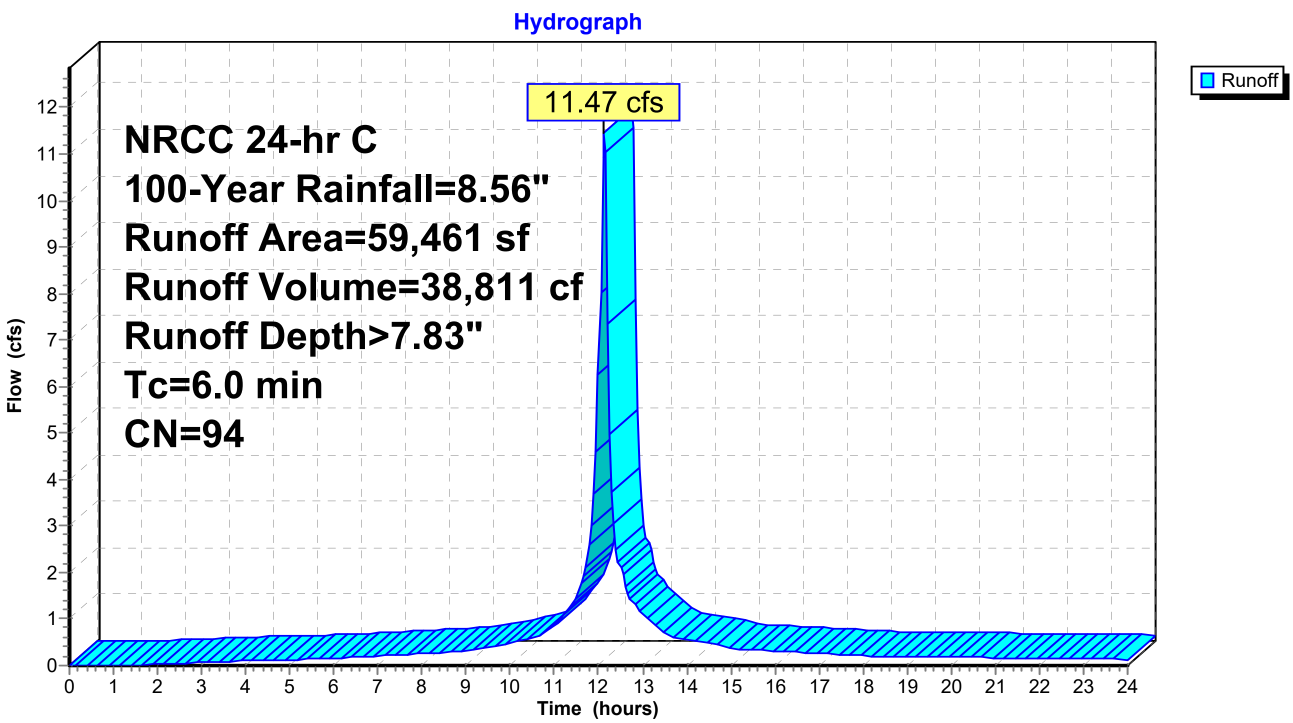
Runoff = 11.47 cfs @ 12.13 hrs, Volume= 38,811 cf, Depth> 7.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 50,470 | 98 | IMPERVIOUS |
| | 8,991 | 74 | >75% Grass cover, Good, HSG C |
| | 59,461 | 94 | Weighted Average |
| | 8,991 | | 15.12% Pervious Area |
| | 50,470 | | 84.88% Impervious Area |

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

### Subcatchment PR-12: TO WQU-6



## Summary for Subcatchment PR-13: TO WQU-7

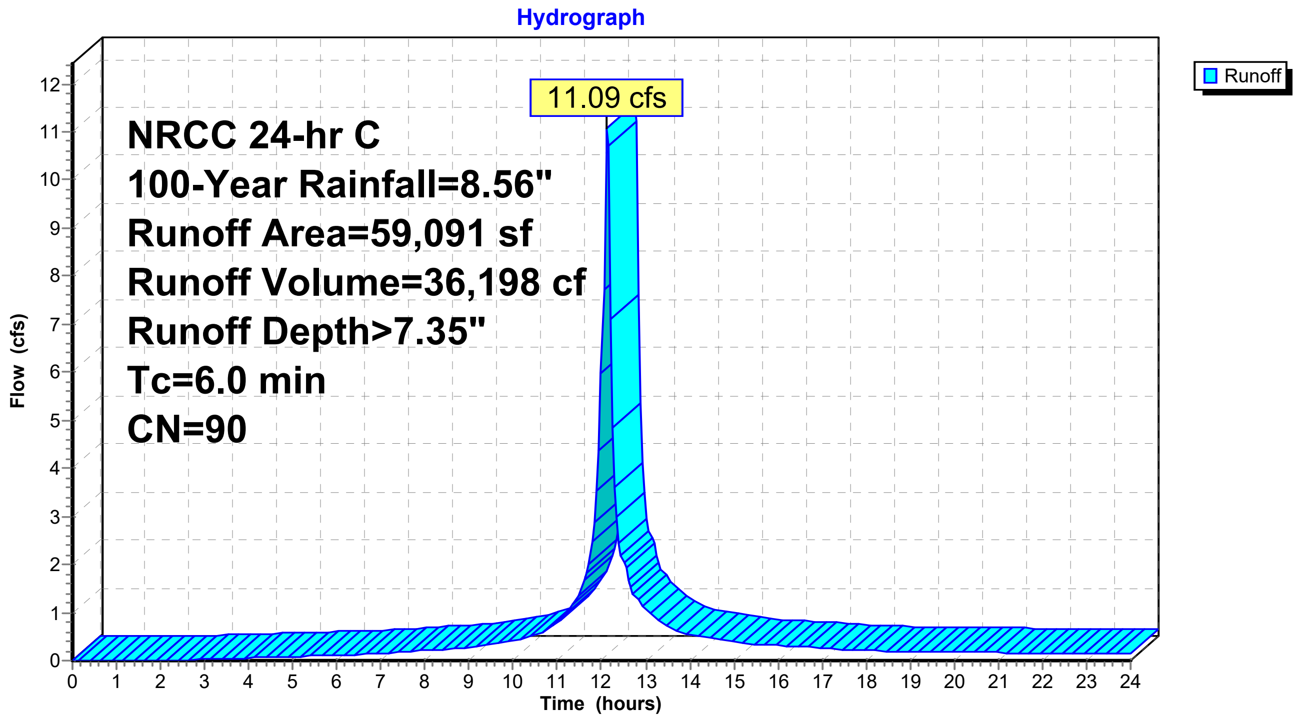
Runoff = 11.09 cfs @ 12.13 hrs, Volume= 36,198 cf, Depth> 7.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 46,105 | 98 | IMPERVIOUS |
| | 12,986 | 61 | >75% Grass cover, Good, HSG B |
| | 59,091 | 90 | Weighted Average |
| | 12,986 | | 21.98% Pervious Area |
| | 46,105 | | 78.02% Impervious Area |

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

## Subcatchment PR-13: TO WQU-7



## Summary for Subcatchment PR-14: TO WQU-8

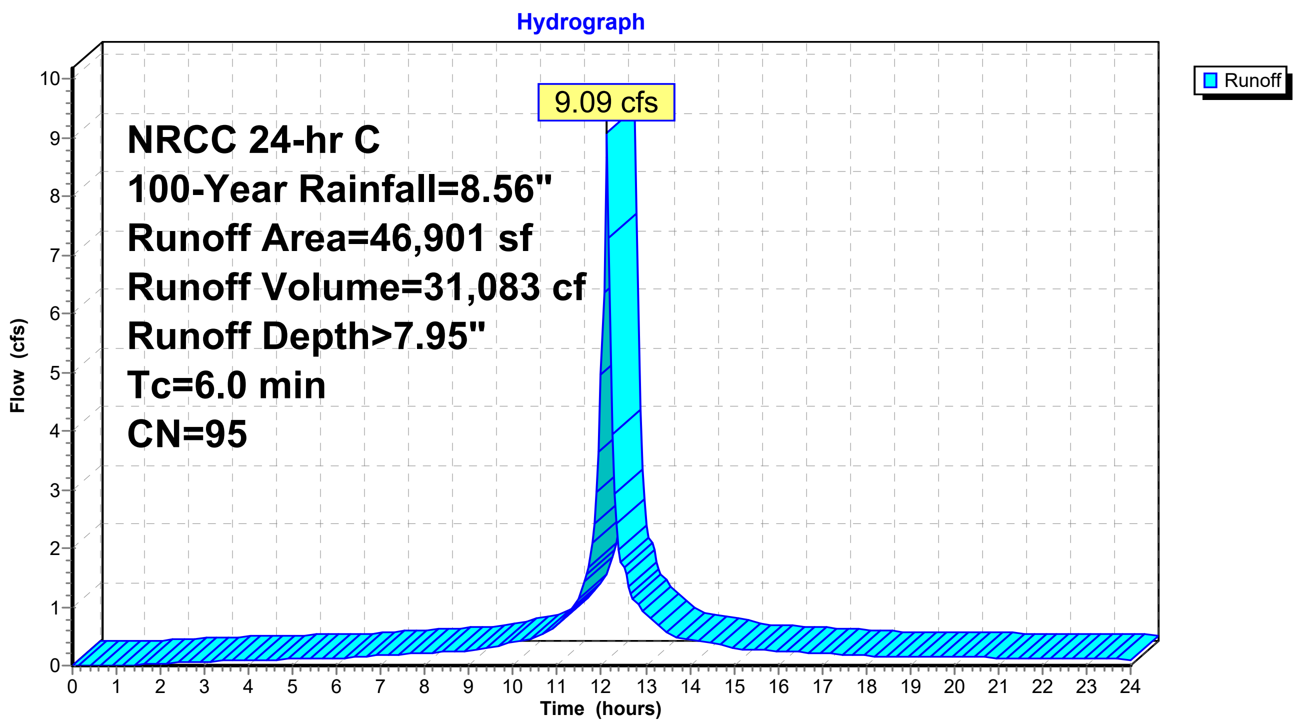
Runoff = 9.09 cfs @ 12.13 hrs, Volume= 31,083 cf, Depth> 7.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 42,641 | 98 | IMPERVIOUS |
| | 4,260 | 61 | >75% Grass cover, Good, HSG B |
| | 46,901 | 95 | Weighted Average |
| | 4,260 | | 9.08% Pervious Area |
| | 42,641 | | 90.92% Impervious Area |

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

## Subcatchment PR-14: TO WQU-8



## Summary for Subcatchment PR-15: TO WQU-9

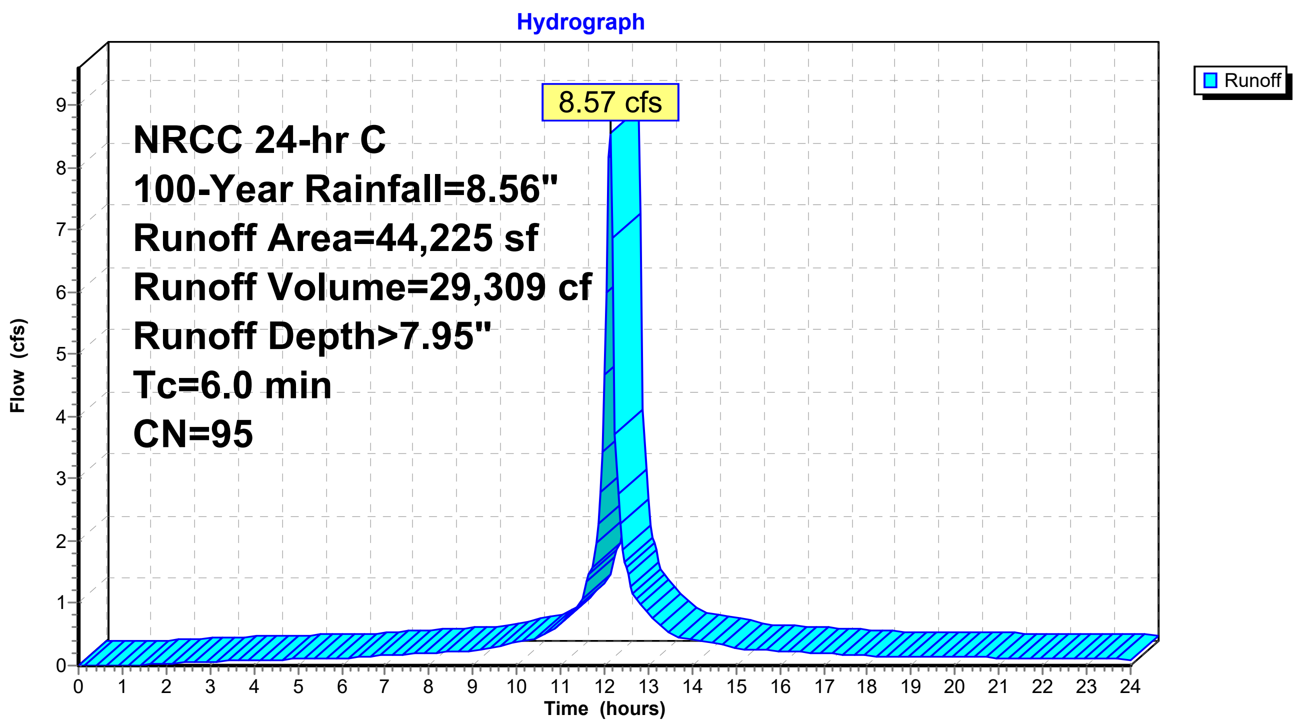
Runoff = 8.57 cfs @ 12.13 hrs, Volume= 29,309 cf, Depth> 7.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 40,778 | 98 | IMPERVIOUS |
| | 3,447 | 61 | >75% Grass cover, Good, HSG B |
| | 44,225 | 95 | Weighted Average |
| | 3,447 | | 7.79% Pervious Area |
| | 40,778 | | 92.21% Impervious Area |

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

## Subcatchment PR-15: TO WQU-9



## Summary for Subcatchment PR-16: TO WQU-10

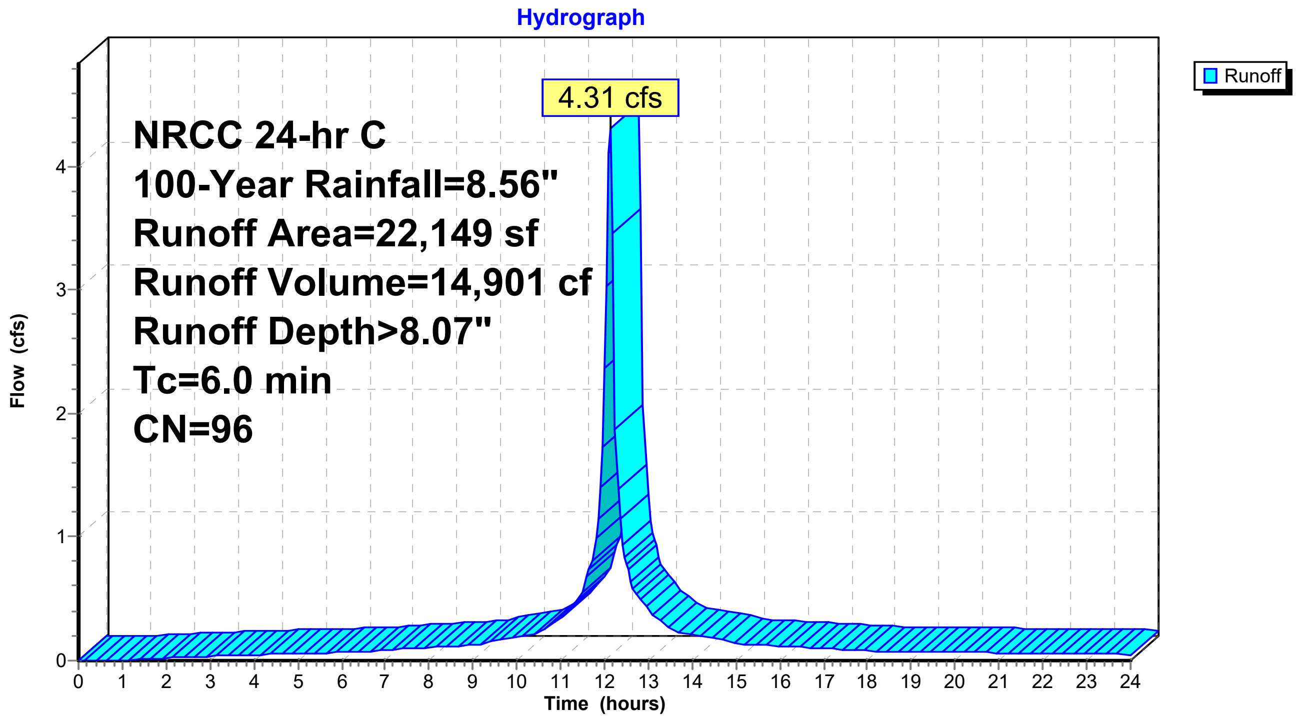
Runoff = 4.31 cfs @ 12.13 hrs, Volume= 14,901 cf, Depth> 8.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 21,009 | 98 | IMPERVIOUS |
| | 1,140 | 61 | >75% Grass cover, Good, HSG B |
| | 22,149 | 96 | Weighted Average |
| | 1,140 | | 5.15% Pervious Area |
| | 21,009 | | 94.85% Impervious Area |

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

### Subcatchment PR-16: TO WQU-10



## Summary for Subcatchment PR-17: TO WQU-11

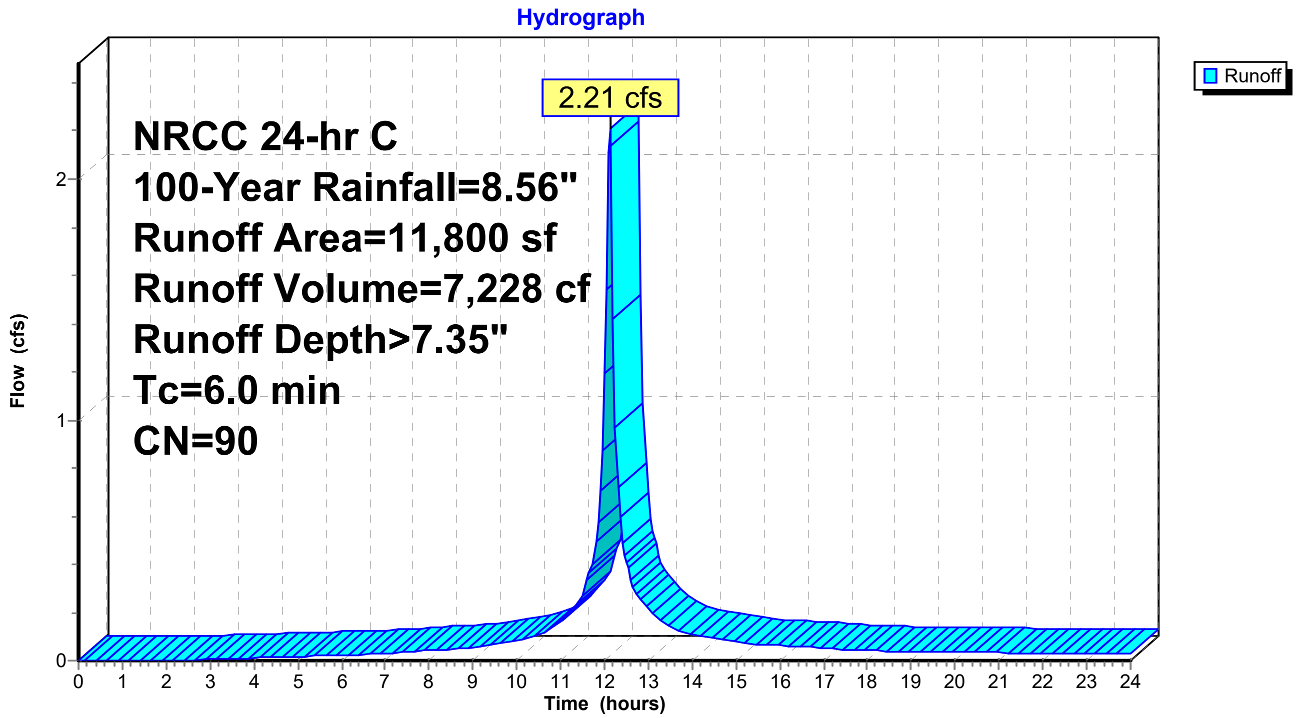
Runoff = 2.21 cfs @ 12.13 hrs, Volume= 7,228 cf, Depth> 7.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 7,968 | 98 | IMPERVIOUS |
| | 3,832 | 74 | >75% Grass cover, Good, HSG C |
| | 11,800 | 90 | Weighted Average |
| | 3,832 | | 32.47% Pervious Area |
| | 7,968 | | 67.53% Impervious Area |

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

### Subcatchment PR-17: TO WQU-11



## Summary for Subcatchment PR-18: TO WQU-12

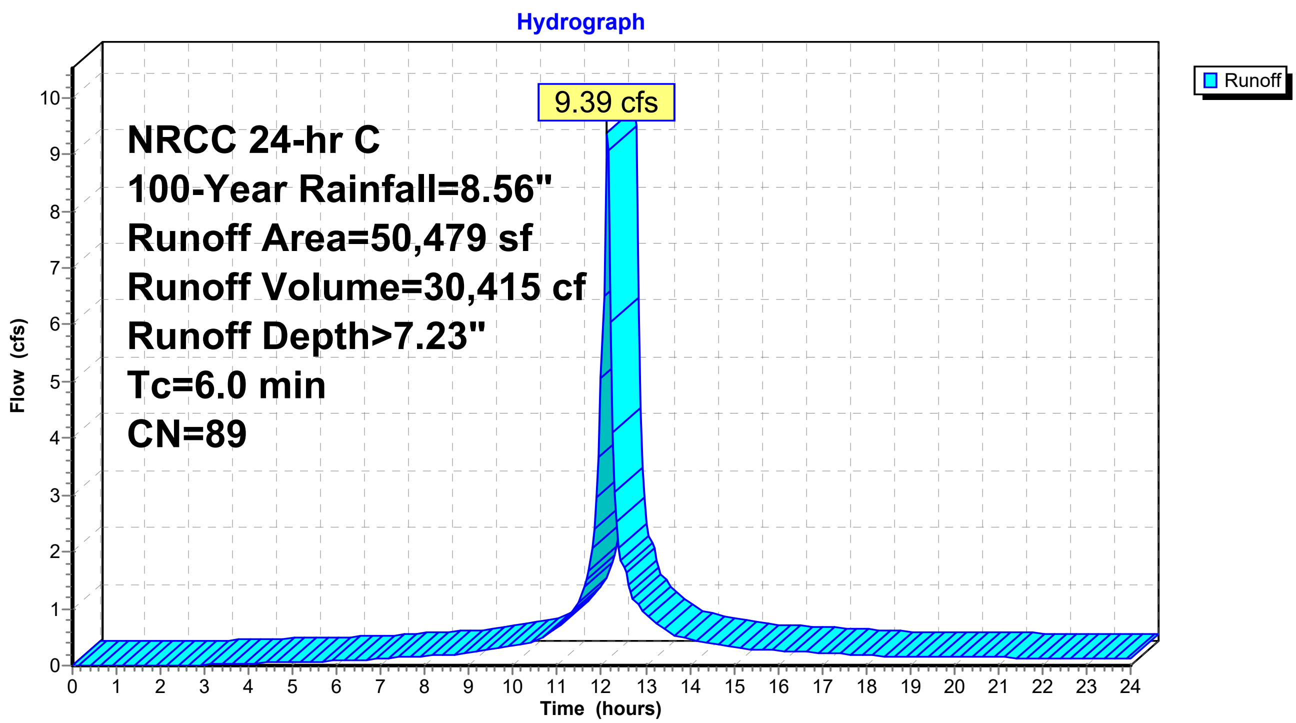
Runoff = 9.39 cfs @ 12.13 hrs, Volume= 30,415 cf, Depth> 7.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 31,033 | 98 | IMPERVIOUS |
| | 19,446 | 74 | >75% Grass cover, Good, HSG C |
| | 50,479 | 89 | Weighted Average |
| | 19,446 | | 38.52% Pervious Area |
| | 31,033 | | 61.48% Impervious Area |

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

### Subcatchment PR-18: TO WQU-12



## Summary for Subcatchment PR-19: TO WQU-13

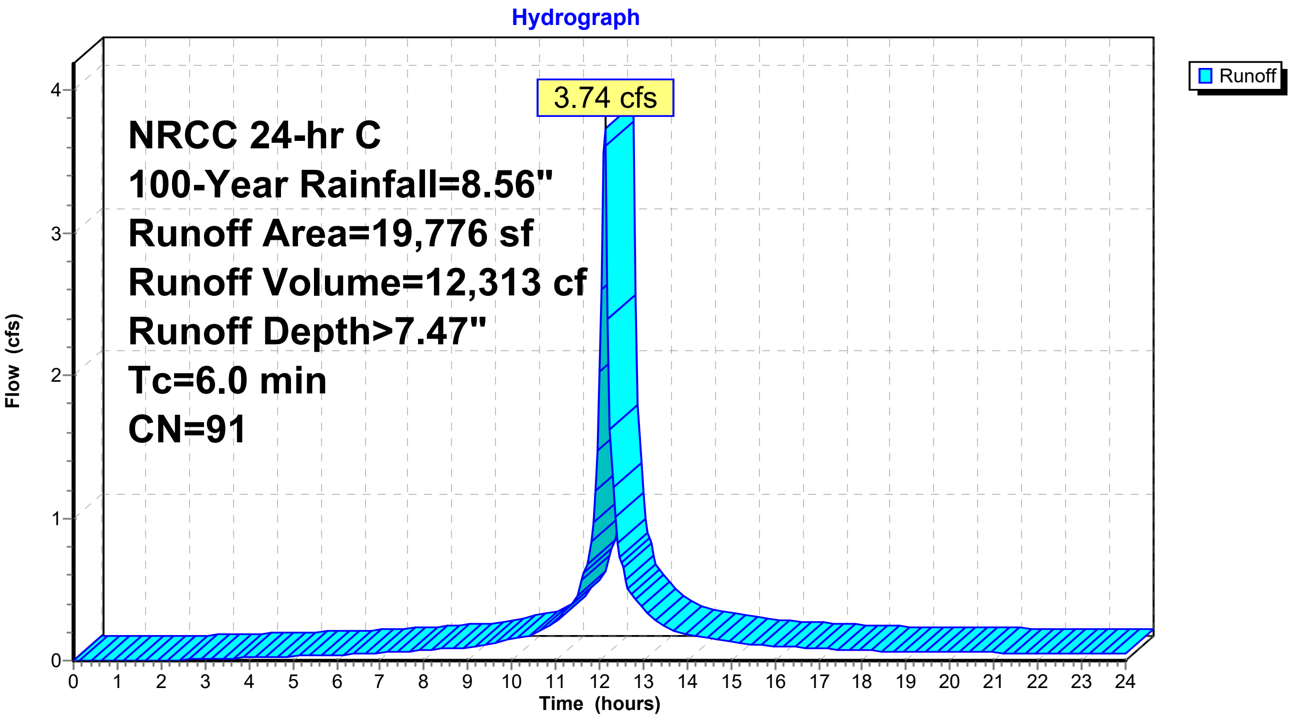
Runoff = 3.74 cfs @ 12.13 hrs, Volume= 12,313 cf, Depth> 7.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 14,228 | 98 | IMPERVIOUS |
| | 5,548 | 74 | >75% Grass cover, Good, HSG C |
| | 19,776 | 91 | Weighted Average |
| | 5,548 | | 28.05% Pervious Area |
| | 14,228 | | 71.95% Impervious Area |

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

## Subcatchment PR-19: TO WQU-13



## Summary for Subcatchment PR-2: TO PRETX

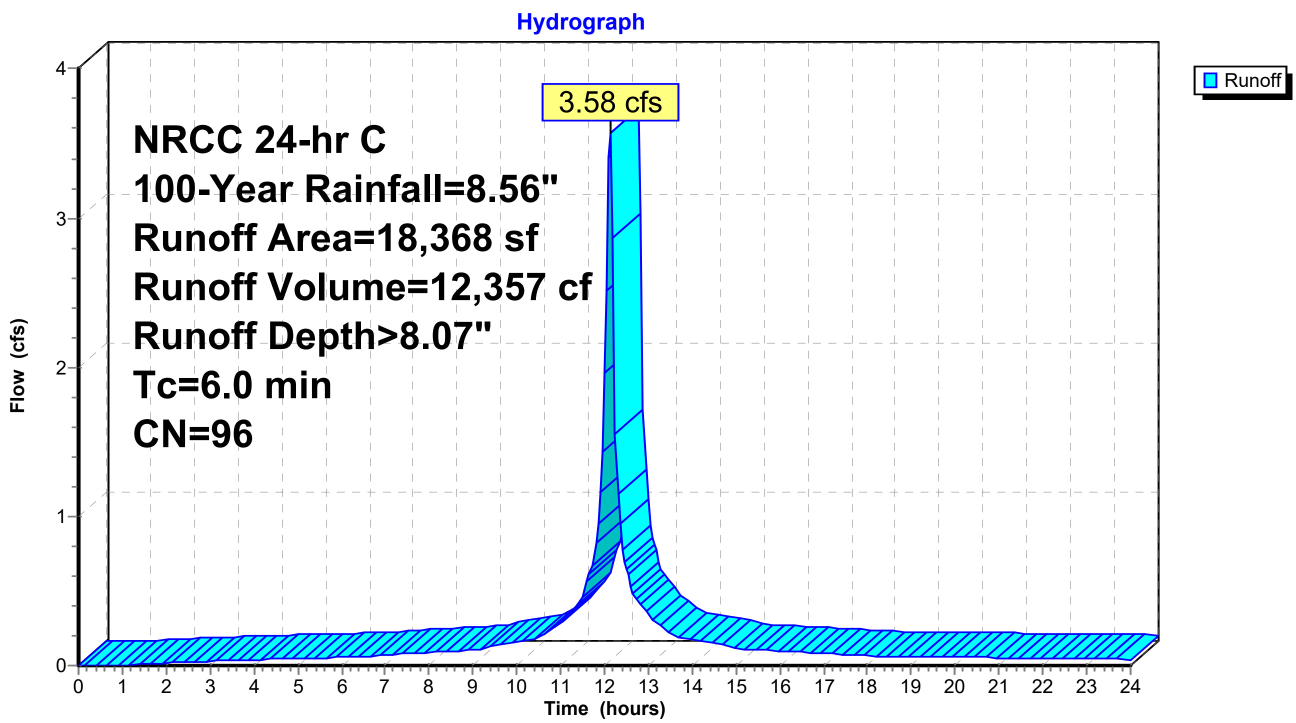
Runoff = 3.58 cfs @ 12.13 hrs, Volume= 12,357 cf, Depth> 8.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 16,637 | 98 | IMPERVIOUS |
| | 1,731 | 74 | >75% Grass cover, Good, HSG C |
| | 18,368 | 96 | Weighted Average |
| | 1,731 | | 9.42% Pervious Area |
| | 16,637 | | 90.58% Impervious Area |

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

## Subcatchment PR-2: TO PRETX



## Summary for Subcatchment PR-20: TO WQU-14

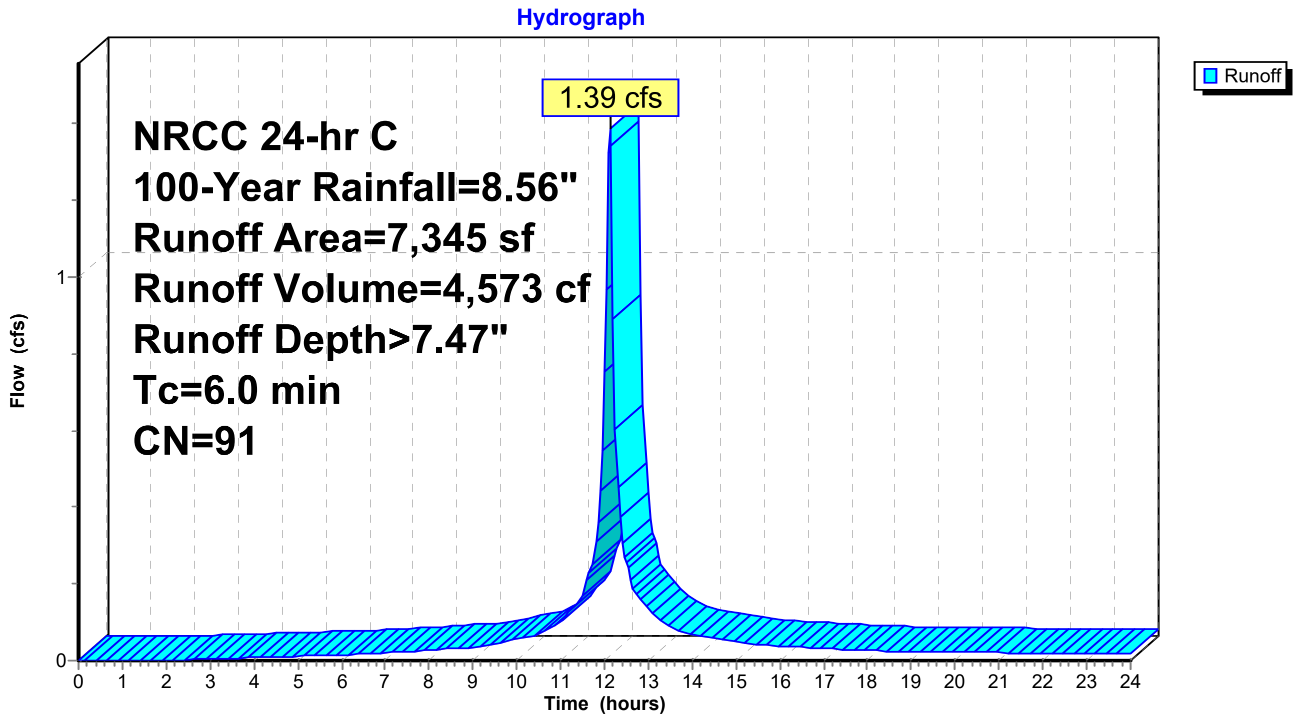
Runoff = 1.39 cfs @ 12.13 hrs, Volume= 4,573 cf, Depth> 7.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 5,138 | 98 | IMPERVIOUS |
| | 2,207 | 74 | >75% Grass cover, Good, HSG C |
| | 7,345 | 91 | Weighted Average |
| | 2,207 | | 30.05% Pervious Area |
| | 5,138 | | 69.95% Impervious Area |

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

### Subcatchment PR-20: TO WQU-14



## Summary for Subcatchment PR-21: TO WQU-15

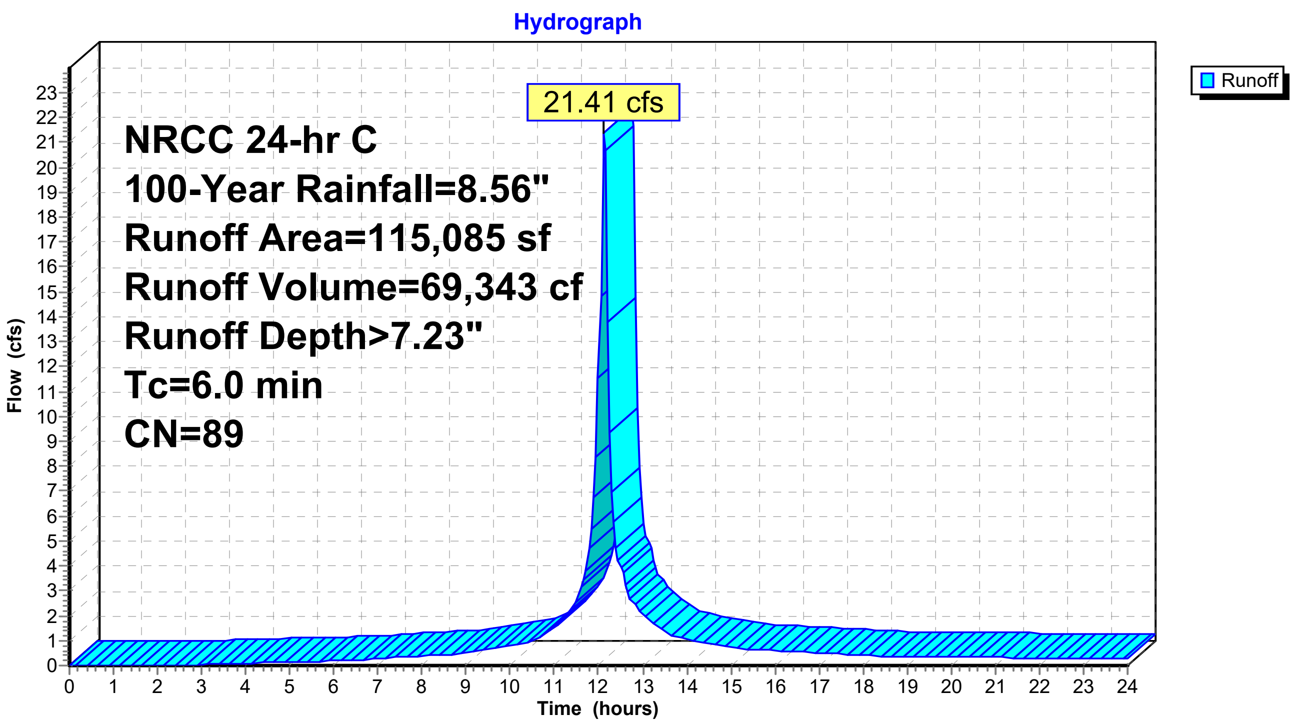
Runoff = 21.41 cfs @ 12.13 hrs, Volume= 69,343 cf, Depth> 7.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 71,553 | 98 | IMPERVIOUS |
| | 43,532 | 74 | >75% Grass cover, Good, HSG C |
| | 115,085 | 89 | Weighted Average |
| | 43,532 | | 37.83% Pervious Area |
| | 71,553 | | 62.17% Impervious Area |

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

### Subcatchment PR-21: TO WQU-15



## Summary for Subcatchment PR-22: TO WQU-16

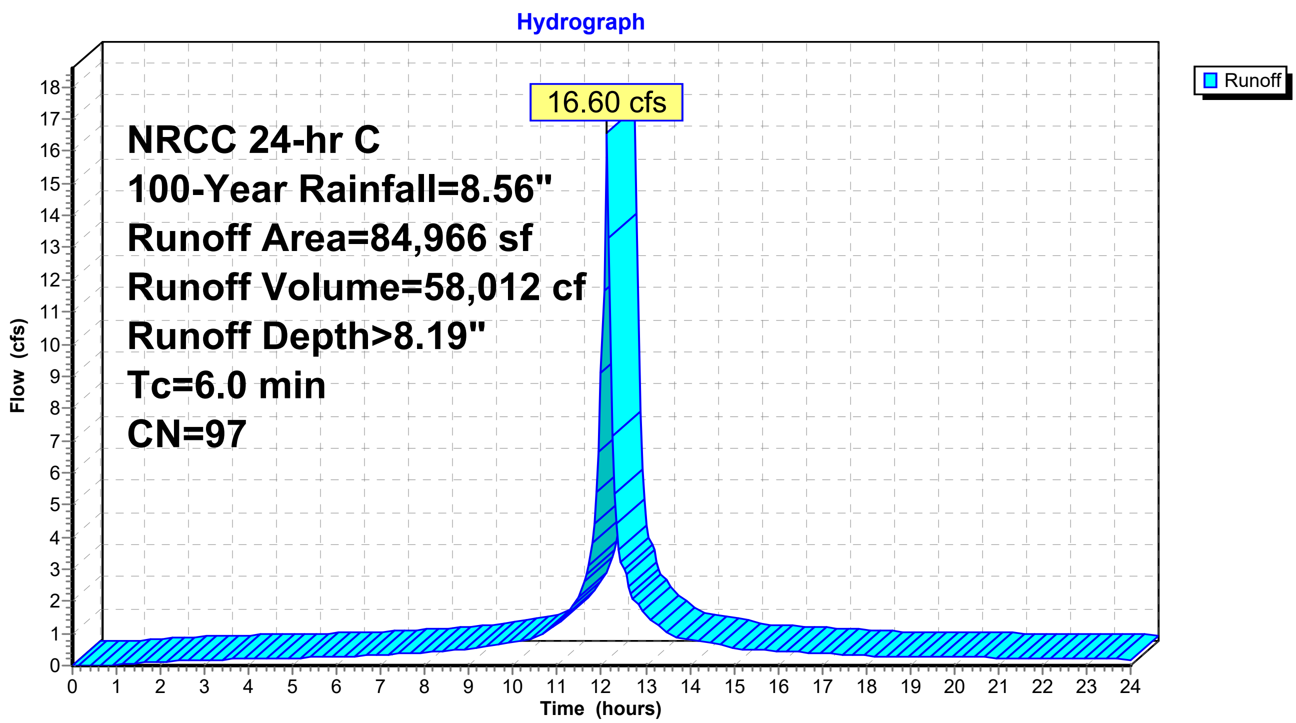
Runoff = 16.60 cfs @ 12.13 hrs, Volume= 58,012 cf, Depth> 8.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 2,771 | 74 | >75% Grass cover, Good, HSG C |
| * | 82,195 | 98 | IMPERVIOUS |
| | 84,966 | 97 | Weighted Average |
| | 2,771 | | 3.26% Pervious Area |
| | 82,195 | | 96.74% Impervious Area |

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

## Subcatchment PR-22: TO WQU-16



## Summary for Subcatchment PR-23: TO WQU-17

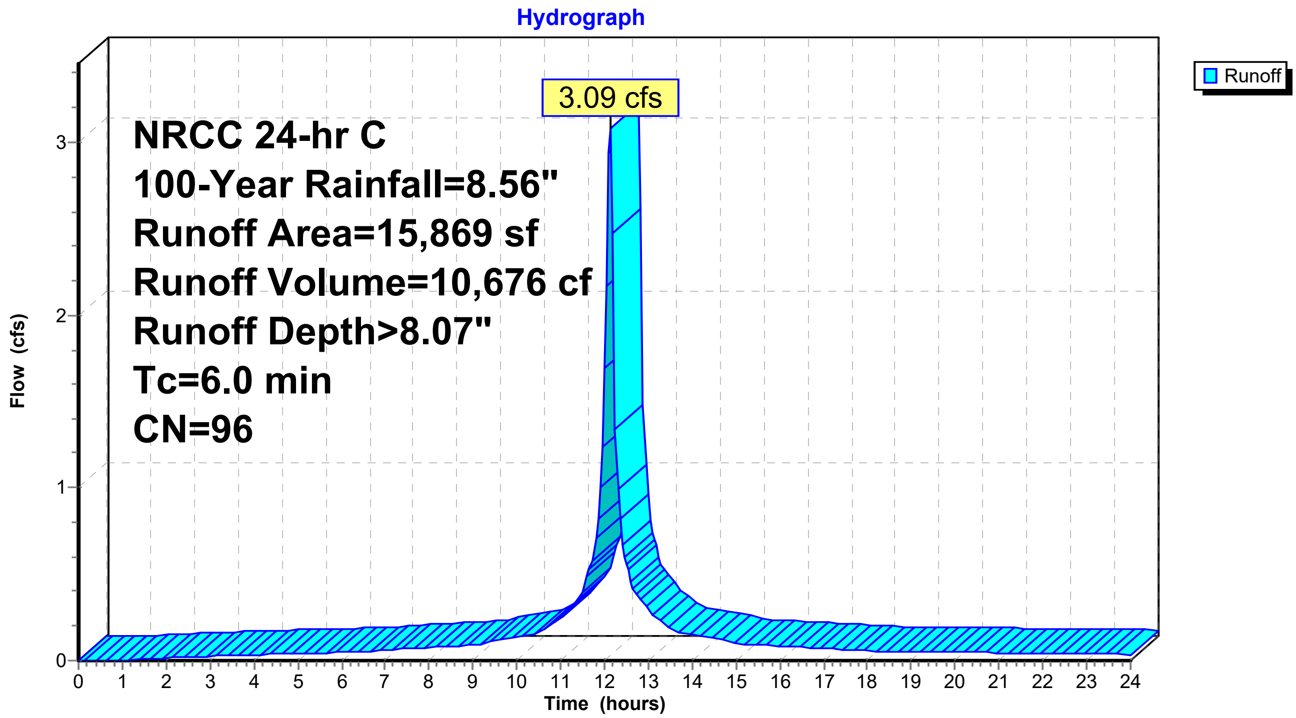
Runoff = 3.09 cfs @ 12.13 hrs, Volume= 10,676 cf, Depth> 8.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 14,403 | 98 | IMPERVIOUS |
| | 1,466 | 74 | >75% Grass cover, Good, HSG C |
| | 15,869 | 96 | Weighted Average |
| | 1,466 | | 9.24% Pervious Area |
| | 14,403 | | 90.76% Impervious Area |

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

## Subcatchment PR-23: TO WQU-17



## Summary for Subcatchment PR-24: TO WQU-18

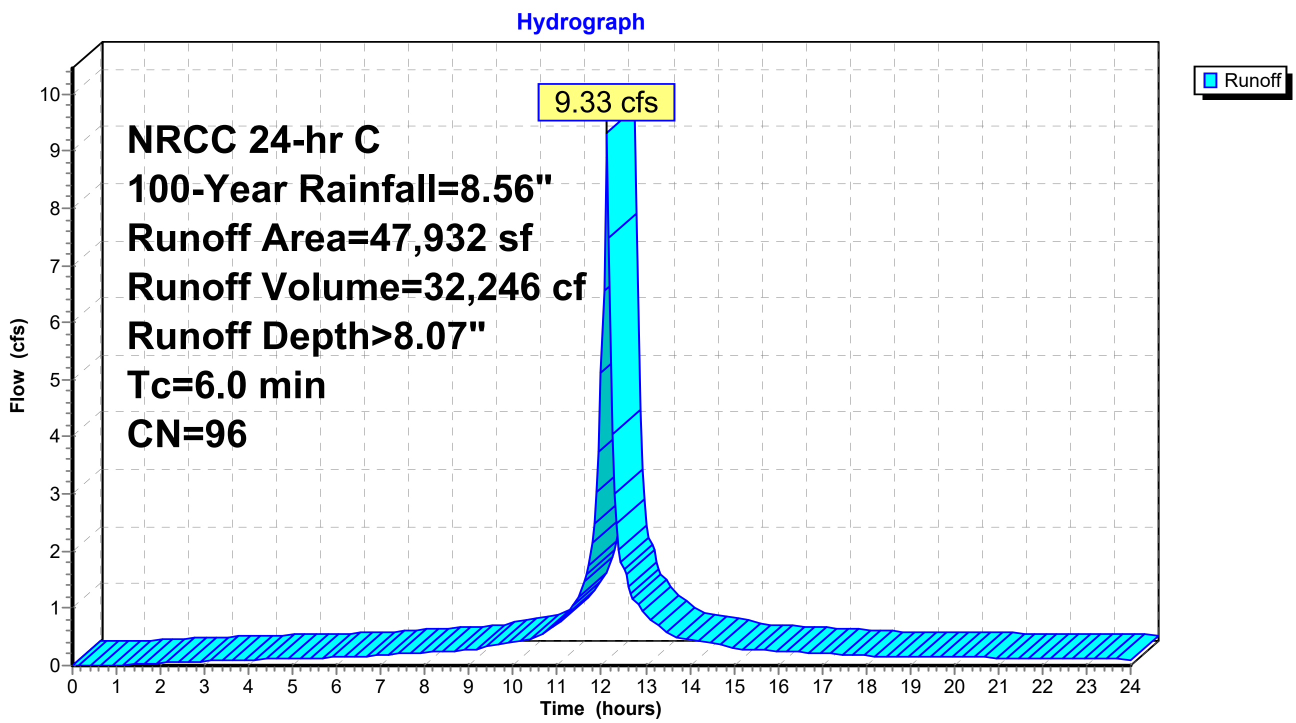
Runoff = 9.33 cfs @ 12.13 hrs, Volume= 32,246 cf, Depth> 8.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 4,668 | 74 | >75% Grass cover, Good, HSG C |
| * | 43,264 | 98 | IMPERVIOUS |
| | 47,932 | 96 | Weighted Average |
| | 4,668 | | 9.74% Pervious Area |
| | 43,264 | | 90.26% Impervious Area |

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

### Subcatchment PR-24: TO WQU-18



## Summary for Subcatchment PR-25: BUILDING 2 ROOF

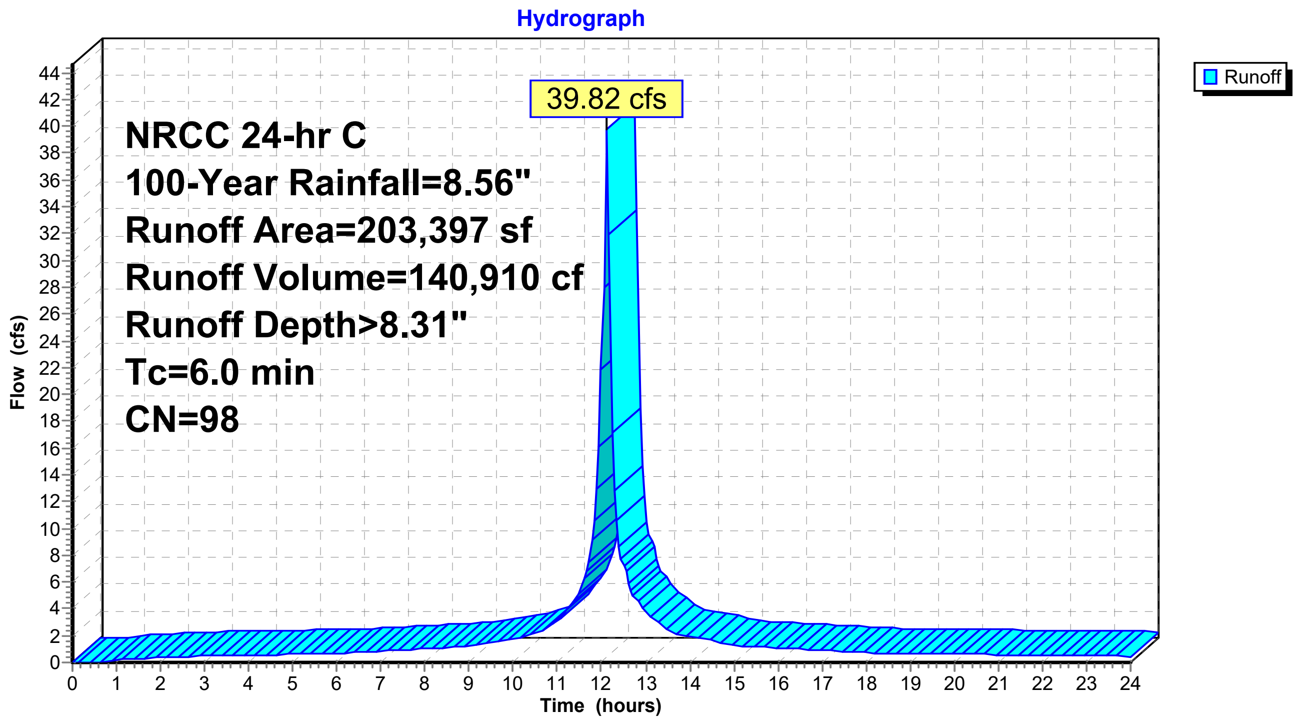
Runoff = 39.82 cfs @ 12.13 hrs, Volume= 140,910 cf, Depth> 8.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 203,397 | 98 | IMPERVIOUS |
| | 203,397 | | 100.00% Impervious Area |

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

## Subcatchment PR-25: BUILDING 2 ROOF



## Summary for Subcatchment PR-26: BUILDING 3 ROOF

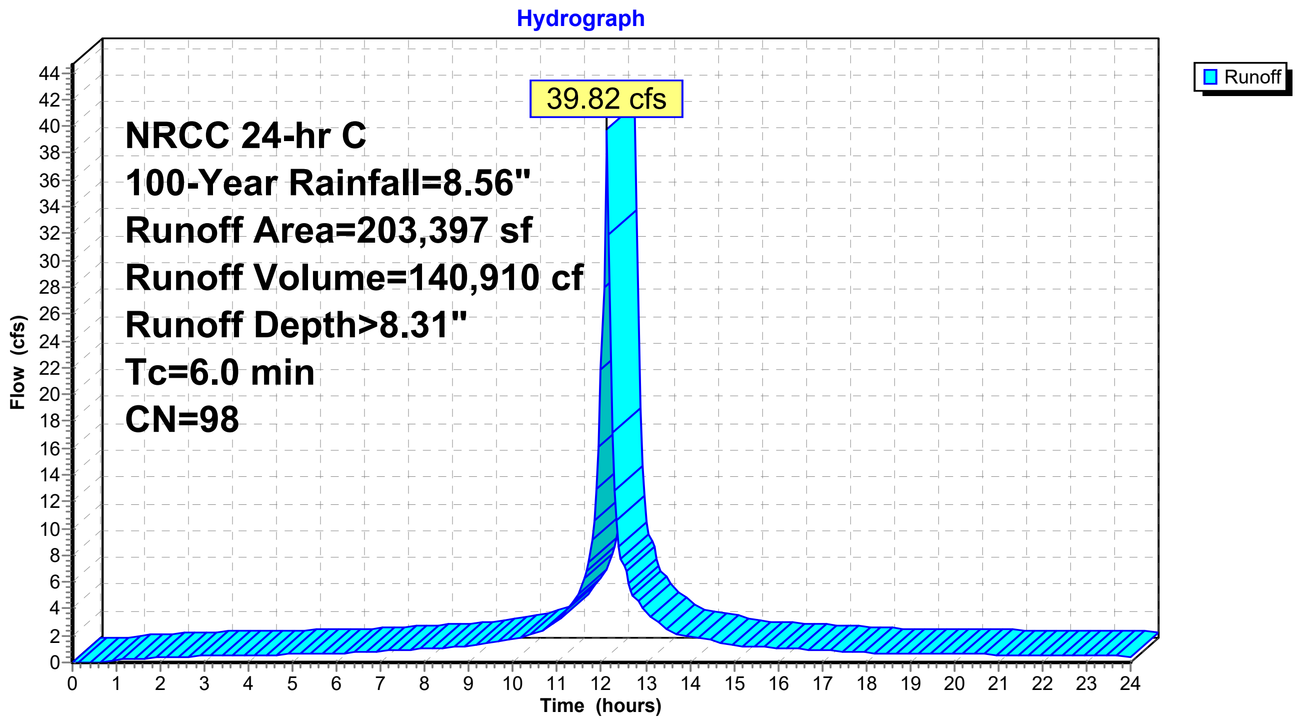
Runoff = 39.82 cfs @ 12.13 hrs, Volume= 140,910 cf, Depth> 8.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 203,397 | 98 | IMPERVIOUS |
| | 203,397 | | 100.00% Impervious Area |

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

### Subcatchment PR-26: BUILDING 3 ROOF



## Summary for Subcatchment PR-27: TO WQU-19

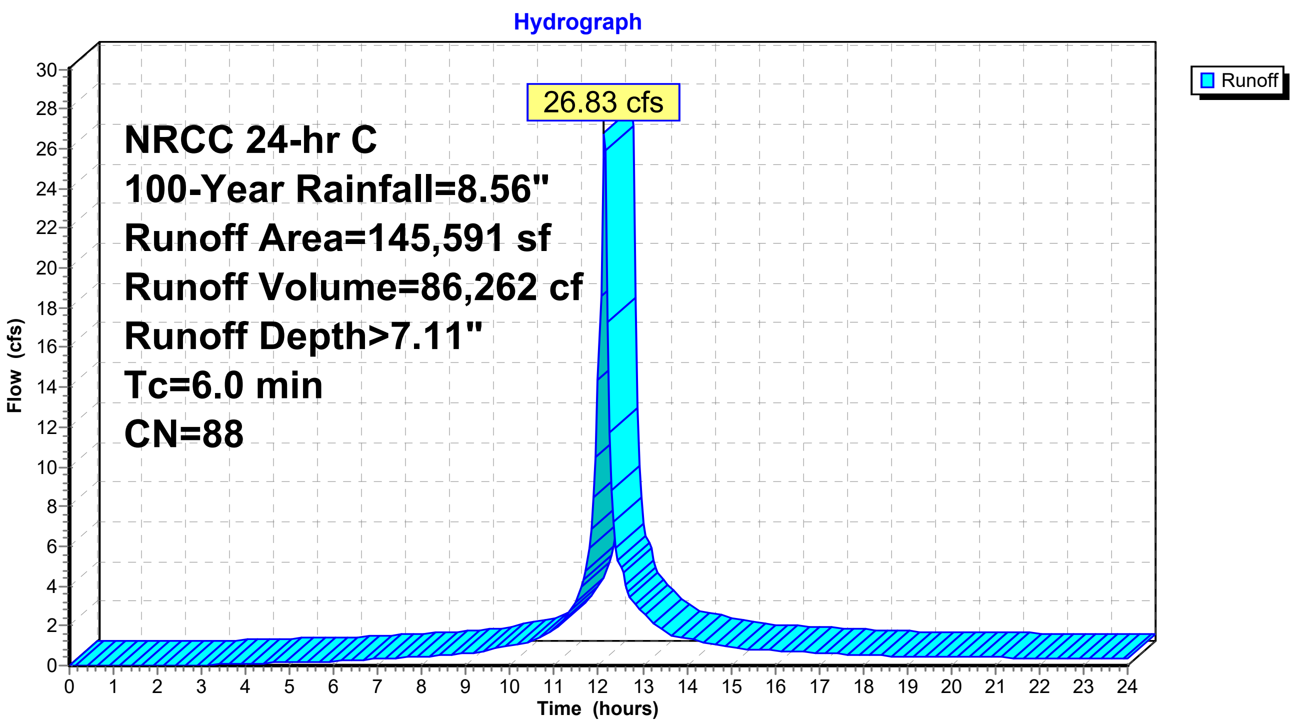
Runoff = 26.83 cfs @ 12.13 hrs, Volume= 86,262 cf, Depth> 7.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 105,426 | 98 | IMPERVIOUS |
| | 40,165 | 61 | >75% Grass cover, Good, HSG B |
| | 145,591 | 88 | Weighted Average |
| | 40,165 | | 27.59% Pervious Area |
| | 105,426 | | 72.41% Impervious Area |

