Stormwater Management Report

For

Waterside Common
1651-1657 Main Street
Concord, MA

February 28, 2020

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SM-2763B File: 2763B StormwaterReportCover.doc

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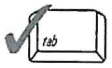
Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

COMMONWEALTH OF MASSACHUSETTS
GEORGE
DIMAKARAKOS
CIVIL
No. 41281
REGISTERED
PROFESSIONAL ENGINEER

2/28/2020

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): Roof Drywells, Infiltration Basins

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.

Narrative

Stormwater Management

The proposed project is to construct 10 single-family units, 2 duplexes, 2 car pavilions, a community building, and shared parking area along a private drive connecting to the Riverwalk Development.

Pre-Development

The site currently consists of a single-family dwelling, a 2-story barn, a paved driveway, a gravel driveway, and associated appurtenances. There are open areas of grass and garden beds behind the buildings, and an informal path that meanders down to the Assabet River. The site has been divided in to 3 subcatchments. Subcatchment E1 drains toward Main Street to the north and contains the paved driveway, a portion of the gravel driveway and walkways, and open space around the front of the buildings. Subcatchment E2 drains towards the BVW located on the southern side of the lot and contains the 2-story single-family dwelling, shed, a portion of the gravel driveway, wooded and open space. A Subcatchment E3 drains to the developed property to the west (Westvale Meadows) and contains the 2-story barn, back deck, a portion of neighboring 1667 Main Street's dwelling and paved driveway, and open space.

Post-Development

The post-development site has been divided into seven Subcatchments with three points of analysis. P1 drains toward Main Street. Subcatchment P1 contains open space and a small portion of the proposed walkway. The total runoff from Subcatchment P1 will be analyzed and compared against the total runoff from Subcatchment E1.

Subcatchment P2 will runoff towards the BVW located on the southern side of the lot. Subcatchment P2 contains open space and woods. No area within Subcatchment P2 is proposed to infiltrate through BMPs prior to reaching the Bordering Vegetated Wetland. Subcatchment P2 will be analyzed and compared against the total runoff from Subcatchment E2.

Subcatchment P3 will runoff towards the developed property (Westvale Meadows) located to the west of the lot. Subcatchment P3 contains open space, a portion of the existing paved driveway and dwelling at 1667 Main Street, and the emergency grass paver connection to Westvale Meadows. There is less than half the area in P3 compared to E3 with similar surfaces, because of the addition of the stormwater controls directing runoff to the basins in other subcatchments. Subcatchment P3 will be analyzed and compared against the total runoff from Subcatchment E3.

Subcatchment P4 contains a large portion of the developed area, including 5 of the single-family dwellings, most of the two car pavilions, most of the proposed private drive and walkways, the parking areas, and open space. All pavement runoff from Subcatchment P4 will flow over stone treatment trenches, before reaching sediment foreybays, and finally Infiltration Basin 2. An overflow standpipe in Infiltration Basin 2 is used in the 100-year storm event, directing overflow to Infiltration Basin 1 which is sized to handle the flow from Subcatchment P5 and Basin 2 overflow in the 100-year storm.

Subcatchment P5 contains the 4 parking spaces off the Riverwalk connection to Main Street, a small portion of the proposed private drive, a portion of 3 of the eastern lower court units, and adjacent open space. All pavement runoff from Subcatchment P5 will flow over stone treatment trenches before reaching sediment forebays, and finally Infiltration Basin 1, which is sized to hold and infiltrate up to and including the 100-year storm event.

Some of the roofs of the proposed dwellings are proposed to drain to roof drywells, shown as subcatchment P6.

The two duplexes closer to Main Street are shown as subcatchment P7 also drain to roof drywells.

Compliance with MA DEP Stormwater Management Standards

Compliance with the Stormwater Management Standards is as follows:

Standard 1: No Untreated Discharges
There is a Bordering Vegetated Wetland located on the south side of the lot. Roof drywells, stone treatment trenches, sediment forebays, and infiltration basins will treat runoff. There is currently no treatment for the existing dwelling, barn, or paved or gravel driveway.

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 100-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 rates and volumes have been decreased. The peak runoff rates and volumes have been summarized in the following tables.

Discharge Summary Tables

Peak Runoff Rate E1 and P1

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
0.006	0	0.040	0.001	0.068	0.002	0.114	0.006

Peak Runoff Rate E2 and P2

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
0.064	0.064	0.787	0.570	1.600	1.042	2.974	1.845

Peak Runoff Rate E3 and P3

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)	Pre (cfs)	Post (cfs)
0.003	0.002	0.049	0.034	0.148	0.093	0.461	0.255

Peak Runoff Volume E1 and P1

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cuft)	Post (cuft)	Pre (cuft)	Post (cuft)	Pre (cuft)	Post (cuft)	Pre (cuft)	Post (cuft)
49.1	0.666	159	8.38	241	16.0	370	29.5

Peak Runoff Volume E2 and P2

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cuft)	Post (cuft)	Pre (cuft)	Post (cuft)	Pre (cuft)	Post (cuft)	Pre (cuft)	Post (cuft)
990	703	4,046	2,538	6,468	3,946	10,412	6,203

Peak Runoff Volume E3 and P3

2-year Storm		10-year Storm		25-year Storm		100-year Storm	
Pre (cuft)	Post (cuft)	Pre (cuft)	Post (cuft)	Pre (cuft)	Post (cuft)	Pre (cuft)	Post (cuft)
42.6	38.6	633	342	1,229	626	2,297	1,119

Standard 3: Stormwater Recharge
The infiltration basins have been sized to infiltrate the required recharge volume as specified in the Massachusetts Stormwater Handbook. The "Simple Dynamic" method was used with a Rawls Rate of 8.27 in/hr in sizing the required storage volume to infiltrate the recharging runoff. Calculations were performed to ensure drawdown within 72 hours to provide storage for the next storm event. Detailed calculations showing compliance with Standard 3 have been attached to this report.

Standard 4: Water Quality
The required water quality volume for this project is 1" of runoff over the impervious area since the infiltration rate is greater than 2.4 inches per hour. This volume will be treated to meet the 80% TSS removal requirement of Standard 4, and 44% of TSS will be removed prior to discharge in infiltration BMPs. In order to achieve this 44% TSS removal, we have proposed stone treatment trenches and sediment forebays. For this development, sediment forebays and infiltration basins are proposed to treat the impervious runoff area. Calculations showing treatment levels are attached. Runoff from this site ultimately discharges to the Assabet River, which has a TMDL for a contribution of excess fecal coliform and phosphorous (total). A portion of the site's sewage is proposed to be treated by a state-of-the-art septic system that complies with town regulations which are more stringent than Title 5 regulations. The remaining portion of the site's sewage is proposed to be connected to the municipal sewer system. These methods of sewage disposal will protect the Assabet River from a significant increase in TMDL.

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
This project is not located within a critical area and there will be no point source discharge to a critical area.

Standard 7: Redevelopment
This standard does not apply to this project.

Standard 8: Construction Period Controls
The erosion and sedimentation control measures will be followed in accordance with the Erosion and Sedimentation Control Plan as shown on the Plan Set.

Standard 9: Operation and Maintenance Plan
An Operation and Maintenance Plan is included in this report.

Standard 10: Illicit Discharges to Drainage System
An Illicit Discharge Compliance will be provided prior to the discharge of stormwater runoff to the post-construction stormwater BMP's.

Design Basis

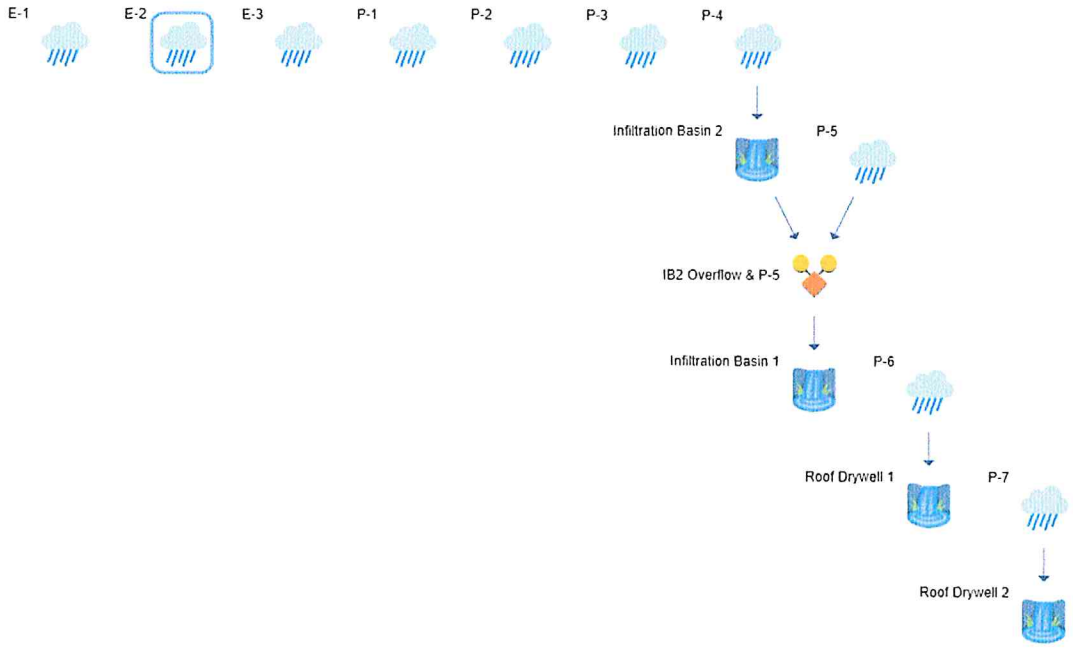
1. The United States Department of Agriculture Natural Resource Conservation Service (N.R.C.S.) TR55 methodology was used to determine offsite rates of runoff.
2. The twenty-four hour rainfall, taken from the United States Department of Agriculture Natural Resource Conservation, is 6.4 inches for the 100-year storm, 5.30 inches for the 25-year storm, 4.50 inches for the 10-year storm, and 3.10 inches for the 2-year storm event.
3. The hydrologic calculations were performed using the computer program: "Hydrology Studio".
4. The soil types of the site were taken from the N.R.C.S. Web Soil Survey Map.
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 presence of Merrimac Fine Sandy Loam, and Sudbury Fine Sandy Loam within the analyzed drainage area. This soil group rates as Hydrologic Group A and B, respectively.

Basin Model

Hydrology Studio v 3.0.0.13

Project Name:

02-21-2020



Hydrograph 2-yr Summary

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

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	E-1	0.006	12.30	49.1	----		
2	NRCS Runoff	E-2	0.064	12.43	990	----		
3	NRCS Runoff	E-3	0.003	22.07	42.6	----		
4	NRCS Runoff	P-1	0.000	22.07	0.666	----		
5	NRCS Runoff	P-2	0.064	12.37	703	----		
6	NRCS Runoff	P-3	0.002	22.07	38.6	----		
7	NRCS Runoff	P-4	0.347	12.13	1,657	----		
8	Pond Route	Infiltration Basin 2	0.000	12.10	0.000	7	127.55	84.0
9	NRCS Runoff	P-5	0.036	12.30	315	----		
10	Junction	IB2 Overflow & P-5	0.036	12.30	315	8, 9		
11	Pond Route	Infiltration Basin 1	0.000	12.33	0.000	10	127.52	12.4
12	NRCS Runoff	P-6	0.058	12.07	195	----		
13	Pond Route	Roof Drywell 1	0.000	11.70	0.000	12	130.87	30.7
14	NRCS Runoff	P-7	0.087	12.07	293	----		
15	Pond Route	Roof Drywell 2	0.000	11.70	0.000	14	130.88	49.3

Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

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	E-1	0.040	12.10	159	----		
2	NRCS Runoff	E-2	0.787	12.10	4,046	----		
3	NRCS Runoff	E-3	0.049	12.40	633	----		
4	NRCS Runoff	P-1	0.001	12.37	8.38	----		
5	NRCS Runoff	P-2	0.570	12.10	2,538	----		
6	NRCS Runoff	P-3	0.034	12.33	342	----		
7	NRCS Runoff	P-4	1.093	12.13	4,117	----		
8	Pond Route	Infiltration Basin 2	0.000	13.97	0.000	7	128.02	855
9	NRCS Runoff	P-5	0.253	12.10	1,015	----		
10	Junction	IB2 Overflow & P-5	0.253	12.10	1,015	8, 9		
11	Pond Route	Infiltration Basin 1	0.000	14.03	0.000	10	127.63	108
12	NRCS Runoff	P-6	0.085	12.07	290	----		
13	Pond Route	Roof Drywell 1	0.000	9.83	0.000	12	131.52	58.9
14	NRCS Runoff	P-7	0.127	12.07	435	----		
15	Pond Route	Roof Drywell 2	0.000	9.47	0.000	14	131.53	95.4

Hydrograph 25-yr Summary

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

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	E-1	0.068	12.07	241	----		
2	NRCS Runoff	E-2	1.600	12.10	6,468	----		
3	NRCS Runoff	E-3	0.148	12.30	1,229	----		
4	NRCS Runoff	P-1	0.002	12.27	16.0	----		
5	NRCS Runoff	P-2	1.042	12.07	3,946	----		
6	NRCS Runoff	P-3	0.093	12.13	626	----		
7	NRCS Runoff	P-4	1.603	12.10	5,799	----		
8	Pond Route	Infiltration Basin 2	0.000	15.47	0.000	7	128.35	1,519
9	NRCS Runoff	P-5	0.434	12.07	1,534	----		
10	Junction	IB2 Overflow & P-5	0.434	12.07	1,534	8, 9		
11	Pond Route	Infiltration Basin 1	0.000	14.27	0.000	10	127.81	248
12	NRCS Runoff	P-6	0.100	12.07	345	----		
13	Pond Route	Roof Drywell 1	0.000	11.03	0.000	12	131.93	75.7
14	NRCS Runoff	P-7	0.150	12.07	517	----		
15	Pond Route	Roof Drywell 2	0.000	10.80	0.000	14	131.94	123

Hydrograph 100-yr Summary

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

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	E-1	0.114	12.07	370	----		
2	NRCS Runoff	E-2	2.974	12.07	10,412	----		
3	NRCS Runoff	E-3	0.461	12.10	2,297	----		
4	NRCS Runoff	P-1	0.006	12.10	29.5	----		
5	NRCS Runoff	P-2	1.845	12.07	6,203	----		
6	NRCS Runoff	P-3	0.255	12.10	1,119	----		
7	NRCS Runoff	P-4	2.380	12.10	8,341	----		
8	Pond Route	Infiltration Basin 2	0.108	12.57	273	7	128.84	2,508
9	NRCS Runoff	P-5	0.725	12.07	2,355	----		
10	Junction	IB2 Overflow & P-5	0.725	12.07	2,627	8, 9		
11	Pond Route	Infiltration Basin 1	0.000	19.13	0.000	10	128.11	555
12	NRCS Runoff	P-6	0.121	12.07	419	----		
13	Pond Route	Roof Drywell 1	0.000	11.47	0.000	12	132.52	99.1
14	NRCS Runoff	P-7	0.181	12.07	629	----		
15	Pond Route	Roof Drywell 2	0.000	8.47	0.000	14	132.54	161

Pre-Development Hydrology

Worksheet 2: Runoff curve number and runoff **SM-2763B**

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present Developed E1

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 Pavement - Driveways/Buildings	98			0.02	1.47
A	Gravel	76			0.00	0.31
A	Open Space - Good Condition	39			0.04	1.68
A	Woods - Good Condition	30			0.00	0.00
B	Open Space - Good Condition	61			0.00	0.00
B	Woods - Good Condition	55			0.00	0.00
				Totals =	0.06	3.46

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{3.46}{0.06} = 55.72$; Use CN = 55.7

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.24	0.78	1.81
Runoff, Q.....	cf	54	176	409

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2763B

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present Developed E1
Circle one: Tc Tt through subarea

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			GRASS			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	33			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.04			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.08			0.08

Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)						
8. Flow Length, L		ft				
9. Watercourse slope, s		ft/ft				
10. Average Velocity, V (figure 3-1)		ft/s				
11. Tt = L / 3600V	Compute Tt	hr				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

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:

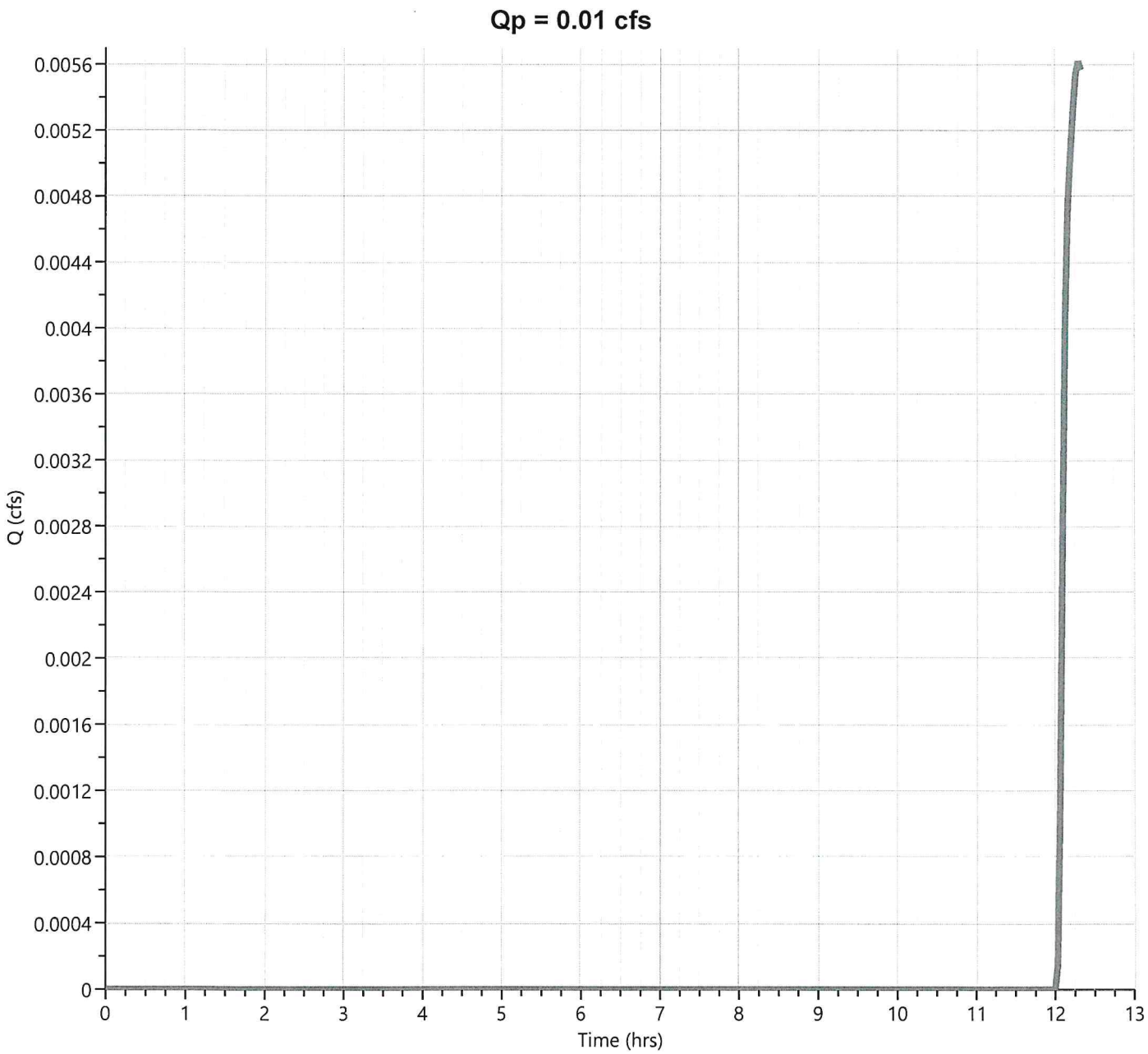
Hydrology Studio v 3.0.0.13

02-21-2020

E-1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.006 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 49.1 cuft
Drainage Area	= 0.06 ac	Curve Number	= 55.7
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 3.10 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

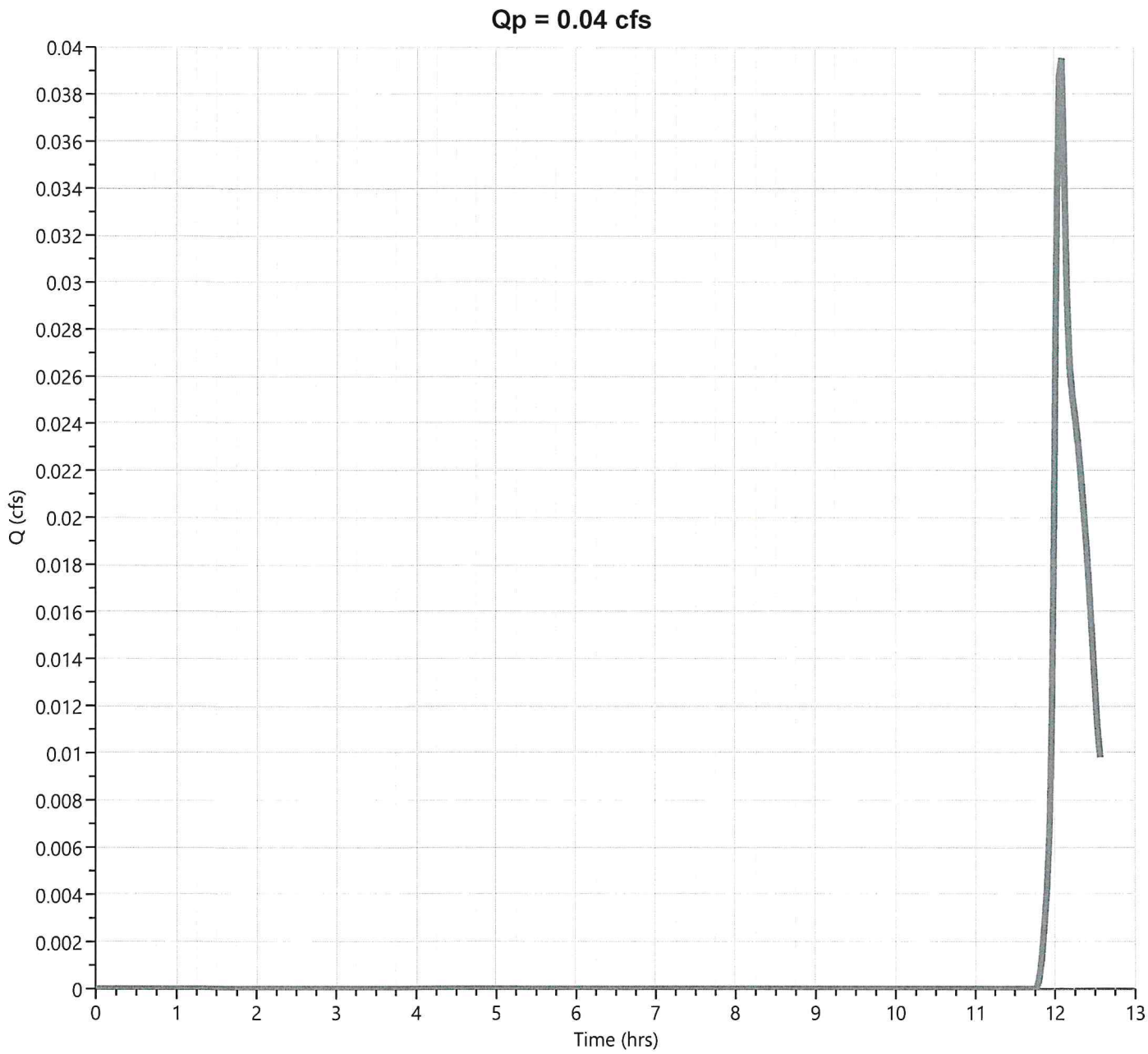
Hydrology Studio v 3.0.0.13

02-21-2020

E-1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.040 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 159 cuft
Drainage Area	= 0.06 ac	Curve Number	= 55.7
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 4.50 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

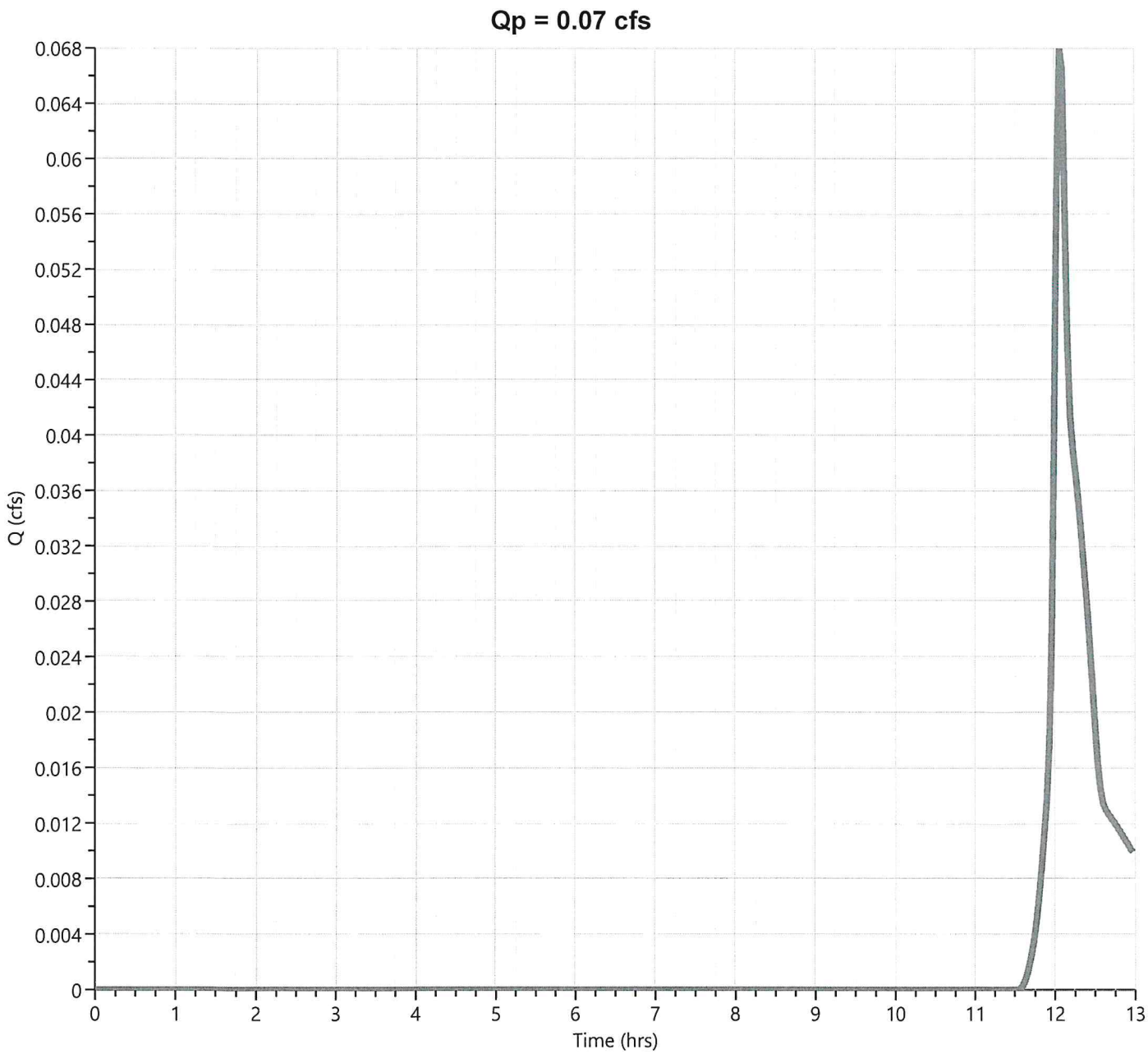
Hydrology Studio v 3.0.0.13

02-21-2020

E-1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.068 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 241 cuft
Drainage Area	= 0.06 ac	Curve Number	= 55.7
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

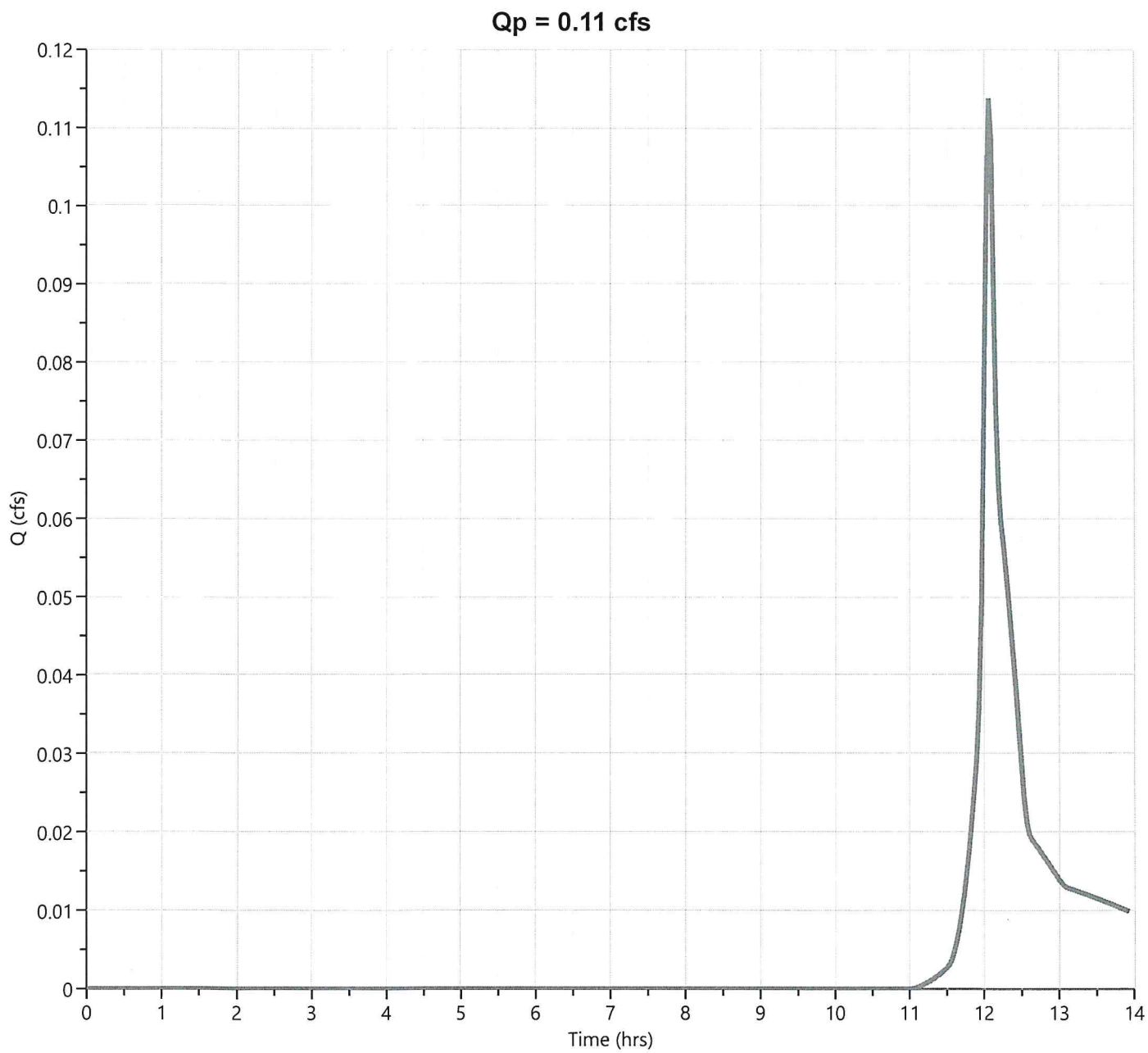
Hydrology Studio v 3.0.0.13

02-21-2020

E-1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.114 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 370 cuft
Drainage Area	= 0.06 ac	Curve Number	= 55.7
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 6.40 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-2763B**

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: [Present] Developed E2

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 Pavement - Driveways/Buildings	98			0.04	4.23
A	Gravel	76			0.01	0.82
A	Open Space - Good Condition	39			0.55	21.35
A	Woods - Good Condition	30			0.13	3.78
B	Open Space - Good Condition	61			0.41	25.22
B	Woods - Good Condition	55			0.95	52.42
				Totals =	2.09	107.83

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{107.83}{2.09} = 51.49$; Use CN = 51.5

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.14	0.57	1.46
Runoff, Q.....	cf	1057	4322	11124

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2763B

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present Developed E2
Circle one: Tc Tt through subarea _____

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			GRASS			
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	0.16			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.06			0.06
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	596			364
9. Watercourse slope, s		ft/ft	0.05			0.06
10. Average Velocity, V (figure 3-1)		ft/s	3.46			
11. Tt = L / 3600V	Compute Tt	hr	0.05			0.05
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

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.11
min 6.5

Hydrograph Report

Project Name:

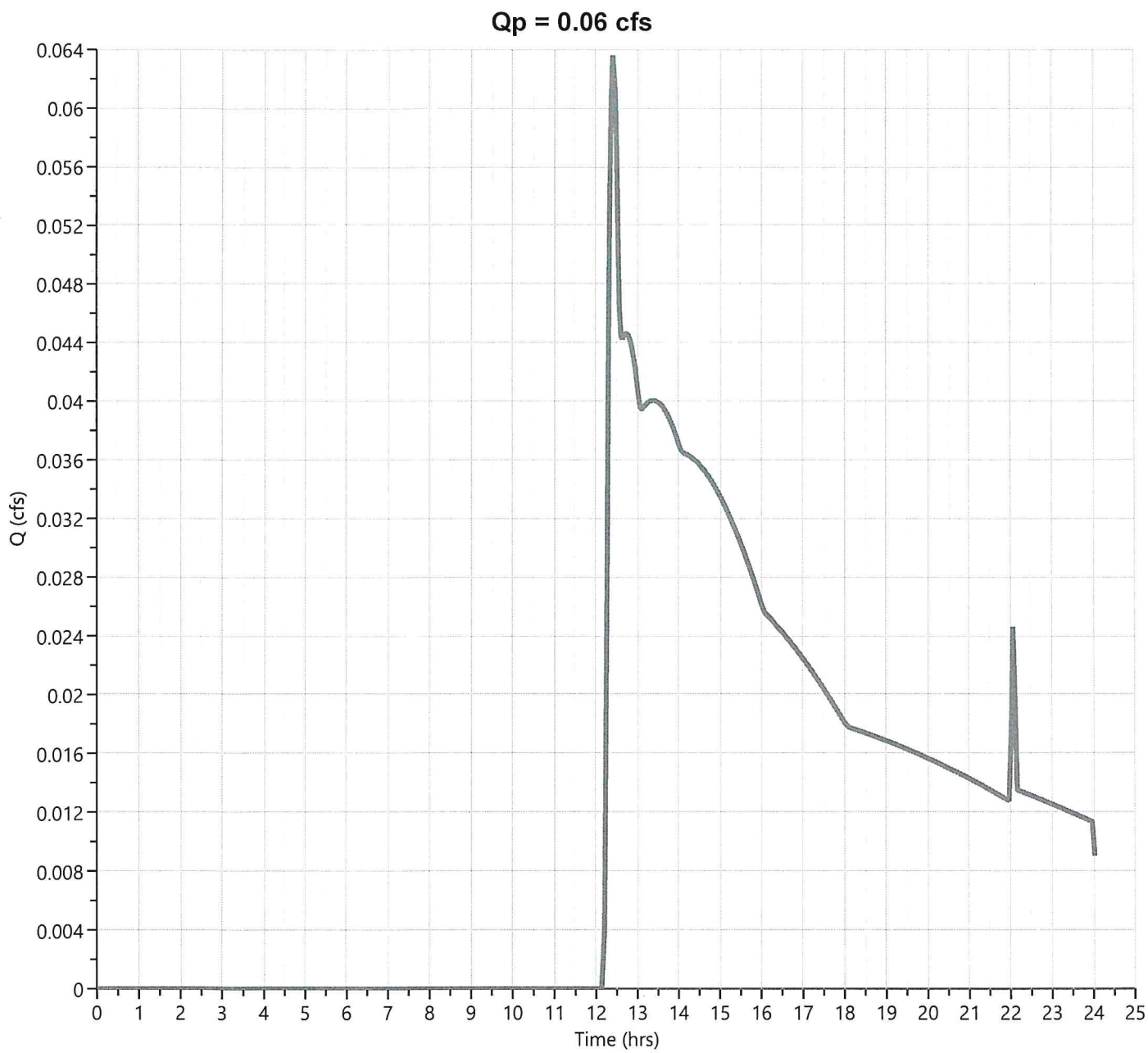
Hydrology Studio v 3.0.0.13

02-21-2020

E-2

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.064 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.43 hrs
Time Interval	= 2 min	Runoff Volume	= 990 cuft
Drainage Area	= 2.09 ac	Curve Number	= 51.5
Tc Method	= User	Time of Conc. (Tc)	= 6.5 min
Total Rainfall	= 3.10 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

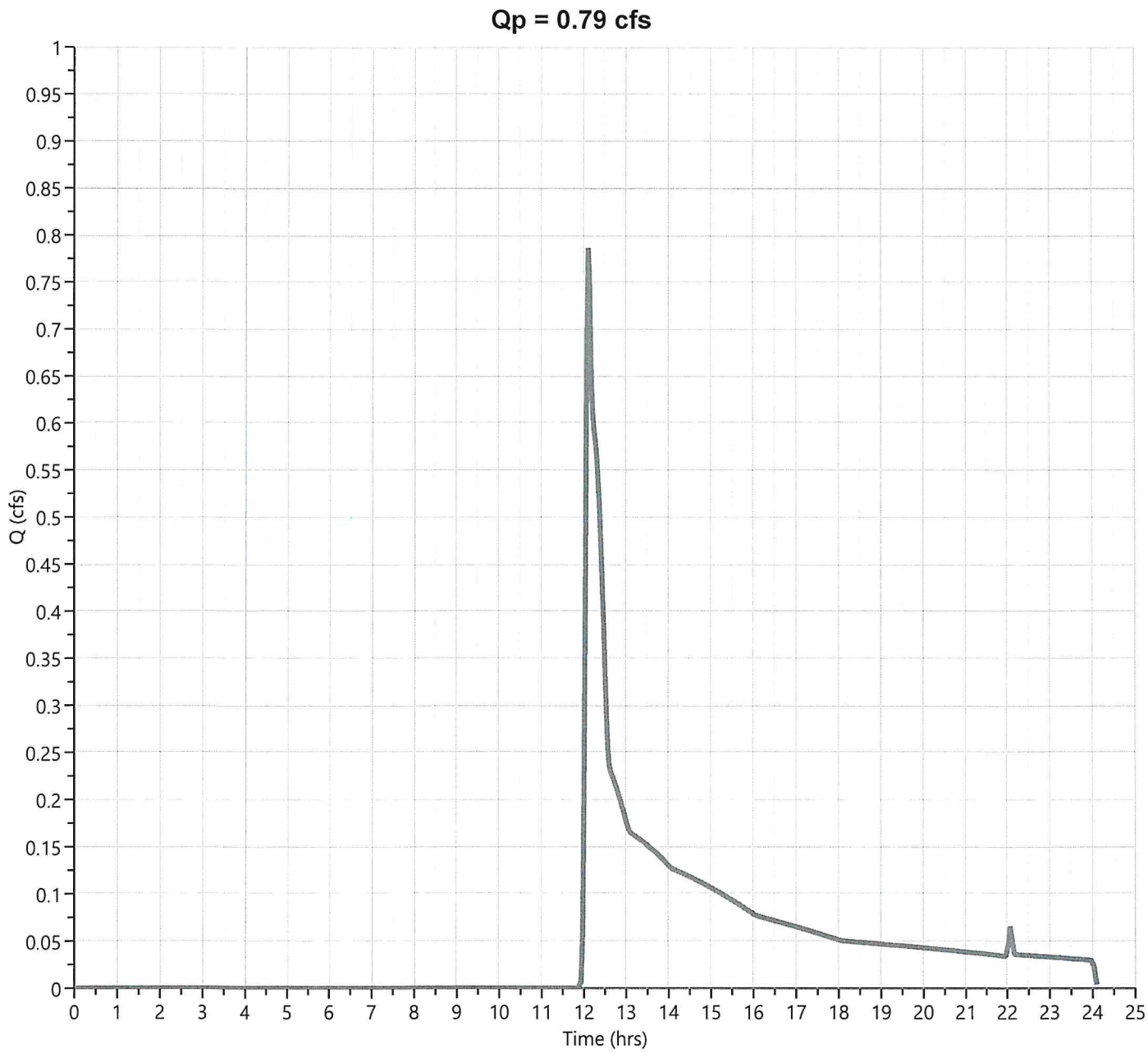
Hydrology Studio v 3.0.0.13

02-21-2020

E-2

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.787 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 4,046 cuft
Drainage Area	= 2.09 ac	Curve Number	= 51.5
Tc Method	= User	Time of Conc. (Tc)	= 6.5 min
Total Rainfall	= 4.50 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

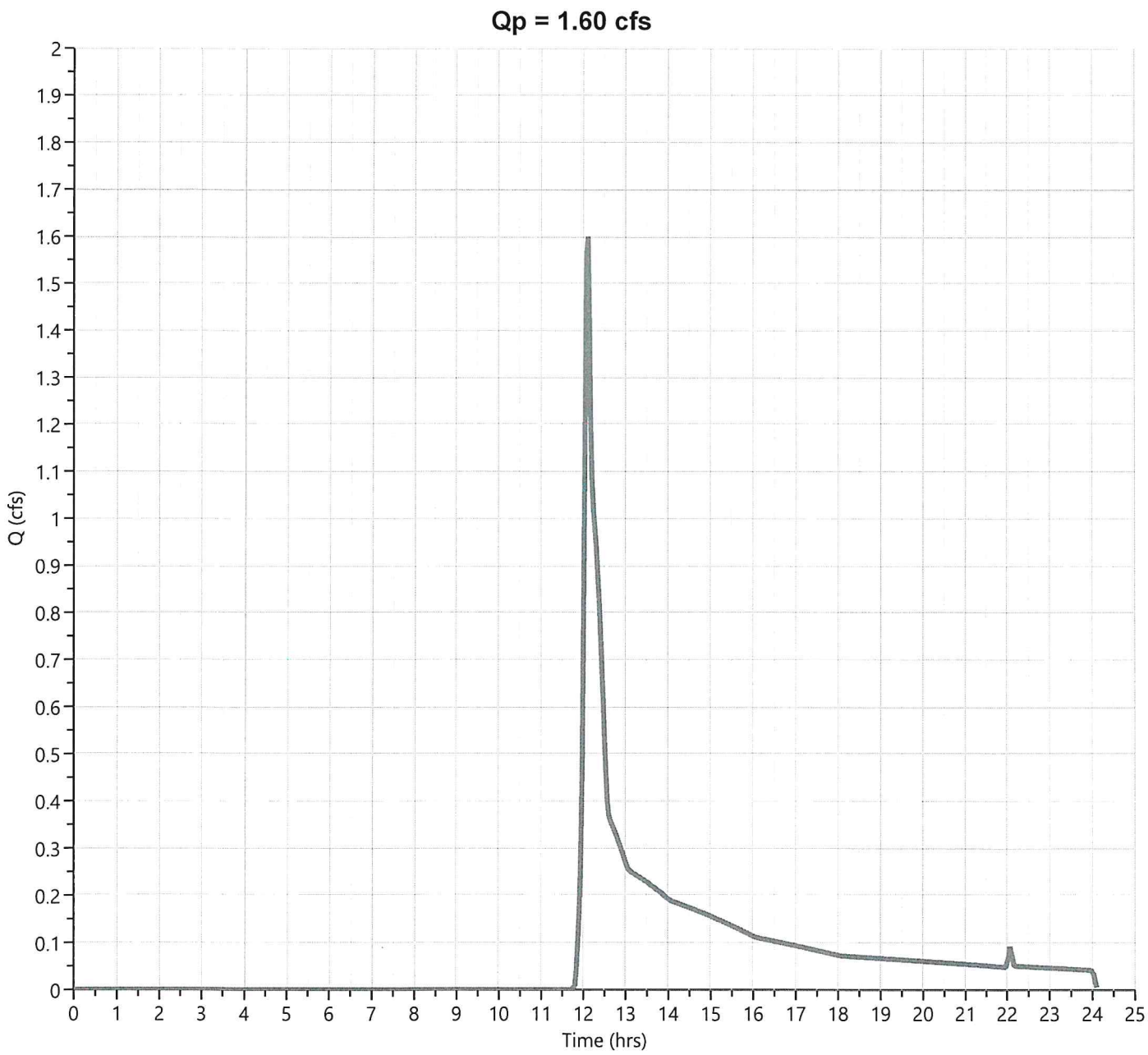
Hydrology Studio v 3.0.0.13

02-21-2020

E-2

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.600 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 6,468 cuft
Drainage Area	= 2.09 ac	Curve Number	= 51.5
Tc Method	= User	Time of Conc. (Tc)	= 6.5 min
Total Rainfall	= 5.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

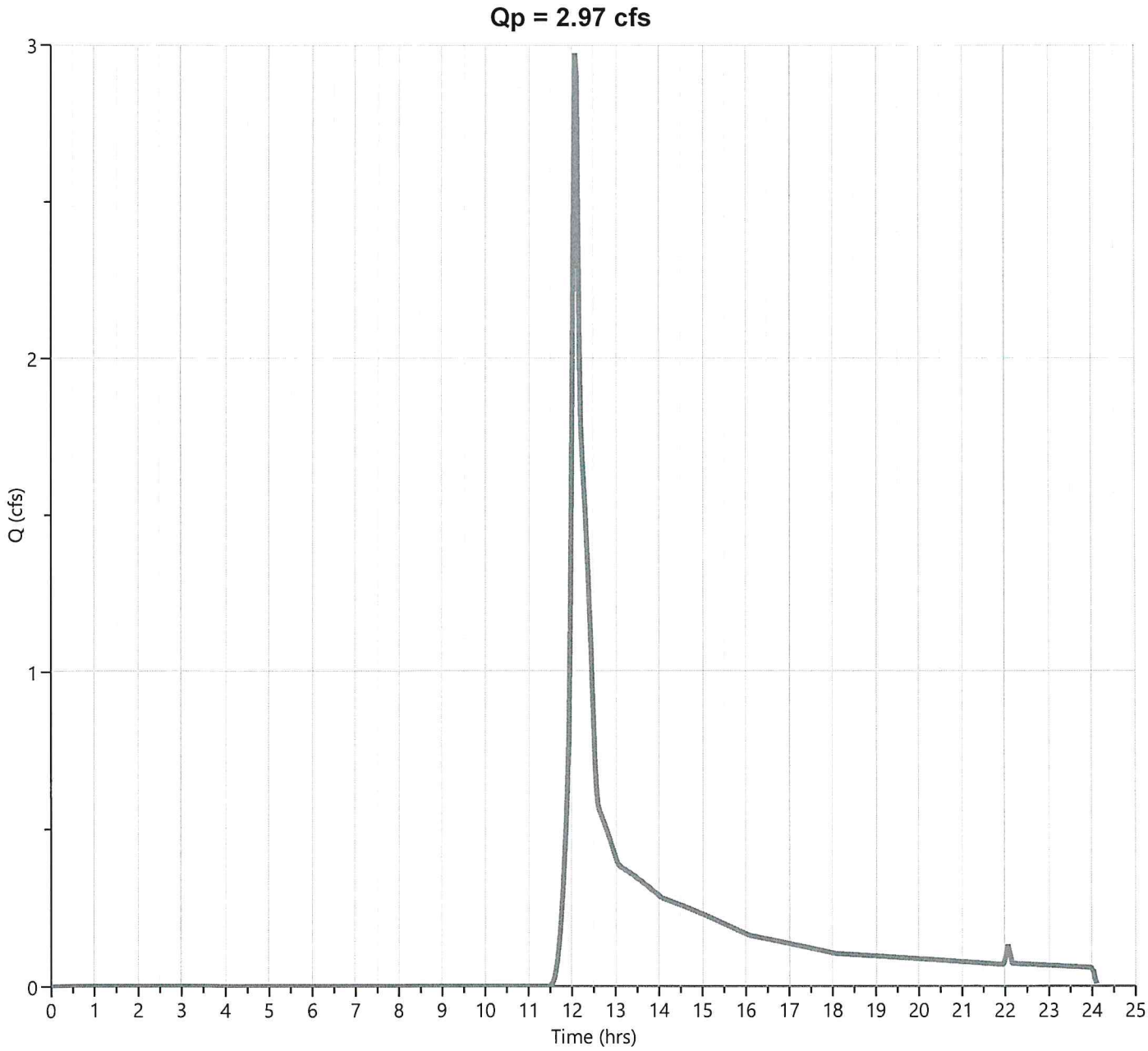
Hydrology Studio v 3.0.0.13

02-21-2020

E-2

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.974 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 10,412 cuft
Drainage Area	= 2.09 ac	Curve Number	= 51.5
Tc Method	= User	Time of Conc. (Tc)	= 6.5 min
Total Rainfall	= 6.40 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-2763B**

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present Developed E3

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 Pavement - Driveways/Buildings	98			0.10	9.51
A	Gravel	76			0.01	0.80
A	Open Space - Good Condition	39			0.39	15.33
A	Woods - Good Condition	30			0.31	9.38
B	Open Space - Good Condition	61			0.00	0.00
B	Woods - Good Condition	55			0.00	0.00
				Totals =	0.81	35.01

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{35.01}{0.81} =$ 43.06 ; Use CN = 43.1

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.02	0.23	0.83
Runoff, Q.....	cf	45	674	2451

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2763B

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present Developed
Circle one: Tc Tt through subarea E3

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			GRASS			
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	0.14			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.06			0.06
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	273			364
9. Watercourse slope, s		ft/ft	0.08			0.06
10. Average Velocity, V (figure 3-1)		ft/s	4.45			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02
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

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:

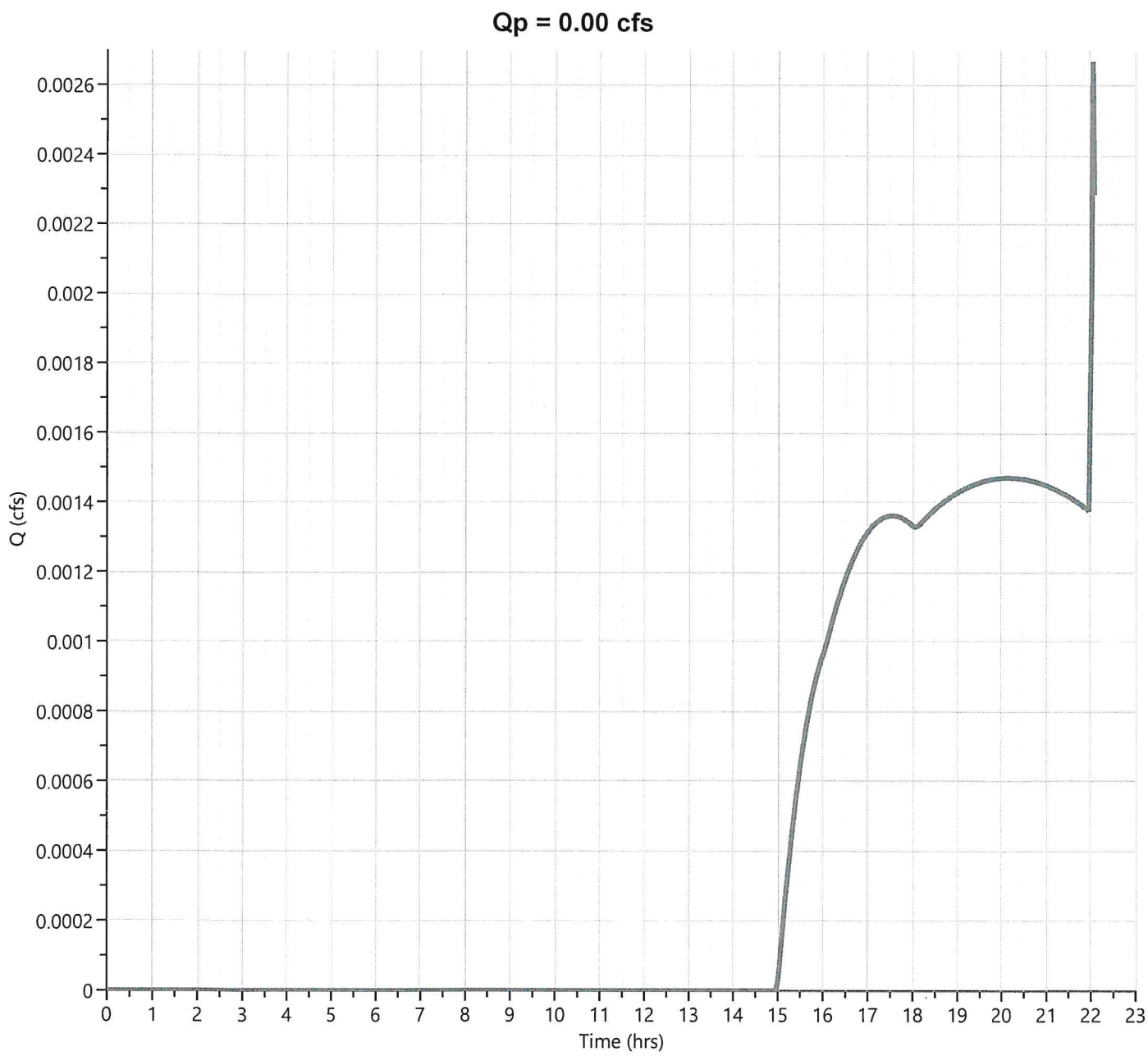
Hydrology Studio v 3.0.0.13

02-21-2020

E-3

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.003 cfs
Storm Frequency	= 2-yr	Time to Peak	= 22.07 hrs
Time Interval	= 2 min	Runoff Volume	= 42.6 cuft
Drainage Area	= 0.81 ac	Curve Number	= 43.1
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 3.10 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

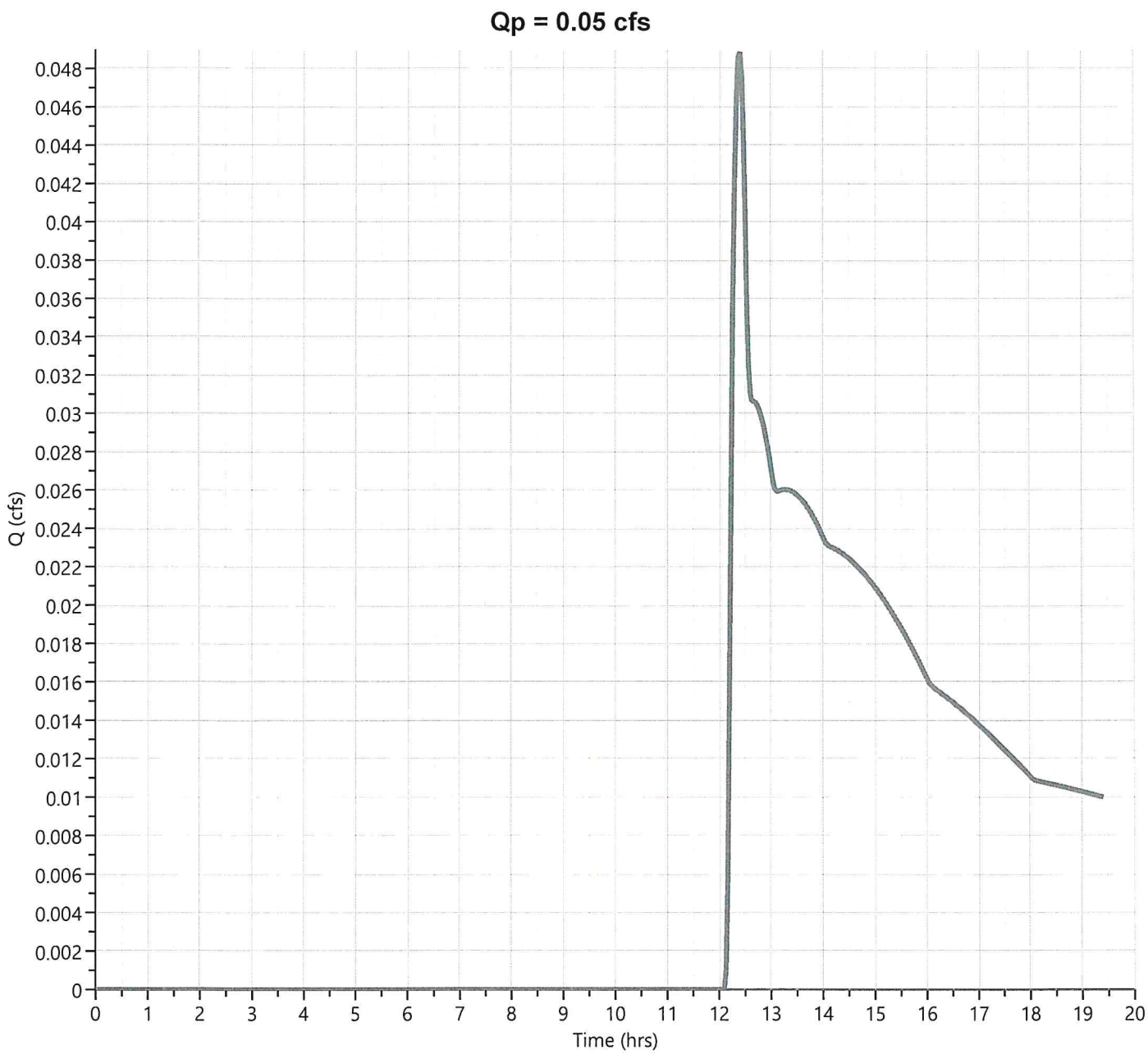
Hydrology Studio v 3.0.0.13

02-21-2020

E-3

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.049 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.40 hrs
Time Interval	= 2 min	Runoff Volume	= 633 cuft
Drainage Area	= 0.81 ac	Curve Number	= 43.1
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 4.50 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

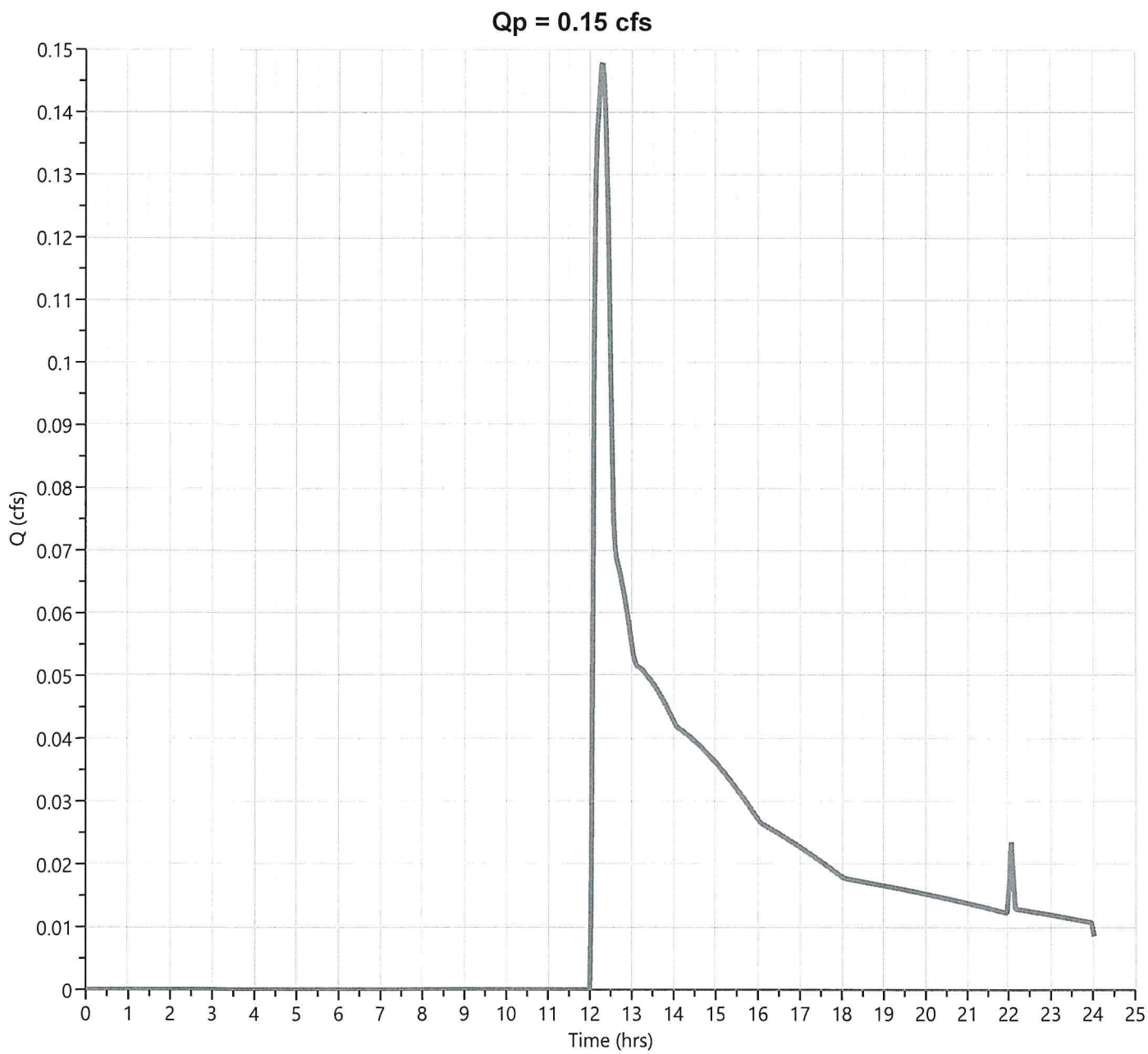
Hydrology Studio v 3.0.0.13

02-21-2020

E-3

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.148 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 1,229 cuft
Drainage Area	= 0.81 ac	Curve Number	= 43.1
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

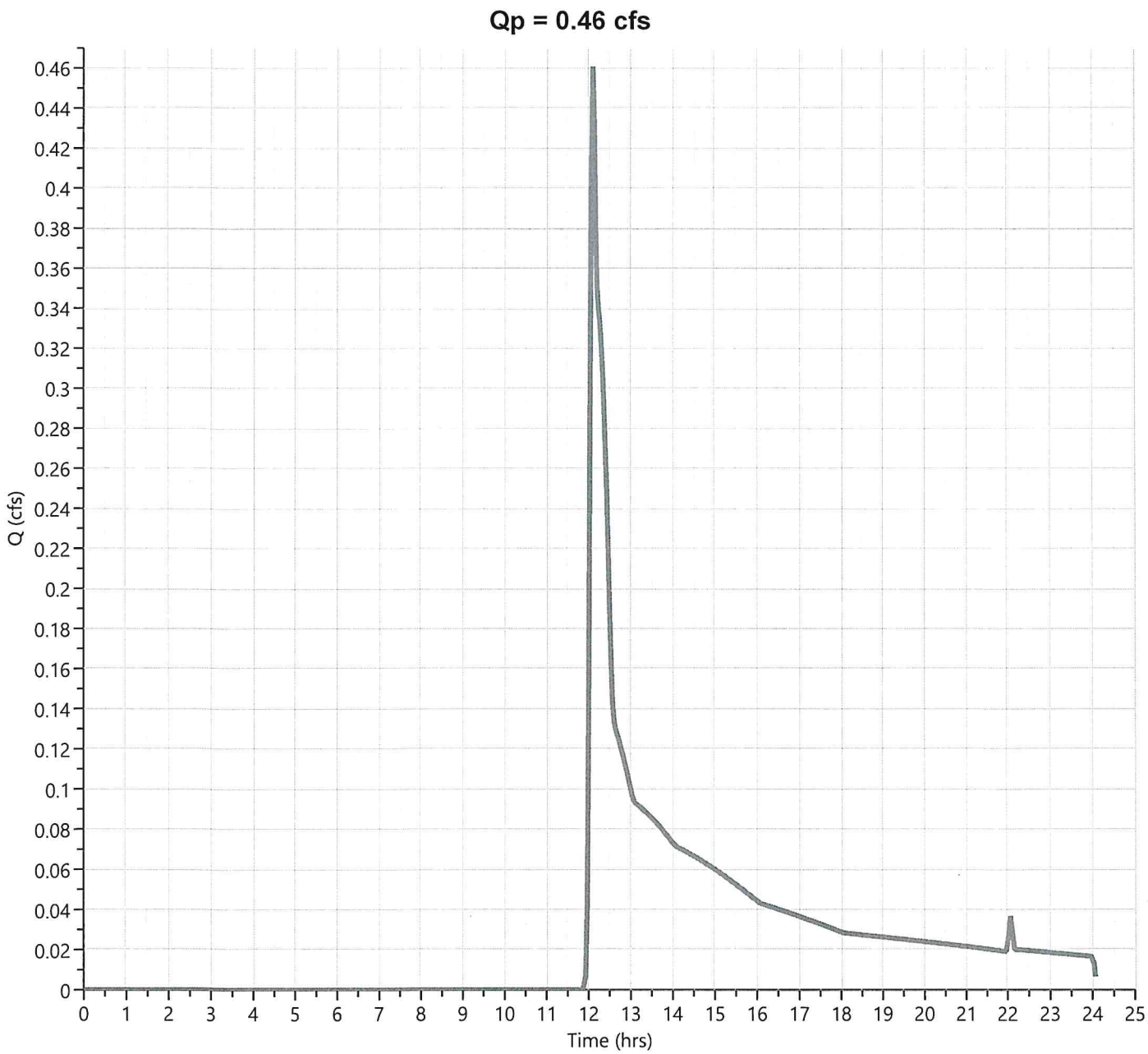
Hydrology Studio v 3.0.0.13

02-21-2020

E-3

Hyd. No. 3

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.461 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 2,297 cuft
Drainage Area	= 0.81 ac	Curve Number	= 43.1
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 6.40 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Post-Development Hydrology

Worksheet 2: Runoff curve number and runoff **SM-2763B**

Project: 1651-1657 Main Street By DJC Date 4/26/2019

Location: Concord, MA Checked _____ Date _____

Circle one: Present [Developed] P1

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 Pavement - Driveways/Buildings	98			0.00	0.04
-	Gravel	76			0.00	0.00
A	Open Space - Good Condition	39			0.00	0.18
A	Woods - Good Condition	30			0.00	0.00
B	Open Space - Good Condition	61			0.00	0.00
B	Woods - Good Condition	55			0.00	0.00
				Totals =	0.01	0.22

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{0.22}{0.01} = 43.60$; Use CN = 43.6

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.02	0.25	0.87
Runoff, Q.....	cf	0	4	16

Hydrograph Report

Project Name:

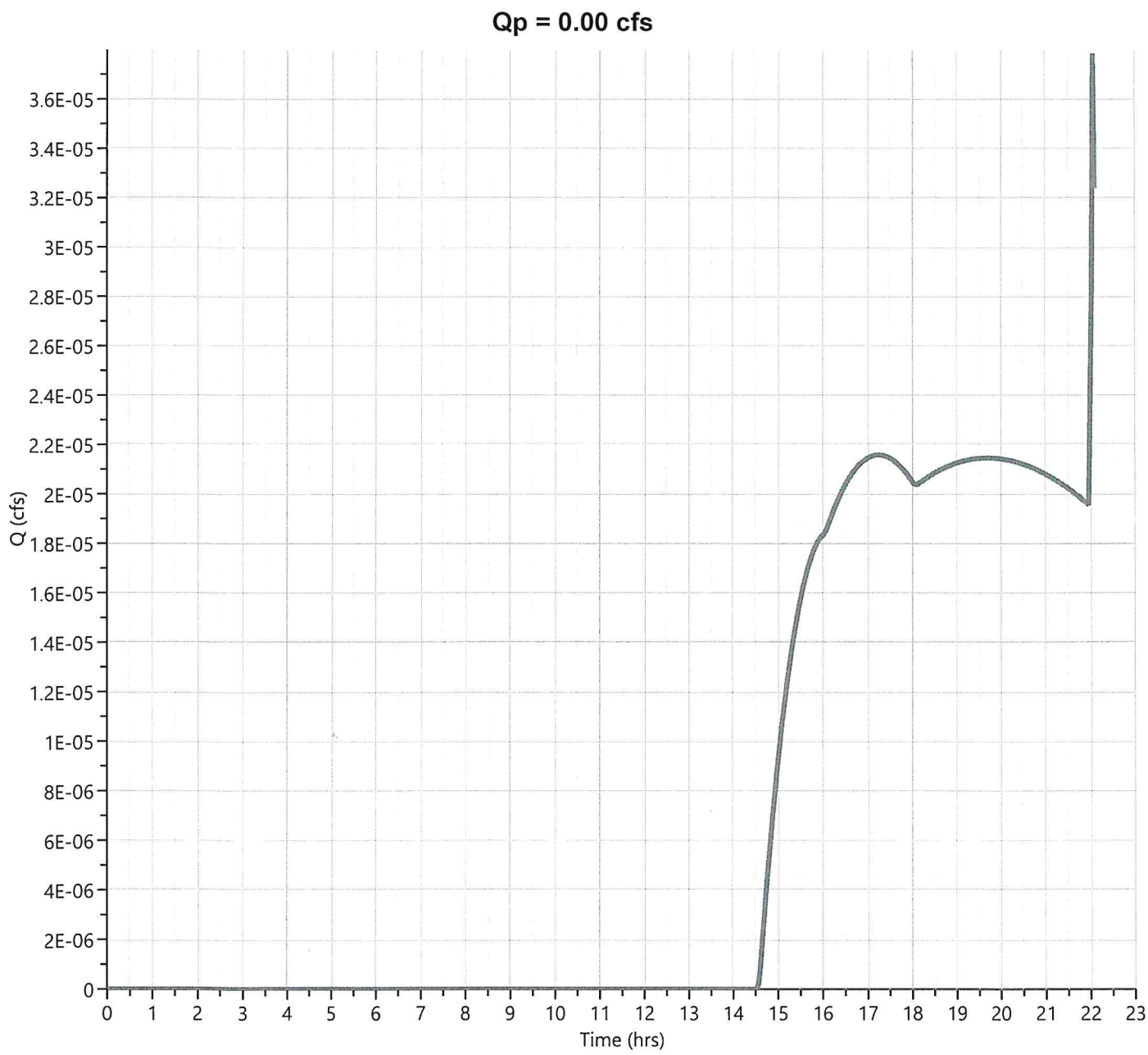
Hydrology Studio v 3.0.0.13

02-21-2020

P-1

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 22.07 hrs
Time Interval	= 2 min	Runoff Volume	= 0.666 cuft
Drainage Area	= 0.01 ac	Curve Number	= 43.6
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 3.10 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

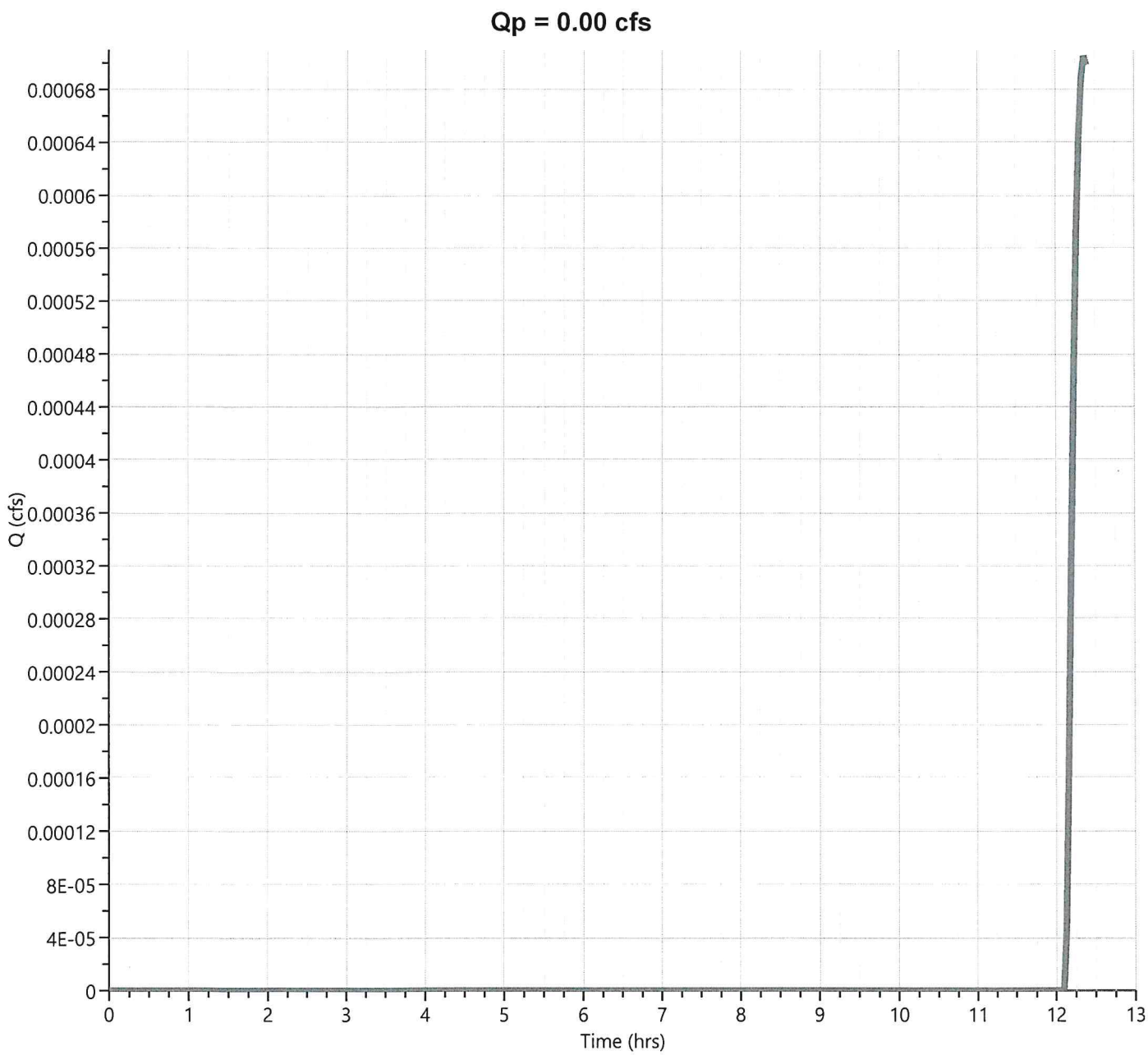
Hydrology Studio v 3.0.0.13

02-21-2020

P-1

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.001 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 8.38 cuft
Drainage Area	= 0.01 ac	Curve Number	= 43.6
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 4.50 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

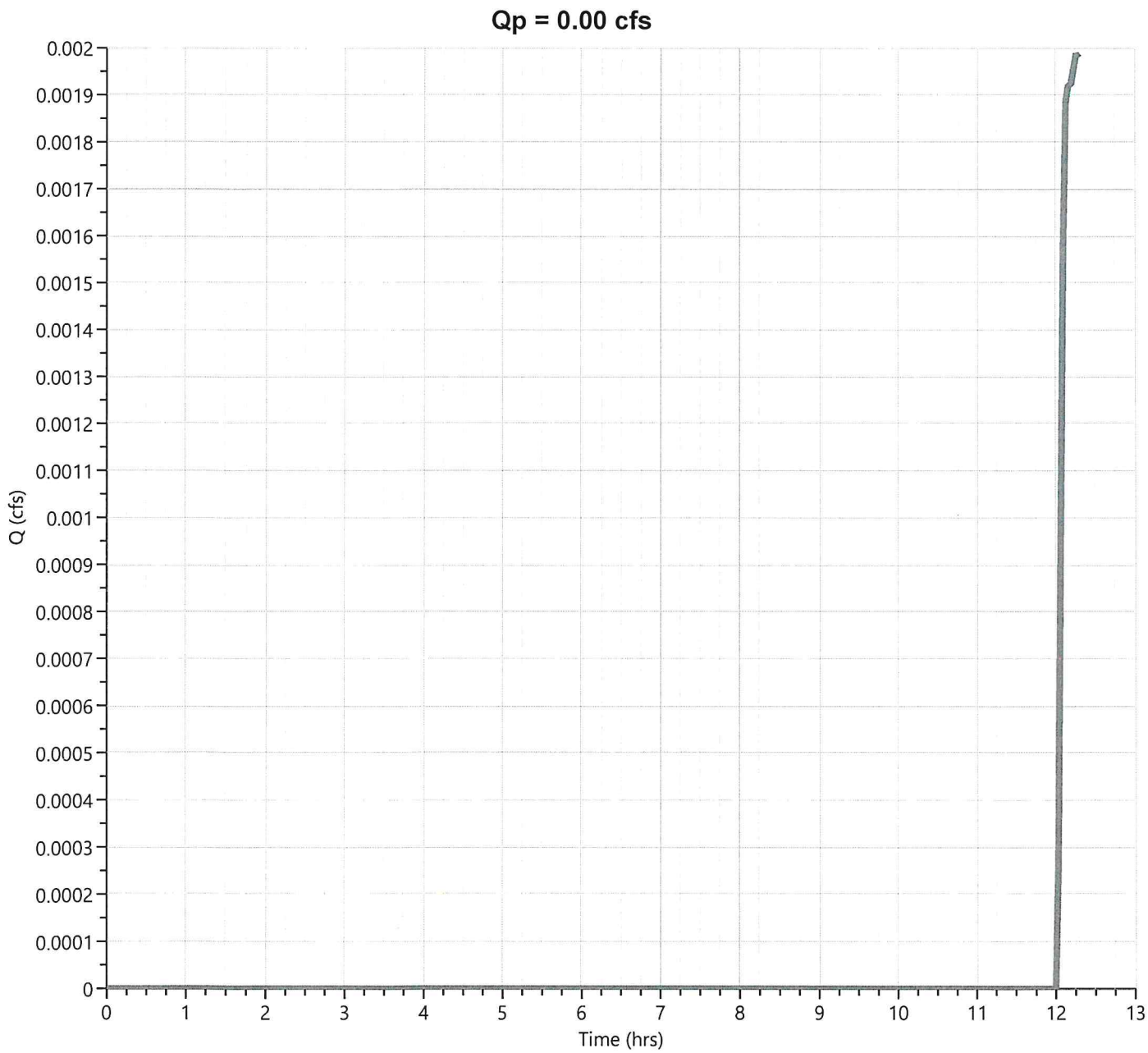
Hydrology Studio v 3.0.0.13

02-21-2020

P-1

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.002 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 16.0 cuft
Drainage Area	= 0.01 ac	Curve Number	= 43.6
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

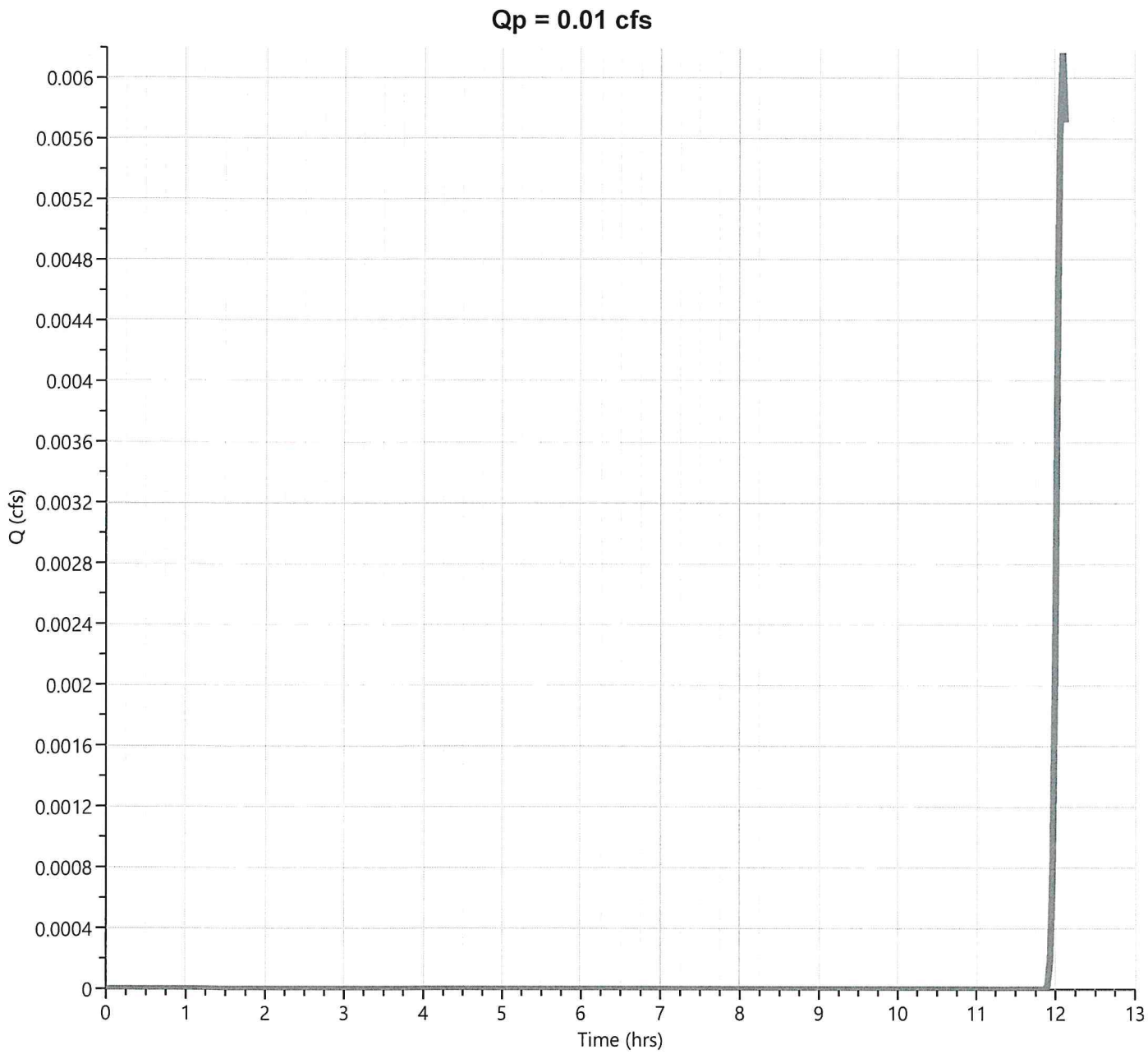
Hydrology Studio v 3.0.0.13

02-21-2020

P-1

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.006 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 29.5 cuft
Drainage Area	= 0.01 ac	Curve Number	= 43.6
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 6.40 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-2763B**

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present [Developed] P2

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 Pavement - Driveways/Buildings	98			0.00	0.00
A	Gravel	76			0.00	0.00
A	Open Space - Good Condition	39			0.01	0.25
A	Woods - Good Condition	30			0.00	0.00
B	Open Space - Good Condition	61			0.00	0.00
B	Woods - Good Condition	55			0.88	48.64
B	Brush	48			0.23	10.89
				Totals =	1.12	59.78

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{59.78}{1.12} = 53.49$; Use CN = 53.5

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.18	0.67	1.63
Runoff, Q.....	cf	747	2699	6598

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2763B

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present Developed
Circle one: Tc Tt through subarea P2

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			GRASS			
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	0.06			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.09			0.09

Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	239			364
9. Watercourse slope, s		ft/ft	0.05			0.06
10. Average Velocity, V (figure 3-1)		ft/s	3.46			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02

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

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.11
min 6.5

Hydrograph Report

Project Name:

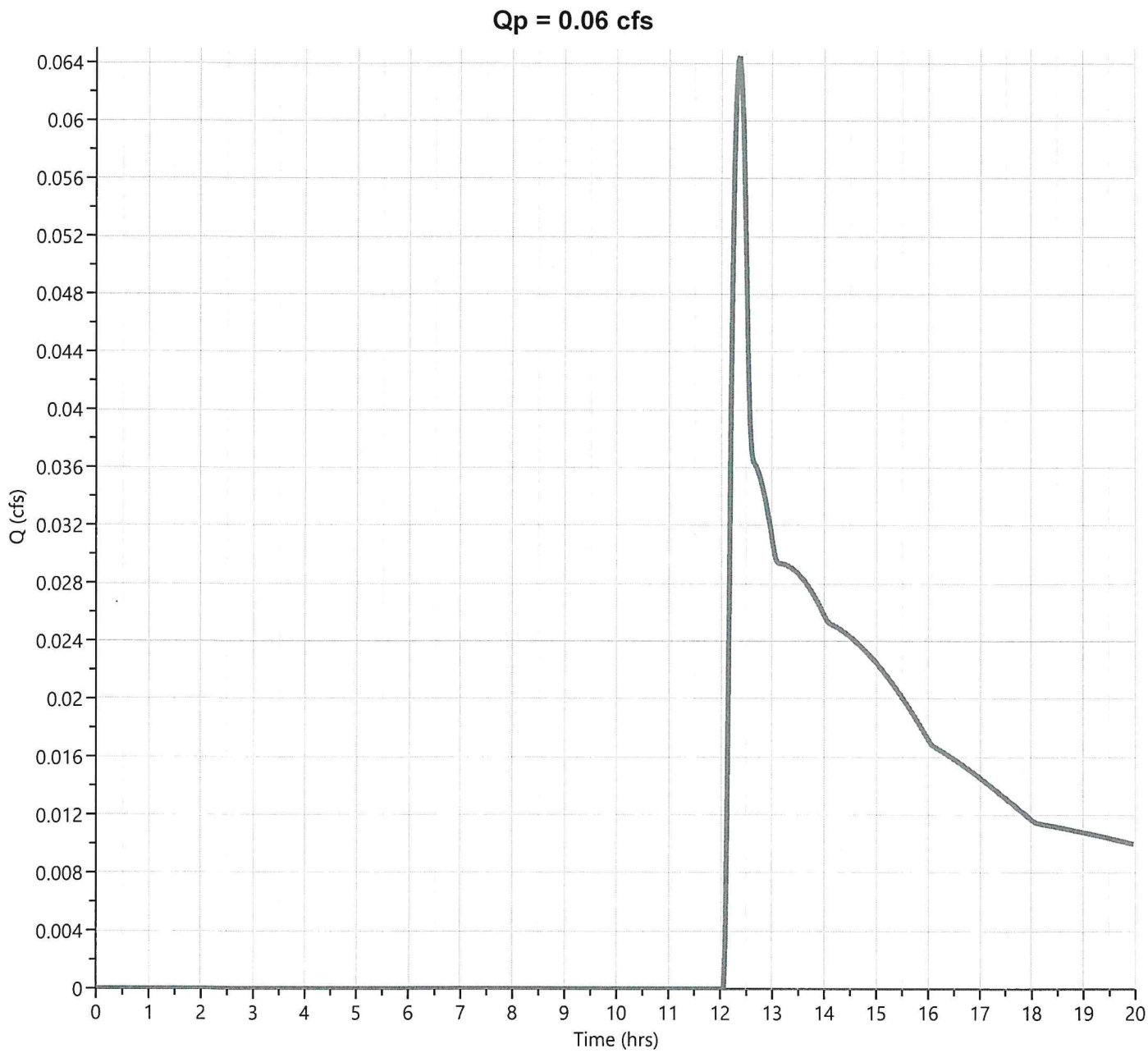
Hydrology Studio v 3.0.0.13

02-21-2020

P-2

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.064 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 703 cuft
Drainage Area	= 1.12 ac	Curve Number	= 53.5
Tc Method	= User	Time of Conc. (Tc)	= 6.5 min
Total Rainfall	= 3.10 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

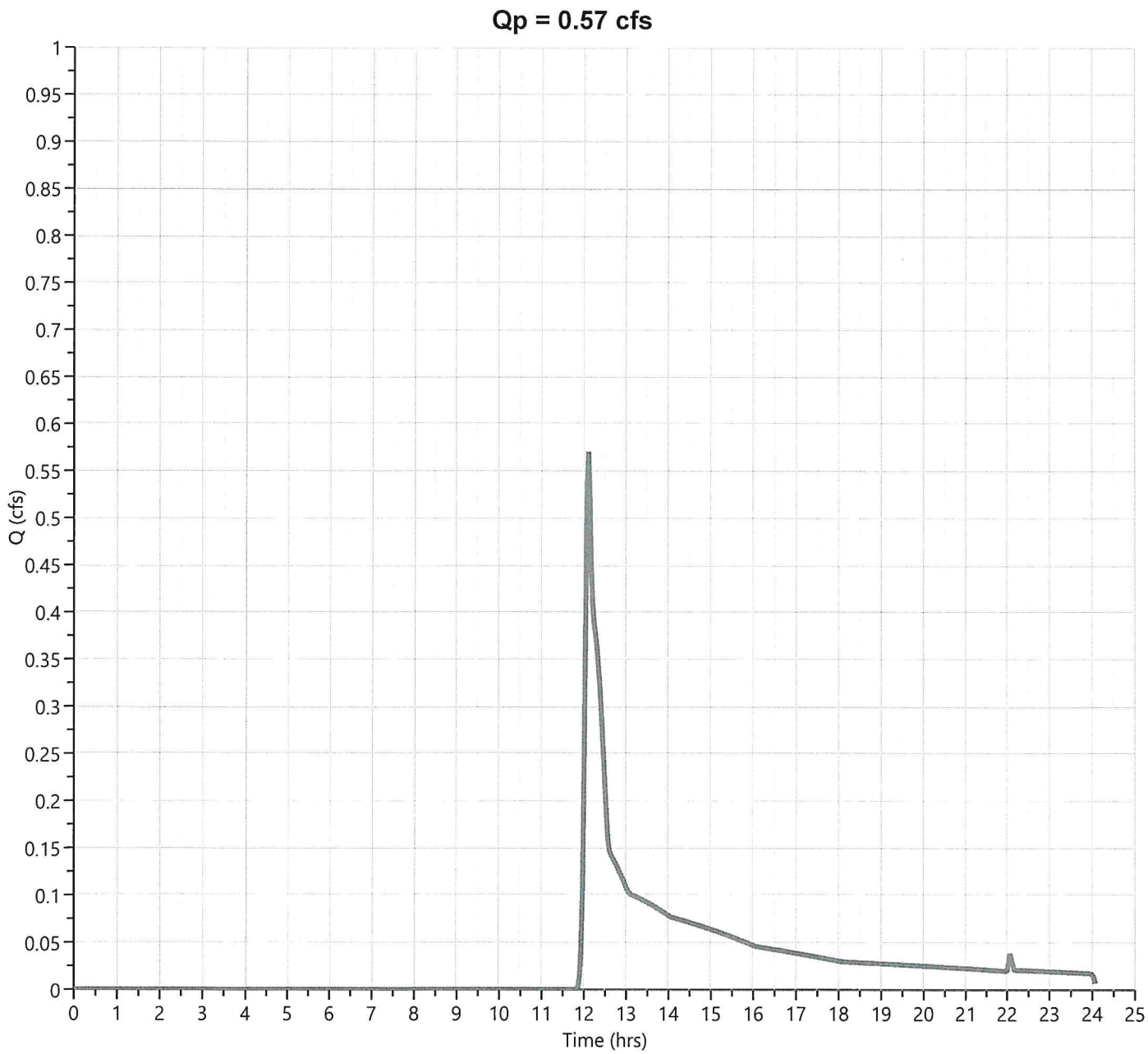
Hydrology Studio v 3.0.0.13

02-21-2020

P-2

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.570 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 2,538 cuft
Drainage Area	= 1.12 ac	Curve Number	= 53.5
Tc Method	= User	Time of Conc. (Tc)	= 6.5 min
Total Rainfall	= 4.50 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

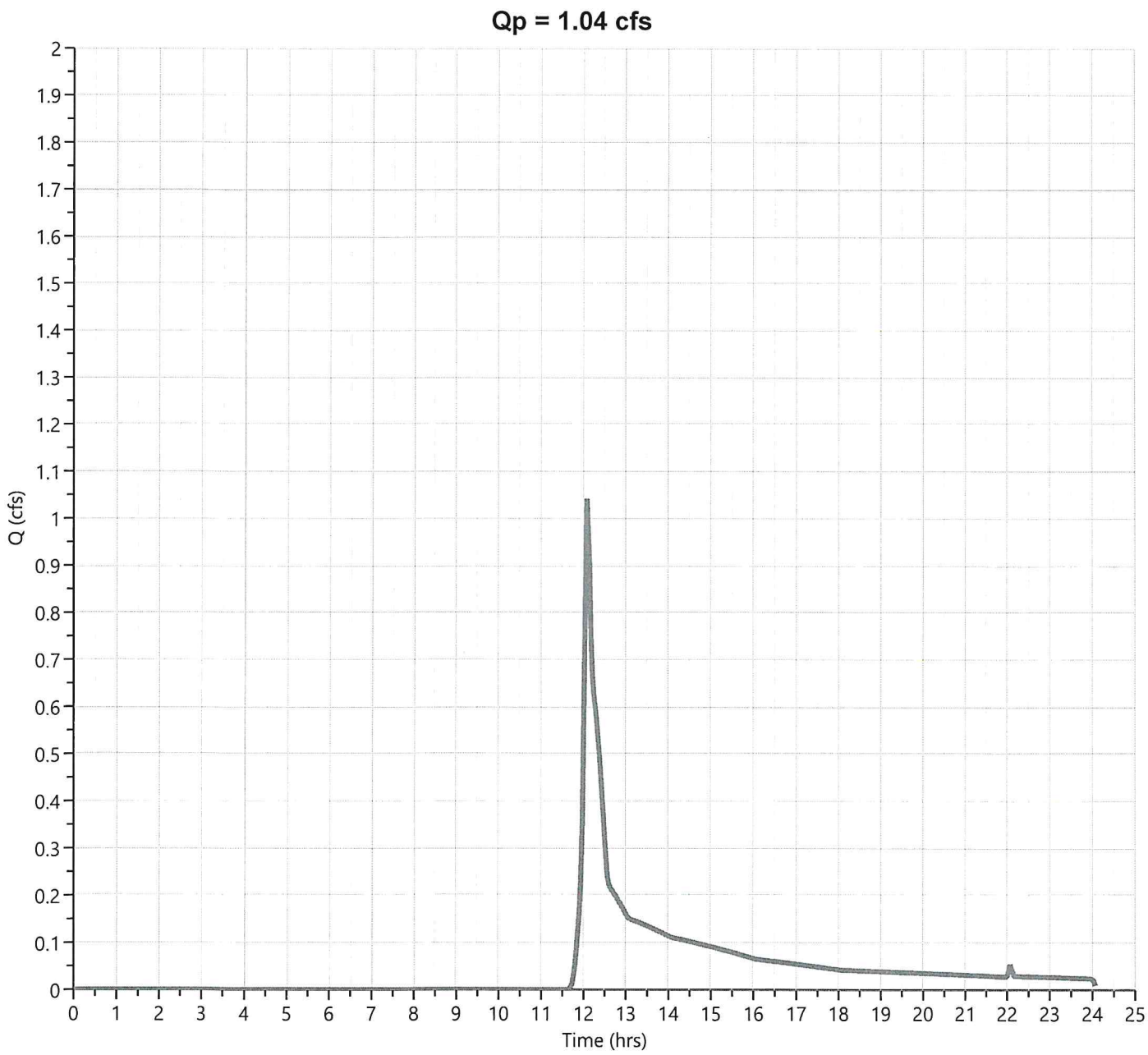
Hydrology Studio v 3.0.0.13

02-21-2020

P-2

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.042 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 3,946 cuft
Drainage Area	= 1.12 ac	Curve Number	= 53.5
Tc Method	= User	Time of Conc. (Tc)	= 6.5 min
Total Rainfall	= 5.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

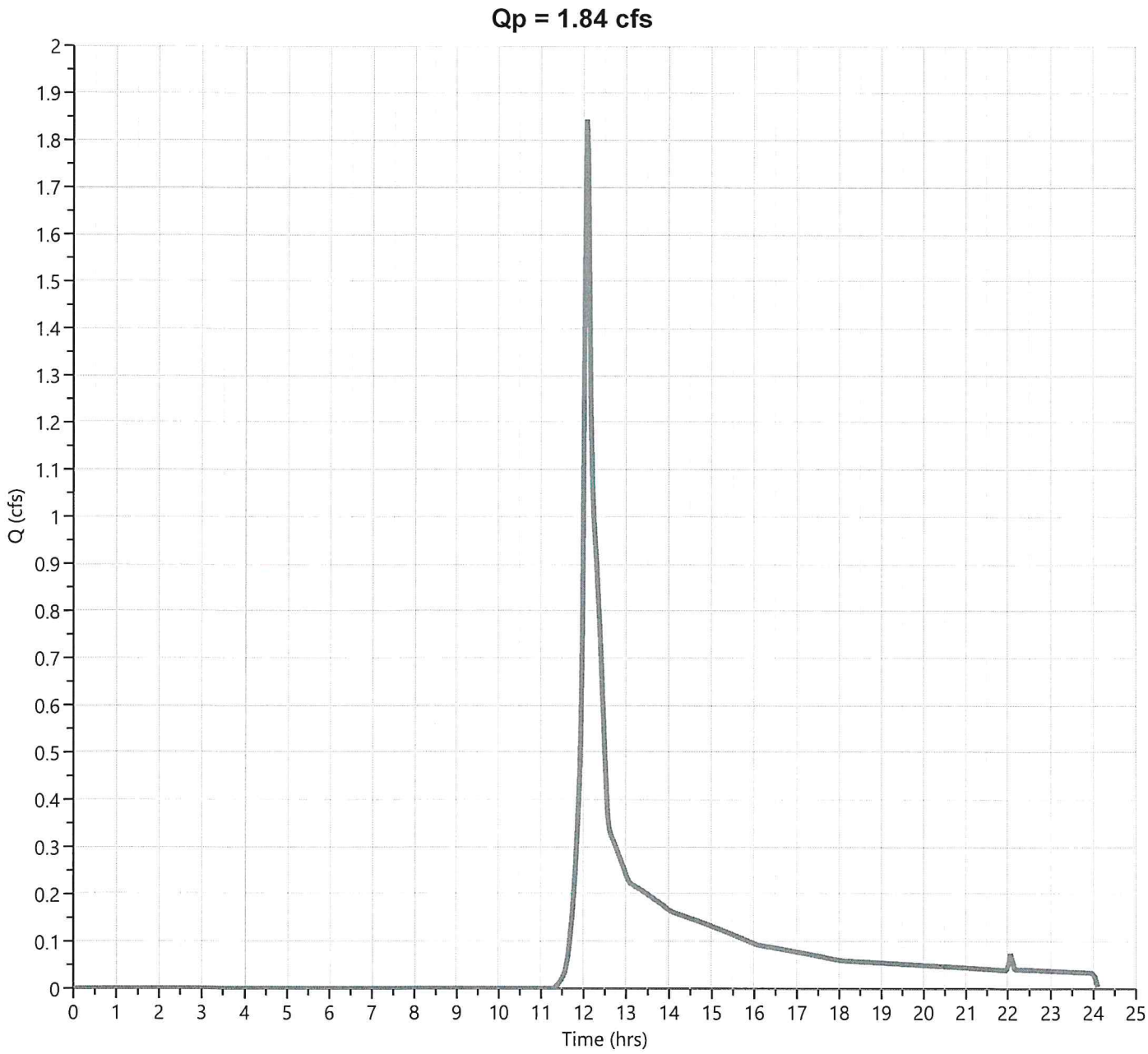
Hydrology Studio v 3.0.0.13

02-21-2020

P-2

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.845 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 6,203 cuft
Drainage Area	= 1.12 ac	Curve Number	= 53.5
Tc Method	= User	Time of Conc. (Tc)	= 6.5 min
Total Rainfall	= 6.40 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-2763B**

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present [Developed] P3

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 Pavement - Driveways/Buildings	98			0.03	3.35
A	Gravel	76			0.00	0.00
A	Open Space - Good Condition	39			0.30	11.77
A	Woods - Good Condition	30			0.00	0.00
B	Open Space - Good Condition	61			0.00	0.00
B	Woods - Good Condition	55			0.00	0.00
				Totals =	0.34	15.12

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{15.12}{0.34} = 45.01$; Use CN = 45.0

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.03	0.30	0.97
Runoff, Q.....	cf	41	361	1180

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2763B

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present Developed
Circle one: Tc Tt through subarea P3

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			GRASS			
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	0.11			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.07			0.07
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	247			364
9. Watercourse slope, s		ft/ft	0.08			0.06
10. Average Velocity, V (figure 3-1)		ft/s	4.62			
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

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:

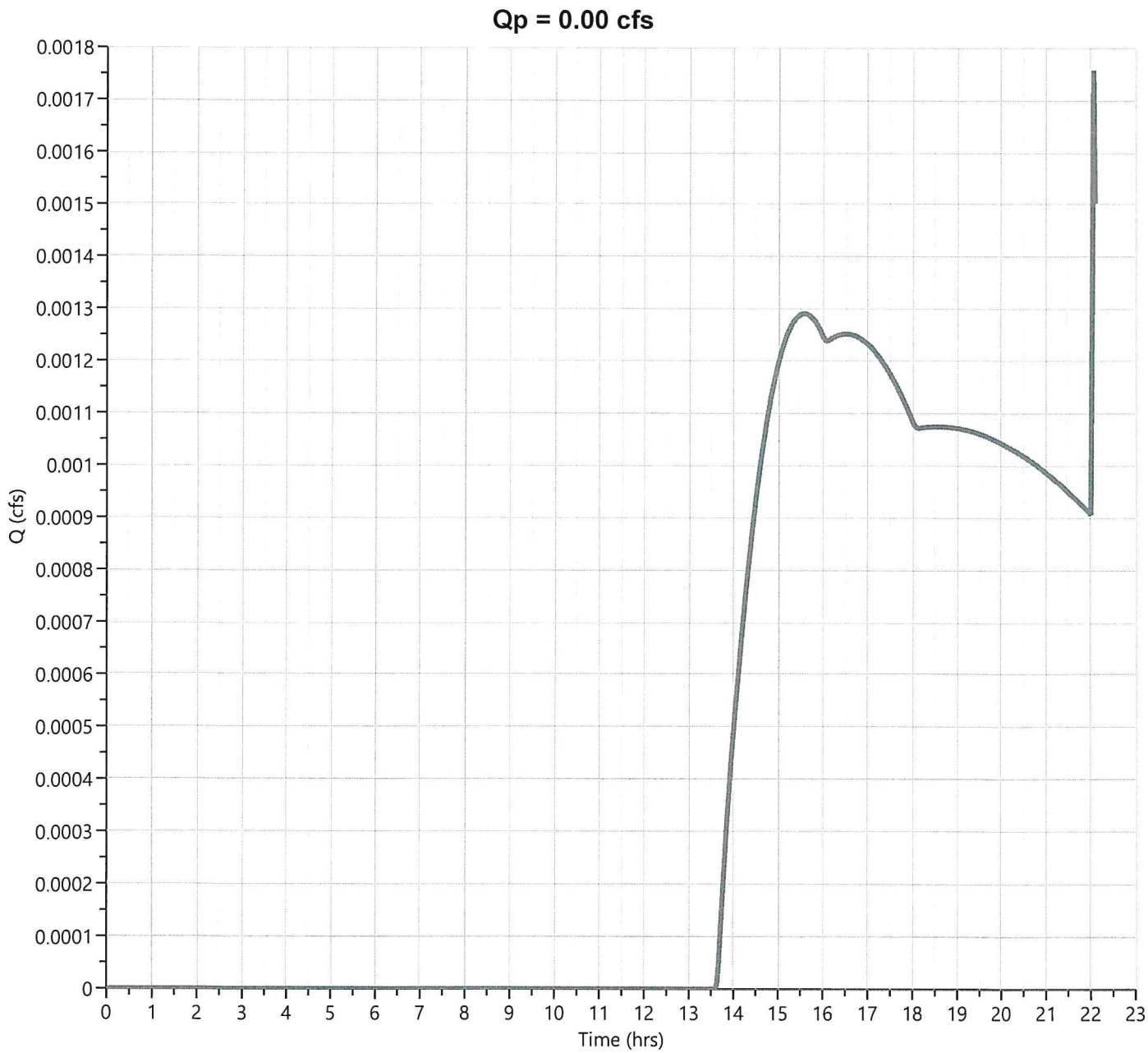
Hydrology Studio v 3.0.0.13

02-21-2020

P-3

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.002 cfs
Storm Frequency	= 2-yr	Time to Peak	= 22.07 hrs
Time Interval	= 2 min	Runoff Volume	= 38.6 cuft
Drainage Area	= 0.34 ac	Curve Number	= 45
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 3.10 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

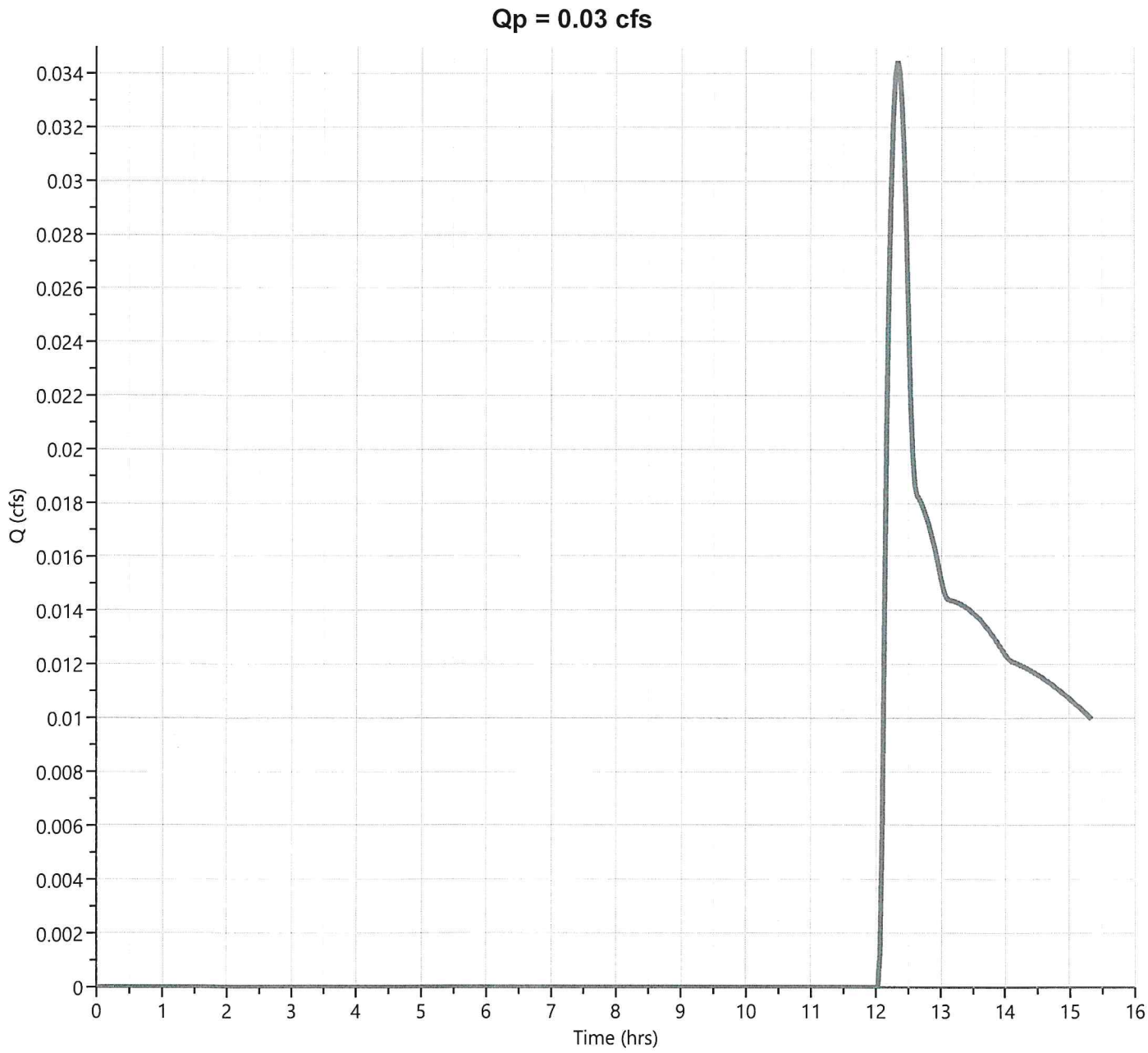
Hydrology Studio v 3.0.0.13

02-21-2020

P-3

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.034 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 342 cuft
Drainage Area	= 0.34 ac	Curve Number	= 45
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 4.50 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

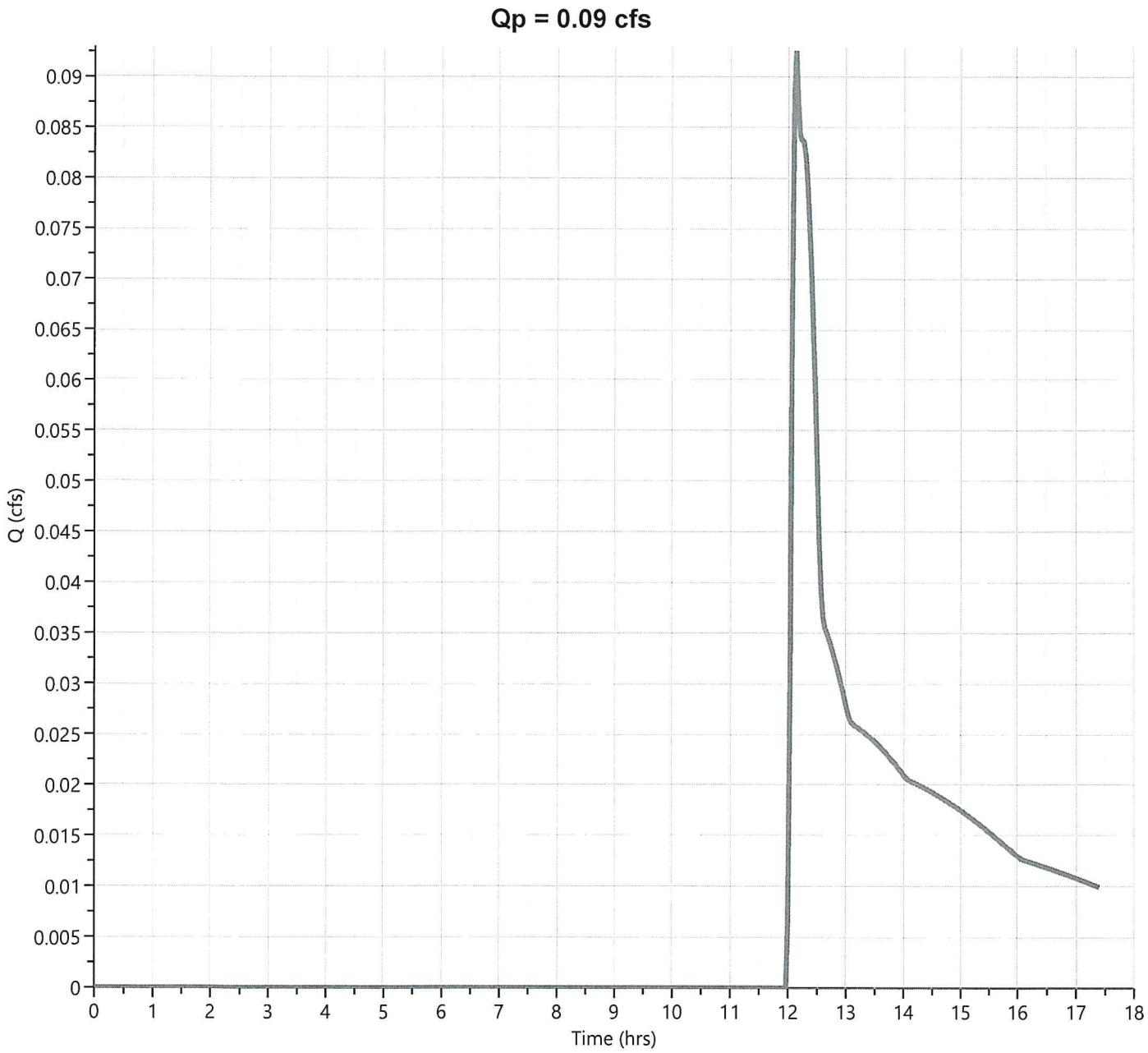
Hydrology Studio v 3.0.0.13

02-21-2020

P-3

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.093 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 626 cuft
Drainage Area	= 0.34 ac	Curve Number	= 45
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

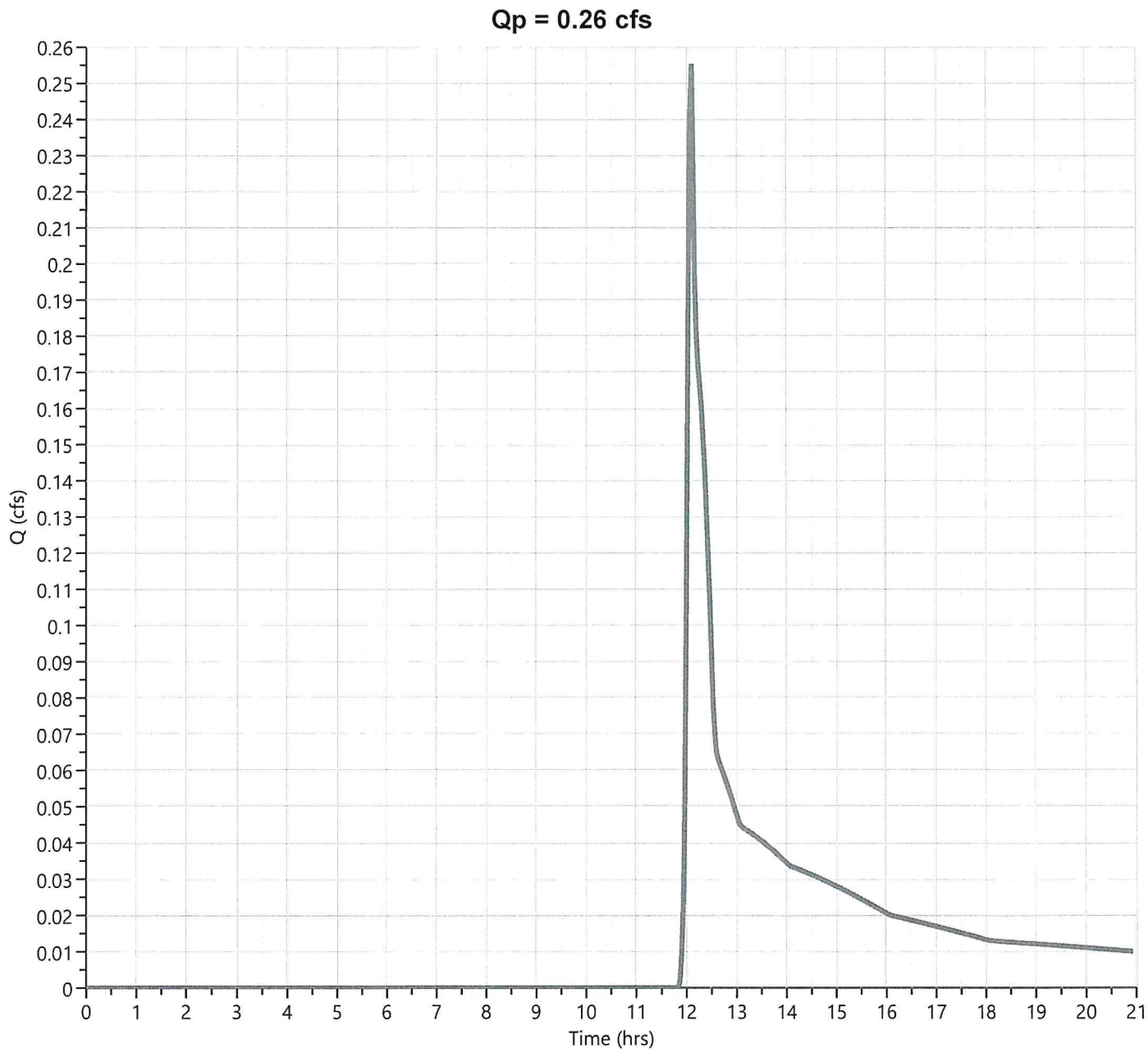
Hydrology Studio v 3.0.0.13

02-21-2020

P-3

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.255 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 1,119 cuft
Drainage Area	= 0.34 ac	Curve Number	= 45
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 6.40 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Worksheet 2: Runoff curve number and runoff **SM-2763B**

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present [Developed] P4

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 Pavement - Driveways/Buildings	98			0.36	34.84
A	Gravel	76			0.00	0.00
A	Open Space - Good Condition	39			0.49	18.94
A	Woods - Good Condition	30			0.00	0.00
B	Open Space - Good Condition	61			0.07	4.43
B	Woods - Good Condition	55			0.00	0.00
				Totals =	0.91	58.21

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{58.21}{0.91} = 63.70$; Use CN = 63.7

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.50	1.25	2.53
Runoff, Q.....	cf	1665	4135	8376

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2763B

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present Developed
Circle one: Tc Tt through subarea P4

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			GRASS			
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	C-D	D-E	
7. Surface Description (paved or unpaved)			UNPAVED	PAVED	UNPAVED	
8. Flow Length, L		ft	105	98	229	364
9. Watercourse slope, s		ft/ft	0.11	0.04	0.045	0.06
10. Average Velocity, V (figure 3-1)		ft/s	5.40	4.07	3.42	
11. Tt = L / 3600V	Compute Tt	hr	0.01	0.01	0.02	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

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.13
min 7.6

Hydrograph Report

Project Name:

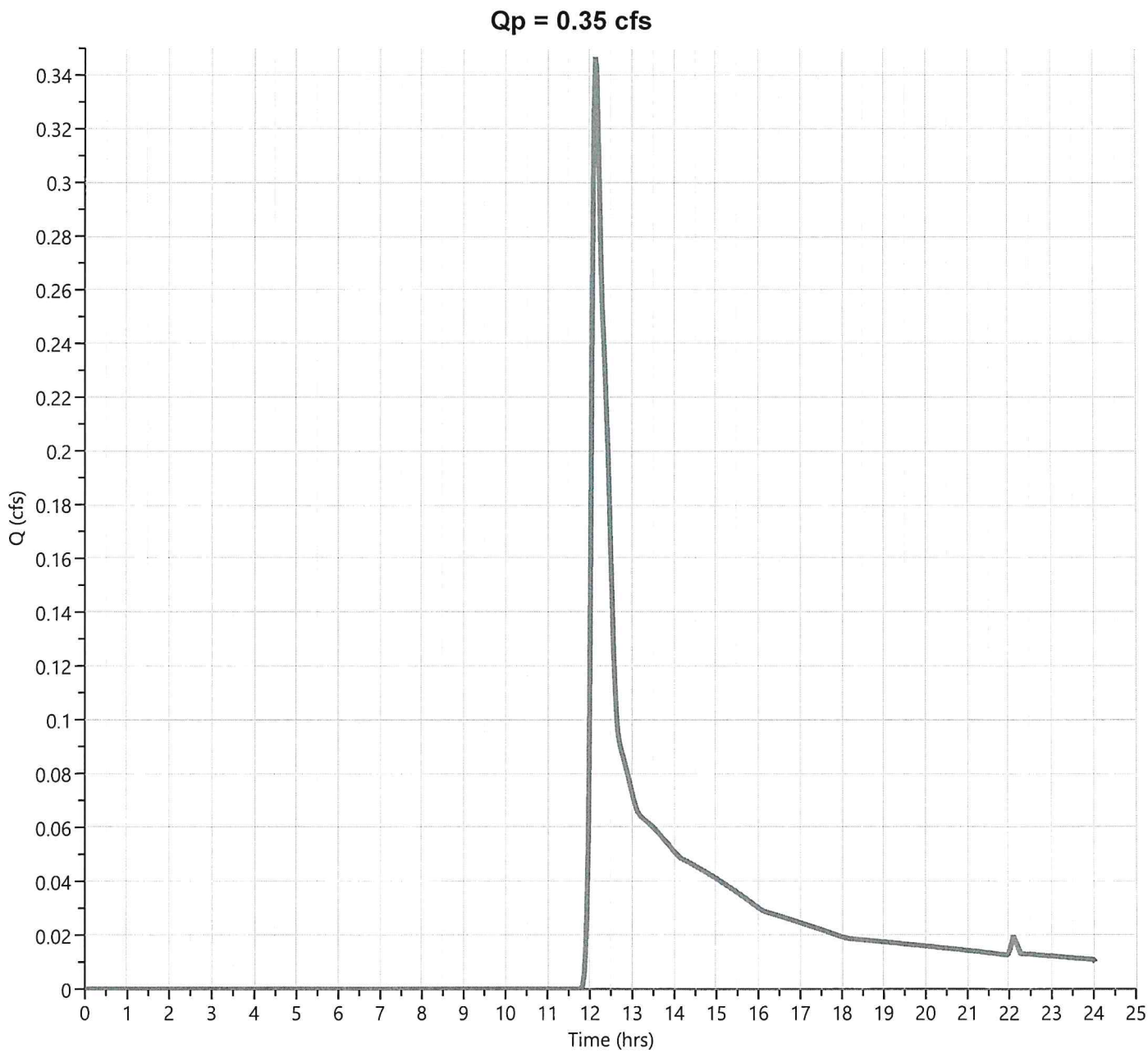
Hydrology Studio v 3.0.0.13

02-21-2020

P-4

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.347 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 1,657 cuft
Drainage Area	= 0.91 ac	Curve Number	= 63.7
Tc Method	= User	Time of Conc. (Tc)	= 7.6 min
Total Rainfall	= 3.10 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

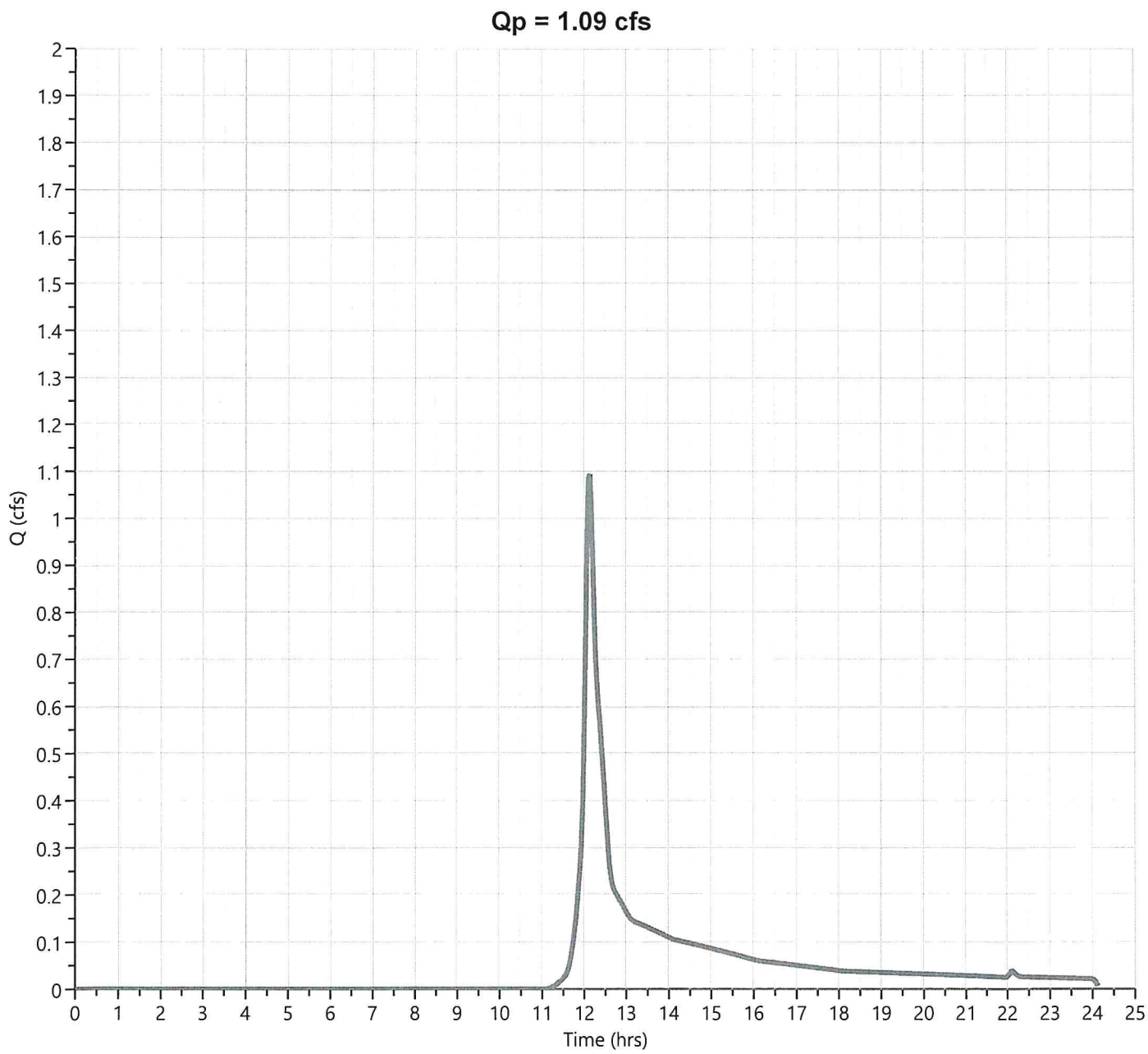
Hydrology Studio v 3.0.0.13

02-21-2020

P-4

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.093 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.13 hrs
Time Interval	= 2 min	Runoff Volume	= 4,117 cuft
Drainage Area	= 0.91 ac	Curve Number	= 63.7
Tc Method	= User	Time of Conc. (Tc)	= 7.6 min
Total Rainfall	= 4.50 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

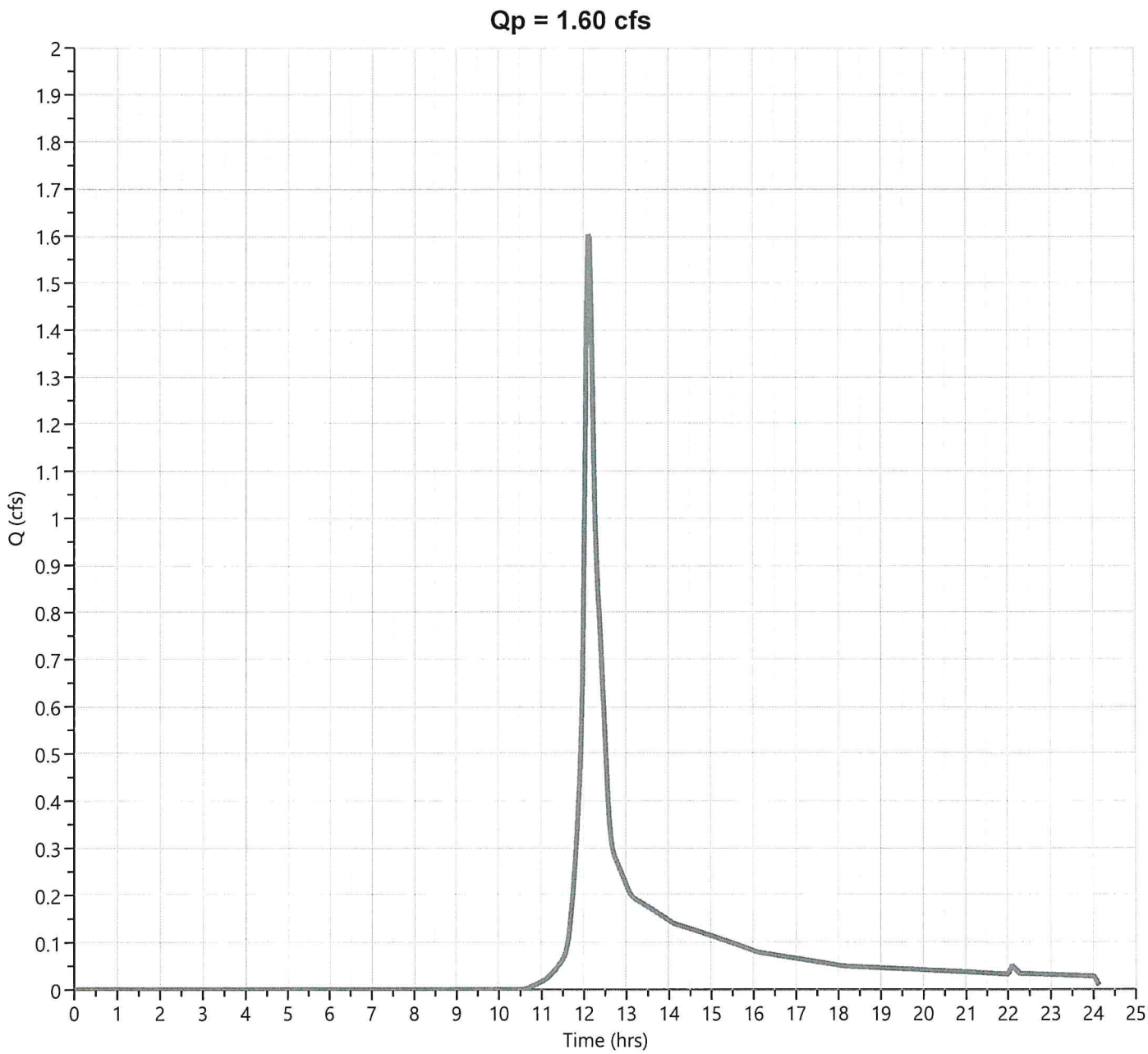
Hydrology Studio v 3.0.0.13

02-21-2020

P-4

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.603 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 5,799 cuft
Drainage Area	= 0.91 ac	Curve Number	= 63.7
Tc Method	= User	Time of Conc. (Tc)	= 7.6 min
Total Rainfall	= 5.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

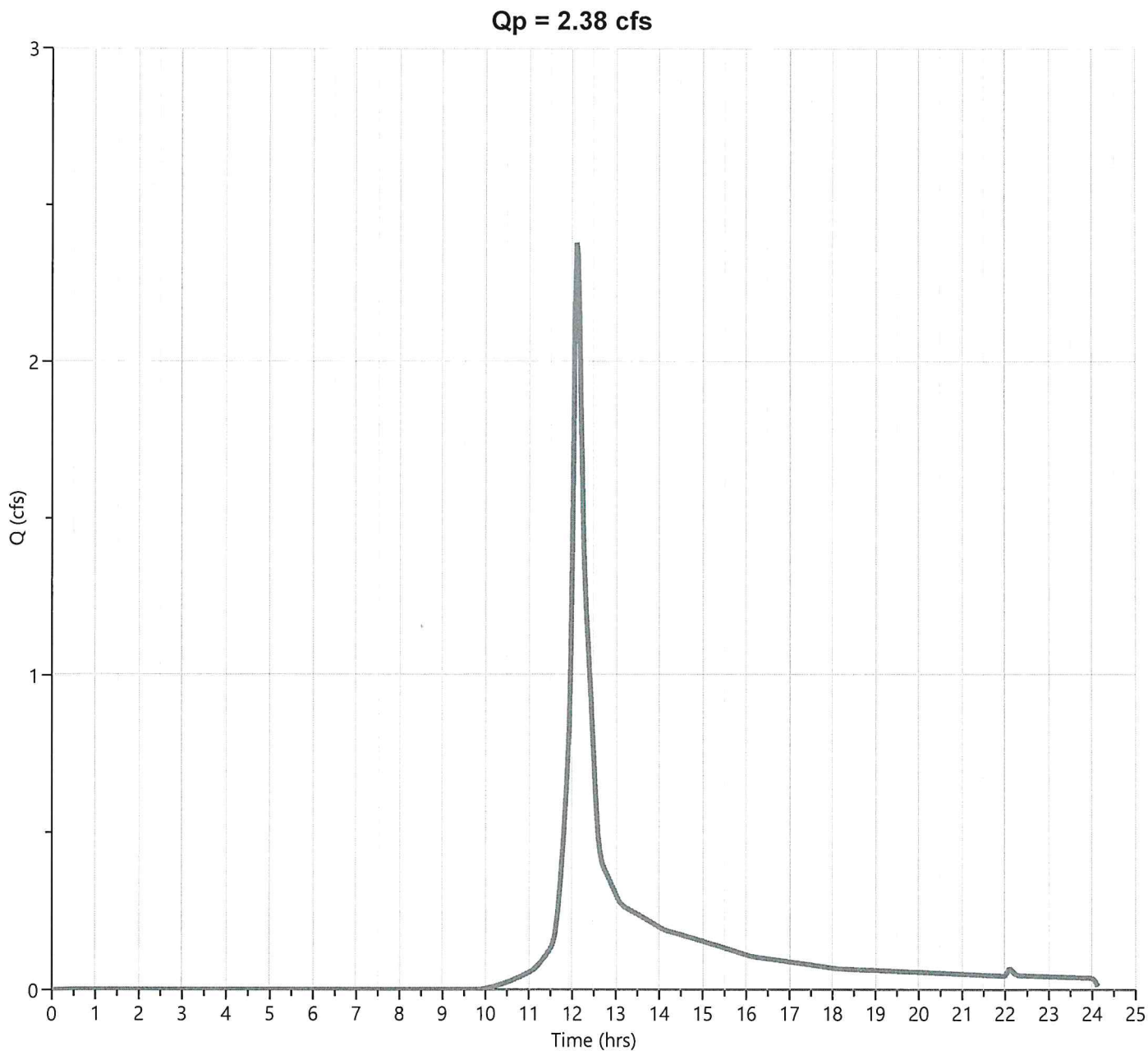
Hydrology Studio v 3.0.0.13

02-21-2020

P-4

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.380 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 8,341 cuft
Drainage Area	= 0.91 ac	Curve Number	= 63.7
Tc Method	= User	Time of Conc. (Tc)	= 7.6 min
Total Rainfall	= 6.40 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

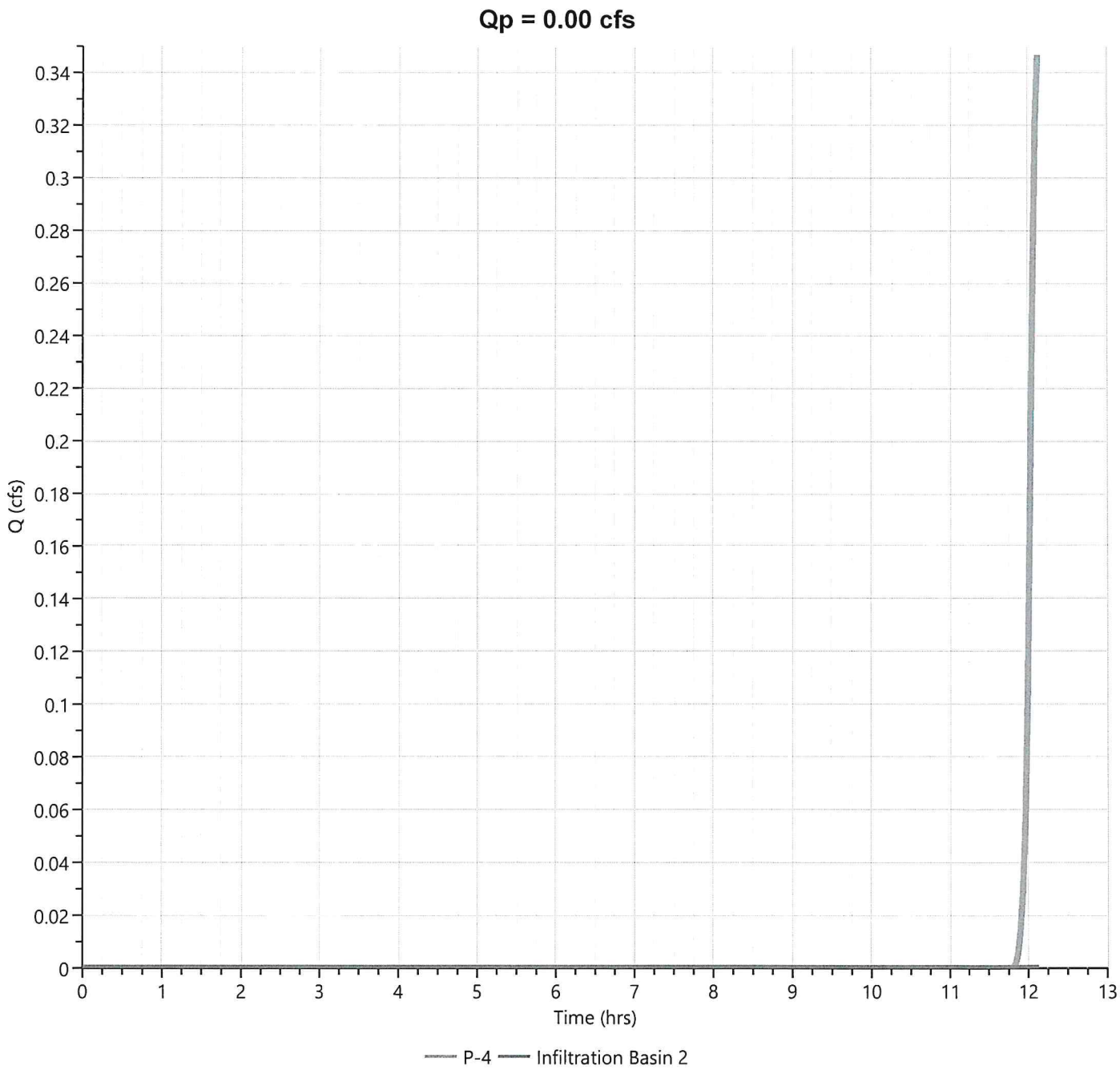
02-21-2020

Infiltration Basin 2

Hyd. No. 8

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 7 - P-4	Max. Elevation	= 127.55 ft
Pond Name	= Infiltration Basin 2	Max. Storage	= 84.0 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

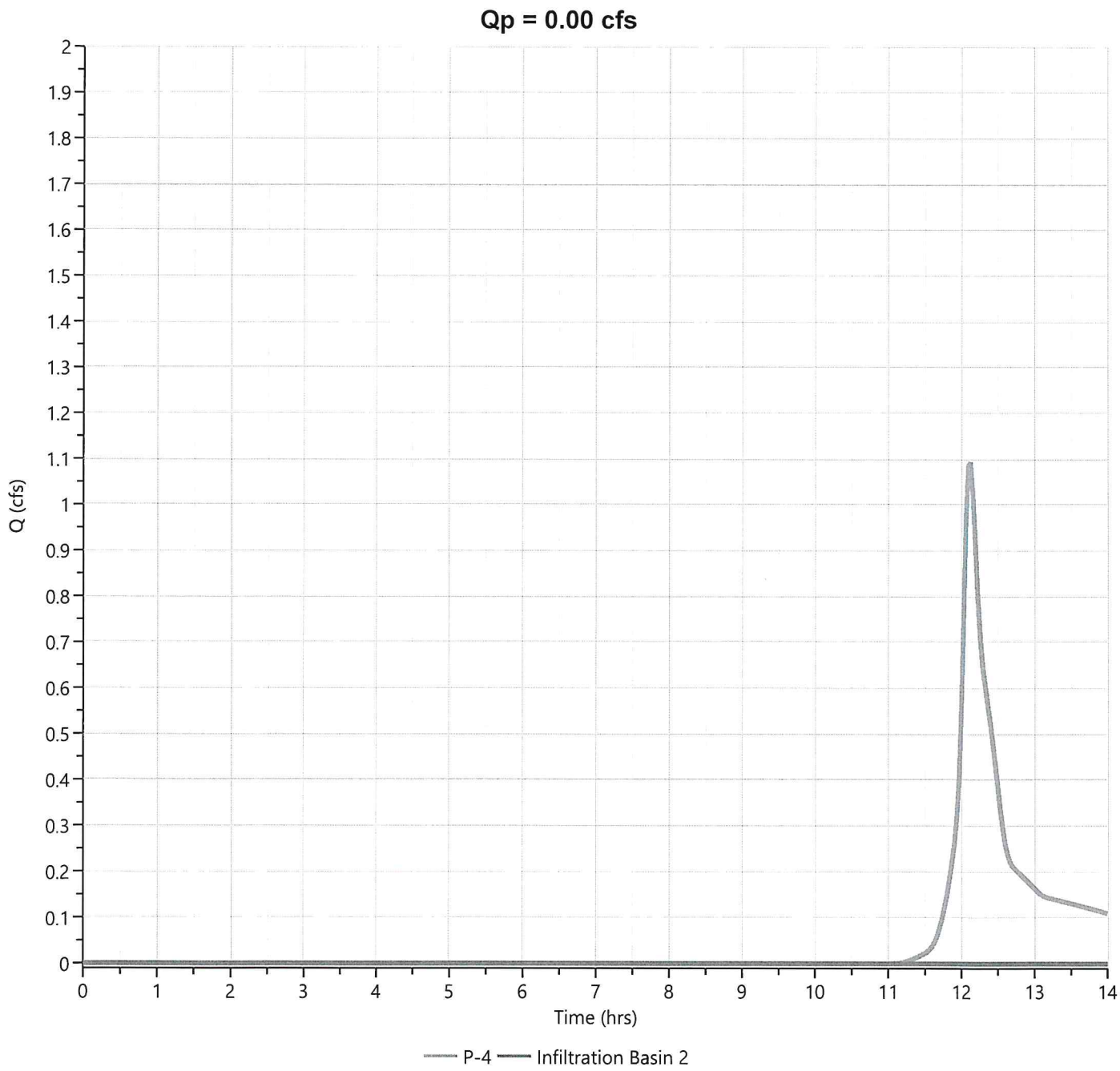
02-21-2020

Infiltration Basin 2

Hyd. No. 8

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.97 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 7 - P-4	Max. Elevation	= 128.02 ft
Pond Name	= Infiltration Basin 2	Max. Storage	= 855 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

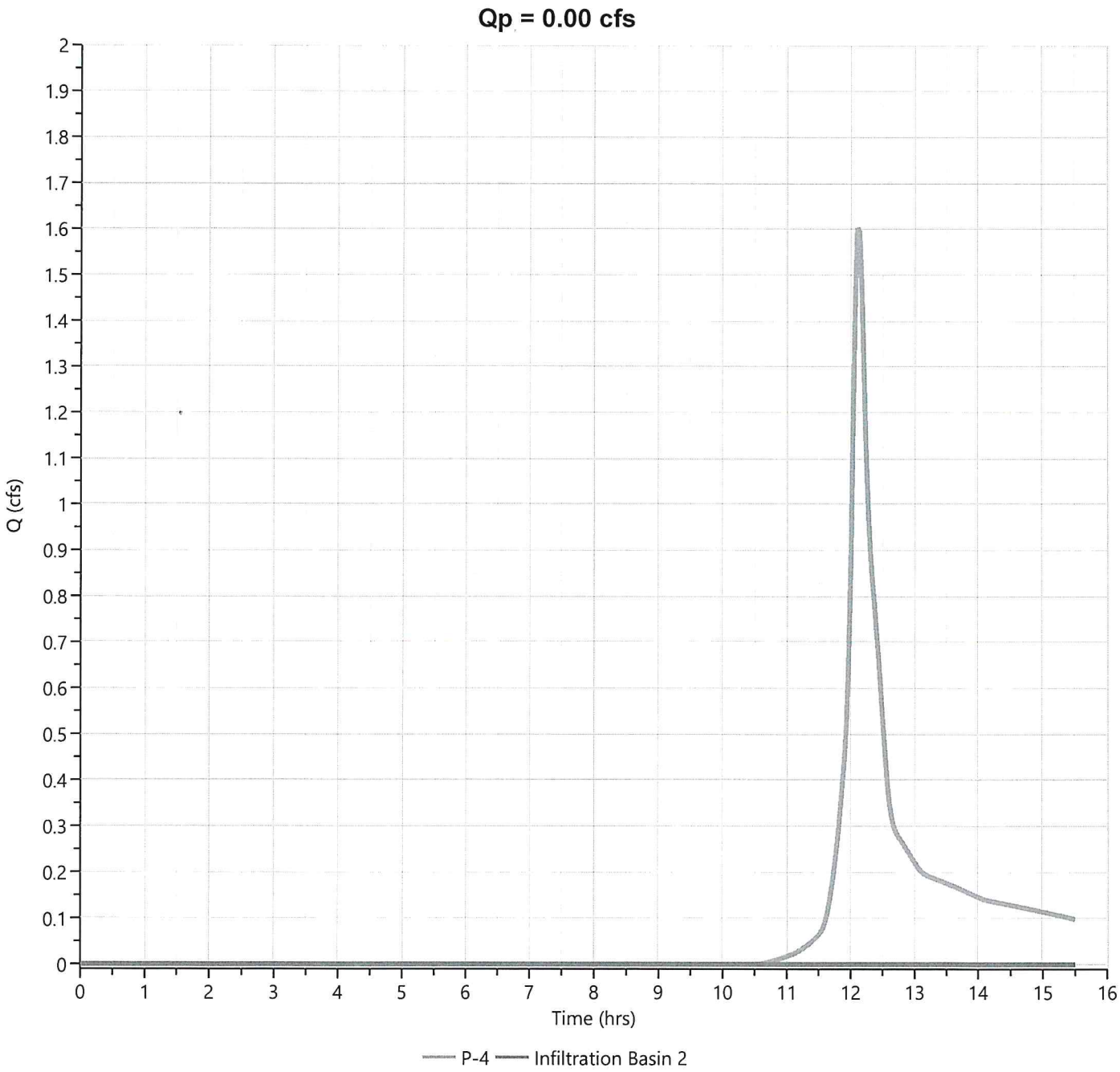
Infiltration Basin 2

Hyd. No. 8

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 15.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 7 - P-4	Max. Elevation	= 128.35 ft
Pond Name	= Infiltration Basin 2	Max. Storage	= 1,519 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 16 min



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

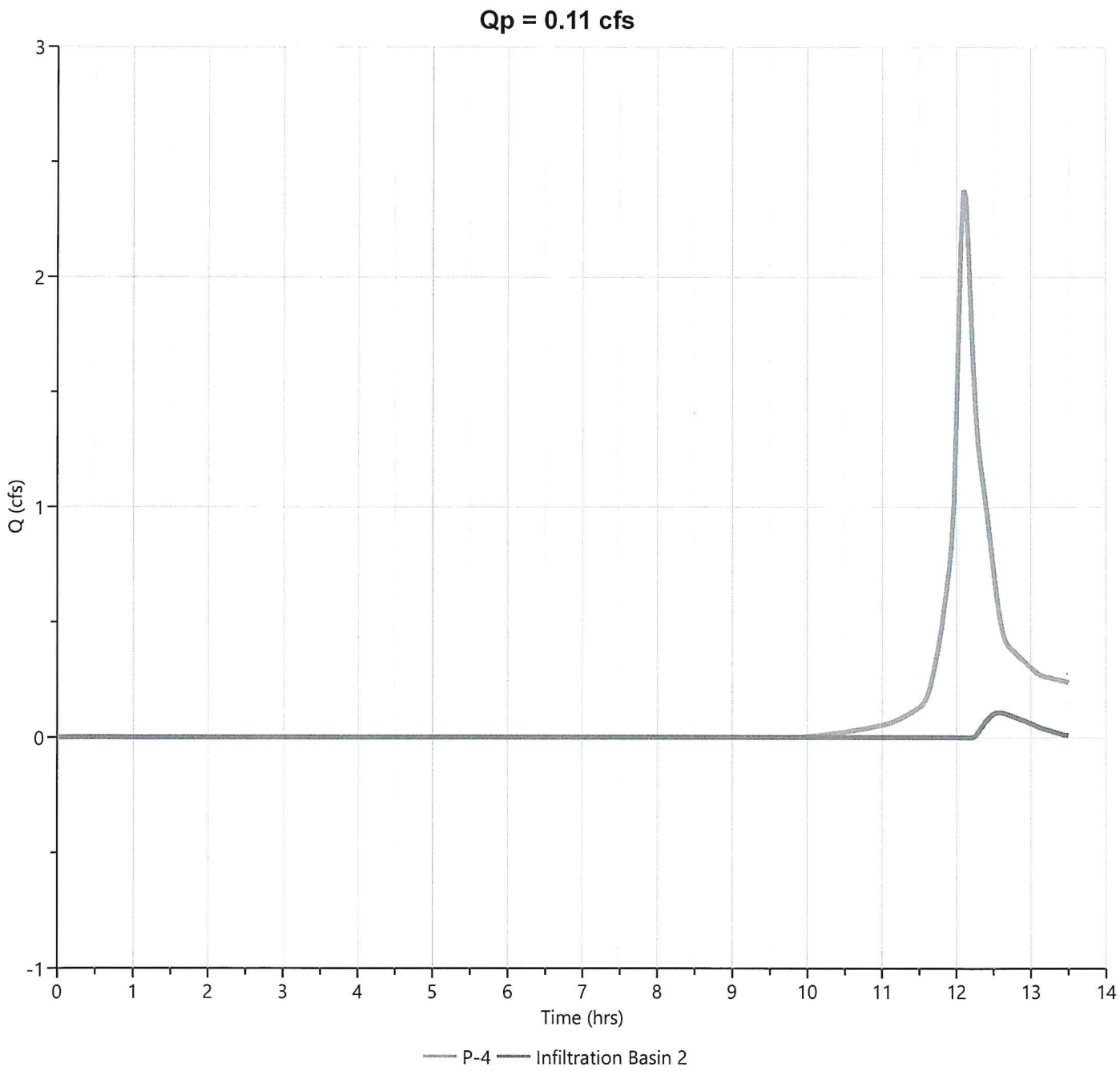
02-21-2020

Infiltration Basin 2

Hyd. No. 8

Hydrograph Type	= Pond Route	Peak Flow	= 0.108 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.57 hrs
Time Interval	= 2 min	Hydrograph Volume	= 273 cuft
Inflow Hydrograph	= 7 - P-4	Max. Elevation	= 128.84 ft
Pond Name	= Infiltration Basin 2	Max. Storage	= 2,508 cuft

Pond Routing by Storage Indication Method



Pond Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

Infiltration Basin 2

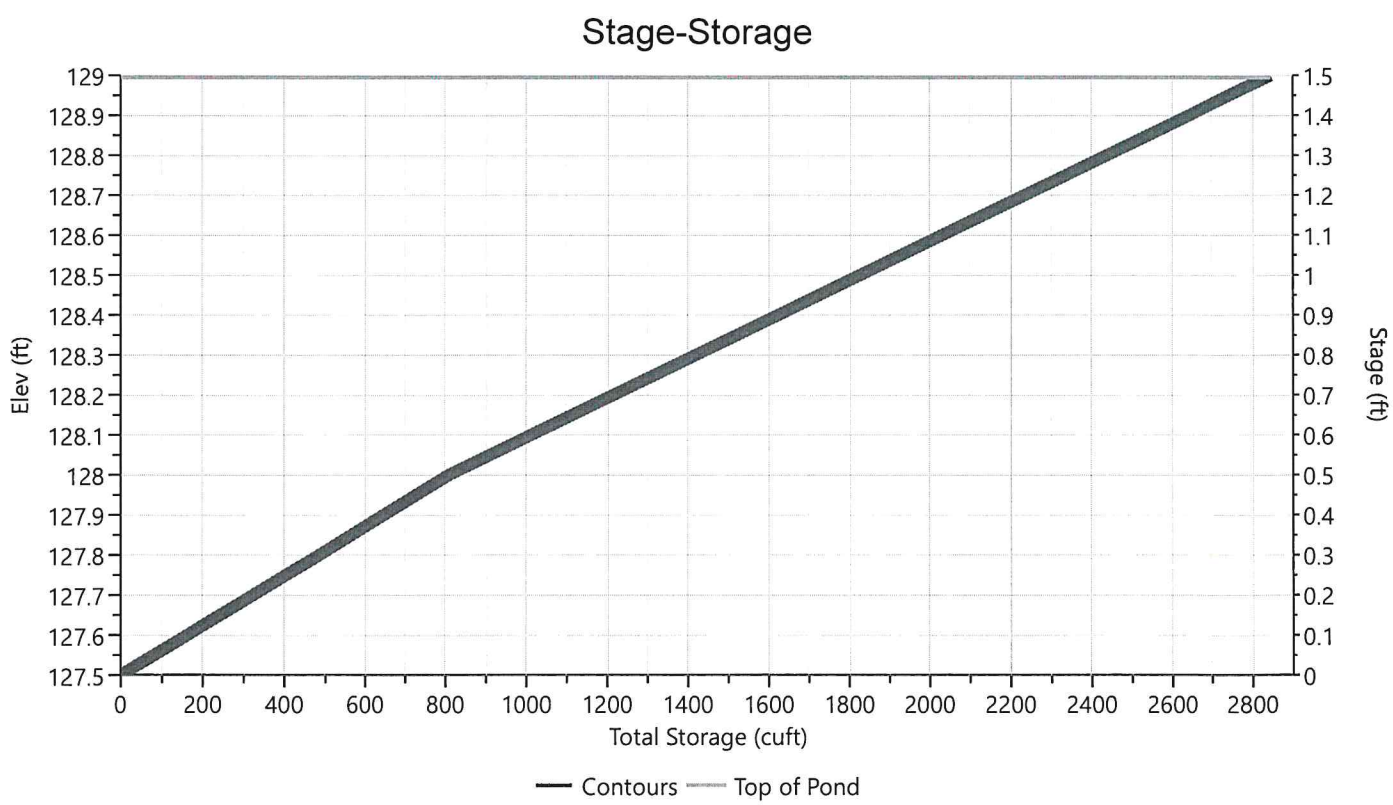
Stage-Storage

User Defined Contours

Description	Input
Bottom Elevation, ft	127.50
Voids (%)	100.00
Volume Calc	Conic

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	127.50	1,505	0.000	0.000
0.50	128.00	1,738	810	810
1.50	129.00	2,347	2,035	2,845



Pond Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

Infiltration Basin 2

Stage-Discharge

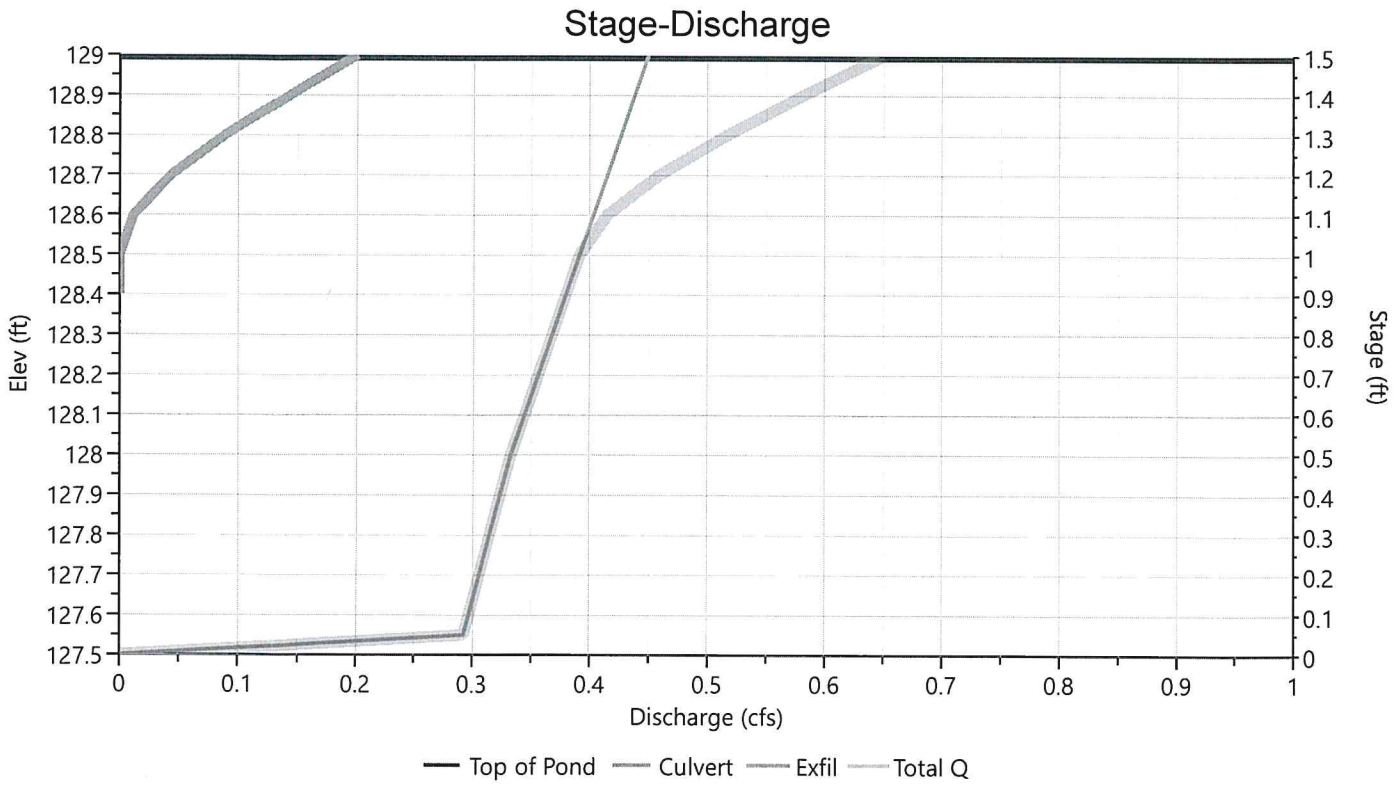
Culvert / Orifices	Culvert	Orifices 1	Orifices 2	Orifices 3
Rise, in	12			
Span, in	12			
No. Barrels	1			
Invert Elevation, ft	128.50			
Orifice Coefficient, Co	0.60			
Length, ft	35			
Barrel Slope, %	.03			
N-Value, n	0.013			

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

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

Ancillary	
Exfiltration, in/hr	8.27**

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

Infiltration Basin 2

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	127.50	0.000	0.000									0.000		0.000
0.50	128.00	810	0.000									0.333		0.333
1.50	129.00	2,845	0.201 oc									0.449		0.650

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

Pond Report

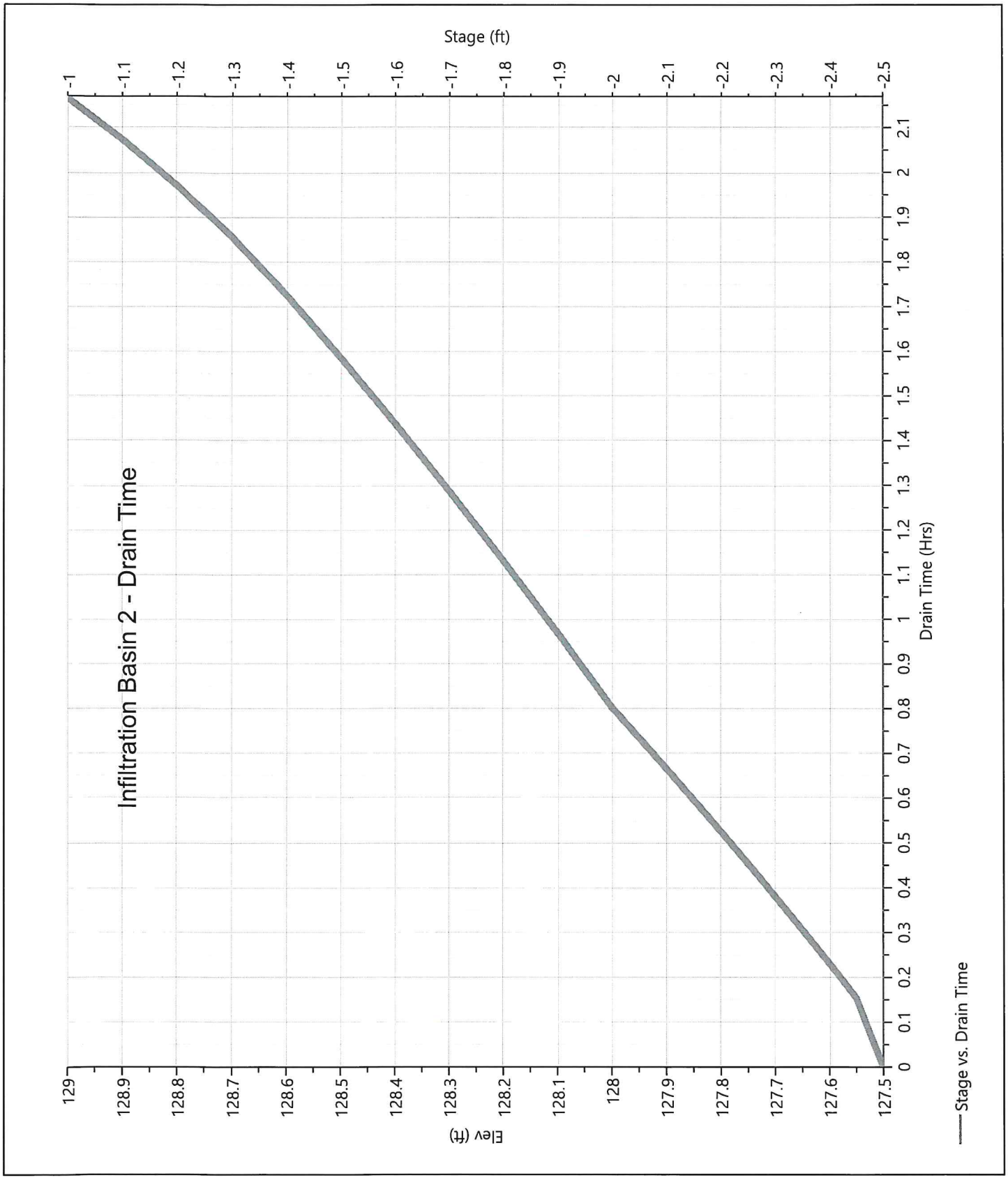
Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

Infiltration Basin 2

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-2763B**

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present [Developed] P5

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 Pavement - Driveways/Buildings	98			0.08	7.41
A	Gravel	76			0.00	0.00
A	Open Space - Good Condition	39			0.22	8.50
A	Woods - Good Condition	30			0.00	0.00
B	Open Space - Good Condition	61			0.09	5.32
B	Woods - Good Condition	55			0.00	0.00
				Totals =	0.38	21.23

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{21.23}{0.38} = 55.75$; Use CN = 55.8

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.24	0.78	1.82
Runoff, Q.....	cf	335	1081	2512

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-2763B

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present | Developed
Circle one: Tc | Tt through subarea P5

Sheet flow (Applicable to Tc only)		Segment ID	A-B	B-C		
1. Surface Description (table 3-1)			GRASS	PAVEMENT		
2. Mannings roughness coeff., n (table 3-1)			0.24	0.011		
3. Flow length, L (total L <= 300 ft)		ft	14	36		
4. Two-yr 24-hr rainfall, P2		in	3.1	3.1		
5. Land Slope, s		ft/ft	0.09	0.05		
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.03	0.01		0.03

Shallow concentrated Flow		Segment ID	C_D			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	351			364
9. Watercourse slope, s		ft/ft	0.07			0.06
10. Average Velocity, V (figure 3-1)		ft/s	4.27			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02

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

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:

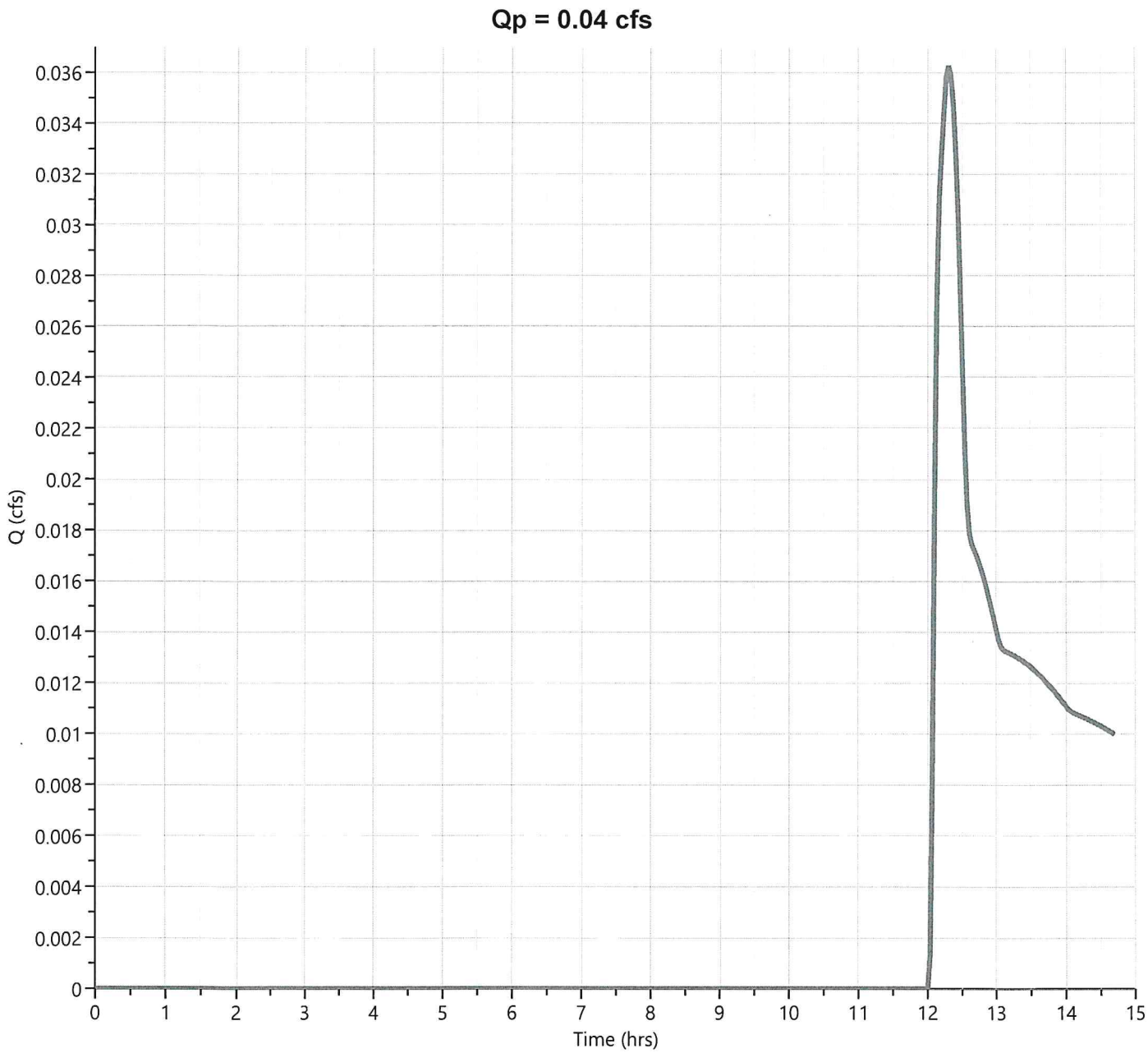
Hydrology Studio v 3.0.0.13

02-21-2020

P-5

Hyd. No. 9

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.036 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 315 cuft
Drainage Area	= 0.38 ac	Curve Number	= 55.8
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 3.10 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

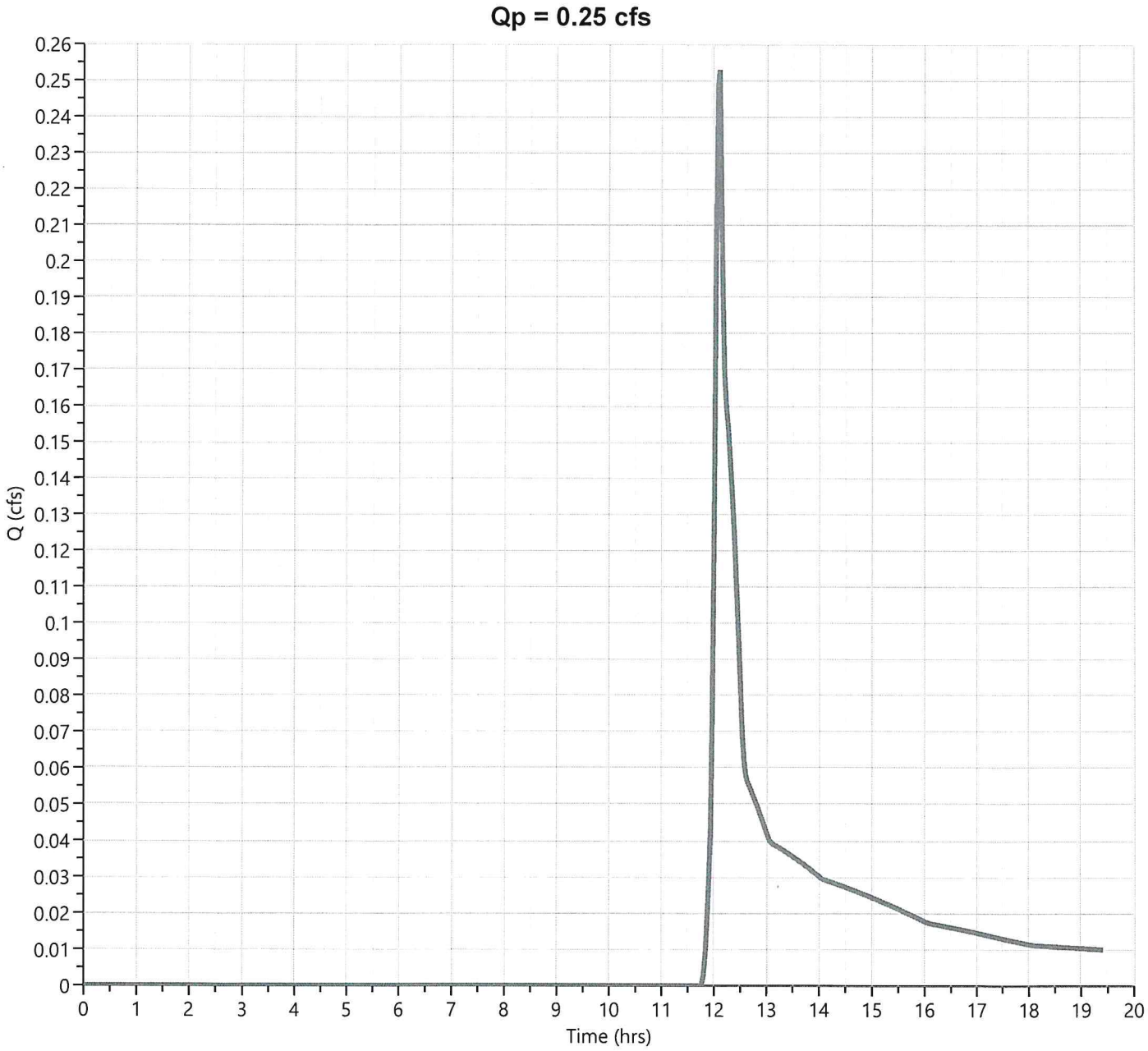
Hydrology Studio v 3.0.0.13

02-21-2020

P-5

Hyd. No. 9

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.253 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Runoff Volume	= 1,015 cuft
Drainage Area	= 0.38 ac	Curve Number	= 55.8
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 4.50 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

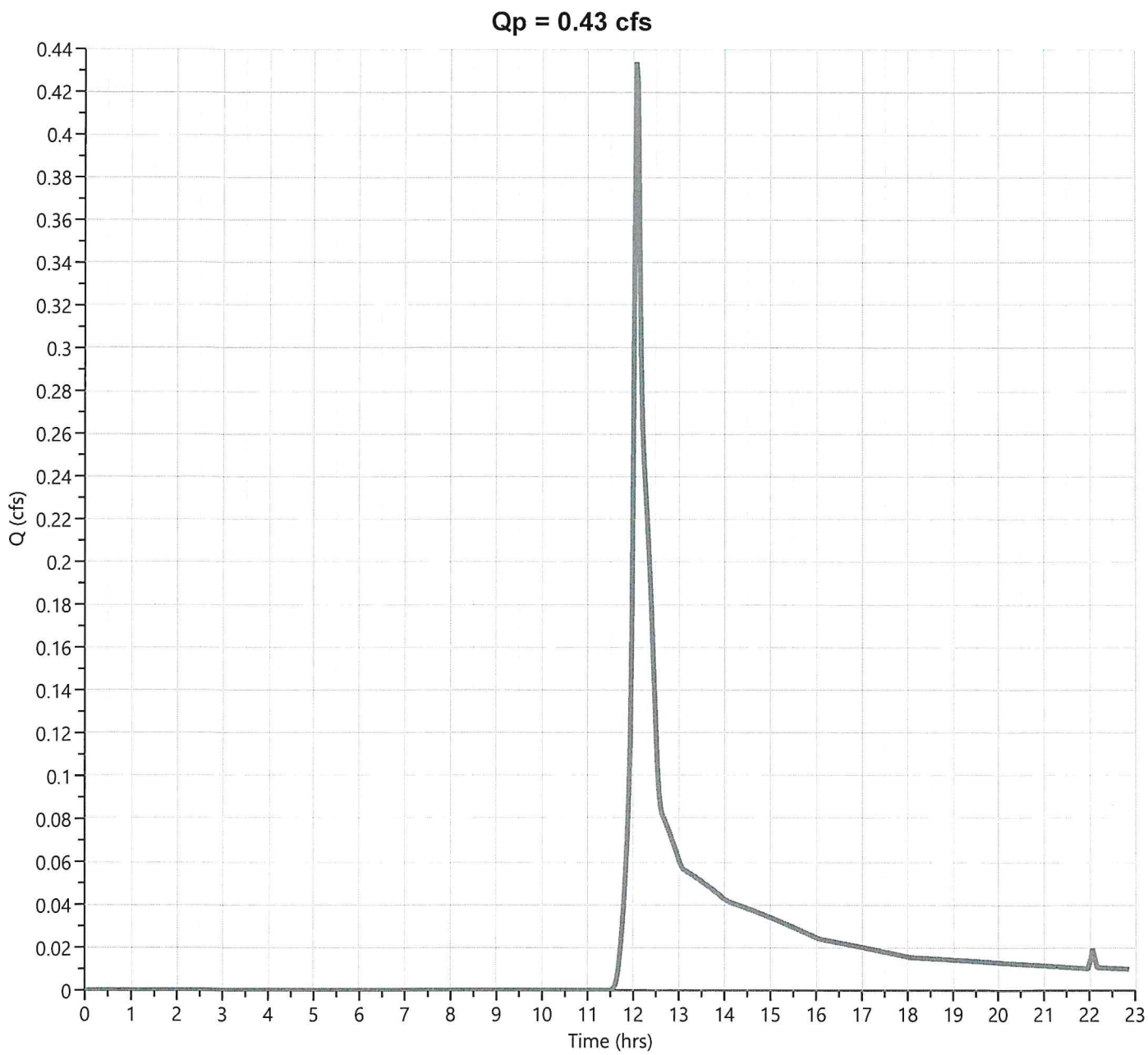
Hydrology Studio v 3.0.0.13

02-21-2020

P-5

Hyd. No. 9

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.434 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 1,534 cuft
Drainage Area	= 0.38 ac	Curve Number	= 55.8
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

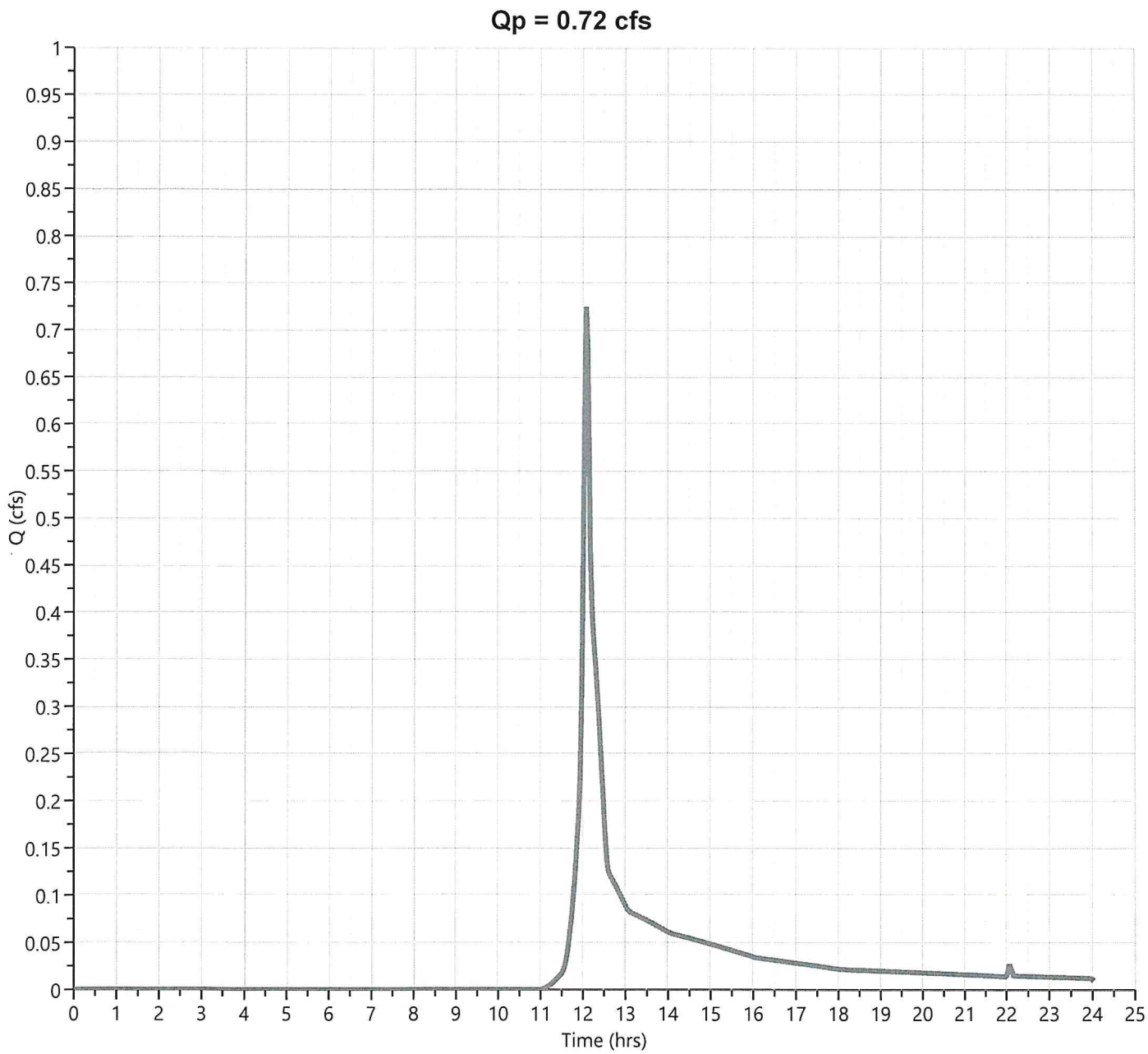
Hydrology Studio v 3.0.0.13

02-21-2020

P-5

Hyd. No. 9

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.725 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 2,355 cuft
Drainage Area	= 0.38 ac	Curve Number	= 55.8
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 6.40 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

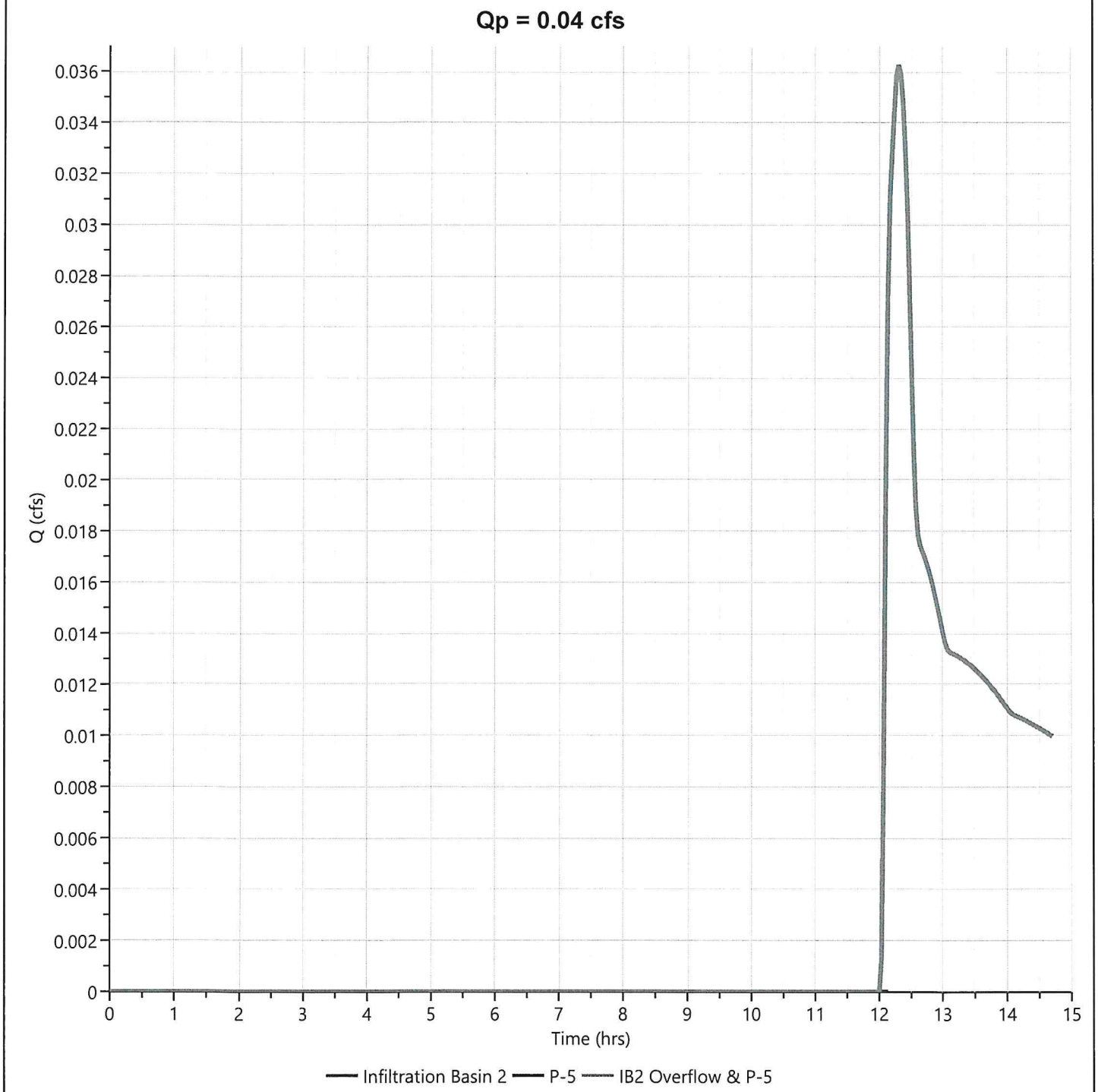
Hydrology Studio v 3.0.0.13

02-21-2020

IB2 Overflow & P-5

Hyd. No. 10

Hydrograph Type	= Junction	Peak Flow	= 0.036 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Hydrograph Volume	= 315 cuft
Inflow Hydrographs	= 8, 9	Total Contrib. Area	= 0.38 ac



Hydrograph Report

Project Name:

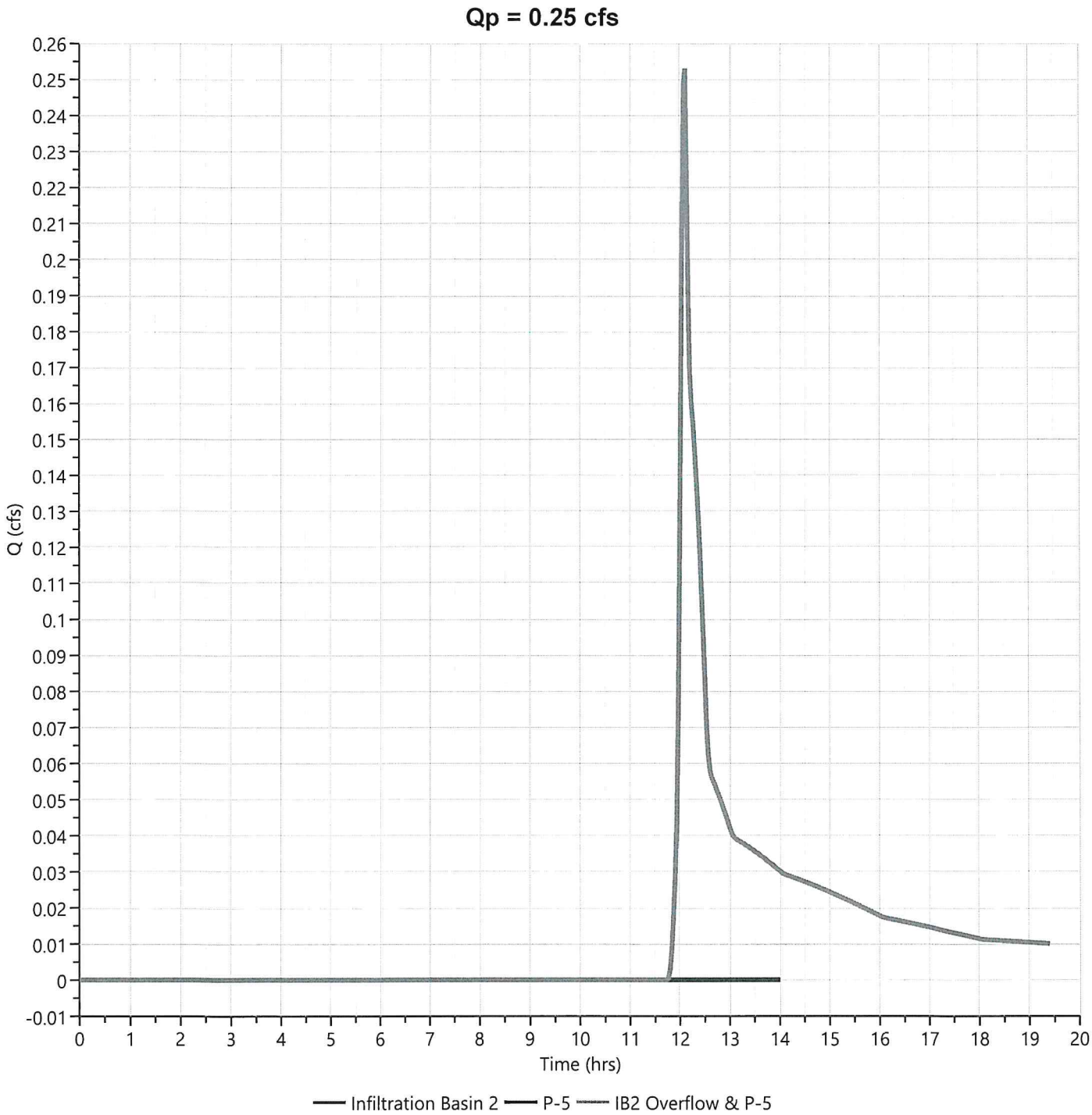
Hydrology Studio v 3.0.0.13

02-21-2020

IB2 Overflow & P-5

Hyd. No. 10

Hydrograph Type	= Junction	Peak Flow	= 0.253 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.10 hrs
Time Interval	= 2 min	Hydrograph Volume	= 1,015 cuft
Inflow Hydrographs	= 8, 9	Total Contrib. Area	= 0.38 ac



Hydrograph Report

Project Name:

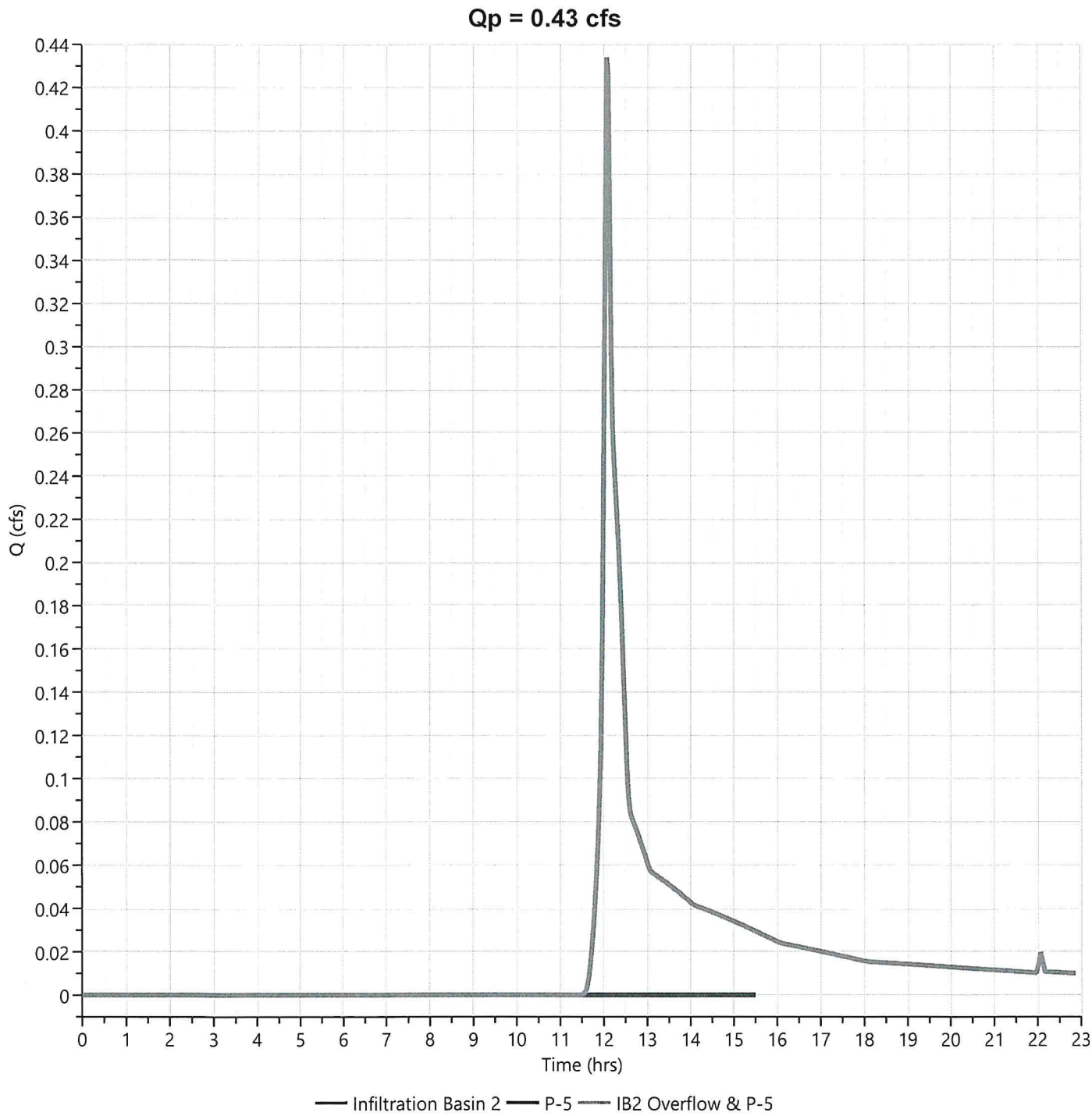
Hydrology Studio v 3.0.0.13

02-21-2020

IB2 Overflow & P-5

Hyd. No. 10

Hydrograph Type	= Junction	Peak Flow	= 0.434 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Hydrograph Volume	= 1,534 cuft
Inflow Hydrographs	= 8, 9	Total Contrib. Area	= 0.38 ac



Hydrograph Report

Project Name:

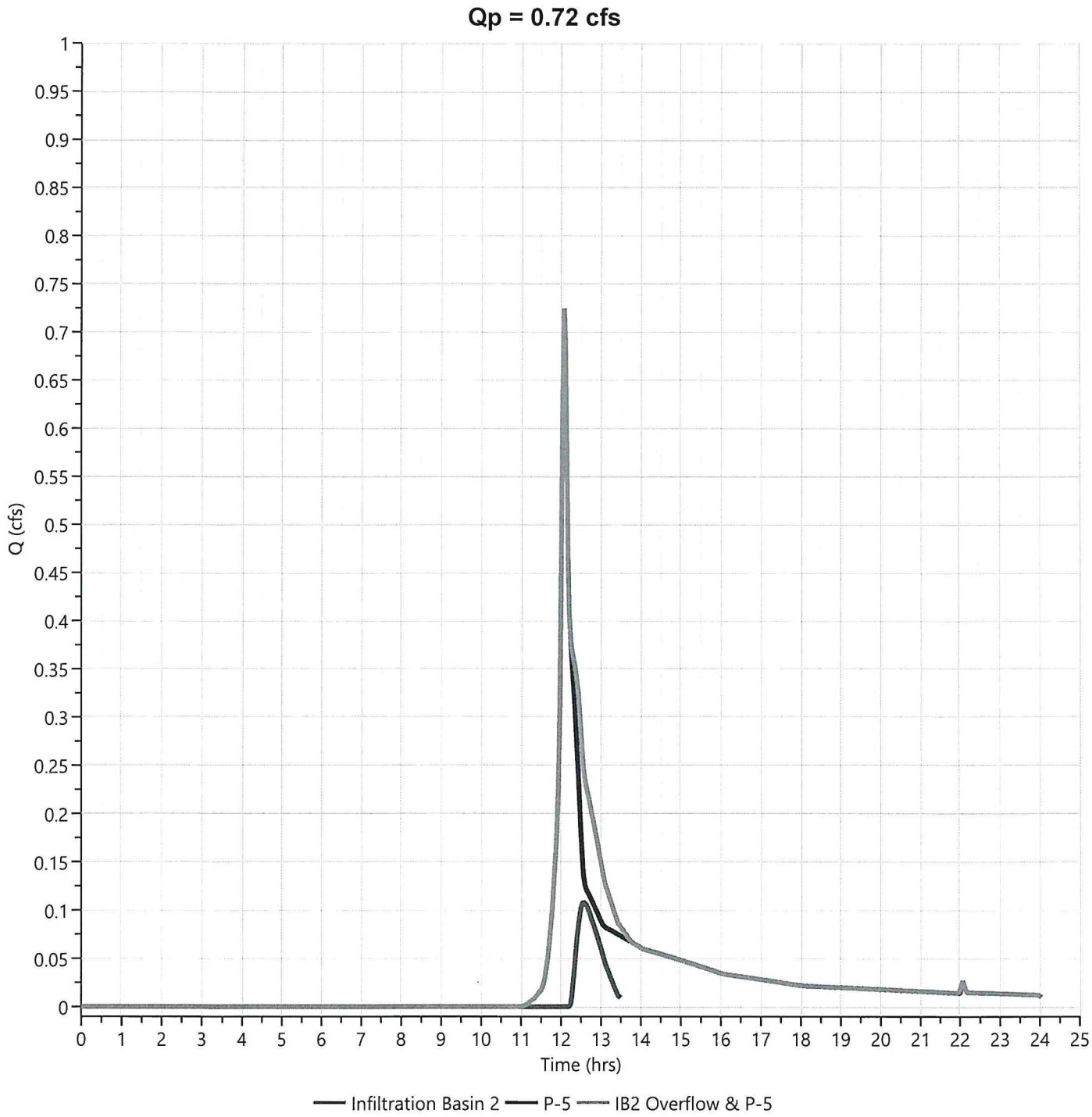
Hydrology Studio v 3.0.0.13

02-21-2020

IB2 Overflow & P-5

Hyd. No. 10

Hydrograph Type	= Junction	Peak Flow	= 0.725 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Hydrograph Volume	= 2,627 cuft
Inflow Hydrographs	= 8, 9	Total Contrib. Area	= 0.38 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

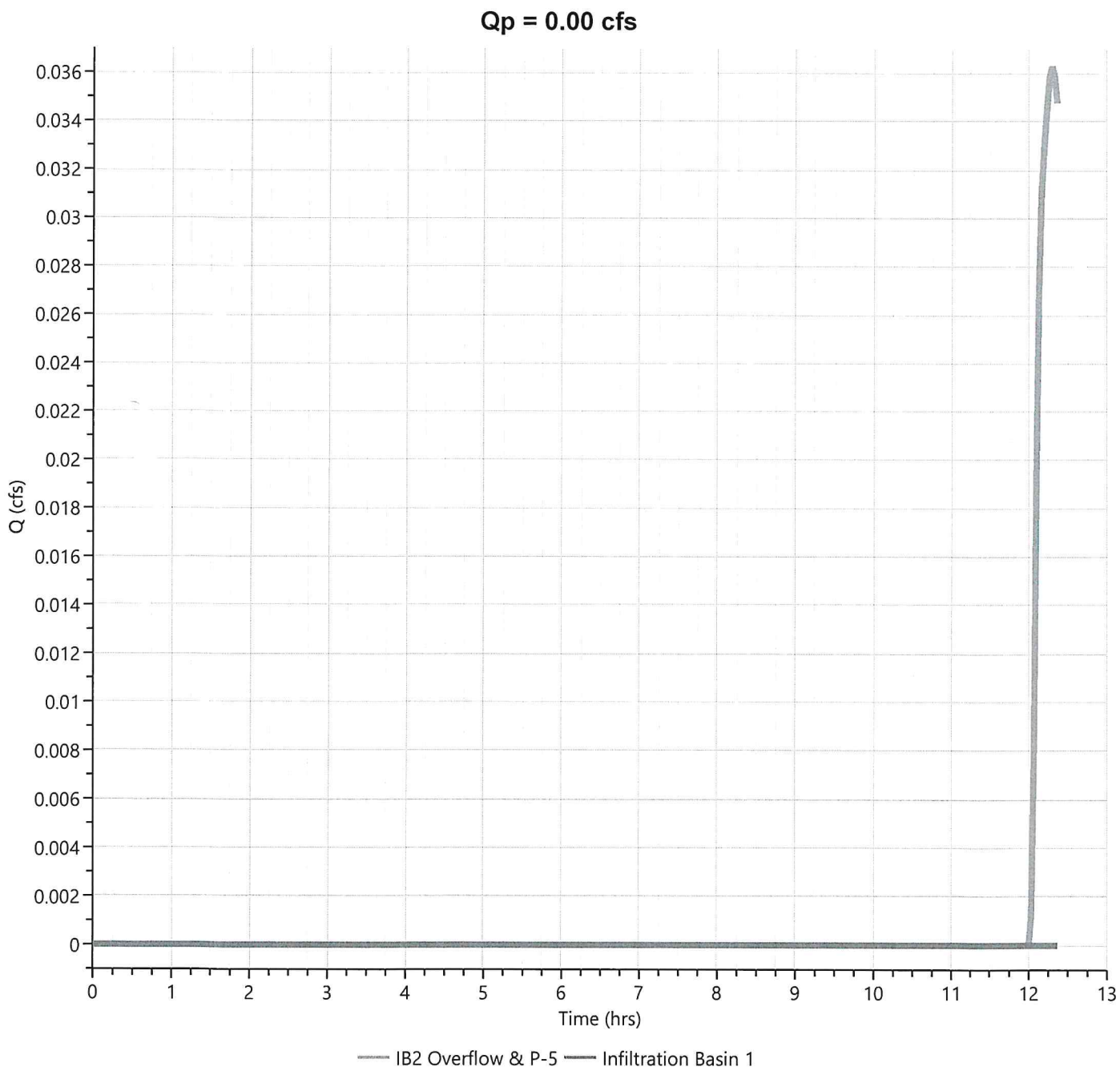
02-21-2020

Infiltration Basin 1

Hyd. No. 11

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 10 - IB2 Overflow & P-5	Max. Elevation	= 127.52 ft
Pond Name	= Infiltration Basin 1	Max. Storage	= 12.4 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

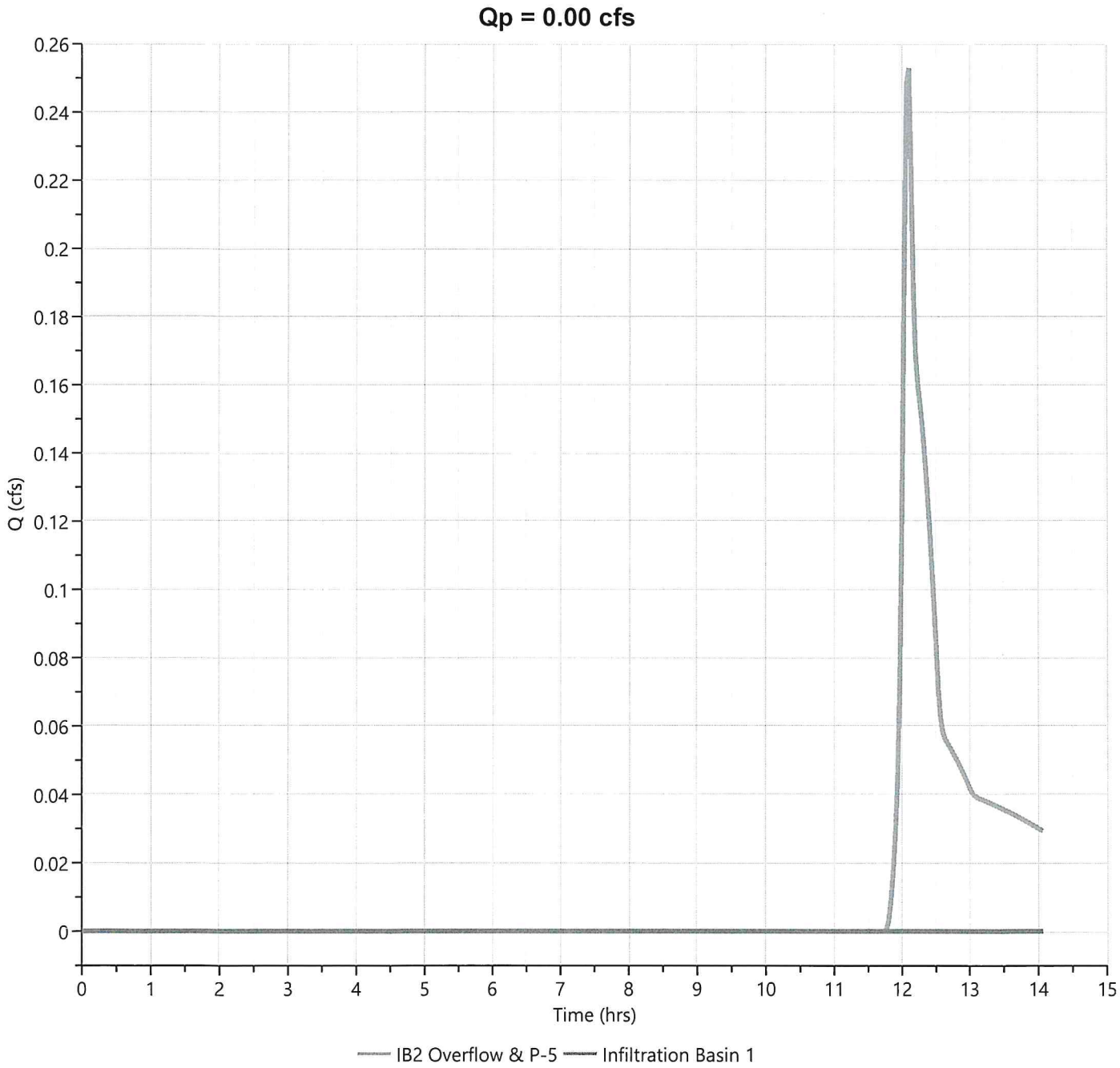
02-21-2020

Infiltration Basin 1

Hyd. No. 11

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 14.03 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 10 - IB2 Overflow & P-5	Max. Elevation	= 127.63 ft
Pond Name	= Infiltration Basin 1	Max. Storage	= 108 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

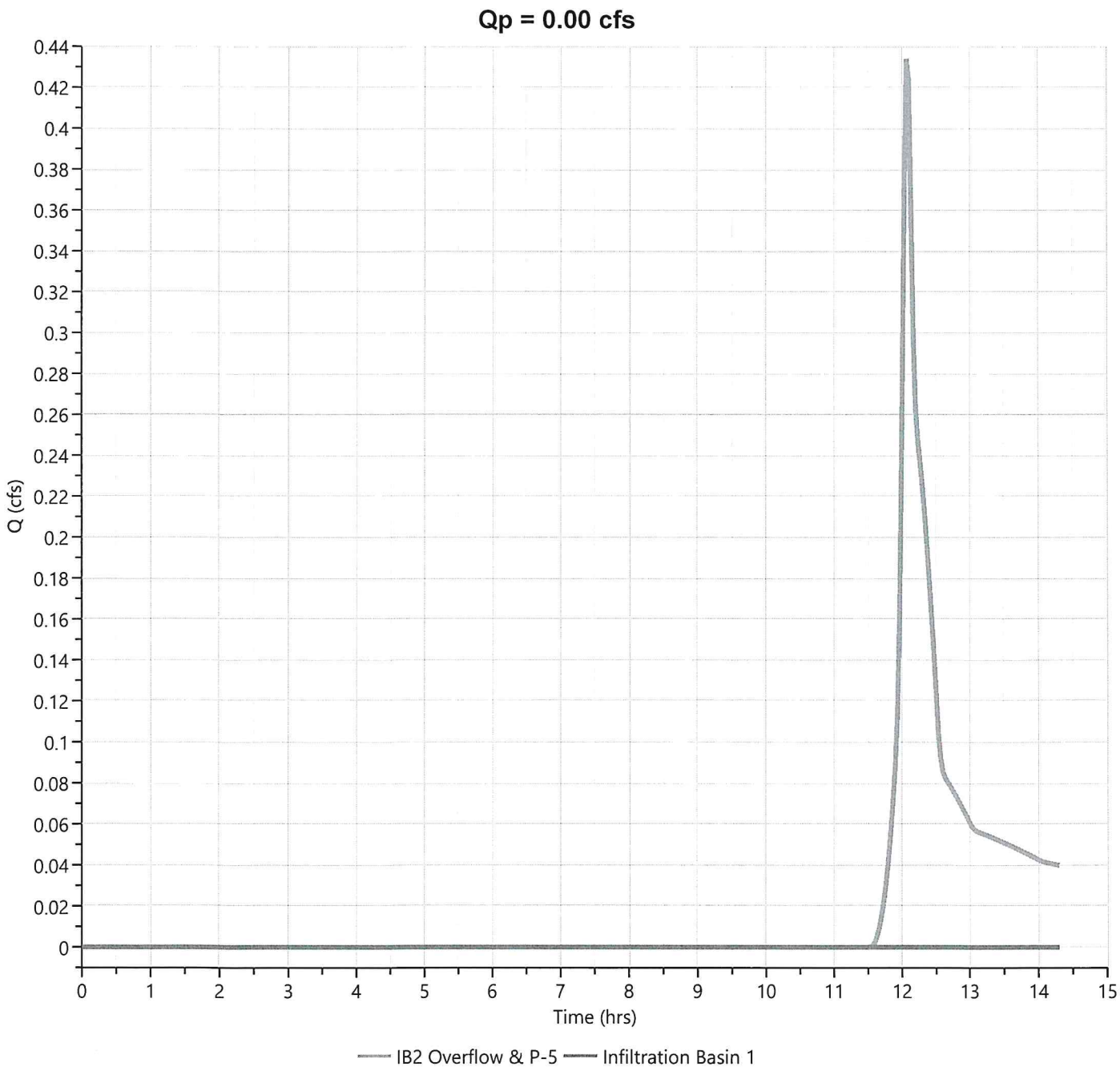
02-21-2020

Infiltration Basin 1

Hyd. No. 11

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 14.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 10 - IB2 Overflow & P-5	Max. Elevation	= 127.81 ft
Pond Name	= Infiltration Basin 1	Max. Storage	= 248 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

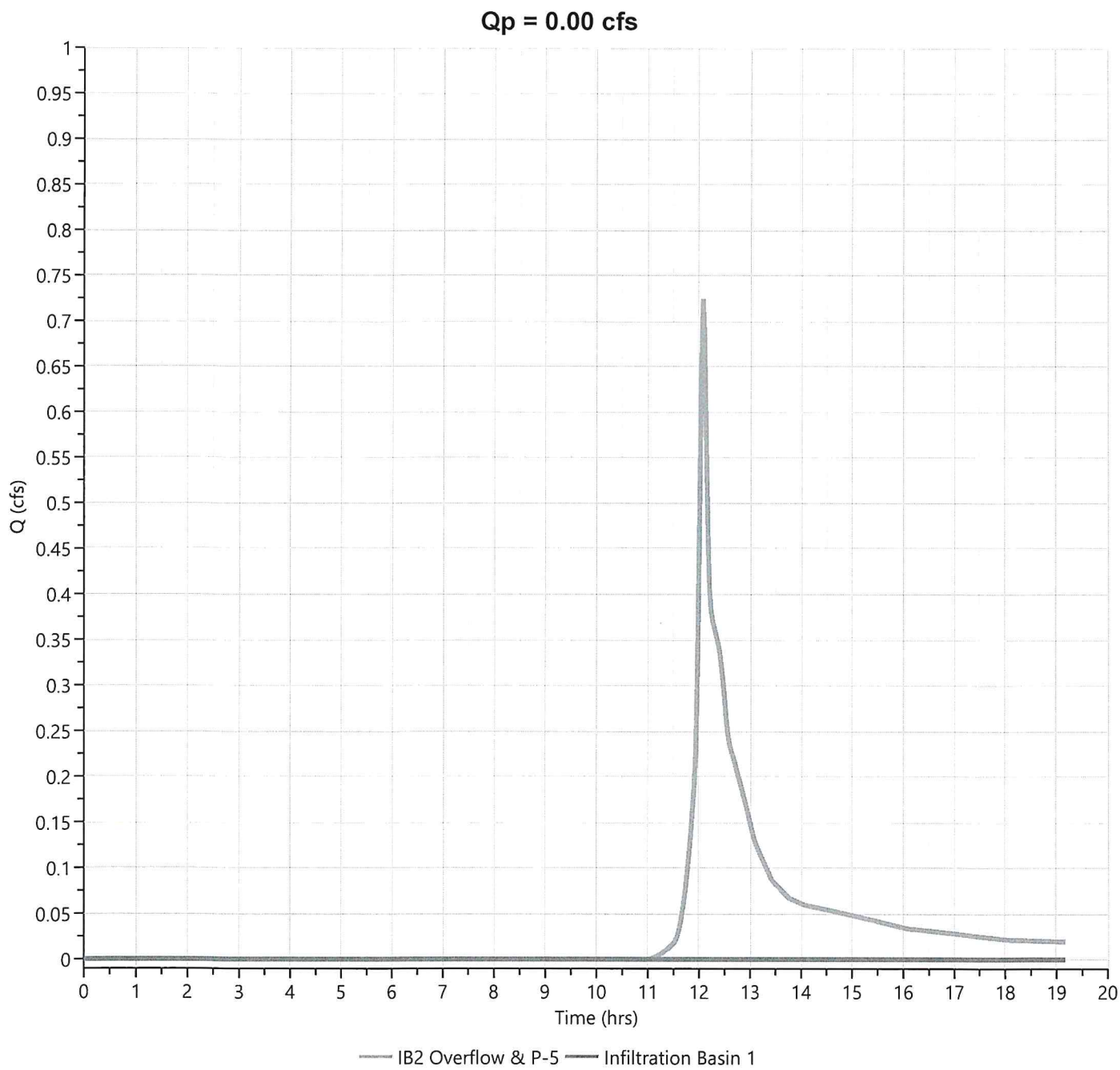
02-21-2020

Infiltration Basin 1

Hyd. No. 11

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 19.13 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 10 - IB2 Overflow & P-5	Max. Elevation	= 128.11 ft
Pond Name	= Infiltration Basin 1	Max. Storage	= 555 cuft

Pond Routing by Storage Indication Method



Pond Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

Infiltration Basin 1

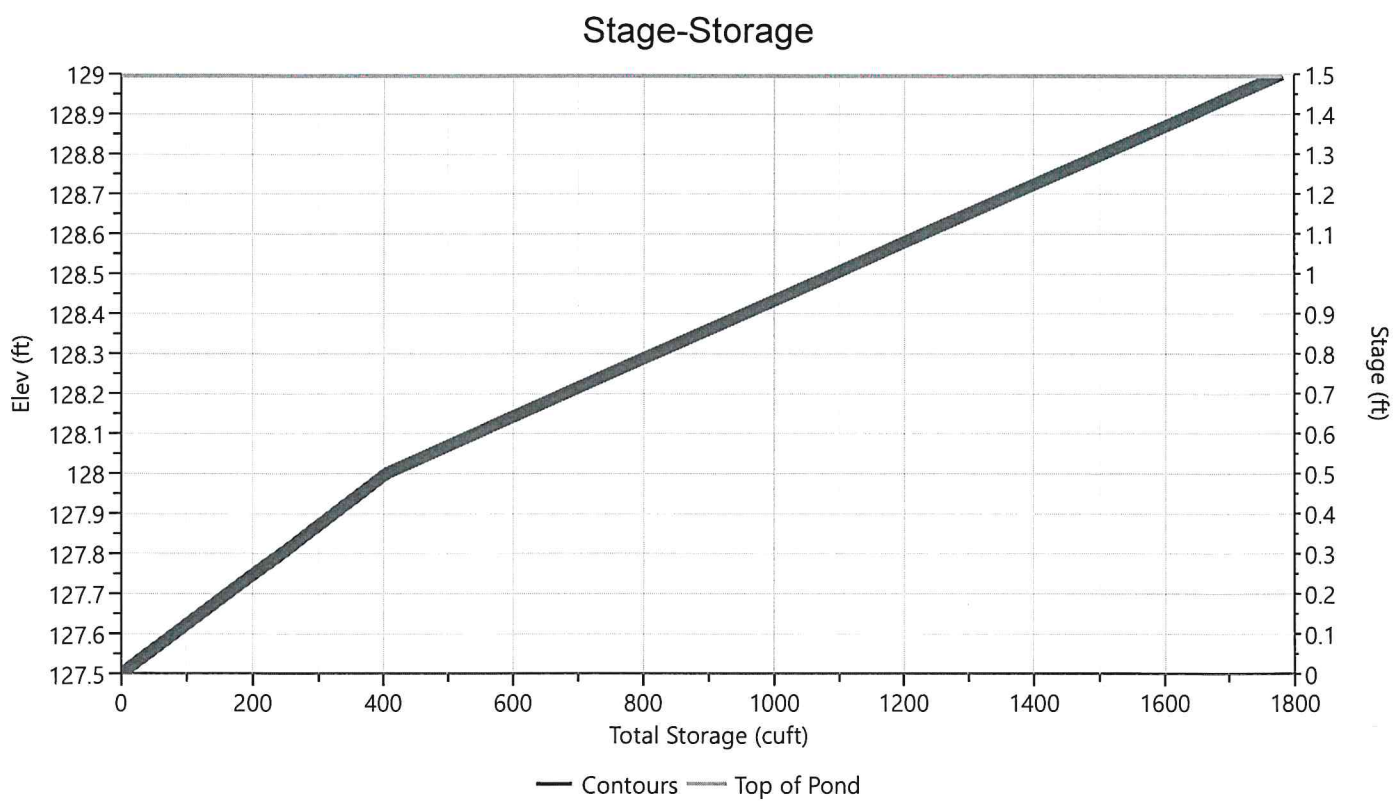
Stage-Storage

User Defined Contours

Description	Input
Bottom Elevation, ft	127.50
Voids (%)	100.00
Volume Calc	None

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	127.50	498	0.000	0.000
0.50	128.00	1,123	405	405
1.50	129.00	1,628	1,376	1,781



Pond Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

Infiltration Basin 1

Stage-Discharge

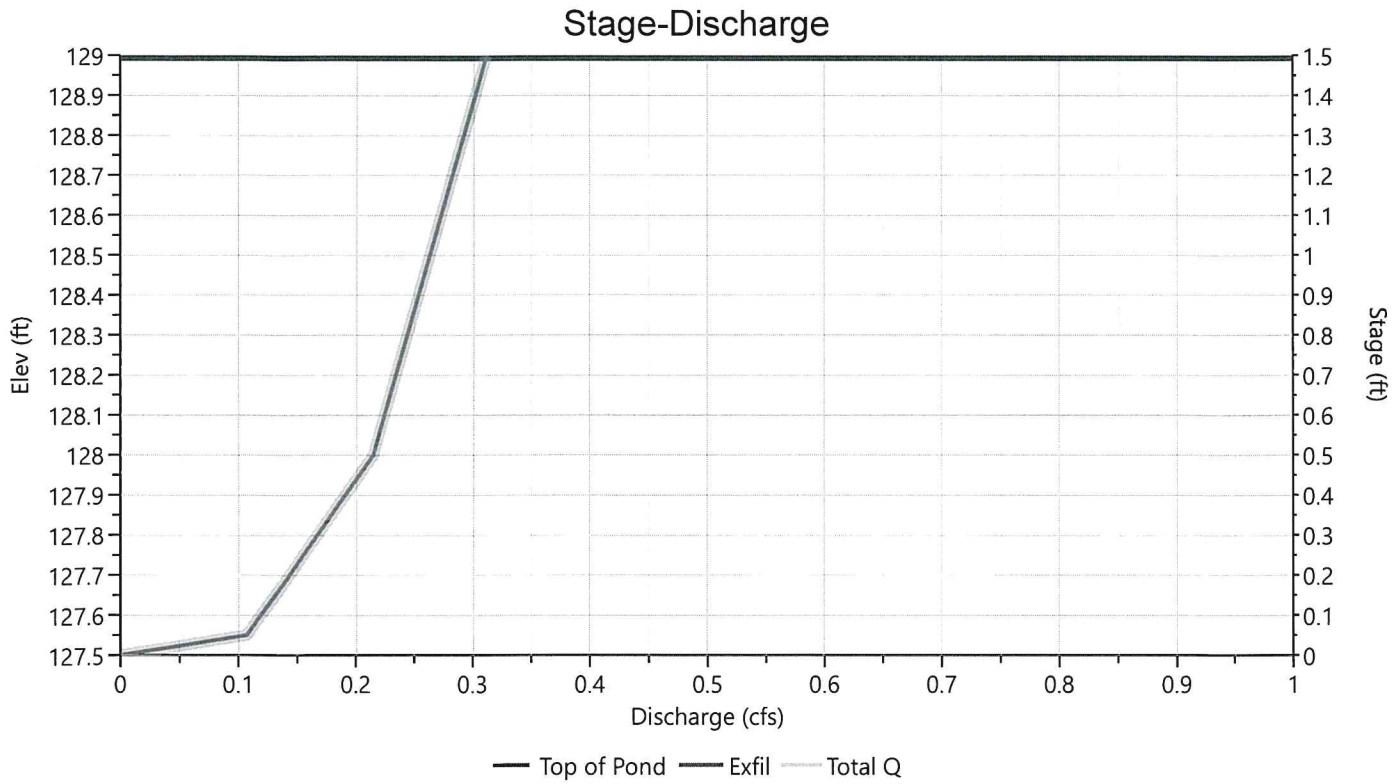
Culvert / Orifices	Culvert	Orifices 1	Orifices 2	Orifices 3
Rise, in				
Span, in				
No. Barrels				
Invert Elevation, ft				
Orifice Coefficient, Co				
Length, ft				
Barrel Slope, %				
N-Value, n	0.000			

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

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

Ancillary	
Exfiltration, in/hr	8.27**

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

Infiltration Basin 1

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	127.50	0.000										0.000		0.000
0.50	128.00	405										0.215		0.215
1.50	129.00	1,781										0.312		0.312

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

Pond Report

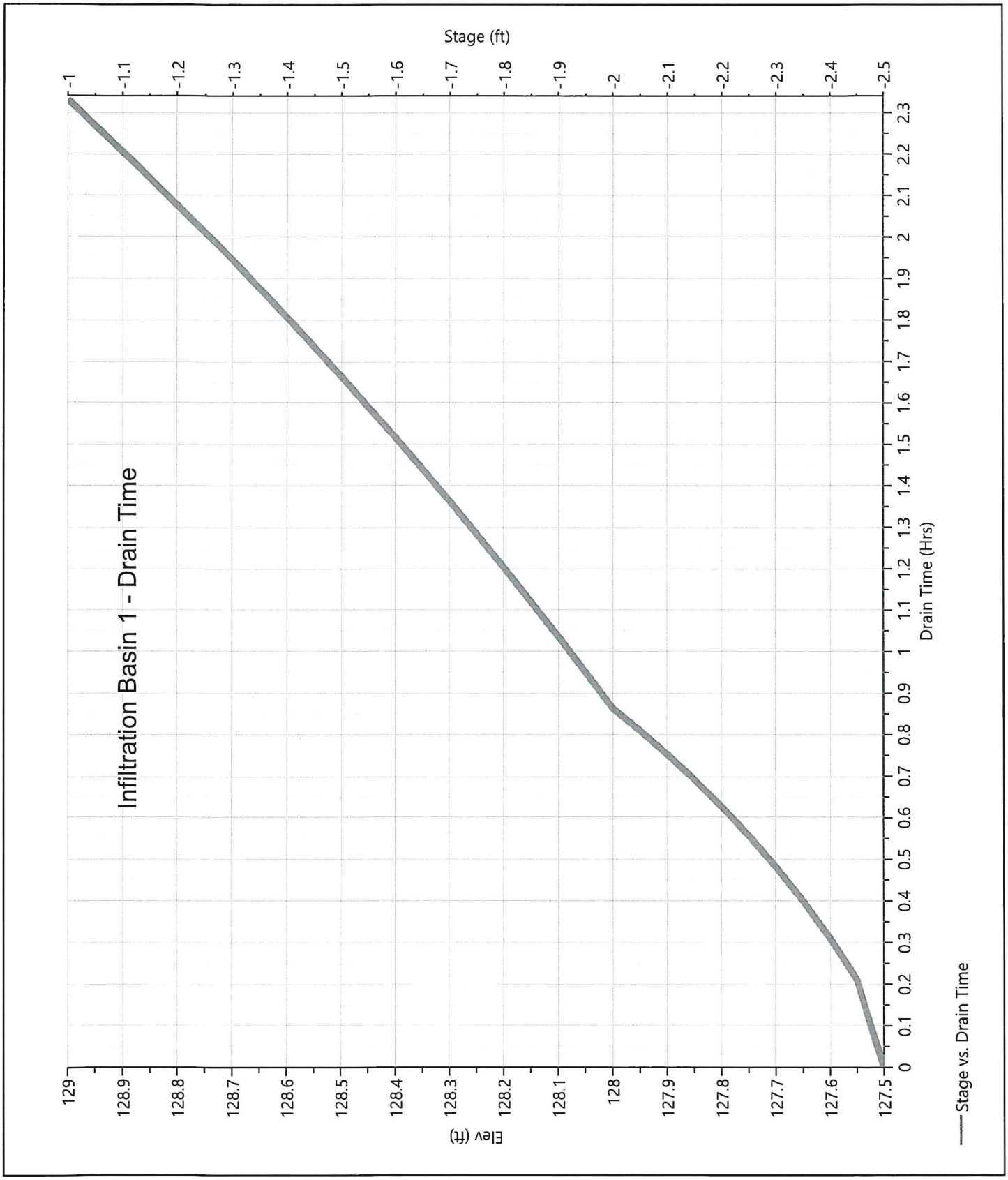
Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

Infiltration Basin 1

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-2763B**

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present [Developed] P6

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 Pavement - Driveways/Buildings Total P6= 0.15 acres (6 dwellings, 1 community building)	98			0.02	2.33
A	Gravel	76			0.00	0.00
A	Open Space - Good Condition	39			0.00	0.00
A	Woods - Good Condition	30			0.00	0.00
B	Open Space - Good Condition	61			0.00	0.00
B	Woods - Good Condition	55			0.00	0.00
				Totals =	0.02	2.33

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{2.33}{0.02} = 98.00$; Use CN = 98.0

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	2.87	4.26	6.16
Runoff, Q.....	cf	248	368	532

D-2 (210-VI-TR-55, Second Ed., June 1986)

Hydrograph Report

Project Name:

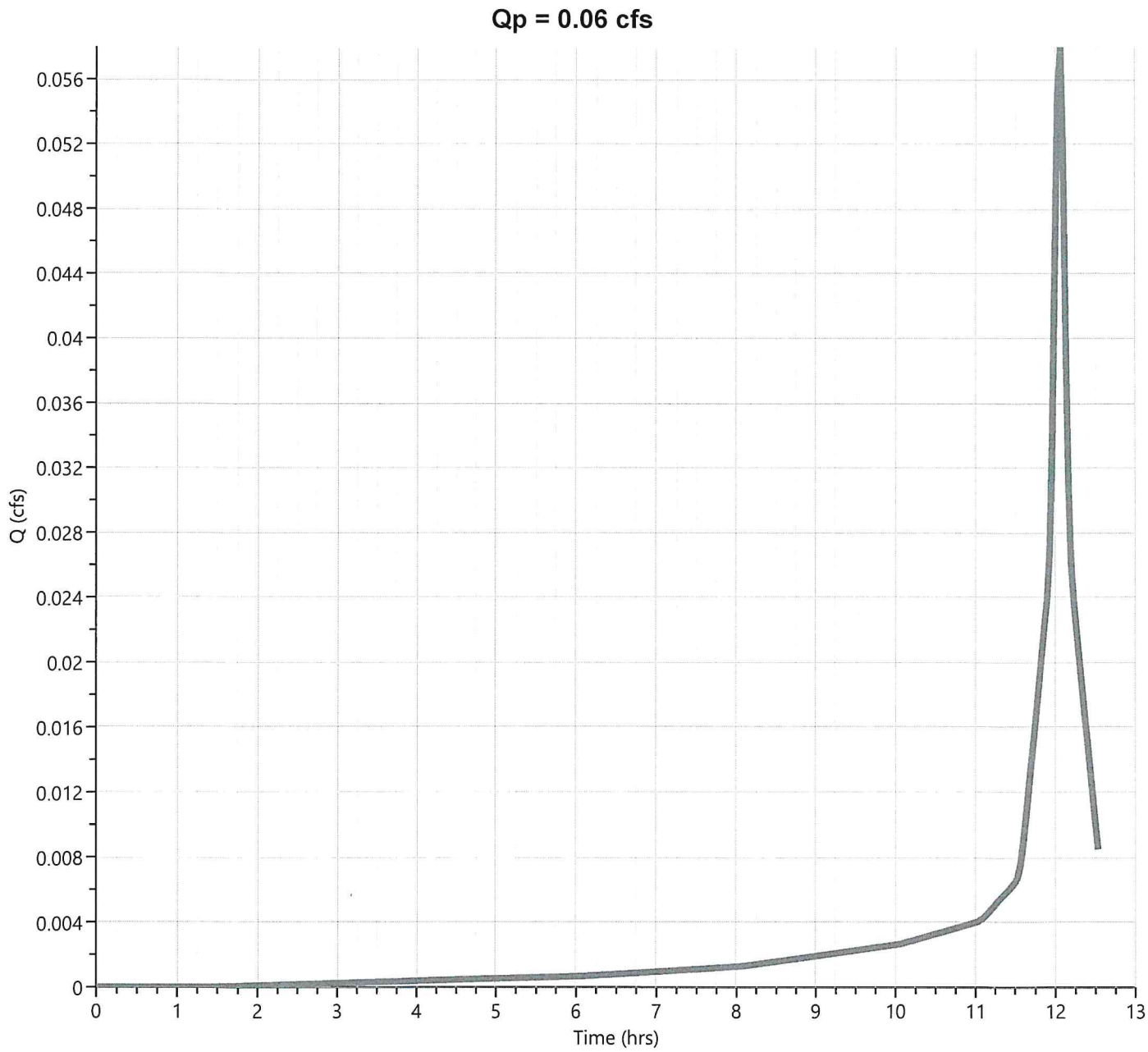
Hydrology Studio v 3.0.0.13

02-21-2020

P-6

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.058 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 195 cuft
Drainage Area	= 0.02 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 3.10 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

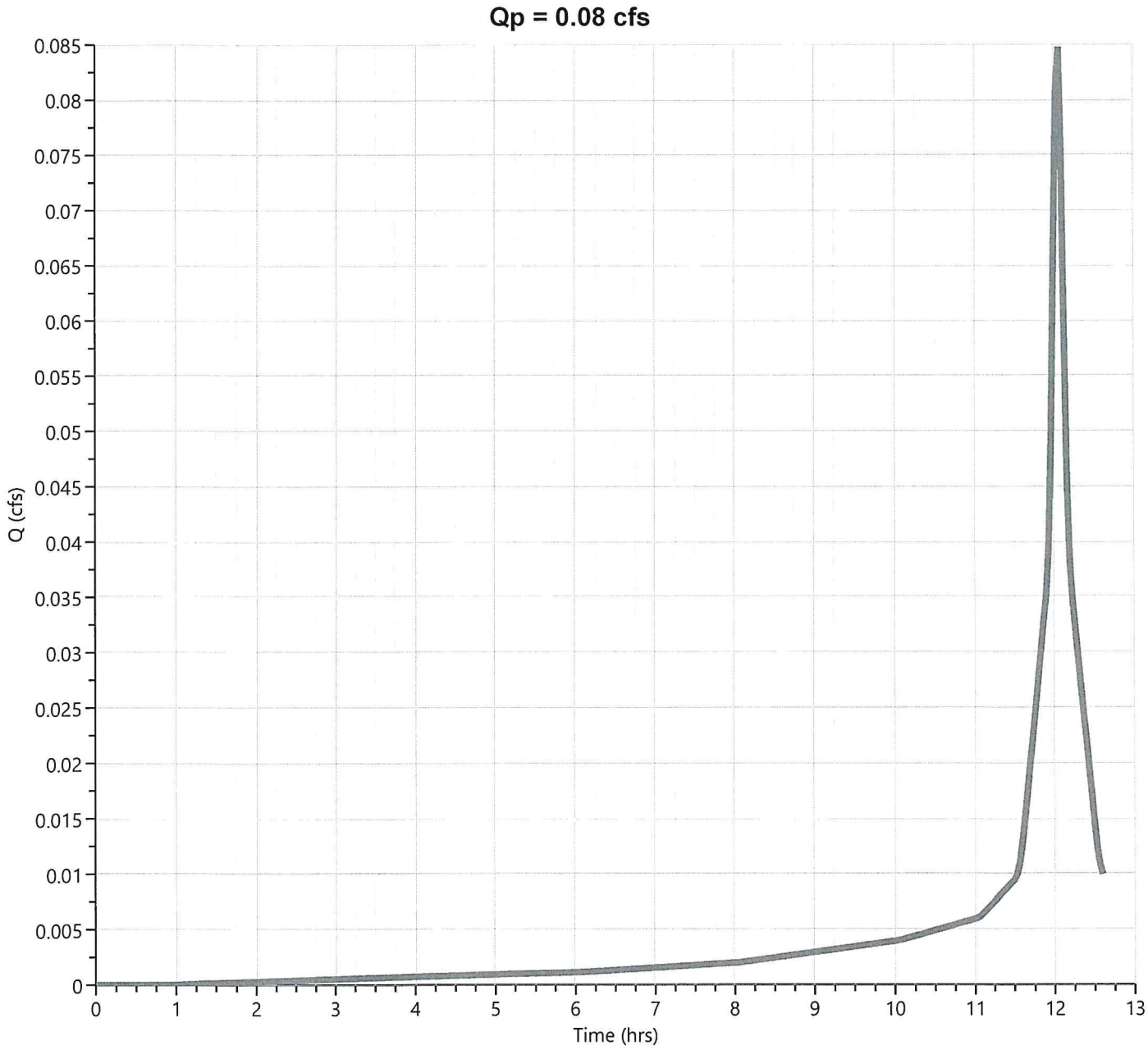
Hydrology Studio v 3.0.0.13

02-21-2020

P-6

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.085 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 290 cuft
Drainage Area	= 0.02 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 4.50 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

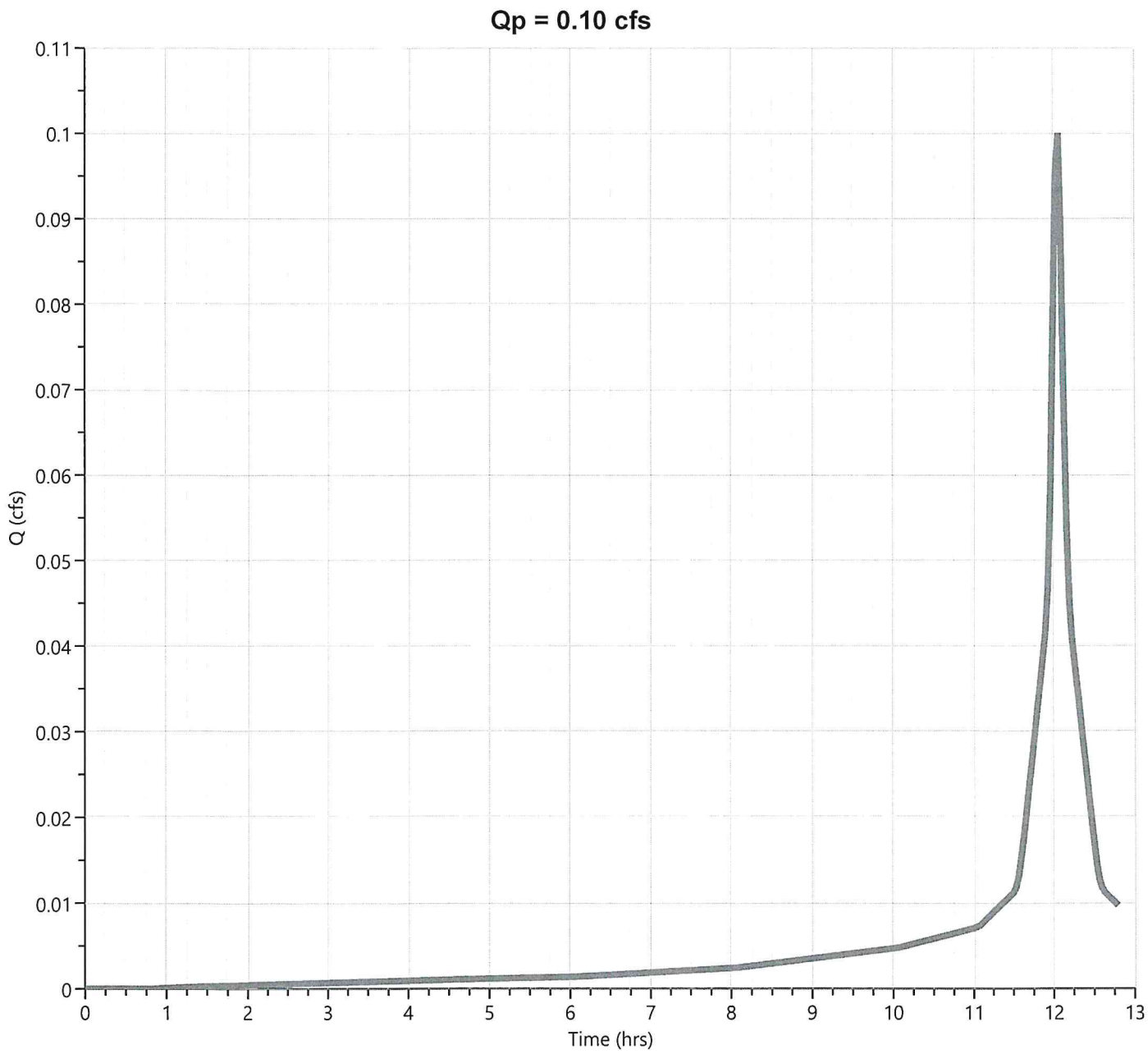
Hydrology Studio v 3.0.0.13

02-21-2020

P-6

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.100 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 345 cuft
Drainage Area	= 0.02 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

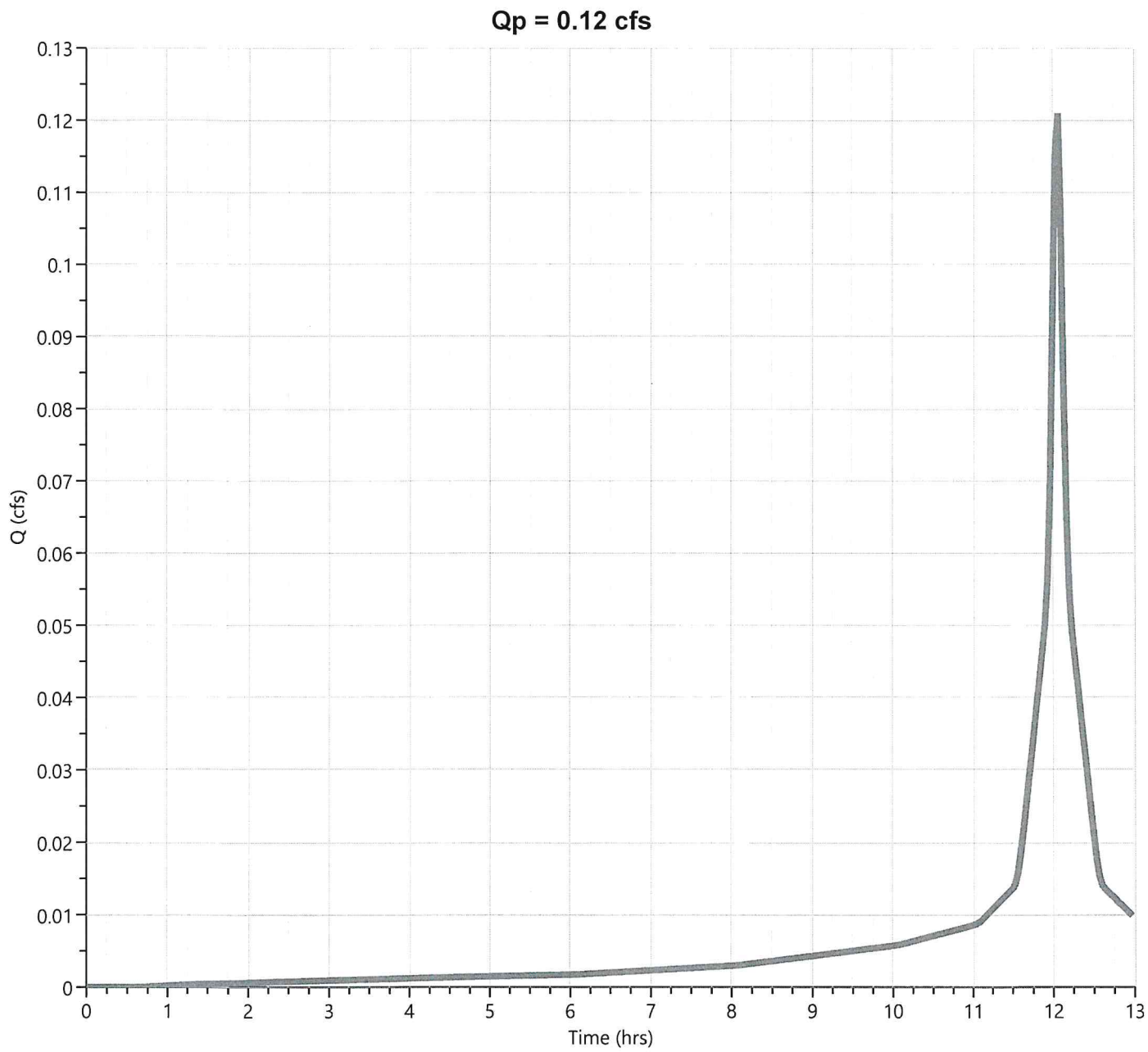
Hydrology Studio v 3.0.0.13

02-21-2020

P-6

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.121 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 419 cuft
Drainage Area	= 0.02 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 6.40 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

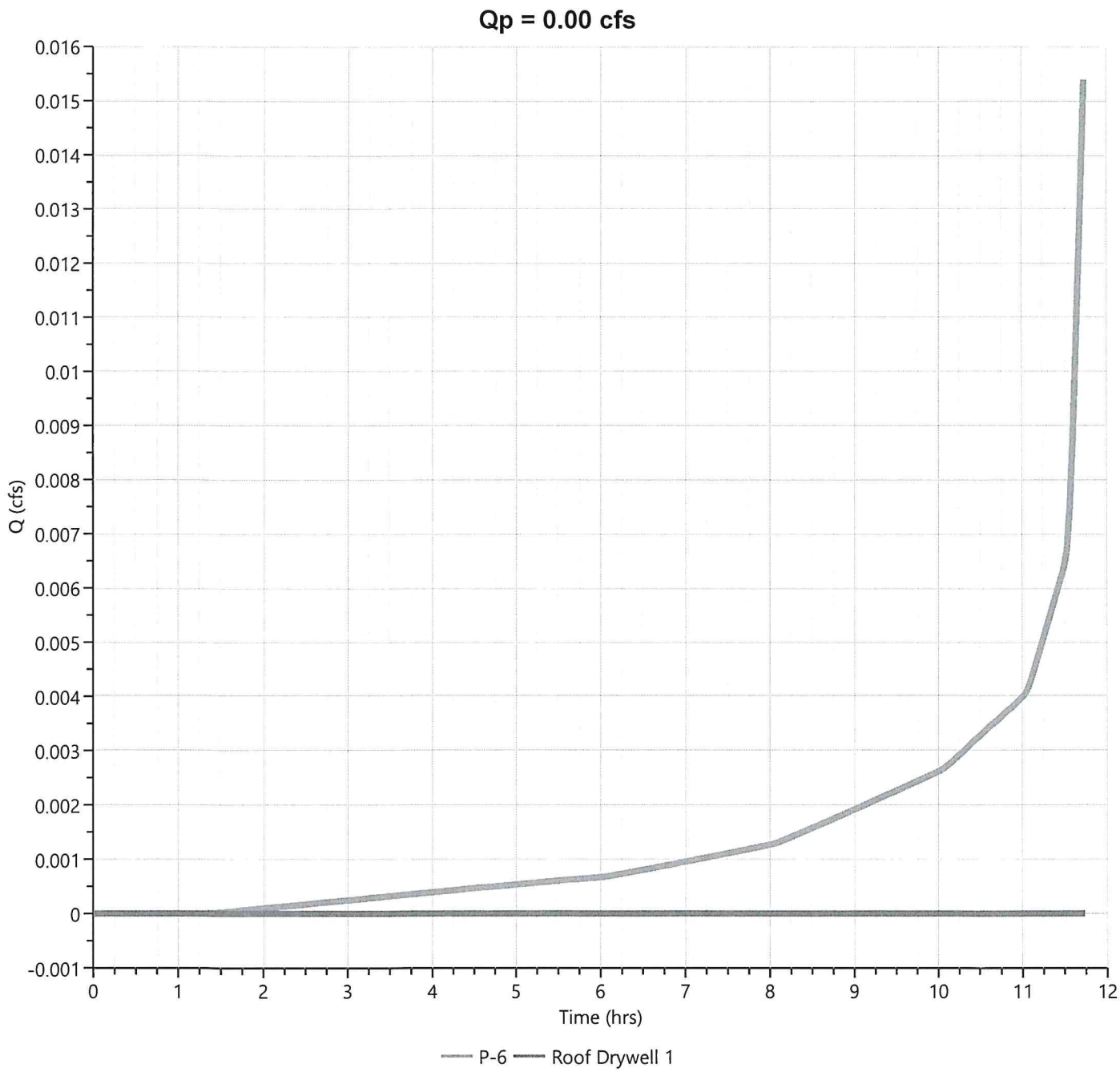
02-21-2020

Roof Drywell 1

Hyd. No. 13

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 11.70 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 12 - P-6	Max. Elevation	= 130.87 ft
Pond Name	= 1 Stormtech	Max. Storage	= 30.7 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

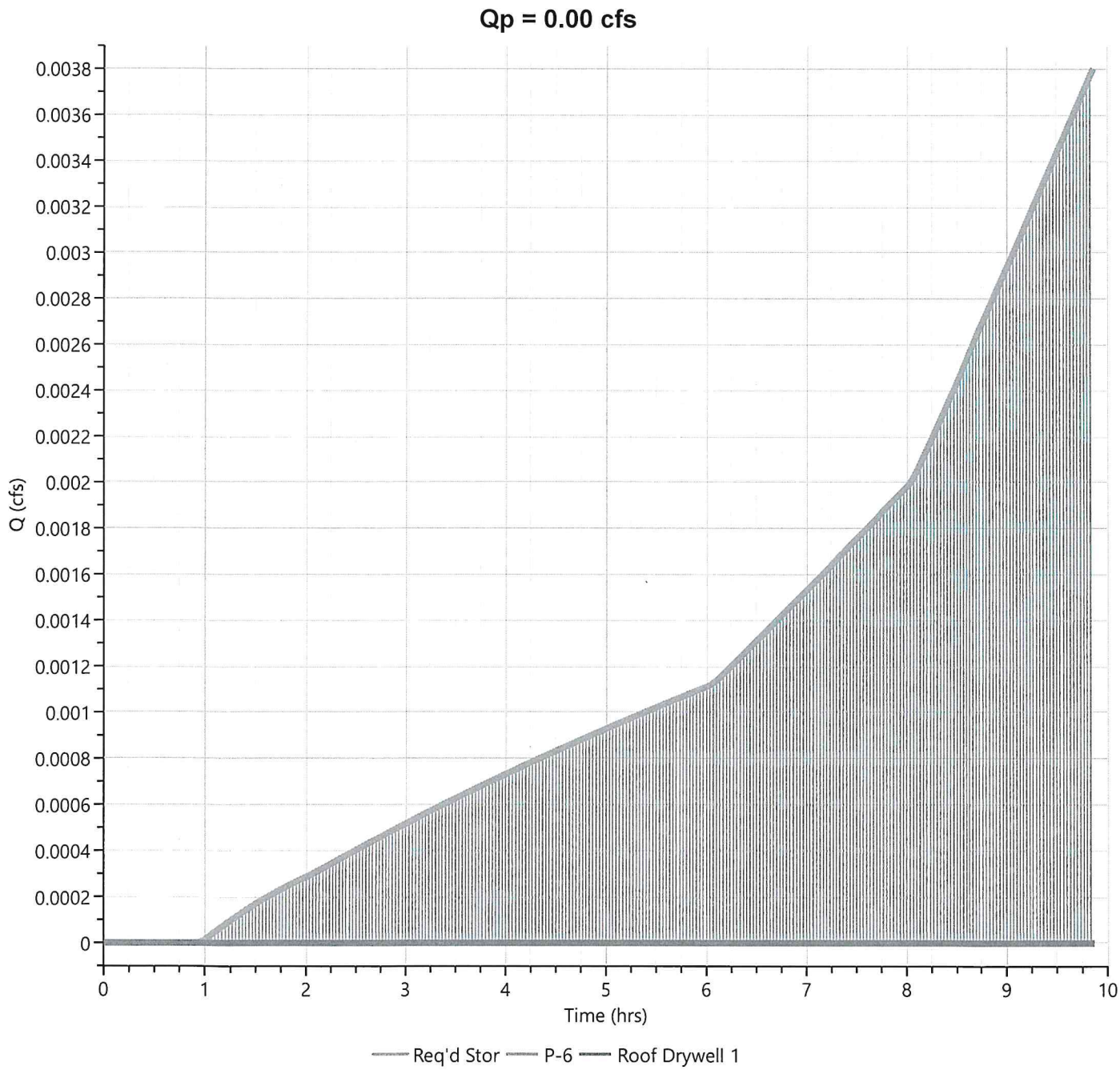
02-21-2020

Roof Drywell 1

Hyd. No. 13

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 9.83 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 12 - P-6	Max. Elevation	= 131.52 ft
Pond Name	= 1 Stormtech	Max. Storage	= 58.9 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

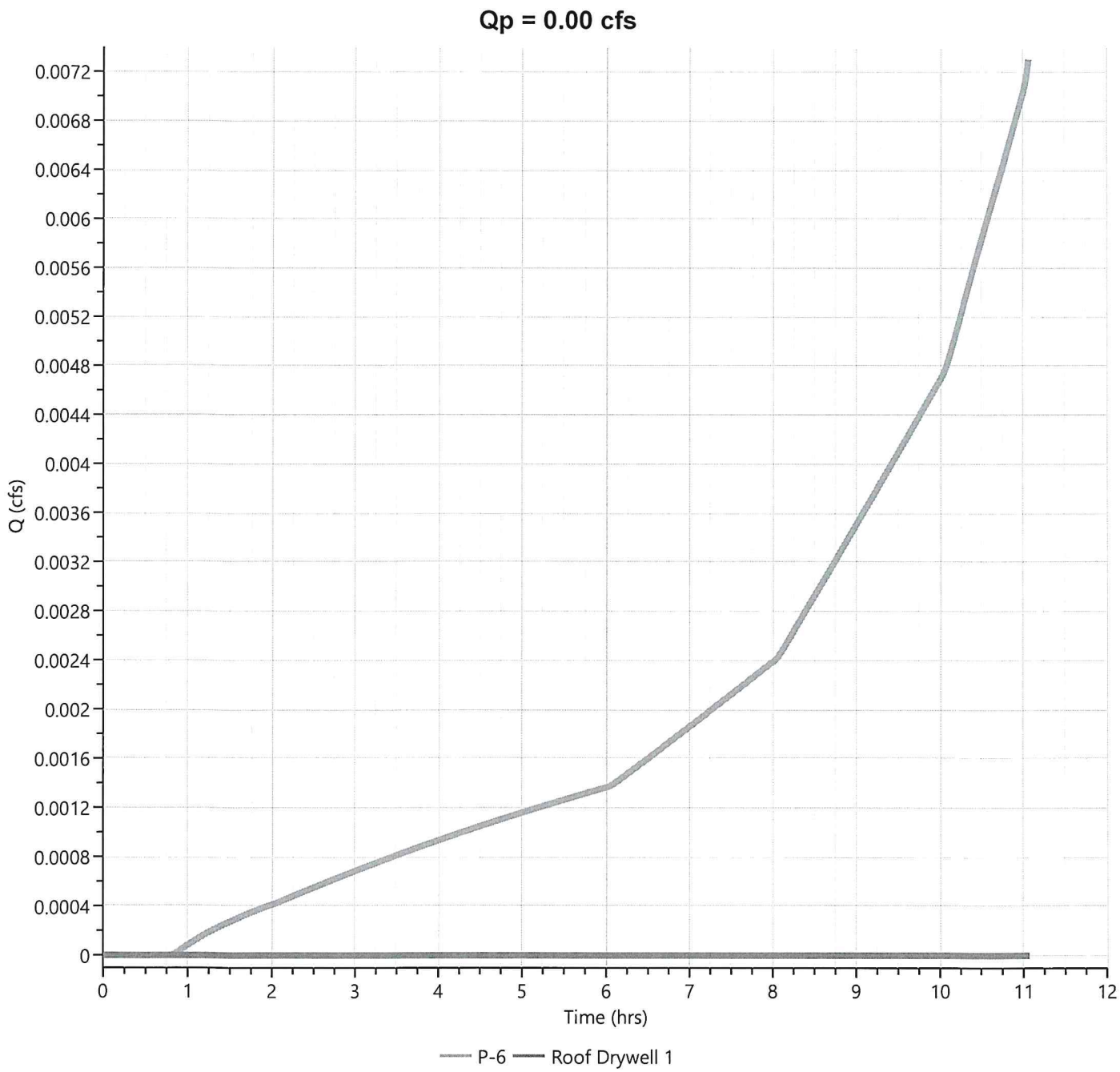
02-21-2020

Roof Drywell 1

Hyd. No. 13

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 11.03 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 12 - P-6	Max. Elevation	= 131.93 ft
Pond Name	= 1 Stormtech	Max. Storage	= 75.7 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

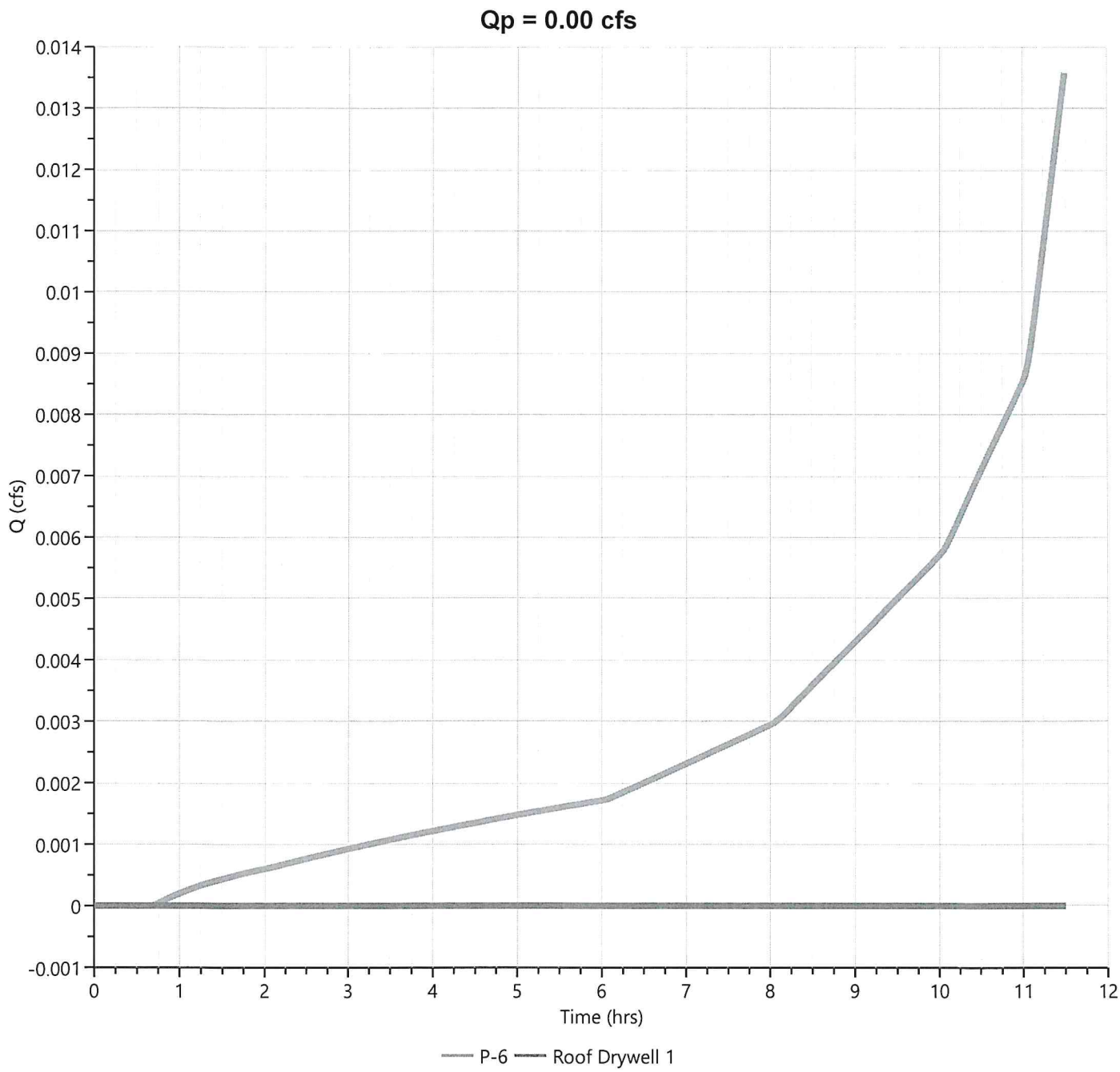
02-21-2020

Roof Drywell 1

Hyd. No. 13

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 11.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 12 - P-6	Max. Elevation	= 132.52 ft
Pond Name	= 1 Stormtech	Max. Storage	= 99.1 cuft

Pond Routing by Storage Indication Method



Pond Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

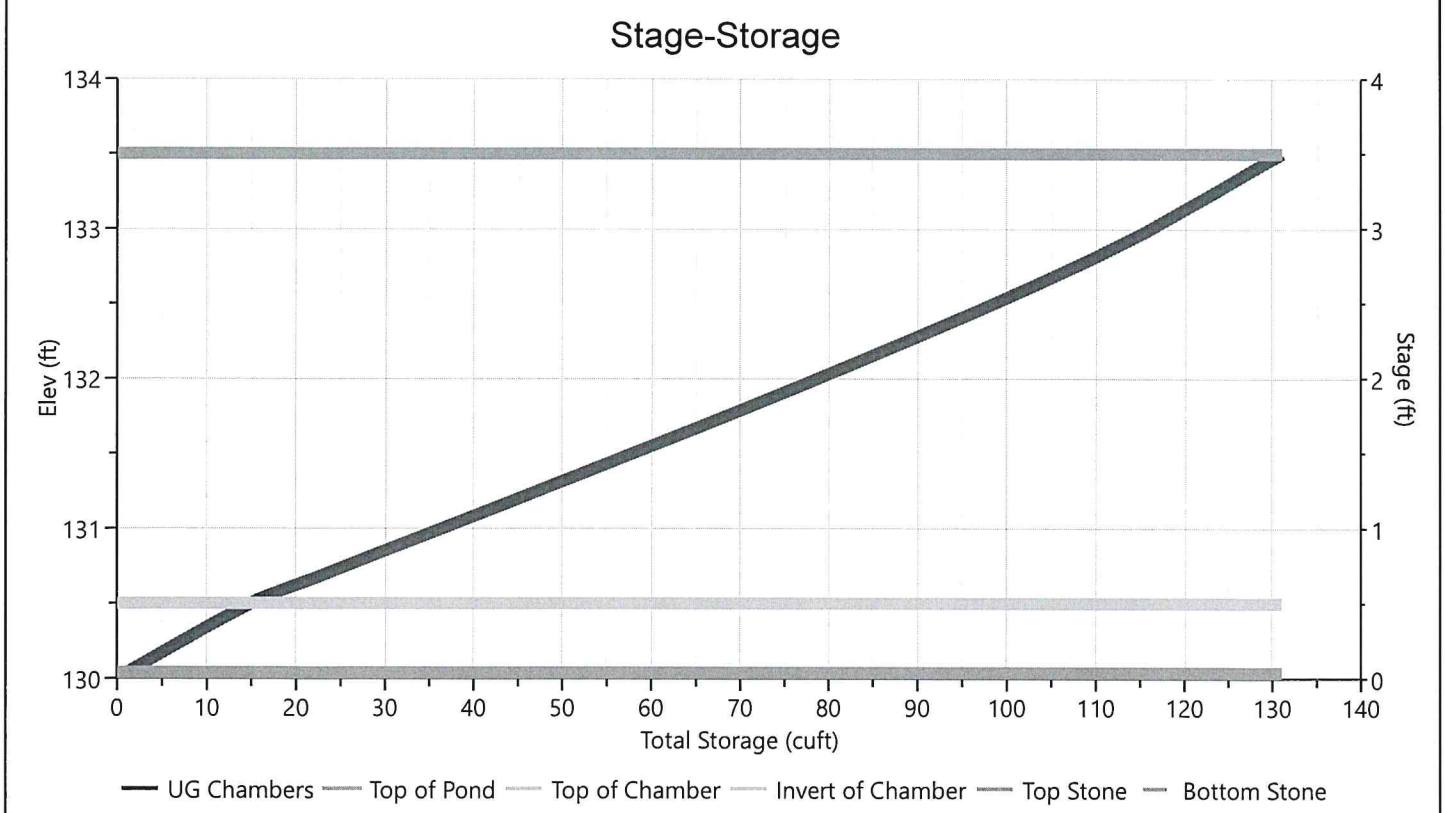
1 Stormtech

Stage-Storage

StormTech® SC-740™ Chamber	
Description	**Input**
Chamber Height, in	30
Chamber Shape	Arch
Chamber Width, in	51
Installed Length, ft	7.12
No. Chambers	1
Bare Chamber Stor, cuft	45.9
No. Rows	1
Space Between Rows, in	6
Stone Above, in	6
Stone Below, in	6
Stone Sides, in	15
Stone Ends, in	15
Encasement Voids, %	40.00
Encasement Bottom Elevation, ft	130.00

Stage / Storage Table

Stage (in)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.0	130.00	74	0.000	0.000
2.1	130.18	74	5.18	5.18
4.2	130.35	74	5.18	10.4
6.3	130.53	74	5.50	15.8
8.4	130.70	74	7.62	23.5
10.5	130.88	74	7.61	31.1
12.6	131.05	74	7.58	38.7
14.7	131.23	74	7.55	46.2
16.8	131.40	74	7.49	53.7
18.9	131.58	74	7.43	61.1
21.0	131.75	74	7.35	68.5
23.1	131.93	74	7.25	75.7
25.2	132.10	74	7.13	82.9
27.3	132.28	74	6.98	89.8
29.4	132.45	74	6.81	96.6
31.5	132.63	74	6.59	103
33.6	132.80	74	6.31	110
35.7	132.98	74	5.88	115
37.8	133.15	74	5.26	121
39.9	133.33	74	5.18	126
42.0	133.50	74	5.18	131



Pond Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

1 Stormtech

Stage-Discharge

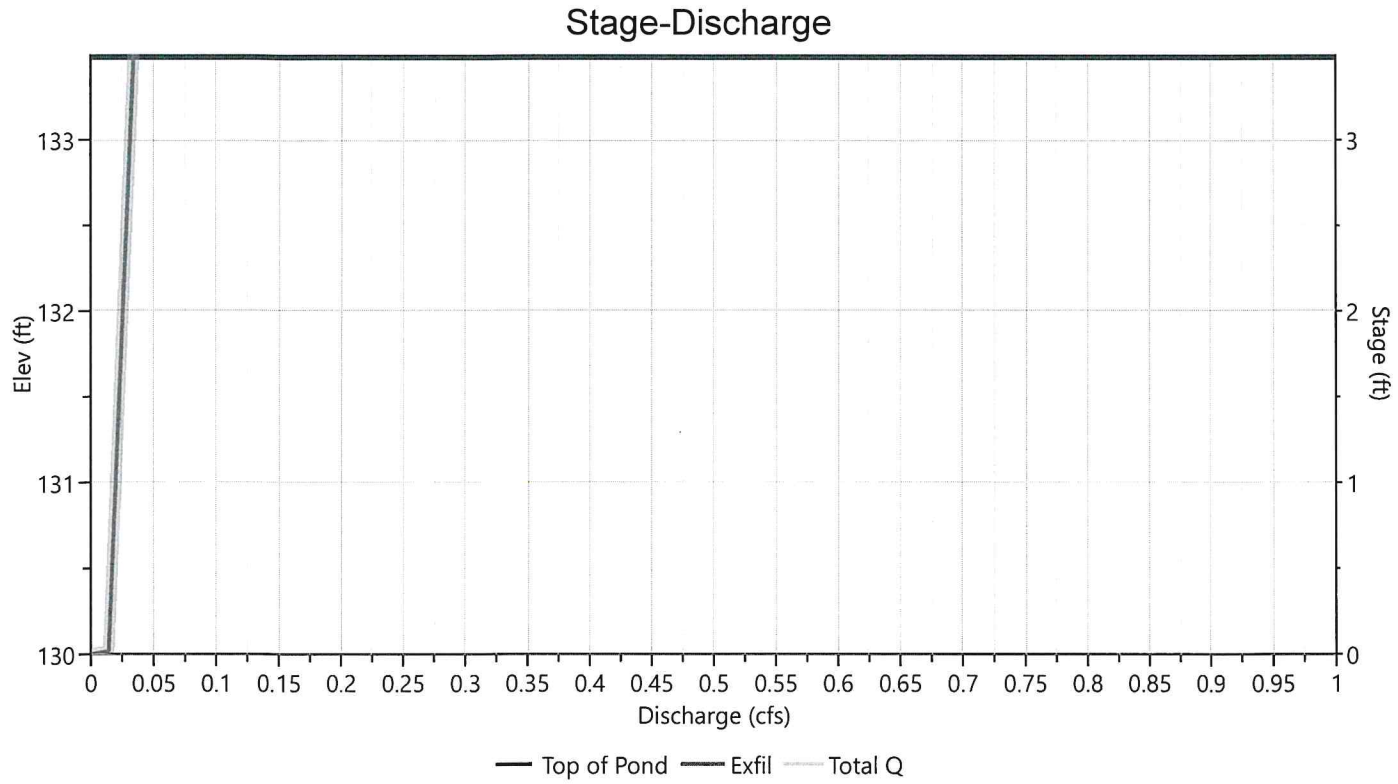
Culvert / Orifices	Culvert	Orifices 1	Orifices 2	Orifices 3
Rise, in				
Span, in				
No. Barrels				
Invert Elevation, ft				
Orifice Coefficient, Co				
Length, ft				
Barrel Slope, %				
N-Value, n	0.000			

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

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

Ancillary	
Exfiltration, in/hr	8.27**

**Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.*



Pond Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

1 Stormtech

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	130.00	0.000										0.000		0.000
0.18	130.18	5.18										0.015		0.015
0.35	130.35	10.4										0.016		0.016
0.53	130.53	15.8										0.017		0.017
0.70	130.70	23.5										0.018		0.018
0.88	130.88	31.1										0.019		0.019
1.05	131.05	38.7										0.020		0.020
1.23	131.23	46.2										0.021		0.021
1.40	131.40	53.7										0.022		0.022
1.58	131.58	61.1										0.023		0.023
1.75	131.75	68.5										0.024		0.024
1.93	131.93	75.7										0.025		0.025
2.10	132.10	82.9										0.026		0.026
2.28	132.28	89.8										0.027		0.027
2.45	132.45	96.6										0.028		0.028
2.63	132.63	103										0.029		0.029
2.80	132.80	110										0.030		0.030
2.97	132.98	115										0.031		0.031
3.15	133.15	121										0.032		0.032
3.32	133.33	126										0.033		0.033
3.50	133.50	131										0.034		0.034

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

Pond Report

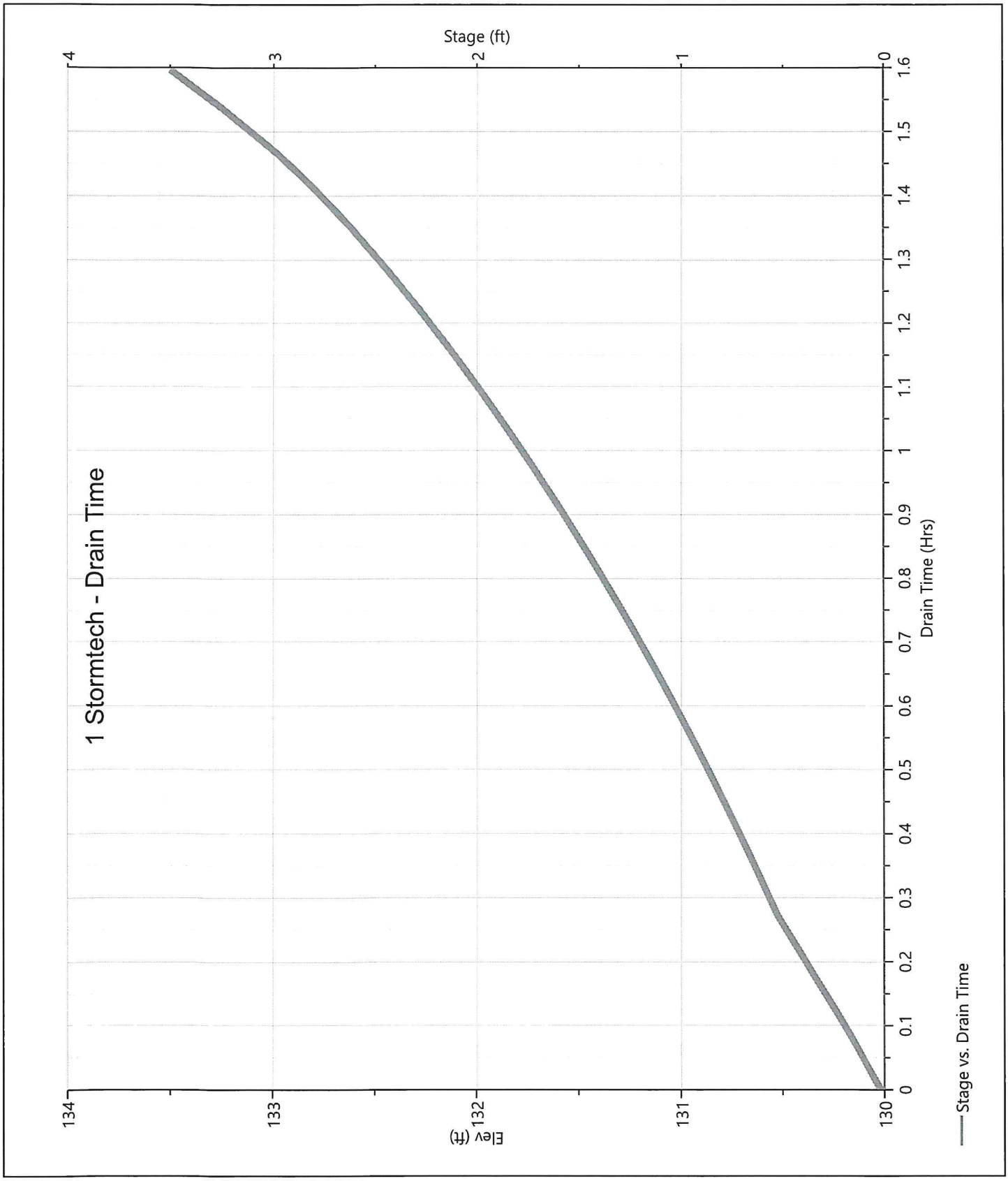
Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

1 Stormtech

Pond Drawdown



Worksheet 2: Runoff curve number and runoff **SM-2763B**

Project: 1651-1657 Main Street By DJC Date 2/21/2020

Location: Concord, MA Checked _____ Date _____

Circle one: Present [Developed] P7

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 Pavement - Driveways/Buildings Total P7= 0.05 acres (2 duplexes)	98			0.03	2.47
A	Gravel	76			0.00	0.00
A	Open Space - Good Condition	39			0.00	0.00
A	Woods - Good Condition	30			0.00	0.00
B	Open Space - Good Condition	61			0.00	0.00
B	Woods - Good Condition	55			0.00	0.00
				Totals =	0.03	2.47

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{2.47}{0.03} = 98.00$; Use CN = 98.0

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	2.87	4.26	6.16
Runoff, Q.....	cf	263	391	565

D-2 (210-VI-TR-55, Second Ed., June 1986)

Hydrograph Report

Project Name:

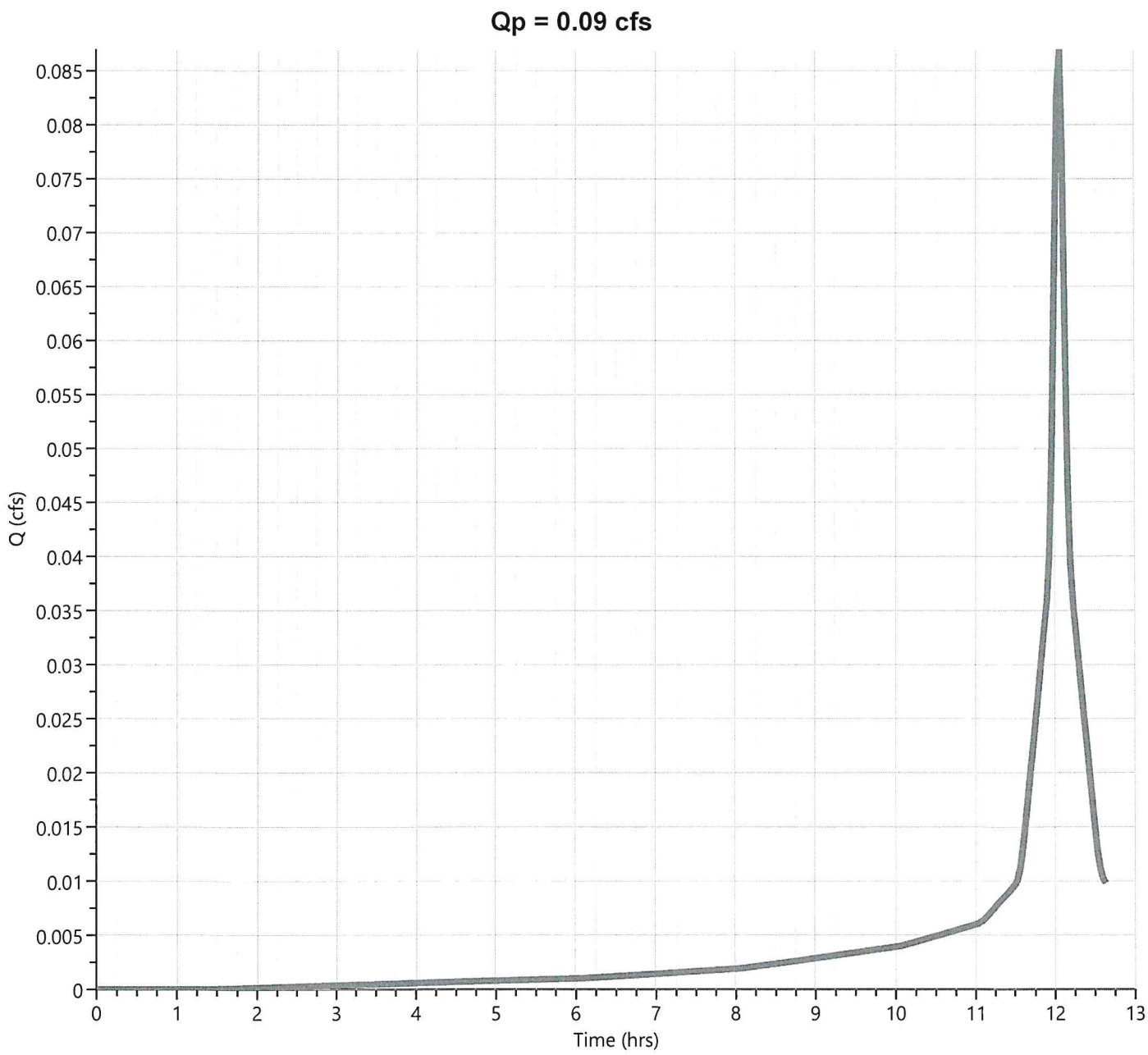
Hydrology Studio v 3.0.0.13

02-21-2020

P-7

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.087 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 293 cuft
Drainage Area	= 0.03 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 3.10 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

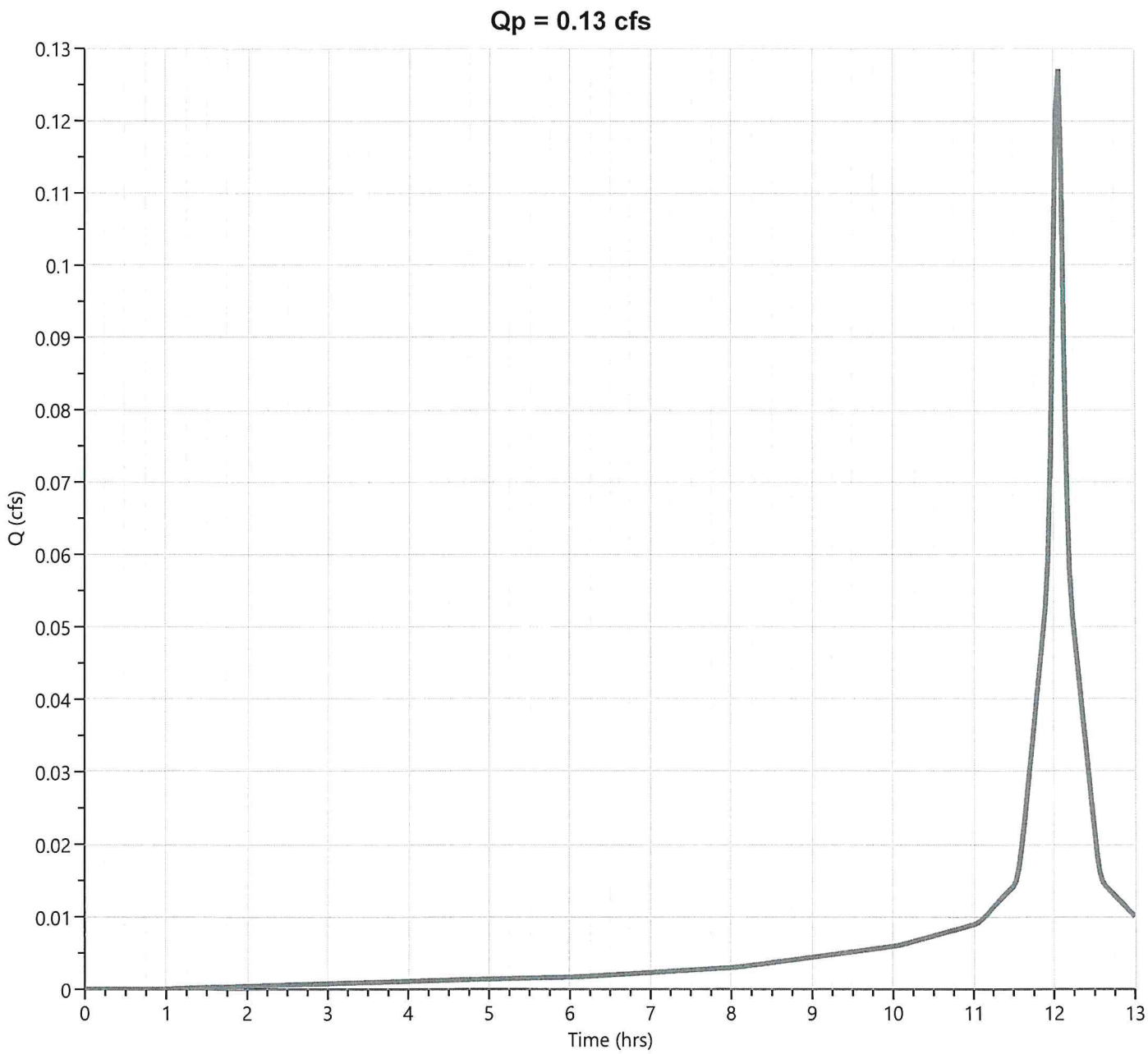
Hydrology Studio v 3.0.0.13

02-21-2020

P-7

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.127 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 435 cuft
Drainage Area	= 0.03 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 4.50 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

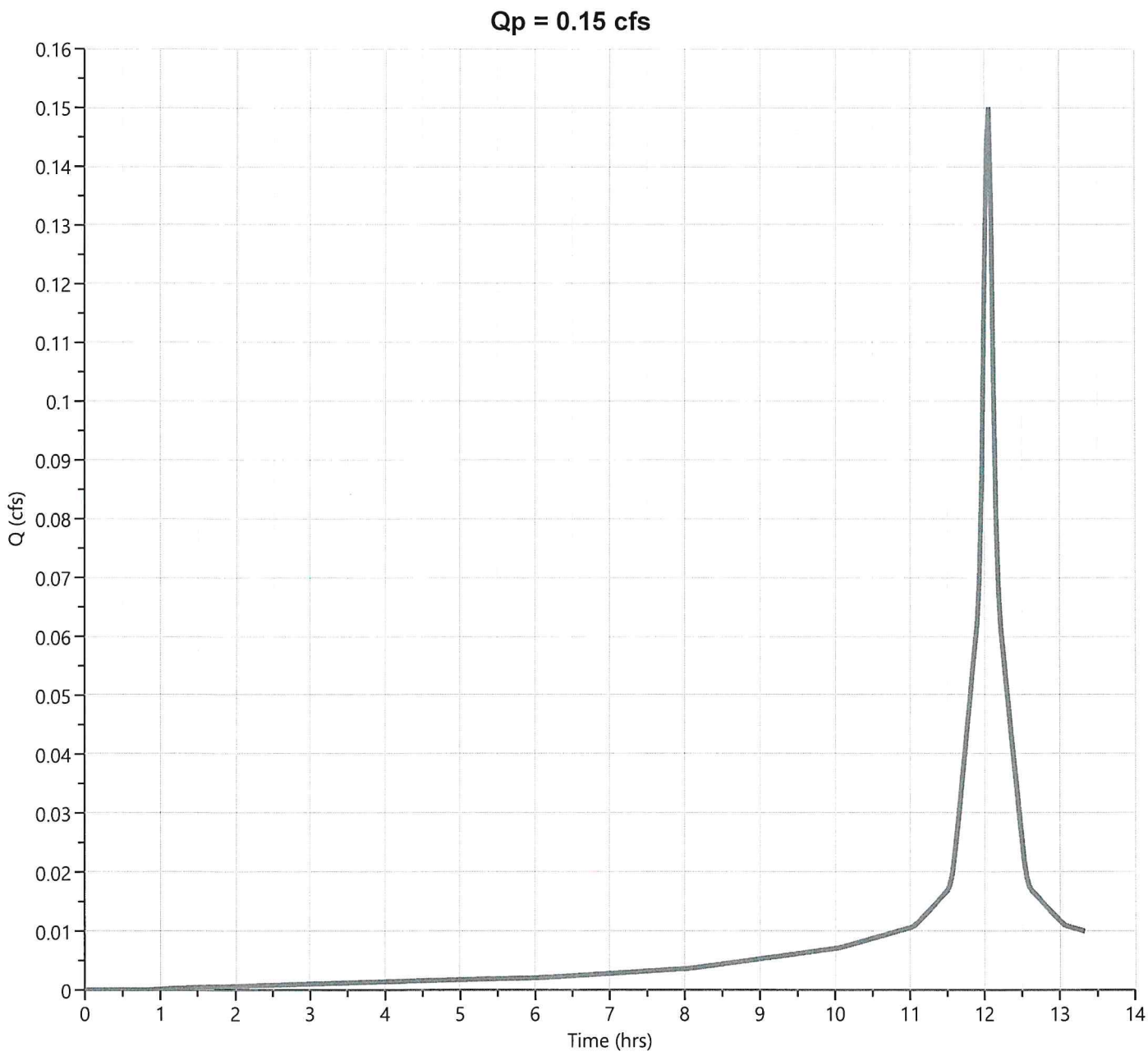
Hydrology Studio v 3.0.0.13

02-21-2020

P-7

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.150 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 517 cuft
Drainage Area	= 0.03 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 5.30 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

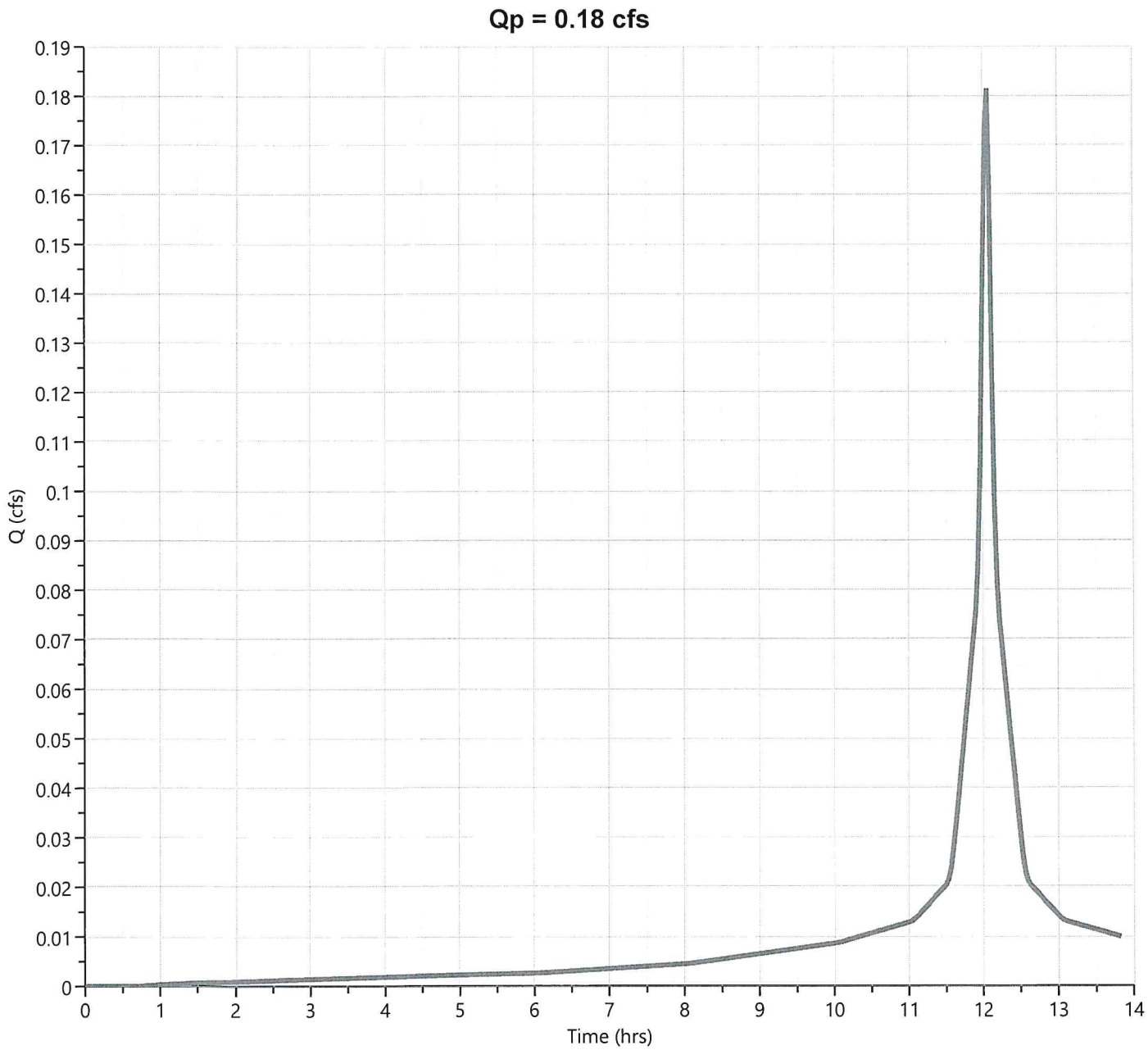
Hydrology Studio v 3.0.0.13

02-21-2020

P-7

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.181 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.07 hrs
Time Interval	= 2 min	Runoff Volume	= 629 cuft
Drainage Area	= 0.03 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 6.0 min
Total Rainfall	= 6.40 in	Design Storm	= Type III
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

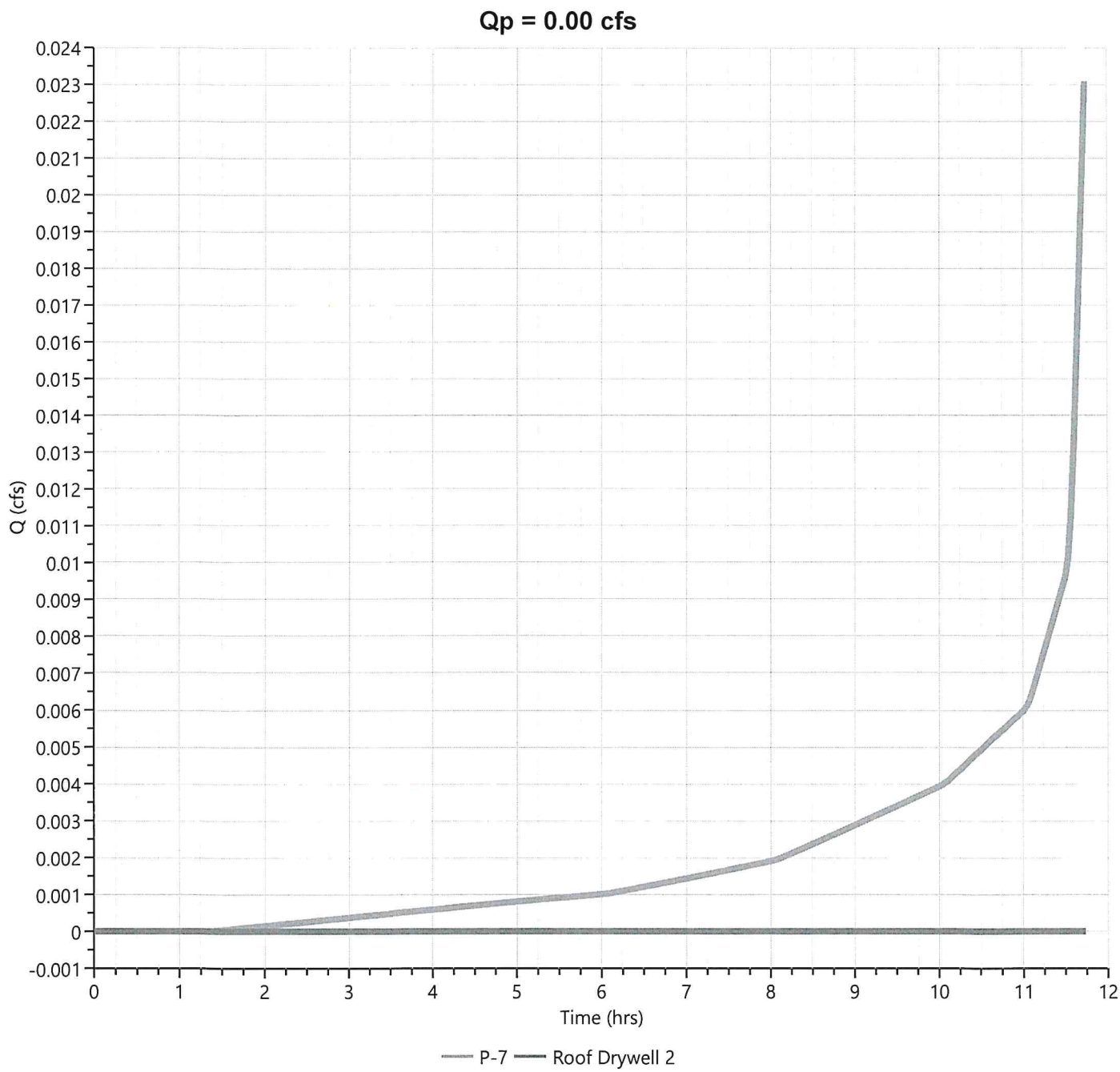
02-21-2020

Roof Drywell 2

Hyd. No. 15

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 11.70 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 14 - P-7	Max. Elevation	= 130.88 ft
Pond Name	= 2 Stormtechs	Max. Storage	= 49.3 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

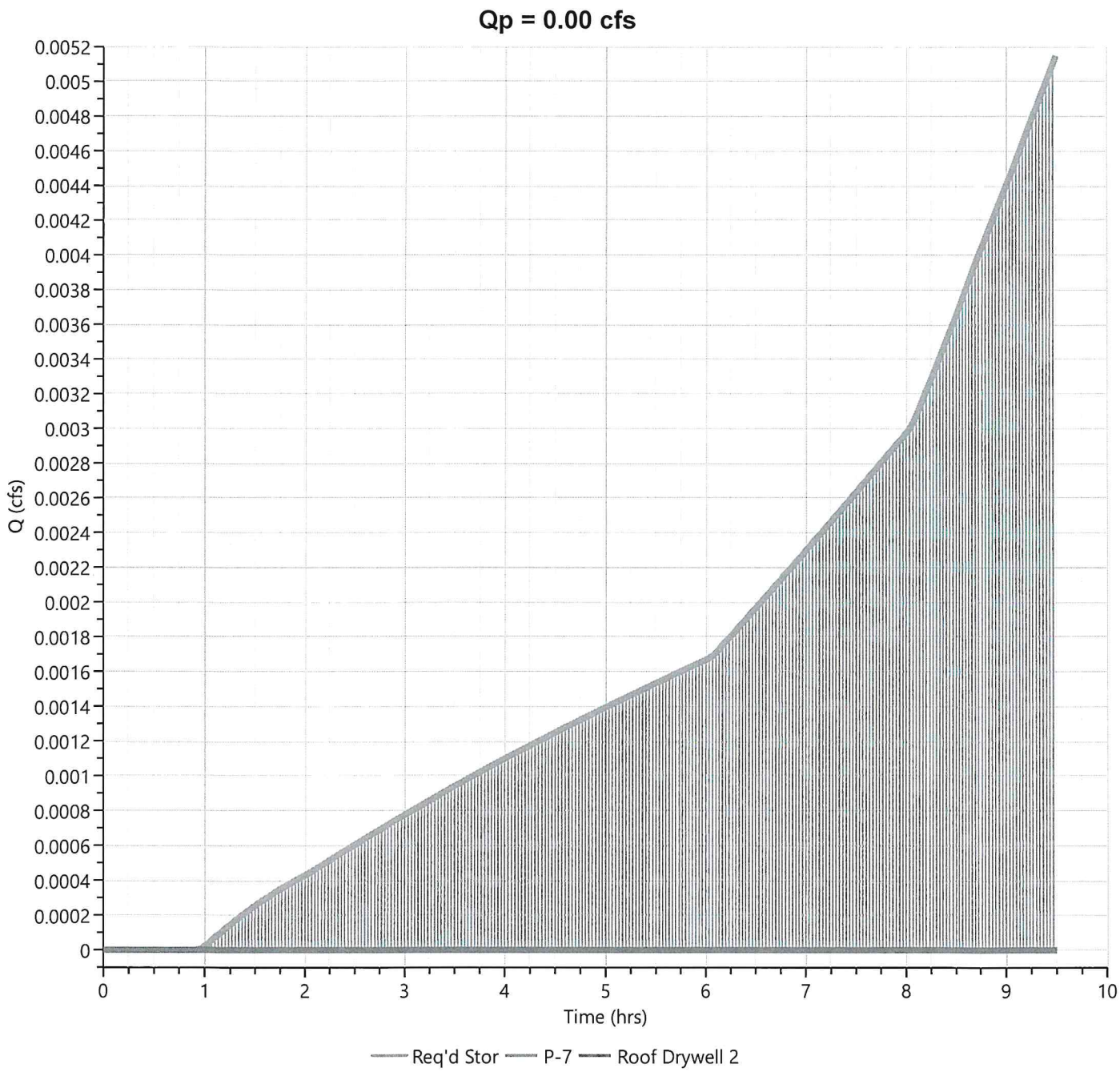
02-21-2020

Roof Drywell 2

Hyd. No. 15

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 9.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 14 - P-7	Max. Elevation	= 131.53 ft
Pond Name	= 2 Stormtechs	Max. Storage	= 95.4 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

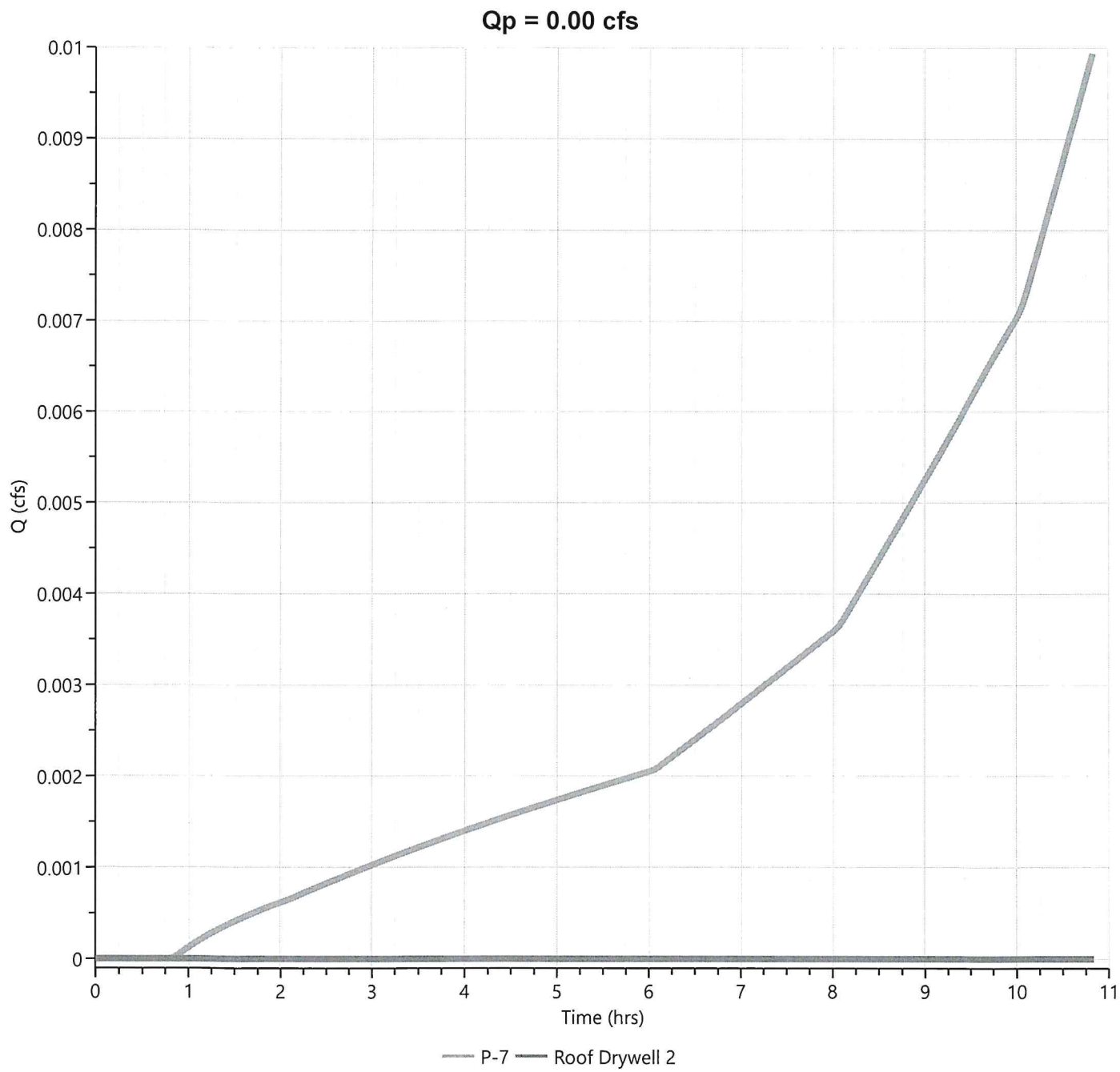
02-21-2020

Roof Drywell 2

Hyd. No. 15

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 10.80 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 14 - P-7	Max. Elevation	= 131.94 ft
Pond Name	= 2 Stormtechs	Max. Storage	= 123 cuft

Pond Routing by Storage Indication Method



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.13

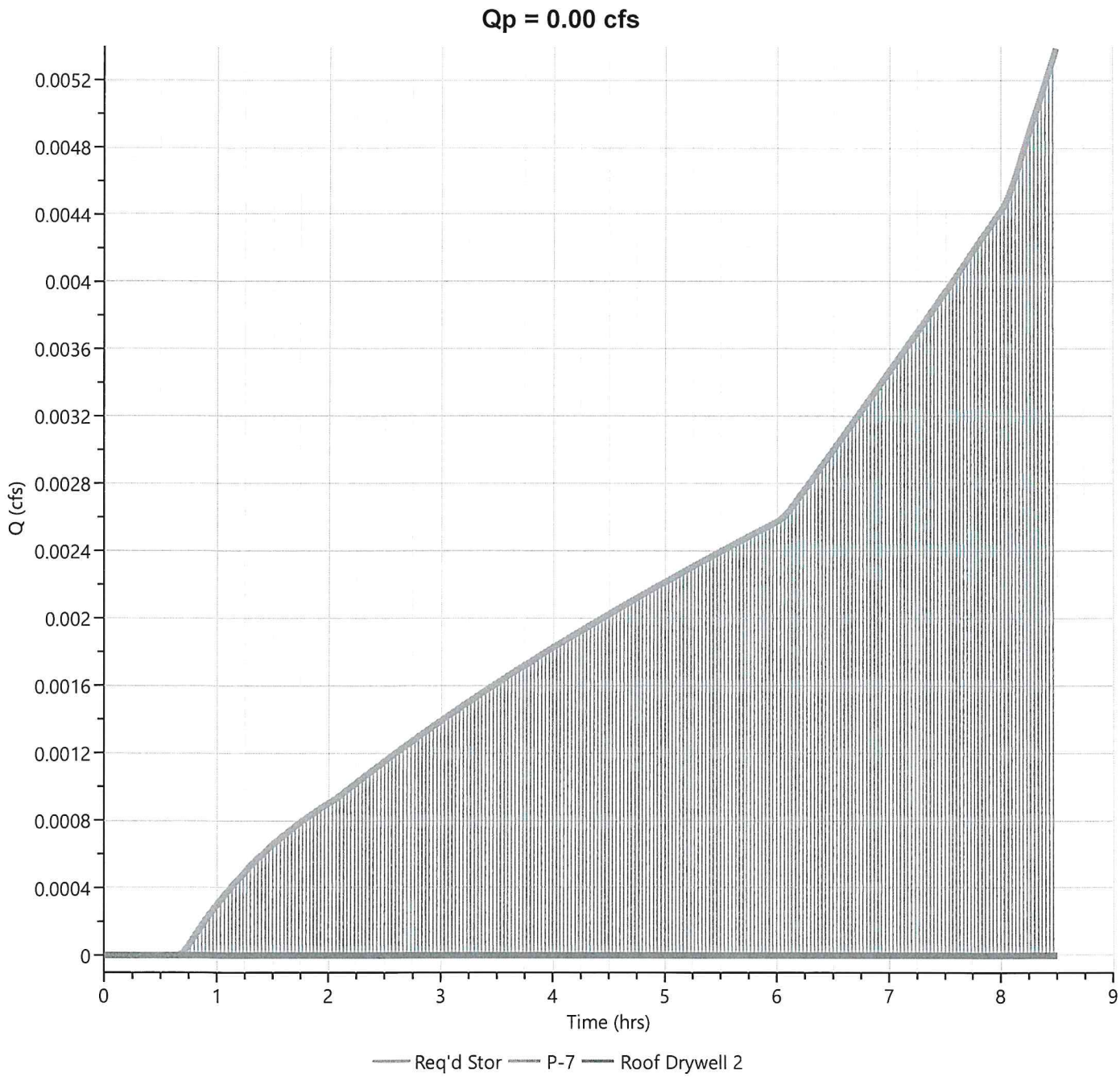
02-21-2020

Roof Drywell 2

Hyd. No. 15

Hydrograph Type	= Pond Route	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 8.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 0.000 cuft
Inflow Hydrograph	= 14 - P-7	Max. Elevation	= 132.54 ft
Pond Name	= 2 Stormtechs	Max. Storage	= 161 cuft

Pond Routing by Storage Indication Method



Pond Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

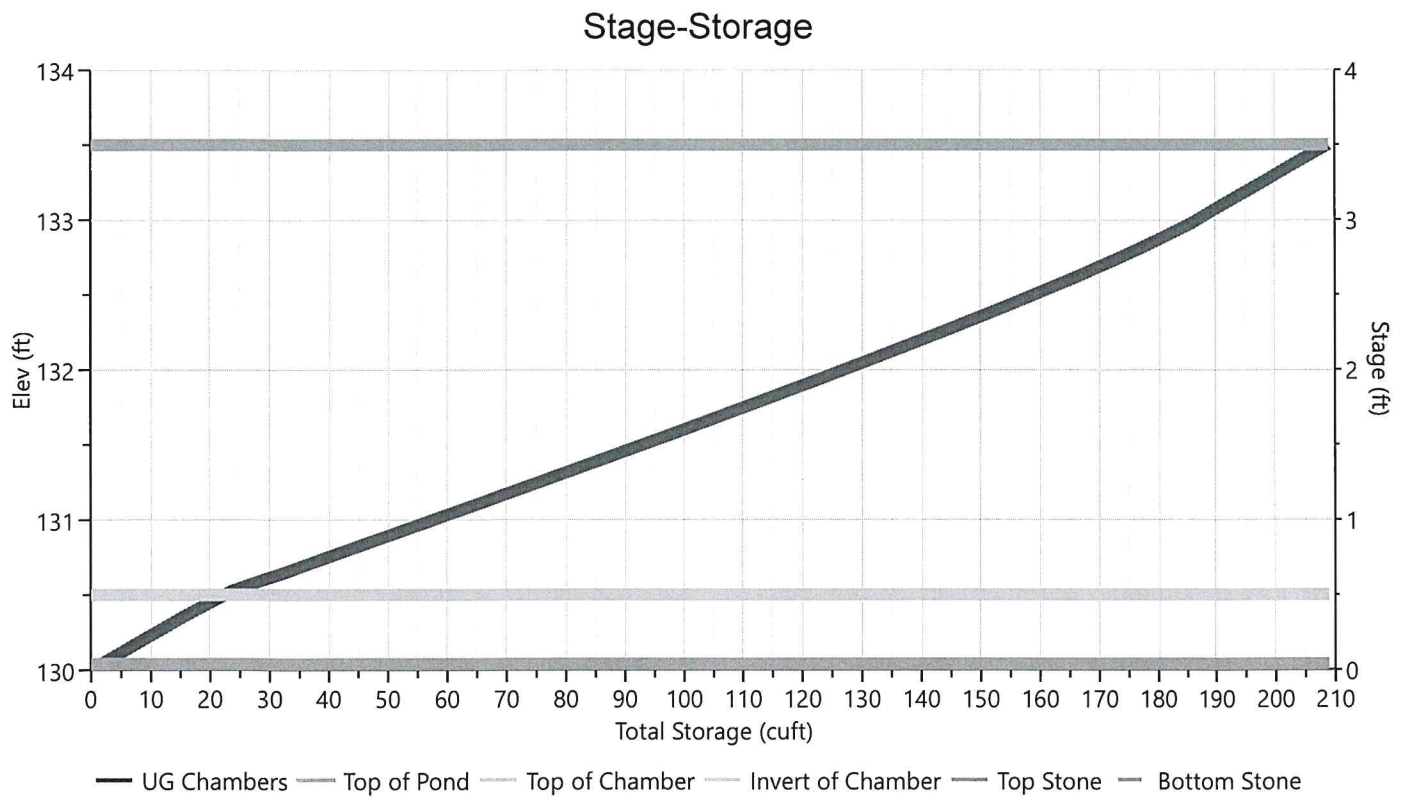
2 Stormtechs

Stage-Storage

StormTech® SC-740™ Chamber	
Description	**Input**
Chamber Height, in	30
Chamber Shape	Arch
Chamber Width, in	51
Installed Length, ft	7.12
No. Chambers	2
Bare Chamber Stor, cuft	91.8
No. Rows	1
Space Between Rows, in	6
Stone Above, in	6
Stone Below, in	6
Stone Sides, in	12
Stone Ends, in	12
Encasement Voids, %	40.00
Encasement Bottom Elevation, ft	130.00

Stage / Storage Table

Stage (in)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.0	130.00	110	0.000	0.000
2.1	130.18	110	7.69	7.69
4.2	130.35	110	7.69	15.4
6.3	130.53	110	8.33	23.7
8.4	130.70	110	12.6	36.3
10.5	130.88	110	12.6	48.9
12.6	131.05	110	12.5	61.4
14.7	131.23	110	12.4	73.8
16.8	131.40	110	12.3	86.1
18.9	131.58	110	12.2	98.3
21.0	131.75	110	12.0	110
23.1	131.93	110	11.8	122
25.2	132.10	110	11.6	134
27.3	132.28	110	11.3	145
29.4	132.45	110	11.0	156
31.5	132.63	110	10.5	167
33.6	132.80	110	9.96	177
35.7	132.98	110	9.10	186
37.8	133.15	110	7.86	193
39.9	133.33	110	7.69	201
42.0	133.50	110	7.69	209



Pond Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

2 Stormtechs

Stage-Discharge

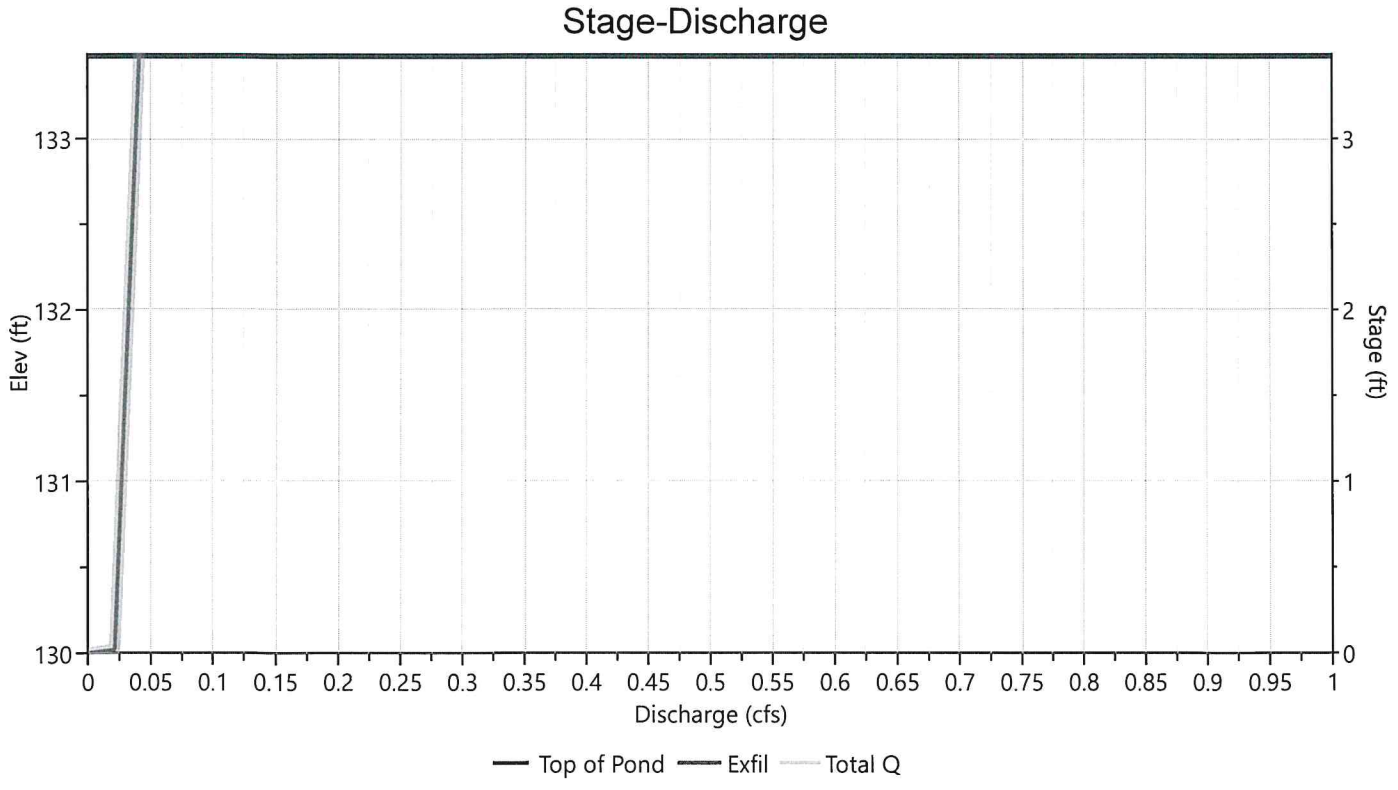
Culvert / Orifices	Culvert	Orifices 1	Orifices 2	Orifices 3
Rise, in				
Span, in				
No. Barrels				
Invert Elevation, ft				
Orifice Coefficient, Co				
Length, ft				
Barrel Slope, %				
N-Value, n	0.000			

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

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

Ancillary	
Exfiltration, in/hr	8.27**

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

2 Stormtechs

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	130.00	0.000										0.000		0.000
0.18	130.18	7.69										0.022		0.022
0.35	130.35	15.4										0.023		0.023
0.53	130.53	23.7										0.024		0.024
0.70	130.70	36.3										0.025		0.025
0.88	130.88	48.9										0.026		0.026
1.05	131.05	61.4										0.027		0.027
1.23	131.23	73.8										0.028		0.028
1.40	131.40	86.1										0.029		0.029
1.58	131.58	98.3										0.030		0.030
1.75	131.75	110										0.031		0.031
1.93	131.93	122										0.032		0.032
2.10	132.10	134										0.033		0.033
2.28	132.28	145										0.034		0.034
2.45	132.45	156										0.035		0.035
2.63	132.63	167										0.036		0.036
2.80	132.80	177										0.037		0.037
2.97	132.98	186										0.038		0.038
3.15	133.15	193										0.039		0.039
3.32	133.33	201										0.040		0.040
3.50	133.50	209										0.041		0.041

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

Pond Report

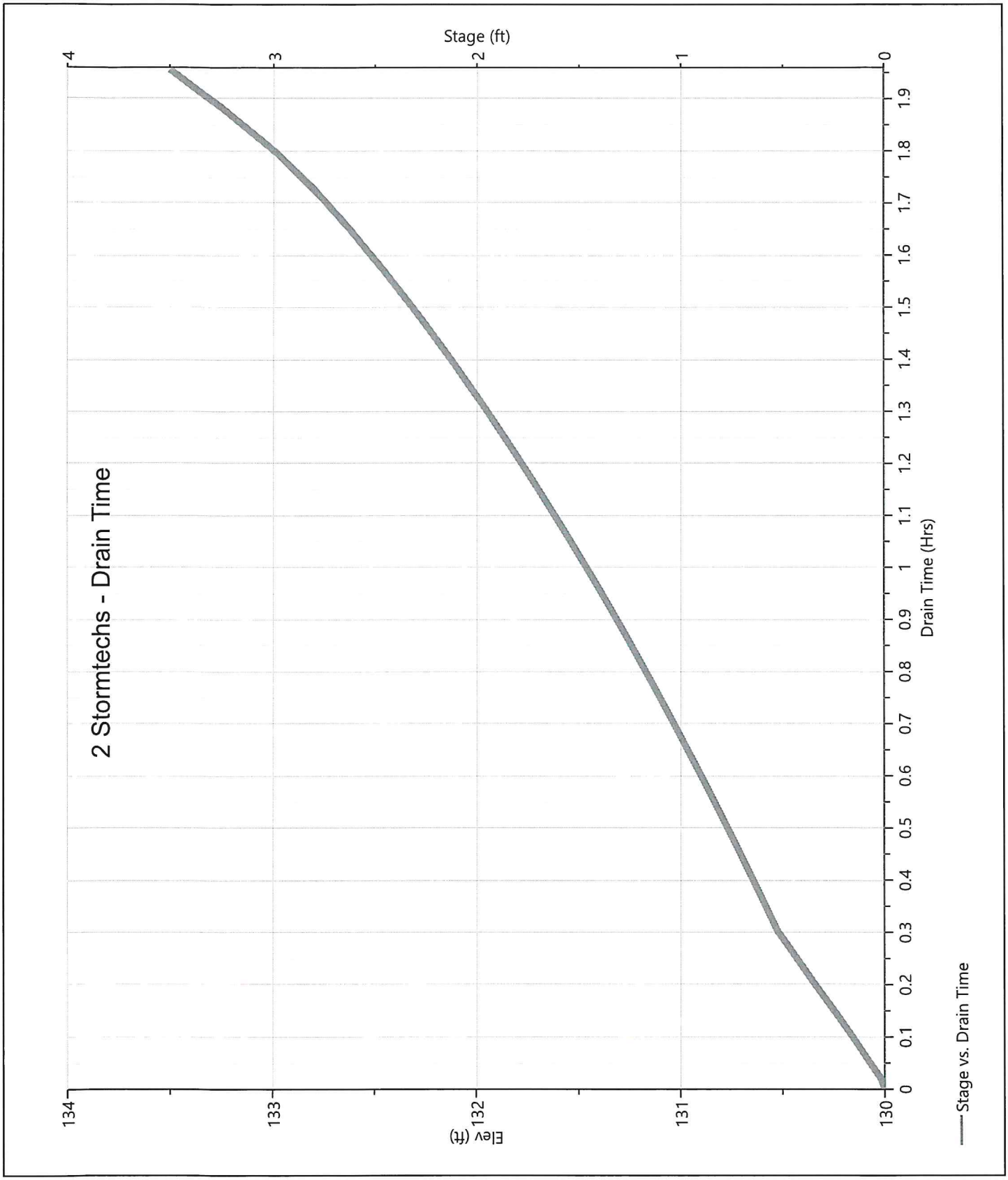
Project Name:

Hydrology Studio v 3.0.0.13

02-21-2020

2 Stormtechs

Pond Drawdown



Water Quality Volume Calculations

Water Quality Volume Calculations

Job: 2763B

Calculated by: DJC
Date: 2/21/2020

Basin 1
Soils:
Hydrologic Group: A
Required First Flush Volume
1 inch of runoff x impervious area

Impervious area: 0.08 acres
3,485 s.f.

Basin 1 Size

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
127.5	0	498		
128	0.5	1123	405.25	
129	1	1628	1375.5	
				1781

Required Water Quality Volume

$$V = 3{,}485 \text{ s.f.} \times \frac{1}{12} = \mathbf{290} \text{ c.f.}$$

Volume Provided 1,781 c.f. *(volume provided below emergency overflow)*

1,781 c.f. > 290 c.f. O.K.

Water Quality Volume Calculations

Job: 2763B

Calculated by: DJC
Date: 2/21/2020

Basin 2
Soils:
Hydrologic Group: A
Required First Flush Volume
1 inch of runoff x impervious area

Impervious area: 0.36 acres
15,682 s.f.

Basin 2 Size

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
127.5	0	1505		
128	0.5	1738	810.75	
128.5	0.5	1985	930.75	
				1742

Required Water Quality Volume

$$V = 15{,}682 \text{ s.f.} \times \frac{1}{12} = \mathbf{1{,}307 \text{ c.f.}}$$

Volume Provided 1,742 c.f. *(volume provided below standpipe overflow)*

1,742 c.f. > 1,307 c.f. O.K.

Groundwater Recharge Calculations

Recharge Volume Calculations

Job: SM-2763B

Calculated by: DJC
Date: 2/21/2020

Infiltration Basin 1
Soils:
Hydrologic Group: A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious area: 0.08 acres
3,485 s.f.

Required Recharge Volume (Rv)

Rv = 3,485 s.f. x $\frac{0.6}{12}$ = **174 c.f.**

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

D (depth of infiltration facility):	1	ft		
K (saturated hydraulic conductivity):	8.27	inches/hour (confirmed with onsite soil evaluations)		
	0.69	feet/hour		
T (time):	2	hours		
A=	498	s.f.		
Voids=	1.00			
Rv=	1,184	c.f.	>	174 c.f.
Basin Volume:	1,781	c.f.		

72 Hour Drawdown
Rv/(K x Bottom Area)= 3.45 Hours
3.45 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-2763B

Calculated by: DJC
Date: 2/21/2020

Infiltration Basin 2
Soils:
Hydrologic Group: A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious area: 0.36 acres
15,682 s.f.

Required Recharge Volume (Rv)

$$Rv = 15{,}682 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{784} \text{ c.f.}$$

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

D (depth of infiltration facility):	1	ft		
K (saturated hydraulic conductivity):	8.27	inches/hour (confirmed with onsite soil evaluations)		
	0.69	feet/hour		
T (time):	2	hours		
A=	1,505	s.f.		
Voids=	1.00			
Rv=	3,579	c.f.	>	784 c.f.
Basin Volume:	2,845	c.f.		

72 Hour Drawdown
Rv/(K x Bottom Area)= 3.45 Hours
3.45 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-2763B

Calculated by: DJC
Date: 2/21/2020

Roof Drywell 1
Soils:
Hydrologic Group: A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious area: 0.02 acres
871 s.f.

Required Recharge Volume (Rv)

$$Rv = 871 \text{ s.f. } x \frac{0.6}{12} = \mathbf{44} \text{ c.f.}$$

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

D (depth of infiltration facility):	3.5	ft
K (saturated hydraulic conductivity):	8.27	inches/hour (confirmed with onsite soil evaluations)
	0.69	feet/hour
T (time):	2	hours
A=	65	s.f.
Voids=	0.40	
Rv=	181	c.f. > 44 c.f.
Drywell Volume:	75	c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 4.03 Hours
4.03 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-2763B

Calculated by: DJC
Date: 2/21/2020

Roof Drywell 2
Soils:
Hydrologic Group: A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious area: 0.03 acres
1,307 s.f.

Required Recharge Volume (Rv)

$$Rv = 1{,}307 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{65} \text{ c.f.}$$

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

D (depth of infiltration facility):	3.5	ft
K (saturated hydraulic conductivity):	8.27	inches/hour (confirmed with onsite soil evaluations)
	0.69	feet/hour
T (time):	2	hours
A=	101	s.f.
Voids=	0.40	
Rv=	281	c.f. > 65 c.f.
Drywell Volume:	150	c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 4.03 Hours
4.03 < 72 hours O.K.

TSS Removal Calculations

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

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

Location: 1651-1657 Main Street (Basin 1 & 2)

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Stone Treatment Trench	**0.25**	**1.00**	**0.25**	**0.75**
Sediment Forebay	**0.25**	**0.75**	**0.19**	**0.56**

Total TSS Removal = **44%**

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

Project: **SM-2763B**

Prepared By: **DJC**

Date: **2/21/2020**

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

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

1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

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

Version 1, Automated: Mar. 4, 2008

Location: 1651-1657 Main Street

TSS Removal Calculation Worksheet

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

Total TSS Removal = **80%**

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

Project: SM-2763B
Prepared By: DJC
Date: 2/21/2020

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

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

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

Version 1, Automated: Mar. 4, 2008

Location: 1651-1657 Main Street

TSS Removal Calculation Worksheet

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

Total TSS Removal = **80%**

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

Project: SM-2763B
Prepared By: DJC
Date: 2/21/2020

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

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

Mass. Dept. of Environmental Protection

Sediment Forebay Calculations

Sediment Forebay Sizing Calculations

Job: SM-2763B

Calculated by: DJC
Date: 1/15/2020

Sediment forebay #1
Sediment forebay sizing
1 inches of runoff x pavement area

Pavement area: 0.03 acres
1,125 s.f.

Required Sediment Forebay Size

V= 1,125 s.f. x $\frac{1}{12}$ = **94** **c.f.**

Provided 96 c.f.

96	c.f. >	94	c.f. O.K.

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)
143	0	39	
144	1	153	96
			96

Sediment Forebay Sizing Calculations

Job: SM-2763B

Calculated by: DJC
Date: 1/15/2020

Sediment forebay #2
Sediment forebay sizing
1 inches of runoff x pavement area

Pavement area: 0.02 acres
667 s.f.

Required Sediment Forebay Size

$$V = 667 \text{ s.f.} \times \frac{1}{12} = \mathbf{56} \text{ c.f.}$$

Provided 83 c.f.

83	c.f. >	56	c.f. O.K.

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)
128	0	53	
129	1	113	83
			83

Sediment Forebay Sizing Calculations

Job: SM-2763B

Calculated by: DJC
Date: 1/15/2020

Sediment forebay #3
Sediment forebay sizing
1 inches of runoff x pavement area

Pavement area: 0.19 acres
8,159 s.f.

Required Sediment Forebay Size

$$V = 8{,}159 \text{ s.f.} \times \frac{1}{12} = \mathbf{680} \text{ c.f.}$$

Provided 683 c.f.

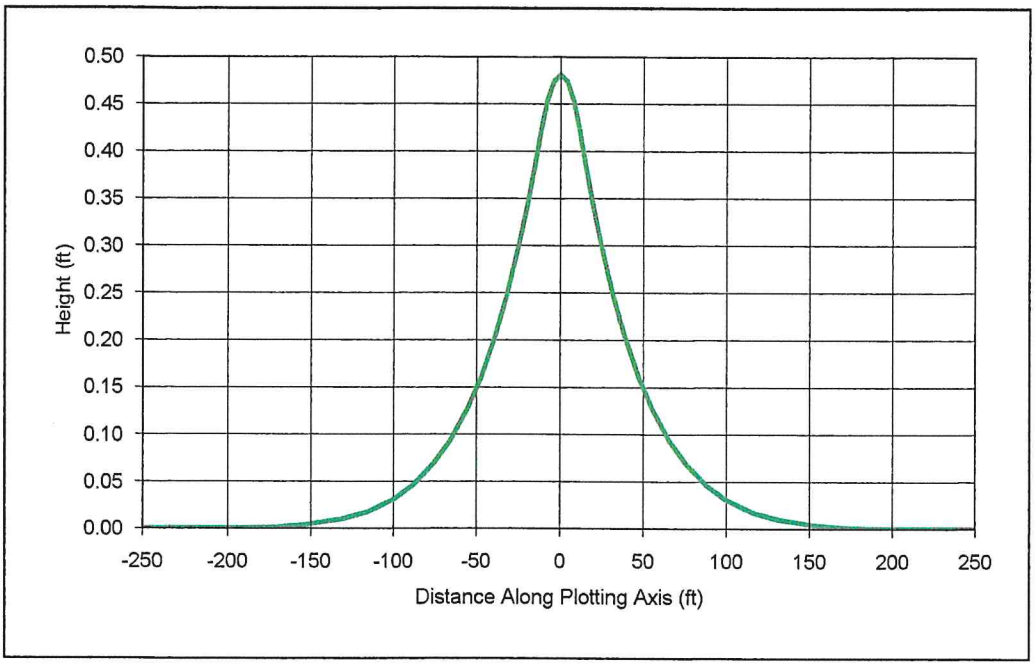
683	c.f. >	680	c.f. O.K.

Sediment Forebay

Elev. (FT)	Change Elev. (FT)	Area (SF)	Inc. Volume (CF)	
129.5	0	134		
130	0.5	335	117.25	
131	1	796	565.5	
				682.75

Groundwater Mounding

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Infiltration Basin 1

ANALYST: DJC

DATE: 2/24/2020 TIME: 11:57:39 AM

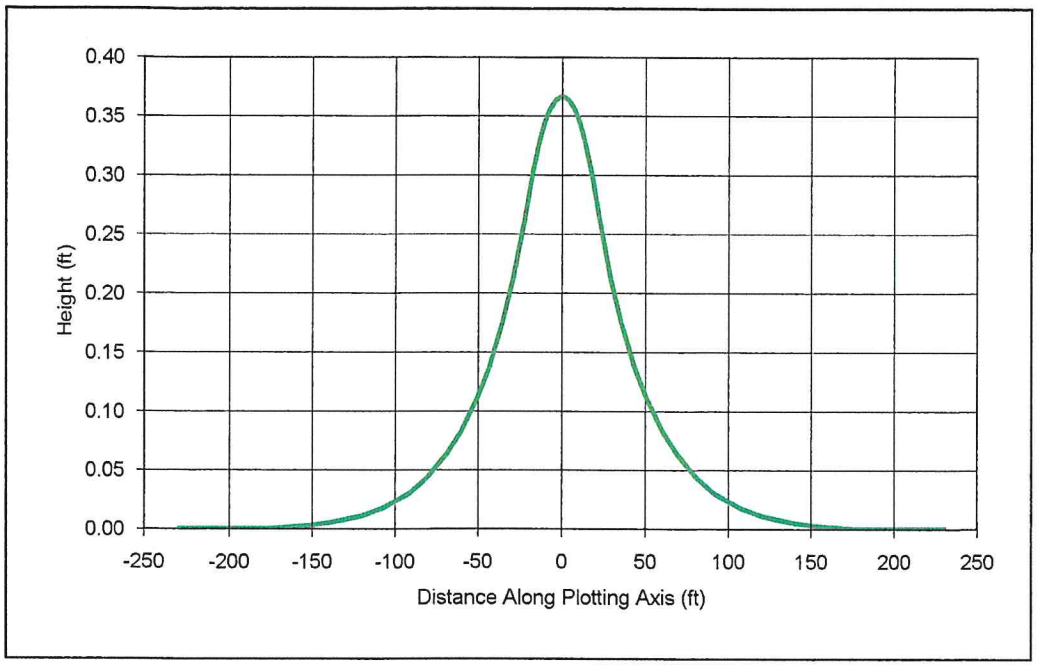
INPUT PARAMETERS

Application rate: 0.8139 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.28
Hydraulic conductivity: 65 ft/day
Initial saturated thickness: 10 ft
Length of application area: 75 ft
Width of application area: 22 ft
No constant head boundary used
Plotting axis from Y-Axis: 69 degrees
Edge of recharge area:
positive X: 11 ft
positive Y: 4.2 ft
Total volume applied: 1342.935 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-233.4	-89.6	-250	0
-196.3	-75.3	-210	0
-159.2	-61.1	-170	0
-122	-46.8	-131	0.01
-92.9	-35.6	-99	0.03
-70.3	-27	-75	0.07
-51.8	-19.9	-55	0.13
-36.2	-13.9	-39	0.2
-22.6	-8.7	-24	0.3
-13.5	-5.2	-14	0.39
-7.4	-2.8	-8	0.45
0	0	0	0.48
7.4	2.8	8	0.45
13.5	5.2	14	0.39
22.6	8.7	24	0.3
36.2	13.9	39	0.2
51.8	19.9	55	0.13
70.3	27	75	0.07
92.9	35.6	99	0.03
122	46.8	131	0.01
159.2	61.1	170	0
196.3	75.3	210	0
233.4	89.6	250	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Infiltration Basin 2

ANALYST: DJC

DATE: 2/24/2020 TIME: 12:01:27 PM

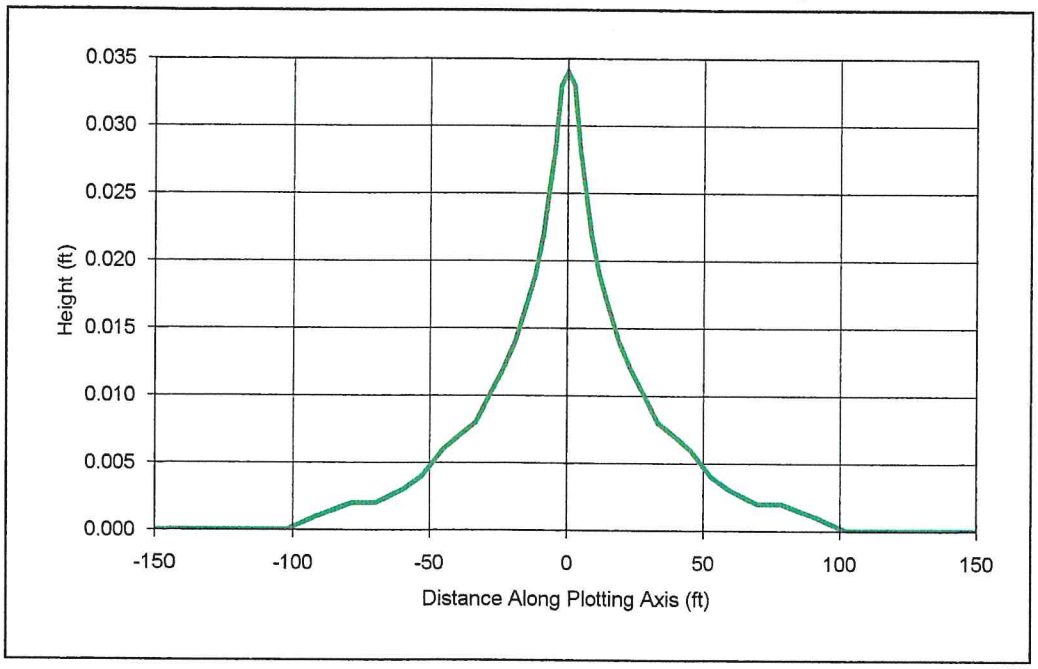
INPUT PARAMETERS

Application rate: 0.5209 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.28
Hydraulic conductivity: 65 ft/day
Initial saturated thickness: 10 ft
Length of application area: 46 ft
Width of application area: 39 ft
No constant head boundary used
Plotting axis from Y-Axis: 73 degrees
Edge of recharge area:
positive X: 19.5 ft
positive Y: 6 ft
Total volume applied: 934.4946 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-220	-67.2	-230	0
-185	-56.6	-193	0
-150	-45.9	-157	0
-115	-35.2	-120	0.01
-87.5	-26.8	-92	0.03
-66.2	-20.2	-69	0.06
-48.8	-14.9	-51	0.11
-34.1	-10.4	-36	0.18
-21.3	-6.5	-22	0.26
-12.8	-3.9	-13	0.33
-6.9	-2.1	-7	0.36
0	0	0	0.37
6.9	2.1	7	0.36
12.8	3.9	13	0.33
21.3	6.5	22	0.26
34.1	10.4	36	0.18
48.8	14.9	51	0.11
66.2	20.2	69	0.06
87.5	26.8	92	0.03
115	35.2	120	0.01
150	45.9	157	0
185	56.6	193	0
220	67.2	230	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Roof Drywell 1

ANALYST: DJC

DATE: 2/24/2020 TIME: 12:03:24 PM

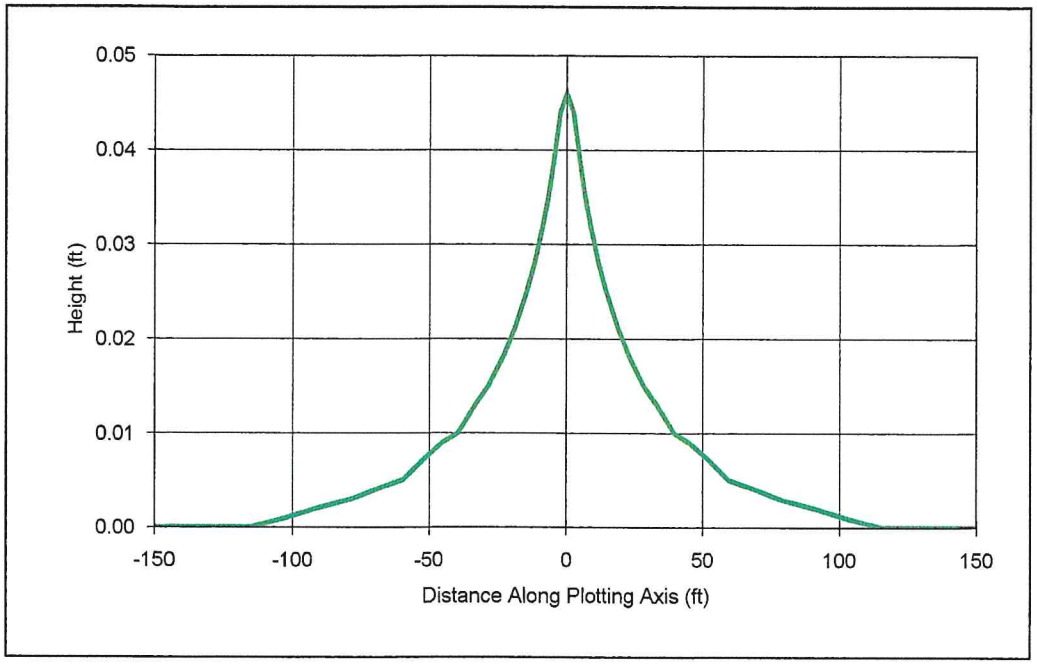
INPUT PARAMETERS

Application rate: 0.6778 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.28
Hydraulic conductivity: 65 ft/day
Initial saturated thickness: 10 ft
Length of application area: 9.62 ft
Width of application area: 6.75 ft
No constant head boundary used
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 3.4 ft
positive Y: 0 ft
Total volume applied: 44.01294 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-150	0	-150	0
-126.2	0	-126	0
-102.3	0	-102	0
-78.4	0	-78	0
-59.7	0	-60	0
-45.2	0	-45	0.01
-33.3	0	-33	0.01
-23.2	0	-23	0.01
-14.5	0	-15	0.02
-8.7	0	-9	0.02
-4.7	0	-5	0.03
0	0	0	0.03
4.7	0	5	0.03
8.7	0	9	0.02
14.5	0	15	0.02
23.2	0	23	0.01
33.3	0	33	0.01
45.2	0	45	0.01
59.7	0	60	0
78.4	0	78	0
102.3	0	102	0
126.2	0	126	0
150	0	150	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Stamski and McNary, Inc.

PROJECT: Roof Drywell 2

ANALYST: DJC

DATE: 2/24/2020 TIME: 12:04:45 PM

INPUT PARAMETERS

Application rate: 0.6407 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.28
Hydraulic conductivity: 65 ft/day
Initial saturated thickness: 10 ft
Length of application area: 16.23 ft
Width of application area: 6.25 ft
No constant head boundary used
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 3.1 ft
positive Y: 0 ft
Total volume applied: 64.991 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-150	0	-150	0
-126.2	0	-126	0
-102.3	0	-102	0
-78.4	0	-78	0
-59.7	0	-60	0
-45.2	0	-45	0.01
-33.3	0	-33	0.01
-23.2	0	-23	0.02
-14.5	0	-15	0.02
-8.7	0	-9	0.03
-4.7	0	-5	0.04
0	0	0	0.05
4.7	0	5	0.04
8.7	0	9	0.03
14.5	0	15	0.02
23.2	0	23	0.02
33.3	0	33	0.01
45.2	0	45	0.01
59.7	0	60	0
78.4	0	78	0
102.3	0	102	0
126.2	0	126	0
150	0	150	0

SPECIFIC YIELD VALUES (%)

Coarse gravel	0.23
Medium gravel	0.24
Fine gravel	0.25
Coarse sand	0.27
Medium sand	0.28
Fine sand	0.23
Silt	0.08
Clay	0.03

HYDRAULIC CONDUCTIVITY VALUES (FT/DAY)

MATERIAL	AVERAGE	RANGE
Fine gravel	1476	1181 - 3280
Medium gravel	886	689 - 1181
Coarse gravel	492	328 – 689
Coarse sand	148	65 - 328
Medium sand	39	16 - 65
Fine sand	8	3 - 16
Silt	0.3	0.03 – 3
Clay	0.0007	<0.03
S & G mix	172	16 – 328
S & G glacial till		<100
Glacial till		<10

*Mass DEP Groundwater Mounding for Systems Larger than 2,000 GPD Presentation

Soil Testing

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

ANNETTE C. MASLOWSKI
Owner Name

1657 MAIN STREET
Street Address

10C / 2637
Map/Lot #

CONCORD
City

MA
State

01742
Zip Code

B. Site Information

1. (Check one) ☑ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☑ Yes ☐ No If yes: NE SOIL - WEB SOIL SURVEY (Source) 254B (Soil Map Unit)

   MERRIMAC FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES
   Soil Name

   Soil Limitations

   GLACIOFLUVIAL DEPOSITS
   Geologic/Parent Material

   ESKERS, OUTWASH ~~[illegible]~~ PLAINS & TERRACES
   Landform

3. Surficial Geological Report Available? ☑ Yes ☐ No If yes: OLIVER (Year Published/Source) 1:25,000 (Publication Scale) SAND (Map Unit)

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? ☑ Yes ☐ No Within the 100-year flood boundary? ☐ Yes ☐ No
   If Yes, continue to #5.

5. Within a velocity zone? ☐ Yes ☑ No

6. Within a Mapped Wetland Area? ☐ Yes ☑ No MassGIS Wetland Data Layer: _____ (Wetland Type)

7. Current Water Resource Conditions (USGS): 5/21/2018 (Month/Year) Range: ☑ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-1A | 5/23/19 (Date) | 8:20 (Time) | SUNNY (Weather)

1. Location

Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: /

Description of Location: _____

2. Land Use: SINGLE FAMILY (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.): ND Slope (%): 2-5

Vegetation: GRASS/BRUSH Landform: _____ Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from:

Open Water Body	>200' feet	Drainage Way	– feet	Wetlands	>100' feet
Property Line	>10' feet	Drinking Water Well	– feet	Other	– feet

4. Parent Material: GLACIOFLUVIAL Unsuitable Materials Present: ☐ Yes ☑ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: 100" Depth Weeping from Pit _____ Depth Standing Water in Hole

Estimated Depth to High Groundwater: 100" inches _____ elevation

Deep Observation Hole Number: TP-1A

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-22	FILL	–	–	–	–	–	–	–	–	–	
22-32	B	10YR 4/6	–	–	–	LS	–	–	M	F	
32-78	C1	10YR 5/3	–	–	–	S	–	–	SG	L	
78-120	C2	10YR 4/4	108"	HIGH/LOW	>2	COARSE SAND	2	5	SG	L	

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-2A 5/23/18 (Date) 8:45 (Time) SUNNY (Weather)

1. Location

Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: /

Description of Location: _____

2. Land Use: SINGLE FAMILY (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.): NO Slope (%): 2-5

Vegetation: GRASS/BRUSH Landform: _____ Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from:

Open Water Body	>200' feet	Drainage Way	- feet	Wetlands	>100' feet
Property Line	>10' feet	Drinking Water Well	- feet	Other	- feet

4. Parent Material: GLACIOFLUVIAL DEPOSITS Unsuitable Materials Present: ☐ Yes ☑ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: 102" Depth Weeping from Pit _____ Depth Standing Water in Hole

Estimated Depth to High Groundwater: 100" inches _____ elevation

Deep Observation Hole Number: TP-2A

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-28	FILL	-	-	-	-	-	-	-	-	-	-
28-38	B	10YR 4/6	-	-	-	LS	-	-	M	F	-
42-72	C1	10YR 5/3	-	-	-	S	2	-	SG	L	-
72-120	C2	10YR 4/4	96"	HIGH/LOW	72	COARSE SAND	5	15	SG	L	-

Additional Notes:

_____

_____

_____

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-3A | Date: 5/23/18 | Time: 9:10 | Weather: SUNNY

1. Location

Ground Elevation at Surface of Hole: _____ feet | Latitude/Longitude: /

Description of Location: LAWN

2. Land Use: SINGLE FAMILY (e.g., woodland, agricultural field, vacant lot, etc.) | Surface Stones (e.g., cobbles, stones, boulders, etc.): NO | Slope (%): ~2

Vegetation: GRASS | Landform: _____ | Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from:

Open Water Body	>200' feet	Drainage Way	- feet	Wetlands	>100' feet
Property Line	>10' feet	Drinking Water Well	- feet	Other	- feet

4. Parent Material: GLACIOFLUVIAL DEPOSITS | Unsuitable Materials Present: ☐ Yes ☑ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No | If yes: Depth Weeping from Pit: BOTTOM OF PIT | Depth Standing Water in Hole: _____

Estimated Depth to High Groundwater: 90" inches | elevation: _____

Deep Observation Hole Number: TP-3A

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12	A	10YR 3/2	-	-	-	SL	-	-	M	F	-
12-30	B	10YR 4/6	-	-	-	LS	-	-	M	F	
30-120	C	10YR 5/3	90"	High/Low	>2	S	-	-	SG	L	

Additional Notes:

Commonwealth of Massachusetts
City/Town of
Percolation Test
Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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

A. Site Information

ANNETTE MASLOWSKI
Owner Name

1657 MAIN STREET
Street Address or Lot #

CONCORD — City/Town
MA — State
01742 — Zip Code

BENTLEY BUILDING CORP — Contact Person (if different from Owner)
(978) 618-5940 — Telephone Number

B. Test Results

	5/23/18	10:00	5/23/18	10:20
	Date	Time	Date	Time
Observation Hole #	PT-A1		PT-B1	
Depth of Perc	56"		50"	
Start Pre-Soak	10:08		10:28	
End Pre-Soak	10:23		UNABLE TO SATURATE	
Time at 12"	10:23			
Time at 9"	10:25			
Time at 6"	10:28			
Time (9"-6")	3 MIN			
Rate (Min./Inch)	< 2 MPI			
	Test Passed: ☑		Test Passed: ☑	
	Test Failed: ☐		Test Failed: ☐	

MOLLY OBENDORF
Test Performed By:

STAN SOSNICKI
Witnessed By:

Comments:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # _____	Obs. Hole # _____
☐ Depth observed standing water in observation hole	_____ inches	_____ inches
☐ Depth weeping from side of observation hole	_____ inches	_____ inches
☑ Depth to soil redoximorphic features (mottles)	SEE SOIL LOGS _____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☑ Yes ☐ No

   SEE SOIL LOGS

   b. If yes, at what depth was it observed? Upper boundary: _____ inches Lower boundary: _____ inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator	5/29/18 Date
MOLLY OBENDORF Typed or Printed Name of Soil Evaluator / License #	7/1/19 Expiration Date of License
STAN SOSNICKI Name of Board of Health Witness	CONCORD Board of Health

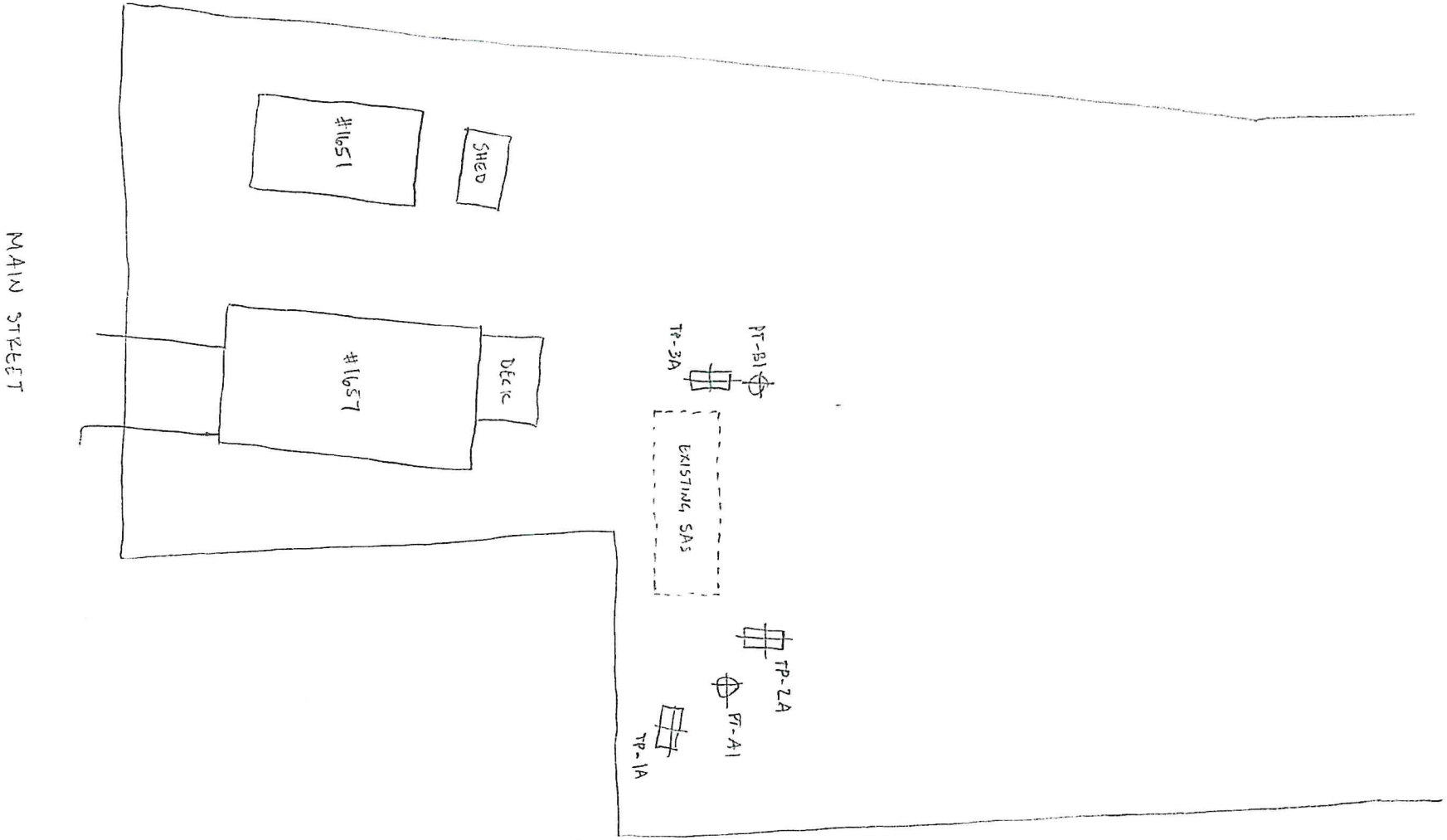
Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:



Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Now Communities, LLC
Owner Name

1657 Main Street
Street Address

Map/Lot #

Concord — MA — 01742
City — State — Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Web Soil Survey (Source) 254B (Soil Map Unit)

Merrimac fine sandy loam (Soil Name) N/A (Soil Limitations)

Glaciofluvial Deposits (Soil Parent material) Eskers, outwash plains & terraces (Landform)

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: OLIVER (Year Published/Source) Sand (Map Unit)

Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No If yes, MassGIS Wetland Data Layer: (Wetland Type)

7. Current Water Resource Conditions (USGS): 02/12/2020 (Month/Day/ Year) Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: V1-1 (Hole #) 2/12/2020 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

   Description of Location: _____

2. Soil Parent Material: Outwash _____ Landform _____ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet
   Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 74" Depth Weeping from Pit 74" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-9	Ap	SL	10YR 3/2	–	–	–	–	–	M	F	
9-24	Bw	LS	10YR 4/6	–	–	–	5%	–	M	F	
24-100	C	Sand	10YR 4/4	36"	10YR 4/6	3%	–	–	SG	Loose	

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: U-2 (Hole #) 2/12/2020 (Date) ____ Time ____ Weather ____ Latitude ____ Longitude:

1. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) Vegetation ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%) ____

   Description of Location: ____

2. Soil Parent Material: Outwash Landform ____ Position on Landscape (SU, SH, BS, FS, TS) ____

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet
   Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 52" Depth Weeping from Pit 52" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-9	Ap	SL	10YR3/2	-	-	-	-	-	M	F	
9-24	Bw	LS	10YR4/6	-	-	-	-	-	M	F	
24-86	C	Sand	10YR4/4	44"	10YR4/6	5%	-	-	SG	Loose	

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: V-3 (Hole #) 2/12/2020 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

   Description of Location: _____

2. Soil Parent Material: _____ Landform _____ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet
   Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: 40" Depth Weeping from Pit ____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-9	A_p	SL	10YR 3/2	–	–	–	–	–	M	F	
9-24	B_w	LS	10YR 4/6	–	–	–	–	3%	M	F	
24-120	C	fine S. Loam	2.5Y 5/2	32"	10YR 4/6	5%	–	–	SG	Loose	

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: V-4 (Hole #) 2/12/2020 (Date) ____ (Time) ____ (Weather) ____ (Latitude) ____ (Longitude:)

1. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) Vegetation ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%) ____

   Description of Location: ____

2. Soil Parent Material: ____ Landform ____ Position on Landscape (SU, SH, BS, FS, TS) ____

3. Distances from: Open Water Body ____ feet; Drainage Way ____ feet; Wetlands ____ feet; Property Line ____ feet; Drinking Water Well ____ feet; Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 66" Depth Weeping from Pit — Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	Ap	SL	10YR 3/2	-	-	-	-	-	M	F	
10-24	Bw	LS	10YR 4/6	-	-	-	-	-	M	F	
24-64	C1	Sand	10YR 4/4	44"	10YR 4/6	3%	-	-	SG	Loose	
64-115	C2	fine sandy loam	2.5Y 5/2	-	-	-	-	-	M	F	

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 1)-5 (Hole #) 2/12/2026 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ (Vegetation) _____ (Surface Stones (e.g., cobbles, stones, boulders, etc.)) _____ (Slope (%))

   Description of Location: _____

2. Soil Parent Material: Outwash _____ (Landform) _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body _____ feet; Drainage Way _____ feet; Wetlands _____ feet; Property Line _____ feet; Drinking Water Well _____ feet; Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 48" Depth Weeping from Pit 80" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-9	Ap	SL	10YR 3/2	-	-	-	-	-	M	F	
9-24	Bw	LS	10YR 4/6	-	-	-	-	-	M	F	
24-96	C	Sand	10YR 4/4	42"	10YR 4/6	3%	-	-	SG	Loose	

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: U-6 (Hole #) 2/12/2020 (Date) ____ (Time) ____ (Weather) ____ (Latitude) ____ (Longitude:)

1. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) Vegetation ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%) ____

   Description of Location: ____

2. Soil Parent Material: ____ Landform ____ Position on Landscape (SU, SH, BS, FS, TS) ____

3. Distances from: Open Water Body ____ feet; Drainage Way ____ feet; Wetlands ____ feet; Property Line ____ feet; Drinking Water Well ____ feet; Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 67" Depth Weeping from Pit 108" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Ap	SL	10YR 3/2	-	-	-	-	-	M	F	
12-30	Bw	LS	10YR 4/6	-	-	-	-	-	M	F	
30-84	C_1	Sand	10YR 4/4	54"	10YR 4/6	3%	-	-	SG	Loose	
84-120	C_2	Fine Sand	2.5Y 5/2	-	-	-	-	-	M	F	

Additional Notes: ____

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: V-7 (Hole #) 2/12/2020 (Date) ____ (Time) ____ (Weather) ____ (Latitude) ____ (Longitude:)

1. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) Vegetation ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%) ____

   Description of Location: ____

2. Soil Parent Material: Outwash Landform ____ Position on Landscape (SU, SH, BS, FS, TS) ____

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet
   Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: — Depth Weeping from Pit — Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Ap	SL	10YR 3/2	–	–	–	–	–	M	F	
12-30	Bw	LS	10YR 4/6	–	–	–	–	–	M	F	
30-132	C	Sand	2.5Y 5/4	115"	10YR 4/6	3%	–	–	SG	Loose	

Additional Notes: ____

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: U-8 (Hole #) 2/12/2020 (Date) ____ (Time) ____ (Weather) ____ (Latitude) ____ (Longitude:)

1. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) Vegetation ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%) ____

   Description of Location: ____

2. Soil Parent Material: Outwash Landform ____ Position on Landscape (SU, SH, BS, FS, TS) ____

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands ____ feet
   Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: — Depth Weeping from Pit — Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	Ap	SL	10YR 3/2	–	–	–	–	–	M	F	
12-16	Bw	LS	10YR 4/6	–	–	–	–	–	M	F	
16-86	C1	Sand	2.5Y 5/4	–	–	–	–	–	SG	Loose	
86-96	C2	fine sand	2.5Y 5/2	–	–	–	–	–	M	F	

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

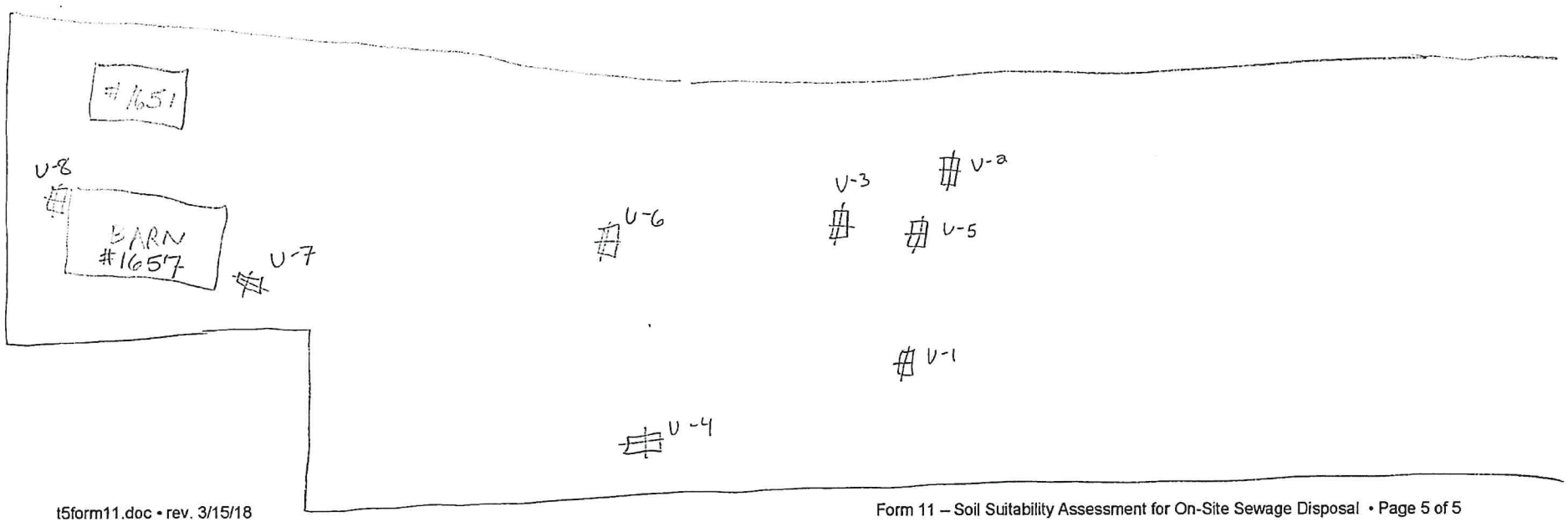
F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Daniel Carr	2/12/2020
Signature of Soil Evaluator	Date
Daniel Carr / SE 13801	6/30/2021
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Not witnessed	—
Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:



Drainage Maps

Stormwater Operation and Maintenance Manual

Stormwater Operation and Maintenance Manual

For

1651-1657 Main Street
Damon Village
Concord, MA

February 28, 2020

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

SM-2763B

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Long Term Operation and Maintenance Plan

Operation and Maintenance Sample Inspection Log

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.

Roof Drywells:
Inspect the drywell after every major storm for the first few months to ensure proper stabilization and function. Thereafter, inspect and clean as needed. Water levels should be recorded over several days to check the drywell drainage.

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 Basins:
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 even (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.

Stone Treatment 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.

Emergency Contacts:
In the event of a hazardous materials spill on the site the following parties shall be contacted: Concord Fire Department: ph: 978-318-3488

Records:
The Responsible Party shall maintain an inspection log of all elements of the storm water management plan. The Responsible Party shall maintain a maintenance log documenting the inspection and maintenance of the drainage structures under his control. A copy of the erosion control and storm water maintenance plan and inspection logs shall be kept onsite at all times.

Responsibility Party:
The Applicant shall be responsible for all inspection and maintenance of the items included in the Manual during construction.

Budget: The estimated annual operation and maintenance budget is $2,000.

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

Name: _____

Signature: _____

Date: _____

Operation and Maintenance Sample Inspection Log

1651-1657 Main Street, Concord, MA

Operation and Maintenance Inspection Log

Year: _____

Inspection Items:	Frequency:
Street Sweeping	**Four times per year**
Drywells	**Two times per year**
Stone Treatment Trenches	**Twice per year**
Sediment Forebays	**Monthly**
Infiltration Basins	**Monthly**

Street Sweeping:

Previous Inspection Date: _____

Inspection Date: _____

Inspector Name: _____

Comments:

Action Required:

Drywells

Previous Inspection Date: _____

Inspection Date: _____

Inspector Name: _____

Sediment in Drywell: _____

Comments:

Action Required:

Stone Treatment Trenches:

Previous Inspection Date: _____

Inspection Date: _____

Inspector Name: _____

Comments:

Action Required:

Sediment Forebay:

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Erosion in Forebay: _____
Comments:

Action Required:

Infiltration Basin:

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Sediment Forebay: _____ (Remove if depth greater than 18")
Erosion in Basin: _____
Outlet Structure: _____
Comments:

Action Required: