
STORMWATER MANAGEMENT REPORT

for

**1251 Jumping Brook Road
Block 128.03, Lot 47
Borough of Tinton Falls
Monmouth County, New Jersey**

Prepared For:

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1.0 INTRODUCTION

On This report presents the results of the stormwater management and conveyance system design for the proposed redevelopment on Block 128.03, Lot 47 in Tinton Falls, Monmouth County, New Jersey. Refer to Figure 1. The proposed stormwater management system was designed in accordance with the following:

- Standards for Soil Erosion and Sediment Control in New Jersey;
- N.J.A.C. 7:8 Stormwater Management Regulations;
- New Jersey Stormwater Best Management Practices Manual; and
- Borough of Tinton Falls Land Use Ordinance, Section 40-68.

2.0 DESIGN METHODOLOGY

2.1 Stormwater Runoff Quantity Management

The proposed stormwater quantity management design is in accordance with Section 40-68 of the Borough of Tinton Falls Land Use Ordinance, N.J.A.C. 7:8-5.4(a)(3), and N.J.A.C. 5:21-7.1 through 7.9. The stormwater management design will comply with the following requirements listed below and further described in Section 4.2 of this report:

- The post-construction peak runoff rates for the 2, 10, and 100-year storm events are 50, 75, and 80 percent, respectively, of the pre-construction peak runoff rates for those watersheds that are affected by the proposed improvements.
- Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the 2, 10 and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events.

The stormwater quantity calculations were performed using the method described by the USDA Natural Resources Conservation Service (NRCS) Publication TR-55, "Urban Hydrology for Small Watersheds." TR-55 outlines procedures for calculating peak runoff rates resulting from precipitation events and procedures for developing runoff hydrographs. The TR-55 procedure simulates runoff from a watershed using the drainage area, curve number (CN), time of concentration (Tc) and a prescribed rainfall distribution.

As prescribed in the New Jersey Stormwater Best Management Practices Manual, hydrographs have been computed separately for pervious and impervious areas.

The curve number is a land sensitive coefficient that dictates the relationship between total rainfall depth and direct stormwater runoff. CN values were determined based on the coverage of soil group and land use in each area of the watershed. The NRCS classification system evaluates the runoff potential of a soil according to its infiltration and transmission rates. "A" soils have a lower CN value and the lowest runoff potential

and "D" soils have a higher CN value and the greatest runoff potential. Soils throughout the project area are rated as NRCS hydrologic soil group "A", hydrologic soil group "B", and hydrologic soil group "D", as shown on Figure 3.

The following curve numbers were used:

Curve Numbers

Hydrologic Soil Group	Land Cover	CN
A	Woods	30
A	Open Space	39
B	Woods	55
B	Open Space	61
D	Woods	77
D	Open Space	80
A / B / D	Impervious	98

The time of concentration is defined as the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest. Values of the time of concentration were determined based on land cover and slope of the flow path using methods described in TR-55.

The 24-hour NOAA Type D rainfall distribution was used in the analysis. The total rainfall depth that was used for each return-period storm was taken for Neptune Township.

2.2 Stormwater Runoff Water Quality Design

Stormwater quality management for the site has been designed using the pollutant removal requirements set forth in the NJDEP Stormwater Management Rules (N.J.A.C. 7:8-5.5), and Section 40-68 of the Borough of Tinton Falls Land Use Ordinance. For new development, the standards require an 80% reduction of the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm as compared to the pre-construction load. For redeveloped areas (where new impervious surfaces replace existing impervious surfaces), the standards require a 50% reduction in post-construction load of TSS from the water quality design storm.

Since a portion of the site is being redeveloped, a weighted TSS removal rate was calculated for each watershed and is further described in Section 4.4 of this report.

The design complies with the stormwater quality requirements by incorporating five extended detention basins, and three manufactured treatment devices. The NJDEP stormwater quality design storm consisting of 1.25 inches of rainfall in two hours with a variable distribution was used in the stormwater quality analysis.

2.3 Groundwater Recharge Design

Per N.J.A.C. 7:8-5.4 (a) 2i, 100 percent of the site's average pre-development groundwater recharge volume must be maintained after development. The groundwater recharge calculations were performed using the New Jersey Groundwater Recharge Spreadsheet. The soil types were obtained from the NRCS Web Soil Survey for Monmouth County. The land cover was determined from site investigations and the topographic survey.

2.4 Stormwater Conveyance Design

The storm sewer conveyance system was analyzed using the Rational Method for estimating runoff from a 25-year design storm. The site was divided into sub-areas, each contributing runoff to an individual catch basin inlet or roof drain. A value for area, time of concentration, and runoff coefficient were entered for each sub-area. Times of concentration of 6 minutes were used for the inlets and roof drains. Each sub-area was assigned a weighted average runoff coefficient based on the percentage of each type of land cover. The below runoff coefficient values were used and are based on Hydrologic Group B soils. Hydrologic Group B soils were selected, as these values represent a collective average for the various soils onsite.

LAND COVER	C
Grass / Landscaped	0.51
Paved	0.99
Roof	0.99

Rainfall intensities were determined from NOAA for Borough of Tinton Falls. Storm drainage pipes were sized with Manning's Equation using the computer program Hydraflow Storm Sewers Extension for AutoCAD Civil 3D 2013.

3.0 EXISTING CONDITIONS

3.1 Existing Site Description and History

The project site is approximately 50.7 acres and is known as Block 128.03, Lot 47 in Tinton Falls, Monmouth County, New Jersey. The site is bound Jumping Brook Road to the east, commercial and industrial properties to the south and west, and residential development to the north (Refer to Figure 1).

The on-site soils are identified as primarily Atsion sand, Downer loam, Evesboro san, Klej Loamy Sand., and Lakewood sand. These soils are designated as hydrologic soil group "A", hydrologic soil group "B", and hydrologic soil group "D" in accordance with the NRCS Soil Map (Figure 3).

3.2 Existing Watersheds and Drainage Description

The project consists of 3 watersheds as shown on drawing DA 101 and described below. Watershed A conveys runoff to low lying wetlands located in the northern portion of the site. This stormwater is ultimately conveyed to the Jumping Brook unnamed tributary located in the northern portion of the site, shown on Figure 2. Watershed B conveys runoff to a low lying wetland located in the southwest corner of the site. Watershed C conveys runoff to Jumping Brook Road.

The peak discharges for the site are summarized in the following table. Watershed data and hydrographs are provided in Appendix A.

Summary of Existing Peak Discharges

Storm Frequency (year)	Watershed A (cfs)		Watershed B (cfs)	Watershed C (cfs)
	Disturbed	Undisturbed		
2	4.36	0.36	0.16	0.33
10	17.02	1.86	0.89	0.51
100	76.21	10.23	2.90	2.19

4.0 PROPOSED CONDITIONS

4.1 Proposed Development

The proposed development consists of a 113,016 square-foot delivery station warehouse building and associated driveways, car parking areas, van parking areas, truck loading areas and van loading areas. In addition, associated site improvements including utilities, landscaping, and lighting will be incorporated into the proposed development.

Consistent with the Tinton Falls land use ordinance, stormwater inlets and conveyance pipes will be constructed to manage stormwater runoff from the development.

4.2 Proposed Watersheds and Drainage Description

The proposed site consists of three overall watersheds, similar to that of the existing conditions. These watersheds are shown on DA 102 and described below.

Watershed A conveys runoff to the low lying wetland area located at the northern portion of the site. Watershed A is divided into 8 subwatersheds, as further described below.

Watershed A1: Watershed A1 includes basin 1, the western portions of the roof, the van parking area located in the northwestern portion of the site, the van queuing area, and the truck court. Watershed A1 is split into Watershed A1a and Watershed A1b in order to separately calculate the volume and flow that discharges into Underground Recharge / Detention Basin (West).

Watershed A1 (Undisturbed): Watershed A1 (Undisturbed) includes the western portion of the site that will remain undisturbed. This watershed will be routed through basin 1 prior to reaching the ultimate point of analysis. Watershed A1 (Undisturbed) is split into Watershed A1a (Undisturbed) and Watershed A1b (Undisturbed) in order to separately calculate the volume and flow that discharges into Underground Recharge / Detention Basin (West).

Watershed A2: Watershed A2 includes basin 2 and a portion of the van parking area to the north of the building.

Watershed A3 (Undisturbed): Watershed A3 includes the northern portion of the site that will remain undisturbed.

Watershed A4: Watershed A4 includes basin 3, the eastern portion of the roof, the canopy, the car parking area, and a portion of the van parking area to northeast of the building. Watershed A4 is split into Watershed A4a and Watershed A4b in order to separately calculate the volume and flow that discharges into Underground Recharge / Detention Basin (East).

Watershed A5: Watershed A5 includes basin 4 and the eastern driveway.

Watershed A6: Watershed A6 includes basin 5 and the van parking area located in the northeastern portion of the site.

Watershed A7: Watershed A7 includes the northern portion of the site that sheet flows into the wetlands, undetained.

All of these subwatersheds convey stormwater runoff to the low lying wetland area on the northern portion of the site. The proposed watershed data and hydrographs are provided in Appendix B. The results are summarized below.

WATERSHED A						
STORM EVENT	EXISTING FLOW (DISTURBED)	REDUCTION	REQ. PROPOSED FLOW (DISTURBED)	EXISTING FLOW (UNDISTURBED)	ALLOWABLE FLOW	PROPOSED FLOW
2	4.36 cfs	50 %	2.18 cfs	0.36 cfs	2.54 cfs	2.41 cfs
10	17.02 cfs	25 %	12.77 cfs	1.86 cfs	14.61 cfs	7.18 cfs
100	76.21 cfs	20%	60.97 cfs	10.23 cfs	71.20 cfs	60.67 cfs

Summary of Allowable Flows and Proposed Discharges

Watershed B conveys runoff to low lying wetland area located in the southern portion of the site and is only made up of one subwatershed. Since there no changes to the existing area as part of the proposed development, this watershed will comply with the requirement to that the post-construction runoff hydrographs for the 2, 10 and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events. The proposed watershed data and hydrographs are provided in Appendix B.

Summary of Existing and Proposed Discharges

WATERSHED B		
STORM EVENT	EXISTING FLOW	PROPOSED FLOW
2	0.16 cfs	0.16 cfs
10	0.89 cfs	0.89 cfs
100	2.90 cfs	2.90 cfs

Watershed C conveys runoff to the Jumping Brook Road and is only made up of one subwatershed. Peak reductions were applied this watershed as part of the proposed development.

The proposed watershed data and hydrographs are provided in Appendix B. The results are summarized below.

Summary of Allowable Flows and Proposed Discharges

WATERSHED C				
STORM EVENT	EXISTING FLOW	REDUCTION	ALLOWABLE FLOW	PROPOSED FLOW
2	0.33 cfs	50 %	0.16 cfs	0.16 cfs
10	0.51 cfs	25 %	0.38 cfs	0.26 cfs
100	2.19 cfs	20 %	1.75 cfs	1.34 cfs

4.3 Proposed Stormwater Management

The below tables provide a summary of the peak discharges and water surface elevations for the basins. The information is summarized below and the computations and outflow hydrographs are provided in Appendix B.

Basin 1			
Storm Frequency (year)	Peak Outflow (cfs)	Maximum Water Surface Elevation (ft)	Spillway Elevation (ft)
2	0.49	97.41	100.75
10	3.16	98.51	100.75
25	7.71	98.75	100.75
100	24.21	99.38	100.75

Basin 2			
Storm Frequency (year)	Peak Outflow (cfs)	Maximum Water Surface Elevation (ft)	Spillway Elevation (ft)
2	0.93	85.21	87.75
10	4.26	85.99	87.75
25	11.24	86.28	87.75
100	24.65	86.68	87.75

Basin 3			
Storm Frequency (year)	Peak Outflow (cfs)	Maximum Water Surface Elevation (ft)	Spillway Elevation (ft)
2	0.94	91.74	95.75
10	1.23	93.48	95.75
25	4.83	94.06	95.75
100	20.23	94.72	95.75

Basin 4			
Storm Frequency (year)	Peak Outflow (cfs)	Maximum Water Surface Elevation (ft)	Spillway Elevation (ft)
2	0.78	84.94	87.3
10	1.24	85.04	87.3
25	3.98	85.22	87.3
100	14.64	85.91	87.3

Basin 5			
Storm Frequency (year)	Peak Outflow (cfs)	Maximum Water Surface Elevation (ft)	Spillway Elevation (ft)
2	0.50	73.75	75.80
10	0.66	74.20	75.80
25	1.65	74.38	75.80
100	5.55	74.66	75.80

The below tables provide a summary of the basin bottom elevations in comparison to the seasonal high groundwater table, Geotechnical information regarding seasonal high groundwater can be found in Appendix I.

	Bottom of Basin Elevation (ft)	Approx. Groundwater Elevation (ft)
Basin 1	95	83
Basin 2	83	75.5
Basin 3	89	87
Basin 4	84	78.5
Basin 5	73	71

All of the stormwater management basins have been designed to have a spillway designed with a non-erosive velocity. Detailed calculations for spillway the proposed spillways can be found in Appendix E.

4.4 Proposed Water Quality Analysis

The water quality standards set forth in the proposed NJDEP Stormwater Management Rules (N.J.A.C. 7:8, Subchapter 5) and related Best Management Practices have provided the basis for the water quality design. As required, a weighted TSS removal has been provided for the project, based on the areas of new development to be treated at 80% TSS removal and the redeveloped areas to be treated at 50% TSS removal. Refer to Drawings DA 104 TSS Removal Plan. A description of the water quality design for each watershed is provided below.

Proposed Watershed A

A total weighted average TSS removal of 76.03% is required for Watershed A. Water quality treatment of the landscaped and paved areas of Watershed A will be provided by a five extended detention basins and three Water Quality Units. A total TSS removal of 77.01% is proposed.

In addition to the water quality measures discussed above, the site also incorporates four rain gardens to capture runoff from the proposed parking area. These rain gardens provide additional water quality benefits that are not captured in the proposed TSS removal rate for the proposed development.

Proposed Watersheds B and C

NJAC 7:8-5.5 requires that stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm by 80% of the anticipated load from the developed site, expressed as an annual percentage for projects that increase impervious areas by at least one quarter acre or more. Runoff quality measures will not be required for Watersheds B and C, as there is no increase in impervious area.

Water quality hydrographs are provided in Appendix C.

4.5 Groundwater Recharge

Per the NJDEP Stormwater Management Rules, 100 percent of the site's average pre-developed groundwater recharge volume will be maintained after development. The groundwater recharge requirements will be met by two proposed recharge basins located north of the building.

These basins consist of 36-inch diameter perforated pipes surrounded by a stone recharge bed. Percolation tests were performed in the vicinity of the recharge basins to ensure that the minimum infiltration rate was met. Calculations are provided in Appendix D.

Detailed information, including infiltration test results, is also provided in Appendix I.

4.6 Stormwater Conveyance

Storm pipes were designed to convey the flows resulting from a 25-year storm event. The results of the hydraulic calculations are provided in Appendix F and the drainage areas to each inlet are shown on Drawing DA 103.

Scour holes for the stormwater conveyance outfalls have been designed in accordance with the "Standards for Soil Erosion and Sediment Control in New Jersey". The analyses of the proposed scour holes are included in Appendix G.

4.7 Low Impact Development

In accordance with N.J.A.C. 7:8-5.3(b), the following nonstructural strategies have been incorporated into the proposed redevelopments:

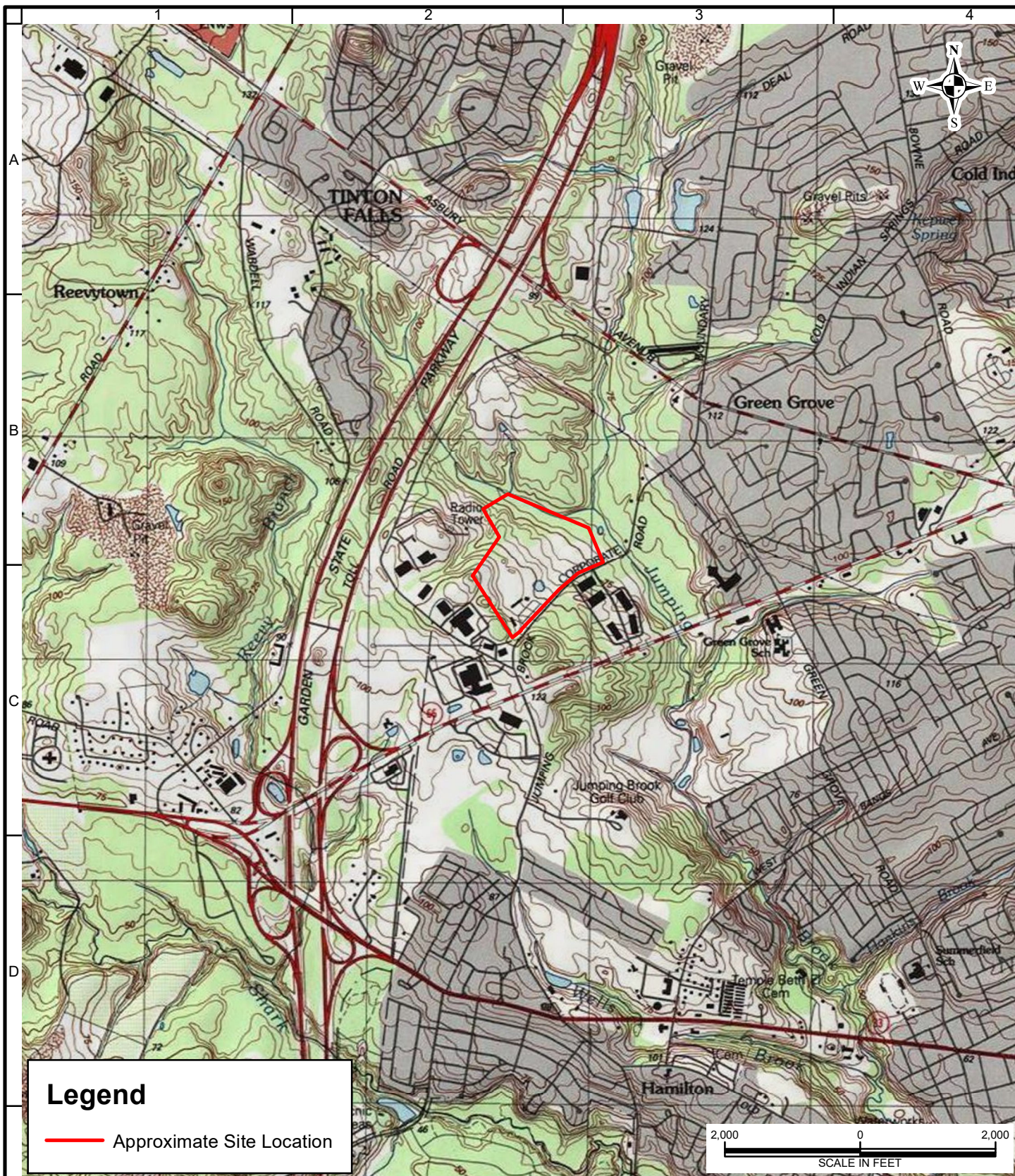
- Protect areas that provide water quality benefits or area particularly susceptible to erosion and sediment loss - the wetlands in the southwest and northern areas of the site will be maintained.
- Maximize the protection of natural drainage features and vegetation – Silt fence and tree protection fence are provided during construction to protect wetlands in the southwest and northern areas of the site.
- Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides – The landscaping design incorporates the planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.
- Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas – The stormwater design utilizes existing wetlands to the north of the project area.
- Provide preventative source controls – A trash compactor will be provided along the rear of the building and storm inlets will comply with NJPDES criteria.

The NJDEP Low Impact Development checklist has also been included in Appendix H.

4.8 Point of Discharge and Downstream Stability

Stormwater runoff collected by the proposed basins discharges into the existing wetlands area in the northern portion of the site and ultimately into the unnamed Jumping Brook tributary. In accordance with the NJ Standard for Offsite Stability, scour holes are proposed at the points of discharge and downstream conditions have been analyzed to ensure the stability and integrity of natural resources downstream of the basin. The downstream stability analyses is included in Appendix K.

FIGURES



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NJ CERTIFICATE OF AUTHORIZATION No. 24GA27996400

Project

**1251 JUMPING
BROOK ROAD**

BLOCK No. 128.03, LOT No. 47

BOROUGH OF TINTON FALLS

MONMOUTH COUNTY NEW JERSEY

Drawing Title

**USGS SITE
LOCATION MAP**

Project No.

100775501

Date

9/4/2019

Scale

1" = 2,000'

Drawn By

MWen

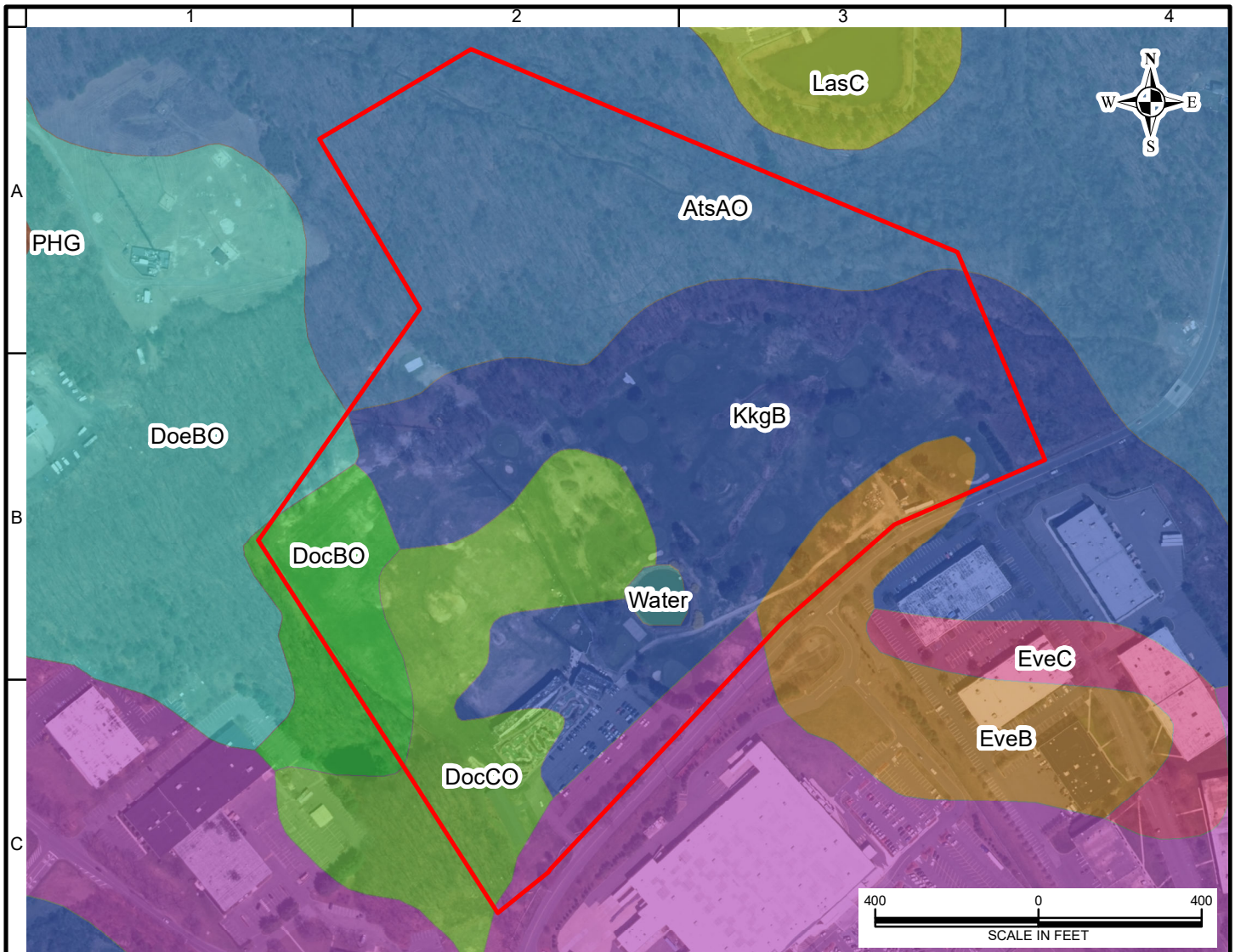
Figure

1



Map References: NJDEP Surface Water Quality Standards GIS Data, 03/27/2020; NJDEP Aerial Imagery 2015

LANGAN 300 Kimball Drive Parsippany, NJ 07054 T: 973.560.4900 F: 973.560.4901 www.langan.com Langan Engineering & Environmental Services, Inc. Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C. Langan International LLC Collectively known as Langan	Project 1251 JUMPING BROOK ROAD BLOCK No. 128.03, LOT No. 47 BOROUGH OF TINTON FALLS MONMOUTH COUNTY NEW JERSEY	Drawing Title NJDEP SURFACE WATERS MAP	Project No. 100775501 Date 04/11/2020 Scale 1" = 500' Drawn By SEP	Figure 2
	NJ CERTIFICATE OF AUTHORIZATION No. 24GA27996400			
	© 2020 Langan			
	Path: \\angan.com\data\PAR\data5\100775501\Project Data\ArcGIS\MXD\Natural_Resource_Figures\Figure 5 - Surface Waters.mxd			



Legend

— Approximate Site Location

NRCS Soils

AtsAO: Atsion sand, 0 to 2 percent slopes, Northern Tidewater Area

DocBO: Downer loamy sand, 0 to 5 percent slopes, Northern Tidewater Area

DocCO: Downer loamy sand, 5 to 10 percent slopes, Northern Tidewater Area

DoeBO: Downer sandy loam, 2 to 5 percent slopes, Northern Tidewater Area

EveB: Evesboro sand, 0 to 5 percent slopes

EveC: Evesboro sand, 5 to 10 percent slopes

KkgB: Klej loamy sand, 0 to 5 percent slopes

LasB: Lakewood sand, 0 to 5 percent slopes

LasC: Lakewood sand, 5 to 10 percent slopes

PHG: Pits, sand and gravel

Water

Map References: NRCS Web Soil Survey GIS Data 2018; NJDEP Aerial Imagery 2015

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Project

1251 JUMPING
BROOK ROAD

BLOCK No. 128.03, LOT No. 47

BOROUGH OF TINTON FALLS

MONMOUTH COUNTY NEW JERSEY

Drawing Title

NRCS SOILS
MAP

Project No.

100775501

Date

9/4/2019

Scale

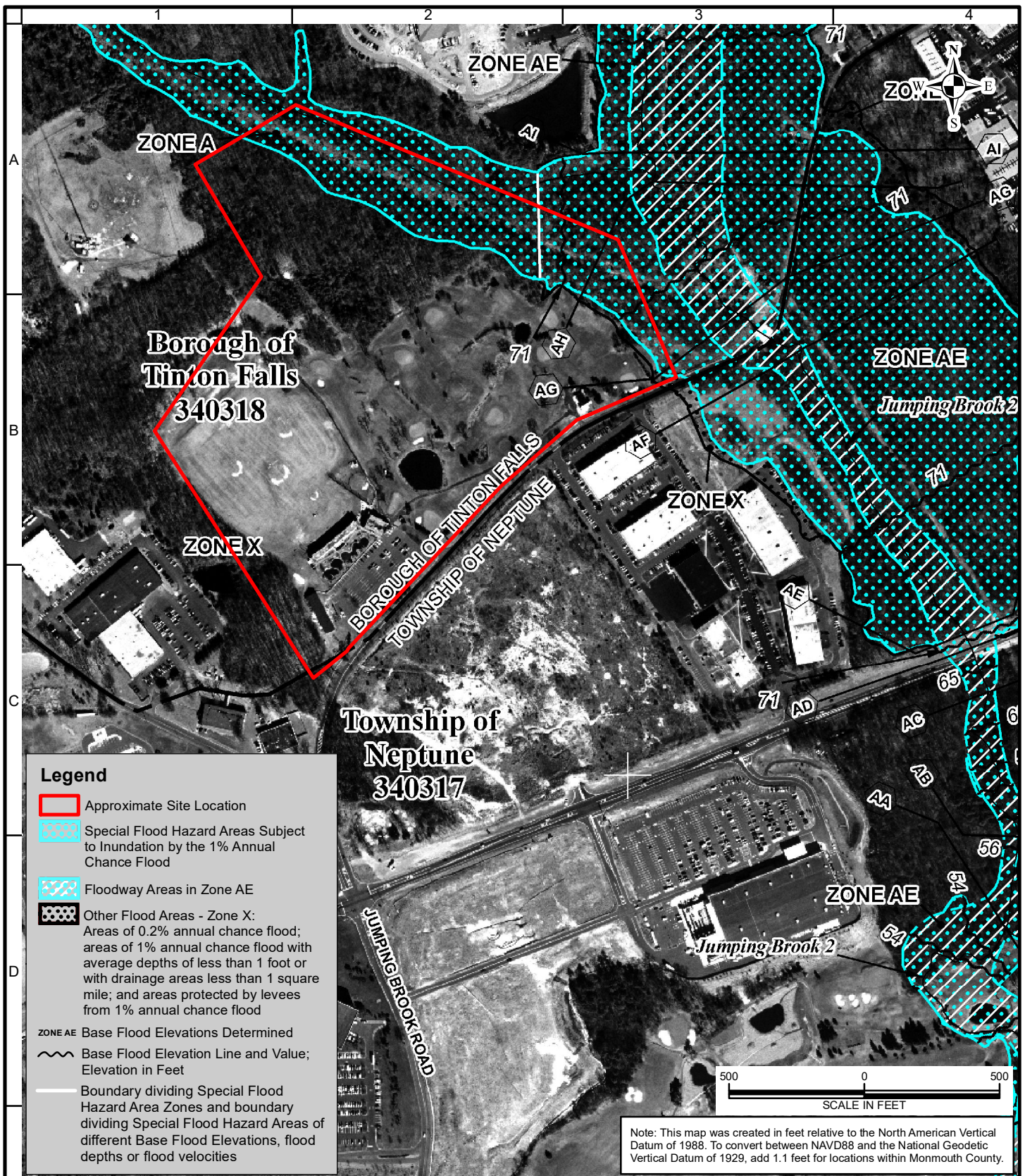
1" = 400'

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Figure

3



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Collectively known as Langan

NJ CERTIFICATE OF AUTHORIZATION No. 24GA27996400

Project

**1251 JUMPING
BROOK ROAD**

BLOCK No. 128.03, LOT No. 47

BOROUGH OF TINTON FALLS

MONMOUTH COUNTY NEW JERSEY

Drawing Title

**FEMA EFFECTIVE
FIRM MAP**

Project No.

100775501

Date

9/4/2019

Scale

1" = 500'

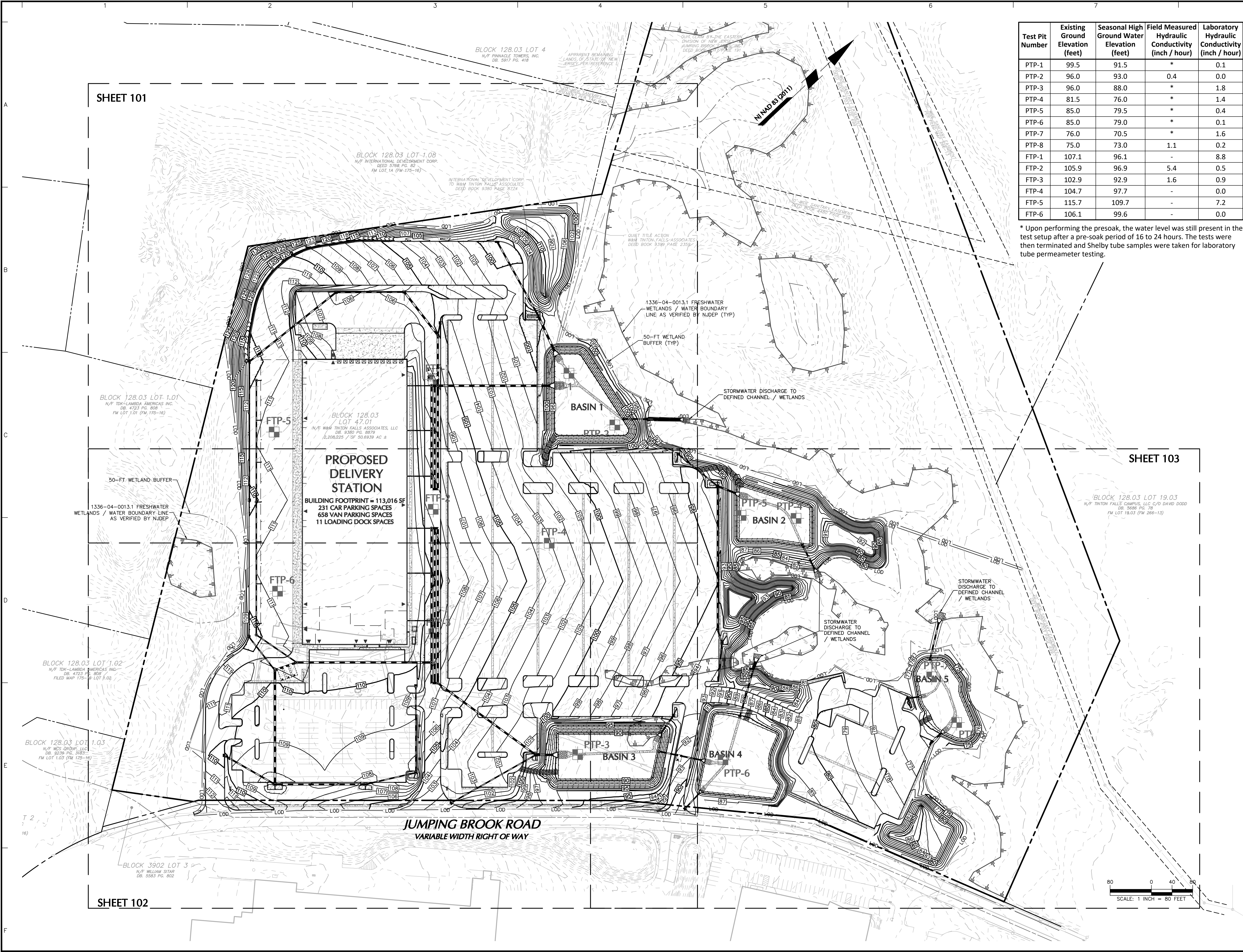
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Figure

4

DRAWINGS



Test Pit Number	Existing Ground Elevation (feet)	Seasonal High Ground Water Elevation (feet)	Field Measured Hydraulic Conductivity (inch / hour)	Laboratory Hydraulic Conductivity (inch / hour)
PTP-1	99.5	91.5	*	0.1
PTP-2	96.0	93.0	0.4	0.0
PTP-3	96.0	88.0	*	1.8
PTP-4	81.5	76.0	*	1.4
PTP-5	85.0	79.5	*	0.4
PTP-6	85.0	79.0	*	0.1
PTP-7	76.0	70.5	*	1.6
PTP-8	75.0	73.0	1.1	0.2
FTP-1	107.1	96.1	-	8.8
FTP-2	105.9	96.9	5.4	0.5
FTP-3	102.9	92.9	1.6	0.9
FTP-4	104.7	97.7	-	0.0
FTP-5	115.7	109.7	-	7.2
FTP-6	106.1	99.6	-	0.0

* Upon performing the presoak, the water level was still present in the test setup after a pre-soak period of 16 to 24 hours. The tests were then terminated and Shelby tube samples were taken for laboratory tube permeameter testing.

- NOTES:
- BOUNDARY INFORMATION AND EXISTING FEATURES FOR BLOCK 128.03, LOTS 47 SHOWN HEREON ARE BASED ON "ALTA/NSPS LAND TITLE SURVEY" DATED 06/24/2020 PREPARED BY LANGAN ENGINEERING, THE CONTRACTOR SHALL VERIFY ALL INFORMATION TO HIS SATISFACTION PRIOR TO THE EXECUTION OF CONTRACTS OR COMMENCING WORK. ANY DISCREPANCIES SHALL BE IMMEDIATELY REPORTED TO THE ENGINEER OF RECORD.
 - ALL ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
 - SITE GRADING SHALL BE PERFORMED IN ACCORDANCE WITH THESE PLANS AND SPECIFICATIONS, THE FILL MATERIAL, PLACEMENT OF FILL, COMPACTION REQUIREMENTS AND THE COMPACTION TESTING REQUIREMENTS ARE DEFINED IN THE GEOTECHNICAL REPORT.
 - THE CONTRACTOR SHALL BE RESPONSIBLE TO NOTIFY LOCAL WATER AND SEWER DEPARTMENTS TO MARK OUT THEIR UTILITIES.
 - CONTRACTOR TO CONFIRM ALL STRUCTURE INVERTS AND NOTIFY ENGINEER OF ANY INCONSISTENCIES PRIOR TO CONSTRUCTION.
 - CONTRACTOR TO BEGIN PIPE NETWORK CONSTRUCTION AT TIE-IN LOCATION (DOWNSTREAM) AND BUILD UPSTREAM.
 - REFER TO ARCHITECTURAL DRAWINGS FOR EXACT ROOF LEADER CONNECTION LOCATIONS, WHERE CONFLICTS EXIST BETWEEN THESE PLANS AND ARCHITECTURAL PLANS, CONTRACTOR TO NOTIFY THE ENGINEER BEFORE CONSTRUCTION.
 - ALL PIPES SHALL BE HDPE UNLESS OTHERWISE NOTED.
 - ALL INLETS SHALL BE TYPE B OR TYPE E UNLESS OTHERWISE NOTED.
 - PROPOSED PIPE CONNECTIONS TO STRUCTURES ARE TO BE EQUIPPED WITH WATER-TIGHT JOINTS.
 - SPOT GRADES REPRESENT PAVEMENT GRADES OR BOTTOM OF CURB UNLESS OTHERWISE NOTED.
 - ALL AREAS SHALL BE WELL GRADED TO MINIMIZE FLAT AREAS, TO PROVIDE PROPER DRAINAGE, AND TO PREVENT LOCALIZED PONDING.
 - ALL SLOPES SHALL BE EQUAL TO OR LESS THAN 3:1, WHERE SLOPES ARE GREATER THAN 3H:1V, EROSION CONTROL MATTING SHALL BE USED.
 - ALL STORMWATER MANAGEMENT FEATURES ON THE PROPERTY SHALL BE INSPECTED AND CLEANED/REPAIRED UNDER THE SUPERVISION OF THE TOWNSHIP ENGINEER AT THE TIME OF CONSTRUCTION.
 - ALL STORMWATER INLETS ON THE PROPERTY AND ALONG ITS FRONTAGES SHALL BE EQUIPPED "N-ECO" GRATES. THE SIZES OF THE PROPOSED BERMS ARE SCHEMATICALLY SHOWN AND SUBJECT TO CHANGE BASED ON FIELD CONDITIONS.
 - ALL REINFORCED CONCRETE PIPES SHALL HAVE RUBBER O-RING GASKETS.

1/05/21	PER AGENCY COMMENTS	2
9/17/20	PER TOWNSHIP COMMENTS	1
Date	Description	No.

REVISIONS

SIGNATURE RICHARD BURROW DATE SIGNED
PROFESSIONAL ENGINEER
NJ Lic. No. 24GE04459300

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NJ CERTIFICATE OF AUTHORIZATION No. 24GA27996400

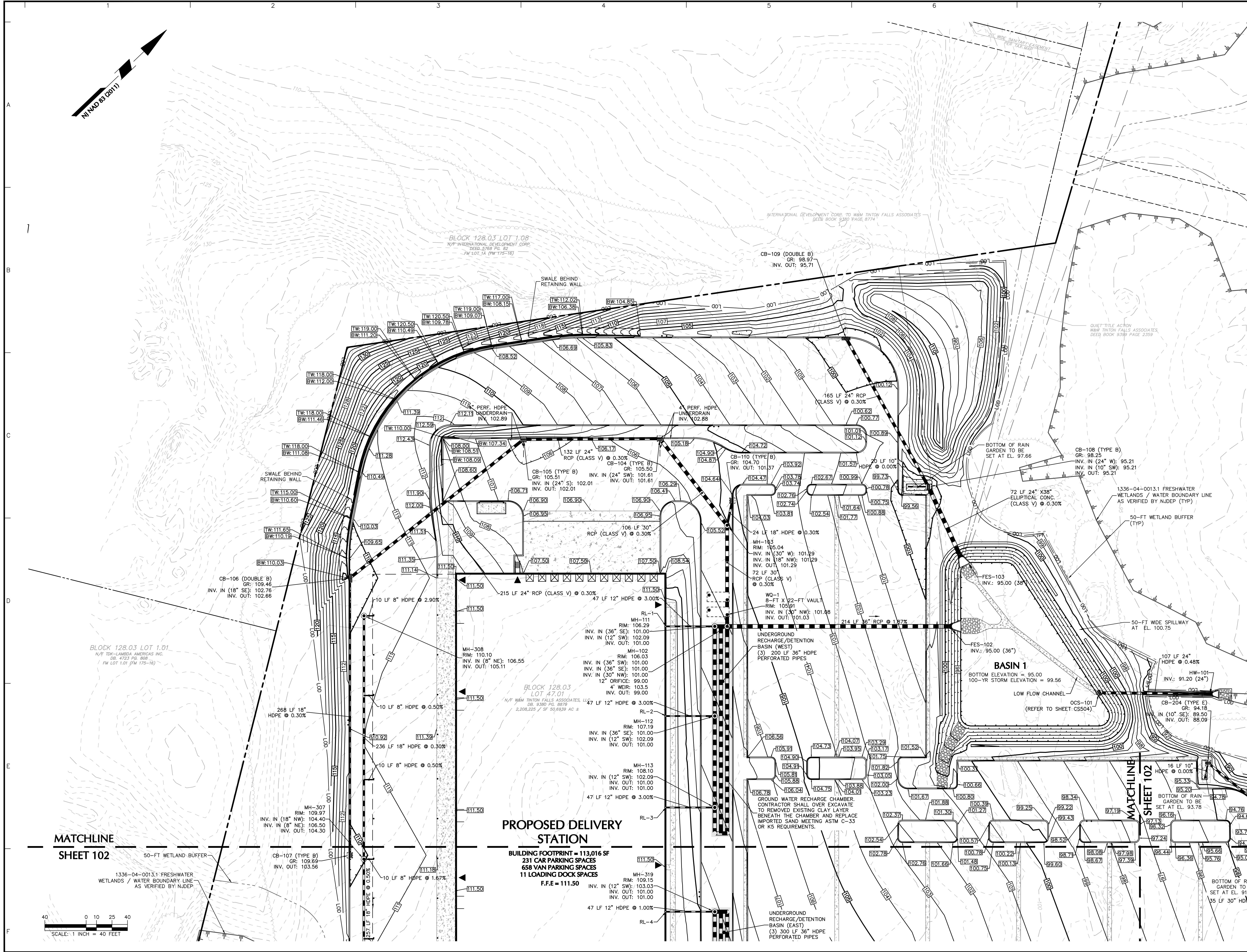
Project

1251 JUMPING BROOK ROAD
BOROUGH OF TINTON FALLS
BLOCK 128.03, LOT 47

MONMOUTH COUNTY NEW JERSEY
Drawing Title

OVERALL GRADING AND DRAINAGE PLAN

Project No.	Drawing No.
100775501	CG100
Date	06/25/2020
Drawn By	RY
Checked By	RB
Sheet 14 of 50	



- NOTES:
1. BOUNDARY INFORMATION AND EXISTING FEATURES FOR BLOCK 128.03, LOTS 47 SHOWN HEREON ARE BASED ON "ALTA/NSPS LAND TITLE SURVEY" DATED 06/24/2020 PREPARED BY LANGAN ENGINEERING, THE CONTRACTOR SHALL VERIFY ALL INFORMATION TO HIS SATISFACTION PRIOR TO THE EXECUTION OF CONTRACTS OR COMMENCING WORK. ANY DISCREPANCIES SHALL BE IMMEDIATELY REPORTED TO THE ENGINEER OF RECORD.
 2. ALL ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
 3. SITE GRADING SHALL BE PERFORMED IN ACCORDANCE WITH THESE PLANS AND SPECIFICATIONS. THE FILL MATERIAL, PLACEMENT OF FILL, COMPACTION REQUIREMENTS AND THE COMPACTION TESTING REQUIREMENTS ARE DEFINED IN THE GEOTECHNICAL REPORT.
 4. THE CONTRACTOR SHALL BE RESPONSIBLE TO NOTIFY LOCAL WATER AND SEWER DEPARTMENTS TO MARK OUT THEIR UTILITIES.
 5. CONTRACTOR TO CONFIRM ALL STRUCTURE INVERTS AND NOTIFY ENGINEER OF ANY INCONSISTENCIES PRIOR TO CONSTRUCTION.
 6. CONTRACTOR TO BEGIN PIPE NETWORK CONSTRUCTION AT TIE-IN LOCATION (DOWNSTREAM) AND BUILD UPSTREAM.
 7. REFER TO ARCHITECTURAL DRAWINGS FOR EXACT ROOF LEADER CONNECTION LOCATIONS. WHERE CONFLICTS EXIST BETWEEN THESE PLANS AND ARCHITECTURAL PLANS, CONTRACTOR TO NOTIFY THE ENGINEER BEFORE CONSTRUCTION.
 8. ALL PIPES SHALL BE HDPE UNLESS OTHERWISE NOTED.
 9. ALL INLETS SHALL BE TYPE B OR TYPE E UNLESS OTHERWISE NOTED.
 10. PROPOSED PIPE CONNECTIONS TO STRUCTURES ARE TO BE EQUIPPED WITH WATER-TIGHT JOINTS.
 11. SPOT GRADES REPRESENT PAVEMENT GRADES OR BOTTOM OF CURB UNLESS OTHERWISE NOTED.
 12. ALL AREAS SHALL BE WELL GRADED TO MINIMIZE FLAT AREAS, TO PROVIDE PROPER DRAINAGE, AND TO PREVENT LOCALIZED PONDING.
 13. ALL SLOPES SHALL BE EQUAL TO OR LESS THAN 3:1, WHERE SLOPES ARE GREATER THAN 3:1, EROSION CONTROL MATTING SHALL BE USED.
 14. ALL STORMWATER MANAGEMENT FEATURES ON THE PROPERTY SHALL BE INSPECTED AND CLEANED/REPAIRED UNDER THE SUPERVISION OF THE TOWNSHIP ENGINEER AT THE TIME OF CONSTRUCTION.
 15. ALL STORMWATER INLETS ON THE PROPERTY AND ALONG ITS FRONTAGES SHALL BE EQUIPPED "N-ECO" GRATES. THE SIZES OF THE PROPOSED BERMS ARE SCHEMATICALLY SHOWN AND SUBJECT TO CHANGE BASED ON FIELD CONDITIONS.
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1/05/21	PER AGENCY COMMENTS	2
9/17/20	PER TOWNSHIP COMMENTS	1
Date	Description	No.

REVISIONS

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Project

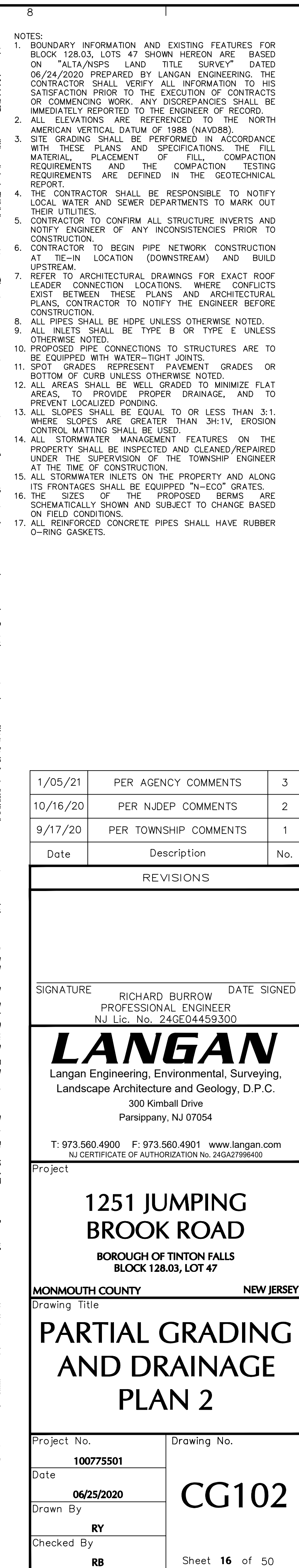
1251 JUMPING BROOK ROAD
BOROUGH OF TINTON FALLS
BLOCK 128.03, LOT 47

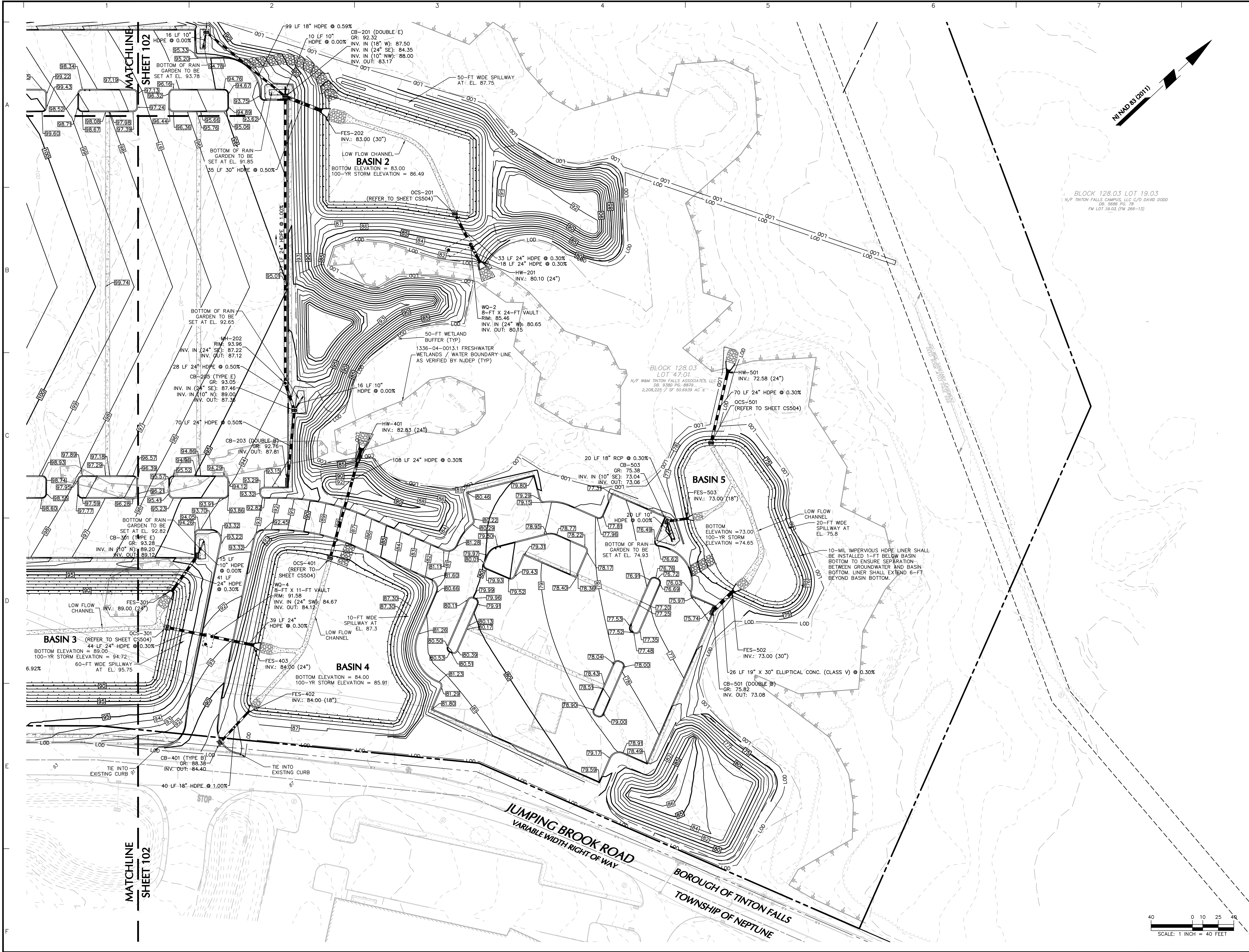
MONMOUTH COUNTY NEW JERSEY

Drawing Title

PARTIAL GRADING AND DRAINAGE PLAN 1

Project No.	Drawing No.
100775501	CG101
Date	06/25/2020
Drawn By	RY
Checked By	RB
Sheet 15 of 50	





- NOTES:
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1/05/21	PER AGENCY COMMENTS	3
10/16/20	PER NUDEP COMMENTS	2
9/17/20	PER TOWNSHIP COMMENTS	1
Date	Description	No.

REVISIONS

SIGNATURE RICHARD BURROW DATE SIGNED
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Project

**1251 JUMPING
BROOK ROAD**
BOROUGH OF TINTON FALLS
BLOCK 128.03, LOT 47

MONMOUTH COUNTY NEW JERSEY

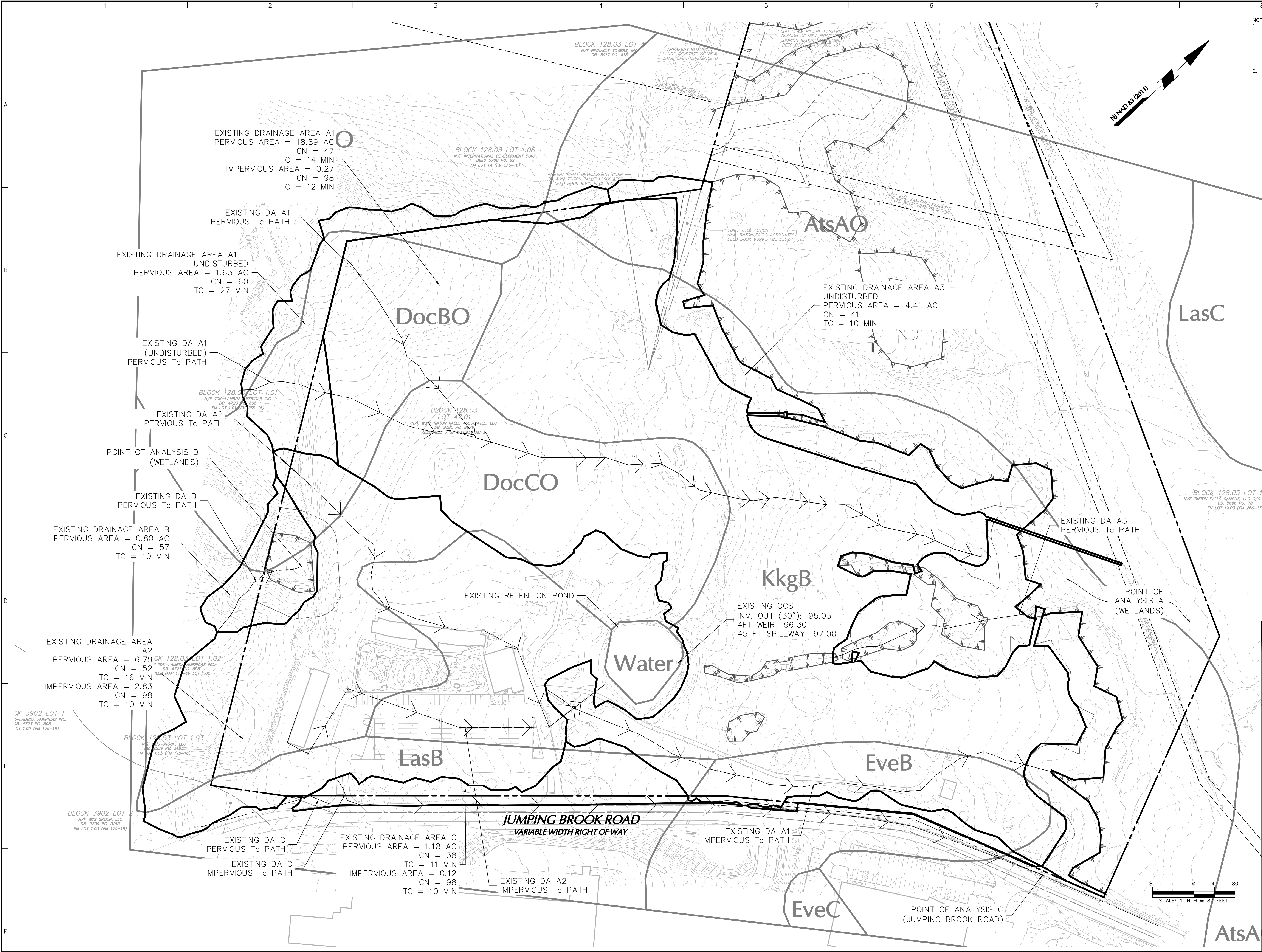
Drawing Title

**PARTIAL GRADING
AND DRAINAGE
PLAN 3**

Project No.	Drawing No.
100775501	CG103
Date	06/25/2020
Drawn By	RY
Checked By	RB
Sheet 17 of 50	

40 0 10 25 40
SCALE: 1 INCH = 40 FEET





NOTES:
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Project

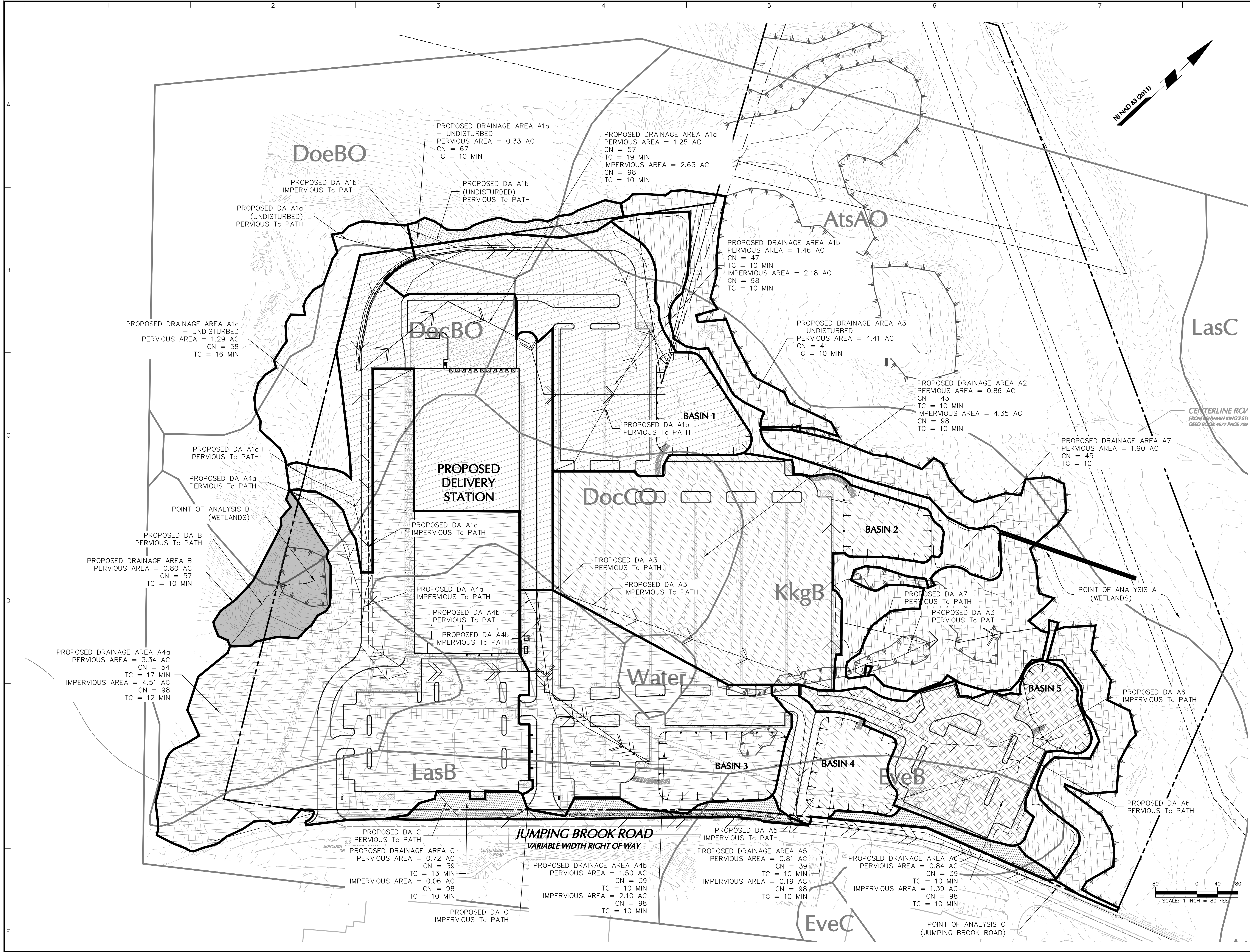
**1251 JUMPING
BROOK ROAD**
BOROUGH OF TINTON FALLS
BLOCK 128.03, LOT 47

MONMOUTH COUNTY NEW JERSEY

Drawing Title

**EXISTING
DRAINAGE AREAS**

Project No.	100775501	Drawing No.	DA101
Date	01/04/2021	Drawn By	RY
Checked By	RB		1



NOTES:
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2. ALL ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LEGEND

A1

A1 - UNDISTURBED

A2

A3

A4

A5

A6

A7

B

C

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Project

1251 JUMPING
BROOK ROAD

BOROUGH OF TINTON FALLS
BLOCK 128.03, LOT 47

MONMOUTH COUNTY NEW JERSEY

Drawing Title

PROPOSED
DRAINAGE AREAS

Project No.
100775501

Date
01/04/2021

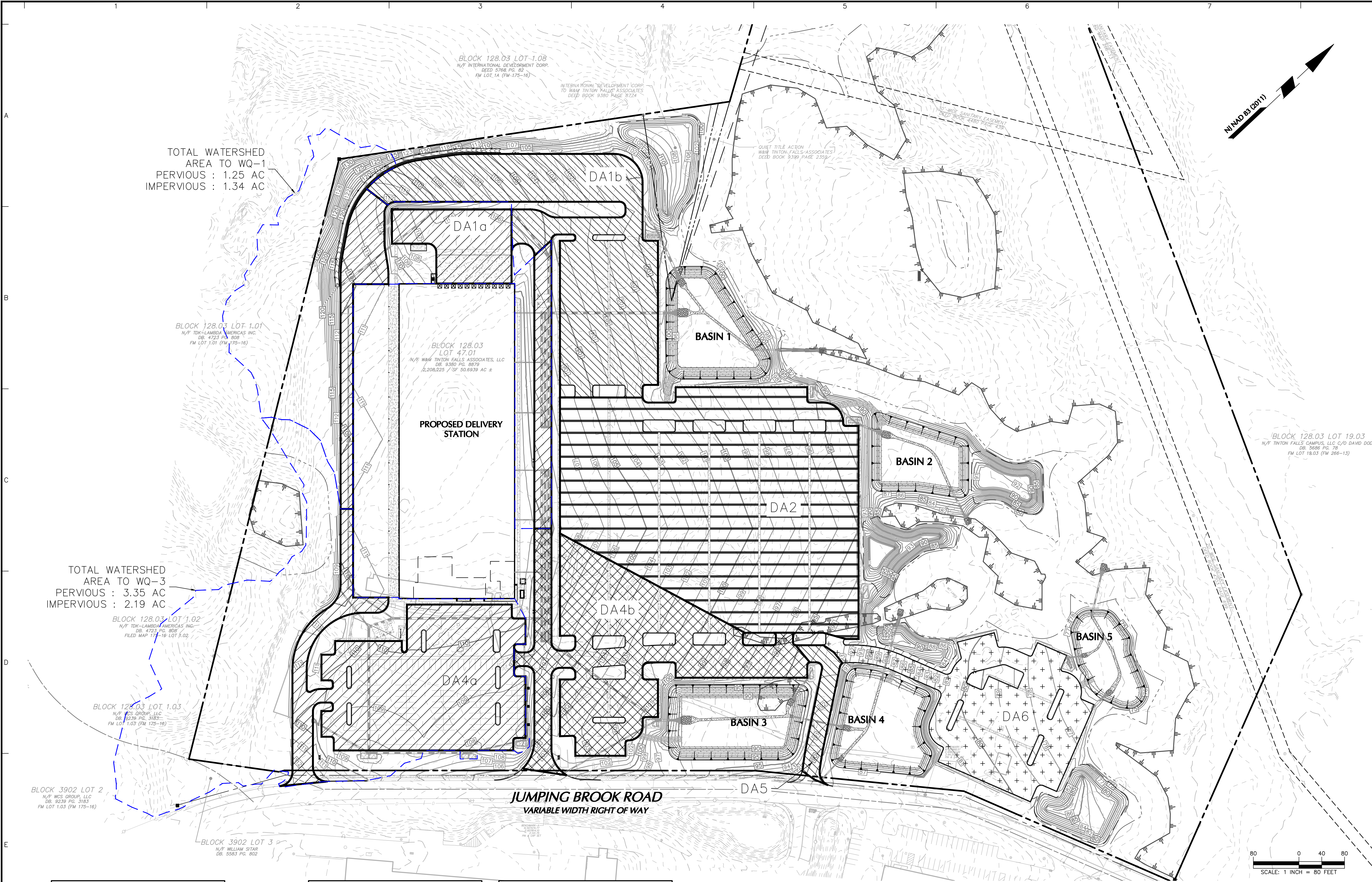
Drawn By
RY

Checked By
RB

Drawing No.

DA102

2



NOTES:
1. BOUNDARY INFORMATION AND EXISTING FEATURES FOR BLOCK 128.03, LOTS 47 SHOWN HEREON ARE BASED ON "ALTA/NSPS LAND TITLE SURVEY" DATED 06/24/2020 PREPARED BY LANGAN ENGINEERING. THE CONTRACTOR SHALL VERIFY ALL INFORMATION TO HIS SATISFACTION PRIOR TO THE EXECUTION OF CONTRACTS OR COMMENCING WORK. ANY DISCREPANCIES SHALL BE IMMEDIATELY REPORTED TO THE ENGINEER OF RECORD.
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LEGEND

91% TSS REMOVAL

89% TSS REMOVAL

80% TSS REMOVAL

60% TSS REMOVAL

42% TSS REMOVAL

TOTAL WATERSHED
AREA TO WQ-3
PERVIOUS : 3.35 AC
IMPERVIOUS : 2.19 AC

TOTAL WATERSHED
AREA TO WQ-1
PERVIOUS : 1.25 AC
IMPERVIOUS : 1.34 AC

Existing Watershed A		
Total Area	34.81 AC	
Pervious Area	31.69 AC	
Buildings	0.40 AC	
Impervious Area	0.98 AC	
Vehicular Pavement Area	1.73 AC	
Proposed Pavement Area 13.11 AC		
Area of Treatment	TSS Removal Rate Required	Acreage-Removal Rate
1.73 AC	50%	86.71
11.38 AC	80%	910.07
Total		996.77
TSS Removal Required		76.03%

Existing Watershed B	
Total Area	0.80 AC
Pervious Area	0.80 AC
Buildings	0.00 AC
Impervious Area	0.00 AC
Vehicular Pavement Area	0.00 AC
Proposed Pavement Area 0.00 AC	

Existing Watershed C	
Total Area	1.14 AC
Pervious Area	1.03 AC
Buildings	0.00 AC
Impervious Area	0.00 AC
Vehicular Pavement Area	0.11 AC
Proposed Pavement Area 0.05 AC	

Watershed	Area of Treatment	BMP Method	TSS Removal Rate	BMP Method	TSS Removal Rate	Total TSS Removal Rate	Acreage-Removal Rate
A1a	1.29	MTD	80%	-----	0%	80%	102.9
A1b	2.10	-----	0%	Extended Detention	60%	60%	126.0
A2	4.13	Extended Detention	43%	MTD	80%	89%	365.9
A4a	2.12	MTD	80%	-----	0%	80%	169.9
A4b	1.96	Extended Detention	54%	MTD	80%	91%	178.1
A5	0.18	Extended Detention	60%	-----	0%	60%	10.9
A6	1.32	Extended Detention	42%	-----	0%	42%	55.6
Total Area	13.11 AC	Total Acreage-Removal Rate					1009.3
		Average TSS Provided					77.01 %
		Average TSS Required					76.03%

* Please note that "Area of Treatment" excludes landscaping and areas of roof.

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Project

1251 JUMPING
BROOK ROAD

BOROUGH OF TINTON FALLS
BLOCK 128.03, LOT 47

MONMOUTH COUNTY NEW JERSEY

Drawing Title

PROPOSED TSS
REMOVAL

Project No.	Drawing No.
100775501	DA104
Date	
01/04/2021	
Drawn By	
RY	4
Checked By	
RB	

APPENDIX A

Pre-Development Quantity Calculations

Existing Curve Number Calculations

Drainage Area	Area (ac)	HSG A		HSG B		HSG D		Weighted Pervious CN	Total Pervious Area (ac)	Impervious Area (ac)
		Grass Area (ac)	Wooded Area (ac)	Grass Area (ac)	Wooded Area (ac)	Grass Area (ac)	Wooded Area (ac)			
		CN = 39	CN = 30	CN = 61	CN = 55	CN = 80	CN = 77			CN = 98
A1	19.16	11.74	0.46	6.19	0.00	0.42	0.07	47	18.89	0.27
A1 -Undisturbed	1.63	0.01	0.00	0.90	0.59	0.11	0.01	60	1.63	0.00
A2	9.62	2.62	0.00	3.10	1.08	0.00	0.00	52	6.79	2.83
A3 - Undisturbed	4.41	3.24	0.72	0.00	0.00	0.06	0.40	41	4.41	0.00
B	0.80	0.00	0.00	0.23	0.57	0.00	0.00	57	0.80	0.00
C	1.30	1.07	0.11	0.00	0.00	0.00	0.00	38	1.18	0.12

EXISTING DRAINAGE AREA A1 - PVIOUS

SHEET FLOW			
$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}s^{0.4}}$		n = Manning's roughness coefficient L = flow length P ₂ = 2-year, 24 hour rainfall (in.) s = slope of hydraulic grade line (ft/ft)	
SHALLOW CONCENTRATED FLOW			
$T_c = \frac{L}{3600V}$		L = flow length (ft) V = flow velocities (from table or eqn.) V (unpaved) = $16.135s^{0.5}$ V(paved) = $20.3282s^{0.5}$	
CHANNEL FLOW			
$T_c = \frac{L}{3600V}$		L = flow length (ft) V = flow velocity from Manning's eqn. (ft/sec)	

SHEET FLOW			
n =	0.15		
L =	100 ft		
P ₂ =	3.44 in		
delta elevation =	6.8 ft		
s =	0.068 ft/ft		
T _c =	0.097 hr	=	5.8 min
SHALLOW CONCENTRATED FLOW			
L =	1452 ft		
delta elevation =	51.2 ft		
s =	0.035 ft/ft		
V (unpaved) =	3.03 ft/s	(eqn.)	
T _c =	0.133 hr	=	8.0 min

TOTAL	14 min
--------------	--------

EXISTING DRAINAGE AREA A1 - IMPERVIOUS

SHEET FLOW			
$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}s^{0.4}}$		n = Manning's roughness coefficient	
		L = flow length	
		P ₂ = 2-year, 24 hour rainfall (in.)	
		s = slope of hydraulic grade line (ft/ft)	
SHALLOW CONCENTRATED FLOW			
$T_c = \frac{L}{3600V}$		L = flow length (ft)	
		V = flow velocities (from table or eqn.)	
		V (unpaved) = $16.135s^{0.5}$	
		V (paved) = $20.328s^{0.5}$	
CHANNEL FLOW			
$T_c = \frac{L}{3600V}$		L = flow length (ft)	
		V = flow velocity from Manning's eqn. (ft/sec)	

SHEET FLOW			
n =	0.01		
L =	41 ft		
P ₂ =	3.44 in		
delta elevation =	1 ft		
s =	0.024 ft/ft		
T _c =	0.008 hr	=	0.5 min

SHEET FLOW			
n =	0.15		
L =	59 ft		
P ₂ =	3.44 in		
delta elevation =	1.5 ft		
s =	0.025 ft/ft		
T _c =	0.094 hr	=	5.6 min

SHALLOW CONCENTRATED FLOW			
L =	499 ft		
delta elevation =	13.5 ft		
s =	0.027 ft/ft		
V (unpaved) =	2.65 ft/s	(eqn.)	
T _c =	0.052 hr	=	3.1 min

SHALLOW CONCENTRATED FLOW			
L =	226 ft		
delta elevation =	4.9 ft		
s =	0.022 ft/ft		
V (paved) =	2.99 ft/s	(eqn.)	
T _c =	0.021 hr	=	1.3 min

SHALLOW CONCENTRATED FLOW			
L =	227 ft		
delta elevation =	7.6 ft		
s =	0.033 ft/ft		
V (unpaved) =	2.95 ft/s	(eqn.)	
T _c =	0.021 hr	=	1.3 min

TOTAL	12 min
--------------	---------------

EXISTING DRAINAGE AREA A1 (UNDISTURBED) - PVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.40
 L = 100 ft
 P₂ = 3.44 in
 delta elevation = 2.7 ft
 s = 0.027 ft/ft

$$T_c = 0.306 \text{ hr} = 18.4 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 1486 ft
 delta elevation = 47.5 ft
 s = 0.032 ft/ft

$$V \text{ (unpaved)} = 2.88 \text{ ft/s (eqn.)}$$

$$T_c = 0.143 \text{ hr} = 8.6 \text{ min}$$

TOTAL	27 min
--------------	---------------

EXISTING DRAINAGE AREA A2 - PERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P_2 = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V (\text{unpaved}) = 16.135s^{0.5}$$

$$V (\text{paved}) = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.40
 L = 69 ft
 P_2 = 3.44 in
 delta elevation = 5.9 ft
 s = 0.086 ft/ft

$$T_c = 0.143 \text{ hr} = 8.6 \text{ min}$$

SHEET FLOW

n = 0.15
 L = 31 ft
 P_2 = 3.44 in
 delta elevation = 3.9 ft
 s = 0.126 ft/ft

$$T_c = 0.030 \text{ hr} = 1.8 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 492 ft
 delta elevation = 19.6 ft
 s = 0.040 ft/ft

$$V (\text{unpaved}) = 3.22 \text{ ft/s} \quad (\text{eqn.})$$

$$T_c = 0.042 \text{ hr} = 2.5 \text{ min}$$

PIPE FLOW

$$V = 2.00 \text{ ft/s}$$

$$L = 372 \text{ ft}$$

$$T_c = 0.052 \text{ hr} = 3.1 \text{ min}$$

TOTAL	16 min
--------------	---------------

EXISTING DRAINAGE AREA A2 - IMPERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P_2 = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

V (unpaved) = $16.135s^{0.5}$
 V(paved) = $20.3282s^{0.5}$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.01
 L = 100 ft
 P_2 = 3.44 in
 delta elevation = 2 ft
 s = 0.020 ft/ft

$$T_c = 0.018 \text{ hr} = 1.1 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 11 ft
 delta elevation = 1.1 ft
 s = 0.100 ft/ft

V (unpaved) = 5.10 ft/s (eqn.)

$$T_c = 0.001 \text{ hr} = 0.0 \text{ min}$$

PIPE FLOW

V = 2.00 ft/s

L = 685 ft

$$T_c = 0.095 \text{ hr} = 5.7 \text{ min}$$

TOTAL	7 min
	USE 10 min

EXISTING DRAINAGE AREA A3 - PERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V (\text{unpaved}) = 16.135s^{0.5}$$

$$V (\text{paved}) = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.15
 L = 100 ft
 P₂ = 3.44 in
 delta elevation = 3.6 ft
 s = 0.036 ft/ft

$$T_c = 0.125 \text{ hr} = 7.5 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 286 ft
 delta elevation = 5.9 ft
 s = 0.021 ft/ft

$$V (\text{unpaved}) = 2.32 \text{ ft/s} \quad (\text{eqn.})$$

$$T_c = 0.034 \text{ hr} = 2.1 \text{ min}$$

TOTAL	10 min
--------------	---------------

EXISTING DRAINAGE AREA B - PERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.40
 L = 100 ft
 P₂ = 3.44 in
 delta elevation = 16.6 ft
 s = 0.166 ft/ft

$$T_c = 0.148 \text{ hr} = 8.9 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 119 ft
 delta elevation = 8.5 ft
 s = 0.072 ft/ft

$$V \text{ (unpaved)} = 4.32 \text{ ft/s (eqn.)}$$

$$T_c = 0.008 \text{ hr} = 0.5 \text{ min}$$

TOTAL 9 min

USE 10 min

EXISTING DRAINAGE AREA C - PERVIOUS

SHEET FLOW			
$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}s^{0.4}}$		n = Manning's roughness coefficient L = flow length P ₂ = 2-year, 24 hour rainfall (in.) s = slope of hydraulic grade line (ft/ft)	
SHALLOW CONCENTRATED FLOW			
$T_c = \frac{L}{3600V}$		L = flow length (ft) V = flow velocities (from table or eqn.) V (unpaved) = $16.135s^{0.5}$ V (paved) = $20.3282s^{0.5}$	
CHANNEL FLOW			
$T_c = \frac{L}{3600V}$		L = flow length (ft) V = flow velocity from Manning's eqn. (ft/sec)	

SHEET FLOW			
n =	0.15		
L =	43 ft		
P2 =	3.44 in		
delta elevation =	2.33 ft		
s =	0.054 ft/ft		
Tc =	0.054 hr	=	3.2 min

SHEET FLOW			
n =	0.01		
L =	57 ft		
P2 =	3.44 in		
delta elevation =	1.67 ft		
s =	0.029 ft/ft		
Tc =	0.010 hr	=	0.6 min

SHALLOW CONCENTRATED FLOW			
L =	1345 ft		
delta elevation =	35.9 ft		
s =	0.027 ft/ft		
V (paved) =	3.32 ft/s	(eqn.)	
Tc =	0.113 hr	=	6.8 min

TOTAL	11 min
--------------	--------

EXISTING DRAINAGE AREA C - IMPERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.328s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.01
 L = 100 ft
 P₂ = 3.44 in
 delta elevation = 3.32 ft
 s = 0.033 ft/ft

$$T_c = 0.015 \text{ hr} = 0.9 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 1318 ft
 delta elevation = 34.9 ft
 s = 0.026 ft/ft

$$V \text{ (paved)} = 3.31 \text{ ft/s} \quad (\text{eqn.})$$

$$T_c = 0.111 \text{ hr} = 6.6 \text{ min}$$

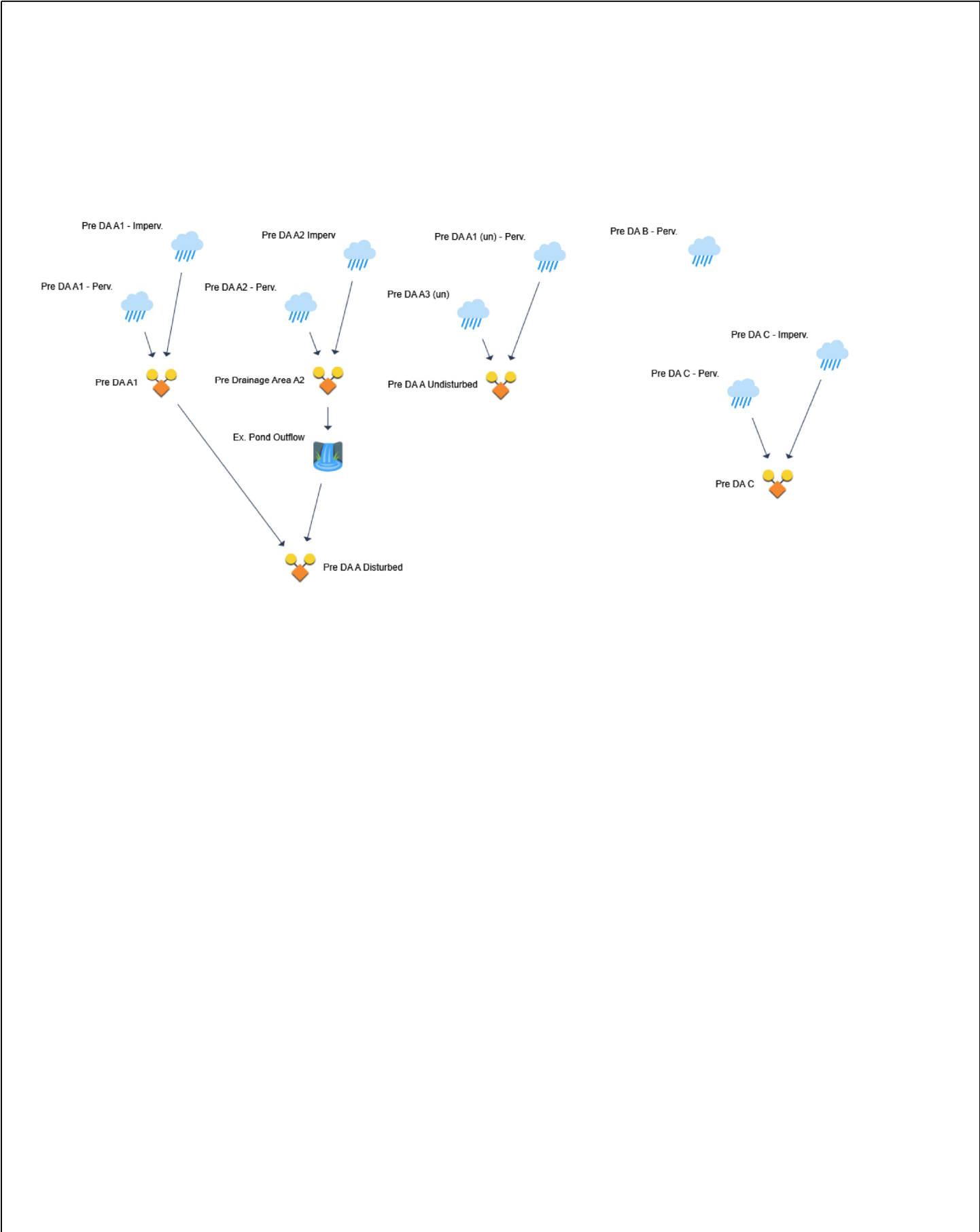
TOTAL	8 min
	USE 10 min

Basin Model

Hydrology Studio v 3.0.0.16

Project Name:

01-04-2021



Hydrograph 2-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

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	Pre DAA1 - Perv.	0.280	13.30	7,529	----		
2	NRCS Runoff	Pre DAA1 - Imperv.	0.732	12.17	3,241	----		
3	Junction	Pre DAA1	0.732	12.17	10,770	1, 2		
5	NRCS Runoff	Pre DAA1 (un) - Perv.	0.362	12.47	2,993	----		
7	NRCS Runoff	Pre DAA2 - Perv.	0.391	12.47	5,635	----		
8	NRCS Runoff	Pre DAA2 Imperv	7.678	12.17	33,971	----		
9	Junction	Pre Drainage Area A2	7.757	12.17	39,606	7, 8		
10	Pond Route	Ex. Pond Outflow	3.975	12.37	37,632	9	96.75	33,332
12	NRCS Runoff	Pre DAA3 (un)	0.014	23.07	349	----		
14	Junction	Pre DAA Disturbed	4.360	12.33	48,402	3, 10		
15	Junction	Pre DAA Undisturbed	0.362	12.47	3,342	5, 12		
17	NRCS Runoff	Pre DA B - Perv.	0.162	12.27	1,179	----		
19	NRCS Runoff	Pre DA C - Perv.	0.001	23.93	8.38	----		
20	NRCS Runoff	Pre DA C - Imperv.	0.326	12.17	1,440	----		
21	Junction	Pre DA C	0.326	12.17	1,449	19, 20		

Hydrograph Report

Project Name:

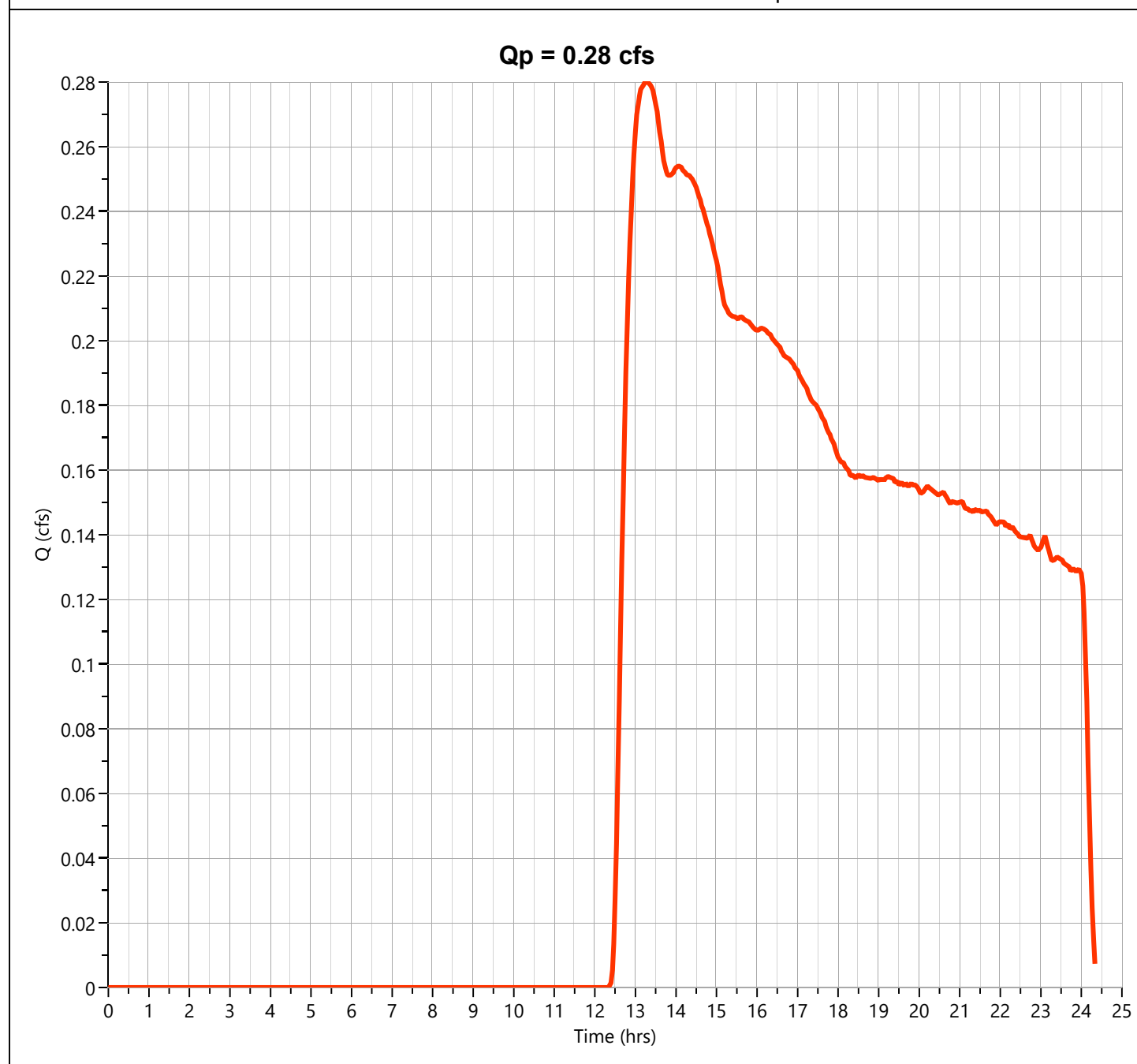
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1 - Perv.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.280 cfs
Storm Frequency	= 2-yr	Time to Peak	= 13.30 hrs
Time Interval	= 2 min	Runoff Volume	= 7,529 cuft
Drainage Area	= 18.89 ac	Curve Number	= 47
Tc Method	= User	Time of Conc. (Tc)	= 14.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

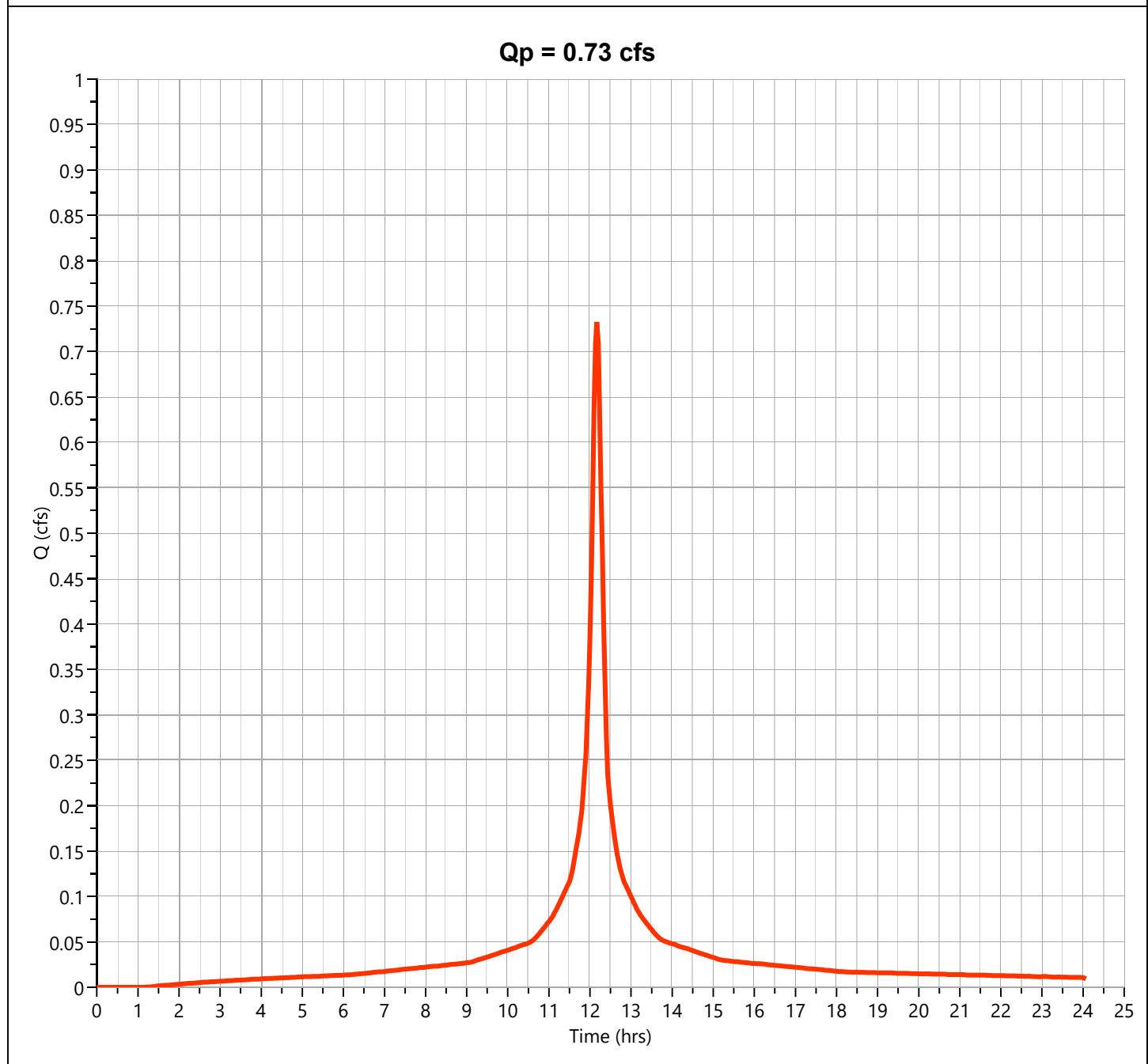
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1 - Imperv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.732 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 3,241 cuft
Drainage Area	= 0.27 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

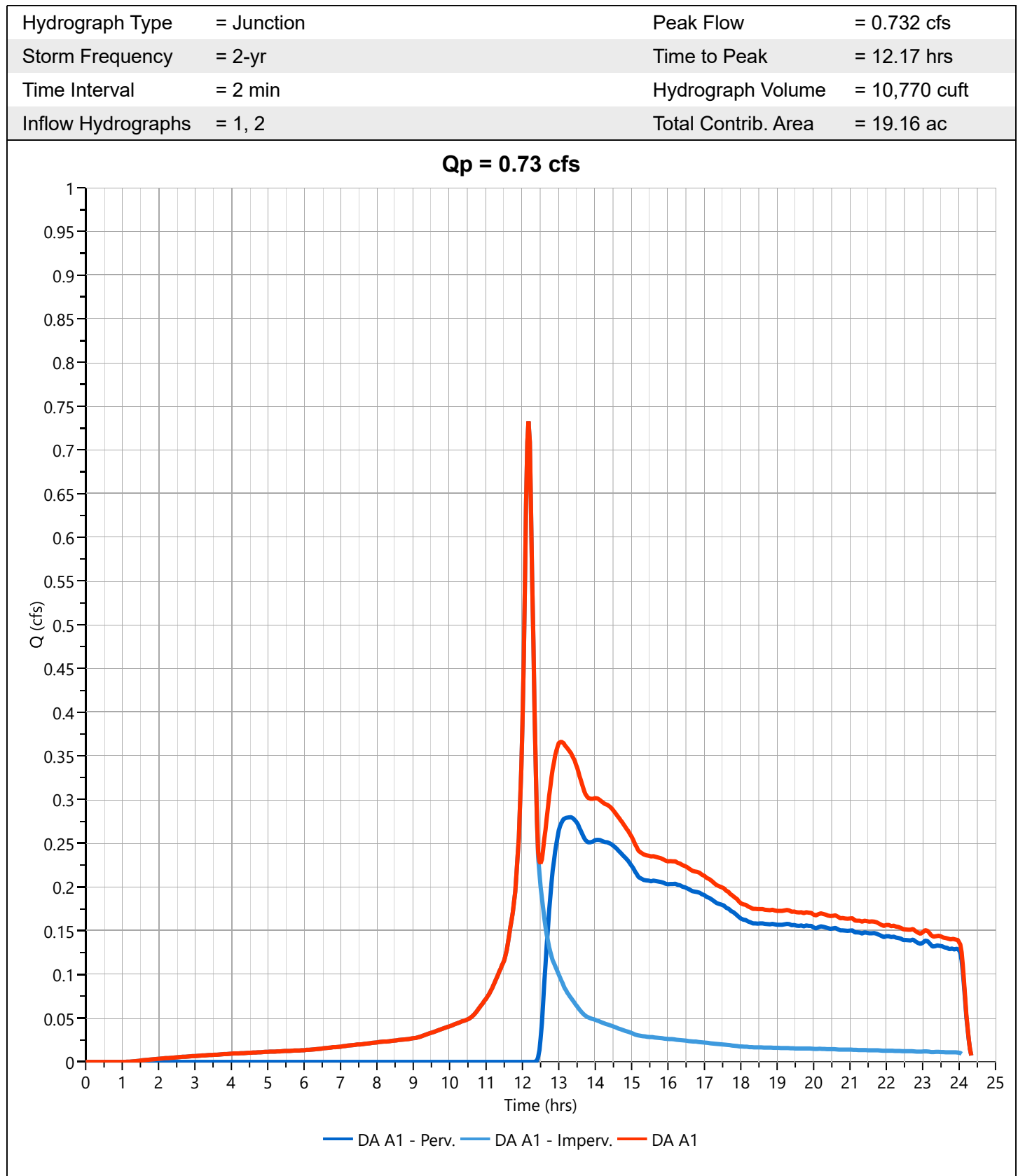
Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1

Hyd. No. 3



Hydrograph Report

Project Name:

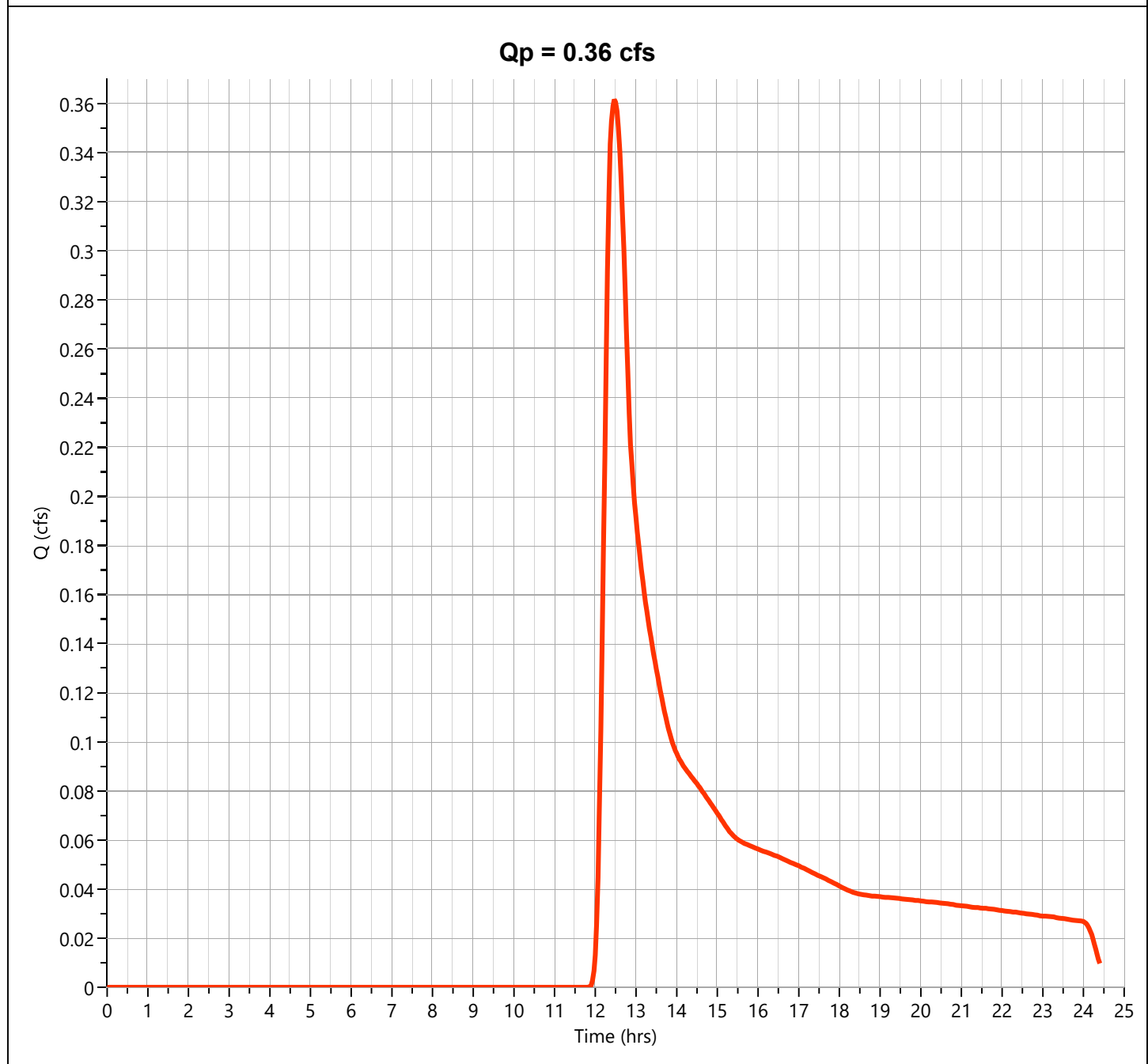
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1 (un) - Perv.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.362 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Runoff Volume	= 2,993 cuft
Drainage Area	= 1.63 ac	Curve Number	= 60
Tc Method	= User	Time of Conc. (Tc)	= 27.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

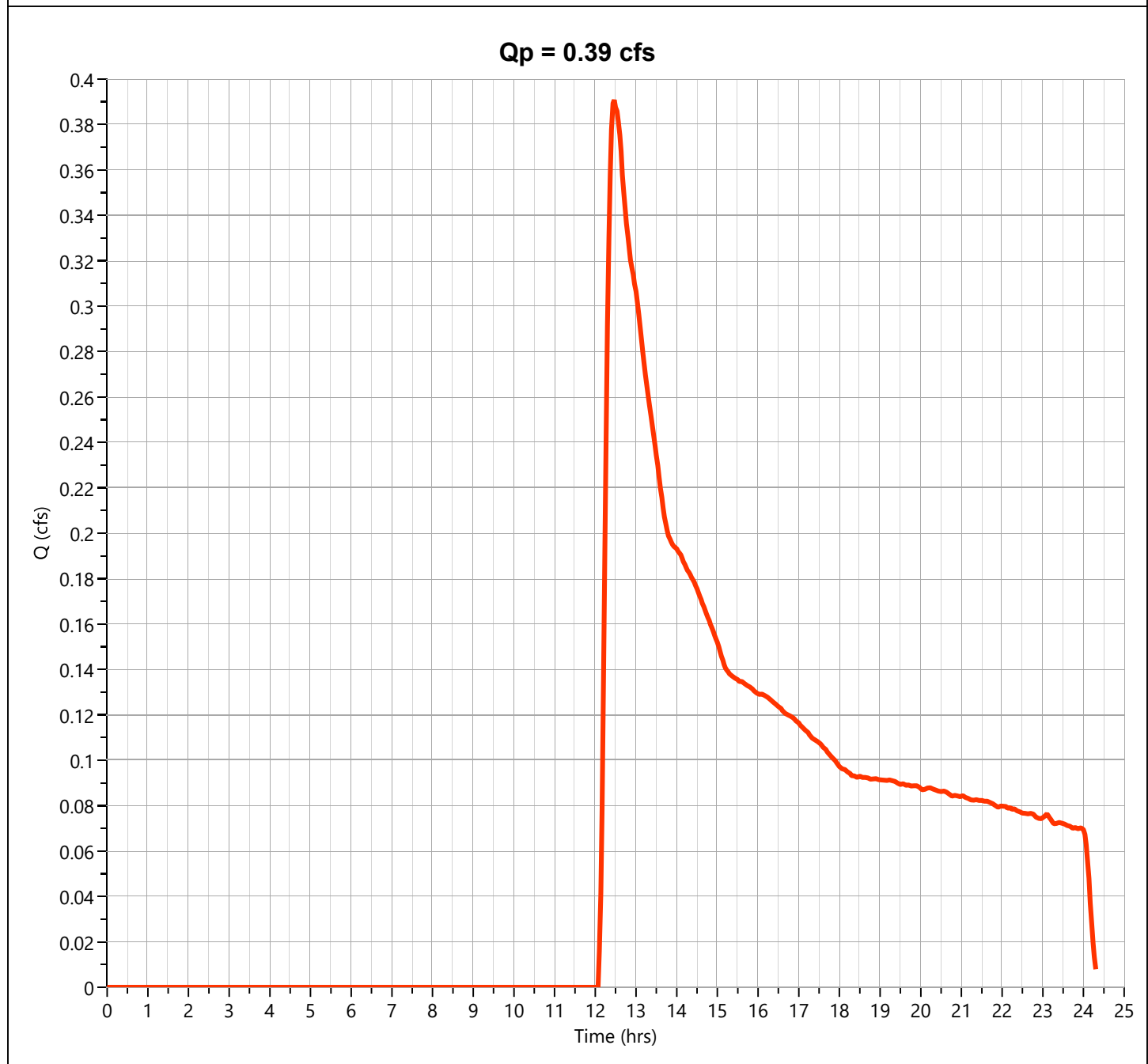
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A2 - Perv.

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.391 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Runoff Volume	= 5,635 cuft
Drainage Area	= 6.79 ac	Curve Number	= 52
Tc Method	= User	Time of Conc. (Tc)	= 16.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

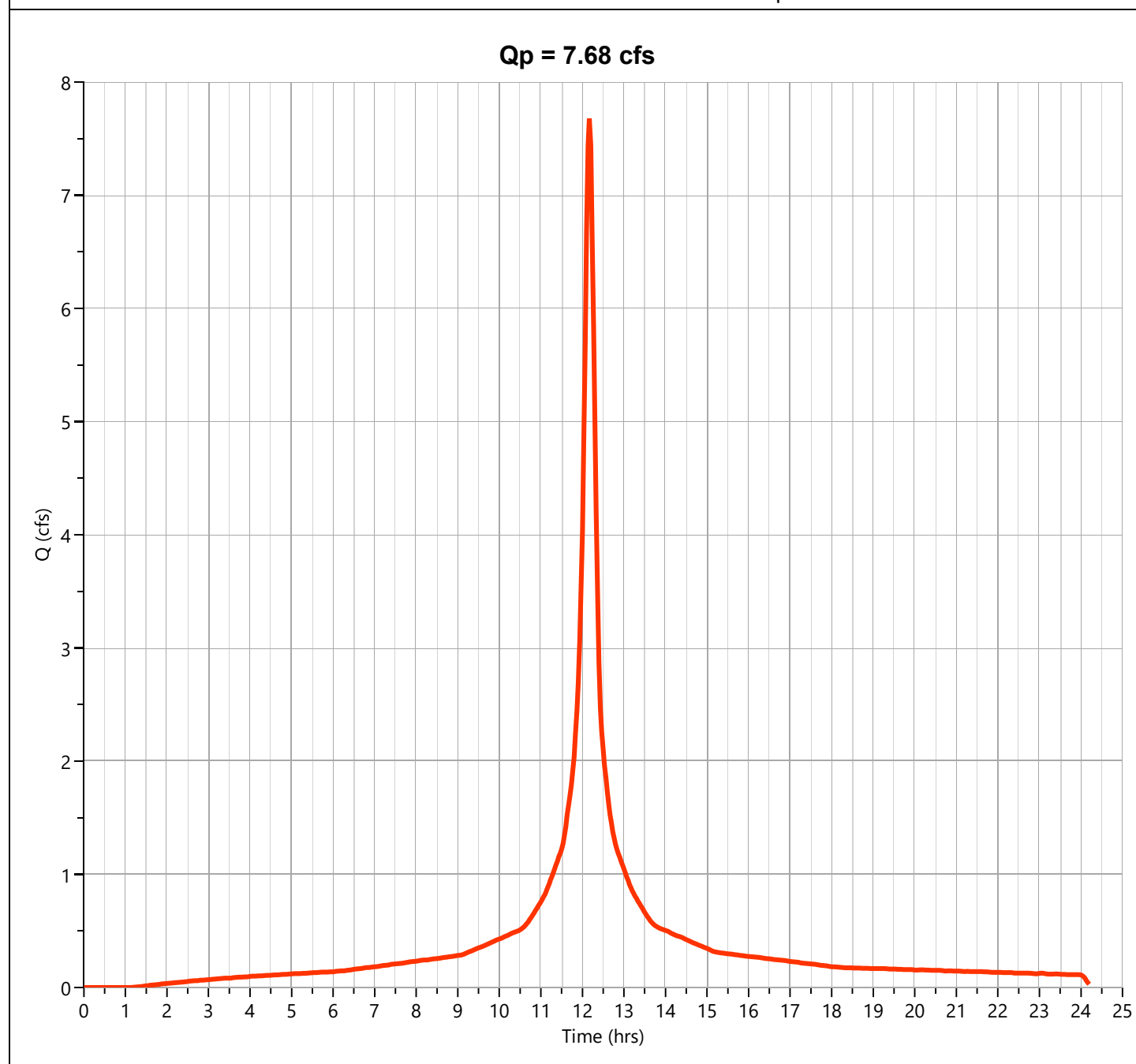
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A2 Imperv

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 7.678 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 33,971 cuft
Drainage Area	= 2.83 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

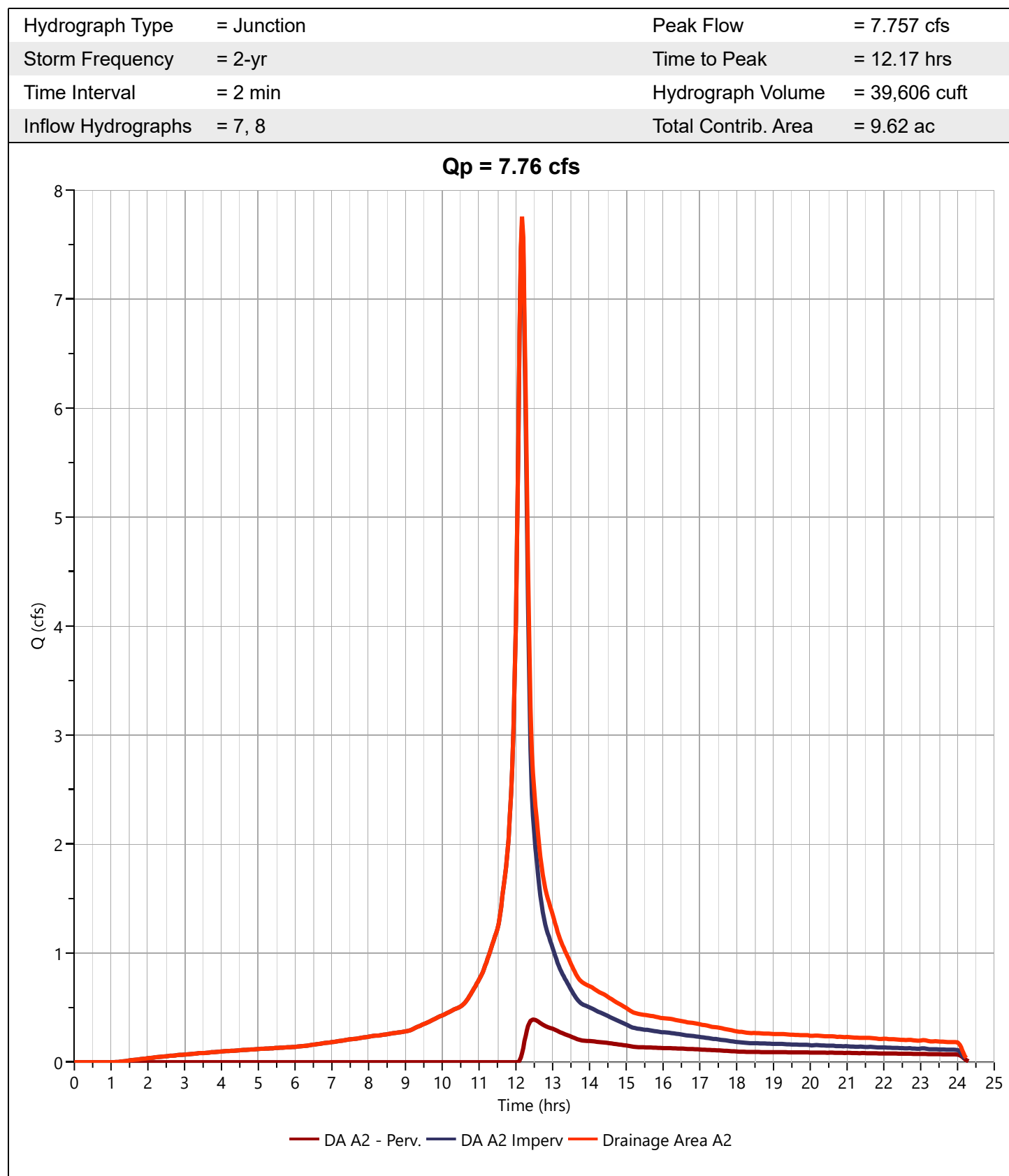
Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Pre Drainage Area A2

Hyd. No. 9



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

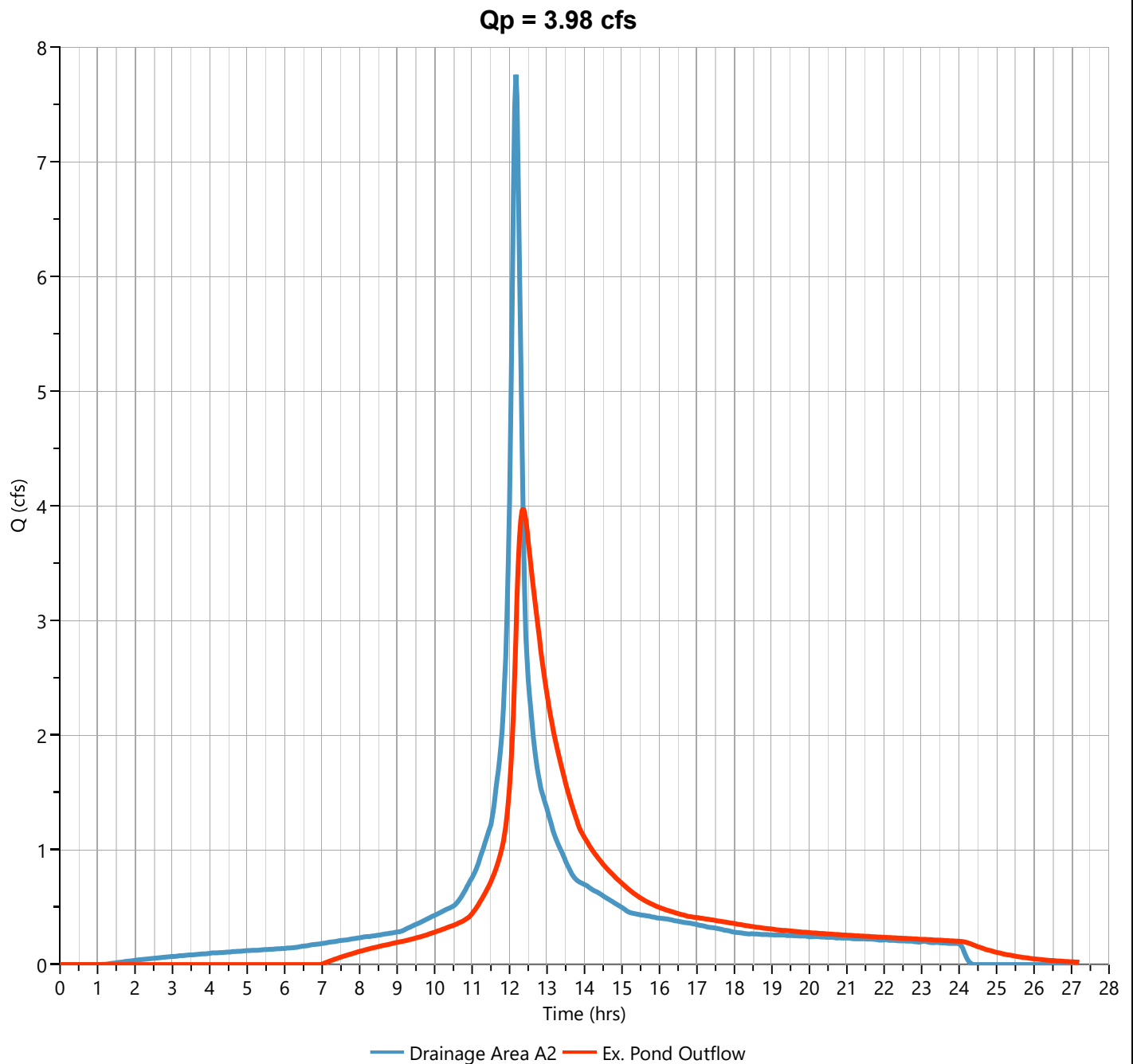
Ex. Pond Outflow

Hyd. No. 10

Hydrograph Type	= Pond Route	Peak Flow	= 3.975 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 37,632 cuft
Inflow Hydrograph	= 9 - Drainage Area A2	Max. Elevation	= 96.75 ft
Pond Name	= Existing Pond	Max. Storage	= 33,332 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 1.36 hrs



Pond Report

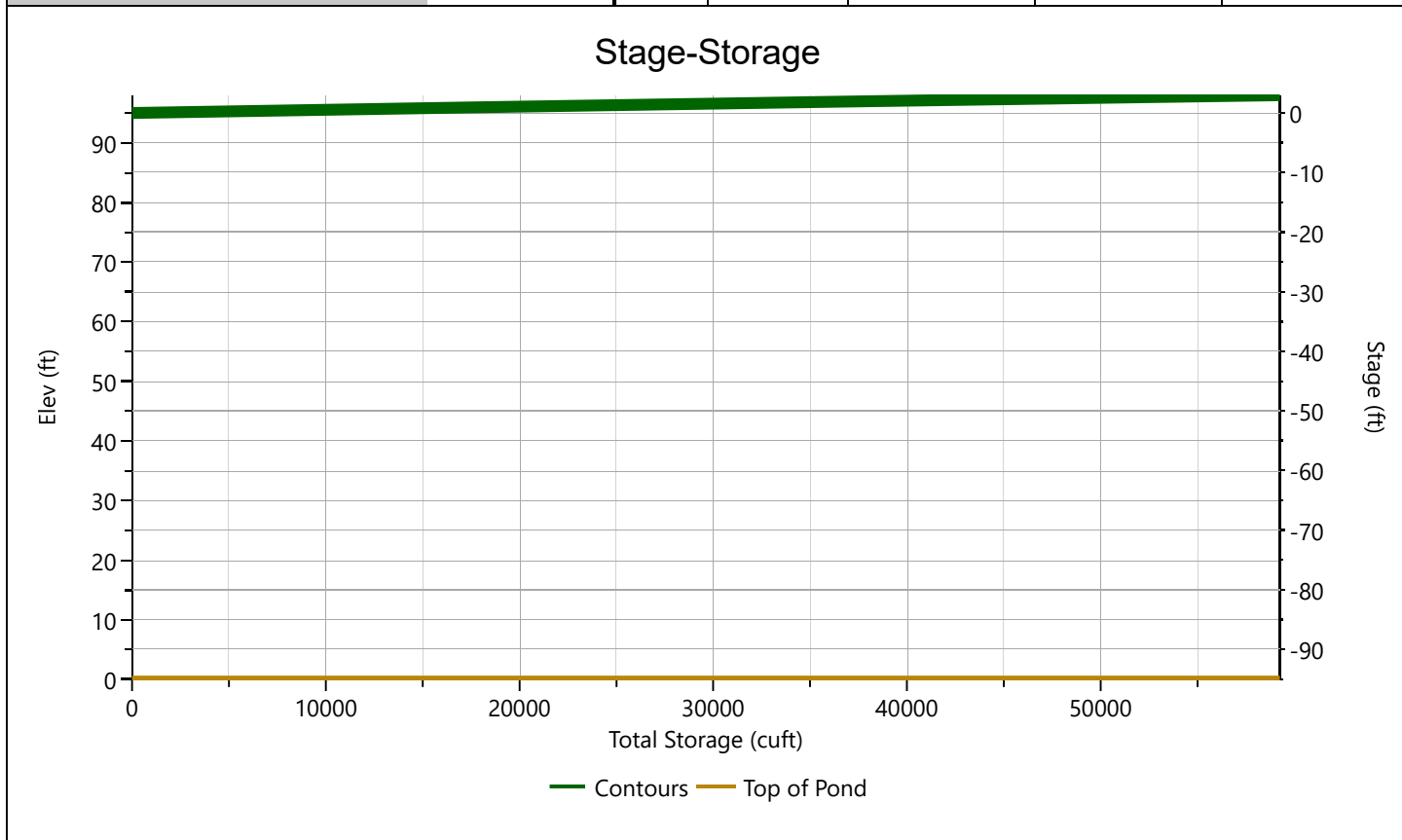
Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Existing Pond

Stage-Storage

[illegible]

Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

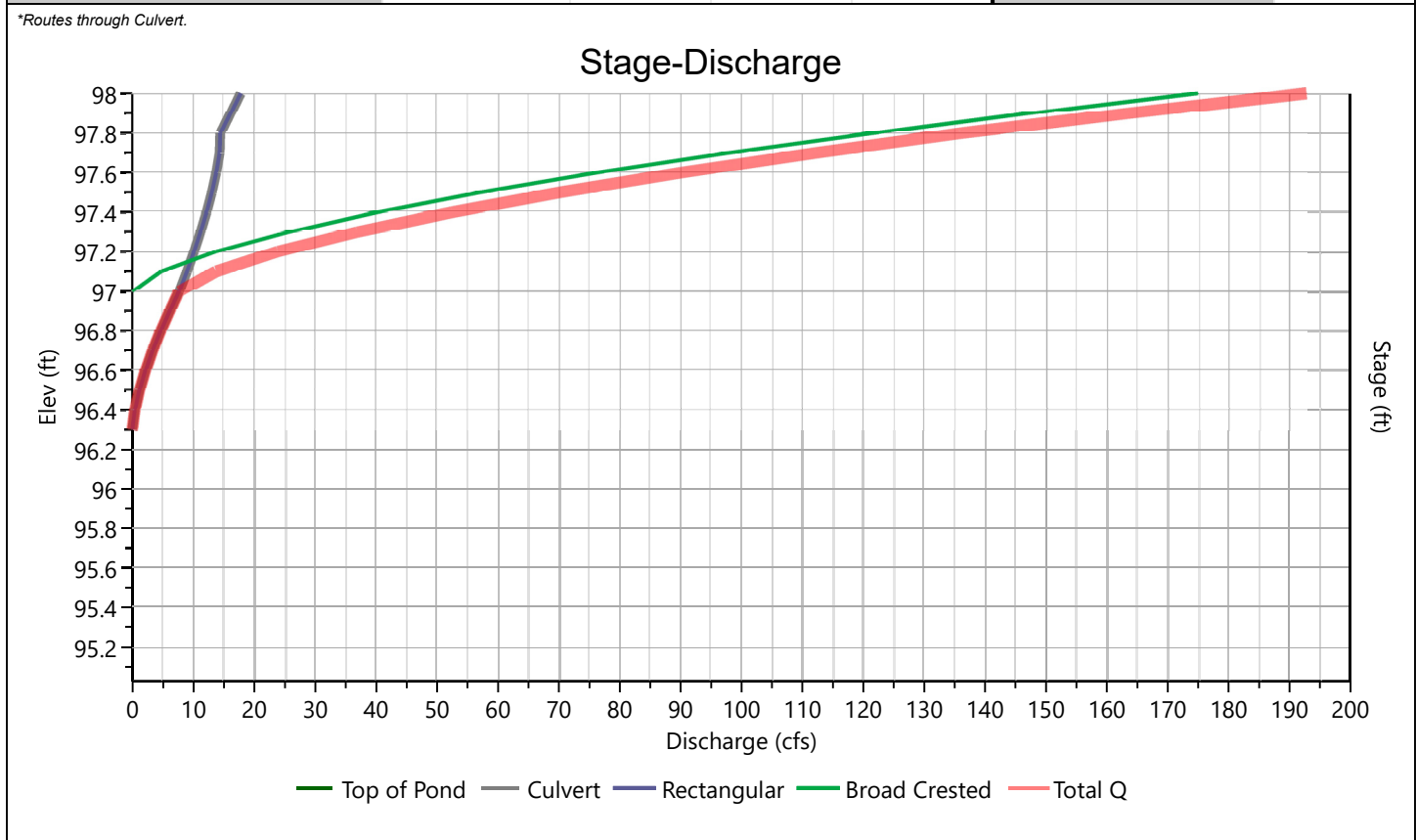
01-04-2021

Existing Pond

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1	2	3	
Rise, in	30				Hole Diameter, in
Span, in	30				No. holes
No. Barrels	1				Invert Elevation, ft
Invert Elevation, ft	95.03				Height, ft
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co
Length, ft	53				
Barrel Slope, %	.5				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type	Circular	Rectangular	Broad Crested		Exfiltration, in/hr
Crest Elevation, ft		96.3	97		
Crest Length, ft		4	45		
Angle, deg			5.7 (10:1)		
Weir Coefficient, Cw		3.3	3.3		

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Existing Pond

Stage-Storage-Discharge Summary

[illegible]

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

Pond Report

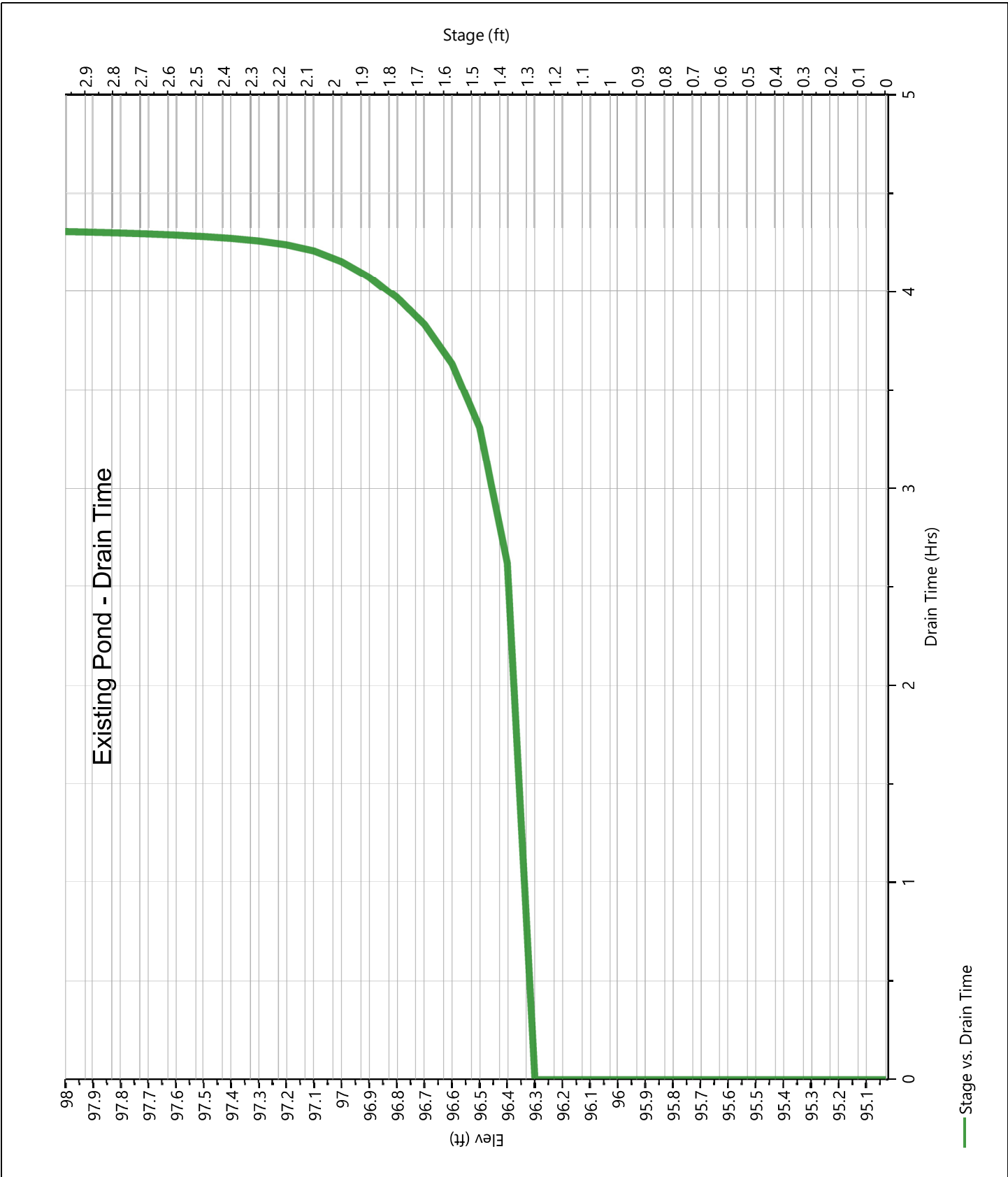
Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Existing Pond

Pond Drawdown



Hydrograph Report

Project Name:

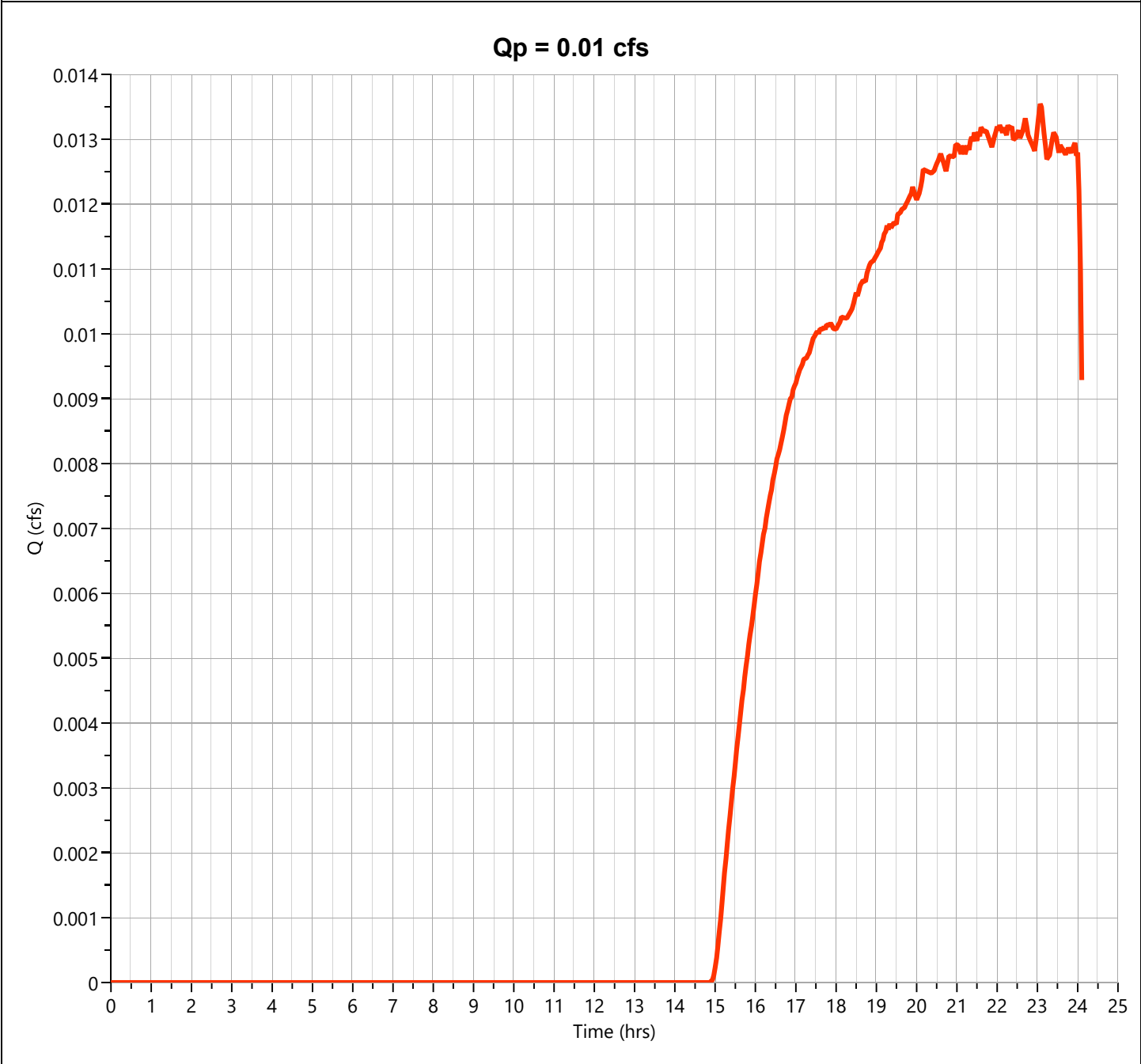
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A3 (un)

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.014 cfs
Storm Frequency	= 2-yr	Time to Peak	= 23.07 hrs
Time Interval	= 2 min	Runoff Volume	= 349 cuft
Drainage Area	= 4.41 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

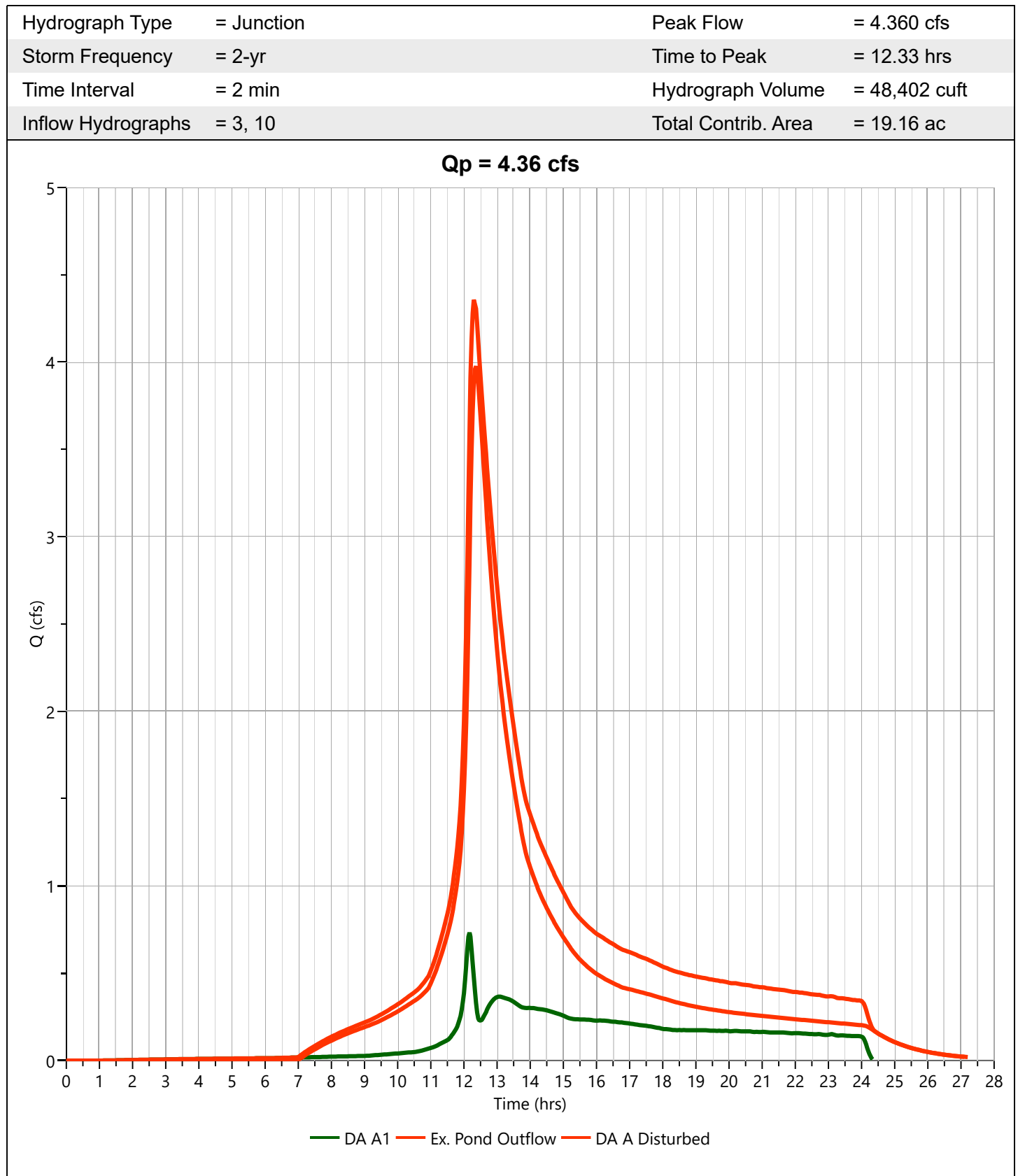
Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A Disturbed

Hyd. No. 14



Hydrograph Report

Project Name:

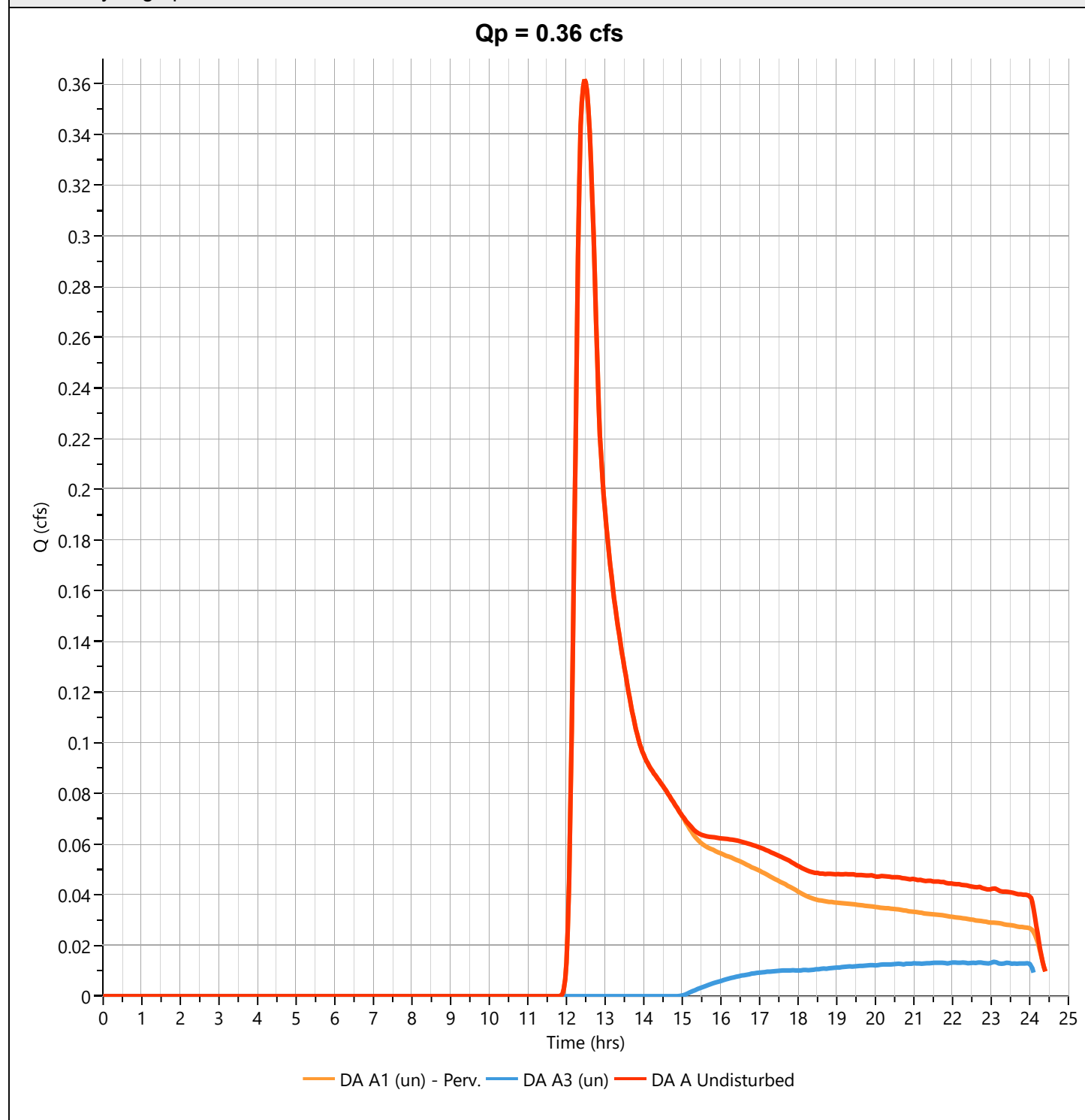
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A Undisturbed

Hyd. No. 15

Hydrograph Type	= Junction	Peak Flow	= 0.362 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 3,342 cuft
Inflow Hydrographs	= 5, 12	Total Contrib. Area	= 6.04 ac



Hydrograph Report

Project Name:

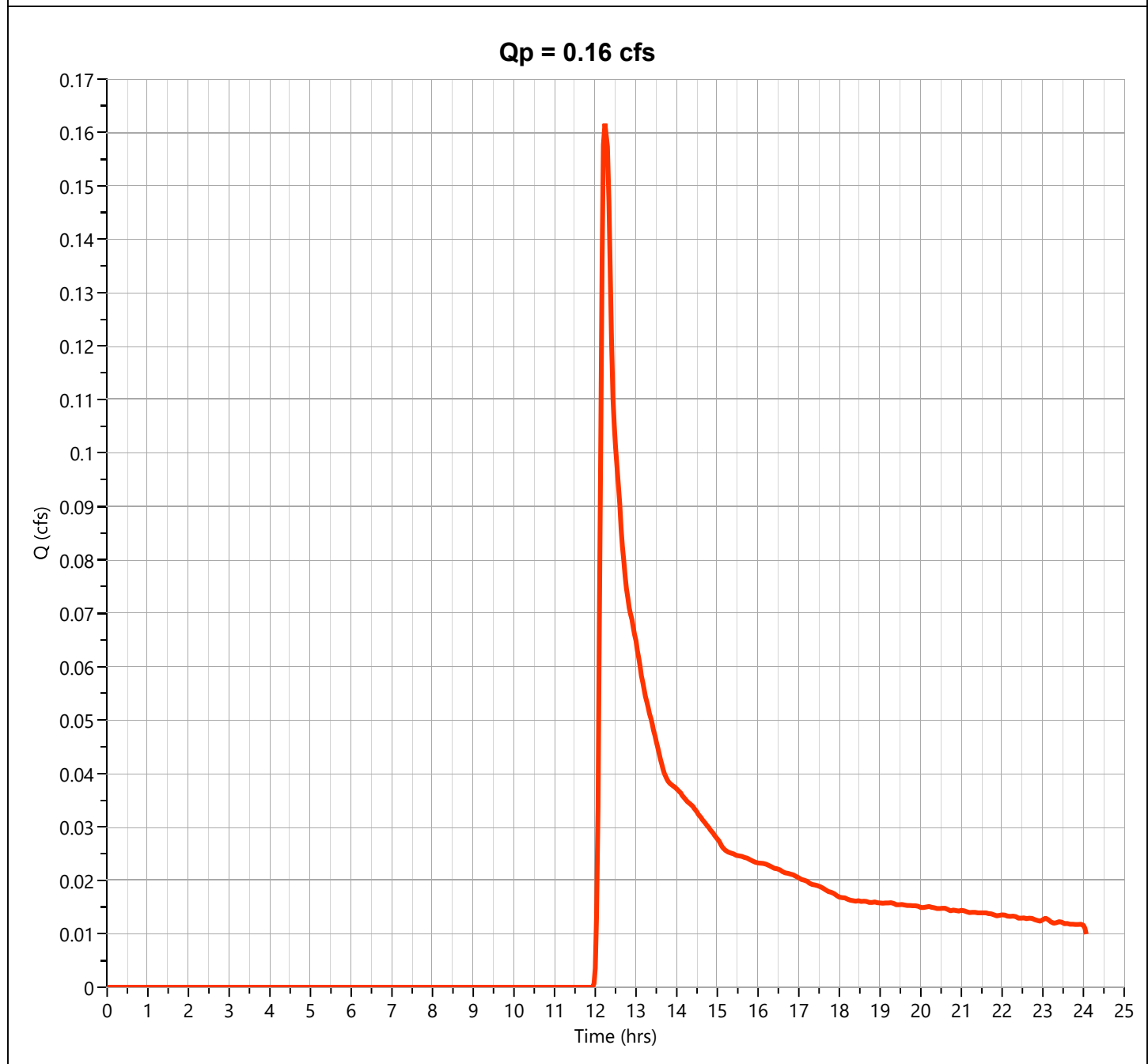
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA B - Perv.

Hyd. No. 17

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.162 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 1,179 cuft
Drainage Area	= 0.8 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

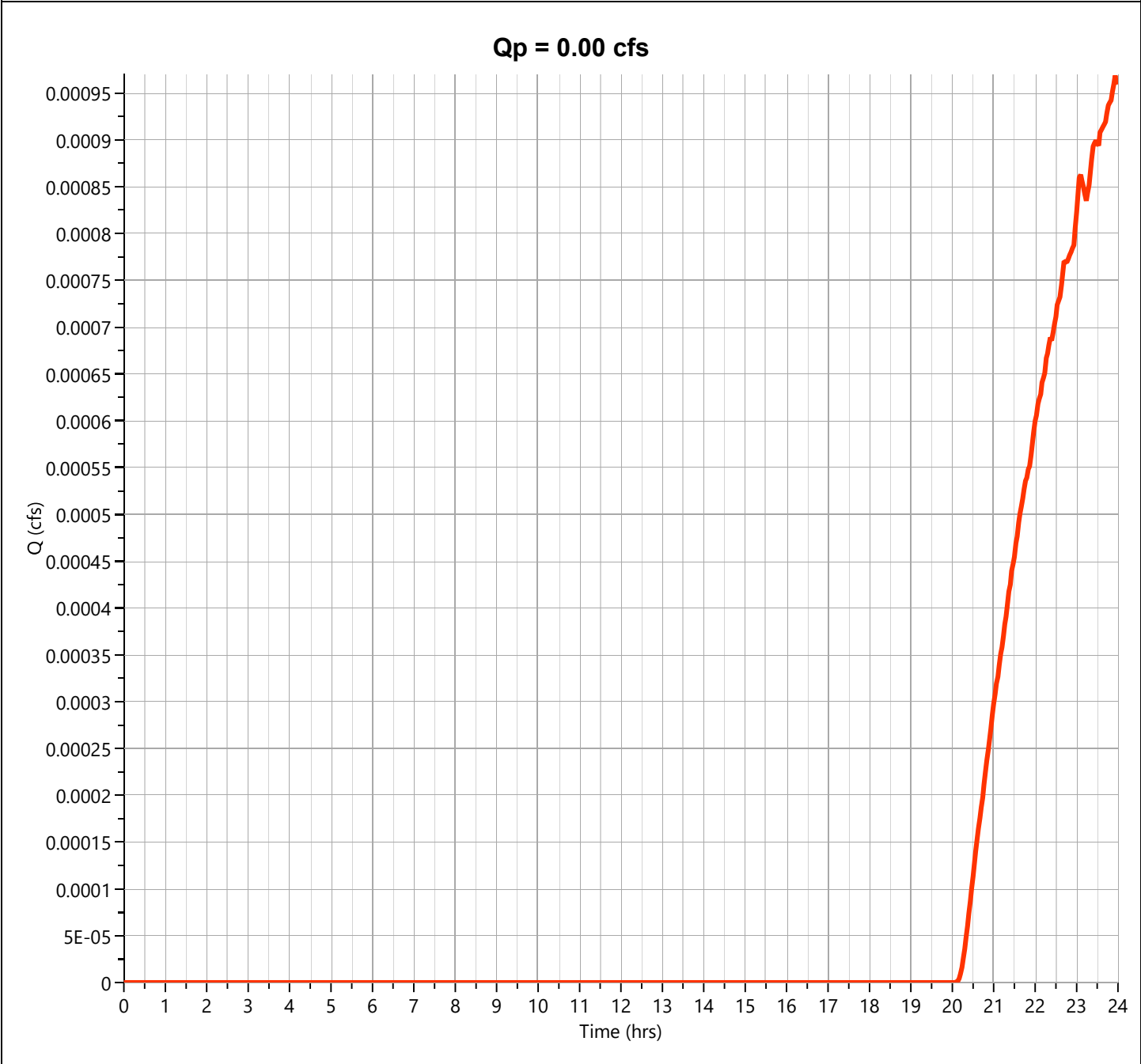
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA C - Perv.

Hyd. No. 19

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.001 cfs
Storm Frequency	= 2-yr	Time to Peak	= 23.93 hrs
Time Interval	= 2 min	Runoff Volume	= 8.38 cuft
Drainage Area	= 1.18 ac	Curve Number	= 38
Tc Method	= User	Time of Conc. (Tc)	= 11.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

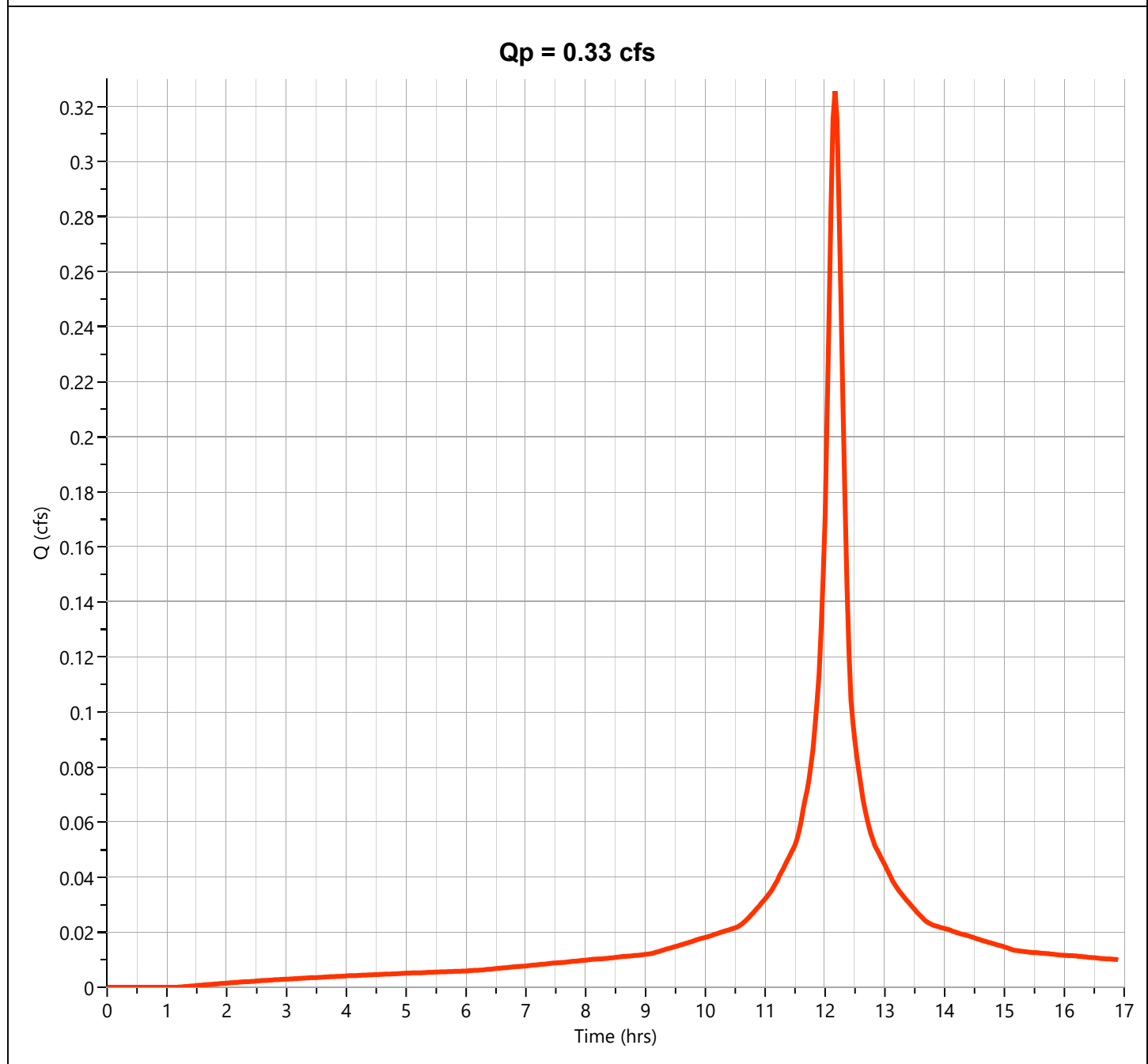
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA C - Imperv.

Hyd. No. 20

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.326 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 1,440 cuft
Drainage Area	= 0.12 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

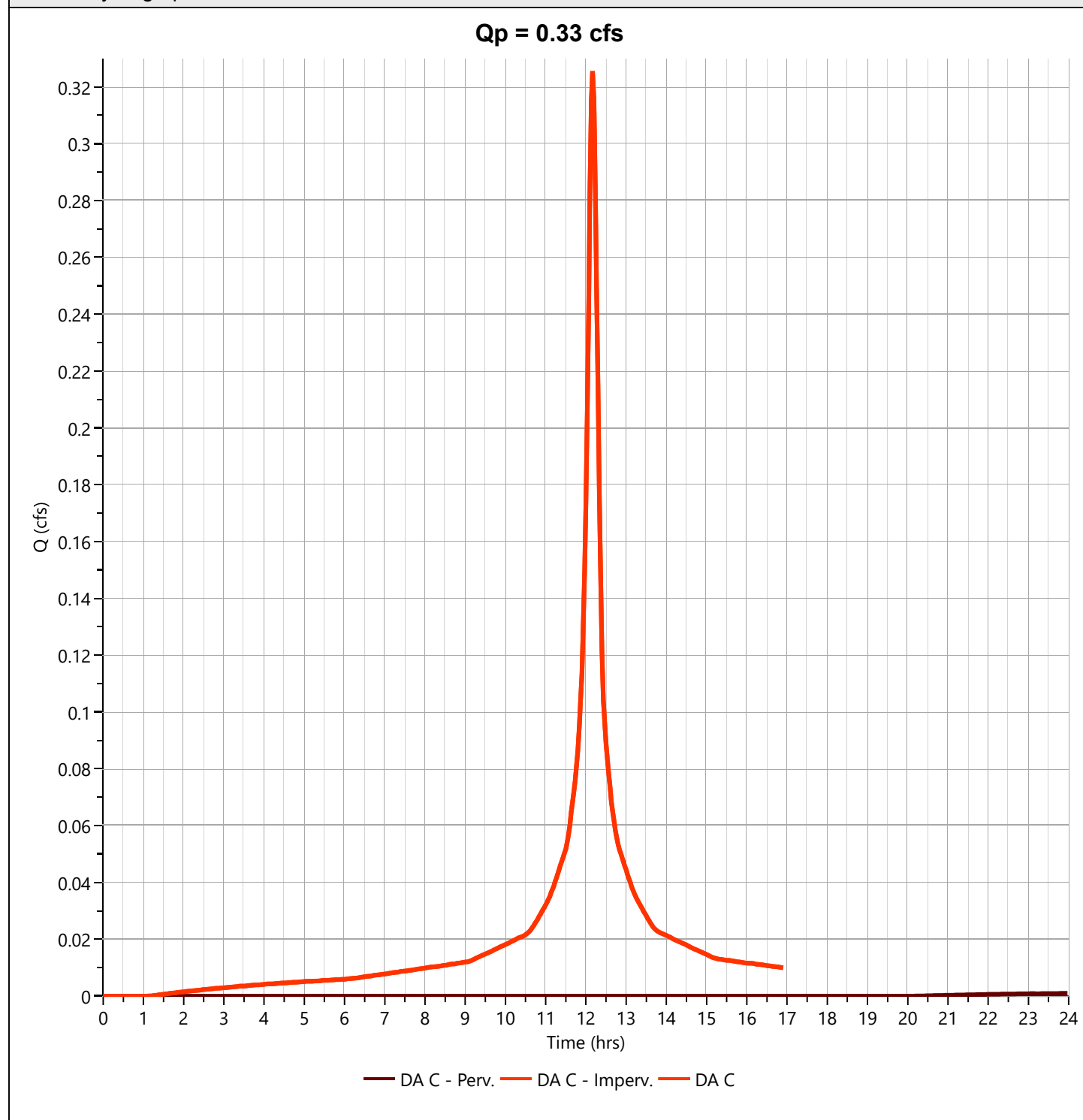
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA C

Hyd. No. 21

Hydrograph Type	= Junction	Peak Flow	= 0.326 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 1,449 cuft
Inflow Hydrographs	= 19, 20	Total Contrib. Area	= 1.3 ac



Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

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	Pre DAA1 - Perv.	6.148	12.30	44,033	----		
2	NRCS Runoff	Pre DAA1 - Imperv.	1.142	12.17	5,147	----		
3	Junction	Pre DAA1	7.006	12.23	49,180	1, 2		
5	NRCS Runoff	Pre DAA1 (un) - Perv.	1.459	12.37	8,863	----		
7	NRCS Runoff	Pre DAA2 - Perv.	4.329	12.23	22,940	----		
8	NRCS Runoff	Pre DAA2 Imperv	11.97	12.17	53,951	----		
9	Junction	Pre Drainage Area A2	15.74	12.20	76,892	7, 8		
10	Pond Route	Ex. Pond Outflow	10.40	12.33	74,917	9	97.04	39,232
12	NRCS Runoff	Pre DAA3 (un)	0.405	12.40	5,890	----		
14	Junction	Pre DAA Disturbed	17.02	12.33	124,097	3, 10		
15	Junction	Pre DAA Undisturbed	1.856	12.37	14,754	5, 12		
17	NRCS Runoff	Pre DA B - Perv.	0.886	12.20	3,848	----		
19	NRCS Runoff	Pre DA C - Perv.	0.047	13.00	1,026	----		
20	NRCS Runoff	Pre DA C - Imperv.	0.508	12.17	2,288	----		
21	Junction	Pre DA C	0.508	12.17	3,314	19, 20		

Hydrograph Report

Project Name:

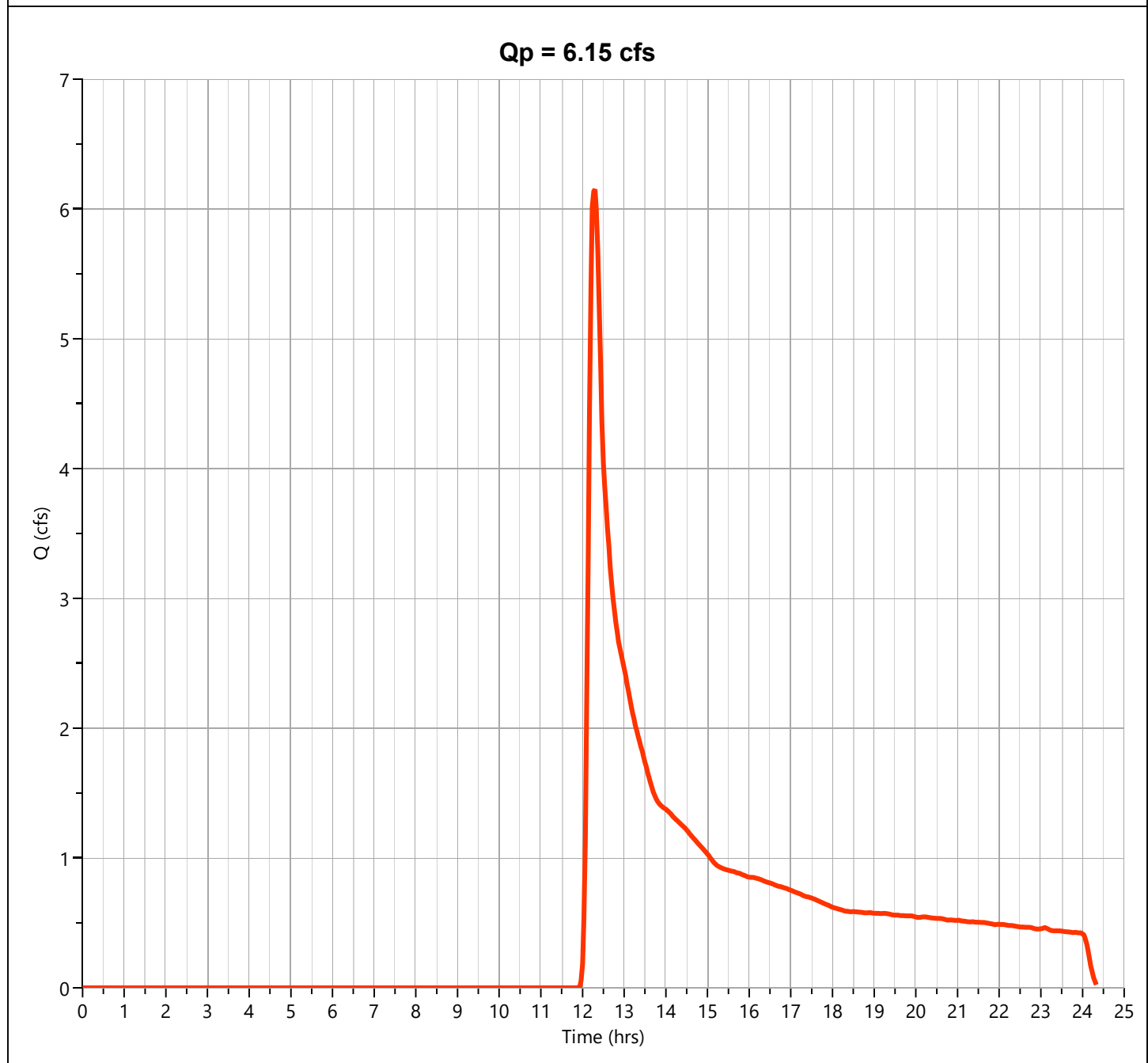
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1 - Perv.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.148 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 44,033 cuft
Drainage Area	= 18.89 ac	Curve Number	= 47
Tc Method	= User	Time of Conc. (Tc)	= 14.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

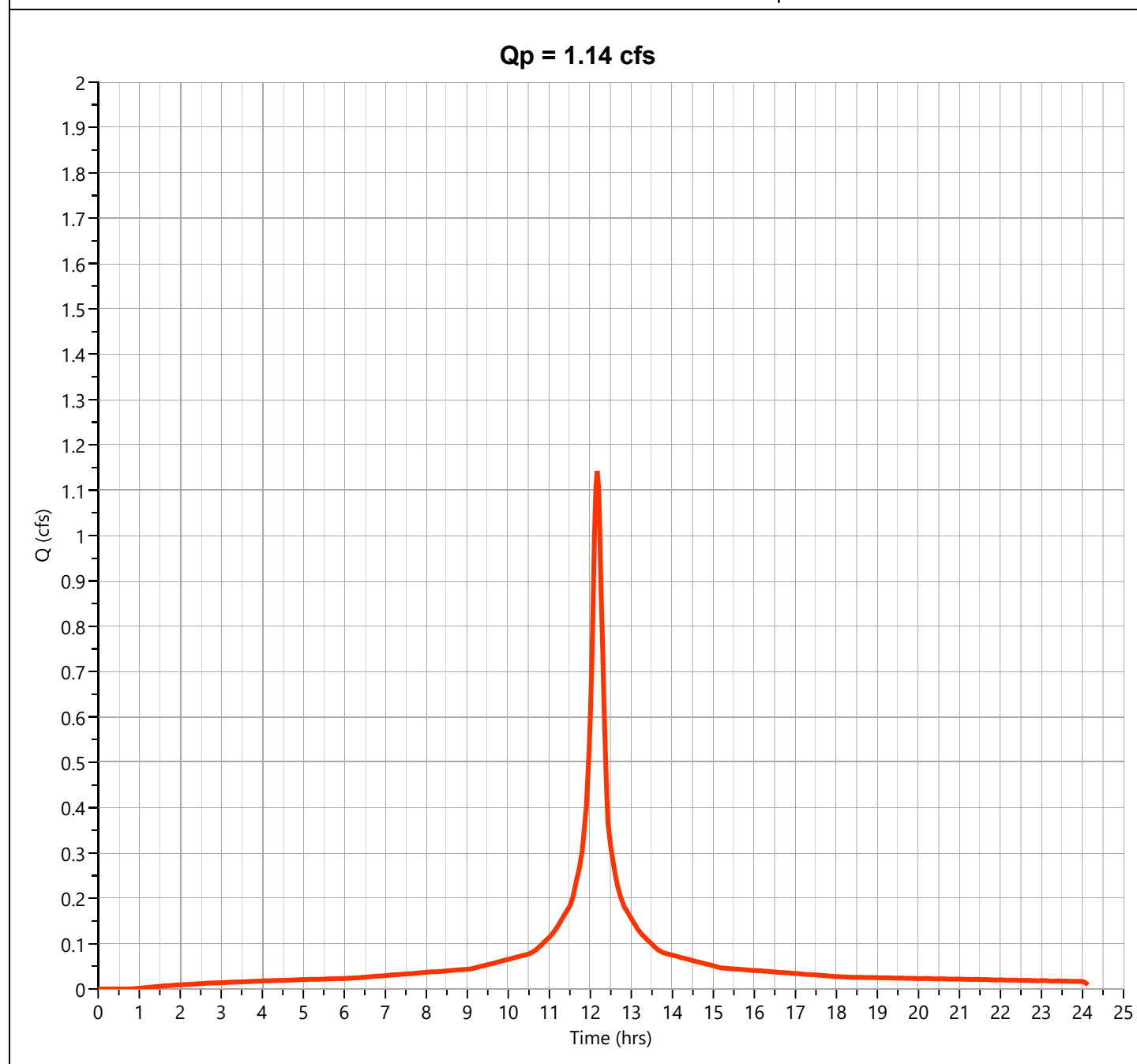
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1 - Imperv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.142 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 5,147 cuft
Drainage Area	= 0.27 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

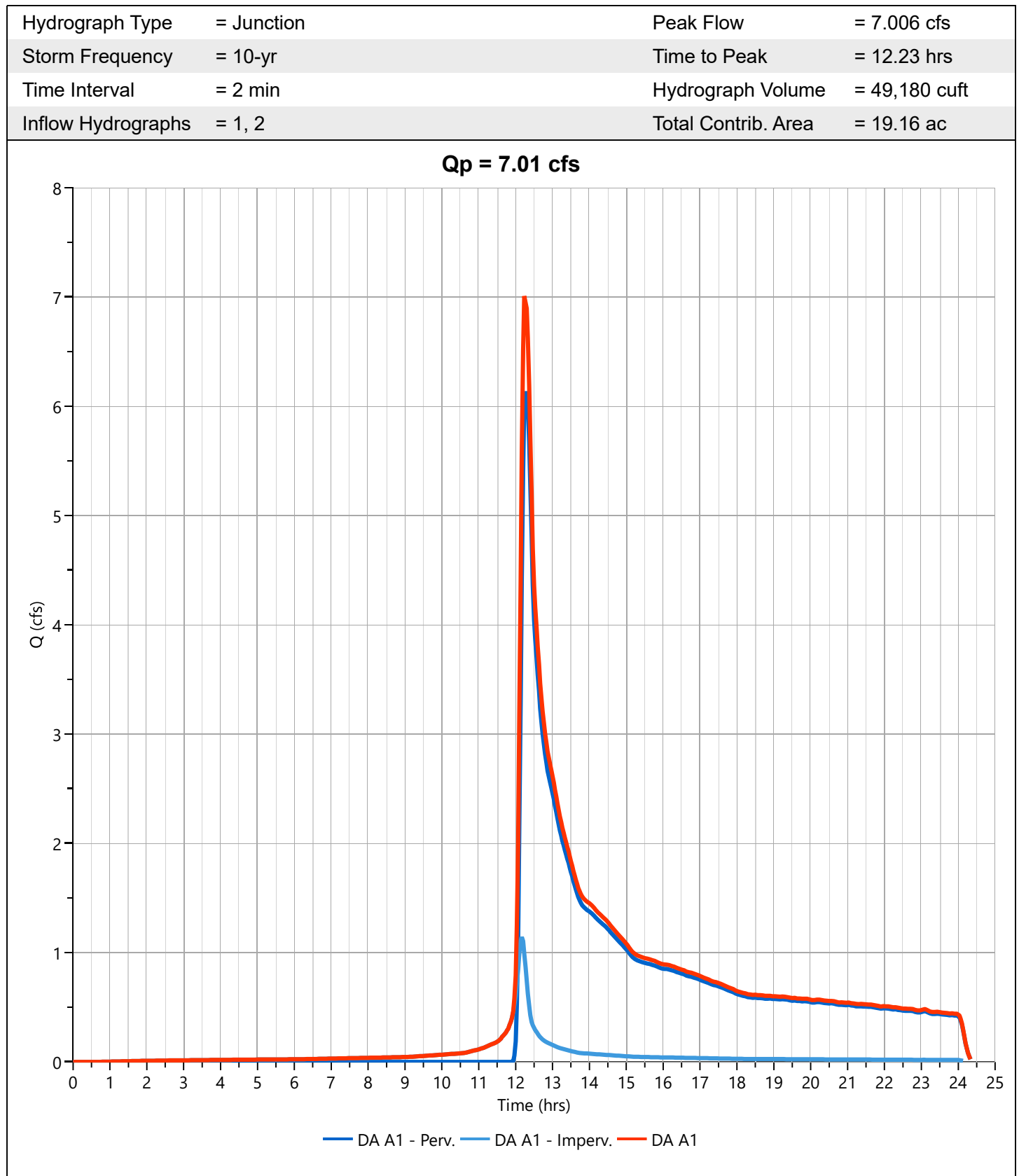
Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1

Hyd. No. 3



Hydrograph Report

Project Name:

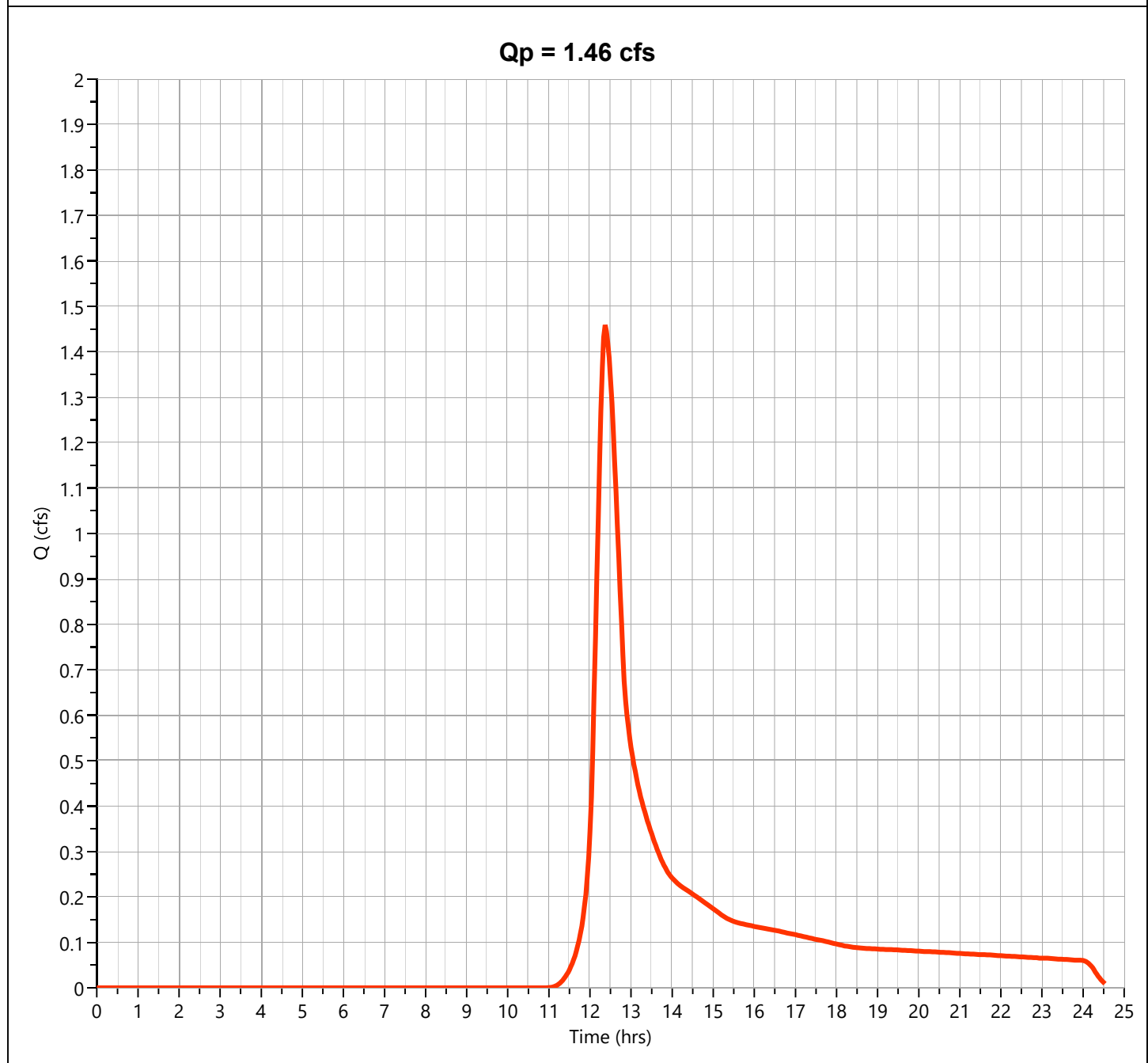
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1 (un) - Perv.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.459 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 8,863 cuft
Drainage Area	= 1.63 ac	Curve Number	= 60
Tc Method	= User	Time of Conc. (Tc)	= 27.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

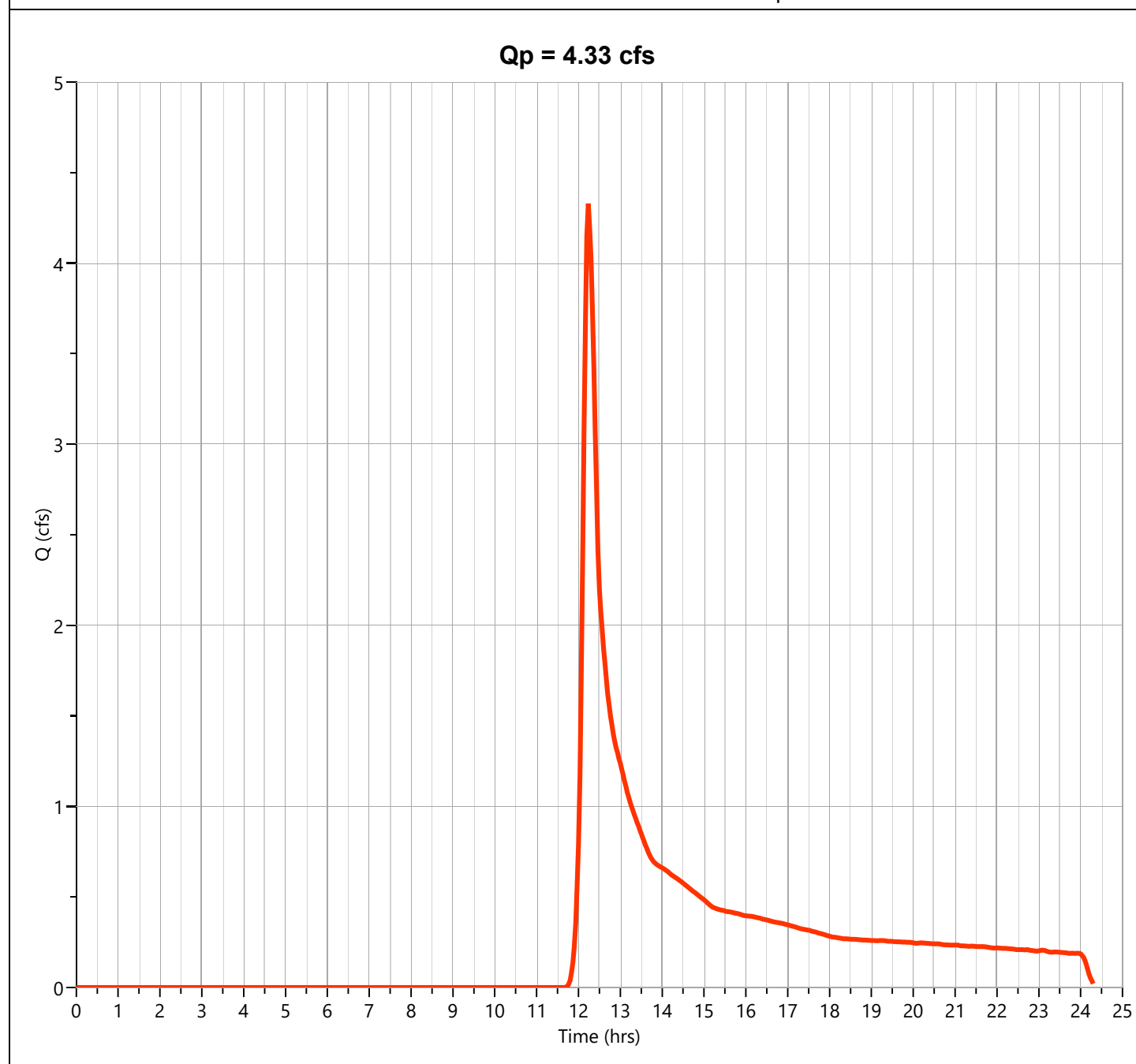
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A2 - Perv.

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.329 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 22,940 cuft
Drainage Area	= 6.79 ac	Curve Number	= 52
Tc Method	= User	Time of Conc. (Tc)	= 16.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

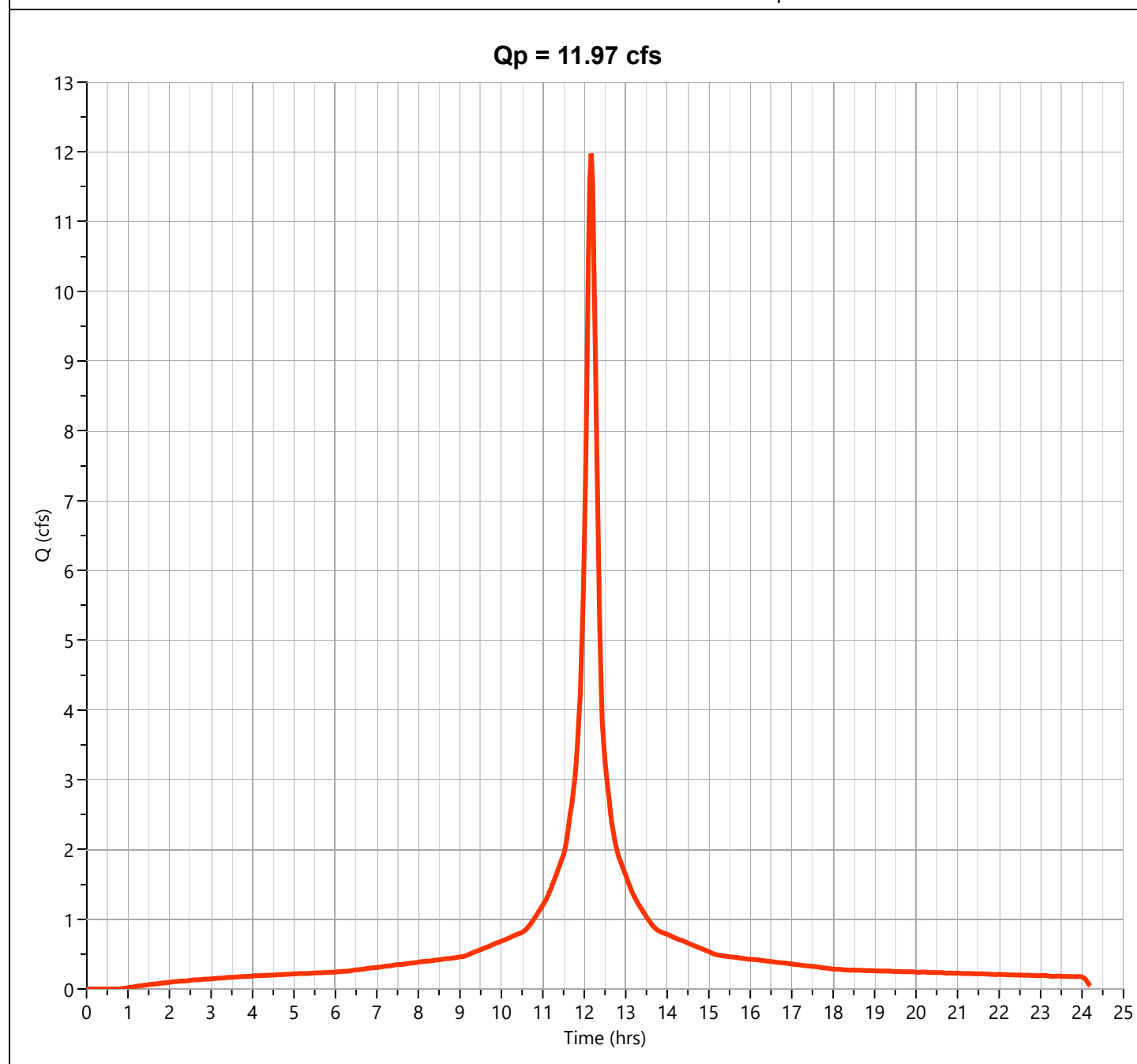
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A2 Imperv

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.97 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 53,951 cuft
Drainage Area	= 2.83 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

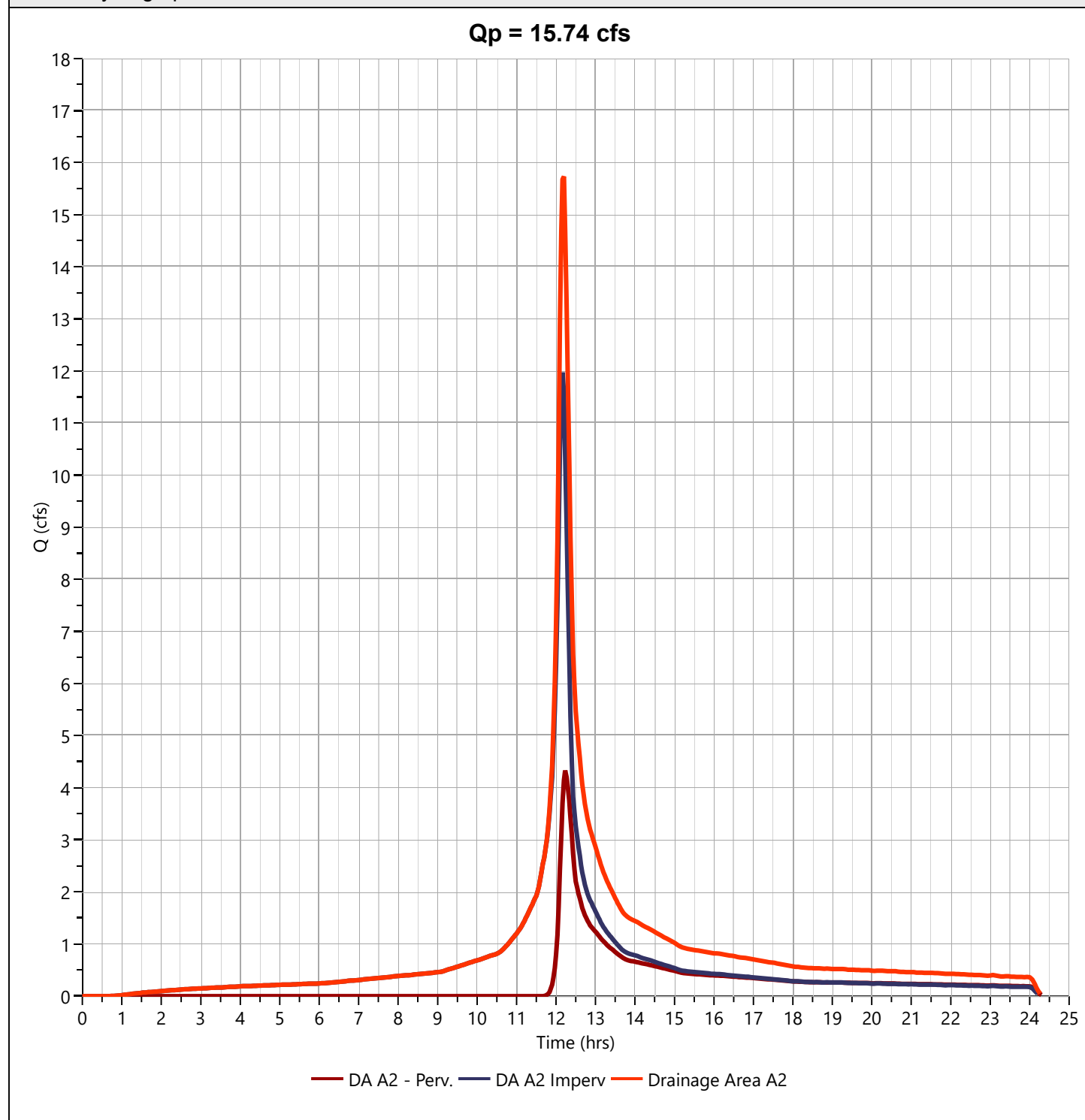
Hydrology Studio v 3.0.0.16

01-04-2021

Pre Drainage Area A2

Hyd. No. 9

Hydrograph Type	= Junction	Peak Flow	= 15.74 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 76,892 cuft
Inflow Hydrographs	= 7, 8	Total Contrib. Area	= 9.62 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Ex. Pond Outflow

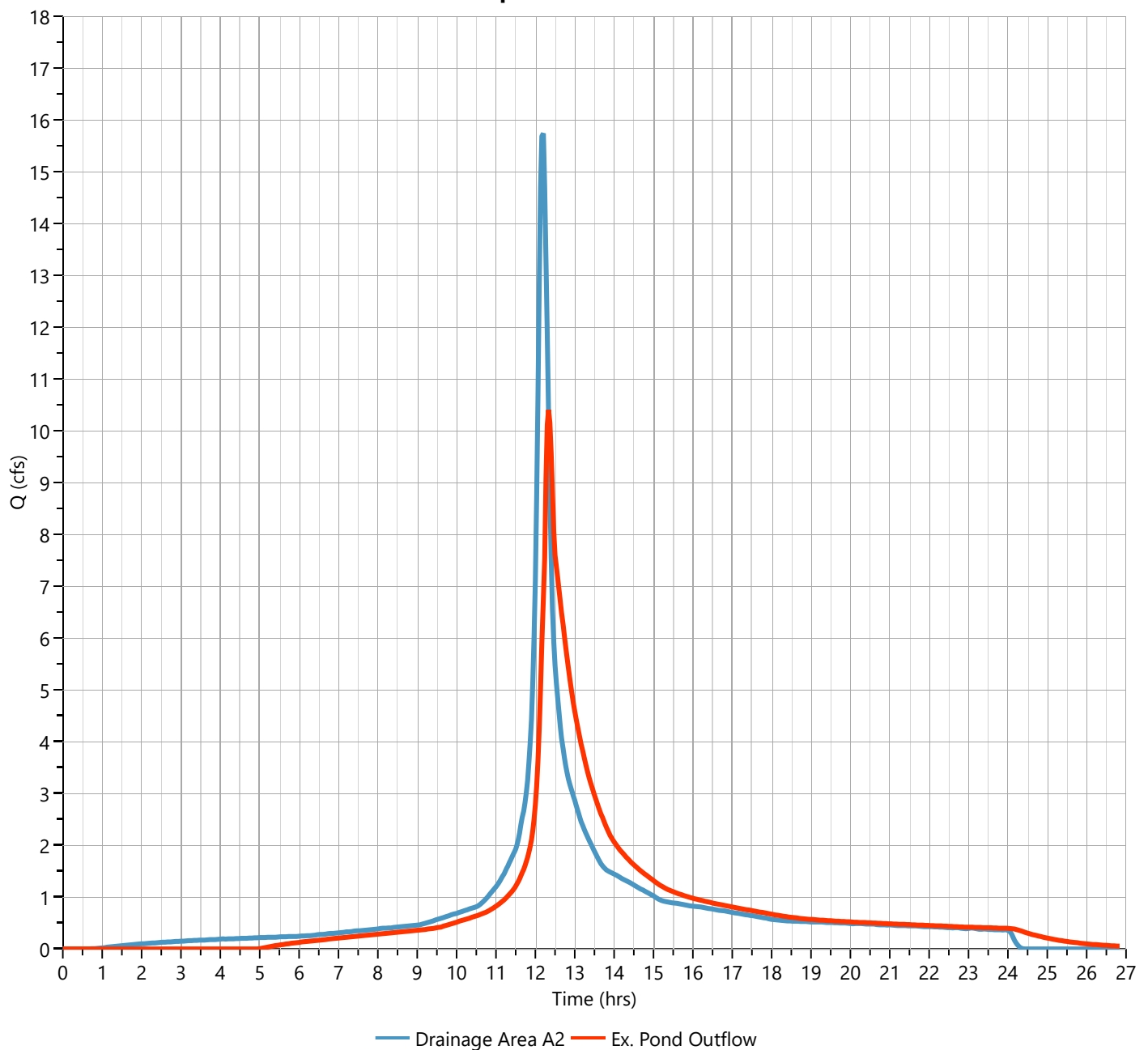
Hyd. No. 10

Hydrograph Type	= Pond Route	Peak Flow	= 10.40 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 74,917 cuft
Inflow Hydrograph	= 9 - Drainage Area A2	Max. Elevation	= 97.04 ft
Pond Name	= Existing Pond	Max. Storage	= 39,232 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 1.01 hrs

Qp = 10.40 cfs



Hydrograph Report

Project Name:

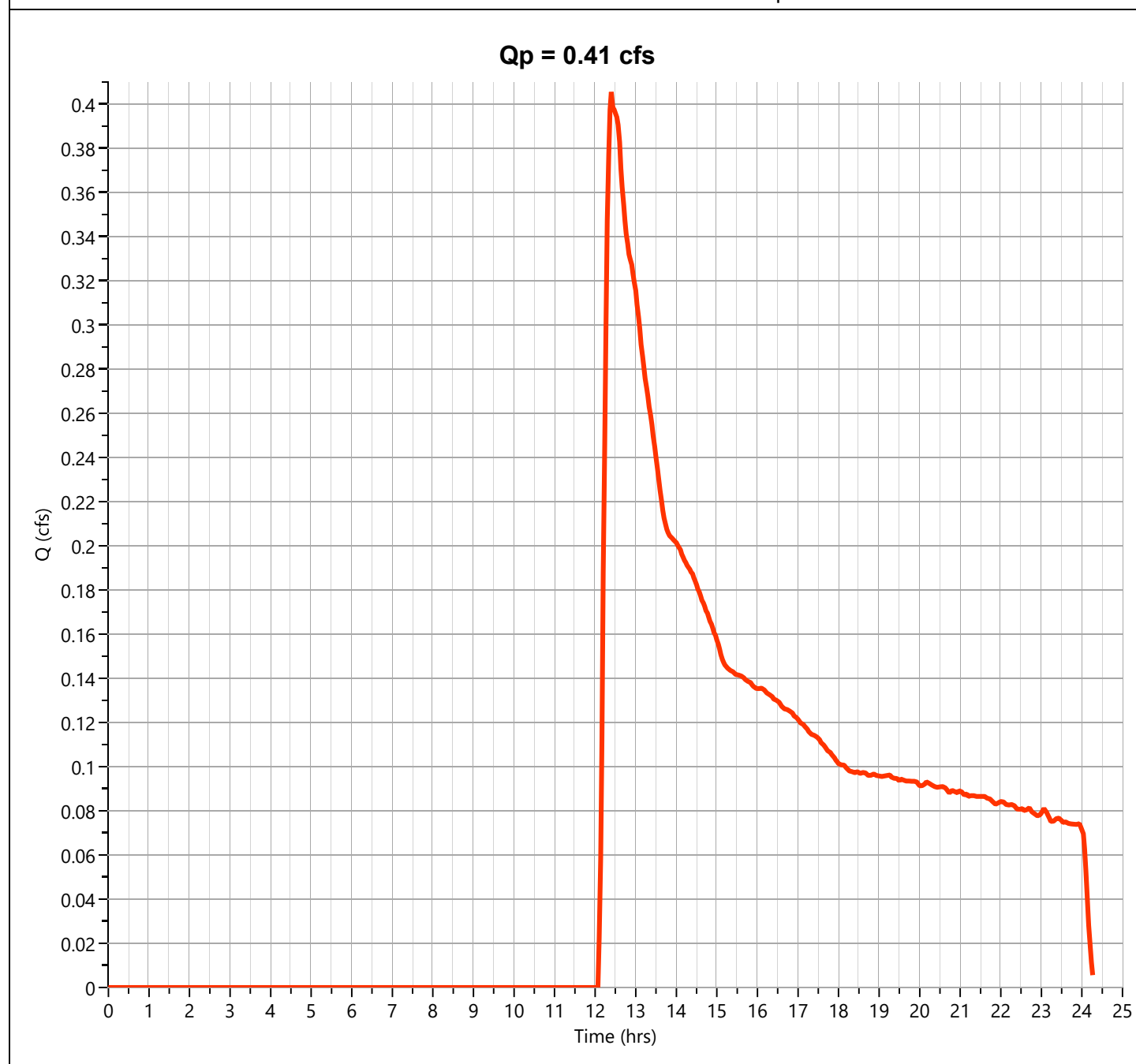
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A3 (un)

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.405 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.40 hrs
Time Interval	= 2 min	Runoff Volume	= 5,890 cuft
Drainage Area	= 4.41 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

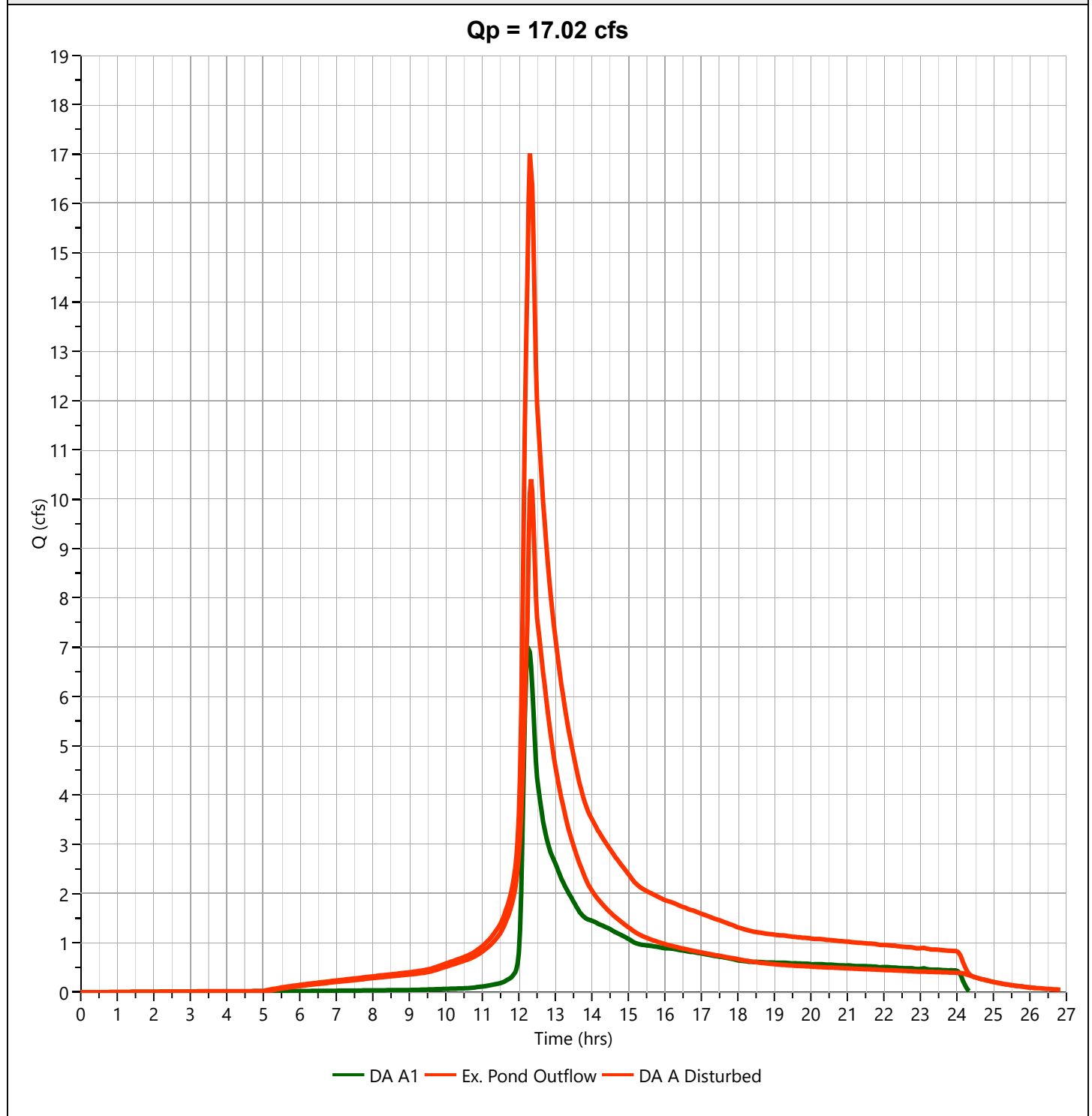
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A Disturbed

Hyd. No. 14

Hydrograph Type	= Junction	Peak Flow	= 17.02 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 124,097 cuft
Inflow Hydrographs	= 3, 10	Total Contrib. Area	= 19.16 ac



Hydrograph Report

Project Name:

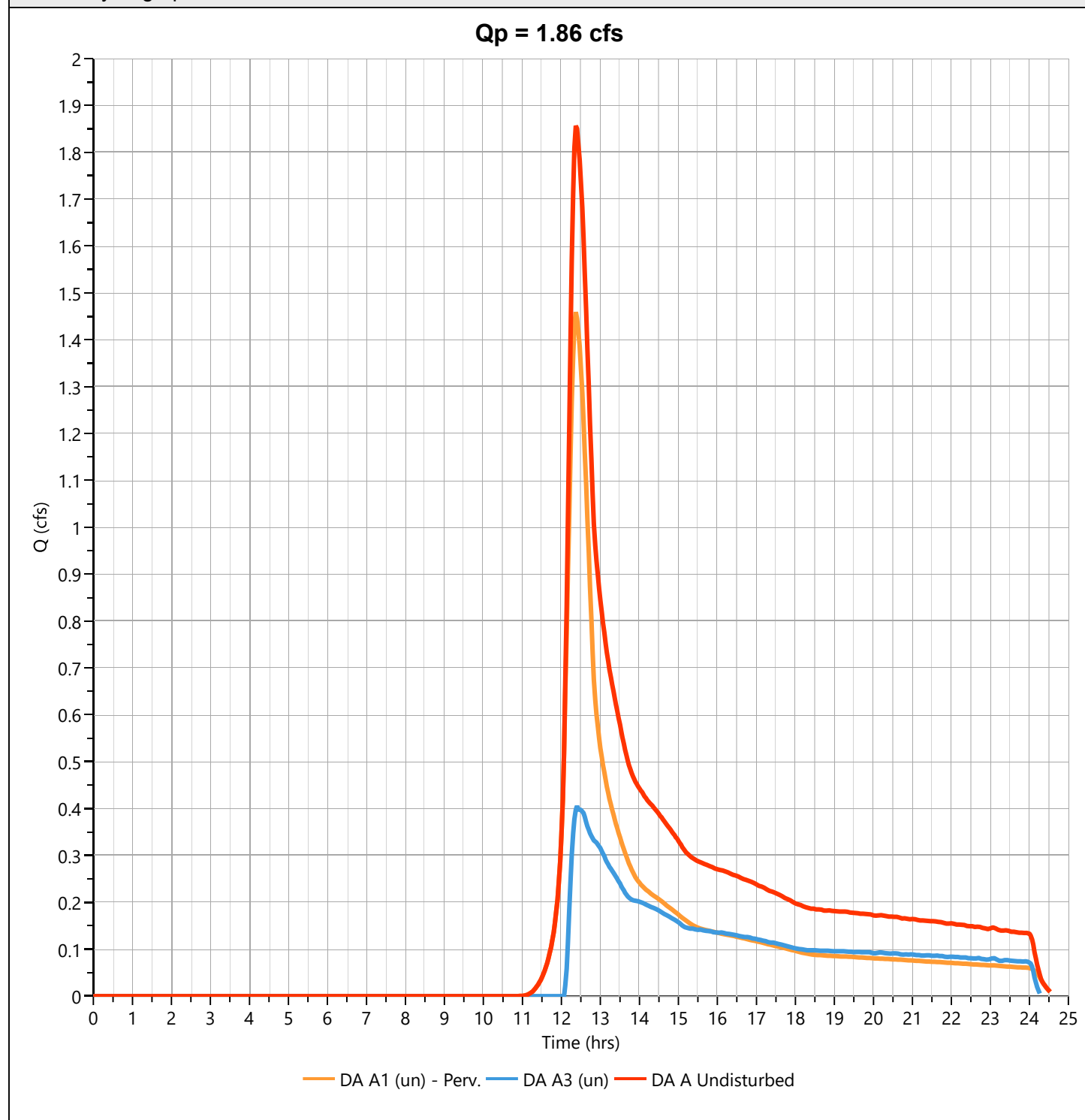
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A Undisturbed

Hyd. No. 15

Hydrograph Type	= Junction	Peak Flow	= 1.856 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 14,754 cuft
Inflow Hydrographs	= 5, 12	Total Contrib. Area	= 6.04 ac



Hydrograph Report

Project Name:

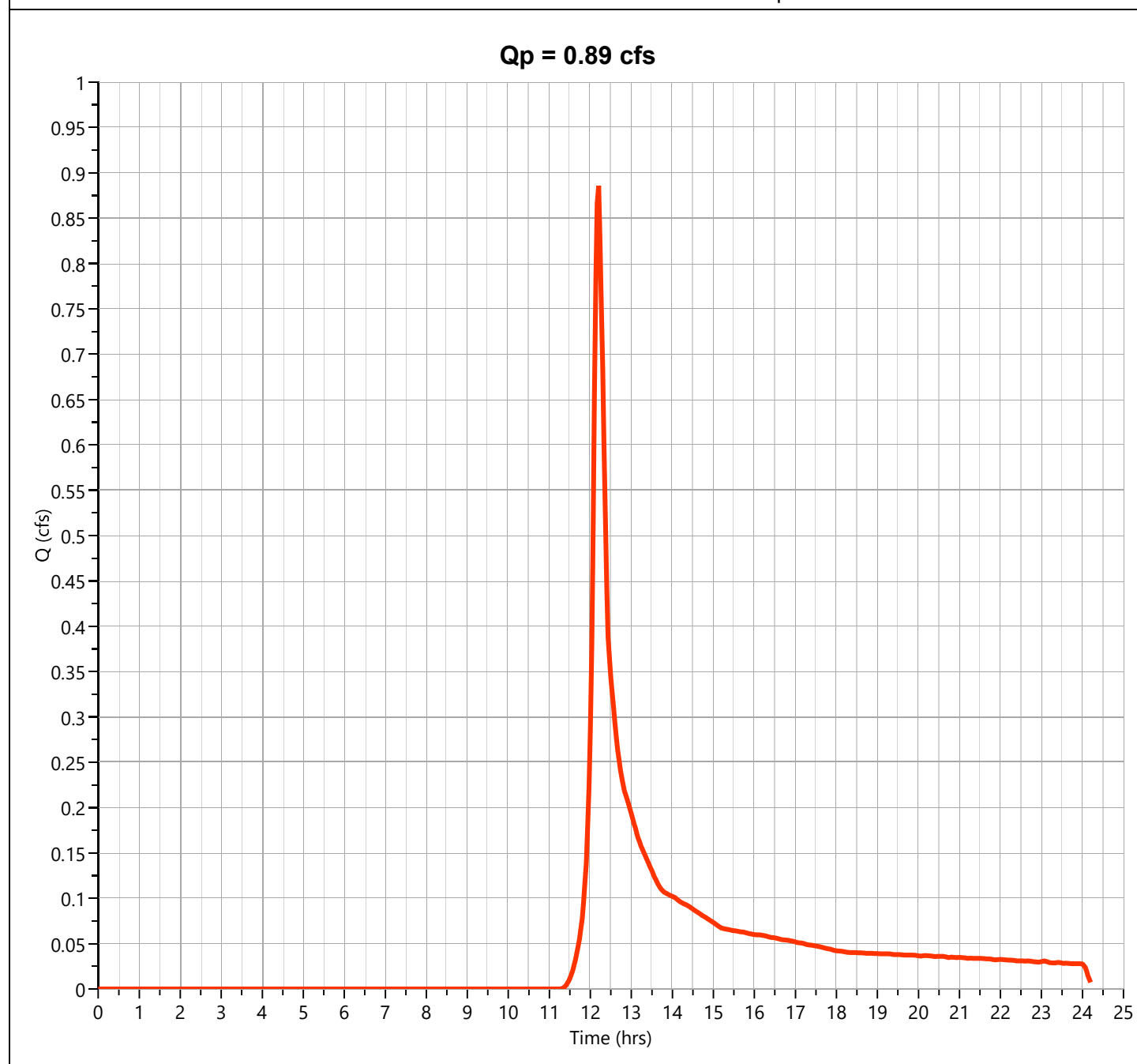
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA B - Perv.

Hyd. No. 17

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.886 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 3,848 cuft
Drainage Area	= 0.8 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

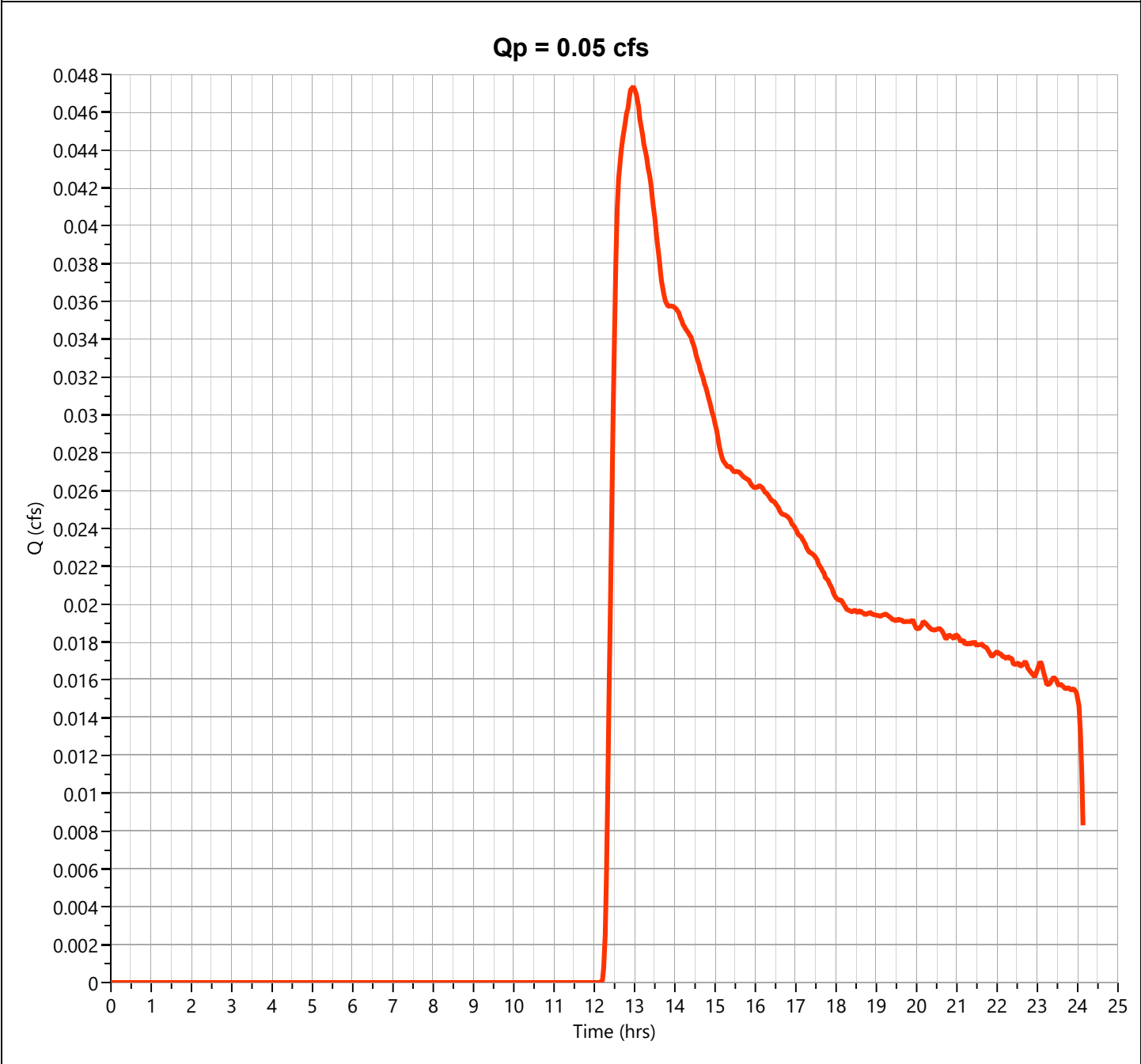
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA C - Perv.

Hyd. No. 19

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.047 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.00 hrs
Time Interval	= 2 min	Runoff Volume	= 1,026 cuft
Drainage Area	= 1.18 ac	Curve Number	= 38
Tc Method	= User	Time of Conc. (Tc)	= 11.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

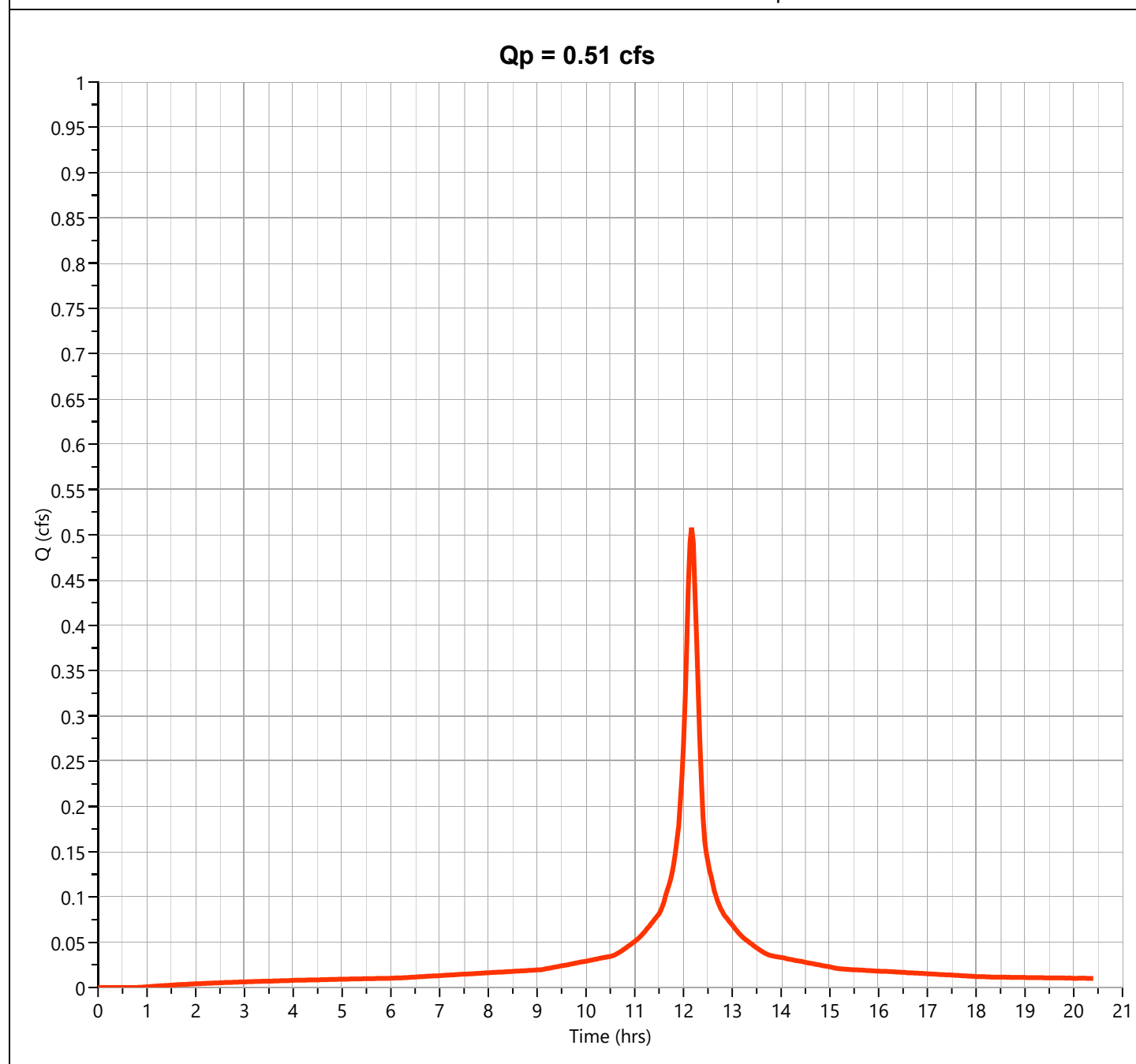
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA C - Imperv.