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

### Subcatchment PR-27: TO WQU-19



## Summary for Subcatchment PR-28: TO WQU-20

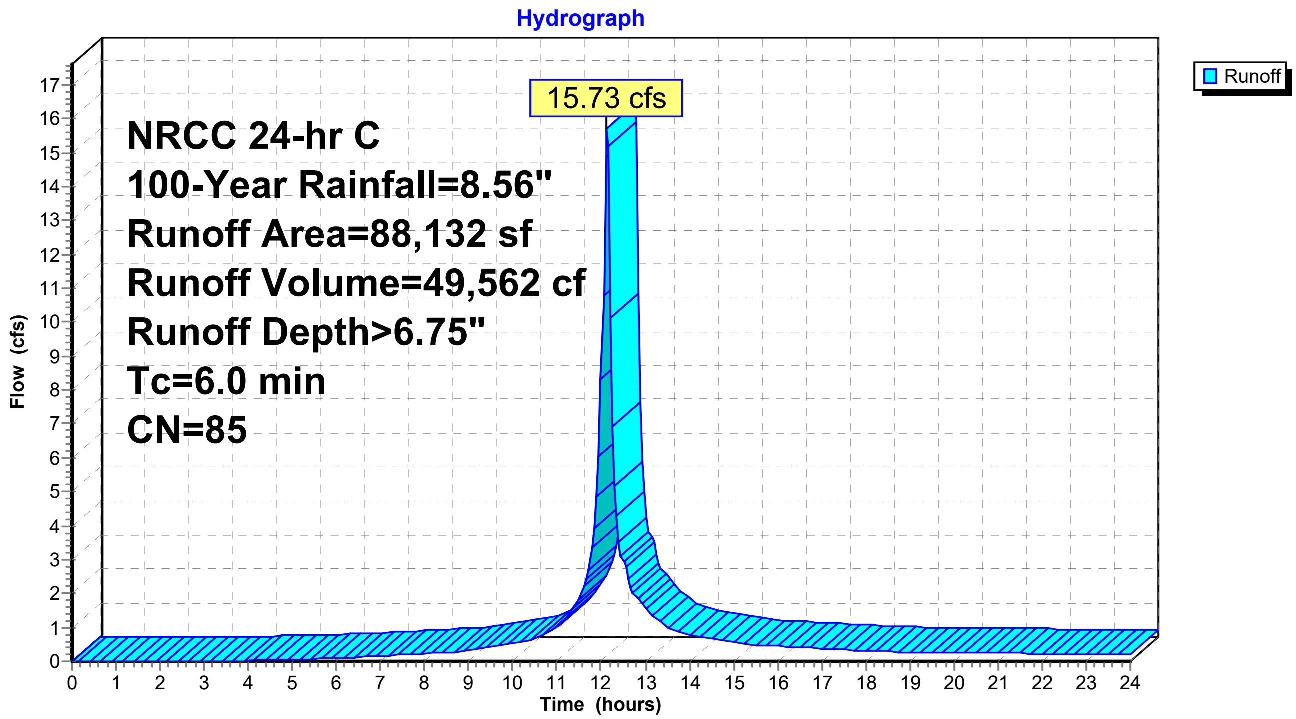
Runoff = 15.73 cfs @ 12.13 hrs, Volume= 49,562 cf, Depth> 6.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 55,365 | 98 | IMPERVIOUS |
| | 7,996 | 55 | Woods, Good, HSG B |
| | 5,832 | 80 | >75% Grass cover, Good, HSG D |
| | 18,939 | 61 | >75% Grass cover, Good, HSG B |
| | 88,132 | 85 | Weighted Average |
| | 32,767 | | 37.18% Pervious Area |
| | 55,365 | | 62.82% Impervious Area |

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

### Subcatchment PR-28: TO WQU-20



## Summary for Subcatchment PR-29: TO WQU-21

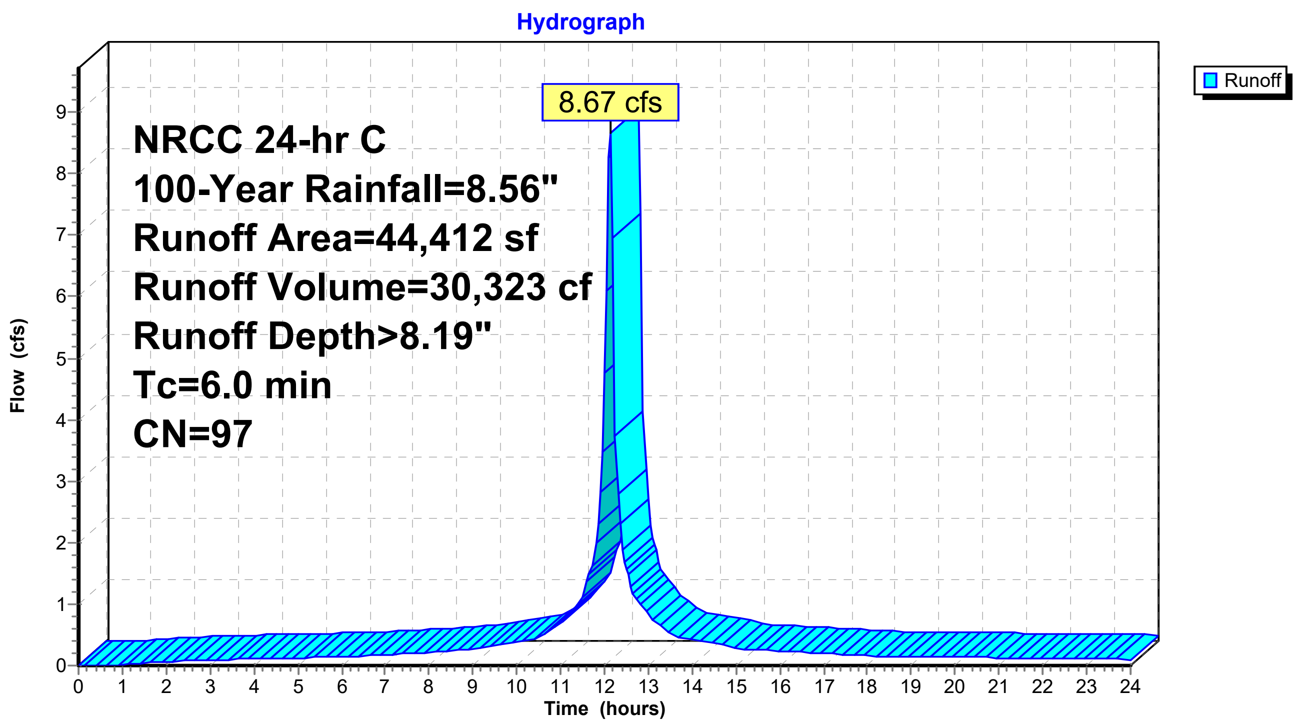
Runoff = 8.67 cfs @ 12.13 hrs, Volume= 30,323 cf, Depth> 8.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 41,857 | 98 | IMPERVIOUS |
| | 2,555 | 80 | >75% Grass cover, Good, HSG D |
| | 44,412 | 97 | Weighted Average |
| | 2,555 | | 5.75% Pervious Area |
| | 41,857 | | 94.25% Impervious Area |

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

## Subcatchment PR-29: TO WQU-21



## Summary for Subcatchment PR-3: TO FOCAL POINT

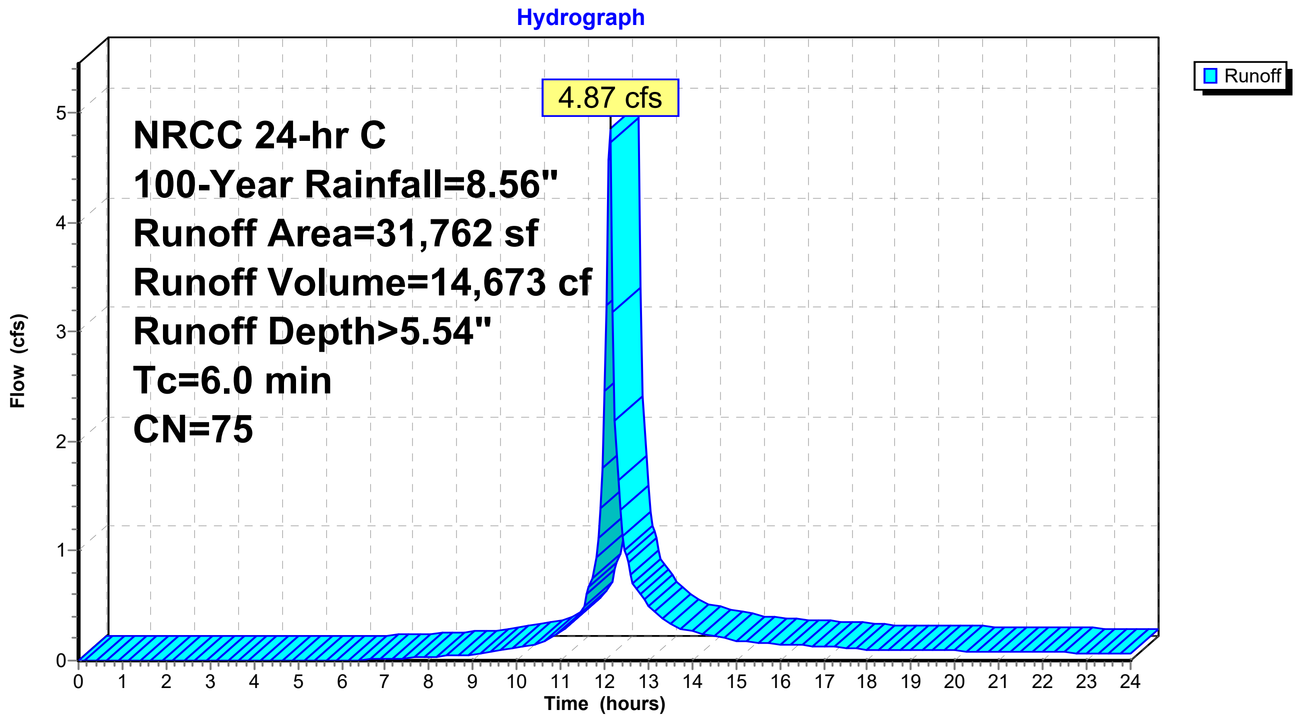
Runoff = 4.87 cfs @ 12.13 hrs, Volume= 14,673 cf, Depth> 5.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 1,048 | 98 | IMPERVIOUS |
| | 30,714 | 74 | >75% Grass cover, Good, HSG C |
| | 31,762 | 75 | Weighted Average |
| | 30,714 | | 96.70% Pervious Area |
| | 1,048 | | 3.30% Impervious Area |

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

### Subcatchment PR-3: TO FOCAL POINT



## Summary for Subcatchment PR-30: TO WQU-22

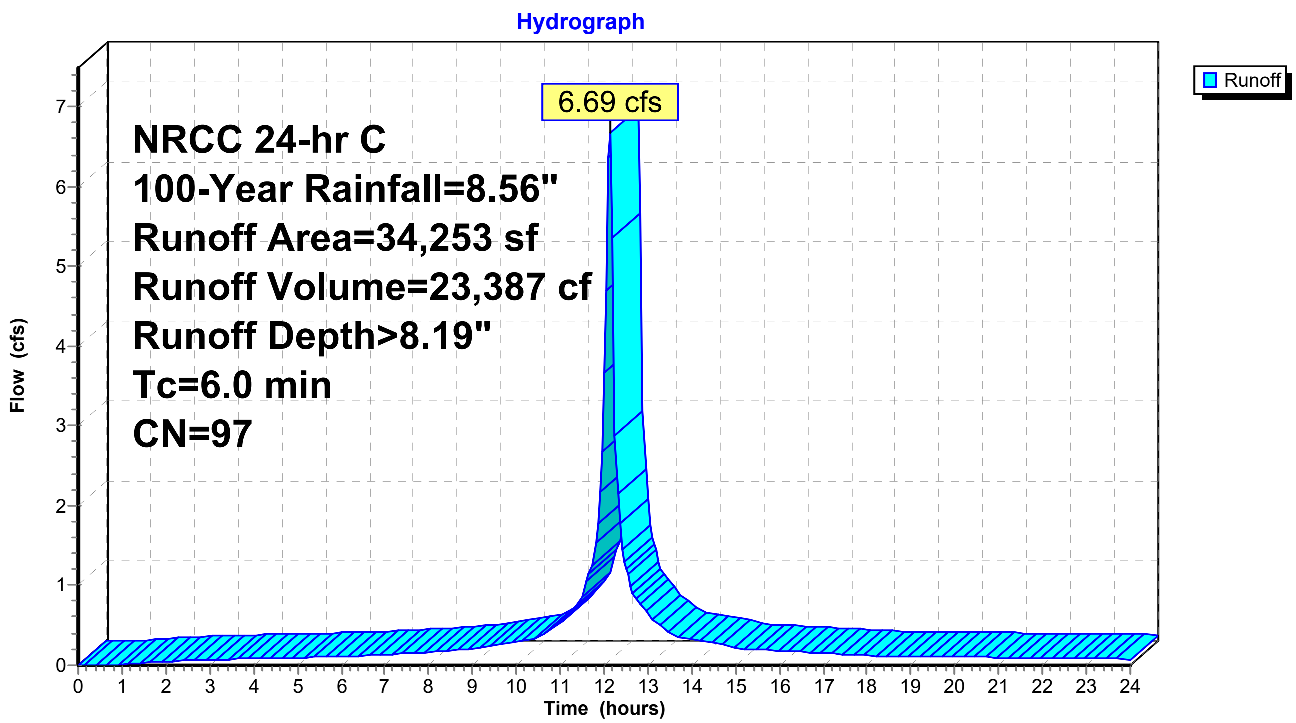
Runoff = 6.69 cfs @ 12.13 hrs, Volume= 23,387 cf, Depth> 8.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 31,439 | 98 | IMPERVIOUS |
| | 2,814 | 80 | >75% Grass cover, Good, HSG D |
| | 34,253 | 97 | Weighted Average |
| | 2,814 | | 8.22% Pervious Area |
| | 31,439 | | 91.78% Impervious Area |

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

## Subcatchment PR-30: TO WQU-22



## Summary for Subcatchment PR-31: TO WQU-23

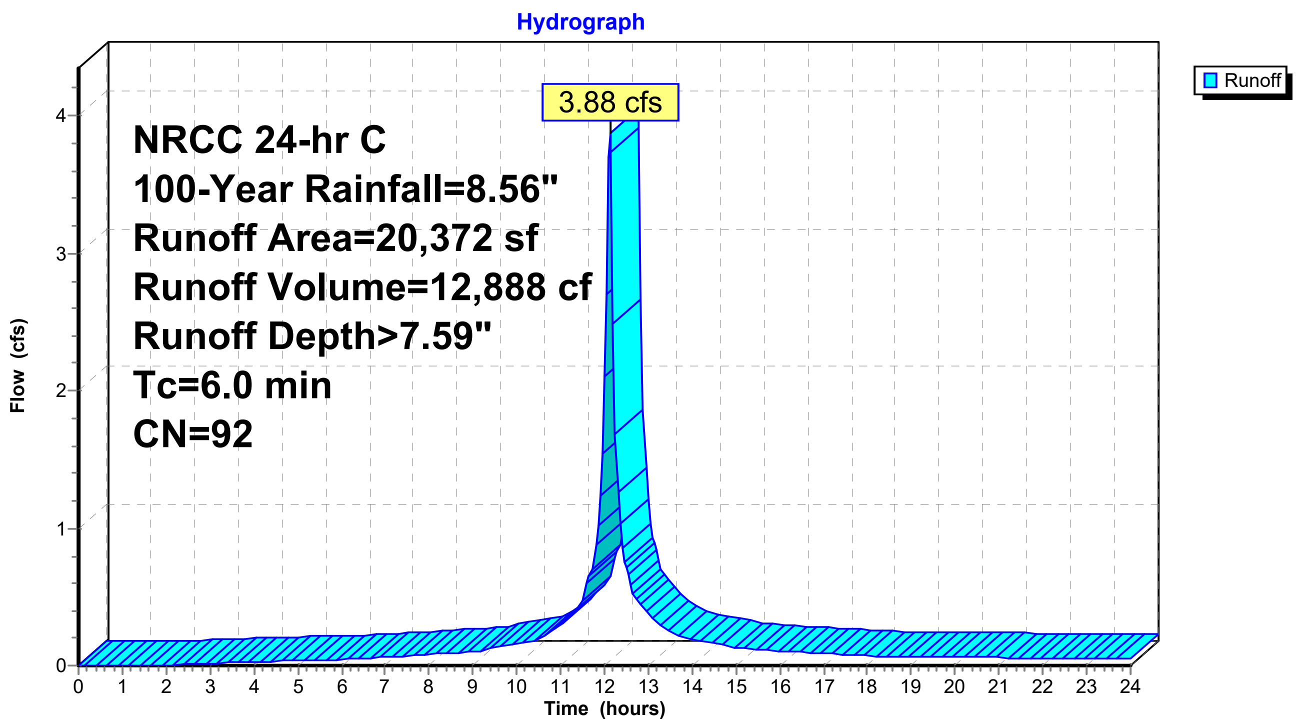
Runoff = 3.88 cfs @ 12.13 hrs, Volume= 12,888 cf, Depth> 7.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 13,946 | 98 | IMPERVIOUS |
| | 6,426 | 80 | >75% Grass cover, Good, HSG D |
| | 20,372 | 92 | Weighted Average |
| | 6,426 | | 31.54% Pervious Area |
| | 13,946 | | 68.46% Impervious Area |

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

### Subcatchment PR-31: TO WQU-23



## Summary for Subcatchment PR-32: BUILDING 4 ROOF

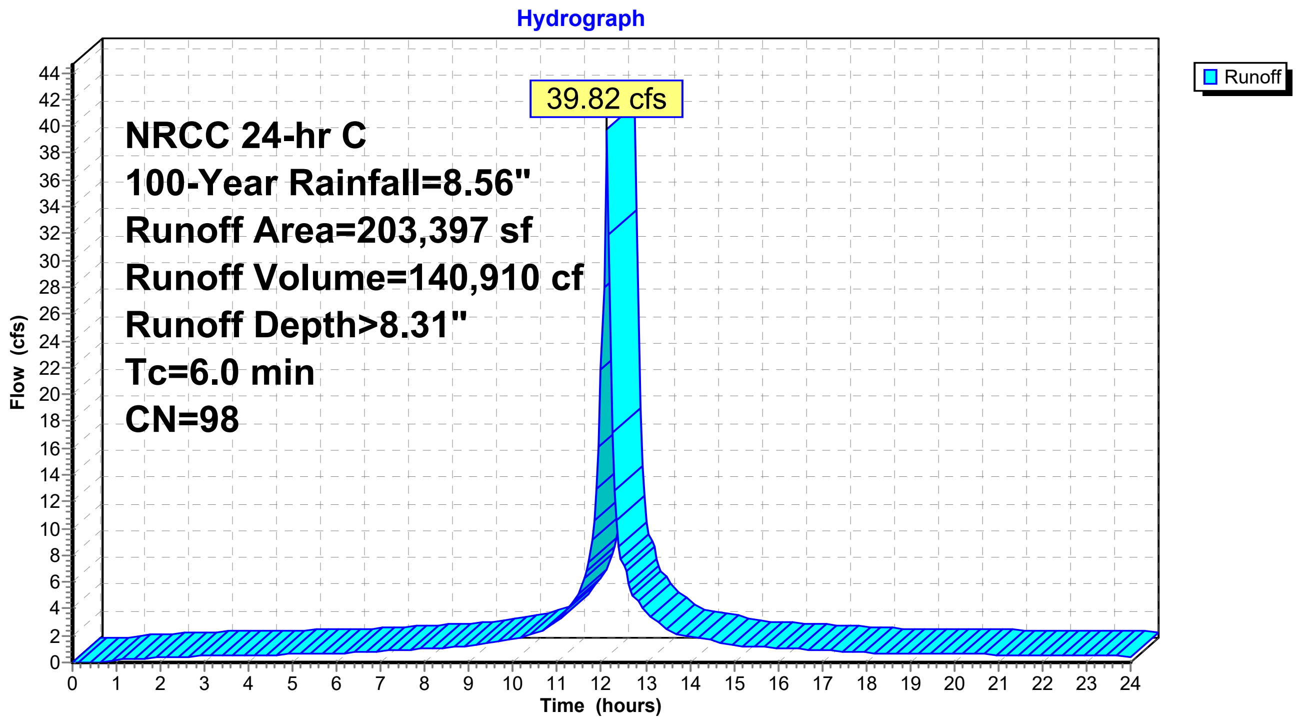
Runoff = 39.82 cfs @ 12.13 hrs, Volume= 140,910 cf, Depth> 8.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 203,397 | 98 | IMPERVIOUS |
| | 203,397 | | 100.00% Impervious Area |

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

## Subcatchment PR-32: BUILDING 4 ROOF



## Summary for Subcatchment PR-33: TO BASIN A

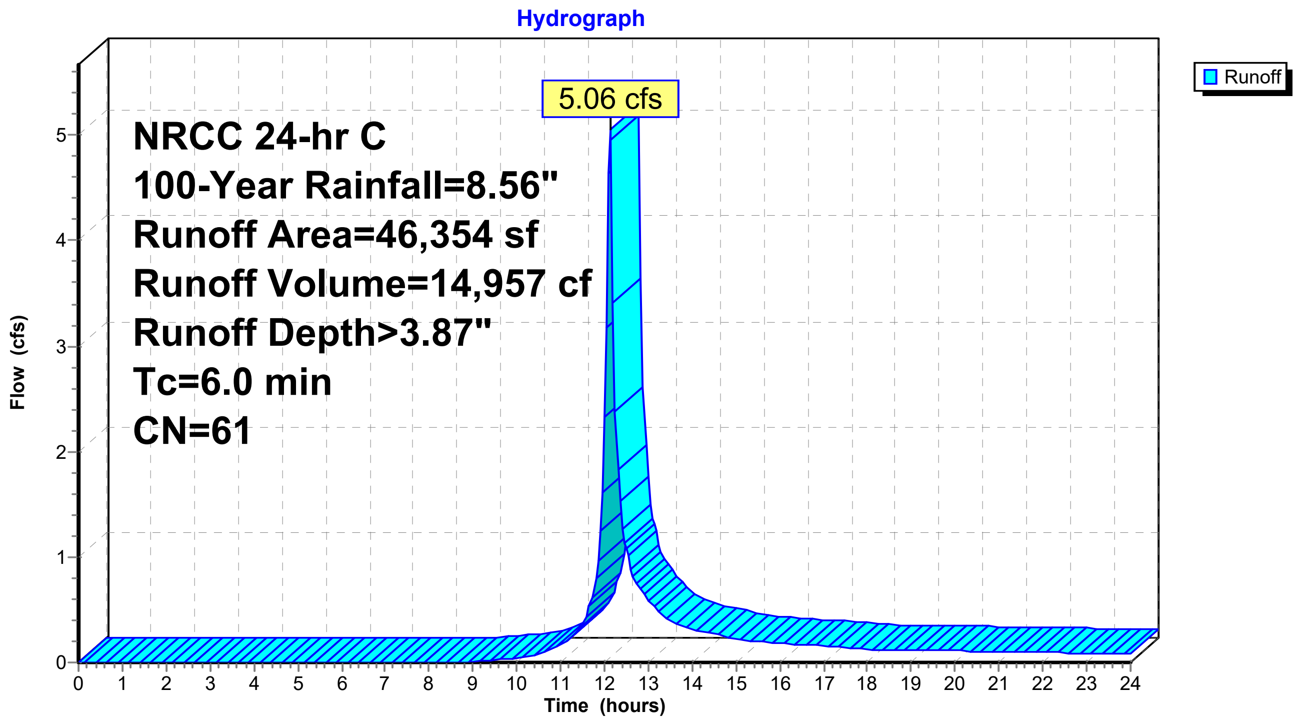
Runoff = 5.06 cfs @ 12.13 hrs, Volume= 14,957 cf, Depth> 3.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| Area (sf) | CN | Description |
|---|---|---|
| 46,354 | 61 | >75% Grass cover, Good, HSG B |
| 46,354 | | 100.00% Pervious Area |

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

## Subcatchment PR-33: TO BASIN A



## Summary for Subcatchment PR-34: TO BASIN B

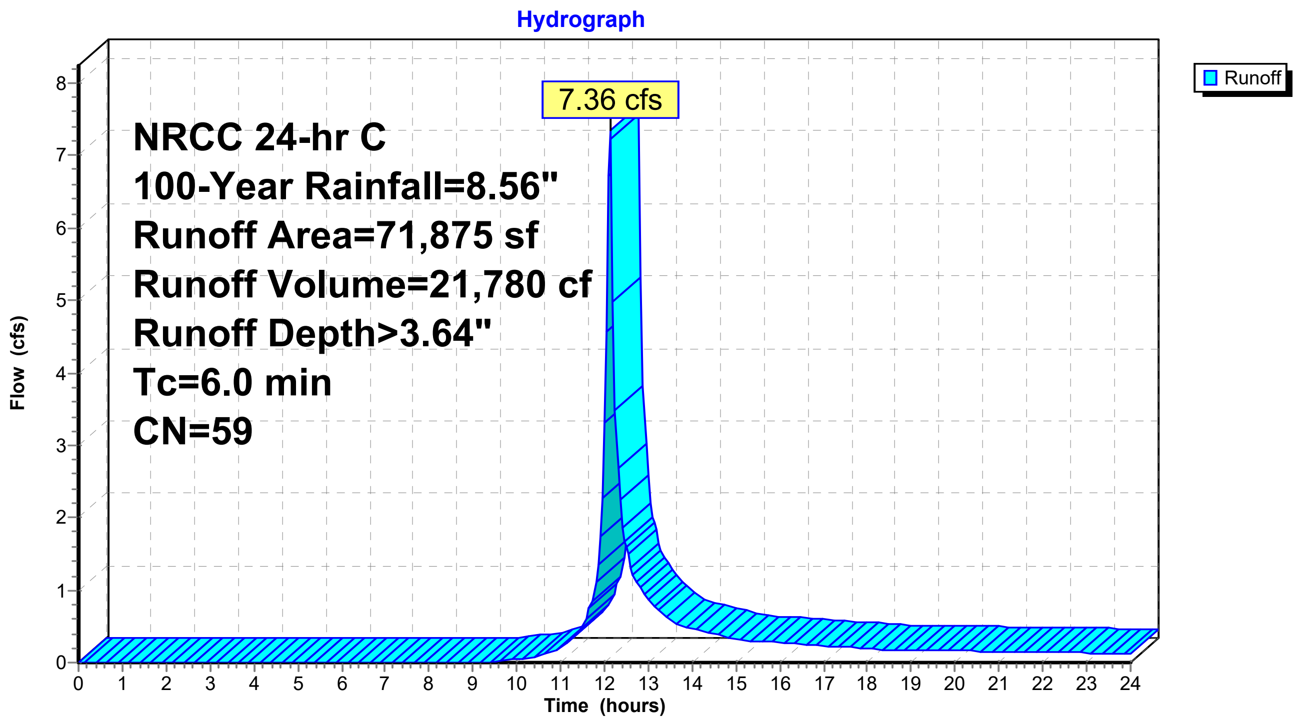
Runoff = 7.36 cfs @ 12.13 hrs, Volume= 21,780 cf, Depth> 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| Area (sf) | CN | Description |
|---|---|---|
| 24,851 | 55 | Woods, Good, HSG B |
| 47,024 | 61 | >75% Grass cover, Good, HSG B |
| 71,875 | 59 | Weighted Average |
| 71,875 | | 100.00% Pervious Area |

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

## Subcatchment PR-34: TO BASIN B



### Summary for Subcatchment PR-35: TO BASIN C

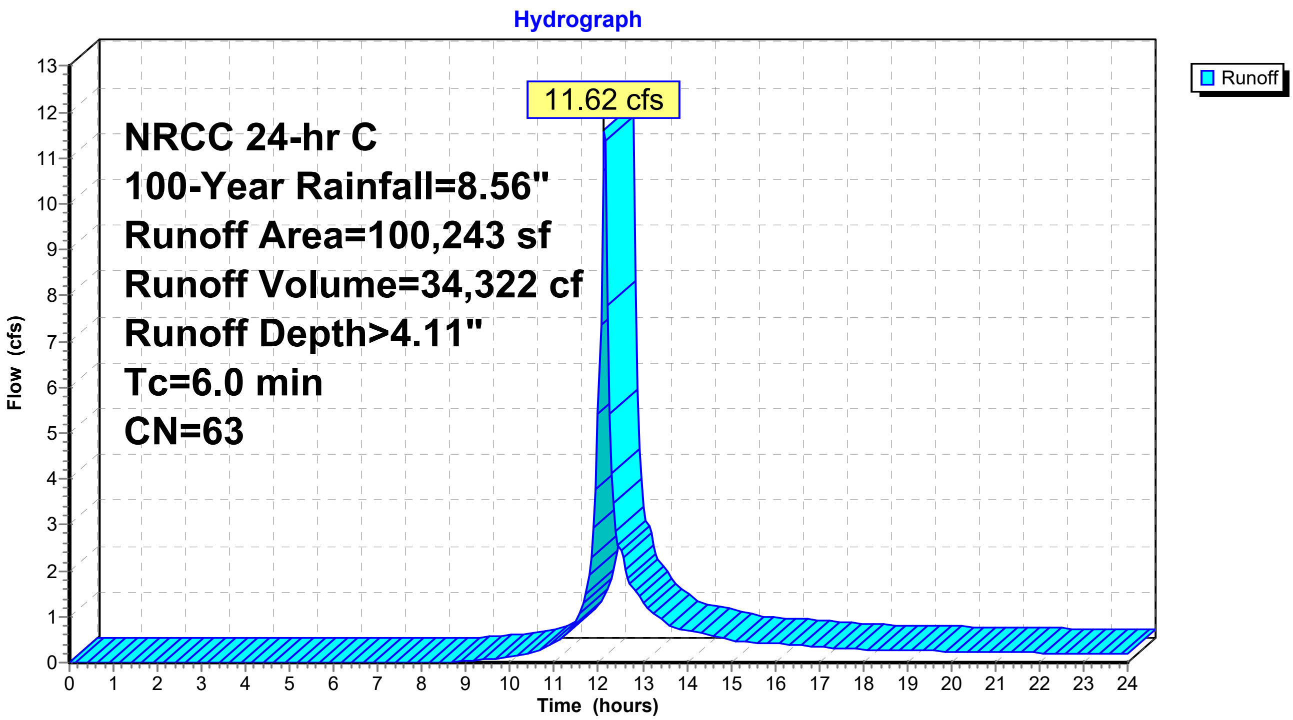
Runoff = 11.62 cfs @ 12.13 hrs, Volume= 34,322 cf, Depth> 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| Area (sf) | CN | Description |
|---|---|---|
| 17,490 | 74 | >75% Grass cover, Good, HSG C |
| 82,753 | 61 | >75% Grass cover, Good, HSG B |
| 100,243 | 63 | Weighted Average |
| 100,243 | | 100.00% Pervious Area |

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

### Subcatchment PR-35: TO BASIN C



## Summary for Subcatchment PR-36: TO OFFSITE EAST

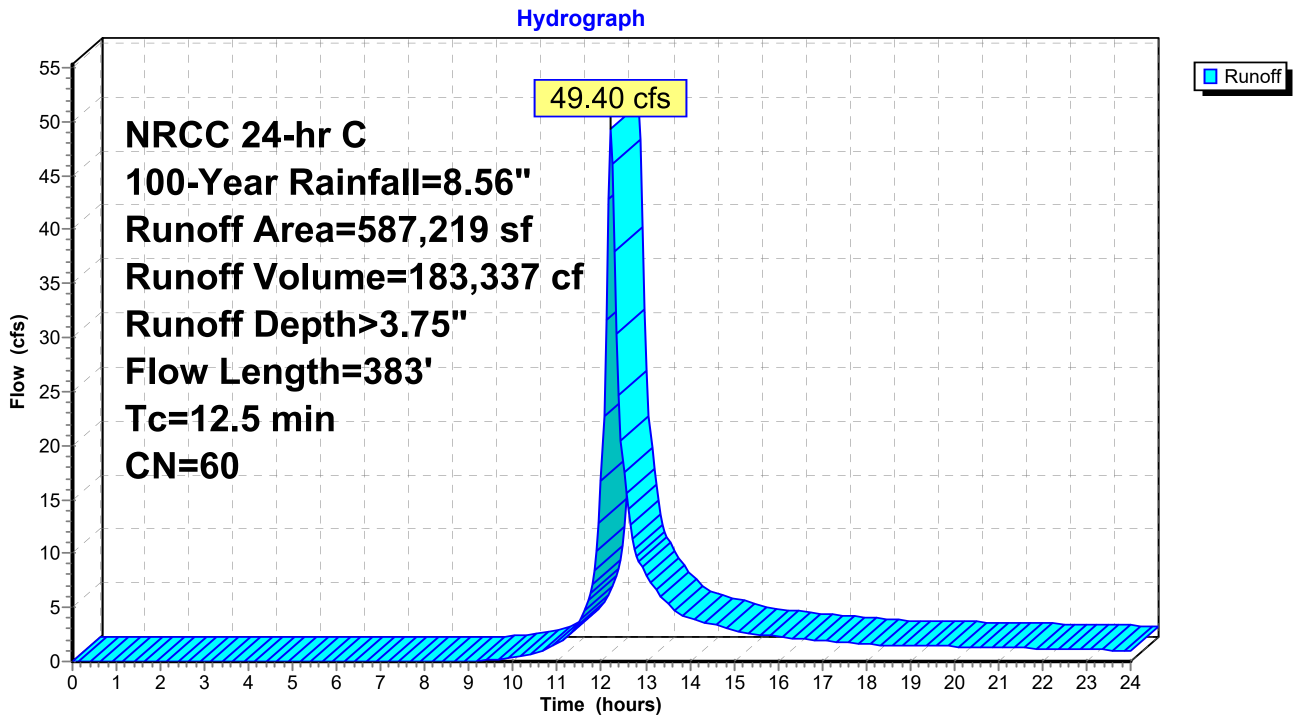
Runoff = 49.40 cfs @ 12.21 hrs, Volume= 183,337 cf, Depth> 3.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| Area (sf) | CN | Description |
|---|---|---|
| 402,759 | 55 | Woods, Good, HSG B |
| 6,465 | 70 | Woods, Good, HSG C |
| 112,740 | 77 | Woods, Good, HSG D |
| 52,096 | 61 | >75% Grass cover, Good, HSG B |
| 9,612 | 74 | >75% Grass cover, Good, HSG C |
| 3,547 | 80 | >75% Grass cover, Good, HSG D |
| 587,219 | 60 | Weighted Average |
| 587,219 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.0 | 50 | 0.0640 | 0.10 | | **Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.00" |
| 4.5 | 333 | 0.0604 | 1.23 | | **Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps |
| 12.5 | 383 | Total | | | |

### Subcatchment PR-36: TO OFFSITE EAST



## Summary for Subcatchment PR-4: TO OFFSITE SOUTH

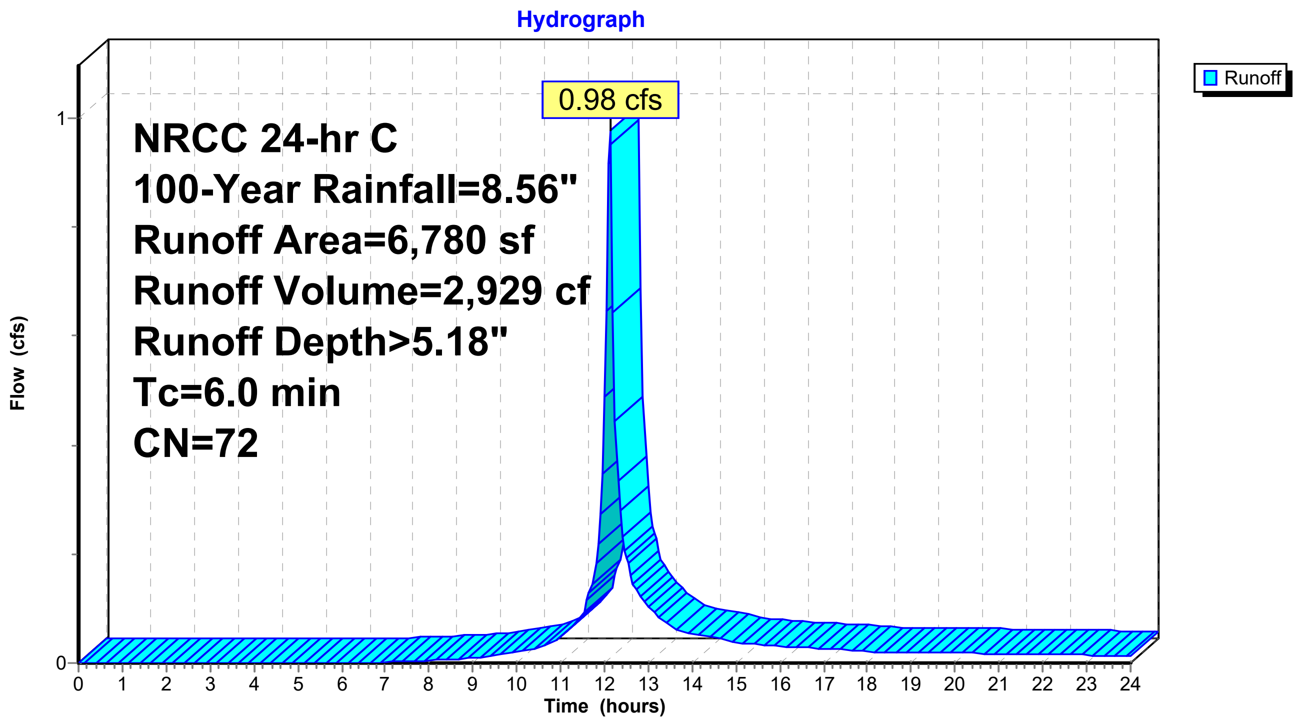
Runoff = 0.98 cfs @ 12.13 hrs, Volume= 2,929 cf, Depth> 5.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| Area (sf) | CN | Description |
|---|---|---|
| 2,686 | 74 | >75% Grass cover, Good, HSG C |
| 4,094 | 70 | Woods, Good, HSG C |
| 6,780 | 72 | Weighted Average |
| 6,780 | | 100.00% Pervious Area |

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

## Subcatchment PR-4: TO OFFSITE SOUTH



## Summary for Subcatchment PR-5: TO WQU-5

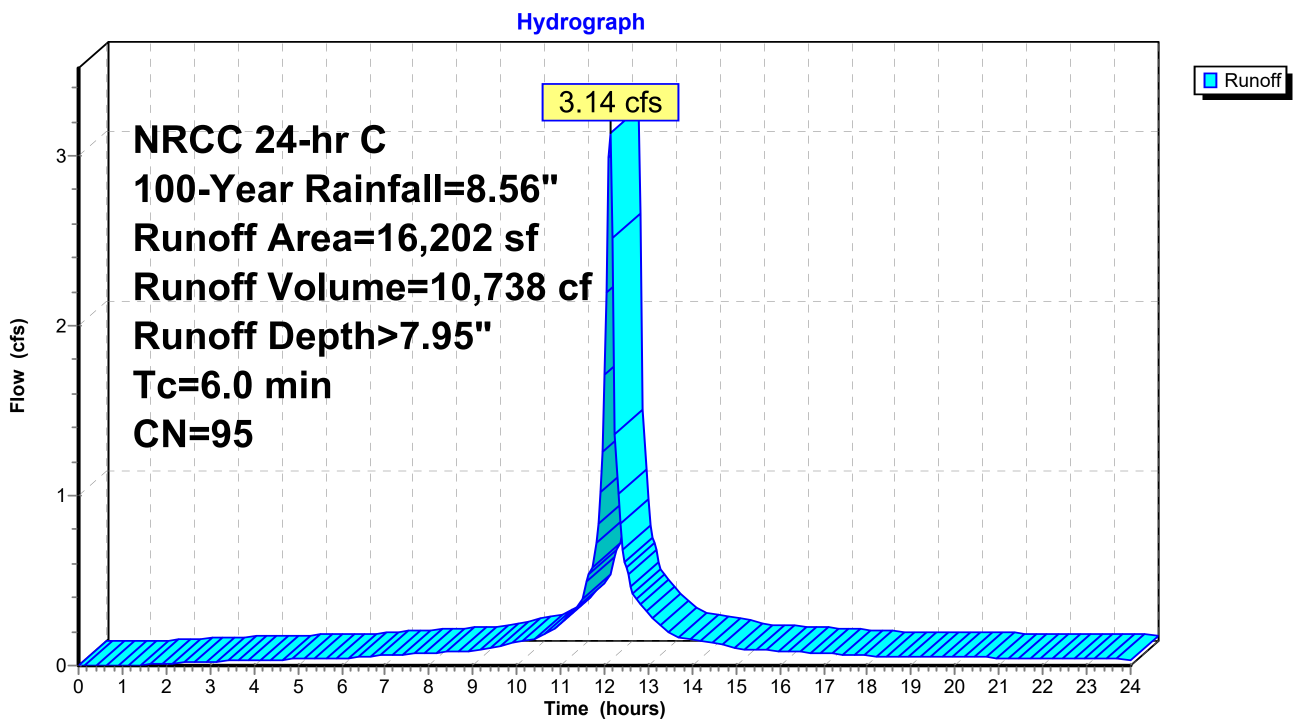
Runoff = 3.14 cfs @ 12.13 hrs, Volume= 10,738 cf, Depth> 7.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 14,419 | 98 | IMPERVIOUS |
| | 1,783 | 74 | >75% Grass cover, Good, HSG C |
| | 16,202 | 95 | Weighted Average |
| | 1,783 | | 11.00% Pervious Area |
| | 14,419 | | 89.00% Impervious Area |

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

## Subcatchment PR-5: TO WQU-5



## Summary for Subcatchment PR-6: TO WQU-4

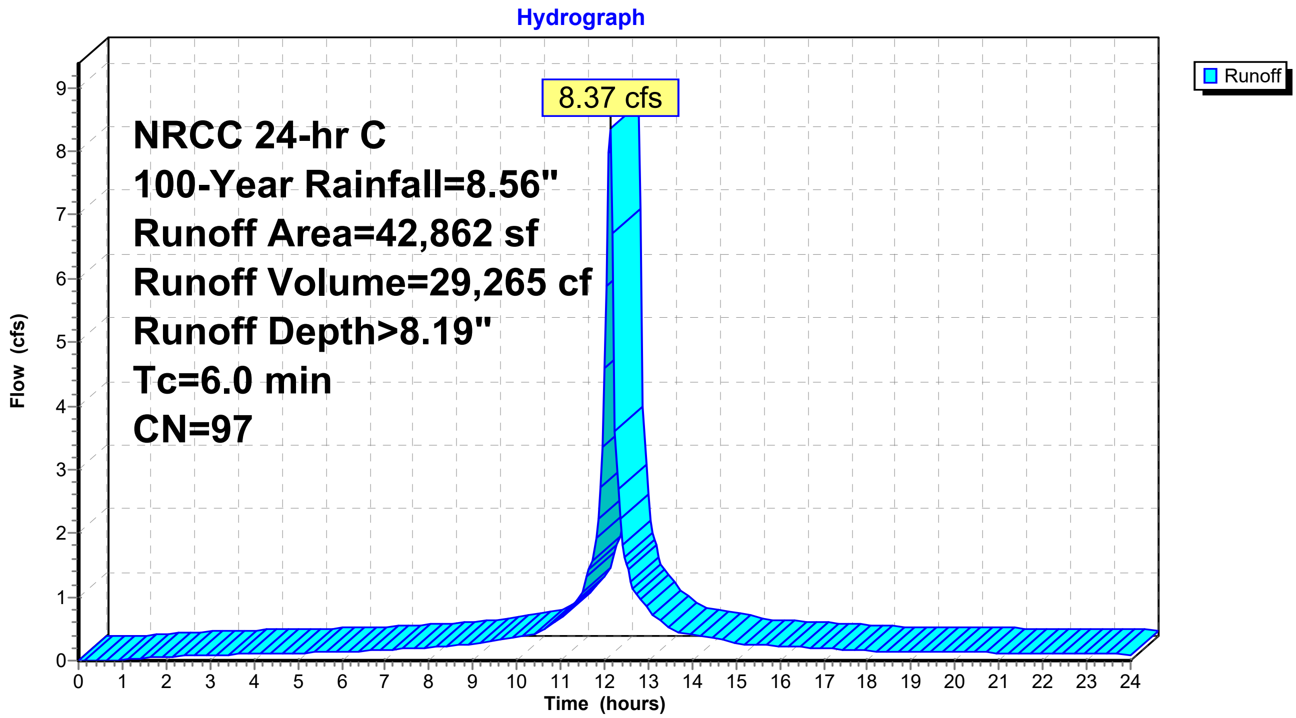
Runoff = 8.37 cfs @ 12.13 hrs, Volume= 29,265 cf, Depth> 8.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 41,625 | 98 | IMPERVIOUS |
| | 1,237 | 74 | >75% Grass cover, Good, HSG C |
| | 42,862 | 97 | Weighted Average |
| | 1,237 | | 2.89% Pervious Area |
| | 41,625 | | 97.11% Impervious Area |

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

### Subcatchment PR-6: TO WQU-4



## Summary for Subcatchment PR-7: TO WQU-3

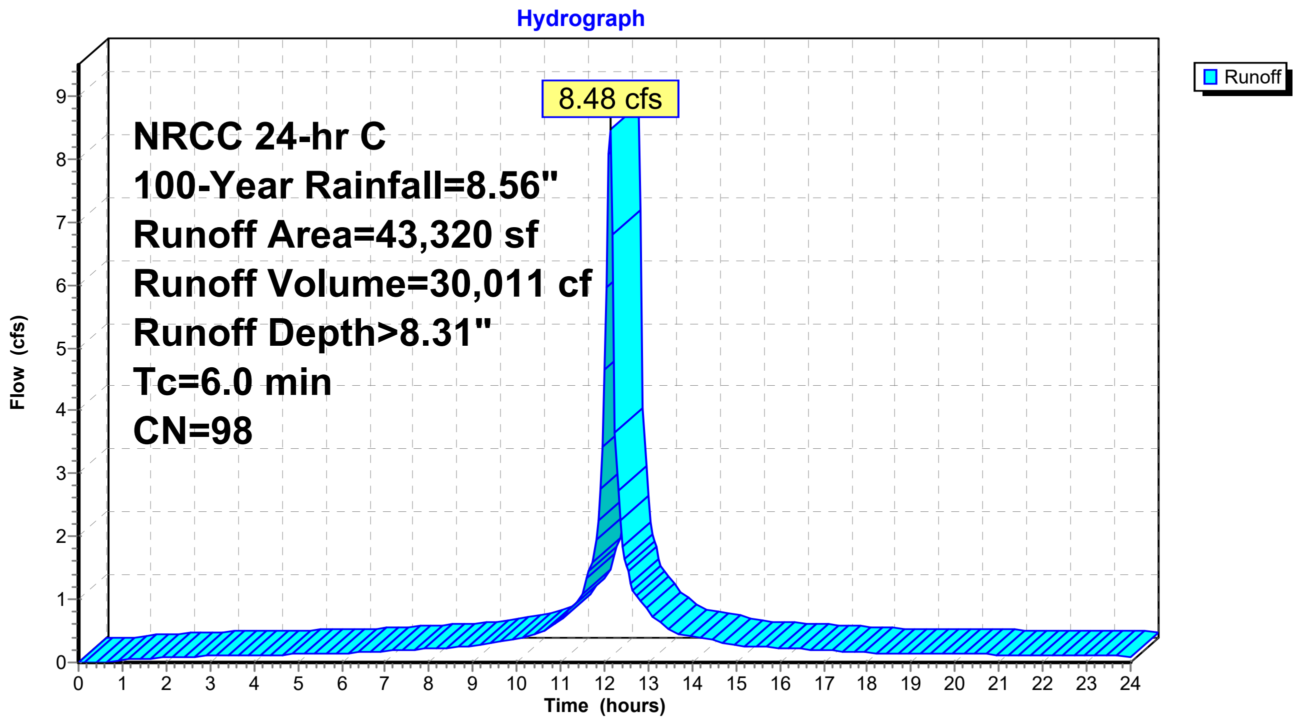
Runoff = 8.48 cfs @ 12.13 hrs, Volume= 30,011 cf, Depth> 8.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 43,320 | 98 | IMPERVIOUS |
| | 43,320 | | 100.00% Impervious Area |

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

## Subcatchment PR-7: TO WQU-3



## Summary for Subcatchment PR-8: TO WQU-2

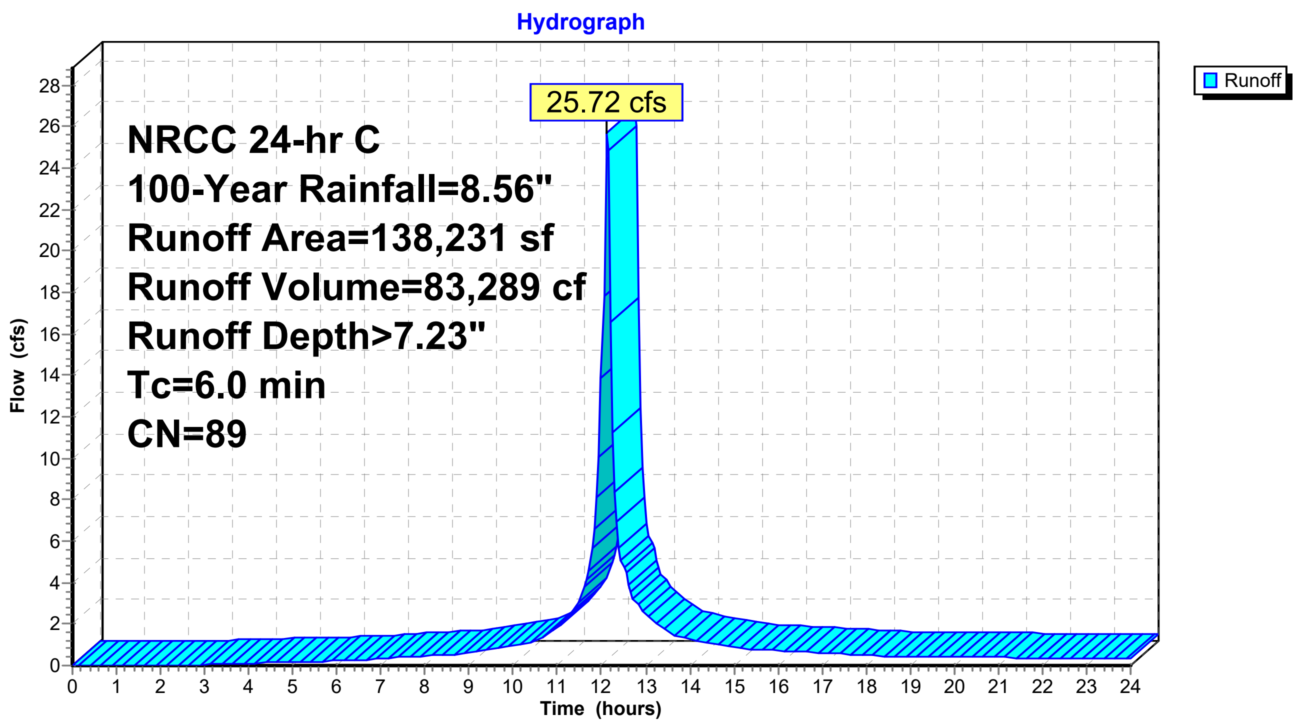
Runoff = 25.72 cfs @ 12.13 hrs, Volume= 83,289 cf, Depth> 7.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 88,857 | 98 | IMPERVIOUS |
| | 49,374 | 74 | >75% Grass cover, Good, HSG C |
| | 138,231 | 89 | Weighted Average |
| | 49,374 | | 35.72% Pervious Area |
| | 88,857 | | 64.28% Impervious Area |

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

### Subcatchment PR-8: TO WQU-2



## Summary for Subcatchment PR-9: BUILDING 1 ROOF

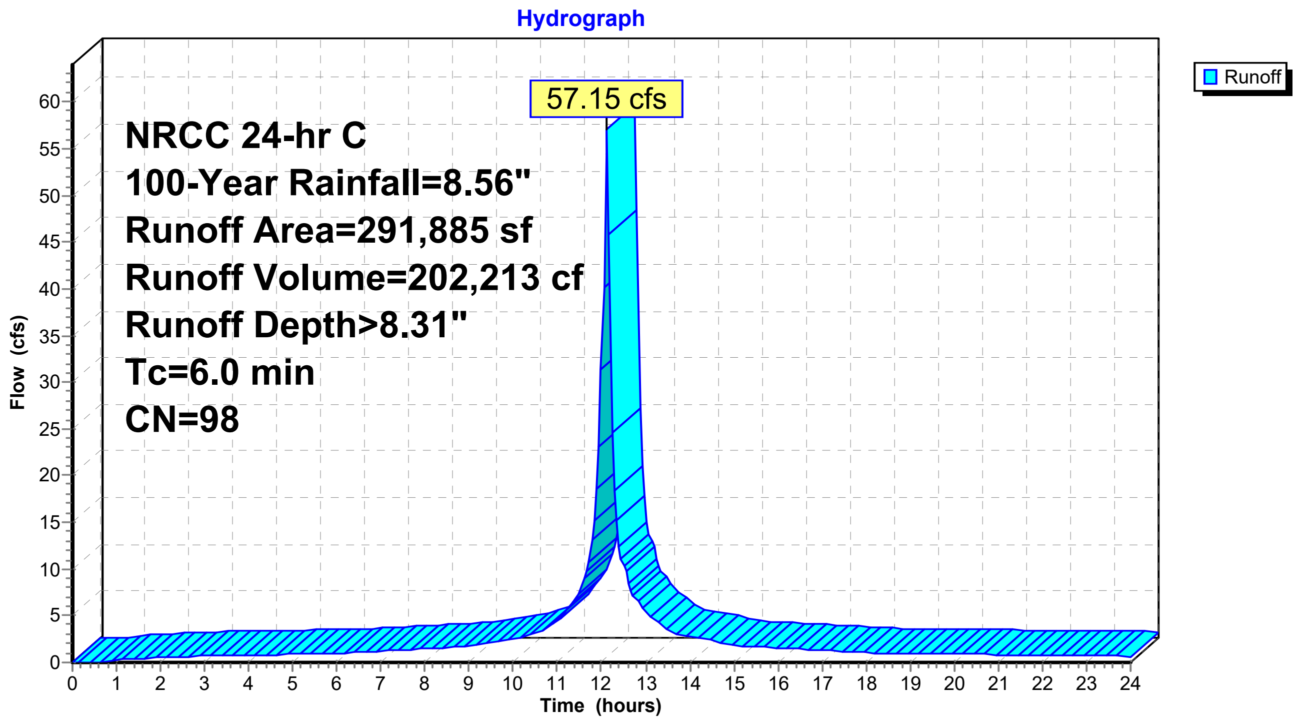
Runoff = 57.15 cfs @ 12.13 hrs, Volume= 202,213 cf, Depth> 8.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.56"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 291,885 | 98 | IMPERVIOUS |
| | 291,885 | | 100.00% Impervious Area |

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

## Subcatchment PR-9: BUILDING 1 ROOF

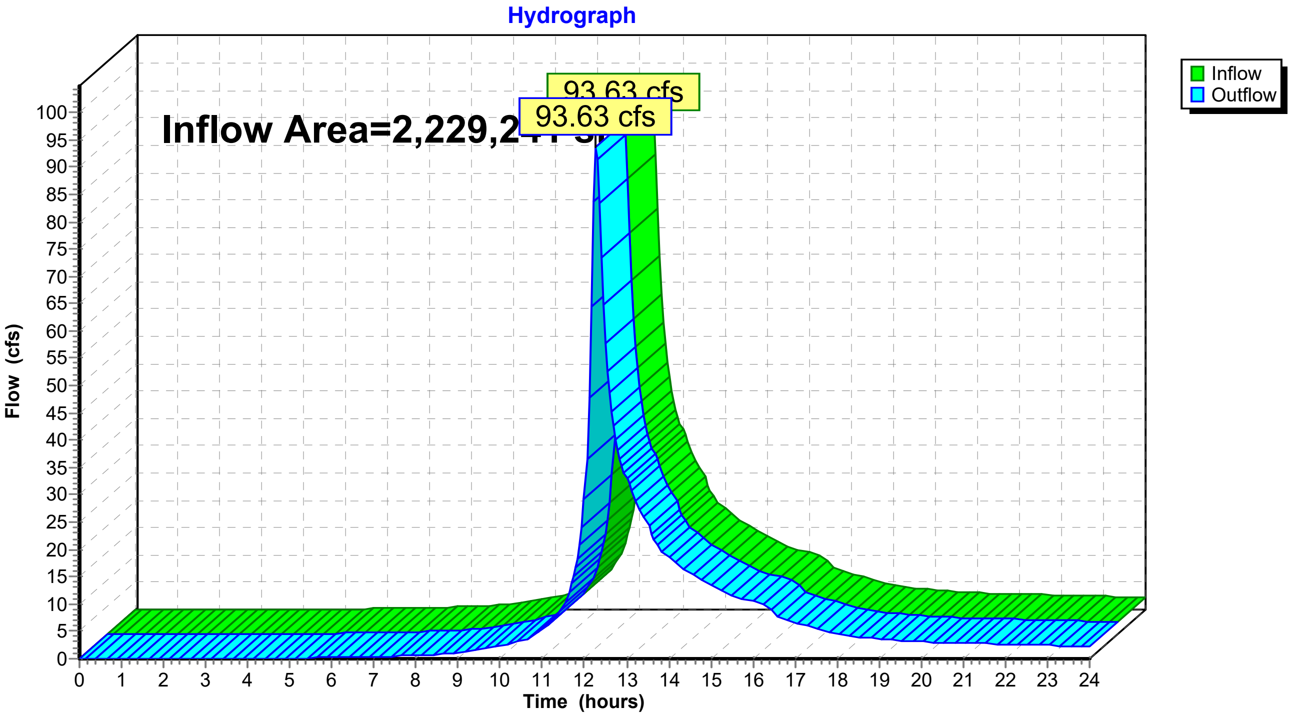


## Summary for Reach 1R: WETLANDS CENTER

Inflow Area = 2,229,241 sf, 42.29% Impervious, Inflow Depth > 3.06" for 100-Year event
Inflow = 93.63 cfs @ 12.27 hrs, Volume= 569,110 cf
Outflow = 93.63 cfs @ 12.27 hrs, Volume= 569,110 cf, Atten= 0%, Lag= 0.0 min

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

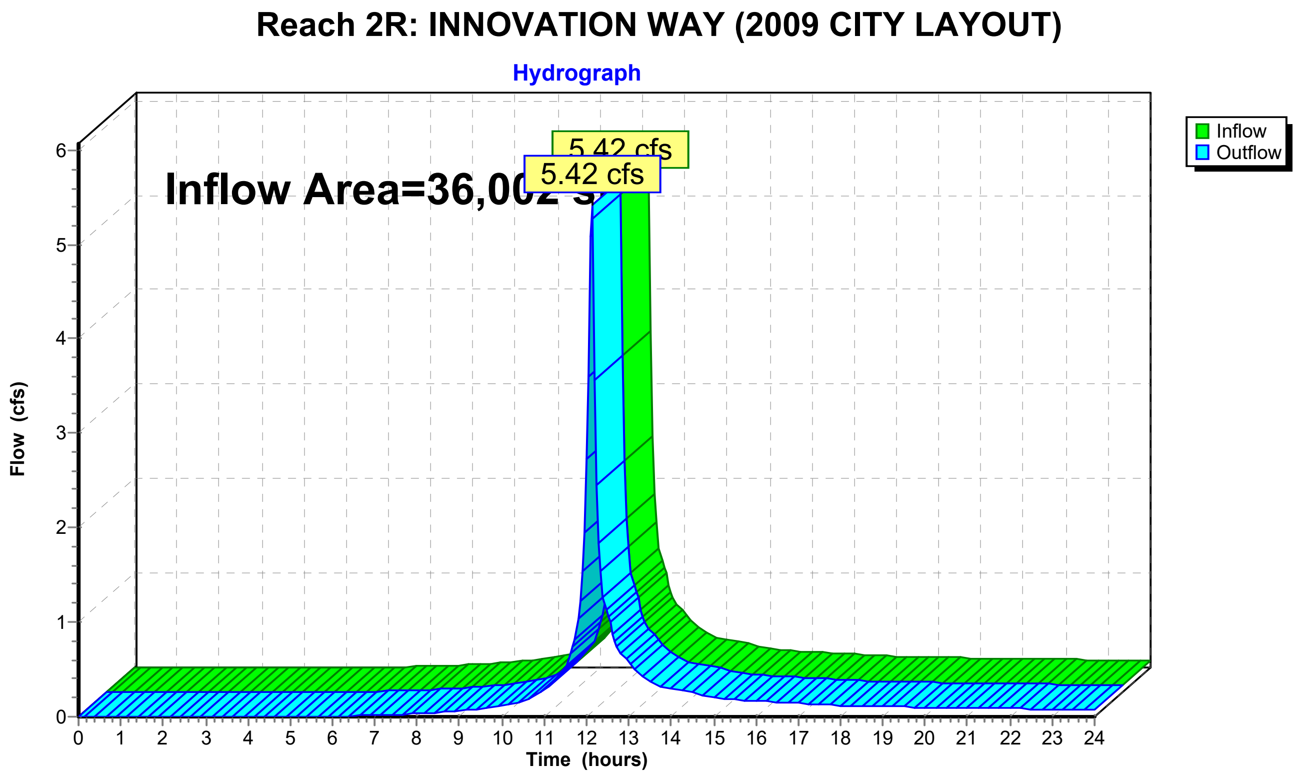
### Reach 1R: WETLANDS CENTER



## Summary for Reach 2R: INNOVATION WAY (2009 CITY LAYOUT)

Inflow Area = 36,002 sf, 0.00% Impervious, Inflow Depth > 5.42" for 100-Year event
Inflow = 5.42 cfs @ 12.13 hrs, Volume= 16,272 cf
Outflow = 5.42 cfs @ 12.13 hrs, Volume= 16,272 cf, Atten= 0%, Lag= 0.0 min

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

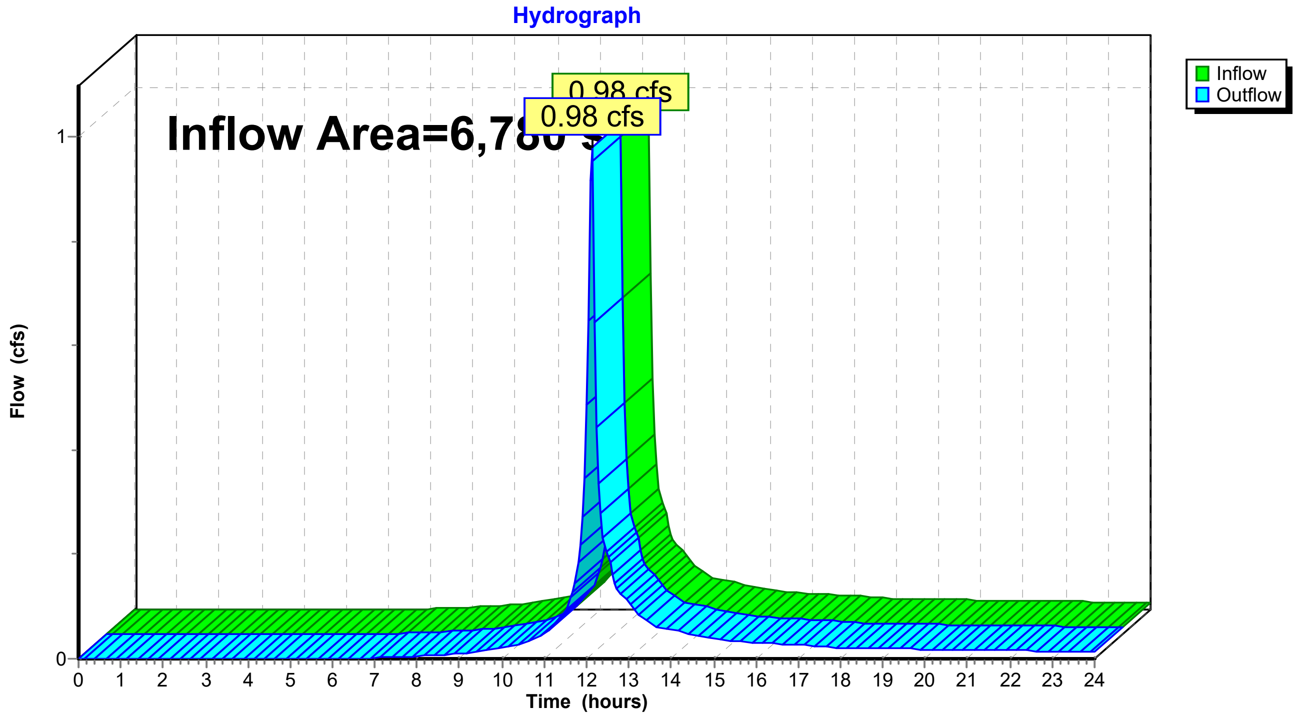


## Summary for Reach 3R: OFFSITE SOUTH

Inflow Area = 6,780 sf, 0.00% Impervious, Inflow Depth > 5.18" for 100-Year event
Inflow = 0.98 cfs @ 12.13 hrs, Volume= 2,929 cf
Outflow = 0.98 cfs @ 12.13 hrs, Volume= 2,929 cf, Atten= 0%, Lag= 0.0 min

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

### Reach 3R: OFFSITE SOUTH

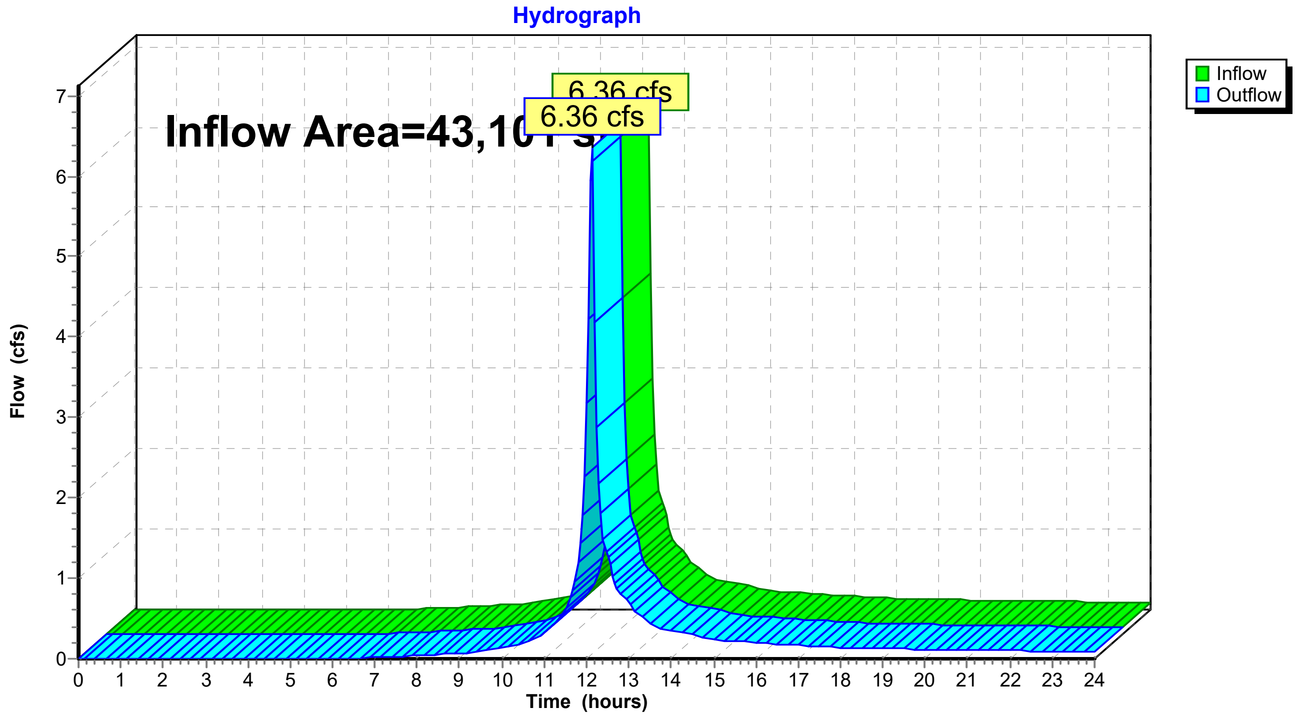


## Summary for Reach 4R: INNOVATION WAY (2009 SHLO)

Inflow Area = 43,101 sf, 0.00% Impervious, Inflow Depth > 5.30" for 100-Year event
Inflow = 6.36 cfs @ 12.13 hrs, Volume= 19,049 cf
Outflow = 6.36 cfs @ 12.13 hrs, Volume= 19,049 cf, Atten= 0%, Lag= 0.0 min

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

### Reach 4R: INNOVATION WAY (2009 SHLO)

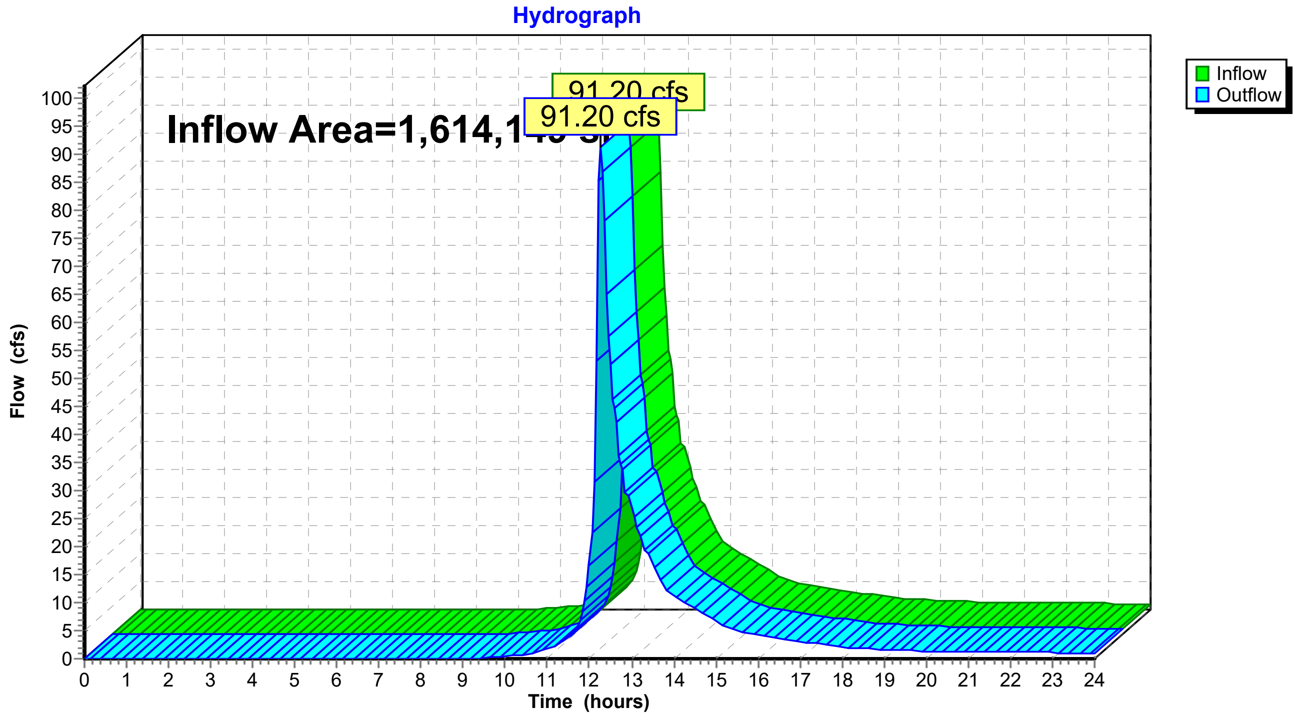


## Summary for Reach 23R: OFFSITE EAST

Inflow Area = 1,614,149 sf, 48.12% Impervious, Inflow Depth > 2.69" for 100-Year event
Inflow = 91.20 cfs @ 12.25 hrs, Volume= 362,248 cf
Outflow = 91.20 cfs @ 12.25 hrs, Volume= 362,248 cf, Atten= 0%, Lag= 0.0 min

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

### Reach 23R: OFFSITE EAST



## Summary for Pond 5P: Focal Point System A

Inflow Area = 235,410 sf, 48.35% Impervious, Inflow Depth > 6.78" for 100-Year event
Inflow = 41.89 cfs @ 12.13 hrs, Volume= 133,086 cf
Outflow = 7.44 cfs @ 12.54 hrs, Volume= 133,136 cf, Atten= 82%, Lag= 24.5 min
Primary = 4.31 cfs @ 11.45 hrs, Volume= 120,356 cf
Secondary = 3.14 cfs @ 12.54 hrs, Volume= 12,780 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 189.39' @ 12.54 hrs Surf.Area= 1,860 sf Storage= 36,534 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 41.3 min ( 831.0 - 789.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 184.25' | 837 cf | **40.00'W x 46.50'L x 2.25'H FOCIAL POINT**<br>4,185 cf Overall x 20.0% Voids |
| #2 | 186.50' | 45,685 cf | **Custom Stage Data (Prismatic)**Listed below (Recalc) -Impervious |
| | | 46,522 cf | Total Available Storage |

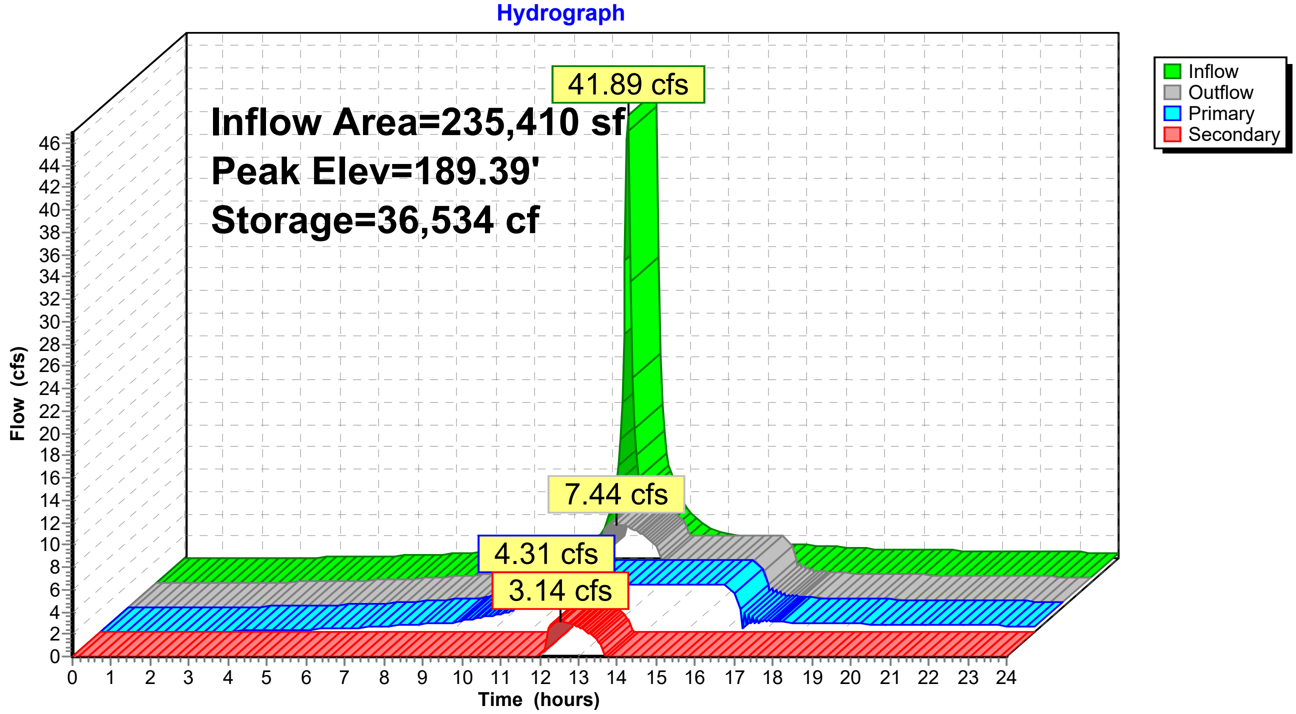
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 186.50 | 3,206 | 0 | 0 |
| 187.00 | 11,178 | 3,596 | 3,596 |
| 188.00 | 13,067 | 12,123 | 15,719 |
| 189.00 | 14,971 | 14,019 | 29,738 |
| 190.00 | 16,924 | 15,948 | 45,685 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 184.25' | **100.000 in/hr Exfiltration over Surface area** Phase-In= 0.10' |
| #2 | Secondary | 188.70' | **48.0" x 48.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #3 | Device 2 | 185.00' | **12.0" Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=4.31 cfs @ 11.45 hrs HW=184.40' TW=183.30' (Dynamic Tailwater)
└─**1=Exfiltration** (Exfiltration Controls 4.31 cfs)

**Secondary OutFlow** Max=3.14 cfs @ 12.54 hrs HW=189.39' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Passes 3.14 cfs of 29.82 cfs potential flow)
  └─**3=Orifice/Grate** (Orifice Controls 3.14 cfs @ 3.99 fps)

## Pond 5P: Focal Point System A



## Summary for Pond 8P: RTANKS

Inflow Area = 235,410 sf, 48.35% Impervious, Inflow Depth > 6.14" for 100-Year event
Inflow = 4.31 cfs @ 11.45 hrs, Volume= 120,356 cf
Outflow = 4.31 cfs @ 15.90 hrs, Volume= 118,881 cf, Atten= 0%, Lag= 267.0 min
Primary = 2.64 cfs @ 15.90 hrs, Volume= 90,084 cf
Secondary = 1.66 cfs @ 15.90 hrs, Volume= 28,797 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 183.64' @ 15.50 hrs Surf.Area= 3,844 sf Storage= 7,837 cf

Plug-Flow detention time= 34.7 min calculated for 118,633 cf (99% of inflow)
Center-of-Mass det. time= 27.7 min ( 865.3 - 837.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 181.18' | 943 cf | **48.62'W x 79.07'L x 3.07'H Field A**<br>11,807 cf Overall - 9,450 cf Embedded = 2,357 cf x 40.0% Voids |
| #2A | 181.43' | 8,978 cf | **ACF R-Tank HD 2** x 1088 Inside #1<br>Inside= 15.7"W x 33.9"H => 3.52 sf x 2.35'L = 8.3 cf<br>Outside= 15.7"W x 33.9"H => 3.70 sf x 2.35'L = 8.7 cf<br>1088 Chambers in 34 Rows |
| | | 9,921 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 181.43' | **6.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |
| #2 | Secondary | 183.17' | **12.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Primary OutFlow** Max=2.64 cfs @ 15.90 hrs HW=183.64' TW=0.00' (Dynamic Tailwater)
└─**1=Orifice/Grate** (Orifice Controls 2.64 cfs @ 6.73 fps)

**Secondary OutFlow** Max=1.66 cfs @ 15.90 hrs HW=183.64' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Orifice Controls 1.66 cfs @ 2.32 fps)

## Pond 8P: RTANKS - Chamber Wizard Field A

**Chamber Model = ACF R-Tank HD 2 (ACF Environmental R-Tank HD)**
Inside= 15.7"W x 33.9"H => 3.52 sf x 2.35'L = 8.3 cf
Outside= 15.7"W x 33.9"H => 3.70 sf x 2.35'L = 8.7 cf

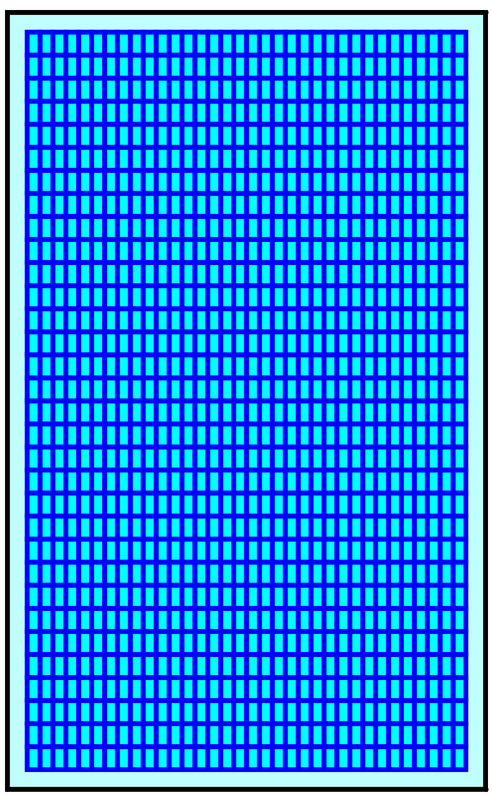
32 Chambers/Row x 2.35' Long = 75.07' Row Length +24.0" End Stone x 2 = 79.07' Base Length
34 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 48.62' Base Width
3.0" Stone Base + 33.9" Chamber Height = 3.07' Field Height

1,088 Chambers x 8.3 cf = 8,977.8 cf Chamber Storage
1,088 Chambers x 8.7 cf = 9,450.4 cf Displacement

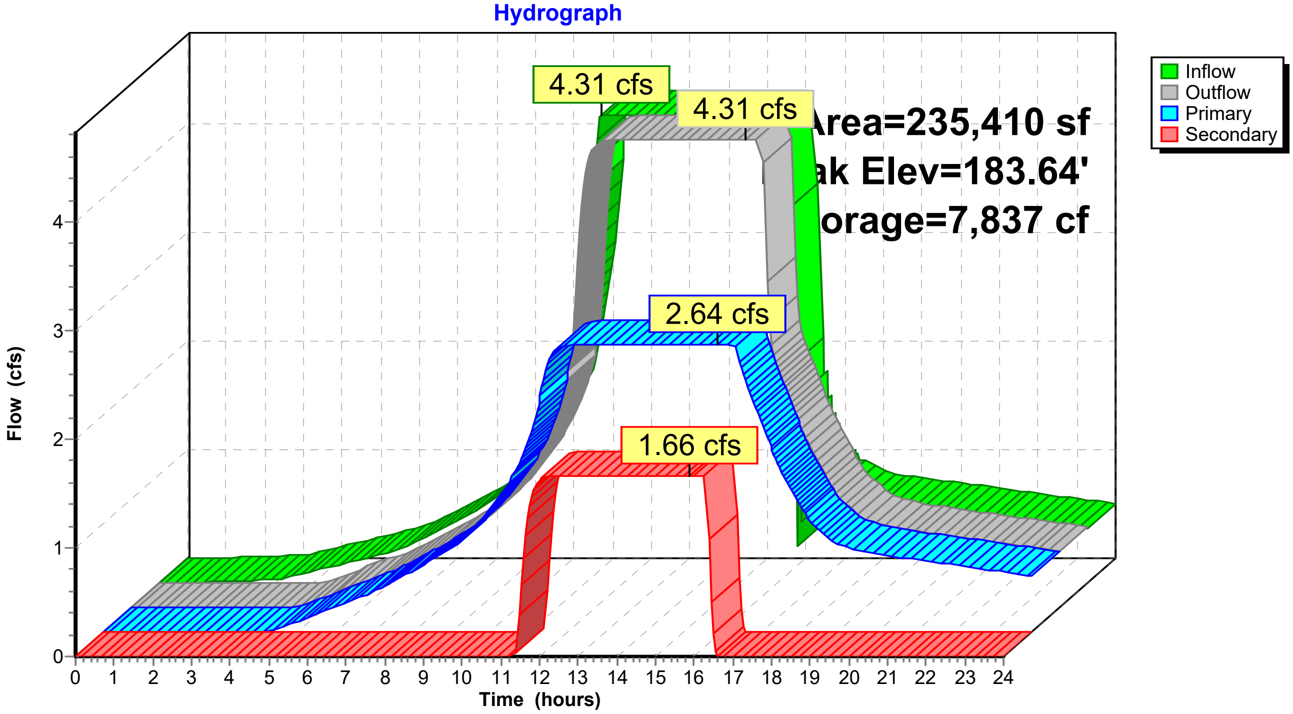
11,807.3 cf Field - 9,450.4 cf Chambers = 2,357.0 cf Stone x 40.0% Voids = 942.8 cf Stone Storage

Chamber Storage + Stone Storage = 9,920.6 cf = 0.228 af
Overall Storage Efficiency = 84.0%
Overall System Size = 79.07' x 48.62' x 3.07'

1,088 Chambers
437.3 cy Field
87.3 cy Stone



## Pond 8P: RTANKS



## Summary for Pond 10P: STORMTRAP SYSTEM C

Inflow Area = 15,869 sf, 90.76% Impervious, Inflow Depth > 8.07" for 100-Year event
Inflow = 3.09 cfs @ 12.13 hrs, Volume= 10,676 cf
Outflow = 0.29 cfs @ 13.04 hrs, Volume= 9,544 cf, Atten= 91%, Lag= 55.0 min
Discarded = 0.14 cfs @ 10.90 hrs, Volume= 8,853 cf
Primary = 0.14 cfs @ 13.04 hrs, Volume= 692 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 220.93' @ 13.04 hrs Surf.Area= 2,561 sf Storage= 4,309 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 150.1 min ( 902.2 - 752.1 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 219.25' | 1 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) 7,683 cf Overall - 7,682 cf Embedded = 1 cf |
| #2 | 219.25' | 7,682 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 7,683 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 219.25 | 2,561 | 0 | 0 |
| 219.75 | 2,561 | 1,281 | 1,281 |
| 220.25 | 2,561 | 1,281 | 2,561 |
| 220.75 | 2,561 | 1,281 | 3,842 |
| 221.25 | 2,561 | 1,281 | 5,122 |
| 221.75 | 2,561 | 1,281 | 6,403 |
| 222.25 | 2,561 | 1,281 | 7,683 |

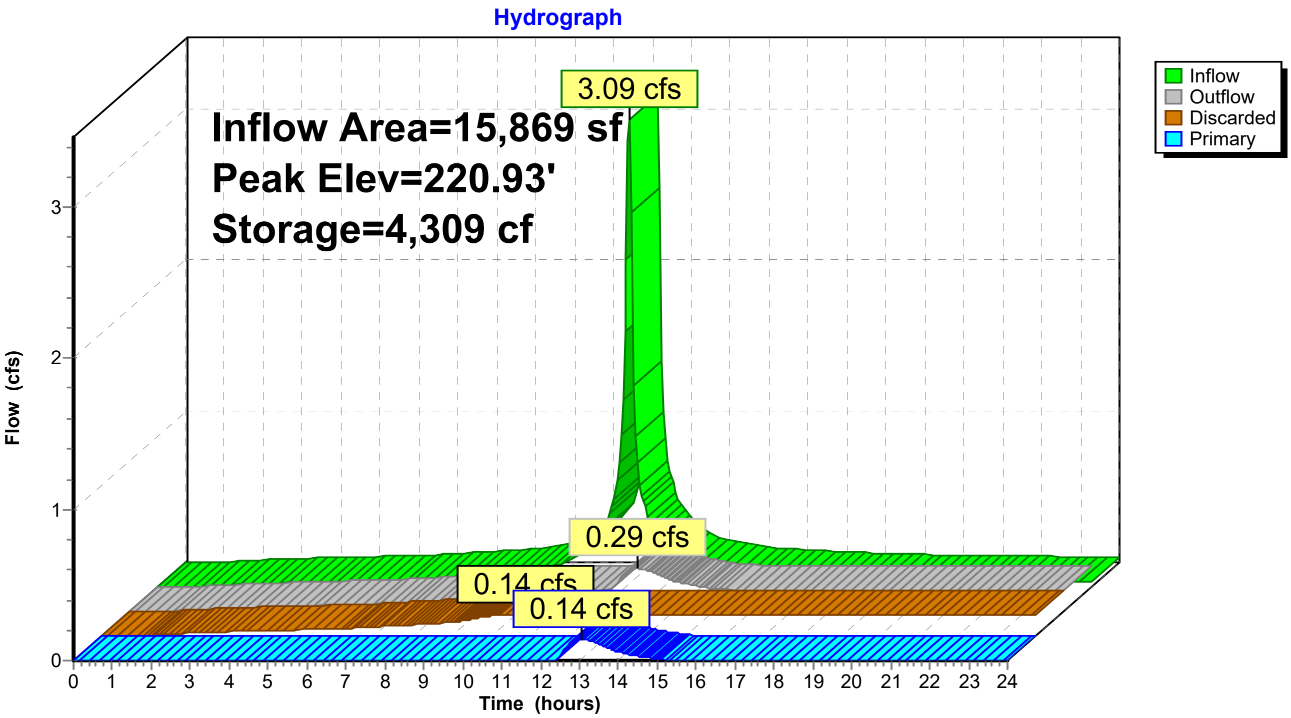
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 219.25 | 0 |
| 219.75 | 1,280 |
| 220.25 | 2,561 |
| 220.75 | 3,841 |
| 221.25 | 5,121 |
| 221.75 | 6,401 |
| 222.25 | 7,682 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 219.25' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 220.75' | **12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.14 cfs @ 10.90 hrs HW=219.28' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

**Primary OutFlow** Max=0.14 cfs @ 13.04 hrs HW=220.93' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 1.45 fps)

## Pond 10P: STORMTRAP SYSTEM C



## Summary for Pond 12P: STORMTRAP 13 FT SYSTEM D

Inflow Area = 203,397 sf,100.00% Impervious, Inflow Depth > 8.31" for 100-Year event
Inflow = 39.82 cfs @ 12.13 hrs, Volume= 140,910 cf
Outflow = 0.25 cfs @ 1.40 hrs, Volume= 21,122 cf, Atten= 99%, Lag= 0.0 min
Discarded = 0.25 cfs @ 1.40 hrs, Volume= 21,122 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 183.65' @ 24.00 hrs Surf.Area= 10,737 sf Storage= 119,770 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 6.5 min ( 747.1 - 740.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 170.75' | 0 cf | **64.19'W x 167.27'L x 14.00'H Field A**<br>150,314 cf Overall - 150,314 cf Embedded = 0 cf x 40.0% Voids |
| #2A | 170.75' | 125,597 cf | **StormTrap ST2 DoubleTrap 13-0** x 60 Inside #1<br>Inside= 101.7"W x 156.0"H => 101.45 sf x 15.40'L = 1,561.9 cf<br>Outside= 101.7"W x 168.0"H => 118.71 sf x 15.40'L = 1,827.6 cf<br>60 Chambers in 6 Rows<br>50.88' x 153.96' Core + 6.66' Border = 64.19' x 167.27' System |
| | | 125,597 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 170.75' | **1.020 in/hr Exfiltration over Surface area** |

**Discarded OutFlow** Max=0.25 cfs @ 1.40 hrs HW=171.25' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.25 cfs)

## Pond 12P: STORMTRAP 13 FT SYSTEM D - Chamber Wizard Field A

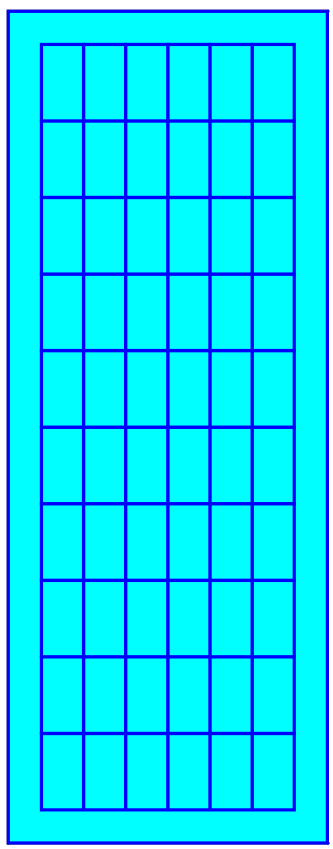
**Chamber Model = StormTrap ST2 DoubleTrap 13-0 (StormTrap ST2 DoubleTrap® Type I+III)**
Inside= 101.7"W x 156.0"H => 101.45 sf x 15.40'L = 1,561.9 cf
Outside= 101.7"W x 168.0"H => 118.71 sf x 15.40'L = 1,827.6 cf

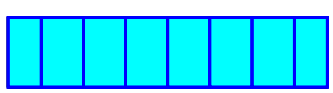
10 Chambers/Row x 15.40' Long = 153.96' Row Length +79.9" Border x 2 = 167.27' Base Length
6 Rows x 101.7" Wide + 79.9" Side Border x 2 = 64.19' Base Width
168.0" Chamber Height = 14.00' Field Height

60 Chambers x 1,561.9 cf + 31,885.6 cf Border = 125,597.4 cf Chamber Storage
60 Chambers x 1,827.6 cf + 40,656.9 cf Border = 150,313.8 cf Displacement

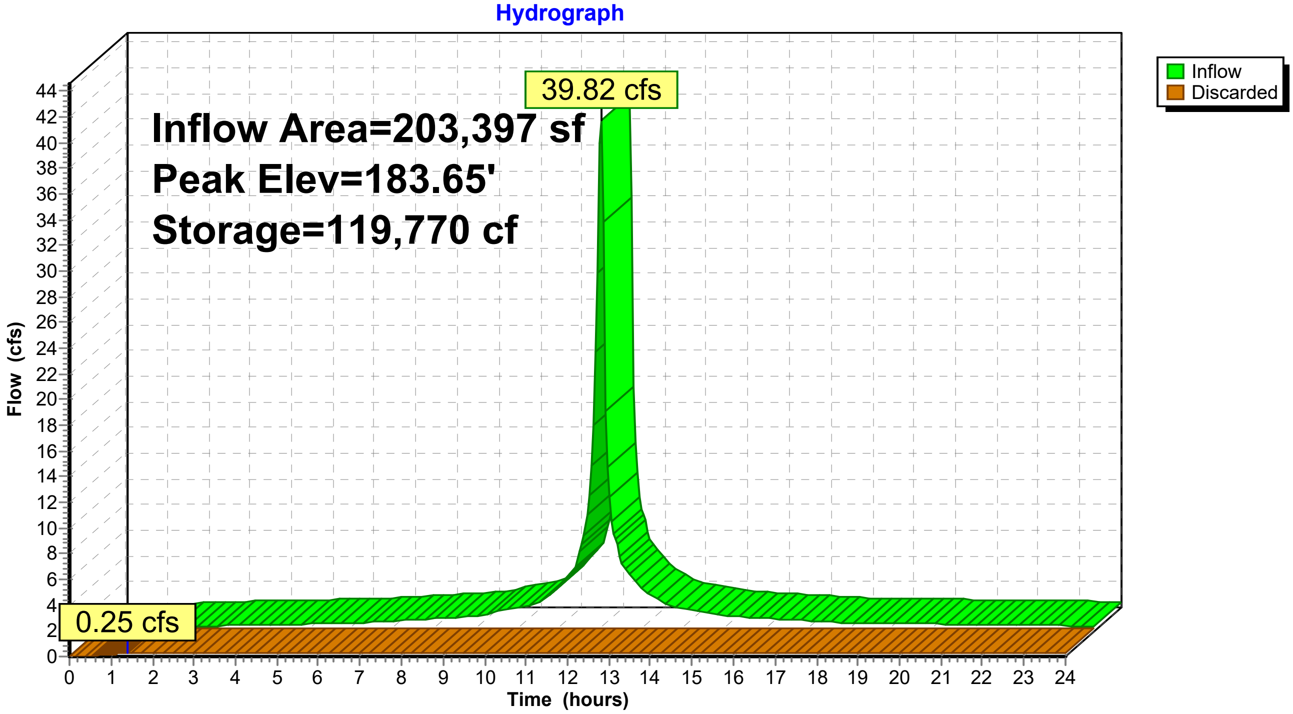
Chamber Storage = 125,597.4 cf = 2.883 af
Overall Storage Efficiency = 83.6%
Overall System Size = 167.27' x 64.19' x 14.00'

60 Chambers (plus border)
5,567.2 cy Field





## Pond 12P: STORMTRAP 13 FT SYSTEM D



## Summary for Pond 13P: BASIN A

Inflow Area = 456,714 sf, 65.34% Impervious, Inflow Depth > 6.95" for 100-Year event
Inflow = 81.38 cfs @ 12.13 hrs, Volume= 264,681 cf
Outflow = 1.58 cfs @ 17.96 hrs, Volume= 91,412 cf, Atten= 98%, Lag= 349.7 min
Discarded = 1.58 cfs @ 17.96 hrs, Volume= 91,412 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 177.65' @ 17.96 hrs Surf.Area= 28,402 sf Storage= 180,321 cf

Plug-Flow detention time= 309.5 min calculated for 91,412 cf (35% of inflow)
Center-of-Mass det. time= 143.9 min ( 924.0 - 780.1 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 169.00' | 214,942 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc) |

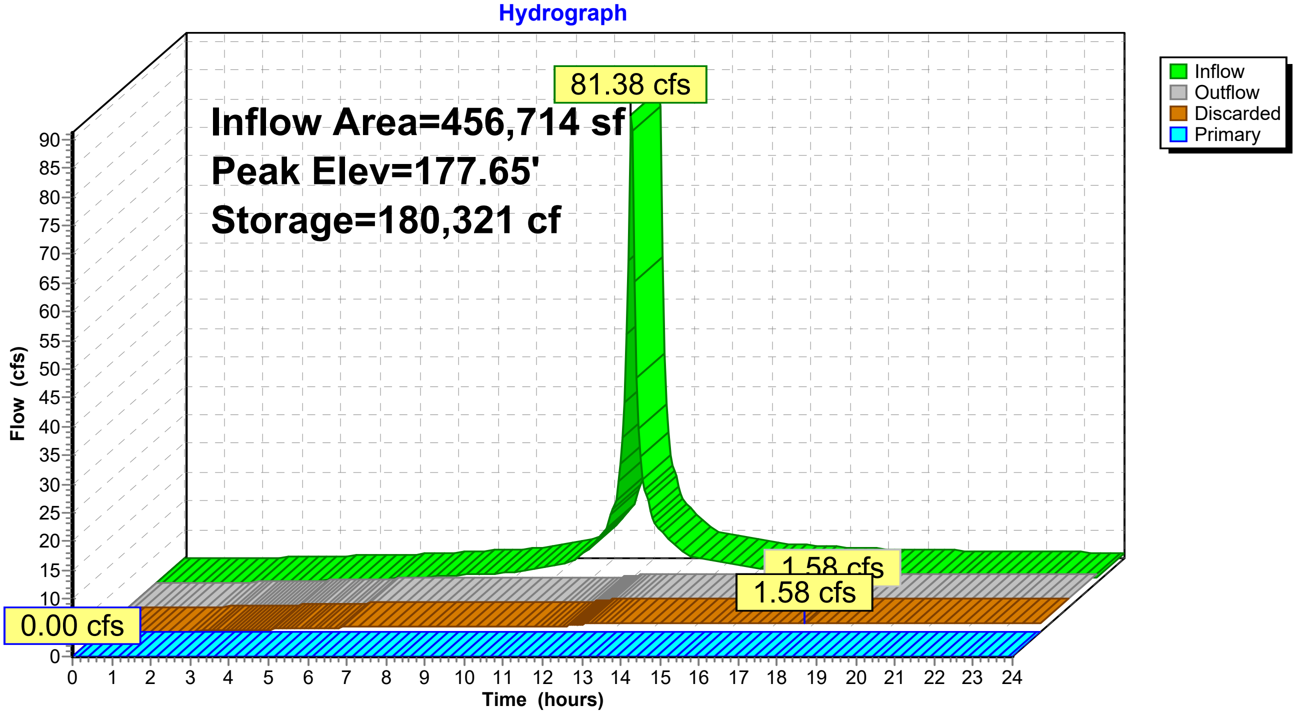
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 169.00 | 14,114 | 0 | 0 |
| 170.00 | 15,529 | 14,822 | 14,822 |
| 171.00 | 17,000 | 16,265 | 31,086 |
| 172.00 | 18,527 | 17,764 | 48,850 |
| 173.00 | 20,111 | 19,319 | 68,169 |
| 174.00 | 21,751 | 20,931 | 89,100 |
| 175.00 | 23,448 | 22,600 | 111,699 |
| 176.00 | 25,345 | 24,397 | 136,096 |
| 177.00 | 27,180 | 26,263 | 162,358 |
| 178.00 | 29,071 | 28,126 | 190,484 |
| 178.80 | 32,074 | 24,458 | 214,942 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 169.00' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 177.80' | **20.0' long x 15.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63 |

**Discarded OutFlow** Max=1.58 cfs @ 17.96 hrs HW=177.65' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.58 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=169.00' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond 13P: BASIN A



## Summary for Pond 59P: BASIN B

Inflow Area = 271,926 sf, 56.54% Impervious, Inflow Depth > 6.58" for 100-Year event
Inflow = 45.34 cfs @ 12.13 hrs, Volume= 149,135 cf
Outflow = 14.89 cfs @ 12.32 hrs, Volume= 102,704 cf, Atten= 67%, Lag= 11.3 min
Discarded = 1.20 cfs @ 12.32 hrs, Volume= 65,526 cf
Primary = 13.69 cfs @ 12.32 hrs, Volume= 37,177 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 214.31' @ 12.32 hrs Surf.Area= 21,468 sf Storage= 61,733 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 94.0 min ( 872.3 - 778.3 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 210.00' | 77,098 cf | **Custom Stage Data (Irregular)** Listed below (Recalc) |

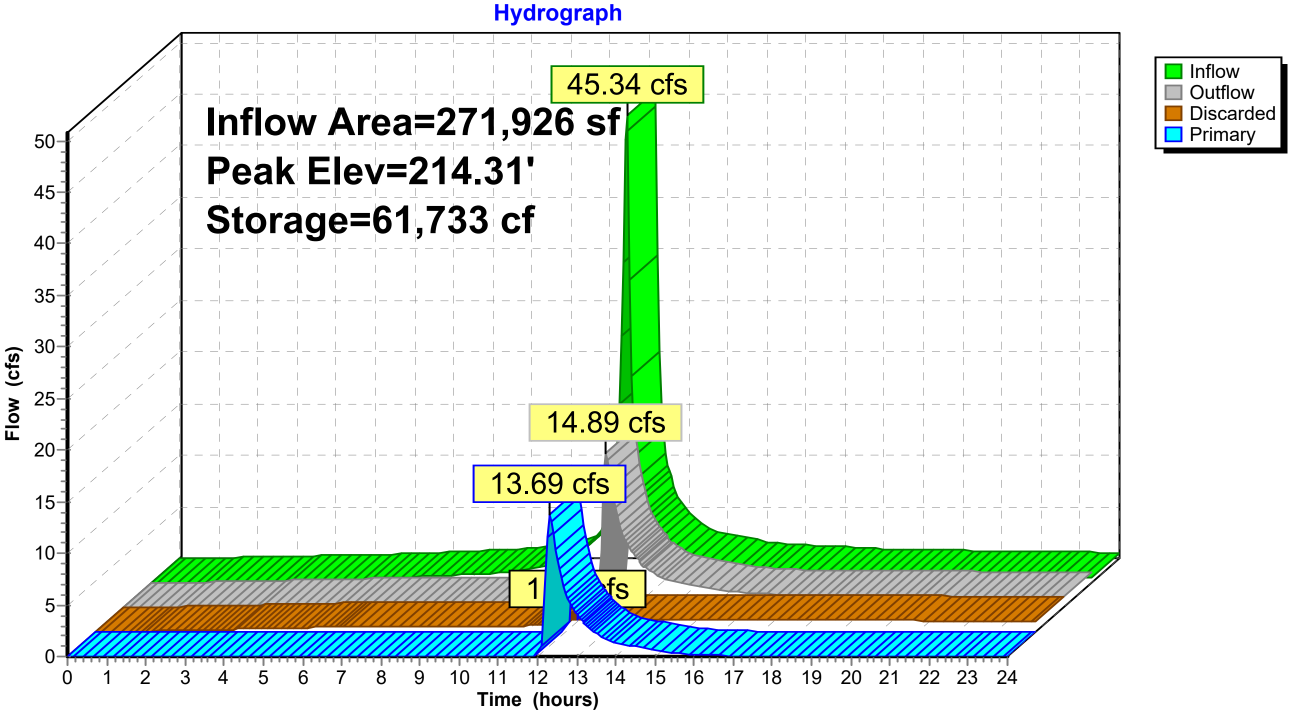
| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|---|---|---|---|---|---|
| 210.00 | 9,182 | 374.9 | 0 | 0 | 9,182 |
| 211.00 | 10,335 | 393.7 | 9,753 | 9,753 | 10,394 |
| 212.00 | 14,140 | 565.6 | 12,188 | 21,941 | 23,526 |
| 213.00 | 15,865 | 584.4 | 14,994 | 36,935 | 25,340 |
| 214.00 | 20,870 | 647.8 | 18,310 | 55,245 | 31,587 |
| 215.00 | 22,851 | 666.2 | 21,853 | 77,098 | 33,620 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 210.00' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 214.00' | **30.0' long x 15.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63 |

**Discarded OutFlow** Max=1.20 cfs @ 12.32 hrs HW=214.30' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.20 cfs)

**Primary OutFlow** Max=13.41 cfs @ 12.32 hrs HW=214.30' TW=0.00' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 13.41 cfs @ 1.48 fps)

## Pond 59P: BASIN B



## Summary for Pond 61P: BASIN C

Inflow Area = 351,572 sf, 70.16% Impervious, Inflow Depth > 7.08" for 100-Year event
Inflow = 60.75 cfs @ 12.13 hrs, Volume= 207,478 cf
Outflow = 28.17 cfs @ 12.26 hrs, Volume= 139,510 cf, Atten= 54%, Lag= 7.8 min
Discarded = 1.20 cfs @ 12.26 hrs, Volume= 70,730 cf
Primary = 26.97 cfs @ 12.26 hrs, Volume= 68,781 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 216.43' @ 12.26 hrs Surf.Area= 21,556 sf Storage= 83,642 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 66.9 min ( 826.8 - 759.9 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 211.00' | 91,926 cf | **Custom Stage Data (Irregular)** Listed below (Recalc) |

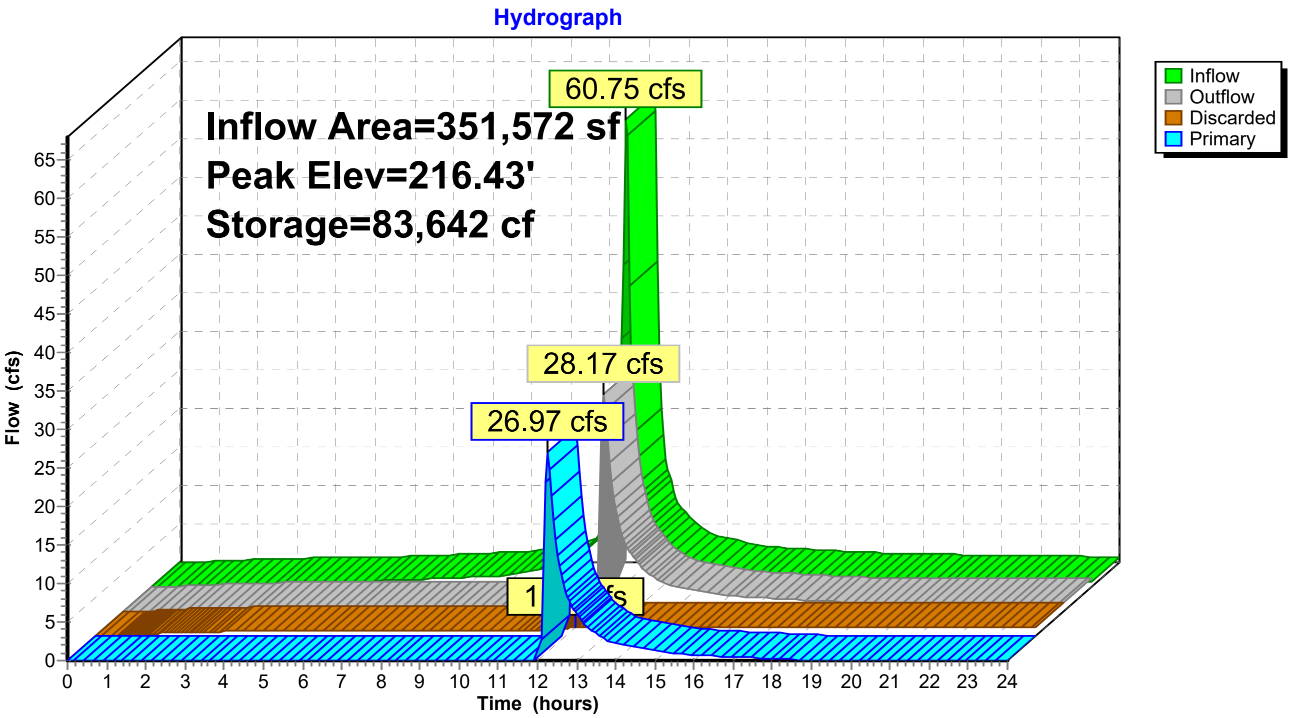
| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|---|---|---|---|---|---|
| 211.00 | 10,407 | 575.7 | 0 | 0 | 10,407 |
| 212.00 | 12,162 | 594.5 | 11,273 | 11,273 | 12,253 |
| 213.00 | 13,974 | 613.4 | 13,058 | 24,331 | 14,167 |
| 214.00 | 15,842 | 632.2 | 14,898 | 39,229 | 16,132 |
| 215.00 | 17,767 | 651.1 | 16,795 | 56,024 | 18,166 |
| 216.00 | 19,749 | 669.9 | 18,749 | 74,773 | 20,250 |
| 216.80 | 23,177 | 701.3 | 17,152 | 91,926 | 23,720 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 211.00' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 215.80' | **20.0' long x 10.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64 |

**Discarded OutFlow** Max=1.20 cfs @ 12.26 hrs HW=216.42' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.20 cfs)

**Primary OutFlow** Max=26.62 cfs @ 12.26 hrs HW=216.42' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 26.62 cfs @ 2.13 fps)

## Pond 61P: BASIN C



## Summary for Pond 65P: STORMTRAP 3.5 FT SYSTEM B

Inflow Area = 375,763 sf, 94.19% Impervious, Inflow Depth > 8.06" for 100-Year event
Inflow = 72.89 cfs @ 12.13 hrs, Volume= 252,400 cf
Outflow = 68.58 cfs @ 12.13 hrs, Volume= 231,127 cf, Atten= 6%, Lag= 0.4 min
Discarded = 0.96 cfs @ 6.50 hrs, Volume= 74,637 cf
Primary = 67.63 cfs @ 12.13 hrs, Volume= 156,491 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 215.68' @ 12.55 hrs Surf.Area= 17,139 sf Storage= 43,464 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 38.1 min ( 788.6 - 750.5 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 213.14' | 2 cf | **Custom Stage Data (Prismatic)** Listed below<br>59,987 cf Overall - 59,985 cf Embedded = 2 cf |
| #2 | 213.14' | 59,985 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 59,987 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 213.14 | 17,139 | 0 | 0 |
| 213.39 | 17,139 | 4,285 | 4,285 |
| 214.14 | 17,139 | 12,854 | 17,139 |
| 214.64 | 17,139 | 8,570 | 25,709 |
| 215.14 | 17,139 | 8,570 | 34,278 |
| 215.64 | 17,139 | 8,570 | 42,848 |
| 216.14 | 17,139 | 8,570 | 51,417 |
| 216.64 | 17,139 | 8,570 | 59,987 |

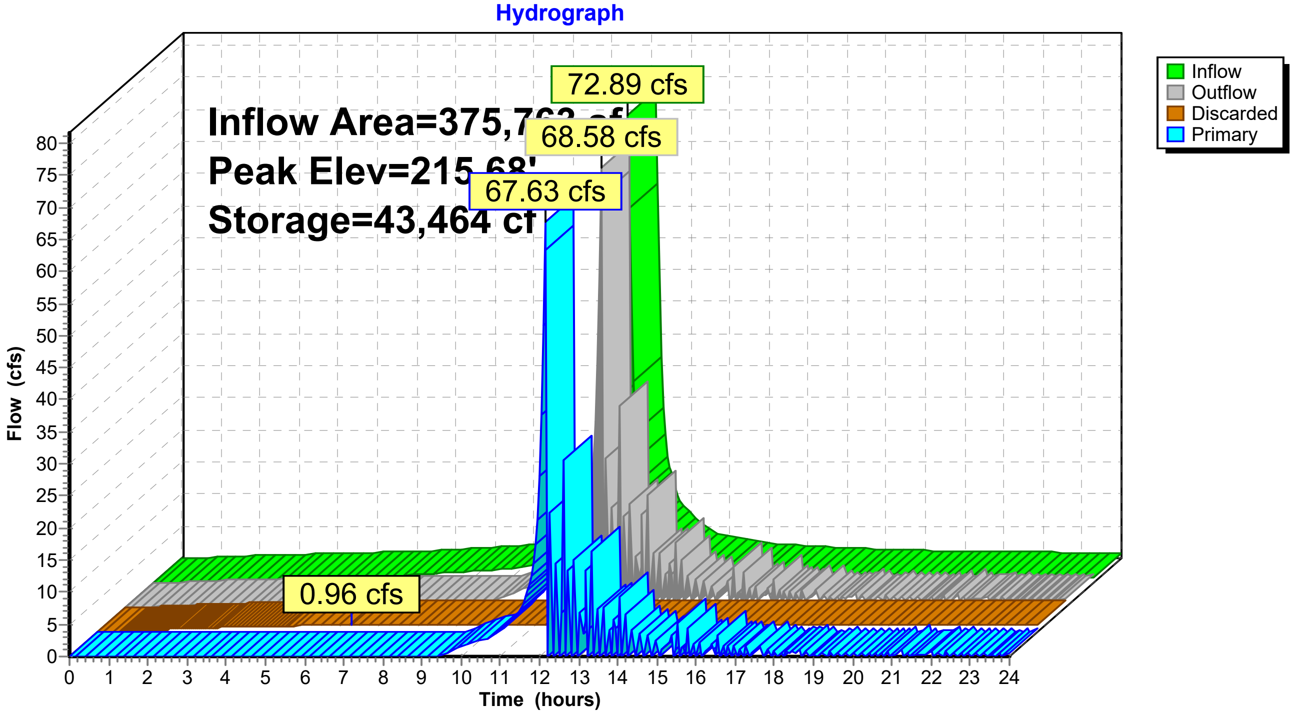
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 213.14 | 0 |
| 213.64 | 8,569 |
| 214.14 | 17,138 |
| 214.64 | 25,708 |
| 215.14 | 34,277 |
| 215.64 | 42,846 |
| 216.14 | 51,416 |
| 216.64 | 59,985 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 213.14' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 213.64' | **24.0" Vert. Orifice/Grate X 10.00** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.96 cfs @ 6.50 hrs HW=213.18' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.96 cfs)

**Primary OutFlow** Max=0.00 cfs @ 12.13 hrs HW=214.70' TW=214.71' (Dynamic Tailwater)
└─**2=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 65P: STORMTRAP 3.5 FT SYSTEM B



## Summary for Pond 67P: CULTEC SYSTEM E

Inflow Area = 59,461 sf, 84.88% Impervious, Inflow Depth > 7.83" for 100-Year event
Inflow = 11.47 cfs @ 12.13 hrs, Volume= 38,811 cf
Outflow = 1.70 cfs @ 12.61 hrs, Volume= 28,786 cf, Atten= 85%, Lag= 29.0 min
Discarded = 0.33 cfs @ 9.80 hrs, Volume= 21,668 cf
Primary = 1.37 cfs @ 12.61 hrs, Volume= 7,118 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 214.18' @ 12.61 hrs Surf.Area= 5,889 sf Storage= 16,233 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 101.5 min ( 863.1 - 761.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1A | 210.36' | 8,095 cf | **37.50'W x 157.03'L x 5.75'H Field A**<br>33,860 cf Overall - 13,622 cf Embedded = 20,238 cf x 40.0% Voids |
| #2A | 211.11' | 13,622 cf | **Cultec R-902HD** x 210 Inside #1<br>Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf<br>Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap<br>210 Chambers in 5 Rows<br>Cap Storage= +2.8 cf x 2 x 5 rows = 27.6 cf |
| | | 21,717 cf | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 210.36' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 213.56' | **12.0" Vert. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.33 cfs @ 9.80 hrs HW=210.42' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.33 cfs)

**Primary OutFlow** Max=1.37 cfs @ 12.61 hrs HW=214.18' TW=0.00' (Dynamic Tailwater)
└─**2=Orifice/Grate** (Orifice Controls 1.37 cfs @ 2.68 fps)

## Pond 67P: CULTEC SYSTEM E - Chamber Wizard Field A

**Chamber Model = Cultec R-902HD (Cultec Recharger® 902HD)**
Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= +2.8 cf x 2 x 5 rows = 27.6 cf

78.0" Wide + 9.0" Spacing = 87.0" C-C Row Spacing

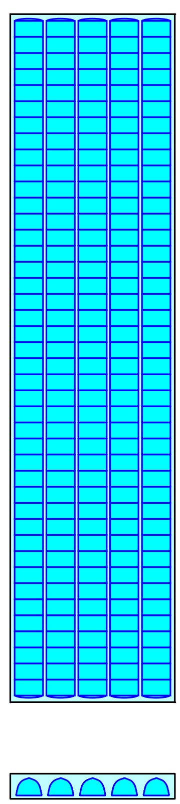
42 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 155.03' Row Length +12.0" End Stone x 2 = 157.03' Base Length
5 Rows x 78.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.50' Base Width
9.0" Stone Base + 48.0" Chamber Height + 12.0" Stone Cover = 5.75' Field Height

210 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 5 Rows = 13,622.0 cf Chamber Storage

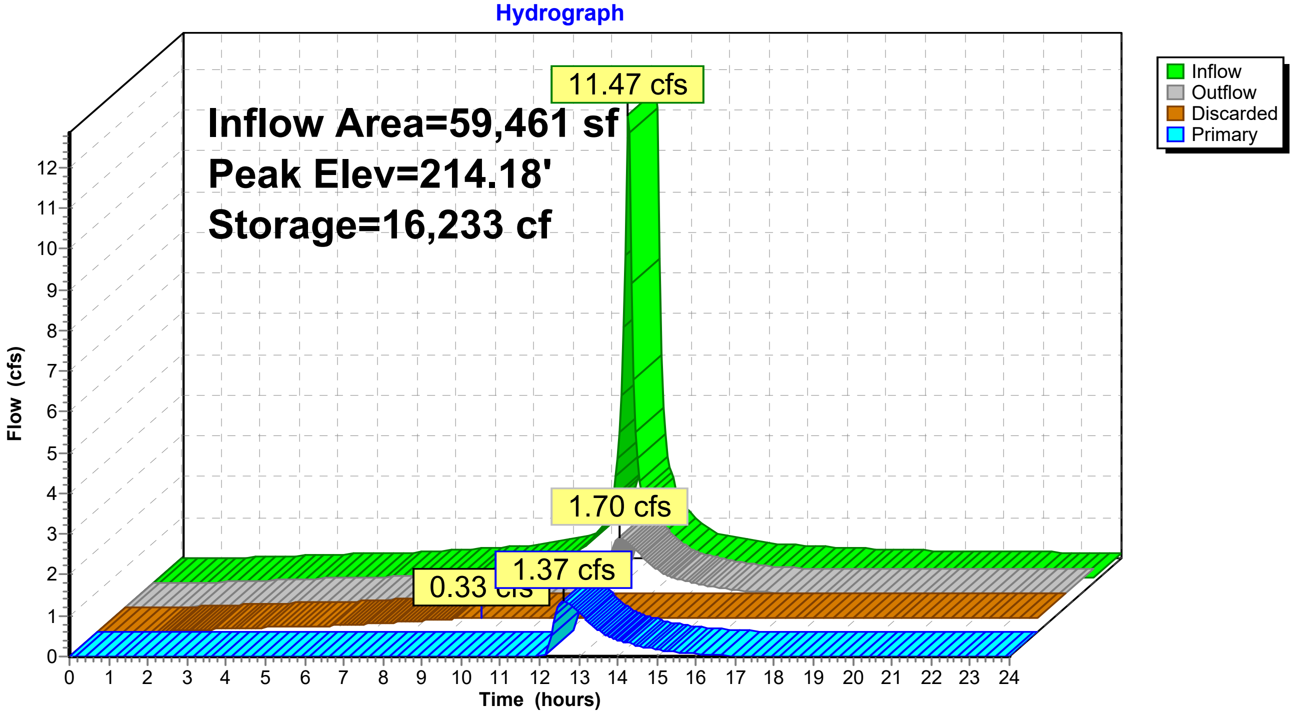
33,860.3 cf Field - 13,622.0 cf Chambers = 20,238.4 cf Stone x 40.0% Voids = 8,095.3 cf Stone Storage

Chamber Storage + Stone Storage = 21,717.3 cf = 0.499 af
Overall Storage Efficiency = 64.1%
Overall System Size = 157.03' x 37.50' x 5.75'

210 Chambers
1,254.1 cy Field
749.6 cy Stone



## Pond 67P: CULTEC SYSTEM E



## Summary for Pond 69P: STORMTRAP 7.5 FT SYSTEM B

Inflow Area = 387,563 sf, 93.38% Impervious, Inflow Depth > 5.07" for 100-Year event
Inflow = 69.84 cfs @ 12.13 hrs, Volume= 163,719 cf
Outflow = 13.78 cfs @ 12.35 hrs, Volume= 105,346 cf, Atten= 80%, Lag= 13.0 min
Discarded = 0.62 cfs @ 10.05 hrs, Volume= 33,084 cf
Primary = 13.16 cfs @ 12.35 hrs, Volume= 72,262 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 215.76' @ 12.35 hrs Surf.Area= 11,144 sf Storage= 73,748 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 85.2 min ( 873.2 - 788.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 209.14' | 5 cf | **Custom Stage Data (Prismatic)** Listed below<br>83,580 cf Overall - 83,575 cf Embedded = 5 cf |
| #2 | 209.14' | 83,575 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 83,580 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 209.14 | 11,144 | 0 | 0 |
| 209.64 | 11,144 | 5,572 | 5,572 |
| 210.14 | 11,144 | 5,572 | 11,144 |
| 210.64 | 11,144 | 5,572 | 16,716 |
| 211.14 | 11,144 | 5,572 | 22,288 |
| 211.64 | 11,144 | 5,572 | 27,860 |
| 212.14 | 11,144 | 5,572 | 33,432 |
| 212.64 | 11,144 | 5,572 | 39,004 |
| 213.14 | 11,144 | 5,572 | 44,576 |
| 213.64 | 11,144 | 5,572 | 50,148 |
| 214.14 | 11,144 | 5,572 | 55,720 |
| 214.64 | 11,144 | 5,572 | 61,292 |
| 215.14 | 11,144 | 5,572 | 66,864 |
| 215.64 | 11,144 | 5,572 | 72,436 |
| 216.14 | 11,144 | 5,572 | 78,008 |
| 216.64 | 11,144 | 5,572 | 83,580 |

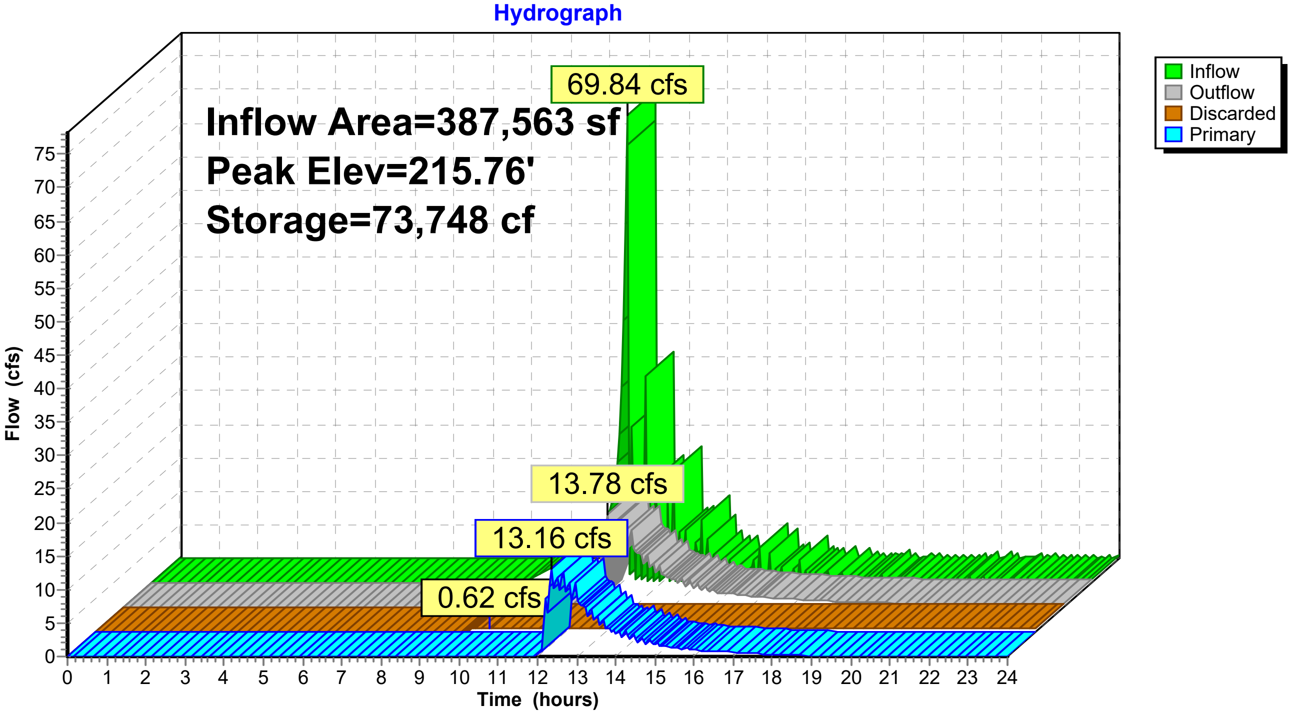
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 209.14 | 0 |
| 209.64 | 5,572 |
| 210.14 | 11,144 |
| 210.64 | 16,715 |
| 211.14 | 22,287 |
| 211.64 | 27,858 |
| 212.14 | 33,430 |
| 212.64 | 39,002 |
| 213.14 | 44,573 |
| 213.64 | 50,145 |
| 214.14 | 55,717 |
| 214.64 | 61,289 |
| 215.14 | 66,860 |
| 215.64 | 72,432 |
| 216.14 | 78,004 |
| 216.64 | 83,575 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 209.14' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 214.64' | **15.0" Round Culvert X 4.00**<br>L= 12.0' CPP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 214.64' / 214.40' S= 0.0200 '/' Cc= 0.900<br>n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf |

**Discarded OutFlow** Max=0.62 cfs @ 10.05 hrs HW=209.22' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.62 cfs)

**Primary OutFlow** Max=13.10 cfs @ 12.35 hrs HW=215.75' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Inlet Controls 13.10 cfs @ 2.84 fps)

## Pond 69P: STORMTRAP 7.5 FT SYSTEM B



## Summary for Pond 70P: STORMTRAP 4 FT SYSTEM A

Inflow Area = 532,500 sf, 90.16% Impervious, Inflow Depth > 8.01" for 100-Year event
Inflow = 102.86 cfs @ 12.13 hrs, Volume= 355,516 cf
Outflow = 12.41 cfs @ 12.76 hrs, Volume= 278,187 cf, Atten= 88%, Lag= 38.0 min
Discarded = 2.56 cfs @ 9.55 hrs, Volume= 179,788 cf
Primary = 9.85 cfs @ 12.76 hrs, Volume= 98,399 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 188.12' @ 12.76 hrs Surf.Area= 45,880 sf Storage= 150,950 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 94.2 min ( 845.2 - 751.0 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 184.83' | 0 cf | **Custom Stage Data (Prismatic)** Listed below<br>183,520 cf Overall - 183,520 cf Embedded = 0 cf |
| #2 | 184.83' | 183,520 cf | **Custom Stage Data** Listed below Inside #1 |
| | | 183,520 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 184.83 | 45,880 | 0 | 0 |
| 185.33 | 45,880 | 22,940 | 22,940 |
| 185.83 | 45,880 | 22,940 | 45,880 |
| 186.33 | 45,880 | 22,940 | 68,820 |
| 186.83 | 45,880 | 22,940 | 91,760 |
| 187.33 | 45,880 | 22,940 | 114,700 |
| 187.83 | 45,880 | 22,940 | 137,640 |
| 188.33 | 45,880 | 22,940 | 160,580 |
| 188.83 | 45,880 | 22,940 | 183,520 |

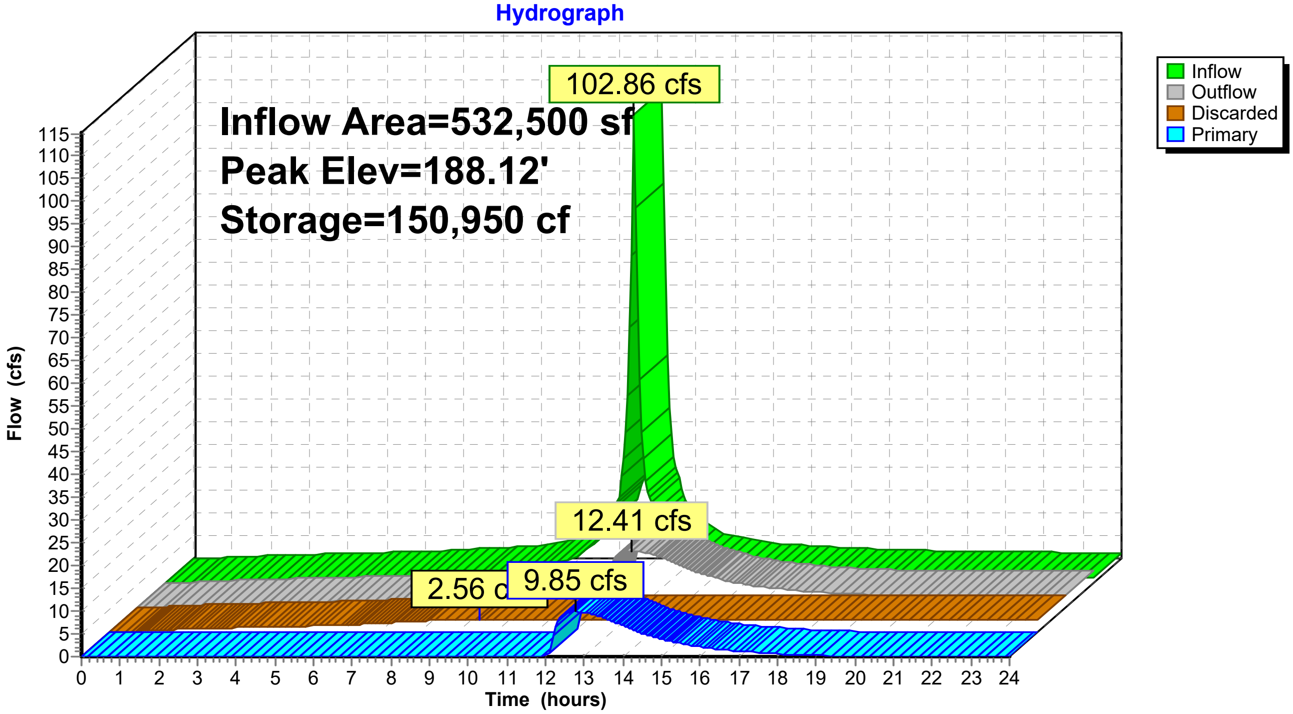
| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 184.83 | 0 |
| 185.33 | 22,940 |
| 185.83 | 45,880 |
| 186.33 | 68,820 |
| 186.83 | 91,760 |
| 187.33 | 114,700 |
| 187.83 | 137,640 |
| 188.33 | 160,580 |
| 188.83 | 183,520 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 184.83' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 186.80' | **15.0" Vert. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=2.56 cfs @ 9.55 hrs HW=184.87' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 2.56 cfs)

**Primary OutFlow** Max=9.85 cfs @ 12.76 hrs HW=188.12' TW=0.00' (Dynamic Tailwater)
└**2=Orifice/Grate** (Orifice Controls 9.85 cfs @ 4.01 fps)

## Pond 70P: STORMTRAP 4 FT SYSTEM A



# APPENDIX B: HYDRAULIC ANALYSIS

# PIPE SIZING CALCULATIONS

MBL Land Development & Permitting, Corp.
*Land Development, Transportation & Environmental Solutions*

Project No.: 2021-036
Location: Innovation Way
Calculated By: JAW
Calculated On: November 17, 2022

R = Hydraulic Radius = Area/Wetted Per

# 25 YEAR STORM
# PROPOSED BUILDING 1

| WATERSHED CHARACTERISTICS | | | | | | | | | | | | PIPE CHARACTERISTICS | | | | | | | | | | | FLOW CHARACTERISTICS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | | | | LAND USE | | | FLOW TIME | | | FLOW | | R = hydraulic radius = area/wetted perimeter | | | | | | | | | | | | | | Tc |
| Description | Cover | Increm. (ACRE) | Total_A (ACRE) | C | CA | Total CA | To Inlet (MIN) | In Pipe (MIN) | Tc (MIN) | I (IPH) | Q (CFS) | Structure | Invert | Pipe | Size (IN) | Length (FT) | Area (SF) | R (FT) | Slope | n | Qf (CFS) | Vf (FT/S) | Q/Qf | V/Vf | V (FT/S) | L/V (MIN) |
| WS CB-1 | LANDSCAPED | 0.036 | | 0.350 | | | | | | | | From: CB-1 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.098 | | 0.250 | | | | | | | | | | RCP | 12 | 34 | 0.79 | 0.250 | 0.005 | 0.011 | 2.98 | 3.79 | 0.04 | 0.41 | 1.56 | 0.36 |
| | | | 0.134 | 0.277 | 0.037 | 0.037 | 6.00 | NONE | 6.00 | 6.39 | 0.24 | To: DMH-1 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-1 | Out: | | | | | | | | | | | | | |
| **DMH-1 TO** | **DMH-2** | | | | | 0.037 | 6.00 | 0.36 | 6.36 | 6.33 | 0.24 | | | HDPE | 12 | 99 | 0.79 | 0.250 | 0.005 | 0.013 | 2.52 | 3.21 | 0.09 | 0.53 | 1.69 | 0.98 |
| | | | | | | | | | | | | To: DMH-2 | In: | | | | | | | | | | | | | |
| WS DCB-2 | LANDSCAPED | 0.315 | | 0.350 | | | | | | | | From: DCB-2 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.311 | | 0.850 | | | | | | | | | | RCP | 12 | 5 | 0.79 | 0.250 | 0.010 | 0.011 | 4.21 | 5.36 | 0.28 | 0.73 | 3.90 | 0.02 |
| | | | 0.626 | 0.599 | 0.375 | | 6.00 | NONE | 6.00 | 6.39 | 2.39 | To: DMH-2 | In: | | | | | | | | | | | | | |
| WS CB-3 | LANDSCAPED | 0.253 | | 0.350 | | | | | | | | From: CB-3 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.138 | | 0.850 | | | | | | | | | | RCP | 12 | 32 | 0.79 | 0.250 | 0.015 | 0.011 | 5.16 | 6.57 | 0.13 | 0.58 | 3.78 | 0.14 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | 1.32 | To: DMH-2 | In: | | | | | | | | | | | | | |
| | | | 0.391 | 0.527 | 0.206 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-2 | Out: | | | | | | | | | | | | | |
| **DMH-2 TO** | **DMH-3** | | | | | 0.618 | 6.36 | 0.98 | 7.34 | 6.16 | 3.81 | | | HDPE | 15 | 201 | 1.23 | 0.313 | 0.005 | 0.013 | 4.57 | 3.72 | 0.83 | 0.99 | 3.70 | 0.91 |
| | | | | | | | | | | | | To: DMH-3 | In: | | | | | | | | | | | | | |
| WS DCB-4 | LANDSCAPED | 0.107 | | 0.350 | | | | | | | | From: DCB-4 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.355 | | 0.850 | | | | | | | | | | HDPE | 12 | 8 | 0.79 | 0.250 | 0.010 | 0.013 | 3.56 | 4.54 | 0.30 | 0.74 | 3.36 | 0.04 |
| | | | 0.462 | 0.734 | 0.339 | | 6.00 | NONE | 6.00 | 6.39 | 2.16 | To: DMH-3 | In: | | | | | | | | | | | | | |
| WS CB-5 | LANDSCAPED | 0.433 | | 0.350 | | | | | | | | From: CB-5 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.182 | | 0.850 | | | | | | | | | | HDPE | 12 | 56 | 0.79 | 0.250 | 0.015 | 0.013 | 4.36 | 5.56 | 0.22 | 0.68 | 3.77 | 0.25 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | 1.95 | To: DMH-3 | In: | | | | | | | | | | | | | |
| | | | 0.615 | 0.498 | 0.306 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-3 | Out: | | | | | | | | | | | | | |
| **DMH-3 TO** | **DMH-4** | | | | | 1.263 | 7.34 | 0.91 | 8.25 | 6.01 | 7.59 | | | HDPE | 18 | 211 | 1.77 | 0.375 | 0.005 | 0.013 | 7.43 | 4.20 | 1.02 | 1.05 | 4.43 | 0.79 |
| | | | | | | | | | | | | To: DMH-4 | In: | | | | | | | | | | | | | |
| WS CB-6 | LANDSCAPED | 0.257 | | 0.350 | | | | | | | | From: CB-6 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.178 | | 0.850 | | | | | | | | | | HDPE | 12 | 32 | 0.79 | 0.250 | 0.040 | 0.013 | 7.13 | 9.07 | 0.11 | 0.55 | 4.98 | 0.11 |
| | | | 0.435 | 0.554 | 0.241 | | 6.00 | NONE | 6.00 | 6.39 | 1.54 | To: DMH-4 | In: | | | | | | | | | | | | | |
| WS DCB-7 | LANDSCAPED | 0.119 | | 0.350 | | | | | | | | From: DCB-7 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.350 | | 0.850 | | | | | | | | | | HDPE | 12 | 8 | 0.79 | 0.250 | 0.020 | 0.013 | 5.04 | 6.42 | 0.21 | 0.67 | 4.30 | 0.03 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | 2.16 | To: DMH-4 | In: | | | | | | | | | | | | | |
| | | | 0.469 | 0.723 | 0.339 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-4 | Out: | | | | | | | | | | | | | |
| **DMH-4 TO** | **DMH-5** | | | | | 1.843 | 8.25 | 0.79 | 9.04 | 5.89 | 10.85 | | | HDPE | 21 | 200 | 2.41 | 0.438 | 0.005 | 0.013 | 11.20 | 4.66 | 0.97 | 1.04 | 4.83 | 0.69 |
| | | | | | | | | | | | | To: DMH-5 | In: | | | | | | | | | | | | | |
| WS DCB-8 | LANDSCAPED | 0.135 | | 0.350 | | | | | | | | From: DCB-8 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.310 | | 0.850 | | | | | | | | | | HDPE | 12 | 11 | 0.79 | 0.250 | 0.010 | 0.013 | 3.56 | 4.54 | 0.28 | 0.72 | 3.28 | 0.06 |
| | | | 0.444 | 0.698 | 0.310 | | 6.00 | NONE | 6.00 | 6.39 | 1.98 | To: DMH-5 | In: | | | | | | | | | | | | | |
| WS CB-9 | LANDSCAPED | 0.224 | | 0.350 | | | | | | | | From: CB-9 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.138 | | 0.850 | | | | | | | | | | HDPE | 12 | 25 | 0.79 | 0.250 | 0.035 | 0.013 | 6.67 | 8.49 | 0.09 | 0.53 | 4.47 | 0.09 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | 1.25 | To: DMH-5 | In: | | | | | | | | | | | | | |
| | | | 0.362 | 0.541 | 0.196 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-5 | Out: | | | | | | | | | | | | | |
| **DMH-5 TO** | **DMH-6** | | | | | 2.349 | 9.04 | 0.69 | 9.73 | 5.79 | 13.60 | | | HDPE | 24 | 106 | 3.14 | 0.500 | 0.005 | 0.013 | 16.00 | 5.09 | 0.85 | 1.00 | 5.09 | 0.35 |
| | | | | | | | | | | | | To: DMH-6 | In: | | | | | | | | | | | | | |

**MBL** Land Development & Permitting, Corp.
*Land Development, Transportation & Environmental Solutions*

Project No.: 2021-036
Location: Innovation Way
Calculated By: JAW
Calculated On: November 17, 2022

R = Hydraulic Radius = Area/Wetted Per

# 25 YEAR STORM
# PROPOSED BUILDING 1

| WATERSHED CHARACTERISTICS | | | | | | | | | | | | PIPE CHARACTERISTICS | | | | | | | | | | | FLOW CHARACTERISTICS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | | | | LAND USE | | | FLOW TIME | | | FLOW | | R = hydraulic radius = area/wetted perimeter | | | | | | | | | | | | | | |
| Description | Cover | Increm. (ACRE) | Total_A (ACRE) | C | CA | Total CA | To Inlet (MIN) | In Pipe (MIN) | Tc (MIN) | I (IPH) | Q (CFS) | Structure | Invert | Pipe | Size (IN) | Length (FT) | Area (SF) | R (FT) | Slope | n | Qf (CFS) | Vf (FT/S) | Q/Qf | V/Vf | V (FT/S) | Tc L/V (MIN) |
| **DMH-6 TO WQU-1** | | | | | | 2.349 | 9.73 | 0.35 | 10.08 | 5.74 | **13.48** | From: DMH-6<br>To: WQU-1 | Out:<br>In: | HDPE | 24 | 78 | 3.14 | 0.500 | 0.005 | 0.013 | **16.00** | **5.09** | **0.84** | **1.00** | **5.07** | **0.26** |
| WS CB-10 | LANDSCAPED | 0.168 | | 0.350 | | | | | | | | | | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.148 | | 0.250 | | | | | | | | From: CB-10<br>To: FES-1 | Out:<br>In: | HDPE | 12 | 12 | 0.79 | 0.250 | 0.030 | 0.013 | **6.17** | **7.86** | 0.05 | 0.44 | 3.44 | 0.06 |
| | | | 0.316 | 0.303 | 0.096 | 0.096 | 6.00 | NONE | 6.00 | 6.39 | **0.61** | | | | | | | | | | | | | | | |
| **WQU-1 TO FES-1** | | | | | | 2.445 | 10.08 | 0.35 | 10.43 | 5.69 | **13.91** | From: WQU-1<br>To: FES-1 | Out:<br>In: | HDPE | 24 | 46 | 3.14 | 0.500 | 0.005 | 0.013 | **16.00** | **5.09** | **0.87** | **1.01** | **5.12** | **0.15** |
| WS DCB-11 | LANDSCAPED | 0.831 | | 0.350 | | | | | | | | | | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.316 | | 0.250 | | | | | | | | From: DCB-11<br>To: DMH-7 | Out:<br>In: | RCP | 12 | 74 | 0.79 | 0.250 | 0.005 | 0.011 | **2.98** | **3.79** | 0.40 | 0.80 | 3.04 | 0.41 |
| | | | 1.148 | 0.322 | 0.370 | 0.370 | 6.00 | NONE | 6.00 | 6.39 | **2.36** | | | | | | | | | | | | | | | |
| **DMH-7 TO DMH-9** | | | | | | 0.370 | 6.00 | 0.41 | 6.41 | 6.32 | **2.34** | From: DMH-7<br>To: DMH-9 | Out:<br>In: | HDPE | 15 | 88 | 1.23 | 0.313 | 0.005 | 0.013 | **4.57** | **3.72** | **0.51** | **0.86** | **3.21** | **0.46** |
| WS CB-12 | LANDSCAPED | 0.000 | | 0.350 | | | | | | | | | | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.119 | | 0.250 | | | | | | | | From: CB-12<br>To: DMH-8 | Out:<br>In: | RCP | 12 | 7 | 0.79 | 0.250 | 0.010 | 0.011 | **4.21** | **5.36** | 0.02 | 0.35 | 1.87 | 0.06 |
| | | | 0.119 | 0.250 | 0.030 | 0.030 | 6.00 | NONE | 6.00 | 6.39 | **0.19** | | | | | | | | | | | | | | | |
| **DMH-8 TO DMH-9** | | | | | | 0.030 | 6.00 | 0.06 | 6.06 | 6.38 | **0.19** | From: DMH-8<br>To: DMH-9 | Out:<br>In: | HDPE | 12 | 151 | 0.79 | 0.250 | 0.035 | 0.013 | **6.67** | **8.49** | **0.03** | **0.37** | **3.17** | **0.79** |
| **DMH-9 TO DMH-10** | | | | | | 0.400 | 6.41 | 0.79 | 7.20 | 6.18 | **2.47** | From: DMH-9<br>To: DMH-10 | Out:<br>In: | HDPE | 12 | 128 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | **0.69** | **0.94** | **4.27** | **0.50** |
| WS CB-13 | LANDSCAPED | 0.258 | | 0.350 | | | | | | | | | | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.198 | | 0.250 | | | | | | | | From: CB-13<br>To: DMH-10 | Out:<br>In: | RCP | 12 | 7 | 0.79 | 0.250 | 0.010 | 0.011 | **4.21** | **5.36** | 0.11 | 0.55 | 2.93 | 0.04 |
| | | | 0.456 | 0.306 | 0.140 | 0.140 | 6.00 | NONE | 6.00 | 6.39 | **0.89** | | | | | | | | | | | | | | | |
| **DMH-10 TO DMH-11** | | | | | | 0.540 | 7.20 | 0.50 | 7.70 | 6.10 | **3.29** | From: DMH-10<br>To: DMH-11 | Out:<br>In: | HDPE | 15 | 92 | 1.23 | 0.313 | 0.015 | 0.013 | **7.91** | **6.45** | **0.42** | **0.81** | **5.23** | **0.29** |

MBL Land Development & Permitting, Corp.
*Land Development, Transportation & Environmental Solutions*

Project No.: 2021-036
Location: Innovation Way
Calculated By: JAW
Calculated On: November 17, 2022

R = Hydraulic Radius = Area/Wetted Per

# 25 YEAR STORM
# PROPOSED BUILDING 1

| WATERSHED CHARACTERISTICS | | | | | | | | | | | | PIPE CHARACTERISTICS | | | | | | | | | | | FLOW CHARACTERISTICS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | | | | LAND USE | | | FLOW TIME | | | FLOW | | R = hydraulic radius = area/wetted perimeter | | | | | | | | | | | | | | Tc |
| Description | Cover | Increm. (ACRE) | Total_A (ACRE) | C | CA | Total CA | To Inlet (MIN) | In Pipe (MIN) | Tc (MIN) | I (IPH) | Q (CFS) | Structure | Invert | Pipe | Size (IN) | Length (FT) | Area (SF) | R (FT) | Slope | n | Qf (CFS) | Vf (FT/S) | Q/Qf | V/Vf | V (FT/S) | L/V (MIN) |
| WS DCB-14 | LANDSCAPED | 0.043 | | 0.350 | | | | | | | | From: DCB-14 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.413 | | 0.250 | | | | | | | | | | RCP | 12 | 38 | 0.79 | 0.250 | 0.005 | 0.011 | **2.98** | **3.79** | 0.13 | 0.58 | 2.18 | 0.29 |
| | | | 0.456 | 0.259 | 0.118 | 0.118 | 6.00 | NONE | 6.00 | 6.39 | **0.76** | To: WQU-2 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-11 | Out: | | | | | | | | | | | | | |
| **DMH-11 TO WQU-2** | | | | | | 0.658 | 7.70 | 0.29 | 7.99 | 6.05 | **3.98** | To: WQU-2 | In: | HDPE | 18 | 112 | 1.77 | 0.375 | 0.008 | 0.013 | **9.40** | **5.32** | **0.42** | **0.82** | **4.34** | **0.43** |
| WS DCB-15 | LANDSCAPED | 0.000 | | 0.350 | | | | | | | | From: DCB-15 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.497 | | 0.850 | | | | | | | | | | HDPE | 12 | 54 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.38 | 0.79 | 3.58 | 0.25 |
| | | | 0.497 | 0.850 | 0.423 | | 6.00 | NONE | 6.00 | 6.39 | **2.70** | To: DMH-12 | In: | | | | | | | | | | | | | |
| WS DCB-16 | LANDSCAPED | 0.000 | | 0.350 | | | | | | | | From: DCB-16 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.497 | | 0.850 | | | | | | | | | | HDPE | 12 | 54 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.38 | 0.79 | 3.58 | 0.25 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **2.70** | To: DMH-12 | In: | | | | | | | | | | | | | |
| | | | 0.497 | 0.850 | 0.423 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-12 | Out: | | | | | | | | | | | | | |
| **DMH-12 TO WQU-2** | | | | | | 0.845 | 6.00 | 0.25 | 6.25 | 6.34 | **5.36** | | | HDPE | 18 | 26 | 1.77 | 0.375 | 0.070 | 0.013 | **27.79** | **15.73** | **0.19** | **0.65** | **10.22** | **0.04** |
| | | | | | | | | | | | | To: WQU-2 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-2 | Out: | | | | | | | | | | | | | |
| **WQU-2 TO CHAMBERS A** | | | | | | 1.503 | 7.99 | 0.43 | 8.42 | 5.99 | **9.00** | | | HDPE | 18 | 77 | 1.77 | 0.375 | 0.010 | 0.013 | **10.50** | **5.94** | **0.86** | **1.00** | **5.95** | **0.22** |
| | | | | | | | | | | | | To: CHAMBERS A | In: | | | | | | | | | | | | | |
| WS DCB-17 | LANDSCAPED | 0.000 | | 0.350 | | | | | | | | From: DCB-17 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.495 | | 0.850 | | | | | | | | | | HDPE | 12 | 55 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.38 | 0.79 | 3.58 | 0.26 |
| | | | 0.495 | 0.850 | 0.421 | | 6.00 | NONE | 6.00 | 6.39 | **2.69** | To: WQU-3 | In: | | | | | | | | | | | | | |
| WS DCB-18 | LANDSCAPED | 0.000 | | 0.350 | | | | | | | | From: DCB-18 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.495 | | 0.850 | | | | | | | | | | HDPE | 12 | 56 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.38 | 0.79 | 3.58 | 0.26 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **2.69** | To: WQU-3 | In: | | | | | | | | | | | | | |
| | | | 0.495 | 0.850 | 0.421 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-3 | Out: | | | | | | | | | | | | | |
| **WQU-3 TO CHAMBERS A** | | | | | | 0.842 | 6.00 | 0.26 | 6.26 | 6.34 | **5.34** | | | HDPE | 15 | 7 | 1.23 | 0.313 | 0.010 | 0.013 | **6.46** | **5.26** | **0.83** | **0.99** | **5.22** | **0.02** |
| | | | | | | | | | | | | To: CHAMBERS A | In: | | | | | | | | | | | | | |
| WS DCB-19 | LANDSCAPED | 0.000 | | 0.350 | | | | | | | | From: DCB-19 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.495 | | 0.850 | | | | | | | | | | HDPE | 12 | 56 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.38 | 0.79 | 3.58 | 0.26 |
| | | | 0.495 | 0.850 | 0.421 | | 6.00 | NONE | 6.00 | 6.39 | **2.69** | To: WQU-4 | In: | | | | | | | | | | | | | |
| WS DCB-20 | LANDSCAPED | 0.028 | | 0.350 | | | | | | | | From: DCB-20 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.458 | | 0.850 | | | | | | | | | | HDPE | 12 | 46 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.36 | 0.78 | 3.53 | 0.22 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **2.55** | To: WQU-4 | In: | | | | | | | | | | | | | |
| | | | 0.487 | 0.821 | 0.400 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-4 | Out: | | | | | | | | | | | | | |
| **WQU-4 TO CHAMBERS** | | | | | | 0.821 | 6.00 | 0.26 | 6.26 | 6.34 | **5.20** | | | HDPE | 15 | 7 | 1.23 | 0.313 | 0.010 | 0.013 | **6.46** | **5.26** | **0.81** | **0.98** | **5.18** | **0.02** |
| | | | | | | | | | | | | To: CHAMBERS | In: | | | | | | | | | | | | | |
| WS **WQU-5** | LANDSCAPED | 0.041 | | 0.350 | | | | | | | | From: WQU-5 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.331 | | 0.250 | | | | | | | | | | RCP | 12 | 28 | 0.79 | 0.250 | 0.010 | 0.011 | **4.21** | **5.36** | **0.07** | **0.49** | **2.63** | **0.18** |
| | | | 0.372 | 0.261 | 0.097 | 0.097 | 6.00 | NONE | 6.00 | 6.39 | **0.62** | To: CHAMBERS A | In: | | | | | | | | | | | | | |

MBL Land Development & Permitting, Corp.
*Land Development, Transportation & Environmental Solutions*

Project No.: 2021-036
Location: Innovation Way
Calculated By: JAW
Calculated On: November 17, 2022

R = Hydraulic Radius = Area/Wetted Per

# 25 YEAR STORM
# PROPOSED BUILDING 2

| WATERSHED CHARACTERISTICS | | | | | | | | | | | | PIPE CHARACTERISTICS | | | | | | | | | | | FLOW CHARACTERISTICS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | | | | LAND USE | | | FLOW TIME | | | FLOW | | R = hydraulic radius = area/wetted perimeter | | | | | | | | | | | | | | Tc |
| Description | Cover | Increm. (ACRE) | Total (ACRE) | C | CA | Total CA | To Inlet (MIN) | In Pipe (MIN) | Tc (MIN) | I (IPH) | Q (CFS) | Structure | Invert | Pipe | Size (IN) | Length (FT) | Area (SF) | R (FT) | Slope | n | Qf (CFS) | Vf (FT/S) | Q/Qf | V/Vf | V (FT/S) | L/V (MIN) |
| WS CB-25 | LANDSCAPED | 0.112 | | 0.350 | | | | | | | | From: CB-25 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.089 | | 0.250 | | | | | | | | | | RCP | 12 | 98 | 0.79 | 0.250 | 0.005 | 0.011 | **2.98** | **3.79** | 0.07 | 0.48 | 1.80 | 0.90 |
| | | | 0.201 | 0.306 | 0.062 | | 6.00 | NONE | 6.00 | 6.39 | **0.39** | To: DMH-16 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-16 | Out: | | | | | | | | | | | | | |
| **DMH-16** | **TO DMH-15** | | | | | 0.062 | 6.00 | 0.90 | 6.90 | 6.23 | **0.38** | | | HDPE | 12 | 82 | 0.79 | 0.250 | 0.008 | 0.013 | **3.19** | **4.06** | **0.12** | **0.57** | **2.30** | **0.59** |
| | | | | | | | | | | | | To: DMH-15 | In: | | | | | | | | | | | | | |
| WS DCB-24 | LANDSCAPED | 0.023 | | 0.350 | | | | | | | | From: DCB-24 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.343 | | 0.250 | | | | | | | | | | HDPE | 12 | 15 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.08 | 0.51 | 2.32 | 0.11 |
| | | | 0.367 | 0.256 | 0.094 | | 6.00 | NONE | 6.00 | 6.39 | **0.60** | To: DMH-15 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-15 | Out: | | | | | | | | | | | | | |
| **DMH-15** | **TO DMH-14** | | | | | 0.156 | 6.90 | 0.59 | 7.50 | 6.13 | **0.95** | | | HDPE | 12 | 205 | 0.79 | 0.250 | 0.008 | 0.013 | **3.19** | **4.06** | **0.30** | **0.74** | **2.99** | **1.14** |
| | | | | | | | | | | | | To: DMH-14 | In: | | | | | | | | | | | | | |
| WS DCB-23 | LANDSCAPED | 0.021 | | 0.350 | | | | | | | | From: DCB-23 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.330 | | 0.250 | | | | | | | | | | HDPE | 12 | 22 | 0.79 | 0.250 | 0.030 | 0.013 | **6.17** | **7.86** | 0.05 | 0.43 | 3.38 | 0.11 |
| | | | 0.351 | 0.256 | 0.090 | | 6.00 | NONE | 6.00 | 6.39 | **0.57** | To: DMH-14 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-14 | Out: | | | | | | | | | | | | | |
| **DMH-14** | **TO DMH-13** | | | | | 0.245 | 7.50 | 1.14 | 8.64 | 5.95 | **1.46** | | | HDPE | 12 | 138 | 0.79 | 0.250 | 0.008 | 0.013 | **3.19** | **4.06** | **0.46** | **0.84** | **3.39** | **0.68** |
| | | | | | | | | | | | | To: DMH-13 | In: | | | | | | | | | | | | | |
| WS DCB-21 | LANDSCAPED | 0.037 | | 0.350 | | | | | | | | From: DCB-21 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.328 | | 0.850 | | | | | | | | | | HDPE | 12 | 142 | 0.79 | 0.250 | 0.020 | 0.013 | **5.04** | **6.42** | 0.18 | 0.64 | 4.12 | 0.57 |
| | | | 0.365 | 0.799 | 0.292 | | 6.00 | NONE | 6.00 | 6.39 | **1.86** | To: DMH-13 | In: | | | | | | | | | | | | | |
| WS CB-22 | LANDSCAPED | 0.013 | | 0.350 | | | | | | | | From: CB-22 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.068 | | 0.850 | | | | | | | | | | RCP | 12 | 41 | 0.79 | 0.250 | 0.010 | 0.011 | **4.21** | **5.36** | 0.05 | 0.43 | 2.32 | 0.29 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **0.40** | To: DMH-13 | In: | | | | | | | | | | | | | |
| | | | 0.081 | 0.772 | 0.063 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-13 | Out: | | | | | | | | | | | | | |
| **DMH-13** | **TO WQU-6** | | | | | 0.600 | 8.64 | 0.68 | 9.32 | 5.85 | **3.51** | | | HDPE | 15 | 15 | 1.23 | 0.313 | 0.008 | 0.013 | **5.78** | **4.71** | **0.61** | **0.91** | **4.27** | **0.06** |
| | | | | | | | | | | | | To: WQU-6 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-6 | Out: | | | | | | | | | | | | | |
| **WQU-6** | **TO CHAMBERS E** | | | | | 0.600 | 9.32 | 0.06 | 9.38 | 5.84 | **3.50** | | | HDPE | 15 | 121 | 1.23 | 0.313 | 0.005 | 0.013 | **4.57** | **3.72** | **0.77** | **0.97** | **3.61** | **0.56** |
| | | | | | | | | | | | | To: CHAMBERS E | In: | | | | | | | | | | | | | |
| WS DCB-26 | LANDSCAPED | 0.032 | | 0.350 | | | | | | | | From: DCB-26 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.388 | | 0.250 | | | | | | | | | | RCP | 12 | 182 | 0.79 | 0.250 | 0.008 | 0.011 | **3.77** | **4.80** | 0.09 | 0.52 | 2.51 | 1.21 |
| | | | 0.420 | 0.258 | 0.108 | | 6.00 | NONE | 6.00 | 6.39 | **0.69** | To: WQU-7 | In: | | | | | | | | | | | | | |
| WS CB-27 | LANDSCAPED | 0.112 | | 0.350 | | | | | | | | From: CB-27 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.250 | | 0.850 | | | | | | | | | | RCP | 12 | 59 | 0.79 | 0.250 | 0.005 | 0.011 | **2.98** | **3.79** | 0.27 | 0.72 | 2.71 | 0.36 |
| | | | 0.362 | 0.695 | 0.252 | | 6.00 | NONE | 6.00 | 6.39 | **1.61** | To: WQU-7 | In: | | | | | | | | | | | | | |
| WS DCB-28 | LANDSCAPED | 0.154 | | 0.350 | | | | | | | | From: DCB-28 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.421 | | 0.850 | | | | | | | | | | RCP | 12 | 10 | 0.79 | 0.250 | 0.010 | 0.011 | **4.21** | **5.36** | 0.31 | 0.75 | 4.01 | 0.04 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **2.63** | To: WQU-7 | In: | | | | | | | | | | | | | |
| | | | 0.575 | 0.716 | 0.412 | | | | | | | From: WQU-7 | Out: | | | | | | | | | | | | | |
| **WQU-7** | **TO DMH-17** | | | | | 0.771 | 6.00 | 1.21 | 7.21 | 6.18 | **4.77** | | | RCP | 18 | 142 | 1.77 | 0.375 | 0.005 | 0.011 | **8.78** | **4.97** | **0.54** | **0.88** | **4.36** | **0.54** |
| | | | | | | | | | | | | To: DMH-17 | In: | | | | | | | | | | | | | |

**MBL** Land Development & Permitting, Corp.
*Land Development, Transportation & Environmental Solutions*

Project No.: 2021-036
Location: Innovation Way
Calculated By: JAW
Calculated On: November 17, 2022

R = Hydraulic Radius = Area/Wetted Per

# 25 YEAR STORM
# PROPOSED BUILDING 2

| WATERSHED CHARACTERISTICS | | | | | | | | | | | | PIPE CHARACTERISTICS | | | | | | | | | | | FLOW CHARACTERISTICS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | | | | LAND USE | | | FLOW TIME | | | FLOW | | R = hydraulic radius = area/wetted perimeter | | | | | | | | | | | | | | Tc |
| Description | Cover | Increm. (ACRE) | Total (ACRE) | C | CA | Total CA | To Inlet (MIN) | In Pipe (MIN) | Tc (MIN) | I (IPH) | Q (CFS) | Structure | Invert | Pipe | Size (IN) | Length (FT) | Area (SF) | R (FT) | Slope | n | Qf (CFS) | Vf (FT/S) | Q/Qf | V/Vf | V (FT/S) | L/V (MIN) |
| WS DCB-29 | LANDSCAPED | 0.057 | | 0.350 | | | | | | | | From: DCB-29 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.488 | | 0.850 | | | | | | | | | | RCP | 12 | 52 | 0.79 | 0.250 | 0.008 | 0.011 | **3.77** | **4.80** | 0.37 | 0.78 | 3.76 | 0.23 |
| | | | 0.545 | 0.798 | 0.435 | | 6.00 | NONE | 6.00 | 6.39 | **2.78** | To: WQU-8 | In: | | | | | | | | | | | | | |
| WS DCB-30 | LANDSCAPED | 0.041 | | 0.350 | | | | | | | | From: DCB-30 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.491 | | 0.850 | | | | | | | | | | RCP | 12 | 53 | 0.79 | 0.250 | 0.008 | 0.011 | **3.77** | **4.80** | 0.37 | 0.78 | 3.75 | 0.24 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **2.76** | To: WQU-8 | In: | | | | | | | | | | | | | |
| | | | 0.532 | 0.811 | 0.431 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-8 | Out: | | | | | | | | | | | | | |
| **WQU-8 TO** | **DMH-17** | | | | | 0.866 | 6.00 | 0.24 | 6.24 | 6.35 | **5.50** | | | RCP | 15 | 10 | 1.23 | 0.313 | 0.010 | 0.011 | **7.63** | **6.22** | **0.72** | **0.95** | **5.92** | **0.03** |
| | | | | | | | | | | | | To: DMH-17 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-17 | Out: | | | | | | | | | | | | | |
| **DMH-17 TO** | **DMH-18** | | | | | 1.638 | 7.21 | 0.54 | 7.75 | 6.09 | **9.98** | | | RCP | 21 | 282 | 2.41 | 0.438 | 0.005 | 0.011 | **13.24** | **5.51** | **0.75** | **0.96** | **5.31** | **0.89** |
| | | | | | | | | | | | | To: DMH-18 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-18 | Out: | | | | | | | | | | | | | |
| **DMH-18 TO** | **CHAMBERS B** | | | | | 1.638 | 7.75 | 0.89 | 8.64 | 5.95 | **9.75** | | | HDPE | 21 | 15 | 2.41 | 0.438 | 0.008 | 0.013 | **14.17** | **5.89** | **0.69** | **0.94** | **5.53** | **0.05** |
| | | | | | | | | | | | | To: CHAMBERS B | In: | | | | | | | | | | | | | |
| WS DCB-31 | LANDSCAPED | 0.079 | | 0.350 | | | | | | | | From: DCB-31 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.439 | | 0.850 | | | | | | | | | | RCP | 12 | 68 | 0.79 | 0.250 | 0.008 | 0.011 | **3.77** | **4.80** | 0.34 | 0.77 | 3.67 | 0.31 |
| | | | 0.518 | 0.774 | 0.401 | | 6.00 | NONE | 6.00 | 6.39 | **2.56** | To: WQU-9 | In: | | | | | | | | | | | | | |
| WS DCB-32 | LANDSCAPED | 0.024 | | 0.350 | | | | | | | | From: DCB-32 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.497 | | 0.850 | | | | | | | | | | RCP | 12 | 41 | 0.79 | 0.250 | 0.012 | 0.011 | **4.61** | **5.87** | 0.30 | 0.74 | 4.33 | 0.16 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **2.75** | To: WQU-9 | In: | | | | | | | | | | | | | |
| | | | 0.521 | 0.827 | 0.431 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-9 | Out: | | | | | | | | | | | | | |
| **WQU-9 TO** | **CHAMBERS B** | | | | | 0.832 | 6.00 | 0.31 | 6.31 | 6.33 | **5.27** | | | RCP | 15 | 70 | 1.23 | 0.313 | 0.010 | 0.011 | **7.63** | **6.22** | **0.69** | **0.94** | **5.85** | **0.20** |
| | | | | | | | | | | | | To: CHAMBERS B | In: | | | | | | | | | | | | | |
| WS DCB-33 | LANDSCAPED | 0.026 | | 0.350 | | | | | | | | From: DCB-33 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.484 | | 0.250 | | | | | | | | | | RCP | 12 | 17 | 0.79 | 0.250 | 0.010 | 0.011 | **4.21** | **5.36** | 0.10 | 0.54 | 2.87 | 0.10 |
| | | | 0.511 | 0.255 | 0.130 | | 6.00 | NONE | 6.00 | 6.39 | **0.83** | To: WQU-10 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-10 | Out: | | | | | | | | | | | | | |
| **WQU-10 TO** | **CHAMBERS B** | | | | | 0.130 | 6.00 | 0.10 | 6.10 | 6.37 | **0.83** | | | RCP | 12 | 20 | 0.79 | 0.250 | 0.035 | 0.011 | **7.88** | **10.03** | **0.11** | **0.55** | **5.47** | **0.06** |
| | | | | | | | | | | | | To: CHAMBERS B | In: | | | | | | | | | | | | | |
| WS WQU-11 | LANDSCAPED | 0.088 | | 0.350 | | | | | | | | From: WQU-11 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.183 | | 0.250 | | | | | | | | | | RCP | 12 | 35 | 0.79 | 0.250 | 0.025 | 0.011 | **6.66** | **8.48** | **0.04** | **0.40** | **3.40** | **0.17** |
| | | | 0.271 | 0.282 | 0.077 | 0.077 | 6.00 | NONE | 6.00 | 6.39 | **0.49** | To: CHAMBERS B | In: | | | | | | | | | | | | | |
| **CHAMBERS B** | | | | | | | | | | | | | | | | | | | | | | | | | | |

MBL Land Development & Permitting, Corp.
*Land Development, Transportation & Environmental Solutions*

Project No.: 2021-036
Location: Innovation Way
Calculated By: JAW
Calculated On: November 17, 2022

R = Hydraulic Radius = Area/Wetted Per

# 25 YEAR STORM
# PROPOSED BUILDING 2

| WATERSHED CHARACTERISTICS | | | | | | | | | | | | | PIPE CHARACTERISTICS | | | | | | | | | | | | FLOW CHARACTERISTICS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | | | | LAND USE | | | FLOW TIME | | | FLOW | | | R = hydraulic radius = area/wetted perimeter | | | | | | | | | | | | | | | Tc |
| Description | | Cover | Increm. (ACRE) | Total (ACRE) | C | CA | Total CA | To Inlet (MIN) | In Pipe (MIN) | Tc (MIN) | I (IPH) | Q (CFS) | Structure | Invert | Pipe | Size (IN) | Length (FT) | Area (SF) | R (FT) | Slope | n | Qf (CFS) | Vf (FT/S) | Q/Qf | V/Vf | V (FT/S) | L/V (MIN) |
| WS DCB-34 | | LANDSCAPED | 0.107 | | 0.350 | | | | | | | | From: DCB-34 | Out: | | | | | | | | | | | | | |
| | | IMPERVIOUS | 0.365 | | 0.850 | | | | | | | | | | HDPE | 12 | 26 | 0.79 | 0.250 | 0.025 | 0.013 | **5.63** | **7.17** | 0.20 | 0.65 | 4.69 | 0.09 |
| | | | | 0.472 | 0.736 | 0.348 | | 6.00 | NONE | 6.00 | 6.39 | **2.22** | To: WQU-12 | In: | | | | | | | | | | | | | |
| WS DCB-35 | | LANDSCAPED | 0.339 | | 0.350 | | | | | | | | From: DCB-35 | Out: | | | | | | | | | | | | | |
| | | IMPERVIOUS | 0.348 | | 0.850 | | | | | | | | | | HDPE | 12 | 23 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.37 | 0.79 | 3.56 | 0.11 |
| | | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **2.65** | To: WQU-12 | In: | | | | | | | | | | | | | |
| | | | | 0.687 | 0.603 | 0.414 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | From: WQU-12 | Out: | | | | | | | | | | | | | |
| **WQU-12** | **TO** | **DMH-19** | | | | | 0.762 | 6.00 | 0.11 | 6.11 | 6.37 | **4.85** | | | HDPE | 15 | 264 | 1.23 | 0.313 | 0.012 | 0.013 | **7.08** | **5.77** | **0.69** | **0.94** | **5.41** | **0.81** |
| | | | | | | | | | | | | | To: DMH-19 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | | From: DMH-19 | Out: | | | | | | | | | | | | | |
| **DMH-19** | **TO** | **DMH-20** | | | | | 0.762 | 6.11 | 0.81 | 6.92 | 6.23 | **4.75** | | | HDPE | 15 | 223 | 1.23 | 0.313 | 0.012 | 0.013 | **7.08** | **5.77** | **0.67** | **0.93** | **5.38** | **0.69** |
| | | | | | | | | | | | | | To: DMH-20 | In: | | | | | | | | | | | | | |
| WS DCB-36 | | LANDSCAPED | 0.058 | | 0.350 | | | | | | | | From: DCB-36 | Out: | | | | | | | | | | | | | |
| | | IMPERVIOUS | 0.144 | | 0.850 | | | | | | | | | | HDPE | 12 | 38 | 0.79 | 0.250 | 0.015 | 0.013 | **4.36** | **5.56** | 0.10 | 0.54 | 3.02 | 0.21 |
| | | | | 0.202 | 0.707 | 0.143 | | 6.00 | NONE | 6.00 | 6.39 | **0.91** | To: WQU-13 | In: | | | | | | | | | | | | | |
| WS CB-37 | | LANDSCAPED | 0.070 | | 0.350 | | | | | | | | From: CB-37 | Out: | | | | | | | | | | | | | |
| | | IMPERVIOUS | 0.182 | | 0.850 | | | | | | | | | | RCP | 12 | 72 | 0.79 | 0.250 | 0.010 | 0.011 | **4.21** | **5.36** | 0.14 | 0.59 | 3.15 | 0.38 |
| | | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **1.14** | To: WQU-13 | In: | | | | | | | | | | | | | |
| | | | | 0.252 | 0.712 | 0.179 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | From: WQU-13 | Out: | | | | | | | | | | | | | |
| **WQU-13** | **TO** | **DMH-20** | | | | | 0.322 | 6.00 | 0.38 | 6.38 | 6.32 | **2.04** | | | HDPE | 15 | 17 | 1.23 | 0.313 | 0.010 | 0.013 | **6.46** | **5.26** | **0.32** | **0.75** | **3.94** | **0.07** |
| | | | | | | | | | | | | | To: DMH-20 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | | From: DMH-20 | Out: | | | | | | | | | | | | | |
| **DMH-20** | **TO** | **DMH-21** | | | | | 1.084 | 6.92 | 0.69 | 7.61 | 6.12 | **6.63** | | | HDPE | 15 | 332 | 1.23 | 0.313 | 0.022 | 0.013 | **9.58** | **7.81** | **0.69** | **0.94** | **7.35** | **0.75** |
| | | | | | | | | | | | | | To: DMH-21 | In: | | | | | | | | | | | | | |
| WS WQU-14 | | LANDSCAPED | 0.051 | | 0.350 | | | | | | | | From: WQU-14 | Out: | | | | | | | | | | | | | |
| | | IMPERVIOUS | 0.118 | | 0.250 | | | | | | | | | | HDPE | 12 | 10 | 0.79 | 0.250 | 0.015 | 0.013 | **4.36** | **5.56** | 0.03 | 0.39 | 2.19 | 0.08 |
| | | | | 0.169 | 0.280 | 0.047 | 0.047 | 6.00 | NONE | 6.00 | 6.39 | **0.30** | To: DMH-21 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | | From: DMH-21 | Out: | | | | | | | | | | | | | |
| **DMH-21** | **TO** | **DMH-22** | | | | | 1.131 | 7.61 | 0.75 | 8.37 | 6.00 | **6.78** | | | HDPE | 18 | 219 | 1.77 | 0.375 | 0.022 | 0.013 | **15.58** | **8.82** | **0.44** | **0.82** | **7.25** | **0.50** |
| | | | | | | | | | | | | | To: DMH-22 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | | From: DMH-22 | Out: | | | | | | | | | | | | | |
| **DMH-22** | **TO** | **FES-1** | | | | | 1.131 | 8.37 | 0.50 | 8.87 | 5.92 | **6.69** | | | HDPE | 18 | 298 | 1.77 | 0.375 | 0.025 | 0.013 | **16.61** | **9.40** | **0.40** | **0.80** | **7.56** | **0.66** |
| | | | | | | | | | | | | | To: FES-1 | In: | | | | | | | | | | | | | |

MBL Land Development & Permitting, Corp.

*Land Development, Transportation & Environmental Solutions*

Project No.: 2021-036
Location: Innovation Way
Calculated By: JAW
Calculated On: November 17, 2022

R = Hydraulic Radius = Area/Wetted Per

# 25 YEAR STORM
# PROPOSED BUILDINGS 3

| WATERSHED CHARACTERISTICS | | | | | | | | | | | | PIPE CHARACTERISTICS | | | | | | | | | | | FLOW CHARACTERISTICS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | | | | LAND USE | | | FLOW TIME | | | FLOW | | R = hydraulic radius = area/wetted perimeter | | | | | | | | | | | | | | Tc |
| Description | Cover | Increm. (ACRE) | Total (ACRE) | C | CA | Total CA | To Inlet (MIN) | In Pipe (MIN) | Tc (MIN) | I (IPH) | Q (CFS) | Structure | Invert | Pipe | Size (IN) | Length (FT) | Area (SF) | R (FT) | Slope | n | Qf (CFS) | Vf (FT/S) | Q/Qf | V/Vf | V (FT/S) | L/V (MIN) |
| WS DCB-38 | LANDSCAPED | 0.064 | | 0.350 | | | | | | | | From: DCB-38 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.280 | | 0.850 | | | | | | | | | | RCP | 12 | 89 | 0.79 | 0.250 | 0.008 | 0.011 | 3.77 | 4.80 | 0.22 | 0.68 | 3.24 | 0.46 |
| | | | 0.344 | 0.757 | 0.260 | | 6.00 | NONE | 6.00 | 6.39 | 1.66 | To: DMH-23 | In: | | | | | | | | | | | | | |
| WS CB-39 | LANDSCAPED | 0.009 | | 0.350 | | | | | | | | From: CB-39 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.089 | | 0.850 | | | | | | | | | | RCP | 12 | 22 | 0.79 | 0.250 | 0.012 | 0.011 | 4.61 | 5.87 | 0.05 | 0.45 | 2.65 | 0.14 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | 0.50 | To: DMH-23 | In: | | | | | | | | | | | | | |
| | | | 0.098 | 0.804 | 0.079 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-23 | Out: | | | | | | | | | | | | | |
| DMH-23 TO DMH-24 | | | | | | 0.339 | 6.00 | 0.46 | 6.46 | 6.31 | 2.14 | | | HDPE | 12 | 189 | 0.79 | 0.250 | 0.005 | 0.013 | 2.52 | 3.21 | 0.85 | 1.00 | 3.20 | 0.98 |
| | | | | | | | | | | | | To: DMH-24 | In: | | | | | | | | | | | | | |
| WS DCB-40 | LANDSCAPED | 0.045 | | 0.350 | | | | | | | | From: DCB-40 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.403 | | 0.250 | | | | | | | | | | HDPE | 12 | 19 | 0.79 | 0.250 | 0.020 | 0.013 | 5.04 | 6.42 | 0.07 | 0.49 | 3.15 | 0.10 |
| | | | 0.447 | 0.260 | 0.116 | 0.116 | 6.00 | NONE | 6.00 | 6.39 | 0.74 | To: DMH-24 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-24 | Out: | | | | | | | | | | | | | |
| DMH-24 TO DMH-25 | | | | | | 0.455 | 6.46 | 0.98 | 7.44 | 6.14 | 2.80 | | | HDPE | 15 | 263 | 1.23 | 0.313 | 0.005 | 0.013 | 4.57 | 3.72 | 0.61 | 0.91 | 3.38 | 1.30 |
| | | | | | | | | | | | | To: DMH-25 | In: | | | | | | | | | | | | | |
| WS DCB-41 | LANDSCAPED | 0.027 | | 0.350 | | | | | | | | From: DCB-41 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.430 | | 0.250 | | | | | | | | | | HDPE | 12 | 19 | 0.79 | 0.250 | 0.020 | 0.013 | 5.04 | 6.42 | 0.07 | 0.49 | 3.16 | 0.10 |
| | | | 0.457 | 0.256 | 0.117 | 0.117 | 6.00 | NONE | 6.00 | 6.39 | 0.75 | To: DMH-25 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-25 | Out: | | | | | | | | | | | | | |
| DMH-25 TO DMH-26 | | | | | | 0.572 | 7.44 | 1.30 | 8.74 | 5.94 | 3.40 | | | HDPE | 15 | 186 | 1.23 | 0.313 | 0.005 | 0.013 | 4.57 | 3.72 | 0.74 | 0.96 | 3.58 | 0.87 |
| | | | | | | | | | | | | To: DMH-26 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-26 | Out: | | | | | | | | | | | | | |
| DMH-26 TO DMH-27 | | | | | | 0.572 | 8.74 | 0.87 | 9.61 | 5.81 | 3.32 | | | HDPE | 15 | 139 | 1.23 | 0.313 | 0.005 | 0.013 | 4.57 | 3.72 | 0.73 | 0.95 | 3.55 | 0.65 |
| | | | | | | | | | | | | To: DMH-27 | In: | | | | | | | | | | | | | |
| WS DCB-42 | LANDSCAPED | 0.360 | | 0.350 | | | | | | | | From: DCB-42 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.257 | | 0.850 | | | | | | | | | | RCP | 12 | 24 | 0.79 | 0.250 | 0.010 | 0.011 | 4.21 | 5.36 | 0.26 | 0.71 | 3.80 | 0.11 |
| | | | 0.617 | 0.558 | 0.344 | | 6.00 | NONE | 6.00 | 6.39 | 2.20 | To: DMH-27 | In: | | | | | | | | | | | | | |
| WS DCB-43 | LANDSCAPED | 0.455 | | 0.350 | | | | | | | | From: DCB-43 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.248 | | 0.850 | | | | | | | | | | RCP | 12 | 24 | 0.79 | 0.250 | 0.010 | 0.011 | 4.21 | 5.36 | 0.28 | 0.72 | 3.88 | 0.10 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | 2.36 | To: DMH-27 | In: | | | | | | | | | | | | | |
| | | | 0.703 | 0.527 | 0.370 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-27 | Out: | | | | | | | | | | | | | |
| DMH-27 TO WQU-15 | | | | | | 1.287 | 9.61 | 0.65 | 10.26 | 5.71 | 7.35 | | | RCP | 18 | 214 | 1.77 | 0.375 | 0.005 | 0.011 | 8.78 | 4.97 | 0.84 | 0.99 | 4.94 | 0.72 |
| | | | | | | | | | | | | To: WQU-15 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-15 | Out: | | | | | | | | | | | | | |
| WQU-15 TO DMH-30 | | | | | | 1.287 | 10.26 | 0.72 | 10.98 | 5.61 | 7.22 | | | HDPE | 18 | 120 | 1.77 | 0.375 | 0.005 | 0.013 | 7.43 | 4.20 | 0.97 | 1.04 | 4.36 | 0.46 |
| | | | | | | | | | | | | To: DMH-30 | In: | | | | | | | | | | | | | |

MBL Land Development & Permitting, Corp.
*Land Development, Transportation & Environmental Solutions*

Project No.: 2021-036
Location: Innovation Way
Calculated By: JAW
Calculated On: November 17, 2022

R = Hydraulic Radius = Area/Wetted Per

# 25 YEAR STORM
# PROPOSED BUILDINGS 3

| WATERSHED CHARACTERISTICS | | | | | | | | | | | | PIPE CHARACTERISTICS | | | | | | | | | | | FLOW CHARACTERISTICS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | | | | LAND USE | | | FLOW TIME | | | FLOW | | R = hydraulic radius = area/wetted perimeter | | | | | | | | | | | | | | Tc |
| Description | Cover | Increm. (ACRE) | Total (ACRE) | C | CA | Total CA | To Inlet (MIN) | In Pipe (MIN) | Tc (MIN) | I (IPH) | Q (CFS) | Structure | Invert | Pipe | Size (IN) | Length (FT) | Area (SF) | R (FT) | Slope | n | Qf (CFS) | Vf (FT/S) | Q/Qf | V/Vf | V (FT/S) | L/V (MIN) |
| WS DCB-44 | LANDSCAPED | 0.000 | | 0.350 | | | | | | | | From: DCB-44 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.499 | | 0.850 | | | | | | | | | | RCP | 12 | 111 | 0.79 | 0.250 | 0.005 | 0.011 | **2.98** | **3.79** | 0.45 | 0.83 | 3.16 | 0.59 |
| | | | 0.499 | 0.850 | 0.424 | | 6.00 | NONE | 6.00 | 6.39 | **2.71** | To: DMH-28 | In: | | | | | | | | | | | | | |
| WS DCB-45 | LANDSCAPED | 0.000 | | 0.350 | | | | | | | | From: DCB-45 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.499 | | 0.850 | | | | | | | | | | HDPE | 12 | 9 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.38 | 0.79 | 3.59 | 0.04 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **2.71** | To: DMH-28 | In: | | | | | | | | | | | | | |
| | | | 0.499 | 0.850 | 0.424 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-28 | Out: | | | | | | | | | | | | | |
| **DMH-28 TO DMH-29** | | | | | | 0.848 | 6.00 | 0.59 | 6.59 | 6.29 | **5.33** | | | HDPE | 18 | 111 | 1.77 | 0.375 | 0.005 | 0.013 | **7.43** | **4.20** | **0.72** | **0.95** | **4.00** | **0.46** |
| | | | | | | | | | | | | To: DMH-29 | In: | | | | | | | | | | | | | |
| WS DCB-46 | LANDSCAPED | 0.000 | | 0.350 | | | | | | | | From: DCB-46 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.499 | | 0.250 | | | | | | | | | | HDPE | 12 | 9 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.11 | 0.55 | 2.52 | 0.06 |
| | | | 0.499 | 0.250 | 0.125 | 0.125 | 6.00 | NONE | 6.00 | 6.39 | **0.80** | To: DMH-29 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-29 | Out: | | | | | | | | | | | | | |
| **DMH-29 TO WQU-16** | | | | | | 0.972 | 6.59 | 0.46 | 7.05 | 6.21 | **6.04** | | | HDPE | 18 | 98 | 1.77 | 0.375 | 0.005 | 0.013 | **7.43** | **4.20** | **0.81** | **0.99** | **4.14** | **0.39** |
| | | | | | | | | | | | | To: WQU-16 | In: | | | | | | | | | | | | | |
| WS DCB-47 | LANDSCAPED | 0.064 | | 0.350 | | | | | | | | From: DCB-47 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.493 | | 0.250 | | | | | | | | | | HDPE | 12 | 9 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.13 | 0.58 | 2.63 | 0.06 |
| | | | 0.557 | 0.261 | 0.146 | 0.146 | 6.00 | NONE | 6.00 | 6.39 | **0.93** | To: WQU-16 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-16 | Out: | | | | | | | | | | | | | |
| **WQU-16 TO DMH-30** | | | | | | 1.118 | 7.05 | 0.39 | 7.44 | 6.14 | **6.87** | | | HDPE | 18 | 71 | 1.77 | 0.375 | 0.008 | 0.013 | **9.40** | **5.32** | **0.73** | **0.96** | **5.08** | **0.23** |
| | | | | | | | | | | | | To: DMH-30 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-30 | Out: | | | | | | | | | | | | | |
| **DMH-30 TO FES-3** | | | | | | 2.404 | 10.98 | 0.46 | 11.44 | 5.55 | **13.35** | | | HDPE | 24 | 176 | 3.14 | 0.500 | 0.005 | 0.013 | **16.00** | **5.09** | **0.83** | **0.99** | **5.06** | **0.58** |
| | | | | | | | | | | | | To: FES-3 | In: | | | | | | | | | | | | | |
| WS CB-48 | LANDSCAPED | 0.018 | | 0.350 | | | | | | | | From: CB-48 | Out: | DOUBLE | | | | | | | | | | | | |
| | IMPERVIOUS | 0.157 | | 0.850 | | | | | | | | | | N-12 | 6 | 123 | 0.39 | 0.500 | 0.005 | 0.012 | **2.17** | **5.52** | 0.21 | 0.66 | 3.65 | 0.56 |
| | | | 0.175 | 0.799 | 0.140 | | 6.00 | NONE | 6.00 | 6.39 | **0.89** | To: WQU-17 | In: | | | | | | | | | | | | | |
| WS CB-49 | LANDSCAPED | 0.015 | | 0.350 | | | | | | | | From: CB-49 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.174 | | 0.850 | | | | | | | | | | RCP | 12 | 6 | 0.79 | 0.250 | 0.010 | 0.011 | **4.21** | **5.36** | 0.12 | 0.56 | 3.01 | 0.03 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **0.98** | To: WQU-17 | In: | | | | | | | | | | | | | |
| | | | 0.189 | 0.810 | 0.153 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-17 | Out: | | | | | | | | | | | | | |
| **WQU-17 TO CHAMBERS C** | | | | | | 0.293 | 6.00 | 0.56 | 6.56 | 6.29 | **1.84** | | | RCP | 12 | 5 | 0.79 | 0.250 | 0.020 | 0.011 | **5.95** | **7.58** | **0.31** | **0.75** | **5.65** | **0.01** |
| | | | | | | | | | | | | To: CHAMBERS C | In: | | | | | | | | | | | | | |
| WS DCB-50 | LANDSCAPED | 0.065 | | 0.350 | | | | | | | | From: DCB-50 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.493 | | 0.850 | | | | | | | | | | RCP | 12 | 87 | 1.57 | 1.000 | 0.010 | 0.011 | **21.22** | **13.51** | 0.07 | 0.48 | 6.45 | 0.22 |
| | | | 0.558 | 0.792 | 0.442 | | 6.00 | NONE | 6.00 | 6.39 | **2.82** | To: WQU-18 | In: | | | | | | | | | | | | | |
| WS DCB-51 | LANDSCAPED | 0.018 | | 0.350 | | | | | | | | From: DCB-51 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.500 | | 0.850 | | | | | | | | | | RCP | 12 | 15 | 0.79 | 0.250 | 0.010 | 0.011 | **4.21** | **5.36** | 0.33 | 0.76 | 4.06 | 0.06 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **2.75** | To: WQU-18 | In: | | | | | | | | | | | | | |
| | | | 0.518 | 0.833 | 0.431 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-18 | Out: | | | | | | | | | | | | | |
| **WQU-18 TO FES-5** | | | | | | 0.873 | 6.00 | 0.22 | 6.22 | 6.35 | **5.54** | | | HDPE | 18 | 245 | 1.77 | 0.375 | 0.005 | 0.013 | **7.43** | **4.20** | **0.75** | **0.96** | **4.04** | **1.01** |
| | | | | | | | | | | | | To: FES-5 | In: | | | | | | | | | | | | | |

MBL Land Development & Permitting, Corp.
*Land Development, Transportation & Environmental Solutions*

Project No.: 2021-036
Location: Innovation Way
Calculated By: JAW
Calculated On: November 17, 2022

R = Hydraulic Radius = Area/Wetted Per

# 25 YEAR STORM
# PROPOSED BUILDING 4

| WATERSHED CHARACTERISTICS | | | | | | | | | | | | PIPE CHARACTERISTICS | | | | | | | | | | | FLOW CHARACTERISTICS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | | | | LAND USE | | | FLOW TIME | | | FLOW | | R = hydraulic radius = area/wetted perimeter | | | | | | | | | | | | | | Tc |
| Description | Cover | Increm. (ACRE) | Total (ACRE) | C | CA | Total CA | To Inlet (MIN) | In Pipe (MIN) | Tc (MIN) | I (IPH) | Q (CFS) | Structure | Invert | Pipe | Size (IN) | Length (FT) | Area (SF) | R (FT) | Slope | n | Qf (CFS) | Vf (FT/S) | Q/Qf | V/Vf | V (FT/S) | L/V (MIN) |
| WS CB-52 | LANDSCAPED | 0.243 | | 0.350 | | | | | | | | From: CB-52 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.135 | | 0.850 | | | | | | | | | | HDPE | 12 | 181 | 0.79 | 0.250 | 0.015 | 0.013 | **4.36** | **5.56** | 0.15 | 0.60 | 3.33 | 0.91 |
| | | | 0.378 | 0.528 | 0.200 | | 6.00 | NONE | 6.00 | 6.39 | **1.27** | To: DMH-31 | In: | | | | | | | | | | | | | |
| WS CB-53 | LANDSCAPED | 0.046 | | 0.350 | | | | | | | | From: CB-53 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.123 | | 0.850 | | | | | | | | | | HDPE | 12 | 27 | 0.79 | 0.250 | 0.040 | 0.013 | **7.13** | **9.07** | 0.05 | 0.45 | 4.07 | 0.11 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **0.77** | To: DMH-31 | In: | | | | | | | | | | | | | |
| | | | 0.169 | 0.713 | 0.120 | | | | | | | From: DMH-31 | Out: | | | | | | | | | | | | | |
| **DMH-31 TO** | **DMH-33** | | | | | 0.320 | 6.00 | 0.91 | 6.91 | 6.23 | **1.99** | | | HDPE | 12 | 111 | 0.79 | 0.250 | 0.030 | 0.013 | **6.17** | **7.86** | **0.32** | **0.75** | **5.93** | **0.31** |
| | | | | | | | | | | | | To: DMH-33 | In: | | | | | | | | | | | | | |
| WS CB-54 | LANDSCAPED | 0.099 | | 0.350 | | | | | | | | From: CB-54 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.191 | | 0.850 | | | | | | | | | | HDPE | 12 | 49 | 0.79 | 0.250 | 0.025 | 0.013 | **5.63** | **7.17** | 0.11 | 0.55 | 3.98 | 0.21 |
| | | | 0.291 | 0.679 | 0.197 | | 6.00 | NONE | 6.00 | 6.39 | **1.26** | To: DMH-32 | In: | | | | | | | | | | | | | |
| WS CB-55 | LANDSCAPED | 0.026 | | 0.350 | | | | | | | | From: CB-55 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.215 | | 0.850 | | | | | | | | | | HDPE | 12 | 27 | 0.79 | 27.000 | 0.030 | 0.013 | **139.95** | **178.19** | 0.00 | 0.22 | 38.61 | 0.01 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **1.22** | To: DMH-32 | In: | | | | | | | | | | | | | |
| | | | 0.240 | 0.797 | 0.192 | | | | | | | | | | | | | | | | | | | | | |
| WS DCB-56 | LANDSCAPED | 0.111 | | 0.350 | | | | | | | | From: DCB-56 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.267 | | 0.250 | | | | | | | | | | HDPE | 12 | 21 | 0.79 | 0.250 | 0.008 | 0.013 | **3.19** | **4.06** | 0.11 | 0.55 | 2.21 | 0.16 |
| | | | 0.377 | 0.279 | 0.105 | | 6.00 | NONE | 6.00 | 6.39 | **0.67** | To: #REF! | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-32 | Out: | | | | | | | | | | | | | |
| **DMH-32 TO** | **DMH-33** | | | | | 0.494 | 6.00 | 0.21 | 6.21 | 6.35 | **3.14** | | | HDPE | 15 | 241 | 1.23 | 0.313 | 0.010 | 0.013 | **6.46** | **5.26** | **0.49** | **0.85** | **4.47** | **0.90** |
| | | | | | | | | | | | | To: DMH-33 | In: | | | | | | | | | | | | | |
| WS DCB-57 | LANDSCAPED | 0.058 | | 0.350 | | | | | | | | From: DCB-57 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.249 | | 0.850 | | | | | | | | | | HDPE | 12 | 40 | 0.79 | 0.250 | 0.020 | 0.013 | **5.04** | **6.42** | 0.15 | 0.60 | 3.85 | 0.17 |
| | | | 0.307 | 0.756 | 0.232 | | 6.00 | NONE | 6.00 | 6.39 | **1.48** | To: DMH-33 | In: | | | | | | | | | | | | | |
| WS DCB-58 | LANDSCAPED | 0.094 | | 0.350 | | | | | | | | From: DCB-58 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.308 | | 0.850 | | | | | | | | | | HDPE | 12 | 32 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.26 | 0.71 | 3.23 | 0.17 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **1.88** | To: DMH-33 | In: | | | | | | | | | | | | | |
| | | | 0.402 | 0.733 | 0.294 | | | | | | | From: DMH-33 | Out: | | | | | | | | | | | | | |
| **DMH-33 TO** | **DMH-34** | | | | | 1.341 | 6.91 | 0.90 | 7.80 | 6.08 | **8.16** | | | HDPE | 18 | 152 | 1.77 | 0.375 | 0.010 | 0.013 | **10.50** | **5.94** | **0.78** | **0.97** | **5.78** | **0.44** |
| | | | | | | | | | | | | To: DMH-34 | In: | | | | | | | | | | | | | |
| WS DCB-59 | LANDSCAPED | 0.166 | | 0.350 | | | | | | | | From: DCB-59 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.330 | | 0.250 | | | | | | | | | | HDPE | 12 | 16 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.13 | 0.57 | 2.61 | 0.10 |
| | | | 0.496 | 0.283 | 0.141 | 0.141 | 6.00 | NONE | 6.00 | 6.39 | **0.90** | To: DMH-34 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-34 | Out: | | | | | | | | | | | | | |
| **DMH-34 TO** | **DMH-35** | | | | | 1.481 | 7.80 | 0.44 | 8.24 | 6.01 | **8.91** | | | HDPE | 18 | 150 | 1.77 | 0.375 | 0.010 | 0.013 | **10.50** | **5.94** | **0.85** | **1.00** | **5.93** | **0.42** |
| | | | | | | | | | | | | To: DMH-35 | In: | | | | | | | | | | | | | |

MBL Land Development & Permitting, Corp.
*Land Development, Transportation & Environmental Solutions*

Project No.: 2021-036
Location: Innovation Way
Calculated By: JAW
Calculated On: November 17, 2022

R = Hydraulic Radius = Area/Wetted Per

# 25 YEAR STORM
# PROPOSED BUILDING 4

| WATERSHED CHARACTERISTICS | | | | | | | | | | | | PIPE CHARACTERISTICS | | | | | | | | | | | FLOW CHARACTERISTICS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | | | | LAND USE | | | FLOW TIME | | | FLOW | | R = hydraulic radius = area/wetted perimeter | | | | | | | | | | | | | | Tc |
| Description | Cover | Increm. | Total | C | CA | Total CA | To Inlet | In Pipe | Tc | I | Q | Structure | Invert | Pipe | Size | Length | Area | R | Slope | n | Qf | Vf | Q/Qf | V/Vf | V | L/V |
| WS DCB-60 | LANDSCAPED | 0.036 | | 0.350 | | | | | | | | From: DCB-60 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.207 | | 0.250 | | | | | | | | | | HDPE | 12 | 16 | 0.79 | 0.250 | 0.030 | 0.013 | **6.17** | **7.86** | 0.03 | 0.39 | 3.07 | 0.09 |
| | | | 0.244 | 0.265 | 0.065 | 0.065 | 6.00 | NONE | 6.00 | 6.39 | **0.41** | To: DMH-35 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-35 | Out: | | | | | | | | | | | | | |
| **DMH-35 TO WQU-19** | | | | | | 1.546 | 8.24 | 0.42 | 8.66 | 5.95 | **9.20** | | | HDPE | 18 | 162 | 1.77 | 0.375 | 0.010 | 0.013 | **10.50** | **5.94** | **0.88** | **1.01** | **5.99** | **0.45** |
| | | | | | | | | | | | | To: WQU-19 | In: | | | | | | | | | | | | | |
| WS DCB-61 | LANDSCAPED | 0.062 | | 0.350 | | | | | | | | From: DCB-61 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.324 | | 0.850 | | | | | | | | | | HDPE | 12 | 25 | 0.79 | 0.250 | 0.050 | 0.013 | **7.97** | **10.14** | 0.12 | 0.56 | 5.73 | 0.07 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **1.90** | To: DMH-36 | In: | | | | | | | | | | | | | |
| | | | 0.386 | 0.769 | 0.297 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-36 | Out: | | | | | | | | | | | | | |
| **DMH-36 TO WQU-19** | | | | | | 0.297 | 6.00 | 0.07 | 6.07 | 6.38 | **1.89** | | | HDPE | 12 | 12 | 0.79 | 0.250 | 0.040 | 0.013 | **7.13** | **9.07** | **0.27** | **0.71** | **6.47** | **0.03** |
| | | | | | | | | | | | | To: WQU-19 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-19 | Out: | | | | | | | | | | | | | |
| **WQU-19 TO FES-2** | | | | | | 1.843 | 8.66 | 0.45 | 9.11 | 5.88 | **10.84** | | | HDPE | 21 | 70 | 2.41 | 0.438 | 0.010 | 0.013 | **15.85** | **6.59** | **0.68** | **0.94** | **6.18** | **0.19** |
| | | | | | | | | | | | | To: FES-2 | In: | | | | | | | | | | | | | |
| WS CB-62 | LANDSCAPED | 0.105 | | 0.350 | | | | | | | | From: CB-62 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.094 | | 0.850 | | | | | | | | | | RCP | 12 | 264 | 0.79 | 0.250 | 0.015 | 0.011 | **5.16** | **6.57** | 0.07 | 0.49 | 3.21 | 1.37 |
| | | | 0.199 | 0.585 | 0.116 | | 6.00 | NONE | 6.00 | 6.39 | **0.74** | To: DMH-37 | In: | | | | | | | | | | | | | |
| WS DCB-63 | LANDSCAPED | 0.524 | | 0.350 | | | | | | | | From: DCB-63 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.219 | | 0.850 | | | | | | | | | | RCP | 12 | 45 | 0.79 | 0.250 | 0.005 | 0.011 | **2.98** | **3.79** | 0.40 | 0.80 | 3.04 | 0.25 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **2.36** | To: DMH-37 | In: | | | | | | | | | | | | | |
| | | | 0.743 | 0.498 | 0.370 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-37 | Out: | | | | | | | | | | | | | |
| **DMH-37 TO WQU-20** | | | | | | 0.486 | 6.00 | 1.37 | 7.37 | 6.15 | **2.99** | | | RCP | 15 | 159 | 1.23 | 0.313 | 0.010 | 0.011 | **7.63** | **6.22** | **0.39** | **0.80** | **4.96** | **0.53** |
| | | | | | | | | | | | | To: WQU-20 | In: | | | | | | | | | | | | | |
| WS DCB-65 | LANDSCAPED | 0.017 | | 0.350 | | | | | | | | From: DCB-65 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.497 | | 0.850 | | | | | | | | | | RCP | 12 | 54 | 0.79 | 0.250 | 0.005 | 0.011 | **2.98** | **3.79** | 0.46 | 0.84 | 3.17 | 0.28 |
| | | | 0.514 | 0.833 | 0.429 | | 6.00 | NONE | 6.00 | 6.39 | **2.74** | To: DMH-38 | In: | | | | | | | | | | | | | |
| WS DCB-64 | LANDSCAPED | 0.095 | | 0.350 | | | | | | | | From: DCB-64 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.472 | | 0.850 | | | | | | | | | | RCP | 12 | 55 | 0.79 | 0.250 | 0.005 | 0.011 | **2.98** | **3.79** | 0.47 | 0.84 | 3.18 | 0.29 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **2.78** | To: DMH-38 | In: | | | | | | | | | | | | | |
| | | | 0.567 | 0.766 | 0.435 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-38 | Out: | | | | | | | | | | | | | |
| **DMH-38 TO WQU-20** | | | | | | 0.863 | 6.00 | 0.29 | 6.29 | 6.34 | **5.47** | | | RCP | 15 | 11 | 1.23 | 0.313 | 0.008 | 0.011 | **6.83** | **5.56** | **0.80** | **0.98** | **5.46** | **0.03** |
| | | | | | | | | | | | | To: WQU-20 | In: | | | | | | | | | | | | | |

MBL Land Development & Permitting, Corp.
*Land Development, Transportation & Environmental Solutions*

Project No.: 2021-036
Location: Innovation Way
Calculated By: JAW
Calculated On: November 17, 2022

R = Hydraulic Radius = Area/Wetted Per

# 25 YEAR STORM
# PROPOSED BUILDING 4

| WATERSHED CHARACTERISTICS | | | | | | | | | | | | PIPE CHARACTERISTICS | | | | | | | | | | | FLOW CHARACTERISTICS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | | | | LAND USE | | | FLOW TIME | | | FLOW | | R = hydraulic radius = area/wetted perimeter | | | | | | | | | | | | | | Tc |
| Description | Cover | Increm. | Total | C | CA | Total CA | To Inlet | In Pipe | Tc | I | Q | Structure | Invert | Pipe | Size | Length | Area | R | Slope | n | Qf | Vf | Q/Qf | V/Vf | V | L/V |
| | | | | | | | | | | | | From: WQU-20 | Out: | | | | | | | | | | | | | |
| **WQU-20 TO DMH-39** | | | | | | 1.349 | 7.37 | 0.53 | 7.91 | 6.07 | **8.19** | | | HDPE | 21 | 224 | 2.41 | 0.438 | 0.008 | 0.013 | **14.17** | **5.89** | **0.58** | **0.89** | **5.26** | **0.71** |
| | | | | | | | | | | | | To: DMH-39 | In: | | | | | | | | | | | | | |
| WS DCB-67 | LANDSCAPED | 0.042 | | 0.350 | | | | | | | | From: DCB-67 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.464 | | 0.850 | | | | | | | | | | HDPE | 12 | 53 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.37 | 0.78 | 3.55 | 0.25 |
| | | | 0.505 | 0.809 | 0.409 | | 6.00 | NONE | 6.00 | 6.39 | **2.61** | To: WQU-21 | In: | | | | | | | | | | | | | |
| WS DCB-66 | LANDSCAPED | 0.017 | | 0.350 | | | | | | | | From: DCB-66 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.497 | | 0.850 | | | | | | | | | | HDPE | 12 | 53 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.38 | 0.79 | 3.60 | 0.25 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **2.74** | To: WQU-21 | In: | | | | | | | | | | | | | |
| | | | 0.514 | 0.833 | 0.429 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-21 | Out: | | | | | | | | | | | | | |
| **WQU-21 TO DMH-39** | | | | | | 0.837 | 6.00 | 0.25 | 6.25 | 6.35 | **5.31** | | | HDPE | 15 | 19 | 1.23 | 0.313 | 0.015 | 0.013 | **7.91** | **6.45** | **0.67** | **0.93** | **6.01** | **0.05** |
| | | | | | | | | | | | | To: DMH-39 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-39 | Out: | | | | | | | | | | | | | |
| **DMH-39 TO DMH-40** | | | | | | 2.187 | 7.91 | 0.71 | 8.62 | 5.96 | **13.02** | | | HDPE | 24 | 240 | 3.14 | 0.500 | 0.005 | 0.013 | **16.00** | **5.09** | **0.81** | **0.99** | **5.02** | **0.80** |
| | | | | | | | | | | | | To: DMH-40 | In: | | | | | | | | | | | | | |
| WS DCB-69 | LANDSCAPED | 0.039 | | 0.350 | | | | | | | | From: DCB-69 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.440 | | 0.850 | | | | | | | | | | HDPE | 12 | 44 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.35 | 0.77 | 3.50 | 0.21 |
| | | | 0.479 | 0.809 | 0.387 | | 6.00 | NONE | 6.00 | 6.39 | **2.48** | To: WQU-22 | In: | | | | | | | | | | | | | |
| WS DCB-68 | LANDSCAPED | 0.025 | | 0.350 | | | | | | | | From: DCB-68 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.276 | | 0.850 | | | | | | | | | | HDPE | 12 | 82 | 0.79 | 0.250 | 0.010 | 0.013 | **3.56** | **4.54** | 0.22 | 0.67 | 3.05 | 0.45 |
| | | | | | | | 6.00 | NONE | 6.00 | 6.39 | **1.55** | To: WQU-22 | In: | | | | | | | | | | | | | |
| | | | 0.301 | 0.808 | 0.243 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: WQU-22 | Out: | | | | | | | | | | | | | |
| **WQU-22 TO DMH-40** | | | | | | 0.631 | 6.00 | 0.45 | 6.45 | 6.31 | **3.98** | | | HDPE | 15 | 31 | 1.23 | 0.313 | 0.015 | 0.013 | **7.91** | **6.45** | **0.50** | **0.86** | **5.53** | **0.09** |
| | | | | | | | | | | | | To: DMH-40 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-40 | Out: | | | | | | | | | | | | | |
| **DMH-40 TO DMH-41** | | | | | | 2.817 | 8.62 | 0.80 | 9.41 | 5.84 | **16.44** | | | HDPE | 30 | 121 | 4.91 | 0.625 | 0.005 | 0.013 | **29.00** | **5.91** | **0.57** | **0.89** | **5.25** | **0.38** |
| | | | | | | | | | | | | To: DMH-41 | In: | | | | | | | | | | | | | |
| WS WQU-23 | LANDSCAPED | 0.141 | | 0.350 | | | | | | | | From: WQU-23 | Out: | | | | | | | | | | | | | |
| | IMPERVIOUS | 0.333 | | 0.250 | | | | | | | | | | HDPE | 12 | 10 | 0.79 | 0.250 | 0.025 | 0.013 | **5.63** | **7.17** | 0.08 | 0.49 | 3.55 | 0.05 |
| | | | 0.474 | 0.280 | 0.133 | 0.133 | 6.00 | NONE | 6.00 | 6.39 | **0.85** | To: DMH-41 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-41 | Out: | | | | | | | | | | | | | |
| **DMH-41 TO DMH-42** | | | | | | 2.950 | 6.45 | 0.09 | 6.54 | 6.29 | **18.57** | | | HDPE | 30 | 85 | 4.91 | 0.625 | 0.008 | 0.013 | **36.69** | **7.47** | **0.51** | **0.86** | **6.42** | **0.22** |
| | | | | | | | | | | | | To: DMH-42 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-42 | Out: | | | | | | | | | | | | | |
| **DMH-42 TO DMH-43** | | | | | | 2.950 | 6.54 | 0.22 | 6.76 | 6.26 | **18.45** | | | HDPE | 30 | 175 | 4.91 | 0.625 | 0.005 | 0.013 | **29.00** | **5.91** | **0.64** | **0.92** | **5.43** | **0.54** |
| | | | | | | | | | | | | To: DMH-43 | In: | | | | | | | | | | | | | |
| | | | | | | | | | | | | From: DMH-43 | Out: | | | | | | | | | | | | | |
| **DMH-43 TO FES-6** | | | | | | 2.950 | 6.76 | 0.54 | 7.30 | 6.17 | **18.19** | | | HDPE | 30 | 76 | 4.91 | 0.625 | 0.008 | 0.013 | **36.69** | **7.47** | **0.50** | **0.85** | **6.38** | **0.20** |
| | | | | | | | | | | | | To: FES-6 | In: | | | | | | | | | | | | | |

# APPENDIX C: GROUNDWATER RECHARGE CALCULATIONS & 72-HR DRAWDOWN CALCULATIONS

**Groundwater Recharge Calculations**

**Project No.** 2021-036
**Project:** Proposed Warehouse Building
**Location:** Innovation Way Fall River MA
**Date:** November 21, 2022

**Calculate the Required Recharge Volume:**

| NRCS Hydrologic Soil Group | Volume to Recharge (inches) | Impervious Area (square feet) | Required Recharge Volume (cubic feet) |
|---|---|---|---|
| A | 0.60 | 0 | 0 |
| B | 0.35 | 60060 | 1752 |
| C | 0.25 | 533871 | 11122 |
| D | 0.10 | 0 | 0 |
| | | Total Required Recharge Volume | 12874 |

**Capture Area Adjustment**

A minimum of 65% of the total site impervious area must be directed to a recharge BMP:

| Impervious Area Directed to Recharge BMP (square feet) | Total Site Impervious Area (square feet) | % of Total Site Directed to Recharge BMP |
|---|---|---|
| 480106 | 593931 | 81% |

Calculate the Adjustment Factor:

| Impervious Area Directed to Recharge BMP (square feet) | Total Site Impervious Area (square feet) | Ratio of Total Impervious Area to Impervious Area Directed to BMP |
|---|---|---|
| 480106 | 593931 | 1.24 |

Calculate the Adjusted Required Recharge Volume:

| Required Recharge Volume (cubic feet) | Ratio of Total Impervious Area to Impervious Area Directed to BMP | Adjusted Required Recharge Volume (cubic feet) |
|---|---|---|
| 12874 | 1.24 | 15926 |
| | Total Required Recharge Volume | 15926 |
| | Provided Recharge Volume (Elev. 186.82 in StormTrap Chambers A) | 91299 |
| | Total Provided Recharge Volume | 91299 |

## Groundwater Recharge Calculations

**Project No.** 2021-036
**Project:** Proposed Warehouse Building
**Location:** Innovation Way Fall River MA
**Date:** November 21, 2022

**Calculate the Required Recharge Volume:**

| NRCS Hydrologic Soil Group | Volume to Recharge (inches) | Impervious Area (square feet) | Required Recharge Volume (cubic feet) |
|---|---|---|---|
| A | 0.60 | 0 | 0 |
| B | 0.35 | 206986 | 6037 |
| C | 0.25 | 205382 | 4279 |
| D | 0.10 | 0 | 0 |
| | | Total Required Recharge Volume | 10316 |

**Capture Area Adjustment**

A minimum of 65% of the total site impervious area must be directed to a recharge BMP:

| Impervious Area Directed to Recharge BMP (square feet) | Total Site Impervious Area (square feet) | % of Total Site Directed to Recharge BMP |
|---|---|---|
| 412368 | 412368 | 100% |

Calculate the Adjustment Factor:

| Impervious Area Directed to Recharge BMP (square feet) | Total Site Impervious Area (square feet) | Ratio of Total Impervious Area to Impervious Area Directed to BMP |
|---|---|---|
| 412368 | 412368 | 1.00 |

Calculate the Adjusted Required Recharge Volume:

| Required Recharge Volume (cubic feet) | Ratio of Total Impervious Area to Impervious Area Directed to BMP | Adjusted Required Recharge Volume (cubic feet) |
|---|---|---|
| 10316 | 1.00 | 10316 |
| | Total Required Recharge Volume | 10316 |
| | Provided Recharge Volume (Elev. 214.65 in Stormtrap System B) | 86206 |
| | Provided Recharge Volume (Elev. 215.84 in Cultec System E) | 21088 |
| | Total Provided Recharge Volume | 107294 |

## Groundwater Recharge Calculations

**Project No.** 2021-036
**Project:** Proposed Warehouse Building
**Location:** Innovation Way Fall River MA
**Date:** November 21, 2022

### Calculate the Required Recharge Volume:

| NRCS Hydrologic Soil Group | Volume to Recharge (inches) | Impervious Area (square feet) | Required Recharge Volume (cubic feet) |
|---|---|---|---|
| A | 0.60 | 0 | 0 |
| B | 0.35 | 99049 | 2889 |
| C | 0.25 | 315763 | 6578 |
| D | 0.10 | 0 | 0 |
| | | Total Required Recharge Volume | 9467 |

### Capture Area Adjustment

A minimum of 65% of the total site impervious area must be directed to a recharge BMP:

| Impervious Area Directed to Recharge BMP (square feet) | Total Site Impervious Area (square feet) | % of Total Site Directed to Recharge BMP |
|---|---|---|
| 414812 | 414812 | 100% |

Calculate the Adjustment Factor:

| Impervious Area Directed to Recharge BMP (square feet) | Total Site Impervious Area (square feet) | Ratio of Total Impervious Area to Impervious Area Directed to BMP |
|---|---|---|
| 414812 | 414812 | 1.00 |

Calculate the Adjusted Required Recharge Volume:

| Required Recharge Volume (cubic feet) | Ratio of Total Impervious Area to Impervious Area Directed to BMP | Adjusted Required Recharge Volume (cubic feet) |
|---|---|---|
| 9467 | 1.00 | 9467 |
| | Total Required Recharge Volume | 9467 |
| | Provided Recharge Volume (Elev. 220.82 in StormTrap Chambers C) | 4046 |
| | Provided Recharge Volume (Elev. 214.00 in Basin B) | 55203 |
| | Provided Recharge Volume (Elev. 215.80 in Basin C) | 70804 |
| | Total Provided Recharge Volume | 130053 |

**Groundwater Recharge Calculations**

**Project No.** 2021-036
**Project:** Proposed Warehouse Building
**Location:** Innovation Way Fall River MA
**Date:** November 21, 2022

**Calculate the Required Recharge Volume:**

| NRCS Hydrologic Soil Group | Volume to Recharge (inches) | Impervious Area (square feet) | Required Recharge Volume (cubic feet) |
|---|---|---|---|
| A | 0.60 | 0 | 0 |
| B | 0.35 | 379285 | 11062 |
| C | 0.25 | 35322 | 736 |
| D | 0.10 | 87222 | 727 |
| | | Total Required Recharge Volume | 12525 |

**Capture Area Adjustment**

A minimum of 65% of the total site impervious area must be directed to a recharge BMP:

| Impervious Area Directed to Recharge BMP (square feet) | Total Site Impervious Area (square feet) | % of Total Site Directed to Recharge BMP |
|---|---|---|
| 501829 | 501829 | 100% |

Calculate the Adjustment Factor:

| Impervious Area Directed to Recharge BMP (square feet) | Total Site Impervious Area (square feet) | Ratio of Total Impervious Area to Impervious Area Directed to BMP |
|---|---|---|
| 501829 | 501829 | 1.00 |

Calculate the Adjusted Required Recharge Volume:

| Required Recharge Volume (cubic feet) | Ratio of Total Impervious Area to Impervious Area Directed to BMP | Adjusted Required Recharge Volume (cubic feet) |
|---|---|---|
| 12525 | 1.00 | 12525 |
| | Total Required Recharge Volume | 12525 |
| | Provided Recharge Volume (Elev. 177.69 in Basin A) | 181486 |
| | Provided Recharge Volume (Elev. 183.72 in StormTrap Chambers D) | 120442 |
| | Total Provided Recharge Volume | 301928 |

**72 Hour Drawdown Calculations**

**Project No.** 2021-036
**Project:** Proposed Warhouse Building
**Location:** Innovation Way Fall River, MA
**Date:** November 21, 2022

According to the Massachusetts Stormwater Management Handbook, recharge BMP's must be designed to drain within 72 hours. Below is the drawdown calculation used:

**Time $_{(Drawdown)}$ = $R_v$ / (K*A)**

Where:

**$R_v$**: Total Chamber System Storage ($ft^3$)

**K**: Recharge Rate (Rawl's Rate) used to size the infiltration BMP (in/hour)

**A**: Bottom Area of the Infiltration Facility ($ft^2$)

| Location | $R_v$ | K (in/hour) | K (ft/hr) | A | Drawdown Time (hrs) | Drawdown Time Less than 72 Hours? |
|---|---|---|---|---|---|---|
| Subsurface Recharge StomTrap System A | 91299 | 2.41 | 0.20 | 45880 | 9.91 | YES |
| Subsurface Recharge StormTrap System B | 86206 | 2.41 | 0.20 | 27730 | 15.48 | YES |
| Subsurface Recharge Cultec System E | 21088 | 2.41 | 0.20 | 5889 | 17.83 | YES |
| Subsurface Recharge StomTrap System C | 4046 | 2.41 | 0.20 | 2902 | 6.94 | YES |
| Proposed Infiltration Basin B | 58115 | 2.41 | 0.20 | 10154 | 28.50 | YES |
| Proposed Infiltration Basin C | 70804 | 2.41 | 0.20 | 10407 | 33.88 | YES |
| Subsurface Recharge StomTrap System D | 120442 | 2.41 | 0.20 | 10737 | 55.85 | YES |
| Proposed Infiltration Basin A | 181486 | 2.41 | 0.20 | 14114 | 64.03 | YES |

Drawdown Conforms to the Stormwater Management Standards

# APPENDIX D: REQUIRED WATER QUALITY VOLUME & TSS REMOVAL CALCULATIONS

**Water Quality Calculations**

**Project No.** 2021-036
**Project:** Proposed Warehouse Building
**Location:** Innovation Way Fall River, MA
**Date:** November 21, 2022

## Calculate the Required Water Quality Volume

**To Focal Point Biofiltration System A:**

| Depth of Runoff (inches) | Discharge To: | Total Impervious Area (square feet) | Required Water Quality Volume (cubic feet) |
|---|---|---|---|
| 0.5 | Not Discharging to a Critical Area | | 0 |
| 1 | Discharging to a Critical Area | 113825 | 9485 |
| 1 | Soils with Rapid Infiltration Rate >2.41 "/hr | | 0 |
| | | Required Water Quality Volume | 9485 |
| | | Provided Water Quality Volume (Elev. 187.44 in Biofiltration) | 9540 |

**To Subsurface Infiltration StormTrap System A:**

| Depth of Runoff (inches) | Discharge To: | Total Impervious Area (square feet) | Required Water Quality Volume (cubic feet) |
|---|---|---|---|
| 0.5 | Not Discharging to a Critical Area | | 0 |
| 1 | Discharging to a Critical Area | 480106 | 40009 |
| 1 | Soils with Rapid Infiltration Rate >2.41 "/hr | | 0 |
| | | Required Water Quality Volume | 40009 |
| | | Provided Water Quality Volume (Elev. 185.70 in StormTrap System A) | 40099 |

**To Subsurface Infiltration StormTrap System B:**

| Depth of Runoff (inches) | Discharge To: | Total Impervious Area (square feet) | Required Water Quality Volume (cubic feet) |
|---|---|---|---|
| 0.5 | Not Discharging to a Critical Area | | 0 |
| 1 | Discharging to a Critical Area | 361898 | 30158 |
| 1 | Soils with Rapid Infiltration Rate >2.41 "/hr | | 0 |
| | | Required Water Quality Volume | 30158 |
| | | Provided Water Quality Volume (Elev. 211.86 in StormTrap (7.5) System B) | 30262 |

## Water Quality Calculations

**Project No.** 2021-036
**Project:** Proposed Warehouse Building
**Location:** Innovation Way Fall River, MA
**Date:** November 21, 2022

### Calculate the Required Water Quality Volume

**To Infiltration Basin B:**

| Depth of Runoff (inches) | Discharge To: | Total Impervious Area (square feet) | Required Water Quality Volume (cubic feet) |
|---|---|---|---|
| 0.5 | Not Discharging to a Critical Area | | 0 |
| 1 | Discharging to a Critical Area | 153748 | 12812 |
| 1 | Soils with Rapid Infiltration Rate >2.41 "/hr | | 0 |
| | | Required Water Quality Volume | 12812 |
| | | Provided Water Quality Volume (Elev. 211.29 in Infiltration Basin B) | 12902 |

**To Infiltration Basin C:**

| Depth of Runoff (inches) | Discharge To: | Total Impervious Area (square feet) | Required Water Quality Volume (cubic feet) |
|---|---|---|---|
| 0.5 | Not Discharging to a Critical Area | | 0 |
| 1 | Discharging to a Critical Area | 246661 | 20555 |
| 1 | Soils with Rapid Infiltration Rate >2.41 "/hr | | 0 |
| | | Required Water Quality Volume | 20555 |
| | | Provided Water Quality Volume (Elev. 212.73 in Infiltration Basin C) | 20650 |

**To Subsurface Infiltration StormTrap System C:**

| Depth of Runoff (inches) | Discharge To: | Total Impervious Area (square feet) | Required Water Quality Volume (cubic feet) |
|---|---|---|---|
| 0.5 | Not Discharging to a Critical Area | | 0 |
| 1 | Discharging to a Critical Area | 14403 | 1200 |
| 1 | Soils with Rapid Infiltration Rate >2.41 "/hr | | 0 |
| | | Required Water Quality Volume | 1200 |
| | | Provided Water Quality Volume (Elev. 219.73 in StormTrap System C) | 1231 |

**Water Quality Calculations**

**Project No.** 2021-036
**Project:** Proposed Warehouse Building
**Location:** Innovation Way Fall River, MA
**Date:** November 21, 2022

## Calculate the Required Water Quality Volume

**To Infiltration Basin A:**

| Depth of Runoff (inches) | Discharge To: | Total Impervious Area (square feet) | Required Water Quality Volume (cubic feet) |
|---|---|---|---|
| 0.5 | Not Discharging to a Critical Area | | 0 |
| 1 | Discharging to a Critical Area | 298432 | 24869 |
| 1 | Soils with Rapid Infiltration Rate >2.41 "/hr | | 0 |
| | | Required Water Quality Volume | 24869 |
| | | Provided Water Quality Volume (Elev. 170.63 in Infiltration Basin A) | 24933 |

**To Subsurface Infiltration StormTrap System D:**

| Depth of Runoff (inches) | Discharge To: | Total Impervious Area (square feet) | Required Water Quality Volume (cubic feet) |
|---|---|---|---|
| 0.5 | Not Discharging to a Critical Area | | 0 |
| 1 | Discharging to a Critical Area | 203397 | 16950 |
| 1 | Soils with Rapid Infiltration Rate >2.41 "/hr | | 0 |
| | | Required Water Quality Volume | 16950 |
| | | Provided Water Quality Volume (Elev. 173.01 in StormTrap System D) | 17004 |

**To Subsurface Infiltration Cultec System E:**

| Depth of Runoff (inches) | Discharge To: | Total Impervious Area (square feet) | Required Water Quality Volume (cubic feet) |
|---|---|---|---|
| 0.5 | Not Discharging to a Critical Area | | 0 |
| 1 | Discharging to a Critical Area | 50470 | 4206 |
| 1 | Soils with Rapid Infiltration Rate >2.41 "/hr | | 0 |
| | | Required Water Quality Volume | 4206 |
| | | Provided Water Quality Volume (Elev. 211.60 in Cultec System E) | 4237 |

## TSS Removal Spreadsheet

**Project No.** 2021-036
**Project:** Proposed Warehouse Building
**Location:** Innovation Way Fall River MA
**Date:** November 21, 2022

### Treatment Train: To Focal Point Bioretention System A:

| Pre-Treatment | | | | | |
|---|---|---|---|---|---|
| **BMP** | **TSS Removal Rate** | **Starting TSS Load** | **Amount Removed** | **Remaining Load** | **TSS Removed** |
| **Deep Sump Hooded Catch Basins** | **25%** | **100%** | **25%** | **75%** | **25%** |
| **Water Quality Unit** | **81%** | **75%** | **61%** | **14%** | **86%** |

Since this site is located within a Critical Area, 44% pretreatment is required. Based on the calculations above, 86% of TSS is removed prior to the Bioretention System.

| Total TSS Removal | | | | | |
|---|---|---|---|---|---|
| **BMP** | **TSS Removal Rate** | **Starting TSS Load** | **Amount Removed** | **Remaining Load** | **TSS Removed** |
| **Focal Point Bioretention System A** | **90%** | **14%** | **13%** | **1%** | **99%** |

Per the MA Stormwater Handbook, 80% of TSS is required to be removed prior to discharging and the City of Fall River requires 90% TSS removal. Therefore, the project complies with the Stormwater Standards and local requirements.

**Treatment Train: To Focal Point Bioretention System A:**

| Pre-Treatment | | | | | |
|---|---|---|---|---|---|
| **BMP** | **TSS Removal Rate** | **Starting TSS Load** | **Amount Removed** | **Remaining Load** | **TSS Removed** |
| **PRETX Pretreatment Unit** | **44%** | **100%** | **44%** | **56%** | **44%** |

Since this site is located within a Critical Area, 44% pretreatment is required. Based on the calculations above, 44% of TSS is removed prior to the Recharge Chamber System.

| Total TSS Removal | | | | | |
|---|---|---|---|---|---|
| **BMP** | **TSS Removal Rate** | **Starting TSS Load** | **Amount Removed** | **Remaining Load** | **TSS Removed** |
| **Focal Point Bioretention System A** | **90%** | **56%** | **50%** | **6%** | **94%** |

Per the MA Stormwater Handbook, 80% of TSS is required to be removed prior to discharging and the City of Fall River requires 90% TSS removal. Therefore, the project complies with the Stormwater Standards and local requirements.

**Treatment Train: To StormTrap Recharge Chamber System A - D**

| Pre-Treatment | | | | | |
|---|---|---|---|---|---|
| **BMP** | **TSS Removal Rate** | **Starting TSS Load** | **Amount Removed** | **Remaining Load** | **TSS Removed** |
| **Deep Sump Hooded Catch Basins** | **25%** | **100%** | **25%** | **75%** | **25%** |
| **Water Quality Unit** | **84%** | **75%** | **63%** | **12%** | **88%** |

Since this site is located within a Critical Area, 44% pretreatment is required. Based on the calculations above, 88% of TSS is removed prior to the Recharge Chamber System.

| Total TSS Removal | | | | | |
|---|---|---|---|---|---|
| **BMP** | **TSS Removal Rate** | **Starting TSS Load** | **Amount Removed** | **Remaining Load** | **TSS Removed** |
| **Subsurface StormTrap Chambers A-D** | **80%** | **12%** | **10%** | **2%** | **98%** |

Per the MA Stormwater Handbook, 80% of TSS is required to be removed prior to discharging and the City of Fall River requires 90% TSS removal. Therefore, the project complies with the Stormwater Standards and local requirements.

**Treatment Train: To Proposed Inflitration Basin A-C:**

| Pre-Treatment | | | | | |
|---|---|---|---|---|---|
| **BMP** | **TSS Removal Rate** | **Starting TSS Load** | **Amount Removed** | **Remaining Load** | **TSS Removed** |
| **Deep Sump Hooded Catch Basins** | **25%** | **100%** | **25%** | **75%** | **25%** |
| **Water Quality Unit** | **84%** | **75%** | **63%** | **12%** | **88%** |

Since this site is located within a Critical Area, 44% pretreatment is required. Based on the calculations above, 88% of TSS is removed prior to the Recharge Chamber System.

| Total TSS Removal | | | | | |
|---|---|---|---|---|---|
| **BMP** | **TSS Removal Rate** | **Starting TSS Load** | **Amount Removed** | **Remaining Load** | **TSS Removed** |
| **Infiltration Basin A-C** | **80%** | **12%** | **10%** | **2%** | **98%** |

Per the MA Stormwater Handbook, 80% of TSS is required to be removed prior to discharging and the City of Fall River requires 90% TSS removal. Therefore, the project complies with the Stormwater Standards and local requirements.

**Treatment Train: To Cultec Recharge Chamber System E**

| Pre-Treatment | | | | | |
|---|---|---|---|---|---|
| **BMP** | **TSS Removal Rate** | **Starting TSS Load** | **Amount Removed** | **Remaining Load** | **TSS Removed** |
| **Deep Sump Hooded Catch Basins** | **25%** | **100%** | **25%** | **75%** | **25%** |
| **Water Quality Unit** | **84%** | **75%** | **63%** | **12%** | **88%** |

Since this site is located within a Critical Area, 44% pretreatment is required. Based on the calculations above, 88% of TSS is removed prior to the Recharge Chamber System.

| Total TSS Removal | | | | | |
|---|---|---|---|---|---|
| **BMP** | **TSS Removal Rate** | **Starting TSS Load** | **Amount Removed** | **Remaining Load** | **TSS Removed** |
| **Cultec System E** | **80%** | **12%** | **10%** | **2%** | **98%** |

Per the MA Stormwater Handbook, 80% of TSS is required to be removed prior to discharging and the City of Fall River requires 90% TSS removal. Therefore, the project complies with the Stormwater Standards and local requirements.

# WATER QUALITY UNIT SIZING

**Project:** **0 Innovation Way**
**Location:** **Fall River, MA**
**Prepared For:** **MBL Land Development**

CONTECH ENGINEERED SOLUTIONS

**Purpose:** To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1" of runoff from the contributing impervious surface.

**Reference:** Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

**Procedure:** Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi$^2$/watershed inches (csm/in).

Compute Q Rate using the following equation:

**Q = (qu) (A) (WQV)**

where:

Q = flow rate associated with first 1" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1" in this case)

| Structure Name | Impv. (acres) | A (miles$^2$) | $t_c$ (min) | $t_c$ (hr) | WQV (in) | qu (csm/in.) | Q (cfs) |
|---|---|---|---|---|---|---|---|
| WQU 1 | 2.21 | 0.0034485 | 6.0 | 0.100 | 1.00 | 774.00 | 2.67 |
| WQU 2 | 2.04 | 0.0031873 | 6.0 | 0.100 | 1.00 | 774.00 | 2.47 |
| WQU 3 | 0.99 | 0.0015539 | 6.0 | 0.100 | 1.00 | 774.00 | 1.20 |
| WQU 4 | 0.96 | 0.0014931 | 6.0 | 0.100 | 1.00 | 774.00 | 1.16 |
| WQU 5 | 0.33 | 0.0005172 | 6.0 | 0.100 | 1.00 | 774.00 | 0.40 |
| WQU 6 | 1.16 | 0.0018104 | 6.0 | 0.100 | 1.00 | 774.00 | 1.40 |
| WQU 7 | 1.06 | 0.0016538 | 6.0 | 0.100 | 1.00 | 774.00 | 1.28 |
| WQU 8 | 0.98 | 0.0015295 | 6.0 | 0.100 | 1.00 | 774.00 | 1.18 |
| WQU 9 | 0.94 | 0.0014627 | 6.0 | 0.100 | 1.00 | 774.00 | 1.13 |
| WQU 10 | 0.48 | 0.0007536 | 6.0 | 0.100 | 1.00 | 774.00 | 0.58 |

The WQf sizing calculation selects the minimum size CDS/Cascade/StormCeptor model capable of operating at the computed WQf peak flowrate prior to bypassing. It assumes free discharge of the WQf through the unit and ignores the routing effect of any upstream storm drain piping. As with all hydrodynamic separators, there will be some impact to the Hydraulic Gradient of the corresponding drainage system, and evaluation of this impact should be considered in the design.

**Project:** 0 Innovation Way
**Location:** Fall River, MA
**Prepared For:** MBL Land Development

CONTECH ENGINEERED SOLUTIONS

**Purpose:** To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1" of runoff from the contributing impervious surface.

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**Procedure:** Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi$^2$/watershed inches (csm/in).

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where:

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qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1" in this case)

| Structure Name | Impv. (acres) | A (miles$^2$) | $t_c$ (min) | $t_c$ (hr) | WQV (in) | qu (csm/in.) | Q (cfs) |
|---|---|---|---|---|---|---|---|
| WQU 11 | 0.18 | 0.0002858 | 6.0 | 0.100 | 1.00 | 774.00 | 0.22 |
| WQU 12 | 0.71 | 0.0011132 | 6.0 | 0.100 | 1.00 | 774.00 | 0.86 |
| WQU 13 | 0.33 | 0.0005104 | 6.0 | 0.100 | 1.00 | 774.00 | 0.40 |
| WQU 14 | 0.12 | 0.0001843 | 6.0 | 0.100 | 1.00 | 774.00 | 0.14 |
| WQU 15 | 1.64 | 0.0025666 | 6.0 | 0.100 | 1.00 | 774.00 | 1.99 |
| WQU 16 | 1.89 | 0.0029483 | 6.0 | 0.100 | 1.00 | 774.00 | 2.28 |
| WQU 17 | 0.33 | 0.0005166 | 6.0 | 0.100 | 1.00 | 774.00 | 0.40 |
| WQU 18 | 0.99 | 0.0015519 | 6.0 | 0.100 | 1.00 | 774.00 | 1.20 |
| WQU 19 | 2.42 | 0.0037816 | 6.0 | 0.100 | 1.00 | 774.00 | 2.93 |
| WQU 20 | 1.27 | 0.0019859 | 6.0 | 0.100 | 1.00 | 774.00 | 1.54 |

The WQf sizing calculation selects the minimum size CDS/Cascade/StormCeptor model capable of operating at the computed WQf peak flowrate prior to bypassing. It assumes free discharge of the WQf through the unit and ignores the routing effect of any upstream storm drain piping. As with all hydrodynamic separators, there will be some impact to the Hydraulic Gradient of the corresponding drainage system, and evaluation of this impact should be considered in the design.

**Project:** 0 Innovation Way
**Location:** Fall River, MA
**Prepared For:** MBL Land Development

CONTECH ENGINEERED SOLUTIONS

**Purpose:** To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1" of runoff from the contributing impervious surface.

**Reference:** Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

**Procedure:** Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi$^2$/watershed inches (csm/in).

Compute Q Rate using the following equation:

**Q = (qu) (A) (WQV)**

where:

Q = flow rate associated with first 1" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1" in this case)

| Structure Name | Impv. (acres) | A (miles$^2$) | $t_c$ (min) | $t_c$ (hr) | WQV (in) | qu (csm/in.) | Q (cfs) |
|---|---|---|---|---|---|---|---|
| WQU 21 | 0.96 | 0.0015014 | 6.0 | 0.100 | 1.00 | 774.00 | 1.16 |
| WQU 22 | 0.72 | 0.0011277 | 6.0 | 0.100 | 1.00 | 774.00 | 0.87 |
| WQU 23 | 0.32 | 0.0005002 | 6.0 | 0.100 | 1.00 | 774.00 | 0.39 |
| | | | | | | | |
| | | | | | | | |
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| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

The WQf sizing calculation selects the minimum size CDS/Cascade/StormCeptor model capable of operating at the computed WQf peak flowrate prior to bypassing. It assumes free discharge of the WQf through the unit and ignores the routing effect of any upstream storm drain piping. As with all hydrodynamic separators, there will be some impact to the Hydraulic Gradient of the corresponding drainage system, and evaluation of this impact should be considered in the design.

Estimated Net Annual Solids Load Reduction
Based on the Rational Rainfall Method

CONTECH ENGINEERED SOLUTIONS

CASCADE separator™

0 INNOVATION WAY
FALL RIVER, MA
WQU 1

| | | | | |
|---|---|---|---|---|
| AREA | 2.21 | acres | CASCADE MODEL | CS-5 |
| WEIGHTED C | 0.95 | | | |
| TC | 6.00 | minutes | RAINFALL STATION | 66 |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Hydraulic Loading Rate (gpm/ft2) | Removal Efficiency (%) | Incremental Removal (%) |
|---|---|---|---|---|
| 0.08 | 35.3% | 3.84 | 100.0 | 35.3 |
| 0.16 | 23.8% | 7.68 | 100.0 | 23.8 |
| 0.24 | 12.9% | 11.52 | 100.0 | 12.9 |
| 0.32 | 7.8% | 15.36 | 97.5 | 7.6 |
| 0.40 | 4.9% | 19.20 | 93.9 | 4.6 |
| 0.48 | 3.5% | 23.04 | 90.2 | 3.2 |
| 0.56 | 1.7% | 26.88 | 86.6 | 1.5 |
| 0.64 | 1.8% | 30.71 | 83.0 | 1.5 |
| 0.72 | 1.9% | 34.55 | 79.4 | 1.5 |
| 0.80 | 0.9% | 38.39 | 75.8 | 0.7 |
| 1.00 | 2.3% | 47.99 | 66.8 | 1.5 |
| 2.00 | 2.9% | 80.01 | 30.6 | 0.9 |
| 3.00 | 0.2% | 80.01 | 20.4 | 0.0 |
| | | | | 95.1 |
| | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | Predicted % Annual Rainfall Treated = | 99.4% |
| | | | Predicted Net Annual Load Removal Efficiency = | 95.1% |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Estimated Net Annual Solids Load Reduction
Based on the Rational Rainfall Method

CONTECH ENGINEERED SOLUTIONS

CASCADE separator™

0 INNOVATION WAY
FALL RIVER, MA
WQU 2

| | | | | |
|---|---|---|---|---|
| AREA | 2.04 | acres | CASCADE MODEL | CS-5 |
| WEIGHTED C | 0.95 | | | |
| TC | 6.00 | minutes | RAINFALL STATION | 66 |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Hydraulic Loading Rate (gpm/ft2) | Removal Efficiency (%) | Incremental Removal (%) |
|---|---|---|---|---|
| 0.08 | 35.3% | 3.54 | 100.0 | 35.3 |
| 0.16 | 23.8% | 7.09 | 100.0 | 23.8 |
| 0.24 | 12.9% | 10.63 | 100.0 | 12.9 |
| 0.32 | 7.8% | 14.18 | 98.6 | 7.7 |
| 0.40 | 4.9% | 17.72 | 95.2 | 4.7 |
| 0.48 | 3.5% | 21.26 | 91.9 | 3.2 |
| 0.56 | 1.7% | 24.81 | 88.6 | 1.5 |
| 0.64 | 1.8% | 28.35 | 85.2 | 1.6 |
| 0.72 | 1.9% | 31.90 | 81.9 | 1.5 |
| 0.80 | 0.9% | 35.44 | 78.6 | 0.7 |
| 1.00 | 2.3% | 44.30 | 70.3 | 1.6 |
| 2.00 | 2.9% | 80.01 | 33.1 | 1.0 |
| 3.00 | 0.2% | 80.01 | 22.1 | 0.1 |
| | | | | 95.6 |
| | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | Predicted % Annual Rainfall Treated = | 99.6% |
| | | | Predicted Net Annual Load Removal Efficiency = | 95.6% |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

## CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

### 0 INNOVATION WAY
### FALL RIVER, MA

| | | | |
|---|---|---|---|
| Area | **0.99 ac** | Unit Site Designation | **WQU 3** |
| Weighted C | **0.9** | Rainfall Station # | **66** |
| $t_c$ | **6 min** | | |
| CDS Model | **2015-4** | CDS Treatment Capacity | **1.4 cfs** |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Cumulative Rainfall Volume | Total Flowrate (cfs) | Treated Flowrate (cfs) | Incremental Removal (%) |
|---|---|---|---|---|---|
| 0.08 | 35.3% | 35.3% | 0.07 | 0.07 | 33.1 |
| 0.16 | 23.8% | 59.1% | 0.14 | 0.14 | 21.5 |
| 0.24 | 12.9% | 72.0% | 0.21 | 0.21 | 11.2 |
| 0.32 | 7.8% | 79.8% | 0.29 | 0.29 | 6.5 |
| 0.40 | 4.9% | 84.7% | 0.36 | 0.36 | 3.9 |
| 0.48 | 3.5% | 88.3% | 0.43 | 0.43 | 2.7 |
| 0.56 | 1.7% | 90.0% | 0.50 | 0.50 | 1.2 |
| 0.64 | 1.8% | 91.8% | 0.57 | 0.57 | 1.3 |
| 0.72 | 1.9% | 93.7% | 0.64 | 0.64 | 1.2 |
| 0.80 | 0.9% | 94.6% | 0.72 | 0.72 | 0.6 |
| 1.00 | 2.3% | 96.9% | 0.90 | 0.90 | 1.2 |
| 2.00 | 2.9% | 99.8% | 1.79 | 1.40 | 0.7 |
| 3.00 | 0.2% | 100.0% | 2.69 | 1.40 | 0.0 |
| | | | | | 85.1 |

Removal Efficiency Adjustment[2] = 0.0%

Predicted % Annual Rainfall Treated = 99.3%

**Predicted Net Annual Load Removal Efficiency = 85.1%**

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

# CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

## 0 INNOVATION WAY
## FALL RIVER, MA

| | | | |
|---|---|---|---|
| Area | 0.96 ac | Unit Site Designation | WQU 4 |
| Weighted C | 0.9 | Rainfall Station # | 66 |
| $t_c$ | 6 min | | |
| CDS Model | 2015-4 | CDS Treatment Capacity | **1.4 cfs** |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Cumulative Rainfall Volume | Total Flowrate (cfs) | Treated Flowrate (cfs) | Incremental Removal (%) |
|---|---|---|---|---|---|
| 0.08 | 35.3% | 35.3% | 0.07 | 0.07 | 33.1 |
| 0.16 | 23.8% | 59.1% | 0.14 | 0.14 | 21.5 |
| 0.24 | 12.9% | 72.0% | 0.21 | 0.21 | 11.3 |
| 0.32 | 7.8% | 79.8% | 0.28 | 0.28 | 6.6 |
| 0.40 | 4.9% | 84.7% | 0.34 | 0.34 | 3.9 |
| 0.48 | 3.5% | 88.3% | 0.41 | 0.41 | 2.7 |
| 0.56 | 1.7% | 90.0% | 0.48 | 0.48 | 1.3 |
| 0.64 | 1.8% | 91.8% | 0.55 | 0.55 | 1.3 |
| 0.72 | 1.9% | 93.7% | 0.62 | 0.62 | 1.3 |
| 0.80 | 0.9% | 94.6% | 0.69 | 0.69 | 0.6 |
| 1.00 | 2.3% | 96.9% | 0.86 | 0.86 | 1.3 |
| 2.00 | 2.9% | 99.8% | 1.72 | 1.40 | 0.7 |
| 3.00 | 0.2% | 100.0% | 2.58 | 1.40 | 0.0 |
| | | | | | 85.5 |
| | | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | | Predicted % Annual Rainfall Treated = | 99.4% |
| | | | | **Predicted Net Annual Load Removal Efficiency =** | **85.5%** |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

# Brief Stormceptor Sizing Report - WQU 5

| Project Information & Location | | | |
|---|---|---|---|
| **Project Name** | 0 Innovation Way | **Project Number** | 714965 |
| **City** | Fall River | **State/ Province** | Massachusetts |
| **Country** | United States of America | **Date** | 6/23/2022 |
| **Designer Information** | | **EOR Information (optional)** | |
| **Name** | Dave Adams | **Name** | |
| **Company** | Contech Engineered Solutions | **Company** | MBL Land Development |
| **Phone #** | 207-885-6191 | **Phone #** | |
| **Email** | dave.adams@conteches.com | **Email** | |

**Stormwater Treatment Recommendation**

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

| | |
|---|---|
| **Site Name** | WQU 5 |
| **Target TSS Removal (%)** | 80 |
| **TSS Removal (%) Provided** | 91 |
| **Recommended Stormceptor Model** | STC 450i |

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

**Stormceptor Sizing Summary**

| Stormceptor Model | % TSS Removal Provided |
|---|---|
| STC 450i | 91 |
| STC 900 | 95 |
| STC 1200 | 95 |
| STC 1800 | 96 |
| STC 2400 | 97 |
| STC 3600 | 97 |
| STC 4800 | 98 |
| STC 6000 | 98 |
| STC 7200 | 99 |
| STC 11000 | 99 |
| STC 13000 | 99 |
| STC 16000 | 99 |

Stormceptor®

CONTECH ENGINEERED SOLUTIONS
A QUIKRETE® COMPANY

## Sizing Details

| Drainage Area | |
|---|---|
| Total Area (acres) | 0.33 |
| Imperviousness % | 100.0 |

| Rainfall | |
|---|---|
| Station Name | BLUE HILL |
| State/Province | Massachusetts |
| Station ID # | 0736 |
| Years of Records | 58 |
| Latitude | 42°12'44"N |
| Longitude | 71°6'53"W |

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

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

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

### Particle Size Distribution (PSD)
### The selected PSD defines TSS removal

| OK-110 | | |
|---|---|---|
| Particle Diameter (microns) | Distribution % | Specific Gravity |
| 1.0 | 0.0 | 2.65 |
| 53.0 | 3.0 | 2.65 |
| 75.0 | 15.0 | 2.65 |
| 88.0 | 25.0 | 2.65 |
| 106.0 | 41.0 | 2.65 |
| 125.0 | 15.0 | 2.65 |
| 150.0 | 1.0 | 2.65 |
| 212.0 | 0.0 | 2.65 |

## Notes

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

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

## CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
## BASED ON THE RATIONAL RAINFALL METHOD

### 0 INNOVATION WAY
### FALL RIVER, MA

| | | | |
|---|---|---|---|
| Area | **1.16 ac** | Unit Site Designation | **WQU 6** |
| Weighted C | **0.9** | Rainfall Station # | **66** |
| $t_c$ | **6 min** | | |
| CDS Model | **2015-4** | CDS Treatment Capacity | **1.4 cfs** |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Cumulative Rainfall Volume | Total Flowrate (cfs) | Treated Flowrate (cfs) | Incremental Removal (%) |
|---|---|---|---|---|---|
| 0.08 | 35.3% | 35.3% | 0.08 | 0.08 | 32.9 |
| 0.16 | 23.8% | 59.1% | 0.17 | 0.17 | 21.2 |
| 0.24 | 12.9% | 72.0% | 0.25 | 0.25 | 11.0 |
| 0.32 | 7.8% | 79.8% | 0.33 | 0.33 | 6.3 |
| 0.40 | 4.9% | 84.7% | 0.42 | 0.42 | 3.8 |
| 0.48 | 3.5% | 88.3% | 0.50 | 0.50 | 2.6 |
| 0.56 | 1.7% | 90.0% | 0.58 | 0.58 | 1.2 |
| 0.64 | 1.8% | 91.8% | 0.67 | 0.67 | 1.2 |
| 0.72 | 1.9% | 93.7% | 0.75 | 0.75 | 1.1 |
| 0.80 | 0.9% | 94.6% | 0.84 | 0.84 | 0.5 |
| 1.00 | 2.3% | 96.9% | 1.04 | 1.04 | 1.1 |
| 2.00 | 2.9% | 99.8% | 2.09 | 1.40 | 0.6 |
| 3.00 | 0.2% | 100.0% | 3.13 | 1.40 | 0.0 |
| | | | | | 83.4 |
| | | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | | Predicted % Annual Rainfall Treated = | 98.9% |
| | | | | **Predicted Net Annual Load Removal Efficiency =** | **83.4%** |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

## CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

## 0 INNOVATION WAY
## FALL RIVER, MA

| | | | |
|---|---|---|---|
| Area | **1.06 ac** | Unit Site Designation | **WQU 7** |
| Weighted C | **0.9** | Rainfall Station # | **66** |
| $t_c$ | **6 min** | | |
| CDS Model | **2015-5** | CDS Treatment Capacity | **1.4 cfs** |

| **Rainfall Intensity[1] (in/hr)** | **Percent Rainfall Volume[1]** | **Cumulative Rainfall Volume** | **Total Flowrate (cfs)** | **Treated Flowrate (cfs)** | **Incremental Removal (%)** |
|---|---|---|---|---|---|
| 0.08 | 35.3% | 35.3% | 0.08 | 0.08 | 33.0 |
| 0.16 | 23.8% | 59.1% | 0.15 | 0.15 | 21.4 |
| 0.24 | 12.9% | 72.0% | 0.23 | 0.23 | 11.1 |
| 0.32 | 7.8% | 79.8% | 0.31 | 0.31 | 6.5 |
| 0.40 | 4.9% | 84.7% | 0.38 | 0.38 | 3.9 |
| 0.48 | 3.5% | 88.3% | 0.46 | 0.46 | 2.6 |
| 0.56 | 1.7% | 90.0% | 0.53 | 0.53 | 1.2 |
| 0.64 | 1.8% | 91.8% | 0.61 | 0.61 | 1.2 |
| 0.72 | 1.9% | 93.7% | 0.69 | 0.69 | 1.2 |
| 0.80 | 0.9% | 94.6% | 0.76 | 0.76 | 0.5 |
| 1.00 | 2.3% | 96.9% | 0.95 | 0.95 | 1.2 |
| 2.00 | 2.9% | 99.8% | 1.91 | 1.40 | 0.6 |
| 3.00 | 0.2% | 100.0% | 2.86 | 1.40 | 0.0 |
| | | | | | 84.4 |
| | | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | | Predicted % Annual Rainfall Treated = | 99.1% |
| | | | | **Predicted Net Annual Load Removal Efficiency =** | **84.4%** |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

## CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
## BASED ON THE RATIONAL RAINFALL METHOD

### 0 INNOVATION WAY
### FALL RIVER, MA

| | | | |
|---|---|---|---|
| Area | **0.98 ac** | Unit Site Designation | **WQU 8** |
| Weighted C | **0.9** | Rainfall Station # | **66** |
| $t_c$ | **6 min** | | |
| CDS Model | **2015-4** | CDS Treatment Capacity | **1.4 cfs** |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Cumulative Rainfall Volume | Total Flowrate (cfs) | Treated Flowrate (cfs) | Incremental Removal (%) |
|---|---|---|---|---|---|
| 0.08 | 35.3% | 35.3% | 0.07 | 0.07 | 33.1 |
| 0.16 | 23.8% | 59.1% | 0.14 | 0.14 | 21.5 |
| 0.24 | 12.9% | 72.0% | 0.21 | 0.21 | 11.2 |
| 0.32 | 7.8% | 79.8% | 0.28 | 0.28 | 6.5 |
| 0.40 | 4.9% | 84.7% | 0.35 | 0.35 | 3.9 |
| 0.48 | 3.5% | 88.3% | 0.42 | 0.42 | 2.7 |
| 0.56 | 1.7% | 90.0% | 0.49 | 0.49 | 1.3 |
| 0.64 | 1.8% | 91.8% | 0.56 | 0.56 | 1.3 |
| 0.72 | 1.9% | 93.7% | 0.63 | 0.63 | 1.2 |
| 0.80 | 0.9% | 94.6% | 0.70 | 0.70 | 0.6 |
| 1.00 | 2.3% | 96.9% | 0.88 | 0.88 | 1.3 |
| 2.00 | 2.9% | 99.8% | 1.76 | 1.40 | 0.7 |
| 3.00 | 0.2% | 100.0% | 2.64 | 1.40 | 0.0 |
| | | | | | 85.3 |
| | | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | | Predicted % Annual Rainfall Treated = | 99.3% |
| | | | | **Predicted Net Annual Load Removal Efficiency =** | **85.3%** |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

# CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

## 0 INNOVATION WAY
## FALL RIVER, MA

| | | | |
|---|---|---|---|
| Area | 0.94 ac | Unit Site Designation | WQU 9 |
| Weighted C | 0.9 | Rainfall Station # | 66 |
| $t_c$ | 6 min | | |
| CDS Model | 2015-5 | CDS Treatment Capacity | 1.4 cfs |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Cumulative Rainfall Volume | Total Flowrate (cfs) | Treated Flowrate (cfs) | Incremental Removal (%) |
|---|---|---|---|---|---|
| 0.08 | 35.3% | 35.3% | 0.07 | 0.07 | 33.2 |
| 0.16 | 23.8% | 59.1% | 0.14 | 0.14 | 21.6 |
| 0.24 | 12.9% | 72.0% | 0.20 | 0.20 | 11.3 |
| 0.32 | 7.8% | 79.8% | 0.27 | 0.27 | 6.6 |
| 0.40 | 4.9% | 84.7% | 0.34 | 0.34 | 4.0 |
| 0.48 | 3.5% | 88.3% | 0.41 | 0.41 | 2.7 |
| 0.56 | 1.7% | 90.0% | 0.47 | 0.47 | 1.3 |
| 0.64 | 1.8% | 91.8% | 0.54 | 0.54 | 1.3 |
| 0.72 | 1.9% | 93.7% | 0.61 | 0.61 | 1.3 |
| 0.80 | 0.9% | 94.6% | 0.68 | 0.68 | 0.6 |
| 1.00 | 2.3% | 96.9% | 0.85 | 0.85 | 1.3 |
| 2.00 | 2.9% | 99.8% | 1.69 | 1.40 | 0.7 |
| 3.00 | 0.2% | 100.0% | 2.54 | 1.40 | 0.0 |
| | | | | | 85.7 |
| | | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | | Predicted % Annual Rainfall Treated = | 99.4% |
| | | | | **Predicted Net Annual Load Removal Efficiency =** | **85.7%** |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

# CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

## 0 INNOVATION WAY
## FALL RIVER, MA

| | | | |
|---|---|---|---|
| Area | 0.48 ac | Unit Site Designation | WQU 10 |
| Weighted C | 0.9 | Rainfall Station # | 66 |
| $t_c$ | 6 min | | |
| CDS Model | 1515-3 | CDS Treatment Capacity | 1.0 cfs |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Cumulative Rainfall Volume | Total Flowrate (cfs) | Treated Flowrate (cfs) | Incremental Removal (%) |
|---|---|---|---|---|---|
| 0.08 | 35.3% | 35.3% | 0.03 | 0.03 | 33.5 |
| 0.16 | 23.8% | 59.1% | 0.07 | 0.07 | 22.0 |
| 0.24 | 12.9% | 72.0% | 0.10 | 0.10 | 11.6 |
| 0.32 | 7.8% | 79.8% | 0.14 | 0.14 | 6.9 |
| 0.40 | 4.9% | 84.7% | 0.17 | 0.17 | 4.2 |
| 0.48 | 3.5% | 88.3% | 0.21 | 0.21 | 2.9 |
| 0.56 | 1.7% | 90.0% | 0.24 | 0.24 | 1.4 |
| 0.64 | 1.8% | 91.8% | 0.28 | 0.28 | 1.4 |
| 0.72 | 1.9% | 93.7% | 0.31 | 0.31 | 1.4 |
| 0.80 | 0.9% | 94.6% | 0.35 | 0.35 | 0.7 |
| 1.00 | 2.3% | 96.9% | 0.43 | 0.43 | 1.6 |
| 2.00 | 2.9% | 99.8% | 0.87 | 0.87 | 1.1 |
| 3.00 | 0.2% | 100.0% | 1.30 | 1.00 | 0.1 |
| | | | | | 88.7 |
| | | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | | Predicted % Annual Rainfall Treated = | 99.9% |
| | | | | **Predicted Net Annual Load Removal Efficiency =** | **88.7%** |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

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# Brief Stormceptor Sizing Report - WQU 11

| Project Information & Location | | | |
|---|---|---|---|
| **Project Name** | 0 Innovation Way | **Project Number** | 714965 |
| **City** | Fall River | **State/ Province** | Massachusetts |
| **Country** | United States of America | **Date** | 6/23/2022 |
| **Designer Information** | | **EOR Information (optional)** | |
| **Name** | Dave Adams | **Name** | |
| **Company** | Contech Engineered Solutions | **Company** | MBL Land Development |
| **Phone #** | 207-885-6191 | **Phone #** | |
| **Email** | dave.adams@conteches.com | **Email** | |

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

| | |
|---|---|
| **Site Name** | WQU 11 |
| **Target TSS Removal (%)** | 80 |
| **TSS Removal (%) Provided** | 94 |
| **Recommended Stormceptor Model** | STC 450i |

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

| Stormceptor Sizing Summary | |
|---|---|
| **Stormceptor Model** | **% TSS Removal Provided** |
| STC 450i | 94 |
| STC 900 | 97 |
| STC 1200 | 97 |
| STC 1800 | 97 |
| STC 2400 | 98 |
| STC 3600 | 98 |
| STC 4800 | 99 |
| STC 6000 | 99 |
| STC 7200 | 99 |
| STC 11000 | 99 |
| STC 13000 | 99 |
| STC 16000 | 100 |

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## Sizing Details

| Drainage Area | |
|---|---|
| Total Area (acres) | 0.18 |
| Imperviousness % | 100.0 |

| Rainfall | |
|---|---|
| Station Name | BLUE HILL |
| State/Province | Massachusetts |
| Station ID # | 0736 |
| Years of Records | 58 |
| Latitude | 42°12'44"N |
| Longitude | 71°6'53"W |

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

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

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

| Particle Size Distribution (PSD)<br>The selected PSD defines TSS removal | | |
|---|---|---|
| OK-110 | | |
| Particle Diameter (microns) | Distribution % | Specific Gravity |
| 1.0 | 0.0 | 2.65 |
| 53.0 | 3.0 | 2.65 |
| 75.0 | 15.0 | 2.65 |
| 88.0 | 25.0 | 2.65 |
| 106.0 | 41.0 | 2.65 |
| 125.0 | 15.0 | 2.65 |
| 150.0 | 1.0 | 2.65 |
| 212.0 | 0.0 | 2.65 |

## Notes

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

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

## CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
## BASED ON THE RATIONAL RAINFALL METHOD

### 0 INNOVATION WAY
### FALL RIVER, MA

| | | | |
|---|---|---|---|
| Area | 0.71 ac | Unit Site Designation | WQU 12 |
| Weighted C | 0.9 | Rainfall Station # | 66 |
| $t_c$ | 6 min | | |
| CDS Model | 1515-3 | CDS Treatment Capacity | **1.0 cfs** |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Cumulative Rainfall Volume | Total Flowrate (cfs) | Treated Flowrate (cfs) | Incremental Removal (%) |
|---|---|---|---|---|---|
| 0.08 | 35.3% | 35.3% | 0.05 | 0.05 | 33.1 |
| 0.16 | 23.8% | 59.1% | 0.10 | 0.10 | 21.5 |
| 0.24 | 12.9% | 72.0% | 0.15 | 0.15 | 11.2 |
| 0.32 | 7.8% | 79.8% | 0.21 | 0.21 | 6.5 |
| 0.40 | 4.9% | 84.7% | 0.26 | 0.26 | 3.9 |
| 0.48 | 3.5% | 88.3% | 0.31 | 0.31 | 2.7 |
| 0.56 | 1.7% | 90.0% | 0.36 | 0.36 | 1.2 |
| 0.64 | 1.8% | 91.8% | 0.41 | 0.41 | 1.3 |
| 0.72 | 1.9% | 93.7% | 0.46 | 0.46 | 1.2 |
| 0.80 | 0.9% | 94.6% | 0.51 | 0.51 | 0.6 |
| 1.00 | 2.3% | 96.9% | 0.64 | 0.64 | 1.2 |
| 2.00 | 2.9% | 99.8% | 1.28 | 1.00 | 0.7 |
| 3.00 | 0.2% | 100.0% | 1.92 | 1.00 | 0.0 |
| | | | | | 85.1 |
| | | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | | Predicted % Annual Rainfall Treated = | 99.3% |
| | | | | **Predicted Net Annual Load Removal Efficiency =** | **85.1%** |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

# Brief Stormceptor Sizing Report - WQU 13

| Project Information & Location | | | |
|---|---|---|---|
| **Project Name** | 0 Innovation Way | **Project Number** | 714965 |
| **City** | Fall River | **State/ Province** | Massachusetts |
| **Country** | United States of America | **Date** | 6/23/2022 |
| **Designer Information** | | **EOR Information (optional)** | |
| **Name** | Dave Adams | **Name** | |
| **Company** | Contech Engineered Solutions | **Company** | MBL Land Development |
| **Phone #** | 207-885-6191 | **Phone #** | |
| **Email** | dave.adams@conteches.com | **Email** | |

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

| | |
|---|---|
| **Site Name** | WQU 13 |
| **Target TSS Removal (%)** | 80 |
| **TSS Removal (%) Provided** | 91 |
| **Recommended Stormceptor Model** | STC 450i |

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

| Stormceptor Sizing Summary | |
|---|---|
| **Stormceptor Model** | **% TSS Removal Provided** |
| STC 450i | 91 |
| STC 900 | 95 |
| STC 1200 | 95 |
| STC 1800 | 96 |
| STC 2400 | 97 |
| STC 3600 | 97 |
| STC 4800 | 98 |
| STC 6000 | 98 |
| STC 7200 | 99 |
| STC 11000 | 99 |
| STC 13000 | 99 |
| STC 16000 | 99 |

## Sizing Details

| Drainage Area | |
|---|---|
| **Total Area (acres)** | 0.33 |
| **Imperviousness %** | 100.0 |

| Rainfall | |
|---|---|
| **Station Name** | BLUE HILL |
| **State/Province** | Massachusetts |
| **Station ID #** | 0736 |
| **Years of Records** | 58 |
| **Latitude** | 42°12'44"N |
| **Longitude** | 71°6'53"W |

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

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

| Up Stream Flow Diversion | |
|---|---|
| **Max. Flow to Stormceptor (cfs)** | |

| Particle Size Distribution (PSD)<br>The selected PSD defines TSS removal | | |
|---|---|---|
| **OK-110** | | |
| **Particle Diameter (microns)** | **Distribution %** | **Specific Gravity** |
| 1.0 | 0.0 | 2.65 |
| 53.0 | 3.0 | 2.65 |
| 75.0 | 15.0 | 2.65 |
| 88.0 | 25.0 | 2.65 |
| 106.0 | 41.0 | 2.65 |
| 125.0 | 15.0 | 2.65 |
| 150.0 | 1.0 | 2.65 |
| 212.0 | 0.0 | 2.65 |

## Notes

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

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

# Brief Stormceptor Sizing Report - WQU 14

| Project Information & Location | | | |
|---|---|---|---|
| **Project Name** | 0 Innovation Way | **Project Number** | 714965 |
| **City** | Fall River | **State/ Province** | Massachusetts |
| **Country** | United States of America | **Date** | 6/23/2022 |
| **Designer Information** | | **EOR Information (optional)** | |
| **Name** | Dave Adams | **Name** | |
| **Company** | Contech Engineered Solutions | **Company** | MBL Land Development |
| **Phone #** | 207-885-6191 | **Phone #** | |
| **Email** | dave.adams@conteches.com | **Email** | |

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

| | |
|---|---|
| **Site Name** | WQU 14 |
| **Target TSS Removal (%)** | 80 |
| **TSS Removal (%) Provided** | 95 |
| **Recommended Stormceptor Model** | STC 450i |

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

| Stormceptor Sizing Summary | |
|---|---|
| **Stormceptor Model** | **% TSS Removal Provided** |
| STC 450i | 95 |
| STC 900 | 98 |
| STC 1200 | 98 |
| STC 1800 | 98 |
| STC 2400 | 99 |
| STC 3600 | 99 |
| STC 4800 | 99 |
| STC 6000 | 99 |
| STC 7200 | 99 |
| STC 11000 | 100 |
| STC 13000 | 100 |
| STC 16000 | 100 |

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## Sizing Details

| Drainage Area | |
|---|---|
| Total Area (acres) | 0.12 |
| Imperviousness % | 100.0 |

| Rainfall | |
|---|---|
| Station Name | BLUE HILL |
| State/Province | Massachusetts |
| Station ID # | 0736 |
| Years of Records | 58 |
| Latitude | 42°12'44"N |
| Longitude | 71°6'53"W |

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

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

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

| Particle Size Distribution (PSD) The selected PSD defines TSS removal | | |
|---|---|---|
| OK-110 | | |
| Particle Diameter (microns) | Distribution % | Specific Gravity |
| 1.0 | 0.0 | 2.65 |
| 53.0 | 3.0 | 2.65 |
| 75.0 | 15.0 | 2.65 |
| 88.0 | 25.0 | 2.65 |
| 106.0 | 41.0 | 2.65 |
| 125.0 | 15.0 | 2.65 |
| 150.0 | 1.0 | 2.65 |
| 212.0 | 0.0 | 2.65 |

## Notes

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

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

Estimated Net Annual Solids Load Reduction
Based on the Rational Rainfall Method

CONTECH ENGINEERED SOLUTIONS

CASCADE separator™

0 INNOVATION WAY
FALL RIVER, MA
WQU 15

| | | | | |
|---|---|---|---|---|
| AREA | 1.64 | acres | CASCADE MODEL | CS-4 |
| WEIGHTED C | 0.95 | | | |
| TC | 6.00 | minutes | RAINFALL STATION | 66 |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Hydraulic Loading Rate (gpm/ft2) | Removal Efficiency (%) | Incremental Removal (%) |
|---|---|---|---|---|
| 0.08 | 35.3% | 4.45 | 100.0 | 35.3 |
| 0.16 | 23.8% | 8.90 | 100.0 | 23.8 |
| 0.24 | 12.9% | 13.36 | 99.3 | 12.8 |
| 0.32 | 7.8% | 17.81 | 95.2 | 7.5 |
| 0.40 | 4.9% | 22.26 | 91.0 | 4.5 |
| 0.48 | 3.5% | 26.71 | 86.8 | 3.0 |
| 0.56 | 1.7% | 31.16 | 82.6 | 1.4 |
| 0.64 | 1.8% | 35.61 | 78.4 | 1.4 |
| 0.72 | 1.9% | 40.07 | 74.2 | 1.4 |
| 0.80 | 0.9% | 44.52 | 70.1 | 0.6 |
| 1.00 | 2.3% | 55.65 | 59.6 | 1.4 |
| 2.00 | 2.9% | 76.08 | 27.6 | 0.8 |
| 3.00 | 0.2% | 76.08 | 18.4 | 0.0 |
| | | | | 94.0 |
| | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | Predicted % Annual Rainfall Treated = | 99.0% |
| | | | Predicted Net Annual Load Removal Efficiency = | 94.0% |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Estimated Net Annual Solids Load Reduction
Based on the Rational Rainfall Method

CONTECH ENGINEERED SOLUTIONS

CASCADE separator™

0 INNOVATION WAY
FALL RIVER, MA
WQU 16

| | | | | |
|---|---|---|---|---|
| AREA | 1.89 | acres | CASCADE MODEL | CS-4 |
| WEIGHTED C | 0.95 | | | |
| TC | 6.00 | minutes | RAINFALL STATION | 66 |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Hydraulic Loading Rate (gpm/ft2) | Removal Efficiency (%) | Incremental Removal (%) |
|---|---|---|---|---|
| 0.08 | 35.3% | 5.13 | 100.0 | 35.3 |
| 0.16 | 23.8% | 10.26 | 100.0 | 23.8 |
| 0.24 | 12.9% | 15.39 | 97.4 | 12.6 |
| 0.32 | 7.8% | 20.52 | 92.6 | 7.3 |
| 0.40 | 4.9% | 25.65 | 87.8 | 4.3 |
| 0.48 | 3.5% | 30.78 | 83.0 | 2.9 |
| 0.56 | 1.7% | 35.91 | 78.1 | 1.3 |
| 0.64 | 1.8% | 41.04 | 73.3 | 1.3 |
| 0.72 | 1.9% | 46.17 | 68.5 | 1.3 |
| 0.80 | 0.9% | 51.30 | 63.7 | 0.6 |
| 1.00 | 2.3% | 64.13 | 51.6 | 1.2 |
| 2.00 | 2.9% | 76.08 | 24.0 | 0.7 |
| 3.00 | 0.2% | 76.08 | 16.0 | 0.0 |
| | | | | 92.6 |

| | |
|---|---|
| Removal Efficiency Adjustment[2] = | 0.0% |
| Predicted % Annual Rainfall Treated = | 98.7% |
| Predicted Net Annual Load Removal Efficiency = | 92.6% |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

# Brief Stormceptor Sizing Report - WQU 17

| Project Information & Location | | | |
|---|---|---|---|
| **Project Name** | 0 Innovation Way | **Project Number** | 714965 |
| **City** | Fall River | **State/ Province** | Massachusetts |
| **Country** | United States of America | **Date** | 6/23/2022 |
| **Designer Information** | | **EOR Information (optional)** | |
| **Name** | Dave Adams | **Name** | |
| **Company** | Contech Engineered Solutions | **Company** | MBL Land Development |
| **Phone #** | 207-885-6191 | **Phone #** | |
| **Email** | dave.adams@conteches.com | **Email** | |

**Stormwater Treatment Recommendation**

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

| | |
|---|---|
| **Site Name** | WQU 17 |
| **Target TSS Removal (%)** | 80 |
| **TSS Removal (%) Provided** | 91 |
| **Recommended Stormceptor Model** | STC 450i |

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

| Stormceptor Sizing Summary | |
|---|---|
| **Stormceptor Model** | **% TSS Removal Provided** |
| STC 450i | 91 |
| STC 900 | 95 |
| STC 1200 | 95 |
| STC 1800 | 96 |
| STC 2400 | 97 |
| STC 3600 | 97 |
| STC 4800 | 98 |
| STC 6000 | 98 |
| STC 7200 | 99 |
| STC 11000 | 99 |
| STC 13000 | 99 |
| STC 16000 | 99 |

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## Sizing Details

| Drainage Area | |
|---|---|
| Total Area (acres) | 0.33 |
| Imperviousness % | 100.0 |

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

| Rainfall | |
|---|---|
| Station Name | BLUE HILL |
| State/Province | Massachusetts |
| Station ID # | 0736 |
| Years of Records | 58 |
| Latitude | 42°12'44"N |
| Longitude | 71°6'53"W |

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

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

### Particle Size Distribution (PSD)
### The selected PSD defines TSS removal

| OK-110 | | |
|---|---|---|
| Particle Diameter (microns) | Distribution % | Specific Gravity |
| 1.0 | 0.0 | 2.65 |
| 53.0 | 3.0 | 2.65 |
| 75.0 | 15.0 | 2.65 |
| 88.0 | 25.0 | 2.65 |
| 106.0 | 41.0 | 2.65 |
| 125.0 | 15.0 | 2.65 |
| 150.0 | 1.0 | 2.65 |
| 212.0 | 0.0 | 2.65 |

## Notes

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

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

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

## CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

## 0 INNOVATION WAY
## FALL RIVER, MA

| | | | |
|---|---|---|---|
| Area | **0.99 ac** | Unit Site Designation | **WQU 18** |
| Weighted C | **0.9** | Rainfall Station # | **66** |
| $t_c$ | **6 min** | | |
| CDS Model | **2015-4** | CDS Treatment Capacity | **1.4 cfs** |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Cumulative Rainfall Volume | Total Flowrate (cfs) | Treated Flowrate (cfs) | Incremental Removal (%) |
|---|---|---|---|---|---|
| 0.08 | 35.3% | 35.3% | 0.07 | 0.07 | 33.1 |
| 0.16 | 23.8% | 59.1% | 0.14 | 0.14 | 21.5 |
| 0.24 | 12.9% | 72.0% | 0.21 | 0.21 | 11.2 |
| 0.32 | 7.8% | 79.8% | 0.29 | 0.29 | 6.5 |
| 0.40 | 4.9% | 84.7% | 0.36 | 0.36 | 3.9 |
| 0.48 | 3.5% | 88.3% | 0.43 | 0.43 | 2.7 |
| 0.56 | 1.7% | 90.0% | 0.50 | 0.50 | 1.2 |
| 0.64 | 1.8% | 91.8% | 0.57 | 0.57 | 1.3 |
| 0.72 | 1.9% | 93.7% | 0.64 | 0.64 | 1.2 |
| 0.80 | 0.9% | 94.6% | 0.72 | 0.72 | 0.6 |
| 1.00 | 2.3% | 96.9% | 0.89 | 0.89 | 1.2 |
| 2.00 | 2.9% | 99.8% | 1.79 | 1.40 | 0.7 |
| 3.00 | 0.2% | 100.0% | 2.68 | 1.40 | 0.0 |
| | | | | | 85.1 |

| | |
|---|---|
| Removal Efficiency Adjustment[2] = | 0.0% |
| Predicted % Annual Rainfall Treated = | 99.3% |
| **Predicted Net Annual Load Removal Efficiency =** | **85.1%** |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Estimated Net Annual Solids Load Reduction
Based on the Rational Rainfall Method

CONTECH ENGINEERED SOLUTIONS

CASCADE separator™

0 INNOVATION WAY
FALL RIVER, MA
WQU 19

| | | | | |
|---|---|---|---|---|
| AREA | 2.42 | acres | CASCADE MODEL | CS-5 |
| WEIGHTED C | 0.95 | | | |
| TC | 6.00 | minutes | RAINFALL STATION | 66 |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Hydraulic Loading Rate (gpm/ft2) | Removal Efficiency (%) | Incremental Removal (%) |
|---|---|---|---|---|
| 0.08 | 35.3% | 4.20 | 100.0 | 35.3 |
| 0.16 | 23.8% | 8.41 | 100.0 | 23.8 |
| 0.24 | 12.9% | 12.61 | 100.0 | 12.9 |
| 0.32 | 7.8% | 16.82 | 96.1 | 7.5 |
| 0.40 | 4.9% | 21.02 | 92.1 | 4.5 |
| 0.48 | 3.5% | 25.23 | 88.2 | 3.1 |
| 0.56 | 1.7% | 29.43 | 84.2 | 1.4 |
| 0.64 | 1.8% | 33.63 | 80.3 | 1.5 |
| 0.72 | 1.9% | 37.84 | 76.3 | 1.4 |
| 0.80 | 0.9% | 42.04 | 72.4 | 0.7 |
| 1.00 | 2.3% | 52.55 | 62.5 | 1.4 |
| 2.00 | 2.9% | 80.01 | 27.9 | 0.8 |
| 3.00 | 0.2% | 80.01 | 18.6 | 0.0 |
| | | | | 94.4 |
| | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | Predicted % Annual Rainfall Treated = | 99.2% |
| | | | Predicted Net Annual Load Removal Efficiency = | 94.4% |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Estimated Net Annual Solids Load Reduction
Based on the Rational Rainfall Method

CONTECH ENGINEERED SOLUTIONS

CASCADE separator™

0 INNOVATION WAY
FALL RIVER, MA
WQU 20

| | | | | |
|---|---|---|---|---|
| AREA | 1.27 | acres | CASCADE MODEL | CS-4 |
| WEIGHTED C | 0.95 | | | |
| TC | 6.00 | minutes | RAINFALL STATION | 66 |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Hydraulic Loading Rate (gpm/ft2) | Removal Efficiency (%) | Incremental Removal (%) |
|---|---|---|---|---|
| 0.08 | 35.3% | 3.45 | 100.0 | 35.3 |
| 0.16 | 23.8% | 6.89 | 100.0 | 23.8 |
| 0.24 | 12.9% | 10.34 | 100.0 | 12.9 |
| 0.32 | 7.8% | 13.79 | 98.9 | 7.7 |
| 0.40 | 4.9% | 17.24 | 95.7 | 4.7 |
| 0.48 | 3.5% | 20.68 | 92.5 | 3.2 |
| 0.56 | 1.7% | 24.13 | 89.2 | 1.5 |
| 0.64 | 1.8% | 27.58 | 86.0 | 1.6 |
| 0.72 | 1.9% | 31.03 | 82.7 | 1.5 |
| 0.80 | 0.9% | 34.47 | 79.5 | 0.7 |
| 1.00 | 2.3% | 43.09 | 71.4 | 1.7 |
| 2.00 | 2.9% | 76.08 | 35.7 | 1.0 |
| 3.00 | 0.2% | 76.08 | 23.8 | 0.1 |
| | | | | 95.8 |
| | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | Predicted % Annual Rainfall Treated = | 99.6% |
| | | | Predicted Net Annual Load Removal Efficiency = | 95.8% |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

# CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

## 0 INNOVATION WAY
## FALL RIVER, MA

| | | | |
|---|---|---|---|
| Area | **0.96 ac** | Unit Site Designation | **WQU 21** |
| Weighted C | **0.9** | Rainfall Station # | **66** |
| $t_c$ | **6 min** | | |
| CDS Model | **2015-4** | CDS Treatment Capacity | **1.4 cfs** |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Cumulative Rainfall Volume | Total Flowrate (cfs) | Treated Flowrate (cfs) | Incremental Removal (%) |
|---|---|---|---|---|---|
| 0.08 | 35.3% | 35.3% | 0.07 | 0.07 | 33.1 |
| 0.16 | 23.8% | 59.1% | 0.14 | 0.14 | 21.5 |
| 0.24 | 12.9% | 72.0% | 0.21 | 0.21 | 11.2 |
| 0.32 | 7.8% | 79.8% | 0.28 | 0.28 | 6.6 |
| 0.40 | 4.9% | 84.7% | 0.35 | 0.35 | 3.9 |
| 0.48 | 3.5% | 88.3% | 0.42 | 0.42 | 2.7 |
| 0.56 | 1.7% | 90.0% | 0.48 | 0.48 | 1.3 |
| 0.64 | 1.8% | 91.8% | 0.55 | 0.55 | 1.3 |
| 0.72 | 1.9% | 93.7% | 0.62 | 0.62 | 1.2 |
| 0.80 | 0.9% | 94.6% | 0.69 | 0.69 | 0.6 |
| 1.00 | 2.3% | 96.9% | 0.86 | 0.86 | 1.3 |
| 2.00 | 2.9% | 99.8% | 1.73 | 1.40 | 0.7 |
| 3.00 | 0.2% | 100.0% | 2.59 | 1.40 | 0.0 |
| | | | | | 85.5 |
| | | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | | Predicted % Annual Rainfall Treated = | 99.3% |
| | | | | **Predicted Net Annual Load Removal Efficiency =** | **85.5%** |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

## CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
## BASED ON THE RATIONAL RAINFALL METHOD

### 0 INNOVATION WAY
### FALL RIVER, MA

| | | | |
|---|---|---|---|
| Area | **0.72 ac** | Unit Site Designation | **WQU 22** |
| Weighted C | **0.9** | Rainfall Station # | **66** |
| $t_c$ | **6 min** | | |
| CDS Model | **2015-4** | CDS Treatment Capacity | **1.4 cfs** |

| **Rainfall Intensity[1] (in/hr)** | **Percent Rainfall Volume[1]** | **Cumulative Rainfall Volume** | **Total Flowrate (cfs)** | **Treated Flowrate (cfs)** | **Incremental Removal (%)** |
|---|---|---|---|---|---|
| 0.08 | 35.3% | 35.3% | 0.05 | 0.05 | 33.4 |
| 0.16 | 23.8% | 59.1% | 0.10 | 0.10 | 21.9 |
| 0.24 | 12.9% | 72.0% | 0.16 | 0.16 | 11.6 |
| 0.32 | 7.8% | 79.8% | 0.21 | 0.21 | 6.8 |
| 0.40 | 4.9% | 84.7% | 0.26 | 0.26 | 4.2 |
| 0.48 | 3.5% | 88.3% | 0.31 | 0.31 | 2.9 |
| 0.56 | 1.7% | 90.0% | 0.36 | 0.36 | 1.4 |
| 0.64 | 1.8% | 91.8% | 0.41 | 0.41 | 1.4 |
| 0.72 | 1.9% | 93.7% | 0.47 | 0.47 | 1.4 |
| 0.80 | 0.9% | 94.6% | 0.52 | 0.52 | 0.7 |
| 1.00 | 2.3% | 96.9% | 0.65 | 0.65 | 1.5 |
| 2.00 | 2.9% | 99.8% | 1.30 | 1.30 | 1.0 |
| 3.00 | 0.2% | 100.0% | 1.94 | 1.40 | 0.0 |
| | | | | | 88.2 |
| | | | | Removal Efficiency Adjustment[2] = | 0.0% |
| | | | | Predicted % Annual Rainfall Treated = | 99.9% |
| | | | | **Predicted Net Annual Load Removal Efficiency =** | **88.2%** |

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

# CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

## 0 INNOVATION WAY
## FALL RIVER, MA

| | | | |
|---|---|---|---|
| Area | **0.32 ac** | Unit Site Designation | **WQU 23** |
| Weighted C | **0.9** | Rainfall Station # | **66** |
| $t_c$ | **6 min** | | |
| CDS Model | **2015-5** | CDS Treatment Capacity | **1.4 cfs** |

| Rainfall Intensity[1] (in/hr) | Percent Rainfall Volume[1] | Cumulative Rainfall Volume | Total Flowrate (cfs) | Treated Flowrate (cfs) | Incremental Removal (%) |
|---|---|---|---|---|---|
| 0.08 | 35.3% | 35.3% | 0.02 | 0.02 | 33.9 |
| 0.16 | 23.8% | 59.1% | 0.05 | 0.05 | 22.6 |
| 0.24 | 12.9% | 72.0% | 0.07 | 0.07 | 12.1 |
| 0.32 | 7.8% | 79.8% | 0.09 | 0.09 | 7.3 |
| 0.40 | 4.9% | 84.7% | 0.12 | 0.12 | 4.5 |
| 0.48 | 3.5% | 88.3% | 0.14 | 0.14 | 3.2 |
| 0.56 | 1.7% | 90.0% | 0.16 | 0.16 | 1.5 |
| 0.64 | 1.8% | 91.8% | 0.18 | 0.18 | 1.6 |
| 0.72 | 1.9% | 93.7% | 0.21 | 0.21 | 1.6 |
| 0.80 | 0.9% | 94.6% | 0.23 | 0.23 | 0.8 |
| 1.00 | 2.3% | 96.9% | 0.29 | 0.29 | 1.9 |
| 2.00 | 2.9% | 99.8% | 0.58 | 0.58 | 2.0 |
| 3.00 | 0.2% | 100.0% | 0.86 | 0.86 | 0.1 |
| | | | | | 93.2 |

Removal Efficiency Adjustment[2] = 0.0%

Predicted % Annual Rainfall Treated = 100.0%

**Predicted Net Annual Load Removal Efficiency = 93.2%**

1 - Based on 14 years of 15 minute precipitation data from NCDC station 3821, Hyannis, in Barnstable County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

# APPENDIX E: CONSTRUCTION PERIOD POLLUTION PREVENTION PLAN

This construction period pollution prevention plan has been prepared in accordance with the Stormwater Management Policy issued by the Department of Environmental Protection (DEP), for the proposed site development at:

0 Innovation Way, Fall River, Massachusetts (Map W-19 Lots 185 & 189)

31 Innovation Way, Freetown, Massachusetts (Map 236 Parcel 006.01)

## SECTION I: POTENTIAL SOURCES OF POLLUTION

The following potential sources of pollution should be monitored during construction.

### WASTE MATERIALS

All waste materials will be collected and stored in a securely lidded dumpster located more than 100 feet from any resource area as is reasonably practical. The dumpster will meet all local and State solid waste management regulations. All trash and construction debris from the site will be deposited in the dumpster. No construction waste materials will be buried onsite. All personnel will be instructed regarding the correct procedure for waste disposal. Notices stating these practices will be posted in the office trailer, and the individual who manages day-to-day site operations will be responsible for seeing that these practices are followed.

### HAZARDOUS WASTE

All hazardous waste materials will be disposed of in the manner specified by local or State regulation or by the manufacturer. Site personnel will be instructed in these practices and the individual, whom manages day-to-day site operations, will be responsible for seeing that these practices are followed.

### SANITARY WASTE

All sanitary waste will be collected from the portable units a minimum of once per week by a licensed sanitary waste management contractor, as required by the local or State regulation.

### NON-STORM WATER DISCHARGES

During construction activities at the site, some water from the site will be suitable for discharge. Uncontaminated groundwater from de-watering activities will be directed to recharge groundwater on-site. The construction de-watering and all non-stormwater discharges will be directed through a silt bag, dewatering or sedimentation basin prior to discharge to the wetlands. The general contractor will comply with the EPA.'s Final General Permit for Construction De-watering Discharges and the Stormwater Pollution Prevention Plan.

### CONCRETE TRUCK WASHOUT AREAS

Concrete trucks will be directed to a washout area located outside of the 100-foot Wetland Buffer. Washout areas shall consist of a layer of polyurethane sheeting draped over a rectangular area built out of straw bales.

### PROPER EQUIPMENT/ VEHICLE FUELING AND MAINTENANCE PRACTICES

Petroleum products related to the operation of said equipment will be stored and tightly sealed containers, which will be clearly labeled. Spray guns will be cleaned on a disposable tarp. Vehicles will not be allowed to refuel on-site.

## SPILL PREVENTION AND CONTROL PLAN

Materials and equipment necessary for spill cleanup will be kept on-site. Equipment will include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, saw dust and plastic and metal trash containers. All spills will be cleaned up immediately upon discovery. Spills large enough to reach the stormwater management system shall be reported to the Massachusetts DEP or National Response Center at 1-800-424-8802.

## SECTION II: BEST MANAGEMENT PRACTICES

An Erosion Control and Sedimentation Control program will be implemented to prevent indirect impact to the existing wetland, existing roadways, and surrounding sites during the construction. The program incorporates Best Management Practices (BMP's) as specified in the guidelines developed by DEP and the Environmental Protection Agency and complies with the requirements of the NPDES General Permit for Storm Water Discharges for Construction Activities. These measures include the installation of temporary erosion and sedimentation controls and construction sequencing. Areas of exposed soil will be kept to a minimum and/or phased during construction and a permanent vegetative cover or other forms of stabilization will be established as soon as practicable.

Proper implementation of the erosion and sedimentation control program will:

- Minimize exposed soils through temporary mulching or seeding or by sequencing so that the amount of exposed soil is kept to a minimum.
- Place erosion controls structures to manage erosion and site runoff.
- Managing the control structures through the life of the construction activities and repairing all damaged structures as well as removing trapped silt as soon as recommended.
- Establish a permanent vegetative cover or other forms of stabilization as soon as practicable.

The following erosion and sedimentation control BMP's are presented in the sequence to which they will be implemented at the site. The measures will be inspected on a weekly basis or immediately before and or after storm event greater than 0.5”. The controls will be routinely maintained throughout the duration of the project. Any damaged controls will be repaired and or replaced immediately. The locations of the specified sedimentation and erosion control measures are depicted on the proposed design drawings.

## EROSION CONTROL BARRIERS

Erosion control barriers will be installed and inspected by the appropriate authority at the down gradient limit of work prior to construction. The barriers will consist of staked silt fence and will be entrenched into the ground to prevent under flow. When necessary, additional erosion controls will be installed immediately down gradient of the erosion prone areas, such as the base of steep exposed slopes, around material stockpile areas, throughout the construction phase of the project. A sufficient supply of material shall be kept on site to facilitate the repair or replacement of the proposed barriers.

## STABILIZED CONSTRUCTION ENTRANCE

The stabilized construction entrance shall be installed after site clearing but before any earth moving activities. The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic topdressing with additional stone. Remove mud and sediment tracked or washed onto public road immediately. Reshape pad as needed for drainage and runoff control. Repair any broken road pavement immediately. All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed. Trapped sediment shall be removed or stabilized on site. Inspect the pad and sediment disposal area weekly and after heavy rains or heavy use.

## TEMPORARY SURFACE AND SLOPE STABILIZATION

Any area of exposed soil that will remain unstabilized for a period of more than fourteen days will be covered with a layer of straw or mulch until the time of final loam and seeding.

## TEMPORARY SEEDING

A temporary vegetative cover of fast-growing indigenous grasses will be established on areas of exposed soils that remain unstable for a period of fourteen days. Depending on the slope, the seeded surfaces will be covered with a layer of mulch.

## PERMANENT SEEDING

Upon completion of the final grading, any area not covered by pavement, other forms of stabilization, or other landscaped methods will be loamed and seeded with New England Erosion Control/Restoration Mix (for dry sites) produced by New England Wetland Plants, Inc. (or approved equivalent). This mix includes grasses and broad leaf herbaceous plants that are indigenous to the northeastern Massachusetts. Depending on slope the seeded area will be covered with mulch or erosion control blanket. The seed mix will be applied at a rate of 25lbs/acre.

## INFILTRATION PROTECTION

The following practices should be implemented by the contractor to protect the in-situ soils in the location of the infiltration chambers:

- Never allow heavy construction equipment to drive across areas;
- Limit smearing and compacting of soils in infiltration areas;
- Rotary till or disc harrow to a depth of 12” to restore infiltration rates after final grading.

## SECTION III: INSPECTIONS

Construction Inspections: Construction inspections shall be performed by personnel from the site contractor and/or the Engineer of Record, as appointed by the owner. Inspection forms shall be executed for each corresponding inspection.

- Perimeter Sediment Controls: Silt fence will be laid and staked into the ground in advance of construction along the perimeter of the project site in locations shown on the Erosion & Sedimentation Control Plan. Such barriers shall be inspected within 12 hours of a storm event in excess of 0.5” and weekly. Sediment deposits must be removed when the level of deposition reaches approximately one-half the height of the barrier.

- Construction Entrance: The temporary construction entrance should be maintained in a condition that will prevent tracking or flowing of sediment into the street. This may require periodic topdressing with additional stone.

  The entrance should be inspected weekly and within 12 hours of a storm event in excess of 0.5”. Mud and soil particles will eventually clog the voids in the gravel and the effectiveness of the gravel pad. When this occurs, the pad should be top dressed with new stone. Complete replacement of the pad may be necessary when the pad becomes completely clogged.

- Catch Basin Inlet Protection: Silt sacks have been proposed in all catch basins to prevent sediment from entering the municipal drainage system prior to permanent stabilization. Silt sacks should be inspected after rainstorm in excess of 0.5” and weekly. Sediment should be disposed of in a suitable area and protected from erosion by either structural or vegetative means. Catch basin inlet protection should be removed and the area repaired as soon as the contributing drainage area to the inlet has been completely stabilized.

# APPENDIX F: LONG TERM POLLUTION PREVENTION PLAN

To keep the stormwater management system functioning properly, a Long-Term Pollution Prevention Plan is required. Adherence to this Long-Term Pollution Prevention Plan will be the responsibility of the following:

V.M.D. Companies, LLC
733 Turnpike Street, Route 114
North Andover, Massachusetts

**LONG TERM POLLUTION PREVENTION PLAN TRAINING**

Annual stormwater pollution prevention plan training shall be conducted. Training records shall be kept on file.

**GOOD HOUSEKEEPING PRACTICES**
Employees shall be trained in the importance of not spilling fluids and chemicals such as oil, antifreeze, etc. onto the bare ground. All areas exposed to the weather shall be kept clean.

**SOLID WASTE MANAGMENT**
Solid waste shall be kept in the covered dumpster and collected at a minimum of once per week and disposed of in a legal manner, at a state licensed recycling center or landfill.

**REQUIREMENTS FOR STORAGE AND USE OF FERTILIZERS, HERBICIDES AND PESTICIDES**
Fertilizers shall not be used within 100 feet of the wetland resource areas. Excess fertilizers shall be swept up from all impervious surfaces and not be allowed to run into the stormwater management system.

All fertilizers, herbicides and pesticides shall be stored at least 100 feet from the wetlands resource areas and be kept in a wrapped or sealed container and under cover.

**SNOW DISPOSAL AND PLOWING PLANS**
Snow shall be plowed to the area indicated on the permitting plans. Snow shall not be stored within 100 feet of the wetland resource areas. If not possible to store the snow on-site, it shall be trucked away and disposed of in the same manner described above.

**WINTER ROAD SALT/ SAND USE AND STORAGE RESTRICTIONS**
Road salt shall not be used on the site. Sand is an acceptable alternative.

**STREET SWEEPING SCHEDULE**
Street sweeping shall be performed on paved surfaces no less than four times per year.

# APPENDIX G:  OPERATION & MAINTENANCE PLAN

To keep the stormwater management system functioning properly and to ensure that the Total Suspended Solids (TSS) are reduced, periodic inspections and maintenance of the system is required. The operation and maintenance of all components of the proposed stormwater management system will be the responsibility of the following:

V.M.D. Companies, LLC
733 Turnpike Street, Route 114
North Andover, Massachusetts

The following is a guideline of the specific maintenance schedules and tasks on a component-by-component basis that is required to keep the stormwater management system functioning properly.

## DEEP SUMP CATCH BASINS

Unscheduled Maintenance: At the end of foliage and snow-removal seasons, inspect or clean the basin. Remove any branches, trash or other large debris that could interfere with the proper operation of the stormwater management system. Whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin, remove any accumulated sediment with clamshell buckets or vacuum trucks.

Quarterly Maintenance: Inspect or clean the basin. Remove any branches, trash or other large debris that could interfere with the proper operation of the stormwater management system. Remove any accumulated sediment with clamshell buckets or vacuum trucks.

## WATER QUALITY UNITS

See attached on the following pages, the operation and maintenance requirements and owner's manual for the Cascade Separator, CDS, and Stormceptor Water Quality Units.

Quarterly Annual Maintenance: Check inlets, separation screens and outlets for clogging and remove any debris that could interfere with the proper operation of the system. Remove any accumulated sediment with vacuum trucks when it reaches 75% of the capacity in the sump.

## ROOF LEADER AND GUTTERS

Unscheduled Maintenance: Maintain the gutters and downspouts in clean condition free of debris so they are able to quickly drain water from the roof and the building.

## PAVED AREAS

Quarterly Maintenance: Sweep, vacuum, or clean paved areas to reduce the amount of sediment entering the stormwater management system.

## FLARED END SECTIONS WITH RIPRAP PLUNGE POOL:

General Maintenance: During the spring and fall after leaf drop, remove any accumulated leaves from the flared end section. Remove any accumulated sediment by the use of hand tools (rakes, shovels, wheelbarrows, etc.). Reset any displaced riprap from the flared end section.

## SUBSURFACE STORMTRAP RECHARGE SYSTEMS

The StormTrap subsurface recharge systems shall be maintained per the manufacturer's recommendations (See full O&M requirements attached on following pages).

## BIORETENTION SYSTEM

Unscheduled Maintenance: Re-mulch voided areas and treat diseased vegetation as needed. The entirety of the media and vegetation should be replaced as needed

General Maintenance: Inspect soil, repair eroded areas, and remove litter and debris monthly.

Annual Maintenance: Vegetation should be tended to on an annual basis. Dead vegetation can be removed and pruned in the Fall and Spring and replaced in the Spring. Mulch can be replaced in the Spring on a bi-annual basis.

## PRETX CURB INLET PRETREATMENT UNIT

The Pretx Curb Inlet Pretreatment unit shall be maintained per the manufacturer's recommendations (See full O&M requirements attached on following pages).

## CULTEC SUBSURFACE RECHARGE CHAMBERS

The subsurface recharge chambers shall be maintained per the manufacturer's recommendations (See full O&M requirements attached on following pages).

Monthly Maintenance (first year only): Check inlets and outlets for clogging and remove any debris that could interfere with the proper operation of the system. Check for depressions in areas over and surrounding the recharge system.

Semi-Annual Maintenance (Spring and Fall): Check inlets and outlets for clogging and remove any debris that could interfere with the proper operation of the system. Clean gutters and downspouts and remove any debris that could interfere with the proper operation of the system. Check for depressions in areas over and surrounding the recharge system.

Annual Maintenance: Confirm that no unauthorized modifications have been made to the system.

1 Year After Commissioning and Every 3rd Year Following: Clean the inlets and outlets with vacuum trucks.

2 Years After Commissioning: Inspect the interior of the chambers through inspection port for deficiencies using CCTV or comparable technique. Clean the chambers and feed connectors of any debris with vacuum trucks.

9 Years After Commissioning and every 9 Years Following: Inspect the interior of the chambers through inspection port for deficiencies using CCTV or comparable technique.

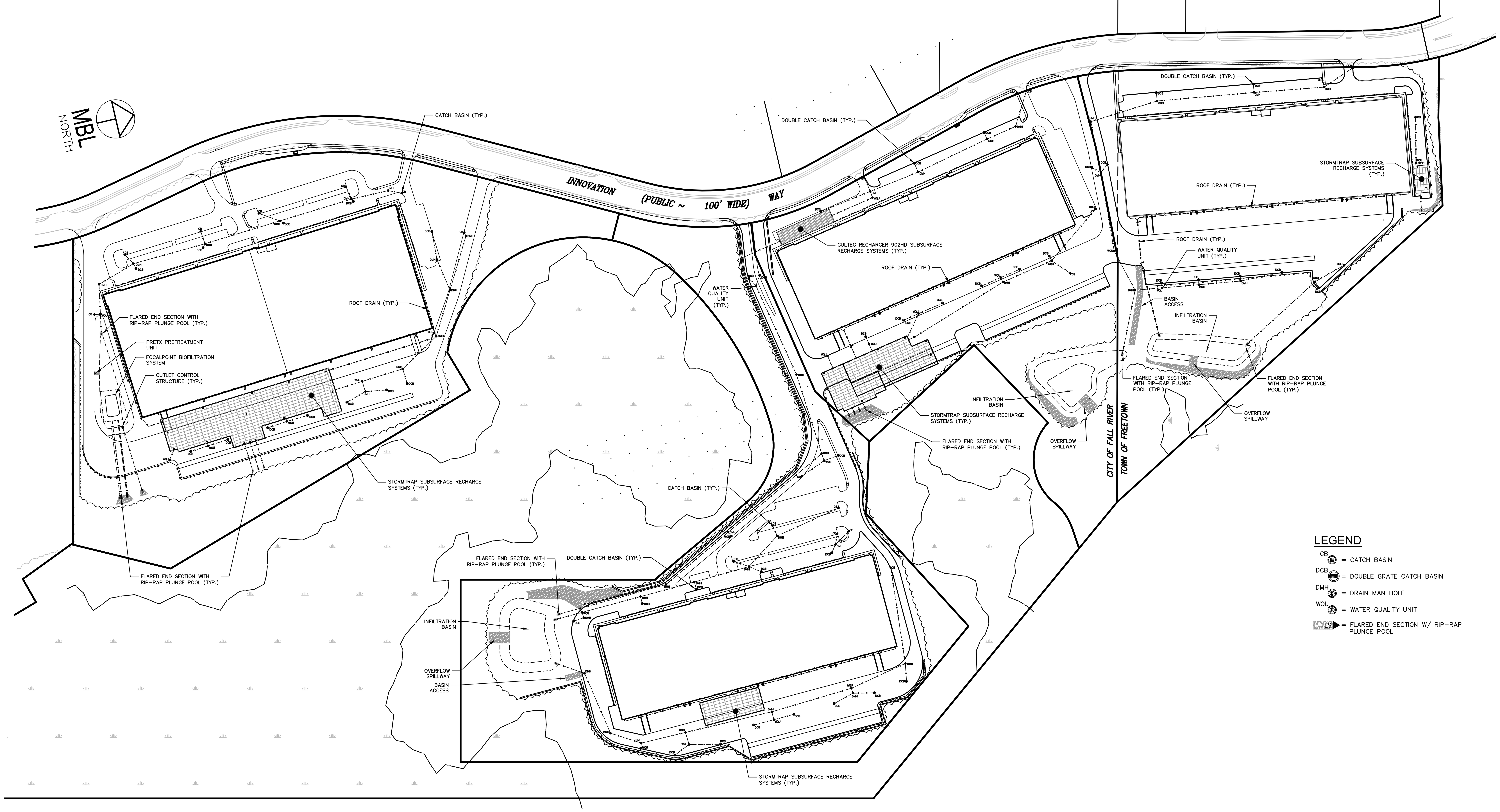
**INFILTRATION BASINS WITH OVERFLOW SPILLWAY**

Unscheduled Maintenance: After rain events in excess of two inches, or after any snow or rain event accompanied by high winds, inspect the basin for debris. Remove any branches, trash, or other large debris that could interfere with the proper operation of the stormwater management system.

General Maintenance: Maintain the grassed side slopes of the basin through regular mowing. Keep the grass between three to six inches in length. Remove grass clippings to prevent them from impeding the flow of stormwater. During the spring and fall, remove any accumulated leaves from the basin including the rip rap overflow spillway. Reset any displaced rip rap.

Quarterly Maintenance: Inspect the basin for debris. Remove any branches, trash or other large debris that could interfere with the proper operation of the stormwater management system. Remove any accumulated sediment by the use of hand tools (rakes, shovels, wheelbarrows, etc.) when it exceeds three inches.

Annual Maintenance: Inspect the basin for debris. Remove any branches, trash or other large debris that could interfere with the proper operation of the stormwater management system. Remove any accumulated sediment by the use of hand tools (rakes, shovels, wheelbarrows, etc.) annually. Reset any displaced rip rap from the overflow spillway.




## STORMWATER OPERTAION + MAINTENANCE (O+M) NOTES

DEEP SUMP CATCH BASINS

UNSCHEDULED MAINTENANCE: AT THE END OF FOLIAGE AND SNOW-REMOVAL SEASONS, INSPECT OR CLEAN THE BASIN. REMOVE ANY BRANCHES, TRASH OR OTHER LARGE DEBRIS THAT COULD INTERFERE WITH THE PROPER OPERATION OF THE STORMWATER MANAGEMENT SYSTEM. WHENEVER THE DEPTH OF DEPOSITS IS GREATER THAN OR EQUAL TO ONE HALF THE DEPTH FROM THE BOTTOM OF THE INVERT OF THE LOWEST PIPE IN THE BASIN, REMOVE ANY ACCUMULATED SEDIMENT WITH CLAMSHELL BUCKETS OR VACUUM TRUCKS.

QUARTERLY MAINTENANCE: INSPECT OR CLEAN THE BASIN. REMOVE ANY BRANCHES, TRASH OR OTHER LARGE DEBRIS THAT COULD INTERFERE WITH THE PROPER OPERATION OF THE STORMWATER MANAGEMENT SYSTEM. REMOVE ANY ACCUMULATED SEDIMENT WITH CLAMSHELL BUCKETS OR VACUUM TRUCKS.

WATER QUALITY UNITS

SEE ATTACHED ON THE FOLLOWING PAGES, THE OPERATION AND MAINTENANCE REQUIREMENTS AND OWNER'S MANUAL FOR THE WATER QUALITY UNITS.

QUARTERLY ANNUAL MAINTENANCE: CHECK INLETS, SEPARATION SCREENS AND OUTLETS FOR CLOGGING AND REMOVE ANY DEBRIS THAT COULD INTERFERE WITH THE PROPER OPERATION OF THE SYSTEM. REMOVE ANY ACCUMULATED SEDIMENT WITH VACUUM TRUCKS WHEN IT REACHES 75% OF THE CAPACITY IN THE SUMP.

ROOF LEADER AND GUTTERS

UNSCHEDULED MAINTENANCE: MAINTAIN THE GUTTERS AND DOWNSPOUTS IN CLEAN CONDITION FREE OF DEBRIS SO THEY ARE ABLE TO QUICKLY DRAIN WATER FROM THE ROOF AND THE BUILDING.

PAVED AREAS

QUARTERLY MAINTENANCE: SWEEP, VACUUM, OR CLEAN PAVED AREAS TO REDUCE THE AMOUNT OF SEDIMENT ENTERING THE STORMWATER MANAGEMENT SYSTEM.

FLARED END SECTIONS WITH RIPRAP PLUNGE POOL:

GENERAL MAINTENANCE: DURING THE SPRING AND FALL AFTER LEAF DROP, REMOVE ANY ACCUMULATED LEAVES FROM THE FLARED END SECTION. REMOVE ANY ACCUMULATED SEDIMENT BY THE USE OF HAND TOOLS (RAKES, SHOVELS, WHEELBARROWS, ETC.). RESET ANY DISPLACED RIPRAP FROM THE FLARED END SECTION.

SUBSURFACE STORMTRAP RECHARGE SYSTEMS

THE SUBSURFACE STORMTRAP RECHARGE SYSTEMS SHALL BE MAINTAINED PER THE MANUFACTURER'S RECOMMENDATIONS (SEE FULL O&M REQUIREMENTS ATTACHED ON FOLLOWING PAGES).

BIORETENTION SYSTEM

UNSCHEDULED MAINTENANCE: RE-MULCH VOIDED AREAS AND TREAT DISEASED VEGETATION AS NEEDED. THE ENTIRETY OF THE MEDIA AND VEGETATION SHOULD BE REPLACED AS NEEDED

GENERAL MAINTENANCE: INSPECT SOIL, REPAIR ERODED AREAS, AND REMOVE LITTER AND DEBRIS MONTHLY.

ANNUAL MAINTENANCE: VEGETATION SHOULD BE TENDED TO ON AN ANNUAL BASIS. DEAD VEGETATION CAN BE REMOVED AND PRUNED IN THE FALL AND SPRING AND REPLACED IN THE SPRING. MULCH CAN BE REPLACED IN THE SPRING ON A BI-ANNUAL BASIS.

PRETX CURB INLET PRETREATMENT UNIT

THE PRETX CURB INLET PRETREATMENT UNIT SHALL BE MAINTAINED PER THE MANUFACTURER'S RECOMMENDATIONS (SEE FULL O&M REQUIREMENTS ATTACHED ON FOLLOWING PAGES).

INFILTRATION BASINS WITH OVERFLOW SPILLWAY

UNSCHEDULED MAINTENANCE: AFTER RAIN EVENTS IN EXCESS OF TWO INCHES, OR AFTER ANY SNOW OR RAIN EVENT ACCOMPANIED BY HIGH WINDS, INSPECT THE BASIN FOR DEBRIS. REMOVE ANY BRANCHES, TRASH, OR OTHER LARGE DEBRIS THAT COULD INTERFERE WITH THE PROPER OPERATION OF THE STORMWATER MANAGEMENT SYSTEM.

GENERAL MAINTENANCE: MAINTAIN THE GRASSED SIDE SLOPES OF THE BASIN THROUGH REGULAR MOWING. KEEP THE GRASS BETWEEN THREE TO SIX INCHES IN LENGTH. REMOVE GRASS CLIPPINGS TO PREVENT THEM FROM IMPEDING THE FLOW OF STORMWATER. DURING THE SPRING AND FALL, REMOVE ANY ACCUMULATED LEAVES FROM THE BASIN INCLUDING THE RIP RAP OVERFLOW SPILLWAY. RESET ANY DISPLACED RIP RAP.

QUARTERLY MAINTENANCE: INSPECT THE BASIN FOR DEBRIS. REMOVE ANY BRANCHES, TRASH OR OTHER LARGE DEBRIS THAT COULD INTERFERE WITH THE PROPER OPERATION OF THE STORMWATER MANAGEMENT SYSTEM. REMOVE ANY ACCUMULATED SEDIMENT BY THE USE OF HAND TOOLS (RAKES, SHOVELS, WHEELBARROWS, ETC.) WHEN IT EXCEEDS THREE INCHES.

ANNUAL MAINTENANCE: INSPECT THE BASIN FOR DEBRIS. REMOVE ANY BRANCHES, TRASH OR OTHER LARGE DEBRIS THAT COULD INTERFERE WITH THE PROPER OPERATION OF THE STORMWATER MANAGEMENT SYSTEM. REMOVE ANY ACCUMULATED SEDIMENT BY THE USE OF HAND TOOLS (RAKES, SHOVELS, WHEELBARROWS, ETC.) ANNUALLY. RESET ANY DISPLACED RIP RAP FROM THE OVERFLOW SPILLWAY.

CULTEC SUBSURFACE RECHARGE CHAMBERS

THE SUBSURFACE RECHARGE CHAMBERS SHALL BE MAINTAINED PER THE MANUFACTURER'S RECOMMENDATIONS (SEE FULL O&M REQUIREMENTS ATTACHED ON FOLLOWING PAGES).

MONTHLY MAINTENANCE (FIRST YEAR ONLY): CHECK INLETS AND OUTLETS FOR CLOGGING AND REMOVE ANY DEBRIS THAT COULD INTERFERE WITH THE PROPER OPERATION OF THE SYSTEM. CHECK FOR DEPRESSIONS IN AREAS OVER AND SURROUNDING THE RECHARGE SYSTEM.

SEMI-ANNUAL MAINTENANCE (SPRING AND FALL): CHECK INLETS AND OUTLETS FOR CLOGGING AND REMOVE ANY DEBRIS THAT COULD INTERFERE WITH THE PROPER OPERATION OF THE SYSTEM. CLEAN GUTTERS AND DOWNSPOUTS AND REMOVE ANY DEBRIS THAT COULD INTERFERE WITH THE PROPER OPERATION OF THE SYSTEM. CHECK FOR DEPRESSIONS IN AREAS OVER AND SURROUNDING THE RECHARGE SYSTEM.

ANNUAL MAINTENANCE: CONFIRM THAT NO UNAUTHORIZED MODIFICATIONS HAVE BEEN MADE TO THE SYSTEM.

1 YEAR AFTER COMMISSIONING AND EVERY 3RD/ YEAR FOLLOWING: CLEAN THE INLETS AND OUTLETS WITH VACUUM TRUCKS.

811 DigSafe MA·ME·NH·RI·VT

| No. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| 4 | 11/21/2022 | REVISION PER COMMENTS | JAW |
| 3 | 11/10/2022 | REVISION PER MASSDOT COMMENTS | JAW |
| 2 | 10/12/2022 | REVISION PER MASSDOT COMMENTS | JAW |
| 1 | 09/08/2022 | REVISION PER COMMENT FROM CITY OF FALL RIVER | JAW |

REVISIONS

PROJ. MANAGER: MBL
CHIEF DESIGNER: MBL
REVIEWED BY: DATE

SEAL

SEAL

PREPARED FOR
V.M.D. COMPANIES, LLC
733 TURNPIKE STREET, ROUTE 114
NORTH ANDOVER MASSACHUSETTS

SCALE:
HORZ.: 1"=150'
VERT.:
DATUM:
HORZ.: NAD83
VERT.: NAVD88
150 75 0 150
GRAPHIC SCALE

MBL
LAND DEVELOPMENT & PERMITTING, CORP.
LAND DEVELOPMENT, TRANSPORTATION AND ENVIRONMENTAL SOLUTIONS
5 BRISTOL DRIVE, SUITE 3A
SOUTH EASTON, MA 02375
P.508.297.2746
EMAIL:info@MBLLandDevelopment.com
WEB: www.MBLLandDevelopment.com

PROPOSED WAREHOUSE DEVELOPMENT
OPERATION & MAINTENANCE PLAN
0 INNOVATION WAY
FALL RIVER- MAP W-19 LOTS 185 & 189
FREETOWN - PARCEL ID 236-006.01
FALL RIVER/FREETOWN MASSACHUSETTS

PROJ. No.: 2021-036
DATE: JULY 25, 2022

O&M

UCS: MS VIEW: LMAN: CTB:

X:\2021\2021-036\CIVIL\Design\Drainage\2021-036 O&M Plan.dwg, 11/21/2022 10:55:33 AM, DWG To PDF.pc3

CONTECH®
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# Cascade Separator® Inspection and Maintenance Guide

CASCADE
separator®

## Maintenance

The Cascade Separator® system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects sediment and debris will depend upon on-site activities and site pollutant characteristics. For example, unstable soils or heavy winter sanding will cause the sediment storage sump to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

## Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall). However, more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment wash-down areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

A visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet chamber, flumes or outlet channel. The inspection should also quantify the accumulation of hydrocarbons, trash and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided in this Inspection and Maintenance Guide.

Access to the Cascade Separator unit is typically achieved through one manhole access cover. The opening allows for inspection and cleanout of the center chamber (cylinder) and sediment storage sump, as well as inspection of the inlet chamber and slanted skirt. For large units, multiple manhole covers allow access to the chambers and sump.

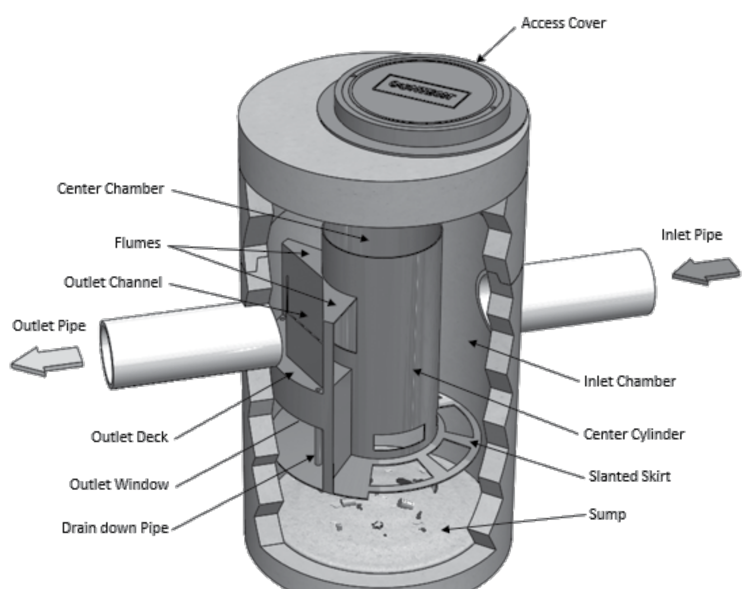
The Cascade Separator system should be cleaned before the level of sediment in the sump reaches the maximum sediment depth and/or when an appreciable level of hydrocarbons and trash has accumulated. If sorbent material is used, it must be replaced when significant discoloration has occurred. Performance may be impacted when maximum sediment storage capacity is exceeded. Contech recommends maintaining the system when sediment level reaches 50% of maximum storage volume. The level of sediment is easily determined by measuring the distance from the system outlet invert (standing water level) to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Finer, silty particles at the top of the pile typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the chart in this document to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage.

## Cleaning

Cleaning of a Cascade Separator system should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole cover and insert the vacuum tube down through the center chamber and into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The areas outside the center chamber and the slanted skirt should also be washed off if pollutant build-up exists in these areas.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. Then the system should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and to ensure proper safety precautions. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the Cascade Separator system must be done in accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal. If any components are damaged, replacement parts can be ordered from the manufacturer.



## Cascade Separator® Maintenance Indicators and Sediment Storage Capacities

| Model Number | Diameter | | Distance from Water Surface to Top of Sediment Pile | | Sediment Storage Capacity | |
|---|---|---|---|---|---|---|
| | ft | m | ft | m | $y^3$ | $m^3$ |
| CS-3 | 3 | 0.9 | 1.5 | 0.5 | 0.4 | 0.3 |
| CS-4 | 4 | 1.2 | 2.5 | 0.8 | 0.7 | 0.5 |
| CS-5 | 5 | 1.3 | 3 | 0.9 | 1.1 | 0.8 |
| CS-6 | 6 | 1.8 | 3.5 | 1 | 1.6 | 1.2 |
| CS-8 | 8 | 2.4 | 4.8 | 1.4 | 2.8 | 2.1 |
| CS-10 | 10 | 3.0 | 6.2 | 1.9 | 4.4 | 3.3 |
| CS-12 | 12 | 3.6 | 7.5 | 2.3 | 6.3 | 4.8 |

Note: The information in the chart is for standard units. Units may have been designed with non-standard sediment storage depth.

A Cascade Separator unit can be easily cleaned in less than 30 minutes.

A vacuum truck excavates pollutants from the systems.

# Cascade Separator® Inspection & Maintenance Log

| Cascade Model: | | | Location: | | |
|---|---|---|---|---|---|
| Date | Depth Below Invert to Top of Sediment[1] | Floatable Layer Thickness[2] | Describe Maintenance Performed | Maintenance Personnel | Comments |
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1. The depth to sediment is determined by taking a measurement from the manhole outlet invert (standing water level) to the top of the sediment pile. Once this measurement is recorded, it should be compared to the chart in the maintenance guide to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage. Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.
2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.





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# CDS® Inspection and Maintenance Guide


CDS TECHNOLOGIES

## Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

## Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

## Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

| CDS Model | Diameter | | Distance from Water Surface to Top of Sediment Pile | | Sediment Storage Capacity | |
|---|---|---|---|---|---|---|
| | ft | m | ft | m | y³ | m³ |
| CDS1515 | 3 | 0.9 | 3.0 | 0.9 | 0.5 | 0.4 |
| CDS2015 | 4 | 1.2 | 3.0 | 0.9 | 0.9 | 0.7 |
| CDS2015 | 5 | 1.3 | 3.0 | 0.9 | 1.3 | 1.0 |
| CDS2020 | 5 | 1.3 | 3.5 | 1.1 | 1.3 | 1.0 |
| CDS2025 | 5 | 1.3 | 4.0 | 1.2 | 1.3 | 1.0 |
| CDS3020 | 6 | 1.8 | 4.0 | 1.2 | 2.1 | 1.6 |
| CDS3025 | 6 | 1.8 | 4.0 | 1.2 | 2.1 | 1.6 |
| CDS3030 | 6 | 1.8 | 4.6 | 1.4 | 2.1 | 1.6 |
| CDS3035 | 6 | 1.8 | 5.0 | 1.5 | 2.1 | 1.6 |
| CDS4030 | 8 | 2.4 | 4.6 | 1.4 | 5.6 | 4.3 |
| CDS4040 | 8 | 2.4 | 5.7 | 1.7 | 5.6 | 4.3 |
| CDS4045 | 8 | 2.4 | 6.2 | 1.9 | 5.6 | 4.3 |
| CDS5640 | 10 | 3.0 | 6.3 | 1.9 | 8.7 | 6.7 |
| CDS5653 | 10 | 3.0 | 7.7 | 2.3 | 8.7 | 6.7 |
| CDS5668 | 10 | 3.0 | 9.3 | 2.8 | 8.7 | 6.7 |
| CDS5678 | 10 | 3.0 | 10.3 | 3.1 | 8.7 | 6.7 |

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

**Support**

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.



Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treament products. For information, visit www.ContechES.com or call 800.338.1122

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The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; 7,517,450 related foreign patents or other patents pending.

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# CDS Inspection & Maintenance Log

CDS Model: ______________________ Location: ______________________

| Date | Water depth to sediment[1] | Floatable Layer Thickness[2] | Describe Maintenance Performed | Maintenance Personnel | Comments |
|---|---|---|---|---|---|
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1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

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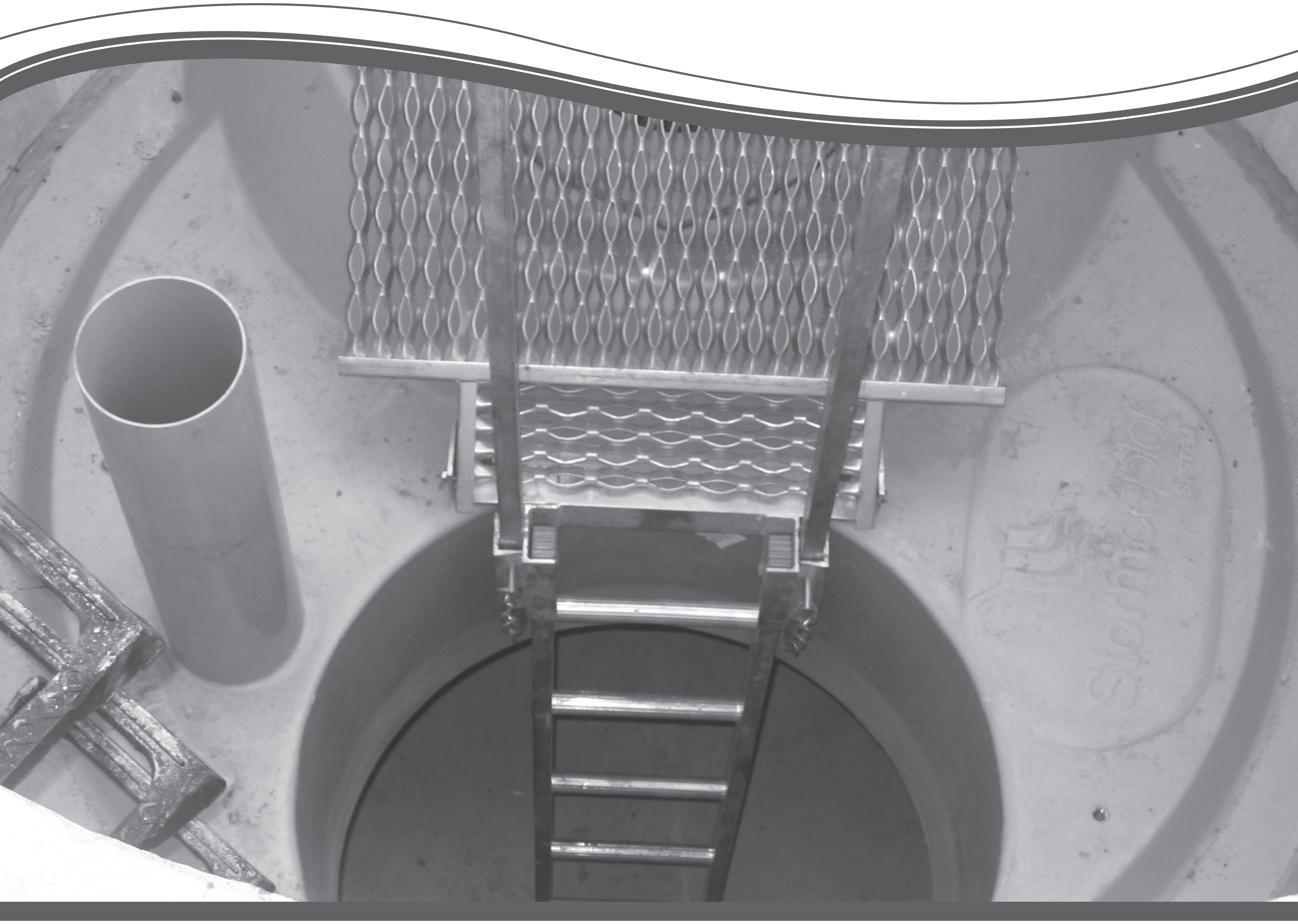
# Stormceptor® STC
# Operation and Maintenance Guide



Stormceptor® STC

## Stormceptor Design Notes

- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.

### Inlet and outlet invert elevation differences are as follows:

| Inlet and Outlet Pipe Invert Elevations Differences | | | |
|---|---|---|---|
| Inlet Pipe Configuration | STC 450i | STC 900 to STC 7200 | STC 11000 to STC 16000 |
| Single inlet pipe | 3 in. (75 mm) | 1 in. (25 mm) | 3 in. (75 mm) |
| Multiple inlet pipes | 3 in. (75 mm) | 3 in. (75 mm) | Only one inlet pipe. |

### Maximum inlet and outlet pipe diameters:

| Inlet/Outlet Configuration | Inlet Unit STC 450i | In-Line Unit STC 900 to STC 7200 | Series* STC 11000 to STC 16000 |
|---|---|---|---|
| Straight Through | 24 inch (600 mm) | 42 inch (1050 mm) | 60 inch (1500 mm) |
| Bend (90 degrees) | 18 inch (450 mm) | 33 inch (825 mm) | 33 inch (825 mm) |

- The inlet and in-line Stormceptor units can accommodate turns to a maximum of 90 degrees.
- Minimum distance from top of grade to crown is 2 feet (0.6 m)
- Submerged conditions. A unit is submerged when the standing water elevation at the proposed location of the Stormceptor unit is greater than the outlet invert elevation during zero flow conditions. In these cases, please contact your local Stormceptor representative and provide the following information:
- Top of grade elevation
- Stormceptor inlet and outlet pipe diameters and invert elevations
- Standing water elevation
- Stormceptor head loss, K = 1.3 (for submerged condition, K = 4)

Stormceptor® STC

# OPERATION AND MAINTENANCE GUIDE
## Table of Content

# 1. About Stormceptor

The Stormceptor® STC (Standard Treatment Cell) was developed by Imbrium™ Systems to address the growing need to remove and isolate pollution from the storm drain system before it enters the environment. The Stormceptor STC targets hydrocarbons and total suspended solids (TSS) in stormwater runoff. It improves water quality by removing contaminants through the gravitational settling of fine sediments and floatation of hydrocarbons while preventing the re-suspension or scour of previously captured pollutants.

The development of the Stormceptor STC revolutionized stormwater treatment, and created an entirely new category of environmental technology. Protecting thousands of waterways around the world, the Stormceptor System has set the standard for effective stormwater treatment.

## 1.1. Patent Information

The Stormceptor technology is protected by the following patents:

- Australia Patent No. 693,164 • 693,164 • 707,133 • 729,096 • 779401
- Austrian Patent No. 289647
- Canadian Patent No 2,009,208 •2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending)
- China Patent No 1168439
- Denmark DK 711879
- German DE 69534021
- Indonesian Patent No 16688
- Japan Patent No 9-11476 (Pending)
- Korea 10-2000-0026101 (Pending)
- Malaysia Patent No PI9701737 (Pending)
- New Zealand Patent No 314646
- United States Patent No 4,985,148 • 5,498,331 • 5,725,760 • 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690
- Stormceptor OSR Patent Pending • Stormceptor LCS Patent Pending

# 2. Stormceptor Design Overview

## 2.1. Design Philosophy

The patented Stormceptor System has been designed to focus on the environmental objective of providing long-term pollution control. The unique and innovative Stormceptor design allows for continuous positive treatment of runoff during all rainfall events, while ensuring that all captured pollutants are retained within the system, even during intense storm events.

An integral part of the Stormceptor design is PCSWMM for Stormceptor - sizing software developed in conjunction with Computational Hydraulics Inc. (CHI) and internationally acclaimed expert, Dr. Bill James. Using local historical rainfall data and continuous simulation modeling, this software allows a Stormceptor unit to be designed for each individual site and the corresponding water quality objectives.

By using PCSWMM for Stormceptor, the Stormceptor System can be designed to remove a wide range of particles (typically from 20 to 2,000 microns), and can also be customized to remove a specific particle size distribution (PSD). The specified PSD should accurately reflect what is in the stormwater runoff to ensure the device is achieving the desired water quality objective. Since stormwater runoff contains small particles (less than 75 microns), it is important to design a treatment system to remove smaller particles in addition to coarse particles.

## 2.2. Benefits

The Stormceptor System removes free oil and suspended solids from stormwater, preventing spills and non-point source pollution from entering downstream lakes and rivers. The key benefits, capabilities and applications of the Stormceptor System are as follows:

- Provides continuous positive treatment during all rainfall events
- Can be designed to remove over 80% of the annual sediment load
- Removes a wide range of particles
- Can be designed to remove a specific particle size distribution (PSD)
- Captures free oil from stormwater
- Prevents scouring or re-suspension of trapped pollutants
- Pre-treatment to reduce maintenance costs for downstream treatment measures (ponds, swales, detention basins, filters)
- Groundwater recharge protection
- Spills capture and mitigation
- Simple to design and specify
- Designed to your local watershed conditions
- Small footprint to allow for easy retrofit installations
- Easy to maintain (vacuum truck)
- Multiple inlets can connect to a single unit
- Suitable as a bend structure
- Pre-engineered for traffic loading (minimum AASHTO HS-20)
- Minimal elevation drop between inlet and outlet pipes
- Small head loss
- Additional protection provided by an 18” (457 mm) fiberglass skirt below the top of the insert, for the containment of hydrocarbons in the event of a spill.

## 2.3. Environmental Benefit

Freshwater resources are vital to the health and welfare of their surrounding communities. There is increasing public awareness, government regulations and corporate commitment to reducing the pollution entering our waterways. A major source of this pollution originates from stormwater runoff from urban areas. Rainfall runoff carries oils, sediment and other contaminants from roads and parking lots discharging directly into our streams, lakes and coastal waterways.

The Stormceptor System is designed to isolate contaminants from getting into the natural environment. The Stormceptor technology provides protection for the environment from spills that occur at service stations and vehicle accident sites, while also removing contaminated sediment in runoff that washes from roads and parking lots.

# 3. Key Operation Features

## 3.1. Scour Prevention

A key feature of the Stormceptor System is its patented scour prevention technology. This innovation ensures pollutants are captured and retained during all rainfall events, even extreme storms. The Stormceptor System provides continuous positive treatment for all rainfall events, including intense storms. Stormceptor slows incoming runoff, controlling and reducing velocities in the lower chamber to create a non-turbulent environment that promotes free oils and floatable debris to rise and sediment to settle.

The patented scour prevention technology, the fiberglass insert, regulates flows into the lower chamber through a combination of a weir and orifice while diverting high energy flows away through the upper chamber to prevent scouring. Laboratory testing demonstrated no scouring when tested up to 125% of the unit's operating rate, with the unit loaded to 100% sediment capacity (NJDEP, 2005). Second, the depth of the lower chamber ensures the sediment storage zone is adequately separated from the path of flow in the lower chamber to prevent scouring.

## 3.2. Operational Hydraulic Loading Rate

Designers and regulators need to evaluate the treatment capacity and performance of manufactured stormwater treatment systems. A commonly used parameter is the "operational hydraulic loading rate" which originated as a design methodology for wastewater treatment devices.

Operational hydraulic loading rate may be calculated by dividing the flow rate into a device by its settling area. This represents the critical settling velocity that is the prime determinant to quantify the influent particle size and density captured by the device. PCSWMM for Stormceptor uses a similar parameter that is calculated by dividing the hydraulic detention time in the device by the fall distance of the sediment.

$$v_{SC} = \frac{H}{6_H} = \frac{Q}{A_S}$$

Where:

$v_{SC}$ = critical settling velocity, ft/s (m/s)

H = tank depth, ft (m)

$Ø_H$ = hydraulic detention time, ft/s (m/s)

Q = volumetric flow rate, ft3/s (m3/s)

$A_S$ = surface area, $ft^2$ ($m^2$)

(Tchobanoglous, G. and Schroeder, E.D. 1987. Water Quality. Addison Wesley.)

Unlike designing typical wastewater devices, stormwater systems are designed for highly variable flow rates including intense peak flows. PCSWMM for Stormceptor incorporates all of the flows into its calculations, ensuring that the operational hydraulic loading rate is considered not only for one flow rate, but for all flows including extreme events.

## 3.3. Double Wall Containment

The Stormceptor System was conceived as a pollution identifier to assist with identifying illicit discharges. The fiberglass insert has a continuous skirt that lines the concrete barrel wall for a depth of 18 inches (457 mm) that provides double wall containment for hydrocarbons storage. This protective barrier ensures that toxic floatables do not migrate through the concrete wall into the surrounding soils.

# 4. Stormceptor Product Line

## 4.1. Stormceptor Models

A summary of Stormceptor models and capacities are listed in Table 1.

**Table 1. Stormceptor Models**

| Stormceptor Model | Total Storage Volume U.S. Gal (L) | Hydrocarbon Storage Capacity U.S. Gal (L) | Maximum Sediment Capacity ft³ (L) |
|---|---|---|---|
| STC 450i | 470 (1,780) | 86 (330) | 46 (1,302) |
| STC 900 | 952 (3,600) | 251 (950) | 89 (2,520) |
| STC 1200 | 1,234 (4,670) | 251 (950) | 127 (3,596) |
| STC 1800 | 1,833 (6,940) | 251 (950) | 207 (5,861) |
| STC 2400 | 2,462 (9,320) | 840 (3,180) | 205 (5,805) |
| STC 3600 | 3,715 (1,406) | 840 (3,180) | 373 (10,562) |
| STC 4800 | 5,059 (1,950) | 909 (3,440) | 543 (15,376) |
| STC 6000 | 6,136 (23,230) | 909 (3,440) | 687 (19,453) |
| STC 7200 | 7,420 (28,090) | 1,059 (4,010) | 839 (23,757) |
| STC 11000 | 11,194 (42,370) | 2,797 (10, 590) | 1,086 (30,752) |
| STC 13000 | 13,348 (50,530) | 2,797 (10, 590) | 1,374 (38,907) |
| STC 16000 | 15,918 (60,260) | 3,055 (11, 560) | 1,677 (47,487) |

NOTE: Storage volumes may vary slightly from region to region. For detailed information, contact your local Stormceptor representative.

## 4.2. Inline Stormceptor

The Inline Stormceptor, Figure 1, is the standard design for most stormwater treatment applications. The patented Stormceptor design allows the Inline unit to maintain continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate. The Inline Stormceptor is composed of a precast concrete tank with a fiberglass insert situated at the invert of the storm sewer pipe, creating an upper chamber above the insert and a lower chamber below the insert.

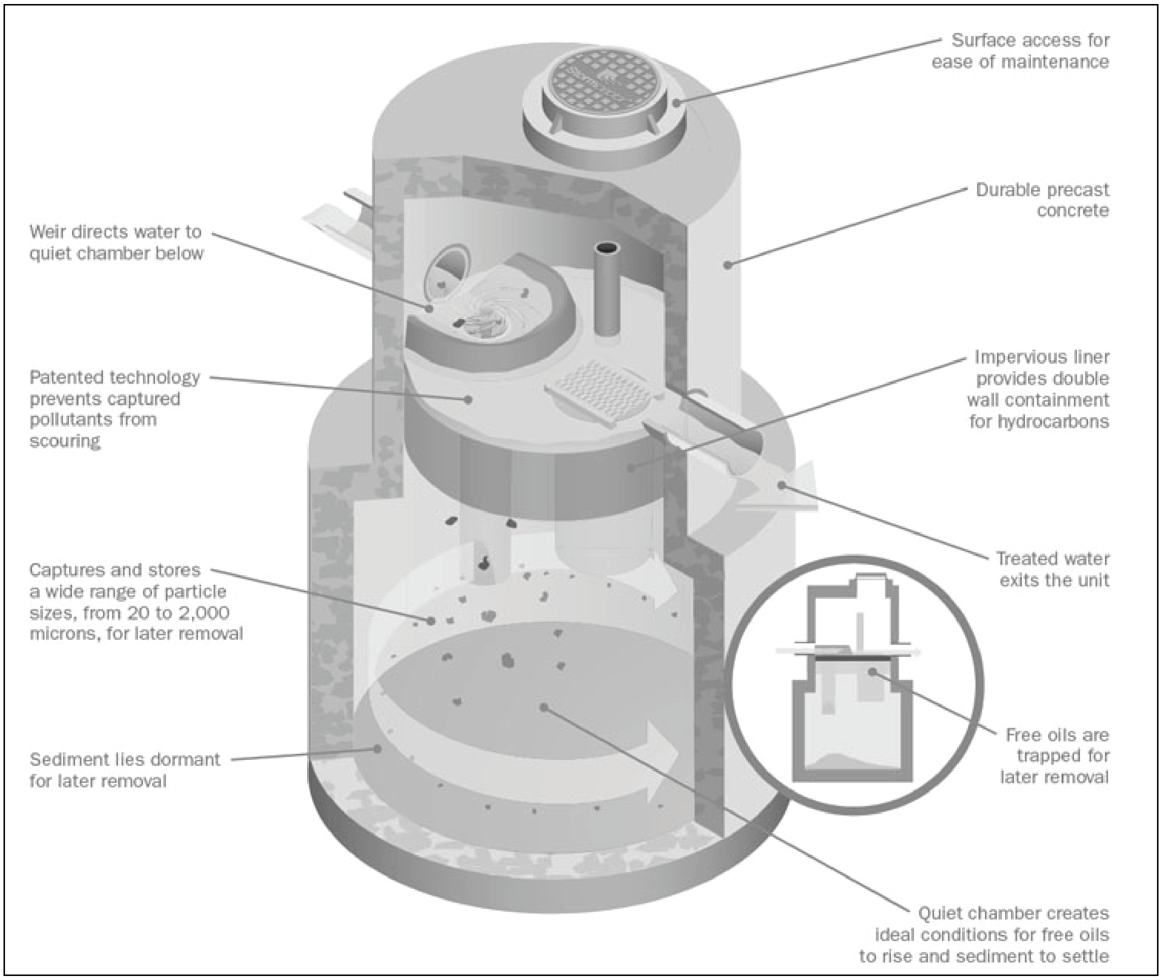



**Figure 1. Inline Stormceptor**

## Operation

As water flows into the Stormceptor unit, it is slowed and directed to the lower chamber by a weir and drop tee. The stormwater enters the lower chamber, a non-turbulent environment, allowing free oils to rise and sediment to settle. The oil is captured underneath the fiberglass insert and shielded from exposure to the concrete walls by a fiberglass skirt. After the pollutants separate, treated water continues up a riser pipe, and exits the lower chamber on the downstream side of the weir before leaving the unit. During high flow events, the Stormceptor System's patented scour prevention technology ensures continuous pollutant removal and prevents re-suspension of previously captured pollutants.

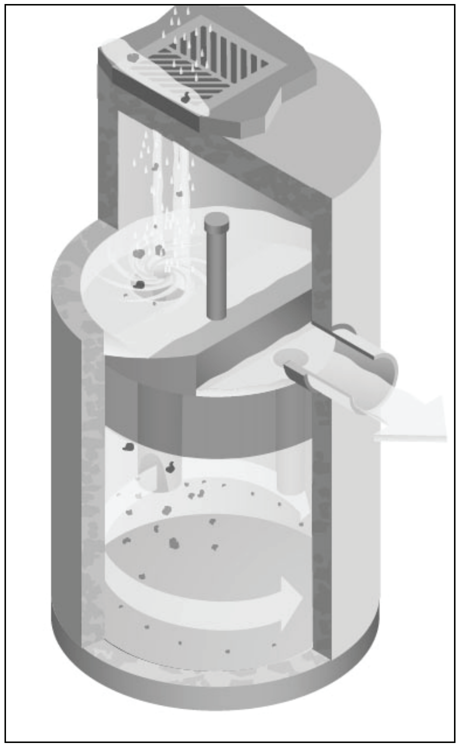


**Figure 2. Inlet Stormceptor**

### 4.3. Inlet Stormceptor

The Inlet Stormceptor System, Figure 2, was designed to provide protection for parking lots, loading bays, gas stations and other spill-prone areas. The Inlet Stormceptor is designed to remove sediment from stormwater introduced through a grated inlet, a storm sewer pipe, or both.

The Inlet Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

### 4.4. Series Stormceptor

Designed to treat larger drainage areas, the Series Stormceptor System, Figure 3, consists of two adjacent Stormceptor models that function in parallel. This design eliminates the need for additional structures and piping to reduce installation costs.

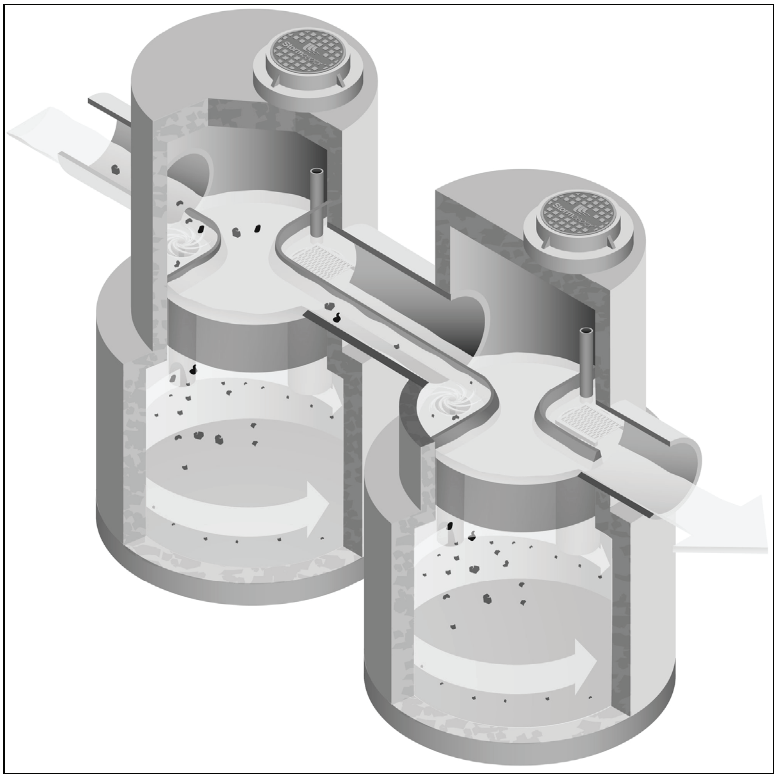


**Figure 3. Series System**

The Series Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

## 5. Sizing the Stormceptor System

The Stormceptor System is a versatile product that can be used for many different aspects of water quality improvement. While addressing these needs, there are conditions that the designer needs to be aware of in order to size the Stormceptor model to meet the demands of each individual site in an efficient and cost-effective manner.

PCSWMM for Stormceptor is the support tool used for identifying the appropriate Stormceptor model. In order to size a unit, it is recommended the user follow the seven design steps in the program. The steps are as follows:

### STEP 1 – Project Details

The first step prior to sizing the Stormceptor System is to clearly identify the water quality objective for the development. It is recommended that a level of annual sediment (TSS) removal be identified and defined by a particle size distribution.

### STEP 2 – Site Details

Identify the site development by the drainage area and the level of imperviousness. It is recommended that imperviousness be calculated based on the actual area of imperviousness based on paved surfaces, sidewalks and rooftops.

### STEP 3 – Upstream Attenuation

The Stormceptor System is designed as a water quality device and is sometimes used in conjunction with onsite water quantity control devices such as ponds or underground detention systems. When possible, a greater benefit is typically achieved when installing a Stormceptor unit upstream of a detention facility. By placing the Stormceptor unit upstream of a detention structure, a benefit of less maintenance of the detention facility is realized.

## STEP 4 – Particle Size Distribution

It is critical that the PSD be defined as part of the water quality objective. PSD is critical for the design of treatment system for a unit process of gravity settling and governs the size of a treatment system. A range of particle sizes has been provided and it is recommended that clays and silt-sized particles be considered in addition to sand and gravel-sized particles. Options and sample PSDs are provided in PCSWMM for Stormceptor. The default particle size distribution is the Fine Distribution, Table 2, option.

**Table 2. Fine Distribution**

| Particle Size | Distribution | Specific Gravity |
|---|---|---|
| 20 | 20% | 1.3 |
| 60 | 20% | 1.8 |
| 150 | 20% | 2.2 |
| 400 | 20% | 2.65 |
| 2000 | 20% | 2.65 |

If the objective is the long-term removal of 80% of the total suspended solids on a given site, the PSD should be representative of the expected sediment on the site. For example, a system designed to remove 80% of coarse particles (greater than 75 microns) would provide relatively poor removal efficiency of finer particles that may be naturally prevalent in runoff from the site.

Since the small particle fraction contributes a disproportionately large amount of the total available particle surface area for pollutant adsorption, a system designed primarily for coarse particle capture will compromise water quality objectives.

## STEP 5 – Rainfall Records

Local historical rainfall has been acquired from the U.S. National Oceanic and Atmospheric Administration, Environment Canada and regulatory agencies across North America. The rainfall data provided with PCSMM for Stormceptor provides an accurate estimation of small storm hydrology by modeling actual historical storm events including duration, intensities and peaks.

## STEP 6 – Summary

At this point, the program may be executed to predict the level of TSS removal from the site. Once the simulation has completed, a table shall be generated identifying the TSS removal of each Stormceptor unit.

## STEP 7 – Sizing Summary

Performance estimates of all Stormceptor units for the given site parameters will be displayed in a tabular format. The unit that meets the water quality objective, identified in Step 1, will be highlighted.

## 5.1. PCSWMM for Stormceptor

The Stormceptor System has been developed in conjunction with PCSWMM for Stormceptor as a technological solution to achieve water quality goals. Together, these two innovations model, simulate, predict and calculate the water quality objectives desired by a design engineer for TSS removal.

PCSWMM for Stormceptor is a proprietary sizing program which uses site specific inputs to a computer model to simulate sediment accumulation, hydrology and long-term total suspended solids removal. The model has been calibrated to field monitoring results from Stormceptor units that have been monitored in North America. The sizing methodology can be described by three processes:

1. Determination of real time hydrology
2. Buildup and wash off of TSS from impervious land areas
3. TSS transport through the Stormceptor (settling and discharge). The use of a calibrated model is the preferred method for sizing stormwater quality structures for the following reasons:
   - The hydrology of the local area is properly and accurately incorporated in the sizing (distribution of flows, flow rate ranges and peaks, back-to-back storms, inter-event times)
   - The distribution of TSS with the hydrology is properly and accurately considered in the sizing
   - Particle size distribution is properly considered in the sizing
   - The sizing can be optimized for TSS removal
   - The cost benefit of alternate TSS removal criteria can be easily assessed
   - The program assesses the performance of all Stormceptor models. Sizing may be selected based on a specific water quality outcome or based on the Maximum Extent Practicable

For more information regarding PCSWMM for Stormceptor, contact your local Stormceptor representative, or visit www.imbriumsystems.com to download a free copy of the program.

## 5.2. Sediment Loading Characteristics

The way in which sediment is transferred to stormwater can have a considerable effect on which type of system is implemented. On typical impervious surfaces (e.g. parking lots) sediment will build over time and wash off with the next rainfall. When rainfall patterns are examined, a short intense storm will have a higher concentration of sediment than a long slow drizzle. Together with rainfall data representing the site's typical rainfall patterns, sediment loading characteristics play a part in the correct sizing of a stormwater quality device.

Typical Sites

For standard site design of the Stormceptor System, PCSWMM for Stormceptor is utilized to accurately assess the unit's performance. As an integral part of the product's design, the program can be used to meet local requirements for total suspended solid removal. Typical installations of manufactured stormwater treatment devices would occur on areas such as paved parking lots or paved roads. These are considered "stable" surfaces which have non – erodible surfaces.

Unstable Sites

While standard sites consist of stable concrete or asphalt surfaces, sites such as gravel parking lots, or maintenance yards with stockpiles of sediment would be classified as "unstable". These types of sites do not exhibit first flush characteristics, are highly erodible and exhibit atypical sediment loading characteristics and must therefore be sized more carefully. Contact your local Stormceptor representative for assistance in selecting a proper unit sized for such unstable sites.

# 6. Spill Controls

When considering the removal of total petroleum hydrocarbons (TPH) from a storm sewer system there are two functions of the system: oil removal, and spill capture.

'Oil Removal' describes the capture of the minute volumes of free oil mobilized from impervious surfaces. In this instance relatively low concentrations, volumes and flow rates are considered. While the Stormceptor unit will still provide an appreciable oil removal function during higher flow events and/or with higher TPH concentrations, desired effluent limits may be exceeded under these conditions.

‘Spill Capture’ describes a manner of TPH removal more appropriate to recovery of a relatively high volume of a single phase deleterious liquid that is introduced to the storm sewer system over a relatively short duration. The two design criteria involved when considering this manner of introduction are overall volume and the specific gravity of the material. A standard Stormceptor unit will be able to capture and retain a maximum spill volume and a minimum specific gravity.

For spill characteristics that fall outside these limits, unit modifications are required. Contact your local Stormceptor Representative for more information.

One of the key features of the Stormceptor technology is its ability to capture and retain spills. While the standard Stormceptor System provides excellent protection for spill control, there are additional options to enhance spill protection if desired.

## 6.1. Oil Level Alarm

The oil level alarm is an electronic monitoring system designed to trigger a visual and audible alarm when a pre-set level of oil is reached within the lower chamber. As a standard, the oil

level alarm is designed to trigger at approximately 85% of the unit’s available depth level for oil capture. The feature acts as a safeguard against spills caused by exceeding the oil storage capacity of the separator and eliminates the need for manual oil level inspection.

The oil level alarm installed on the Stormceptor insert is illustrated in Figure 4.

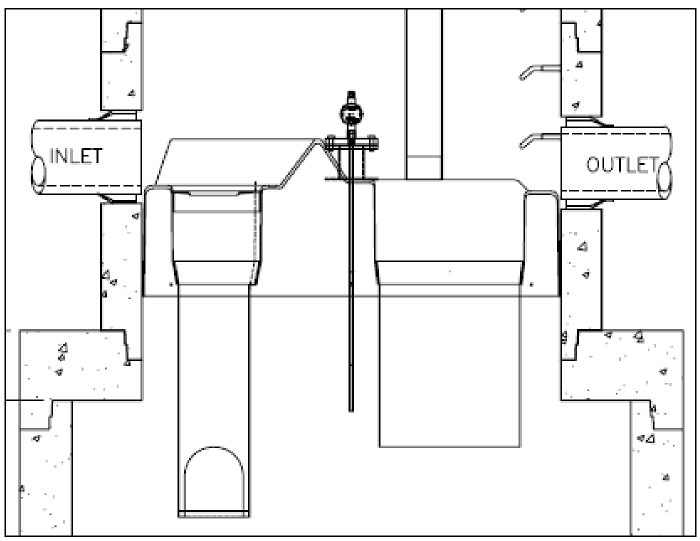



**Figure 4. Oil level alarm**

## 6.2. Increased Volume Storage Capacity

The Stormceptor unit may be modified to store a greater spill volume than is typically available. Under such a scenario, instead of installing a larger than required unit, modifications can be made to the recommended Stormceptor model to accommodate larger volumes. Contact your local Stormceptor representative for additional information and assistance for modifications.

# 7. Stormceptor Options

The Stormceptor System allows flexibility to incorporate to existing and new storm drainage infrastructure. The following section identifies considerations that should be reviewed when installing the system into a drainage network. For conditions that fall outside of the recommendations in this section, please contact your local Stormceptor representative for further guidance.

## 7.1. Installation Depth Minimum Cover

The minimum distance from the top of grade to the crown of the inlet pipe is 24 inches (600 mm). For situations that have a lower minimum distance, contact your local Stormceptor representative.

## 7.2. Maximum Inlet and Outlet Pipe Diameters

Maximum inlet and outlet pipe diameters are illustrated in Figure 5. Contact your local Stormceptor representative for larger pipe diameters

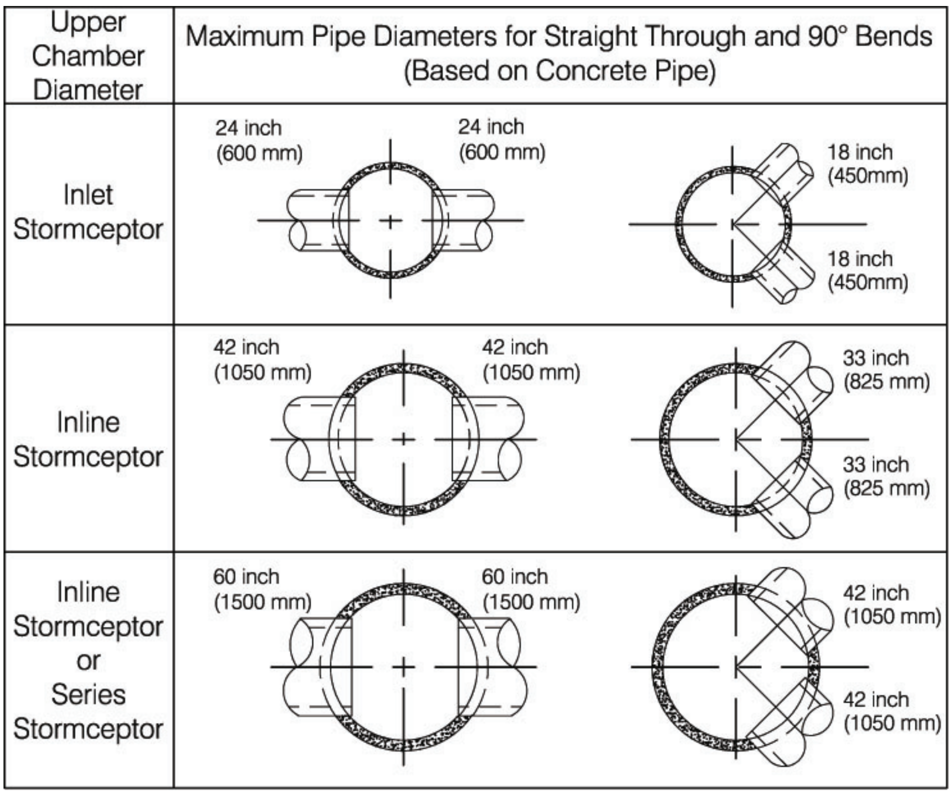



**Figure 5. Maximum pipe diameters for straight through and bend applications**

*The bend should only be incorporated into the second structure (downstream structure) of the Series Stormceptor System

## 7.3. Bends

The Stormceptor System can be used to change horizontal alignment in the storm drain network up to a maximum of 90 degrees. Figure 6 illustrates the typical bend situations of the Stormceptor System. Bends should only be applied to the second structure (downstream structure) of the Series Stormceptor System.

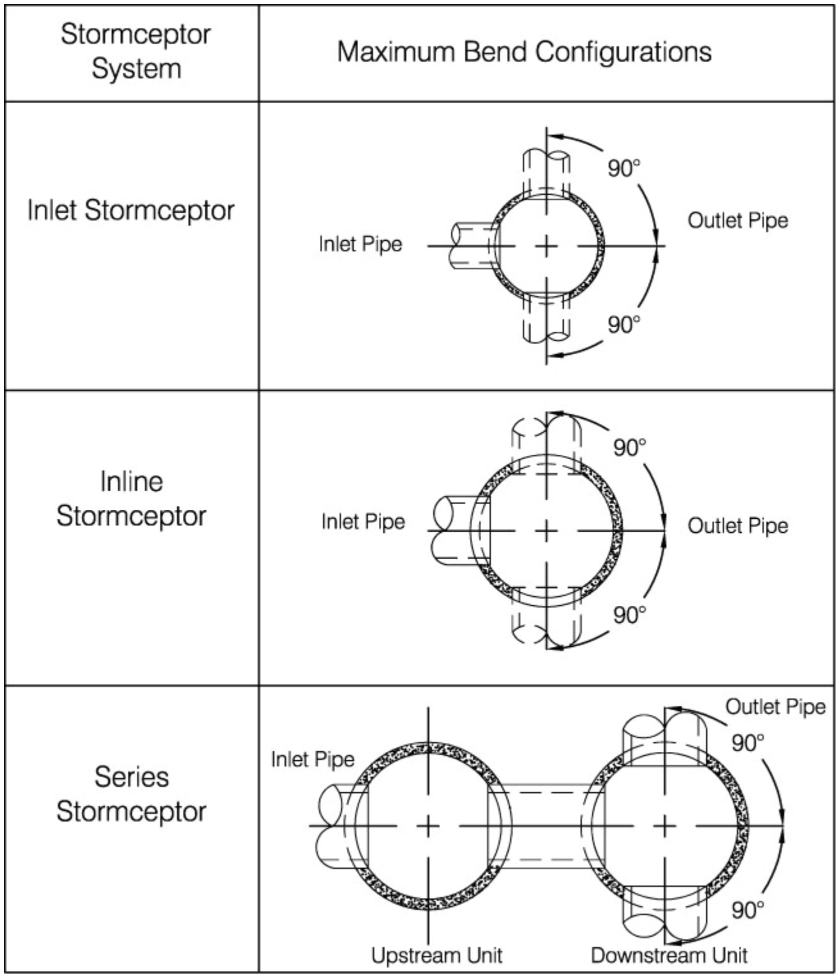



**Figure 6. Maximum bend angles**

## 7.4. Multiple Inlet Pipes

The Inlet and Inline Stormceptor System can accommodate two or more inlet pipes. The maximum number of inlet pipes that can be accommodated into a Stormceptor unit is a function of the number, alignment and diameter of the pipes and its effects on the structural integrity of the precast concrete. When multiple inlet pipes are used for new developments, each inlet pipe shall have an invert elevation 3 inches (75 mm) higher than the outlet pipe invert elevation.

## 7.5. Inlet/Outlet Pipe Invert Elevations

Recommended inlet and outlet pipe invert differences are listed in Table 3.

**Table 3. Recommended Drops Between Inlet and Outlet Pipe Inverts**

| Number of Inlet Pipes | Inlet System | In-Line System | Series System |
|---|---|---|---|
| 1 | 3 inches (75 mm) | 1 inch (25 mm) | 3 inches (75 mm) |
| >1 | 3 inches (75 mm) | 3 inches (75 mm) | Not Applicable |

## 7.6. Shallow Stormceptor

In cases where there may be restrictions to the depth of burial of storm sewer systems. In this situation, for selected Stormceptor models, the lower chamber components may be increased in diameter to reduce the overall depth of excavation required.

## 7.7. Customized Live Load

The Stormceptor system is typically designed for local highway truck loading (AASHTO HS- 20). When the project requires live loads greater than HS-20, the Stormceptor System may be customized structurally for a pre-specified live load. Contact your local Stormceptor representative for customized loading conditions.

## 7.8. Pre-treatment

The Stormceptor System may be sized to remove sediment and for spills control in conjunction with other stormwater BMPs to meet the water quality objective. For pretreatment applications, the Stormceptor System should be the first unit in a treatment train. The benefits of pre-treatment include the extension of the operational life (extension of maintenance frequency) of large stormwater management facilities, prevention of spills and lower total life- cycle maintenance cost.

## 7.9. Head loss

The head loss through the Stormceptor System is similar to a 60 degree bend at a manhole. The K value for calculating minor losses is approximately 1.3 (minor loss = k*1.3v2/2g).

However, when a Submerged modification is applied to a Stormceptor unit, the corresponding K value is 4.

## 7.10. Submerged

The Submerged modification, Figure 7, allows the Stormceptor System to operate in submerged or partially submerged storm sewers. This configuration can be installed on all models of the Stormceptor System by modifying the fiberglass insert. A customized weir height and a secondary drop tee are added.

Submerged instances are defined as standing water in the storm drain system during zero flow conditions. In these instances, the following information is necessary for the proper design and application of submerged modifications:

- Stormceptor top of grade elevation
- Stormceptor outlet pipe invert elevation
- Standing water elevation

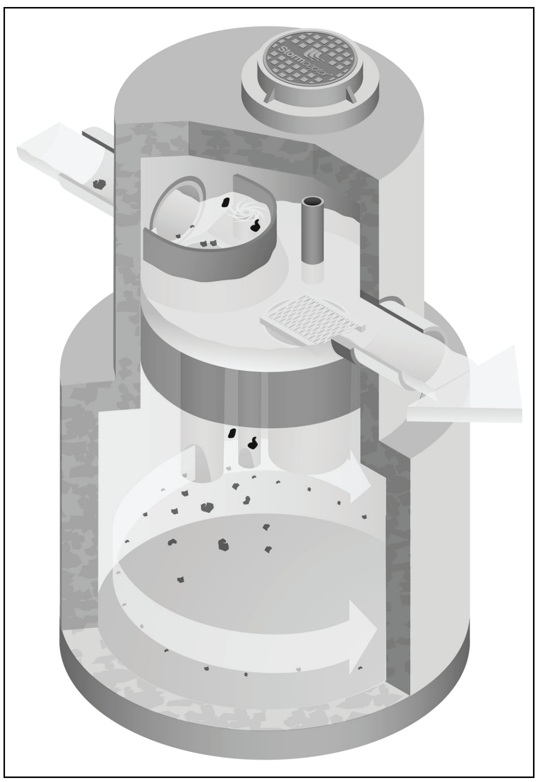


**Figure 7. Submerged Stormceptor**

# 8. Comparing Technologies

Designers have many choices available to achieve water quality goals in the treatment of stormwater runoff. Since many alternatives are available for use in stormwater quality treatment it is important to consider how to make an appropriate comparison between “approved alternatives”. The following is a guide to assist with the accurate comparison of differing technologies and performance claims.

## 8.1. Particle Size Distribution (PSD)

The most sensitive parameter to the design of a stormwater quality device is the selection of the design particle size. While it is recommended that the actual particle size distribution (PSD) for sites be measured prior to sizing, alternative values for particle size should be selected to represent what is likely to occur naturally on the site. A reasonable estimate of a particle size distribution likely to be found on parking lots or other impervious surfaces should consist of a wide range of particles such as 20 microns to 2,000 microns (Ontario MOE, 1994).

There is no absolute right particle size distribution or specific gravity and the user is cautioned to review the site location, characteristics, material handling practices and regulatory requirements when selecting a particle size distribution. When comparing technologies, designs using different PSDs will result in incomparable TSS removal efficiencies. The PSD of the TSS removed needs to be standard between two products to allow for an accurate comparison.

## 8.2. Scour Prevention

In order to accurately predict the performance of a manufactured treatment device, there must be confidence that it will perform under all conditions. Since rainfall patterns cannot be predicted, stormwater quality devices placed in storm sewer systems must be able to withstand extreme events, and ensure that all pollutants previously captured are retained in the system.

In order to have confidence in a system‘s performance under extreme conditions, independent validation of scour prevention is essential when examining different technologies. Lack of independent verification of scour prevention should make a designer wary of accepting any product’s performance claims.

## 8.3. Hydraulics

Full scale laboratory testing has been used to confirm the hydraulics of the Stormceptor System. Results of lab testing have been used to physically design the Stormceptor System and the sewer pipes entering and leaving the unit. Key benefits of Stormceptor are:

- Low head loss (typical k value of 1.3)
- Minimal inlet/outlet invert elevation drop across the structure
- Use as a bend structure
- Accommodates multiple inlets

The adaptability of the treatment device to the storm sewer design infrastructure can affect the overall performance and cost of the site.

## 8.4. Hydrology

Stormwater quality treatment technologies need to perform under varying climatic conditions. These can vary from long low intensity rainfall to short duration, high intensity storms. Since a treatment device is expected to perform under all these conditions, it makes sense that any system’s design should accommodate those conditions as well.

Long-term continuous simulation evaluates the performance of a technology under the varying conditions expected in the climate of the subject site. Single, peak event design does not provide this information and is not equivalent to long-term simulation. Designers should request long-term simulation performance to ensure the technology can meet the long-term water quality objective.

# 9. Testing

The Stormceptor System has been the most widely monitored stormwater treatment technology in the world. Performance verification and monitoring programs are completed to the strictest standards and integrity. Since its introduction in 1990, numerous independent field tests and studies detailing the effectiveness of the Stormceptor System have been completed.

- Coventry University, UK – 97% removal of oil, 83% removal of sand and 73% removal of peat
- National Water Research Institute, Canada, - scaled testing for the development of the Stormceptor System identifying both TSS removal and scour prevention.
- New Jersey TARP Program – full scale testing of an STC 900 demonstrating 75% TSS removal of particles from 1 to 1000 microns. Scour testing completed demonstrated that the system does not scour. The New Jersey Department of Environmental Protection was followed.
- City of Indianapolis – full scale testing of an STC 900 demonstrating over 80% TSS removal of particles from 50 microns to 300 microns at 130% of the unit's operating rate. Scour testing completed demonstrated that the system does not scour.
- Westwood Massachusetts (1997), demonstrated >80% TSS removal
- Como Park (1997), demonstrated 76% TSS removal
- Ontario MOE SWAMP Program – 57% removal of 1 to 25 micron particles
- Laval Quebec – 50% removal of 1 to 25 micron particles

# 10. Installation

The installation of the concrete Stormceptor should conform in general to state highway, or local specifications for the installation of manholes. Selected sections of a general specification that are applicable are summarized in the following sections.

## 10.1. Excavation

Excavation for the installation of the Stormceptor should conform to state highway, or local specifications. Topsoil removed during the excavation for the Stormceptor should be stockpiled in designated areas and should not be mixed with subsoil or other materials.

Topsoil stockpiles and the general site preparation for the installation of the Stormceptor should conform to state highway or local specifications.

The Stormceptor should not be installed on frozen ground. Excavation should extend a minimum of 12 inches (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

In areas with a high water table, continuous dewatering may be required to ensure that the excavation is stable and free of water.

## 10.2. Backfilling

Backfill material should conform to state highway or local specifications. Backfill material should be placed in uniform layers not exceeding 12 inches (300mm) in depth and compacted to state highway or local specifications.

# 11. Stormceptor Construction Sequence

The concrete Stormceptor is installed in sections in the following sequence:

1. Aggregate base
2. Base slab
3. Lower chamber sections
4. Upper chamber section with fiberglass insert
5. Connect inlet and outlet pipes
6. Assembly of fiberglass insert components (drop tee, riser pipe, oil cleanout port and orifice plate
7. Remainder of upper chamber
8. Frame and access cover

The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

Adjustment of the Stormceptor can be performed by lifting the upper sections free of the excavated area, re-leveling the base and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the Stormceptor has been constructed, any lift holes must be plugged with mortar.

# 12. Maintenance

## 12.1. Health and Safety

The Stormceptor System has been designed considering safety first. It is recommended that confined space entry protocols be followed if entry to the unit is required. In addition, the fiberglass insert has the following health and safety features:

- Designed to withstand the weight of personnel
- A safety grate is located over the 24 inch (600 mm) riser pipe opening
- Ladder rungs can be provided for entry into the unit, if required

## 12.2. Maintenance Procedures

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The vacuum service industry is a well- established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances.

The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the guideline values provided in the Table 4.

**Table 4. Sediment Depths Indicating Required Servicing***

| Particle Size | Specific Gravity |
|---|---|
| Model | Sediment Depth inches (mm) |
| 450i | 8 (200) |
| 900 | 8 (200) |
| 1200 | 10 (250) |
| 1800 | 15 (381) |
| 2400 | 12 (300) |
| 3600 | 17 (430) |
| 4800 | 15 (380) |
| 6000 | 18 (460) |
| 7200 | 15 (381) |
| 11000 | 17 (380) |
| 13000 | 20 (500) |
| 16000 | 17 (380) |
| * based on 15% of the Stormceptor unit's total storage | |

Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years).

Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 24 inches (600 mm) opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

1. Check for oil through the oil cleanout port
2. Remove any oil separately using a small portable pump
3. Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank
4. Remove the sludge from the bottom of the unit using the vacuum truck
5. Re-fill Stormceptor with water where required by the local jurisdiction

## 12.3. Submerged Stormceptor

Careful attention should be paid to maintenance of the Submerged Stormceptor System. In cases where the storm drain system is submerged, there is a requirement to plug both the inlet and outlet pipes to economically clean out the unit.

## 12.4. Hydrocarbon Spills

The Stormceptor is often installed in areas where the potential for spills is great. The Stormceptor System should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

## 12.5. Disposal

Requirements for the disposal of material from the Stormceptor System are similar to that of any other stormwater Best Management Practice (BMP) where permitted. Disposal options for the sediment may range from disposal in a sanitary trunk sewer upstream of a sewage treatment plant, to disposal in a sanitary landfill site. Petroleum waste products collected in the Stormceptor (free oil/chemical/fuel spills) should be removed by a licensed waste management company.

## 12.6. Oil Sheens

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a rainbow or sheen can be seen at very small oil concentrations (<10 mg/L). Stormceptor will remove over 98% of all free oil spills from storm sewer systems for dry weather or frequently occurring runoff events.

The appearance of a sheen at the outlet with high influent oil concentrations does not mean the unit is not working to this level of removal. In addition, if the influent oil is emulsified the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified conditions.


**SUPPORT**

Drawings and specifications are available at www.ContechES.com.

Site-specific design support is available from our engineers.



Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122



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April 2019

**STORMTRAP MAINTENANCE MANUAL**

## 1. Introduction

As with any Stormwater system regular inspections are recommended to ensure the long-term function of the system per design. As Stormwater migrates through the system, both sediment and debris could collect or settle within the system invert. Such events would prompt a regular inspection and or maintenance plan. Please call your Authorized StormTrap Representative (877-867-6872) if you have questions regarding the inspection and/or maintenance of the StormTrap system(s). Prior to entry into any underground storm sewer or underground detention systems, appropriate OSHA and local safety regulations and guidelines should be followed.

## 2. Inspection Schedules

StormTrap Stormwater Management Systems are recommended for inspection whenever the upstream and downstream catch basins and stormwater pipes of the stormwater collection system are inspected and/or maintained. This will economize the cost of the inspection if it is done at the same time the municipal crews are servicing the area.

During the first year of service, StormTrap recommends an accelerated inspection schedule to establish baseline levels of debris and/or sediment within the system. Inspections should be made after each significant rain event or runoff period. We also recommend a quarterly inspection in addition to the event-based inspections for the first 12 months. Based upon the results of the first year of inspections, a more appropriate schedule can be generated.

StormTrap Stormwater Management Systems for a private development are recommended for inspection after construction activities are complete and system is functioning per design and after each major storm water event. Until a cleaning schedule can be established, a quarterly inspection is recommended for the first 12 months. After the first 12 months, a regular schedule can be implemented. If inspected on a biannual basis, the inspection should be conducted before the stormwater season begins to be sure that everything is functioning properly for the upcoming storm season. If inspected on an annual basis, the inspection should be conducted before the stormwater season begins to be sure that everything is functioning properly for the upcoming storm season.

## 3. Inspection Process

Inspections should be done such that at least 2-3 days has lapsed since the most recent rain event to allow for complete draining. Visually inspect the system at all manhole locations. Utilizing a sediment pole, measure and document the amount of silt at each manhole location (Figure 1). Inspect each pipe opening to ensure that the silt level or any foreign objects are not blocking the pipes. Be sure to inspect the outlet pipe(s) because this is typically the smallest pipe in the system. It is common that most of the larger materials will be collected upstream of the system in catch basins, and it is therefore important at time of inspections to check these structures for large trash or blockages.

Remove any blockages if you can during the inspection process only if you can do so safely from the top of the system without entering into the system**. Do not go into the system under any circumstances** without proper ventilation equipment and confined space training. Pass any information requiring action onto the appropriate maintenance personnel if you cannot remove the blockages from above during the inspection process. Be sure to describe the location of each manhole and the type of material that needs to be removed.

The sediment level of the system should also be measured and recorded during the inspection process. Recording the sediment level at each manhole is very important in order get a history of sediment that can be graphed over time (i.e. years) in order to estimate when the system will need to be maintained next. It is also important to keep these records to verify that the inspection process was actually performed if anyone asks for your records in the future. ***(Please see Appendix A for reference)***

The sediment level in the underground detention system can be determined from the outside of the system by opening up all the manholes and using a sediment pole to measure the amount of sediment at each location. Force the stick to the bottom of the system and then remove it and measure the amount of sediment at that location. Again, do not enter into the system under any circumstances without proper ventilation equipment and training. Please see Appendix A for a sample inspection document.

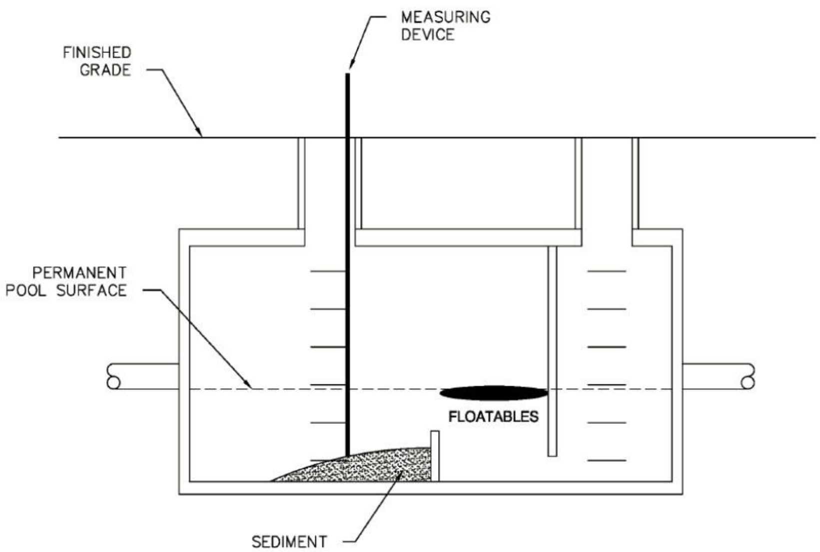



**Figure 1.** During inspection, measure the distance from finished grade to the top of the sediment inside the system.

## 4. When to Clean the System

Any blockages should be safely removed as soon as it is safely possible to ensure the StormTrap detention system will fill and drain properly before the next stormwater event.

The dry detention system should be completely cleaned whenever the sediment occupies more than 10% to 15% of the originally designed system's volume. A wet system (sometimes referred to as a wet vault) should be cleaned when the sediment occupies more than 30% or 1/3rd of the originally designed system's volume.

NOTE: Check with your municipality to ensure compliance with local guidelines regarding cleaning criteria, as the allowable sediment before cleaning may different that StormTrap's recommended ranges.

## 5. How to Clean the StormTrap

StormTrap systems should be completely cleaned back to 100% of the originally designed storage volume whenever the above sediment levels have been reached. Be sure to wait at least 3 days after a stormwater event to be sure that the system is completely drained (if it is a dry detention system), and all the sediments have settled to the bottom of the system (if it is a wet detention system).

There are many maintenance companies that can be contracted to clean your underground stormwater detention systems and water quality units. Please call your StormTrap representative for referrals in your area.

### Product Specific Maintenance Recommendations

#### A. SingleTrap on a Concrete Slab

Maintenance is typically performed using a vacuum truck or jet-vac system. If headroom allows, sediment can be manually gathered near access openings and removed with suction. Shorter systems will require a mobile jet vac system that operates throughout the system to collect and remove sediment.

Sediment should be flushed towards a vacuum hose for thorough removal. For a dry system, remove the manhole cover at the top of the system and lower a vacuum hose into one of the rows of the StormTrap system. If present, open the manhole at the opposite end of the StormTrap and use sewer jetting equipment to force water in the same row from one end of the StormTrap row to the opposite side. The rows of the StormTrap are completely open in one contiguous channel from one end to the other for easy cleaning.

If the system was designed to maintain a permanent pool of water, floatables and any oil should be removed in a separate procedure prior to the removal of all sediment.

The floatable trash is removed first by using a bucket strainer to capture and remove any floating debris.

The floatable oils are then removed off the top of the water by using the vacuum truck to suck off any floatable fluids and liquids.

The next step is to use the vacuum truck to gently remove the clarified water above the sediment layer.

The final step is to clean the sediment for each row as described above. For smaller systems, the vacuum truck can remove all the sediment in the basin without using the sewer jetting equipment because of the smaller space.

### B. SingleTrap on Stone

SingleTrap systems on a stone base require a similar cleaning process as a SingleTrap on a concrete slab. However, extra care needs to be taken to make sure the stone base retains levelness. If system headroom allows, manual raking of sediment a debris can be performed. Shorter systems may require jet vac equipment. Adjusting the pressure setting on the jet vac to ensure the stability of the stone base.

Sediment should be flushed towards a vacuum hose for thorough removal. Remove the manhole cover at the top of the system and lower a vacuum hose into one of the rows of the StormTrap system. Access the manhole at the opposite end of the StormTrap and use sewer jetting equipment to force water in the same row from one end of the StormTrap row to the opposite side. The rows of the StormTrap are completely open in one contiguous channel from one end to the other for easy cleaning.

### C. DoubleTrap

A DoubleTrap system can be maintained in a similar fashion as a SingleTrap on a concrete slab. Typically, headroom is greater in DoubleTrap systems and access is easier for manual gathering of sediment and debris. Again, maintenance is typically performed using a vacuum truck or jet-vac system. Sediment can be gathered near access openings and removed with suction. Alternately, a jet vac system that operates throughout the system can be used to remove sediment.

Sediment should be flushed towards a vacuum hose for thorough removal. For a dry system, remove the manhole cover at the top of the system and lower a vacuum hose into one of the rows of the StormTrap system. If present, open the manhole at the opposite end of the StormTrap and use sewer jetting equipment to force water in the same row from one end of the StormTrap row to the opposite side. The rows of the StormTrap are completely open in one contiguous channel from one end to the other for easy cleaning.

If the system was designed to maintain a permanent pool of water, floatables and any oil should be removed in a separate procedure prior to the removal of all sediment.

The floatable trash is removed first by using a bucket strainer to capture and remove any floating debris.

The floatable oils are then removed off the top of the water by using the vacuum truck to suck off any floatable fluids and liquids.

The next step is to use the vacuum truck to gently remove the clarified water above the sediment layer.

The final step is to clean the sediment for each row as described above. For smaller systems, the vacuum truck can remove all the sediment in the basin without using the sewer jetting equipment because of the smaller space.

**D. ShallowTrap**

A ShallowTrap system can be cleaned in a similar fashion as a Single Trap on a stone base. The headroom limitation will not allow for manual entry removal of sediment. Precautions will need to be taken to ensure the stone base retains levelness. Using a jet vac system to flush out the sediment is the recommended method.

Sediment should be flushed towards a vacuum hose for thorough removal. Remove the manhole cover at the top of the system and lower a vacuum hose into one of the rows of the ShallowTrap system. Access the manhole at the opposite end of the ShallowTrap and use sewer jetting equipment to force water in the same row from one end of the ShallowTrap row to the opposite side. The rows of the ShallowTrap are completely open in one contiguous channel from one end to the other for easy cleaning.

**E. SiteSaver**

Site Savers have 3 potential components that require maintenance and cleaning. Depending on the specifications of the system, trash nets, oil mats, and sediment removal will all need to be addressed.

Inspections should be done such that a enough time has lapsed since the most recent rain event to allow for a static water condition. Visually inspect the system at all manhole and access opening locations. For debris accumulation, visually inspect the netting or screening basket components (if utilized) to determine the bag or basket capacity. Nets or baskets containing only minor quantities of debris may be retained in place. It is recommended to replace the nets or clean the screening baskets when they appear 1/2 - 2/3 full. Failure to replace nets and/or remove floatables from bypass screening (if applicable) will lead to hydraulic relief, drain down deficiencies, and decrease the long-term functionality of the system.

For sediment accumulation, utilize either a sludge sampler or a sediment pole to measure and document the amount of sediment accumulation. To determine the amount of sediment in the system with a sludge sampler follow the manufacturer's instructions. If utilizing a sediment pole, first insert the pole to the top of the sediment layer and record the depth. Then, insert the pole to the bottom of the system and record the depth. The difference in the two measurements corresponds to the amount of sediment in the system. Finally, inspect the inlet pipe opening to ensure that the silt level or any foreign objects are not blocking the pipe.

Maintenance should be done utilizing proper personal protective equipment such as: safety glasses, hard-hat, gloves, first aid kit, etc. Maintenance should occur only when a sufficient

time has lapsed since the most recent rain event to allow for a static water condition for the duration of the maintenance process.
In the case that only trash and floatables need to be removed, and a netting configuration or a removable screening basket is utilized, a vacuum truck is not required. However, a vacuum truck is required if a fixed screening basket configuration is utilized. If the maintenance event is to include oil removal and or sediment removal a vacuum truck or similar equipment would be needed.

Install a new net assembly by sliding the netting frame down the support frame and ensure the netting lays over the plate assembly such that the netting is not restricted. To order additional disposable nets, contact your local SiteSaver representative. New nets come with tie wraps temporarily holding the net material to the frame component for easy handling and storage. It is not recommended to remove the tie wraps until the net is ready to be installed. The frame is tapered from top (widest part) to bottom, and is also tapered from front (towards the sewer) to back. Cut the tie wraps that secures the netting material to the frame for shipment and lower the net down the guide rails. If debris has accumulated in the net support frame, remove the objects so the new net seats fully in the channel when installed.
When lowering the net, the following details should be exercised when placing the net:

- Watch the lowering to make sure that there are no unexpected entanglements.
- Be careful not to let the toe of the net get caught under the frame when it reaches the bottom of the support frame. This is typically accomplished by holding the toe of the net until after the net has started to prop into place.
- Ensure the netting lays over the plate assembly such that the netting is not restricted.

Access to the netting chamber can be achieved via the square grated opening atop the Site Saver unit. Trash net needs to be removed completely (including the frame) with a service vehicle (crane/hoist/boom truck).

For sediment removal, the SiteSaver is designed with clear access at both the inlet and outlet. A vacuum truck, or similar trailer mounted equipment, can be used to remove the sediment, hydrocarbons, and water within the unit. For more effective removal, it is recommended to use sewer jetting equipment or a spray lance to force the sediment to the vacuum hose. When the floor is sufficiently cleaned, fill the system back to its normal water elevation (to the pipe inverts).

Complete a post maintenance inspection to ensure that all components have been replaced and are properly secured within the SiteSaver device. It is a good practice to take time stamped photographs after every maintenance event to include within maintenance logs. After verifying all components, secure the access openings and ensure proper disposal of all pollutants removed during maintenance per local, state, and federal guidelines.

Proof of inspections and maintenance is the responsibility of the owner. All inspection reports and data should be kept on site or at a location where they will be accessible for years in the future. Some municipalities require these inspection and cleaning reports to be forwarded to the proper governmental permitting agency on an annual basis. Refer to your local and national regulations for any additional maintenance requirements and schedules not contained herein. Inspections should be a part of the standard operating procedure. It is good practice to keep records of rainfall events between maintenance events and the weight of material removed, even if no report is required.

### F. Sand Filter

Sand filter beds can crust over and become clogged or partially clogged, for this reason we recommend inspecting the sand filters at least annually. To remove this, the upper layer of clogged and / or hardened sand will need to be broken up with a steel rake or a similar device. After breaking up the top 2-5 inches of contaminated media, the lose sand can be scrapped off and removed via a vacuum truck. Replace and regrade the media with the approved material per the original design.

Various contractors specialize in this work. Maintenance methodologies range from manual replacement and removal to robotic devices that require no human entry into the system. Please consult to local maintenance contractors for additional information.

## 6. Inspection Reports

Proof of these inspections is the responsibility of the property owner. All inspection reports and data should be kept on site or at a location where they will be accessible for years in the future. Some municipalities require these inspection and cleaning reports to be forwarded to the proper governmental permitting agency on an annual basis.

Refer to your local and national regulations for any additional maintenance requirements and schedules not contained herein. Inspections should be a part of your standard operating procedure. Please see Appendix A for a sample Inspection and Maintenance form.

**Appendix A**

Sample inspection and maintenance log

StormTrap®

**Underground Detention System Inspection and Maintenance Checklist**

| | | | |
|---|---|---|---|
| **Facility:** | | | |
| **Location/Address:** | | | |
| **Date:** | **Time:** | **Weather Conditions:** | **Date of Last Inspection:** |
| **Inspector:** | | **Title:** | |
| **Rain in Last 48 Hours** □ Yes □ No | | **If yes, list amount and timing:** | |
| **Pretreatment:** □ vegetated filter strip □ swale □ turf grass □ forebay □ other, specify: □ none | | | |
| **Site Plan or As-Built Plan Available:** □ Yes □ No | | | |

*Do not enter underground detention chambers to inspect system unless Occupational Safety & Health Administration (OSHA) regulations for confined space entry are followed.
*Follow inspection and maintenance instructions and schedules provided by system manufacturer and installer.
* Properly dispose of all wastes.

| Inspection Item | | Comment | Action Needed |
|---|---|---|---|
| **1. PRETREATMENT** | | | |
| Sediment has accumulated. | ☐Yes ☐No ☐N/A | | ☐Yes ☐No |
| Trash and debris have accumulated. | ☐Yes ☐No ☐N/A | | ☐Yes ☐No |
| **2. INLETS** | | | |
| Inlets are in poor structural condition. | ☐Yes ☐No ☐N/A | | ☐Yes ☐No |
| Sediment, trash, or debris have accumulated and/or is blocking the inlets. | ☐Yes ☐No ☐N/A | | ☐Yes ☐No |
| **3. CHAMBERS** | | | |
| Sediment accumulation threshold has been reached. | ☐Yes ☐No ☐N/A | | ☐Yes ☐No |
| Trash and debris have accumulated in chambers. | ☐Yes ☐No ☐N/A | | ☐Yes ☐No |
| **4. OTHER SYSTEM COMPONENTS** | | | |
| Structural deterioration is evident. | ☐Yes ☐No ☐N/A | | ☐Yes ☐No |
| **5. OUTLETS** | | | |
| Outlets in poor structural condition. | ☐Yes ☐No ☐N/A | | ☐Yes ☐No |
| Sediment, trash or debris are blocking outlets. | ☐Yes ☐No ☐N/A | | ☐Yes ☐No |
| Erosion is occurring around outlets. | ☐Yes ☐No ☐N/A | | ☐Yes ☐No |
| **6. OTHER** | | | |
| Evidence of ponding water on area draining to system. | ☐Yes ☐No ☐N/A | | ☐Yes ☐No |
| Evidence that water is not being conveyed through the system. | ☐Yes ☐No ☐N/A | | ☐Yes ☐No |
| **Additional Notes** | | | |
| | | | |
| **Wet weather inspection needed** □ Yes □ No | | | |

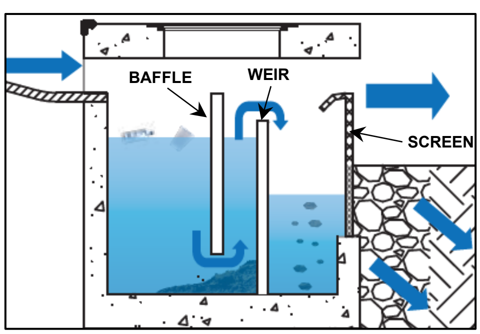
# PRETX™ BIOFILTER PRETREATMENT OPERATION AND MAINTENANCE GUIDANCE

PRETX systems provide pretreatment of sediment and debris prior to filtration and infiltration. Maintenance of PRETX pretreatment catch basins is simple and typically uses a standard vactor truck for cleaning. Simply remove the manhole cover and vactor out debris from within the sump and clean internal components by pressure washing. PRETX units are comprised of an outer precast concrete shell and consist of HDPE and stainless-steel internals that are resistant to rust and rot from corrosive winter runoff. Ideal tools include camera, shovel, hoe/rake, manhole pick, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local authority or company procedures.

Routine annual inspections and periodic maintenance is required for the effective operation of PRETX systems. The Responsible Parties should maintain PRETX systems in accordance with the minimum design standards. This page provides guidance on maintenance activities that are typically required for PRETX systems, along with a suggested frequency for each activity. Individual systems may have more, or less, frequent maintenance needs, depending upon a variety of factors including land use intensity, seasonality, the occurrence of large storm events, overly wet or dry (i.e., drought) regional hydrologic conditions, and any changes or redevelopment in the upstream land use.

| Activity | Frequency |
|---|---|
| **NOTE:** A properly functioning PRETX system will trap floatables such as bottles, cups, and leaves within the first sump area behind the baffle. Settleables such as sand, saturated leaves and trash will fall to the bottom of the sump area behind the weir wall. Lastly, removal of smaller debris such as cigarettes, grass clippings, etc. will be removed by the screened outlet. | Annual Inspection |
| Cleaning of PRETX systems is best conducted by a vactor truck with pressure washing for removal of accumulated sediment, trash, and debris. | |
| Remove maintenance cover and inspect for accumulation of trash and debris. | |
| Inspect for floatables behind baffle wall and remove as needed by vactor. | |
| Inspect for settleable behind weir wall and remove as needed by vactor. | |
| Inspect outlet screen for accumulated debris and clean as needed by pressure wash. | |
| Check the inlet area (curb throat or drop inlet grate) and surrounding pavement area immediately upstream for sediment deposition, weed growth, etc. Remove as needed with a broom and shovel or by vactor. | |
| Check to insure the PRETX system drains to the outvert level completely after storm events. | |
| This process is to be repeated until proper drainage and function has been restored. | As Needed |
| Repair or replace any damaged structural parts, inlets, outlets, grates. | |

TOP VIEW WITH COVER REMOVED




SIDE VIEW OF TRASH AND DEBRIS ACCUMULATION

REAR VIEW OF OUTLET SCREEN

# CHECKLIST FOR OPERATION & MAINTENANCE
# PRETX™ BIOFILTER PRETREATMENT

Location:
Inspector:
Date: Time: Site Conditions:
Date Since Last Rain Event:

**NOTE:** A properly functioning PRETX system will trap floatables such as bottles, cups, and leaves within the first sump area behind the baffle. Settleables such as sand, saturated leaves and trash will fall to the bottom of the sump area behind the weir wall. Lastly, removal of smaller debris such as cigarettes, grass clippings, etc. will be removed by the screened outlet.

| Inspection Items | Satisfactory (S) or Unsatisfactory (U) | | Comments/Corrective Action |
|---|---|---|---|
| 1. Remove maintenance cover to allow for visual inspection | **S** | **U** | |
| 2. Complete drainage of PRETX system to outvert elevation after storm flow ceases | **S** | **U** | |
| 3. Proper grading and drainage to PRETX inlet and outlet, no evidence of short-circuit or bypass of flow around or under structure | **S** | **U** | |
| 4. Accumulation of settleable trash and debris within PRETX sump is 6” or less | **S** | **U** | |
| 5. Sump area is empty of floatable trash and debris. Excessive accumulation of floatables will bypass baffle wall. | **S** | **U** | |
| 6. Outlet screen is clear of debris | **S** | **U** | |
| 7. Clogging and function of inlet/outlet components | **S** | **U** | |
| 8. Cracking, spalling, or deterioration of concrete | **S** | **U** | |
| 9. Nuisance vegetation, animal burrows, or settling of structure | **S** | **U** | |
| 10. Undesirable odors | **S** | **U** | |
| 11. Complaints from residents | **S** | **U** | |
| 12. Public hazards noted | **S** | **U** | |
| 13. | **S** | **U** | |
| 14. | **S** | **U** | |
| 15. | **S** | **U** | |

| Corrective Action Needed | Due Date |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| 4. | |
| 5. | |


# FocalPoint

## BIOFILTRATION SYSTEMS

HIGH PERFORMANCE MODULAR BIOFILTRATION SYSTEM (HPMBS)

Operations & Maintenance

ACF ENVIRONMENTAL

*Customer Focused, Environmentally Committed*

## GENERAL DESCRIPTION

The following general specifications describe the general operations and maintenance requirements for the FocalPoint® High Performance Modular Biofiltration System (HPMBS). The system utilizes physical, chemical and biological mechanisms of a soil, plant and microbe complex to remove pollutants typically found in urban stormwater runoff. The treatment system is a fully equipped, modular, constructed in place system designed to treat contaminated runoff.

Stormwater enters the FocalPoint® HPMBS, is filtered by the High Flow Biofiltration Media and passes through to the underdrain/storage system where the treated water is detained, retained or infiltrated to sub-soils, prior to discharge to the storm sewer system of any remaining flow.

Higher flows bypass the FocalPoint® HPMBS via a downstream inlet or other overflow conveyance. Maintenance is a simple, inexpensive and safe operation that does not require confined space entry, pumping or vacuum equipment, or specialized tools. Properly trained landscape personnel can effectively maintain FocalPoint® HPMBS by following instructions in this manual.

## BASIC OPERATIONS

FocalPoint® is a modular, high performance biofiltration system that often works in tandem with other integrated management practices (IMP). Contaminated stormwater runoff enters the biofiltration bed through a conveyance swale, planter box, or directly through a curb cut or false inlet. Energy is dissipated by a rock or vegetative dissipation device and is absorbed by a 3-inch layer of aged, double shredded hardwood mulch, with fines removed, (when specified) on the surface of the biofiltration media.

As the water passes through the mulch layer, most of the larger sediment particles and heavy metals are removed through sedimentation and chemical reactions with the organic material in the mulch. Water passes through the biofiltration media where the finer particles are removed and numerous chemical reactions take place to immobilize and capture pollutants in the soil media.

The cleansed water passes into the underdrain/storage system and remaining flows are directed to a storm sewer system or other appropriate discharge point. Once the pollutants are in the soil, bacteria begin to break down and metabolize the materials and the plants begin to uptake and metabolize the pollutants. Some pollutants such as heavy metals, which are chemically bound to organic particles in the mulch, are released over time as the organic matter decomposes to release the metals to the feeder roots of the plants and the cells of the bacteria in the soil where they remain and are recycled. Other pollutants such as phosphorus are chemically bound to the soil particles and released slowly back to the plants and bacteria and used in their metabolic processes. Nitrogen goes through a variety of very complex biochemical processes where it can ultimately end up in the plant/bacteria biomass, turned to nitrogen gas or dissolves back into the water column as nitrates depending on soil temperature, pH and the availability of oxygen. The pollutants ultimately are retained in the mulch, soil and biomass with some passing out of the system into the air or back into the water.

## DESIGN AND INSTALLATION

Each project presents different scopes for the use of FocalPoint® HPMBS. To ensure the safe and specified function of this stormwater BMP, Convergent Water Technologies and/or its Value Added Resellers (VAR) review each application before supply. Information and design assistance is available to the design engineer during the planning process. Correct FocalPoint® sizing is essential to optimum performance. The engineer shall submit calculations for approval by the local jurisdiction when required. The contractor and/or VAR is responsible for the correct installation of FocalPoint® HPMBS units as described in approved plans. A comprehensive installation manual is available at www.convergentwater.com.

## MAINTENANCE

*Why Maintain?*

All stormwater treatment systems require maintenance for effective operation. This necessity is often incorporated in your property's permitting process as a legally binding BMP maintenance agreement. Other reasons for maintenance include:

- Avoid legal challenges from your jurisdiction's maintenance enforcement program.
- Prolong the lifespan of your FocalPoint® HPMBS.
- Avoid costly repairs.
- Help reduce pollutant loads leaving your property.

Simple maintenance of the FocalPoint® HPMBS is required to continue effective pollutant removal from stormwater runoff before any discharge into downstream waters. This procedure will also extend the longevity of the living biofiltration system. The unit will recycle and accumulate pollutants within the biomass, but may also subjected to other materials entering the surface of the system. This may include trash, silt and leaves etc. which will be contained above the mulch and/or biofiltration media layer. Too much silt may inhibit the FocalPoint's® HPMBS flow rate, which is a primary reason for system maintenance. Removal of accumulated silt/sediment and/or replacement of the mulch layer (when specified), is an important activity that prevents over accumulation of such silt/sediment.

*When to Maintain?*

Convergent Water Technologies and/or its VAR includes a 1-year maintenance plan with each system purchased. Annual included maintenance consists of two (2) scheduled maintenance visits. Additional maintenance may be necessary depending on sediment and trash loading (by Owner or at additional cost). The start of the maintenance plan begins when the system is activated for full operation. Full operation is defined as when the site is appropriately stabilized, the unit is installed and activated (by VAR), i.e., when mulch (if specified) and plantings are added.

Activation should be avoided until the site is fully stabilized (full landscaping, grass cover, final paving and street sweeping completed). Maintenance visits are scheduled seasonally; the spring visit aims to clean up after winter loads including salts and sands. The fall visit helps the system by removing excessive leaf litter.

A first inspection to determine if maintenance is necessary should be performed at least twice annually after storm events of greater than (1) one inch total depth (subject to regional climate). Please refer to the maintenance checklist for specific conditions that indicate if maintenance is necessary.

It has been found that in regions which receive between 30-50 inches of annual rainfall, (2) two visits are generally required. Regions with less rainfall often only require (1) one visit per annum. Varying land uses can affect maintenance frequency.

Some sites may be subjected to extreme sediment or trash loads, requiring more frequent maintenance visits. This is the reason for detailed notes of maintenance actions per unit, helping the VAR/Maintenance contractor and Owner predict future maintenance frequencies, reflecting individual site conditions.

Owners must promptly notify the VAR/Maintenance contractor of any damage to the plant(s), which constitute(s) an integral part of the biofiltration technology. Owners should also advise other landscape or maintenance contractors to leave all maintenance of the FocalPoint® HPMBS to the VAR/Maintenance contractor (i.e. no pruning or fertilizing).

## EXCLUSION OF SERVICES

It is the responsibility of the owner to provide adequate irrigation when necessary to the plant(s) in the FocalPoint® HPMBS.

Clean up due to major contamination such as oils, chemicals, toxic spills, etc. will result in additional costs and are not covered under the VAR/Maintenance contractor maintenance contract. Should a major contamination event occur, the Owner must block off the outlet pipe of the FocalPoint® (where the cleaned runoff drains to, such as drop-inlet) and block off the point where water enters of the FocalPoint® HPMBS. The VAR/Maintenance contractor should be informed immediately.

## MAINTENANCE VISIT SUMMARY

Each maintenance visit consists of the following simple tasks (detailed instructions below).

1. Inspection of FocalPoint® HPMBS and surrounding area

2. Removal of debris, trash and mulch

3. Mulch replacement

4. Plant health evaluation (including measurements) and pruning or replacement as necessary

5. Clean area around FocalPoint® HPMBS

6. Complete paperwork, including date stamped photos of the tasks listed above.

## MAINTENANCE TOOLS, SAFETY EQUIPMENT AND SUPPLIES

Ideal tools include: camera, bucket, shovel, broom, pruners, hoe/rake, and tape measure. Appropriate Personal Protective Equipment (PPE) should be used in accordance with local or company procedures. This may include impervious gloves where the type of trash is unknown, high visibility clothing and barricades when working in close proximity to traffic and also safety hats and shoes.

## MAINTENANCE VISIT PROCEDURE

### Inspection of FocalPoint® HPMBS and surrounding area

Record individual unit before maintenance with photograph (numbered). Record on Maintenance Report (see example in this document) the following:

- Standing Water yes | no
- Is Bypass Inlet Clear? yes | no
- Damage to HPMBS System yes | no
- to Overflow conveyance yes | no

### Removal of Silt / Sediment / Clay

Dig out silt (if any) and mulch and remove trash & foreign items.

- Silt / Clay Found? yes | no
- Cups / Bags Found? yes | no
- Leaves? yes | no
- Volume of material removed ________ (volume or weight)

### Removal of debris, trash and mulch

After removal of mulch and debris, measure distance from the top of the FocalPoint® HPMBS engineered media soil to the flow line elevation of the adjacent overflow conveyance. If this distance is greater than that specified on the plans (typ. 6" - 12"), add media (not top soil or other) to recharge to the distance specified.

- Distance to media surface to flow line of overflow conveyance (inches) ____________
- # of Buckets of Media Added _________

### Mulch Replacement

Most maintenance visits require only replacement mulch (if utilized) which must be, aged, double shredded hardwood mulch with fines removed. For smaller projects, one cubic foot of mulch will cover four square feet of biofiltration bed, and for larger projects, one cubic yard of mulch will cover 108 square feet of biofiltration bed. Some visits may require additional FocalPoint® HPMBS engineered soil media available from the VAR/Contractor.

- Add double shredded, aged hardwood mulch which has been screened to remove fines, evenly across the entire biofiltration media bed to a depth of 3".
- Clean accumulated sediment from energy dissipation system at the inlet to the FocalPoint® HPMBS to allow for entry of trash during a storm event.

### Plant health evaluation and pruning or replacement as necessary

Examine the plant's health and replace if dead or dying.
Prune as necessary to encourage growth in the correct directions

- Height above Grate (feet) _______
- Width at Widest point (feet) _______
- Health alive | dead
- Damage to Plant yes | no

### Clean area around FocalPoint® HPMBS

- Clean area around unit and remove all refuse to be disposed of appropriately.

### Complete paperwork

- Deliver Maintenance Report and photographs as appropriate.
- Some jurisdictions may require submission of maintenance reports in accordance with approvals.
- It is the responsibility of the Owner to comply with local regulations.

FocalPoint

BIOFILTRATION SYSTEM

# FocalPoint Warranty

Seller warrants goods sold hereunder against defects in materials and workmanship only, for a period of (1) year from date the Seller activates the system into service. Seller makes no other warranties, express or implied.

Seller's liability hereunder shall be conditioned upon the Buyer's installation, maintenance, and service of the goods in strict compliance with the written instructions and specifications provided by the Seller. Any deviation from Seller's instructions and specifications or any abuse or neglect shall void warranties.

In the event of any claim upon Seller's warranty, the burden shall be upon the Buyer to prove strict compliance with all instructions and specifications provided by the Seller.

Seller's liability hereunder shall be limited only to the cost or replacement of the goods. Buyer agrees that Seller shall not be liable for any consequential losses arising from the purchase, installation, and/or use of the goods.

# Maintenance Checklist

| Element | Problem | What To Check | Should Exist | Action |
|---|---|---|---|---|
| **Inlet** | Excessive sediment or trash accumulation | Accumulation of sediment or trash impair free flow of water into FocalPoint | Inlet free of obstructions allowing free flow into FocalPoint System | Sediments or trash should be removed |
| **Mulch Cover** | Trash and floatable debris accumulation | Excessive trash or debris accumulation. | Minimal trash or other debris on mulch cover | Trash and debris should be removed and mulch cover raked level. Ensure that bark nugget |
| **Mulch Cover** | Ponding of water on mulch cover | Ponding in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils | Stormwater should drain freely and evenly over mulch cover. | Contact VAR for advice. |
| **Plants** | Plants not growing, or in poor condition | Soil/mulch too wet, evidence of spill. Pest infestation. Vandalism to plants. | Plants should be healthy and pest free. | Contact VAR for advice. |
| **Plants** | Plant growth excessive | Plants should be appropriate to the species and location of FocalPoint | | Trim/prune plants in accordance with typical landscaping and |

R TANK

# R-TANK OPERATION, INSPECTION & MAINTENANCE

## Operation

Your ACF R-Tank System has been designed to function in conjunction with the engineered drainage system on your site, the existing municipal infrastructure, and/or the existing soils and geography of the receiving watershed. Unless your site included certain unique and rare features, the operation of your R-Tank System will be driven by naturally occurring systems and will function autonomously. However, upholding a proper schedule of Inspection & Maintenance is critical to ensuring continued functionality and optimum performance of the system.

## Inspection

Both the R-Tank and all stormwater pre-treatment features incorporated into your site must be inspected regularly. Inspection frequency for your system must be determined based on the contributing drainage area, but should never exceed one year between inspections (six months during the first year of operation).

Inspections may be required more frequently for pre-treatment systems. You should refer to the manufacturer requirements for the proper inspection schedule.

With the right equipment your inspection and measurements can be accomplished from the surface without physically entering any confined spaces. If your inspection does require confined space entry, you MUST follow all local/regional requirements as well as OSHA standards.

R-Tank Systems may incorporate Inspection Ports, Maintenance Ports, and/or adjoining manholes. Each of these features are easily accessed by removing the lid at the surface. With the cover removed, a visual inspection can be performed to identify sediment deposits within the structure. Using a flashlight, ALL access points should be examined to complete a thorough inspection.

**Inspection Ports**
Usually located centrally in the R-Tank System, these perforated columns are designed to give the user a base-line sediment depth across the system floor.

**Maintenance Ports**
Usually located near the inlet and outlet connections, you'll likely find deeper deposits of heavier sediments when compared to the Inspection Ports.

**Manholes**
Most systems will include at least two manholes - one at the inlet and another at the outlet. There may be more than one location where stormwater enters the system, which would result in additional manholes to inspect.

Bear in mind that these manholes often include a sump below the invert of the pipe connecting to the R-Tank. These sumps are designed to capture sediment before it reaches the R-Tank, and they should be kept clean to ensure they function properly. However, existence of sediment in the sump does NOT necessarily mean sediment has accumulated in the R-Tank.

After inspecting the bottom of the structure, use a mirror on a pole (or some other device) to check for sediment or debris in the pipe connecting to the R-Tank.

If sediment or debris is observed in any of these structures, you should determine the depth of the material. This is typically accomplished with a stadia rod, but you should determine the best way to obtain the measurement.

All observations and measurements should be recorded on an Inspection Log kept on file. We've included a form you can use at the end of this guideline.

## Maintenance

The R-Tank System should be back-flushed once sediment accumulation has reached 6" or 15% of the total system height. Use the chart below as a guideline to determine the point at which maintenance is required on your system.

| R-Tank Unit | Height | Max Sediment Dept |
|---|---|---|
| Mini | 9.5" | 1.5" |
| Single | 17" | 3" |
| Double | 34" | 5" |
| Triple | 50" | 6" |
| Quad | 67" | 6" |
| Pent | 84" | 6" |

**Before any maintenance is performed on your system, be sure to plug the outlet pipe to prevent contamination of the adjacent systems.**

To back-flush the R-Tank, water is pumped into the system through the Maintenance Ports as rapidly as possible. Water should be pumped into ALL Maintenance Ports. The turbulent action of the water moving through the R-Tank will suspend sediments which may then be pumped out.

If your system includes an Outlet Structure, this will be the ideal location to pump contaminated water out of the system. However, removal of back-flush water may be accomplished through the Maintenance Ports, as well.

For systems with large footprints that would require extensive volumes of water to properly flush the system, you should consider performing your maintenance within 24 hours of a rain event. Stormwater entering the system will aid in the suspension of sediments and reduce the volume of water required to properly flush the system.

Once removed, sediment-laden water may be captured for disposal or pumped through a Dirtbag™ (if permitted by the locality).

## Step-By-Step Inspection & Maintenance Routine

1) **Inspection**
   a. Inspection Port
      i. Remove Cap
      ii. Use flashlight to detect sediment deposits
      iii. If present, measure sediment depth with stadia rod
      iv. Record results on Maintenance Log
      v. Replace Cap
   b. Maintenance Port/s
      i. Remove Cap
      ii. Use flashlight to detect sediment deposits
      iii. If present, measure sediment depth with stadia rod
      iv. Record results on Maintenance Log
      v. Replace Cap
      vi. Repeat for ALL Maintenance Ports
   c. Adjacent Manholes
      i. Remove Cover
      ii. Use flashlight to detect sediment deposits
      iii. If present, measure sediment depth with stadia rod, accounting for depth of sump (if present)
      iv. Inspect pipes connecting to R-Tank
      v. Record results on Maintenance Log
      vi. Replace Cover
      vii. Repeat for ALL Manholes that connect to the R-Tank

2) **Maintenance**
   a. Plug system outlet to prevent discharge of back-flush water
   b. Determine best location to pump out back-flush water
   c. Remove Cap from Maintenance Port
   d. Pump water as rapidly as possible (without over-topping port) into system until at least 1”
      of water covers system bottom
   e. Replace Cap
   f. Repeat at ALL Maintenance Ports
   g. Pump out back-flush water to complete back-flushing
   h. Vacuum all adjacent structures and any other structures or stormwater pre-treatment systems that require attention
   i. Sediment-laden water may be captured for disposal or pumped through a Dirtbag™.
   j. Replace any remaining Caps or Covers
   k. Record the back-flushing event in your Maintenance Log with any relevant specifics

# R-Tank Maintenance Log

Site Name:______________________________ Company Responsible for Maintenance:______________________________

Location:______________________________ Contact:______________________________

System Owner:______________________________ Phone Number:______________________________

| Date | Location | Depth to Bottom | Depth to Sediment | Sediment Depth | Observations/Notes | Initials |
|---|---|---|---|---|---|---|
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# Contactor® & Recharger®
## Stormwater Chambers


# Operation and Maintenance Guidelines
**for CULTEC Stormwater Management Systems**

The Founder of Plastic Chamber Technology

www.cultec.com | 1(800) 4-CULTEC |

CULTEC

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For technical support, please call (203)775-4416 ext. 203 or e-mail tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

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*These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.*
*All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.*
*Actual designs may vary.*

*This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.*

## Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

## Operation and Maintenance Requirements

### I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

### II. Inspection and Maintenance Options

**A.** The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pre-treatment device). CCTV inspection of this row can be deployed through this access port to deter mine if any sediment has accumulated in the inlet row.

**B.** If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

**1. Manhole Access**
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

2. **StormFilter Access**
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

**C.** The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

## III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

**A.** The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.

**B.** The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

**C.** Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

**D.** Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

## IV. Suggested Maintenance Schedules

**A.** **Minor Maintenance**
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

| Frequency | Action |
|---|---|
| Monthly in first year | Check inlets and outlets for clogging and remove any debris, as required. |
| Spring and Fall | Check inlets and outlets for clogging and remove any debris, as required. |
| One year after commissioning and every third year following | Check inlets and outlets for clogging and remove any debris, as required. |

**B.** **Major Maintenance**
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

| | Frequency | Action |
|---|---|---|
| Inlets and Outlets | Every 3 years | • Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended. |
| | Spring and Fall | • Check inlet and outlets for clogging and remove any debris as required. |
| CULTEC Stormwater Chambers | 2 years after commissioning | • Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique.<br>• Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated. |
| | 9 years after commissioning every 9 years following | • Clean stormwater management chambers and feed connectors of any debris.<br>• Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique.<br>• Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended. |
| | 45 years after commissioning | • Clean stormwater management chambers and feed connectors of any debris.<br>• Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required.<br>• Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.<br>• Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection.<br>• Attain the appropriate approvals as required.<br>• Establish a new operation and maintenance schedule. |
| Surrounding Site | Monthly in 1st year | • Check for depressions in areas over and surrounding the stormwater management system. |
| | Spring and Fall | • Check for depressions in areas over and surrounding the stormwater management system. |
| | Yearly | • Confirm that no unauthorized modifications have been performed to the site. |

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.



 

# WQMP
# Operation & Maintenance (O&M) Plan

Project Name:______________________________________________

**Prepared for:**

Project Name: _____________________________________________

Address:__________________________________________________

City, State Zip:____________________________________________

**Prepared on:**

Date:____________________________________________________

This O&M Plan describes the designated responsible party for implementation of this WQMP, including: operation and maintenance of all the structural BMP(s), conducting the training/educational program and duties, and any other necessary activities. The O&M Plan includes detailed inspection and maintenance requirements for all structural BMPs, including copies of any maintenance contract agreements, manufacturer's maintenance requirements, permits, etc.

### 8.1.1 Project Information

| | |
|---|---|
| Project name | |
| Address | |
| City, State Zip | |
| Site size | |
| List of structural BMPs, number of each | |
| Other notes | |

### 8.1.2 Responsible Party

The responsible party for implementation of this WQMP is:

| | |
|---|---|
| Name of Person or HOA Property Manager | |
| Address | |
| City, State Zip | |
| Phone number | |
| 24-Hour Emergency Contact number | |
| Email | |

### 8.1.3 Record Keeping

Parties responsible for the O&M plan shall retain records for at least 5 years.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. A sample Training Log and Inspection and Maintenance Log are included in this document.

### 8.1.4 Electronic Data Submittal

This document along with the Site Plan and Attachments shall be provided in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City.



 

# Appendix ____

## BMP SITE PLAN

Site plan is preferred on minimum 11” by 17” colored sheets, as long as legible.





 

# BMP OPERATION & MAINTENANCE LOG

Project Name: ______________________________________________

Today's Date: ______________________________________________

Name of Person Performing Activity (Printed): ______________________________

Signature: ______________________________________________

| BMP Name (As Shown in O&M Plan) | Brief Description of Implementation, Maintenance, and Inspection Activity Performed |
|---|---|
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## Minor Maintenance

| Frequency | | Action |
|---|---|---|
| **Monthly in first year** | | Check inlets and outlets for clogging and remove any debris, as required. |
| | | Notes |
| □ Month 1 | Date: | |
| □ Month 2 | Date: | |
| □ Month 3 | Date: | |
| □ Month 4 | Date | |
| □ Month 5 | Date: | |
| □ Month 6 | Date: | |
| □ Month 7 | Date: | |
| □ Month 8 | Date: | |
| □ Month 9 | Date: | |
| □ Month 10 | Date: | |
| □ Month 11 | Date: | |
| □ Month 12 | Date: | |
| **Spring and Fall** | | Check inlets and outlets for clogging and remove any debris, as required. |
| | | Notes |
| □ Spring | Date: | |
| □ Fall | Date: | |
| □ Spring | Date: | |
| □ Fall | Date: | |
| □ Spring | Date: | |
| □ Fall | Date: | |
| □ Spring | Date: | |
| □ Fall | Date: | |
| □ Spring | Date: | |
| □ Fall | Date: | |
| □ Spring | Date: | |
| □ Fall | Date: | |
| **One year after commissioning and every third year following** | | Check inlets and outlets for clogging and remove any debris, as required. |
| | | Notes |
| □ Year 1 | Date: | |
| □ Year 4 | Date: | |
| □ Year 7 | Date: | |
| □ Year 10 | Date: | |
| □ Year 13 | Date: | |
| □ Year 16 | Date: | |
| □ Year 19 | Date: | |
| □ Year 22 | Date: | |

## Major Maintenance

| | Frequency | | Action |
|---|---|---|---|
| Inlets and Outlets | **Every 3 years** | | Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended. |
| | | | Notes |
| | □ Year 1 | Date: | |
| | □ Year 4 | Date: | |
| | □ Year 7 | Date: | |
| | □ Year 10 | Date: | |
| | □ Year 13 | Date: | |
| | □ Year 16 | Date: | |
| | □ Year 19 | Date: | |
| | □ Year 22 | Date: | |
| | **Spring and Fall** | | Check inlet and outlets for clogging and remove any debris, as required. |
| | | | Notes |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| CULTEC Stormwater Chambers | **2 years after commissioning** | | □ Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique.<br><br>□ Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated. |
| | | | Notes |
| | □ Year 2 | Date: | |





## Major Maintenance

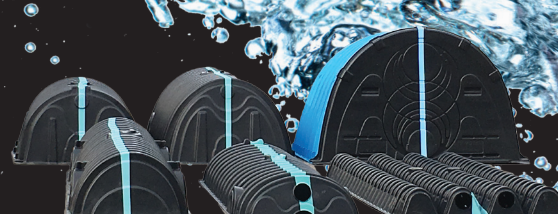
| | Frequency | | Action |
|---|---|---|---|
| CULTEC Stormwater Chambers | **9 years after commissioning every 9 years following** | | □ Clean stormwater management chambers and feed connectors of any debris.<br><br>□ Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique.<br><br>□ Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended. |
| | | | Notes |
| | □ Year 9 | Date: | |
| | □ Year 18 | Date: | |
| | □ Year 27 | Date: | |
| | □ Year 36 | Date: | |
| | **45 years after commissioning** | | □ Clean stormwater management chambers and feed connectors of any debris.<br><br>□ Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required.<br><br>□ Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.<br><br>□ Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection.<br><br>□ Attain the appropriate approvals as required.<br><br>□ Establish a new operation and maintenance schedule. |
| | | | Notes |
| | □ Year 45 | Date: | |

## Major Maintenance

| | Frequency | | Action |
|---|---|---|---|
| Surrounding Site | **Monthly in 1st year** | | □ Check for depressions in areas over and surrounding the stormwater management system. |
| | | | Notes |
| | □ Month 1 | Date: | |
| | □ Month 2 | Date: | |
| | □ Month 3 | Date: | |
| | □ Month 4 | Date: | |
| | □ Month 5 | Date: | |
| | □ Month 6 | Date: | |
| | □ Month 7 | Date: | |
| | □ Month 8 | Date: | |
| | □ Month 9 | Date: | |
| | □ Month 10 | Date: | |
| | □ Month 11 | Date: | |
| | □ Month 12 | Date: | |
| | **Spring and Fall** | | □ Check for depressions in areas over and surrounding the stormwater management system. |
| | | | Notes |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | □ Spring | Date: | |
| | □ Fall | Date: | |
| | **Yearly** | | □ Confirm that no unauthorized modifications have been performed to the site. |
| | | | Notes |
| | □ Year 1 | Date: | |
| | □ Year 2 | Date: | |
| | □ Year 3 | Date: | |
| | □ Year 4 | Date: | |
| | □ Year 5 | Date: | |
| | □ Year 6 | Date: | |
| | □ Year 7 | Date: | |





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CULG008 05-17

# APPENDIX H: ILLICIT DISCHARGE COMPLIANCE STATEMENT

An illicit discharge is any discharge to a municipal separate storm sewer that is not comprised entirely of stormwater, discharges from fire-fighting activities, and certain non-designated non-stormwater discharges.

To the best of my knowledge, no detectable illicit discharges exist on-site. The site plans included with this report detail the stormwater management system that manages stormwater on the site and demonstrate that the system does not include the entry of an illicit discharge. As the owner, I will ultimately be responsible for implementing the Long-Term Pollution Prevention Plan which includes measures to prevent illicit discharges.

Signature ______________________________

Owner