Stormwater Report

Tacoma Street, Great Brook Valley Avenue, Great Brook Valley Avenue Extension, Brookview Drive, & Joseph P. Carlson Way
Worcester, Massachusetts 01605

Curtis Apartments Redevelopment Phase Two

January 4, 2024
Rev. 2: April 17, 2024

JOB NO: ENG22-0480

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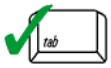
Stormwater Checklist

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

4-17-2024

Signature and Date

Checklist

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

☐ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☒ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☒ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☒ Other (describe): Infiltration Trench

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☐ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

☐ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☒ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

☐ Limited Project

☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.

☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area

☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff

☐ Bike Path and/or Foot Path

☒ Redevelopment Project

☐ Redevelopment portion of mix of new and redevelopment.

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

Stormwater Report Summary

Stormwater Report
April 17, 2024

Project Name/Applicant:	Curtis Apartments Redevelopment Phase Two Trinity Curtis Phase Two Limited Partnership
Project Address:	Tacoma Street, Great Brook Valley Avenue, Great Brook Valley Avenue Extension, Brookview Drive, & Joseph P. Carlson Way, Worcester, MA

Application Prepared by:

Firm:	Weston & Sampson Engineers, Inc.
Registered PE:	Jesse Johnson, PE

General:

Trinity Curtis Phase Two Limited Partnership proposes to redevelop a +/-8.0 acre portion of the Curtis Apartments neighborhood along and within the right-of-ways for Tacoma Street, Great Brook Valley Avenue, Great Brook Valley Avenue Extension, Brookview Drive, & Joseph P. Carlson Way and within portions of the lots identified on Assessor Map 52 as Parcels 1G, 1A, 1, and 3H. Phase Two of the proposed neighborhood redevelopment will include the demolition of three existing multi-family residential buildings, one vacant office building, and one vacant maintenance facility; construction of six new multi-family residential buildings; construction of a mixed-use building consisting of a library, Economic Opportunity Center, and residential units; construction of a new park; as well as proposed reconfigurations to surface level parking areas and driveways. Site improvements will include updates to pedestrian access, multiple hardscape areas, a new closed stormwater collection and conveyance system, utility connections to buildings, as well as site lighting and landscaping. The Phase Two portion of the redevelopment project will allow continued access to and operation of existing facilities within the Curtis Apartments Site that are outside of Phase Two limits.

The Phase Two improvements will also include the relocation of property lines within the limit of work. Since this will create differing lot sizes in the pre- and post- development conditions, an adjusted limit of the drainage study is required. The pre- and post-development stormwater analyses have been configured in a manner that compares the conditions within the Phase Two limit of work (and contributing upgradient areas) as opposed to studying the conditions within the private parcel limits alone. This method of analysis allows for the comparison of the same area of pre- and post- development stormwater conditions as required by MADEP Stormwater Guidelines.

The Phase Two area of study is predominantly developed, consisting mostly of roadways, parking areas, and residential buildings, with landscape areas scattered throughout. The change in topography within the area of study is relatively small and ranges from elevations of 480 at the northwest corner of the study to 444 at the southeast. NRCS soil mapping describes the soils within the area of study to be urban land and Paxton fine sandy loam. This soil mapping plus original design plans from the 1950s indicate that the majority of the project area was built on “fill”.

Design Standards

The proposed project is subject to the requirements of the Wetlands Protection Regulations of the City of Worcester, approved by the Worcester Conservation Commission on July 2, 1990 (Amended June 24, 2019). These standards define the Stormwater Protection Zone (SPZ) as “all land within 100-feet of any existing or proposed inlet to any storm drain, catch basin or storm drain system component discharging into any lake, pond, river, stream, or wetland”. Under this definition, the majority of the area within the Phase Two improvements lies within the SPZ.

Activities that fall within the Stormwater Protection Zone are required to meet the performance standards in Section 4.3 of the City of Worcester Wetlands Protection Regulations. These standards, and the means by which they will be met, are described as follows:

Standard 4.3.4(a): *Erosion and Sediment Controls must be provided according to a plan conforming to the provisions of section 3.2 herein and approved by the Conservation Commission.*

An Erosion and Sediment Controls Plan is included in the design documents. Erosion and Sediment Controls will consist of catch basin filter bags, and perimeter erosion controls consisting of compost mulch filter tubes or silt fence along steep slopes.

Standard 4.3.4(b): *The general performance of erosion controls shall be considered adequate if there is no visibly silted effluent entering the stormwater system*

The proposed work will be competitively bid and will be installed by a contractor that will be required to monitor erosion controls to ensure that no visibly silted effluent enters the stormwater system during construction.

Standard 4.3.4(c): *For projects resulting in the conversion of five thousand (5,000) square feet or more of pervious surface to impervious surface, measures shall be provided to mitigate peak rates of runoff and minimize discharge of pollutants to the stormwater system.*

There will be a net *reduction* in impervious surfaces as a result of the Phase Two improvements and overall neighborhood redevelopment. There are also three rain gardens and three infiltration trenches proposed that will attenuate, treat, and infiltrate collected flows. As a result of these improvements, pollutant levels and peak discharge rate of runoff from the disturbance area will be reduced in the post development condition.

The 2, 10, and 100-year 24-hour storm events were analyzed using HydroCAD. Existing conditions were modeled based on the current condition of the site at the date of this report. Phase I improvements are also considered part of the existing conditions since Phase I construction will be completed prior to Phase Two. The calculations are included herein for reference, and a summary table is provided within the attachments of this report.

Additionally, the project has been analyzed for compliance with the Massachusetts Stormwater Handbook. Discussion is provided below:

Standard 1: No New Untreated Discharges

The proposed project will create no new untreated discharges. The existing stormwater conveyance system for the Curtis Apartments neighborhood will be upgraded and modified to fit with proposed site renovations. Existing stormwater discharge locations will also be maintained in the proposed condition.

Standard 2: Peak Rate Attenuation

Existing and proposed conditions were modeled using HydroCAD software. There is a 0.05 CFS increase in peak discharge rate for the 2-year 24-hour storm event at Analysis Point A. Per the Massachusetts Stormwater Handbook, increases in peak discharge less than or equal to 1 CFS for the 2-year 24-hour storm are considered de minimis. Peak discharge rates are decreased for all other storm events at all Analysis Points.

Standard 3: Recharge

The proposed project is classified as a “redevelopment” per MADEP Stormwater Guidelines. As a result, Standard 3 only has to be met to the maximum extent practicable. There is a reduction in impervious area from the existing to the proposed conditions which results in an increase in recharge volume. In addition to reduction in impervious area, rain gardens and infiltration trenches are proposed to provide groundwater recharge.

Standard 4: Water Quality

The proposed project is classified as a "redevelopment" per MADEP Stormwater Guidelines. As a result, Standard 4 only has to be met to the maximum extent practicable. It is proposed to have stormwater from the impervious surfaces subjected to vehicular traffic undergo treatment from deep sump catch basins and hydrodynamic separators. Impervious area on site is being reduced from the pre- to post-development condition which is consistent with a low impact development (LID) approach. Additionally, there is a reduction in impervious areas (vehicular access) on site that generate sediment loads. Many of the existing parking areas are being converted to lawn, sidewalk, and roof which generate "clean" runoff. The proposed stormwater management methods are an improvement from existing conditions and TSS removal rates are increased site wide compared to existing conditions. Lastly, rain gardens and infiltration trenches are proposed to provide treatment to captured flows from the adjacent park and roadway areas.

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

There are no LUHPPLs in the work area.

Standard 6: Critical Areas

There will be no new discharge to critical areas.

Standard 7: Redevelopments and Other Projects Subject to the Standards Only to the Maximum Extent Practicable

The proposed project is classified as a "redevelopment" per MADEP Stormwater Guidelines. The entire project area proposed for redevelopment falls within limits of the current development that consist of landscaping, walkways, site driveways and parking, and roadway systems.

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

To ensure that the work incorporates the performance standards recommended in the DEP's Stormwater Management Policy, necessary erosion and sedimentation control measures will be utilized during construction. These measures will include compost filter tubes, silt fencing, and catch basin protection as depicted on the site development plans.

A detailed Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in Attachment H. To ensure that the work incorporates the performance standards recommended in the DEP's Stormwater Management Policy, necessary erosion and sedimentation control measures will be utilized during construction.

Standard 9: Operation and Maintenance Plan

An operations and maintenance plan is included in Attachment I.

Standard 10: Prohibition of Illicit Discharges

An illicit discharge compliance statement has been included in Attachment J.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including any relevant soil evaluations, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan, the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement 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

4-17-2024

Signature and Date

Attachment A - Locus Map

300 150 0 300

SCALE 1"= 300'

LOCUS MAP

Weston & Sampson

Weston & Sampson Engineers, Inc.
55 Walkers Brook Drive, Suite 100, Reading MA 01867

Attachment B - NOAA Atlas 14 Precipitation Frequency Estimates

NOAA Atlas 14, Volume 10, Version 3
Location name: Worcester, Massachusetts, USA*
Latitude: 42.3014°, Longitude: -71.7649°
Elevation: 442 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.345** (0.272-0.432)	**0.405** (0.319-0.507)	**0.503** (0.395-0.633)	**0.585** (0.456-0.739)	**0.697** (0.525-0.921)	**0.782** (0.575-1.06)	**0.869** (0.619-1.22)	**0.963** (0.652-1.39)	**1.09** (0.711-1.64)	**1.20** (0.758-1.84)
10-min	**0.489** (0.386-0.612)	**0.574** (0.452-0.719)	**0.713** (0.560-0.896)	**0.828** (0.646-1.05)	**0.987** (0.743-1.30)	**1.11** (0.816-1.50)	**1.23** (0.877-1.73)	**1.36** (0.923-1.97)	**1.55** (1.01-2.33)	**1.70** (1.08-2.61)
15-min	**0.575** (0.454-0.720)	**0.675** (0.532-0.846)	**0.839** (0.659-1.05)	**0.974** (0.761-1.23)	**1.16** (0.875-1.54)	**1.30** (0.960-1.76)	**1.45** (1.03-2.03)	**1.61** (1.09-2.32)	**1.82** (1.18-2.74)	**2.00** (1.26-3.07)
30-min	**0.776** (0.613-0.971)	**0.912** (0.719-1.14)	**1.13** (0.891-1.42)	**1.32** (1.03-1.67)	**1.57** (1.18-2.08)	**1.77** (1.30-2.39)	**1.96** (1.40-2.76)	**2.18** (1.47-3.15)	**2.48** (1.61-3.72)	**2.71** (1.72-4.16)
60-min	**0.977** (0.771-1.22)	**1.15** (0.906-1.44)	**1.43** (1.12-1.80)	**1.66** (1.30-2.10)	**1.98** (1.50-2.62)	**2.23** (1.64-3.01)	**2.48** (1.77-3.48)	**2.75** (1.86-3.98)	**3.13** (2.03-4.70)	**3.42** (2.17-5.26)
2-hr	**1.23** (0.975-1.52)	**1.46** (1.16-1.82)	**1.84** (1.45-2.30)	**2.15** (1.69-2.70)	**2.58** (1.96-3.41)	**2.91** (2.16-3.93)	**3.25** (2.34-4.58)	**3.65** (2.48-5.25)	**4.23** (2.75-6.31)	**4.71** (2.99-7.19)
3-hr	**1.40** (1.12-1.74)	**1.68** (1.34-2.08)	**2.13** (1.69-2.65)	**2.50** (1.97-3.13)	**3.01** (2.30-3.96)	**3.39** (2.54-4.58)	**3.80** (2.76-5.35)	**4.29** (2.92-6.15)	**5.01** (3.27-7.46)	**5.62** (3.57-8.54)
6-hr	**1.77** (1.42-2.17)	**2.13** (1.71-2.62)	**2.72** (2.18-3.37)	**3.22** (2.55-4.00)	**3.90** (2.99-5.10)	**4.40** (3.31-5.91)	**4.94** (3.61-6.93)	**5.59** (3.82-7.97)	**6.58** (4.30-9.73)	**7.42** (4.73-11.2)
12-hr	**2.21** (1.78-2.70)	**2.68** (2.16-3.28)	**3.44** (2.77-4.23)	**4.08** (3.26-5.04)	**4.96** (3.83-6.45)	**5.60** (4.24-7.48)	**6.30** (4.62-8.78)	**7.14** (4.89-10.1)	**8.40** (5.52-12.3)	**9.48** (6.06-14.2)
24-hr	**2.62** (2.14-3.19)	**3.20** (2.60-3.89)	**4.14** (3.36-5.06)	**4.93** (3.96-6.05)	**6.00** (4.66-7.77)	**6.80** (5.17-9.02)	**7.66** (5.66-10.6)	**8.70** (5.98-12.2)	**10.3** (6.77-15.0)	**11.6** (7.45-17.3)
2-day	**2.96** (2.42-3.57)	**3.63** (2.97-4.39)	**4.73** (3.86-5.74)	**5.64** (4.57-6.89)	**6.90** (5.40-8.89)	**7.83** (6.00-10.3)	**8.84** (6.58-12.2)	**10.1** (6.96-14.1)	**12.0** (7.92-17.4)	**13.6** (8.78-20.2)
3-day	**3.20** (2.64-3.85)	**3.93** (3.23-4.73)	**5.11** (4.19-6.18)	**6.10** (4.96-7.41)	**7.45** (5.85-9.56)	**8.44** (6.49-11.1)	**9.53** (7.11-13.1)	**10.9** (7.52-15.1)	**12.9** (8.57-18.7)	**14.7** (9.50-21.7)
4-day	**3.44** (2.84-4.12)	**4.19** (3.46-5.04)	**5.44** (4.46-6.55)	**6.46** (5.27-7.84)	**7.88** (6.21-10.1)	**8.93** (6.88-11.7)	**10.1** (7.52-13.8)	**11.5** (7.95-15.9)	**13.6** (9.04-19.6)	**15.5** (10.0-22.8)
7-day	**4.10** (3.40-4.89)	**4.92** (4.08-5.88)	**6.27** (5.18-7.52)	**7.39** (6.06-8.91)	**8.92** (7.06-11.3)	**10.1** (7.77-13.1)	**11.3** (8.45-15.4)	**12.8** (8.89-17.6)	**15.0** (9.99-21.5)	**16.9** (11.0-24.8)
10-day	**4.76** (3.97-5.66)	**5.62** (4.68-6.69)	**7.02** (5.82-8.40)	**8.19** (6.74-9.85)	**9.79** (7.76-12.4)	**11.0** (8.50-14.2)	**12.3** (9.16-16.5)	**13.8** (9.61-18.9)	**16.0** (10.7-22.8)	**17.8** (11.6-26.0)
20-day	**6.80** (5.71-8.04)	**7.72** (6.47-9.12)	**9.21** (7.68-10.9)	**10.4** (8.66-12.5)	**12.1** (9.66-15.1)	**13.4** (10.4-17.1)	**14.8** (11.0-19.5)	**16.2** (11.4-22.1)	**18.2** (12.2-25.7)	**19.7** (12.8-28.5)
30-day	**8.51** (7.17-10.0)	**9.45** (7.96-11.1)	**11.0** (9.22-13.0)	**12.3** (10.2-14.6)	**14.0** (11.2-17.3)	**15.4** (11.9-19.4)	**16.8** (12.4-21.8)	**18.1** (12.8-24.5)	**19.8** (13.3-27.9)	**21.1** (13.8-30.5)
45-day	**10.6** (9.00-12.5)	**11.6** (9.81-13.6)	**13.2** (11.1-15.6)	**14.5** (12.2-17.2)	**16.4** (13.1-20.1)	**17.8** (13.8-22.3)	**19.2** (14.2-24.8)	**20.5** (14.5-27.6)	**22.0** (14.9-30.8)	**23.0** (15.0-33.1)
60-day	**12.4** (10.5-14.5)	**13.4** (11.4-15.7)	**15.1** (12.7-17.7)	**16.5** (13.8-19.5)	**18.4** (14.7-22.4)	**19.9** (15.5-24.7)	**21.3** (15.8-27.3)	**22.5** (16.0-30.2)	**23.9** (16.2-33.4)	**24.8** (16.3-35.5)

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

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

Please refer to NOAA Atlas 14 document for more information.

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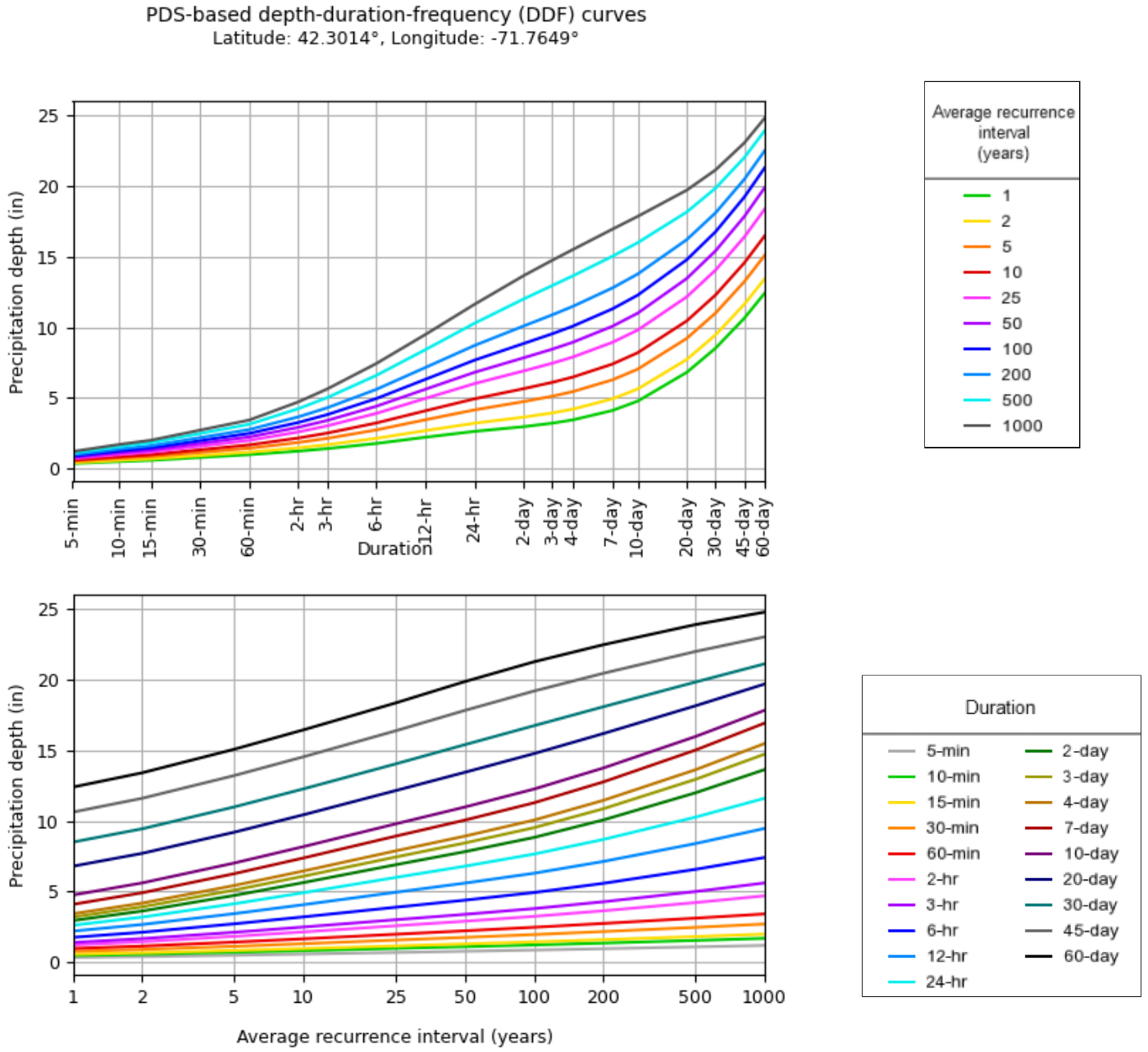
PF graphical



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Created (GMT): Thu Jan 4 02:22:42 2024

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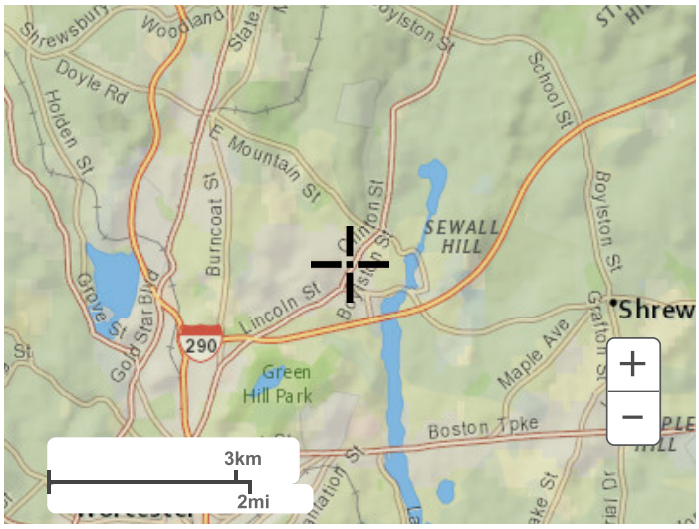
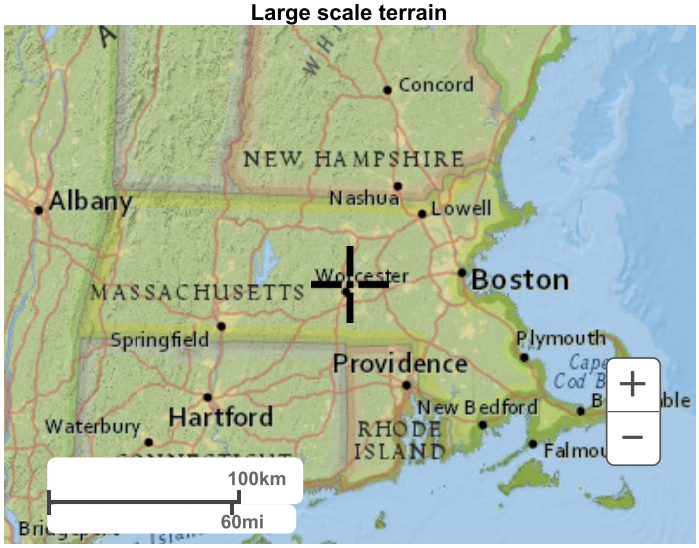
Maps & aerials

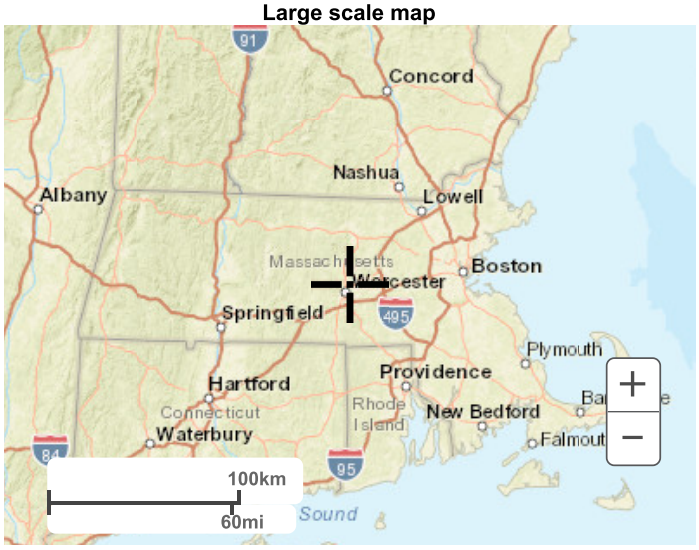
Small scale terrain



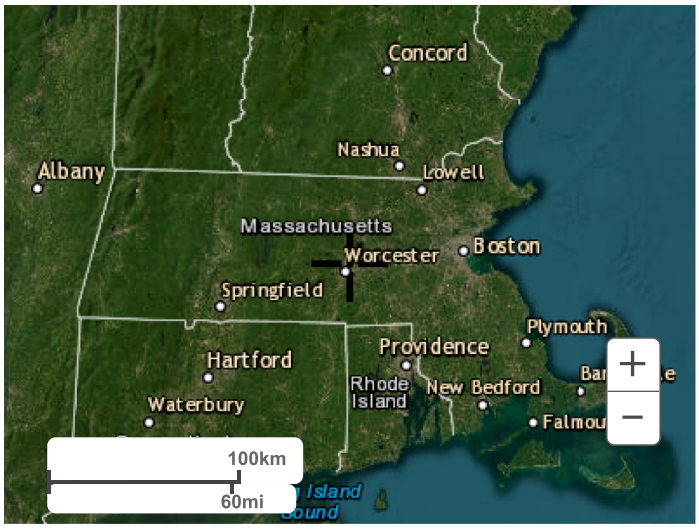
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Attachment C - NRCS Soils Map, Soils Report, HSG Classifications and Soil Boring Logs with Boring Location Plan

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Worcester County, Massachusetts, Northeastern Part

December 21, 2023

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:5,110 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part
Survey Area Data: Version 18, Sep 10, 2023

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
5A	Saco silt loam, frequently ponded, 0 to 2 percent slopes, frequently flooded	1.6	2.6%
31A	Walpole sandy loam, 0 to 3 percent slopes	1.4	2.3%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	1.1	1.7%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	6.7	11.0%
602	Urban land	32.8	53.6%
651	Udorthents, smoothed	17.6	28.8%
Totals for Area of Interest		**61.3**	**100.0%**

Map Unit Descriptions

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

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

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

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

Worcester County, Massachusetts, Northeastern Part

5A—Saco silt loam, frequently ponded, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 2zvfp
Elevation: 210 to 790 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Saco

Setting

Landform: Alluvial flats
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Friable coarse-silty alluvium derived from schist

Typical profile

H1 - 0 to 12 inches: silt loam
H2 - 12 to 37 inches: very fine sandy loam
H3 - 37 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 2 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 13.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D
Ecological site: F144AY016MA - Very Wet Low Floodplain
Hydric soil rating: Yes

Minor Components

Limerick

Percent of map unit: 10 percent

Landform: Alluvial flats
Hydric soil rating: Yes

Swansea

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

31A—Walpole sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svkl
Elevation: 0 to 1,350 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Walpole

Setting

Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy glaciofluvial deposits derived from igneous, metamorphic and sedimentary rock

Typical profile

Oe - 0 to 1 inches: mucky peat
A - 1 to 7 inches: sandy loam
Bg - 7 to 21 inches: sandy loam
BC - 21 to 25 inches: gravelly sandy loam
C - 25 to 65 inches: very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 4 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Ecological site: F144AY028MA - Wet Outwash
Hydric soil rating: Yes

Minor Components

Sudbury

Percent of map unit: 10 percent
Landform: Outwash plains
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Scarboro

Percent of map unit: 10 percent
Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

254B—Merrimac fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyqs
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread
Down-slope shape: Convex

Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Windsor

Percent of map unit: 3 percent
Landform: Outwash terraces, dunes, deltas, outwash plains

Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Outwash plains, outwash terraces, moraines, stream terraces, eskers, kames
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

305B—Paxton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2qp
Elevation: 0 to 1,570 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Paxton

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Drainage class: Well drained

Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge
Percent of map unit: 9 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury
Percent of map unit: 6 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Charlton
Percent of map unit: 5 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

602—Urban land

Map Unit Setting
National map unit symbol: w3q8
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Excavated and filled land

651—Udorthents, smoothed

Map Unit Setting

National map unit symbol: w3q6

Elevation: 180 to 1,020 feet

Mean annual precipitation: 32 to 50 inches

Mean annual air temperature: 45 to 50 degrees F

Frost-free period: 145 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 80 percent

Urban land: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Parent material: Made land over firm loamy basal till

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

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Project: Curtis Apartments
Location:
City/State: Worcester, MA

Job #: 7478.2.00
Date Started: 9-16-22
Date Finished: 9-16-22

Boring No.
B-1 (OW)

Contractor: TDS
Driller/Helper: Arry/Gary
Logged By/Reviewed By: C. Skeldon
Surface Elevation (ft): 449.2

Casing Type/Depth (ft): 3.75" HSA
Casing Hammer (lbs)/Drop (in): NA
Sampler Size/Type: 24" Split Spoon
Sampler Hammer (lbs)/Drop (in): 140/30

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample TVOC (ppm)	Sample N-Value / RQD	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows/6" / Min/ft	Sample Description and Boring Notes
	449		0.3 / 448.9	ASPHALT							
1	448				0.1	17	S1	24/12	0.0-2.0	13 7 10 16	Compact, light brown, SAND and GRAVEL, some silt. (Fill)
2	447				0.0	22	S2	12/6	2.0-3.0	14 8	Compact, light brown, SAND and GRAVEL, some silt. (Fill)
3	446			FILL	0.0	10	S2A	12/8	3.0-4.0	6 4	Loose to compact, light brown, silty fine to medium SAND, trace to some gravel. (Alluvium)
4	445				0.1	10	S3	18/12	4.0-5.5	7 5 5	Loose to compact, brown, fine to coarse SAND and GRAVEL, some silt. (Glacial Outwash)
5	444		5.5 / 443.7		0.1	7/6"	S3A	6/4	5.5-6.0	7 11	Compact, light brown, fine to coarse SAND and GRAVEL, trace silt. (Glacial Outwash)
6	443				0.1	16	S4	24/14	6.0-8.0	6 10 16	Compact, light brown, fine to coarse SAND and GRAVEL, trace to some silt. (Glacial Outwash)
7	442										
8	441				0.1	23	S5	24/8	8.0-10.0	13 13 10 15	Compact, light brown, fine to coarse SAND and GRAVEL, trace silt. (Glacial Outwash)
9	440										
10	439				0.1	14	S6	24/14	10.0-12.0	13 7 7 6	Compact, light brown, fine to medium SAND and GRAVEL, trace silt, with 2 inch band of silty fine sand. (Glacial Outwash)
11	438										
12	437										
13	436										
14	435			GLACIAL OUTWASH							
15	434				0.0	16	S7	24/12	15.0-17.0	15 8 8 9	Compact, light brown, fine to coarse SAND and GRAVEL, trace silt. (Glacial Outwash)
16	433										
17	432										
18	431										
19	430										
20	429				0.0	17	S8	24/3	20.0-22.0	9 9 8 7	Compact, light brown, fine to coarse SAND and GRAVEL, trace to some silt. (Glacial Outwash)
21	428										
22	427		22.0 / 427.2	Bottom of borehole 22 feet below ground surface.							
23	426										
24	425										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
20 foot well with 10 feet of screen installed.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Clear
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Curtis Apartments
Location:
City/State: Worcester, MA

Job #: 7478.2.00
Date Started: 9-16-22
Date Finished: 9-16-22

Boring No.
B-2 (OW)

Contractor: TDS
Driller/Helper: Arry/Gary
Logged By/Reviewed By: C. Skeldon
Surface Elevation (ft): 449.7

Casing Type/Depth (ft): 3.75" HSA
Casing Hammer (lbs)/Drop (in): NA
Sampler Size/Type: 24" Split Spoon
Sampler Hammer (lbs)/Drop (in): 140/30

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample: TVOC (ppm)	Sample: N-Value / RQD	Sample: No.	Sample: Pen./Rec. (in)	Sample: Depth (ft)	Sample: Blows/6" Min/ft	Sample Description and Boring Notes
1	449		0.3 / 449.4	ASPHALT						26	
				FILL		11	S1	24/	0.0-2.0	7	Compact, light brown, SAND and GRAVEL, some silt, with asphalt and brick. (Fill)
2	448									4	
			2.5 / 447.2							4	
3	447				0.1	3/6"	S2	6/2	2.0-2.5	3	
				ALLUVIUM						2	Loose, light brown, sandy GRAVEL, trace to some silt, with asphalt. (Fill)
4	446		4.0 / 445.7		0.1	3	S2A	18/10	2.5-4.0	1	Very loose, light brown, silty fine to medium SAND, trace to some gravel. (Alluvium)
										5	
5	445									6	
					0.8	21	S3	24/12	4.0-6.0	9	Compact, light brown, fine to coarse SAND and GRAVEL, trace silt. (Glacial Outwash)
6	444									12	
										11	
7	443				0.2	23	S4	24/14	6.0-8.0	12	Compact, light brown, fine to coarse SAND and GRAVEL, trace silt. (Glacial Outwash)
										12	
8	442									11	
										14	
9	441				0.6	18	S5	24/10	8.0-10.0	10	Compact, light brown, fine to coarse SAND and GRAVEL, trace silt. (Glacial Outwash)
10	440									10	
										8	
11	439									6	
					0.0	20	S6	24/5	10.0-12.0	11	Compact, light brown, fine to coarse SAND and GRAVEL, trace to some silt. (Glacial Outwash)
12	438			GLACIAL OUTWASH						11	
										9	
13	437									8	
14	436										
15	435										
					0.5	16	S7	24/12	15.0-17.0	5	Compact, light brown, fine to coarse SAND and GRAVEL, trace silt. (Glacial Outwash)
16	434									6	
										10	
17	433									12	
18	432										
19	431										
20	430		20.0 / 429.7								
				GLACIAL TILL	0.2	34	S8	24/14	20.0-22.0	14	Dense, gray-brown, silty fine to medium SAND and GRAVEL. (Glacial Till)
21	429									15	
22	428		22.0 / 427.7							19	
										23	
23	427			Bottom of borehole 22 feet below ground surface.							
24	426										
	425										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
20 foot well with 10 feet of screen installed.

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Clear
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

-Potential UST location

-Elevation benchmark

-Location of monitoring well installation

NORTH

BROOKVIEW DRIVE
PUBLIC- 60' WIDE R.O.W.)
60' WIDE
(ASPHALT ROADWAY)

Building #32

BOYLSTON STREET
(PUBLIC - 100' WIDE R.O.W.)
VARIABLE WIDTH
(ASPHALT ROADWAY)

GREAT BROOK VALLEY AVENUE
PUBLIC- 60' WIDE R.O.W.)
60' WIDE
(ASPHALT ROADWAY)

Borings within Phase 2 Limits

B-1(OW)
B-2(OW)
B-4(OW)

Estimate at 36" DIAM. CO

TACOMA STREET
PUBLIC 50' WIDE ROW
50' WIDE
TWITC
(ASPHALT ROADWAY)

GREAT BROOK VALLEY AVENUE
(PUBLIC - 60' WIDE R.O.W.)
60' WIDE
(ASPHALT ROADWAY)

PASADENA PARKWAY
(PUBLIC - 50' WIDE R.O.W.)
50' WIDE
(ASPHALT ROADWAY)

GRAPHIC SCALE

50 0 50 100 200

LEGEND

— APPROXIMATE LOCATION OF PROPOSED BORING

APPROXIMATE LIMITS OF PROPOSED BUILDING

REFERENCE: THIS PLAN WAS PREPARED FROM A _____

FILE NAME: N:\Acad\JOBS\7478\7478-F02.dwg

McPHAIL ASSOCIATES, LLC
Geotechnical and Geoenvironmental Engineers
2269 Massachusetts Avenue
Cambridge, MA 02140
617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

CURTIS APARTMENTS

WORCESTER MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

FOR

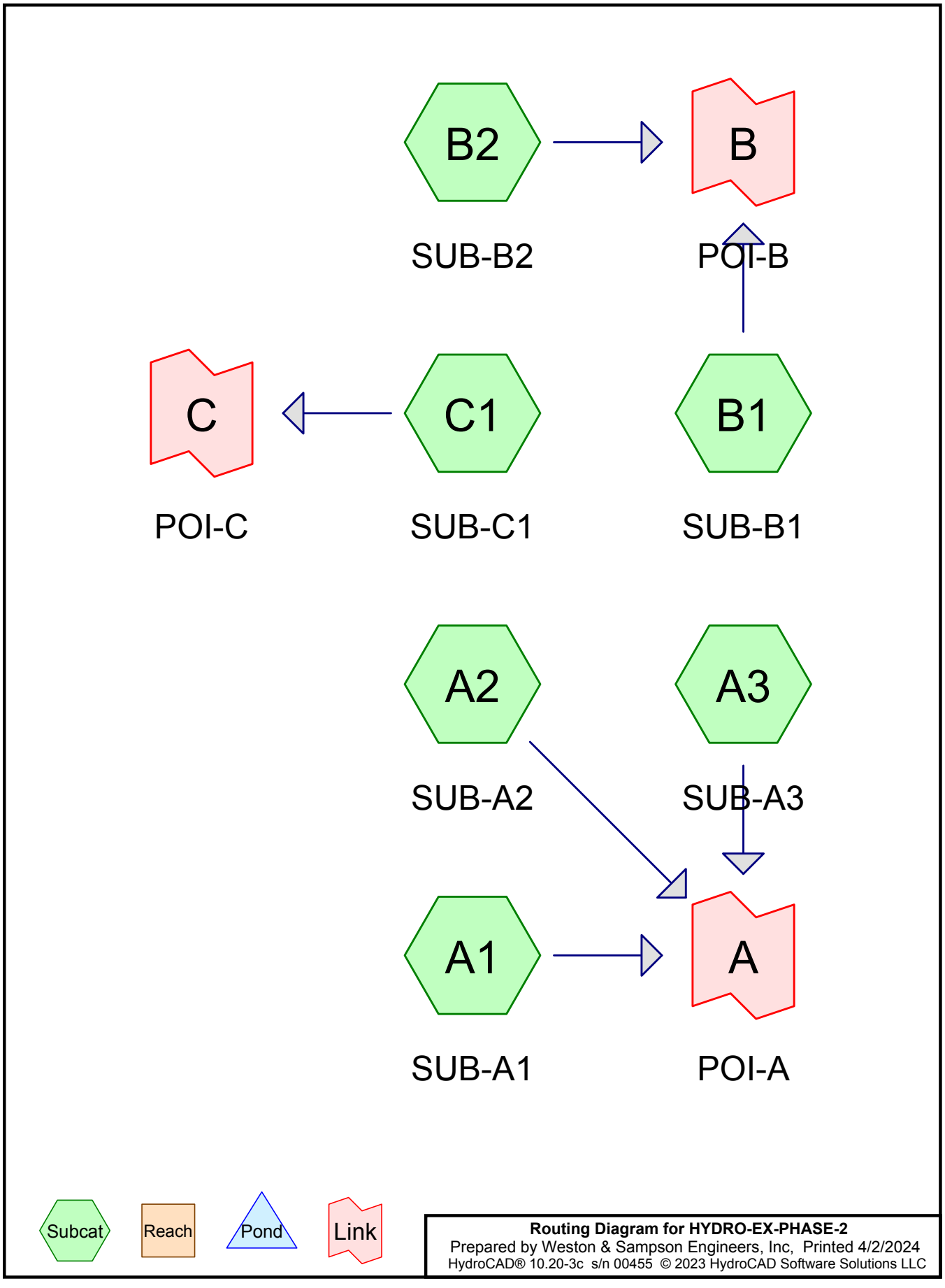
TRINITY FINANCIAL, INC.

BY

McPHAIL ASSOCIATES, LLC

Date: AUGUST 2022	Dwn: F.G.P.	Chkd: J.D.S.	Scale: 1" = 50'
Project No: 7478			FIGURE 2

Attachment D - HydroCAD Reports



Routing Diagram for HYDRO-EX-PHASE-2

Prepared by Weston & Sampson Engineers, Inc, Printed 4/2/2024

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.20	2
2	10-year	Type III 24-hr		Default	24.00	1	4.93	2
3	100-year	Type III 24-hr		Default	24.00	1	7.66	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
90,419	39	>75% Grass cover, Good, HSG A (A2, A3, B1, B2, C1)
49,578	74	>75% Grass cover, Good, HSG C (A1)
276	96	Gravel surface, HSG C (A1)
260,753	98	Impervious Surfaces (A1, A2, A3, B1, B2, C1)
2,372	30	Woods, Good, HSG A (C1)
403,398	**81**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
92,791	HSG A	A2, A3, B1, B2, C1
0	HSG B	
49,854	HSG C	A1
0	HSG D	
260,753	Other	A1, A2, A3, B1, B2, C1
403,398		**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	Su Nu
90,419	0	49,578	0	0	139,997	>75% Grass cover, Good	
0	0	276	0	0	276	Gravel surface	
0	0	0	0	260,753	260,753	Impervious Surfaces	
2,372	0	0	0	0	2,372	Woods, Good	
92,791	**0**	**49,854**	**0**	**260,753**	**403,398**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=99,996 sf 50.14% Impervious Runoff Depth=1.84"
Flow Length=531' Tc=6.0 min CN=86 Runoff=4.94 cfs 15,292 cf

SubcatchmentA2: SUB-A2 Runoff Area=27,998 sf 69.77% Impervious Runoff Depth=1.40"
Flow Length=30' Tc=6.0 min CN=80 Runoff=1.05 cfs 3,271 cf

SubcatchmentA3: SUB-A3 Runoff Area=49,976 sf 58.46% Impervious Runoff Depth=0.98"
Flow Length=82' Tc=6.0 min CN=73 Runoff=1.24 cfs 4,093 cf

SubcatchmentB1: SUB-B1 Runoff Area=156,547 sf 69.36% Impervious Runoff Depth=1.40"
Flow Length=188' Tc=6.2 min CN=80 Runoff=5.81 cfs 18,289 cf

SubcatchmentB2: SUB-B2 Runoff Area=42,241 sf 81.83% Impervious Runoff Depth=1.91"
Flow Length=67' Tc=6.0 min CN=87 Runoff=2.18 cfs 6,741 cf

SubcatchmentC1: SUB-C1 Runoff Area=26,640 sf 70.22% Impervious Runoff Depth=1.40"
Flow Length=431' Tc=7.3 min CN=80 Runoff=0.95 cfs 3,112 cf

Link A: POI-A Inflow=7.22 cfs 22,656 cf
Primary=7.22 cfs 22,656 cf

Link B: POI-B Inflow=7.98 cfs 25,029 cf
Primary=7.98 cfs 25,029 cf

Link C: POI-C Inflow=0.95 cfs 3,112 cf
Primary=0.95 cfs 3,112 cf

Total Runoff Area = 403,398 sf Runoff Volume = 50,798 cf Average Runoff Depth = 1.51"
35.36% Pervious = 142,645 sf 64.64% Impervious = 260,753 sf

Summary for Subcatchment A1: SUB-A1

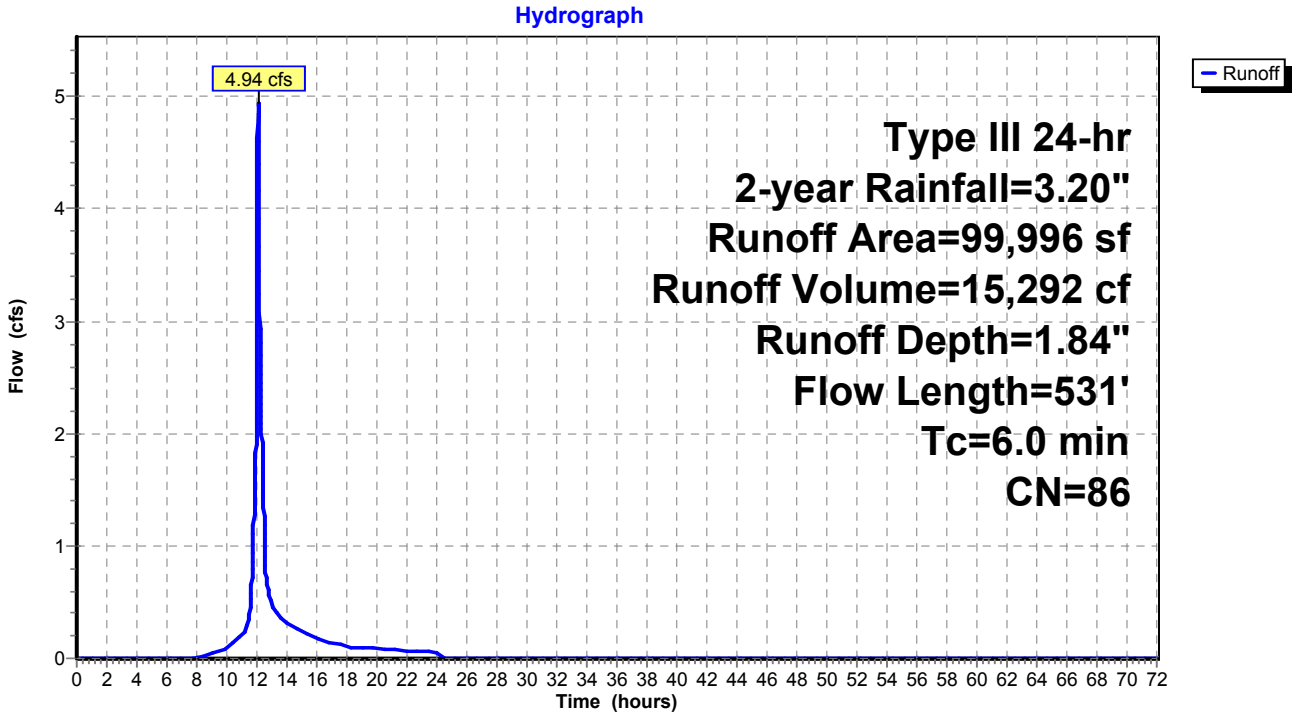
Runoff = 4.94 cfs @ 12.09 hrs, Volume= 15,292 cf, Depth= 1.84"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
*	50,142	98	Impervious Surfaces
	49,578	74	>75% Grass cover, Good, HSG C
	276	96	Gravel surface, HSG C
	99,996	86	Weighted Average
	49,854		49.86% Pervious Area
	50,142		50.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0750	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.6	214	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	127	0.0314	3.60		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	140	0.0600	11.11	8.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
5.7	531	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

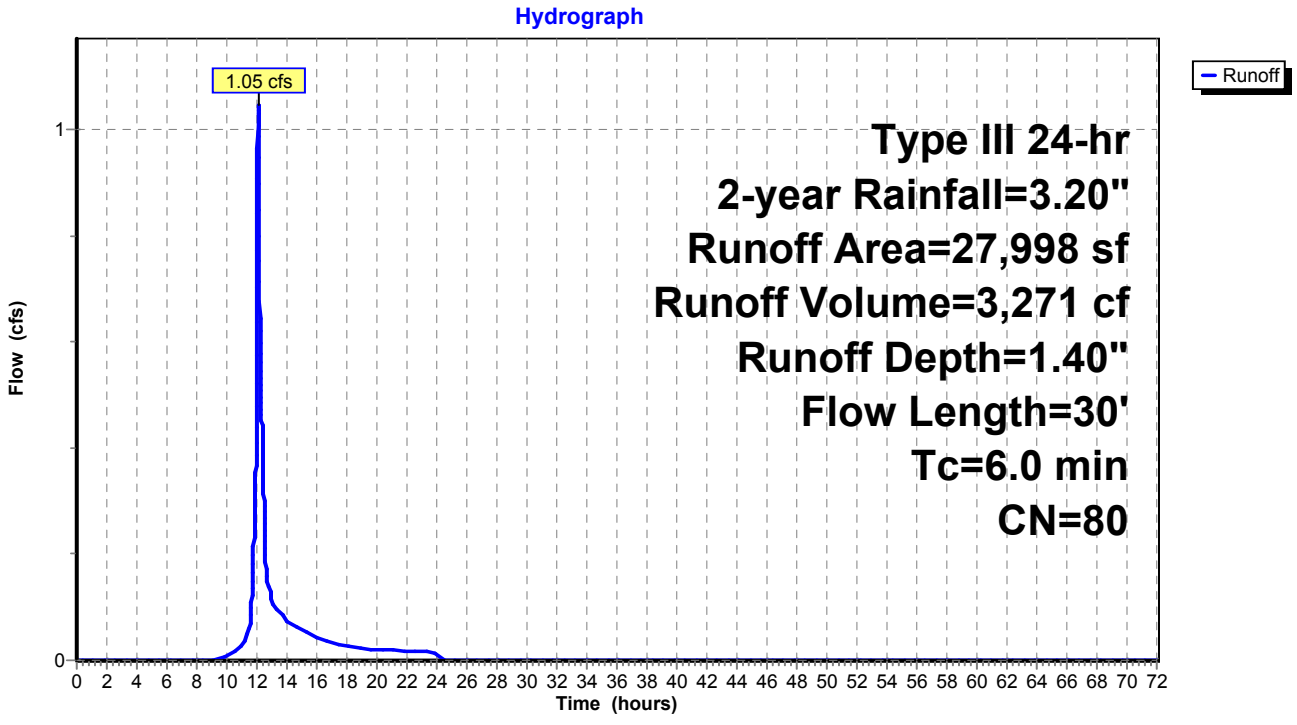
Runoff = 1.05 cfs @ 12.09 hrs, Volume= 3,271 cf, Depth= 1.40"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
*	19,533	98	Impervious Surfaces
	8,465	39	>75% Grass cover, Good, HSG A
	27,998	80	Weighted Average
	8,465		30.23% Pervious Area
	19,533		69.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	22	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	8	0.0150	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.1	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A2: SUB-A2



Summary for Subcatchment A3: SUB-A3

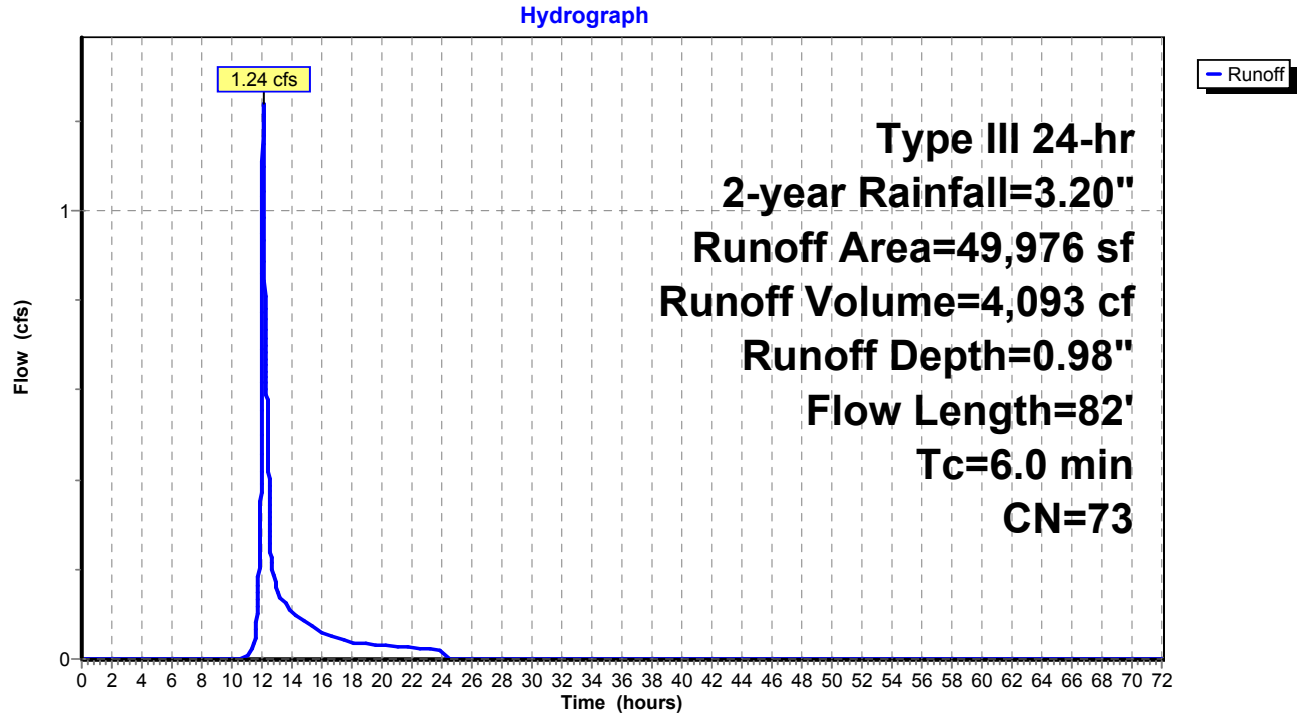
Runoff = 1.24 cfs @ 12.10 hrs, Volume= 4,093 cf, Depth= 0.98"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
*	29,218	98	Impervious Surfaces
	20,758	39	>75% Grass cover, Good, HSG A
	49,976	73	Weighted Average
	20,758		41.54% Pervious Area
	29,218		58.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	38	0.0310	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	12	0.0150	0.80		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.5	21	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.6	82	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A3: SUB-A3



Summary for Subcatchment B1: SUB-B1

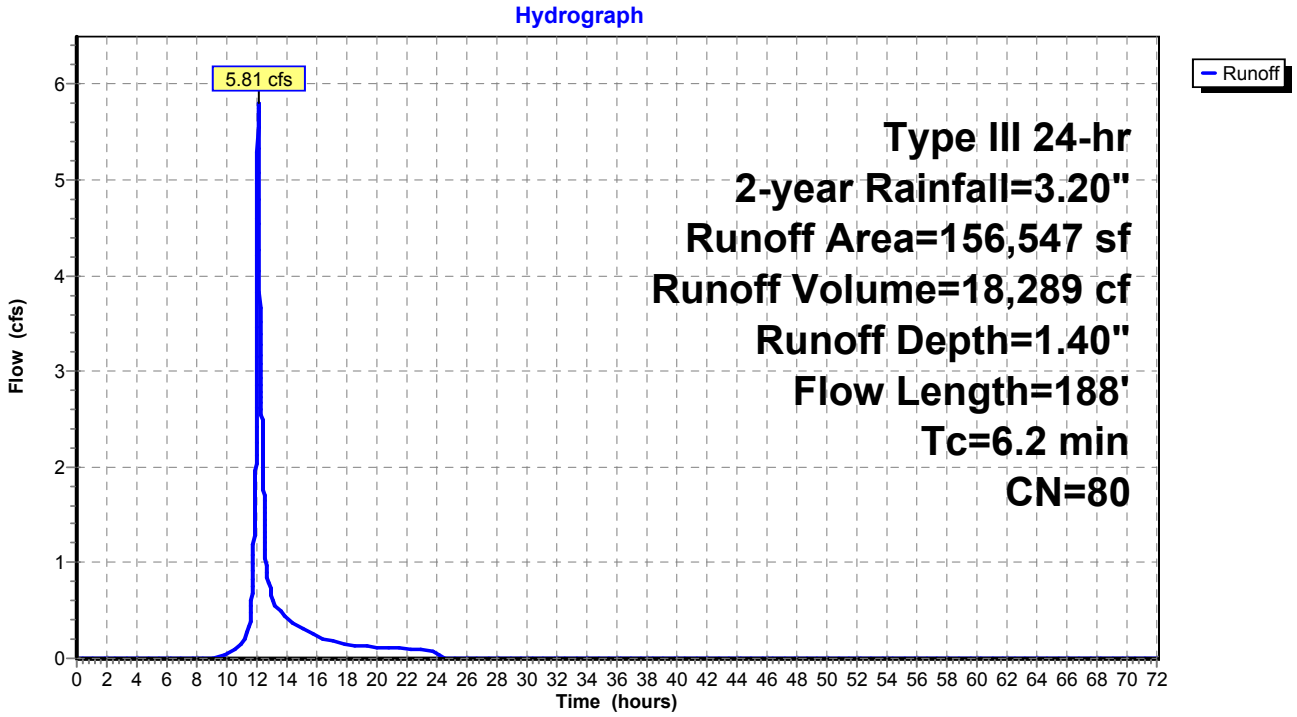
Runoff = 5.81 cfs @ 12.09 hrs, Volume= 18,289 cf, Depth= 1.40"
Routed to Link B : POI-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
*	108,587	98	Impervious Surfaces
	47,960	39	>75% Grass cover, Good, HSG A
	156,547	80	Weighted Average
	47,960		30.64% Pervious Area
	108,587		69.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0280	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	14	0.0280	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	10	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	39	0.0256	1.12		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	75	0.0245	3.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	188	Total			

Subcatchment B1: SUB-B1



Summary for Subcatchment B2: SUB-B2

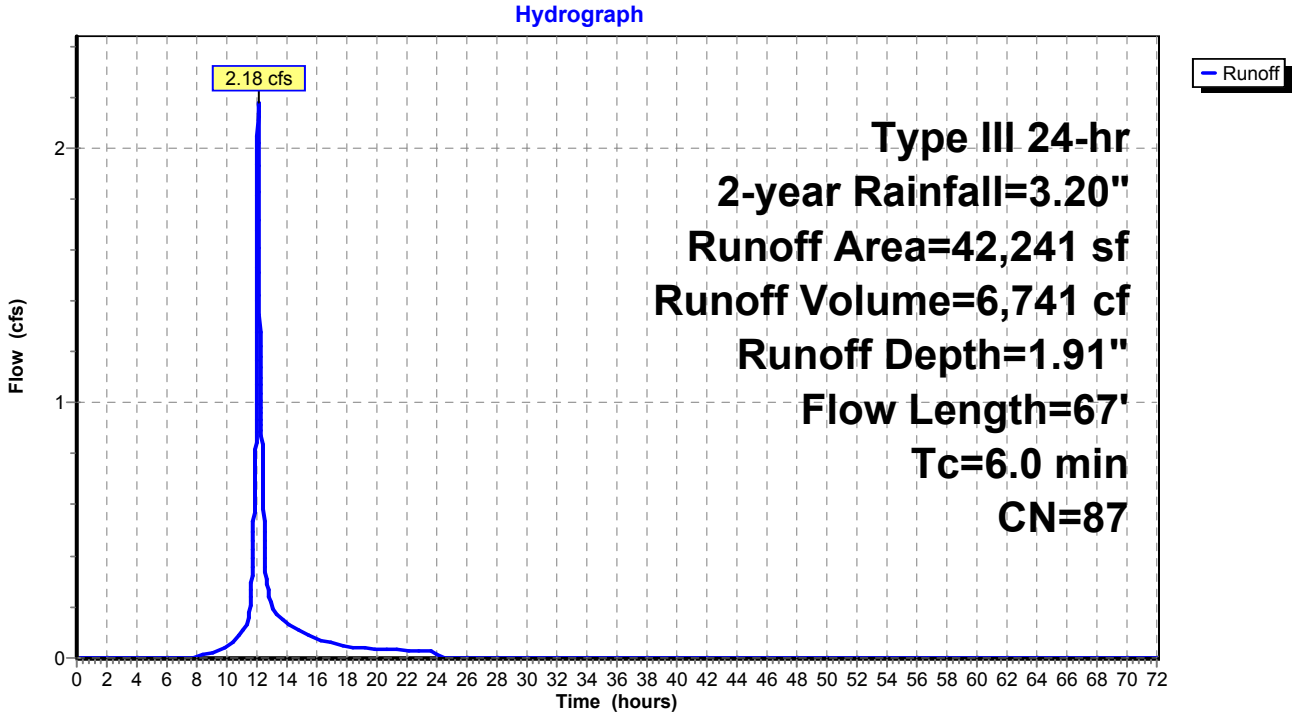
Runoff = 2.18 cfs @ 12.09 hrs, Volume= 6,741 cf, Depth= 1.91"
Routed to Link B : POI-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
*	34,567	98	Impervious Surfaces
	7,674	39	>75% Grass cover, Good, HSG A
	42,241	87	Weighted Average
	7,674		18.17% Pervious Area
	34,567		81.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	47	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.1	3	0.0150	0.61		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.1	17	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.6	67	Total, Increased to minimum Tc = 6.0 min			

Subcatchment B2: SUB-B2



Summary for Subcatchment C1: SUB-C1

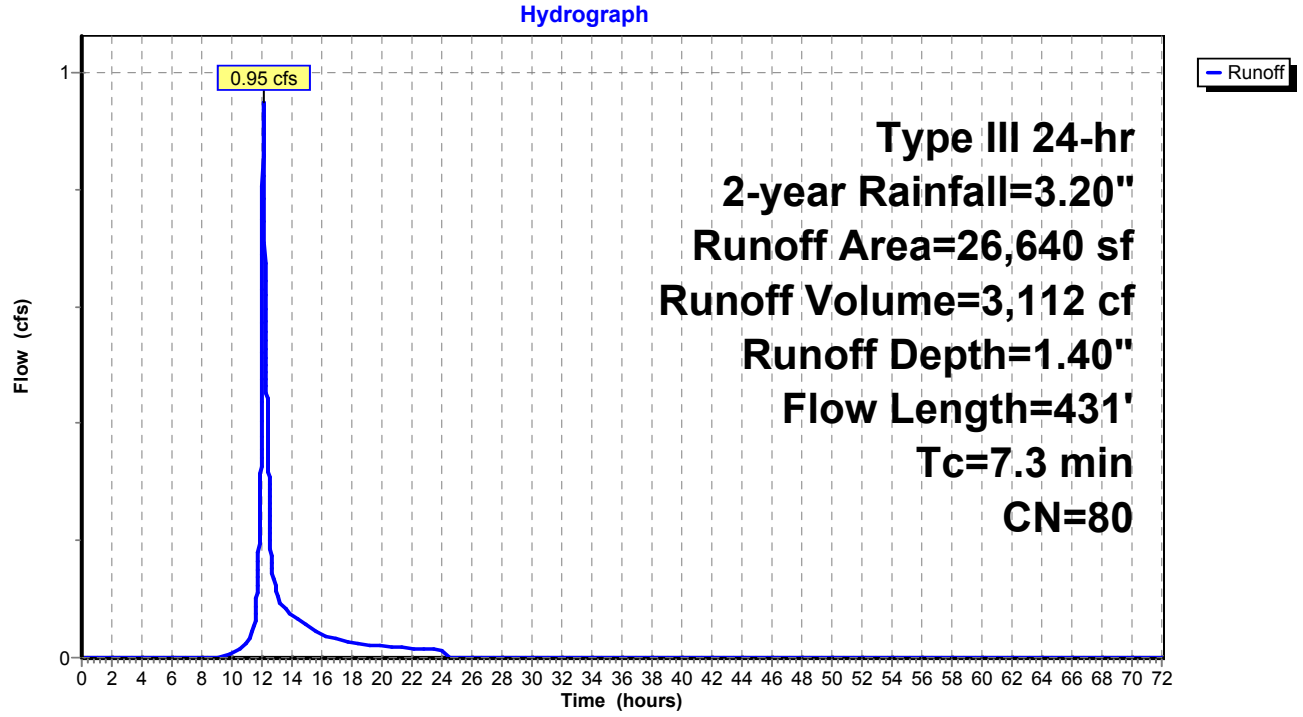
Runoff = 0.95 cfs @ 12.11 hrs, Volume= 3,112 cf, Depth= 1.40"
Routed to Link C : POI-C

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
*	18,706	98	Impervious Surfaces
	5,562	39	>75% Grass cover, Good, HSG A
	2,372	30	Woods, Good, HSG A
	26,640	80	Weighted Average
	7,934		29.78% Pervious Area
	18,706		70.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	85	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.3	296	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	431	Total			

Subcatchment C1: SUB-C1

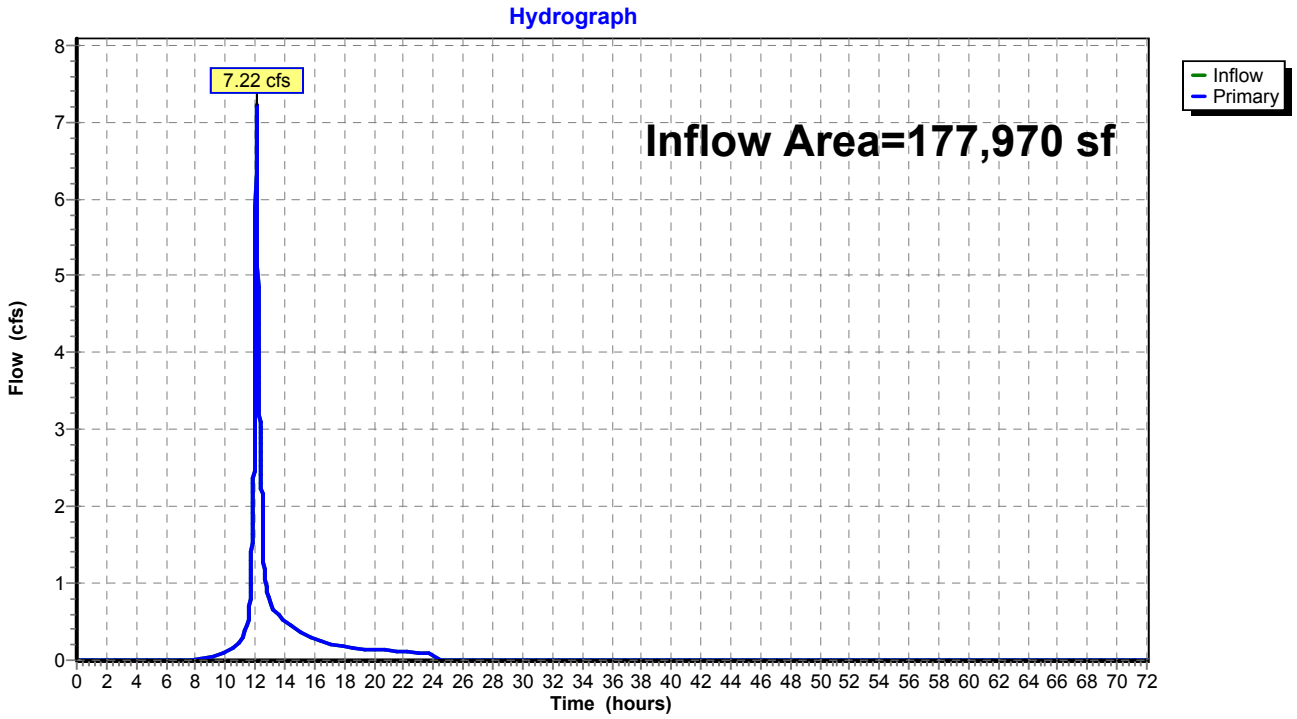


Summary for Link A: POI-A

Inflow Area = 177,970 sf, 55.57% Impervious, Inflow Depth = 1.53" for 2-year event
Inflow = 7.22 cfs @ 12.09 hrs, Volume= 22,656 cf
Primary = 7.22 cfs @ 12.09 hrs, Volume= 22,656 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link A: POI-A

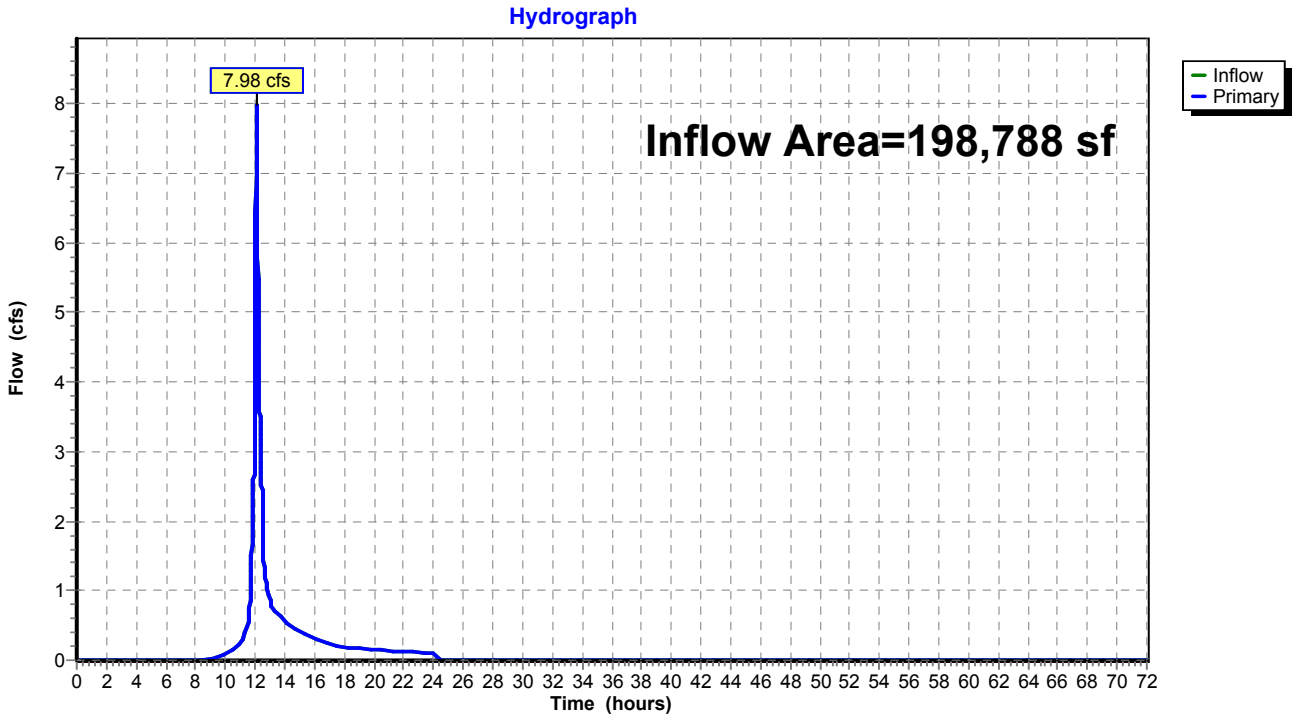


Summary for Link B: POI-B

Inflow Area = 198,788 sf, 72.01% Impervious, Inflow Depth = 1.51" for 2-year event
Inflow = 7.98 cfs @ 12.09 hrs, Volume= 25,029 cf
Primary = 7.98 cfs @ 12.09 hrs, Volume= 25,029 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link B: POI-B

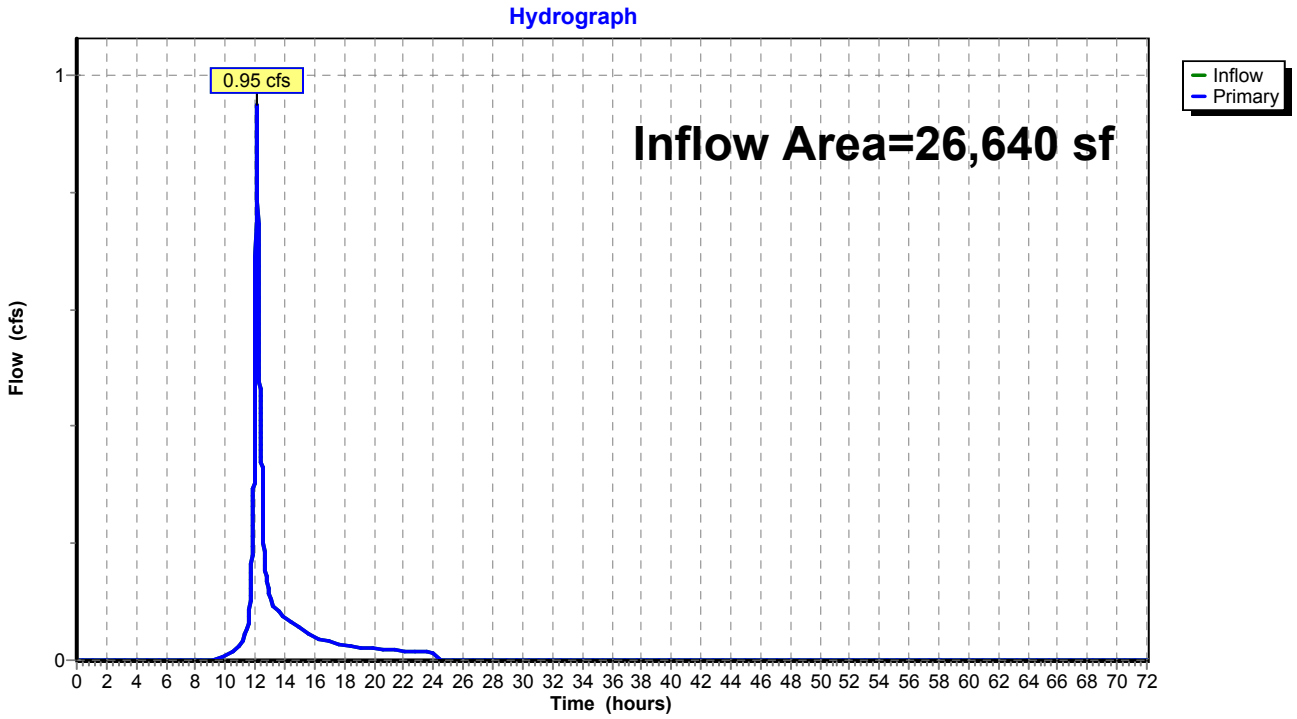


Summary for Link C: POI-C

Inflow Area = 26,640 sf, 70.22% Impervious, Inflow Depth = 1.40" for 2-year event
Inflow = 0.95 cfs @ 12.11 hrs, Volume= 3,112 cf
Primary = 0.95 cfs @ 12.11 hrs, Volume= 3,112 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link C: POI-C



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=99,996 sf 50.14% Impervious Runoff Depth=3.40"
Flow Length=531' Tc=6.0 min CN=86 Runoff=9.04 cfs 28,347 cf

SubcatchmentA2: SUB-A2 Runoff Area=27,998 sf 69.77% Impervious Runoff Depth=2.83"
Flow Length=30' Tc=6.0 min CN=80 Runoff=2.13 cfs 6,607 cf

SubcatchmentA3: SUB-A3 Runoff Area=49,976 sf 58.46% Impervious Runoff Depth=2.23"
Flow Length=82' Tc=6.0 min CN=73 Runoff=2.97 cfs 9,269 cf

SubcatchmentB1: SUB-B1 Runoff Area=156,547 sf 69.36% Impervious Runoff Depth=2.83"
Flow Length=188' Tc=6.2 min CN=80 Runoff=11.85 cfs 36,943 cf

SubcatchmentB2: SUB-B2 Runoff Area=42,241 sf 81.83% Impervious Runoff Depth=3.50"
Flow Length=67' Tc=6.0 min CN=87 Runoff=3.91 cfs 12,325 cf

SubcatchmentC1: SUB-C1 Runoff Area=26,640 sf 70.22% Impervious Runoff Depth=2.83"
Flow Length=431' Tc=7.3 min CN=80 Runoff=1.94 cfs 6,287 cf

Link A: POI-A Inflow=14.14 cfs 44,223 cf
Primary=14.14 cfs 44,223 cf

Link B: POI-B Inflow=15.76 cfs 49,269 cf
Primary=15.76 cfs 49,269 cf

Link C: POI-C Inflow=1.94 cfs 6,287 cf
Primary=1.94 cfs 6,287 cf

Total Runoff Area = 403,398 sf Runoff Volume = 99,779 cf Average Runoff Depth = 2.97"
35.36% Pervious = 142,645 sf 64.64% Impervious = 260,753 sf

Summary for Subcatchment A1: SUB-A1

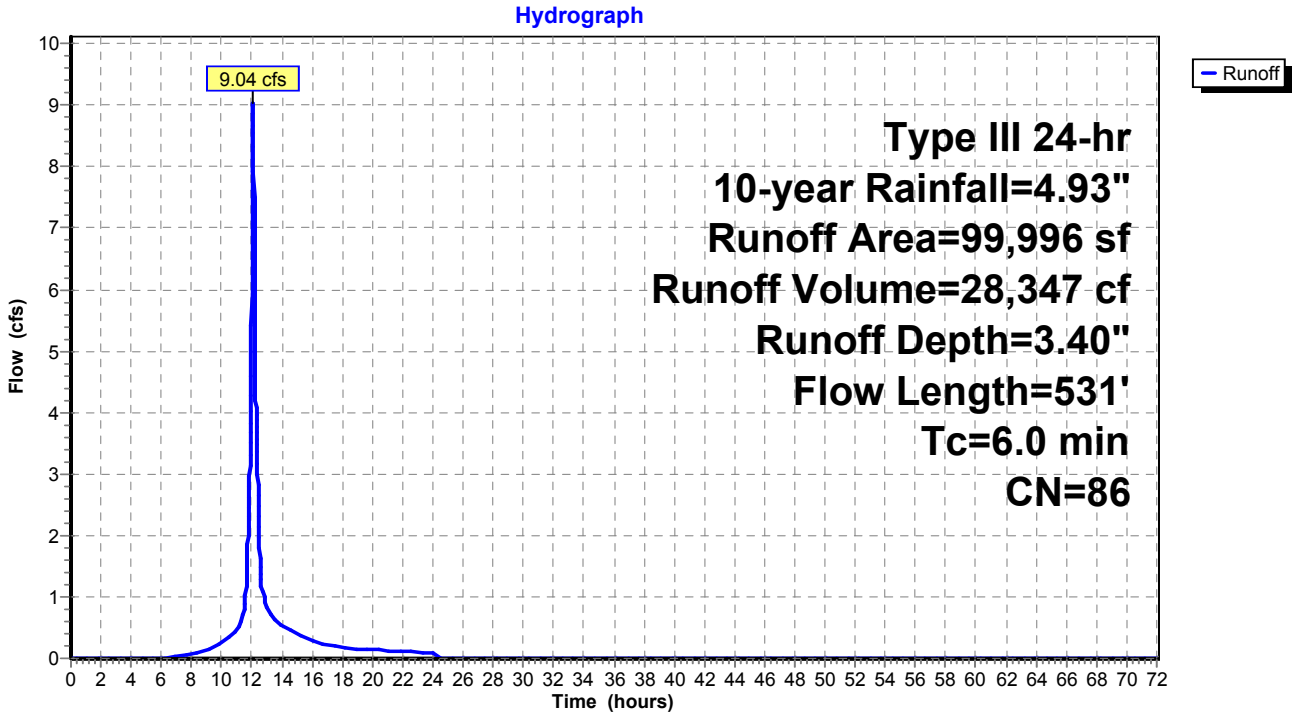
Runoff = 9.04 cfs @ 12.09 hrs, Volume= 28,347 cf, Depth= 3.40"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
*	50,142	98	Impervious Surfaces
	49,578	74	>75% Grass cover, Good, HSG C
	276	96	Gravel surface, HSG C
	99,996	86	Weighted Average
	49,854		49.86% Pervious Area
	50,142		50.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0750	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.6	214	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	127	0.0314	3.60		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	140	0.0600	11.11	8.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
5.7	531	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

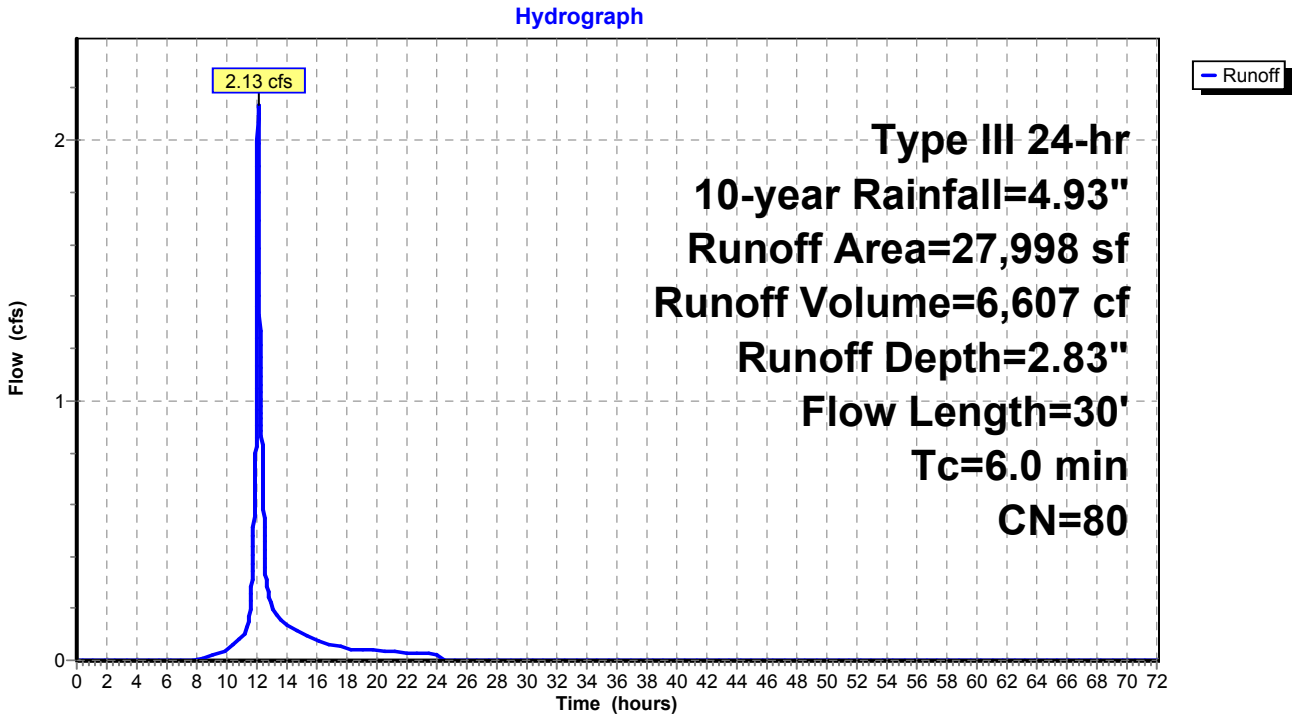
Runoff = 2.13 cfs @ 12.09 hrs, Volume= 6,607 cf, Depth= 2.83"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
*	19,533	98	Impervious Surfaces
	8,465	39	>75% Grass cover, Good, HSG A
	27,998	80	Weighted Average
	8,465		30.23% Pervious Area
	19,533		69.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	22	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	8	0.0150	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.1	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A2: SUB-A2



Summary for Subcatchment A3: SUB-A3

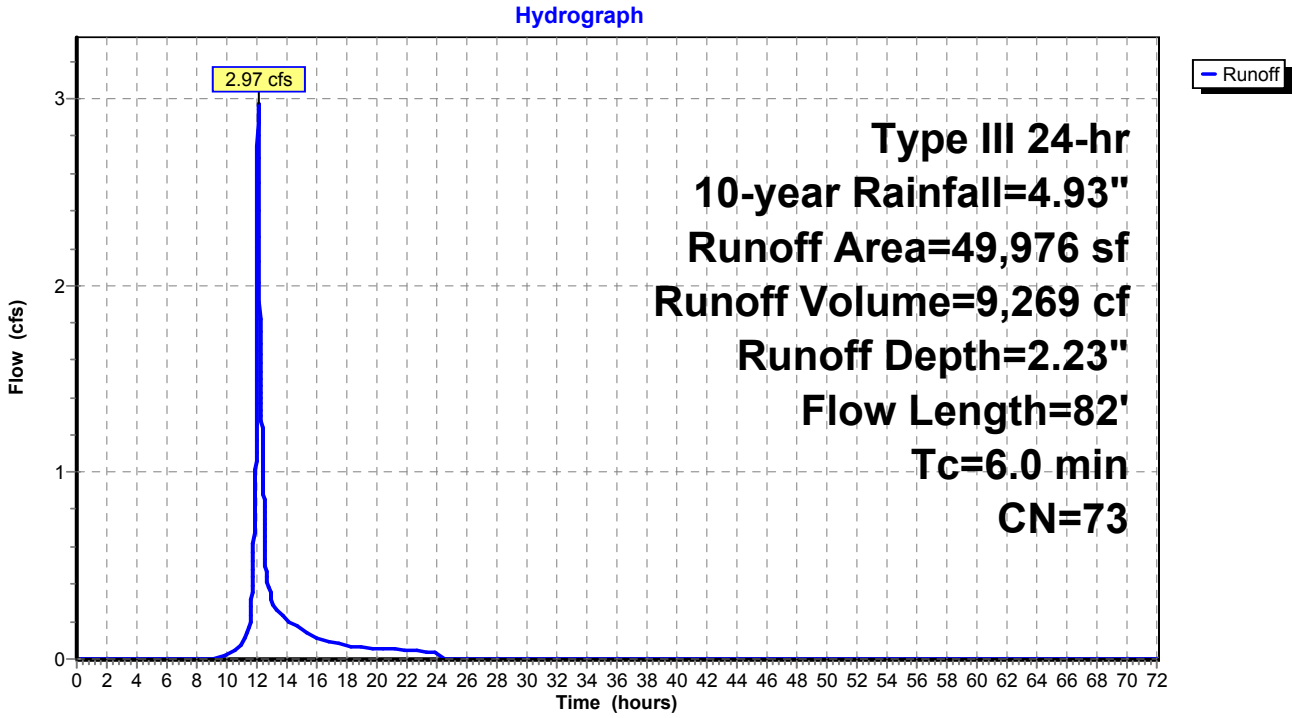
Runoff = 2.97 cfs @ 12.09 hrs, Volume= 9,269 cf, Depth= 2.23"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
*	29,218	98	Impervious Surfaces
	20,758	39	>75% Grass cover, Good, HSG A
	49,976	73	Weighted Average
	20,758		41.54% Pervious Area
	29,218		58.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	38	0.0310	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	12	0.0150	0.80		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.5	21	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.6	82	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A3: SUB-A3



Summary for Subcatchment B1: SUB-B1

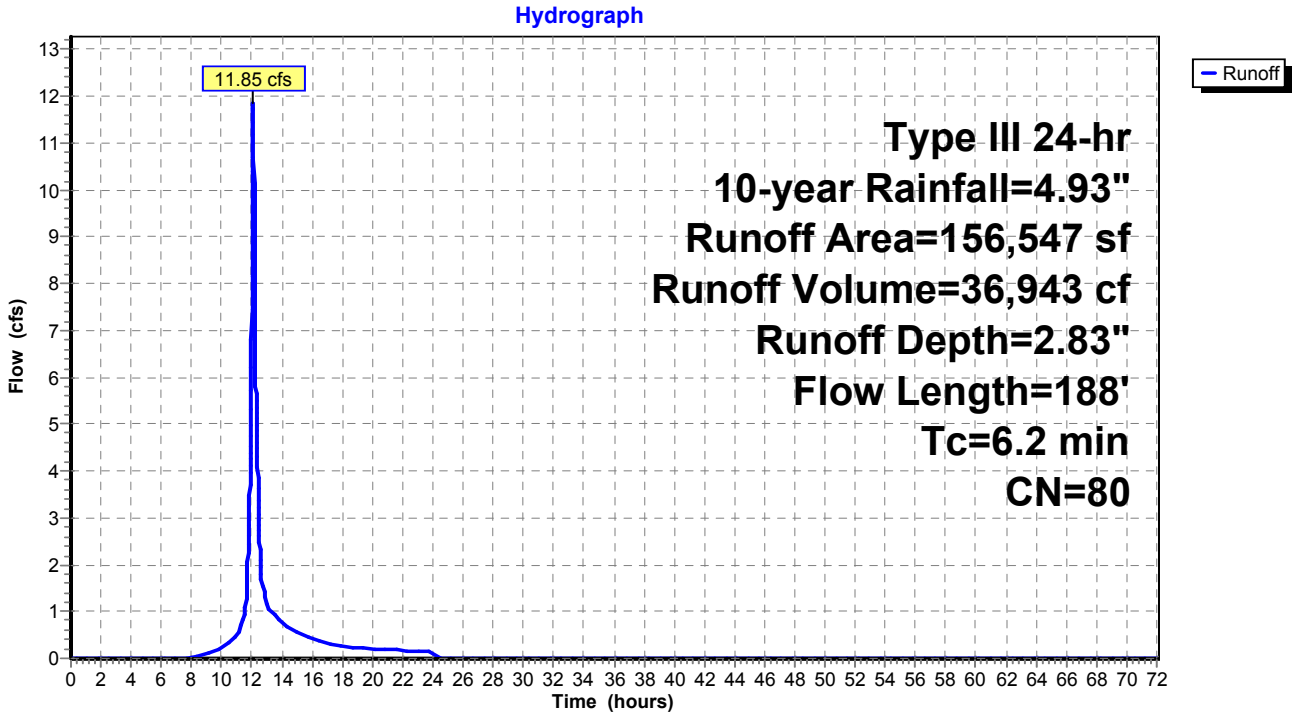
Runoff = 11.85 cfs @ 12.09 hrs, Volume= 36,943 cf, Depth= 2.83"
Routed to Link B : POI-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
*	108,587	98	Impervious Surfaces
	47,960	39	>75% Grass cover, Good, HSG A
	156,547	80	Weighted Average
	47,960		30.64% Pervious Area
	108,587		69.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0280	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	14	0.0280	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	10	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	39	0.0256	1.12		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	75	0.0245	3.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	188	Total			

Subcatchment B1: SUB-B1



Summary for Subcatchment B2: SUB-B2

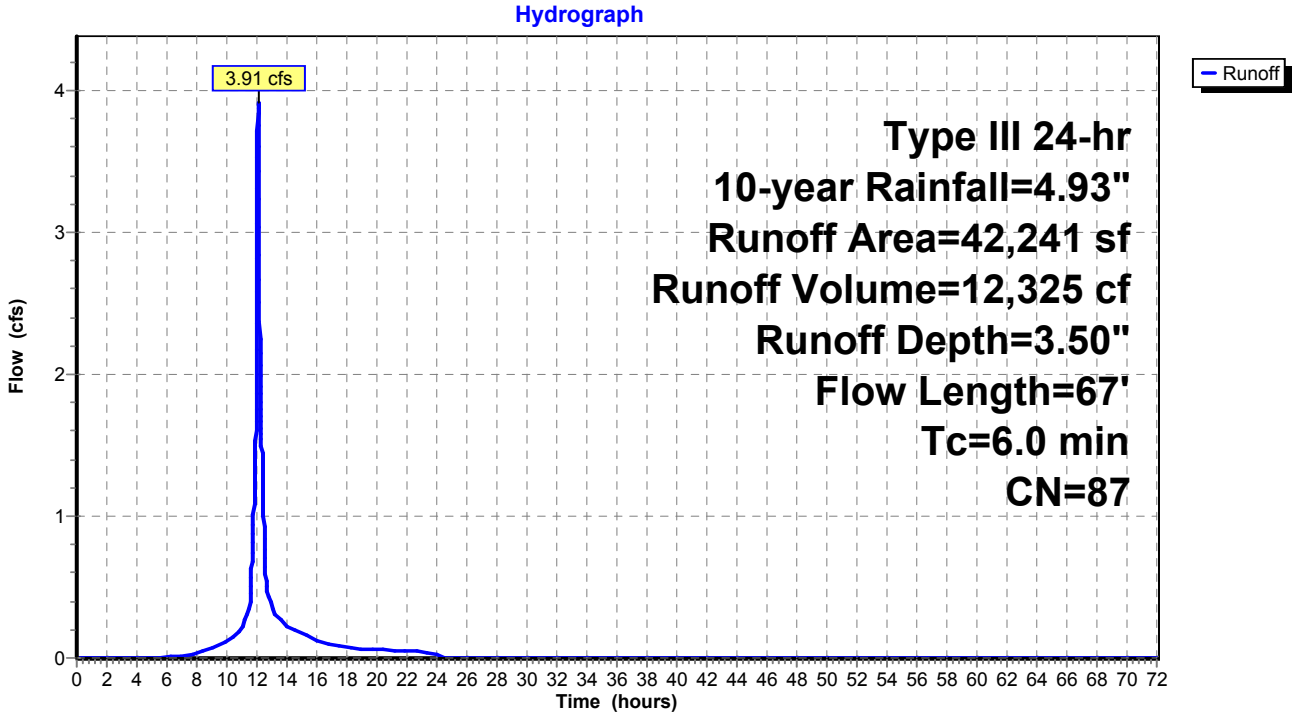
Runoff = 3.91 cfs @ 12.09 hrs, Volume= 12,325 cf, Depth= 3.50"
Routed to Link B : POI-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
*	34,567	98	Impervious Surfaces
	7,674	39	>75% Grass cover, Good, HSG A
	42,241	87	Weighted Average
	7,674		18.17% Pervious Area
	34,567		81.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	47	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.1	3	0.0150	0.61		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.1	17	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.6	67	Total, Increased to minimum Tc = 6.0 min			

Subcatchment B2: SUB-B2



Summary for Subcatchment C1: SUB-C1

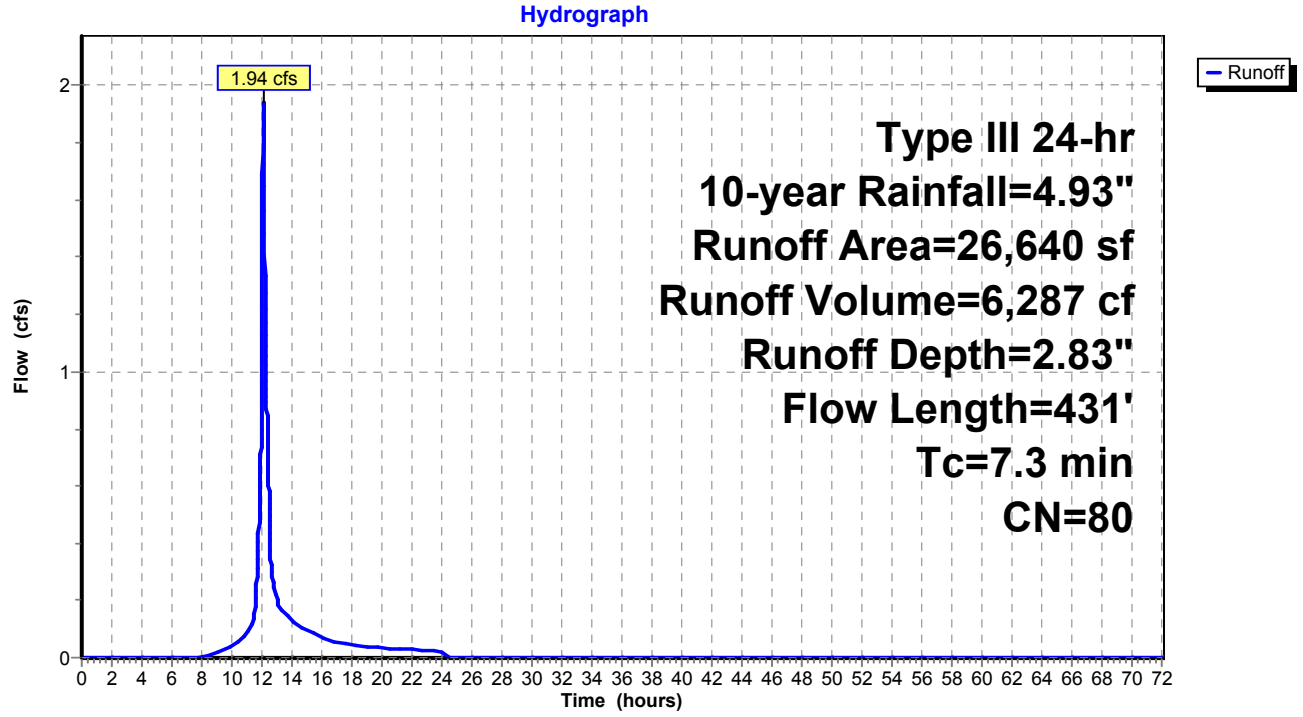
Runoff = 1.94 cfs @ 12.11 hrs, Volume= 6,287 cf, Depth= 2.83"
Routed to Link C : POI-C

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
*	18,706	98	Impervious Surfaces
	5,562	39	>75% Grass cover, Good, HSG A
	2,372	30	Woods, Good, HSG A
	26,640	80	Weighted Average
	7,934		29.78% Pervious Area
	18,706		70.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	85	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.3	296	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	431	Total			

Subcatchment C1: SUB-C1

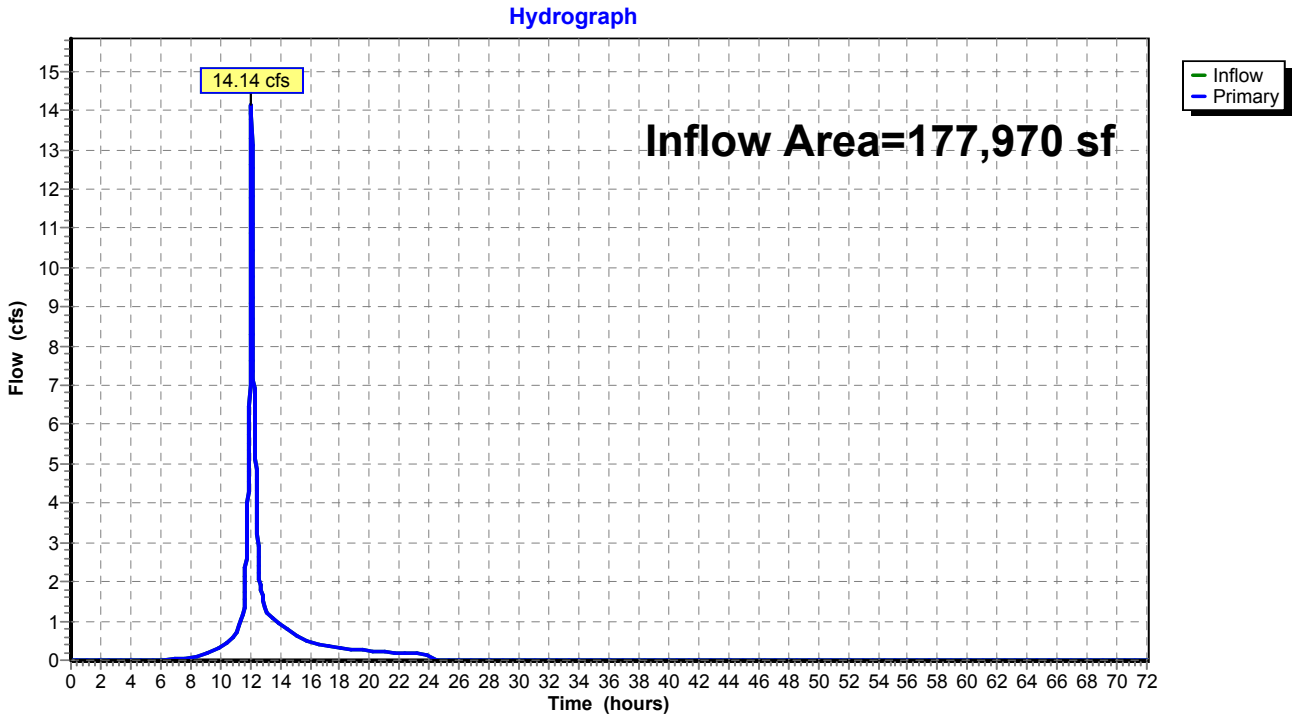


Summary for Link A: POI-A

Inflow Area = 177,970 sf, 55.57% Impervious, Inflow Depth = 2.98" for 10-year event
Inflow = 14.14 cfs @ 12.09 hrs, Volume= 44,223 cf
Primary = 14.14 cfs @ 12.09 hrs, Volume= 44,223 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link A: POI-A

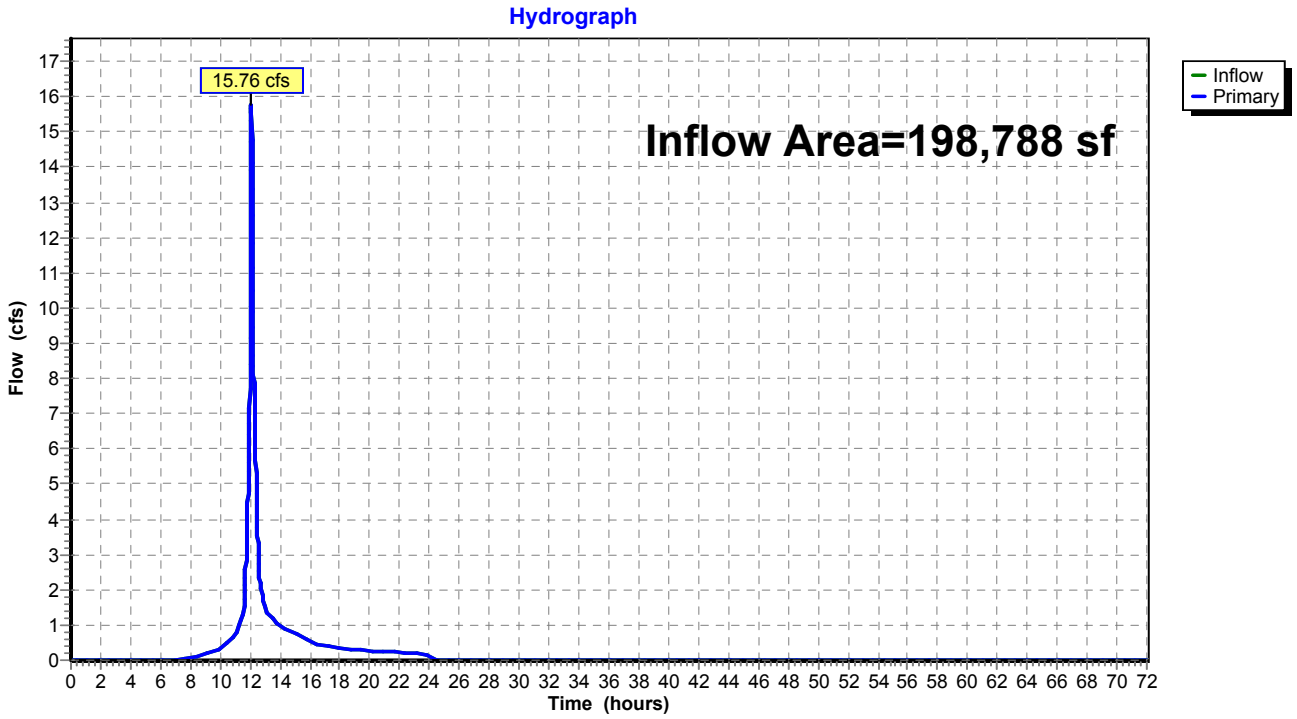


Summary for Link B: POI-B

Inflow Area = 198,788 sf, 72.01% Impervious, Inflow Depth = 2.97" for 10-year event
Inflow = 15.76 cfs @ 12.09 hrs, Volume= 49,269 cf
Primary = 15.76 cfs @ 12.09 hrs, Volume= 49,269 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link B: POI-B

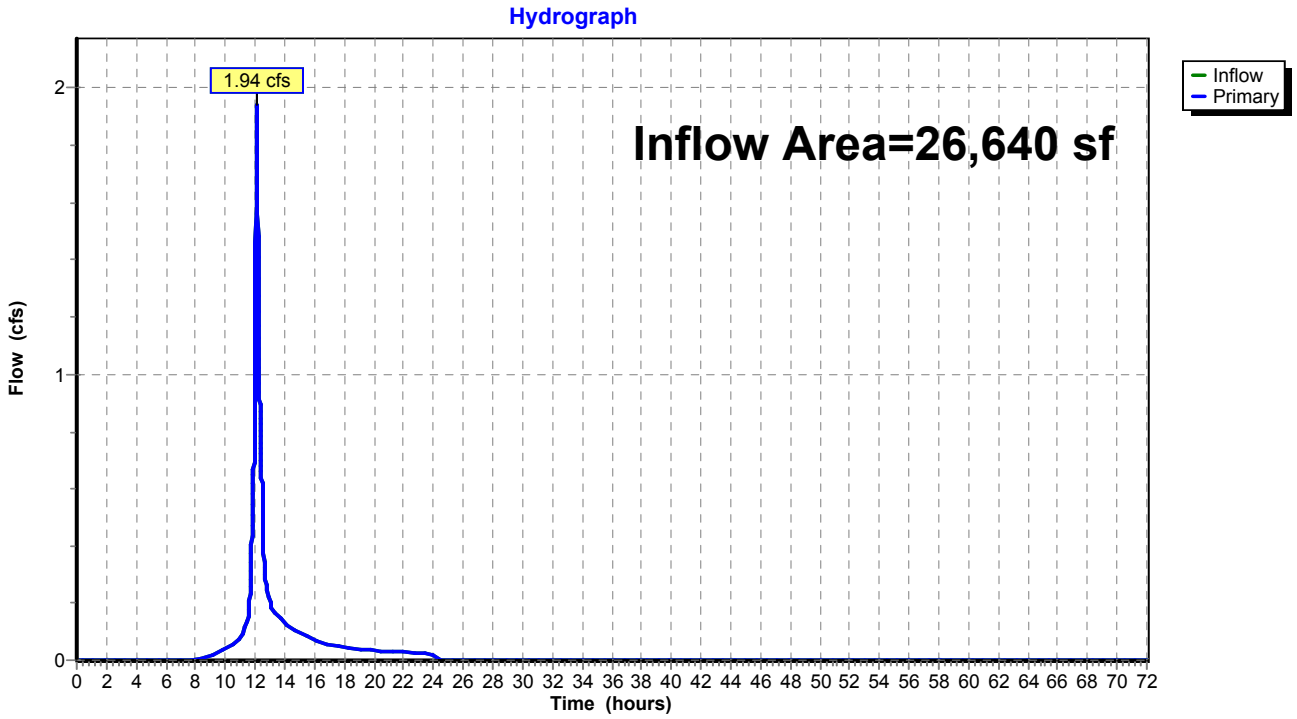


Summary for Link C: POI-C

Inflow Area = 26,640 sf, 70.22% Impervious, Inflow Depth = 2.83" for 10-year event
Inflow = 1.94 cfs @ 12.11 hrs, Volume= 6,287 cf
Primary = 1.94 cfs @ 12.11 hrs, Volume= 6,287 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link C: POI-C



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=99,996 sf 50.14% Impervious Runoff Depth=6.00"
Flow Length=531' Tc=6.0 min CN=86 Runoff=15.54 cfs 50,016 cf

SubcatchmentA2: SUB-A2 Runoff Area=27,998 sf 69.77% Impervious Runoff Depth=5.31"
Flow Length=30' Tc=6.0 min CN=80 Runoff=3.94 cfs 12,382 cf

SubcatchmentA3: SUB-A3 Runoff Area=49,976 sf 58.46% Impervious Runoff Depth=4.51"
Flow Length=82' Tc=6.0 min CN=73 Runoff=6.06 cfs 18,782 cf

SubcatchmentB1: SUB-B1 Runoff Area=156,547 sf 69.36% Impervious Runoff Depth=5.31"
Flow Length=188' Tc=6.2 min CN=80 Runoff=21.91 cfs 69,233 cf

SubcatchmentB2: SUB-B2 Runoff Area=42,241 sf 81.83% Impervious Runoff Depth=6.12"
Flow Length=67' Tc=6.0 min CN=87 Runoff=6.65 cfs 21,540 cf

SubcatchmentC1: SUB-C1 Runoff Area=26,640 sf 70.22% Impervious Runoff Depth=5.31"
Flow Length=431' Tc=7.3 min CN=80 Runoff=3.59 cfs 11,782 cf

Link A: POI-A Inflow=25.54 cfs 81,181 cf
Primary=25.54 cfs 81,181 cf

Link B: POI-B Inflow=28.56 cfs 90,772 cf
Primary=28.56 cfs 90,772 cf

Link C: POI-C Inflow=3.59 cfs 11,782 cf
Primary=3.59 cfs 11,782 cf

Total Runoff Area = 403,398 sf Runoff Volume = 183,735 cf Average Runoff Depth = 5.47"
35.36% Pervious = 142,645 sf 64.64% Impervious = 260,753 sf

Summary for Subcatchment A1: SUB-A1

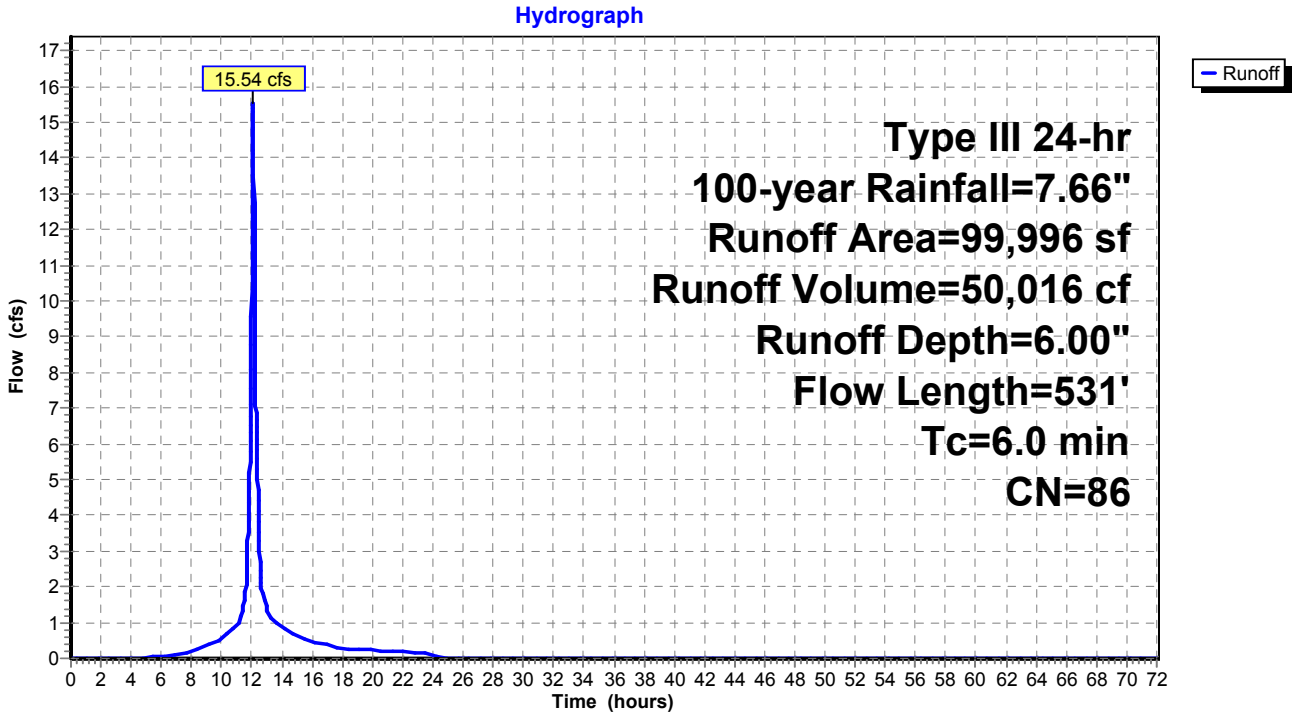
Runoff = 15.54 cfs @ 12.08 hrs, Volume= 50,016 cf, Depth= 6.00"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
*	50,142	98	Impervious Surfaces
	49,578	74	>75% Grass cover, Good, HSG C
	276	96	Gravel surface, HSG C
	99,996	86	Weighted Average
	49,854		49.86% Pervious Area
	50,142		50.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0750	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.6	214	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	127	0.0314	3.60		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	140	0.0600	11.11	8.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
5.7	531	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

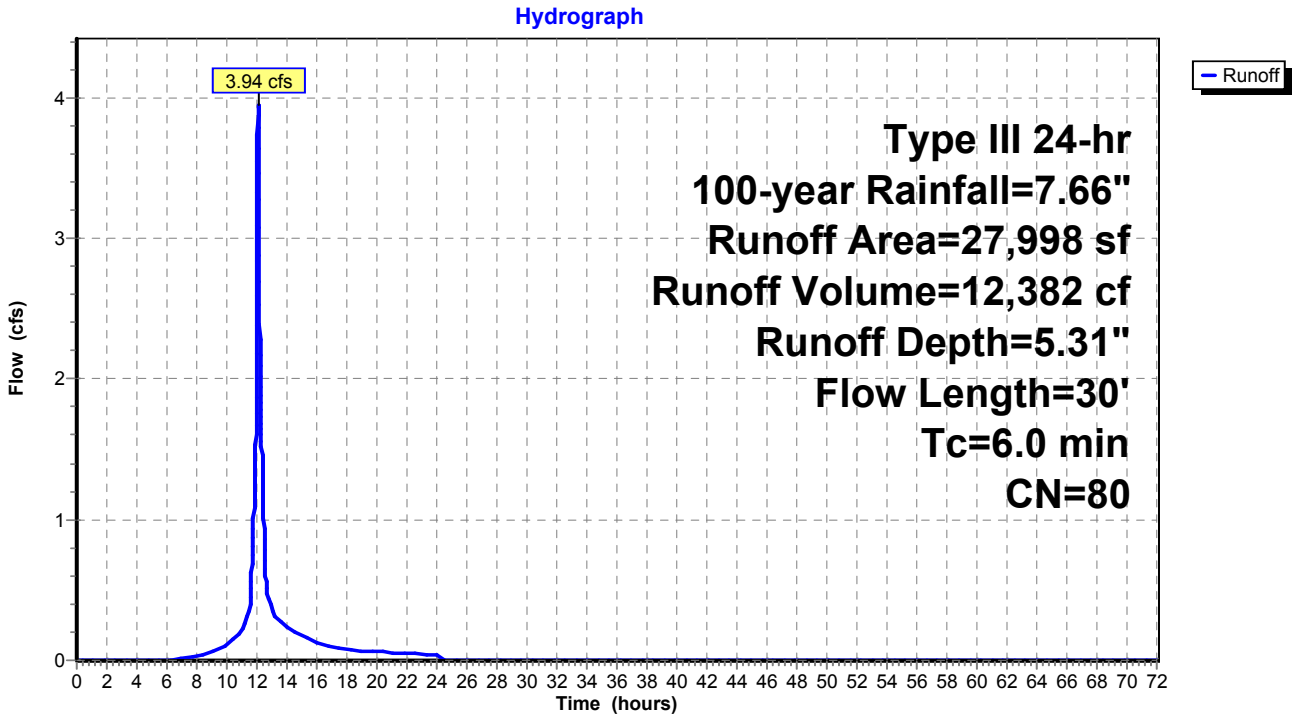
Runoff = 3.94 cfs @ 12.09 hrs, Volume= 12,382 cf, Depth= 5.31"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
*	19,533	98	Impervious Surfaces
	8,465	39	>75% Grass cover, Good, HSG A
	27,998	80	Weighted Average
	8,465		30.23% Pervious Area
	19,533		69.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	22	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	8	0.0150	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.1	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A2: SUB-A2



Summary for Subcatchment A3: SUB-A3

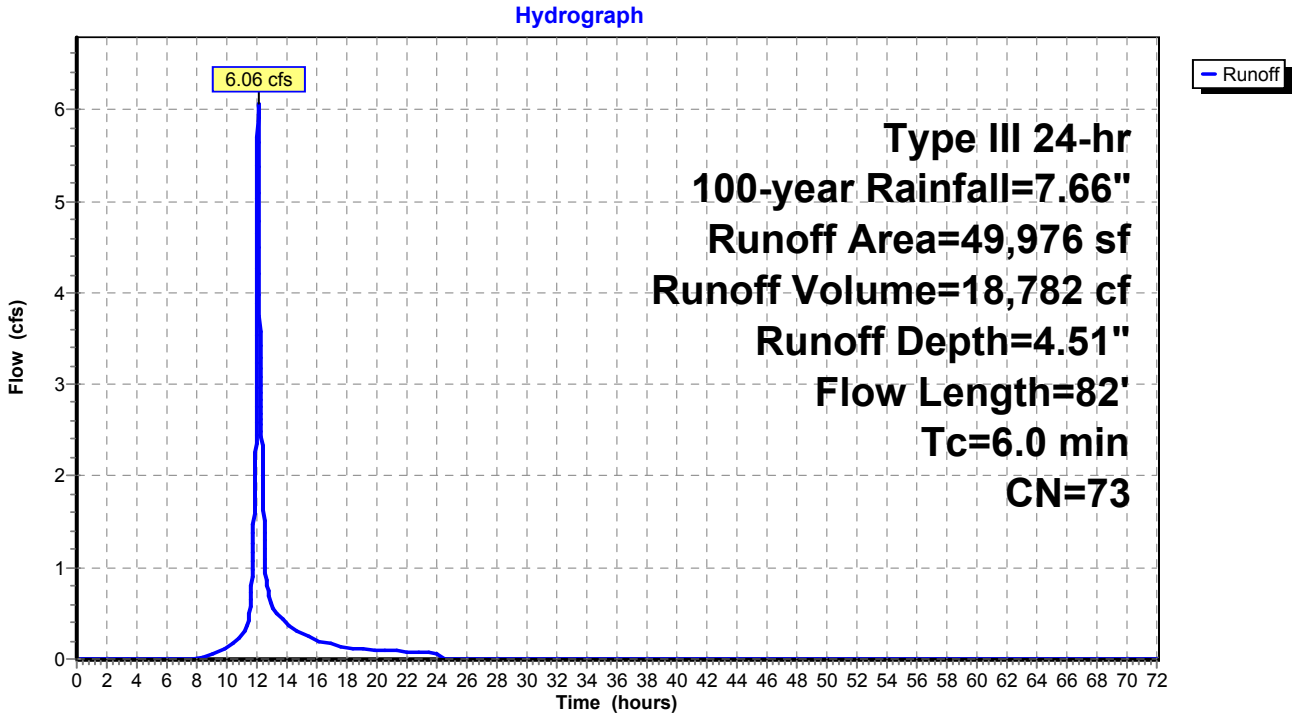
Runoff = 6.06 cfs @ 12.09 hrs, Volume= 18,782 cf, Depth= 4.51"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
*	29,218	98	Impervious Surfaces
	20,758	39	>75% Grass cover, Good, HSG A
	49,976	73	Weighted Average
	20,758		41.54% Pervious Area
	29,218		58.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.8	38	0.0310	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	12	0.0150	0.80		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.5	21	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.6	82	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A3: SUB-A3



Summary for Subcatchment B1: SUB-B1

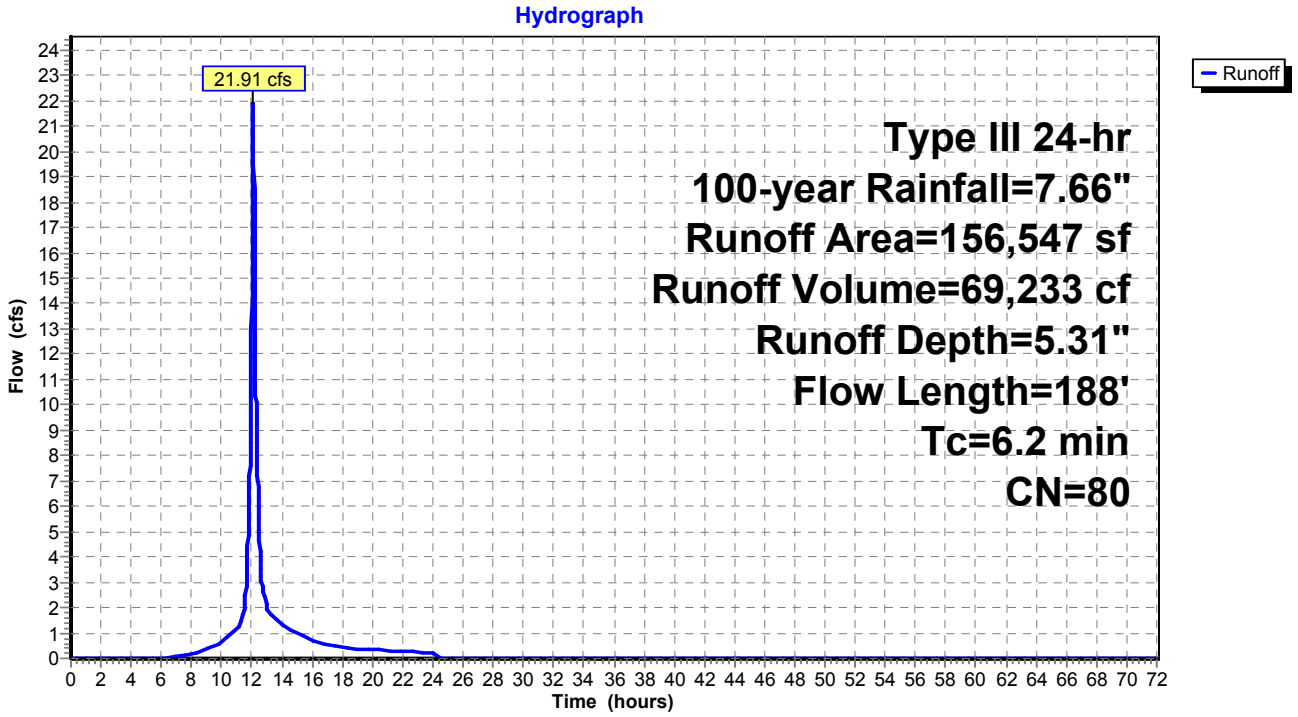
Runoff = 21.91 cfs @ 12.09 hrs, Volume= 69,233 cf, Depth= 5.31"
Routed to Link B : POI-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
*	108,587	98	Impervious Surfaces
	47,960	39	>75% Grass cover, Good, HSG A
	156,547	80	Weighted Average
	47,960		30.64% Pervious Area
	108,587		69.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0280	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	14	0.0280	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	10	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	39	0.0256	1.12		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	75	0.0245	3.18		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	188	Total			

Subcatchment B1: SUB-B1



Summary for Subcatchment B2: SUB-B2

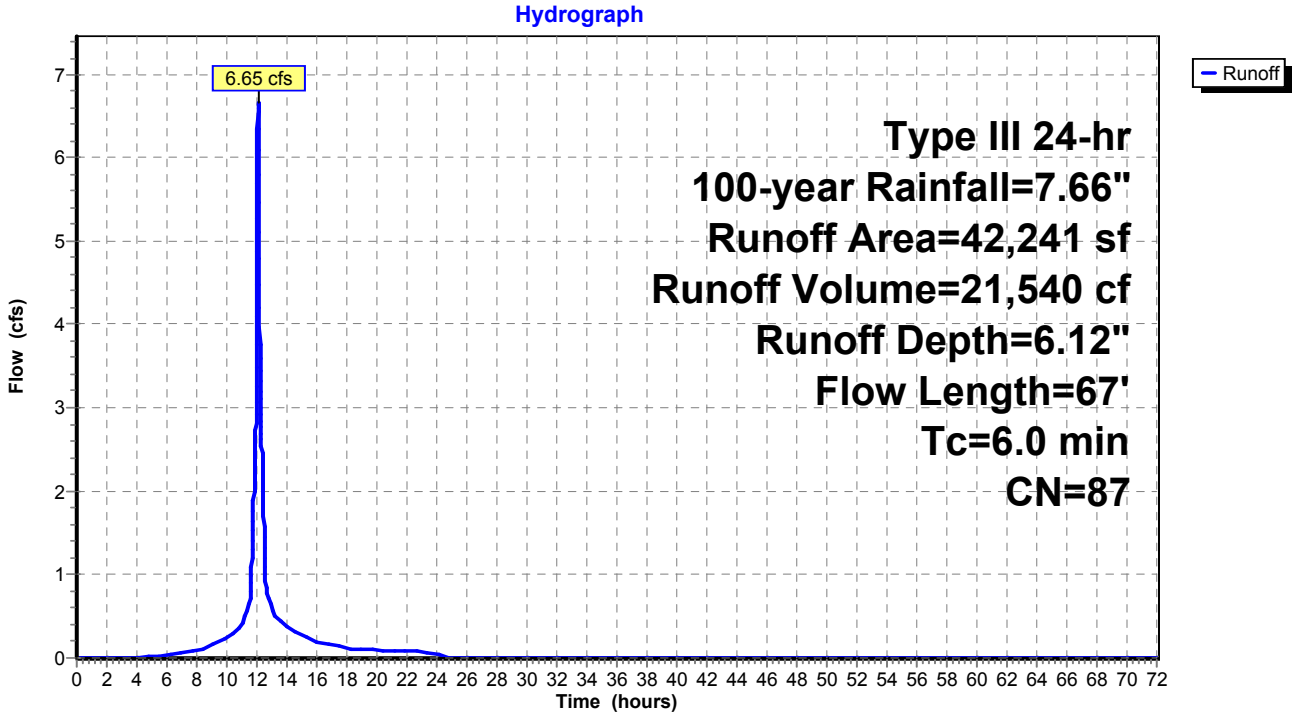
Runoff = 6.65 cfs @ 12.08 hrs, Volume= 21,540 cf, Depth= 6.12"
Routed to Link B : POI-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
*	34,567	98	Impervious Surfaces
	7,674	39	>75% Grass cover, Good, HSG A
	42,241	87	Weighted Average
	7,674		18.17% Pervious Area
	34,567		81.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	47	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.1	3	0.0150	0.61		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.1	17	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.6	67	Total, Increased to minimum Tc = 6.0 min			

Subcatchment B2: SUB-B2



Summary for Subcatchment C1: SUB-C1

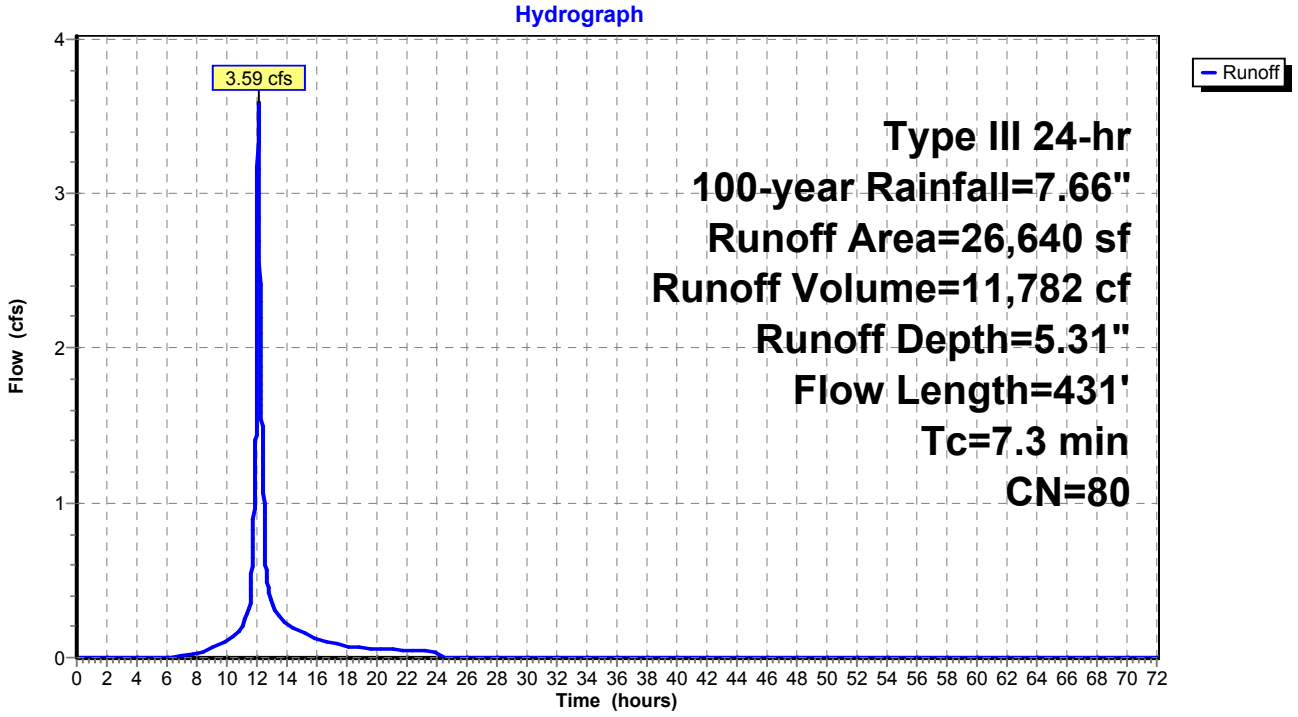
Runoff = 3.59 cfs @ 12.10 hrs, Volume= 11,782 cf, Depth= 5.31"
Routed to Link C : POI-C

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
*	18,706	98	Impervious Surfaces
	5,562	39	>75% Grass cover, Good, HSG A
	2,372	30	Woods, Good, HSG A
	26,640	80	Weighted Average
	7,934		29.78% Pervious Area
	18,706		70.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	85	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.3	296	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.3	431	Total			

Subcatchment C1: SUB-C1

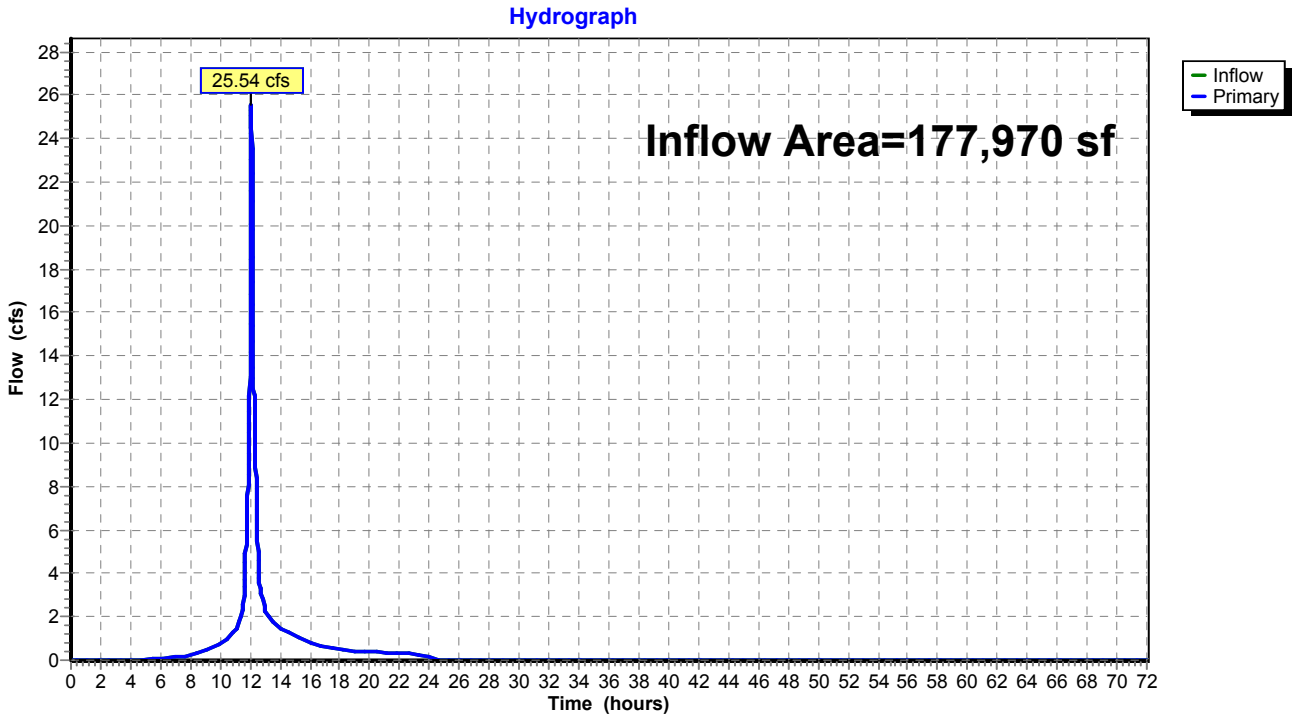


Summary for Link A: POI-A

Inflow Area = 177,970 sf, 55.57% Impervious, Inflow Depth = 5.47" for 100-year event
Inflow = 25.54 cfs @ 12.09 hrs, Volume= 81,181 cf
Primary = 25.54 cfs @ 12.09 hrs, Volume= 81,181 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link A: POI-A

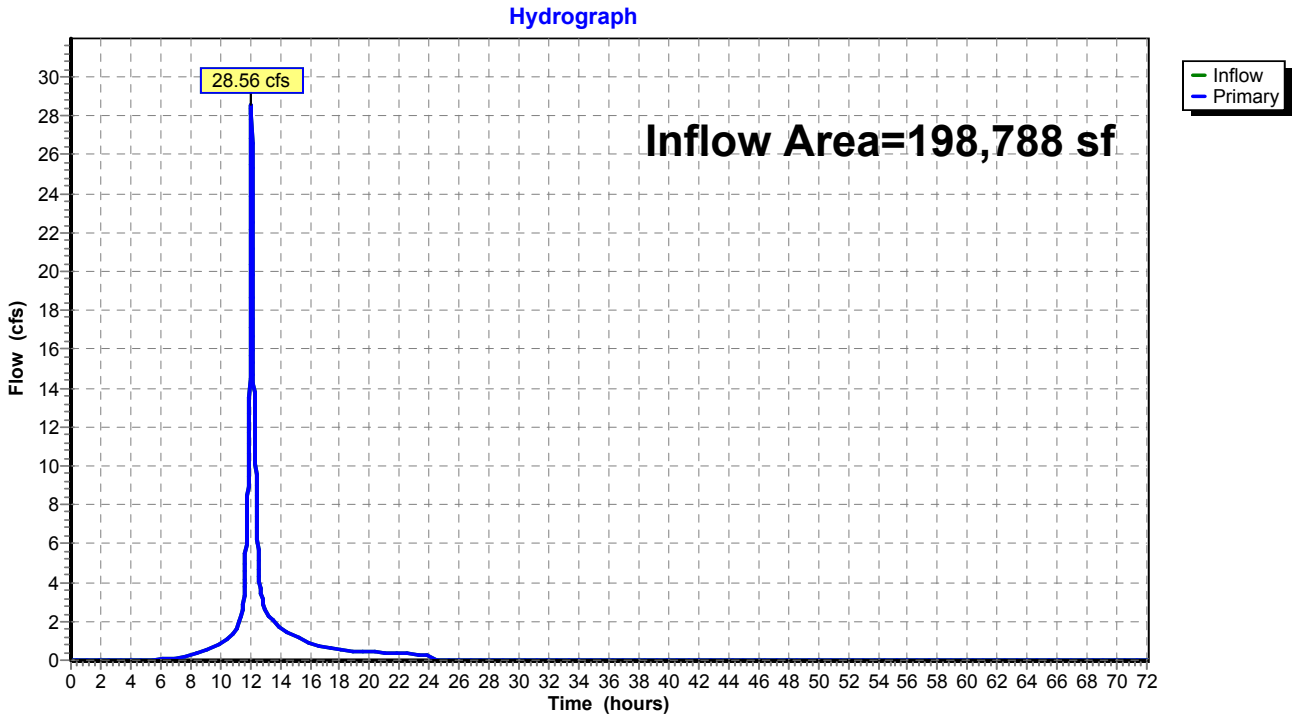


Summary for Link B: POI-B

Inflow Area = 198,788 sf, 72.01% Impervious, Inflow Depth = 5.48" for 100-year event
Inflow = 28.56 cfs @ 12.09 hrs, Volume= 90,772 cf
Primary = 28.56 cfs @ 12.09 hrs, Volume= 90,772 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link B: POI-B

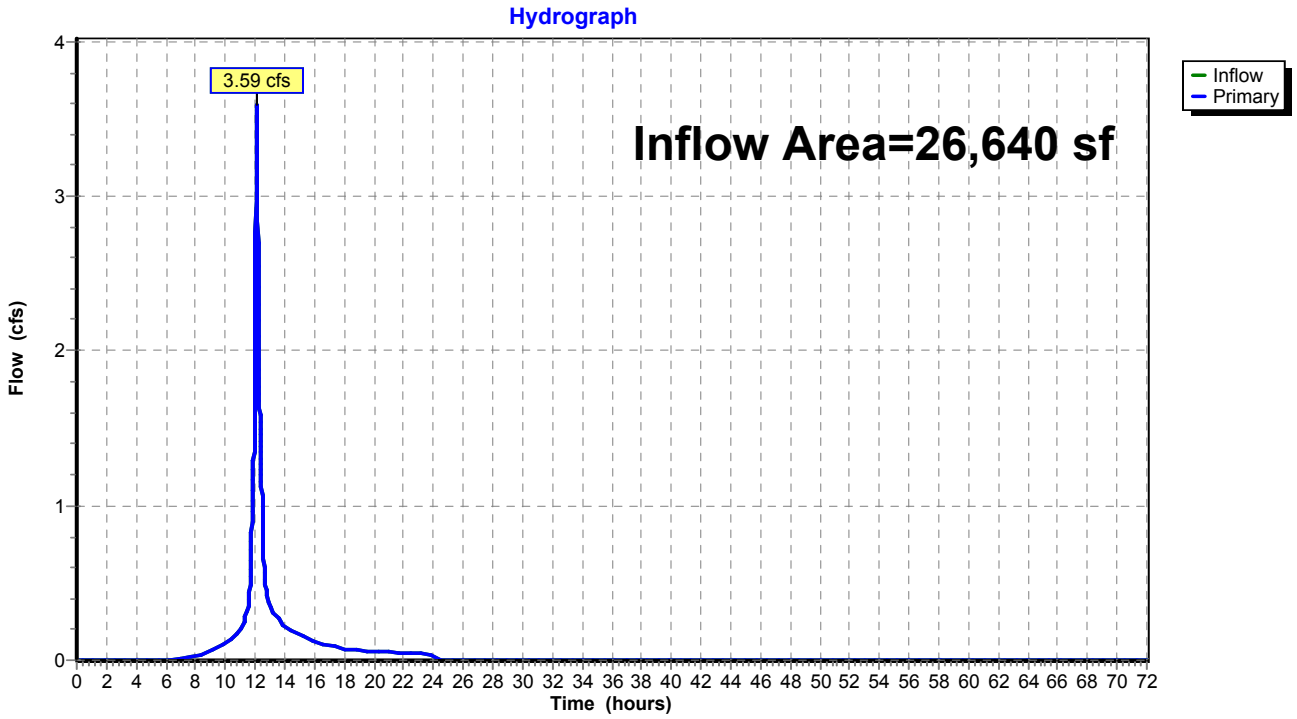


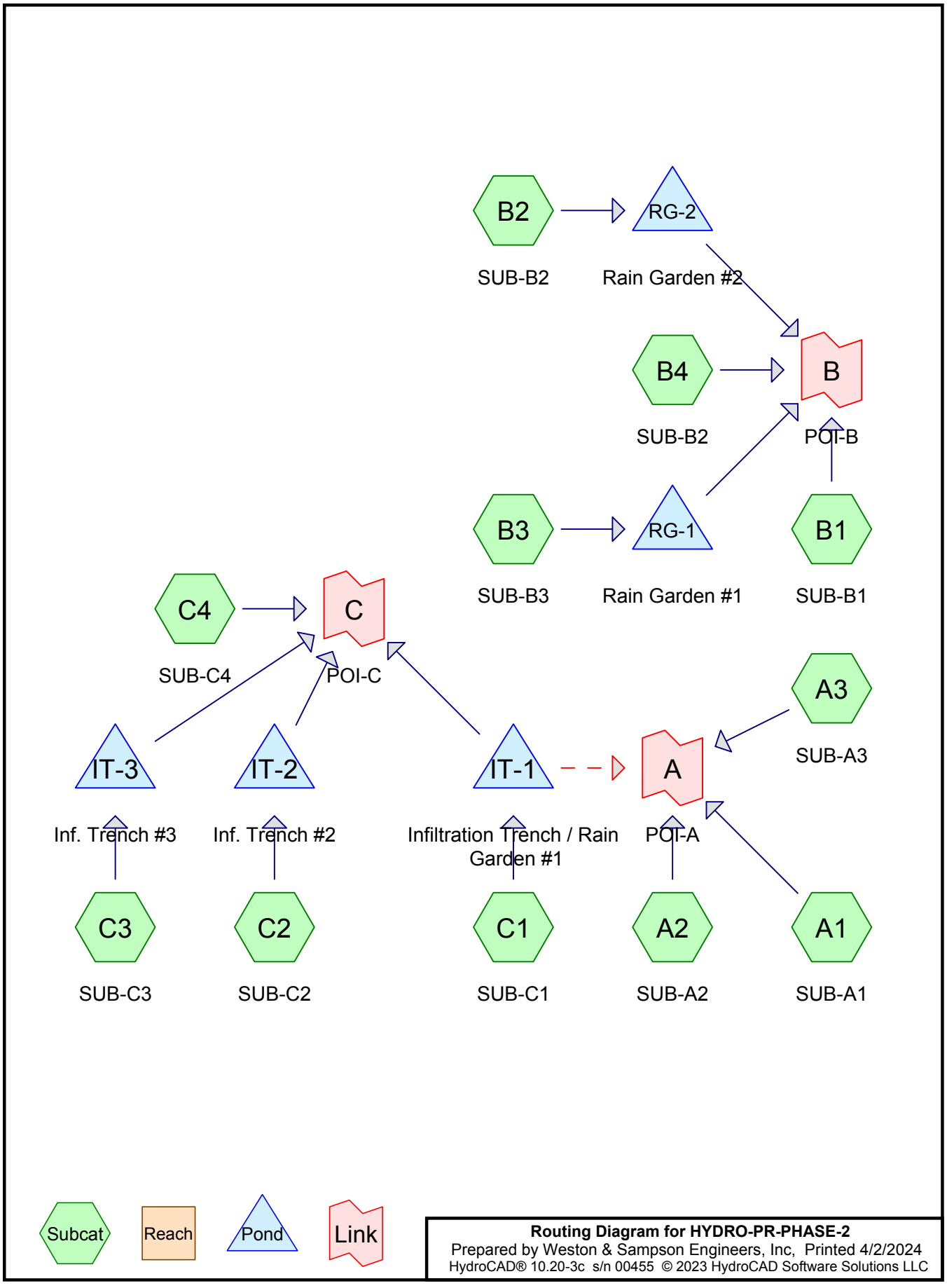
Summary for Link C: POI-C

Inflow Area = 26,640 sf, 70.22% Impervious, Inflow Depth = 5.31" for 100-year event
Inflow = 3.59 cfs @ 12.10 hrs, Volume= 11,782 cf
Primary = 3.59 cfs @ 12.10 hrs, Volume= 11,782 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link C: POI-C





Routing Diagram for HYDRO-PR-PHASE-2
Prepared by Weston & Sampson Engineers, Inc, Printed 4/2/2024

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.20	2
2	10-year	Type III 24-hr		Default	24.00	1	4.93	2
3	100-year	Type III 24-hr		Default	24.00	1	7.66	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
107,256	39	>75% Grass cover, Good, HSG A (A2, A3, B1, B2, B3, B4, C1, C2, C3, C4)
53,207	74	>75% Grass cover, Good, HSG C (A1)
241,028	98	Impervious Surfaces (A1, A2, A3, B1, B2, B3, B4, C1, C2, C3)
318	98	Infiltration Trench (C2, C3)
190	98	Infiltration Trench/Rain Garden (C1)
1,399	98	Rain Garden (B2, B3)
403,398	**79**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
107,256	HSG A	A2, A3, B1, B2, B3, B4, C1, C2, C3, C4
0	HSG B	
53,207	HSG C	A1
0	HSG D	
242,935	Other	A1, A2, A3, B1, B2, B3, B4, C1, C2, C3
403,398		**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
107,256	0	53,207	0	0	160,463	>75% Grass cover, Good
0	0	0	0	241,028	241,028	Impervious Surfaces
0	0	0	0	318	318	Infiltration Trench
0	0	0	0	190	190	Infiltration Trench/Rain Garden
0	0	0	0	1,399	1,399	Rain Garden
107,256	**0**	**53,207**	**0**	**242,935**	**403,398**	**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	A1	0.00	0.00	336.0	0.0050	0.013	0.0	12.0	0.0	
2	IT-1	446.03	445.70	66.0	0.0050	0.013	0.0	8.0	0.0	
3	RG-1	446.31	445.62	34.5	0.0200	0.013	0.0	8.0	0.0	
4	RG-2	445.47	444.73	37.0	0.0200	0.013	0.0	8.0	0.0	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A1: SUB-A1 Runoff Area=99,996 sf 46.79% Impervious Runoff Depth=1.76"
Flow Length=622' Tc=6.8 min CN=85 Runoff=4.60 cfs 14,646 cf

Subcatchment A2: SUB-A2 Runoff Area=10,386 sf 78.95% Impervious Runoff Depth=1.84"
Flow Length=39' Slope=0.0150 '/' Tc=6.0 min CN=86 Runoff=0.51 cfs 1,588 cf

Subcatchment A3: SUB-A3 Runoff Area=39,335 sf 68.13% Impervious Runoff Depth=1.34"
Flow Length=36' Tc=6.0 min CN=79 Runoff=1.39 cfs 4,382 cf

Subcatchment B1: SUB-B1 Runoff Area=167,239 sf 67.73% Impervious Runoff Depth=1.34"
Flow Length=174' Tc=6.9 min CN=79 Runoff=5.74 cfs 18,629 cf

Subcatchment B2: SUB-B2 Runoff Area=11,053 sf 19.41% Impervious Runoff Depth=0.13"
Flow Length=130' Slope=0.0200 '/' Tc=6.9 min CN=50 Runoff=0.01 cfs 118 cf

Subcatchment B3: SUB-B3 Runoff Area=12,741 sf 7.29% Impervious Runoff Depth=0.02"
Flow Length=189' Slope=0.0200 '/' Tc=7.9 min CN=43 Runoff=0.00 cfs 23 cf

Subcatchment B4: SUB-B2 Runoff Area=14,865 sf 87.90% Impervious Runoff Depth=2.26"
Flow Length=140' Tc=6.2 min CN=91 Runoff=0.88 cfs 2,797 cf

Subcatchment C1: SUB-C1 Runoff Area=23,899 sf 70.96% Impervious Runoff Depth=1.47"
Flow Length=452' Tc=7.4 min CN=81 Runoff=0.89 cfs 2,926 cf

Subcatchment C2: SUB-C2 Runoff Area=9,871 sf 72.91% Impervious Runoff Depth=1.54"
Flow Length=124' Slope=0.0200 '/' Tc=6.0 min CN=82 Runoff=0.41 cfs 1,265 cf

Subcatchment C3: SUB-C3 Runoff Area=8,102 sf 93.48% Impervious Runoff Depth=2.54"
Flow Length=122' Slope=0.0200 '/' Tc=6.0 min CN=94 Runoff=0.53 cfs 1,718 cf

Subcatchment C4: SUB-C4 Runoff Area=5,911 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=20' Slope=0.0200 '/' Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Pond IT-1: Infiltration Trench / Rain Garden #1 Peak Elev=449.60' Storage=250 cf Inflow=0.89 cfs 2,926 cf
Discarded=0.10 cfs 2,036 cf Primary=0.00 cfs 0 cf Secondary=0.79 cfs 889 cf Outflow=0.89 cfs 2,926 cf

Pond IT-2: Inf. Trench #2 Peak Elev=450.76' Storage=65 cf Inflow=0.41 cfs 1,265 cf
Discarded=0.03 cfs 821 cf Primary=0.39 cfs 445 cf Outflow=0.42 cfs 1,265 cf

Pond IT-3: Inf. Trench #3 Peak Elev=448.91' Storage=126 cf Inflow=0.53 cfs 1,718 cf
Discarded=0.06 cfs 1,247 cf Primary=0.50 cfs 471 cf Outflow=0.56 cfs 1,718 cf

Pond RG-1: Rain Garden #1 Peak Elev=449.50' Storage=0 cf Inflow=0.00 cfs 23 cf
Discarded=0.00 cfs 23 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 23 cf

Pond RG-2: Rain Garden #2 Peak Elev=448.25' Storage=0 cf Inflow=0.01 cfs 118 cf
Discarded=0.01 cfs 118 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 118 cf

Link A: POI-A Inflow=7.27 cfs 21,506 cf
Primary=7.27 cfs 21,506 cf

Link B: POI-B Inflow=6.61 cfs 21,427 cf
Primary=6.61 cfs 21,427 cf

Link C: POI-C Inflow=0.88 cfs 915 cf
Primary=0.88 cfs 915 cf

Total Runoff Area = 403,398 sf Runoff Volume = 48,093 cf Average Runoff Depth = 1.43"
39.78% Pervious = 160,463 sf 60.22% Impervious = 242,935 sf

Summary for Subcatchment A1: SUB-A1

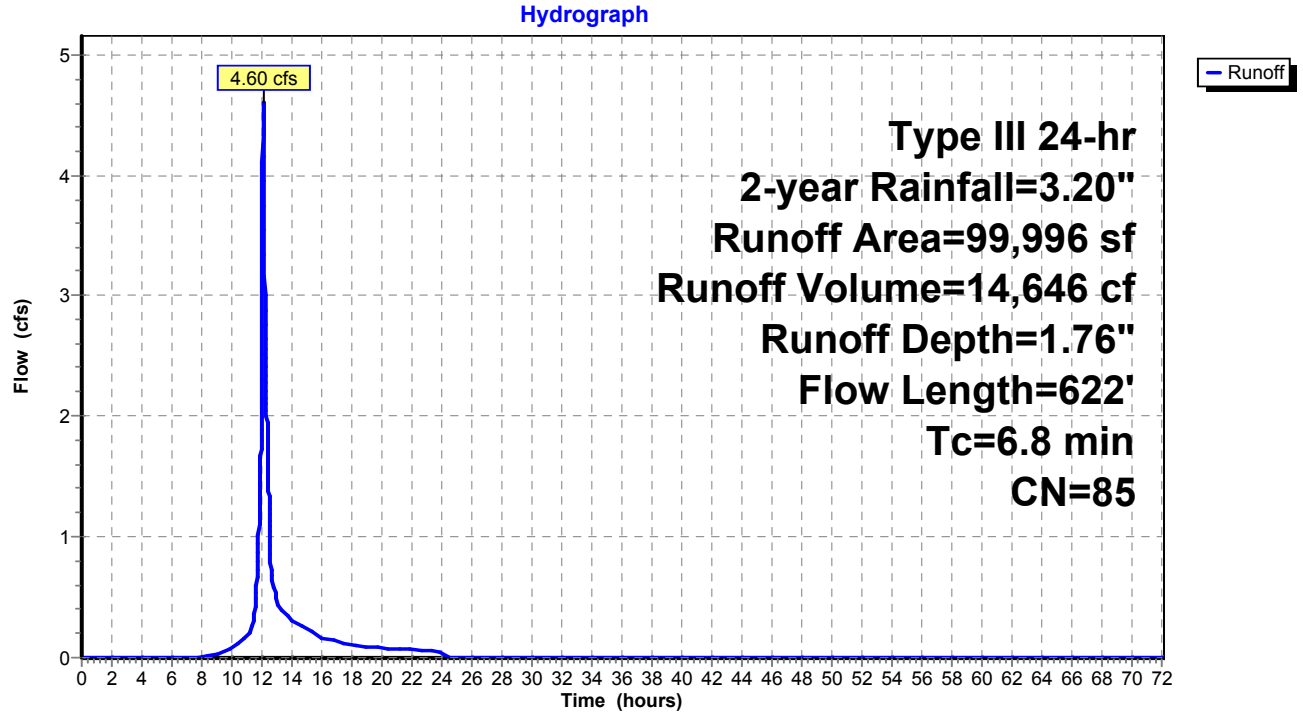
Runoff = 4.60 cfs @ 12.10 hrs, Volume= 14,646 cf, Depth= 1.76"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
*	46,789	98	Impervious Surfaces
	53,207	74	>75% Grass cover, Good, HSG C
	99,996	85	Weighted Average
	53,207		53.21% Pervious Area
	46,789		46.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0750	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.8	236	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	336	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
6.8	622	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

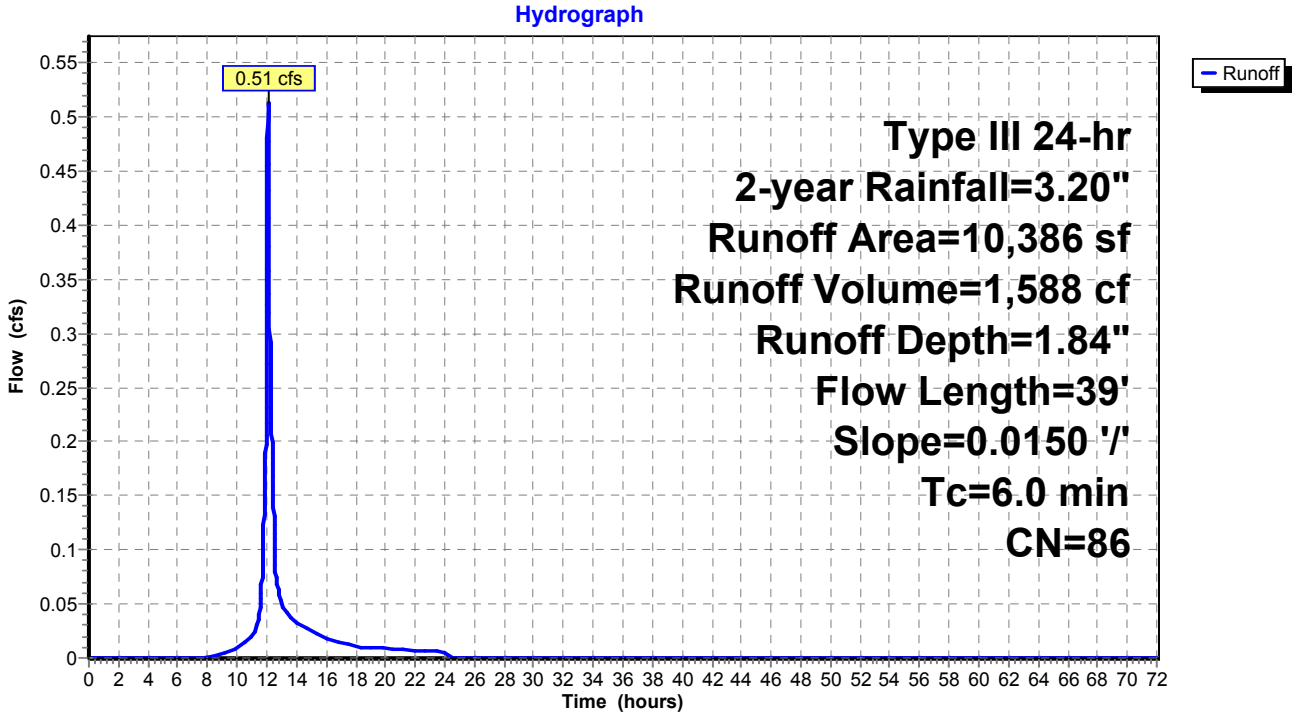
Runoff = 0.51 cfs @ 12.09 hrs, Volume= 1,588 cf, Depth= 1.84"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
	2,186	39	>75% Grass cover, Good, HSG A
*	8,200	98	Impervious Surfaces
	10,386	86	Weighted Average
	2,186		21.05% Pervious Area
	8,200		78.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	6	0.0150	0.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.7	3	0.0150	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.5	30	0.0150	0.96		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.3	39	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A2: SUB-A2



Summary for Subcatchment A3: SUB-A3

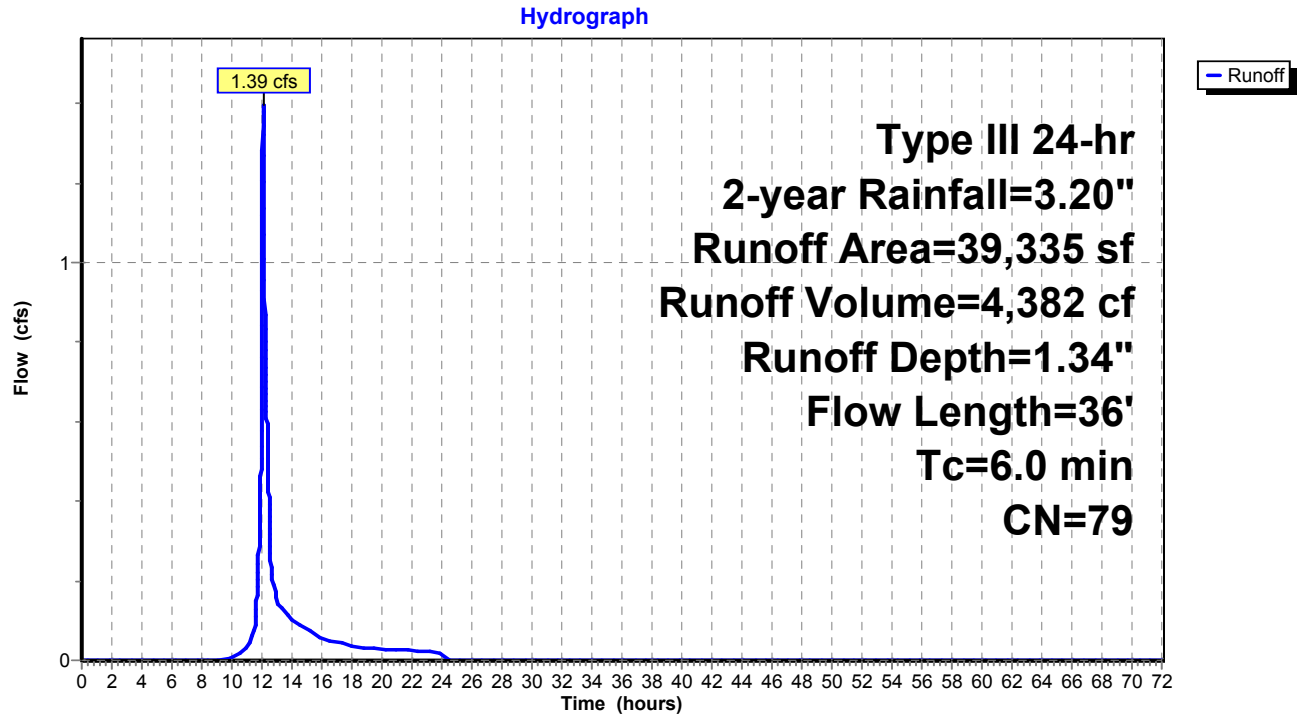
Runoff = 1.39 cfs @ 12.09 hrs, Volume= 4,382 cf, Depth= 1.34"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
	12,537	39	>75% Grass cover, Good, HSG A
*	26,798	98	Impervious Surfaces
	39,335	79	Weighted Average
	12,537		31.87% Pervious Area
	26,798		68.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	28	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	8	0.0150	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.7	36	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A3: SUB-A3



Summary for Subcatchment B1: SUB-B1

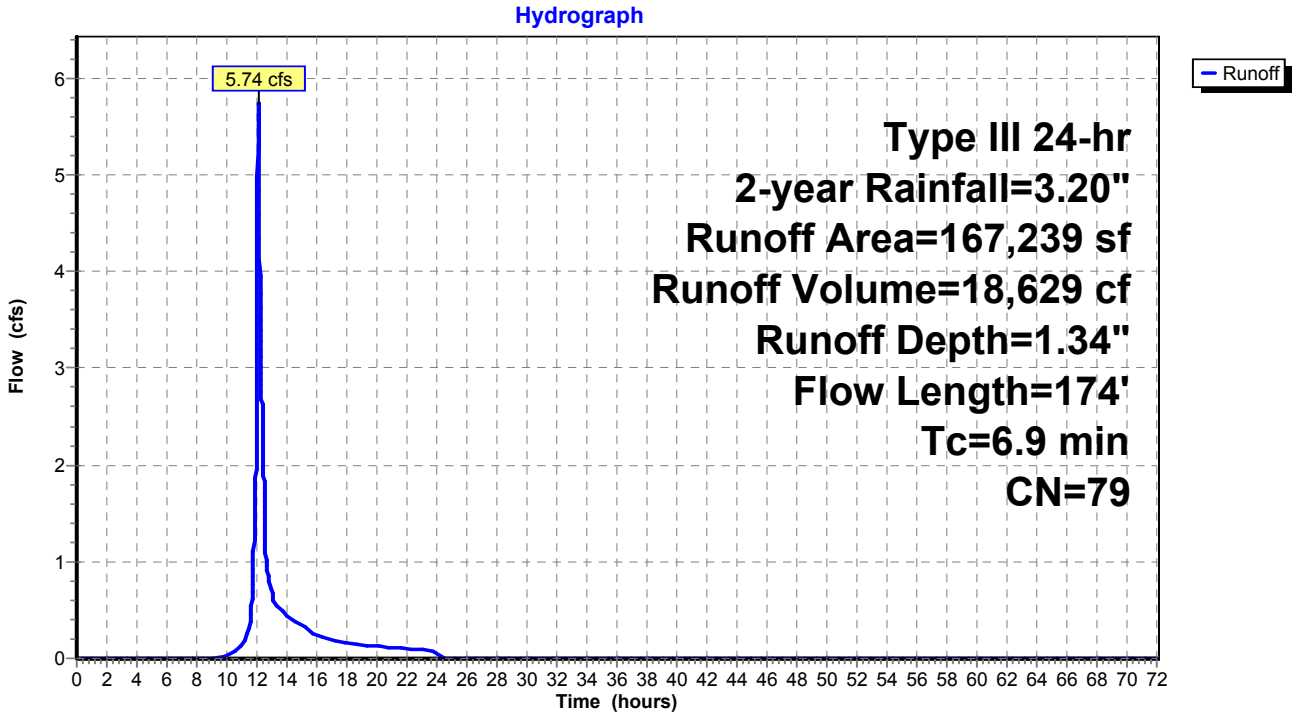
Runoff = 5.74 cfs @ 12.10 hrs, Volume= 18,629 cf, Depth= 1.34"
Routed to Link B : POI-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
*	113,277	98	Impervious Surfaces
	53,962	39	>75% Grass cover, Good, HSG A
	167,239	79	Weighted Average
	53,962		32.27% Pervious Area
	113,277		67.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	14	0.0200	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.1	6	0.0150	0.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.7	30	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.0	6	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	27	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	91	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.9	174	Total			

Subcatchment B1: SUB-B1



Summary for Subcatchment B2: SUB-B2

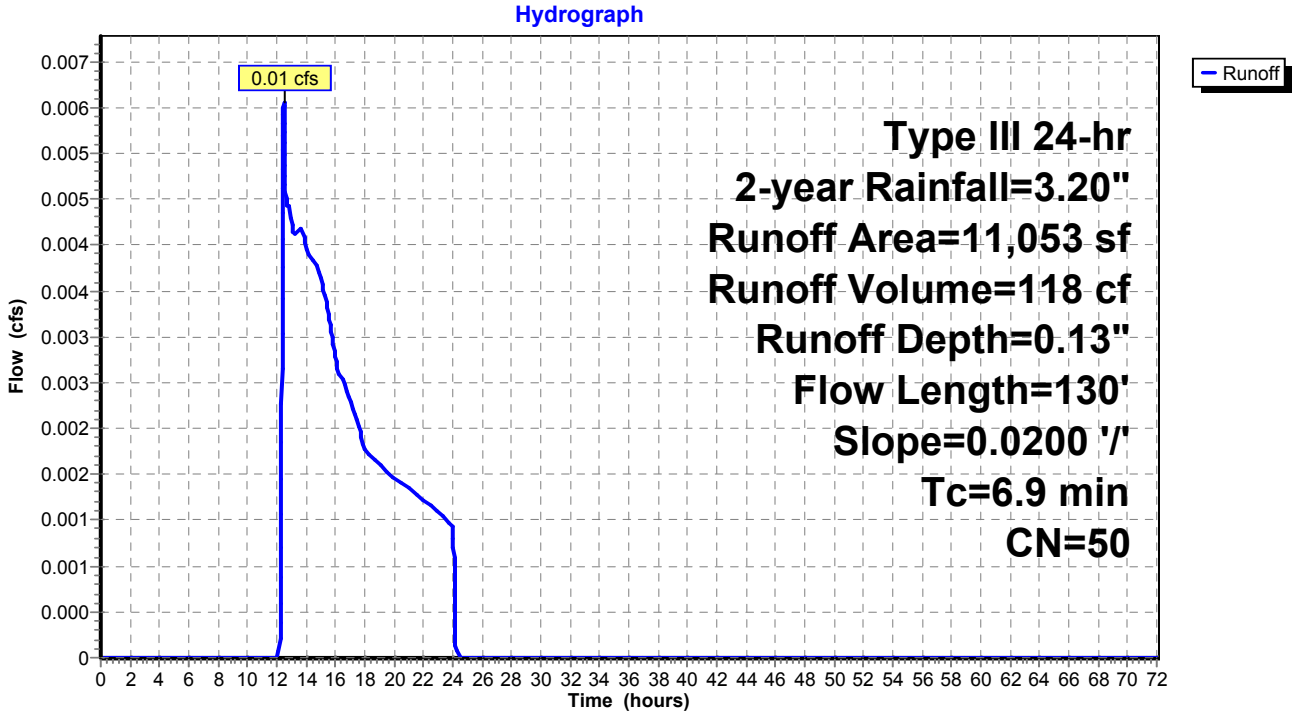
Runoff = 0.01 cfs @ 12.49 hrs, Volume= 118 cf, Depth= 0.13"
Routed to Pond RG-2 : Rain Garden #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
	8,908	39	>75% Grass cover, Good, HSG A
*	1,088	98	Impervious Surfaces
*	1,057	98	Rain Garden
	11,053	50	Weighted Average
	8,908		80.59% Pervious Area
	2,145		19.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.3	80	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.9	130	Total			

Subcatchment B2: SUB-B2



Summary for Subcatchment B3: SUB-B3

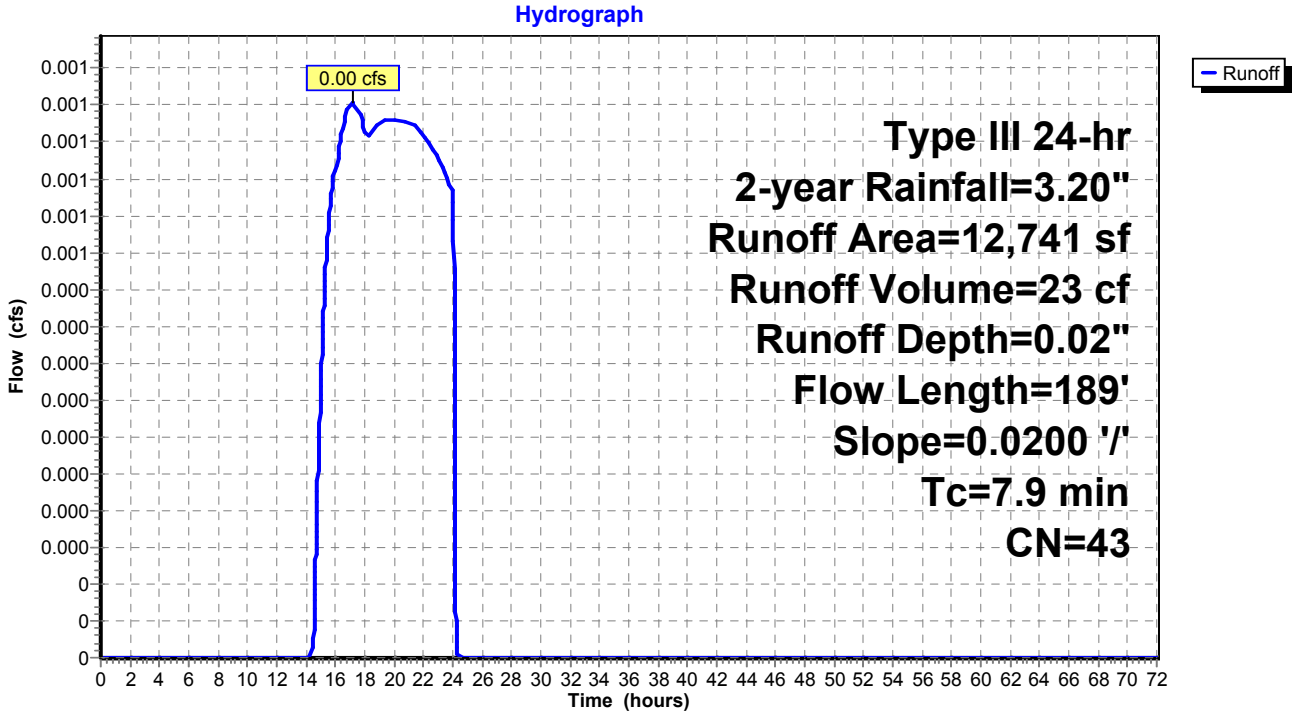
Runoff = 0.00 cfs @ 17.18 hrs, Volume= 23 cf, Depth= 0.02"
Routed to Pond RG-1 : Rain Garden #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
	11,812	39	>75% Grass cover, Good, HSG A
*	342	98	Rain Garden
*	587	98	Impervious Surfaces
	12,741	43	Weighted Average
	11,812		92.71% Pervious Area
	929		7.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	139	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.9	189	Total			

Subcatchment B3: SUB-B3



Summary for Subcatchment B4: SUB-B2

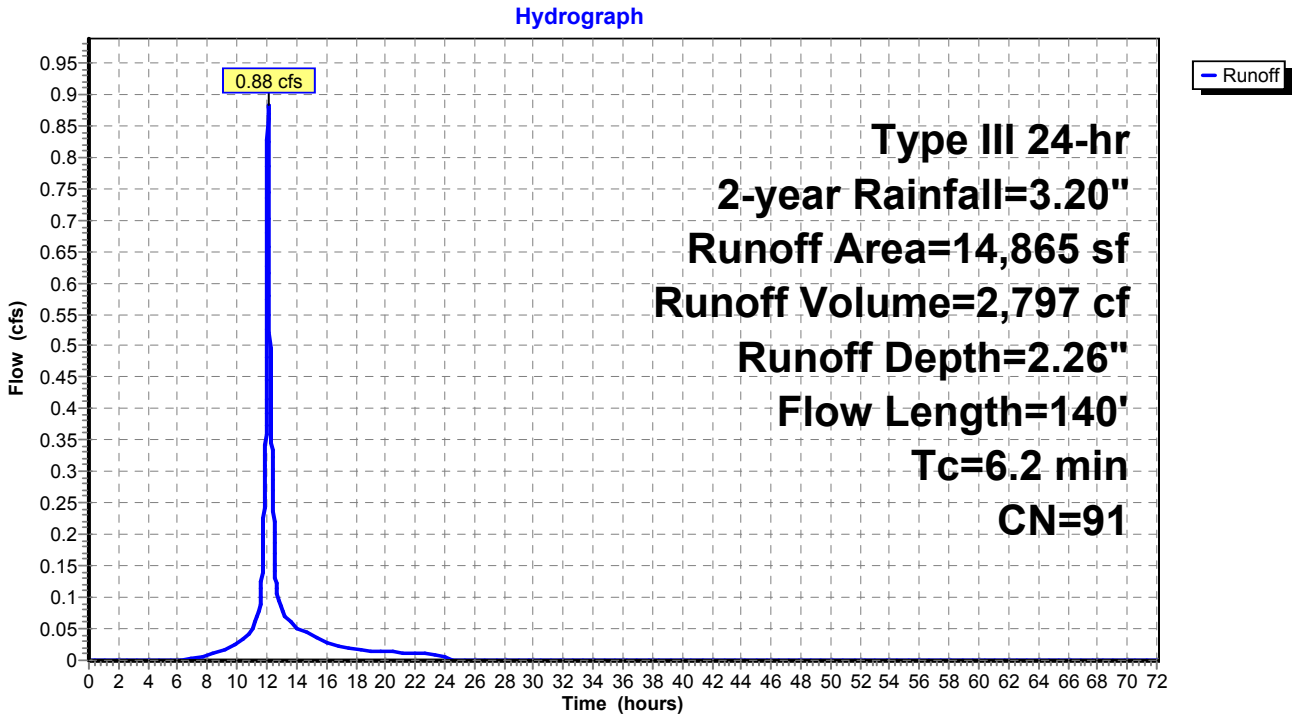
Runoff = 0.88 cfs @ 12.09 hrs, Volume= 2,797 cf, Depth= 2.26"
Routed to Link B : POI-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
	1,798	39	>75% Grass cover, Good, HSG A
*	13,067	98	Impervious Surfaces
	14,865	91	Weighted Average
	1,798		12.10% Pervious Area
	13,067		87.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	90	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	140	Total			

Subcatchment B4: SUB-B2



Summary for Subcatchment C1: SUB-C1

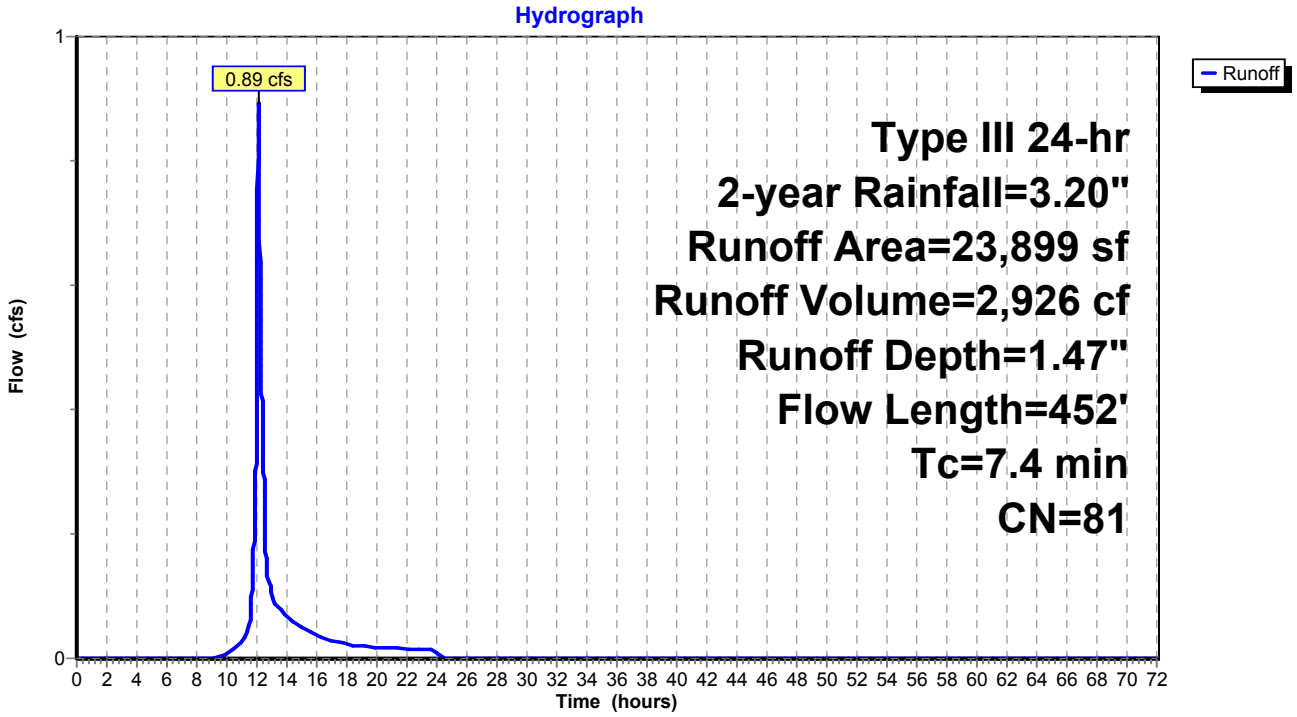
Runoff = 0.89 cfs @ 12.11 hrs, Volume= 2,926 cf, Depth= 1.47"
Routed to Pond IT-1 : Infiltration Trench / Rain Garden #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
	6,940	39	>75% Grass cover, Good, HSG A
*	16,769	98	Impervious Surfaces
*	190	98	Infiltration Trench/Rain Garden
	23,899	81	Weighted Average
	6,940		29.04% Pervious Area
	16,959		70.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	85	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.4	315	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	2	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.4	452	Total			

Subcatchment C1: SUB-C1



Summary for Subcatchment C2: SUB-C2

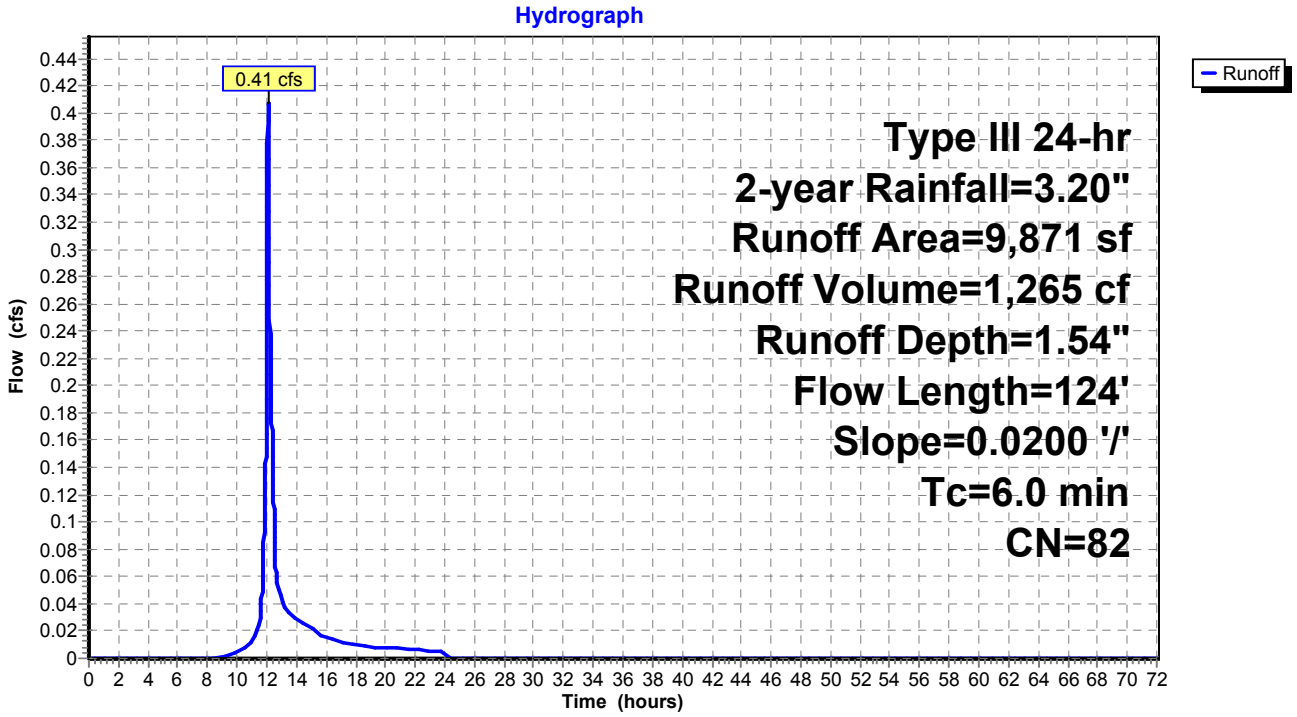
Runoff = 0.41 cfs @ 12.09 hrs, Volume= 1,265 cf, Depth= 1.54"
Routed to Pond IT-2 : Inf. Trench #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
*	7,089	98	Impervious Surfaces
	2,674	39	>75% Grass cover, Good, HSG A
*	108	98	Infiltration Trench
	9,871	82	Weighted Average
	2,674		27.09% Pervious Area
	7,197		72.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	42	0.0200	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	8	0.0200	0.83		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.4	72	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	2	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.5	124	Total, Increased to minimum Tc = 6.0 min			

Subcatchment C2: SUB-C2



Summary for Subcatchment C3: SUB-C3

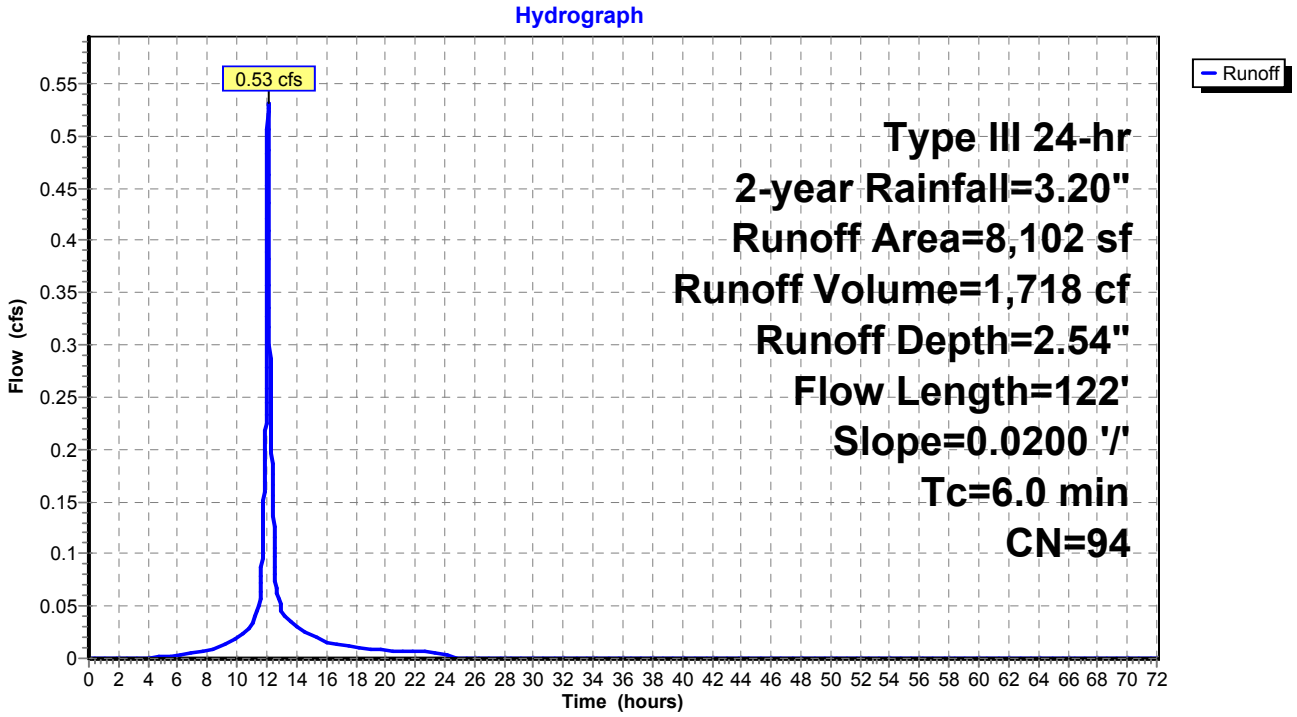
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 1,718 cf, Depth= 2.54"
Routed to Pond IT-3 : Inf. Trench #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

	Area (sf)	CN	Description
*	7,364	98	Impervious Surfaces
	528	39	>75% Grass cover, Good, HSG A
*	210	98	Infiltration Trench
	8,102	94	Weighted Average
	528		6.52% Pervious Area
	7,574		93.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	8	0.0200	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	42	0.0200	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.4	70	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	2	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.3	122	Total, Increased to minimum Tc = 6.0 min			

Subcatchment C3: SUB-C3



Summary for Subcatchment C4: SUB-C4

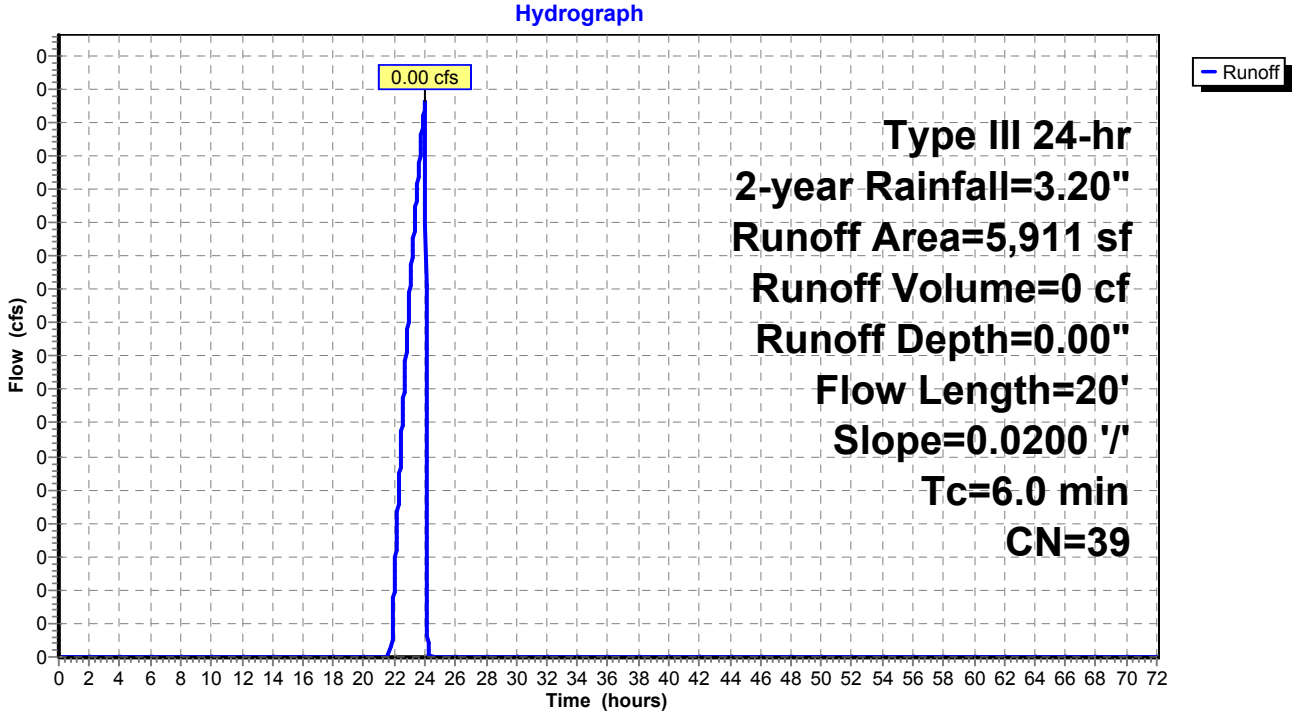
Runoff = 0.00 cfs @ 24.01 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Link C : POI-C

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
5,911	39	>75% Grass cover, Good, HSG A
5,911		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	20	0.0200	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.7	20	Total, Increased to minimum Tc = 6.0 min			

Subcatchment C4: SUB-C4



Summary for Pond IT-1: Infiltration Trench / Rain Garden #1

Inflow Area = 23,899 sf, 70.96% Impervious, Inflow Depth = 1.47" for 2-year event
Inflow = 0.89 cfs @ 12.11 hrs, Volume= 2,926 cf
Outflow = 0.89 cfs @ 12.12 hrs, Volume= 2,926 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.10 cfs @ 12.12 hrs, Volume= 2,036 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link C : POI-C
Secondary = 0.79 cfs @ 12.12 hrs, Volume= 889 cf
Routed to Link A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 449.60' @ 12.12 hrs Surf.Area= 442 sf Storage= 250 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 14.7 min (855.5 - 840.8)

Volume	Invert	Avail.Storage	Storage Description
#1	448.50'	499 cf	**Rain Garden (Conic)** Listed below (Recalc)
#2	447.75'	105 cf	**Infiltration Trench (Conic)** Listed below (Recalc) 350 cf Overall x 30.0% Voids
		604 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
448.50	15	0	0	15
449.00	140	33	33	141
450.00	375	248	282	382
450.50	497	217	499	510

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
447.75	175	0	0	175
449.75	175	350	350	269

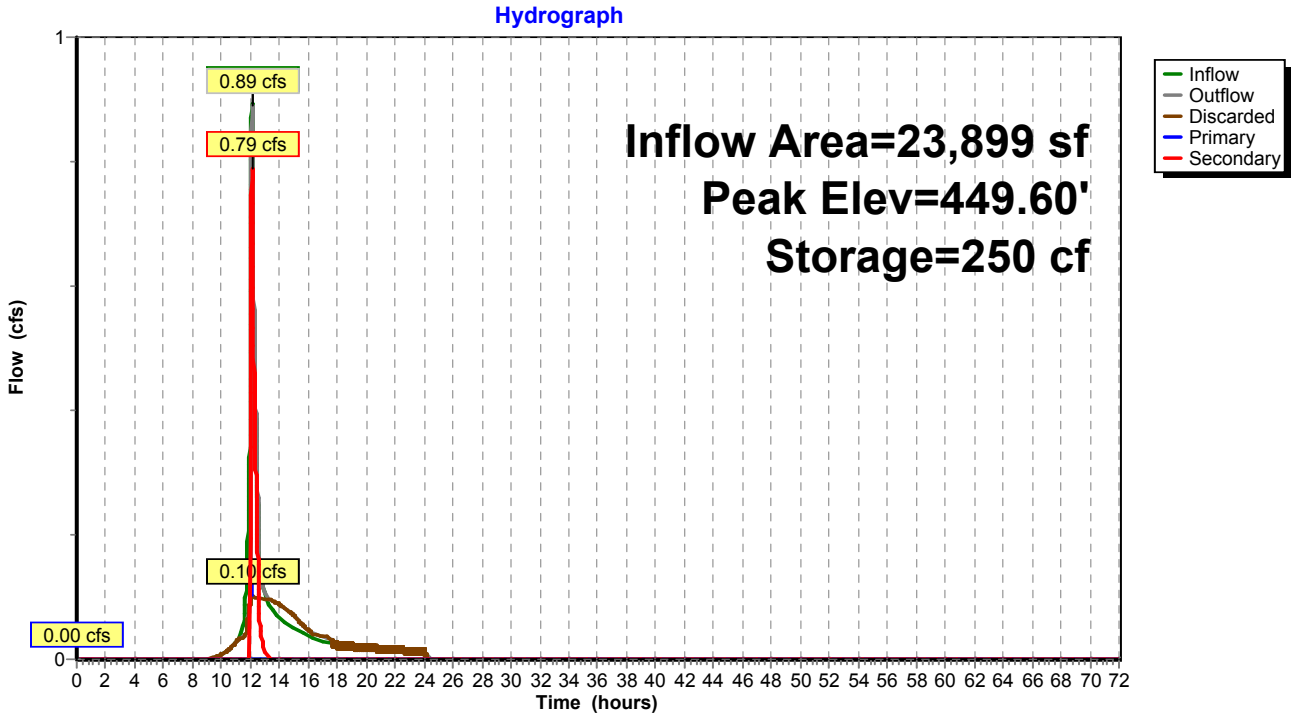
Device	Routing	Invert	Outlet Devices
#1	Secondary	446.03'	**8.0" Round Culvert** L= 66.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.03' / 445.70' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	449.50'	**30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	450.00'	**25.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#4	Discarded	447.75'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.10 cfs @ 12.12 hrs HW=449.60' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=447.75' TW=0.00' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Secondary OutFlow Max=0.79 cfs @ 12.12 hrs HW=449.60' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.79 cfs of 2.16 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 0.79 cfs @ 1.02 fps)

Pond IT-1: Infiltration Trench / Rain Garden #1



Summary for Pond IT-2: Inf. Trench #2

Inflow Area = 9,871 sf, 72.91% Impervious, Inflow Depth = 1.54" for 2-year event
Inflow = 0.41 cfs @ 12.09 hrs, Volume= 1,265 cf
Outflow = 0.42 cfs @ 12.09 hrs, Volume= 1,265 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.97 hrs, Volume= 821 cf
Primary = 0.39 cfs @ 12.09 hrs, Volume= 445 cf
Routed to Link C : POI-C

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 450.76' @ 12.09 hrs Surf.Area= 108 sf Storage= 65 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 10.1 min (846.4 - 836.3)

Volume	Invert	Avail.Storage	Storage Description
#1	448.75'	65 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 216 cf Overall x 30.0% Voids

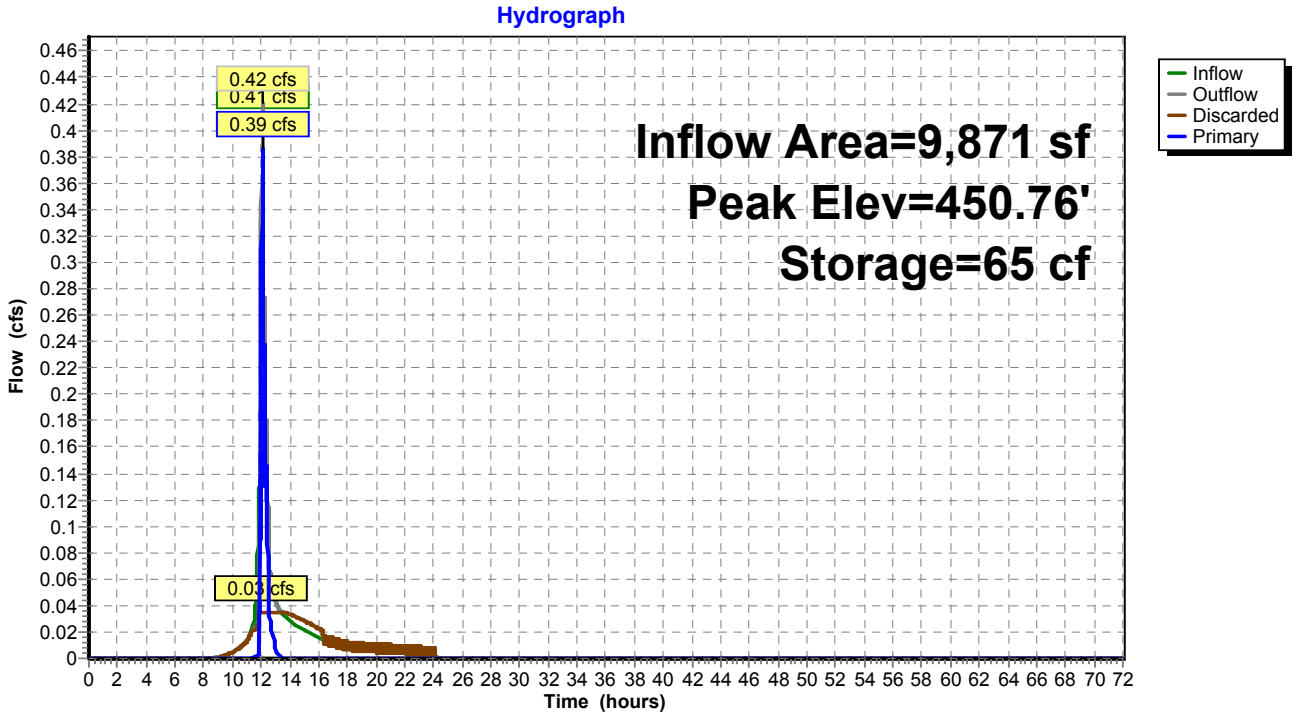
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
448.75	108	0	0	108
450.75	108	216	216	182

Device	Routing	Invert	Outlet Devices
#1	Primary	450.74'	**54.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	448.75'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.03 cfs @ 11.97 hrs HW=450.75' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.39 cfs @ 12.09 hrs HW=450.76' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.39 cfs @ 0.37 fps)

Pond IT-2: Inf. Trench #2



Summary for Pond IT-3: Inf. Trench #3

Inflow Area = 8,102 sf, 93.48% Impervious, Inflow Depth = 2.54" for 2-year event
Inflow = 0.53 cfs @ 12.08 hrs, Volume= 1,718 cf
Outflow = 0.56 cfs @ 12.09 hrs, Volume= 1,718 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.06 cfs @ 11.95 hrs, Volume= 1,247 cf
Primary = 0.50 cfs @ 12.09 hrs, Volume= 471 cf
Routed to Link C : POI-C

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 448.91' @ 12.09 hrs Surf.Area= 210 sf Storage= 126 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 9.2 min (796.4 - 787.1)

Volume	Invert	Avail.Storage	Storage Description
#1	446.90'	126 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 420 cf Overall x 30.0% Voids

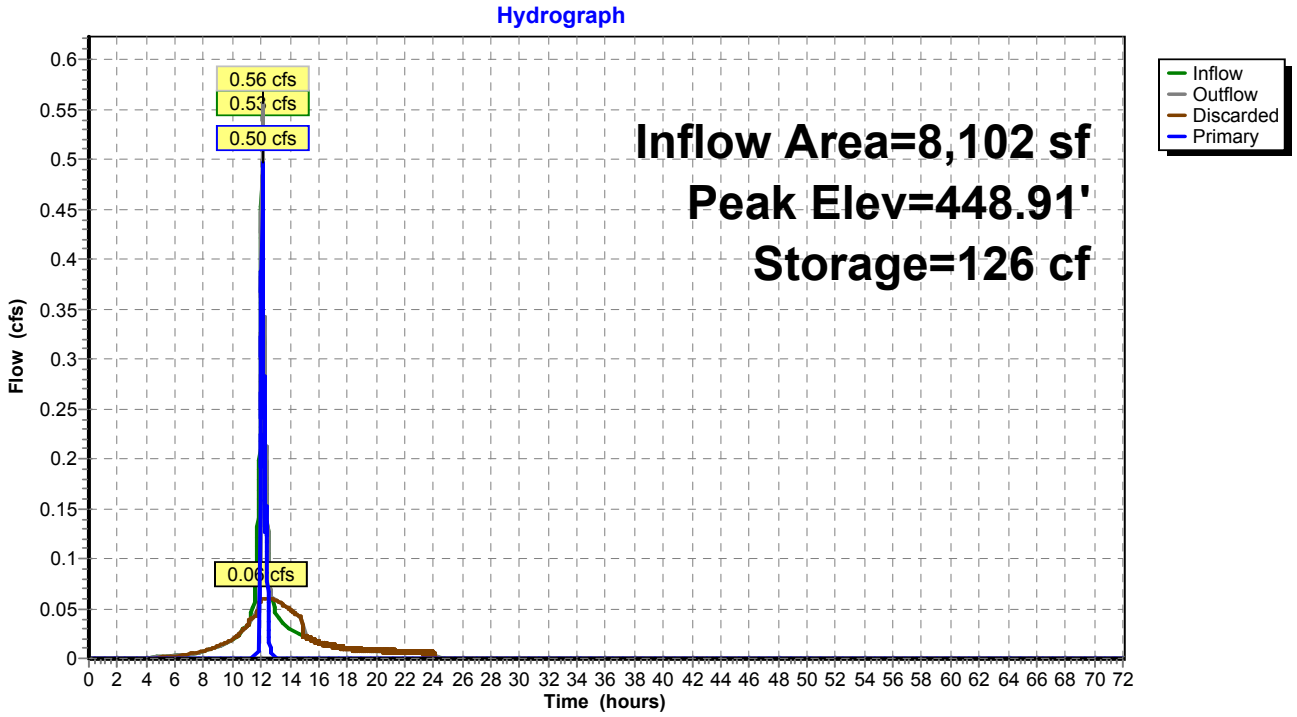
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
446.90	210	0	0	210
448.90	210	420	420	313

Device	Routing	Invert	Outlet Devices
#1	Primary	448.89'	**54.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	446.90'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.06 cfs @ 11.95 hrs HW=448.90' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.49 cfs @ 12.09 hrs HW=448.91' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.49 cfs @ 0.40 fps)

Pond IT-3: Inf. Trench #3



Summary for Pond RG-1: Rain Garden #1

Inflow Area = 12,741 sf, 7.29% Impervious, Inflow Depth = 0.02" for 2-year event
Inflow = 0.00 cfs @ 17.18 hrs, Volume= 23 cf
Outflow = 0.00 cfs @ 17.18 hrs, Volume= 23 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 17.18 hrs, Volume= 23 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link B : POI-B

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 449.50' @ 0.00 hrs Surf.Area= 342 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (1,171.8 - 1,171.8)

Volume	Invert	Avail.Storage	Storage Description
#1	449.50'	200 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

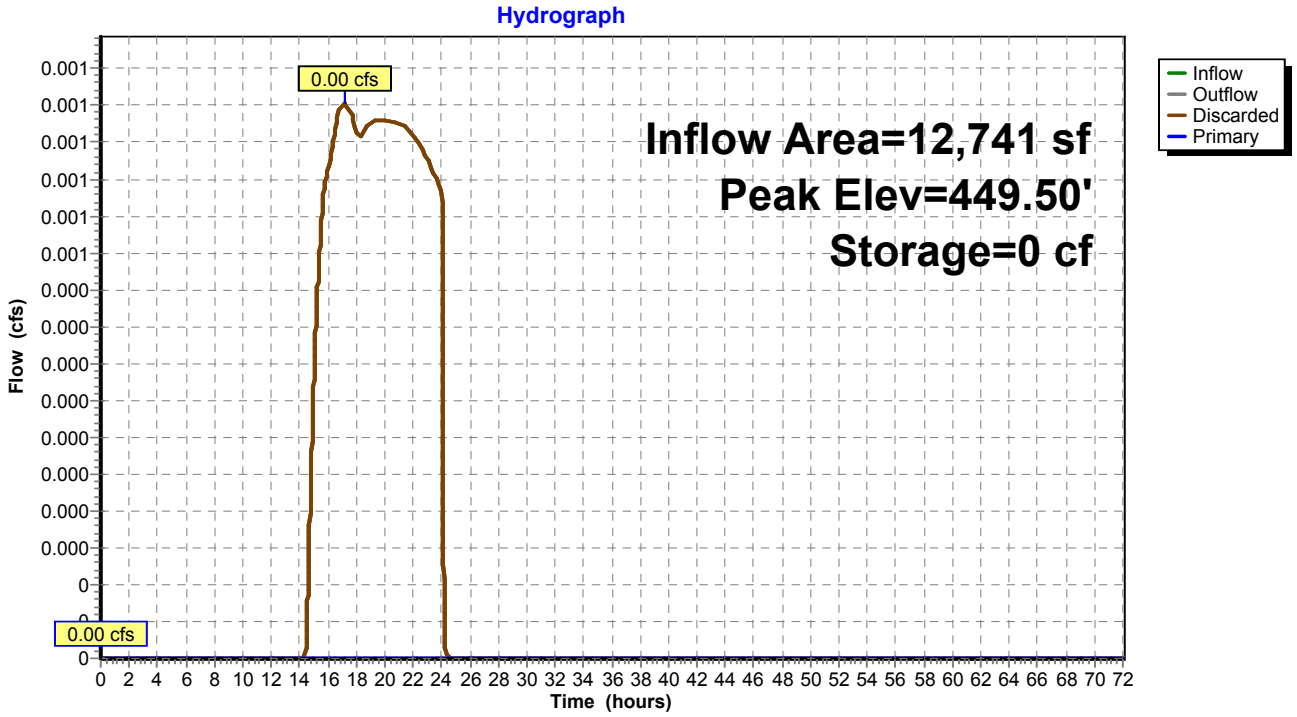
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
449.50	342	0	0	342
450.00	461	200	200	466

Device	Routing	Invert	Outlet Devices
#1	Discarded	449.50'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	446.31'	**8.0" Round Culvert** L= 34.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.31' / 445.62' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	450.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 17.18 hrs HW=449.50' (Free Discharge)
└**1=Exfiltration** (Passes 0.00 cfs of 0.07 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=449.50' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.00 cfs of 2.24 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond RG-1: Rain Garden #1



Summary for Pond RG-2: Rain Garden #2

Inflow Area = 11,053 sf, 19.41% Impervious, Inflow Depth = 0.13" for 2-year event
Inflow = 0.01 cfs @ 12.49 hrs, Volume= 118 cf
Outflow = 0.01 cfs @ 12.49 hrs, Volume= 118 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.01 cfs @ 12.49 hrs, Volume= 118 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link B : POI-B

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 448.25' @ 0.00 hrs Surf.Area= 1,057 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (1,010.8 - 1,010.8)

Volume	Invert	Avail.Storage	Storage Description
#1	448.25'	583 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

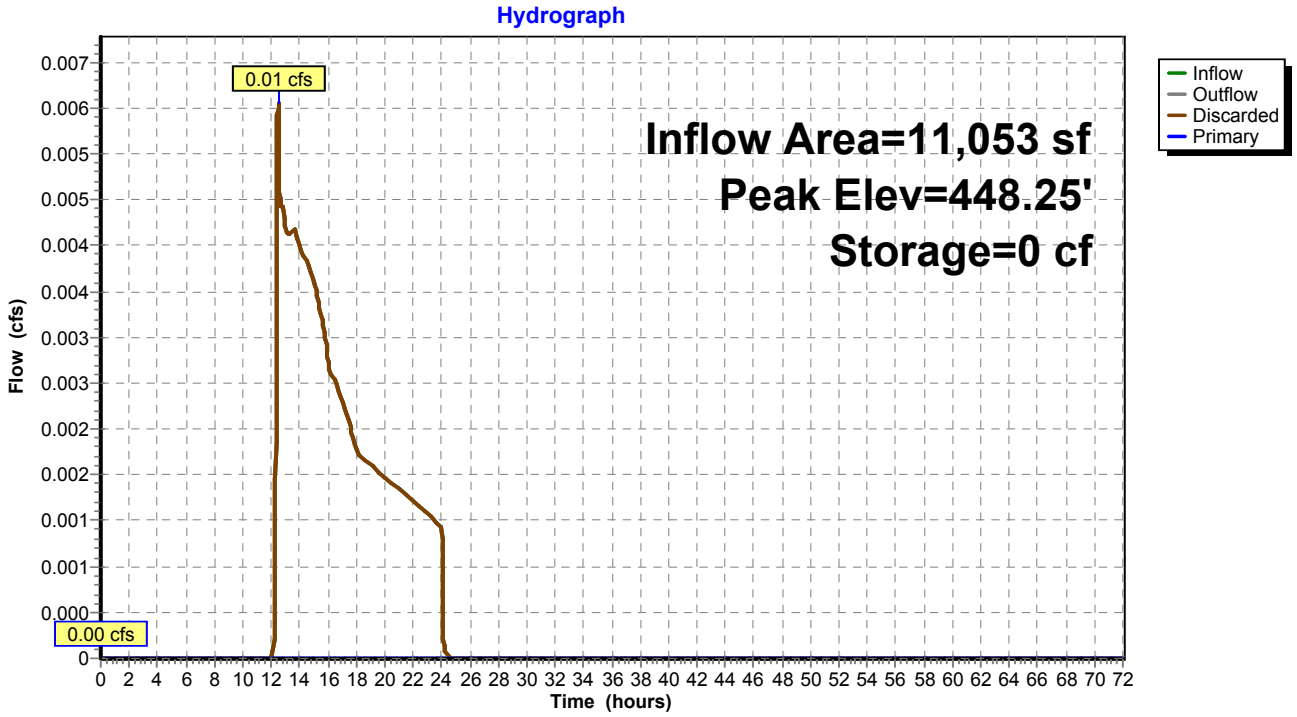
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
448.25	1,057	0	0	1,057
448.75	1,278	583	583	1,286

Device	Routing	Invert	Outlet Devices
#1	Discarded	448.25'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	445.47'	**8.0" Round Culvert** L= 37.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 445.47' / 444.73' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	448.75'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 12.49 hrs HW=448.25' (Free Discharge)
└**1=Exfiltration** (Passes 0.00 cfs of 0.20 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=448.25' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.00 cfs of 2.08 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond RG-2: Rain Garden #2

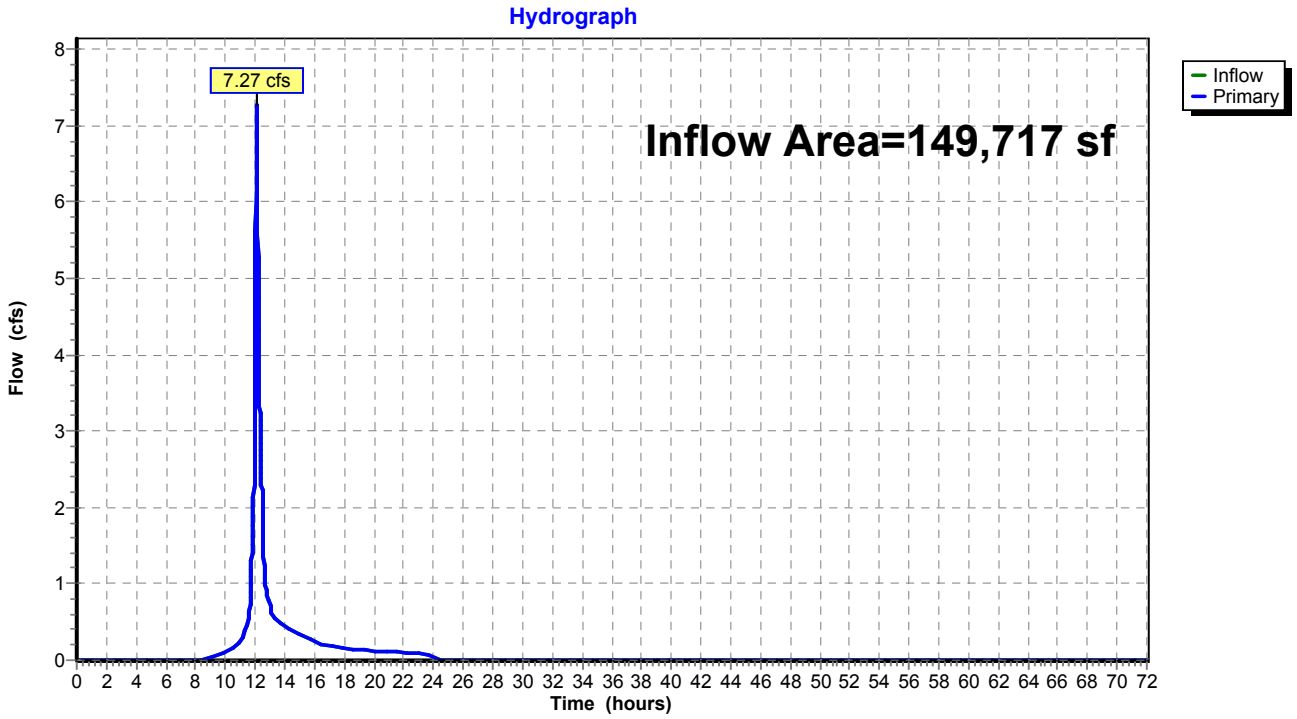


Summary for Link A: POI-A

Inflow Area = 149,717 sf, 54.63% Impervious, Inflow Depth = 1.72" for 2-year event
Inflow = 7.27 cfs @ 12.10 hrs, Volume= 21,506 cf
Primary = 7.27 cfs @ 12.10 hrs, Volume= 21,506 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link A: POI-A

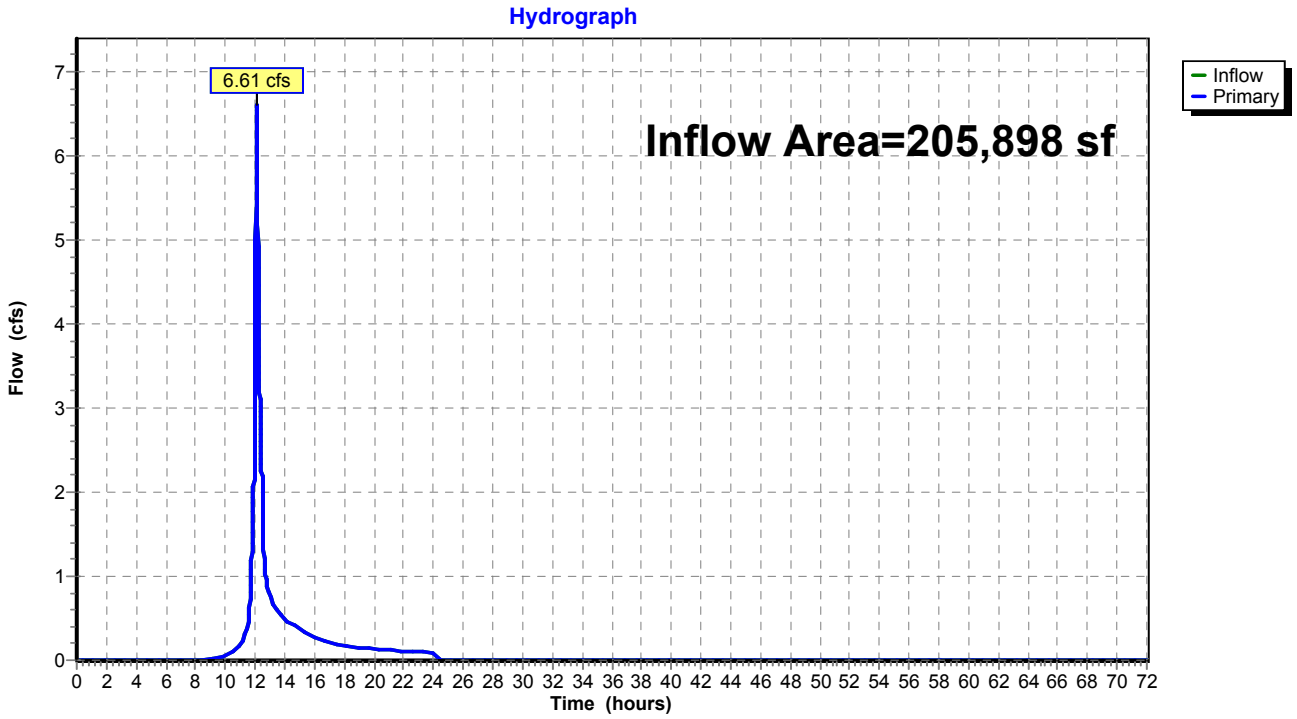


Summary for Link B: POI-B

Inflow Area = 205,898 sf, 62.86% Impervious, Inflow Depth = 1.25" for 2-year event
Inflow = 6.61 cfs @ 12.10 hrs, Volume= 21,427 cf
Primary = 6.61 cfs @ 12.10 hrs, Volume= 21,427 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link B: POI-B

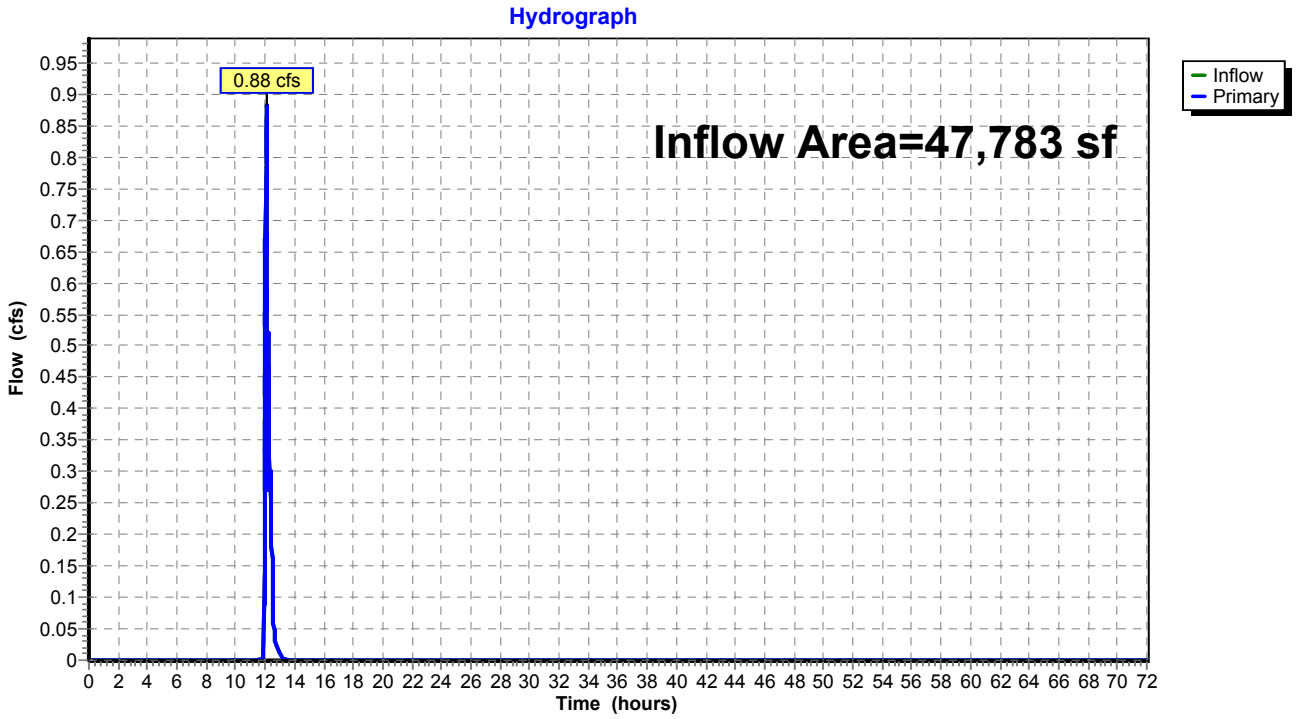


Summary for Link C: POI-C

Inflow Area = 47,783 sf, 66.40% Impervious, Inflow Depth = 0.23" for 2-year event
Inflow = 0.88 cfs @ 12.09 hrs, Volume= 915 cf
Primary = 0.88 cfs @ 12.09 hrs, Volume= 915 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link C: POI-C



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=99,996 sf 46.79% Impervious Runoff Depth=3.30"
Flow Length=622' Tc=6.8 min CN=85 Runoff=8.57 cfs 27,527 cf

SubcatchmentA2: SUB-A2 Runoff Area=10,386 sf 78.95% Impervious Runoff Depth=3.40"
Flow Length=39' Slope=0.0150 '/' Tc=6.0 min CN=86 Runoff=0.94 cfs 2,944 cf

SubcatchmentA3: SUB-A3 Runoff Area=39,335 sf 68.13% Impervious Runoff Depth=2.74"
Flow Length=36' Tc=6.0 min CN=79 Runoff=2.90 cfs 8,986 cf

SubcatchmentB1: SUB-B1 Runoff Area=167,239 sf 67.73% Impervious Runoff Depth=2.74"
Flow Length=174' Tc=6.9 min CN=79 Runoff=11.96 cfs 38,207 cf

SubcatchmentB2: SUB-B2 Runoff Area=11,053 sf 19.41% Impervious Runoff Depth=0.66"
Flow Length=130' Slope=0.0200 '/' Tc=6.9 min CN=50 Runoff=0.12 cfs 612 cf

SubcatchmentB3: SUB-B3 Runoff Area=12,741 sf 7.29% Impervious Runoff Depth=0.33"
Flow Length=189' Slope=0.0200 '/' Tc=7.9 min CN=43 Runoff=0.04 cfs 355 cf

SubcatchmentB4: SUB-B2 Runoff Area=14,865 sf 87.90% Impervious Runoff Depth=3.91"
Flow Length=140' Tc=6.2 min CN=91 Runoff=1.49 cfs 4,849 cf

SubcatchmentC1: SUB-C1 Runoff Area=23,899 sf 70.96% Impervious Runoff Depth=2.92"
Flow Length=452' Tc=7.4 min CN=81 Runoff=1.79 cfs 5,823 cf

SubcatchmentC2: SUB-C2 Runoff Area=9,871 sf 72.91% Impervious Runoff Depth=3.02"
Flow Length=124' Slope=0.0200 '/' Tc=6.0 min CN=82 Runoff=0.80 cfs 2,481 cf

SubcatchmentC3: SUB-C3 Runoff Area=8,102 sf 93.48% Impervious Runoff Depth=4.24"
Flow Length=122' Slope=0.0200 '/' Tc=6.0 min CN=94 Runoff=0.86 cfs 2,862 cf

SubcatchmentC4: SUB-C4 Runoff Area=5,911 sf 0.00% Impervious Runoff Depth=0.19"
Flow Length=20' Slope=0.0200 '/' Tc=6.0 min CN=39 Runoff=0.00 cfs 92 cf

Pond IT-1: Infiltration Trench / Rain Garden #1 Peak Elev=449.66' Storage=271 cf Inflow=1.79 cfs 5,823 cf
Discarded=0.11 cfs 3,123 cf Primary=0.00 cfs 0 cf Secondary=1.68 cfs 2,700 cf Outflow=1.79 cfs 5,822 cf

Pond IT-2: Inf. Trench #2 Peak Elev=450.77' Storage=65 cf Inflow=0.80 cfs 2,481 cf
Discarded=0.03 cfs 1,227 cf Primary=0.77 cfs 1,254 cf Outflow=0.80 cfs 2,481 cf

Pond IT-3: Inf. Trench #3 Peak Elev=448.92' Storage=126 cf Inflow=0.86 cfs 2,862 cf
Discarded=0.06 cfs 1,796 cf Primary=0.83 cfs 1,066 cf Outflow=0.89 cfs 2,862 cf

Pond RG-1: Rain Garden #1 Peak Elev=449.50' Storage=0 cf Inflow=0.04 cfs 355 cf
Discarded=0.04 cfs 355 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 355 cf

Pond RG-2: Rain Garden #2 Peak Elev=448.25' Storage=0 cf Inflow=0.12 cfs 612 cf
Discarded=0.12 cfs 612 cf Primary=0.00 cfs 0 cf Outflow=0.12 cfs 612 cf

Link A: POI-A Inflow=14.04 cfs 42,157 cf
Primary=14.04 cfs 42,157 cf

Link B: POI-B Inflow=13.43 cfs 43,056 cf
Primary=13.43 cfs 43,056 cf

Link C: POI-C Inflow=1.59 cfs 2,412 cf
Primary=1.59 cfs 2,412 cf

Total Runoff Area = 403,398 sf Runoff Volume = 94,738 cf Average Runoff Depth = 2.82"
39.78% Pervious = 160,463 sf 60.22% Impervious = 242,935 sf

Summary for Subcatchment A1: SUB-A1

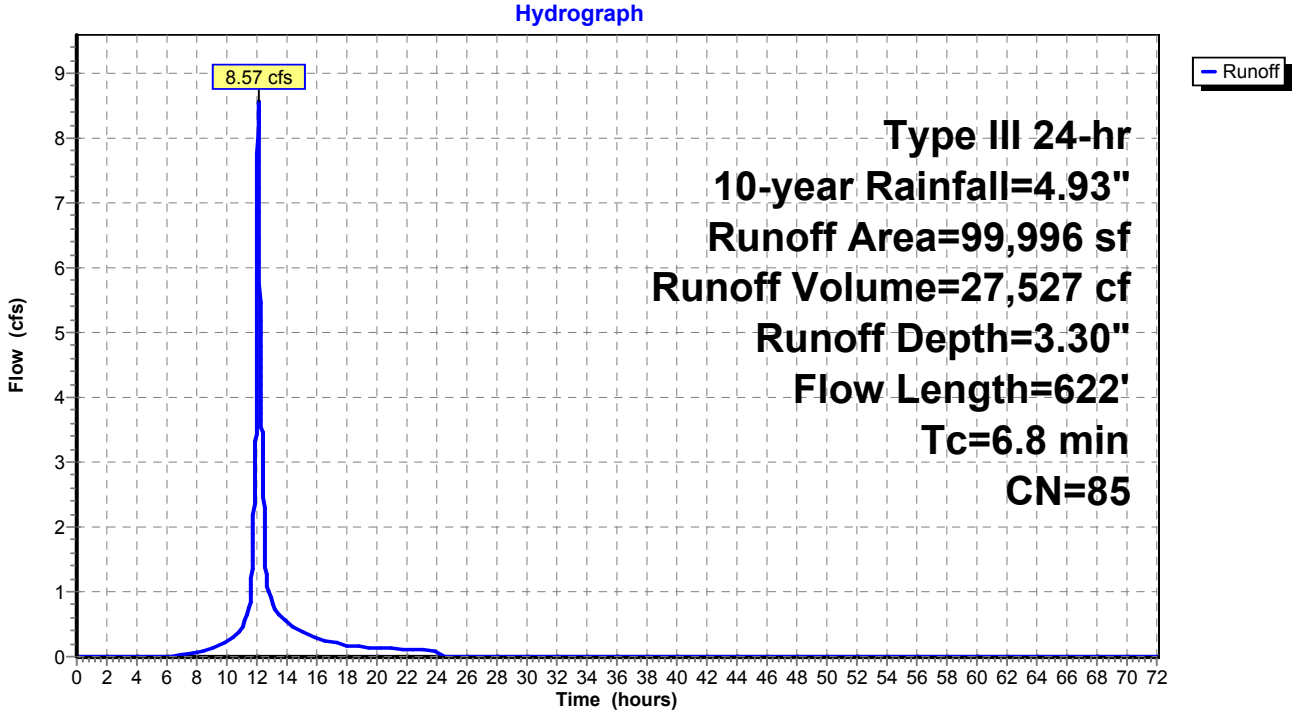
Runoff = 8.57 cfs @ 12.10 hrs, Volume= 27,527 cf, Depth= 3.30"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
*	46,789	98	Impervious Surfaces
	53,207	74	>75% Grass cover, Good, HSG C
	99,996	85	Weighted Average
	53,207		53.21% Pervious Area
	46,789		46.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0750	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.8	236	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	336	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
6.8	622	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

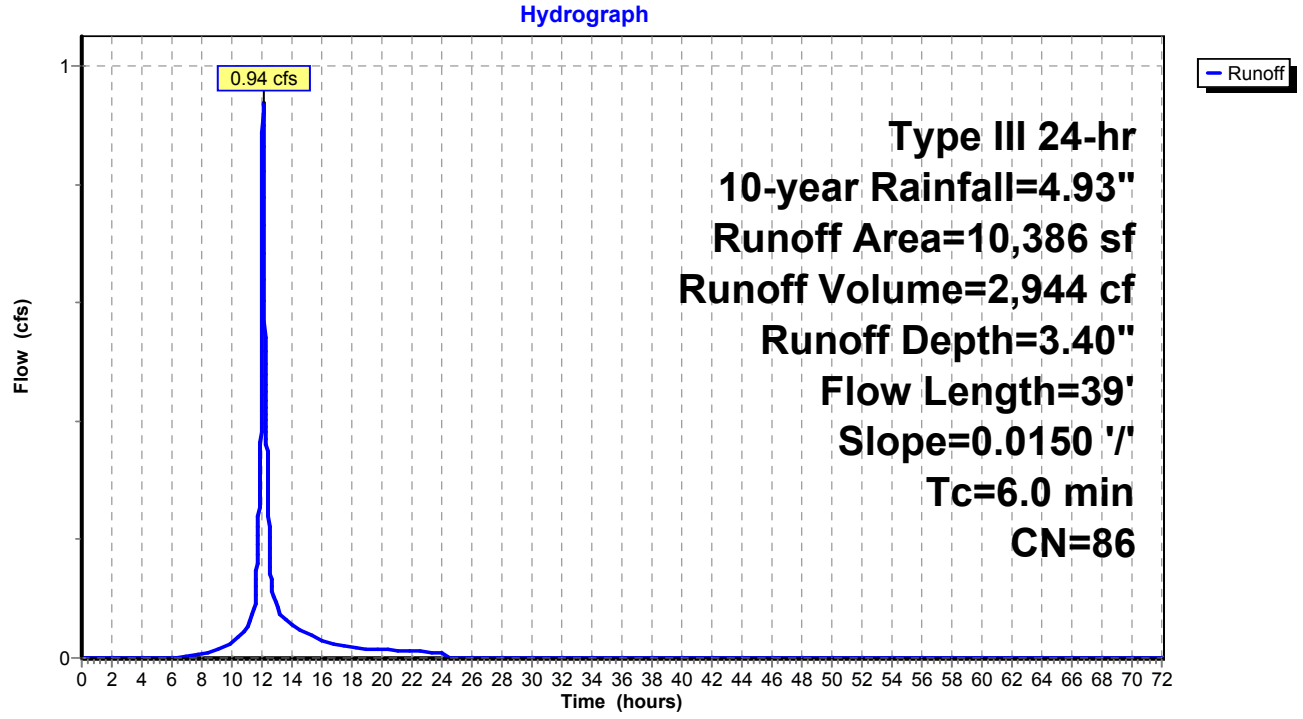
Runoff = 0.94 cfs @ 12.09 hrs, Volume= 2,944 cf, Depth= 3.40"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
	2,186	39	>75% Grass cover, Good, HSG A
*	8,200	98	Impervious Surfaces
	10,386	86	Weighted Average
	2,186		21.05% Pervious Area
	8,200		78.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	6	0.0150	0.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.7	3	0.0150	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.5	30	0.0150	0.96		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.3	39	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A2: SUB-A2



Summary for Subcatchment A3: SUB-A3

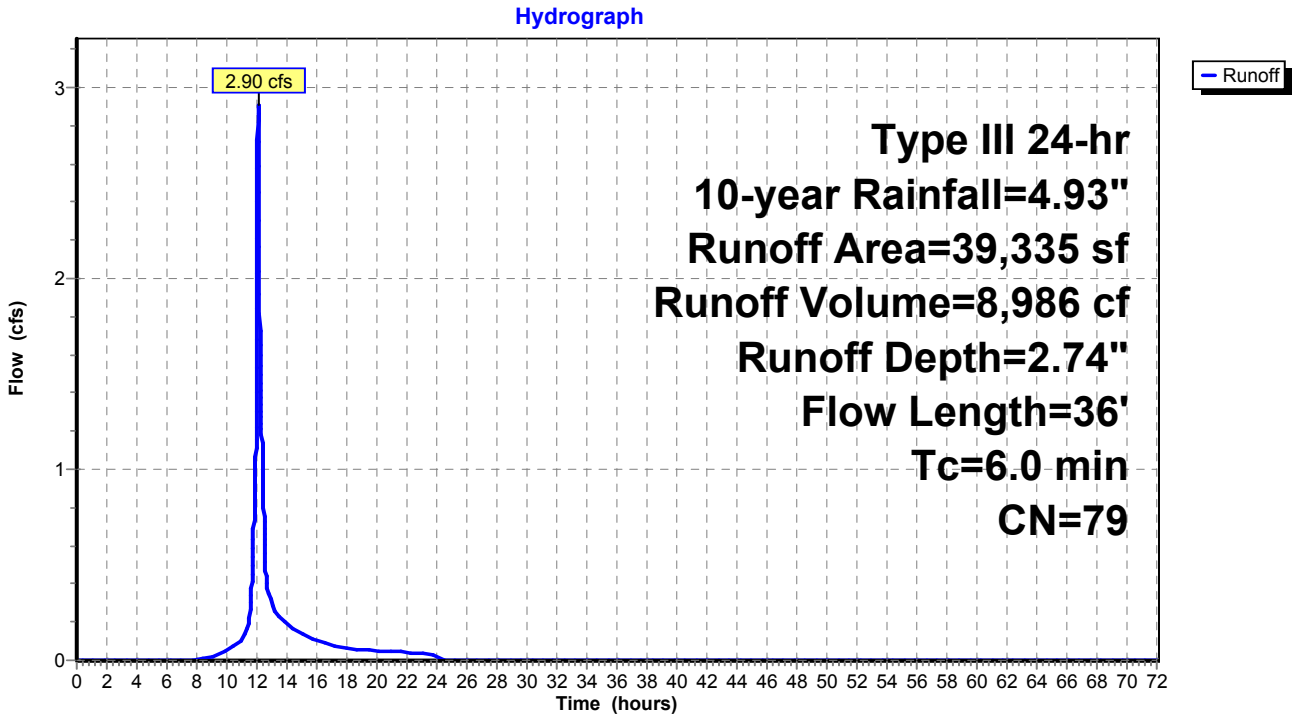
Runoff = 2.90 cfs @ 12.09 hrs, Volume= 8,986 cf, Depth= 2.74"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
	12,537	39	>75% Grass cover, Good, HSG A
*	26,798	98	Impervious Surfaces
	39,335	79	Weighted Average
	12,537		31.87% Pervious Area
	26,798		68.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	28	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	8	0.0150	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.7	36	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A3: SUB-A3



Summary for Subcatchment B1: SUB-B1

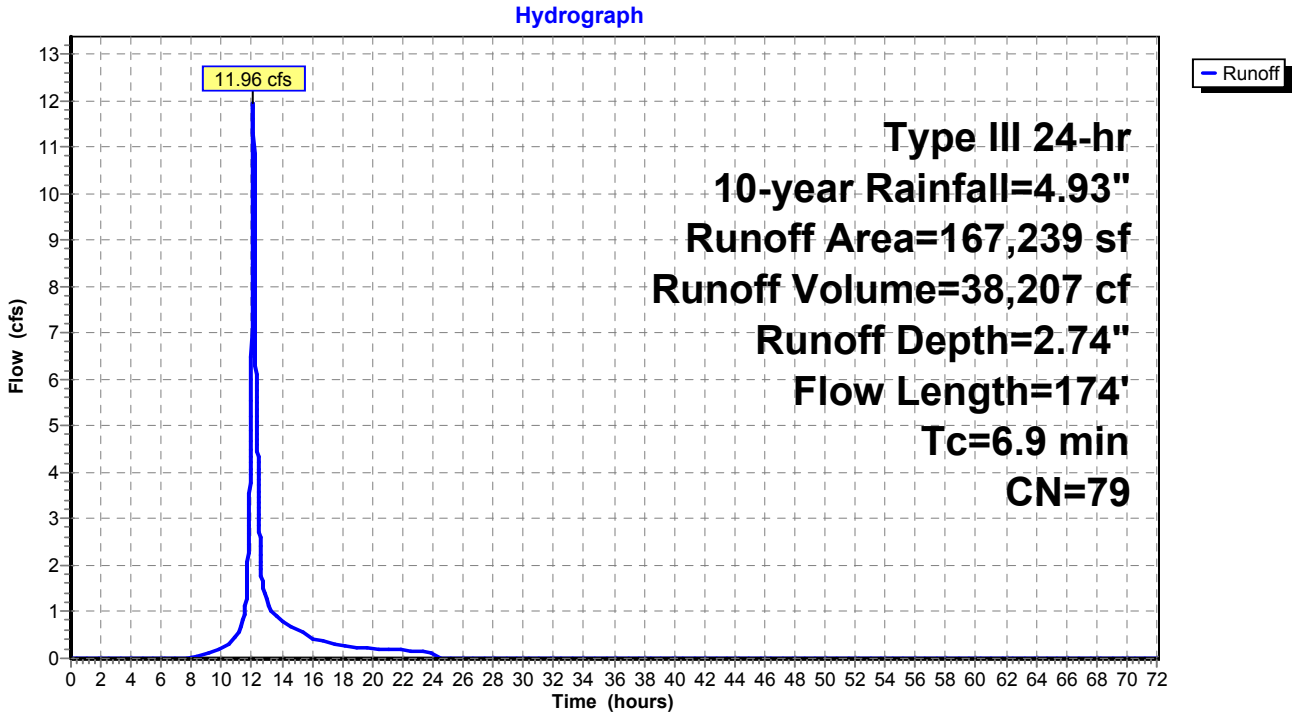
Runoff = 11.96 cfs @ 12.10 hrs, Volume= 38,207 cf, Depth= 2.74"
Routed to Link B : POI-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
*	113,277	98	Impervious Surfaces
	53,962	39	>75% Grass cover, Good, HSG A
	167,239	79	Weighted Average
	53,962		32.27% Pervious Area
	113,277		67.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	14	0.0200	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.1	6	0.0150	0.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.7	30	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.0	6	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	27	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	91	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.9	174	Total			

Subcatchment B1: SUB-B1



Summary for Subcatchment B2: SUB-B2

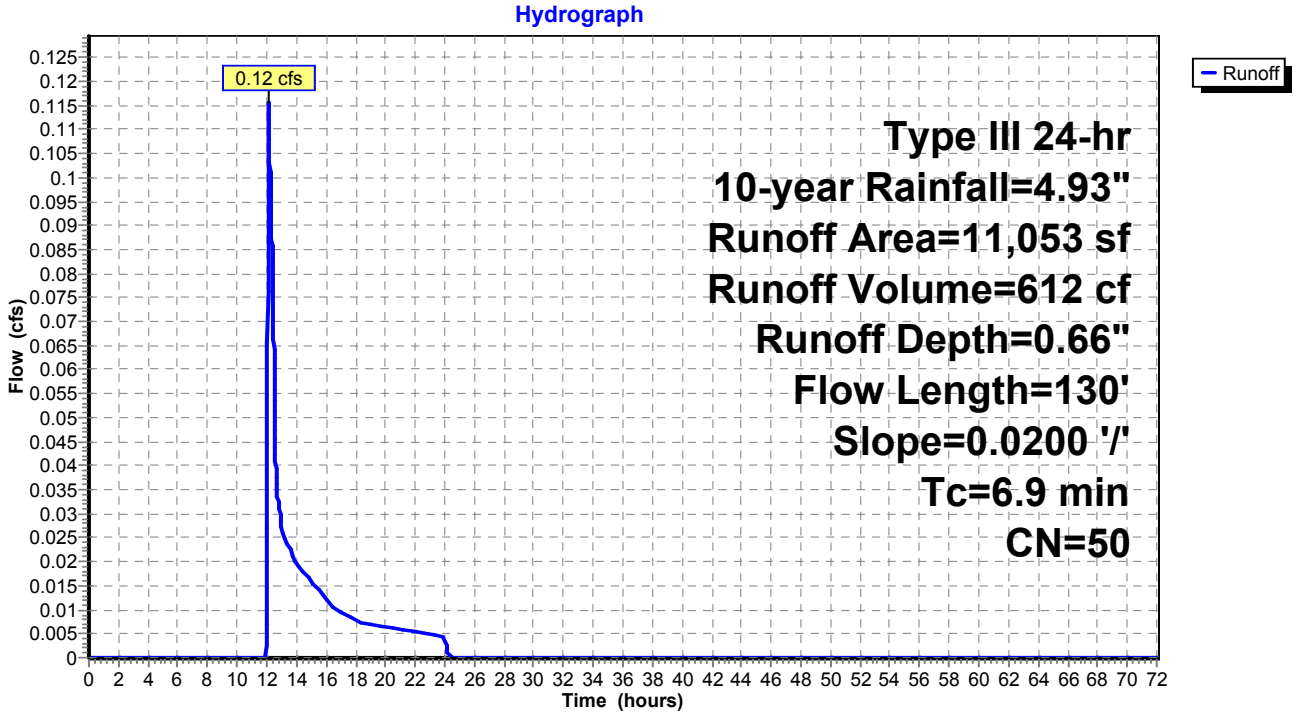
Runoff = 0.12 cfs @ 12.14 hrs, Volume= 612 cf, Depth= 0.66"
Routed to Pond RG-2 : Rain Garden #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
	8,908	39	>75% Grass cover, Good, HSG A
*	1,088	98	Impervious Surfaces
*	1,057	98	Rain Garden
	11,053	50	Weighted Average
	8,908		80.59% Pervious Area
	2,145		19.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.3	80	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.9	130	Total			

Subcatchment B2: SUB-B2



Summary for Subcatchment B3: SUB-B3

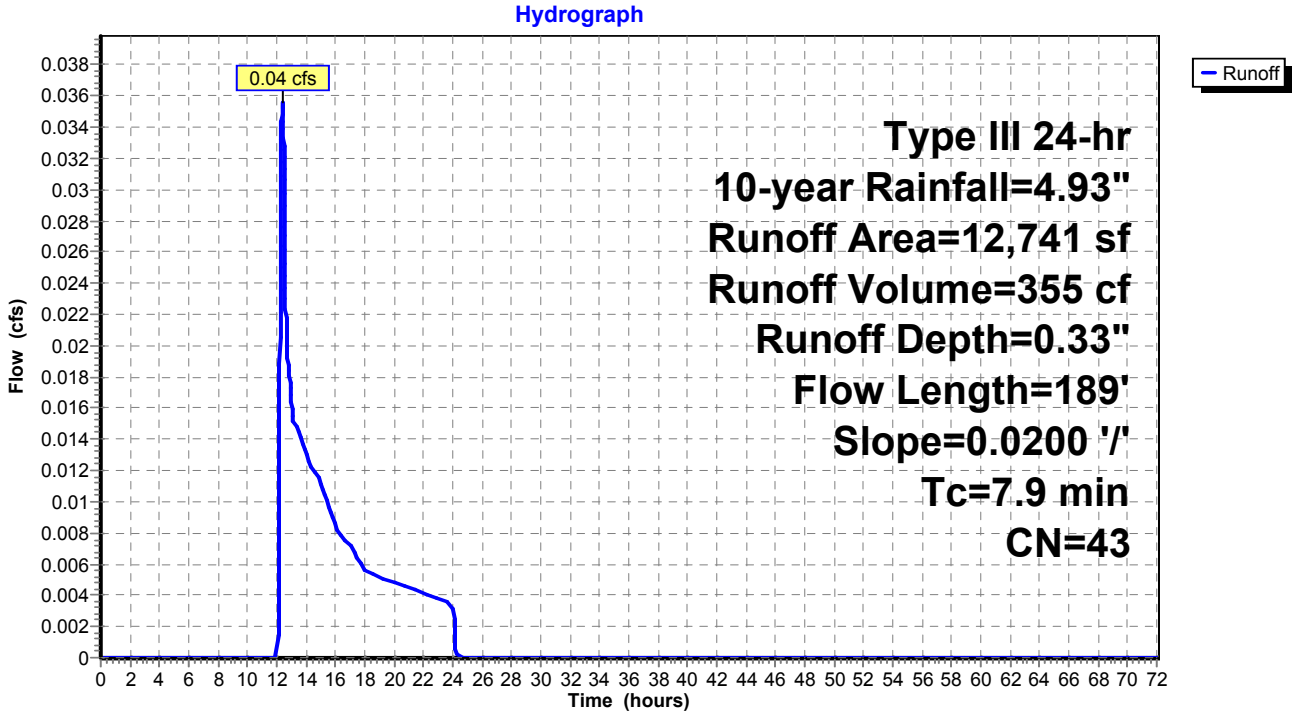
Runoff = 0.04 cfs @ 12.39 hrs, Volume= 355 cf, Depth= 0.33"
Routed to Pond RG-1 : Rain Garden #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
	11,812	39	>75% Grass cover, Good, HSG A
*	342	98	Rain Garden
*	587	98	Impervious Surfaces
	12,741	43	Weighted Average
	11,812		92.71% Pervious Area
	929		7.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	139	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.9	189	Total			

Subcatchment B3: SUB-B3



Summary for Subcatchment B4: SUB-B2

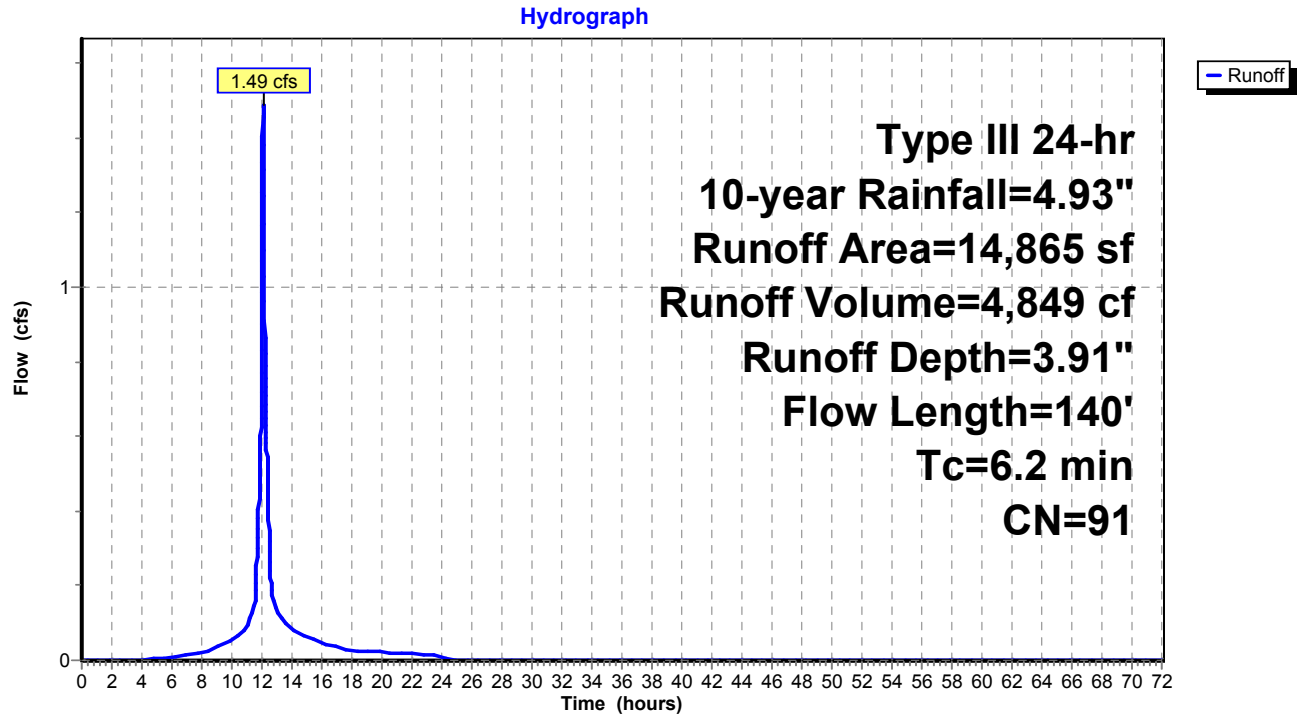
Runoff = 1.49 cfs @ 12.09 hrs, Volume= 4,849 cf, Depth= 3.91"
Routed to Link B : POI-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
	1,798	39	>75% Grass cover, Good, HSG A
*	13,067	98	Impervious Surfaces
	14,865	91	Weighted Average
	1,798		12.10% Pervious Area
	13,067		87.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	90	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	140	Total			

Subcatchment B4: SUB-B2



Summary for Subcatchment C1: SUB-C1

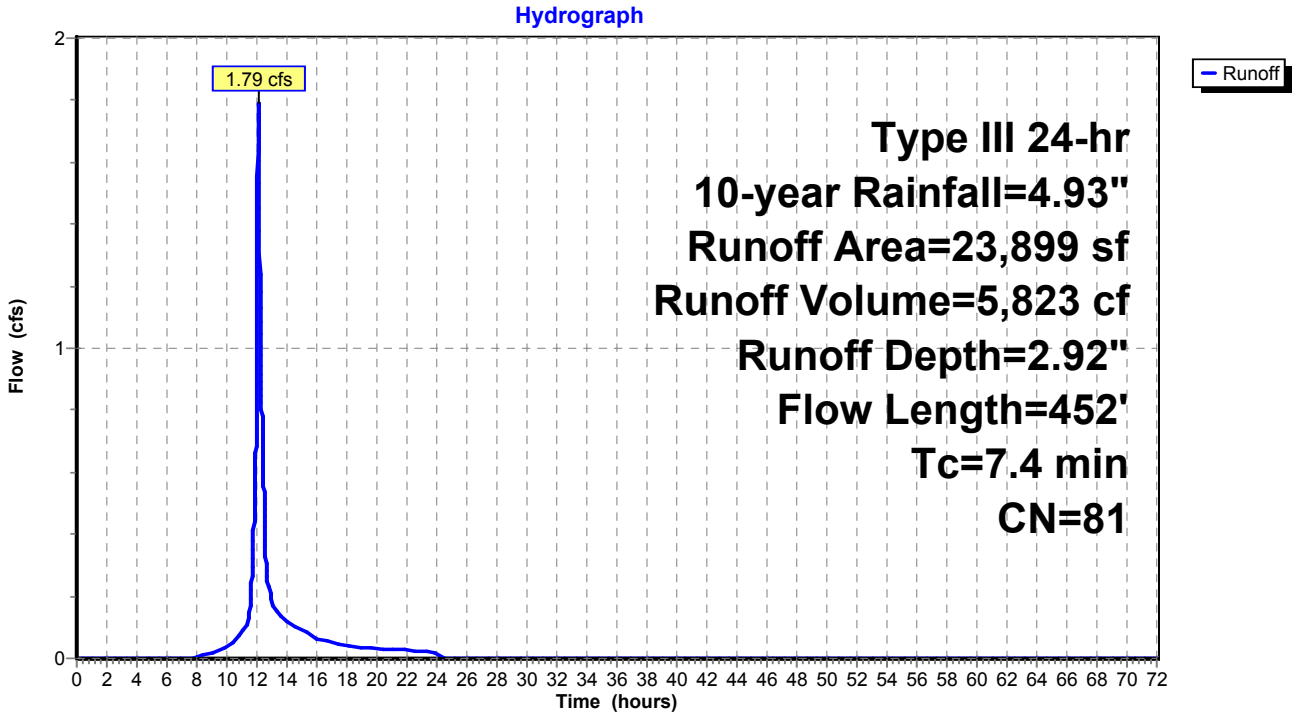
Runoff = 1.79 cfs @ 12.11 hrs, Volume= 5,823 cf, Depth= 2.92"
Routed to Pond IT-1 : Infiltration Trench / Rain Garden #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
	6,940	39	>75% Grass cover, Good, HSG A
*	16,769	98	Impervious Surfaces
*	190	98	Infiltration Trench/Rain Garden
	23,899	81	Weighted Average
	6,940		29.04% Pervious Area
	16,959		70.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	85	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.4	315	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	2	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.4	452	Total			

Subcatchment C1: SUB-C1



Summary for Subcatchment C2: SUB-C2

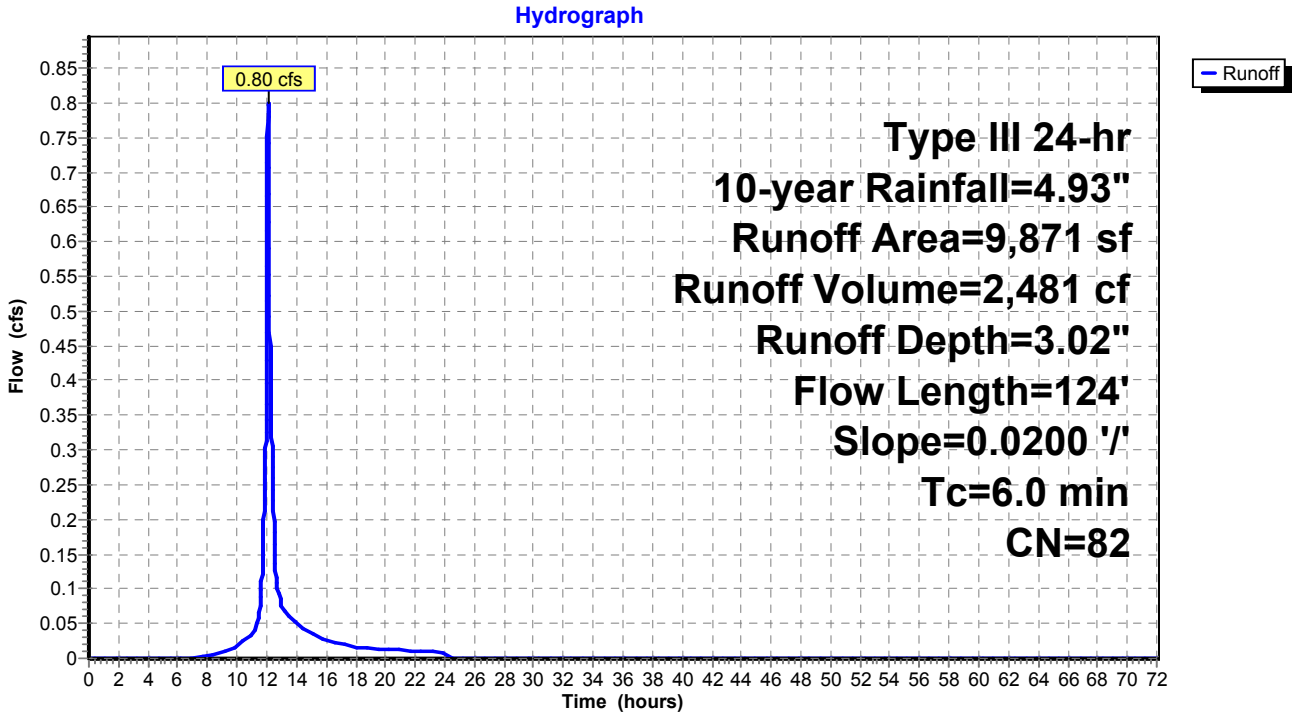
Runoff = 0.80 cfs @ 12.09 hrs, Volume= 2,481 cf, Depth= 3.02"
Routed to Pond IT-2 : Inf. Trench #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
*	7,089	98	Impervious Surfaces
	2,674	39	>75% Grass cover, Good, HSG A
*	108	98	Infiltration Trench
	9,871	82	Weighted Average
	2,674		27.09% Pervious Area
	7,197		72.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	42	0.0200	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	8	0.0200	0.83		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.4	72	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	2	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.5	124	Total, Increased to minimum Tc = 6.0 min			

Subcatchment C2: SUB-C2



Summary for Subcatchment C3: SUB-C3

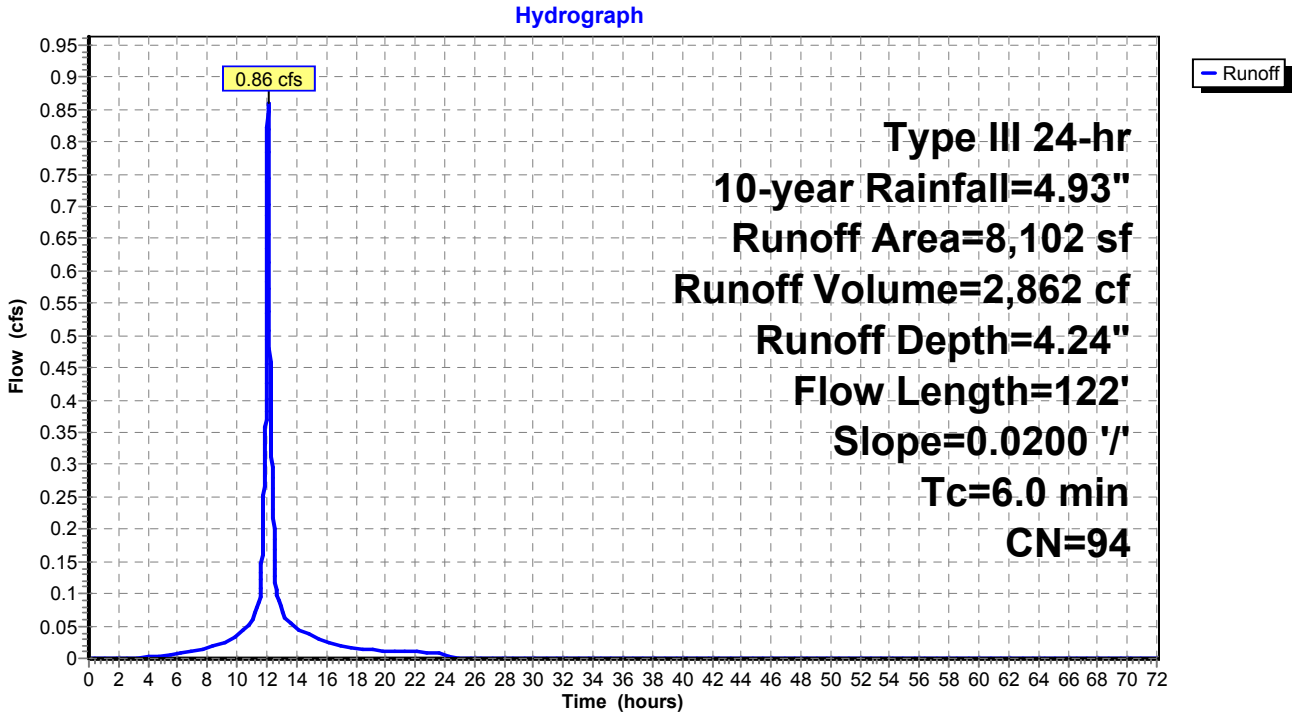
Runoff = 0.86 cfs @ 12.08 hrs, Volume= 2,862 cf, Depth= 4.24"
Routed to Pond IT-3 : Inf. Trench #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

	Area (sf)	CN	Description
*	7,364	98	Impervious Surfaces
	528	39	>75% Grass cover, Good, HSG A
*	210	98	Infiltration Trench
	8,102	94	Weighted Average
	528		6.52% Pervious Area
	7,574		93.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	8	0.0200	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	42	0.0200	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.4	70	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	2	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.3	122	Total, Increased to minimum Tc = 6.0 min			

Subcatchment C3: SUB-C3



Summary for Subcatchment C4: SUB-C4

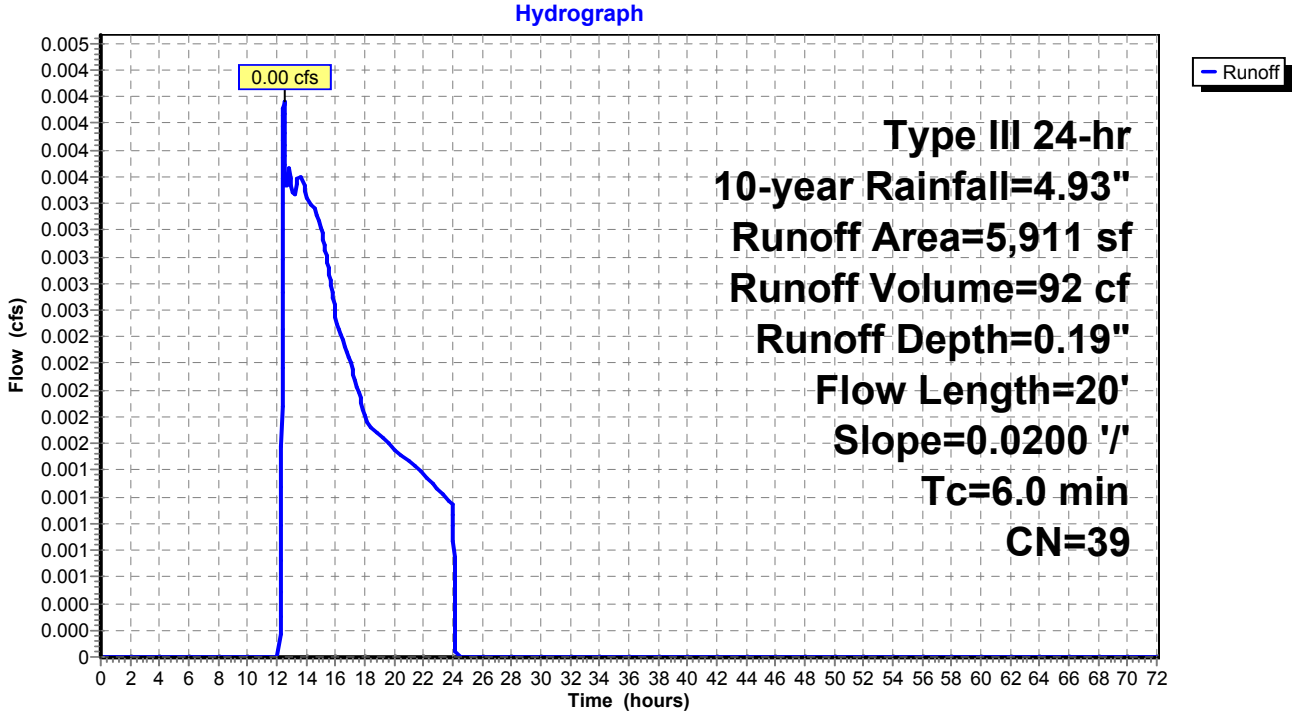
Runoff = 0.00 cfs @ 12.49 hrs, Volume= 92 cf, Depth= 0.19"
Routed to Link C : POI-C

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-year Rainfall=4.93"

Area (sf)	CN	Description
5,911	39	>75% Grass cover, Good, HSG A
5,911		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	20	0.0200	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.7	20	Total, Increased to minimum Tc = 6.0 min			

Subcatchment C4: SUB-C4



Summary for Pond IT-1: Infiltration Trench / Rain Garden #1

Inflow Area = 23,899 sf, 70.96% Impervious, Inflow Depth = 2.92" for 10-year event
Inflow = 1.79 cfs @ 12.11 hrs, Volume= 5,823 cf
Outflow = 1.79 cfs @ 12.11 hrs, Volume= 5,822 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.11 cfs @ 12.11 hrs, Volume= 3,123 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link C : POI-C
Secondary = 1.68 cfs @ 12.11 hrs, Volume= 2,700 cf
Routed to Link A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 449.66' @ 12.11 hrs Surf.Area= 458 sf Storage= 271 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 13.6 min (834.5 - 821.0)

Volume	Invert	Avail.Storage	Storage Description
#1	448.50'	499 cf	**Rain Garden (Conic)** Listed below (Recalc)
#2	447.75'	105 cf	**Infiltration Trench (Conic)** Listed below (Recalc) 350 cf Overall x 30.0% Voids
		604 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
448.50	15	0	0	15
449.00	140	33	33	141
450.00	375	248	282	382
450.50	497	217	499	510

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
447.75	175	0	0	175
449.75	175	350	350	269

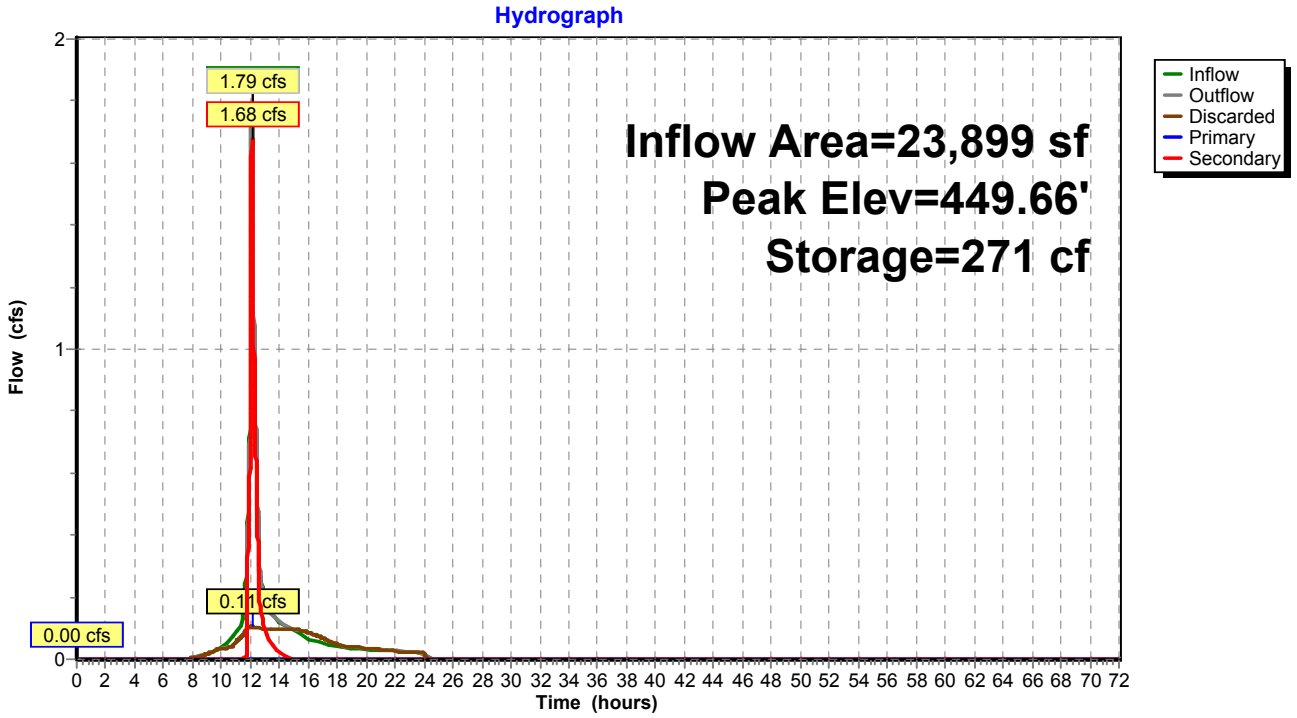
Device	Routing	Invert	Outlet Devices
#1	Secondary	446.03'	**8.0" Round Culvert** L= 66.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.03' / 445.70' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	449.50'	**30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	450.00'	**25.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#4	Discarded	447.75'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.11 cfs @ 12.11 hrs HW=449.66' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=447.75' TW=0.00' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Secondary OutFlow Max=1.68 cfs @ 12.11 hrs HW=449.66' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 1.68 cfs of 2.18 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 1.68 cfs @ 1.32 fps)

Pond IT-1: Infiltration Trench / Rain Garden #1



Summary for Pond IT-2: Inf. Trench #2

Inflow Area = 9,871 sf, 72.91% Impervious, Inflow Depth = 3.02" for 10-year event
Inflow = 0.80 cfs @ 12.09 hrs, Volume= 2,481 cf
Outflow = 0.80 cfs @ 12.09 hrs, Volume= 2,481 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.77 hrs, Volume= 1,227 cf
Primary = 0.77 cfs @ 12.09 hrs, Volume= 1,254 cf
Routed to Link C : POI-C

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 450.77' @ 12.09 hrs Surf.Area= 108 sf Storage= 65 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 9.0 min (825.9 - 816.9)

Volume	Invert	Avail.Storage	Storage Description
#1	448.75'	65 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 216 cf Overall x 30.0% Voids

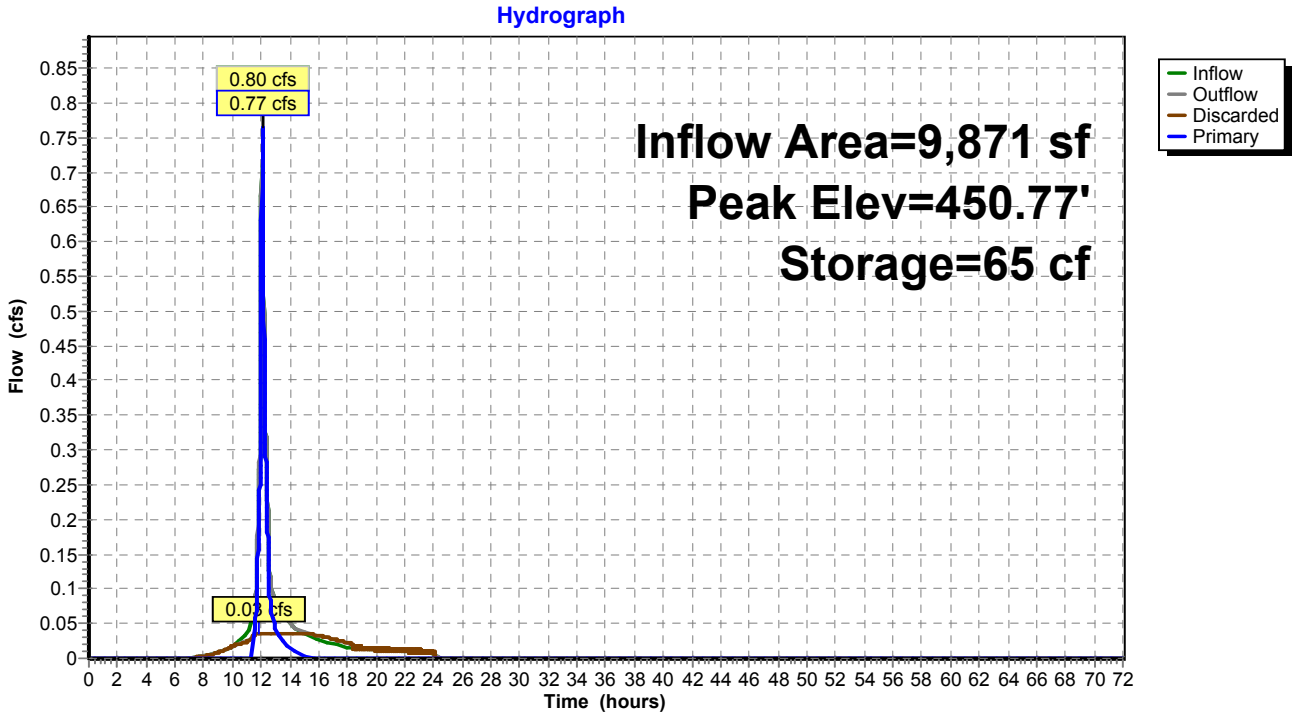
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
448.75	108	0	0	108
450.75	108	216	216	182

Device	Routing	Invert	Outlet Devices
#1	Primary	450.74'	**54.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	448.75'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.03 cfs @ 11.77 hrs HW=450.75' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.76 cfs @ 12.09 hrs HW=450.77' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.76 cfs @ 0.47 fps)

Pond IT-2: Inf. Trench #2



Summary for Pond IT-3: Inf. Trench #3

Inflow Area = 8,102 sf, 93.48% Impervious, Inflow Depth = 4.24" for 10-year event
Inflow = 0.86 cfs @ 12.08 hrs, Volume= 2,862 cf
Outflow = 0.89 cfs @ 12.08 hrs, Volume= 2,862 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.06 cfs @ 11.74 hrs, Volume= 1,796 cf
Primary = 0.83 cfs @ 12.08 hrs, Volume= 1,066 cf
Routed to Link C : POI-C

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 448.92' @ 12.08 hrs Surf.Area= 210 sf Storage= 126 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 9.4 min (783.3 - 773.9)

Volume	Invert	Avail.Storage	Storage Description
#1	446.90'	126 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 420 cf Overall x 30.0% Voids

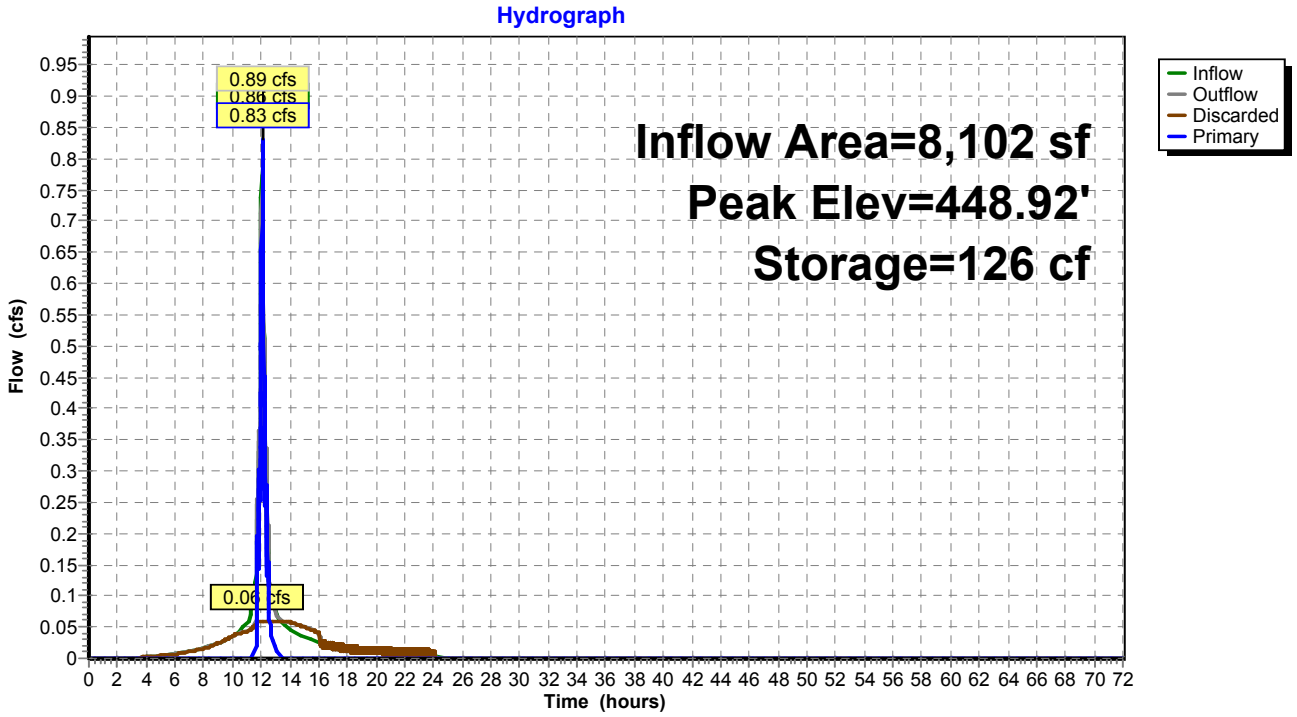
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
446.90	210	0	0	210
448.90	210	420	420	313

Device	Routing	Invert	Outlet Devices
#1	Primary	448.89'	**54.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	446.90'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.06 cfs @ 11.74 hrs HW=448.90' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.83 cfs @ 12.08 hrs HW=448.92' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.83 cfs @ 0.48 fps)

Pond IT-3: Inf. Trench #3



Summary for Pond RG-1: Rain Garden #1

Inflow Area = 12,741 sf, 7.29% Impervious, Inflow Depth = 0.33" for 10-year event
Inflow = 0.04 cfs @ 12.39 hrs, Volume= 355 cf
Outflow = 0.04 cfs @ 12.39 hrs, Volume= 355 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.04 cfs @ 12.39 hrs, Volume= 355 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link B : POI-B

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 449.50' @ 12.40 hrs Surf.Area= 342 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (968.4 - 968.4)

Volume	Invert	Avail.Storage	Storage Description
#1	449.50'	200 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

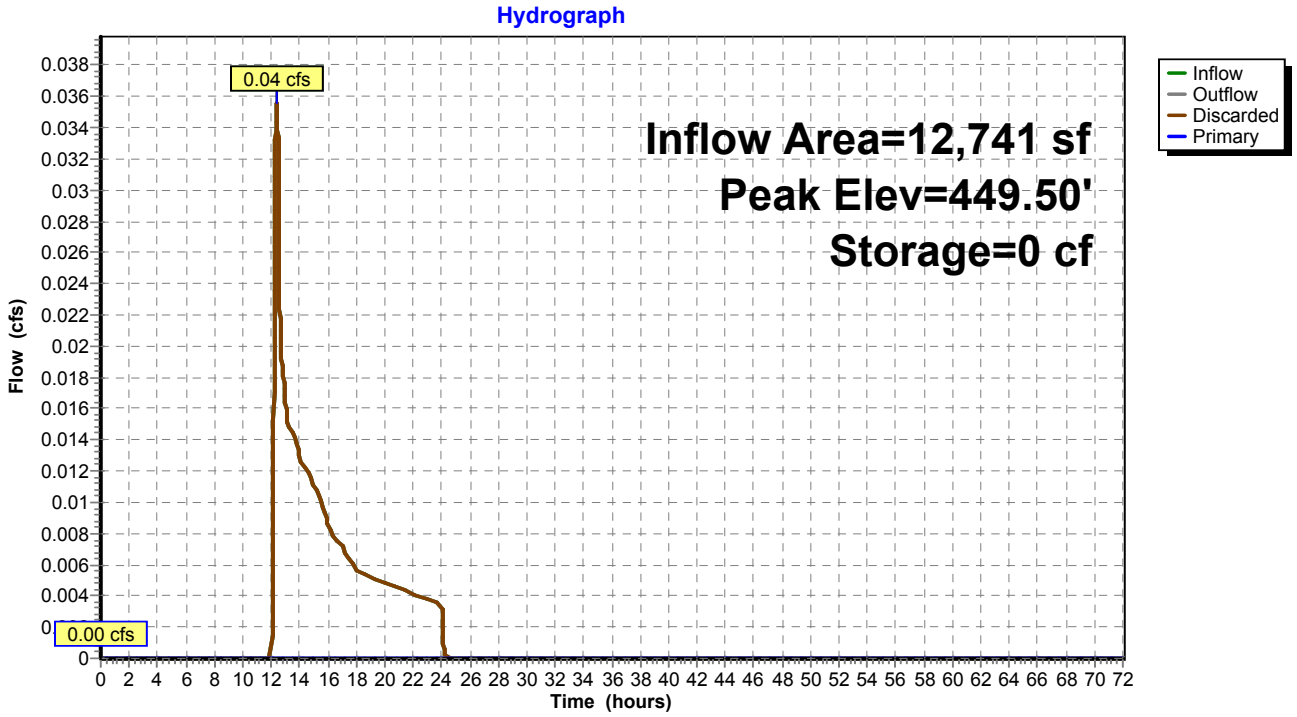
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
449.50	342	0	0	342
450.00	461	200	200	466

Device	Routing	Invert	Outlet Devices
#1	Discarded	449.50'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	446.31'	**8.0" Round Culvert** L= 34.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.31' / 445.62' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	450.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.07 cfs @ 12.39 hrs HW=449.50' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=449.50' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.00 cfs of 2.24 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond RG-1: Rain Garden #1



Summary for Pond RG-2: Rain Garden #2

Inflow Area = 11,053 sf, 19.41% Impervious, Inflow Depth = 0.66" for 10-year event
Inflow = 0.12 cfs @ 12.14 hrs, Volume= 612 cf
Outflow = 0.12 cfs @ 12.14 hrs, Volume= 612 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.12 cfs @ 12.14 hrs, Volume= 612 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link B : POI-B

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 448.25' @ 12.14 hrs Surf.Area= 1,057 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (917.6 - 917.6)

Volume	Invert	Avail.Storage	Storage Description
#1	448.25'	583 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

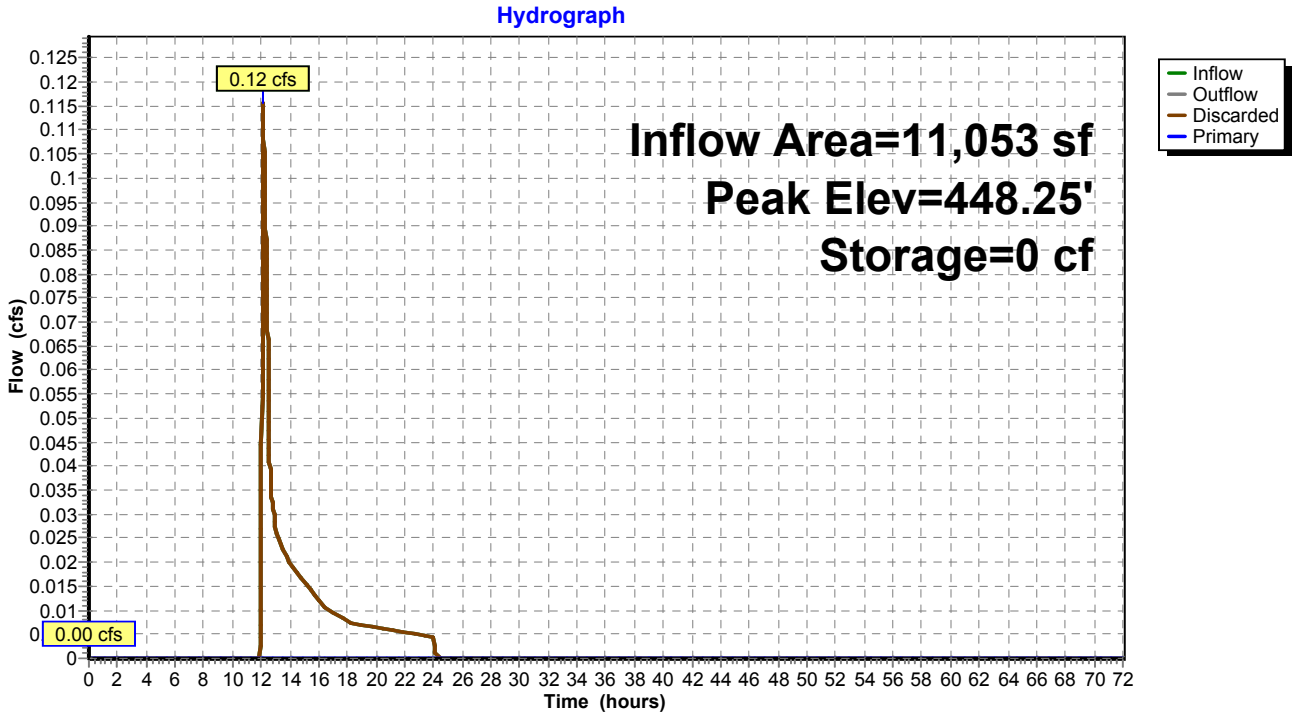
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
448.25	1,057	0	0	1,057
448.75	1,278	583	583	1,286

Device	Routing	Invert	Outlet Devices
#1	Discarded	448.25'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	445.47'	**8.0" Round Culvert** L= 37.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 445.47' / 444.73' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	448.75'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.20 cfs @ 12.14 hrs HW=448.25' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.20 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=448.25' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.00 cfs of 2.08 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond RG-2: Rain Garden #2

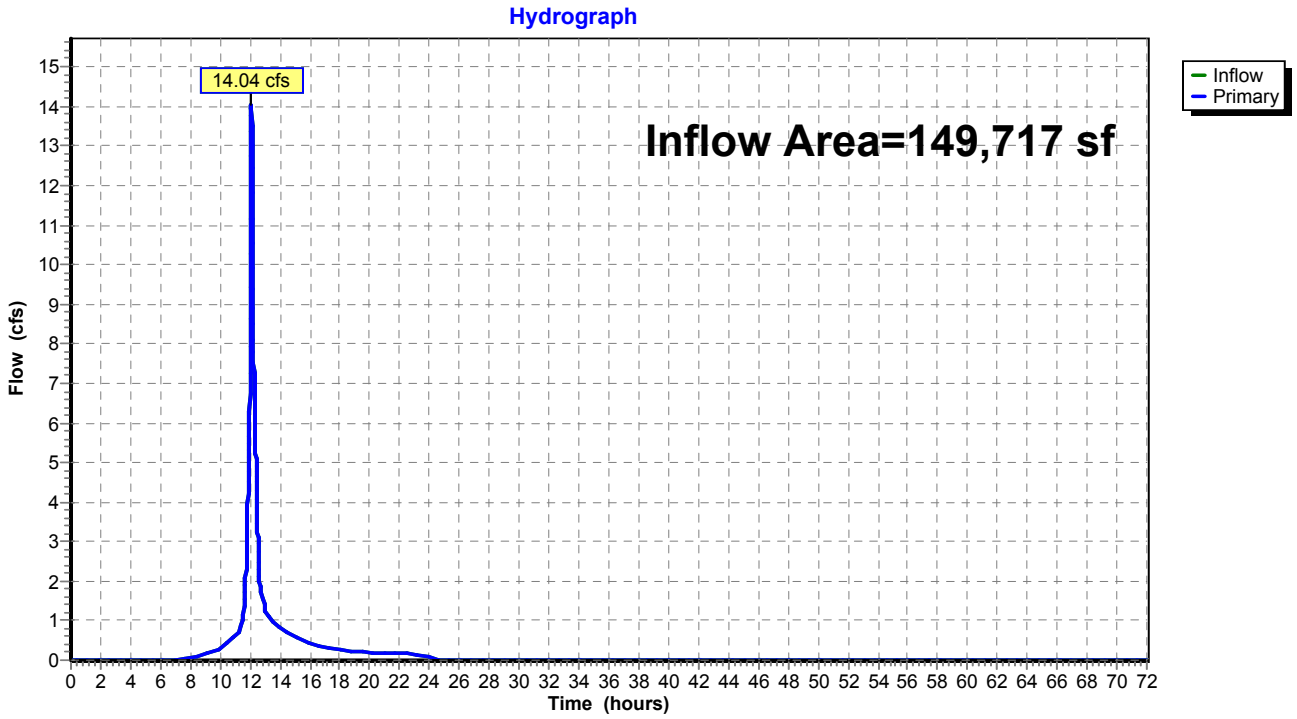


Summary for Link A: POI-A

Inflow Area = 149,717 sf, 54.63% Impervious, Inflow Depth = 3.38" for 10-year event
Inflow = 14.04 cfs @ 12.10 hrs, Volume= 42,157 cf
Primary = 14.04 cfs @ 12.10 hrs, Volume= 42,157 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link A: POI-A

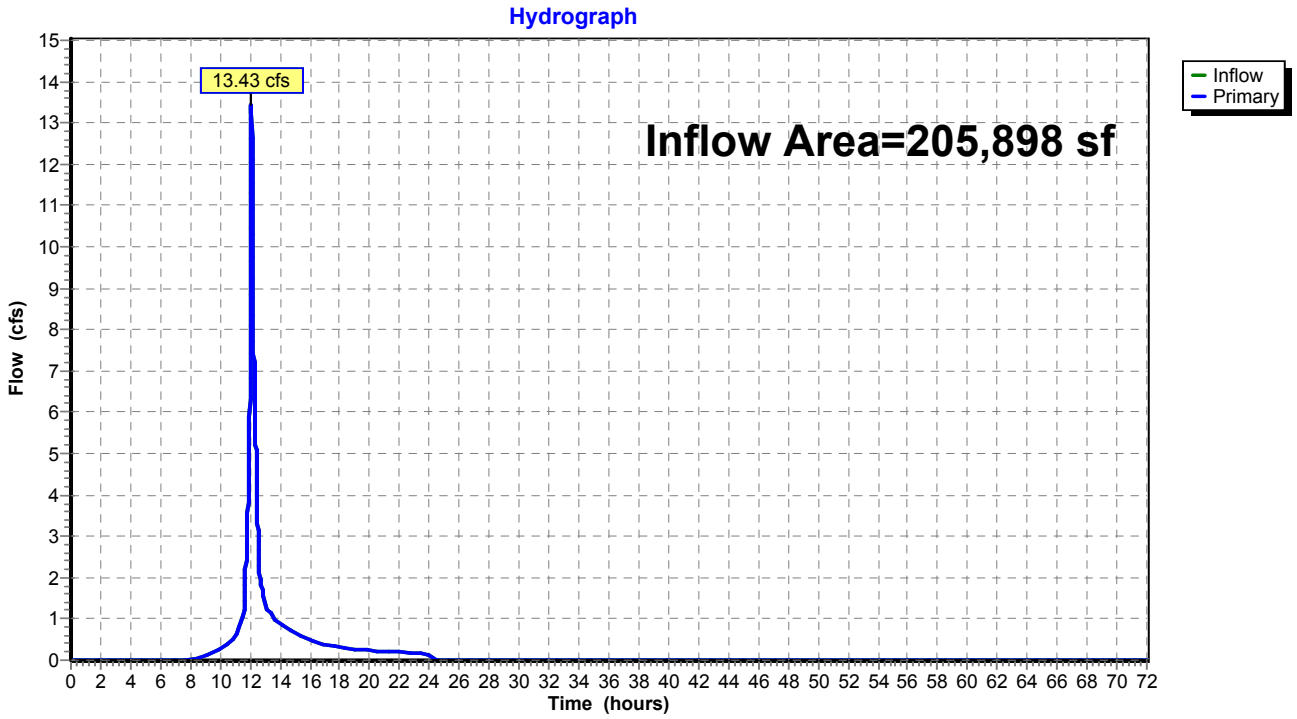


Summary for Link B: POI-B

Inflow Area = 205,898 sf, 62.86% Impervious, Inflow Depth = 2.51" for 10-year event
Inflow = 13.43 cfs @ 12.10 hrs, Volume= 43,056 cf
Primary = 13.43 cfs @ 12.10 hrs, Volume= 43,056 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link B: POI-B

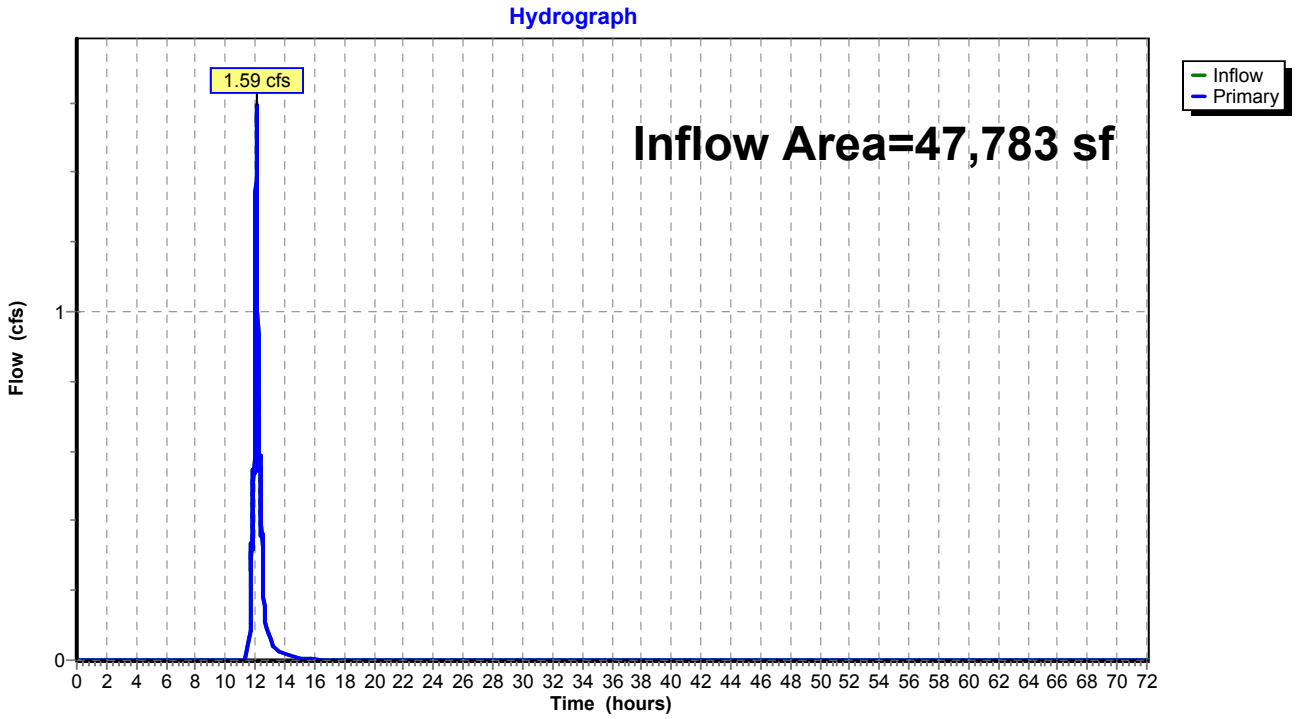


Summary for Link C: POI-C

Inflow Area = 47,783 sf, 66.40% Impervious, Inflow Depth = 0.61" for 10-year event
Inflow = 1.59 cfs @ 12.08 hrs, Volume= 2,412 cf
Primary = 1.59 cfs @ 12.08 hrs, Volume= 2,412 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link C: POI-C



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: SUB-A1 Runoff Area=99,996 sf 46.79% Impervious Runoff Depth=5.89"
Flow Length=622' Tc=6.8 min CN=85 Runoff=14.90 cfs 49,045 cf

SubcatchmentA2: SUB-A2 Runoff Area=10,386 sf 78.95% Impervious Runoff Depth=6.00"
Flow Length=39' Slope=0.0150 '/' Tc=6.0 min CN=86 Runoff=1.61 cfs 5,195 cf

SubcatchmentA3: SUB-A3 Runoff Area=39,335 sf 68.13% Impervious Runoff Depth=5.19"
Flow Length=36' Tc=6.0 min CN=79 Runoff=5.44 cfs 17,019 cf

SubcatchmentB1: SUB-B1 Runoff Area=167,239 sf 67.73% Impervious Runoff Depth=5.19"
Flow Length=174' Tc=6.9 min CN=79 Runoff=22.40 cfs 72,361 cf

SubcatchmentB2: SUB-B2 Runoff Area=11,053 sf 19.41% Impervious Runoff Depth=2.05"
Flow Length=130' Slope=0.0200 '/' Tc=6.9 min CN=50 Runoff=0.53 cfs 1,884 cf

SubcatchmentB3: SUB-B3 Runoff Area=12,741 sf 7.29% Impervious Runoff Depth=1.37"
Flow Length=189' Slope=0.0200 '/' Tc=7.9 min CN=43 Runoff=0.33 cfs 1,458 cf

SubcatchmentB4: SUB-B2 Runoff Area=14,865 sf 87.90% Impervious Runoff Depth=6.59"
Flow Length=140' Tc=6.2 min CN=91 Runoff=2.44 cfs 8,162 cf

SubcatchmentC1: SUB-C1 Runoff Area=23,899 sf 70.96% Impervious Runoff Depth=5.42"
Flow Length=452' Tc=7.4 min CN=81 Runoff=3.27 cfs 10,799 cf

SubcatchmentC2: SUB-C2 Runoff Area=9,871 sf 72.91% Impervious Runoff Depth=5.54"
Flow Length=124' Slope=0.0200 '/' Tc=6.0 min CN=82 Runoff=1.44 cfs 4,555 cf

SubcatchmentC3: SUB-C3 Runoff Area=8,102 sf 93.48% Impervious Runoff Depth=6.94"
Flow Length=122' Slope=0.0200 '/' Tc=6.0 min CN=94 Runoff=1.37 cfs 4,688 cf

SubcatchmentC4: SUB-C4 Runoff Area=5,911 sf 0.00% Impervious Runoff Depth=1.02"
Flow Length=20' Slope=0.0200 '/' Tc=6.0 min CN=39 Runoff=0.10 cfs 501 cf

Pond IT-1: Infiltration Trench / Rain Garden Peak Elev=450.06' Storage=408 cf Inflow=3.27 cfs 10,799 cf
Discarded=0.13 cfs 4,415 cf Primary=0.84 cfs 186 cf Secondary=2.30 cfs 6,197 cf Outflow=3.27 cfs 10,799 cf

Pond IT-2: Inf. Trench #2 Peak Elev=450.79' Storage=65 cf Inflow=1.44 cfs 4,555 cf
Discarded=0.03 cfs 1,692 cf Primary=1.41 cfs 2,863 cf Outflow=1.44 cfs 4,555 cf

Pond IT-3: Inf. Trench #3 Peak Elev=448.93' Storage=126 cf Inflow=1.37 cfs 4,688 cf
Discarded=0.06 cfs 2,481 cf Primary=1.31 cfs 2,207 cf Outflow=1.37 cfs 4,688 cf

Pond RG-1: Rain Garden #1 Peak Elev=450.06' Storage=200 cf Inflow=0.33 cfs 1,458 cf
Discarded=0.09 cfs 1,373 cf Primary=0.27 cfs 86 cf Outflow=0.36 cfs 1,459 cf

Pond RG-2: Rain Garden #2 Peak Elev=448.46' Storage=229 cf Inflow=0.53 cfs 1,884 cf
Discarded=0.22 cfs 1,885 cf Primary=0.00 cfs 0 cf Outflow=0.22 cfs 1,885 cf

Link A: POI-A Inflow=24.21 cfs 77,457 cf
Primary=24.21 cfs 77,457 cf

Link B: POI-B Inflow=24.82 cfs 80,608 cf
Primary=24.82 cfs 80,608 cf

Link C: POI-C Inflow=3.52 cfs 5,758 cf
Primary=3.52 cfs 5,758 cf

Total Runoff Area = 403,398 sf Runoff Volume = 175,669 cf Average Runoff Depth = 5.23"
39.78% Pervious = 160,463 sf 60.22% Impervious = 242,935 sf

Summary for Subcatchment A1: SUB-A1

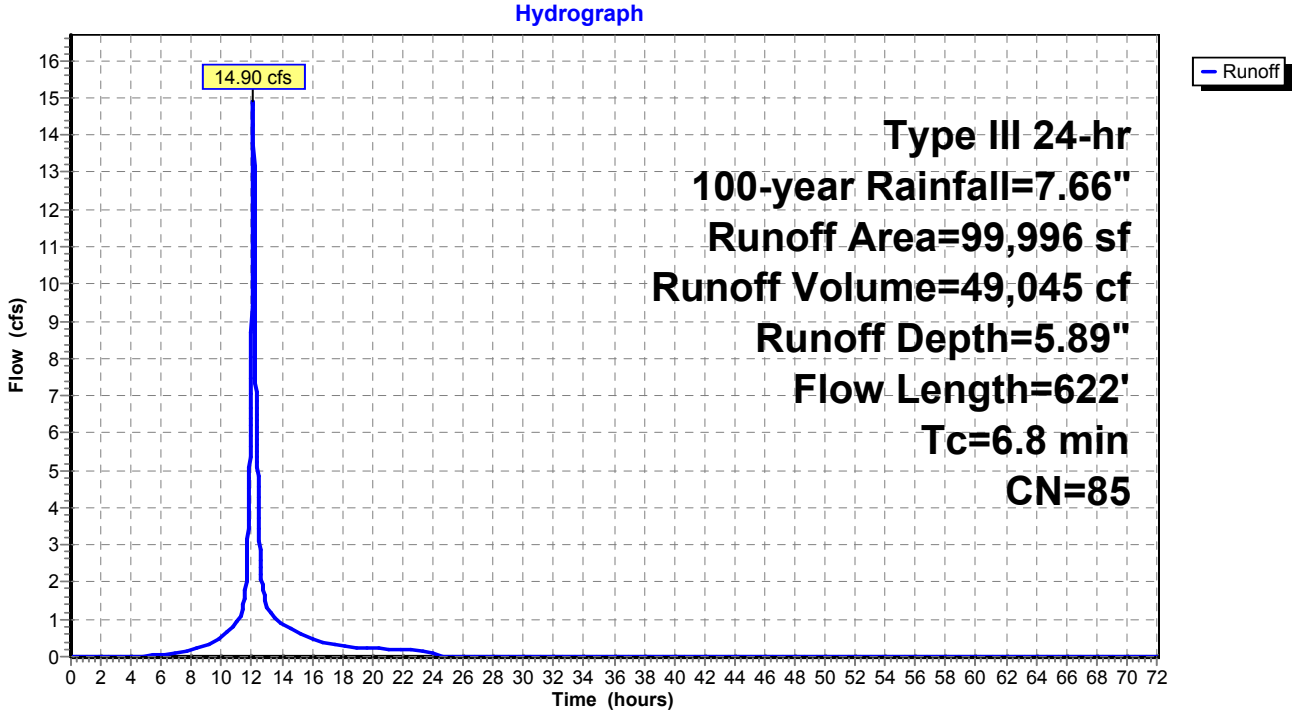
Runoff = 14.90 cfs @ 12.10 hrs, Volume= 49,045 cf, Depth= 5.89"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
*	46,789	98	Impervious Surfaces
	53,207	74	>75% Grass cover, Good, HSG C
	99,996	85	Weighted Average
	53,207		53.21% Pervious Area
	46,789		46.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0750	0.25		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.8	236	0.1000	2.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	336	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
6.8	622	Total			

Subcatchment A1: SUB-A1



Summary for Subcatchment A2: SUB-A2

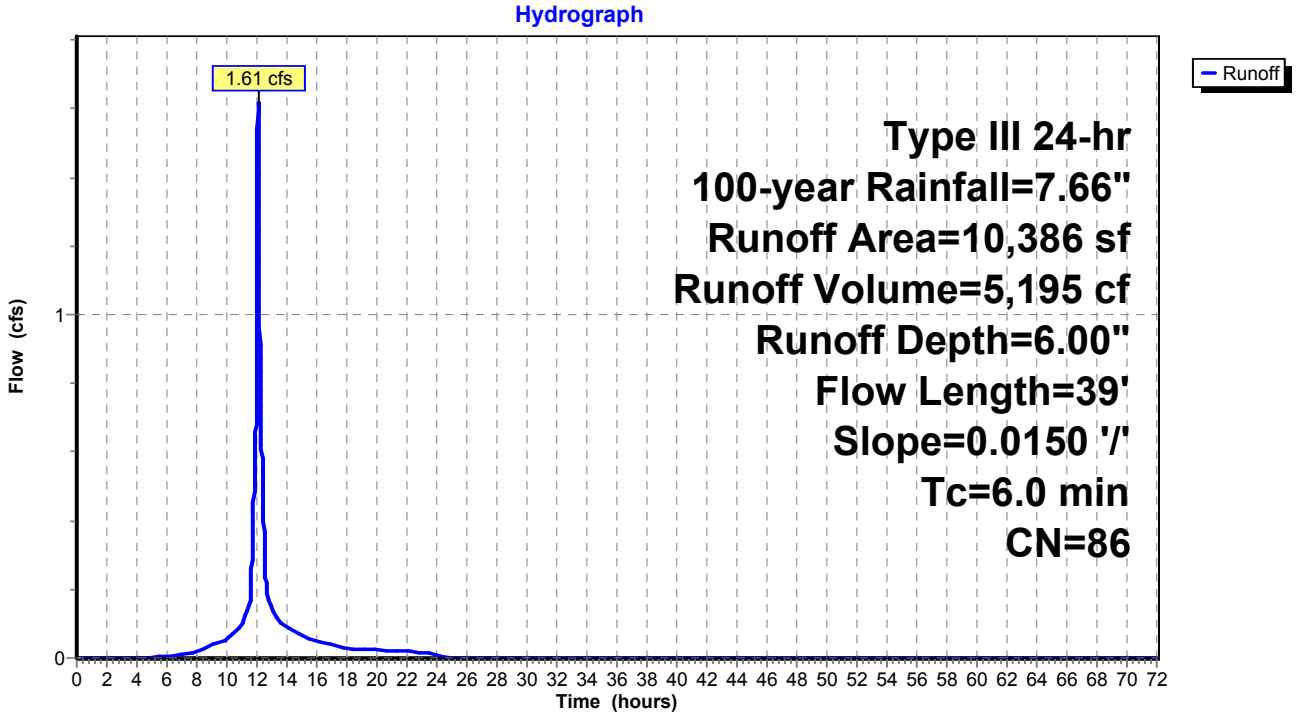
Runoff = 1.61 cfs @ 12.08 hrs, Volume= 5,195 cf, Depth= 6.00"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
	2,186	39	>75% Grass cover, Good, HSG A
*	8,200	98	Impervious Surfaces
	10,386	86	Weighted Average
	2,186		21.05% Pervious Area
	8,200		78.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	6	0.0150	0.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.7	3	0.0150	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.5	30	0.0150	0.96		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
1.3	39	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A2: SUB-A2



Summary for Subcatchment A3: SUB-A3

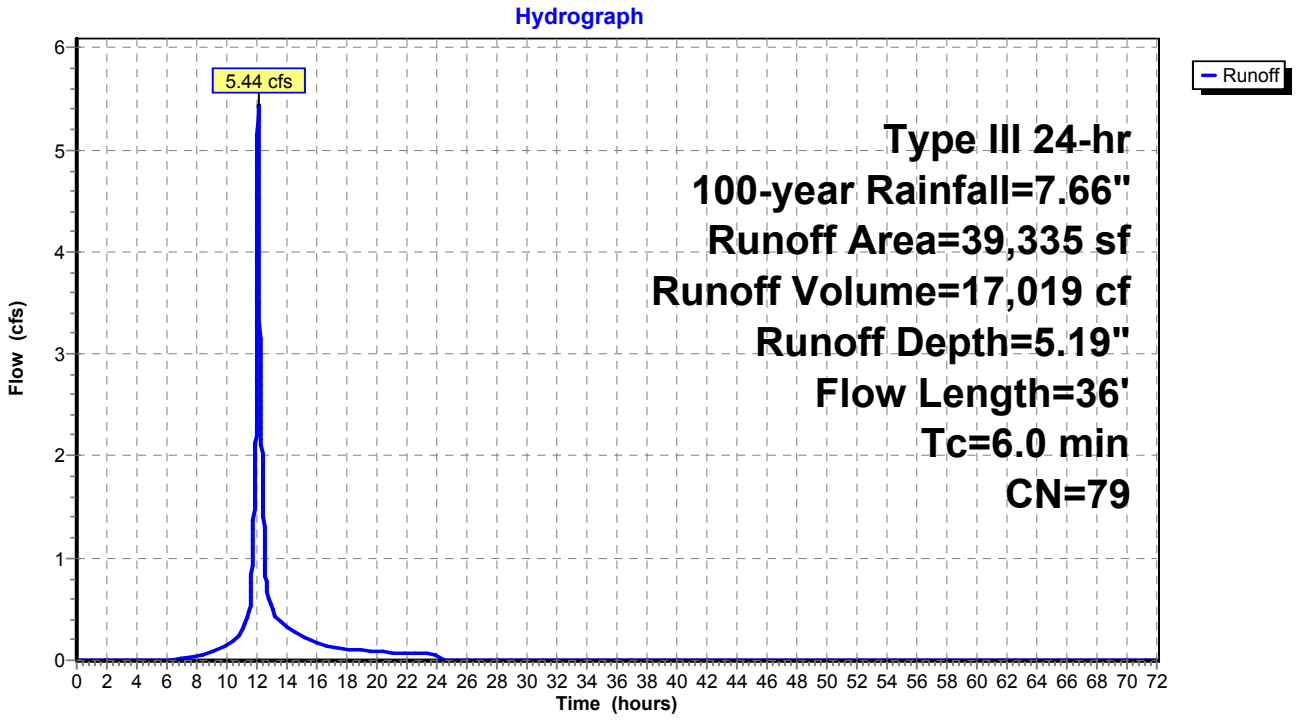
Runoff = 5.44 cfs @ 12.09 hrs, Volume= 17,019 cf, Depth= 5.19"
Routed to Link A : POI-A

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
	12,537	39	>75% Grass cover, Good, HSG A
*	26,798	98	Impervious Surfaces
	39,335	79	Weighted Average
	12,537		31.87% Pervious Area
	26,798		68.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	28	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	8	0.0150	0.74		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.7	36	Total, Increased to minimum Tc = 6.0 min			

Subcatchment A3: SUB-A3



Summary for Subcatchment B1: SUB-B1

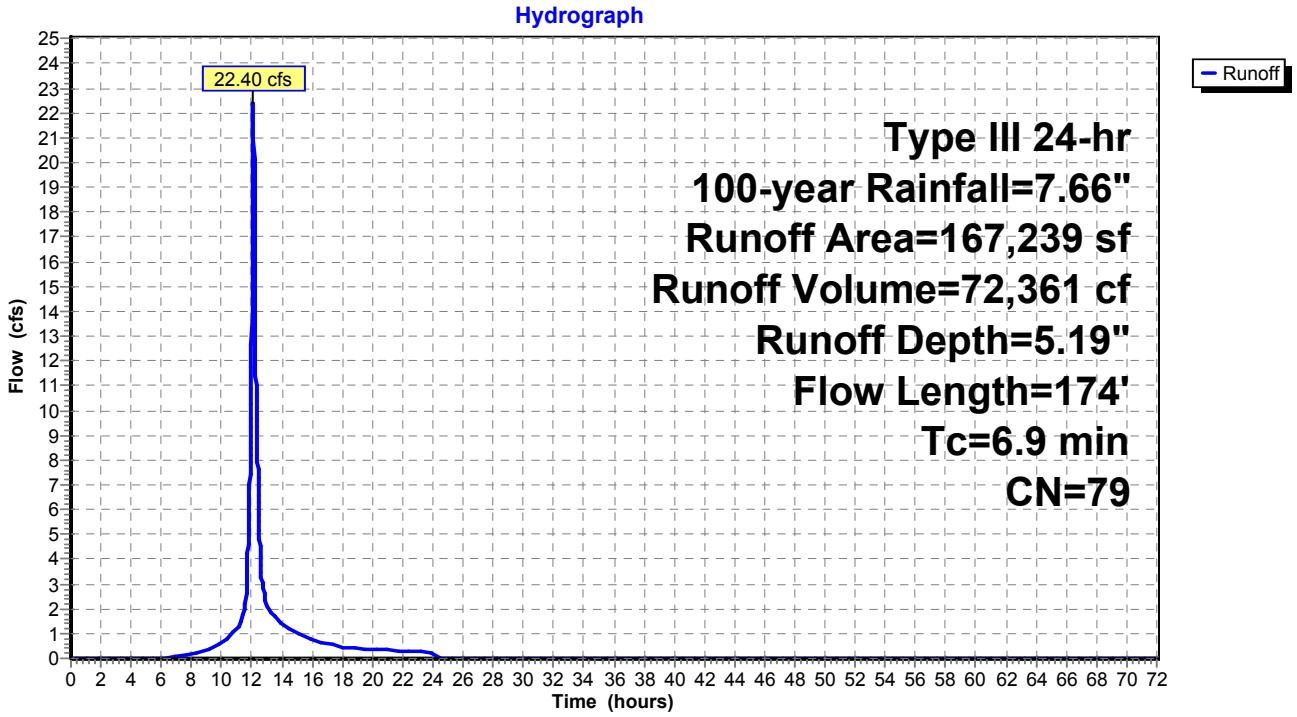
Runoff = 22.40 cfs @ 12.10 hrs, Volume= 72,361 cf, Depth= 5.19"
Routed to Link B : POI-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
*	113,277	98	Impervious Surfaces
	53,962	39	>75% Grass cover, Good, HSG A
	167,239	79	Weighted Average
	53,962		32.27% Pervious Area
	113,277		67.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	14	0.0200	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.1	6	0.0150	0.70		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
3.7	30	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.0	6	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	27	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.6	91	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.9	174	Total			

Subcatchment B1: SUB-B1



Summary for Subcatchment B2: SUB-B2

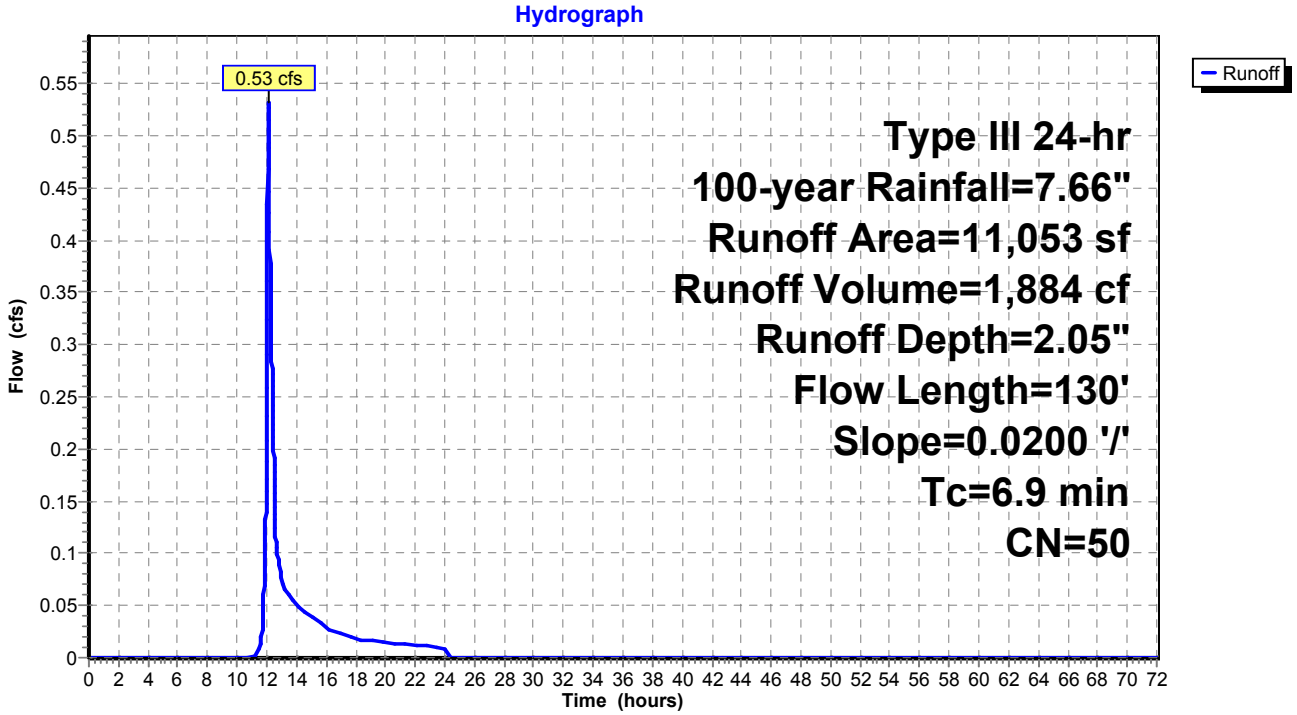
Runoff = 0.53 cfs @ 12.11 hrs, Volume= 1,884 cf, Depth= 2.05"
Routed to Pond RG-2 : Rain Garden #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
	8,908	39	>75% Grass cover, Good, HSG A
*	1,088	98	Impervious Surfaces
*	1,057	98	Rain Garden
	11,053	50	Weighted Average
	8,908		80.59% Pervious Area
	2,145		19.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.3	80	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.9	130	Total			

Subcatchment B2: SUB-B2



Summary for Subcatchment B3: SUB-B3

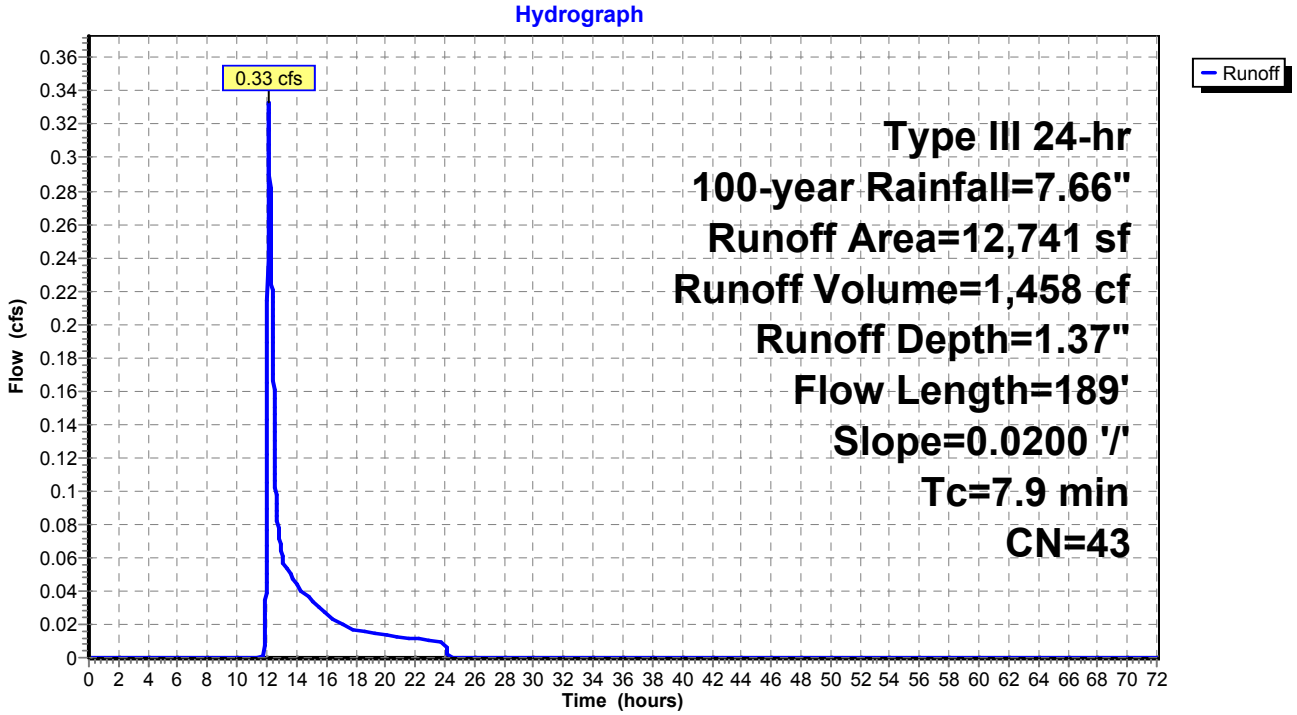
Runoff = 0.33 cfs @ 12.14 hrs, Volume= 1,458 cf, Depth= 1.37"
Routed to Pond RG-1 : Rain Garden #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
	11,812	39	>75% Grass cover, Good, HSG A
*	342	98	Rain Garden
*	587	98	Impervious Surfaces
	12,741	43	Weighted Average
	11,812		92.71% Pervious Area
	929		7.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.3	139	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.9	189	Total			

Subcatchment B3: SUB-B3



Summary for Subcatchment B4: SUB-B2

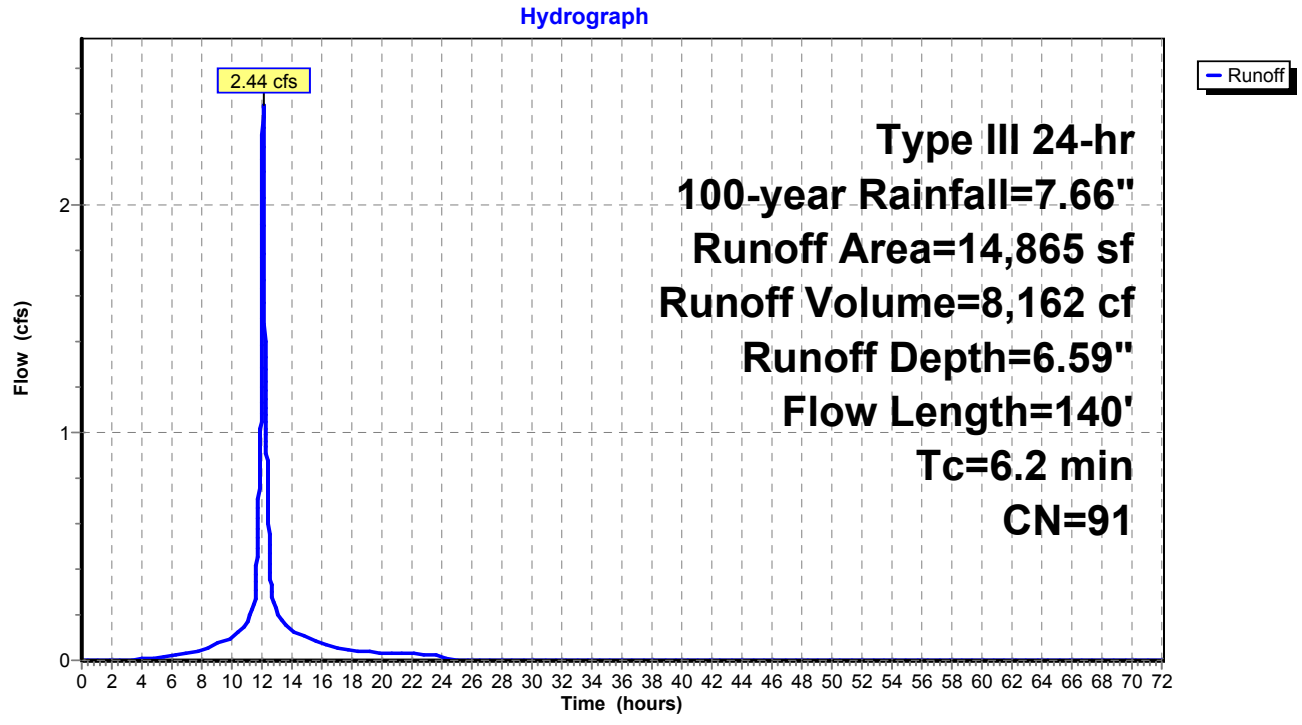
Runoff = 2.44 cfs @ 12.09 hrs, Volume= 8,162 cf, Depth= 6.59"
Routed to Link B : POI-B

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
	1,798	39	>75% Grass cover, Good, HSG A
*	13,067	98	Impervious Surfaces
	14,865	91	Weighted Average
	1,798		12.10% Pervious Area
	13,067		87.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	90	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.2	140	Total			

Subcatchment B4: SUB-B2



Summary for Subcatchment C1: SUB-C1

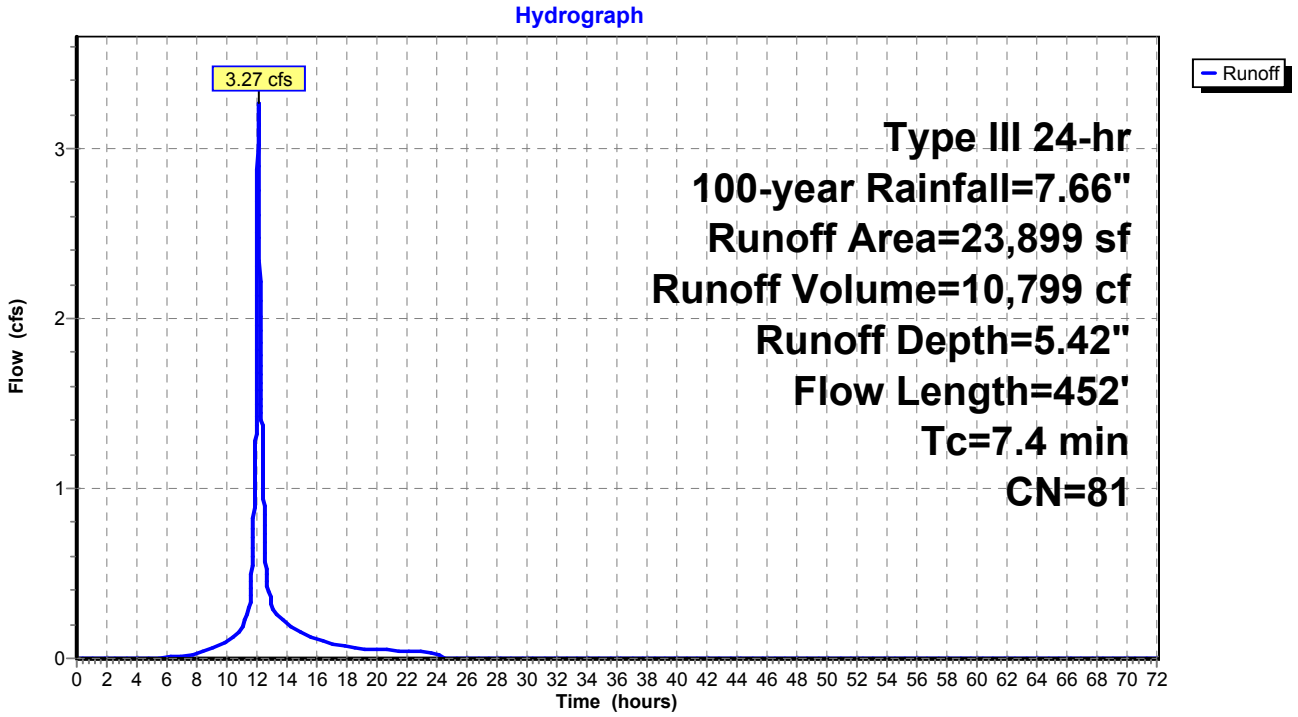
Runoff = 3.27 cfs @ 12.10 hrs, Volume= 10,799 cf, Depth= 5.42"
Routed to Pond IT-1 : Infiltration Trench / Rain Garden #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
	6,940	39	>75% Grass cover, Good, HSG A
*	16,769	98	Impervious Surfaces
*	190	98	Infiltration Trench/Rain Garden
	23,899	81	Weighted Average
	6,940		29.04% Pervious Area
	16,959		70.96% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
1.2	85	0.0300	1.21		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.4	315	0.0340	3.74		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	2	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.4	452	Total			

Subcatchment C1: SUB-C1



Summary for Subcatchment C2: SUB-C2

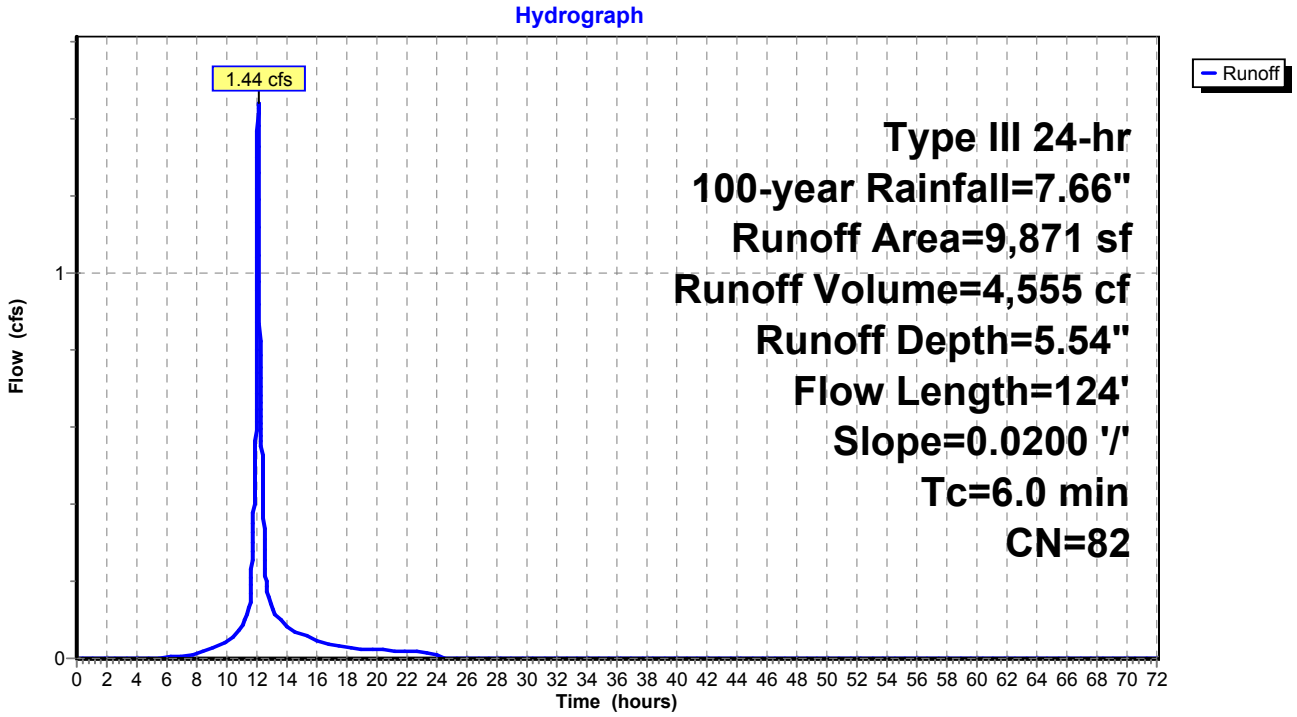
Runoff = 1.44 cfs @ 12.09 hrs, Volume= 4,555 cf, Depth= 5.54"
Routed to Pond IT-2 : Inf. Trench #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
*	7,089	98	Impervious Surfaces
	2,674	39	>75% Grass cover, Good, HSG A
*	108	98	Infiltration Trench
	9,871	82	Weighted Average
	2,674		27.09% Pervious Area
	7,197		72.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	42	0.0200	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.2	8	0.0200	0.83		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.4	72	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	2	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
5.5	124	Total, Increased to minimum Tc = 6.0 min			

Subcatchment C2: SUB-C2



Summary for Subcatchment C3: SUB-C3

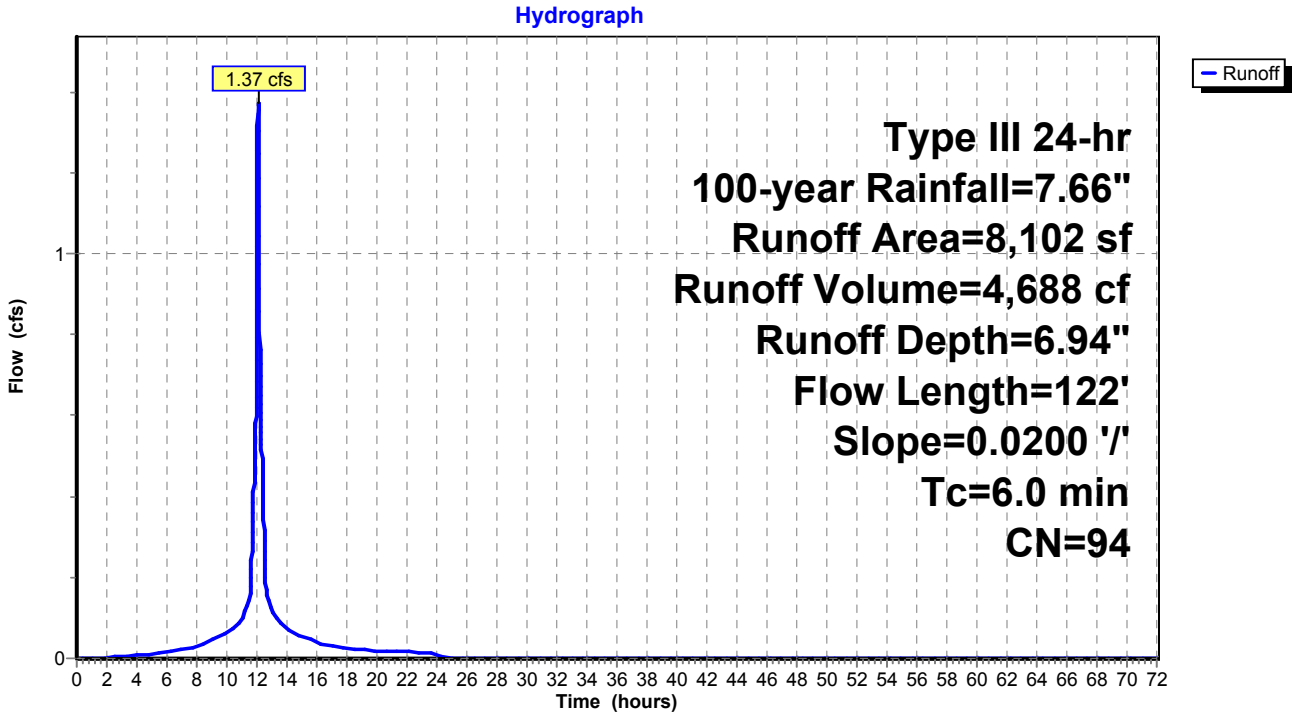
Runoff = 1.37 cfs @ 12.08 hrs, Volume= 4,688 cf, Depth= 6.94"
Routed to Pond IT-3 : Inf. Trench #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

	Area (sf)	CN	Description
*	7,364	98	Impervious Surfaces
	528	39	>75% Grass cover, Good, HSG A
*	210	98	Infiltration Trench
	8,102	94	Weighted Average
	528		6.52% Pervious Area
	7,574		93.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	8	0.0200	0.10		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
0.6	42	0.0200	1.16		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.20"
0.4	70	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	2	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.3	122	Total, Increased to minimum Tc = 6.0 min			

Subcatchment C3: SUB-C3



Summary for Subcatchment C4: SUB-C4

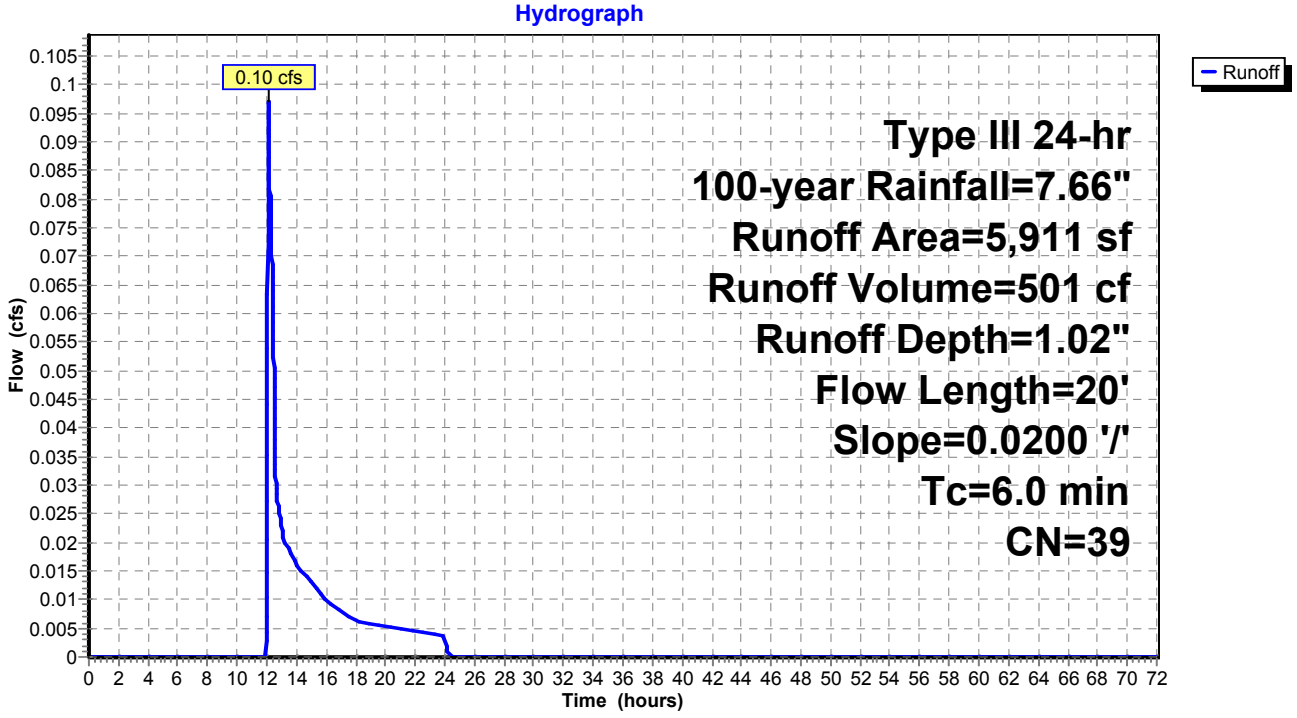
Runoff = 0.10 cfs @ 12.13 hrs, Volume= 501 cf, Depth= 1.02"
Routed to Link C : POI-C

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-year Rainfall=7.66"

Area (sf)	CN	Description
5,911	39	>75% Grass cover, Good, HSG A
5,911		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	20	0.0200	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.20"
2.7	20	Total, Increased to minimum Tc = 6.0 min			

Subcatchment C4: SUB-C4



Summary for Pond IT-1: Infiltration Trench / Rain Garden #1

Inflow Area = 23,899 sf, 70.96% Impervious, Inflow Depth = 5.42" for 100-year event
Inflow = 3.27 cfs @ 12.10 hrs, Volume= 10,799 cf
Outflow = 3.27 cfs @ 12.11 hrs, Volume= 10,799 cf, Atten= 0%, Lag= 0.5 min
Discarded = 0.13 cfs @ 12.11 hrs, Volume= 4,415 cf
Primary = 0.84 cfs @ 12.11 hrs, Volume= 186 cf
Routed to Link C : POI-C
Secondary = 2.30 cfs @ 12.11 hrs, Volume= 6,197 cf
Routed to Link A : POI-A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 450.06' @ 12.11 hrs Surf.Area= 563 sf Storage= 408 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 12.4 min (815.8 - 803.4)

Volume	Invert	Avail.Storage	Storage Description
#1	448.50'	499 cf	**Rain Garden (Conic)** Listed below (Recalc)
#2	447.75'	105 cf	**Infiltration Trench (Conic)** Listed below (Recalc) 350 cf Overall x 30.0% Voids
		604 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
448.50	15	0	0	15
449.00	140	33	33	141
450.00	375	248	282	382
450.50	497	217	499	510

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
447.75	175	0	0	175
449.75	175	350	350	269

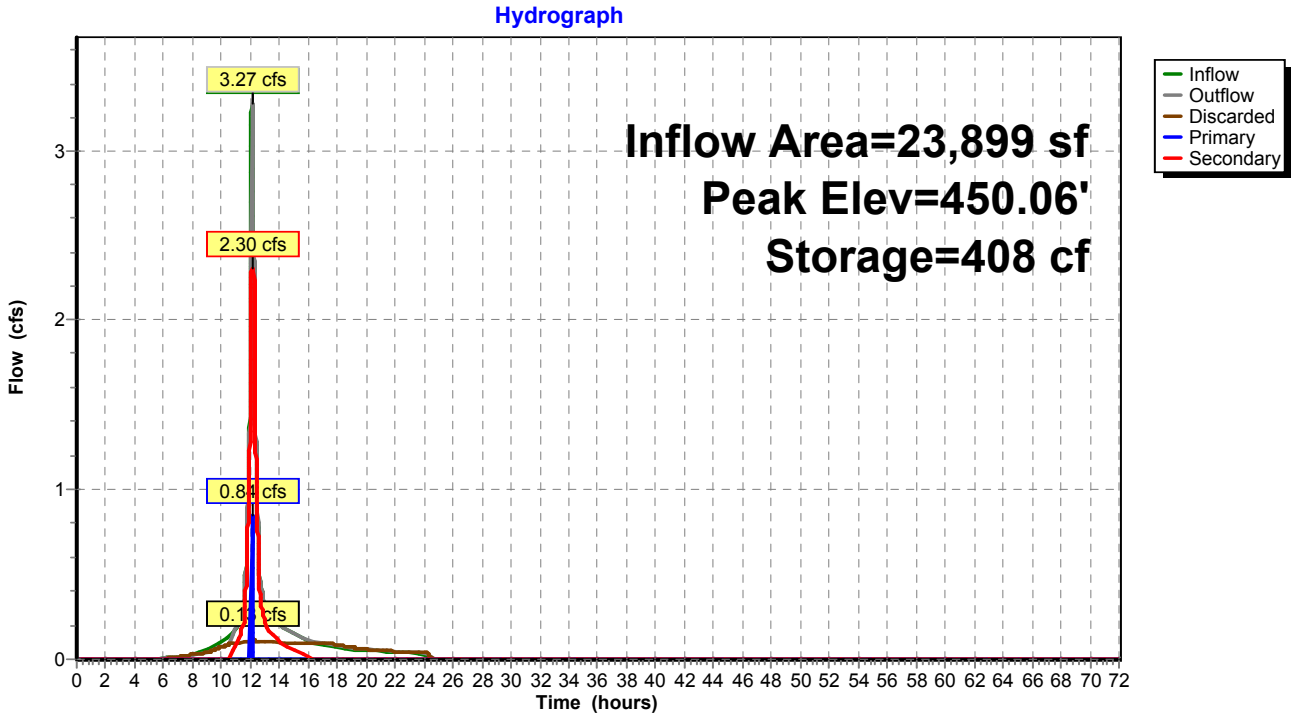
Device	Routing	Invert	Outlet Devices
#1	Secondary	446.03'	**8.0" Round Culvert** L= 66.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.03' / 445.70' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Device 1	449.50'	**30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	450.00'	**25.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#4	Discarded	447.75'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.13 cfs @ 12.11 hrs HW=450.06' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.83 cfs @ 12.11 hrs HW=450.06' TW=0.00' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.83 cfs @ 0.60 fps)

Secondary OutFlow Max=2.30 cfs @ 12.11 hrs HW=450.06' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Barrel Controls 2.30 cfs @ 6.60 fps)
└**2=Orifice/Grate** (Passes 2.30 cfs of 10.63 cfs potential flow)

Pond IT-1: Infiltration Trench / Rain Garden #1



Summary for Pond IT-2: Inf. Trench #2

Inflow Area = 9,871 sf, 72.91% Impervious, Inflow Depth = 5.54" for 100-year event
Inflow = 1.44 cfs @ 12.09 hrs, Volume= 4,555 cf
Outflow = 1.44 cfs @ 12.09 hrs, Volume= 4,555 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.03 cfs @ 11.62 hrs, Volume= 1,692 cf
Primary = 1.41 cfs @ 12.09 hrs, Volume= 2,863 cf
Routed to Link C : POI-C

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 450.79' @ 12.09 hrs Surf.Area= 108 sf Storage= 65 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 8.2 min (807.8 - 799.7)

Volume	Invert	Avail.Storage	Storage Description
#1	448.75'	65 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 216 cf Overall x 30.0% Voids

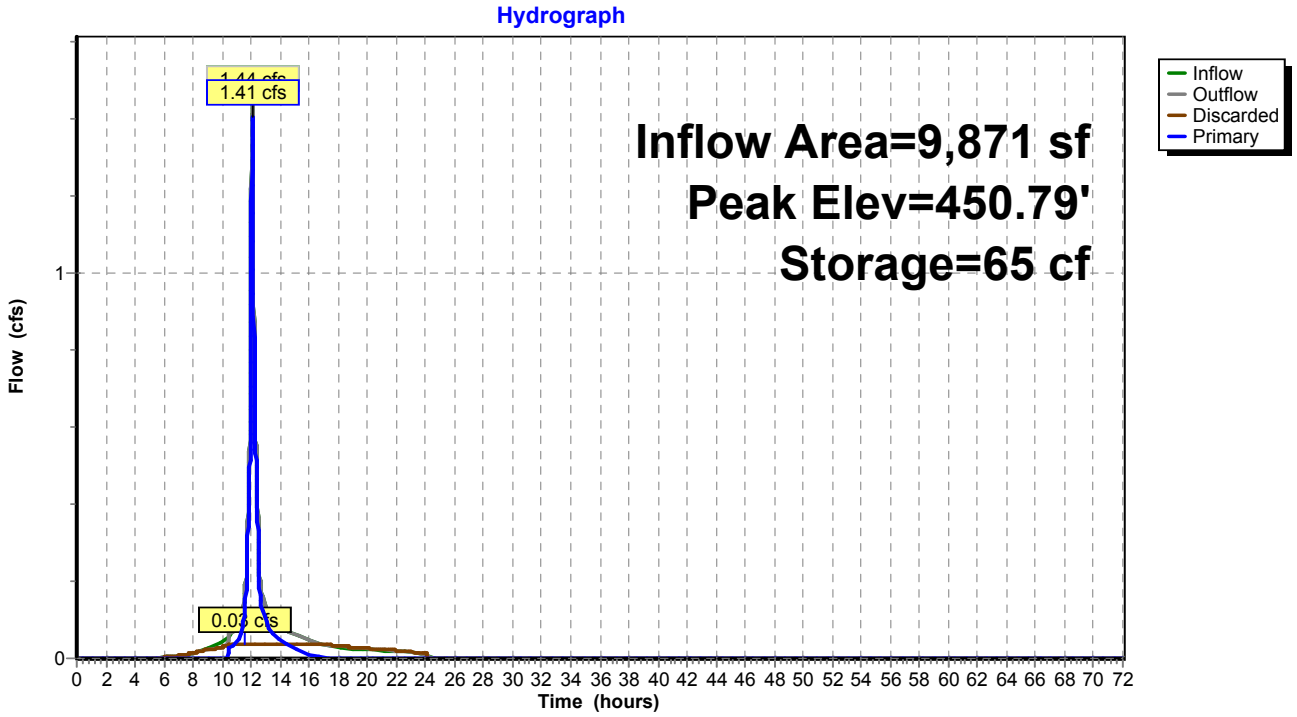
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
448.75	108	0	0	108
450.75	108	216	216	182

Device	Routing	Invert	Outlet Devices
#1	Primary	450.74'	**54.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	448.75'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.03 cfs @ 11.62 hrs HW=450.75' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.40 cfs @ 12.09 hrs HW=450.79' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.40 cfs @ 0.57 fps)

Pond IT-2: Inf. Trench #2



Summary for Pond IT-3: Inf. Trench #3

Inflow Area = 8,102 sf, 93.48% Impervious, Inflow Depth = 6.94" for 100-year event
Inflow = 1.37 cfs @ 12.08 hrs, Volume= 4,688 cf
Outflow = 1.37 cfs @ 12.08 hrs, Volume= 4,688 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.06 cfs @ 11.63 hrs, Volume= 2,481 cf
Primary = 1.31 cfs @ 12.08 hrs, Volume= 2,207 cf
Routed to Link C : POI-C

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 448.93' @ 12.08 hrs Surf.Area= 210 sf Storage= 126 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 9.9 min (772.3 - 762.4)

Volume	Invert	Avail.Storage	Storage Description
#1	446.90'	126 cf	**Custom Stage Data (Conic)** Listed below (Recalc) 420 cf Overall x 30.0% Voids

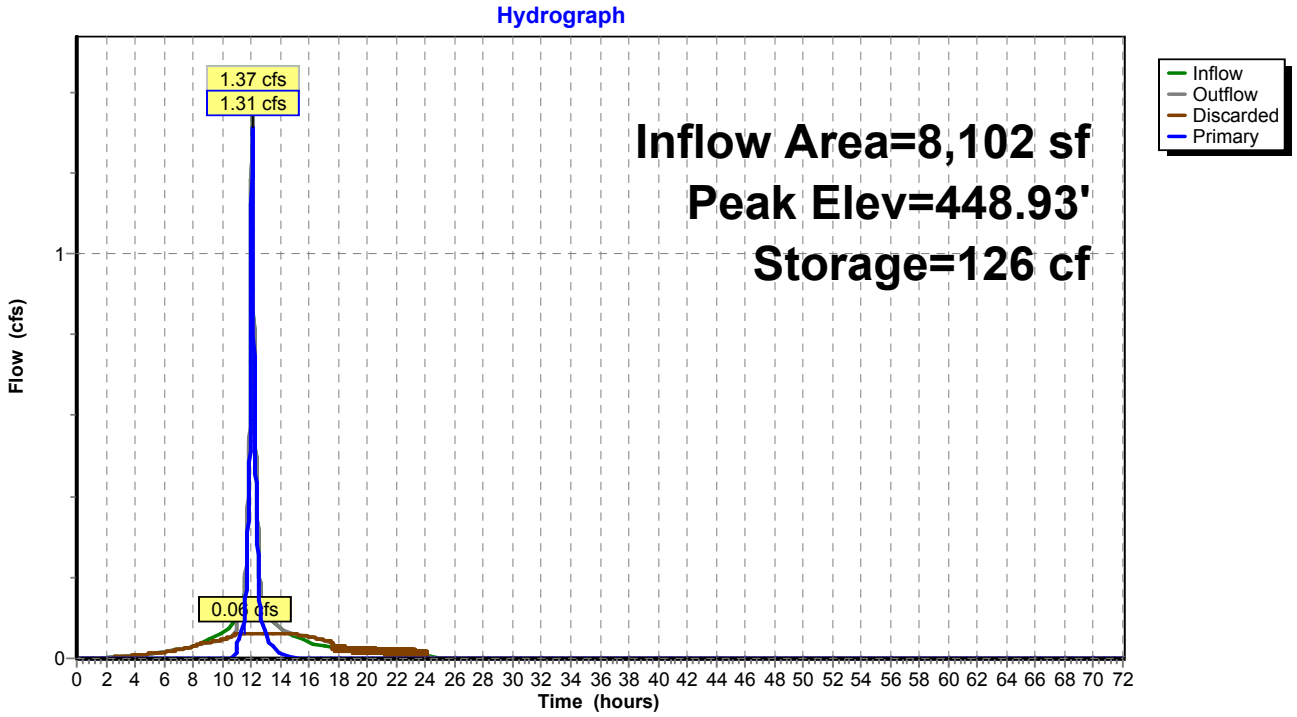
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
446.90	210	0	0	210
448.90	210	420	420	313

Device	Routing	Invert	Outlet Devices
#1	Primary	448.89'	**54.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	446.90'	**8.270 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.06 cfs @ 11.63 hrs HW=448.90' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=1.31 cfs @ 12.08 hrs HW=448.93' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.31 cfs @ 0.56 fps)

Pond IT-3: Inf. Trench #3



Summary for Pond RG-1: Rain Garden #1

Inflow Area = 12,741 sf, 7.29% Impervious, Inflow Depth = 1.37" for 100-year event
Inflow = 0.33 cfs @ 12.14 hrs, Volume= 1,458 cf
Outflow = 0.36 cfs @ 12.32 hrs, Volume= 1,459 cf, Atten= 0%, Lag= 10.9 min
Discarded = 0.09 cfs @ 12.31 hrs, Volume= 1,373 cf
Primary = 0.27 cfs @ 12.32 hrs, Volume= 86 cf
Routed to Link B : POI-B

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 450.06' @ 12.32 hrs Surf.Area= 461 sf Storage= 200 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 13.3 min (913.3 - 900.0)

Volume	Invert	Avail.Storage	Storage Description
#1	449.50'	200 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

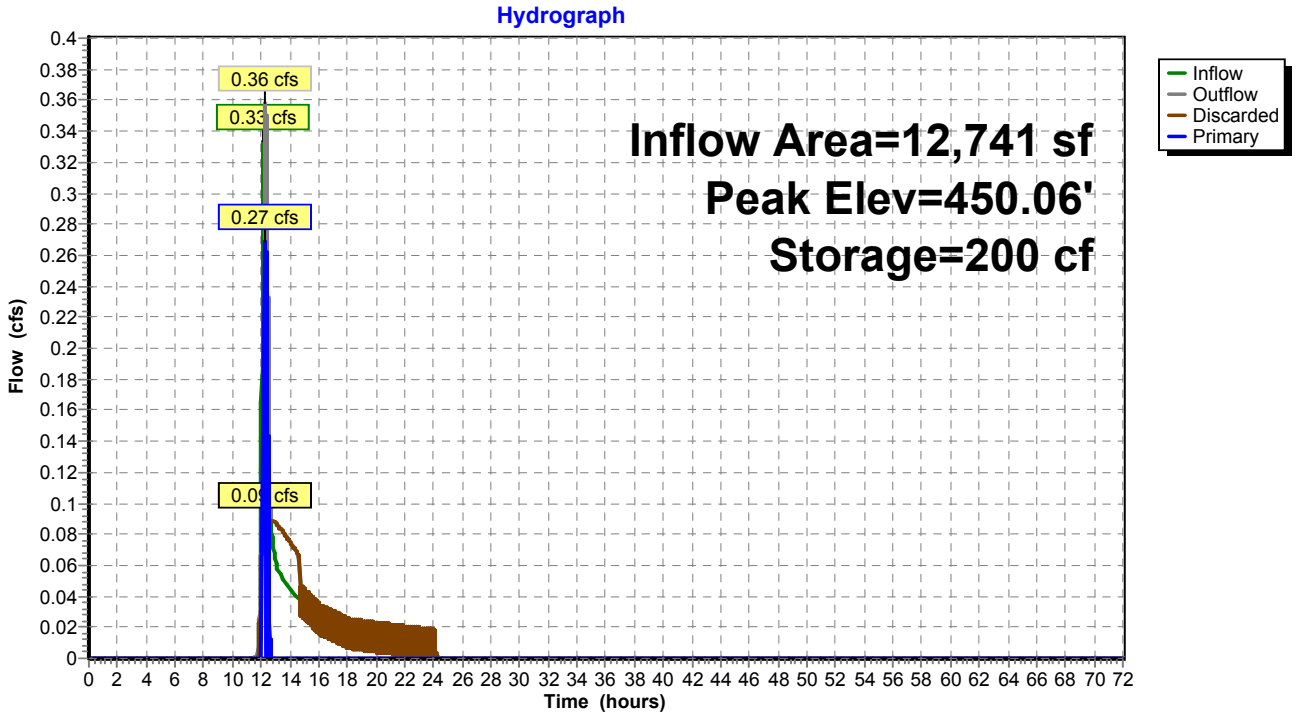
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
449.50	342	0	0	342
450.00	461	200	200	466

Device	Routing	Invert	Outlet Devices
#1	Discarded	449.50'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	446.31'	**8.0" Round Culvert** L= 34.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 446.31' / 445.62' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	450.00'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.09 cfs @ 12.31 hrs HW=450.01' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.27 cfs @ 12.32 hrs HW=450.06' TW=0.00' (Dynamic Tailwater)
↑└**2=Culvert** (Passes 0.27 cfs of 2.45 cfs potential flow)
↑└**3=Orifice/Grate** (Weir Controls 0.27 cfs @ 0.77 fps)

Pond RG-1: Rain Garden #1



Summary for Pond RG-2: Rain Garden #2

Inflow Area = 11,053 sf, 19.41% Impervious, Inflow Depth = 2.05" for 100-year event
Inflow = 0.53 cfs @ 12.11 hrs, Volume= 1,884 cf
Outflow = 0.22 cfs @ 12.44 hrs, Volume= 1,885 cf, Atten= 59%, Lag= 19.4 min
Discarded = 0.22 cfs @ 12.44 hrs, Volume= 1,885 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link B : POI-B

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 448.46' @ 12.44 hrs Surf.Area= 1,146 sf Storage= 229 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.7 min (879.4 - 874.7)

Volume	Invert	Avail.Storage	Storage Description
#1	448.25'	583 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

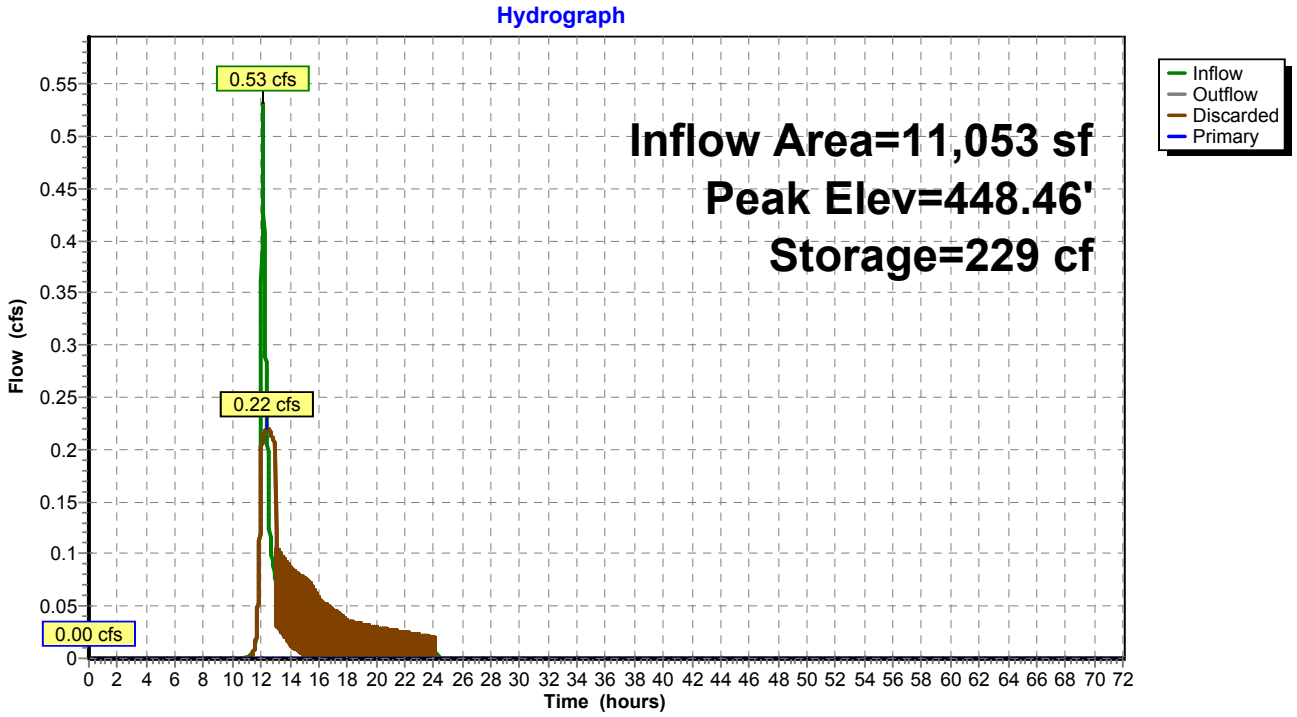
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
448.25	1,057	0	0	1,057
448.75	1,278	583	583	1,286

Device	Routing	Invert	Outlet Devices
#1	Discarded	448.25'	**8.270 in/hr Exfiltration over Wetted area**
#2	Primary	445.47'	**8.0" Round Culvert** L= 37.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 445.47' / 444.73' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	448.75'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.22 cfs @ 12.44 hrs HW=448.46' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=448.25' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.00 cfs of 2.08 cfs potential flow)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond RG-2: Rain Garden #2

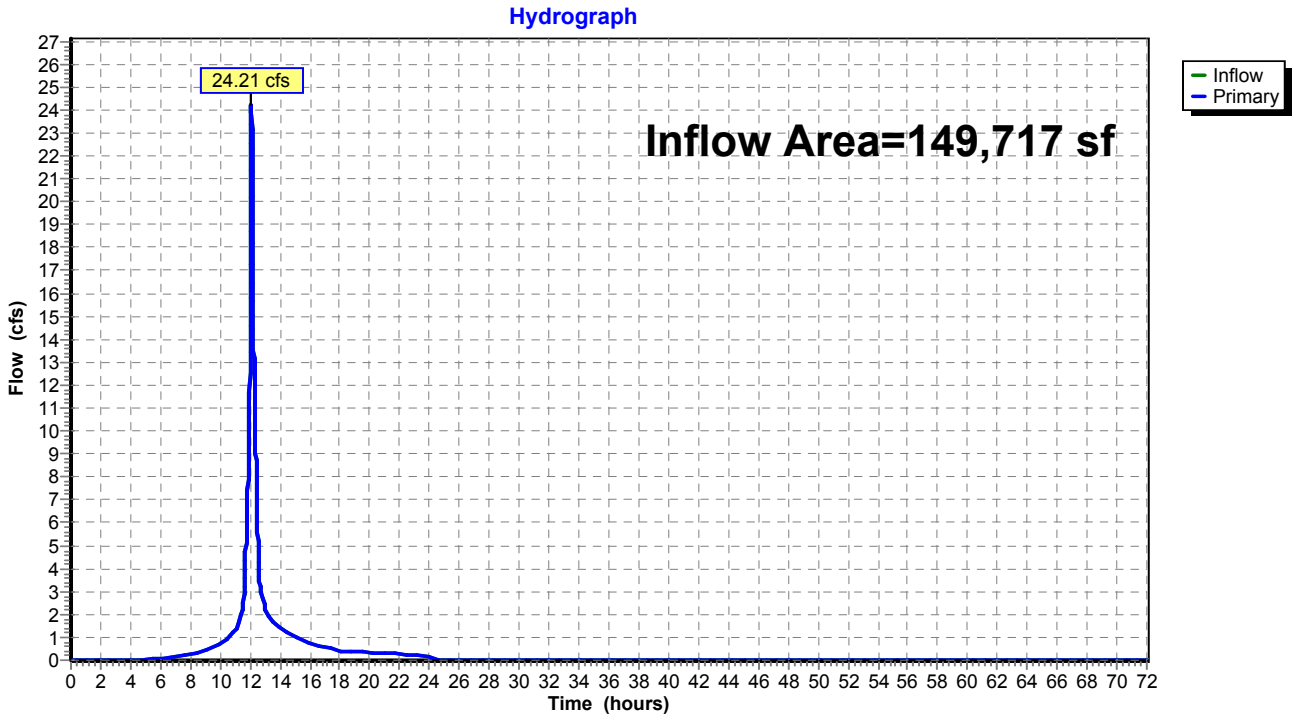


Summary for Link A: POI-A

Inflow Area = 149,717 sf, 54.63% Impervious, Inflow Depth = 6.21" for 100-year event
Inflow = 24.21 cfs @ 12.09 hrs, Volume= 77,457 cf
Primary = 24.21 cfs @ 12.09 hrs, Volume= 77,457 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link A: POI-A

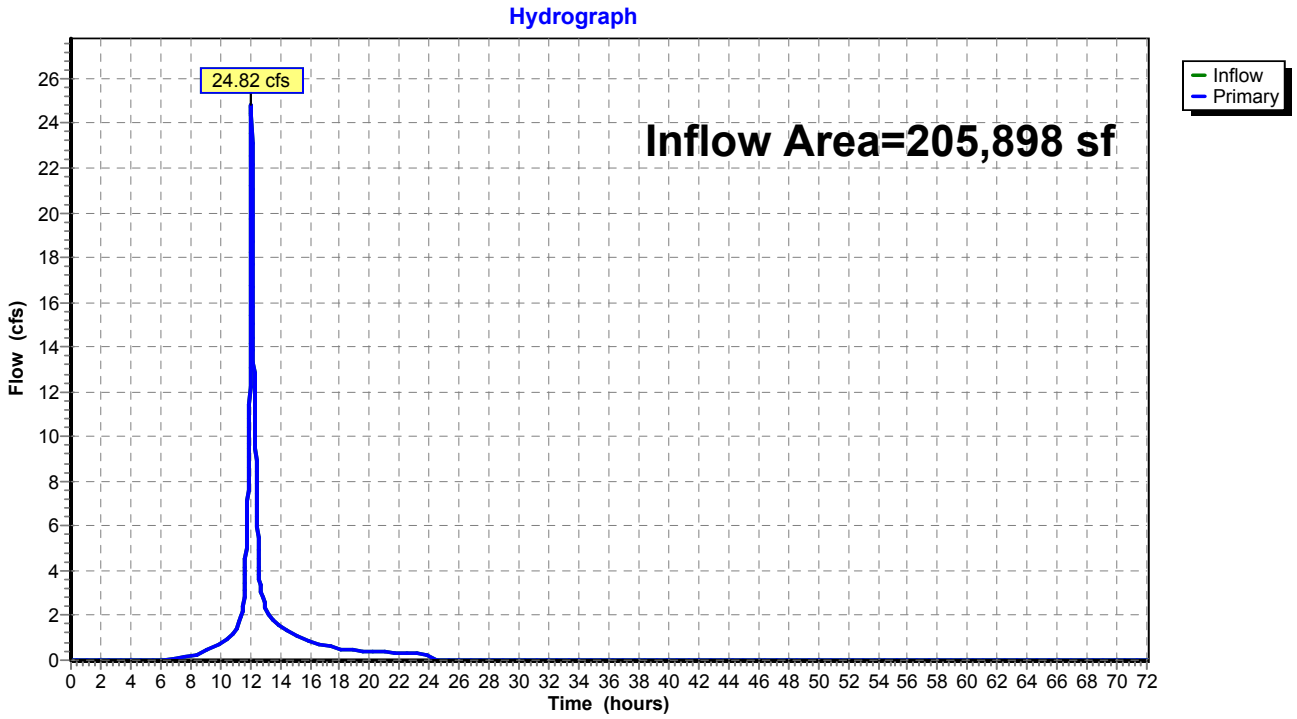


Summary for Link B: POI-B

Inflow Area = 205,898 sf, 62.86% Impervious, Inflow Depth = 4.70" for 100-year event
Inflow = 24.82 cfs @ 12.10 hrs, Volume= 80,608 cf
Primary = 24.82 cfs @ 12.10 hrs, Volume= 80,608 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link B: POI-B

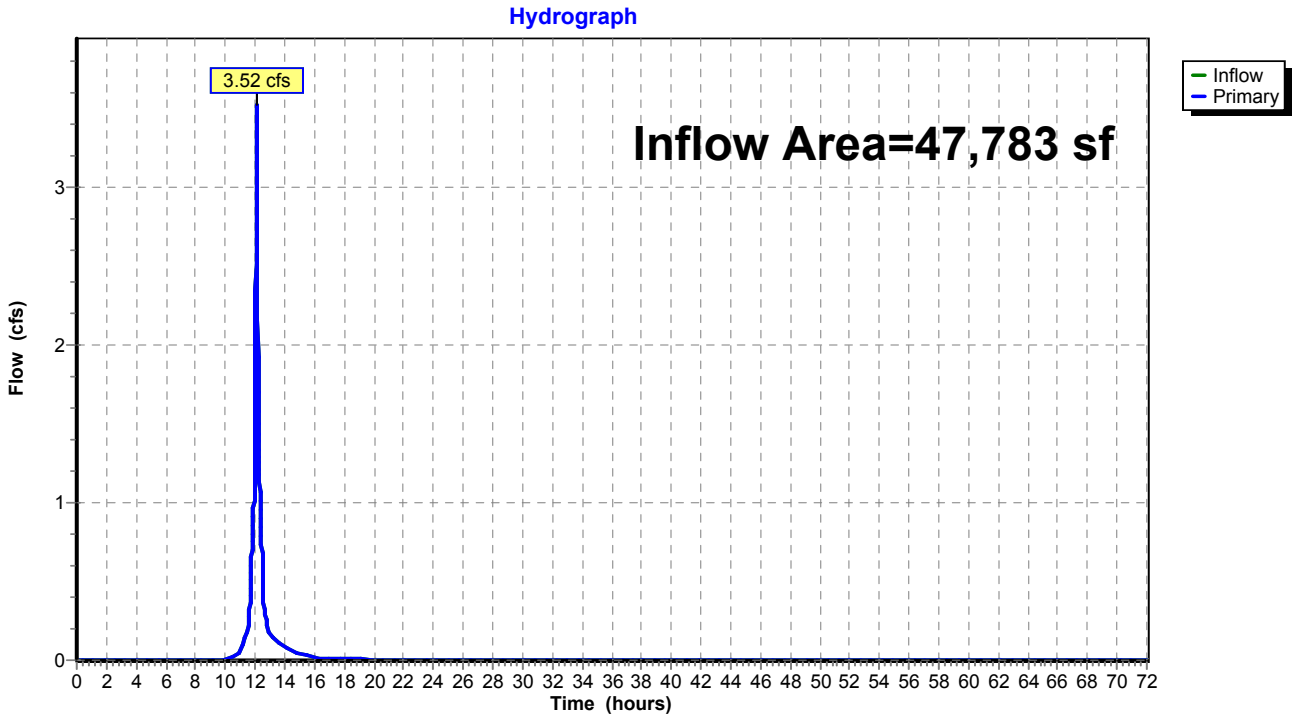


Summary for Link C: POI-C

Inflow Area = 47,783 sf, 66.40% Impervious, Inflow Depth = 1.45" for 100-year event
Inflow = 3.52 cfs @ 12.11 hrs, Volume= 5,758 cf
Primary = 3.52 cfs @ 12.11 hrs, Volume= 5,758 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link C: POI-C



Attachment E - Existing & Proposed Hydrologic Maps

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Project:

CURTIS APARTMENTS REDEVELOPMENT PHASE TWO

TRINITY FINANCIAL

75 Federal Street, 4th Floor
Boston, MA 02110
617.720.8400

GREAT BROOK VALLEY AVENUE, BROOKVIEW DRIVE, JOHN P. CARLSON WAY & TACOMA STREET WORCESTER MA 01605

Weston & Sampson

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978.532.1900 800.SAMPSON
www.westonandsampson.com

Consultant:

CWDG

Copley Wolff Design Group, Inc.
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Boston, MA 02109

Revisions:

No.	Date	Description
1	1/31/24	LOT 2 REVISIONS
2	2/09/24	70% DRAFT CD

Seal:

COMMONWEALTH OF MASSACHUSETTS
JESSE M. JOHNSON
CIVIL
No. 45050
REGISTERED
PROFESSIONAL ENGINEER

Issued For:

NOT FOR CONSTRUCTION

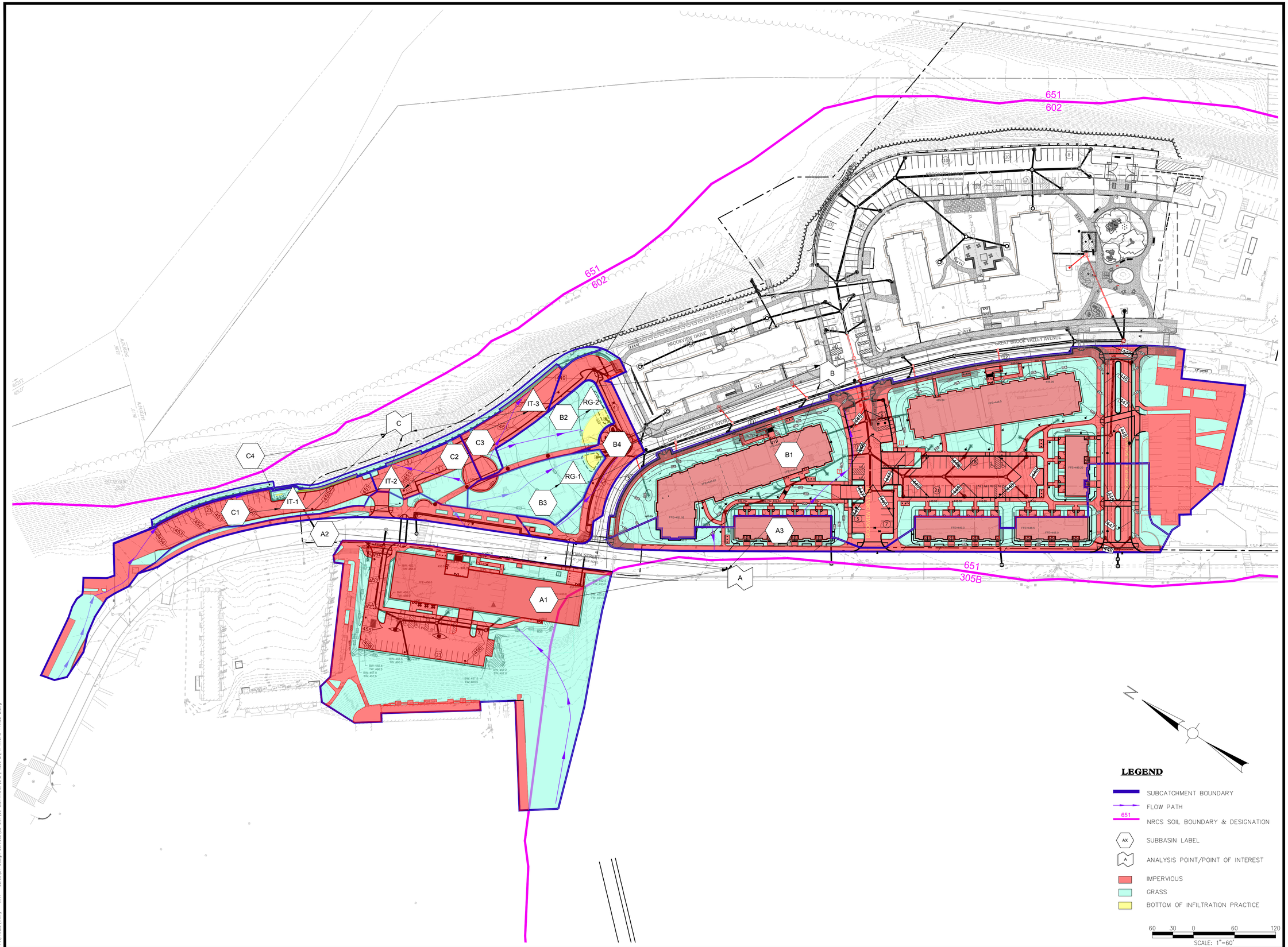
Scale:	AS SHOWN
Date:	JANUARY 24, 2024
Drawn By:	REB
Reviewed By:	MJY
Approved By:	JMJ
W&S Project No:	ENG23-3319
W&S File No:	-

Drawing Title:

EXISTING HYDROLOGIC MAP

Sheet Number:

FIG-1



P:\Projects\Trinity - IW4 - Curtis\04 Design Services\03 Civil\09 Stormwater\CAD\Phase 2\RR-HYDRO-PHASE-2.dwg

Project:

CURTIS APARTMENTS REDEVELOPMENT PHASE TWO

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No.	Date	Description
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COMMONWEALTH OF MASSACHUSETTS
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Scale:	AS SHOWN
Date:	JANUARY 24, 2024
Drawn By:	REB
Reviewed By:	MJY
Approved By:	JMJ
W&S Project No:	ENG23-3319
W&S File No:	-

Drawing Title:

PROPOSED HYDROLOGIC MAP

Sheet Number:

FIG-2

Attachment F - Calculations

Attachment F.1 - Peak Discharge Summary

Curtis Apartments Redevelopment Phase 2
Worcester, MA
Stormwater Discharge Summary Table
17-Apr-24

		Peak Discharge (cfs)	
Analysis Point	**24 Hr Storm**	**Pre-Development**	**Post-Development**
A	2yr	7.22	**7.27***
	10yr	14.14	**14.04**
	100yr	25.54	**24.21**
B	2yr	7.98	**6.61**
	10yr	15.76	**13.43**
	100yr	28.56	**24.82**
C	2yr	0.95	**0.88**
	10yr	1.94	**1.59**
	100yr	3.59	**3.52**

* Per Massachusetts Stormwater Handbook, increases in peak discharge less than or equal to 1 CFS for the 2-year 24-hour storm are considered *de minimis* .

Attachment F.2 - Water Quality Flow Calculation

Water Quality Flow Calculations (Hydrodynamic Separator CDS-1)
Curtis Apartments
Great Brook Valley Avenue, Brookview Drive, John P. Carlson Way & Tacoma Street
WSE Project No. ENG23-3319

Water Quality Flow:

WQV = Required WQV Design Precipitation = 1.0"
A = 15,942 S.F. = 0.0006 sq. mi.

1. Compute (T_c)

From HydroCAD Calculations, (Tc) =	6.8
(Based on TR-55 Method)	0.11

2. From MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices:

For first 1.0" runoff: Ia / P = 0.034

For Tc = 0.11 hours

q_u = 755 csm/in or (cfs/m^2/in)

Compute Water Quality Flow:

WQF = (q_u) x (A) x (WQV)

q_u =	755	csm/in or (cfs/m2/in)
A =	0.0006	square miles
WQV =	1.00	inches

WQF = 0.50 c.f.s. (see note)

Note: The Water Quality Structure shall be required to treat a water quality flow = **0.50 (c.f.s.)**

The Maximum Treatment flow rate for model CDS2015-4-C = **0.93 (c.f.s.)**

Water Quality Flow Calculations (Hydrodynamic Separator CDS-2)
Curtis Apartments
Great Brook Valley Avenue, Brookview Drive, John P. Carlson Way & Tacoma Street
WSE Project No. ENG23-3319

Water Quality Flow:

WQV = Required WQV Design Precipitation = 1.0"
A = 27,174 S.F. = 0.00097 sq. mi.

1. Compute (T_c)

From HydroCAD Calculations, (Tc) =	6
(Based on TR-55 Method)	0.10

2. From MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices:

For first 1.0" runoff: Ia / P = 0.034

For Tc = 0.10 hours

q_u = 774 csm/in or (cfs/m^2/in)

Compute Water Quality Flow:

WQF = (q_u) x (A) x (WQV)

q_u =	774	csm/in or (cfs/m2/in)
A =	0.00097	square miles
WQV =	1.00	inches

WQF = 0.80 c.f.s. (see note)

Note: The Water Quality Structure shall be required to treat a water quality flow = **0.80 (c.f.s.)**

The Maximum Treatment flow rate for model CDS2015-4-C = **0.93 (c.f.s.)**

Water Quality Flow Calculations (Hydrodynamic Separator CDS-3)
Curtis Apartments
Great Brook Valley Avenue, Brookview Drive, John P. Carlson Way & Tacoma Street
WSE Project No. ENG23-3319

Water Quality Flow:

WQV = Required WQV Design Precipitation = 1.0"
A = 8,638 S.F. = 0.0003 sq. mi.

1. Compute (T_c)

From HydroCAD Calculations, (Tc) =	6
(Based on TR-55 Method)	0.10

2. From MassDEP Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices:

For first 1.0" runoff: Ia / P = 0.034

For Tc = 0.10 hours

q_u = 774 csm/in or (cfs/m^2/in)

Compute Water Quality Flow:

WQF = (q_u) x (A) x (WQV)

q_u =	774	csm/in or (cfs/m2/in)
A =	0.0003	square miles
WQV =	1.00	inches

WQF = 0.30 c.f.s. (see note)

Note: The Water Quality Structure shall be required to treat a water quality flow = **0.30 (c.f.s.)**

The Maximum Treatment flow rate for model CDS2015-4-C = **0.93 (c.f.s.)**

Attachment F.3 – TSS Removal Worksheet

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: Deep Sump CB/CDS Unit (EOC)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump and Hooded Catch Basin	0.25	**1.00**	0.25	0.75
Hydrodynamic Separator	0.50	0.75	0.38	0.37
	0.00	0.37	0.00	0.37
	0.00	0.37	0.00	0.37
	0.00	0.37	0.00	0.37

Total TSS Removal = 63%

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

Project: Curtis Apartments Redevelopment Phase 2

Prepared By: Dylan Erickson

Date: 1/4/2024

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

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

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: Deep Sump CB/CDS Unit (Brookview)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump and Hooded Catch Basin	0.25	**1.00**	0.25	0.75
Hydrodynamic Separator	0.50	0.75	0.38	0.37
	0.00	0.37	0.00	0.37
	0.00	0.37	0.00	0.37
	0.00	0.37	0.00	0.37

Total TSS Removal = 63%

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

Project: Curtis Apartments Redevelopment Phase 2

Prepared By: Dylan Erickson

Date: 1/4/2024

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

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

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: Deep Sump CB/CDS Unit (Carlson)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump and Hooded Catch Basin	0.25	**1.00**	0.25	0.75
Hydrodynamic Separator	0.50	0.75	0.38	0.37
	0.00	0.37	0.00	0.37
	0.00	0.37	0.00	0.37
	0.00	0.37	0.00	0.37

Total TSS Removal = 63%

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

Project: Curtis Apartments Redevelopment Phase 2

Prepared By: Dylan Erickson

Date: 1/4/2024

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

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

1. From MassDEP Stormwater Handbook Vol. 1

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

Version 1, Automated: Mar. 4, 2008

Location: Rain Garden

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Rain Garden	**0.90**	**1.00**	**0.90**	**0.10**
	0.00	**0.10**	**0.00**	**0.10**
	0.00	**0.10**	**0.00**	**0.10**
	0.00	**0.10**	**0.00**	**0.10**
	0.00	**0.10**	**0.00**	**0.10**

Total TSS Removal = **90%**

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

Project: **Curtis Apartments Redevelopment Phase 2**
Prepared By: **Dylan Erickson**
Date: **1/4/2024**

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

Non-automated TSS Calculation Sheet
must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

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

Version 1, Automated: Mar. 4, 2008

Location: Infiltration Trench

TSS Removal Calculation Worksheet

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

Total TSS Removal = **80%**

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

Project: **Curtis Apartments Redevelopment Phase 2**
Prepared By: **Dylan Erickson**
Date: **1/4/2024**

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

Non-automated TSS Calculation Sheet
must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

March 21, 2017

Derek M. Berg
Contech Engineered Solutions, LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: Revised MTD Lab Certification
Continuous Deflective Separator (CDS®) Stormwater Treatment Device by Contech Engineered Solutions, LLC
On-line Installation

TSS Removal Rate 50%

Dear Mr. Berg:

This revised certification letter supersedes the Department's prior certification dated January 9, 2015. This revision was completed to reflect the updated Manufactured Treatment Device (MTD) scaling methodology as agreed upon by the manufacturers' working group on September 19, 2016. In part, the updated scaling for hydrodynamic MTDs is based on the depth of the reference (tested) MTD from the top of the false floor utilized during removal efficiency testing, not from the physical bottom of the unit. Based on the above decision, Table A-2 of the NJCAT Technology Verification report located at http://www.njcat.org/uploads/newDocs/CDSVerificationReportFinal1.pdf has been revised, and Table 1 noted below has been added.

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7 (c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions, LLC has requested an MTD Laboratory Certification for the CDS® Stormwater Treatment Device.

The verification is subject to the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification

Appendix dated September 2014 (Revised January 2017) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the CDS® Stormwater Treatment Device by Contech Engineered Solutions, LLC at a TSS removal rate of 50% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5.

2. The CDS® Stormwater Treatment Device shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in item 6 below.

3. This CDS® Stormwater Treatment Device cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the CDS® Stormwater Treatment Device. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at http://www.conteches.com/products/stormwater-management/treatment/cds.aspx#1822141-technical-info for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for the CDS®:

   Example: A 0.25-acre impervious site is to be treated to 50% TSS removal using a CDS®. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:
   time of concentration = 10 minutes
   i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
   c=0.99 (runoff coefficient for impervious)
   Q=ciA=0.99x3.2x0.25=0.79 cfs

   Given the site runoff is 0.79 cfs and based on Table 1 below, the CDS® Model CDS-4 with an MTFR of 0.93 cfs would be the smallest model approved that could be used for this site that could remove 50% of the TSS from the impervious area without exceeding the MTFR.

The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the Verification Appendix under Table A-1 and A-2.

Table 1 CDS Models

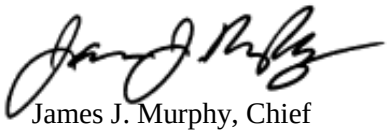
CDS Model	Manhole Diameter (ft.)	Treatment Chamber Depth (ft.)	MTFR (cfs)
CDS-3	3	3.50	0.52
CDS-4	4	3.50	0.93
CDS-5	5	3.75	1.5
CDS-6	6	4.50	2.1
CDS-7	7	5.25	2.8
CDS-8	8	6.00	3.7
CDS-10	10	7.50	5.8
CDS-12	12	9.00	8.4

- Treatment Chamber Depth is defined as the depth below the invert to the top of the false floor installed at 50% sediment depth.

A detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Mr. Shashi Nayak of my office at (609) 633-7021.

Sincerely,



James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

c: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Shashi Nayak, NJDEP – BNPC

Attachment F.4 - Recharge Volume Calculations

Project:	Curtis Apartments Redevelopment Phase Two	Project Number:	ENG23-3319
Location:	Worcester, MA	Prepared By:	DKE
Client:	Trinity Curtis Phase Two Limited Partnership	Date:	April 17, 2024

Standard 3: Recharge Calculations (Static Method)

Infiltration Trench / Rain Garden #1 (IT-1)

Hydrologic Soils Group:	A	B	C	D		
Total Proposed Impervious Area (AC):	0.3850	0.0000	0.0000	0.0000	0.38	
Target Factor:	0.60	0.35	0.25	0.10		
Required Recharge Volume:	838	0	0	0	838	CF
Volume Below Lowest Outlet:					220	CF
Elevation of Lowest Invert:					449.50	
Determine Drawdown Time						
Saturated Hydraulic Conductivity (Rawls Rate):					8.27	IN/HR
Bottom Area of Infiltration Area:					190	SF
Drawdown Time:					1.7	HRS

Infiltration Trench #2 (IT-2)

Hydrologic Soils Group:	A	B	C	D		
Total Proposed Impervious Area (AC):	0.1627	0.0000	0.0000	0.0000	0.16	
Target Factor:	0.60	0.35	0.25	0.10		
Required Recharge Volume:	354	0	0	0	354	CF
Volume Below Lowest Outlet:					65	CF
Elevation of Lowest Invert:					450.75	
Determine Drawdown Time						
Saturated Hydraulic Conductivity (Rawls Rate):					8.27	IN/HR
Bottom Area of Infiltration Basin:					108	SF
Drawdown Time:					0.9	HRS

Infiltration Trench #3 (IT-3)

Hydrologic Soils Group:	A	B	C	D		
Total Proposed Impervious Area (AC):	0.1691	0.0000	0.0000	0.0000	0.17	
Target Factor:	0.60	0.35	0.25	0.10		
Required Recharge Volume:	368	0	0	0	368	CF
Volume Below Lowest Outlet:					126	CF
Elevation of Lowest Invert:					448.90	
Determine Drawdown Time						
Saturated Hydraulic Conductivity (Rawls Rate):					8.27	IN/HR
Bottom Area of Infiltration Basin:					210	SF
Drawdown Time:					0.9	HRS

Rain Garden #1 (RG-1)

	A	B	C	D		
Hydrologic Soils Group:						
Total Proposed Impervious Area (AC):	0.0135	0.0000	0.0000	0.0000	0.01	
Target Factor:	0.60	0.35	0.25	0.10		
Required Recharge Volume:	29	0	0	0	29	CF

Volume Below Lowest Outlet:	200	CF
Elevation of Lowest Invert:	450.00	
Determine Drawdown Time		
Saturated Hydraulic Conductivity (Rawls Rate):	8.27	IN/HR
Bottom Area of Infiltration Basin:	342	SF
Drawdown Time:	0.8	HRS

Rain Garden #2 (RG-2)

	A	B	C	D		
Hydrologic Soils Group:						
Total Proposed Impervious Area (AC):	0.0250	0.0000	0.0000	0.0000	0.02	
Target Factor:	0.60	0.35	0.25	0.10		
Required Recharge Volume:	54	0	0	0	54	CF

Volume Below Lowest Outlet:	583	CF
Elevation of Lowest Invert:	448.75	
Determine Drawdown Time		
Saturated Hydraulic Conductivity (Rawls Rate):	8.27	IN/HR
Bottom Area of Infiltration Basin:	1,057	SF
Drawdown Time:	0.8	HRS

Note: There is a reduction in total impervious area as a result of the project and there is a net negative required recharge volume for the site.

Stage-Area-Storage for Pond IT-1: Infiltration Trench / Rain Garden #1

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
447.75	175	0
447.76	175	1
447.77	176	1
447.78	176	2
447.79	177	2
447.80	177	3
447.81	178	3
447.82	178	4
447.83	179	4
447.84	179	5
447.85	180	5
447.86	180	6
447.87	181	6
447.88	181	7
447.89	182	7
447.90	182	8
447.91	183	8
447.92	183	9
447.93	183	9
447.94	184	10
447.95	184	10
447.96	185	11
447.97	185	12
447.98	186	12
447.99	186	13
448.00	187	13
448.01	187	14
448.02	188	14
448.03	188	15
448.04	189	15
448.05	189	16
448.06	190	16
448.07	190	17
448.08	190	17
448.09	191	18
448.10	191	18
448.11	192	19
448.12	192	19
448.13	193	20
448.14	193	20
448.15	194	21
448.16	194	22
448.17	195	22
448.18	195	23
448.19	196	23
448.20	196	24
448.21	197	24
448.22	197	25
448.23	198	25
448.24	198	26
448.25	198	26
448.26	199	27
448.27	199	27
448.28	200	28
448.29	200	28
448.30	201	29
448.31	201	29
448.32	202	30
448.33	202	30
448.34	203	31
448.35	203	32
448.36	204	32
448.37	204	33
448.38	205	33
448.39	205	34
448.40	205	34
448.41	206	35
448.42	206	35
448.43	207	36
448.44	207	36
448.45	208	37
448.46	208	37
448.47	209	38
448.48	209	38
448.49	210	39
448.50	225	39
448.51	227	40
448.52	229	41
448.53	231	41
448.54	232	42
448.55	234	43
448.56	236	44
448.57	238	44
448.58	240	45
448.59	243	46
448.60	245	47
448.61	247	48
448.62	249	49
448.63	252	49
448.64	254	50
448.65	257	51
448.66	259	52
448.67	262	53
448.68	264	54
448.69	267	55
448.70	270	56
448.71	272	57
448.72	275	58
448.73	278	59
448.74	281	60
448.75	284	61
448.76	287	63
448.77	290	64
448.78	293	65

Stage-Area-Storage for Pond IT-1: Infiltration Trench / Rain Garden #1 (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
448.79	296	66
448.80	299	67
448.81	303	69
448.82	306	70
448.83	309	71
448.84	313	73
448.85	316	74
448.86	320	76
448.87	323	77
448.88	327	79
448.89	331	80
448.90	334	82
448.91	338	83
448.92	342	85
448.93	346	87
448.94	350	88
448.95	354	90
448.96	358	92
448.97	362	93
448.98	366	95
448.99	370	97
449.00	374	99
449.01	377	101
449.02	379	103
449.03	381	105
449.04	384	107
449.05	386	109
449.06	388	111
449.07	391	113
449.08	393	115
449.09	396	117
449.10	398	119
449.11	400	121
449.12	403	124
449.13	405	126
449.14	408	128
449.15	410	130
449.16	413	132
449.17	415	134
449.18	418	137
449.19	420	139
449.20	423	141
449.21	425	144
449.22	428	146
449.23	430	148
449.24	433	151
449.25	436	153
449.26	438	156
449.27	441	158
449.28	443	160
449.29	446	163
449.30	449	165

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
449.31	451	168
449.32	454	170
449.33	457	173
449.34	459	176
449.35	462	178
449.36	465	181
449.37	467	183
449.38	470	186
449.39	473	189
449.40	476	192
449.41	478	194
449.42	481	197
449.43	484	200
449.44	487	203
449.45	490	205
449.46	493	208
449.47	495	211
449.48	498	214
449.49	501	217
449.50	504	220
449.51	507	223
449.52	510	226
449.53	513	229
449.54	516	232
449.55	519	235
449.56	521	238
449.57	524	241
449.58	527	244
449.59	530	248
449.60	533	251
449.61	536	254
449.62	539	257
449.63	542	260
449.64	545	264
449.65	549	267
449.66	552	270
449.67	555	274
449.68	558	277
449.69	561	281
449.70	564	284
449.71	567	287
449.72	570	291
449.73	573	294
449.74	577	298
449.75	580	302
449.76	582	305
449.77	585	308
449.78	588	311
449.79	591	314
449.80	593	317
449.81	596	320
449.82	599	324

VOLUME BELOW LOWEST OUTLET

Stage-Area-Storage for Pond IT-1: Infiltration Trench / Rain Garden #1 (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
449.83	602	327
449.84	605	330
449.85	607	333
449.86	610	337
449.87	613	340
449.88	616	344
449.89	619	347
449.90	622	350
449.91	624	354
449.92	627	357
449.93	630	361
449.94	633	365
449.95	636	368
449.96	639	372
449.97	642	375
449.98	645	379
449.99	648	383
450.00	651	387
450.01	653	390
450.02	656	394
450.03	658	398
450.04	661	402
450.05	663	406
450.06	665	409
450.07	668	413
450.08	670	417
450.09	673	421
450.10	675	425
450.11	677	429
450.12	680	433
450.13	682	437
450.14	685	441
450.15	687	445
450.16	690	449
450.17	692	454
450.18	695	458
450.19	697	462
450.20	700	466
450.21	702	470
450.22	705	475
450.23	707	479
450.24	710	483
450.25	712	488
450.26	715	492
450.27	718	496
450.28	720	501
450.29	723	505
450.30	725	510
450.31	728	514
450.32	730	519
450.33	733	523
450.34	736	528
450.35	738	532
450.36	741	537
450.37	744	541
450.38	746	546
450.39	749	551
450.40	752	555
450.41	754	560
450.42	757	565
450.43	760	570
450.44	762	574
450.45	765	579
450.46	768	584
450.47	770	589
450.48	773	594
450.49	776	599
450.50	**778**	**604**

Stage-Area-Storage for Pond IT-2: Inf. Trench #2

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
448.75	108	108	0
448.76	108	108	0
448.77	108	109	1
448.78	108	109	1
448.79	108	109	1
448.80	108	110	2
448.81	108	110	2
448.82	108	111	2
448.83	108	111	3
448.84	108	111	3
448.85	108	112	3
448.86	108	112	4
448.87	108	112	4
448.88	108	113	4
448.89	108	113	5
448.90	108	114	5
448.91	108	114	5
448.92	108	114	6
448.93	108	115	6
448.94	108	115	6
448.95	108	115	6
448.96	108	116	7
448.97	108	116	7
448.98	108	116	7
448.99	108	117	8
449.00	108	117	8
449.01	108	118	8
449.02	108	118	9
449.03	108	118	9
449.04	108	119	9
449.05	108	119	10
449.06	108	119	10
449.07	108	120	10
449.08	108	120	11
449.09	108	121	11
449.10	108	121	11
449.11	108	121	12
449.12	108	122	12
449.13	108	122	12
449.14	108	122	13
449.15	108	123	13
449.16	108	123	13
449.17	108	123	14
449.18	108	124	14
449.19	108	124	14
449.20	108	125	15
449.21	108	125	15
449.22	108	125	15
449.23	108	126	16
449.24	108	126	16
449.25	108	126	16
449.26	108	127	17

Stage-Area-Storage for Pond IT-2: Inf. Trench #2 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
449.27	108	127	17
449.28	108	128	17
449.29	108	128	17
449.30	108	128	18
449.31	108	129	18
449.32	108	129	18
449.33	108	129	19
449.34	108	130	19
449.35	108	130	19
449.36	108	130	20
449.37	108	131	20
449.38	108	131	20
449.39	108	132	21
449.40	108	132	21
449.41	108	132	21
449.42	108	133	22
449.43	108	133	22
449.44	108	133	22
449.45	108	134	23
449.46	108	134	23
449.47	108	135	23
449.48	108	135	24
449.49	108	135	24
449.50	108	136	24
449.51	108	136	25
449.52	108	136	25
449.53	108	137	25
449.54	108	137	26
449.55	108	137	26
449.56	108	138	26
449.57	108	138	27
449.58	108	139	27
449.59	108	139	27
449.60	108	139	28
449.61	108	140	28
449.62	108	140	28
449.63	108	140	29
449.64	108	141	29
449.65	108	141	29
449.66	108	142	29
449.67	108	142	30
449.68	108	142	30
449.69	108	143	30
449.70	108	143	31
449.71	108	143	31
449.72	108	144	31
449.73	108	144	32
449.74	108	144	32
449.75	108	145	32
449.76	108	145	33
449.77	108	146	33
449.78	108	146	33

Stage-Area-Storage for Pond IT-2: Inf. Trench #2 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
449.79	108	146	34
449.80	108	147	34
449.81	108	147	34
449.82	108	147	35
449.83	108	148	35
449.84	108	148	35
449.85	108	149	36
449.86	108	149	36
449.87	108	149	36
449.88	108	150	37
449.89	108	150	37
449.90	108	150	37
449.91	108	151	38
449.92	108	151	38
449.93	108	151	38
449.94	108	152	39
449.95	108	152	39
449.96	108	153	39
449.97	108	153	40
449.98	108	153	40
449.99	108	154	40
450.00	108	154	41
450.01	108	154	41
450.02	108	155	41
450.03	108	155	41
450.04	108	156	42
450.05	108	156	42
450.06	108	156	42
450.07	108	157	43
450.08	108	157	43
450.09	108	157	43
450.10	108	158	44
450.11	108	158	44
450.12	108	158	44
450.13	108	159	45
450.14	108	159	45
450.15	108	160	45
450.16	108	160	46
450.17	108	160	46
450.18	108	161	46
450.19	108	161	47
450.20	108	161	47
450.21	108	162	47
450.22	108	162	48
450.23	108	163	48
450.24	108	163	48
450.25	108	163	49
450.26	108	164	49
450.27	108	164	49
450.28	108	164	50
450.29	108	165	50
450.30	108	165	50

Stage-Area-Storage for Pond IT-2: Inf. Trench #2 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
450.31	108	165	51
450.32	108	166	51
450.33	108	166	51
450.34	108	167	52
450.35	108	167	52
450.36	108	167	52
450.37	108	168	52
450.38	108	168	53
450.39	108	168	53
450.40	108	169	53
450.41	108	169	54
450.42	108	170	54
450.43	108	170	54
450.44	108	170	55
450.45	108	171	55
450.46	108	171	55
450.47	108	171	56
450.48	108	172	56
450.49	108	172	56
450.50	108	172	57
450.51	108	173	57
450.52	108	173	57
450.53	108	174	58
450.54	108	174	58
450.55	108	174	58
450.56	108	175	59
450.57	108	175	59
450.58	108	175	59
450.59	108	176	60
450.60	108	176	60
450.61	108	177	60
450.62	108	177	61
450.63	108	177	61
450.64	108	178	61
450.65	108	178	62
450.66	108	178	62
450.67	108	179	62
450.68	108	179	63
450.69	108	179	63
450.70	108	180	63
450.71	108	180	64
450.72	108	181	64
450.73	108	181	64
450.74	108	181	64
450.75	**108**	**182**	**65**
450.76	108	182	65
450.77	108	182	65
450.78	108	182	65
450.79	108	182	65

VOLUME BELOW
LOWEST OUTLET

Stage-Area-Storage for Pond IT-3: Inf. Trench #3

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
446.90	210	210	0
446.91	210	211	1
446.92	210	211	1
446.93	210	212	2
446.94	210	212	3
446.95	210	213	3
446.96	210	213	4
446.97	210	214	4
446.98	210	214	5
446.99	210	215	6
447.00	210	215	6
447.01	210	216	7
447.02	210	216	8
447.03	210	217	8
447.04	210	217	9
447.05	210	218	9
447.06	210	218	10
447.07	210	219	11
447.08	210	219	11
447.09	210	220	12
447.10	210	220	13
447.11	210	221	13
447.12	210	221	14
447.13	210	222	14
447.14	210	222	15
447.15	210	223	16
447.16	210	223	16
447.17	210	224	17
447.18	210	224	18
447.19	210	225	18
447.20	210	225	19
447.21	210	226	20
447.22	210	226	20
447.23	210	227	21
447.24	210	227	21
447.25	210	228	22
447.26	210	228	23
447.27	210	229	23
447.28	210	230	24
447.29	210	230	25
447.30	210	231	25
447.31	210	231	26
447.32	210	232	26
447.33	210	232	27
447.34	210	233	28
447.35	210	233	28
447.36	210	234	29
447.37	210	234	30
447.38	210	235	30
447.39	210	235	31
447.40	210	236	32
447.41	210	236	32

Stage-Area-Storage for Pond IT-3: Inf. Trench #3 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
447.42	210	237	33
447.43	210	237	33
447.44	210	238	34
447.45	210	238	35
447.46	210	239	35
447.47	210	239	36
447.48	210	240	37
447.49	210	240	37
447.50	210	241	38
447.51	210	241	38
447.52	210	242	39
447.53	210	242	40
447.54	210	243	40
447.55	210	243	41
447.56	210	244	42
447.57	210	244	42
447.58	210	245	43
447.59	210	245	43
447.60	210	246	44
447.61	210	246	45
447.62	210	247	45
447.63	210	248	46
447.64	210	248	47
447.65	210	249	47
447.66	210	249	48
447.67	210	250	49
447.68	210	250	49
447.69	210	251	50
447.70	210	251	50
447.71	210	252	51
447.72	210	252	52
447.73	210	253	52
447.74	210	253	53
447.75	210	254	54
447.76	210	254	54
447.77	210	255	55
447.78	210	255	55
447.79	210	256	56
447.80	210	256	57
447.81	210	257	57
447.82	210	257	58
447.83	210	258	59
447.84	210	258	59
447.85	210	259	60
447.86	210	259	60
447.87	210	260	61
447.88	210	260	62
447.89	210	261	62
447.90	210	261	63
447.91	210	262	64
447.92	210	262	64
447.93	210	263	65

Stage-Area-Storage for Pond IT-3: Inf. Trench #3 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
447.94	210	263	66
447.95	210	264	66
447.96	210	264	67
447.97	210	265	67
447.98	210	265	68
447.99	210	266	69
448.00	210	267	69
448.01	210	267	70
448.02	210	268	71
448.03	210	268	71
448.04	210	269	72
448.05	210	269	72
448.06	210	270	73
448.07	210	270	74
448.08	210	271	74
448.09	210	271	75
448.10	210	272	76
448.11	210	272	76
448.12	210	273	77
448.13	210	273	77
448.14	210	274	78
448.15	210	274	79
448.16	210	275	79
448.17	210	275	80
448.18	210	276	81
448.19	210	276	81
448.20	210	277	82
448.21	210	277	83
448.22	210	278	83
448.23	210	278	84
448.24	210	279	84
448.25	210	279	85
448.26	210	280	86
448.27	210	280	86
448.28	210	281	87
448.29	210	281	88
448.30	210	282	88
448.31	210	282	89
448.32	210	283	89
448.33	210	283	90
448.34	210	284	91
448.35	210	284	91
448.36	210	285	92
448.37	210	286	93
448.38	210	286	93
448.39	210	287	94
448.40	210	287	95
448.41	210	288	95
448.42	210	288	96
448.43	210	289	96
448.44	210	289	97
448.45	210	290	98

Stage-Area-Storage for Pond IT-3: Inf. Trench #3 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
448.46	210	290	98
448.47	210	291	99
448.48	210	291	100
448.49	210	292	100
448.50	210	292	101
448.51	210	293	101
448.52	210	293	102
448.53	210	294	103
448.54	210	294	103
448.55	210	295	104
448.56	210	295	105
448.57	210	296	105
448.58	210	296	106
448.59	210	297	106
448.60	210	297	107
448.61	210	298	108
448.62	210	298	108
448.63	210	299	109
448.64	210	299	110
448.65	210	300	110
448.66	210	300	111
448.67	210	301	112
448.68	210	301	112
448.69	210	302	113
448.70	210	302	113
448.71	210	303	114
448.72	210	303	115
448.73	210	304	115
448.74	210	305	116
448.75	210	305	117
448.76	210	306	117
448.77	210	306	118
448.78	210	307	118
448.79	210	307	119
448.80	210	308	120
448.81	210	308	120
448.82	210	309	121
448.83	210	309	122
448.84	210	310	122
448.85	210	310	123
448.86	210	311	123
448.87	210	311	124
448.88	210	312	125
448.89	210	312	125
448.90	**210**	**313**	**126**
448.91	210	313	126
448.92	210	313	126
448.93	210	313	126
448.94	210	313	126

VOLUME BELOW
LOWEST OUTLET

Stage-Area-Storage for Pond RG-1: Rain Garden #1

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
449.50	342	342	0
449.51	344	344	3
449.52	346	347	7
449.53	349	349	10
449.54	351	351	14
449.55	353	354	17
449.56	355	356	21
449.57	358	358	24
449.58	360	361	28
449.59	362	363	32
449.60	364	365	35
449.61	367	368	39
449.62	369	370	43
449.63	371	373	46
449.64	374	375	50
449.65	376	377	54
449.66	378	380	58
449.67	380	382	61
449.68	383	385	65
449.69	385	387	69
449.70	387	389	73
449.71	390	392	77
449.72	392	394	81
449.73	395	397	85
449.74	397	399	89
449.75	399	402	93
449.76	402	404	97
449.77	404	407	101
449.78	406	409	105
449.79	409	412	109
449.80	411	414	113
449.81	414	417	117
449.82	416	419	121
449.83	419	422	125
449.84	421	424	129
449.85	423	427	134
449.86	426	430	138
449.87	428	432	142
449.88	431	435	147
449.89	433	437	151
449.90	436	440	155
449.91	438	442	160
449.92	441	445	164
449.93	443	448	168
449.94	446	450	173
449.95	448	453	177
449.96	451	456	182
449.97	453	458	186
449.98	456	461	191
449.99	458	463	195
450.00	**461**	**466**	**200**
450.01	461	466	200

VOLUME BELOW
LOWEST OUTLET

Stage-Area-Storage for Pond RG-1: Rain Garden #1 (continued)

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
450.02	461	466	200
450.03	461	466	200
450.04	461	466	200
450.05	461	466	200
450.06	461	466	200

Stage-Area-Storage for Pond RG-2: Rain Garden #2

Elevation (feet)	Surface (sq-ft)	Wetted (sq-ft)	Storage (cubic-feet)
448.25	1,057	1,057	0
448.26	1,061	1,061	11
448.27	1,065	1,066	21
448.28	1,070	1,070	32
448.29	1,074	1,075	43
448.30	1,078	1,079	53
448.31	1,082	1,083	64
448.32	1,087	1,088	75
448.33	1,091	1,092	86
448.34	1,095	1,097	97
448.35	1,100	1,101	108
448.36	1,104	1,106	119
448.37	1,108	1,110	130
448.38	1,112	1,114	141
448.39	1,117	1,119	152
448.40	1,121	1,123	163
448.41	1,125	1,128	175
448.42	1,130	1,132	186
448.43	1,134	1,137	197
448.44	1,139	1,142	209
448.45	1,143	1,146	220
448.46	1,147	1,151	231
448.47	1,152	1,155	243
448.48	1,156	1,160	254
448.49	1,160	1,164	266
448.50	1,165	1,169	278
448.51	1,169	1,173	289
448.52	1,174	1,178	301
448.53	1,178	1,183	313
448.54	1,183	1,187	325
448.55	1,187	1,192	336
448.56	1,192	1,197	348
448.57	1,196	1,201	360
448.58	1,201	1,206	372
448.59	1,205	1,210	384
448.60	1,209	1,215	396
448.61	1,214	1,220	408
448.62	1,219	1,224	421
448.63	1,223	1,229	433
448.64	1,228	1,234	445
448.65	1,232	1,239	457
448.66	1,237	1,243	470
448.67	1,241	1,248	482
448.68	1,246	1,253	495
448.69	1,250	1,257	507
448.70	1,255	1,262	520
448.71	1,260	1,267	532
448.72	1,264	1,272	545
448.73	1,269	1,277	557
448.74	1,273	1,281	570
448.75	**1,278**	**1,286**	**583**

VOLUME BELOW
LOWEST OUTLET

Attachment G – Long Term Pollution Prevention Plan

Long Term Pollution Prevention Plan
Curtis Apartments Redevelopment Phase Two
Worcester, MA

To meet the requirements of Standard 4 of the Massachusetts Stormwater Handbook, this Long Term Pollution Prevention Plan is provided to identify the proper procedures of practices for source control and pollution prevention.

Storage and Handling of Oil and other Hazardous Materials

Any hazardous materials that will be used ancillary to the apartments will be stored inside, or off site.

Spill Prevention/Response

Spill kits will be kept on site, and spills shall be cleaned up immediately. Spills of any hazardous material over 10 gallons will be reported to the Massachusetts Department of Environmental Protection within 24 hours.

Operation and Maintenance of Stormwater Control Structures

Included in Attachment I of this appendix is the Operation and Maintenance plan for this site, which includes street sweeping of the paved areas and periodic cleaning of stormwater structures. The City will be responsible for the implementation of the plan.

Landscaping

The landscaped areas will be maintained by the City. Use of fertilizers, herbicides, and pesticides shall be allowed for all vegetated areas on site. If kept on site, all chemicals shall be stored under cover. Any storage for fertilizers, herbicides and pesticides shall not be located within 100 feet of any wetland or within proximity to the stormwater management system where spills could enter the storm drain system.

Septic System

There will be no onsite septic facilities. The sewer facilities currently in use for the existing building on site shall be retained.

Vehicle Washing

Vehicle washing shall not be performed on site. Vehicles can be rinsed with a high volume of water at low pressure. This is considered dust water by the DEP and accounts for what may be rinsed off of the vehicle when it rains. Pre-treatment BMP’s downstream of these activities will include deep-sump hooded catch basins.

Non-Hazardous Waste Management/Good Housekeeping Practices

All non-hazardous waste shall be stored in designated trash or recycling containers onsite for periodic collection by the local trash collector. The City shall have maintenance staff who monitor the site for the accumulation of trash. Any trash that is seen onsite shall immediately be collected and placed into designated trash or recycling containers. The City's maintenance staff shall inspect the site once per week at minimum.

Prohibition of Illicit Discharges

Illicit discharges to the onsite stormwater management system shall be strictly prohibited. Illicit discharges are defined as any direct or indirect non-stormwater discharge to the onsite stormwater system. Requirements related to Illicit Discharges are further detailed in the attached Illicit Discharge Compliance Statement.

De-icing & Snow Disposal

The operation will utilize salt and sand to treat the paved surfaces of the site during snow and ice events. Snow will be temporarily stored within peripheral areas of the site and allowed to melt and drain back to onsite stormwater systems. When needed, snow shall be removed from the site and disposed of in accordance with all local, state and federal regulations.

Winter Sand/Salt Use & Storage

Any sand and/or salt to be used for de-icing purposes shall be stored inside or under cover and stabilized to prevent the discharge into nearby wetlands or waterbodies.

Emergency Contact Information

Owner/Operator (For Right-Of-Way Infrastructure):
Jay J. Fink, P.E.
Department of Public Works
Commissioner
20 East Worcester Street
Worcester, MA 01604
508-929-1300

Engineer (For Parcel Infrastructure):
Jesse Johnson, P.E.
Weston & Sampson, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
978-532-1900

Attachment H - Construction Period Pollution and Erosion and Sedimentation Control Plan

Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan

SECTION 1: Introduction

The project applicant, Trinity Curtis Phase Two Limited Partnership, proposes the second phase of a redevelopment project at the Curtis Apartments located at Tacoma Street, Great Brook Valley Avenue, Great Brook Valley Avenue Extension, Brookview Drive, & Joseph P. Carlson Way in Worcester to construct seven new multi-family residential buildings as well as a mixed use building consisting of a library, Economic Opportunity Center, and residential units. Site work will include, but is not limited to grading, drainage, utility work, paving and landscaping.

As part of this project, this "Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan" has been created to ensure that onsite erosion is prevented and sediment is controlled to prevent it from leaving the site.

SECTION 2: Construction Period Pollution Prevention Measures

Best Management Practices (BMPs) will be utilized as Construction Period Pollution Prevention Measures to reduce potential pollutants and prevent any off-site discharge. The objectives of the BMPs for construction activity are to minimize the disturbed areas, stabilize any disturbed areas, control the site perimeter and retain sediment. Both erosion and sedimentation controls and non-stormwater best management measures will be used to minimize site disturbance and ensure compliance with the performance standards of the WPA and Stormwater Standards. Measures will be taken to minimize the area disturbed by construction activities to reduce the potential for soil erosion and stormwater pollution problems. All pollution prevention and erosion control measures which are required on the site plans and in the SWPPP shall be followed along with the guidance in this document. In addition, good housekeeping measures will be followed for the day-to-day operation of the construction site under the control of the contractor to minimize the impact of construction. This section describes the control practices that will be in place during construction activities. All recommended control practices will comply with the standards set in the MA DEP Stormwater Policy Handbook.

2.1 Minimize Disturbed Area and Protect Natural Features and Soil

In order to minimize disturbed areas all work will be completed within well-defined work limits. These work limits are shown on the construction plans. The Contractor shall not disturb native vegetation in the undisturbed wooded area without prior approval from the Engineer. The Contractor will be responsible to make sure that all workers know the proper work limits and do not extend their

work into the undisturbed areas. The protective measures are described in more detail in the following sections.

2.2 Control Stormwater Flowing onto and through the project

A portion of the perimeter around the construction area will be lined with compost filter tubes and silt fence. The tubes/fence will be inspected daily and accumulated silt will be removed as appropriate. In addition, any storage of material will require a second level of protection by surrounding the areas with another row of compost filter tubes.

2.3 Stabilize Soils

The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) weeks, mulching, the use of erosion control mats, or other protective measures shall be provided as specified.

The Contractor shall take account of the conditions of the soil where erosion control seeding will take place to ensure that materials used for re-vegetation are adaptive to the sediment control.

Following the completion of construction, embankment areas will be finished with topsoil and seed. The overland areas of the proposed construction staging areas will also be re-seeded.

2.4 Proper storage and cover of any stockpiles

The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project and shall require written approval of the Engineer.

Adequate measures for erosion and sediment control such as the placement of compost filter tubes around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

2.5 Perimeter Controls and Sediment Barriers

Erosion control lines as described in Section 5 will be utilized to ensure that no sedimentation occurs outside the perimeter of the work area.

2.6 Storm Drain Inlet Protection

Storm drain inlets will be protected from sediment.

2.7 Retain Sediment On-Site

The Contractor will be responsible to monitor all erosion control measures. Whenever necessary the Contractor will clear all sediment from the compost filter tubes that have been silted up during construction. Daily monitoring should be conducted using the attached Monitoring Form.

The following good housekeeping practices will be followed on-site during the construction project.

2.8 Material Handling and Waste Management

All materials stored on-site will be stored in a neat, orderly manner in appropriate containers. All materials will be kept in their original containers with the original manufacturer's label. Substances will not be mixed with one another unless recommended by the manufacturer.

All waste materials will be collected and stored in a securely lidded metal container from a licensed management company. The waste and any construction debris from the site will be hauled off-site daily and disposed of properly. The contractor will be responsible for all waste removal. Manufacturer's recommendations for proper use and disposal will be followed for all materials. Sanitary waste will be collected from the portable units a minimum of once a week, by a licensed sanitary waste management contractor.

2.9 Designated Washout Areas

The Contractor shall perform washout into contained areas designated for that purpose to prevent cement-laden water from leaving the site.

2.10 Proper Equipment/Vehicle Fueling and Maintenance Practices

On-site vehicles will be monitored for leaks and receive regular preventative maintenance to reduce the risk of leakage. To ensure that leaks on stored equipment do not contaminate the site, oil-absorbing mats will be placed under all equipment during storage. Regular fueling and service of the equipment may be performed using approved methods and with care taken to minimize chance of spills. Any petroleum products will be stored in tightly sealed containers that are clearly labeled.

2.11 Equipment/Vehicle Washing

The Contractor will be responsible to ensure that no equipment is washed on-site.

SECTION 3: Spill Prevention and Control Plan

The Contractor will be responsible for preventing spills in accordance with the project specifications and applicable federal, state and local regulations. The Contractor will identify a properly trained site employee, involved with the day-to-day site operations to be the spill prevention and cleanup coordinator. The name(s) of the responsible spill personnel will be posted on-site. Each employee will be instructed that all spills are to be reported to the spill prevention and cleanup coordinator.

3.1 Spill Control Equipment

Spill control/containment equipment will be kept in the Work Area. Materials and equipment necessary for spill cleanup will be kept either in the Work Area or in an otherwise accessible on-site location. Equipment and materials will include, but not be limited to, absorbent booms/mats, brooms, dust pans, mops, rags, gloves, goggles, sand, plastic and metal containers specifically for this purpose. It is the responsibility of the Contractor to ensure the inventory will be readily accessible and maintained.

3.2 Notification

All workers will be directed to inform the on-site supervisor of a spill event. The supervisor will assess the incident and initiate proper containment and response procedures immediately upon notification. Workers should avoid direct contact with spilled materials during the containment procedures. Primary notification of a spill should be made to the local Fire Department and Police Departments. Secondary Notification will be to the certified cleanup contractor if deemed necessary by Fire and/or Police personnel. The third level of notification is to the DEP. The specific cleanup contractor to be used will be identified by the Contractor prior to commencement of construction activities.

3.3 Spill Containment and Clean-Up Measures

Spills will be contained with granular sorbent material, sand, sorbent pads, booms or all of the above to prevent spreading. Certified cleanup contractors should complete spill cleanup. The material manufacturer's recommended methods for spill cleanup will be clearly posted and on-site personnel will be made aware of the procedures and the location of the information and cleanup

supplies.

3.4 Hazardous Materials Spill Report

The Contractor will report and record any spill. The spill report will present a description of the release, including the quantity and type of material, date of the spill, circumstances leading to the release, location of spill, response actions and personnel, documentation of notifications and corrective measures implemented to prevent reoccurrence.

This document does not relieve the Contractor of the Federal reporting requirements of 40 CFR Part 110, 40 CFR Part 117, 40 CFR Part 302 and the State requirements specified under the Massachusetts Contingency Plan (M.C.P) relating to spills or other releases of oils or hazardous substances. Where a release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117 or 40 CFR Part 302, occurs during a twenty-four (24) hour period, the Contractor is required to comply with the response requirements of the above mentioned regulations. Spills of oil or hazardous material in excess of the reportable quantity will be reported to the National Response Center (NRC).

SECTION 4: Contact Information/Responsible Parties

Owner/Operator (For Right-Of-Way Infrastructure):
Jay J. Fink, P.E.
Department of Public Works
Commissioner
20 East Worcester Street
Worcester, MA 01604
508-929-1300

Engineer (For Parcel Infrastructure):
Jesse Johnson, P.E.
Weston & Sampson, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
978-532-1900

Site Inspector:
TBD

Contractor:
TBD

SECTION 5: Erosion and Sedimentation Control

Erosion and Sedimentation Controls are shown on the project plans. A Stormwater Pollution Prevention Plan (SWPPP) will be required for this project in accordance with EPA regulations. The contractor shall refer to the SWPPP for additional requirements.

SECTION 6: Site Development Plans

A full set of site development plans are included with this submittal.

SECTION 7: Operation and Maintenance of Erosion Control

If there is a failure to the controls the Contractor, under the supervision of the Engineer, will be required to stop work until the failure is repaired.

Periodically throughout the work, whenever the Engineer deems it necessary, the sediment that has been deposited against the controls will be removed to ensure that the controls are working properly.

SECTION 8: Inspection Schedule

During construction the erosion and sedimentation controls will be inspected daily. Once the Contractor is selected, an on site inspector will be selected to work closely with the Engineer to insure that all erosion and sedimentation controls are in place and working properly. An Inspection Form is included.

Inspection Form

Inspected By:_____ Date: _____Time:_____

YES	NO	DOES NOT APPLY	ITEM
			Do any erosion/siltation control measures require repair or clean out to maintain adequate function?
			Is there any evidence that sediment is leaving the site and entering the wetlands?
			Are any temporary soil stockpiles or construction materials located in non-approved areas?
			Are on-site construction traffic routes, parking, and storage of equipment and supplies located in areas not specifically designed for them?
			Is there any evidence that sediment is entering subsurface stormwater chamber systems?

Specific location, current weather conditions, and action to be taken:

_____

_____

_____

_____

_____

_____

Other Comments:

_____

_____

_____

Pending the actions noted above I certify that the site is in compliance with the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan.

Signature:_____Date: _____

Attachment I – Operations and Maintenance Plan

1.0 Introduction

The following document has been written to comply with the stormwater guidelines set forth by the Massachusetts Department of Environmental Protection (MassDEP) to the maximum extent practicable. The intent of these guidelines is to encourage Low Impact Development techniques to improve the quality of the stormwater runoff. These techniques, also known as Best Management Practices (BMPs), collect and treat the runoff before discharging to adjacent environmental resources.

2.0 Purpose

This Operation and Maintenance Plan (O&M Plan) is intended to provide a mechanism for the consistent inspection and maintenance of each BMP installed on the project site. Included in this O&M Plan is a description of each BMP type and an inspection form for each BMP. The City of Worcester is the owner and operator of the system and is responsible for its upkeep and maintenance. This work will be funded on an annual basis through the owner's operating budget.

In the event the Owner sells the property, it is the Owner's responsibility to transfer this plan as well as the design plans, shop drawings, as-built plans, and past three years of operation and maintenance records to the new property owner.

3.0 BMP Description and Locations

3.1 Street Sweeping

Street sweeping consists of using a sweeper machine to clean impervious areas of accumulated sediment, debris, and trash at paved areas.

3.2 Yard Drains and Deep Sump Catch Basins

Deep sump catch basins utilizing catch basin hoods will be located throughout the site and used as pre-treatment before entering other City stormwater infrastructure. The deep sump catch basins are designed to remove trash, debris, hydrocarbons, and coarse sediment from the stormwater runoff.

3.3 Rain Garden

The rain garden mitigates peak runoff rates and filters the stormwater to provide treatment, significantly reducing TSS as well as phosphorus, nitrogen and heavy metals.

3.4 Hydrodynamic separator

The hydrodynamic separator is designed to remove sediments, hydrocarbons and trash from stormwater flows for pretreatment/treatment purposes.

3.5 Drain Manholes

Drain Manholes will be located throughout the site and used to convey and redirect stormwater collected from deep sump catch basins. They allow for access, connection points, and change-in-direction points in the underground drainage system.

3.6 Grassed Areas

There are several grassed areas throughout the site. These grassed areas are intended to slow runoff velocities.

3.7 Infiltration Trench

The infiltration trench mitigates peak runoff rates and filters the stormwater to provide treatment, significantly reducing TSS as well as phosphorus, nitrogen and heavy metals.

4.0 Inspection, Maintenance Checklist and Schedule

4.1 Street Sweeping

Street sweeping shall be performed on all impervious surfaces on a quarterly average, with sweeping performed primarily in the spring and fall. Street sweeping shall be performed using a high efficiency vacuum street sweeping machine or a regenerative air sweeper. A mechanical rotary broom sweeper may be used if sweeping is performed on a monthly basis.

In the event of contamination by a spill or other means, all street sweeping cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000 and handled as hazardous waste.

In the absence of evidence of contamination, street sweeping cleanings may be taken to a landfill or other facility permitted by MassDEP to accept Solid Waste without any prior approval by MassDEP. Please note that current MassDEP regulations prevent landfills from accepting materials that contain free-draining liquids.

4.2 Yard Drains and Deep Sump Catch Basins

Inspect and/or clean catch basin at least four times per year and at the end of foliage and snow removal seasons. Sediments must be removed 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. The structures should be cleaned a minimum of four times per year regardless of the amount of sediment in the basin. If catch basins are found to be filled to capacity with sediment during a cleaning, the frequency of cleaning shall be increased. Catch basins shall be cleaned with clamshell buckets or by hand tools where necessary. Catch basin hoods shall be inspected annually. Open and close the access hatch and flush or rod the anti-siphon device to ensure proper operation.

In the event of contamination by a spill or other means, all cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000 and handled as hazardous waste.

In the absence of evidence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept Solid Waste without any prior approval by MassDEP. Please note that current MassDEP regulations prevent landfills from accepting materials that contain free-draining liquids.

4.3 Rain Garden

Premature failure of rain gardens is a significant problem caused by lack of regular maintenance. Careful attention must be paid while plantings are being established and seasonal landscaping maintenance is required thereafter. Maintenance shall be conducted in accordance with the following schedule:

Activity	Time of Year	Frequency
Inspect & remove trash	Year round	Monthly
Remove dead vegetation	Fall or Spring	Annually
Replace dead vegetation	Spring	Annually
Prune	Spring or Fall	Annually
Replace entire media & all vegetation	Late Spring/early Summer	As needed*

*Paying careful attention to pretreatment and operation & maintenance can extend the life of the soil media

Basin inspection should include checking for rilling and other signs of erosion. When encountered, repairs shall be made immediately. Debris and litter should be removed while inspecting for erosion.

Care must be taken to maintain the plants in the basin. Salt use must be restricted where runoff flows to the raingardens to maintain the plantings.

4.4 Hydrodynamic Separator

The hydrodynamic separator units shall be inspected four times a year at a minimum. The maintenance cycle shall be determined by the depth of sediment buildup witnessed in previous inspections. The hydrodynamic separator units should be inspected and cleaned a minimum of four times per year regardless of the amount of sediment in the basins. See the Maintenance Guide following this O&M plan for additional information regarding maintenance intervals and procedures.

The interior of the CDS unit shall be visually inspected upon opening. Use a sediment probe and oil dipstick to check respected levels of sediment and hydrocarbons. When cleaning is necessary, use a vacuum truck to clean and remove pollutants. All pollutants shall be disposed of according to local, state and federal regulations.

4.5 Drain Manholes and Outlet Control Structure

Inspect and/or clean drain manholes and the outlet control structure at least four times per year while inspecting the catch basins. Remove all accumulated sediments and debris and dispose of in accordance with local, state, and federal regulations. Drain Manholes and the outlet control structure shall be cleaned with clamshell buckets or by hand tools where necessary.

In the event of contamination by a spill or other means, all cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000 and handled as hazardous waste.

In the absence of evidence of contamination, manhole cleanings may be taken to a landfill or other facility permitted by MassDEP to accept Solid Waste without any prior approval by MassDEP. Please note that current MassDEP regulations prevent landfills from accepting materials that contain free-draining liquids.

4.6 Grassed Areas

All sediment and debris should be removed and disposed of according to local, state, and federal regulations. During the growing season, vegetation should not exceed six inches in height, and should be mowed as necessary. Any grassed areas in close proximity to any areas that use salt in deicing applications should be re-seeded in the spring. Bare spots should be re-seeded as needed. Fertilizers containing phosphorous shall not be used on site.

4.7 Infiltration Trench

Remove accumulated sediment, trash, debris, leaves and grass clippings from mowing. Remove tree seedlings, before they become firmly established. Inspect the infiltration trench after the first several rainfall events, after all major storms, and on regularly scheduled dates every six months. If the top of the trench is grassed, it must be mowed on a seasonal basis. Grass height must be maintained to be no more than four inches.

Routinely remove grass clippings leaves and accumulated sediment from the surface of the trench. Inspect the trench 24 hours or several days after a rain event, to look for ponded water. If there is ponded water at the surface of the trench, it is likely that the trench surface is clogged. To address surface clogging, remove and replace the topsoil or first layer of stone aggregate and the filter fabric. If water is ponded inside the trench, it may indicate that the bottom of the trench has failed. To rehabilitate a failed trench, all accumulated sediment must be stripped from the bottom, the bottom of the trench must be scarified and tilled to induce infiltration, and all of the stone aggregate and filter fabric or media must be removed and replaced.

4.8 Inspections and Record Keeping

- An inspection form should be filled out each and every time maintenance work is performed.

- A binder should be kept at the facility that contains all of the completed inspection forms and any other related materials.

- A review of all Operation & Maintenance actions should take place annually to ensure that these Stormwater BMPs are being taken care of in the manner illustrated in this Operation & Maintenance Plan. All operation and maintenance log forms for the last three years, at a minimum, shall be kept on site at the facility.

- The inspection and maintenance schedule may be refined in the future based on the findings and results of this operation and maintenance program or policy.

5.0 Stormwater Management System Owner/Responsible Party

The stormwater management system shall be owned and maintained by the following party or its future designee/assigns:

Jay J. Fink, P.E.
Department of Public Works
Commissioner
20 East Worcester Street
Worcester, MA 01604
508-929-1300

This operation and Maintenance Plan will be recorded with the registry of deeds so that current and future owners are aware of the requirement for proper operation and maintenance of the onsite stormwater system.

6.0 General Good Housekeeping Practices

All non-hazardous waste shall be stored in designated trash or recycling containers onsite for periodic collection by the local trash collector. The owner shall have maintenance staff who monitor the site for the accumulation of trash. Any trash that is seen onsite shall immediately be collected and placed into designated trash or recycling containers. The owner's maintenance staff shall make an inspection of the site once per week at minimum.

7.0 Estimated Operations and Maintenance Budget

The estimated budget for annual operations and maintenance of this stormwater system is $8,000 per year.

Curtis Apartments Redevelopment Phase Two
Permanent BMP Inspection Checklist

Street Sweeping

Frequency:	Quarterly average, primarily in the spring and fall if using a high efficiency vacuum sweeper or regenerative air sweeper. Monthly, if using a mechanical rotary broom sweeper.
Location:	Parking Areas and Driveway.
Inspected By:	_____ Date: _____
Observations:	_____ _____ _____
Actions Taken:	_____ _____ _____
Instructions:	Sweep all impervious areas, including parking lots and driveways using high efficiency vacuum street sweeping machine, regenerative air sweeper, or mechanical rotary broom sweeper. All trash, debris, and sediments should be disposed of in accordance with local, state, and federal regulations.

Yard Drains and Deep Sump Catch Basins

Frequency: Inspect and clean deep sump catch basins and yard drains in March, June, September and December.

Structure Number: _____

Inspected By: _____ Date: _____

Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Clean units four times per year or whenever the depth of the deposits is greater than or equal to one half the depth from the bottom of the invert to the lowest pipe in the structure.

Drain Manholes

Frequency: Inspect and clean drain manholes/outlet control structure in March, June, September and December.

Structure Number: _____

Inspected By: _____ Date: _____

Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Clean units four times per year at a minimum, or whenever catch basins are inspected. Remove sediment and debris. All debris, and sediments should be disposed of in accordance with local, state, and federal regulations. Drain Manholes and outlet control structure shall be cleaned with clamshell buckets or by hand tools where necessary.

Grassed Areas

Frequency: Grassed areas should be inspected every six months during the first year and annually thereafter.

Structure Number: _____

Inspected By: _____ Date: _____

Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Inspect grassed area. Mow grass as needed. Remove accumulated trash and debris. Remove sediment and re-seed bare spots as needed. All trash, debris, and sediments should be disposed of in accordance with local, state and federal regulations.

Hydrodynamic Separator

Frequency: Inspect and clean unit four times a year at a minimum.

Structure Number: _____

Inspected By: _____ Date: _____

Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Clean the system whenever the depth of the deposits is equal to 50% of the maximum storage volume. Visually inspect unit via manhole. Use vacuum truck to remove sediment, trash, and hydrocarbons. The hydrodynamic separator units should be inspected and cleaned a minimum of four times per year regardless of the amount of sediment in the basins. See attached maintenance guide for additional information.

CONTECH®
ENGINEERED SOLUTIONS

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	y^3	m^3
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

CONTECH®
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800.925.5240
www.ContechES.com

CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

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.

Rain Garden

Frequency: The rain garden should be inspected monthly.

Inspected By: _____ Date: _____

Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Inspect grassed area. Mow grass as needed on basin side slopes and embankment. Remove accumulated trash and debris. Remove sediment and re-plant bare spots as needed in basin bottom. Inspect pipe inlets/outfalls for damage, erosion or blockage, remove blockage as needed, repair erosion with riprap. Inspect embankments, spillways and swales for erosion or blockage. Repair erosion with riprap, remove blockage as needed. Check sediment accumulation in forebays and remove as necessary. All trash, debris, and sediments should be disposed of in accordance with local, state, and federal regulations.

Infiltration Trench

Frequency: The infiltration trench should be inspected every 6 months and after every major storm.

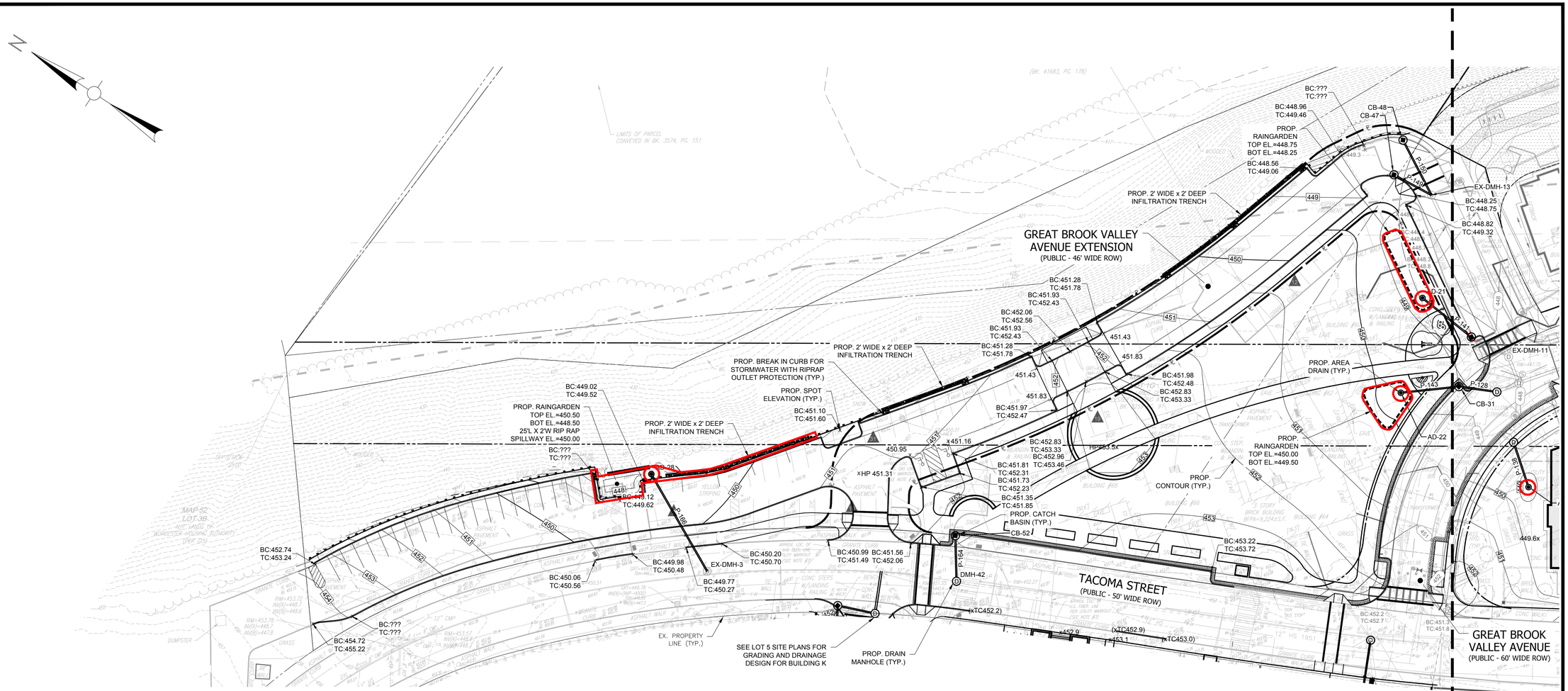
Inspected By: _____ Date: _____

Observations: _____
_____
_____

Actions Taken: _____
_____
_____

Instructions: Remove accumulated sediment, trash, debris, leaves and grass clippings from mowing. Remove tree seedlings, before they become firmly established. Inspect the infiltration trench after the first several rainfall events, after all major storms, and on regularly scheduled dates every six months. If the top of the trench is grassed, it must be mowed on a seasonal basis. Grass height must be maintained to be no more than four inches.

Routinely remove grass clippings leaves and accumulated sediment from the surface of the trench. Inspect the trench 24 hours or several days after a rain event, to look for ponded water. If there is ponded water at the surface of the trench, it is likely that the trench surface is clogged. To address surface clogging, remove and replace the topsoil or first layer of stone aggregate and the filter fabric. If water is ponded inside the trench, it may indicate that the bottom of the trench has failed. To rehabilitate a failed trench, all accumulated sediment must be stripped from the bottom, the bottom of the trench must be scarified and tilled to induce infiltration, and all of the stone aggregate and filter fabric or media must be removed and replaced.



LEGEND

ITEM TO BE INSPECTED/MAINTAINED

P:\Private\Trinity – WHA – Curtis\04 Design Services\03 Civil\01 CAD\04 Sheet\Phase 2\C106.dwg

Project:

CURTIS APARTMENTS REDEVELOPMENT PHASE TWO

TRINITY FINANCIAL
75 Federal Street, 4th Floor
Boston, MA 02110
617.720.8400

GREAT BROOK VALLEY AVENUE, BROOKVIEW DRIVE, JOHN P. CARLSON WAY & TACOMA STREET WORCESTER MA 01605

Weston & Sampson
Weston & Sampson Engineers, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
978.532.1900 800.SAMPSON
www.westonandsampson.com

Consultant:

CWDG
Copley Wolff Design Group, Inc.
10 Post Office Square
Suite 1315
Boston, MA 02109

Revisions:

No.	Date	Description
1	1/31/24	LOT 2 REVISIONS
2	2/09/24	70% DRAFT CD

Seal:

COMMONWEALTH OF MASSACHUSETTS
JESSE M. JOHNSON
CIVIL
No. 45050
REGISTERED
PROFESSIONAL ENGINEER

Issued For:

NOT FOR CONSTRUCTION

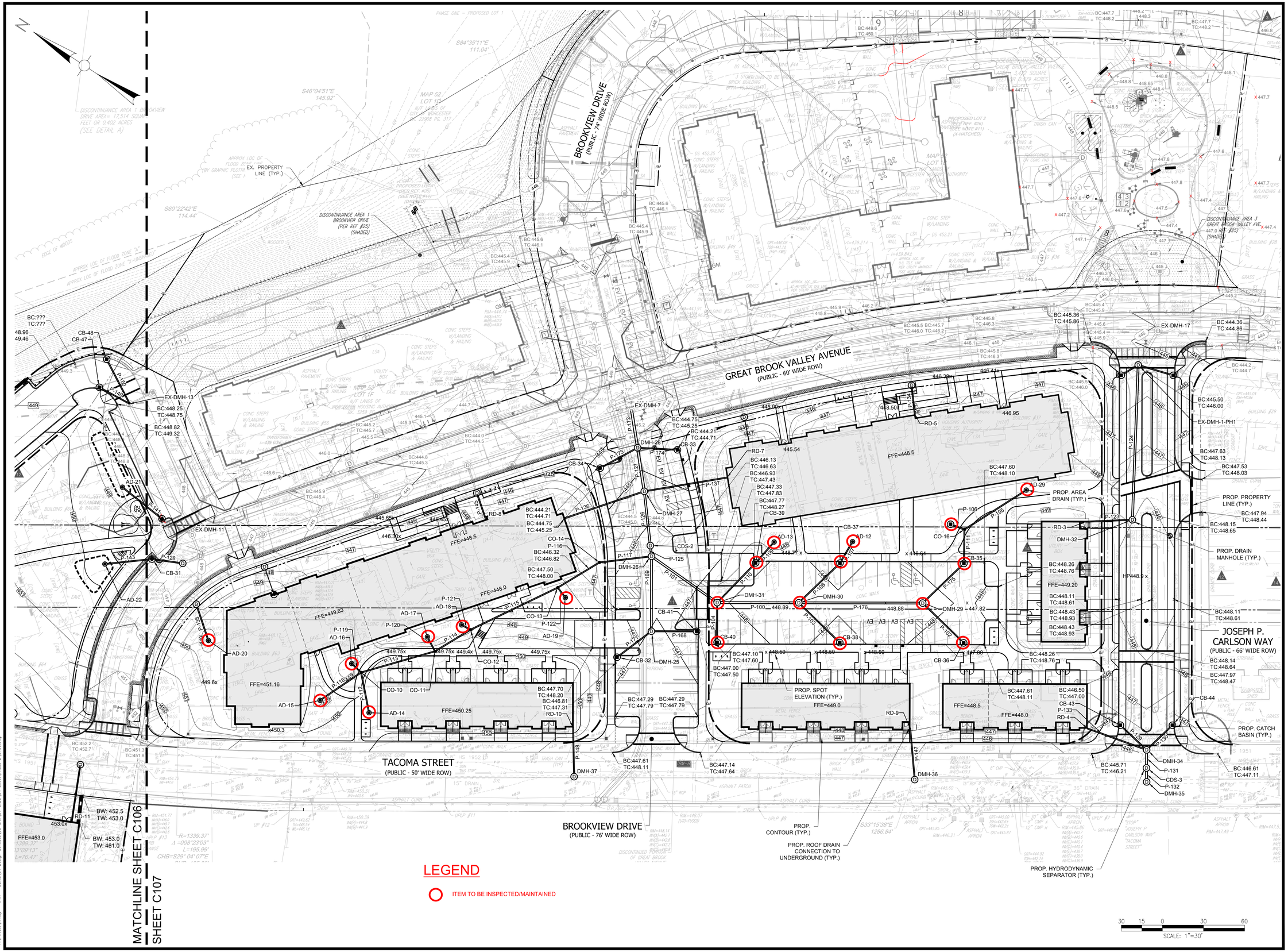
Scale:	AS SHOWN
Date:	JANUARY 24, 2024
Drawn By:	REB
Reviewed By:	MJY
Approved By:	JMJ
W&S Project No:	ENG23-3319
W&S File No:	-

Drawing Title:

O&M KEY PLAN (NORTH)

Sheet Number:

FIG-3



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Project:

CURTIS APARTMENTS REDEVELOPMENT PHASE TWO

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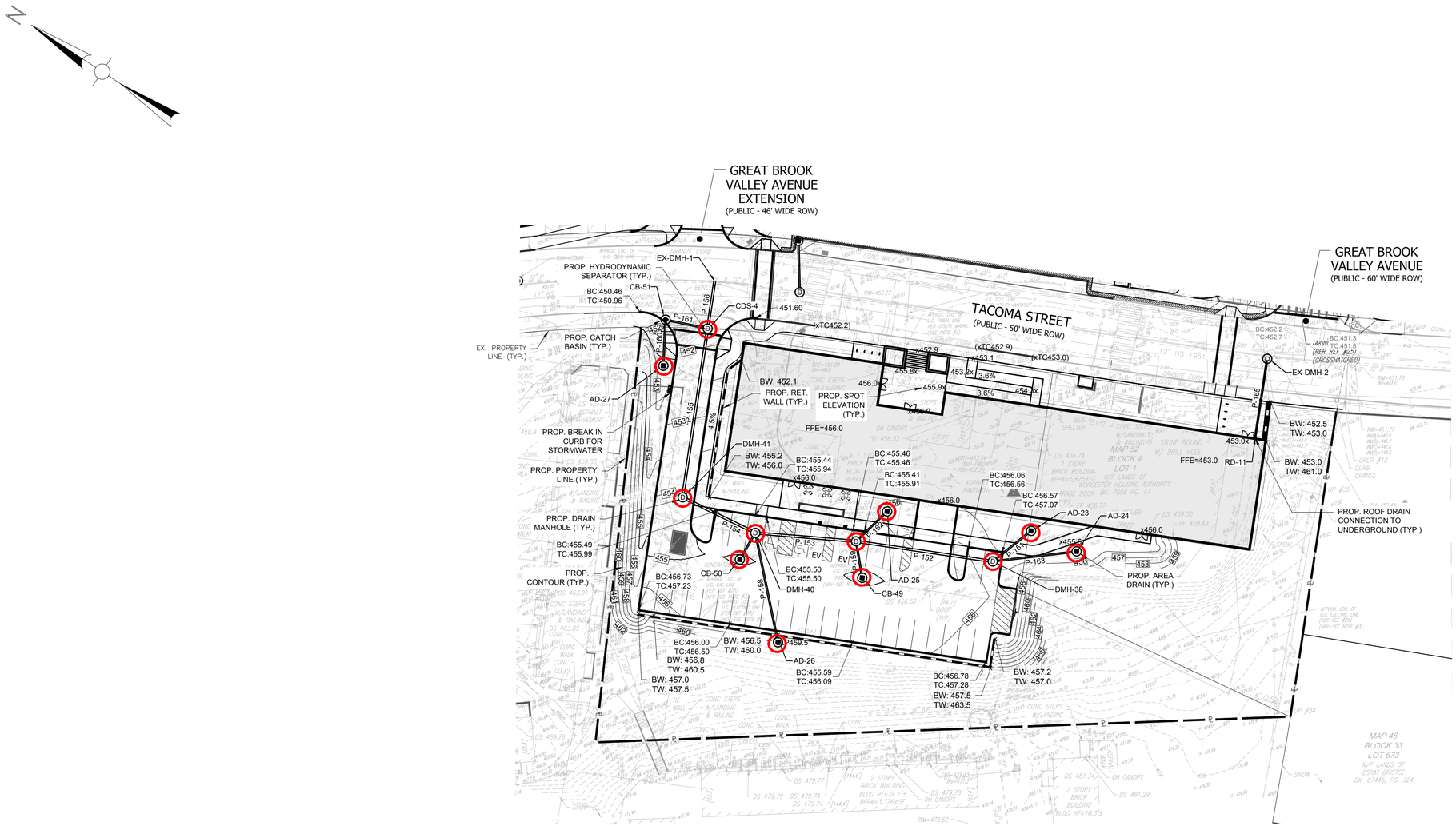
Reviewed By:	MJY
Approved By:	JMJ
W&S Project No:	ENG23-3319
W&S File No:	-

Drawing Title:

O&M KEY PLAN (SOUTH)

Sheet Number:

FIG-4



LEGEND

ITEM TO BE INSPECTED/MAINTAINED

30 15 0 30 60

SCALE: 1"=30'

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Revisions:

No.	Date	Description
1	1/31/24	Lot 5 Revisions
2	2/09/24	70% DRAFT CD

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COMMONWEALTH OF MASSACHUSETTS
JESSE M. JOHNSON
CIVIL
No. 45050
REGISTERED
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Reviewed By:	MJY
Approved By:	JMJ
W&S Project No:	ENG22-0480
W&S File No:	-

Drawing Title:

O&M KEY PLAN (EOC SITE)

Sheet Number:

FIG-5

Attachment J – Illicit Discharge Compliance Statement

Illicit Discharge Compliance Statement

Section I – Purpose/Intent

The purpose of this document is to provide for the health, safety, and general welfare of the citizens of Massachusetts through the regulation of non-stormwater discharges into existing outstanding resource areas near the site to the maximum extent practicable, as required by federal and state law. To the best of our knowledge and belief, there are no illicit discharges occurring under existing conditions on this site within the meaning expressed under Standard 10 of the Massachusetts Stormwater Handbook. This document establishes methods for controlling the introduction of pollutants into existing outstanding resource areas to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) permit process.

Section II - Definitions

For the purposes of this statement, the following shall mean:

Best Management Practices (BMPs): Schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

Clean Water Act: The federal Water Pollution Control Act (33 U.S.C § 1251 et seq.), and any subsequent amendments thereto.

Construction Activity: Activities subject to the Massachusetts Erosion and Sedimentation Control Act or NPDES Construction Permits. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

Hazardous Materials: Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Illegal Connection: An illegal connection is defined as either of the following:

a. Any pipe, open channel, drain or conveyance, whether on the surface or subsurface, which allows an illicit discharge to enter the outstanding resource area including but not limited to any conveyances which allow any non-stormwater discharge including sewage, process wastewater, and wash water, regardless of whether said drain or connection has been previously allowed, permitted, or approved by an authorized enforcement agency; or
b. Any pipe, open channel, drain or conveyance connected to the City of Worcester storm water treatment system which has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

Illicit Discharge: Any direct or indirect non-stormwater discharge to the City of Worcester stormwater treatment system, except as exempted in Section III of this ordinance.

Industrial Activity: Activities subject to NPDES Industrial Permits as defined in 40CFR, Section 122.26 (b) (14).

National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit: A permit issued by MassDEP under authority delegated pursuant to 33 USC § 1342 (b) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

City of Worcester Stormwater Treatment System: Any facility, owned or maintained by the City of Worcester, designed or used for collecting and/or conveying stormwater, including but not limited to roads with drainage systems, City of Worcester streets, curbs, gutters, inlets, catch basins, piped storm drains, pumping facilities, infiltration, retention and detention basins, natural and man-made or altered drainage channels, reservoirs, and other drainage structures.

Non-Stormwater Discharge: Any discharge to the storm drain system that is not composed entirely of stormwater.

Person: Any individual, association, organization, partnership, firm, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, Town, county or other political subdivision of the State, interstate body, or any other legal entity.

Pollutant: Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; petroleum hydrocarbons; automotive fluids; cooking grease; detergents (biodegradable or otherwise); degreasers; cleaning chemicals; non-hazardous liquid and solid wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; liquid and solid wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal

wastes; wastes and residues that result from constructing a building or structure; concrete and cement; and noxious or offensive matter of any kind.

Pollution: Contamination or other alteration of any water's physical, chemical, or biological properties by addition of any constituent including but not limited to a change in temperature, taste, color, turbidity, or odor of such waters, or the discharge of any liquid, gaseous, solid, radioactive, or other substance into any such waters as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, welfare, or environment, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.

Premises: Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

Stormwater: Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation and resulting from such precipitation.

Wastewater: Any water or other liquid discharged from a facility, that has been used, as for washing, flushing, or in a manufacturing process, and so contains waste products.

Section III - Prohibitions

Prohibition of Illicit Discharges:

No person shall throw, drain, or otherwise discharge, cause or allow others under its control to throw, drain, or otherwise discharge into the City of Worcester stormwater treatment system or watercourses any materials, including but not limited to, any pollutants or waters containing any pollutants, other than stormwater. To the best of the knowledge and belief of the site operator, no illicit discharges currently exist at the site. The commencement, conduct or continuance of any illicit discharge to the storm drain system is prohibited except as described as follows:

1. Water line flushing performed by a government agency, other potable water sources, landscape irrigation or lawn watering, diverted stream flows, rising ground water, ground water infiltration to storm drains, uncontaminated pumped ground water, foundation or footing drains (not including active groundwater dewatering systems), crawl space pumps, air conditioning condensation, springs, natural riparian habitat or wetland flows, and any other water source not containing pollutants;

2. Discharges or flows from fire fighting, and other discharges specified in writing by the City of Worcester as being necessary to protect public health and safety;

3. Dye testing is an allowable discharge, but requires notification to the City of Worcester prior to the time of the test;

4. Any non-stormwater discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the Federal Environmental Protection Agency, provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for a discharge to the City of Worcester stormwater treatment system.

Section IV - Industrial or Construction Activity Discharges

Any person subject to an industrial or construction activity NPDES stormwater discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the City of Worcester prior to allowing discharges to the City of Worcester stormwater treatment system.

Section V - Notification of Spills and Accidental Discharges

Notwithstanding other requirements of law, as soon as any person responsible for a facility, activity or operation, or responsible for emergency response for a facility, activity or operation has information of any known or suspected release of pollutants or non-stormwater discharges from that facility, activity, or operation which are resulting or may result in illicit discharges or pollutants discharging into stormwater, the City of Worcester stormwater treatment system, State Waters, or Waters of the U.S., said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release so as to minimize the effects of the discharge. In the event of such a release of hazardous materials, said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, said person shall notify the City of Worcester in person or by phone no later than the next business day, including the nature, quantity and time of occurrence of the discharge. Notifications in person or by phone shall be confirmed by written notice, via certified mail return receipt requested addressed to the City of Worcester within three (3) business days of the initial notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

IN WITNESS WHEREOF the parties hereto have executed copies of this Agreement on the _____ day of **_____, _____.**

_____