Hyd. No. 20

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.508 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 2,288 cuft
Drainage Area	= 0.12 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

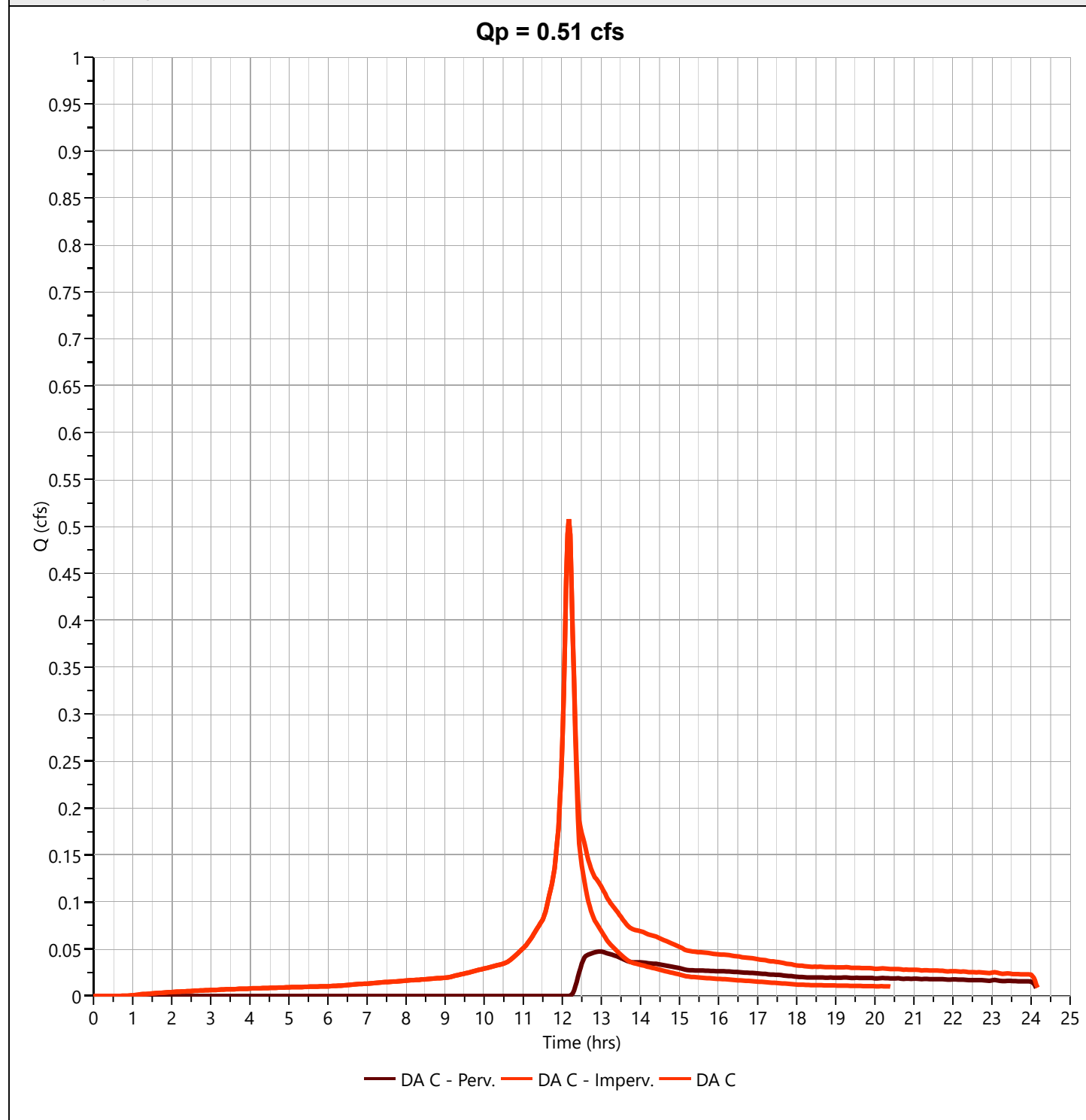
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA C

Hyd. No. 21

Hydrograph Type	= Junction	Peak Flow	= 0.508 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 3,314 cuft
Inflow Hydrographs	= 19, 20	Total Contrib. Area	= 1.3 ac



Hydrograph 25-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

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	Pre DAA1 - Perv.	15.84	12.23	82,392	----		
2	NRCS Runoff	Pre DAA1 - Imperv.	1.428	12.17	6,480	----		
3	Junction	Pre DAA1	17.08	12.23	88,872	1, 2		
5	NRCS Runoff	Pre DAA1 (un) - Perv.	2.416	12.37	13,957	----		
7	NRCS Runoff	Pre DAA2 - Perv.	8.515	12.23	39,514	----		
8	NRCS Runoff	Pre DAA2 Imperv	14.97	12.17	67,920	----		
9	Junction	Pre Drainage Area A2	22.86	12.20	107,434	7, 8		
10	Pond Route	Ex. Pond Outflow	19.56	12.27	105,460	9	97.16	41,591
12	NRCS Runoff	Pre DAA3 (un)	1.835	12.23	12,931	----		
14	Junction	Pre DAA Disturbed	35.98	12.27	194,332	3, 10		
15	Junction	Pre DAA Undisturbed	4.067	12.30	26,888	5, 12		
17	NRCS Runoff	Pre DA B - Perv.	1.523	12.20	6,240	----		
19	NRCS Runoff	Pre DA C - Perv.	0.254	12.30	2,570	----		
20	NRCS Runoff	Pre DA C - Imperv.	0.635	12.17	2,880	----		
21	Junction	Pre DA C	0.819	12.20	5,450	19, 20		

Hydrograph Report

Project Name:

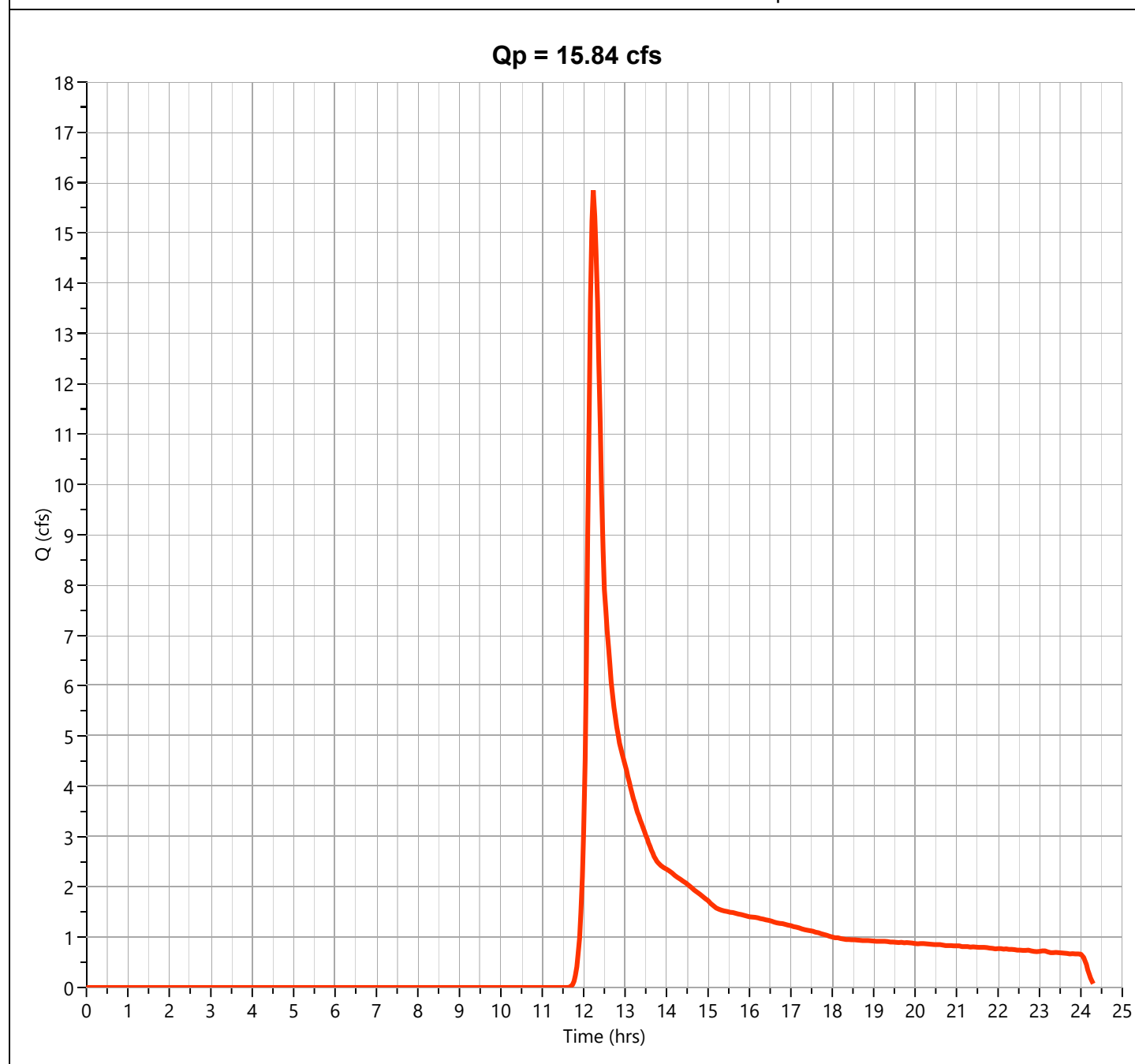
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1 - Perv.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 15.84 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 82,392 cuft
Drainage Area	= 18.89 ac	Curve Number	= 47
Tc Method	= User	Time of Conc. (Tc)	= 14.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

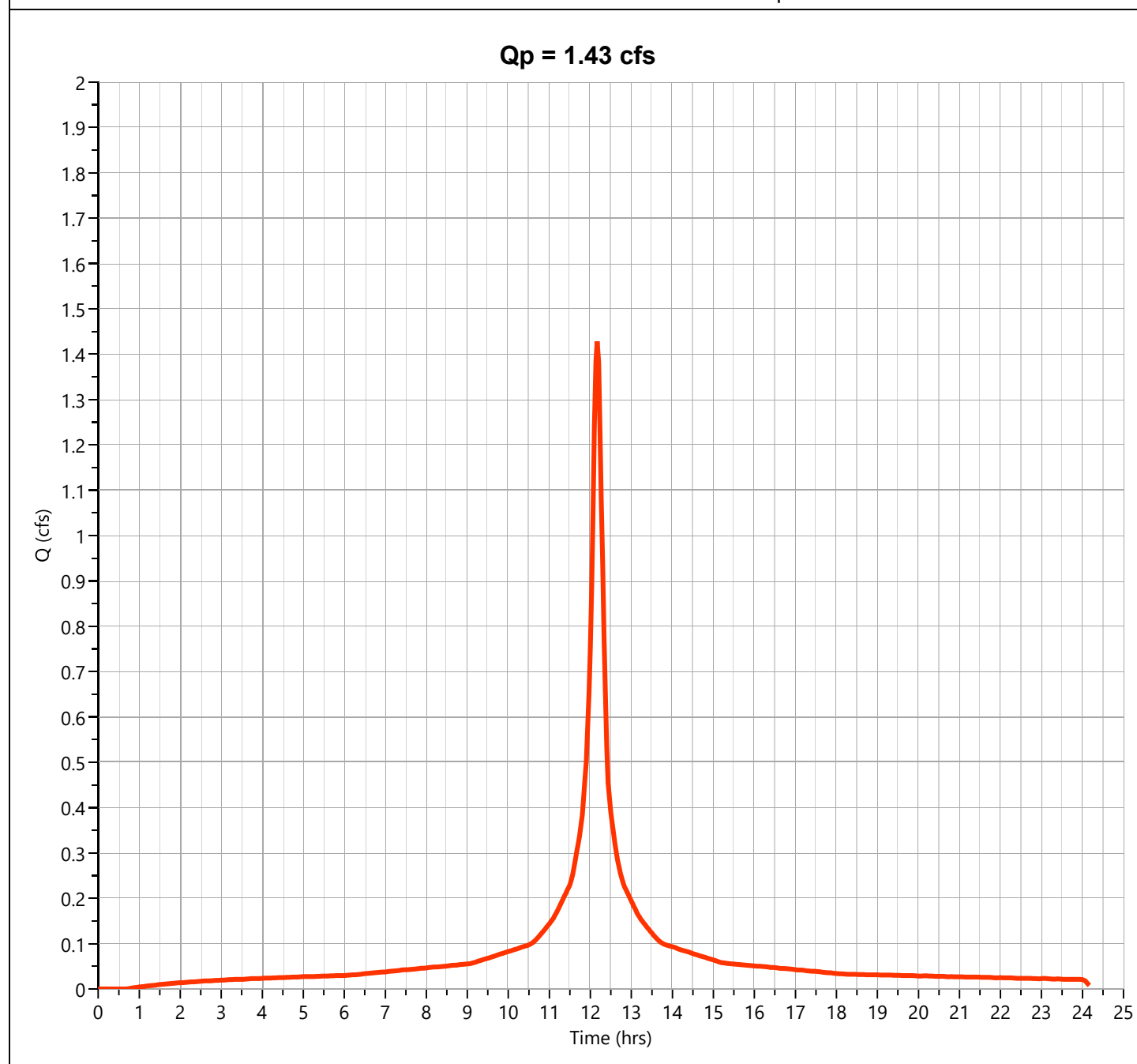
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1 - Imperv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.428 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 6,480 cuft
Drainage Area	= 0.27 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

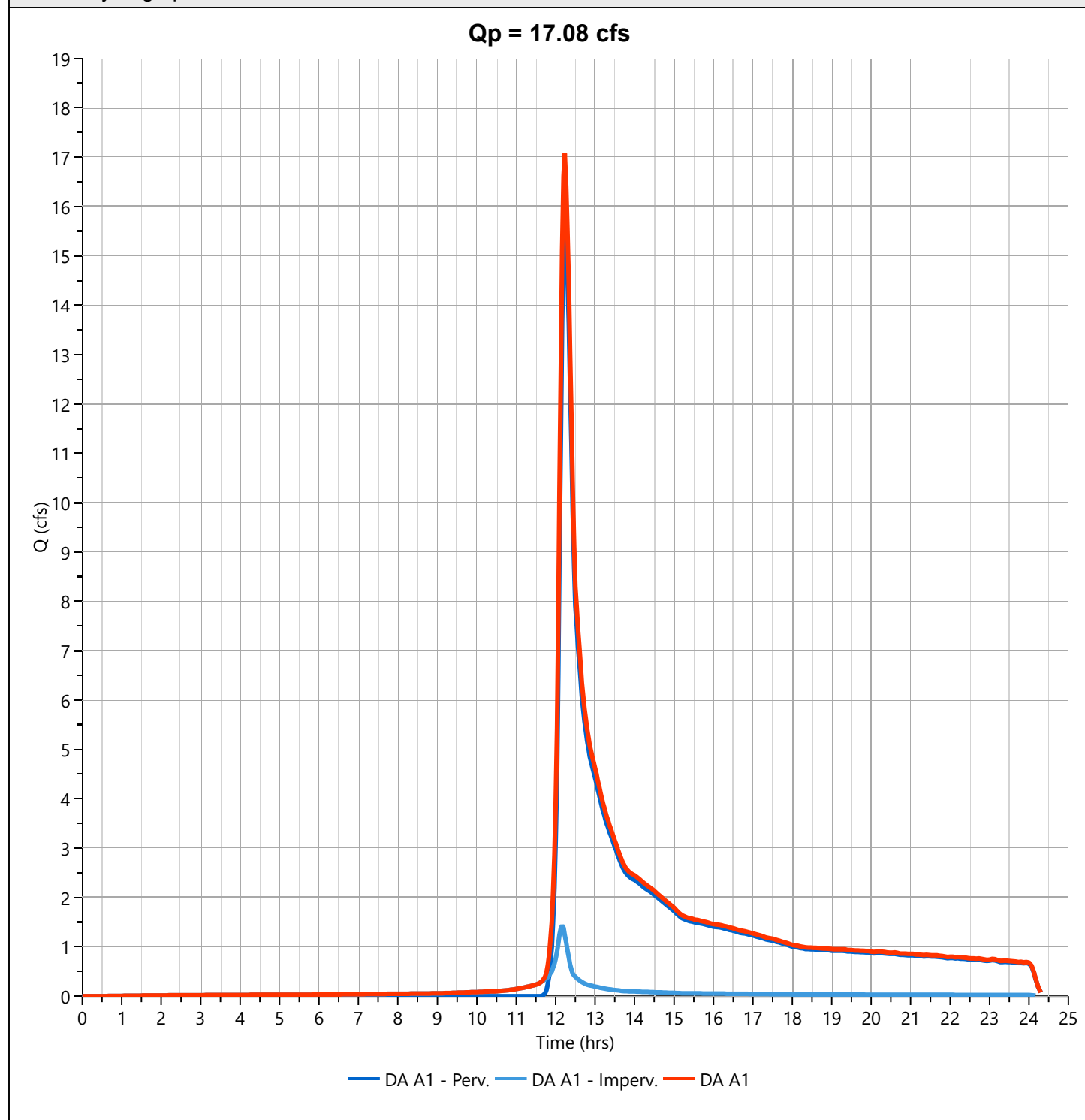
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 17.08 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 88,872 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 19.16 ac



Hydrograph Report

Project Name:

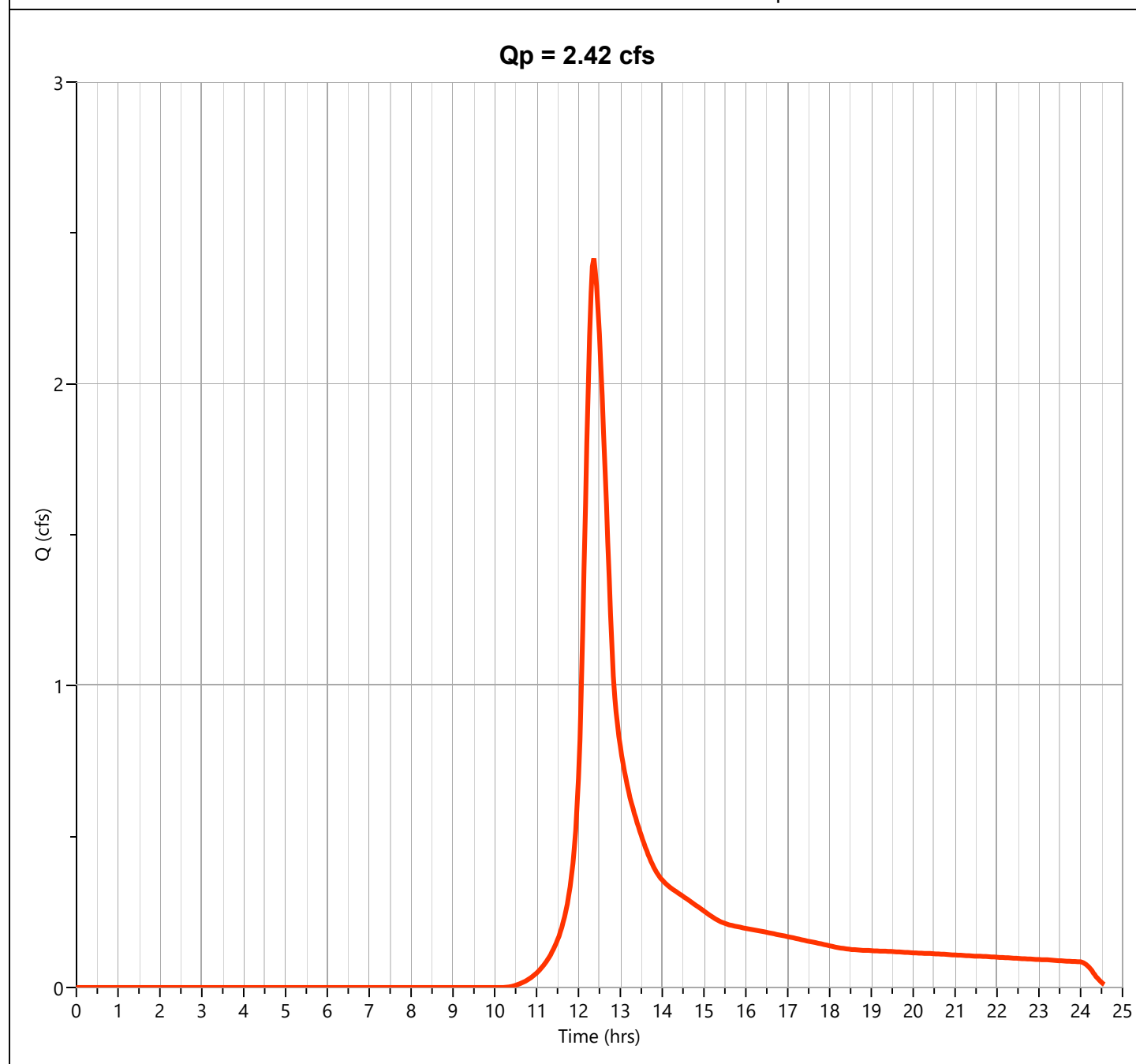
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1 (un) - Perv.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.416 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 13,957 cuft
Drainage Area	= 1.63 ac	Curve Number	= 60
Tc Method	= User	Time of Conc. (Tc)	= 27.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

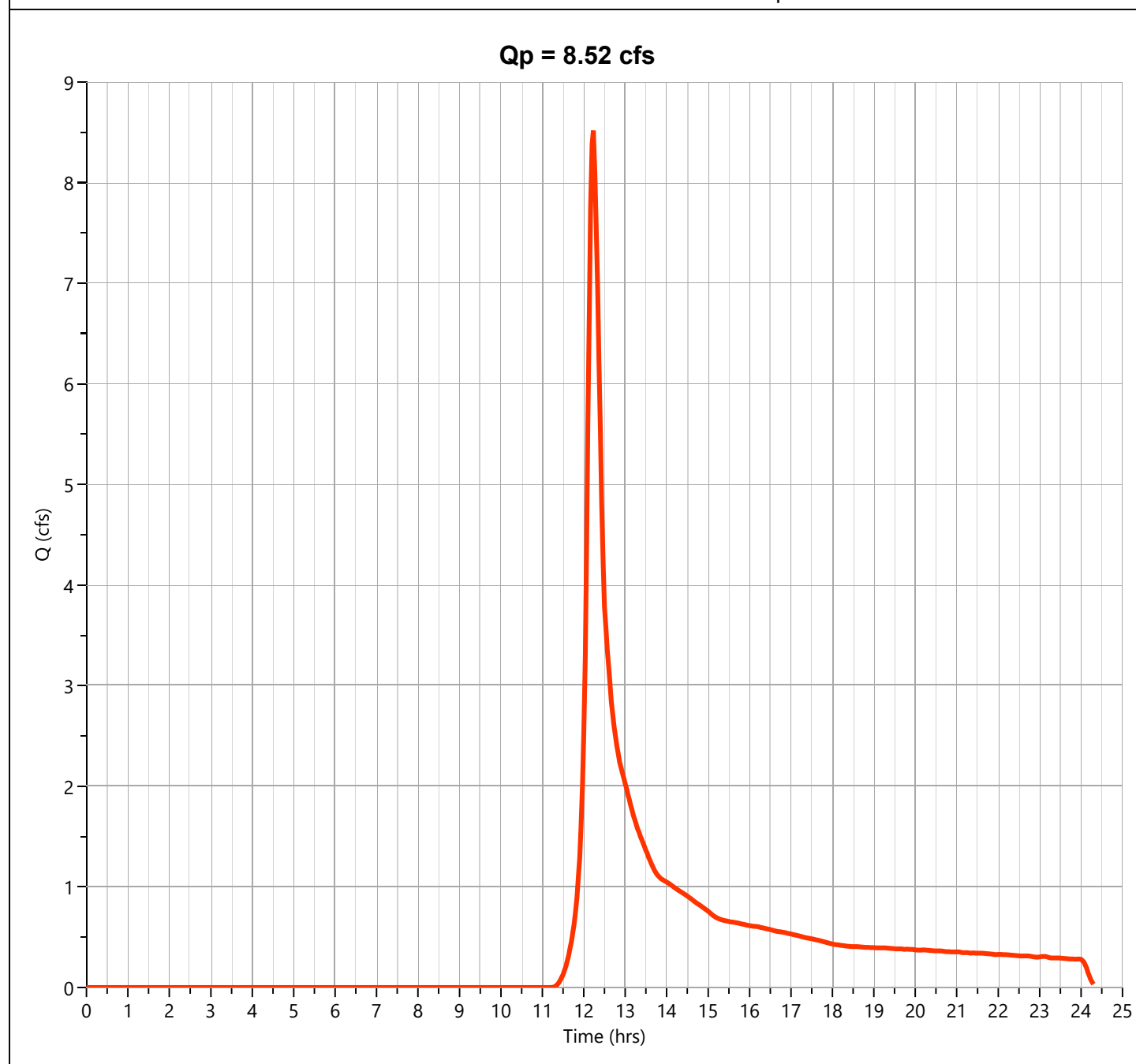
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A2 - Perv.

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.515 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 39,514 cuft
Drainage Area	= 6.79 ac	Curve Number	= 52
Tc Method	= User	Time of Conc. (Tc)	= 16.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

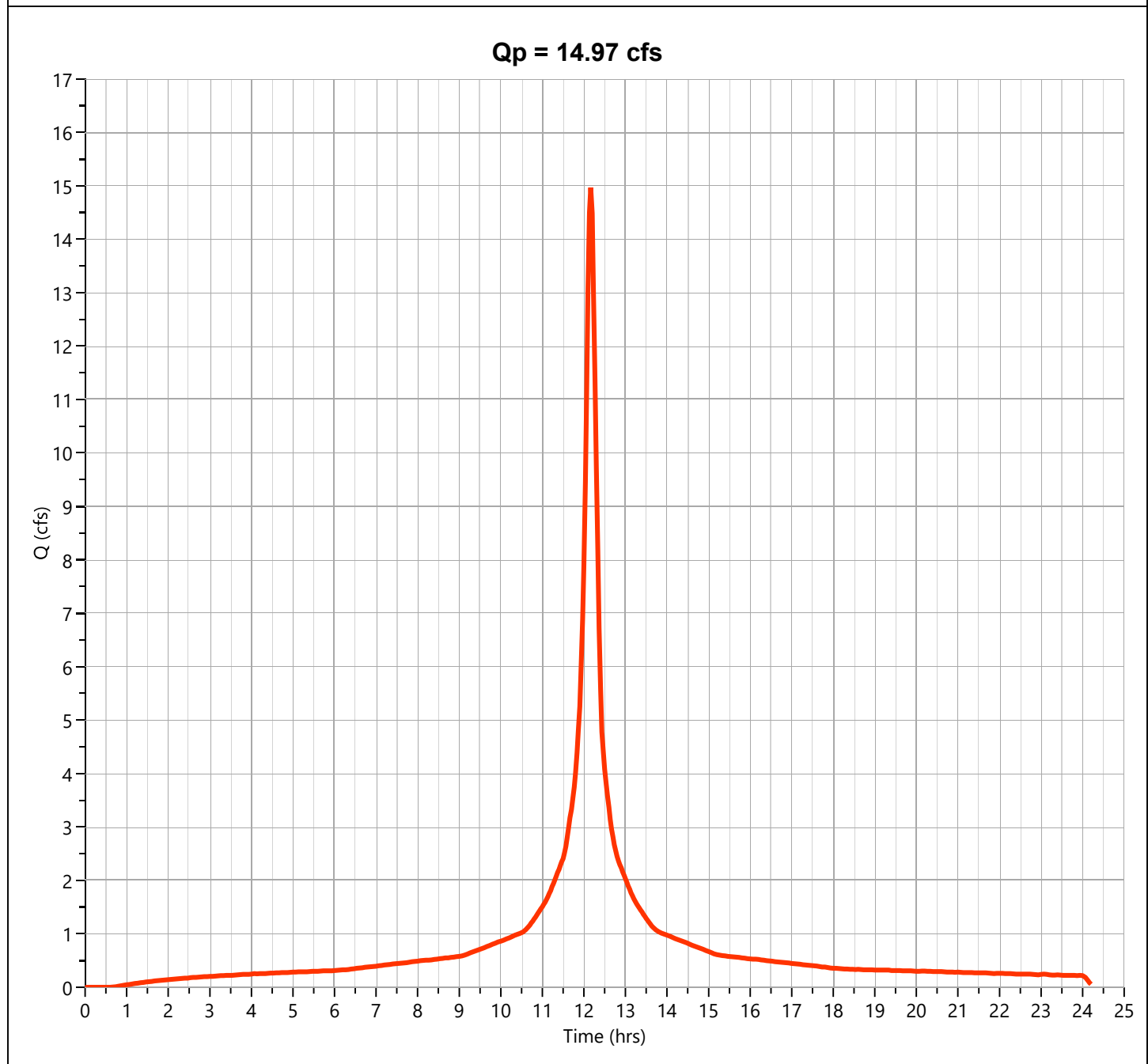
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A2 Imperv

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 14.97 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 67,920 cuft
Drainage Area	= 2.83 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

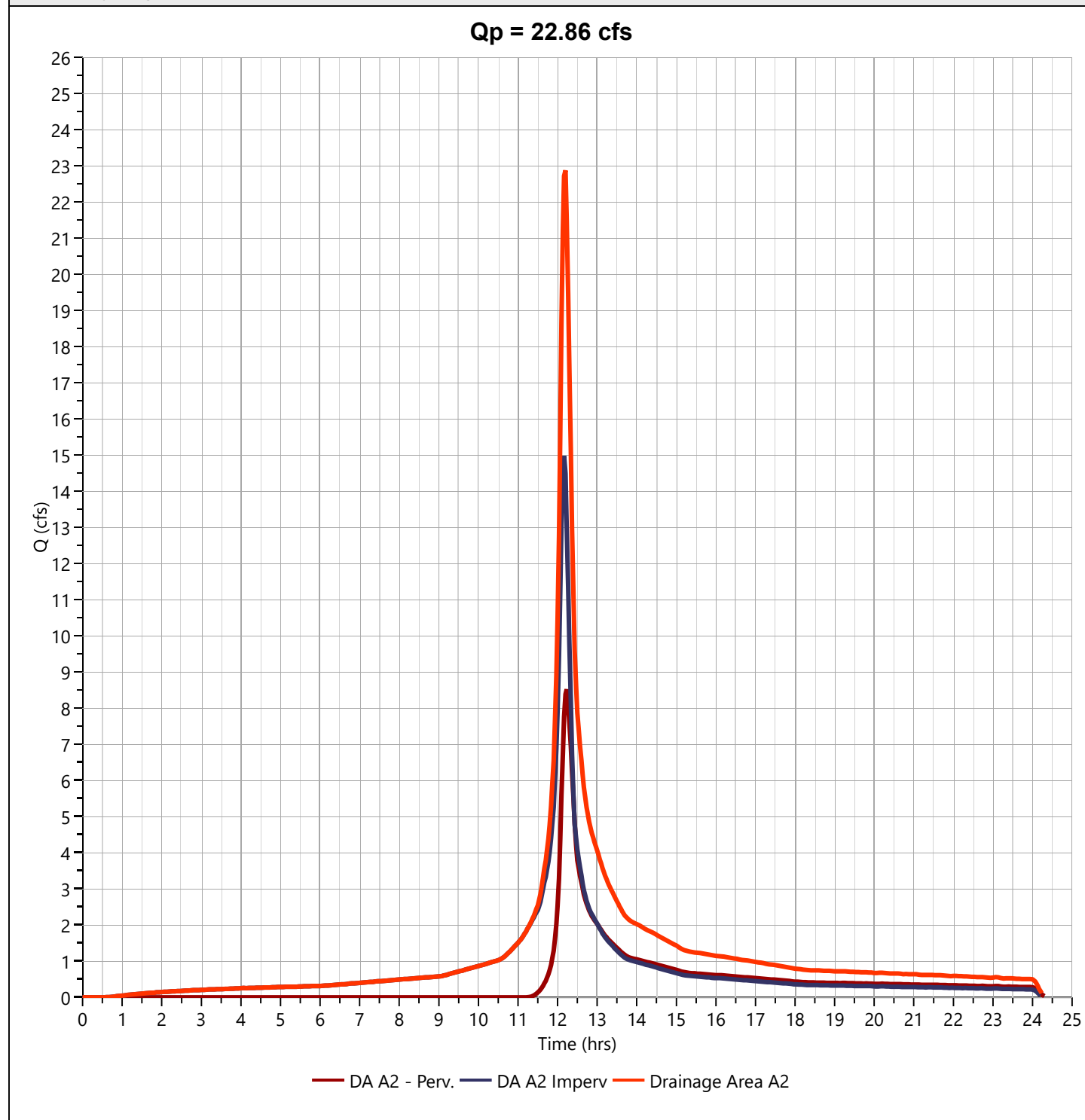
Hydrology Studio v 3.0.0.16

01-04-2021

Pre Drainage Area A2

Hyd. No. 9

Hydrograph Type	= Junction	Peak Flow	= 22.86 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 107,434 cuft
Inflow Hydrographs	= 7, 8	Total Contrib. Area	= 9.62 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Ex. Pond Outflow

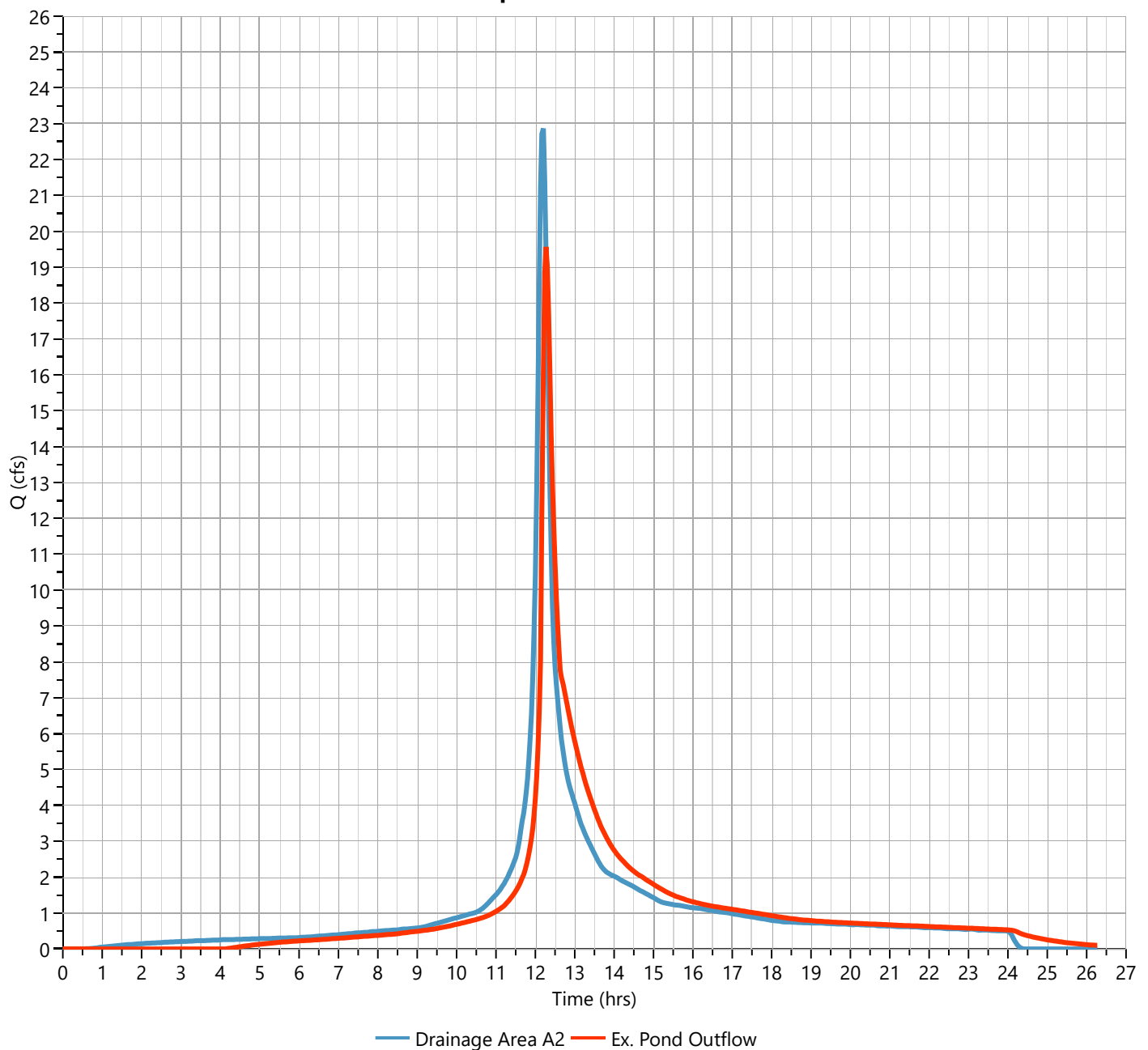
Hyd. No. 10

Hydrograph Type	= Pond Route	Peak Flow	= 19.56 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 105,460 cuft
Inflow Hydrograph	= 9 - Drainage Area A2	Max. Elevation	= 97.16 ft
Pond Name	= Existing Pond	Max. Storage	= 41,591 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 49 min

Qp = 19.56 cfs



Hydrograph Report

Project Name:

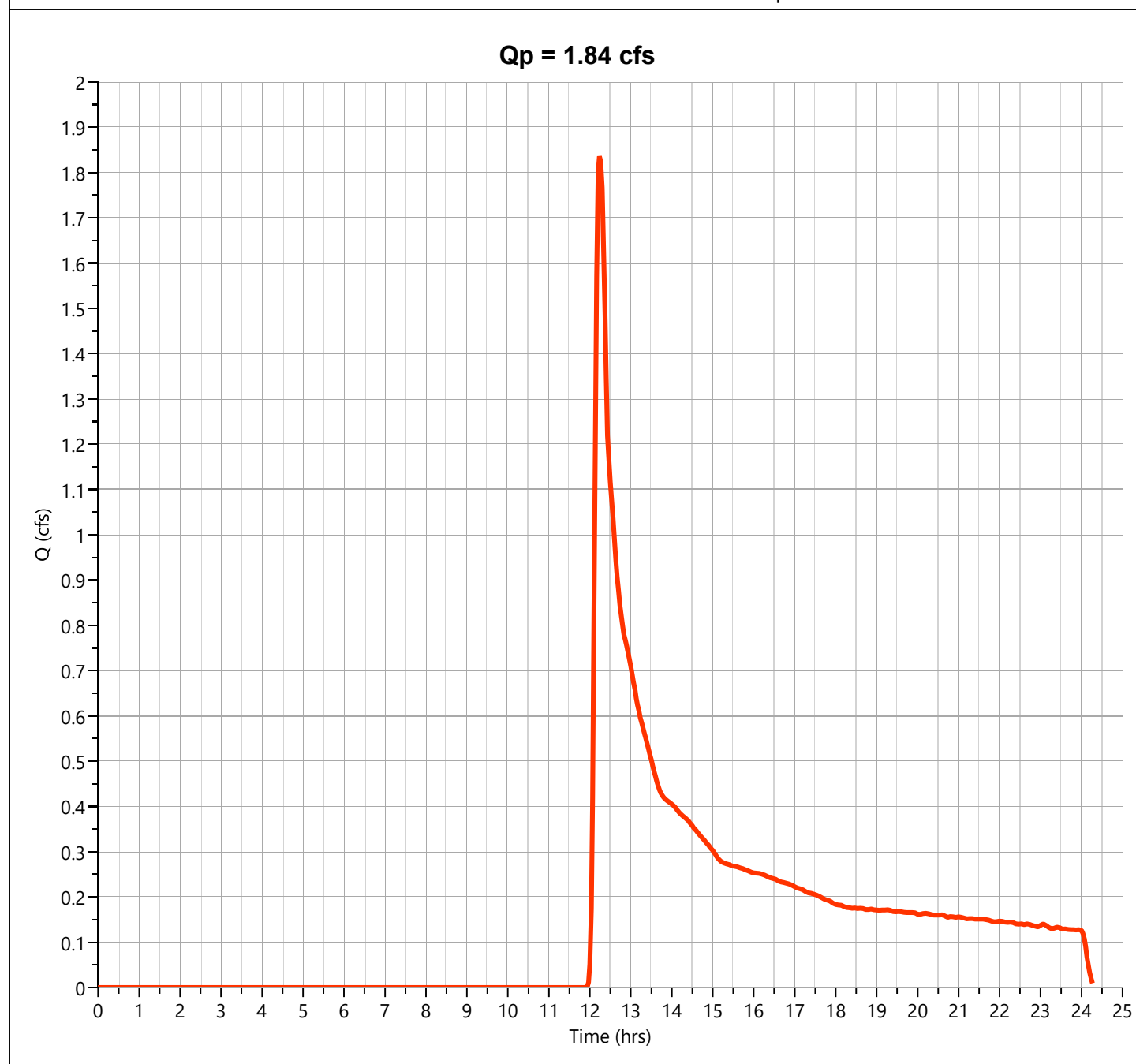
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A3 (un)

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.835 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 12,931 cuft
Drainage Area	= 4.41 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

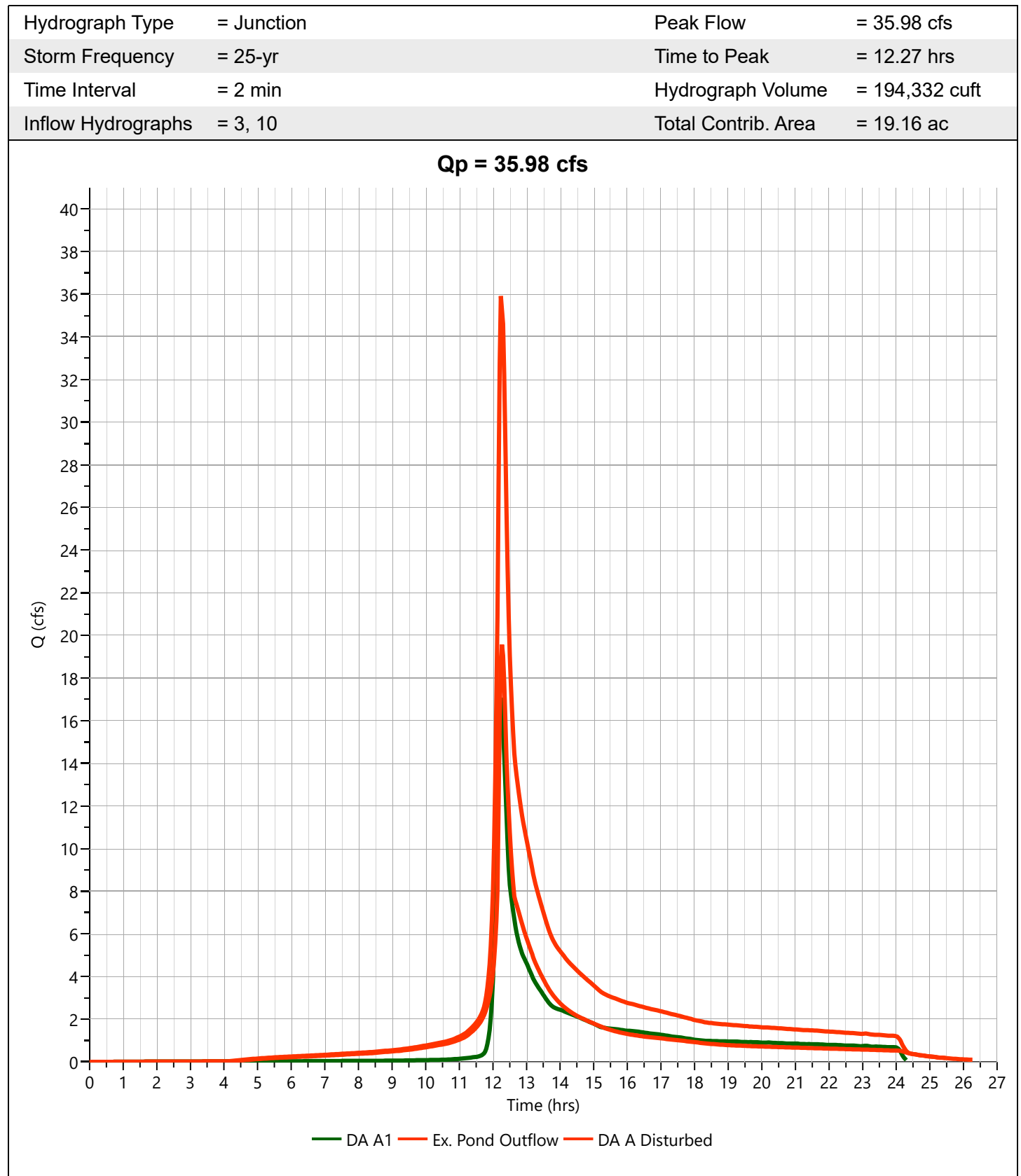
Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A Disturbed

Hyd. No. 14



Hydrograph Report

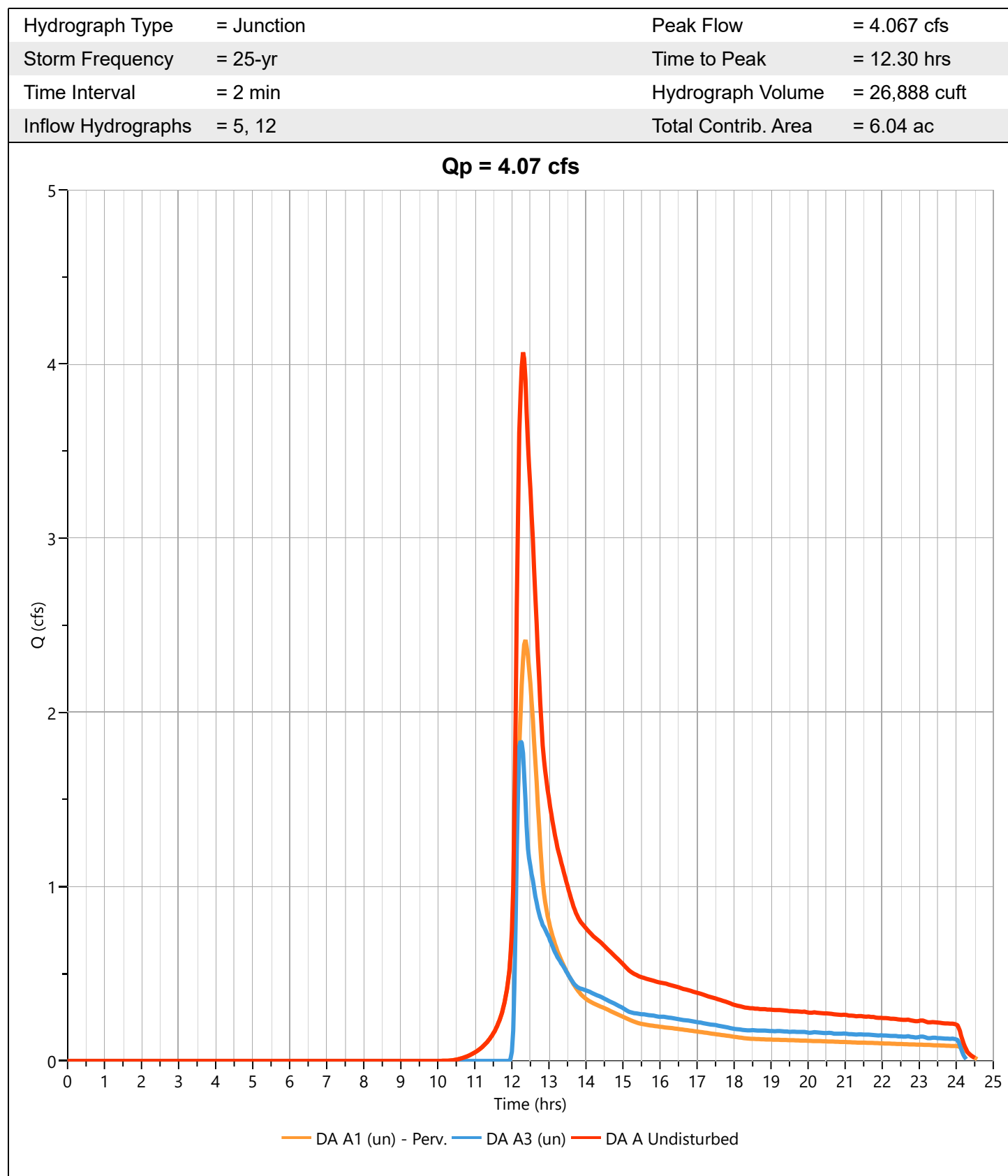
Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A Undisturbed

Hyd. No. 15



Hydrograph Report

Project Name:

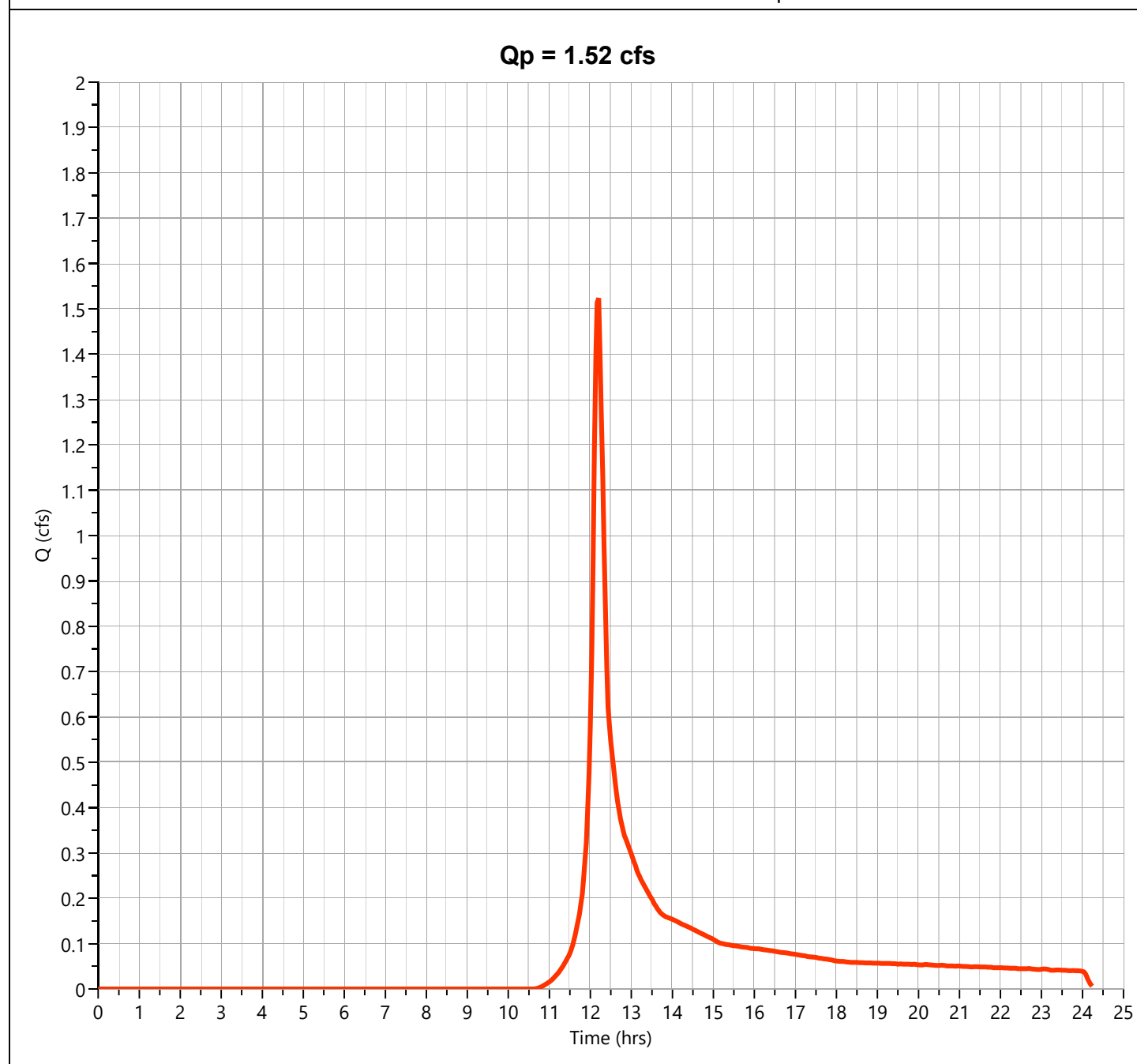
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA B - Perv.

Hyd. No. 17

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.523 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 6,240 cuft
Drainage Area	= 0.8 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

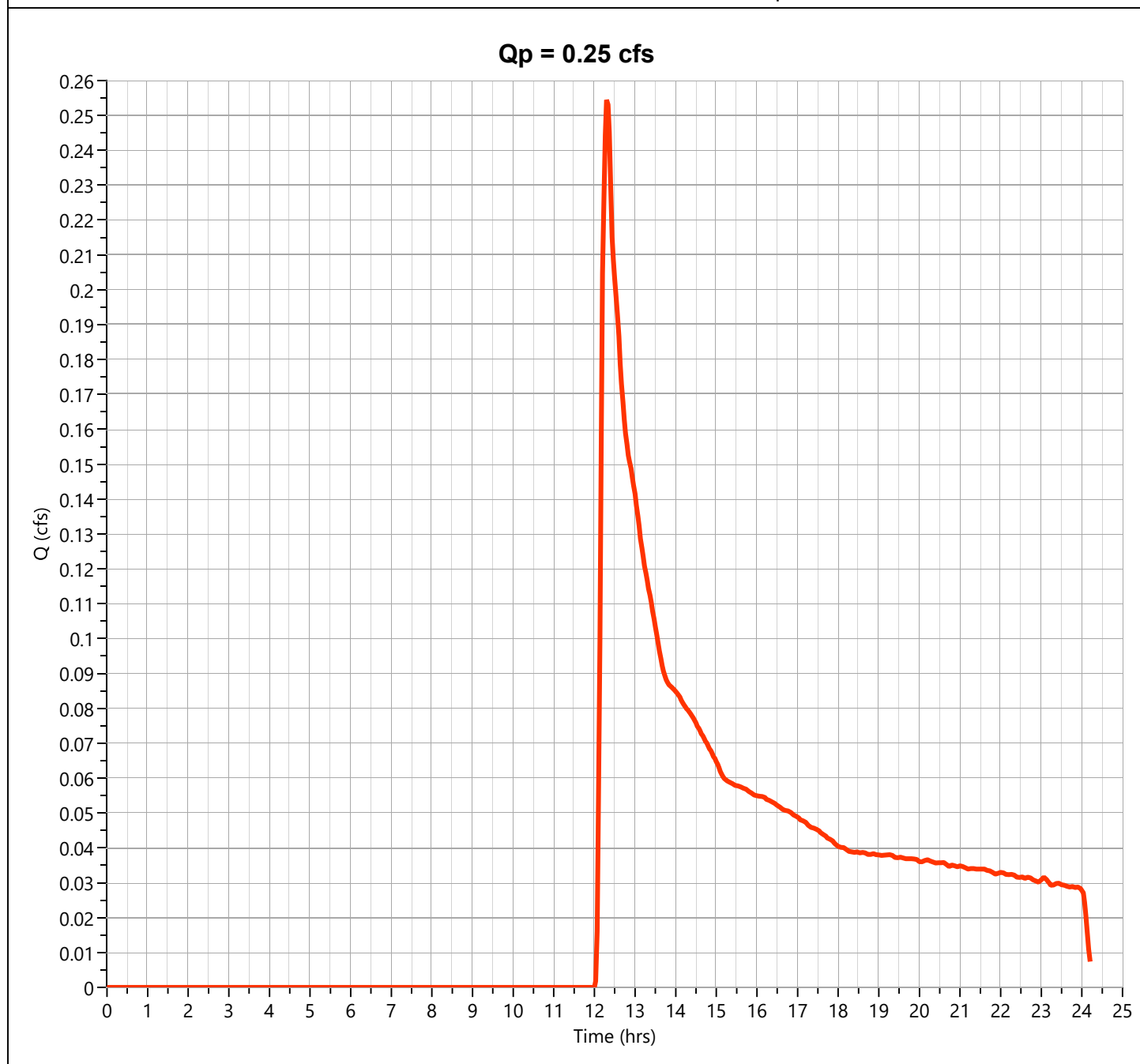
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA C - Perv.

Hyd. No. 19

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.254 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 2,570 cuft
Drainage Area	= 1.18 ac	Curve Number	= 38
Tc Method	= User	Time of Conc. (Tc)	= 11.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

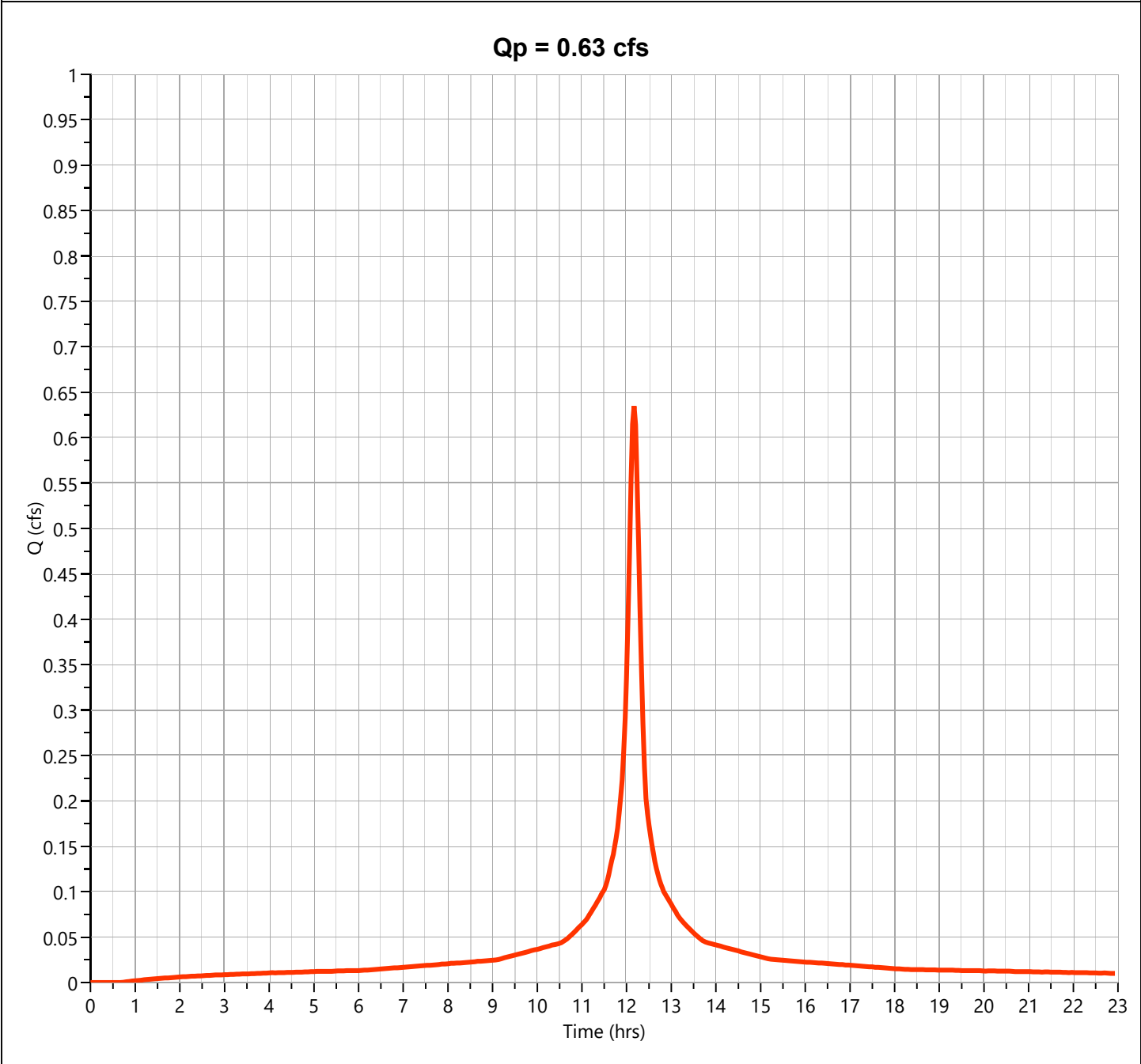
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA C - Imperv.

Hyd. No. 20

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.635 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 2,880 cuft
Drainage Area	= 0.12 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

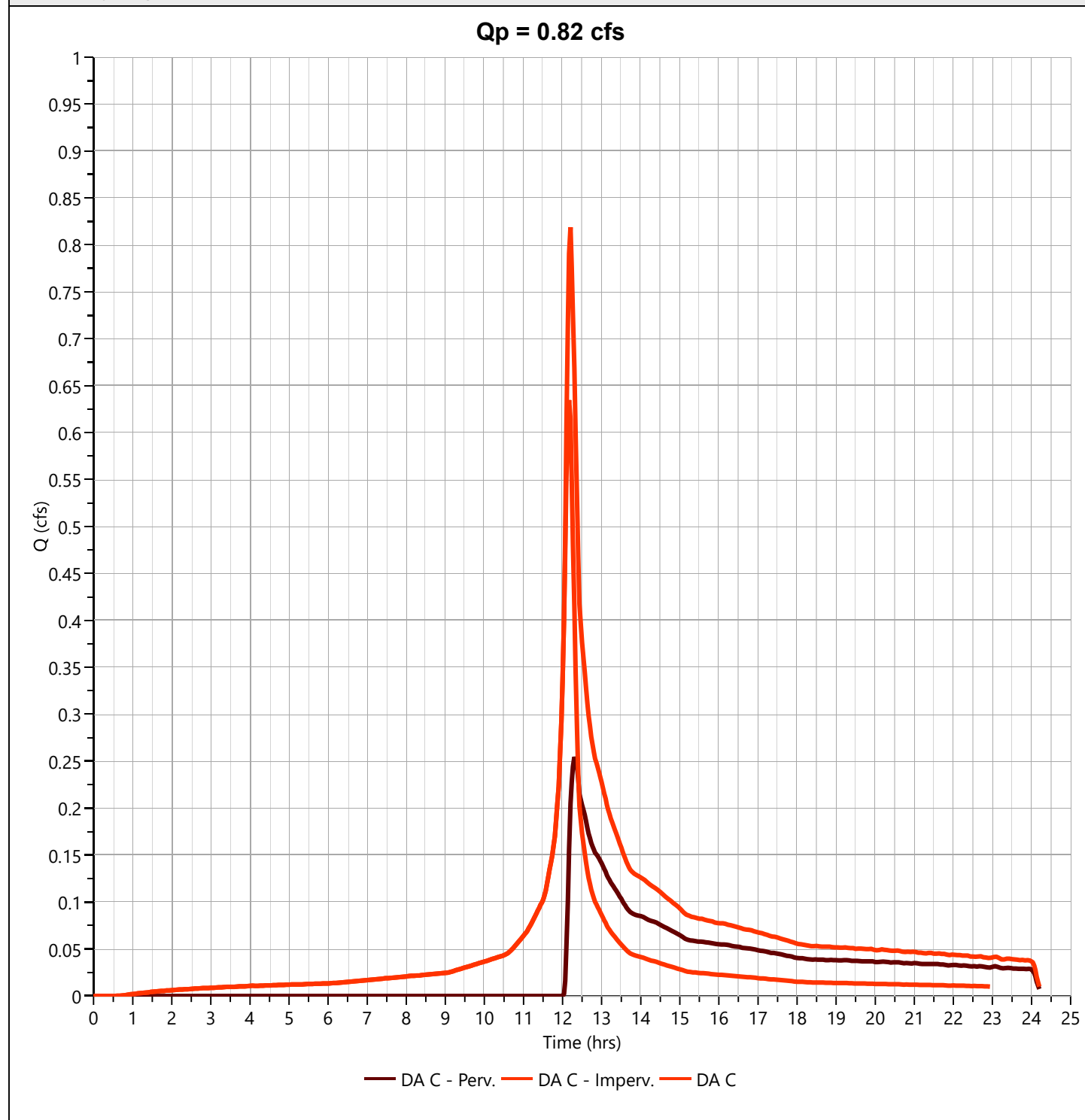
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA C

Hyd. No. 21

Hydrograph Type	= Junction	Peak Flow	= 0.819 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 5,450 cuft
Inflow Hydrographs	= 19, 20	Total Contrib. Area	= 1.3 ac



Hydrograph 100-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

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	Pre DAA1 - Perv.	38.66	12.23	173,256	----		
2	NRCS Runoff	Pre DAA1 - Imperv.	1.959	12.17	8,965	----		
3	Junction	Pre DAA1	40.36	12.23	182,220	1, 2		
5	NRCS Runoff	Pre DAA1 (un) - Perv.	4.416	12.37	24,775	----		
7	NRCS Runoff	Pre DAA2 - Perv.	17.80	12.20	76,873	----		
8	NRCS Runoff	Pre DAA2 Imperv	20.53	12.17	93,964	----		
9	Junction	Pre Drainage Area A2	37.67	12.20	170,837	7, 8		
10	Pond Route	Ex. Pond Outflow	35.85	12.23	168,862	9	97.29	44,412
12	NRCS Runoff	Pre DAA3 (un)	6.782	12.20	31,090	----		
14	Junction	Pre DAA Disturbed	76.21	12.23	351,082	3, 10		
15	Junction	Pre DAA Undisturbed	10.23	12.20	55,865	5, 12		
17	NRCS Runoff	Pre DA B - Perv.	2.895	12.17	11,425	----		
19	NRCS Runoff	Pre DA C - Perv.	1.343	12.20	6,813	----		
20	NRCS Runoff	Pre DA C - Imperv.	0.871	12.17	3,984	----		
21	Junction	Pre DA C	2.186	12.20	10,798	19, 20		

Hydrograph Report

Project Name:

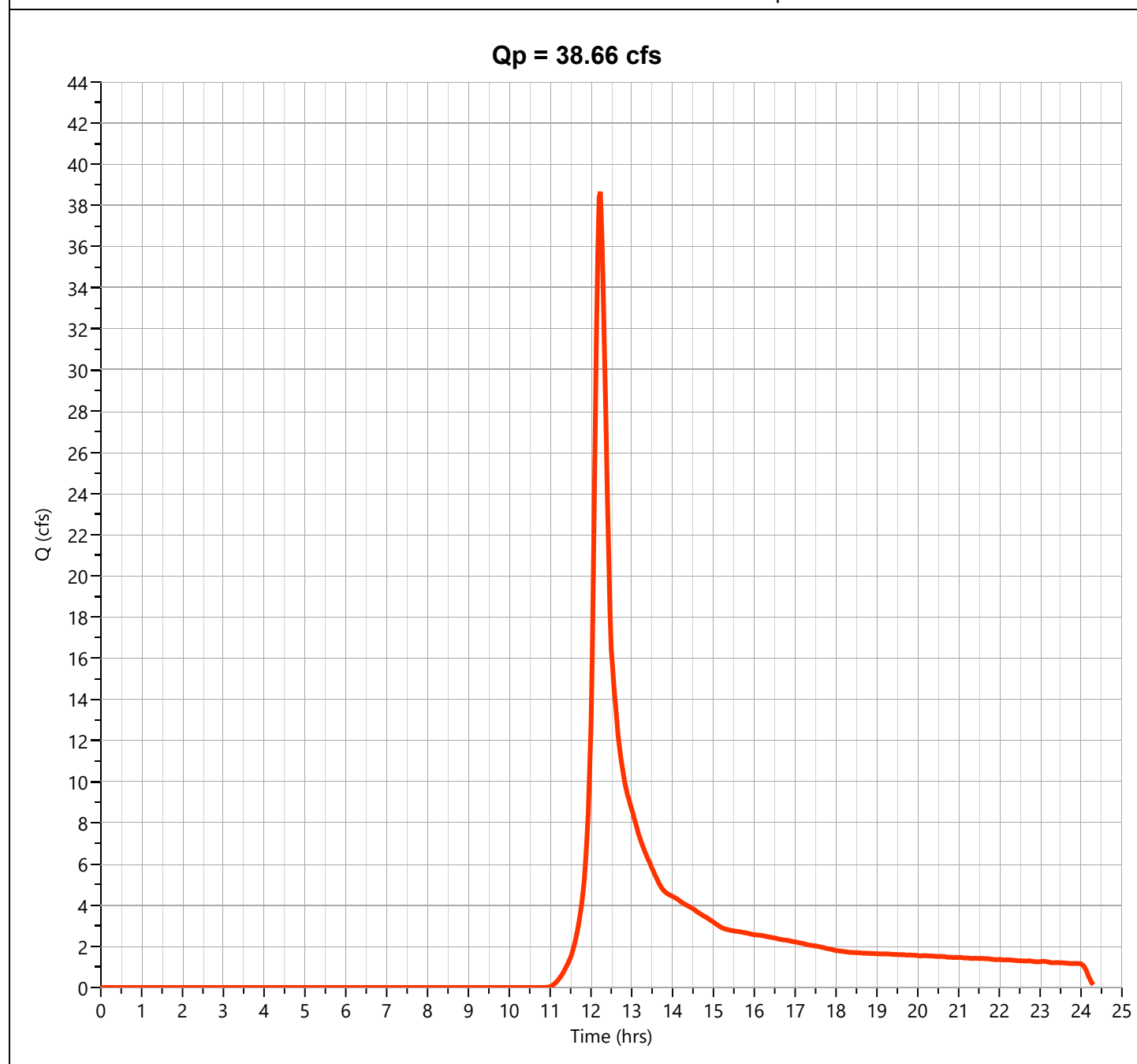
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1 - Perv.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 38.66 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 173,256 cuft
Drainage Area	= 18.89 ac	Curve Number	= 47
Tc Method	= User	Time of Conc. (Tc)	= 14.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

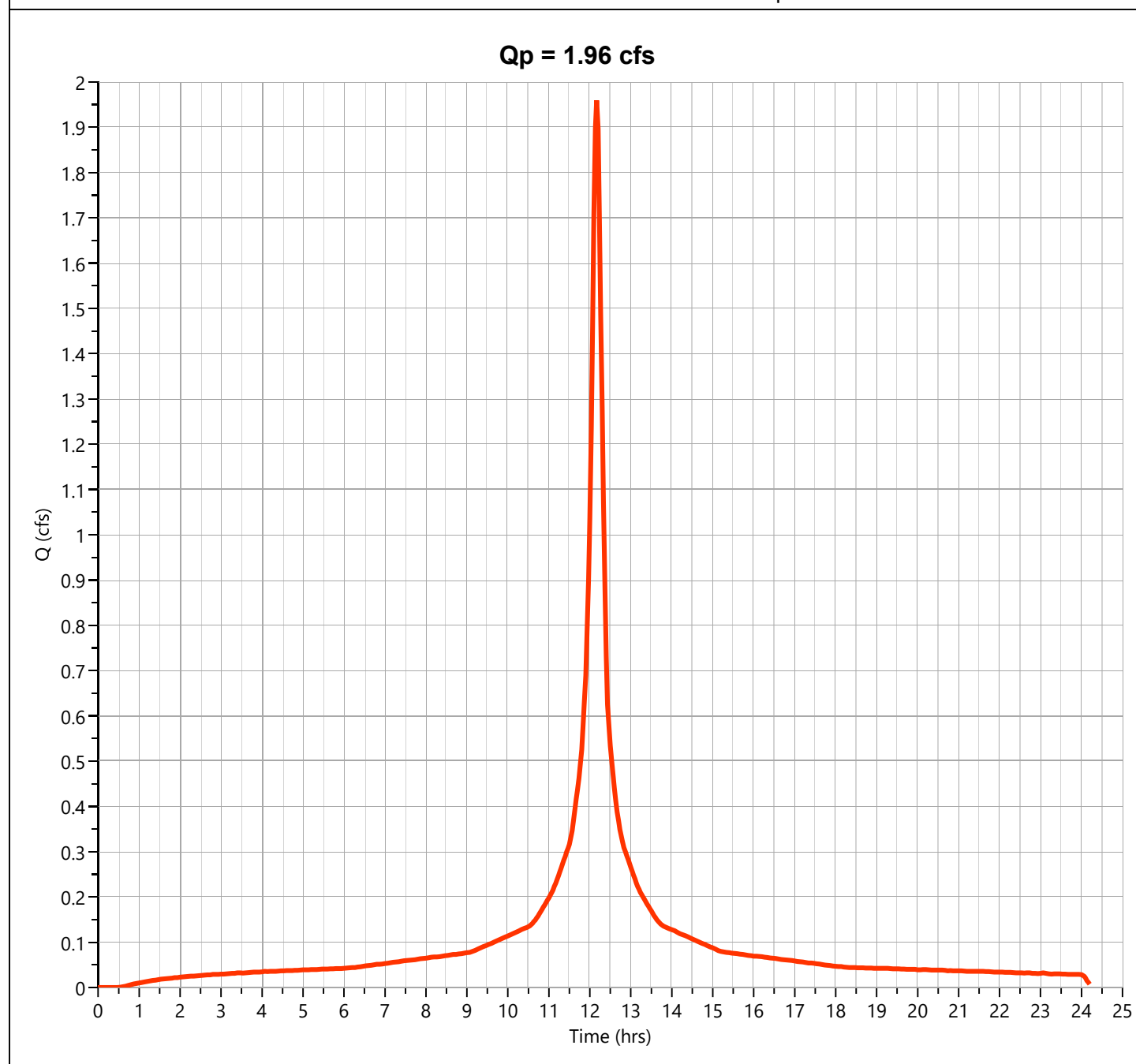
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1 - Imperv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.959 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 8,965 cuft
Drainage Area	= 0.27 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

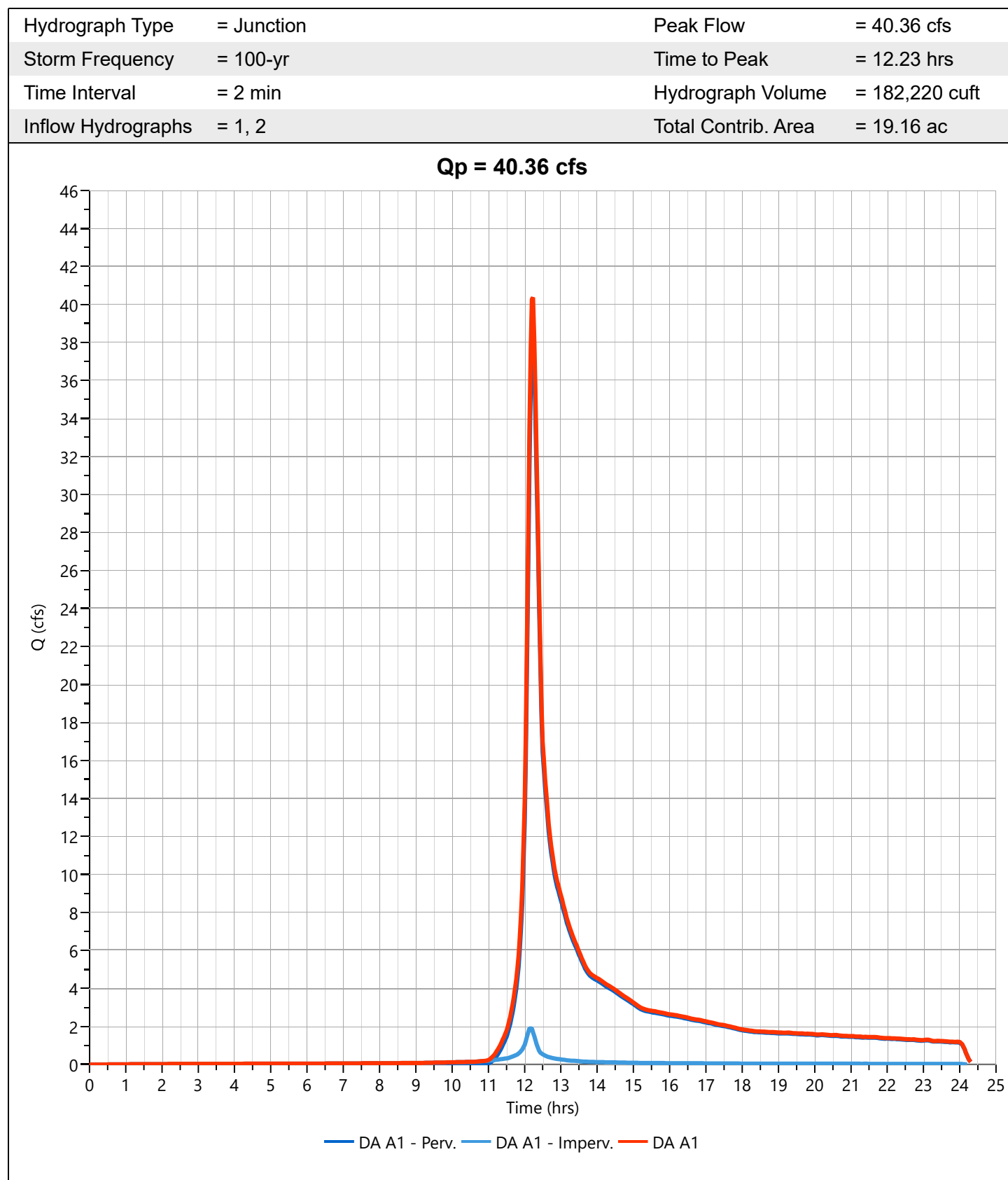
Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1

Hyd. No. 3



Hydrograph Report

Project Name:

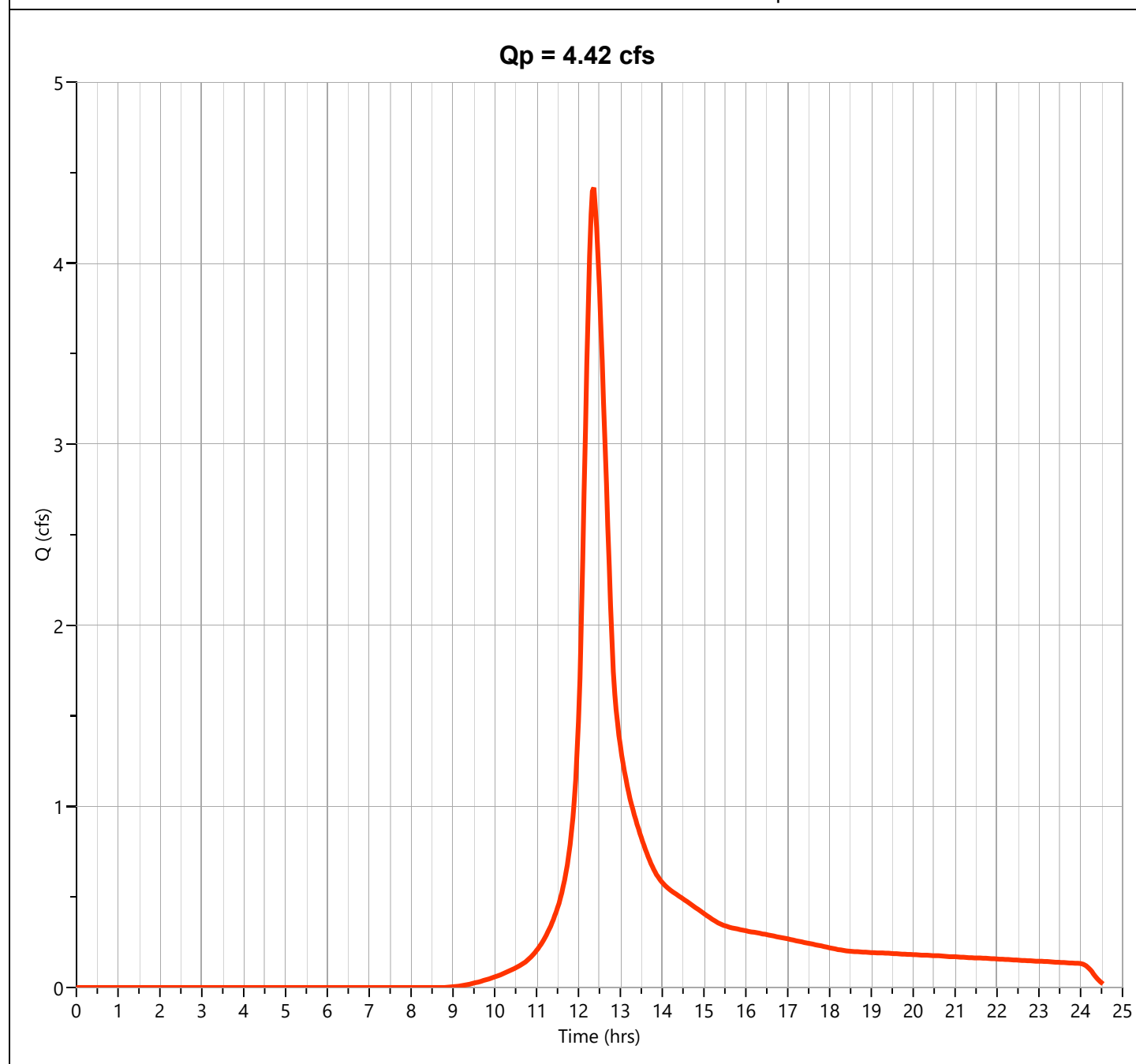
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A1 (un) - Perv.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.416 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 24,775 cuft
Drainage Area	= 1.63 ac	Curve Number	= 60
Tc Method	= User	Time of Conc. (Tc)	= 27.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

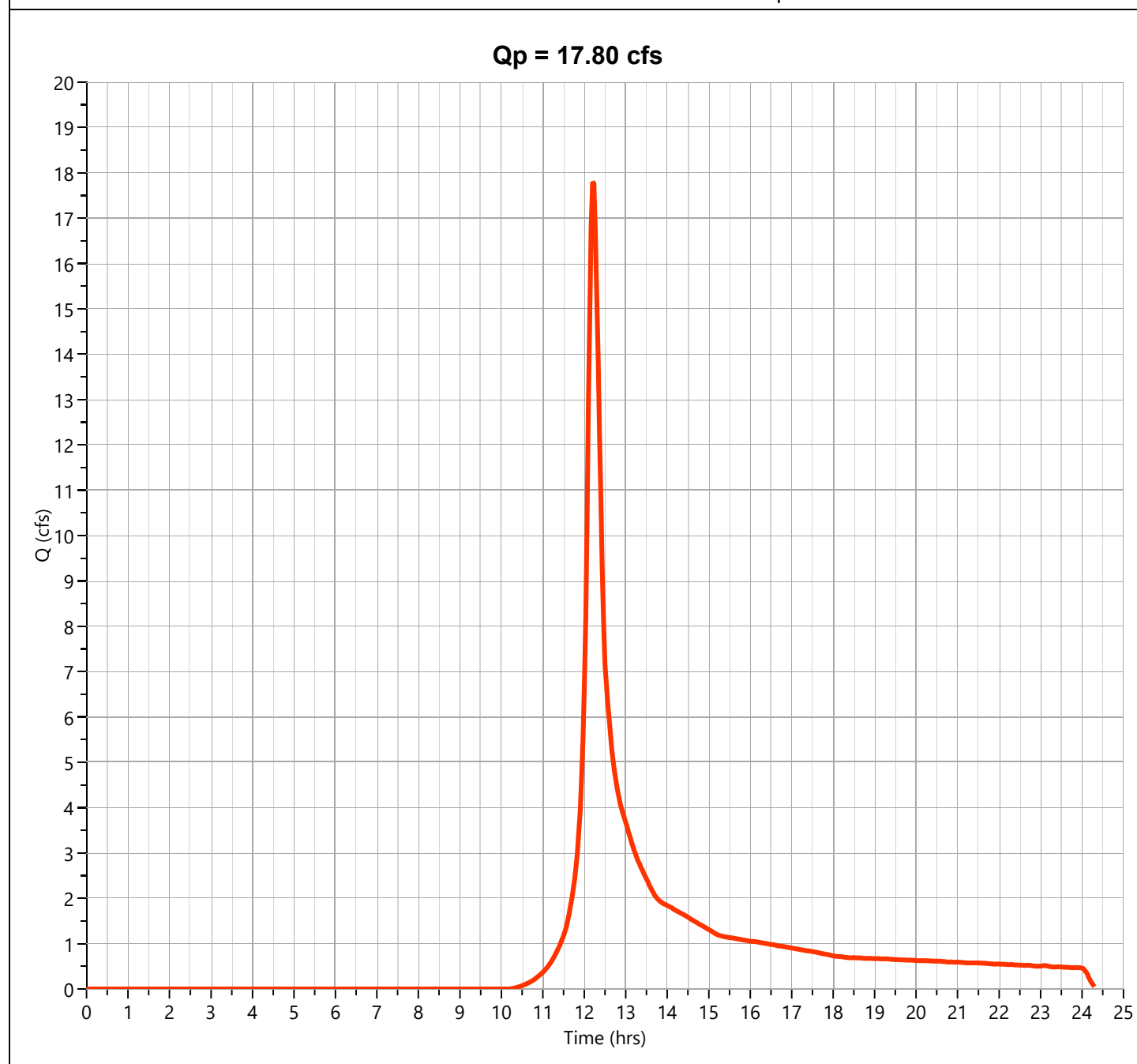
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A2 - Perv.

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 17.80 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 76,873 cuft
Drainage Area	= 6.79 ac	Curve Number	= 52
Tc Method	= User	Time of Conc. (Tc)	= 16.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

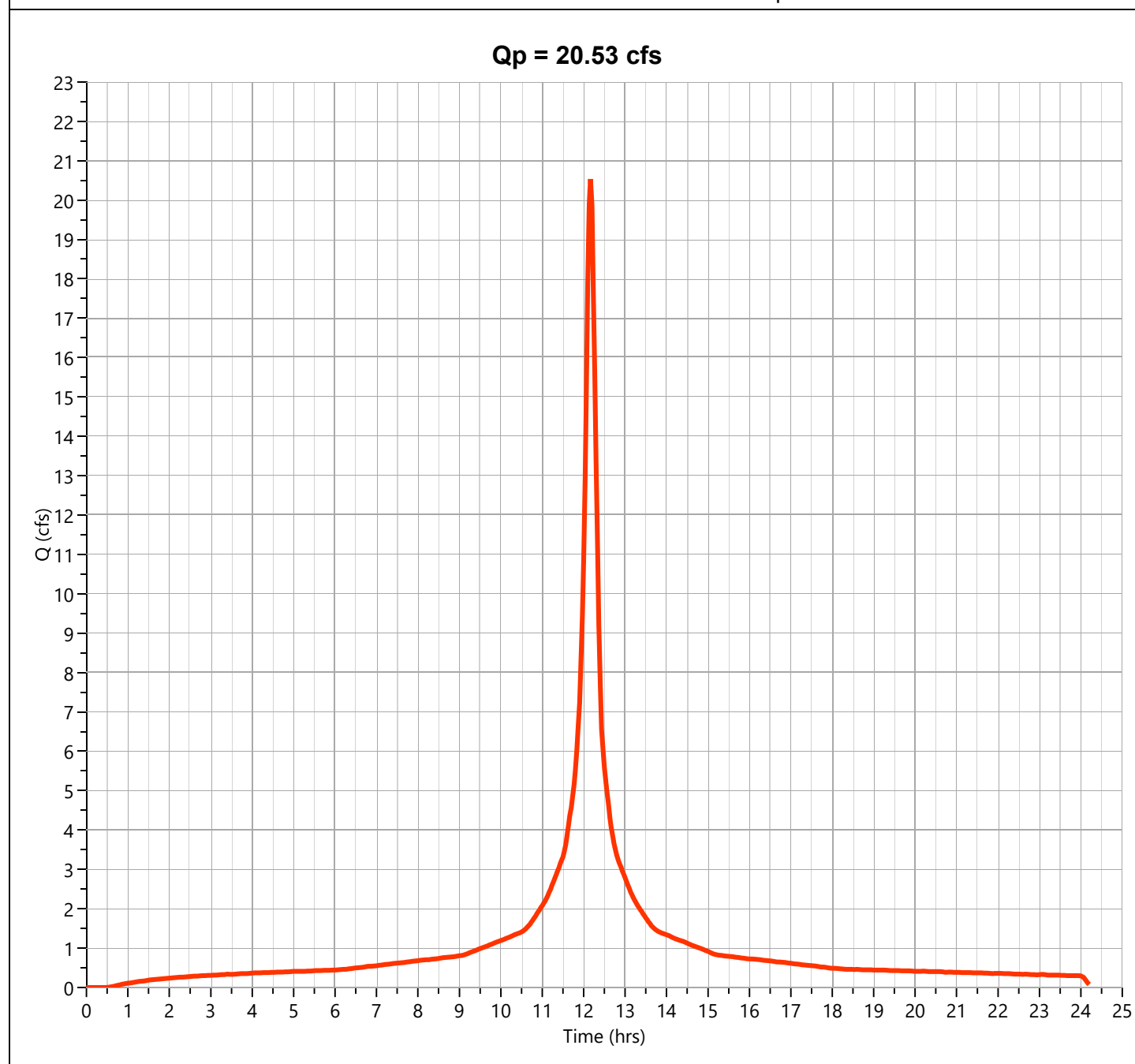
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A2 Imperv

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 20.53 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 93,964 cuft
Drainage Area	= 2.83 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

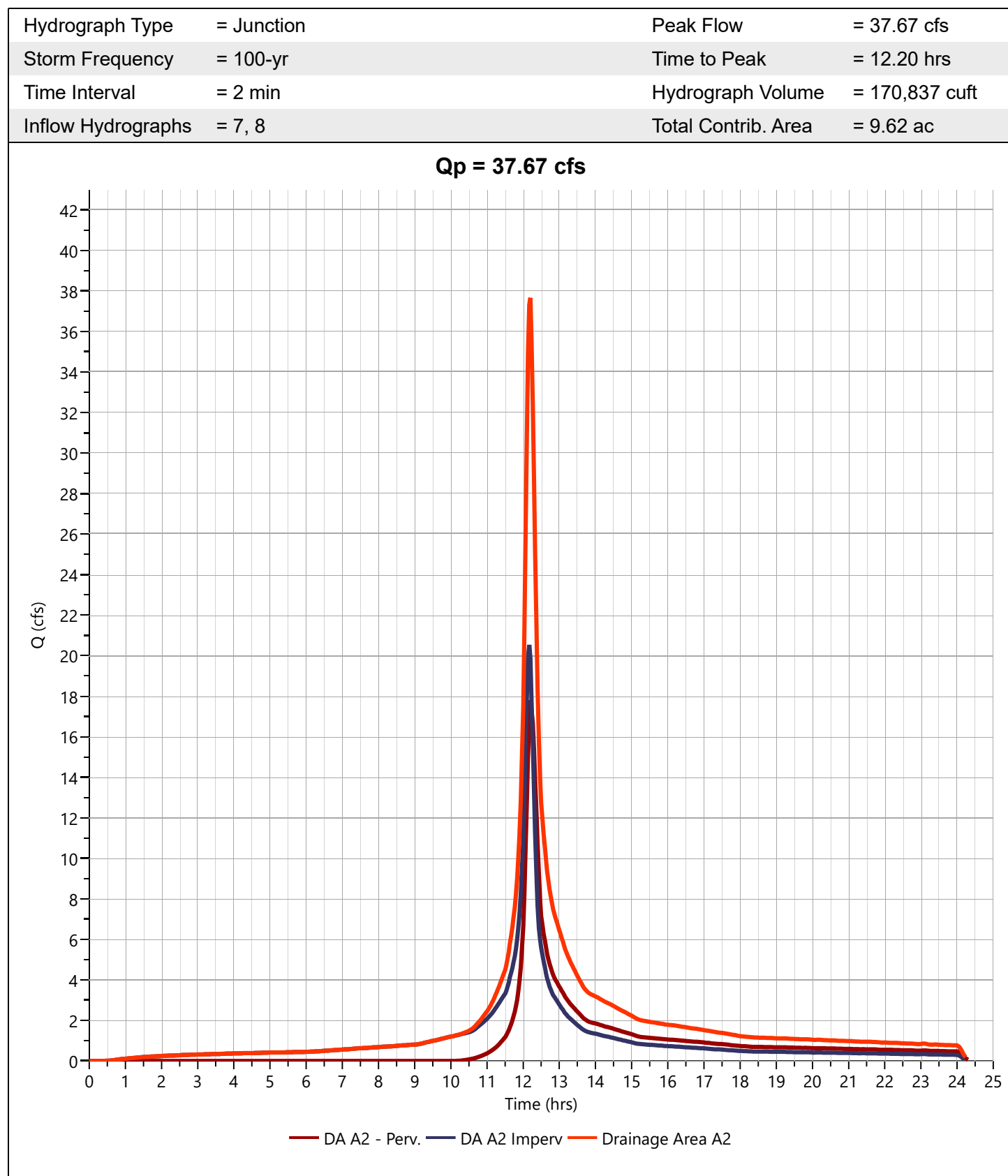
Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Pre Drainage Area A2

Hyd. No. 9



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

01-04-2021

Ex. Pond Outflow

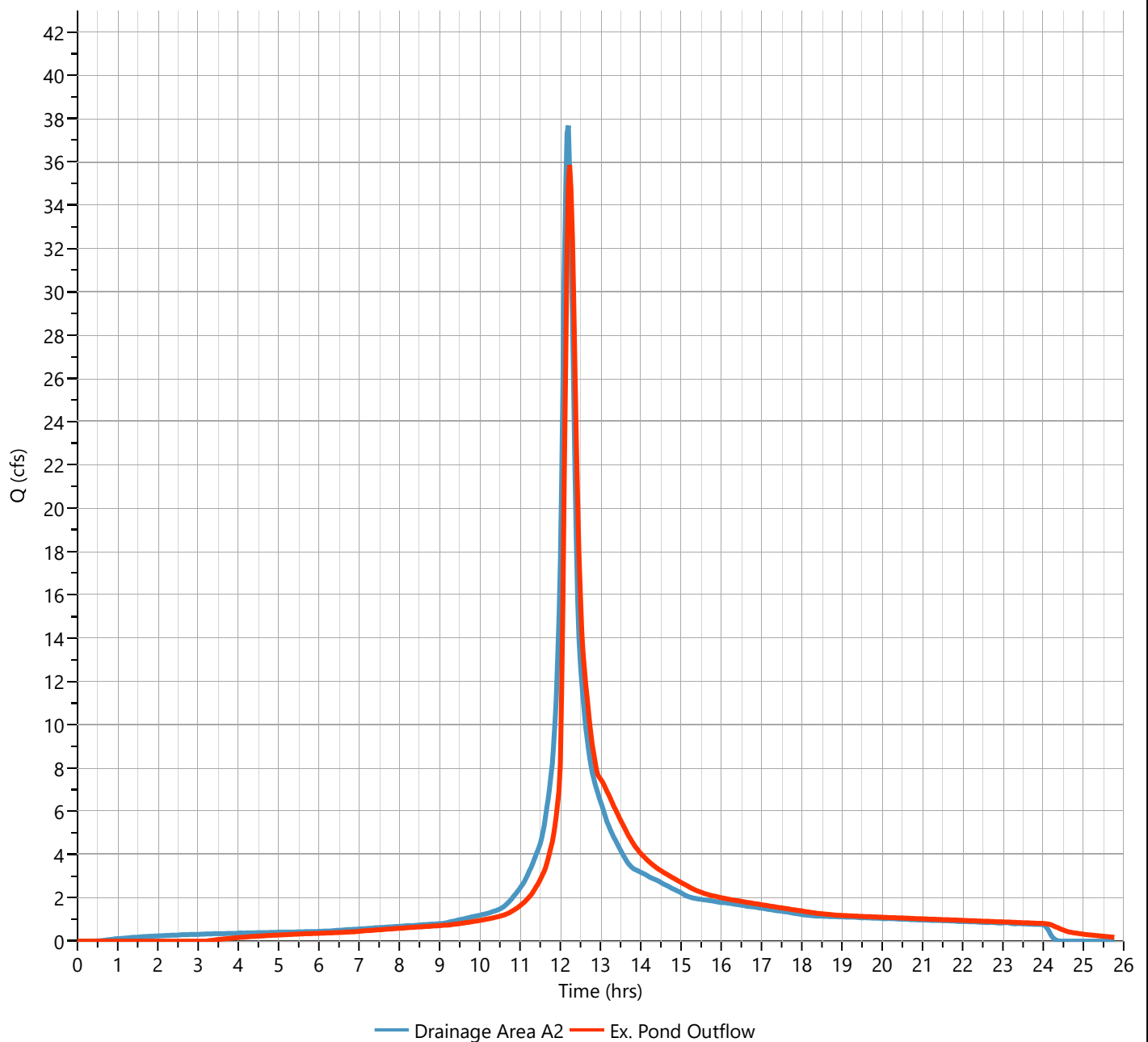
Hyd. No. 10

Hydrograph Type	= Pond Route	Peak Flow	= 35.85 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 168,862 cuft
Inflow Hydrograph	= 9 - Drainage Area A2	Max. Elevation	= 97.29 ft
Pond Name	= Existing Pond	Max. Storage	= 44,412 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 37 min

Qp = 35.85 cfs



Hydrograph Report

Project Name:

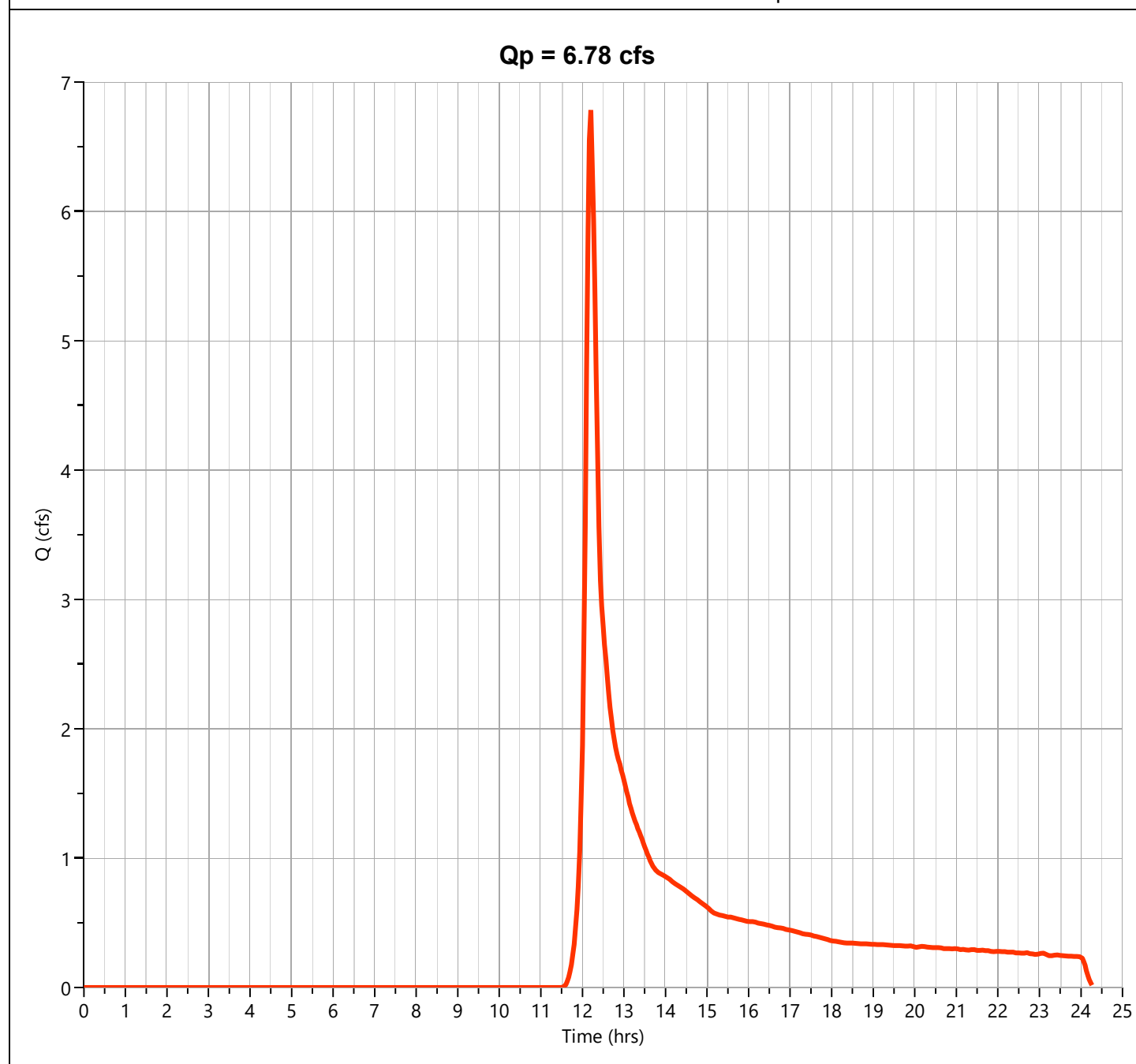
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A3 (un)

Hyd. No. 12

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.782 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 31,090 cuft
Drainage Area	= 4.41 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

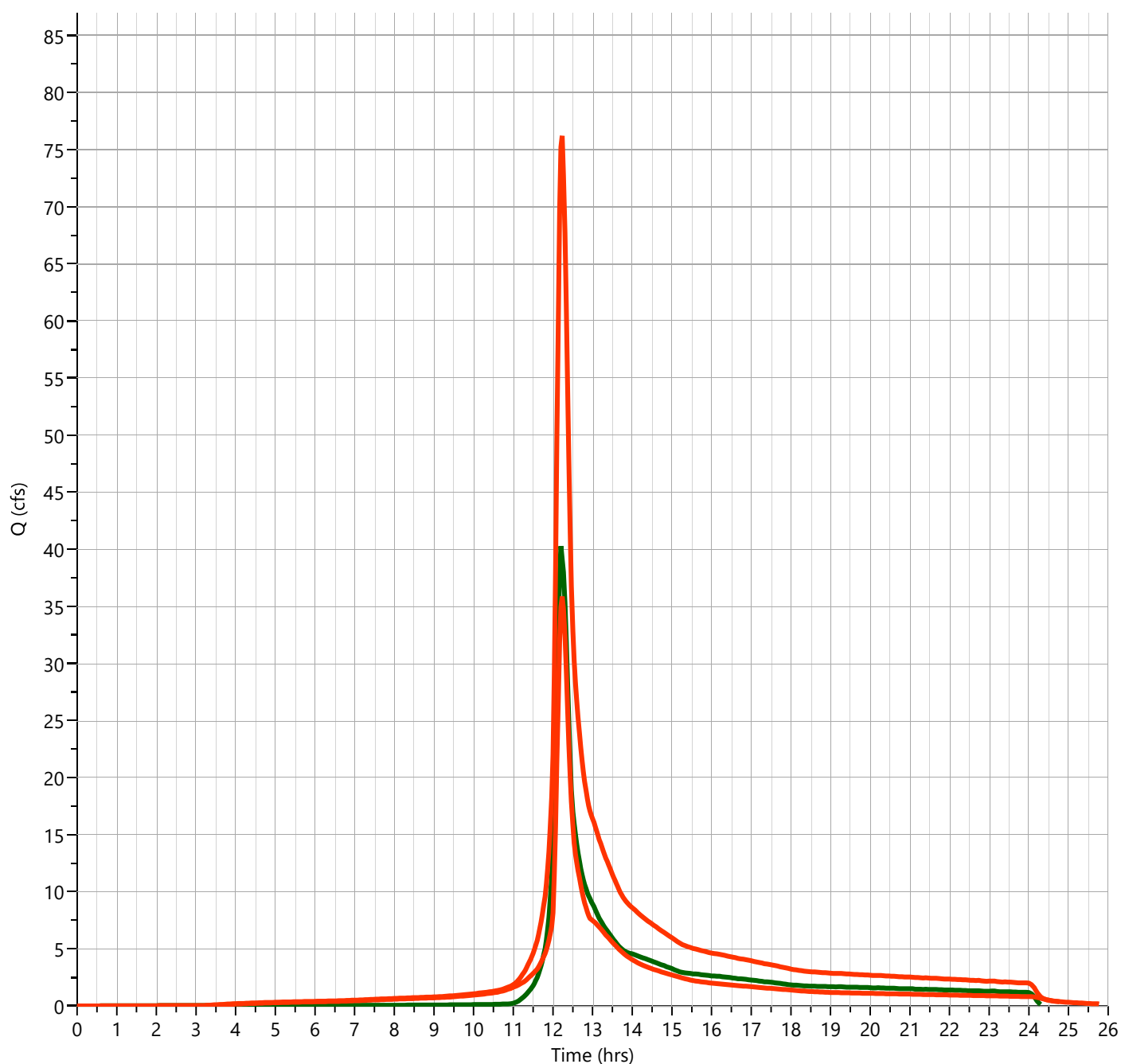
01-04-2021

Pre DA A Disturbed

Hyd. No. 14

Hydrograph Type	= Junction	Peak Flow	= 76.21 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 351,082 cuft
Inflow Hydrographs	= 3, 10	Total Contrib. Area	= 19.16 ac

Qp = 76.21 cfs



— DA A1 — Ex. Pond Outflow — DA A Disturbed

Hydrograph Report

Project Name:

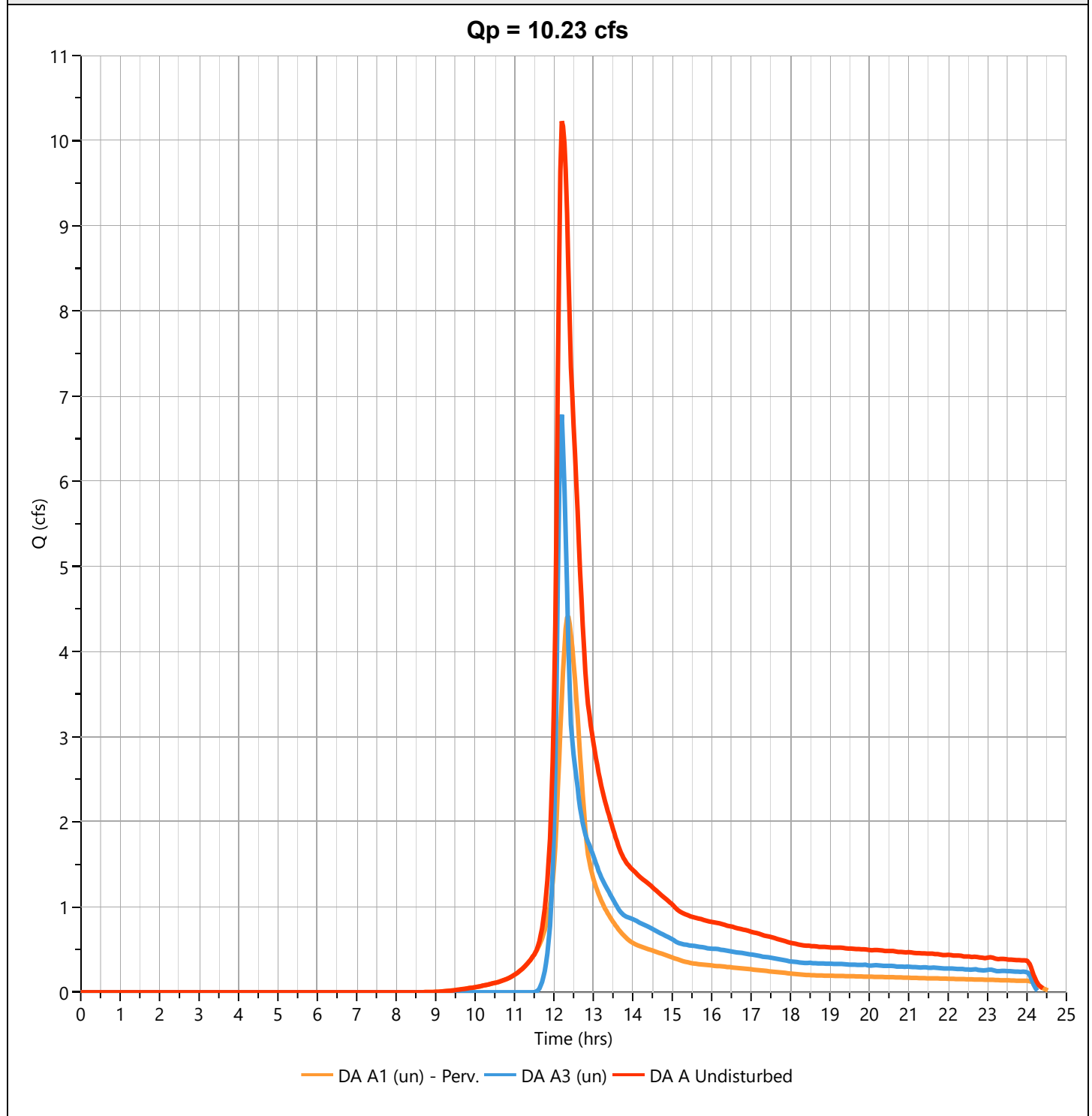
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA A Undisturbed

Hyd. No. 15

Hydrograph Type	= Junction	Peak Flow	= 10.23 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 55,865 cuft
Inflow Hydrographs	= 5, 12	Total Contrib. Area	= 6.04 ac



Hydrograph Report

Project Name:

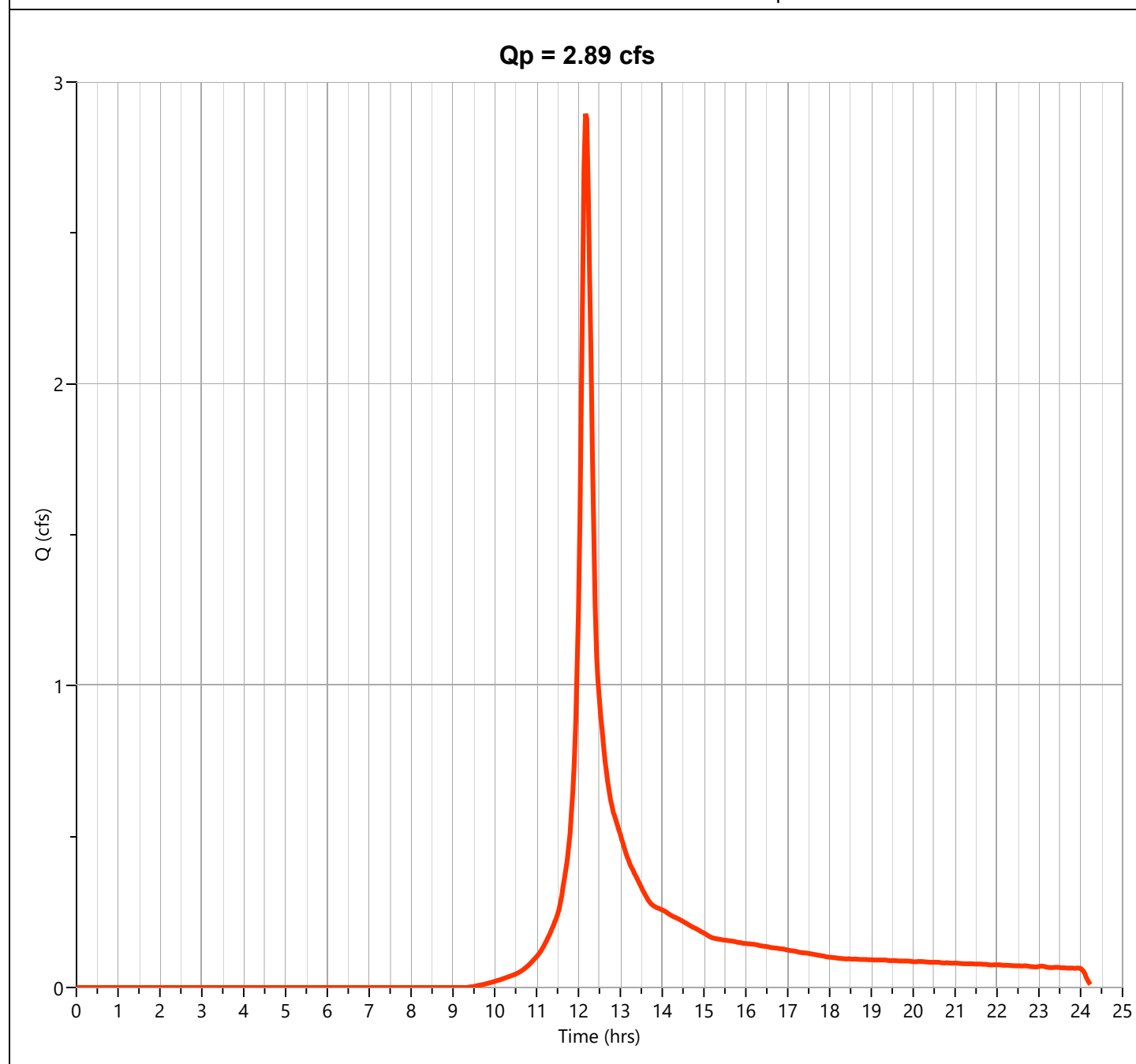
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA B - Perv.

Hyd. No. 17

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.895 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 11,425 cuft
Drainage Area	= 0.8 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

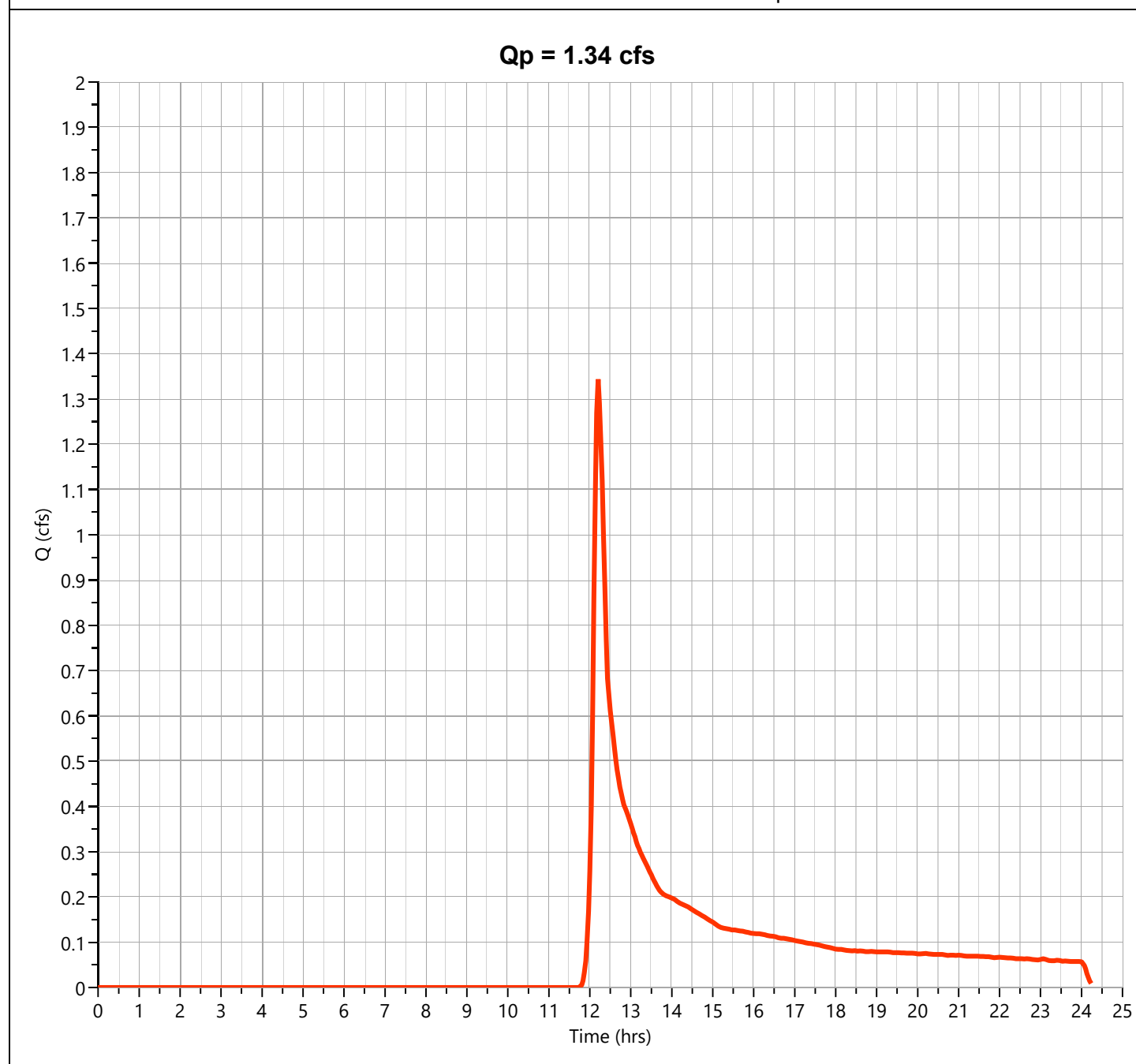
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA C - Perv.

Hyd. No. 19

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.343 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 6,813 cuft
Drainage Area	= 1.18 ac	Curve Number	= 38
Tc Method	= User	Time of Conc. (Tc)	= 11.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

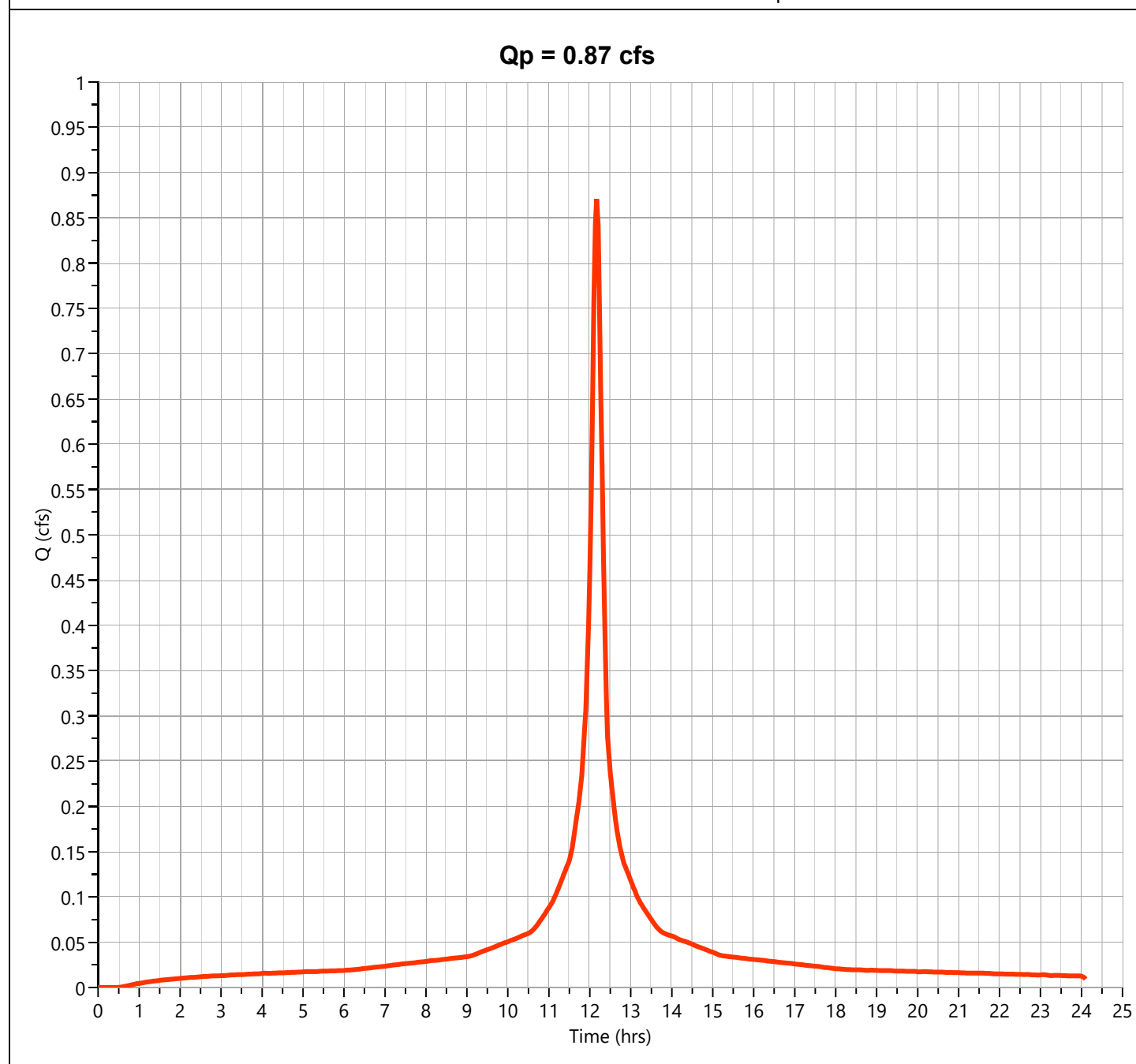
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA C - Imperv.

Hyd. No. 20

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.871 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 3,984 cuft
Drainage Area	= 0.12 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

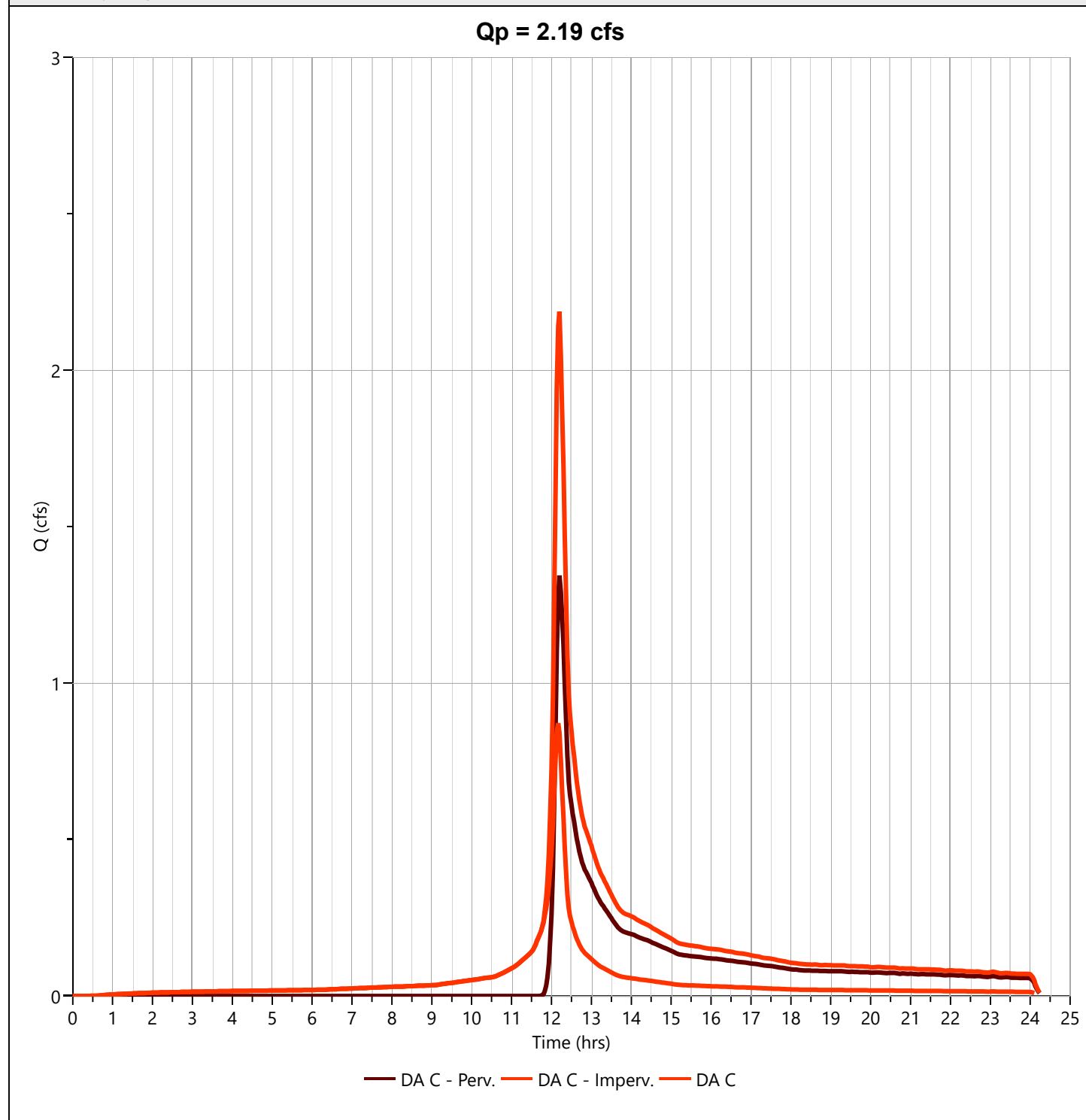
Hydrology Studio v 3.0.0.16

01-04-2021

Pre DA C

Hyd. No. 21

Hydrograph Type	= Junction	Peak Flow	= 2.186 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 10,798 cuft
Inflow Hydrographs	= 19, 20	Total Contrib. Area	= 1.3 ac



APPENDIX B

Post-Development Quantity Calculations

Proposed Curve Number Calculations

Drainage Area	Area (ac)	HSG A		HSG B		HSG D		Weighted Pervious CN	Total Pervious Area (ac)	Impervious Area (ac)
		Grass Area (ac)	Wooded Area (ac)	Grass Area (ac)	Wooded Area (ac)	Grass Area (ac)	Wooded Area (ac)			
		CN = 39	CN = 30	CN = 61	CN = 55	CN = 80	CN = 77			CN = 98
A1a	3.88	0.19	0.00	1.01	0.06	0.00	0.00	57	1.25	2.63
A1b	3.64	1.04	0.00	0.26	0.00	0.16	0.00	47	1.46	2.18
A1a -Undisturbed	1.29	0.00	0.00	0.72	0.58	0.00	0.00	58	1.29	0.00
A1b -Undisturbed	0.33	0.01	0.00	0.19	0.01	0.11	0.01	67	0.33	0.00
A2	5.21	0.72	0.00	0.14	0.00	0.00	0.00	43	0.86	4.35
A3 - Undisturbed	4.41	3.24	0.72	0.00	0.00	0.06	0.40	41	4.41	0.00
A4a	7.85	0.83	0.00	1.49	1.02	0.00	0.00	54	3.34	4.51
A4b	3.60	1.50	0.00	0.00	0.00	0.00	0.00	39	1.50	2.10
A5	1.00	0.81	0.00	0.00	0.00	0.00	0.00	39	0.81	0.19
A6	2.23	0.84	0.00	0.00	0.00	0.00	0.00	39	0.84	1.39
A7	1.90	1.61	0.00	0.00	0.00	0.29	0.00	45	1.90	0.00
B	0.80	0.00	0.00	0.23	0.57	0.00	0.00	57	0.80	0.00
C	0.78	0.72	0.00	0.00	0.00	0.00	0.00	39	0.72	0.06

PROPOSED DRAINAGE AREA A1a - PERVIOUS

SHEET FLOW			
$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$		n = Manning's roughness coefficient L = flow length P ₂ = 2-year, 24 hour rainfall (in.) s = slope of hydraulic grade line (ft/ft)	
SHALLOW CONCENTRATED FLOW			
$T_c = \frac{L}{3600V}$		L = flow length (ft) V = flow velocities (from table or eqn.) V (unpaved) = 16.135s ^{0.5} V (paved) = 20.3282s ^{0.5}	
CHANNEL FLOW			
$T_c = \frac{L}{3600V}$		L = flow length (ft) V = flow velocity from Manning's eqn. (ft/sec)	

SHEET FLOW			
n =	0.40		
L =	59 ft		
P2 =	3.44 in		
delta elevation =	5.4 ft		
s =	0.092 ft/ft		
Tc =	0.123 hr	=	7.4 min

SHEET FLOW			
n =	0.15		
L =	41 ft		
P2 =	3.44 in		
delta elevation =	7.3 ft		
s =	0.178 ft/ft		
Tc =	0.032 hr	=	1.9 min

SHALLOW CONCENTRATED FLOW			
L =	120 ft		
delta elevation =	7.3 ft		
s =	0.061 ft/ft		
V (unpaved) =	3.98 ft/s	(eqn.)	
Tc =	0.008 hr	=	0.5 min

SHALLOW CONCENTRATED FLOW			
L =	52 ft		
delta elevation =	0.5 ft		
s =	0.010 ft/ft		
V (paved) =	2.01 ft/s	(eqn.)	
Tc =	0.007 hr	=	0.4 min

PIPE FLOW			
V =	2.00 ft/s		
L =	998 ft		
Tc =	0.139 hr	=	8.3 min

TOTAL	19 min
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PROPOSED DRAINAGE AREA A1a - IMPERVIOUS

SHEET FLOW	
$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}s^{0.4}}$	n = Manning's roughness coefficient L = flow length P₂ = 2-year, 24 hour rainfall (in.) s = slope of hydraulic grade line (ft/ft)
SHALLOW CONCENTRATED FLOW	
$T_c = \frac{L}{3600V}$	L = flow length (ft) V = flow velocities (from table or eqn.) V (unpaved) = $16.135s^{0.5}$ V(paved) = $20.3282s^{0.5}$
CHANNEL FLOW	
$T_c = \frac{L}{3600V}$	L = flow length (ft) V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW	
n = 0.01 L = 100 ft P₂ = 3.44 in delta elevation = 1.080 ft s = 0.011 ft/ft	T_c = 0.023 hr = 1.4 min
SHALLOW CONCENTRATED FLOW	
L = 24 ft delta elevation = 0.5 ft s = 0.021 ft/ft V (unpaved) = 2.33 ft/s (eqn.)	T_c = 0.003 hr = 0.2 min
PIPE FLOW	
V = 2.00 ft/s L = 998 ft	T_c = 0.139 hr = 8.3 min

TOTAL	10 min
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PROPOSED DRAINAGE AREA A1b - PERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P_2 = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.15
 L = 45 ft
 P_2 = 3.44 in
 delta elevation = 1.9 ft
 s = 0.042 ft/ft

$$T_c = 0.062 \text{ hr} = 3.7 \text{ min}$$

SHEET FLOW

n = 0.01
 L = 55 ft
 P_2 = 3.44 in
 delta elevation = 1.3 ft
 s = 0.024 ft/ft

$$T_c = 0.010 \text{ hr} = 0.6 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 238 ft
 delta elevation = 8.3 ft
 s = 0.035 ft/ft

$$V \text{ (paved)} = 3.80 \text{ ft/s} \quad (\text{eqn.})$$

$$T_c = 0.017 \text{ hr} = 1.0 \text{ min}$$

PIPE FLOW

$$V = 2.00 \text{ ft/s}$$

$$L = 74 \text{ ft}$$

$$T_c = 0.010 \text{ hr} = 0.6 \text{ min}$$

TOTAL	6 min
	USE 10 min

PROPOSED DRAINAGE AREA A1b - IMPERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P_2 = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

V (unpaved) = $16.135s^{0.5}$
 V(paved) = $20.3282s^{0.5}$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.01
 L = 100 ft
 P_2 = 3.44 in
 delta elevation = 4.100 ft
 s = 0.041 ft/ft

$$T_c = 0.014 \text{ hr} = 0.8 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 331 ft
 delta elevation = 11.8 ft
 s = 0.036 ft/ft

V (paved) = 3.84 ft/s (eqn.)

$$T_c = 0.024 \text{ hr} = 1.4 \text{ min}$$

PIPE FLOW

V = 2.00 ft/s

L = 246 ft

$$T_c = 0.034 \text{ hr} = 2.1 \text{ min}$$

TOTAL	4 min
	USE 10 min

PROPOSED DRAINAGE AREA A1a UNDISTURBED - PERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient

L = flow length

P₂ = 2-year, 24 hour rainfall (in.)

s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)

V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)

V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.40
L = 14 ft
P₂ = 3.44 in
delta elevation = 1.3 ft
s = 0.093 ft/ft

T_c = 0.039 hr = 2.3 min

SHEET FLOW

n = 0.15
L = 86 ft
P₂ = 3.44 in
delta elevation = 4.5 ft
s = 0.052 ft/ft

T_c = 0.095 hr = 5.7 min

SHALLOW CONCENTRATED FLOW

L = 60 ft
delta elevation = 10.9 ft
s = 0.182 ft/ft

V (unpaved) = 6.88 ft/s (eqn.)

T_c = 0.002 hr = 0.1 min

CHANNEL / PIPE FLOW

V = 2.00 ft/s

L = 990 ft

T_c = 0.137 hr = 8.2 min

TOTAL 16 min

PROPOSED DRAINAGE AREA A1a UNDISTURBED - PVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

V (unpaved) = 16.135s^{0.5}
 V(paved) = 20.3282s^{0.5}

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.15
 L = 100 ft
 P₂ = 3.44 in
 delta elevation = 12 ft
 s = 0.120 ft/ft

T_c = 0.077 hr = 4.6 min

CHANNEL / PIPE FLOW

V = 2.00 ft/s

L = 217 ft

T_c = 0.030 hr = 1.8 min

SHALLOW CONCENTRATED FLOW

L = 75 ft
 delta elevation = 4.3 ft
 s = 0.057 ft/ft

V (paved) = 4.86 ft/s (eqn.)

T_c = 0.004 hr = 0.3 min

CHANNEL / PIPE FLOW

V = 2.00 ft/s

L = 245 ft

T_c = 0.034 hr = 2.0 min

TOTAL 9 min

USE 10 min

PROPOSED DRAINAGE AREA A2 - PERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P_2 = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.15
 L = 12 ft
 P_2 = 3.44 in
 delta elevation = 0.7 ft
 s = 0.058 ft/ft

$$T_c = 0.019 \text{ hr} = 1.1 \text{ min}$$

SHEET FLOW

n = 0.01
 L = 88 ft
 P_2 = 3.44 in
 delta elevation = 3.1 ft
 s = 0.035 ft/ft

$$T_c = 0.013 \text{ hr} = 0.8 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 472 ft
 delta elevation = 13.5 ft
 s = 0.029 ft/ft

$$V \text{ (unpaved)} = 2.73 \text{ ft/s} \quad (\text{eqn.})$$

$$T_c = 0.048 \text{ hr} = 2.9 \text{ min}$$

PIPE FLOW

$$V = 2.00 \text{ ft/s}$$

$$L = 407 \text{ ft}$$

$$T_c = 0.057 \text{ hr} = 3.4 \text{ min}$$

TOTAL	8 min
	USE 10 min

PROPOSED DRAINAGE AREA A2 - IMPERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.01
 L = 100 ft
 P₂ = 3.44 in
 delta elevation = 3.470 ft
 s = 0.035 ft/ft

$$T_c = 0.014 \text{ hr} = 0.9 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 460 ft
 delta elevation = 13.2 ft
 s = 0.029 ft/ft

$$V \text{ (paved)} = 3.44 \text{ ft/s (eqn.)}$$

$$T_c = 0.037 \text{ hr} = 2.2 \text{ min}$$

PIPE FLOW

$$V = 2.00 \text{ ft/s}$$

$$L = 407 \text{ ft}$$

$$T_c = 0.057 \text{ hr} = 3.4 \text{ min}$$

TOTAL	6 min
	USE 10 min

PROPOSED DRAINAGE AREA A3 - PERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V (\text{unpaved}) = 16.135s^{0.5}$$

$$V (\text{paved}) = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.15
 L = 100 ft
 P₂ = 3.44 in
 delta elevation = 3.6 ft
 s = 0.036 ft/ft

$$T_c = 0.125 \text{ hr} = 7.5 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 286 ft
 delta elevation = 5.9 ft
 s = 0.021 ft/ft

$$V (\text{unpaved}) = 2.32 \text{ ft/s} \quad (\text{eqn.})$$

$$T_c = 0.034 \text{ hr} = 2.1 \text{ min}$$

TOTAL	10 min
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PROPOSED DRAINAGE AREA A4a - PERVIOUS

SHEET FLOW			
$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$		n = Manning's roughness coefficient L = flow length P ₂ = 2-year, 24 hour rainfall (in.) s = slope of hydraulic grade line (ft/ft)	
SHALLOW CONCENTRATED FLOW			
$T_c = \frac{L}{3600V}$		L = flow length (ft) V = flow velocities (from table or eqn.) V (unpaved) = 16.135s ^{0.5} V (paved) = 20.3282s ^{0.5}	
CHANNEL FLOW			
$T_c = \frac{L}{3600V}$		L = flow length (ft) V = flow velocity from Manning's eqn. (ft/sec)	

SHEET FLOW			
n =	0.40		
L =	54 ft		
P2 =	3.44 in		
delta elevation =	5 ft		
s =	0.093 ft/ft		
Tc =	0.114 hr	=	6.9 min

SHEET FLOW			
n =	0.15		
L =	46 ft		
P2 =	3.44 in		
delta elevation =	6.05 ft		
s =	0.132 ft/ft		
Tc =	0.040 hr	=	2.4 min

SHALLOW CONCENTRATED FLOW			
L =	162 ft		
delta elevation =	7.5 ft		
s =	0.046 ft/ft		
V (unpaved) =	3.47 ft/s	(eqn.)	
Tc =	0.013 hr	=	0.8 min

SHALLOW CONCENTRATED FLOW			
L =	93 ft		
delta elevation =	1.0 ft		
s =	0.010 ft/ft		
V (paved) =	2.08 ft/s	(eqn.)	
Tc =	0.012 hr	=	0.7 min

PIPE FLOW			
V =	2.00 ft/s		
L =	717 ft		
Tc =	0.100 hr	=	6.0 min

TOTAL	17 min
--------------	--------

PROPOSED DRAINAGE AREA A4a - IMPERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.01
 L = 88 ft
 P₂ = 3.44 in
 delta elevation = 0.250 ft
 s = 0.003 ft/ft

$$T_c = 0.036 \text{ hr} = 2.1 \text{ min}$$

PIPE FLOW

$$V = 2.00 \text{ ft/s}$$

$$L = 1187 \text{ ft}$$

$$T_c = 0.165 \text{ hr} = 9.9 \text{ min}$$

TOTAL	12 min
--------------	---------------

PROPOSED DRAINAGE AREA A4b - PERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P_2 = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.15
 L = 55 ft
 P_2 = 3.44 in
 delta elevation = 1.8 ft
 s = 0.033 ft/ft

$$T_c = 0.080 \text{ hr} = 4.8 \text{ min}$$

SHEET FLOW

n = 0.01
 L = 46 ft
 P_2 = 3.44 in
 delta elevation = 1 ft
 s = 0.022 ft/ft

$$T_c = 0.009 \text{ hr} = 0.6 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 365 ft
 delta elevation = 9.1 ft
 s = 0.025 ft/ft

$$V \text{ (paved)} = 3.20 \text{ ft/s} \quad (\text{eqn.})$$

$$T_c = 0.032 \text{ hr} = 1.9 \text{ min}$$

PIPE FLOW

$$V = 2.00 \text{ ft/s}$$

$$L = 42 \text{ ft}$$

$$T_c = 0.006 \text{ hr} = 0.4 \text{ min}$$

TOTAL	8 min
	USE 10 min

PROPOSED DRAINAGE AREA A4b - IMPERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5}s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

V (unpaved) = 16.135s^{0.5}
 V(paved) = 20.3282s^{0.5}

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.01
 L = 100 ft
 P₂ = 3.44 in
 delta elevation = 1.700 ft
 s = 0.017 ft/ft

$$T_c = 0.019 \text{ hr} = 1.2 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 358 ft
 delta elevation = 9.1 ft
 s = 0.025 ft/ft

V (paved) = 3.23 ft/s (eqn.)

$$T_c = 0.031 \text{ hr} = 1.8 \text{ min}$$

PIPE FLOW

V = 2.00 ft/s

L = 42 ft

$$T_c = 0.006 \text{ hr} = 0.4 \text{ min}$$

TOTAL	3 min
	USE 10 min

PROPOSED DRAINAGE AREA A5 - IMPERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.01
 L = 35 ft
 P₂ = 3.44 in
 delta elevation = 2.546 ft
 s = 0.073 ft/ft

$$T_c = 0.005 \text{ hr} = 0.3 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 174 ft
 delta elevation = 4.4 ft
 s = 0.025 ft/ft

$$V \text{ (unpaved)} = 2.55 \text{ ft/s (eqn.)}$$

$$T_c = 0.019 \text{ hr} = 1.1 \text{ min}$$

PIPE FLOW

V = 2.00 ft/s
 L = 46 ft

$$T_c = 0.006 \text{ hr} = 0.4 \text{ min}$$

TOTAL 2 min

USE 10 min

PROPOSED DRAINAGE AREA A6 - PERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P_2 = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.15
 L = 35 ft
 P_2 = 3.44 in
 delta elevation = 5 ft
 s = 0.143 ft/ft

$$T_c = 0.031 \text{ hr} = 1.9 \text{ min}$$

SHEET FLOW

n = 0.01
 L = 67 ft
 P_2 = 3.44 in
 delta elevation = 2 ft
 s = 0.030 ft/ft

$$T_c = 0.011 \text{ hr} = 0.7 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 253 ft
 delta elevation = 4.0 ft
 s = 0.016 ft/ft

$$V \text{ (unpaved)} = 2.03 \text{ ft/s (eqn.)}$$

$$T_c = 0.035 \text{ hr} = 2.1 \text{ min}$$

PIPE FLOW

$$V = 2.00 \text{ ft/s}$$

$$L = 28 \text{ ft}$$

$$T_c = 0.004 \text{ hr} = 0.2 \text{ min}$$

TOTAL	5 min
	USE 10 min

PROPOSED DRAINAGE AREA A6 - IMPERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P_2 = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V (\text{unpaved}) = 16.135s^{0.5}$$

$$V (\text{paved}) = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.01
 L = 100 ft
 P_2 = 3.44 in
 delta elevation = 5.100 ft
 s = 0.051 ft/ft

$$T_c = 0.012 \text{ hr} = 0.7 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 379 ft
 delta elevation = 12.0 ft
 s = 0.032 ft/ft

$$V (\text{unpaved}) = 2.87 \text{ ft/s} \quad (\text{eqn.})$$

$$T_c = 0.037 \text{ hr} = 2.2 \text{ min}$$

PIPE FLOW

$$V = 2.00 \text{ ft/s}$$

$$L = 28 \text{ ft}$$

$$T_c = 0.004 \text{ hr} = 0.2 \text{ min}$$

TOTAL	3 min
	USE 10 min

PROPOSED DRAINAGE AREA A7 - PERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.15
 L = 100 ft
 P₂ = 3.44 in
 delta elevation = 18.7 ft
 s = 0.187 ft/ft

$$T_c = 0.064 \text{ hr} = 3.9 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 291 ft
 delta elevation = 8.3 ft
 s = 0.029 ft/ft

$$V \text{ (unpaved)} = 2.72 \text{ ft/s (eqn.)}$$

$$T_c = 0.030 \text{ hr} = 1.8 \text{ min}$$

TOTAL	6 min
	USE 10 min

PROPOSED DRAINAGE AREA B - PERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.40
 L = 100 ft
 P₂ = 3.44 in
 delta elevation = 16.6 ft
 s = 0.166 ft/ft

$$T_c = 0.148 \text{ hr} = 8.9 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 119 ft
 delta elevation = 8.5 ft
 s = 0.072 ft/ft

$$V \text{ (unpaved)} = 4.32 \text{ ft/s (eqn.)}$$

$$T_c = 0.008 \text{ hr} = 0.5 \text{ min}$$

TOTAL 9 min

USE 10 min

PROPOSED DRAINAGE AREA C - PVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P_2 = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V (\text{unpaved}) = 16.135s^{0.5}$$

$$V (\text{paved}) = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.15
 L = 43 ft
 P_2 = 3.44 in
 delta elevation = 3.4 ft
 s = 0.079 ft/ft

$$T_c = 0.046 \text{ hr} = 2.8 \text{ min}$$

SHEET FLOW

n = 0.01
 L = 5 ft
 P_2 = 3.44 in
 delta elevation = 0.1 ft
 s = 0.020 ft/ft

$$T_c = 0.002 \text{ hr} = 0.1 \text{ min}$$

SHEET FLOW

n = 0.15
 L = 38 ft
 P_2 = 3.44 in
 delta elevation = 1 ft
 s = 0.026 ft/ft

$$T_c = 0.065 \text{ hr} = 3.9 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 1145 ft
 delta elevation = 29.0 ft
 s = 0.025 ft/ft

$$V (\text{paved}) = 3.24 \text{ ft/s} \quad (\text{eqn.})$$

$$T_c = 0.098 \text{ hr} = 5.9 \text{ min}$$

TOTAL	13 min
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PROPOSED DRAINAGE AREA C - IMPERVIOUS

SHEET FLOW

$$T_c = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}}$$

n = Manning's roughness coefficient
 L = flow length
 P₂ = 2-year, 24 hour rainfall (in.)
 s = slope of hydraulic grade line (ft/ft)

SHALLOW CONCENTRATED FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocities (from table or eqn.)

$$V \text{ (unpaved)} = 16.135s^{0.5}$$

$$V \text{ (paved)} = 20.3282s^{0.5}$$

CHANNEL FLOW

$$T_c = \frac{L}{3600V}$$

L = flow length (ft)
 V = flow velocity from Manning's eqn. (ft/sec)

SHEET FLOW

n = 0.01
 L = 100 ft
 P₂ = 3.44 in
 delta elevation = 3.000 ft
 s = 0.030 ft/ft

$$T_c = 0.015 \text{ hr} = 0.9 \text{ min}$$

SHALLOW CONCENTRATED FLOW

L = 955 ft
 delta elevation = 25.7 ft
 s = 0.027 ft/ft

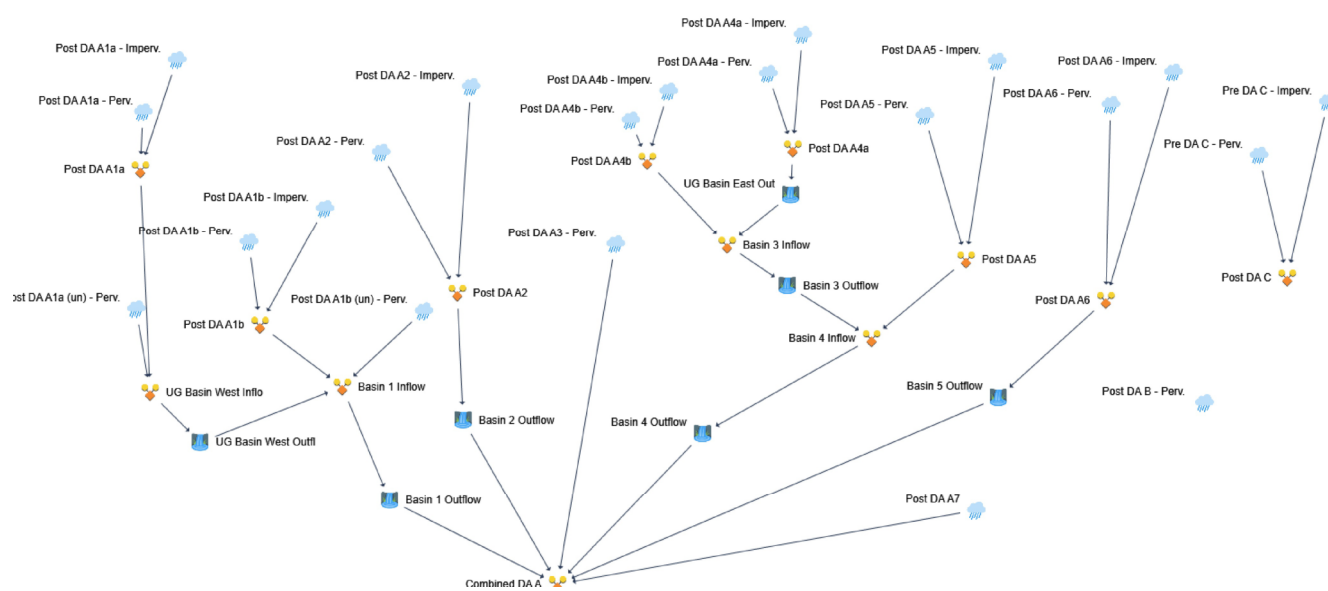
$$V \text{ (unpaved)} = 2.65 \text{ ft/s (eqn.)}$$

$$T_c = 0.100 \text{ hr} = 6.0 \text{ min}$$

TOTAL	7 min
	USE 10 min

Hydrology Studio v 3.0.0.16

12-30-2020



Hydrograph 2-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

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	Post DAA1a - Perv.	0.212	12.37	1,786	----		
2	NRCS Runoff	Post DAA1a - Imperv.	7.135	12.17	31,570	----		
3	Junction	Post DAA1a	7.243	12.17	33,356	1, 2		
5	NRCS Runoff	Post DAA1a (un) - Perv.	0.276	12.30	1,961	----		
7	Junction	UG Basin West Inflow	7.444	12.17	35,318	3, 5		
8	Pond Route	UG Basin West Outflow	4.578	12.33	35,318	7	101.47	3,549
10	NRCS Runoff	Post DAA1b - Perv.	0.023	13.30	615	----		
11	NRCS Runoff	Post DAA1b - Imperv.	5.914	12.17	26,169	----		
12	Junction	Post DAA1b	5.914	12.17	26,784	10, 11		
14	NRCS Runoff	Post DAA1b (un) - Perv.	0.231	12.20	1,009	----		
16	Junction	Basin 1 Inflow	10.11	12.20	63,111	8, 12, 14		
17	Pond Route	Basin 1 Outflow	0.485	17.03	62,596	16	97.41	43,169
19	NRCS Runoff	Post DAA2 - Perv.	0.004	16.87	143	----		
20	NRCS Runoff	Post DAA2 - Imperv.	11.80	12.17	52,217	----		
21	Junction	Post DAA2	11.80	12.17	52,360	19, 20		
22	Pond Route	Basin 2 Outflow	0.928	13.60	52,316	21	85.21	28,977
24	NRCS Runoff	Post DAA3 - Perv.	0.014	23.07	349	----		
26	NRCS Runoff	Post DAA4a - Perv.	0.310	12.47	3,560	----		
27	NRCS Runoff	Post DAA4a - Imperv.	12.24	12.17	54,138	----		
28	Junction	Post DAA4a	12.33	12.17	57,698	26, 27		
29	Pond Route	UG Basin East Out	10.62	12.23	57,697	28	101.36	3,340
31	NRCS Runoff	Post DAA4b - Perv.	0.002	23.93	34.2	----		
32	NRCS Runoff	Post DAA4b - Imperv.	5.697	12.17	25,208	----		
33	Junction	Post DAA4b	5.697	12.17	25,242	31, 32		
35	Junction	Basin 3 Inflow	15.91	12.20	82,940	29, 33		
36	Pond Route	Basin 3 Outflow	0.944	14.93	82,782	35	91.74	51,336

Hydrograph 2-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

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)
38	NRCS Runoff	Post DAA5 - Perv.	0.001	23.93	18.5	---		
39	NRCS Runoff	Post DAA5 - Imperv.	0.515	12.17	2,281	---		
40	Junction	Post DAA5	0.515	12.17	2,299	38, 39		
41	Junction	Basin 4 Inflow	1.217	12.20	85,081	36, 40		
42	Pond Route	Basin 4 Outflow	0.783	25.17	84,494	41	84.94	18,077
44	NRCS Runoff	Post DAA6 - Perv.	0.000	0.00	0.000	---		
45	NRCS Runoff	Post DAA6 - Imperv.	3.433	1.13	5,383	---		
46	Junction	Post DAA6	3.433	1.13	5,383	44, 45		
47	Pond Route	Basin 5 Outflow	0.326	1.87	5,359	46	73.40	4,365
49	NRCS Runoff	Post DAA7	0.016	14.47	533	---		
51	Junction	Combined DAA	2.411	14.97	216,967	17, 22, 24, 42, 47, 49		
53	NRCS Runoff	Post DA B - Perv.	0.162	12.27	1,179	---		
55	NRCS Runoff	Pre DA C - Perv.	0.001	23.93	16.4	---		
56	NRCS Runoff	Pre DA C - Imperv.	0.163	12.17	720	---		
57	Junction	Post DA C	0.163	12.17	737	55, 56		

Hydrograph Report

Project Name:

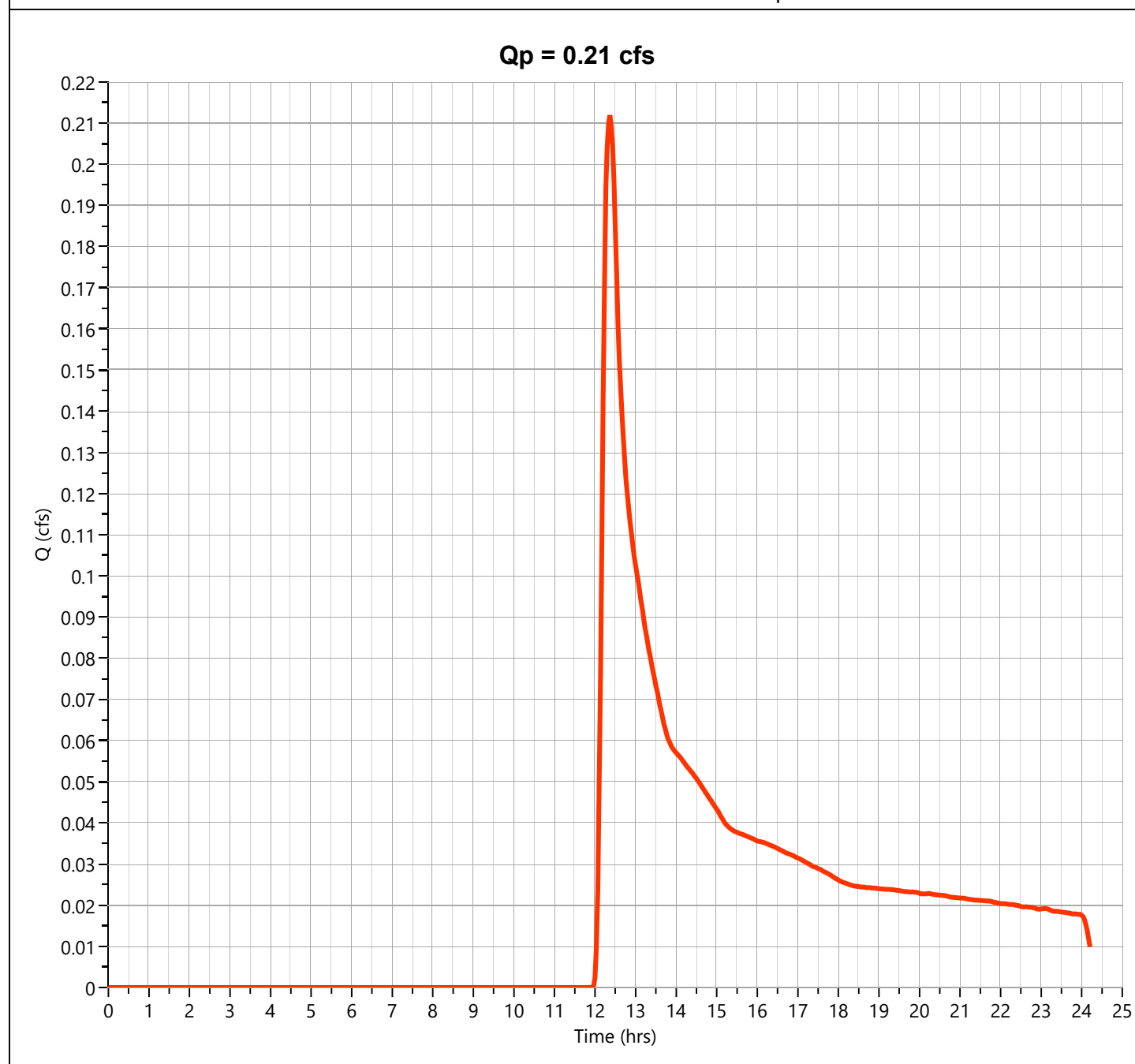
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a - Perv.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.212 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Runoff Volume	= 1,786 cuft
Drainage Area	= 1.25 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 19.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

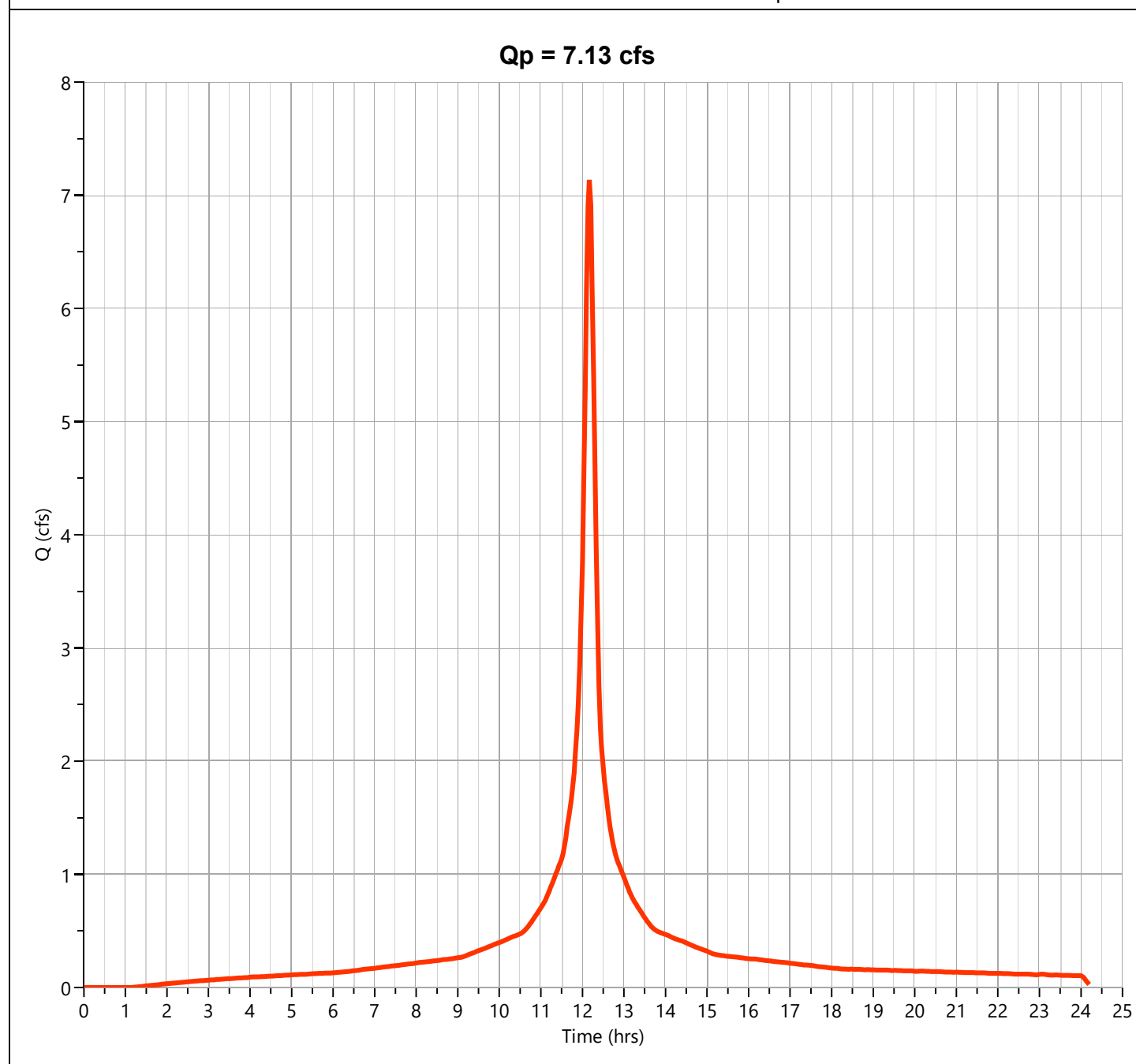
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a - Imperv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 7.135 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 31,570 cuft
Drainage Area	= 2.63 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

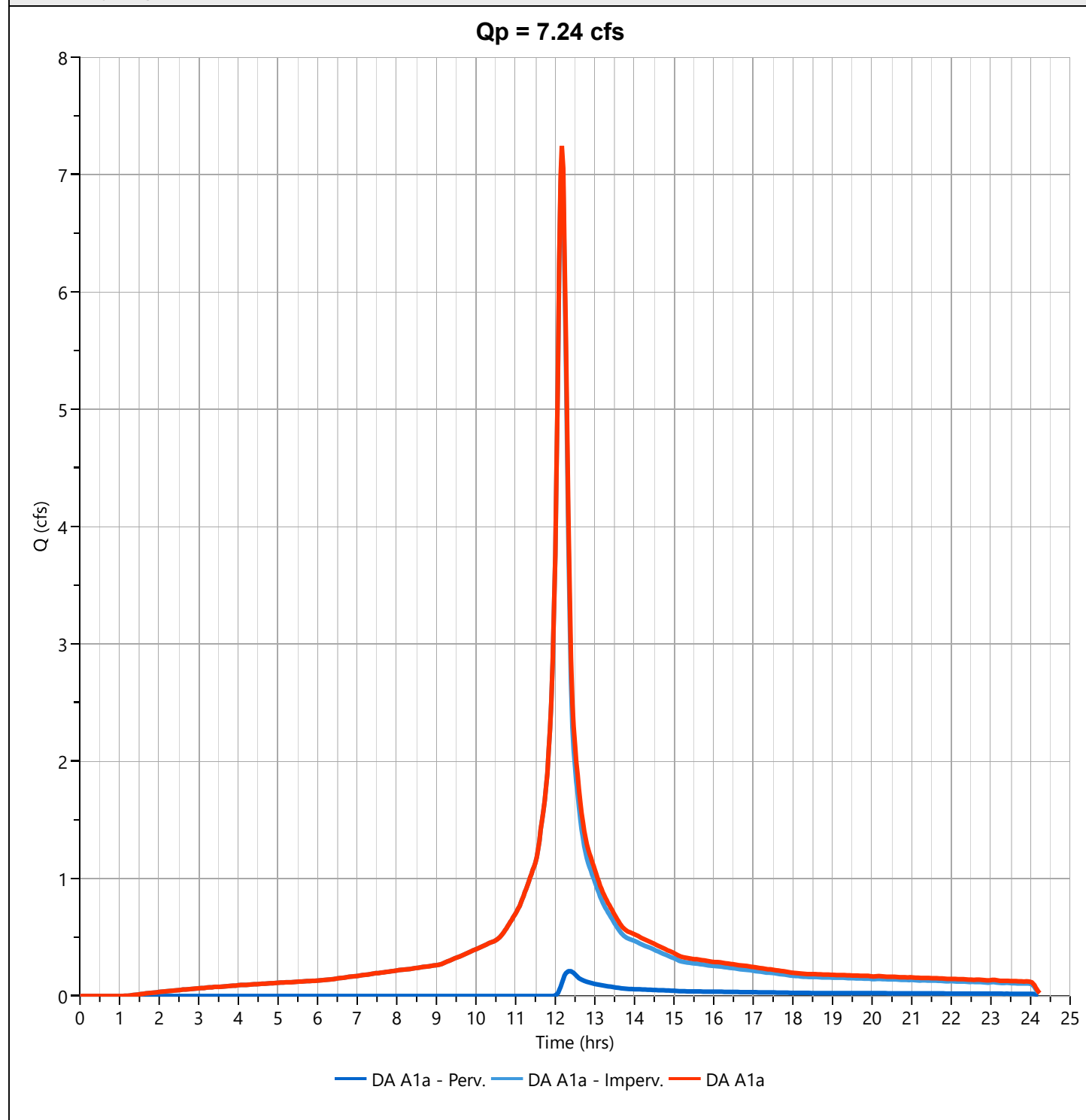
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 7.243 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 33,356 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 3.88 ac



Hydrograph Report

Project Name:

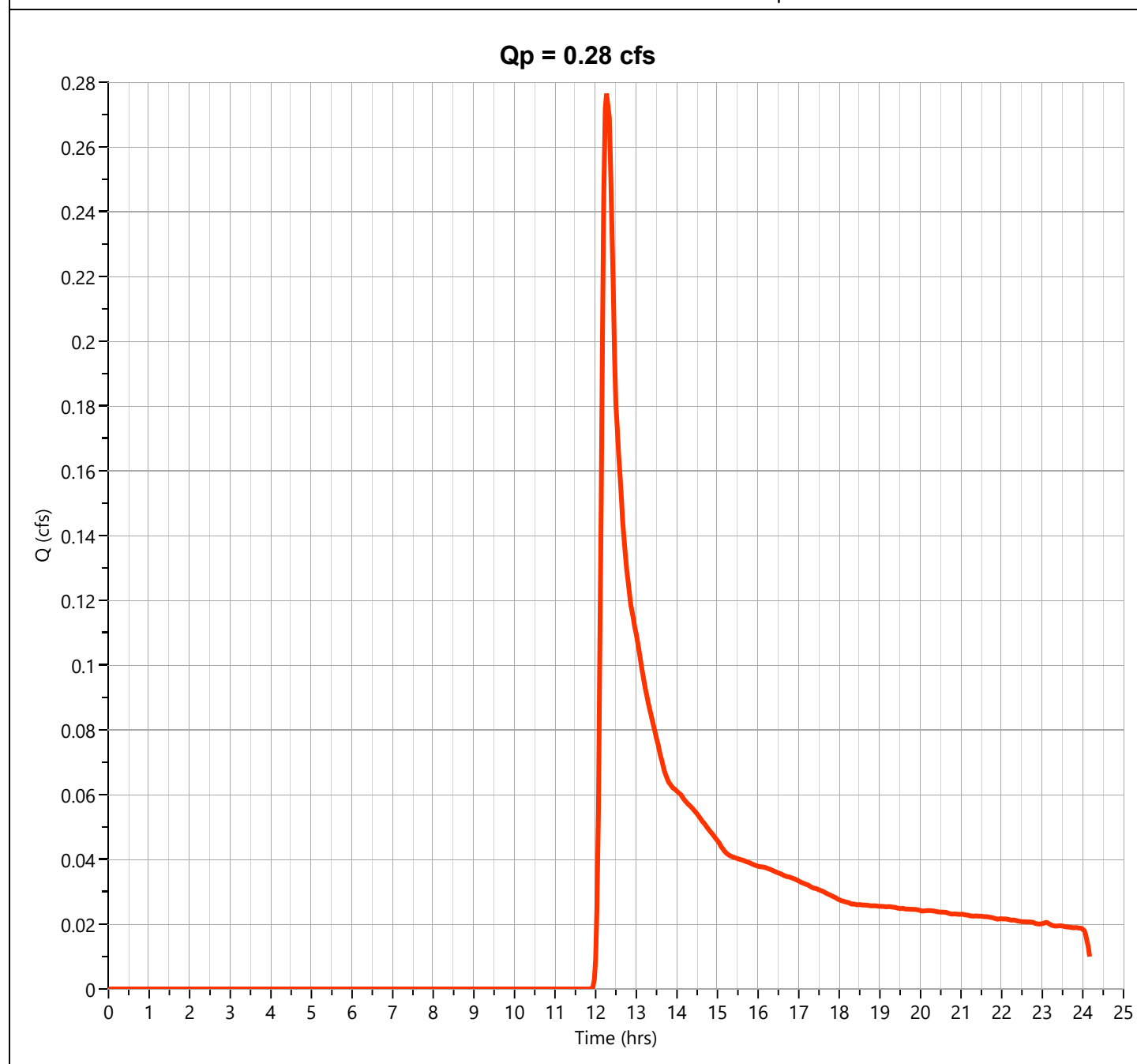
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a (un) - Perv.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.276 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 1,961 cuft
Drainage Area	= 1.29 ac	Curve Number	= 58
Tc Method	= User	Time of Conc. (Tc)	= 16.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

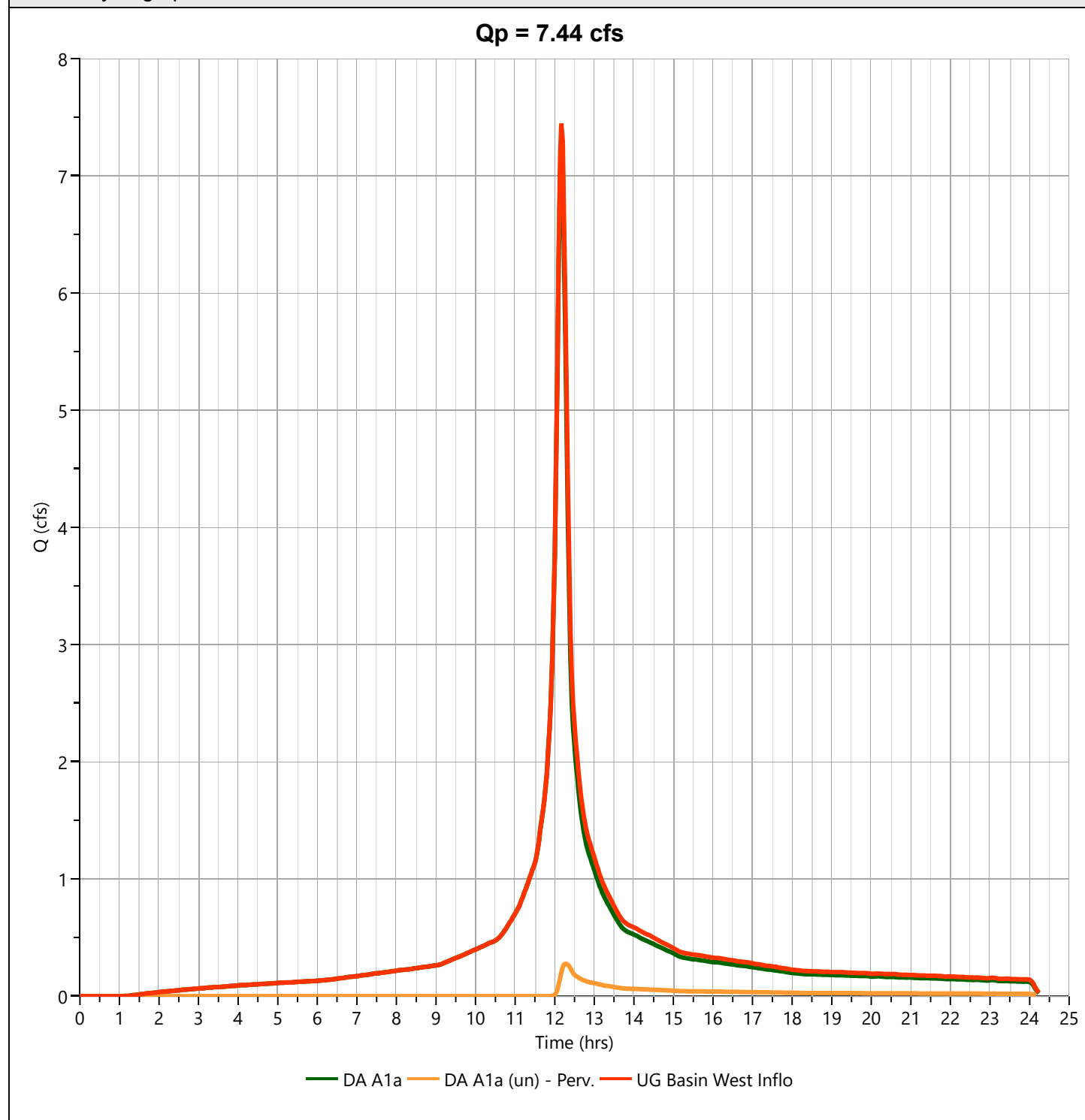
Hydrology Studio v 3.0.0.16

12-30-2020

UG Basin West Inflo

Hyd. No. 7

Hydrograph Type	= Junction	Peak Flow	= 7.444 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 35,318 cuft
Inflow Hydrographs	= 3, 5	Total Contrib. Area	= 5.17 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Basin West Outfl

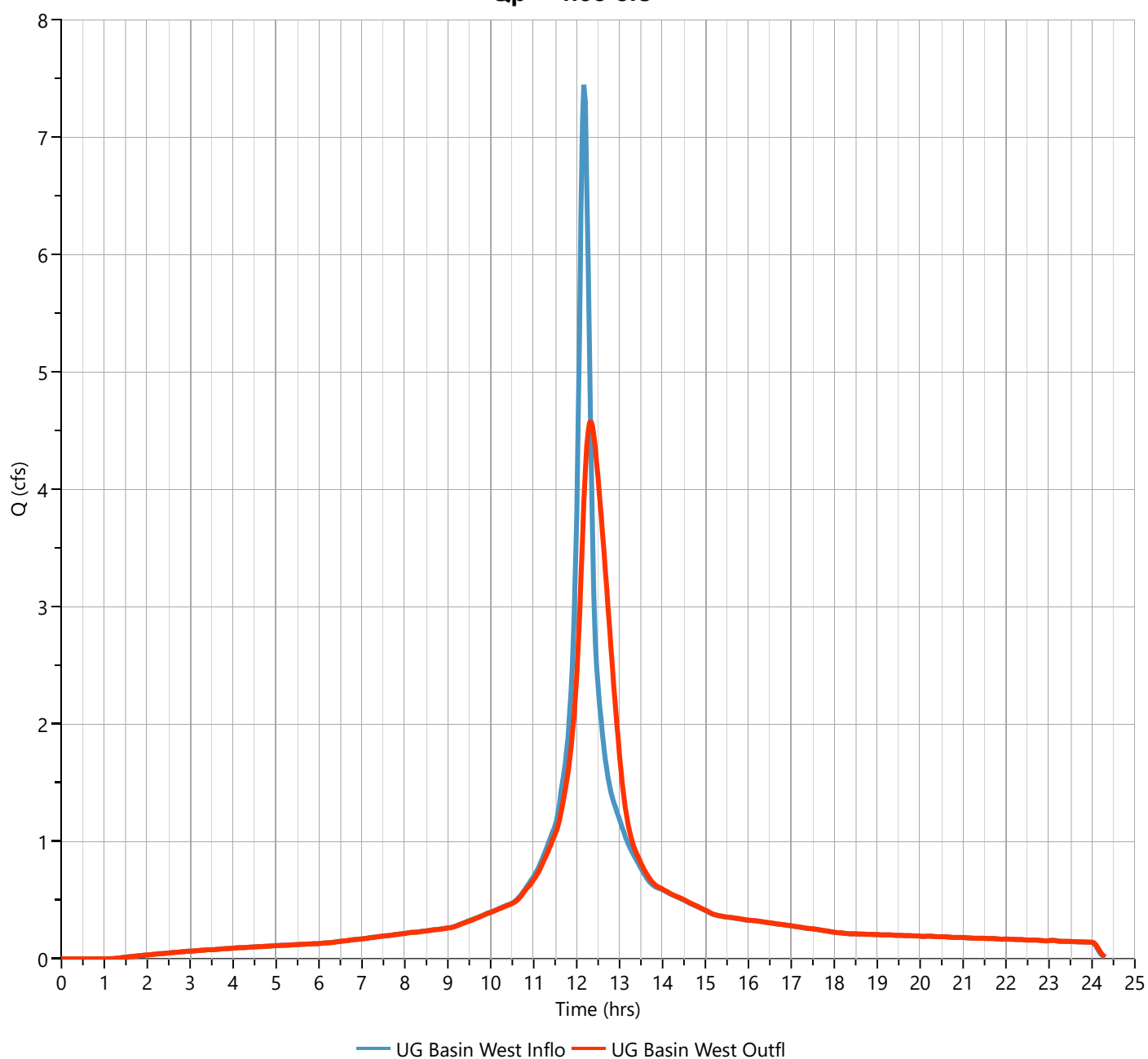
Hyd. No. 8

Hydrograph Type	= Pond Route	Peak Flow	= 4.578 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 35,318 cuft
Inflow Hydrograph	= 7 - UG Basin West Inflo	Max. Elevation	= 101.47 ft
Pond Name	= UG Recharge / Detention Basin West	Max. Storage	= 3,549 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 5 min

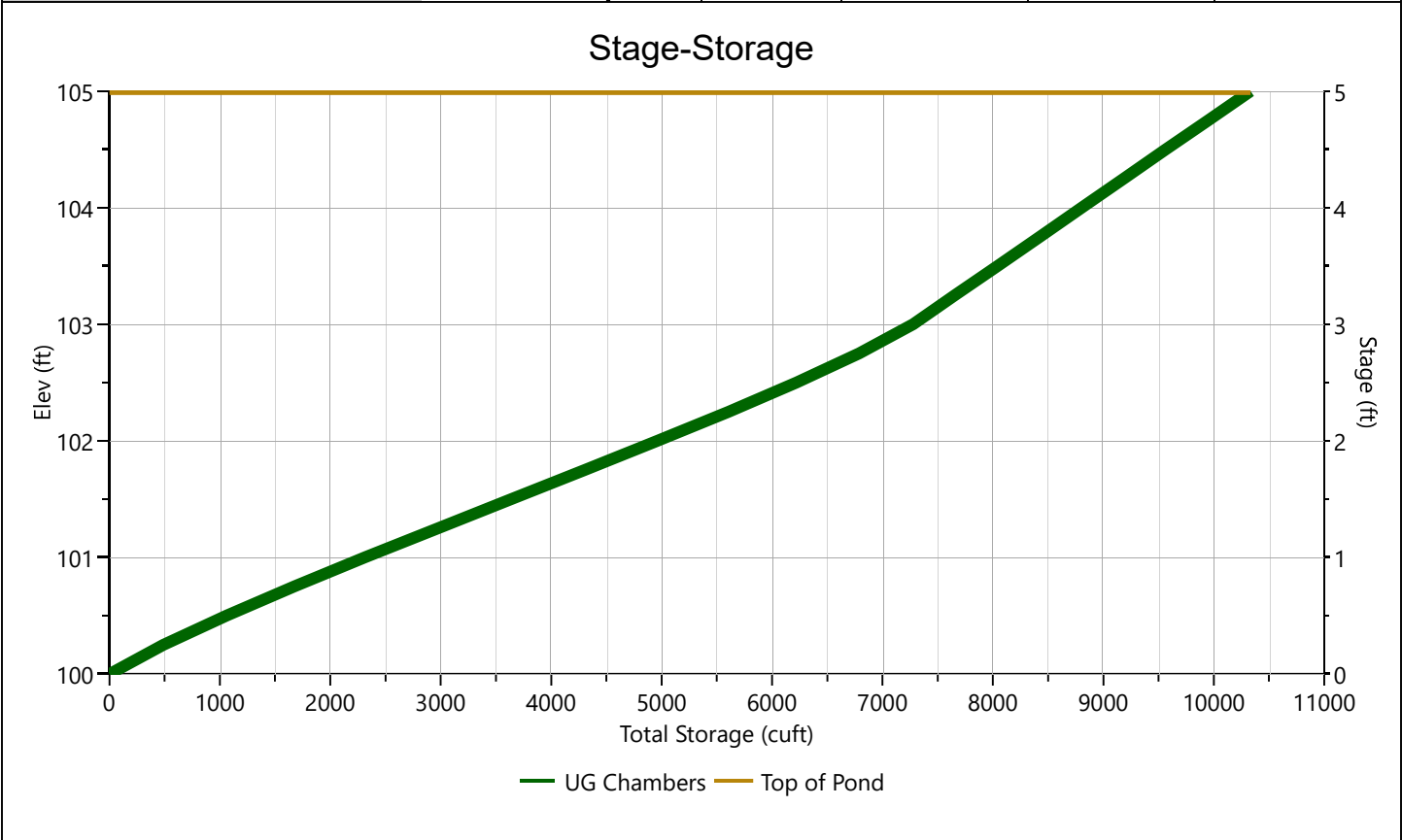
Qp = 4.58 cfs



UG Recharge / Detention Basin West

Stage-Storage

Underground Chambers		Stage / Storage Table				
Description	Input	Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
Invert Elev Down, ft	100.00	0.00	100.00	3,816	0.000	0.000
Chamber Rise, ft	3.00	0.25	100.25	3,816	489	489
Chamber Shape	Circular	0.50	100.50	3,816	570	1,059
Chamber Span, ft	3.00	0.75	100.75	3,816	614	1,673
Barrel Length, ft	200.00	1.00	101.00	3,816	641	2,314
No. Barrels	3	1.25	101.25	3,816	659	2,973
Barrel Slope, %	0.00	1.50	101.50	3,816	667	3,639
Headers, y/n	Yes	1.75	101.75	3,816	667	4,306
Stone Encasement, y/n	Yes	2.00	102.00	3,816	659	4,965
Encasement Bottom Elevation, ft	100.00	2.25	102.25	3,816	641	5,606
Encasement Width per Chamber, ft	6.00	2.50	102.50	3,816	614	6,219
Encasement Depth, ft	5.00	2.75	102.75	3,816	569	6,789
Encasement Voids, %	40.00	3.00	103.00	3,816	489	7,278
		3.25	103.25	3,816	382	7,660
		3.50	103.50	3,816	382	8,041
		3.75	103.75	3,816	382	8,423
		4.00	104.00	3,816	382	8,805
		4.25	104.25	3,816	382	9,186
		4.50	104.50	3,816	382	9,568
		4.75	104.75	3,816	382	9,950
		5.00	105.00	3,816	382	10,331



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

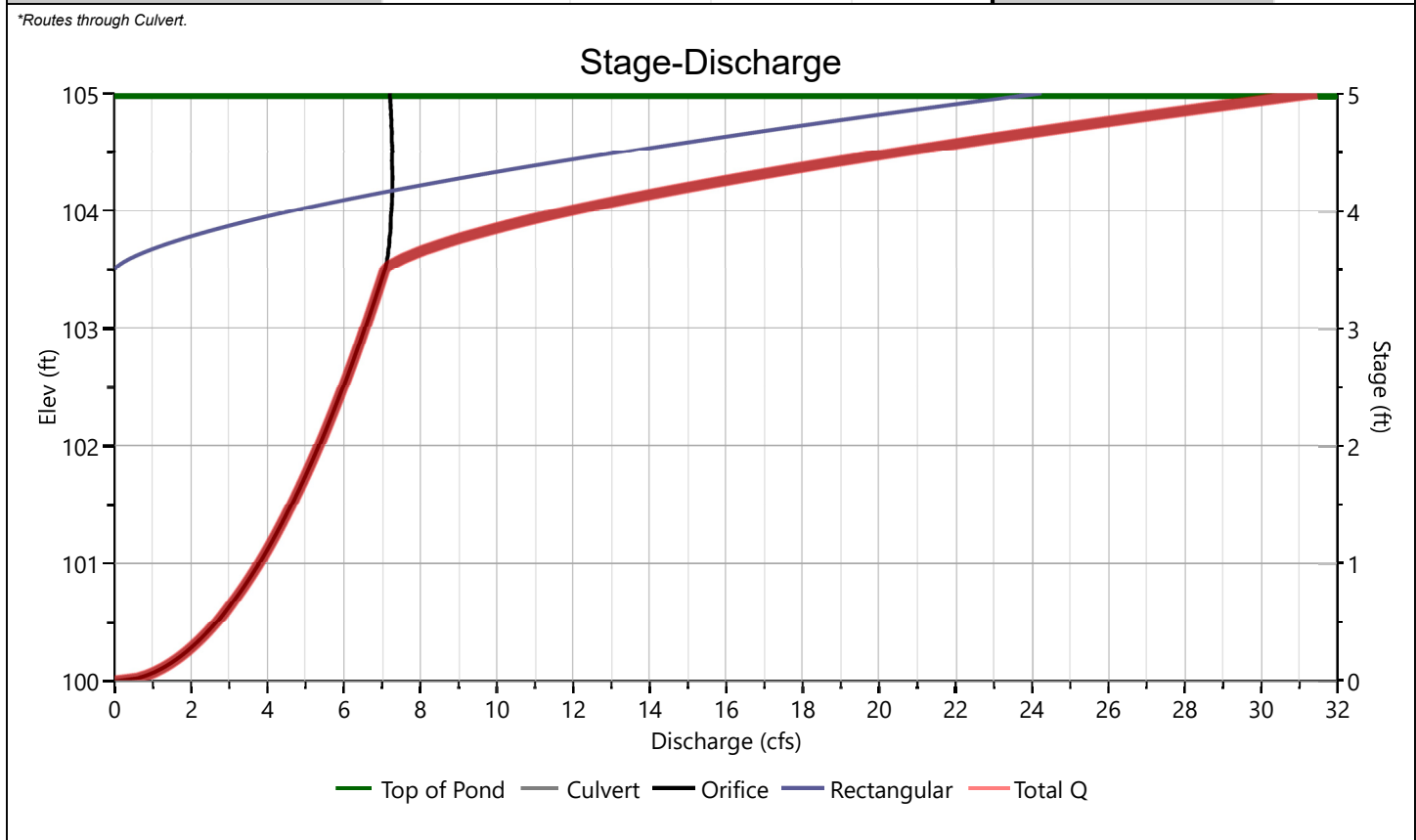
12-30-2020

UG Recharge / Detention Basin West

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	36	12			Hole Diameter, in
Span, in	36	12			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	99.00	99.00			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	211				
Barrel Slope, %	1.42				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type		Rectangular			Exfiltration, in/hr
Crest Elevation, ft		103.5			
Crest Length, ft		4			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Recharge / Detention Basin West

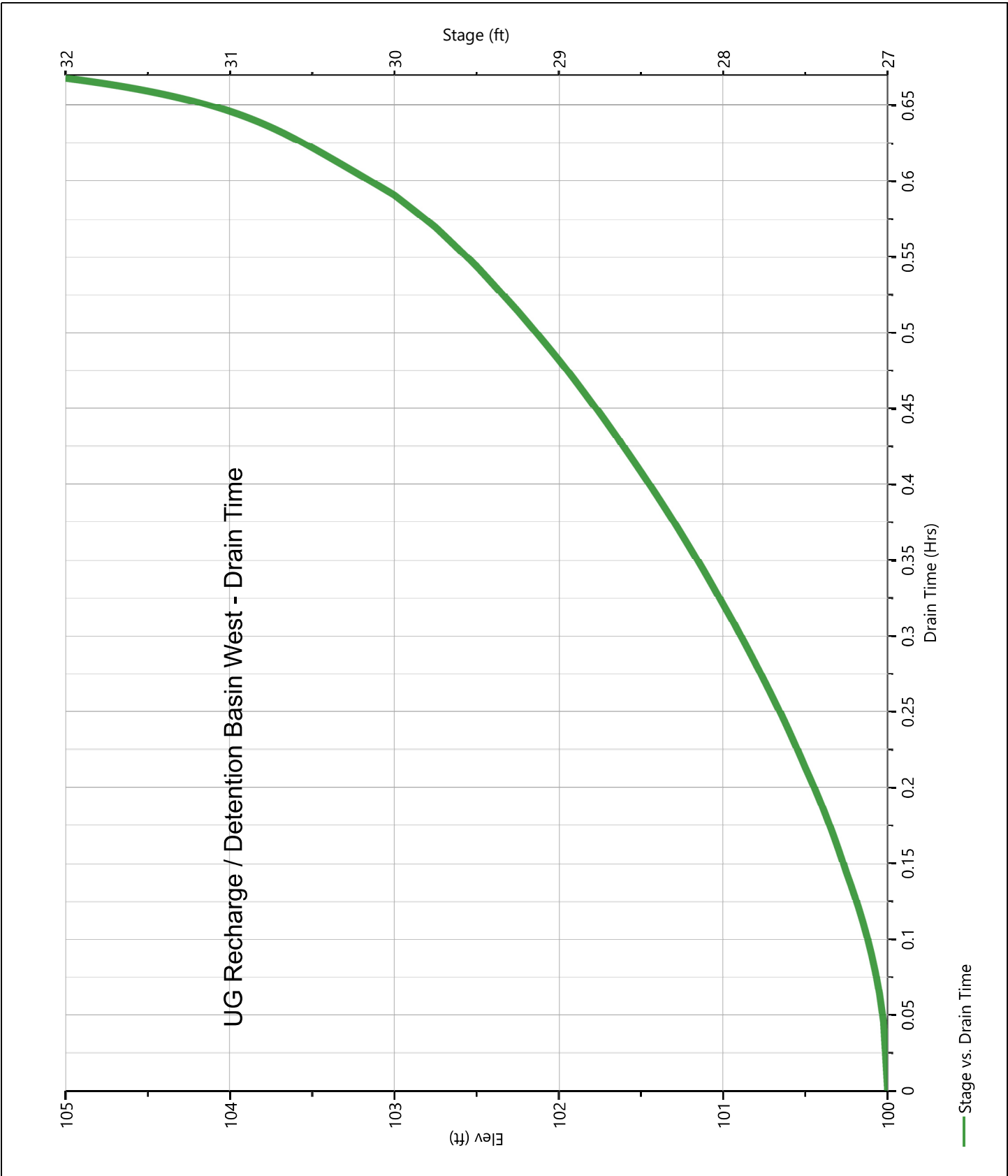
Stage-Storage-Discharge Summary

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	100.00	0.000	0.000	0.000				0.000						0.000
0.25	100.25	489	1.891 ic	1.891				0.000						1.891
0.50	100.50	1,059	2.674 ic	2.674				0.000						2.674
0.75	100.75	1,673	3.275 ic	3.275				0.000						3.275
1.00	101.00	2,314	3.781 ic	3.781				0.000						3.781
1.25	101.25	2,973	4.228 ic	4.228				0.000						4.228
1.50	101.50	3,639	4.631 ic	4.631				0.000						4.631
1.75	101.75	4,306	5.002 ic	5.002				0.000						5.002
2.00	102.00	4,965	5.347 ic	5.347				0.000						5.347
2.25	102.25	5,606	5.672 ic	5.672				0.000						5.672
2.50	102.50	6,219	5.979 ic	5.979				0.000						5.979
2.75	102.75	6,789	6.270 ic	6.270				0.000						6.270
3.00	103.00	7,278	6.549 ic	6.549				0.000						6.549
3.25	103.25	7,660	6.817 ic	6.817				0.000						6.817
3.50	103.50	8,041	7.074 ic	7.074				0.000						7.074
3.75	103.75	8,423	8.847 ic	7.197				1.650						8.847
4.00	104.00	8,805	11.92 ic	7.249				4.667						11.92
4.25	104.25	9,186	15.85 ic	7.276				8.574						15.85
4.50	104.50	9,568	20.47 ic	7.269				13.20						20.47
4.75	104.75	9,950	25.70 ic	7.250				18.45						25.70
5.00	105.00	10,331	31.46 ic	7.212				24.25						31.46

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

UG Recharge / Detention Basin West

Pond Drawdown



Hydrograph Report

Project Name:

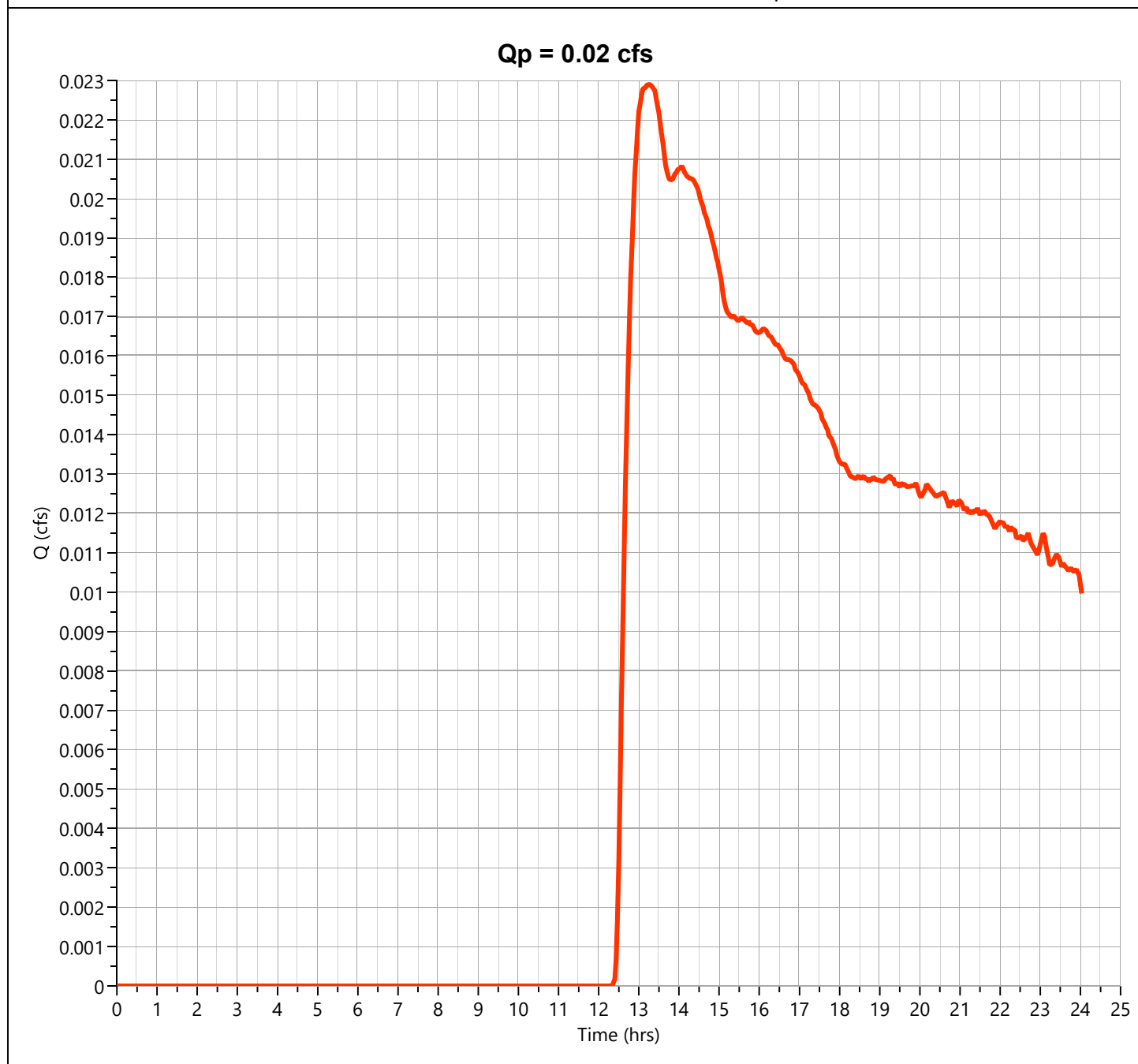
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b - Perv.

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.023 cfs
Storm Frequency	= 2-yr	Time to Peak	= 13.30 hrs
Time Interval	= 2 min	Runoff Volume	= 615 cuft
Drainage Area	= 1.46 ac	Curve Number	= 47
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

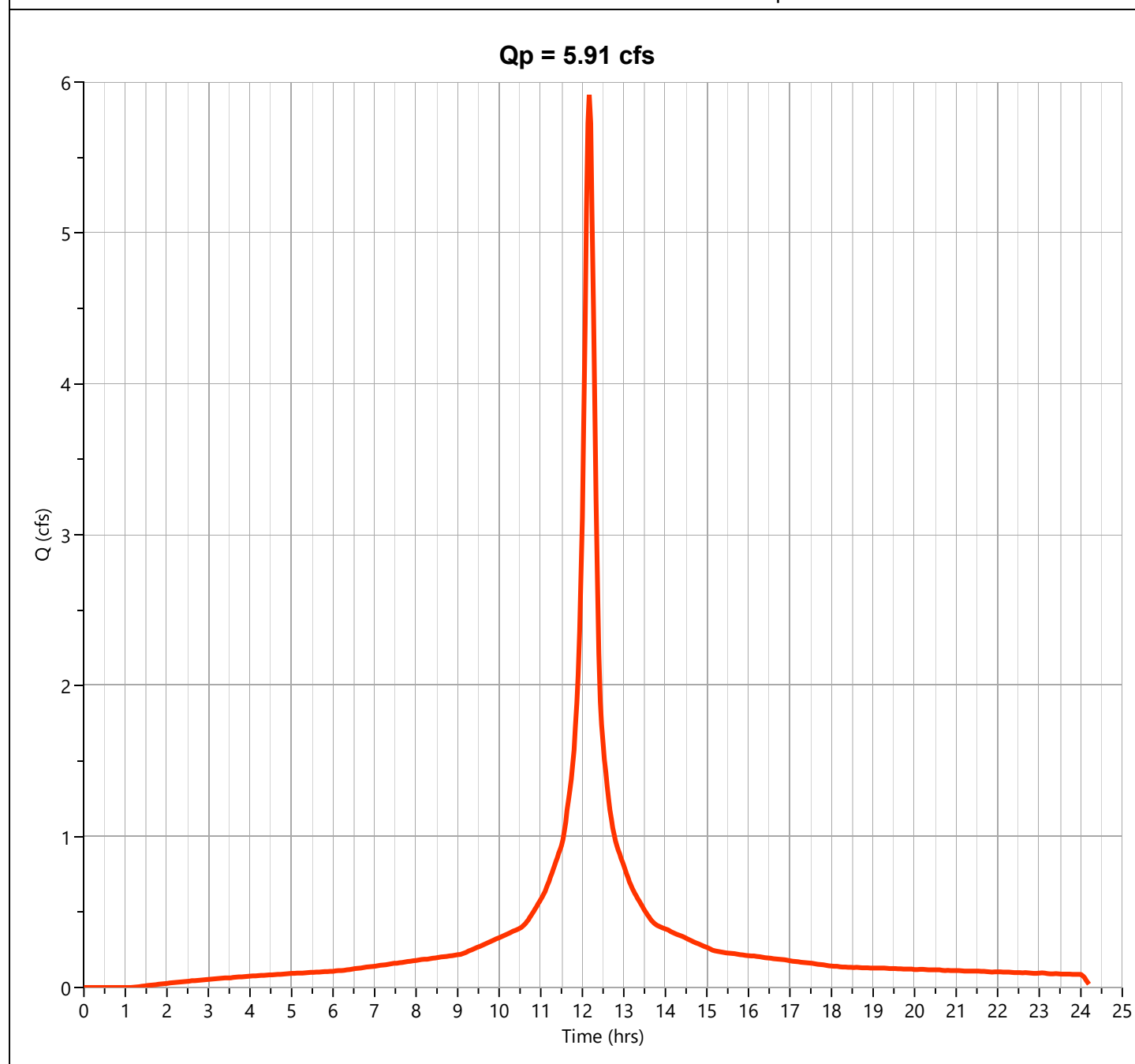
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b - Imperv.

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.914 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 26,169 cuft
Drainage Area	= 2.18 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

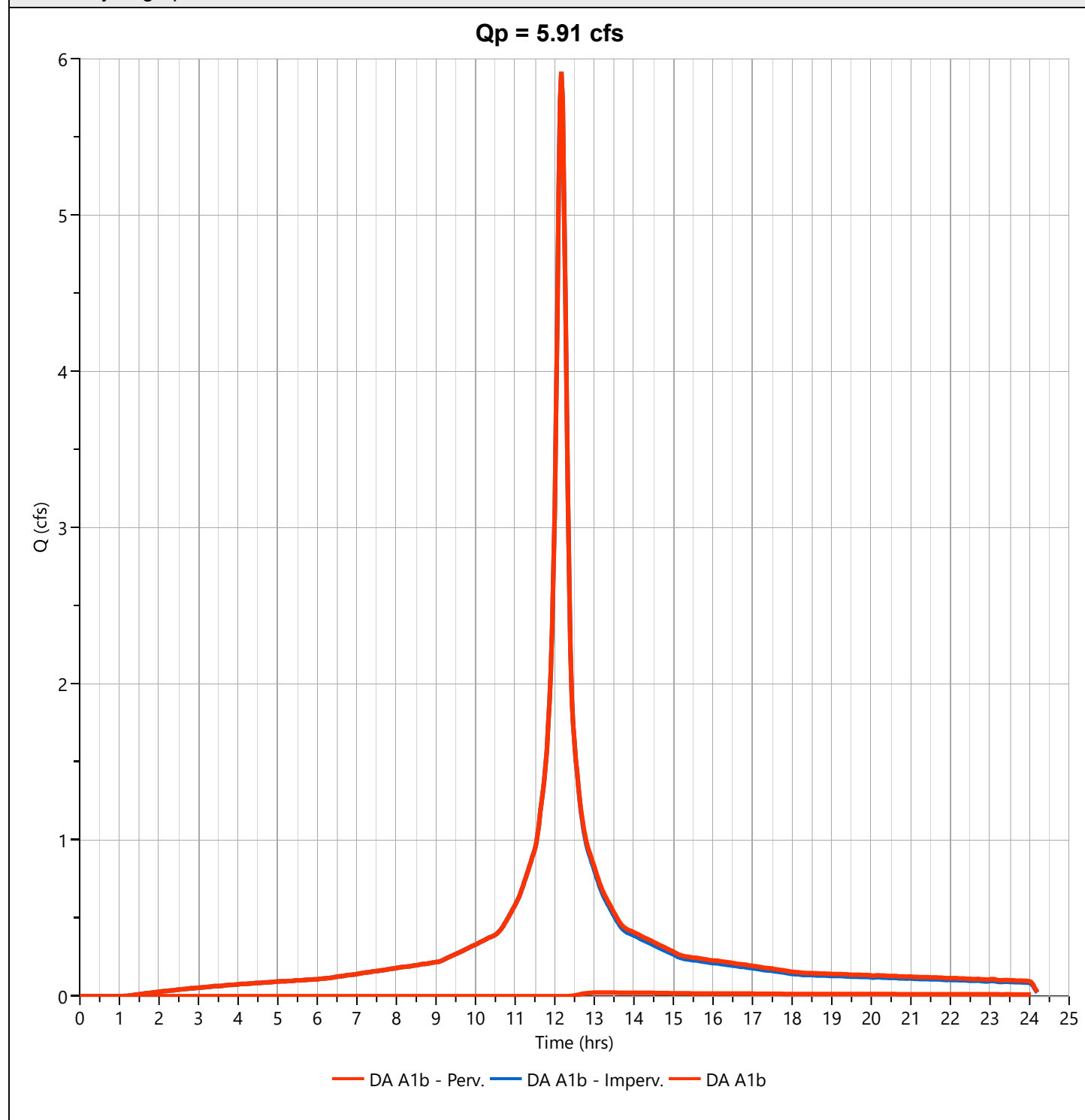
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b

Hyd. No. 12

Hydrograph Type	= Junction	Peak Flow	= 5.914 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 26,784 cuft
Inflow Hydrographs	= 10, 11	Total Contrib. Area	= 3.64 ac



Hydrograph Report

Project Name:

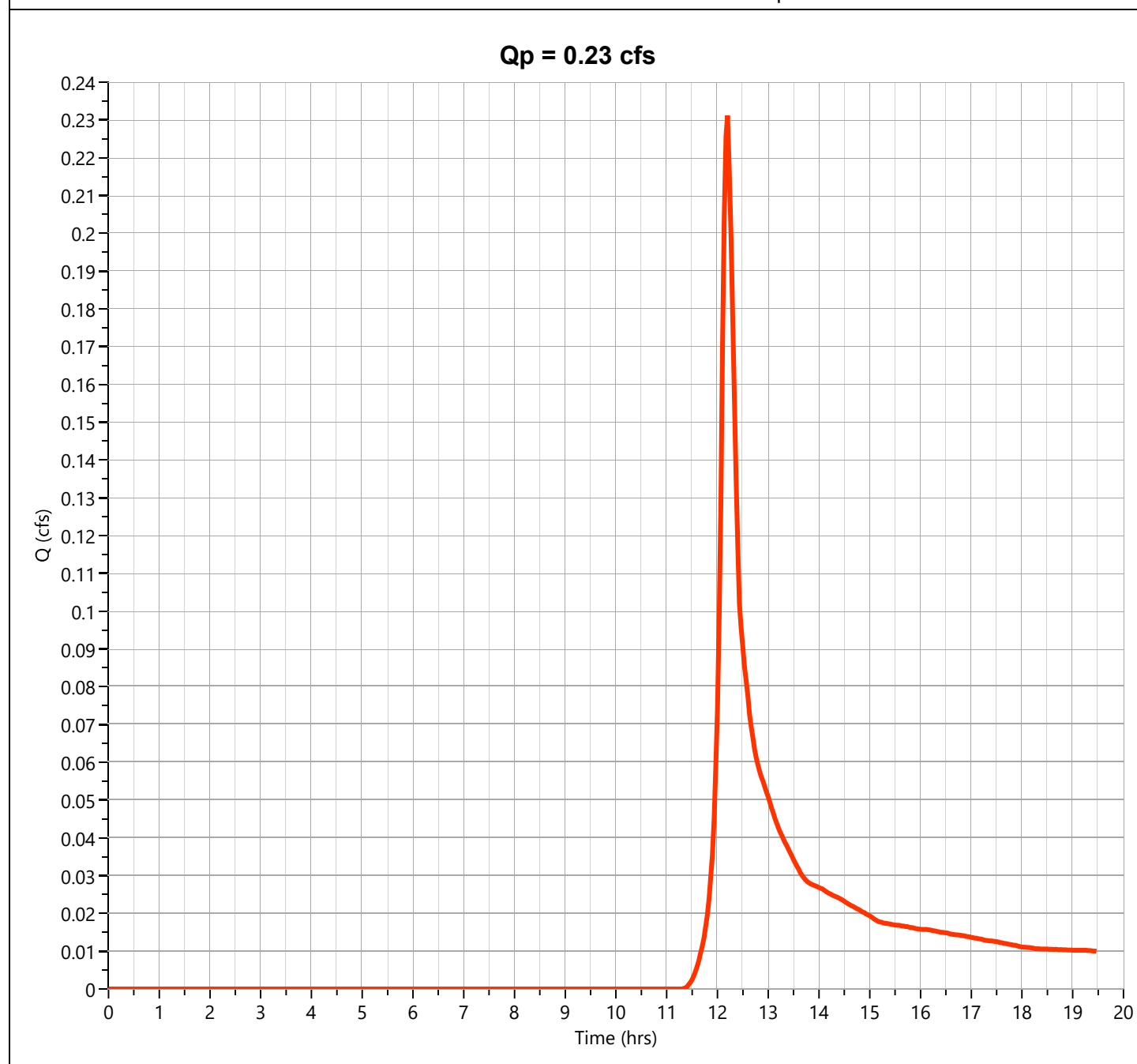
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b (un) - Perv.

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.231 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 1,009 cuft
Drainage Area	= 0.33 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

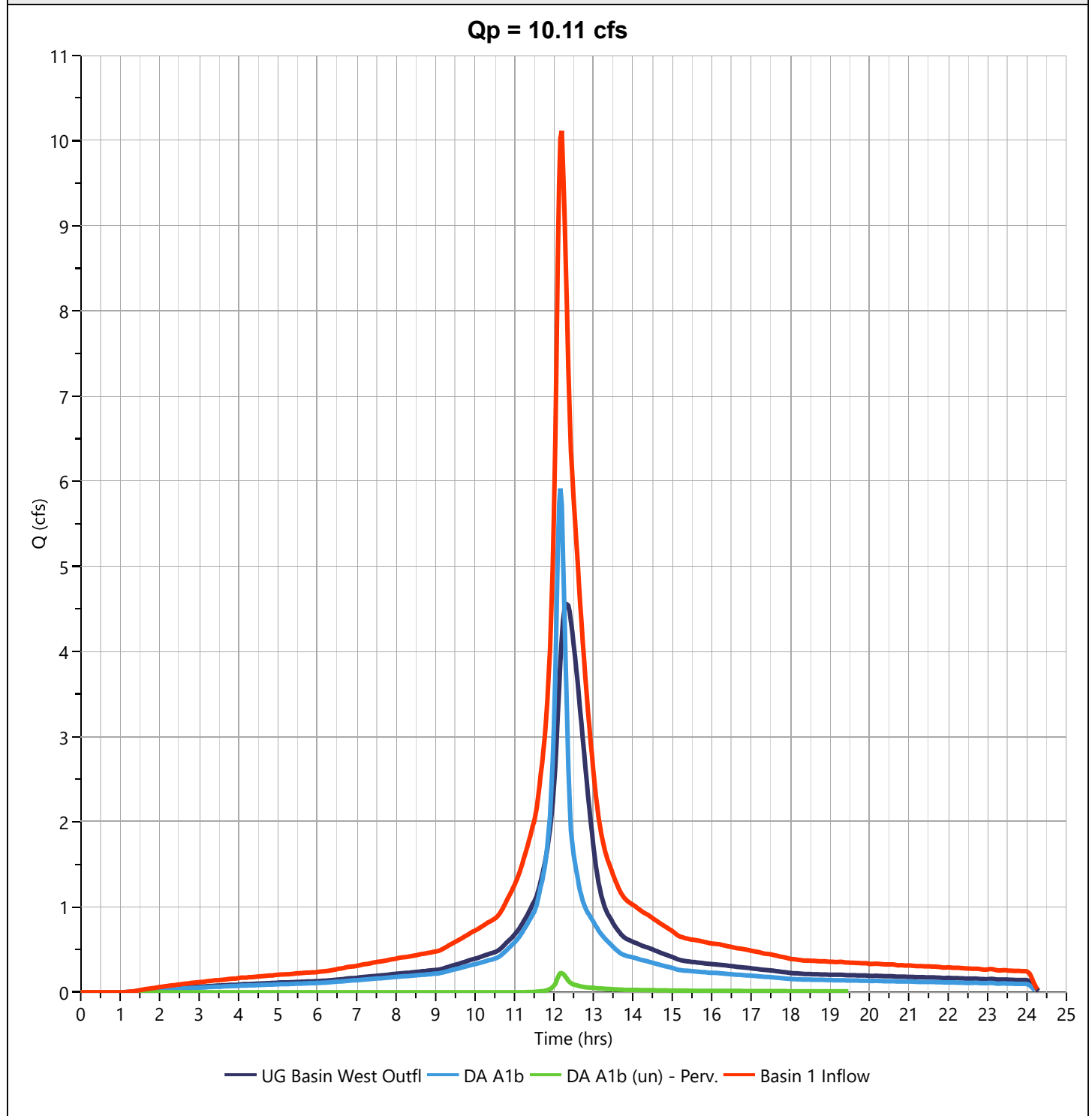
Hydrology Studio v 3.0.0.16

12-30-2020

Basin 1 Inflow

Hyd. No. 16

Hydrograph Type	= Junction	Peak Flow	= 10.11 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 63,111 cuft
Inflow Hydrographs	= 8, 12, 14	Total Contrib. Area	= 3.97 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

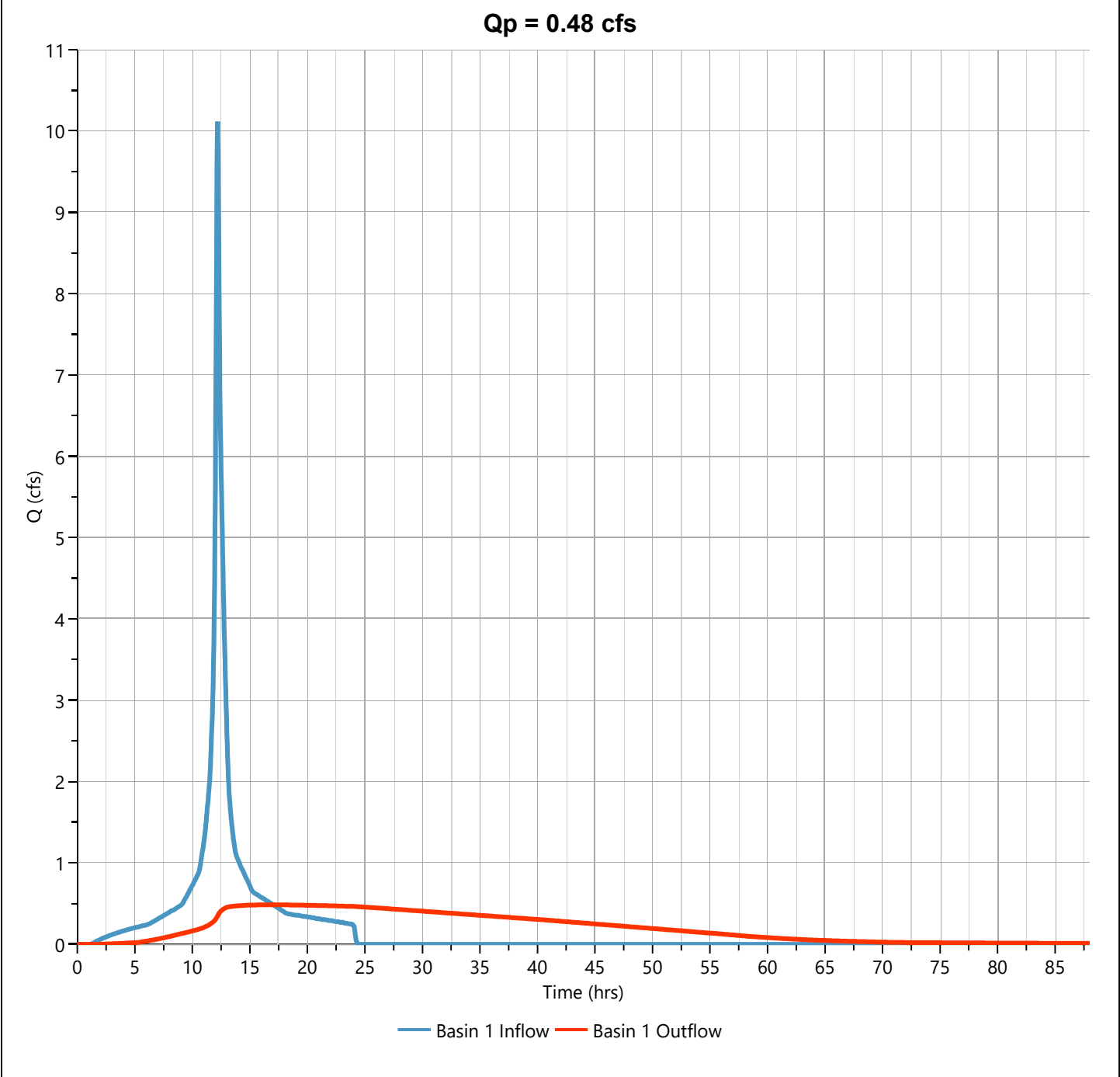
Basin 1 Outflow

Hyd. No. 17

Hydrograph Type	= Pond Route	Peak Flow	= 0.485 cfs
Storm Frequency	= 2-yr	Time to Peak	= 17.03 hrs
Time Interval	= 2 min	Hydrograph Volume	= 62,596 cuft
Inflow Hydrograph	= 16 - Basin 1 Inflow	Max. Elevation	= 97.41 ft
Pond Name	= Basin 1	Max. Storage	= 43,169 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 18.61 hrs



Pond Report

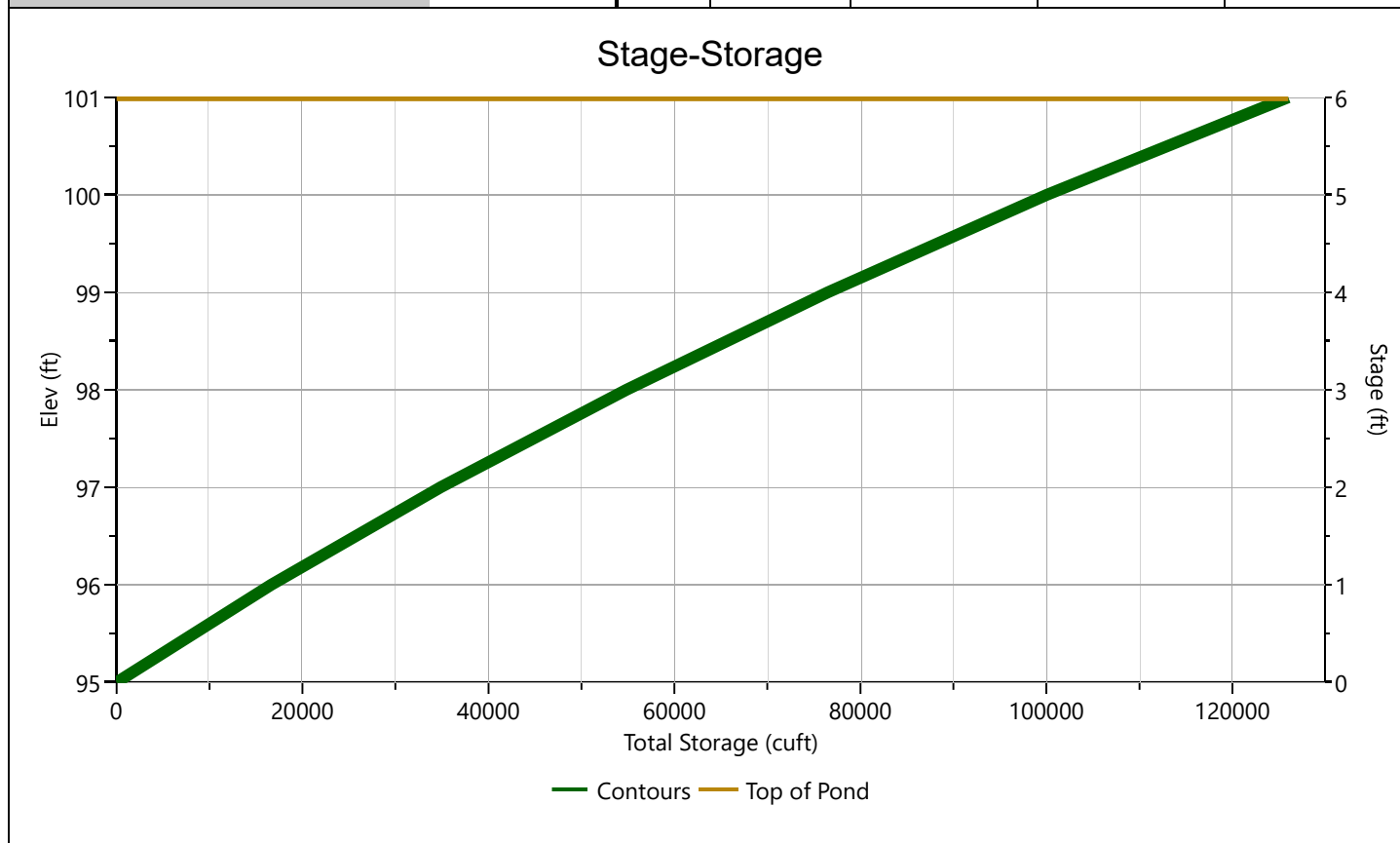
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 1

Stage-Storage

[illegible]

Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

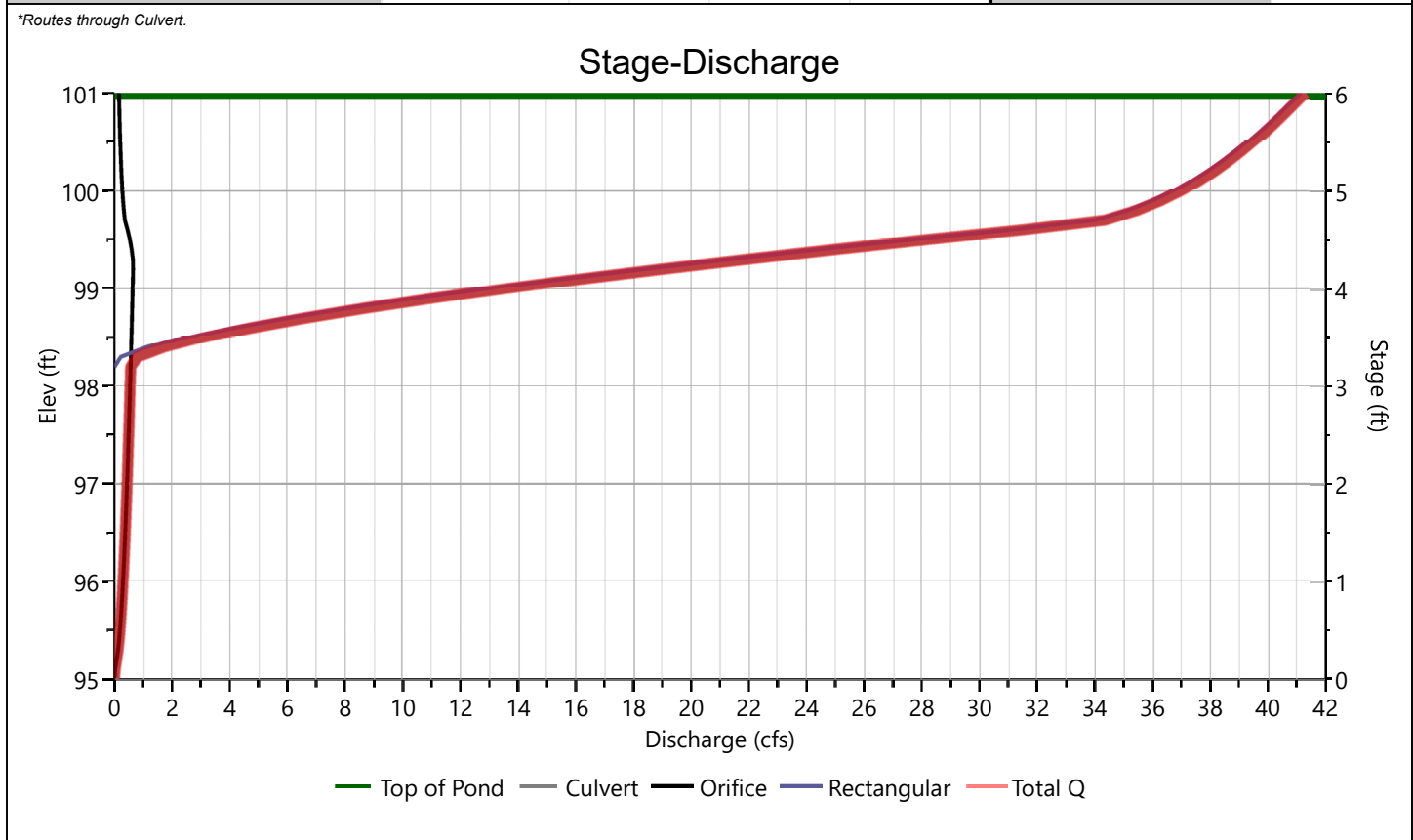
12-30-2020

Basin 1

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	24	3.5			Hole Diameter, in
Span, in	24	3.5			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	91.71	95.00			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	107				
Barrel Slope, %	.48				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type	Circular	Rectangular			Exfiltration, in/hr
Crest Elevation, ft		98.25			
Crest Length, ft		6			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 1

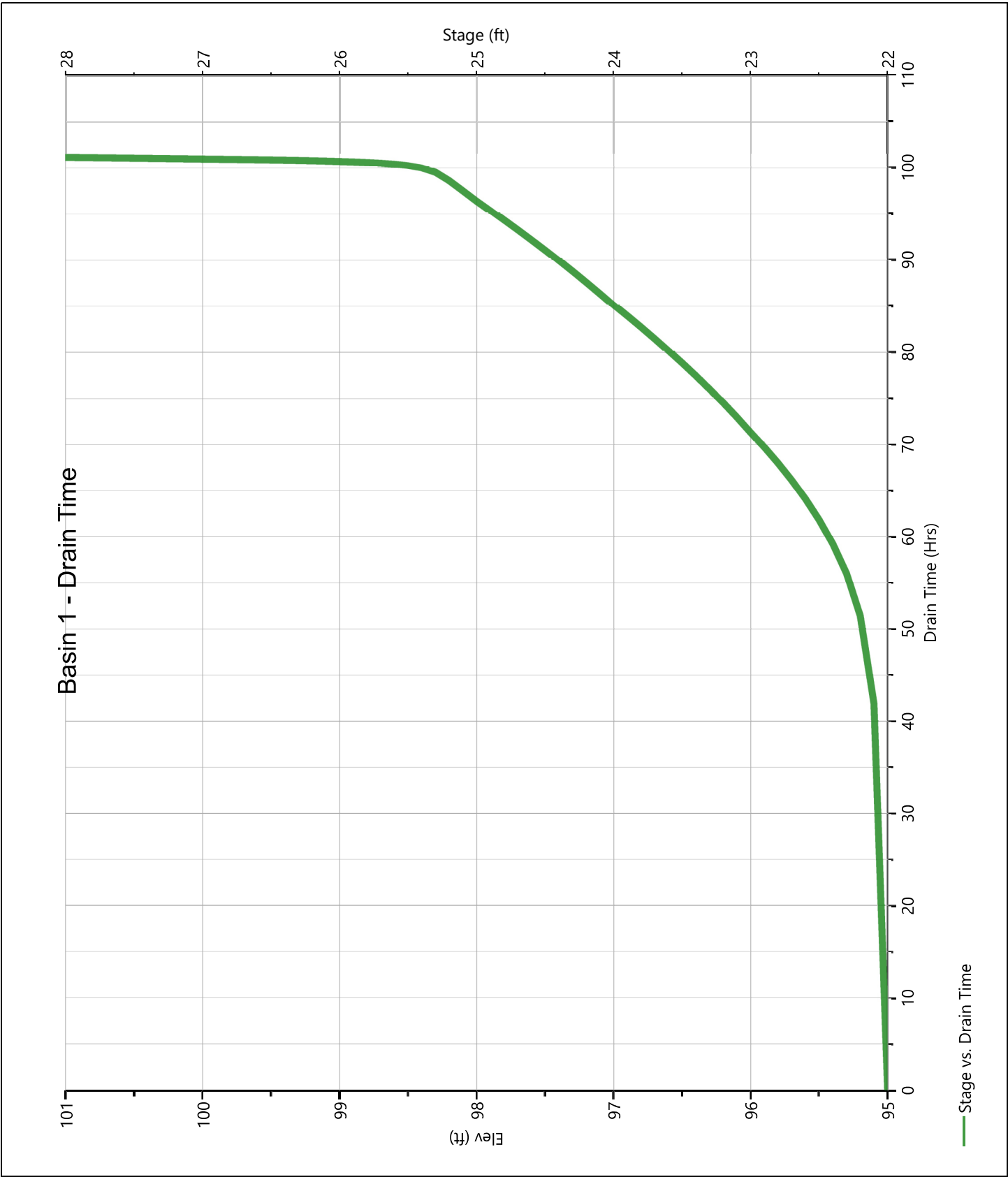
Stage-Storage-Discharge Summary

[illegible]

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

Basin 1

Pond Drawdown



Hydrograph Report

Project Name:

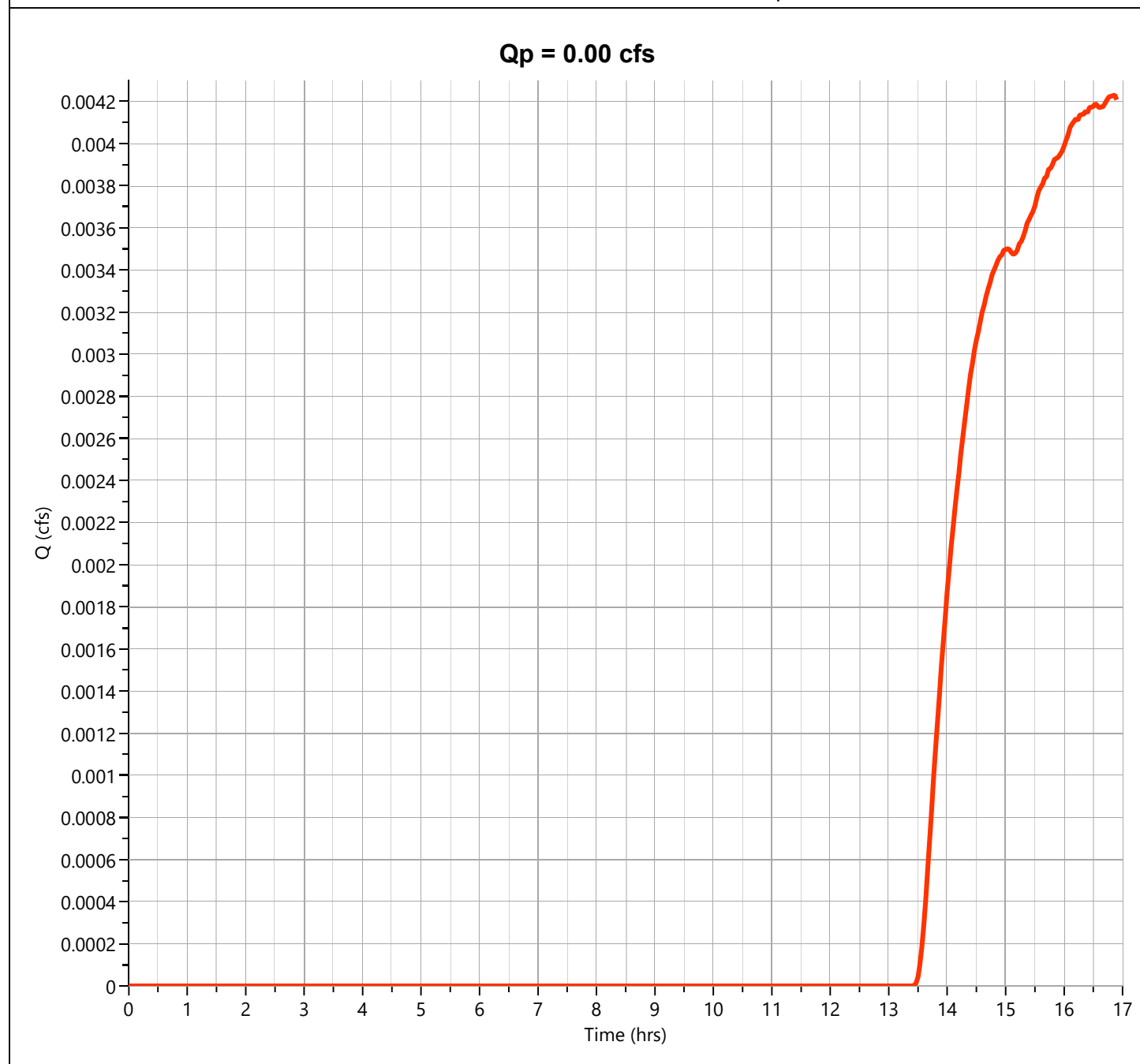
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2 - Perv.

Hyd. No. 19

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.004 cfs
Storm Frequency	= 2-yr	Time to Peak	= 16.87 hrs
Time Interval	= 2 min	Runoff Volume	= 143 cuft
Drainage Area	= 0.86 ac	Curve Number	= 43
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

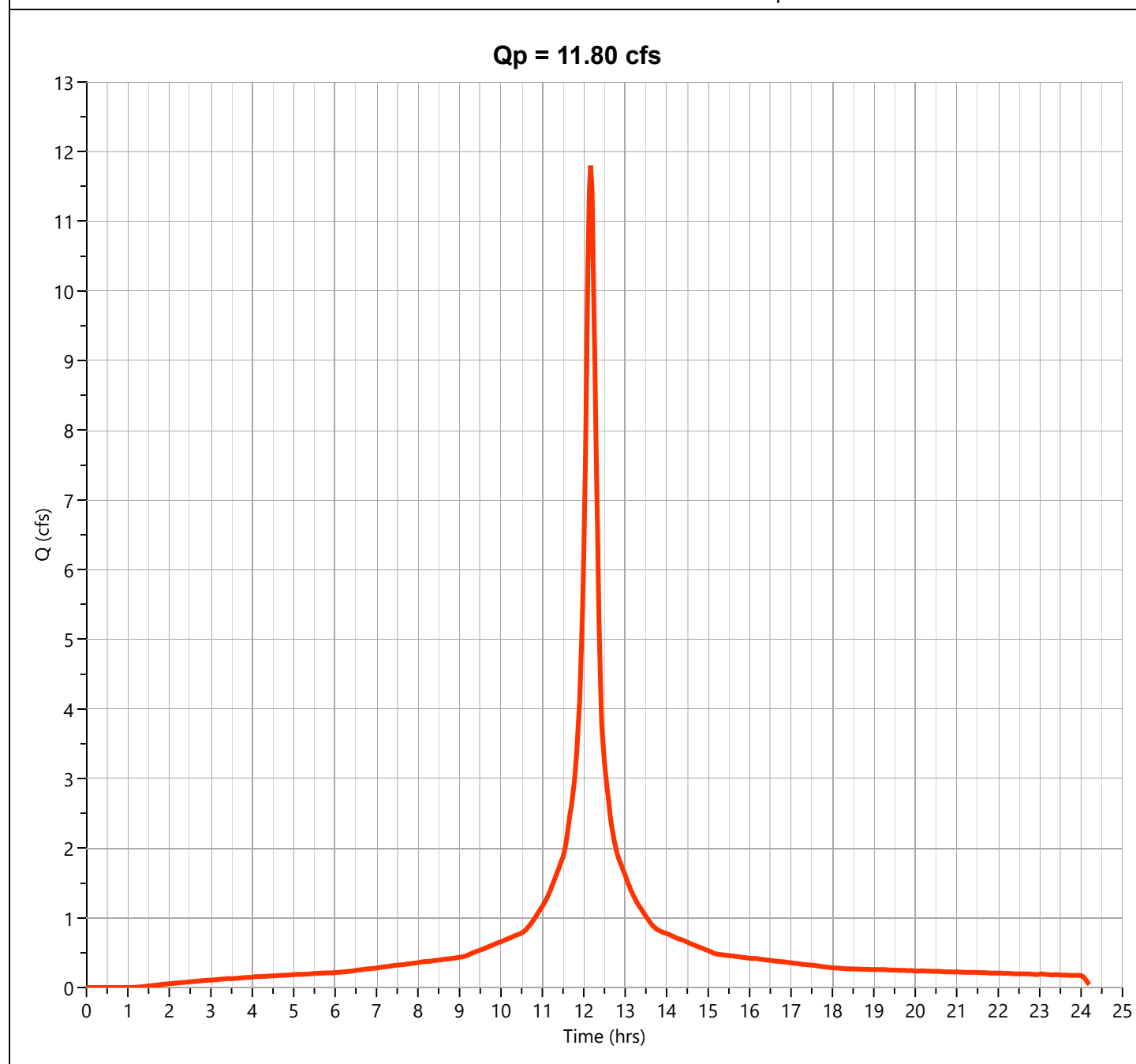
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2 - Imperv.

Hyd. No. 20

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.80 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 52,217 cuft
Drainage Area	= 4.35 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

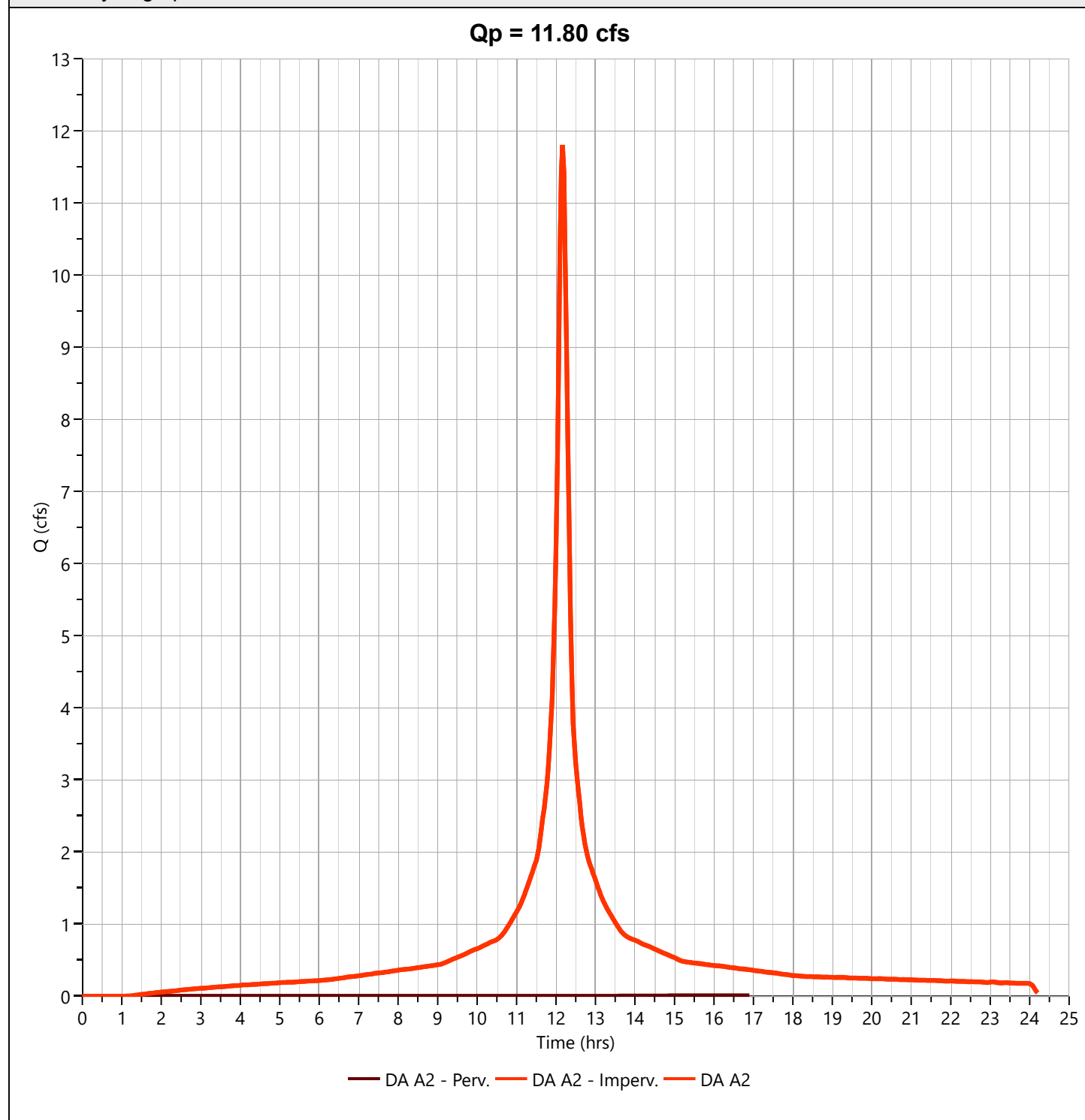
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2

Hyd. No. 21

Hydrograph Type	= Junction	Peak Flow	= 11.80 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 52,360 cuft
Inflow Hydrographs	= 19, 20	Total Contrib. Area	= 5.21 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

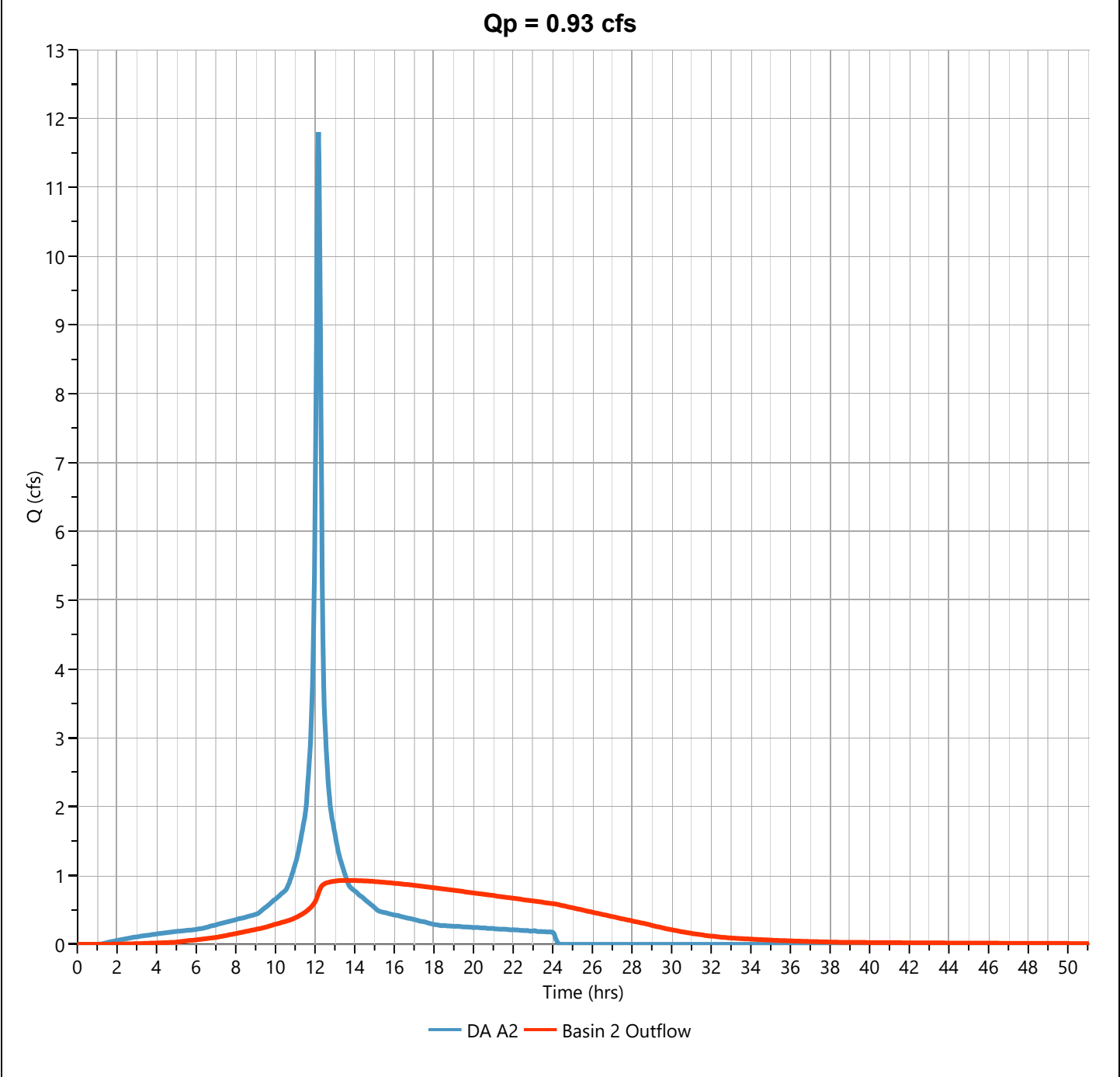
Basin 2 Outflow

Hyd. No. 22

Hydrograph Type	= Pond Route	Peak Flow	= 0.928 cfs
Storm Frequency	= 2-yr	Time to Peak	= 13.60 hrs
Time Interval	= 2 min	Hydrograph Volume	= 52,316 cuft
Inflow Hydrograph	= 21 - DA A2	Max. Elevation	= 85.21 ft
Pond Name	= Basin 2	Max. Storage	= 28,977 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 6.73 hrs



Pond Report

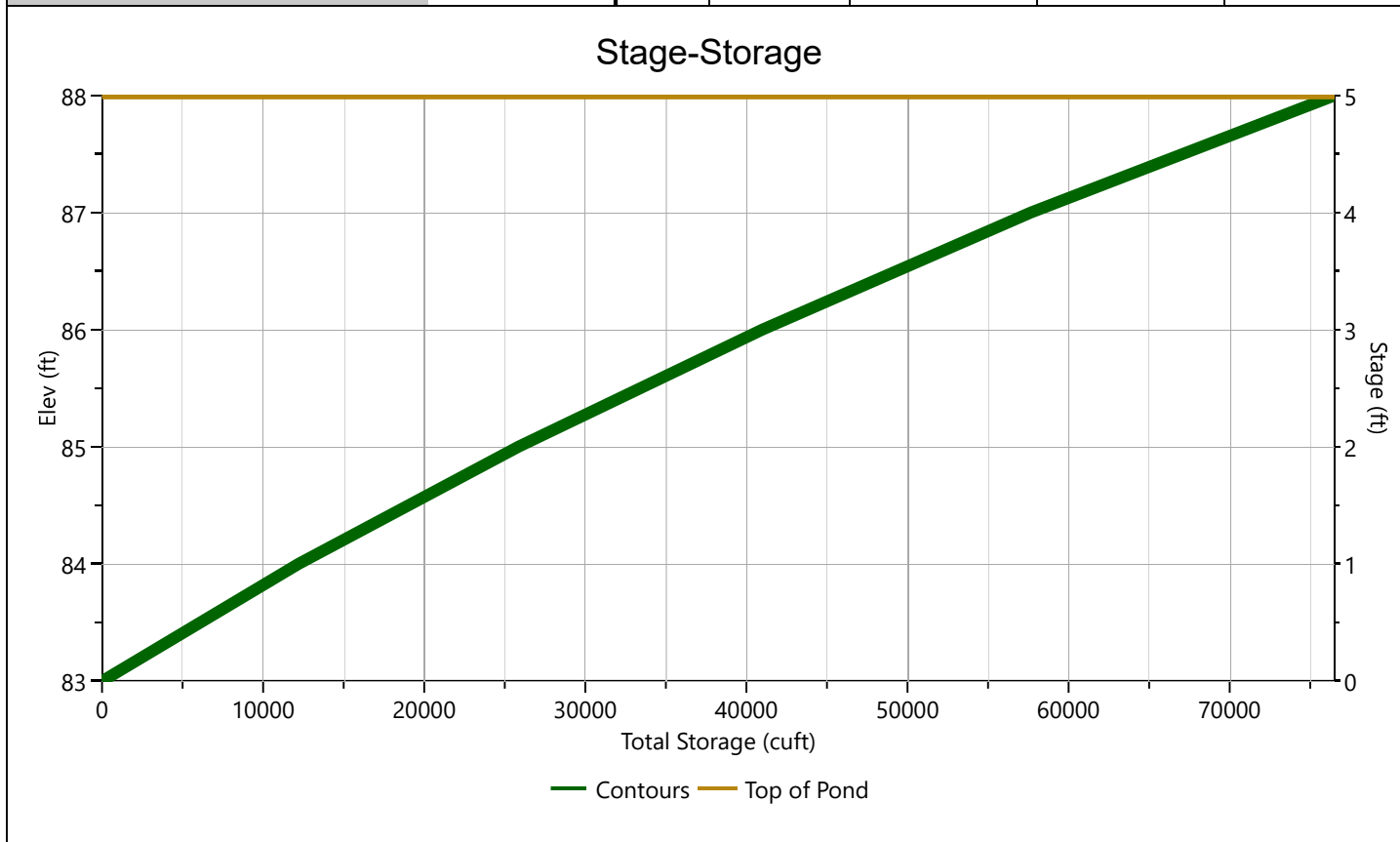
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 2

Stage-Storage

[illegible]

Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

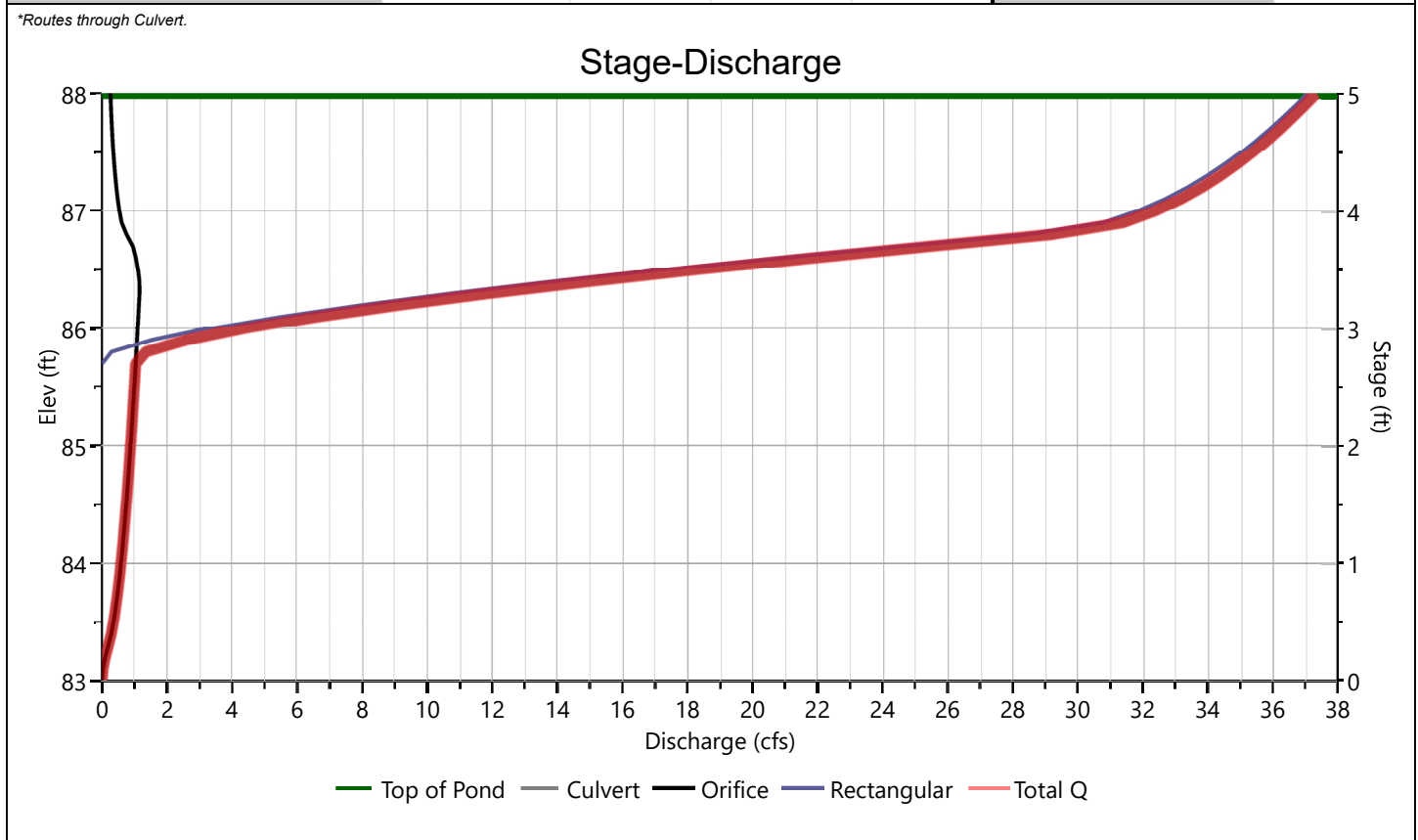
12-30-2020

Basin 2

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	24	5			Hole Diameter, in
Span, in	24	5			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	80.75	83.00			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	33				
Barrel Slope, %	.3				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type	Circular	Rectangular			Exfiltration, in/hr
Crest Elevation, ft		85.75			
Crest Length, ft		8			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 2

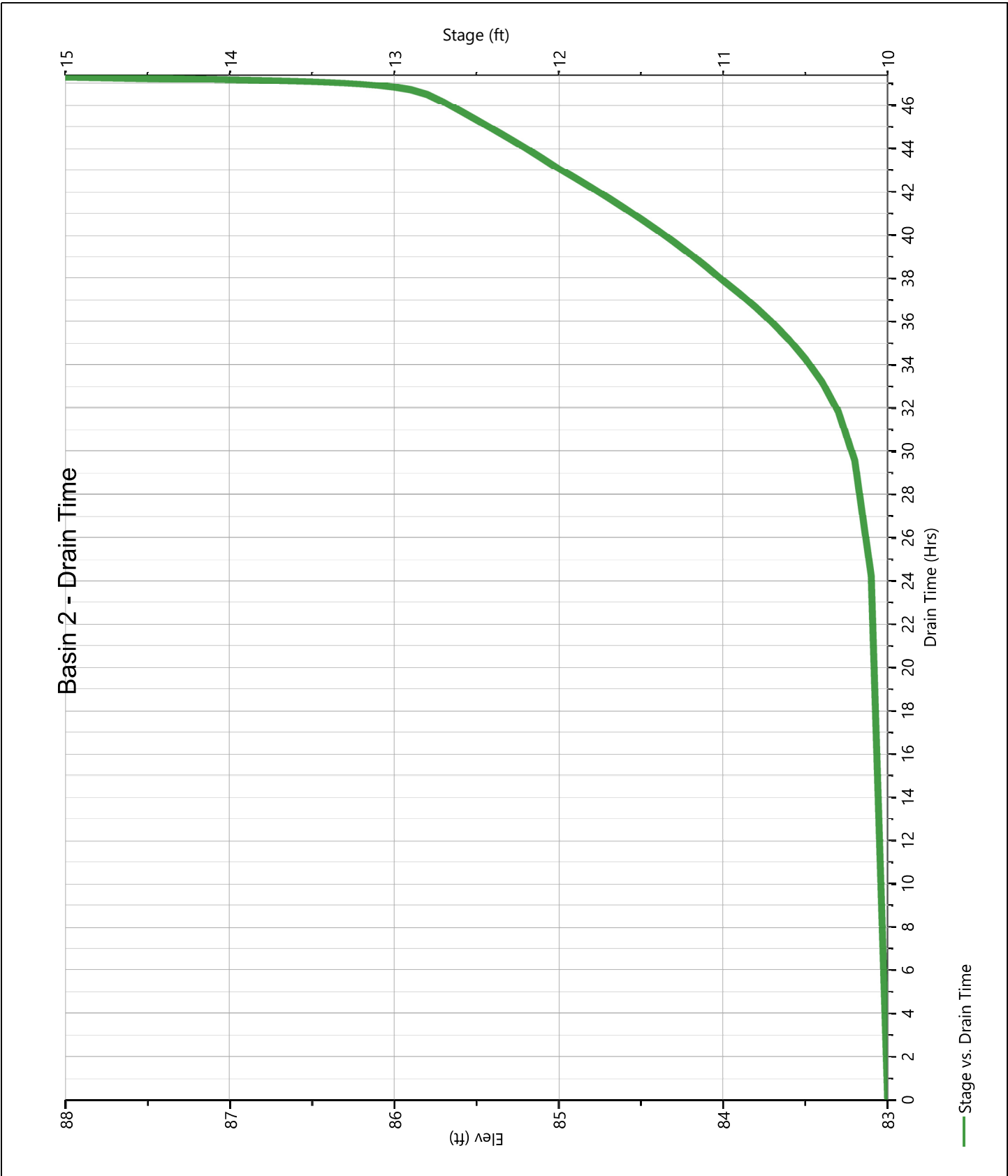
Stage-Storage-Discharge Summary

[illegible]

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

Basin 2

Pond Drawdown



Hydrograph Report

Project Name:

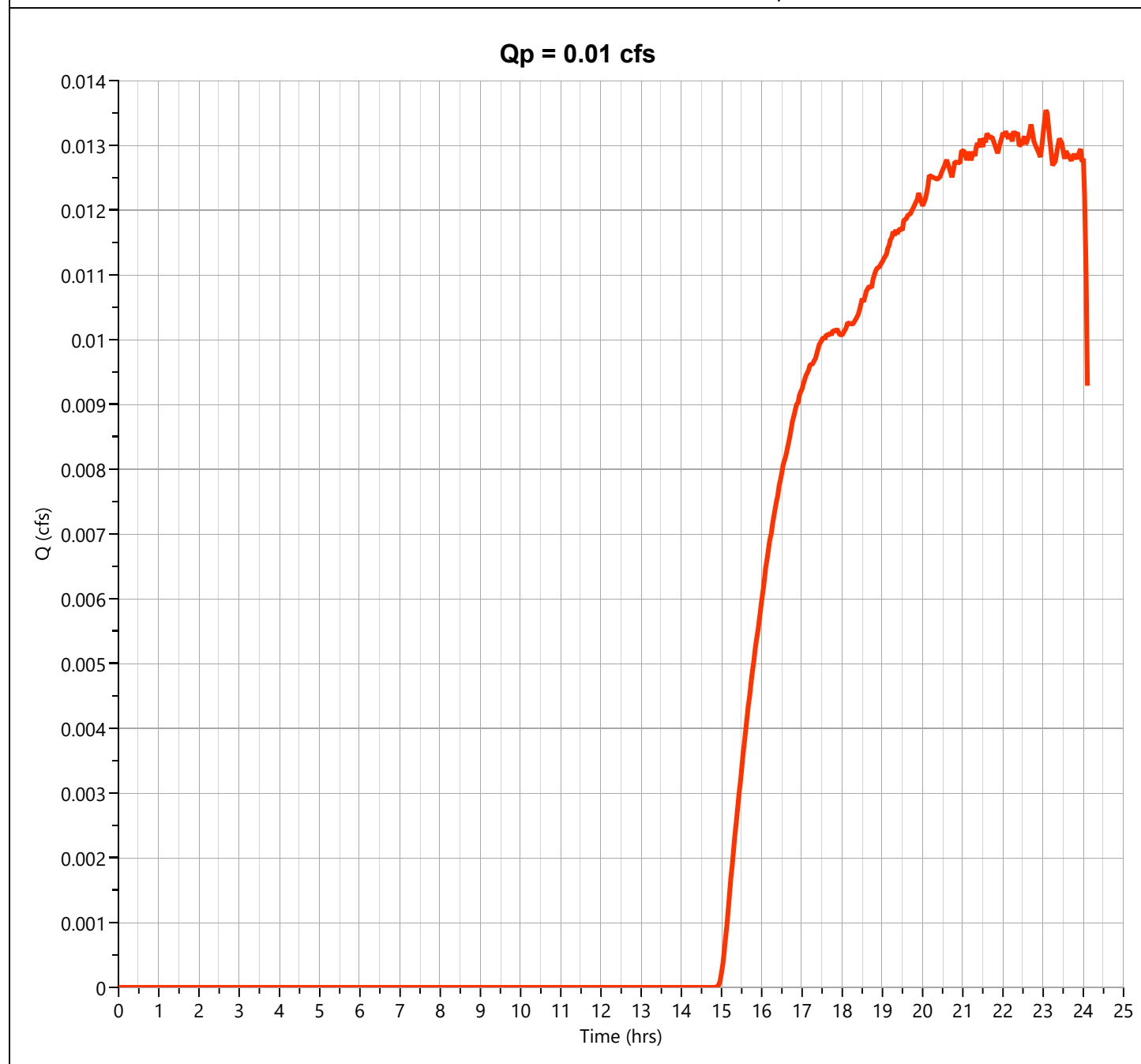
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A3 - Perv.

Hyd. No. 24

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.014 cfs
Storm Frequency	= 2-yr	Time to Peak	= 23.07 hrs
Time Interval	= 2 min	Runoff Volume	= 349 cuft
Drainage Area	= 4.41 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

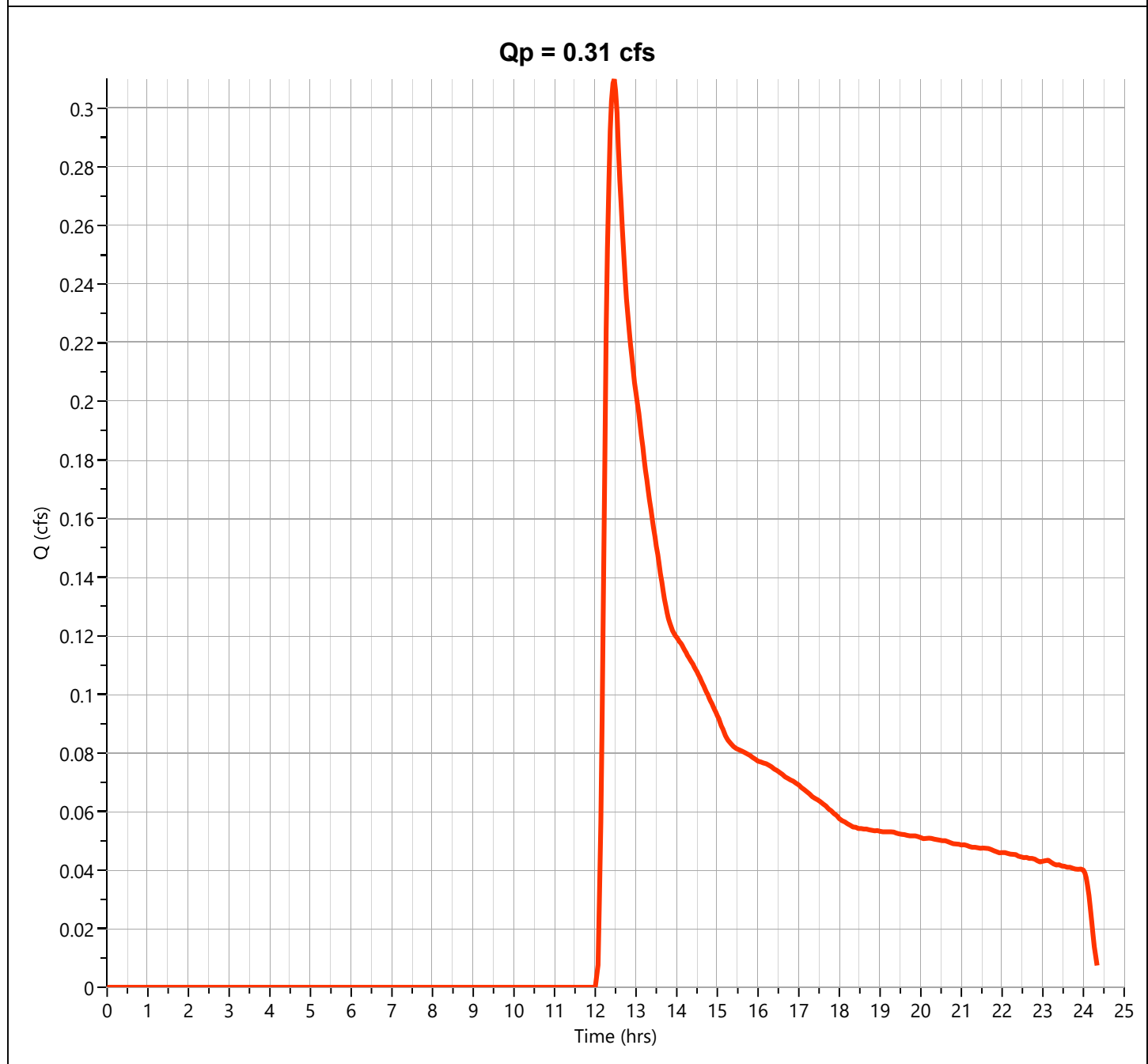
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a - Perv.

Hyd. No. 26

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.310 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.47 hrs
Time Interval	= 2 min	Runoff Volume	= 3,560 cuft
Drainage Area	= 3.34 ac	Curve Number	= 54
Tc Method	= User	Time of Conc. (Tc)	= 17.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

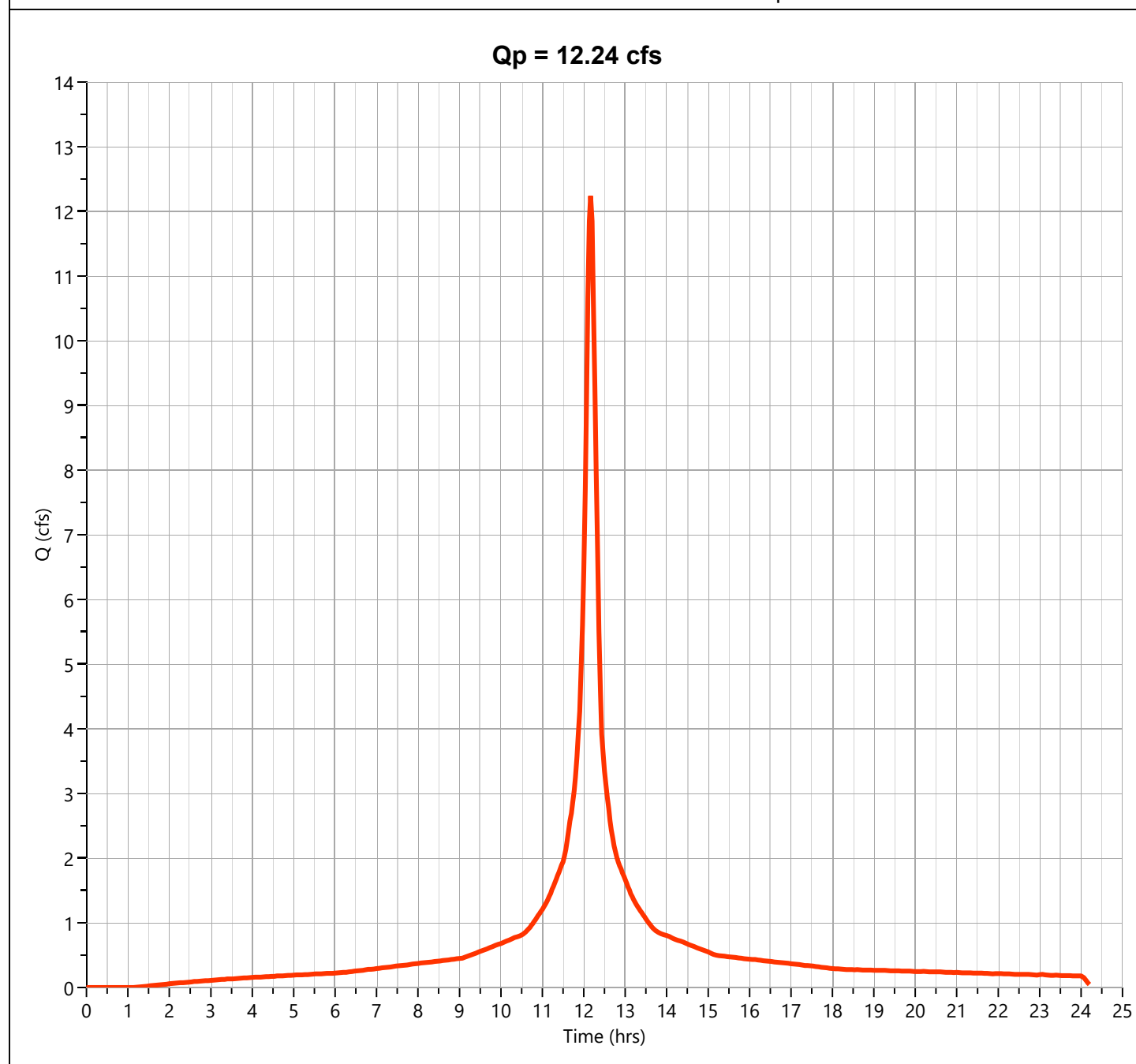
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a - Imperv.

Hyd. No. 27

Hydrograph Type	= NRCS Runoff	Peak Flow	= 12.24 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 54,138 cuft
Drainage Area	= 4.51 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

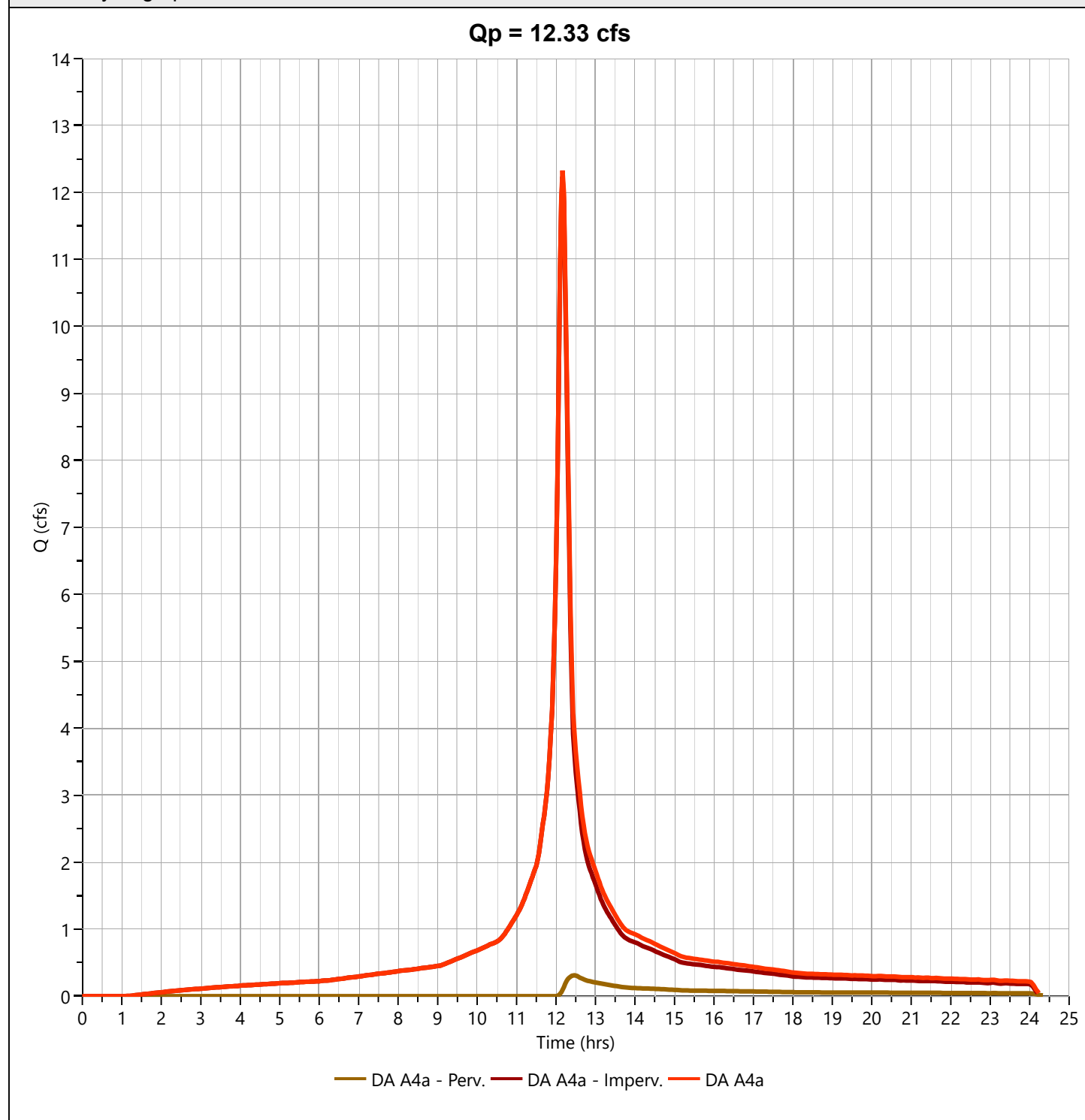
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a

Hyd. No. 28

Hydrograph Type	= Junction	Peak Flow	= 12.33 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 57,698 cuft
Inflow Hydrographs	= 26, 27	Total Contrib. Area	= 7.85 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Basin East Out

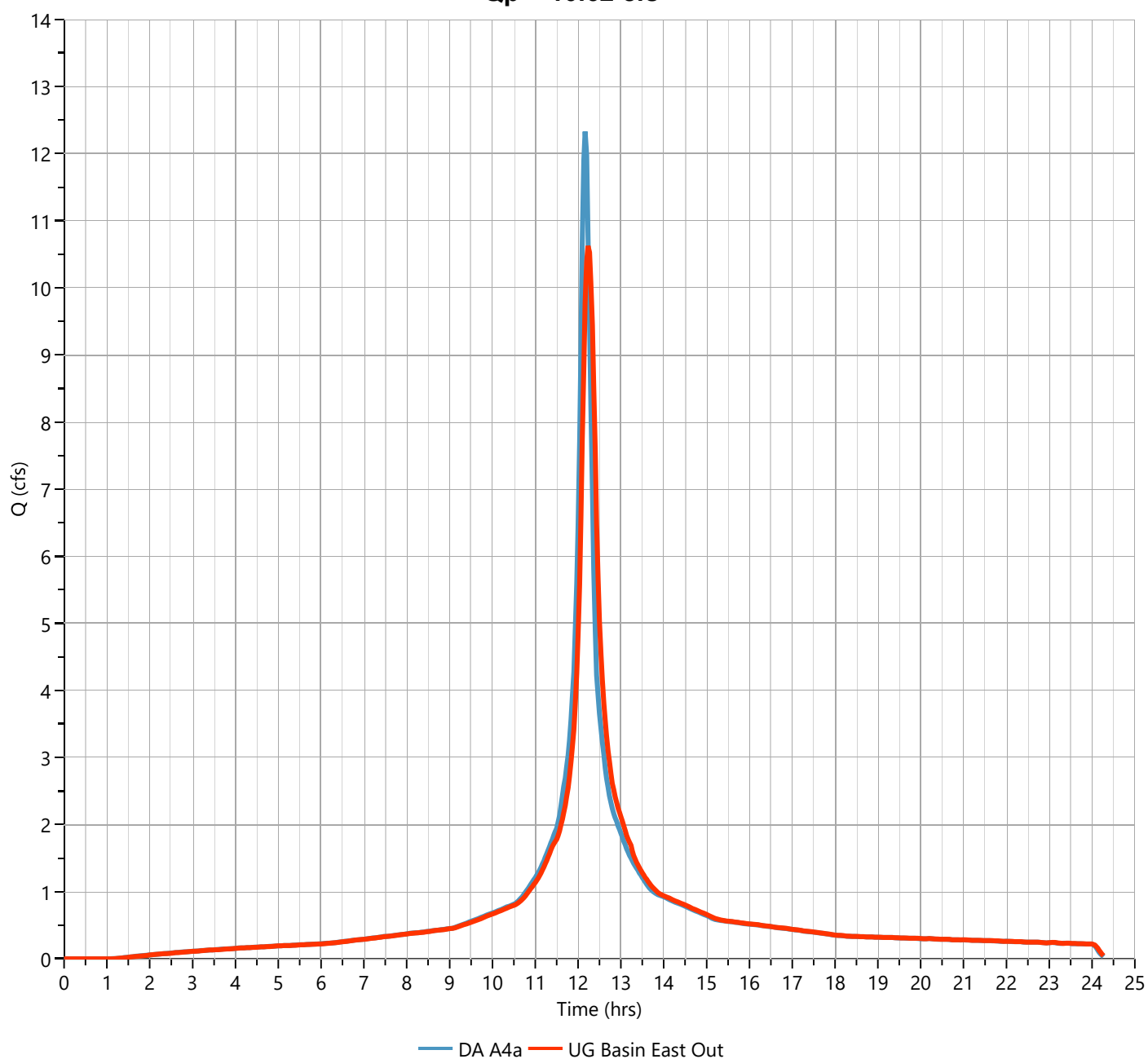
Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 10.62 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 57,697 cuft
Inflow Hydrograph	= 28 - DA A4a	Max. Elevation	= 101.36 ft
Pond Name	= UG Recharge / Detention Basin East	Max. Storage	= 3,340 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 3 min

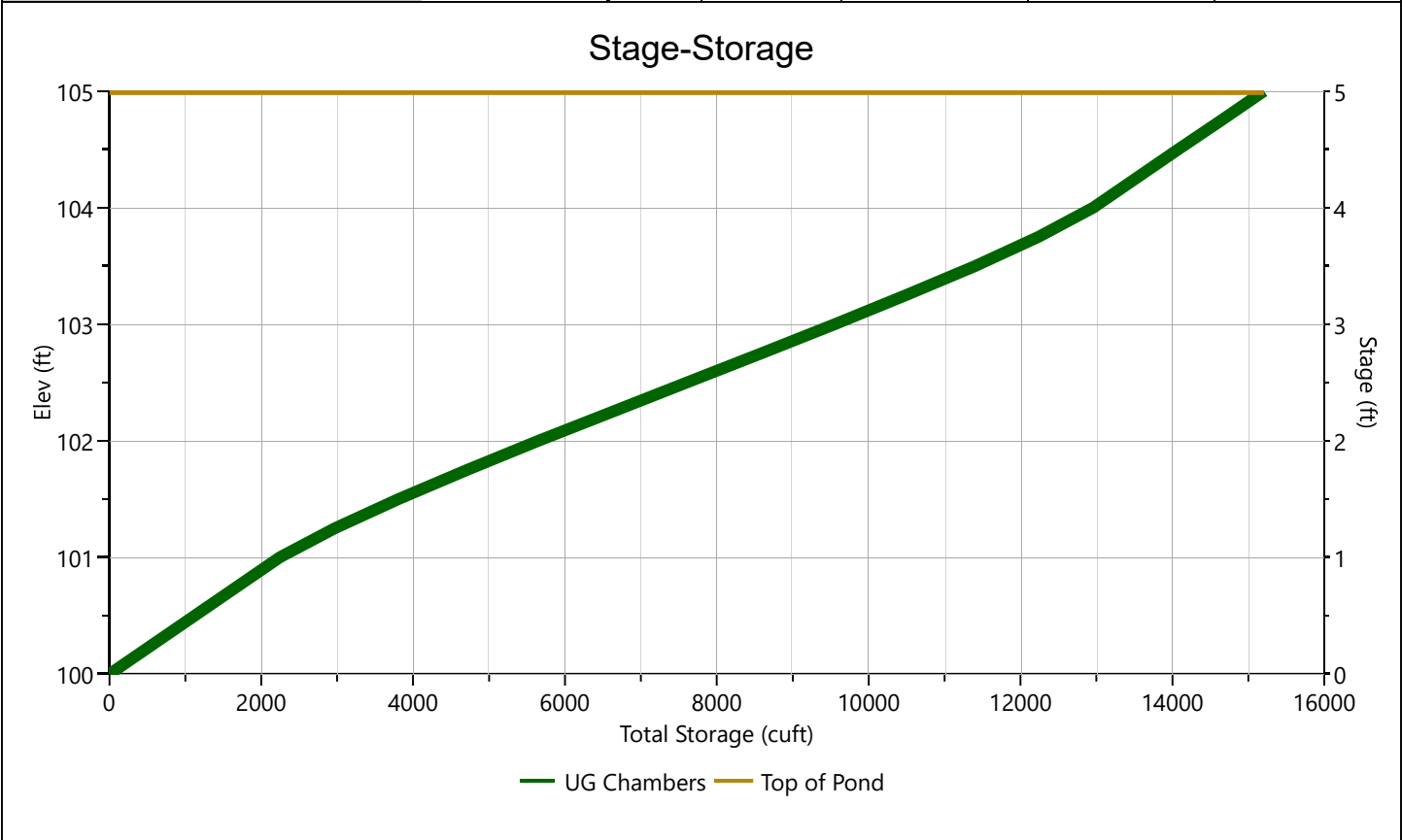
Qp = 10.62 cfs



UG Recharge / Detention Basin East

Stage-Storage

Underground Chambers		Stage / Storage Table				
Description	Input	Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
Invert Elev Down, ft	101.00	0.00	100.00	5,616	0.000	0.000
Chamber Rise, ft	3.00	0.25	100.25	5,616	562	562
Chamber Shape	Circular	0.50	100.50	5,616	562	1,123
Chamber Span, ft	3.00	0.75	100.75	5,616	562	1,685
Barrel Length, ft	300.00	1.00	101.00	5,616	562	2,247
No. Barrels	3	1.25	101.25	5,616	720	2,967
Barrel Slope, %	0.00	1.50	101.50	5,616	839	3,806
Headers, y/n	Yes	1.75	101.75	5,616	903	4,709
Stone Encasement, y/n	Yes	2.00	102.00	5,616	944	5,652
Encasement Bottom Elevation, ft	100.00	2.25	102.25	5,616	969	6,622
Encasement Width per Chamber, ft	6.00	2.50	102.50	5,616	981	7,603
Encasement Depth, ft	5.00	2.75	102.75	5,616	981	8,584
Encasement Voids, %	40.00	3.00	103.00	5,616	969	9,553
		3.25	103.25	5,616	943	10,497
		3.50	103.50	5,616	903	11,400
		3.75	103.75	5,616	838	12,238
		4.00	104.00	5,616	720	12,958
		4.25	104.25	5,616	562	13,520
		4.50	104.50	5,616	562	14,081
		4.75	104.75	5,616	562	14,643
		5.00	105.00	5,616	562	15,205



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

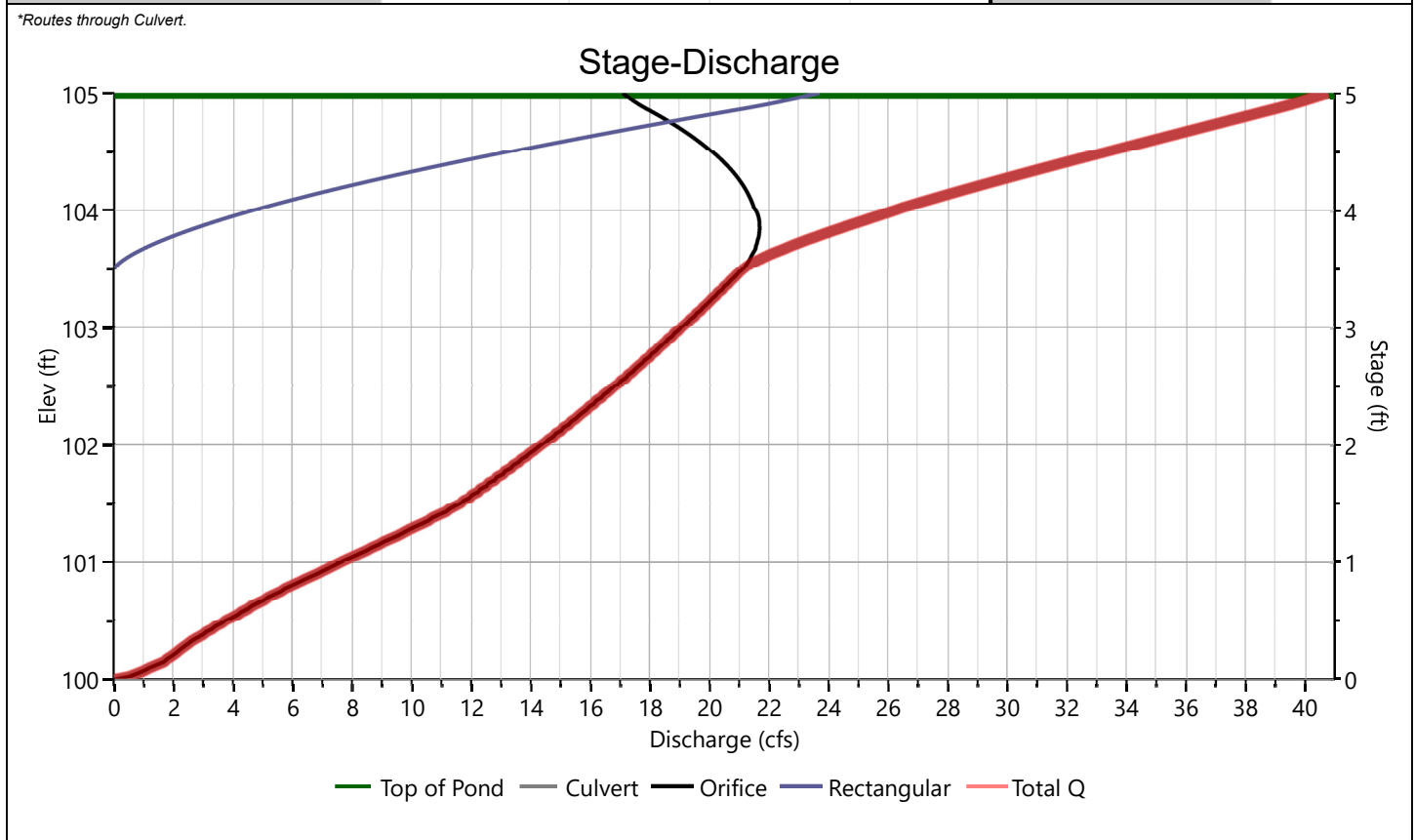
12-30-2020

UG Recharge / Detention Basin East

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	30	24			Hole Diameter, in
Span, in	30	24			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	99.50	99.50			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	235				
Barrel Slope, %	3.19				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type		Rectangular			Exfiltration, in/hr
Crest Elevation, ft		103.5			
Crest Length, ft		4			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Recharge / Detention Basin East

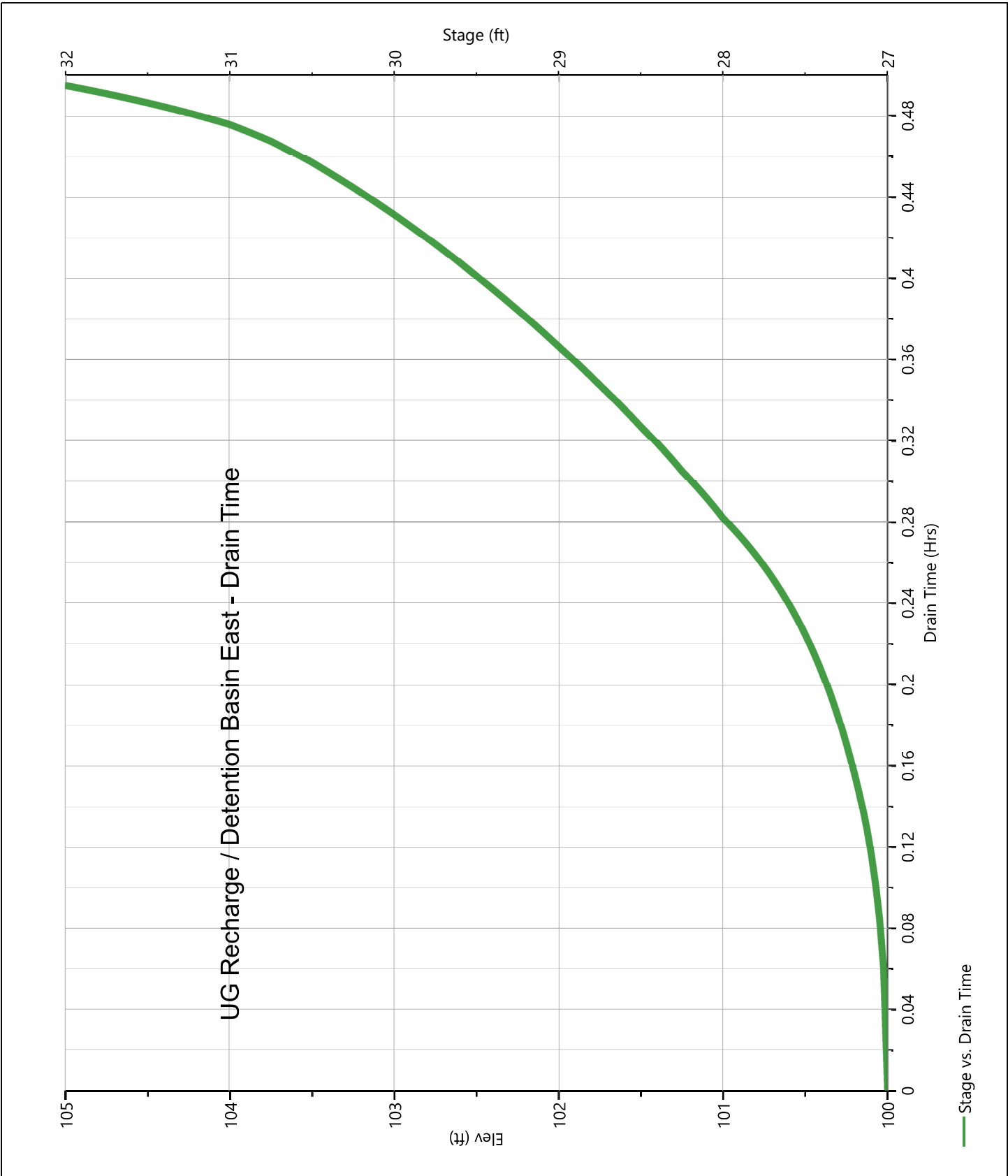
Stage-Storage-Discharge Summary

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	100.00	0.000	0.000	0.000				0.000						0.000
0.25	100.25	562	2.216 ic	2.216				0.000						2.216
0.50	100.50	1,123	3.754 ic	3.754				0.000						3.754
0.75	100.75	1,685	5.617 ic	5.617				0.000						5.617
1.00	101.00	2,247	7.618 ic	7.618				0.000						7.618
1.25	101.25	2,967	9.727 ic	9.727				0.000						9.727
1.50	101.50	3,806	11.65 ic	11.65				0.000						11.65
1.75	101.75	4,709	13.07 ic	13.07				0.000						13.07
2.00	102.00	5,652	14.36 ic	14.36				0.000						14.36
2.25	102.25	6,622	15.62 ic	15.62				0.000						15.62
2.50	102.50	7,603	16.81 ic	16.81				0.000						16.81
2.75	102.75	8,584	17.99 ic	17.99				0.000						17.99
3.00	103.00	9,553	19.05 ic	19.05				0.000						19.05
3.25	103.25	10,497	20.10 ic	20.10				0.000						20.10
3.50	103.50	11,400	21.11 ic	21.11				0.000						21.11
3.75	103.75	12,238	23.26 ic	21.61				1.650						23.26
4.00	104.00	12,958	26.22 ic	21.55				4.667						26.22
4.25	104.25	13,520	29.59 ic	21.02				8.574						29.59
4.50	104.50	14,081	33.29 ic	20.09				13.20						33.29
4.75	104.75	14,643	37.15 ic	18.70				18.45						37.15
5.00	105.00	15,205	40.77 ic	17.07				23.69 s						40.77

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

UG Recharge / Detention Basin East

Pond Drawdown



Hydrograph Report

Project Name:

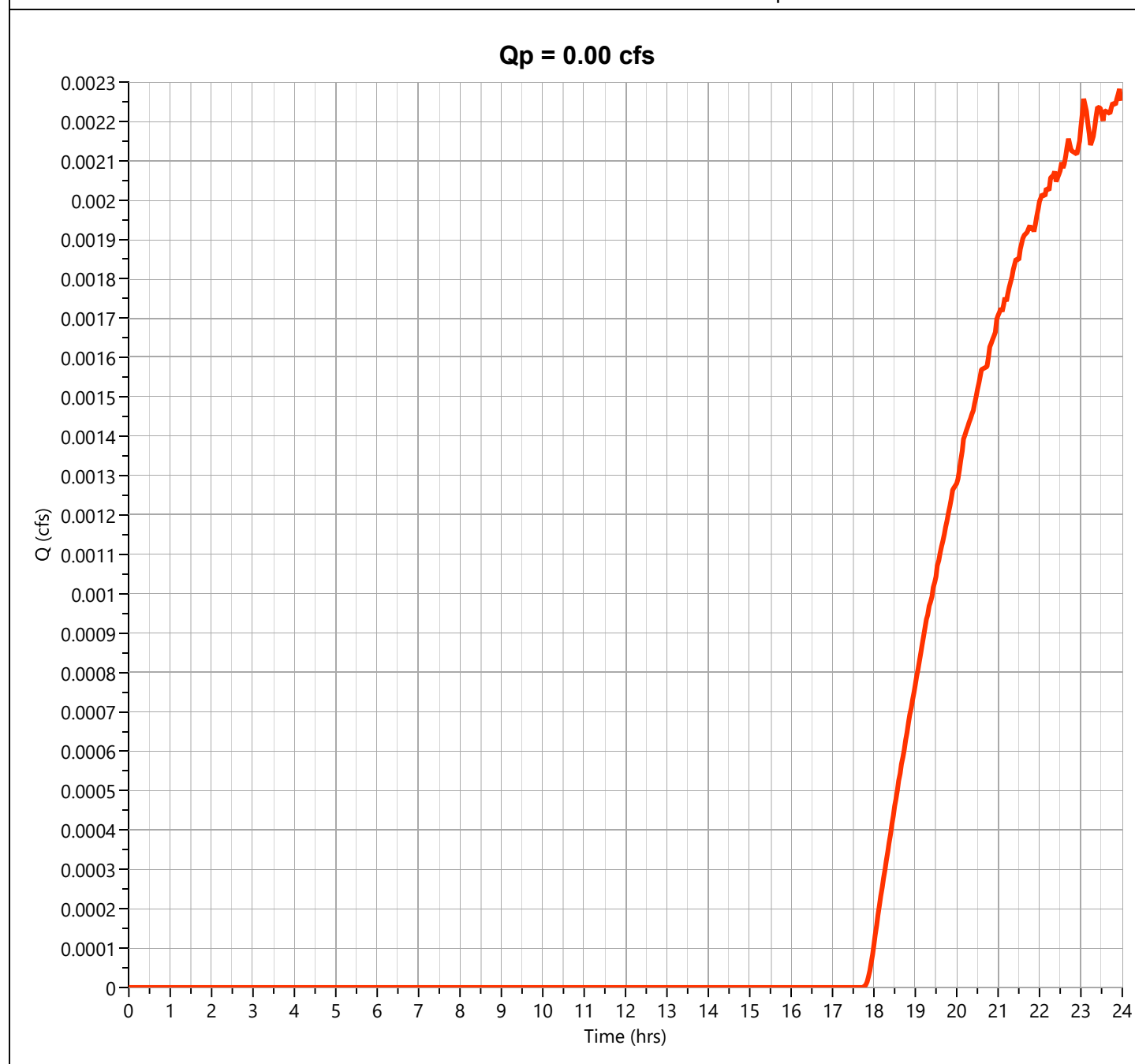
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b - Perv.

Hyd. No. 31

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.002 cfs
Storm Frequency	= 2-yr	Time to Peak	= 23.93 hrs
Time Interval	= 2 min	Runoff Volume	= 34.2 cuft
Drainage Area	= 1.5 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

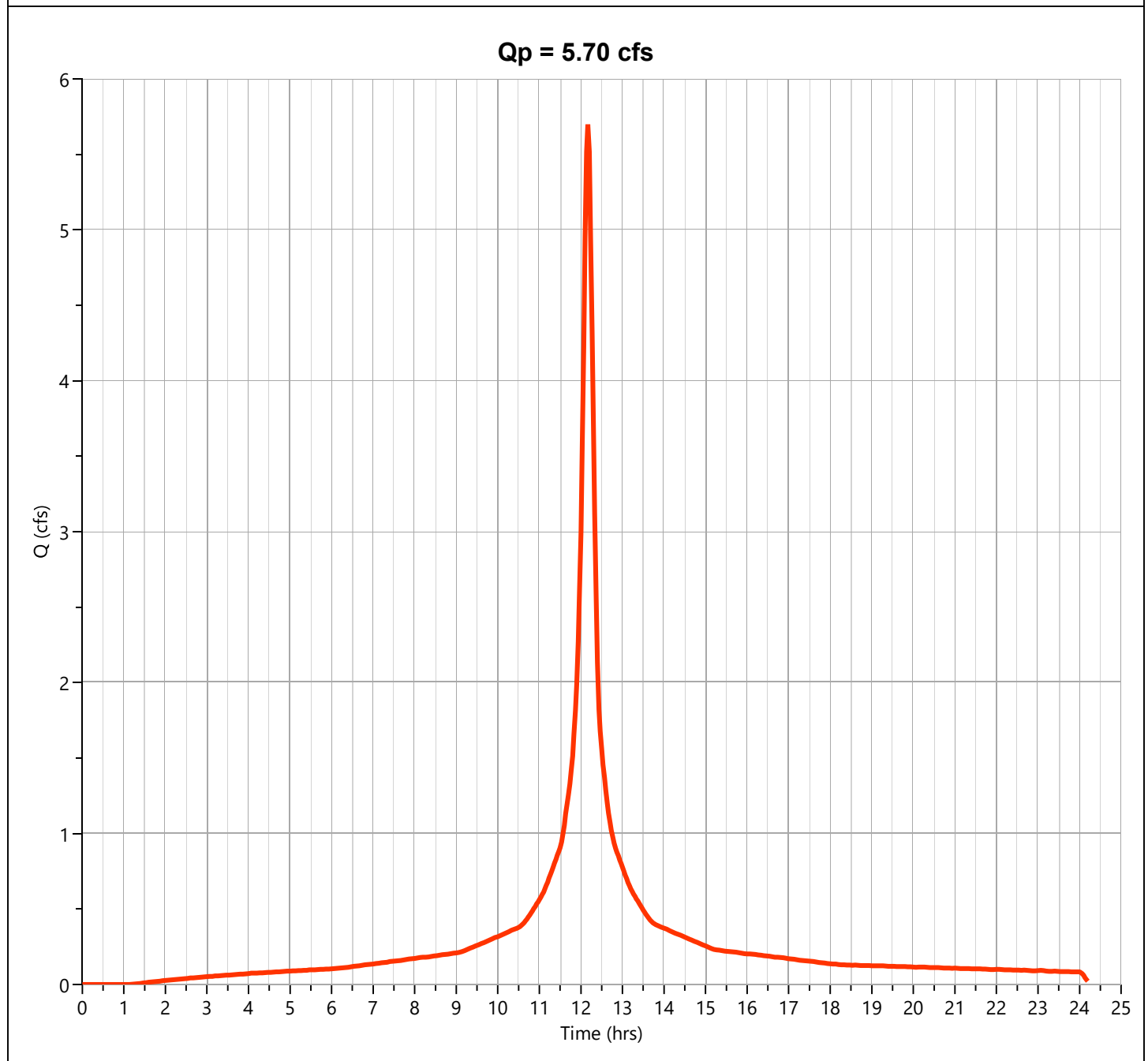
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b - Imperv.

Hyd. No. 32

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.697 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 25,208 cuft
Drainage Area	= 2.1 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

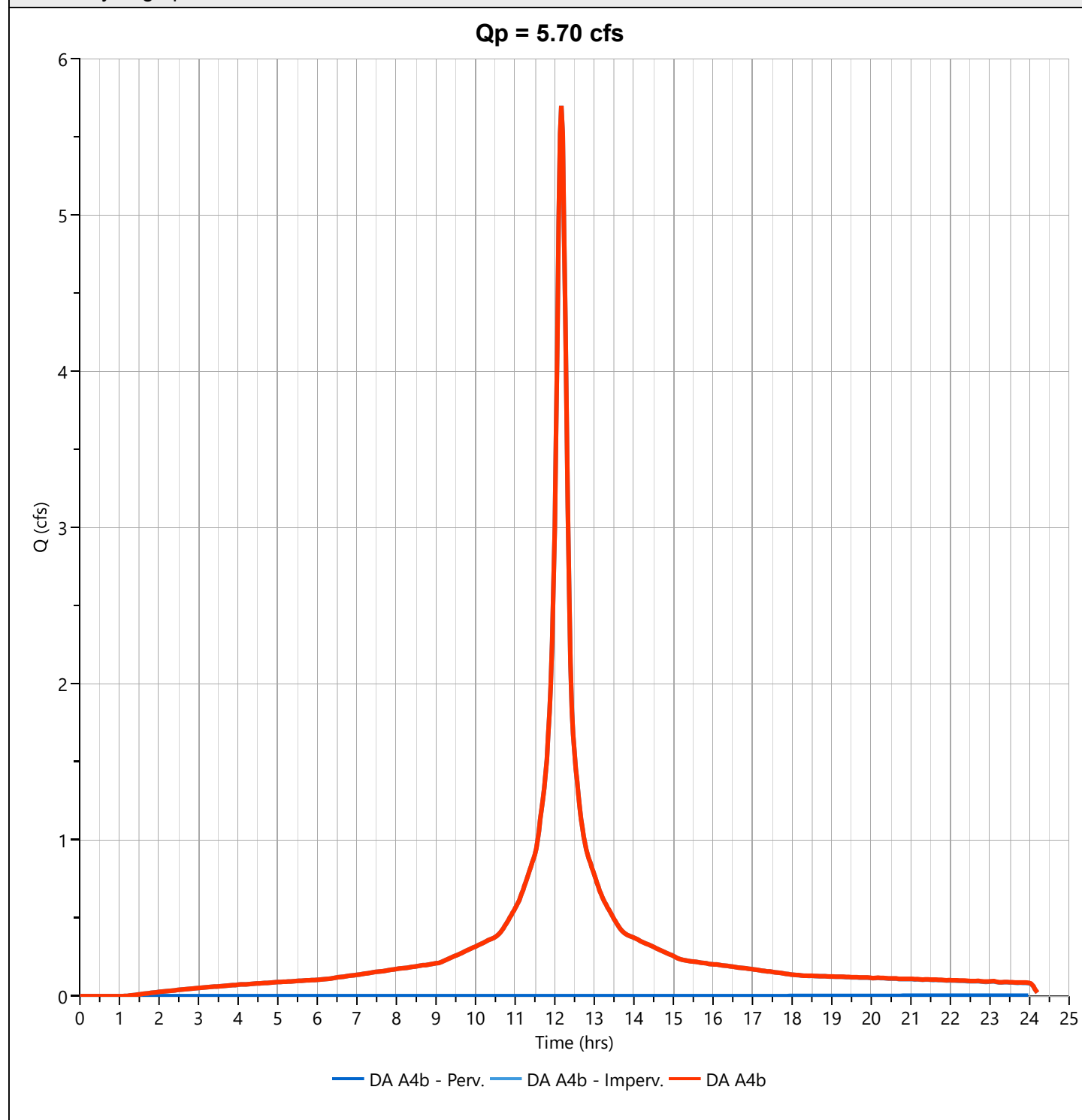
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b

Hyd. No. 33

Hydrograph Type	= Junction	Peak Flow	= 5.697 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 25,242 cuft
Inflow Hydrographs	= 31, 32	Total Contrib. Area	= 3.6 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

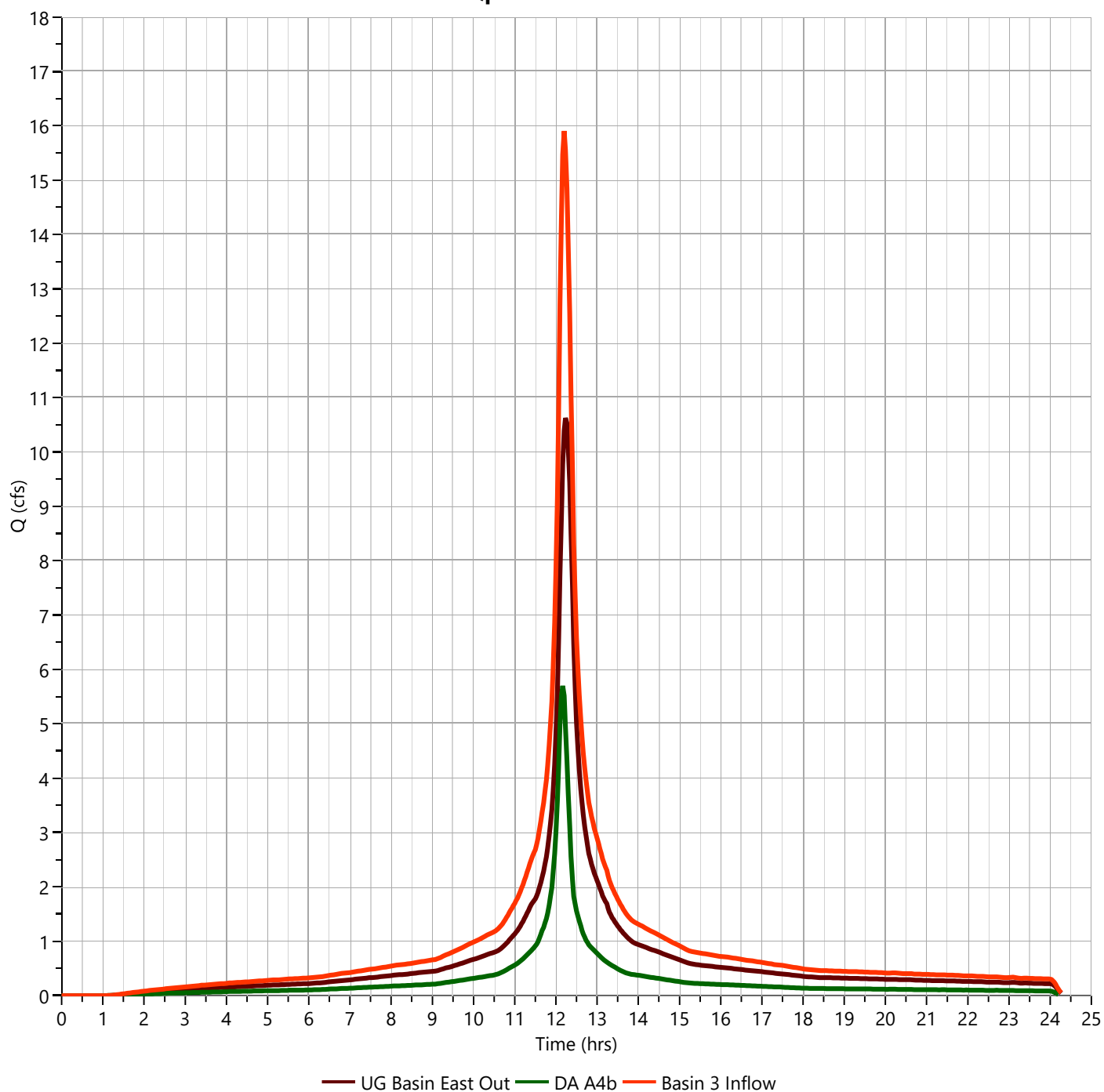
12-30-2020

Basin 3 Inflow

Hyd. No. 35

Hydrograph Type	= Junction	Peak Flow	= 15.91 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 82,940 cuft
Inflow Hydrographs	= 29, 33	Total Contrib. Area	= 3.6 ac

Qp = 15.91 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

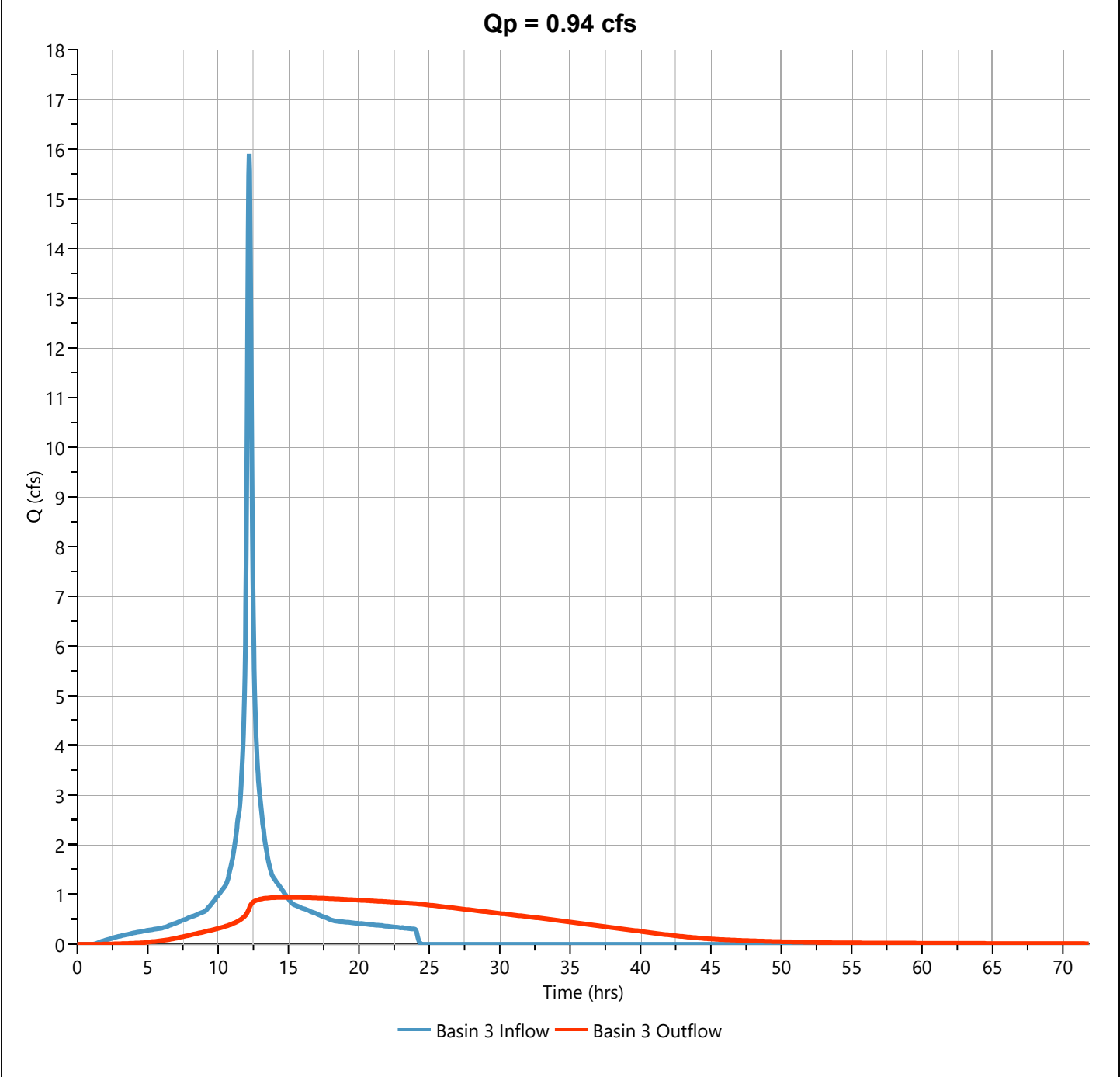
Basin 3 Outflow

Hyd. No. 36

Hydrograph Type	= Pond Route	Peak Flow	= 0.944 cfs
Storm Frequency	= 2-yr	Time to Peak	= 14.93 hrs
Time Interval	= 2 min	Hydrograph Volume	= 82,782 cuft
Inflow Hydrograph	= 35 - Basin 3 Inflow	Max. Elevation	= 91.74 ft
Pond Name	= Basin 3	Max. Storage	= 51,336 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 11.55 hrs



Pond Report

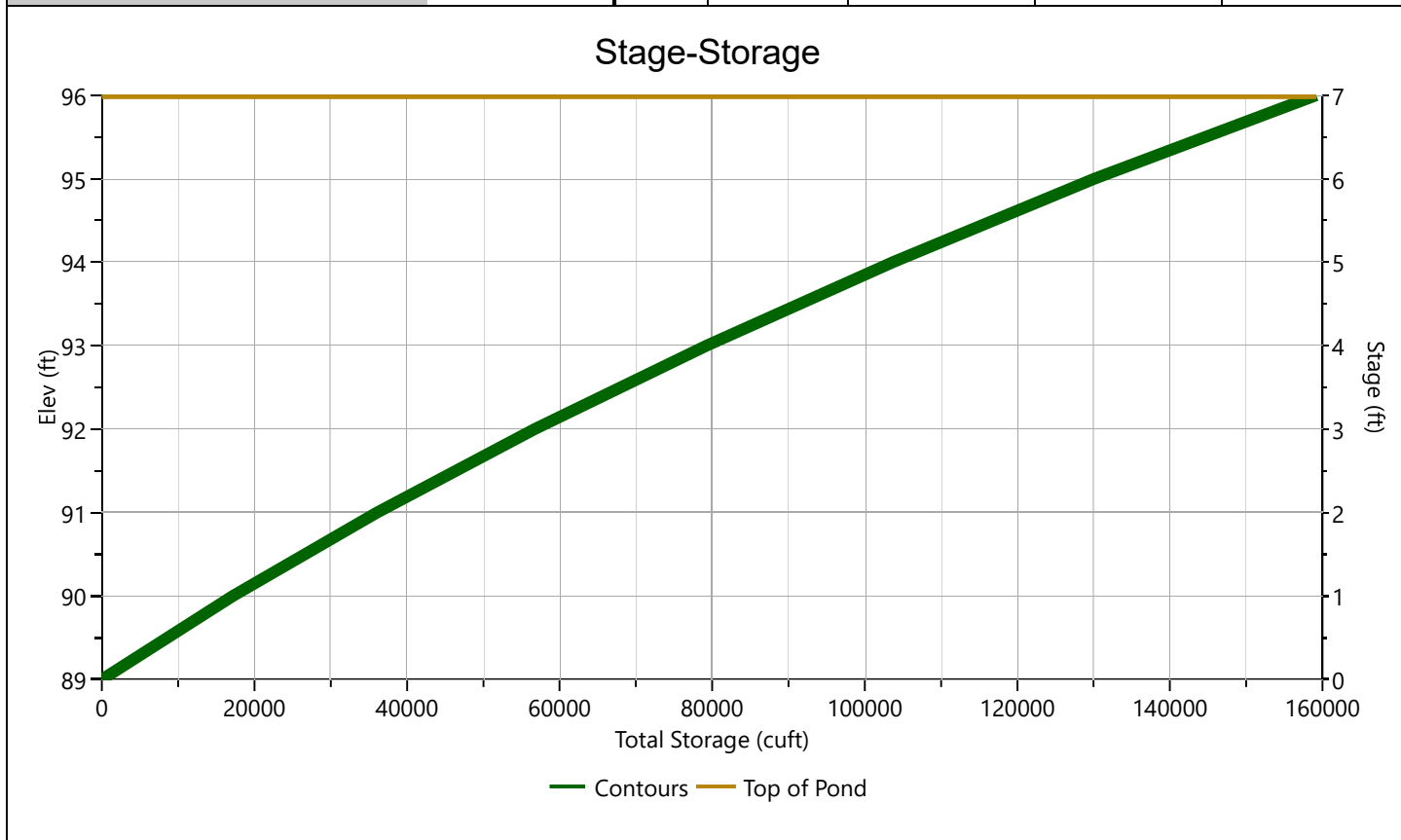
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 3

Stage-Storage

[illegible]

Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

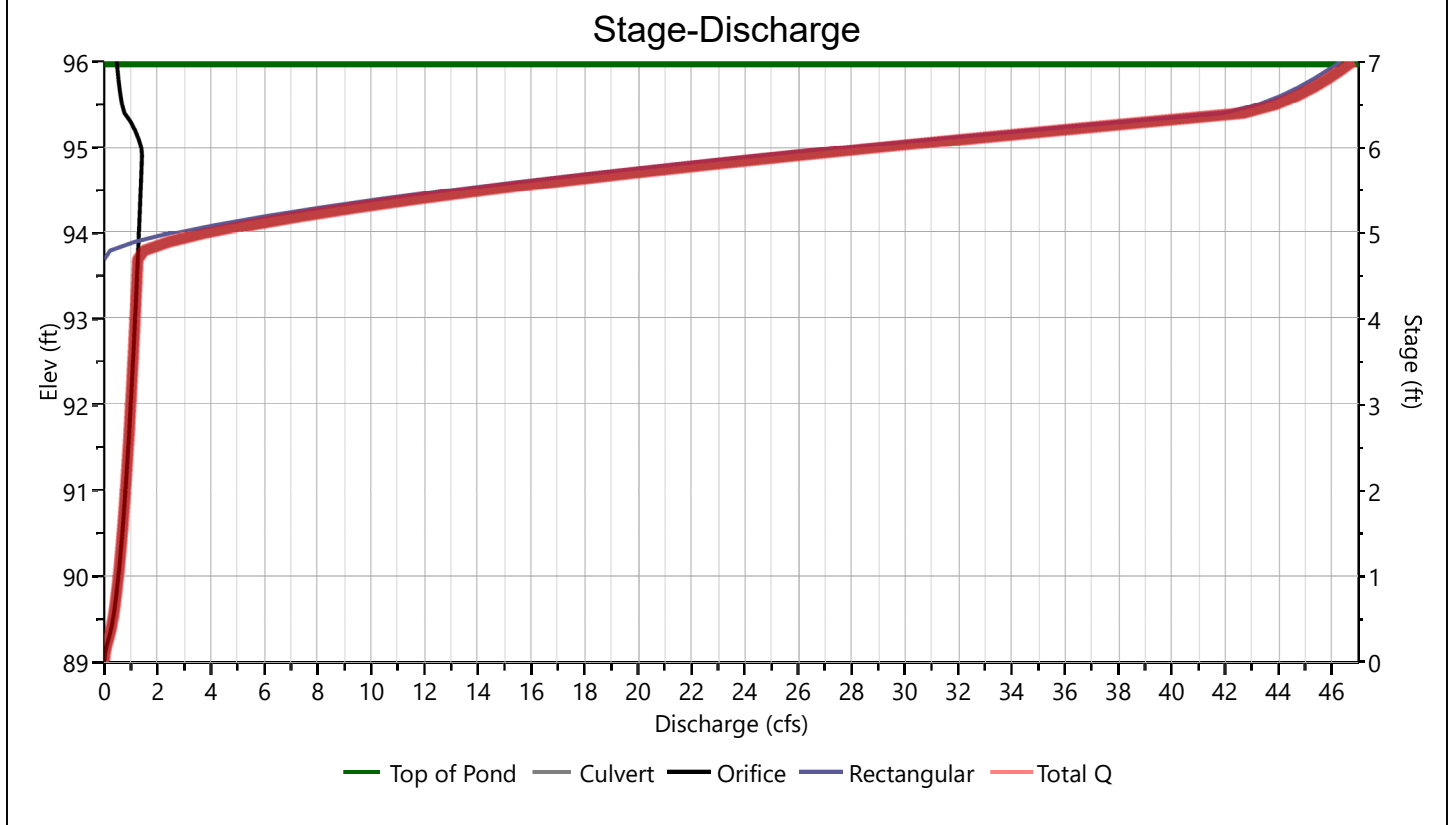
12-30-2020

Basin 3

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	24	4.75			Hole Diameter, in
Span, in	24	4.75			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	84.80	89.00			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	44				
Barrel Slope, %	.3				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type		Rectangular			Exfiltration, in/hr
Crest Elevation, ft		93.75			
Crest Length, ft		6			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 3

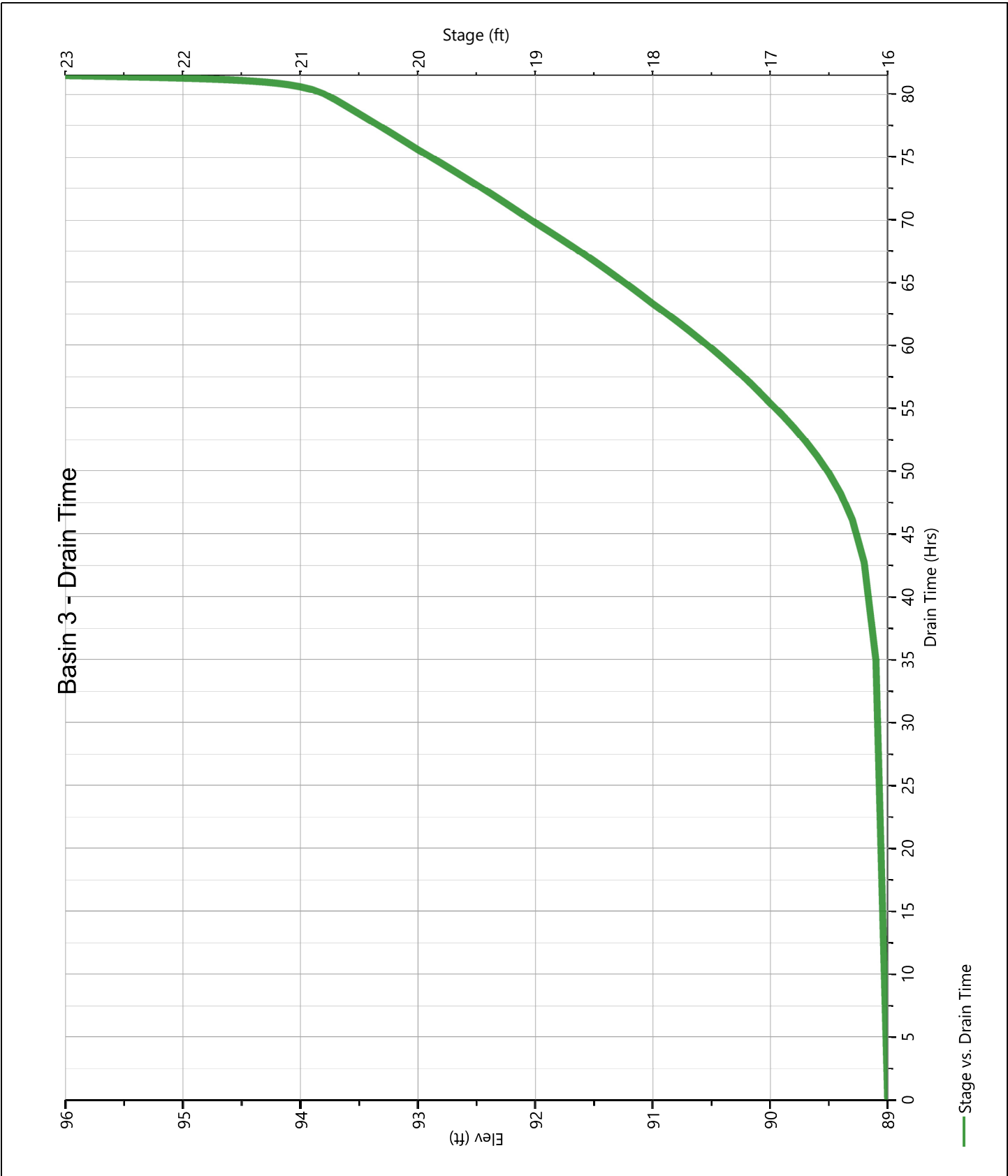
Stage-Storage-Discharge Summary

[illegible]

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

Basin 3

Pond Drawdown



Hydrograph Report

Project Name:

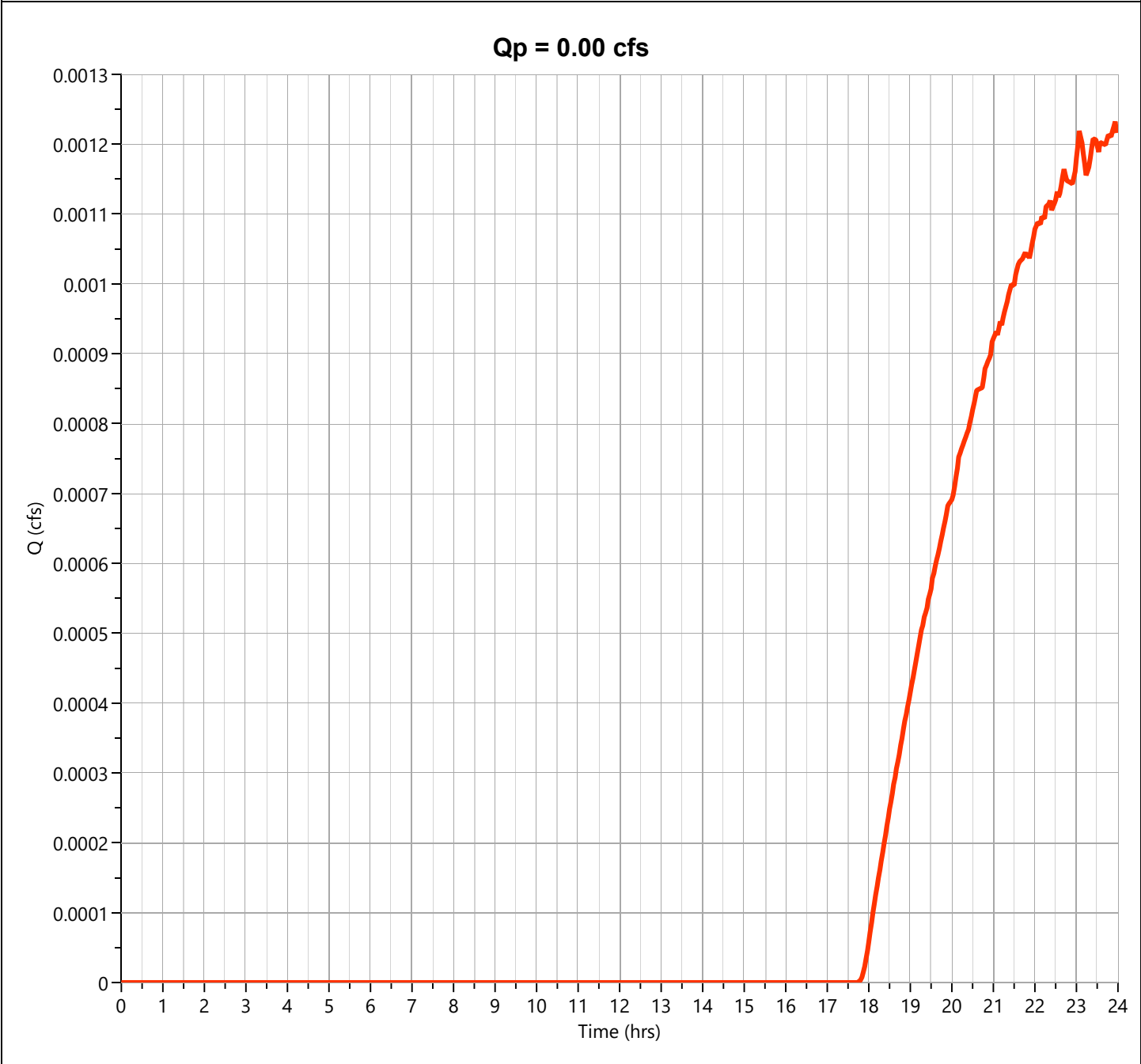
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5 - Perv.

Hyd. No. 38

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.001 cfs
Storm Frequency	= 2-yr	Time to Peak	= 23.93 hrs
Time Interval	= 2 min	Runoff Volume	= 18.5 cuft
Drainage Area	= 0.81 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

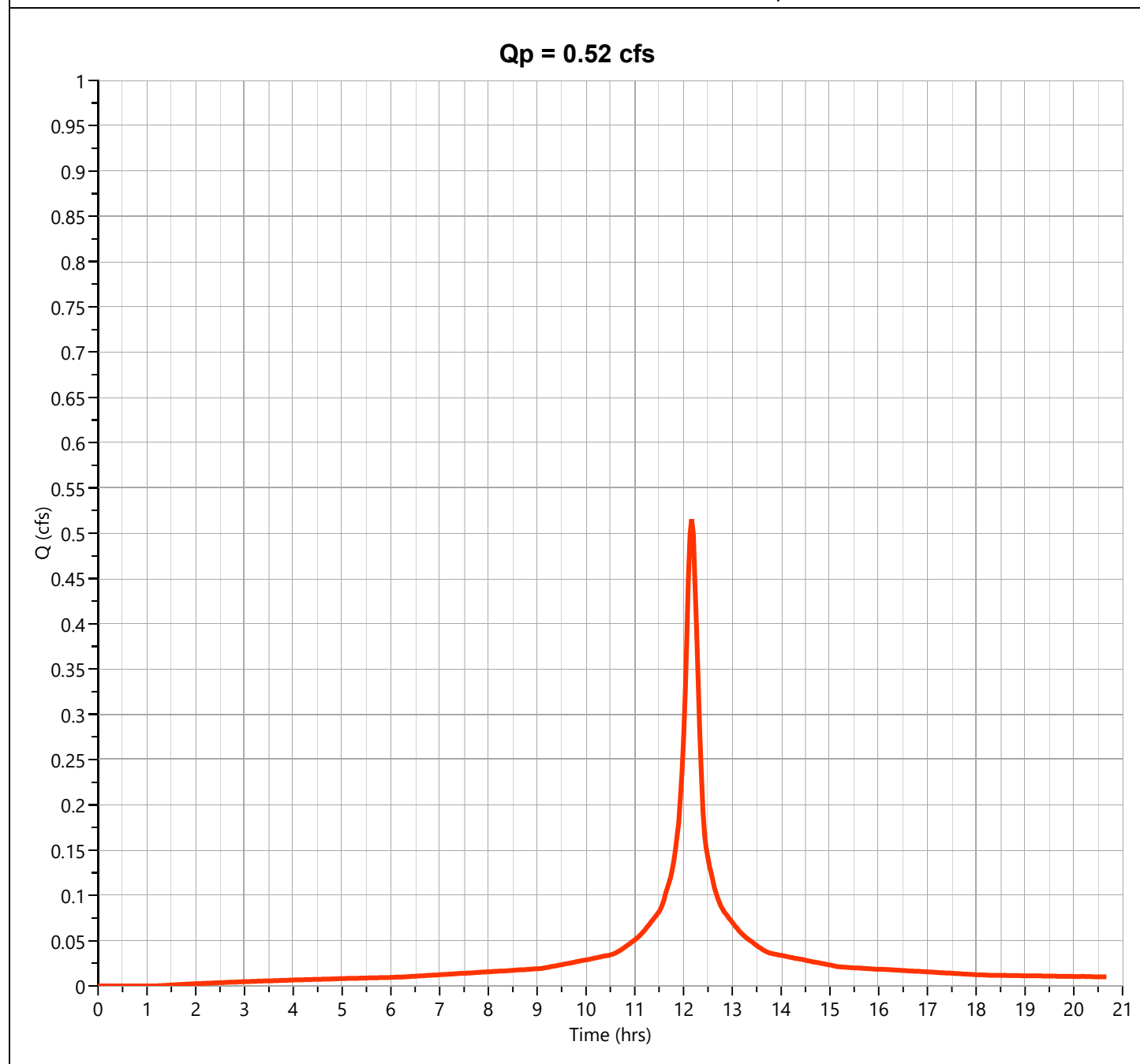
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5 - Imperv.

Hyd. No. 39

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.515 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 2,281 cuft
Drainage Area	= 0.19 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

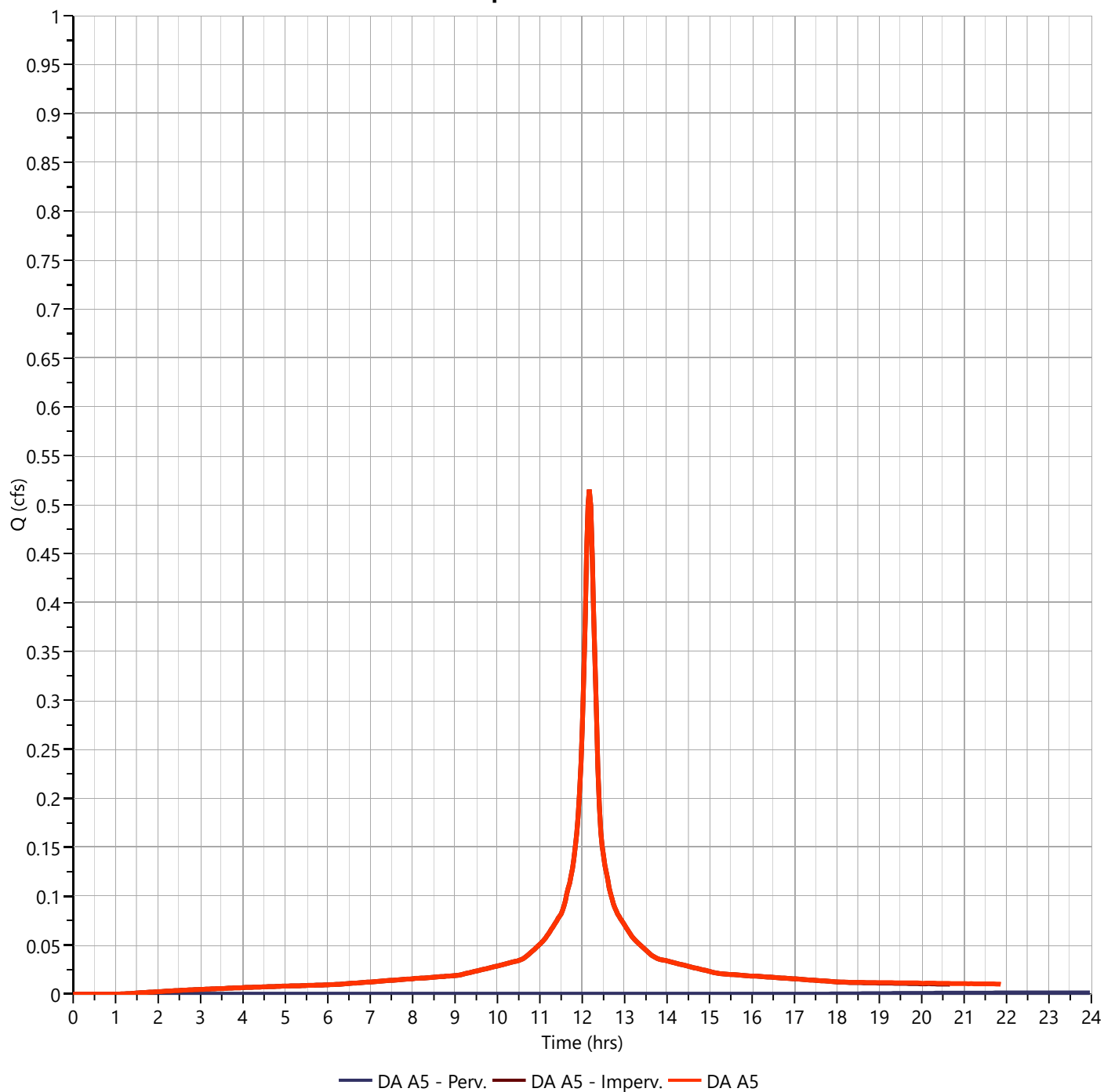
12-30-2020

Post DA A5

Hyd. No. 40

Hydrograph Type	= Junction	Peak Flow	= 0.515 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 2,299 cuft
Inflow Hydrographs	= 38, 39	Total Contrib. Area	= 1.0 ac

Qp = 0.52 cfs



Hydrograph Report

Project Name:

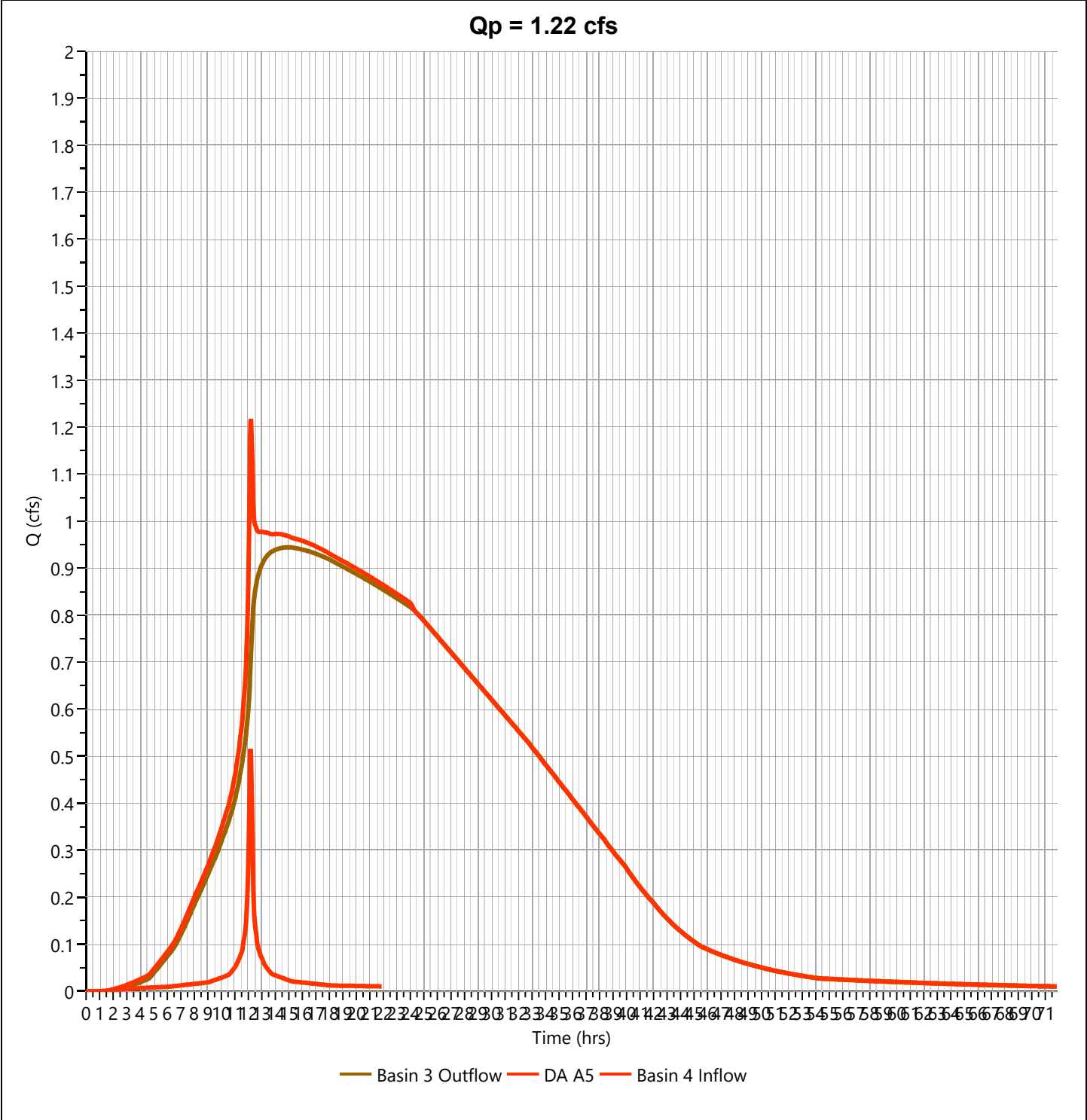
Hydrology Studio v 3.0.0.16

12-30-2020

Basin 4 Inflow

Hyd. No. 41

Hydrograph Type	= Junction	Peak Flow	= 1.217 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 85,081 cuft
Inflow Hydrographs	= 36, 40	Total Contrib. Area	= 1.0 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 4 Outflow

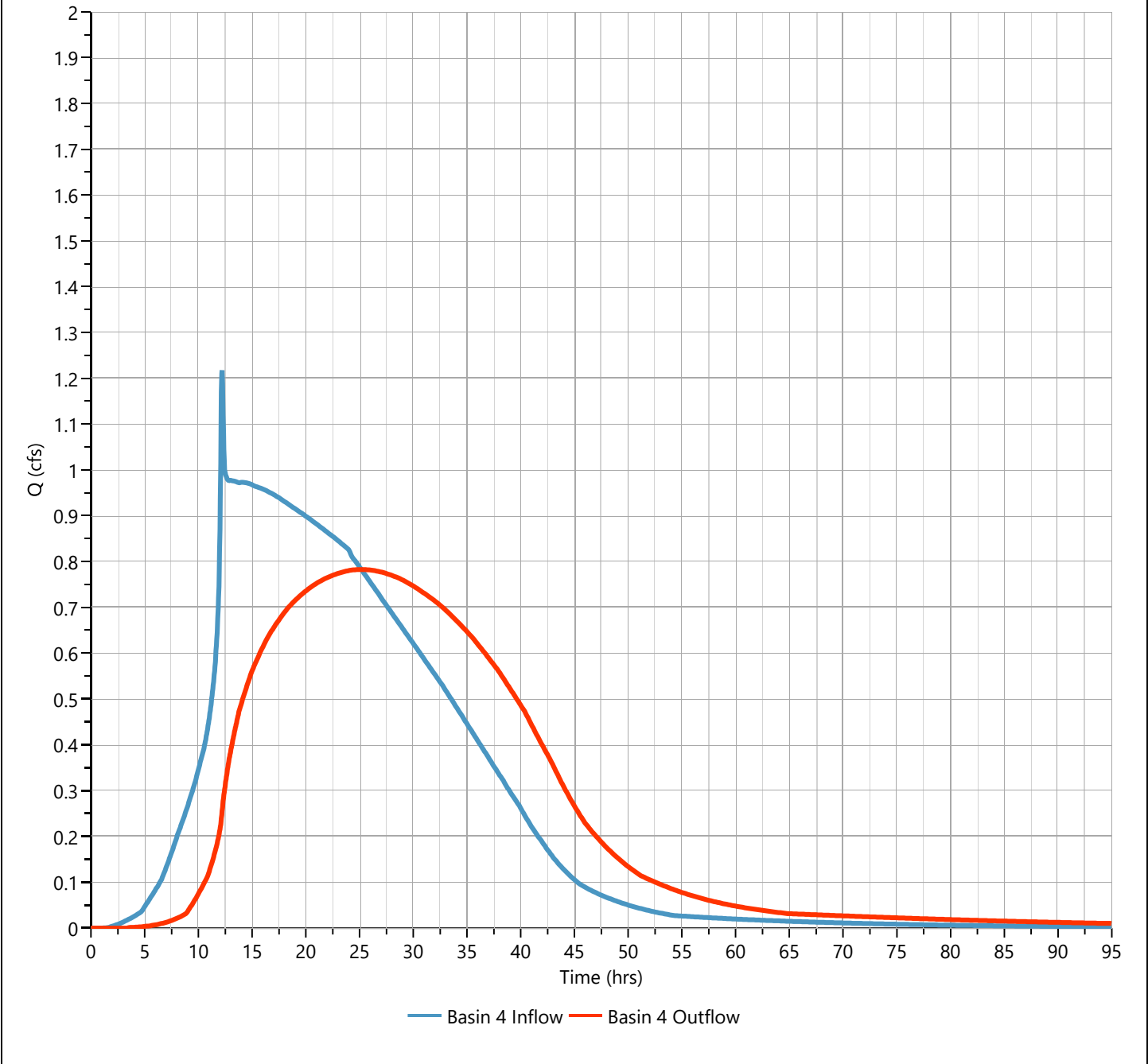
Hyd. No. 42

Hydrograph Type	= Pond Route	Peak Flow	= 0.783 cfs
Storm Frequency	= 2-yr	Time to Peak	= 25.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 84,494 cuft
Inflow Hydrograph	= 41 - Basin 4 Inflow	Max. Elevation	= 84.94 ft
Pond Name	= Basin 4	Max. Storage	= 18,077 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 6.64 hrs

Qp = 0.78 cfs



Pond Report

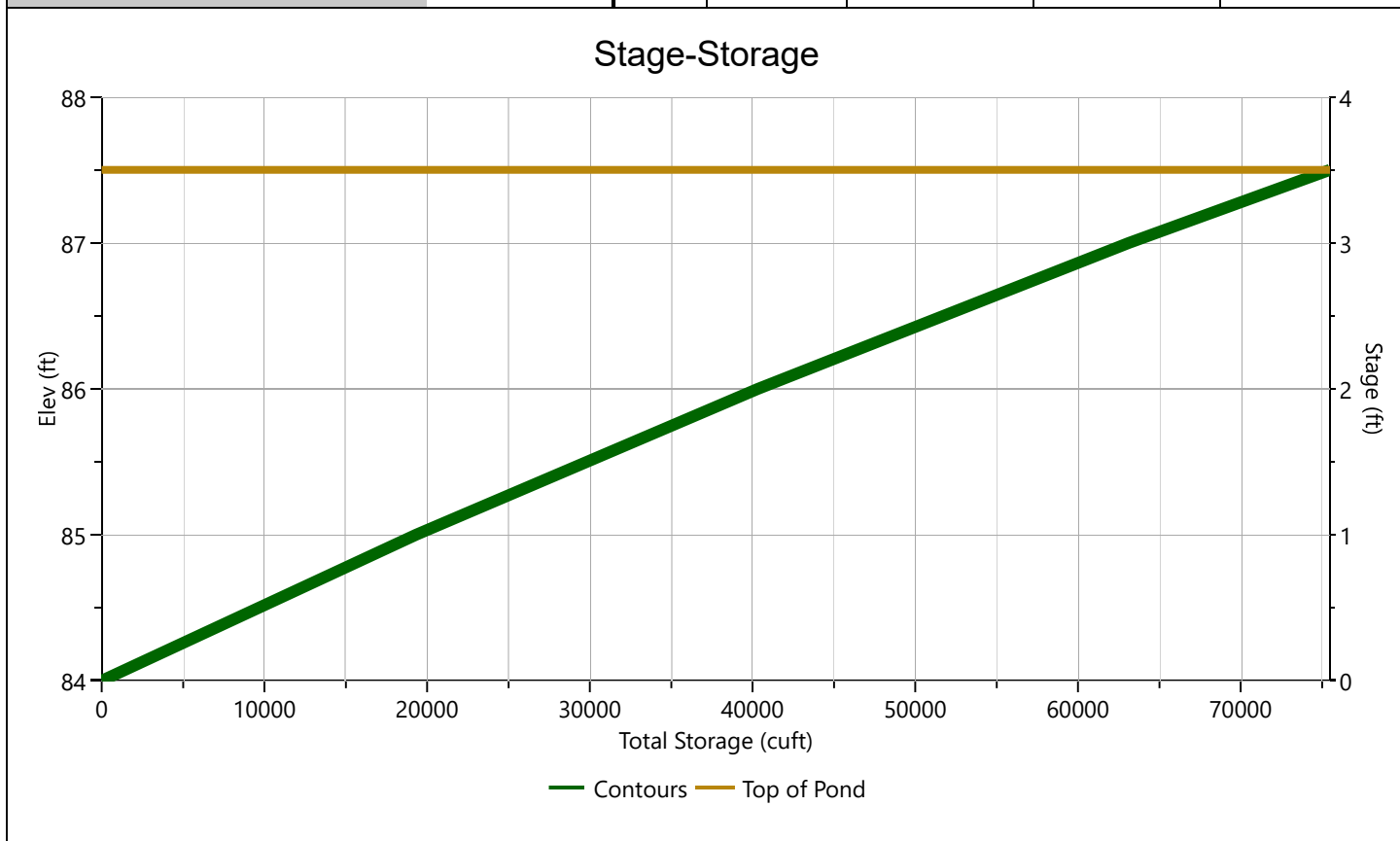
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 4

Stage-Storage

[illegible]

Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

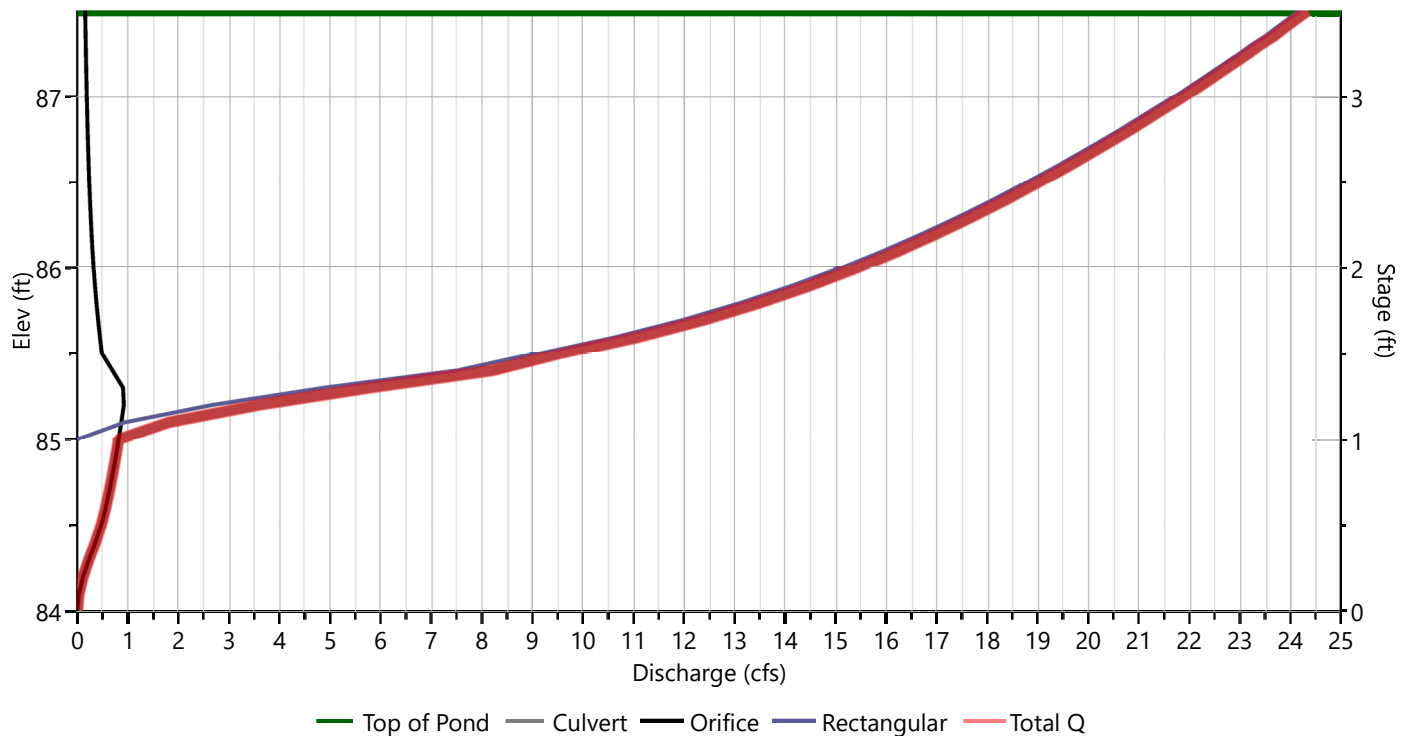
Basin 4

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	24	6			Hole Diameter, in
Span, in	24	6			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	83.15	84.00			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	108				
Barrel Slope, %	.3				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type	Circular	Rectangular			Exfiltration, in/hr
Crest Elevation, ft		85			
Crest Length, ft		9			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.

Stage-Discharge



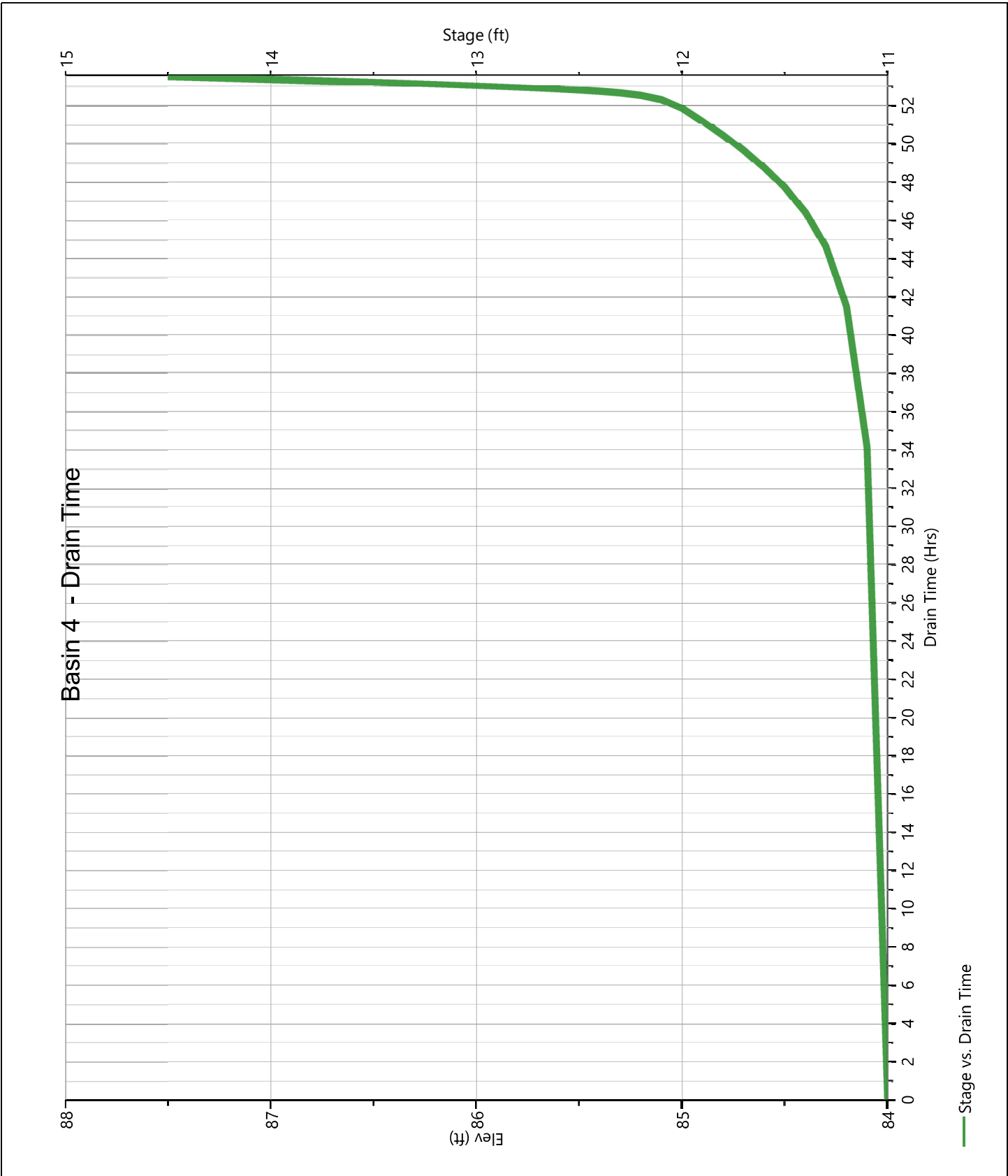
Project Name:

12-30-2020

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

Basin 4

Pond Drawdown



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6 - Perv.

Hyd. No. 44

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.84 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

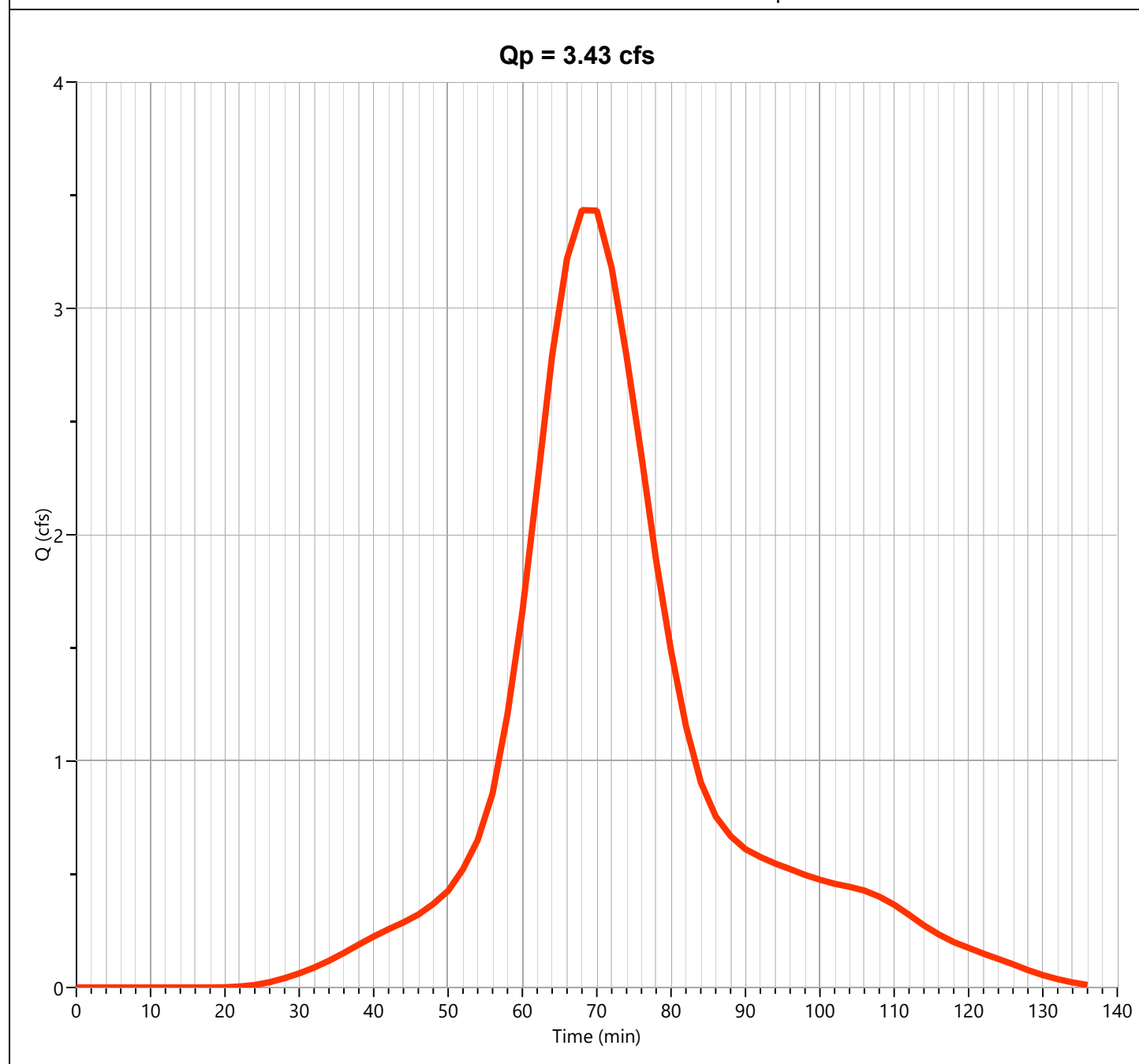
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6 - Imperv.

Hyd. No. 45

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.433 cfs
Storm Frequency	= 2-yr	Time to Peak	= 1.13 hrs
Time Interval	= 2 min	Runoff Volume	= 5,383 cuft
Drainage Area	= 1.39 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

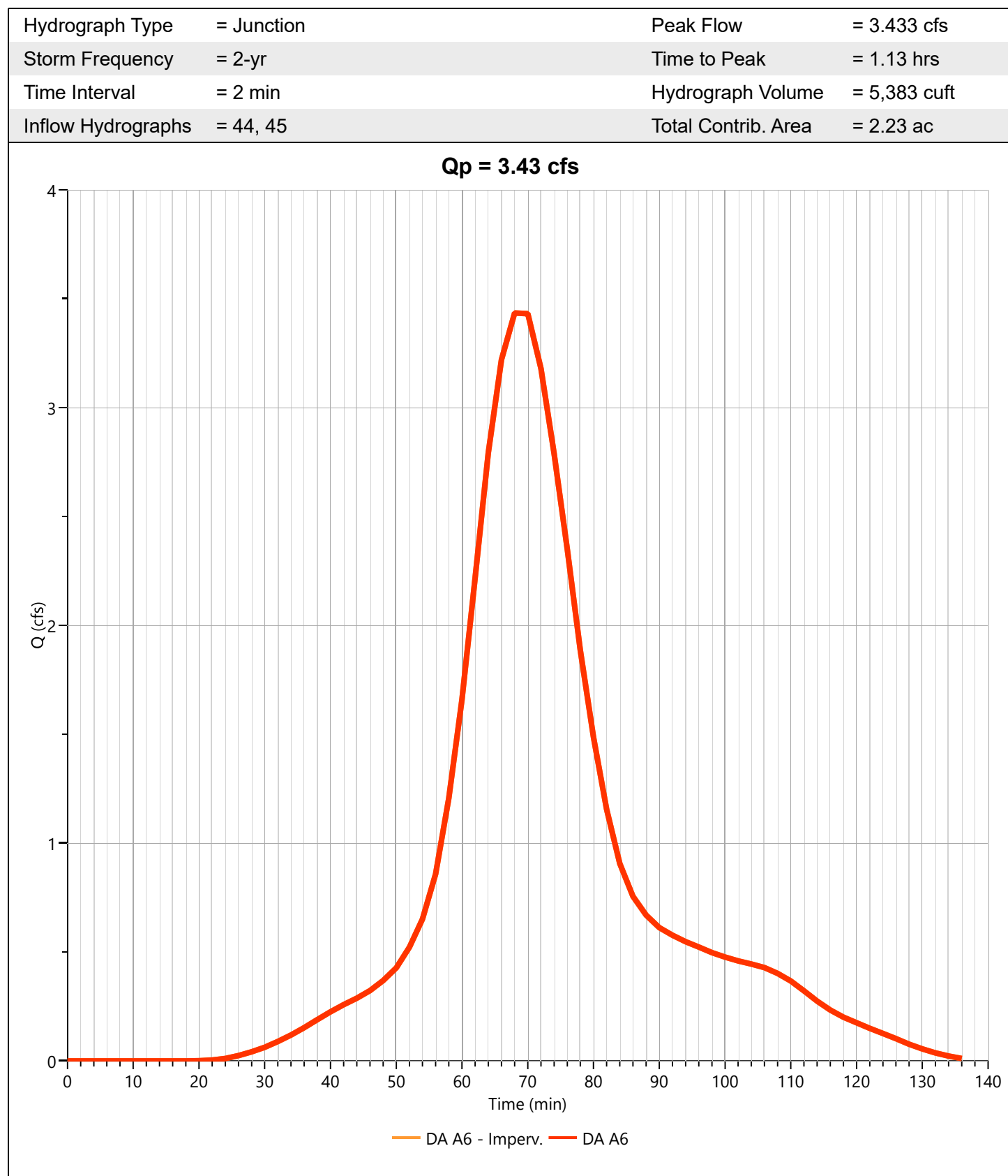
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6

Hyd. No. 46



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

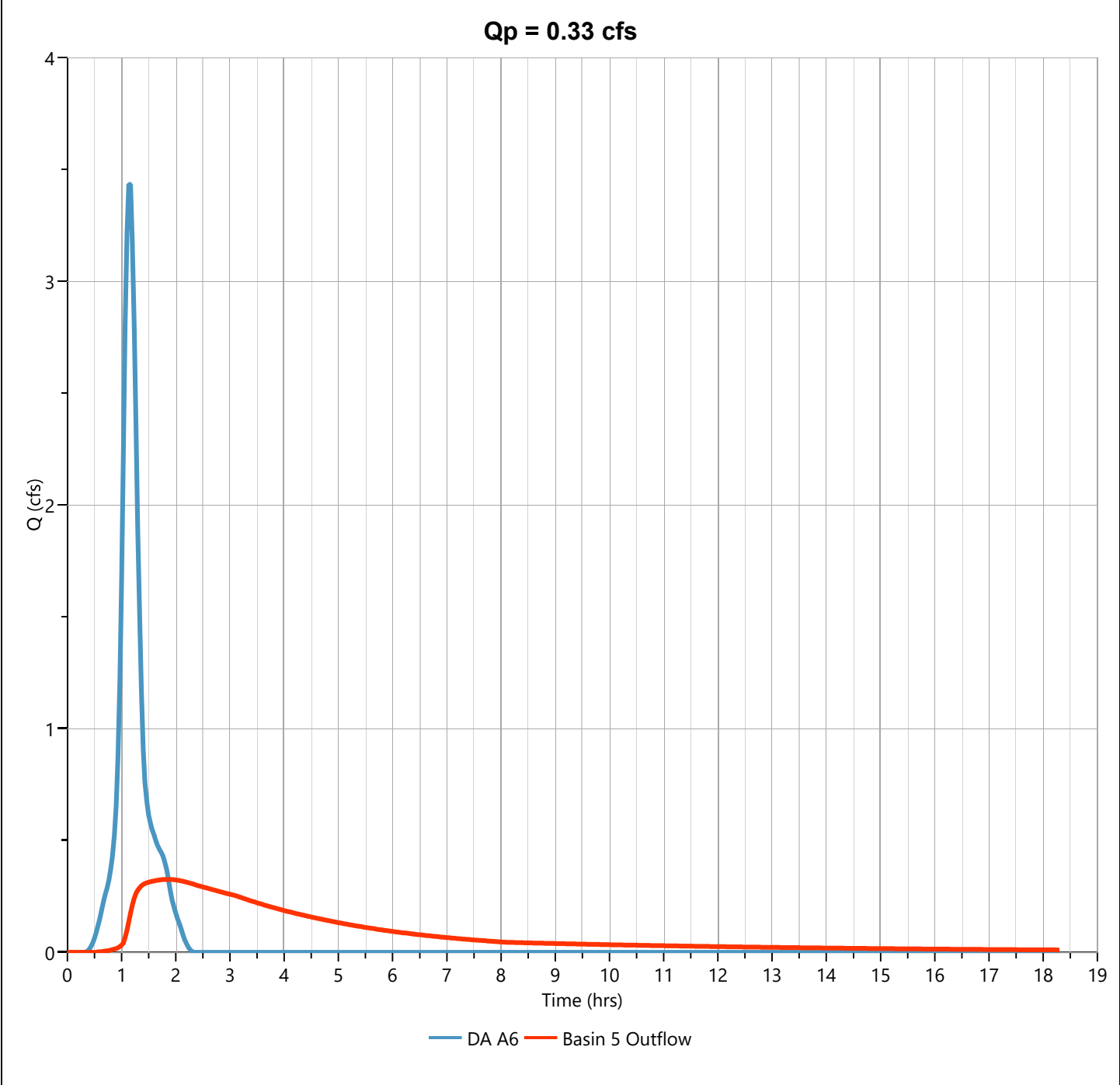
Basin 5 Outflow

Hyd. No. 47

Hydrograph Type	= Pond Route	Peak Flow	= 0.326 cfs
Storm Frequency	= 2-yr	Time to Peak	= 1.87 hrs
Time Interval	= 2 min	Hydrograph Volume	= 5,359 cuft
Inflow Hydrograph	= 46 - DA A6	Max. Elevation	= 73.40 ft
Pond Name	= Basin 5	Max. Storage	= 4,365 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 4.19 hrs



Pond Report

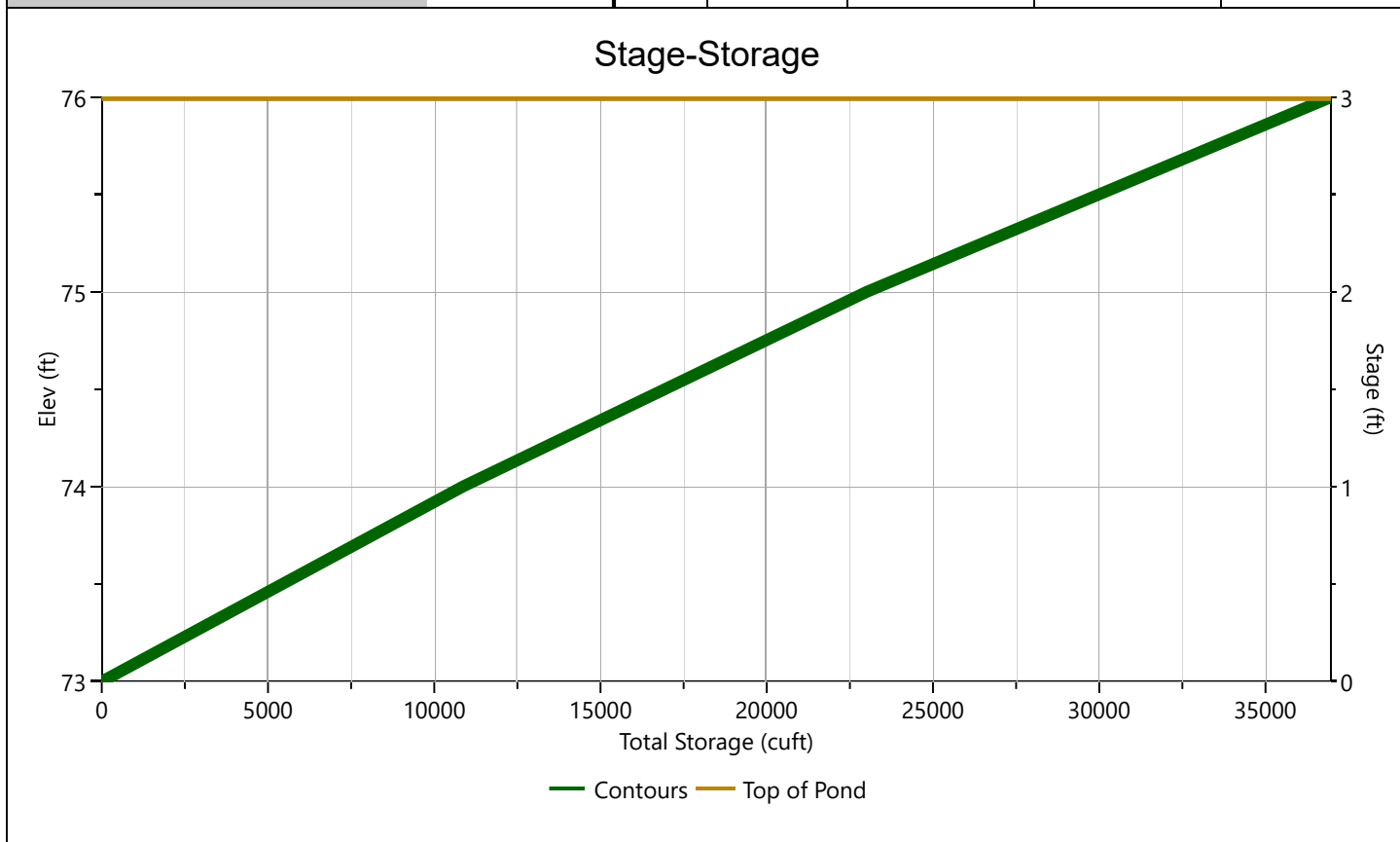
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 5

Stage-Storage

[illegible]

Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

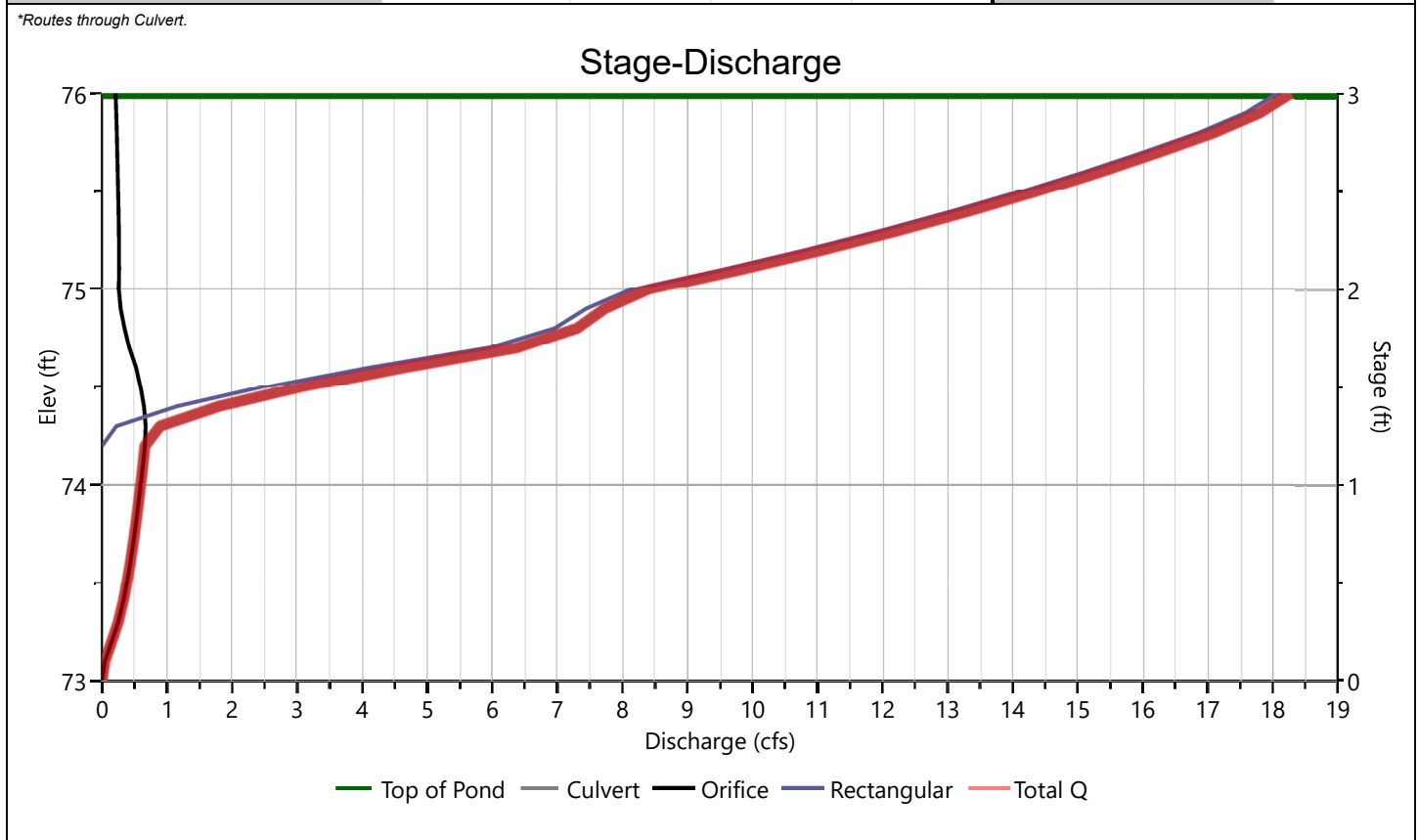
12-30-2020

Basin 5

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	24	3.5			Hole Diameter, in
Span, in	24	3.5			No. holes
No. Barrels	1	2			Invert Elevation, ft
Invert Elevation, ft	72.79	73.00			Height, ft
Orifice Coefficient, Co	0.50	0.60			Orifice Coefficient, Co
Length, ft	73				
Barrel Slope, %	.3				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type	Circular	Rectangular			Exfiltration, in/hr
Crest Elevation, ft		74.25			
Crest Length, ft		6			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 5

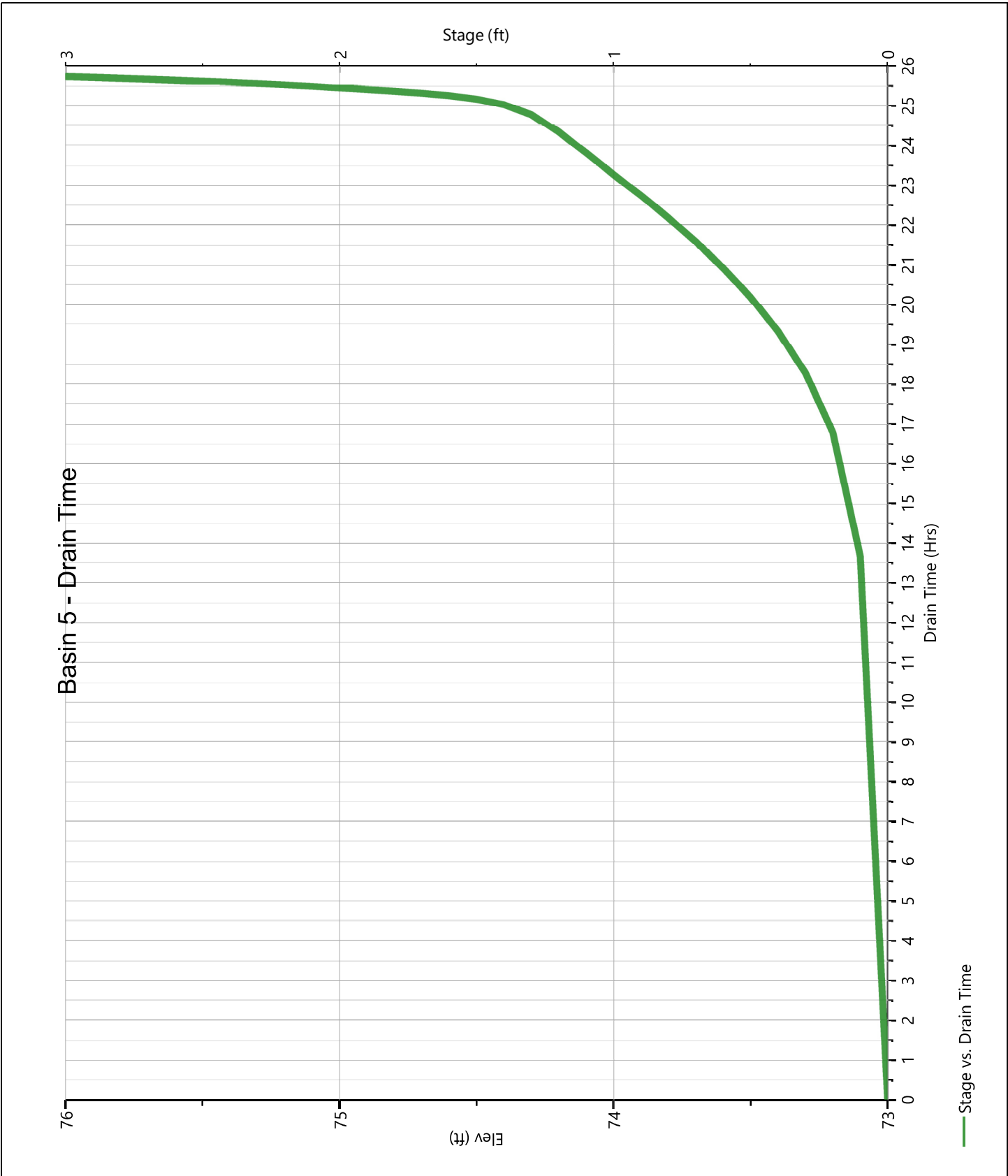
Stage-Storage-Discharge Summary

[illegible]

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

Basin 5

Pond Drawdown



Hydrograph Report

Project Name:

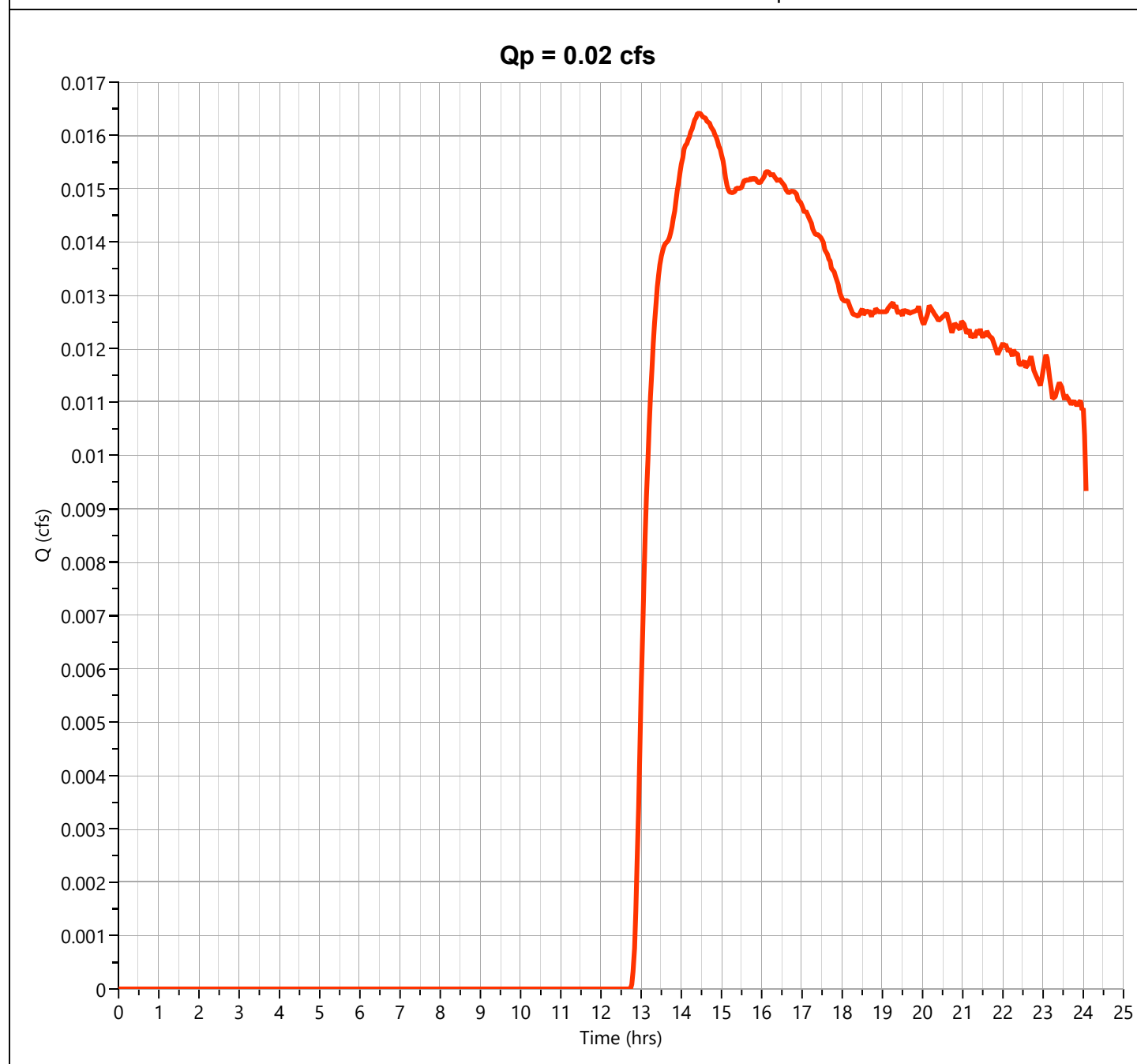
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A7

Hyd. No. 49

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.016 cfs
Storm Frequency	= 2-yr	Time to Peak	= 14.47 hrs
Time Interval	= 2 min	Runoff Volume	= 533 cuft
Drainage Area	= 1.9 ac	Curve Number	= 45
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

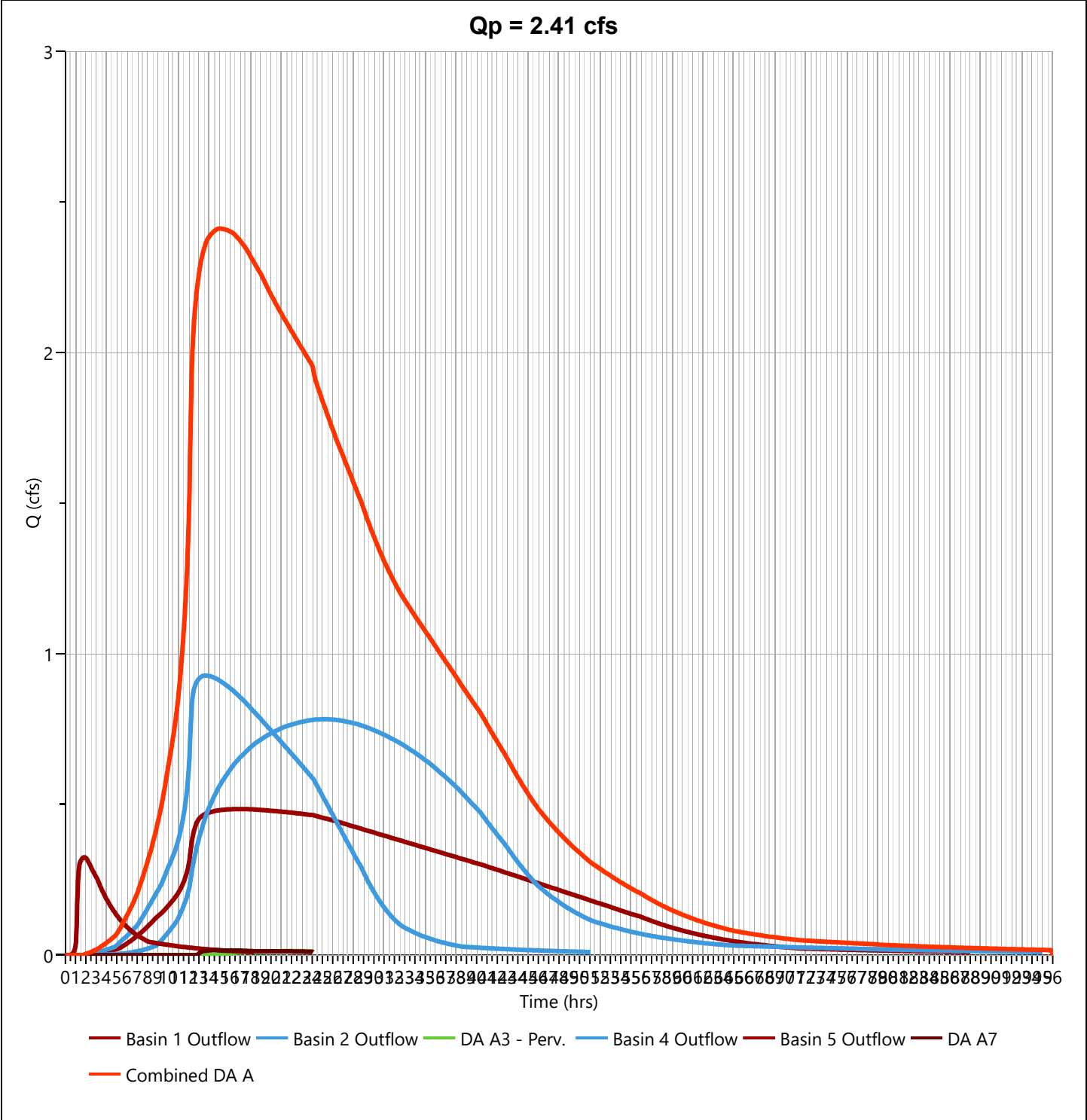
Hydrology Studio v 3.0.0.16

12-30-2020

Combined DA A

Hyd. No. 51

Hydrograph Type	= Junction	Peak Flow	= 2.411 cfs
Storm Frequency	= 2-yr	Time to Peak	= 14.97 hrs
Time Interval	= 2 min	Hydrograph Volume	= 216,967 cuft
Inflow Hydrographs	= 17, 22, 24, 42, 47, 49	Total Contrib. Area	= 6.31 ac



Hydrograph Report

Project Name:

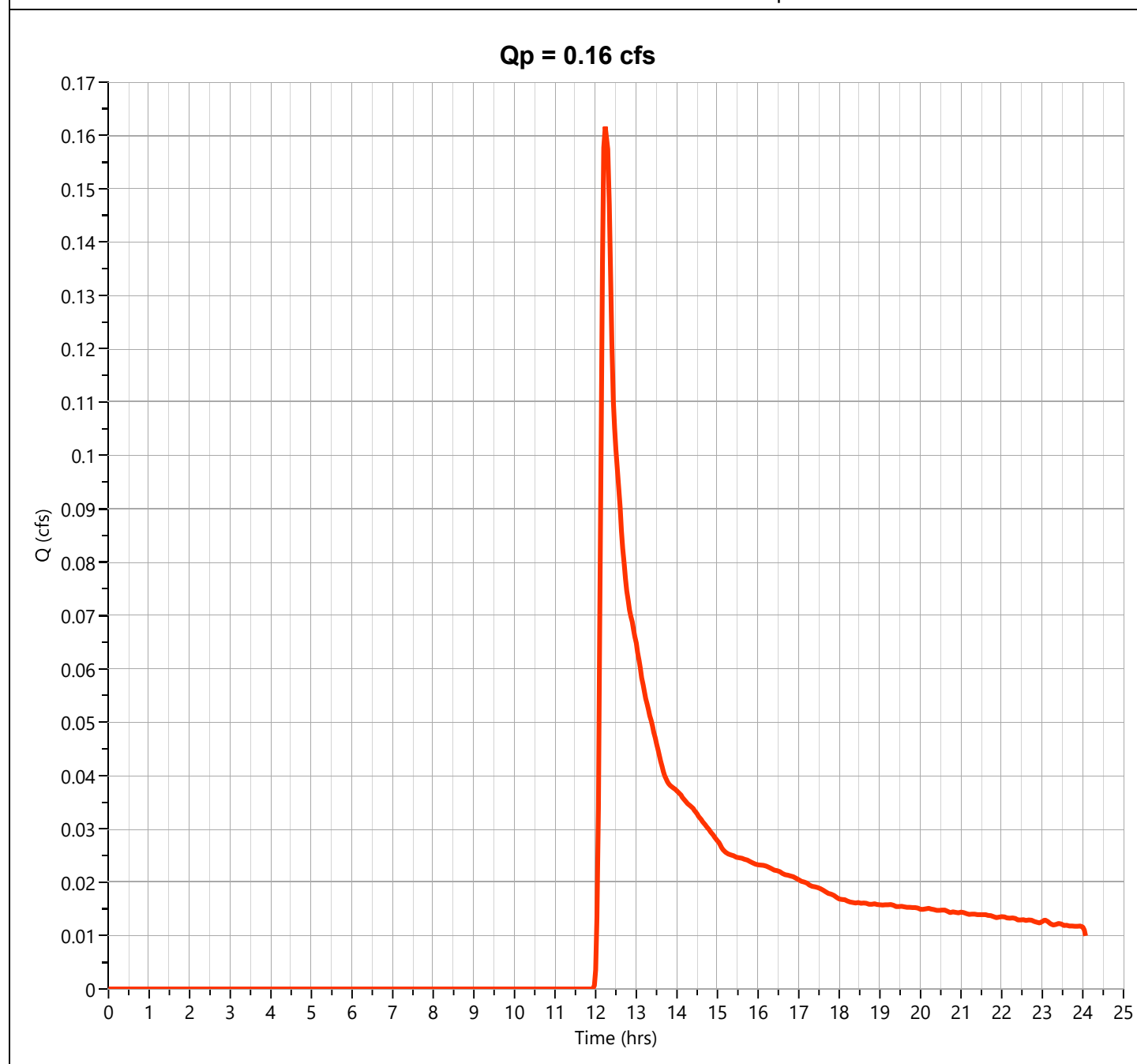
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA B - Perv.

Hyd. No. 53

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.162 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 1,179 cuft
Drainage Area	= 0.8 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

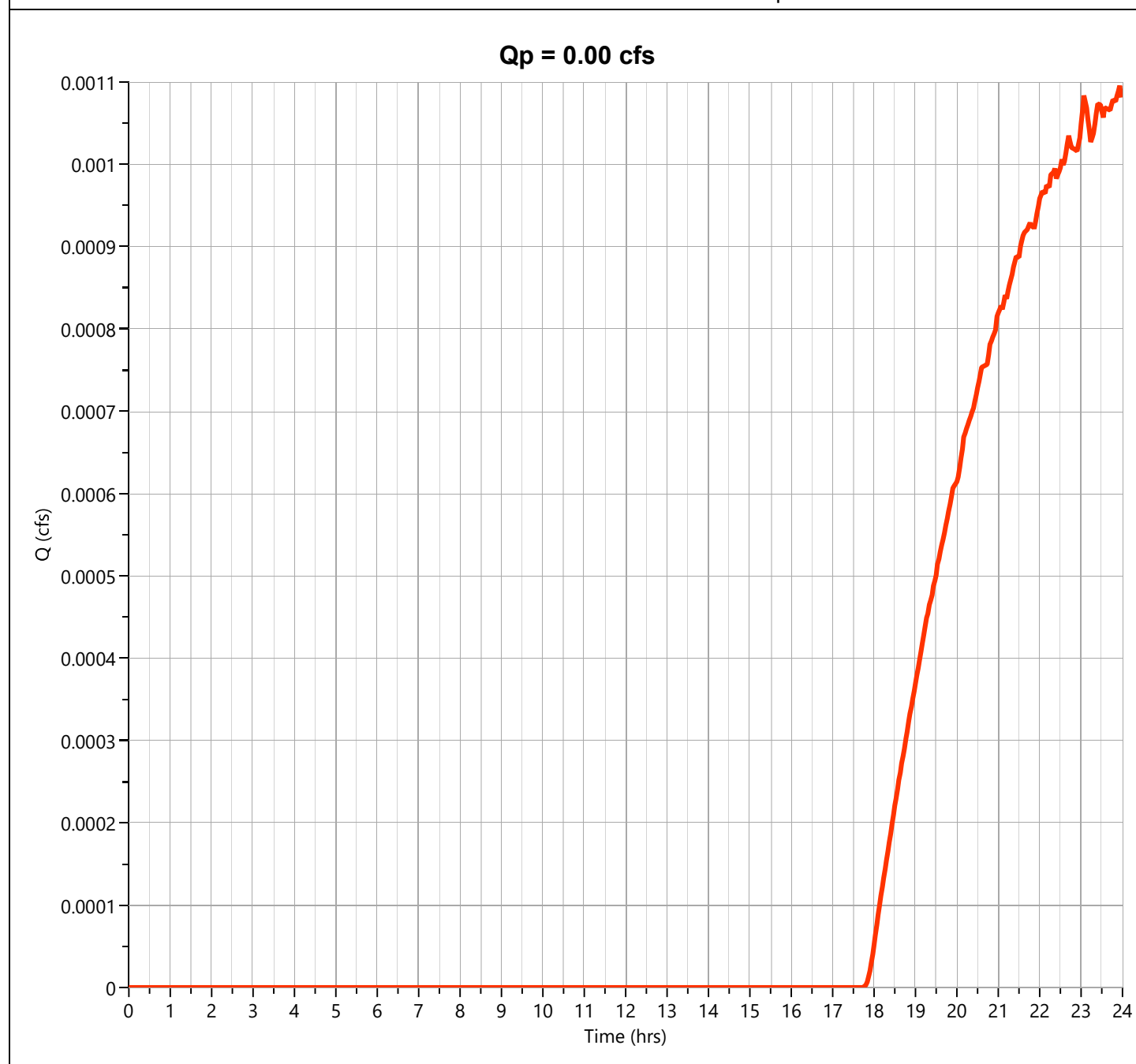
Hydrology Studio v 3.0.0.16

12-30-2020

Pre DA C - Perv.

Hyd. No. 55

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.001 cfs
Storm Frequency	= 2-yr	Time to Peak	= 23.93 hrs
Time Interval	= 2 min	Runoff Volume	= 16.4 cuft
Drainage Area	= 0.72 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

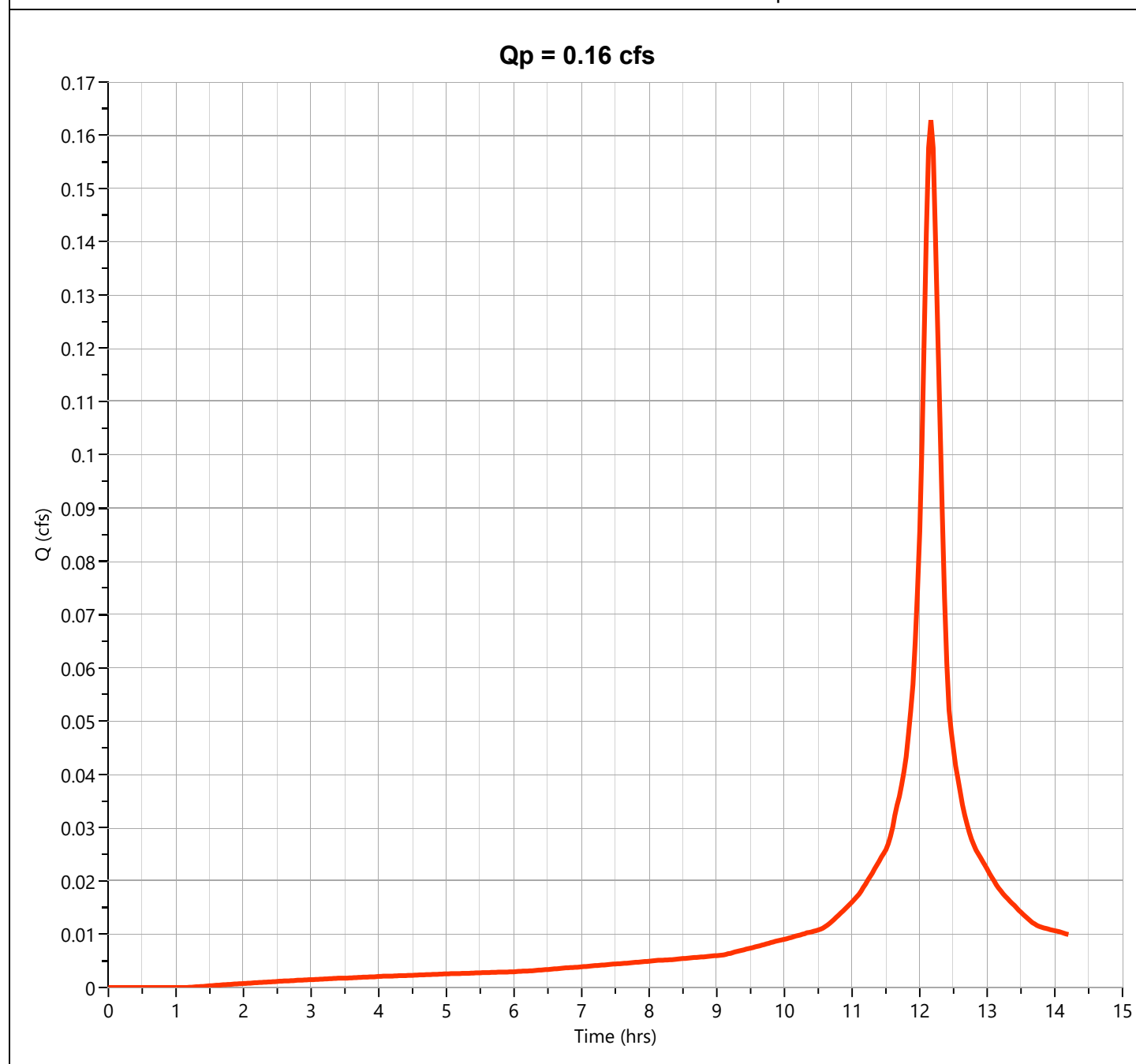
Hydrology Studio v 3.0.0.16

12-30-2020

Pre DA C - Imperv.

Hyd. No. 56

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.163 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 720 cuft
Drainage Area	= 0.06 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

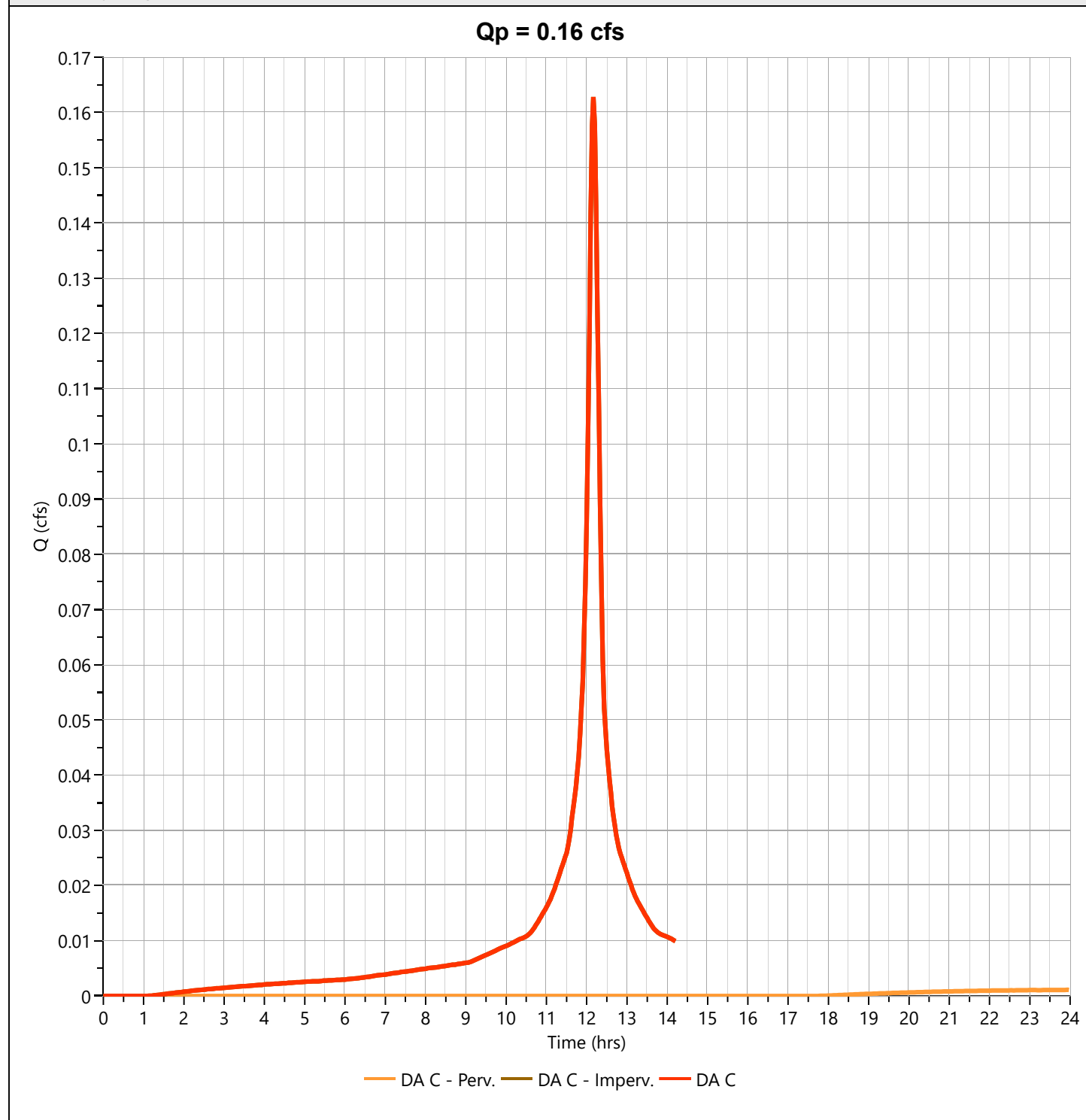
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA C

Hyd. No. 57

Hydrograph Type	= Junction	Peak Flow	= 0.163 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 737 cuft
Inflow Hydrographs	= 55, 56	Total Contrib. Area	= 0.78 ac



Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

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	Post DAA1a - Perv.	1.130	12.27	5,830	----		
2	NRCS Runoff	Post DAA1a - Imperv.	11.13	12.17	50,139	----		
3	Junction	Post DAA1a	12.04	12.17	55,968	1, 2		
5	NRCS Runoff	Post DAA1a (un) - Perv.	1.343	12.23	6,185	----		
7	Junction	UG Basin West Inflow	13.26	12.17	62,153	3, 5		
8	Pond Route	UG Basin West Outflow	7.774	12.33	62,153	7	103.65	8,238
10	NRCS Runoff	Post DAA1b - Perv.	0.539	12.23	3,600	----		
11	NRCS Runoff	Post DAA1b - Imperv.	9.224	12.17	41,560	----		
12	Junction	Post DAA1b	9.695	12.17	45,159	10, 11		
14	NRCS Runoff	Post DAA1b (un) - Perv.	0.631	12.17	2,516	----		
16	Junction	Basin 1 Inflow	16.13	12.20	109,828	8, 12, 14		
17	Pond Route	Basin 1 Outflow	3.163	13.47	108,977	16	98.51	65,816
19	NRCS Runoff	Post DAA2 - Perv.	0.136	12.33	1,448	----		
20	NRCS Runoff	Post DAA2 - Imperv.	18.40	12.17	82,929	----		
21	Junction	Post DAA2	18.48	12.17	84,377	19, 20		
22	Pond Route	Basin 2 Outflow	4.259	12.60	84,333	21	85.99	40,866
24	NRCS Runoff	Post DAA3 - Perv.	0.405	12.40	5,890	----		
26	NRCS Runoff	Post DAA4a - Perv.	2.377	12.27	13,127	----		
27	NRCS Runoff	Post DAA4a - Imperv.	19.08	12.17	85,979	----		
28	Junction	Post DAA4a	20.91	12.17	99,107	26, 27		
29	Pond Route	UG Basin East Out	16.07	12.27	99,107	28	102.35	6,977
31	NRCS Runoff	Post DAA4b - Perv.	0.079	12.60	1,526	----		
32	NRCS Runoff	Post DAA4b - Imperv.	8.885	12.17	40,035	----		
33	Junction	Post DAA4b	8.887	12.17	41,560	31, 32		
35	Junction	Basin 3 Inflow	23.71	12.20	140,667	29, 33		
36	Pond Route	Basin 3 Outflow	1.226	16.23	140,362	35	93.48	91,062

Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

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)
38	NRCS Runoff	Post DAA5 - Perv.	0.043	12.60	824	----		
39	NRCS Runoff	Post DAA5 - Imperv.	0.804	12.17	3,622	----		
40	Junction	Post DAA5	0.805	12.17	4,446	38, 39		
41	Junction	Basin 4 Inflow	1.698	12.20	144,808	36, 40		
42	Pond Route	Basin 4 Outflow	1.241	19.30	143,858	41	85.04	20,200
44	NRCS Runoff	Post DAA6 - Perv.	0.000	0.00	0.000	----		
45	NRCS Runoff	Post DAA6 - Imperv.	3.433	1.13	5,383	----		
46	Junction	Post DAA6	3.433	1.13	5,383	44, 45		
47	Pond Route	Basin 5 Outflow	0.326	1.87	5,359	46	73.40	4,365
49	NRCS Runoff	Post DAA7	0.479	12.27	3,920	----		
51	Junction	Combined DAA	7.177	13.33	374,307	17, 22, 24, 42, 47, 49		
53	NRCS Runoff	Post DA B - Perv.	0.886	12.20	3,848	----		
55	NRCS Runoff	Pre DA C - Perv.	0.038	12.60	732	----		
56	NRCS Runoff	Pre DA C - Imperv.	0.254	12.17	1,144	----		
57	Junction	Post DA C	0.255	12.17	1,876	55, 56		

Hydrograph Report

Project Name:

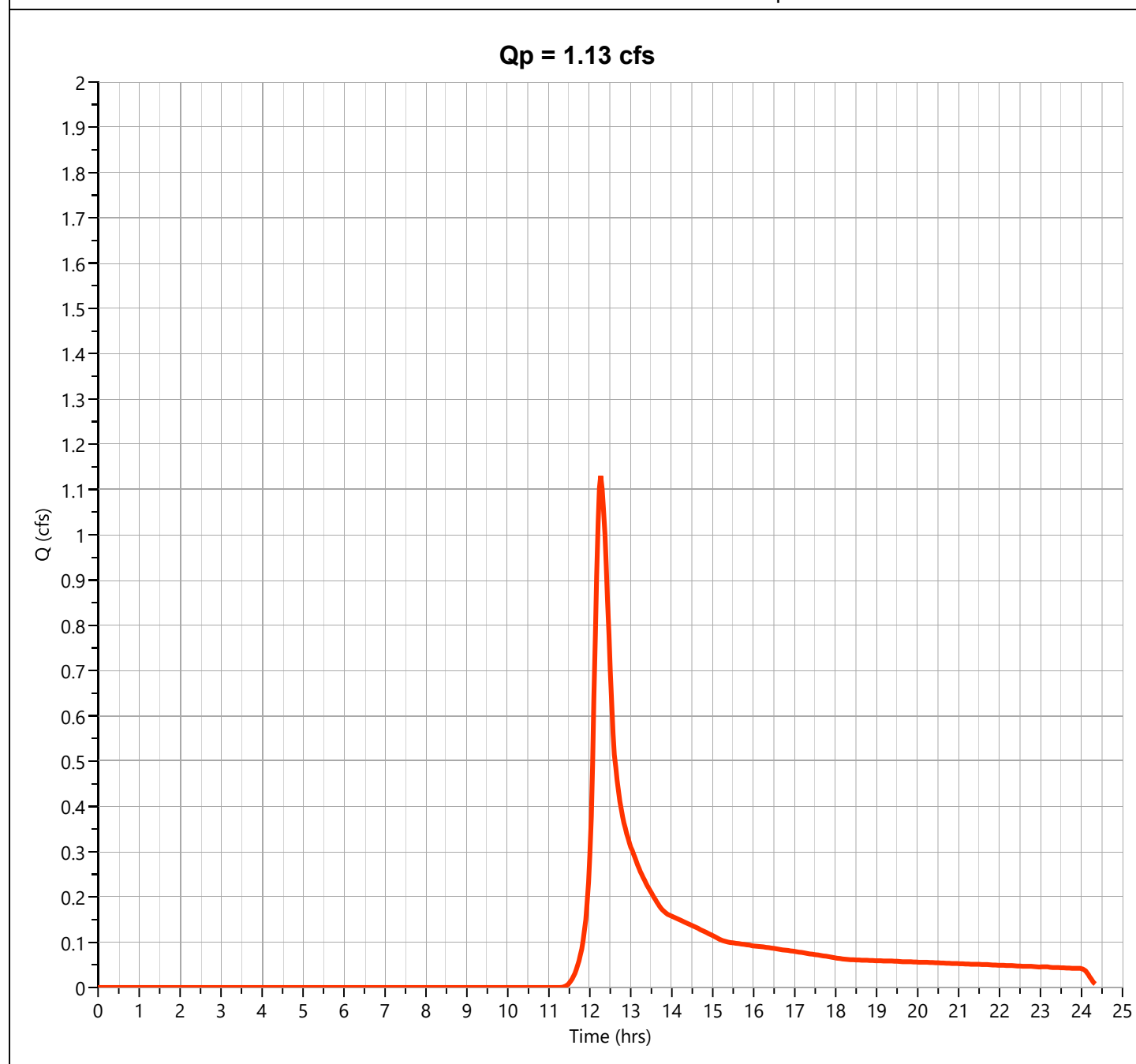
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a - Perv.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.130 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 5,830 cuft
Drainage Area	= 1.25 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 19.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

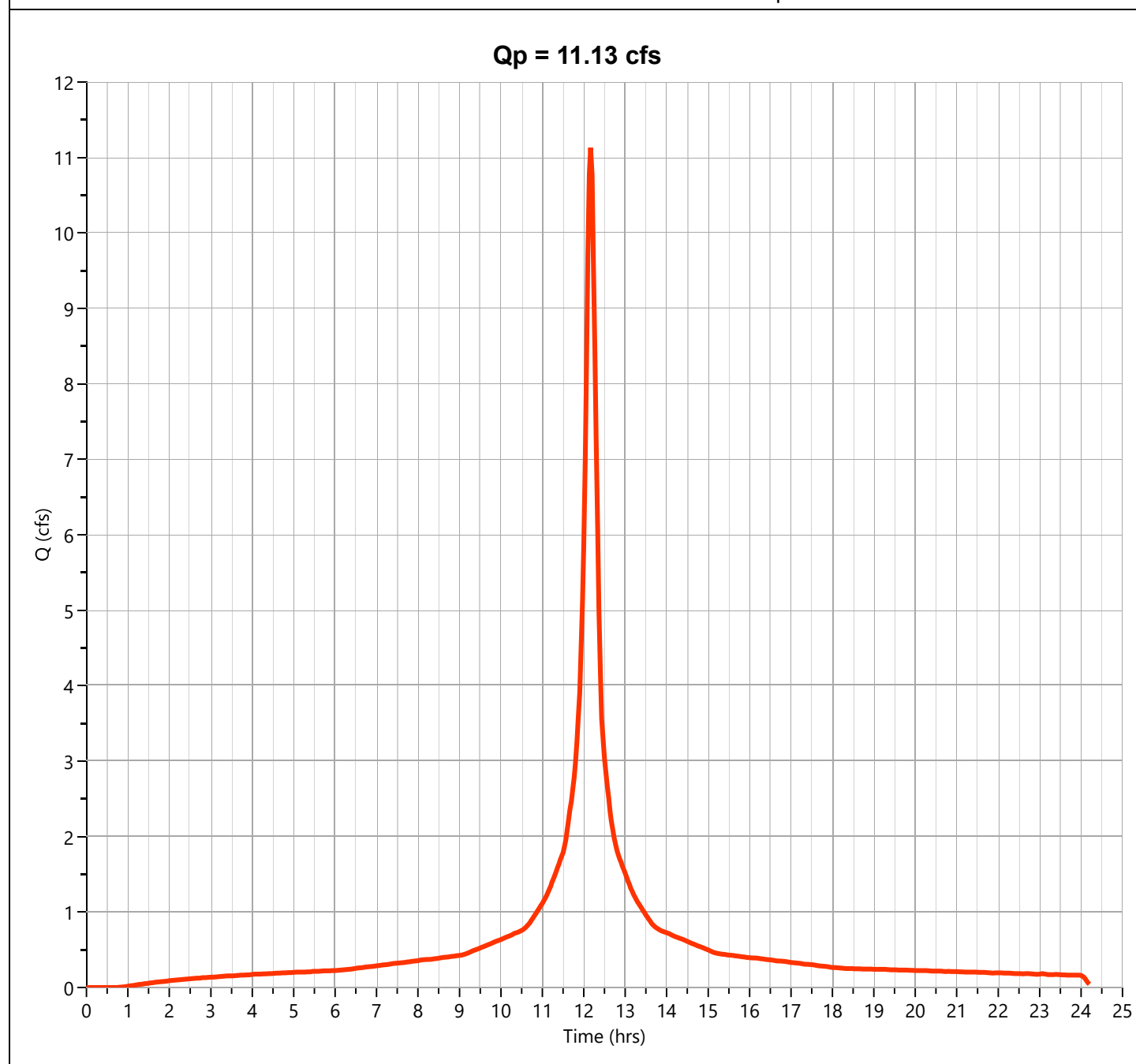
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a - Imperv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.13 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 50,139 cuft
Drainage Area	= 2.63 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

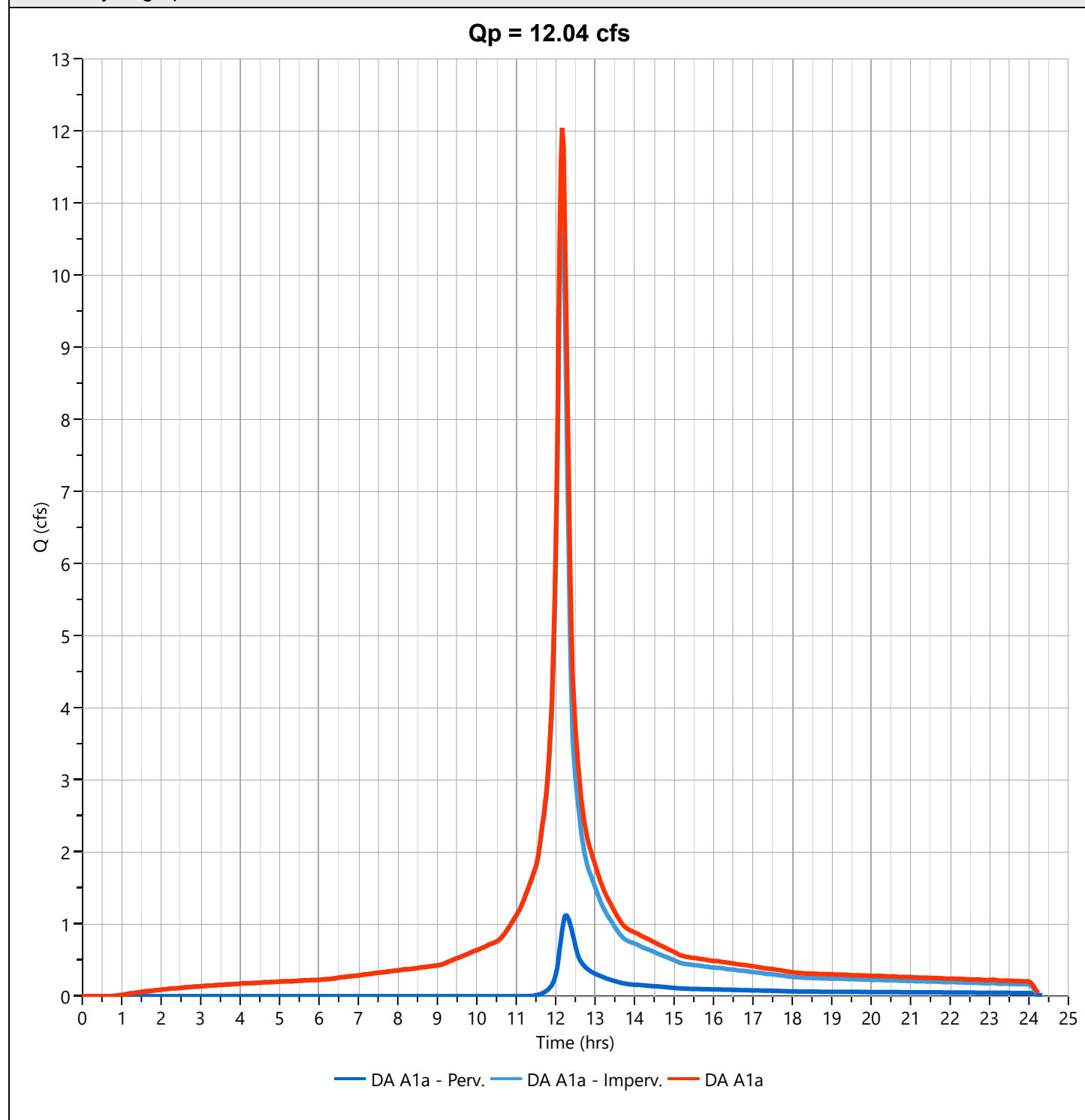
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 12.04 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 55,968 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 3.88 ac



Hydrograph Report

Project Name:

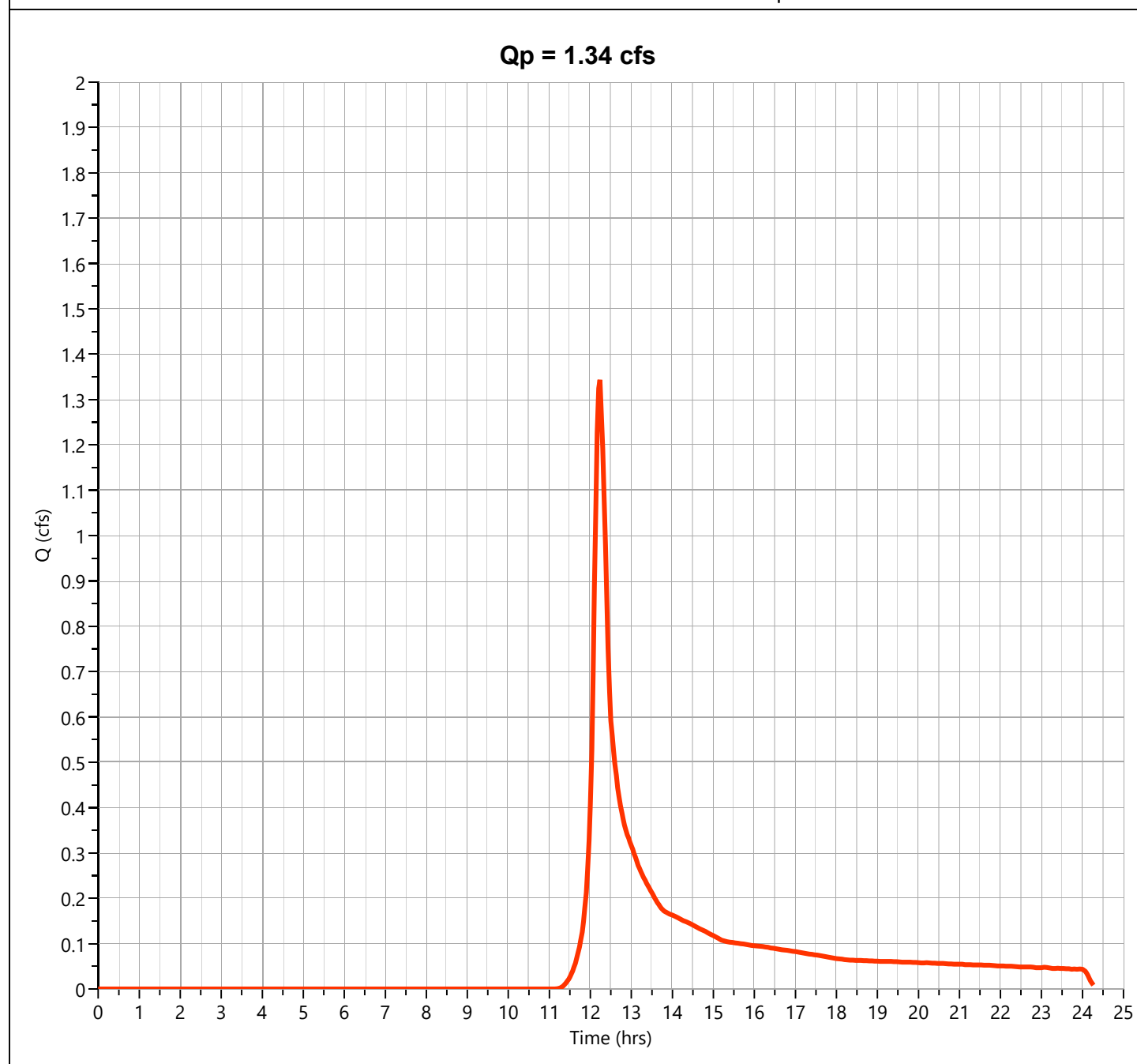
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a (un) - Perv.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.343 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 6,185 cuft
Drainage Area	= 1.29 ac	Curve Number	= 58
Tc Method	= User	Time of Conc. (Tc)	= 16.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

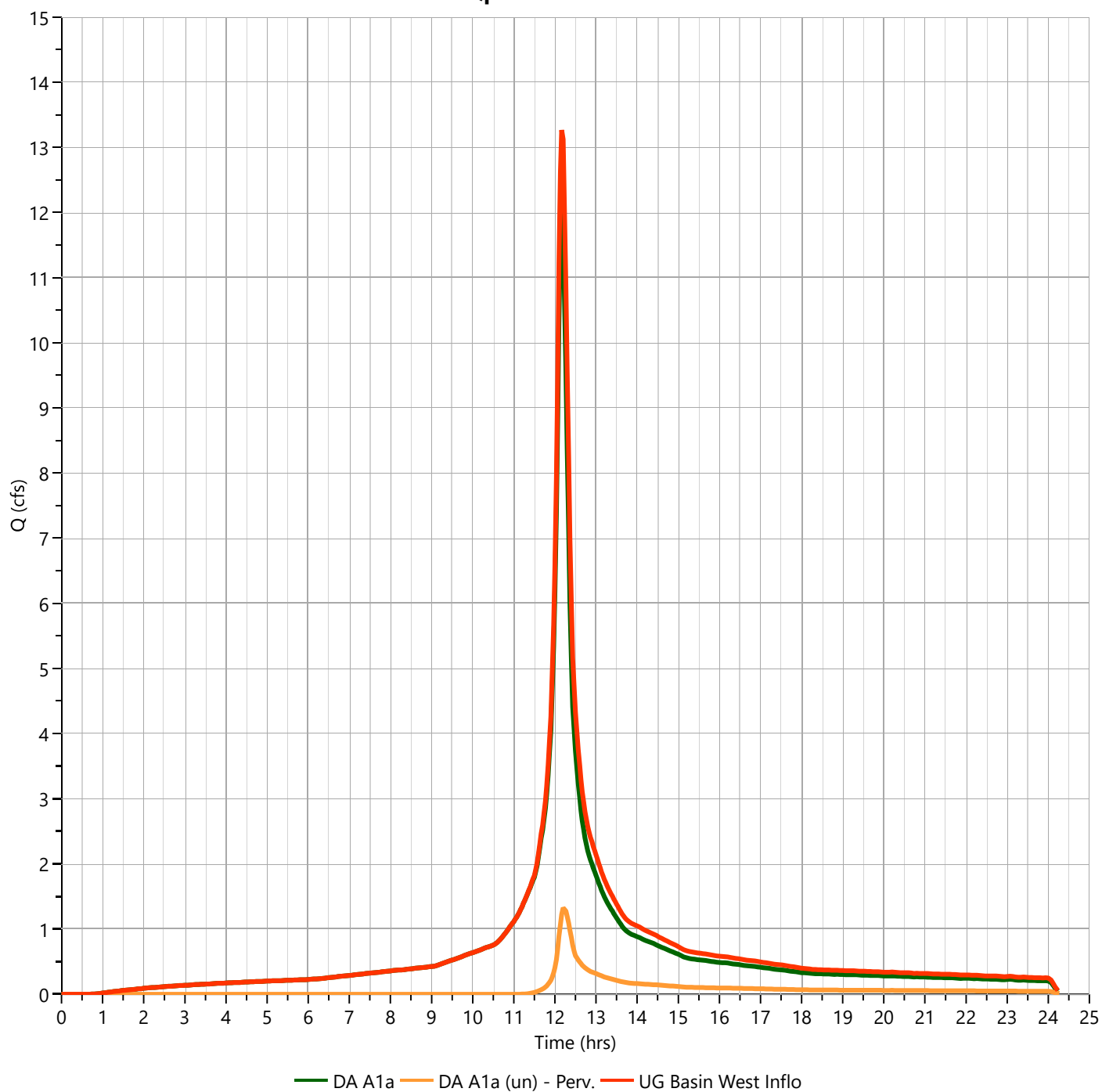
12-30-2020

UG Basin West Inflo

Hyd. No. 7

Hydrograph Type	= Junction	Peak Flow	= 13.26 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 62,153 cuft
Inflow Hydrographs	= 3, 5	Total Contrib. Area	= 5.17 ac

Qp = 13.26 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Basin West Outfl

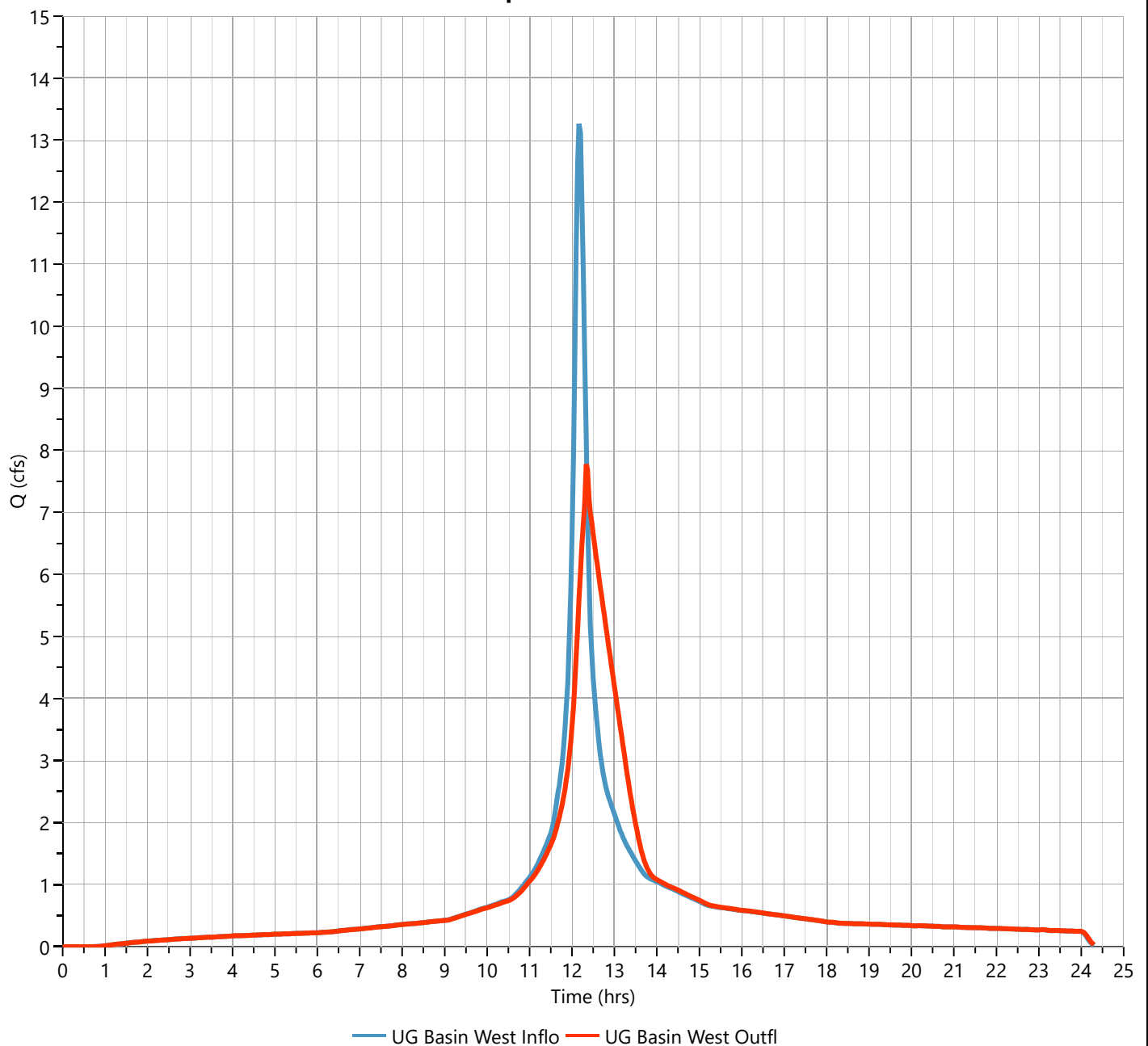
Hyd. No. 8

Hydrograph Type	= Pond Route	Peak Flow	= 7.774 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 62,153 cuft
Inflow Hydrograph	= 7 - UG Basin West Inflo	Max. Elevation	= 103.65 ft
Pond Name	= UG Recharge / Detention Basin West	Max. Storage	= 8,238 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 8 min

Qp = 7.77 cfs



Hydrograph Report

Project Name:

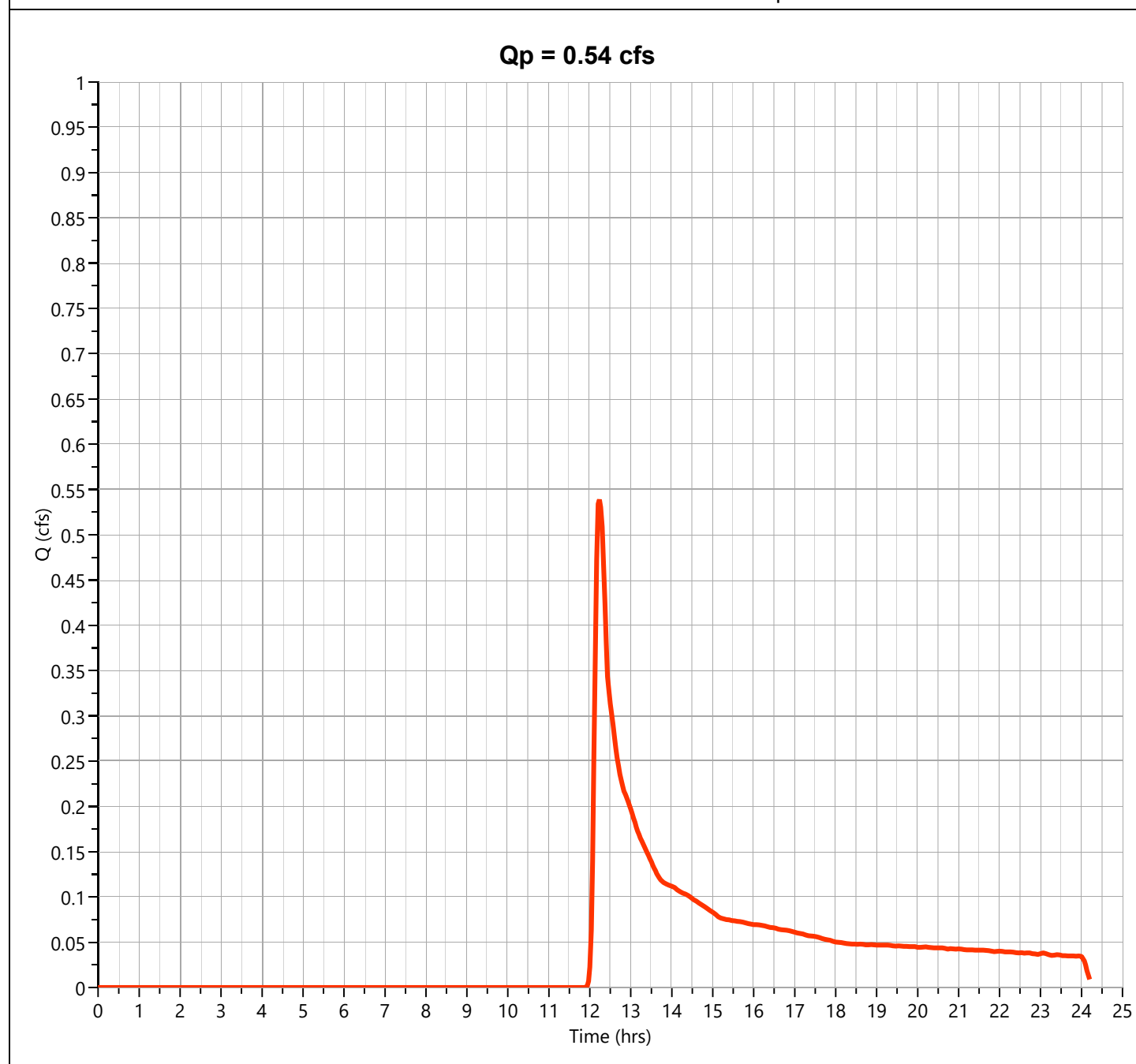
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b - Perv.

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.539 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 3,600 cuft
Drainage Area	= 1.46 ac	Curve Number	= 47
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

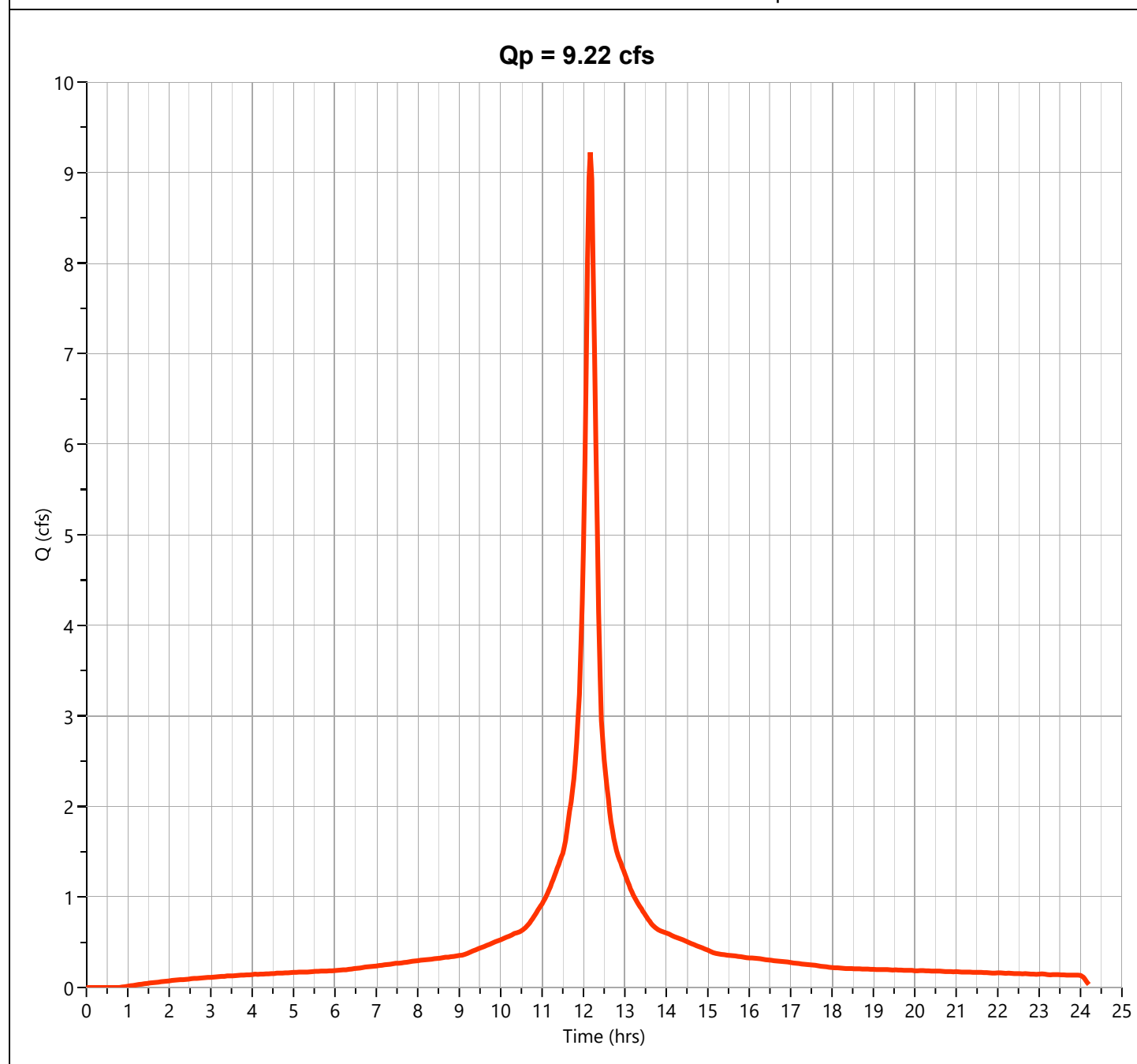
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b - Imperv.

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 9.224 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 41,560 cuft
Drainage Area	= 2.18 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

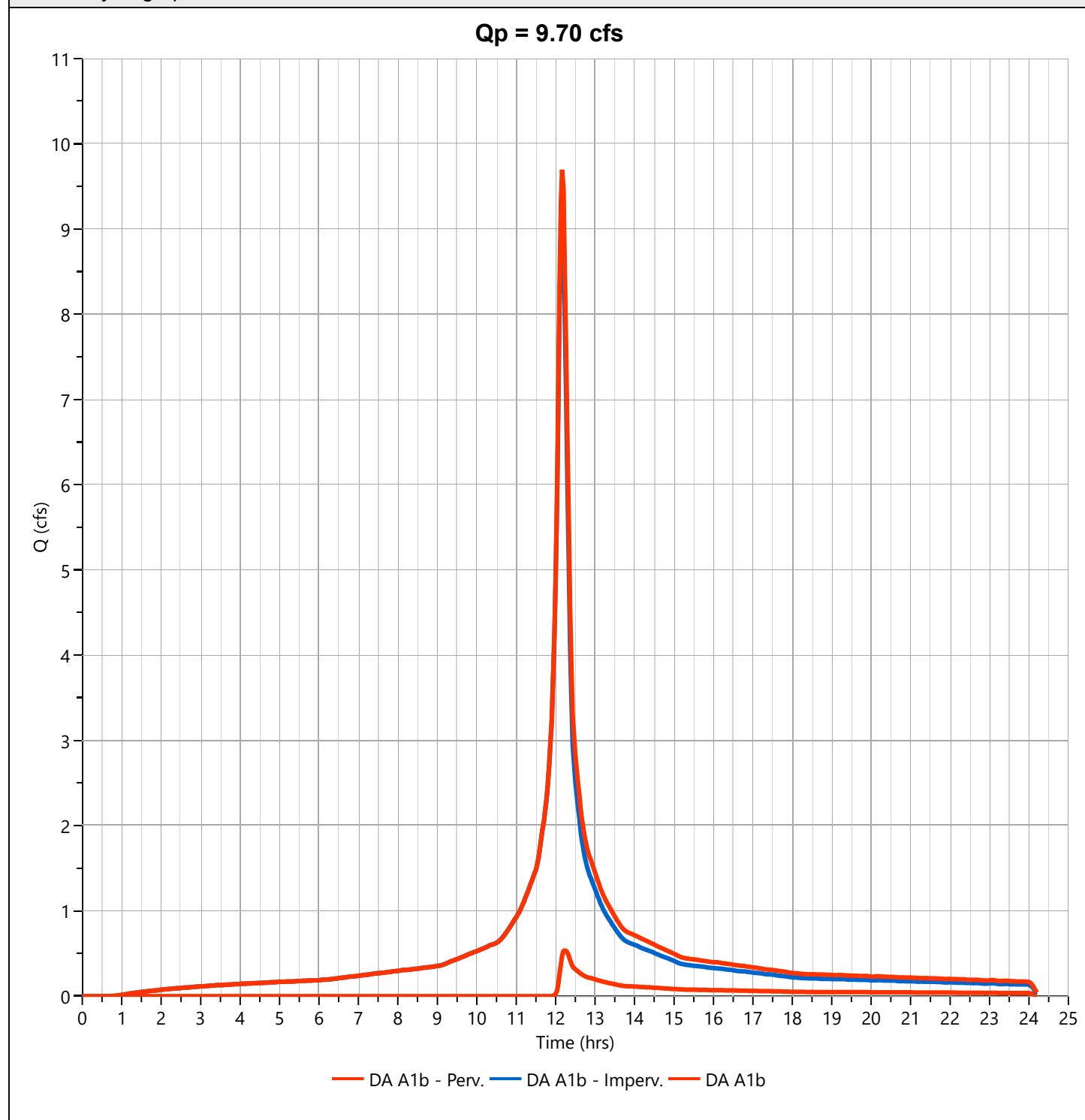
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b

Hyd. No. 12

Hydrograph Type	= Junction	Peak Flow	= 9.695 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 45,159 cuft
Inflow Hydrographs	= 10, 11	Total Contrib. Area	= 3.64 ac



Hydrograph Report

Project Name:

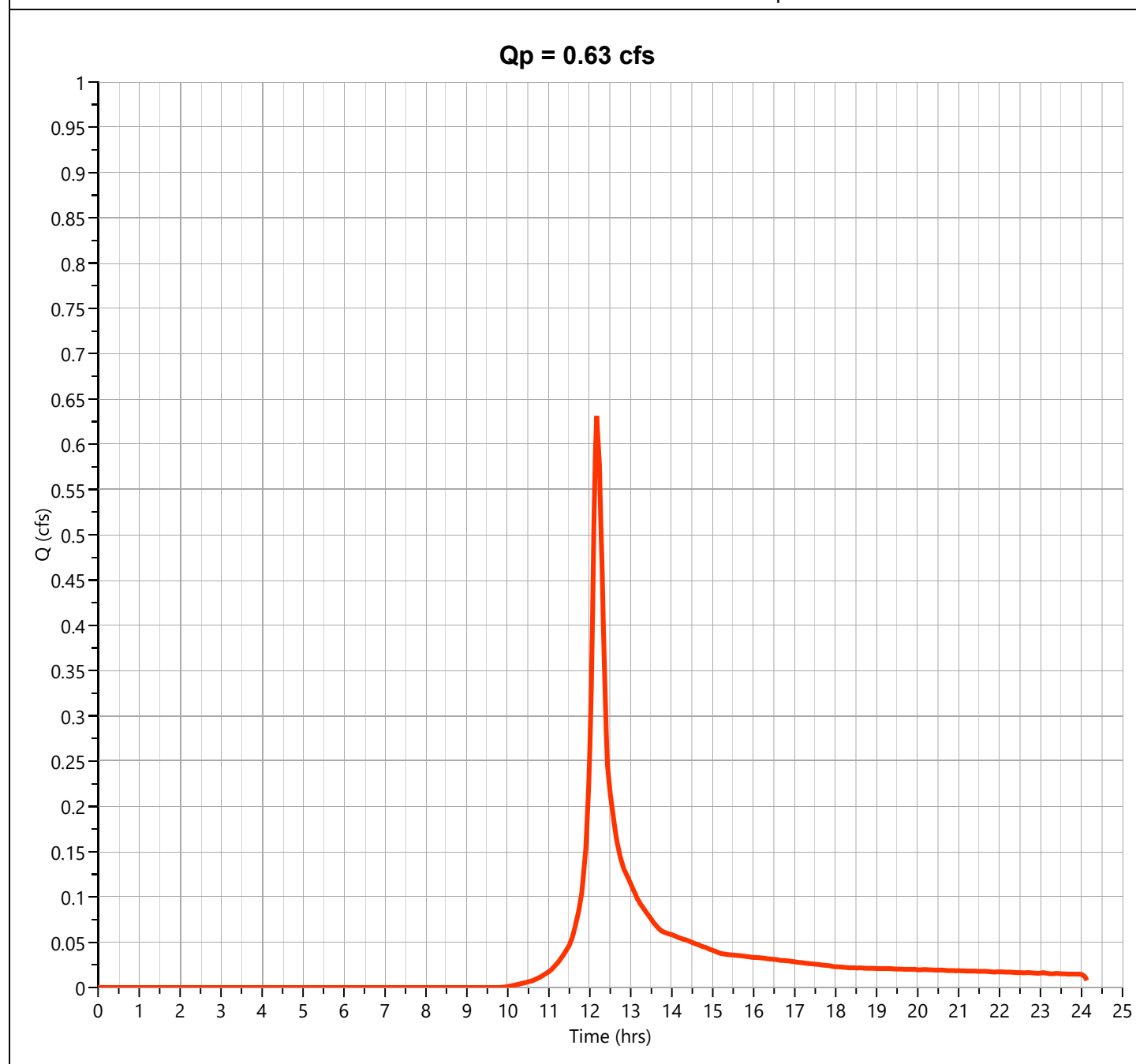
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b (un) - Perv.

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.631 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 2,516 cuft
Drainage Area	= 0.33 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

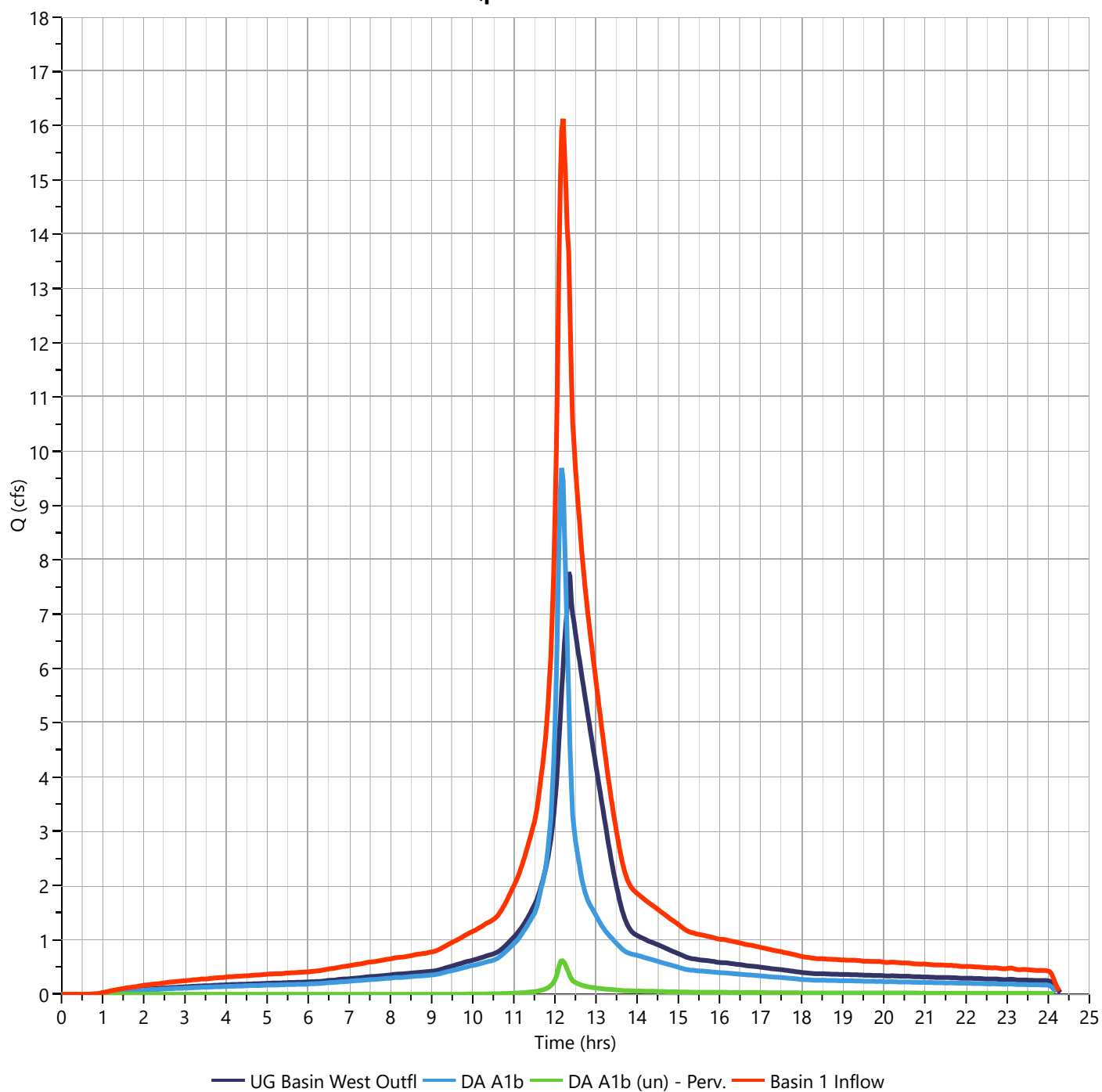
12-30-2020

Basin 1 Inflow

Hyd. No. 16

Hydrograph Type	= Junction	Peak Flow	= 16.13 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 109,828 cuft
Inflow Hydrographs	= 8, 12, 14	Total Contrib. Area	= 3.97 ac

Qp = 16.13 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 1 Outflow

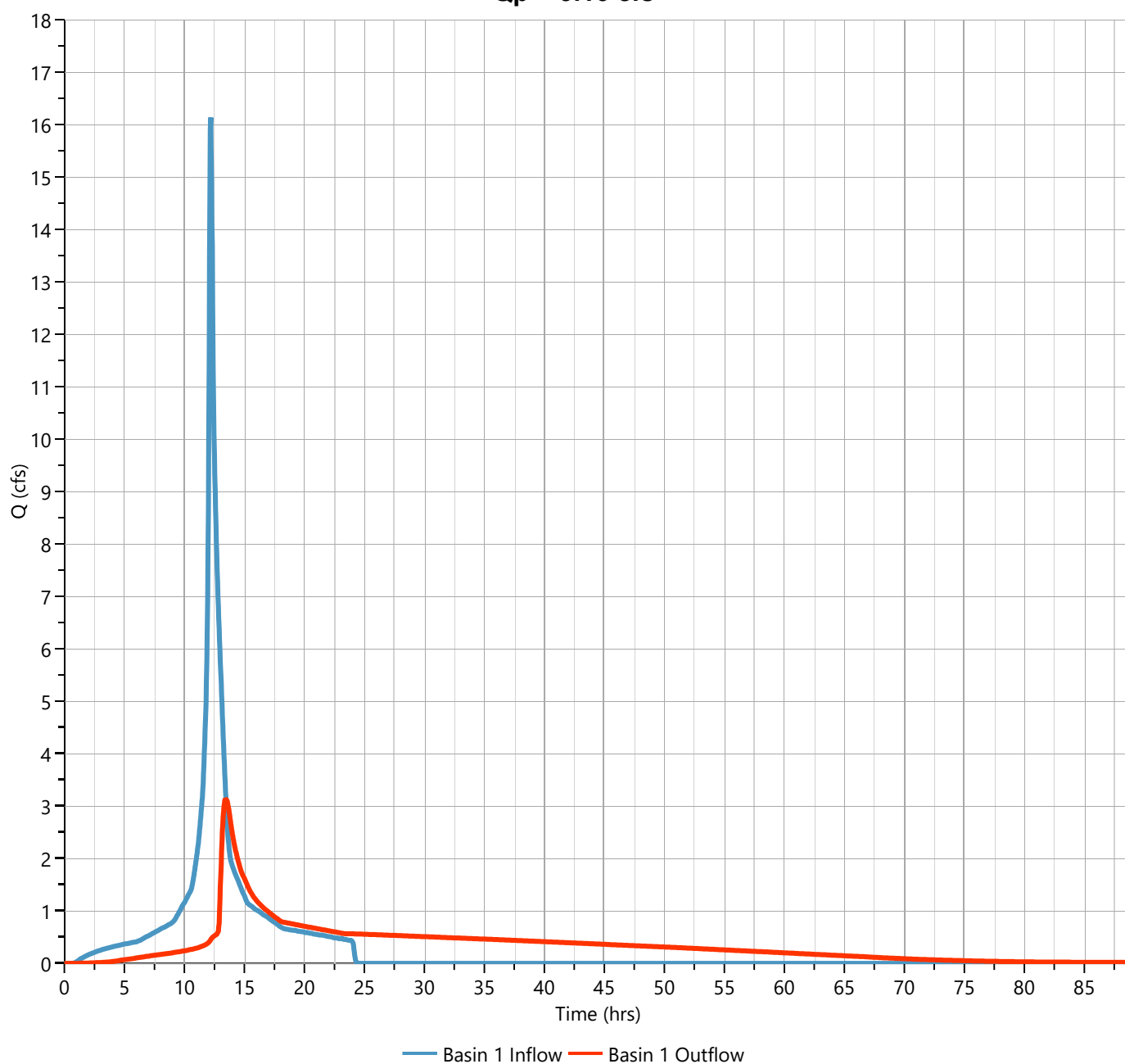
Hyd. No. 17

Hydrograph Type	= Pond Route	Peak Flow	= 3.163 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.47 hrs
Time Interval	= 2 min	Hydrograph Volume	= 108,977 cuft
Inflow Hydrograph	= 16 - Basin 1 Inflow	Max. Elevation	= 98.51 ft
Pond Name	= Basin 1	Max. Storage	= 65,816 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 17.00 hrs

Qp = 3.16 cfs



Hydrograph Report

Project Name:

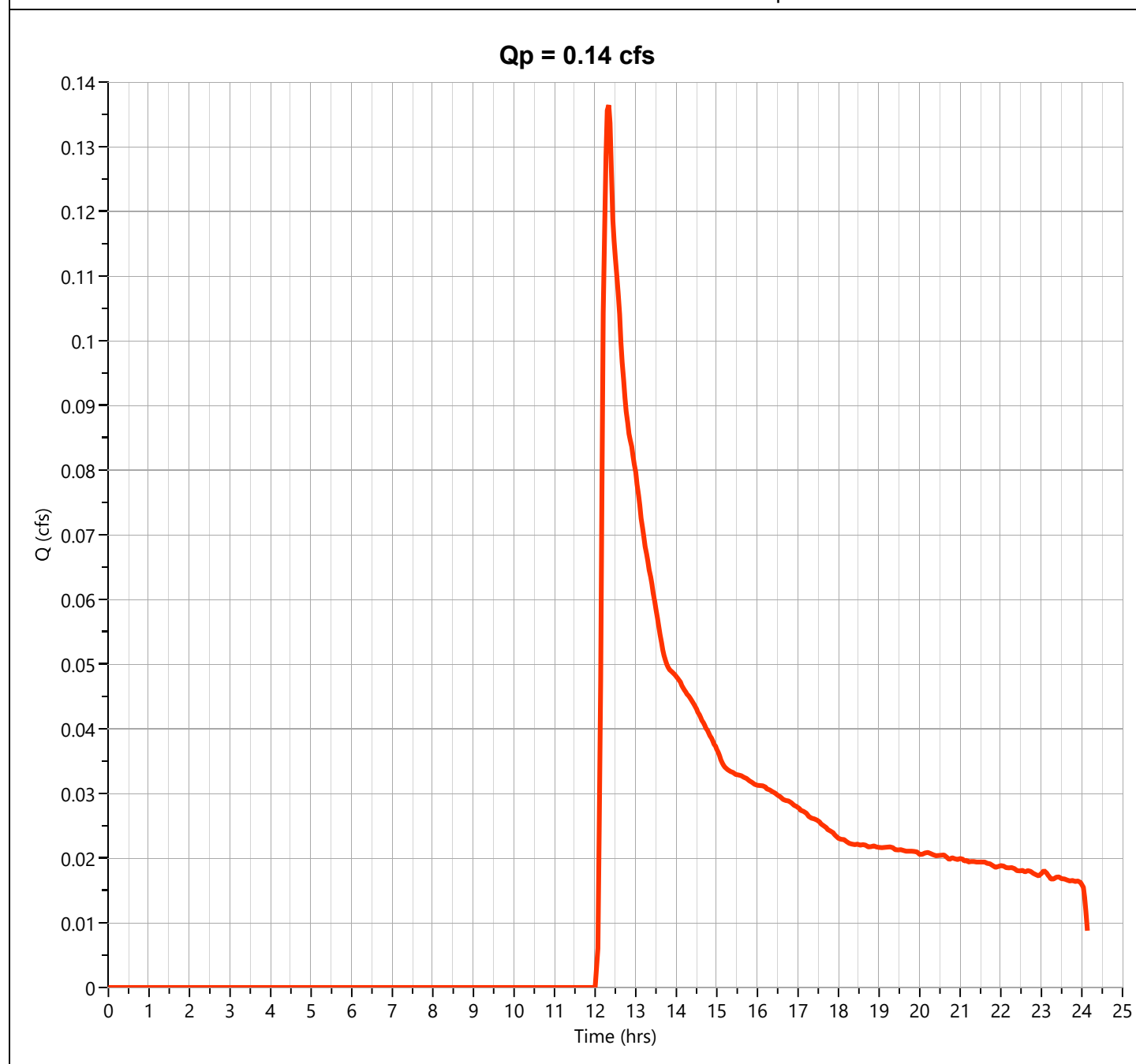
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2 - Perv.

Hyd. No. 19

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.136 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.33 hrs
Time Interval	= 2 min	Runoff Volume	= 1,448 cuft
Drainage Area	= 0.86 ac	Curve Number	= 43
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

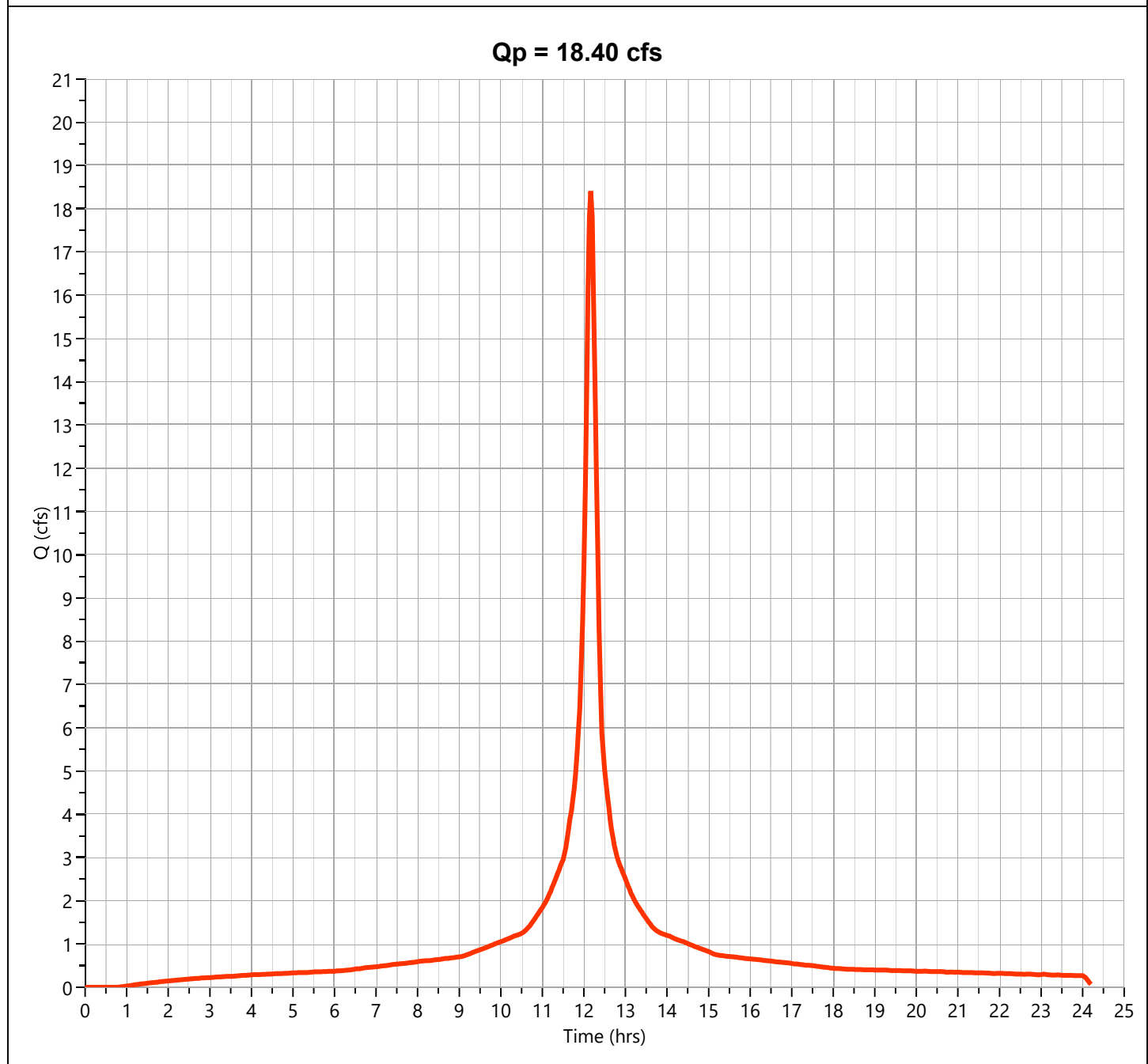
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2 - Imperv.

Hyd. No. 20

Hydrograph Type	= NRCS Runoff	Peak Flow	= 18.40 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 82,929 cuft
Drainage Area	= 4.35 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

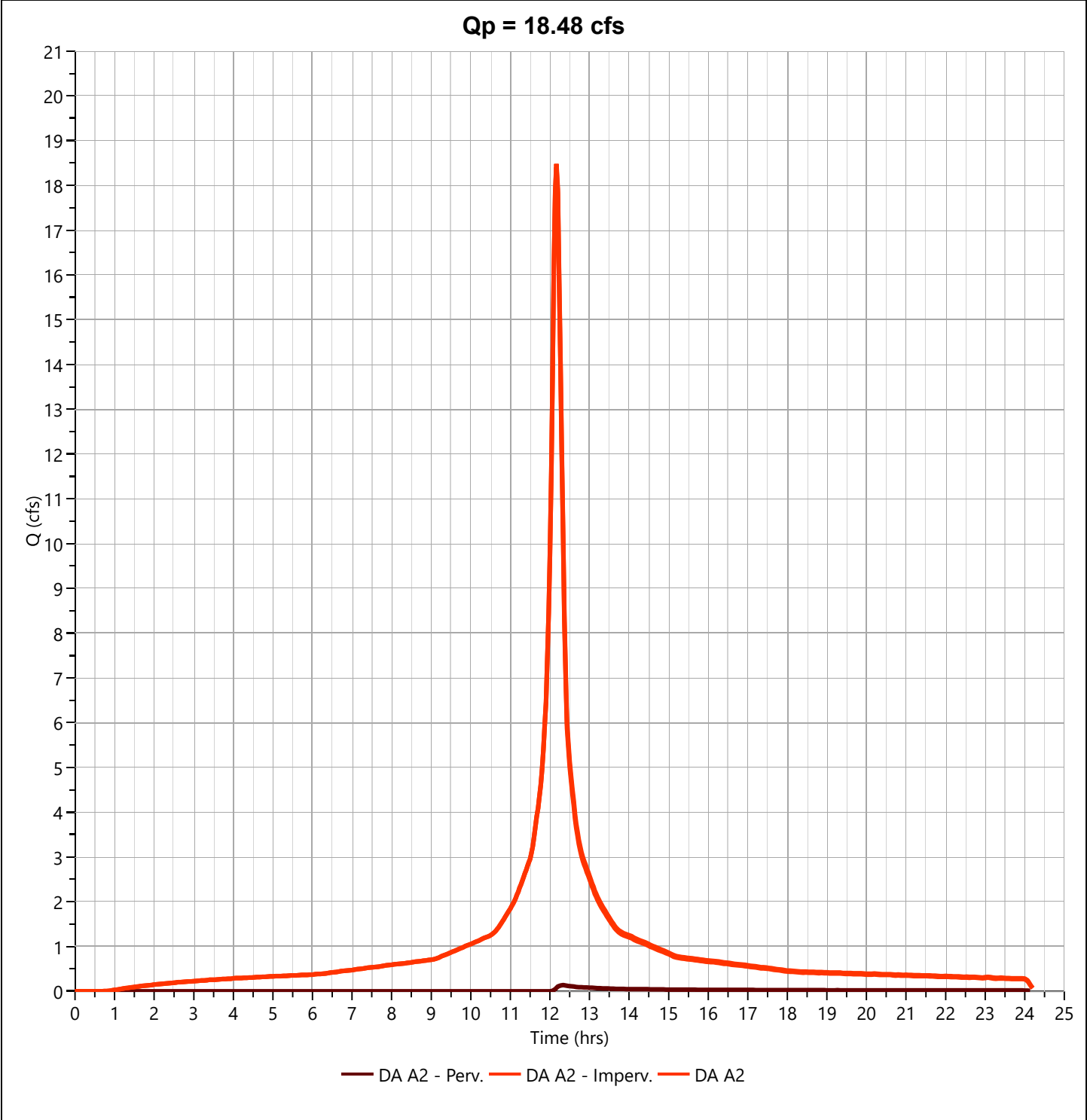
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2

Hyd. No. 21

Hydrograph Type	= Junction	Peak Flow	= 18.48 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 84,377 cuft
Inflow Hydrographs	= 19, 20	Total Contrib. Area	= 5.21 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 2 Outflow

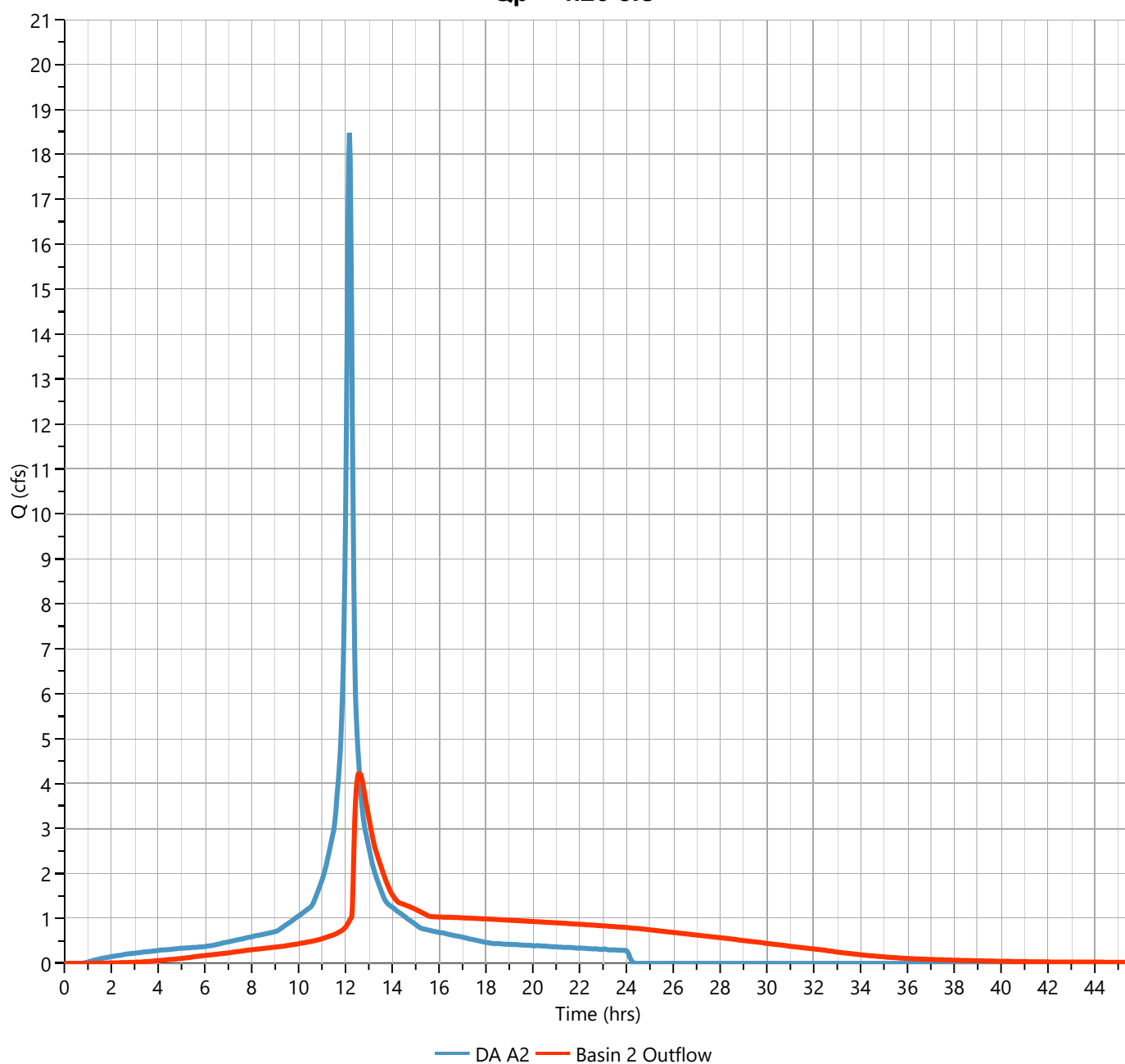
Hyd. No. 22

Hydrograph Type	= Pond Route	Peak Flow	= 4.259 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.60 hrs
Time Interval	= 2 min	Hydrograph Volume	= 84,333 cuft
Inflow Hydrograph	= 21 - DA A2	Max. Elevation	= 85.99 ft
Pond Name	= Basin 2	Max. Storage	= 40,866 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 6.22 hrs

Qp = 4.26 cfs



Hydrograph Report

Project Name:

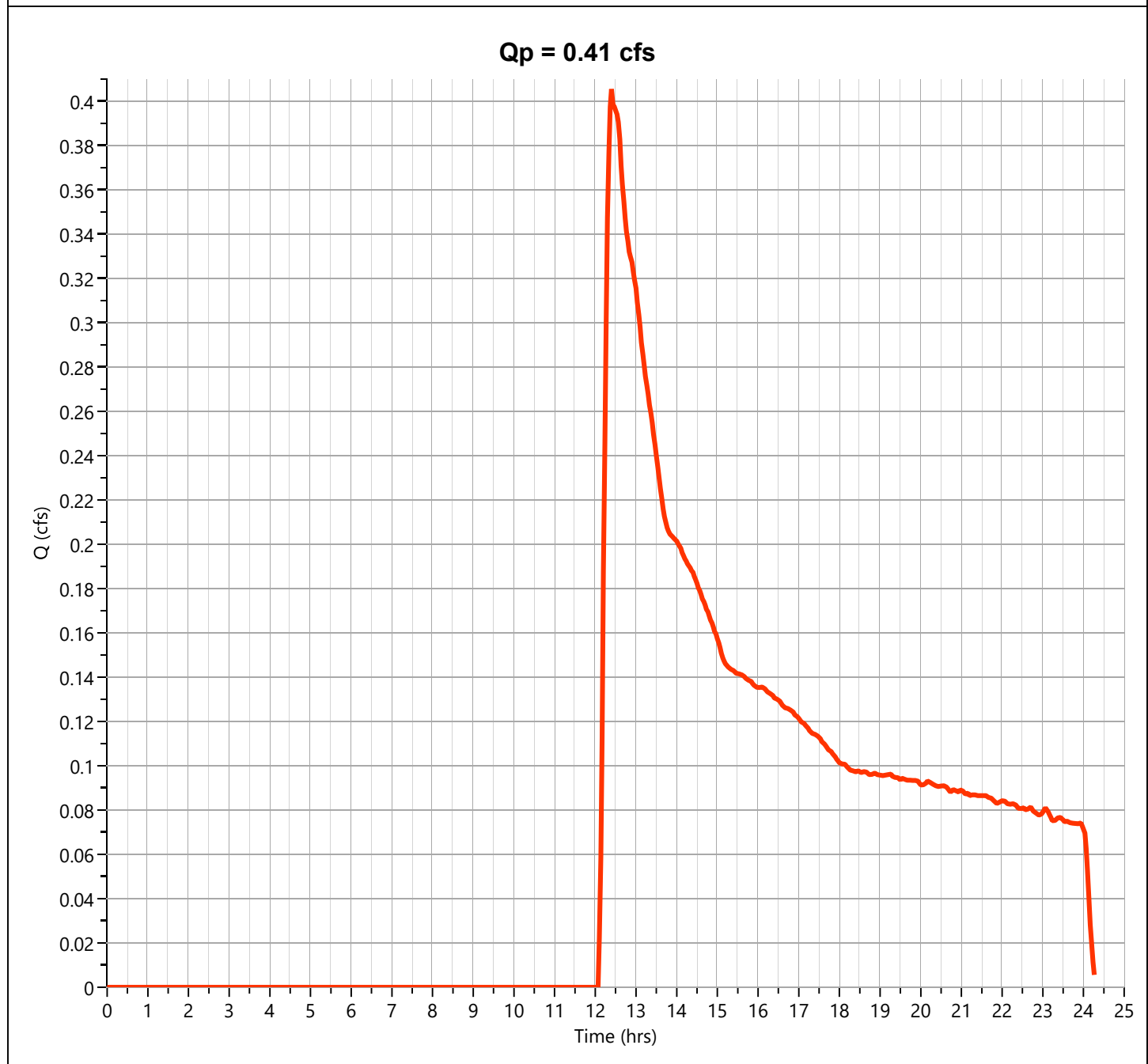
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A3 - Perv.

Hyd. No. 24

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.405 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.40 hrs
Time Interval	= 2 min	Runoff Volume	= 5,890 cuft
Drainage Area	= 4.41 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

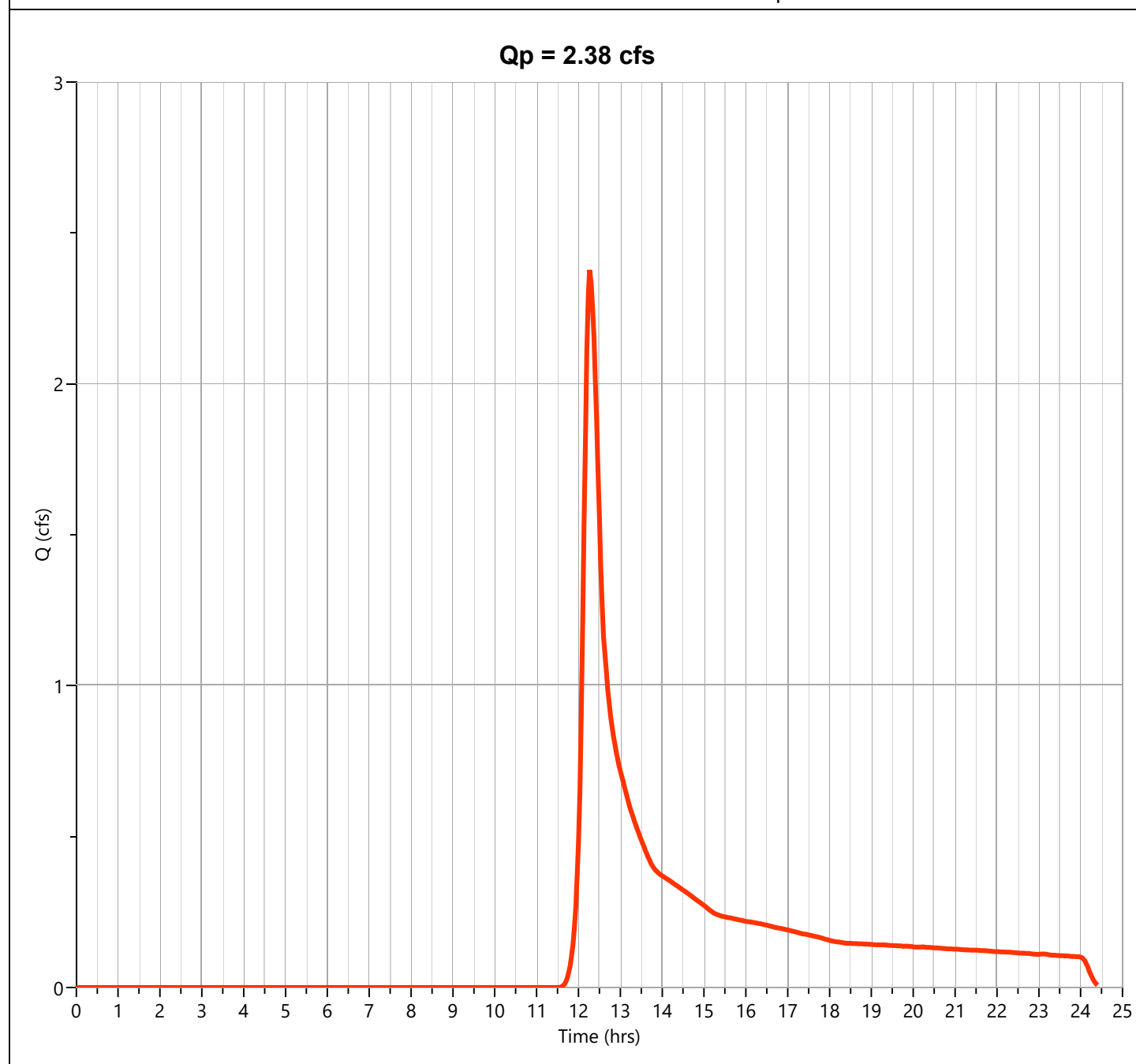
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a - Perv.

Hyd. No. 26

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.377 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 13,127 cuft
Drainage Area	= 3.34 ac	Curve Number	= 54
Tc Method	= User	Time of Conc. (Tc)	= 17.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

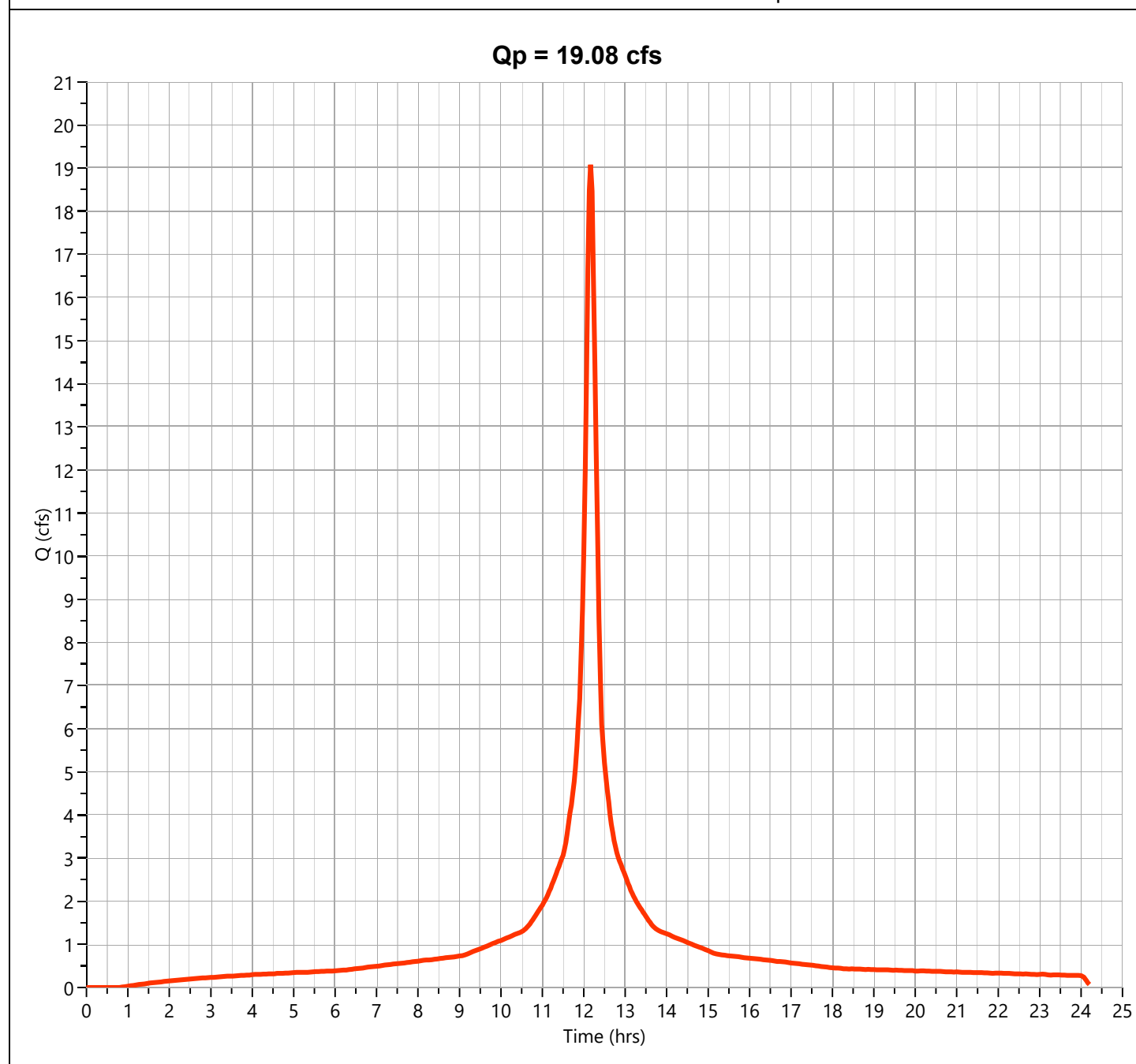
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a - Imperv.

Hyd. No. 27

Hydrograph Type	= NRCS Runoff	Peak Flow	= 19.08 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 85,979 cuft
Drainage Area	= 4.51 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

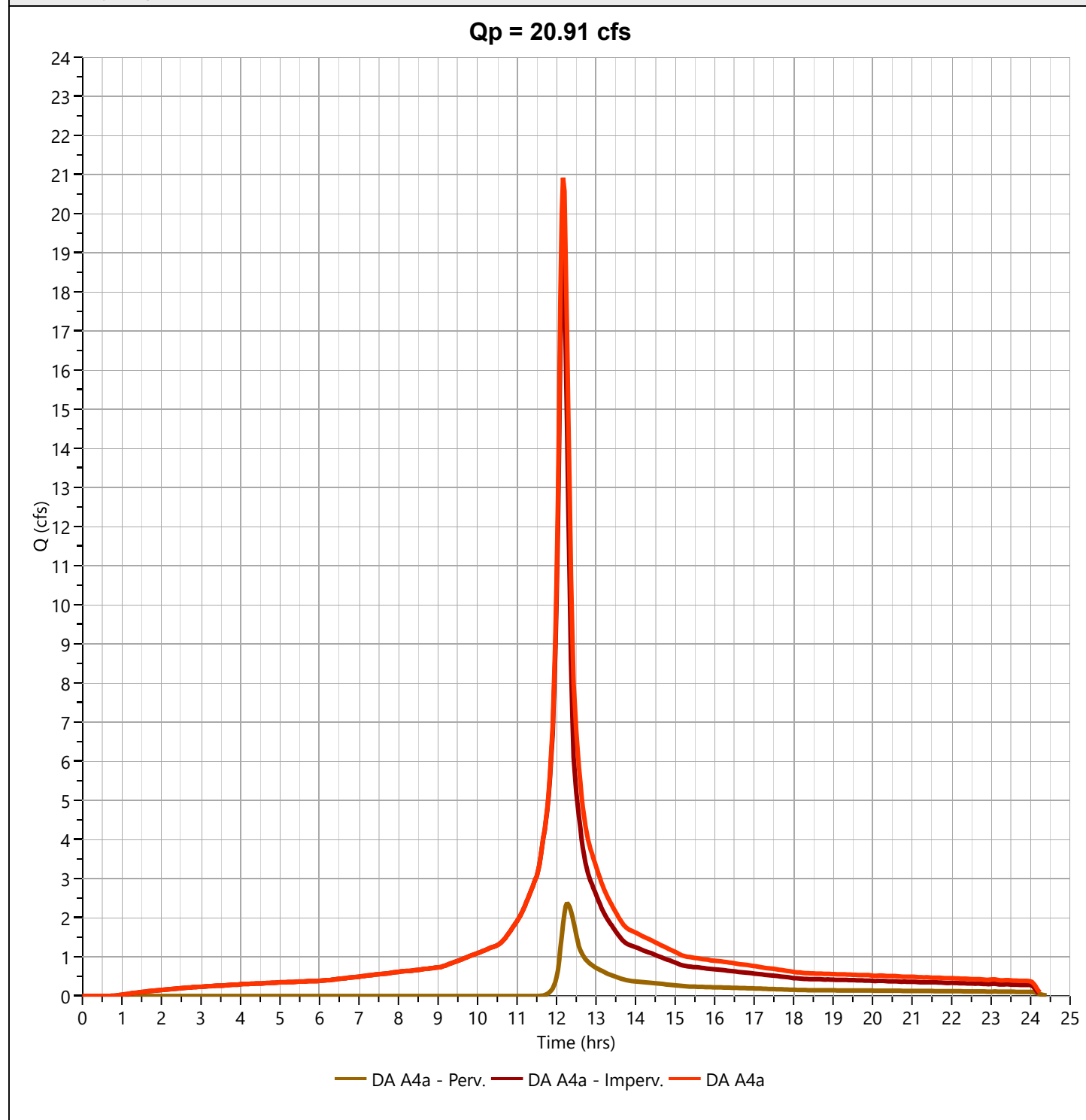
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a

Hyd. No. 28

Hydrograph Type	= Junction	Peak Flow	= 20.91 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 99,107 cuft
Inflow Hydrographs	= 26, 27	Total Contrib. Area	= 7.85 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Basin East Out

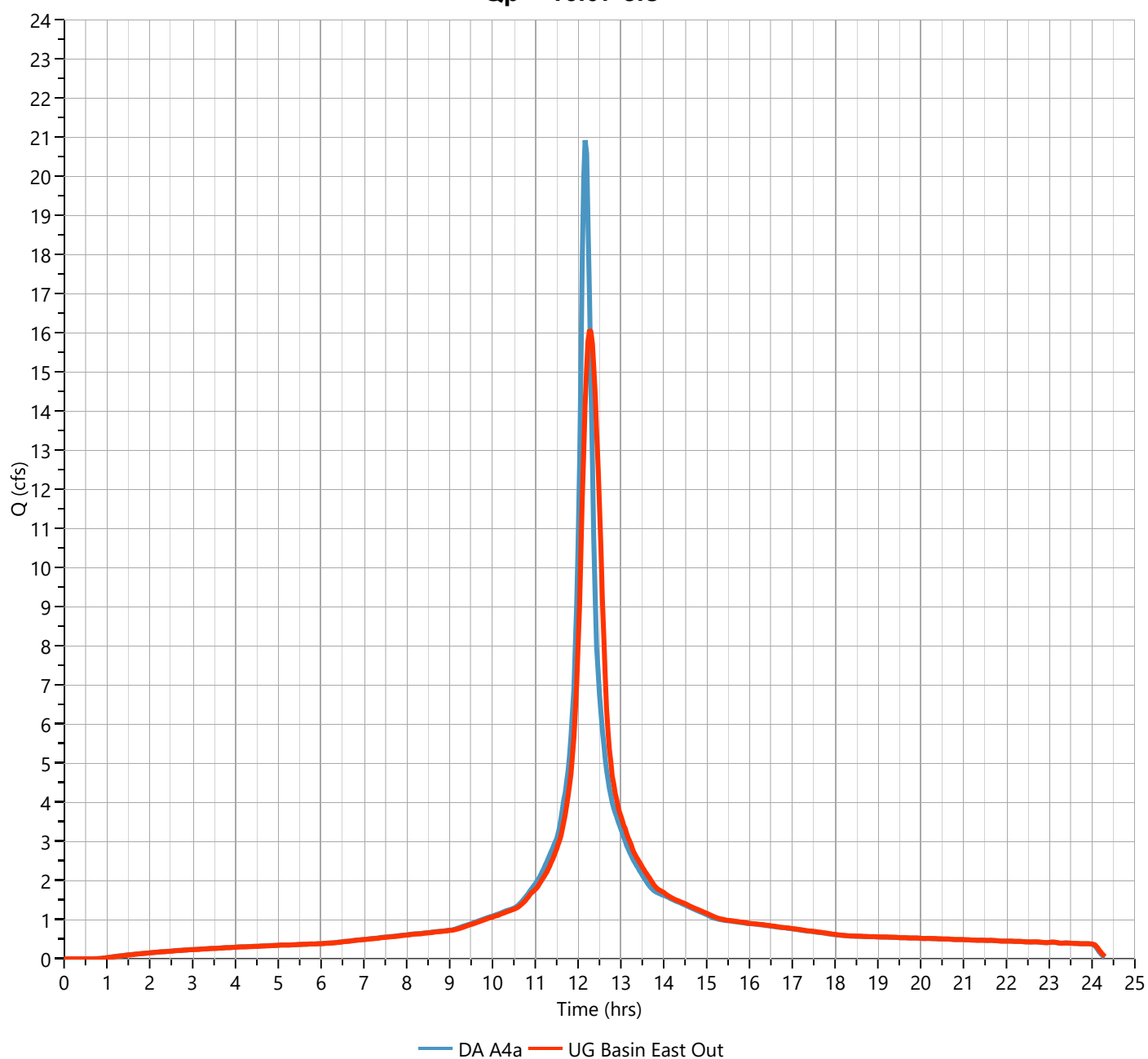
Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 16.07 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 99,107 cuft
Inflow Hydrograph	= 28 - DA A4a	Max. Elevation	= 102.35 ft
Pond Name	= UG Recharge / Detention Basin East	Max. Storage	= 6,977 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 4 min

Qp = 16.07 cfs



Hydrograph Report

Project Name:

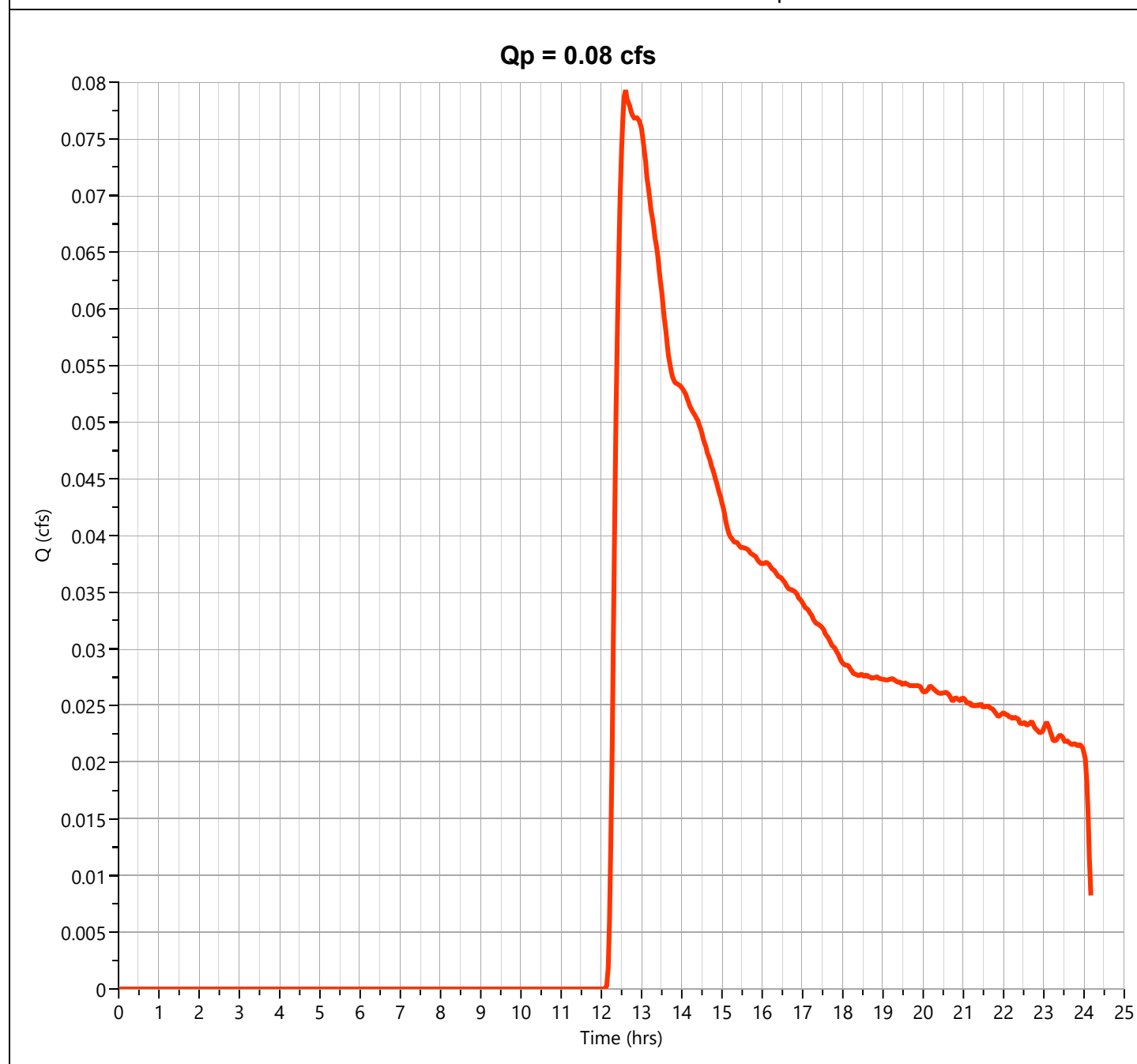
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b - Perv.

Hyd. No. 31

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.079 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.60 hrs
Time Interval	= 2 min	Runoff Volume	= 1,526 cuft
Drainage Area	= 1.5 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

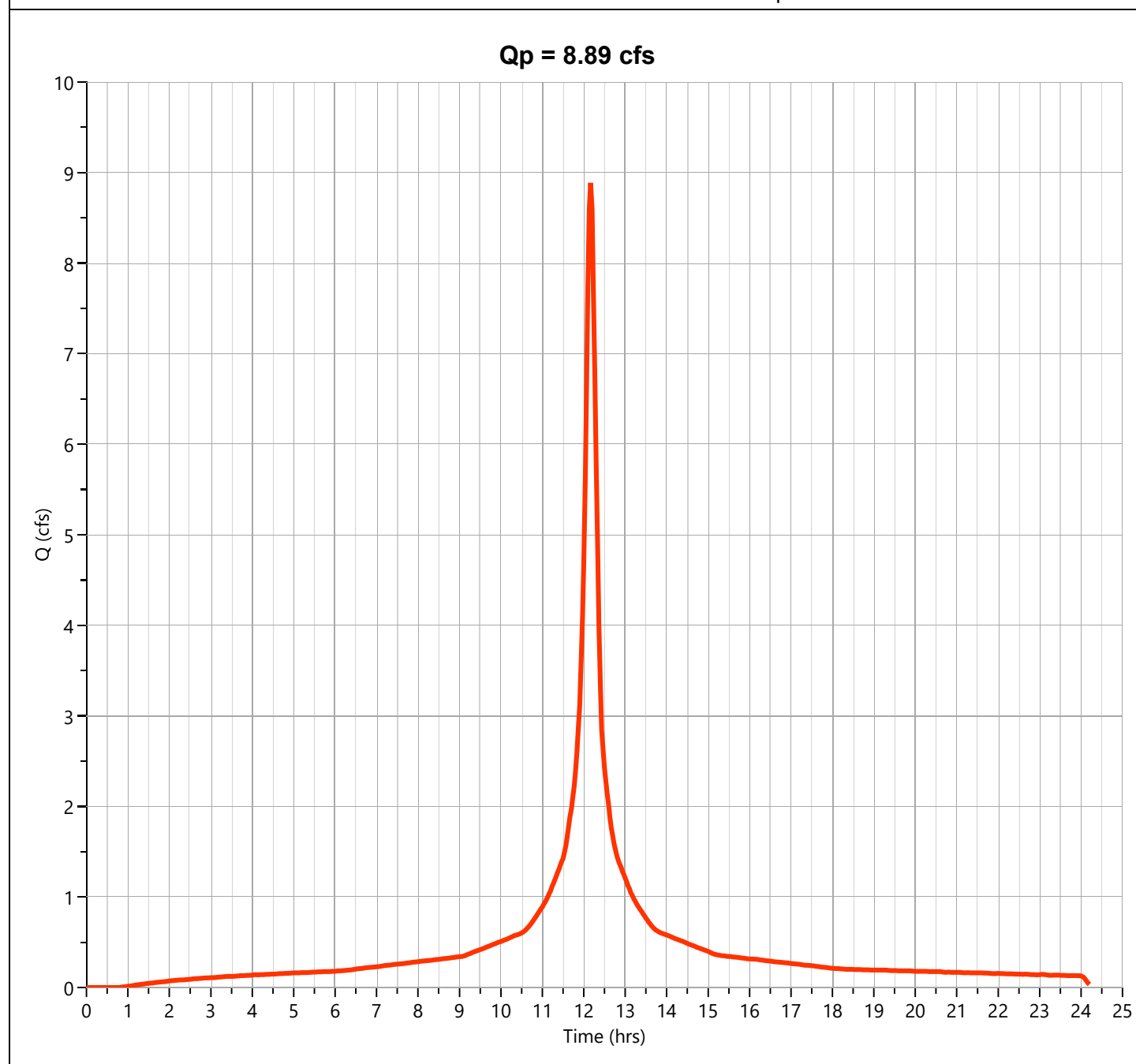
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b - Imperv.

Hyd. No. 32

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.885 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 40,035 cuft
Drainage Area	= 2.1 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

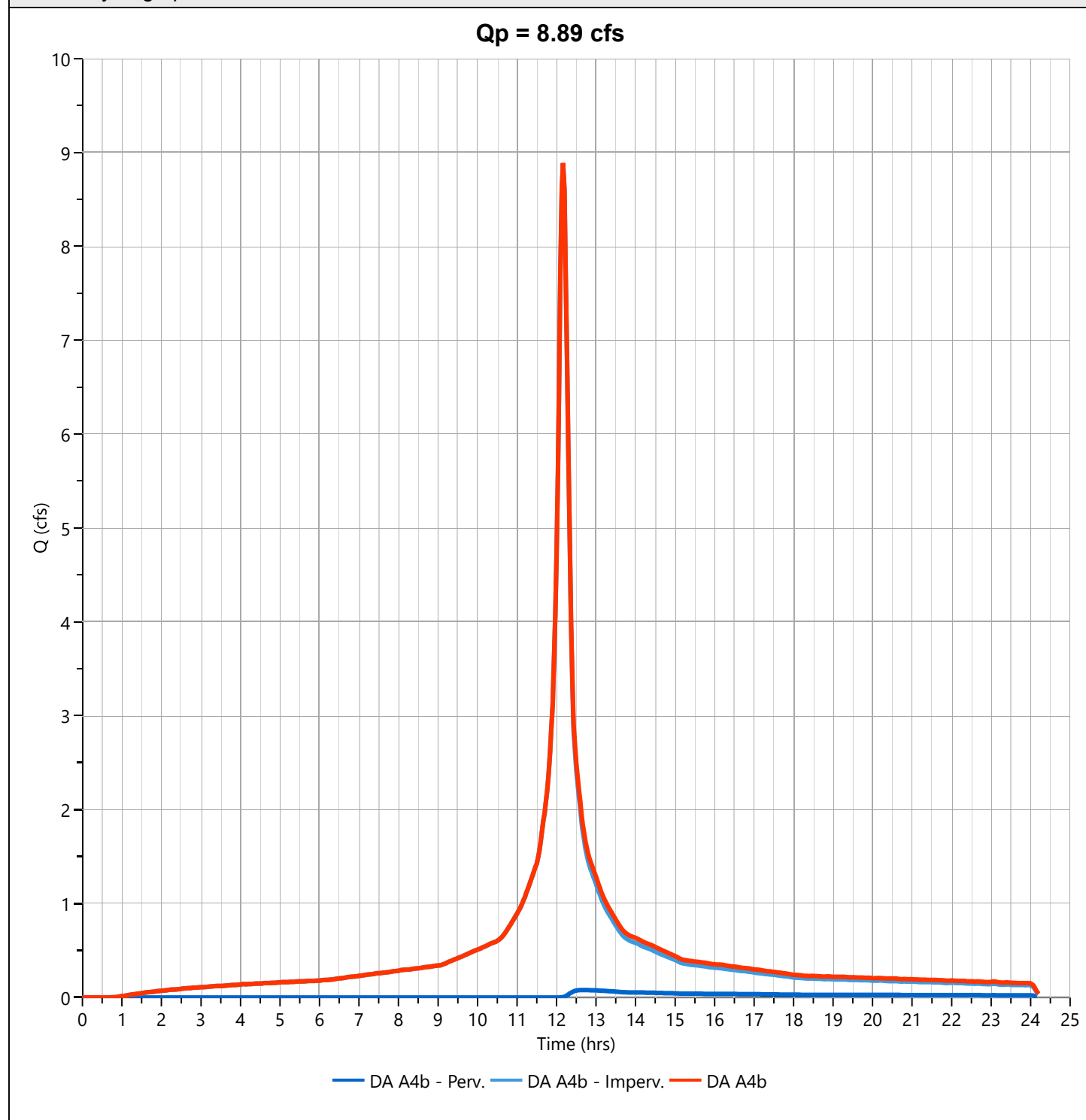
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b

Hyd. No. 33

Hydrograph Type	= Junction	Peak Flow	= 8.887 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 41,560 cuft
Inflow Hydrographs	= 31, 32	Total Contrib. Area	= 3.6 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

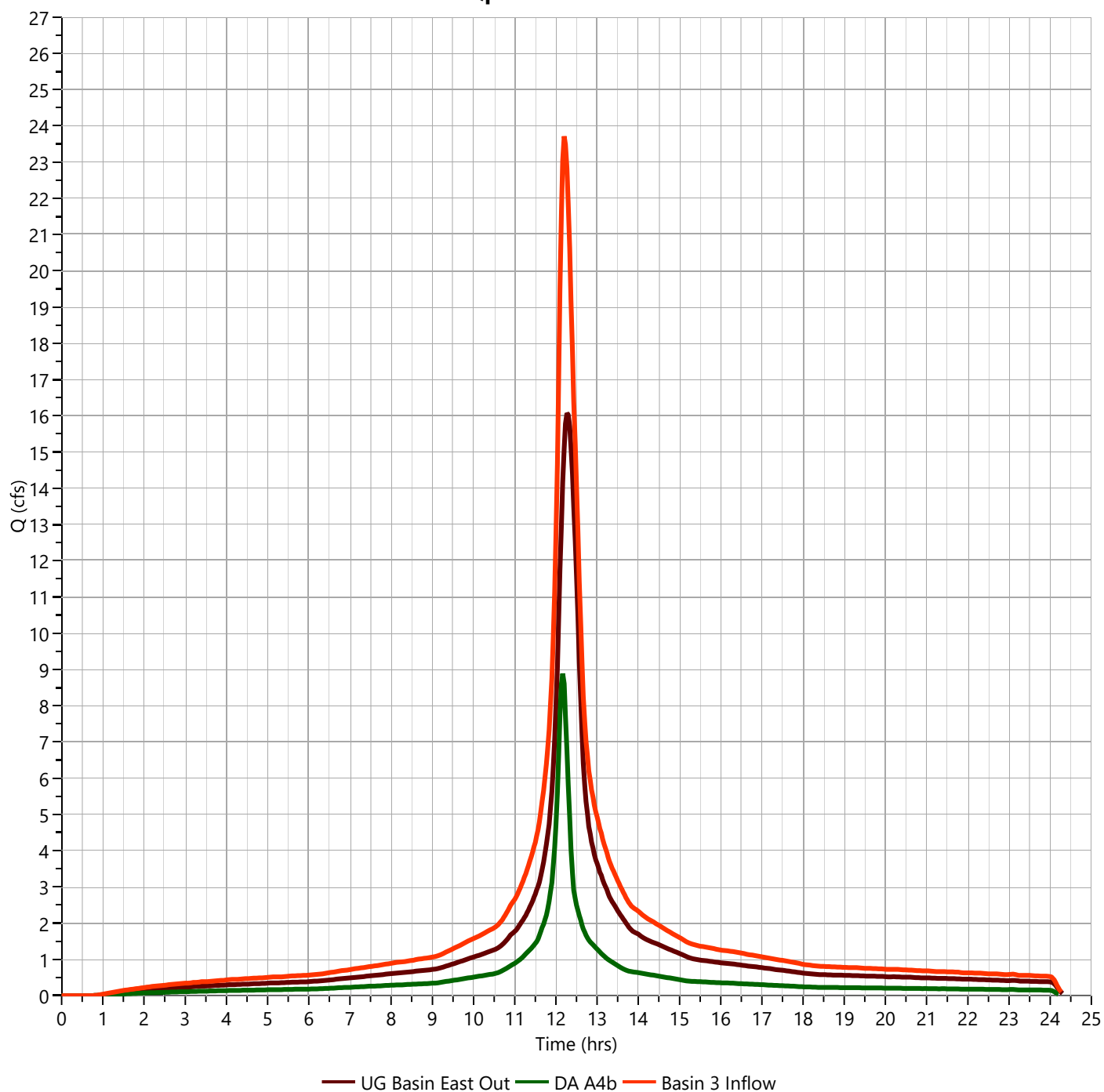
12-30-2020

Basin 3 Inflow

Hyd. No. 35

Hydrograph Type	= Junction	Peak Flow	= 23.71 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 140,667 cuft
Inflow Hydrographs	= 29, 33	Total Contrib. Area	= 3.6 ac

Qp = 23.71 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 3 Outflow

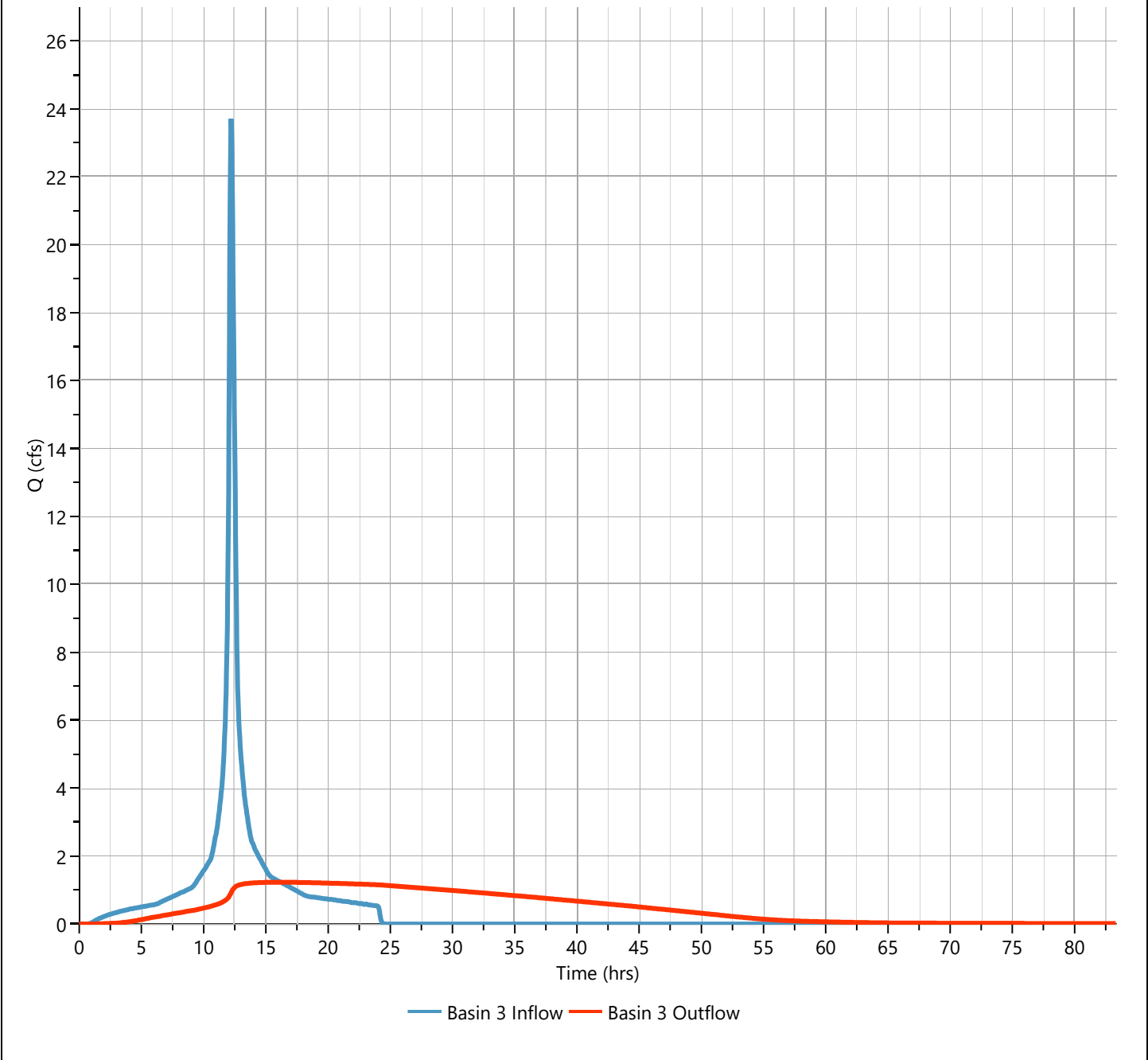
Hyd. No. 36

Hydrograph Type	= Pond Route	Peak Flow	= 1.226 cfs
Storm Frequency	= 10-yr	Time to Peak	= 16.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 140,362 cuft
Inflow Hydrograph	= 35 - Basin 3 Inflow	Max. Elevation	= 93.48 ft
Pond Name	= Basin 3	Max. Storage	= 91,062 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 15.02 hrs

Qp = 1.23 cfs



Hydrograph Report

Project Name:

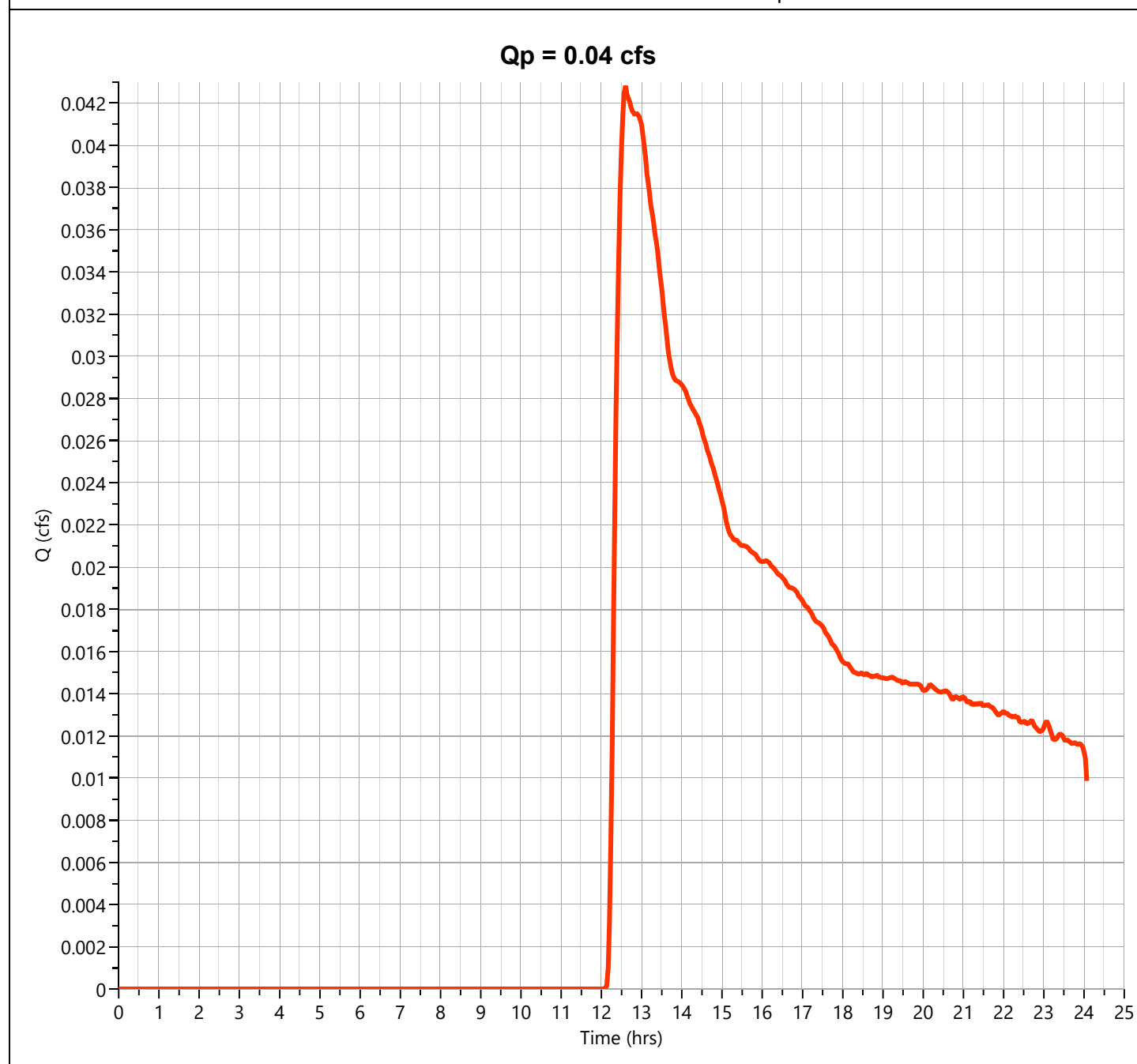
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5 - Perv.

Hyd. No. 38

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.043 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.60 hrs
Time Interval	= 2 min	Runoff Volume	= 824 cuft
Drainage Area	= 0.81 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

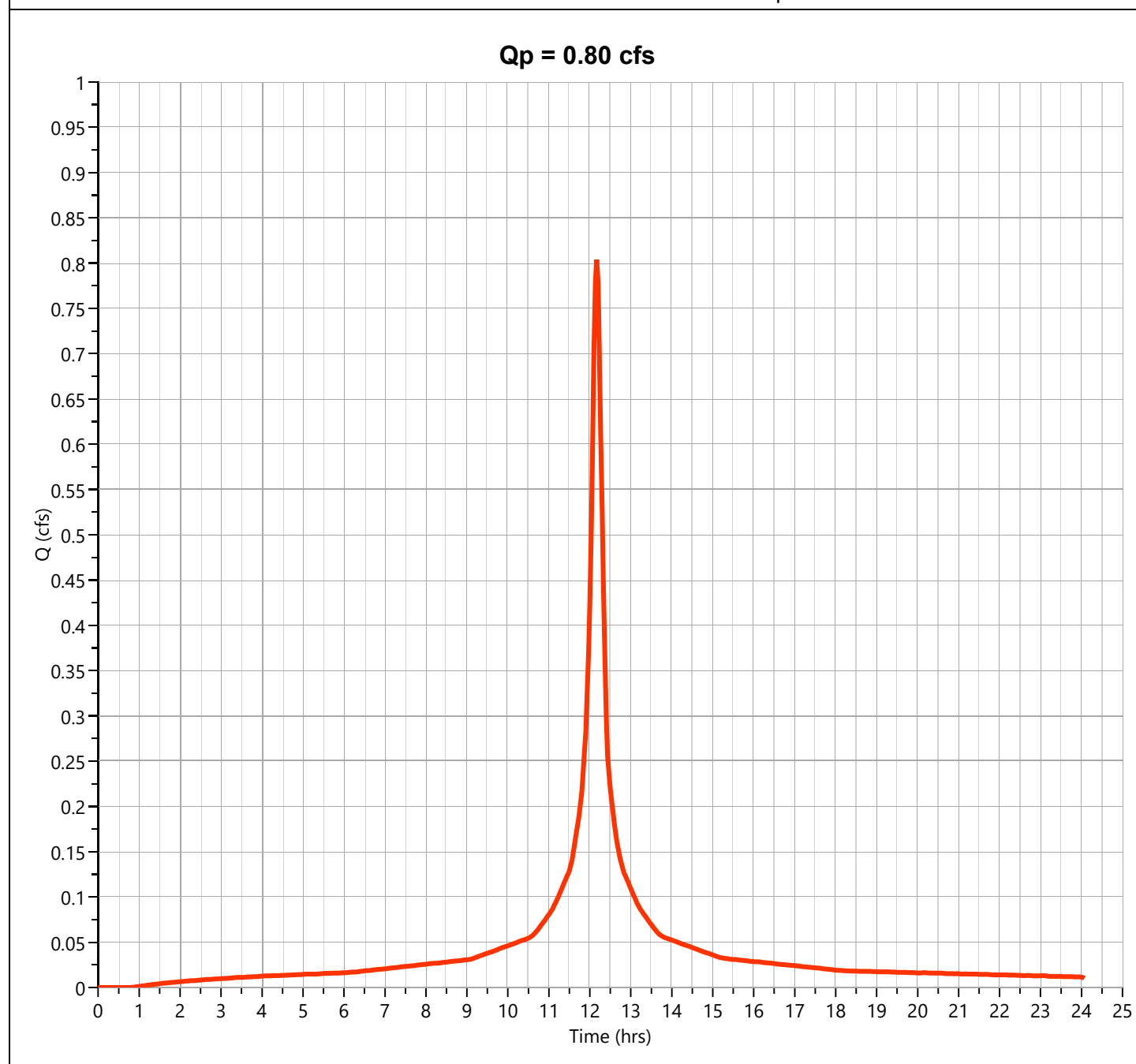
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5 - Imperv.

Hyd. No. 39

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.804 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 3,622 cuft
Drainage Area	= 0.19 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

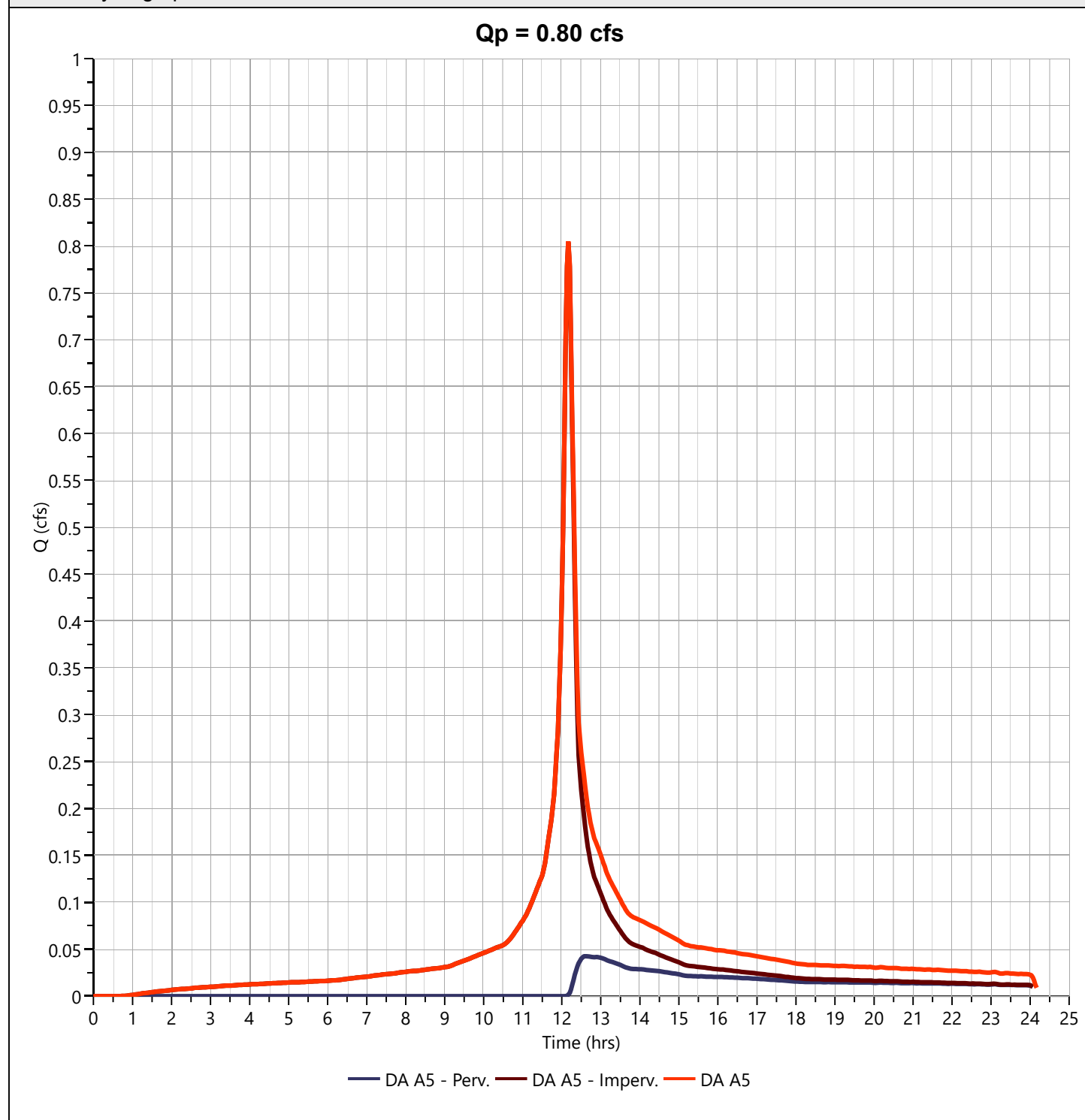
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5

Hyd. No. 40

Hydrograph Type	= Junction	Peak Flow	= 0.805 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 4,446 cuft
Inflow Hydrographs	= 38, 39	Total Contrib. Area	= 1.0 ac



Hydrograph Report

Project Name:

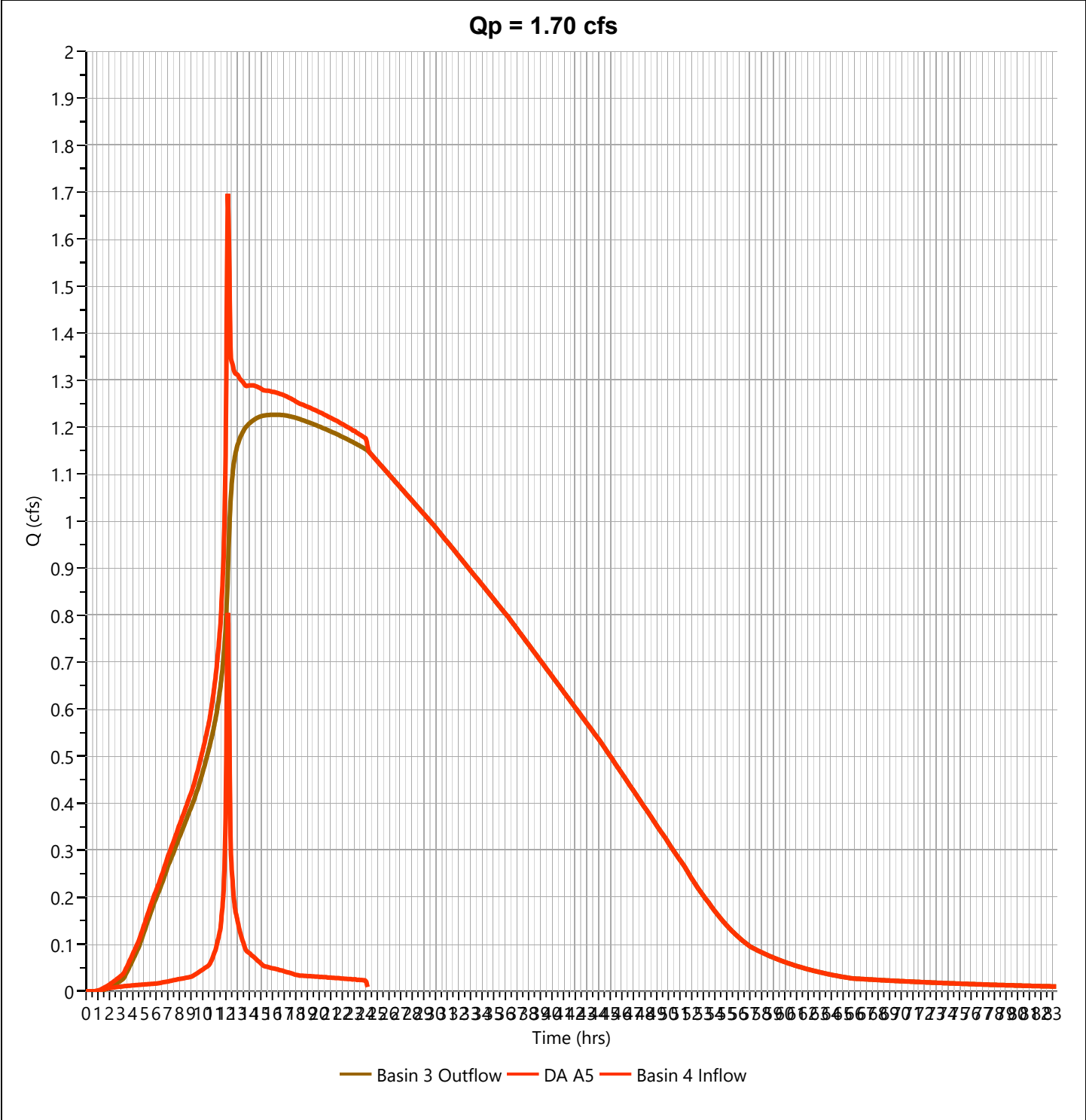
Hydrology Studio v 3.0.0.16

12-30-2020

Basin 4 Inflow

Hyd. No. 41

Hydrograph Type	= Junction	Peak Flow	= 1.698 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 144,808 cuft
Inflow Hydrographs	= 36, 40	Total Contrib. Area	= 1.0 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 4 Outflow

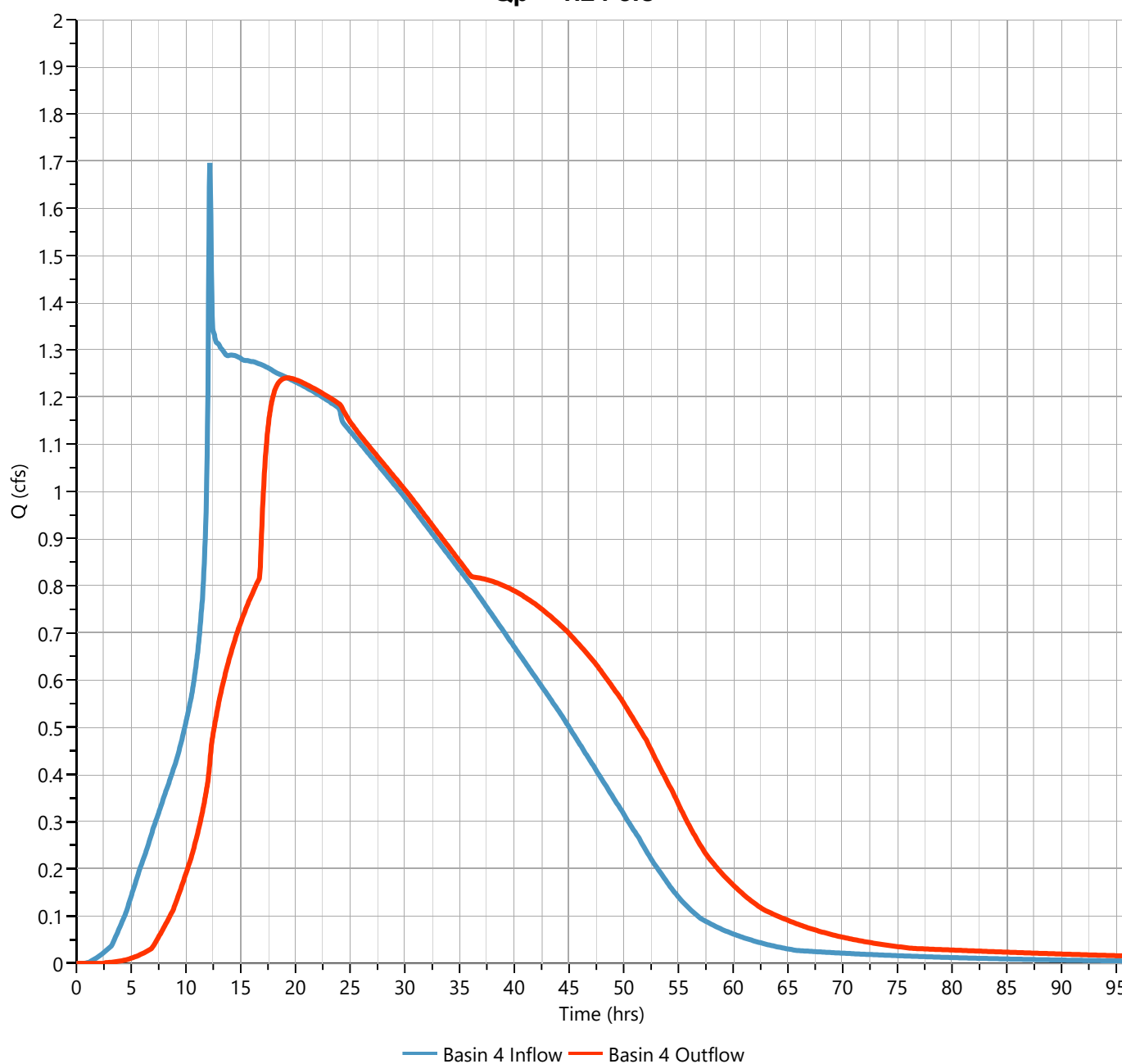
Hyd. No. 42

Hydrograph Type	= Pond Route	Peak Flow	= 1.241 cfs
Storm Frequency	= 10-yr	Time to Peak	= 19.30 hrs
Time Interval	= 2 min	Hydrograph Volume	= 143,858 cuft
Inflow Hydrograph	= 41 - Basin 4 Inflow	Max. Elevation	= 85.04 ft
Pond Name	= Basin 4	Max. Storage	= 20,200 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 5.80 hrs

Qp = 1.24 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6 - Perv.

Hyd. No. 44

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.84 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

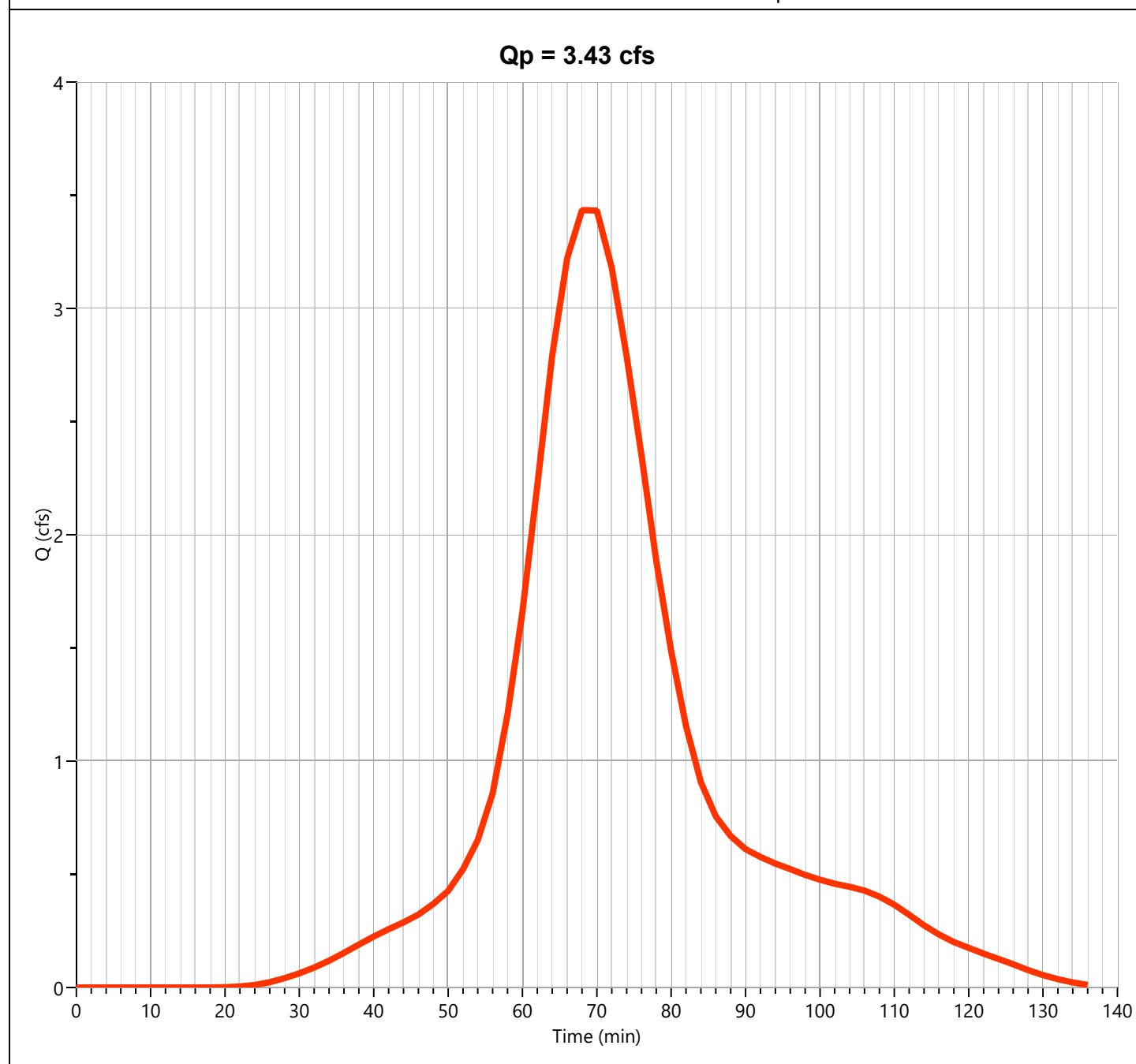
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6 - Imperv.

Hyd. No. 45

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.433 cfs
Storm Frequency	= 10-yr	Time to Peak	= 1.13 hrs
Time Interval	= 2 min	Runoff Volume	= 5,383 cuft
Drainage Area	= 1.39 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

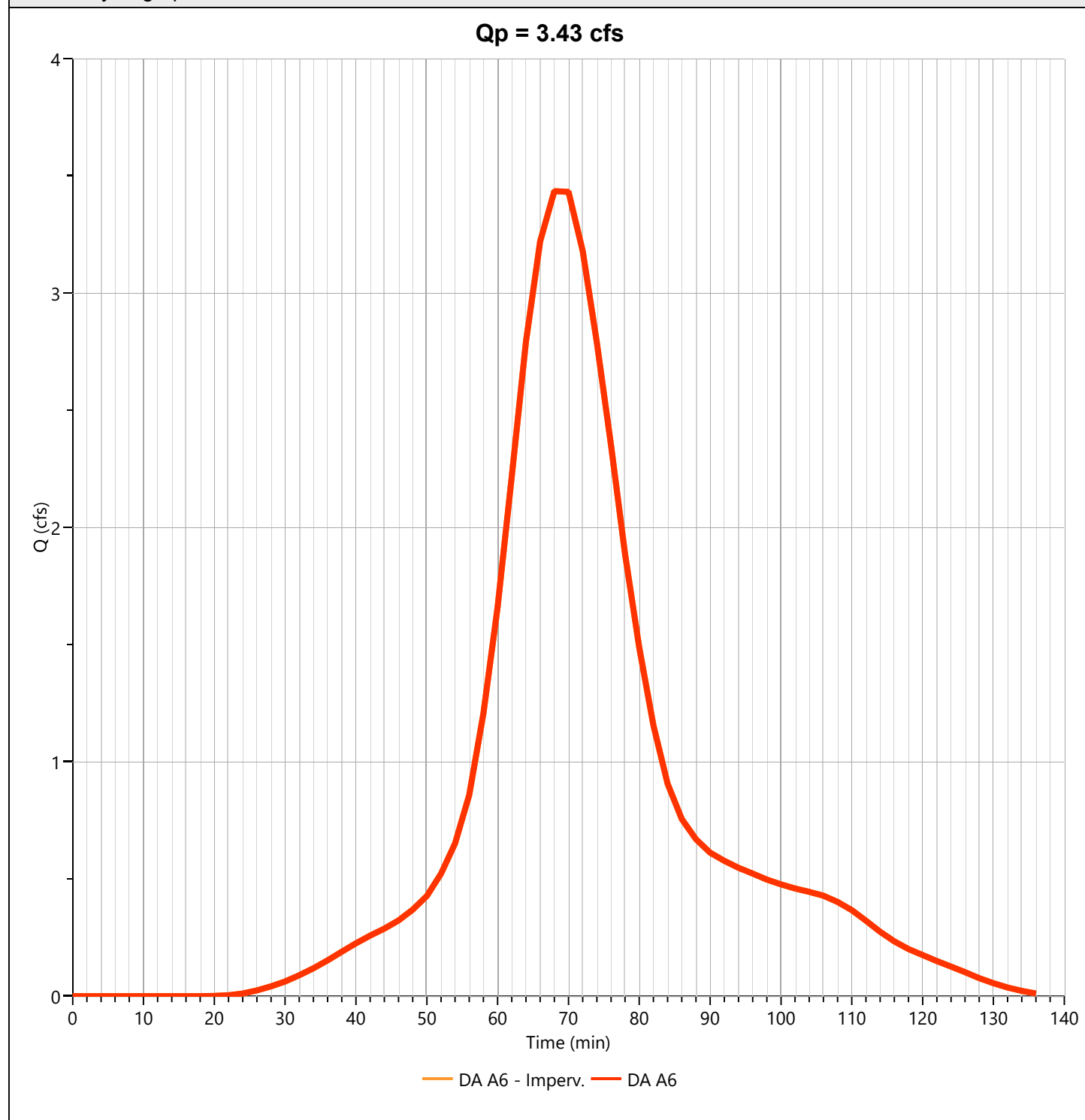
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6

Hyd. No. 46

Hydrograph Type	= Junction	Peak Flow	= 3.433 cfs
Storm Frequency	= 10-yr	Time to Peak	= 1.13 hrs
Time Interval	= 2 min	Hydrograph Volume	= 5,383 cuft
Inflow Hydrographs	= 44, 45	Total Contrib. Area	= 2.23 ac



Hydrograph Report

Project Name:

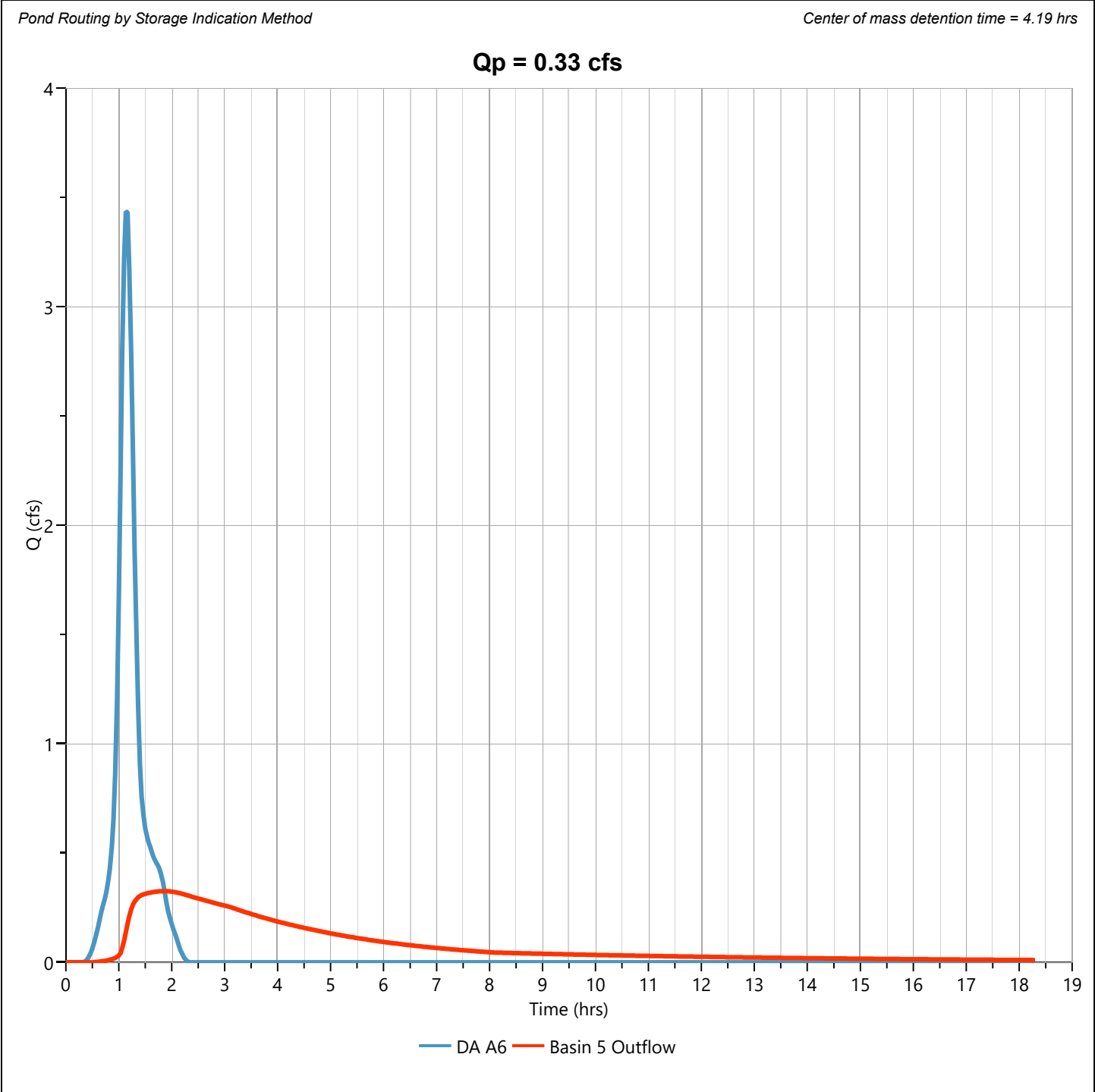
Hydrology Studio v 3.0.0.16

12-30-2020

Basin 5 Outflow

Hyd. No. 47

Hydrograph Type	= Pond Route	Peak Flow	= 0.326 cfs
Storm Frequency	= 10-yr	Time to Peak	= 1.87 hrs
Time Interval	= 2 min	Hydrograph Volume	= 5,359 cuft
Inflow Hydrograph	= 46 - DA A6	Max. Elevation	= 73.40 ft
Pond Name	= Basin 5	Max. Storage	= 4,365 cuft



Hydrograph Report

Project Name:

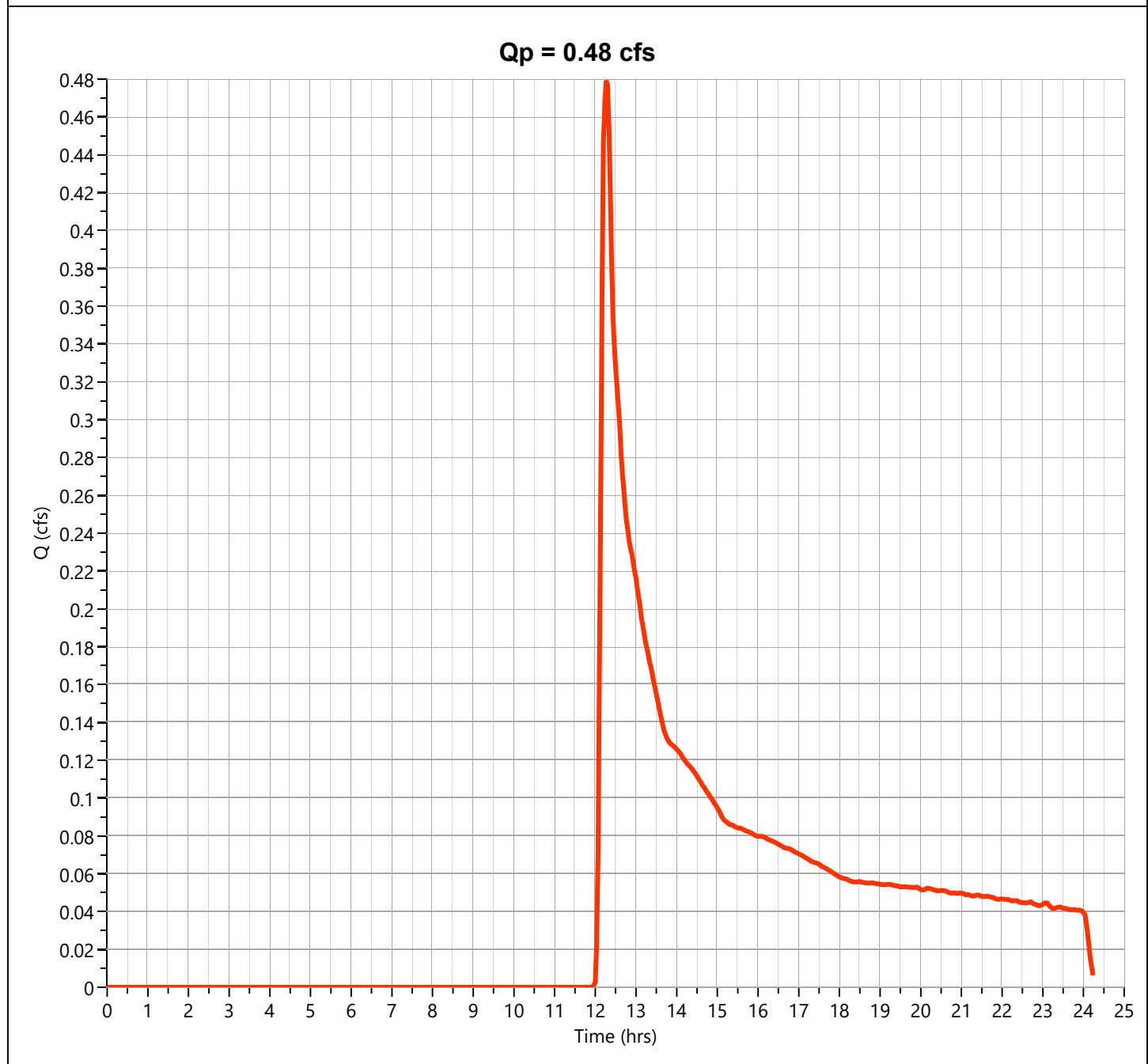
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A7

Hyd. No. 49

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.479 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 3,920 cuft
Drainage Area	= 1.9 ac	Curve Number	= 45
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

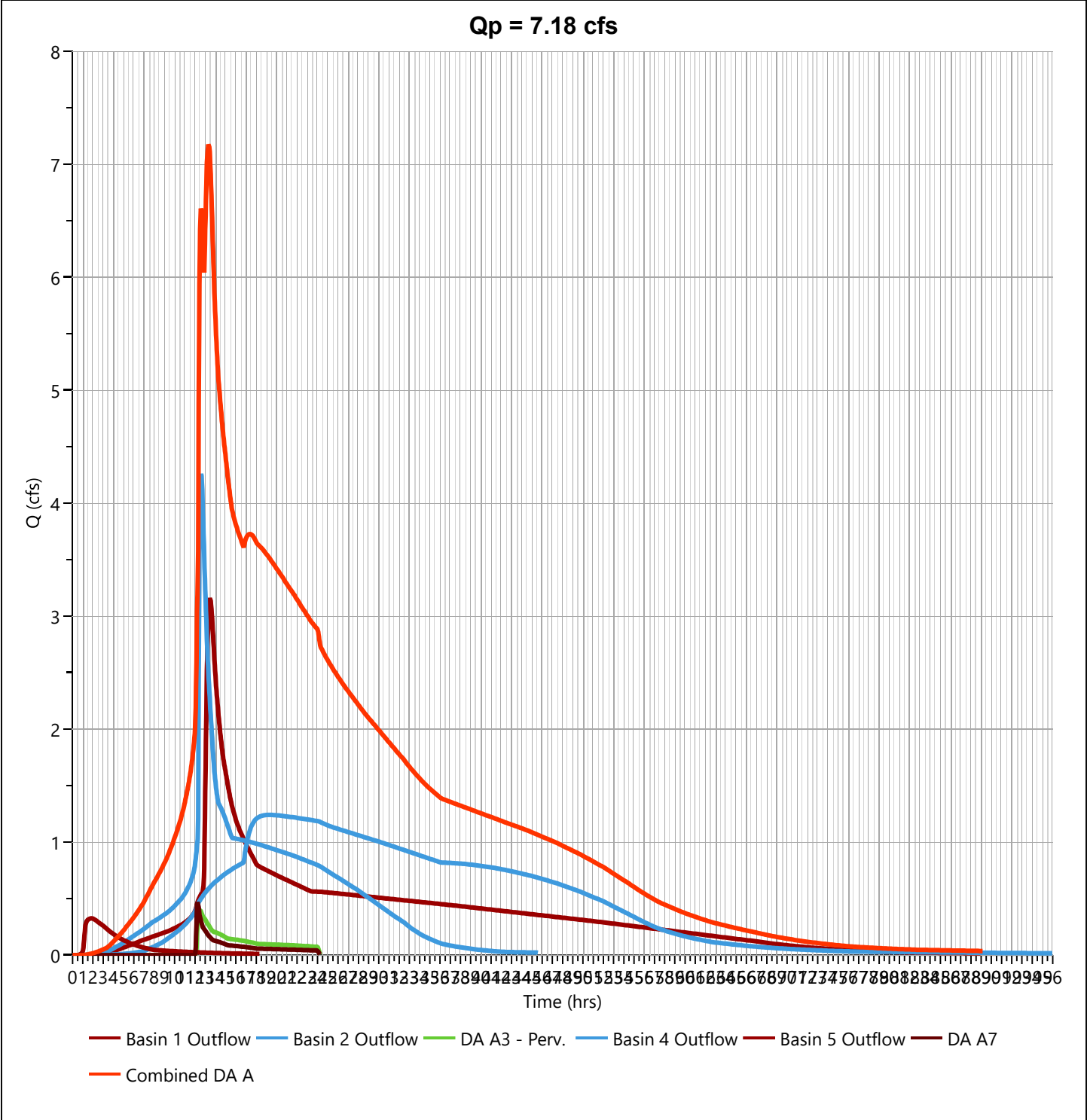
Hydrology Studio v 3.0.0.16

12-30-2020

Combined DA A

Hyd. No. 51

Hydrograph Type	= Junction	Peak Flow	= 7.177 cfs
Storm Frequency	= 10-yr	Time to Peak	= 13.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 374,307 cuft
Inflow Hydrographs	= 17, 22, 24, 42, 47, 49	Total Contrib. Area	= 6.31 ac



Hydrograph Report

Project Name:

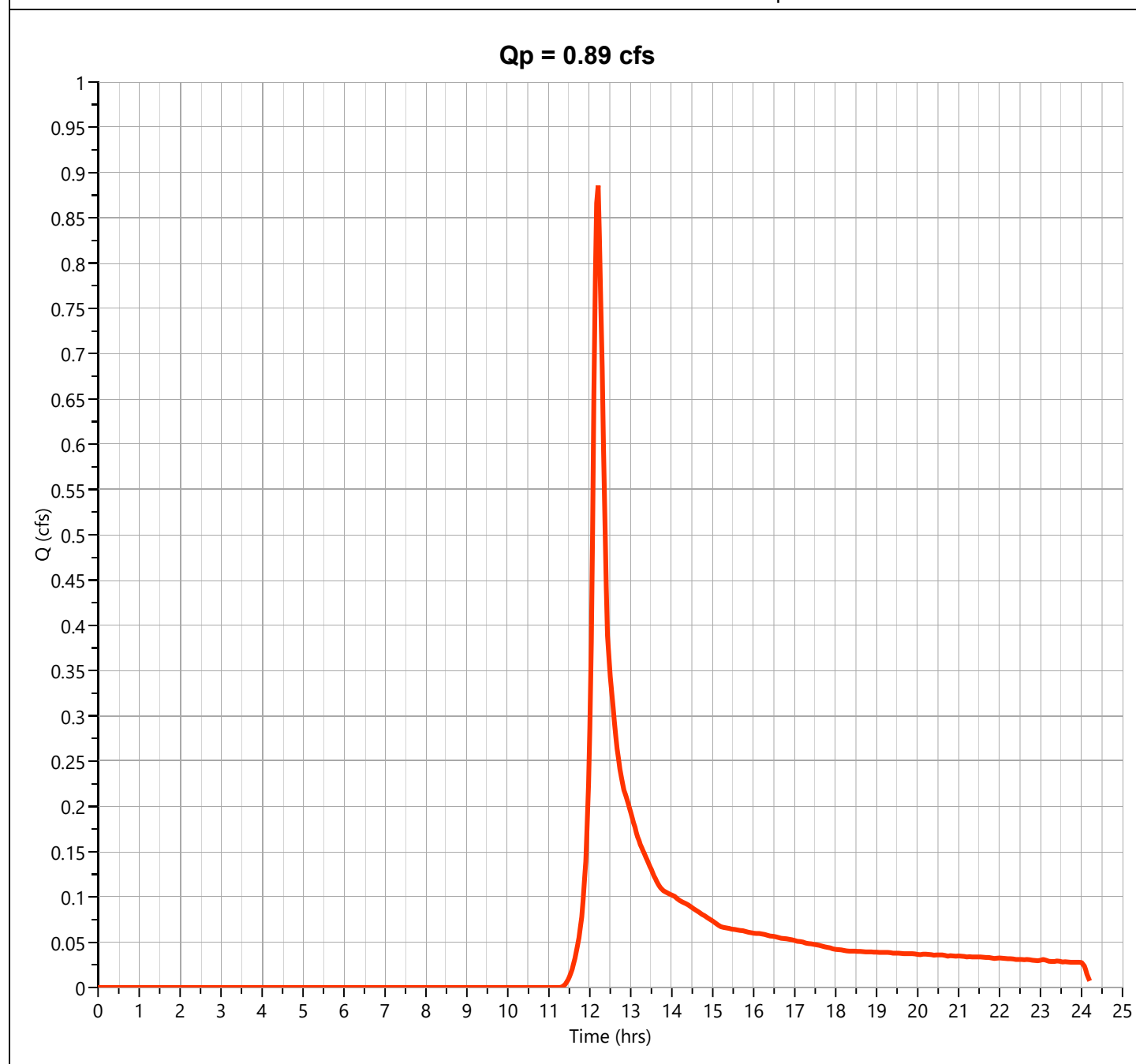
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA B - Perv.

Hyd. No. 53

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.886 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 3,848 cuft
Drainage Area	= 0.8 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

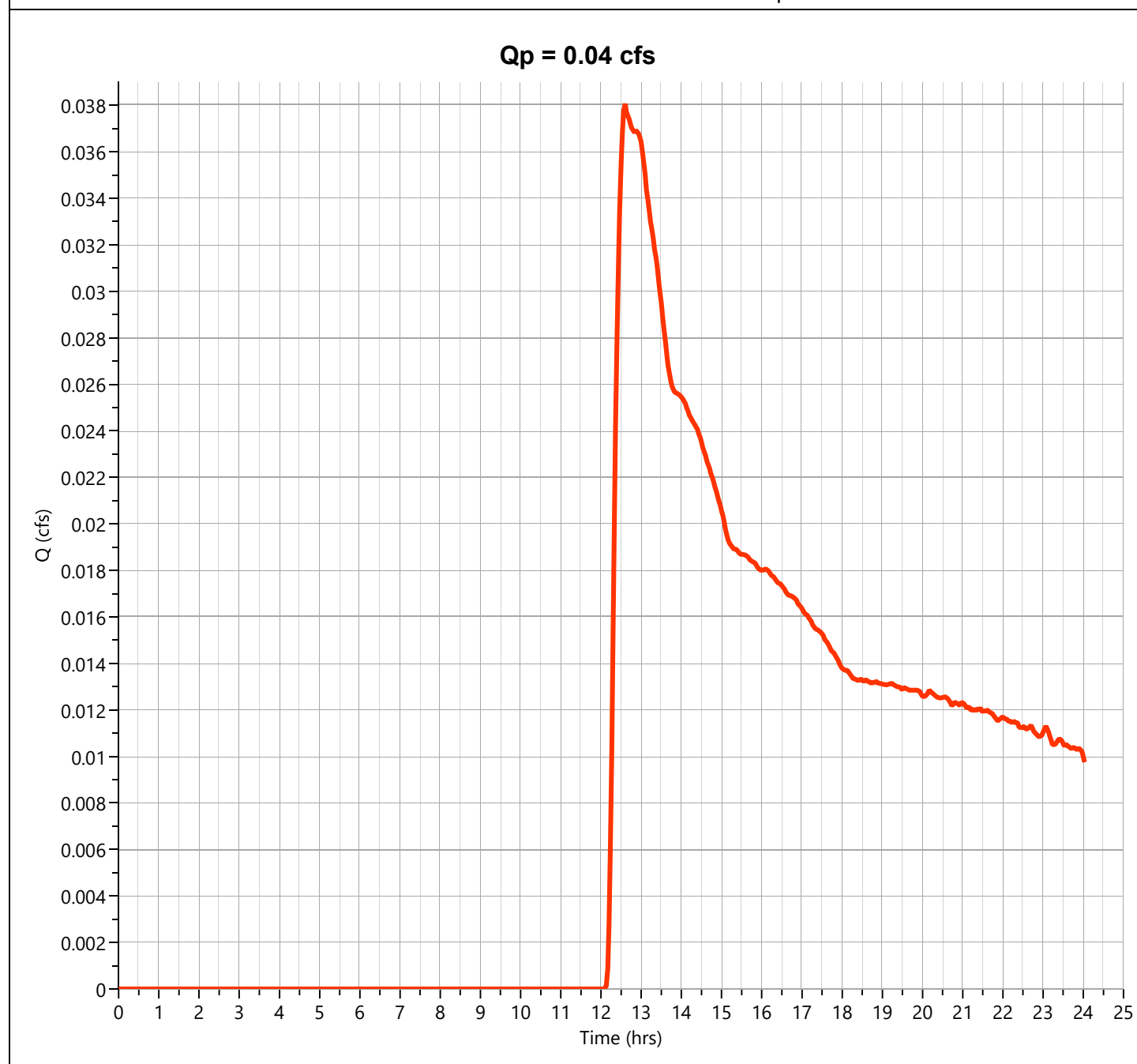
Hydrology Studio v 3.0.0.16

12-30-2020

Pre DA C - Perv.

Hyd. No. 55

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.038 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.60 hrs
Time Interval	= 2 min	Runoff Volume	= 732 cuft
Drainage Area	= 0.72 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

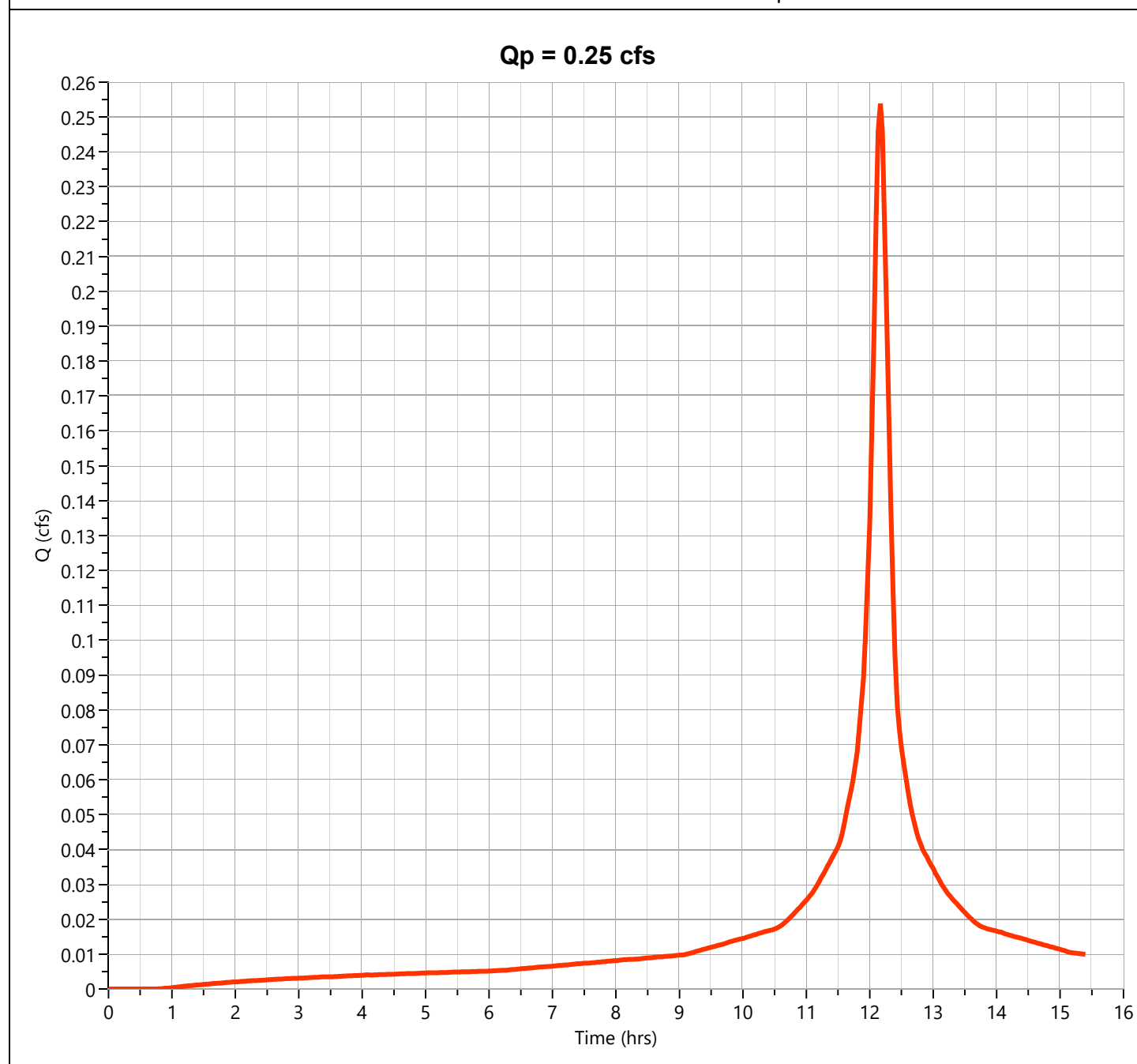
Hydrology Studio v 3.0.0.16

12-30-2020

Pre DA C - Imperv.

Hyd. No. 56

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.254 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 1,144 cuft
Drainage Area	= 0.06 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.33 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

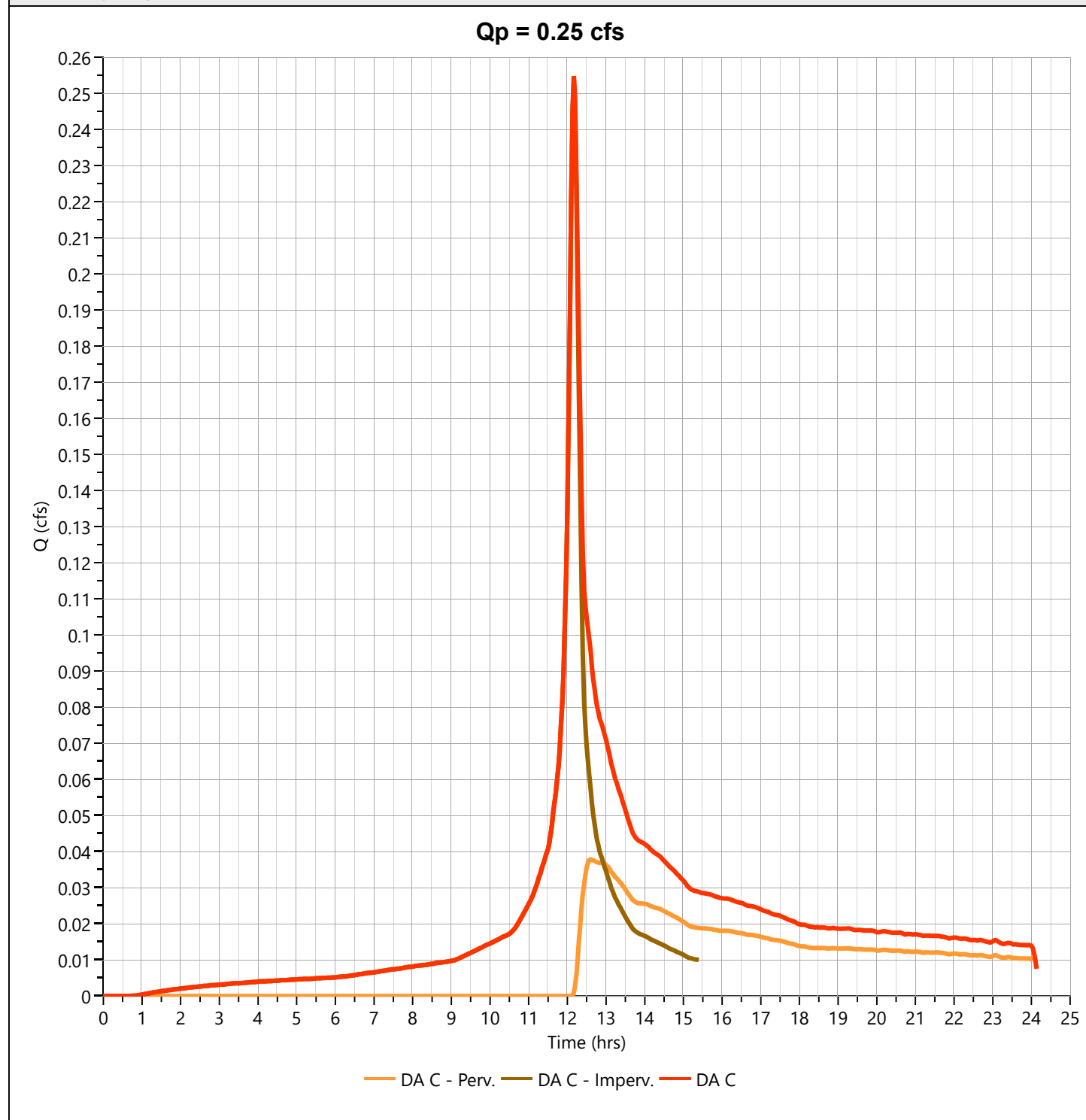
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA C

Hyd. No. 57

Hydrograph Type	= Junction	Peak Flow	= 0.255 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 1,876 cuft
Inflow Hydrographs	= 55, 56	Total Contrib. Area	= 0.78 ac



Hydrograph 25-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

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	Post DAA1a - Perv.	1.959	12.27	9,455	----		
2	NRCS Runoff	Post DAA1a - Imperv.	13.91	12.17	63,120	----		
3	Junction	Post DAA1a	15.56	12.17	72,575	1, 2		
5	NRCS Runoff	Post DAA1a (un) - Perv.	2.272	12.23	9,928	----		
7	Junction	UG Basin West Inflow	17.70	12.17	82,503	3, 5		
8	Pond Route	UG Basin West Outflow	16.14	12.23	82,503	7	104.27	9,211
10	NRCS Runoff	Post DAA1b - Perv.	1.398	12.20	6,735	----		
11	NRCS Runoff	Post DAA1b - Imperv.	11.53	12.17	52,320	----		
12	Junction	Post DAA1b	12.86	12.17	59,055	10, 11		
14	NRCS Runoff	Post DAA1b (un) - Perv.	0.955	12.17	3,743	----		
16	Junction	Basin 1 Inflow	28.31	12.23	145,302	8, 12, 14		
17	Pond Route	Basin 1 Outflow	7.713	12.90	144,424	16	98.75	71,184
19	NRCS Runoff	Post DAA2 - Perv.	0.506	12.20	2,983	----		
20	NRCS Runoff	Post DAA2 - Imperv.	23.00	12.17	104,400	----		
21	Junction	Post DAA2	23.46	12.17	107,383	19, 20		
22	Pond Route	Basin 2 Outflow	11.24	12.37	107,339	21	86.28	45,581
24	NRCS Runoff	Post DAA3 - Perv.	1.835	12.23	12,931	----		
26	NRCS Runoff	Post DAA4a - Perv.	4.428	12.27	22,030	----		
27	NRCS Runoff	Post DAA4a - Imperv.	23.85	12.17	108,240	----		
28	Junction	Post DAA4a	27.50	12.17	130,270	26, 27		
29	Pond Route	UG Basin East Out	20.12	12.30	130,270	28	103.26	10,513
31	NRCS Runoff	Post DAA4b - Perv.	0.414	12.30	3,633	----		
32	NRCS Runoff	Post DAA4b - Imperv.	11.11	12.17	50,400	----		
33	Junction	Post DAA4b	11.40	12.17	54,033	31, 32		
35	Junction	Basin 3 Inflow	29.60	12.20	184,303	29, 33		
36	Pond Route	Basin 3 Outflow	4.834	13.33	183,948	35	94.06	105,396

Hydrograph 25-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

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)
38	NRCS Runoff	Post DAA5 - Perv.	0.223	12.30	1,962	---		
39	NRCS Runoff	Post DAA5 - Imperv.	1.005	12.17	4,560	---		
40	Junction	Post DAA5	1.171	12.20	6,522	38, 39		
41	Junction	Basin 4 Inflow	5.025	13.30	190,470	36, 40		
42	Pond Route	Basin 4 Outflow	3.955	14.00	189,414	41	85.22	23,869
44	NRCS Runoff	Post DAA6 - Perv.	0.000	0.00	0.000	---		
45	NRCS Runoff	Post DAA6 - Imperv.	3.433	1.13	5,383	---		
46	Junction	Post DAA6	3.433	1.13	5,383	44, 45		
47	Pond Route	Basin 5 Outflow	0.326	1.87	5,359	46	73.40	4,365
49	NRCS Runoff	Post DAA7	1.466	12.20	7,657	---		
51	Junction	Combined DAA	18.02	12.57	497,136	17, 22, 24, 42, 47, 49		
53	NRCS Runoff	Post DA B - Perv.	1.523	12.20	6,240	---		
55	NRCS Runoff	Pre DA C - Perv.	0.199	12.30	1,744	---		
56	NRCS Runoff	Pre DA C - Imperv.	0.317	12.17	1,440	---		
57	Junction	Post DA C	0.484	12.20	3,184	55, 56		

Hydrograph Report

Project Name:

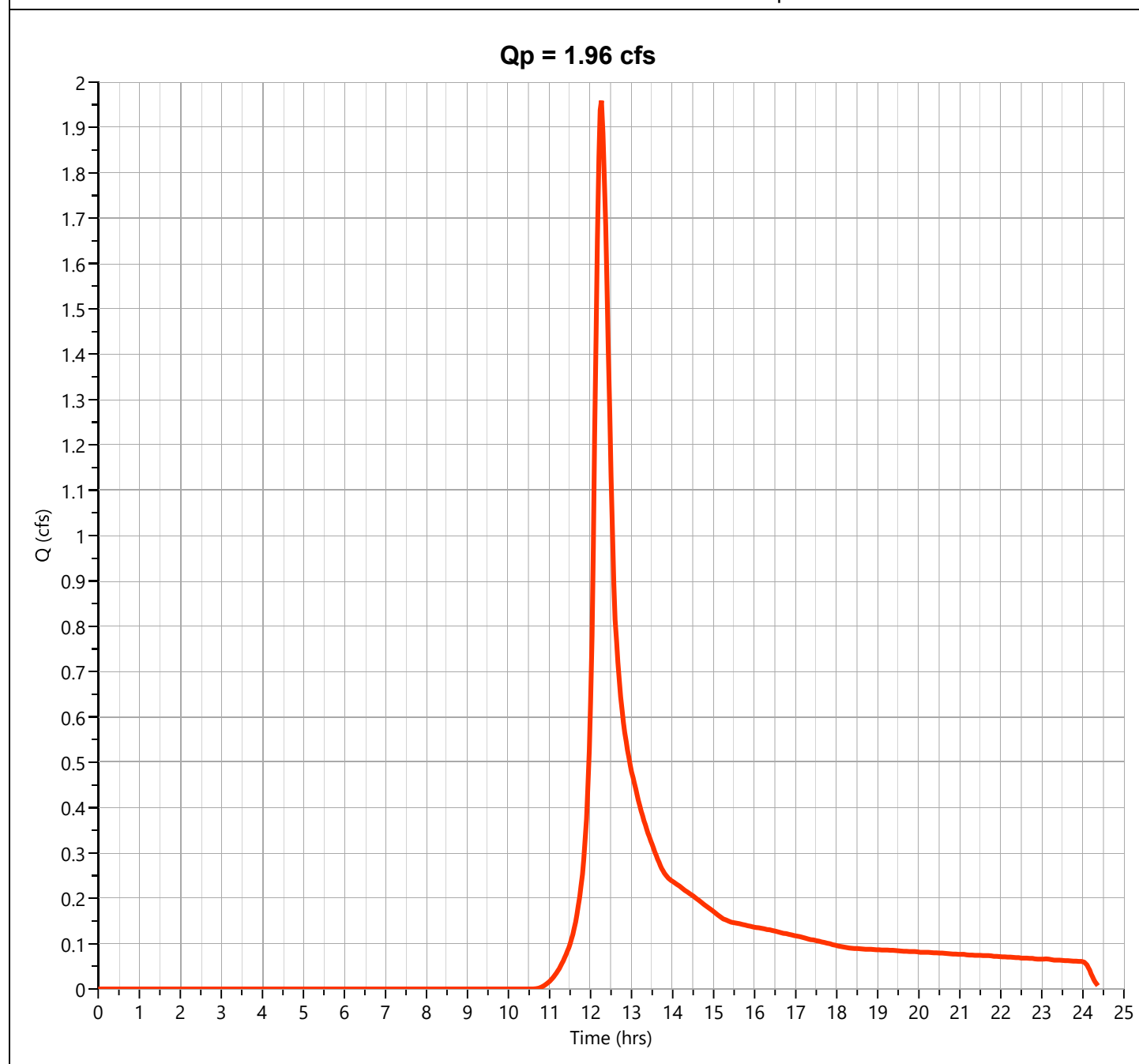
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a - Perv.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.959 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 9,455 cuft
Drainage Area	= 1.25 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 19.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

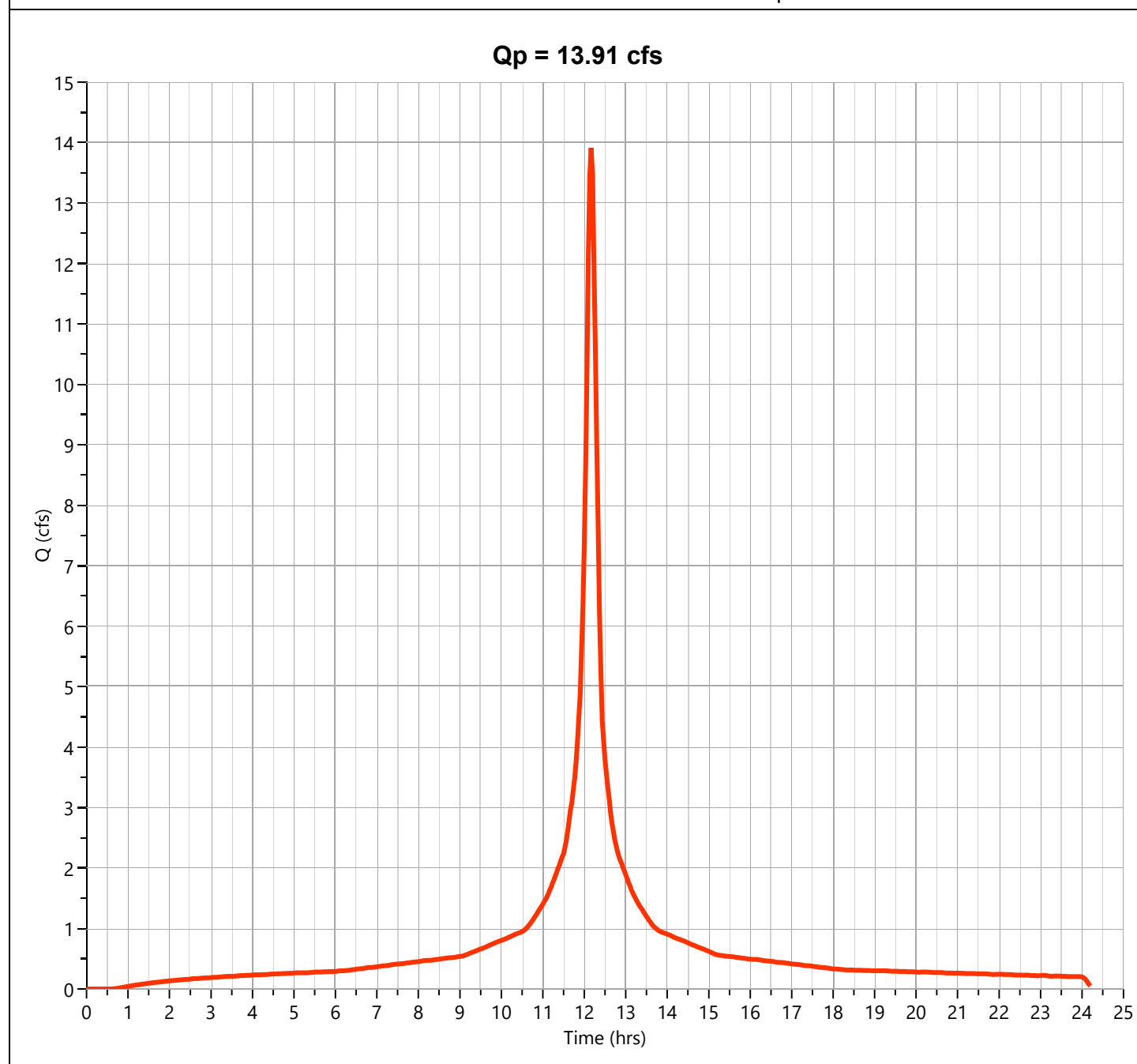
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a - Imperv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 13.91 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 63,120 cuft
Drainage Area	= 2.63 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

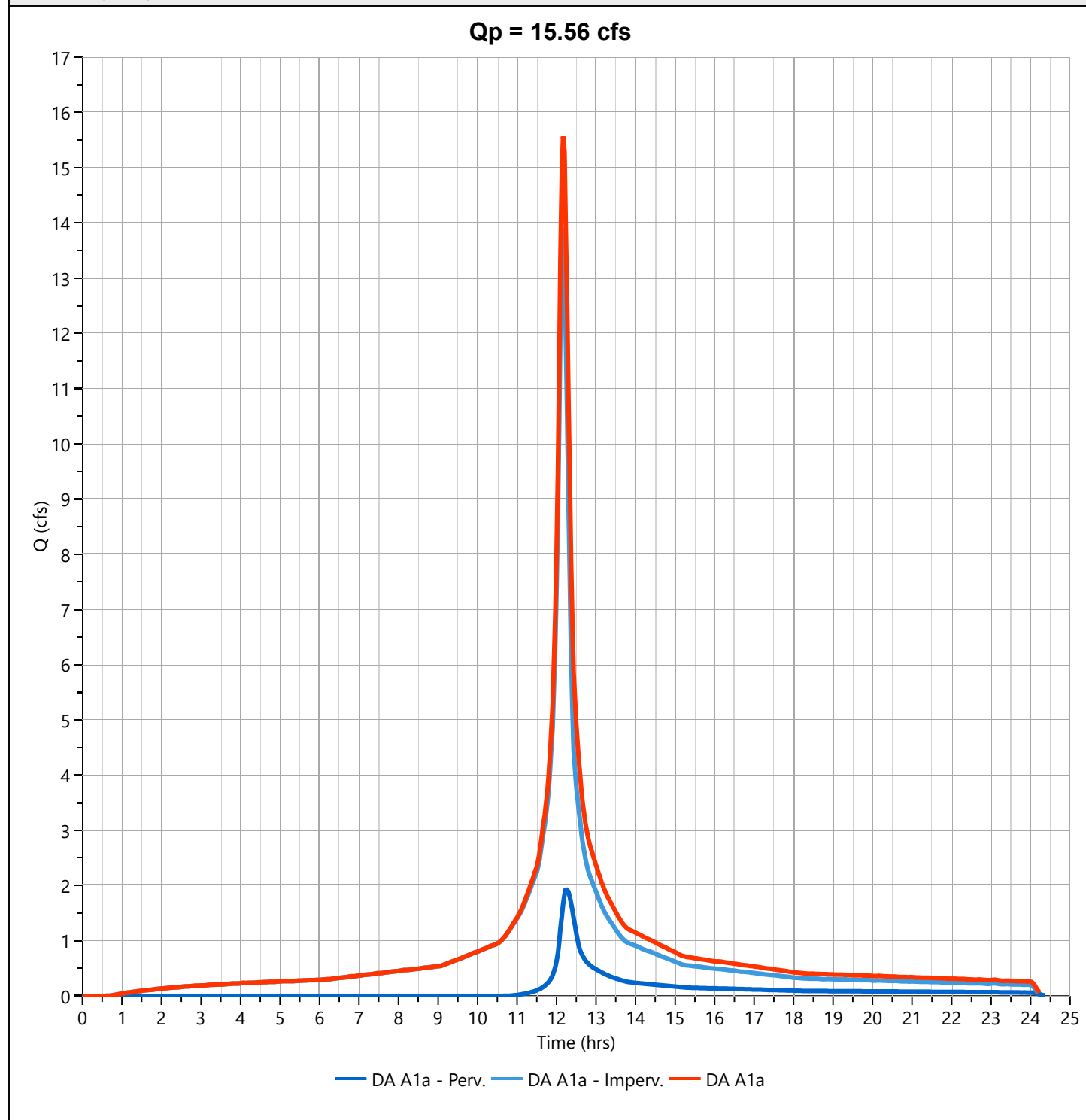
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 15.56 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 72,575 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 3.88 ac



Hydrograph Report

Project Name:

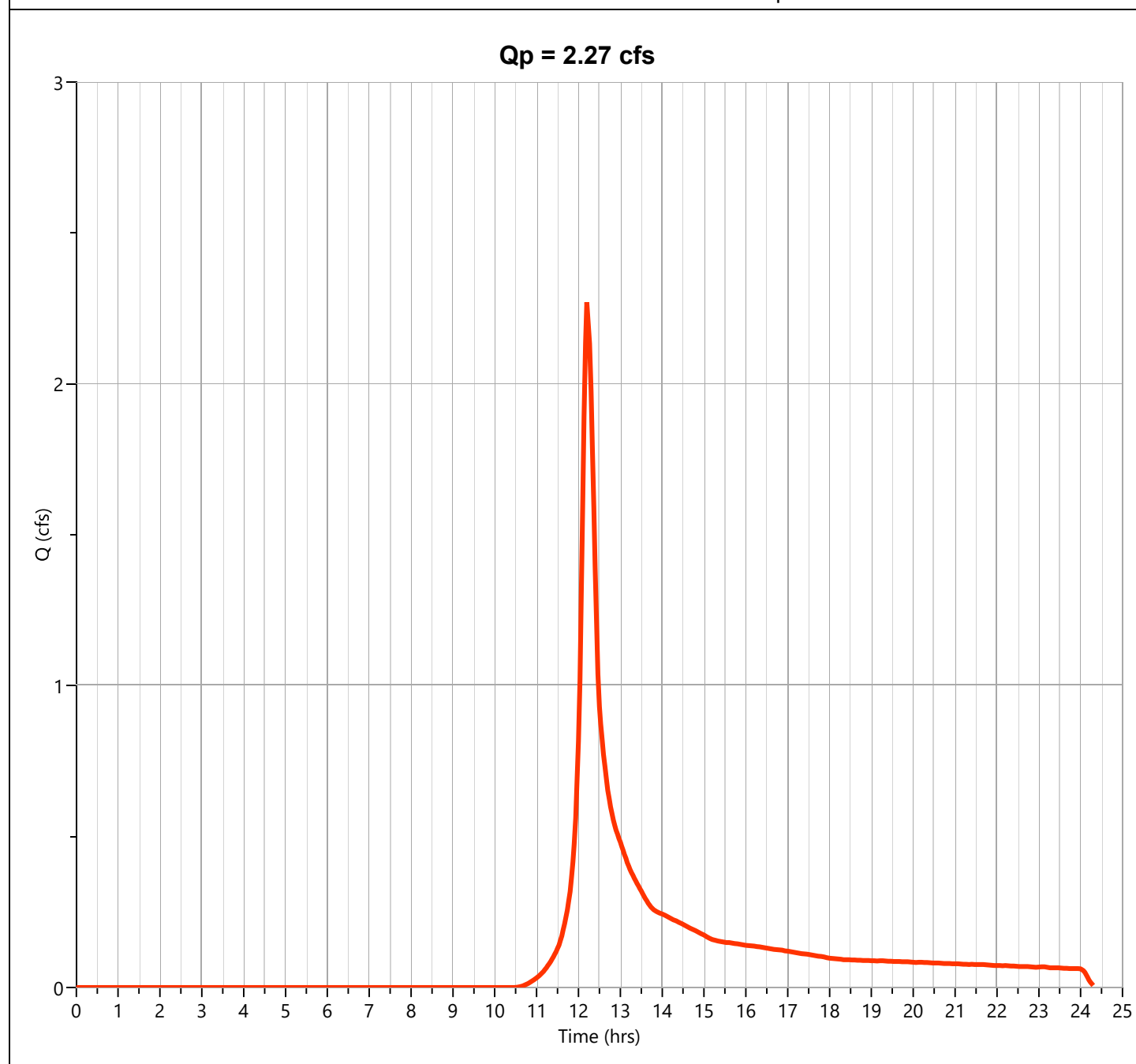
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a (un) - Perv.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.272 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 9,928 cuft
Drainage Area	= 1.29 ac	Curve Number	= 58
Tc Method	= User	Time of Conc. (Tc)	= 16.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

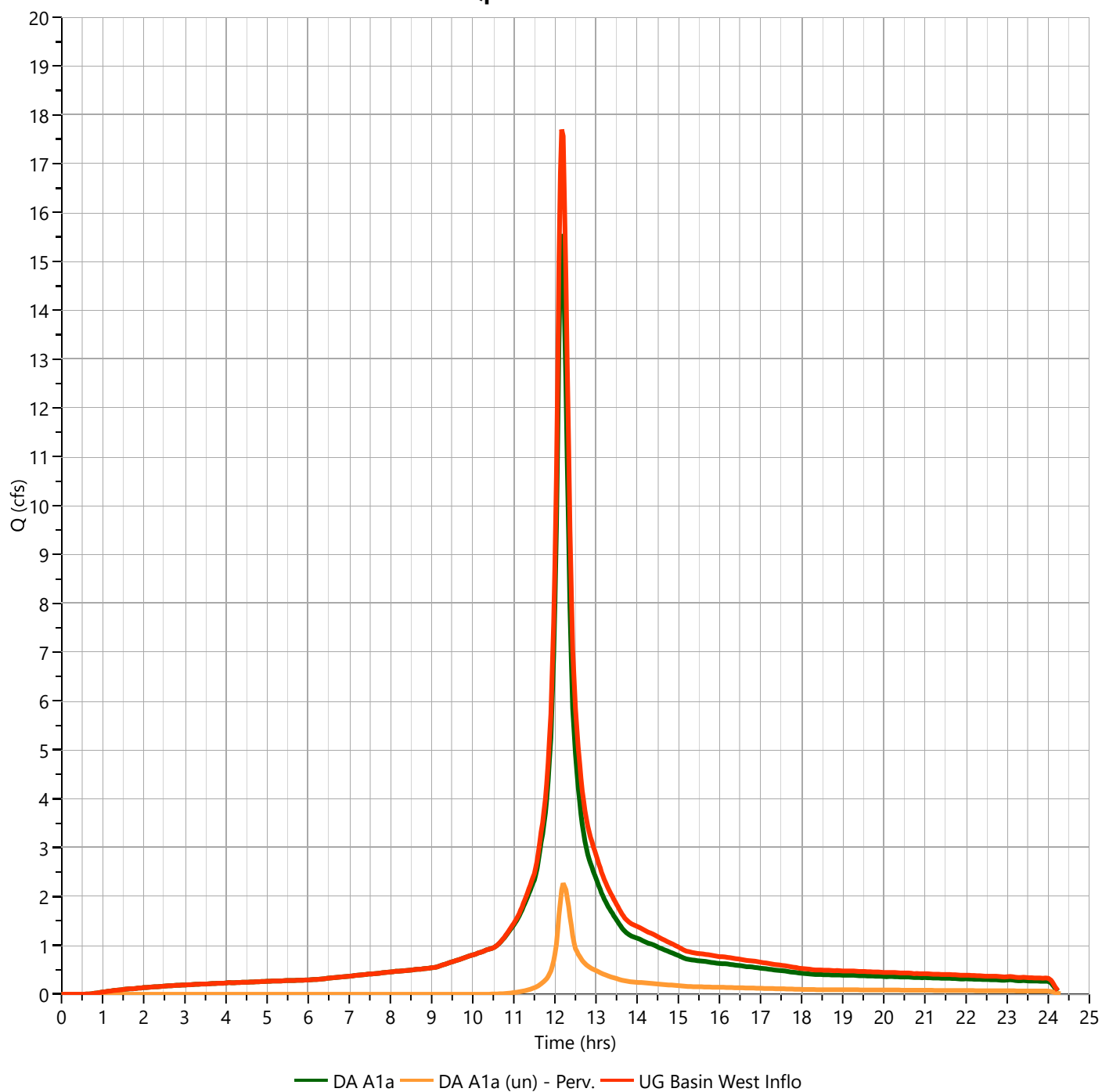
12-30-2020

UG Basin West Inflo

Hyd. No. 7

Hydrograph Type	= Junction	Peak Flow	= 17.70 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 82,503 cuft
Inflow Hydrographs	= 3, 5	Total Contrib. Area	= 5.17 ac

Qp = 17.70 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Basin West Outfl

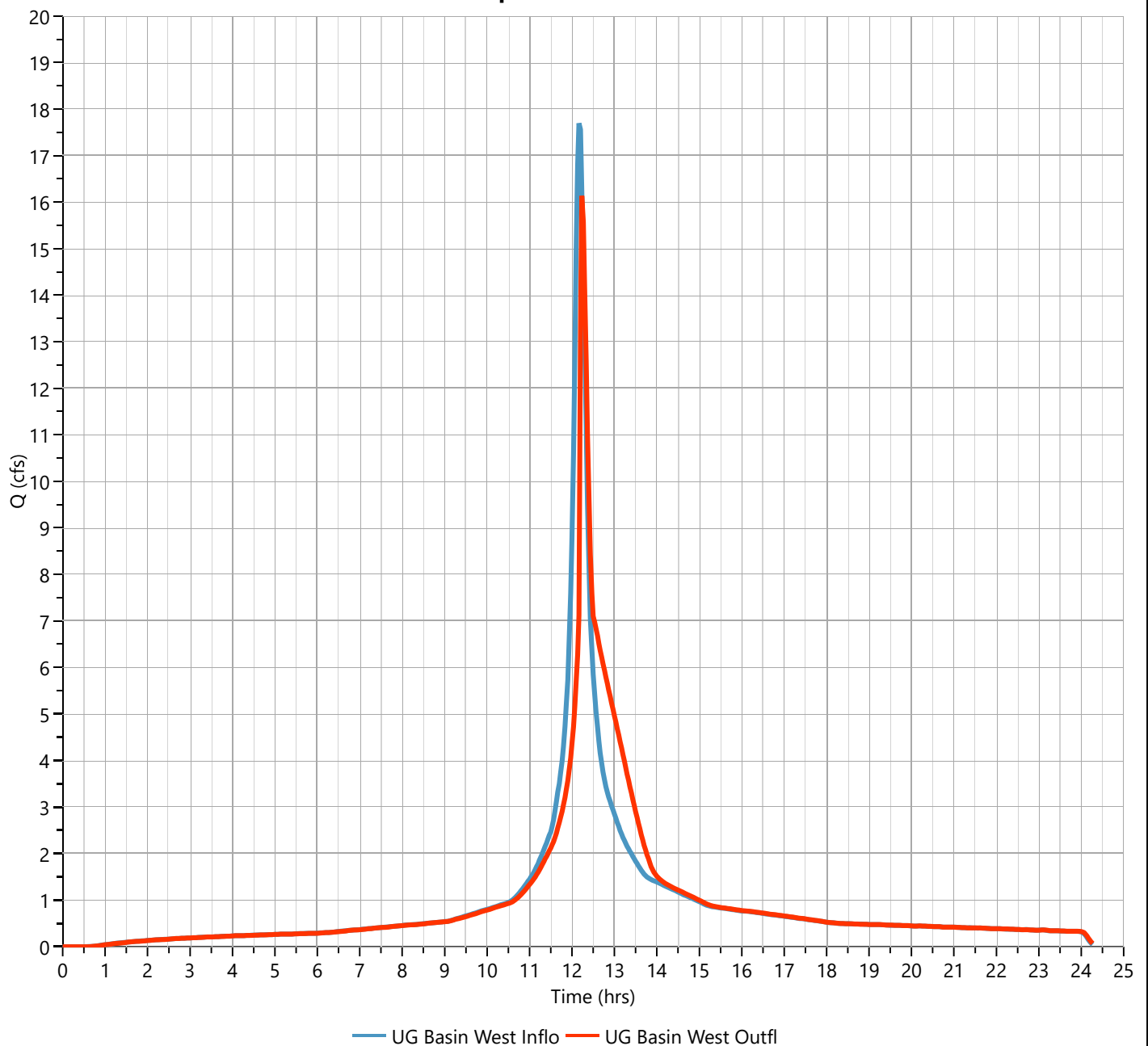
Hyd. No. 8

Hydrograph Type	= Pond Route	Peak Flow	= 16.14 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 82,503 cuft
Inflow Hydrograph	= 7 - UG Basin West Inflo	Max. Elevation	= 104.27 ft
Pond Name	= UG Recharge / Detention Basin West	Max. Storage	= 9,211 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 8 min

Qp = 16.14 cfs



Hydrograph Report

Project Name:

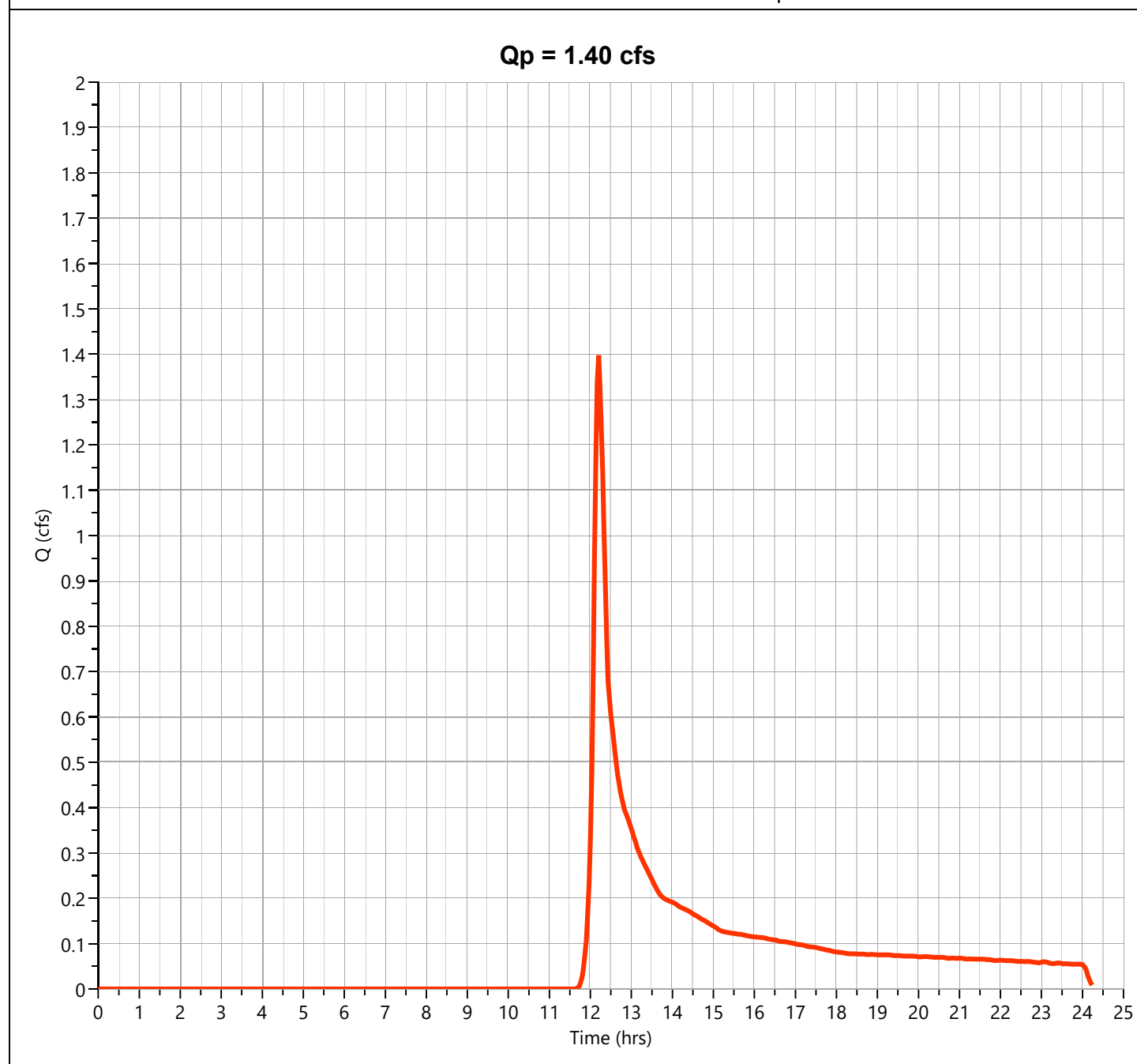
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b - Perv.

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.398 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 6,735 cuft
Drainage Area	= 1.46 ac	Curve Number	= 47
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

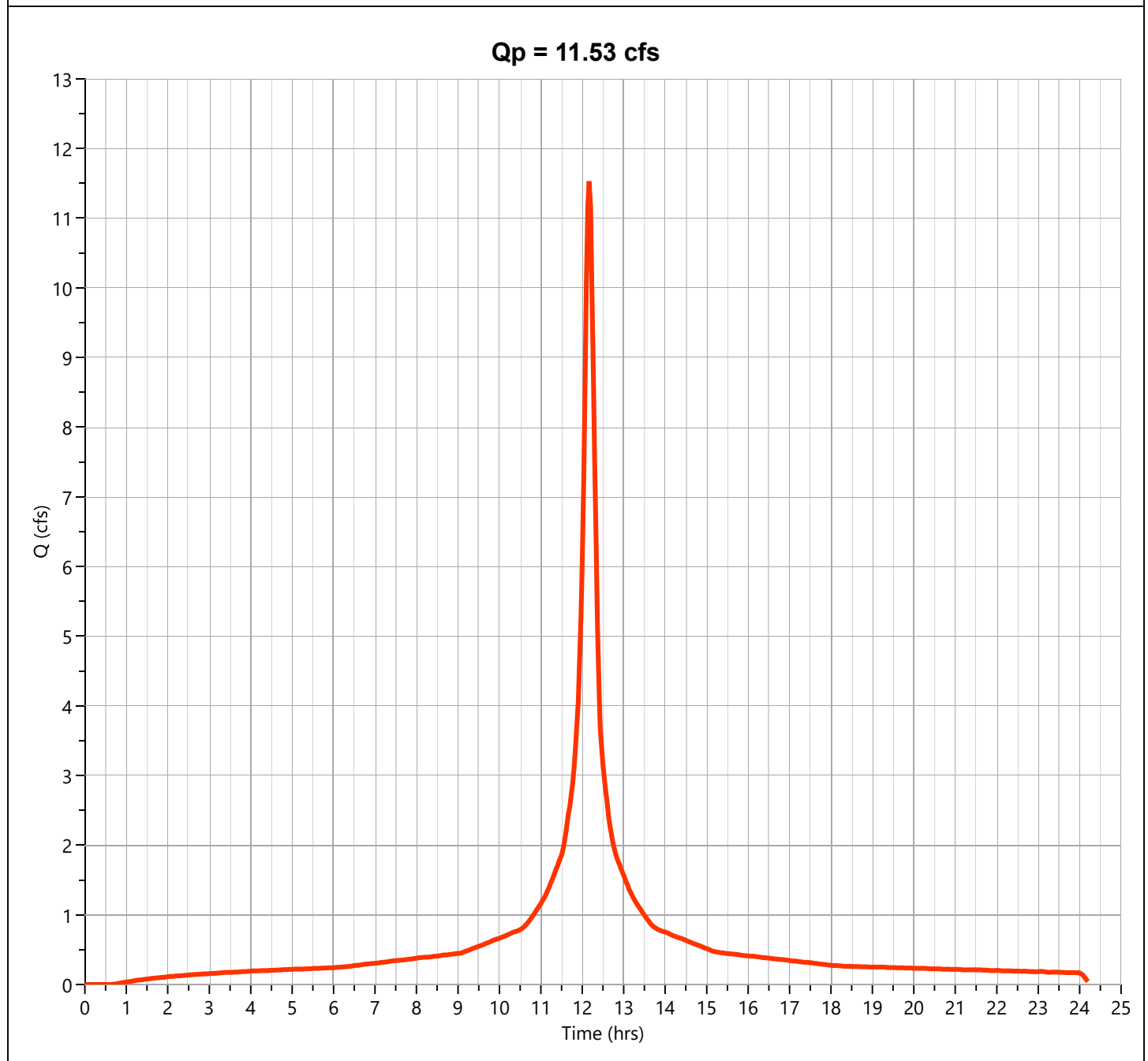
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b - Imperv.

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.53 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 52,320 cuft
Drainage Area	= 2.18 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

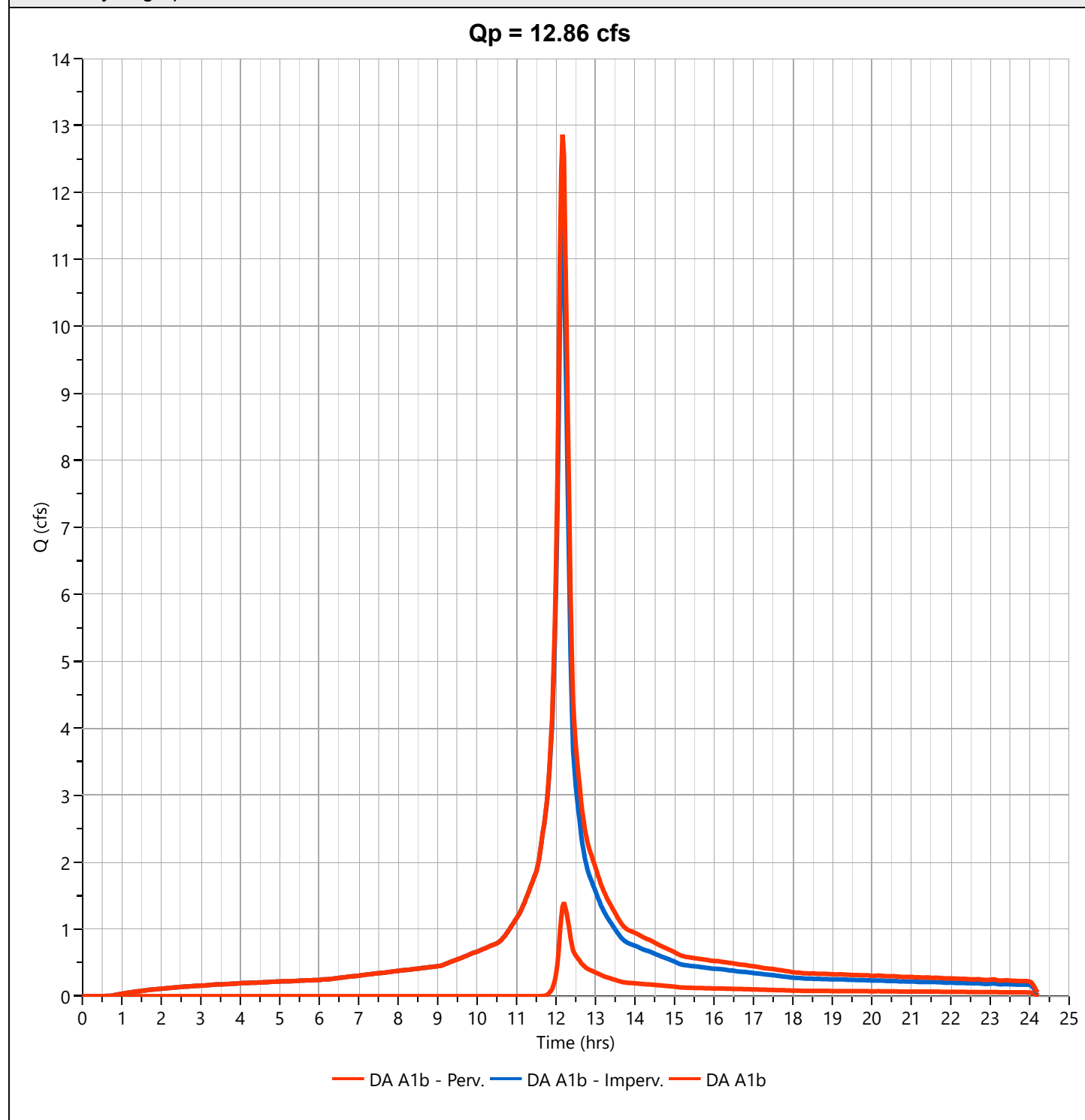
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b

Hyd. No. 12

Hydrograph Type	= Junction	Peak Flow	= 12.86 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 59,055 cuft
Inflow Hydrographs	= 10, 11	Total Contrib. Area	= 3.64 ac



Hydrograph Report

Project Name:

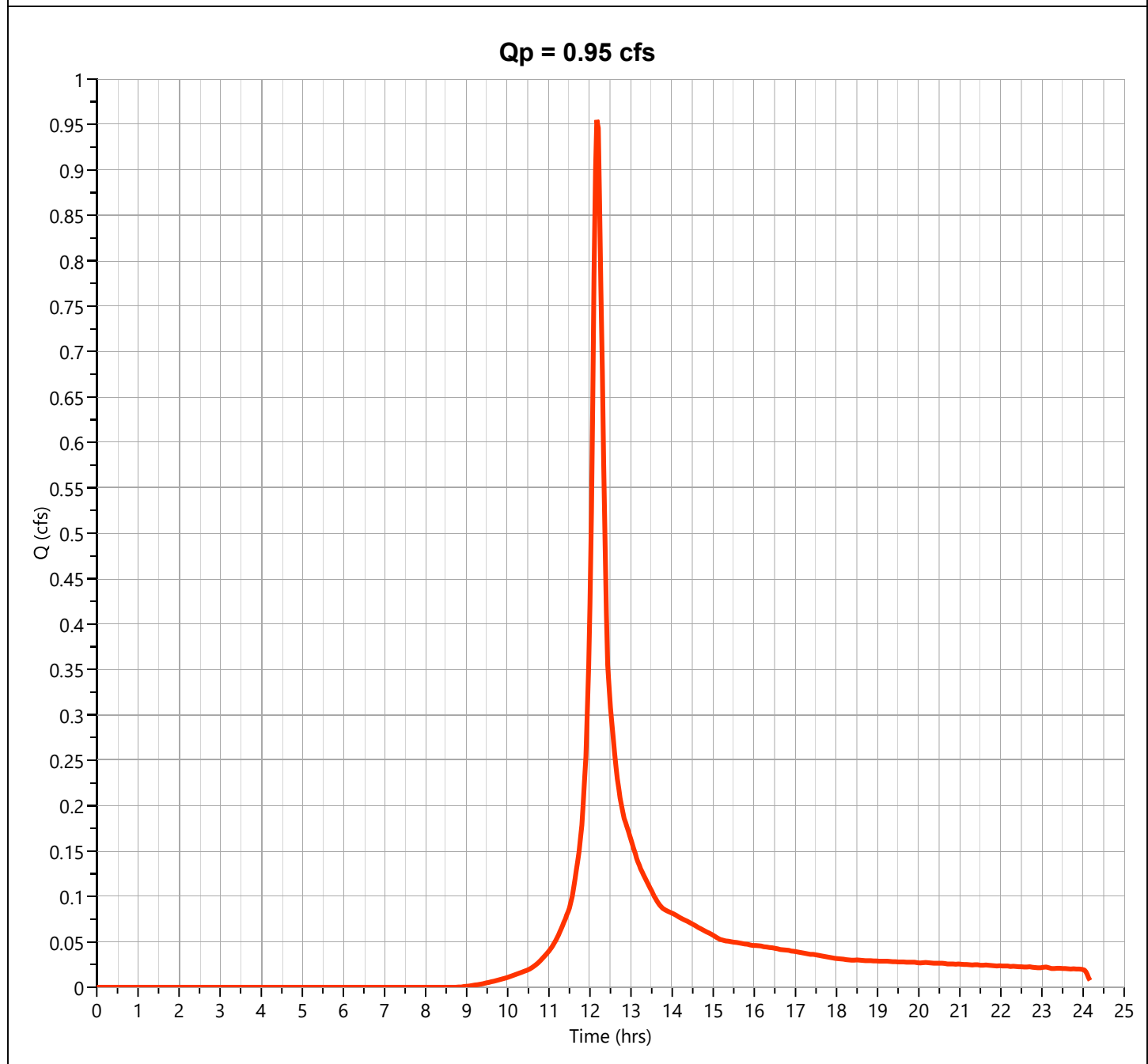
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b (un) - Perv.

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.955 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 3,743 cuft
Drainage Area	= 0.33 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

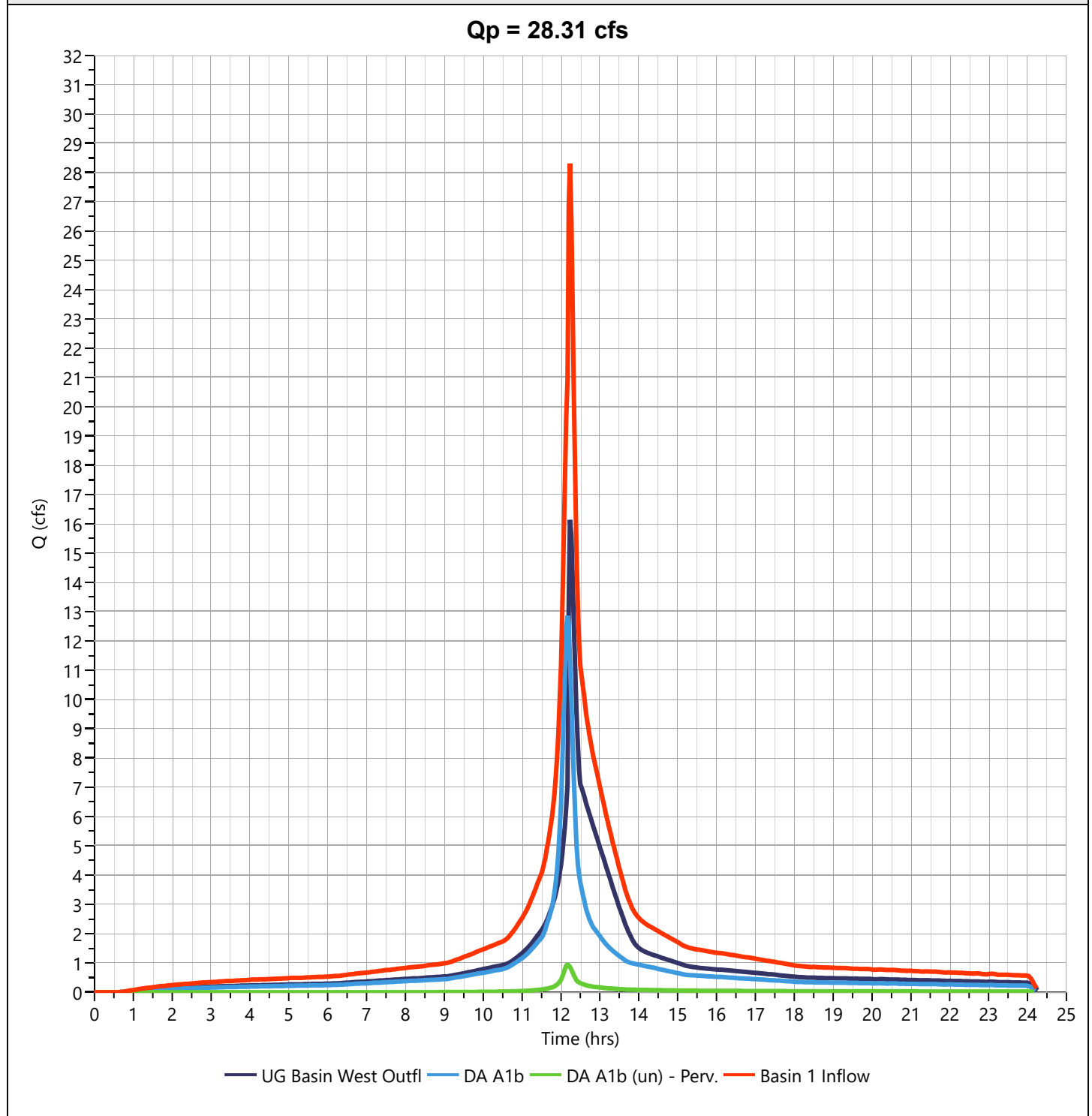
Hydrology Studio v 3.0.0.16

12-30-2020

Basin 1 Inflow

Hyd. No. 16

Hydrograph Type	= Junction	Peak Flow	= 28.31 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 145,302 cuft
Inflow Hydrographs	= 8, 12, 14	Total Contrib. Area	= 3.97 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 1 Outflow

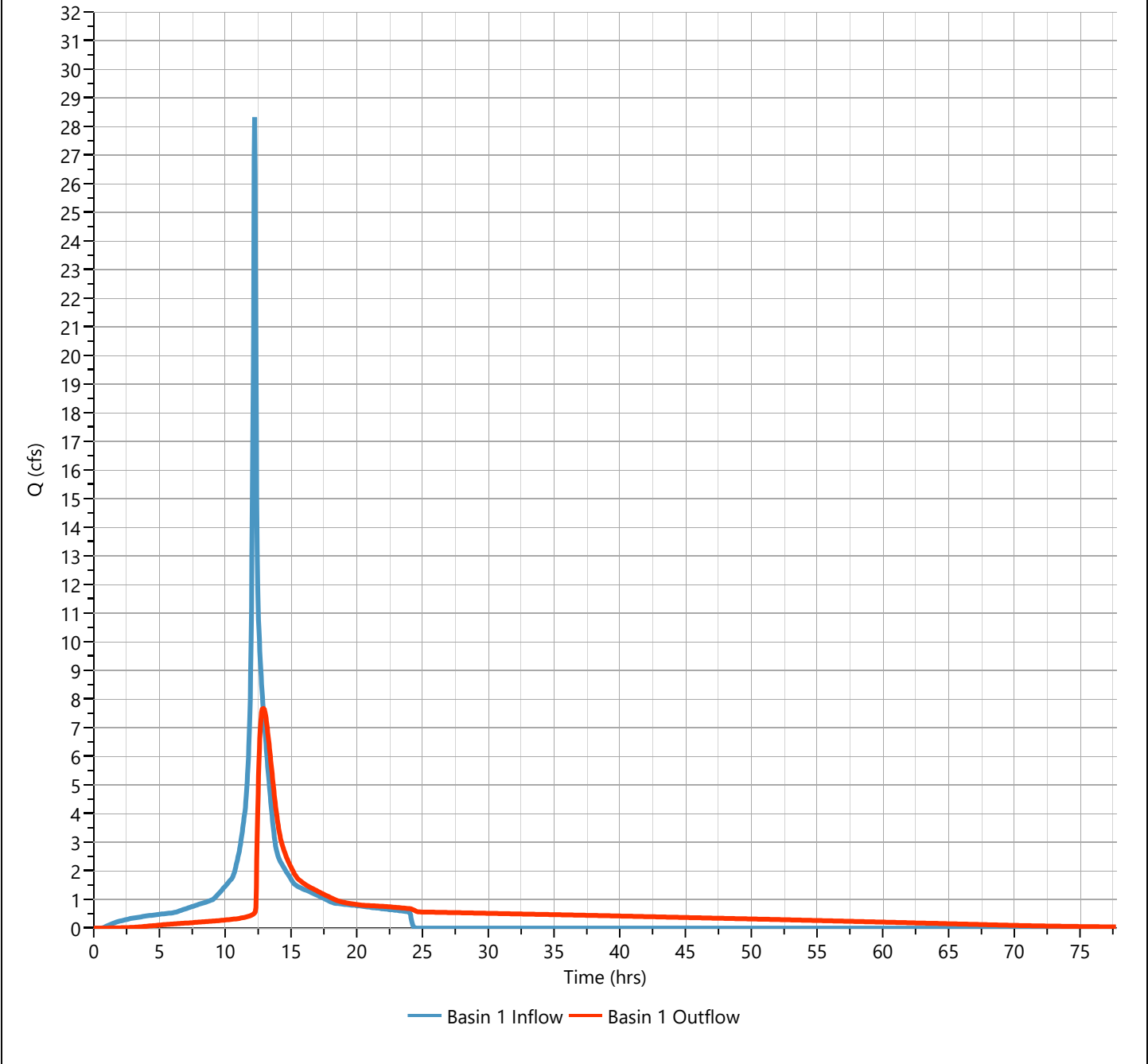
Hyd. No. 17

Hydrograph Type	= Pond Route	Peak Flow	= 7.713 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.90 hrs
Time Interval	= 2 min	Hydrograph Volume	= 144,424 cuft
Inflow Hydrograph	= 16 - Basin 1 Inflow	Max. Elevation	= 98.75 ft
Pond Name	= Basin 1	Max. Storage	= 71,184 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 12.91 hrs

Qp = 7.71 cfs



Hydrograph Report

Project Name:

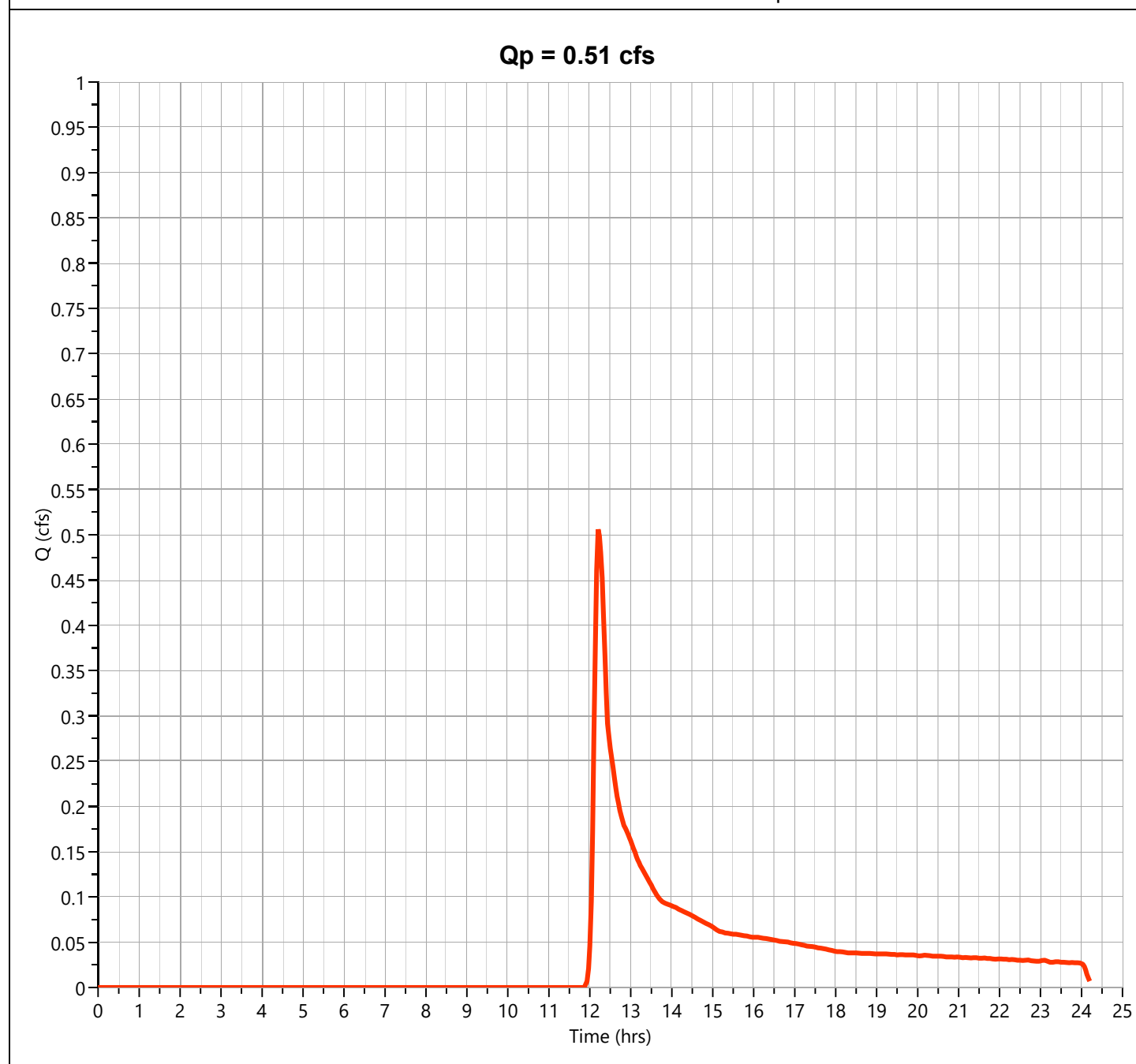
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2 - Perv.

Hyd. No. 19

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.506 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 2,983 cuft
Drainage Area	= 0.86 ac	Curve Number	= 43
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

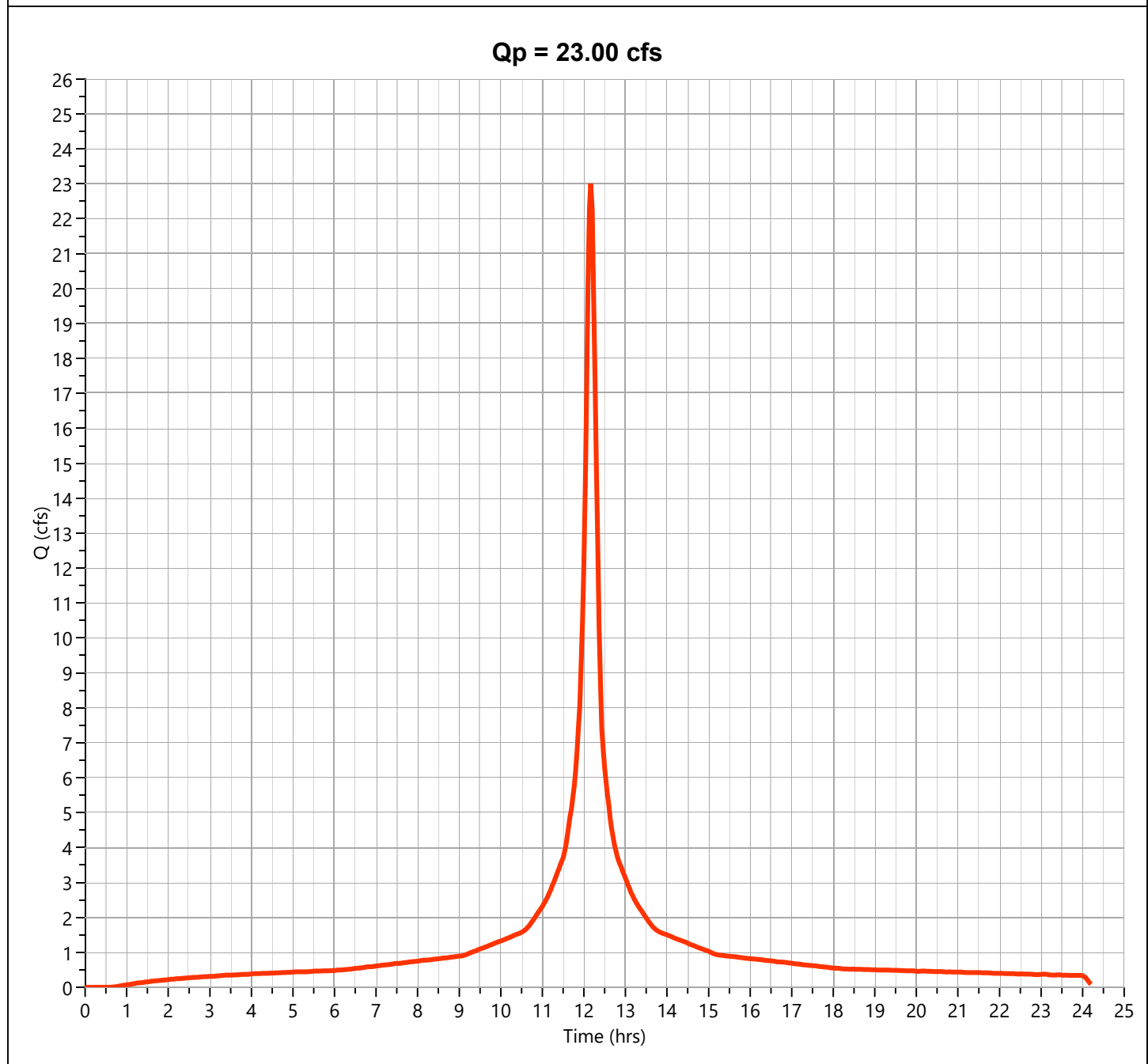
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2 - Imperv.

Hyd. No. 20

Hydrograph Type	= NRCS Runoff	Peak Flow	= 23.00 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 104,400 cuft
Drainage Area	= 4.35 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

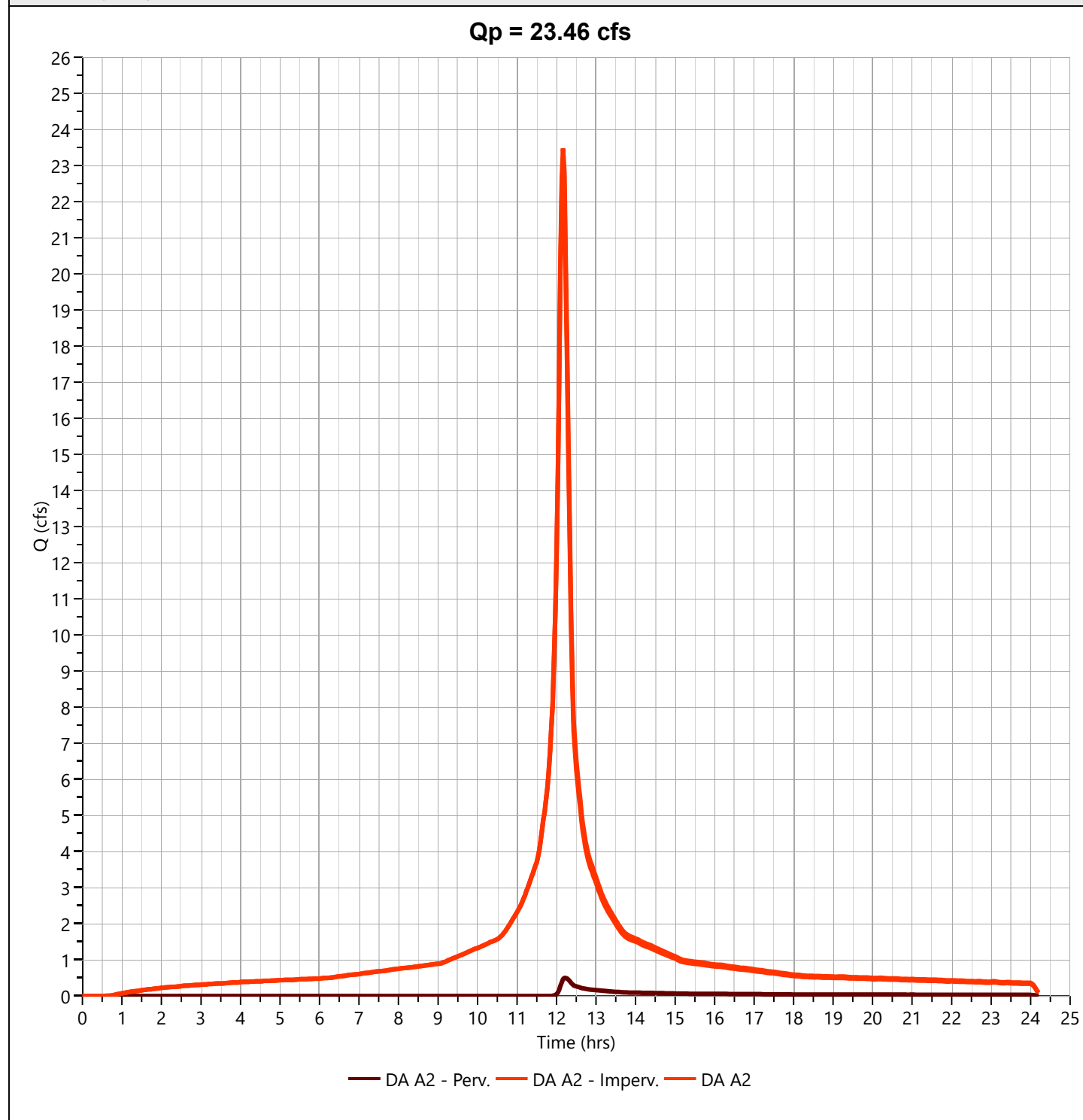
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2

Hyd. No. 21

Hydrograph Type	= Junction	Peak Flow	= 23.46 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 107,383 cuft
Inflow Hydrographs	= 19, 20	Total Contrib. Area	= 5.21 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 2 Outflow

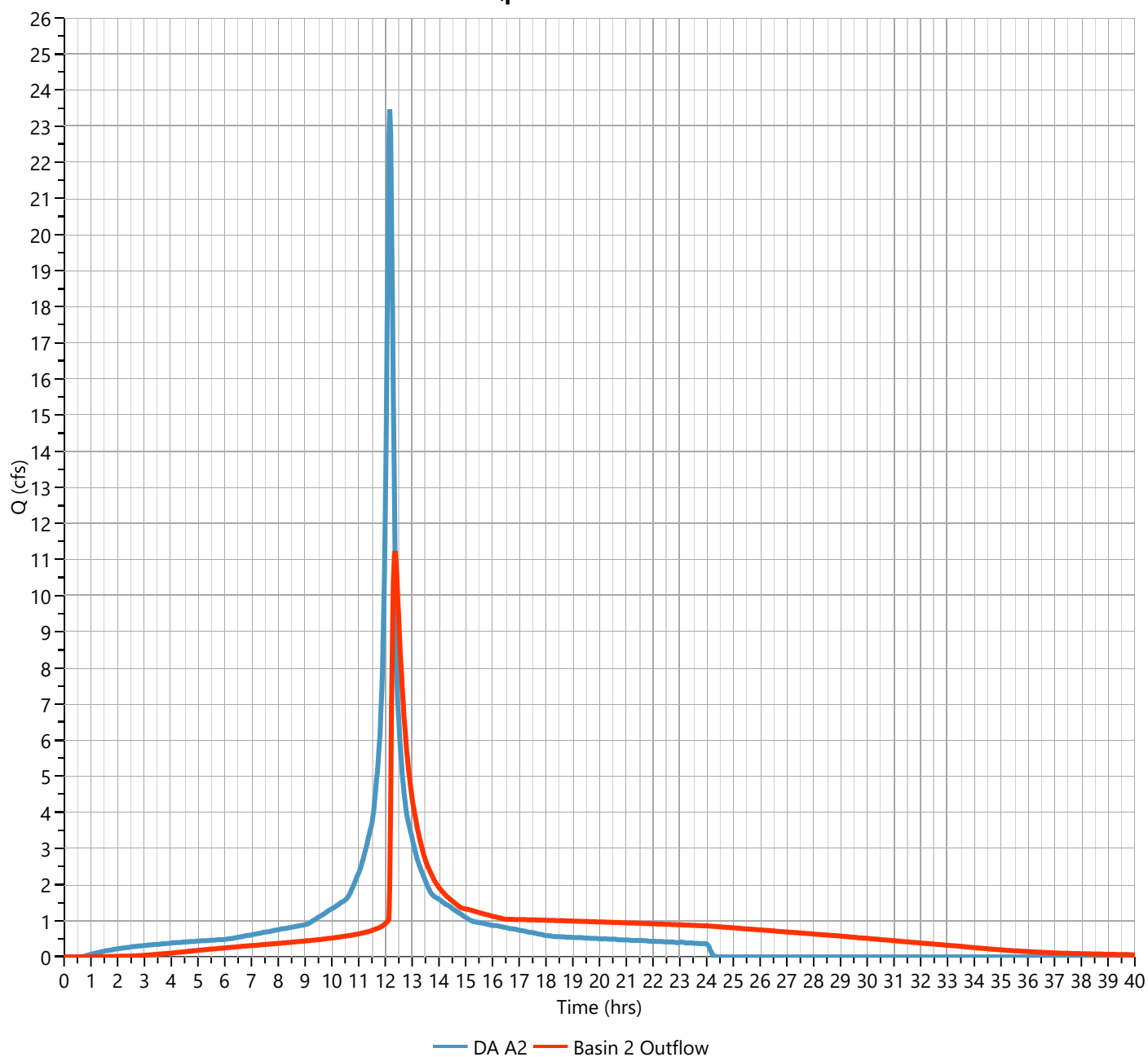
Hyd. No. 22

Hydrograph Type	= Pond Route	Peak Flow	= 11.24 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 107,339 cuft
Inflow Hydrograph	= 21 - DA A2	Max. Elevation	= 86.28 ft
Pond Name	= Basin 2	Max. Storage	= 45,581 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 5.24 hrs

Qp = 11.24 cfs



Hydrograph Report

Project Name:

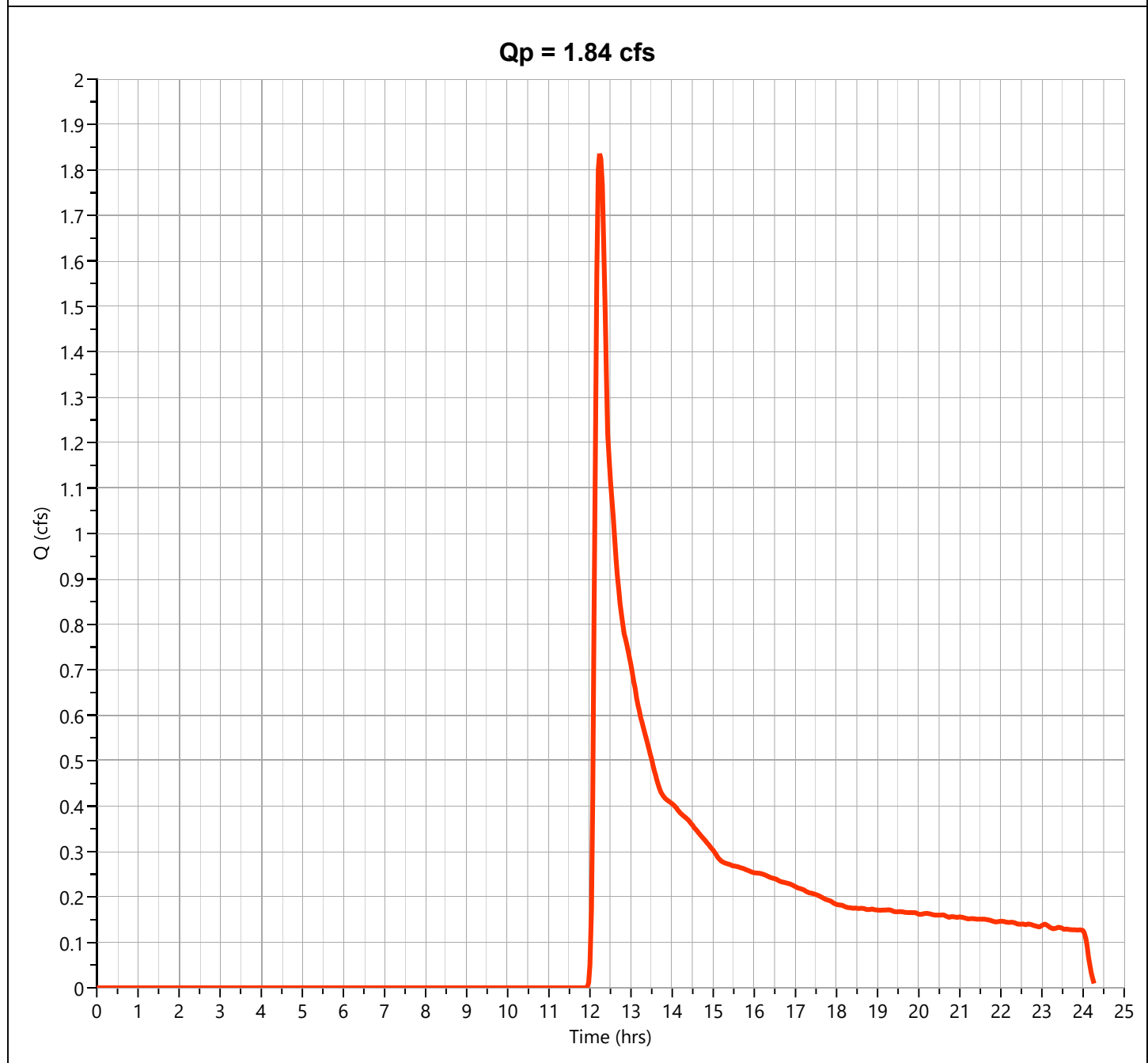
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A3 - Perv.

Hyd. No. 24

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.835 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 12,931 cuft
Drainage Area	= 4.41 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

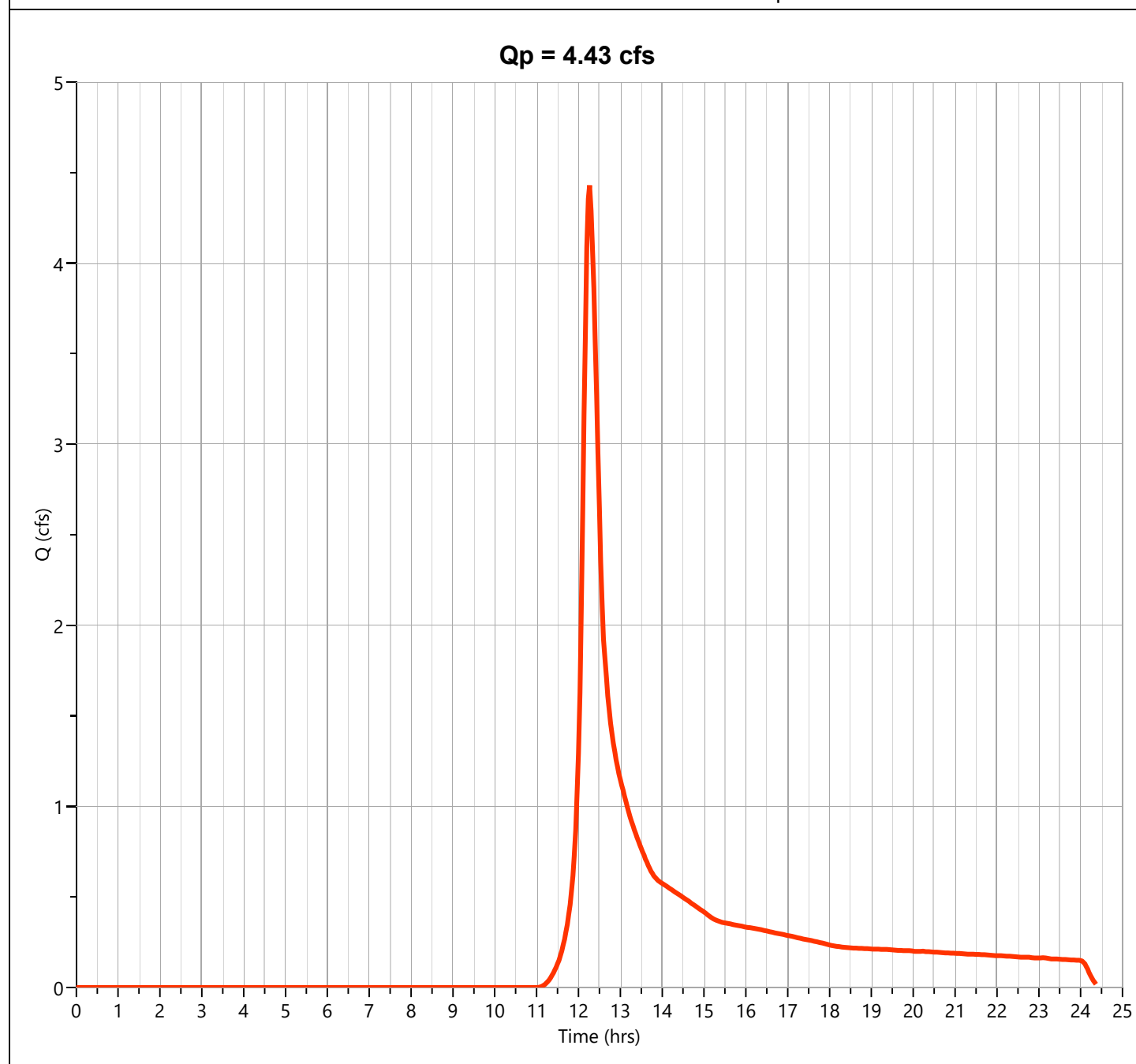
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a - Perv.

Hyd. No. 26

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.428 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 22,030 cuft
Drainage Area	= 3.34 ac	Curve Number	= 54
Tc Method	= User	Time of Conc. (Tc)	= 17.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

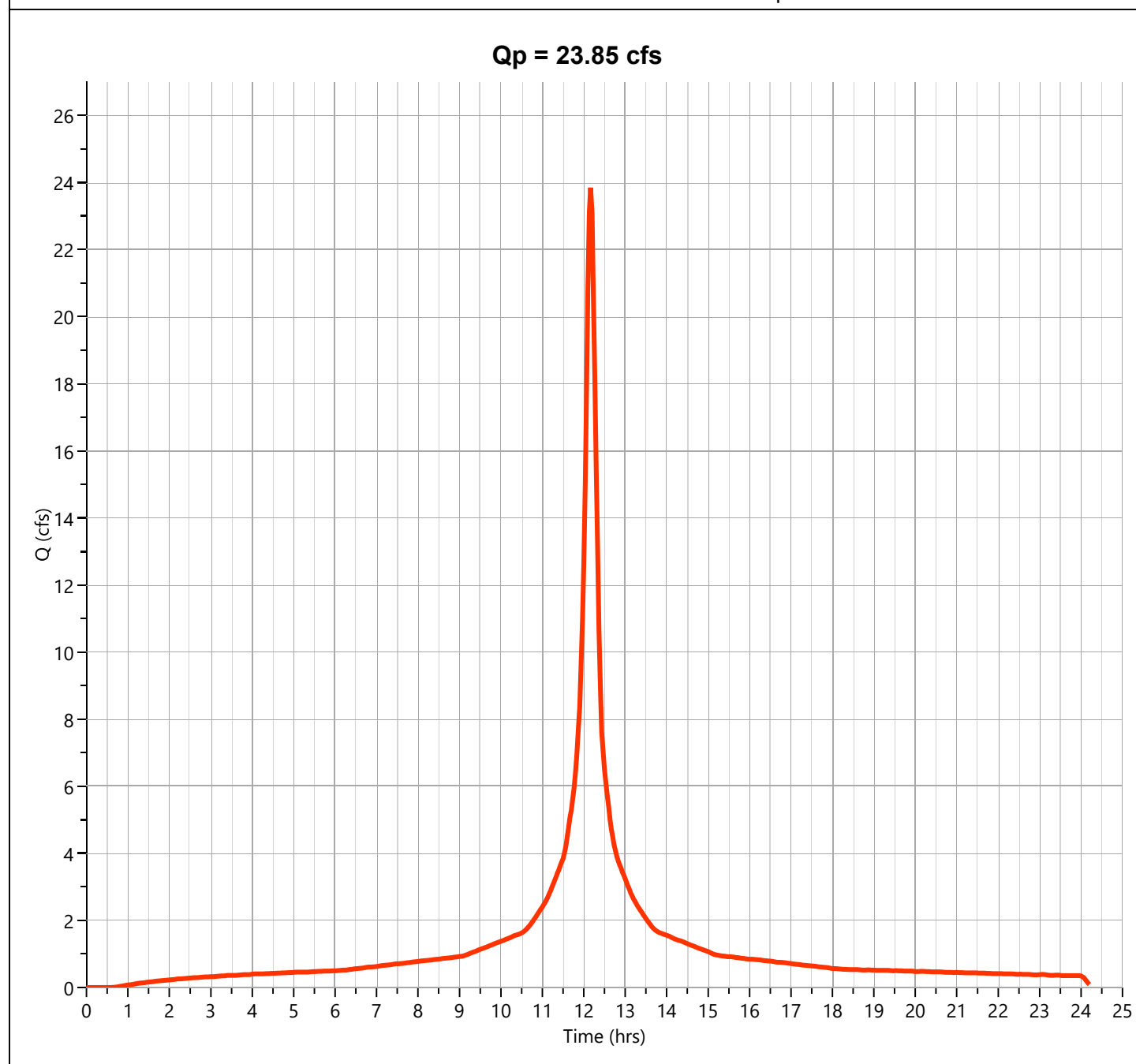
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a - Imperv.

Hyd. No. 27

Hydrograph Type	= NRCS Runoff	Peak Flow	= 23.85 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 108,240 cuft
Drainage Area	= 4.51 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

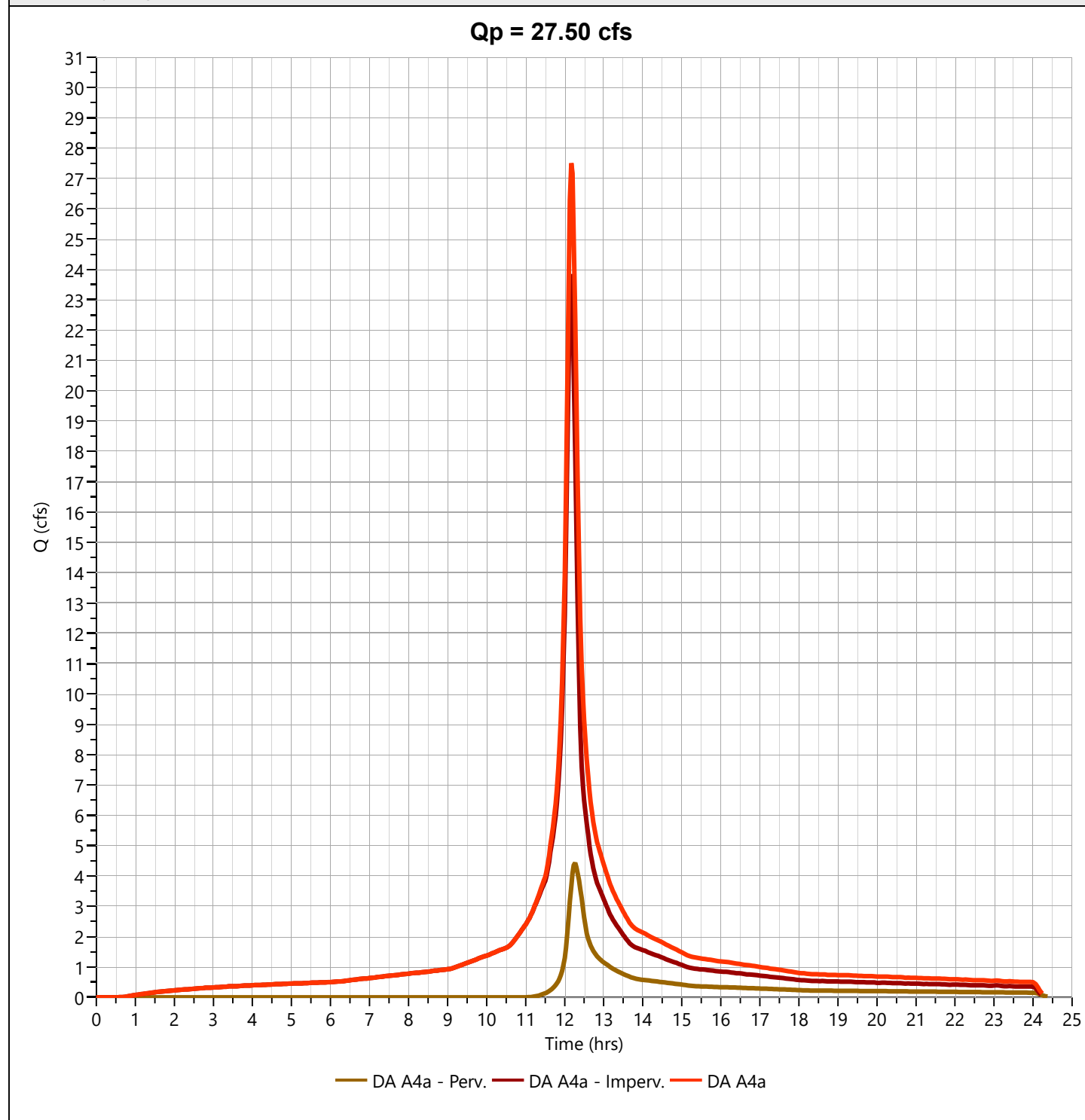
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a

Hyd. No. 28

Hydrograph Type	= Junction	Peak Flow	= 27.50 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 130,270 cuft
Inflow Hydrographs	= 26, 27	Total Contrib. Area	= 7.85 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Basin East Out

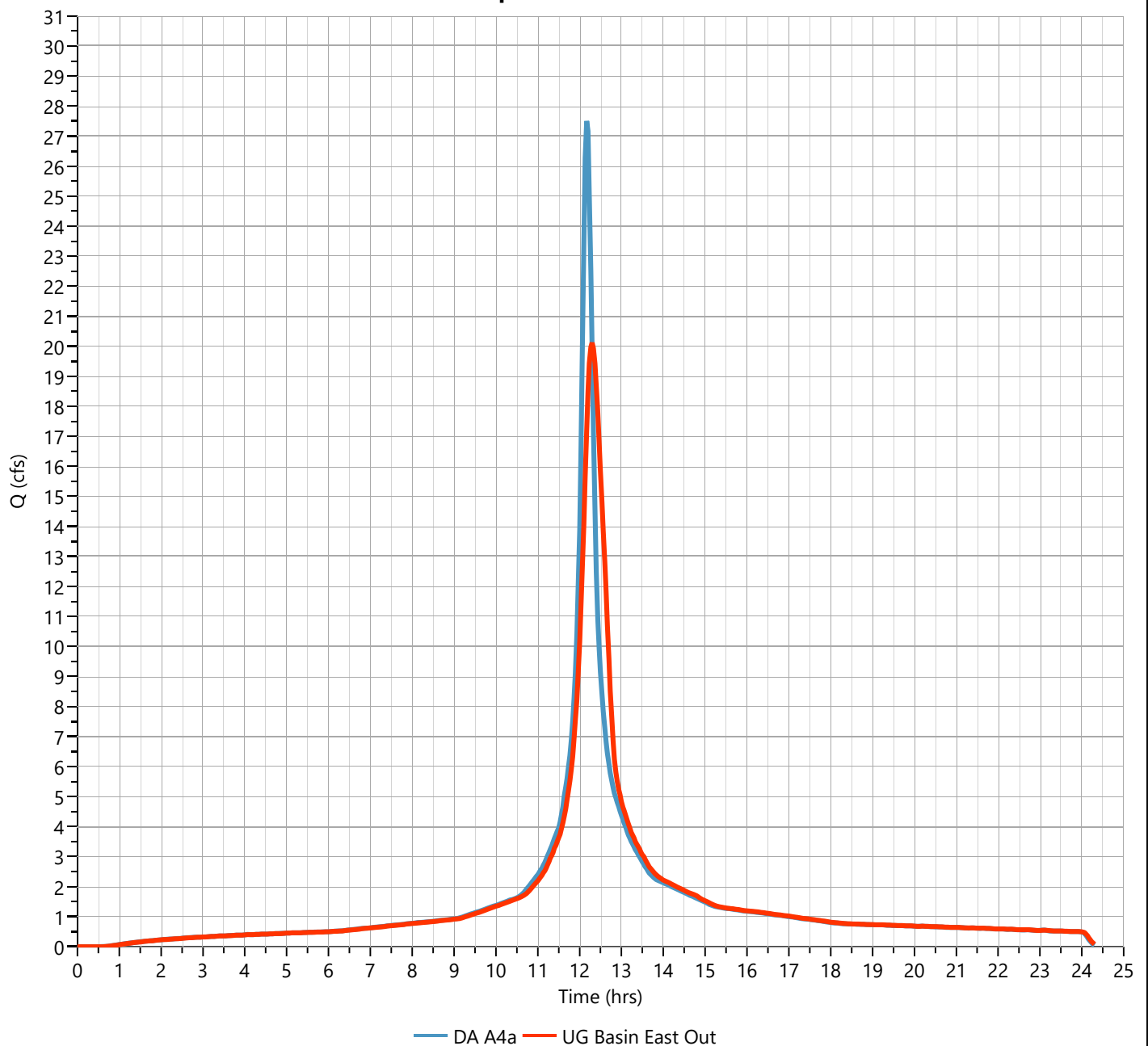
Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 20.12 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Hydrograph Volume	= 130,270 cuft
Inflow Hydrograph	= 28 - DA A4a	Max. Elevation	= 103.26 ft
Pond Name	= UG Recharge / Detention Basin East	Max. Storage	= 10,513 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 5 min

Qp = 20.12 cfs



Hydrograph Report

Project Name:

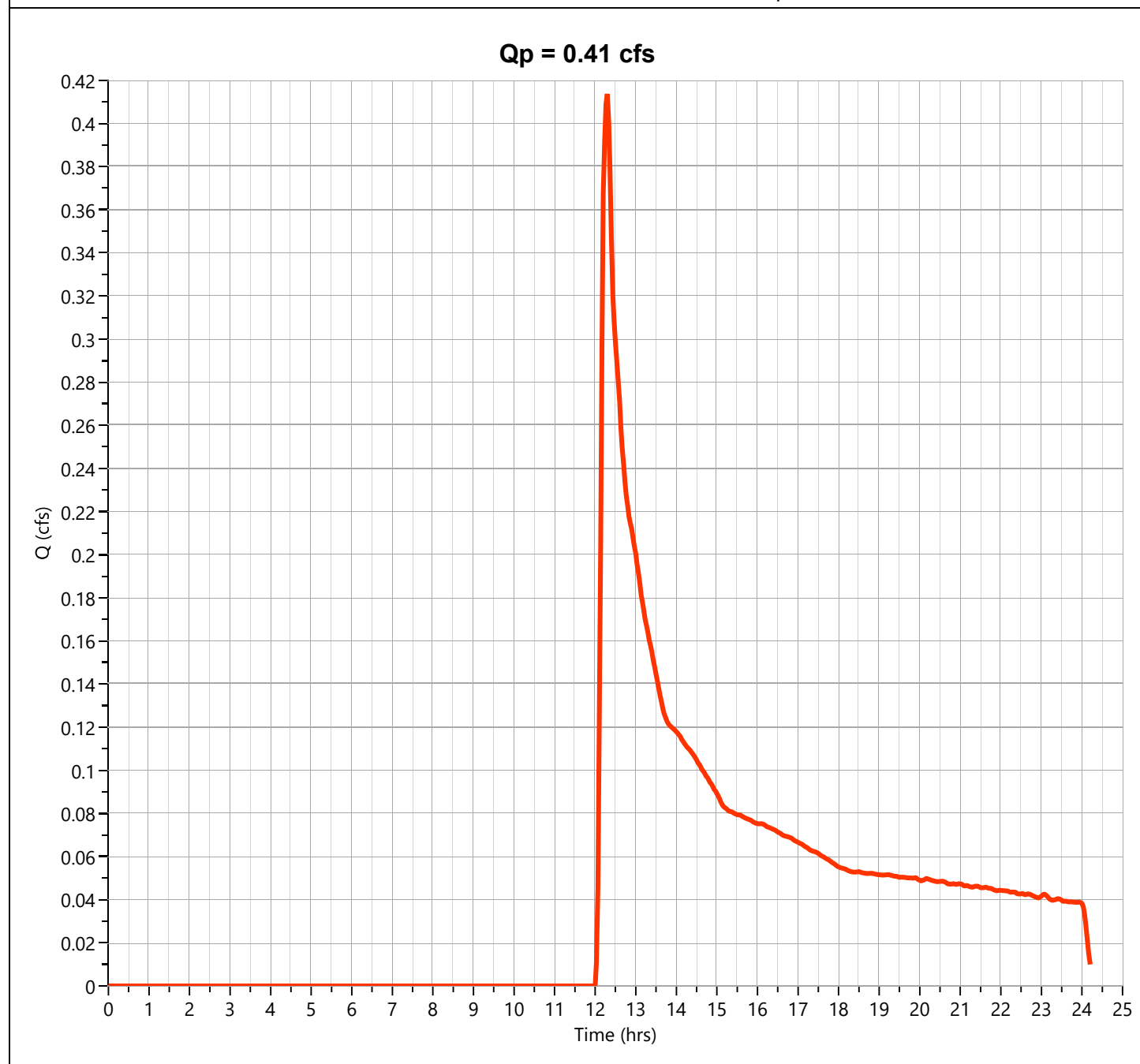
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b - Perv.

Hyd. No. 31

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.414 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 3,633 cuft
Drainage Area	= 1.5 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

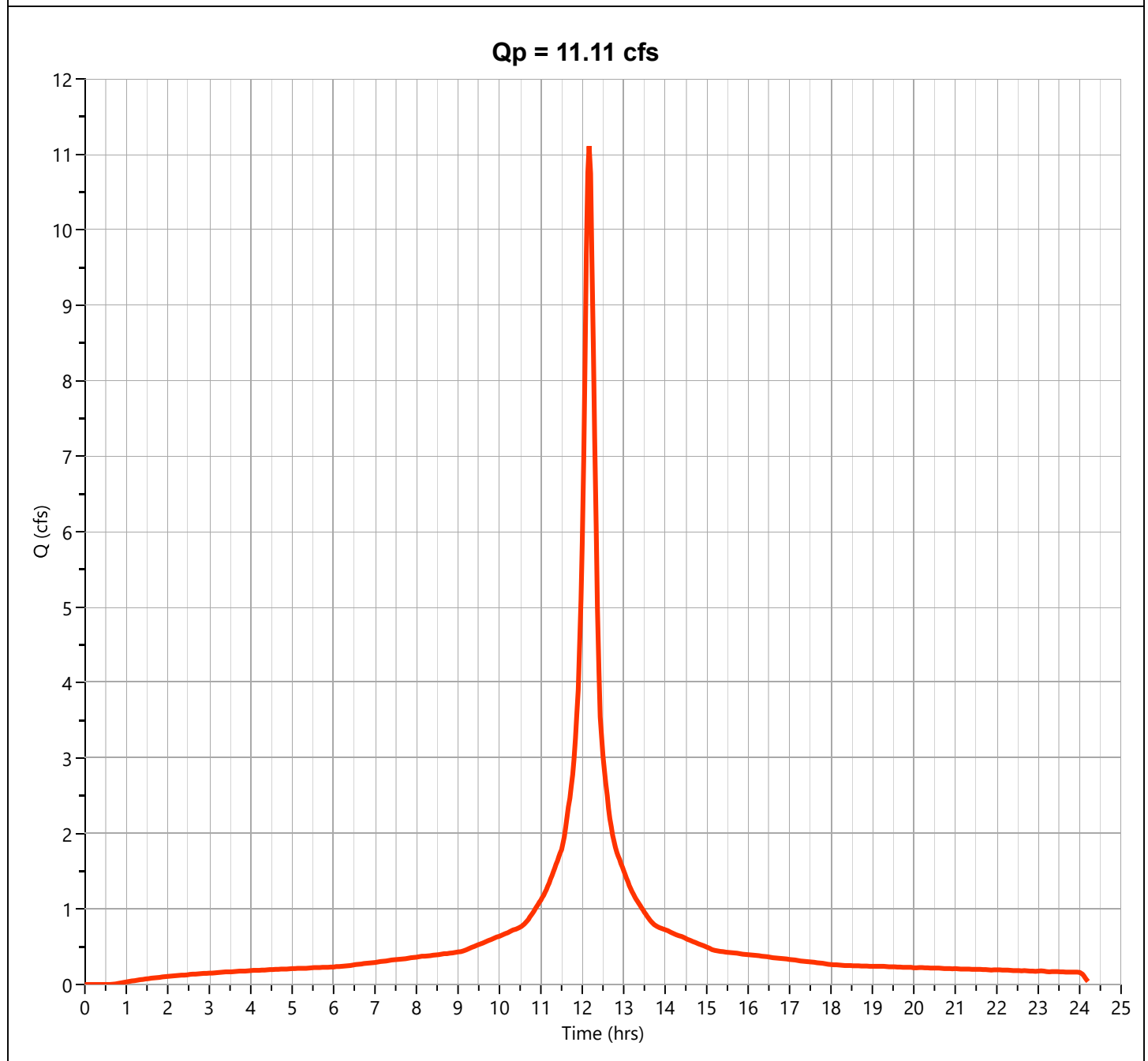
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b - Imperv.

Hyd. No. 32

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.11 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 50,400 cuft
Drainage Area	= 2.1 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

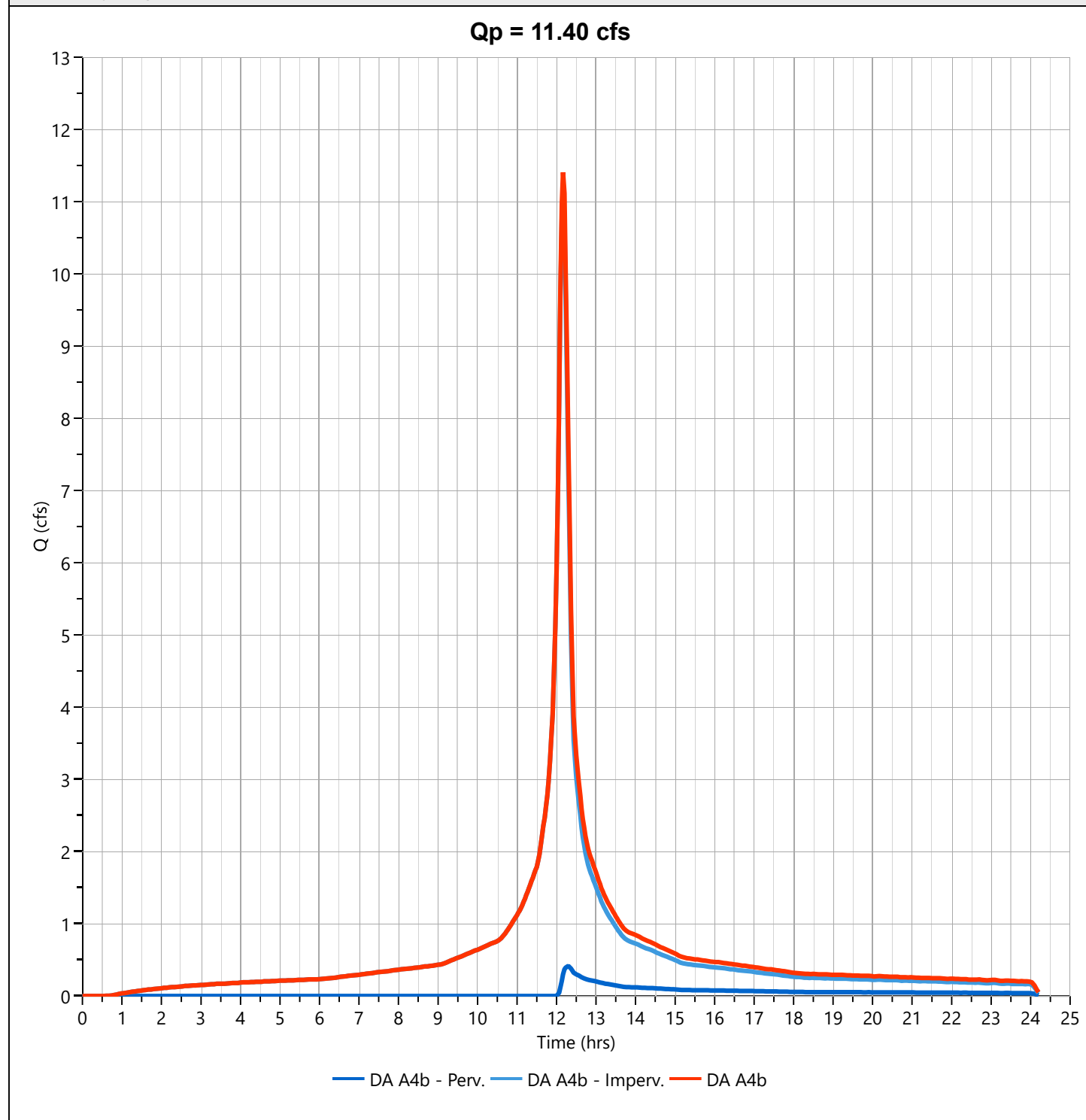
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b

Hyd. No. 33

Hydrograph Type	= Junction	Peak Flow	= 11.40 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 54,033 cuft
Inflow Hydrographs	= 31, 32	Total Contrib. Area	= 3.6 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

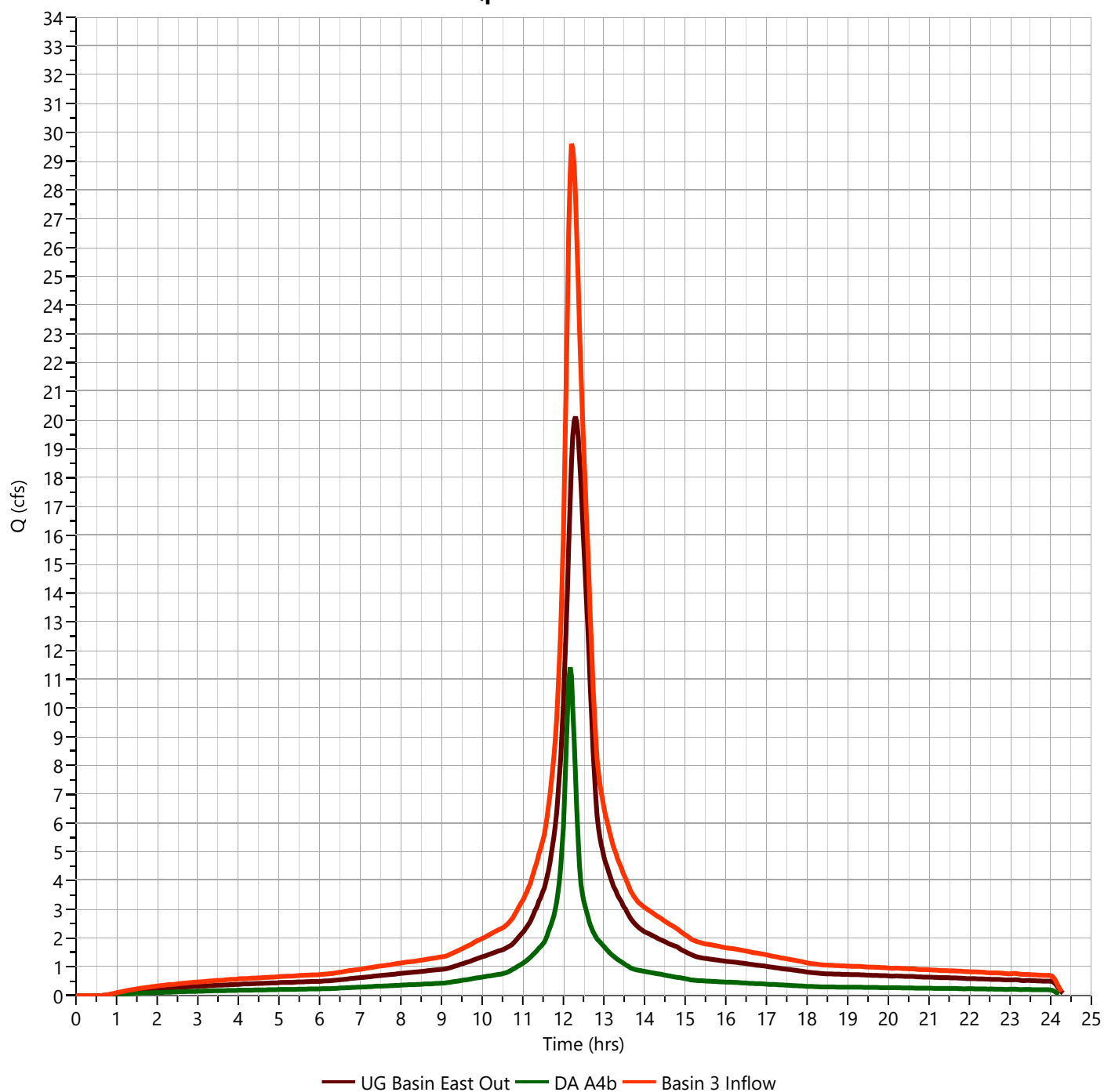
12-30-2020

Basin 3 Inflow

Hyd. No. 35

Hydrograph Type	= Junction	Peak Flow	= 29.60 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 184,303 cuft
Inflow Hydrographs	= 29, 33	Total Contrib. Area	= 3.6 ac

Qp = 29.60 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

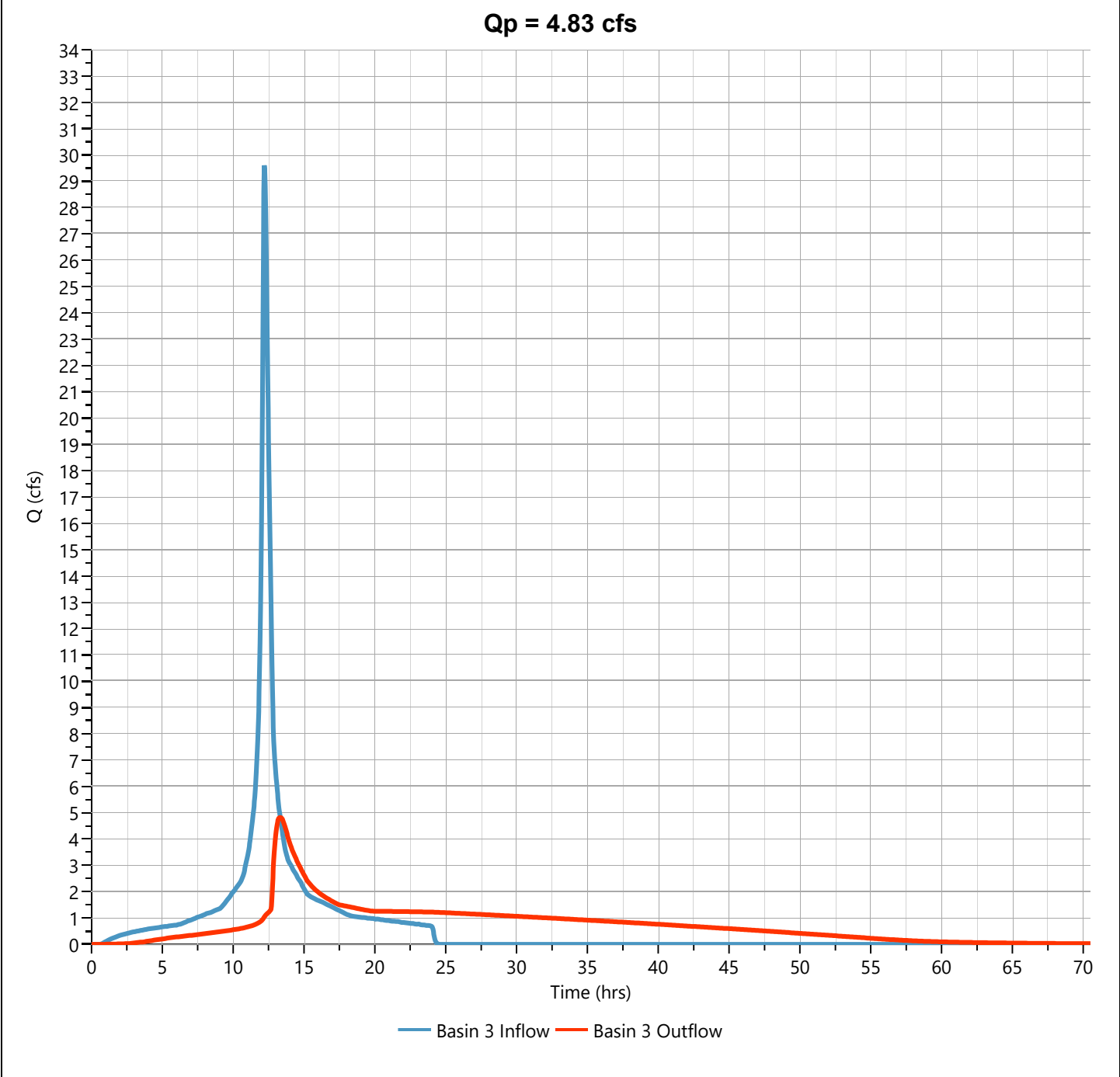
Basin 3 Outflow

Hyd. No. 36

Hydrograph Type	= Pond Route	Peak Flow	= 4.834 cfs
Storm Frequency	= 25-yr	Time to Peak	= 13.33 hrs
Time Interval	= 2 min	Hydrograph Volume	= 183,948 cuft
Inflow Hydrograph	= 35 - Basin 3 Inflow	Max. Elevation	= 94.06 ft
Pond Name	= Basin 3	Max. Storage	= 105,396 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 13.20 hrs



Hydrograph Report

Project Name:

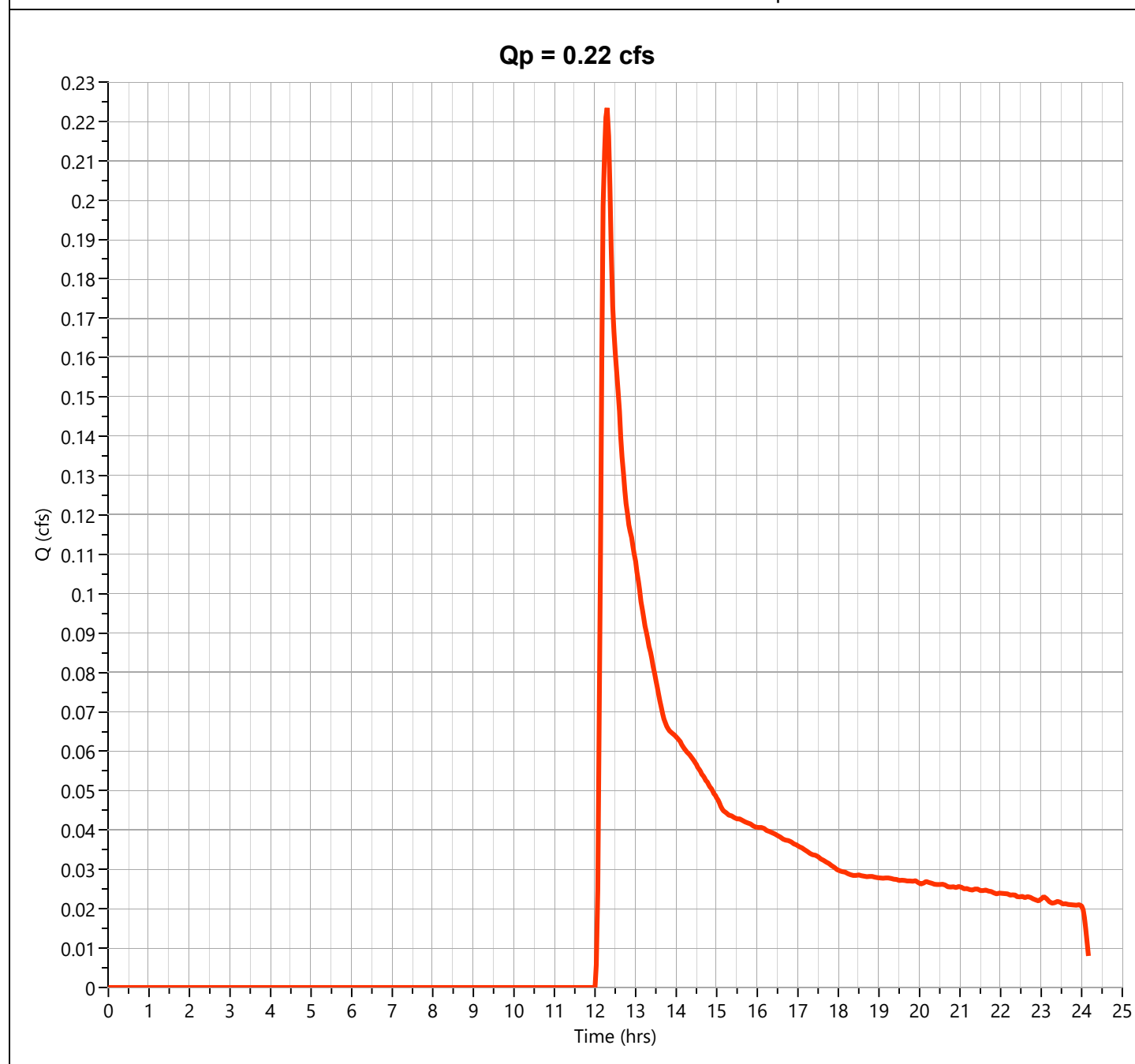
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5 - Perv.

Hyd. No. 38

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.223 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 1,962 cuft
Drainage Area	= 0.81 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

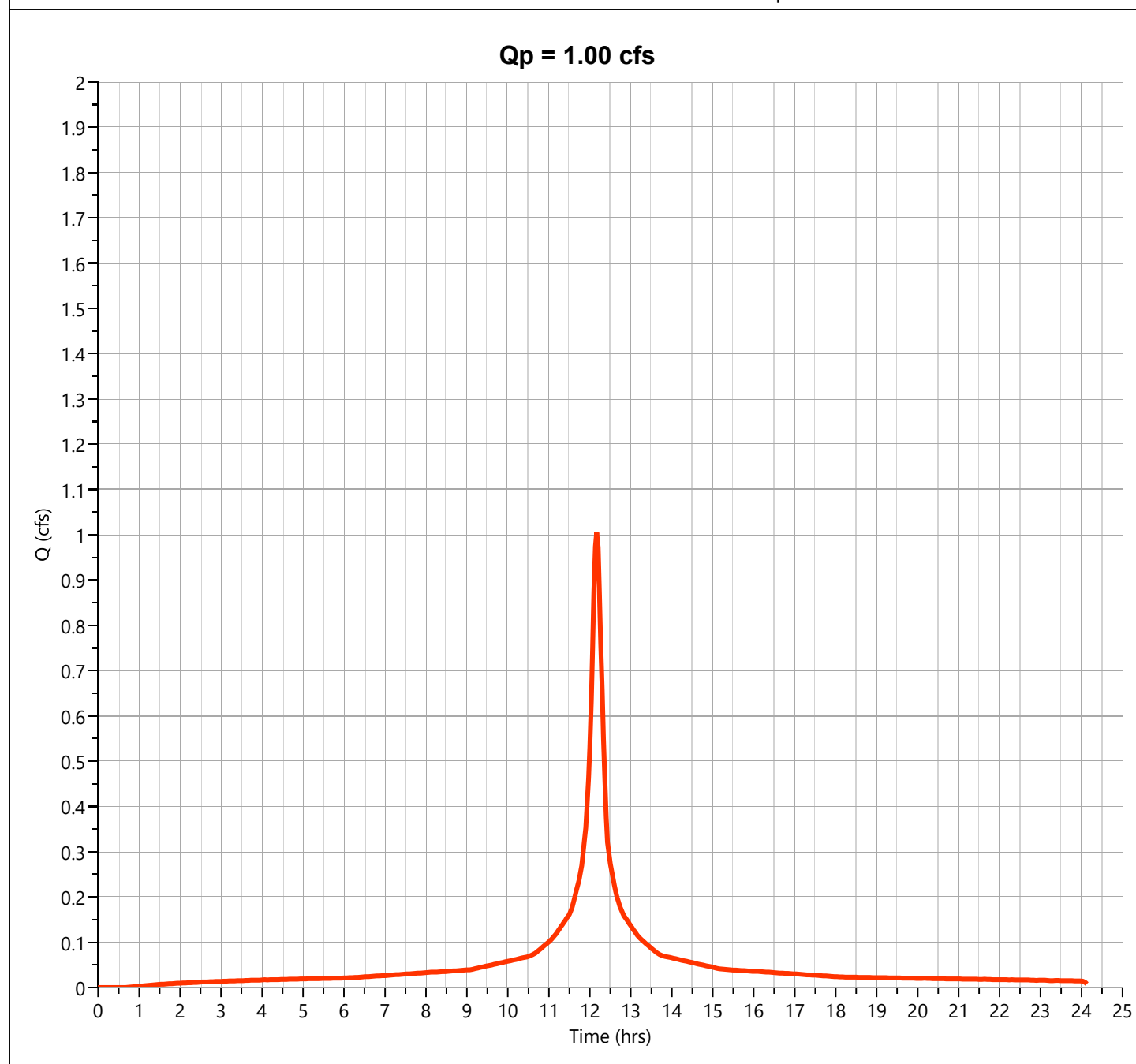
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5 - Imperv.

Hyd. No. 39

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.005 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 4,560 cuft
Drainage Area	= 0.19 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

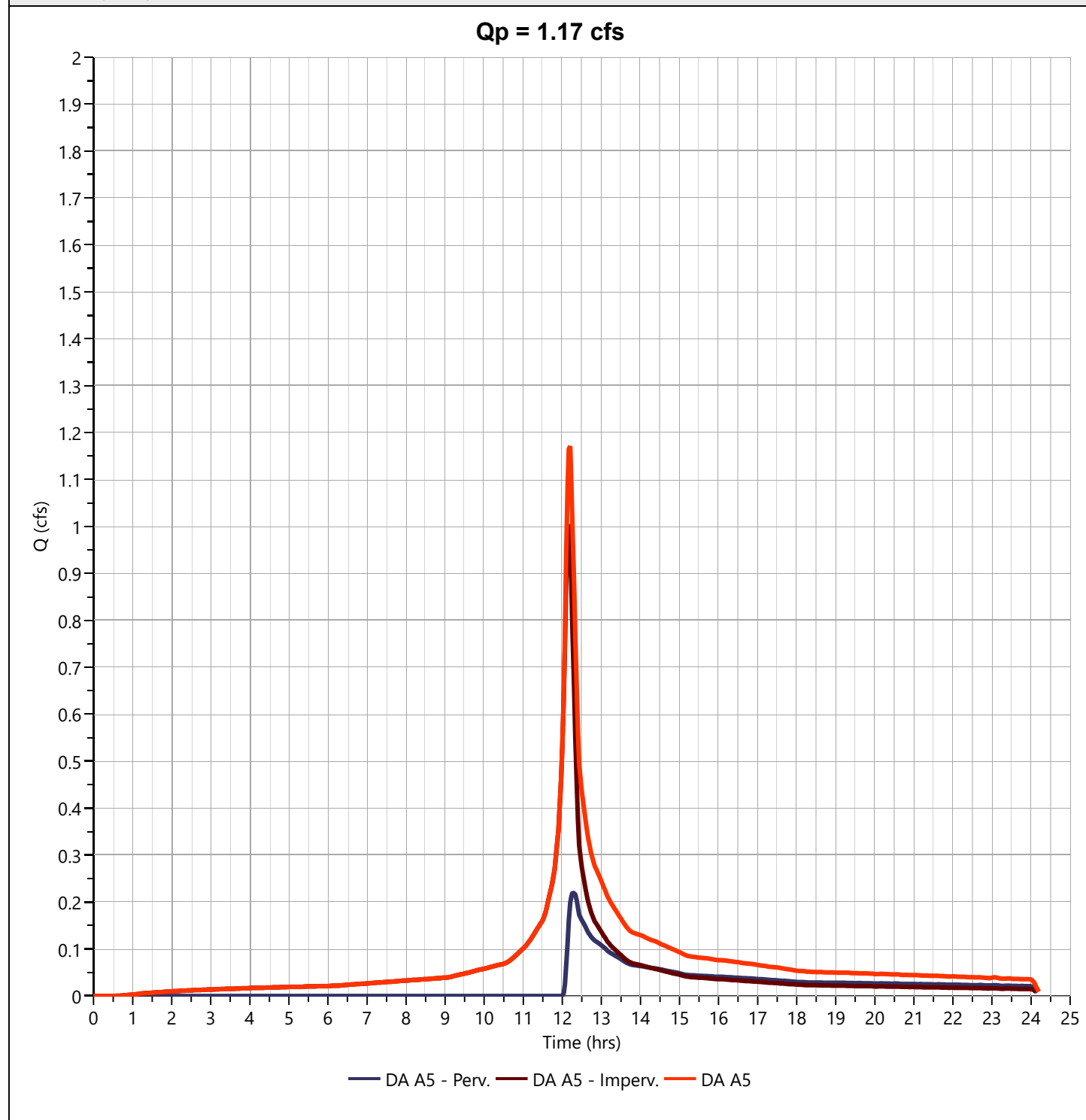
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5

Hyd. No. 40

Hydrograph Type	= Junction	Peak Flow	= 1.171 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 6,522 cuft
Inflow Hydrographs	= 38, 39	Total Contrib. Area	= 1.0 ac



Hydrograph Report

Project Name:

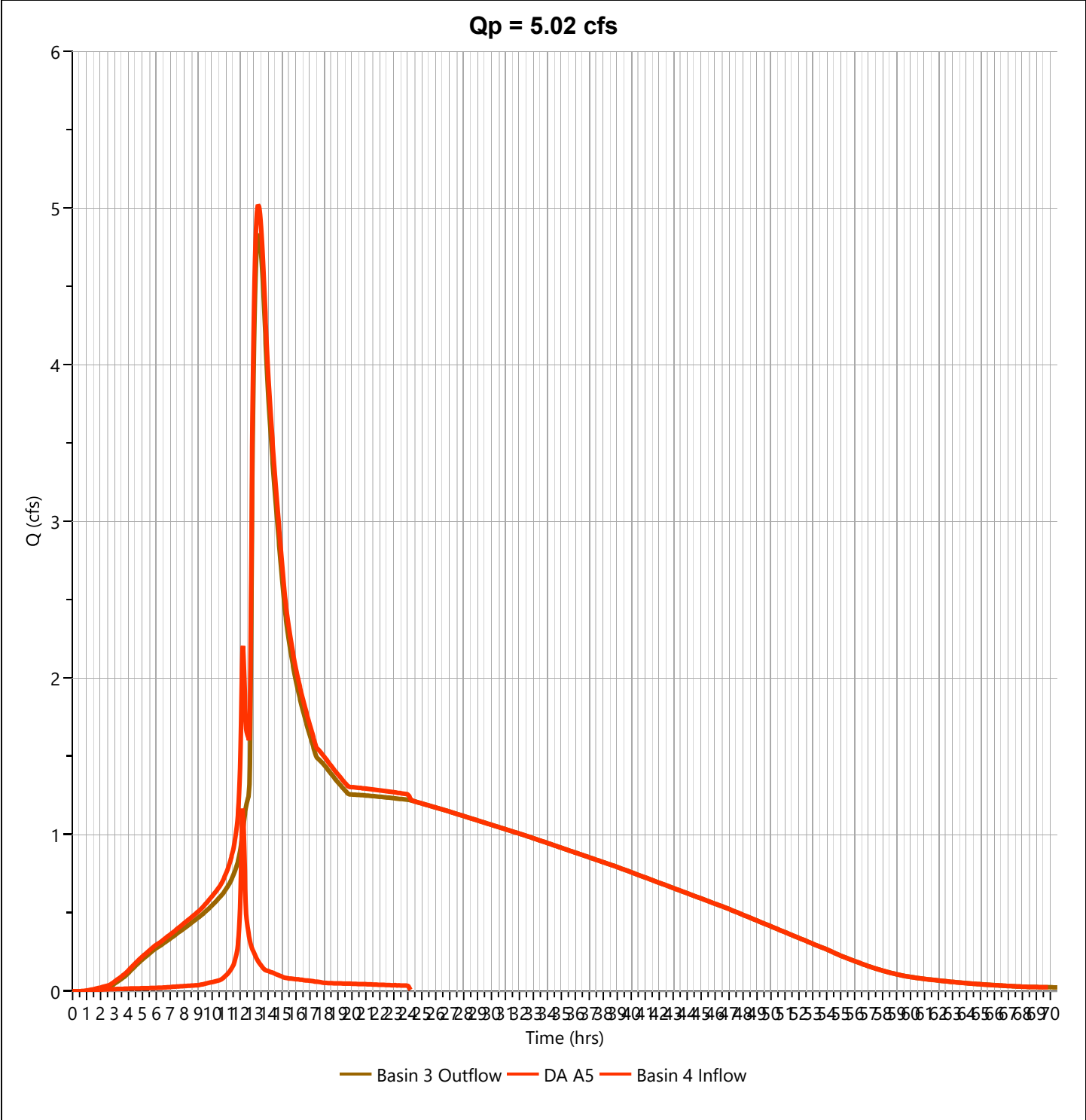
Hydrology Studio v 3.0.0.16

12-30-2020

Basin 4 Inflow

Hyd. No. 41

Hydrograph Type	= Junction	Peak Flow	= 5.025 cfs
Storm Frequency	= 25-yr	Time to Peak	= 13.30 hrs
Time Interval	= 2 min	Hydrograph Volume	= 190,470 cuft
Inflow Hydrographs	= 36, 40	Total Contrib. Area	= 1.0 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 4 Outflow

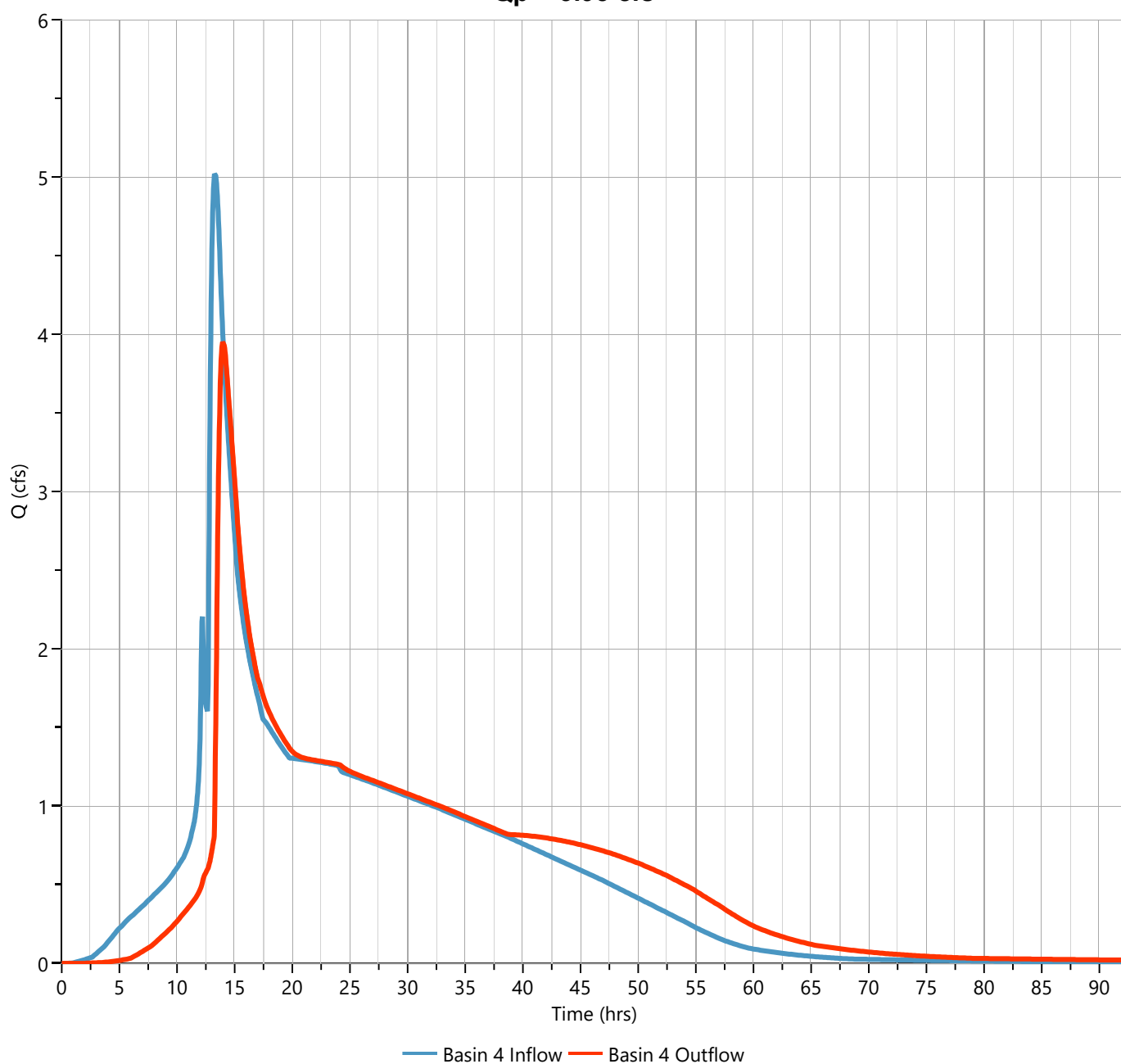
Hyd. No. 42

Hydrograph Type	= Pond Route	Peak Flow	= 3.955 cfs
Storm Frequency	= 25-yr	Time to Peak	= 14.00 hrs
Time Interval	= 2 min	Hydrograph Volume	= 189,414 cuft
Inflow Hydrograph	= 41 - Basin 4 Inflow	Max. Elevation	= 85.22 ft
Pond Name	= Basin 4	Max. Storage	= 23,869 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 4.58 hrs

Qp = 3.95 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6 - Perv.

Hyd. No. 44

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 25-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.84 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

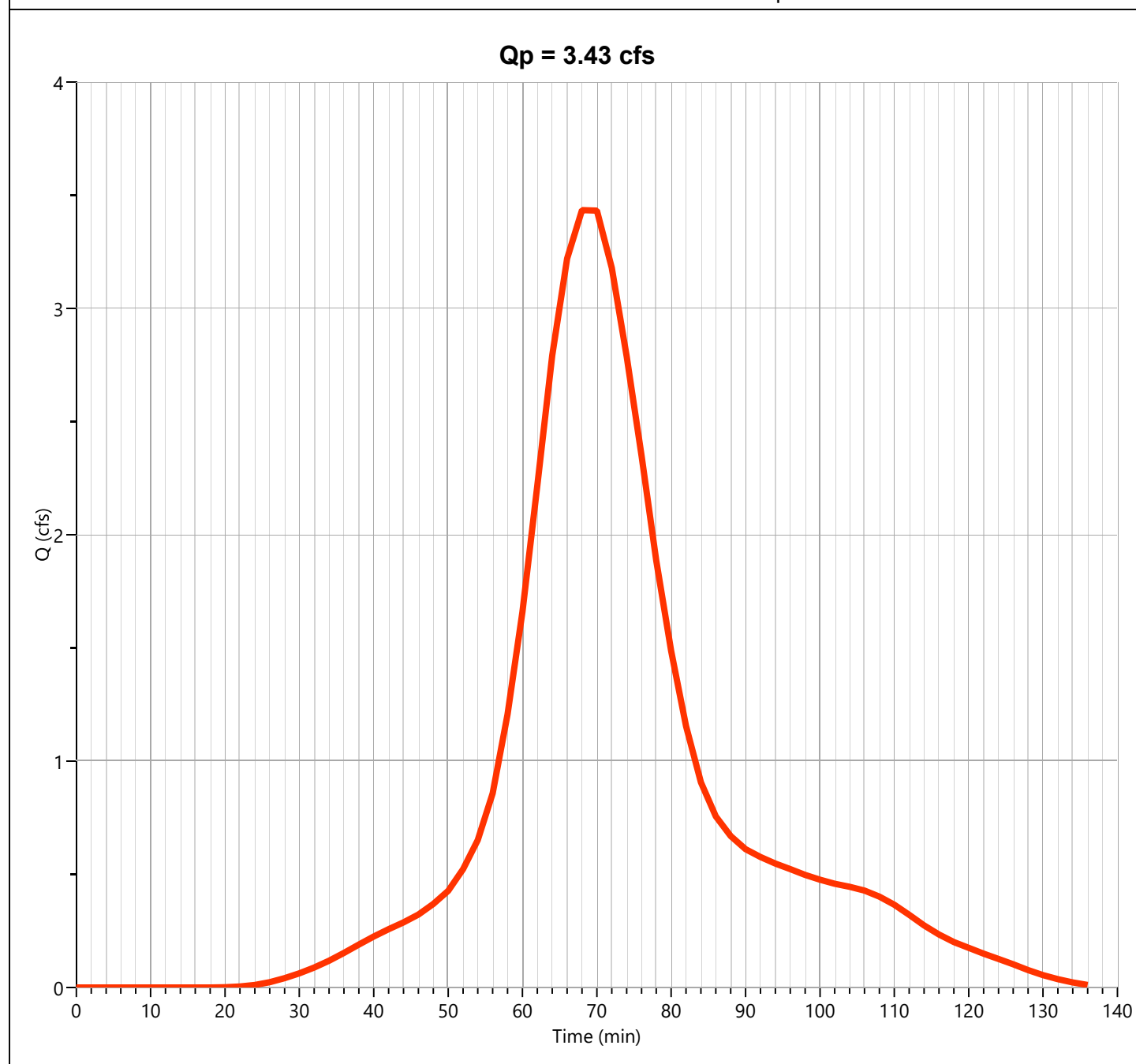
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6 - Imperv.

Hyd. No. 45

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.433 cfs
Storm Frequency	= 25-yr	Time to Peak	= 1.13 hrs
Time Interval	= 2 min	Runoff Volume	= 5,383 cuft
Drainage Area	= 1.39 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

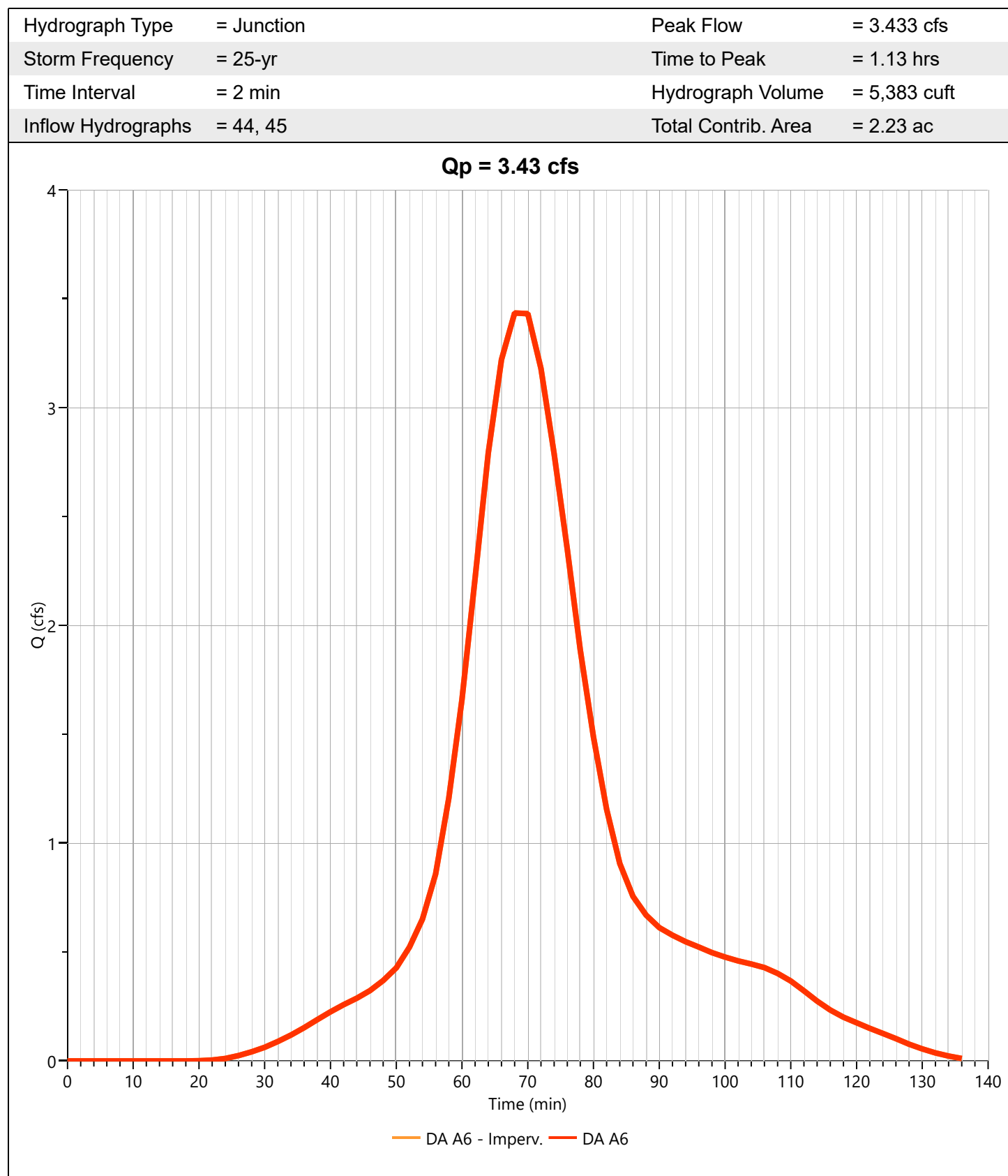
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6

Hyd. No. 46



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

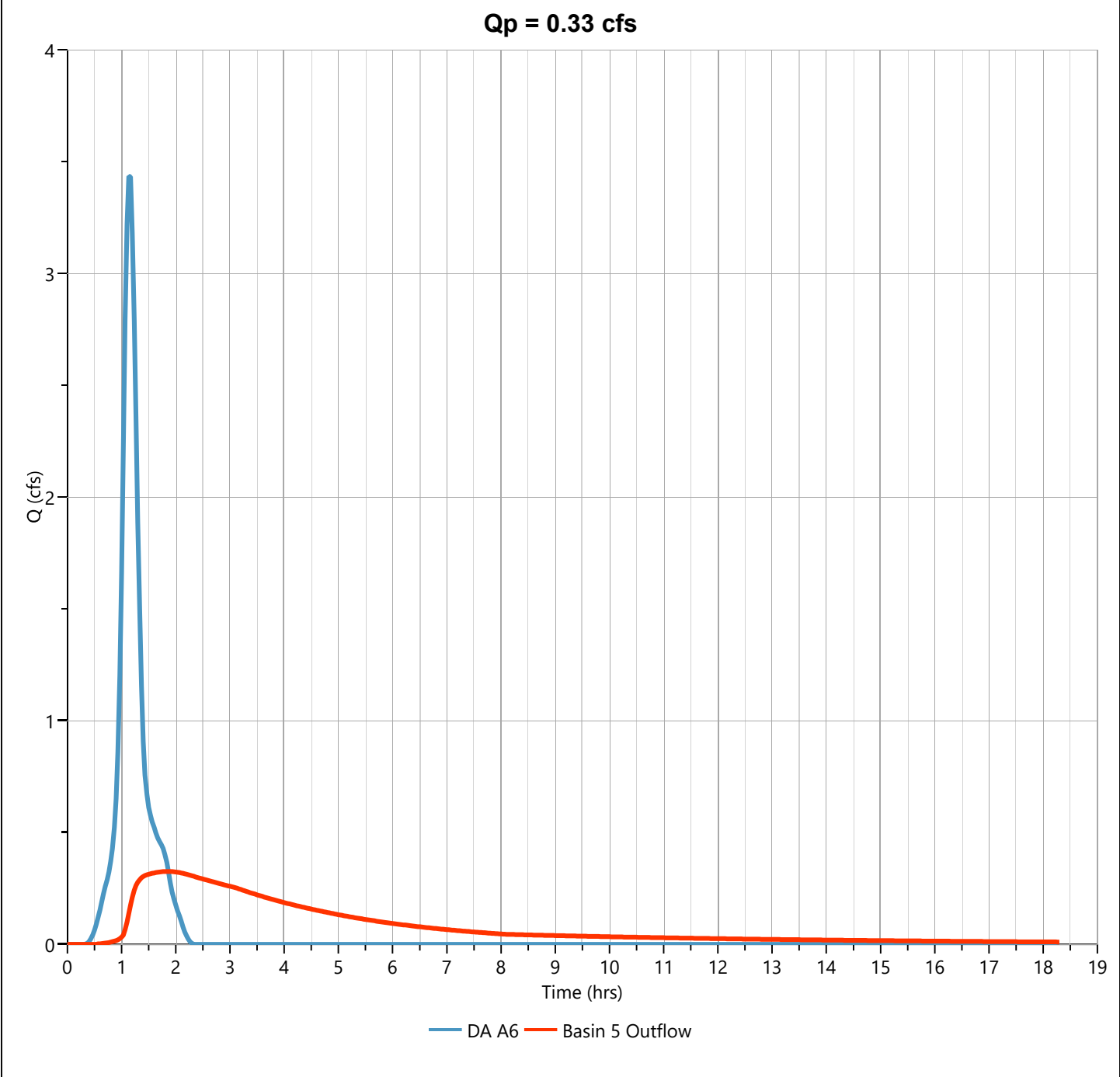
Basin 5 Outflow

Hyd. No. 47

Hydrograph Type	= Pond Route	Peak Flow	= 0.326 cfs
Storm Frequency	= 25-yr	Time to Peak	= 1.87 hrs
Time Interval	= 2 min	Hydrograph Volume	= 5,359 cuft
Inflow Hydrograph	= 46 - DA A6	Max. Elevation	= 73.40 ft
Pond Name	= Basin 5	Max. Storage	= 4,365 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 4.19 hrs



Hydrograph Report

Project Name:

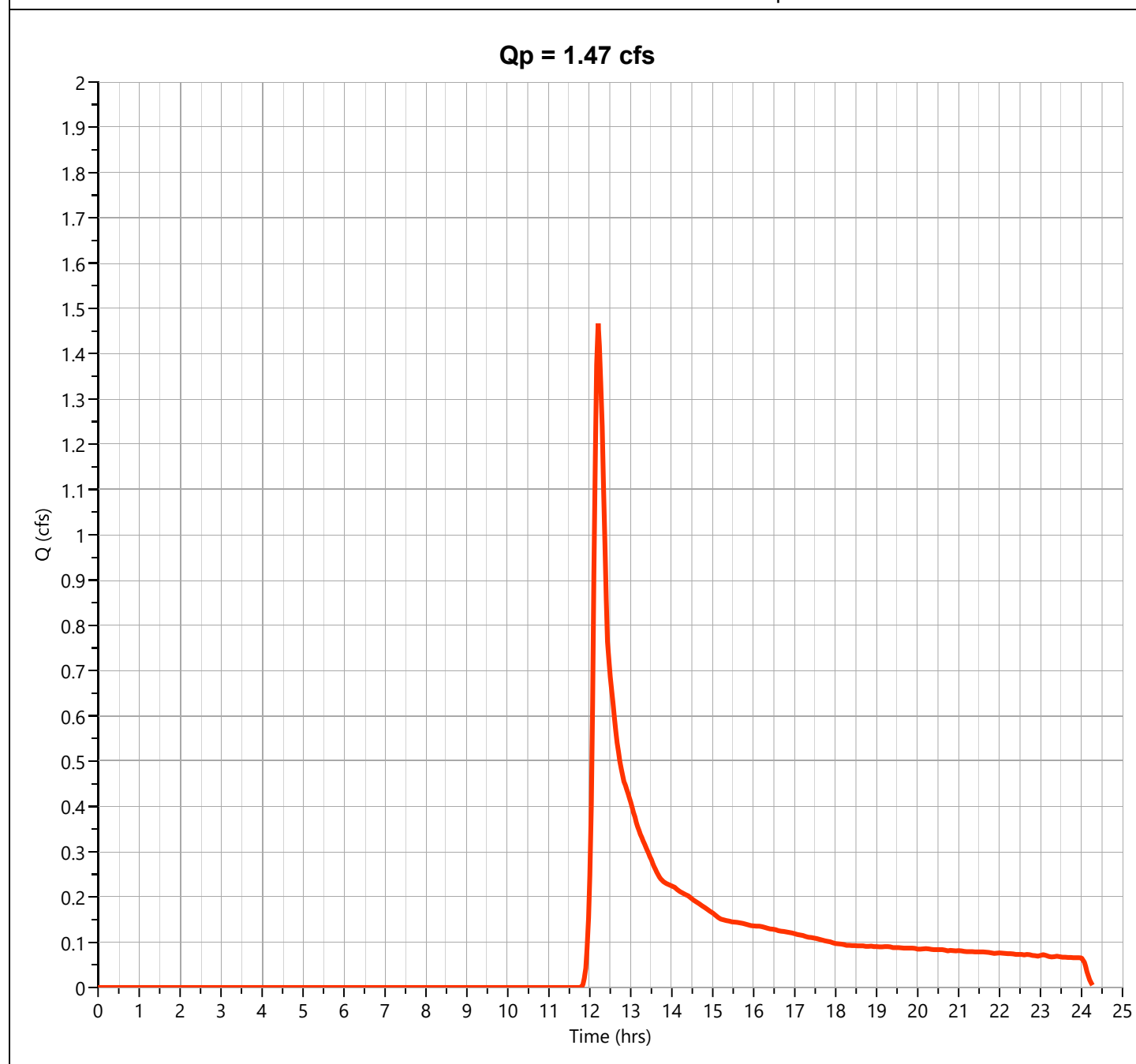
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A7

Hyd. No. 49

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.466 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 7,657 cuft
Drainage Area	= 1.9 ac	Curve Number	= 45
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

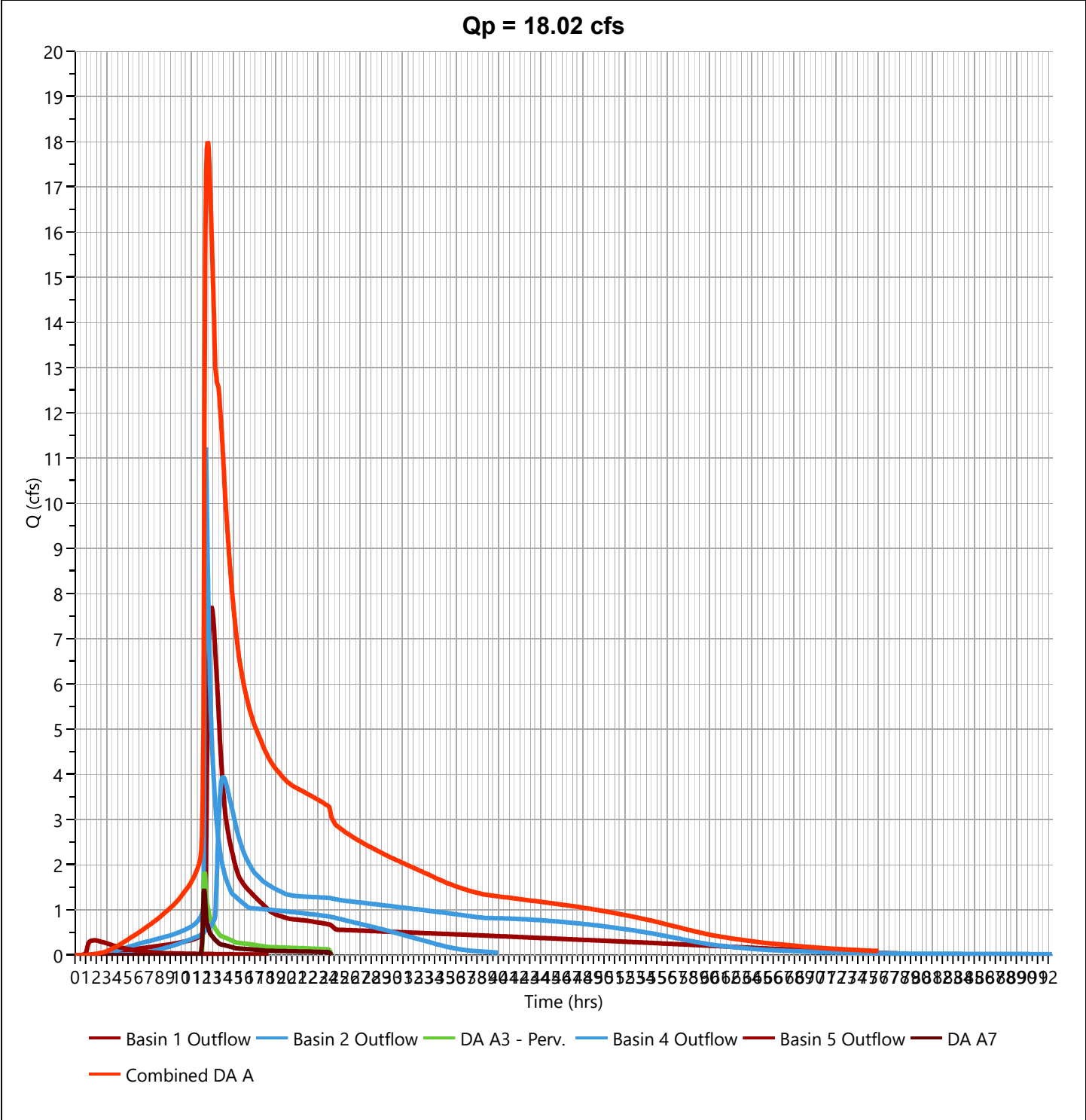
Hydrology Studio v 3.0.0.16

12-30-2020

Combined DA A

Hyd. No. 51

Hydrograph Type	= Junction	Peak Flow	= 18.02 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.57 hrs
Time Interval	= 2 min	Hydrograph Volume	= 497,136 cuft
Inflow Hydrographs	= 17, 22, 24, 42, 47, 49	Total Contrib. Area	= 6.31 ac



Hydrograph Report

Project Name:

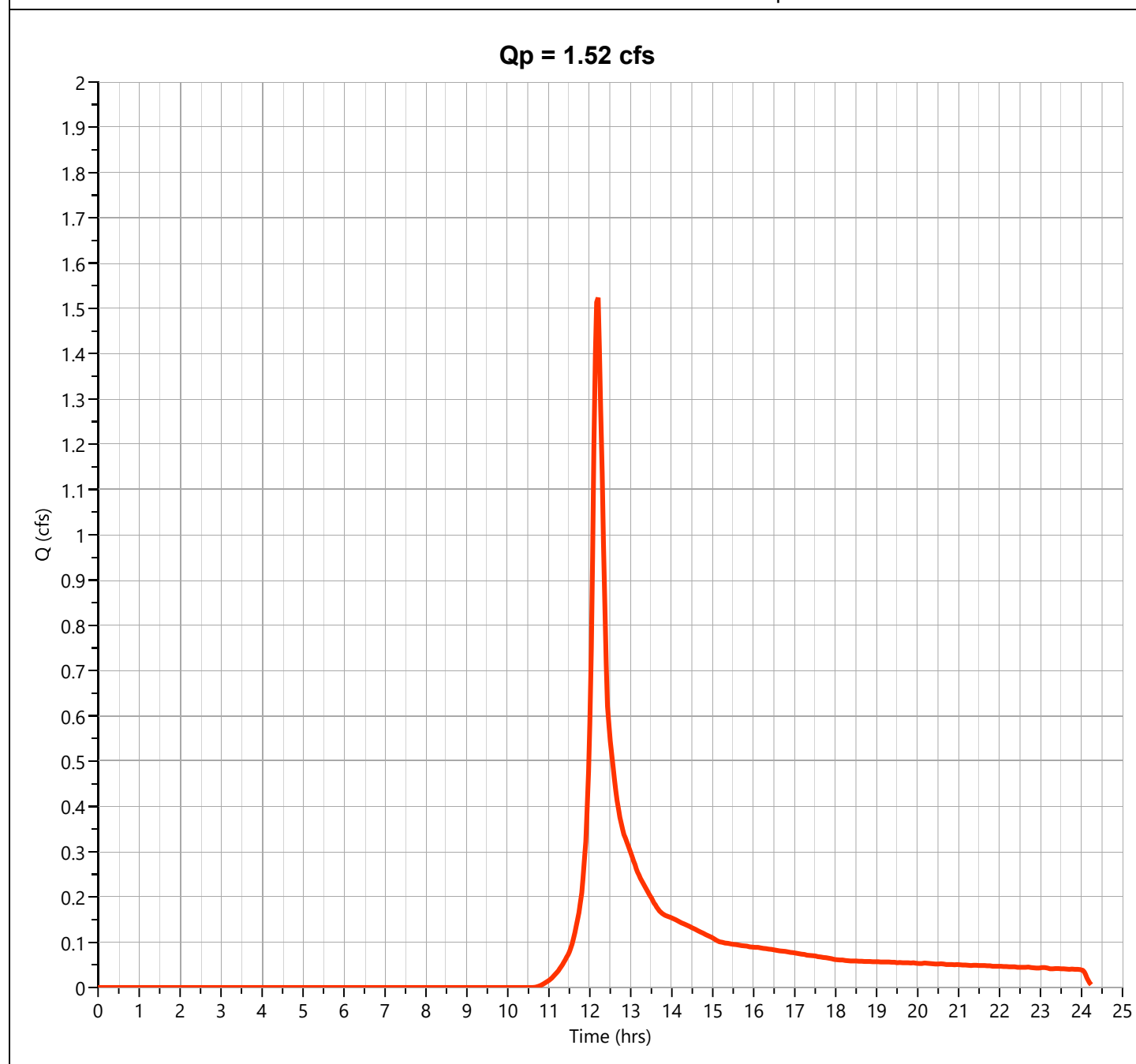
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA B - Perv.

Hyd. No. 53

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.523 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 6,240 cuft
Drainage Area	= 0.8 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

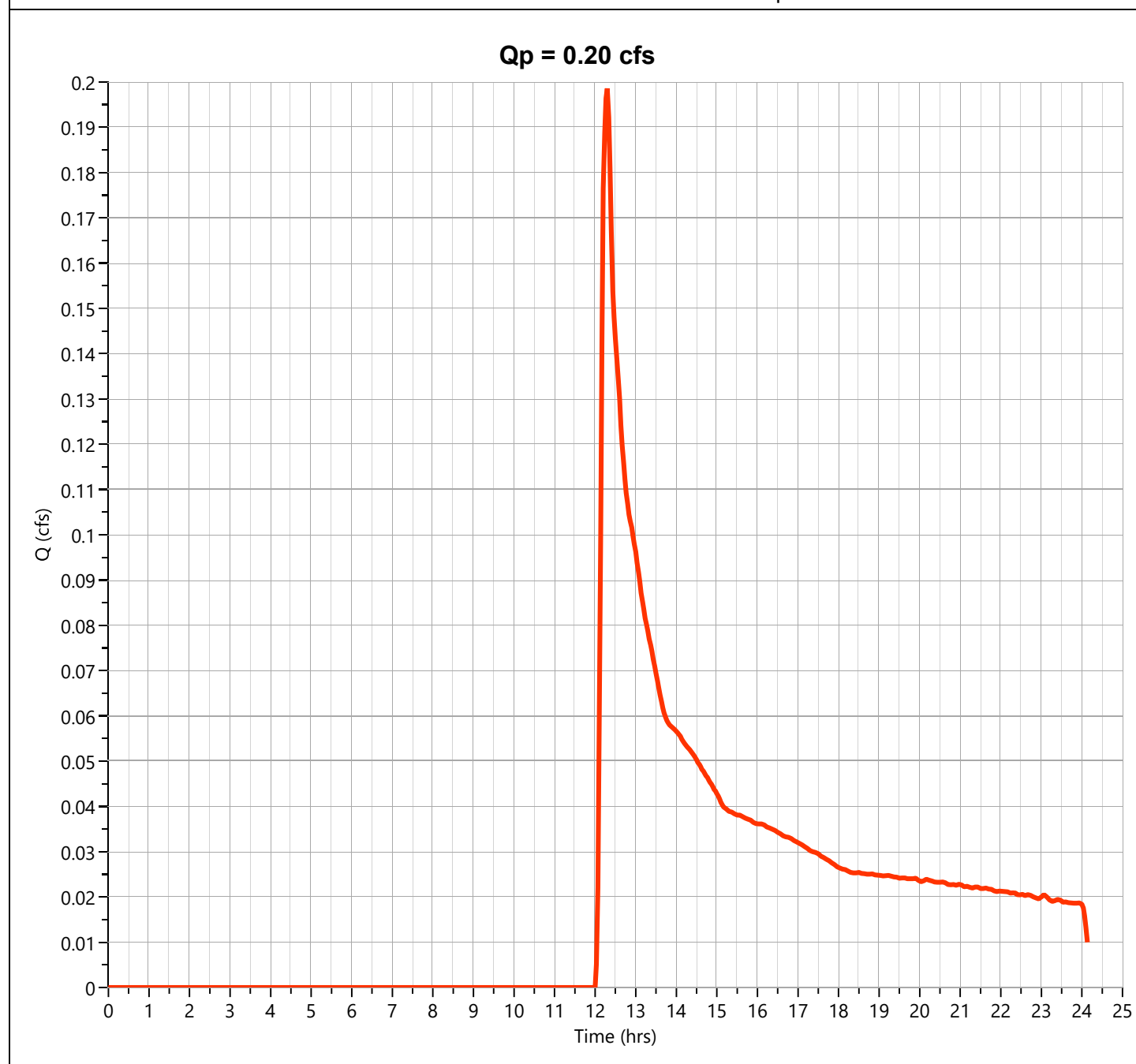
Hydrology Studio v 3.0.0.16

12-30-2020

Pre DA C - Perv.

Hyd. No. 55

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.199 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Runoff Volume	= 1,744 cuft
Drainage Area	= 0.72 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

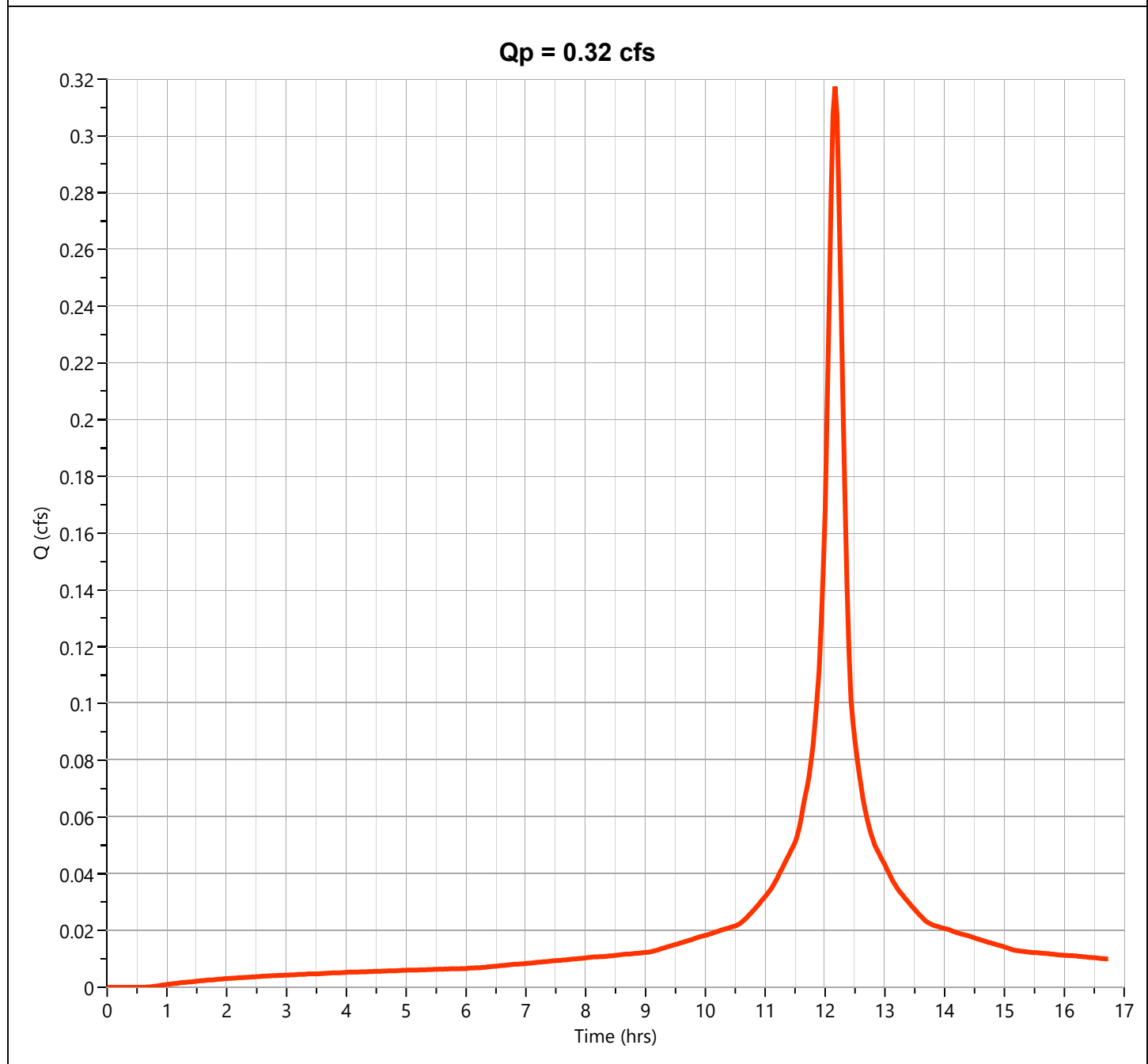
Hydrology Studio v 3.0.0.16

12-30-2020

Pre DA C - Imperv.

Hyd. No. 56

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.317 cfs
Storm Frequency	= 25-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 1,440 cuft
Drainage Area	= 0.06 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 6.65 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

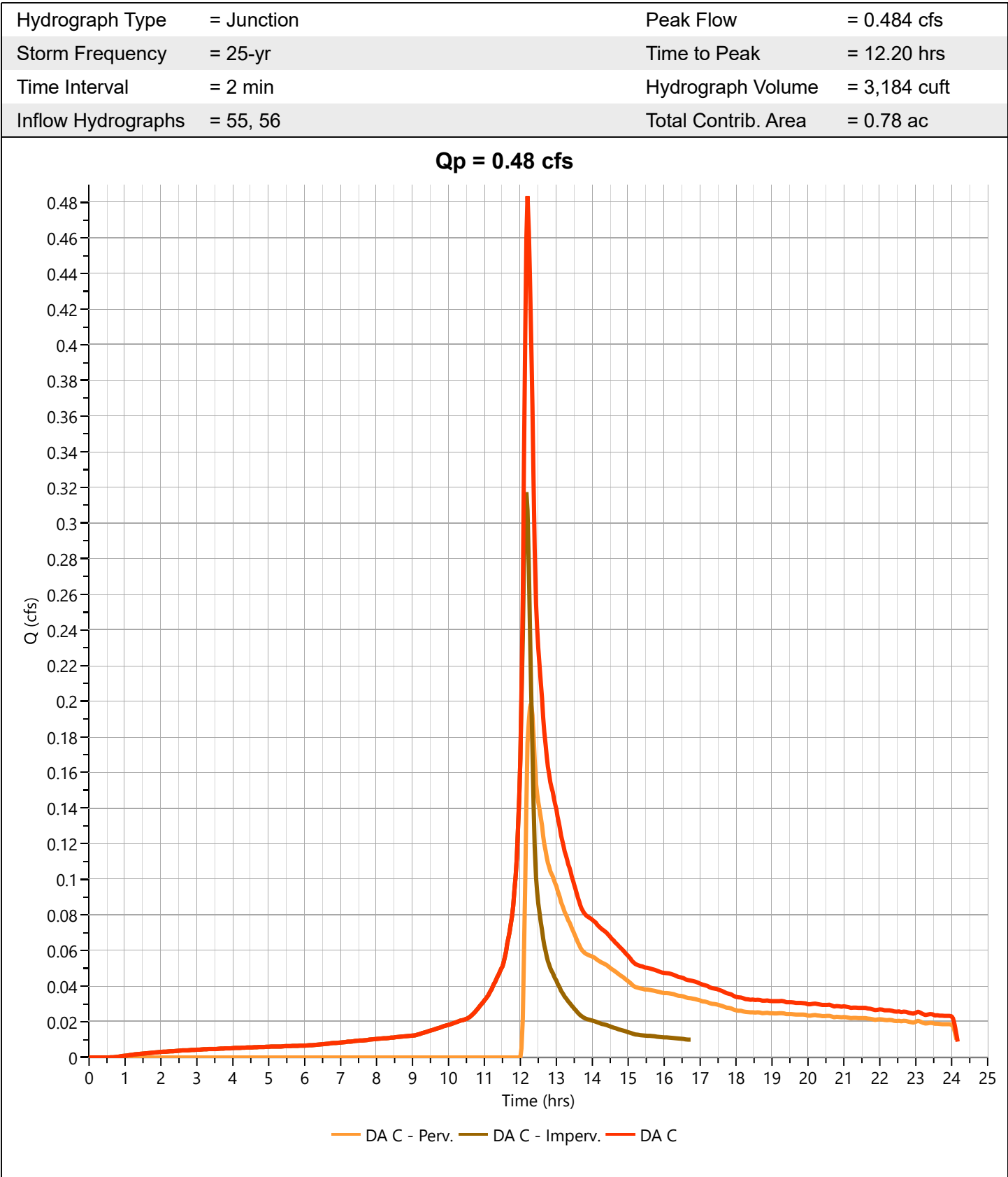
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA C

Hyd. No. 57



Hydrograph 100-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

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	Post DAA1a - Perv.	3.724	12.23	17,311	----		
2	NRCS Runoff	Post DAA1a - Imperv.	19.08	12.17	87,323	----		
3	Junction	Post DAA1a	22.34	12.17	104,634	1, 2		
5	NRCS Runoff	Post DAA1a (un) - Perv.	4.272	12.20	17,984	----		
7	Junction	UG Basin West Inflow	26.41	12.17	122,617	3, 5		
8	Pond Route	UG Basin West Outflow	26.30	12.20	122,618	7	104.78	9,991
10	NRCS Runoff	Post DAA1b - Perv.	3.397	12.20	14,163	----		
11	NRCS Runoff	Post DAA1b - Imperv.	15.82	12.17	72,382	----		
12	Junction	Post DAA1b	19.17	12.17	86,545	10, 11		
14	NRCS Runoff	Post DAA1b (un) - Perv.	1.601	12.17	6,249	----		
16	Junction	Basin 1 Inflow	46.57	12.20	215,412	8, 12, 14		
17	Pond Route	Basin 1 Outflow	24.21	12.37	214,513	16	99.38	85,305
19	NRCS Runoff	Post DAA2 - Perv.	1.550	12.20	6,812	----		
20	NRCS Runoff	Post DAA2 - Imperv.	31.56	12.17	144,432	----		
21	Junction	Post DAA2	33.07	12.17	151,244	19, 20		
22	Pond Route	Basin 2 Outflow	24.65	12.27	151,201	21	86.68	52,318
24	NRCS Runoff	Post DAA3 - Perv.	6.782	12.20	31,090	----		
26	NRCS Runoff	Post DAA4a - Perv.	8.897	12.27	41,762	----		
27	NRCS Runoff	Post DAA4a - Imperv.	32.72	12.17	149,744	----		
28	Junction	Post DAA4a	40.42	12.17	191,506	26, 27		
29	Pond Route	UG Basin East Out	36.77	12.23	191,506	28	104.74	14,588
31	NRCS Runoff	Post DAA4b - Perv.	1.908	12.20	9,292	----		
32	NRCS Runoff	Post DAA4b - Imperv.	15.24	12.17	69,726	----		
33	Junction	Post DAA4b	17.06	12.17	79,018	31, 32		
35	Junction	Basin 3 Inflow	51.78	12.23	270,524	29, 33		
36	Pond Route	Basin 3 Outflow	20.23	12.63	270,140	35	94.72	122,617

Hydrograph 100-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

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)
38	NRCS Runoff	Post DAA5 - Perv.	1.030	12.20	5,018	----		
39	NRCS Runoff	Post DAA5 - Imperv.	1.379	12.17	6,309	----		
40	Junction	Post DAA5	2.364	12.20	11,326	38, 39		
41	Junction	Basin 4 Inflow	20.89	12.63	281,466	36, 40		
42	Pond Route	Basin 4 Outflow	14.62	13.07	280,349	41	85.91	38,502
44	NRCS Runoff	Post DAA6 - Perv.	0.000	0.00	0.000	----		
45	NRCS Runoff	Post DAA6 - Imperv.	3.433	1.13	5,383	----		
46	Junction	Post DAA6	3.433	1.13	5,383	44, 45		
47	Pond Route	Basin 5 Outflow	0.326	1.87	5,359	46	73.40	4,365
49	NRCS Runoff	Post DAA7	3.924	12.20	16,731	----		
51	Junction	Combined DAA	60.67	12.30	745,215	17, 22, 24, 42, 47, 49		
53	NRCS Runoff	Post DA B - Perv.	2.895	12.17	11,425	----		
55	NRCS Runoff	Pre DA C - Perv.	0.916	12.20	4,460	----		
56	NRCS Runoff	Pre DA C - Imperv.	0.435	12.17	1,992	----		
57	Junction	Post DA C	1.337	12.20	6,452	55, 56		

Hydrograph Report

Project Name:

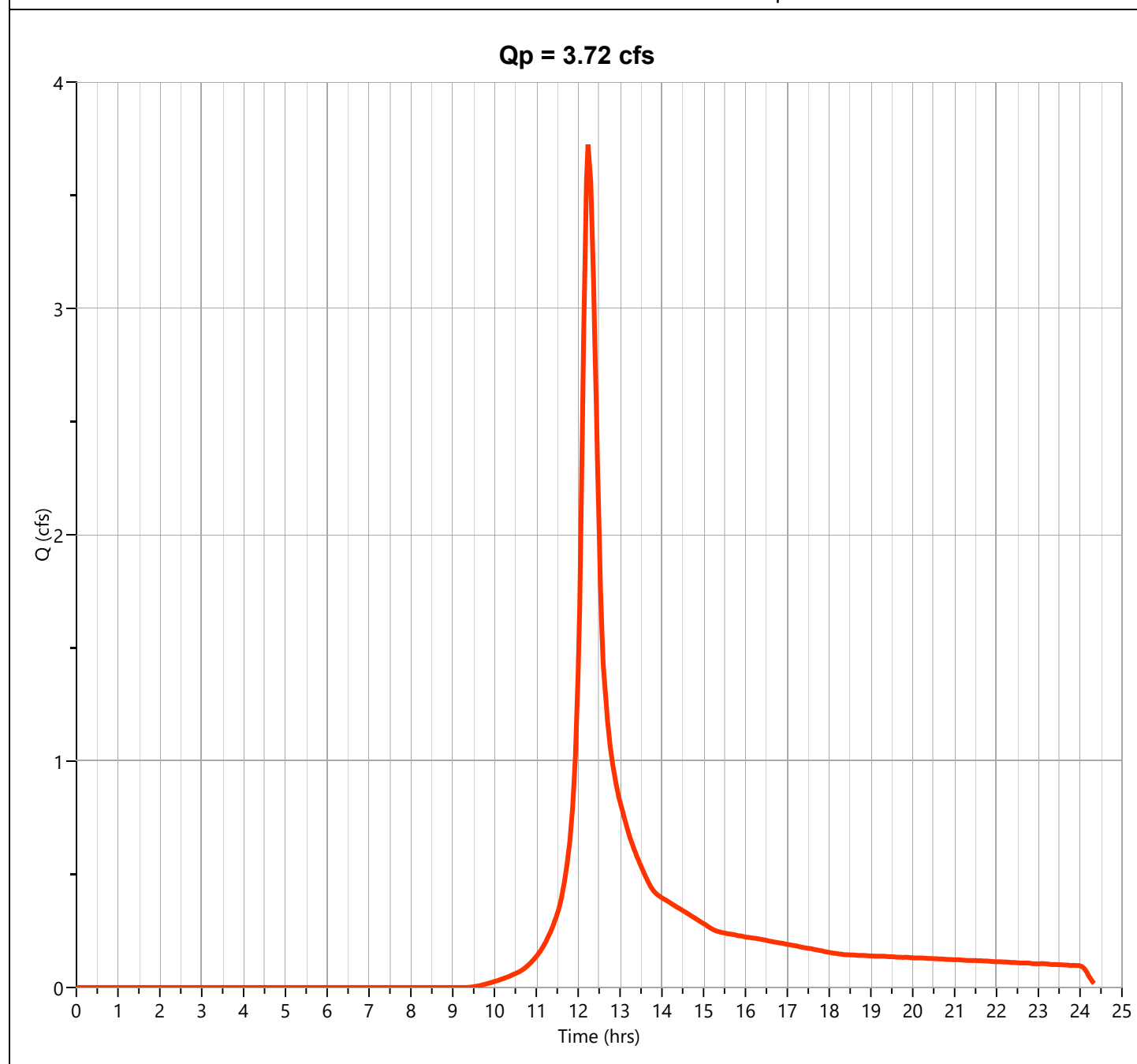
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a - Perv.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.724 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 17,311 cuft
Drainage Area	= 1.25 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 19.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

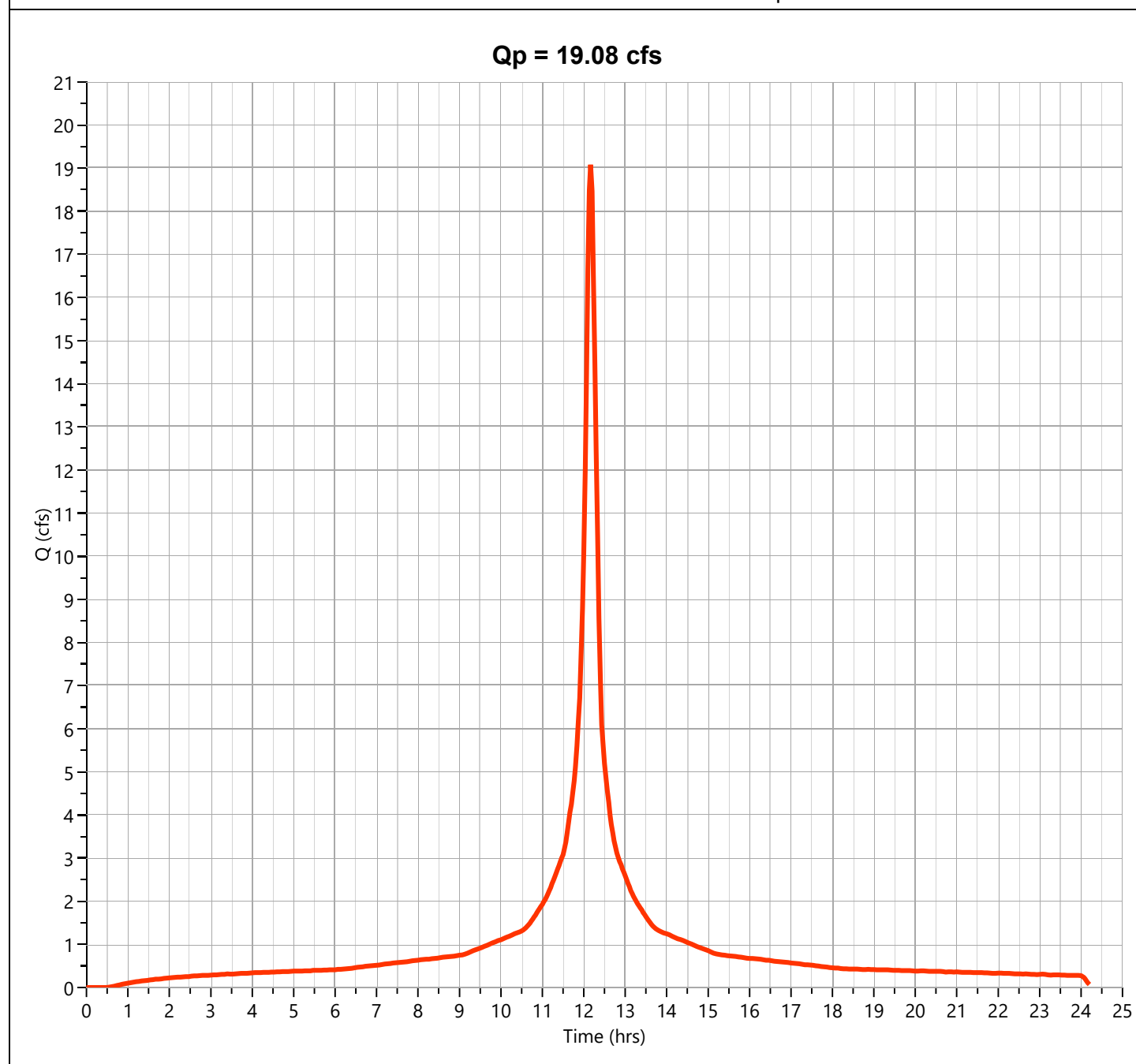
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a - Imperv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 19.08 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 87,323 cuft
Drainage Area	= 2.63 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

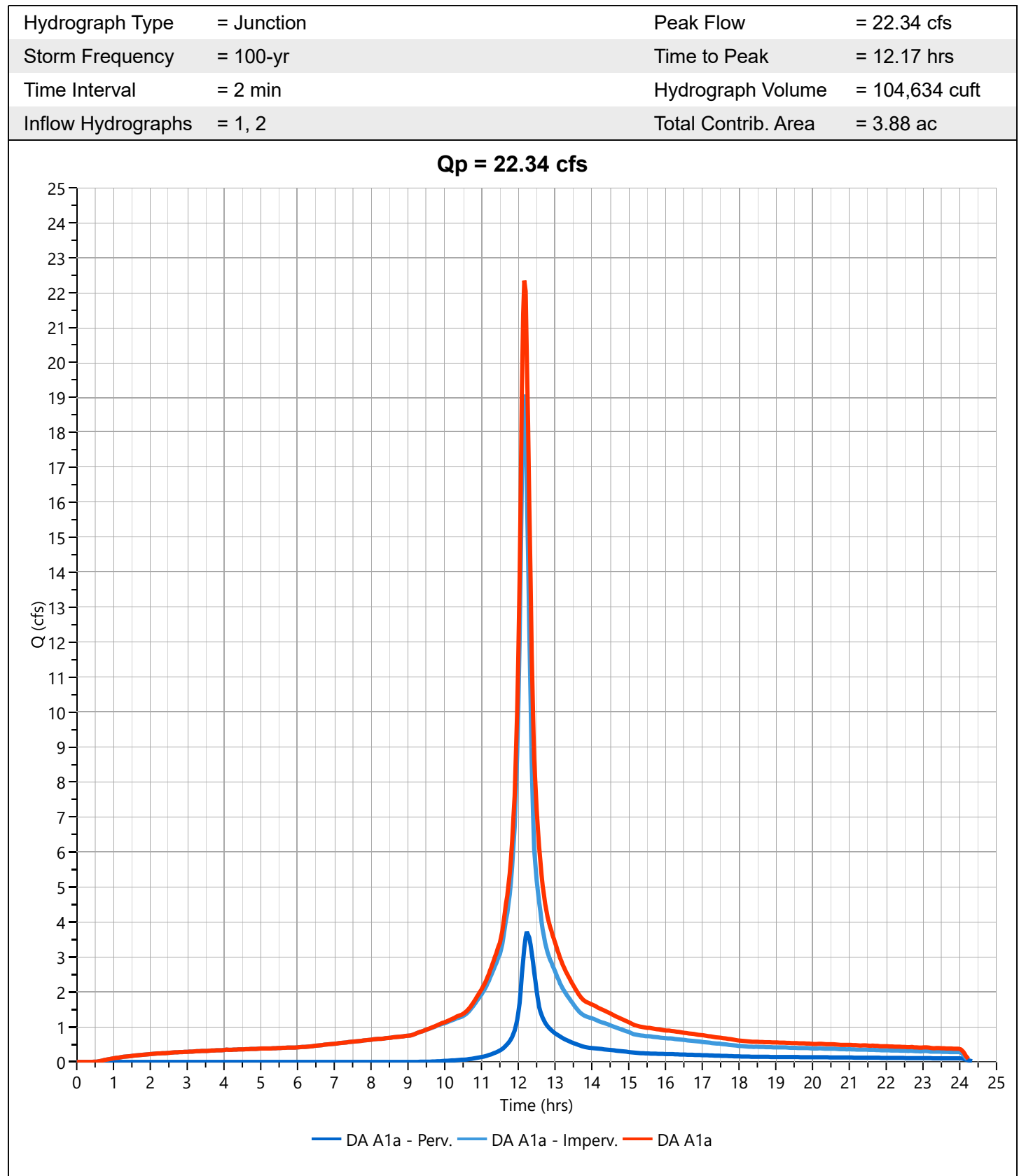
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a

Hyd. No. 3



Hydrograph Report

Project Name:

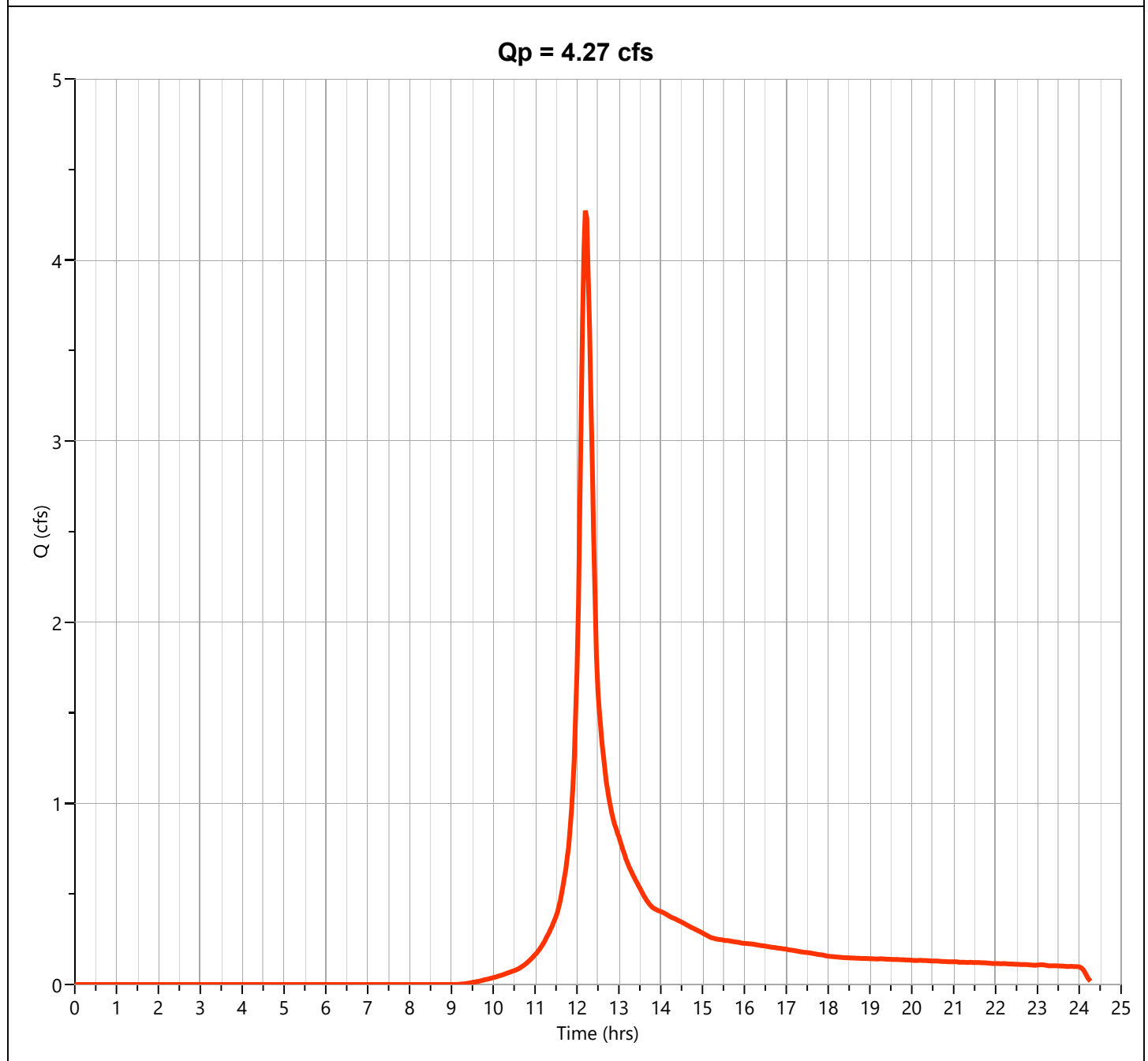
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a (un) - Perv.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.272 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 17,984 cuft
Drainage Area	= 1.29 ac	Curve Number	= 58
Tc Method	= User	Time of Conc. (Tc)	= 16.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

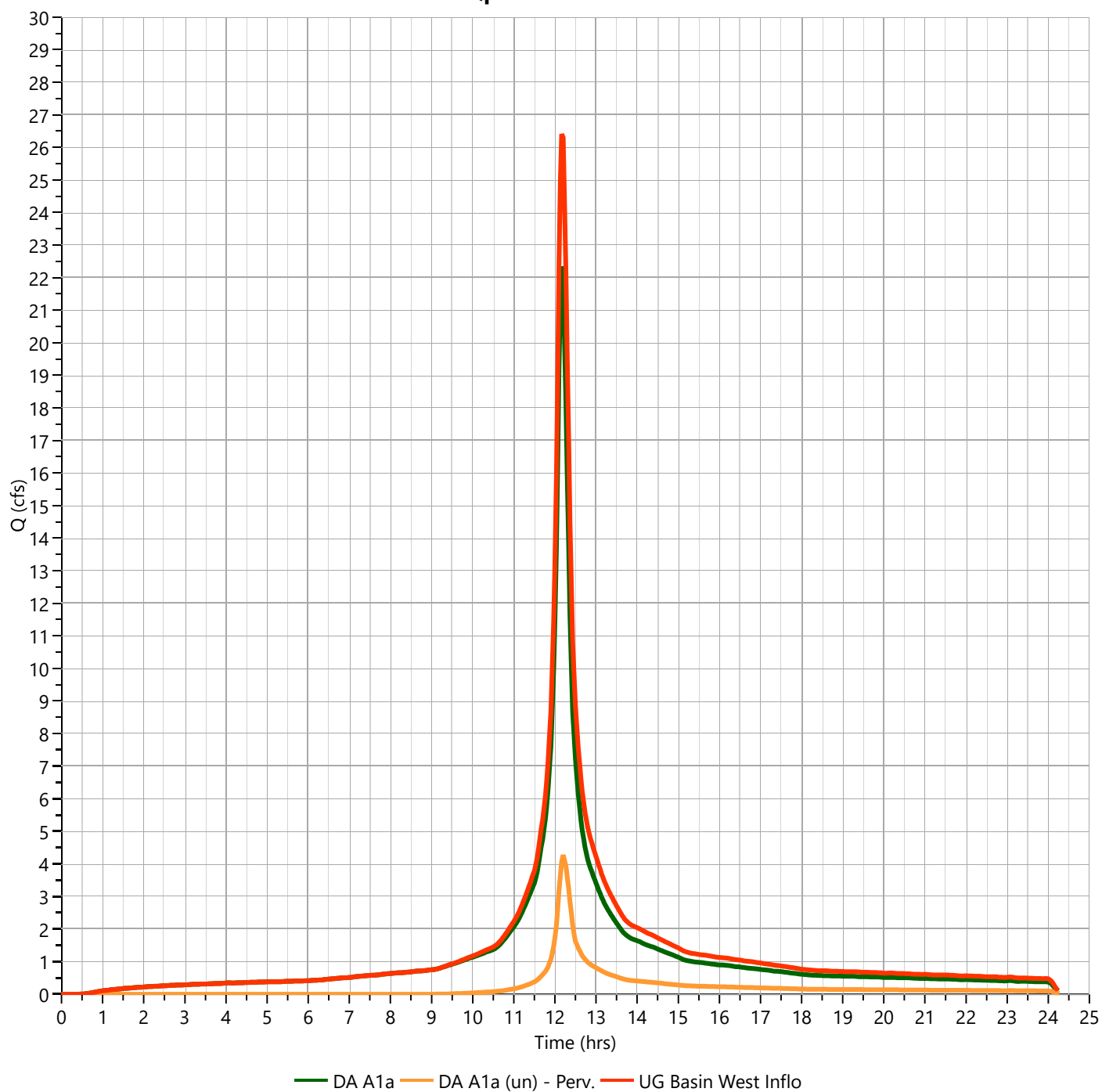
12-30-2020

UG Basin West Inflo

Hyd. No. 7

Hydrograph Type	= Junction	Peak Flow	= 26.41 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 122,617 cuft
Inflow Hydrographs	= 3, 5	Total Contrib. Area	= 5.17 ac

Qp = 26.41 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Basin West Outfl

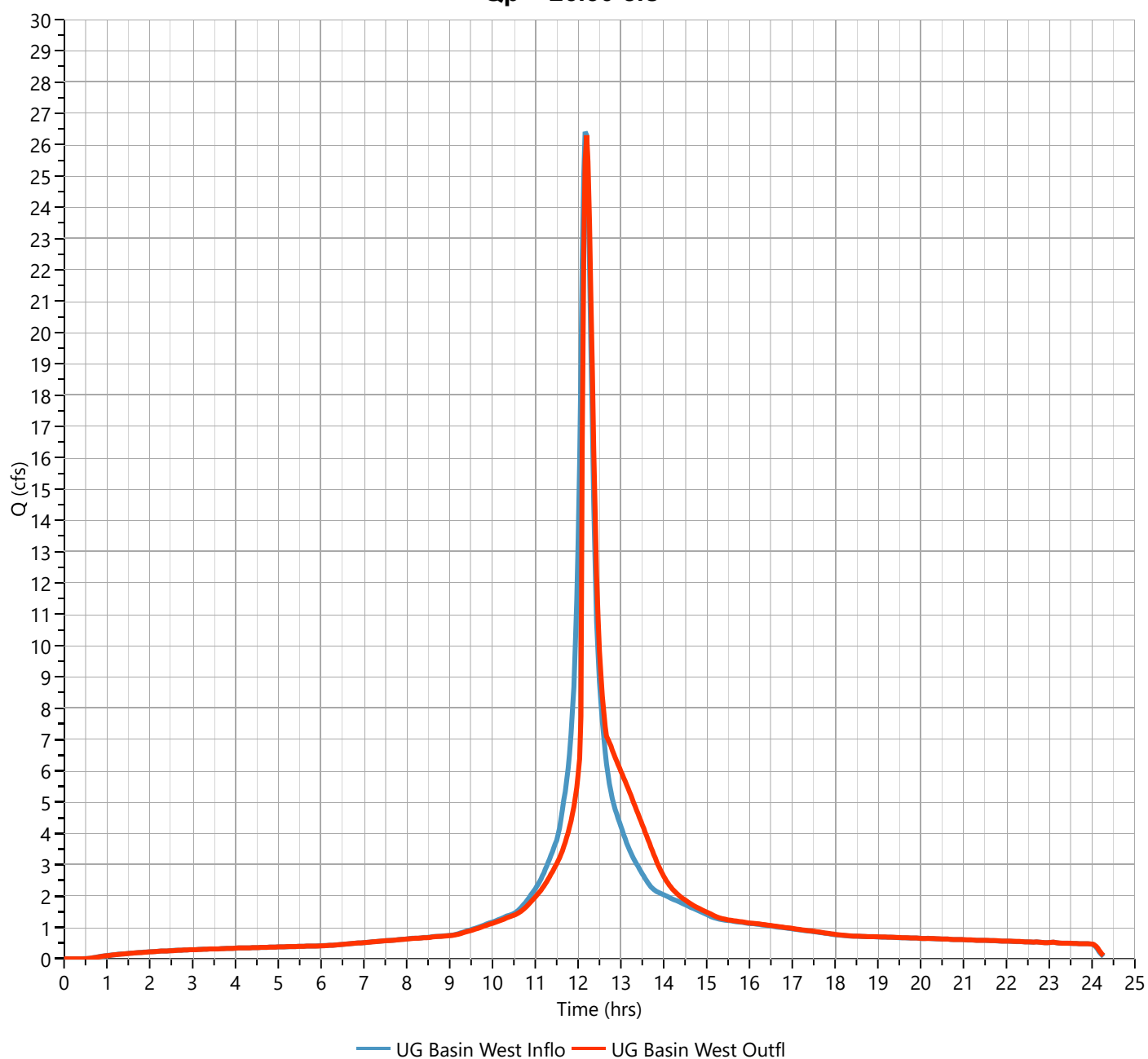
Hyd. No. 8

Hydrograph Type	= Pond Route	Peak Flow	= 26.30 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 122,618 cuft
Inflow Hydrograph	= 7 - UG Basin West Inflo	Max. Elevation	= 104.78 ft
Pond Name	= UG Recharge / Detention Basin West	Max. Storage	= 9,991 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 8 min

Qp = 26.30 cfs



Hydrograph Report

Project Name:

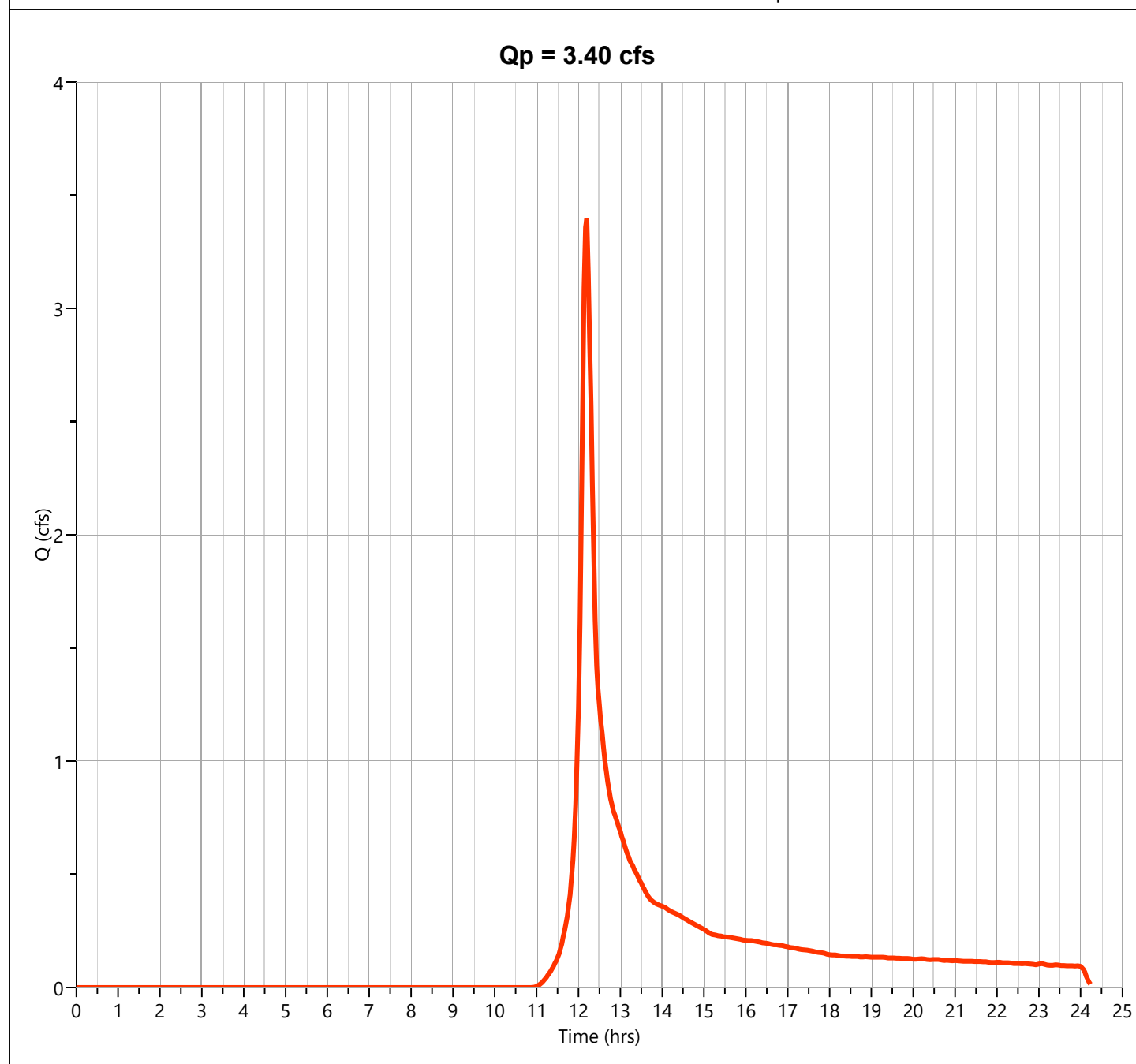
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b - Perv.

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.397 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 14,163 cuft
Drainage Area	= 1.46 ac	Curve Number	= 47
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

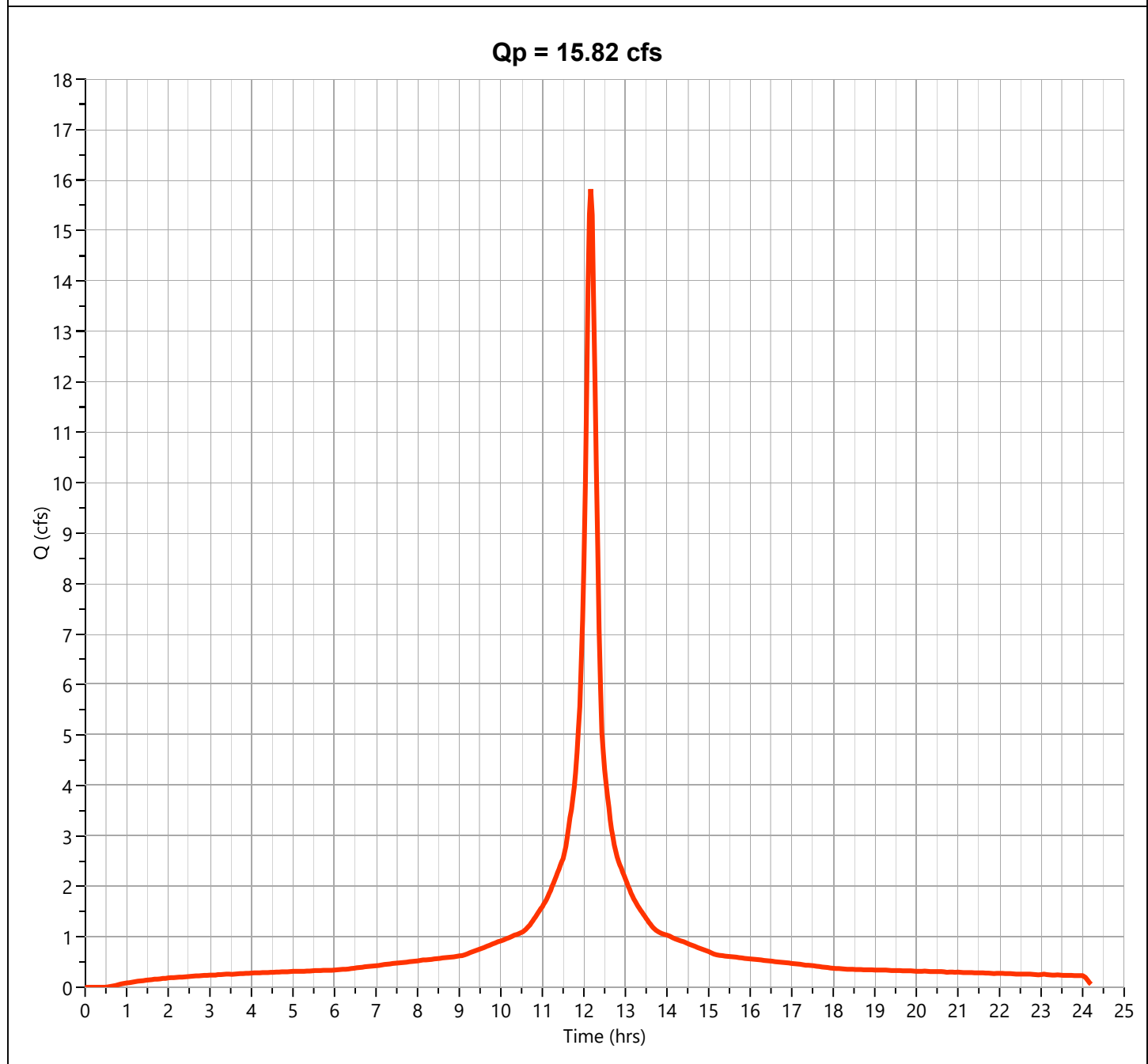
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b - Imperv.

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 15.82 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 72,382 cuft
Drainage Area	= 2.18 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

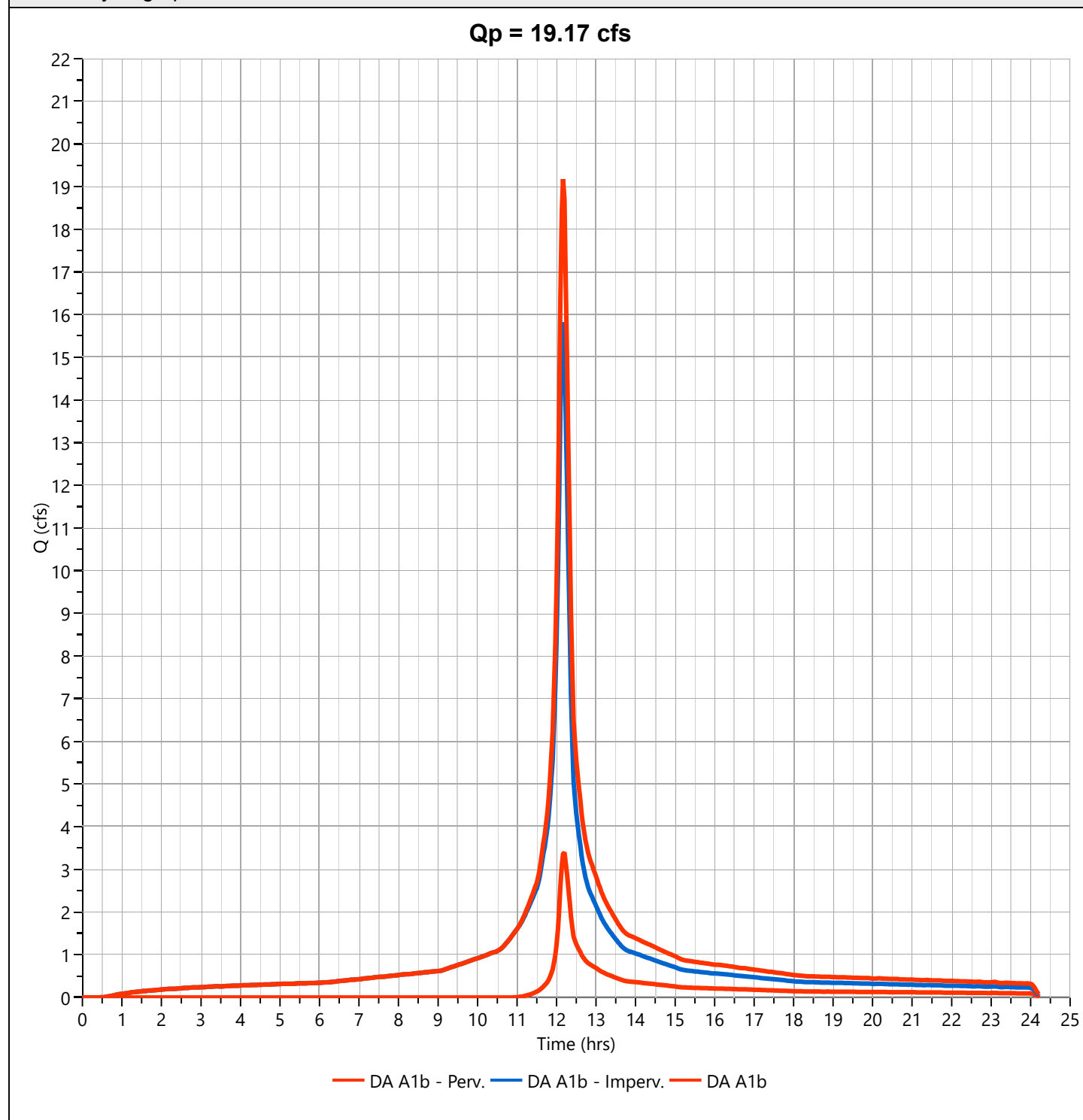
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b

Hyd. No. 12

Hydrograph Type	= Junction	Peak Flow	= 19.17 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 86,545 cuft
Inflow Hydrographs	= 10, 11	Total Contrib. Area	= 3.64 ac



Hydrograph Report

Project Name:

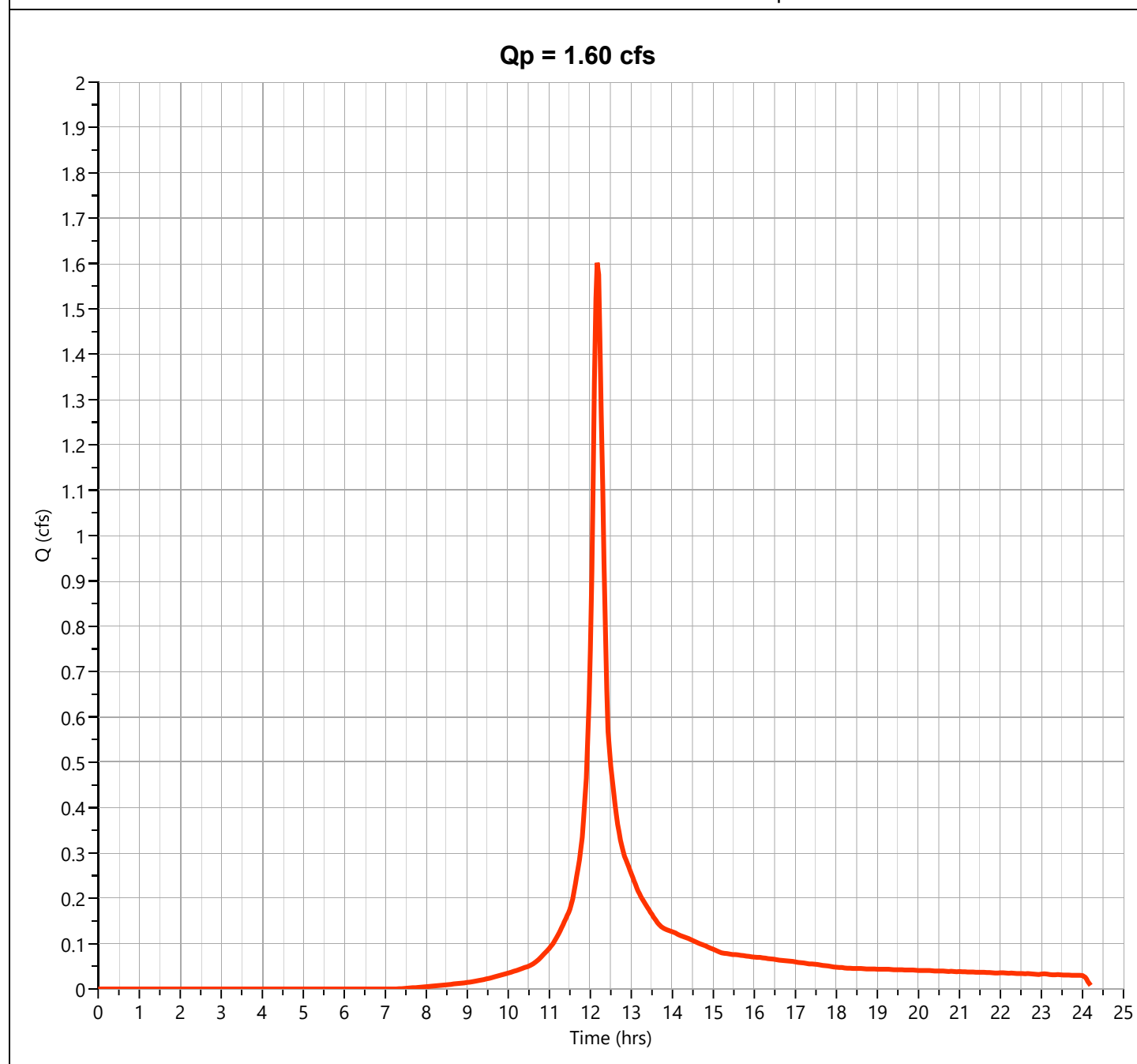
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b (un) - Perv.

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.601 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 6,249 cuft
Drainage Area	= 0.33 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

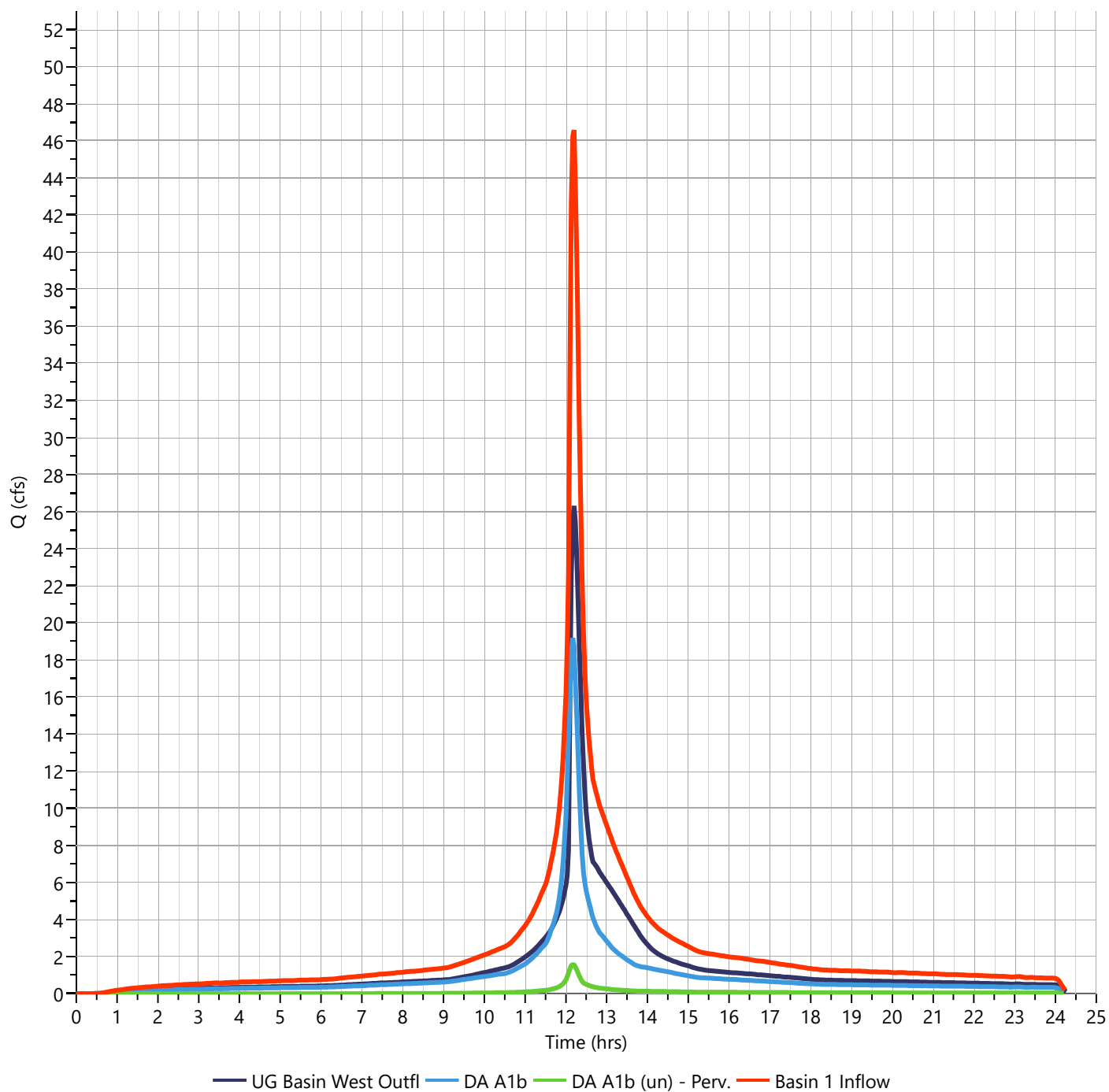
12-30-2020

Basin 1 Inflow

Hyd. No. 16

Hydrograph Type	= Junction	Peak Flow	= 46.57 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 215,412 cuft
Inflow Hydrographs	= 8, 12, 14	Total Contrib. Area	= 3.97 ac

Qp = 46.57 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

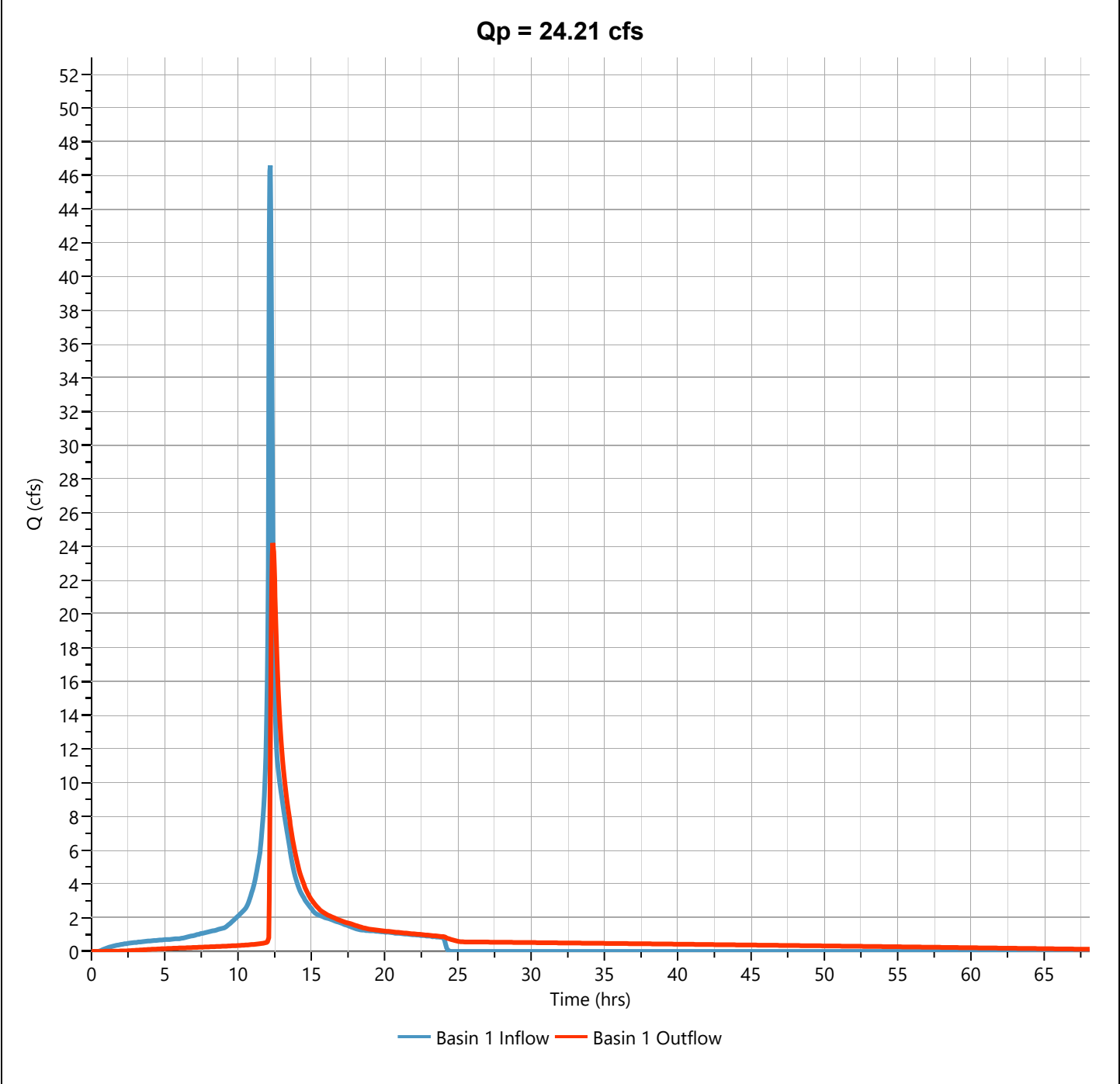
Basin 1 Outflow

Hyd. No. 17

Hydrograph Type	= Pond Route	Peak Flow	= 24.21 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.37 hrs
Time Interval	= 2 min	Hydrograph Volume	= 214,513 cuft
Inflow Hydrograph	= 16 - Basin 1 Inflow	Max. Elevation	= 99.38 ft
Pond Name	= Basin 1	Max. Storage	= 85,305 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 7.41 hrs



Hydrograph Report

Project Name:

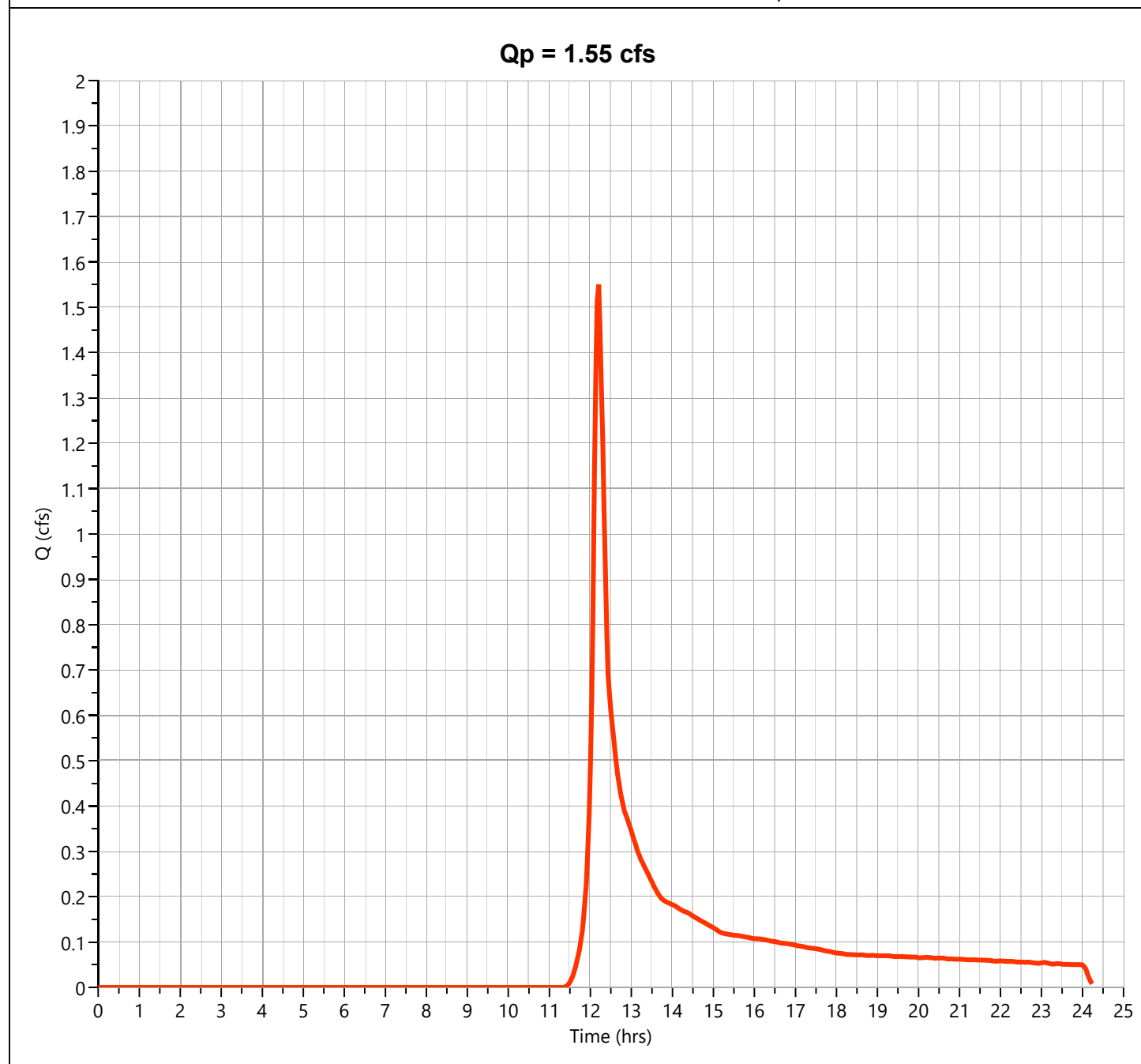
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2 - Perv.

Hyd. No. 19

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.550 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 6,812 cuft
Drainage Area	= 0.86 ac	Curve Number	= 43
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

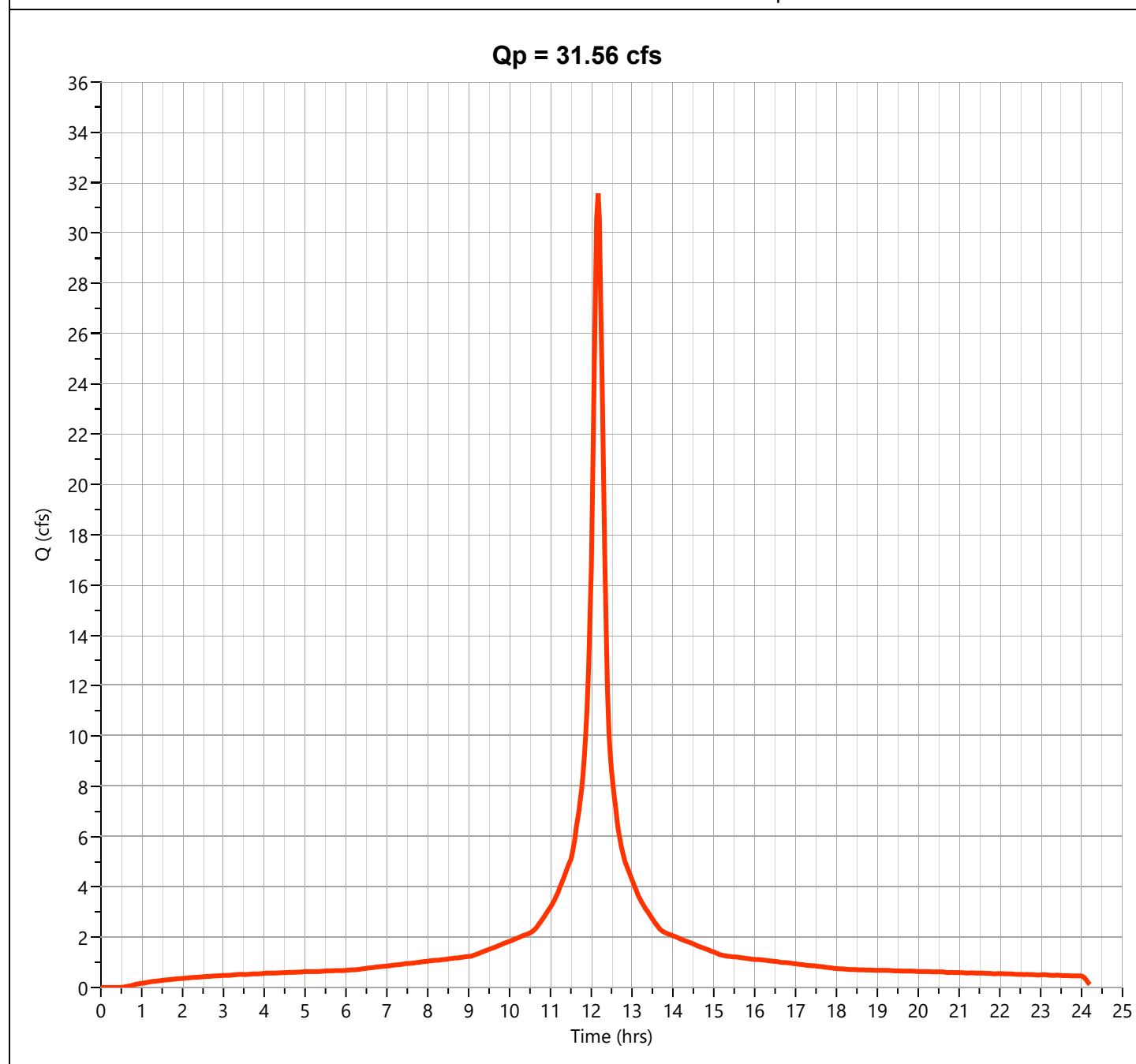
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2 - Imperv.

Hyd. No. 20

Hydrograph Type	= NRCS Runoff	Peak Flow	= 31.56 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 144,432 cuft
Drainage Area	= 4.35 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

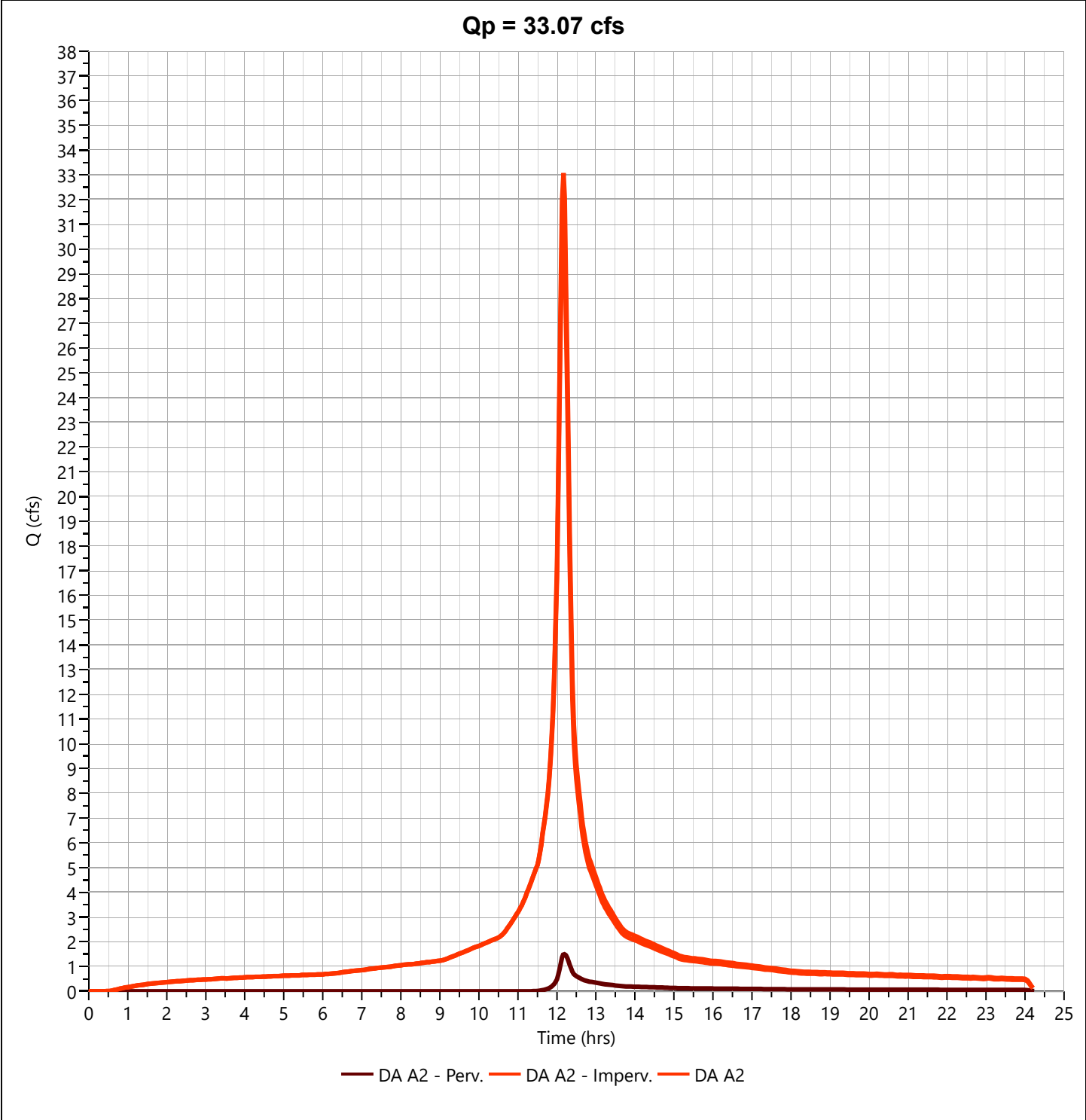
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2

Hyd. No. 21

Hydrograph Type	= Junction	Peak Flow	= 33.07 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 151,244 cuft
Inflow Hydrographs	= 19, 20	Total Contrib. Area	= 5.21 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

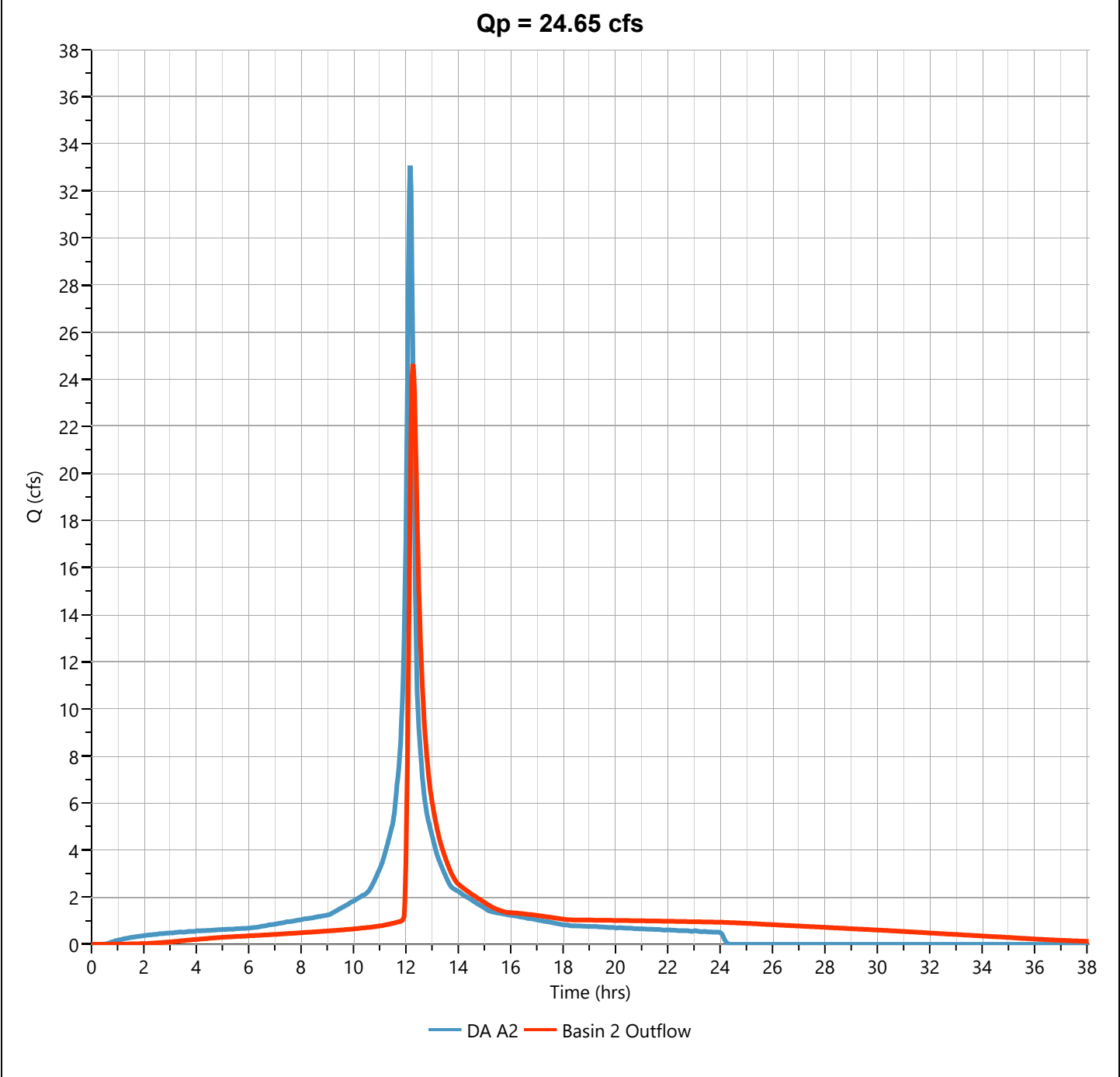
Basin 2 Outflow

Hyd. No. 22

Hydrograph Type	= Pond Route	Peak Flow	= 24.65 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Hydrograph Volume	= 151,201 cuft
Inflow Hydrograph	= 21 - DA A2	Max. Elevation	= 86.68 ft
Pond Name	= Basin 2	Max. Storage	= 52,318 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 4.13 hrs



Hydrograph Report

Project Name:

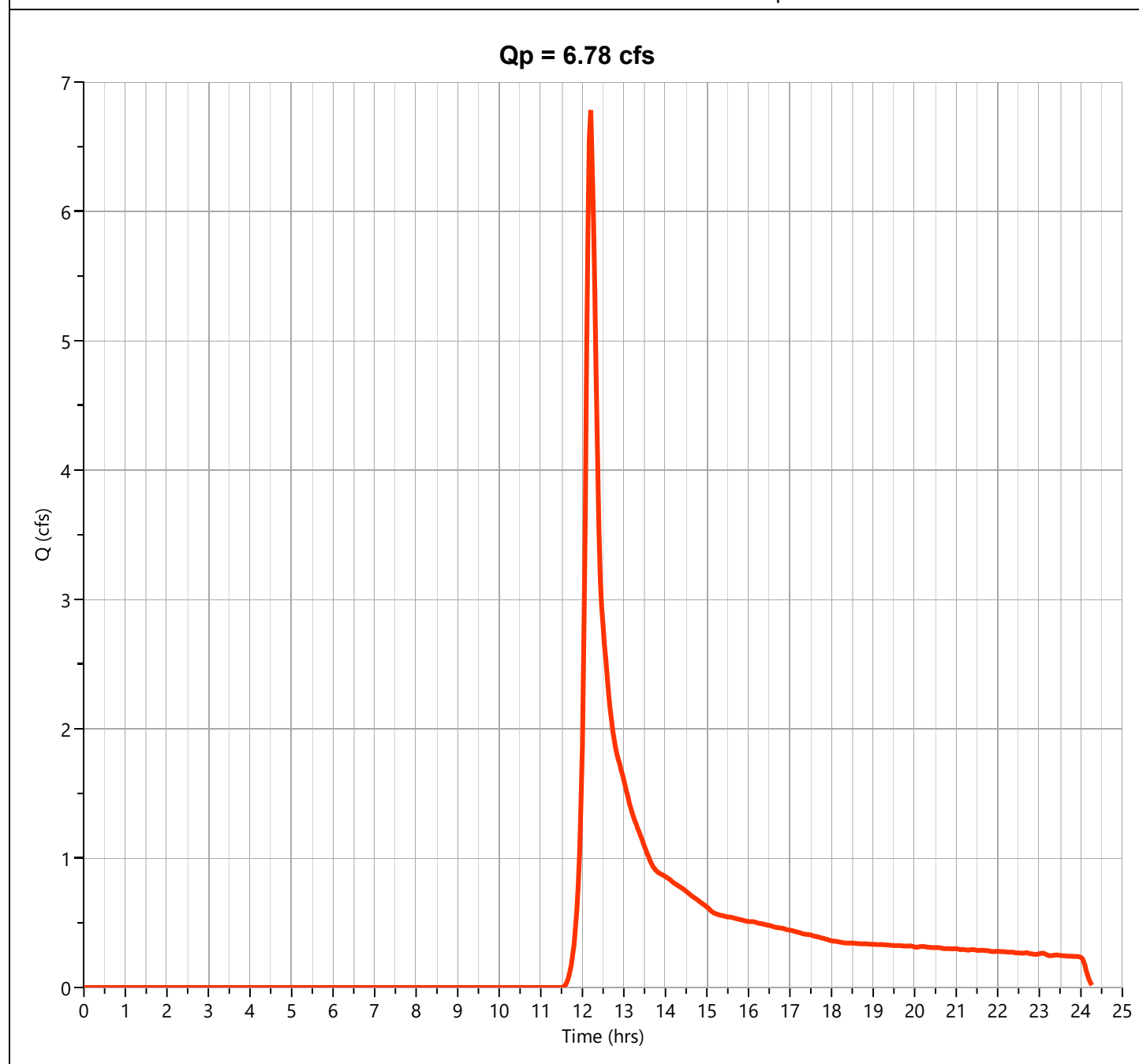
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A3 - Perv.

Hyd. No. 24

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.782 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 31,090 cuft
Drainage Area	= 4.41 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

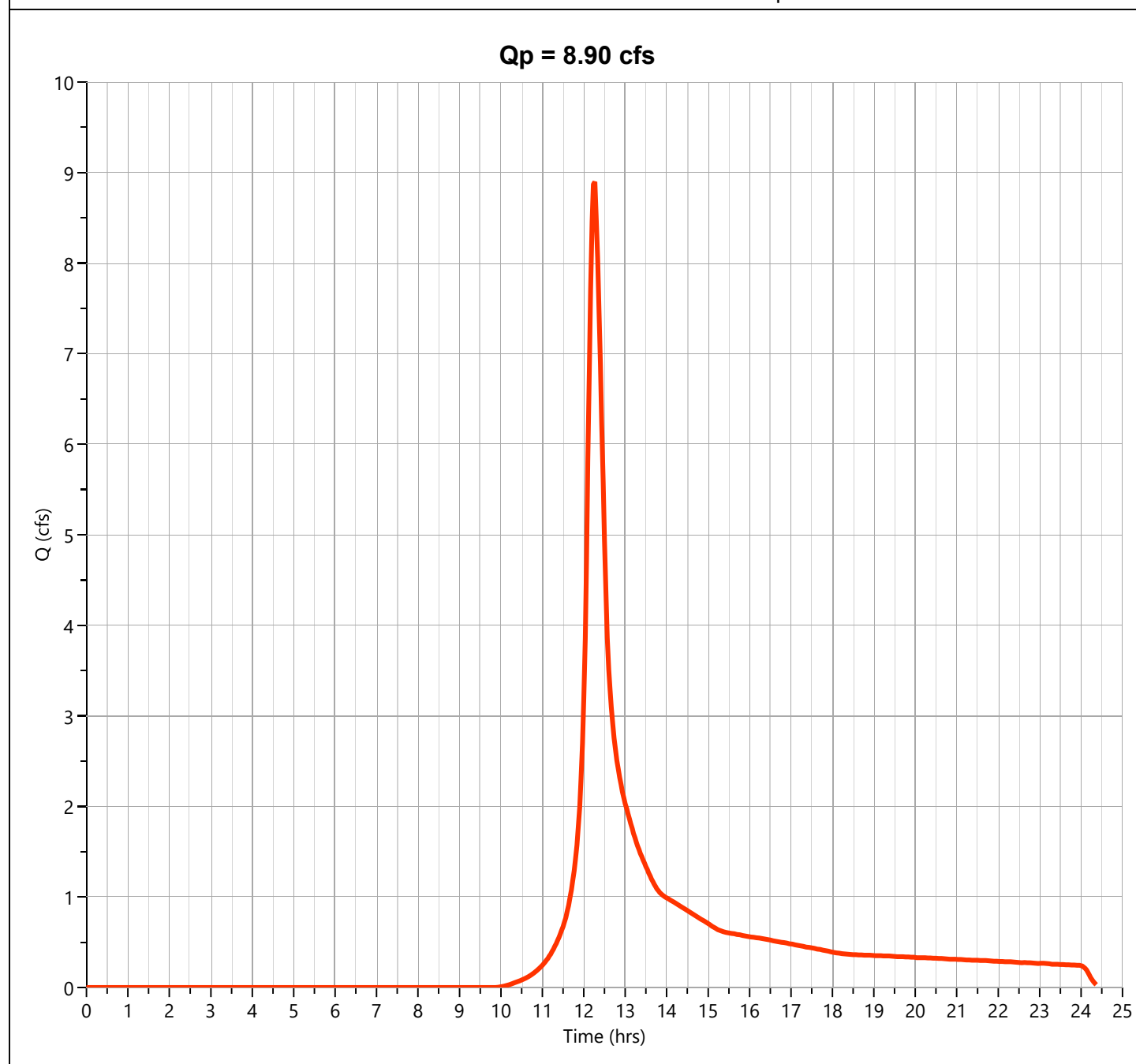
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a - Perv.

Hyd. No. 26

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.897 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 41,762 cuft
Drainage Area	= 3.34 ac	Curve Number	= 54
Tc Method	= User	Time of Conc. (Tc)	= 17.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

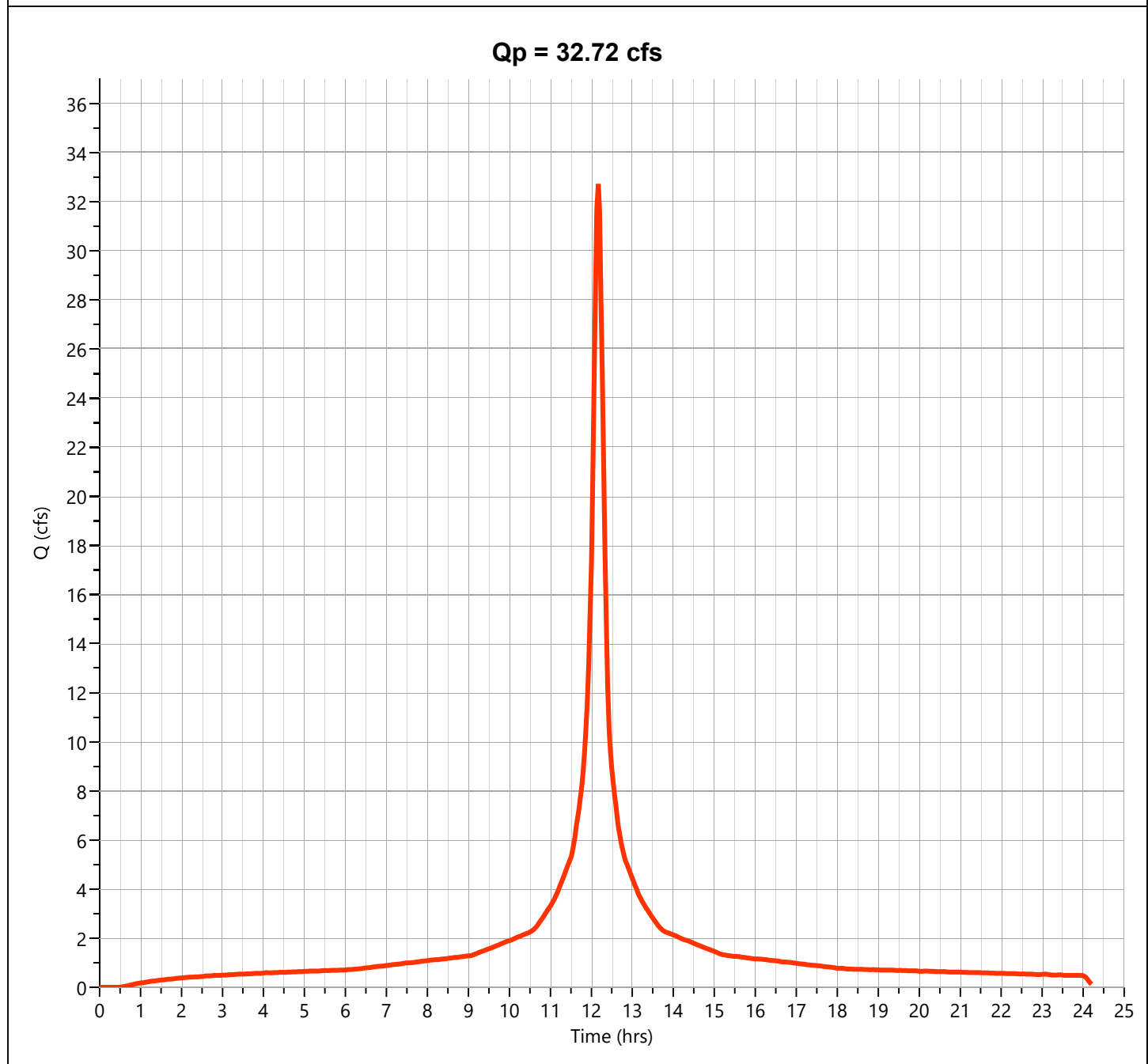
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a - Imperv.

Hyd. No. 27

Hydrograph Type	= NRCS Runoff	Peak Flow	= 32.72 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 149,744 cuft
Drainage Area	= 4.51 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

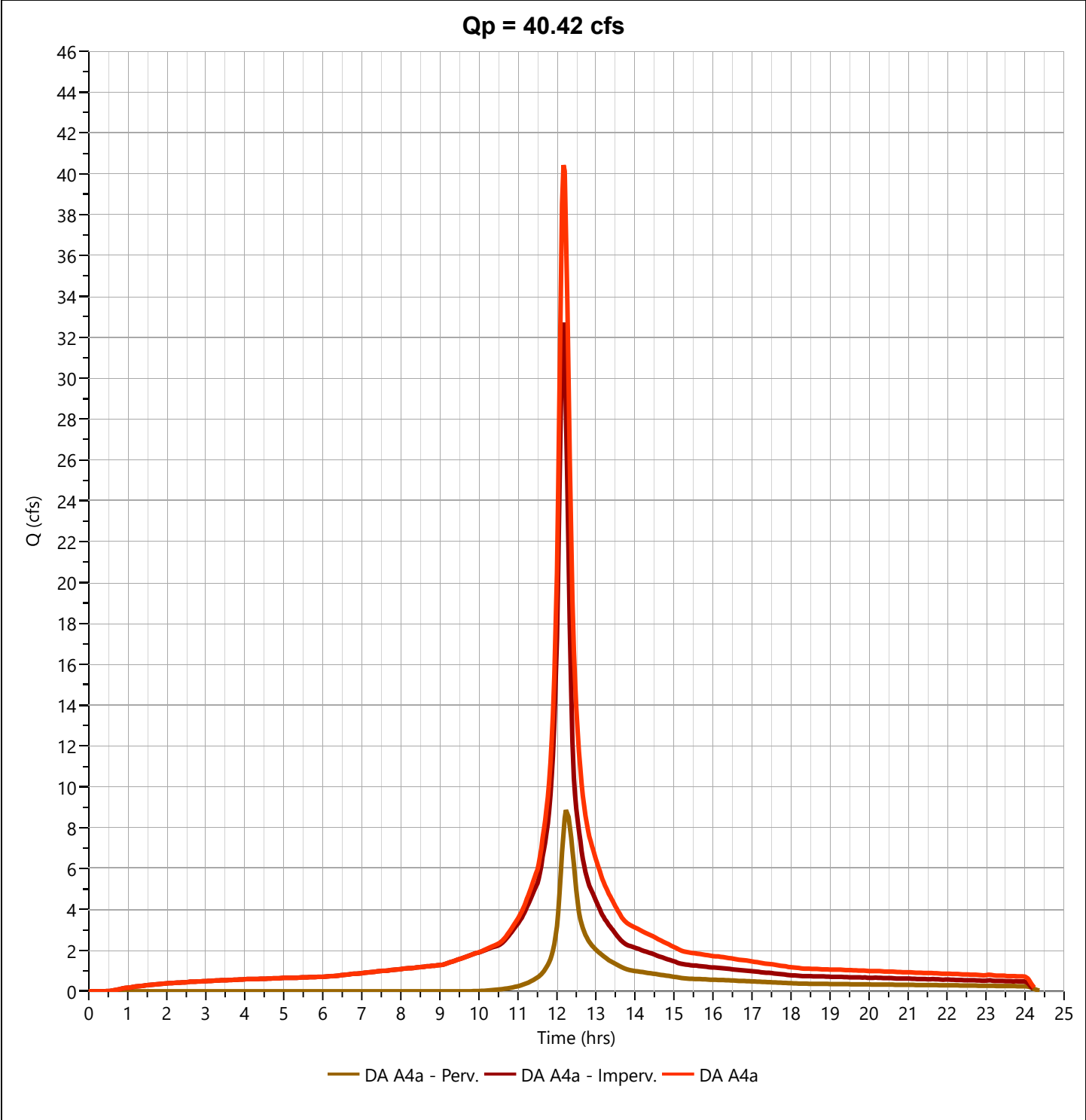
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a

Hyd. No. 28

Hydrograph Type	= Junction	Peak Flow	= 40.42 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 191,506 cuft
Inflow Hydrographs	= 26, 27	Total Contrib. Area	= 7.85 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Basin East Out

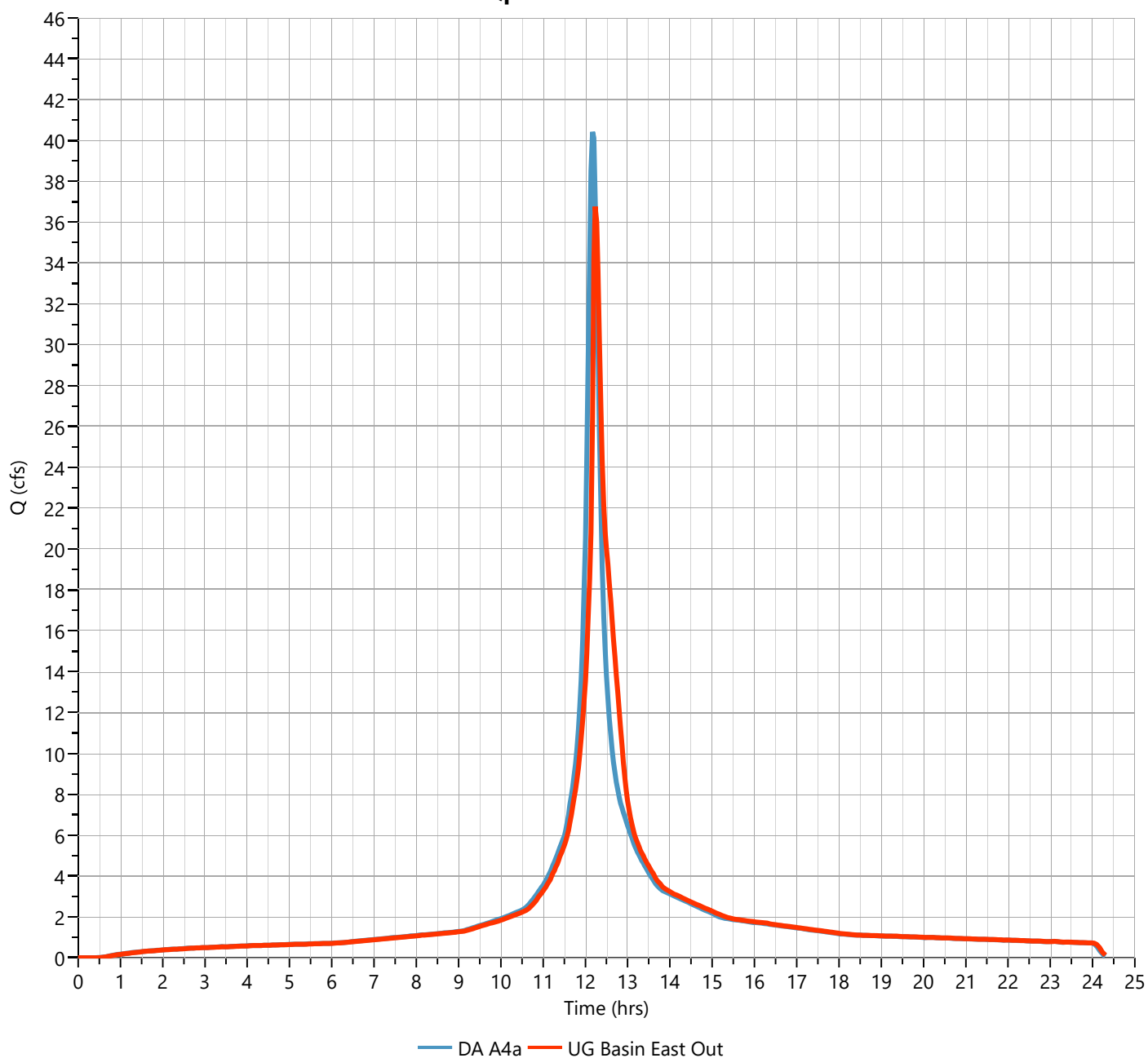
Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 36.77 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 191,506 cuft
Inflow Hydrograph	= 28 - DA A4a	Max. Elevation	= 104.74 ft
Pond Name	= UG Recharge / Detention Basin East	Max. Storage	= 14,588 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 5 min

Qp = 36.77 cfs



Hydrograph Report

Project Name:

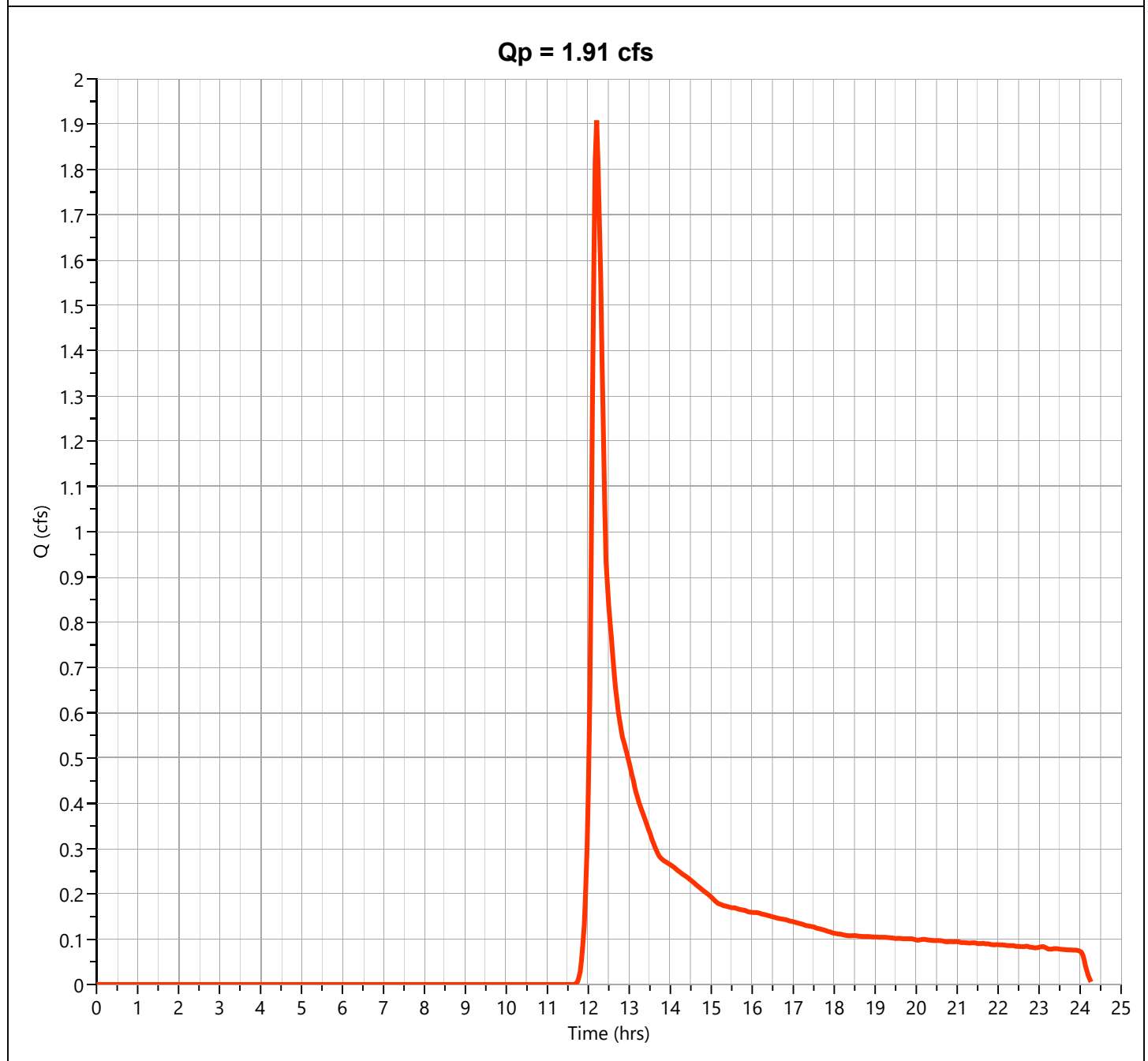
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b - Perv.

Hyd. No. 31

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.908 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 9,292 cuft
Drainage Area	= 1.5 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

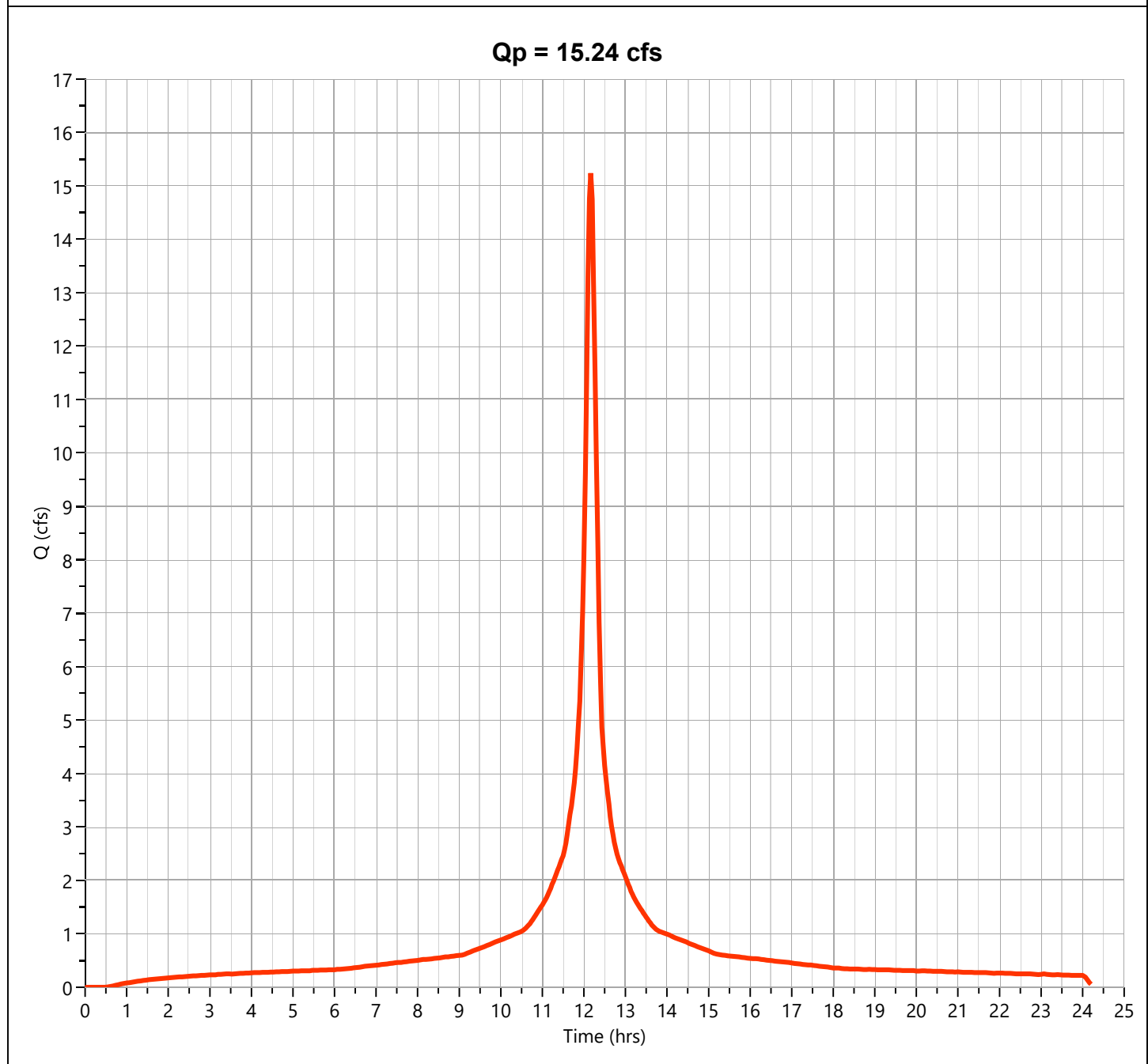
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b - Imperv.

Hyd. No. 32

Hydrograph Type	= NRCS Runoff	Peak Flow	= 15.24 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 69,726 cuft
Drainage Area	= 2.1 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

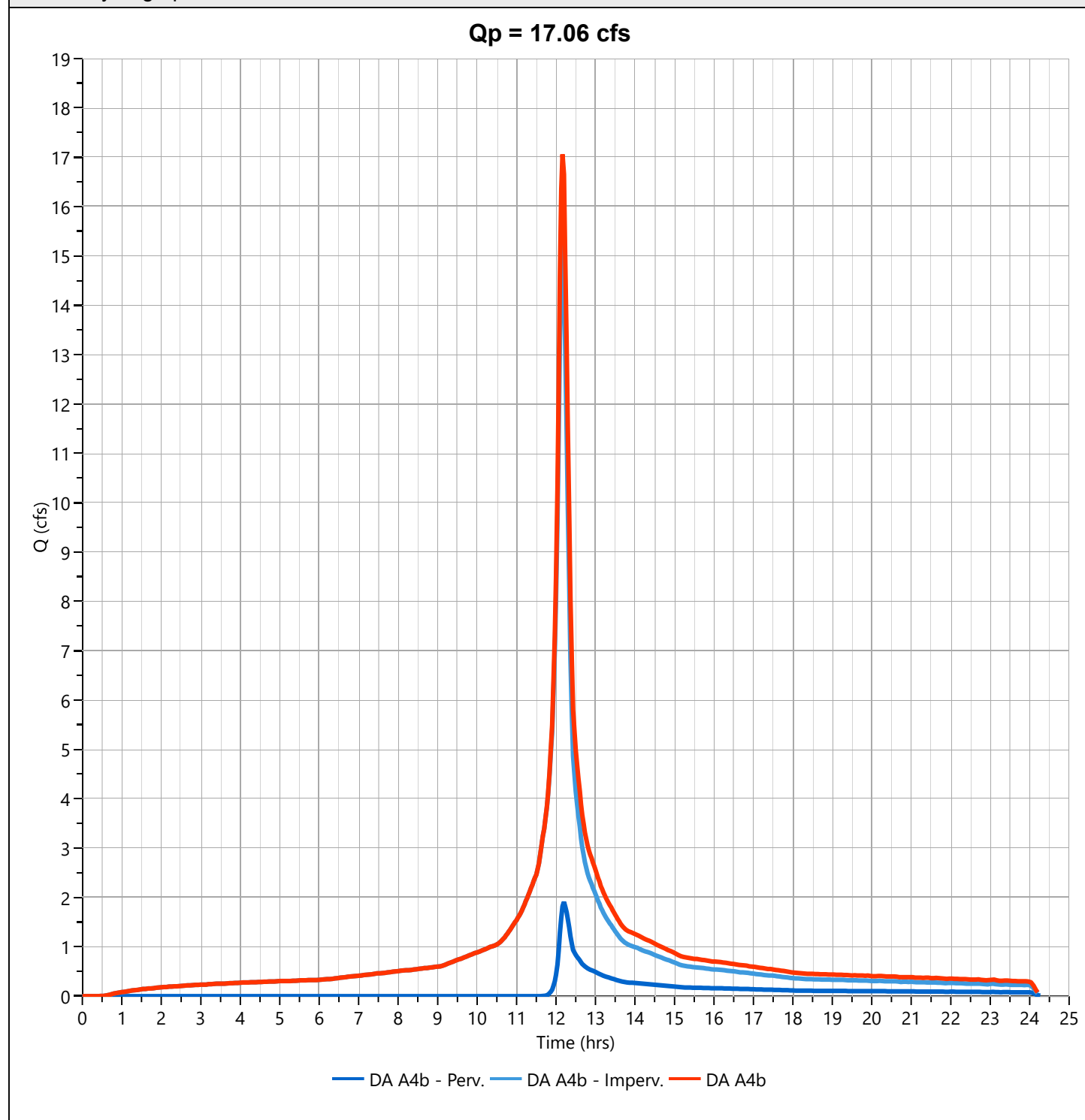
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b

Hyd. No. 33

Hydrograph Type	= Junction	Peak Flow	= 17.06 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 79,018 cuft
Inflow Hydrographs	= 31, 32	Total Contrib. Area	= 3.6 ac



Hydrograph Report

Project Name:

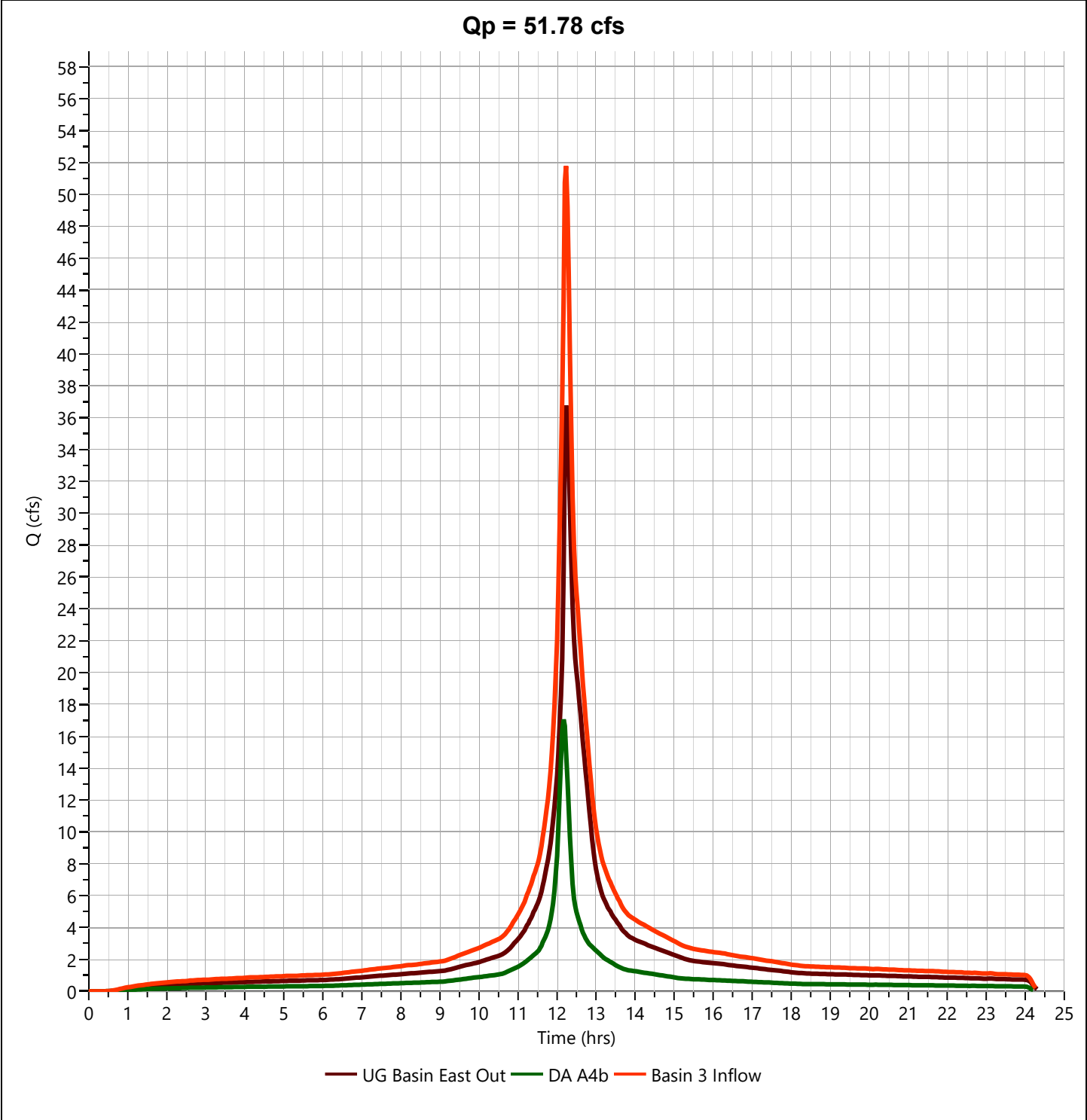
Hydrology Studio v 3.0.0.16

12-30-2020

Basin 3 Inflow

Hyd. No. 35

Hydrograph Type	= Junction	Peak Flow	= 51.78 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Hydrograph Volume	= 270,524 cuft
Inflow Hydrographs	= 29, 33	Total Contrib. Area	= 3.6 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 3 Outflow

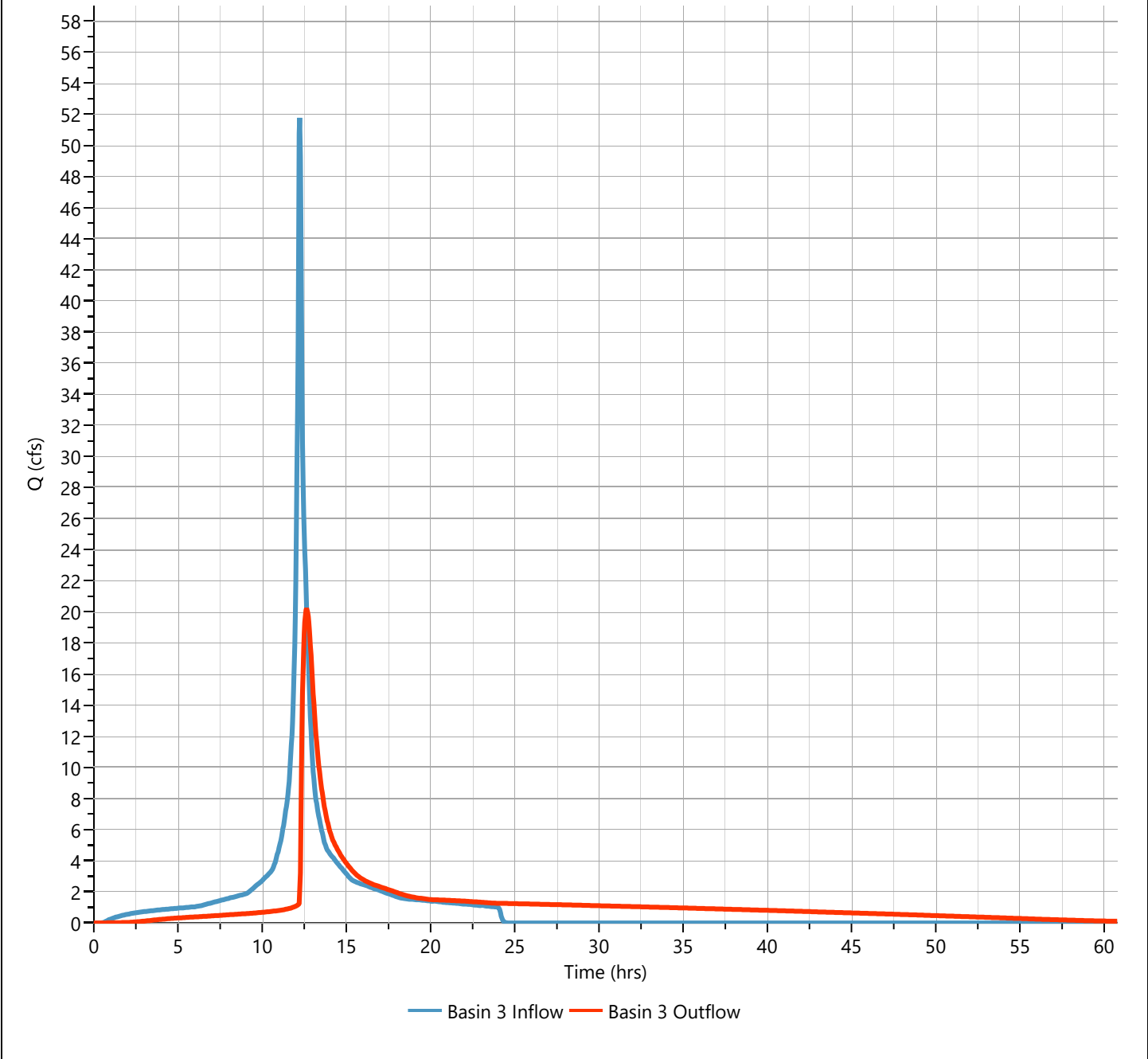
Hyd. No. 36

Hydrograph Type	= Pond Route	Peak Flow	= 20.23 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.63 hrs
Time Interval	= 2 min	Hydrograph Volume	= 270,140 cuft
Inflow Hydrograph	= 35 - Basin 3 Inflow	Max. Elevation	= 94.72 ft
Pond Name	= Basin 3	Max. Storage	= 122,617 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 9.43 hrs

Qp = 20.23 cfs



Hydrograph Report

Project Name:

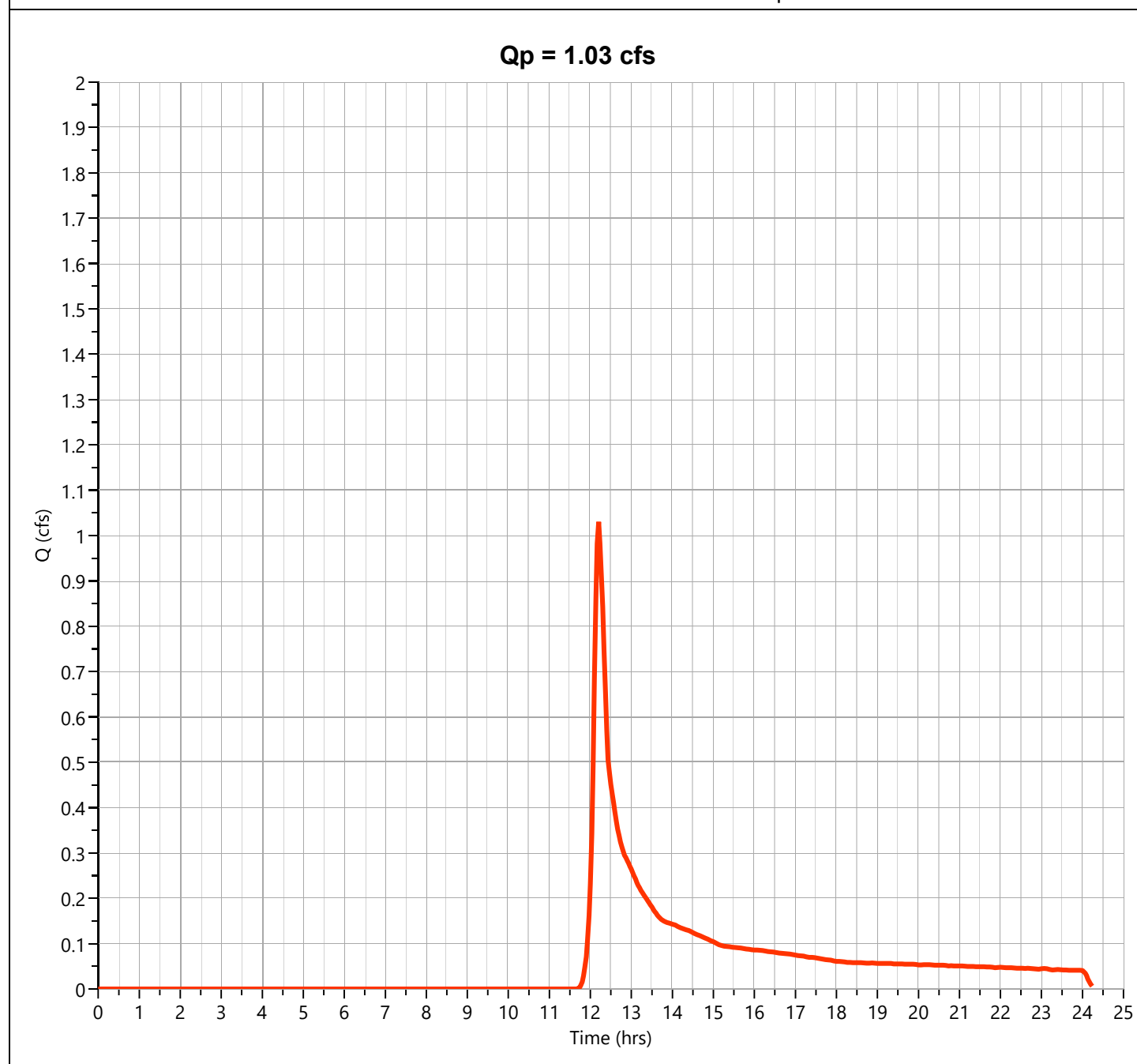
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5 - Perv.

Hyd. No. 38

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.030 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 5,018 cuft
Drainage Area	= 0.81 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

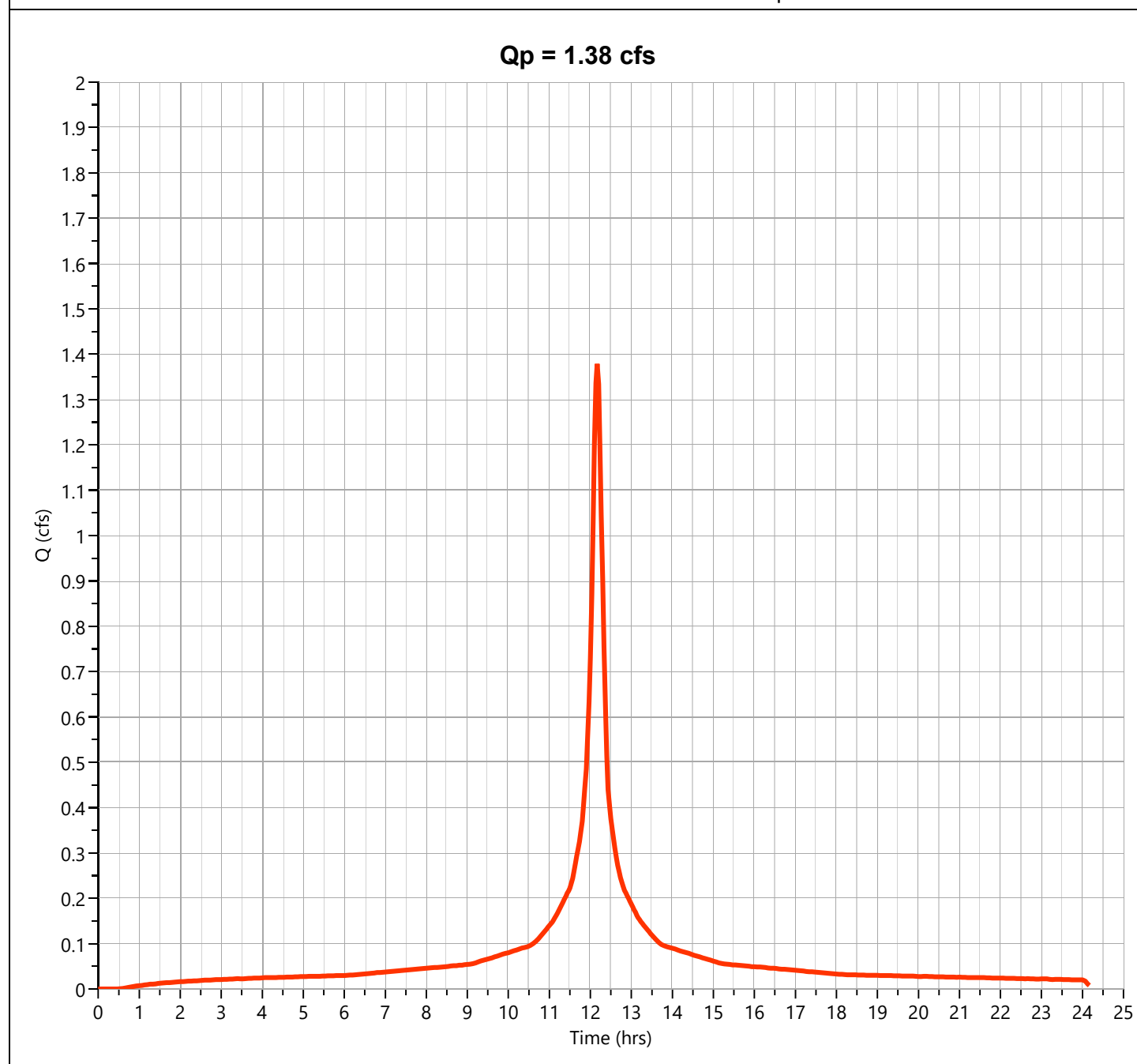
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5 - Imperv.

Hyd. No. 39

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.379 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 6,309 cuft
Drainage Area	= 0.19 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

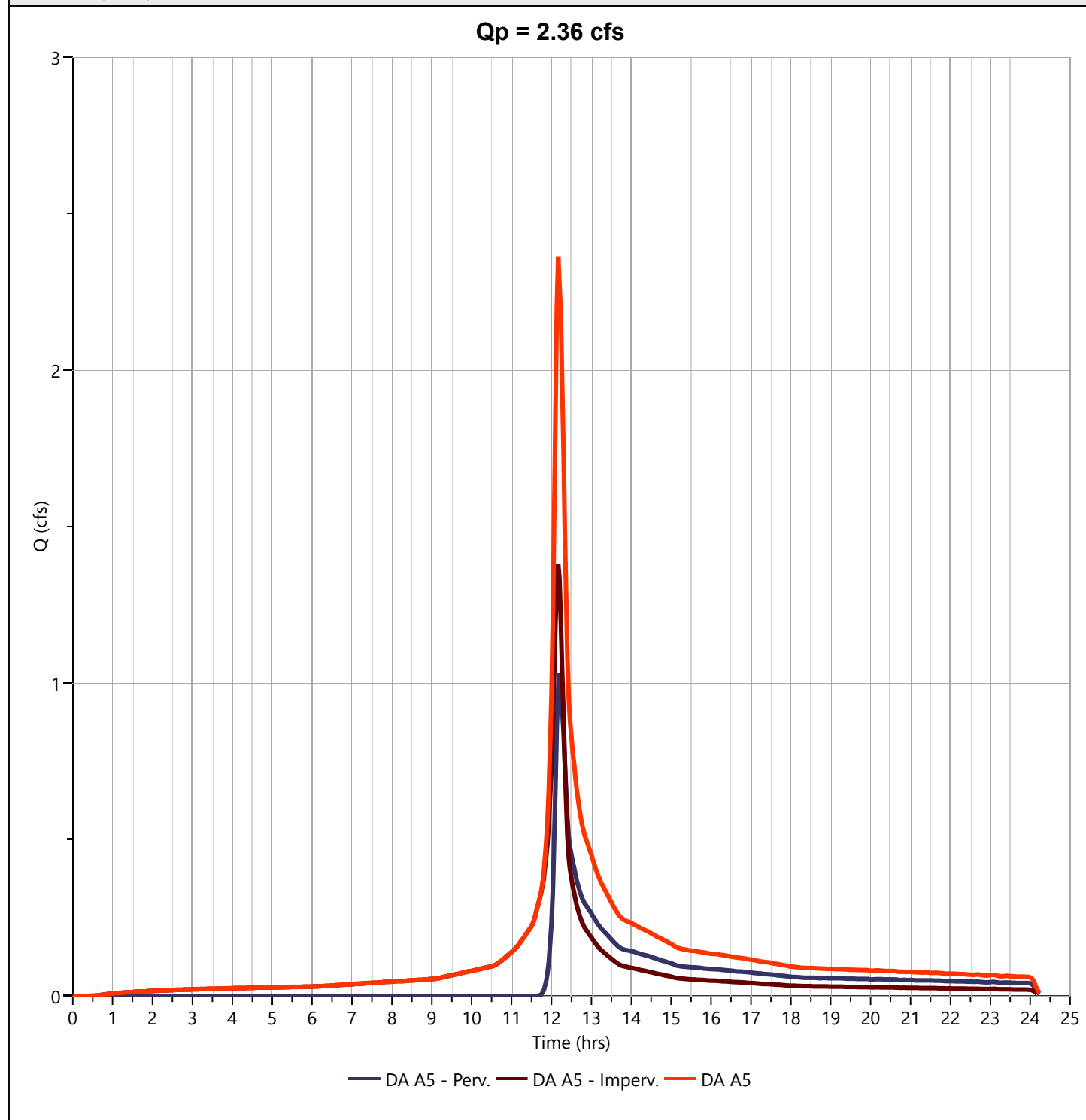
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5

Hyd. No. 40

Hydrograph Type	= Junction	Peak Flow	= 2.364 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 11,326 cuft
Inflow Hydrographs	= 38, 39	Total Contrib. Area	= 1.0 ac



Hydrograph Report

Project Name:

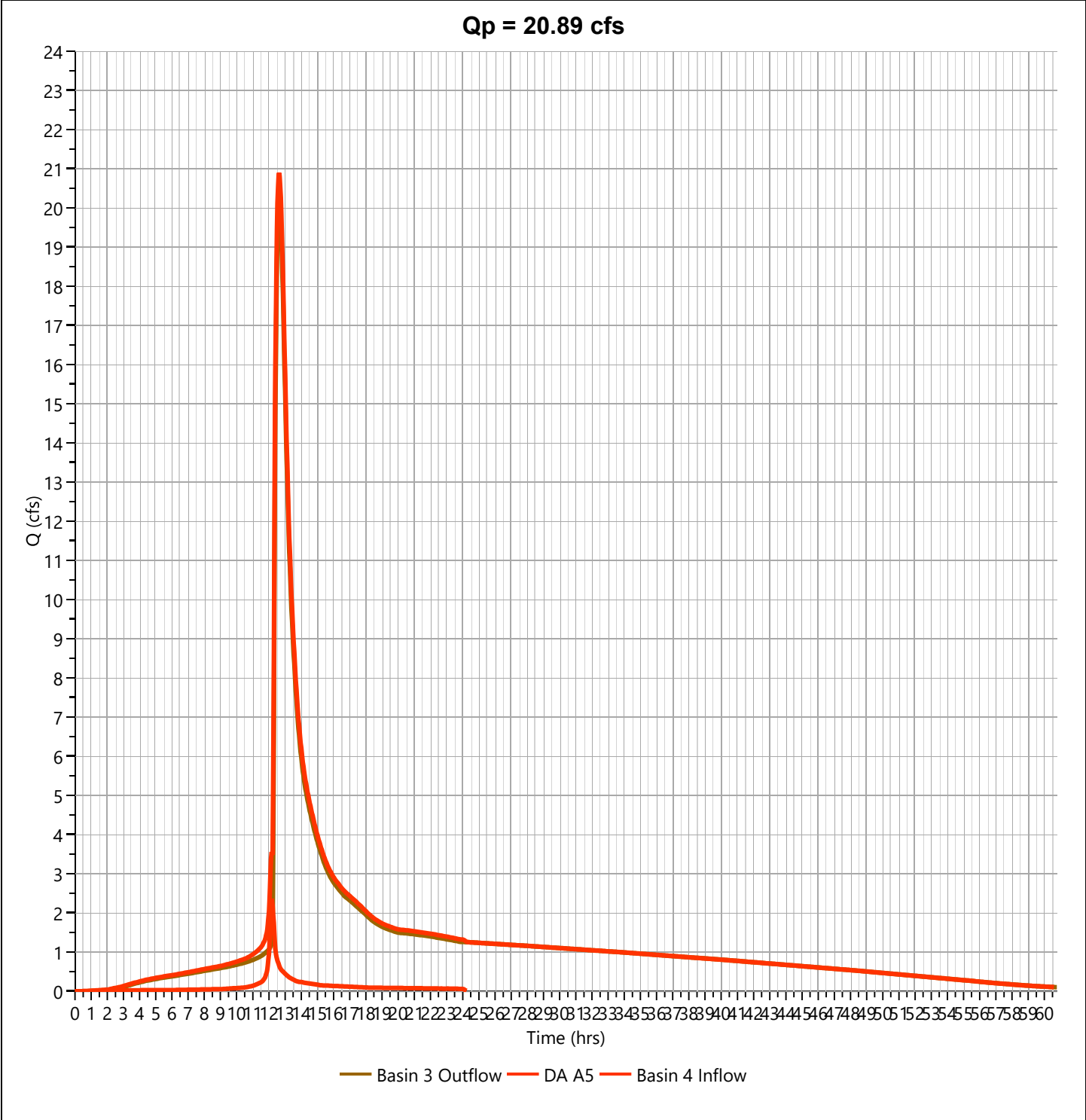
Hydrology Studio v 3.0.0.16

12-30-2020

Basin 4 Inflow

Hyd. No. 41

Hydrograph Type	= Junction	Peak Flow	= 20.89 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.63 hrs
Time Interval	= 2 min	Hydrograph Volume	= 281,466 cuft
Inflow Hydrographs	= 36, 40	Total Contrib. Area	= 1.0 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 4 Outflow

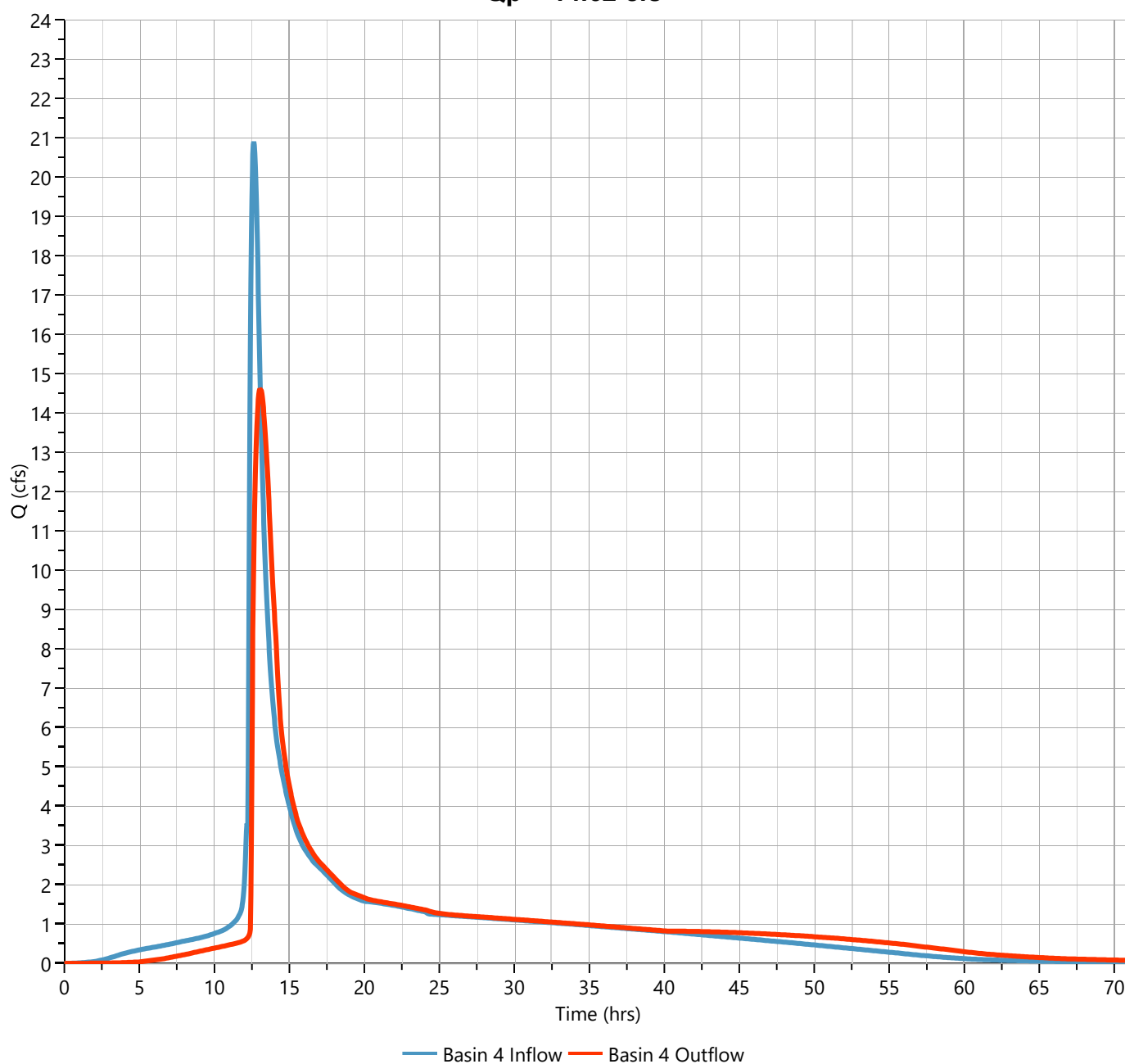
Hyd. No. 42

Hydrograph Type	= Pond Route	Peak Flow	= 14.62 cfs
Storm Frequency	= 100-yr	Time to Peak	= 13.07 hrs
Time Interval	= 2 min	Hydrograph Volume	= 280,349 cuft
Inflow Hydrograph	= 41 - Basin 4 Inflow	Max. Elevation	= 85.91 ft
Pond Name	= Basin 4	Max. Storage	= 38,502 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 3.22 hrs

Qp = 14.62 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6 - Perv.

Hyd. No. 44

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.00 hrs
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.84 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

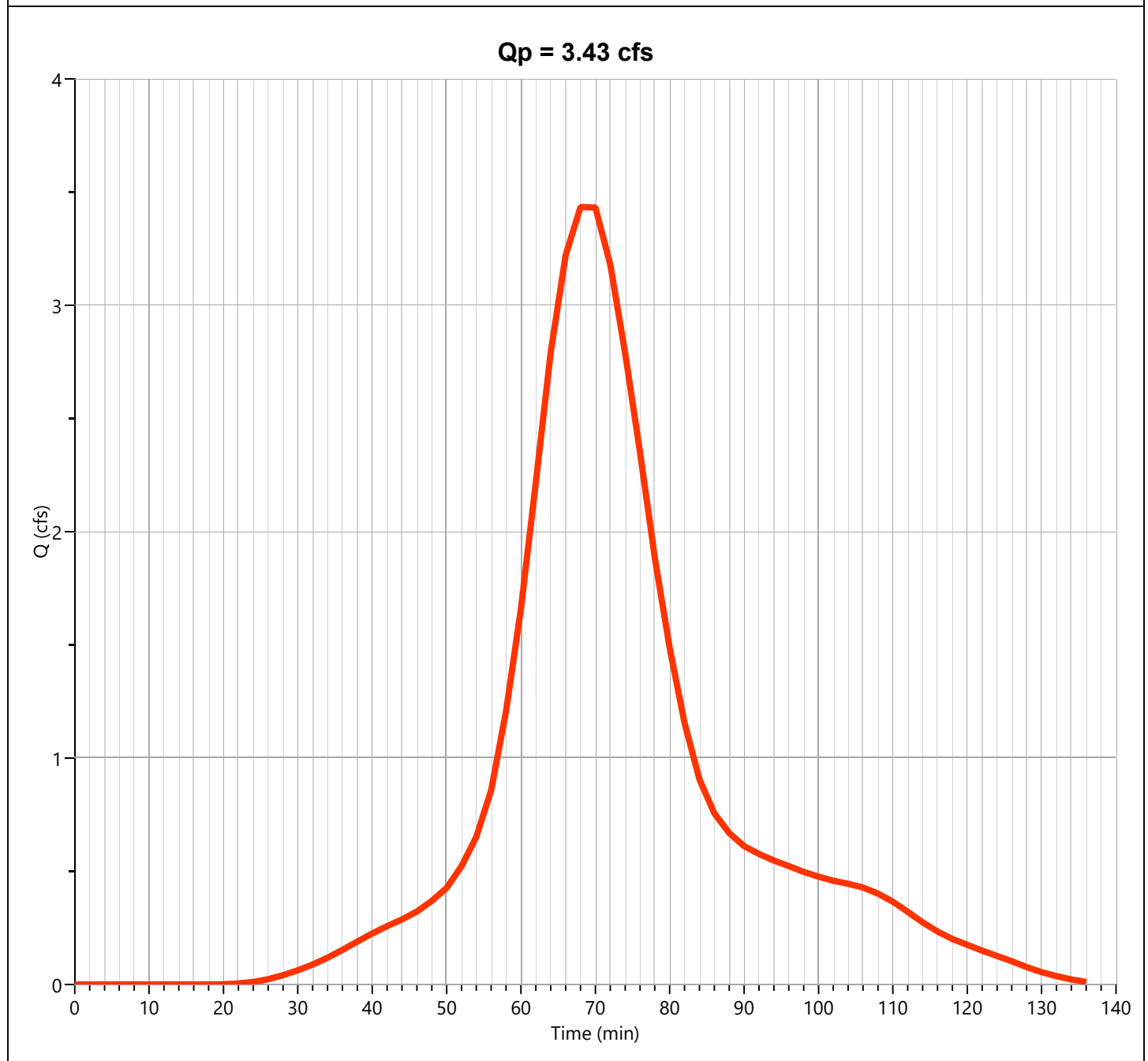
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6 - Imperv.

Hyd. No. 45

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.433 cfs
Storm Frequency	= 100-yr	Time to Peak	= 1.13 hrs
Time Interval	= 2 min	Runoff Volume	= 5,383 cuft
Drainage Area	= 1.39 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

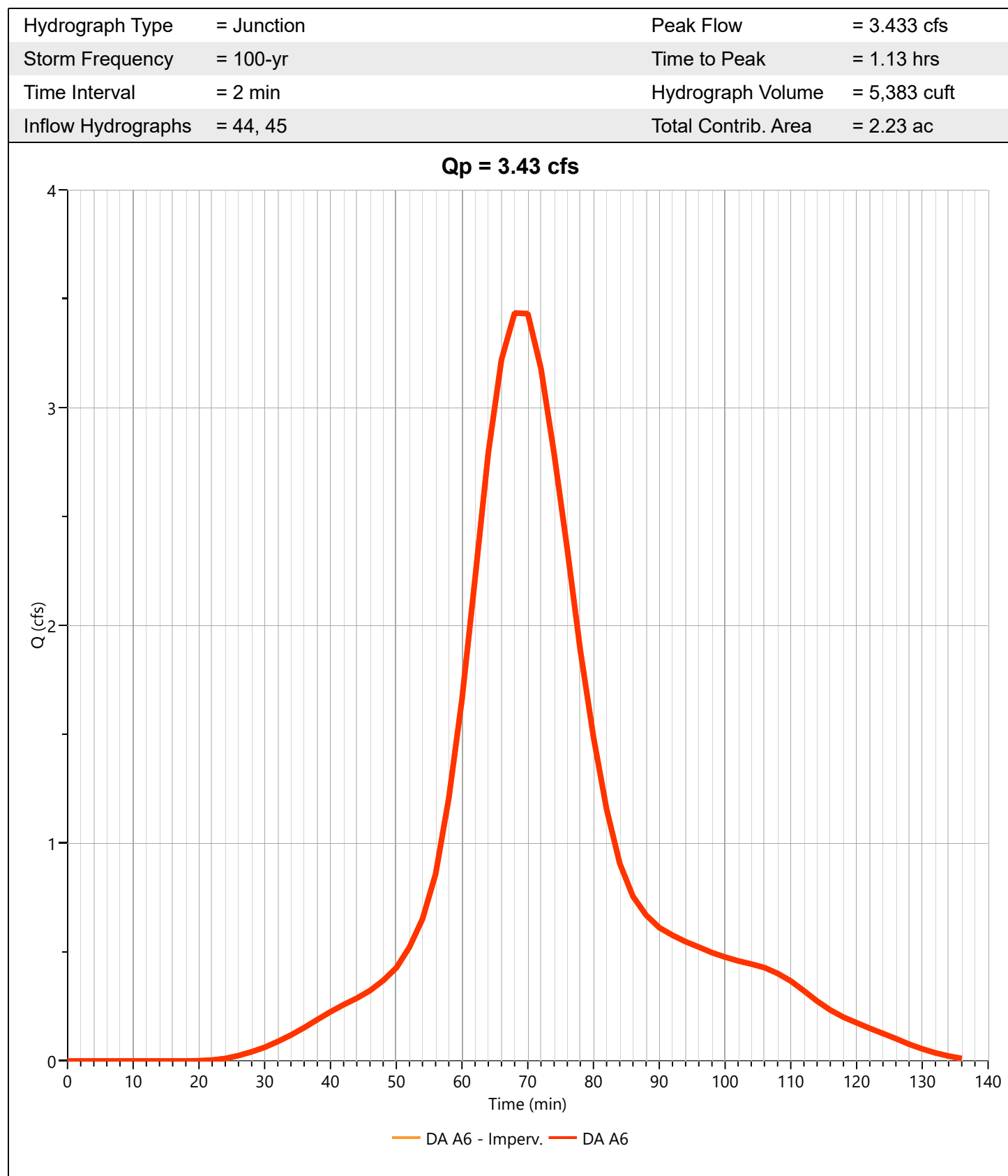
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6

Hyd. No. 46



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

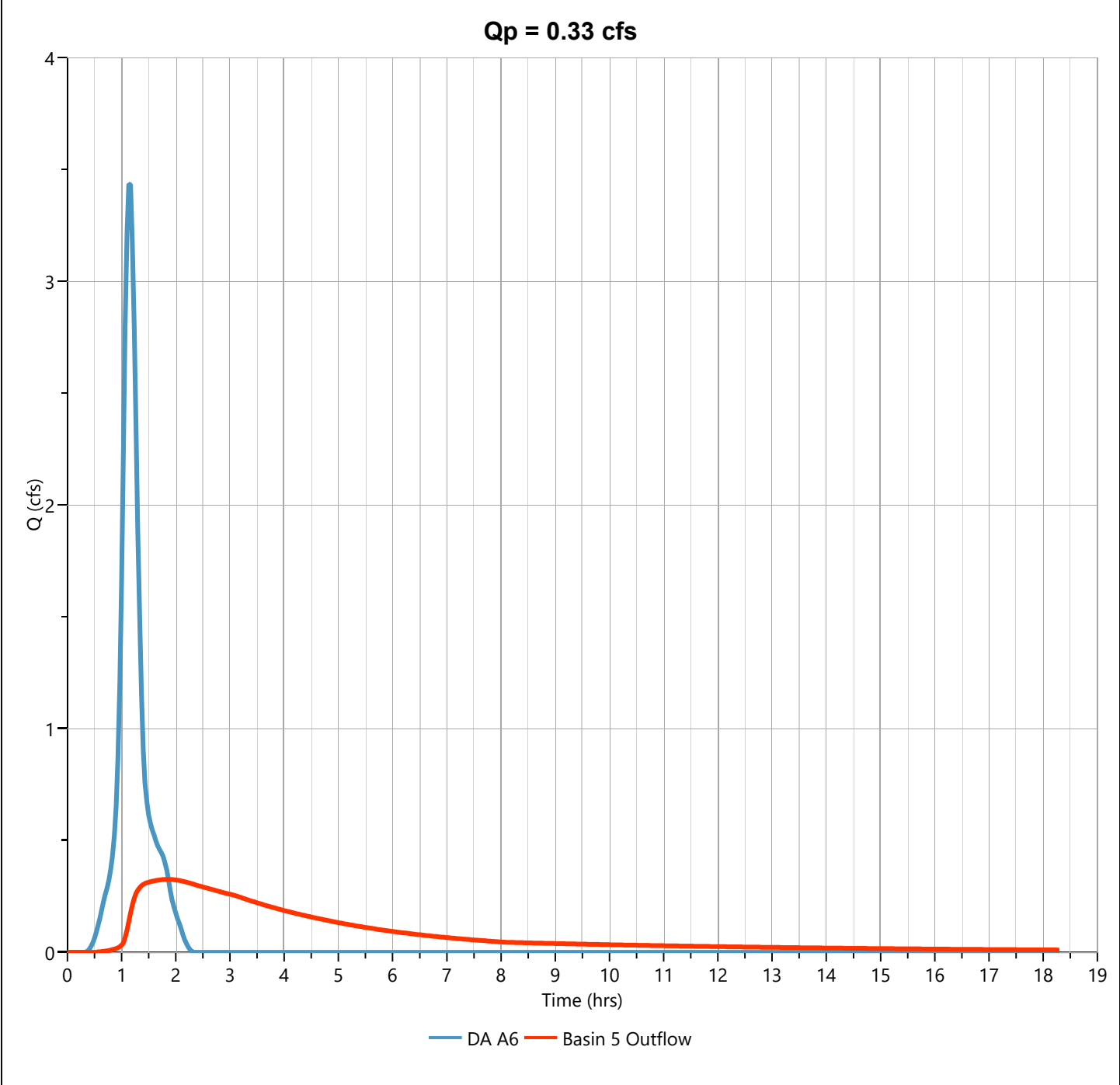
Basin 5 Outflow

Hyd. No. 47

Hydrograph Type	= Pond Route	Peak Flow	= 0.326 cfs
Storm Frequency	= 100-yr	Time to Peak	= 1.87 hrs
Time Interval	= 2 min	Hydrograph Volume	= 5,359 cuft
Inflow Hydrograph	= 46 - DA A6	Max. Elevation	= 73.40 ft
Pond Name	= Basin 5	Max. Storage	= 4,365 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 4.19 hrs



Hydrograph Report

Project Name:

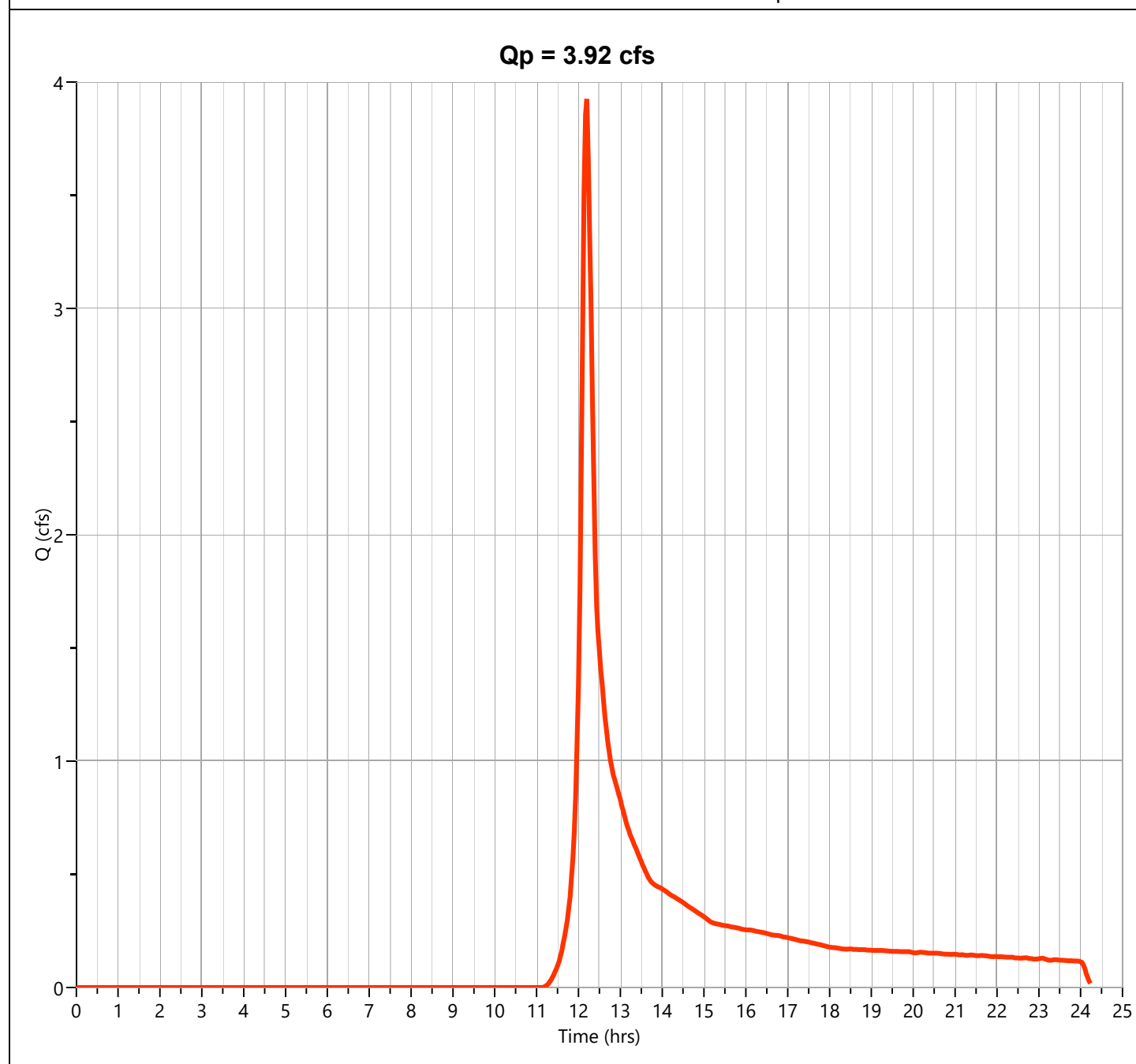
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A7

Hyd. No. 49

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.924 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 16,731 cuft
Drainage Area	= 1.9 ac	Curve Number	= 45
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

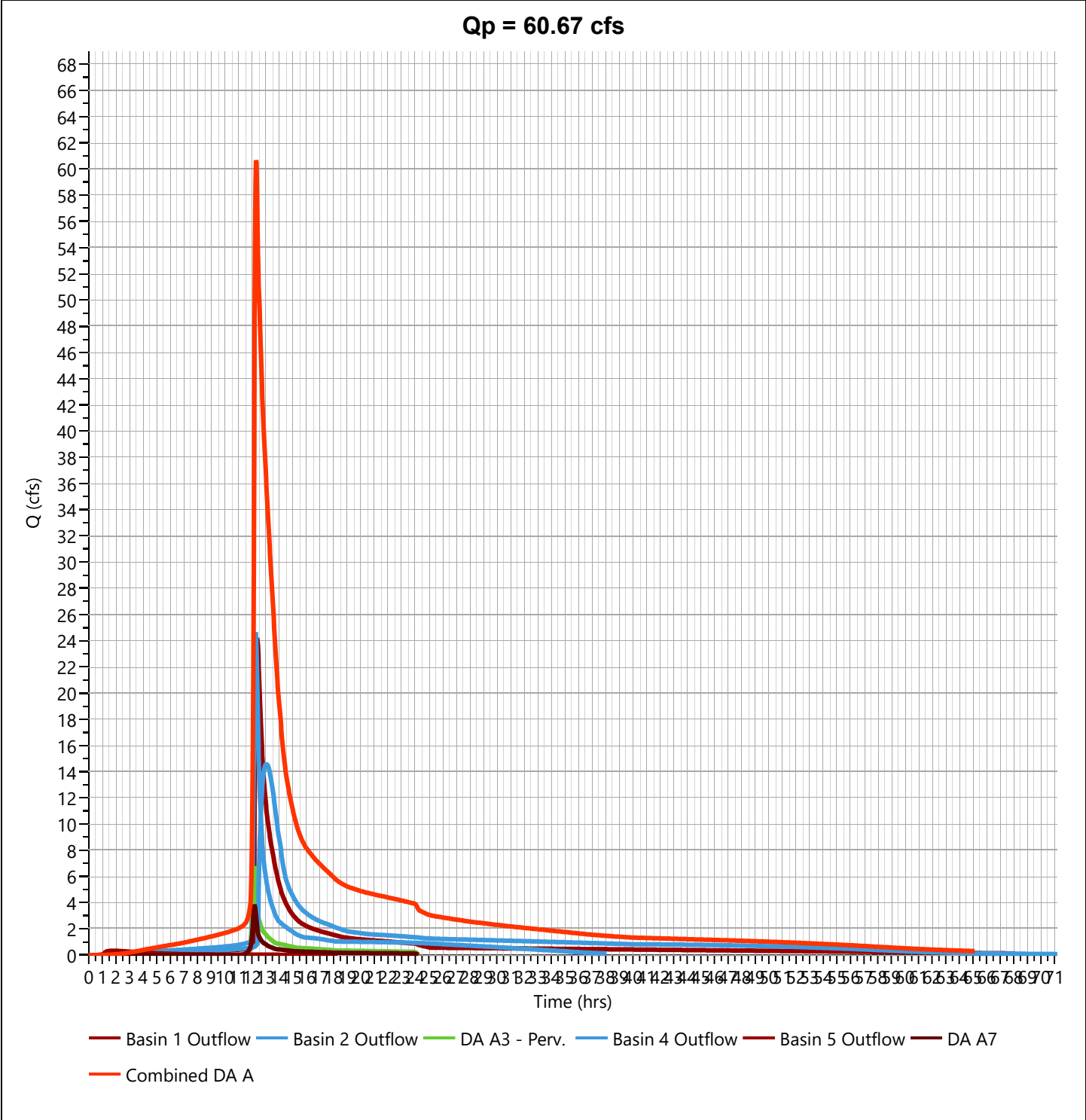
Hydrology Studio v 3.0.0.16

12-30-2020

Combined DA A

Hyd. No. 51

Hydrograph Type	= Junction	Peak Flow	= 60.67 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.30 hrs
Time Interval	= 2 min	Hydrograph Volume	= 745,215 cuft
Inflow Hydrographs	= 17, 22, 24, 42, 47, 49	Total Contrib. Area	= 6.31 ac



Hydrograph Report

Project Name:

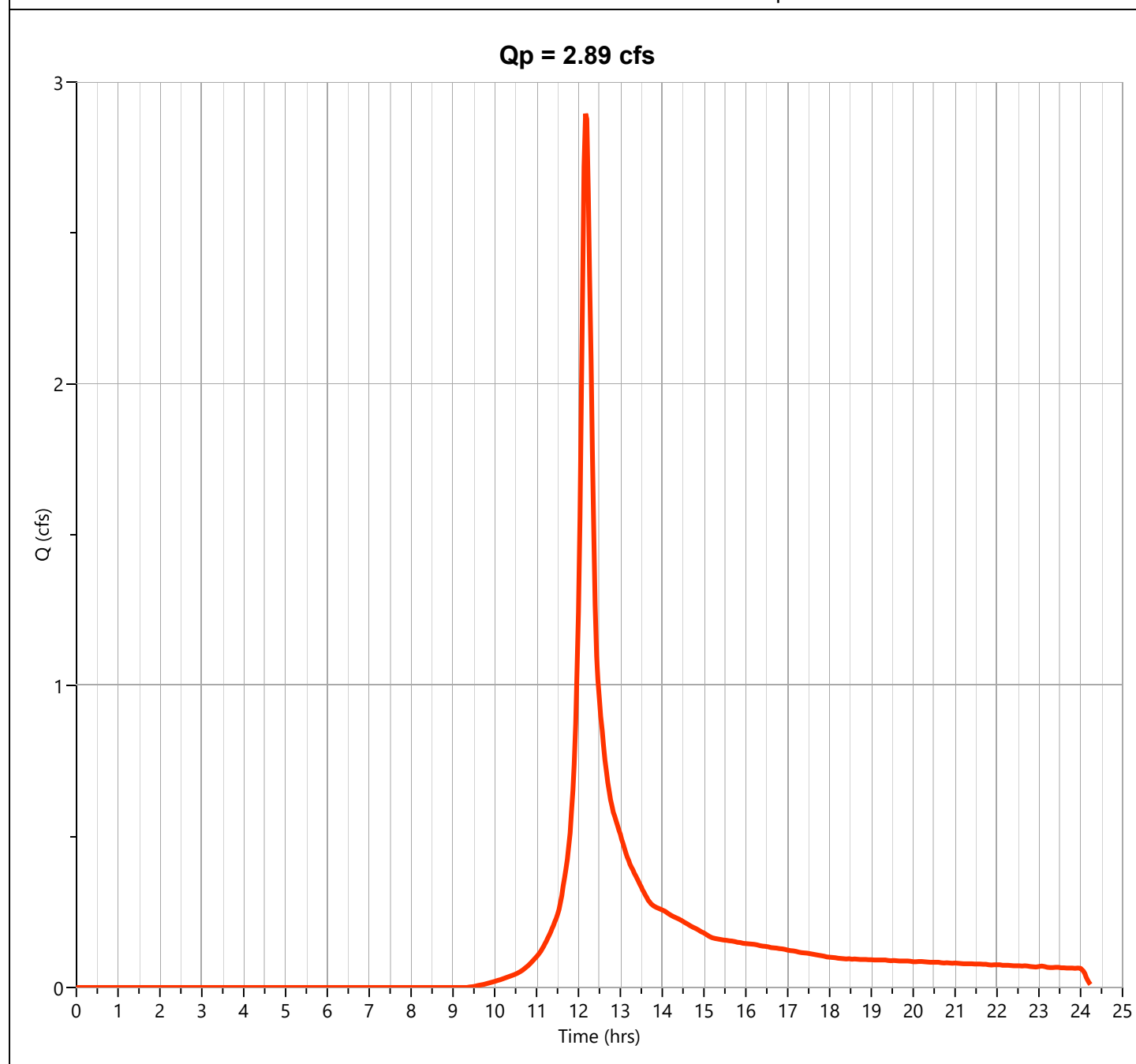
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA B - Perv.

Hyd. No. 53

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.895 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 11,425 cuft
Drainage Area	= 0.8 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

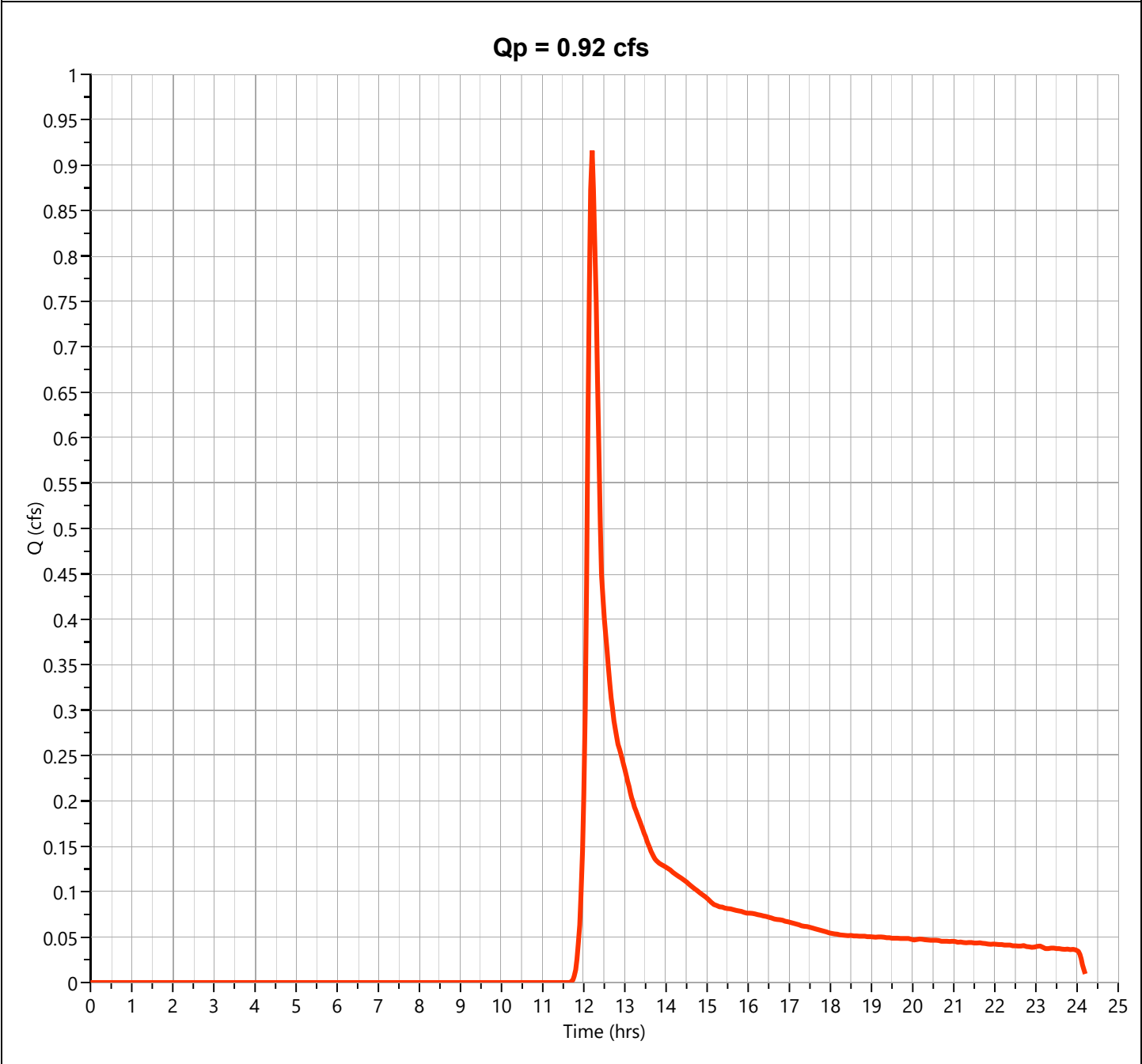
Hydrology Studio v 3.0.0.16

12-30-2020

Pre DA C - Perv.

Hyd. No. 55

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.916 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 4,460 cuft
Drainage Area	= 0.72 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

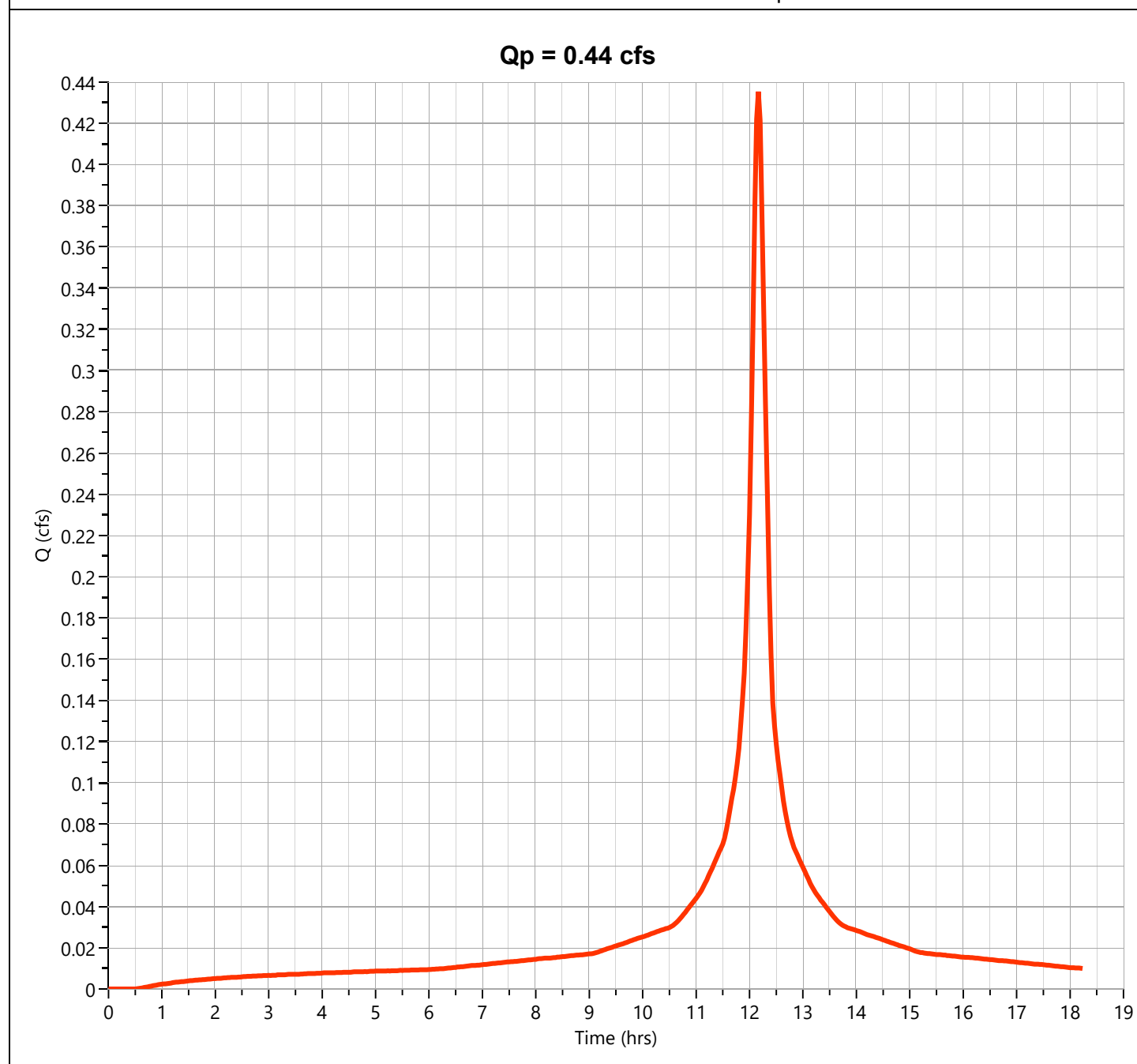
Hydrology Studio v 3.0.0.16

12-30-2020

Pre DA C - Imperv.

Hyd. No. 56

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.435 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 1,992 cuft
Drainage Area	= 0.06 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

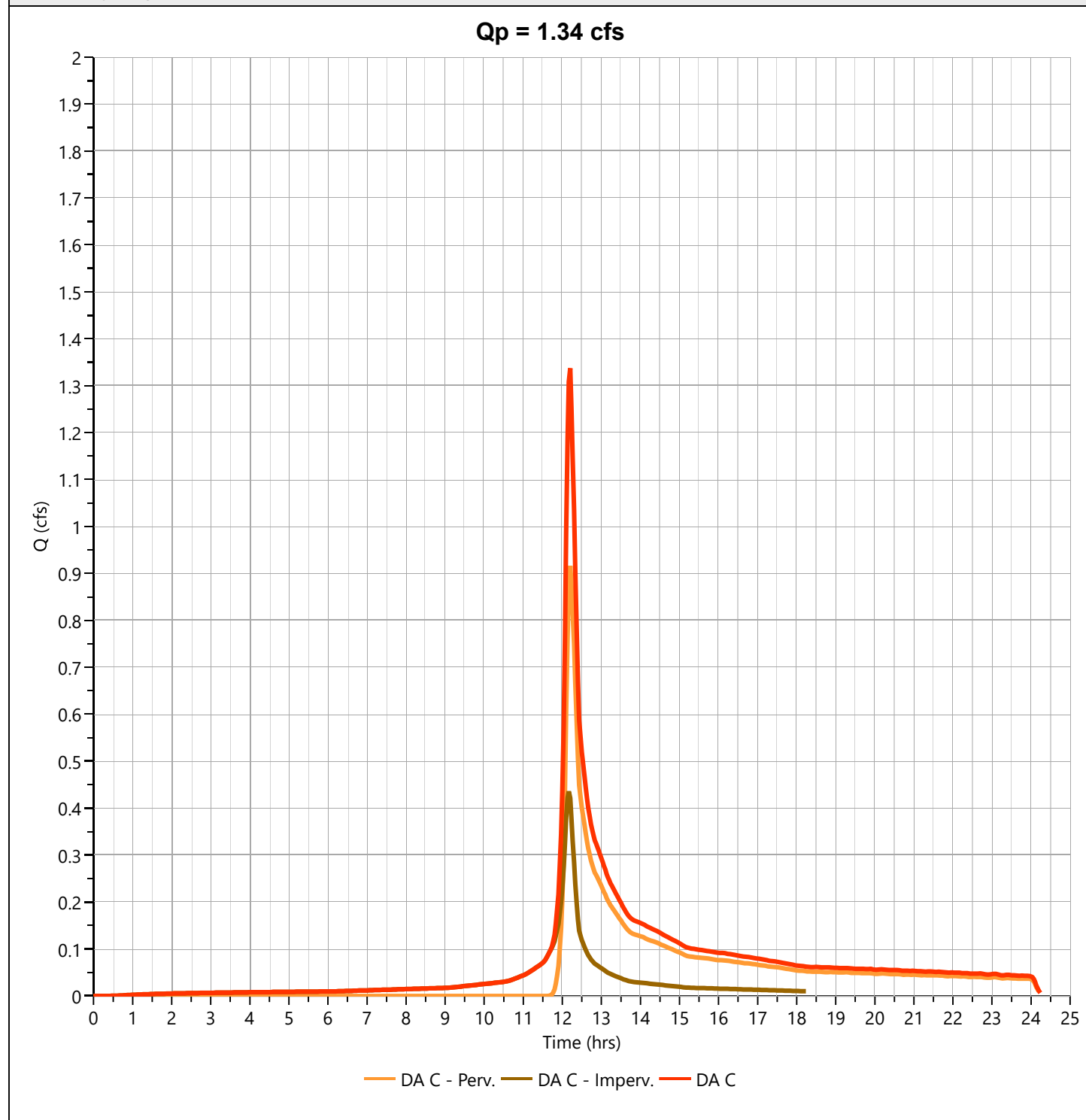
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA C

Hyd. No. 57

Hydrograph Type	= Junction	Peak Flow	= 1.337 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 6,452 cuft
Inflow Hydrographs	= 55, 56	Total Contrib. Area	= 0.78 ac



APPENDIX C

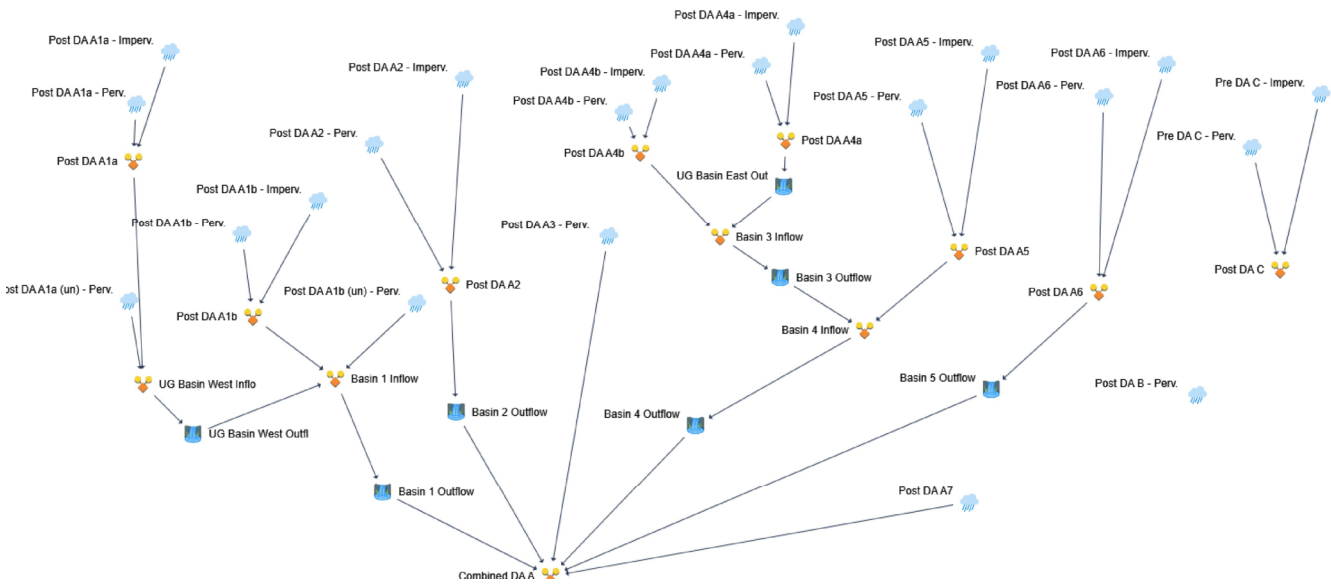
Water Quality Calculations

Basin Model

Hydrology Studio v 3.0.0.16

Project Name:

12-30-2020



Hydrograph 1-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (min)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	Post DAA1a - Perv.	0.000	0	0.000	----		
2	NRCS Runoff	Post DAA1a - Imperv.	6.496	68	10,186	----		
3	Junction	Post DAA1a	6.496	68	10,186	1, 2		
5	NRCS Runoff	Post DAA1a (un) - Perv.	0.000	0	0.000	----		
7	Junction	UG Basin West Inflow	6.496	68	10,186	3, 5		
8	Pond Route	UG Basin West Outflow	4.014	76	10,185	7	101.14	2,649
10	NRCS Runoff	Post DAA1b - Perv.	0.000	0	0.000	----		
11	NRCS Runoff	Post DAA1b - Imperv.	5.385	68	8,443	----		
12	Junction	Post DAA1b	5.385	68	8,443	10, 11		
14	NRCS Runoff	Post DAA1b (un) - Perv.	0.008	106	16.7	----		
16	Junction	Basin 1 Inflow	8.940	70	18,645	8, 12, 14		
17	Pond Route	Basin 1 Outflow	0.306	128	18,560	16	96.05	17,537
19	NRCS Runoff	Post DAA2 - Perv.	0.000	0	0.000	----		
20	NRCS Runoff	Post DAA2 - Imperv.	10.74	68	16,847	----		
21	Junction	Post DAA2	10.74	68	16,847	19, 20		
22	Pond Route	Basin 2 Outflow	0.645	118	16,803	21	84.17	14,591
24	NRCS Runoff	Post DAA3 - Perv.	0.000	0	0.000	----		
26	NRCS Runoff	Post DAA4a - Perv.	0.000	0	0.000	----		
27	NRCS Runoff	Post DAA4a - Imperv.	11.14	68	17,467	----		
28	Junction	Post DAA4a	11.14	68	17,467	26, 27		
29	Pond Route	UG Basin East Out	9.591	74	17,466	28	101.24	2,914
31	NRCS Runoff	Post DAA4b - Perv.	0.000	0	0.000	----		
32	NRCS Runoff	Post DAA4b - Imperv.	5.187	68	8,133	----		
33	Junction	Post DAA4b	5.187	68	8,133	31, 32		
35	Junction	Basin 3 Inflow	14.36	72	25,599	29, 33		
36	Pond Route	Basin 3 Outflow	0.629	126	25,536	35	90.33	23,332

Hydrograph 1-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (min)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
38	NRCS Runoff	Post DAA5 - Perv.	0.000	0	0.000	----		
39	NRCS Runoff	Post DAA5 - Imperv.	0.469	68	736	----		
40	Junction	Post DAA5	0.469	68	736	38, 39		
41	Junction	Basin 4 Inflow	0.820	72	26,272	36, 40		
42	Pond Route	Basin 4 Outflow	0.391	536	26,127	41	84.43	8,213
44	NRCS Runoff	Post DAA6 - Perv.	0.000	0	0.000	----		
45	NRCS Runoff	Post DAA6 - Imperv.	3.433	68	5,383	----		
46	Junction	Post DAA6	3.433	68	5,383	44, 45		
47	Pond Route	Basin 5 Outflow	0.326	112	5,359	46	73.40	4,365
49	NRCS Runoff	Post DAA7	0.000	0	0.000	----		
51	Junction	Combined DAA	1.332	128	66,848	17, 22, 24, 42, 47, 49		
53	NRCS Runoff	Post DA B - Perv.	0.000	0	0.000	----		
55	NRCS Runoff	Pre DA C - Perv.	0.000	0	0.000	----		
56	NRCS Runoff	Pre DA C - Imperv.	0.148	68	232	----		
57	Junction	Post DA C	0.148	68	232	55, 56		

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a - Perv.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 1.25 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 19.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

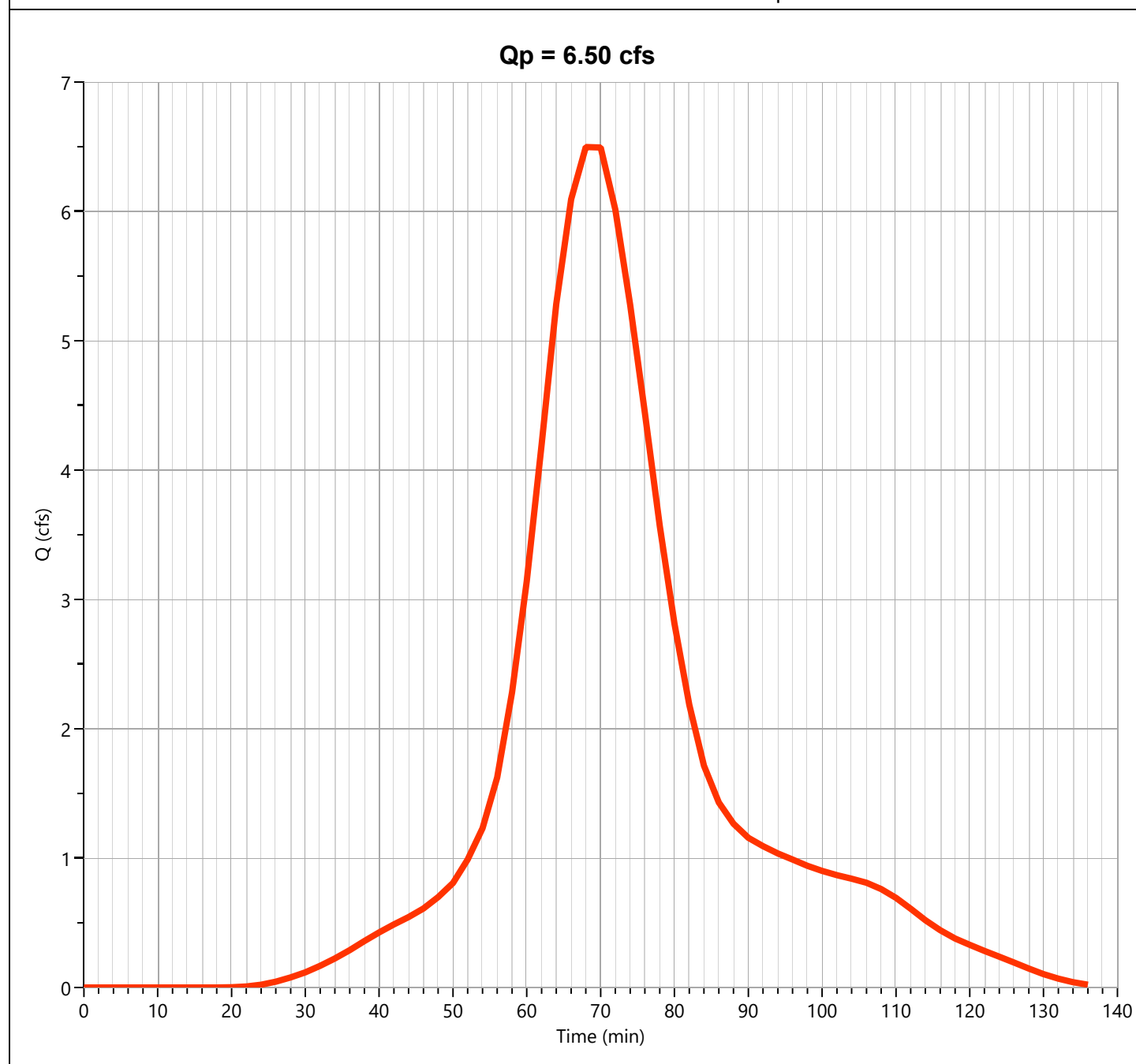
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a - Imperv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.496 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Runoff Volume	= 10,186 cuft
Drainage Area	= 2.63 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484



Hydrograph Report

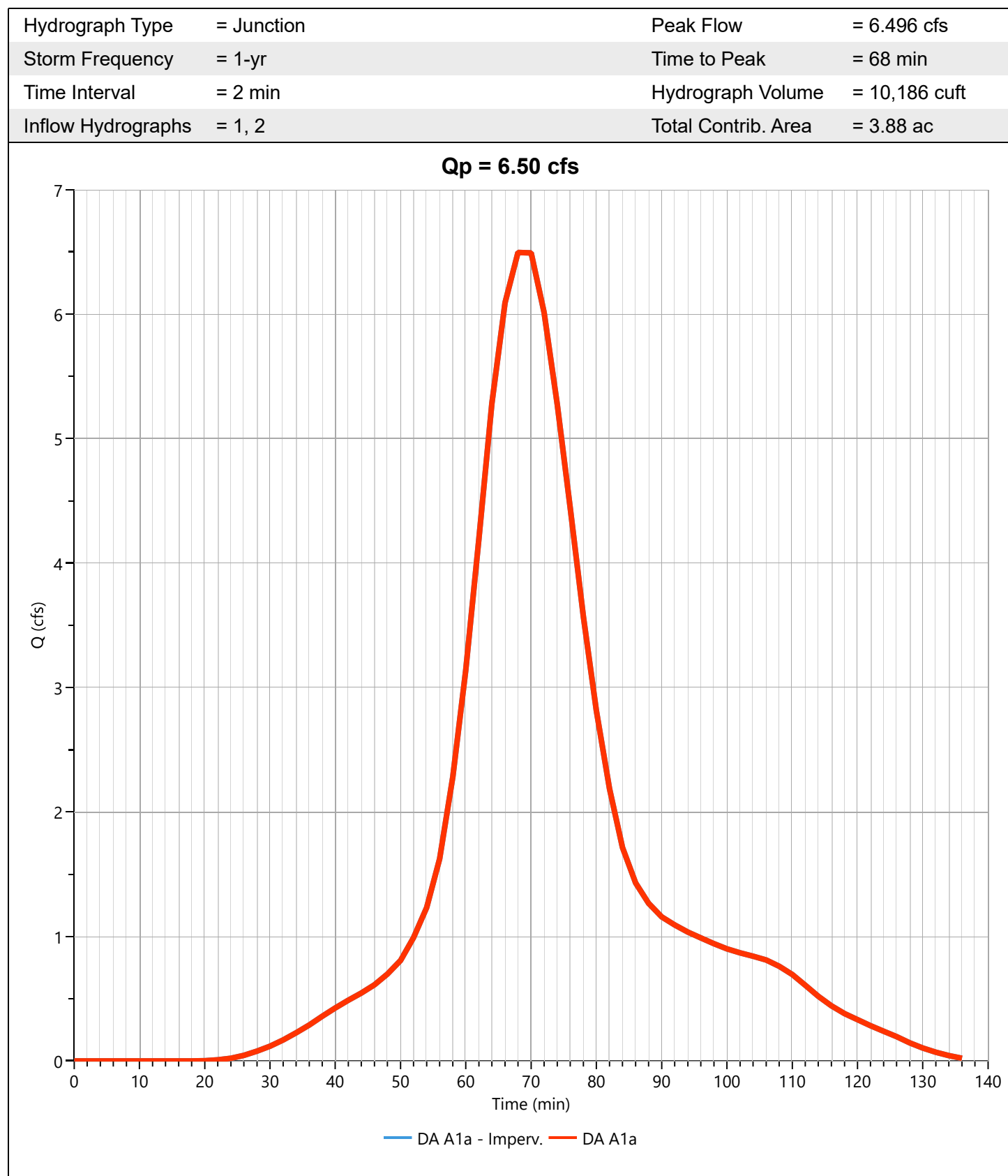
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a

Hyd. No. 3



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1a (un) - Perv.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 1.29 ac	Curve Number	= 58
Tc Method	= User	Time of Conc. (Tc)	= 16.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

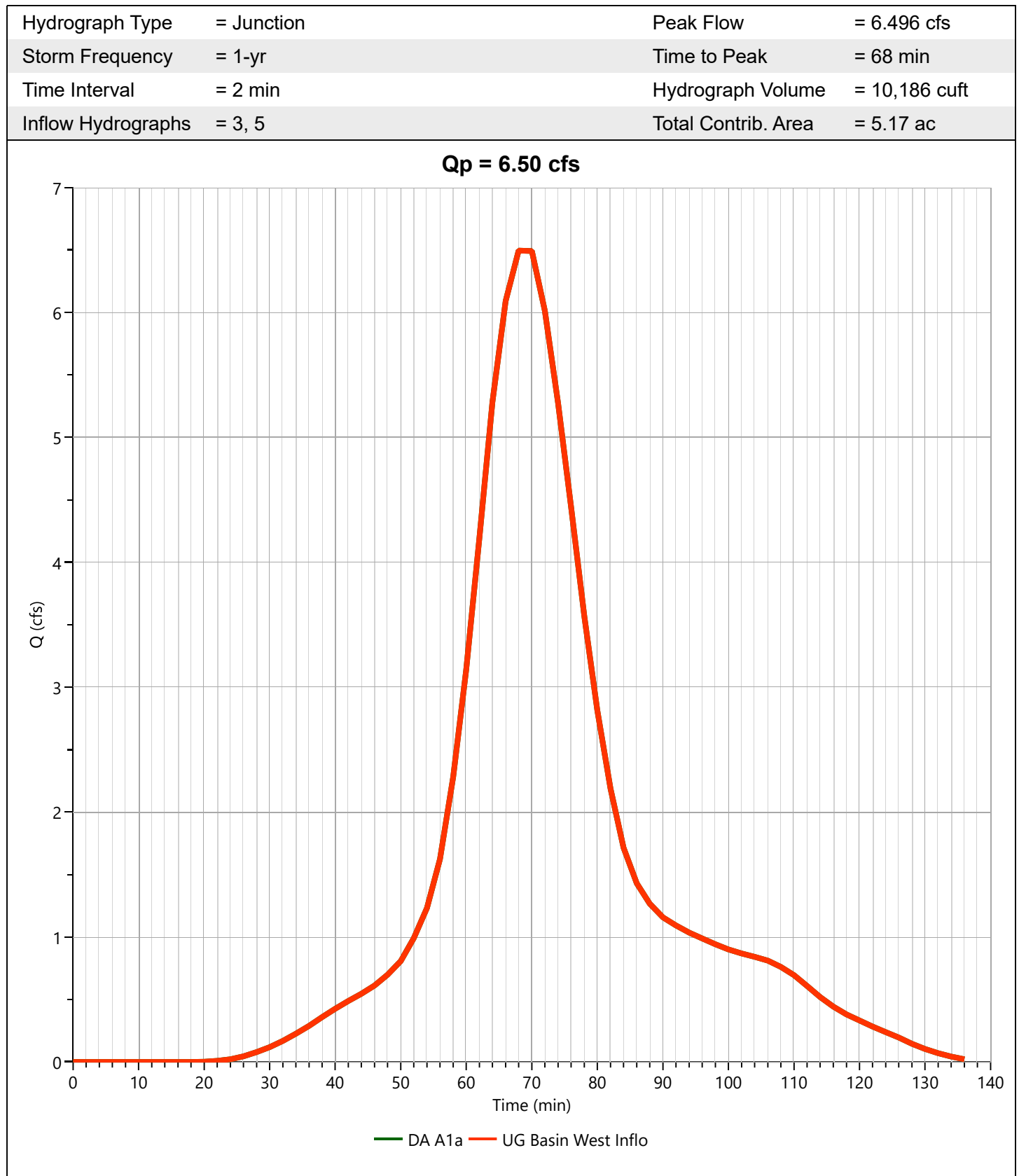
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Basin West Inflo

Hyd. No. 7



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Basin West Outfl

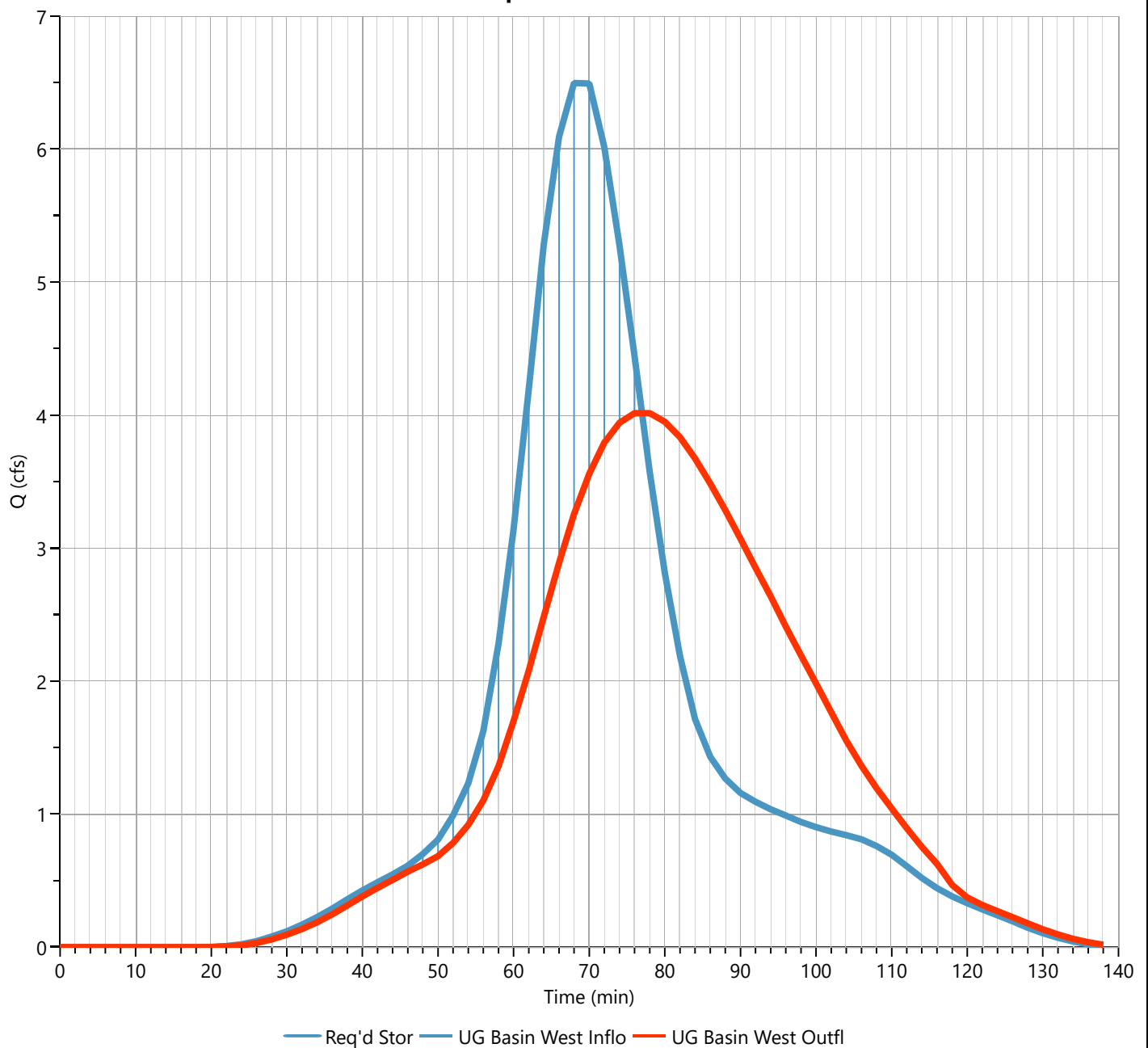
Hyd. No. 8

Hydrograph Type	= Pond Route	Peak Flow	= 4.014 cfs
Storm Frequency	= 1-yr	Time to Peak	= 76 min
Time Interval	= 2 min	Hydrograph Volume	= 10,185 cuft
Inflow Hydrograph	= 7 - UG Basin West Inflo	Max. Elevation	= 101.14 ft
Pond Name	= UG Recharge / Detention Basin West	Max. Storage	= 2,649 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 7 min

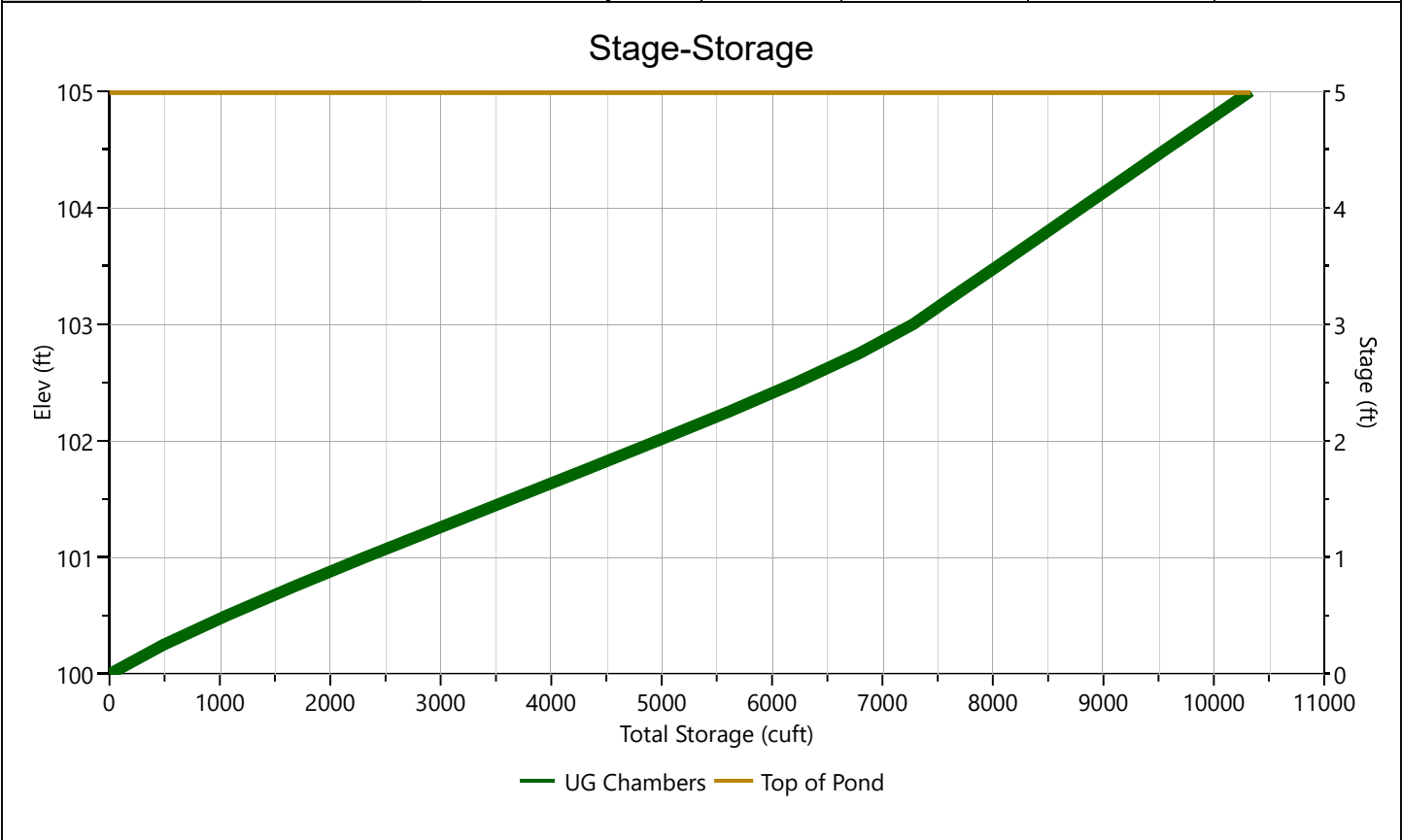
Qp = 4.01 cfs



UG Recharge / Detention Basin West

Stage-Storage

Underground Chambers		Stage / Storage Table				
Description	Input	Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
Invert Elev Down, ft	100.00	0.00	100.00	3,816	0.000	0.000
Chamber Rise, ft	3.00	0.25	100.25	3,816	489	489
Chamber Shape	Circular	0.50	100.50	3,816	570	1,059
Chamber Span, ft	3.00	0.75	100.75	3,816	614	1,673
Barrel Length, ft	200.00	1.00	101.00	3,816	641	2,314
No. Barrels	3	1.25	101.25	3,816	659	2,973
Barrel Slope, %	0.00	1.50	101.50	3,816	667	3,639
Headers, y/n	Yes	1.75	101.75	3,816	667	4,306
Stone Encasement, y/n	Yes	2.00	102.00	3,816	659	4,965
Encasement Bottom Elevation, ft	100.00	2.25	102.25	3,816	641	5,606
Encasement Width per Chamber, ft	6.00	2.50	102.50	3,816	614	6,219
Encasement Depth, ft	5.00	2.75	102.75	3,816	569	6,789
Encasement Voids, %	40.00	3.00	103.00	3,816	489	7,278
		3.25	103.25	3,816	382	7,660
		3.50	103.50	3,816	382	8,041
		3.75	103.75	3,816	382	8,423
		4.00	104.00	3,816	382	8,805
		4.25	104.25	3,816	382	9,186
		4.50	104.50	3,816	382	9,568
		4.75	104.75	3,816	382	9,950
		5.00	105.00	3,816	382	10,331



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

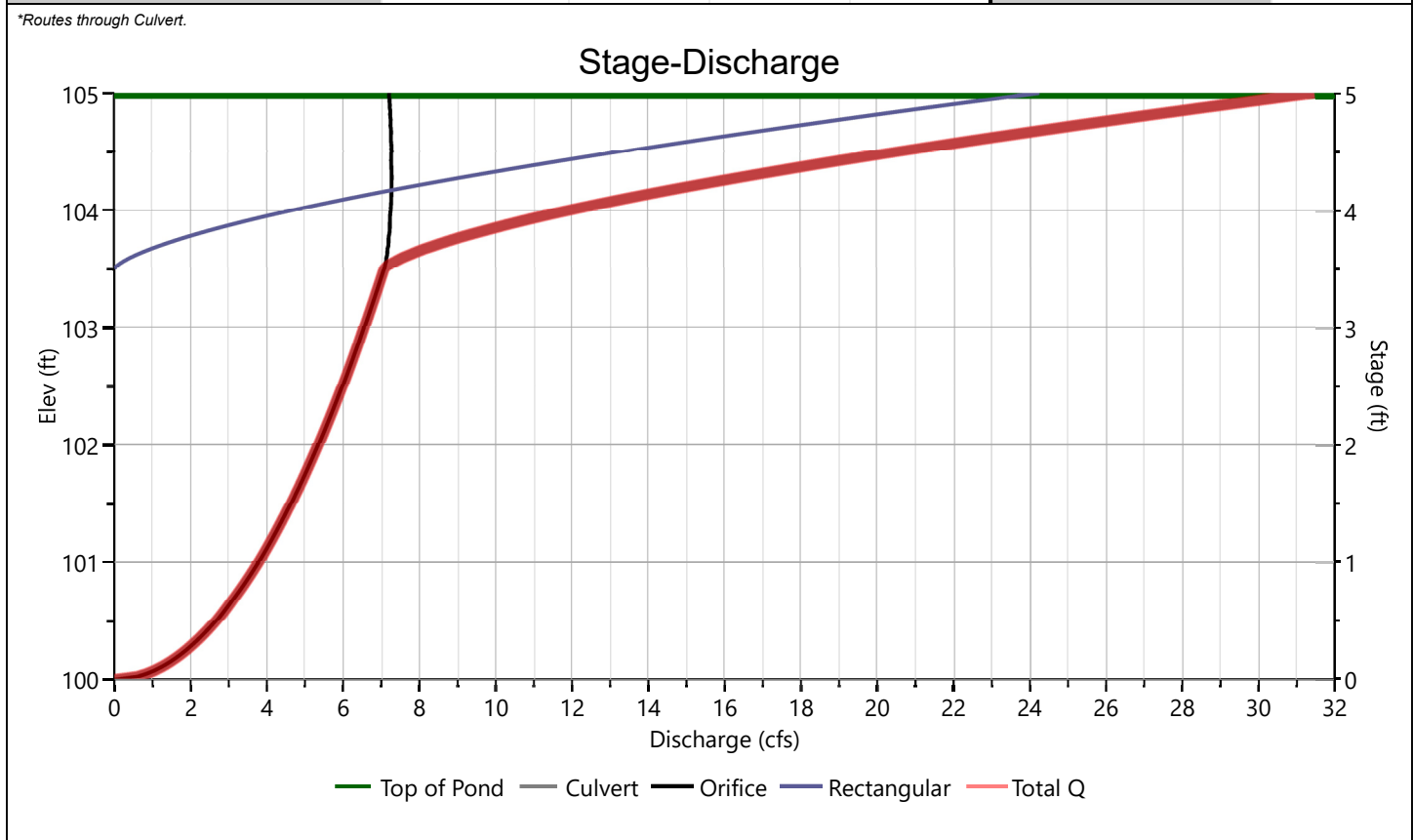
12-30-2020

UG Recharge / Detention Basin West

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	36	12			Hole Diameter, in
Span, in	36	12			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	99.00	99.00			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	211				
Barrel Slope, %	1.42				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type		Rectangular			Exfiltration, in/hr
Crest Elevation, ft		103.5			
Crest Length, ft		4			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Recharge / Detention Basin West

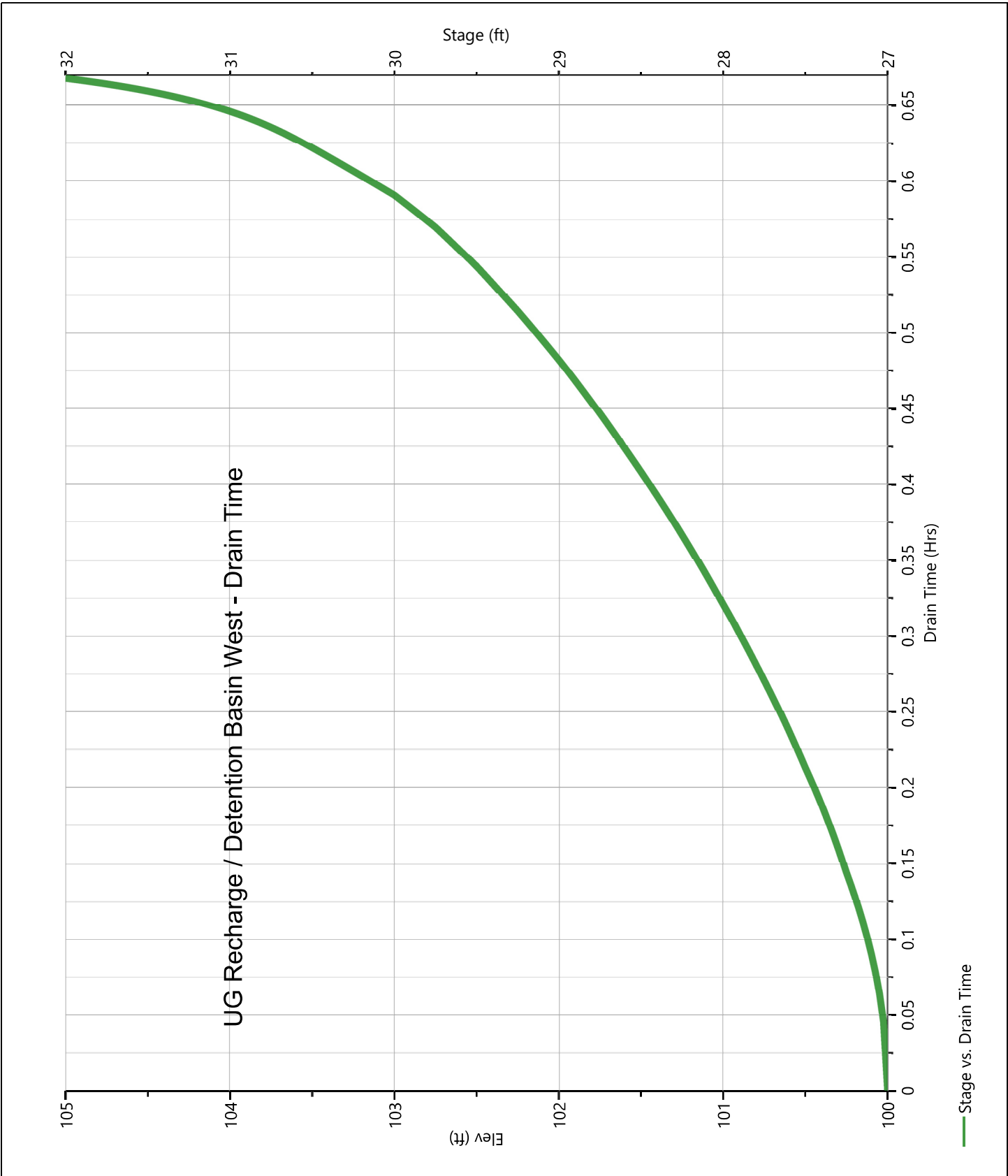
Stage-Storage-Discharge Summary

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	100.00	0.000	0.000	0.000				0.000						0.000
0.25	100.25	489	1.891 ic	1.891				0.000						1.891
0.50	100.50	1,059	2.674 ic	2.674				0.000						2.674
0.75	100.75	1,673	3.275 ic	3.275				0.000						3.275
1.00	101.00	2,314	3.781 ic	3.781				0.000						3.781
1.25	101.25	2,973	4.228 ic	4.228				0.000						4.228
1.50	101.50	3,639	4.631 ic	4.631				0.000						4.631
1.75	101.75	4,306	5.002 ic	5.002				0.000						5.002
2.00	102.00	4,965	5.347 ic	5.347				0.000						5.347
2.25	102.25	5,606	5.672 ic	5.672				0.000						5.672
2.50	102.50	6,219	5.979 ic	5.979				0.000						5.979
2.75	102.75	6,789	6.270 ic	6.270				0.000						6.270
3.00	103.00	7,278	6.549 ic	6.549				0.000						6.549
3.25	103.25	7,660	6.817 ic	6.817				0.000						6.817
3.50	103.50	8,041	7.074 ic	7.074				0.000						7.074
3.75	103.75	8,423	8.847 ic	7.197				1.650						8.847
4.00	104.00	8,805	11.92 ic	7.249				4.667						11.92
4.25	104.25	9,186	15.85 ic	7.276				8.574						15.85
4.50	104.50	9,568	20.47 ic	7.269				13.20						20.47
4.75	104.75	9,950	25.70 ic	7.250				18.45						25.70
5.00	105.00	10,331	31.46 ic	7.212				24.25						31.46

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

UG Recharge / Detention Basin West

Pond Drawdown



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b - Perv.

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 1.46 ac	Curve Number	= 47
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

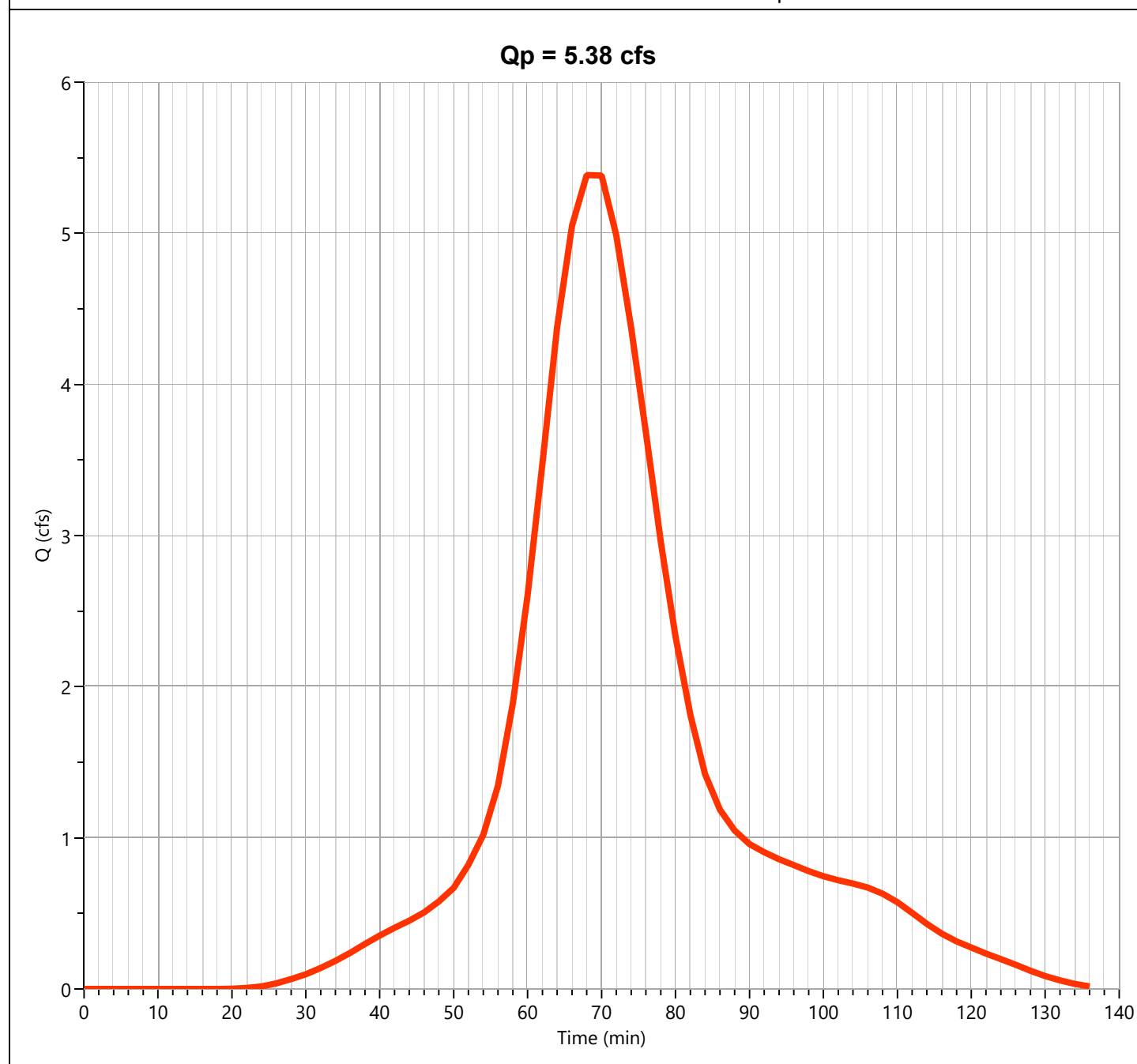
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b - Imperv.

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.385 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Runoff Volume	= 8,443 cuft
Drainage Area	= 2.18 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

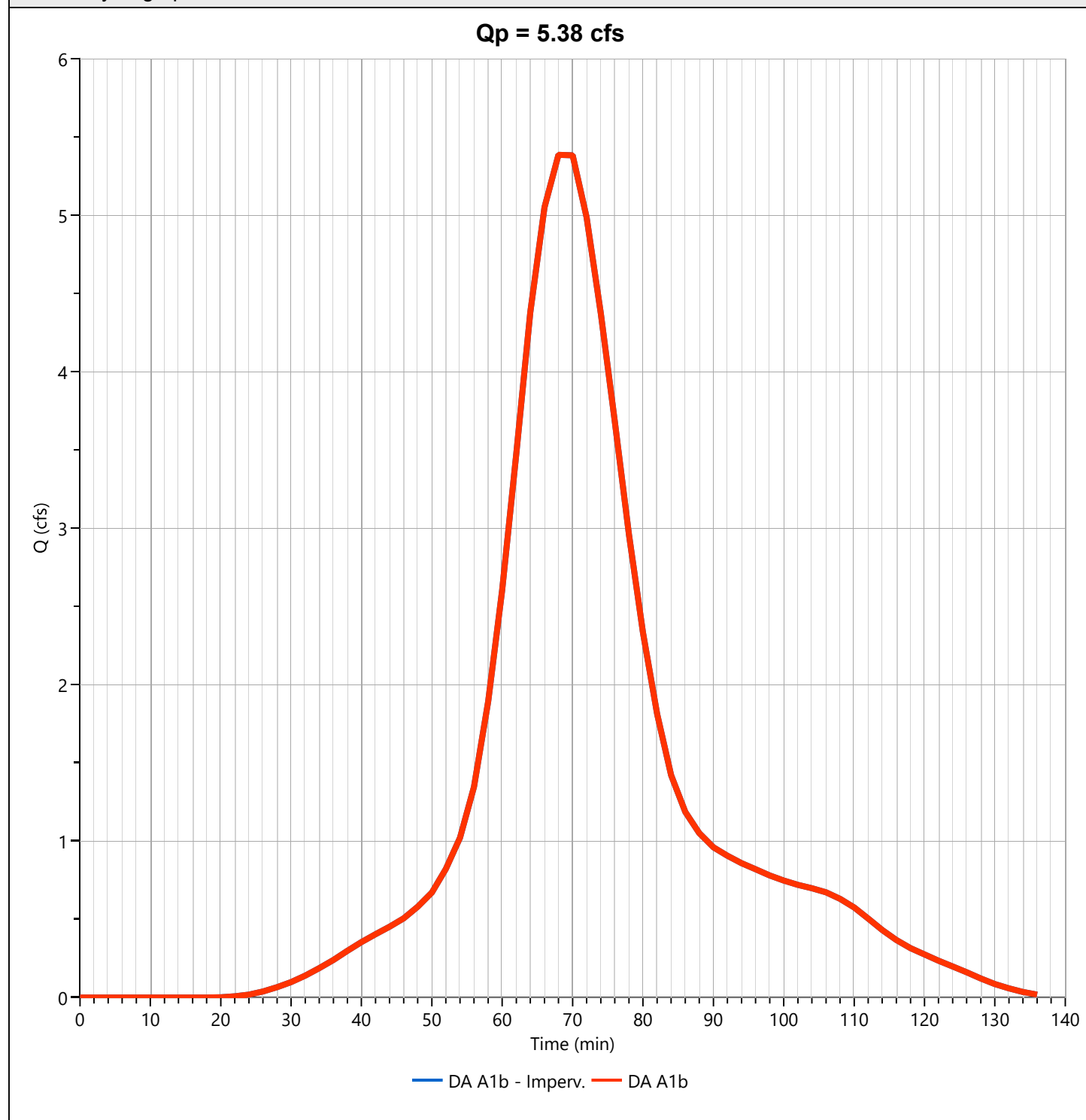
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b

Hyd. No. 12

Hydrograph Type	= Junction	Peak Flow	= 5.385 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Hydrograph Volume	= 8,443 cuft
Inflow Hydrographs	= 10, 11	Total Contrib. Area	= 3.64 ac



Hydrograph Report

Project Name:

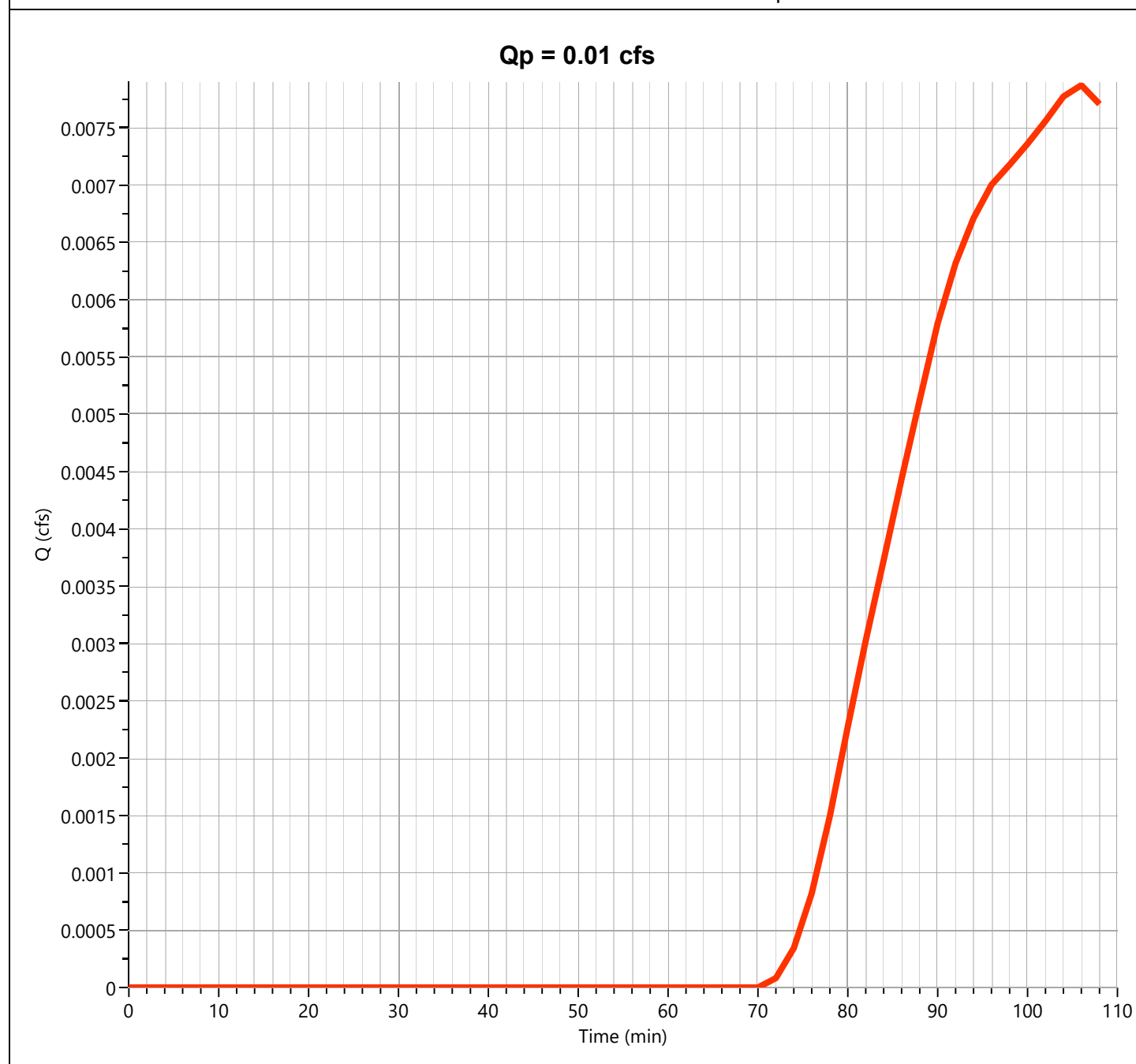
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A1b (un) - Perv.

Hyd. No. 14

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.008 cfs
Storm Frequency	= 1-yr	Time to Peak	= 106 min
Time Interval	= 2 min	Runoff Volume	= 16.7 cuft
Drainage Area	= 0.33 ac	Curve Number	= 67
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484



Hydrograph Report

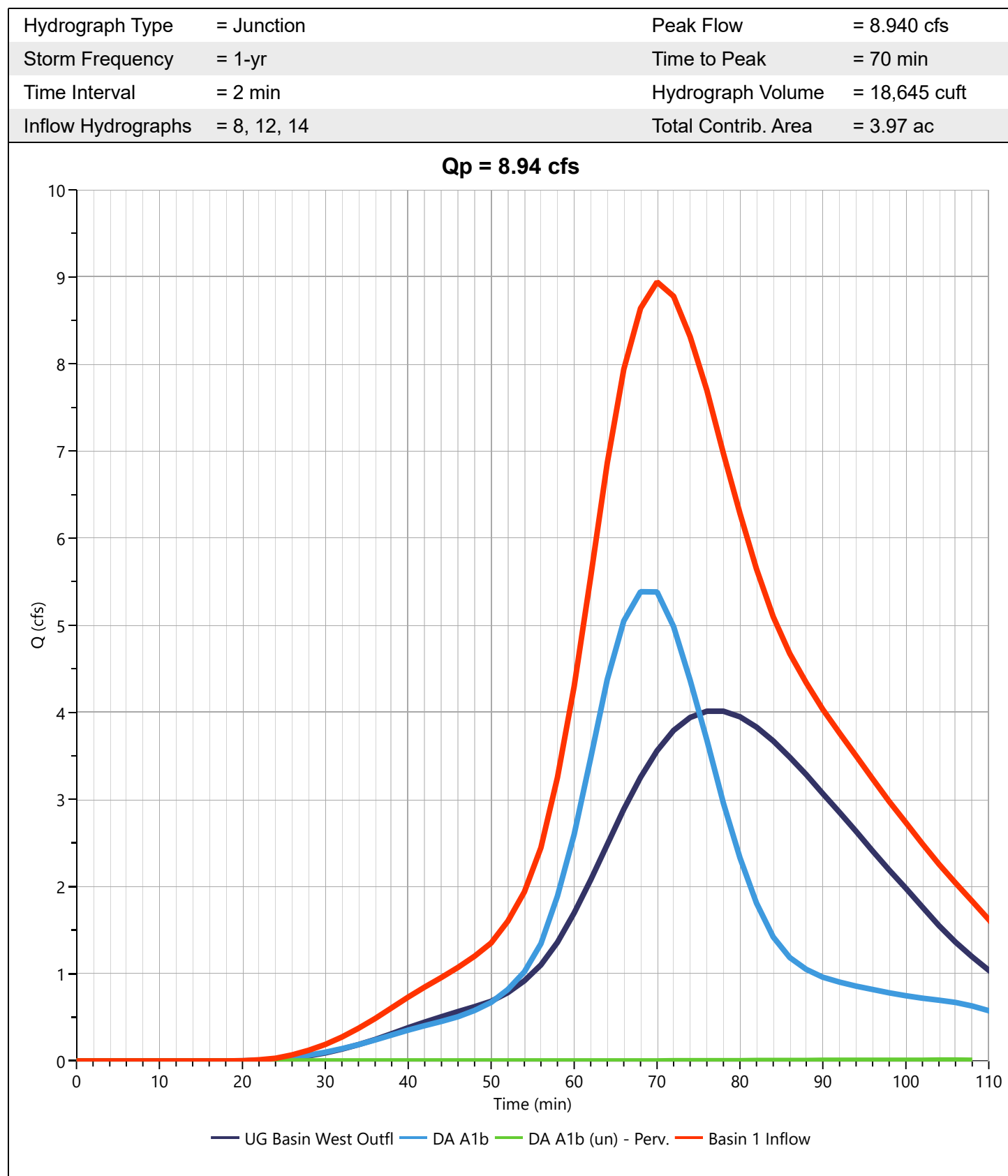
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 1 Inflow

Hyd. No. 16



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 1 Outflow

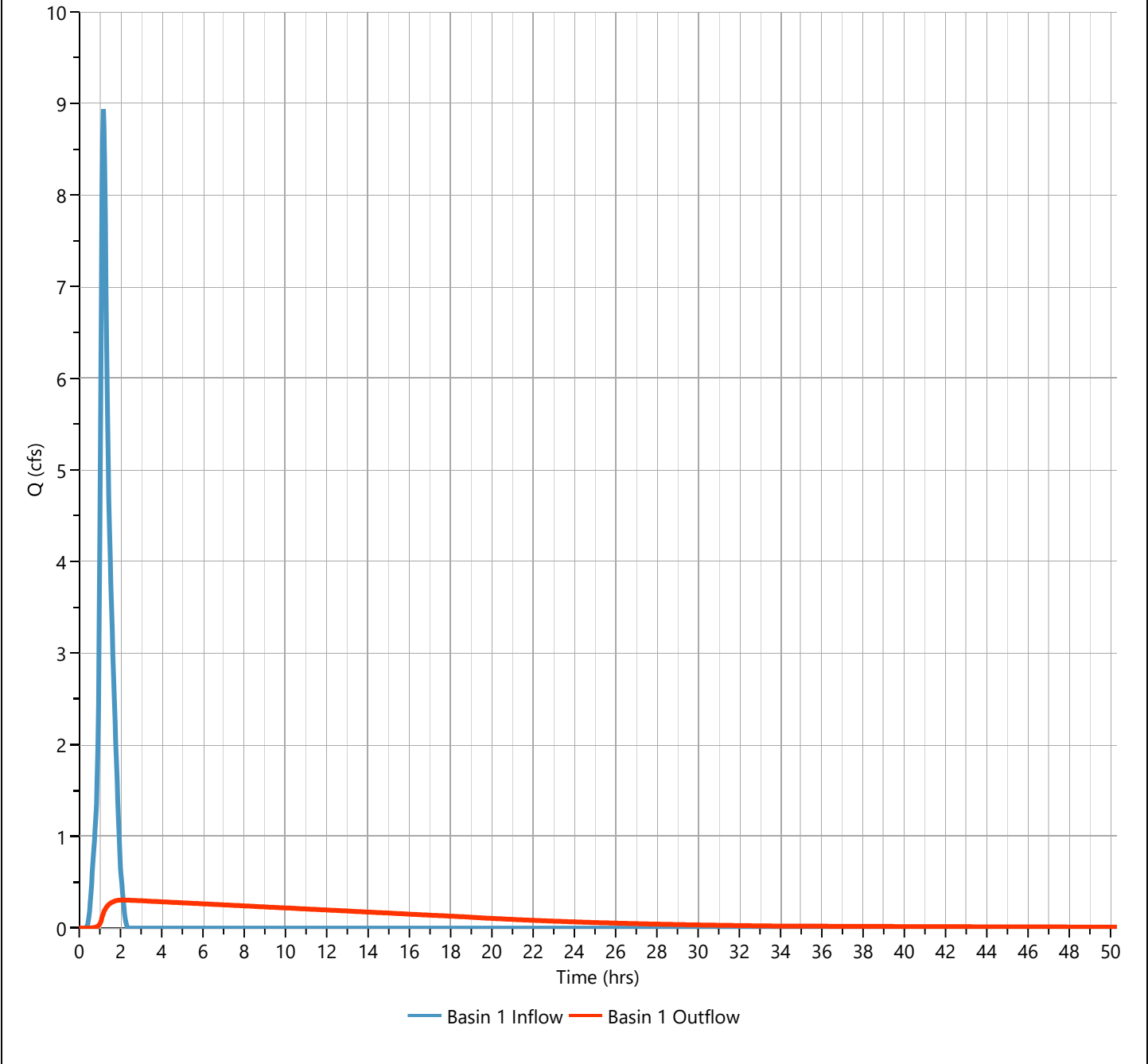
Hyd. No. 17

Hydrograph Type	= Pond Route	Peak Flow	= 0.306 cfs
Storm Frequency	= 1-yr	Time to Peak	= 128 min
Time Interval	= 2 min	Hydrograph Volume	= 18,560 cuft
Inflow Hydrograph	= 16 - Basin 1 Inflow	Max. Elevation	= 96.05 ft
Pond Name	= Basin 1	Max. Storage	= 17,537 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 13.09 hrs

Qp = 0.31 cfs



Pond Report

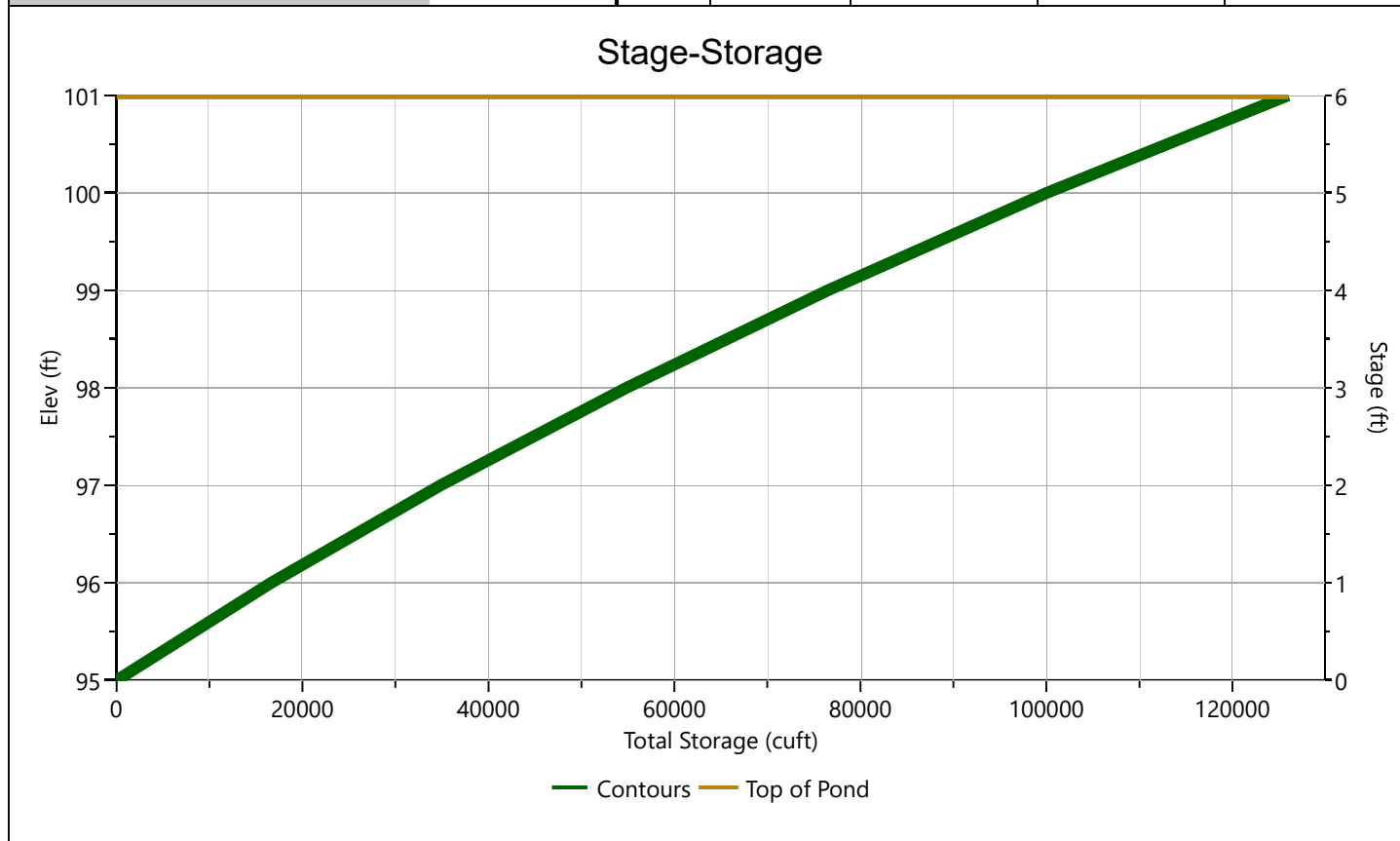
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 1

Stage-Storage

[illegible]

Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

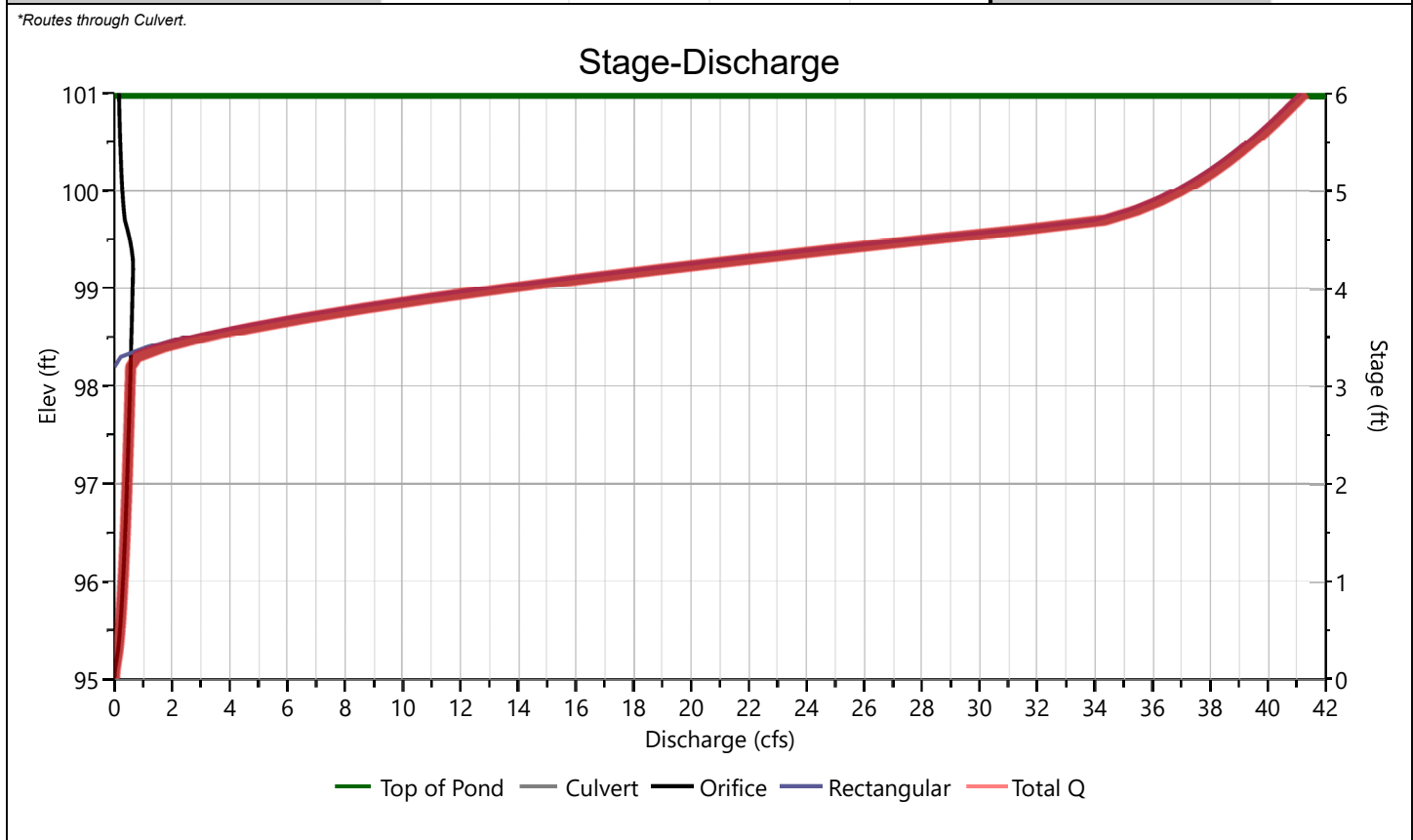
12-30-2020

Basin 1

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	24	3.5			Hole Diameter, in
Span, in	24	3.5			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	91.71	95.00			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	107				
Barrel Slope, %	.48				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type	Circular	Rectangular			Exfiltration, in/hr
Crest Elevation, ft		98.25			
Crest Length, ft		6			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 1

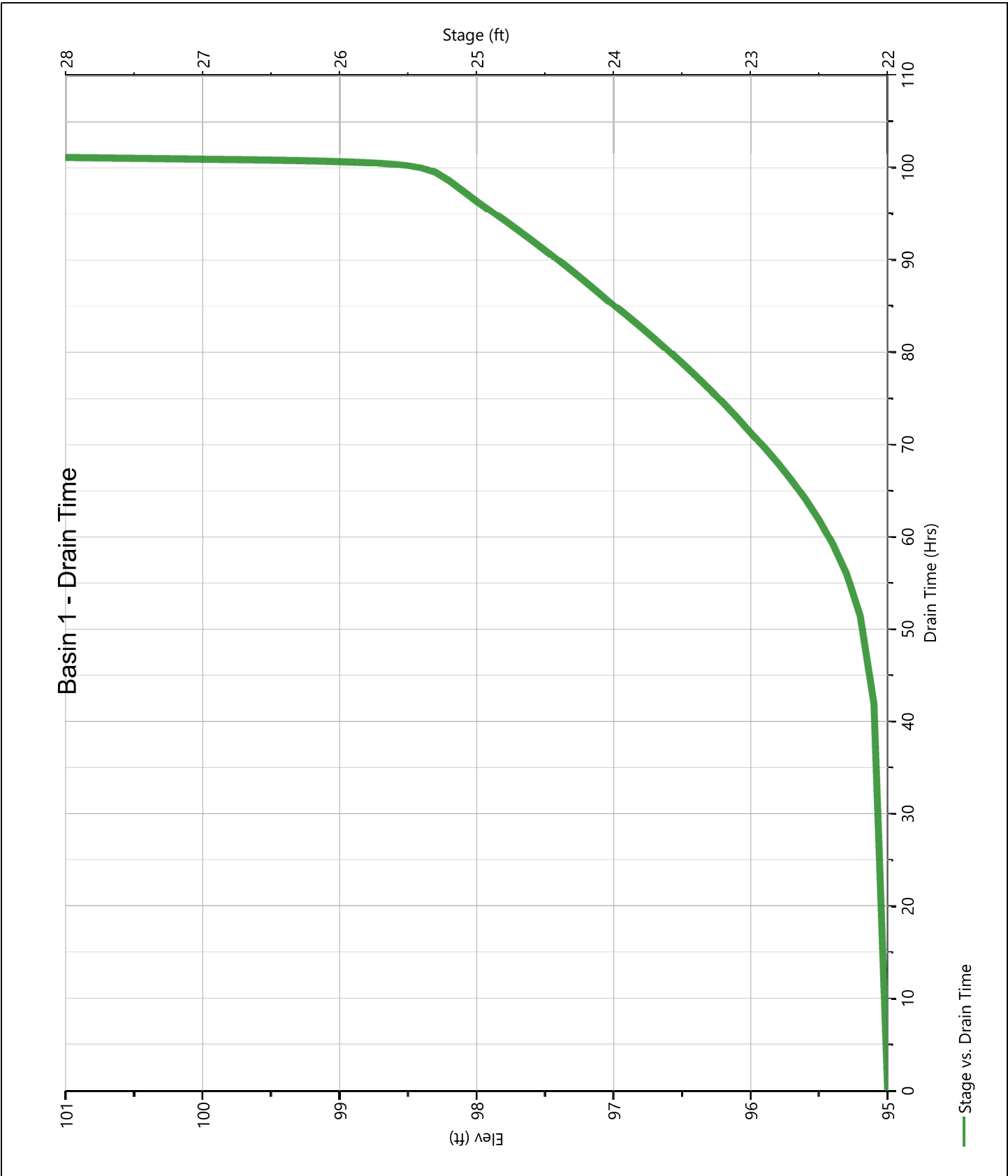
Stage-Storage-Discharge Summary

[illegible]

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

Basin 1

Pond Drawdown



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2 - Perv.

Hyd. No. 19

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.86 ac	Curve Number	= 43
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

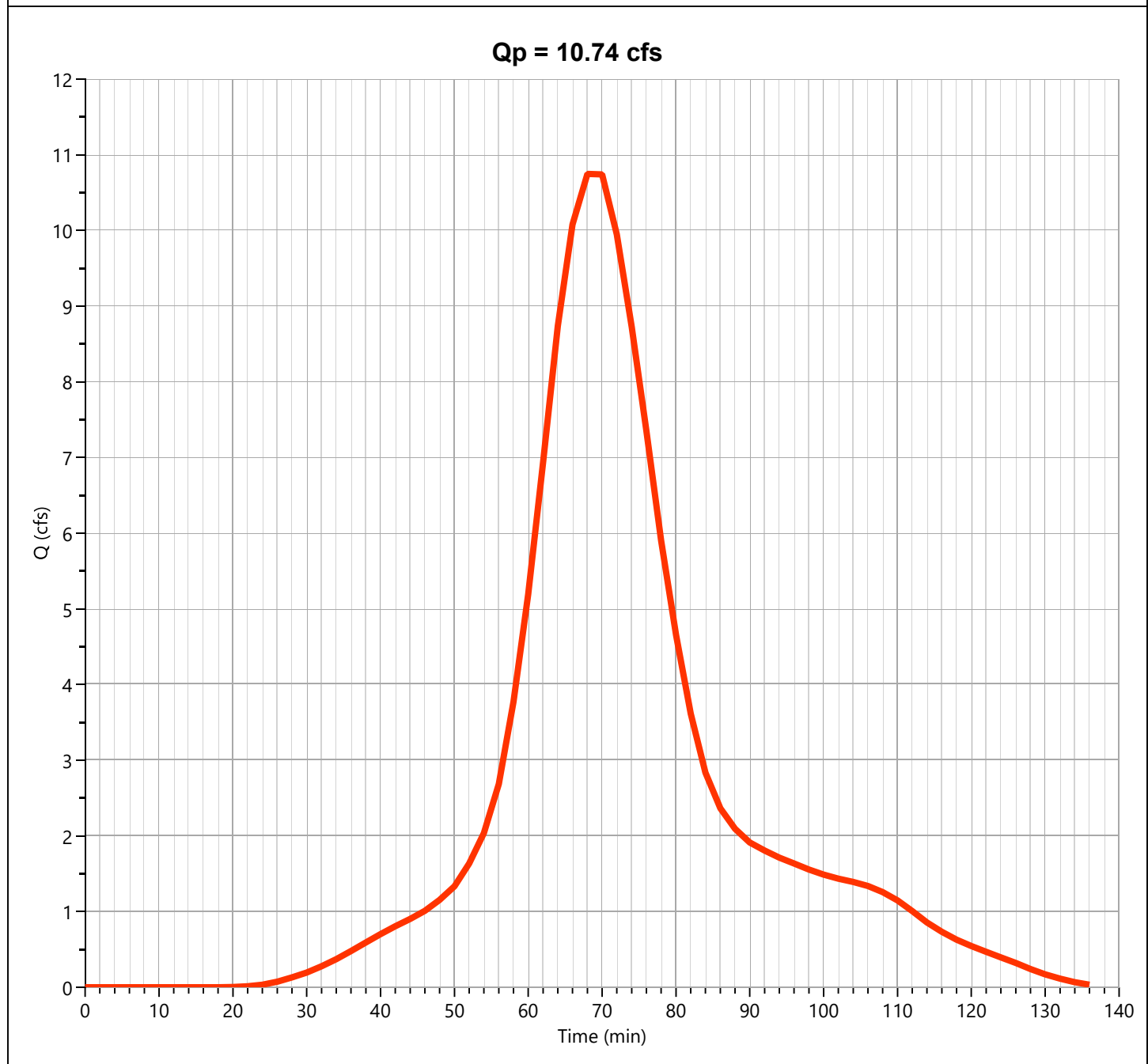
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2 - Imperv.

Hyd. No. 20

Hydrograph Type	= NRCS Runoff	Peak Flow	= 10.74 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Runoff Volume	= 16,847 cuft
Drainage Area	= 4.35 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

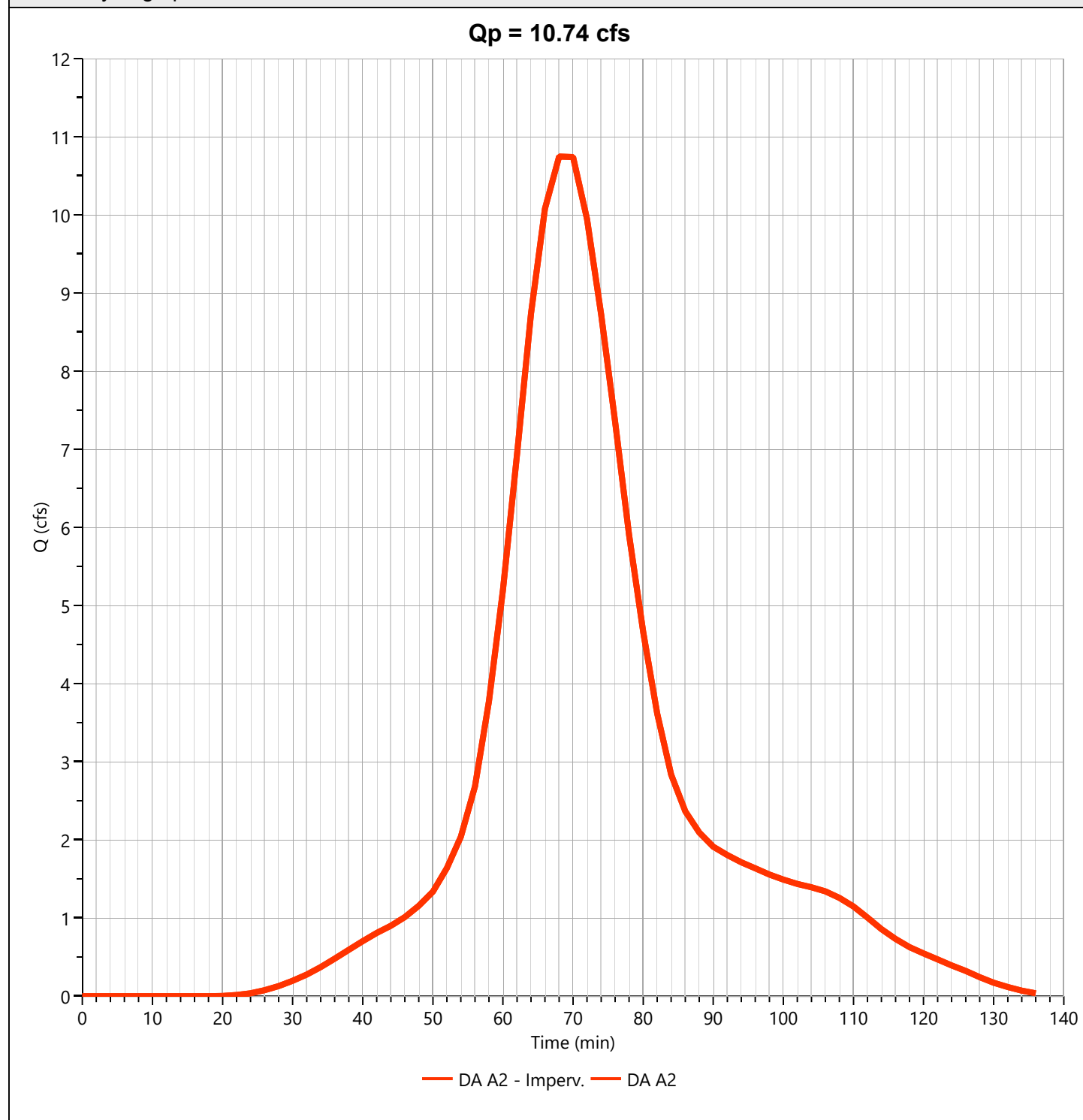
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A2

Hyd. No. 21

Hydrograph Type	= Junction	Peak Flow	= 10.74 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Hydrograph Volume	= 16,847 cuft
Inflow Hydrographs	= 19, 20	Total Contrib. Area	= 5.21 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 2 Outflow

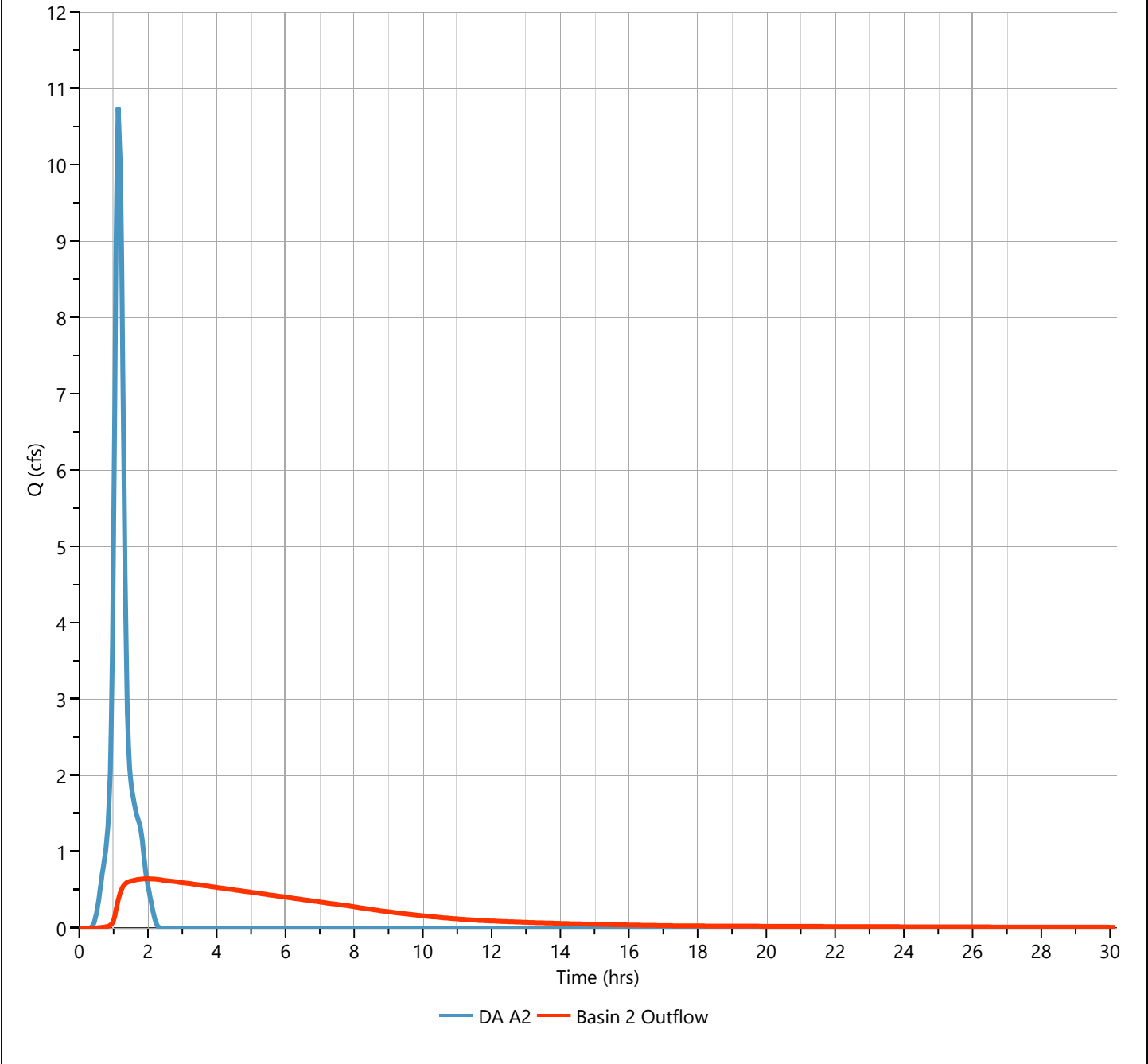
Hyd. No. 22

Hydrograph Type	= Pond Route	Peak Flow	= 0.645 cfs
Storm Frequency	= 1-yr	Time to Peak	= 118 min
Time Interval	= 2 min	Hydrograph Volume	= 16,803 cuft
Inflow Hydrograph	= 21 - DA A2	Max. Elevation	= 84.17 ft
Pond Name	= Basin 2	Max. Storage	= 14,591 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 5.50 hrs

Qp = 0.65 cfs



Pond Report

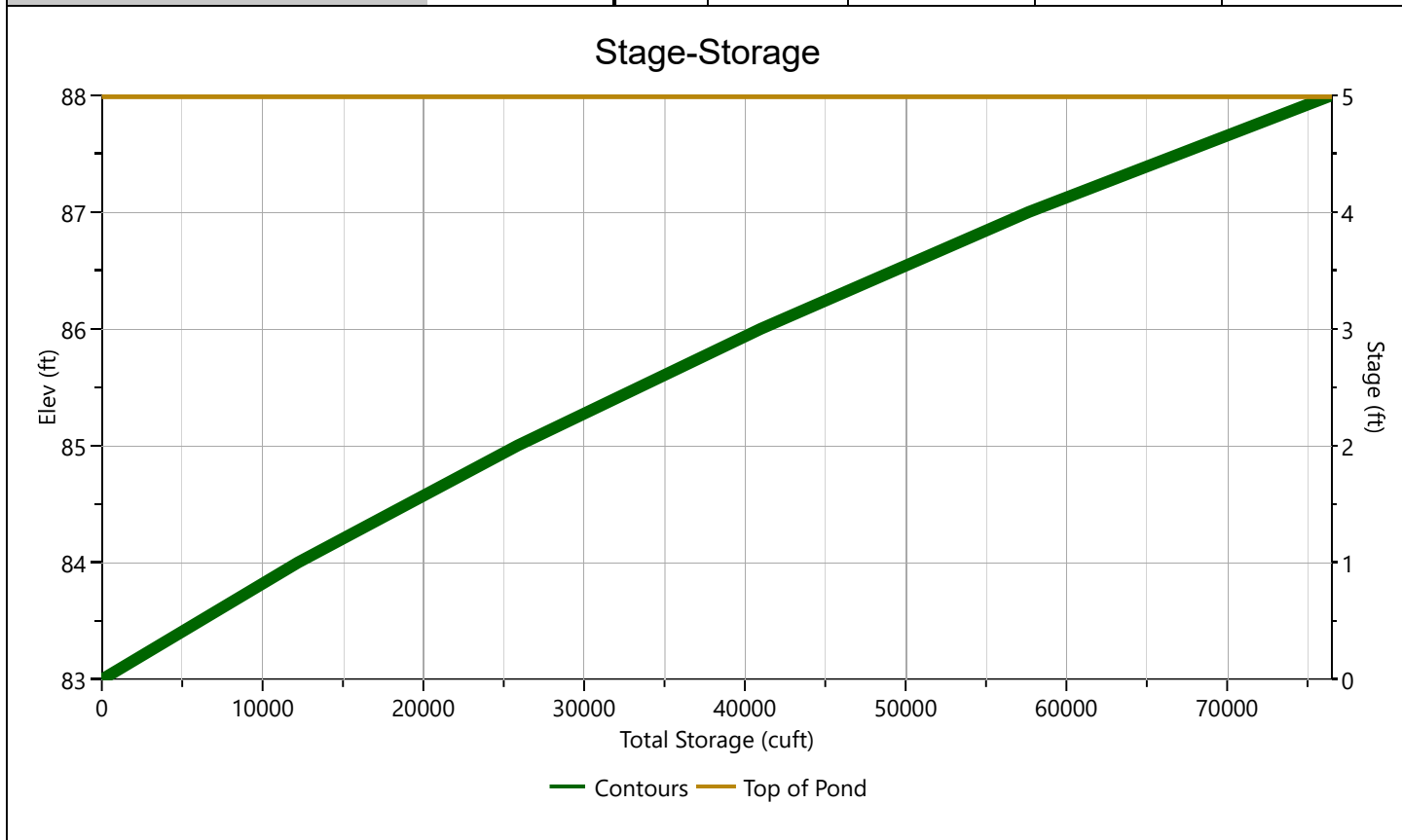
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 2

Stage-Storage

[illegible]

Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

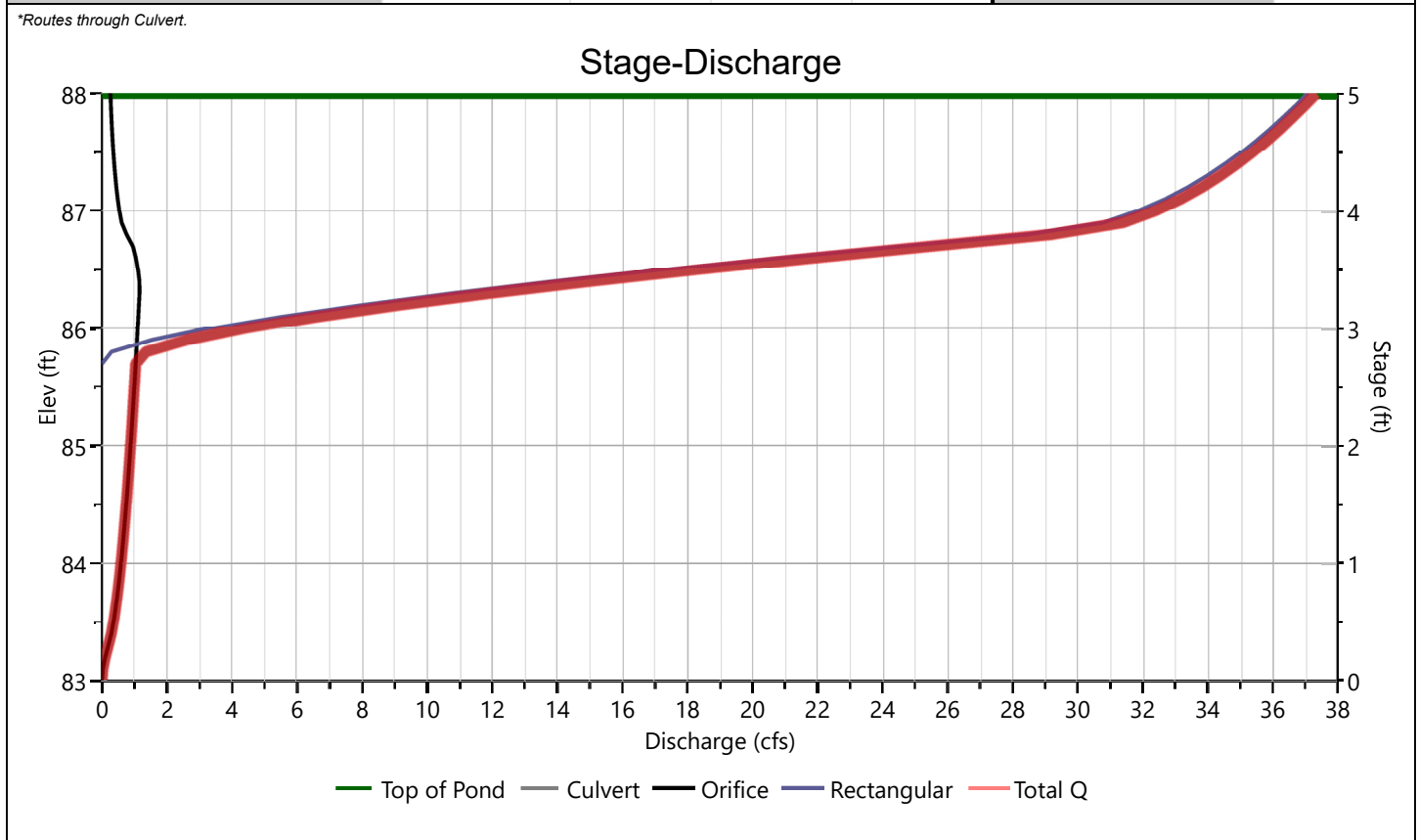
12-30-2020

Basin 2

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	24	5			Hole Diameter, in
Span, in	24	5			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	80.75	83.00			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	33				
Barrel Slope, %	.3				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type	Circular	Rectangular			Exfiltration, in/hr
Crest Elevation, ft		85.75			
Crest Length, ft		8			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 2

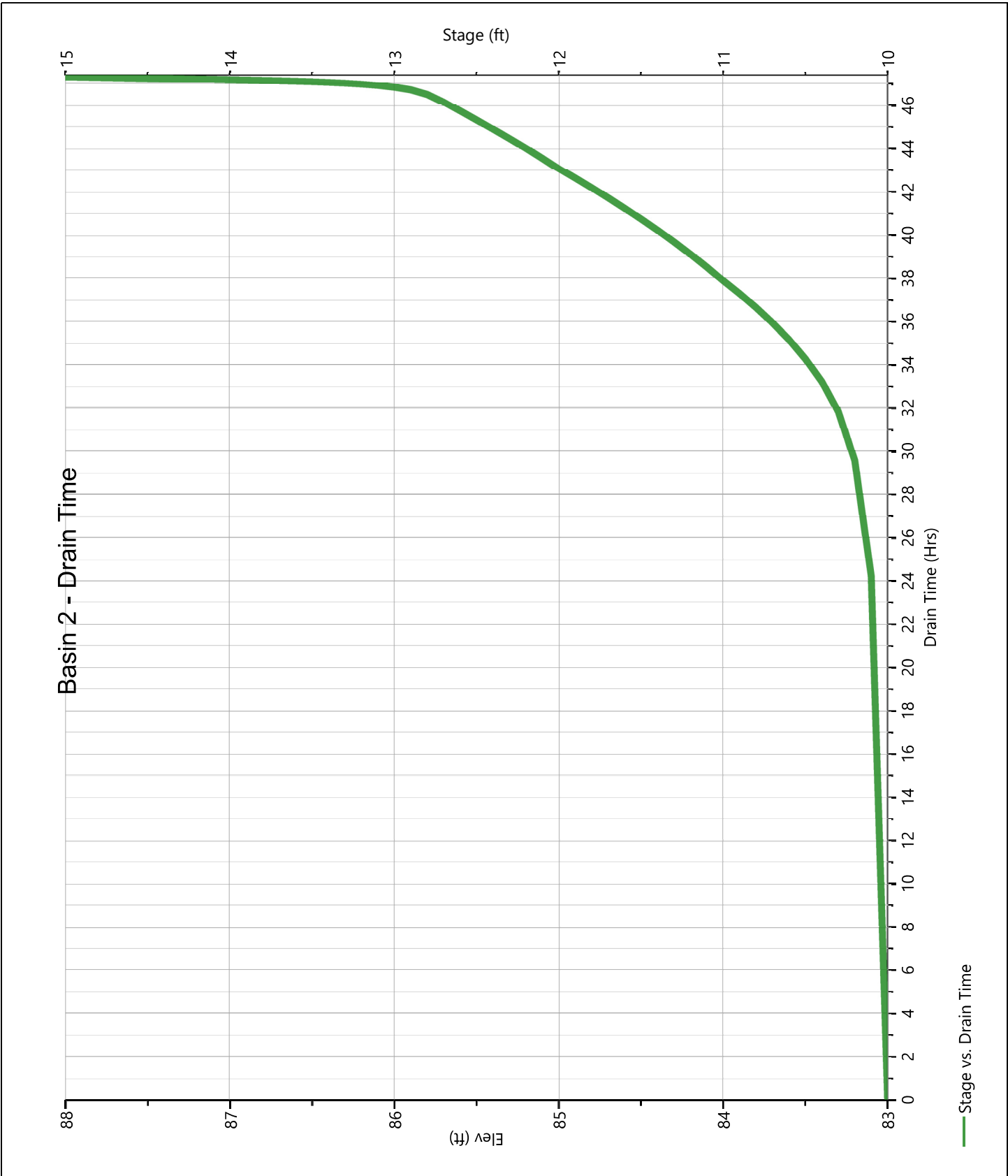
Stage-Storage-Discharge Summary

[illegible]

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

Basin 2

Pond Drawdown



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A3 - Perv.

Hyd. No. 24

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 4.41 ac	Curve Number	= 41
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a - Perv.

Hyd. No. 26

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 3.34 ac	Curve Number	= 54
Tc Method	= User	Time of Conc. (Tc)	= 17.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

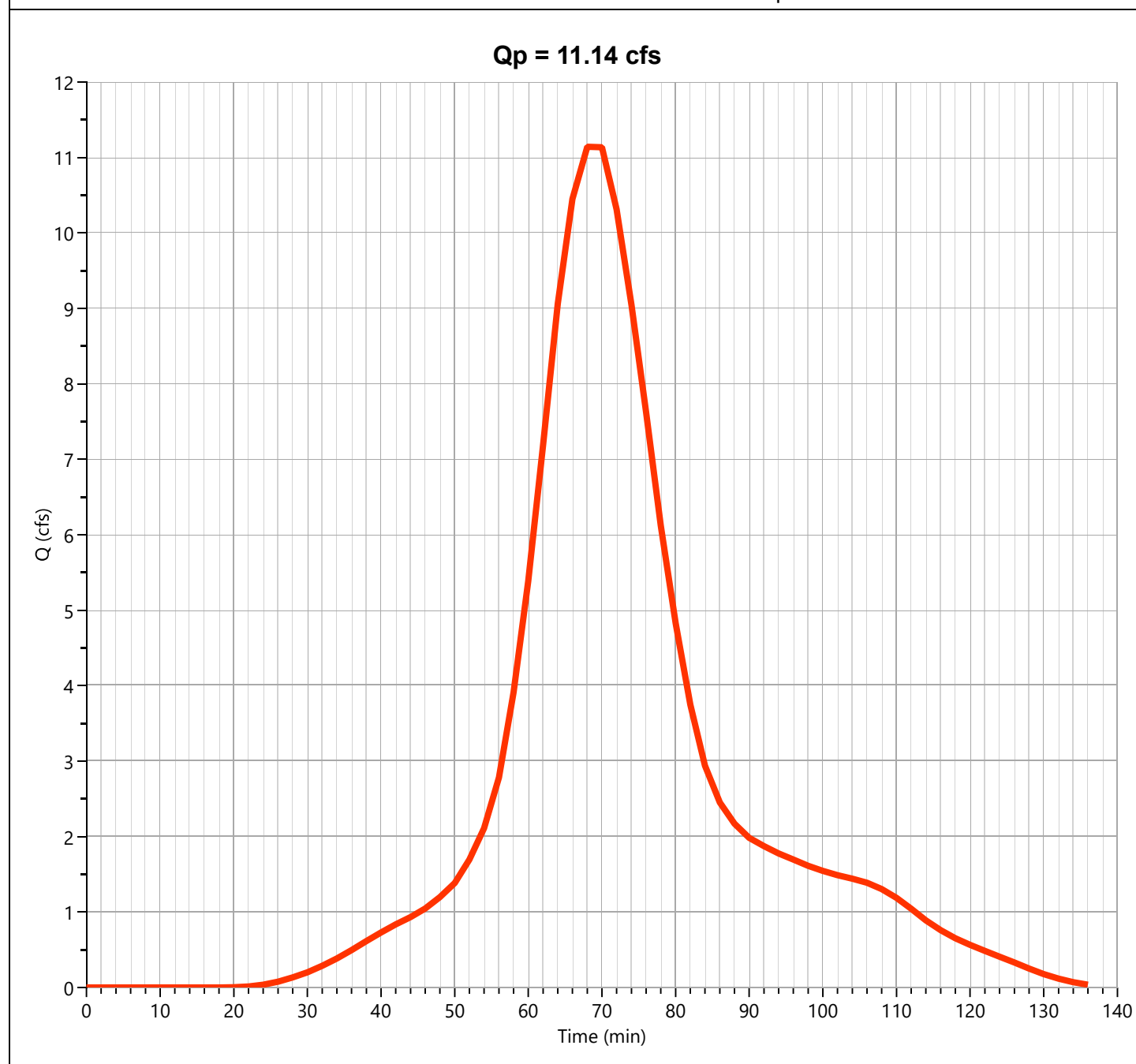
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a - Imperv.

Hyd. No. 27

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.14 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Runoff Volume	= 17,467 cuft
Drainage Area	= 4.51 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 12.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

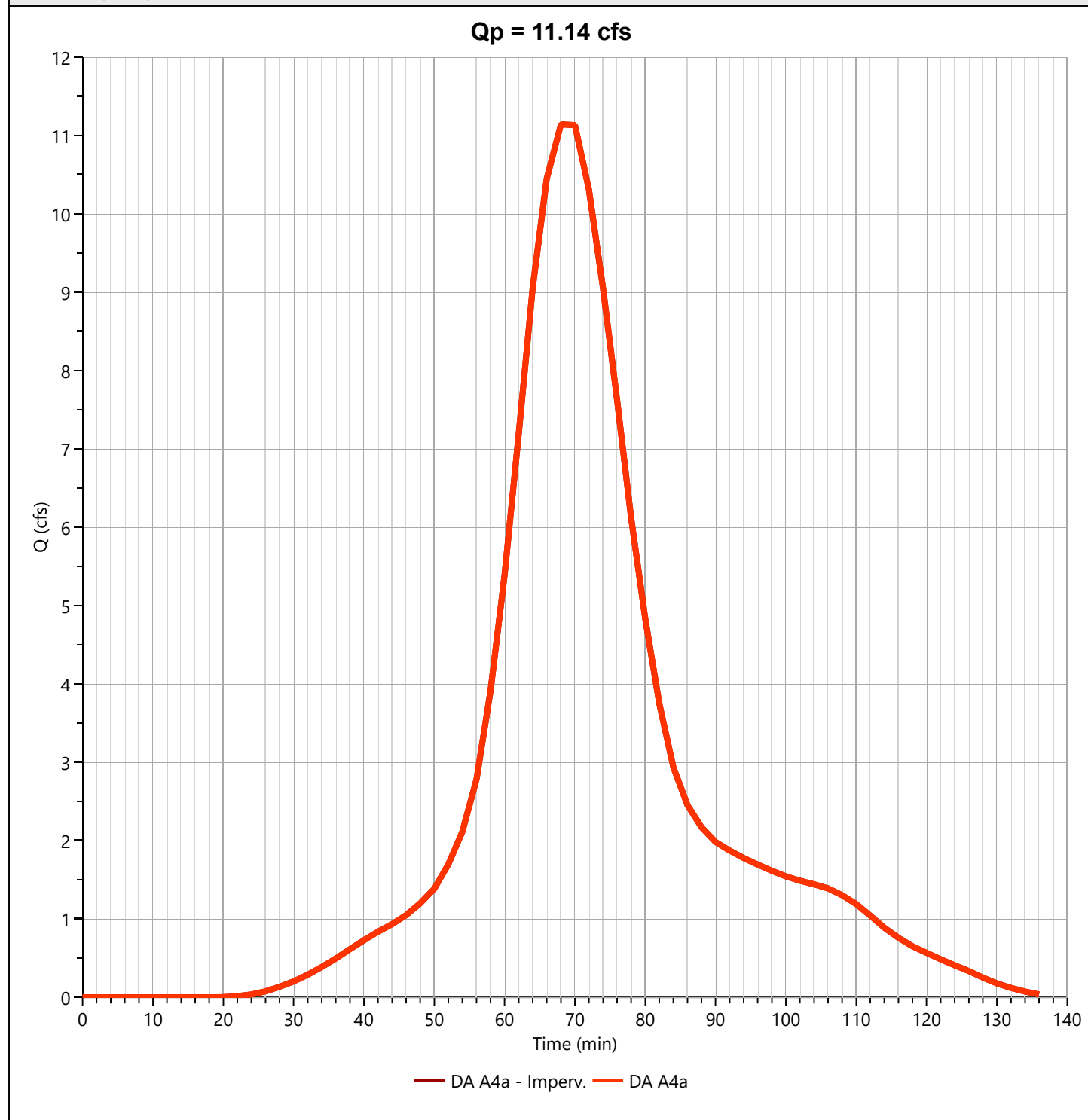
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4a

Hyd. No. 28

Hydrograph Type	= Junction	Peak Flow	= 11.14 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Hydrograph Volume	= 17,467 cuft
Inflow Hydrographs	= 26, 27	Total Contrib. Area	= 7.85 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Basin East Out

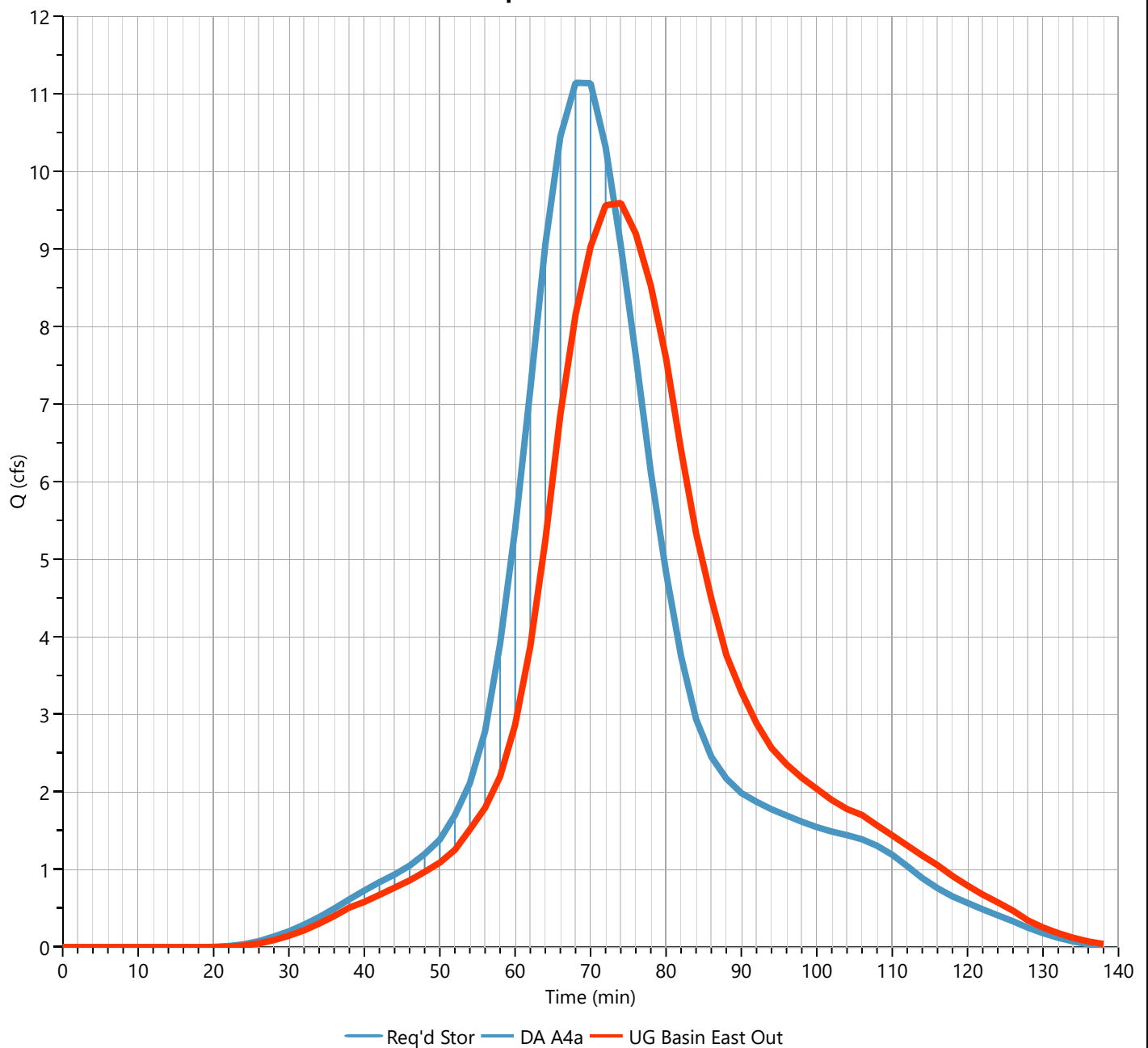
Hyd. No. 29

Hydrograph Type	= Pond Route	Peak Flow	= 9.591 cfs
Storm Frequency	= 1-yr	Time to Peak	= 74 min
Time Interval	= 2 min	Hydrograph Volume	= 17,466 cuft
Inflow Hydrograph	= 28 - DA A4a	Max. Elevation	= 101.24 ft
Pond Name	= UG Recharge / Detention Basin East	Max. Storage	= 2,914 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 5 min

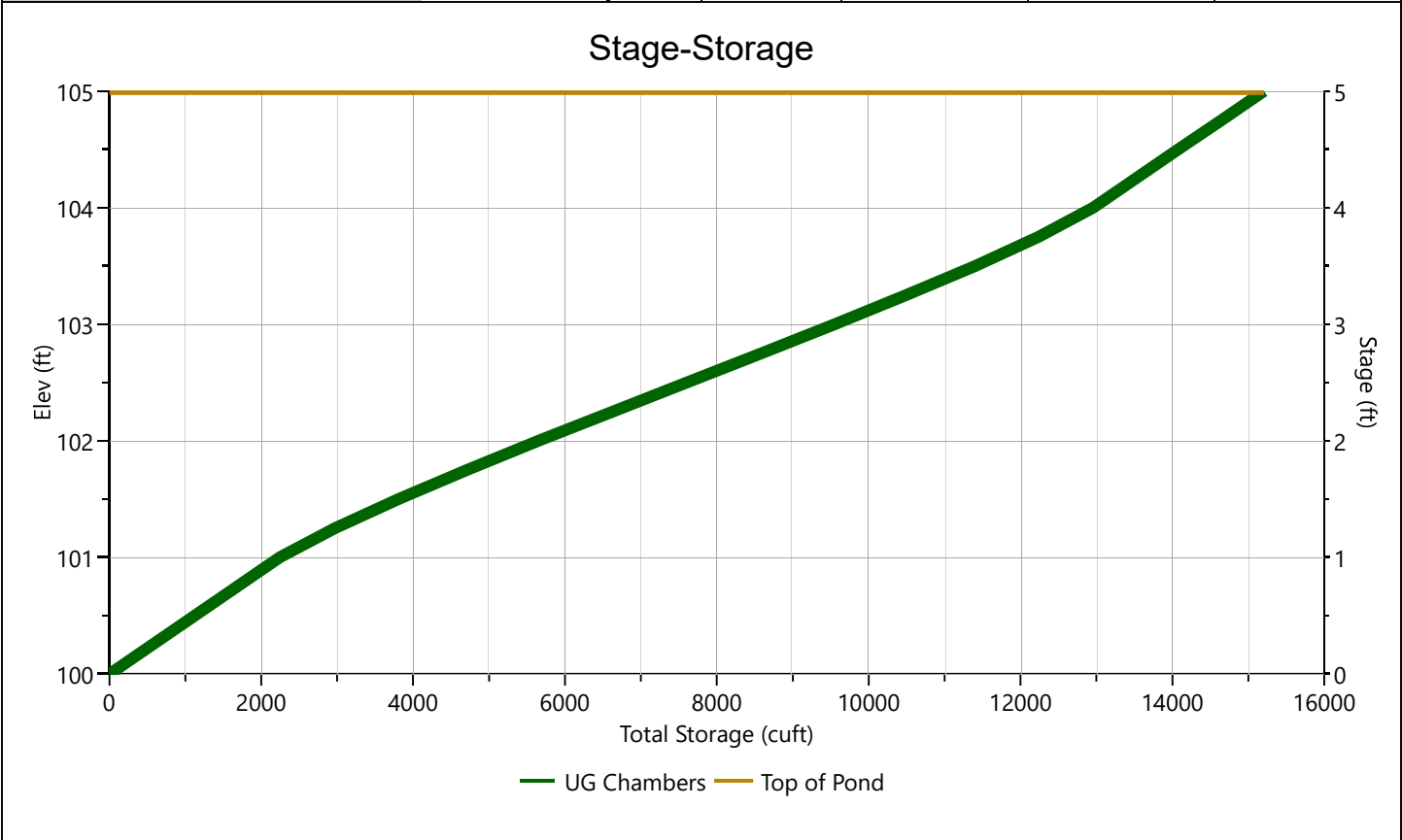
Qp = 9.59 cfs



UG Recharge / Detention Basin East

Stage-Storage

Underground Chambers		Stage / Storage Table				
Description	Input	Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
Invert Elev Down, ft	101.00	0.00	100.00	5,616	0.000	0.000
Chamber Rise, ft	3.00	0.25	100.25	5,616	562	562
Chamber Shape	Circular	0.50	100.50	5,616	562	1,123
Chamber Span, ft	3.00	0.75	100.75	5,616	562	1,685
Barrel Length, ft	300.00	1.00	101.00	5,616	562	2,247
No. Barrels	3	1.25	101.25	5,616	720	2,967
Barrel Slope, %	0.00	1.50	101.50	5,616	839	3,806
Headers, y/n	Yes	1.75	101.75	5,616	903	4,709
Stone Encasement, y/n	Yes	2.00	102.00	5,616	944	5,652
Encasement Bottom Elevation, ft	100.00	2.25	102.25	5,616	969	6,622
Encasement Width per Chamber, ft	6.00	2.50	102.50	5,616	981	7,603
Encasement Depth, ft	5.00	2.75	102.75	5,616	981	8,584
Encasement Voids, %	40.00	3.00	103.00	5,616	969	9,553
		3.25	103.25	5,616	943	10,497
		3.50	103.50	5,616	903	11,400
		3.75	103.75	5,616	838	12,238
		4.00	104.00	5,616	720	12,958
		4.25	104.25	5,616	562	13,520
		4.50	104.50	5,616	562	14,081
		4.75	104.75	5,616	562	14,643
		5.00	105.00	5,616	562	15,205



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

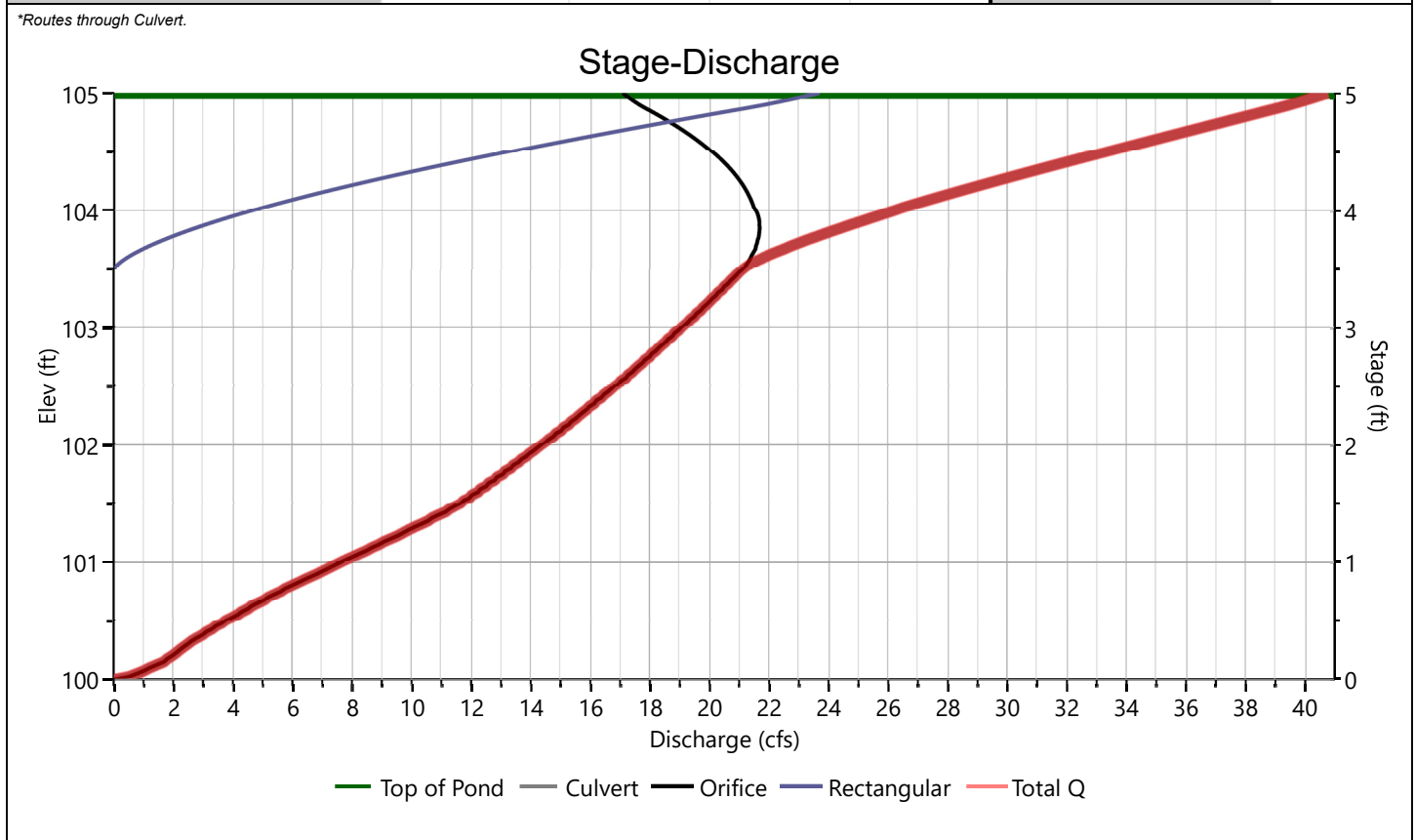
12-30-2020

UG Recharge / Detention Basin East

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	30	24			Hole Diameter, in
Span, in	30	24			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	99.50	99.50			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	235				
Barrel Slope, %	3.19				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type		Rectangular			Exfiltration, in/hr
Crest Elevation, ft		103.5			
Crest Length, ft		4			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

UG Recharge / Detention Basin East

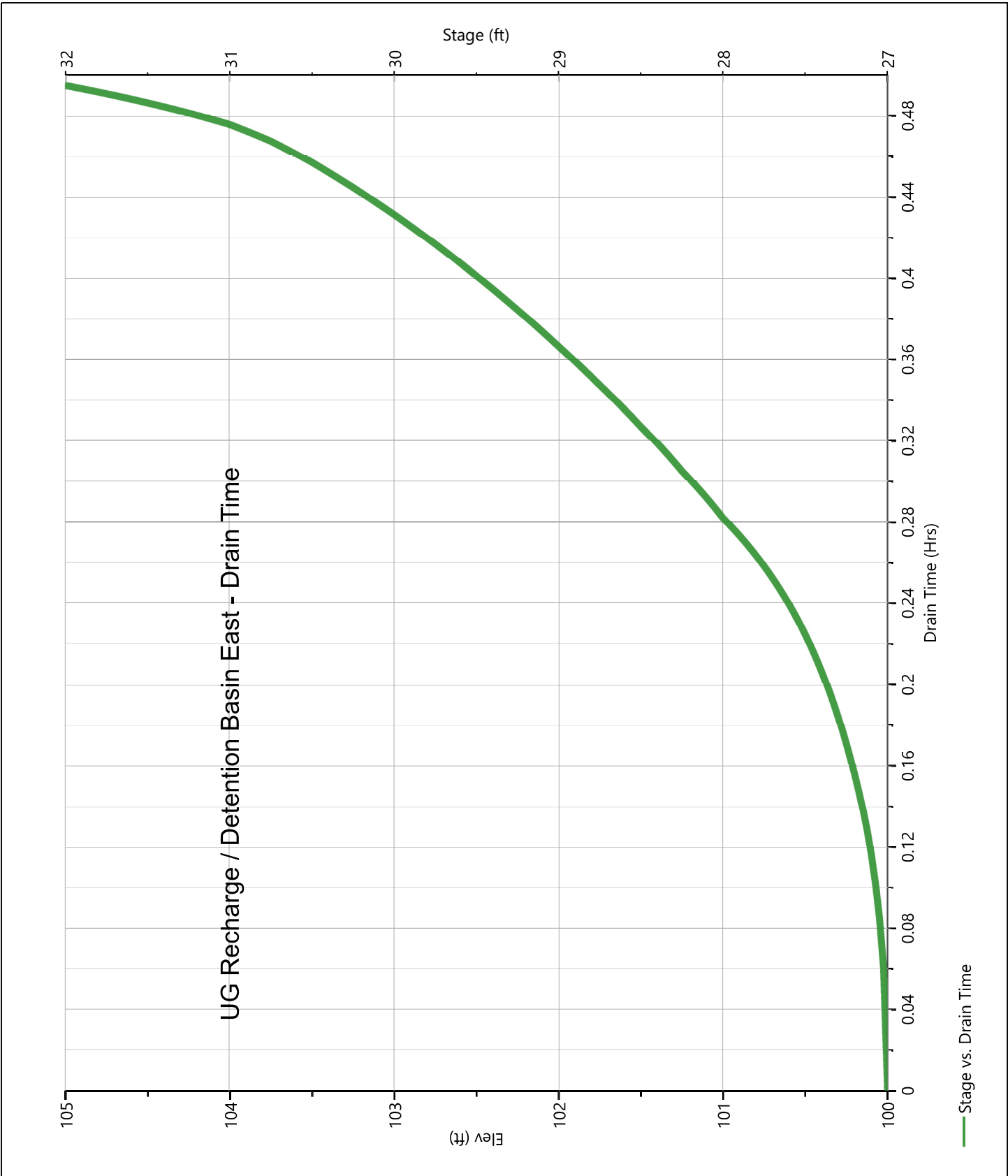
Stage-Storage-Discharge Summary

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	100.00	0.000	0.000	0.000				0.000						0.000
0.25	100.25	562	2.216 ic	2.216				0.000						2.216
0.50	100.50	1,123	3.754 ic	3.754				0.000						3.754
0.75	100.75	1,685	5.617 ic	5.617				0.000						5.617
1.00	101.00	2,247	7.618 ic	7.618				0.000						7.618
1.25	101.25	2,967	9.727 ic	9.727				0.000						9.727
1.50	101.50	3,806	11.65 ic	11.65				0.000						11.65
1.75	101.75	4,709	13.07 ic	13.07				0.000						13.07
2.00	102.00	5,652	14.36 ic	14.36				0.000						14.36
2.25	102.25	6,622	15.62 ic	15.62				0.000						15.62
2.50	102.50	7,603	16.81 ic	16.81				0.000						16.81
2.75	102.75	8,584	17.99 ic	17.99				0.000						17.99
3.00	103.00	9,553	19.05 ic	19.05				0.000						19.05
3.25	103.25	10,497	20.10 ic	20.10				0.000						20.10
3.50	103.50	11,400	21.11 ic	21.11				0.000						21.11
3.75	103.75	12,238	23.26 ic	21.61				1.650						23.26
4.00	104.00	12,958	26.22 ic	21.55				4.667						26.22
4.25	104.25	13,520	29.59 ic	21.02				8.574						29.59
4.50	104.50	14,081	33.29 ic	20.09				13.20						33.29
4.75	104.75	14,643	37.15 ic	18.70				18.45						37.15
5.00	105.00	15,205	40.77 ic	17.07				23.69 s						40.77

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

UG Recharge / Detention Basin East

Pond Drawdown



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b - Perv.

Hyd. No. 31

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 1.5 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

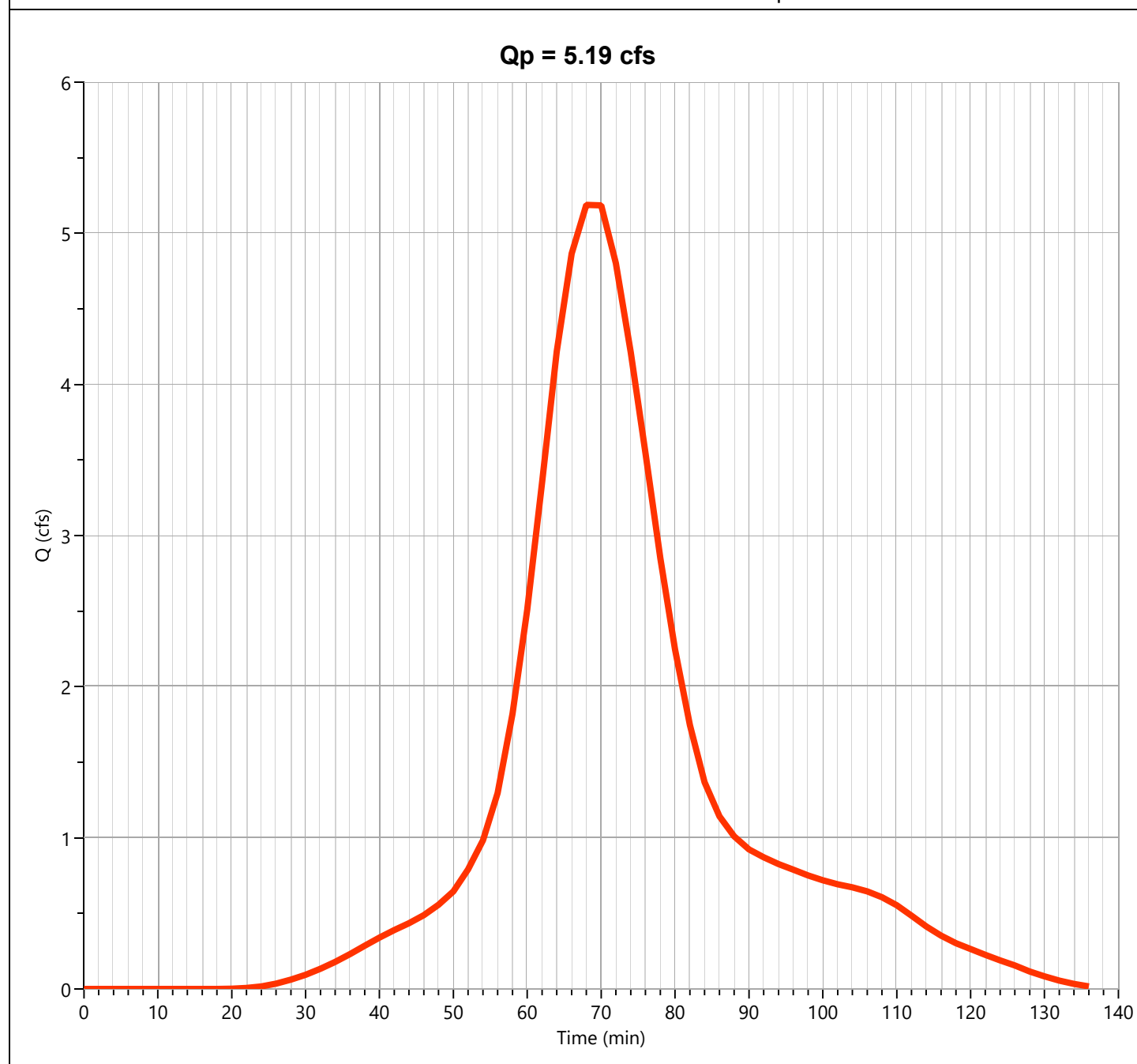
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b - Imperv.

Hyd. No. 32

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.187 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Runoff Volume	= 8,133 cuft
Drainage Area	= 2.1 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

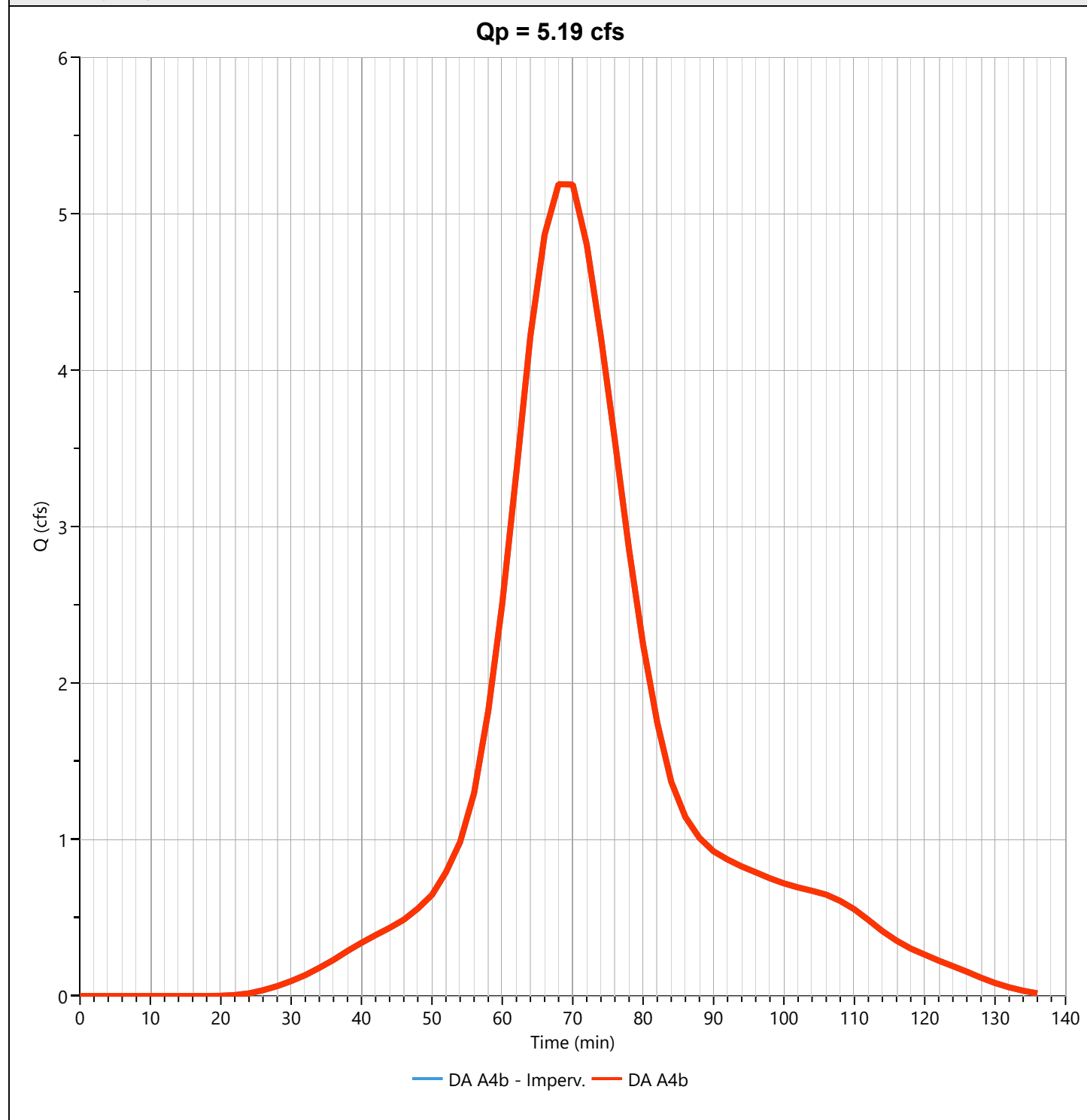
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A4b

Hyd. No. 33

Hydrograph Type	= Junction	Peak Flow	= 5.187 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Hydrograph Volume	= 8,133 cuft
Inflow Hydrographs	= 31, 32	Total Contrib. Area	= 3.6 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

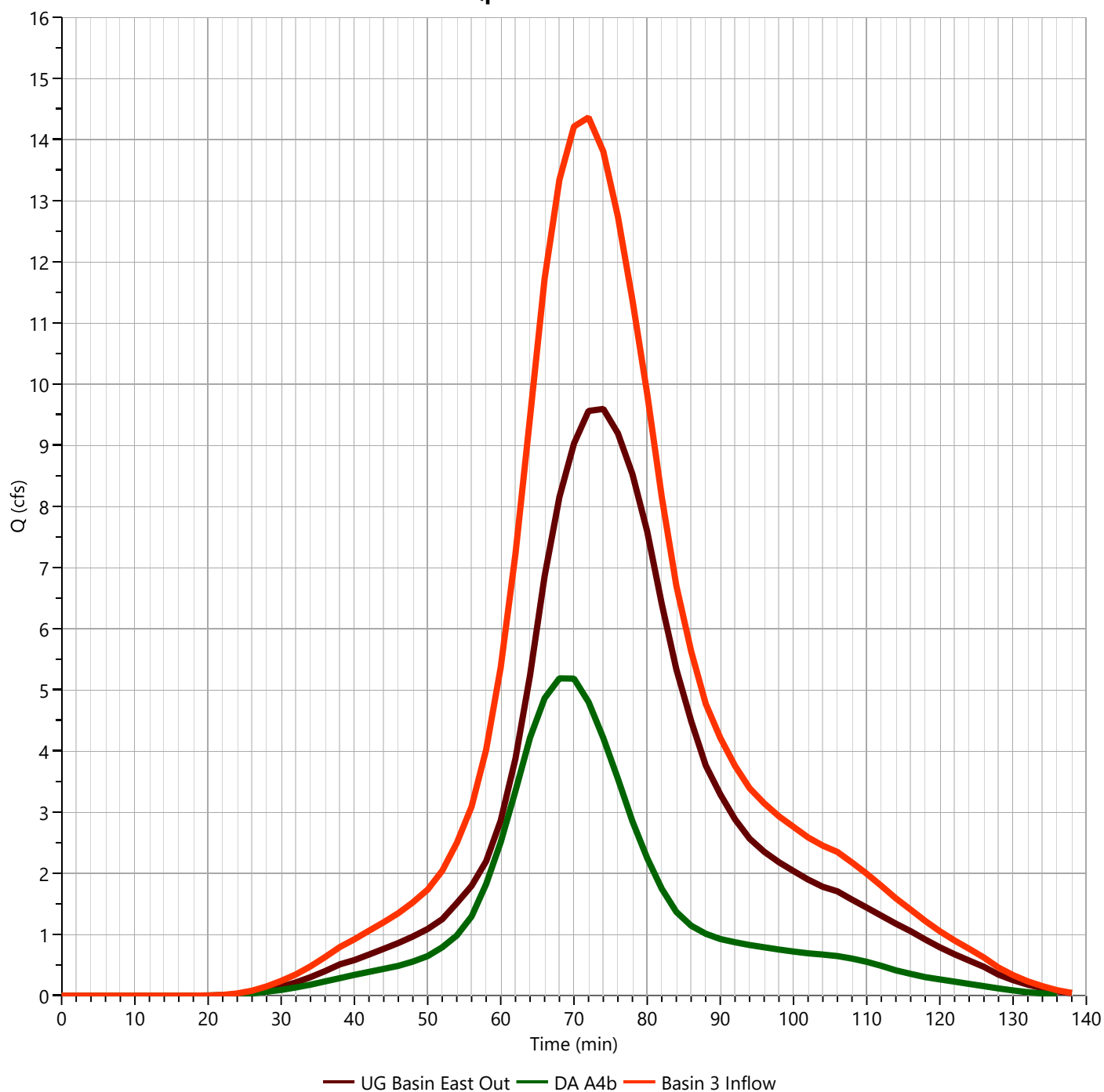
12-30-2020

Basin 3 Inflow

Hyd. No. 35

Hydrograph Type	= Junction	Peak Flow	= 14.36 cfs
Storm Frequency	= 1-yr	Time to Peak	= 72 min
Time Interval	= 2 min	Hydrograph Volume	= 25,599 cuft
Inflow Hydrographs	= 29, 33	Total Contrib. Area	= 3.6 ac

Qp = 14.36 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 3 Outflow

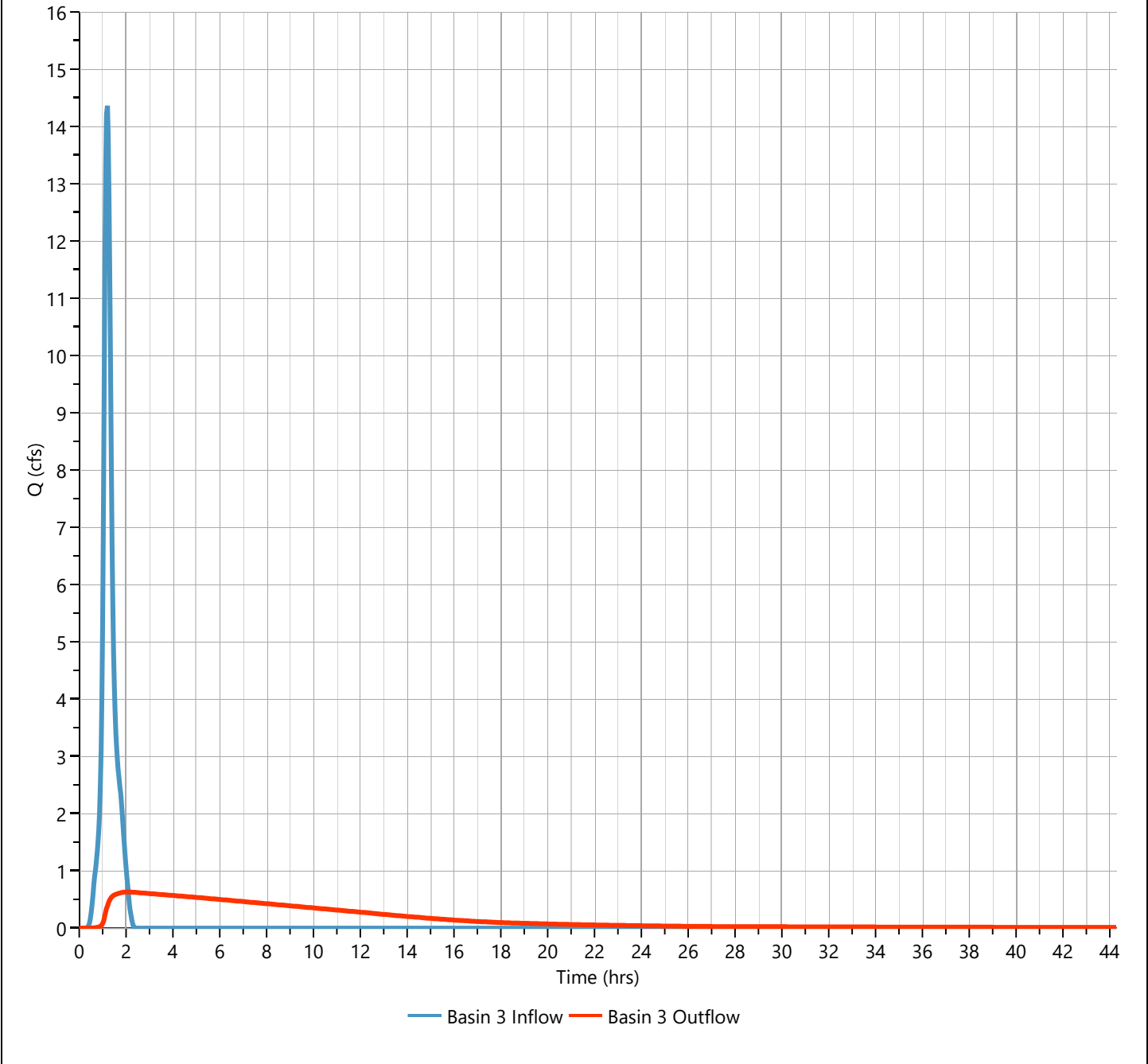
Hyd. No. 36

Hydrograph Type	= Pond Route	Peak Flow	= 0.629 cfs
Storm Frequency	= 1-yr	Time to Peak	= 126 min
Time Interval	= 2 min	Hydrograph Volume	= 25,536 cuft
Inflow Hydrograph	= 35 - Basin 3 Inflow	Max. Elevation	= 90.33 ft
Pond Name	= Basin 3	Max. Storage	= 23,332 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 8.53 hrs

Qp = 0.63 cfs



Pond Report

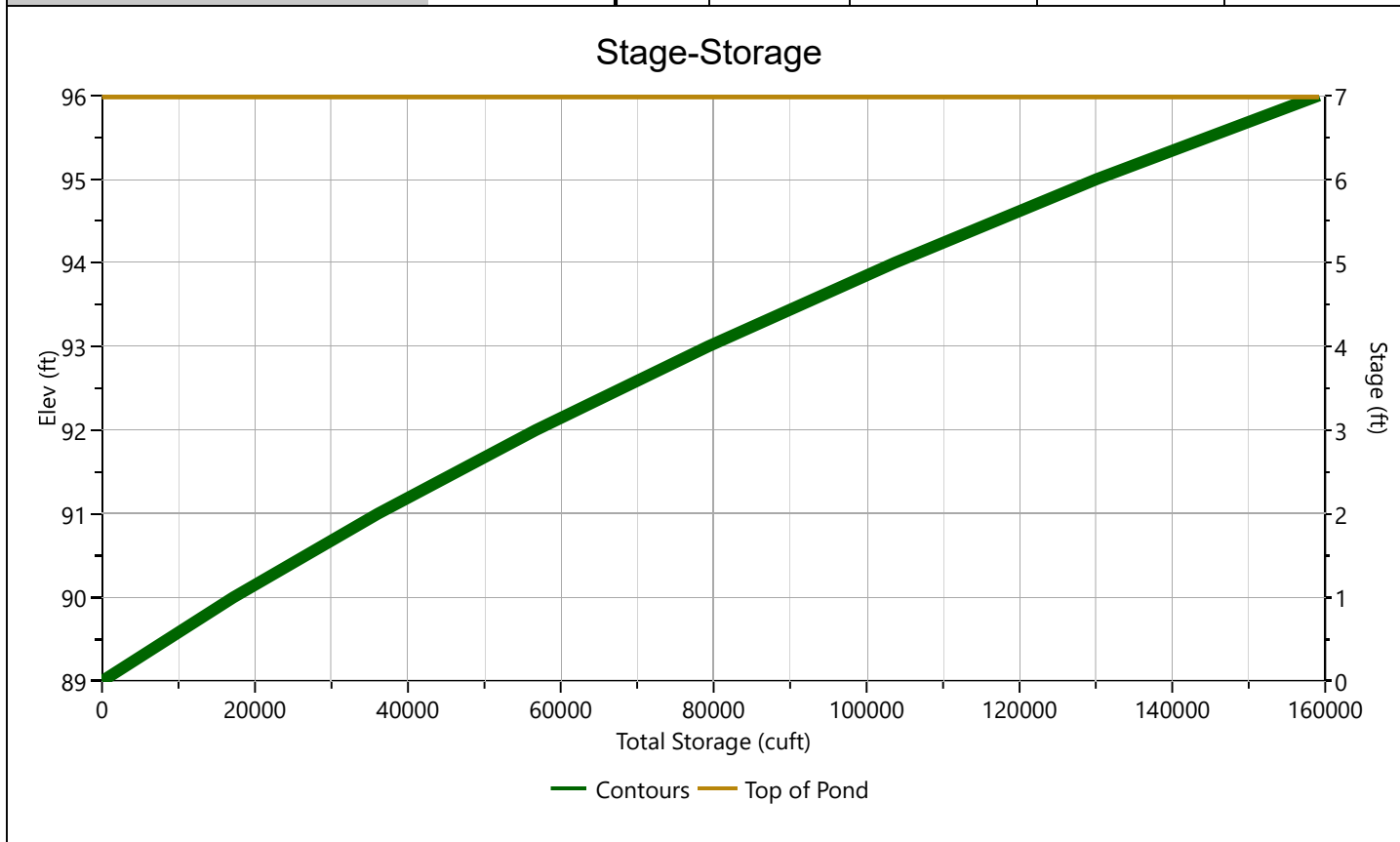
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 3

Stage-Storage

[illegible]

Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

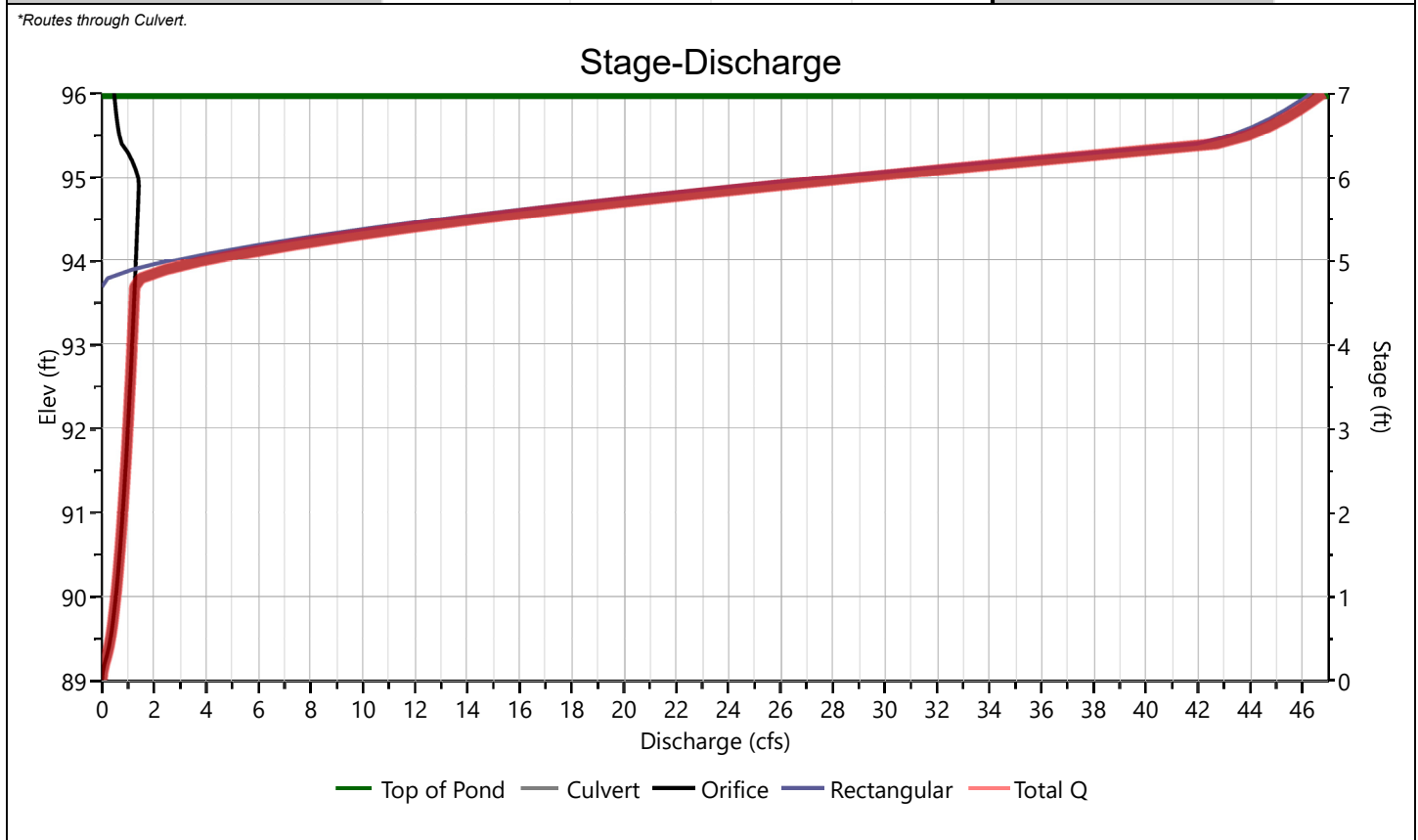
12-30-2020

Basin 3

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	24	4.75			Hole Diameter, in
Span, in	24	4.75			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	84.80	89.00			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	44				
Barrel Slope, %	.3				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type		Rectangular			Exfiltration, in/hr
Crest Elevation, ft		93.75			
Crest Length, ft		6			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 3

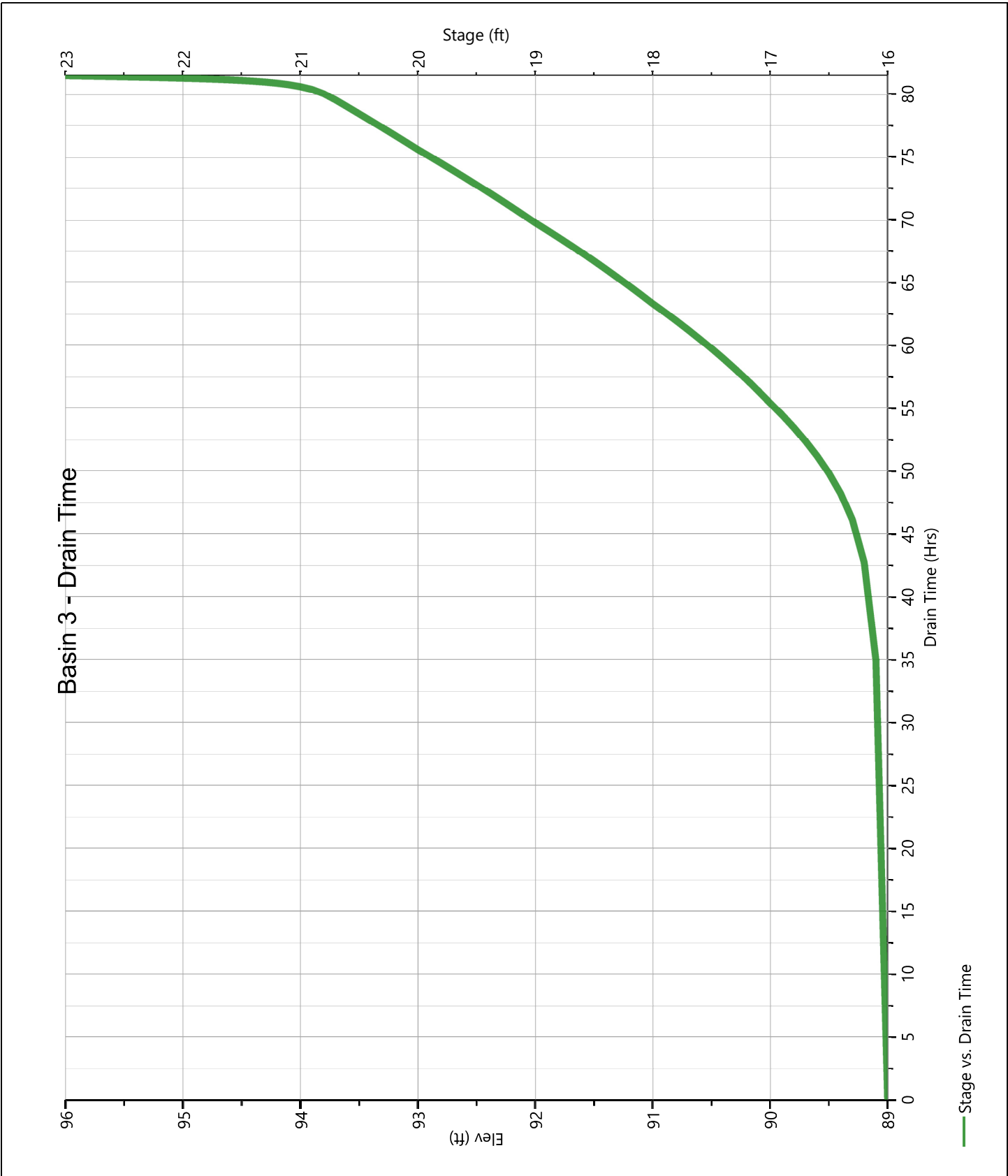
Stage-Storage-Discharge Summary

[illegible]

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

Basin 3

Pond Drawdown



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5 - Perv.

Hyd. No. 38

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.81 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

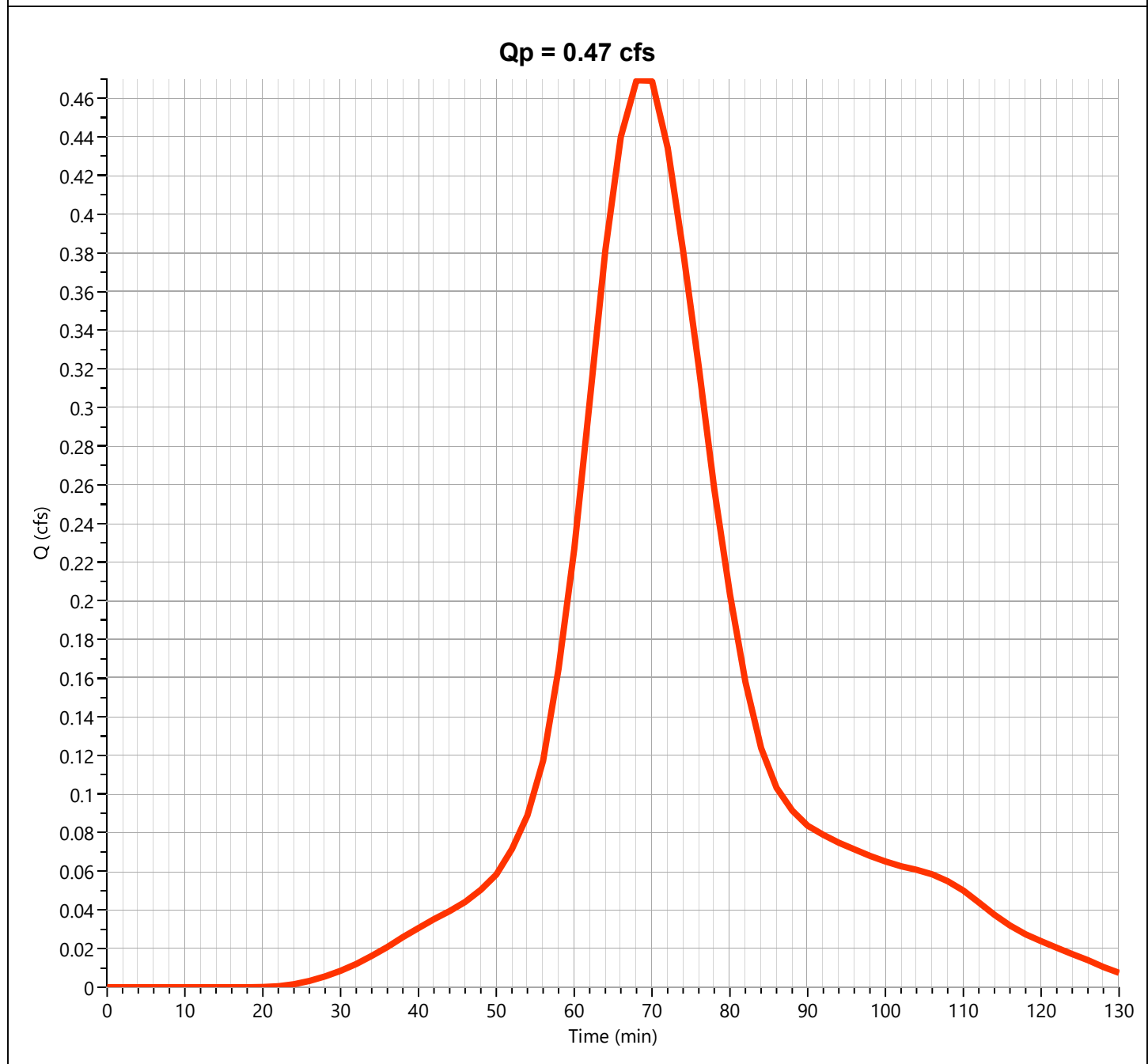
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5 - Imperv.

Hyd. No. 39

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.469 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Runoff Volume	= 736 cuft
Drainage Area	= 0.19 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484



Hydrograph Report

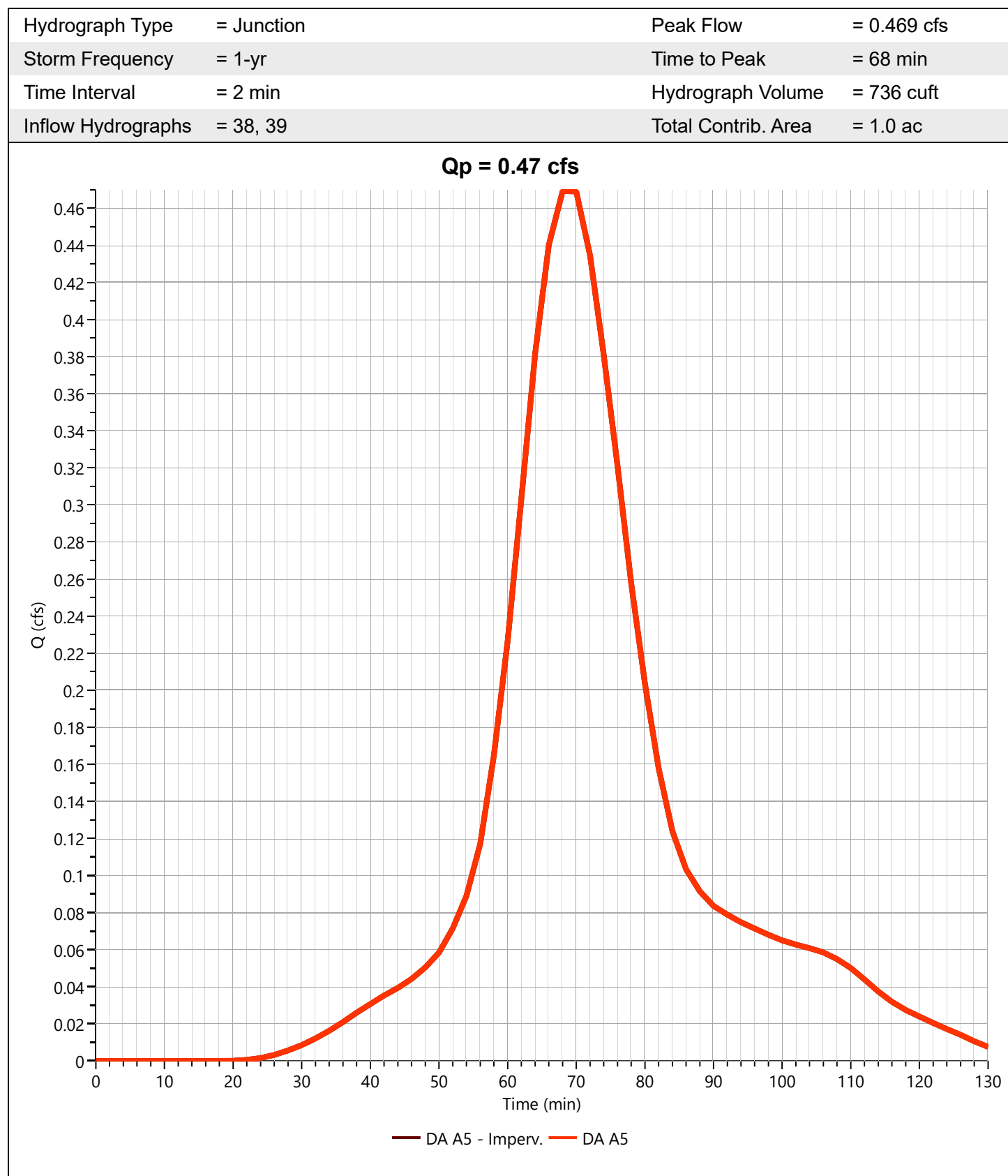
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A5

Hyd. No. 40



Hydrograph Report

Project Name:

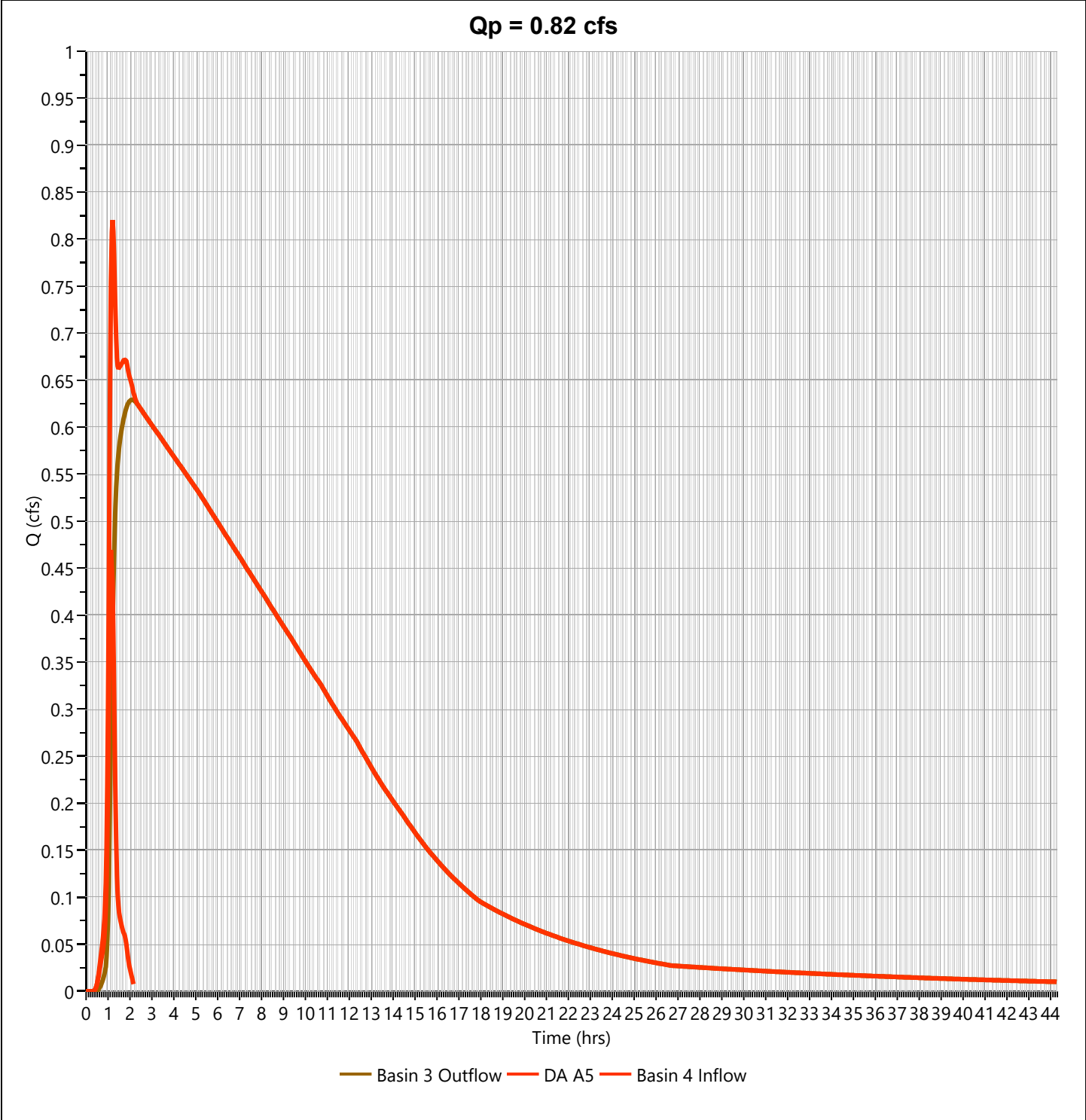
Hydrology Studio v 3.0.0.16

12-30-2020

Basin 4 Inflow

Hyd. No. 41

Hydrograph Type	= Junction	Peak Flow	= 0.820 cfs
Storm Frequency	= 1-yr	Time to Peak	= 72 min
Time Interval	= 2 min	Hydrograph Volume	= 26,272 cuft
Inflow Hydrographs	= 36, 40	Total Contrib. Area	= 1.0 ac



Hydrograph Report

Project Name:

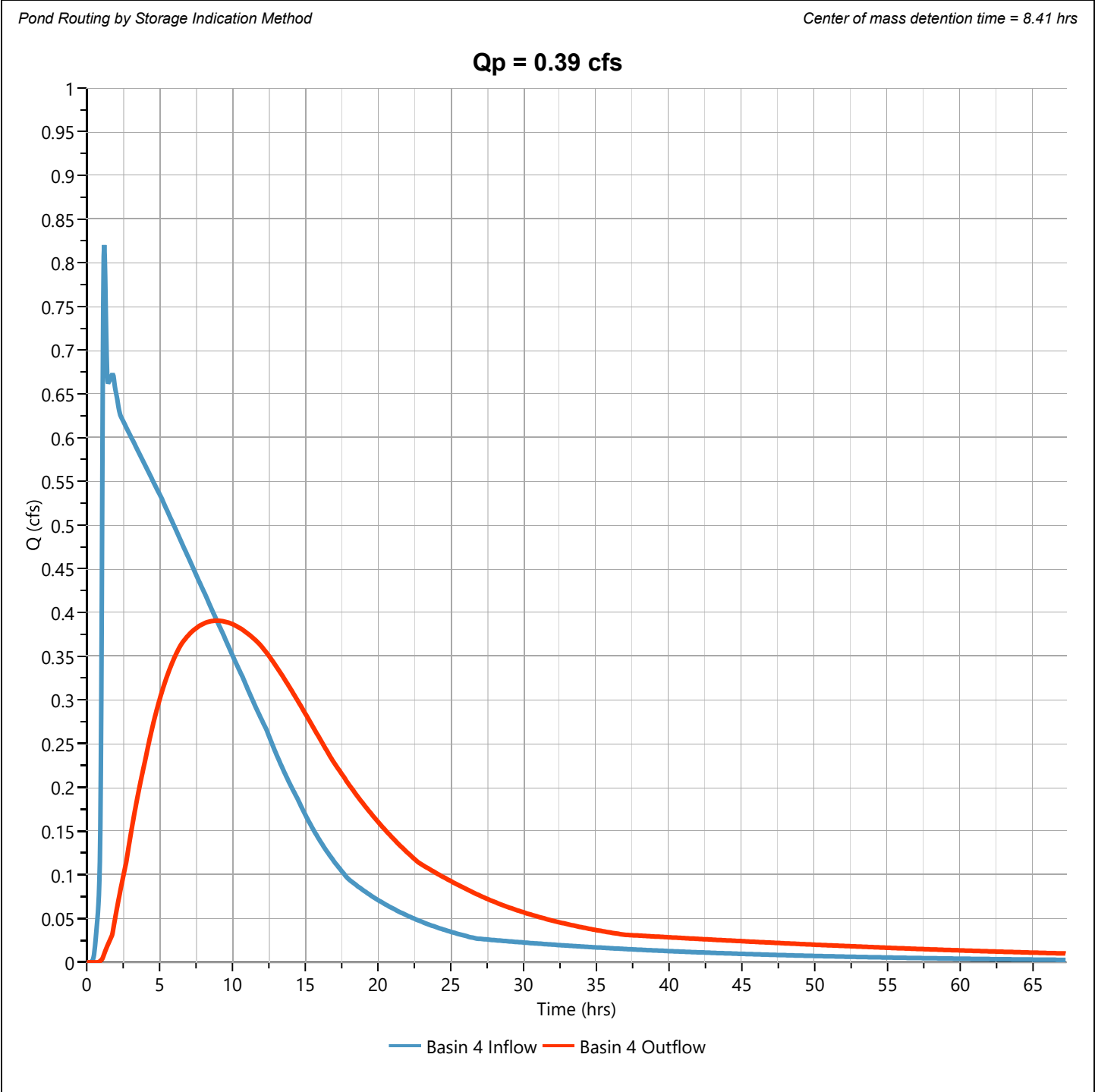
Hydrology Studio v 3.0.0.16

12-30-2020

Basin 4 Outflow

Hyd. No. 42

Hydrograph Type	= Pond Route	Peak Flow	= 0.391 cfs
Storm Frequency	= 1-yr	Time to Peak	= 536 min
Time Interval	= 2 min	Hydrograph Volume	= 26,127 cuft
Inflow Hydrograph	= 41 - Basin 4 Inflow	Max. Elevation	= 84.43 ft
Pond Name	= Basin 4	Max. Storage	= 8,213 cuft



Pond Report

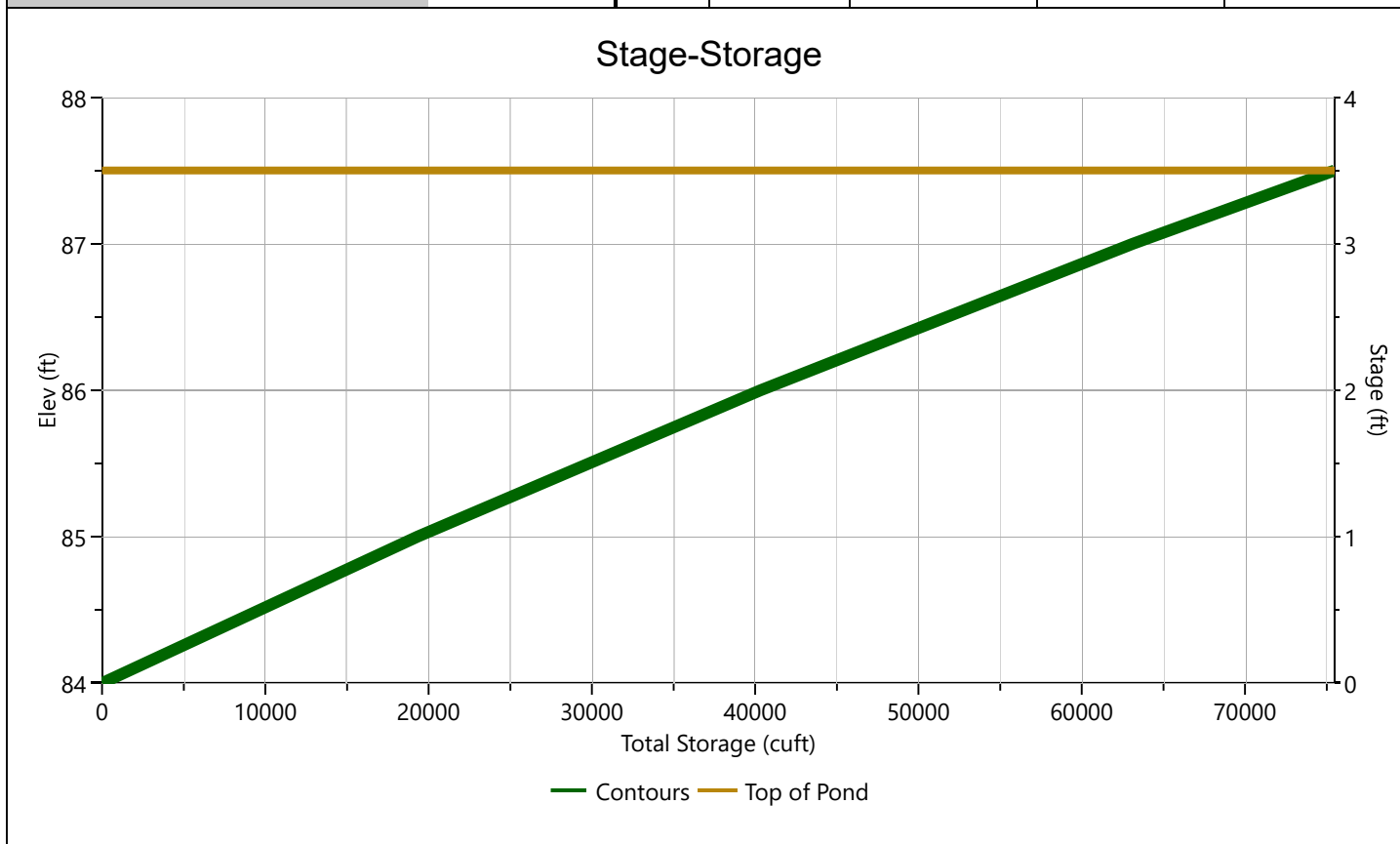
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 4

Stage-Storage

[illegible]

Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

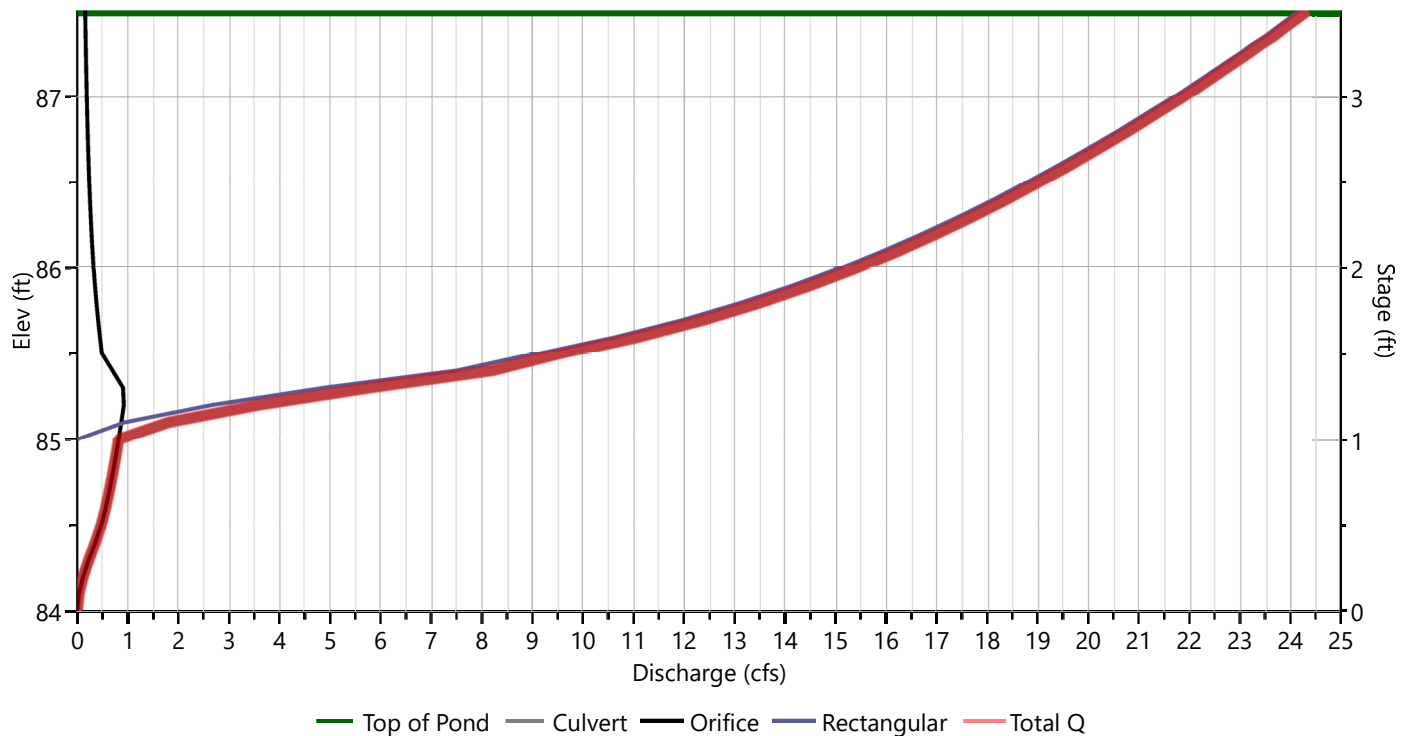
Basin 4

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	24	6			Hole Diameter, in
Span, in	24	6			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	83.15	84.00			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	108				
Barrel Slope, %	.3				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type	Circular	Rectangular			Exfiltration, in/hr
Crest Elevation, ft		85			
Crest Length, ft		9			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.

Stage-Discharge



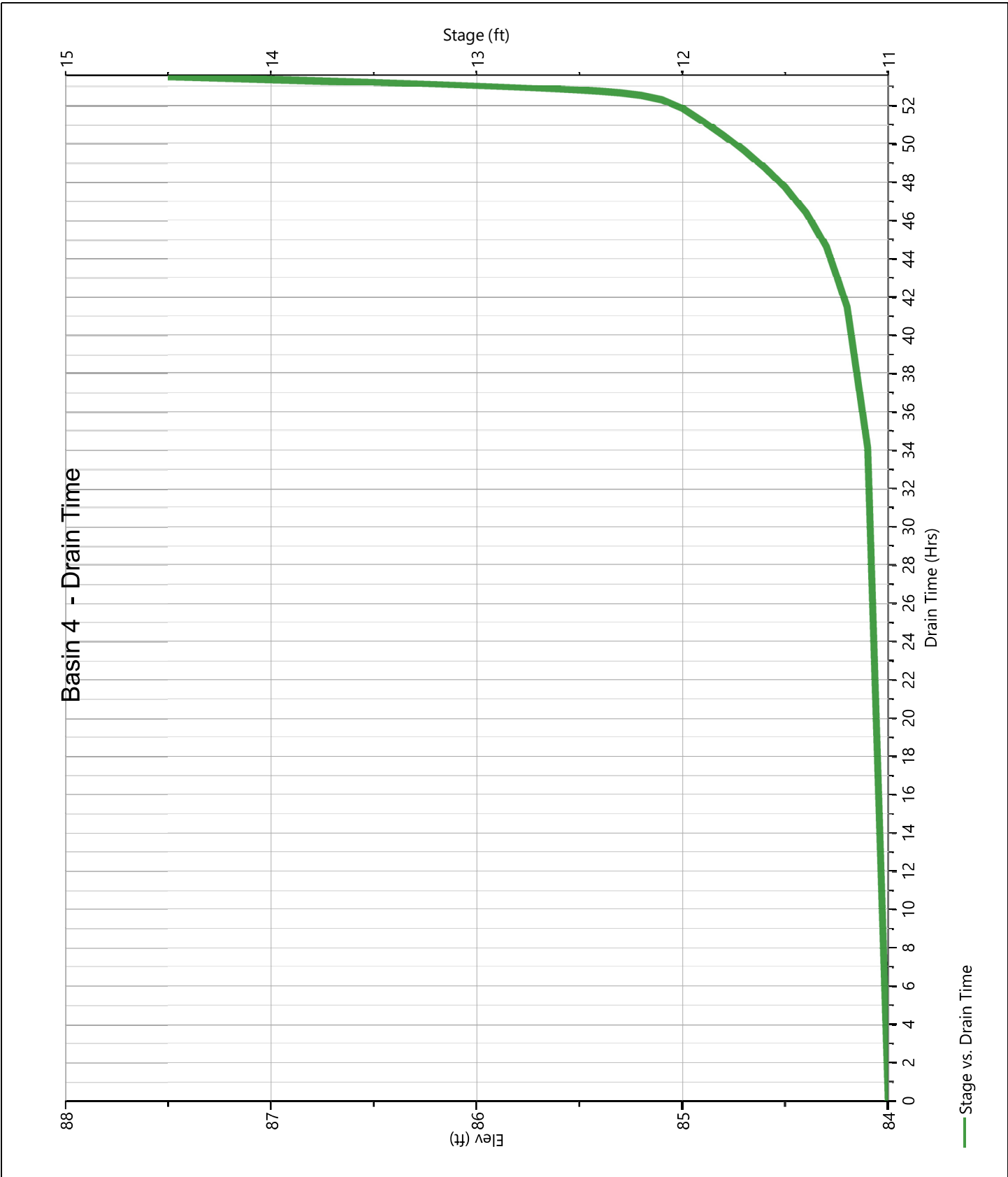
Project Name:

12-30-2020

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

Basin 4

Pond Drawdown



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6 - Perv.

Hyd. No. 44

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.84 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

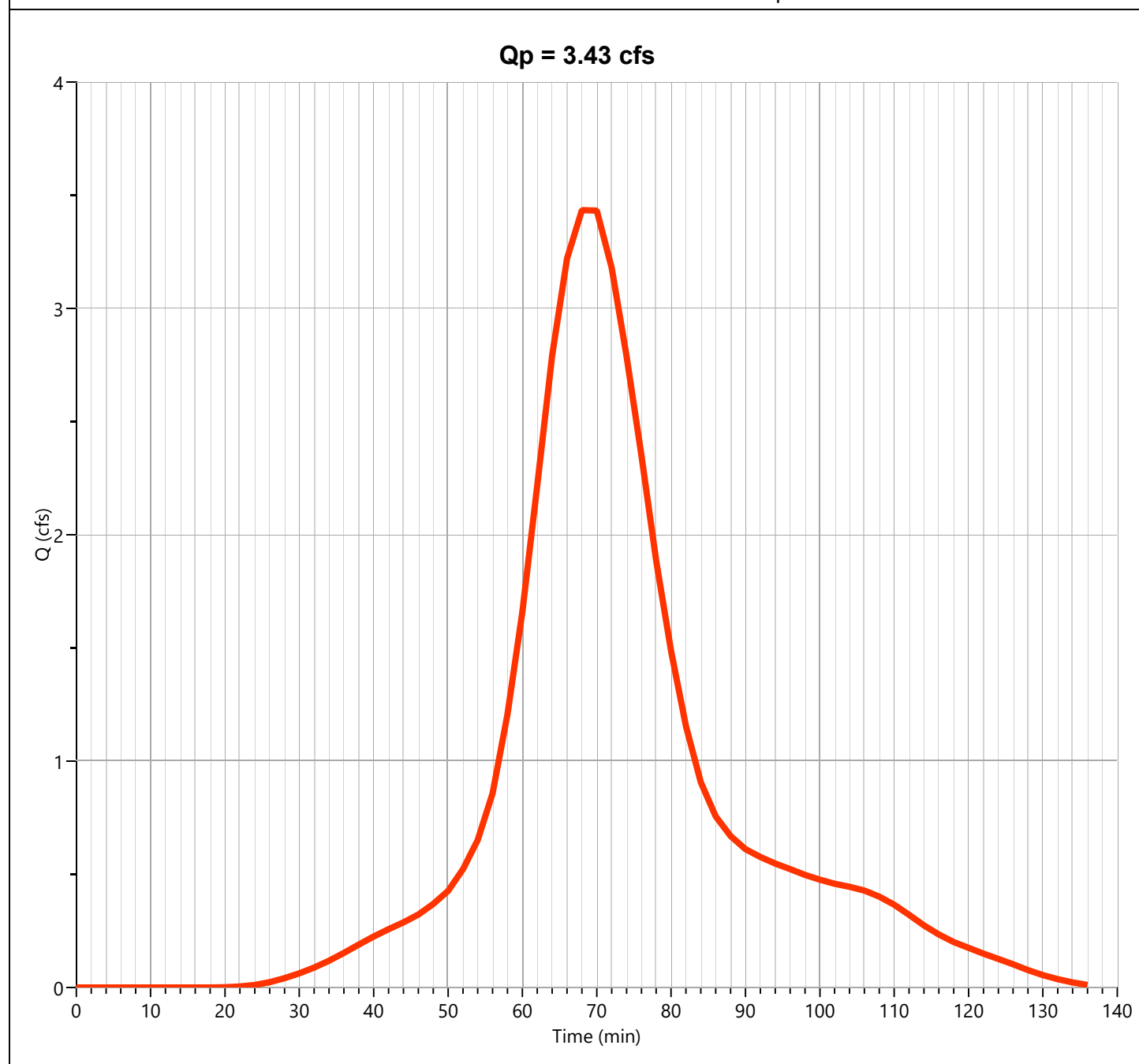
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6 - Imperv.

Hyd. No. 45

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.433 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Runoff Volume	= 5,383 cuft
Drainage Area	= 1.39 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

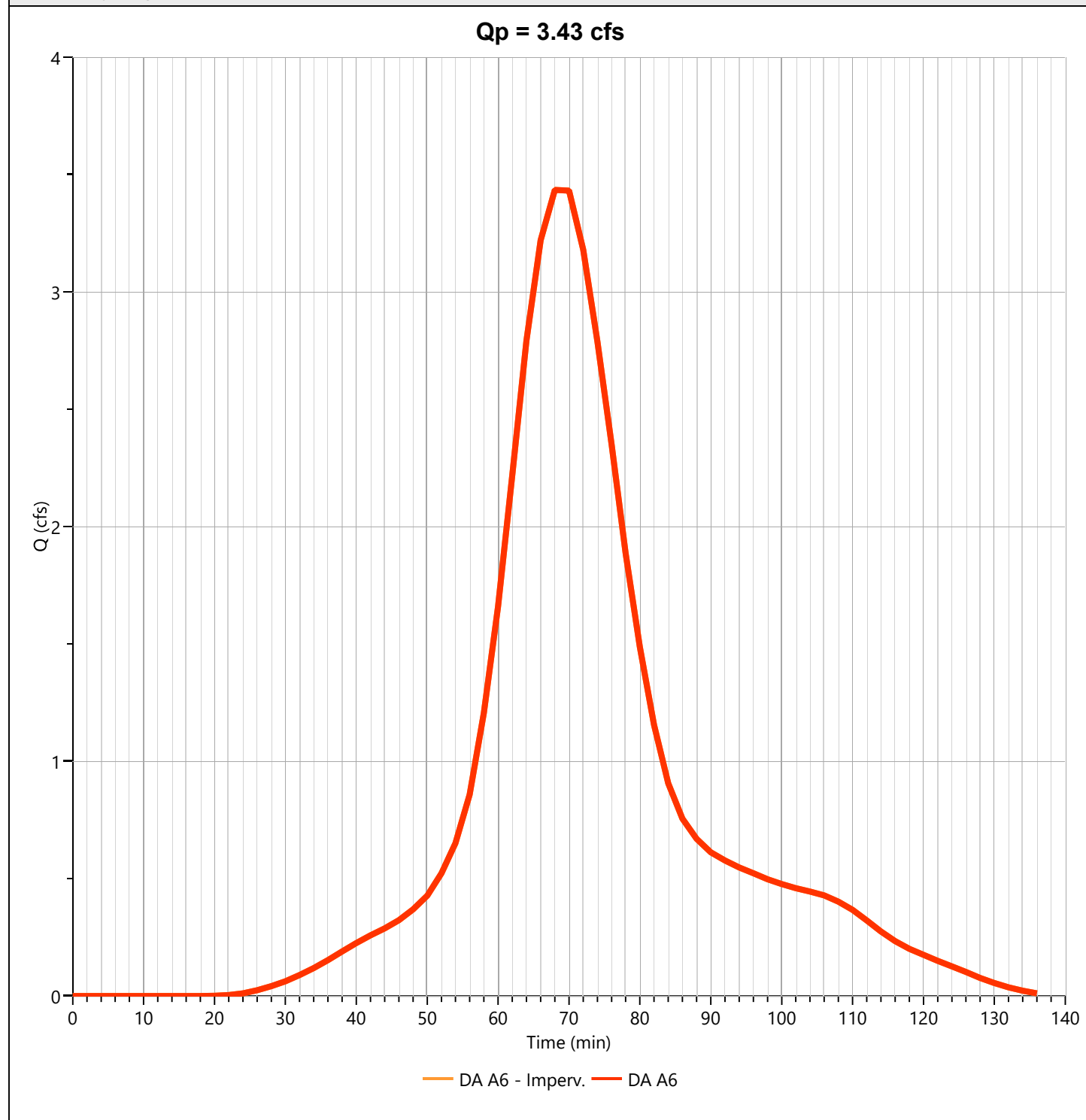
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A6

Hyd. No. 46

Hydrograph Type	= Junction	Peak Flow	= 3.433 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Hydrograph Volume	= 5,383 cuft
Inflow Hydrographs	= 44, 45	Total Contrib. Area	= 2.23 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 5 Outflow

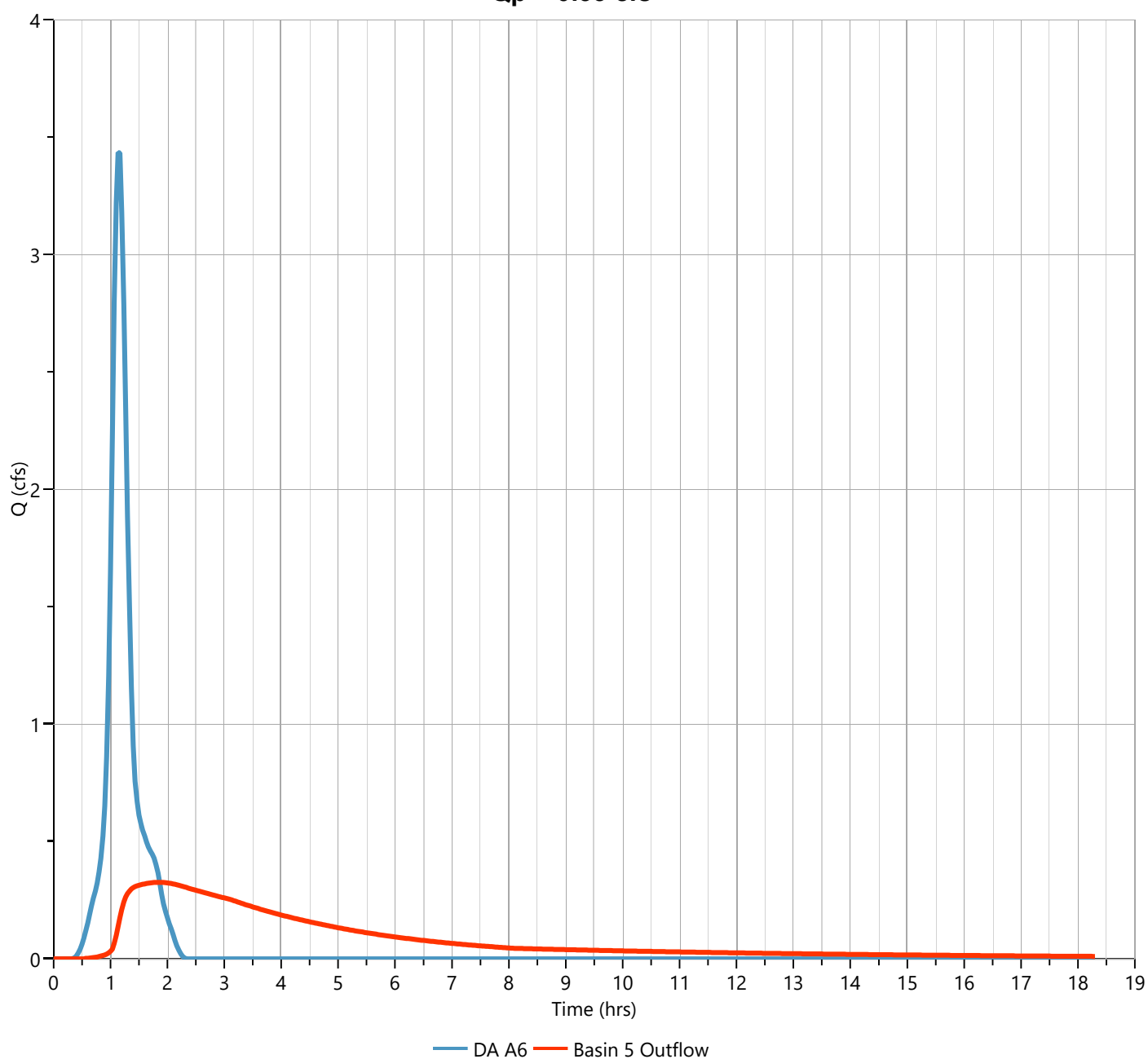
Hyd. No. 47

Hydrograph Type	= Pond Route	Peak Flow	= 0.326 cfs
Storm Frequency	= 1-yr	Time to Peak	= 112 min
Time Interval	= 2 min	Hydrograph Volume	= 5,359 cuft
Inflow Hydrograph	= 46 - DA A6	Max. Elevation	= 73.40 ft
Pond Name	= Basin 5	Max. Storage	= 4,365 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 4.19 hrs

Qp = 0.33 cfs



Pond Report

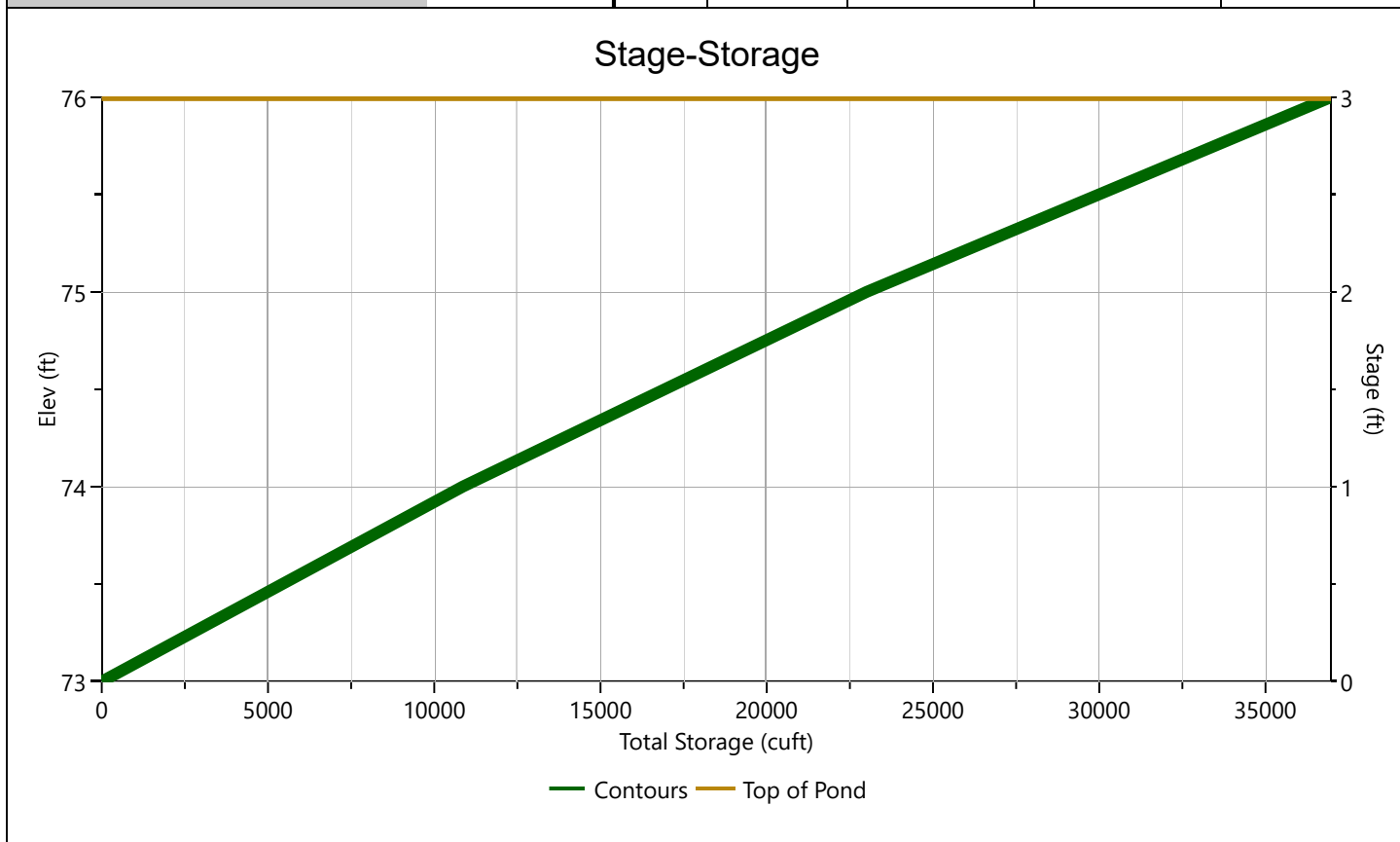
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 5

Stage-Storage

[illegible]

Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

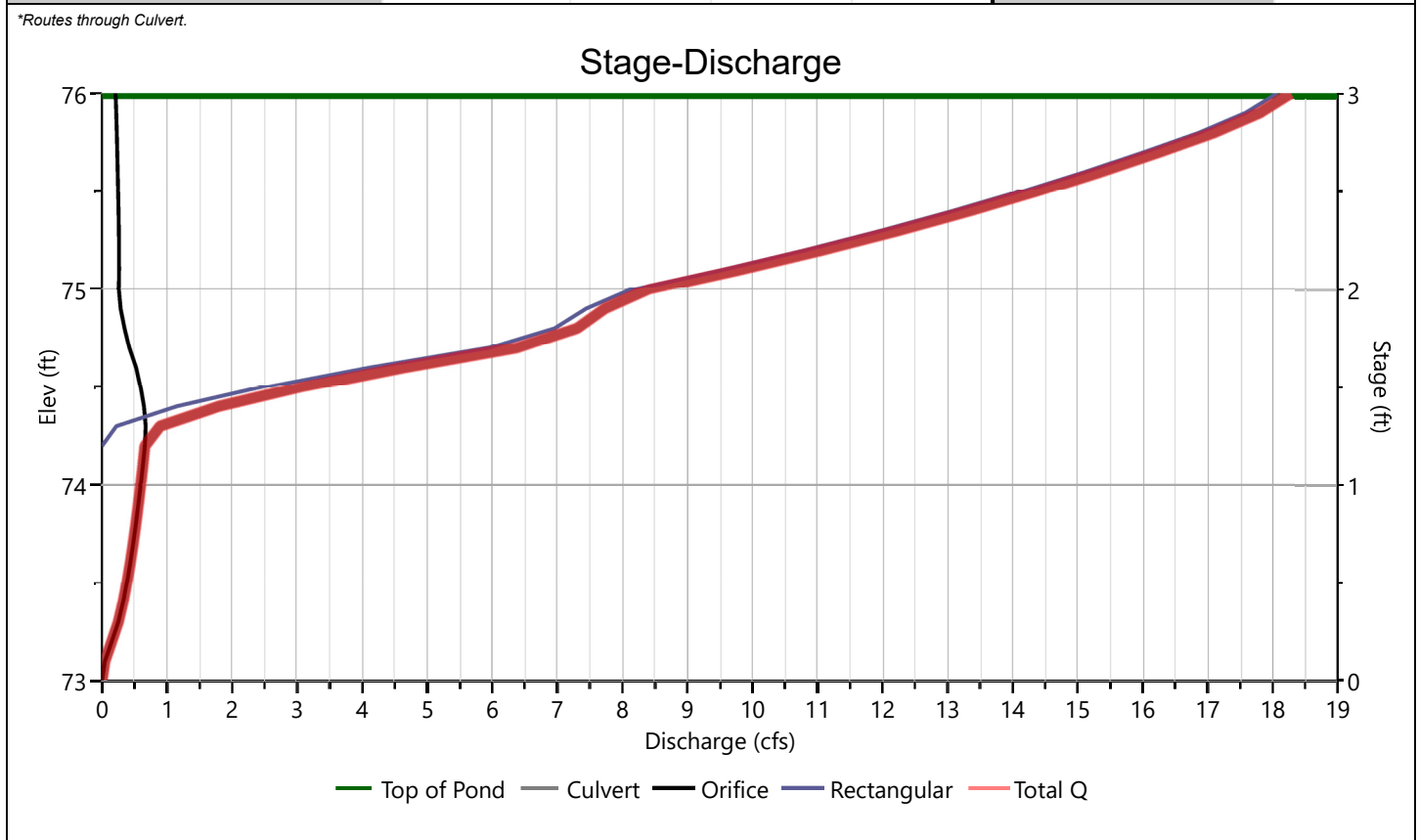
12-30-2020

Basin 5

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1*	2	3	
Rise, in	24	3.5			Hole Diameter, in
Span, in	24	3.5			No. holes
No. Barrels	1	2			Invert Elevation, ft
Invert Elevation, ft	72.79	73.00			Height, ft
Orifice Coefficient, Co	0.50	0.60			Orifice Coefficient, Co
Length, ft	73				
Barrel Slope, %	.3				
N-Value, n	0.013				
Weirs	Riser*	Weirs			Ancillary
		1*	2	3	
Shape / Type	Circular	Rectangular			Exfiltration, in/hr
Crest Elevation, ft		74.25			
Crest Length, ft		6			
Angle, deg					
Weir Coefficient, Cw		3.3			

*Routes through Culvert.



Pond Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Basin 5

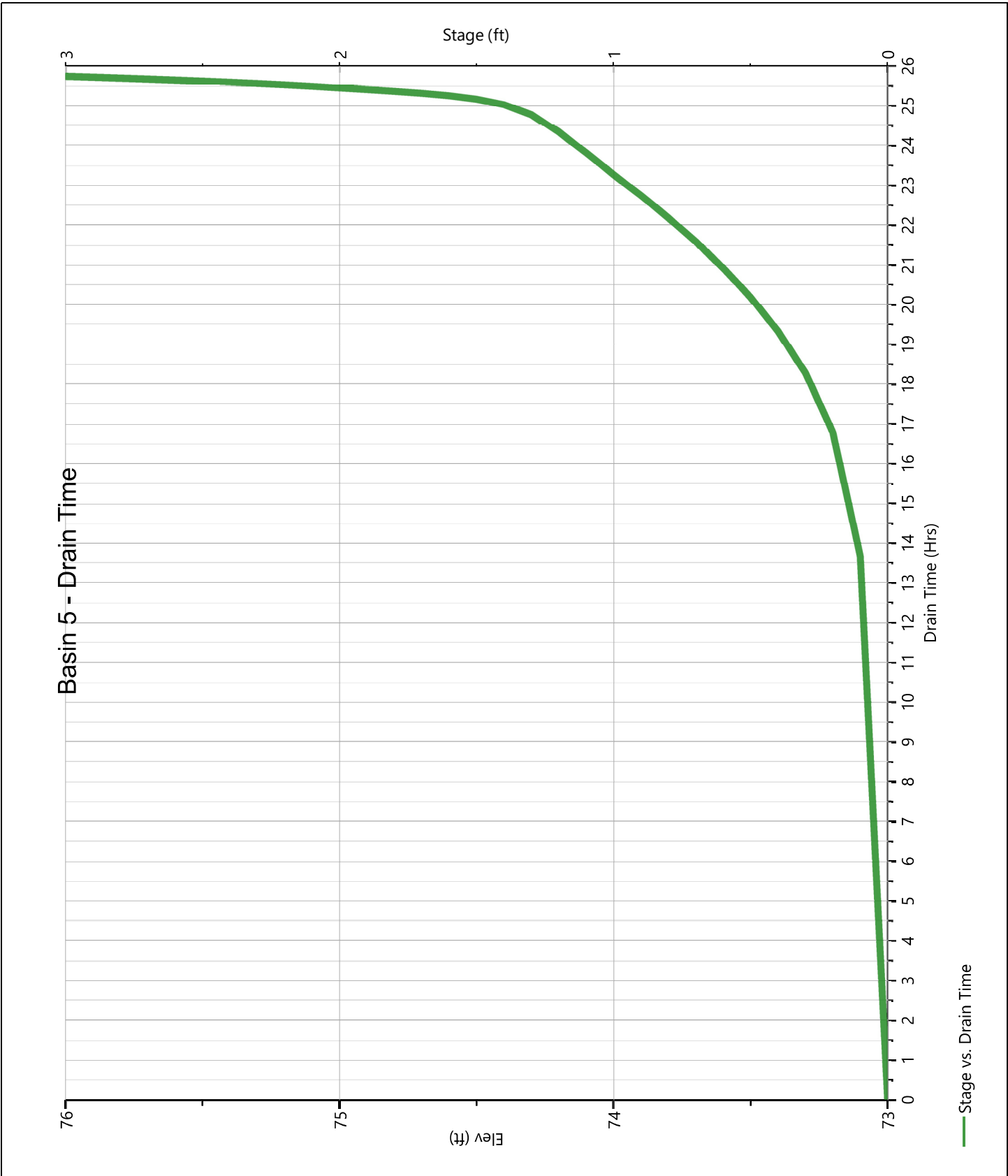
Stage-Storage-Discharge Summary

[illegible]

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

Basin 5

Pond Drawdown



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA A7

Hyd. No. 49

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 1.9 ac	Curve Number	= 45
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

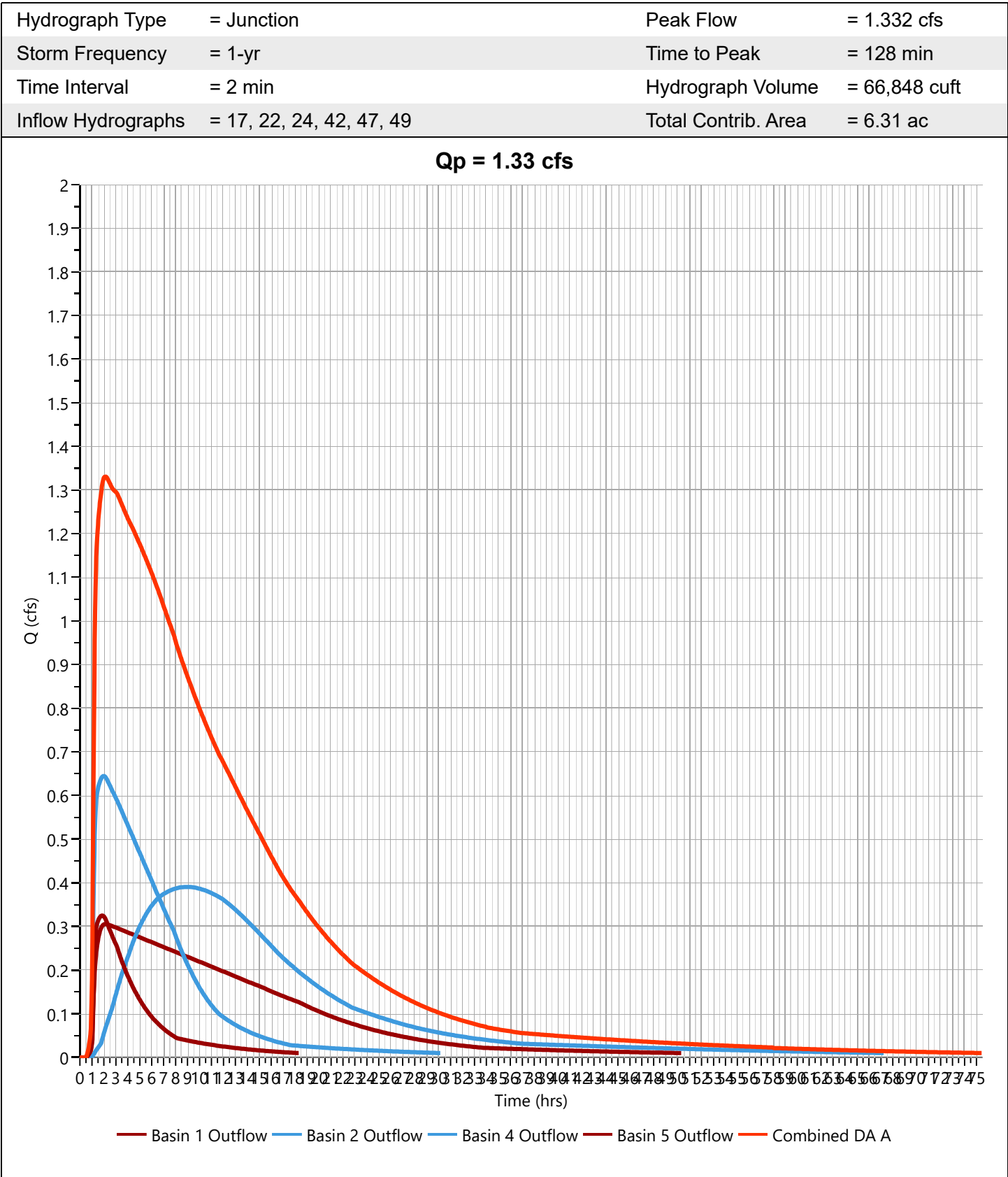
Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Combined DA A

Hyd. No. 51



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Post DA B - Perv.

Hyd. No. 53

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.8 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Pre DA C - Perv.

Hyd. No. 55

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 0.72 ac	Curve Number	= 39
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

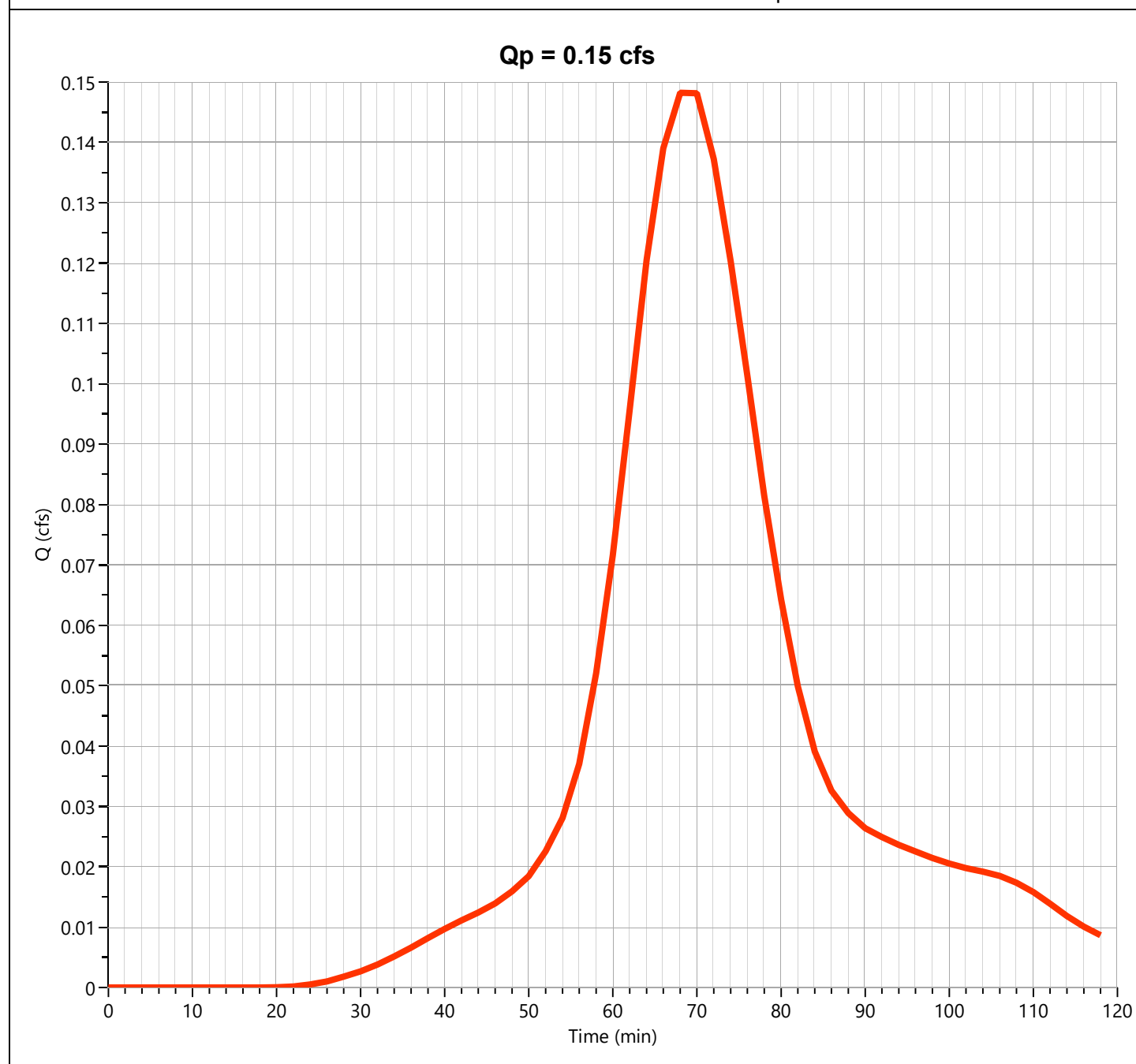
Hydrology Studio v 3.0.0.16

12-30-2020

Pre DA C - Imperv.

Hyd. No. 56

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.148 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Runoff Volume	= 232 cuft
Drainage Area	= 0.06 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

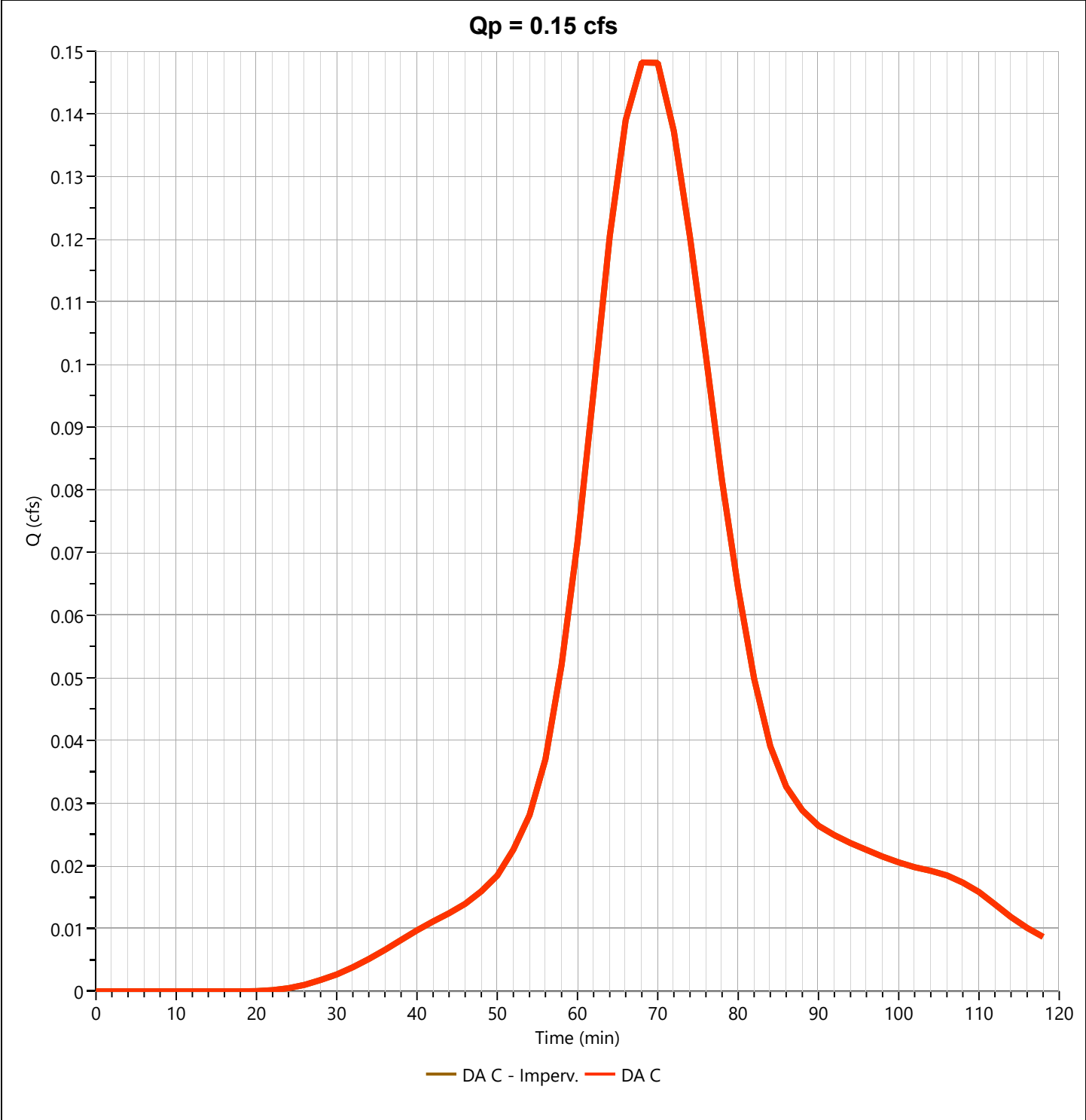
Hydrology Studio v 3.0.0.16

12-30-2020

Post DA C

Hyd. No. 57

Hydrograph Type	= Junction	Peak Flow	= 0.148 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Hydrograph Volume	= 232 cuft
Inflow Hydrographs	= 55, 56	Total Contrib. Area	= 0.78 ac



Hydrograph 1-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (min)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	Post DAA1a - Perv.	0.000	0	0.000	----		
2	NRCS Runoff	Post DAA1a - Imperv.	6.496	68	10,186	----		
3	Junction	Post DAA1a	6.496	68	10,186	1, 2		
5	NRCS Runoff	Post DAA1a (un) - Perv.	0.000	0	0.000	----		
7	Junction	UG Basin West Inflow	6.496	68	10,186	3, 5		
8	Pond Route	UG Basin West Outflow	4.014	76	10,185	7	101.14	2,649
10	NRCS Runoff	Post DAA1b - Perv.	0.000	0	0.000	----		
11	NRCS Runoff	Post DAA1b - Imperv.	5.385	68	8,443	----		
12	Junction	Post DAA1b	5.385	68	8,443	10, 11		
14	NRCS Runoff	Post DAA1b (un) - Perv.	0.008	106	16.7	----		
				TIME TO PEAK: 128 MIN OR 2.23 HRS		PEAK STAGE	VOLUME OF RUNOFF IN BASIN AT PEAK 10% = 1,754 CU FT	
16	Junction	Basin 1 Inflow	8.940	70	18,645	8, 12, 14		
17	Pond Route	Basin 1 Outflow	0.306	128	18,560	16	96.05	17,537
19	NRCS Runoff	Post DAA2 - Perv.	0.000	0	0.000	----		
20	NRCS Runoff	Post DAA2 - Imperv.	10.74	68	16,847	----		
21	Junction	Post DAA2	10.74	68	16,847	19, 20		
22	Pond Route	Basin 2 Outflow	0.645	118	16,803	21	84.17	14,591
				TIME TO PEAK: 118 MIN OR 1.97 HRS		PEAK STAGE	VOLUME OF RUNOFF IN BASIN AT PEAK 10% = 1,459 CU FT	
24	NRCS Runoff	Post DAA3 - Perv.	0.000	0	0.000	----		
26	NRCS Runoff	Post DAA4a - Perv.	0.000	0	0.000	----		
27	NRCS Runoff	Post DAA4a - Imperv.	11.14	68	17,467	----		
28	Junction	Post DAA4a	11.14	68	17,467	26, 27		
29	Pond Route	UG Basin East Out	9.591	74	17,466	28	101.24	2,914
31	NRCS Runoff	Post DAA4b - Perv.	0.000	0	0.000	----		
32	NRCS Runoff	Post DAA4b - Imperv.	5.187	68	8,133	----		
33	Junction	Post DAA4b	5.187	68	8,133	31, 32		
				TIME TO PEAK: 126 MIN OR 2.10 HRS		PEAK STAGE	VOLUME OF RUNOFF IN BASIN AT PEAK 10% = 2,333 CU FT	
35	Junction	Basin 3 Inflow	14.36	72	25,599	29, 33		
36	Pond Route	Basin 3 Outflow	0.629	126	25,536	35	90.33	23,332

Hydrograph 1-yr Summary

Project Name:

Hydrology Studio v 3.0.0.16

12-30-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (min)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
38	NRCS Runoff	Post DAA5 - Perv.	0.000	0	0.000			
39	NRCS Runoff	Post DAA5 - Imperv.	0.469	68	736			
40	Junction	Post DAA5	0.469	68	736	38, 39		
41	Junction	Basin 4 Inflow	0.820	72	26,272	36, 40		
42	Pond Route	Basin 4 Outflow	0.391	536	26,127	41	84.43	8,213
44	NRCS Runoff	Post DAA6 - Perv.	0.000	0	0.000	---		
45	NRCS Runoff	Post DAA6 - Imperv.	3.433	68	5,383	---		
46	Junction	Post DAA6	3.433	68	5,383	44, 45		
47	Pond Route	Basin 5 Outflow	0.326	112	5,359	46	73.40	4,365
49	NRCS Runoff	Post DAA7	0.000	0	0.000	---		
51	Junction	Combined DAA	1.332	128	66,848	17, 22, 24, 42, 47, 49		
53	NRCS Runoff	Post DA B - Perv.	0.000	0	0.000	---		
55	NRCS Runoff	Pre DA C - Perv.	0.000	0	0.000	---		
56	NRCS Runoff	Pre DA C - Imperv.	0.148	68	232	---		
57	Junction	Post DA C	0.148	68	232	55, 56		

TIME TO PEAK: 538 MIN OR 8.97 HRS

VOLUME OF RUNOFF IN BASIN AT PEAK
10% = 821 CU FT

PEAK
STAGE

TIME TO PEAK: 112 MIN OR 1.87 HRS

PEAK
STAGE

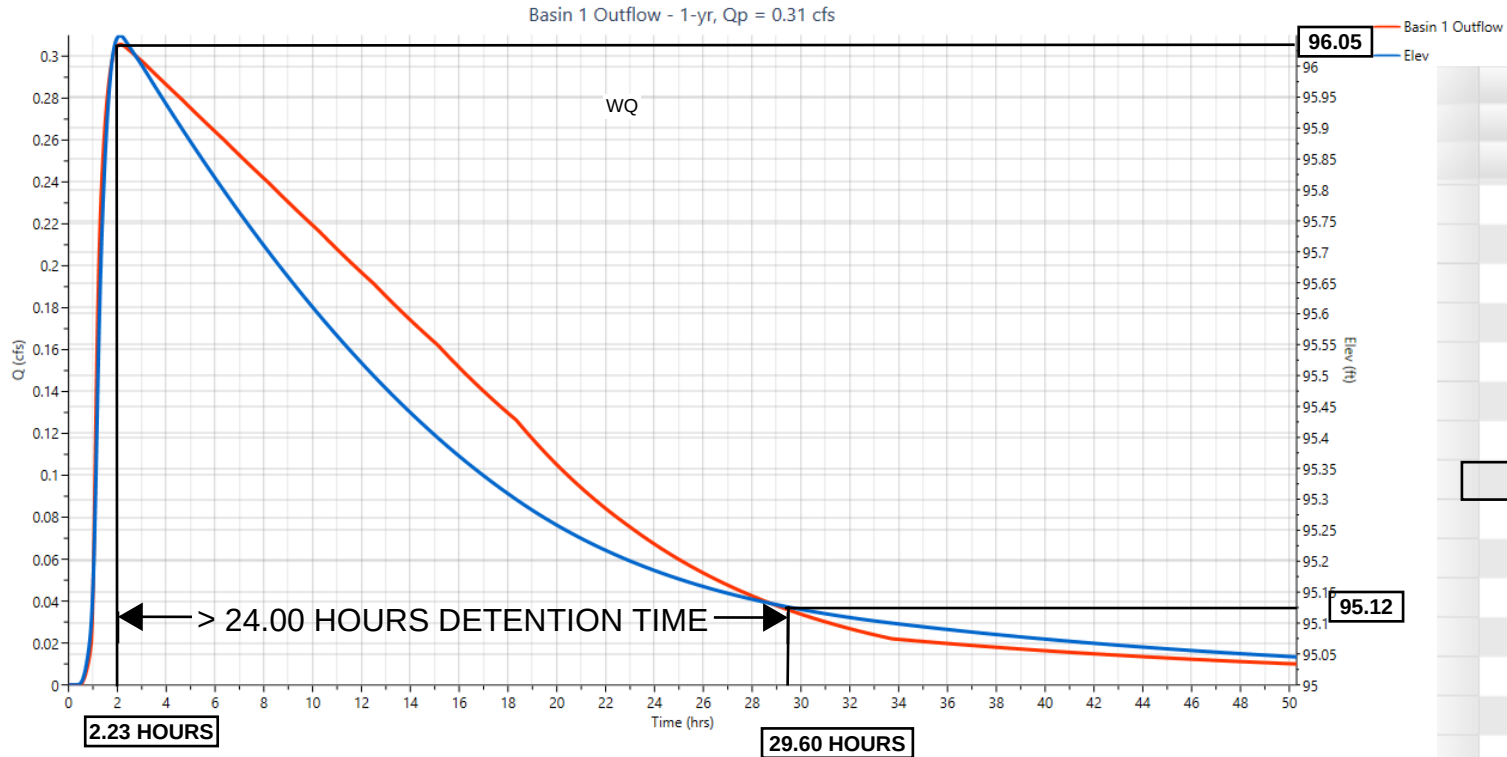
VOLUME OF RUNOFF IN BASIN AT PEAK
10% = 437 CU FT

BASIN 1 SUMMARY TABLE FROM HYDROLOGY STUDIO

Stage (ft)	Elev (ft)	Storage (cuft)	Culvert (cfs)	Culvert (ft/s)	Orifice 1 (cfs)	Weir 1 (cfs)	Total Q (cfs)	Drain Time (hrs)
0	95	0	0	0	0	0	0	0
0.1	95.1	1,663	0.022 oc	0.88	0.022	0	0.022	41.92
0.2	95.2	3,327	0.075 oc	1.28	0.075	0	0.075	51.44
0.3	95.3	4,990	0.126 oc	1.5	0.126	0	0.126	56.03
0.4	95.4	6,653	0.162 oc	1.62	0.162	0	0.162	59.23
0.5	95.5	8,317	0.191 oc	1.7	0.191	0	0.191	61.85
0.6	95.6	9,980	0.217 oc	1.77	0.217	0	0.217	64.11
0.7	95.7	11,643	0.239 oc	1.82	0.239	0	0.239	66.13
0.8	95.8	13,307	0.260 oc	1.87	0.26	0	0.26	67.98
0.9	95.9	14,970	0.279 oc	1.9	0.279	0	0.279	69.7
1	96	16,634	0.297 oc	1.94	0.297	0	0.297	71.3
1.1	96.1	18,460	0.314 oc	1.97	0.314	0	0.314	72.96
1.2	96.2	20,286	0.330 oc	2	0.33	0	0.33	74.53
1.3	96.3	22,112	0.346 oc	2.03	0.346	0	0.346	76.03
1.4	96.4	23,938	0.360 oc	2.06	0.36	0	0.36	77.47
1.5	96.5	25,764	0.374 oc	2.08	0.374	0	0.374	78.85
1.6	96.6	27,590	0.388 oc	2.1	0.388	0	0.388	80.18
1.7	96.7	29,417	0.401 oc	2.13	0.401	0	0.401	81.47
1.8	96.8	31,243	0.414 oc	2.14	0.414	0	0.414	82.71
1.9	96.9	33,069	0.426 oc	2.16	0.426	0	0.426	83.92
2	97	34,895	0.438 oc	2.18	0.438	0	0.438	85.1
2.1	97.1	36,890	0.450 oc	2.2	0.45	0	0.45	86.35
2.2	97.2	38,884	0.461 oc	2.22	0.461	0	0.461	87.56
2.3	97.3	40,879	0.472 oc	2.23	0.472	0	0.472	88.75
2.4	97.4	42,873	0.483 oc	2.25	0.483	0	0.483	89.91
2.5	97.5	44,868	0.494 oc	2.26	0.494	0	0.494	91.04
2.6	97.6	46,863	0.504 oc	2.28	0.504	0	0.504	92.16
2.7	97.7	48,857	0.514 oc	2.29	0.514	0	0.514	93.24
2.8	97.8	50,852	0.524 oc	2.3	0.524	0	0.524	94.31
2.9	97.9	52,846	0.534 oc	2.32	0.534	0	0.534	95.36
3	98	54,841	0.543 oc	2.33	0.543	0	0.543	96.39
3.1	98.1	57,010	0.553 oc	2.34	0.553	0	0.553	97.49
3.2	98.2	59,178	0.562 oc	2.35	0.562	0	0.562	98.57
3.3	98.3	61,347	0.793 oc	2.6	0.571	0.221	0.793	99.46
3.4	98.4	63,516	1.730 oc	3.28	0.58	1.15	1.73	99.93
3.5	98.5	65,684	3.064 oc	3.87	0.589	2.475	3.064	100.19
3.6	98.6	67,853	4.698 oc	4.36	0.598	4.1	4.698	100.34
3.7	98.7	70,022	6.583 oc	4.77	0.606	5.977	6.583	100.45
3.8	98.8	72,190	8.691 oc	5.12	0.615	8.076	8.691	100.53
3.9	98.9	74,359	11.00 oc	5.4	0.623	10.38	11	100.59
4	99	76,528	13.49 oc	5.61	0.631	12.86	13.49	100.64
4.1	99.1	78,696	16.16 oc	5.67	0.64	15.52	16.16	100.68
4.2	99.2	81,225	18.98 oc	6.04	0.648	18.33	18.98	100.72
4.3	99.3	83,573	21.94 oc	6.98	0.641	21.3	21.94	100.75
4.4	99.4	85,922	25.01 oc	7.96	0.596	24.42	25.01	100.78
4.5	99.5	88,270	28.21 oc	8.98	0.536	27.67	28.21	100.8
4.6	99.6	90,619	31.51 oc	10.03	0.455	31.06	31.51	100.82
4.7	99.7	92,967	34.35 oc	10.93	0.363	33.98 s	34.35	100.84
4.8	99.8	95,315	35.46 oc	11.29	0.326	35.13 s	35.46	100.86
4.9	99.9	97,664	36.28 oc	11.55	0.299	35.99 s	36.28	100.88
5	100	100,012	36.97 oc	11.77	0.277	36.70 s	36.97	100.9
5.1	100.1	102,611	37.57 oc	11.96	0.258	37.31 s	37.57	100.92
5.2	100.2	105,209	38.11 oc	12.13	0.241	37.87 s	38.11	100.94
5.3	100.3	107,807	38.59 oc	12.29	0.227	38.37 s	38.59	100.96
5.4	100.4	110,405	39.04 oc	12.43	0.214	38.83 s	39.04	100.97
5.5	100.5	113,003	39.46 oc	12.56	0.202	39.26 s	39.46	100.99
5.6	100.6	115,601	39.86 oc	12.69	0.192	39.67 s	39.86	101.01
5.7	100.7	118,200	40.24 oc	12.81	0.182	40.06 s	40.24	101.03
5.8	100.8	120,798	40.60 oc	12.92	0.174	40.42 s	40.6	101.05
5.9	100.9	123,396	40.95 oc	13.03	0.166	40.78 s	40.95	101.06
6	101	125,994	41.28 oc	13.14	0.159	41.13 s	41.28	101.08

ELEVATION (EL 95.12) IN
BASIN ASSOCIATED WITH 10%
OF PEAK WATER QUALITY
VOLUME

BASIN 1 STAGE VS TIME GRAPH AND TABLE FROM HYDROLOGY STUDIO



Basin 1 Outflow		
Time	Outflow	Elevation
(hrs)	(cfs)	(ft)
29.37	0.036	95.13
29.40	0.036	95.13
29.43	0.036	95.13
29.47	0.036	95.13
29.50	0.036	95.13
29.53	0.036	95.13
29.57	0.035	95.13
29.60	0.035	95.12
29.63	0.035	95.12
29.67	0.035	95.12
29.70	0.035	95.12
29.73	0.035	95.12
29.77	0.035	95.12
29.80	0.035	95.12
29.83	0.034	95.12
29.87	0.034	95.12
29.90	0.034	95.12
29.93	0.034	95.12
29.97	0.034	95.12
30.00	0.034	95.12

EXTENDED DETENTION CALCULATION:

TIME FOR WATER QUALITY STORM TO PEAK IN DETENTION BASIN: 2.23 HOURS

MAXIMUM VOLUME OF WATER IN BASIN AT PEAK: 17,537 CUBIC FEET

NEED 10% OF MAXIMUM VOLUME LEFT IN BASIN 24 HOURS AFTER TIME TO PEAK TO MAXIMIZE TOTAL SUSPENDED SOLIDS REMOVAL IN BASIN (60% TSS REMOVAL FOR EXTENDED DETENTION BASINS).

10% OF PEAK VOLUME = 1,754 CUBIC FEET

1,754 CUBIC FEET OF WATER IS LEFT IN THE BASIN AT STAGE 95.12 FT

STAGE 95.12 FT OCCURS IN BASIN AT TIME 26.08 HOURS SO THE EXTENDED DETENTION IS EQUAL TO: 29.60 HOURS - 2.23 HOURS = 27.37 HOURS

TIME WHEN 10% OF VOLUME IS LEFT IN BASIN (SEE DETENTION BASIN SUMMARY TABLE FROM HYDRAFLOW HYDROGRAPHS PROVIDED IN THIS APPENDIX)

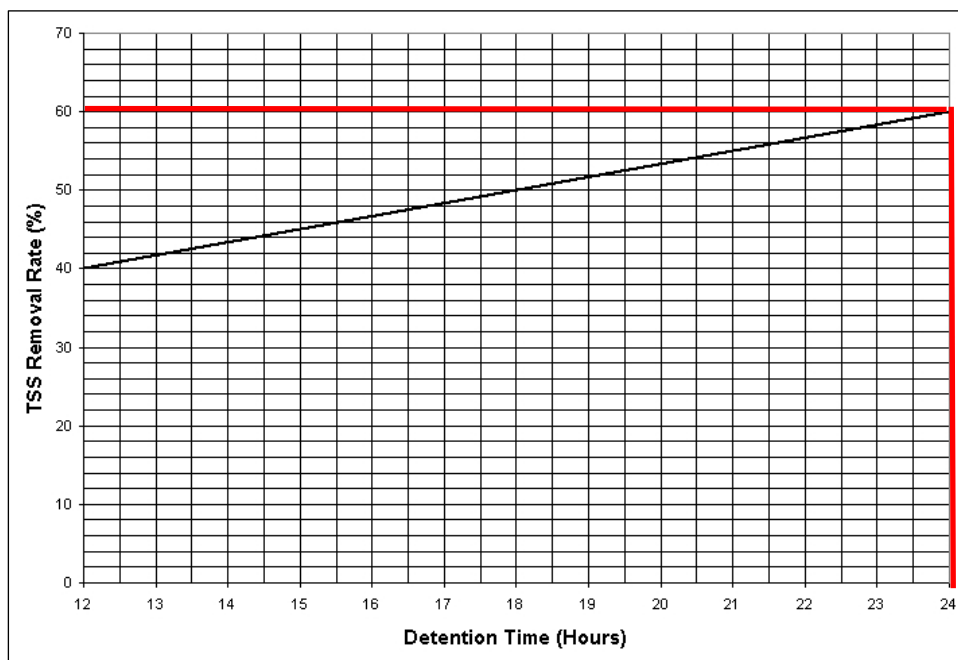
TSS Removal Rates for Extended Detention Basins

Extended detention basins are designed to provide treatment of runoff volume generated by the stormwater quality design storm. Techniques to compute this volume are discussed in *Chapter 5: Computing Stormwater Runoff Rates and Volumes*.

The TSS removal rate for an extended detention basin is based on the basin's detention time. The detention time begins when the maximum storage volume is achieved and ends when only 10% of the maximum volume remains. The chart below shows the TSS removal rate for a given detention time. As previously stated, for the purposes of TSS removal rate calculations, the minimum detention time is 12 hours, and the maximum detention time is 24 hours. Systems with detention times in excess of 24 hours will still only be credited with a 60% TSS removal rate.

TSS Removal Rate of Extended Detention Basins

**BASIN 1
TSS REMOVAL
RATE = 60%**



To determine the TSS removal rate for an extended detention basin, either the chart above or the following equation may be used:

$$\% \text{ TSS Removal Rate} = 40 + \left\{ \left[\frac{t-12}{12} \right] \times 20 \right\},$$

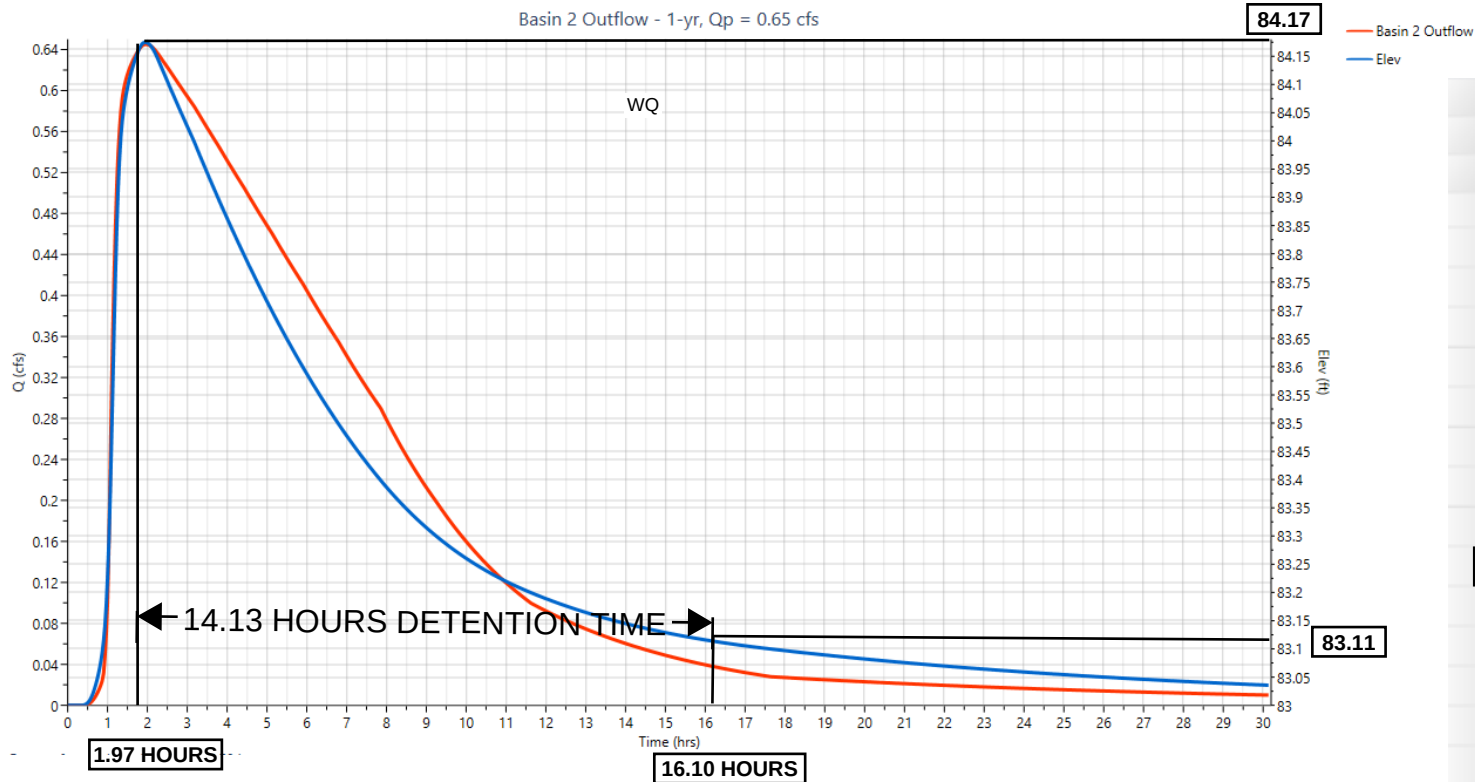
where t is the time of detention in hours and $12 \leq t \leq 24$.

BASIN 2 SUMMARY TABLE FROM HYDROLOGY STUDIO

Stage (ft)	Elev (ft)	Storage (cuft)	Culvert (cfs)	Culvert (ft/s)	Orifice 1 (cfs)	Weir 1 (cfs)	Total Q (cfs)	Drain Time (hrs)
0	83	0	0	0	0	0	0	0
0.1	83.1	1,221	0.028 oc	0.8	0.028	0	0.028	24.25
0.2	83.2	2,442	0.100 oc	1.18	0.1	0	0.1	29.56
0.3	83.3	3,663	0.198 oc	1.46	0.198	0	0.198	31.84
0.4	83.4	4,884	0.290 oc	1.64	0.29	0	0.29	33.23
0.5	83.5	6,105	0.355 oc	1.74	0.355	0	0.355	34.29
0.6	83.6	7,326	0.411 oc	1.81	0.411	0	0.411	35.17
0.7	83.7	8,547	0.460 oc	1.88	0.46	0	0.46	35.95
0.8	83.8	9,768	0.505 oc	1.93	0.505	0	0.505	36.65
0.9	83.9	10,989	0.546 oc	1.98	0.546	0	0.546	37.3
1	84	12,209	0.584 oc	2.02	0.584	0	0.584	37.9
1.1	84.1	13,574	0.620 oc	2.05	0.62	0	0.62	38.53
1.2	84.2	14,938	0.654 oc	2.09	0.654	0	0.654	39.12
1.3	84.3	16,302	0.686 oc	2.12	0.686	0	0.686	39.69
1.4	84.4	17,666	0.717 oc	2.14	0.717	0	0.717	40.23
1.5	84.5	19,030	0.746 oc	2.17	0.746	0	0.746	40.75
1.6	84.6	20,394	0.774 oc	2.19	0.774	0	0.774	41.25
1.7	84.7	21,758	0.802 oc	2.22	0.802	0	0.802	41.73
1.8	84.8	23,122	0.828 oc	2.24	0.828	0	0.828	42.19
1.9	84.9	24,486	0.854 oc	2.26	0.854	0	0.854	42.64
2	85	25,850	0.879 oc	2.28	0.879	0	0.879	43.08
2.1	85.1	27,363	0.903 oc	2.3	0.903	0	0.903	43.55
2.2	85.2	28,876	0.926 oc	2.31	0.926	0	0.926	44.01
2.3	85.3	30,390	0.949 oc	2.33	0.949	0	0.949	44.46
2.4	85.4	31,903	0.972 oc	2.35	0.972	0	0.972	44.9
2.5	85.5	33,416	0.994 oc	2.36	0.994	0	0.994	45.33
2.6	85.6	34,930	1.015 oc	2.38	1.015	0	1.015	45.74
2.7	85.7	36,443	1.036 oc	2.39	1.036	0	1.036	46.15
2.8	85.8	37,956	1.352 oc	2.59	1.057	0.295	1.352	46.51
2.9	85.9	39,470	2.610 oc	3.12	1.077	1.533	2.61	46.72
3	86	40,983	4.397 oc	3.61	1.097	3.3	4.397	46.84
3.1	86.1	42,651	6.583 oc	4	1.116	5.466	6.583	46.92
3.2	86.2	44,320	9.105 oc	4.31	1.135	7.969	9.105	46.98
3.3	86.3	45,988	11.92 oc	4.49	1.154	10.77	11.92	47.03
3.4	86.4	47,656	14.99 oc	4.77	1.151	13.83	14.99	47.06
3.5	86.5	49,325	18.26 oc	5.81	1.108	17.15	18.26	47.09
3.6	86.6	50,993	21.73 oc	6.92	1.045	20.69	21.73	47.11
3.7	86.7	52,661	25.40 oc	8.08	0.954	24.44	25.4	47.13
3.8	86.8	54,330	29.16 ic	9.28	0.758	28.4	29.16	47.15
3.9	86.9	55,998	31.38 ic	9.99	0.604	30.77 s	31.38	47.16
4	87	57,666	32.38 ic	10.31	0.536	31.84 s	32.38	47.18
4.1	87.1	59,551	33.15 ic	10.55	0.485	32.67 s	33.15	47.19
4.2	87.2	61,436	33.80 ic	10.76	0.443	33.36 s	33.8	47.21
4.3	87.3	63,321	34.37 ic	10.94	0.408	33.96 s	34.37	47.22
4.4	87.4	65,206	34.88 ic	11.1	0.377	34.50 s	34.88	47.24
4.5	87.5	67,091	35.35 ic	11.25	0.351	35.00 s	35.35	47.25
4.6	87.6	68,977	35.79 ic	11.39	0.328	35.46 s	35.79	47.27
4.7	87.7	70,862	36.20 ic	11.52	0.308	35.89 s	36.2	47.28
4.8	87.8	72,747	36.59 ic	11.65	0.29	36.30 s	36.59	47.3
4.9	87.9	74,632	36.97 ic	11.77	0.274	36.69 s	36.97	47.31
5	88	76,517	37.33 ic	11.88	0.26	37.07 s	37.33	47.33

ELEVATION (EL 83.11)
IN BASIN ASSOCIATED
WITH 10% OF PEAK
WATER QUALITY
VOLUME

BASIN 2 STAGE VS TIME GRAPH AND TABLE FROM HYDROLOGY STUDIO



Basin 2 Outflow		
Time	Outflow	Elevation
(hrs)	(cfs)	(ft)
15.80	0.041	83.12
15.83	0.041	83.12
15.87	0.041	83.12
15.90	0.040	83.12
15.93	0.040	83.12
15.97	0.040	83.12
16.00	0.040	83.12
16.03	0.039	83.12
16.07	0.039	83.12
16.10	0.039	83.11
16.13	0.038	83.11
16.17	0.038	83.11
16.20	0.038	83.11
16.23	0.038	83.11
16.27	0.037	83.11
16.30	0.037	83.11
16.33	0.037	83.11
16.37	0.037	83.11
16.40	0.036	83.11
16.43	0.036	83.11

EXTENDED DETENTION CALCULATION:

TIME FOR WATER QUALITY STORM TO PEAK IN DETENTION BASIN: 1.97 HOURS

MAXIMUM VOLUME OF WATER IN BASIN AT PEAK: 14,591 CUBIC FEET

NEED 10% OF MAXIMUM VOLUME LEFT IN BASIN 24 HOURS AFTER TIME TO PEAK TO MAXIMIZE TOTAL SUSPENDED SOLIDS REMOVAL IN BASIN (60% TSS REMOVAL FOR EXTENDED DETENTION BASINS).

10% OF PEAK VOLUME = 1,459 CUBIC FEET

1,459 CUBIC FEET OF WATER IS LEFT IN THE BASIN AT STAGE 83.11 FT

STAGE 83.11 FT OCCURS IN BASIN AT TIME 16.10 HOURS SO THE EXTENDED DETENTION IS EQUAL TO: 16.10 HOURS - 1.97 HOURS = 14.13 HOURS

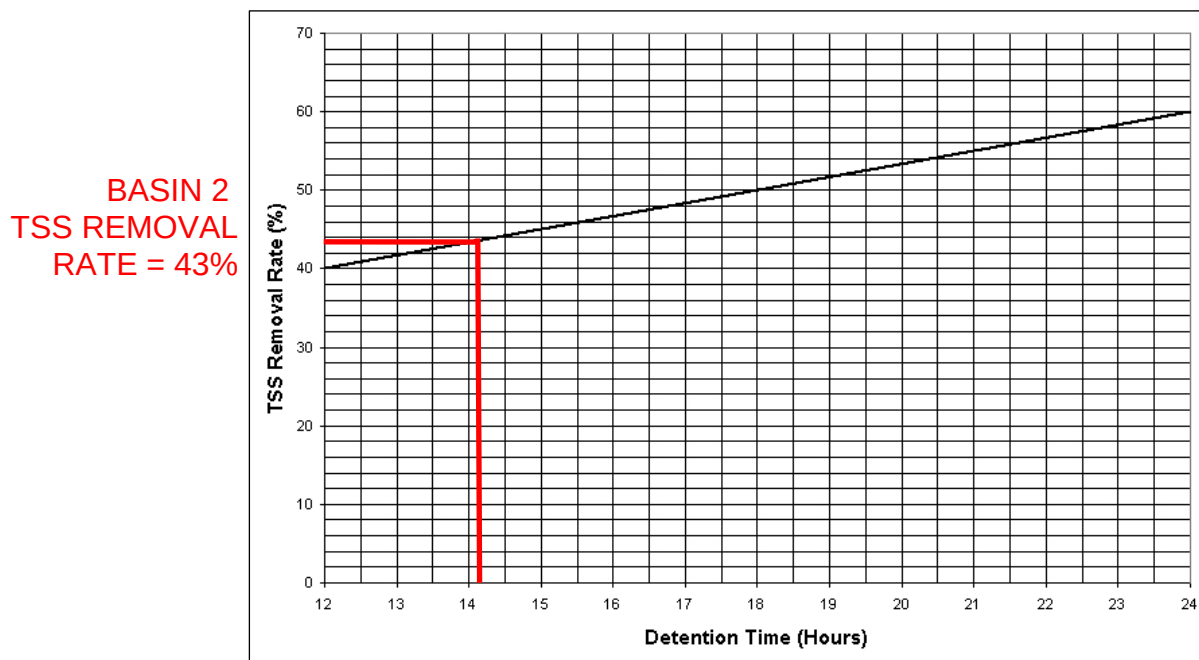
TIME WHEN 10% OF VOLUME IS LEFT IN BASIN (SEE DETENTION BASIN SUMMARY TABLE FROM HYDRAFLOW HYDROGRAPHS PROVIDED IN THIS APPENDIX)

TSS Removal Rates for Extended Detention Basins

Extended detention basins are designed to provide treatment of runoff volume generated by the stormwater quality design storm. Techniques to compute this volume are discussed in *Chapter 5: Computing Stormwater Runoff Rates and Volumes*.

The TSS removal rate for an extended detention basin is based on the basin's detention time. The detention time begins when the maximum storage volume is achieved and ends when only 10% of the maximum volume remains. The chart below shows the TSS removal rate for a given detention time. As previously stated, for the purposes of TSS removal rate calculations, the minimum detention time is 12 hours, and the maximum detention time is 24 hours. Systems with detention times in excess of 24 hours will still only be credited with a 60% TSS removal rate.

TSS Removal Rate of Extended Detention Basins



To determine the TSS removal rate for an extended detention basin, either the chart above or the following equation may be used:

$$\% \text{ TSS Removal Rate} = 40 + \left\{ \left[\frac{t-12}{12} \right] \times 20 \right\},$$

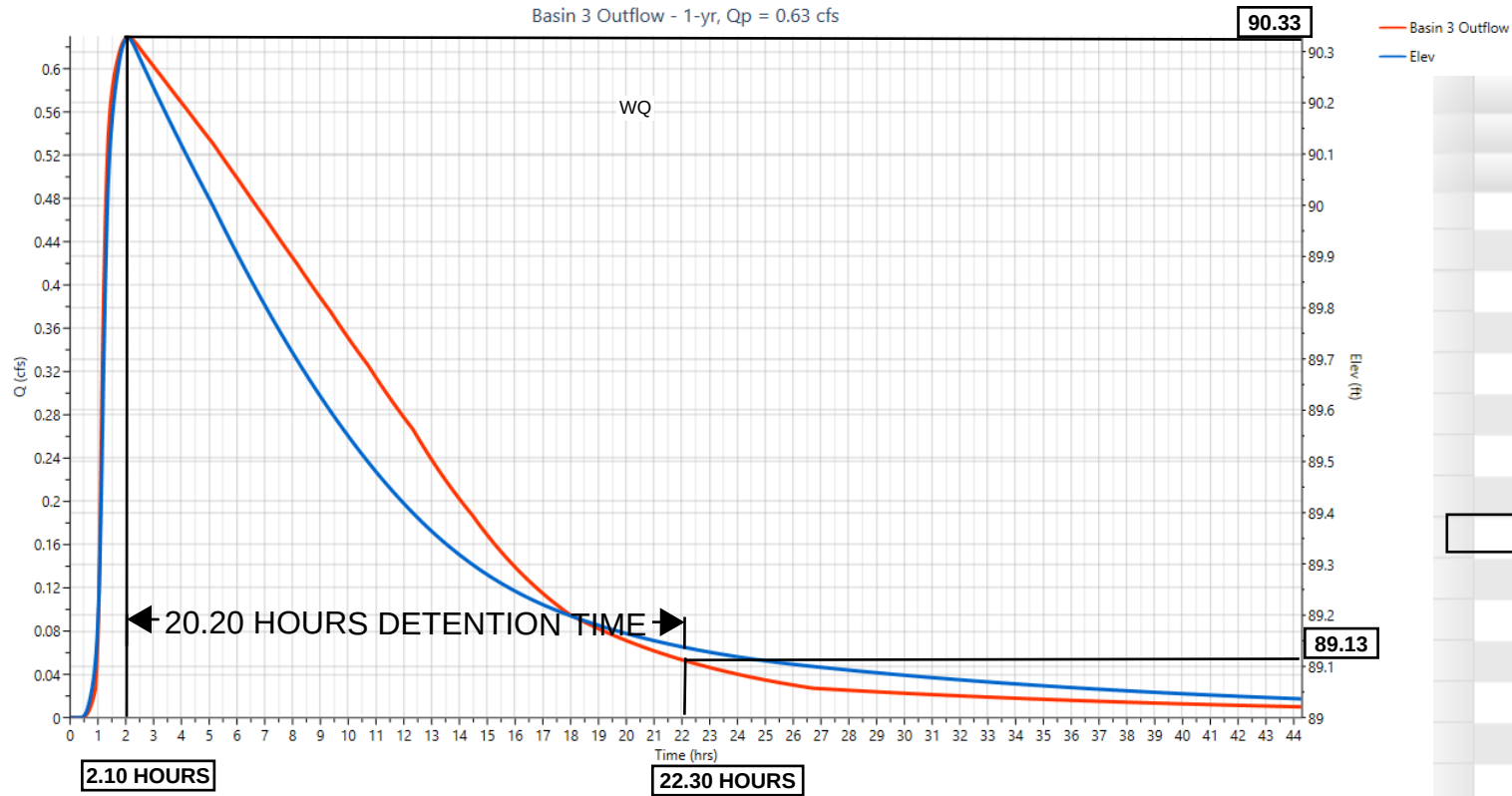
where t is the time of detention in hours and $12 \leq t \leq 24$.

BASIN 3 SUMMARY TABLE FROM HYDROLOGY STUDIO

Stage (ft)	Elev (ft)	Storage (cuft)	Culvert (cfs)	Culvert (ft/s)	Orifice 1 (cfs)	Weir 1 (cfs)	Total Q (cfs)	Drain Time (hrs)
0	89	0	0	0	0	0	0	0
0.1	89.1	1,716	0.027 oc	0.8	0.027	0	0.027	35
0.2	89.2	3,433	0.096 oc	1.17	0.096	0	0.096	42.77
0.3	89.3	5,149	0.187 oc	1.43	0.187	0	0.187	46.14
0.4	89.4	6,866	0.266 oc	1.59	0.266	0	0.266	48.24
0.5	89.5	8,582	0.326 oc	1.69	0.326	0	0.326	49.85
0.6	89.6	10,299	0.376 oc	1.77	0.376	0	0.376	51.21
0.7	89.7	12,015	0.420 oc	1.83	0.42	0	0.42	52.41
0.8	89.8	13,732	0.460 oc	1.88	0.46	0	0.46	53.49
0.9	89.9	15,448	0.496 oc	1.92	0.496	0	0.496	54.49
1	90	17,164	0.531 oc	1.96	0.531	0	0.531	55.42
1.1	90.1	19,053	0.563 oc	2	0.563	0	0.563	56.38
1.2	90.2	20,942	0.593 oc	2.03	0.593	0	0.593	57.29
1.3	90.3	22,830	0.622 oc	2.05	0.622	0	0.622	58.15
1.4	90.4	24,719	0.650 oc	2.08	0.65	0	0.65	58.97
1.5	90.5	26,607	0.676 oc	2.11	0.676	0	0.676	59.77
1.6	90.6	28,496	0.702 oc	2.13	0.702	0	0.702	60.53
1.7	90.7	30,385	0.726 oc	2.15	0.726	0	0.726	61.26
1.8	90.8	32,273	0.750 oc	2.17	0.75	0	0.75	61.97
1.9	90.9	34,162	0.773 oc	2.19	0.773	0	0.773	62.66
2	91	36,050	0.795 oc	2.21	0.795	0	0.795	63.33
2.1	91.1	38,118	0.817 oc	2.23	0.817	0	0.817	64.04
2.2	91.2	40,185	0.838 oc	2.25	0.838	0	0.838	64.74
2.3	91.3	42,253	0.859 oc	2.26	0.859	0	0.859	65.41
2.4	91.4	44,320	0.879 oc	2.28	0.879	0	0.879	66.08
2.5	91.5	46,388	0.899 oc	2.29	0.899	0	0.899	66.72
2.6	91.6	48,455	0.918 oc	2.31	0.918	0	0.918	67.35
2.7	91.7	50,523	0.937 oc	2.32	0.937	0	0.937	67.97
2.8	91.8	52,590	0.956 oc	2.33	0.956	0	0.956	68.58
2.9	91.9	54,658	0.974 oc	2.35	0.974	0	0.974	69.17
3	92	56,725	0.992 oc	2.36	0.992	0	0.992	69.76
3.1	92.1	58,798	1.009 oc	2.37	1.009	0	1.009	70.38
3.2	92.2	61,230	1.027 oc	2.38	1.027	0	1.027	71
3.3	92.3	63,483	1.043 oc	2.4	1.043	0	1.043	71.6
3.4	92.4	65,736	1.060 oc	2.41	1.06	0	1.06	72.2
3.5	92.5	67,988	1.077 oc	2.42	1.077	0	1.077	72.78
3.6	92.6	70,241	1.093 oc	2.43	1.093	0	1.093	73.36
3.7	92.7	72,493	1.109 oc	2.44	1.109	0	1.109	73.93
3.8	92.8	74,746	1.124 oc	2.45	1.124	0	1.124	74.49
3.9	92.9	76,999	1.140 oc	2.46	1.14	0	1.14	75.04
4	93	79,251	1.155 oc	2.47	1.155	0	1.155	75.59
4.1	93.1	81,695	1.170 oc	2.48	1.17	0	1.17	76.17
4.2	93.2	84,138	1.185 oc	2.49	1.185	0	1.185	76.75
4.3	93.3	86,582	1.200 oc	2.5	1.2	0	1.2	77.32
4.4	93.4	89,025	1.214 oc	2.5	1.214	0	1.214	77.88
4.5	93.5	91,469	1.229 oc	2.51	1.229	0	1.229	78.43
4.6	93.6	93,912	1.243 oc	2.52	1.243	0	1.243	78.98
4.7	93.7	96,356	1.257 oc	2.53	1.257	0	1.257	79.53
4.8	93.8	98,799	1.492 oc	2.66	1.271	0.221	1.492	80.02
4.9	93.9	101,243	2.435 oc	3.06	1.285	1.15	2.435	80.37
5	94	103,686	3.773 oc	3.46	1.298	2.475	3.773	80.58
5.1	94.1	106,326	5.412 oc	3.81	1.312	4.1	5.412	80.74
5.2	94.2	108,966	7.302 oc	4.1	1.325	5.977	7.302	80.86
5.3	94.3	111,606	9.414 oc	4.34	1.338	8.076	9.414	80.95
5.4	94.4	114,246	11.73 oc	4.49	1.351	10.38	11.73	81.02
5.5	94.5	116,886	14.22 oc	4.53	1.364	12.86	14.22	81.07
5.6	94.6	119,526	16.89 oc	5.38	1.377	15.52	16.89	81.12
5.7	94.7	122,166	19.72 oc	6.28	1.39	18.33	19.72	81.16
5.8	94.8	124,806	22.71 oc	7.23	1.402	21.3	22.71	81.2
5.9	94.9	127,446	25.83 oc	8.22	1.415	24.42	25.83	81.23
6	95	130,086	29.06 ic	9.25	1.39	27.67	29.06	81.25
6.1	95.1	132,997	32.35 ic	10.3	1.288	31.06	32.35	81.28
6.2	95.2	135,908	35.73 ic	11.37	1.158	34.57	35.73	81.3
6.3	95.3	138,820	39.20 ic	12.48	0.988	38.21	39.2	81.32
6.4	95.4	141,731	42.70 ic	13.59	0.756	41.94 s	42.7	81.34
6.5	95.5	144,642	43.90 ic	13.97	0.669	43.23 s	43.9	81.36
6.6	95.6	147,553	44.68 ic	14.22	0.613	44.07 s	44.68	81.38
6.7	95.7	150,464	45.32 ic	14.43	0.568	44.75 s	45.32	81.4
6.8	95.8	153,375	45.87 ic	14.6	0.53	45.34 s	45.87	81.42
6.9	95.9	156,286	46.36 ic	14.76	0.497	45.86 s	46.36	81.43
7	96	159,197	46.80 ic	14.9	0.468	46.33 s	46.8	81.45

ELEVATION (EL 89.13) IN BASIN
ASSOCIATED WITH 10% OF PEAK
WATER QUALITY VOLUME

BASIN 3 STAGE VS TIME GRAPH AND TABLE FROM HYDROLOGY STUDIO



Basin 3 Outflow		
Time	Outflow	Elevation
(hrs)	(cfs)	(ft)
22.03	0.053	89.14
22.07	0.053	89.14
22.10	0.053	89.14
22.13	0.052	89.14
22.17	0.052	89.14
22.20	0.052	89.14
22.23	0.052	89.14
22.27	0.051	89.14
22.30	0.051	89.13
22.33	0.051	89.13
22.37	0.051	89.13
22.40	0.051	89.13
22.43	0.050	89.13
22.47	0.050	89.13
22.50	0.050	89.13
22.53	0.050	89.13
22.57	0.049	89.13
22.60	0.049	89.13
22.63	0.049	89.13
22.67	0.049	89.13

EXTENDED DETENTION CALCULATION:

TIME FOR WATER QUALITY STORM TO PEAK IN DETENTION BASIN: 2.10 HOURS

MAXIMUM VOLUME OF WATER IN BASIN AT PEAK: 23,332 CUBIC FEET

NEED 10% OF MAXIMUM VOLUME LEFT IN BASIN 24 HOURS AFTER TIME TO PEAK TO MAXIMIZE TOTAL SUSPENDED SOLIDS REMOVAL IN BASIN (60% TSS REMOVAL FOR EXTENDED DETENTION BASINS).

10% OF PEAK VOLUME = 2,333 CUBIC FEET

2,333 CUBIC FEET OF WATER IS LEFT IN THE BASIN AT STAGE 89.13 FT

STAGE 89.13 FT OCCURS IN BASIN AT TIME 22.30 HOURS SO THE EXTENDED DETENTION IS EQUAL TO: 22.30 HOURS - 2.10 HOURS = 20.20 HOURS

TIME WHEN 10% OF VOLUME IS LEFT IN BASIN (SEE DETENTION BASIN SUMMARY TABLE FROM HYDRAFLOW HYDROGRAPHS PROVIDED IN THIS APPENDIX)

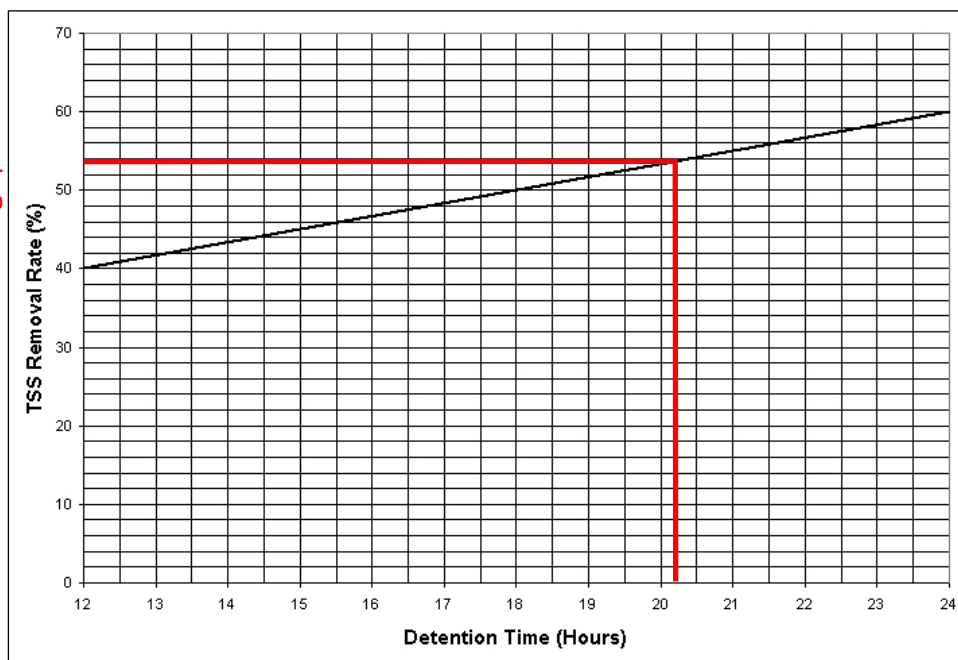
TSS Removal Rates for Extended Detention Basins

Extended detention basins are designed to provide treatment of runoff volume generated by the stormwater quality design storm. Techniques to compute this volume are discussed in *Chapter 5: Computing Stormwater Runoff Rates and Volumes*.

The TSS removal rate for an extended detention basin is based on the basin's detention time. The detention time begins when the maximum storage volume is achieved and ends when only 10% of the maximum volume remains. The chart below shows the TSS removal rate for a given detention time. As previously stated, for the purposes of TSS removal rate calculations, the minimum detention time is 12 hours, and the maximum detention time is 24 hours. Systems with detention times in excess of 24 hours will still only be credited with a 60% TSS removal rate.

TSS Removal Rate of Extended Detention Basins

BASIN 3
TSS REMOVAL
RATE = 54%



To determine the TSS removal rate for an extended detention basin, either the chart above or the following equation may be used:

$$\% \text{ TSS Removal Rate} = 40 + \left\{ \left[\frac{t-12}{12} \right] \times 20 \right\},$$

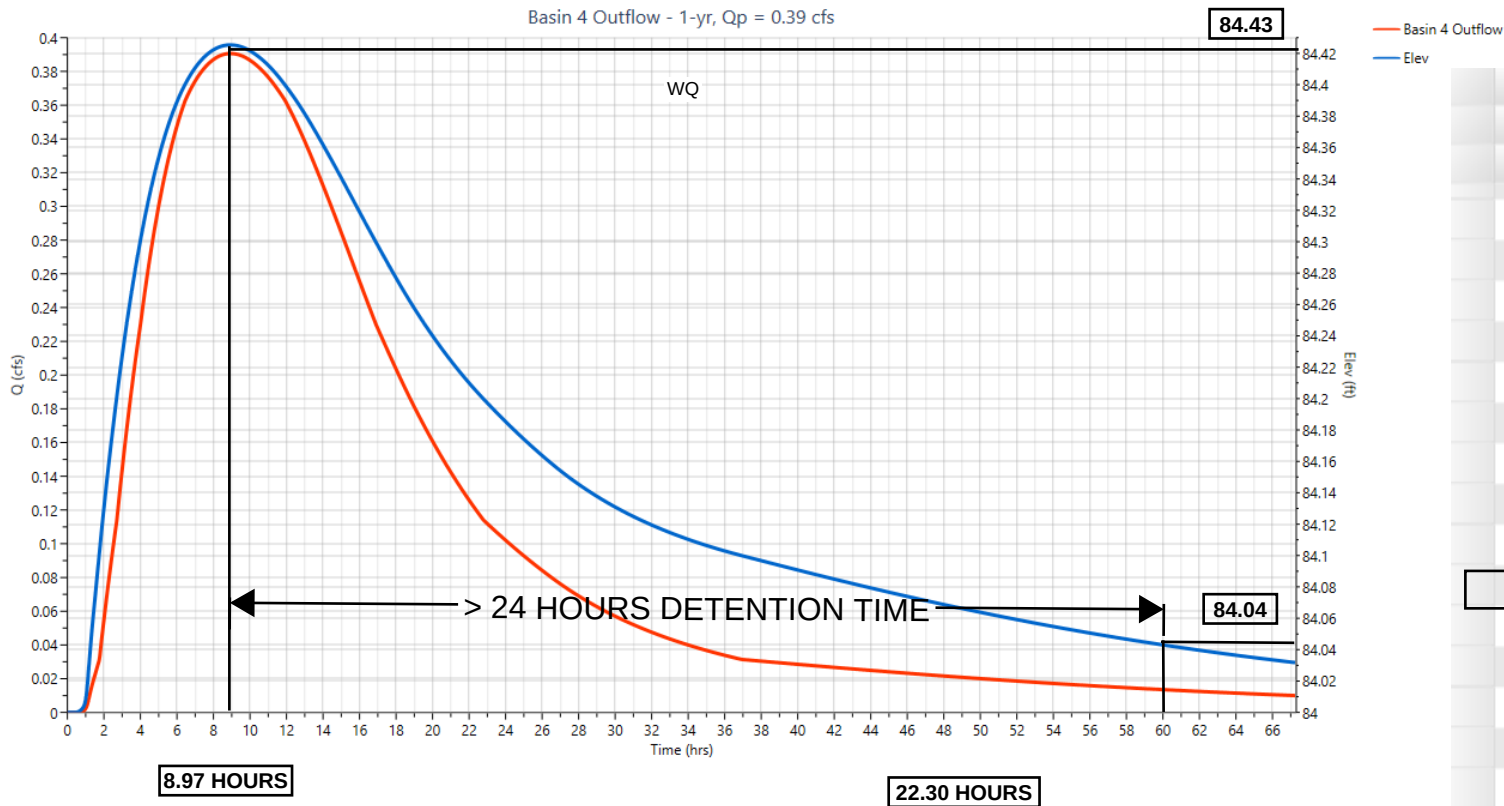
where t is the time of detention in hours and $12 \leq t \leq 24$.

BASIN 4 SUMMARY TABLE FROM HYDROLOGY STUDIO

Stage (ft)	Elev (ft)	Storage (cuft)	Culvert (cfs)	Culvert (ft/s)	Orifice 1 (cfs)	Weir 1 (cfs)	Total Q (cfs)	Drain Time (hrs)
0	84	0	0	0	0	0	0	0
0.1	84.1	1,931	0.031 oc	0.83	0.031	0	0.031	34.14
0.2	84.2	3,861	0.114 oc	1.23	0.114	0	0.114	41.51
0.3	84.3	5,792	0.230 oc	1.52	0.23	0	0.23	44.63
0.4	84.4	7,723	0.363 oc	1.75	0.363	0	0.363	46.44
0.5	84.5	9,653	0.473 oc	1.9	0.473	0	0.473	47.72
0.6	84.6	11,584	0.559 oc	1.99	0.559	0	0.559	48.76
0.7	84.7	13,515	0.634 oc	2.07	0.634	0	0.634	49.66
0.8	84.8	15,445	0.701 oc	2.13	0.701	0	0.701	50.46
0.9	84.9	17,376	0.762 oc	2.18	0.762	0	0.762	51.2
1	85	19,307	0.819 oc	2.23	0.819	0	0.819	51.87
1.1	85.1	21,408	1.811 oc	2.81	0.872	0.939	1.811	52.32
1.2	85.2	23,510	3.578 oc	3.41	0.921	2.656	3.578	52.53
1.3	85.3	25,611	5.785 oc	3.87	0.905	4.88	5.785	52.66
1.4	85.4	27,713	8.210 oc	4.22	0.696	7.513	8.21	52.74
1.5	85.5	29,815	9.553 oc	4.35	0.489	9.064 s	9.553	52.81
1.6	85.6	31,916	11.09 oc	4.46	0.45	10.64 s	11.09	52.86
1.7	85.7	34,018	12.39 oc	4.49	0.413	11.97 s	12.39	52.91
1.8	85.8	36,119	13.51 oc	4.3	0.379	13.13 s	13.51	52.96
1.9	85.9	38,221	14.50 oc	4.62	0.35	14.15 s	14.5	53
2	86	40,323	15.39 oc	4.9	0.325	15.07 s	15.39	53.04
2.1	86.1	42,601	16.21 oc	5.16	0.303	15.91 s	16.21	53.08
2.2	86.2	44,879	16.97 oc	5.4	0.283	16.69 s	16.97	53.12
2.3	86.3	47,157	17.69 oc	5.63	0.266	17.43 s	17.69	53.16
2.4	86.4	49,436	18.37 oc	5.85	0.251	18.12 s	18.37	53.19
2.5	86.5	51,714	19.00 oc	6.05	0.238	18.77 s	19	53.22
2.6	86.6	53,992	19.62 oc	6.24	0.226	19.39 s	19.62	53.26
2.7	86.7	56,270	20.21 oc	6.43	0.215	19.99 s	20.21	53.29
2.8	86.8	58,548	20.79 oc	6.62	0.205	20.59 s	20.79	53.32
2.9	86.9	60,827	21.34 oc	6.79	0.196	21.14 s	21.34	53.35
3	87	63,105	21.89 oc	6.97	0.189	21.70 s	21.89	53.38
3.05	87.05	64,343	22.14 oc	7.05	0.185	21.96 s	22.14	53.39
3.1	87.1	65,581	22.39 oc	7.13	0.181	22.21 s	22.39	53.41
3.15	87.15	66,819	22.64 oc	7.21	0.178	22.47 s	22.64	53.43
3.2	87.2	68,057	22.90 oc	7.29	0.174	22.72 s	22.9	53.44
3.25	87.25	69,295	23.15 oc	7.37	0.171	22.98 s	23.15	53.46
3.3	87.3	70,533	23.39 oc	7.44	0.168	23.22 s	23.39	53.47
3.35	87.35	71,772	23.66 oc	7.53	0.165	23.49 s	23.66	53.48
3.4	87.4	73,010	23.88 oc	7.6	0.162	23.72 s	23.88	53.5
3.45	87.45	74,248	24.11 oc	7.67	0.16	23.95 s	24.11	53.51
3.5	87.5	75,486	24.34 oc	7.75	0.157	24.18 s	24.34	53.53

ELEVATION (EL 84.04) IN BASIN
ASSOCIATED WITH 10% OF PEAK
WATER QUALITY VOLUME

BASIN 4 STAGE VS TIME GRAPH AND TABLE FROM HYDROLOGY STUDIO



Basin 4 Outflow		
Time	Outflow	Elevation
(hrs)	(cfs)	(ft)
58.63	0.014	84.05
58.67	0.014	84.05
58.70	0.014	84.05
58.73	0.014	84.05
58.77	0.014	84.05
58.80	0.014	84.05
58.83	0.014	84.05
58.87	0.014	84.05
58.90	0.014	84.05
58.93	0.014	84.04
58.97	0.014	84.04
59.00	0.014	84.04
59.03	0.014	84.04
59.07	0.014	84.04
59.10	0.014	84.04
59.13	0.014	84.04
59.17	0.014	84.04
59.20	0.014	84.04
59.23	0.014	84.04

EXTENDED DETENTION CALCULATION:

TIME FOR WATER QUALITY STORM TO PEAK IN DETENTION BASIN: 8.97 HOURS

MAXIMUM VOLUME OF WATER IN BASIN AT PEAK: 8,213 CUBIC FEET

NEED 10% OF MAXIMUM VOLUME LEFT IN BASIN 24 HOURS AFTER TIME TO PEAK TO MAXIMIZE TOTAL SUSPENDED SOLIDS REMOVAL IN BASIN (60% TSS REMOVAL FOR EXTENDED DETENTION BASINS).

10% OF PEAK VOLUME = 821 CUBIC FEET

821 CUBIC FEET OF WATER IS LEFT IN THE BASIN AT STAGE 84.04 FT

STAGE 84.04 FT OCCURS IN BASIN AT TIME 58.93 HOURS SO THE EXTENDED DETENTION IS EQUAL TO: 58.93 HOURS - 8.97 HOURS = 49.96 HOURS

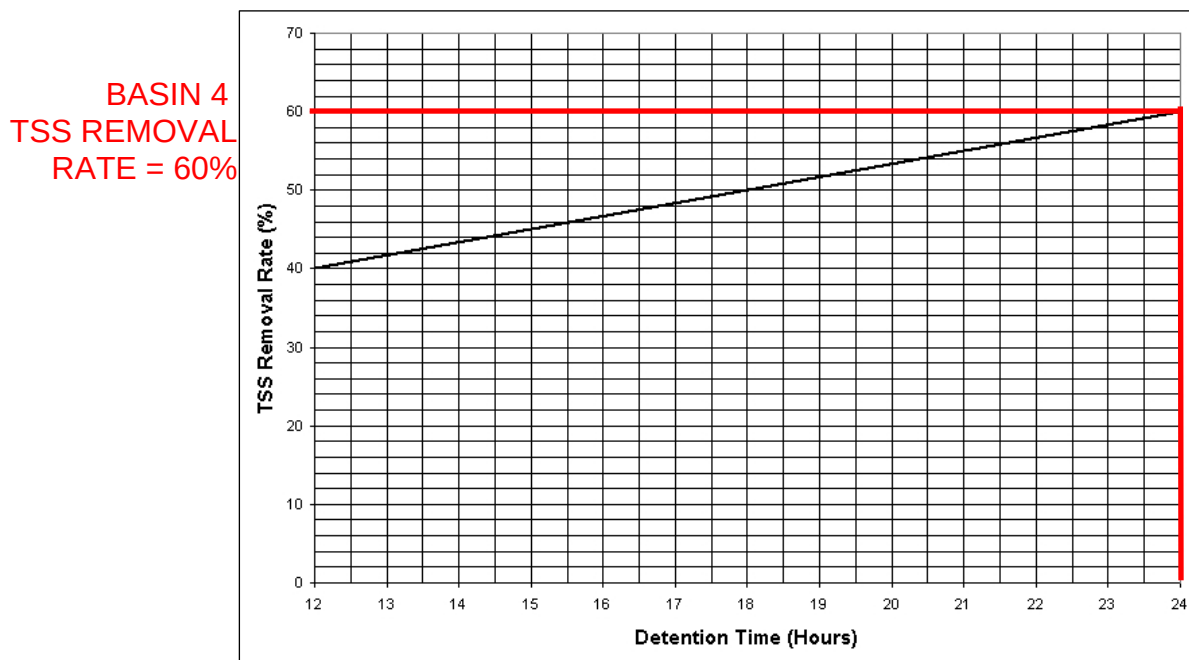
TIME WHEN 10% OF VOLUME IS LEFT IN BASIN (SEE DETENTION BASIN SUMMARY TABLE FROM HYDRAFLOW HYDROGRAPHS PROVIDED IN THIS APPENDIX)

TSS Removal Rates for Extended Detention Basins

Extended detention basins are designed to provide treatment of runoff volume generated by the stormwater quality design storm. Techniques to compute this volume are discussed in *Chapter 5: Computing Stormwater Runoff Rates and Volumes*.

The TSS removal rate for an extended detention basin is based on the basin's detention time. The detention time begins when the maximum storage volume is achieved and ends when only 10% of the maximum volume remains. The chart below shows the TSS removal rate for a given detention time. As previously stated, for the purposes of TSS removal rate calculations, the minimum detention time is 12 hours, and the maximum detention time is 24 hours. Systems with detention times in excess of 24 hours will still only be credited with a 60% TSS removal rate.

TSS Removal Rate of Extended Detention Basins



To determine the TSS removal rate for an extended detention basin, either the chart above or the following equation may be used:

$$\% \text{ TSS Removal Rate} = 40 + \left\{ \left[\frac{t-12}{12} \right] \times 20 \right\},$$

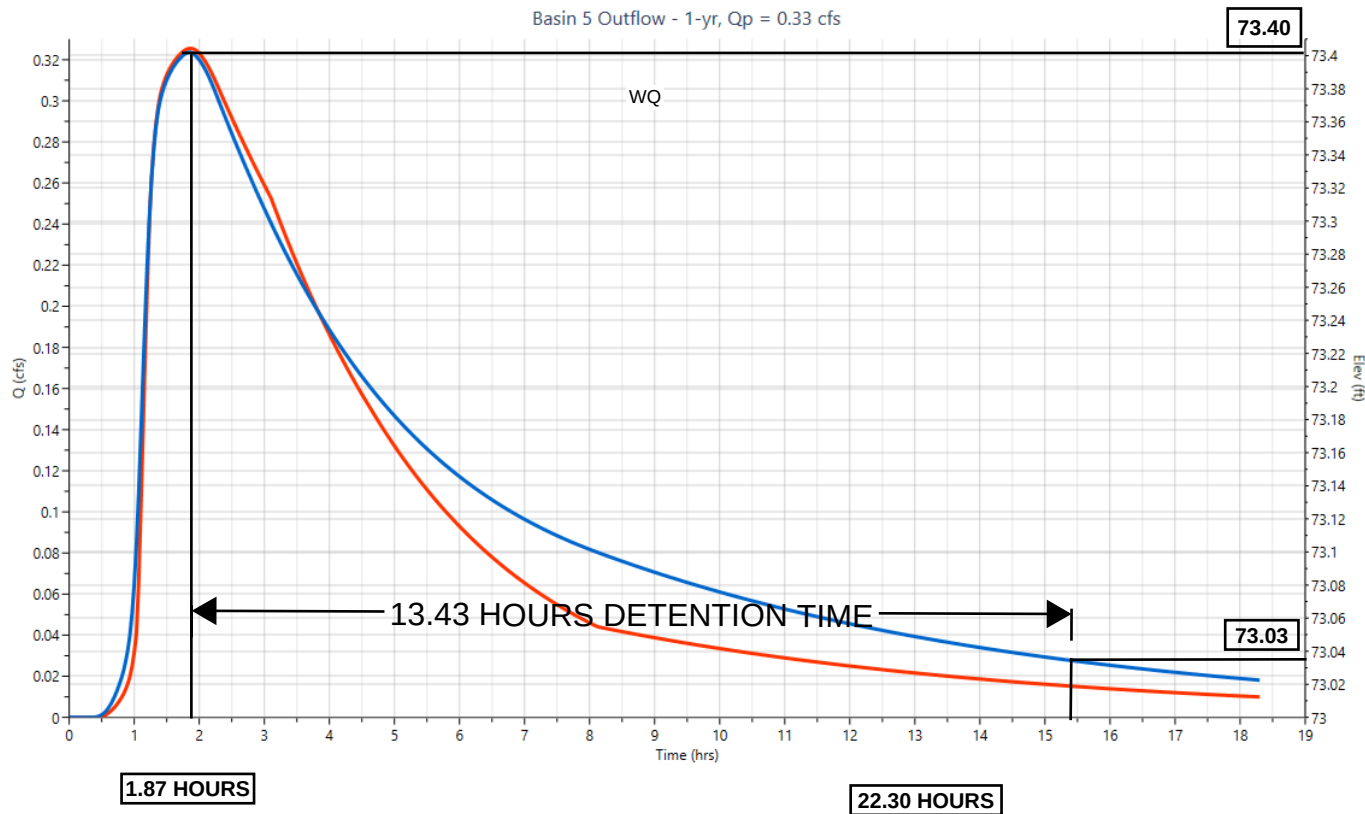
where t is the time of detention in hours and $12 \leq t \leq 24$.

BASIN 5 SUMMARY TABLE FROM HYDROLOGY STUDIO

Stage (ft)	Elev (ft)	Storage (cuft)	Culvert (cfs)	Culvert (ft/s)	Orifice 1 (cfs)	Weir 1 (cfs)	Total Q (cfs)	Drain Time (hrs)
0	73	0	0	0	0	0	0	0
0.1	73.1	1,086	0.044 ic	0.92	0.044	0	0.044	13.68
0.2	73.2	2,171	0.150 ic	1.34	0.15	0	0.15	16.79
0.3	73.3	3,257	0.253 ic	1.57	0.253	0	0.253	18.29
0.4	73.4	4,343	0.324 ic	1.69	0.324	0	0.324	19.33
0.5	73.5	5,429	0.383 ic	1.78	0.383	0	0.383	20.18
0.6	73.6	6,514	0.434 ic	1.85	0.434	0	0.434	20.92
0.7	73.7	7,600	0.479 ic	1.9	0.479	0	0.479	21.58
0.8	73.8	8,686	0.520 ic	1.95	0.52	0	0.52	22.19
0.9	73.9	9,771	0.559 ic	1.99	0.559	0	0.559	22.75
1	74	10,857	0.595 ic	2.03	0.595	0	0.595	23.27
1.1	74.1	12,072	0.628 ic	2.06	0.628	0	0.628	23.82
1.2	74.2	13,287	0.660 ic	2.09	0.66	0	0.66	24.35
1.3	74.3	14,501	0.894 ic	2.29	0.673	0.221	0.894	24.78
1.4	74.4	15,716	1.796 oc	2.81	0.646	1.15	1.796	25.03
1.5	74.5	16,931	3.068 oc	3.27	0.593	2.475	3.068	25.17
1.6	74.6	18,145	4.626 oc	3.66	0.526	4.1	4.626	25.26
1.7	74.7	19,360	6.373 oc	3.97	0.421	5.952 s	6.373	25.32
1.8	74.8	20,575	7.302 oc	4.1	0.347	6.955 s	7.302	25.37
1.9	74.9	21,789	7.729 oc	4.16	0.287	7.442 s	7.729	25.41
2	75	23,004	8.409 oc	4.24	0.259	8.150 s	8.409	25.45
2.1	75.1	24,401	9.779 oc	4.37	0.263	9.516 s	9.779	25.5
2.2	75.2	25,797	11.05 oc	4.46	0.263	10.79 s	11.05	25.53
2.3	75.3	27,194	12.24 oc	4.5	0.26	11.98 s	12.24	25.57
2.4	75.4	28,591	13.34 oc	4.25	0.255	13.08 s	13.34	25.6
2.5	75.5	29,987	14.36 oc	4.57	0.249	14.11 s	14.36	25.63
2.6	75.6	31,384	15.33 oc	4.88	0.242	15.08 s	15.33	25.65
2.7	75.7	32,781	16.23 oc	5.17	0.235	15.99 s	16.23	25.68
2.8	75.8	34,178	17.09 oc	5.44	0.228	16.86 s	17.09	25.7
2.9	75.9	35,574	17.79 ic	5.66	0.22	17.57 s	17.79	25.72
3	76	36,971	18.28 ic	5.82	0.209	18.07 s	18.28	25.74

ELEVATION (EL 73.03) IN BASIN
ASSOCIATED WITH 10% OF PEAK
WATER QUALITY VOLUME

BASIN 5 STAGE VS TIME GRAPH AND TABLE FROM HYDROLOGY STUDIO



Basin 5 Outflow		
Time (hrs)	Outflow (cfs)	Elevation (ft)
15.00	0.016	73.04
15.03	0.016	73.04
15.07	0.016	73.04
15.10	0.016	73.04
15.13	0.016	73.04
15.17	0.016	73.04
15.20	0.016	73.04
15.23	0.016	73.04
15.27	0.016	73.04
15.30	0.015	73.03
15.33	0.015	73.03
15.37	0.015	73.03
15.40	0.015	73.03
15.43	0.015	73.03
15.47	0.015	73.03
15.50	0.015	73.03
15.53	0.015	73.03
15.57	0.015	73.03
15.60	0.015	73.03

EXTENDED DETENTION CALCULATION:

TIME FOR WATER QUALITY STORM TO PEAK IN DETENTION BASIN: 1.87 HOURS

MAXIMUM VOLUME OF WATER IN BASIN AT PEAK: 4,365 CUBIC FEET

NEED 10% OF MAXIMUM VOLUME LEFT IN BASIN 24 HOURS AFTER TIME TO PEAK TO MAXIMIZE TOTAL SUSPENDED SOLIDS REMOVAL IN BASIN (60% TSS REMOVAL FOR EXTENDED DETENTION BASINS).

10% OF PEAK VOLUME = 437 CUBIC FEET

437 CUBIC FEET OF WATER IS LEFT IN THE BASIN AT STAGE 73.03 FT

STAGE 73.03 FT OCCURS IN BASIN AT TIME 58.93 HOURS SO THE EXTENDED DETENTION IS EQUAL TO: 15.30 HOURS - 1.87 HOURS = 13.43 HOURS

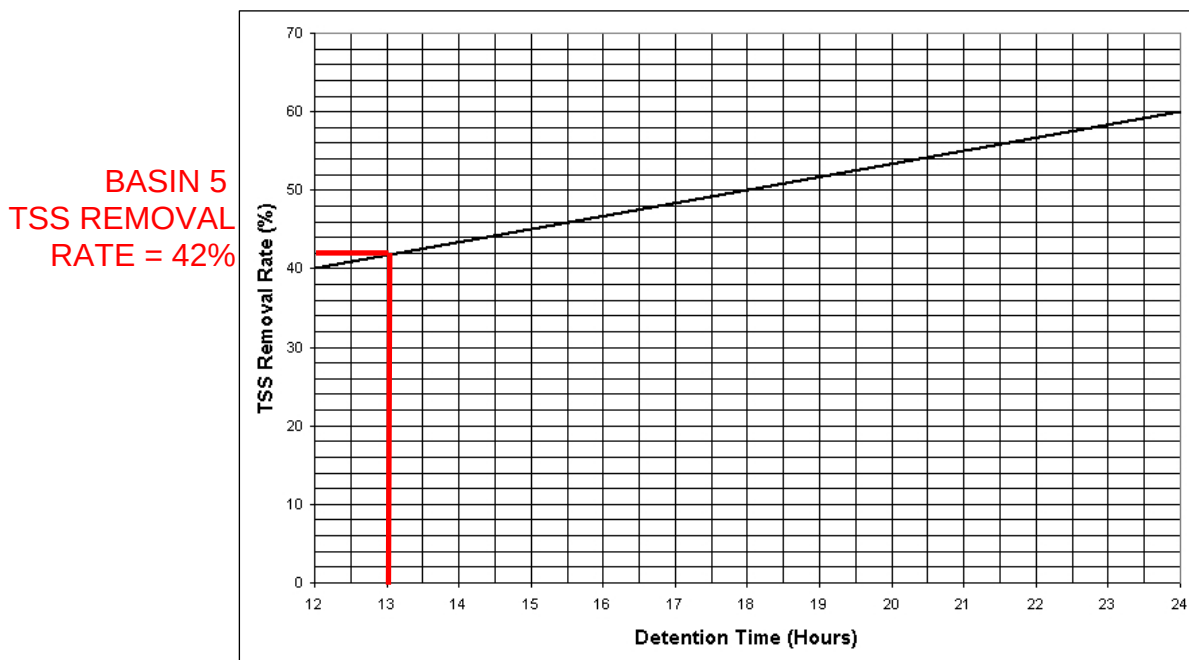
TIME WHEN 10% OF VOLUME IS LEFT IN BASIN (SEE DETENTION BASIN SUMMARY TABLE FROM HYDRAFLOW HYDROGRAPHS PROVIDED IN THIS APPENDIX)

TSS Removal Rates for Extended Detention Basins

Extended detention basins are designed to provide treatment of runoff volume generated by the stormwater quality design storm. Techniques to compute this volume are discussed in *Chapter 5: Computing Stormwater Runoff Rates and Volumes*.

The TSS removal rate for an extended detention basin is based on the basin's detention time. The detention time begins when the maximum storage volume is achieved and ends when only 10% of the maximum volume remains. The chart below shows the TSS removal rate for a given detention time. As previously stated, for the purposes of TSS removal rate calculations, the minimum detention time is 12 hours, and the maximum detention time is 24 hours. Systems with detention times in excess of 24 hours will still only be credited with a 60% TSS removal rate.

TSS Removal Rate of Extended Detention Basins



To determine the TSS removal rate for an extended detention basin, either the chart above or the following equation may be used:

$$\% \text{ TSS Removal Rate} = 40 + \left\{ \left[\frac{t-12}{12} \right] \times 20 \right\},$$

where t is the time of detention in hours and $12 \leq t \leq 24$.

1-Year Treatment Flow to WQ-1 and WQ-3

Hydrograph 1-yr Summary

Project Name:

Hydrology Studio v 3.0.0.17

01-04-2021

[illegible]

Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

01-04-2021

Post DA Aa - Perv.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 1.25 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 19.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

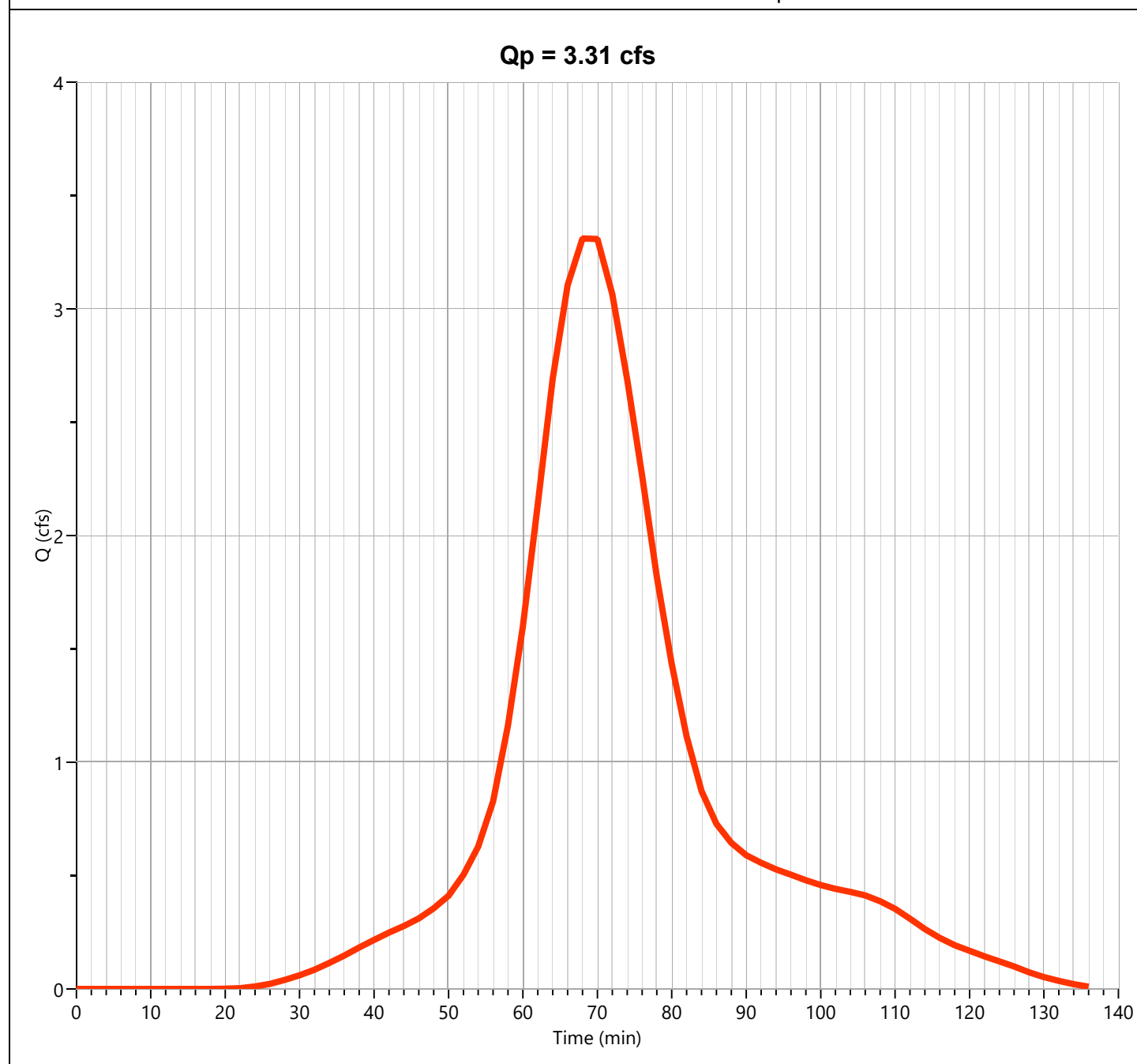
Hydrology Studio v 3.0.0.17

01-04-2021

Post DA A1a - Imperv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.310 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Runoff Volume	= 5,190 cuft
Drainage Area	= 1.34 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

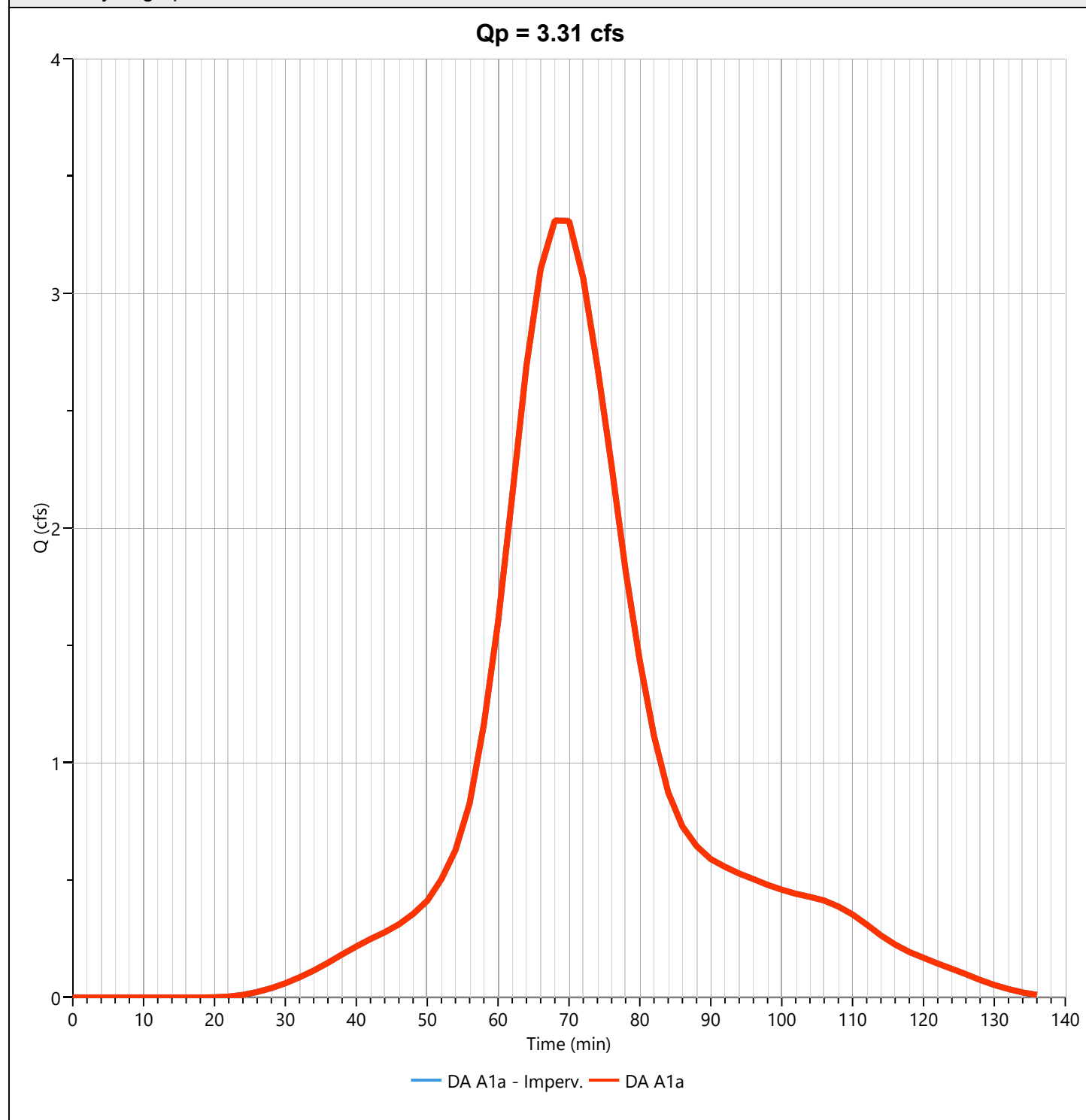
Hydrology Studio v 3.0.0.17

01-04-2021

Post DA A1a

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 3.310 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Hydrograph Volume	= 5,190 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 2.59 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

01-04-2021

Post DA A1a (un) - Perv.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 1.29 ac	Curve Number	= 58
Tc Method	= User	Time of Conc. (Tc)	= 16.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

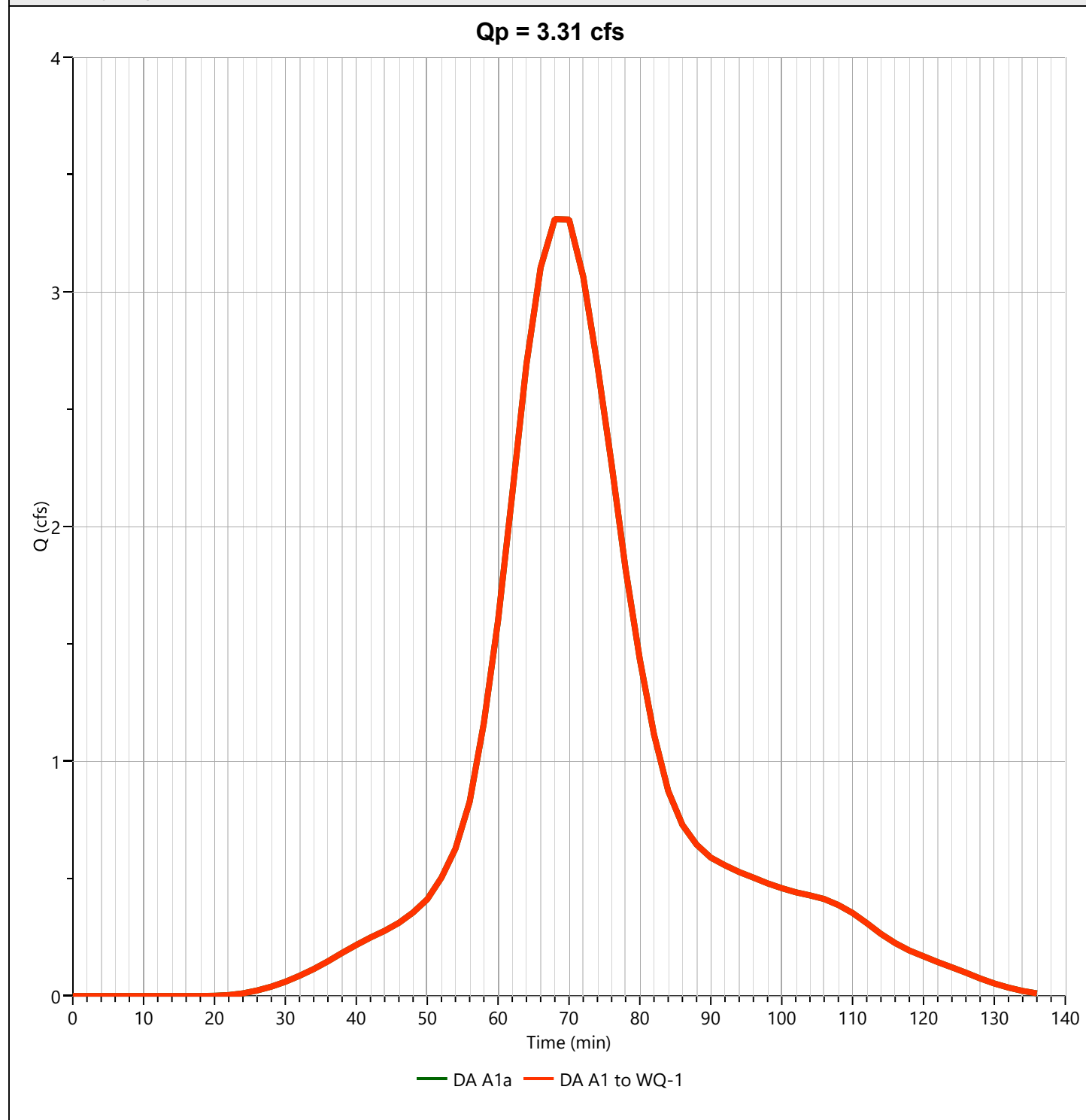
Hydrology Studio v 3.0.0.17

01-04-2021

Post DA A1 to WQ-1

Hyd. No. 7

Hydrograph Type	= Junction	Peak Flow	= 3.310 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Hydrograph Volume	= 5,190 cuft
Inflow Hydrographs	= 3, 5	Total Contrib. Area	= 3.88 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

01-04-2021

Post DA A4a - Perv.

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.000 cfs
Storm Frequency	= 1-yr	Time to Peak	= 0 min
Time Interval	= 2 min	Runoff Volume	= 0.000 cuft
Drainage Area	= 3.35 ac	Curve Number	= 53
Tc Method	= User	Time of Conc. (Tc)	= 17.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484

Qp = 0.00 cfs

Hydrograph Report

Project Name:

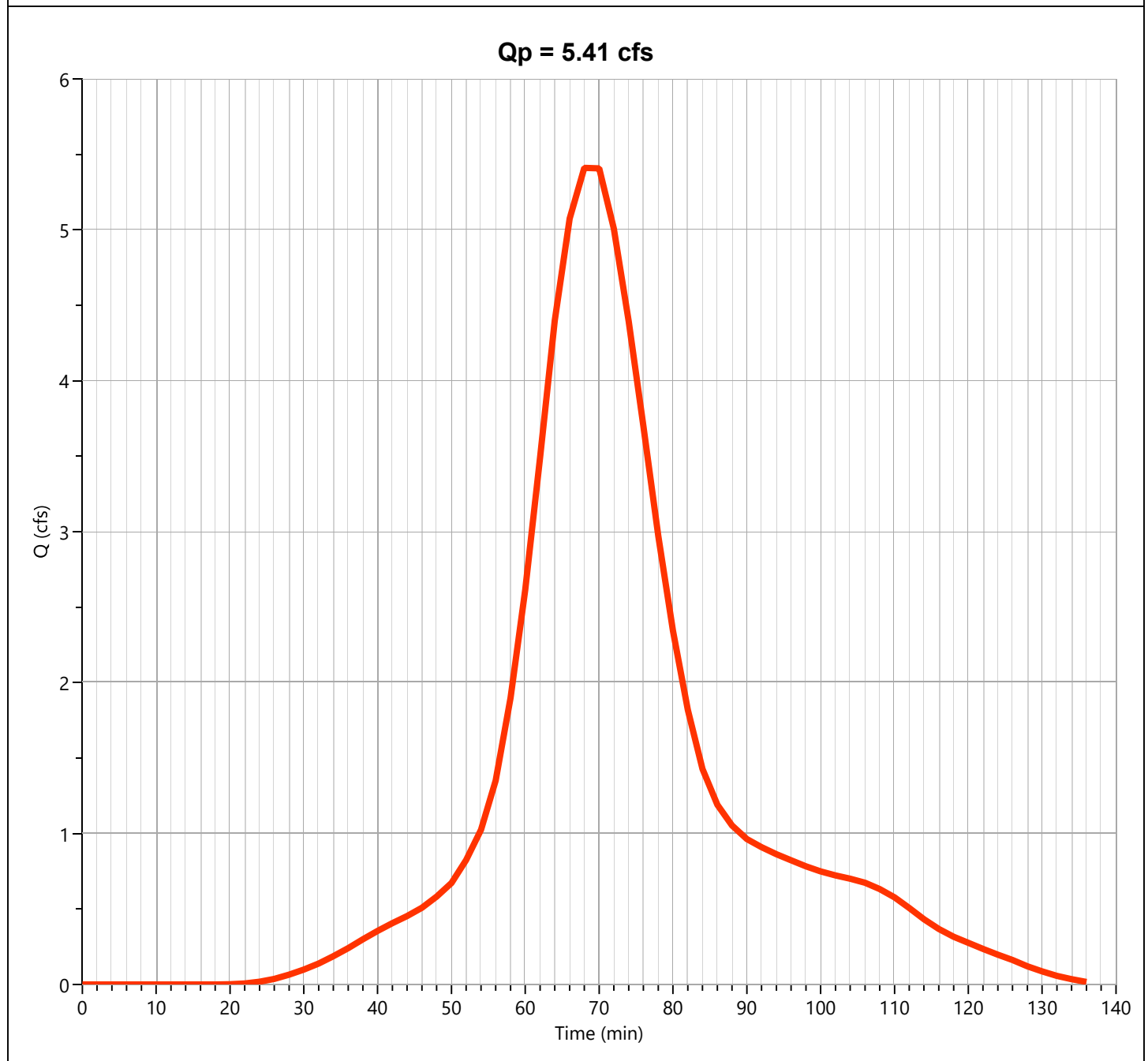
Hydrology Studio v 3.0.0.17

01-04-2021

Post DA A4a - Imperv.

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.409 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Runoff Volume	= 8,482 cuft
Drainage Area	= 2.19 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 1.25 in	Design Storm	= NJ WQ Storm
Storm Duration	= 2 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

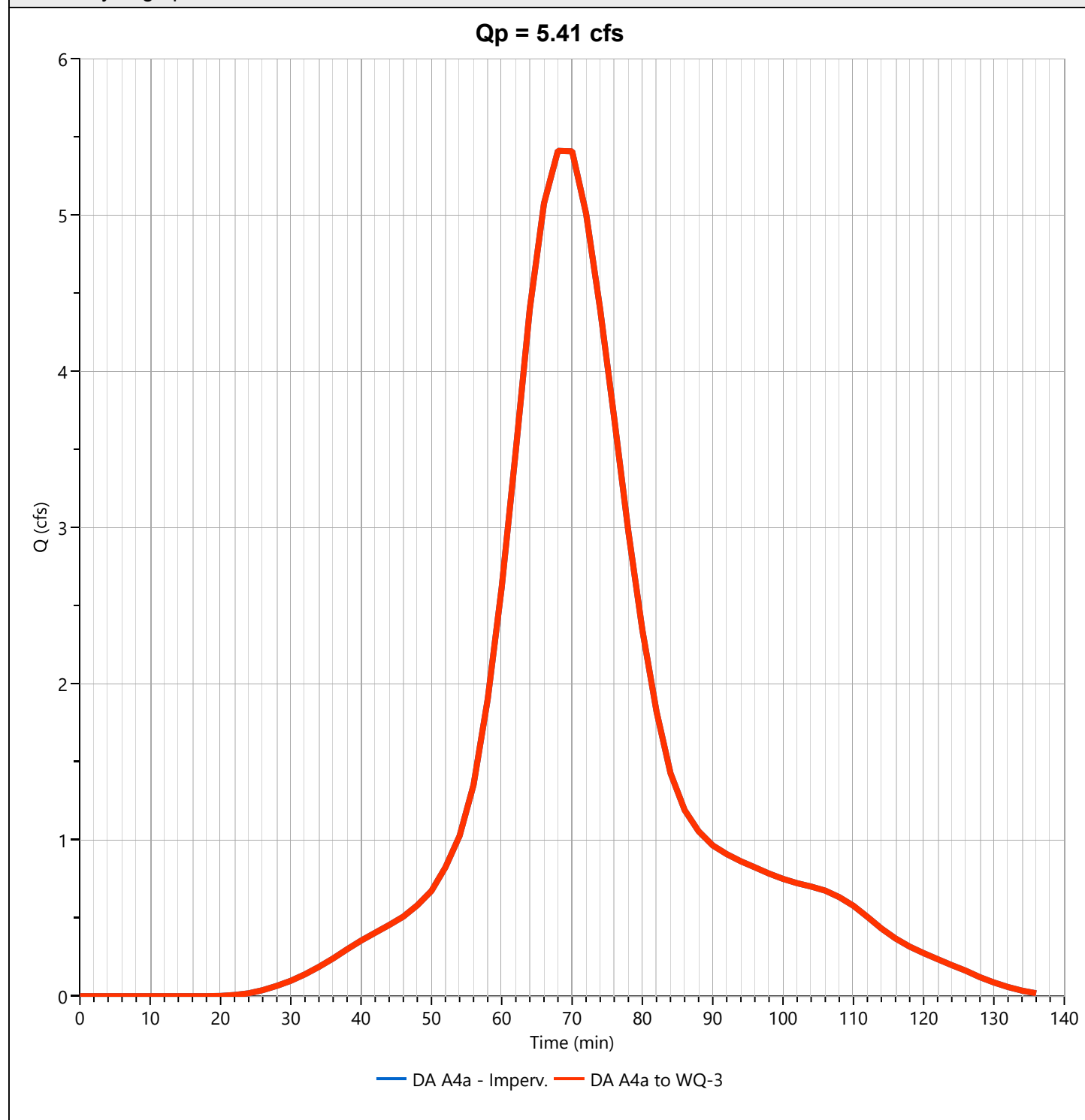
Hydrology Studio v 3.0.0.17

01-04-2021

Post DA A4a to WQ-3

Hyd. No. 12

Hydrograph Type	= Junction	Peak Flow	= 5.409 cfs
Storm Frequency	= 1-yr	Time to Peak	= 68 min
Time Interval	= 2 min	Hydrograph Volume	= 8,482 cuft
Inflow Hydrographs	= 10, 11	Total Contrib. Area	= 5.54 ac



100-Year Storm Flow to WQ-1 and WQ-3

Hydrograph 100-yr Summary

Project Name:

Hydrology Studio v 3.0.0.17

01-04-2021

[illegible]

Hydrograph Report

Project Name:

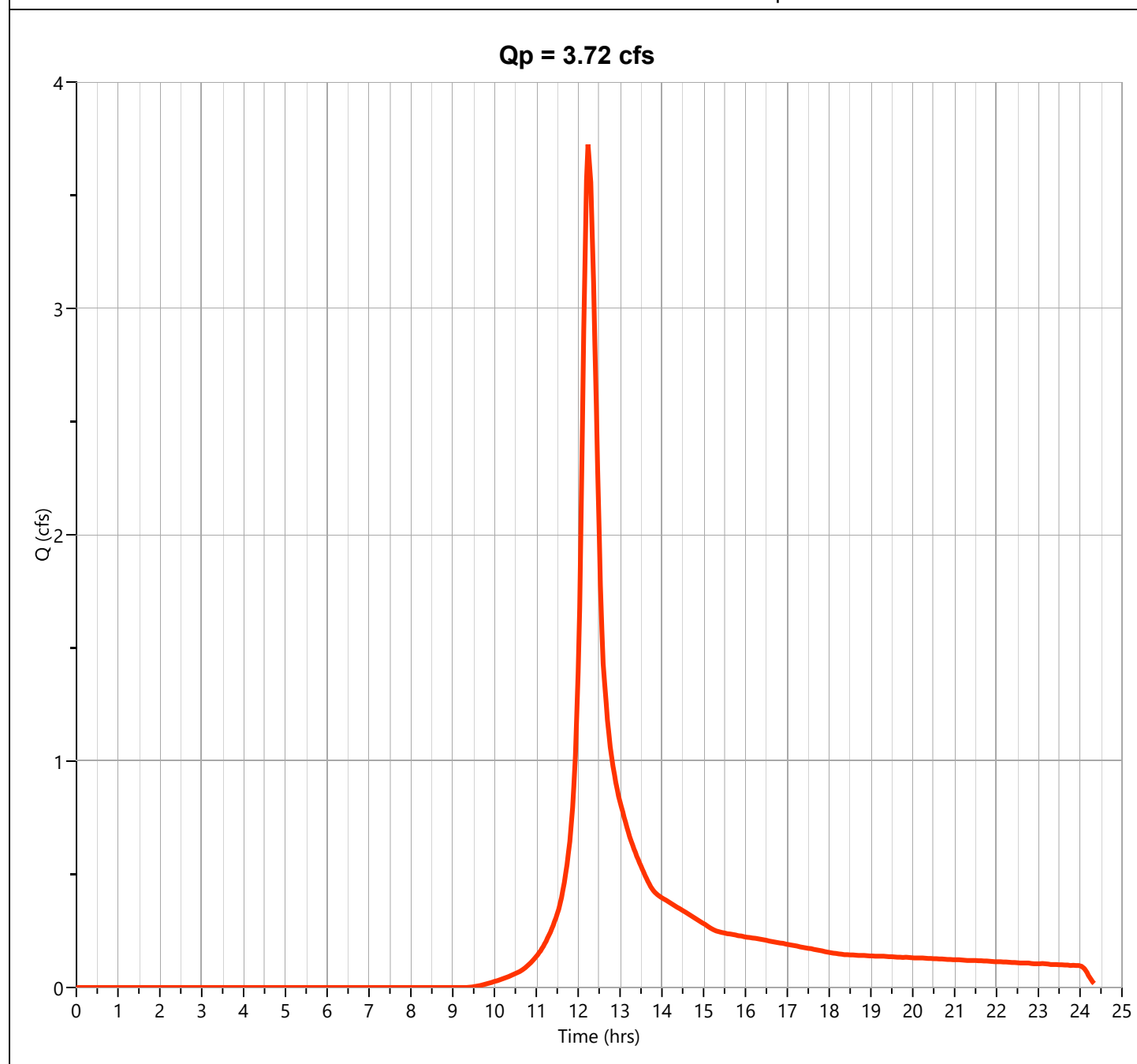
Hydrology Studio v 3.0.0.17

01-04-2021

Post DA Aa - Perv.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.724 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 17,311 cuft
Drainage Area	= 1.25 ac	Curve Number	= 57
Tc Method	= User	Time of Conc. (Tc)	= 19.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

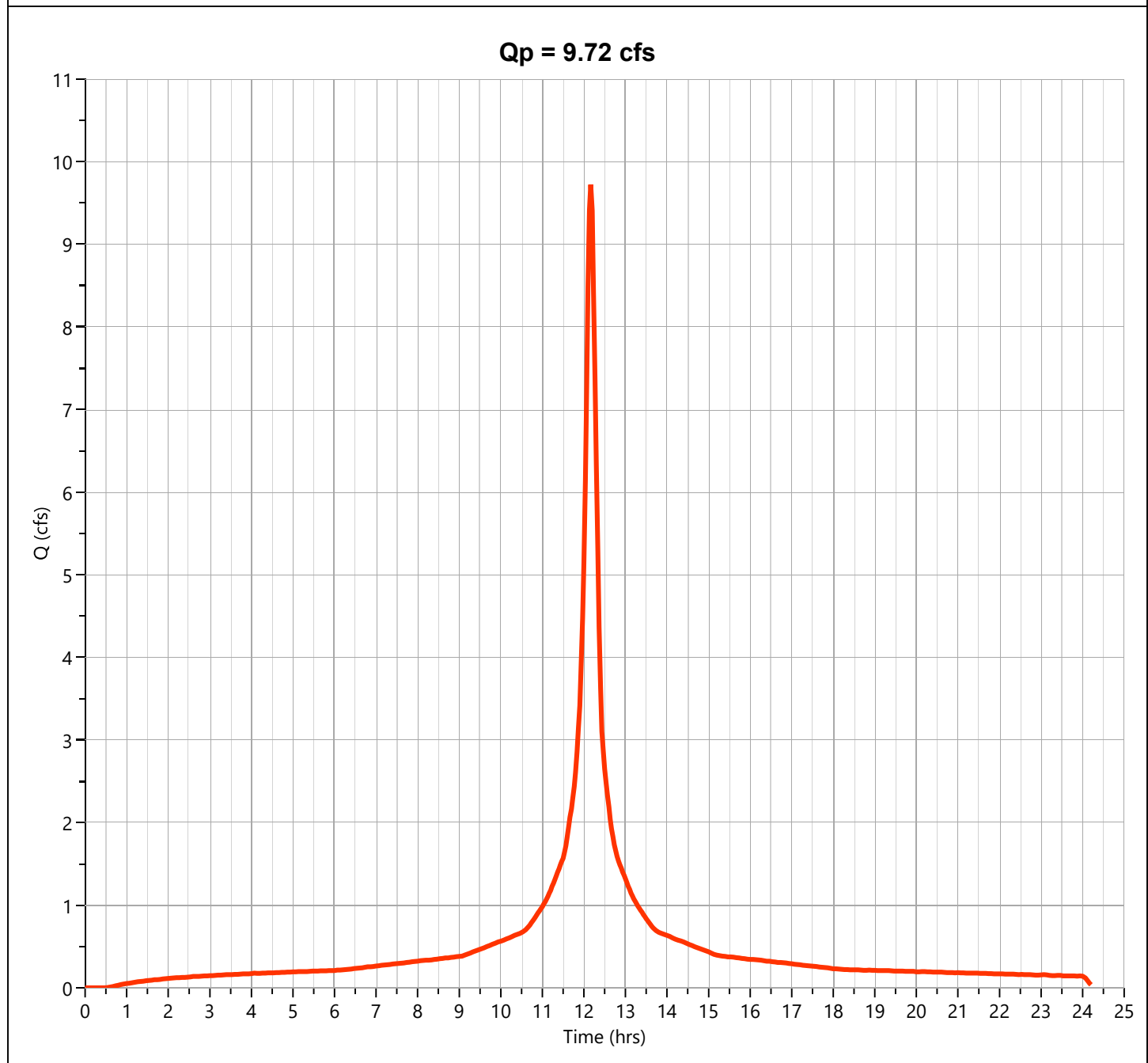
Hydrology Studio v 3.0.0.17

01-04-2021

Post DA A1a - Imperv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 9.723 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 44,492 cuft
Drainage Area	= 1.34 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

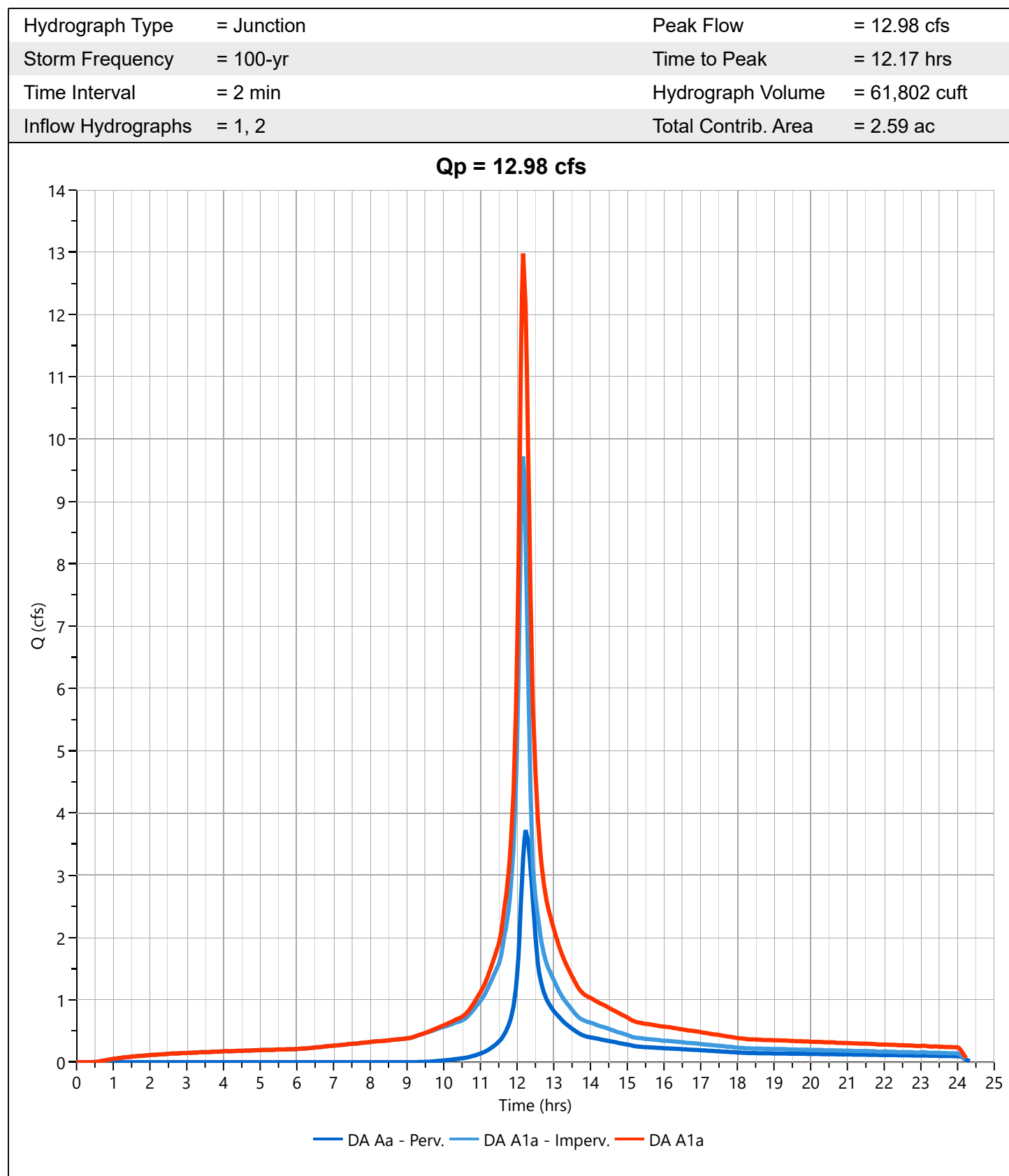
Project Name:

Hydrology Studio v 3.0.0.17

01-04-2021

Post DA A1a

Hyd. No. 3



Hydrograph Report

Project Name:

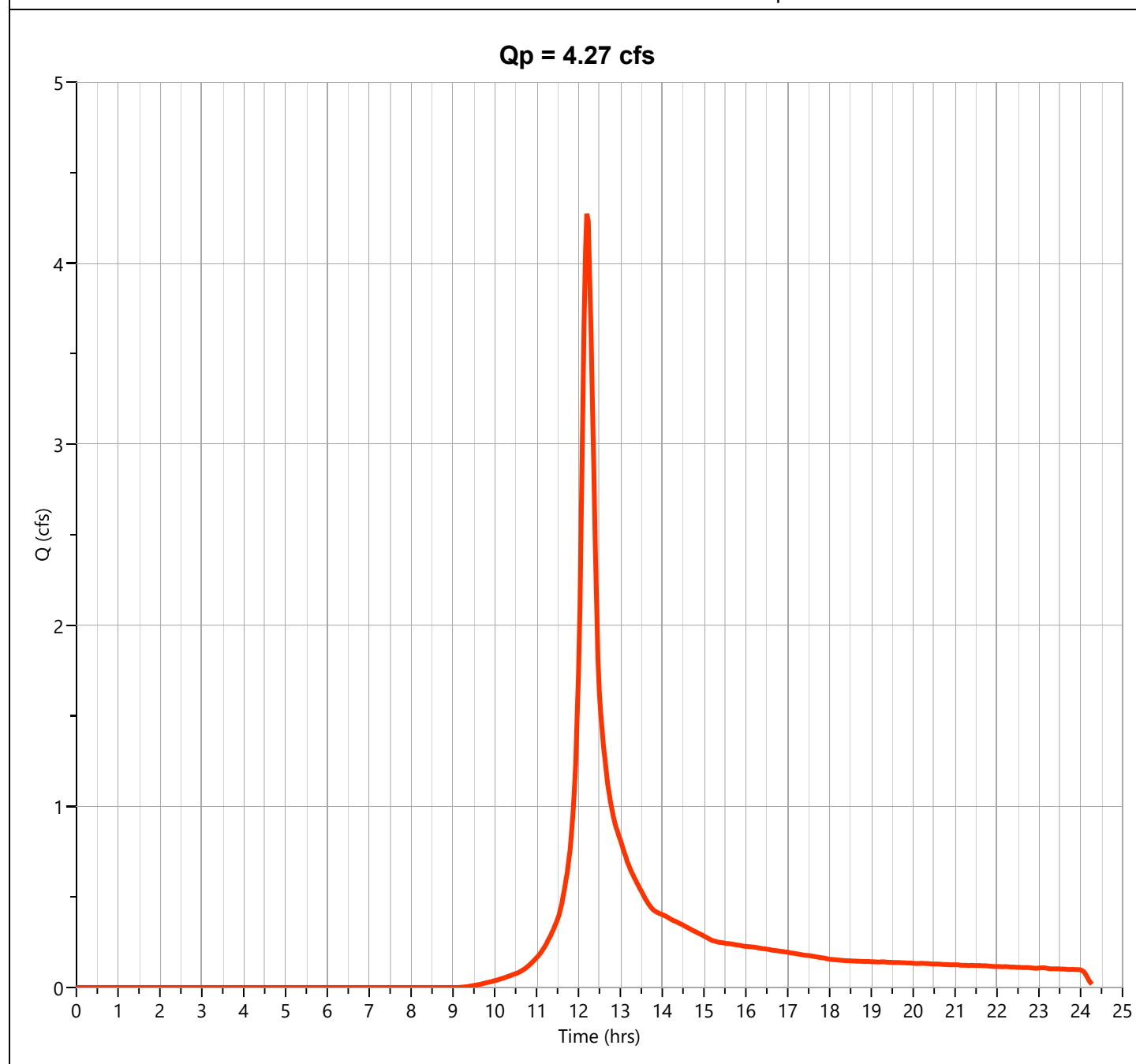
Hydrology Studio v 3.0.0.17

01-04-2021

Post DA A1a (un) - Perv.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.272 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 17,984 cuft
Drainage Area	= 1.29 ac	Curve Number	= 58
Tc Method	= User	Time of Conc. (Tc)	= 16.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

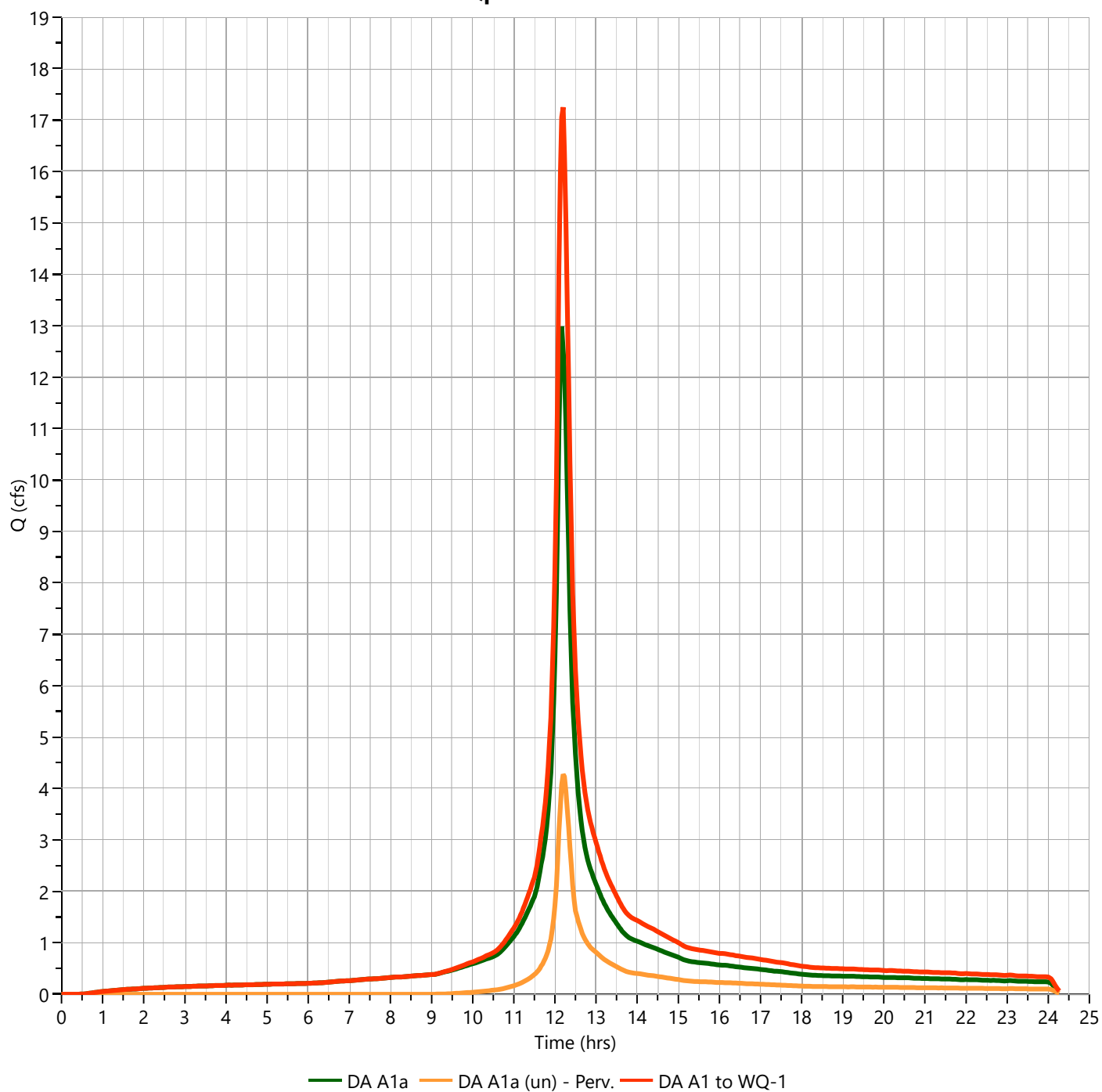
01-04-2021

Post DA A1 to WQ-1

Hyd. No. 7

Hydrograph Type	= Junction	Peak Flow	= 17.25 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 79,786 cuft
Inflow Hydrographs	= 3, 5	Total Contrib. Area	= 3.88 ac

Qp = 17.25 cfs



Hydrograph Report

Project Name:

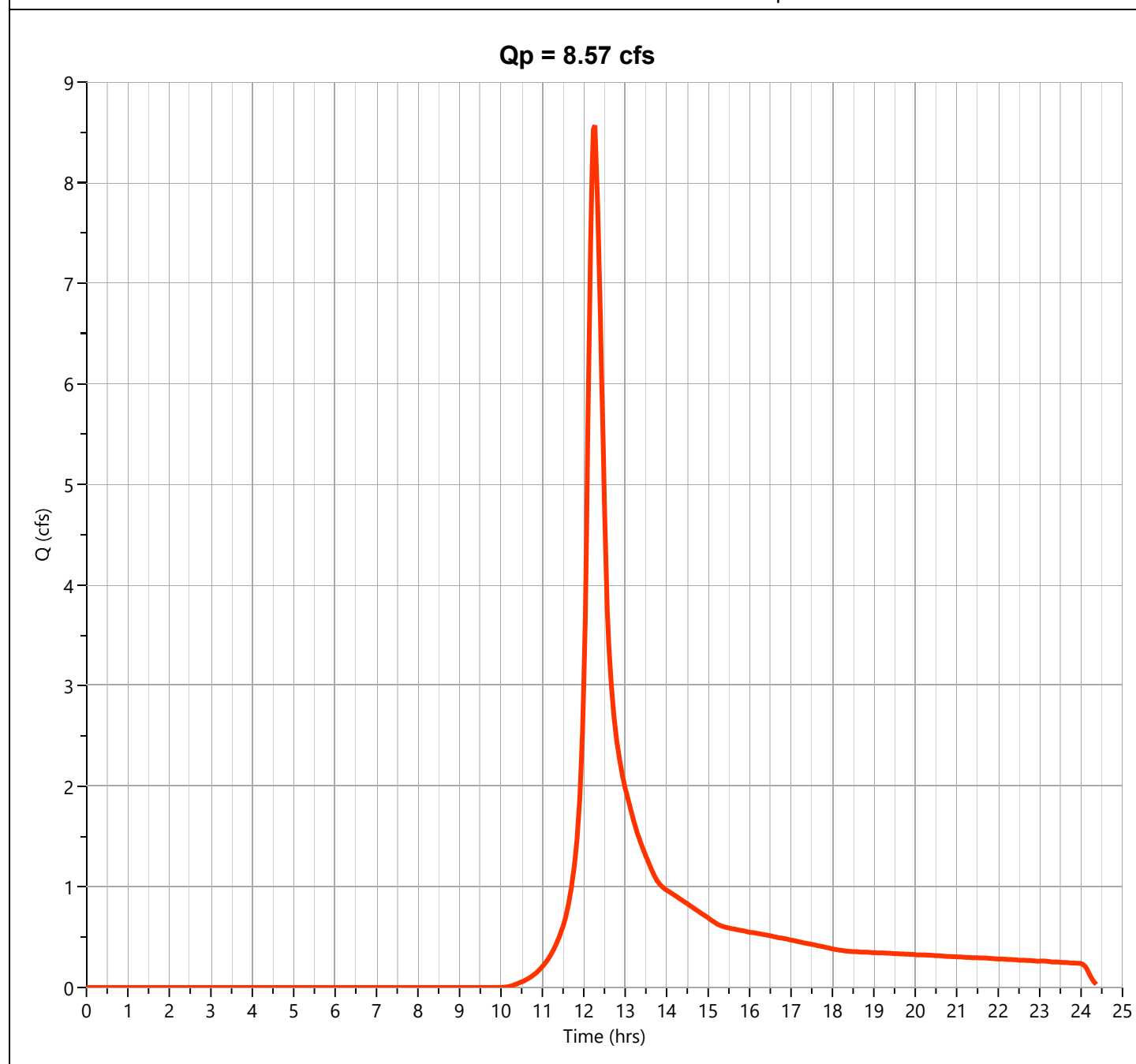
Hydrology Studio v 3.0.0.17

01-04-2021

Post DA A4a - Perv.

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.568 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.27 hrs
Time Interval	= 2 min	Runoff Volume	= 40,391 cuft
Drainage Area	= 3.35 ac	Curve Number	= 53
Tc Method	= User	Time of Conc. (Tc)	= 17.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

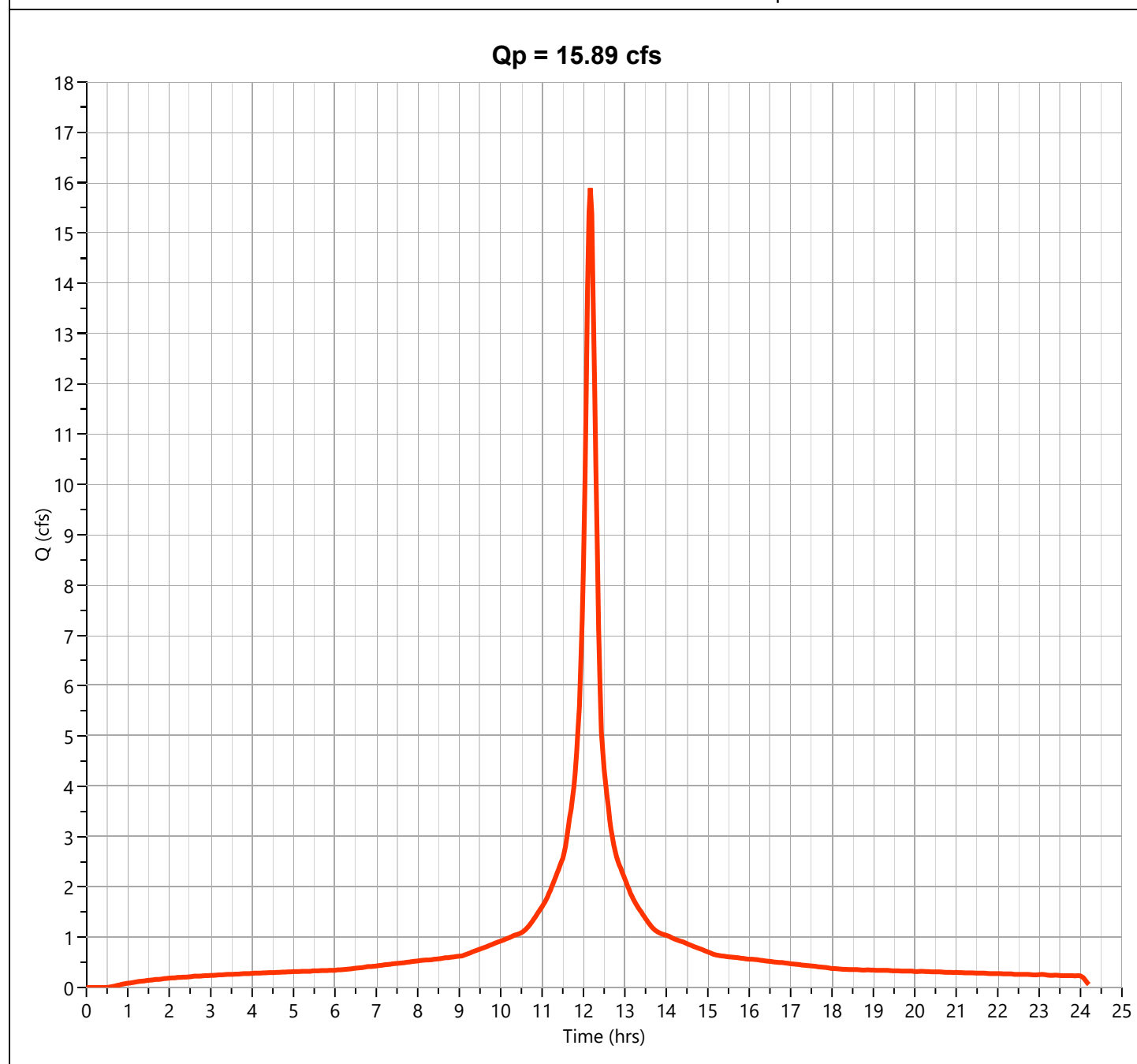
Hydrology Studio v 3.0.0.17

01-04-2021

Post DA A4a - Imperv.

Hyd. No. 11

Hydrograph Type	= NRCS Runoff	Peak Flow	= 15.89 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 72,714 cuft
Drainage Area	= 2.19 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 9.11 in	Design Storm	= NOAA Type D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

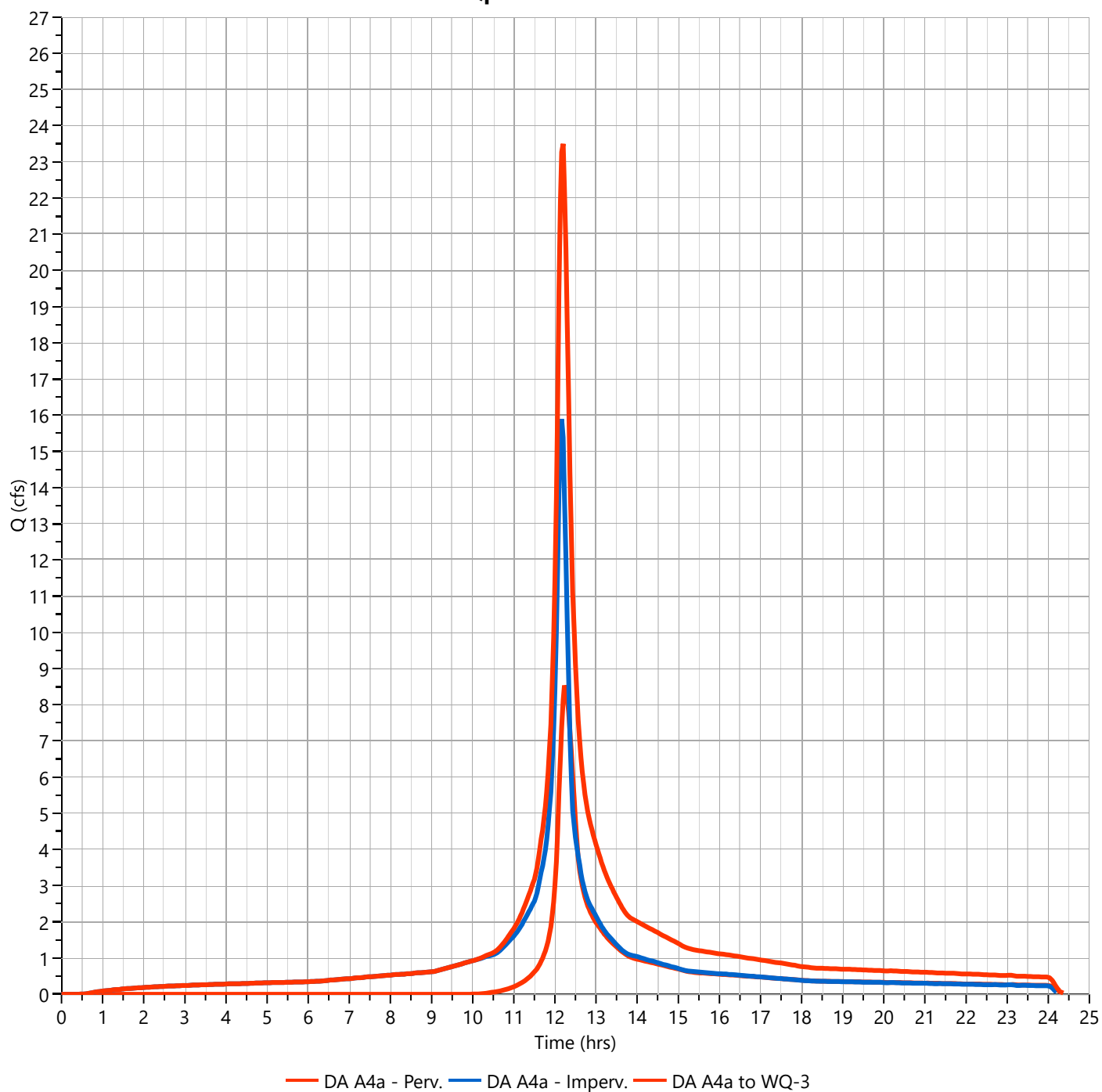
01-04-2021

Post DA A4a to WQ-3

Hyd. No. 12

Hydrograph Type	= Junction	Peak Flow	= 23.50 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Hydrograph Volume	= 113,105 cuft
Inflow Hydrographs	= 10, 11	Total Contrib. Area	= 5.54 ac

Qp = 23.50 cfs



1251 Jumping Brook Road: WQ-1

Tinton Falls, NJ

Information Provided by Engineer (Langan Engineering):

- Required TSS removal rate = 80%
- Treatment flow rate = 3.31 cfs
- 100-yr Storm bypass flow rate = 17.25 cfs
- Impervious drainage area = 1.29 acres
- Presiding agency = NJDEP

StormFilter Information and Cartridge Data:

The Stormwater Management StormFilter® is a passive, siphon-actuated, flow-through stormwater filtration system consisting of a precast concrete structure that houses rechargeable, media-filled filter cartridges. The StormFilter works by passing stormwater through the media-filled cartridges, which trap particulates and adsorb pollutants such as dissolved metals, nutrients, and hydrocarbons. **The StormFilter has received final certification from the NJDEP for 80% TSS removal as a stand-alone treatment system.**

- StormFilter cartridge filter media = Perlite
- StormFilter cartridge media height = 27 inches (nominal)
- StormFilter cartridge surface area = 10.61 square feet (nominal)
- StormFilter cartridge specific treatment flow rate = 2.12 gallons/minute per square foot (nominal)
- StormFilter cartridge treatment flow = 22.5 gpm
- **Hydraulic head required: 3.0 feet** (with 27 inch cartridge)
- Minimum physical drop between inlet and outlet pipe = 6 inches

Design Summary:

The StormFilter is sized based on the NJDEP certification, which lists an approved treatment flow rate and maximum impervious acreage limit per cartridge in Table 1. The number of cartridges required based on the impervious drainage area is compared with the number of cartridges required based on the treatment flow rate; the larger number of cartridges governs the sizing.

The StormFilter for this site was sized to provide **67 cartridges** in order to meet the hydraulic load requirement (calculations shown below). To house this number of cartridges, Contech Engineered Solutions recommends (2) 8' x 22' precast Peak Diversion StormFilter.

$$N_{\text{cartridges hyd.load}} = \frac{Q_{\text{treat}} \times 449 \frac{\text{gpm}}{\text{cfs}}}{Q_{\text{cartridge}}} = \frac{3.31 \text{ cfs} \times 449 \frac{\text{gpm}}{\text{cfs}}}{22.5 \frac{\text{gpm}}{\text{cartridge}}} = 66.05 \Rightarrow (67) \text{ 27" Cartridges}$$

$$N_{\text{cartridges mass load}} = \frac{\text{Area}_{\text{site}}}{\text{Max Area}_{\text{cartridge}}} = \frac{1.29 \text{ acre}}{.136 \frac{\text{acres}}{\text{cartridge}}} = 9.48 \Rightarrow (10) \text{ 27" Cartridges}$$



StormFilter Design Summary

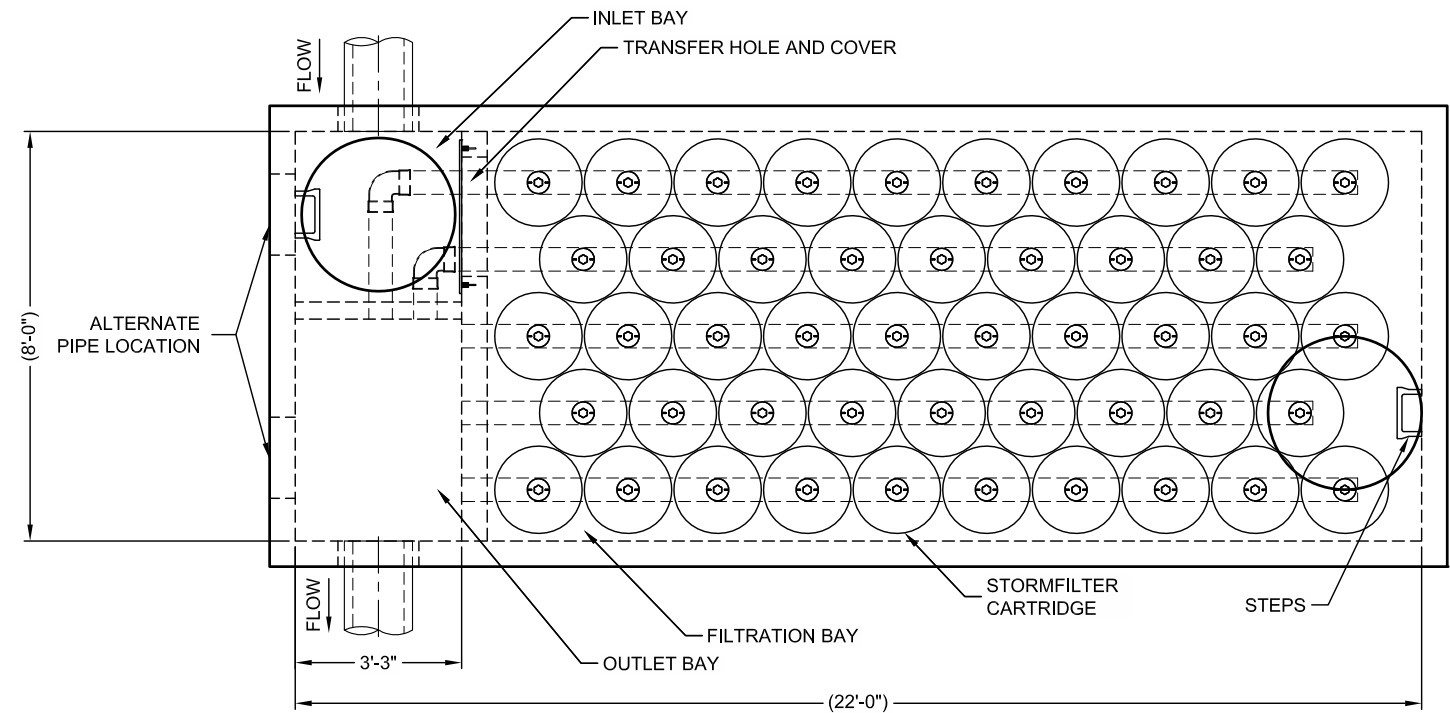
Maintenance:

Maintenance of Stormwater best management practices is required per the New Jersey Administrative Code 7:8-5.8. Recommendations for maintenance are included in chapters 8 & 9 of the New Jersey Stormwater Best Management Practices Manual. To comply with requirements, CONTECH offers a network of Preferred Service Providers that have the capability to perform all necessary inspections, compliance reporting and cleaning services. CONTECH recommends inspecting the system annually and maintaining the system at the recommendation of the annual inspection. Full maintenance is typically required every 24-36 months. Disposal of material should be handled in accordance with local regulations. Please contact CONTECH's Maintenance Department for all questions regarding maintenance at (503) 258-3157 or visit our website at www.conteches.com/maintenance.

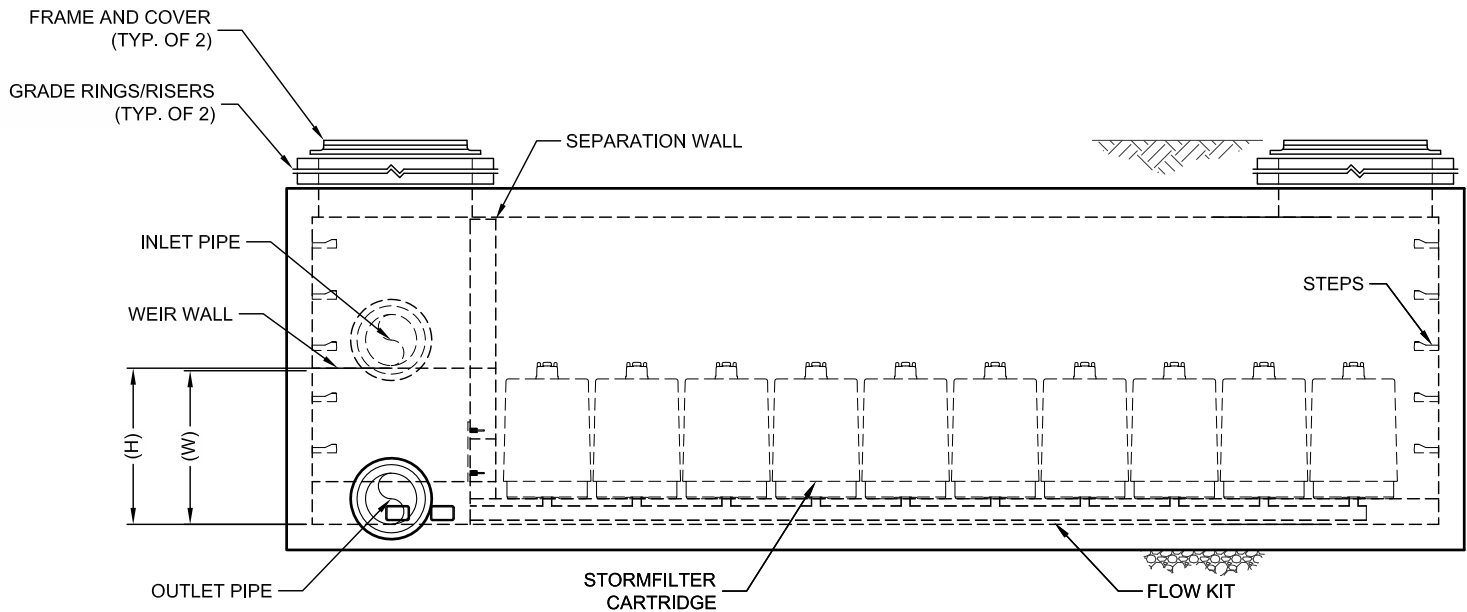
Thank you for the opportunity to present this information to you and your client. If you have any questions, please call me at (410) 609-6140.

Sincerely,

Nicholas T. Busque
Sales Engineer – Pipe & Stormwater Solutions
Contech Engineered Solutions LLC



PLAN VIEW



ELEVATION



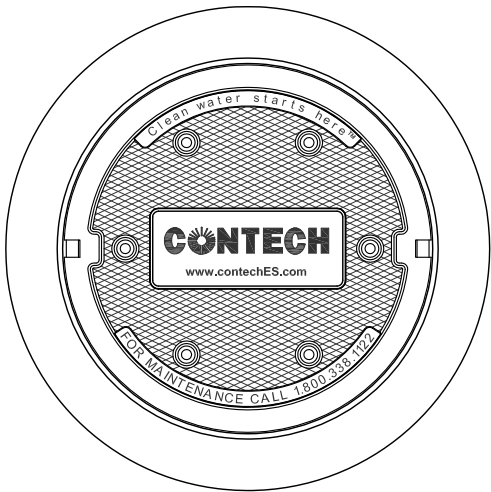
STORMFILTER DESIGN NOTES

- THE 8' x 22' PEAK DIVERSION STORMFILTER TREATMENT CAPACITY VARIES BY CARTRIDGE COUNT AND LOCALLY APPROVED SURFACE AREA SPECIFIC FLOW RATE. PEAK CONVEYANCE CAPACITY TO BE DETERMINED BY ENGINEER OF RECORD.
- THE PEAK DIVERSION STORMFILTER IS AVAILABLE IN A LEFT INLET (AS SHOWN) OR RIGHT INLET CONFIGURATION.
- ALL PARTS AND INTERNAL ASSEMBLY PROVIDED BY CONTECH UNLESS OTHERWISE NOTED.

CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27"			18"			LOW DROP		
RECOMMENDED HYDRAULIC DROP (H)	3.05'			2.3'			1.8'		
HEIGHT OF WEIR (W)	3.00'			2.25'			1.75'		
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf
CARTRIDGE FLOW RATE (gpm)	22.5	18.79	11.25	15	12.53	7.5	10	8.35	5

* 1.67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

PERFORMANCE SPECIFICATION

FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. **RADIAL MEDIA DEPTH SHALL BE 7-INCHES**. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST **38 SECONDS**. SPECIFIC FLOW RATE SHALL BE **2 GPM/SF (MAXIMUM)**. SPECIFIC FLOW RATE IS THE MEASURE OF THE FLOW (GPM) DIVIDED BY THE MEDIA SURFACE CONTACT AREA (SF). MEDIA VOLUMETRIC FLOW RATE SHALL BE **6 GPM/CF OF MEDIA (MAXIMUM)**.

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.contechES.com
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.

INSTALLATION NOTES

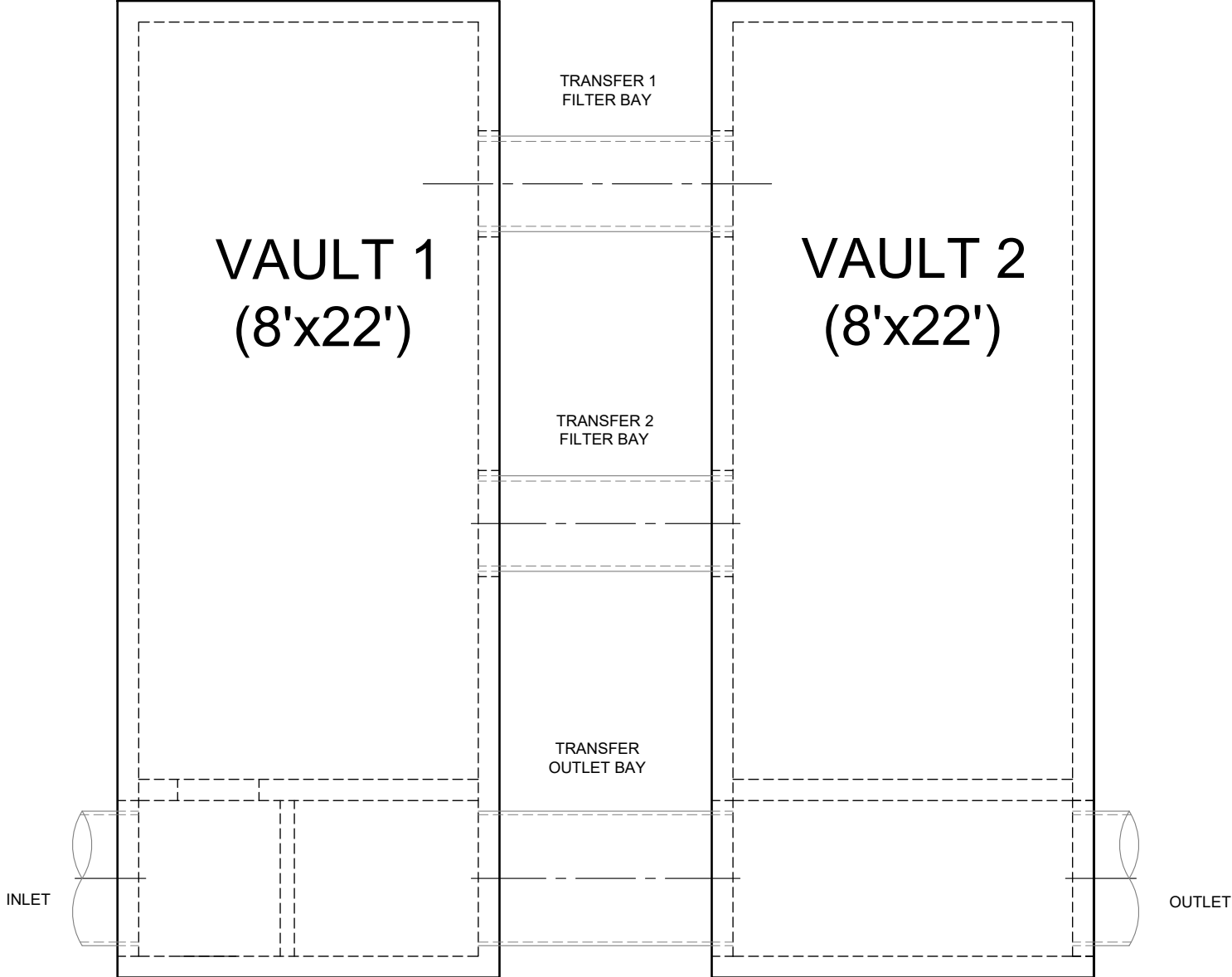
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- C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL SECTIONS AND ASSEMBLE STRUCTURE.
- D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
- E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
- F. CONTRACTOR TO REMOVE THE TRANSFER HOLE COVER WHEN THE SYSTEM IS BROUGHT ONLINE.

SITE SPECIFIC DATA REQUIREMENTS			
STRUCTURE ID			*
WATER QUALITY FLOW RATE (cfs)			*
PEAK FLOW RATE (cfs)			*
RETURN PERIOD OF PEAK FLOW (yrs)			*
CARTRIDGE HEIGHT (27", 18", LOW DROP(LD))			*
NUMBER OF CARTRIDGES REQUIRED			*
CARTRIDGE FLOW RATE			*
MEDIA TYPE (PERLITE, ZPG, PSORB)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE	*	*	*
OUTLET PIPE	*	*	*
UPSTREAM RIM ELEVATION			*
DOWNSTREAM RIM ELEVATION			*
ANTI-FLOTATION BALLAST	WIDTH		HEIGHT
	*		*
NOTES/SPECIAL REQUIREMENTS:			
* PER ENGINEER OF RECORD			



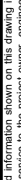
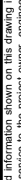
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

THE STORMWATER MANAGEMENT STORMFILTER
8' x 22' PEAK DIVERSION STORMFILTER
STANDARD DETAIL



PLAN VIEW

CONTECH
PROPOSAL
DRAWING

 ENGINEERED SOLUTIONS LLC www.ContechES.com 5670 Greenwood Plaza Blvd., Suite 330, Greenwood Village, CO 80111 800-526-3999 720-587-2700 720-687-2651 FAX		 THIS PRODUCT IS THE PROPERTY OF THE FOLLOWING ALL RIGHTS RESERVED. NO PART OF THIS DOCUMENT MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT PERMISSION IN WRITING FROM THE ENGINEER OF RECORD.	
DATE: 1/06/2020			
DESIGNED: NTB	DRAWN: NTB		
CHECKED:	APPROVED:		
PROJECT NUMBER: ----			
SHEET: 1 OF 1			



State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Nonpoint Pollution Control

Division of Water Quality

Mail Code 401-02B

Post Office Box 420

Trenton, New Jersey 08625-0420

609-633-7021 Fax: 609-777-0432

http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE

Governor

KIM GUADAGNO

Lt. Governor

BOB MARTIN

Commissioner

December 14, 2016

Derek M. Berg
Director - Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Laboratory Certification
Stormwater Management StormFilter® (StormFilter) by Contech Engineered Solutions LLC
Off-line Installation

TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions LLC has requested a Laboratory Certification for the StormFilter System.

This project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix for this device is published online at <http://www.njcat.org/verification-process/technology-verification-database.html>.

The NJDEP certifies the use of the StormFilter System by Contech Engineered Solutions LLC at a TSS removal rate of 80%, when designed, operated and maintained in accordance with the information provided in the Verification Appendix and subject to the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 2.12 gpm/sf of effective filtration treatment area.
2. The StormFilter System shall be installed using the same configuration as the unit tested by NJCAT, and sized in accordance with the criteria specified in item 6 below.
3. This device cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.
4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.
5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the StormFilter, which is attached to this document. However, it is recommended to review the maintenance website at <http://www.conteches.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=2813&PortalId=0&DownloadMethod=attachment> for any changes to the maintenance requirements.
6. Sizing Requirements:

The example below demonstrates the sizing procedure for a StormFilter System.

Example: A 0.25 acre impervious site is to be treated to 80% TSS removal using a StormFilter System. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

The calculation of the minimum number of cartridges for use in the StormFilter System is based upon both the MTFR and the maximum inflow drainage area. It is necessary to calculate the required cartridges using both methods and to rely on the method that results in the highest minimum number of cartridges determined by the two methods.

Inflow Drainage Area Evaluation:

The drainage area to the StormFilter System in this example is 0.25 acres. Based upon the information in Table 1 below, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the maximum drainage area:

1. Five (5) 12" cartridges,
2. Three (3) 18" cartridges, or
3. Two (2) 27" cartridges

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was determined based on the following:

time of concentration = 10 minutes

i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)

c=0.99 (runoff coefficient for impervious)

$Q=ciA=0.99 \times 3.2 \times 0.25 = 0.79$ cfs = 0.79×448.83 gpm = 354.58 gpm

Based on a flow rate of 354.58 gpm, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the MTFR:

1. Thirty-six (36) 12" cartridges,
2. Twenty-four (24) 18" cartridges, or
3. Sixteen (16) 27" cartridges

The MTFR Evaluation results will be used since that method results in the higher minimum number of cartridges determined by the two methods.

The sizing table corresponding to the available system models are noted below:

TABLE 1 STORMFILTER CARTRIDGE HEIGHTS AND NEW JERSEY TREATMENT CAPACITIES

StormFilter Cartridge Heights and New Jersey Treatment Capacities				
StormFilter Cartridge Height	Filtration Surface Area (sq.ft)	MTFR ¹ (GPM)	Mass Capture Capacity (lbs)	Maximum Allowable Inflow Area ² (acres)
Low Drop (12")	4.71	10	36.3	0.061
18"	7.07	15	54.5	0.09
27"	10.61	22.5	81.8	0.136

Notes:

1. MTFR calculated based on 4.72×10^{-3} cfs/sf (2.12 gpm/sf) of effective filtration treatment area.

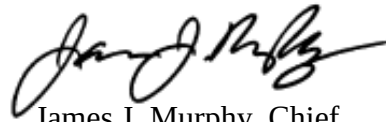
2. Based upon the equation found in the NJDEP Filter Protocol Maximum Inflow Drainage Area (acres) = weight of TSS before 10% loss in MTFR (lbs)/600 lbs/acre of drainage area annually.

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of

indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Shashi Nayak of my office at (609) 633-7021.

Sincerely,

A handwritten signature in black ink, appearing to read "James J. Murphy".

James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File

Richard Magee, NJCAT

Vince Mazzei, NJDEP - DLUR

Ravi Patraju, NJDEP - BES

Gabriel Mahon, NJDEP - BNPC

Shashi Nayak, NJDEP - BNPC

1251 Jumping Brook Road: WQ-2

Tinton Falls, NJ

Information Provided by Engineer (Langan Engineering):

- Required TSS removal rate = 80%
- Treatment flow rate = 0.29 cfs
- 100-yr Storm bypass flow rate = 24.65 cfs
- Impervious drainage area = 4.13 acres
- Presiding agency = NJDEP

StormFilter Information and Cartridge Data:

The Stormwater Management StormFilter® is a passive, siphon-actuated, flow-through stormwater filtration system consisting of a precast concrete structure that houses rechargeable, media-filled filter cartridges. The StormFilter works by passing stormwater through the media-filled cartridges, which trap particulates and adsorb pollutants such as dissolved metals, nutrients, and hydrocarbons. **The StormFilter has received final certification from the NJDEP for 80% TSS removal as a stand-alone treatment system.**

- StormFilter cartridge filter media = Perlite
- StormFilter cartridge media height = 27 inches (nominal)
- StormFilter cartridge surface area = 10.61 square feet (nominal)
- StormFilter cartridge specific treatment flow rate = 2.12 gallons/minute per square foot (nominal)
- StormFilter cartridge treatment flow = 22.5 gpm
- **Hydraulic head required: 3.0 feet** (with 27 inch cartridge)
- Minimum physical drop between inlet and outlet pipe = 6 inches

Design Summary:

The StormFilter is sized based on the NJDEP certification, which lists an approved treatment flow rate and maximum impervious acreage limit per cartridge in Table 1. The number of cartridges required based on the impervious drainage area is compared with the number of cartridges required based on the treatment flow rate; the larger number of cartridges governs the sizing.

The StormFilter for this site was sized to provide **31 cartridges** in order to meet the mass load requirement (calculations shown below). To house this number of cartridges, Contech Engineered Solutions recommends an 8' x 20' precast Peak Diversion StormFilter.

$$N_{\text{cartridges hyd.load}} = \frac{Q_{\text{treat}} \times 449 \text{ gpm/cfs}}{Q_{\text{cartridge}}} = \frac{0.29 \text{ cfs} \times 449 \text{ gpm/cfs}}{22.5 \text{ gpm/cartridge}} = 5.79 \Rightarrow (6) \text{ 27" Cartridges}$$

$$N_{\text{cartridges mass load}} = \frac{\text{Area}_{\text{site}}}{\text{Max Area}_{\text{cartridge}}} = \frac{4.13 \text{ acre}}{.136 \text{ acres/cartridge}} = 30.37 \Rightarrow (31) \text{ 27" Cartridges}$$



StormFilter Design Summary

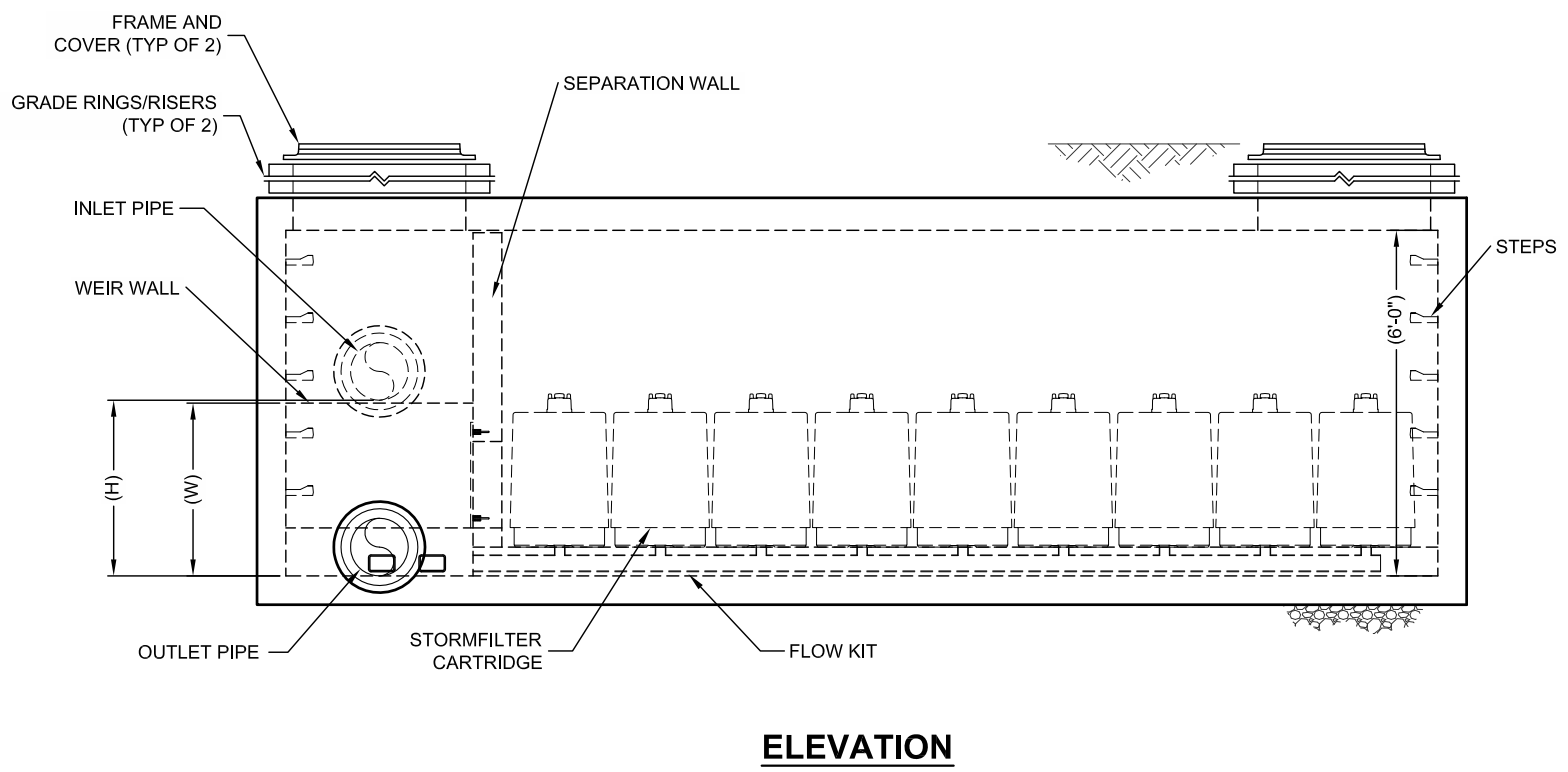
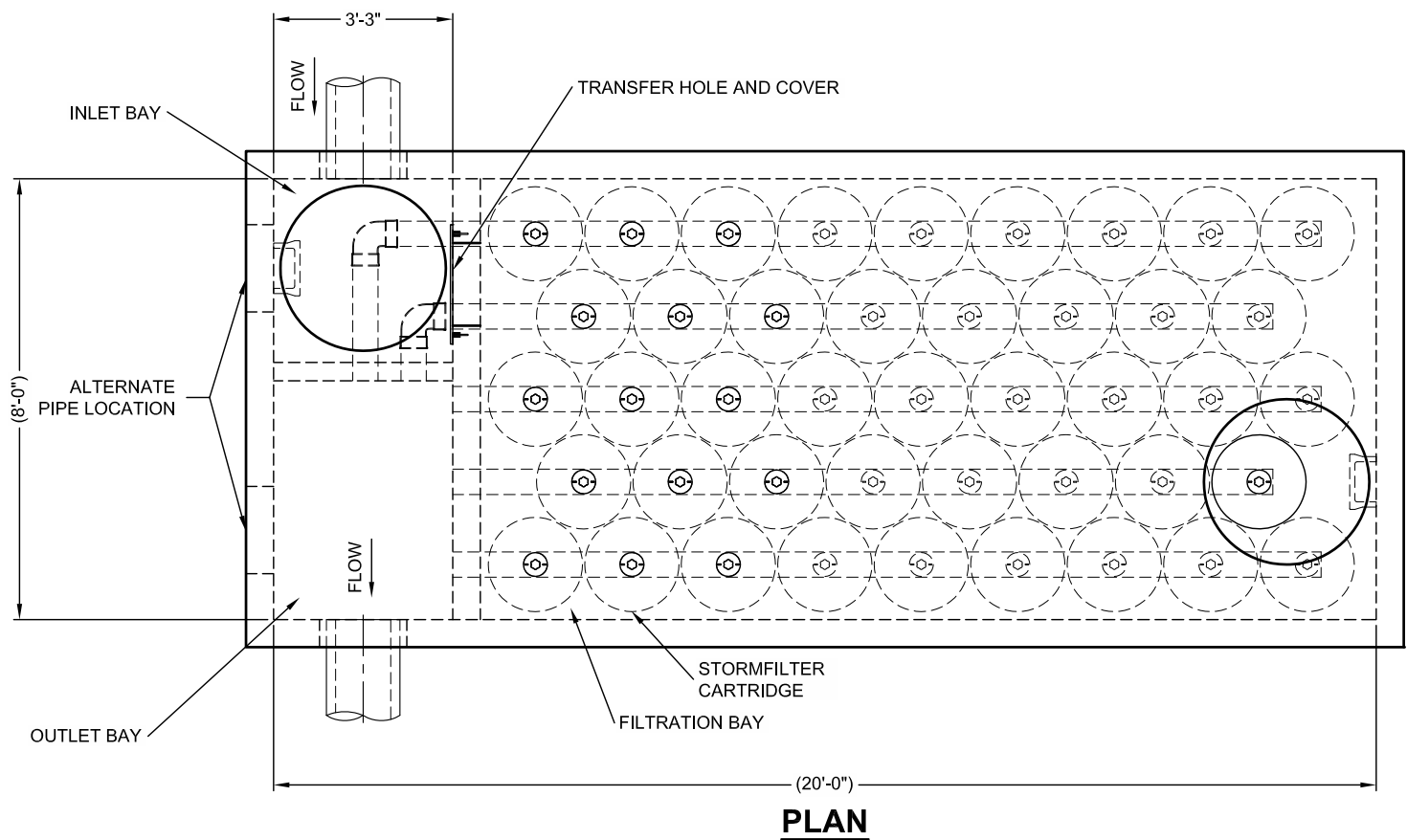
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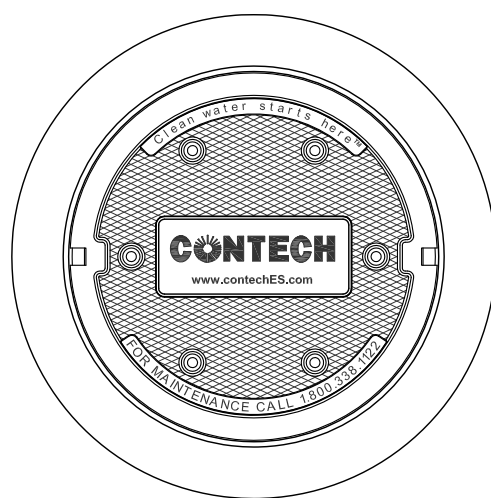


STORMFILTER DESIGN NOTES

- THE 8' x 20' PEAK DIVERSION STORMFILTER TREATMENT CAPACITY VARIES BY CARTRIDGE COUNT AND LOCALLY APPROVED SURFACE AREA SPECIFIC FLOW RATE. PEAK CONVEYANCE CAPACITY TO BE DETERMINED BY ENGINEER OF RECORD.
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CARTRIDGE SELECTION									
CARTRIDGE HEIGHT	27"			18"			LOW DROP		
RECOMMENDED HYDRAULIC DROP (H)	3.05'			2.3'			1.8'		
HEIGHT OF WEIR (W)	3.00'			2.25'			1.75'		
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf
CARTRIDGE FLOW RATE (gpm)	22.5	18.79	11.25	15	12.53	7.5	10	8.35	5

* 1.67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS			
STRUCTURE ID		*	
WATER QUALITY FLOW RATE (cfs)		*	
PEAK FLOW RATE (cfs)		*	
RETURN PERIOD OF PEAK FLOW (yrs)		*	
CARTRIDGE HEIGHT (27", 18", LOW DROP(LD))		*	
NUMBER OF CARTRIDGES REQUIRED		*	
CARTRIDGE FLOW RATE		*	
MEDIA TYPE (PERLITE, ZPG, PSORB)		*	
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE	*	*	*
OUTLET PIPE	*	*	*
UPSTREAM RIM ELEVATION		*	
DOWNSTREAM RIM ELEVATION		*	
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*
NOTES/SPECIAL REQUIREMENTS:			
* PER ENGINEER OF RECORD			

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 - F. CONTRACTOR TO REMOVE THE TRANSFER HOLE COVER WHEN THE SYSTEM IS BROUGHT ONLINE.





ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

THE STORMWATER MANAGEMENT STORMFILTER
8' x 20' PEAK DIVERSION STORMFILTER
STANDARD DETAIL



State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Nonpoint Pollution Control

Division of Water Quality

Mail Code 401-02B

Post Office Box 420

Trenton, New Jersey 08625-0420

609-633-7021 Fax: 609-777-0432

http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE

Governor

KIM GUADAGNO

Lt. Governor

BOB MARTIN

Commissioner

December 14, 2016

Derek M. Berg
Director - Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Laboratory Certification
Stormwater Management StormFilter® (StormFilter) by Contech Engineered Solutions LLC
Off-line Installation

TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions LLC has requested a Laboratory Certification for the StormFilter System.

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The NJDEP certifies the use of the StormFilter System by Contech Engineered Solutions LLC at a TSS removal rate of 80%, when designed, operated and maintained in accordance with the information provided in the Verification Appendix and subject to the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 2.12 gpm/sf of effective filtration treatment area.
2. The StormFilter System shall be installed using the same configuration as the unit tested by NJCAT, and sized in accordance with the criteria specified in item 6 below.
3. This device cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.
4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.
5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the StormFilter, which is attached to this document. However, it is recommended to review the maintenance website at <http://www.conteches.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=2813&PortalId=0&DownloadMethod=attachment> for any changes to the maintenance requirements.
6. Sizing Requirements:

The example below demonstrates the sizing procedure for a StormFilter System.

Example: A 0.25 acre impervious site is to be treated to 80% TSS removal using a StormFilter System. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

The calculation of the minimum number of cartridges for use in the StormFilter System is based upon both the MTFR and the maximum inflow drainage area. It is necessary to calculate the required cartridges using both methods and to rely on the method that results in the highest minimum number of cartridges determined by the two methods.

Inflow Drainage Area Evaluation:

The drainage area to the StormFilter System in this example is 0.25 acres. Based upon the information in Table 1 below, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the maximum drainage area:

1. Five (5) 12" cartridges,
2. Three (3) 18" cartridges, or
3. Two (2) 27" cartridges

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was determined based on the following:

time of concentration = 10 minutes

i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)

c=0.99 (runoff coefficient for impervious)

$Q=ciA=0.99 \times 3.2 \times 0.25 = 0.79$ cfs = 0.79×448.83 gpm = 354.58 gpm

Based on a flow rate of 354.58 gpm, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the MTFR:

1. Thirty-six (36) 12" cartridges,
2. Twenty-four (24) 18" cartridges, or
3. Sixteen (16) 27" cartridges

The MTFR Evaluation results will be used since that method results in the higher minimum number of cartridges determined by the two methods.

The sizing table corresponding to the available system models are noted below:

TABLE 1 STORMFILTER CARTRIDGE HEIGHTS AND NEW JERSEY TREATMENT CAPACITIES

StormFilter Cartridge Heights and New Jersey Treatment Capacities				
StormFilter Cartridge Height	Filtration Surface Area (sq.ft)	MTFR ¹ (GPM)	Mass Capture Capacity (lbs)	Maximum Allowable Inflow Area ² (acres)
Low Drop (12")	4.71	10	36.3	0.061
18"	7.07	15	54.5	0.09
27"	10.61	22.5	81.8	0.136

Notes:

1. MTFR calculated based on 4.72×10^{-3} cfs/sf (2.12 gpm/sf) of effective filtration treatment area.

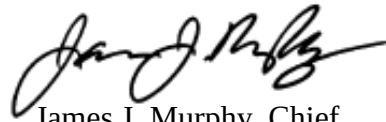
2. Based upon the equation found in the NJDEP Filter Protocol Maximum Inflow Drainage Area (acres) = weight of TSS before 10% loss in MTFR (lbs)/600 lbs/acre of drainage area annually.

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of

indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Shashi Nayak of my office at (609) 633-7021.

Sincerely,

A handwritten signature in black ink, appearing to read "James J. Murphy".

James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File

Richard Magee, NJCAT

Vince Mazzei, NJDEP - DLUR

Ravi Patraju, NJDEP - BES

Gabriel Mahon, NJDEP - BNPC

Shashi Nayak, NJDEP - BNPC

1251 Jumping Brook Road: WQ-3

Tinton Falls, NJ

Information Provided by Engineer (Langan Engineering):

- Required TSS removal rate = 80%
- Treatment flow rate = 5.49 cfs
- 100-yr Storm bypass flow rate = 23.50 cfs
- Impervious drainage area = 2.12 acres
- Presiding agency = NJDEP

StormFilter Information and Cartridge Data:

The Stormwater Management StormFilter® is a passive, siphon-actuated, flow-through stormwater filtration system consisting of a precast concrete structure that houses rechargeable, media-filled filter cartridges. The StormFilter works by passing stormwater through the media-filled cartridges, which trap particulates and adsorb pollutants such as dissolved metals, nutrients, and hydrocarbons. **The StormFilter has received final certification from the NJDEP for 80% TSS removal as a stand-alone treatment system.**

- StormFilter cartridge filter media = Perlite
- StormFilter cartridge media height = 27 inches (nominal)
- StormFilter cartridge surface area = 10.61 square feet (nominal)
- StormFilter cartridge specific treatment flow rate = 2.12 gallons/minute per square foot (nominal)
- StormFilter cartridge treatment flow = 22.5 gpm
- **Hydraulic head required: 3.0 feet** (with 27 inch cartridge)
- Minimum physical drop between inlet and outlet pipe = 6 inches

Design Summary:

The StormFilter is sized based on the NJDEP certification, which lists an approved treatment flow rate and maximum impervious acreage limit per cartridge in Table 1. The number of cartridges required based on the impervious drainage area is compared with the number of cartridges required based on the treatment flow rate; the larger number of cartridges governs the sizing.

The StormFilter for this site was sized to provide **110 cartridges** in order to meet the hydraulic load requirement (calculations shown below). To house this number of cartridges, Contech Engineered Solutions recommends (3) 8' x 24' precast Peak Diversion StormFilter vaults operating in parallel.

$$N_{\text{cartridges hy. load}} = \frac{Q_{\text{treat}} \times 449 \frac{\text{gpm}}{\text{cfs}}}{Q_{\text{cartridge}}} = \frac{5.49 \text{ cfs} \times 449 \frac{\text{gpm}}{\text{cfs}}}{22.5 \frac{\text{gpm}}{\text{cartridge}}} = 109.56 \Rightarrow (110) \text{ 27" Cartridges}$$

$$N_{\text{cartridges mass load}} = \frac{\text{Area}_{\text{site}}}{\text{Max Area}_{\text{cartridge}}} = \frac{2.12 \text{ acre}}{.136 \frac{\text{acres}}{\text{cartridge}}} = 15.59 \Rightarrow (16) \text{ 27" Cartridges}$$



StormFilter Design Summary

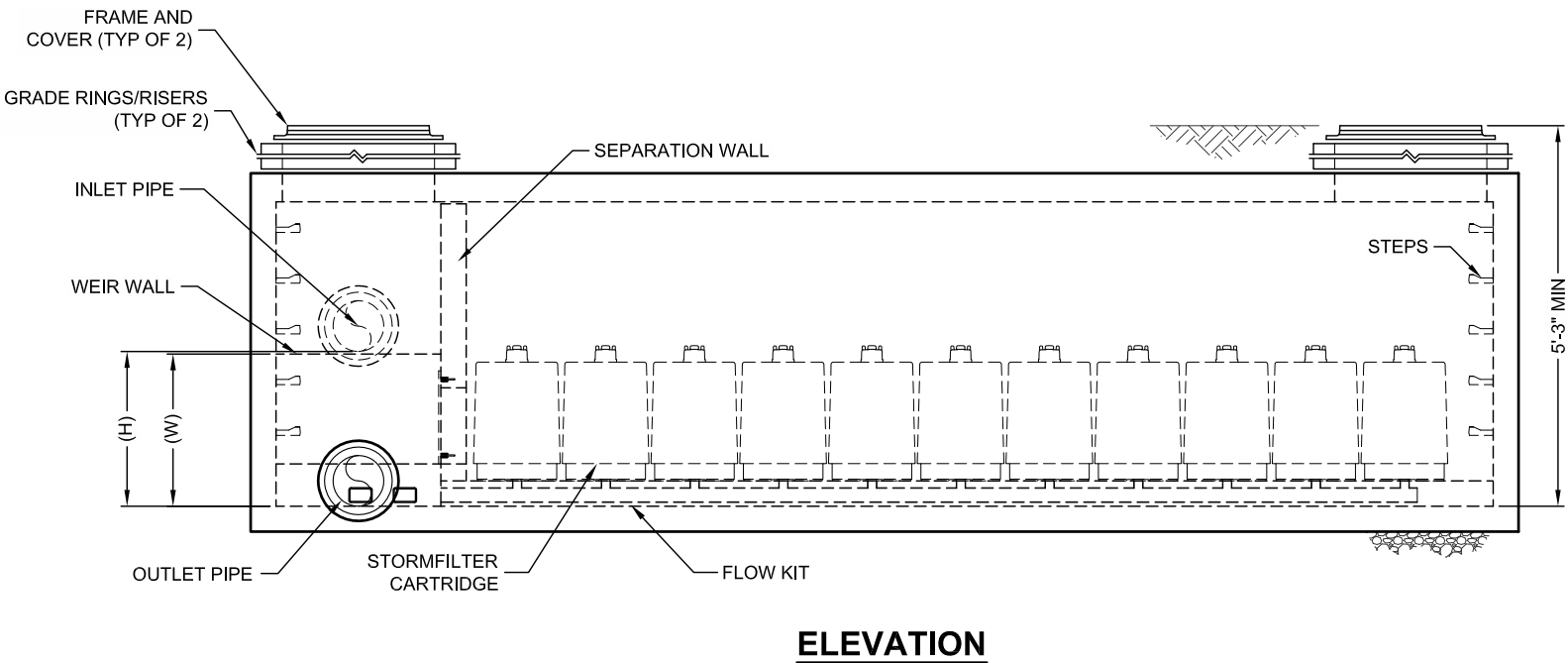
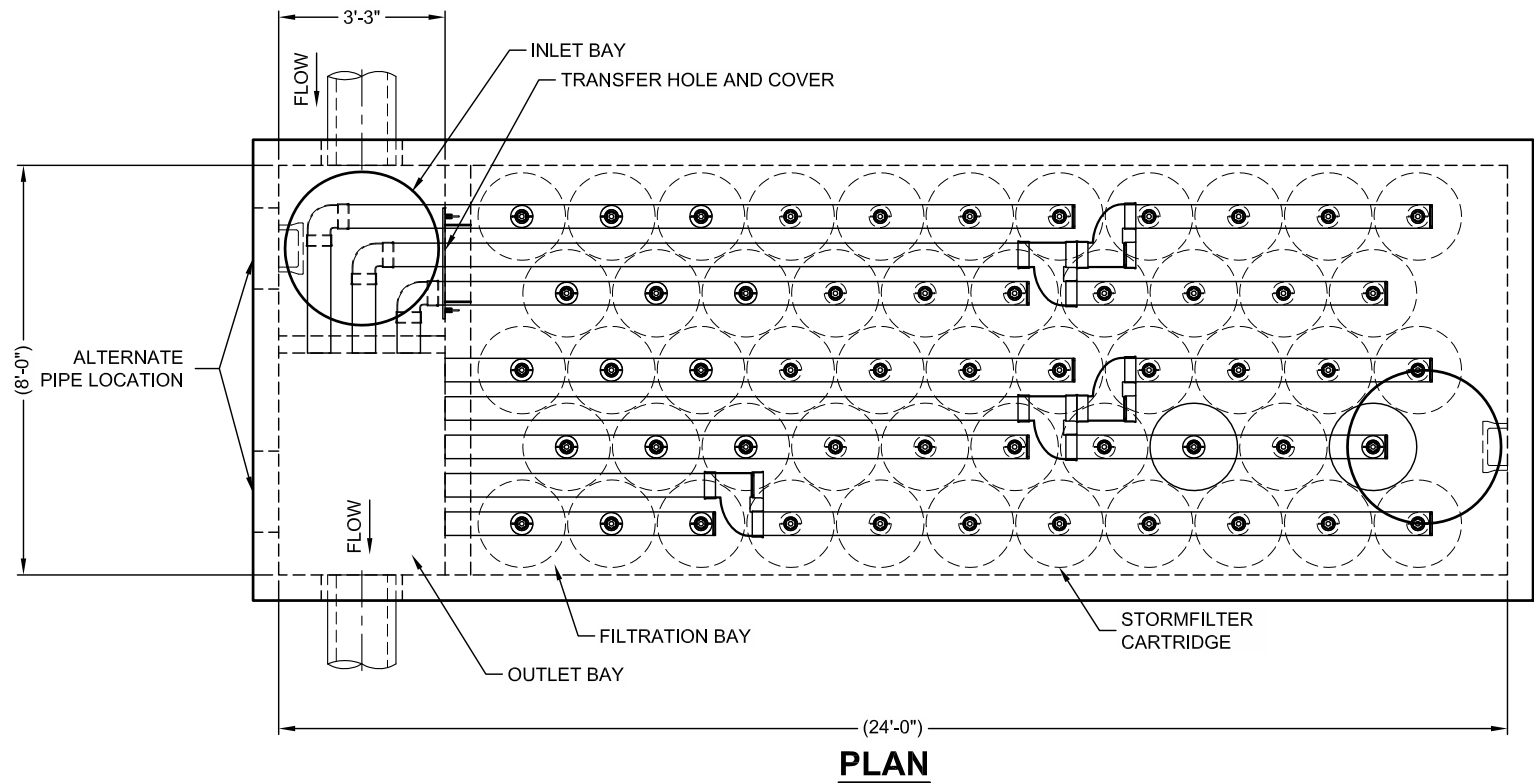
Maintenance:

Maintenance of Stormwater best management practices is required per the New Jersey Administrative Code 7:8-5.8. Recommendations for maintenance are included in chapters 8 & 9 of the New Jersey Stormwater Best Management Practices Manual. To comply with requirements, CONTECH offers a network of Preferred Service Providers that have the capability to perform all necessary inspections, compliance reporting and cleaning services. CONTECH recommends inspecting the system annually and maintaining the system at the recommendation of the annual inspection. Full maintenance is typically required every 24-36 months. Disposal of material should be handled in accordance with local regulations. Please contact CONTECH's Maintenance Department for all questions regarding maintenance at (503) 258-3157 or visit our website at www.conteches.com/maintenance.

Thank you for the opportunity to present this information to you and your client. If you have any questions, please call me at (410) 609-6140.

Sincerely,

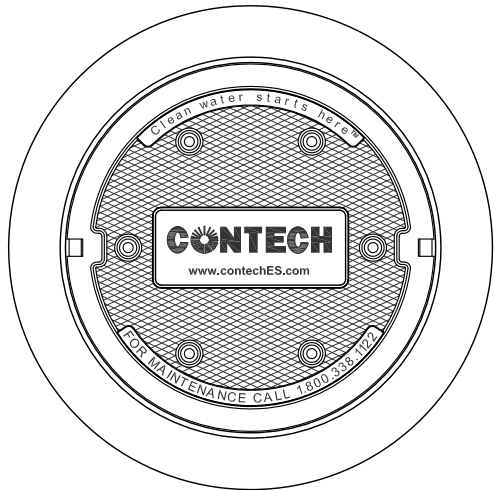
Nicholas T. Busque
Sales Engineer – Pipe & Stormwater Solutions
Contech Engineered Solutions LLC



STORMFILTER DESIGN TABLE

- THE 8' x 24' PEAK DIVERSION STORMFILTER TREATMENT CAPACITY VARIES BY CARTRIDGE COUNT AND LOCALLY APPROVED SURFACE AREA SPECIFIC FLOW RATE. PEAK CONVEYANCE CAPACITY TO BE DETERMINED BY ENGINEER OF RECORD.
- THE PEAK DIVERSION STORMFILTER IS AVAILABLE IN A LEFT INLET (AS SHOWN) OR RIGHT INLET CONFIGURATION.
- ALL PARTS AND INTERNAL ASSEMBLY PROVIDED BY CONTECH UNLESS OTHERWISE NOTED.

CARTRIDGE HEIGHT	27"		18"		LOW DROP	
SYSTEM HYDRAULIC DROP (H - REQ'D. MIN.)	3.05'		2.3'		1.8'	
HEIGHT OF WEIR (W)	3.00'		2.25'		1.75'	
TREATMENT BY MEDIA SURFACE AREA	2 gpm/ft ²	1 gpm/ft ²	2 gpm/ft ²	1 gpm/ft ²	2 gpm/ft ²	1 gpm/ft ²
CARTRIDGE FLOW RATE (gpm)	22.5	11.25	15	7.5	10	5



FRAME AND COVER (DIAMETER VARIES) N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			*
WATER QUALITY FLOW RATE (cfs)			*
PEAK FLOW RATE (cfs)			*
RETURN PERIOD OF PEAK FLOW (yrs)			*
# OF CARTRIDGES REQUIRED			*
CARTRIDGE FLOW RATE			*
MEDIA TYPE (CSF, PERLITE, ZPG)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE	*	*	*
OUTLET PIPE	*	*	*
INLET BAY RIM ELEVATION			*
FILTER BAY RIM ELEVATION			*
ANTI-FLOTATION BALLAST	WIDTH	HEIGHT	
	*	*	
NOTES/SPECIAL REQUIREMENTS:			

PERFORMANCE SPECIFICATION

FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. **RADIAL MEDIA DEPTH SHALL BE 7-INCHES**. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST **37 SECONDS**. SPECIFIC FLOW RATE SHALL BE **2 GPM/SF (MAXIMUM)**. SPECIFIC FLOW RATE IS THE MEASURE OF THE FLOW (GPM) DIVIDED BY THE MEDIA SURFACE CONTACT AREA (SF). MEDIA VOLUMETRIC FLOW RATE SHALL BE **6 GPM/CF OF MEDIA (MAXIMUM)**.

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.ContechES.com
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.

INSTALLATION NOTES

- A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER STRUCTURE (LIFTING CLUTCHES PROVIDED).
- C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL SECTIONS AND ASSEMBLE STRUCTURE.
- D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
- E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
- F. CONTRACTOR TO REMOVE THE TRANSFER HOLE COVER WHEN THE SYSTEM IS BROUGHT ONLINE.

CONTECH
ENGINEERED SOLUTIONS LLC

www.ContechES.com
11815 NE Glenn Widing Drive, Portland, OR 97220
800-548-4667 503-240-3393 800-561-1271 FAX

THE STORMWATER MANAGEMENT STORMFILTER
8' x 24' PEAK DIVERSION STORMFILTER
STANDARD DETAIL



THE PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING:
U.S. PATENTS: 5,322,029; 5,324,016; 5,787,037; 5,846,107; 6,000,000; 6,040,000;
RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING
U.S. PATENT(S): 6,129,629; 6,234,676; 6,707,627; 6,985,107; 6,027,639; 6,640,048.
RELATED FOREIGN PATENT(S), OR OTHER PATENT(S) PENDING.

1 OF 1

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If discrepancies between the supplied information and the drawing is based on actual field conditions, the user of this drawing is responsible for these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by owner.



State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Nonpoint Pollution Control

Division of Water Quality

Mail Code 401-02B

Post Office Box 420

Trenton, New Jersey 08625-0420

609-633-7021 Fax: 609-777-0432

http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE

Governor

KIM GUADAGNO

Lt. Governor

BOB MARTIN

Commissioner

December 14, 2016

Derek M. Berg
Director - Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Laboratory Certification
Stormwater Management StormFilter® (StormFilter) by Contech Engineered Solutions LLC
Off-line Installation

TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions LLC has requested a Laboratory Certification for the StormFilter System.

This project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix for this device is published online at <http://www.njcat.org/verification-process/technology-verification-database.html>.

The NJDEP certifies the use of the StormFilter System by Contech Engineered Solutions LLC at a TSS removal rate of 80%, when designed, operated and maintained in accordance with the information provided in the Verification Appendix and subject to the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 2.12 gpm/sf of effective filtration treatment area.
2. The StormFilter System shall be installed using the same configuration as the unit tested by NJCAT, and sized in accordance with the criteria specified in item 6 below.
3. This device cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.
4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.
5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the StormFilter, which is attached to this document. However, it is recommended to review the maintenance website at <http://www.conteches.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=2813&PortalId=0&DownloadMethod=attachment> for any changes to the maintenance requirements.
6. Sizing Requirements:

The example below demonstrates the sizing procedure for a StormFilter System.

Example: A 0.25 acre impervious site is to be treated to 80% TSS removal using a StormFilter System. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

The calculation of the minimum number of cartridges for use in the StormFilter System is based upon both the MTFR and the maximum inflow drainage area. It is necessary to calculate the required cartridges using both methods and to rely on the method that results in the highest minimum number of cartridges determined by the two methods.

Inflow Drainage Area Evaluation:

The drainage area to the StormFilter System in this example is 0.25 acres. Based upon the information in Table 1 below, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the maximum drainage area:

1. Five (5) 12" cartridges,
2. Three (3) 18" cartridges, or
3. Two (2) 27" cartridges

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was determined based on the following:

time of concentration = 10 minutes

i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)

c=0.99 (runoff coefficient for impervious)

$Q=ciA=0.99 \times 3.2 \times 0.25 = 0.79$ cfs = 0.79×448.83 gpm = 354.58 gpm

Based on a flow rate of 354.58 gpm, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the MTFR:

1. Thirty-six (36) 12" cartridges,
2. Twenty-four (24) 18" cartridges, or
3. Sixteen (16) 27" cartridges

The MTFR Evaluation results will be used since that method results in the higher minimum number of cartridges determined by the two methods.

The sizing table corresponding to the available system models are noted below:

TABLE 1 STORMFILTER CARTRIDGE HEIGHTS AND NEW JERSEY TREATMENT CAPACITIES

StormFilter Cartridge Heights and New Jersey Treatment Capacities				
StormFilter Cartridge Height	Filtration Surface Area (sq.ft)	MTFR ¹ (GPM)	Mass Capture Capacity (lbs)	Maximum Allowable Inflow Area ² (acres)
Low Drop (12")	4.71	10	36.3	0.061
18"	7.07	15	54.5	0.09
27"	10.61	22.5	81.8	0.136

Notes:

1. MTFR calculated based on 4.72×10^{-3} cfs/sf (2.12 gpm/sf) of effective filtration treatment area.

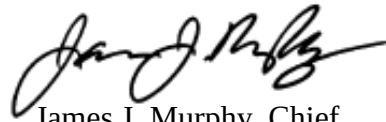
2. Based upon the equation found in the NJDEP Filter Protocol Maximum Inflow Drainage Area (acres) = weight of TSS before 10% loss in MTFR (lbs)/600 lbs/acre of drainage area annually.

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of

indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Shashi Nayak of my office at (609) 633-7021.

Sincerely,

A handwritten signature in black ink, appearing to read "James J. Murphy".

James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File

Richard Magee, NJCAT

Vince Mazzei, NJDEP - DLUR

Ravi Patraju, NJDEP - BES

Gabriel Mahon, NJDEP - BNPC

Shashi Nayak, NJDEP - BNPC

1251 Jumping Brook Road: WQ-4

Tinton Falls, NJ

Information Provided by Engineer (Langan Engineering):

- Required TSS removal rate = 80%
- Treatment flow rate = 0.629 cfs
- 100-yr Storm bypass flow rate = 20.23 cfs
- Impervious drainage area = 1.96 acres
- Presiding agency = NJDEP

StormFilter Information and Cartridge Data:

The Stormwater Management StormFilter® is a passive, siphon-actuated, flow-through stormwater filtration system consisting of a precast concrete structure that houses rechargeable, media-filled filter cartridges. The StormFilter works by passing stormwater through the media-filled cartridges, which trap particulates and adsorb pollutants such as dissolved metals, nutrients, and hydrocarbons. **The StormFilter has received final certification from the NJDEP for 80% TSS removal as a stand-alone treatment system.**

- StormFilter cartridge filter media = Perlite
- StormFilter cartridge media height = 27 inches (nominal)
- StormFilter cartridge surface area = 10.61 square feet (nominal)
- StormFilter cartridge specific treatment flow rate = 2.12 gallons/minute per square foot (nominal)
- StormFilter cartridge treatment flow = 22.5 gpm
- **Hydraulic head required: 3.0 feet** (with 27 inch cartridge)
- Minimum physical drop between inlet and outlet pipe = 6 inches

Design Summary:

The StormFilter is sized based on the NJDEP certification, which lists an approved treatment flow rate and maximum impervious acreage limit per cartridge in Table 1. The number of cartridges required based on the impervious drainage area is compared with the number of cartridges required based on the treatment flow rate; the larger number of cartridges governs the sizing.

The StormFilter for this site was sized to provide **15 cartridges** in order to meet the hydraulic load requirement (calculations shown below). To house this number of cartridges, Contech Engineered Solutions recommends an 8' x 11' precast Peak Diversion StormFilter vault.

$$N_{\text{cartridges hyd.load}} = \frac{Q_{\text{treat}} \times 449 \frac{\text{gpm}}{\text{cfs}}}{Q_{\text{cartridge}}} = \frac{0.629 \text{ cfs} \times 449 \frac{\text{gpm}}{\text{cfs}}}{22.5 \frac{\text{gpm}}{\text{cartridge}}} = 12.55 \Rightarrow (13) \text{ 27" Cartridges}$$

$$N_{\text{cartridges mass load}} = \frac{\text{Area}_{\text{site}}}{\text{Max Area}_{\text{cartridge}}} = \frac{1.96 \text{ acre}}{.136 \frac{\text{acres}}{\text{cartridge}}} = 14.41 \Rightarrow (15) \text{ 27" Cartridges}$$



StormFilter Design Summary

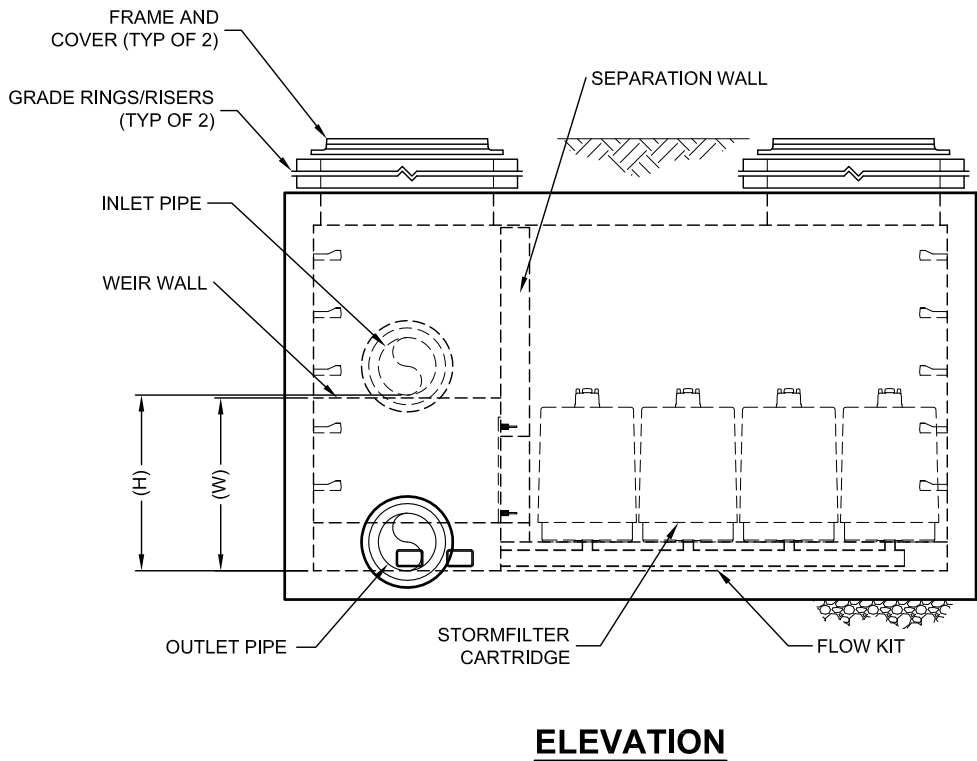
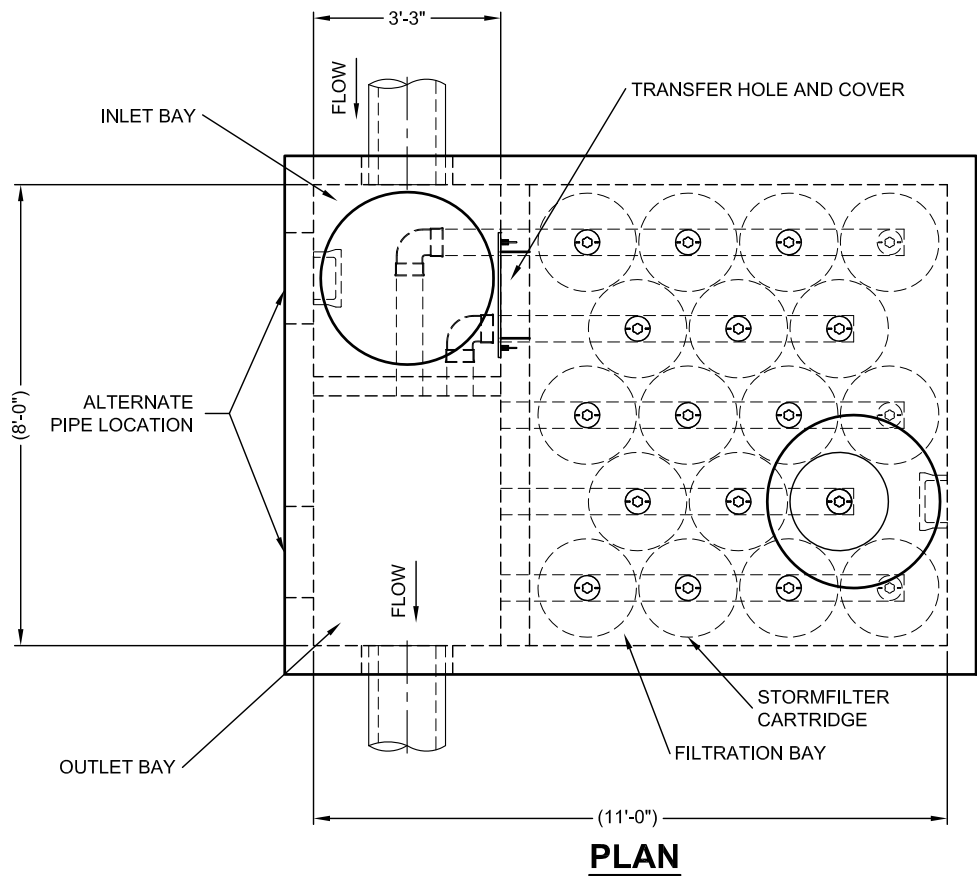
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Sincerely,

Nicholas T. Busque
Sales Engineer – Pipe & Stormwater Solutions
Contech Engineered Solutions LLC



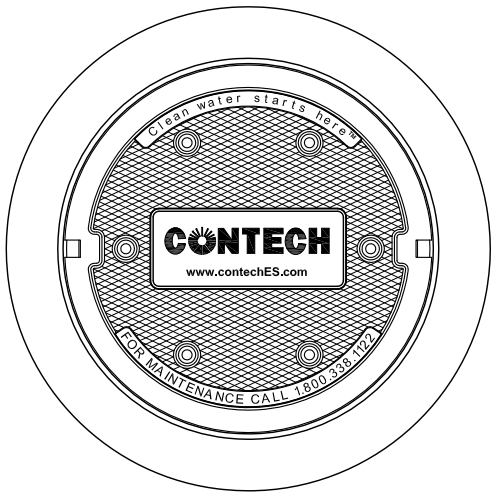
STORMFILTER DESIGN NOTES

- THE 8' x 11' PEAK DIVERSION STORMFILTER TREATMENT CAPACITY VARIES BY CARTRIDGE COUNT AND LOCALLY APPROVED SURFACE AREA SPECIFIC FLOW RATE. PEAK CONVEYANCE CAPACITY TO BE DETERMINED BY ENGINEER OF RECORD.
- THE PEAK DIVERSION STORMFILTER IS AVAILABLE IN A LEFT INLET (AS SHOWN) OR RIGHT INLET CONFIGURATION.
- ALL PARTS AND INTERNAL ASSEMBLY PROVIDED BY CONTECH UNLESS OTHERWISE NOTED.

CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27"			18"			LOW DROP		
RECOMMENDED HYDRAULIC DROP (H)	3.05'			2.3'			1.8'		
HEIGHT OF WEIR (W)	3.00'			2.25'			1.75'		
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf	2 gpm/sf	1.67* gpm/sf	1 gpm/sf
CARTRIDGE FLOW RATE (gpm)	22.5	18.79	11.25	15	12.53	7.5	10	8.35	5

* 1.67 gpm/sf SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS			
STRUCTURE ID			*
WATER QUALITY FLOW RATE (cfs)			*
PEAK FLOW RATE (cfs)			*
RETURN PERIOD OF PEAK FLOW (yrs)			*
CARTRIDGE HEIGHT (27", 18", LOW DROP(LD))			*
NUMBER OF CARTRIDGES REQUIRED			*
CARTRIDGE FLOW RATE			*
MEDIA TYPE (PERLITE, ZPG, PSORB)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE	*	*	*
OUTLET PIPE	*	*	*
UPSTREAM RIM ELEVATION			*
DOWNSTREAM RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*
NOTES/SPECIAL REQUIREMENTS:			
* PER ENGINEER OF RECORD			

PERFORMANCE SPECIFICATION

FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. **RADIAL MEDIA DEPTH SHALL BE 7-INCHES**. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST **38 SECONDS**. SPECIFIC FLOW RATE SHALL BE **2 GPM/SF (MAXIMUM)**. SPECIFIC FLOW RATE IS THE MEASURE OF THE FLOW (GPM) DIVIDED BY THE MEDIA SURFACE CONTACT AREA (SF). MEDIA VOLUMETRIC FLOW RATE SHALL BE **6 GPM/CF OF MEDIA (MAXIMUM)**.

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH REPRESENTATIVE. www.contechES.com
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.

INSTALLATION NOTES

- A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER STRUCTURE (LIFTING CLUTCHES PROVIDED).
- C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL SECTIONS AND ASSEMBLE STRUCTURE.
- D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
- E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
- F. CONTRACTOR TO REMOVE THE TRANSFER HOLE COVER WHEN THE SYSTEM IS BROUGHT ONLINE.

CONTECH
ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

THE STORMWATER MANAGEMENT STORMFILTER
8' x 11' PEAK DIVERSION STORMFILTER
STANDARD DETAIL



State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Nonpoint Pollution Control

Division of Water Quality

Mail Code 401-02B

Post Office Box 420

Trenton, New Jersey 08625-0420

609-633-7021 Fax: 609-777-0432

http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE

Governor

KIM GUADAGNO

Lt. Governor

BOB MARTIN

Commissioner

December 14, 2016

Derek M. Berg
Director - Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Laboratory Certification
Stormwater Management StormFilter® (StormFilter) by Contech Engineered Solutions LLC
Off-line Installation

TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions LLC has requested a Laboratory Certification for the StormFilter System.

This project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix for this device is published online at <http://www.njcat.org/verification-process/technology-verification-database.html>.

The NJDEP certifies the use of the StormFilter System by Contech Engineered Solutions LLC at a TSS removal rate of 80%, when designed, operated and maintained in accordance with the information provided in the Verification Appendix and subject to the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 2.12 gpm/sf of effective filtration treatment area.
2. The StormFilter System shall be installed using the same configuration as the unit tested by NJCAT, and sized in accordance with the criteria specified in item 6 below.
3. This device cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.
4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.
5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the StormFilter, which is attached to this document. However, it is recommended to review the maintenance website at <http://www.conteches.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=2813&PortalId=0&DownloadMethod=attachment> for any changes to the maintenance requirements.
6. Sizing Requirements:

The example below demonstrates the sizing procedure for a StormFilter System.

Example: A 0.25 acre impervious site is to be treated to 80% TSS removal using a StormFilter System. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

The calculation of the minimum number of cartridges for use in the StormFilter System is based upon both the MTFR and the maximum inflow drainage area. It is necessary to calculate the required cartridges using both methods and to rely on the method that results in the highest minimum number of cartridges determined by the two methods.

Inflow Drainage Area Evaluation:

The drainage area to the StormFilter System in this example is 0.25 acres. Based upon the information in Table 1 below, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the maximum drainage area:

1. Five (5) 12" cartridges,
2. Three (3) 18" cartridges, or
3. Two (2) 27" cartridges

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was determined based on the following:

time of concentration = 10 minutes

i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)

c=0.99 (runoff coefficient for impervious)

$Q=ciA=0.99 \times 3.2 \times 0.25 = 0.79$ cfs = 0.79×448.83 gpm = 354.58 gpm

Based on a flow rate of 354.58 gpm, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the MTFR:

1. Thirty-six (36) 12" cartridges,
2. Twenty-four (24) 18" cartridges, or
3. Sixteen (16) 27" cartridges

The MTFR Evaluation results will be used since that method results in the higher minimum number of cartridges determined by the two methods.

The sizing table corresponding to the available system models are noted below:

TABLE 1 STORMFILTER CARTRIDGE HEIGHTS AND NEW JERSEY TREATMENT CAPACITIES

StormFilter Cartridge Heights and New Jersey Treatment Capacities				
StormFilter Cartridge Height	Filtration Surface Area (sq.ft)	MTFR ¹ (GPM)	Mass Capture Capacity (lbs)	Maximum Allowable Inflow Area ² (acres)
Low Drop (12")	4.71	10	36.3	0.061
18"	7.07	15	54.5	0.09
27"	10.61	22.5	81.8	0.136

Notes:

1. MTFR calculated based on 4.72×10^{-3} cfs/sf (2.12 gpm/sf) of effective filtration treatment area.

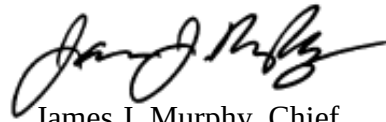
2. Based upon the equation found in the NJDEP Filter Protocol Maximum Inflow Drainage Area (acres) = weight of TSS before 10% loss in MTFR (lbs)/600 lbs/acre of drainage area annually.

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of

indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Shashi Nayak of my office at (609) 633-7021.

Sincerely,

A handwritten signature in black ink, appearing to read "James J. Murphy".

James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File

Richard Magee, NJCAT

Vince Mazzei, NJDEP - DLUR

Ravi Patraju, NJDEP - BES

Gabriel Mahon, NJDEP - BNPC

Shashi Nayak, NJDEP - BNPC

APPENDIX D

Groundwater Recharge Calculations and Documentation

Annual Groundwater Recharge Analysis (based on GSR-32)

Select Township ↓	Average Annual P (in)	Climatic Factor
MONMOUTH CO., TINTON FALLS BORO	47.4	1.55

Project Name: 1251 Jumping Brook Road

Description: Site

Analysis Date: 12/29/20

Pre-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	3.11	Impervious areas	Woodstown	0.0	-
2	9.27	Open space	Downer	16.2	545,922
3	0.96	Woods	Downer	16.2	56,346
4	1.3	Open space	Lakewood	17.5	82,708
5	1.62	Open space	Evesboro	17.6	103,425
6	0.06	Woods	Evesboro	17.2	3,738
7	16.18	Open space	Klej	16.3	958,970
8	3.34	Woods	Klej	16.1	195,103
9	0.5	Open space	Atsion	0.0	-
10	14.3	Woods	Atsion	0.0	-
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	50.6			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				10.6	1,946,211

Post-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	17.13	Impervious areas	Downer	0.0	-
2	2.87	Open space	Downer	16.2	169,018
3	0.96	Woods	Downer	16.2	56,346
4	1.02	Open space	Lakewood	17.5	64,894
5	1.26	Open space	Evesboro	17.6	80,442
6	9.44	Open space	Klej	16.3	559,498
7	3.15	Woods	Klej	16.1	184,004
8	0.49	Open space	Atsion	0.0	-
9	14.28	Woods	Atsion	0.0	-
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	50.6	Warning: make total area equal to Pre-Developed Condition		Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				6.1	1,114,201

Procedure to fill the Pre-Development and Post-Development Conditions Tables

For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

Annual Recharge Requirements Calculation ↓				
% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq.ft)		746,183
Post-Development Annual Recharge Deficit=		832,010	(cubic feet)	
Recharge Efficiency Parameters Calculations (area averages)				
RWC=	2.00	(in)	DRWC=	0.19 (in)
ERWC =	0.45	(in)	EDRWC=	0.04 (in)

Project Name	Description	Analysis Date	BMP or LID Type
1251 Jumping Brook Road	Site	12/29/20	Underground Recharge Chamber (West)

Recharge BMP Input Parameters				Root Zone Water capacity Calculated Parameters				Recharge Design Parameters			
Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit
BMP Area	ABMP	3600.0	sq.ft	Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.45	in	Inches of Runoff to capture	Qdesign	1.27	in
BMP Effective Depth, this is the design variable	dBMP	39.2	in	ERWC Modified to consider dEXC	EDRWC	0.04	in	Inches of Rainfall to capture	Pdesign	1.49	in
Upper level of the BMP surface (negative if above ground)	dBMPu	36.0	in	Empty Portion of RWC under Infil. BMP	RERWC	0.03	in	Recharge Provided Avg. over Imp. Area		33.3	in
Depth of lower surface of BMP, must be >= dBMPu	dEXC	108.0	in					Runoff Captured Avg. over imp. Area		33.3	in
Post-development Land Segment Location of BMP, Input Zero if Location is distributed or undetermined	SegBMP	0	unitless								

BMP Calculated Size Parameters				CALCULATION CHECK MESSAGES	
ABMP/Aimp	Aratio	0.03	unitless	Volume Balance--> Solve Problem to satisfy Annual Recharge	
BMP Volume	VBMP	11,745	cu.ft	dBMP Check--> OK	
				dEXC Check--> OK	
				BMP Location--> Location is selected as distributed or undetermined	

Parameters from Annual Recharge Worksheet				System Performance Calculated Parameters			
Post-D Deficit Recharge (or desired recharge volume)	Vdef	832,010	cu.ft	Annual BMP Recharge Volume		321,099	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	115,873	sq.ft	Avg BMP Recharge Efficiency		99.8%	Represents % Infiltration Recharged
Root Zone Water Capacity	RWC	2.00	in	%Rainfall became Runoff		78.2%	%
RWC Modified to consider dEXC	DRWC	0.19	in	%Runoff Infiltrated		89.9%	%
Climatic Factor	C-factor	1.55	no units	%Runoff Recharged		13.9%	%
Average Annual P	Pavg	47.4	in	%Rainfall Recharged		10.9%	%
Recharge Requirement over Imp. Area	dr	13.4	in				

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensitive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP.

To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration click the "Default Vdef & Aimp" button.

Project Name	Description	Analysis Date	BMP or LID Type
1251 Jumping Brook Road	Site	12/29/20	Underground Recharge Chamber (East)

Recharge BMP Input Parameters				Root Zone Water capacity Calculated Parameters				Recharge Design Parameters			
Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit
BMP Area	ABMP	5400.0	sq.ft	Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.45	in	Inches of Runoff to capture	Qdesign	1.09	in
BMP Effective Depth, this is the design variable	dBMP	39.2	in	ERWC Modified to consider dEXC	EDRWC	0.04	in	Inches of Rainfall to capture	Pdesign	1.31	in
Upper level of the BMP surface (negative if above ground)	dBMPu	36.0	in	Empty Portion of RWC under Infil. BMP	RERWC	0.03	in	Recharge Provided Avg. over Imp. Area		32.4	in
Depth of lower surface of BMP, must be >= dBMPu	dEXC	108.0	in					Runoff Captured Avg. over imp. Area		32.4	in
Post-development Land Segment Location of BMP, Input Zero if Location is distributed or undetermined	SegBMP	0	unitless								

BMP Calculated Size Parameters				CALCULATION CHECK MESSAGES	
ABMP/Aimp	Aratio	0.03	unitless	Volume Balance--> Solve Problem to satisfy Annual Recharge	
BMP Volume	VBMP	17,638	cu.ft	dBMP Check--> OK	
				dEXC Check--> OK	
				BMP Location--> Location is selected as distributed or undetermined	

Parameters from Annual Recharge Worksheet				System Performance Calculated Parameters			
Post-D Deficit Recharge (or desired recharge volume)	Vdef	832,010	cu.ft	Annual BMP Recharge Volume		527,511	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	195,599	sq.ft	Avg BMP Recharge Efficiency		99.8%	Represents % Infiltration Recharged
Root Zone Water Capacity	RWC	2.00	in	%Rainfall became Runoff		78.2%	%
RWC Modified to consider dEXC	DRWC	0.19	in	%Runoff Infiltrated		87.5%	%
Climatic Factor	C-factor	1.55	no units	%Runoff Recharged		22.9%	%
Average Annual P	Pavg	47.4	in	%Rainfall Recharged		17.9%	%
Recharge Requirement over Imp. Area	dr	13.4	in				

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensitive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP. To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration click the "Default Vdef & Aimp" button.

APPENDIX E

Spillway Calculations

EMERGENCY SPILLWAY

Design Criteria: 100% of the 10-year storm must pass assuming outlet control structure is completely blocked. 100% of 10-year storm based on Class III Dam.

Peak inflow into the basin during 100% of 10-year storm is $1.0 \times Q_{10} =$ 16.1 (cfs)

The width of the spillway is set at 50.00 ft

Consider the emergency spillway as a broad crested weir. Then,

$$Q = 3.1 B H^{3/2}$$

where Q = flow rate through spillway, cfs

H = weir height, ft

B = bottom of spillway width 50.00 ft

Side slopes = 3:1

Solving for H, $H = (Q / 3.1 B)^{2/3}$

Substituting and solving for H yields a height of 0.22 ft

Average Velocity $V = Q/A = Q/(B+4H)H =$ 1.43 ft/sec

Allowable velocity for soil type Sandy Loam is 2.50 ft/sec

Adjusted Allowable Velocity 2.50 ft/sec

Actual velocity during 1.0 x 100-year emergency spillway discharge is 1.43 OK

1251 Jumping Brook Road	BY	RY	DATE	12/29/2020	PROJ NO.	100775501
Basin 1					SHEET	1 5

EMERGENCY SPILLWAY

Design Criteria: 100% of the 10-year storm must pass assuming outlet control structure is completely blocked. 100% of 10-year storm based on Class III Dam.

Peak inflow into the basin during 100% of 10-year storm is $1.0 \times Q_{10} =$ 18.5 (cfs)

The width of the spillway is set at 50.00 ft

Consider the emergency spillway as a broad crested weir. Then,

$$Q = 3.1 B H^{3/2}$$

where Q = flow rate through spillway, cfs

H = weir height, ft

B = bottom of spillway width 50.00 ft

Side slopes = 3:1

Solving for H, $H = (Q / 3.1 B)^{2/3}$

Substituting and solving for H yields a height of 0.24 ft

Average Velocity $V = Q/A = Q/(B+4H)H =$ 1.50 ft/sec

Allowable velocity for soil type Sandy Loam is 2.50 ft/sec

Adjusted Allowable Velocity 2.50 ft/sec

Actual velocity during 1.0 x 100-year emergency spillway discharge is 1.50 **OK**

1251 Jumping Brook Road	BY	RY	DATE	12/29/2020	PROJ NO.	100775501
Basin 2					SHEET	2 5

EMERGENCY SPILLWAY

Design Criteria: 100% of the 10-year storm must pass assuming outlet control structure is completely blocked. 100% of 10-year storm based on Class III Dam.

Peak inflow into the basin during 100% of 10-year storm is $1.0 \times Q_{10} =$ 23.7 (cfs)

The width of the spillway is set at 60.00 ft

Consider the emergency spillway as a broad crested weir. Then,

$$Q = 3.1 B H^{3/2}$$

where Q = flow rate through spillway, cfs
 H = weir height, ft
 B = bottom of spillway width 60.00 ft
 Side slopes = 3:1

Solving for H, $H = (Q / 3.1 B)^{2/3}$

Substituting and solving for H yields a height of 0.25 ft

Average Velocity $V = Q/A = Q/(B+4H)H =$ 1.53 ft/sec

Allowable velocity for soil type Sandy Loam is 2.50 ft/sec
Adjusted Allowable Velocity 2.50 ft/sec
Actual velocity during 1.0 x 100-year emergency spillway discharge is 1.53 **OK**

1251 Jumping Brook Road	BY	RY	DATE	12/29/2020	PROJ NO.	100775501
Basin 3					SHEET	3 5

EMERGENCY SPILLWAY

Design Criteria: 100% of the 10-year storm must pass assuming outlet control structure is completely blocked. 100% of 10-year storm based on Class III Dam.

Peak inflow into the basin during 100% of 10-year storm is $1.0 \times Q_{10} =$ 1.7 (cfs)

The width of the spillway is set at 10.00 ft

Consider the emergency spillway as a broad crested weir. Then,

$$Q = 3.1 B H^{3/2}$$

where Q = flow rate through spillway, cfs
 H = weir height, ft
 B = bottom of spillway width 10.00 ft
 Side slopes = 3:1

Solving for H, $H = (Q / 3.1 B)^{2/3}$

Substituting and solving for H yields a height of 0.14 ft

Average Velocity $V = Q/A = Q/(B+4H)H =$ 1.11 ft/sec

Allowable velocity for soil type Sandy Loam is 2.50 ft/sec
Adjusted Allowable Velocity 2.50 ft/sec
Actual velocity during 1.0 x 100-year emergency spillway discharge is 1.11 OK

1251 Jumping Brook Road	BY	RY	DATE	12/29/2020	PROJ NO.	100775501
Basin 4					SHEET	4 5

EMERGENCY SPILLWAY

Design Criteria: 100% of the 10-year storm must pass assuming outlet control structure is completely blocked. 100% of 10-year storm based on Class III Dam.

Peak inflow into the basin during 100% of 10-year storm is $1.0 \times Q_{10} =$ 5.9 (cfs)

The width of the spillway is set at 20.00 ft

Consider the emergency spillway as a broad crested weir. Then,

$$Q = 3.1 B H^{3/2}$$

where Q = flow rate through spillway, cfs
 H = weir height, ft
 B = bottom of spillway width 20.00 ft
 Side slopes = 3:1

Solving for H, $H = (Q / 3.1 B)^{2/3}$

Substituting and solving for H yields a height of 0.21 ft

Average Velocity $V = Q/A = Q/(B+4H)H =$ 1.36 ft/sec

Allowable velocity for soil type Sandy Loam is 2.50 ft/sec
Adjusted Allowable Velocity 2.50 ft/sec
Actual velocity during 1.0 x 100-year emergency spillway discharge is 1.36 **OK**

1251 Jumping Brook Road	BY	RY	DATE	12/29/2020	PROJ NO.	100775501
Basin 5					SHEET	5 5

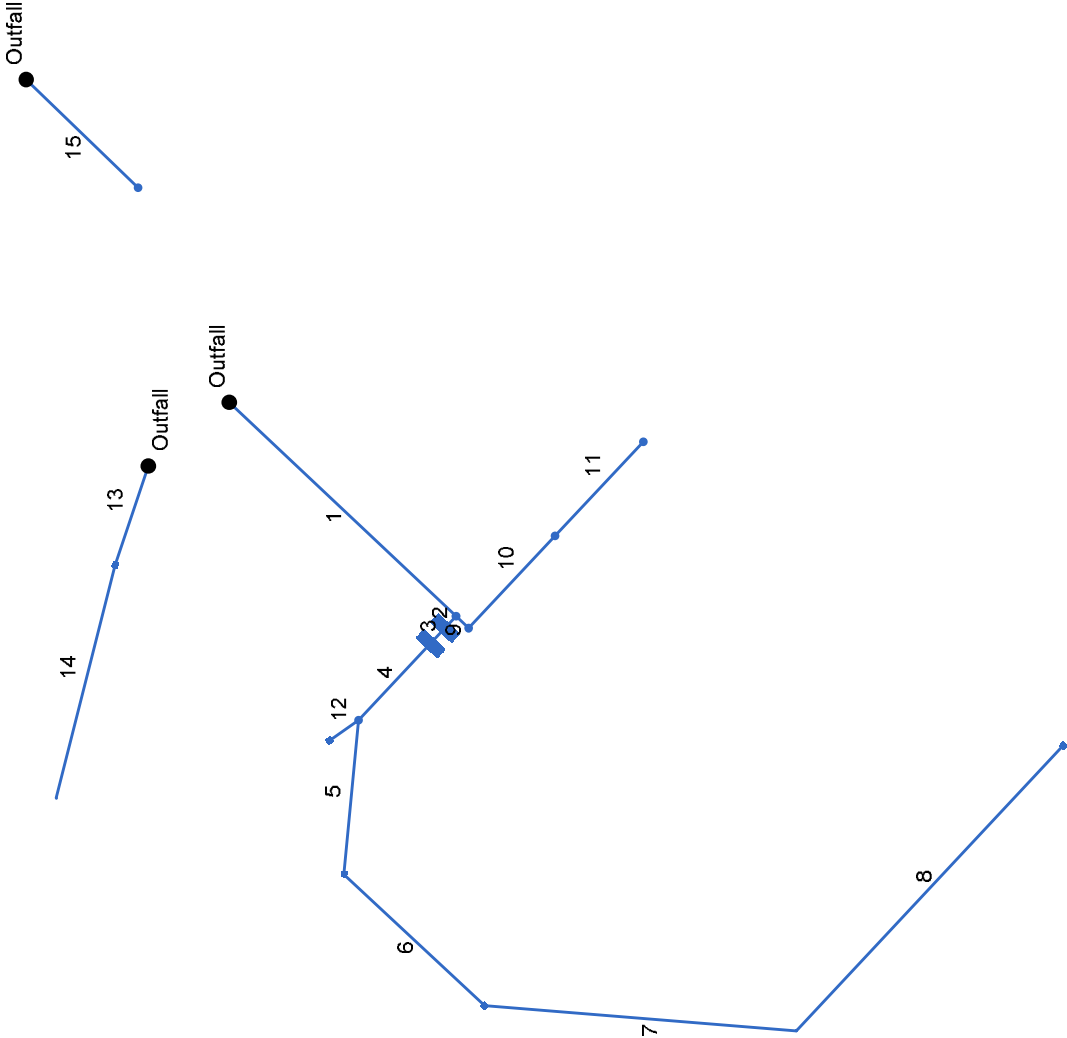
APPENDIX F

Storm Sewer Conveyance Calculations

Proposed Subwatersheds

	Subwatershed	Total Area (AC)	Landscaped Area (AC)	Impervious Area (AC)	Runoff Coefficient, c (Weighted)
BASIN 1	CB-104	0.23	0.03	0.20	0.94
	CB-105	0.51	0.20	0.31	0.80
	CB-106	1.72	1.50	0.22	0.57
	CB-107	0.50	0.38	0.12	0.63
	CB-108	1.61	0.30	1.31	0.90
	CB-109	1.72	0.87	0.85	0.75
	CB-110	0.70	0.31	0.39	0.77
	MH-111	0.45	0.00	0.45	0.99
	MH-112	0.41	0.00	0.41	0.99
	MH-113	0.44	0.00	0.44	0.99
BASIN 2	CB-201	1.64	0.06	1.58	0.97
	CB-203	1.23	0.01	1.22	0.99
	CB-204	1.36	0.19	1.17	0.92
	CB-205	0.39	0.04	0.35	0.94
BASIN 3	CB-301	1.10	0.12	0.98	0.94
	CB-302	1.17	0.27	0.90	0.88
	MH-307	0.58	0.00	0.58	0.99
	MH-308	0.43	0.00	0.43	0.99
	CB-310	1.23	0.41	0.82	0.83
	CB-311	0.81	0.03	0.78	0.97
	CB-312	0.19	0.04	0.15	0.88
	CB-313	0.31	0.13	0.18	0.79
	CB-314	0.99	0.81	0.18	0.60
	CB-315	2.25	2.04	0.21	0.55
	CB-316	0.09	0.02	0.07	0.90
	MH-317	0.43	0.00	0.43	0.99
	MH-318	0.42	0.00	0.42	0.99
	MH-319	0.44	0.00	0.44	0.99
BASIN 4	CB-401	0.27	0.09	0.18	0.84
BASIN 5	CB-501	1.59	0.36	1.23	0.88
	CB-503	0.21	0.06	0.15	0.86

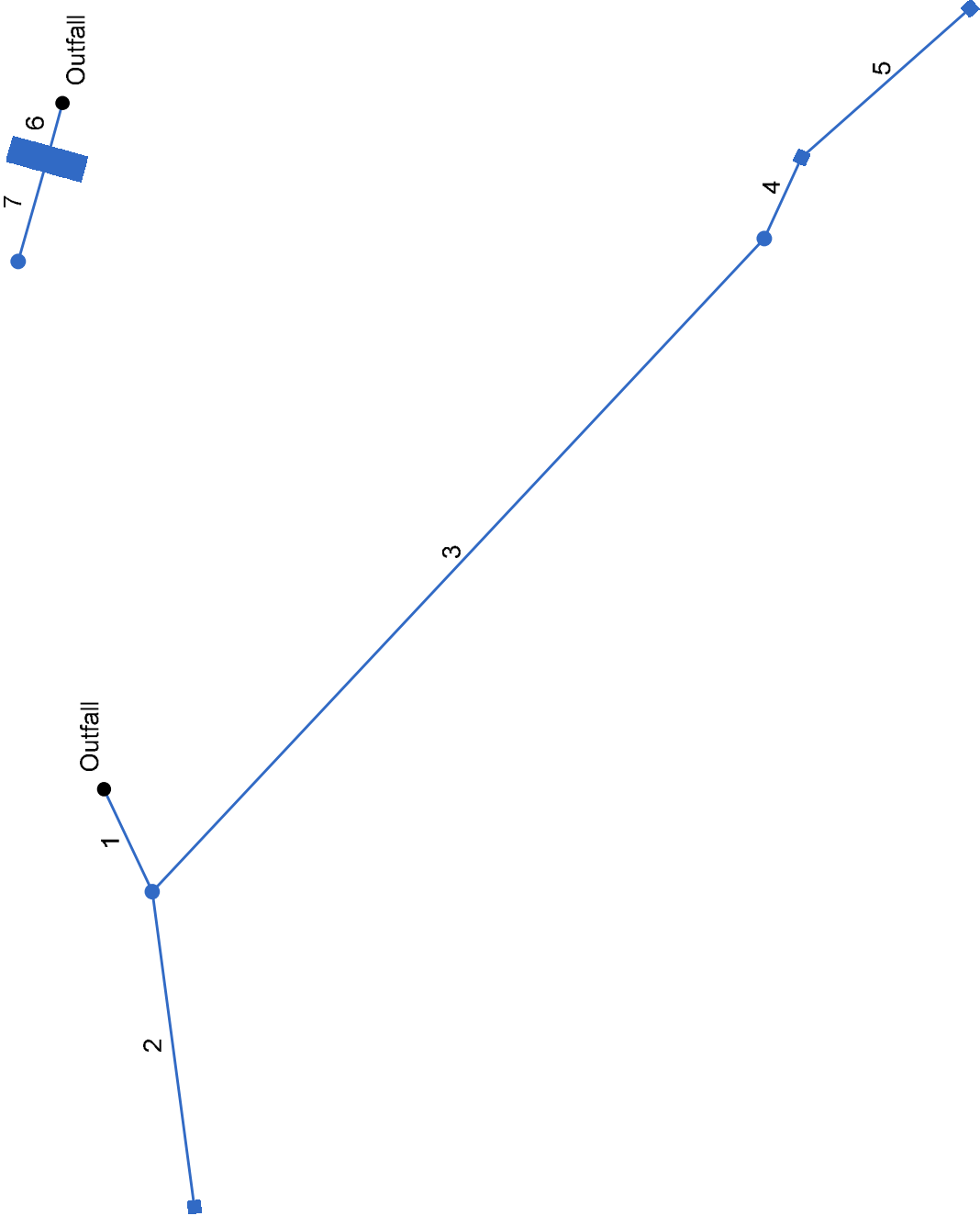
Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	213.999	0.00	4.96	0.00	3.75	0.0	12.9	5.4	20.27	79.02	7.67	36	1.87	95.00	99.00	96.04	100.44	98.50	106.03	MH-102-FES-102	
2	1	11.322	0.00	3.66	0.00	2.46	0.0	12.8	5.4	13.33	18.30	4.06	30	0.30	101.00	101.03	102.58	102.61	106.03	105.91	MH-103- MH-102(1)	
3	2	14.430	0.00	3.66	0.00	2.46	0.0	12.7	5.4	13.36	0.00	4.02	30	0.00	101.08	101.08	102.65	102.71	105.91	105.77	MH-103- MH-102(2)	
4	3	72.137	0.00	3.66	0.00	2.46	0.0	12.3	5.5	13.53	19.63	3.97	30	0.30	101.08	101.30	102.75	102.91	105.77	105.04	MH-103-MH-102	
5	4	106.045	0.23	2.96	0.94	1.92	6.0	11.6	5.6	10.82	19.52	3.09	30	0.30	101.29	101.61	103.08	103.19	105.04	105.50	CB-104-MH-103	
6	5	131.997	0.51	2.73	0.80	1.70	6.0	10.9	5.8	9.81	10.79	3.40	24	0.30	101.61	102.01	103.40	103.69	105.50	105.51	CB-105-CB-104	
7	6	215.086	1.72	2.22	0.57	1.30	6.0	9.6	6.0	7.81	10.78	2.80	24	0.30	102.01	102.66	103.88	104.18	105.51	109.46	CB-106-CB-105	
8	7	268.248	0.50	0.50	0.63	0.32	6.0	6.0	7.0	2.19	6.21	1.59	18	0.30	102.76	103.56	104.36	104.48	109.46	109.69	CB-107-CB-106	
9	1	12.000	0.45	1.30	0.99	0.45	1.29	6.0	5.7	7.34	0.00	4.04	36	0.00	101.00	101.00	101.85	101.98	106.03	106.29	MH-111-MH-102	
10	9	86.763	0.41	0.85	0.99	0.41	0.84	6.0	9.4	6.1	5.11	0.00	1.92	36	0.00	101.00	101.00	102.19	102.23	106.29	107.19	MH-112-MH-111
11	10	88.505	0.44	0.44	0.99	0.44	0.44	6.0	7.0	3.03	0.00	1.09	36	0.00	101.00	101.00	102.24	102.25	107.19	108.10	MH-113-MH-112	
12	4	24.371	0.70	0.70	0.77	0.54	0.54	6.0	7.0	3.75	6.52	2.12	18	0.30	101.29	101.37	103.08	103.10	105.04	104.70	CB-110-MH-103	
13	End	71.749	1.61	3.33	0.90	2.74	6.0	7.0	6.7	18.29	24.04	4.94	24 x 38 e	0.30	95.00	95.21	96.26	96.65	98.34	98.25	CB-108-FES-103	
14	13	164.629	1.72	1.72	0.75	1.29	1.29	6.0	7.0	8.97	10.80	3.76	24	0.30	95.21	95.71	96.65	97.11	98.25	98.97	CB-109-CB-108	
15	End	106.866	0.00	0.00	0.00	0.00	0.00	0.0	0.0	7.71	16.93	5.12	24	0.48	91.20	91.71	92.15	92.70	93.45	101.02	OCS-101-HW-101	
Project File: 100 STORM RUN.stm														Number of lines: 15				Run Date: 1/4/2021				
NOTES:Intensity = 56.34 / (Inlet time + 11.00) ^ 0.74; Return period =Yrs. 25 ; c = cir e = ellip b = box																						

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan

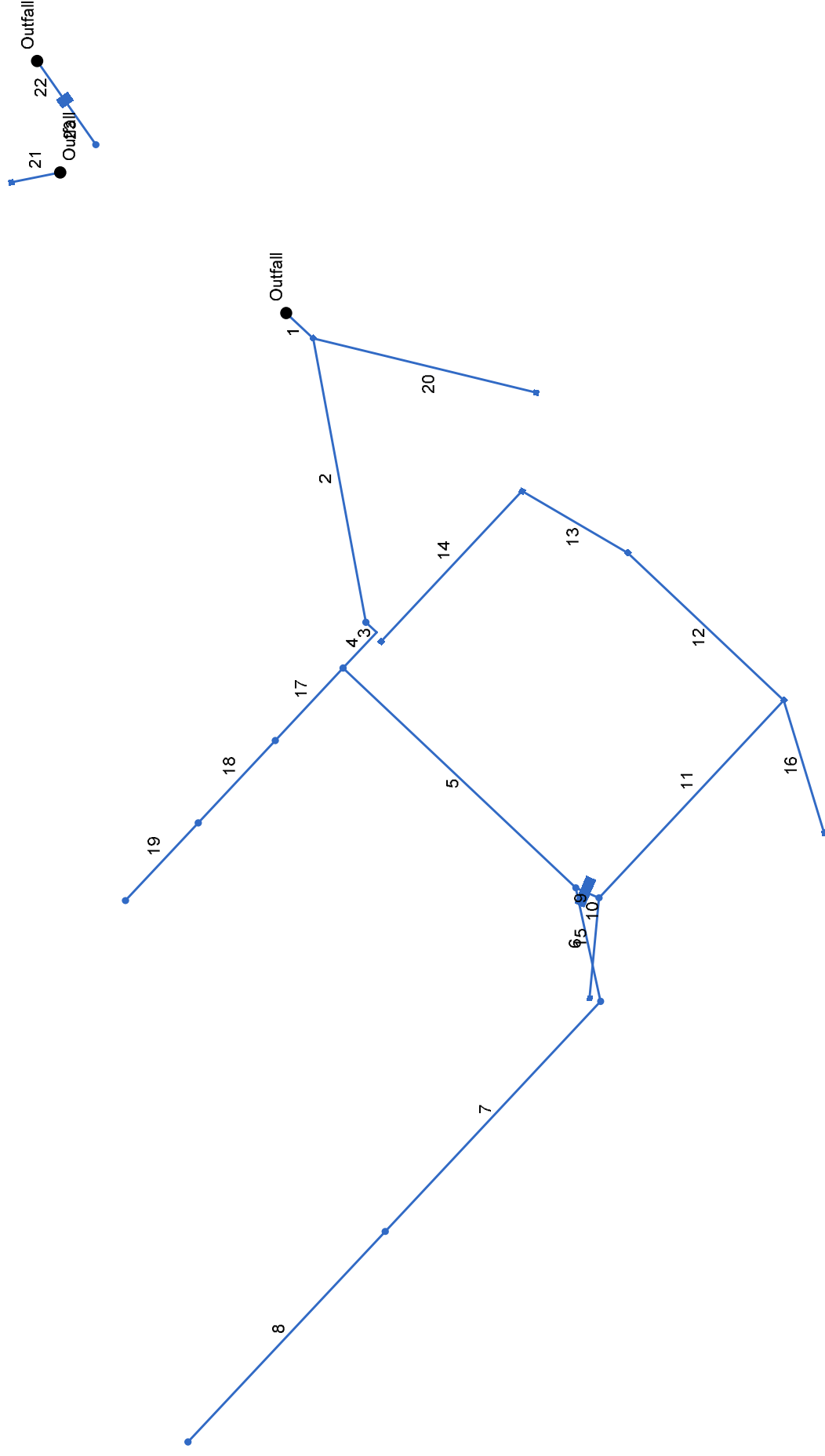


Project File: 200 STORM RUN.stm	Number of lines: 7	Date: 1/5/2021
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Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (l)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr	Total	(C)	Incr	Total	Inlet	Syst	(in/hr)	(cfs)	(cfs)	(ft/s)	Size	Slope	Dn	Up	Dn	Up	Dn	Up	(ft)
			(ac)	(ac)				(min)	(min)					(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	35.033	1.64	4.75	0.97	1.59	4.56	6.0	7.8	6.5	29.45	30.95	7.17	30	0.50	83.00	83.17	84.95	85.12	85.83	92.32	CB-201-FES-202
2	1	98.535	1.36	1.36	0.92	1.25	1.25	6.0	6.0	7.0	8.70	8.80	5.68	18	0.59	87.50	88.09	88.71	89.30	92.32	94.18	CB-204-CB-201
3	1	277.474	0.00	1.75	0.00	0.00	1.71	0.0	6.5	6.8	11.65	24.48	5.09	24	1.00	84.35	87.12	85.92	88.34	92.32	93.96	MH-202-CB-201
4	3	27.667	0.39	1.75	0.94	0.37	1.71	6.0	6.4	6.8	11.71	17.43	5.87	24	0.50	87.22	87.36	88.42	88.59	93.96	93.05	CB-205-MH-202
5	4	69.783	1.36	1.36	0.99	1.35	1.35	6.0	6.0	7.0	9.36	17.35	5.23	24	0.50	87.46	87.81	88.59	88.90	93.05	92.76	CB-203-CB-205
6	End	18.002	0.00	0.00	0.00	0.00	0.00	0.0	0.2	0.0	11.24	12.91	4.58	24	0.30	80.10	80.15	81.56	81.61	82.35	85.46	WQ-2- HW-201
7	6	32.944	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	11.24	13.50	4.81	24	0.30	80.65	80.75	82.04	82.14	85.46	87.84	OCS-201-WQ-2
Project File: 200 STORM RUN.stm																						Run Date: 1/5/2021
Number of lines: 7																						
NOTES:Intensity = 56.34 / (Inlet time + 11.00) ^ 0.74; Return period =Yrs. 25 ; c = cir e = ellip b = box																						

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: 300 STORM RUN.stm	Number of lines: 23	Date: 1/4/2021
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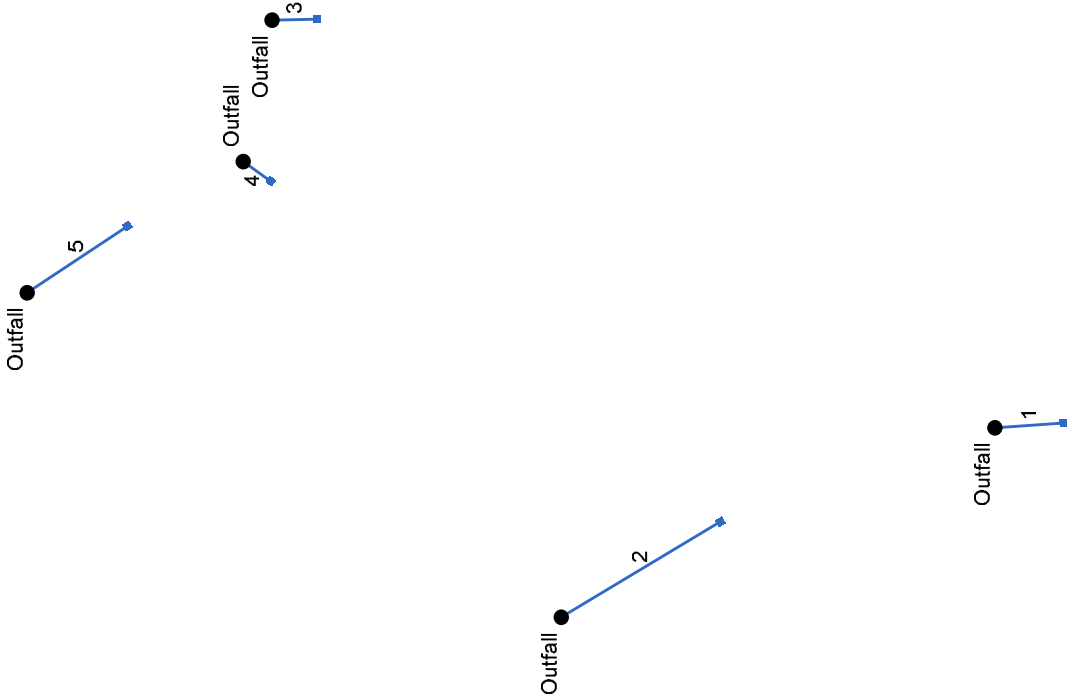
Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID			
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)						
1	End	30.382	1.17	9.34	0.88	1.03	7.44	0.0	21.8	4.3	31.81	190.0	13.49	36	6.92	89.00	91.10	89.83	92.93	92.33	99.44	CB-302-FES-302			
2	1	235.200	0.00	7.86	0.00	0.00	6.16	0.0	21.3	4.3	26.69	79.34	10.90	30	3.19	92.00	99.50	93.00	101.26	99.44	107.31	MH-303-CB-302			
3	2	12.000	0.00	7.86	0.00	0.00	6.16	0.0	21.2	4.3	26.72	0.00	6.18	36	0.00	101.00	101.00	102.67	102.88	107.31	104.43	MH-304-MH-303(1)			
4	3	40.000	0.00	7.86	0.00	0.00	6.16	0.0	21.1	4.3	26.80	0.00	4.38	36	0.00	101.00	101.00	103.39	103.46	104.43	108.15	MH-304-MH-303(2)			
5	4	261.339	0.00	6.57	0.00	0.00	4.89	0.0	20.1	4.5	21.77	39.47	3.62	36	0.30	101.00	101.78	103.75	103.92	108.15	111.42	MH-305-MH-304			
6	5	94.746	0.00	1.01	0.00	0.00	1.00	0.0	9.5	6.1	6.06	8.01	3.47	18	0.50	102.44	102.91	104.08	104.32	111.42	109.81	MH-306-MH-305			
7	6	257.324	0.58	1.01	0.99	0.57	1.00	6.0	8.3	6.3	6.32	8.05	4.34	18	0.50	103.01	104.30	104.48	105.29	109.81	109.97	MH-307-MH-306			
8	7	235.504	0.43	0.43	0.99	0.43	0.43	6.0	6.0	7.0	2.96	6.25	3.10	18	0.30	104.40	105.11	105.35	105.80	109.97	110.10	MH-308-MH-307			
9	5	8.427	0.00	5.56	0.00	0.00	3.89	0.0	20.0	4.5	17.34	43.11	4.36	36	0.30	101.78	101.81	104.08	103.14	111.42	111.39	WQ-3-MH-305			
10	9	12.304	0.00	5.56	0.00	0.00	3.89	0.0	20.0	4.5	17.36	41.20	5.57	36	0.30	101.88	101.92	103.24	103.28	111.39	110.90	MH-309-WQ-3			
11	10	220.900	1.23	4.57	0.83	1.02	3.29	6.0	18.7	4.6	15.17	31.59	3.80	36	0.30	101.92	102.58	103.74	104.10	110.90	107.02	CB-310-MH-309			
12	11	175.240	0.81	1.09	0.97	0.79	1.03	6.0	16.6	4.9	5.03	19.55	1.47	30	0.30	102.58	103.11	104.51	104.56	107.02	107.28	CB-311-CB-310			
13	12	100.233	0.19	0.28	0.88	0.17	0.25	6.0	14.8	5.1	1.27	4.98	0.78	18	0.30	103.11	103.41	104.58	104.60	107.28	106.96	CB-312-CB-311			
14	13	168.196	0.09	0.09	0.90	0.08	0.08	6.0	6.0	7.0	0.56	6.20	0.53	18	0.30	103.41	103.91	104.61	104.62	106.96	109.20	CB-316-CB-312			
15	10	82.305	0.99	0.99	0.60	0.59	0.59	6.0	6.0	7.0	4.13	11.36	4.59	18	1.00	103.00	103.82	103.74	104.60	110.90	109.49	CB-314-MH-309			
16	11	112.988	2.25	2.25	0.55	1.24	1.24	6.0	6.0	7.0	8.61	16.94	3.97	24	0.48	102.58	103.12	104.51	104.17	107.02	109.39	CB-315-CB-310			
17	4	81.000	0.43	1.29	0.99	0.43	1.28	6.0	11.3	5.7	7.28	0.00	1.07	36	0.00	101.00	101.00	103.75	103.76	108.15	109.21	MH-317-MH-304			
18	17	92.023	0.42	0.86	0.99	0.42	0.85	6.0	9.4	6.1	5.18	0.00	0.76	36	0.00	101.00	101.00	103.76	103.76	109.21	110.05	MH-318-MH-317			
19	18	86.976	0.44	0.44	0.99	0.44	0.44	6.0	6.0	7.0	3.03	0.00	0.44	36	0.00	101.00	101.00	103.77	103.77	110.05	109.15	MH-319-MH-318			
20	1	187.744	0.31	0.31	0.79	0.24	0.24	6.0	6.0	7.0	1.70	16.35	3.75	18	2.06	92.50	96.38	92.93	96.87	99.44	101.25	CB-313-CB-302			
21	End	40.698	1.10	1.10	0.94	1.03	1.03	6.0	6.0	7.0	7.19	13.31	2.94	24	0.30	89.00	89.12	90.50	90.53	90.75	93.28	CB-301-FES-301			
22	End	39.252	0.00	0.00	0.00	0.00	0.00	0.0	0.5	0.0	4.83	13.55	3.93	24	0.30	84.00	84.12	84.83	84.95	86.25	91.58	WQ-4-FES-403			
Project File: 300 STORM RUN.stm														Number of lines: 23										Run Date: 1/4/2021	
NOTES:Intensity = 56.34 / (Inlet time + 11.00) ^ 0.74; Return period =Yrs. 25 ; c = cir e = ellip b = box																									

Page 2

Storm Sewers v2020.00

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: 400 + 500 STORM RUN.stm	Number of lines: 5	Date: 1/5/2021
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Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (l)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr	Total	(C)	Incr	Total	Inlet	Syst	(in/hr)	(cfs)	(cfs)	(ft/s)	Size	Slope	Dn	Up	Dn	Up	Dn	Up	(ft)
			(ac)	(ac)				(min)	(min)					(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	39.751	0.27	0.27	0.84	0.23	0.23	6.0	6.0	7.0	1.58	11.41	3.90	18	1.00	84.00	84.40	84.38	84.87	85.75	88.38	CB-401-FES-402
2	End	107.837	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.95	13.35	3.71	24	0.30	82.83	83.15	83.57	83.90	85.08	88.52	OCS-401-HW-401
3	End	26.013	1.59	1.59	0.88	1.40	1.40	6.0	6.0	7.0	9.73	13.17	4.32	19 x 30 e	0.30	73.00	73.08	73.98	74.16	74.94	75.82	CB-501-FES-502
4	End	19.672	0.21	0.21	0.86	0.18	0.18	6.0	6.0	7.0	1.26	4.10	2.04	18	0.30	73.00	73.04	73.57	73.61	74.83	75.38	CB-503- FES-503
5	End	70.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.65	13.42	2.89	24	0.30	72.58	72.79	73.06	73.26	74.83	77.79	OCS-501- HW-50
Project File: 400 + 500 STORM RUN.stm																						Run Date: 1/5/2021
Number of lines: 5																						
NOTES:Intensity = 56.34 / (Inlet time + 11.00) ^ 0.74; Return period =Yrs. 25 ; c = cir e = ellip b = box																						

APPENDIX G

Scour Hole Calculations

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: HW-101

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGAN

$$\begin{aligned}
 Q &= 7.71 \text{ c.f.s.} & W_o &= 2.00 \text{ Ft.} \\
 D_o &= 2.00 \text{ Ft.} & q=Q/W_o &= 3.86 \text{ c.f.s.} \\
 TW &= 0.40 \text{ Ft.}
 \end{aligned}$$

(For areas where Tw cannot be computed, use $TW = 0.2D_o$)**d50 Stone size formula****When $Y = 1/2 D_o$**

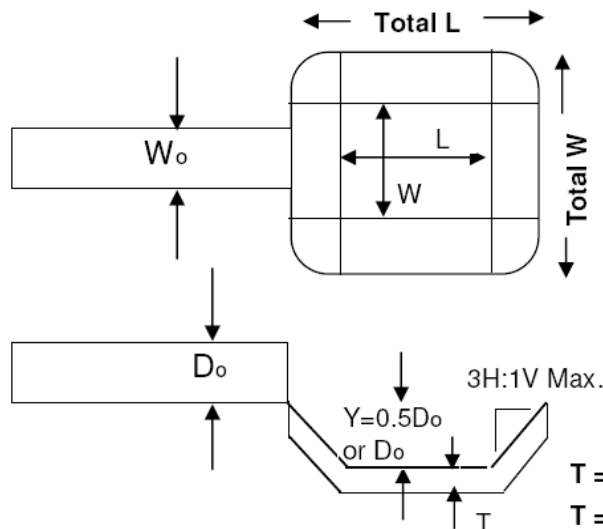
$$\begin{aligned}
 d_{50} &= \frac{0.0125 * q^{1.33}}{TW} = 0.19 \text{ Ft.} = 3 \text{ " Stone Calculated} \\
 & & & 6 \text{ " Stone Used for Construction} \\
 & & & 1.00' = Y
 \end{aligned}$$

d50 Stone size formula**When $Y = D_o$**

$$\begin{aligned}
 d_{50} &= \frac{0.0082 * q^{1.33}}{TW} = 0.12 \text{ Ft.} = 2 \text{ " Stone Calculated} \\
 & & & 6 \text{ " Stone Used for Construction} \\
 & & & 2.00' = Y
 \end{aligned}$$

NJ Standards require $d_{50}=3"$ min, NJDOT requires $d_{50}=6"$ min

Y = Depth of scour hole below culvert invert



$$\begin{aligned}
 L &= 3 D_o = 6.00' \\
 W &= 2 W_o = 4.00'
 \end{aligned}$$

If $Y = 1/2 D_o$

$$\text{Total } L = 12.00, \text{ Total } W = 10.00$$

If $Y = D_o$

$$\text{Total } L = 18.00, \text{ Total } W = 16.00$$

 $T = d_{50}$ Stone size x 2 if filter fabric is used $T = d_{50}$ Stone size x 3 if no filter fabric is used**Structure HW-101 Design Summary****Select Scour Hole Design****Y = 1/2 Do Use Filter Fabric**

$$\begin{aligned}
 \text{Total } L &= 12' & L &= 6' \\
 \text{Total } W &= 10' & W &= 4' \\
 \text{Depth of scour hole (Y)} &= 1' \\
 d_{50} \text{ stone size} &= 6'' \\
 \text{Thickness of riprap (T)} &= 12'' \\
 \text{Volume of riprap (V)} &= 4.44 \text{ CY}
 \end{aligned}$$

Notes:

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: FES-102

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGANQ = **20.27 c.f.s.**W_o = **3.00 Ft.**D_o = **3.00 Ft.**q = Q/W_o = **6.76 c.f.s.**TW = **0.60 Ft.**(For areas where Tw cannot be computed, use Tw = 0.2D_o)**d₅₀ Stone size formula****When Y = 1/2 D_o**

$$d_{50} = \frac{0.0125 * q^{1.33}}{TW} = \mathbf{0.26 \text{ Ft.}} = \mathbf{4 \text{ " Stone Calculated}}$$

4 " Stone Used for Construction
1.50 ' = Y

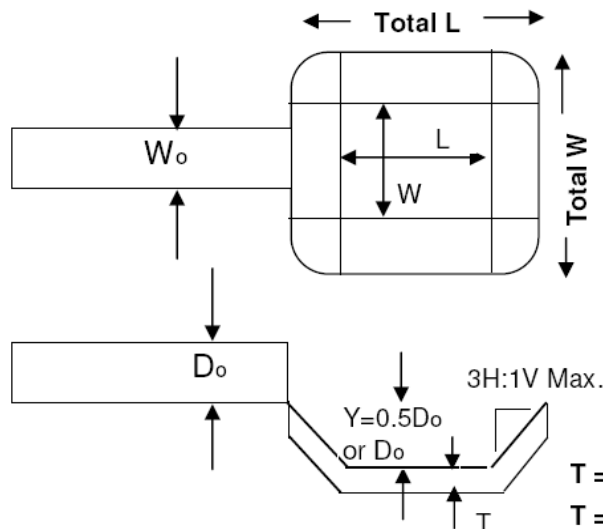
d₅₀ Stone size formula**When Y = D_o**

$$d_{50} = \frac{0.0082 * q^{1.33}}{TW} = \mathbf{0.17 \text{ Ft.}} = \mathbf{3 \text{ " Stone Calculated}}$$

4 " Stone Used for Construction
3.00 ' = Y

NJ Standards require d₅₀=3" min, NJDOT requires d₅₀=6" min

Y = Depth of scour hole below culvert invert



$$L = 3 D_o = \mathbf{9.00'}$$

$$W = 2 W_o = \mathbf{6.00'}$$

If Y = 1/2 D_o

$$\text{Total L} = \mathbf{18.00}, \text{Total W} = \mathbf{15.00}$$

If Y = D_o

$$\text{Total L} = \mathbf{27.00}, \text{Total W} = \mathbf{24.00}$$

T = d₅₀ Stone size x 2 if filter fabric is usedT = d₅₀ Stone size x 3 if no filter fabric is used**Structure FES-102 Design Summary****Select Scour Hole Design****Y = 1/2 D_o Use Filter Fabric**

$$\text{Total L} = \mathbf{18'}, \quad L = \mathbf{9'}$$

$$\text{Total W} = \mathbf{15'}, \quad W = \mathbf{6'}$$

$$\text{Depth of scour hole (Y)} = \mathbf{1.5'}$$

$$d_{50} \text{ stone size} = \mathbf{4 \text{ "}}$$

$$\text{Thickness of riprap (T)} = \mathbf{8 \text{ "}}$$

$$\text{Volume of riprap (V)} = \mathbf{6.67 \text{ CY}}$$

Notes:

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: FES-103

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGANQ = **18.29 c.f.s.**W_o = **3.17 Ft.**D_o = **2.00 Ft.**q = Q/W_o = **5.77 c.f.s.**TW = **0.40 Ft.**(For areas where Tw cannot be computed, use Tw = 0.2D_o)**d₅₀ Stone size formula****When Y = 1/2 D_o**

$$d_{50} = \frac{0.0125 * q^{1.33}}{TW} = \mathbf{0.32 \text{ Ft.}} = \mathbf{4 \text{ " Stone Calculated}}$$

$$\mathbf{4 \text{ " Stone Used for Construction}}$$

$$\mathbf{1.00' = Y}$$

d₅₀ Stone size formula**When Y = D_o**

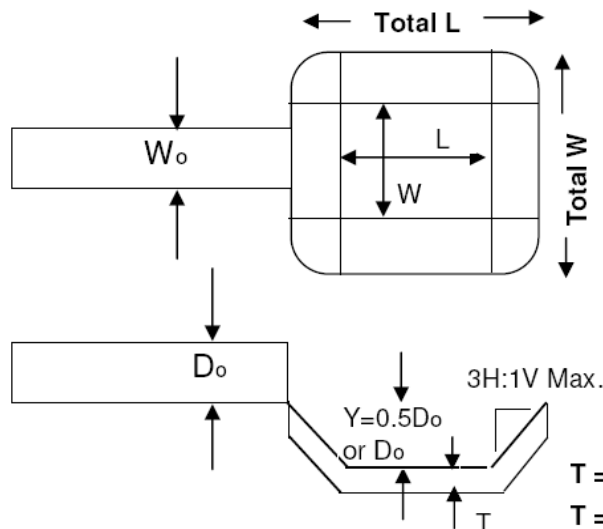
$$d_{50} = \frac{0.0082 * q^{1.33}}{TW} = \mathbf{0.21 \text{ Ft.}} = \mathbf{3 \text{ " Stone Calculated}}$$

$$\mathbf{4 \text{ " Stone Used for Construction}}$$

$$\mathbf{2.00' = Y}$$

NJ Standards require d₅₀=3" min, NJDOT requires d₅₀=6" min

Y = Depth of scour hole below culvert invert



$$L = 3 D_o = \mathbf{6.00'}$$

$$W = 2 W_o = \mathbf{6.34'}$$

If Y = 1/2 D_o

$$\mathbf{Total L = 12.00' , Total W = 12.34'}$$

If Y = D_o

$$\mathbf{Total L = 18.00' , Total W = 18.34'}$$

T = d₅₀ Stone size x 2 if filter fabric is usedT = d₅₀ Stone size x 3 if no filter fabric is used**Structure FES-103 Design Summary****Select Scour Hole Design****Y = 1/2 D_o Use Filter Fabric**

$$\mathbf{Total L = 12' \quad L = 6'}$$

$$\mathbf{Total W = 12.34' \quad W = 6.34'}$$

$$\mathbf{Depth of scour hole (Y) = 1'}$$

$$\mathbf{d_{50} \text{ stone size} = 4 \text{ "}}$$

$$\mathbf{Thickness of riprap (T) = 8 \text{ "}}$$

$$\mathbf{Volume of riprap (V) = 3.66 \text{ CY}}$$

Notes:

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: HW-201

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGAN

Q = 11.24 c.f.s.

W_o = 2.00 Ft.D_o = 2.00 Ft.q = Q/W_o = 5.62 c.f.s.

TW = 0.40 Ft.

(For areas where Tw cannot be computed, use Tw = 0.2D_o)**d₅₀ Stone size formula****When Y = 1/2 D_o**

$$d_{50} = \frac{0.0125 * q^{1.33}}{TW} = 0.31 \text{ Ft.} = 4 \text{ " Stone Calculated}$$

6 " Stone Used for Construction
1.00 ' = Y

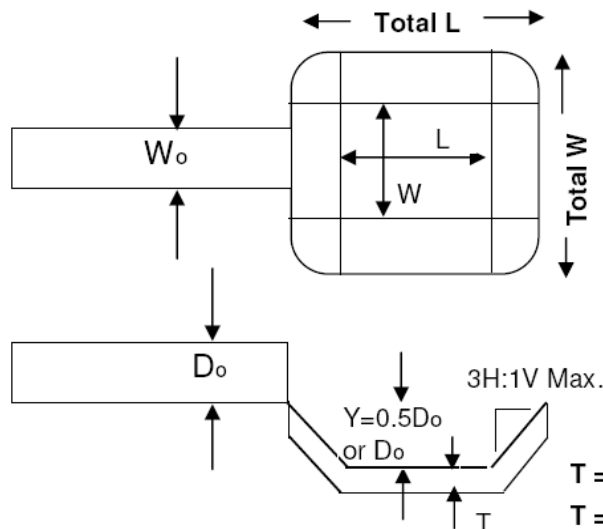
d₅₀ Stone size formula**When Y = D_o**

$$d_{50} = \frac{0.0082 * q^{1.33}}{TW} = 0.20 \text{ Ft.} = 3 \text{ " Stone Calculated}$$

4 " Stone Used for Construction
2.00 ' = Y

NJ Standards require d₅₀=3" min, NJDOT requires d₅₀=6" min

Y = Depth of scour hole below culvert invert



$$L = 3 D_o = 6.00 \text{ '}$$

$$W = 2 W_o = 4.00 \text{ '}$$

If Y = 1/2 D_o

$$\text{Total L} = 12.00, \text{ Total W} = 10.00$$

If Y = D_o

$$\text{Total L} = 18.00, \text{ Total W} = 16.00$$

T = d₅₀ Stone size x 2 if filter fabric is usedT = d₅₀ Stone size x 3 if no filter fabric is used**Structure HW-201 Design Summary****Select Scour Hole Design****Y = 1/2 D_o Use Filter Fabric**

$$\text{Total L} = 12 \text{ '}, \quad L = 6 \text{ '}$$

$$\text{Total W} = 10 \text{ '}, \quad W = 4 \text{ '}$$

$$\text{Depth of scour hole (Y)} = 1 \text{ '}$$

$$d_{50} \text{ stone size} = 6 \text{ "}$$

$$\text{Thickness of riprap (T)} = 12 \text{ "}$$

$$\text{Volume of riprap (V)} = 4.44 \text{ CY}$$

Notes:

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: FES-202

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGANQ = **29.45 c.f.s.**W_o = **2.50 Ft.**D_o = **2.50 Ft.**q = Q/W_o = **11.78 c.f.s.**TW = **0.50 Ft.**(For areas where Tw cannot be computed, use Tw = 0.2D_o)**d₅₀ Stone size formula****When Y = 1/2 D_o**

$$d_{50} = \frac{0.0125 * q^{1.33}}{TW} = \mathbf{0.66 \text{ Ft.}} = \mathbf{8 \text{ " Stone Calculated}}$$

$$\mathbf{10 \text{ " Stone Used for Construction}}$$

$$\mathbf{1.25' = Y}$$

d₅₀ Stone size formula**When Y = D_o**

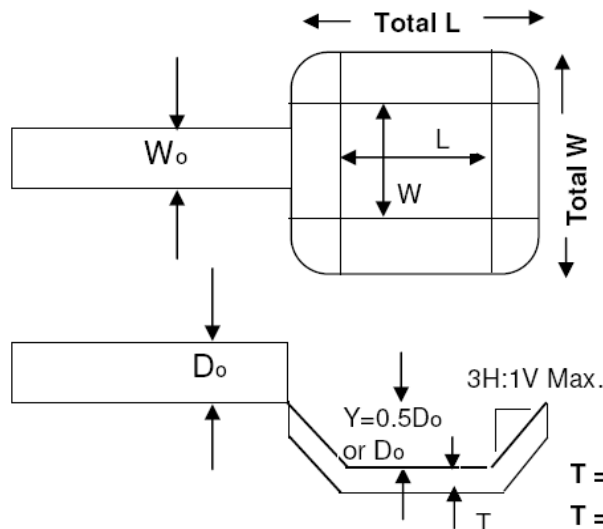
$$d_{50} = \frac{0.0082 * q^{1.33}}{TW} = \mathbf{0.44 \text{ Ft.}} = \mathbf{6 \text{ " Stone Calculated}}$$

$$\mathbf{10 \text{ " Stone Used for Construction}}$$

$$\mathbf{2.50' = Y}$$

NJ Standards require d₅₀=3" min, NJDOT requires d₅₀=6" min

Y = Depth of scour hole below culvert invert



$$L = 3 D_o = \mathbf{7.50'}$$

$$W = 2 W_o = \mathbf{5.00'}$$

If Y = 1/2 D_o

$$\mathbf{Total L = 15.00, Total W = 12.50}$$

If Y = D_o

$$\mathbf{Total L = 22.50, Total W = 20.00}$$

T = d₅₀ Stone size x 2 if filter fabric is usedT = d₅₀ Stone size x 3 if no filter fabric is used**Structure FES-202 Design Summary****Select Scour Hole Design****Y = 1/2 D_o Use Filter Fabric**

$$\mathbf{Total L = 15' \quad L = 7.5'}$$

$$\mathbf{Total W = 12.5' \quad W = 5'}$$

$$\mathbf{Depth of scour hole (Y) = 1.25'}$$

$$\mathbf{d_{50} \text{ stone size} = 10 \text{ "}}$$

$$\mathbf{Thickness of riprap (T) = 20 \text{ "}}$$

$$\mathbf{Volume of riprap (V) = 11.57 \text{ CY}}$$

Notes:

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: FES-301

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGANQ = **7.19 c.f.s.**W_o = **2.00 Ft.**D_o = **2.00 Ft.**q = Q/W_o = **3.60 c.f.s.**TW = **0.40 Ft.**(For areas where Tw cannot be computed, use Tw = 0.2D_o)**d₅₀ Stone size formula****When Y = 1/2 D_o**

$$d_{50} = \frac{0.0125 * q^{1.33}}{TW} = 0.17 \text{ Ft.} = 3 \text{ " Stone Calculated}$$

6 " Stone Used for Construction
1.00 ' = Y

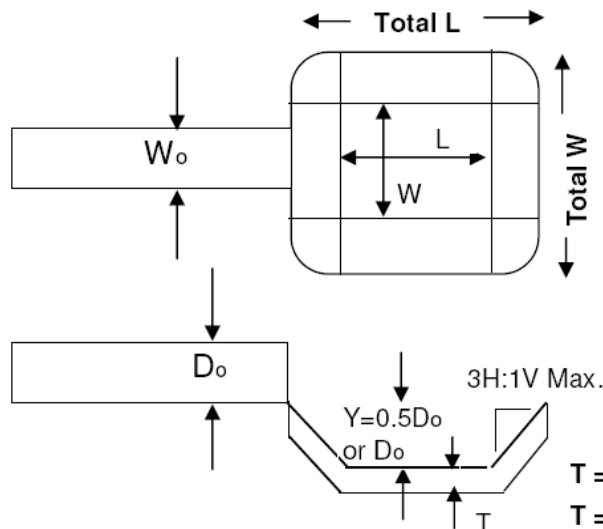
d₅₀ Stone size formula**When Y = D_o**

$$d_{50} = \frac{0.0082 * q^{1.33}}{TW} = 0.11 \text{ Ft.} = 2 \text{ " Stone Calculated}$$

6 " Stone Used for Construction
2.00 ' = Y

NJ Standards require d₅₀=3" min, NJDOT requires d₅₀=6" min

Y = Depth of scour hole below culvert invert



$$L = 3 D_o = 6.00 \text{ '}$$

$$W = 2 W_o = 4.00 \text{ '}$$

If Y = 1/2 D_o

$$\text{Total L} = 12.00, \text{ Total W} = 10.00$$

If Y = D_o

$$\text{Total L} = 18.00, \text{ Total W} = 16.00$$

T = d₅₀ Stone size x 2 if filter fabric is usedT = d₅₀ Stone size x 3 if no filter fabric is used**Structure FES-301 Design Summary****Select Scour Hole Design****Y = 1/2 D_o Use Filter Fabric**

$$\text{Total L} = 12 \text{ '} \quad L = 6 \text{ '}$$

$$\text{Total W} = 10 \text{ '} \quad W = 4 \text{ '}$$

$$\text{Depth of scour hole (Y)} = 1 \text{ '}$$

$$d_{50} \text{ stone size} = 6 \text{ "}$$

$$\text{Thickness of riprap (T)} = 12 \text{ "}$$

$$\text{Volume of riprap (V)} = 4.44 \text{ CY}$$

Notes:

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: FES-302

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGAN

$Q = 31.81 \text{ c.f.s.}$

$W_o = 3.00 \text{ Ft.}$

$D_o = 3.00 \text{ Ft.}$

$q = Q/W_o = 10.60 \text{ c.f.s.}$

$TW = 0.60 \text{ Ft.}$

(For areas where Tw cannot be computed, use $TW = 0.2D_o$)**d50 Stone size formula****When $Y = 1/2 D_o$**

$$d_{50} = \frac{0.0125 * q^{1.33}}{TW} = 0.48 \text{ Ft.} = 6 \text{ " Stone Calculated}$$

$$10 \text{ " Stone Used for Construction}$$

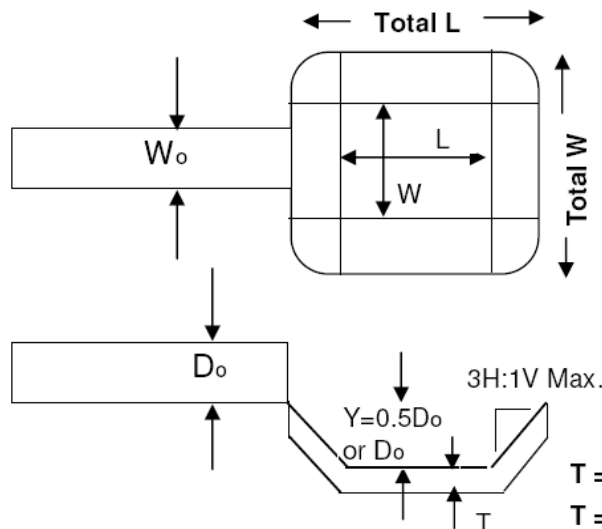
$$1.50 \text{ ' } = Y$$

d50 Stone size formula**When $Y = D_o$**

$$d_{50} = \frac{0.0082 * q^{1.33}}{TW} = 0.32 \text{ Ft.} = 4 \text{ " Stone Calculated}$$

$$10 \text{ " Stone Used for Construction}$$

$$3.00 \text{ ' } = Y$$

NJ Standards require $d_{50} = 3 \text{ " min}$, NJDOT requires $d_{50} = 6 \text{ " min}$ $Y = \text{Depth of scour hole below culvert invert}$ 

$L = 3 D_o = 9.00 \text{ '}$

$W = 2 W_o = 6.00 \text{ '}$

If $Y = 1/2 D_o$

$\text{Total } L = 18.00, \text{ Total } W = 15.00$

If $Y = D_o$

$\text{Total } L = 27.00, \text{ Total } W = 24.00$

$T = d_{50} \text{ Stone size} \times 2 \text{ if filter fabric is used}$

$T = d_{50} \text{ Stone size} \times 3 \text{ if no filter fabric is used}$

Structure FES-302 Design Summary**Select Scour Hole Design** **$Y = 1/2 D_o$ Use Filter Fabric**

$\text{Total } L = 18 \text{ '}, L = 9 \text{ '}$

$\text{Total } W = 15 \text{ '}, W = 6 \text{ '}$

$\text{Depth of scour hole (Y)} = 1.5 \text{ '}$

$d_{50} \text{ stone size} = 10 \text{ "}$

$\text{Thickness of riprap (T)} = 20 \text{ "}$

$\text{Volume of riprap (V)} = 16.67 \text{ CY}$

Notes:

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: HW-401

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGAN

Q = 3.95 c.f.s.

W_o = 2.00 Ft.D_o = 2.00 Ft.q = Q/W_o = 1.98 c.f.s.

TW = 0.40 Ft.

(For areas where Tw cannot be computed, use Tw = 0.2D_o)**d₅₀ Stone size formula****When Y = 1/2 D_o**

$$d_{50} = \frac{0.0125 * q^{1.33}}{TW} = 0.08 \text{ Ft.} = 1 \text{ " Stone Calculated}$$

4 " Stone Used for Construction

1.00 ' = Y

d₅₀ Stone size formula**When Y = D_o**

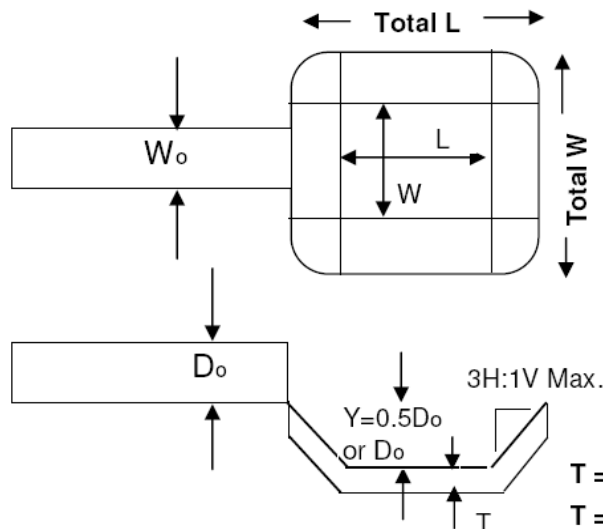
$$d_{50} = \frac{0.0082 * q^{1.33}}{TW} = 0.05 \text{ Ft.} = 1 \text{ " Stone Calculated}$$

4 " Stone Used for Construction

2.00 ' = Y

NJ Standards require d₅₀=3" min, NJDOT requires d₅₀=6" min

Y = Depth of scour hole below culvert invert



$$L = 3 D_o = 6.00 \text{ '}$$

$$W = 2 W_o = 4.00 \text{ '}$$

If Y = 1/2 D_o

$$\text{Total L} = 12.00, \text{ Total W} = 10.00$$

If Y = D_o

$$\text{Total L} = 18.00, \text{ Total W} = 16.00$$

T = d₅₀ Stone size x 2 if filter fabric is usedT = d₅₀ Stone size x 3 if no filter fabric is used**Structure HW-401 Design Summary****Select Scour Hole Design****Y = 1/2 D_o Use Filter Fabric**

$$\text{Total L} = 12 \text{ '}, \quad L = 6 \text{ '}$$

$$\text{Total W} = 10 \text{ '}, \quad W = 4 \text{ '}$$

$$\text{Depth of scour hole (Y)} = 1 \text{ '}$$

$$d_{50} \text{ stone size} = 4 \text{ "}$$

$$\text{Thickness of riprap (T)} = 8 \text{ "}$$

$$\text{Volume of riprap (V)} = 2.96 \text{ CY}$$

Notes:

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: FES-402

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGAN

$$\begin{aligned}
 Q &= 1.58 \text{ c.f.s.} & W_o &= 1.50 \text{ Ft.} \\
 D_o &= 1.50 \text{ Ft.} & q=Q/W_o &= 1.05 \text{ c.f.s.} \\
 TW &= 0.30 \text{ Ft.}
 \end{aligned}$$

(For areas where Tw cannot be computed, use $TW = 0.2D_o$)**d50 Stone size formula****When $Y = 1/2 D_o$**

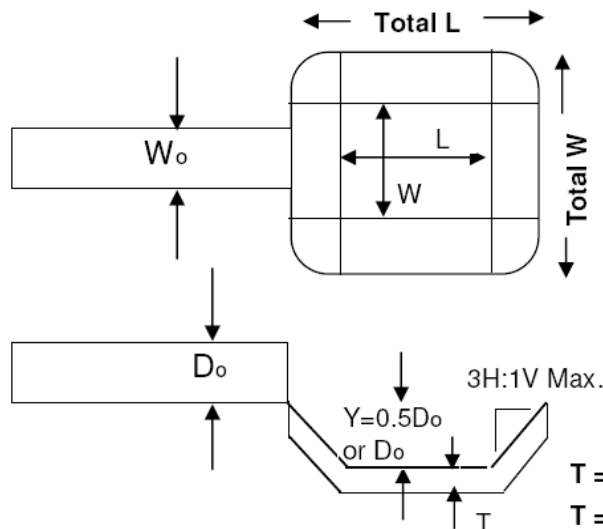
$$\begin{aligned}
 d_{50} &= \frac{0.0125 * q^{1.33}}{TW} = 0.04 \text{ Ft.} = 1 \text{ " Stone Calculated} \\
 & & & & & 4 \text{ " Stone Used for Construction} \\
 & & & & & 0.75 \text{ ' } = Y
 \end{aligned}$$

d50 Stone size formula**When $Y = D_o$**

$$\begin{aligned}
 d_{50} &= \frac{0.0082 * q^{1.33}}{TW} = 0.03 \text{ Ft.} = 1 \text{ " Stone Calculated} \\
 & & & & & 4 \text{ " Stone Used for Construction} \\
 & & & & & 1.50 \text{ ' } = Y
 \end{aligned}$$

NJ Standards require $d_{50}=3"$ min, NJDOT requires $d_{50}=6"$ min

Y = Depth of scour hole below culvert invert



$$\begin{aligned}
 L &= 3 D_o = 4.50 \text{ ' } \\
 W &= 2 W_o = 3.00 \text{ ' }
 \end{aligned}$$

If $Y = 1/2 D_o$

$$Total L = 9.00 \text{ ' }, Total W = 7.50 \text{ ' }$$

If $Y = D_o$

$$Total L = 13.50 \text{ ' }, Total W = 12.00 \text{ ' }$$

 $T = d_{50}$ Stone size x 2 if filter fabric is used $T = d_{50}$ Stone size x 3 if no filter fabric is used**Structure FES-402 Design Summary****Select Scour Hole Design** **$Y = 1/2 D_o$ Use Filter Fabric**

$$\begin{aligned}
 Total L &= 9 \text{ ' } & L &= 4.5 \text{ ' } \\
 Total W &= 7.5 \text{ ' } & W &= 3 \text{ ' } \\
 Depth of scour hole (Y) &= 0.75 \text{ ' } \\
 d_{50} \text{ stone size} &= 4 \text{ " } \\
 Thickness of riprap (T) &= 8 \text{ " } \\
 Volume of riprap (V) &= 1.67 \text{ CY}
 \end{aligned}$$

Notes:

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: FES-403

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGANQ = **4.83 c.f.s.**W_o = **2.00 Ft.**D_o = **2.00 Ft.**q = Q/W_o = **2.42 c.f.s.**TW = **0.40 Ft.**(For areas where Tw cannot be computed, use Tw = 0.2D_o)**d₅₀ Stone size formula****When Y = 1/2 D_o**

$$d_{50} = \frac{0.0125 * q^{1.33}}{TW} = 0.10 \text{ Ft.} = 2 \text{ " Stone Calculated}$$

4 " Stone Used for Construction
1.00 ' = Y

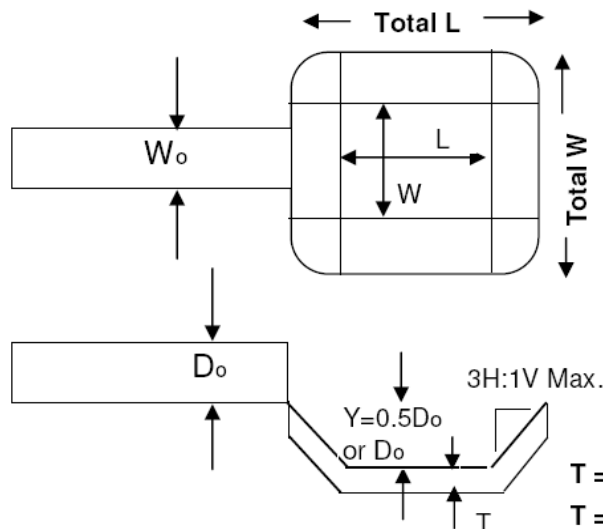
d₅₀ Stone size formula**When Y = D_o**

$$d_{50} = \frac{0.0082 * q^{1.33}}{TW} = 0.07 \text{ Ft.} = 1 \text{ " Stone Calculated}$$

4 " Stone Used for Construction
2.00 ' = Y

NJ Standards require d₅₀=3" min, NJDOT requires d₅₀=6" min

Y = Depth of scour hole below culvert invert



$$L = 3 D_o = 6.00 \text{ '}$$

$$W = 2 W_o = 4.00 \text{ '}$$

If Y = 1/2 D_o

$$\text{Total L} = 12.00, \text{ Total W} = 10.00$$

If Y = D_o

$$\text{Total L} = 18.00, \text{ Total W} = 16.00$$

T = d₅₀ Stone size x 2 if filter fabric is usedT = d₅₀ Stone size x 3 if no filter fabric is used**Structure FES-403 Design Summary****Select Scour Hole Design****Y = 1/2 D_o Use Filter Fabric**

$$\text{Total L} = 12 \text{ '}, \quad L = 6 \text{ '}$$

$$\text{Total W} = 10 \text{ '}, \quad W = 4 \text{ '}$$

$$\text{Depth of scour hole (Y)} = 1 \text{ '}$$

$$d_{50} \text{ stone size} = 4 \text{ "}$$

$$\text{Thickness of riprap (T)} = 8 \text{ "}$$

$$\text{Volume of riprap (V)} = 2.96 \text{ CY}$$

Notes:

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: HW-501

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGAN

$$\begin{aligned}
 Q &= 1.65 \text{ c.f.s.} & W_o &= 2.00 \text{ Ft.} \\
 D_o &= 2.00 \text{ Ft.} & q=Q/W_o &= 0.83 \text{ c.f.s.} \\
 TW &= 0.40 \text{ Ft.}
 \end{aligned}$$

(For areas where Tw cannot be computed, use $TW = 0.2D_o$)**d50 Stone size formula****When $Y = 1/2 D_o$**

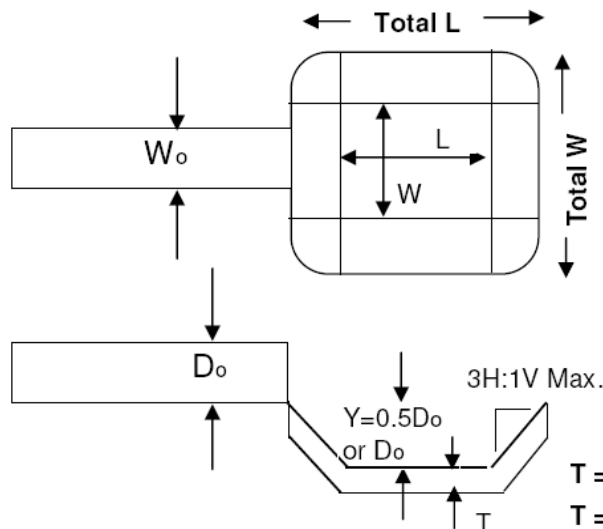
$$\begin{aligned}
 d_{50} &= \frac{0.0125 * q^{1.33}}{TW} = 0.02 \text{ Ft.} = 1 \text{ " Stone Calculated} \\
 & & & & & 4 \text{ " Stone Used for Construction} \\
 & & & & & 1.00' = Y
 \end{aligned}$$

d50 Stone size formula**When $Y = D_o$**

$$\begin{aligned}
 d_{50} &= \frac{0.0082 * q^{1.33}}{TW} = 0.02 \text{ Ft.} = 1 \text{ " Stone Calculated} \\
 & & & & & 4 \text{ " Stone Used for Construction} \\
 & & & & & 2.00' = Y
 \end{aligned}$$

NJ Standards require $d_{50}=3"$ min, NJDOT requires $d_{50}=6"$ min

Y = Depth of scour hole below culvert invert



$$\begin{aligned}
 L &= 3 D_o = 6.00' \\
 W &= 2 W_o = 4.00'
 \end{aligned}$$

If $Y = 1/2 D_o$

$$\text{Total L} = 12.00, \text{ Total W} = 10.00$$

If $Y = D_o$

$$\text{Total L} = 18.00, \text{ Total W} = 16.00$$

 $T = d_{50}$ Stone size x 2 if filter fabric is used $T = d_{50}$ Stone size x 3 if no filter fabric is used**Structure HW-501 Design Summary****Select Scour Hole Design****Y = 1/2 Do Use Filter Fabric**

$$\begin{aligned}
 \text{Total L} &= 12' & L &= 6' \\
 \text{Total W} &= 10' & W &= 4' \\
 \text{Depth of scour hole (Y)} &= 1' \\
 d_{50} \text{ stone size} &= 4'' \\
 \text{Thickness of riprap (T)} &= 8'' \\
 \text{Volume of riprap (V)} &= 2.96 \text{ CY}
 \end{aligned}$$

Notes:

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: FES-502

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGANQ = **9.73 c.f.s.**W_o = **2.50 Ft.**D_o = **1.58 Ft.**q = Q/W_o = **3.89 c.f.s.**TW = **0.32 Ft.**(For areas where Tw cannot be computed, use Tw = 0.2D_o)**d₅₀ Stone size formula****When Y = 1/2 D_o**

$$d_{50} = \frac{0.0125 * q^{1.33}}{TW} = \mathbf{0.24 \text{ Ft.}} = \mathbf{3 \text{ " Stone Calculated}}$$

$$\mathbf{4 \text{ " Stone Used for Construction}}$$

$$\mathbf{0.79' = Y}$$

d₅₀ Stone size formula**When Y = D_o**

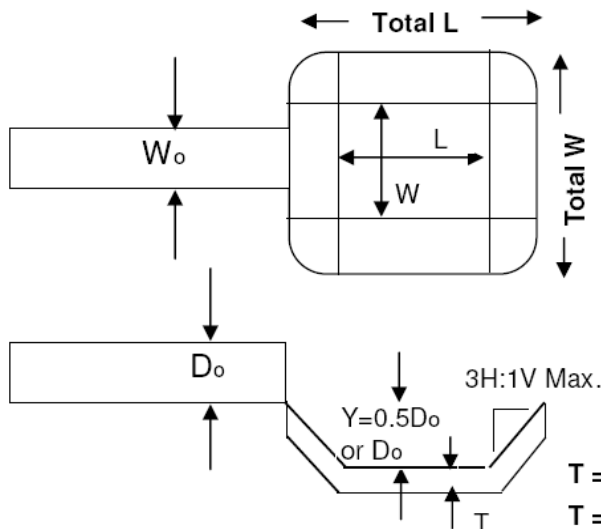
$$d_{50} = \frac{0.0082 * q^{1.33}}{TW} = \mathbf{0.16 \text{ Ft.}} = \mathbf{2 \text{ " Stone Calculated}}$$

$$\mathbf{4 \text{ " Stone Used for Construction}}$$

$$\mathbf{1.58' = Y}$$

NJ Standards require d₅₀=3" min, NJDOT requires d₅₀=6" min

Y = Depth of scour hole below culvert invert



$$L = 3 D_o = \mathbf{4.74'}$$

$$W = 2 W_o = \mathbf{5.00'}$$

If Y = 1/2 D_o

$$\mathbf{Total L = 9.48' , Total W = 9.74'}$$

If Y = D_o

$$\mathbf{Total L = 14.22' , Total W = 14.48'}$$

T = d₅₀ Stone size x 2 if filter fabric is usedT = d₅₀ Stone size x 3 if no filter fabric is used**Structure FES-502 Design Summary****Select Scour Hole Design****Y = 1/2 D_o Use Filter Fabric**

$$\mathbf{Total L = 9.48' \quad L = 4.74'}$$

$$\mathbf{Total W = 9.74' \quad W = 5'}$$

$$\mathbf{Depth of scour hole (Y) = 0.79'}$$

$$\mathbf{d_{50} \text{ stone size} = 4 \text{ "}}$$

$$\mathbf{Thickness of riprap (T) = 8 \text{ "}}$$

$$\mathbf{Volume of riprap (V) = 2.28 \text{ CY}}$$

Notes:

SCOUR HOLE CALCULATIONS

NJ Standards for SESC, Ch. 12, January 2014

Structure: FES-503

Job # 100775501

Job Name: 1251 Jumping Brook Road

Designed by: RY

Checked by: KH

LANGAN

Q = 1.26 c.f.s.

W_o = 1.50 Ft.D_o = 1.50 Ft.q = Q/W_o = 0.84 c.f.s.

TW = 0.30 Ft.

(For areas where Tw cannot be computed, use Tw = 0.2D_o)**d₅₀ Stone size formula****When Y = 1/2 D_o**

$$d_{50} = \frac{0.0125 * q^{1.33}}{TW} = 0.03 \text{ Ft.} = 1 \text{ " Stone Calculated}$$

4 " Stone Used for Construction
0.75 ' = Y

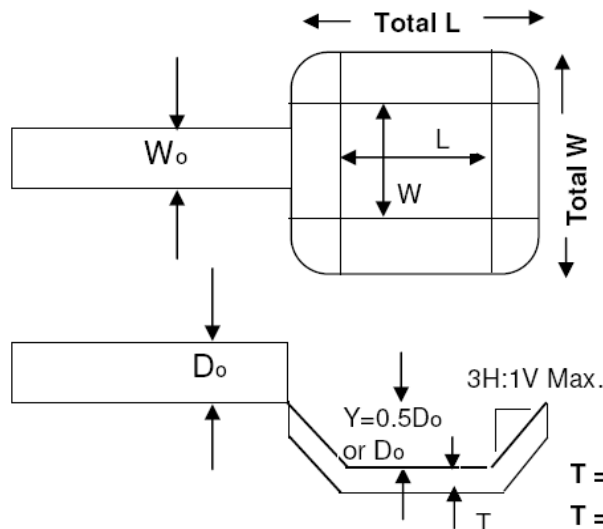
d₅₀ Stone size formula**When Y = D_o**

$$d_{50} = \frac{0.0082 * q^{1.33}}{TW} = 0.02 \text{ Ft.} = 1 \text{ " Stone Calculated}$$

4 " Stone Used for Construction
1.50 ' = Y

NJ Standards require d₅₀=3" min, NJDOT requires d₅₀=6" min

Y = Depth of scour hole below culvert invert



$$L = 3 D_o = 4.50 \text{ '}$$

$$W = 2 W_o = 3.00 \text{ '}$$

If Y = 1/2 D_o

$$\text{Total L} = 9.00 \text{ , Total W} = 7.50$$

If Y = D_o

$$\text{Total L} = 13.50 \text{ , Total W} = 12.00$$

T = d₅₀ Stone size x 2 if filter fabric is usedT = d₅₀ Stone size x 3 if no filter fabric is used**Structure FES-503 Design Summary****Select Scour Hole Design****Y = 1/2 D_o Use Filter Fabric**

$$\text{Total L} = 9 \text{ ' } \quad L = 4.5 \text{ '}$$

$$\text{Total W} = 7.5 \text{ ' } \quad W = 3 \text{ '}$$

$$\text{Depth of scour hole (Y)} = 0.75 \text{ '}$$

$$d_{50} \text{ stone size} = 4 \text{ "}$$

$$\text{Thickness of riprap (T)} = 8 \text{ "}$$

$$\text{Volume of riprap (V)} = 1.67 \text{ CY}$$

Notes:

APPENDIX H

Low Impact Development Checklist

New Jersey Stormwater Best Management Practices Manual

February 2004

A P P E N D I X A

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

According to the NJDEP Stormwater Management Rules at N.J.A.C. 7:8, the groundwater recharge, stormwater quality, and stormwater quantity standards established by the Rules for major land development projects must be met by incorporating nine specific nonstructural stormwater management strategies into the project's design to the maximum extent practicable.

To accomplish this, the Rules require an applicant seeking land development approval from a regulatory board or agency to identify those nonstructural strategies that have been incorporated into the project's design. In addition, if an applicant contends that it is not feasible to incorporate any of the specific strategies into the project's design, particularly for engineering, environmental, or safety reasons, the Rules further require that the applicant provide a basis for that contention.

This checklist has been prepared to assist applicants, site designers, and regulatory boards and agencies in ensuring that the nonstructural stormwater management requirements of the Rules are met. It provides an applicant with a means to identify both the nonstructural strategies incorporated into the development's design and the specific low impact development BMPs (LID-BMPs) that have been used to do so. It can also help an applicant explain the engineering, environmental, and/or safety reasons that a specific nonstructural strategy could not be incorporated into the development's design.

The checklist can also assist municipalities and other land development review agencies in the development of specific requirements for both nonstructural strategies and LID-BMPs in zoning and/or land use ordinances and regulations. As such, where requirements consistent with the Rules have been adopted, they may supersede this checklist.

Finally, the checklist can be used during a pre-design meeting between an applicant and pertinent review personnel to discuss local nonstructural strategies and LID-BMPs requirements in order to optimize the development's nonstructural stormwater management design.

Since this checklist is intended to promote the use of nonstructural stormwater management strategies and provide guidance in their incorporation in land development projects, municipalities are permitted to revise it as necessary to meet the goals and objectives of their specific stormwater management program and plan within the limits of N.J.A.C. 7:8.

Low Impact Development Checklist

A checklist for identifying nonstructural stormwater management strategies incorporated into proposed land development

Municipality: Borough of Tinton Falls

County: Monmouth County Date: 06/22/2020

Review board or agency: Tinton Falls Planning Board

Proposed land development name: 1251 Jumping Brook Road

Lot(s): 47 Block(s): 128.03

Project or application number: _____

Applicant's name: W&M Associates, LLC

Applicant's address: 1481 Oak Tree Road, Iselin, NJ 08830

Telephone: 732-283-9000 Fax: ---

Email address: sitar@sitarcompany.com

Designer's name: Langan Engineering, c/o Richard Burrow

Designer's address: 300 Kimball Drive, 4th Floor, Parsippany, NJ, 07054

Telephone: (973) 560-4704 Fax: (973) 560-4901

Email address: rburrow@langan.com

Part 1: Description of Nonstructural Approach to Site Design

In narrative form, provide an overall description of the nonstructural stormwater management approach and strategies incorporated into the proposed site's design. Attach additional pages as necessary. Details of each nonstructural strategy are provided in Part 3 below.

1.) PROTECT AREAS THAT PROVIDE WATER QUALITY BENEFITS OR AREAS PARTICULARLY

SUSCEPTIBLE TO EROSION AND SEDIMENT LOSS - THE WETLANDS IN THE SOUTHWEST AND NORTHERN AREAS

OF THE SITE WILL BE MAINTAINED.

2.) MAXIMIZE THE PROTECTION OF NATURAL DRAINAGE FEATURES AND VEGETATION - THE WETLANDS IN THE

SOUTHWEST AND NORTHERN AREAS OF THE SITE WILL BE MAINTAINED AND PROTECTED DURING CONSTRUCTION.

A SILT FENCE AND TREE PROTECTION FENCE ARE PROVIDED TO PROTECT EXISTING VEGETATION TO

REMAIN FROM CONSTRUCTION ACTIVITIES.

3.) PROVIDE LOW MAINTENANCE LANDSCAPING THAT ENCOURAGES RETENTION AND PLANTING OF NATIVE

VEGETATION AND MINIMIZES THE USE OF LAWNS, FERTILIZERS, AND PESTICIDES - THE LANDSCAPING

DESIGN INCORPORATES THE PLANTING OF NATIVE VEGETATION AND MINIMIZES THE USE OF LAWNS,

FERTILIZERS, AND PESTICIDES.

4.) PROVIDE VEGETATIVE OPEN CHANNEL COVERANCE SYSTEMS DISCHARGES - THE STORMWATER

DESIGN UTILIZES EXISTING WETLANDS TO THE NORTH OF THE PROJECT AREA.

5.) PROVIDE PREVENTATIVE SOURCE CONTROLS - TRASH COMPACTORS WILL BE PROVIDED ALONG THE

REAR OF THE BUILDING. STORM INLETS WILL COMPLY WITH NJPDES CRITERIA.

Part 2: Review of Local Stormwater Management Regulations

Title and date of stormwater management regulations used in development design:

NJAC 7:8 STORMWATER MANAGEMENT REGULATIONS, NEW JERSEY STORMWATER BEST MANAGEMENT PRACTICES MANUAL, NJ SOIL EROSION AND SEDIMENT CONTROL STANDARDS, BOROUGH OF TINTON FALLS CODE.

Do regulations include nonstructural requirements? Yes: X No: _____

If yes, briefly describe: THE REGULATIONS ARE MODELED AFTER NJDEP REGULATIONS.

List LID-BMPs prohibited by local regulations: NONE NOTED.

Pre-design meeting held? Yes: X Date: 10/03/2020 No: _____

Meeting held with: CHINGWAH LIANG (NJDEP), CBOB KOZACHEK (NJDEP),

RYAN ANDERSON (NJDEP)

Pre-design site walk held? Yes: _____ Date: _____ No: X

Site walk held with: _____

Other agencies with stormwater review jurisdiction:

Name: BOROUGH OF TINTON FALLS

Required approval: PRELIMINARY AND FINAL SITE PLAN APPLICATION

Name: FREEHOLD SOIL CONSERVATION DISTRICT

Required approval: SOIL EROSION AND SEDIMENT CONTROL CERTIFICATION

Name: NJDEP

Required approval: MULTI PERMIT APPLICATION

Part 3: Nonstructural Strategies and LID-BMPs in Design

3.1 Vegetation and Landscaping

Effective management of both existing and proposed site vegetation can reduce a development's adverse impacts on groundwater recharges and runoff quality and quantity. This section of the checklist helps identify the vegetation and landscaping strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to help maintain existing recharge rates and/or minimize or prevent increases in runoff quantity and pollutant loading.

A. Has an inventory of existing site vegetation been performed? Yes: X No:

If yes, was this inventory a factor in the site's layout and design? Yes: X No:

B. Does the site design utilize any of the following nonstructural LID-BMPs?

Preservation of natural areas? Yes: X No: If yes, specify % of site: 46.8%

Native ground cover? Yes: X No: If yes, specify % of site: 46.8%

Vegetated buffers? Yes: No: X If yes, specify % of site:

C. Do the land development regulations require these nonstructural LID-BMPs?

Preservation of natural areas? Yes: No: X If yes, specify % of site:

Native ground cover? Yes: No: X If yes, specify % of site:

Vegetated buffers? Yes: No: X If yes, specify % of site:

D. If vegetated filter strips or buffers are utilized, specify their functions: N/A

Reduce runoff volume increases through lower runoff coefficient: Yes: No:

Reduce runoff pollutant loads through runoff treatment: Yes: No:

Maintain groundwater recharge by preserving natural areas: Yes: No:

3.2 Minimize Land Disturbance

Minimizing land disturbance is a nonstructural LID-BMP that can be applied during both the development's construction and post-construction phases. This section of the checklist helps identify those land disturbance strategies and nonstructural LID-BMPs that have been incorporated into the proposed development's design to minimize land disturbance and the resultant change in the site's hydrologic character.

A. Have inventories of existing site soils and slopes been performed? Yes: X No: _____

If yes, were these inventories factors in the site's layout and design? Yes: X No: _____

B. Does the development's design utilize any of the following nonstructural LID-BMPs?

Restrict permanent site disturbance by land owners? Yes: X No: _____

If yes, how: PRESERVATION OF EXISTING VEGETATION WHERE APPLICABLE.

Restrict temporary site disturbance during construction? Yes: X No: _____

If yes, how: THE CONSTRUCTION LIMIT OF DISTURBANCE IS APPROXIMATELY 27

ACRES BASED ON THE SOIL EROSION AND SEDIMENT CONTROL PLAN.

Consider soils and slopes in selecting disturbance limits? Yes: X No: _____

If yes, how: BOTTOM OR TOP OF SLOPE DICTATED SITE LAYOUT. ALL PROPOSED

SLOPES DO NOT EXCEED 2H:1V.

C. Specify percentage of site to be cleared: 53.23% Regraded: 53.23%

D. Specify percentage of cleared areas done so for buildings: 5.12%

For driveways and parking: 28.15% For roadways: N/A

E. What design criteria and/or site changes would be required to reduce the percentages in C and D above?

THE FOOTPRINT OF THE BUILDING, AMOUNT OF LOADING DOCKS, AND AMOUNT OF CAR PARKING

SPACES WOULD HAVE TO BE REDUCED IN ORDER TO REDUCE THE PERCENTAGES IN C AND D. THESE

CANNOT BE REDUCED BECAUSE OF PROJECT REQUIREMENTS.

F. Specify site's hydrologic soil group (HSG) percentages:

HSG A: 49.4% HSG B: 21.4% HSG C: ----- HSG D: 29.2%

G. Specify percentage of each HSG that will be permanently disturbed:

HSG A: 70.2% HSG B: 80.4% HSG C: ----- HSG D: 3.3%

H. Locating site disturbance within areas with less permeable soils (HSG C and D) and minimizing disturbance within areas with greater permeable soils (HSG A and B) can help maintain groundwater recharge rates and reduce runoff volume increases. In light of the HSG percentages in F and G above, what other practical measures if any can be taken to achieve this?

THE FOOTPRINT OF THE BUILDING, AMOUNT OF LOADING DOCKS, AND AMOUNT OF CAR PARKING

SPACES WOULD HAVE TO BE REDUCED IN ORDER TO REDUCE THE PERCENTAGES IN F AND G. THESE

CANNOT BE REDUCED BECAUSE OF PROJECT REQUIREMENTS.

I. Does the site include Karst topography?

Yes: _____ No: X

If yes, discuss measures taken to limit Karst impacts:

N/A

3.3 Impervious Area Management

New impervious surfaces at a development site can have the greatest adverse effect on groundwater recharge and stormwater quality and quantity. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into a proposed development's design to comprehensively manage the extent and impacts of new impervious surfaces.

A. Specify impervious cover at site: Existing: 6.1% Proposed: 35%

B. Specify maximum site impervious coverage allowed by regulations: 60%

C. Compare proposed street cartway widths with those required by regulations: N/A

Type of Street	Proposed Cartway Width (feet)	Required Cartway Width (feet)
Residential access – low intensity		
Residential access – medium intensity		
Residential access – high intensity with parking		
Residential access – high intensity without parking		
Neighborhood		
Minor collector – low intensity without parking		
Minor collector – with one parking lane		
Minor collector – with two parking lanes		
Minor collector – without parking		
Major collector		

D. Compare proposed parking space dimensions with those required by regulations:

Proposed: 9'X20' Regulations: 9'X18'

E. Compare proposed number of parking spaces with those required by regulations:

Proposed: 231 CAR PARKING SPACES
658 VAN PARKING SPACES Regulations: 70

F. Specify percentage of total site impervious cover created by buildings: 14.6%

By driveways and parking: 80.4% By roadways: N/A

G. What design criteria and/or site changes would be required to reduce the percentages in F above?

THE FOOTPRINT OF THE BUILDING, AMOUNT OF LOADING DOCKS, AND AMOUNT OF CAR PARKING

SPACES WOULD HAVE TO BE REDUCED IN ORDER TO REDUCE THE PERCENTAGES IN F. THESE

CANNOT BE REDUCED BECAUSE OF PROJECT REQUIREMENTS.

H. Specify percentage of total impervious area that will be unconnected:

Total site: 0% Buildings: _____ Driveways and parking: _____ Roads: _____

I. Specify percentage of total impervious area that will be porous:

Total site: 0% Buildings: _____ Driveways and parking: _____ Roads: _____

J. Specify percentage of total building roof area that will be vegetated: 0%

K. Specify percentage of total parking area located beneath buildings: 0%

L. Specify percentage of total parking located within multi-level parking deck: 0%

3.4 Time of Concentration Modifications

Decreasing a site's time of concentration (Tc) can lead directly to increased site runoff rates which, in turn, can create new and/or aggravate existing erosion and flooding problems downstream. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to effectively minimize such Tc decreases.

When reviewing Tc modification strategies, it is important to remember that a drainage area's Tc should reflect the general conditions throughout the area. As a result, Tc modifications must generally be applied throughout a drainage area, not just along a specific Tc route.

A. Specify percentage of site's total stormwater conveyance system length that will be:

Storm sewer: 100% Vegetated swale: _____ Natural channel: _____

Stormwater management facility: _____ Other: _____

Note: the total length of the stormwater conveyance system should be measured from the site's downstream property line to the downstream limit of sheet flow at the system's headwaters.

B. What design criteria and/or site changes would be required to reduce the storm sewer percentages and increase the vegetated swale and natural channel percentages in A above?

THE FOOTPRINT OF THE BUILDING, AMOUNT OF LOADING DOCKS, AND AMOUNT OF CAR PARKING

SPACES WOULD HAVE TO BE REDUCED IN ORDER TO REDUCE THE STORM SEWER PERCENTAGES. THESE

CANNOT BE REDUCED BECAUSE OF PROJECT REQUIREMENTS.

C. In conveyance system subareas that have overland or sheet flow over impervious surfaces or turf grass, what practical and effective site changes can be made to:

Decrease overland flow slope: THE DECREASE IN PRE-CONSTRUCTION TIME OF CONCENTRATION COULD

NOT BE MINIMIZED DUE TO LAYOUT REQUIREMENTS FOR THE SITE'S PARKING FIELD.

Increase overland flow roughness: USE OF NATIVE GRASSES AND VEGETATION WHERE OVERLAND

RUNOFF OCCURS, WHERE APPLICABLE.

3.5 Preventative Source Controls

The most effective way to address water quality concerns is by pollution prevention. This section of the checklist helps identify those nonstructural strategies and LID-BMPs that have been incorporated into the proposed development's design to reduce the exposure of pollutants to prevent their release into the stormwater runoff.

A. Trash Receptacles

Specify the number of trash receptacles provided: 1

Specify the spacing between the trash receptacles: N/A

Compare trash receptacles proposed with those required by regulations:

Proposed: 1 Regulations: N/A

B. Pet Waste Stations

Specify the number of pet waste stations provided: 0

Specify the spacing between the pet waste stations: N/A

Compare pet waste stations proposed with those required by regulations:

Proposed: N/A Regulations: N/A

C. Inlets, Trash Racks, and Other Devices that Prevent Discharge of Large Trash and Debris

Specify percentage of total inlets that comply with the NJPDES storm drain inlet criteria: 100%

D. Maintenance

Specify the frequency of the following maintenance activities:

Street sweeping: Proposed: 0 Regulations: N/A

Litter collection: Proposed: 0 Regulations: N/A

Identify other stormwater management measures on the site that prevent discharge of large trash and debris:

N/A

E. Prevention and Containment of Spills

Identify locations where pollutants are located on the site, and the features that prevent these pollutants from being exposed to stormwater runoff:

Pollutant: N/A Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: _____

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: N/A Location: _____

Part 4: Compliance with Nonstructural Requirements of NJDEP Stormwater Management Rules

1. Based upon the checklist responses above, indicate which nonstructural strategies have been incorporated into the proposed development's design in accordance with N.J.A.C. 7:8-5.3(b):

No.	Nonstructural Strategy	Yes	No
1.	Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.	X	
2.	Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.		X
3.	Maximize the protection of natural drainage features and vegetation.	X	
4.	Minimize the decrease in the pre-construction time of concentration.		X
5.	Minimize land disturbance including clearing and grading.		X
6.	Minimize soil compaction.		X
7.	Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.	X	
8.	Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.	X	
9.	Provide preventative source controls.	X	

2. For those strategies that have not been incorporated into the proposed development's design, provide engineering, environmental, and/or safety reasons. Attached additional pages as necessary.

1.) THE NATURE OF OPERATIONS OF THE WAREHOUSE SITE PROHIBITS THE BREAKUP OF IMPERVIOUS SURFACES.

2.) THE DECREASE IN PRE-CONSTRUCTION TIME OF CONCENTRATION COULD NOT BE MINIMIZED DUE TO
LAYOUT REQUIREMENTS FOR THE SITE'S PARKING FIELD.

3.) LAND DISTURBANCE WAS NOT MINIMIZED DUE TO THE SITE LAYOUT.

4.) SOIL COMPACTION IS NOT MINIMIZED DUE TO THE SOIL COMPACTION REQUIREMENTS OUTLINED IN
THE PROJECT GEOTECHNICAL REPORT.

APPENDIX I

Geotechnical Information

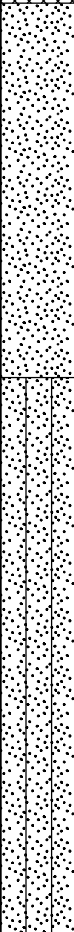
Project Proposed Warehouse Development				Project No. 100775501			
Location 1251 Jumping Brook Rd				Elevation and Datum Approx. el 98 (NAVD88)			
Drilling Company Boring Brothers, Inc.				Date Started 4/8/20		Date Finished 4/8/20	
Drilling Equipment CME Track-Mounted Drill Rig				Completion Depth 17 ft		Rock Depth N/E	
Size and Type of Bit 3 7/8" Tricone Roller Bit				Number of Samples	Disturbed 7	Undisturbed -	Core -
Casing Diameter (in) 4" I.D. Steel		Casing Depth (ft) 4		Water Level (ft.) First 15	Completion 24 HR. -	Core -	
Casing Hammer Automatic	Weight (lbs) 140		Drop (in) 30	Drilling Foreman Rob Dollar			
Sampler 2-inch-diameter split spoon				Field Engineer Cristina Robles			
Sampler Hammer Safety		Weight (lbs) 140		Drop (in) 30			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data					Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
				Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	
	+98.0	Brown f-c SAND, trace fine gravel, trace silt, trace roots (moist) [FILL]	0				4		Started drilling at 10:51 AM on 4/8/20.
		Yellowish brown to orangish brown f-m SAND, trace silt (moist) [FILL]	1	S-1A	SS	18	8	15	S-1 at 0ft
	+96.0	Orangish brown to reddish brown fine SAND, trace silt (moist)	2	S-1B	SS		6		S-2 at 2ft
		Yellowish brown to gray f-c SAND, trace silt (moist)	3	S-2	SS	19	5	11	Drove casing to 4ft. Drilled to 4ft. Orangish brown wash.
		Gray to yellowish brown f-m SAND, trace silt (moist)	4				6		S-3 at 4ft
		Tannish gray fine SAND, trace silt (moist)	5	S-3	SS	7	7	14	S-4 at 6ft
		Tannish gray f-c SAND, trace silt (moist)	6				6		Drilled to 8ft. Yellowish brown wash.
			7	S-4	SS	12	5	11	S-5 at 8ft Soil mottling observed.
			8				7		
			9	S-5	SS	14	10	24	S-6 at 10ft Soil mottling observed.
			10				14		
			11	S-6	SS	15	13	38	Drilled to 15ft. Yellowish brown wash.
			12				19		
			13				19		
			14				16		
		Tannish gray to orangish brown fine SAND, trace silt (wet)	15				6		S-7 at 15ft Soil mottling observed.
			16	S-7	SS	16	16	34	
			17				18		
	+81.0	End of Boring at 17'.	18				22		Finished drilling at 11:28 AM on 4/8/20. Borehole backfilled with soil cuttings and bentonite hole plug upon completion.
			19						
			20						

Project Proposed Warehouse Development				Project No. 100775501			
Location 1251 Jumping Brook Rd				Elevation and Datum Approx. el 89.1 (NAVD88)			
Drilling Company Boring Brothers, Inc.				Date Started 4/9/20		Date Finished 4/9/20	
Drilling Equipment CME Track-Mounted Drill Rig				Completion Depth 17 ft		Rock Depth N/E	
Size and Type of Bit 3 7/8" Tricone Roller Bit				Number of Samples	Disturbed 7	Undisturbed -	Core -
Casing Diameter (in) 4" I.D. Steel		Casing Depth (ft) 4		Water Level (ft.) First 4	Completion 4	24 HR. -	-
Casing Hammer Automatic	Weight (lbs) 140		Drop (in) 30	Drilling Foreman Rob Dollar			
Sampler 2-inch-diameter split spoon				Field Engineer Cristina Robles			
Sampler Hammer Automatic		Weight (lbs) 140		Drop (in) 30			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data						Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)		
				Number	Type	Recov. (in)	Penetr. resist. BL/6in	N-Value (Blows/ft)				
	+89.1		0					10	20	30	40	
	+88.5	Dark brown f-m SAND, some silt, trace organics, trace roots (moist) [TOPSOIL]		S-1A			1					Started drilling at 10:25 AM on 4/9/20. S-1 at 0ft
		Dark brown fine SAND, some silt, trace roots (moist) [FILL]	1		SS	17	2	5				
			2	S-1B			3					S-2 at 2ft
		Dark brown to grayish brown fine SAND, trace silt (moist) [FILL]	3		SS	17	1	3				
			4	S-2			2	1	3			Drove casing to 4ft. Drilled to 4ft. Brown wash. S-3 at 4ft
		Yellowish brown to gray fine SAND, trace silt (wet)	5		SS	13	3	6				
			6	S-3			3	4				S-4 at 6ft
		Tannish gray fine SAND, trace silt (wet)	7		SS	17	5	10				
			8	S-4			5	5				Drilled to 8ft. Light brown wash. S-5 at 8ft
		Yellowish brown to orangish brown to gray f-m SAND, trace silt (wet)	9		SS	11	4	7				
			10	S-5			3	2				S-6 at 10ft
		Orangish brown to gray f-m SAND, trace silt (wet)	11		SS	14	2	7				
			12	S-6			5	2				Drilled to 15ft. Yellowish brown wash. S-7 at 15ft
		Orangish brown to gray fine SAND, trace silt, trace clay (wet)	13									
			14									
			15									
			16	S-7			3	7				Finished drilling at 10:49 AM on 4/9/20. Borehole backfilled with soil cuttings and bentonite hole plug upon completion.
		End of Boring at 17'.	17				2	9				
			18									
			19									
			20									

Project Proposed Warehouse Development				Project No. 100775501			
Location 1251 Jumping Brook Rd				Elevation and Datum Approx. el 83.2 (NAVD88)			
Drilling Company Boring Brothers, Inc.				Date Started 4/9/20		Date Finished 4/9/20	
Drilling Equipment CME Track-Mounted Drill Rig				Completion Depth 17 ft		Rock Depth N/E	
Size and Type of Bit 3 7/8" Tricone Roller Bit				Number of Samples 7		Undisturbed -	
Casing Diameter (in) 4" I.D. Steel				Casing Depth (ft) 4		Core -	
Casing Hammer Automatic		Weight (lbs) 140	Drop (in) 30	Water Level (ft.) First 8		Completion 24 HR. -	
Sampler 2-inch-diameter split spoon				Drilling Foreman Rob Dollar			
Sampler Hammer Safety				Field Engineer Cristina Robles			
Weight (lbs) 140		Drop (in) 30					

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data					Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
				Number	Type	Recov. (in)	Penetr. resist. BL/6in	N-Value (Blows/ft)	
	+83.2		0					10 20 30 40	
	+82.6	Dark brown fine SAND, some silt, some roots (moist) [TOPSOIL]		S-1A			3		Started drilling at 7:58 AM on 4/9/20.
		Dark brown fine SAND, some silt (moist) [FILL]	1		SS	18	3 6	9	S-1 at 0ft
	+81.2		2	S-1B			7		
		Grayish brown fine SAND, trace silt (moist)					9		S-2 at 2ft
			3	S-2	SS	18	15 15	30	
		Yellowish brown to light gray f-m SAND, trace silt (moist)	4				17		
			5	S-3	SS	13	12 10	22	Drove casing to 4ft. Drilled to 4ft. Orangish brown wash.
		Orangish brown f-m SAND, trace silt (moist)	6				6		S-3 at 4ft.
			7	S-4	SS	17	9 6	15	S-4 at 6ft
	+75.2		8				4		Drilled to 8ft. Gray wash.
		Dark brownish gray fine SAND, some silt, trace clay (wet)		S-5	SS	19	9 12	21	S-5 at 8ft
			9				11		
		Dark gray fine SAND, some silt, trace clay (wet)	10				10		S-6 at 10ft
			11	S-6	SS	17	19 16	35	
			12				14		Drilled to 15ft. Gray wash.
			13						
			14						
		Dark gray fine Silty SAND, some clay (wet)	15				8		S-7 at 15ft
			16	S-7	SS	19	10 13	23	
	+66.2		17				17		
		End of Boring at 17'.	18						Finished drilling at 8:32 AM on 4/9/20.
			19						Borehole backfilled with soil cuttings and bentonite hole plug upon completion.
			20						

Project				Project No.				
Proposed Warehouse Development				100775501				
Location				Elevation and Datum				
1251 Jumping Brook Rd				Approx. el 74.8 (NAVD88)				
Drilling Company				Date Started		Date Finished		
Boring Brothers, Inc.				4/9/20		4/9/20		
Drilling Equipment				Completion Depth		Rock Depth		
CME Track-Mounted Drill Rig				17 ft		N/E		
Size and Type of Bit				Number of Samples	Disturbed	Undisturbed	Core	
3 7/8" Tricone Roller Bit					7	-	-	
Casing Diameter (in)			Casing Depth (ft)	Water Level (ft.)	First	Completion	24 HR.	
4" I.D. Steel			4		4	-	-	
Casing Hammer		Weight (lbs)		Drop (in)	Drilling Foreman			
Automatic		140		30	Rob Dollar			
Sampler				Field Engineer				
2-inch-diameter split spoon								
Sampler Hammer		Weight (lbs)		Drop (in)	Cristina Robles			
Safety		140		30				

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data					Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
				Number	Type	Recov. (in)	Penetr. resist. (BL/ft)	N-Value (Blows/ft)	
	+74.8		0						
	+74.2	Dark brown f-m SAND, some silt, trace roots (moist) [TOPSOIL]		S-1A		2			Started drilling at 8:46 AM on 4/9/20.
		Tannish brown fine SAND, trace silt (moist) [FILL]	1		SS	18	3	6	S-1 at 0ft
			2	S-1B		5			S-2 at 2ft
		Light brown to grayish brown f-m SAND, trace silt (moist) [FILL]	3	S-2	SS	18	4	7	
	+70.8		4			16	5		Drove casing to 4ft. Drilled to 4ft. Brown wash.
		Dark grayish brown f-c SAND, some silt (wet)	5	S-3	SS	11	25	42	S-3 at 4ft
	+68.8		6			17	8		
		Dark grayish brown Silty fine SAND, some clay (wet)	7	S-4	SS	8	3	2	S-4 at 6ft
	+66.8		8			10	2	4	Drilled to 8ft. Gray wash.
		Dark grayish brown Silty fine SAND, trace clay (wet)	9	S-5	SS	13	17	38	S-5 at 8ft
			10			20	19		
		Dark grayish brown fine SAND, some silt, trace clay (wet)	11	S-6	SS	21	28	55	S-6 at 10ft
			12			27	27		
			13						Drilled to 15ft. Brown wash.
	+59.8		14						
		Dark grayish brown Sandy CLAY, some silt (wet)	15	S-7	SS	19	5	25	S-7 at 15ft
	+57.8		16				10		
		End of Boring at 17'.	17				15		
			18				18		Finished drilling at 9:16 AM on 4/9/20.
			19						Borehole backfilled with soil cuttings and bentonite hole plug upon completion.
			20						

LOG OF TEST PIT PTP-1

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 4/10/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 99.5 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 14 ft	WATER LEVEL - First 8 ft 
EQUIPMENT Kubota KX057-4 Mini Excavator	FOREMAN John Hemmel	WATER LEVEL - Completion - 
		LANGAN PERSONNEL Rodrigo Fernandez Santoyo

Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+99.5	Grayish brown f-c SAND, some silt, some roots, trace fine gravel (moist) [TOPSOIL]	0	S-1	GRAB	Started excavating on 4/10/2020 at 1:00PM.
	+98.7	Orangish brown f-c SAND, some silt, trace fine gravel (moist) [FILL]	1	S-2	GRAB	
			2			
		Brown f-c SAND, trace silt, trace fine gravel (moist) [FILL]	3	S-3	GRAB	
	+95.3	Orangish brown f-c SAND, some silt, trace roots (moist) [BURIED TOPSOIL]	4	S-4	GRAB	Shelby Tube sample U-1 taken at 5.5ft.
	+94.7	Yellowish brown f-c SAND, some silt, trace fine gravel (moist) [FILL]	5	S-5	GRAB	
			6			
		Brown f-c SAND, trace silt, trace fine gravel (moist) [FILL]	7	S-6	GRAB	
	+91.5	Yellowish brown to light gray f-m SAND, trace silt (wet) 	8	S-7	GRAB	Perched groundwater observed at 8ft. Soil mottling observed from 8-14ft.
			9			
			10			
			11			
			12			Excavation caving at approximately 10ft.
			13			
			14			
	+85.5	End of Test Pit at 14ft.	15			

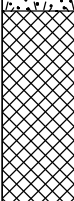
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LOG OF TEST PIT PTP-2

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 4/10/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 96 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 8 ft	WATER LEVEL - First NE 
EQUIPMENT Kubota KX057-4 Mini Excavator	FOREMAN John Hemmel	WATER LEVEL - Completion - 
		LANGAN PERSONNEL Rodrigo Fernandez Santoyo

Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+96.0	Dark brownish gray Silty f-m SAND, some roots (moist) [TOPSOIL]	0	S-1	GRAB	Started excavating on 4/10/2020 at 12:11PM. Shelby Tube sample U-1 taken at 1ft.
	+94.9	Dark grayish brown f-m SAND, some silt, trace fine gravel, trace roots (moist) [FILL]	1	S-2	GRAB	
		Light grayish brown f-c SAND, trace silt, trace roots (moist) [FILL]	2	S-3	GRAB	
	+93.0	Light gray to orangish brown fine SAND, trace silt (moist)	3	S-4	GRAB	
			4			
			5			Soil mottling observed from 3-8ft.
			6			
			7	S-5	GRAB	
		Light gray fine SAND, trace silt, trace fine gravel (moist)	7			
			8			
	+88.0	End of Test Pit at 8ft.	8			Finished excavating at 12:42PM. Backfilled with excavated material upon completion.
			9			
			10			
			11			
			12			
			13			
			14			
			15			

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LOG OF TEST PIT PTP-3

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 4/10/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 96 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 14 ft	WATER LEVEL - First 9 ft ▽
EQUIPMENT Kubota KX057-4 Mini Excavator	FOREMAN John Hemmel	WATER LEVEL - Completion - ▼
		LANGAN PERSONNEL Rodrigo Fernandez Santoyo

Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+96.0	Dark brown f-m SAND, some silt, some roots, trace organics (moist) [TOPSOIL]	0	S-1	GRAB	Started excavating on 4/10/2020 at 7:40AM.
	+95.5	Brownish gray f-m SAND, trace silt, trace roots (moist)	1	S-2	GRAB	
		Dark orangish brown f-m SAND, trace silt (moist)	2	S-3	GRAB	
			3			
	+92.0	Light gray fine SAND, trace silt (moist)	4	S-4	GRAB	Shelby Tube sample U-1 taken at 6ft.
			5			
			6			
			7			
	+88.3	Tan to orangish brown f-m SAND, trace silt, trace fine gravel (moist)	8	S-5	GRAB	Soil mottling observed from 8-14ft.
		Orangish brown to light gray fine SAND, trace silt (wet)	9	S-6	GRAB	
		Light gray to orangish brown fine SAND, trace silt (wet)	10	S-7	GRAB	Slow groundwater infiltration observed at 9ft.
			11			
			12			
			13			
	+82.0	End of Test Pit at 14ft.	14			Excavation caving at 12ft.
			15			

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Sheet 1 of 1

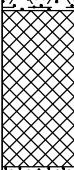
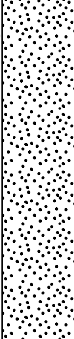
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LOG OF TEST PIT PTP-5

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 4/10/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 85.5 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 11 ft	WATER LEVEL - First NE 
EQUIPMENT Kubota KX057-4 Mini Excavator	FOREMAN John Hemmel	WATER LEVEL - Completion - 
		LANGAN PERSONNEL Rodrigo Fernandez Santoyo

Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+85.5	Dark gray to black f-c SAND, some silt, trace organics, trace fine gravel (moist)	0	S-1	GRAB	Started excavating on 4/10/2020 at 11:15AM.
	+84.3	Dark brown fine SAND, trace silt (moist) [FILL]	1	S-2	GRAB	
	+82.8	Light gray fine SAND, trace silt (moist)	3	S-3	GRAB	Shelby Tube sample U-1 taken at 3ft.
		Tan to orangish brown f-m SAND, trace silt (moist)	4	S-4	GRAB	
	+79.5	Tan to orangish brown Silty f-m SAND, trace clay (moist)	6	S-5	GRAB	Soil mottling observed from 6-9ft.
			7			
	+76.3	Dark gray Silty f-m SAND, some clay (moist)	9	S-6	GRAB	
			10			
	+74.5	End of Test Pit at 11ft.	11			Finished excavating on 4/10/2020 at 11:40AM. Backfilled with excavated material upon completion.
			12			
			13			
			14			
			15			

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LOG OF TEST PIT PTP-6

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 4/10/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 85 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 8 ft	WATER LEVEL - First 6.5 ft
EQUIPMENT Kubota KX057-4 Mini Excavator	FOREMAN John Hemmel	WATER LEVEL - Completion -
		LANGAN PERSONNEL Rodrigo Fernandez Santoyo

Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+85.0	Black f-c SAND, trace silt, trace fine gravel, some roots (moist) [TOPSOIL]	0	S-1	GRAB	Started excavating on 4/10/2020 at 8:39AM.
	+83.8	Light gray f-m SAND, some silt, trace clay, trace roots (moist) [FILL]	1	S-2	GRAB	Shelby Tube sample U-1 taken at 1ft.
			2			
			3			Encountered unmarked 3" O.D clay pipe at 3ft.
	+81.3	Tan to gray fine SAND, trace silt (moist)	4	S-3	GRAB	
			5			
		Light gray to yellowish brown f-c SAND, trace silt, trace clay, trace fine gravel (wet)	6	S-4	GRAB	Soil mottling observed from 6-8ft.
	+78.0	Light gray to orangish brown Clayey f-m SAND, some silt (wet)	7	S-5	GRAB	Rapid groundwater infiltration observed at 6.5ft.
			8			
	+77.0	End of Test Pit at 8ft.	9			Finished excavating at 8:59AM. Backfilled with excavated material upon completion.
			10			
			11			
			12			
			13			
			14			
			15			

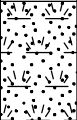
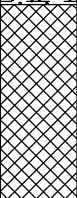
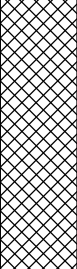
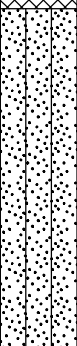
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LOG OF TEST PIT PTP-7

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 4/10/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 76 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 12 ft	WATER LEVEL - First 5.5 ft
EQUIPMENT Kubota KX057-4 Mini Excavator	FOREMAN John Hemmel	WATER LEVEL - Completion -
		LANGAN PERSONNEL Rodrigo Fernandez Santoyo

Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+76.0	Black Silty f-m SAND, some organics, trace roots (moist) [TOPSOIL]	0	S-1	GRAB	Started excavating on 4/10/2020 at 10:05AM. Encountered 4" corrugated HDPE pipe at 0.5ft.
	+74.8	Brown to orangish brown fine SAND, some silt, trace roots [FILL]	1	S-2	GRAB	
		Grayish brown f-m SAND, trace silt, trace roots (moist) [FILL]	2			
			3	S-3	GRAB	
		Grayish brown f-c SAND, some f-c gravel, trace silt (moist) [FILL]	4			Shelby Tube sample U-1 taken at 3.5ft.
			5	S-4	GRAB	
	+70.3	Dark gray f-m SAND, some silt (wet)	6	S-5	GRAB	Rapid groundwater infiltration observed at 5.5ft.
			7			
		Dark gray Silty fine SAND, trace clay (wet)	8			
			9	S-6	GRAB	
	+64.0	End of Test Pit at 12ft.	10			Excavation caving at 10ft.
			11			
			12			Finished excavating at 10:33AM. Backfilled with excavated material upon completion.
			13			
			14			
			15			

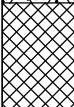
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LOG OF TEST PIT PTP-8

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 4/10/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 75 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 12 ft	WATER LEVEL - First 4 ft 
EQUIPMENT Kubota KX057-4 Mini Excavator	FOREMAN John Hemmel	WATER LEVEL - Completion - 
		LANGAN PERSONNEL Rodrigo Fernandez Santoyo

Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+75.0	Black Silty f-m SAND, some roots (moist) [TOPSOIL]	0	S-1	GRAB	Started excavating on 4/10/2020 at 9:39AM.
	+73.9	Dark brown f-m SAND, trace silt, trace roots (moist) [FILL]	1	S-2	GRAB	
		Tan to orangish brown f-c SAND, trace silt (moist) [FILL]	2	S-3	GRAB	Soil mottling observed from 2-5ft.
		Tan to orangish brown f-c SAND, trace silt (moist) [FILL]	3	S-4	GRAB	
	+71.0	Light gray fine SAND, some silt, trace buried wood, trace roots (wet) [BURIED TOPSOIL]	4	S-5	GRAB	Slow groundwater infiltration observed at 4ft.
	+70.0	Grayish brown f-c SAND, trace silt (wet)	5	S-6	GRAB	
		Dark gray Silty f-m SAND (wet)	10	S-7	GRAB	
		Dark gray fine SAND, some silt (wet)	11	S-8	GRAB	
	+63.0	End of Test Pit at 12ft.	12			Finished excavating at 10:01AM. Backfilled with excavated material upon completion.
			13			
			14			
			15			

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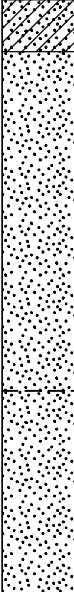
Test Pit Number	Existing Ground Elevation (feet)	Seasonal High Ground Water Elevation (feet)	Field Measured Hydraulic Conductivity (inch / hour)	Laboratory Hydraulic Conductivity (inch / hour)
PTP-1	99.5	91.5	*	0.1
PTP-2	96.0	93.0	0.4	0.0
PTP-3	96.0	88.0	*	1.8
PTP-4	81.5	76.0	*	1.4
PTP-5	85.0	79.5	*	0.4
PTP-6	85.0	79.0	*	0.1
PTP-7	76.0	70.5	*	1.6
PTP-8	75.0	73.0	1.1	0.2
FTP-1	107.1	96.1	-	8.8
FTP-2	105.9	96.9	5.4	0.5
FTP-3	102.9	92.9	1.6	0.9
FTP-4	104.7	97.7	-	0.0
FTP-5	115.7	109.7	-	7.2
FTP-6	106.1	99.6	-	0.0

* Upon performing the presoak, the water level was still present in the test setup after a pre-soak period of 16 to 24 hours. The tests were then terminated and Shelby tube samples were taken for laboratory tube permeameter testing.

LOG OF TEST PIT FTP-1

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 6/8/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 107.1 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 13 ft	WATER LEVEL - First 12 ft 
EQUIPMENT Takeuchi TB260 Excavator	FOREMAN Elizeu	WATER LEVEL - Completion 11.8 ft 
		LANGAN PERSONNEL Patrick Lenihan

Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+107.1	Dark brown f-m SAND, trace silt, trace roots (moist) [TOPSOIL] [3 inches thick]	0	S-1	GRAB	Started excavating on 6/8/2020 at 2:27 PM. Roots (hairline) extended to 6" bsg.
	+106.3	Brown f-m SAND, trace silt, trace fine gravel, trace roots (moist) [FILL] Dark brown fine SAND, some silt (moist) [FILL]	1	S-2	GRAB	
			2	S-3	GRAB	
	+104.6	Orangish-brown fine SAND, some silt, trace clay (moist) [FILL]	3	S-4	GRAB	
	+103.1	Tannish brown fine SAND, trace silt (moist)	4	S-5	GRAB	
			5			
			6			
			7			
	+99.9	Orangish-brown f-m SAND, trace silt, seams of white clay (moist)	8	S-6	GRAB	
	+99.4	Brown f-c SAND, trace fine gravel, trace silt (moist)	9	S-7	GRAB	
			10			Mottling observed. Water seepage observed at 12' bsg.
	+96.1	White to yellowish brown f-m SAND, trace silt (wet)	11	S-8	GRAB	
			12			
	+94.1	End of Test Pit at 13'	13			
			14			
			15			Finished excavating on 6/8/2020 at 3:10 PM. Water seepage observed from the side walls at 12' bsg and at the bottom of the test pit. Water level accumulated to 12' bsg at 3:14 PM. Water level stabilized at 11.75" bsg at 3:19 PM. Backfilled with excavated material upon completion.

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LOG OF TEST PIT FTP-2

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 6/8/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 105.9 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 12 ft	WATER LEVEL - First 11 ft ▽
EQUIPMENT Takeuchi TB260 Excavator	FOREMAN Elizeu	WATER LEVEL - Completion 11 ft ▼
		LANGAN PERSONNEL Patrick Lenihan

Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+105.9	Dark grayish-brown fine SAND, some silt, trace roots (moist)	0	S-1	GRAB	Started excavating on 6/8/2020 at 9:21 AM. Roots (up to 1/8") extended to 6" bsg.
	+105.5	[TOPSOIL] [5 inches thick]				
		Tannish-brown fine SAND, some silt, trace fine gravel (moist) [FILL]	1	S-2	GRAB	
			2			
	+103.4	Orangish-brown f-c SAND, trace silt, trace fine gravel, trace clay (moist) [FILL]	3	S-3	GRAB	Orangish-brown mottling observed
	+102.9	Tannish-brown f-m SAND, some silt (moist)	4	S-4	GRAB	
		Tan f-m SAND, trace silt (moist)	5			
			6			
	+98.9	Orangish-brown f-c SAND, trace silt (wet)	7	S-5	GRAB	
	+97.9		8	S-6	GRAB	
	+96.9	White CLAY, trace f-m sand, trace silt, trace fibers (moist)	9	S-7	GRAB	
	+96.4	Orangish-brown f-m SAND, trace silt (moist)	10	S-8	GRAB	
		Orangish-brown f-c SAND, trace silt (wet)	11	S-9	GRAB	Groundwater seepage observed at 11' bsg.
			12			
	+93.9	End of Test Pit at 12'	13			Finished excavating on 6/8/2020 at 10:19 AM. Backfilled with excavated material upon completion.
			14			
			15			

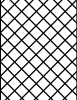
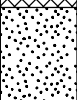
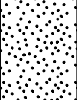
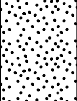
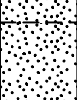
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LOG OF TEST PIT FTP-3

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 6/8/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 102.9 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 11.5 ft	WATER LEVEL - First 10 ft ▽
EQUIPMENT Takeuchi TB260 Excavator	FOREMAN Elizeu	WATER LEVEL - Completion 9.7 ft ▼
		LANGAN PERSONNEL Patrick Lenihan

Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+102.9	Dark brown f-m SAND, some silt, trace fine gravel, trace roots (moist) [TOPSOIL] [10 inches thick]	0	S-1	GRAB	Started excavating on 6/8/2020 at 11:51 AM.
	+102.1	Dark gray f-m SAND, trace silt, trace fine gravel (moist) [FILL]	1	S-2	GRAB	
			2			
			3			
	+100.4	Light tannish-brown fine SAND, trace silt, trace fine gravel (moist)	4	S-3	GRAB	
			5			
			6			
			7			
	+97.4	Light yellowish-brown f-m SAND, trace silt (moist)	8	S-4	GRAB	
			9			
			10			
			11			
	+95.9	White CLAY with trace fibers intermixed with orangish-brown f-m SAND, trace silt (moist)	12	S-5	GRAB	
			13			
			14			
			15			
	+93.9	Orangish-brown f-c SAND, trace silt (wet)	16	S-6	GRAB	Water seepage observed at 10' bsg.
			17			
			18			
			19			
	+91.4	Orangish-brown f-m SAND, trace silt (wet)	20	S-7	GRAB	Possible orangish-brown mottling observed.
			21			
			22			
			23			
		End of Test Pit at 11.5'	24			Finished excavating on 6/8/2020 at 12:45 PM. Hole continued collapsing. Could not observe water deeper than 11' bsg. Water level accumulated to 9.67' bsg at 1:03 PM. Water seepage observed from the NW side wall at 1.5' bsg at 3:20 PM. Backfilled with excavated material upon completion.
			25			
			26			
			27			

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LOG OF TEST PIT FTP-4

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 6/9/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 104.7 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 12 ft	WATER LEVEL - First 11.5 ft
EQUIPMENT Takeuchi TB260 Excavator	FOREMAN Elizeu	WATER LEVEL - Completion -
		LANGAN PERSONNEL Patrick Lenihan

Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+104.7	Brown fine SAND, trace silt, trace roots (moist) [TOPSOIL] [6 inches thick]	0	S-1	GRAB	Started excavating on 6/9/2020 at 1:35 PM. Roots (up to 1/4") extended to 26" bsg.
	+104.2	Tannish-brown f-m SAND, trace silt (moist)	1	S-2	GRAB	
			2			
		Tannish-brown f-m SAND, trace silt (moist)	3	S-3	GRAB	
			4			
			5			
		Tannish-brown fine SAND, trace silt (moist)	6	S-4	GRAB	Orangish-brown mottling observed.
	+97.7	Tannish brown to orangish brown f-m SAND, some silt (moist)	7	S-5	GRAB	
	+96.7	Light tan to orangish-brown fine SAND, trace silt (moist)	8	S-6	GRAB	
	+95.7	Orangish-brown f-c SAND, trace silt, trace clay (moist)	9	S-7	GRAB	Orangish-brown mottling observed.
		Orangish-brown f-c SAND, trace silt (moist)	10	S-8	GRAB	
			11			
	+93.2	Light brown to orangish-brown fine SAND, some silt, trace fine gravel (wet)	12	S-9	GRAB	Water seepage observed at 11.5' bsg.
	+92.7	End of Test Pit at 12'	12			Finished excavating on 6/9/2020 at 2:00 PM. Hole continued collapsing after excavating to 10' bsg. Backfilled with excavated material upon completion.
			13			
			14			
			15			

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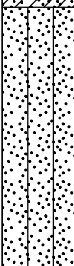
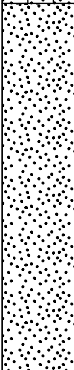
LANGAN

LOG OF TEST PIT FTP-5

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 6/9/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 115.7 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 13.5 ft	WATER LEVEL - First NE 
EQUIPMENT Takeuchi TB260 Excavator	FOREMAN Elizeu	WATER LEVEL - Completion NE 
		LANGAN PERSONNEL Patrick Lenihan

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Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+115.7	Dark brown f-m SAND, some silt, trace fine gravel (moist) [TOPSOIL] [12 inches thick]	0	S-1	GRAB	Started excavating on 6/9/2020 at 7:59 AM. Roots (hairline) extended to 15" bsg.
	+114.7	Brown f-c SAND, some silt, trace fine gravel, trace roots (moist)	1	S-2	GRAB	
	+114.4	[FILL] Dark gray fine SAND, some silt (moist) [FILL]		S-3	GRAB	
	+113.7	Light yellowish-brown f-m SAND, some silt (moist)	2	S-4	GRAB	
	+112.2	Orangish-brown f-m SAND, some clay, some silt (moist)	3			
			4	S-5	GRAB	
			5			
			6			Faint orangish-brown mottling observed.
	+109.7	Light yellowish-brown to orangish-brown fine SAND, some silt (moist)	7	S-6	GRAB	
			8			
			9			Faint orangish-brown mottling observed.
	+107.2	White fine SAND, trace silt (moist)	10	S-7	GRAB	
			11			
			12			Faint orangish-brown mottling observed
		White fine SAND, trace silt (moist)	13	S-8	GRAB	
	+102.2	End of Test Pit at 13.5'	14			Finished excavating on 6/9/2020 at 8:39 AM. Backfilled with excavated material upon completion.
			15			

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LOG OF TEST PIT FTP-6

Sheet 1 of 1

PROJECT NAME Proposed Warehouse Development	PROJECT NUMBER 100775501	DATE 6/9/2020
LOCATION 1251 Jumping Brook Rd	ELEVATION Approximate el 106.1 (NAVD88)	
EXCAVATION CONTRACTOR John Hemmel Excavating Co.	DEPTH 12.5 ft	WATER LEVEL - First 12.25 ft
EQUIPMENT Takeuchi TB260 Excavator	FOREMAN Elizeu	WATER LEVEL - Completion -
		LANGAN PERSONNEL Patrick Lenihan

Symbol	ELEV (feet)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+106.1	Dark brown fine SAND, some silt, some roots (moist) [TOPSOIL] [2 inches thick]	0	S-1	GRAB	Started excavating on 6/9/2020 at 8:55 AM.
	+105.3	Brown f-c SAND, trace silt, trace fine gravel (moist) [FILL]	1	S-2	GRAB	
	+104.8	Gray fine SAND, trace silt, trace coarse gravel (moist) [FILL]	1	S-3	GRAB	
	+104.4	Brown f-c SAND, some silt, some f-c gravel, trace cobbles (moist) [FILL]	2	S-4	GRAB	
	+104.4	Tannish-brown f-c SAND, trace silt (moist)	2	S-5	GRAB	
			3			
	+102.6	Light tannish-brown fine SAND, some silt (moist)	4	S-6	GRAB	
			5			
			6			
	+99.6	Tannish-brown to orangish-brown fine SAND, trace silt (moist)	7	S-7	GRAB	
			8			
			9			
	+96.1	White Silty CLAY interbedded with orangish-brown fine sand (moist)	10	S-8	GRAB	Slow water seepage observed at 10' bsg.
	+95.1	Orangish-brown f-m SAND, some silt, interbedded with white Silty CLAY (moist)	11	S-9	GRAB	
	+94.1	Brown to orangish-brown f-c SAND, trace silt (wet)	12	S-10	GRAB	Groundwater seepage observed at 12.25' bsg.
	+93.6	End of Test Pit at 12.5'	13			
			14			Finished excavating on 6/9/2020 at 9:52 AM. Hole continued collapsing after excavating to 12' bsg. Backfilled with excavated material upon completion.
			15			

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APPENDIX J

Attachment D – Major Development Stormwater Summary

Attachment D – Major Development Stormwater Summary

General Information			
1. Project Name: 1251 Jumping Brook Road			Lot & Block Info:
2. Municipality: Borough of Tinton Falls	County: Monmouth County		Block 128.03, Lot
3. Site Location (State Plane Coordinates – NAD83)	E: 40.226961	N: -74.087327	47
4. Date of Final Approval for Construction by Municipality (MM/DD/YYYY): N/A Date of Certificate of Occupancy (MM/DD/YYYY): N/A			
5. Project Type (place an "x" after all that apply) Residential ☐ Commercial ☐ Industrial ☐ Other (please specify) Delivery Station / Warehouse			
6. Soil Conservation District Project #: 2020-0485			
7. Did the project require a NJDEP Land Use Permit? Yes ☒ No ☐ Land Use Permit #: 1336-04-0013 LUP200001			
8. Did the project require any mitigation measures? Yes ☐ No ☒ If yes, which standard was mitigated?			

Site Design Specifications	
1. Site Area (acres): 50.7	Area of Disturbance (acres): 27.3 Area of Proposed Impervious (acres): 17.19
2. List all Hydrologic Soil Groups: Atsion sand, Downer loam, Evesboro san, Klej Loamy Sand., and Lakewood Sand	
3. Identify the Quantities of Each Type of Best Management Practices (BMPs) Incorporated into the Site Design: Bioretention Systems _____ Constructed Wetlands _____ Dry Wells _____ Extended Detention Basins ⁵ _____ Infiltration Basins _____ Combination Infiltration/Detention Basins _____ Manufactured Treatment Devices ² _____ Pervious Paving Systems _____ Sand Filters _____ Vegetative Filter Strips _____ Wet Ponds _____ Grass Swales _____ Subsurface Gravel Wetlands _____ Other: ² Underground Recharge / Detention Basins	

Storm Event Information	
1. Storm Event – Rainfall (inches) / Duration (hours) 2 year: 3.44 10 year: 5.33 100 year: 9.11	Water Quality Design Storm: ^{1.25}
2. Runoff Computation Method (mark one): NRCS Dimensionless Unit Hydrograph ☐ NRCS Delmarva Unit Hydrograph ☐ Rational Method ☒ Modified Rational Method ☐ Other (describe):	

BMP Specifications (answer all that apply) - If more than one BMP, see reverse side	
1. BMP Name: Basin 1	Type of BMP: Extended Detention Basin
Location (mark one): Surface ☒ Subsurface ☐	Is forebay part of the design? Yes ☐ No ☒
2. Owner (mark one): Public ☐ Private ☒ If private, Owner's Name: W&M Associates, LLC	Owner's Telephone No.: (732) 283-9000
3. BMP Completion Date (MM/DD/YYYY): N/A	
4. Does the BMP have an underdrain? Yes ☐ No ☒	
5. What is the Water Quality Design Storm Drain Down Time (hours)? ²³ What is the Design Soil Permeability (inches/hour): 0.0	
6. What is the Seasonal High Water Table Depth from the BMP bottom (feet)? ³ Month Obtained: April	
7. Groundwater Recharge Methodology (mark one): 2-Year Difference ☐ NJGRS ☐ Other ☐ N/A ☒	
8. Was Groundwater Mounding analyzed? Yes ☐ No ☒ If yes, Methodology:	
9. Was a Maintenance Plan submitted? Yes ☒ No ☐ Is the BMP deed restricted? Yes ☐ No ☒	

Name of Person Completing This Form: Richard Burrow
Title: Managing Principal, Langan Engineering

Signature: _____
Date: 9/18/2020

Comments: _____

BMP Specifications (answer all that apply) – Attach more pages if necessary

1. BMP Name: <u>Basin 2</u>		Type of BMP: <u>Extended Detention Basin</u>	
Location (mark one): Surface ☒ Subsurface ☐		Is forebay part of the design? Yes ☐ No ☒	
2. Owner (mark one): Public ☐ Private ☒			
If private, Owner's Name: <u>W&M Associates, LLC</u>		Owner's Telephone No.: <u>(732) 283-9000</u>	
3. BMP Completion Date (MM/DD/YYYY): <u>N/A</u>			
4. Does the BMP have an underdrain? Yes ☐ No ☒			
5. What is the Water Quality Design Storm Drain Down Time (hours)? ⁷⁰ _____ What is the Design Soil Permeability (inches/hour): ^{0.4} _____			
6. What is the Seasonal High Water Table Depth from the BMP bottom (feet)? ^{3.5} _____ Month Obtained: <u>April</u>			
7. Groundwater Recharge Methodology (mark one): 2-Year Difference ☐ NJGRS ☐ Other ☐ N/A ☒			
8. Was Groundwater Mounding analyzed? Yes ☐ No ☒ If yes, Methodology: _____			
9. Was a Maintenance Plan submitted? Yes ☒ No ☐ Is the BMP deed restricted? Yes ☐ No ☒			

BMP Specifications (answer all that apply) - Attach more pages if necessary

1. BMP Name: <u>Basin 3</u>		Type of BMP: <u>Extended Detention Basin</u>	
Location (mark one): Surface ☒ Subsurface ☐		Is forebay part of the design? Yes ☐ No ☒	
2. Owner (mark one): Public ☐ Private ☒			
If private, Owner's Name: <u>W&M Associates, LLC</u>		Owner's Telephone No.: <u>(732) 283-9000</u>	
3. BMP Completion Date (MM/DD/YYYY): <u>N/A</u>			
4. Does the BMP have an underdrain? Yes ☐ No ☒			
5. What is the Water Quality Design Storm Drain Down Time (hours)? ⁷² _____ What is the Design Soil Permeability (inches/hour): ^{1.8} _____			
6. What is the Seasonal High Water Table Depth from the BMP bottom (feet)? ¹ _____ Month Obtained: <u>April</u>			
7. Groundwater Recharge Methodology (mark one): 2-Year Difference ☐ NJGRS ☐ Other ☐ N/A ☒			
8. Was Groundwater Mounding analyzed? Yes ☐ No ☒ If yes, Methodology: _____			
9. Was a Maintenance Plan submitted? Yes ☒ No ☐ Is the BMP deed restricted? Yes ☐ No ☒			

BMP Specifications (answer all that apply) - Attach more pages if necessary

1. BMP Name: <u>Basin 4</u>		Type of BMP: <u>Extended Detention Basin</u>	
Location (mark one): Surface ☒ Subsurface ☐		Is forebay part of the design? Yes ☐ No ☒	
2. Owner (mark one): Public ☐ Private ☐			
If private, Owner's Name: <u>W&M Associates, LLC</u>		Owner's Telephone No.: <u>(732) 283-9000</u>	
3. BMP Completion Date (MM/DD/YYYY): <u>N/A</u>			
4. Does the BMP have an underdrain? Yes ☐ No ☒			
5. What is the Water Quality Design Storm Drain Down Time (hours)? ⁵² _____ What is the Design Soil Permeability (inches/hour): ^{0.1} _____			
6. What is the Seasonal High Water Table Depth from the BMP bottom (feet)? ⁵ _____ Month Obtained: <u>April</u>			
7. Groundwater Recharge Methodology (mark one): 2-Year Difference ☐ NJGRS ☐ Other ☐ N/A ☒			
8. Was Groundwater Mounding analyzed? Yes ☐ No ☒ If yes, Methodology: _____			
9. Was a Maintenance Plan submitted? Yes ☒ No ☐ Is the BMP deed restricted? Yes ☐ No ☒			

Name of Person Completing This Form: Richard Burrow

Signature: _____

Title: Managing Principal, Langan Engineering

Date: 9/18/2020

Comments: _____

BMP Specifications (answer all that apply) – Attach more pages if necessary

1. BMP Name: <u>Basin 5</u>		Type of BMP: <u>Extended Detention Basin</u>	
Location (mark one): Surface ☐ Subsurface ☒		Is forebay part of the design? Yes ☐ No ☒	
2. Owner (mark one): Public ☐ Private ☒			
If private, Owner's Name: <u>W&M Associates, LLC</u>		Owner's Telephone No.: <u>(732) 283-9000</u>	
3. BMP Completion Date (MM/DD/YYYY): <u>N/A</u>			
4. Does the BMP have an underdrain? Yes ☐ No ☒			
5. What is the Water Quality Design Storm Drain Down Time (hours)? ²³ _____ What is the Design Soil Permeability (inches/hour): <u>0.2</u>			
6. What is the Seasonal High Water Table Depth from the BMP bottom (feet)? <u>< 1 FT, liner proposed</u> Month Obtained: <u>April</u>			
7. Groundwater Recharge Methodology (mark one): 2-Year Difference ☐ NJGRS ☐ Other ☐ N/A ☒			
8. Was Groundwater Mounding analyzed? Yes ☐ No ☒ If yes, Methodology: _____			
9. Was a Maintenance Plan submitted? Yes ☒ No ☐ Is the BMP deed restricted? Yes ☐ No ☒			

BMP Specifications (answer all that apply) - Attach more pages if necessary

1. BMP Name: <u>Underground Recharge / Detention Basins (West)</u>		Type of BMP: <u>Extended Detention Basin</u>	
Location (mark one): Surface ☐ Subsurface ☒		Is forebay part of the design? Yes ☐ No ☒	
2. Owner (mark one): Public ☐ Private ☒			
If private, Owner's Name: <u>W&M Associates, LLC</u>		Owner's Telephone No.: <u>(732) 283-9000</u>	
3. BMP Completion Date (MM/DD/YYYY): <u>N/A</u>			
4. Does the BMP have an underdrain? Yes ☒ No ☐			
5. What is the Water Quality Design Storm Drain Down Time (hours)? ^{0.65} _____ What is the Design Soil Permeability (inches/hour): <u>8.8</u>			
6. What is the Seasonal High Water Table Depth from the BMP bottom (feet)? <u>4.9</u> Month Obtained: <u>May</u>			
7. Groundwater Recharge Methodology (mark one): 2-Year Difference ☐ NJGRS ☒ Other ☐ N/A ☐			
8. Was Groundwater Mounding analyzed? Yes ☐ No ☒ If yes, Methodology: _____			
9. Was a Maintenance Plan submitted? Yes ☒ No ☐ Is the BMP deed restricted? Yes ☐ No ☒			

BMP Specifications (answer all that apply) - Attach more pages if necessary

1. BMP Name: <u>Underground Recharge / Detention Basins (East)</u>		Type of BMP: <u>Extended Detention Basin</u>	
Location (mark one): Surface ☐ Subsurface ☒		Is forebay part of the design? Yes ☐ No ☒	
2. Owner (mark one): Public ☐ Private ☒			
If private, Owner's Name: <u>W&M Associates, LLC</u>		Owner's Telephone No.: <u>(732) 283-9000</u>	
3. BMP Completion Date (MM/DD/YYYY): <u>N/A</u>			
4. Does the BMP have an underdrain? Yes ☒ No ☐			
5. What is the Water Quality Design Storm Drain Down Time (hours)? ^{0.48} _____ What is the Design Soil Permeability (inches/hour): <u>0.9</u>			
6. What is the Seasonal High Water Table Depth from the BMP bottom (feet)? <u>8.2</u> Month Obtained: <u>May</u>			
7. Groundwater Recharge Methodology (mark one): 2-Year Difference ☐ NJGRS ☒ Other ☐ N/A ☐			
8. Was Groundwater Mounding analyzed? Yes ☐ No ☒ If yes, Methodology: _____			
9. Was a Maintenance Plan submitted? Yes ☒ No ☐ Is the BMP deed restricted? Yes ☐ No ☒			

Name of Person Completing This Form: Richard Burrow

Signature: _____

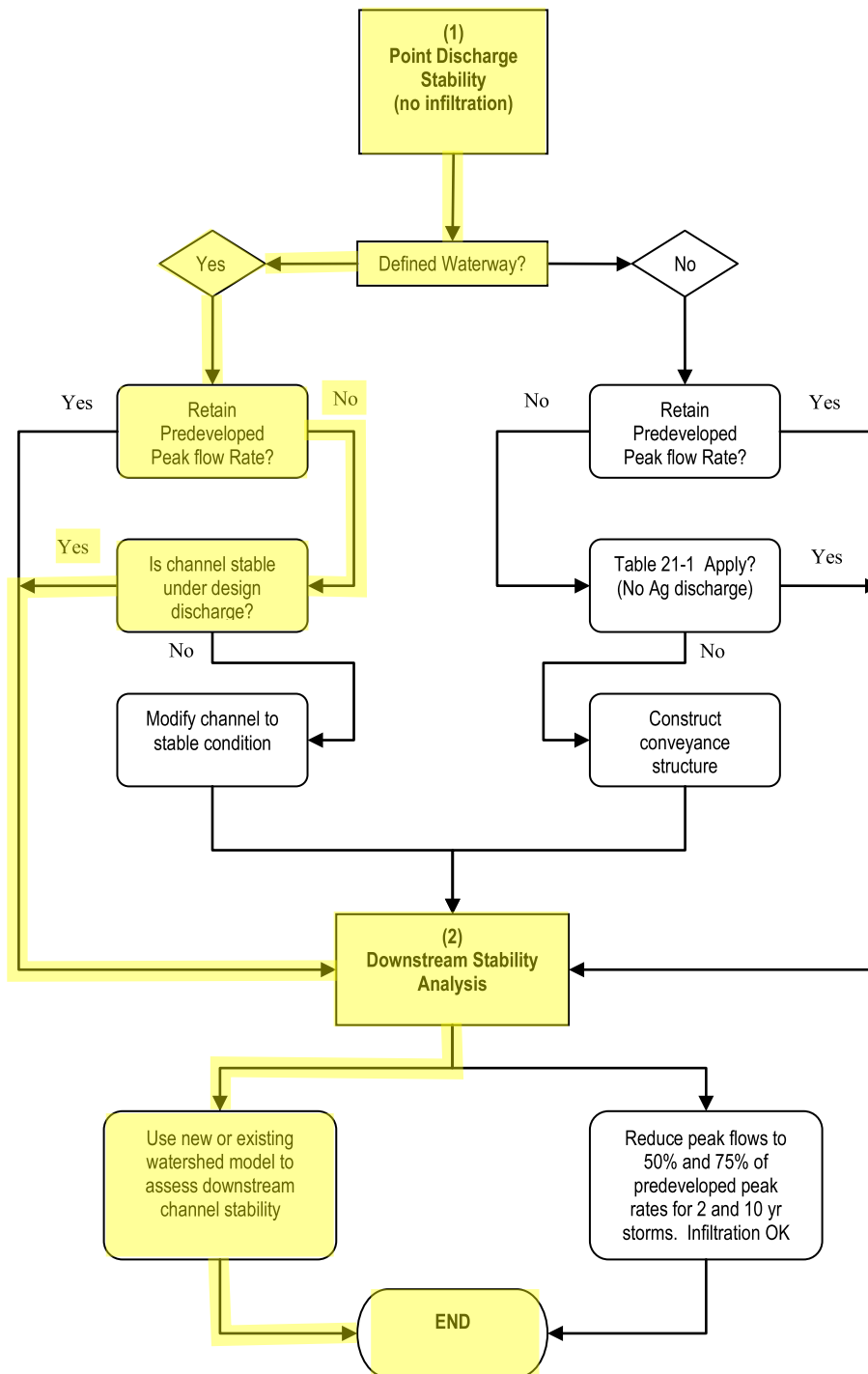
Title: Managing Principal, Langan Engineering

Date: 9/18/2020

APPENDIX K

Downstream Stability Analysis

Figure 21-1
Point Discharge and Downstream Stability Analysis Procedure



DOWNSTREAM (OFF-SITE) STABILITY ANALYSIS

1251 JUMPING BROOK ROAD

100775501

1/4/2021

1. POINT OF DISCHARGE STABILITY

Well-defined waterway below the point of discharge= **Yes**

Outfalls HW-101, HW-201, HW-401, and HW-501 discharge into well-defined waterways / wetlands.

Retain predevelopment peak flow rate = **No**

Peak flow rate reductions were applied per watershed basis. Predevelopment peak flow rate for each outflow was not reduced.

Channel stable under design discharge = **Yes**

Analyze the waterway or channel for stability under the Standard for Channel Stabilization or Grassed Waterways.

Outfall	Direct Discharge Into Defined Waterway	Velocity (ft/sec) 10-Yr	Non-Erosive Velocity	Compliant
HW-101	YES	0.95	YES	YES
HW-201	YES	0.63	YES	YES
HW-401	YES	0.45	YES	YES
HW-501	YES	0.89	YES	YES

Table 11-1
Allowable velocity for various soil textures

SOIL TEXTURE	ALLOWABLE VELOCITY ft./sec.
Sand	1.8
Sandy loam	2.5
Silt loam, loam	3.0
Sandy clay loam	3.5
Clay loam	4.0
Clay, fine gravel, graded loam to gravel	5.0
Cobbles	5.5
Shale (non weathered shale)	6.0

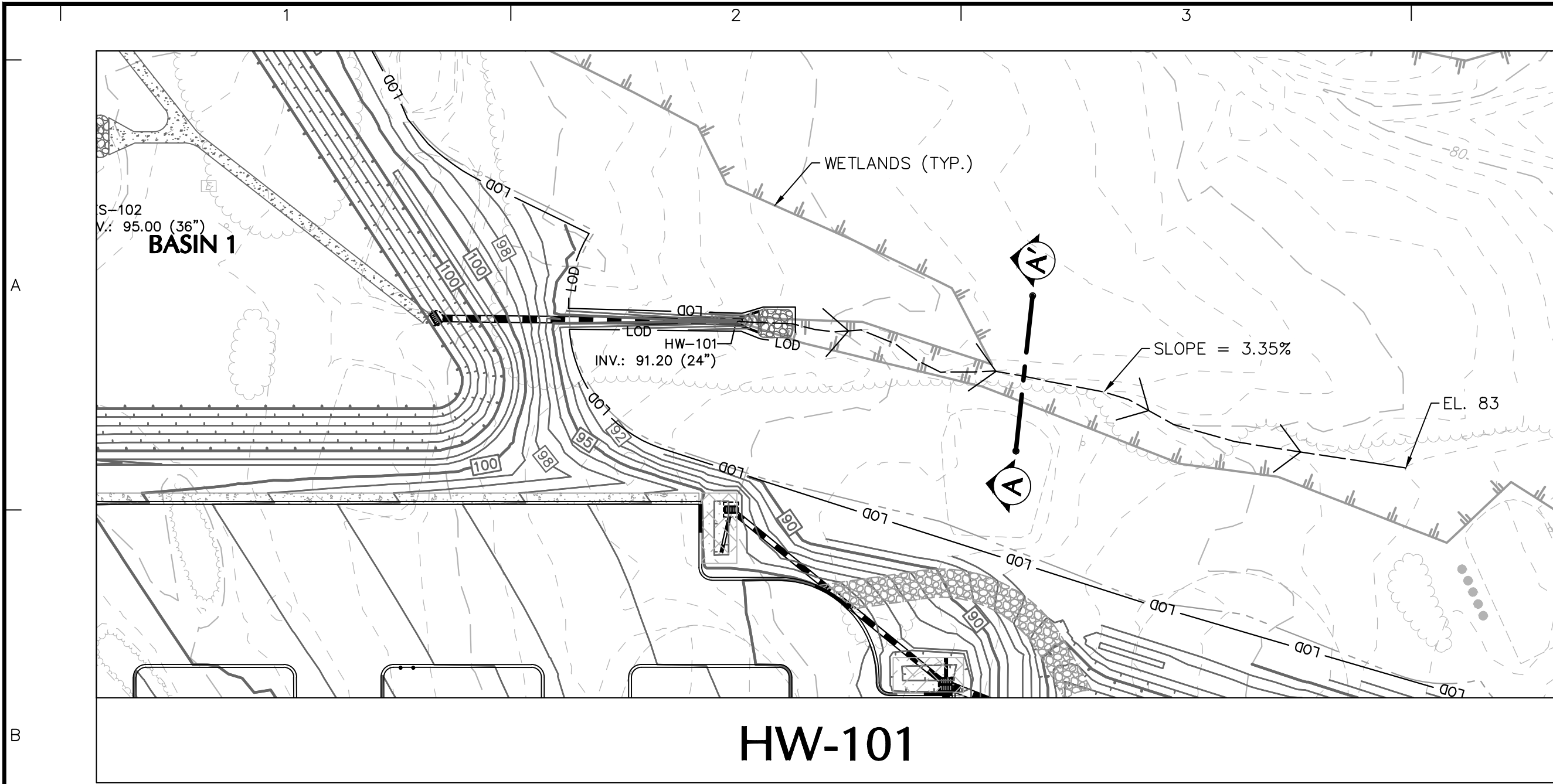
2. DOWNSTREAM STABILITY ANALYSIS

Outlet protection provided = **Yes**

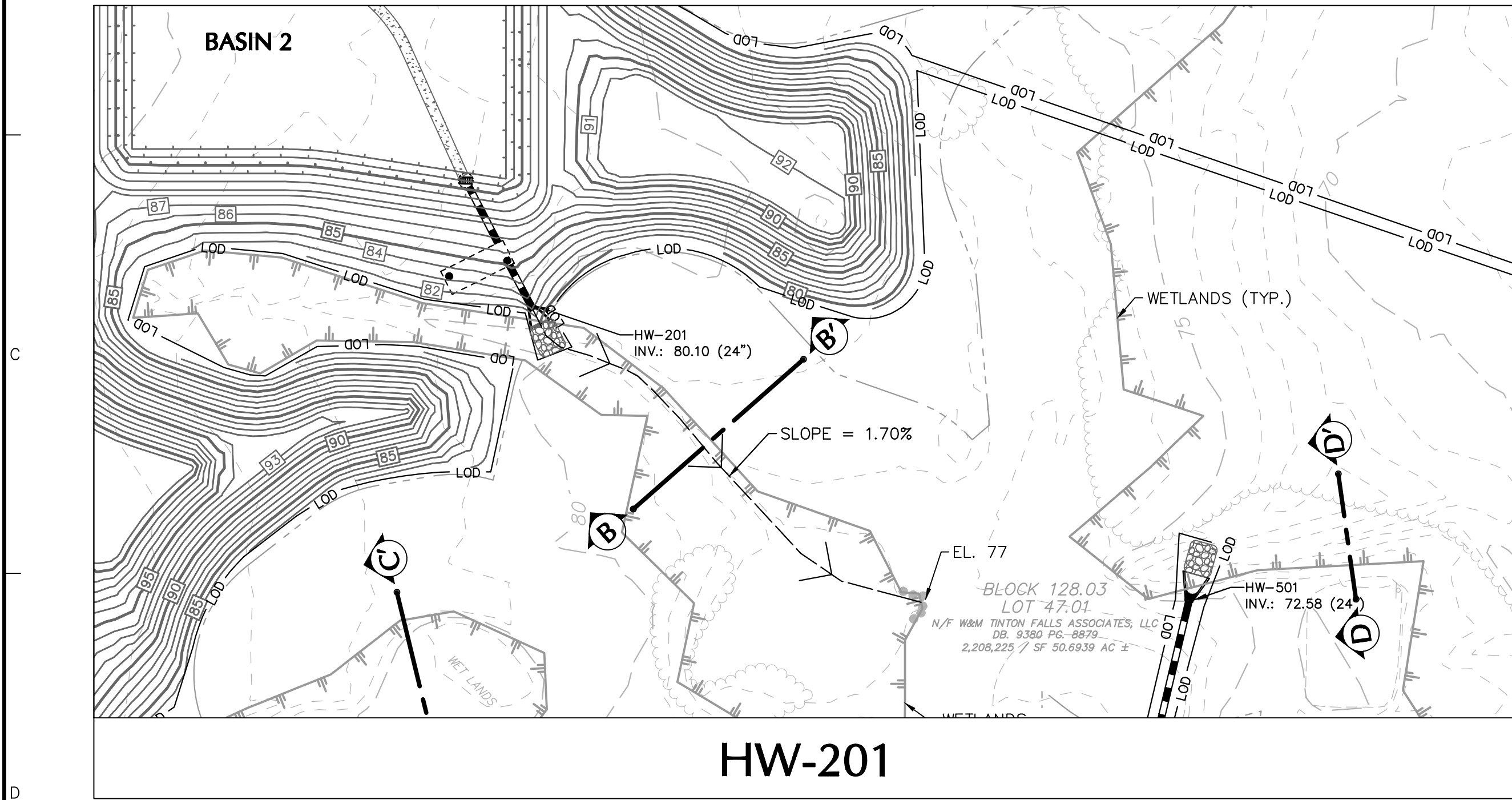
Outlet protection provided at each headwall and flared end section.

Use new or existing watershed model to assess downstream stability **Yes**

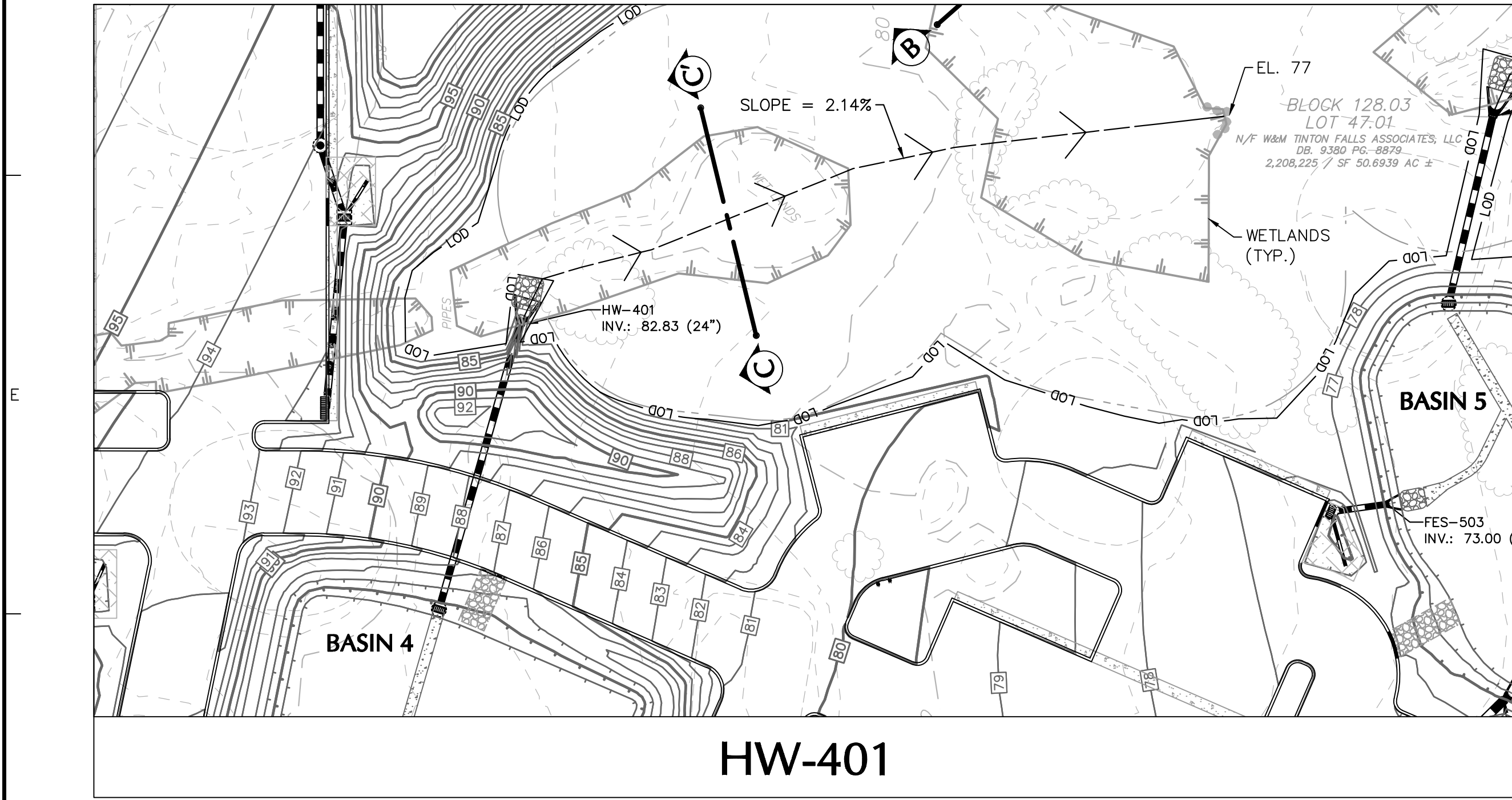
Analyzed existing and proposed watersheds draining to the wetlands area. Reduced watershed peak flows to 50% and 75% of predeveloped peak rate for 2 and 10-yr storms.



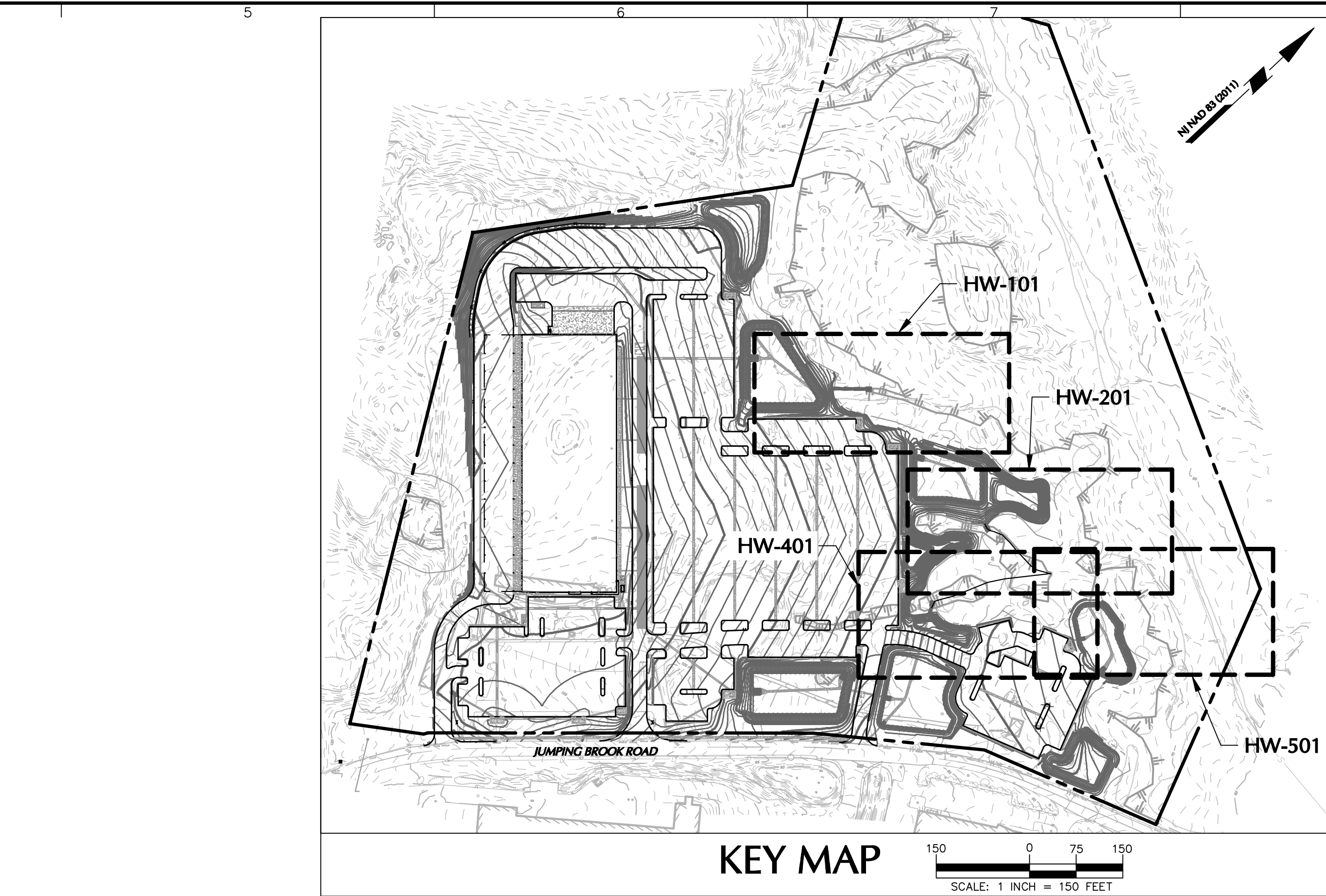
HW-101



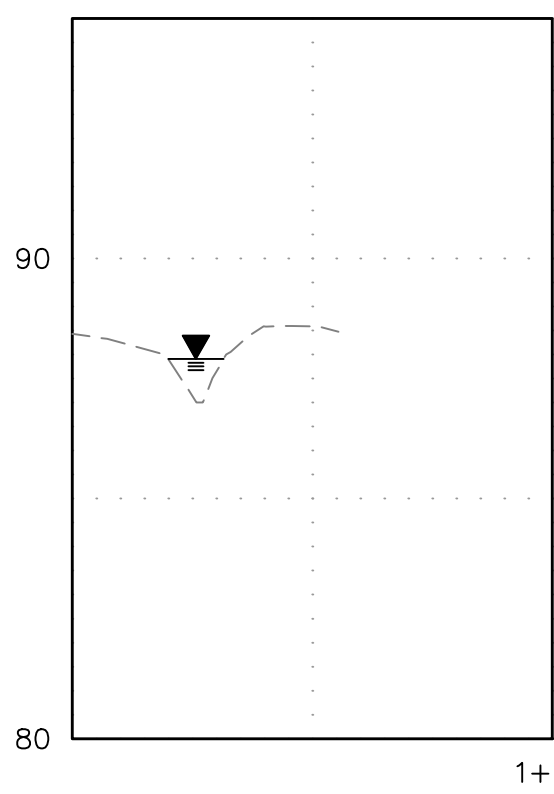
HW-201



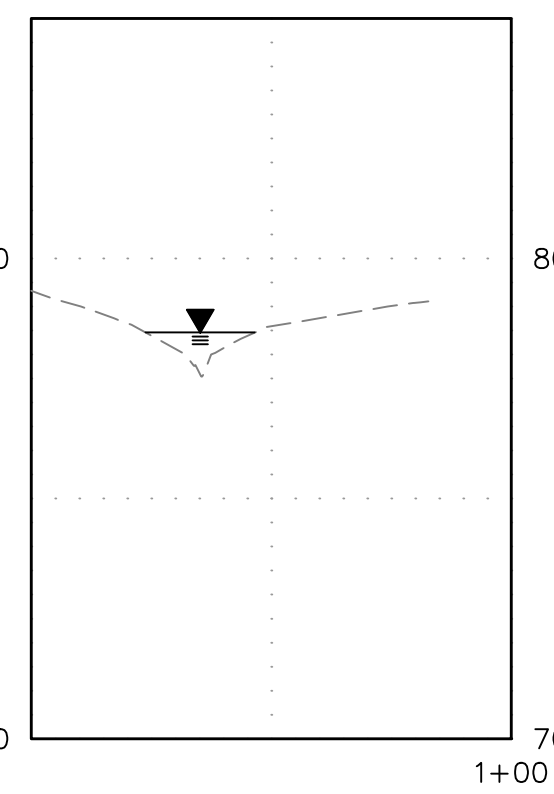
HW-401



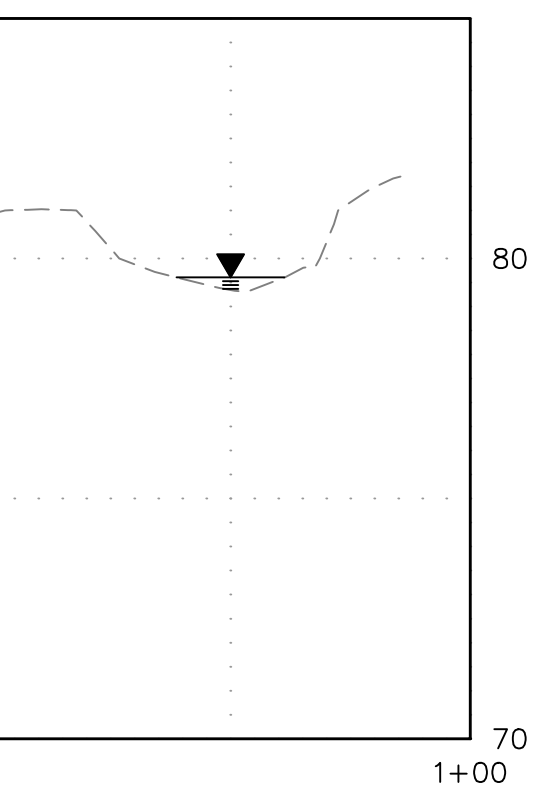
KEY MAP



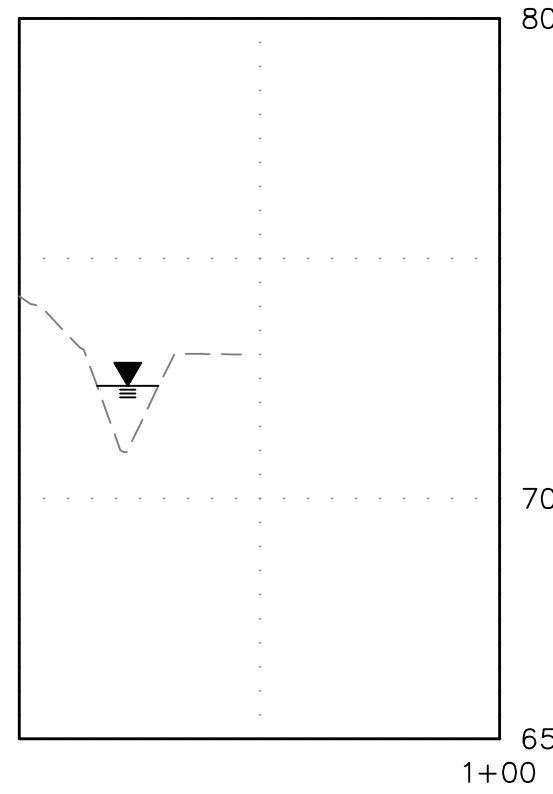
A-A' PROFILE



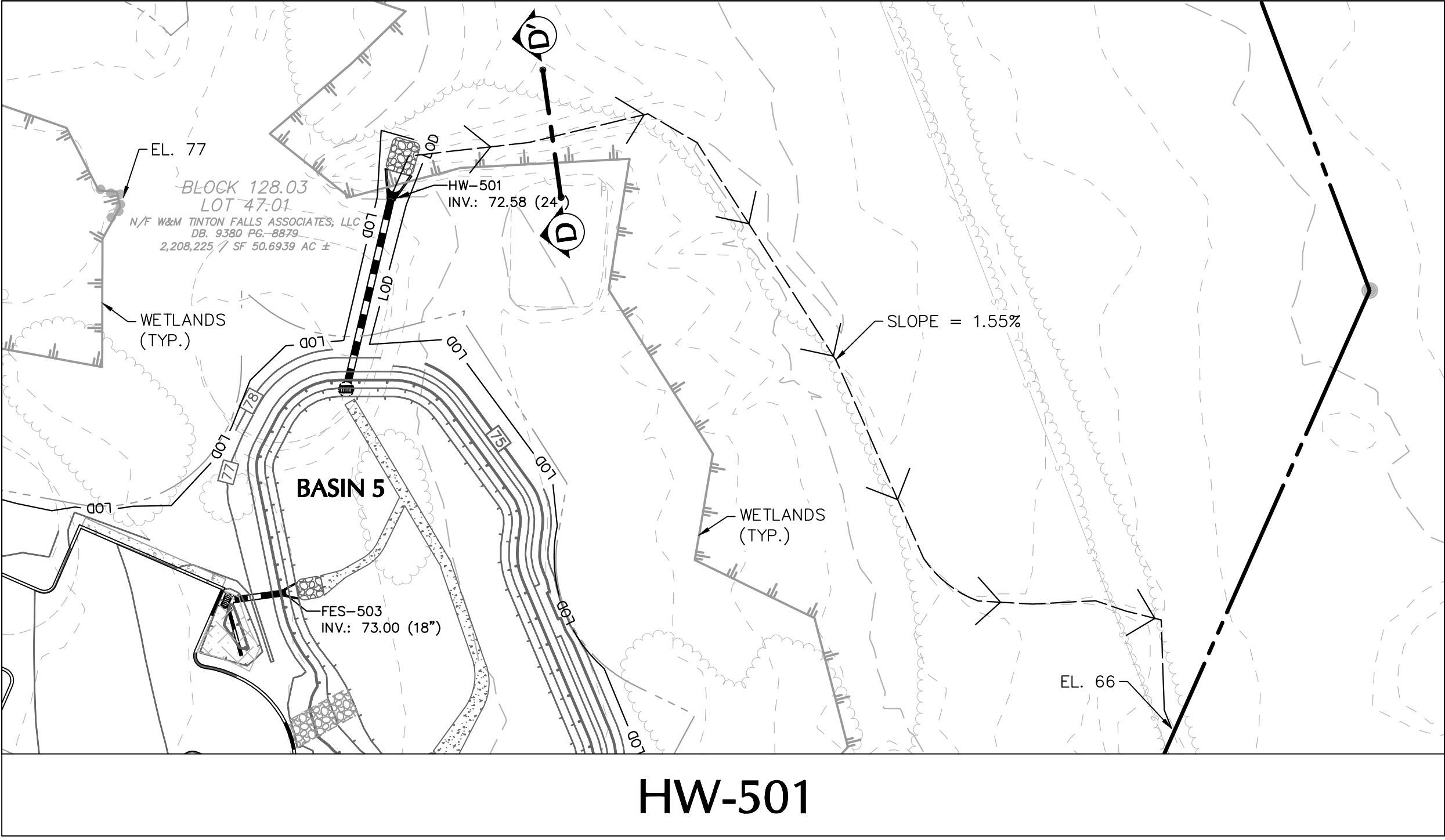
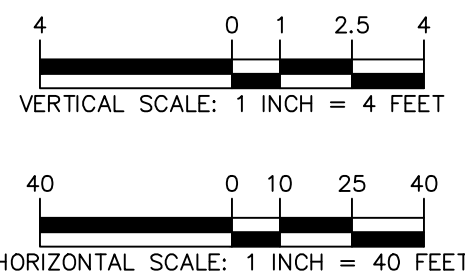
B-B' PROFILE



C-C' PROFILE



D-D' PROFILE



HW-501

NOTES:
1. BOUNDARY INFORMATION AND EXISTING FEATURES FOR BLOCK 128.03, LOTS 47 SHOWN HEREON ARE BASED ON "ALTA/NSPS LAND TITLE SURVEY" DATED 08/24/2020 PREPARED BY LANGAN ENGINEERING. THE CONTRACTOR SHALL VERIFY ALL INFORMATION TO HIS SATISFACTION PRIOR TO THE EXECUTION OF CONTRACTS OR COMMENCING WORK. ANY DISCREPANCIES SHALL BE IMMEDIATELY REPORTED TO THE ENGINEER OF RECORD.
2. ALL ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LANGAN
Langan Engineering, Environmental, Surveying,
Landscape Architecture and Geology, D.P.C.
300 Kimball Drive
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NJ CERTIFICATE OF AUTHORIZATION No. 24GA2796400

Project

**1251 JUMPING
BROOK ROAD**

BOROUGH OF TINTON FALLS
BLOCK 128.03, LOT 47

MONMOUTH COUNTY NEW JERSEY

Drawing Title

**DOWNSTREAM
STABILITY PLAN**

Project No. Drawing No.

100775501

Date

01/04/2021

Drawn By

RY

Checked By

RB

FIG-1

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Tuesday, Jan 5 2021

Downstream of Basin 1 (A-A')

Trapezoidal

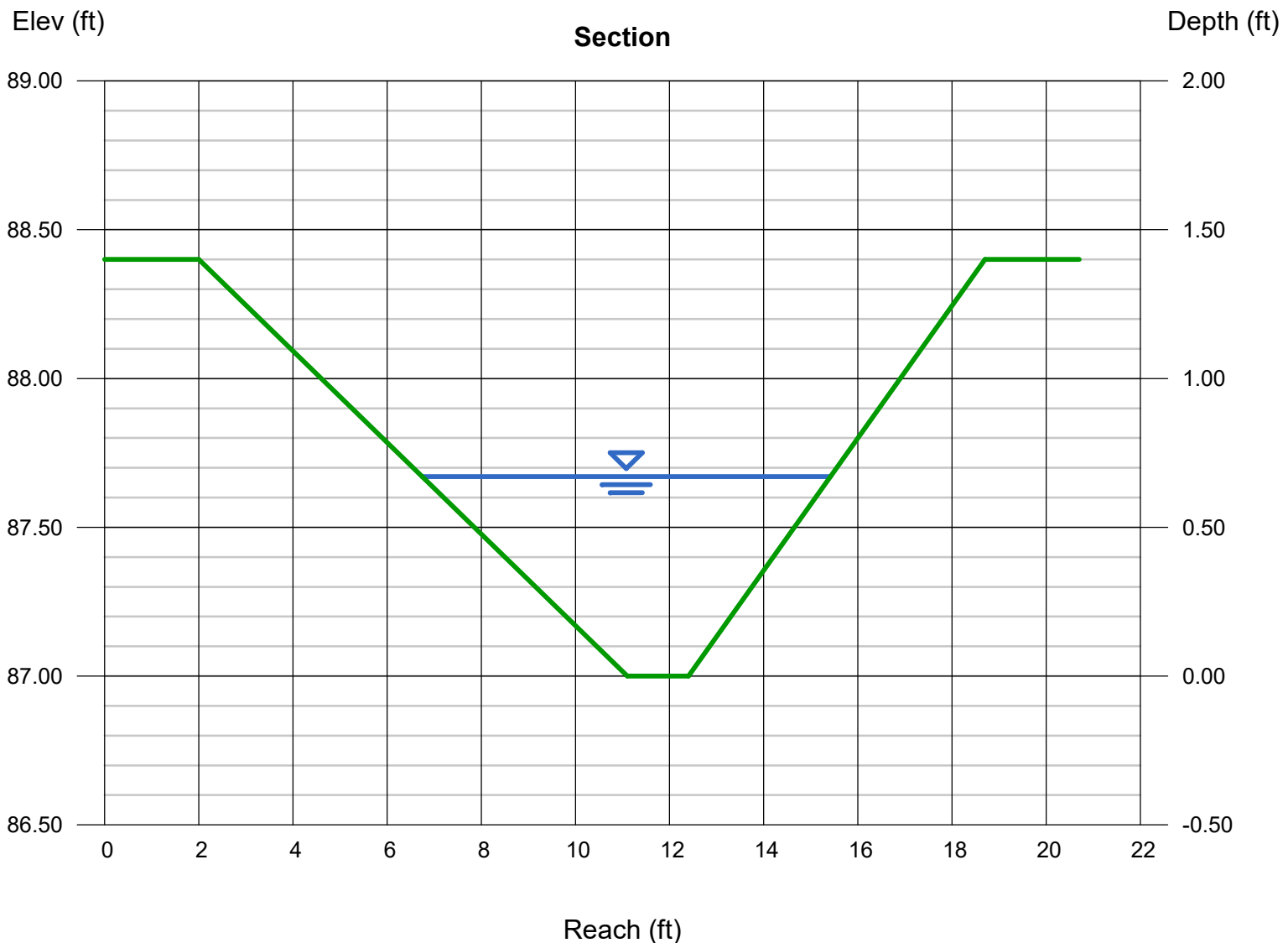
Bottom Width (ft) = 1.30
Side Slopes (z:1) = 6.50, 4.50
Total Depth (ft) = 1.40
Invert Elev (ft) = 87.00
Slope (%) = 3.35
N-Value = 0.150

Highlighted

Depth (ft) = 0.67
Q (cfs) = 3.160
Area (sqft) = 3.34
Velocity (ft/s) = 0.95
Wetted Perim (ft) = 8.79
Crit Depth, Yc (ft) = 0.36
Top Width (ft) = 8.67
EGL (ft) = 0.68

Calculations

Compute by: Known Q
Known Q (cfs) = 3.16



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Tuesday, Jan 5 2021

Downstream of Basin 2 (B-B')

Trapezoidal

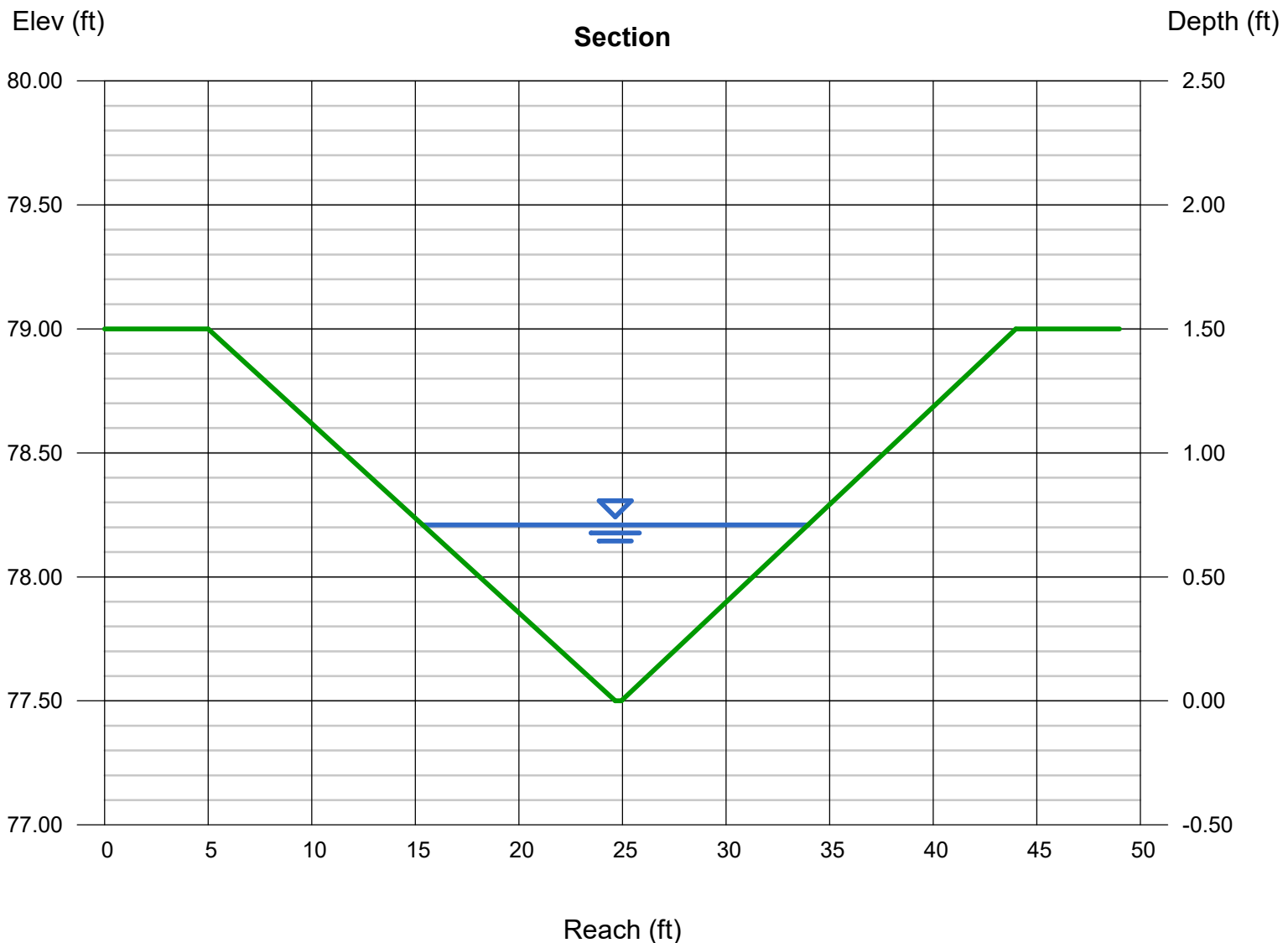
Bottom Width (ft) = 0.30
Side Slopes (z:1) = 13.10, 12.69
Total Depth (ft) = 1.50
Invert Elev (ft) = 77.50
Slope (%) = 1.70
N-Value = 0.150

Highlighted

Depth (ft) = 0.71
Q (cfs) = 4.260
Area (sqft) = 6.71
Velocity (ft/s) = 0.63
Wetted Perim (ft) = 18.67
Crit Depth, Yc (ft) = 0.36
Top Width (ft) = 18.61
EGL (ft) = 0.72

Calculations

Compute by: Known Q
Known Q (cfs) = 4.26



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Tuesday, Jan 5 2021

Downstream of Basin 4 (C-C')

Trapezoidal

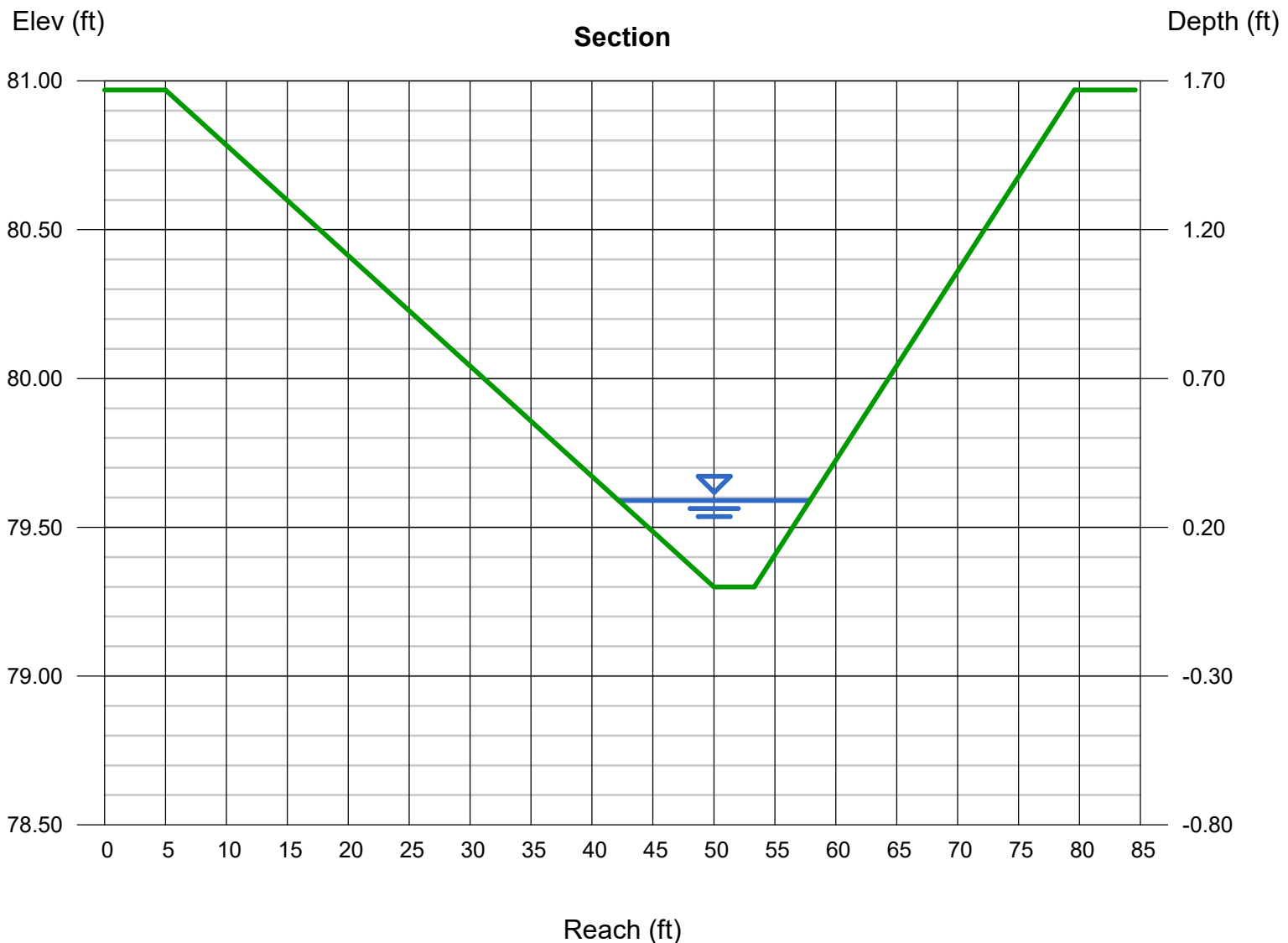
Bottom Width (ft) = 3.30
Side Slopes (z:1) = 26.95, 15.73
Total Depth (ft) = 1.67
Invert Elev (ft) = 79.30
Slope (%) = 2.14
N-Value = 0.150

Highlighted

Depth (ft) = 0.29
Q (cfs) = 1.240
Area (sqft) = 2.75
Velocity (ft/s) = 0.45
Wetted Perim (ft) = 15.69
Crit Depth, Yc (ft) = 0.13
Top Width (ft) = 15.68
EGL (ft) = 0.29

Calculations

Compute by: Known Q
Known Q (cfs) = 1.24



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Tuesday, Jan 5 2021

Downstream of Basin 5 (D-D')

Trapezoidal

Bottom Width (ft) = 1.98
Side Slopes (z:1) = 3.59, 4.17
Total Depth (ft) = 2.04
Invert Elev (ft) = 71.00
Slope (%) = 1.55
N-Value = 0.150

Highlighted

Depth (ft) = 1.07
Q (cfs) = 5.830
Area (sqft) = 6.56
Velocity (ft/s) = 0.89
Wetted Perim (ft) = 10.56
Crit Depth, Yc (ft) = 0.48
Top Width (ft) = 10.28
EGL (ft) = 1.08

Calculations

Compute by: Known Q
Known Q (cfs) = 5.83

