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Engineering - Planning – Surveying
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Stormwater Management Report Addendum

For

Strawberry Farms

95 Taylor Street
Map U40, Parcel 8
Littleton, MA

Date: April 9, 2024

Applicant: Seal Harbor Companies, LLC
P.O. Box 2857
Acton, MA 01720

SM-7306 File: 7306 SW Report Addendum Cover.doc

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Narrative

STORMWATER MANAGEMENT

The proposed project is for the subdivision of the property at 95 Taylor Street to create 3 new building lots. The existing dwelling on the property will be razed to accommodate the proposed subdivision. The proposed project is not subject to the Massachusetts Stormwater Standards (construction of 4 or fewer residential units), but is subject to the Stormwater management design standards under the Town of Littleton's regulations for the Subdivision of Land.

Pre-Development

The project site is 95 Taylor Street. The site currently contains a single-family dwelling with appurtenances. There is a large wooded area to the rear of the existing dwelling. Beaver Brook is located to the rear of the property and projects 200' Riverfront Area onto the site. There are Bordering Vegetated Wetland (BVW) located adjacent to the brook that projects 100' Buffer Zone onto the property. The property was extensively altered in the past by gravel hauling activities, resulting in a unique topography. The site has been divided into 3 subcatchments as shown on the attached drainage map.

Subcatchment E-1 is located on the south side of the project site. The subcatchment contains the existing dwelling at 95 Taylor Street, gravel parking area, lawn area, wooded area, and offsite area. Runoff from this subcatchment drains towards the BVW at the rear of the site. This subcatchment is identified as **Analysis Point 1** on the drainage map.

Subcatchment E-2 is located in the northeastern portion of the site and contains wooded area. Runoff from this subcatchment drains towards abutting properties northeast of the project site. This subcatchment is identified as **Analysis Point 2** on the drainage map.

Subcatchment E-3 is located in the center of the site and contains wooded area. Runoff from this subcatchment is contained onsite in an existing depression.

Post-Development

The proposed work is for the construction of a subdivision roadway and 3 new single family dwellings with appurtenances. The proposed subdivision roadway has been designed as a common driveway to minimize impervious coverage. The proposed Subcatchments are shown on the attached drainage map.

Subcatchment P-1A contains the proposed roadway, lawn area, and offsite area that drains onto the site. Runoff from this subcatchment will be collected via area drains and directed to a proposed infiltration basin. The infiltration basin has been designed to fully infiltrate up to the 100-year design storm.

Subcatchment P-1B is located on the west side of the site and contains lawn and wooded area. Runoff from this subcatchment will flow uncontrolled towards the BVW at the rear of the site. Runoff from this subcatchment combines with the outflow from the proposed infiltration basin to

compare to pre-development Subcatchment E-1. The discharge point for the combined runoff from these two subcatchments is identified as **Analysis Point 1** on the drainage map.

Subcatchment P-2A is located entirely on the proposed Lot 3 and contains lawn area. Runoff from this subcatchment will be directed via swale to a proposed infiltration trench where it will be fully infiltrated up to the 100-year design storm.

Subcatchment P-2B is located in the northeast corner of the site and contains lawn and wooded area. Runoff from this subcatchment will flow uncontrolled towards abutting properties northeast of the development site. This subcatchment compares to pre-development Subcatchment E-2. The discharge point of this subcatchment is identified as **Analysis Point 2** on the drainage map.

Subcatchment P-3 is located in the approximate center of the project site and contains lawn and wooded area. Runoff from this subcatchment will be contained onsite in an existing onsite depression.

Each of the proposed dwellings will be provided with one or two roof drywells to infiltrate roof runoff for up to the 100-year design storms. Lot 3 is provided with a single drywell (Roof Drywell A) to the rear of the proposed dwelling; Roof Drywell A is designed to infiltrate up to 3500 s.f. of roof area. Lots 1 and 2 are proposed with two roof drywells each (Roof Drywell B), which are designed to each infiltrate up to 1750 s.f. of roof area.

Compliance with MA DEP Stormwater Management Standards

Compliance with the Stormwater Management Standards is as follows:

Standard #1 No Untreated Discharges:

No new untreated discharges are proposed. Any additional runoff will be treated and/or infiltrated.

Standard #2 Peak Rate Attenuation:

The Post-Development peak discharge rates must not be increased from pre-development rates for the 2-year, 10-year, 25-year, and 50-year storm events. Also, offsite flood impact from the 100-year storm must not be increased. With a combination of infiltration and detention, the peak runoff rate and volume have been decreased. The peak runoff rates have been summarized in the following tables.

Discharge Summary Tables

Analysis Point 1

	2-year Storm		10-year Storm		25-year Storm		50-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	0.000	0.000	0.052	0.028	0.309	0.167	0.718	0.428	1.361	0.843
Total Volume (cf)	0.000	0.000	1,401	773	3,906	2,362	6,401	3,986	9,709	6,177

Analysis Point 2

	2-year Storm		10-year Storm		25-year Storm		50-year Storm		100-year Storm	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Peak Flow (cfs)	0.000	0.000	0.001	0.000	0.007	0.004	0.019	0.012	0.052	0.032
Total Volume (cf)	0.000	0.000	7.38	4.56	209	129	516	319	994	614

Standard #3 Stormwater Recharge:

This standard prescribes the stormwater volume that must be recharged to groundwater based on the existing site soil conditions. The Natural Resources Conservation Service (N.R.C.S.) Middlesex Soil Survey map and onsite soil evaluations indicate Hydrologic Group A. The Stormwater Management Policy requires 0.6 inches of runoff over the total impervious area to be recharged in areas with Hydrologic Group A soils. Detailed "Recharge Volume Calculations" showing compliance with this standard are attached.

Standard #4 Water Quality:

According to the guidelines provided in the Stormwater Management Standards 80% Total Suspended Solids (TSS) removal is required for the total increase in impervious area associated with the project. This standard requires 1.0 inches of water over the impervious area as the project site is located in Hydrologic Group A. The use of deep sump hooded drop inlets, sediment forebays, infiltration basins, and roof drywells will be utilized to achieve the required treatment levels. Infiltration Basins and roof drywells have been selected due to the TMDL of the Assabet River associated with Phosphorous.

Standard #5 Land Uses with Higher Potential Pollutant Loads:

The site is will not contain "land uses with higher potential pollutant loads."

Standard #6 Critical Areas:

The site is located within a Zone II. The stormwater management system has been designed to provide 44% TSS removal prior to discharge to the proposed infiltration basin.

Standard #7 Redevelopment:

This project is not redevelopment. This standard would require that the Stormwater Management Standards be met to the extent practicable. The project has been designed to meet all of the standards.

Standard #8 Erosion/Sediment Control:

Erosion and sediment controls are incorporated into the project design to prevent erosion, control sediment movement, and stabilize exposed and disturbed soils during construction. Temporary erosion and sedimentation controls during construction include minimizing areas of exposed soil, directing and controlling runoff, and rapidly stabilizing exposed areas. Soils left exposed for extended periods will be mulched and seeded for temporary vegetative cover. Following construction, exposed areas will be permanently vegetated with appropriate ground cover.

Erosion and sedimentation control measures will be maintained throughout all phases of construction. Inspections will be made regularly and after rainfalls exceeding 0.5 inches in a 24-hour period during construction. The contractor will be required to inspect erosion and sedimentation control measures at the end of each workday, when precipitation is forecasted, and after each rainfall. All measures will be inspected prior to each weekend. The contractor will replace and repair any malfunctioning or damaged control measures including vegetative stabilization. Long term erosion and sedimentation control will be realized using the Best Management Practices described previously. Areas where soils have been disturbed will be loamed and vegetated with lawn, trees, and shrubs.

Standard #9 Operation and Maintenance Plan:

An Operation and Maintenance Plan has been prepared and is included in this report as well as shown on the plan set.

Standard #10 Illicit Discharges to Drainage System:

No known illicit discharges exist nor are any proposed.

Design Basis

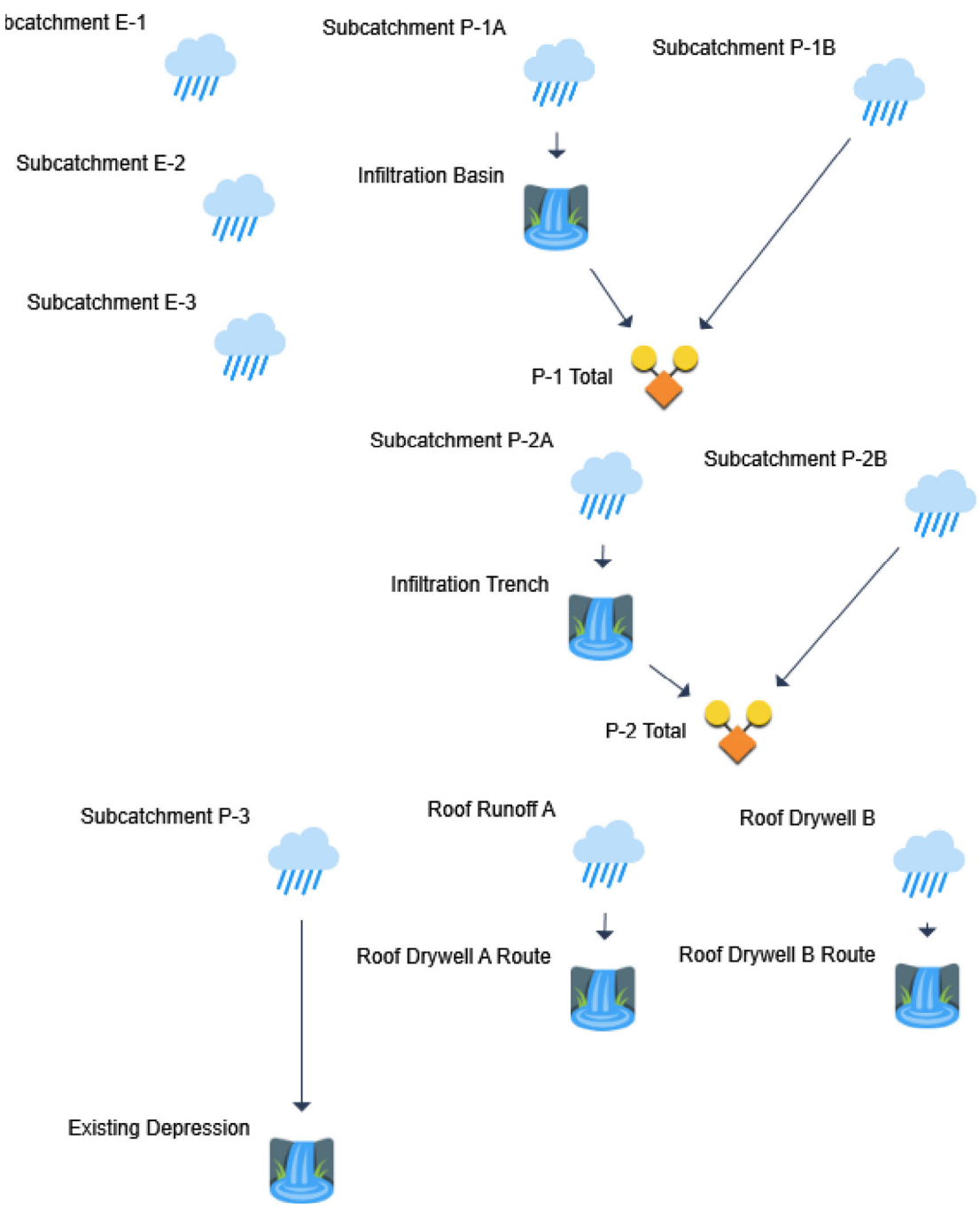
1. The United States Department of Agriculture Natural Resource Conservation Service (N.R.C.S.) TR55 methodology was used to determine offsite rates of runoff.
2. The twenty-four-hour rainfall, taken from the NOAA Atlas, is 7.65 inches for the 100-year storm, 6.78 inches for the 50-year storm, 5.99 inches for the 25-year storm, 4.91 inches for the 10-year storm, and 3.18 inches for the 2-year storm event.
3. The hydrologic calculations were performed using the computer program: "Hydrology Studio" by Hydrology Studio.
4. The soil types of the site were taken from the N.R.C.S. Soil Survey Map for Middlesex County.
5. Soil conditions and estimated seasonal high groundwater table were based on on-site soil evaluations.
6. The Natural Resources Conservation Service (N.R.C.S.) soil survey indicated the presences of Quonset sandy loam. The soil is identified as Hydrologic Group A.

Basin Model

Hydrology Studio v 3.0.0.32

Project Name:

04-09-2024



SUMMARY TABLE **SM-7306**

Project: 95 Taylor Street By PFK Rev Date 4/9/24

Location: Littleton, MA Checked Date

EX	AREA	CN	TIME OF CONCENTRATION
E-1	3.24	37	14.8
E-2	0.81	30	17.9
E-3	1.73	30	20.1
TOTAL	**5.77**		

PROP	AREA	CN	TIME OF CONCENTRATION
P-1A	1.16	56	6.0
P-1B	2.22	36	7.9
P-2A	0.11	39	6.0
P-2B	0.50	30	17.9
P-3	1.60	32	19.2
Roofs	0.19	98	6.0
TOTAL	**5.77**		

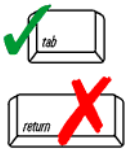
Stormwater Checklist

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.

[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.

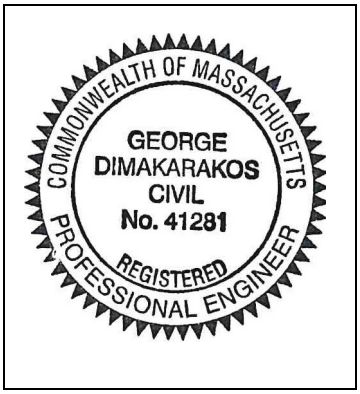
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

Post-Development Hydrology

Hydrograph 2-yr Summary

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	Subcatchment E-1	0.000	0.00	0.000	----		
2	NRCS Runoff	Subcatchment E-2	0.000	0.00	0.000	----		
3	NRCS Runoff	Subcatchment E-3	0.000	0.00	0.000	----		
5	NRCS Runoff	Subcatchment P-1A	0.131	12.27	1,079	----		
6	Pond Route	Infiltration Basin	0.000	12.40	0.000	5	227.09	67.0
7	NRCS Runoff	Subcatchment P-1B	0.000	0.00	0.000	----		
8	Junction	P-1 Total	0.000	12.40	0.000	6, 7		
10	NRCS Runoff	Subcatchment P-2A	0.000	24.00	0.064	----		
11	Pond Route	Infiltration Trench	0.000	0.00	0.000	10	230.50	0.064
12	NRCS Runoff	Subcatchment P-2B	0.000	0.00	0.000	----		
13	Junction	P-2 Total	0.000	0.00	0.000	11, 12		
15	NRCS Runoff	Subcatchment P-3	0.000	0.00	0.000	----		
16	Pond Route	Existing Depression	0.000	0.00	0.000	15	226.50	0.000
18	NRCS Runoff	Roof Runoff A	0.238	12.07	802	----		
19	Pond Route	Roof Drywell A Route	0.000	10.23	0.000	18	2.27	160
21	NRCS Runoff	Roof Drywell B	0.119	12.07	401	----		
22	Pond Route	Roof Drywell B Route	0.000	11.53	0.000	21	1.86	68.2

Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	Subcatchment E-1	0.052	14.80	1,401	----		
2	NRCS Runoff	Subcatchment E-2	0.001	24.00	7.38	----		
3	NRCS Runoff	Subcatchment E-3	0.001	24.00	15.8	----		
5	NRCS Runoff	Subcatchment P-1A	1.059	12.07	3,930	----		
6	Pond Route	Infiltration Basin	0.000	12.50	0.000	5	228.20	1,023
7	NRCS Runoff	Subcatchment P-1B	0.028	14.97	773	----		
8	Junction	P-1 Total	0.028	14.97	773	6, 7		
10	NRCS Runoff	Subcatchment P-2A	0.003	12.47	68.2	----		
11	Pond Route	Infiltration Trench	0.000	12.87	0.000	10	230.50	0.050
12	NRCS Runoff	Subcatchment P-2B	0.000	24.00	4.56	----		
13	Junction	P-2 Total	0.000	24.00	4.56	11, 12		
15	NRCS Runoff	Subcatchment P-3	0.004	21.73	115	----		
16	Pond Route	Existing Depression	0.000	0.00	0.000	15	226.55	115
18	NRCS Runoff	Roof Runoff A	0.370	12.07	1,272	----		
19	Pond Route	Roof Drywell A Route	0.000	11.50	0.000	18	3.19	333
21	NRCS Runoff	Roof Drywell B	0.185	12.07	636	----		
22	Pond Route	Roof Drywell B Route	0.000	11.07	0.000	21	2.64	148

Hydrograph 25-yr Summary

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	Subcatchment E-1	0.309	12.50	3,906	----		
2	NRCS Runoff	Subcatchment E-2	0.007	15.63	209	----		
3	NRCS Runoff	Subcatchment E-3	0.015	15.63	446	----		
5	NRCS Runoff	Subcatchment P-1A	1.894	12.07	6,278	----		
6	Pond Route	Infiltration Basin	0.000	14.47	0.000	5	228.84	1,915
7	NRCS Runoff	Subcatchment P-1B	0.167	12.43	2,362	----		
8	Junction	P-1 Total	0.167	12.43	2,362	6, 7		
10	NRCS Runoff	Subcatchment P-2A	0.018	12.30	166	----		
11	Pond Route	Infiltration Trench	0.000	13.83	0.000	10	230.53	1.05
12	NRCS Runoff	Subcatchment P-2B	0.004	15.63	129	----		
13	Junction	P-2 Total	0.004	15.63	129	11, 12		
15	NRCS Runoff	Subcatchment P-3	0.028	14.97	765	----		
16	Pond Route	Existing Depression	0.000	0.00	0.000	15	226.80	765
18	NRCS Runoff	Roof Runoff A	0.453	12.07	1,566	----		
19	Pond Route	Roof Drywell A Route	0.000	11.37	0.000	18	3.83	446
21	NRCS Runoff	Roof Drywell B	0.226	12.07	783	----		
22	Pond Route	Roof Drywell B Route	0.000	10.53	0.000	21	3.18	199

Hydrograph 50-yr Summary

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	Subcatchment E-1	0.718	12.40	6,401	----		
2	NRCS Runoff	Subcatchment E-2	0.019	14.80	516	----		
3	NRCS Runoff	Subcatchment E-3	0.041	14.80	1,102	----		
5	NRCS Runoff	Subcatchment P-1A	2.571	12.07	8,197	----		
6	Pond Route	Infiltration Basin	0.000	12.43	0.000	5	229.24	2,705
7	NRCS Runoff	Subcatchment P-1B	0.428	12.37	3,986	----		
8	Junction	P-1 Total	0.428	12.37	3,986	6, 7		
10	NRCS Runoff	Subcatchment P-2A	0.038	12.13	259	----		
11	Pond Route	Infiltration Trench	0.000	14.97	0.000	10	231.04	18.2
12	NRCS Runoff	Subcatchment P-2B	0.012	14.80	319	----		
13	Junction	P-2 Total	0.012	14.80	319	11, 12		
15	NRCS Runoff	Subcatchment P-3	0.068	12.73	1,563	----		
16	Pond Route	Existing Depression	0.000	0.00	0.000	15	227.05	1,563
18	NRCS Runoff	Roof Runoff A	0.513	12.07	1,781	----		
19	Pond Route	Roof Drywell A Route	0.000	10.57	0.000	18	4.39	531
21	NRCS Runoff	Roof Drywell B	0.256	12.07	890	----		
22	Pond Route	Roof Drywell B Route	0.000	10.40	0.000	21	3.62	238

Hydrograph 100-yr Summary

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	Subcatchment E-1	1.361	12.33	9,709	----		
2	NRCS Runoff	Subcatchment E-2	0.052	12.63	994	----		
3	NRCS Runoff	Subcatchment E-3	0.110	12.63	2,124	----		
5	NRCS Runoff	Subcatchment P-1A	3.367	12.07	10,467	----		
6	Pond Route	Infiltration Basin	0.000	12.23	0.000	5	229.68	3,720
7	NRCS Runoff	Subcatchment P-1B	0.843	12.23	6,177	----		
8	Junction	P-1 Total	0.843	12.23	6,177	6, 7		
10	NRCS Runoff	Subcatchment P-2A	0.078	12.10	380	----		
11	Pond Route	Infiltration Trench	0.000	14.27	0.000	10	231.87	46.3
12	NRCS Runoff	Subcatchment P-2B	0.032	12.63	614	----		
13	Junction	P-2 Total	0.032	12.63	614	11, 12		
15	NRCS Runoff	Subcatchment P-3	0.221	12.53	2,723	----		
16	Pond Route	Existing Depression	0.000	0.00	0.000	15	227.24	2,723
18	NRCS Runoff	Roof Runoff A	0.579	12.07	2,017	----		
19	Pond Route	Roof Drywell A Route	0.000	10.77	0.000	18	5.25	627
21	NRCS Runoff	Roof Drywell B	0.290	12.07	1,009	----		
22	Pond Route	Roof Drywell B Route	0.000	10.00	0.000	21	4.22	281

Worksheet 2: Runoff curve number and runoff **SM-7306**

Project: 95 Taylor Street By PFK Date 4/9/24

Location: Littleton, MA Checked Date

Circle one: Present [Developed] P-1A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			0.24	23.20
A	Open Space-Good Condition	39			0.62	24.33
A	Woods- Good Condition	30			0.00	0.00
A	Residential Districts - 2 acres	46			0.24	10.89
A	Gravel	76			0.00	0.00
-	Basin Surface	98			0.06	6.07
1/ Use only one CN source per line.					Totals = 1.16	64.50

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{64.50}{1.16} = 55.63$; Use CN = 56

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.18	4.91	7.65
Runoff, Q.....	in	0.26	0.97	2.61

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-7306

Project: 95 Taylor Street By PFK Date 4/9/2024

Location: Littleton, MA Checked _____ Date _____

Circle one: Present | Developed P-1A
Circle one: Tc | Tt through subarea _____

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			Lawn			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.05			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.10			0.10
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	77			
9. Watercourse slope, s		ft/ft	0.1			
10. Average Velocity, V (figure 3-1)		ft/s	5.10			
11. Tt = L / 3600V	Compute Tt	hr	0.00			0.00
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)	hr	0.10
	min	6.0

Hydrograph Report

Project Name:

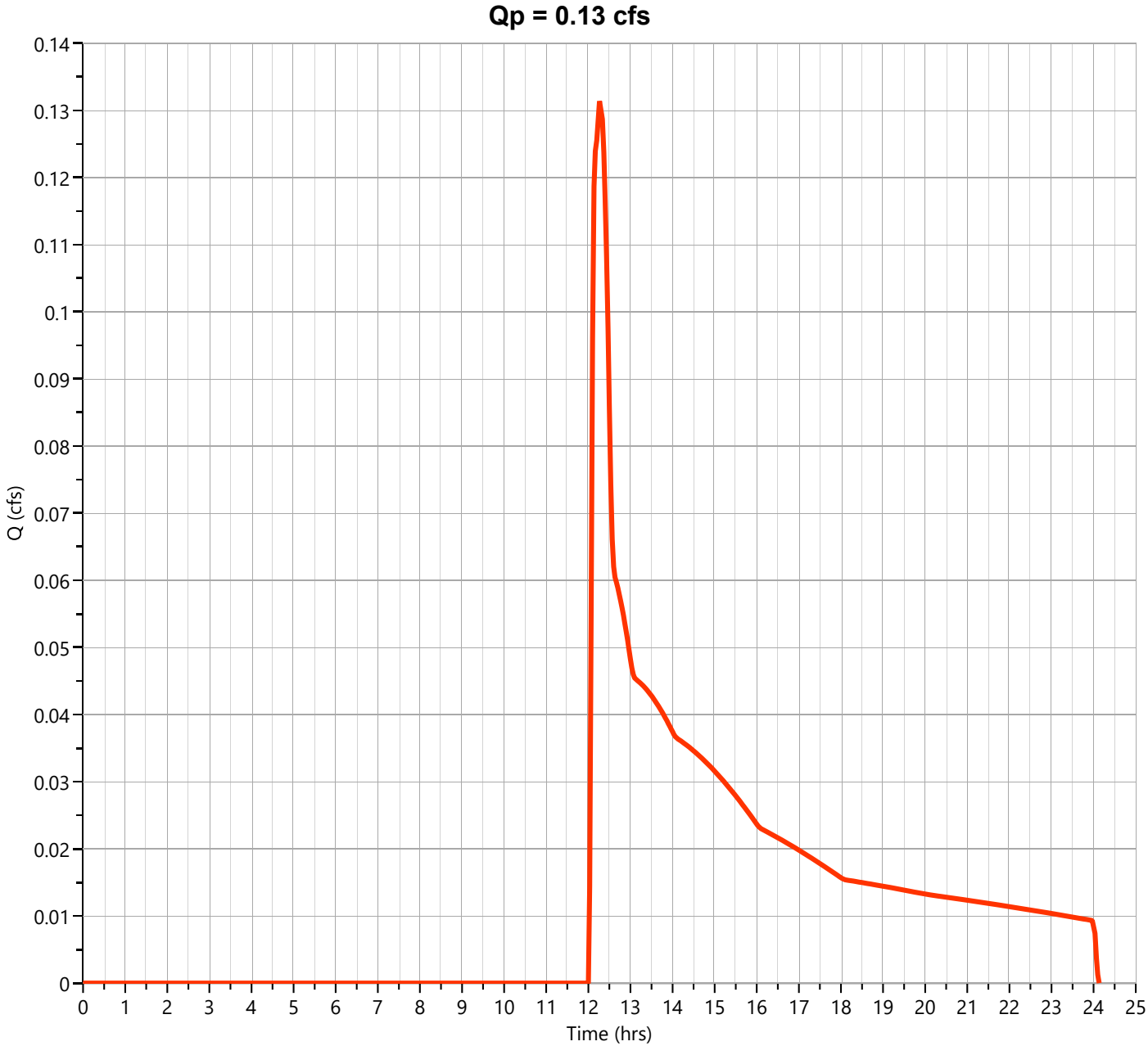
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-1A

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.131 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 1,079 cuft
Drainage Area	= 1.16 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 3.18 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

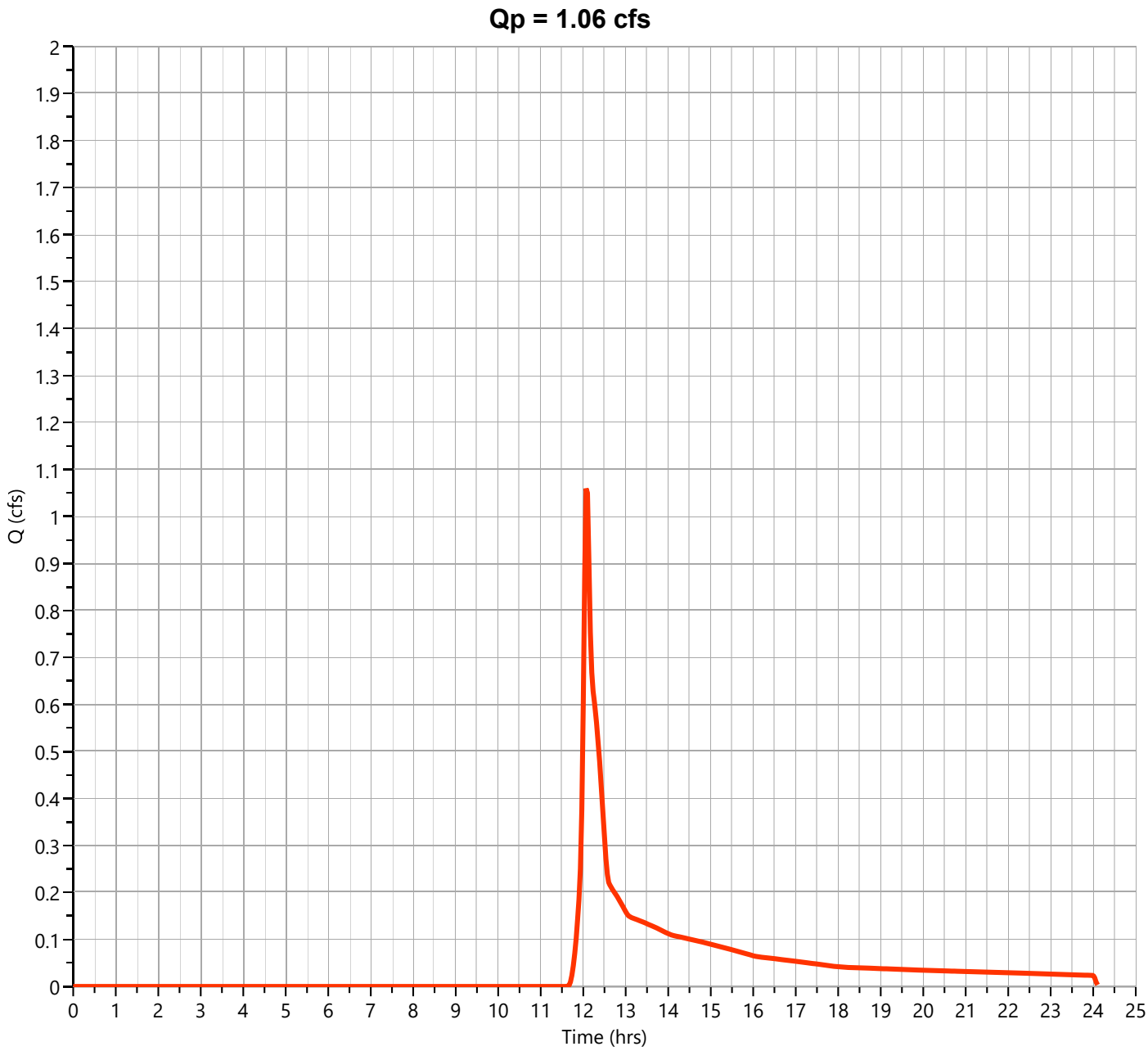
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-1A

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.059 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 3,930 cuft
Drainage Area	= 1.16 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 4.91 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

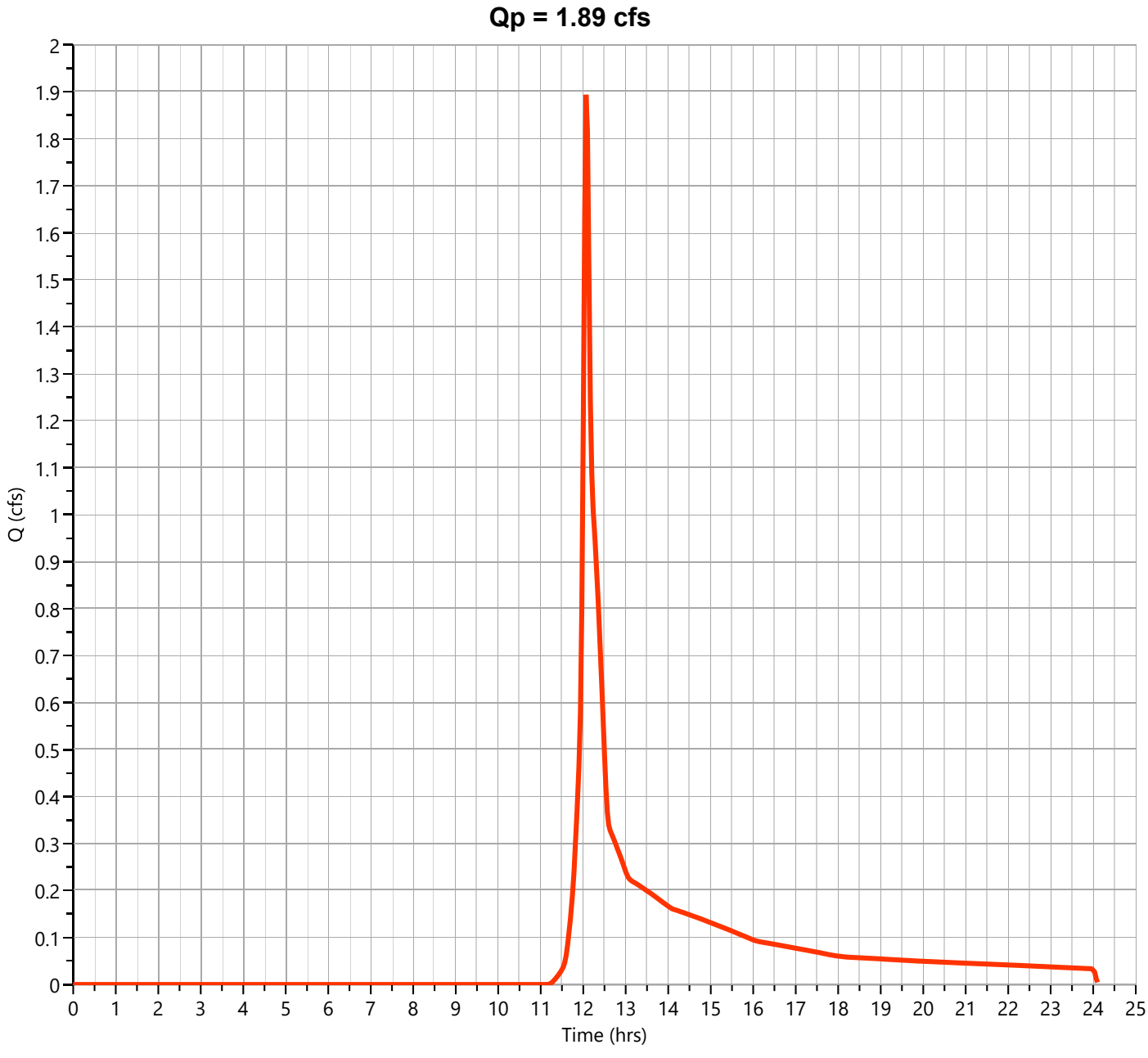
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-1A

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.894 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 6,278 cuft
Drainage Area	= 1.16 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.99 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

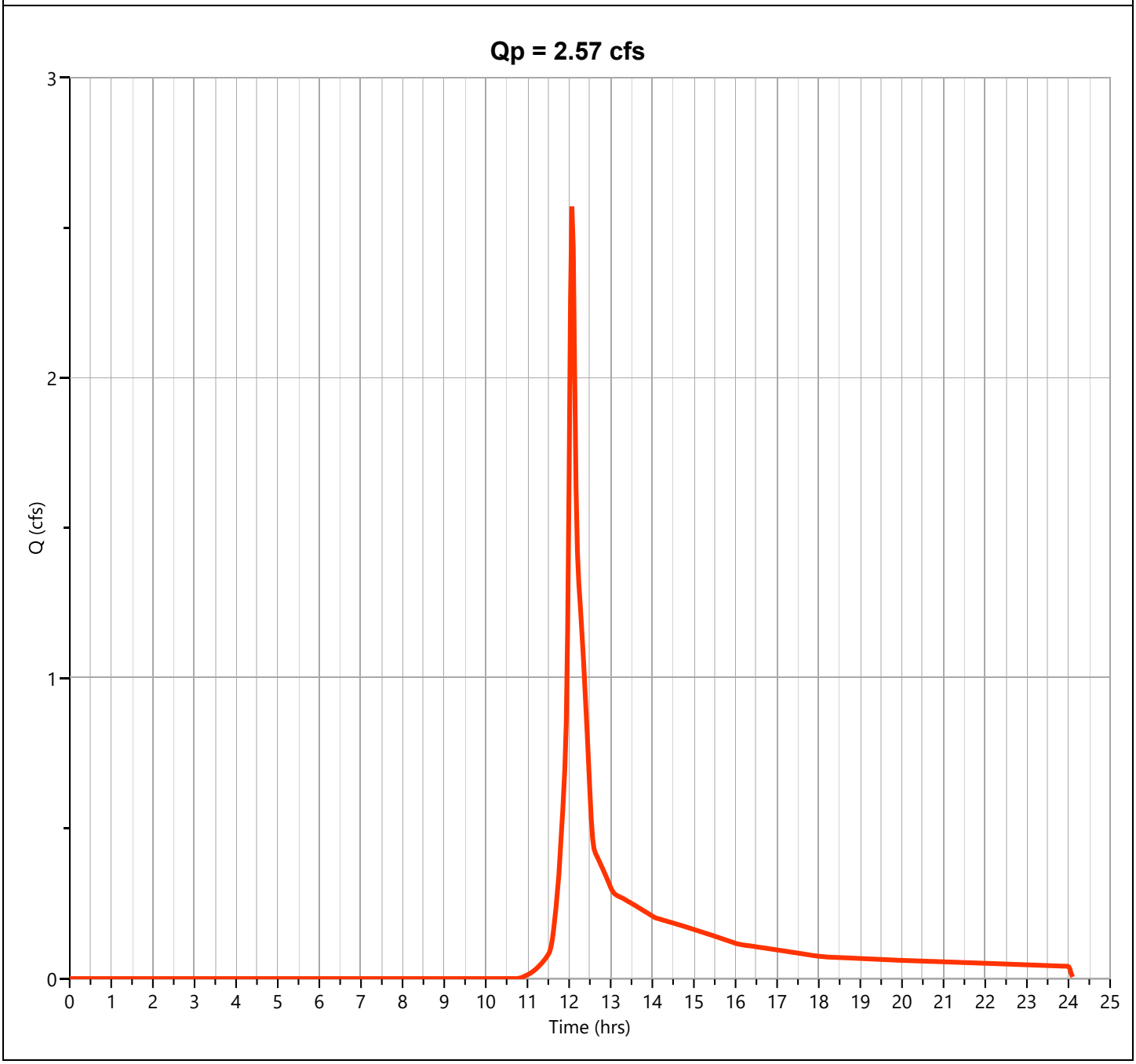
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-1A

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.571 cfs
Storm Frequency	= 50-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 8,197 cuft
Drainage Area	= 1.16 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 6.78 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

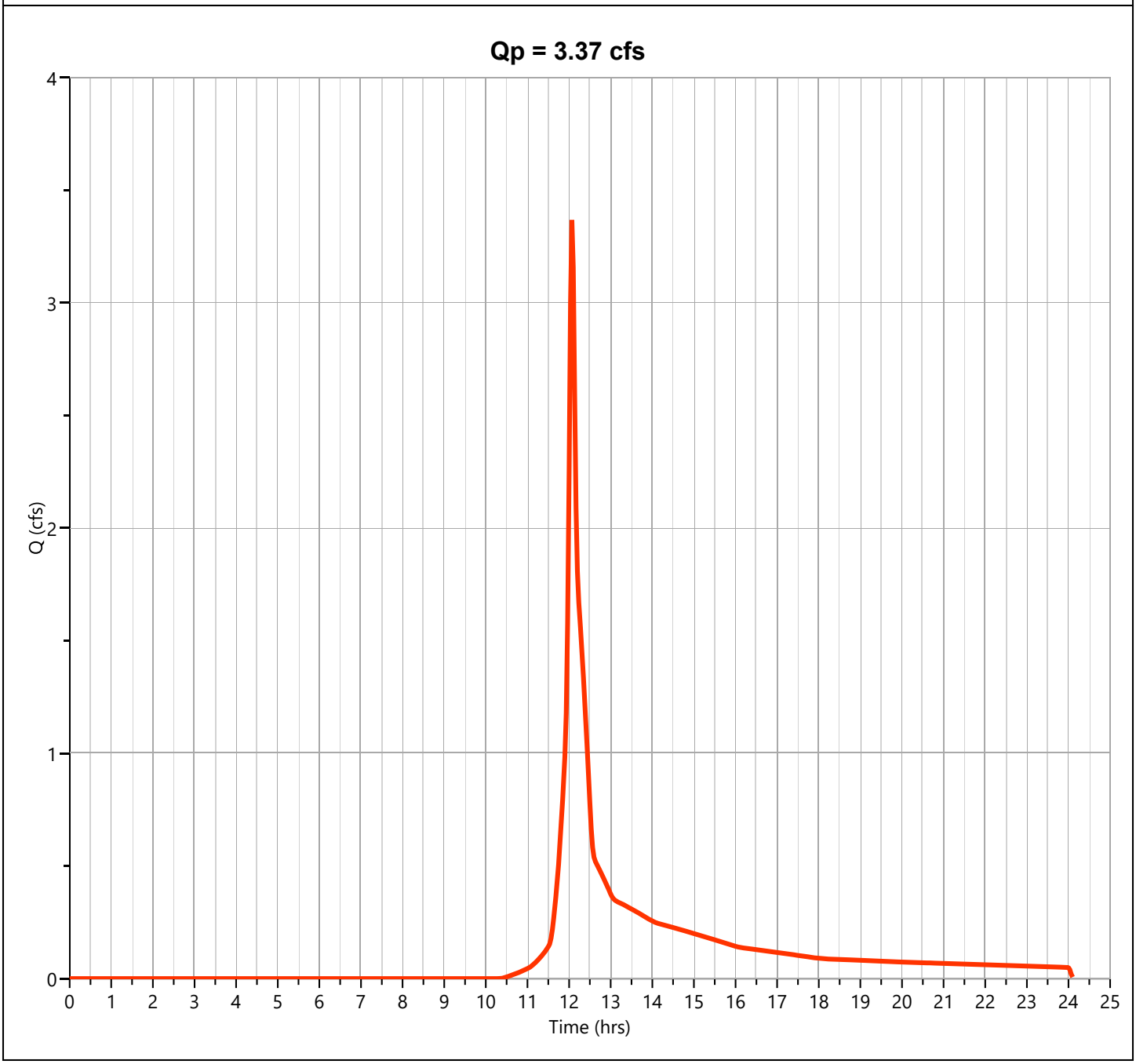
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-1A

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.367 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 10,467 cuft
Drainage Area	= 1.16 ac	Curve Number	= 56
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 7.65 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

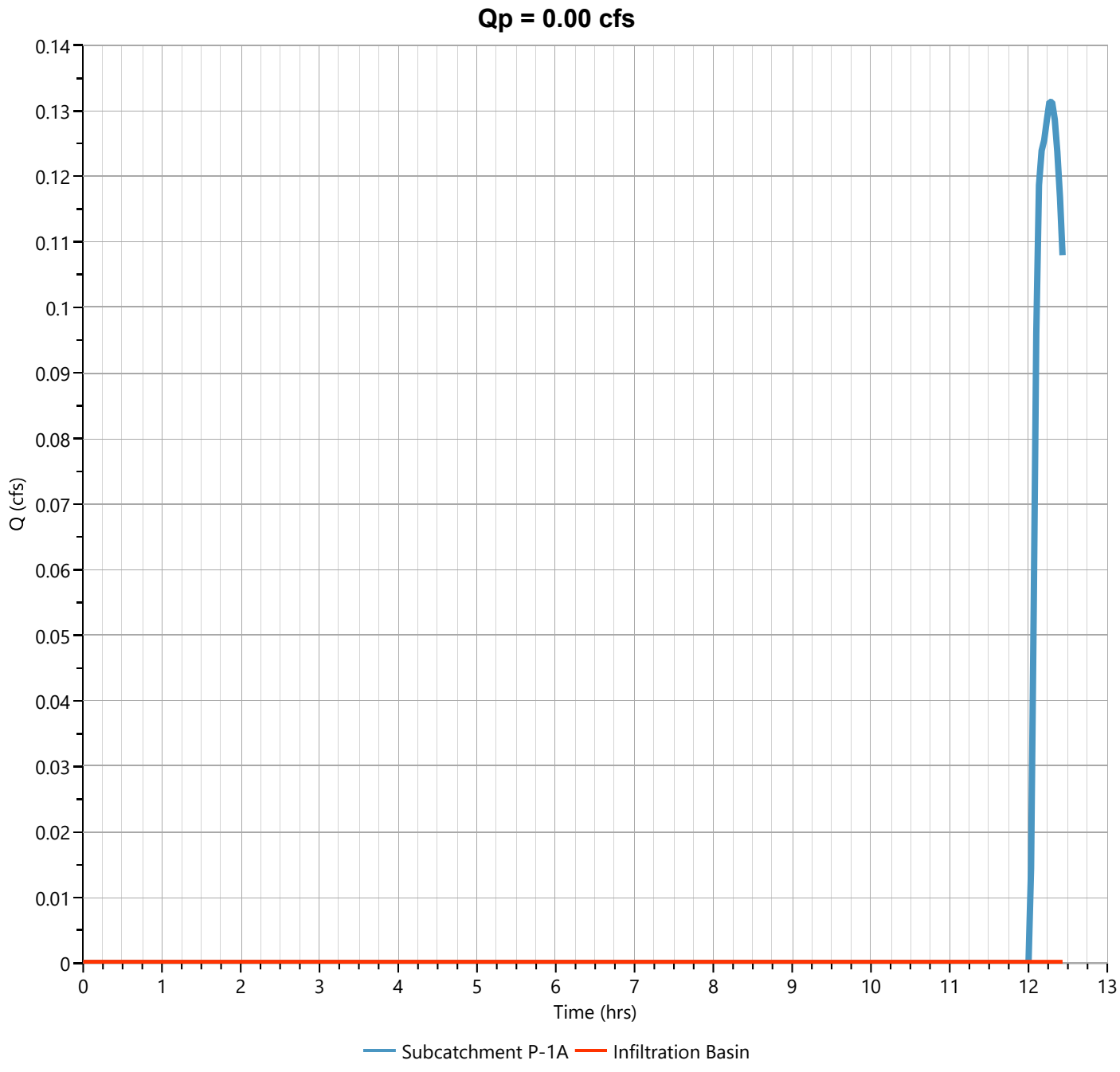
04-09-2024

Infiltration Basin

Hyd. No. 6

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.40 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 5 - Subcatchment P-1A	Max. Elevation	= 227.09 ft
Pond Name	= Infiltration Basin	Max. Storage	= 67.0 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

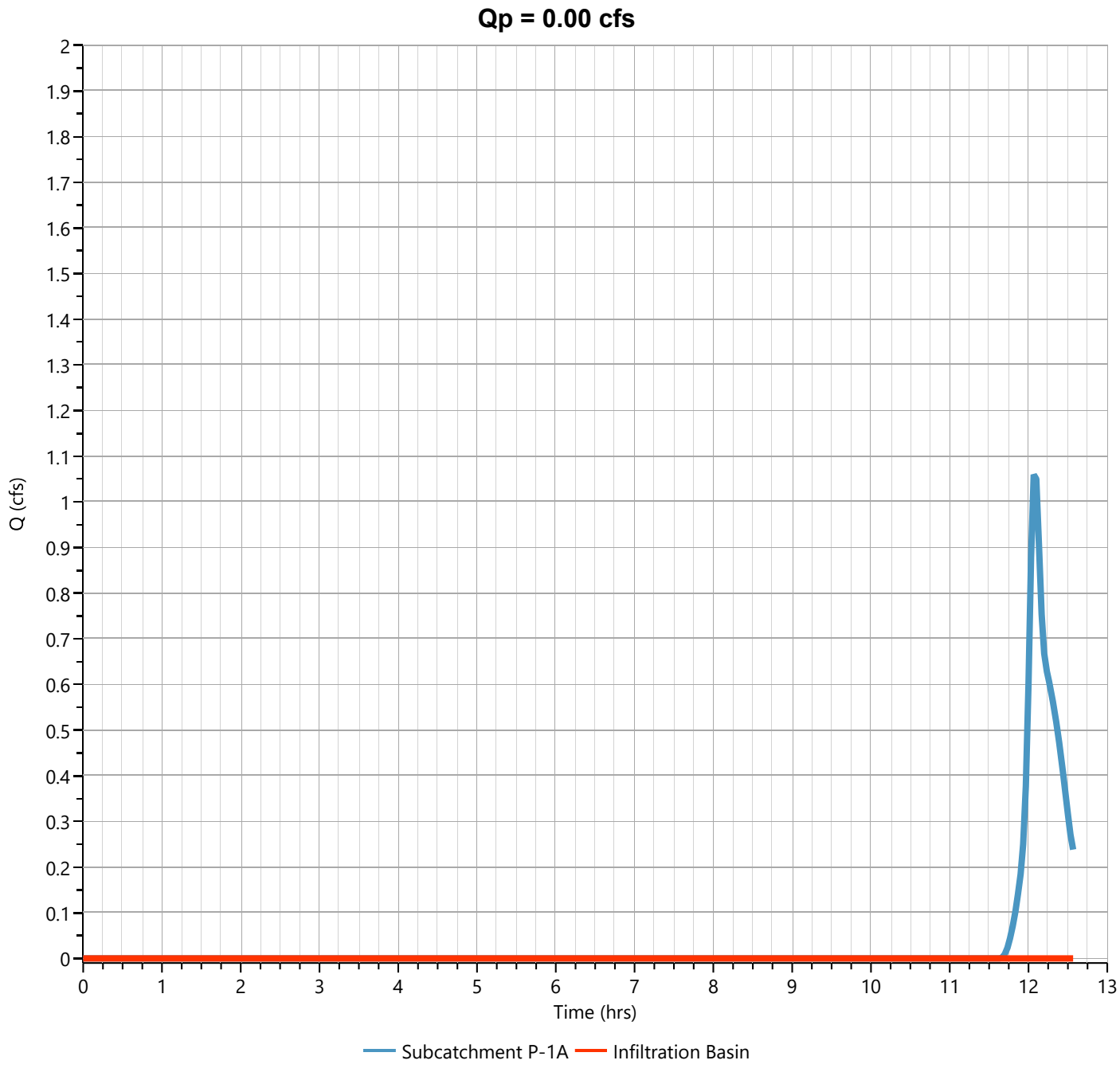
04-09-2024

Infiltration Basin

Hyd. No. 6

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.50 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 5 - Subcatchment P-1A	Max. Elevation	= 228.20 ft
Pond Name	= Infiltration Basin	Max. Storage	= 1,023 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

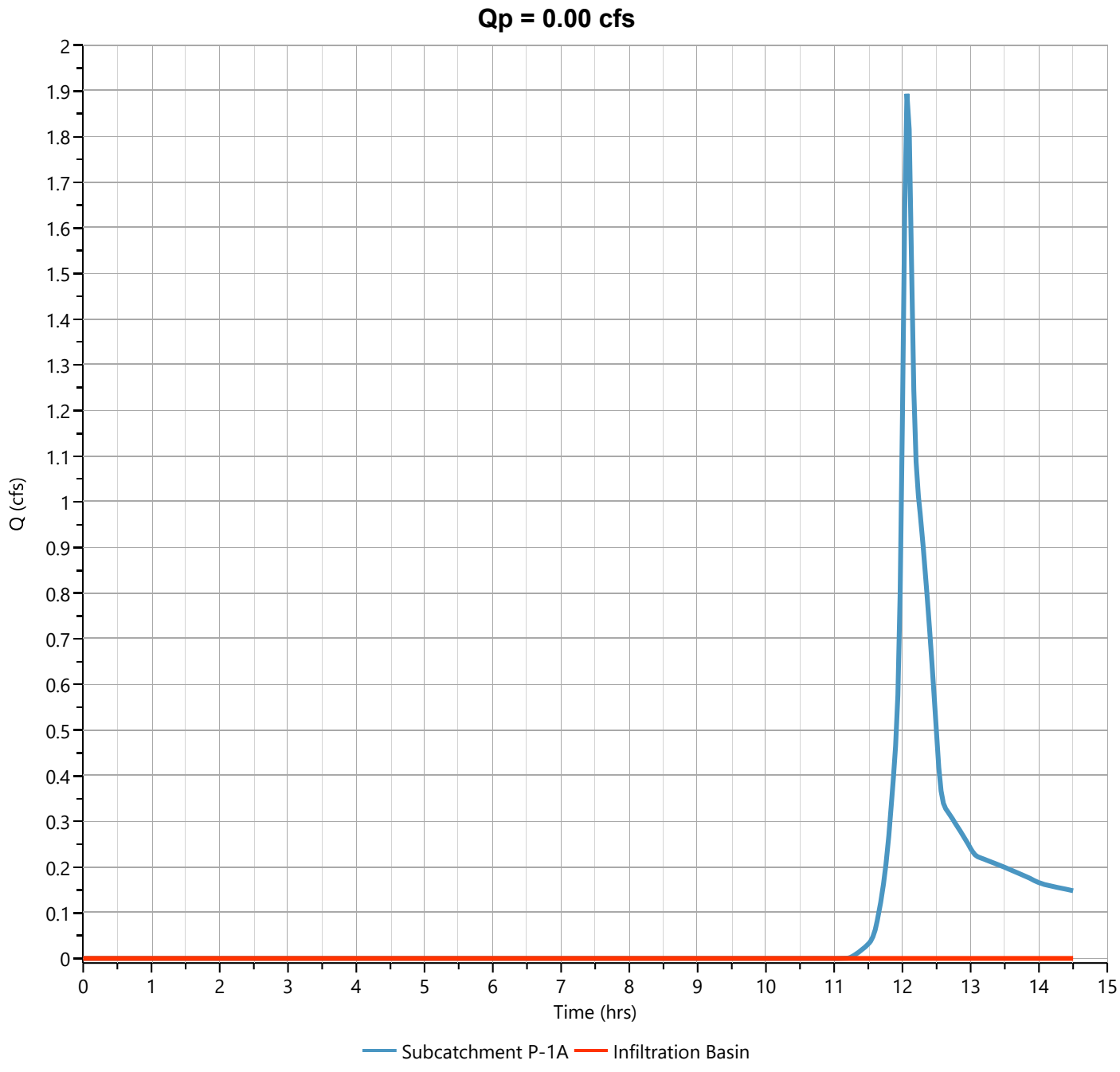
Infiltration Basin

Hyd. No. 6

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 14.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 5 - Subcatchment P-1A	Max. Elevation	= 228.84 ft
Pond Name	= Infiltration Basin	Max. Storage	= 1,915 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 1.40 hrs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

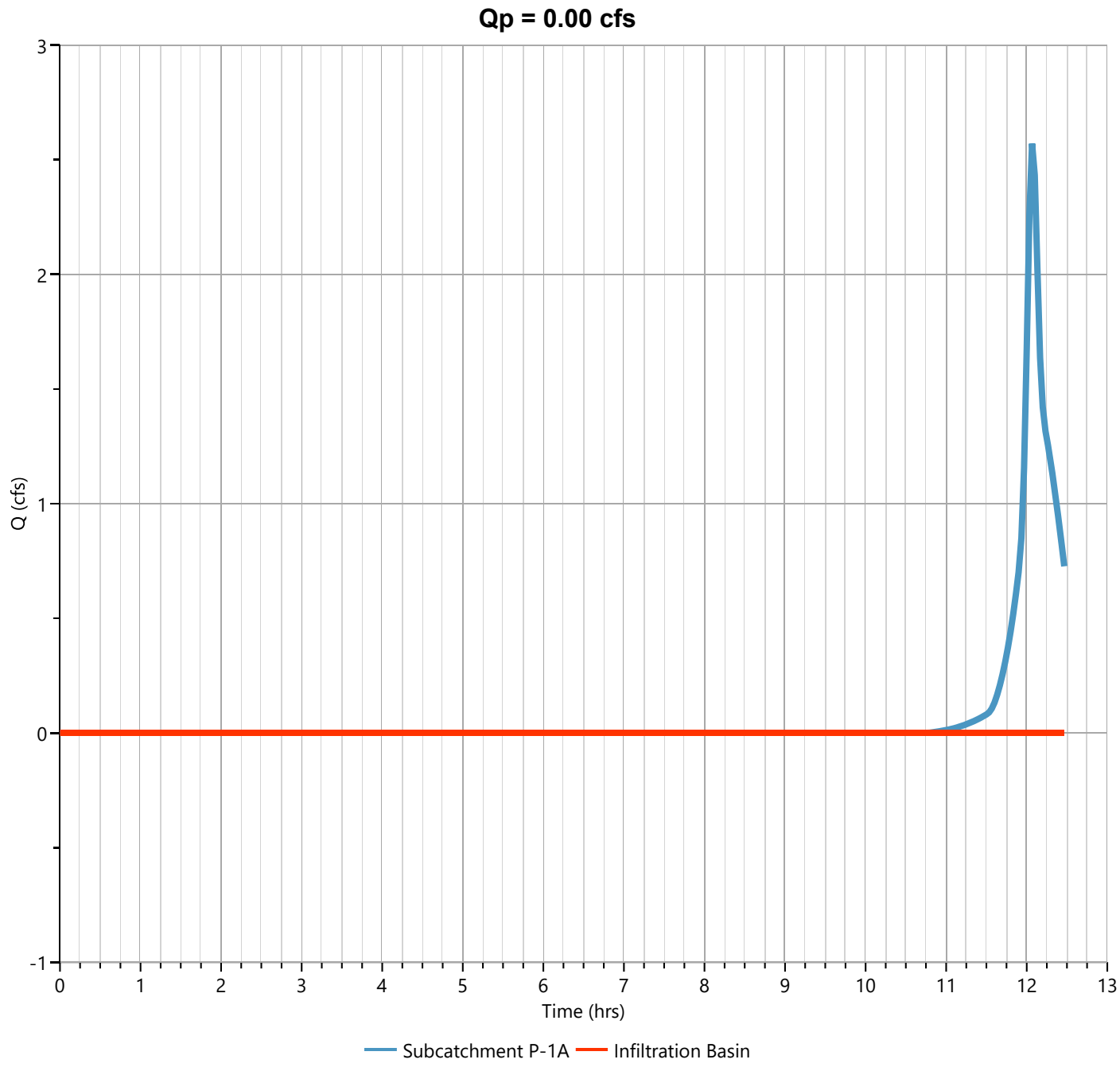
04-09-2024

Infiltration Basin

Hyd. No. 6

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 50-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 5 - Subcatchment P-1A	Max. Elevation	= 229.24 ft
Pond Name	= Infiltration Basin	Max. Storage	= 2,705 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

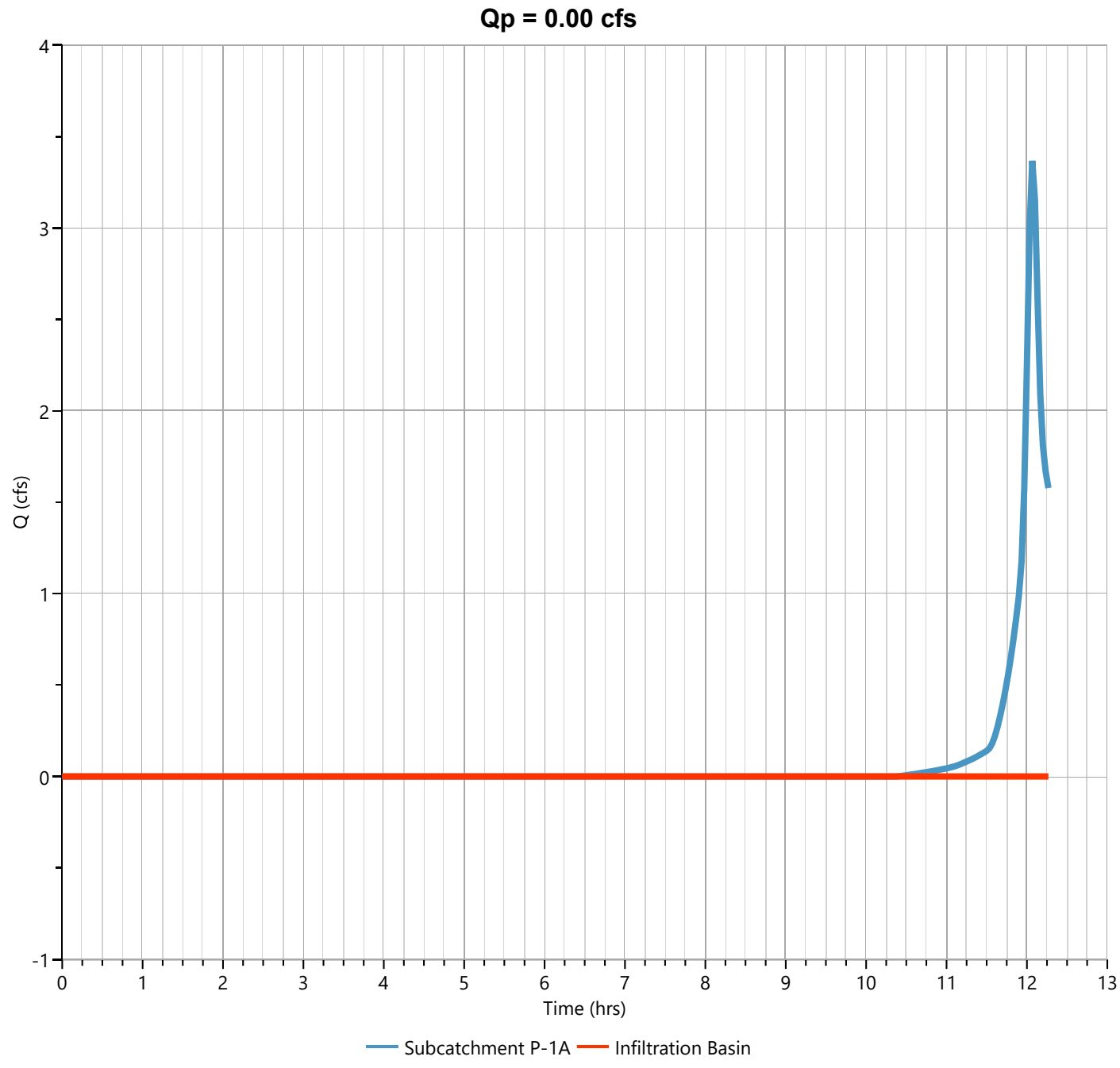
04-09-2024

Infiltration Basin

Hyd. No. 6

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 5 - Subcatchment P-1A	Max. Elevation	= 229.68 ft
Pond Name	= Infiltration Basin	Max. Storage	= 3,720 cuft

Pond Routing by Storage Indication Method



Pond Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

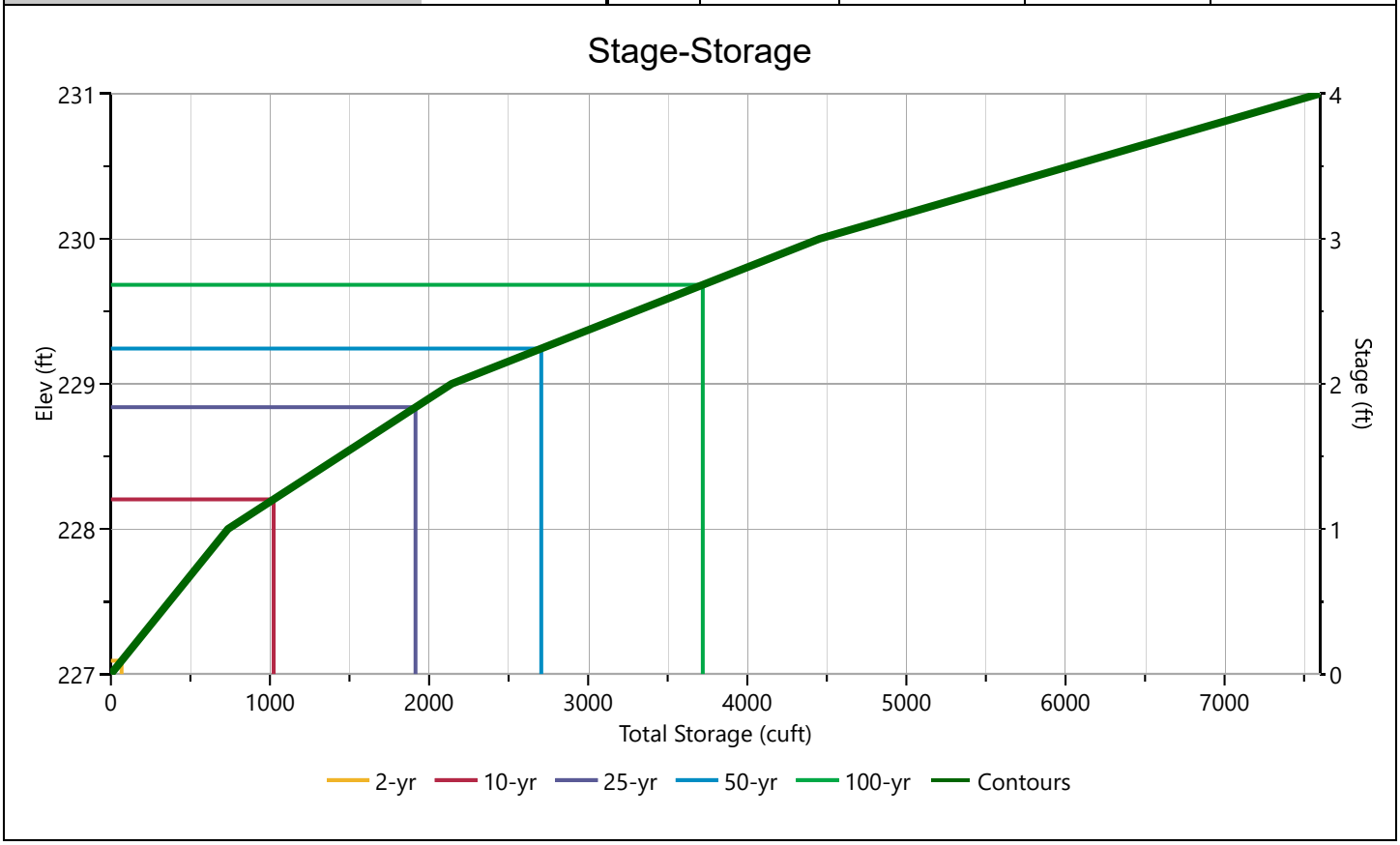
Infiltration Basin

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	227.00
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	227.00	589	0.000	0.000
1.00	228.00	884	737	737
2.00	229.00	1,927	1,406	2,142
3.00	230.00	2,700	2,314	4,456
4.00	231.00	3,586	3,143	7,599



Pond Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Infiltration Basin

Stage-Discharge

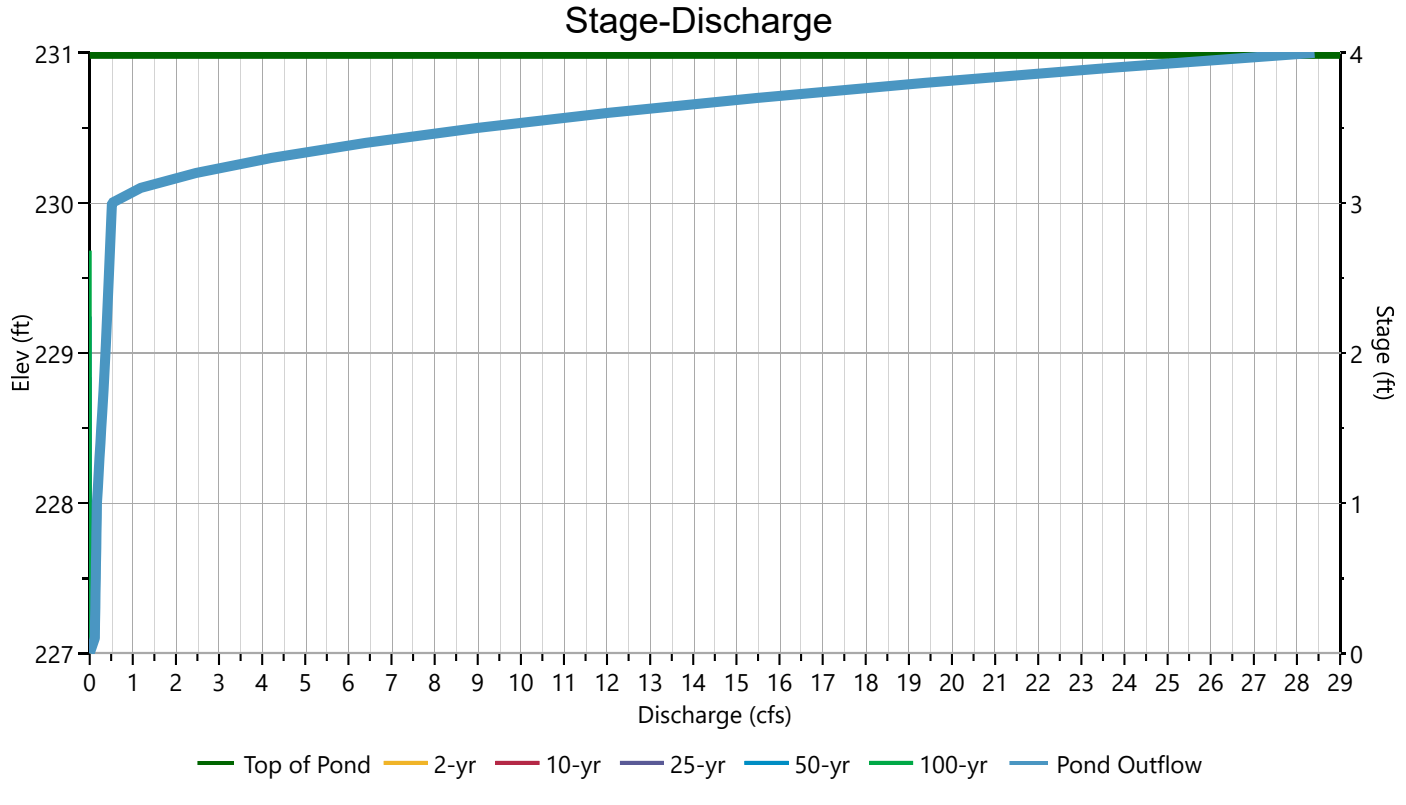
Culvert / Orifices	Culvert	Orifice		
		1	2	3
Rise, in				
Span, in				
No. Barrels				
Invert Elevation, ft				
Orifice Coefficient, Co				
Length, ft				
Barrel Slope, %				
N-Value, n				

Perforated Riser	
Hole Diameter, in	
No. holes	
Invert Elevation, ft	
Height, ft	
Orifice Coefficient, Co	

Weirs	Riser	Weir		
		1 (i)	2	3
Shape / Type		Broad Crested		
Crest Elevation, ft		230		
Crest Length, ft		6		
Angle, deg		18.4 (3:1)		
Weir Coefficient, Cw		3.3		

Ancillary	
Exfiltration, in/hr	8.27**

*m = Flows through Culvert, i = Independent **Exfiltration extracted from outflow hydrograph. Rate applied to contours.*



Pond Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Infiltration Basin

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	227.00	0.000						0.000				0.000		0.000
1.00	228.00	737						0.000				0.169		0.169
2.00	229.00	2,142						0.000				0.369		0.369
3.00	230.00	4,456						0.000				0.517		0.517
4.00	231.00	7,599						27.72				0.686		28.41

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

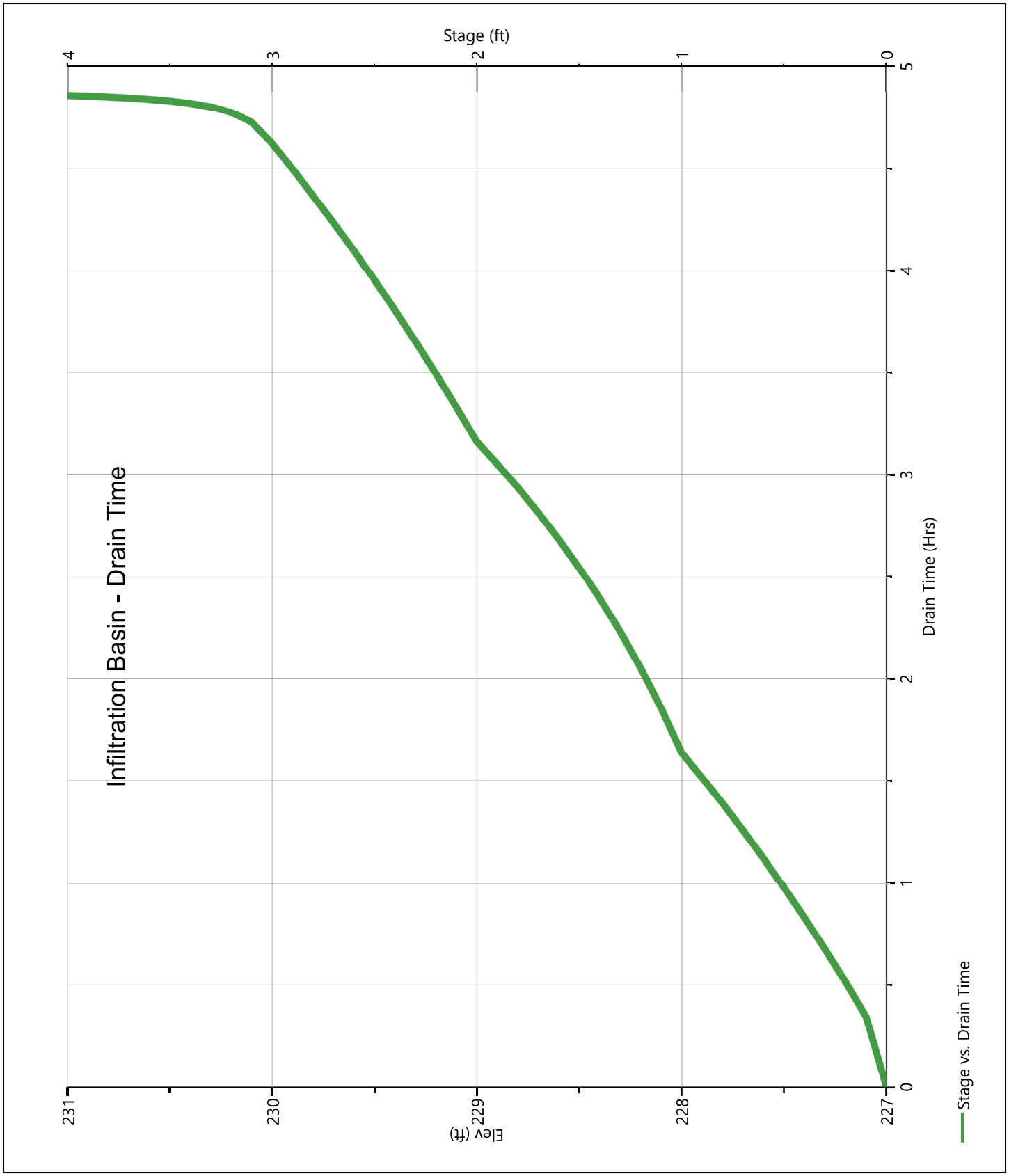
Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Infiltration Basin

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-7306**

Project: 95 Taylor Street By PFK Date 4/9/24

Location: Littleton, MA Checked Date

Circle one: Present [Developed] P-1B

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			0.00	0.00
A	Open Space-Good Condition	39			0.23	8.84
A	Woods- Good Condition	30			1.31	39.31
A	Residential Districts - 2 acres	46			0.68	31.31
A	Gravel	76			0.00	0.00
1/ Use only one CN source per line.				Totals =	2.22	79.47

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{79.47}{2.22} = 35.83$; Use CN = 36

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.18	4.91	7.65
Runoff, Q.....	in	0.01	0.09	0.75

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-7306

Project: 95 Taylor Street By PFK Date 4/9/2024

Location: Littleton, MA Checked _____ Date _____

Circle one: Present / Developed P-1B

Circle one: Tc / Tt through subarea _____

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			LAWN			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.03			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.12			0.12
Shallow concentrated Flow		Segment ID	B-C	C-D		
7. Surface Description (paved or unpaved)			UNPAVED	UNPAVED		
8. Flow Length, L		ft	106	61		
9. Watercourse slope, s		ft/ft	0.03	0.13		
10. Average Velocity, V (figure 3-1)		ft/s	2.79	5.82		
11. Tt = L / 3600V	Compute Tt	hr	0.01	0.00		0.01
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.13
min 7.9

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-1B

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 2.22 ac	Curve Number	= 36
Tc Method	= User	Time of Conc. (Tc)	= 7.9 min
Total Rainfall	= 3.18 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

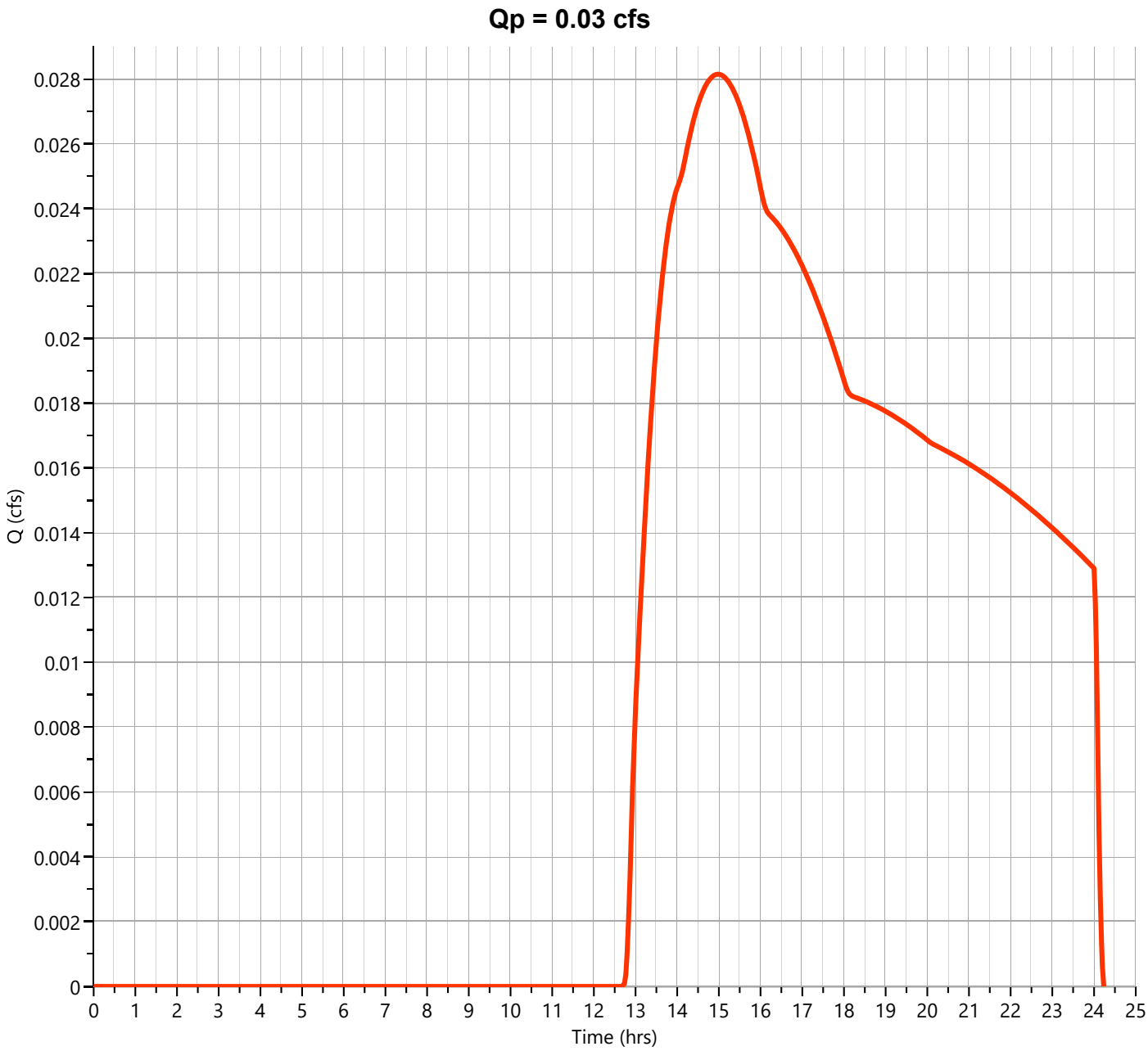
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-1B

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.028 cfs
Storm Frequency	= 10-yr	Time to Peak	= 14.97 hrs
Time Interval	= 2 min	Runoff Volume	= 773 cuft
Drainage Area	= 2.22 ac	Curve Number	= 36
Tc Method	= User	Time of Conc. (Tc)	= 7.9 min
Total Rainfall	= 4.91 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

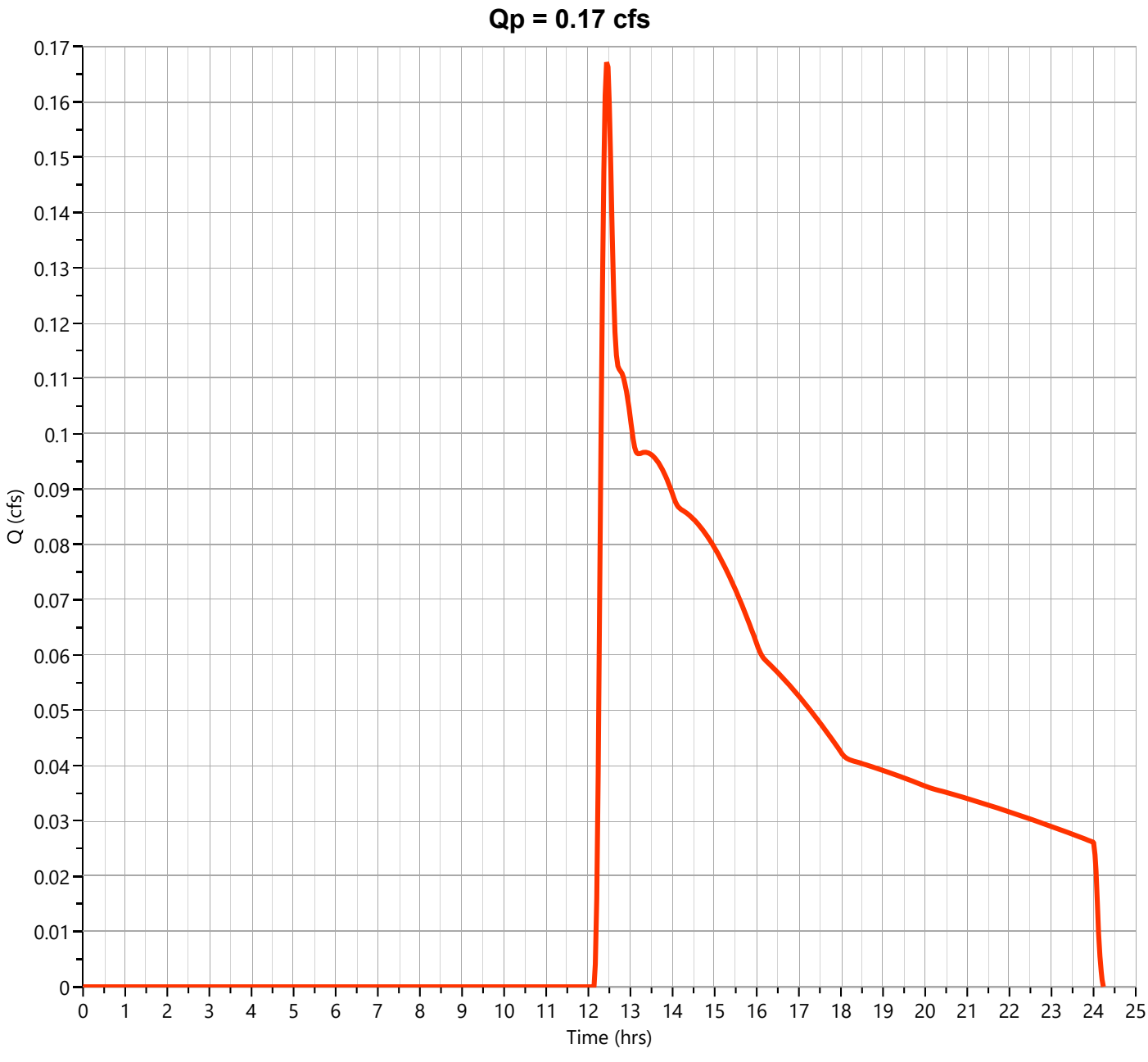
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-1B

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.167 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Runoff Volume	= 2,362 cuft
Drainage Area	= 2.22 ac	Curve Number	= 36
Tc Method	= User	Time of Conc. (Tc)	= 7.9 min
Total Rainfall	= 5.99 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

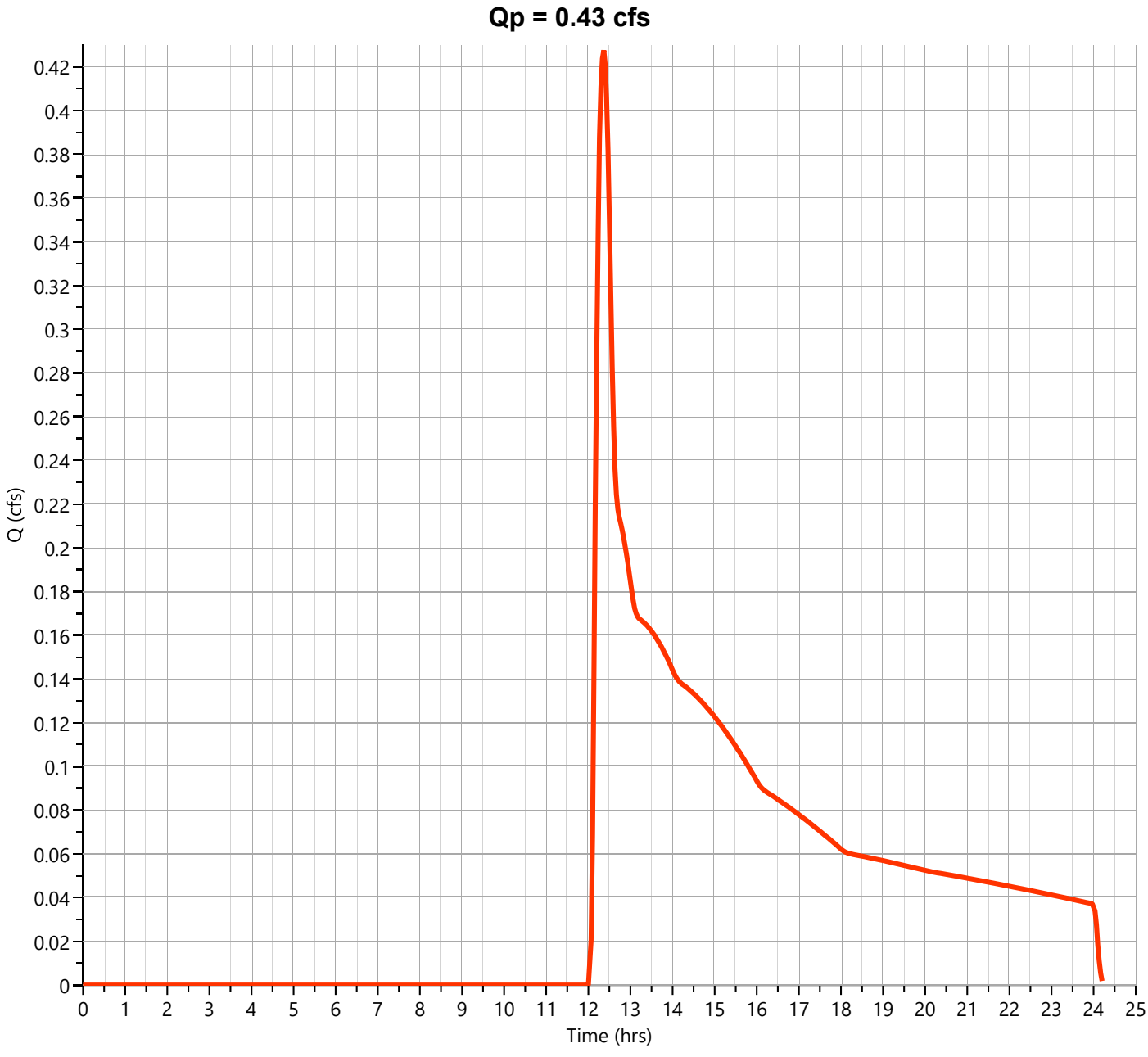
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-1B

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.428 cfs
Storm Frequency	= 50-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 3,986 cuft
Drainage Area	= 2.22 ac	Curve Number	= 36
Tc Method	= User	Time of Conc. (Tc)	= 7.9 min
Total Rainfall	= 6.78 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

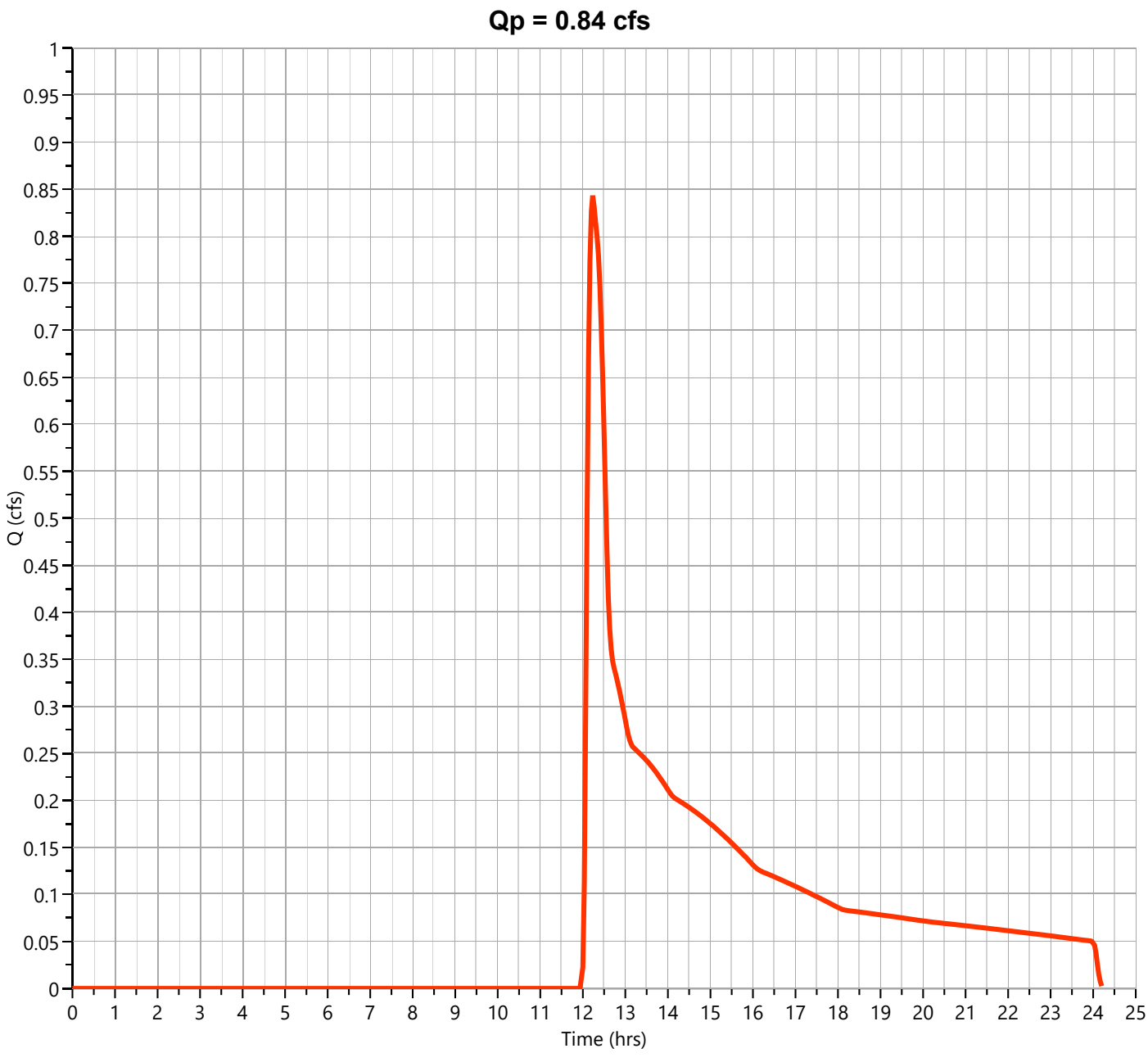
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-1B

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.843 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 6,177 cuft
Drainage Area	= 2.22 ac	Curve Number	= 36
Tc Method	= User	Time of Conc. (Tc)	= 7.9 min
Total Rainfall	= 7.65 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

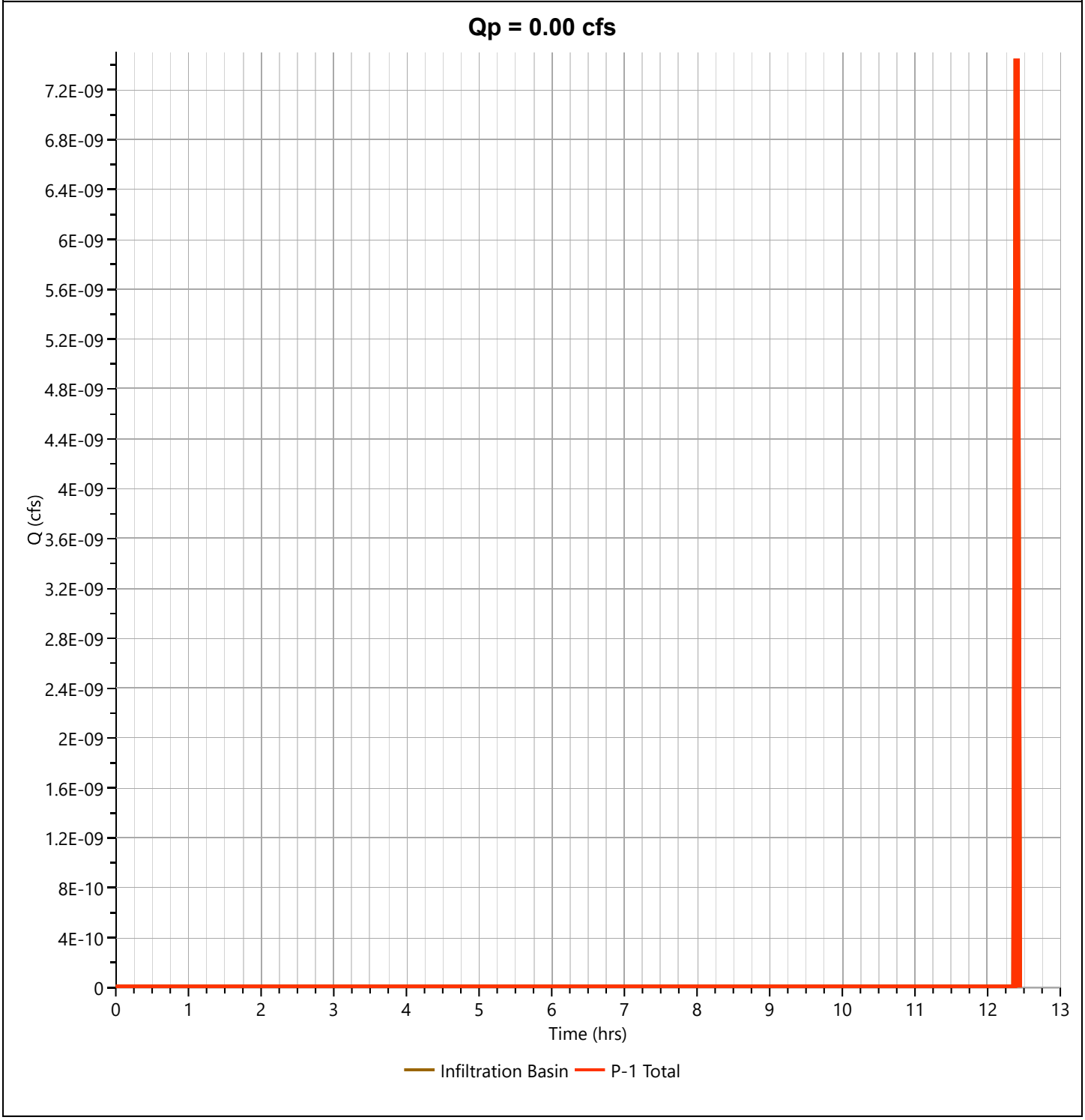
Hydrology Studio v 3.0.0.32

04-09-2024

P-1 Total

Hyd. No. 8

Hydrograph Type	= Junction	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.40 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrographs	= 6, 7	Total Contrib. Area	= 2.22 ac



Hydrograph Report

Project Name:

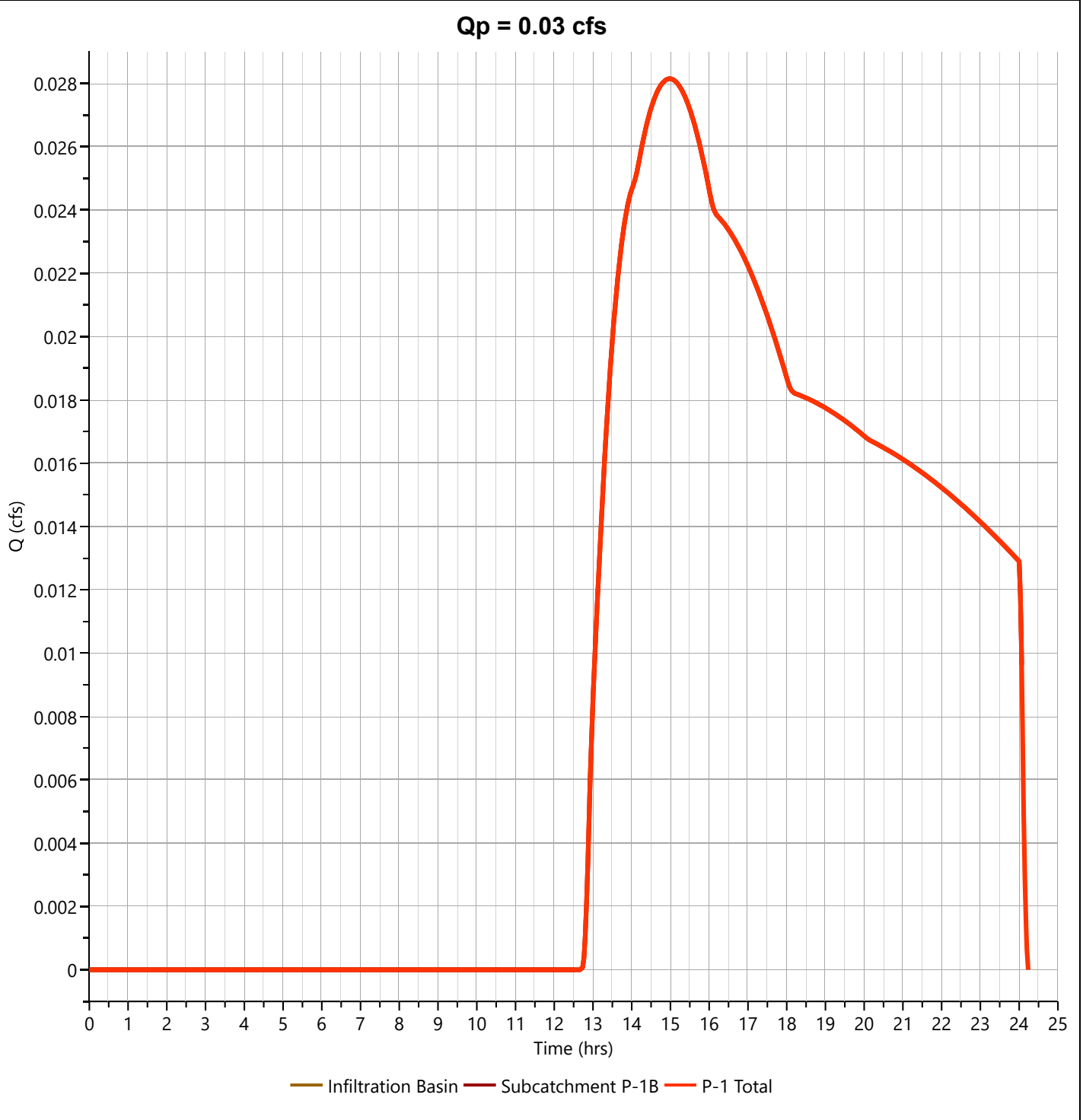
Hydrology Studio v 3.0.0.32

04-09-2024

P-1 Total

Hyd. No. 8

Hydrograph Type	= Junction	Peak Flow	= 0.028 cfs
Storm Frequency	= 10-yr	Time to Peak	= 14.97 hrs
Time Interval	= 2 min	Hydrograph Volume	= 773 cuft
Inflow Hydrographs	= 6, 7	Total Contrib. Area	= 2.22 ac



Hydrograph Report

Project Name:

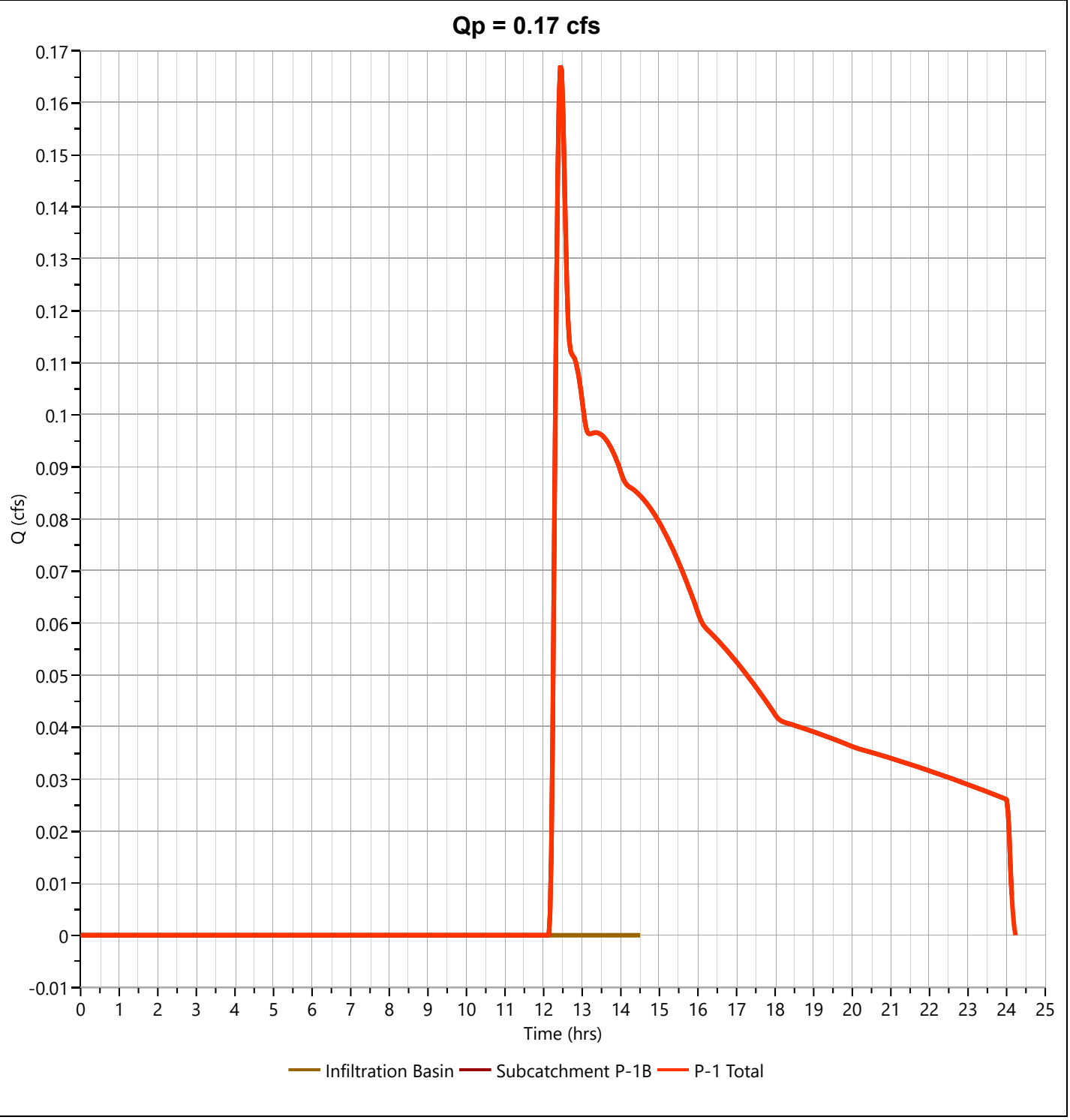
Hydrology Studio v 3.0.0.32

04-09-2024

P-1 Total

Hyd. No. 8

Hydrograph Type	= Junction	Peak Flow	= 0.167 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Hydrograph Volume	= 2,362 cuft
Inflow Hydrographs	= 6, 7	Total Contrib. Area	= 2.22 ac



Hydrograph Report

Project Name:

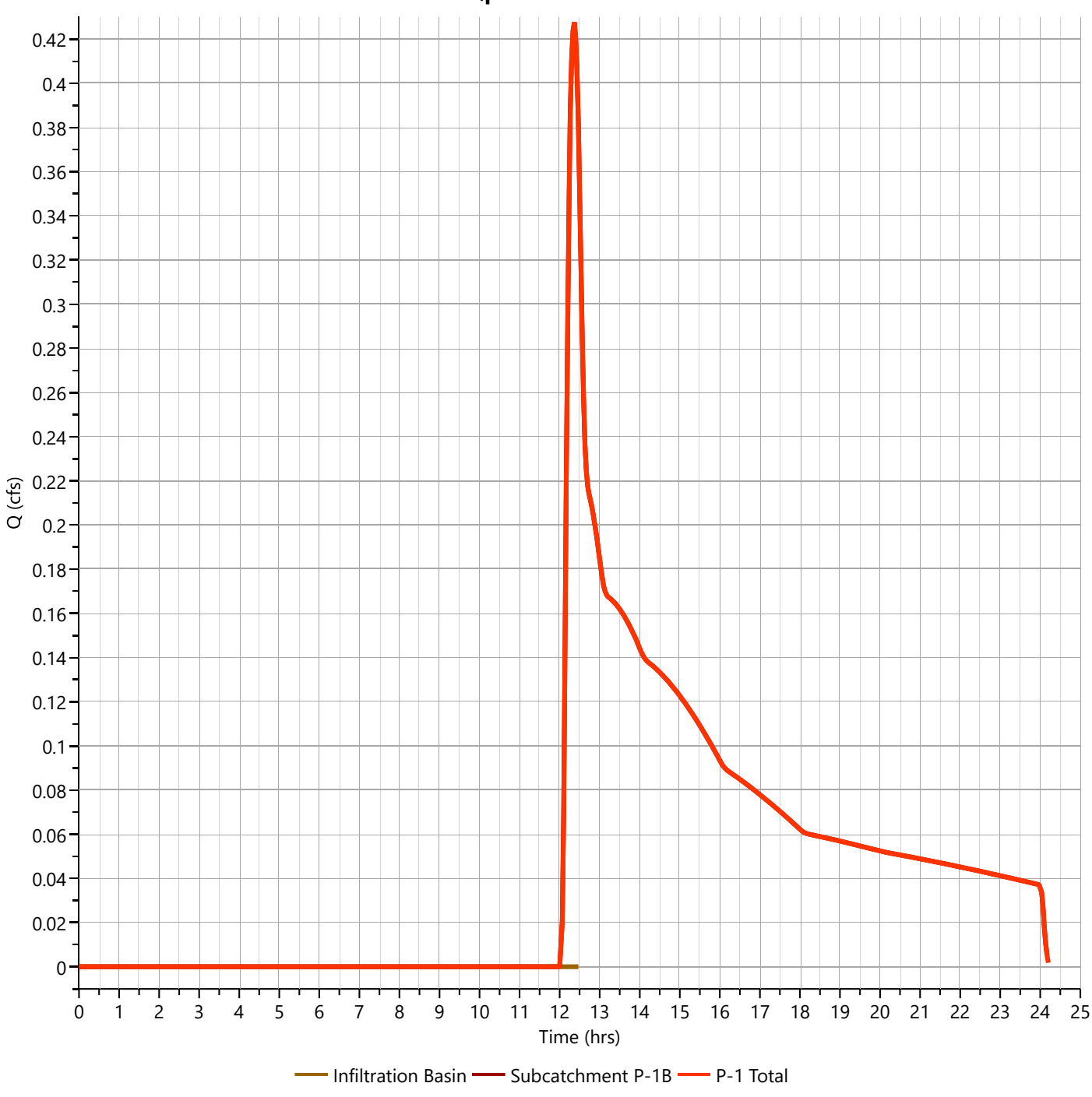
Hydrology Studio v 3.0.0.32

04-09-2024

P-1 Total

Hyd. No. 8

Hydrograph Type	= Junction	Peak Flow	= 0.428 cfs
Storm Frequency	= 50-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 3,986 cuft
Inflow Hydrographs	= 6, 7	Total Contrib. Area	= 2.22 ac



Hydrograph Report

Project Name:

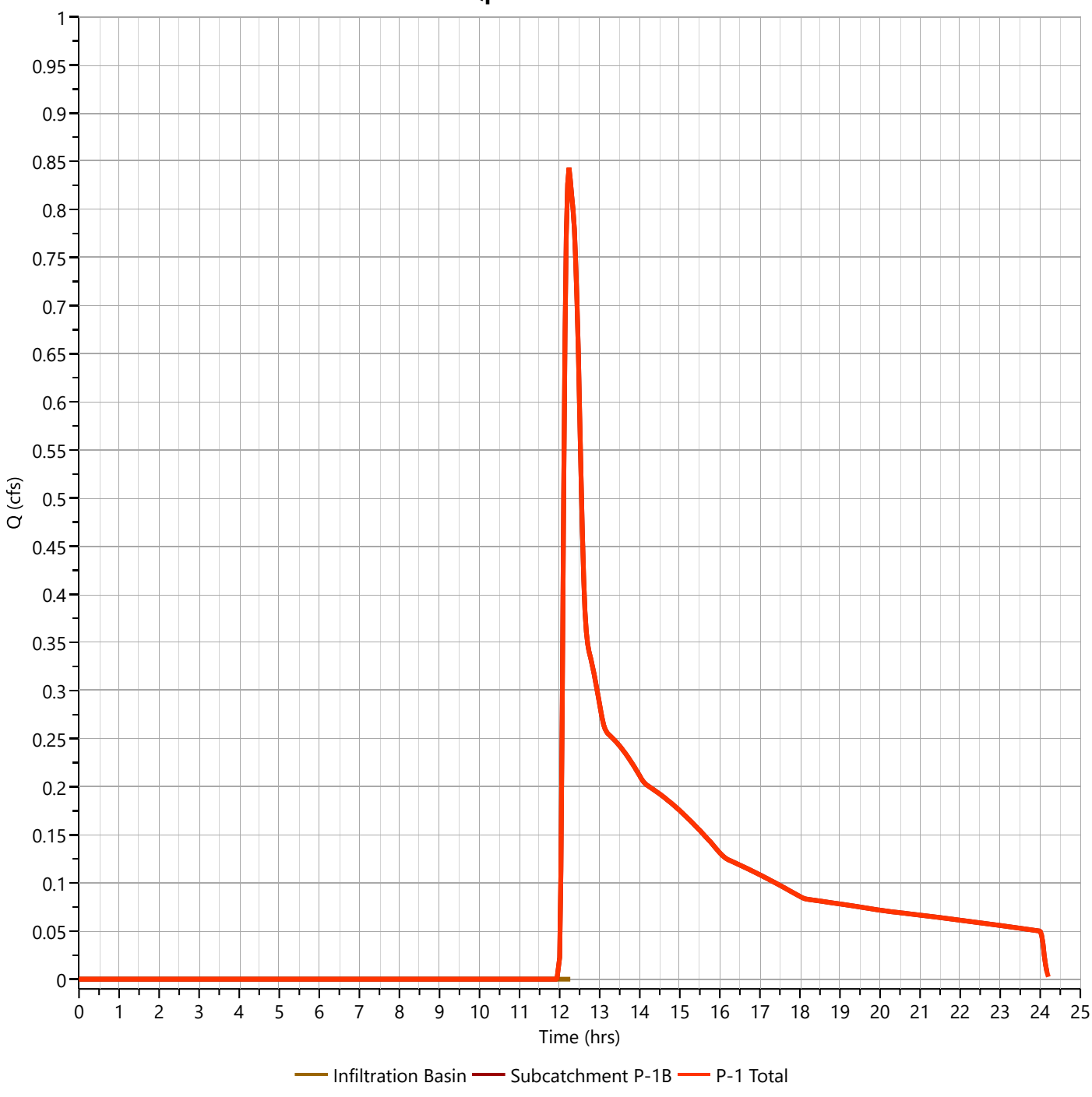
Hydrology Studio v 3.0.0.32

04-09-2024

P-1 Total

Hyd. No. 8

Hydrograph Type	= Junction	Peak Flow	= 0.843 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 6,177 cuft
Inflow Hydrographs	= 6, 7	Total Contrib. Area	= 2.22 ac



Worksheet 2: Runoff curve number and runoff **SM-7306**

Project: 95 Taylor Street By PFK Date 4/9/24

Location: Littleton, MA Checked Date

Circle one: Present [Developed] P-2A

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			0.00	0.00
A	Open Space-Good Condition	39			0.11	4.13
A	Woods- Good Condition	30			0.00	0.00
A	Residential Districts - 2 acres	46			0.00	0.00
A	Gravel	76			0.00	0.00
1/ Use only one CN source per line.				Totals =	0.11	4.13

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{4.13}{0.11} = 39.00$; Use CN = 39

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.18	4.91	7.65
Runoff, Q.....	in	0.00	0.18	1.01

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Hydrograph Report

Project Name:

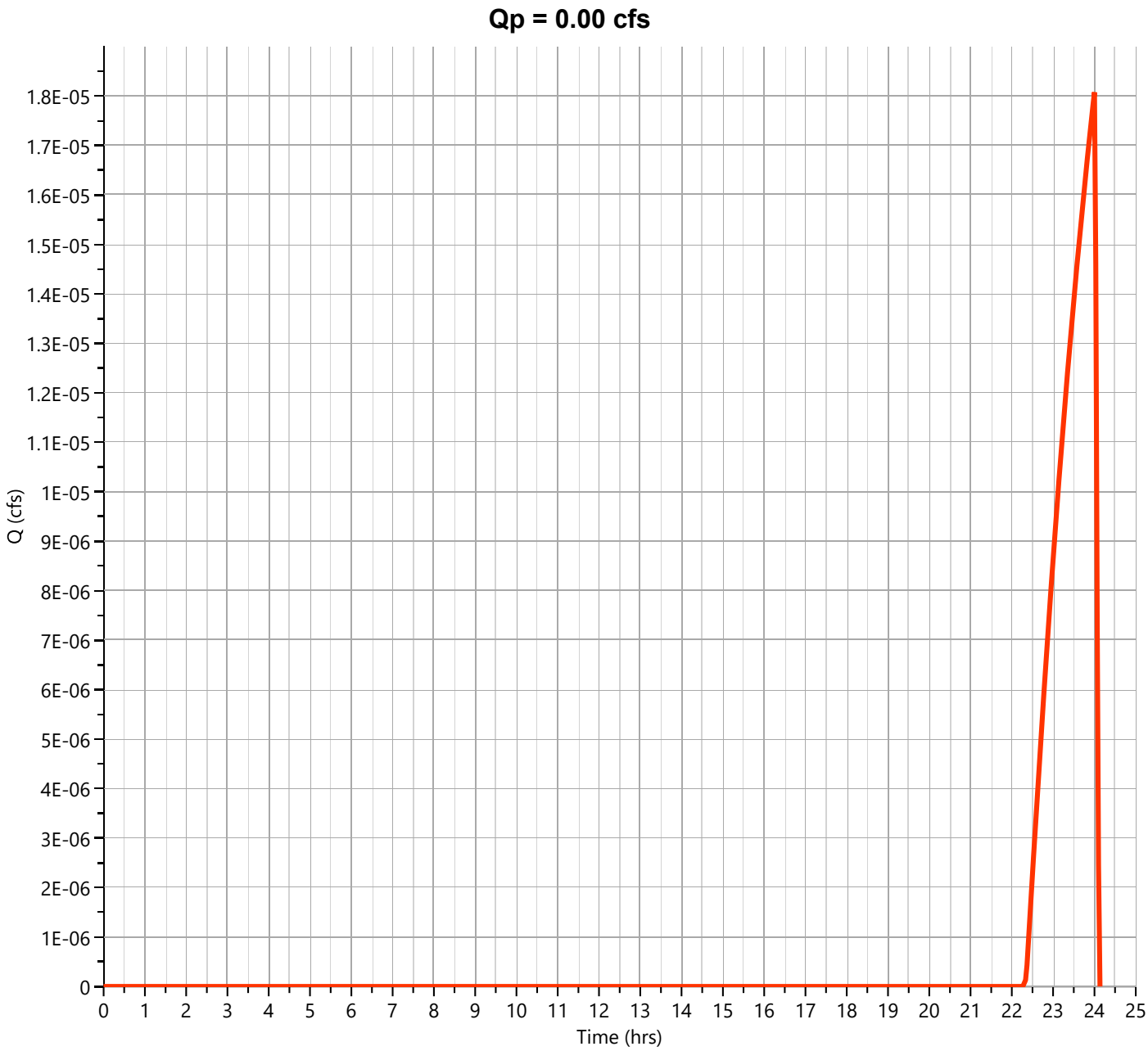
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-2A

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 24.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.064 cuft
Drainage Area	= 0.11 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 3.18 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

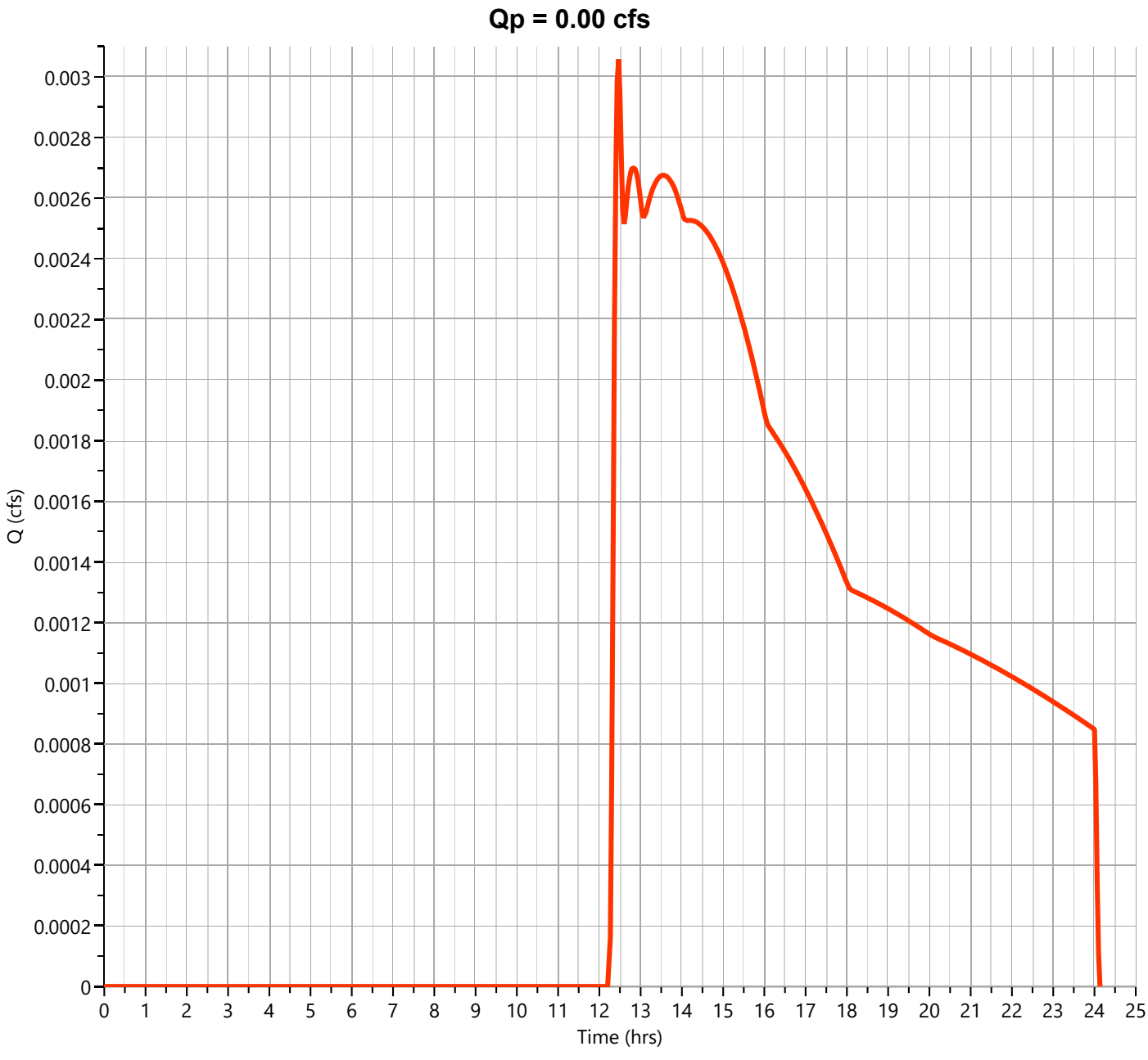
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-2A

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.003 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Runoff Volume	= 68.2 cuft
Drainage Area	= 0.11 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 4.91 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

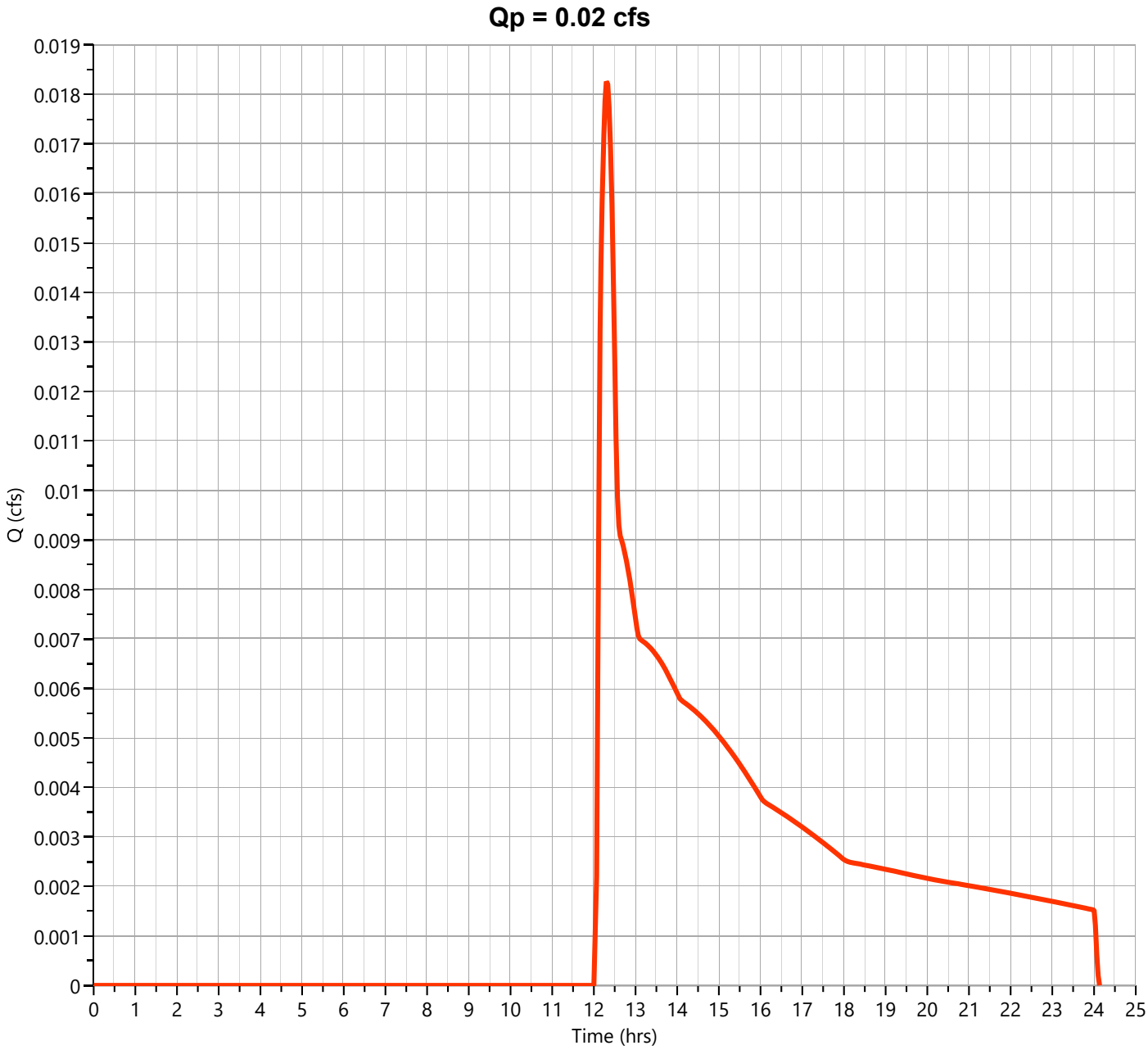
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-2A

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.018 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 166 cuft
Drainage Area	= 0.11 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.99 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

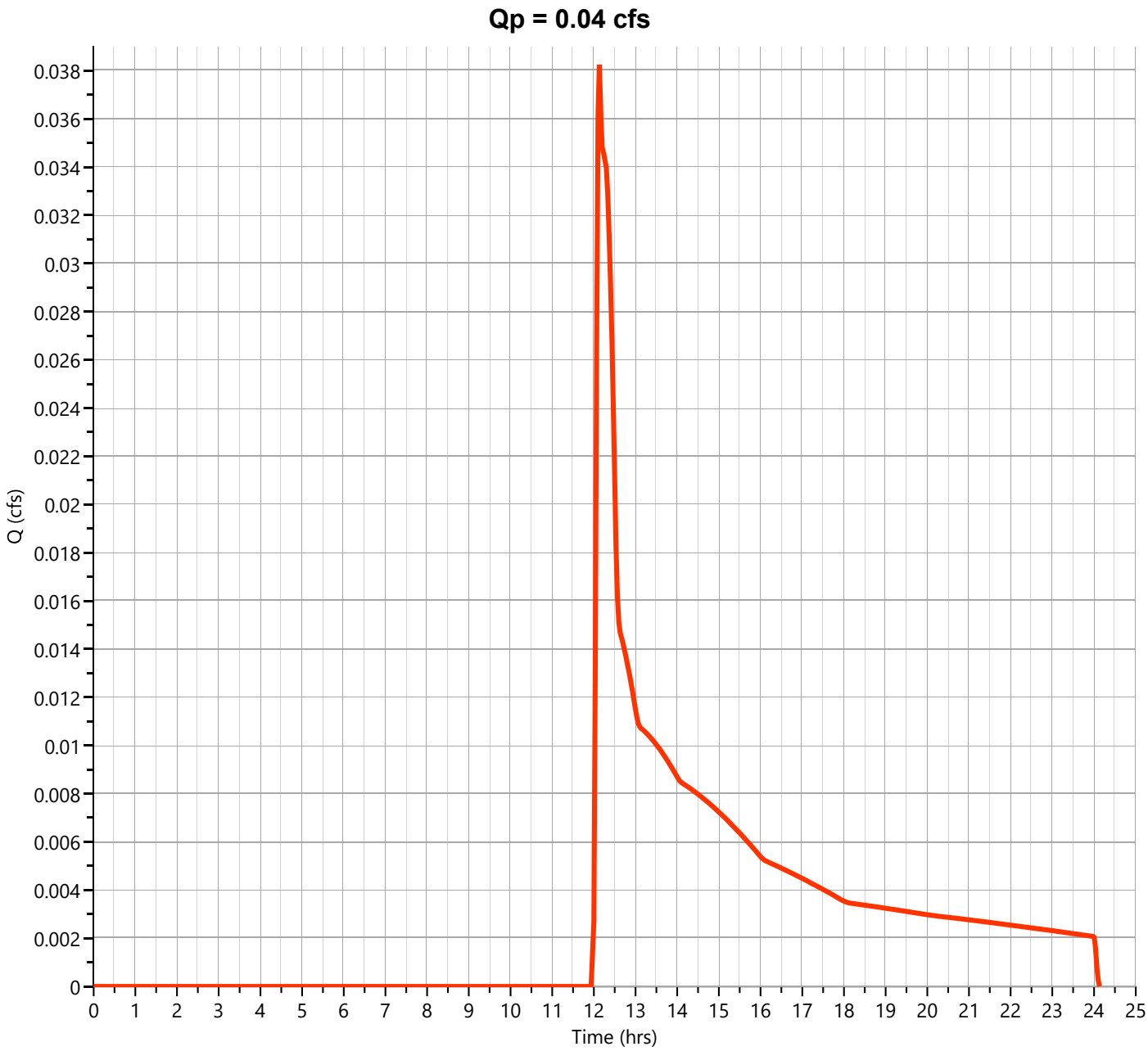
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-2A

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.038 cfs
Storm Frequency	= 50-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 259 cuft
Drainage Area	= 0.11 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 6.78 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

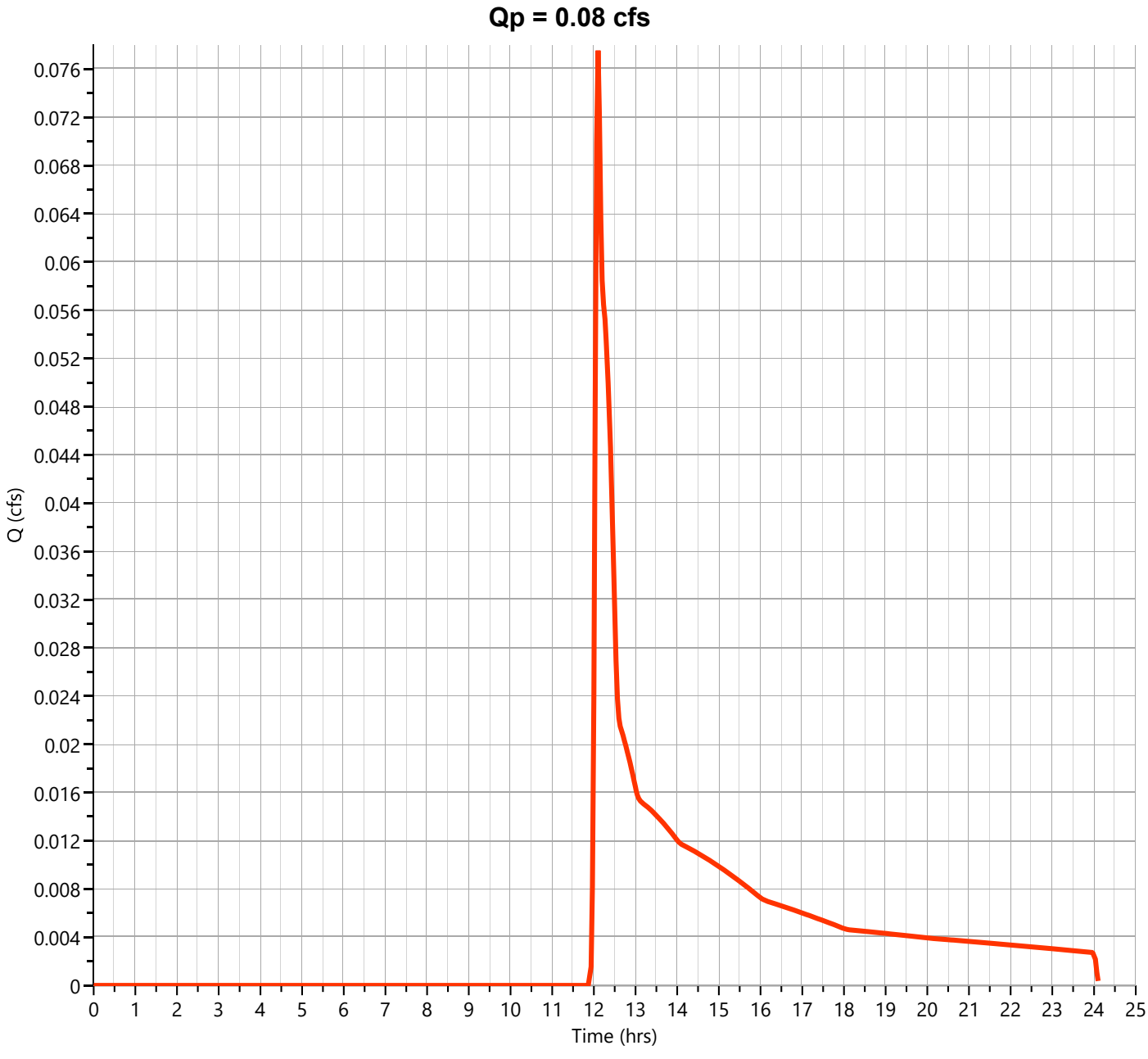
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-2A

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.078 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 380 cuft
Drainage Area	= 0.11 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 7.65 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Infiltration Trench

Hyd. No. 11

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 10 - Subcatchment P-2A	Max. Elevation	= 230.50 ft
Pond Name	= Infiltration Trench	Max. Storage	= 0.064 cuft

Pond Routing by Storage Indication Method

Qp = 0.00 cfs

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

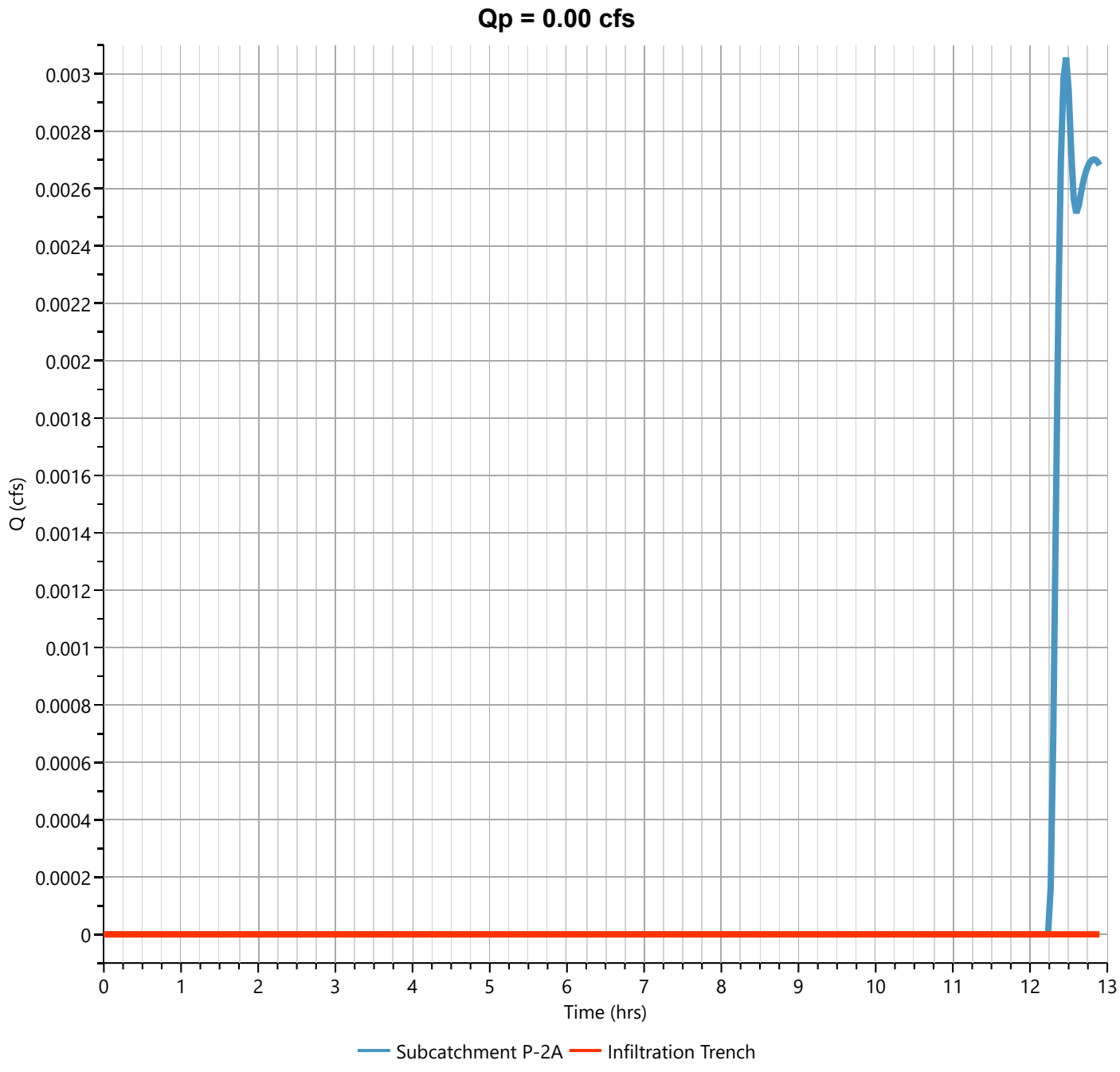
04-09-2024

Infiltration Trench

Hyd. No. 11

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.87 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 10 - Subcatchment P-2A	Max. Elevation	= 230.50 ft
Pond Name	= Infiltration Trench	Max. Storage	= 0.050 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

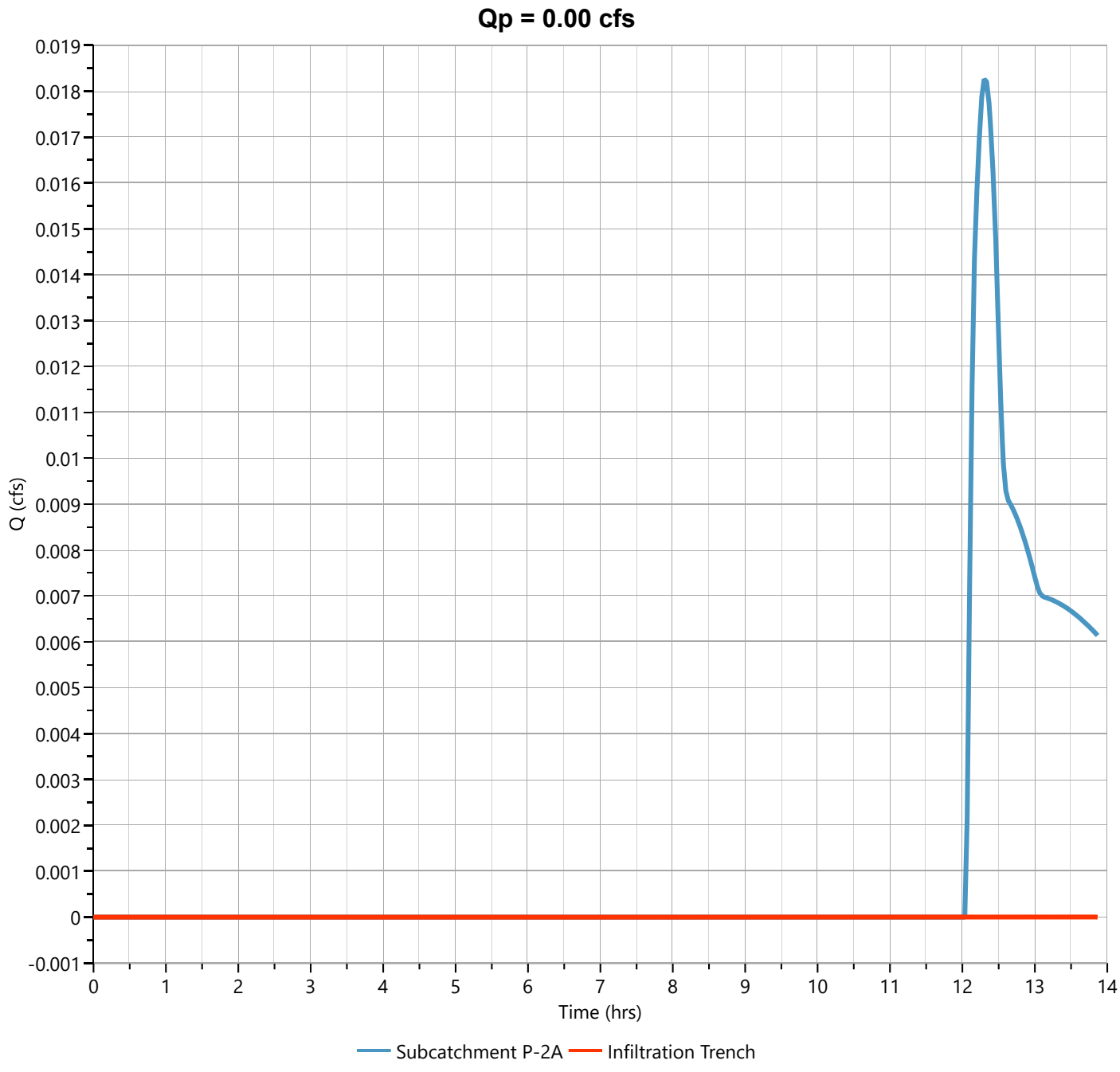
04-09-2024

Infiltration Trench

Hyd. No. 11

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 13.83 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 10 - Subcatchment P-2A	Max. Elevation	= 230.53 ft
Pond Name	= Infiltration Trench	Max. Storage	= 1.05 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

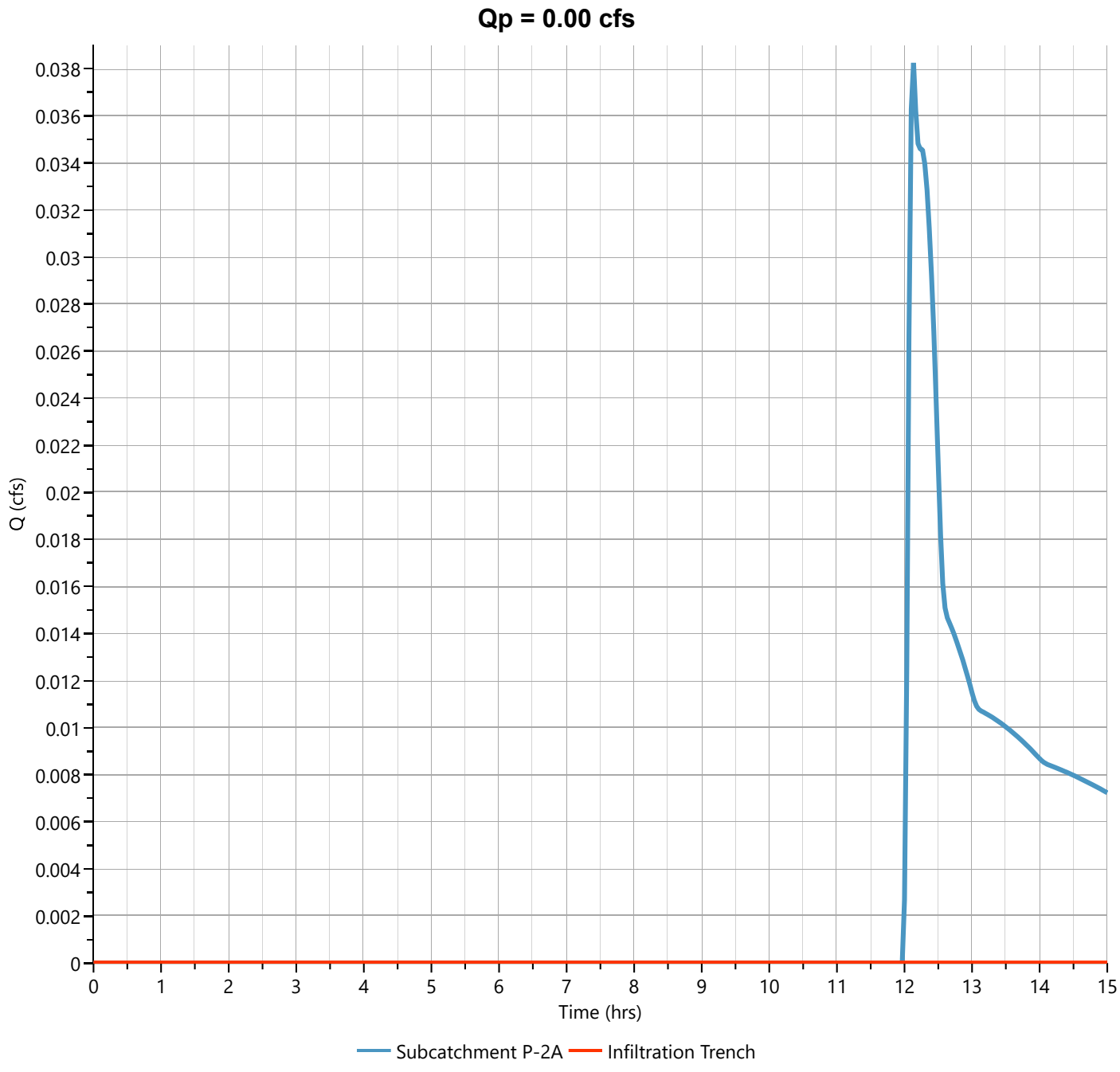
04-09-2024

Infiltration Trench

Hyd. No. 11

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 50-yr	Time to Peak	= 14.97 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 10 - Subcatchment P-2A	Max. Elevation	= 231.04 ft
Pond Name	= Infiltration Trench	Max. Storage	= 18.2 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

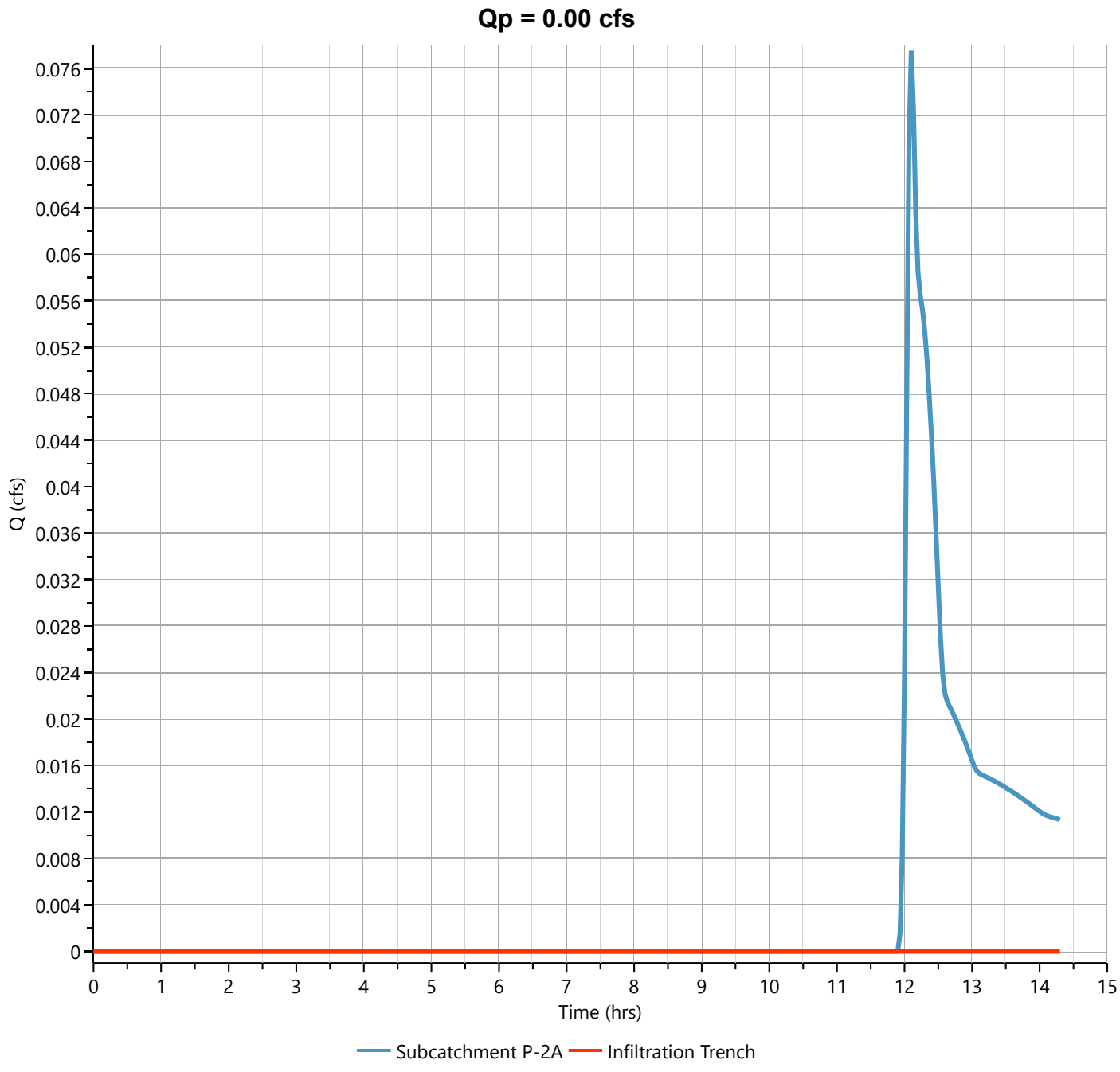
04-09-2024

Infiltration Trench

Hyd. No. 11

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 14.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 10 - Subcatchment P-2A	Max. Elevation	= 231.87 ft
Pond Name	= Infiltration Trench	Max. Storage	= 46.3 cuft

Pond Routing by Storage Indication Method



Pond Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

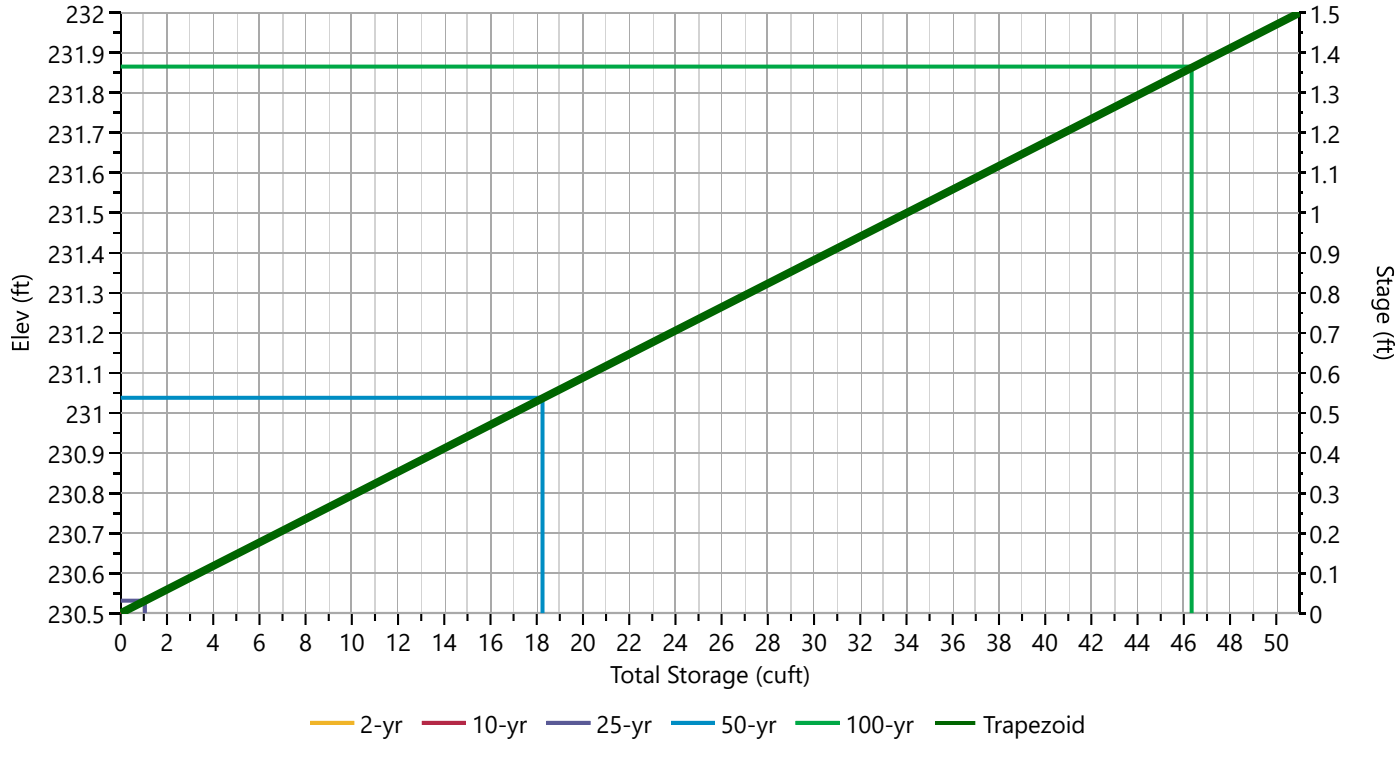
Infiltration Trench

Stage-Storage

Trapezoid	
Description	**Input**
Bottom Elevation, ft	230.50
Bottom Length, ft	17.00
Bottom Width, ft	5.00
Side Slope, H:1	0.00
Total Depth, ft	1.50
Voids (%)	40.00

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	230.50	85	0.000	0.000
0.08	230.58	85	2.55	2.55
0.15	230.65	85	2.55	5.10
0.23	230.73	85	2.55	7.65
0.30	230.80	85	2.55	10.2
0.38	230.88	85	2.55	12.8
0.45	230.95	85	2.55	15.3
0.53	231.03	85	2.55	17.9
0.60	231.10	85	2.55	20.4
0.68	231.18	85	2.55	23.0
0.75	231.25	85	2.55	25.5
0.82	231.33	85	2.55	28.1
0.90	231.40	85	2.55	30.6
0.97	231.48	85	2.55	33.2
1.05	231.55	85	2.55	35.7
1.13	231.63	85	2.55	38.3
1.20	231.70	85	2.55	40.8
1.28	231.78	85	2.55	43.4
1.35	231.85	85	2.55	45.9
1.43	231.93	85	2.55	48.5
1.50	232.00	85	2.55	51.0



Pond Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Infiltration Trench

Stage-Discharge

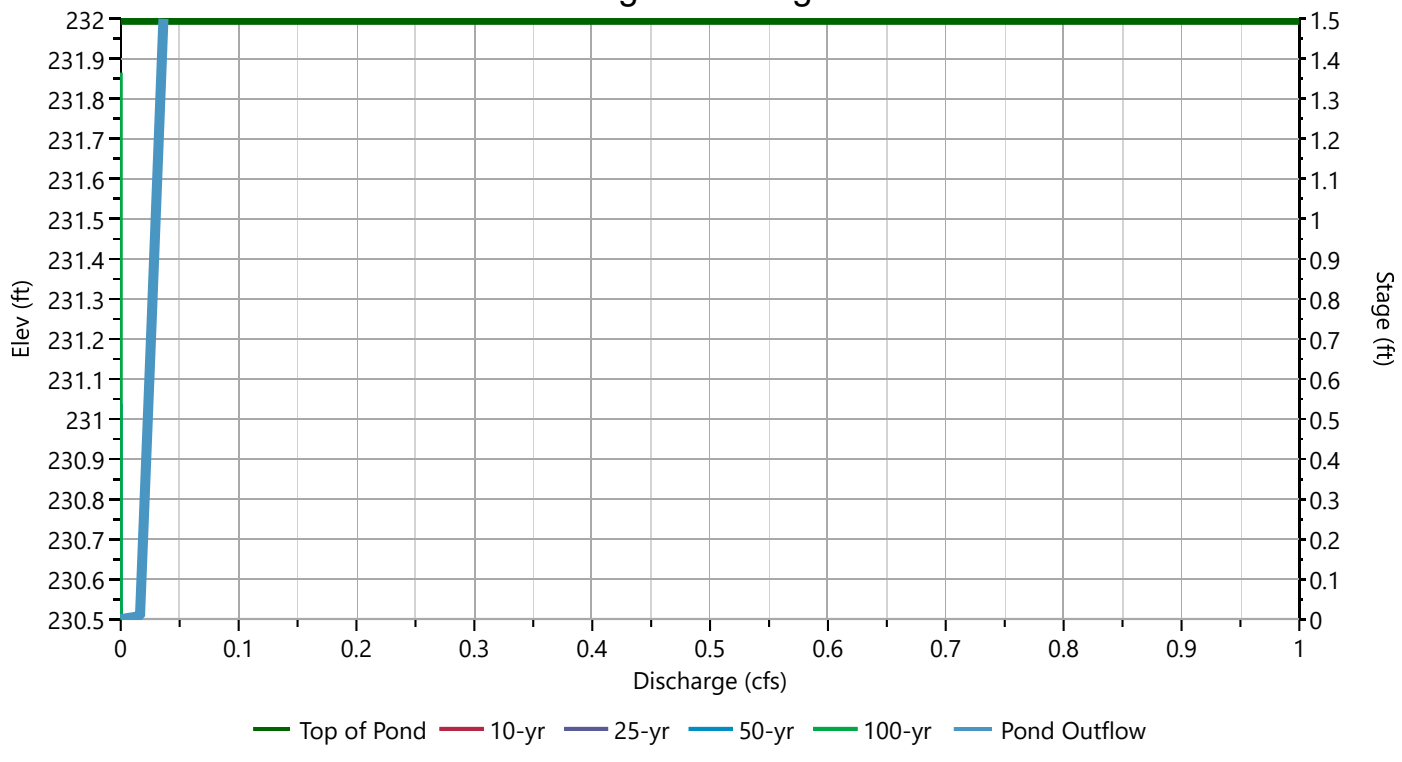
Culvert / Orifices	Culvert	Orifice		
		1	2	3
Rise, in				
Span, in				
No. Barrels				
Invert Elevation, ft				
Orifice Coefficient, Co				
Length, ft				
Barrel Slope, %				
N-Value, n				

Perforated Riser	
Hole Diameter, in	
No. holes	
Invert Elevation, ft	
Height, ft	
Orifice Coefficient, Co	

Weirs	Riser	Weir		
		1	2	3
Shape / Type				
Crest Elevation, ft				
Crest Length, ft				
Angle, deg				
Weir Coefficient, Cw				

Ancillary	
Exfiltration, in/hr	8.27**

***Exfiltration extracted from outflow hydrograph. Rate applied to contours.*



Pond Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Infiltration Trench

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	230.50	0.000										0.000		0.000
0.08	230.58	2.55										0.017		0.017
0.15	230.65	5.10										0.018		0.018
0.23	230.73	7.65										0.019		0.019
0.30	230.80	10.2										0.020		0.020
0.38	230.88	12.8										0.021		0.021
0.45	230.95	15.3										0.022		0.022
0.53	231.03	17.9										0.023		0.023
0.60	231.10	20.4										0.024		0.024
0.68	231.18	23.0										0.025		0.025
0.75	231.25	25.5										0.026		0.026
0.82	231.33	28.1										0.027		0.027
0.90	231.40	30.6										0.028		0.028
0.97	231.48	33.2										0.029		0.029
1.05	231.55	35.7										0.030		0.030
1.13	231.63	38.3										0.031		0.031
1.20	231.70	40.8										0.032		0.032
1.28	231.78	43.4										0.033		0.033
1.35	231.85	45.9										0.034		0.034
1.43	231.93	48.5										0.035		0.035
1.50	232.00	51.0										0.036		0.036

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

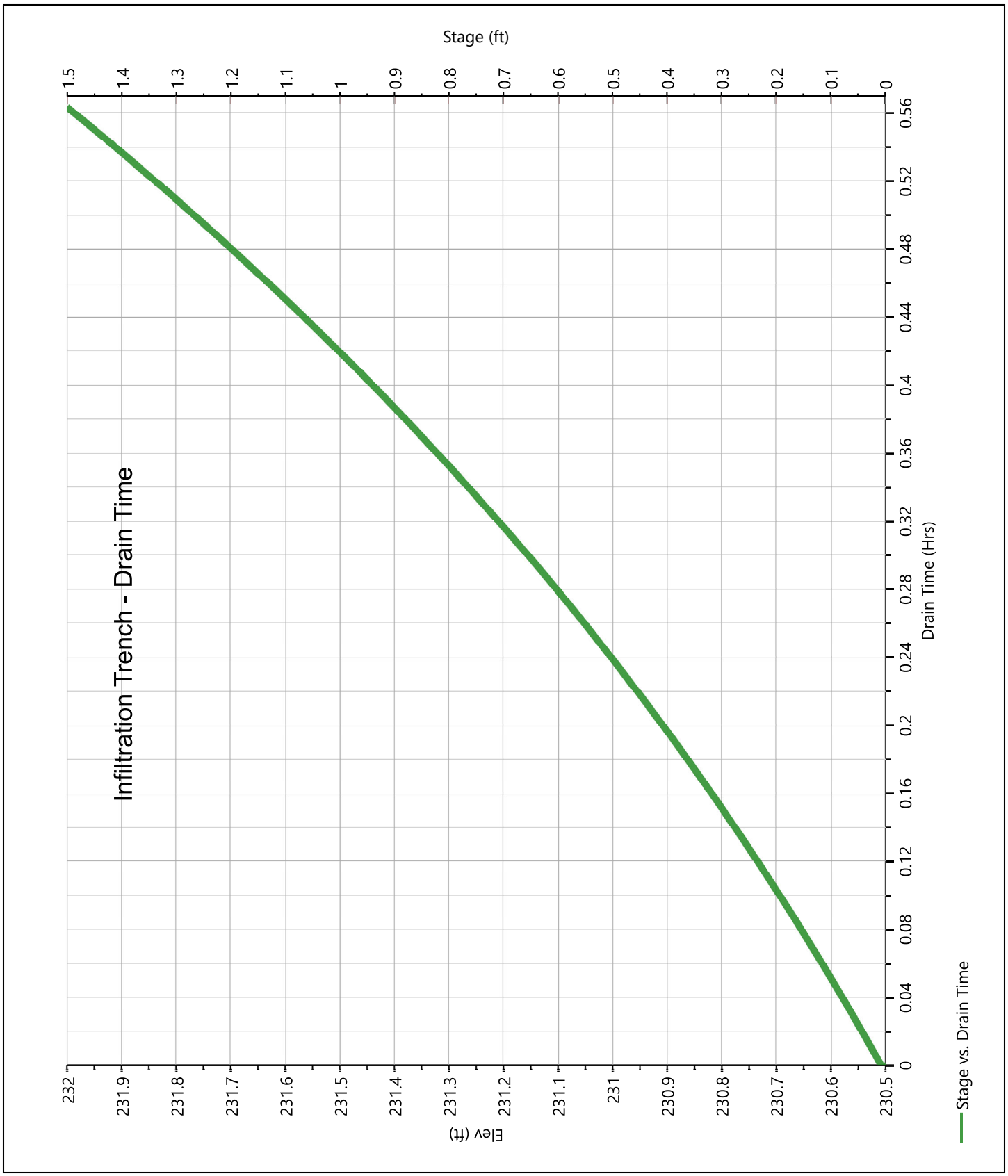
Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Infiltration Trench

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-7306**

Project: 95 Taylor Street By PFK Date 4/9/24

Location: Littleton, MA Checked Date

Circle one: Present [Developed] P-2B

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			0.00	0.00
A	Open Space-Good Condition	39			0.02	0.63
A	Woods- Good Condition	30			0.48	14.52
A	Residential Districts - 2 acres	46			0.00	0.00
A	Gravel	76			0.00	0.00
1/ Use only one CN source per line.				Totals =	0.50	15.15

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{15.15}{0.50}$ = 30.29 ; Use CN = 30

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.18	4.91	7.65
Runoff, Q.....	in	0.09	0.00	0.36

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-7306

Project: 95 Taylor Street By PFK Date 4/9/2024

Location: Littleton, MA Checked _____ Date _____

Circle one: Present | Developed P-2B
Circle one: Tc | Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODED			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.02			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.29			0.29
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	99			
9. Watercourse slope, s		ft/ft	0.03			
10. Average Velocity, V (figure 3-1)		ft/s	2.79			
11. Tt = L / 3600V	Compute Tt	hr	0.01			0.01
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.30
min 17.9

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-2B

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.5 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 3.18 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

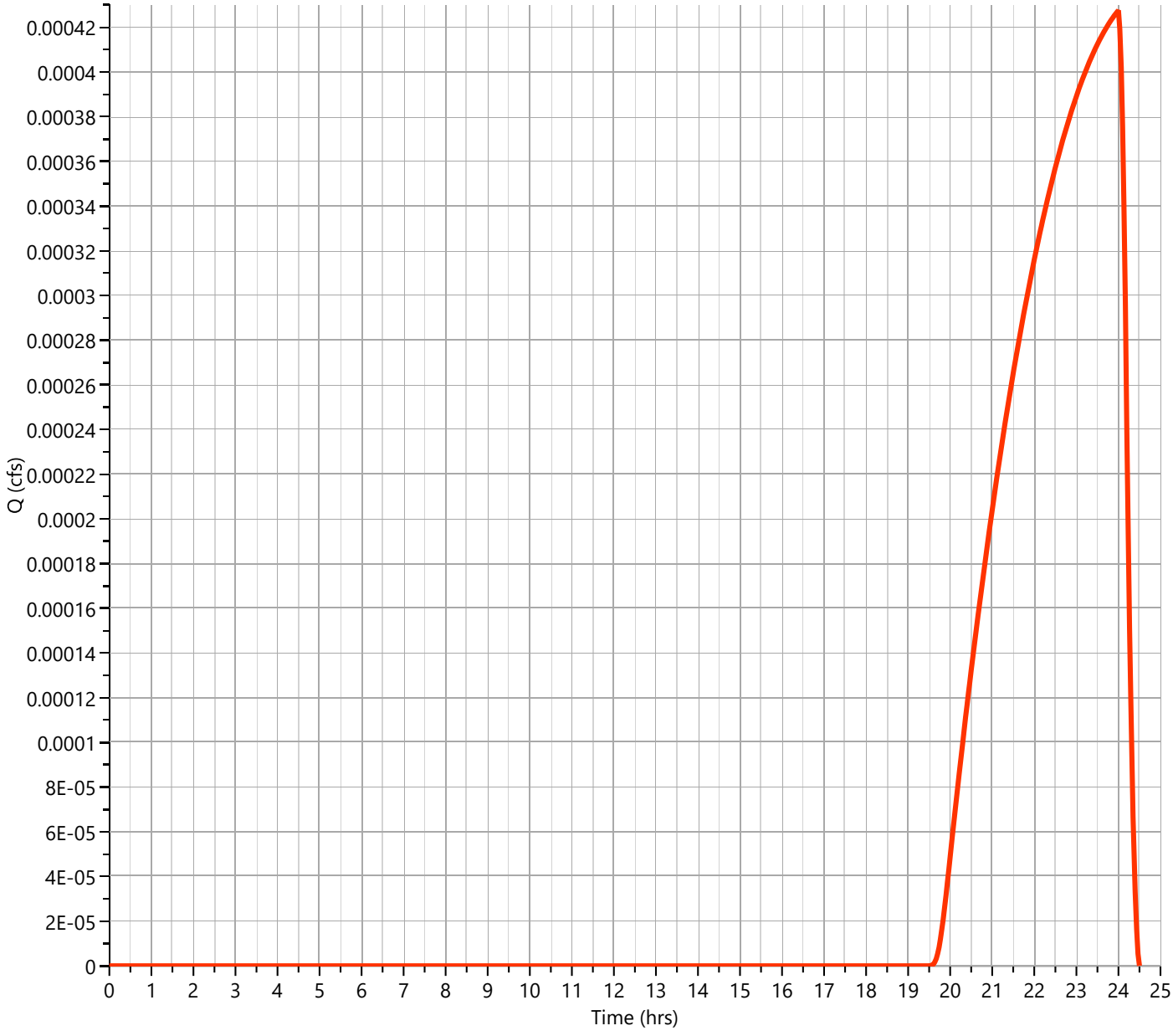
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-2B

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 24.00 hrs
Time Interval	= 2 min	Runoff Volume	= 4.56 cuft
Drainage Area	= 0.5 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 4.91 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

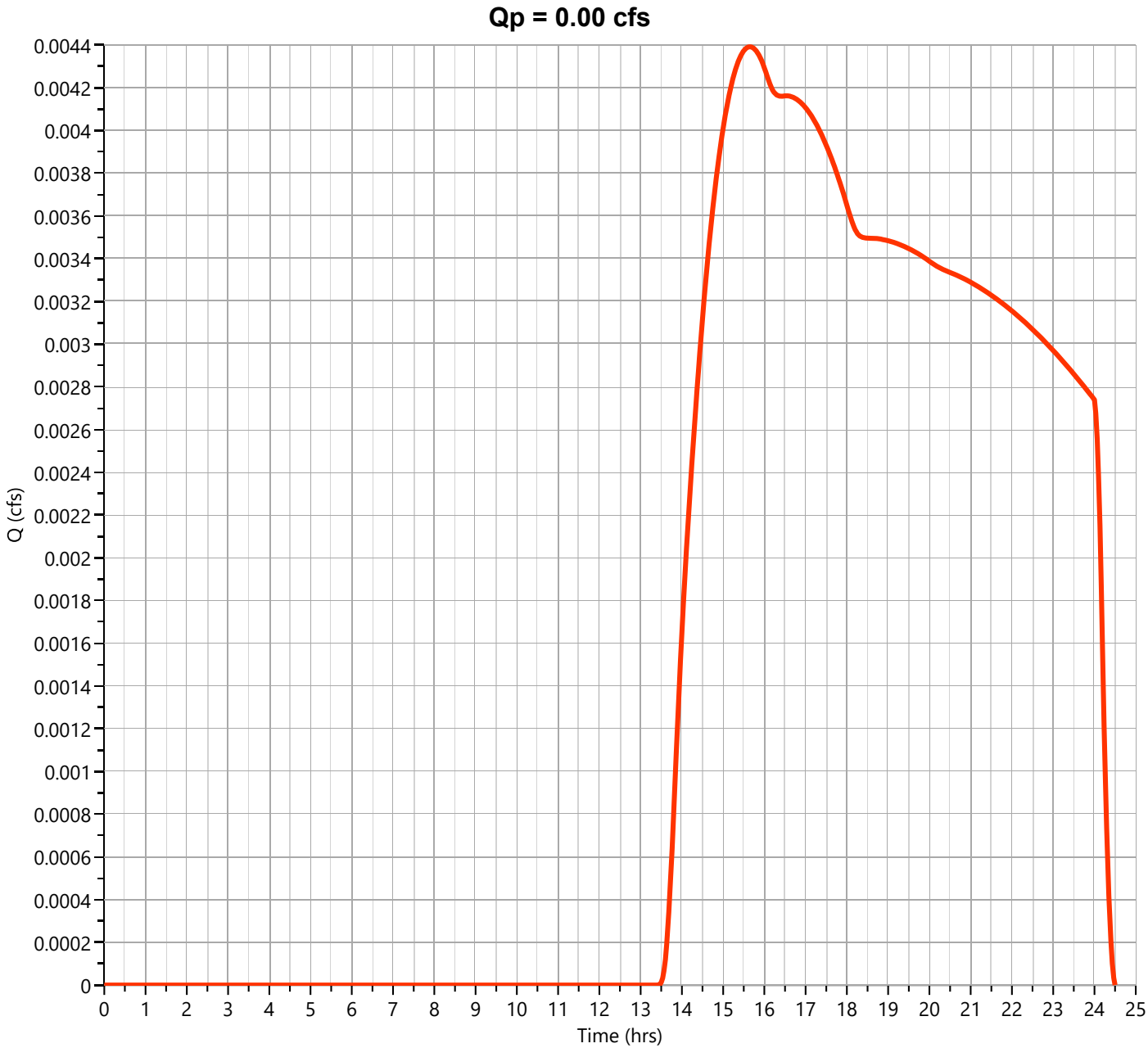
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-2B

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.004 cfs
Storm Frequency	= 25-yr	Time to Peak	= 15.63 hrs
Time Interval	= 2 min	Runoff Volume	= 129 cuft
Drainage Area	= 0.5 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 5.99 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

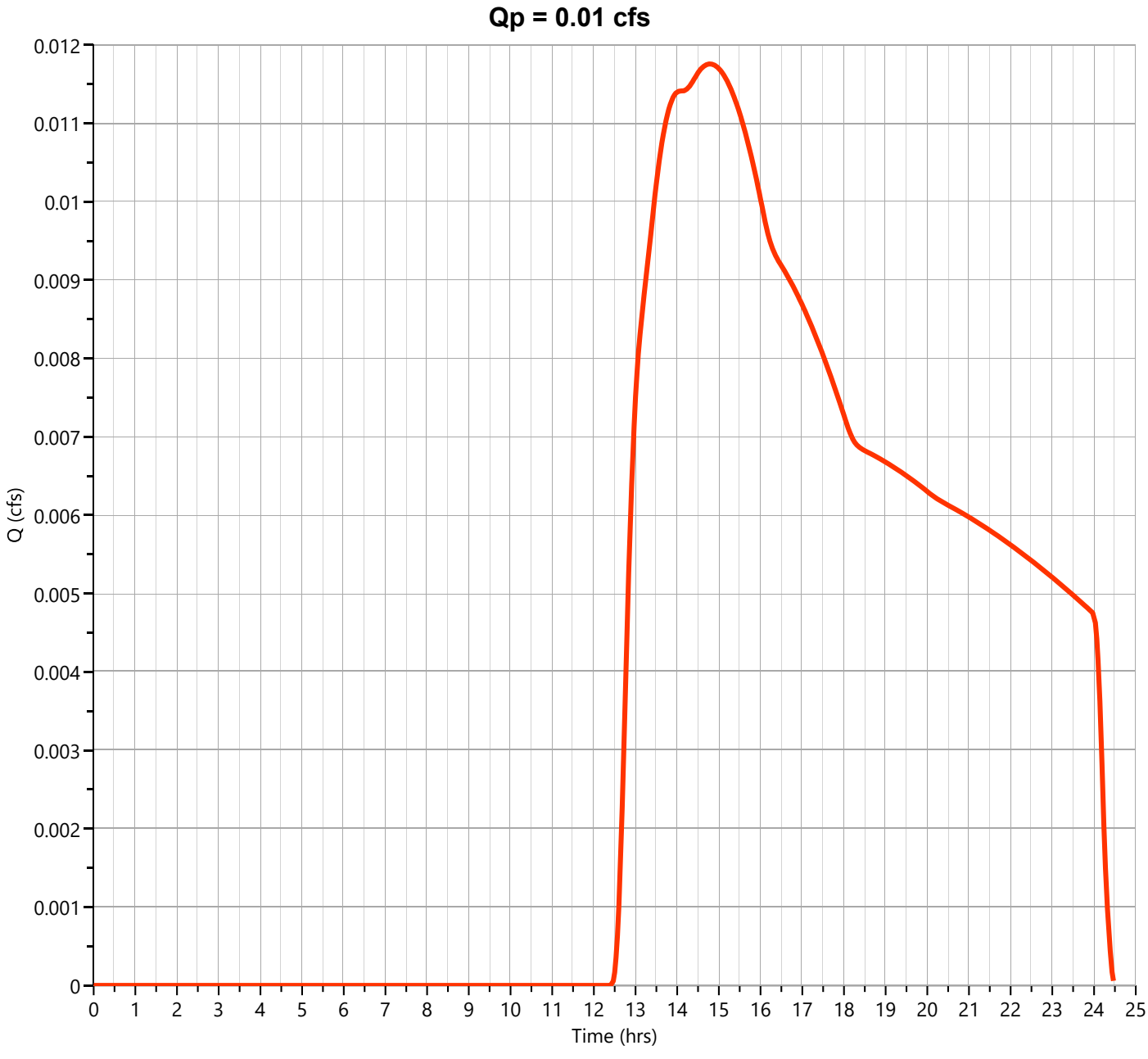
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-2B

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.012 cfs
Storm Frequency	= 50-yr	Time to Peak	= 14.80 hrs
Time Interval	= 2 min	Runoff Volume	= 319 cuft
Drainage Area	= 0.5 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 6.78 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

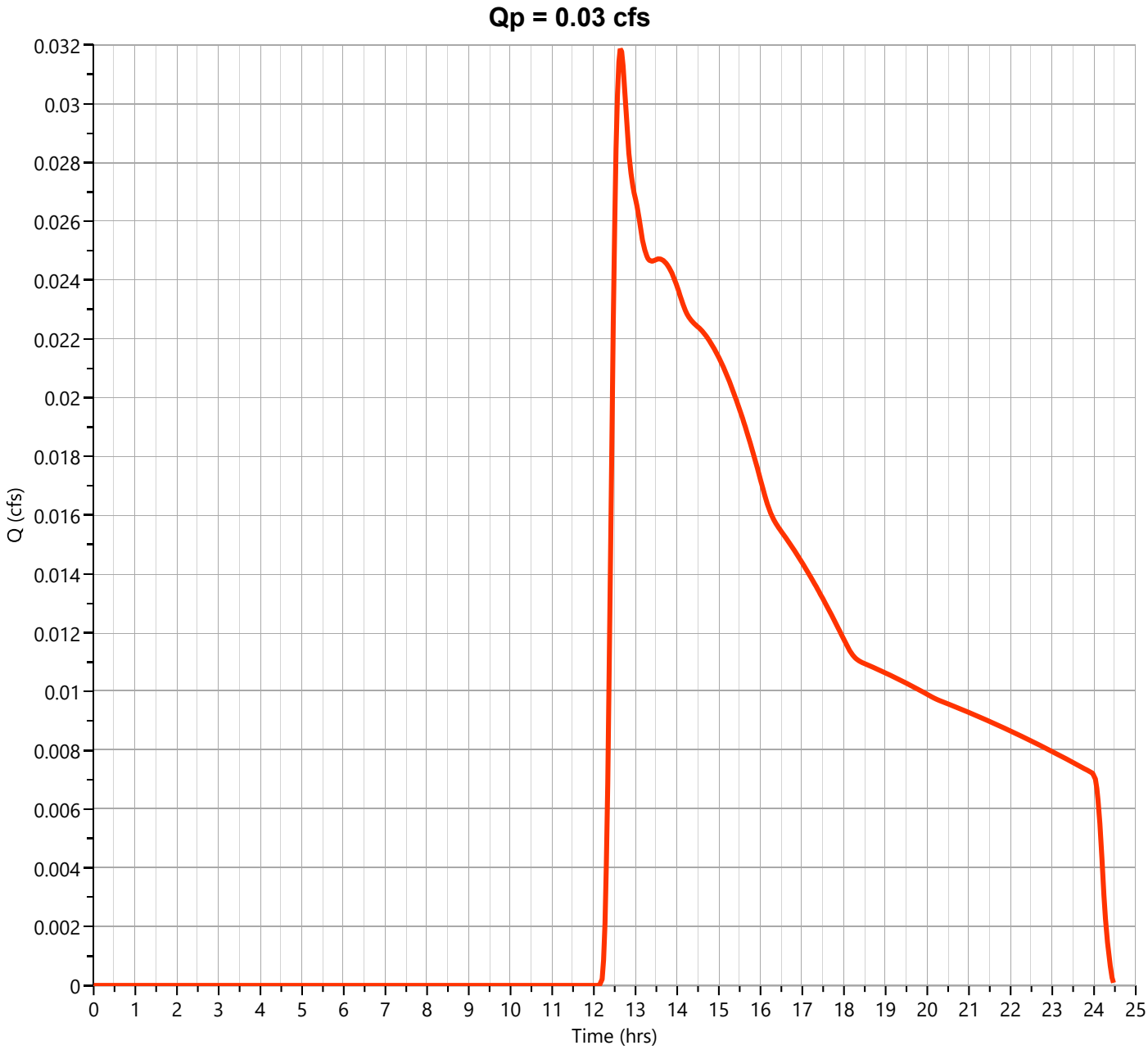
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-2B

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.032 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.63 hrs
Time Interval	= 2 min	Runoff Volume	= 614 cuft
Drainage Area	= 0.5 ac	Curve Number	= 30
Tc Method	= User	Time of Conc. (Tc)	= 17.9 min
Total Rainfall	= 7.65 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

P-2 Total

Hyd. No. 13

Hydrograph Type	= Junction	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrographs	= 11, 12	Total Contrib. Area	= 0.5 ac

Qp = 0.00 cfs

Hydrograph Report

Project Name:

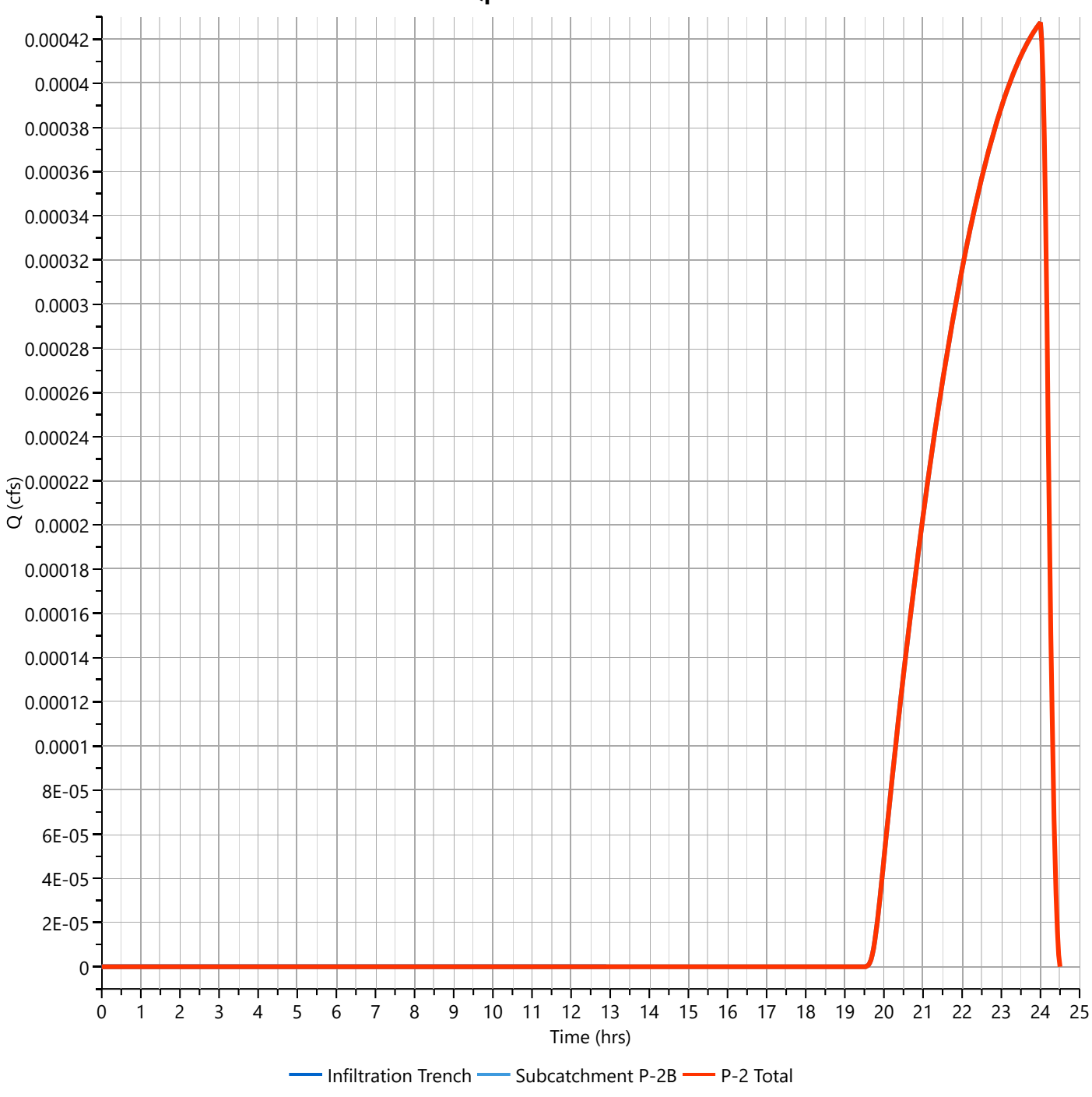
Hydrology Studio v 3.0.0.32

04-09-2024

P-2 Total

Hyd. No. 13

Hydrograph Type	= Junction	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 24.00 hrs
Time Interval	= 2 min	Hydrograph Volume	= 4.56 cuft
Inflow Hydrographs	= 11, 12	Total Contrib. Area	= 0.5 ac



Hydrograph Report

Project Name:

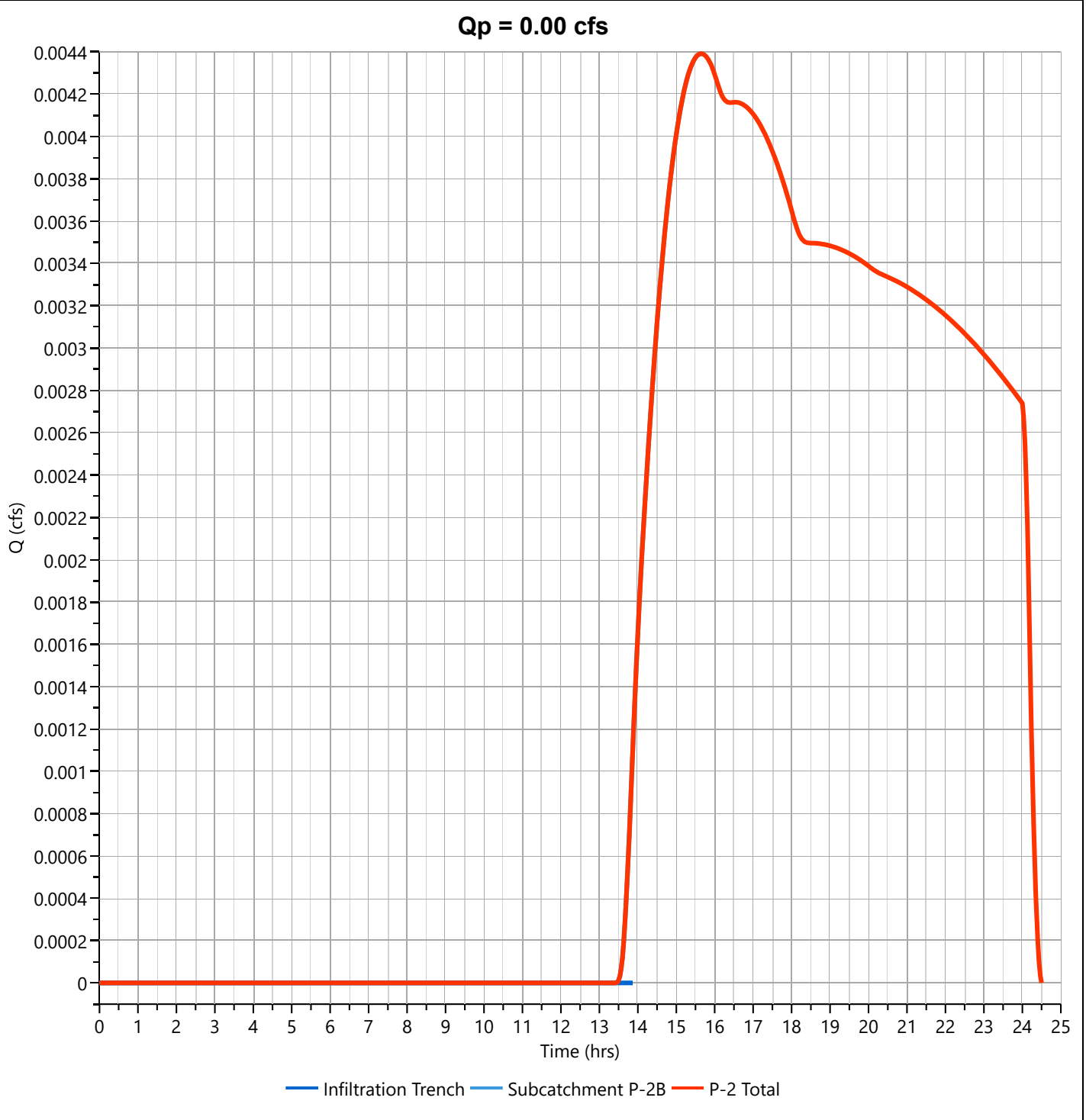
Hydrology Studio v 3.0.0.32

04-09-2024

P-2 Total

Hyd. No. 13

Hydrograph Type	= Junction	Peak Flow	= 0.004 cfs
Storm Frequency	= 25-yr	Time to Peak	= 15.63 hrs
Time Interval	= 2 min	Hydrograph Volume	= 129 cuft
Inflow Hydrographs	= 11, 12	Total Contrib. Area	= 0.5 ac



Hydrograph Report

Project Name:

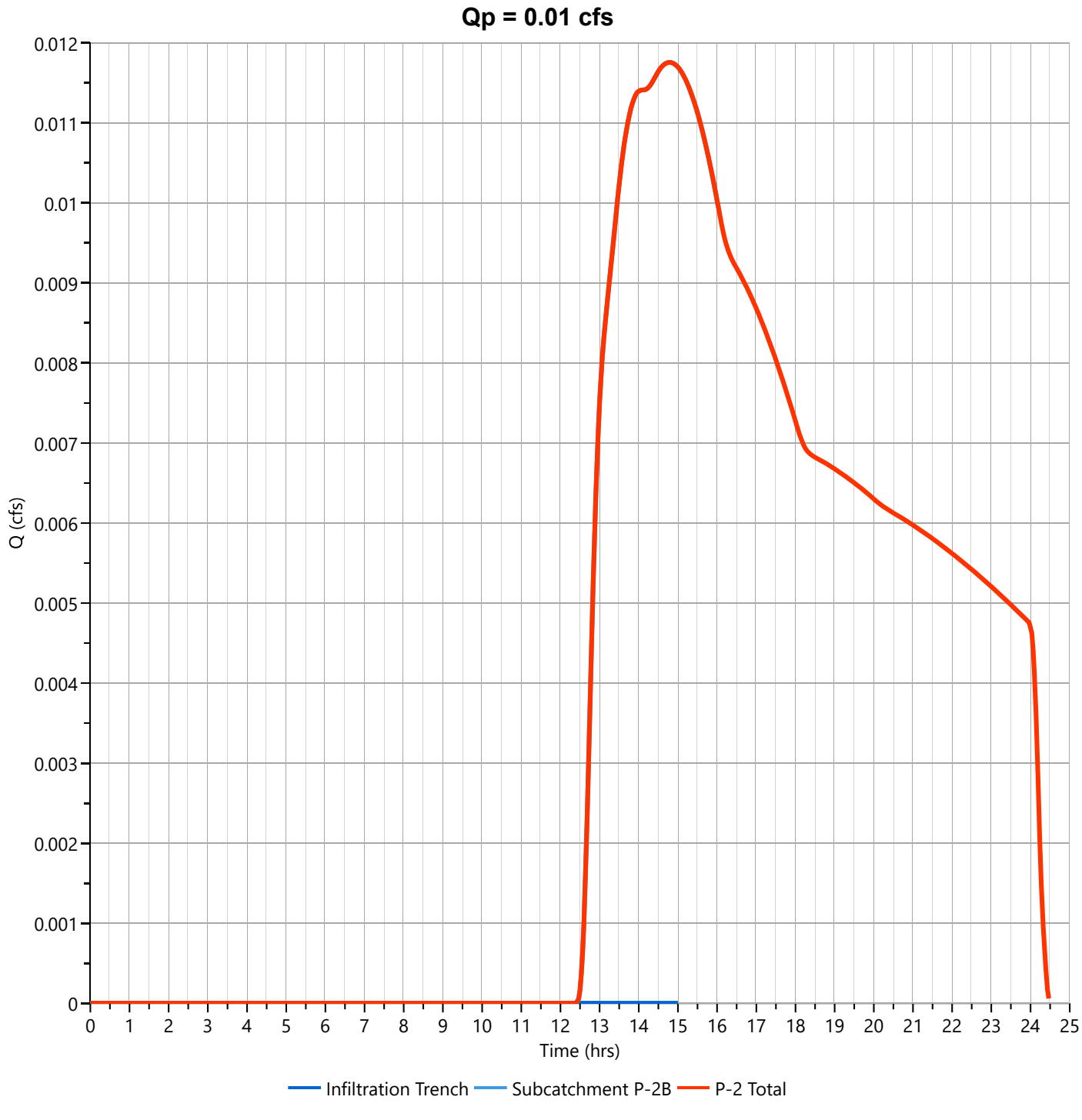
Hydrology Studio v 3.0.0.32

04-09-2024

P-2 Total

Hyd. No. 13

Hydrograph Type	= Junction	Peak Flow	= 0.012 cfs
Storm Frequency	= 50-yr	Time to Peak	= 14.80 hrs
Time Interval	= 2 min	Hydrograph Volume	= 319 cuft
Inflow Hydrographs	= 11, 12	Total Contrib. Area	= 0.5 ac



Hydrograph Report

Project Name:

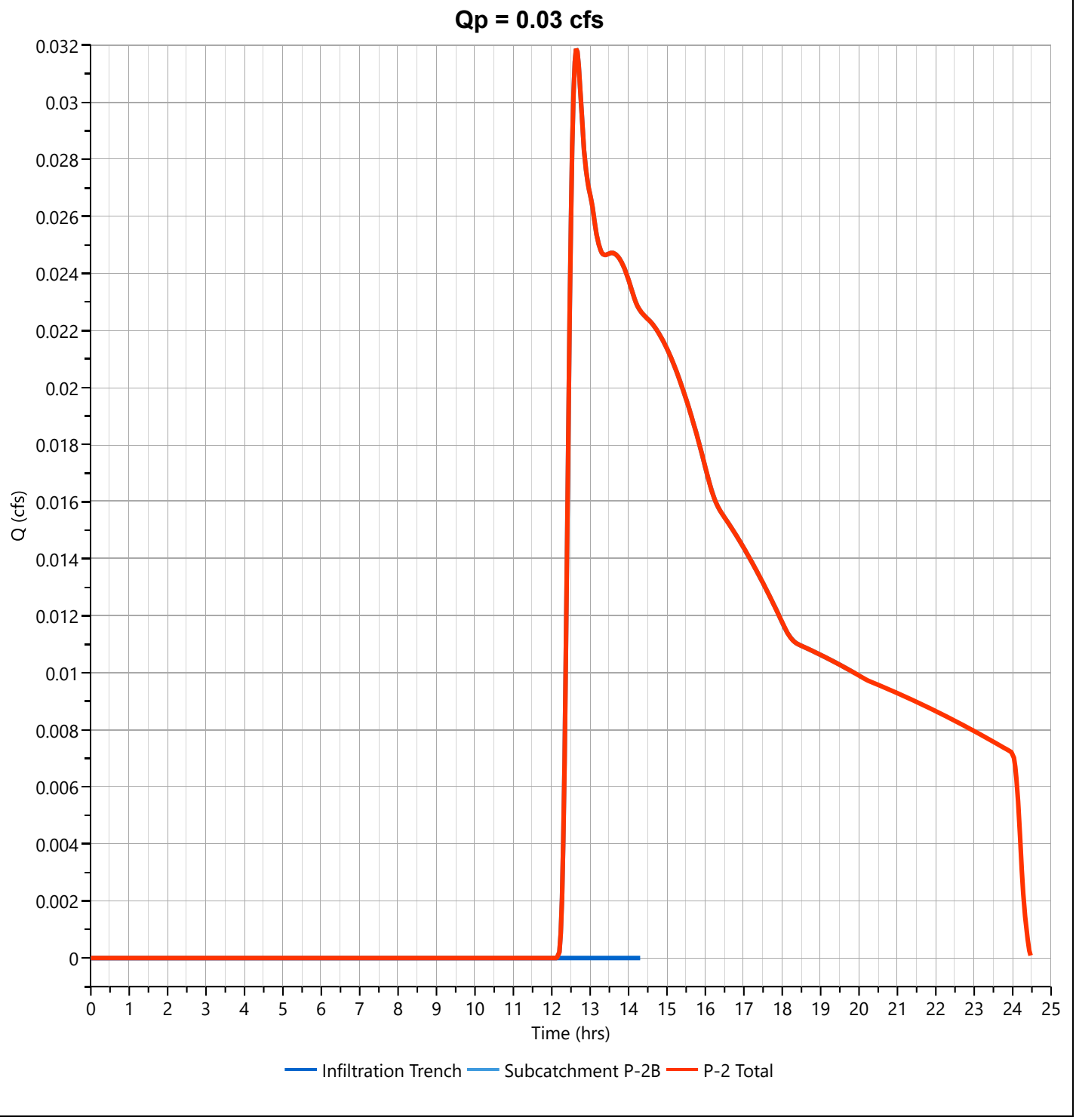
Hydrology Studio v 3.0.0.32

04-09-2024

P-2 Total

Hyd. No. 13

Hydrograph Type	= Junction	Peak Flow	= 0.032 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.63 hrs
Time Interval	= 2 min	Hydrograph Volume	= 614 cuft
Inflow Hydrographs	= 11, 12	Total Contrib. Area	= 0.5 ac



Worksheet 2: Runoff curve number and runoff **SM-7306**

Project: 95 Taylor Street By PFK Date 4/9/24

Location: Littleton, MA Checked Date

Circle one: Present [Developed] P-3

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious	98			0.00	0.00
A	Open Space-Good Condition	39			0.40	15.57
A	Woods- Good Condition	30			1.20	35.90
A	Residential Districts - 2 acres	46			0.00	0.00
A	Gravel	76			0.00	0.00
1/ Use only one CN source per line.				Totals =	1.60	51.46

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{51.46}{1.60} = 32.25$; Use CN = 32

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.18	4.91	7.65
Runoff, Q.....	in	0.05	0.02	0.49

(Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-7306

Project: 95 Taylor Street By PFK Date 4/9/2024

Location: Littleton, MA Checked _____ Date _____

Circle one: Present | Developed P-3

Circle one: Tc | Tt through subarea _____

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			WOODS			
2. Mannings roughness coeff., n (table 3-1)			0.6			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.02			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.29			0.29
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	259			
9. Watercourse slope, s		ft/ft	0.02			
10. Average Velocity, V (figure 3-1)		ft/s	2.28			
11. Tt = L / 3600V	Compute Tt	hr	0.03			0.03
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0.00

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.32
min 19.2

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-3

Hyd. No. 15

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 1.6 ac	Curve Number	= 32
Tc Method	= User	Time of Conc. (Tc)	= 19.2 min
Total Rainfall	= 3.18 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

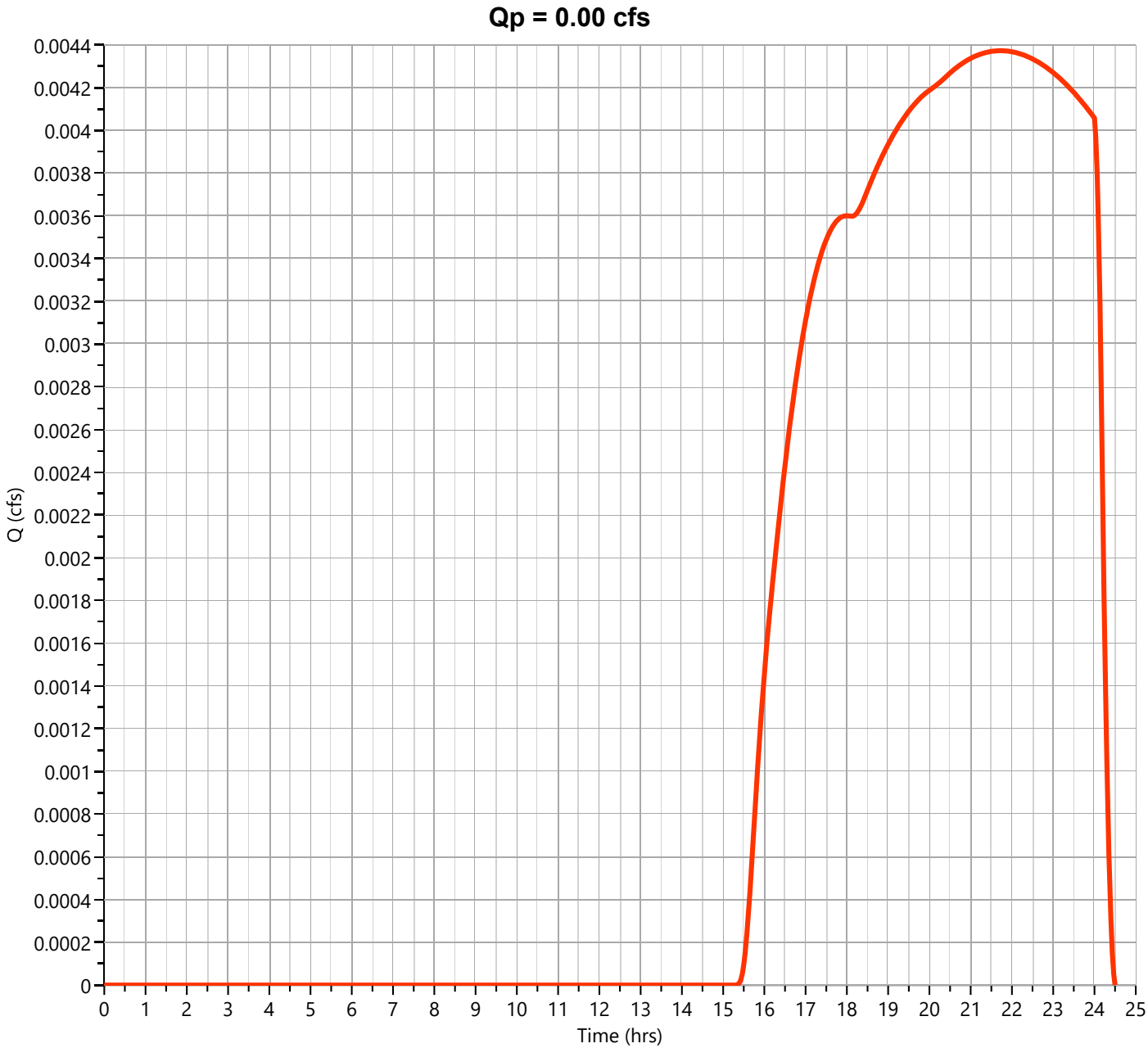
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-3

Hyd. No. 15

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.004 cfs
Storm Frequency	= 10-yr	Time to Peak	= 21.73 hrs
Time Interval	= 2 min	Runoff Volume	= 115 cuft
Drainage Area	= 1.6 ac	Curve Number	= 32
Tc Method	= User	Time of Conc. (Tc)	= 19.2 min
Total Rainfall	= 4.91 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

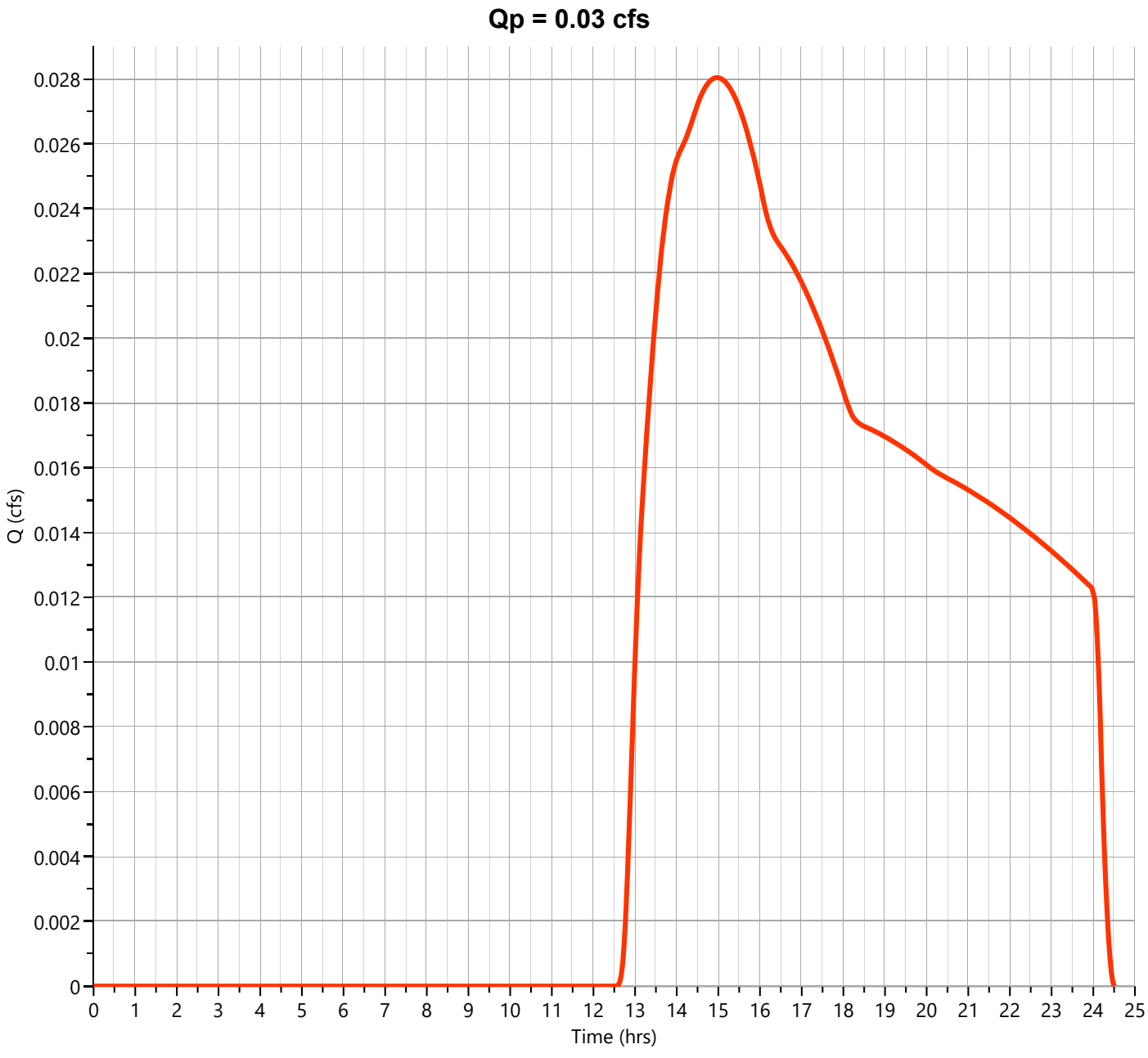
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-3

Hyd. No. 15

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.028 cfs
Storm Frequency	= 25-yr	Time to Peak	= 14.97 hrs
Time Interval	= 2 min	Runoff Volume	= 765 cuft
Drainage Area	= 1.6 ac	Curve Number	= 32
Tc Method	= User	Time of Conc. (Tc)	= 19.2 min
Total Rainfall	= 5.99 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

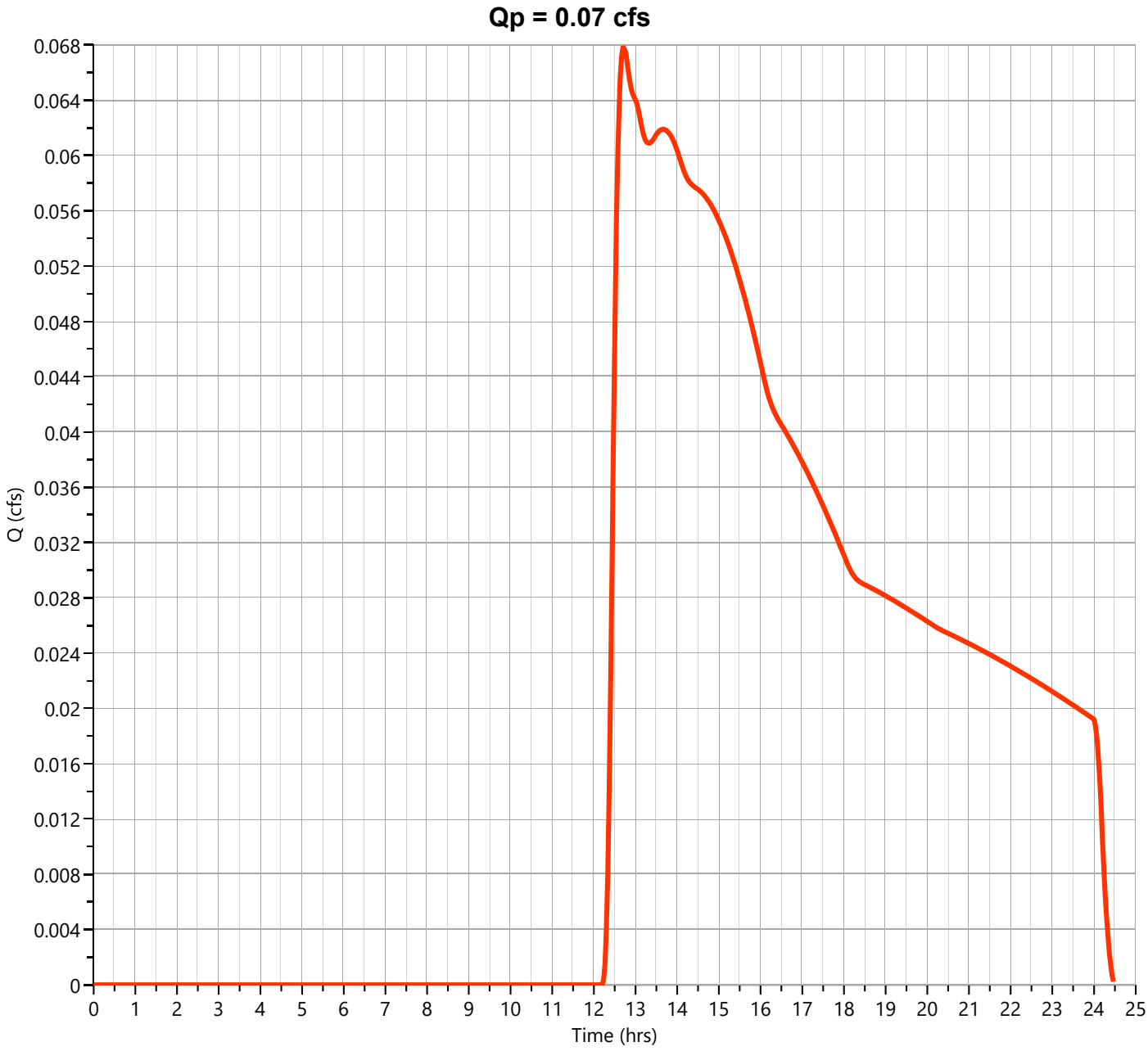
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-3

Hyd. No. 15

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.068 cfs
Storm Frequency	= 50-yr	Time to Peak	= 12.73 hrs
Time Interval	= 2 min	Runoff Volume	= 1,563 cuft
Drainage Area	= 1.6 ac	Curve Number	= 32
Tc Method	= User	Time of Conc. (Tc)	= 19.2 min
Total Rainfall	= 6.78 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

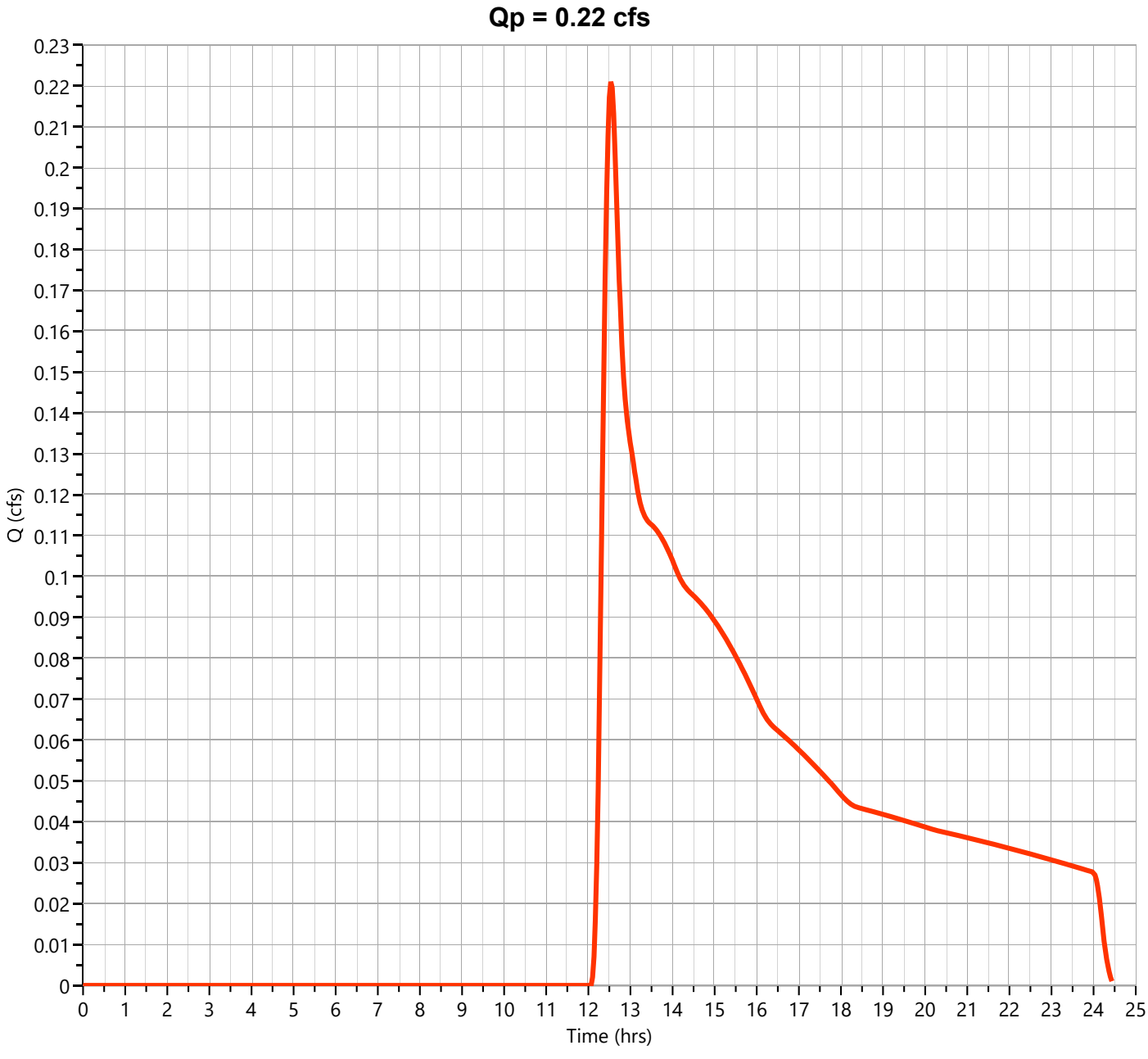
Hydrology Studio v 3.0.0.32

04-09-2024

Subcatchment P-3

Hyd. No. 15

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.221 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.53 hrs
Time Interval	= 2 min	Runoff Volume	= 2,723 cuft
Drainage Area	= 1.6 ac	Curve Number	= 32
Tc Method	= User	Time of Conc. (Tc)	= 19.2 min
Total Rainfall	= 7.65 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Existing Depression

Hyd. No. 16

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 15 - Subcatchment P-3	Max. Elevation	= 226.50 ft
Pond Name	= Existing Depression	Max. Storage	= 0.000 cuft

Pond Routing by Storage Indication Method

Qp = 0.00 cfs

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Existing Depression

Hyd. No. 16

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 15 - Subcatchment P-3	Max. Elevation	= 226.55 ft
Pond Name	= Existing Depression	Max. Storage	= 115 cuft

Pond Routing by Storage Indication Method

Qp = 0.00 cfs

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Existing Depression

Hyd. No. 16

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 15 - Subcatchment P-3	Max. Elevation	= 226.80 ft
Pond Name	= Existing Depression	Max. Storage	= 765 cuft

Pond Routing by Storage Indication Method

Qp = 0.00 cfs

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Existing Depression

Hyd. No. 16

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 50-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 15 - Subcatchment P-3	Max. Elevation	= 227.05 ft
Pond Name	= Existing Depression	Max. Storage	= 1,563 cuft

Pond Routing by Storage Indication Method

Qp = 0.00 cfs

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Existing Depression

Hyd. No. 16

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 15 - Subcatchment P-3	Max. Elevation	= 227.24 ft
Pond Name	= Existing Depression	Max. Storage	= 2,723 cuft

Pond Routing by Storage Indication Method

Qp = 0.00 cfs

Pond Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

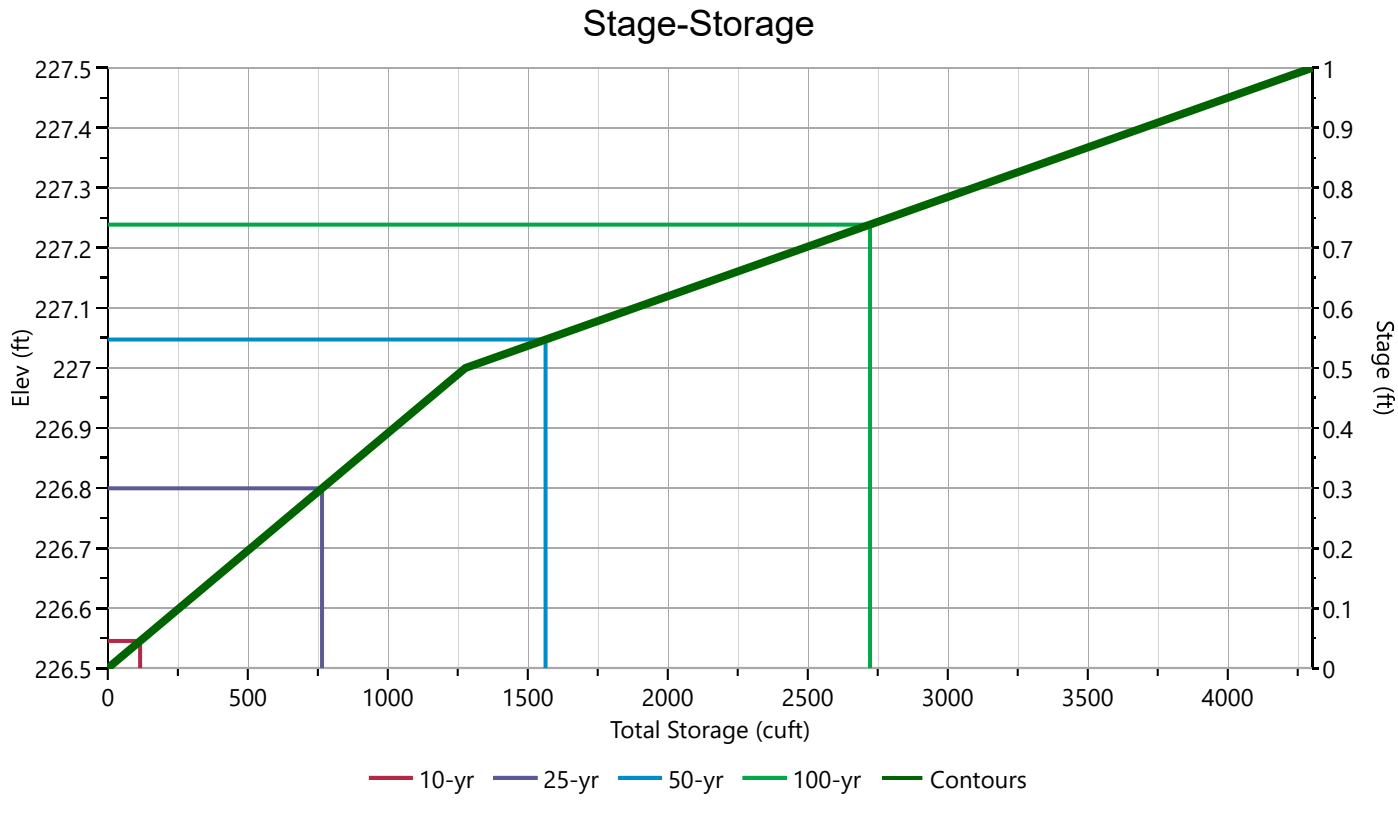
Existing Depression

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	226.50
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	226.50	1,022	0.000	0.000
0.50	227.00	4,087	1,277	1,277
1.00	227.50	8,012	3,025	4,302



Pond Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Existing Depression

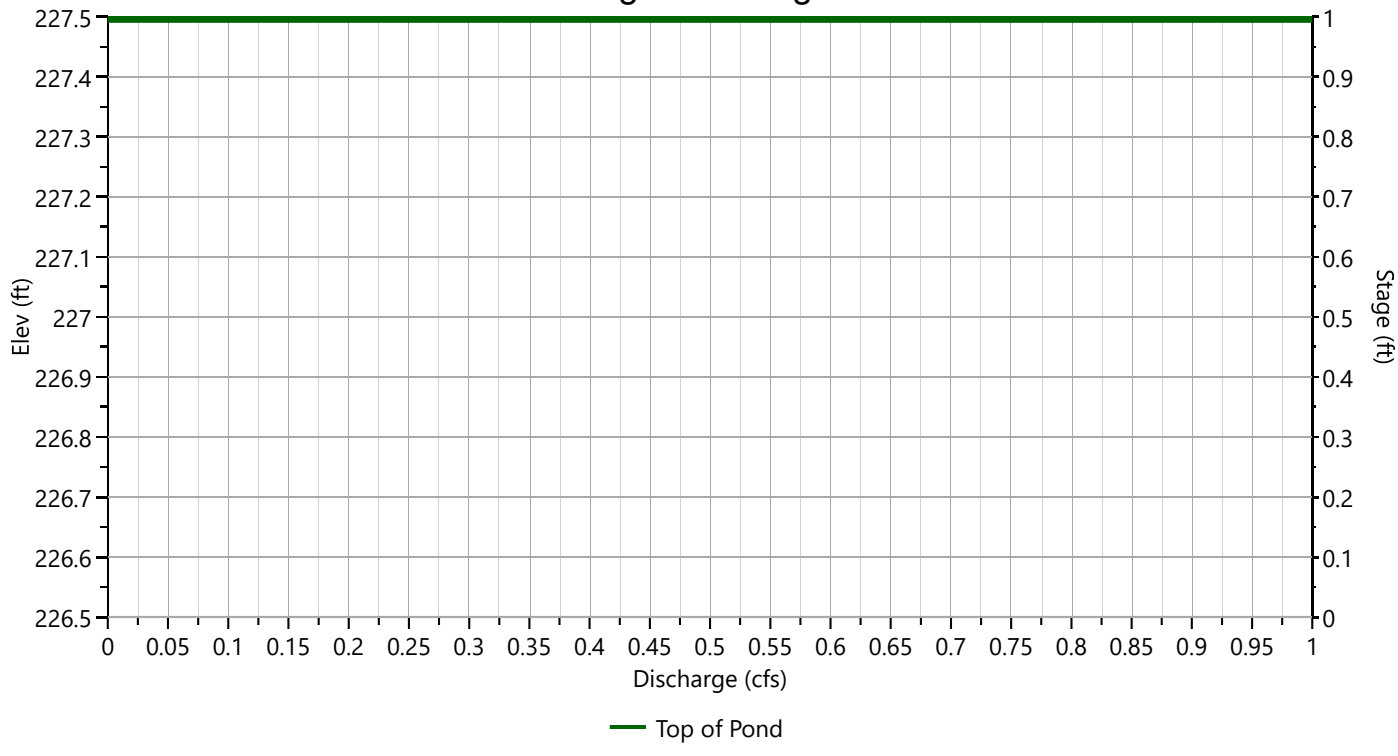
Stage-Discharge

Culvert / Orifices	Culvert	Orifice		
		1	2	3
Rise, in				
Span, in				
No. Barrels				
Invert Elevation, ft				
Orifice Coefficient, Co				
Length, ft				
Barrel Slope, %				
N-Value, n				

Perforated Riser	
Hole Diameter, in	
No. holes	
Invert Elevation, ft	
Height, ft	
Orifice Coefficient, Co	

Weirs	Riser	Weir		
		1	2	3
Shape / Type				
Crest Elevation, ft				
Crest Length, ft				
Angle, deg				
Weir Coefficient, Cw				

Ancillary	
Exfiltration, in/hr	



Pond Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Existing Depression

Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	226.50	0.000												0.000
0.50	227.00	1,277												0.000
1.00	227.50	4,302												0.000

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond Report

Project Name:

Hydrology Studio v 3.0.0.32

04-09-2024

Existing Depression

Pond Drawdown

Recharge Volume Calculations

Recharge Volume Calculations

Job: SM-7306

Calculated PFK
Date: 4/9/2024

INFILTRATION BASIN

Soils: Sand
Hydrologic A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious 0.24 acres
10,311 s.f.

Required Recharge Volume (Rv)

$$Rv = 10{,}311 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{516\ c.f.}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	3	ft				
saturated hydraulic conductivity):	8.27	inches/hour				
	0.69	feet/hour				
T (time):	2	hours				
A=	589	s.f.				
Voids=	1.00					
Rv=	2,579	c.f.		>	516	c.f.
Basin Volume:	4,456	c.f.	(Below Outlet)			

72 Hour Drawdown
Rv/(K x Bottom Area)= 10.98 Hours
10.98 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-7306

Calculated PFK
Date: 4/9/2024

Infiltration Trench

Soils: Sand
Hydrologic A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious 0.00 acres
0 s.f.

Required Recharge Volume (Rv)

$$Rv = \frac{0 \text{ s.f.} \times 0.6}{12} = \mathbf{0} \text{ c.f.}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	1.5	ft			
saturated hydraulic conductivity):	8.27	inches/hour			
	0.69	feet/hour			
T (time):	2	hours			
A=	85	s.f.			
Voids=	0.40				
Rv=	168	c.f.	>	0	c.f.
Basin Volume:	51	c.f.			

72 Hour Drawdown
Rv/(K x Bottom Area)= 0.87 Hours
0.87 < 72 hours O.K.

Water Quality Volume Calculations

Water Quality Volume Calculations

Job: SM-7306

Calculated by: PFK
Date: 4/9/2024

INFILTRATION BASIN
Soils: Sand
Hydrologic A
Required First Flush Volume
1 inch of runoff x impervious area

Impervious 0.24 acres
10,311 s.f.

Required Water Quality Volume

$$V = \frac{10{,}311 \text{ s.f.} \times 1}{12} = \mathbf{859 \text{ c.f.}}$$

Volume Pr 4,456 c.f.

4,456	**c.f. >**	**859**	**c.f. O.K.**

Water Quality Volume Total

Job: **SM-7306**

Calculated by: PFK
Date: 4/9/2024

Required Recharge Volume

Total Impervious Area: 0.43 acres
18,711 s.f.

1.) Retain the volume equivalent to 1" runoff (4.1.3.5.2)

Rv = 18,711 s.f. x $\frac{1}{12}$ = **1,559 c.f.**

= **1,559 c.f.**

Total Storage Provided

INFILTRATION BASIN	=	4,456 c.f.
Roof Drywell A	=	654
Roof Drywell B (4 proposed)	=	1,196
Total Volume Retained	=	**6,306 c.f.**

6,306 c.f. > 1,559 c.f. OK

Phosphorus Reduction Calculations

Phosphorus Load Reduction

Date:	4/9/2024		
Project Location:	95 Taylor Street; Littleton, MA		
Method:	Infiltration Basin (8.27 in/hr)		
Impervious Area:	0.24	acres	16384896 square inches
Pervious Area:	0.92	acres	
Soil type of Receiving Pervious Area	HSG A		
Total Storage in Infiltration Basin	4,456	c.f.	7699968 cubic inches
BMP Capacity: Depth of Runoff Treated from Impervious Area (inches)	0.5	inches	
TP Reduction:	96%	(taken from Table 3-17: Surface Infiltration (8.27 in/hr) BMP Performance Table in Appendix F of the MA MS4 General Permit)	

BMP Subarea ID	Land Use Category	Cover Type	Area (acres)	P export rate (lb/acre/yr)
P-1A	Low Density Residential (LDR)	impervious	0.24	1.52

BMP Load: 0.359796 lbs P/year

TP Reduction (lbs P/year) =	96% of 0.360 lbs P/year=	**0.345 lbs P/year**

Sediment Forebay Sizing Calculations

Sediment Forebay Sizing Calculations

Job: SM-7306

Calculated PFK
Date: 4/9/2024

Forebay via DMH-1

	Elevation	Area (s.f.)	Volume (c.f.)
Sediment forebay Sizing	227	61	
0.1 inches of runoff x impervious area	228	145	**103**

Impervious 0.11 acres
4,686 s.f.

Required Sediment Forebay Size

$$V = 4{,}686 \text{ s.f.} \times \frac{0.1}{12} = \mathbf{39} \text{ c.f.}$$

Provided 103 c.f.

103 c.f. > 39 c.f. O.K.

Forebay via DMH-2

	Elevation	Area (s.f.)	Volume (c.f.)
Sediment forebay Sizing	227	97	
0.1 inches of runoff x impervious area	228	195	**146**

Impervious 0.13 acres
5,625 s.f.

Required Sediment Forebay Size

$$V = 5{,}625 \text{ s.f.} \times \frac{0.1}{12} = \mathbf{47} \text{ c.f.}$$

Provided 146 c.f.

146 c.f. > 47 c.f. O.K.

Pipe Sizing Calculations

DESIGN STORM: 100 YEAR
DATE: **4/9/2024**
DONE BY: PFK
FILE: SM-7306

STORM SEWER DESIGN

(ADS N-12)"n"= 0.012 4"-10"
(ADS N-12)"n"= 0.012 12"-36"
(ADS N-12)"n"= 0.012 42"-60"
(Cast Iron)"n"= 0.011

PROJECT: SM-7306
LOCATION: Littleton, MA

FROM	TO	LENGTH (FT)	TRIBUTARY AREA		TIME OF FLOW		RUNOFF COEFF. "C"	RAINFALL INTENSITY (IN/HR)	"Q" TOTAL RUNOFF (CFS)	SLOPE of PIPE (FT/FT)	DIAM (IN)	MANN. "n"	CAPACITY FULL (CFS)	VELOCITY FULL (FPS)	DESIGN FLOW				MANHOLE INVERT DROP (FT)	FALL IN PIPE (FT)	DRAIN INV. ELEVATION	
			INCR. (ACRES)	TOTAL (ACRES)	TO UPPER END (MIN)	TIME IN SECTION (MIN)									VELOCITY (FPS)	VELOCITY HEAD (FT)	DEPTH OF FLOW (FT)	TOTAL ENERGY HEAD (FT)			UPPER END	LOWER END
AD-1	DMH-1	7	0.27	0.27	10	0.02	0.48	7.6	0.98	0.029	12	0.012	6.51	8.29	5.95	0.55	0.26	0.81		0.20	227.50	227.30
DMH-1	BASIN	12	0.00	0.27	10	0.04	0.48	7.6	0.98	0.017	12	0.012	4.97	6.34	4.92	0.38	0.30	0.68		0.20	227.20	227.00
AD-2	DMH-2	12	0.14	0.14	10	0.07	0.39	7.6	0.42	0.008	12	0.012	3.52	4.48	2.99	0.14	0.23	0.37		0.10	227.30	227.20
AD-3	DMH-2	59	0.33	0.33	10	0.22	0.39	7.6	0.98	0.014	12	0.012	4.49	5.71	4.55	0.32	0.32	0.64		0.80	228.00	227.20
DMH-2	BASIN	12	0.00	0.47	10	0.05	0.39	7.6	1.40	0.008	12	0.012	3.52	4.48	4.21	0.27	0.44	0.71		0.10	227.10	227.00

Closed Drainage System **SM-7306**

Project: Strawberry Farms By PFK Date 4/9/2024

Location: Littleton, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs) i = rainfall intensity inches/hour

C = runoff coefficient, A = area (ac)
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

AD-1 TO DMH-1

Surface Cover	A (ac)	C	Product A x C
impervious	0.11	0.9	0.096818
lands/grass	0.16	0.2	0.031561
woods	0.00	0.15	0
sum =	0.27	sum =	0.13

C = **0.48** = total product / total area

DMH-1 TO BASIN

Surface Cover	A (ac)	C	Product A x C
impervious	0.11	0.9	0.096818
lands/grass	0.16	0.2	0.031561
woods	0.00	0.15	0
sum =	0.27	sum =	0.13

C = **0.48** = total product / total area

Closed Drainage System **SM-7306** 2 of 2

Project: Strawberry Farms By PFK Date 4/9/2024

Location: Littleton, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs) i = rainfall intensity inches/hour

C = runoff coefficient, A = area (ac)
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

AD-2 TO DMH-2

Surface Cover	A (ac)	C	Product A x C
impervious	0.04	0.9	0.034132
lands/grass	0.10	0.2	0.020886
woods	0.00	0.15	0
sum =	0.14	sum =	0.06

C = **0.39** = total product / total area

AD-3 TO DMH-2

Surface Cover	A (ac)	C	Product A x C
impervious	0.09	0.9	0.082087
lands/grass	0.24	0.2	0.047277
woods	0.00	0.15	0
sum =	0.33	sum =	0.13

C = **0.39** = total product / total area

DMH-2 TO BASIN

Surface Cover	A (ac)	C	Product A x C
impervious	0.13	0.9	0.116219
lands/grass	0.34	0.2	0.068163
woods	0.00	0.15	0
sum =	0.47	sum =	0.18

C = **0.39** = total product / total area

Inlet Grate Capacity Calculations

Job: SM-7306

Calculated by: PFK

Date: 4/12/2024

Neenah Foundry R-4353 Beehive (9" height) 259 sq. in.

1.80 sq. ft.

Q = (C*A* SQRT(2*g*h))*f

C = orifice coefficient

C = 0.6 square edges

A = inlet area

A = 1.80 sq. ft.

g = gravitational constant

g = 32.2 ft/sec^2

h = head on inlet

h = 0.75 ft. (low points)

f = clogging factor

f = 0.66

Single Grate

Q (MAX)= 4.95 cfs (LP) low points

*DATA USED IN TABLE TAKEN FROM STORM SEWER DESIGN 100YR.

	TRIBUTARY	TIME OF	100 YR		Q=CiA			single	double
	AREA (AC)	CONC.	INTENSITY	C	Q100	POSITION	Q (MAX)	grate	grate
AD-1	0.27	10	7.6	0.48	0.98	LP	4.95	yes	
AD-2	0.14	10	7.6	0.39	0.42	LP	4.95	yes	
AD-3	0.33	10	7.6	0.39	0.98	LP	4.95	yes	

Drainage Maps

LEGEND:

A ● — ● B TIME OF CONCENTRATION

SUBCATCHMENT DIVIDE

ANALYSIS POINT

EDGE OF BORDERING VEGETATED WETLAND AS DELINEATED BY B&C ASSOCIATES DELINEATION DATE: MAY 2023

FLOOD PLAIN BASE FLOOD ELEVATION=225.2 LOCATION FROM FIELD SURVEY

APPROXIMATE CENTERLINE BEAVER BROOK

N/F TOWN OF LITTLETON (DEED BOOK 49886 PAGE 425)

TIE LINE: N25°17'08"E 435.41'

TIE LINE: N55°56'26"E 344.70'

TIE LINE: N25°39'10"E 218.18'

N56°40'30"E 250.05'

N/F

300.00'

300.00'

86.50'

15.00'

ANALYSIS POINT 2

N/F LI & MAK (DEED BOOK 71164 PAGE 243)

REBAR FOUND

MAGNETIC NAIL FOUND

255.00'

86.89'

REBAR FOUND

S63°04'42"E 160.00'

CONCRETE BOUND/ DRILL HOLE FOUND

S56°49'31"E 100.00'

100' BUFFER ZONE

SUBCATCHMENT E-2

SUBCATCHMENT E-3

SUBCATCHMENT E-1

N/F PROULX (DEED BOOK 79028 PAGE 122)

N

S30°10'28"E 268.00'

N/F CALLANAN (DEED BOOK 58145 PAGE 78)

N10°22'21"E 285.32'

ANALYSIS POINT 1

FLOOD PLAIN BASE FLOOD ELEVATION=225.2 LOCATION FROM FIELD SURVEY

S65°41'00"W 797.07'

N/F HSU & PHOUN (DEED BOOK 65095 PAGE 561)

S10°00'00"W 149.97'

CONCRETE BOUND/ DRILL HOLE FOUND

TAYLOR STREET (PUBLIC - VARIABLE WIDTH)

CENTER STONE BOUND FOUND

S10°00'00"W 82.00'

APPROXIMATE CATCH BASIN

ELEC METER

EXISTING 2 STORY W/ F DWELLING #95

DECK

GARAGE

BARN

GARDEN

GRAVEL DRIVEWAY

ATT POLE

UTILITY NOTE:

ALL UNDERGROUND UTILITIES SHOWN HERE WERE COMPILED ACCORDING TO AVAILABLE RECORD PLANS FROM VARIOUS UTILITY COMPANIES AND PUBLIC AGENCIES AND ARE APPROXIMATE ONLY. ACTUAL LOCATIONS MUST BE DETERMINED IN THE FIELD BEFORE DESIGNING, EXCAVATING, BLASTING, INSTALLING, BACKFILLING, GRADING, PAVEMENT RESTORATION OR REPAIRING. ALL UTILITY COMPANIES, PUBLIC AND PRIVATE, MUST BE CONTACTED INCLUDING THOSE IN CONTROL OF UTILITIES NOT SHOWN ON THIS PLAN. SEE CHAPTER 370, ACTS OF 1963 MASS. WE ASSUME NO RESPONSIBILITY FOR DAMAGES INCURRED AS A RESULT OF UTILITIES OMITTED OR INACCURATELY SHOWN. BEFORE PLANNING FUTURE CONNECTIONS THE APPROPRIATE PUBLIC UTILITY ENGINEERING DEPARTMENT MUST BE CONSULTED. DIG SAFE TELEPHONE No. 1-888-344-7233.

DEFINITIVE SUBDIVISION
STRAWBERRY FARMS
IN
LITTLETON, MASSACHUSETTS
(MIDDLESEX COUNTY)

PRE-DEVELOPMENT DRAINAGE MAP

FOR: SEAL HARBOR COMPANIES, LLC

SCALE: 1"=40' FEBRUARY 20, 2024

REVISED: APRIL 9, 2024

STAMSKI AND MCNARY, INC.
1000 MAIN STREET ACTON, MASSACHUSETTS
ENGINEERING - PLANNING - SURVEYING

0 20 40 80 120 160 FT

(7306.DEFSUB.2B.dwg) SM-7306 SHEET OF 8

LEGEND:

A ● — ● B TIME OF CONCENTRATION
SUBCATCHMENT DIVIDE
ANALYSIS POINT

EDGE OF BORDERING VEGETATED WETLAND
AS DELINEATED BY B&C ASSOCIATES
DELINEATION DATE: MAY 2023

FLOOD PLAIN
BASE FLOOD ELEVATION=225.2
LOCATION FROM FIELD SURVEY

APPROXIMATE CENTERLINE BEAVER BROOK

N56°40'30"E 250.05'

300.00'

300.00'

86.50'

15.00'

REBAR FOUND

MAGNETIC NAIL FOUND

ANALYSIS POINT 2

255.00'

86.89'

REBAR FOUND

S67°04'42"E 160.00'

CONCRETE BOUND/ DRILL HOLE FOUND

100' BUFFER ZONE

S56°49'31"E 100.00'

SUBCATCHMENT P-2A

SUBCATCHMENT P-2B

SUBCATCHMENT P-3

SUBCATCHMENT P-1A

TIE LINE: N55°56'26"E 344.70'

TIE LINE: N25°17'09"E 435.41'

TIE LINE: N25°59'10"E 218.18'

S10°10'28"E 268.00'

N10°22'21"E 285.32'

TAYLOR STREET
(PUBLIC - VARIABLE WIDTH)

CENTER STONE BOUND FOUND

APPROXIMATE CATCH BASIN

ATT POLE

FLOOD PLAIN
BASE FLOOD ELEVATION=225.2
LOCATION FROM FIELD SURVEY

ANALYSIS POINT 1

SUBCATCHMENT P-1B

S89°11'00"W 797.07'

S10°00'00"W 82.00'

S10°00'00"W 149.97'

CONCRETE BOUND/ DRILL HOLE FOUND

UTILITY NOTE:

ALL UNDERGROUND UTILITIES SHOWN HERE WERE COMPILED ACCORDING TO AVAILABLE RECORD PLANS FROM VARIOUS UTILITY COMPANIES AND PUBLIC AGENCIES AND ARE APPROXIMATE ONLY. ACTUAL LOCATIONS MUST BE DETERMINED IN THE FIELD BEFORE DESIGNING, EXCAVATING, BLASTING, INSTALLING, BACKFILLING, GRADING, PAVEMENT RESTORATION OR REPAIRING. ALL UTILITY COMPANIES, PUBLIC AND PRIVATE, MUST BE CONTACTED INCLUDING THOSE IN CONTROL OF UTILITIES NOT SHOWN ON THIS PLAN. SEE CHAPTER 370, ACTS OF 1963 MASS. WE ASSUME NO RESPONSIBILITY FOR DAMAGES INCURRED AS A RESULT OF UTILITIES OMITTED OR INACCURATELY SHOWN. BEFORE PLANNING FUTURE CONNECTIONS THE APPROPRIATE PUBLIC UTILITY ENGINEERING DEPARTMENT MUST BE CONSULTED. DIG SAFE TELEPHONE No. 1-888-344-7233.

DEFINITIVE SUBDIVISION
STRAWBERRY FARMS
IN
LITTLETON, MASSACHUSETTS
(MIDDLESEX COUNTY)

POST-DEVELOPMENT DRAINAGE MAP

FOR: SEAL HARBOR COMPANIES, LLC
SCALE: 1"=40' FEBRUARY 20, 2024
REVISED: APRIL 9, 2024

STAMSKI AND MCNARY, INC.
1000 MAIN STREET ACTON, MASSACHUSETTS
ENGINEERING - PLANNING - SURVEYING

0 20 40 80 120 160 FT

(7306.DEFSUB.2B.dwg) SM-7306 SHEET OF 8

Stormwater Operation and Maintenance Manual

Stormwater Operation and Maintenance Manual

For

Strawberry Farms

Map U40, Parcel 8
95 Taylor Street
Littleton, MA

February 12, 2024
Revised: April 9, 2024

Responsible Party:

Applicant: Seal Harbor Companies, LLC.
P.O. Box 2857
Acton, MA 01720

SM-7306

Stamski And McNary, Inc.
Engineering - Planning – Surveying
1000 Main Street; Acton, MA 01720 (978) 263-8585
www.stamskiandmcnary.com

Table of Contents

Long Term Operation and Maintenance Plan

Schedule for Inspection and Maintenance:

Street Sweeping:
It is recommended that the pavement shall be properly swept twice a year, with concentrations in the spring and the fall.

Deep Sump and Hooded Catch Basins and Drain Manholes:
During construction, catch basin grates shall be wrapped with filter fabric. Catch basins shall be cleaned upon the completion of construction. After construction, the deep sumps for all catch basins and drain manholes shall be inspected four times a year and cleaned four times a year. Sediment removed shall be disposed of in accordance with applicable local, state, and federal guidelines and regulations. The depth of the sediment in a basin shall not exceed a depth of 18 inches as determined by probing with a stick. If the stick hits the bottom within 30 inches of the water level, more than 18 inches of sediment has accumulated and must be removed. Licensed persons should remove and dispose of the contents of the sump in accordance with applicable regulations.

Roof Drywells:
Inspect the system after every major storm for the first few months to ensure proper stabilization and function. Thereafter, inspect and clean it at least twice per year.
Water levels should be recorded over several days to check the structures drainage.
Also mosquito controls may be necessary. See manufacturer's specifications.

Sediment Forebays:
The floor and sidewalls of the sediment forebay must be stabilized before use. Sediment forebays shall be inspected monthly and cleaned a minimum of four times per year and when sediment depth is between 3-6 inches. After sediment removal, any damaged vegetation must be replaced. Grass in the forebay shall not exceed 6 inches in length and any scouring and gullying shall be repaired as necessary.

Infiltration Basin:
Preventative maintenance should be performed at least twice a year, and ideally sediment should be removed from the sediment forebay after every major storm event. Sediment shall be disposed of in accordance with applicable local, state, and federal guidelines and regulations.
Once online, the basins shall be inspected after every major storm event (1" in 24 hours), for the first 3 months. Thereafter, the basin should be inspected at least twice per year. Important items to check for include: differential settlement, cracking, erosion, leakage, or tree growth on the embankments, condition of riprap, sediment accumulation and the health of the turf.
At least twice a year, the buffer area and side slopes of the basin should be mowed. Grass clippings and accumulated organic matter should be removed to prevent the formation of an impervious organic mat. Trash and debris should also be removed at this time. Scarify bottom area and add additional sand if necessary.
Sediment should be removed from the basin as necessary. Removal procedures should not take place until the floor of the basin is thoroughly dry. Pretreatment devices associated with basins should be inspected and cleaned at least twice a year and ideally every other month.
If ponding is observed within the basin 72 hours after a rainfall event, the basin needs to be rehabilitated. Rehabilitation of the basin includes the removal of clogged sand at the bottom of the basin and replacement in accordance with the detail provided on the design plan. After rehabilitation, the basin shall be inspected after every major storm event for the following 3 months to confirm proper basin function.

Infiltration Trenches:
Trenches shall be inspected annually. The filter fabric shall be inspected for excessive sediment build up. If appreciable amounts of sediment are observed the top layer of stone shall be moved aside and the filter fabric cleaned or replaced. The top layer of stone shall then be washed and placed over the filter fabric.
If ponding is observed within the trench 72 hours after a rainfall event, the trench needs to be rehabilitated. Rehabilitation of the trench includes the replacement of stone and filter fabric. After rehabilitation, the trench shall be inspected after every major storm event for the following 3 months to confirm proper basin function.

Emergency Contacts:
In the event of a hazardous materials spill on the site the following parties shall be contacted:
Fire Department: ph: 978-540-2302

Records:
The developer shall maintain an inspection log of all elements of the storm water management plan during construction and until the road is accepted by the Town. A copy of the erosion control and storm water maintenance plan and inspection logs shall be kept onsite at all times until acceptance of the road. Each individual lot owner shall also maintain records for private structures on their lot.

Responsible Party:
During construction, the developer shall be responsible for inspection and maintenance of all stormwater infrastructure.
Upon completion, the individual homeowners shall be responsible for the inspection and maintenance of the infiltration trenches and drywells on their lots. The homeowners shall share equal responsibility for the inspection and maintenance of the infiltration basins, sediment forebays, street sweeping, snow removal, catch basins, and drainage manholes.

Budget: The estimated annual operation and maintenance budget is $1,500.

Illicit Discharges: THERE WILL BE NO ILLICIT DISCHARGES ON SITE.

Name: _____

Signature: _____

Date: _____

12.0 Inspection & Maintenance

StormTech Isolator Row Plus - Step-by-Step Maintenance Procedures

Step 1: Inspect Isolator Row PLUS for sediment

A) Inspection ports (if present)
   i. Remove lid from floor box frame
   ii. Remove cap from inspection riser
   iii. Using a flashlight and stadia rod, measure depth of sediment
   iv. If sediment is at, or above, 3" (76 mm) depth proceed to Step 2. If not proceed to Step 3.

B) All Isolator Plus Rows
   i. Remove cover from manhole at upstream end of Isolator Row PLUS
   ii. Using a flashlight, inspect down Isolator Row PLUS through outlet pipe
      1. Follow OSHA regulations for confined space entry if entering manhole
      2. Mirrors on poles or cameras may be used to avoid a confined space entry
   iii. If sediment is at or above the lower row of sidewall holes [approximately 3" (76 mm)]proceed to Step 2. If not proceed to Step 3.

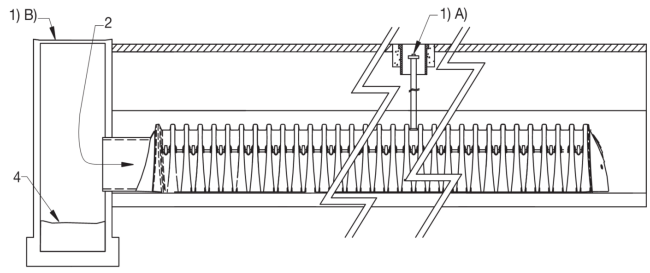
Step 2: Clean out Isolator Row PLUS using the JetVac process

A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45" (1125 mm) or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required during jetting

Step 3: Replace all caps, lids and covers

Step 4: Inspect and clean catch basins and manholes upstream of the StormTech system following local guidelines.

Figure 18 – StormTech Isolator Row Plus (not to scale)



12.3 Eccentric Pipe Header Inspection

Theses guidelines do not supercede a pipe manufacturer's recommended I&M procedures. Consult with the manufacturer of the pipe header system for specific I&M procedures. Inspection of the header system should be carried out quarterly. On sites which generate higher levels of sediment more frequent inspections may be necessary. Headers may be accessed through risers, access ports or manholes. Measurement of sediment may be taken with a stadia rod or similar device. Cleanout of sediment should occur when the sediment volume has reduced the storage area by 25% or the depth of sediment has reached approximately 25% of the diameter of the structure.

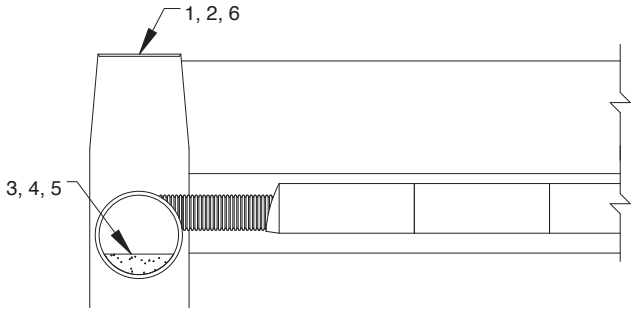
12.4 Eccentric Pipe Manifold Maintenance

Cleanout of accumulated material should be accomplished by vacuum pumping the material from the header. Cleanout should be accomplished during dry weather. Care should be taken to avoid flushing sediments out through the outlet pipes and into the chamber rows.

Eccentric Header Step-by-Step Maintenance Procedures

1. Locate manholes connected to the manifold system
2. Remove grates or covers
3. Using a stadia rod, measure the depth of sediment
4. If sediment is at a depth of about 25% pipe volume or 25% pipe diameter proceed to step 5. If not proceed to step 6.
5. Vacuum pump the sediment. Do not flush sediment out inlet pipes.
6. Replace grates and covers
7. Record depth and date and schedule next inspection

Figure 19 – Eccentric Manifold Maintenance



Please contact StormTech's Technical Services Department at 888-892-2894 for a spreadsheet to estimate cleaning intervals.

Operation and Maintenance Sample Inspection Log

Strawberry Farms

Operation and Maintenance Inspection Log

Year: _____

Inspection Items:	**Frequency:**
Street Sweeping:	**Twice per year**
Catch Basins:	**Four times per year**
Drywells:	**Twice per year**
Infiltration Basins and forebays:	**Monthly**
Infiltration Trench:	**Twice per year**

Street Sweeping:

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Comments:

Action Required:

Infiltration Basin and forebays:

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Comments:

Action Required:

AD-1

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Sediment Depth: _____ (Remove if depth greater than 18")
Comments:

Action Required:

AD-2

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Sediment Depth: _____ (Remove if depth greater than 18")
Comments:

Action Required:

AD-3

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Sediment Depth: _____ (Remove if depth greater than 18")
Comments:

Action Required:

Roof Drywell

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Sediment Depth: _____ (Remove if depth greater than 18")
Comments:

Action Required:

Infiltration Trench

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Sediment Depth: _____ (Remove if depth greater than 18")
Comments:

Action Required: