

PRELIMINARY STORMWATER  
MANAGEMENT REPORT

for

**STOKES ESTATE**

Residential Development  
Westtown Township  
Chester County, Pennsylvania

April 29, 2021

D.L. Howell Job# 3868

Prepared for:

Keystone Custom Homes  
227 Granite Run Drive, Suite 100  
Lancaster, PA 17601

Prepared by:  
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## **1.0 INTRODUCTION**

This Stormwater Management Report presents the preliminary permanent control measures/facilities required to support construction activities for the Stokes Estate Residential Development . The 65 +/--acre tract is located in Westtown Township (Figure 1-1).

The proposed land development consists of constructing 63 residential dwelling units, access roads, stormwater management facilities, and public utilities. One access point to the parcel will be off Shiloh Road, with a second access through an existing right of way to Shiloh Hill Drive. The buildings and roads will be constructed to comply with design standards and safety requirements of the Townships and local Fire Marshals.

## **1.1 LAND USE**

The existing land is currently utilized for agriculture, with a few hedgerows and mature trees scattered throughout, mostly along the existing driveway and near the existing residence and out buildings. The site generally drains to two separate water bodies, where the southern portion of the property drains to an Unnamed Tributary to the East Branch of Chester Creek that flows through the property, and the eastern end of the site drains directly to the East Branch of Chester Creek, also on the property. Therefore, the entire site is located in the Chester Creek watershed. Per Pennsylvania Department of Environmental Protection, 25 Pa. Code, 93.9g "Water Quality Standards" Chester Creek is classified as Trout Stocking Fishery (TSF).

## **1.2 SITE SOILS**

Site soils mapping provided by the United States Department of Agriculture Natural Resources Conservation Service – Web Soil Survey. According to the Web Soil Survey mapping, the following soil types are located within the project study area;

Baile Silt Loam (Ba)  
Codorus Silt Loam (Co)  
Gladstone Gravelly Loam (GdB) (GdC) (GfD)  
Hatboro Silt Loam (Ha)  
Manor Loam (MaD)  
Urban land – Gladstone complex, 0 to 8 percent

Refer to Appendix E for Soils Map and report.

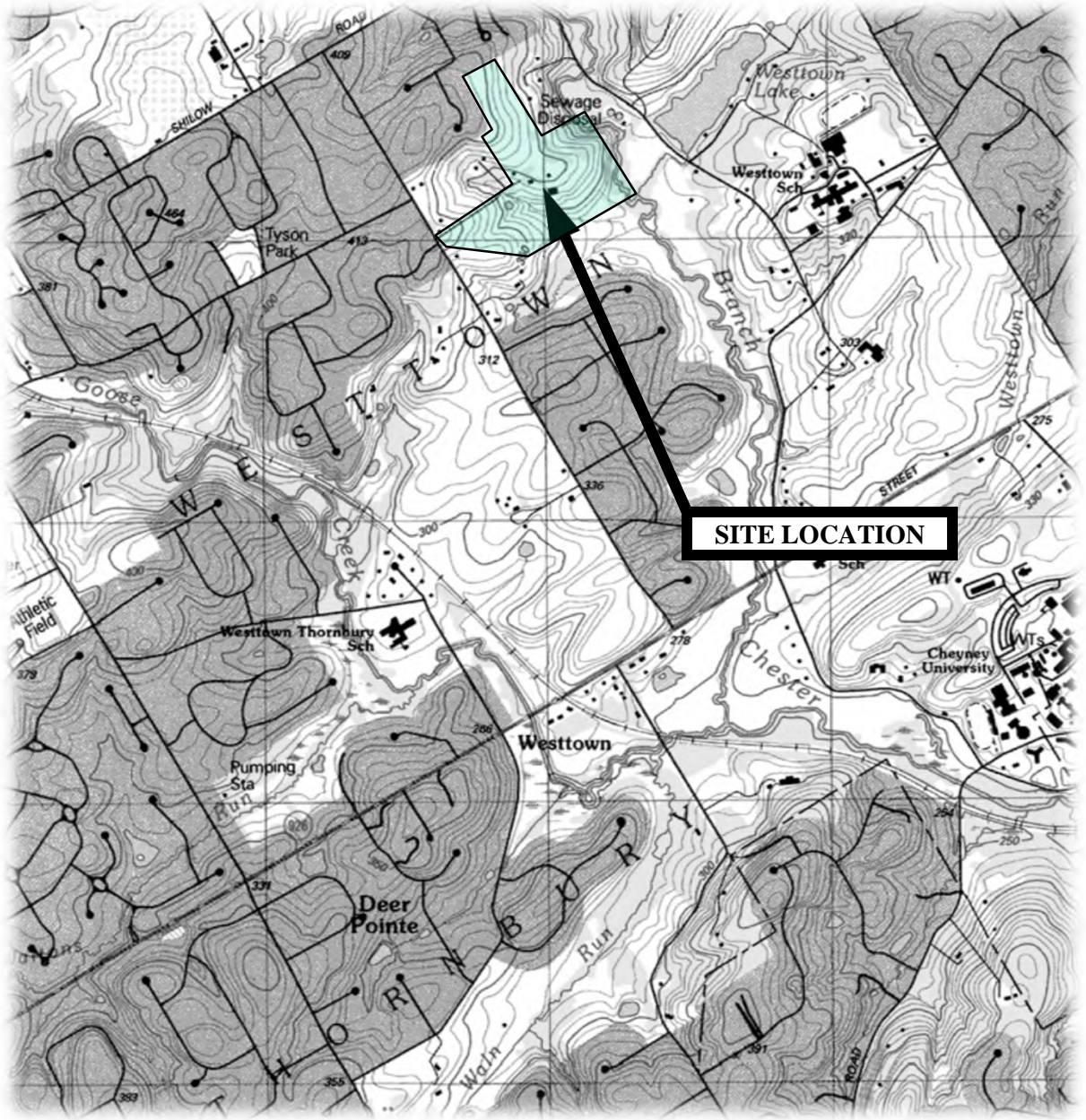
### 1.3 SOIL/GEOLOGIC LIMITATIONS:

Some groundwater and rock were encountered in a few locations during infiltration testing. D.L. Howell has taken into consideration these known soil limitations when designing the infiltration BMPs for the project. The stormwater infiltration facilities have either been relocated to areas where limiting areas weren't encountered or has been set a minimum of 2 feet higher than any prohibitive soil limitation elevations witnessed during infiltration testing and adequate infiltration results have been achieved at the adjusted elevations.

If during construction, any other unknown soil limitation (i.e. bedrock or high water) is discovered the contractor is responsible for immediately contacting the site geo-technical engineer, design engineer, conservation district and the township engineer for an appropriate solution. The site design drawings contain a pumped water filter bag detail which should be utilized if any excavations need to be dewatered due to high groundwater or excessive rainfall.

#### **Geologic formations/soil conditions that may have the potential to cause pollution:**

Furthermore, there are no known geologic formations or soil conditions that have the potential to cause pollution during earth disturbance activities. If during construction, an unknown geologic formations or soil conditions is discovered the contractor is responsible for immediately contacting the Chester County Conservation District and the design engineer.



Source:  
 United States Department of the Interior Geological Survey  
 7.5 Minute Series (Topographic) Map  
 West Chester, Pennsylvania Quadrangle  
 Scale 1:24000



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Stokes Estate  
 Westtown Township  
 Chester County, Pennsylvania

Figure Number:  
**FIGURE 1-1**

Title:  
**SITE LOCATION MAP**

## 2.0 RUNOFF MANAGEMENT

The purpose of the stormwater management design is to quantify and control stormwater runoff generated by the modifications of the ground surface conditions to the site (i.e. roads, buildings, driveways, etc.). Post-development stormwater management is achieved at the site through three combination surface infiltration basins strategically located throughout the site to control runoff.

The infiltration basins have been designed utilizing Soil Conservation Service (SCS) method for infiltration and peak flow requirements and Westtown Township regulations for peak flow calculations (See Appendices for worksheets). The stormwater management control for this project was designed to include all impervious surfaces associated with this subdivision application, with an assumption of 3,800 SF of impervious coverage per single family lot. These systems are designed to provide an overall reduction in the post-developed runoff for the 2-year, 10-year, 25-year, 50-year, and 100-year, 24-hour storm event to less than 50% of the pre-development runoff rates for the equivalent storm events based on the Chester Creek Watershed Release Rate Map. A stormwater conveyance system will be utilized to convey runoff from the proposed improvements to the proposed stormwater facilities. The stormwater conveyance system will be designed to convey flows up to the 100-year storm event. Flows to the pipes will be generated using the Universal Rational Method and the pipes sized using Manning's Method and Hydraulic Grade Line calculations will also be provided. The infiltration basins have been designed and sized to fully infiltrate the increase in volume, pre to post-development for the 2-year storm as required by the NPDES Phase II regulations.

## 3.0 NPDES STORMWATER COMPLIANCE

As stated above, the infiltration facilities have been designed and sized to fully infiltrate the 2-year increase in volume; therefore the NPDES Phase II infiltration requirement has been met. Furthermore, as described above, the infiltration basins have been designed to incorporate Pennsylvania Department of Environmental Protection's infiltration guidelines, as stated in Appendix C of the Pennsylvania Stormwater Best Management Practices Manual dated December 2006. The stormwater management systems have been designed to maximize infiltration best management practice (BMP) technologies and minimize point source discharges. This plan will further act to perform/provide the following:

- Preserve the integrity of stream channels and maintain and protect the physical, biological and chemical qualities of the receiving stream by utilizing several BMPs to handle the increase in runoff and volume prior to reaching the stream.
- Prevent an increase in the rate of stormwater runoff by utilizing BMPs to reduce the peak flow rate of all storm events up to the 100 year to below the equivalent storm in the pre developed condition.
- Minimize any increase in stormwater runoff volume by utilizing infiltration BMPs which are designed and sized to fully infiltrate the 2-year increase in volume.
- Minimize impervious areas
- Maximize the protection of existing drainage features and existing vegetation by capturing stormwater runoff from the proposed impervious areas then conveying the flow to stormwater BMPs facilities prior to any release to the existing stream, thereby protecting it from any sediment.
- Minimize land clearing and grading by protecting and preserving the majority of the existing woodlands, and natural areas.
- Minimize soil compaction by specifying the installation of orange construction fencing to protect the areas of the proposed infiltration BMPs.
- Utilize other structural or nonstructural BMPs that prevent or minimize changes in stormwater runoff. The structural BMPs are infiltration beds, and water quality filters, while the non-

structural BMPs are protecting existing riparian buffers, minimizing total disturbed area, and protecting sensitive features.

D.L. Howell & Associates, Inc. has designed Best management Practices (BMP's) consistent with Chapter 6 of the PA Stormwater Best Management Practices Manual within the stormwater collection and conveyance system in addition to infiltrating the net increase in volume from pre to post-development for the 2-year storm event.

**The applicant has been able to demonstrate compliance with 102.8(b), through the use of infiltration.**

Permanent BMP's proposed for the developed site are as follows:

- Vegetated Swales
- Infiltration Basins
- Forebays
- Level Spreaders

#### 4.0 CONCLUSIONS

D.L. Howell & Associates, Inc. has completed a preliminary stormwater engineering design for the proposed project in Westtown Township, Chester County, Pennsylvania. Using site-specific topography, soils, land cover, hydrologic data, and Township Ordinances, D.L. Howell & Associates, Inc. designed the stormwater management system for the proposed facilities. The objective of the stormwater design was to develop site-specific stormwater management structures that reduced post-development runoff to pre-development runoff rates and provided volumetric storage per PADEP NPDES Phase II requirements. Post-development stormwater management is achieved through a stormwater collection system consisting of curbed inlets, swales, catch basins, and stormwater infiltration basins/beds.

## APPENDIX A

### STORMWATER VOLUME CALCULATIONS



## CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

Worksheet 4, Pennsylvania Stormwater Best Management Practices Manual

Chapter 8

**PROJECT:** Stokes Estate  
**Drainage Area:** DP001 Chester Creek  
**2-Year Rainfall:** 3.2 **in**

**Total Site Area:** \_\_\_\_\_ **acres**  
**Protected Site Area:** \_\_\_\_\_ **acres**  
**Managed Area:** 12.64 **acres**

### Existing Conditions

Cover Type/Conditions	Soil Type	Area (sf)	Area (ac)	CN	S	la (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Woodland	A		0.00	25	30.0000	6.0000	0.29	
Meadow	A		0.00	30	23.3333	4.6667	0.10	
Impervious	A		0.00	98	0.20	0.04	2.97	
Woodland	B		0.00	55	8.1818	1.6364	0.25	
Meadow	B	634,765	14.57	58	7.2414	1.4483	0.34	18,049
Meadow (20% Imperv)	B		0.00	58	7.2414	1.4483	0.34	
Impervious (80%)	B		0.00	98	0.2041	0.0408	2.97	
Woodland	C		0.00	70	4.2857	0.8571	0.83	
Meadow	C		0.00	71	4.0845	0.8169	0.88	
Impervious	C		0.00	98	0.2041	0.0408	2.97	
Woodland	D		0.00	77	2.9870	0.5974	1.21	
Meadow	D		0.00	78	2.8205	0.5641	1.27	
Impervious	D		0.00	98	0.2041	0.0408	2.97	
<b>TOTAL:</b>		<b>634,765</b>	<b>14.57</b>					<b>18,049</b>

### Developed Conditions

Cover Type/Conditions	Soil Type	Area (sf)	Area (ac)	CN	S	la (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Lawn	B	305,933	7.02	61	6.3934	1.2787	0.44	11,319
Impervious	N/A	126,095	2.89	98	0.2041	0.0408	2.97	31,182
Meadow	B	118,483	2.72	58	7.2414	1.4483	0.34	3,369
			0.00					
			0.00					
			0.00					
			0.00					
			0.00					
<b>TOTAL:</b>		<b>550,511</b>	<b>12.64</b>					<b>45,870</b>

**2-Year Volume Increase (ft<sup>3</sup>): 27,821**

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) =  $Q = (P - 0.2S)^2 / (P + 0.8S)$

P = 2-Year Rainfall (in)

S =  $(1000/CN) - 10$

2. Runoff Volume (CF) =  $Q \times \text{Area} \times 1/12$

Q = Runoff (in)

Area = Land Use Area (Sq. Ft)

**Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI.**

**The use of a weighted CN value for volume calculations is not acceptable.**

## CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

Worksheet 4, Pennsylvania Stormwater Best Management Practices Manual

Chapter 8

**PROJECT:** Rustin Residential  
**Drainage Area:** DP002 UNT Chester Creek  
**2-Year Rainfall:** 3.2 in

**Total Site Area:** \_\_\_\_\_ acres  
**Protected Site Area:** \_\_\_\_\_ acres  
**Managed Area:** 22.10 acres

### Existing Conditions

Cover Type/Conditions	Soil Type	Area (sf)	Area (ac)	CN	S	la (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Woodland	A		0.00	25	30.0000	6.0000	0.29	
Meadow	A		0.00	30	23.3333	4.6667	0.10	
Impervious	A		0.00	98	0.20	0.04	2.97	
Woodland	B		0.00	55	8.1818	1.6364	0.25	
Meadow	B	790,996	18.16	58	7.2414	1.4483	0.34	22,491
Meadow (20% Imperv)	B		0.00	58	7.2414	1.4483	0.34	
Impervious (80%)	B		0.00	98	0.2041	0.0408	2.97	
Woodland	C		0.00	70	4.2857	0.8571	0.83	
Meadow	C	91,390	2.10	71	4.0845	0.8169	0.88	6,687
Impervious	C		0.00	98	0.2041	0.0408	2.97	
Woodland	D		0.00	77	2.9870	0.5974	1.21	
Meadow	D		0.00	78	2.8205	0.5641	1.27	
Impervious	D		0.00	98	0.2041	0.0408	2.97	
<b>TOTAL:</b>		<b>882,386</b>	<b>20.26</b>					<b>29,179</b>

### Developed Conditions

Cover Type/Conditions	Soil Type	Area (sf)	Area (ac)	CN	S	la (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>2</sup> (ft <sup>3</sup> )
Lawn	C	91,390	2.10	74	3.5135	0.7027	1.04	7,902
Lawn	B	604,001	13.87	61	6.3934	1.2787	0.44	22,346
Impervious	N/A	267,204	6.13	98	0.2041	0.0408	2.97	66,077
			0.00					
			0.00					
			0.00					
			0.00					
			0.00					
<b>TOTAL:</b>		<b>962,595</b>	<b>22.10</b>					<b>96,325</b>

**2-Year Volume Increase (ft<sup>3</sup>): 67,146**

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) =  $Q = (P - 0.2S)^2 / (P + 0.8S)$

P = 2-Year Rainfall (in)

S =  $(1000/CN) - 10$

2. Runoff Volume (CF) =  $Q \times \text{Area} \times 1/12$

Q = Runoff (in)

Area = Land Use Area (Sq. Ft)

**Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.**

**STRUCTURAL BMP VOLUME CREDITS**

Worksheet 5, Pennsylvania Stormwater Best Management Practices Manual

Chapter 8

**PROJECT:** Stokes Estate  
**Sub-Basin** Chester Creek DP001

**Required Control Volume** 27,821 **Cubic Feet**  
**Non-Structural Volume Credit** 0 **Cubic Feet**  
**Structure Volume Requirement** 27,821 **Cubic Feet**

Section	Proposed BMP	Area (sf)	Storage Volume (ft <sup>3</sup> )
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		28,109
6.4.3	Infiltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretenion		
6.4.6	Dry Well/Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Infiltration Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-Use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond/Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
	Other		
		<b>0</b>	<b>28,109</b>

<b>Total Structural Volume (cf)</b>	<b>28,109</b>
<b>Structural Volume Requirement (cf)</b>	<b>27,821</b>
<b>DIFFERENCE</b>	<b>288</b>

**STRUCTURAL BMP VOLUME CREDITS**

Worksheet 5, Pennsylvania Stormwater Best Management Practices Manual

Chapter 8

**PROJECT:** Stokes Estate  
**Sub-Basin** UNT Chester Creek DP002

**Required Control Volume** 67,146 **Cubic Feet**  
**Non-Structural Volume Credit** 0 **Cubic Feet**  
**Structure Volume Requirement** 67,146 **Cubic Feet**

Section	Proposed BMP	Area (sf)	Storage Volume (ft <sup>3</sup> )
6.4.2	Infiltration Basin 1 Upper		28,533
6.4.2	Infiltration Basin 1 Lower		6,504
6.4.2	Infiltration Basin 2		33,072
6.4.3	Infiltration Bed(s)		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well/Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Infiltration Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-Use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond/Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
	Other		
		<b>0</b>	<b>68,109</b>

<b>Total Structural Volume (cf)</b>	<b>68,109</b>
<b>Structural Volume Requirement (cf)</b>	<b>67,146</b>
<b>DIFFERENCE</b>	<b>963</b>



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## INFILTRATION VOLUME CALCULATION Basin 1 Upper

PROJECT NAME: Stokes Estate

LOCATION: Westtown Township

PREPARED BY: DWG

DATE: 3/30/2021

CHECKED BY: DLH

DATE: \_\_\_\_\_

WATER SURFACE ELEVATION (FEET)	AREA AREA (SQ.FT.)	AVERAGE AREA (SQ.FT.)	DIFFERENCE IN ELEVATION (FEET)	STORAGE VOLUME (CUBIC FEET)	
				INCREMENTAL	TOTAL
314.00	5,570				0
		8,239	2.00	16478	
316.00	10,908				16,478
		13,394	2.00	26788	
318.00	15,880				43,266
		19,412	2.00	38823	
320.00	22,943				82,089

### Proposed Infiltration Volume

Elevation	Storage Volume (CF)
316.00	16,478
<u>316.90</u>	<u>28,533</u>
318.00	43,266

**Volume = 28,533 CF**



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## INFILTRATION VOLUME CALCULATION Basin 1 Lower

PROJECT NAME: Stokes Estate

LOCATION: Westtown Township

PREPARED BY: DWG

DATE: 3/30/2021

CHECKED BY: DLH

DATE: \_\_\_\_\_

WATER SURFACE ELEVATION (FEET)	AREA AREA (SQ.FT.)	AVERAGE AREA (SQ.FT.)	DIFFERENCE IN ELEVATION (FEET)	STORAGE VOLUME (CUBIC FEET)	
				INCREMENTAL	TOTAL
298.00	3,320				0
		4,336	2.00	8672	
300.00	5,352				8,672
		7,856	2.00	15711	
302.00	10,359				24,383
		14,651	2.00	29301	
304.00	18,942				53,684

### Proposed Infiltration Volume

Elevation

Storage Volume

298.00

(CF)

0

299.50

6,504

300.00

8,672

**Volume = 6,504 CF**



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## INFILTRATION VOLUME CALCULATION Basin 2

PROJECT NAME: Stokes Estate

LOCATION: Westtown Township

PREPARED BY: DWG

DATE: 3/30/2021

CHECKED BY: DLH

DATE: \_\_\_\_\_

WATER SURFACE ELEVATION (FEET)	AREA AREA (SQ.FT.)	AVERAGE AREA (SQ.FT.)	DIFFERENCE IN ELEVATION (FEET)	STORAGE VOLUME (CUBIC FEET)	
				INCREMENTAL	TOTAL
304.00	8,255				0
		10,349	2.00	20698	
306.00	12,443				20,698
		14,558	2.00	29116	
308.00	16,673				49,814
		18,892	2.00	37783	
310.00	21,110				87,597

### Proposed Infiltration Volume

Elevation	Storage Volume (CF)
306.00	20,698
<u>306.85</u>	<u>33,072</u>
308.00	49,814

**Volume = 33,072 CF**



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## INFILTRATION VOLUME CALCULATION Basin 3

PROJECT NAME: Stokes Estate

LOCATION: Westtown Township

PREPARED BY: DWG

DATE: 3/30/2021

CHECKED BY: DLH

DATE: \_\_\_\_\_

WATER SURFACE ELEVATION (FEET)	AREA AREA (SQ.FT.)	AVERAGE AREA (SQ.FT.)	DIFFERENCE IN ELEVATION (FEET)	STORAGE VOLUME (CUBIC FEET)	
				INCREMENTAL	TOTAL
312.00	5,900				0
		8,225	2.00	16450	
314.00	10,550				16,450
		12,954	2.00	25908	
316.00	15,358				42,358
		17,640	2.00	35279	
318.00	19,921				77,637

### Proposed Infiltration Volume

Elevation	Storage Volume (CF)
314.00	16,450
<u>314.90</u>	<u>28,109</u>
316.00	42,358

**Volume = 28,109 CF**



**APPENDIX B**  
**TOWNSHIP POST DEVELOPMENT**  
**FLOW REDUCTION SUMMARIES**



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## Stormwater Summary Peak Flow Reduction Requirements

DATE: 4/30/2021

BY: DWG

JOB NO.: 3868

PROJECT: Stokes Estate

TOWNSHIP: Westtown

DESCRIPTION: Stormwater Summary DP001 Chester Creek

				% Reduction
1-year	Pre-Developed	2.54 cfs	Hydrograph 2	65%
1-year	Post-Developed	0.90 cfs	Hydrograph 15	
2-year	Pre-Developed	7.11 cfs	Hydrograph 2	78%
2-year	Post-Developed	1.55 cfs	Hydrograph 15	
5-year	Pre-Developed	18.82 cfs	Hydrograph 2	85%
5-year	Post-Developed	2.86 cfs	Hydrograph 15	
10-year	Pre-Developed	29.99 cfs	Hydrograph 2	87%
10-year	Post-Developed	4.00 cfs	Hydrograph 15	
25-year	Pre-Developed	47.94 cfs	Hydrograph 2	83%
25-year	Post-Developed	8.10 cfs	Hydrograph 15	
50-year	Pre-Developed	64.53 cfs	Hydrograph 2	73%
50-year	Post-Developed	17.64 cfs	Hydrograph 15	
100-year	Pre-Developed	83.36 cfs	Hydrograph 2	54%
100-year	Post-Developed	38.12 cfs	Hydrograph 15	

### CHESTER CREEK 0.50 RELEASE RATE AREA

Post Developed 2 Year Flow = <b>1.55 cfs</b> Pre Developed 1 Year Flow = <b>2.54 cfs</b>	SATISFIED
Post Developed 5 Year Flow = <b>2.86 cfs</b> 50% Pre Developed 5 Year Flow = <b>9.41 cfs</b>	SATISFIED
Post Developed 10 Year Flow = <b>4.00 cfs</b> 50% Pre Developed 10 Year Flow = <b>15.00 cfs</b>	SATISFIED
Post Developed 25 Year Flow = <b>8.10 cfs</b> 50% Pre Developed 25 Year Flow = <b>23.97 cfs</b>	SATISFIED
Post Developed 50 Year Flow = <b>17.64 cfs</b> 50% Pre Developed 50Year Flow = <b>32.27 cfs</b>	SATISFIED
Post Developed 100 Year Flow = <b>38.12 cfs</b> 50% Pre Developed 100 Year Flow = <b>41.68 cfs</b>	SATISFIED



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## Stormwater Summary Peak Flow Reduction Requirements

DATE: 4/30/2021

BY: DWG

JOB NO.: 3868

PROJECT: Stokes Estate

TOWNSHIP: Westtown

DESCRIPTION: Stormwater Summary DP002 UNT Chester Creek

				% Reduction
1-year	Pre-Developed	1.22 cfs	Hydrograph 1	46%
1-year	Post-Developed	0.66 cfs	Hydrograph 7	
2-year	Pre-Developed	4.08 cfs	Hydrograph 1	74%
2-year	Post-Developed	1.06 cfs	Hydrograph 7	
5-year	Pre-Developed	11.87 cfs	Hydrograph 1	84%
5-year	Post-Developed	1.84 cfs	Hydrograph 7	
10-year	Pre-Developed	19.59 cfs	Hydrograph 1	87%
10-year	Post-Developed	2.51 cfs	Hydrograph 7	
25-year	Pre-Developed	32.08 cfs	Hydrograph 1	85%
25-year	Post-Developed	4.96 cfs	Hydrograph 7	
50-year	Pre-Developed	43.70 cfs	Hydrograph 1	82%
50-year	Post-Developed	7.65 cfs	Hydrograph 7	
100-year	Pre-Developed	56.95 cfs	Hydrograph 1	60%
100-year	Post-Developed	22.88 cfs	Hydrograph 7	

### CHESTER CREEK 0.50 RELEASE RATE AREA

<b>Post Developed 2 Year Flow = 1.06 cfs</b> <b>Pre Developed 1 Year Flow = 1.22 cfs</b>	SATISFIED
<b>Post Developed 5 Year Flow = 1.84 cfs</b> <b>50% Pre Developed 5 Year Flow = 5.94 cfs</b>	SATISFIED
<b>Post Developed 10 Year Flow = 2.51 cfs</b> <b>50% Pre Developed 10 Year Flow = 9.80 cfs</b>	SATISFIED
<b>Post Developed 25 Year Flow = 4.96 cfs</b> <b>50% Pre Developed 25 Year Flow = 16.04 cfs</b>	SATISFIED
<b>Post Developed 50 Year Flow = 7.65 cfs</b> <b>50% Pre Developed 50Year Flow = 21.85 cfs</b>	SATISFIED
<b>Post Developed 100 Year Flow = 22.88 cfs</b> <b>50% Pre Developed 100 Year Flow = 28.48 cfs</b>	SATISFIED

**APPENDIX C**  
**SCS METHOD CURVE NUMBER (CN) CALCULATIONS**



# DLHowell

Civil Engineering & Land Planning  
www.DLHowell.com

## SOIL CONSERVATION SERVICE HYDROLOGIC DATA FOR WATERSHED RUNOFF COMPUTATIONS

DATE: 3/29/2021

BY: DWG

**JOB NO.:** 3868      **PROJECT:** Stokes Estate  
**DESCRIPTION:** PREDEVELOPED AREA CHESTER CREEK DP001

**TOWNSHIP:** Westtown

Total Area: 14.57 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	14.57	845.06	
	Loam	B	Woods	Good	55	0.00	0.00	
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Woods	Good	70	0.00	0.00	

**Total Area**      14.57      845.06

$$\text{Weighted Soil Complex Number} = \frac{845.1}{14.6} = \boxed{58.0}$$

*\*SEE HYDRAFLOW REPORT FOR TIME OF CONCENTRATION*



# DLHowell

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## SOIL CONSERVATION SERVICE HYDROLOGIC DATA FOR WATERSHED RUNOFF COMPUTATIONS

DATE: 3/29/2021

BY: DWG

**JOB NO.:** 3868      **PROJECT:** Stokes Estate  
**DESCRIPTION:** PREDEVELOPED AREA UNT CHESTER CREEK

**TOWNSHIP:** Westtown

Total Area: 20.26 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	18.16	1053.28	
	Loam	B	Woods	Good	55	0.00	0.00	
Ba	Baile Silt	C	Meadow	Good	71	2.10	149.10	
	Loam	C	Woods	Good	70	0.00	0.00	

**Total Area**      20.26      1202.38

$$\text{Weighted Soil Complex Number} = \frac{1202.4}{20.3} = \boxed{59.3}$$

*\*SEE HYDRAFLOW REPORT FOR TIME OF CONCENTRATION*



# DLHowell

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## SOIL CONSERVATION SERVICE HYDROLOGIC DATA FOR WATERSHED RUNOFF COMPUTATIONS

DATE: 3/29/2021

BY: DWG

JOB NO.: 3868 PROJECT: Stokes Estate  
DESCRIPTION: POST DEVELOPED BASIN 3

TOWNSHIP: Westtown

Total Area: 11.73 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	2.47	143.26	
	Loam	B	Lawn	Good	61	6.54	398.92	
Ba	Baile Silt	N/A	Impervious	N/A	98	2.72	266.59	
	Loam	C	Meadow	Good	71	0.00	0.00	
		C	Lawn	Good	74	0.00	0.00	

Total Area 11.73 808.77

$$\frac{\text{Weighted Soil Complex Number } 808.8}{11.7} = \boxed{68.9}$$

ASSUMES 5 MINUTE TIME OF CONCENTRATION



# DLHowell

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## SOIL CONSERVATION SERVICE HYDROLOGIC DATA FOR WATERSHED RUNOFF COMPUTATIONS

DATE: 3/29/2021

BY: DWG

**JOB NO.:** 3868      **PROJECT:** Stokes Estate  
**DESCRIPTION:** POST DEVELOPED BYPASS DP002

**TOWNSHIP:** Westtown

Total Area: 0.83 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	0.00	0.00	
	Loam	B	Lawn	Good	61	0.65	39.92	
Ba	Baile Silt	N/A	Impervious	N/A	98	0.18	17.21	
	Loam	C	Meadow	Good	71	0.00	0.00	
		C	Lawn	Good	74	0.00	0.00	

**Total Area**      0.83      57.13

$$\frac{\text{Weighted Soil Complex Number}}{\text{Complex Number}} = \frac{57.1}{0.8} = \boxed{68.8}$$

*ASSUMES 5 MINUTE TIME OF CONCENTRATION*





# DLHowell

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## SOIL CONSERVATION SERVICE HYDROLOGIC DATA FOR WATERSHED RUNOFF COMPUTATIONS

DATE: 3/29/2021

BY: DWG

JOB NO.: 3868      PROJECT: Stokes Estate  
DESCRIPTION: POST DEVELOPED BASIN 1

TOWNSHIP: Westtown

Total Area: 11.91 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	0.00	0.00	
	Loam	B	Lawn	Good	61	8.54	520.94	
Ba	Baile Silt	N/A	Impervious	N/A	98	3.07	301.30	
		C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.30	22.20	

**Total Area**      11.91      844.44

$$\frac{\text{Weighted Soil Complex Number}}{11.9} = \boxed{70.9}$$

ASSUMES 5 MINUTE TIME OF CONCENTRATION



# DLHowell

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## SOIL CONSERVATION SERVICE HYDROLOGIC DATA FOR WATERSHED RUNOFF COMPUTATIONS

DATE: 3/29/2021

BY: DWG

JOB NO.: 3868 PROJECT: Stokes Estate  
DESCRIPTION: POST DEVELOPED BASIN 2

TOWNSHIP: Westtown

Total Area: 8.16 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	0.00	0.00	
	Loam	B	Lawn	Good	61	4.43	270.22	
Ba	Baile Silt	N/A	Impervious	N/A	98	2.83	277.35	
		C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.90	66.60	

Total Area 8.16 614.17

$$\frac{\text{Weighted Soil Complex Number}}{8.2} = 75.3$$

ASSUMES 5 MINUTE TIME OF CONCENTRATION



# DLHowell

Civil Engineering & Land Planning  
www.DLHowell.com

## SOIL CONSERVATION SERVICE HYDROLOGIC DATA FOR WATERSHED RUNOFF COMPUTATIONS

DATE: 3/29/2021

BY: DWG

**JOB NO.:** 3868     **PROJECT:** Stokes Estate  
**DESCRIPTION:** POST DEVELOPED BYPASS DP002

**TOWNSHIP:** Westtown

Total Area: 1.49 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	0.00	0.00	
	Loam	B	Lawn	Good	61	1.29	78.69	
Ba	Baile Silt	N/A	Impervious	N/A	98	0.20	20.05	
	Loam	C	Meadow	Good	71	0.00	0.00	
		C	Lawn	Good	74	0.00	0.00	

**Total Area**     1.49     98.74

Weighted Soil     98.7     =     66.1  
Complex Number     1.5

*ASSUMES 5 MINUTE TIME OF CONCENTRATION*

**APPENDIX D**  
**HYDRAFLOW HYDROGRAPH REPORTS**

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# Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	1.222	4.081	-----	11.87	19.59	32.08	43.70	56.95	Pre Developed DP001
2	SCS Runoff	-----	2.540	7.109	-----	18.82	29.99	47.94	64.53	83.36	Pre Developed DP002
4	SCS Runoff	-----	9.467	15.05	-----	26.13	35.62	50.04	62.85	77.33	Post Basin 3
5	Reservoir	4	0.000	0.134	-----	0.756	1.841	3.754	7.143	21.02	Basin 3 Routed
6	SCS Runoff	-----	0.664	1.057	-----	1.840	2.510	3.529	4.433	5.457	Post Bypass DP001
7	Combine	5, 6	0.664	1.057	-----	1.840	2.510	4.955	7.648	22.88	Post Total DP001
9	SCS Runoff	-----	11.44	17.46	-----	29.23	39.20	54.21	67.77	82.71	Post Basin 1
10	Reservoir	9	0.000	0.256	-----	1.201	3.104	16.39	35.31	41.97	Basin 1 Upper Routed
11	Reservoir	10	0.000	0.043	-----	0.896	2.032	4.031	9.583	23.11	Basin 1 Lower Routed
12	SCS Runoff	-----	10.82	15.44	-----	24.23	31.52	42.66	52.34	62.84	Post Basin 2
13	Reservoir	12	0.000	0.000	-----	0.496	1.267	3.834	8.399	22.93	Basin 2 Routed
14	SCS Runoff	-----	0.899	1.546	-----	2.858	4.000	5.758	7.327	9.073	Post Bypass DP002
15	Combine	11, 13, 14	0.899	1.546	-----	2.858	4.000	8.100	17.64	38.12	Post Total DP002



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

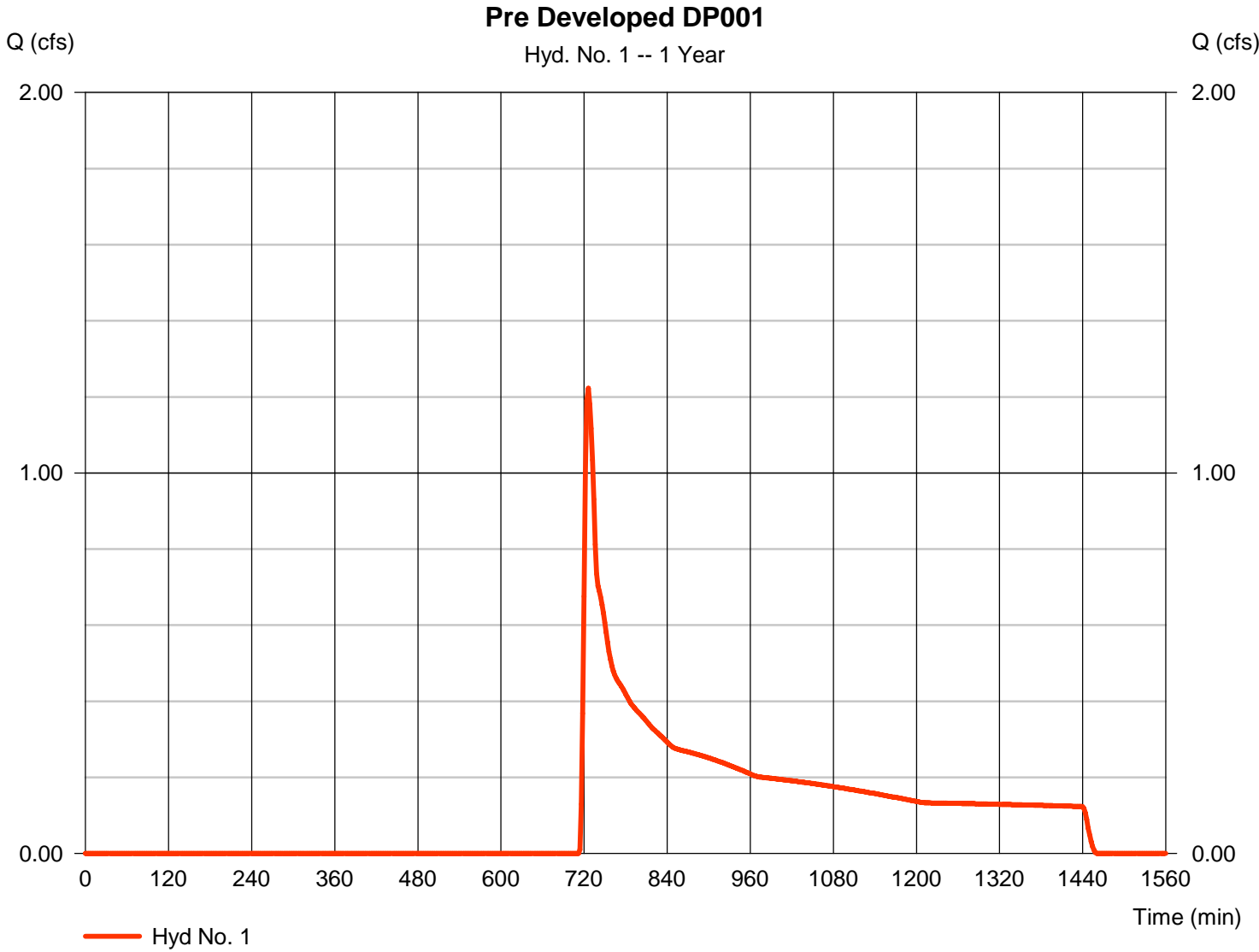
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	1.222	2	726	10,036	-----	-----	-----	Pre Developed DP001	
2	SCS Runoff	2.540	2	724	16,310	-----	-----	-----	Pre Developed DP002	
4	SCS Runoff	9.467	2	718	20,431	-----	-----	-----	Post Basin 3	
5	Reservoir	0.000	2	n/a	0	4	314.31	20,431	Basin 3 Routed	
6	SCS Runoff	0.664	2	718	1,435	-----	-----	-----	Post Bypass DP001	
7	Combine	0.664	2	718	1,435	5, 6	-----	-----	Post Total DP001	
9	SCS Runoff	11.44	2	718	23,919	-----	-----	-----	Post Basin 1	
10	Reservoir	0.000	2	n/a	0	9	316.56	23,919	Basin 1 Upper Routed	
11	Reservoir	0.000	2	n/a	0	10	298.20	0.000	Basin 1 Lower Routed	
12	SCS Runoff	10.82	2	718	21,817	-----	-----	-----	Post Basin 2	
13	Reservoir	0.000	2	n/a	0	12	306.08	21,817	Basin 2 Routed	
14	SCS Runoff	0.899	2	718	2,089	-----	-----	-----	Post Bypass DP002	
15	Combine	0.899	2	718	2,089	11, 13, 14	-----	-----	Post Total DP002	
SWM.gpw					Return Period: 1 Year			Friday, 04 / 30 / 2021		

# Hydrograph Report

## Hyd. No. 1

Pre Developed DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 1.222 cfs
Storm frequency	= 1 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 10,036 cuft
Drainage area	= 14.570 ac	Curve number	= 58
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

## Hyd. No. 1

Pre Developed DP001

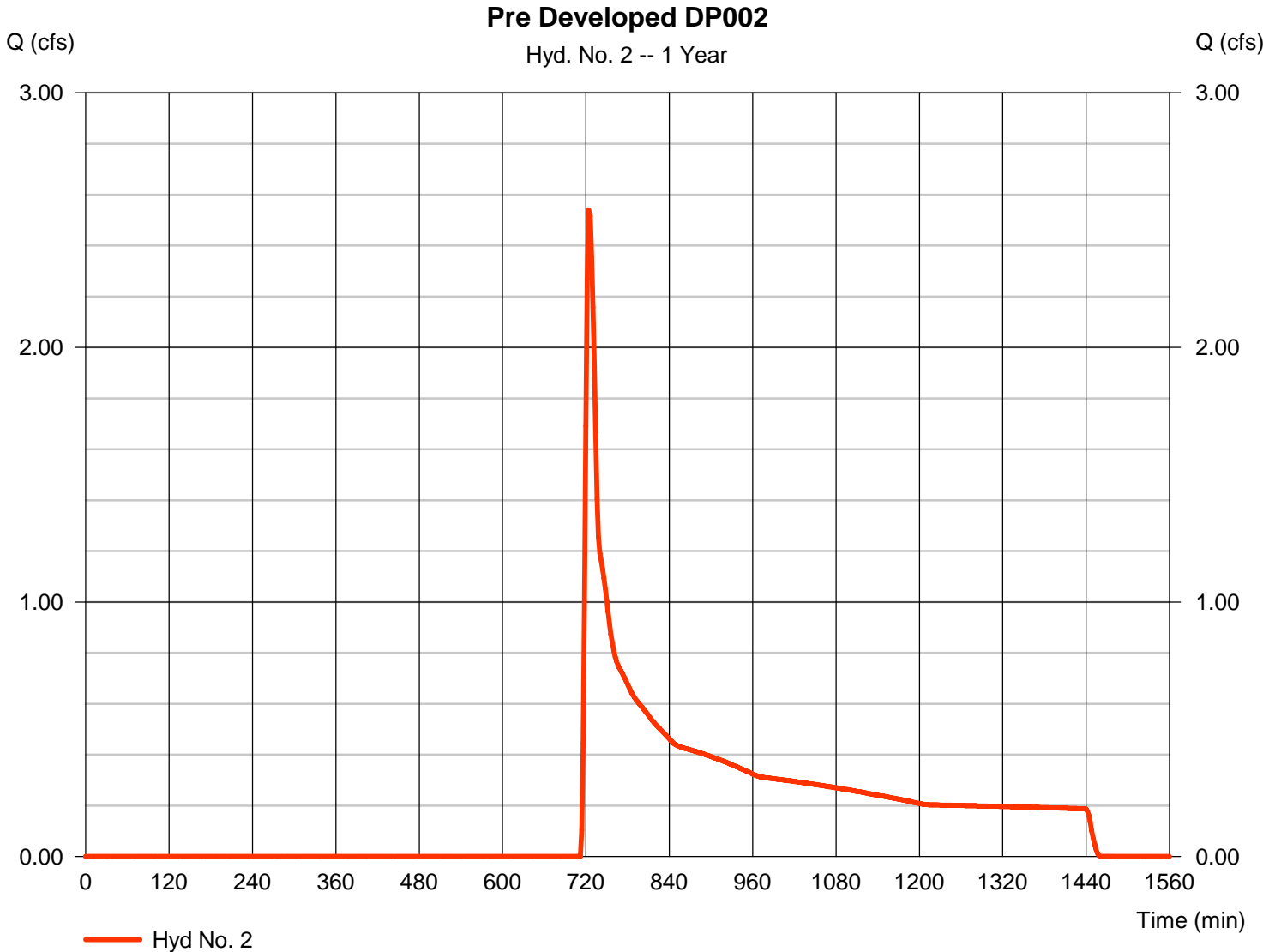
<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.20	0.00	0.00	
Land slope (%)	= 4.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 10.81</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 10.81</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 330.00	0.00	0.00	
Watercourse slope (%)	= 9.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.84	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 1.14</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 1.14</b>
<b>Channel Flow</b>				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	0.0	0.0	0.0	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>12.00 min</b>

# Hydrograph Report

## Hyd. No. 2

Pre Developed DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 2.540 cfs
Storm frequency	= 1 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 16,310 cuft
Drainage area	= 20.260 ac	Curve number	= 59.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

## Hyd. No. 2

Pre Developed DP002

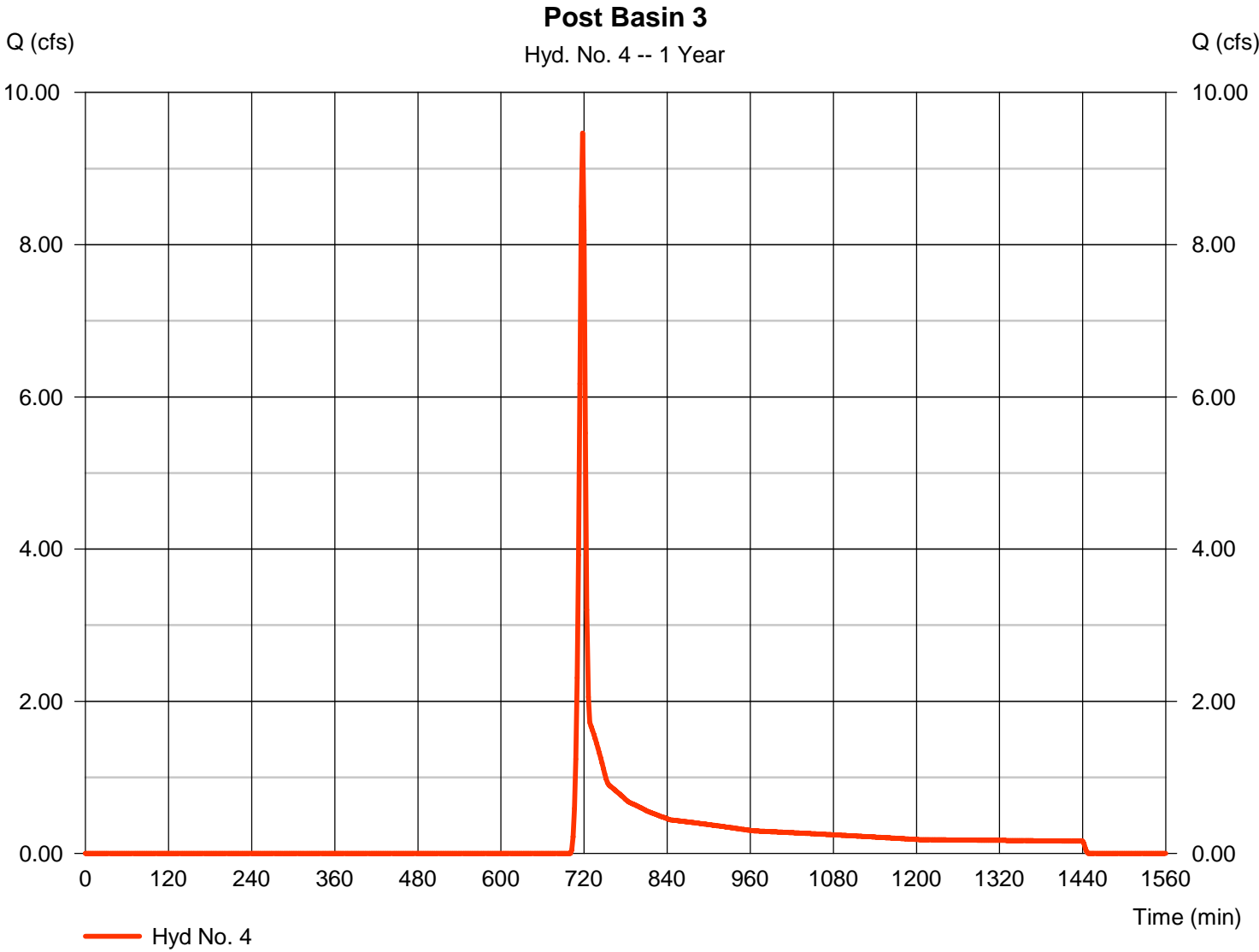
<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.20	0.00	0.00	
Land slope (%)	= 7.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 8.65</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 8.65</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 957.00	0.00	0.00	
Watercourse slope (%)	= 8.90	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.81	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 3.31</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 3.31</b>
<b>Channel Flow</b>				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>12.00 min</b>

# Hydrograph Report

## Hyd. No. 4

### Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 9.467 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 20,431 cuft
Drainage area	= 11.730 ac	Curve number	= 68.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

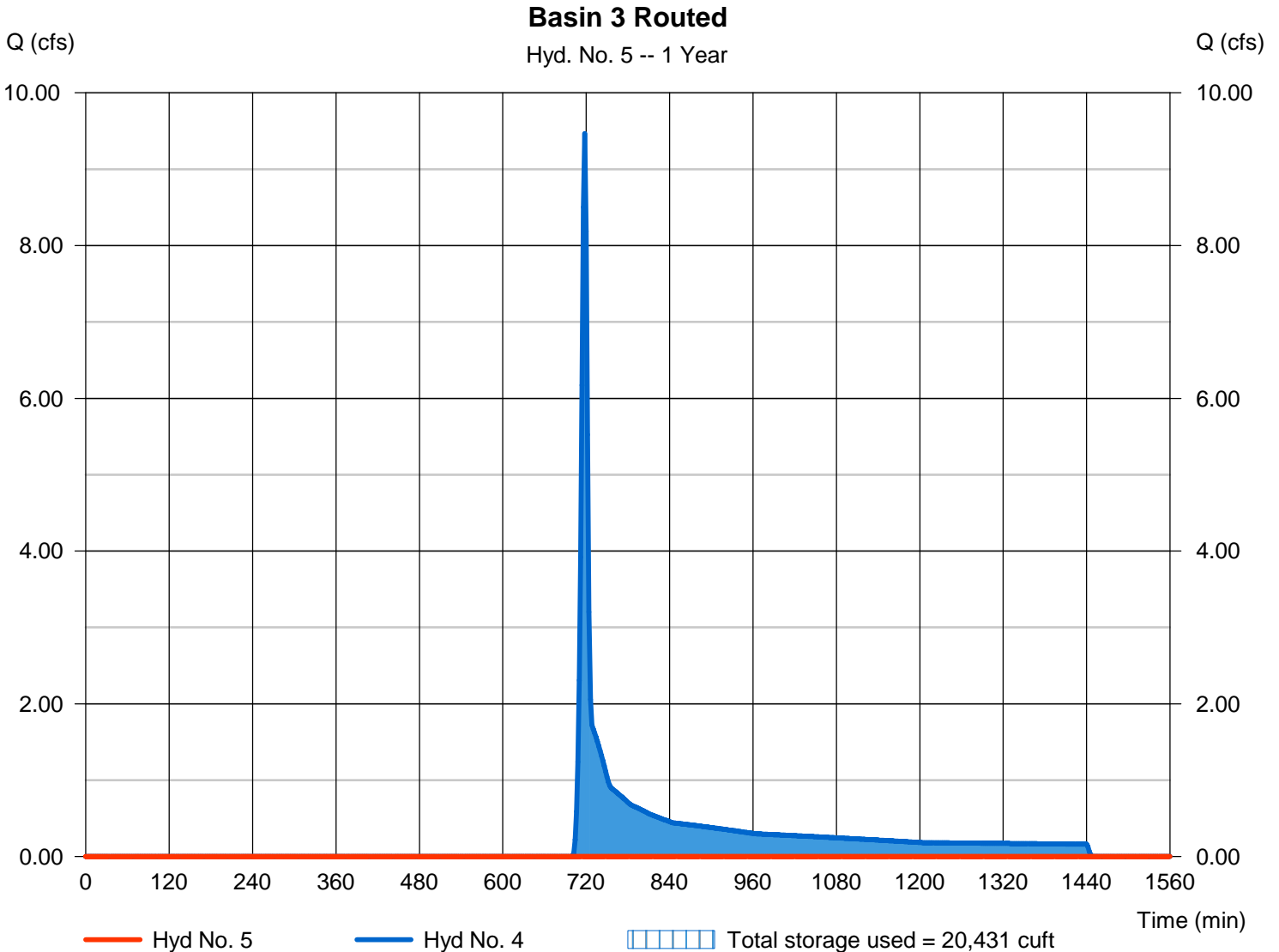
Friday, 04 / 30 / 2021

## Hyd. No. 5

Basin 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 4 - Post Basin 3	Max. Elevation	= 314.31 ft
Reservoir name	= Basin 3	Max. Storage	= 20,431 cuft

Storage Indication method used.



## Pond No. 4 - Basin 3

### Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 312.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	312.00	5,900	0	0
2.00	314.00	10,550	16,450	16,450
4.00	316.00	15,358	25,908	42,358
6.00	318.00	19,921	35,279	77,637
7.00	319.00	22,275	21,098	98,735

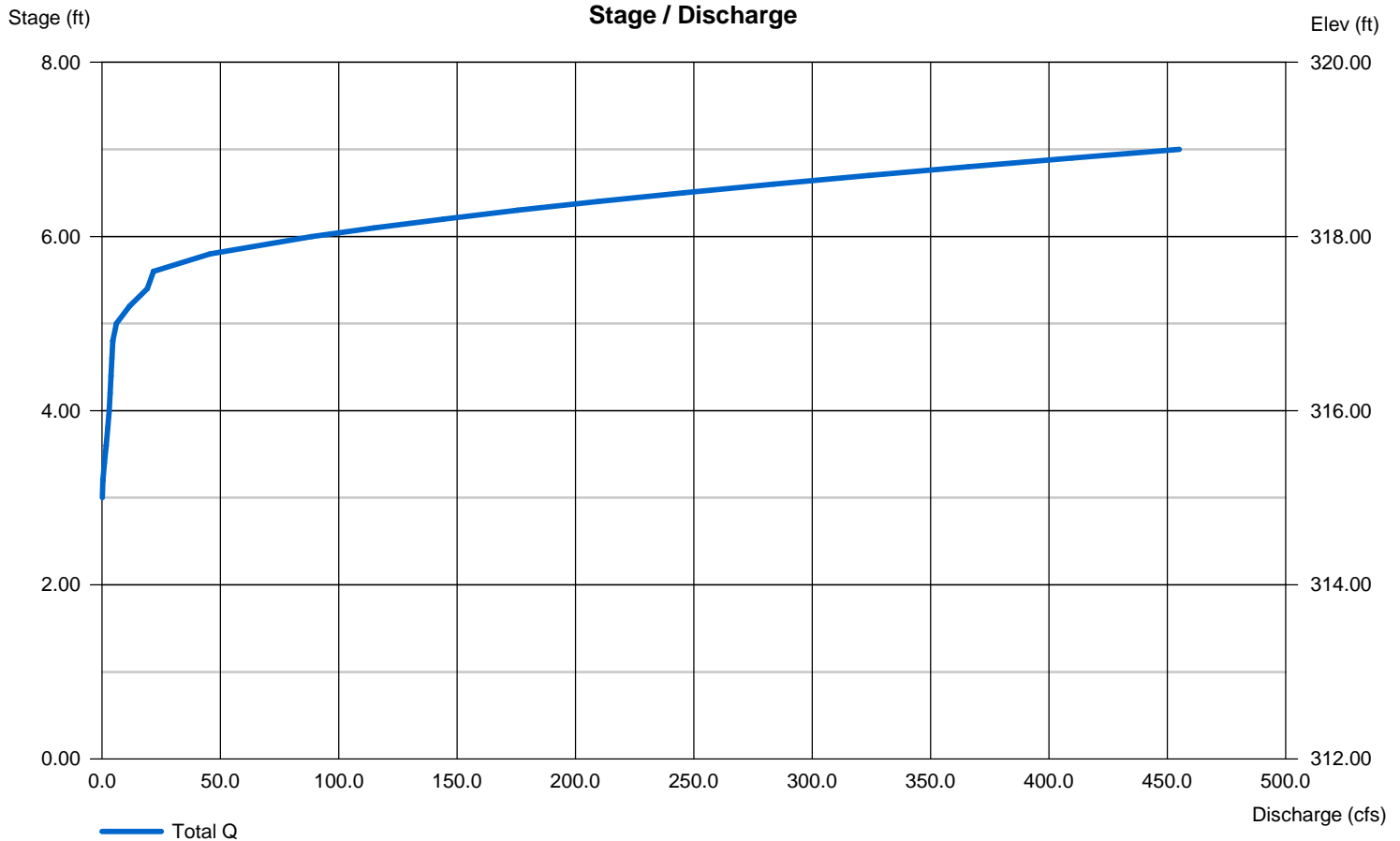
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	12.00	0.00	0.00
Span (in)	= 18.00	12.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 310.00	314.90	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	Inactive	100.00	0.00
Crest El. (ft)	= 316.90	314.90	317.60	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	Rect	Broad	---
Multi-Stage	= Yes	Yes	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).





# Hydrograph Report

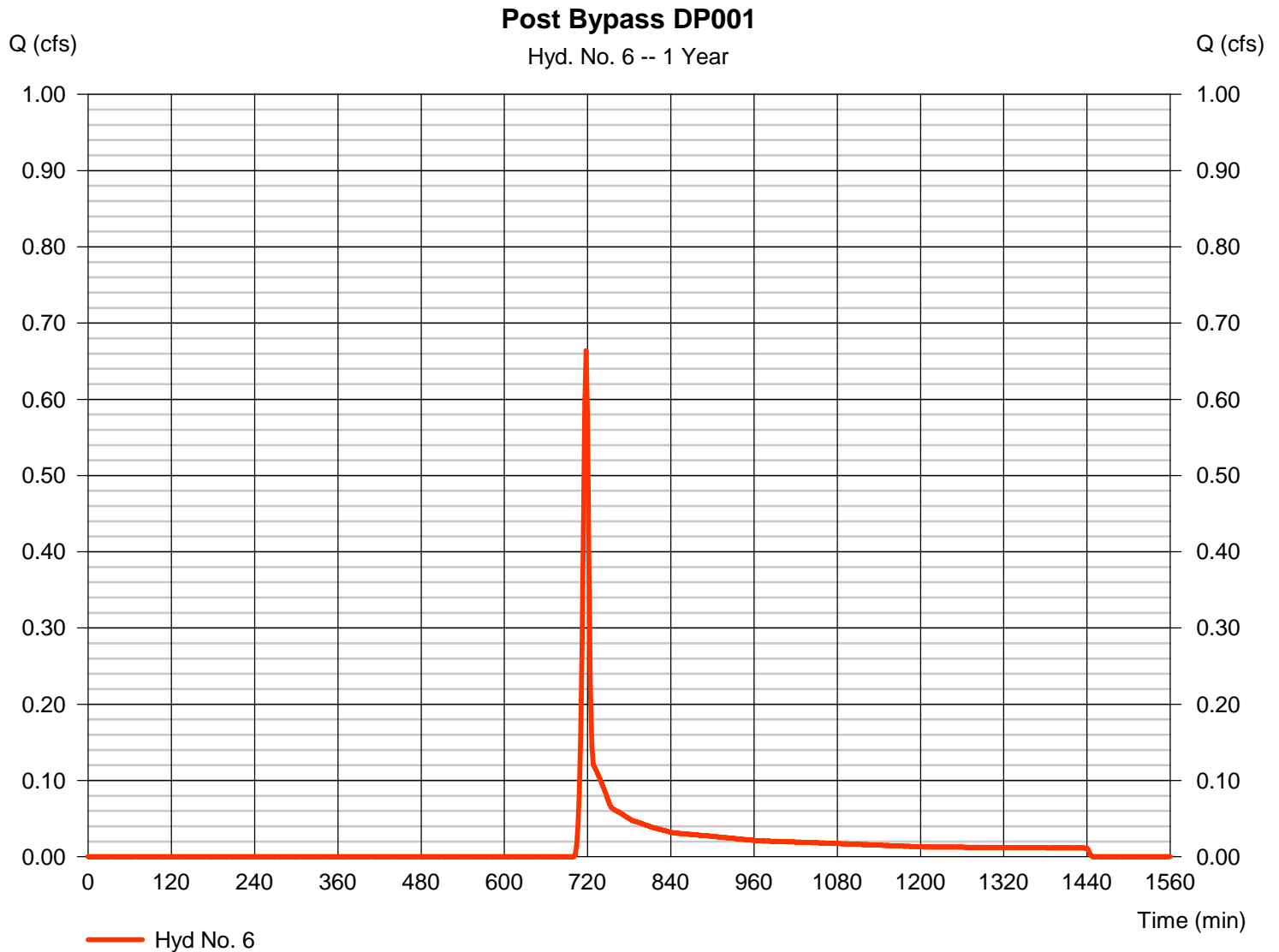
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 6

Post Bypass DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 0.664 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,435 cuft
Drainage area	= 0.830 ac	Curve number	= 68.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

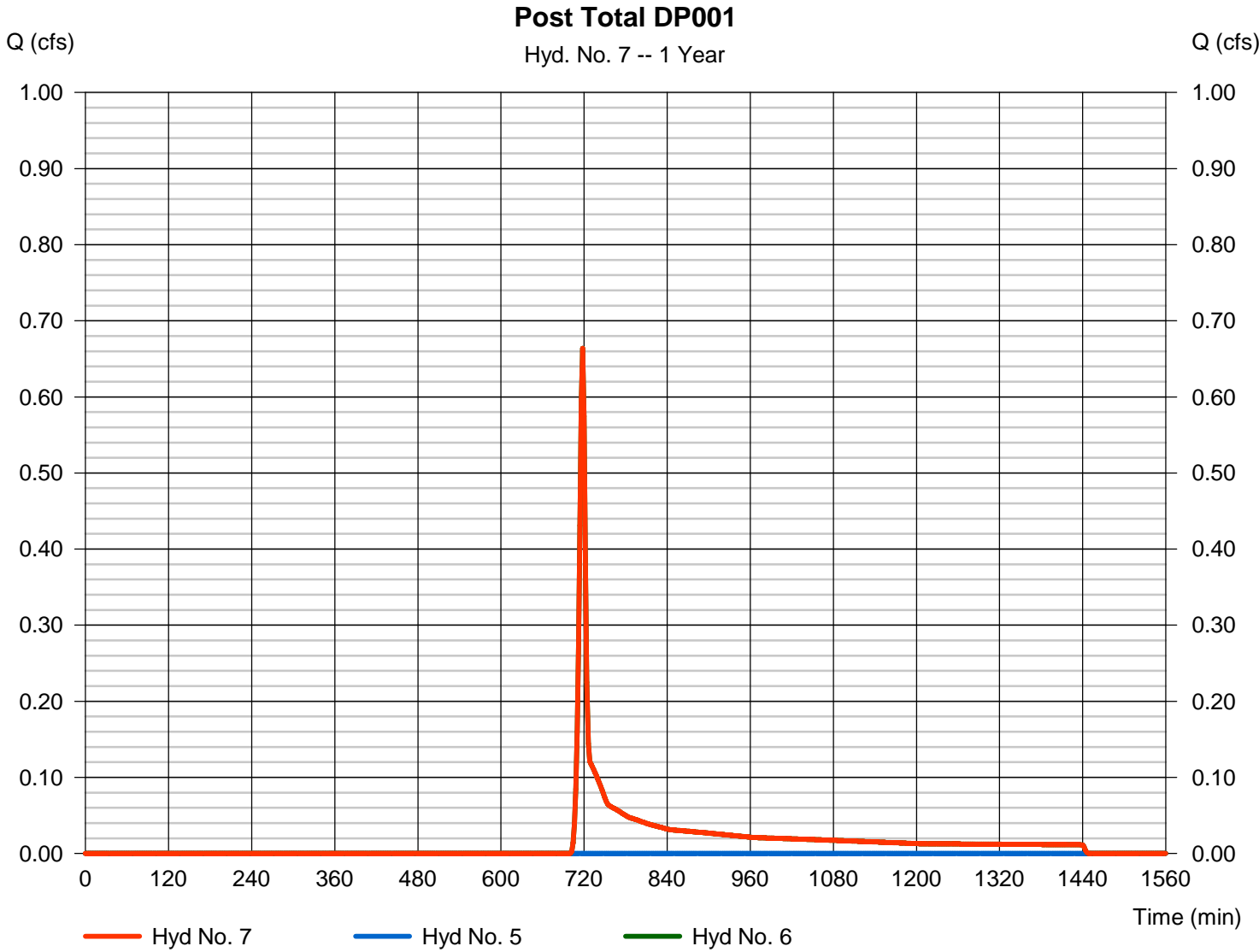
Friday, 04 / 30 / 2021

## Hyd. No. 7

Post Total DP001

Hydrograph type = Combine  
Storm frequency = 1 yrs  
Time interval = 2 min  
Inflow hyds. = 5, 6

Peak discharge = 0.664 cfs  
Time to peak = 718 min  
Hyd. volume = 1,435 cuft  
Contrib. drain. area = 0.830 ac



# Hydrograph Report

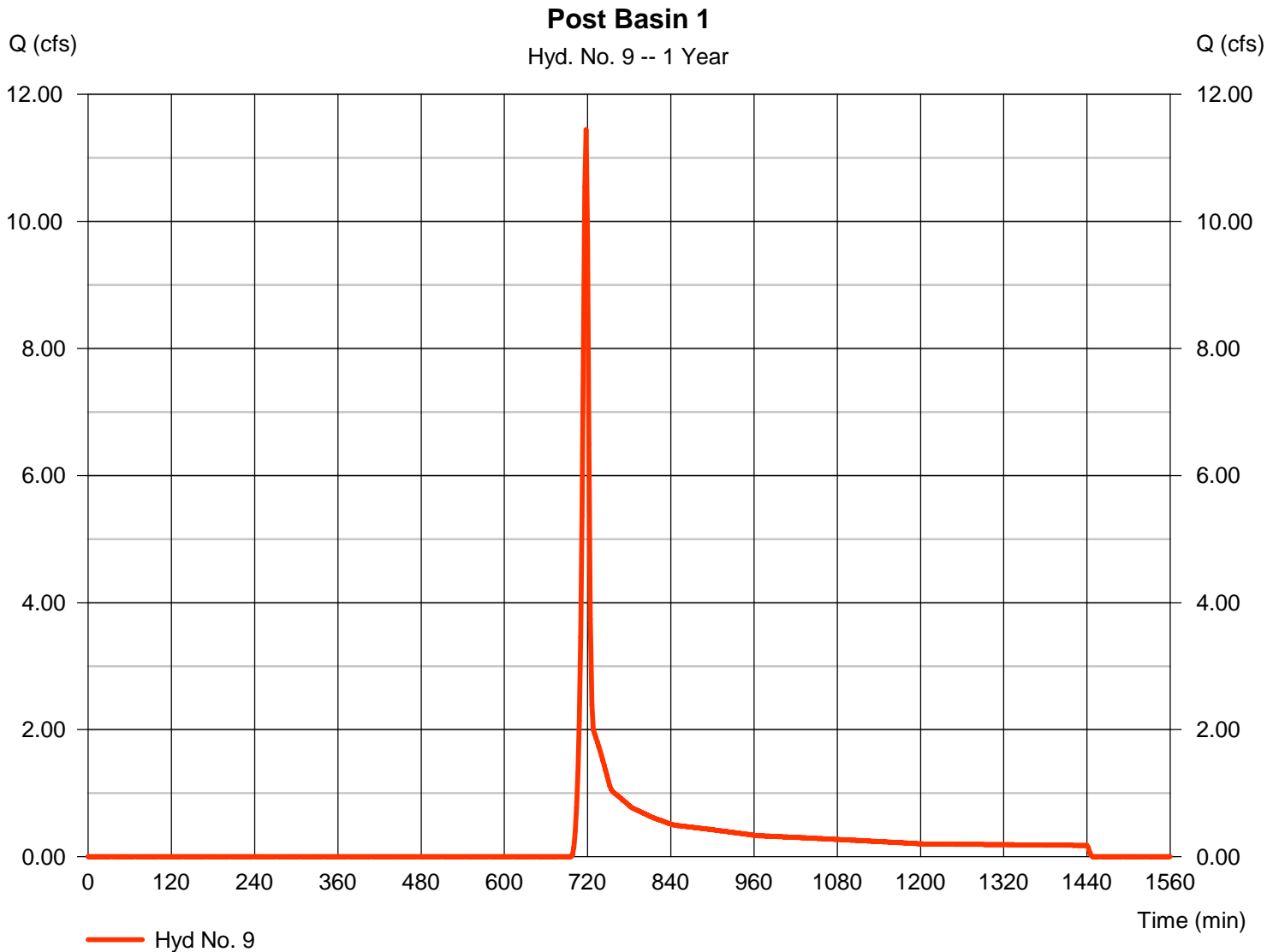
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 9

Post Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 11.44 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 23,919 cuft
Drainage area	= 11.910 ac	Curve number	= 70.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

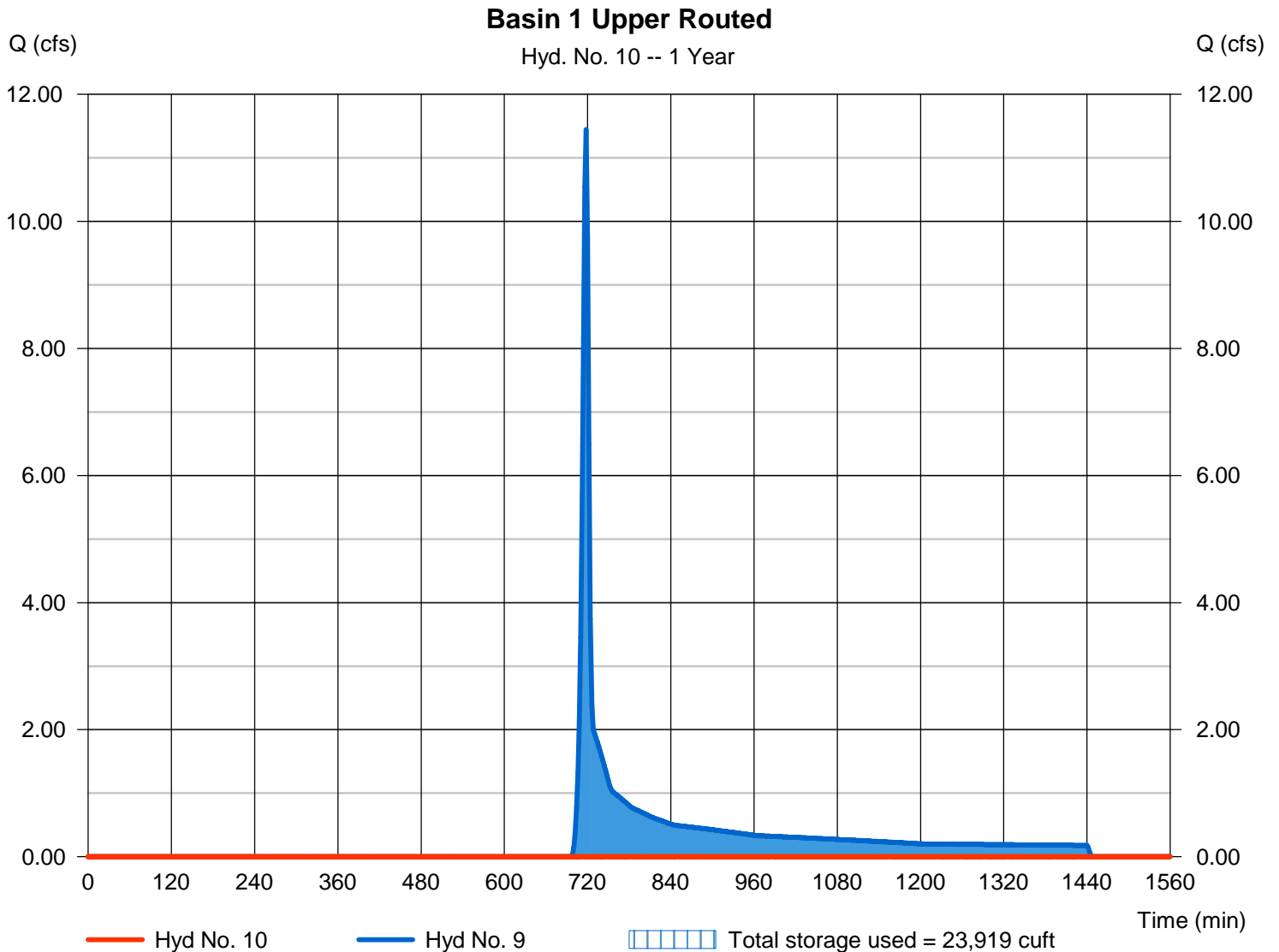
Friday, 04 / 30 / 2021

## Hyd. No. 10

Basin 1 Upper Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 9 - Post Basin 1	Max. Elevation	= 316.56 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 23,919 cuft

Storage Indication method used.



## Pond No. 2 - Basin 1 Upper

### Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 314.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	314.00	5,570	0	0
2.00	316.00	10,908	16,478	16,478
4.00	318.00	15,880	26,788	43,266
6.00	320.00	22,943	38,823	82,089

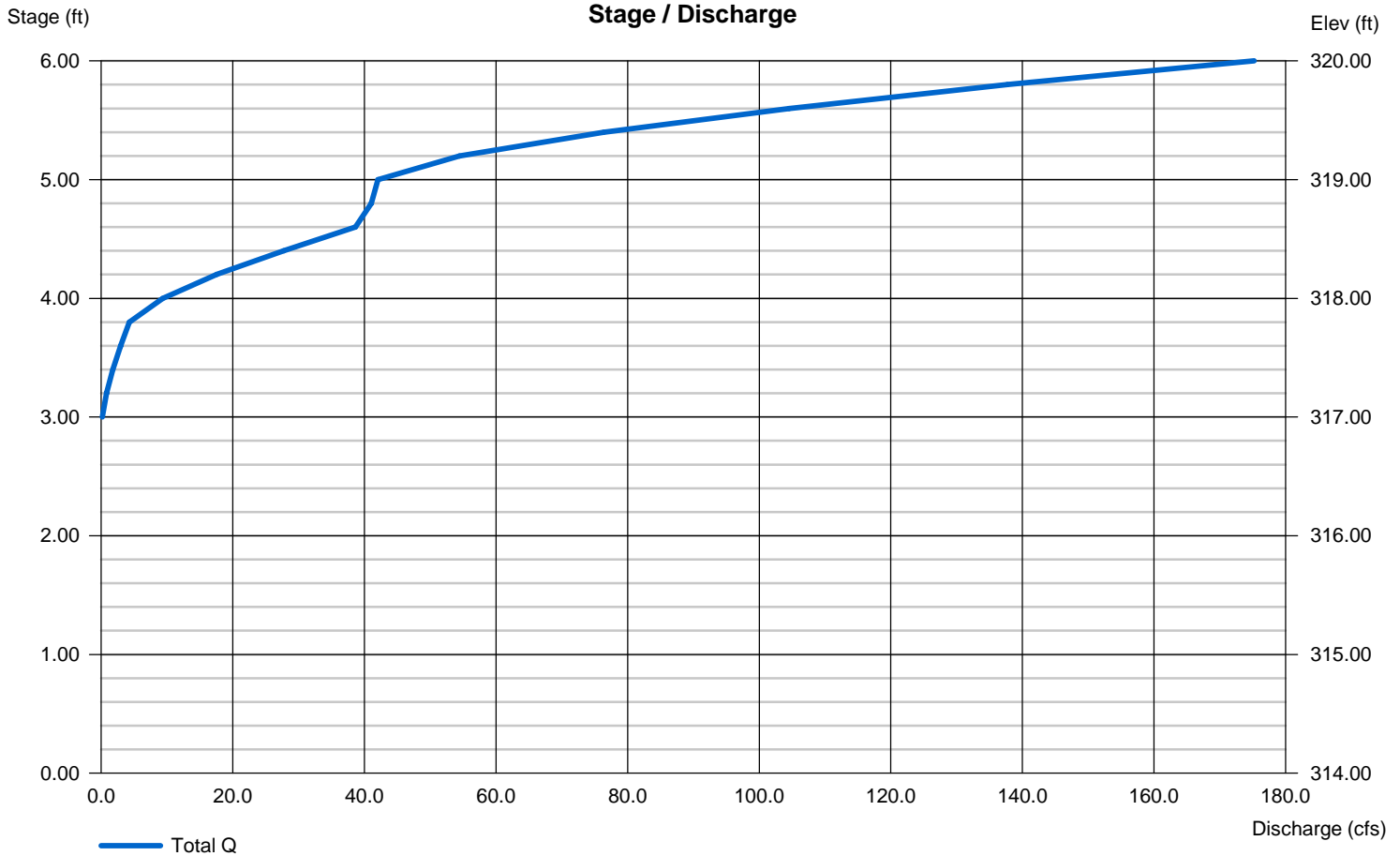
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 310.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	1.50	50.00	0.00
Crest El. (ft)	= 317.80	316.90	319.00	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	Rect	Broad	---
Multi-Stage	= Yes	Yes	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



# Hydrograph Report

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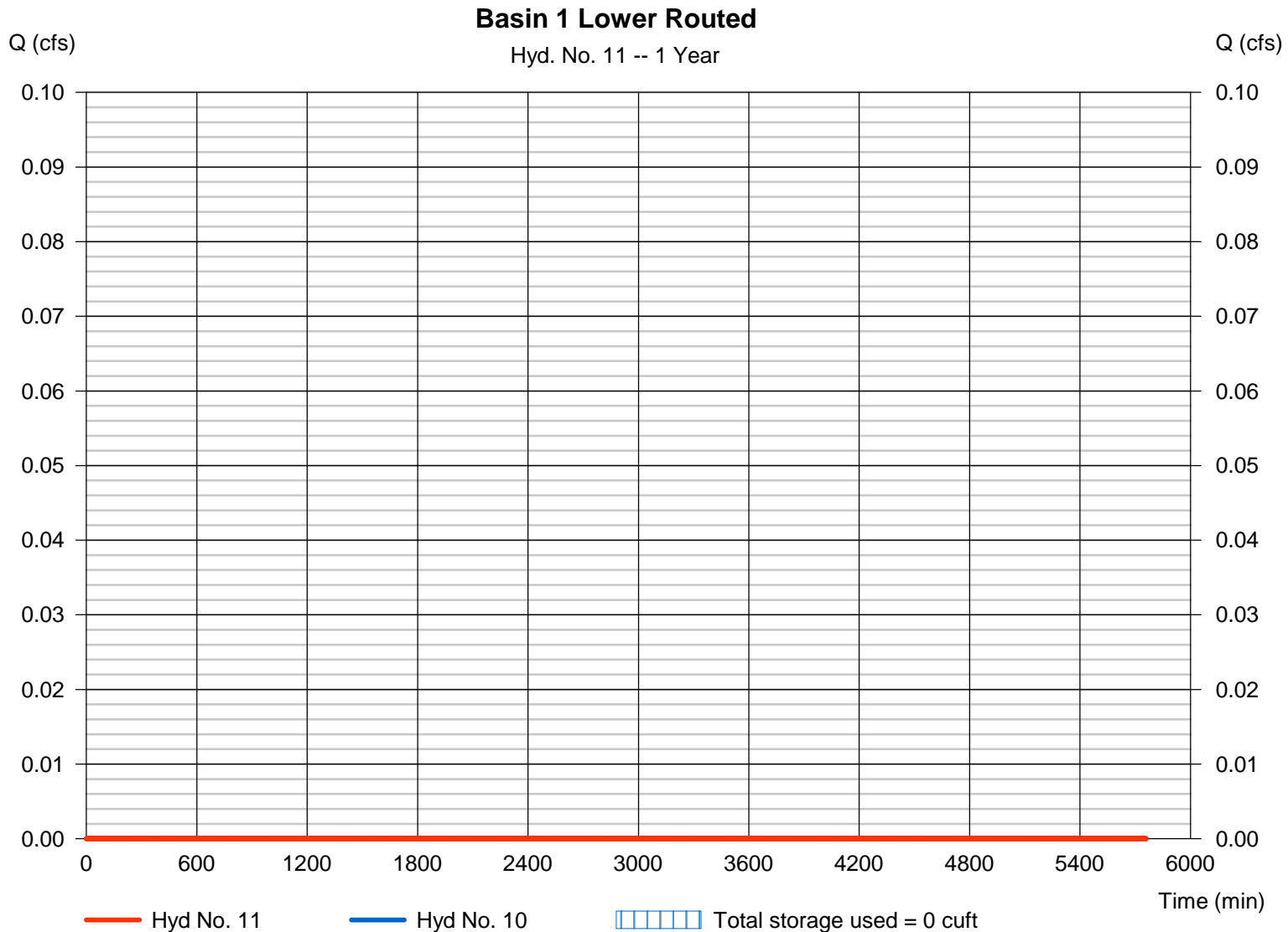
Friday, 04 / 30 / 2021

## Hyd. No. 11

### Basin 1 Lower Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 10 - Basin 1 Upper Routed	Max. Elevation	= 298.20 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 0 cuft

Storage Indication method used.



## Pond No. 1 - Basin 1 Lower

### Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 298.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	298.00	3,320	0	0
2.00	300.00	5,352	8,672	8,672
4.00	302.00	10,359	15,711	24,383
6.00	304.00	18,942	29,301	53,684

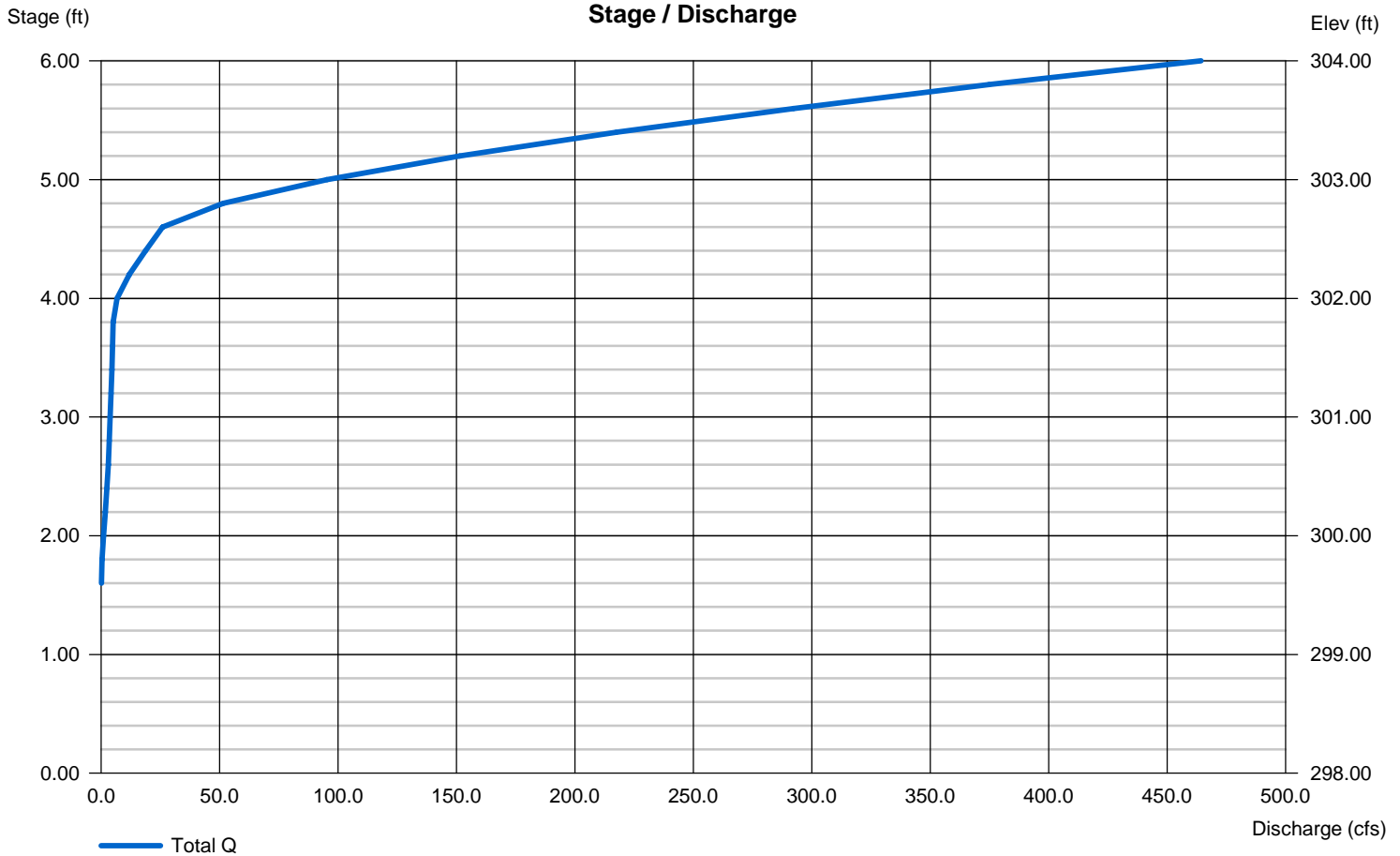
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	12.00	0.00	0.00
Span (in)	= 24.00	12.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 298.00	299.50	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	100.00	0.00	0.00
Crest El. (ft)	= 301.90	302.60	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



# Hydrograph Report

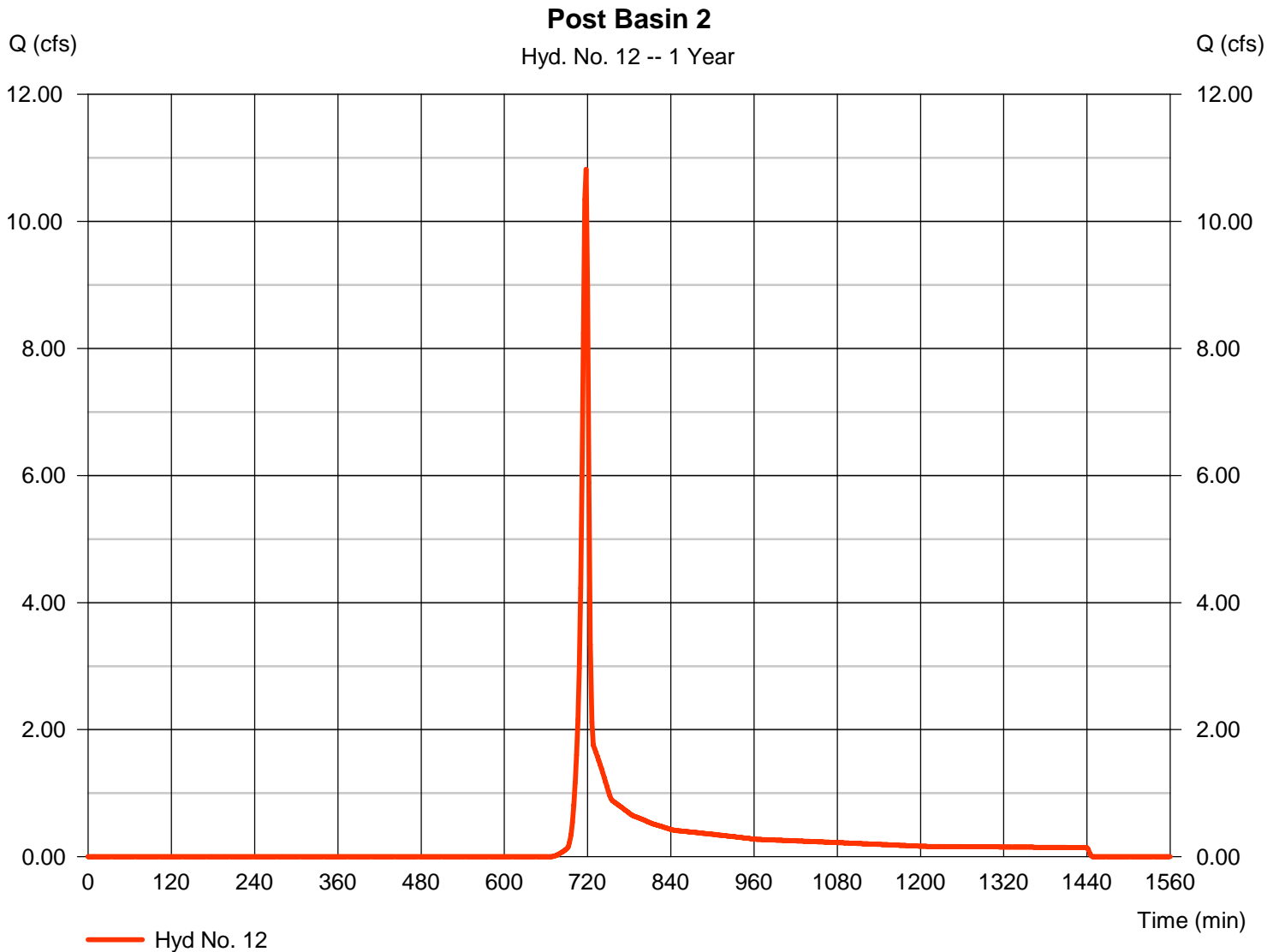
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

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## Hyd. No. 12

Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 10.82 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 21,817 cuft
Drainage area	= 8.170 ac	Curve number	= 75.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

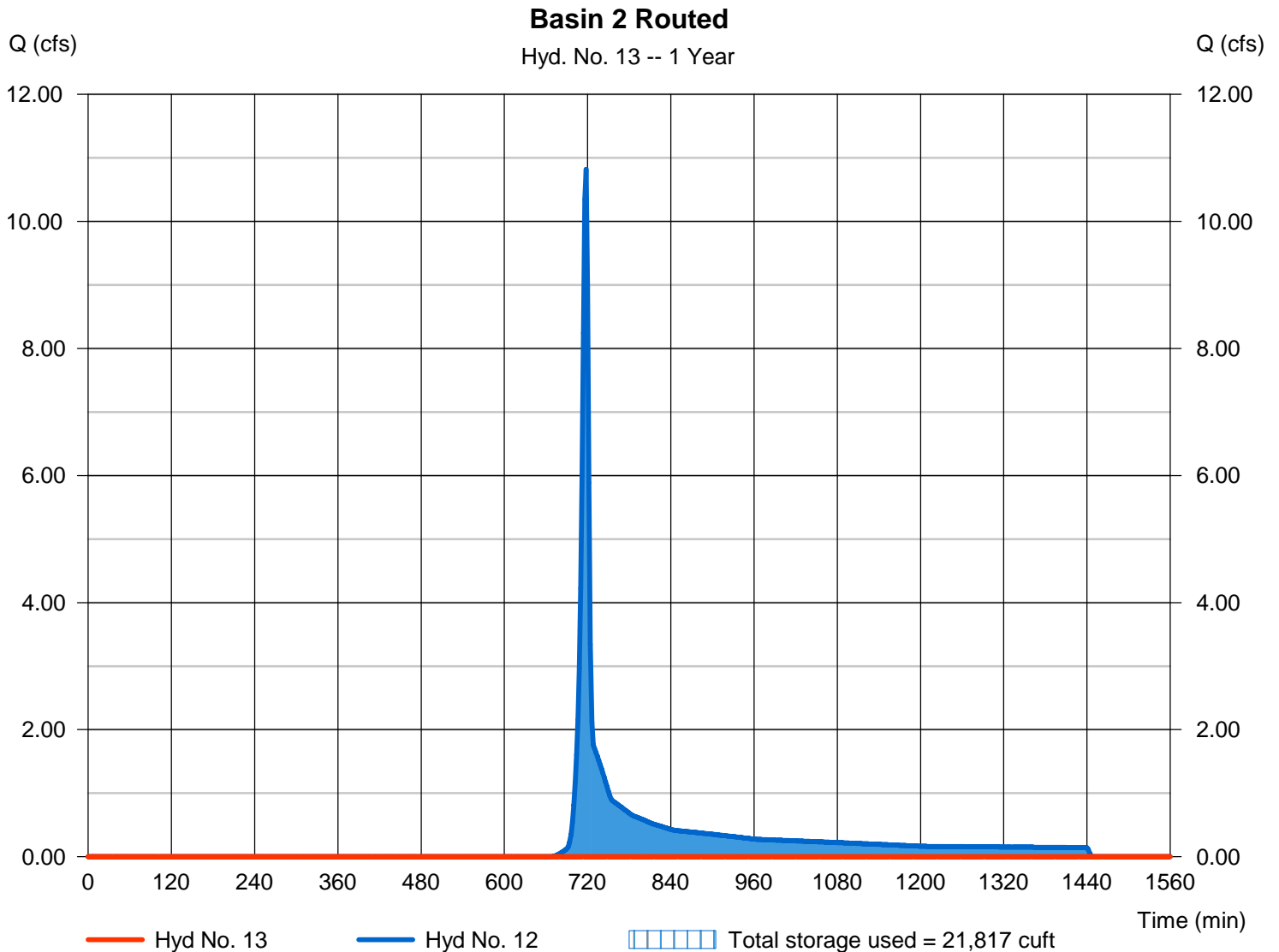
Friday, 04 / 30 / 2021

## Hyd. No. 13

Basin 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 12 - Post Basin 2	Max. Elevation	= 306.08 ft
Reservoir name	= Basin 2	Max. Storage	= 21,817 cuft

Storage Indication method used.



## Pond No. 3 - Basin 2

### Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 304.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	304.00	8,255	0	0
2.00	306.00	12,443	20,698	20,698
4.00	308.00	16,673	29,116	49,814
6.00	310.00	21,110	37,783	87,597

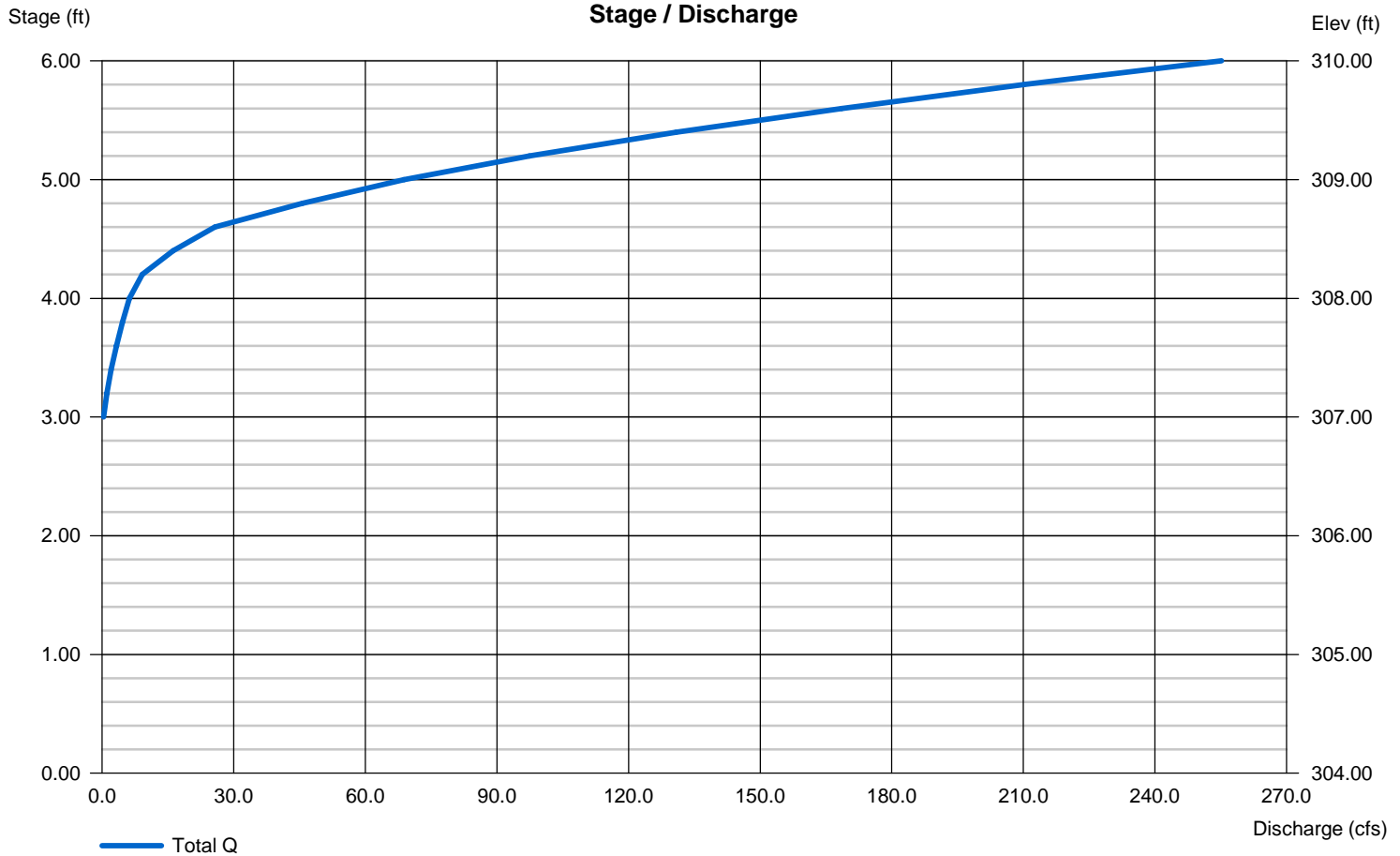
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 302.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	1.50	50.00	0.00
Crest El. (ft)	= 308.10	306.85	308.60	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	Rect	Broad	---
Multi-Stage	= Yes	Yes	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



# Hydrograph Report

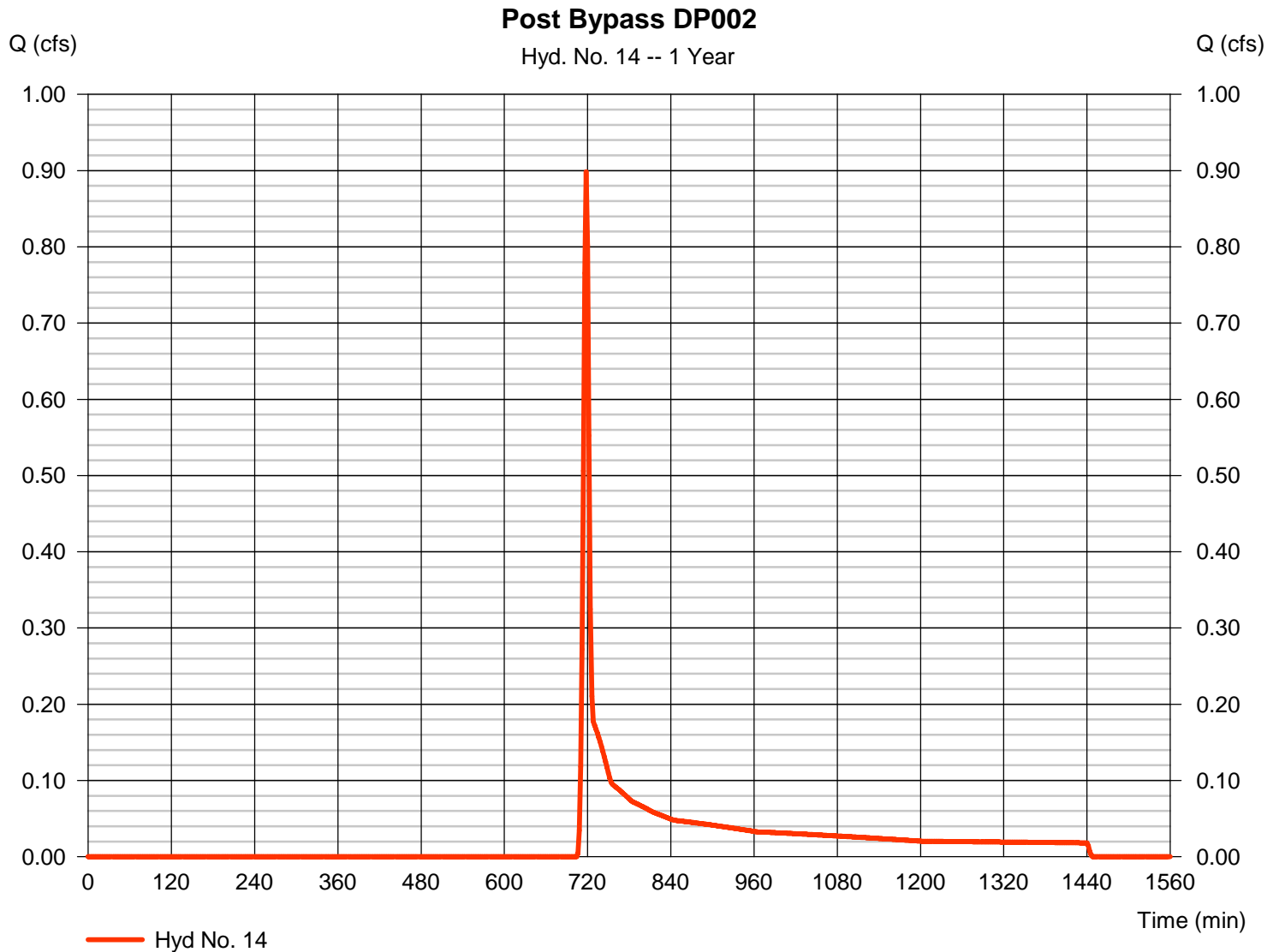
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

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## Hyd. No. 14

Post Bypass DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 0.899 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,089 cuft
Drainage area	= 1.490 ac	Curve number	= 66.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

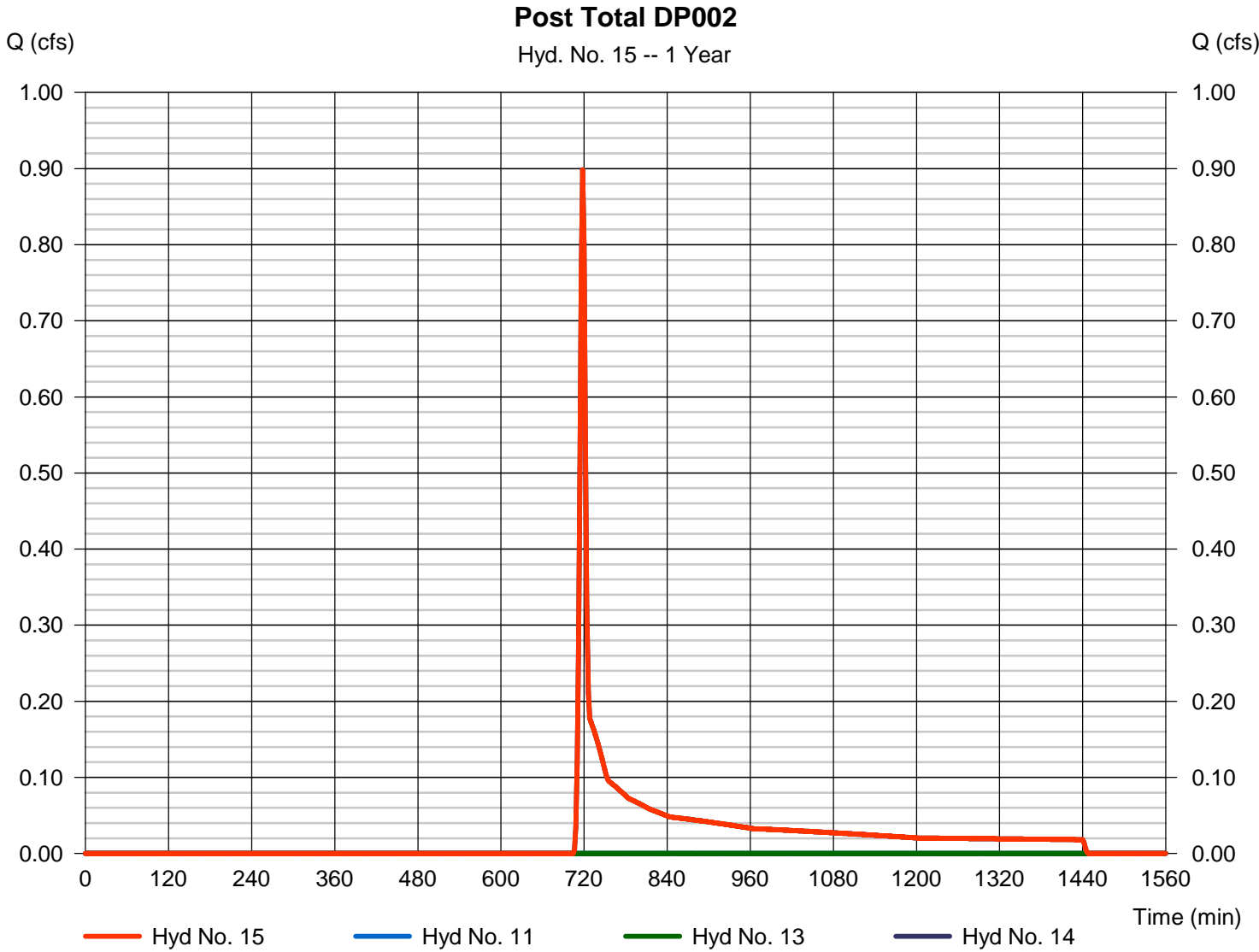
Friday, 04 / 30 / 2021

## Hyd. No. 15

Post Total DP002

Hydrograph type = Combine  
 Storm frequency = 1 yrs  
 Time interval = 2 min  
 Inflow hyds. = 11, 13, 14

Peak discharge = 0.899 cfs  
 Time to peak = 718 min  
 Hyd. volume = 2,089 cuft  
 Contrib. drain. area = 1.490 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

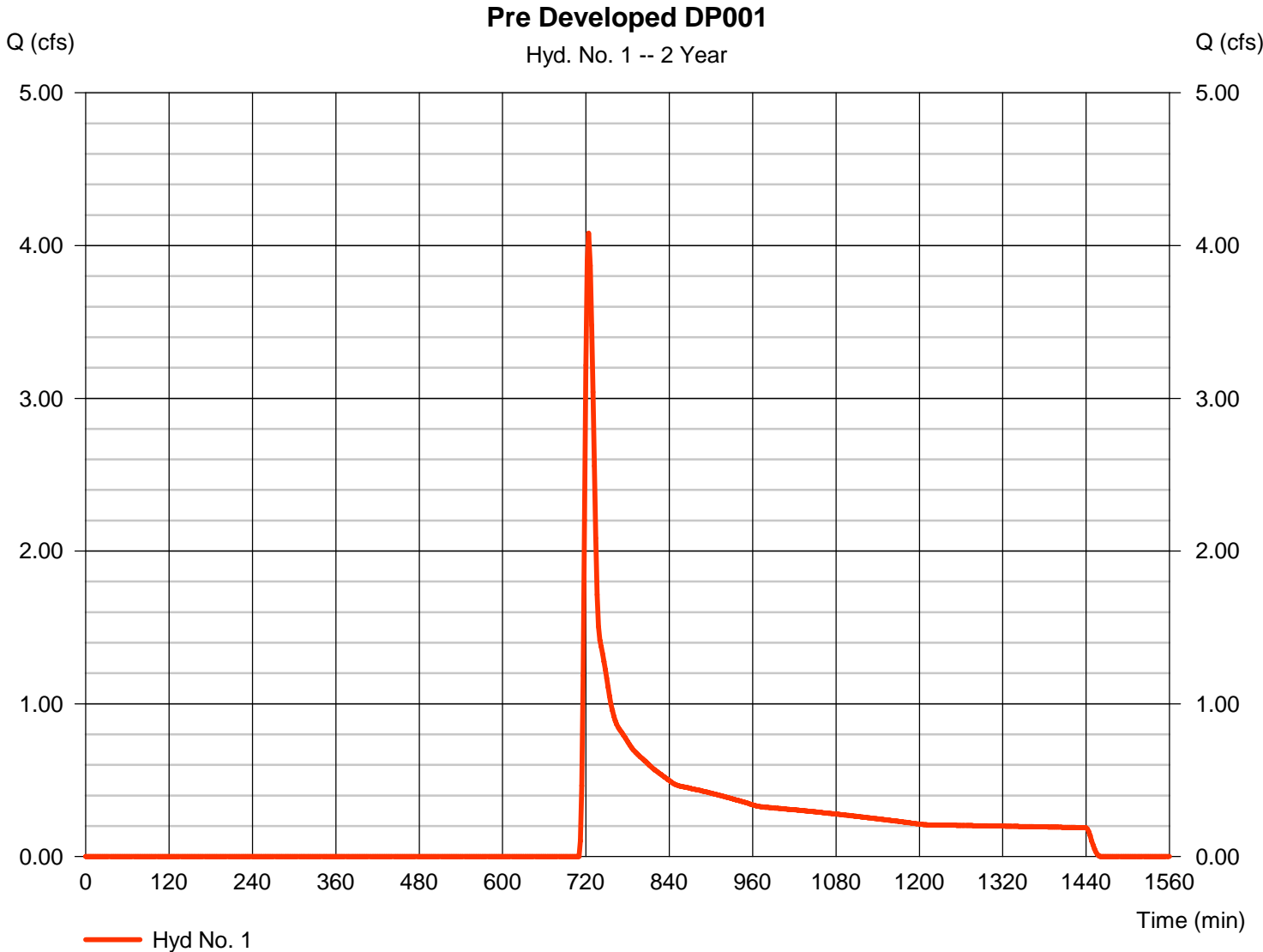
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	4.081	2	724	18,589	-----	-----	-----	Pre Developed DP001	
2	SCS Runoff	7.109	2	724	29,139	-----	-----	-----	Pre Developed DP002	
4	SCS Runoff	15.05	2	718	30,930	-----	-----	-----	Post Basin 3	
5	Reservoir	0.134	2	1442	4,058	4	315.05	30,113	Basin 3 Routed	
6	SCS Runoff	1.057	2	718	2,175	-----	-----	-----	Post Bypass DP001	
7	Combine	1.057	2	718	6,233	5, 6	-----	-----	Post Total DP001	
9	SCS Runoff	17.46	2	718	35,385	-----	-----	-----	Post Basin 1	
10	Reservoir	0.256	2	1314	8,174	9	317.03	30,269	Basin 1 Upper Routed	
11	Reservoir	0.043	2	1844	2,084	10	299.59	6,909	Basin 1 Lower Routed	
12	SCS Runoff	15.44	2	718	30,895	-----	-----	-----	Post Basin 2	
13	Reservoir	0.000	2	n/a	0	12	306.70	30,895	Basin 2 Routed	
14	SCS Runoff	1.546	2	718	3,282	-----	-----	-----	Post Bypass DP002	
15	Combine	1.546	2	718	5,367	11, 13, 14	-----	-----	Post Total DP002	
SWM.gpw					Return Period: 2 Year			Friday, 04 / 30 / 2021		

# Hydrograph Report

## Hyd. No. 1

Pre Developed DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 4.081 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 18,589 cuft
Drainage area	= 14.570 ac	Curve number	= 58
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

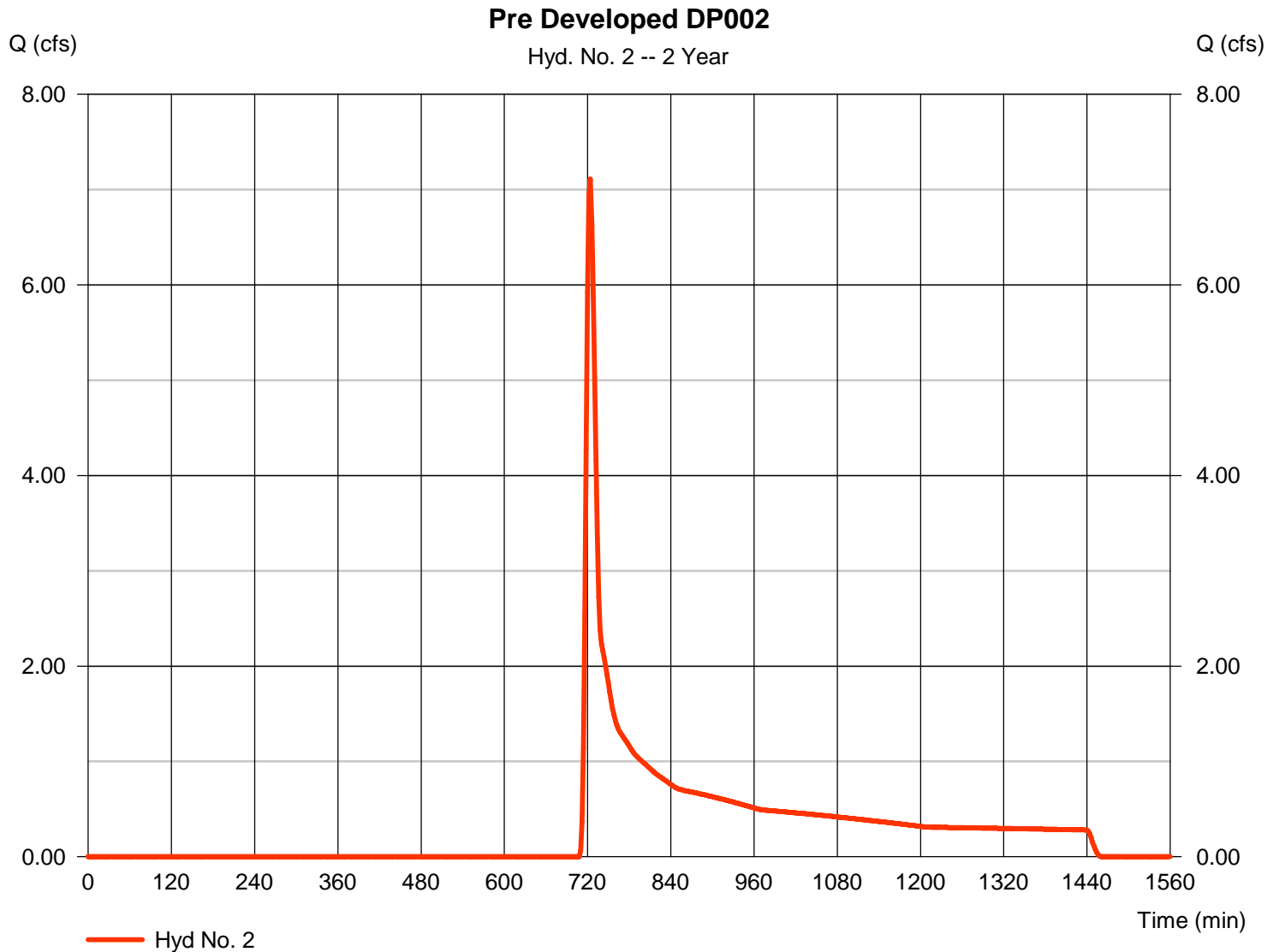
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## Hyd. No. 2

Pre Developed DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 7.109 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 29,139 cuft
Drainage area	= 20.260 ac	Curve number	= 59.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

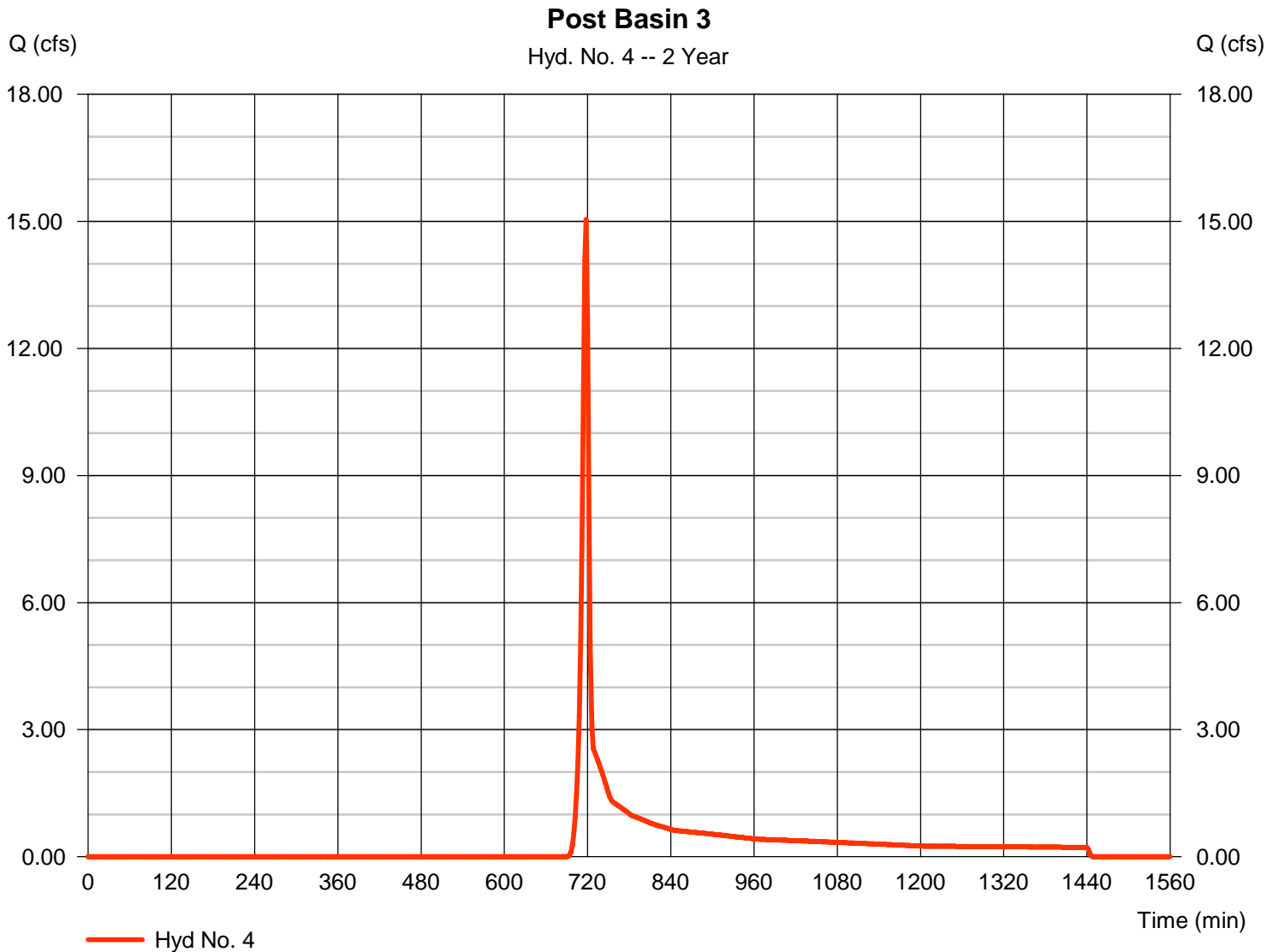
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

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## Hyd. No. 4

Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 15.05 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 30,930 cuft
Drainage area	= 11.730 ac	Curve number	= 68.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

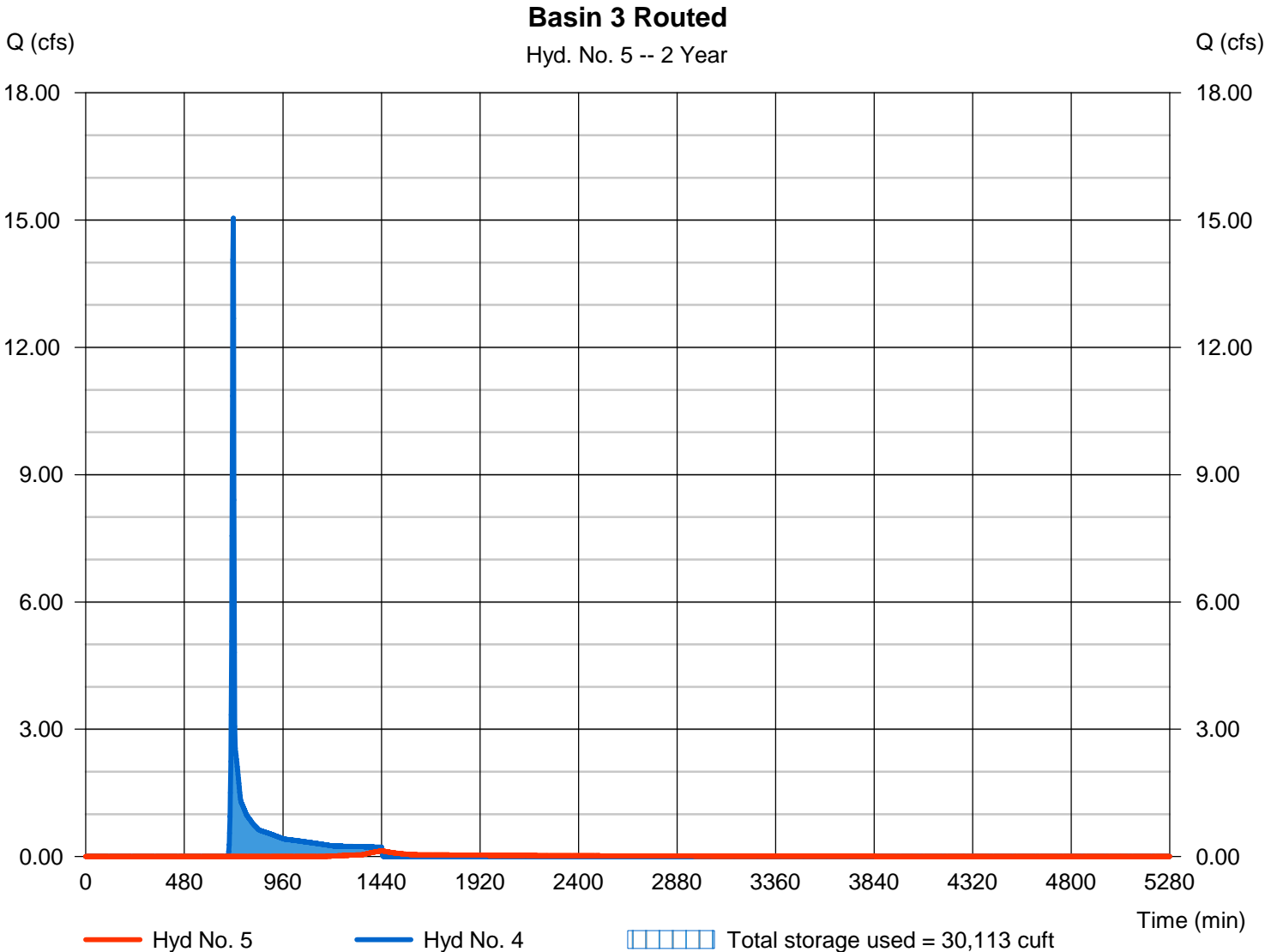
Friday, 04 / 30 / 2021

## Hyd. No. 5

Basin 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.134 cfs
Storm frequency	= 2 yrs	Time to peak	= 1442 min
Time interval	= 2 min	Hyd. volume	= 4,058 cuft
Inflow hyd. No.	= 4 - Post Basin 3	Max. Elevation	= 315.05 ft
Reservoir name	= Basin 3	Max. Storage	= 30,113 cuft

Storage Indication method used.



# Hydrograph Report

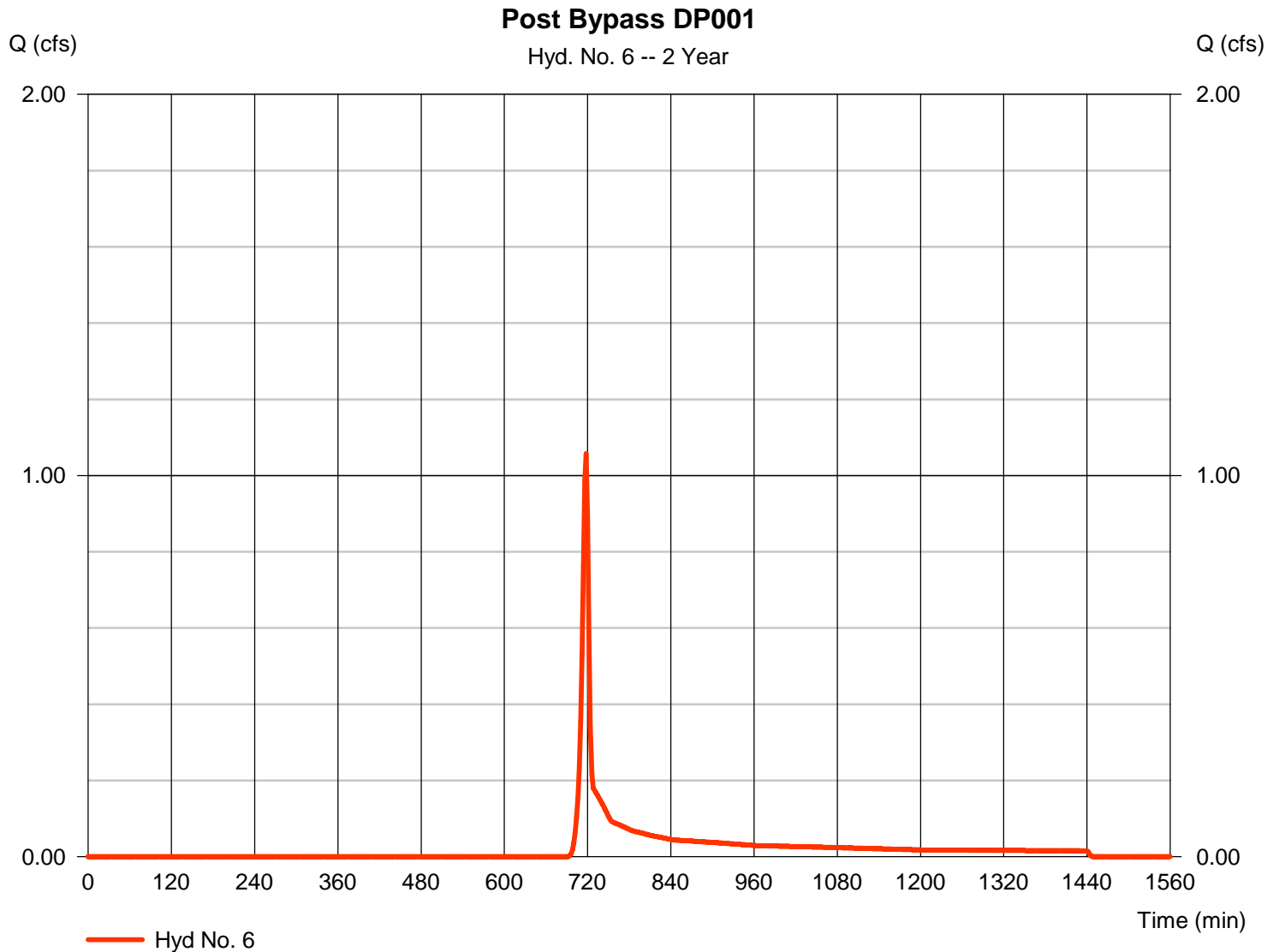
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

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## Hyd. No. 6

Post Bypass DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 1.057 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,175 cuft
Drainage area	= 0.830 ac	Curve number	= 68.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

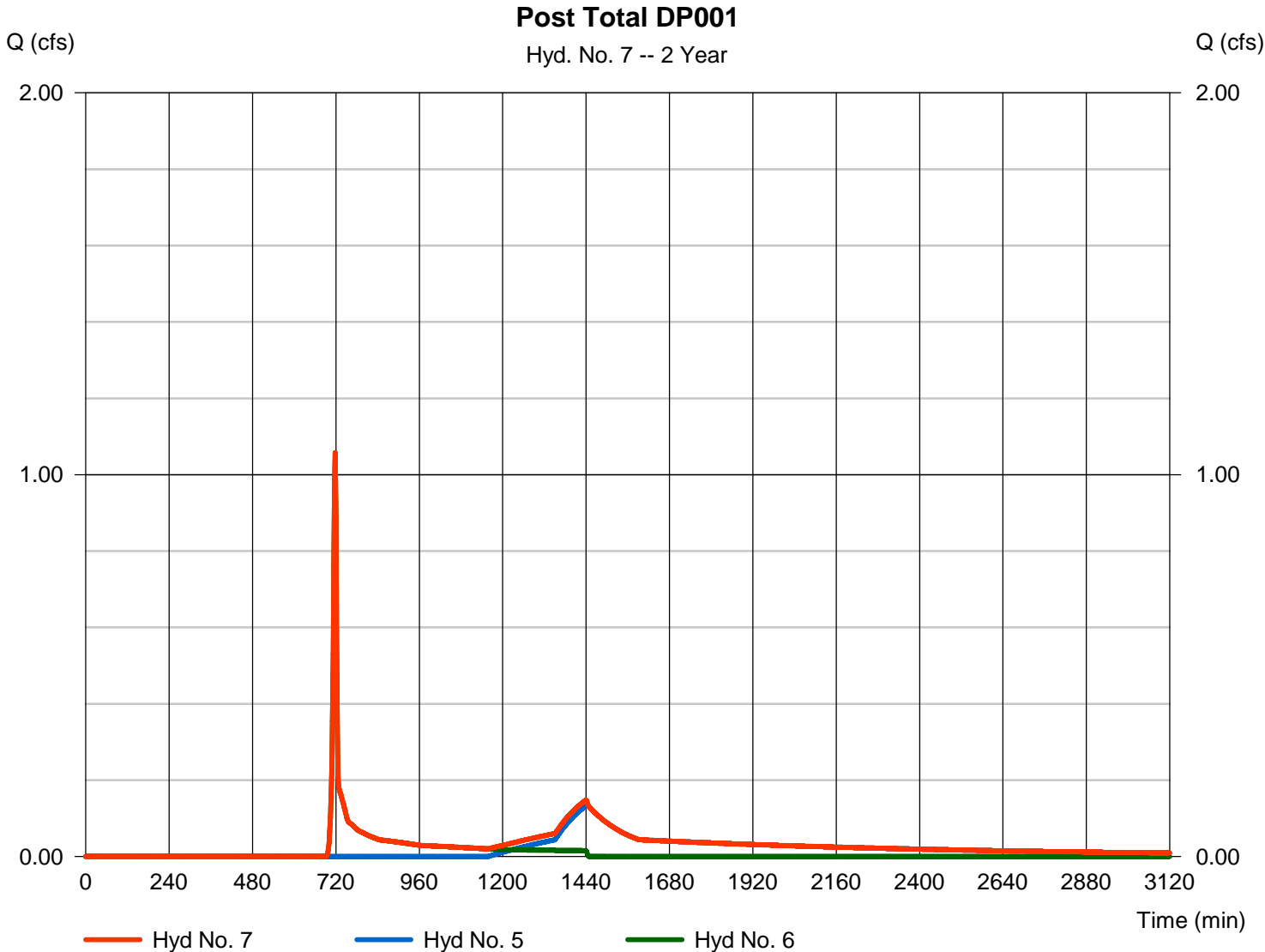
Friday, 04 / 30 / 2021

## Hyd. No. 7

Post Total DP001

Hydrograph type = Combine  
Storm frequency = 2 yrs  
Time interval = 2 min  
Inflow hyds. = 5, 6

Peak discharge = 1.057 cfs  
Time to peak = 718 min  
Hyd. volume = 6,233 cuft  
Contrib. drain. area = 0.830 ac

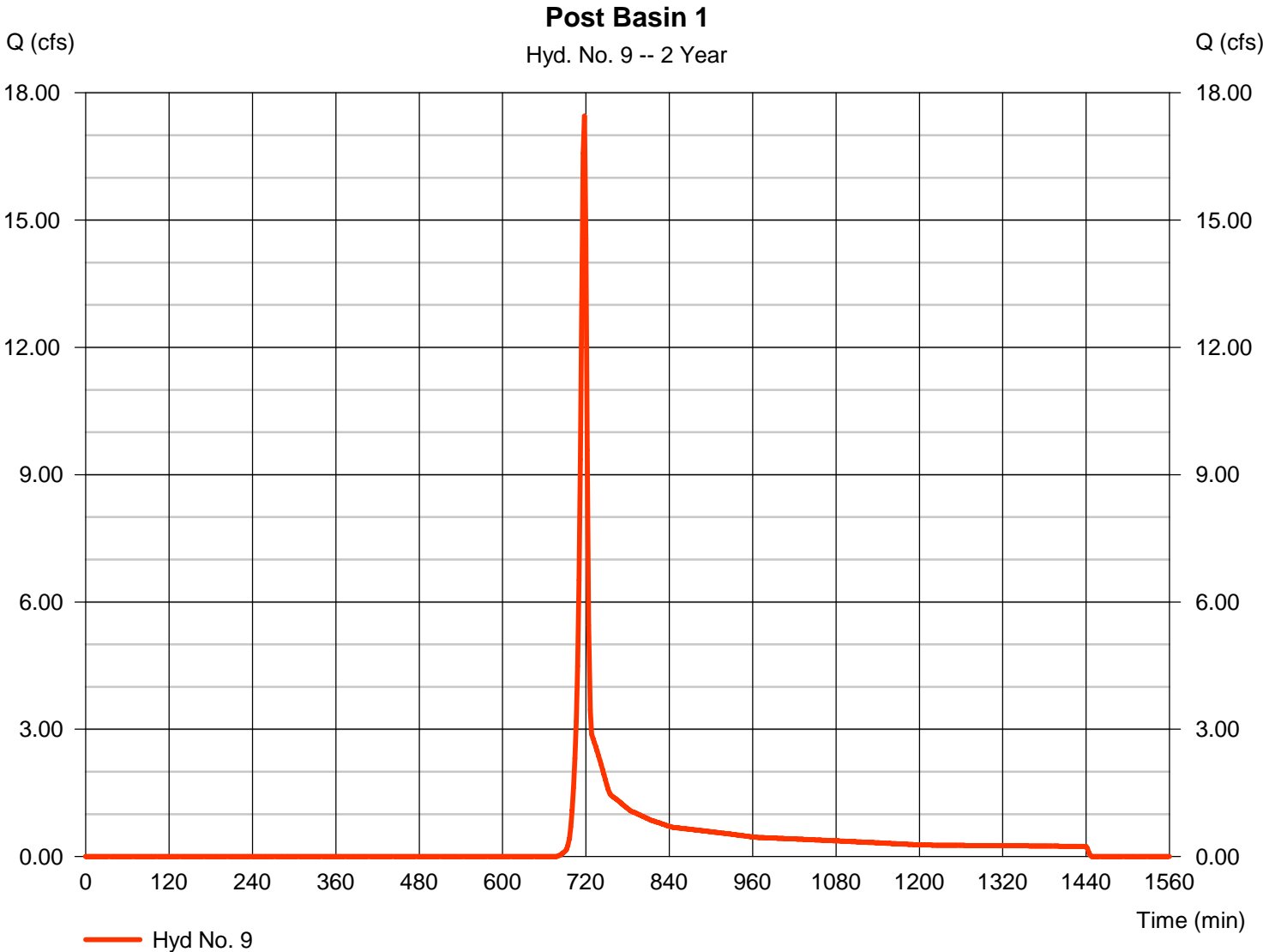


# Hydrograph Report

## Hyd. No. 9

### Post Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 17.46 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 35,385 cuft
Drainage area	= 11.910 ac	Curve number	= 70.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

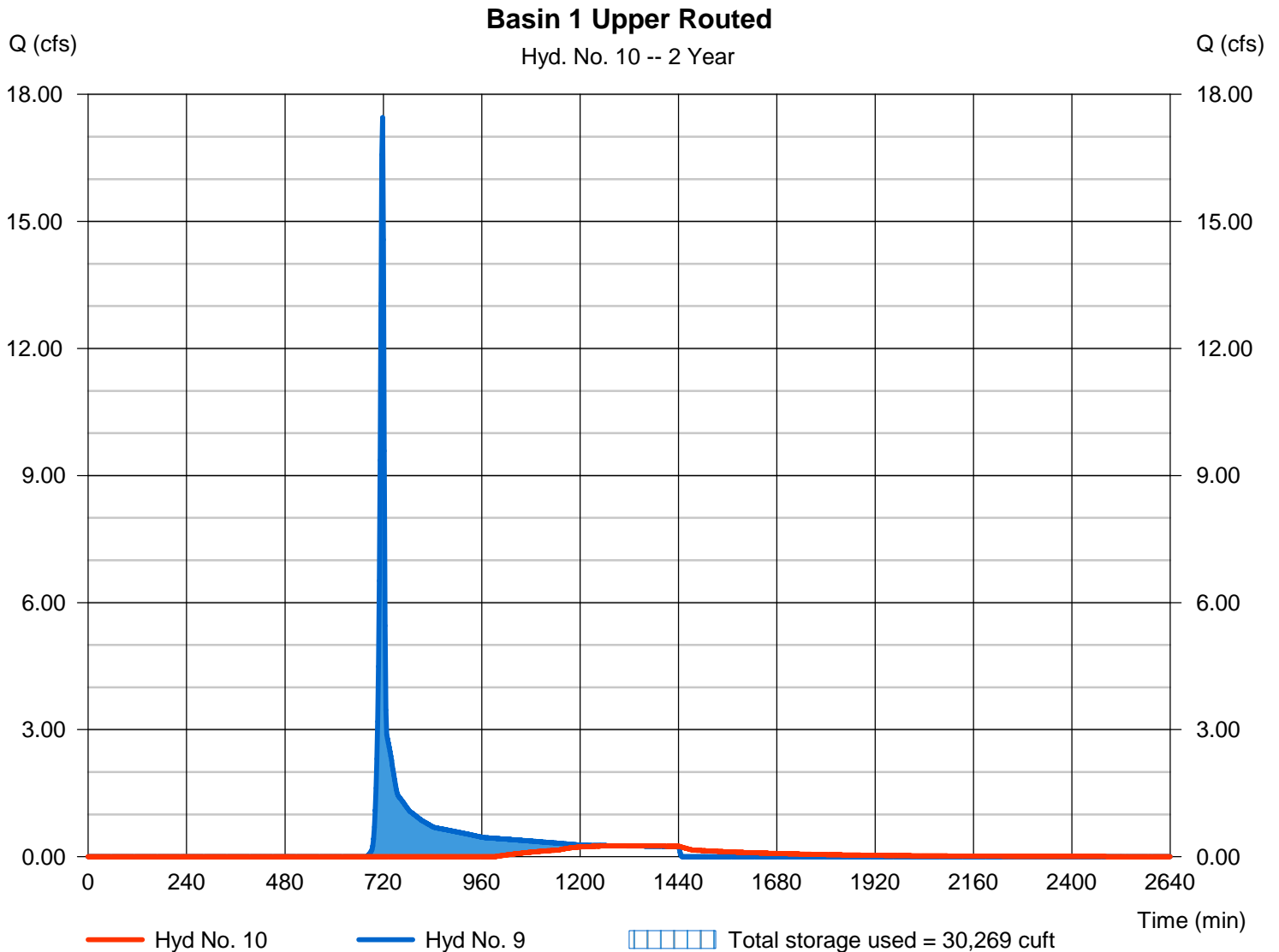
Friday, 04 / 30 / 2021

## Hyd. No. 10

Basin 1 Upper Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.256 cfs
Storm frequency	= 2 yrs	Time to peak	= 1314 min
Time interval	= 2 min	Hyd. volume	= 8,174 cuft
Inflow hyd. No.	= 9 - Post Basin 1	Max. Elevation	= 317.03 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 30,269 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

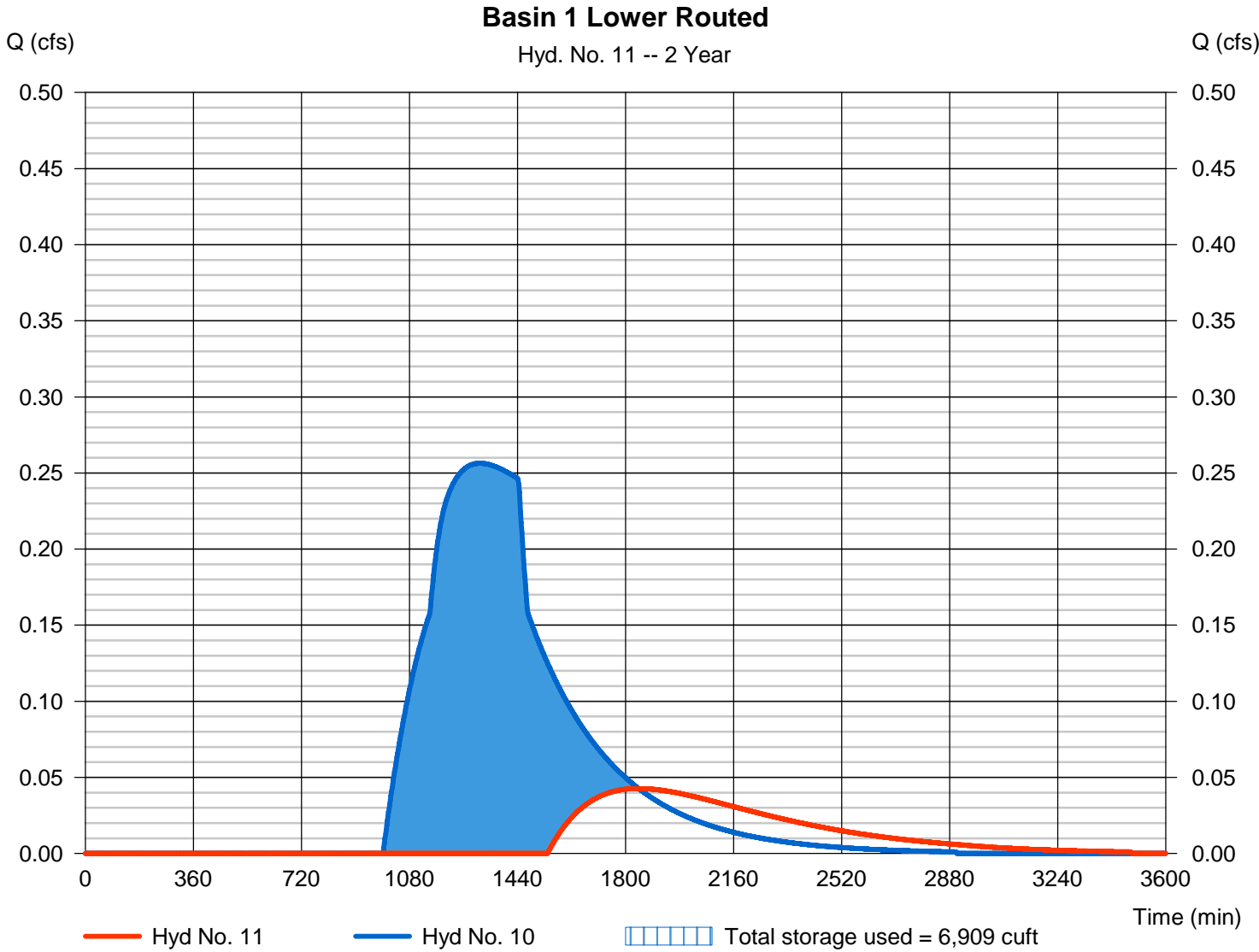
Friday, 04 / 30 / 2021

## Hyd. No. 11

Basin 1 Lower Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.043 cfs
Storm frequency	= 2 yrs	Time to peak	= 1844 min
Time interval	= 2 min	Hyd. volume	= 2,084 cuft
Inflow hyd. No.	= 10 - Basin 1 Upper Routed	Max. Elevation	= 299.59 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 6,909 cuft

Storage Indication method used.

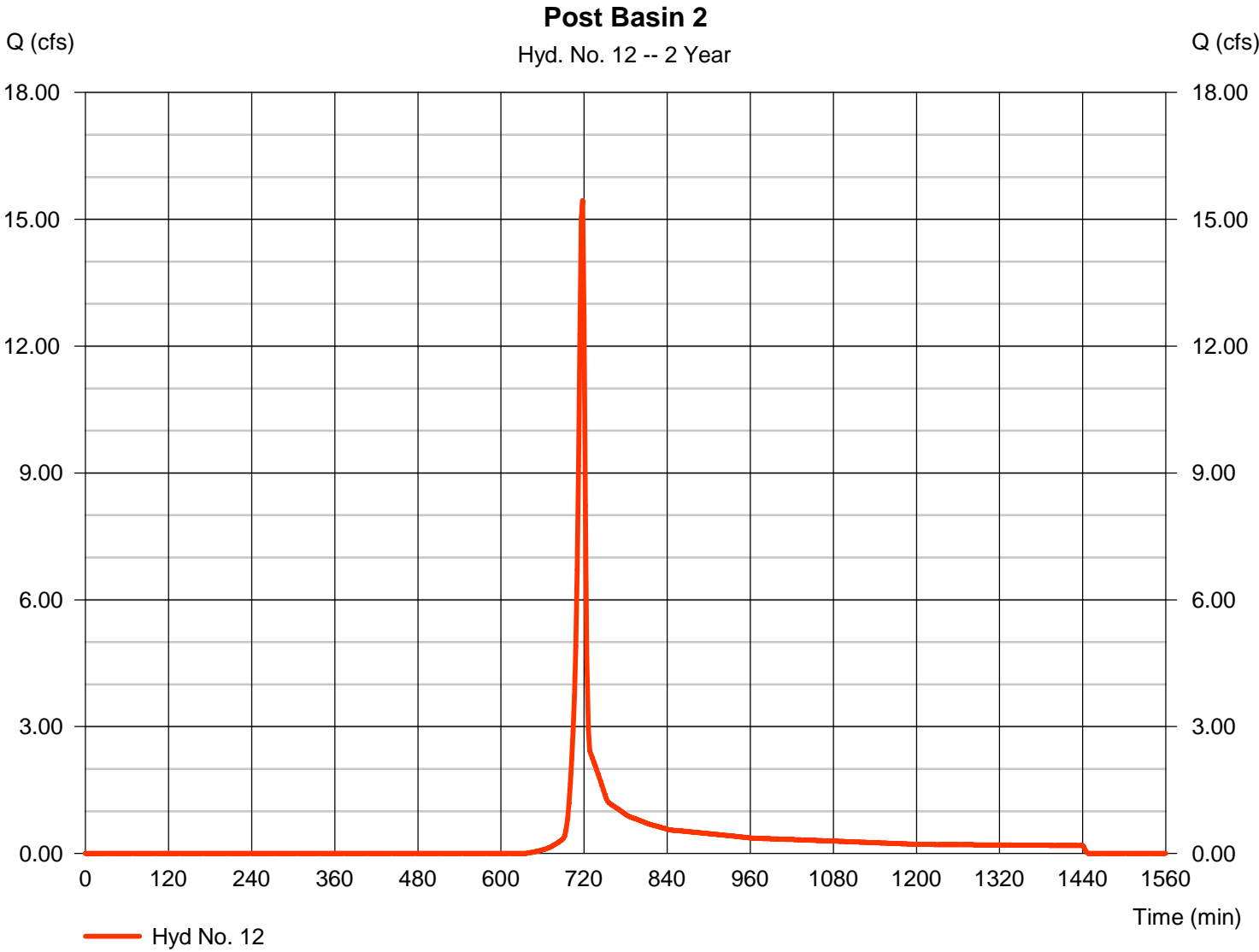


# Hydrograph Report

## Hyd. No. 12

### Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 15.44 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 30,895 cuft
Drainage area	= 8.170 ac	Curve number	= 75.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

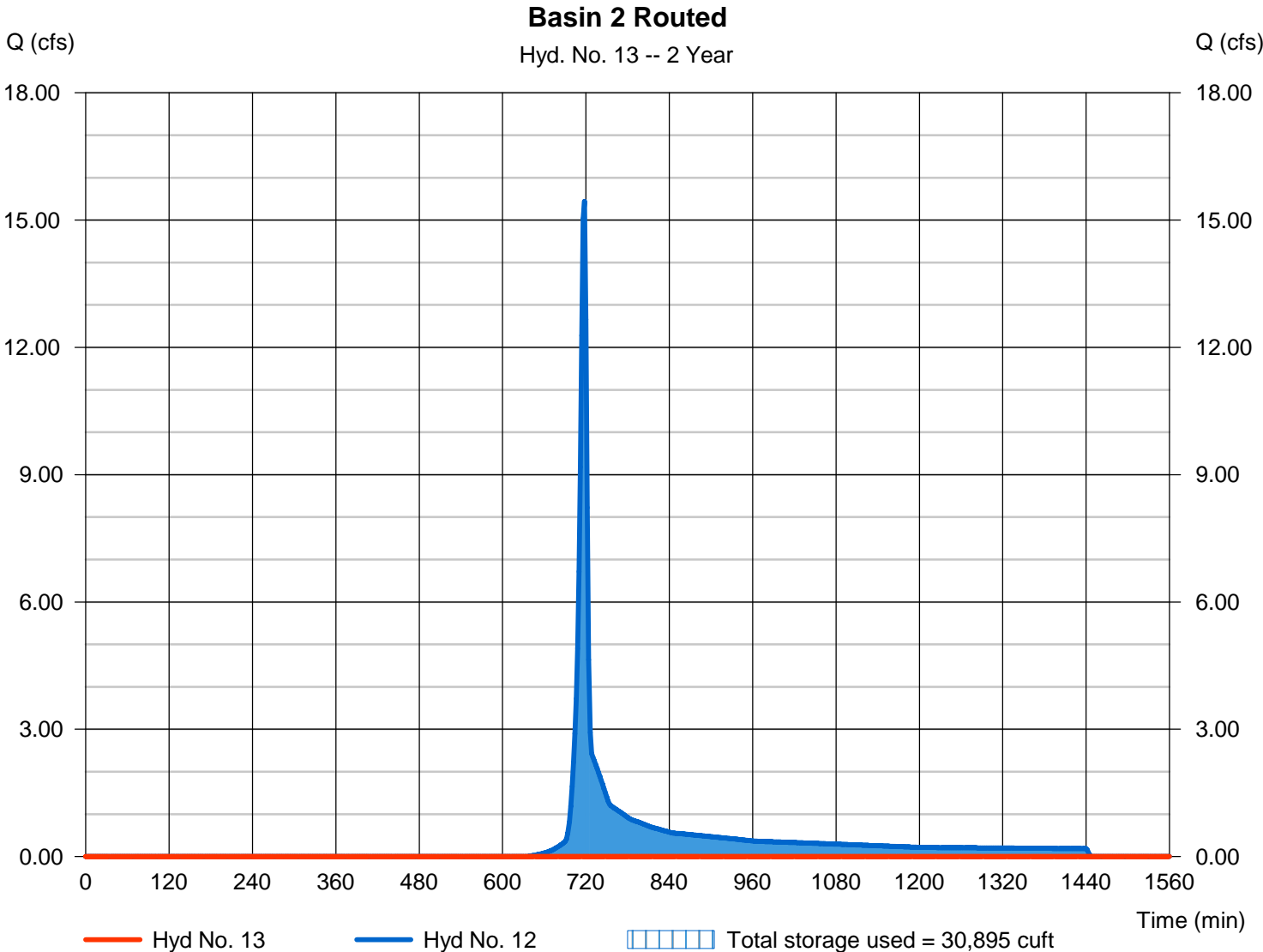
Friday, 04 / 30 / 2021

## Hyd. No. 13

Basin 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 12 - Post Basin 2	Max. Elevation	= 306.70 ft
Reservoir name	= Basin 2	Max. Storage	= 30,895 cuft

Storage Indication method used.



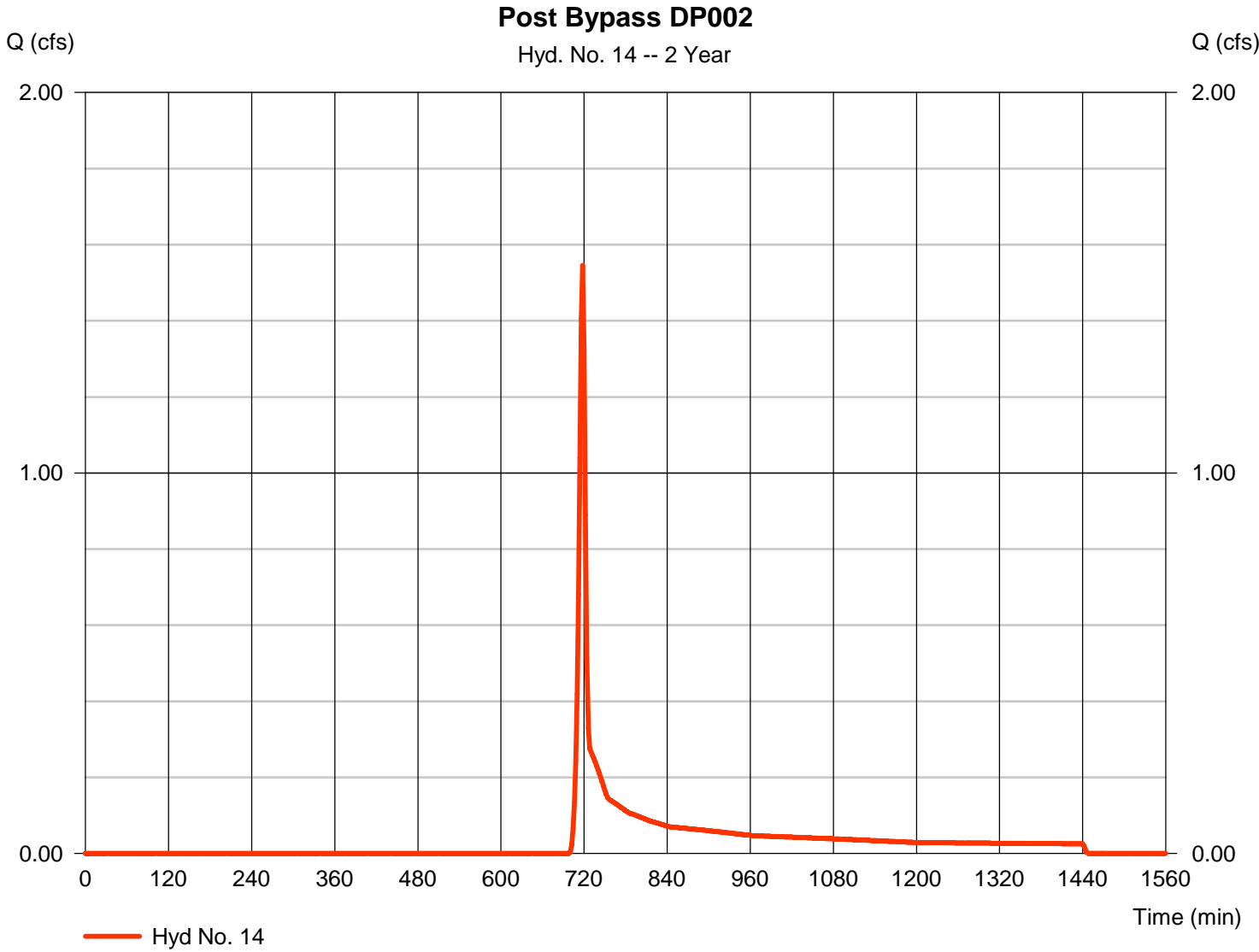


# Hydrograph Report

## Hyd. No. 14

Post Bypass DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 1.546 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 3,282 cuft
Drainage area	= 1.490 ac	Curve number	= 66.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

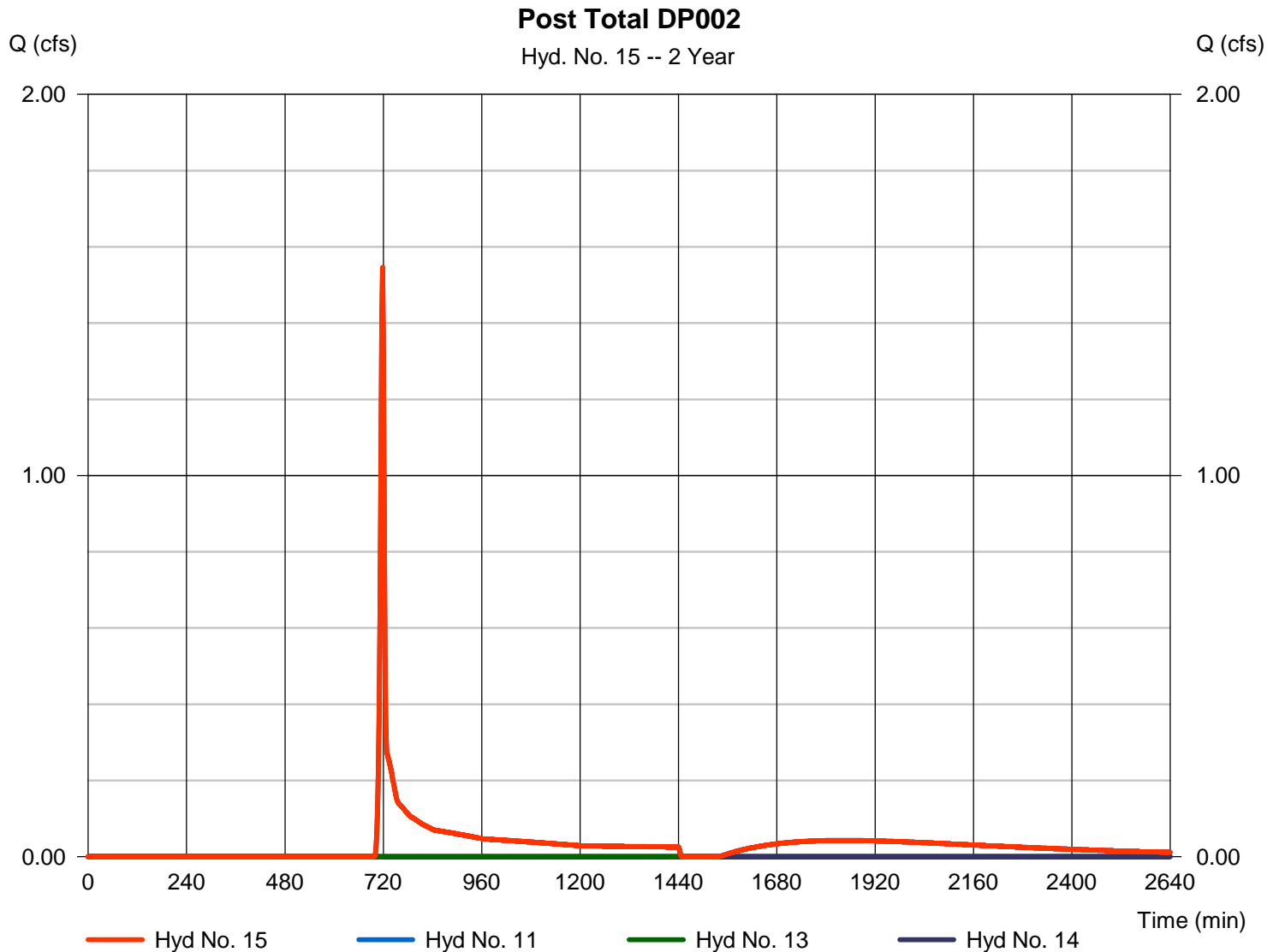
Friday, 04 / 30 / 2021

## Hyd. No. 15

Post Total DP002

Hydrograph type = Combine  
Storm frequency = 2 yrs  
Time interval = 2 min  
Inflow hyds. = 11, 13, 14

Peak discharge = 1.546 cfs  
Time to peak = 718 min  
Hyd. volume = 5,367 cuft  
Contrib. drain. area = 1.490 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

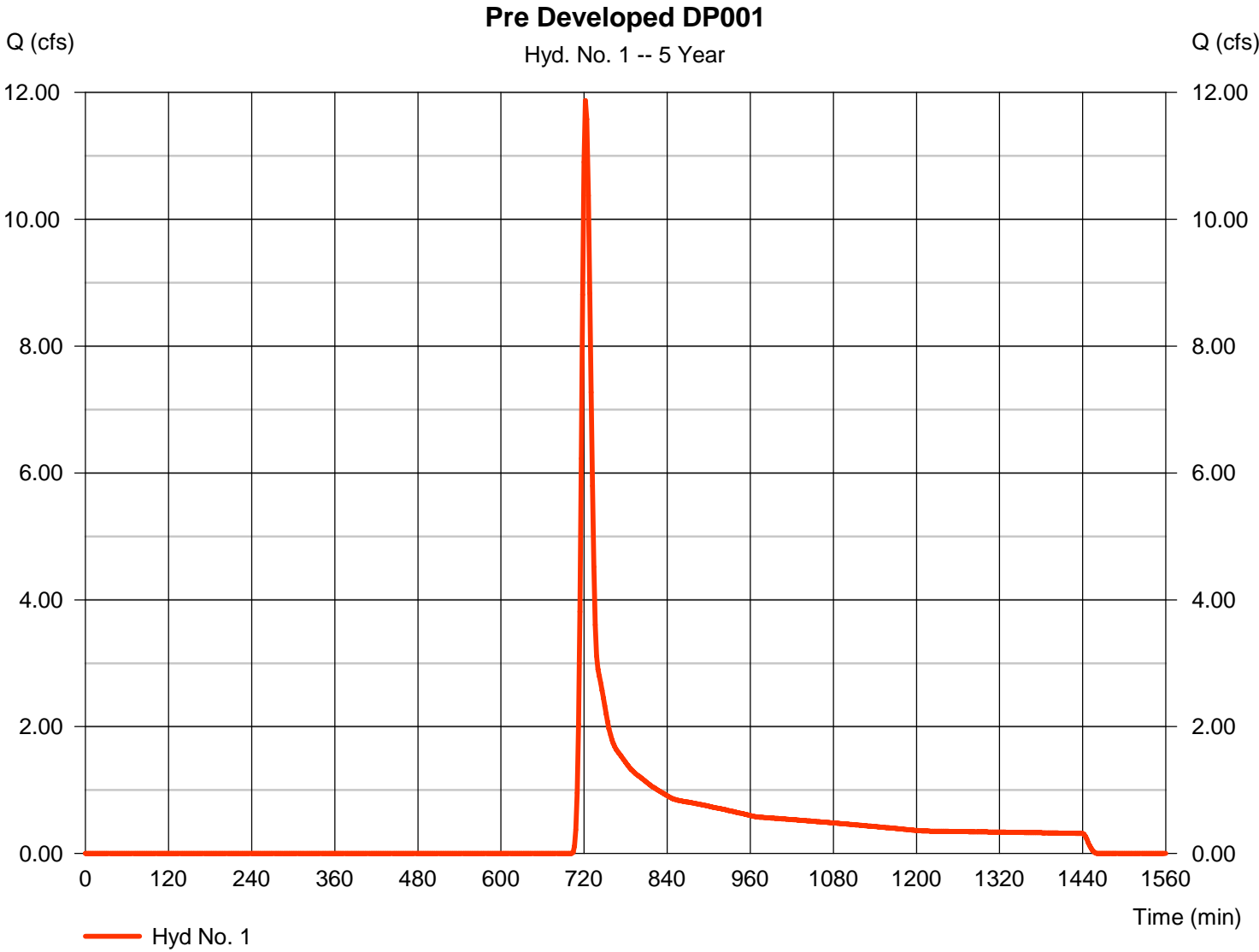
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	11.87	2	722	38,261	-----	-----	-----	Pre Developed DP001
2	SCS Runoff	18.82	2	722	58,082	-----	-----	-----	Pre Developed DP002
4	SCS Runoff	26.13	2	718	52,395	-----	-----	-----	Post Basin 3
5	Reservoir	0.756	2	922	25,523	4	315.33	33,676	Basin 3 Routed
6	SCS Runoff	1.840	2	718	3,689	-----	-----	-----	Post Bypass DP001
7	Combine	1.840	2	718	29,213	5, 6	-----	-----	Post Total DP001
9	SCS Runoff	29.23	2	718	58,467	-----	-----	-----	Post Basin 1
10	Reservoir	1.201	2	826	31,256	9	317.28	33,627	Basin 1 Upper Routed
11	Reservoir	0.896	2	942	25,166	10	299.98	8,597	Basin 1 Lower Routed
12	SCS Runoff	24.23	2	718	48,620	-----	-----	-----	Post Basin 2
13	Reservoir	0.496	2	996	16,265	12	307.06	36,060	Basin 2 Routed
14	SCS Runoff	2.858	2	718	5,781	-----	-----	-----	Post Bypass DP002
15	Combine	2.858	2	718	47,212	11, 13, 14	-----	-----	Post Total DP002
SWM.gpw					Return Period: 5 Year			Friday, 04 / 30 / 2021	

# Hydrograph Report

## Hyd. No. 1

Pre Developed DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 11.87 cfs
Storm frequency	= 5 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 38,261 cuft
Drainage area	= 14.570 ac	Curve number	= 58
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 4.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

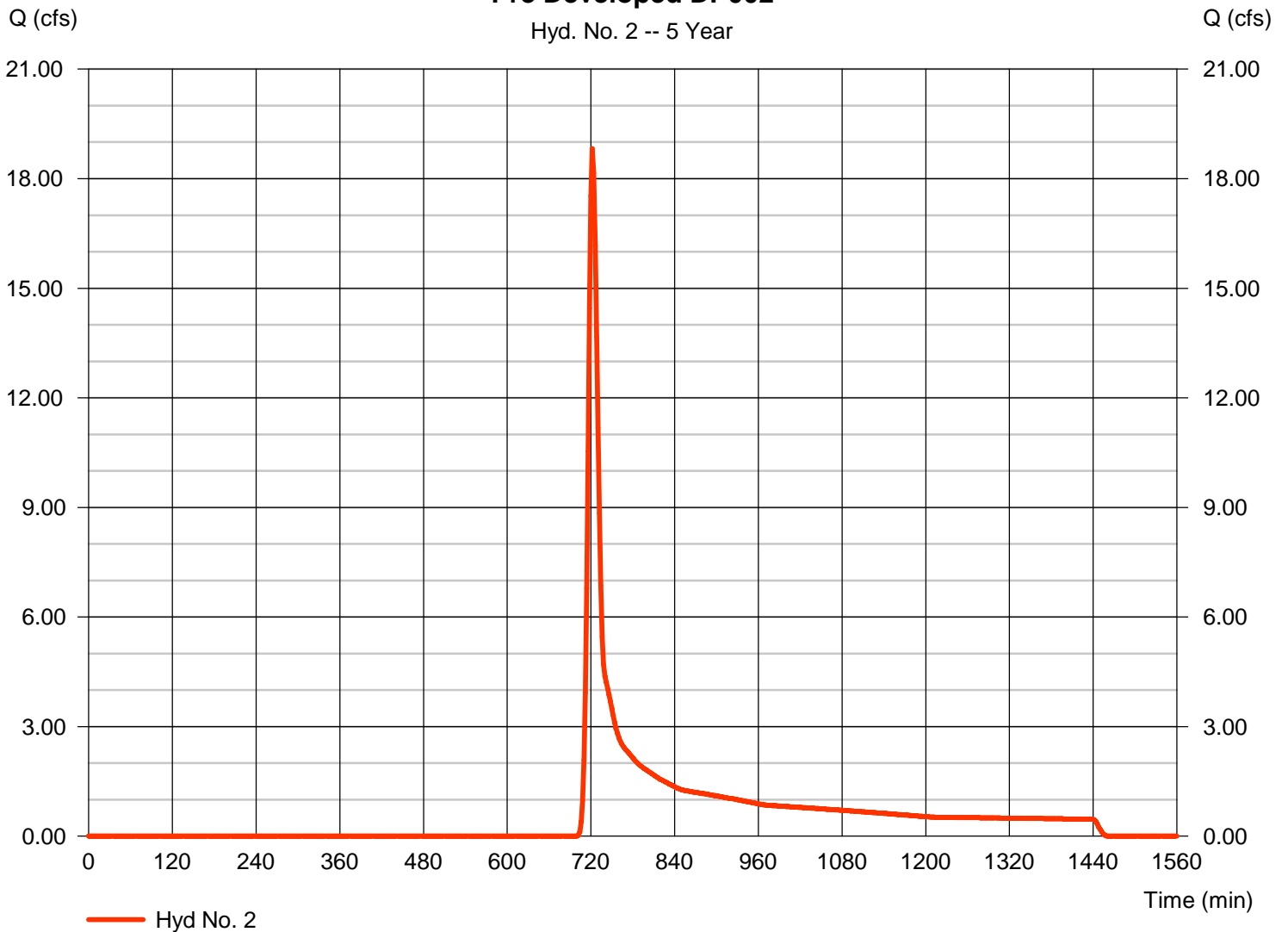
## Hyd. No. 2

Pre Developed DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 18.82 cfs
Storm frequency	= 5 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 58,082 cuft
Drainage area	= 20.260 ac	Curve number	= 59.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 4.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Pre Developed DP002

Hyd. No. 2 -- 5 Year

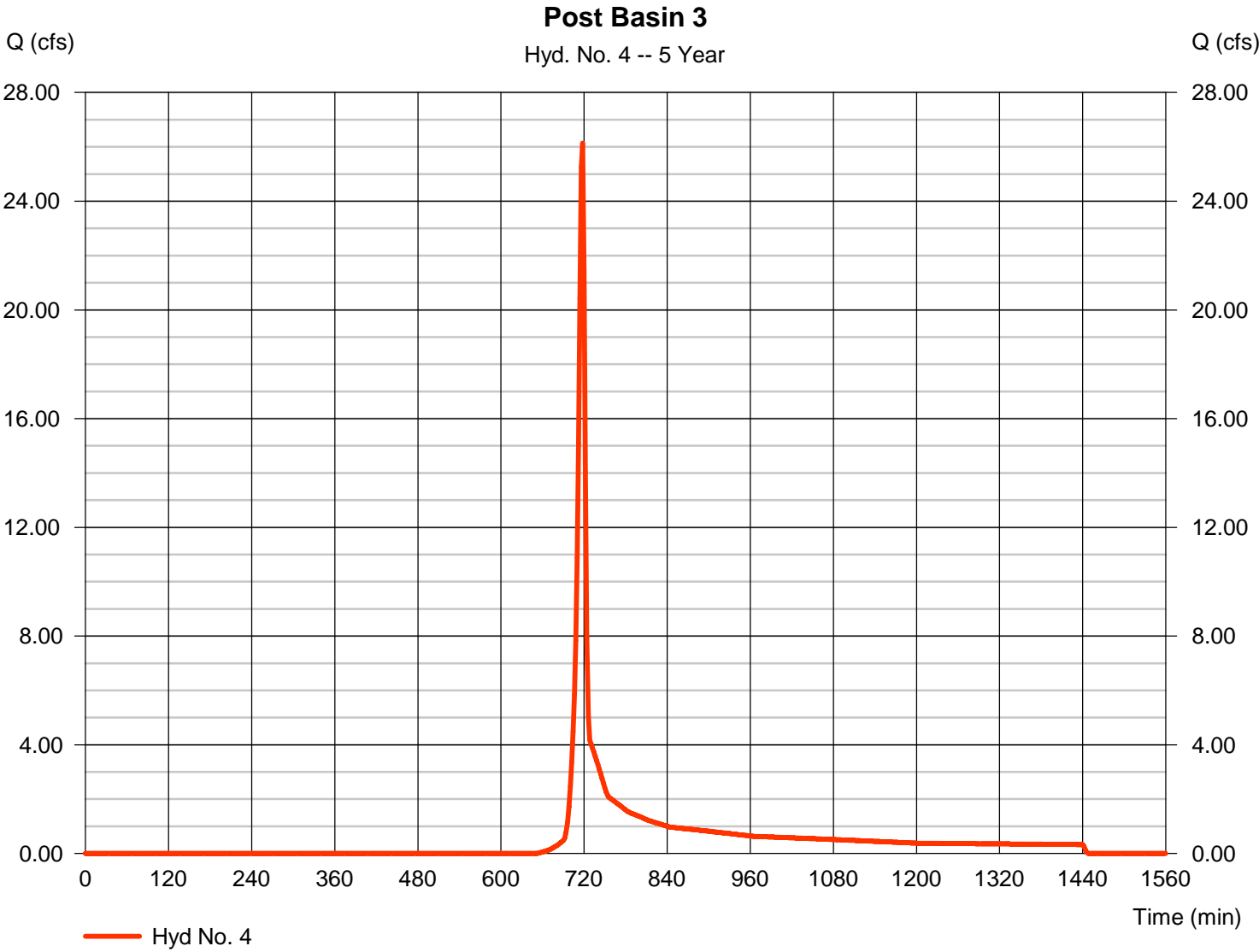


# Hydrograph Report

## Hyd. No. 4

### Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 26.13 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 52,395 cuft
Drainage area	= 11.730 ac	Curve number	= 68.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

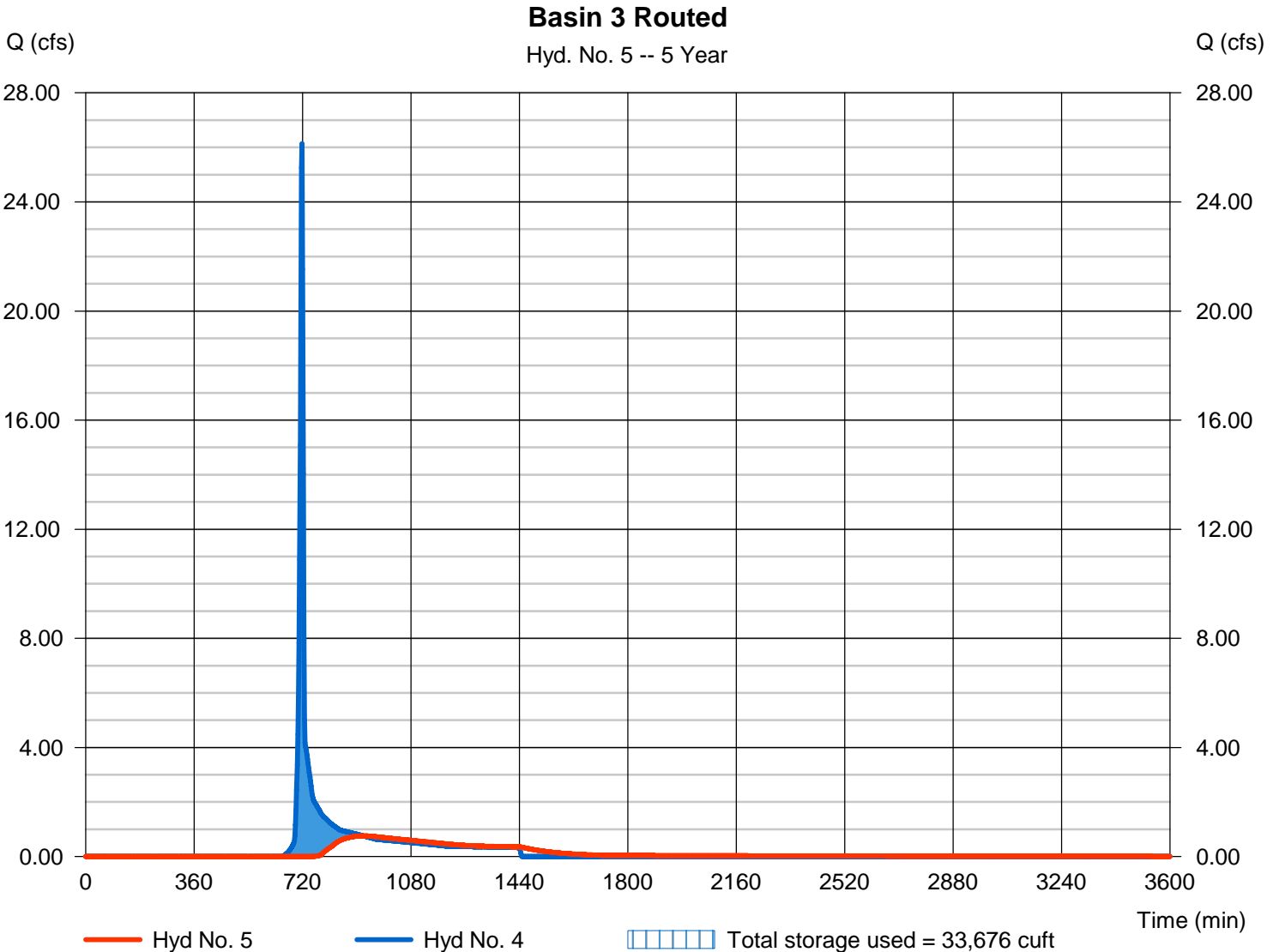
Friday, 04 / 30 / 2021

## Hyd. No. 5

Basin 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.756 cfs
Storm frequency	= 5 yrs	Time to peak	= 922 min
Time interval	= 2 min	Hyd. volume	= 25,523 cuft
Inflow hyd. No.	= 4 - Post Basin 3	Max. Elevation	= 315.33 ft
Reservoir name	= Basin 3	Max. Storage	= 33,676 cuft

Storage Indication method used.

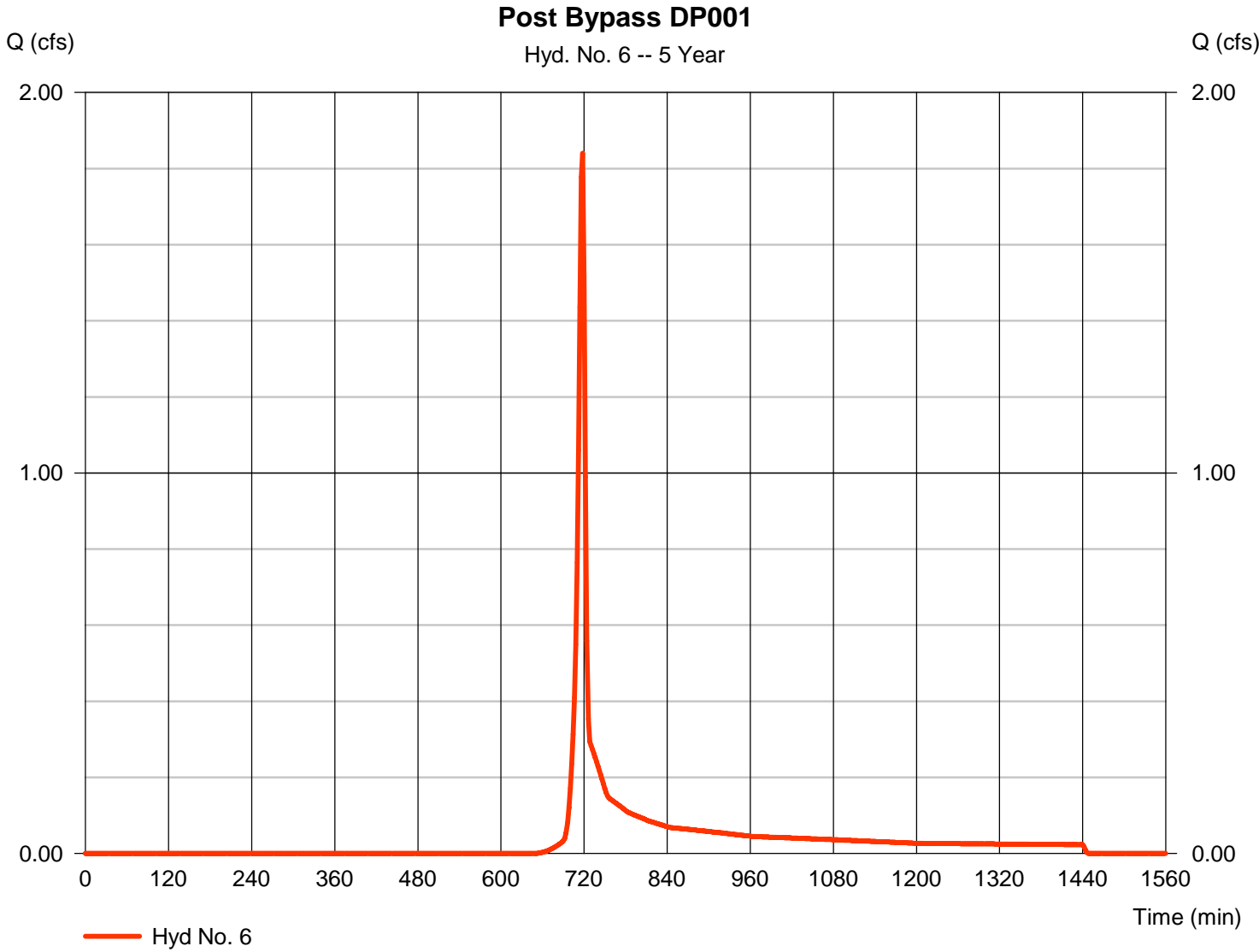


# Hydrograph Report

## Hyd. No. 6

Post Bypass DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 1.840 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 3,689 cuft
Drainage area	= 0.830 ac	Curve number	= 68.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

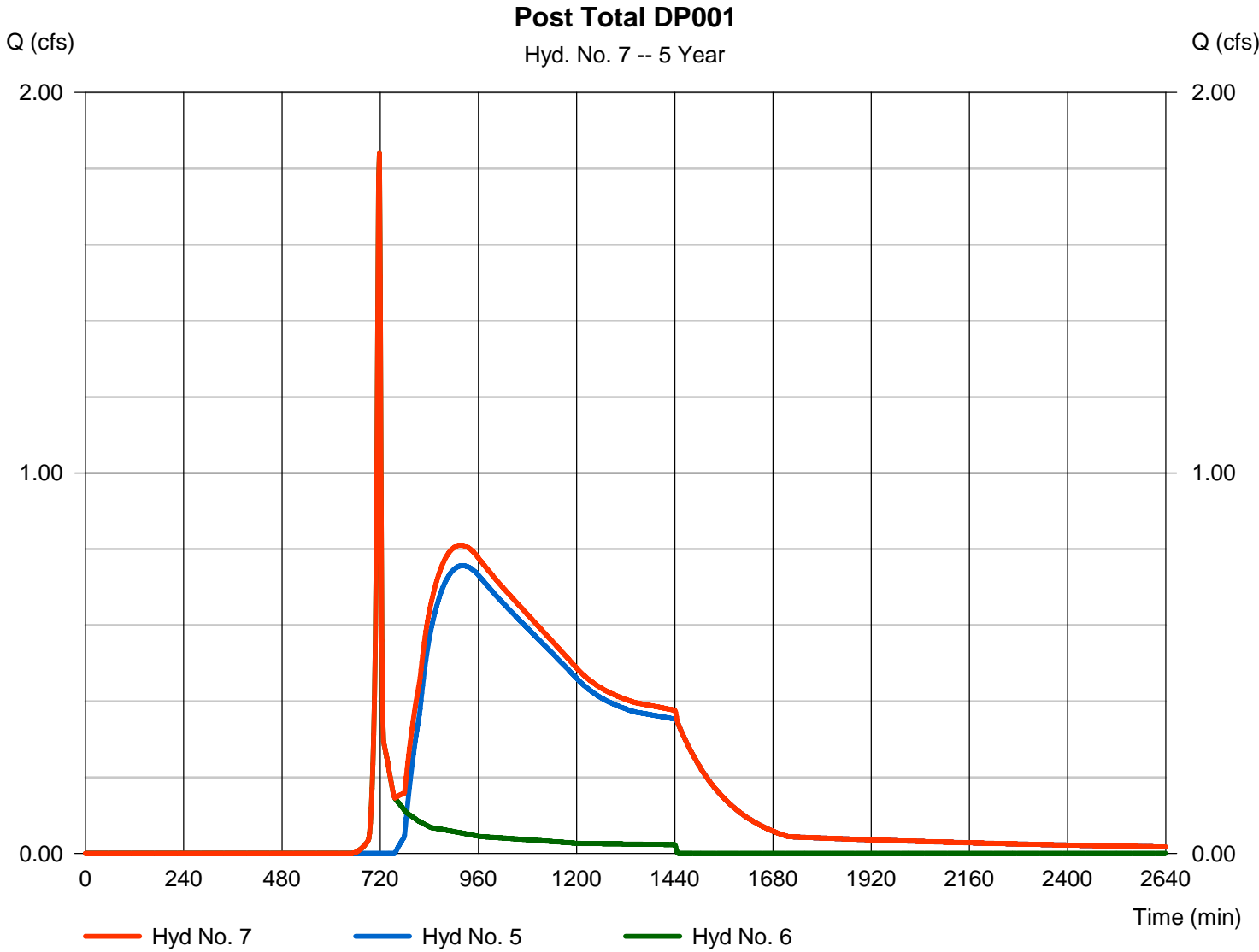
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 7

Post Total DP001

Hydrograph type	= Combine	Peak discharge	= 1.840 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 29,213 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.830 ac



# Hydrograph Report

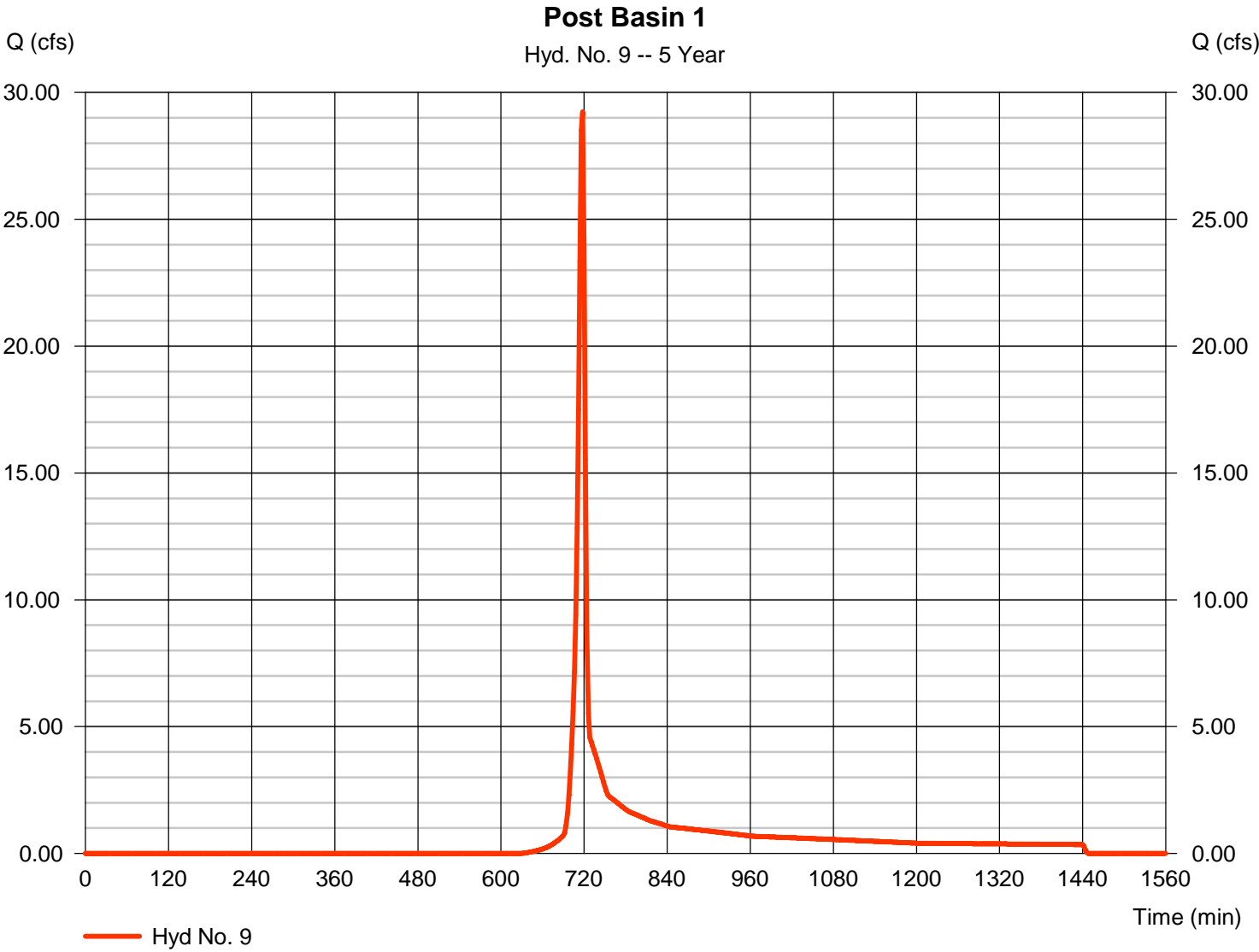
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 9

Post Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 29.23 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 58,467 cuft
Drainage area	= 11.910 ac	Curve number	= 70.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

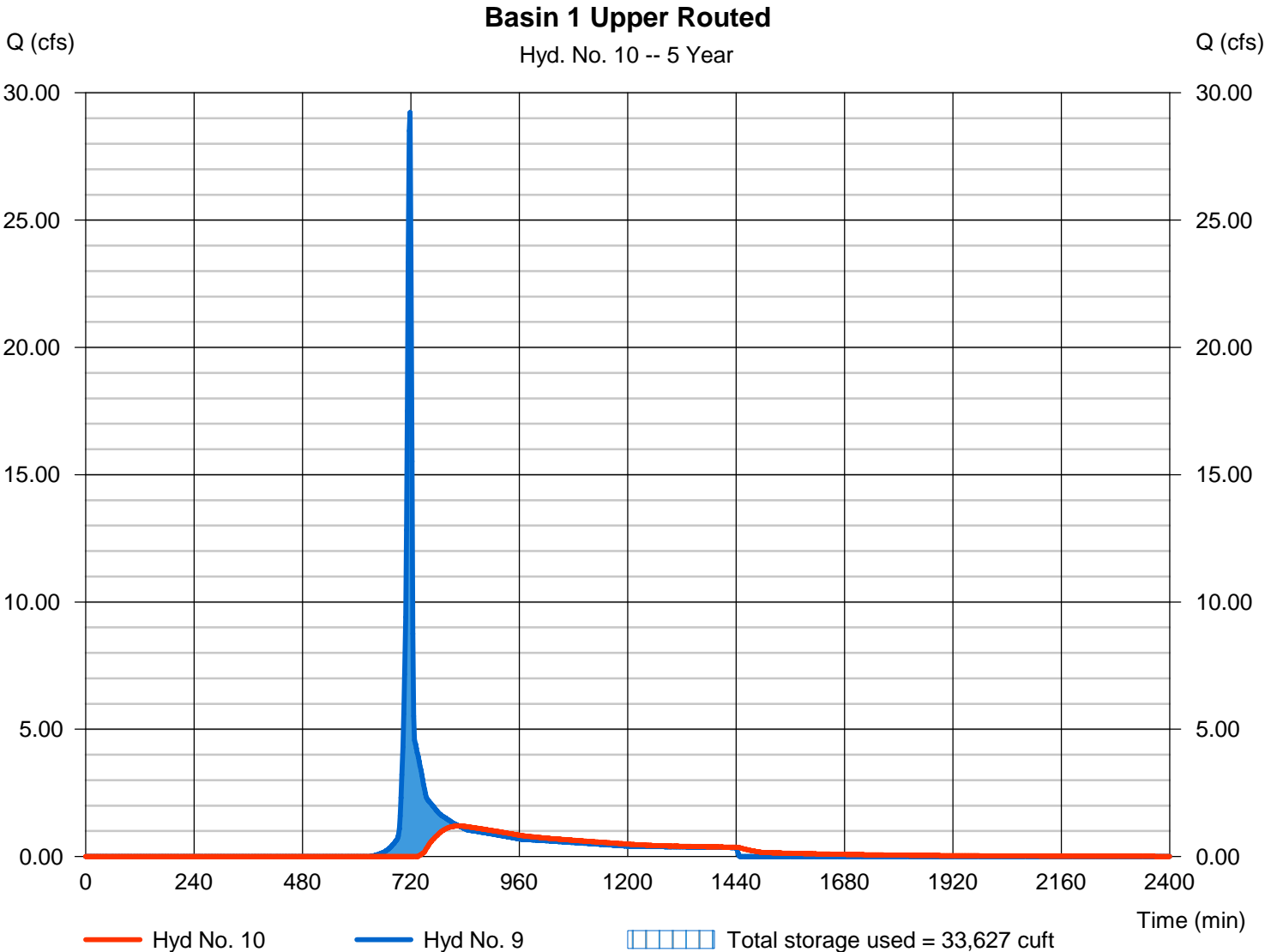
Friday, 04 / 30 / 2021

## Hyd. No. 10

Basin 1 Upper Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.201 cfs
Storm frequency	= 5 yrs	Time to peak	= 826 min
Time interval	= 2 min	Hyd. volume	= 31,256 cuft
Inflow hyd. No.	= 9 - Post Basin 1	Max. Elevation	= 317.28 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 33,627 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

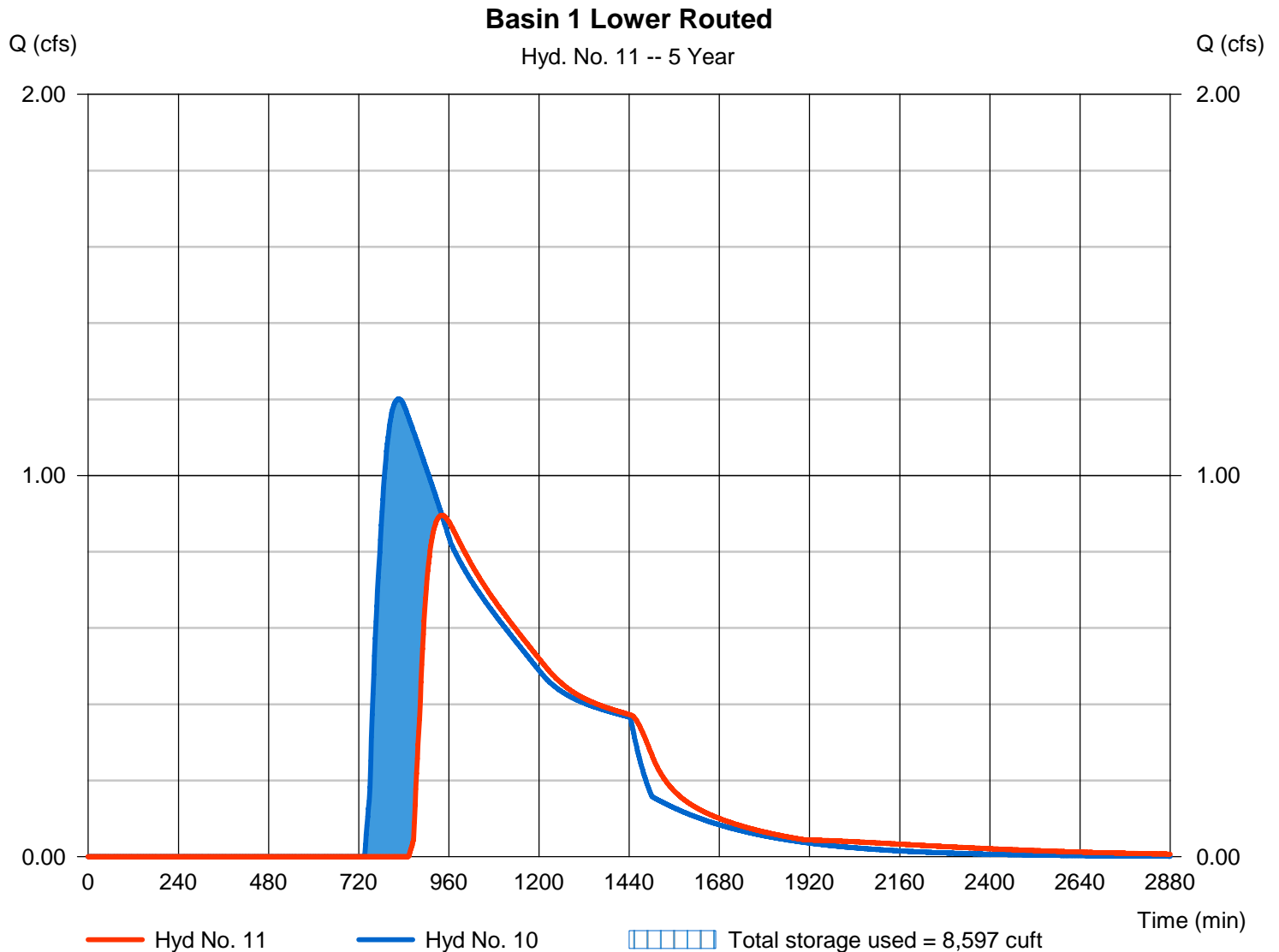
Friday, 04 / 30 / 2021

## Hyd. No. 11

### Basin 1 Lower Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.896 cfs
Storm frequency	= 5 yrs	Time to peak	= 942 min
Time interval	= 2 min	Hyd. volume	= 25,166 cuft
Inflow hyd. No.	= 10 - Basin 1 Upper Routed	Max. Elevation	= 299.98 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 8,597 cuft

Storage Indication method used.



# Hydrograph Report

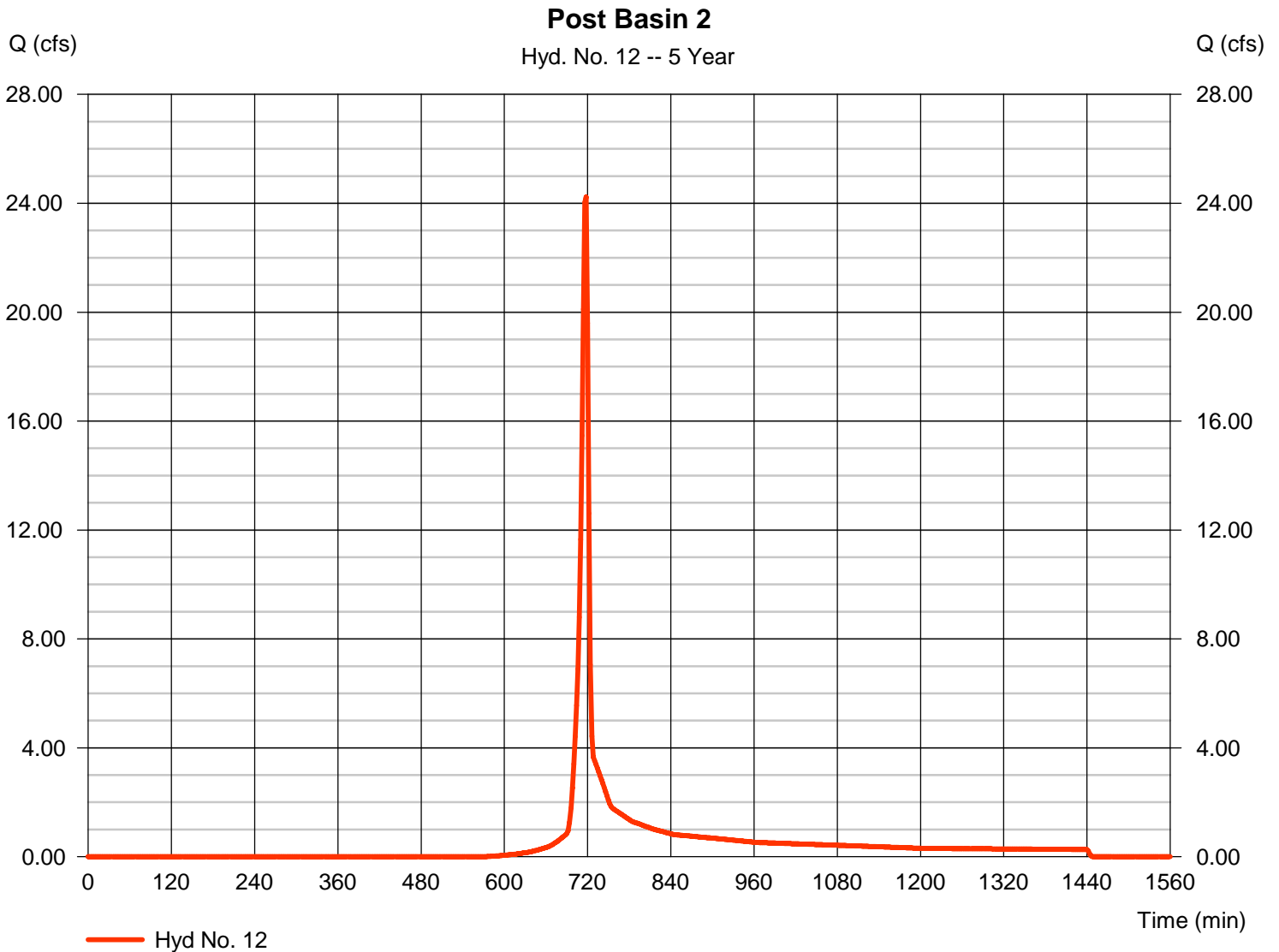
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 12

Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 24.23 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 48,620 cuft
Drainage area	= 8.170 ac	Curve number	= 75.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

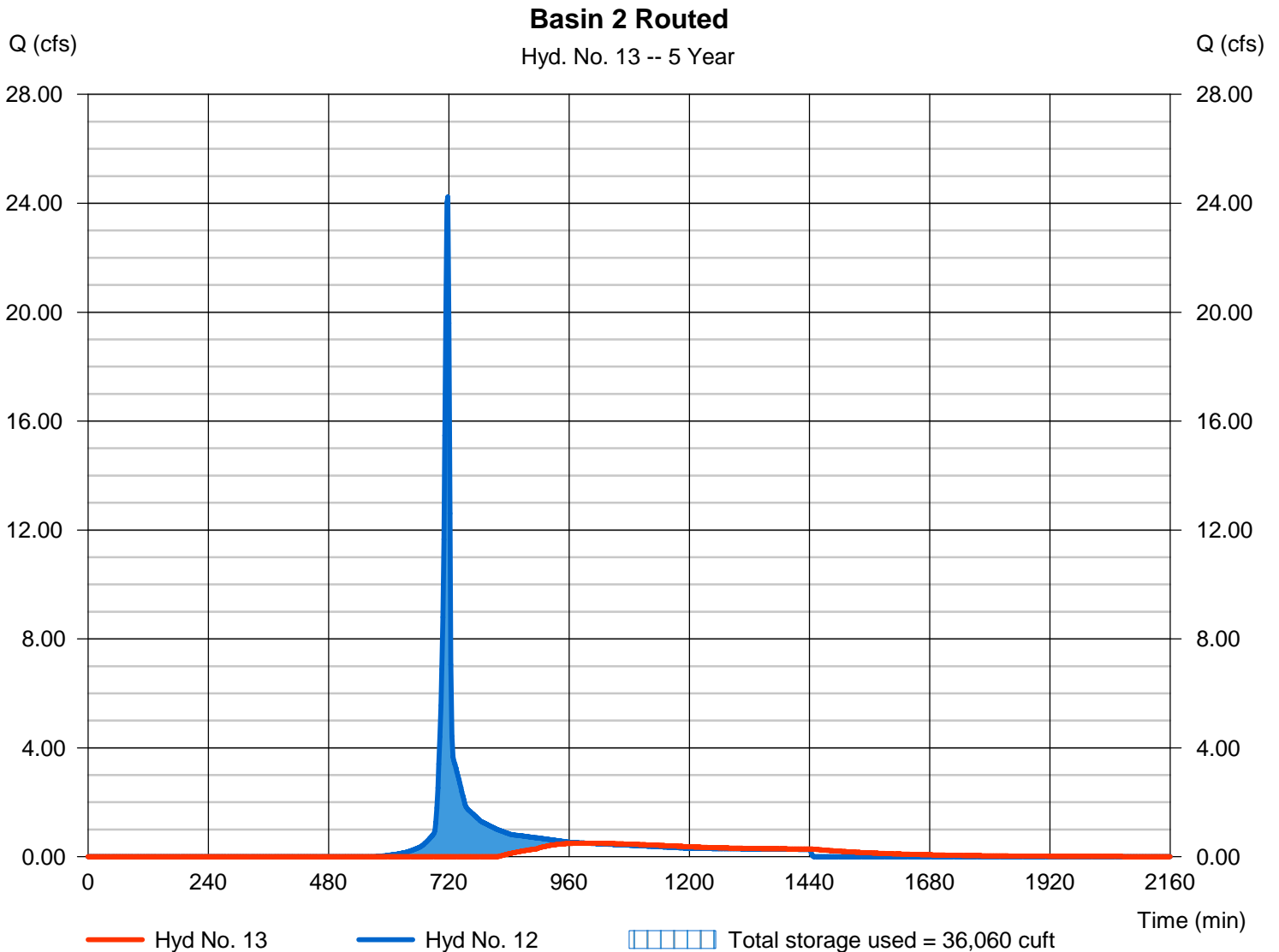
Friday, 04 / 30 / 2021

## Hyd. No. 13

Basin 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.496 cfs
Storm frequency	= 5 yrs	Time to peak	= 996 min
Time interval	= 2 min	Hyd. volume	= 16,265 cuft
Inflow hyd. No.	= 12 - Post Basin 2	Max. Elevation	= 307.06 ft
Reservoir name	= Basin 2	Max. Storage	= 36,060 cuft

Storage Indication method used.

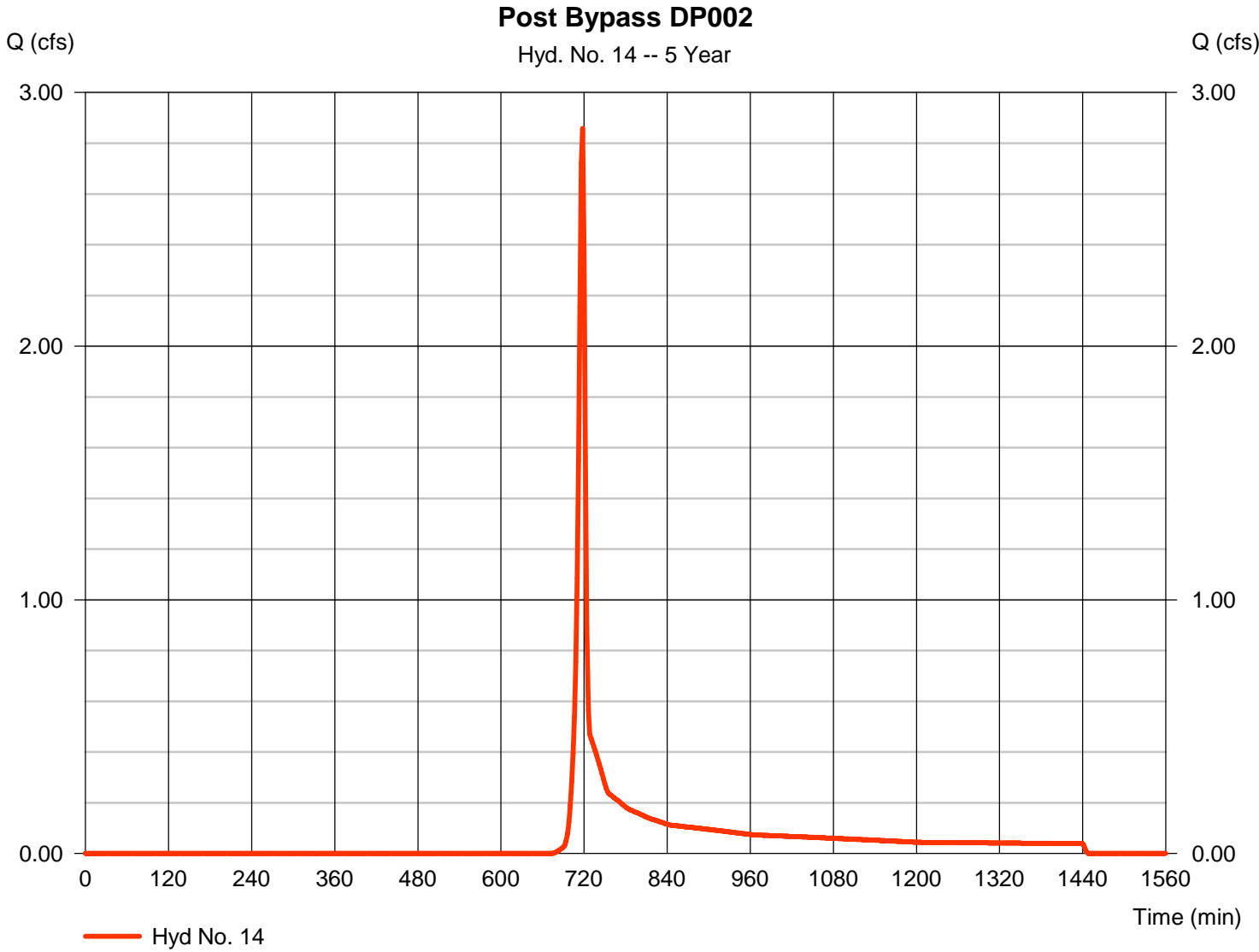


# Hydrograph Report

## Hyd. No. 14

Post Bypass DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 2.858 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 5,781 cuft
Drainage area	= 1.490 ac	Curve number	= 66.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

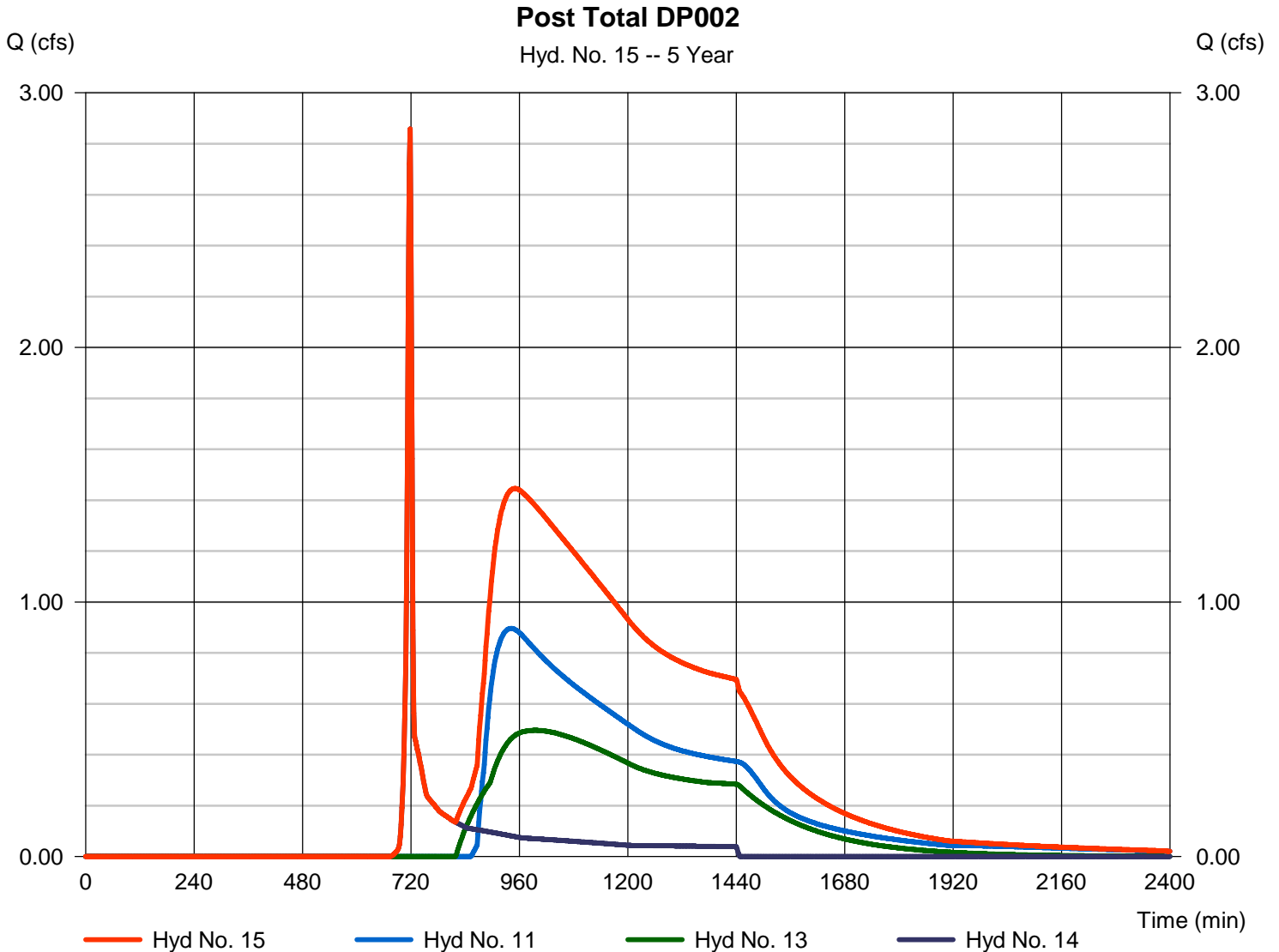
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

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## Hyd. No. 15

Post Total DP002

Hydrograph type	= Combine	Peak discharge	= 2.858 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 47,212 cuft
Inflow hyds.	= 11, 13, 14	Contrib. drain. area	= 1.490 ac





# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	19.59	2	722	56,971	-----	-----	-----	Pre Developed DP001	
2	SCS Runoff	29.99	2	722	85,311	-----	-----	-----	Pre Developed DP002	
4	SCS Runoff	35.62	2	718	71,233	-----	-----	-----	Post Basin 3	
5	Reservoir	1.841	2	794	44,361	4	315.64	37,723	Basin 3 Routed	
6	SCS Runoff	2.510	2	718	5,019	-----	-----	-----	Post Bypass DP001	
7	Combine	2.510	2	718	49,380	5, 6	-----	-----	Post Total DP001	
9	SCS Runoff	39.20	2	718	78,489	-----	-----	-----	Post Basin 1	
10	Reservoir	3.104	2	754	51,279	9	317.63	38,265	Basin 1 Upper Routed	
11	Reservoir	2.032	2	830	45,189	10	300.29	10,988	Basin 1 Lower Routed	
12	SCS Runoff	31.52	2	716	63,640	-----	-----	-----	Post Basin 2	
13	Reservoir	1.267	2	816	31,286	12	307.25	38,843	Basin 2 Routed	
14	SCS Runoff	4.000	2	718	8,012	-----	-----	-----	Post Bypass DP002	
15	Combine	4.000	2	718	84,486	11, 13, 14	-----	-----	Post Total DP002	
SWM.gpw					Return Period: 10 Year			Friday, 04 / 30 / 2021		

# Hydrograph Report

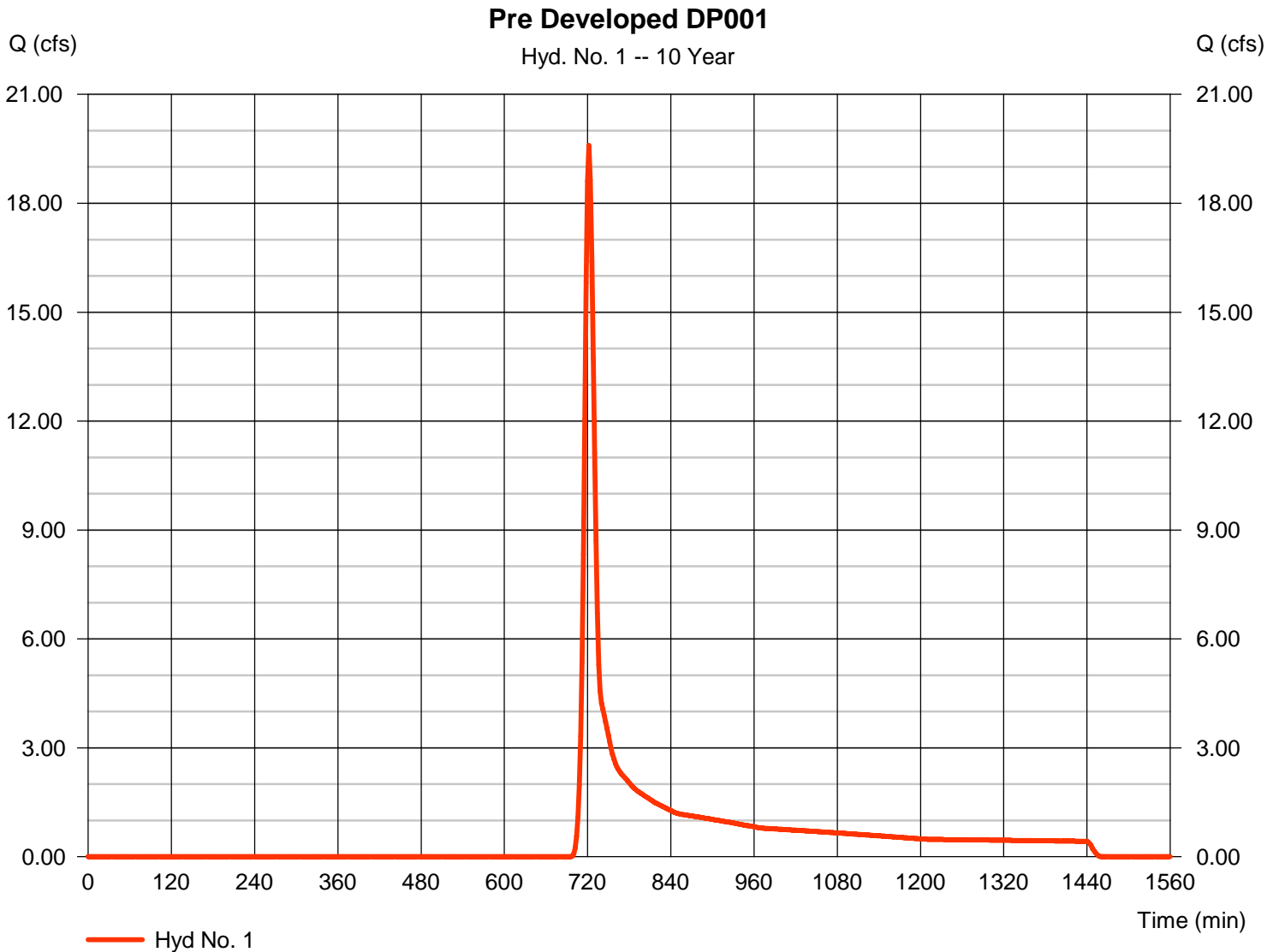
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 1

Pre Developed DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 19.59 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 56,971 cuft
Drainage area	= 14.570 ac	Curve number	= 58
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 4.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

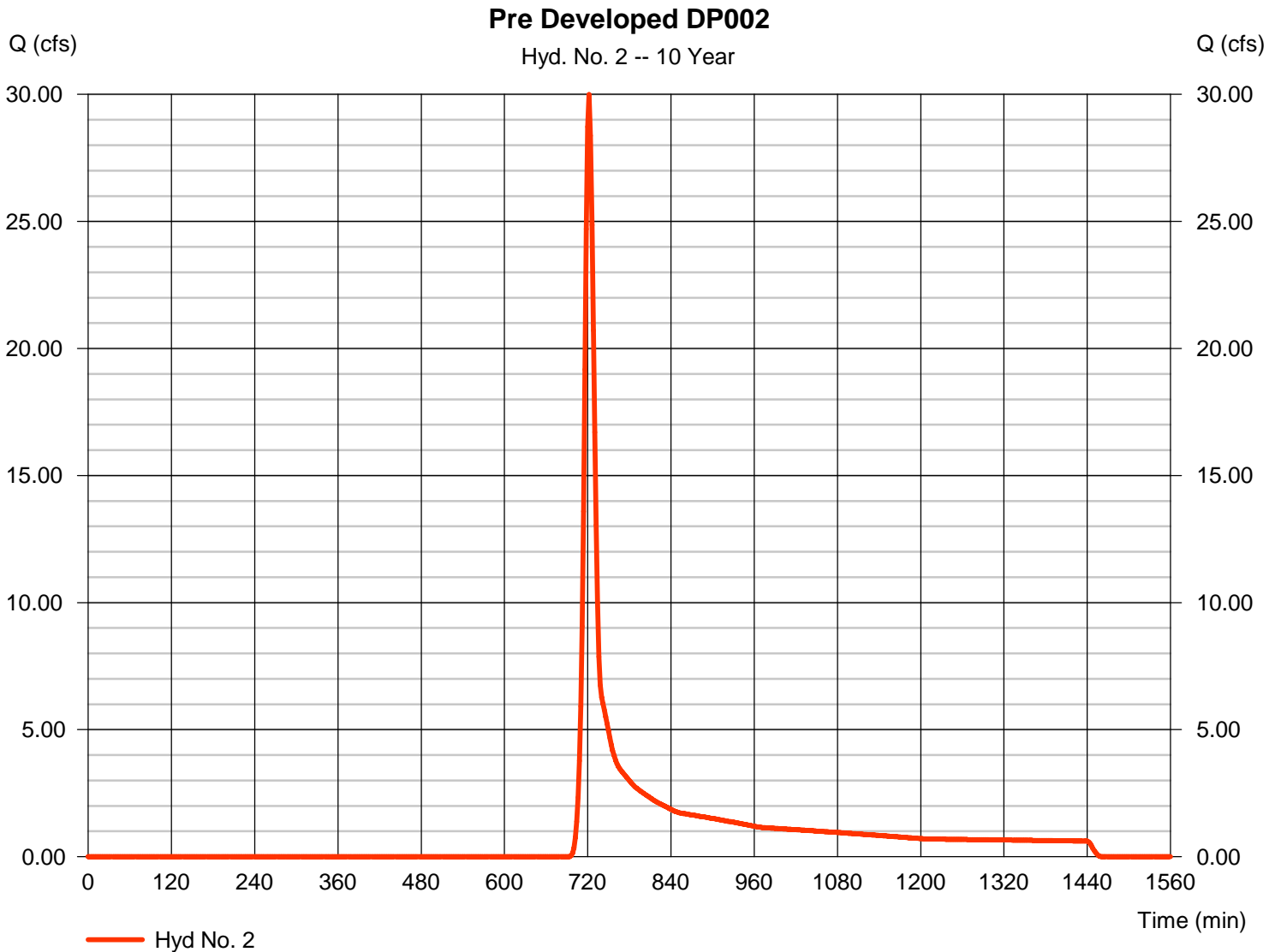
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

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## Hyd. No. 2

Pre Developed DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 29.99 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 85,311 cuft
Drainage area	= 20.260 ac	Curve number	= 59.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 4.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

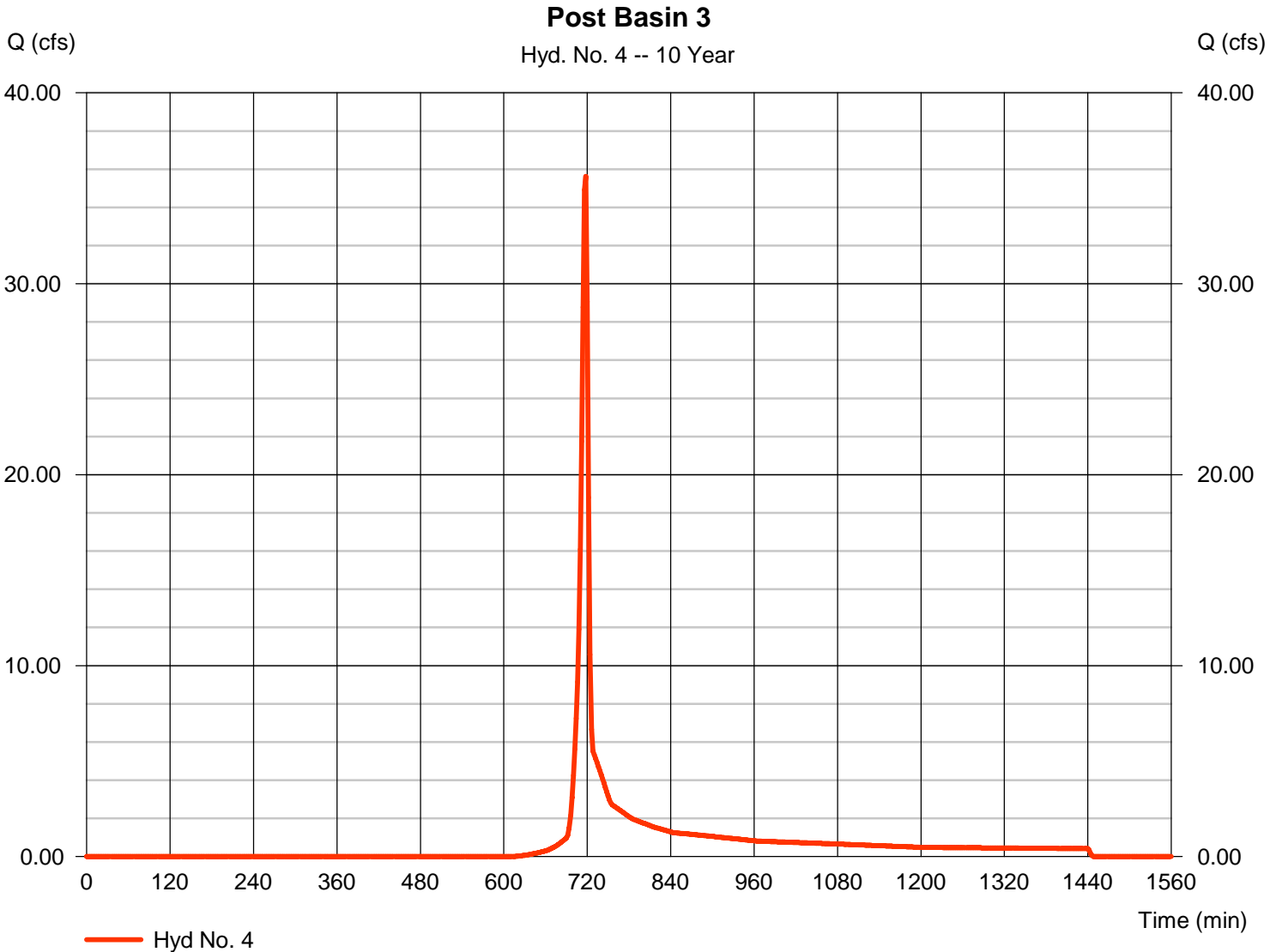
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 4

Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 35.62 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 71,233 cuft
Drainage area	= 11.730 ac	Curve number	= 68.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

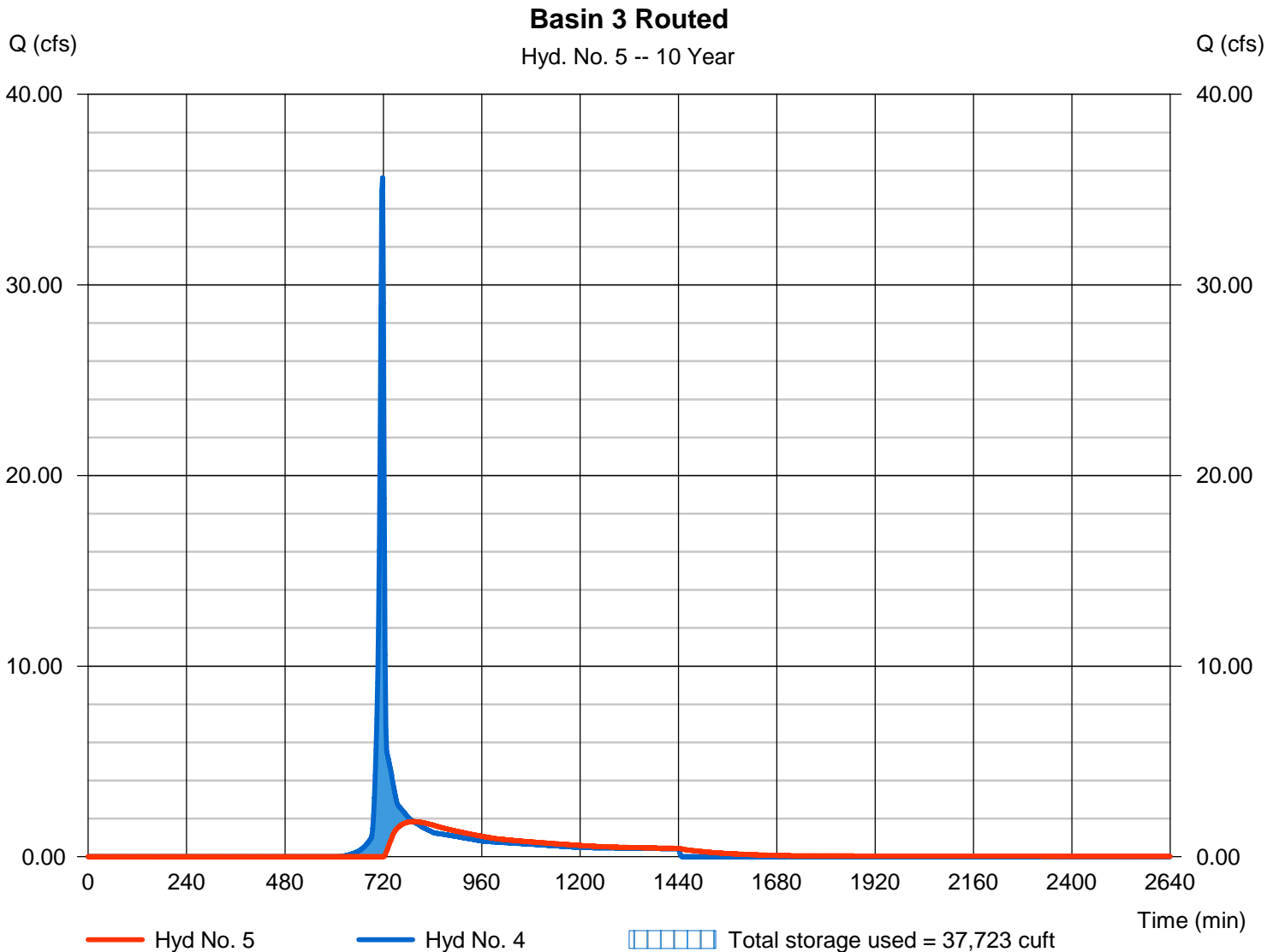
Friday, 04 / 30 / 2021

## Hyd. No. 5

Basin 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.841 cfs
Storm frequency	= 10 yrs	Time to peak	= 794 min
Time interval	= 2 min	Hyd. volume	= 44,361 cuft
Inflow hyd. No.	= 4 - Post Basin 3	Max. Elevation	= 315.64 ft
Reservoir name	= Basin 3	Max. Storage	= 37,723 cuft

Storage Indication method used.

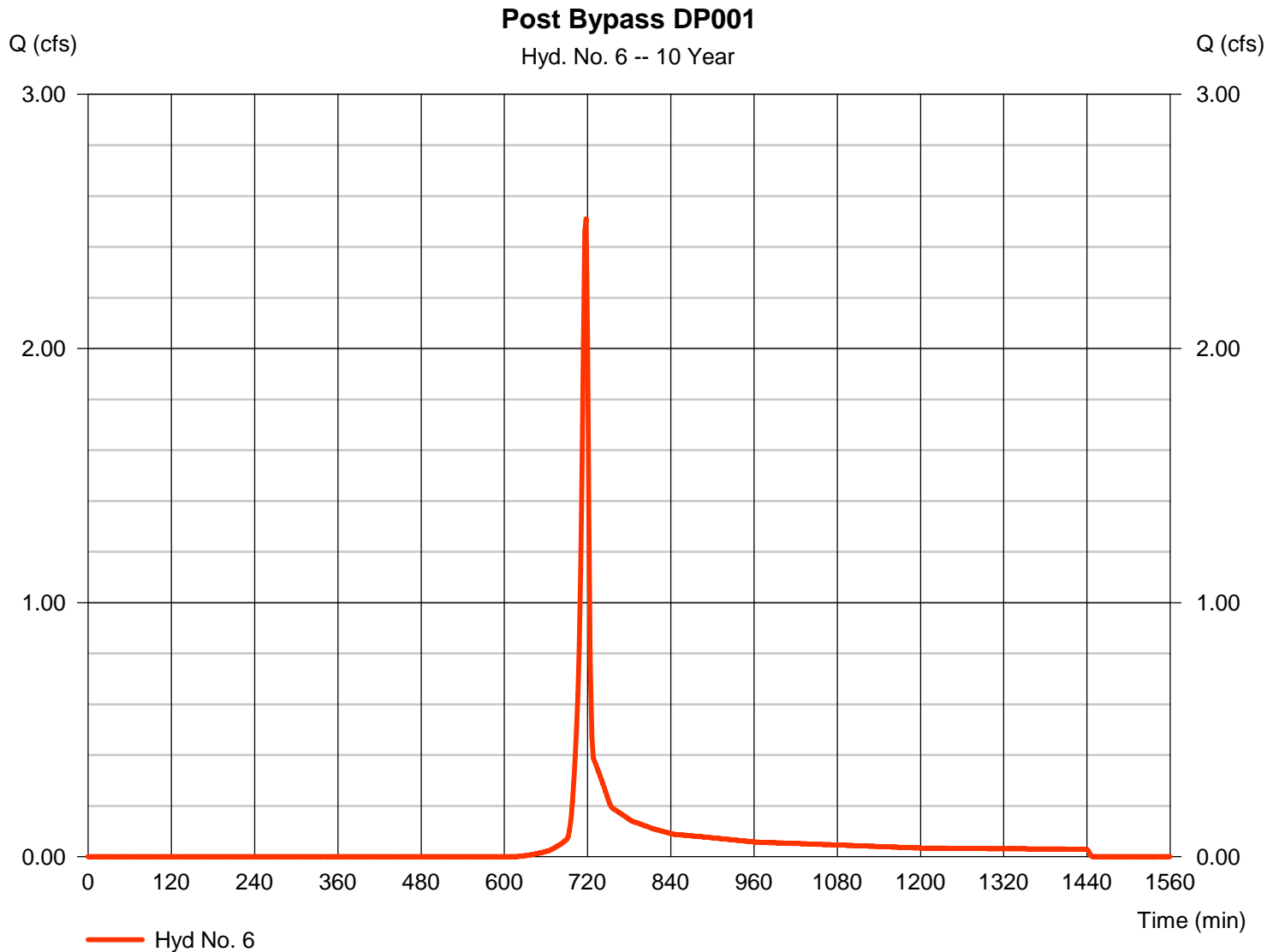


# Hydrograph Report

## Hyd. No. 6

Post Bypass DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 2.510 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 5,019 cuft
Drainage area	= 0.830 ac	Curve number	= 68.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

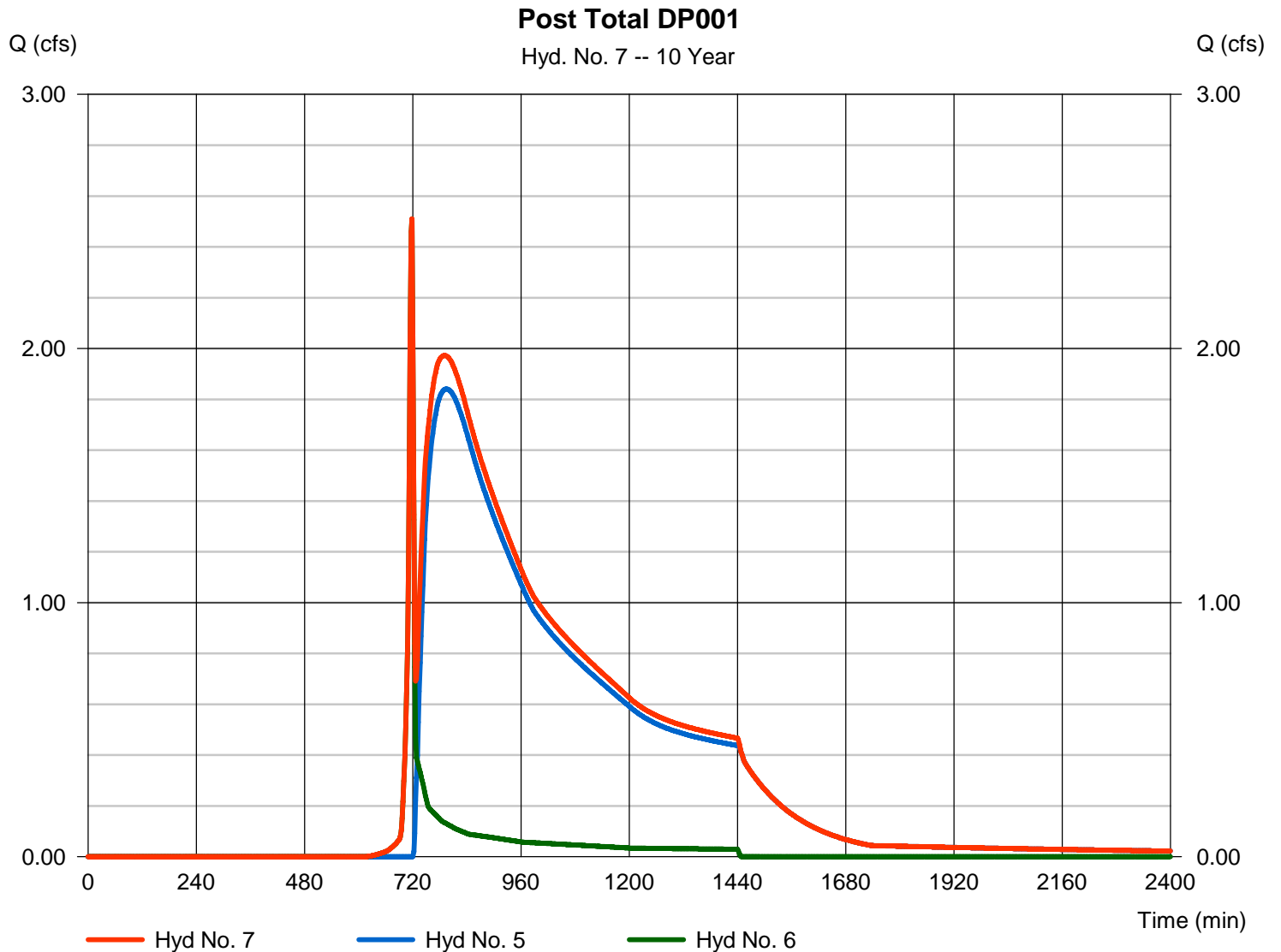
Friday, 04 / 30 / 2021

## Hyd. No. 7

Post Total DP001

Hydrograph type = Combine  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Inflow hyds. = 5, 6

Peak discharge = 2.510 cfs  
 Time to peak = 718 min  
 Hyd. volume = 49,380 cuft  
 Contrib. drain. area = 0.830 ac



# Hydrograph Report

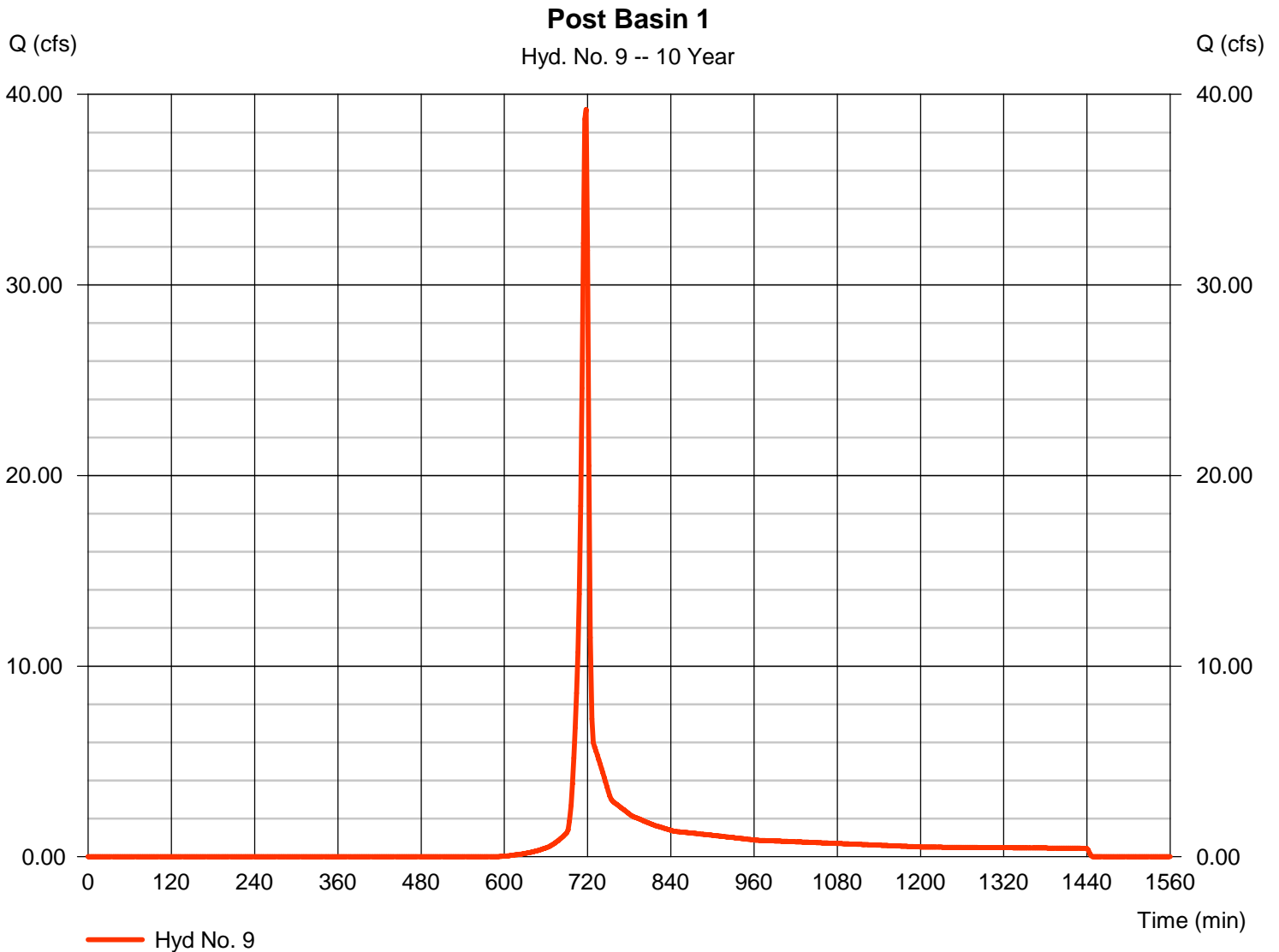
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 9

### Post Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 39.20 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 78,489 cuft
Drainage area	= 11.910 ac	Curve number	= 70.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

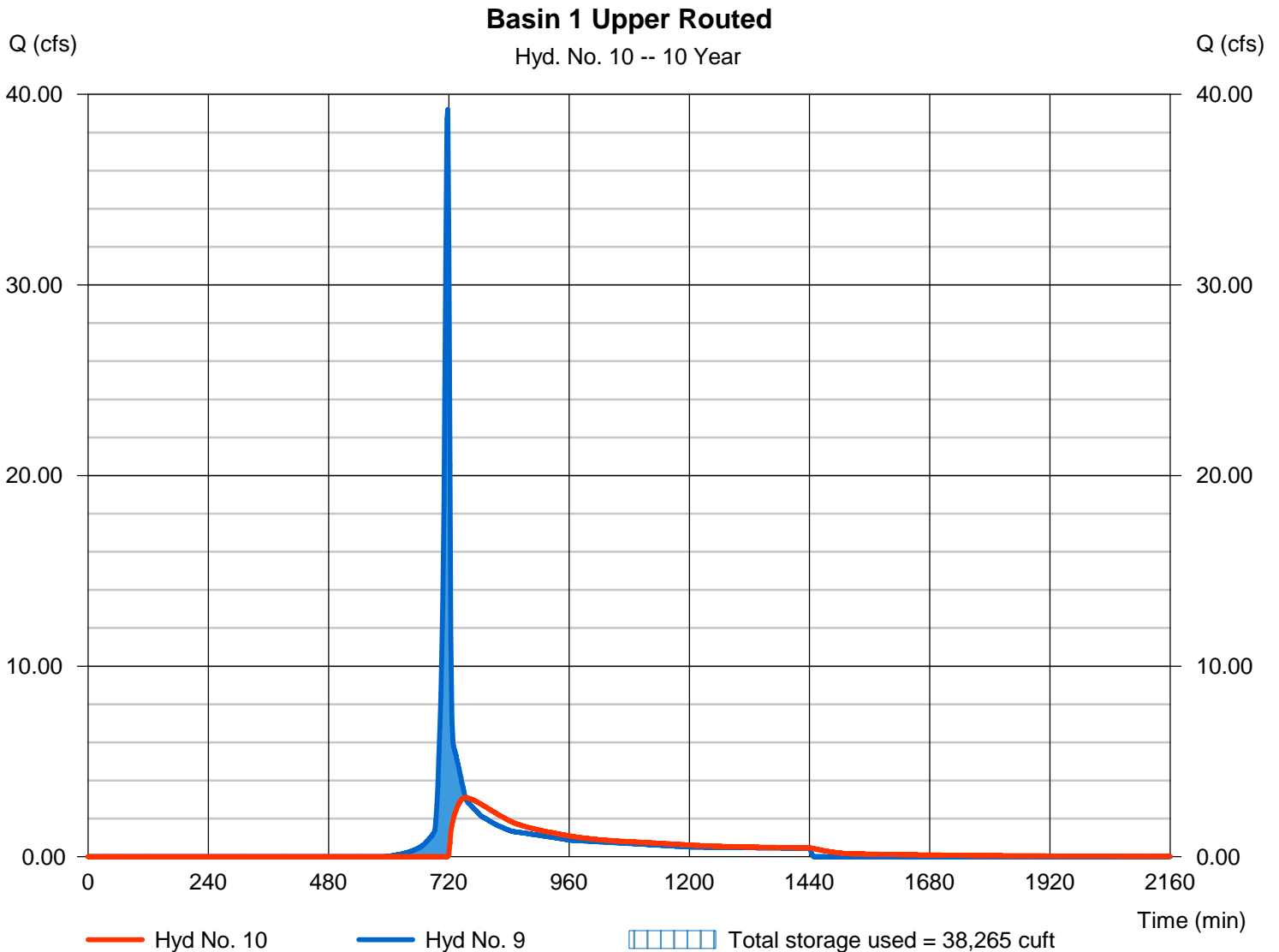
Friday, 04 / 30 / 2021

## Hyd. No. 10

Basin 1 Upper Routed

Hydrograph type	= Reservoir	Peak discharge	= 3.104 cfs
Storm frequency	= 10 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 51,279 cuft
Inflow hyd. No.	= 9 - Post Basin 1	Max. Elevation	= 317.63 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 38,265 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

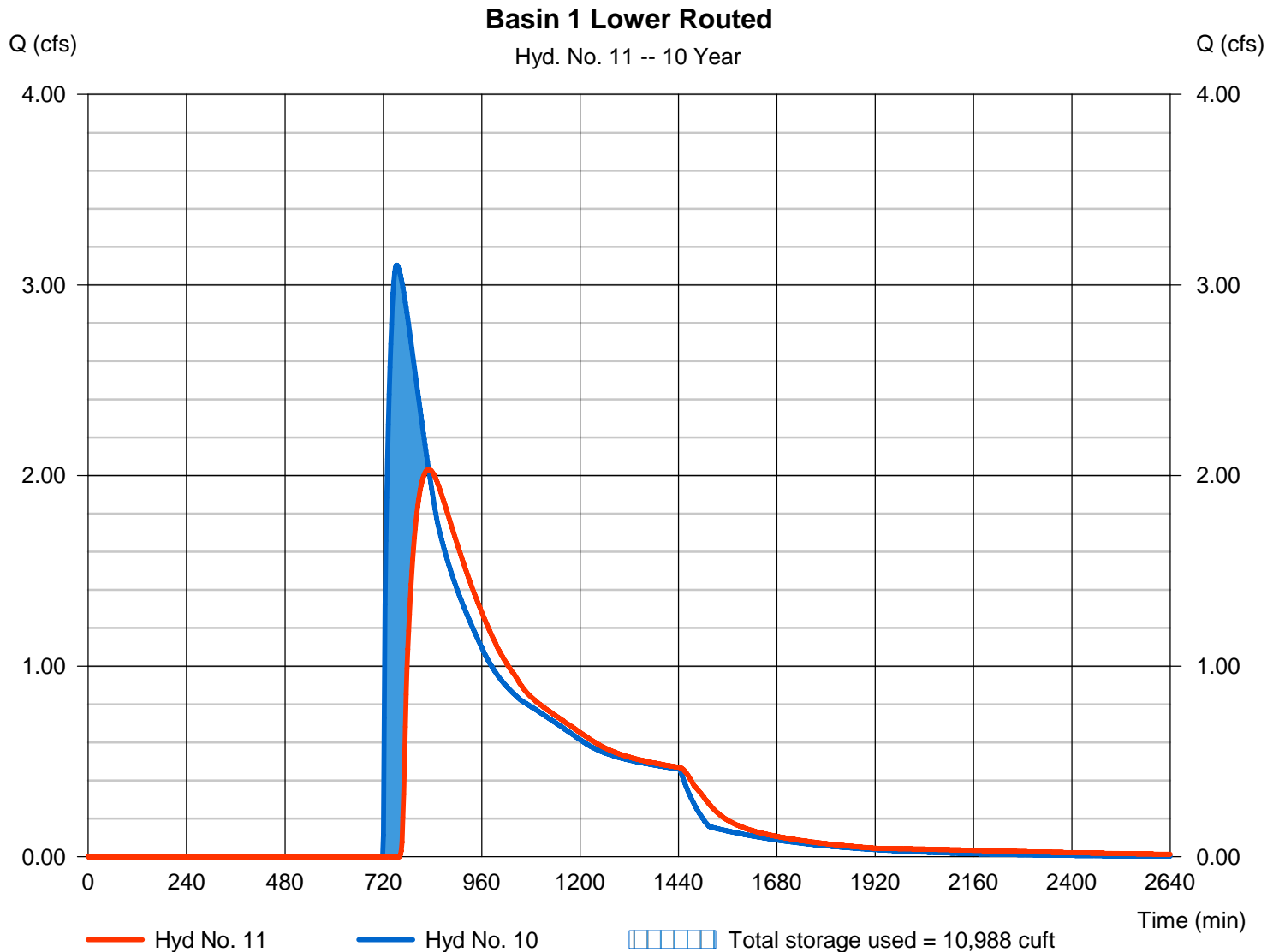
Friday, 04 / 30 / 2021

## Hyd. No. 11

### Basin 1 Lower Routed

Hydrograph type	= Reservoir	Peak discharge	= 2.032 cfs
Storm frequency	= 10 yrs	Time to peak	= 830 min
Time interval	= 2 min	Hyd. volume	= 45,189 cuft
Inflow hyd. No.	= 10 - Basin 1 Upper Routed	Max. Elevation	= 300.29 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 10,988 cuft

Storage Indication method used.

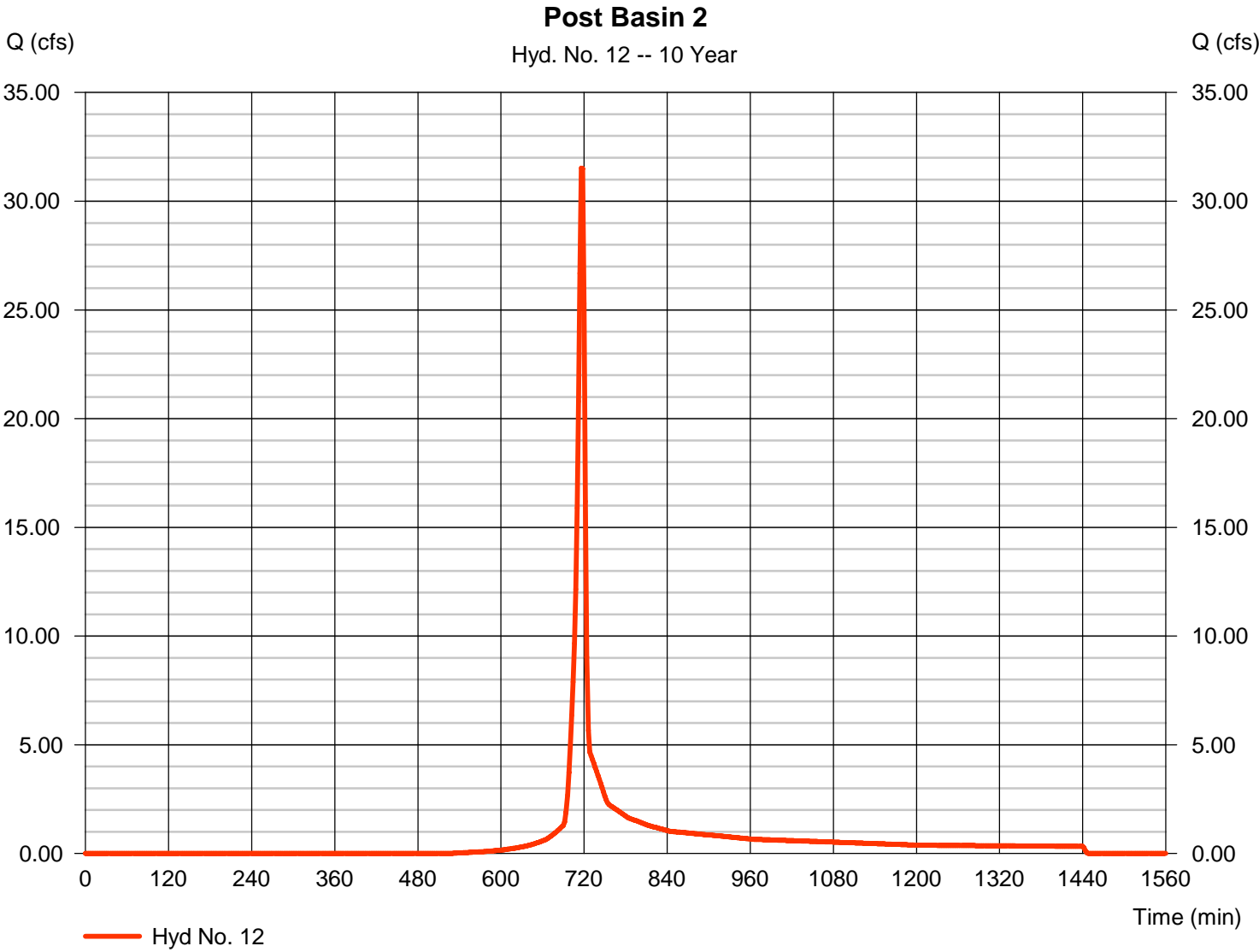


# Hydrograph Report

## Hyd. No. 12

### Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 31.52 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 63,640 cuft
Drainage area	= 8.170 ac	Curve number	= 75.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

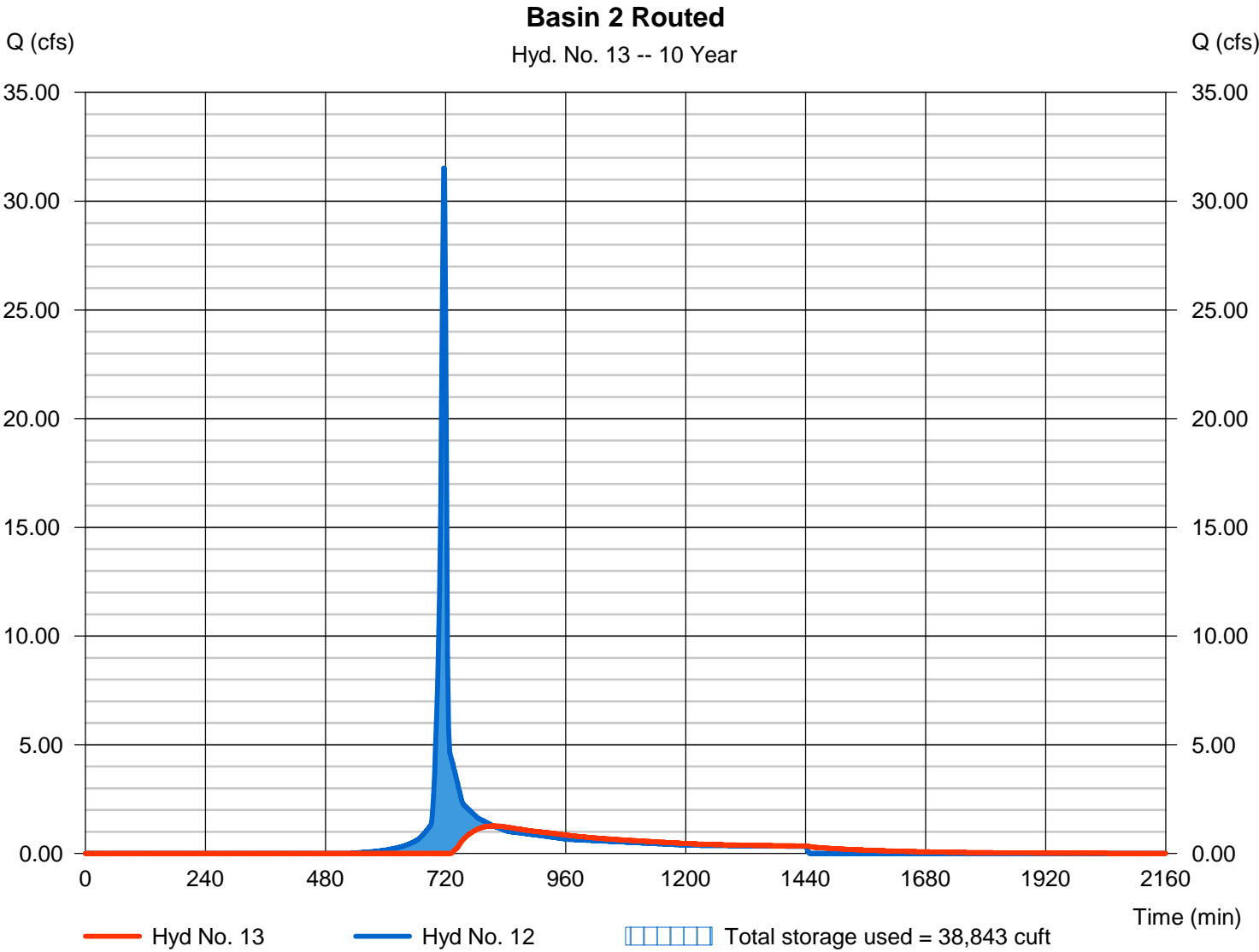
Friday, 04 / 30 / 2021

## Hyd. No. 13

Basin 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.267 cfs
Storm frequency	= 10 yrs	Time to peak	= 816 min
Time interval	= 2 min	Hyd. volume	= 31,286 cuft
Inflow hyd. No.	= 12 - Post Basin 2	Max. Elevation	= 307.25 ft
Reservoir name	= Basin 2	Max. Storage	= 38,843 cuft

Storage Indication method used.

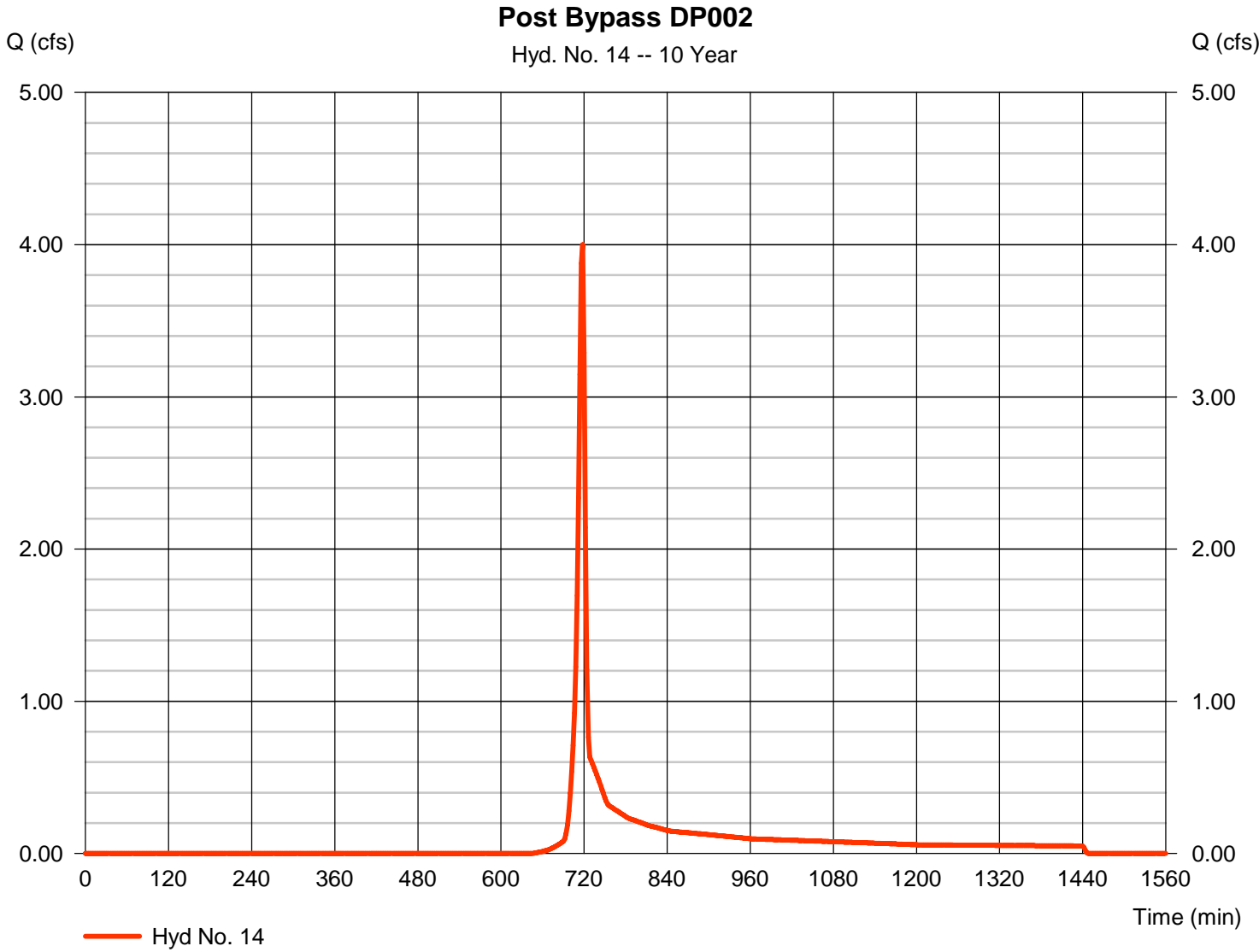


# Hydrograph Report

## Hyd. No. 14

Post Bypass DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 4.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 8,012 cuft
Drainage area	= 1.490 ac	Curve number	= 66.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.77 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

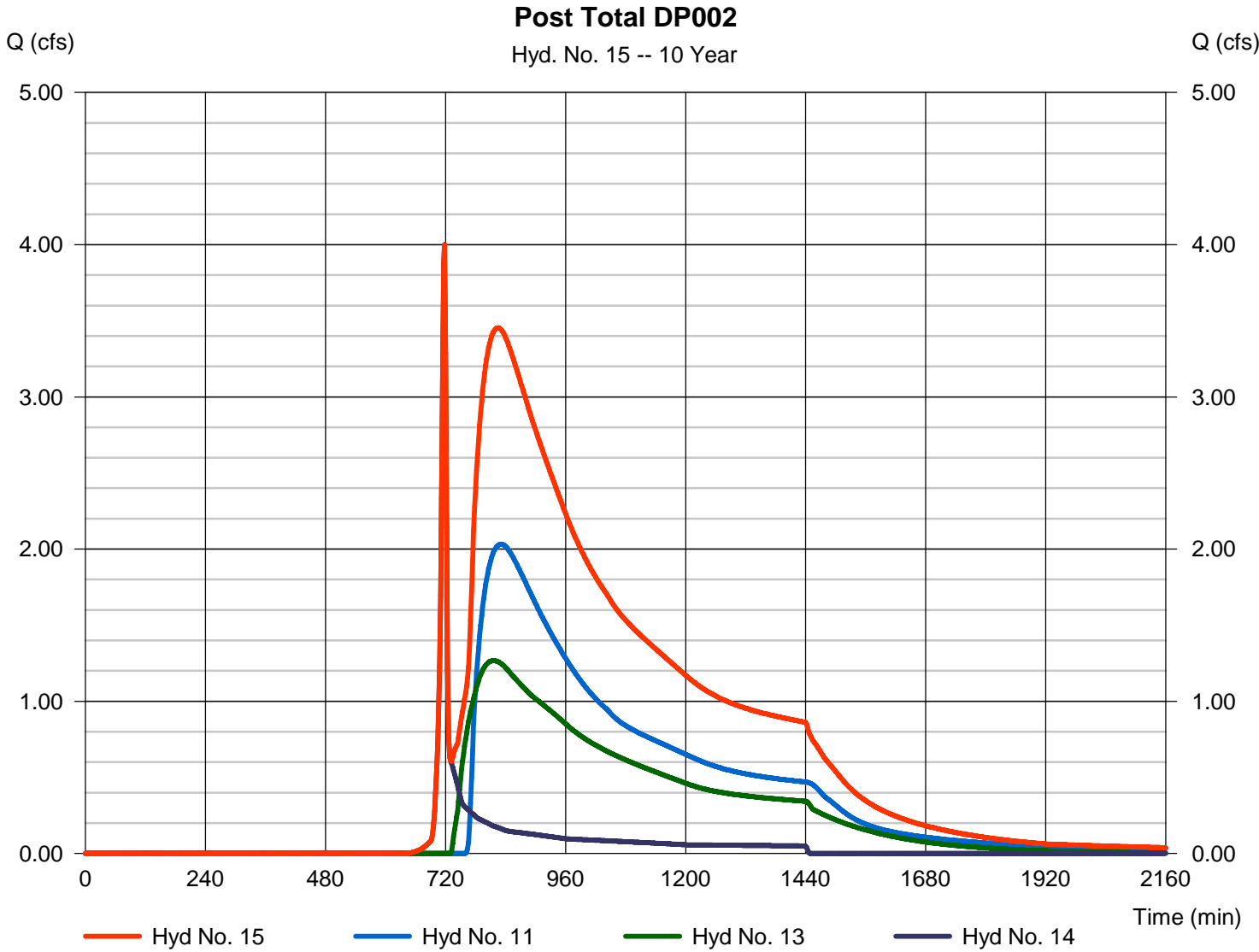
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 15

Post Total DP002

Hydrograph type	= Combine	Peak discharge	= 4.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 84,486 cuft
Inflow hyds.	= 11, 13, 14	Contrib. drain. area	= 1.490 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	32.08	2	722	87,767	-----	-----	-----	Pre Developed DP001
2	SCS Runoff	47.94	2	722	129,756	-----	-----	-----	Pre Developed DP002
4	SCS Runoff	50.04	2	718	100,501	-----	-----	-----	Post Basin 3
5	Reservoir	3.754	2	754	73,629	4	316.39	49,171	Basin 3 Routed
6	SCS Runoff	3.529	2	718	7,086	-----	-----	-----	Post Bypass DP001
7	Combine	4.955	2	720	80,715	5, 6	-----	-----	Post Total DP001
9	SCS Runoff	54.21	2	718	109,334	-----	-----	-----	Post Basin 1
10	Reservoir	16.39	2	724	82,123	9	318.17	46,615	Basin 1 Upper Routed
11	Reservoir	4.031	2	774	76,033	10	301.14	17,616	Basin 1 Lower Routed
12	SCS Runoff	42.66	2	716	86,388	-----	-----	-----	Post Basin 2
13	Reservoir	3.834	2	746	54,034	12	307.69	45,233	Basin 2 Routed
14	SCS Runoff	5.758	2	718	11,523	-----	-----	-----	Post Bypass DP002
15	Combine	8.100	2	752	141,590	11, 13, 14	-----	-----	Post Total DP002
SWM.gpw					Return Period: 25 Year			Friday, 04 / 30 / 2021	

# Hydrograph Report

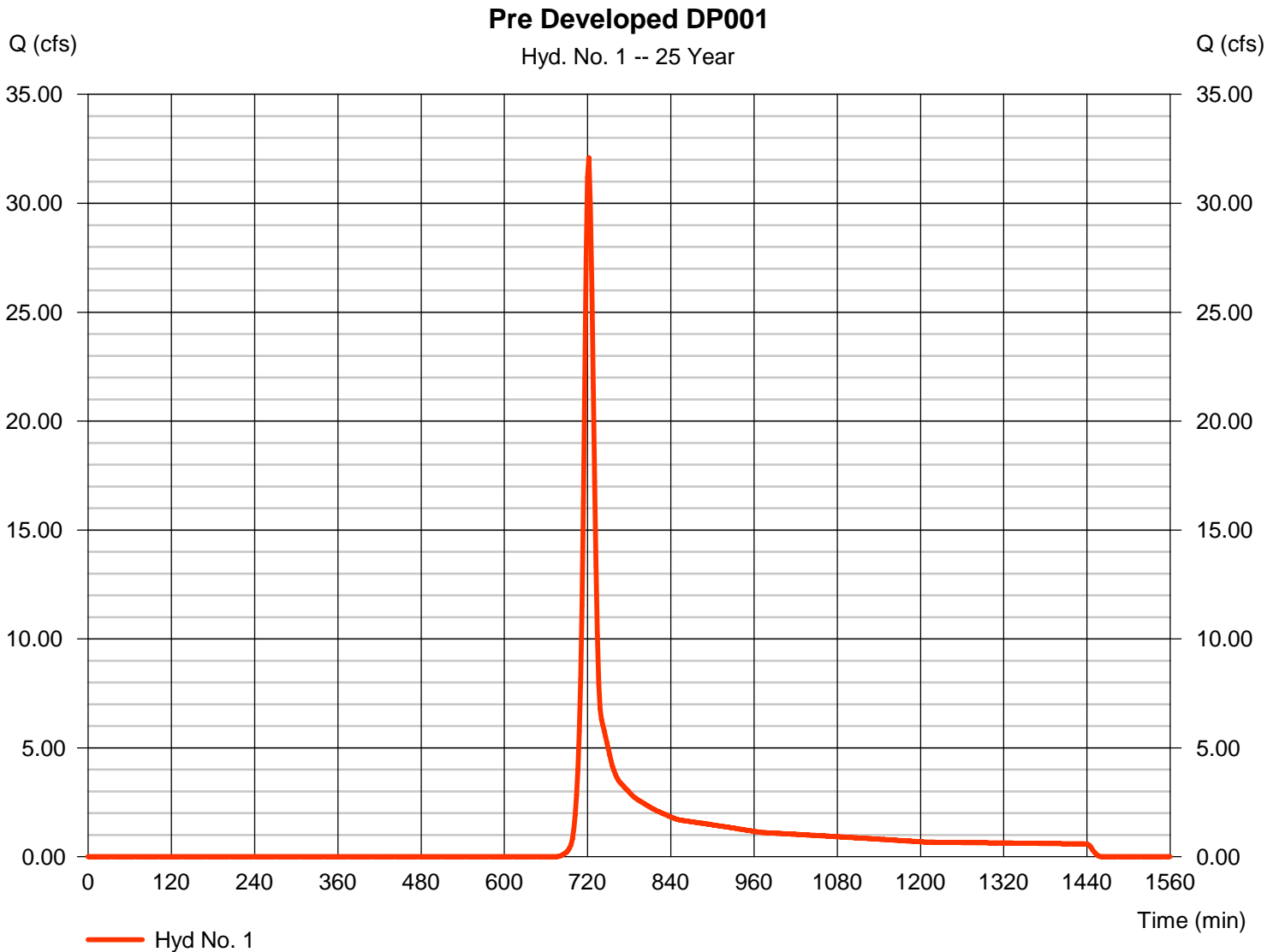
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 1

Pre Developed DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 32.08 cfs
Storm frequency	= 25 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 87,767 cuft
Drainage area	= 14.570 ac	Curve number	= 58
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 5.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



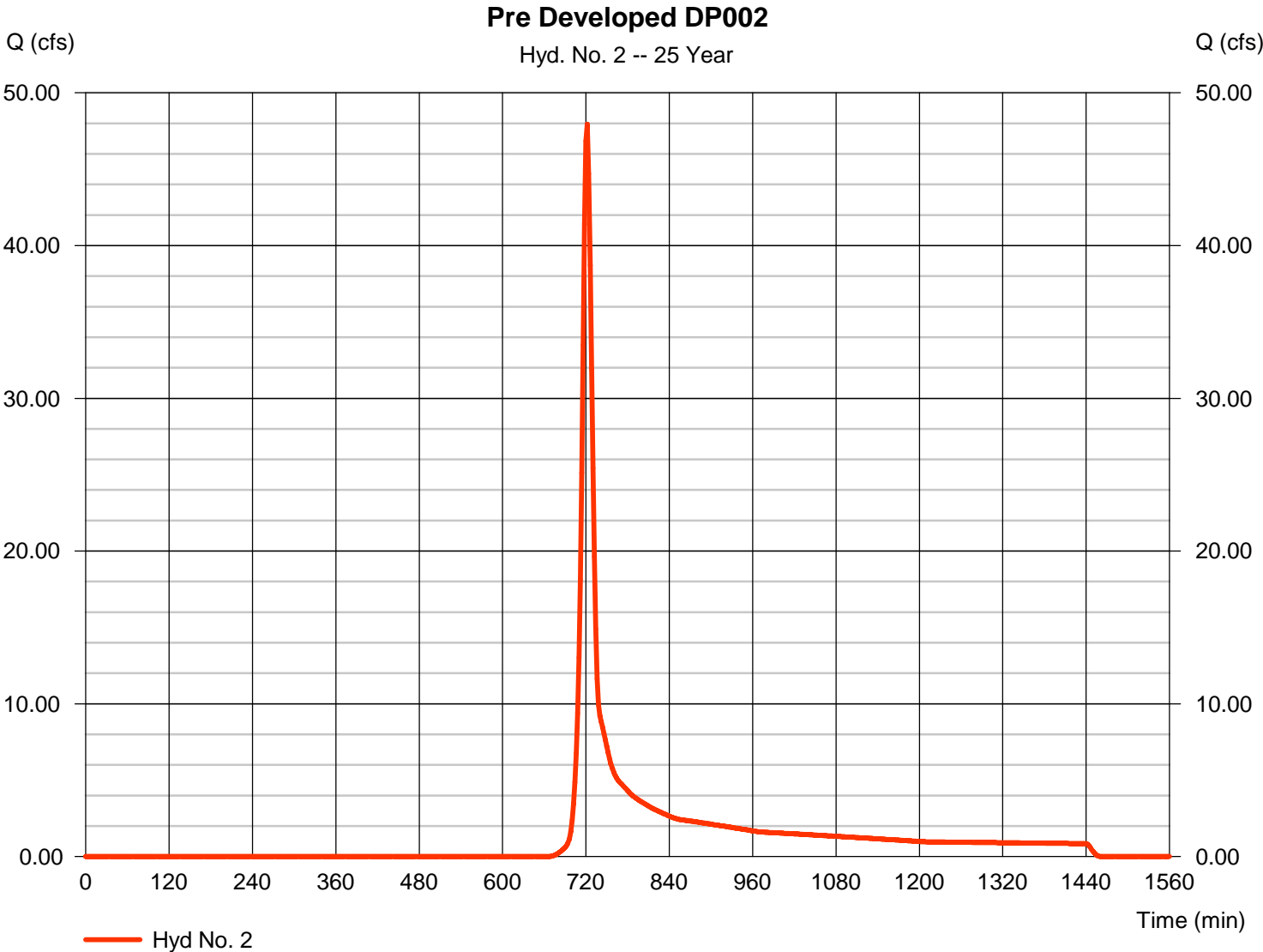


# Hydrograph Report

## Hyd. No. 2

Pre Developed DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 47.94 cfs
Storm frequency	= 25 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 129,756 cuft
Drainage area	= 20.260 ac	Curve number	= 59.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 5.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

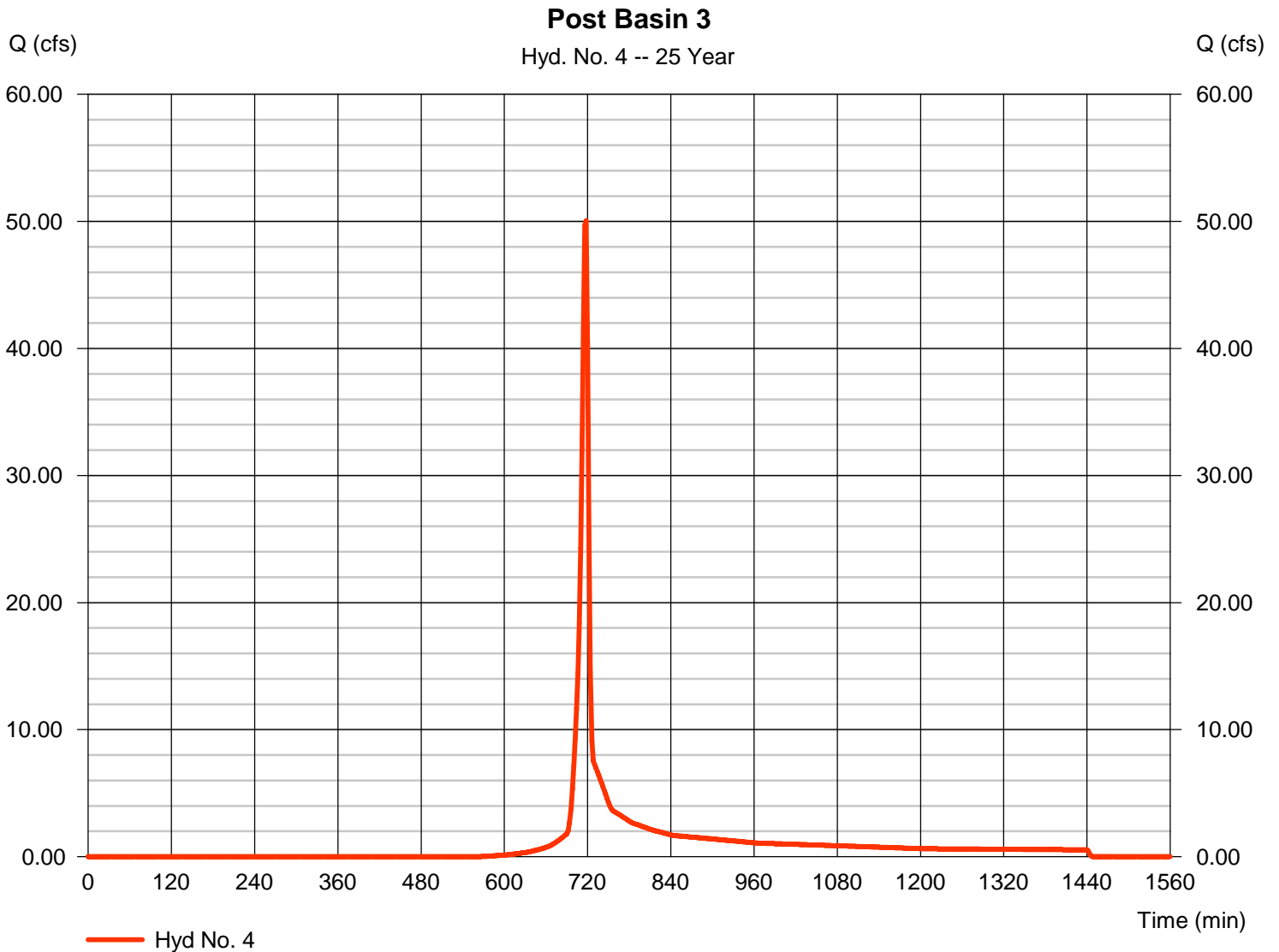
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 4

Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 50.04 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 100,501 cuft
Drainage area	= 11.730 ac	Curve number	= 68.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

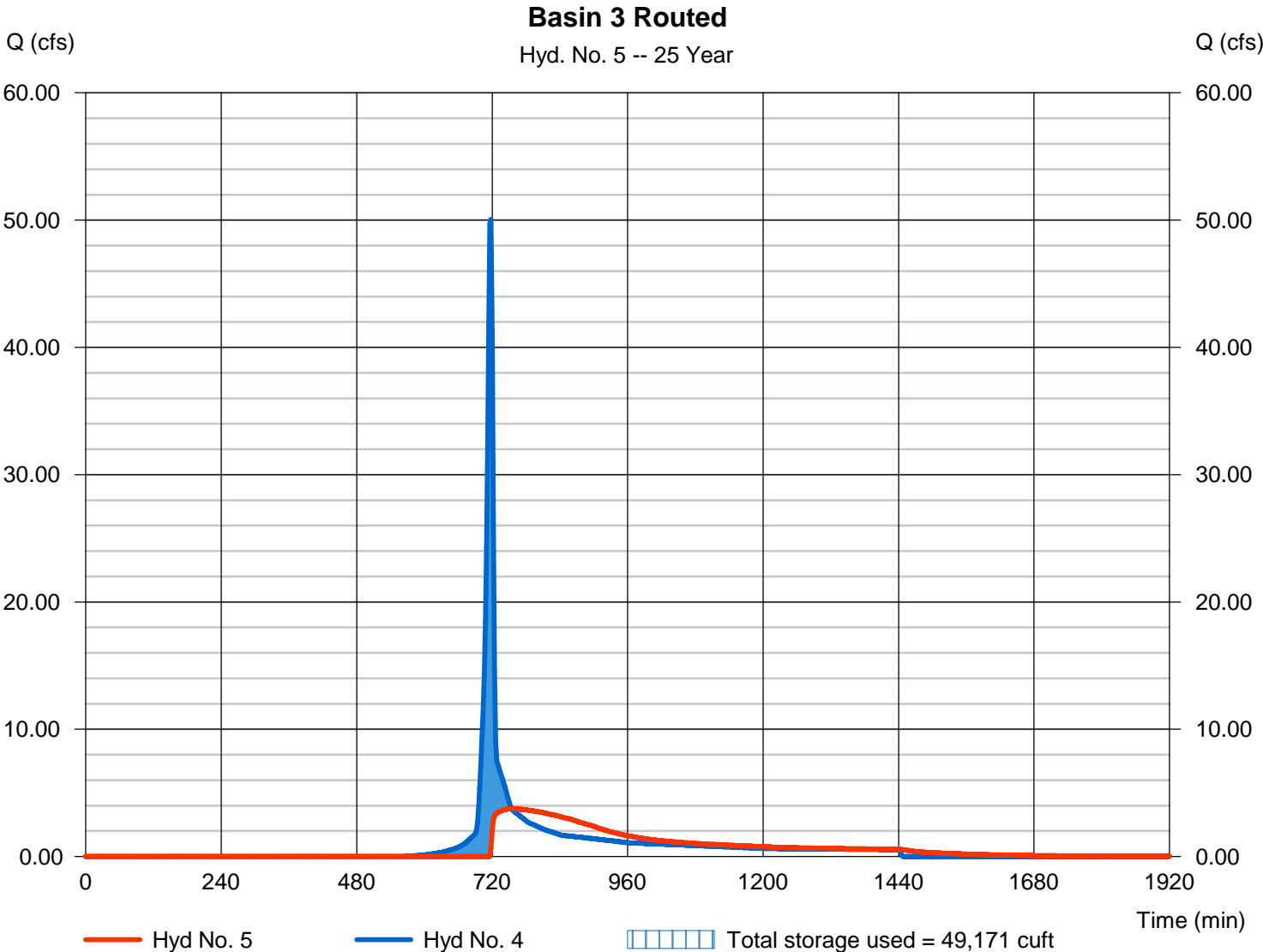
Friday, 04 / 30 / 2021

## Hyd. No. 5

Basin 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 3.754 cfs
Storm frequency	= 25 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 73,629 cuft
Inflow hyd. No.	= 4 - Post Basin 3	Max. Elevation	= 316.39 ft
Reservoir name	= Basin 3	Max. Storage	= 49,171 cuft

Storage Indication method used.

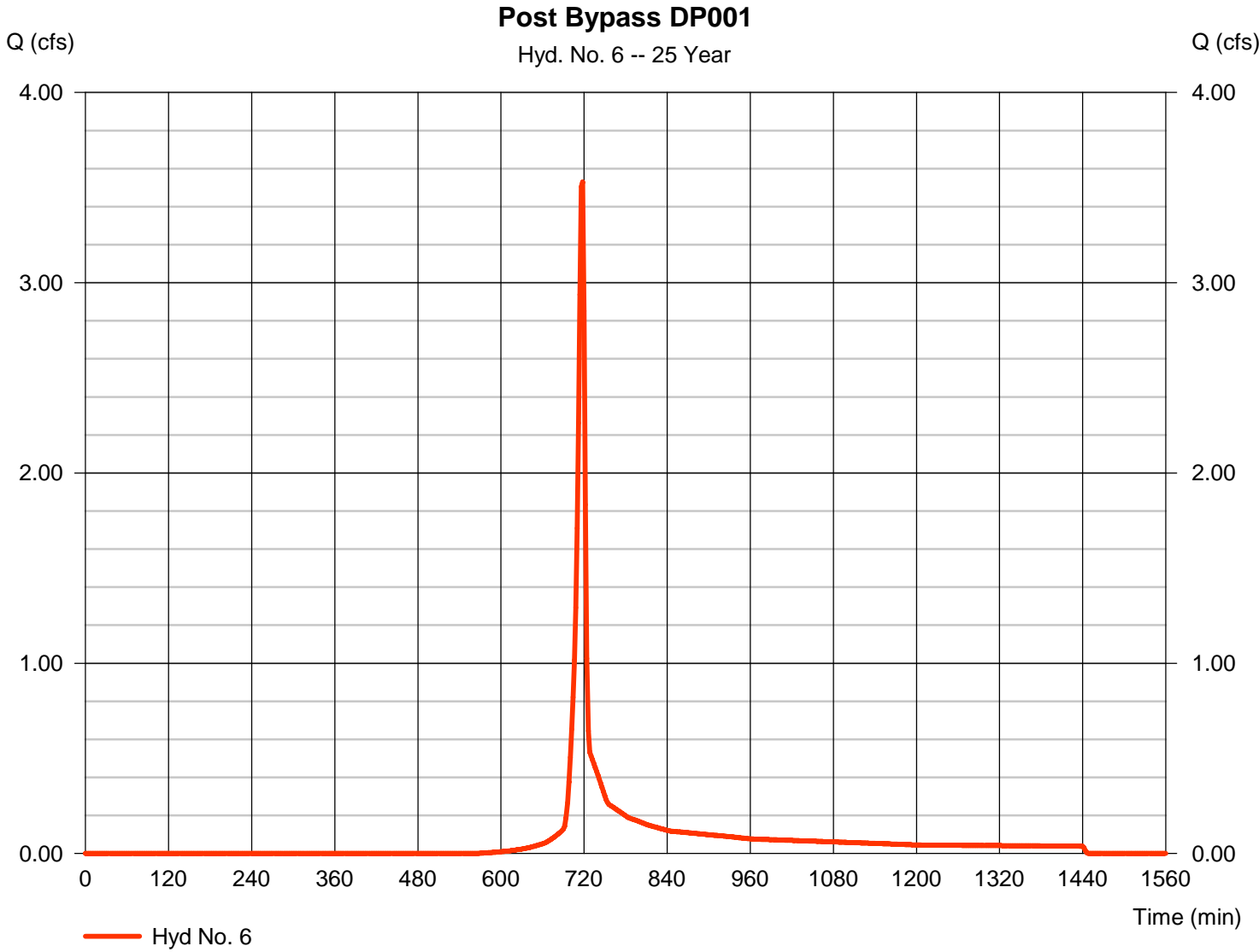


# Hydrograph Report

## Hyd. No. 6

Post Bypass DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 3.529 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 7,086 cuft
Drainage area	= 0.830 ac	Curve number	= 68.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

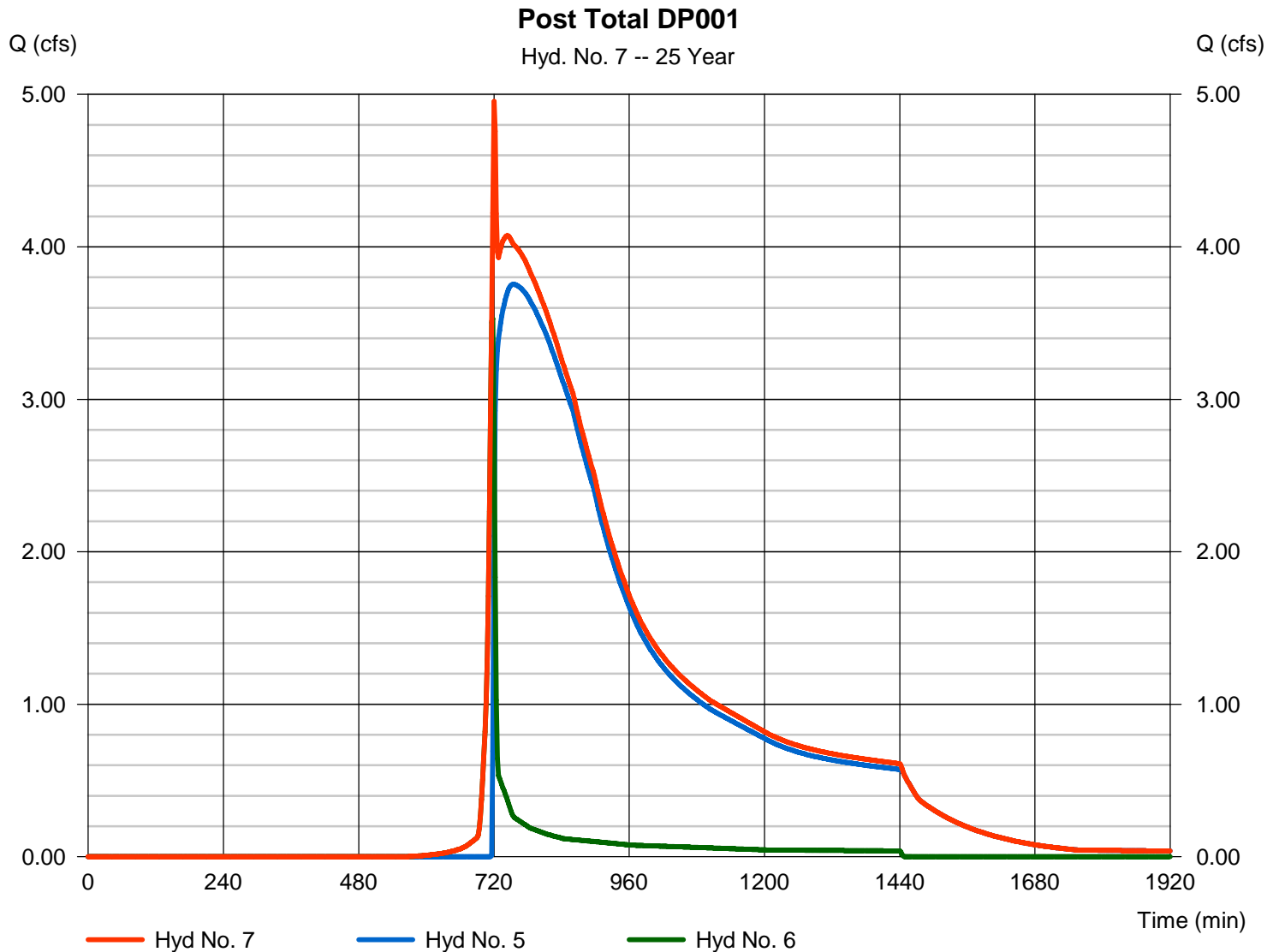
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 7

Post Total DP001

Hydrograph type	= Combine	Peak discharge	= 4.955 cfs
Storm frequency	= 25 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 80,715 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.830 ac

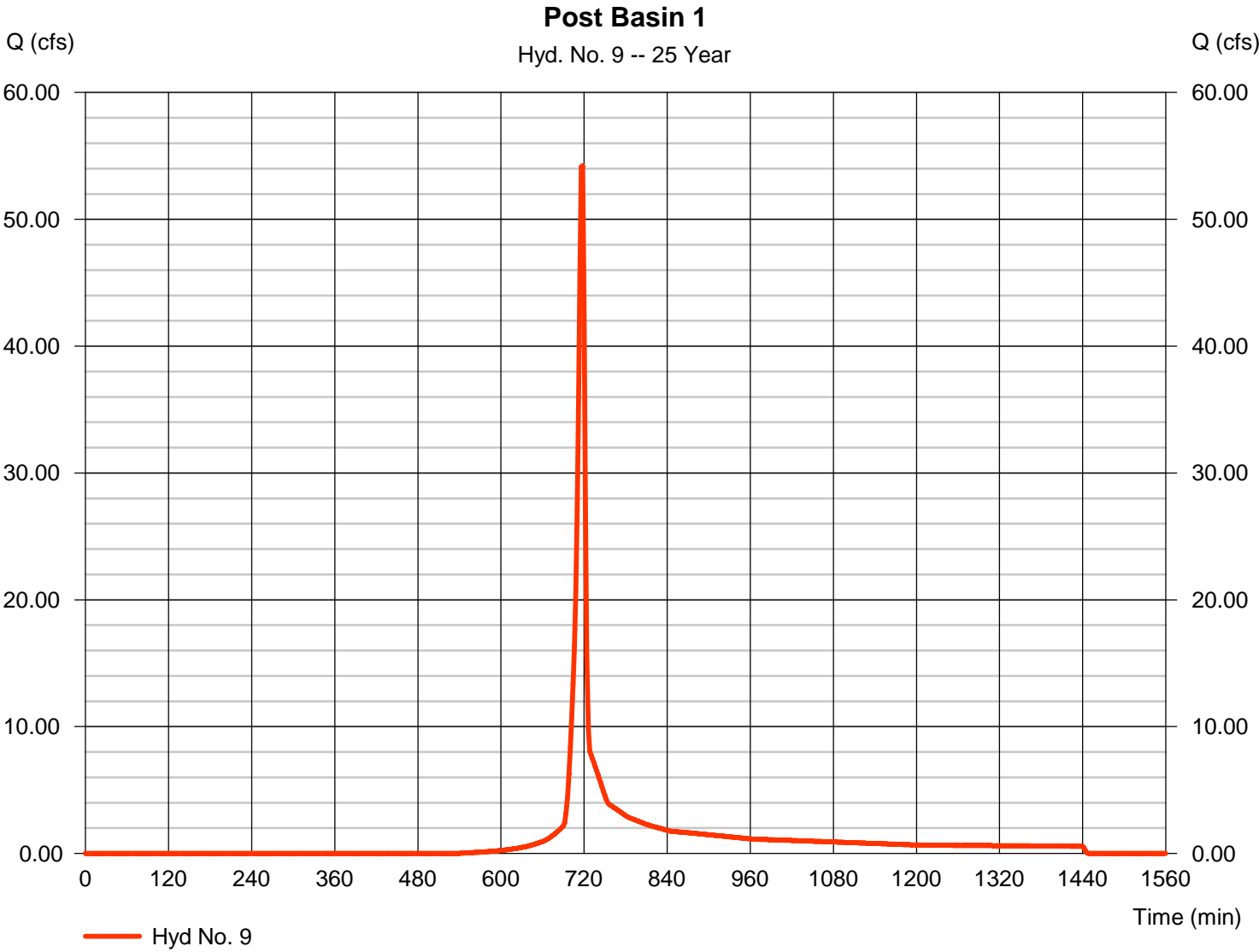


# Hydrograph Report

## Hyd. No. 9

### Post Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 54.21 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 109,334 cuft
Drainage area	= 11.910 ac	Curve number	= 70.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

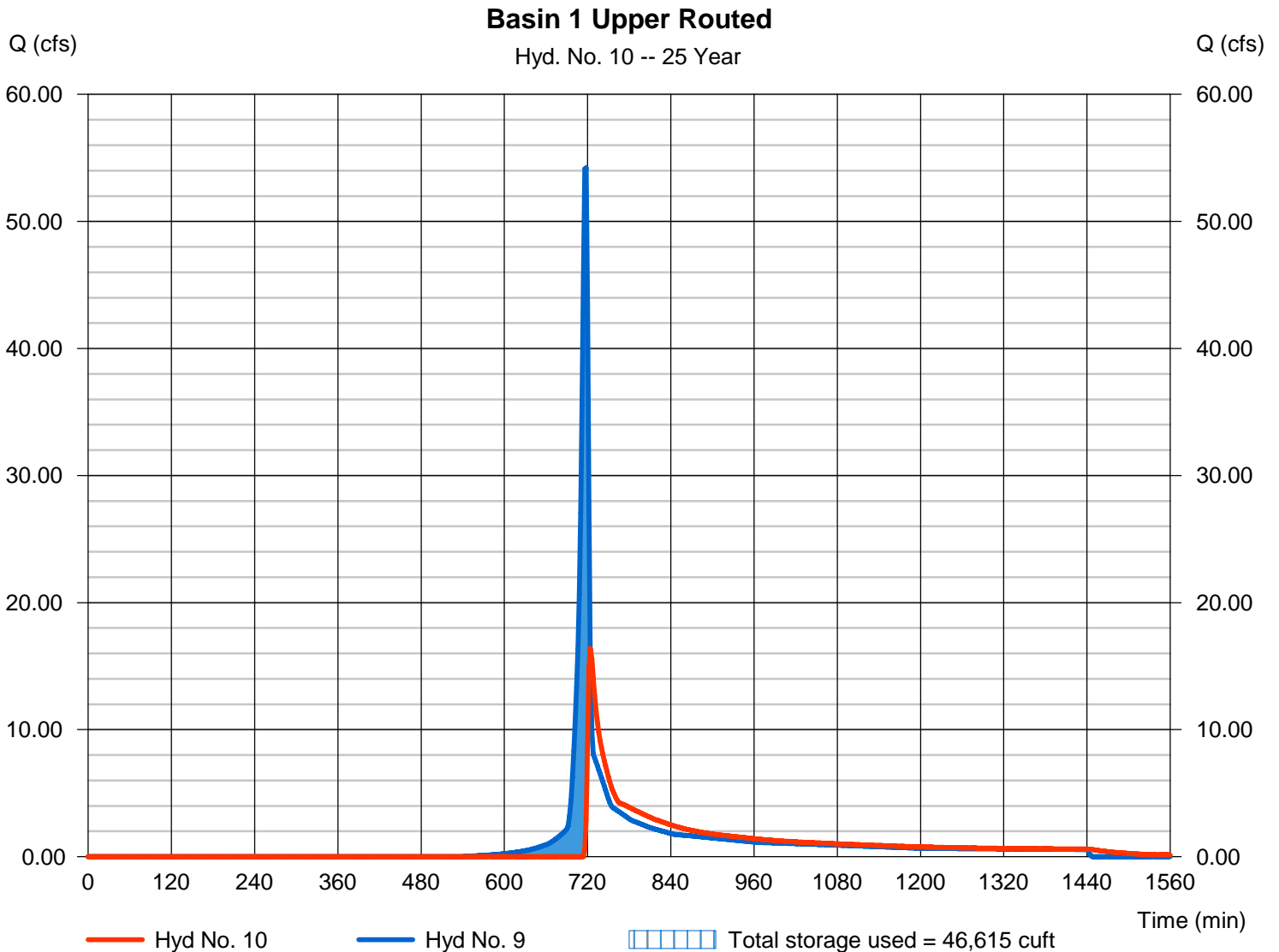
Friday, 04 / 30 / 2021

## Hyd. No. 10

Basin 1 Upper Routed

Hydrograph type	= Reservoir	Peak discharge	= 16.39 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 82,123 cuft
Inflow hyd. No.	= 9 - Post Basin 1	Max. Elevation	= 318.17 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 46,615 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

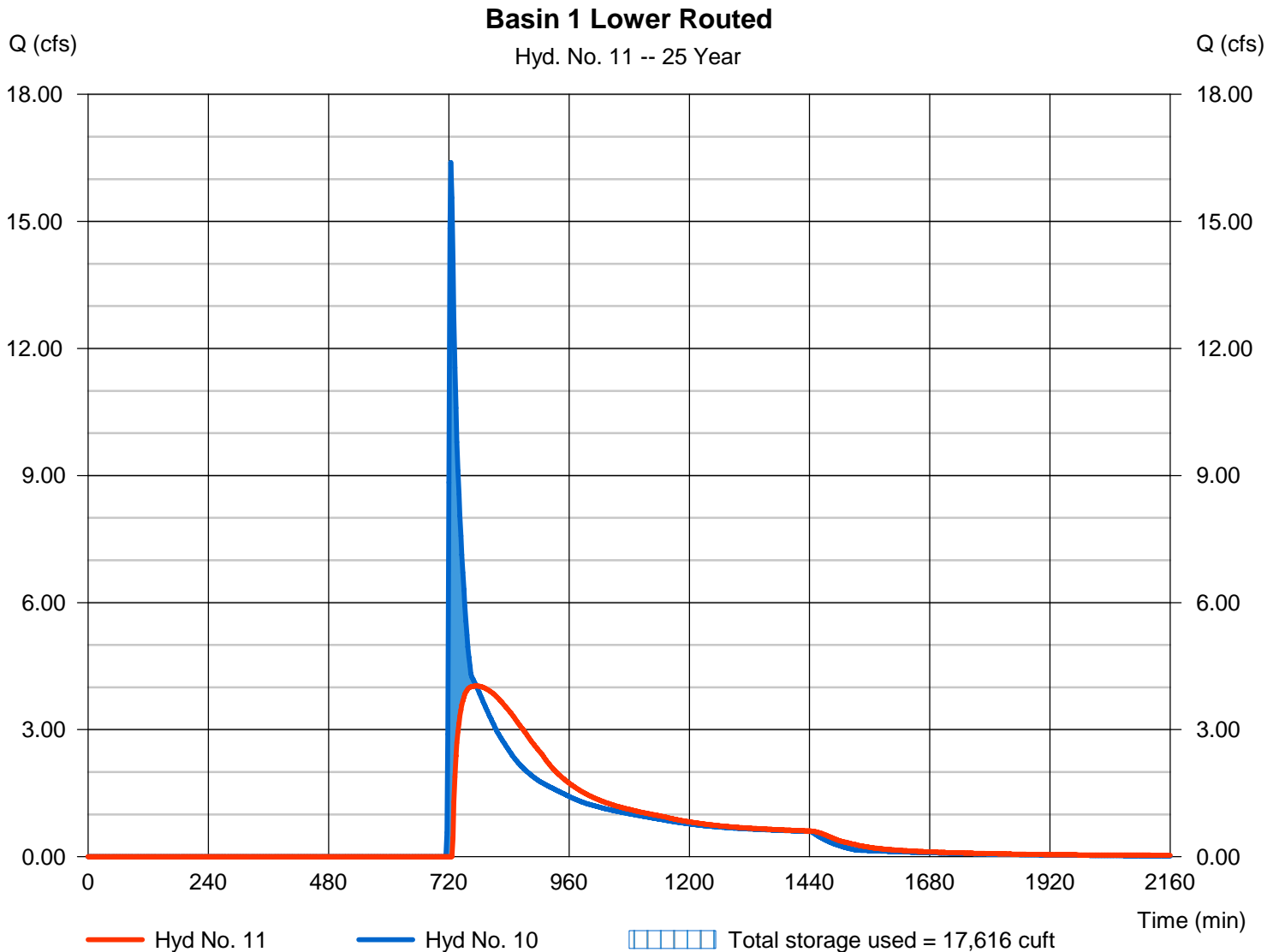
Friday, 04 / 30 / 2021

## Hyd. No. 11

### Basin 1 Lower Routed

Hydrograph type	= Reservoir	Peak discharge	= 4.031 cfs
Storm frequency	= 25 yrs	Time to peak	= 774 min
Time interval	= 2 min	Hyd. volume	= 76,033 cuft
Inflow hyd. No.	= 10 - Basin 1 Upper Routed	Max. Elevation	= 301.14 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 17,616 cuft

Storage Indication method used.





# Hydrograph Report

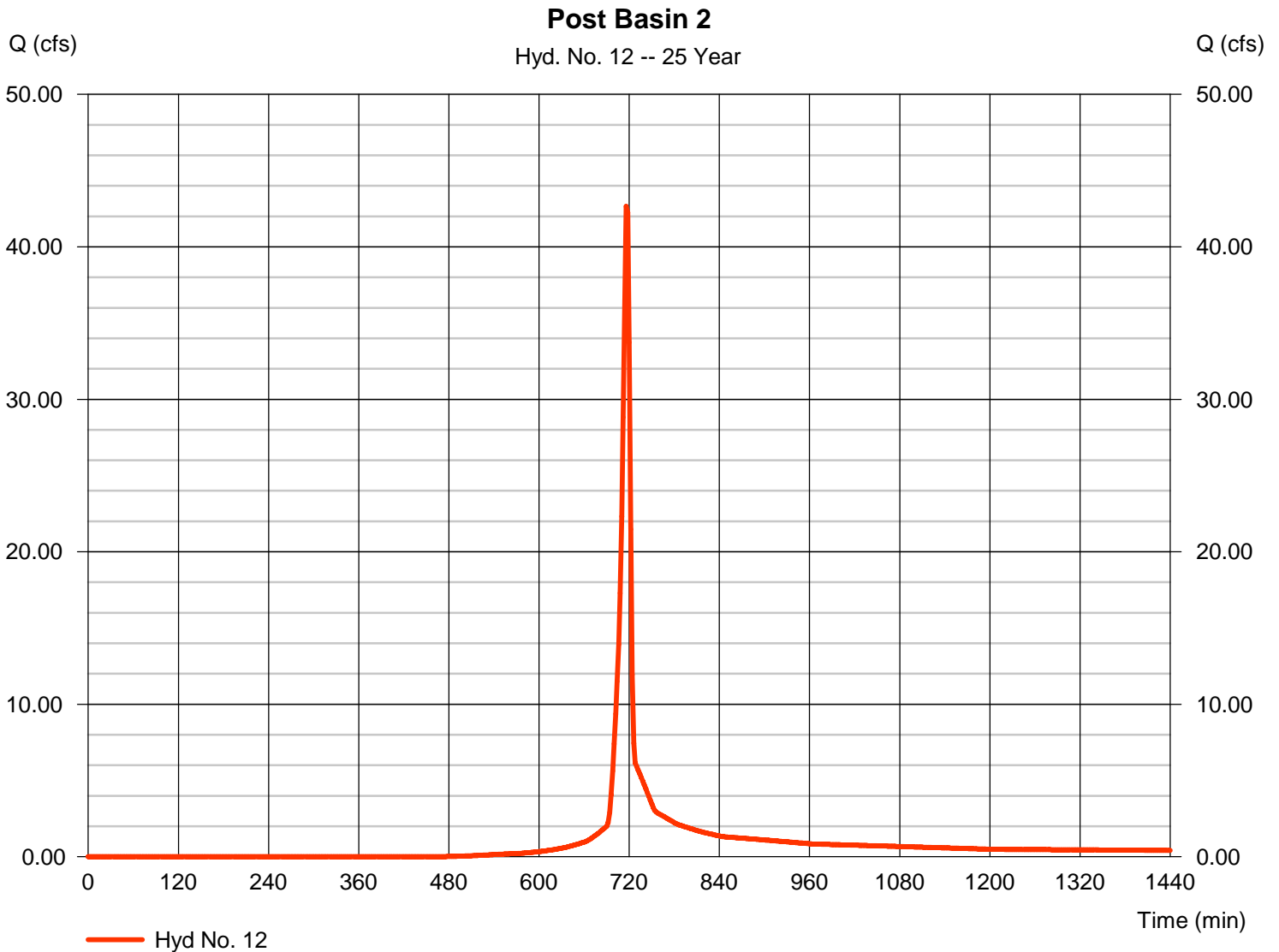
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 12

Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 42.66 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 86,388 cuft
Drainage area	= 8.170 ac	Curve number	= 75.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

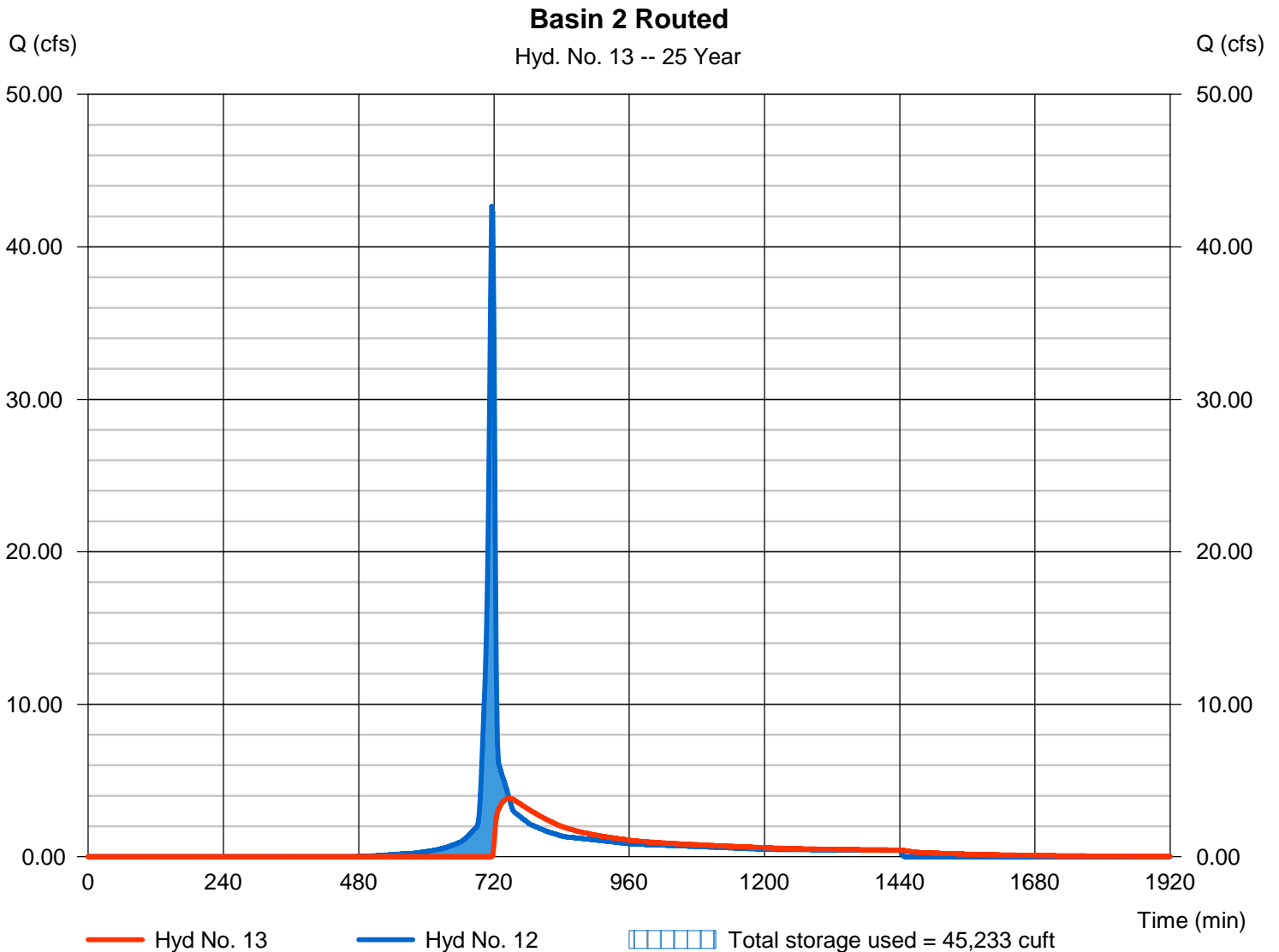
Friday, 04 / 30 / 2021

## Hyd. No. 13

Basin 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 3.834 cfs
Storm frequency	= 25 yrs	Time to peak	= 746 min
Time interval	= 2 min	Hyd. volume	= 54,034 cuft
Inflow hyd. No.	= 12 - Post Basin 2	Max. Elevation	= 307.69 ft
Reservoir name	= Basin 2	Max. Storage	= 45,233 cuft

Storage Indication method used.



# Hydrograph Report

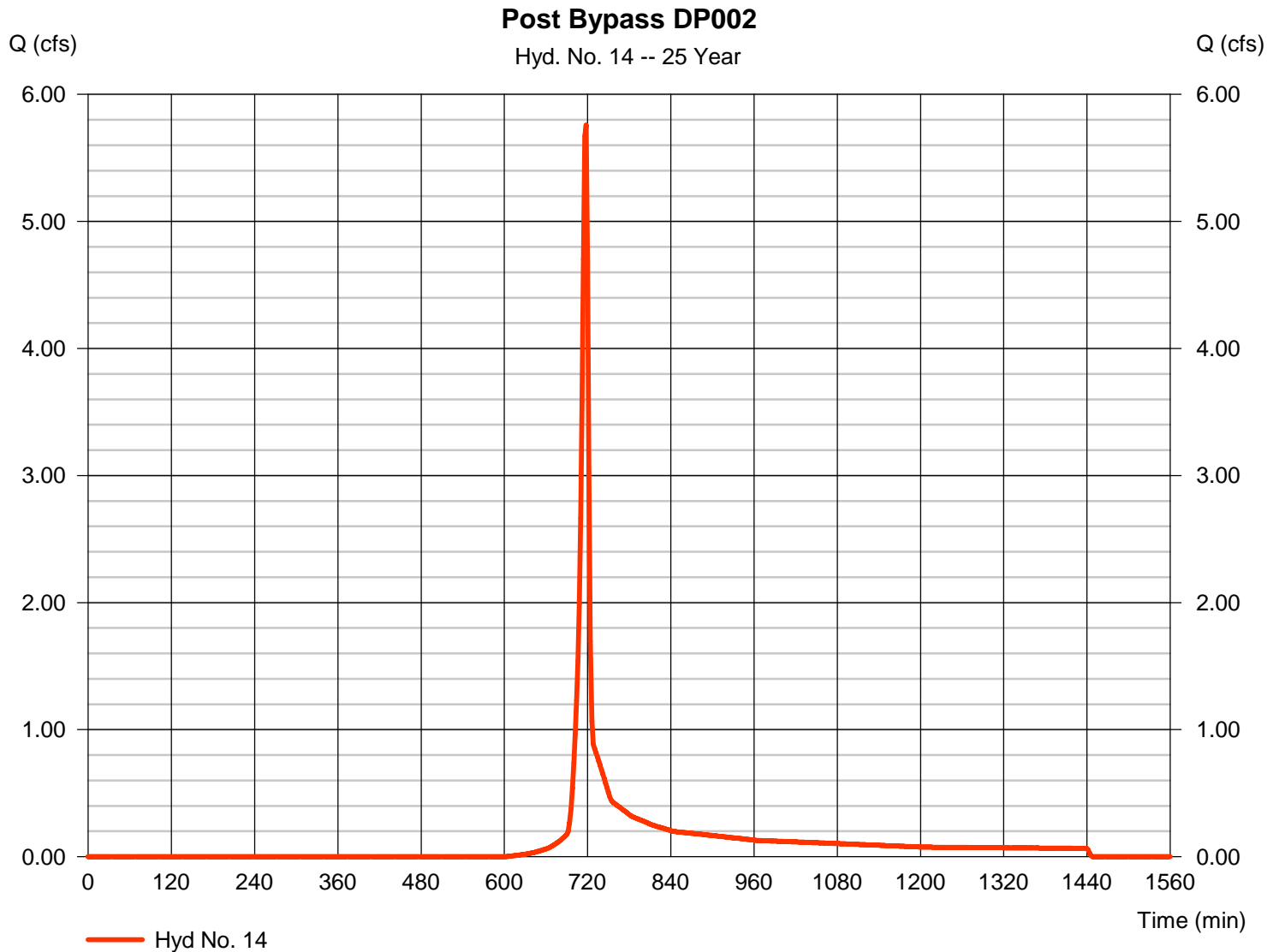
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 14

Post Bypass DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 5.758 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 11,523 cuft
Drainage area	= 1.490 ac	Curve number	= 66.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

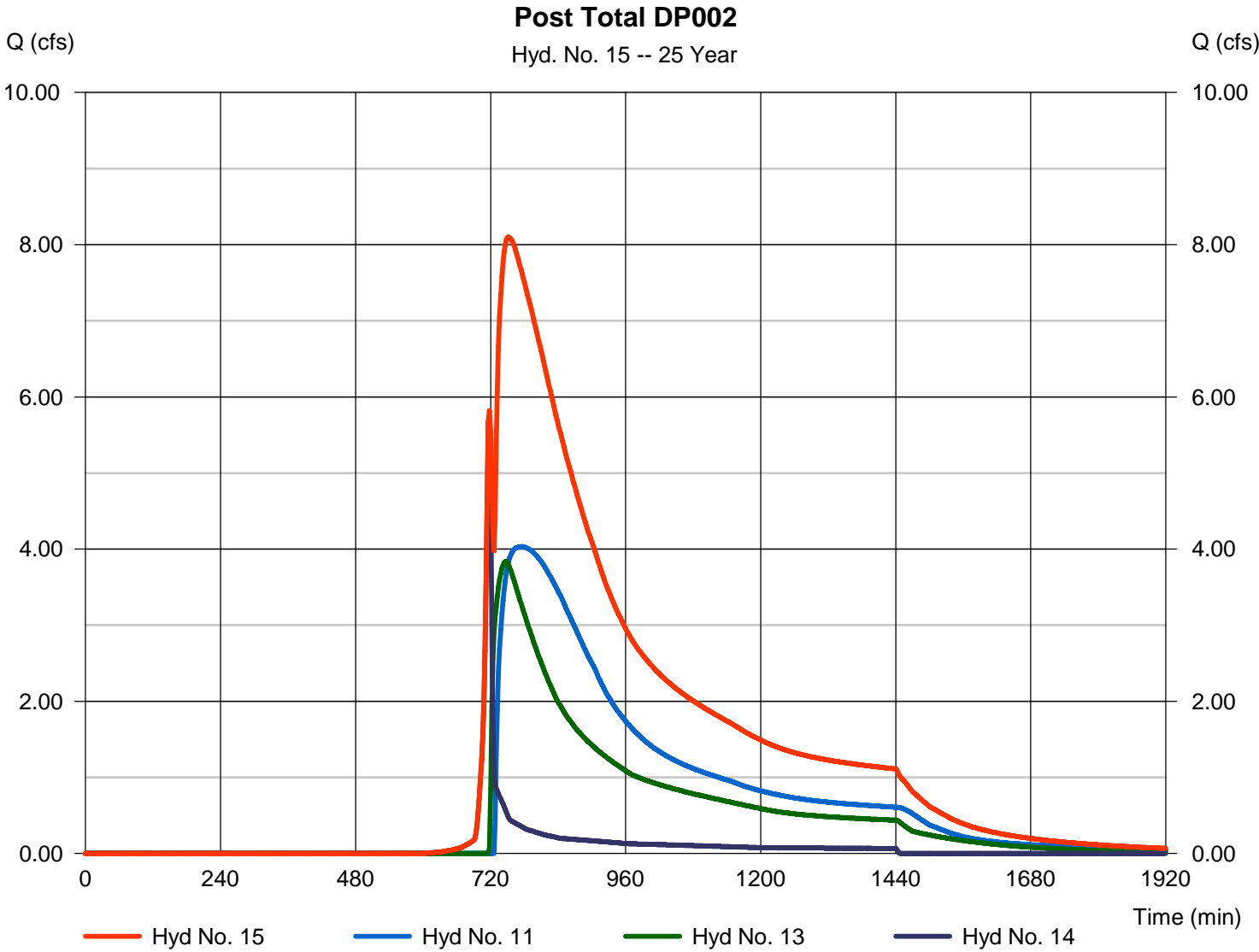
Friday, 04 / 30 / 2021

## Hyd. No. 15

Post Total DP002

Hydrograph type = Combine  
Storm frequency = 25 yrs  
Time interval = 2 min  
Inflow hyds. = 11, 13, 14

Peak discharge = 8.100 cfs  
Time to peak = 752 min  
Hyd. volume = 141,590 cuft  
Contrib. drain. area = 1.490 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	43.70	2	722	116,803	-----	-----	-----	Pre Developed DP001
2	SCS Runoff	64.53	2	722	171,402	-----	-----	-----	Pre Developed DP002
4	SCS Runoff	62.85	2	716	126,892	-----	-----	-----	Post Basin 3
5	Reservoir	7.143	2	740	100,020	4	317.04	60,688	Basin 3 Routed
6	SCS Runoff	4.433	2	716	8,951	-----	-----	-----	Post Bypass DP001
7	Combine	7.648	2	740	108,971	5, 6	-----	-----	Post Total DP001
9	SCS Runoff	67.77	2	716	136,963	-----	-----	-----	Post Basin 1
10	Reservoir	35.31	2	722	109,753	9	318.54	53,728	Basin 1 Upper Routed
11	Reservoir	9.583	2	744	103,663	10	302.11	26,034	Basin 1 Lower Routed
12	SCS Runoff	52.34	2	716	106,494	-----	-----	-----	Post Basin 2
13	Reservoir	8.399	2	726	74,139	12	308.15	52,693	Basin 2 Routed
14	SCS Runoff	7.327	2	718	14,721	-----	-----	-----	Post Bypass DP002
15	Combine	17.64	2	742	192,524	11, 13, 14	-----	-----	Post Total DP002
SWM.gpw					Return Period: 50 Year			Friday, 04 / 30 / 2021	

# Hydrograph Report

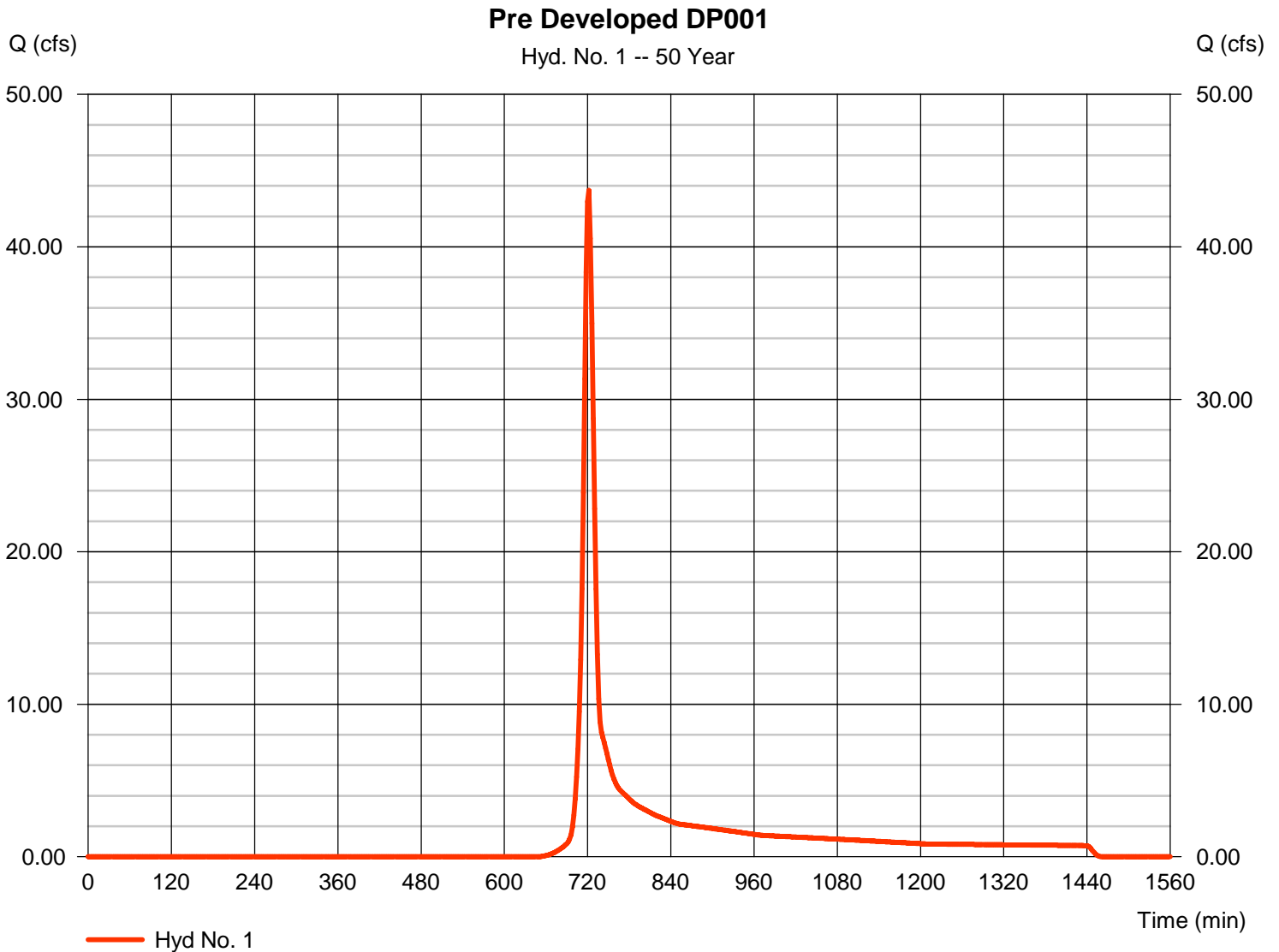
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 1

Pre Developed DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 43.70 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 116,803 cuft
Drainage area	= 14.570 ac	Curve number	= 58
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 6.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



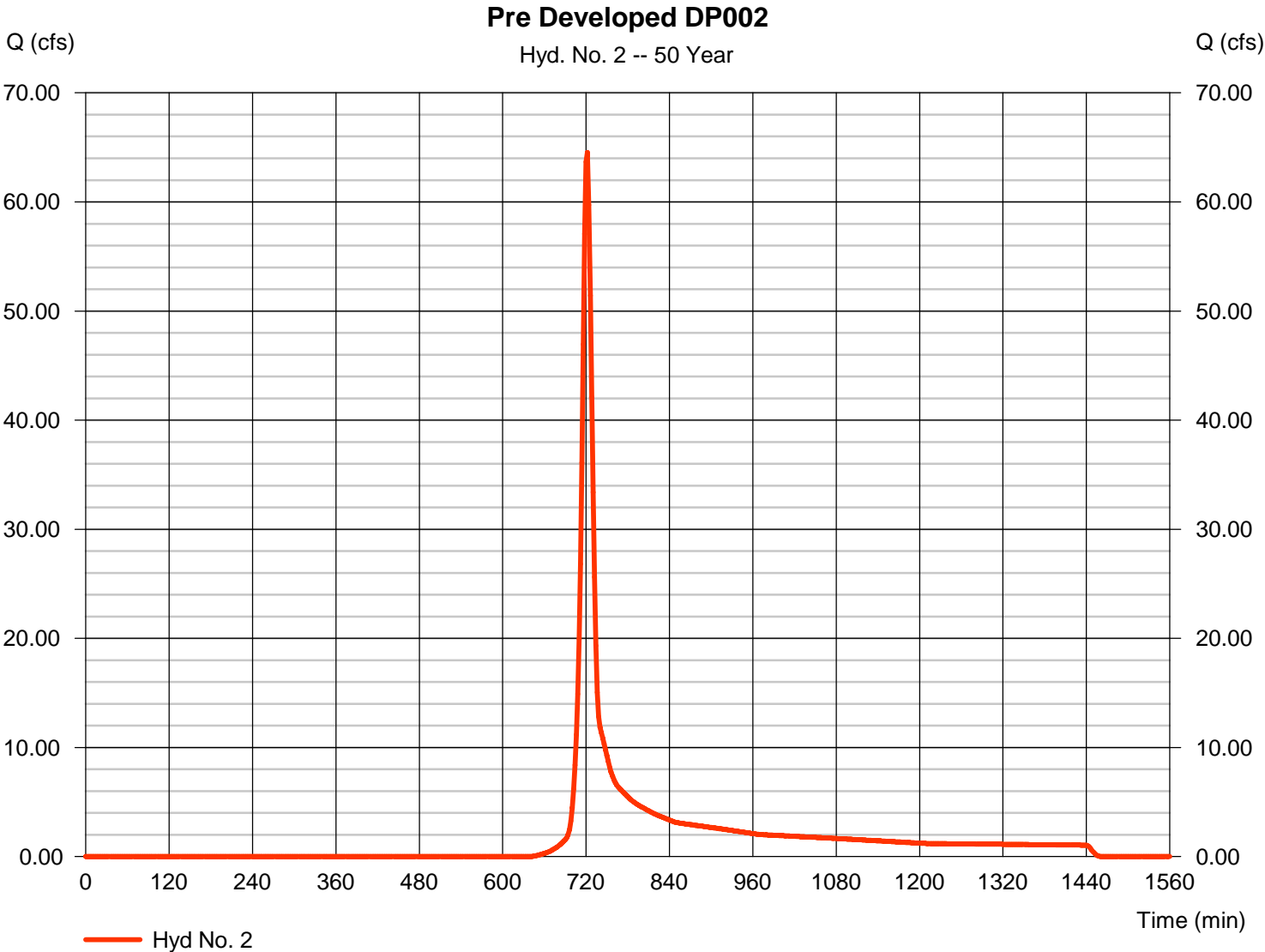
# Hydrograph Report

## Hyd. No. 2

Pre Developed DP002

Hydrograph type = SCS Runoff  
Storm frequency = 50 yrs  
Time interval = 2 min  
Drainage area = 20.260 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 6.60 in  
Storm duration = 24 hrs

Peak discharge = 64.53 cfs  
Time to peak = 722 min  
Hyd. volume = 171,402 cuft  
Curve number = 59.3  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 12.00 min  
Distribution = Type II  
Shape factor = 484

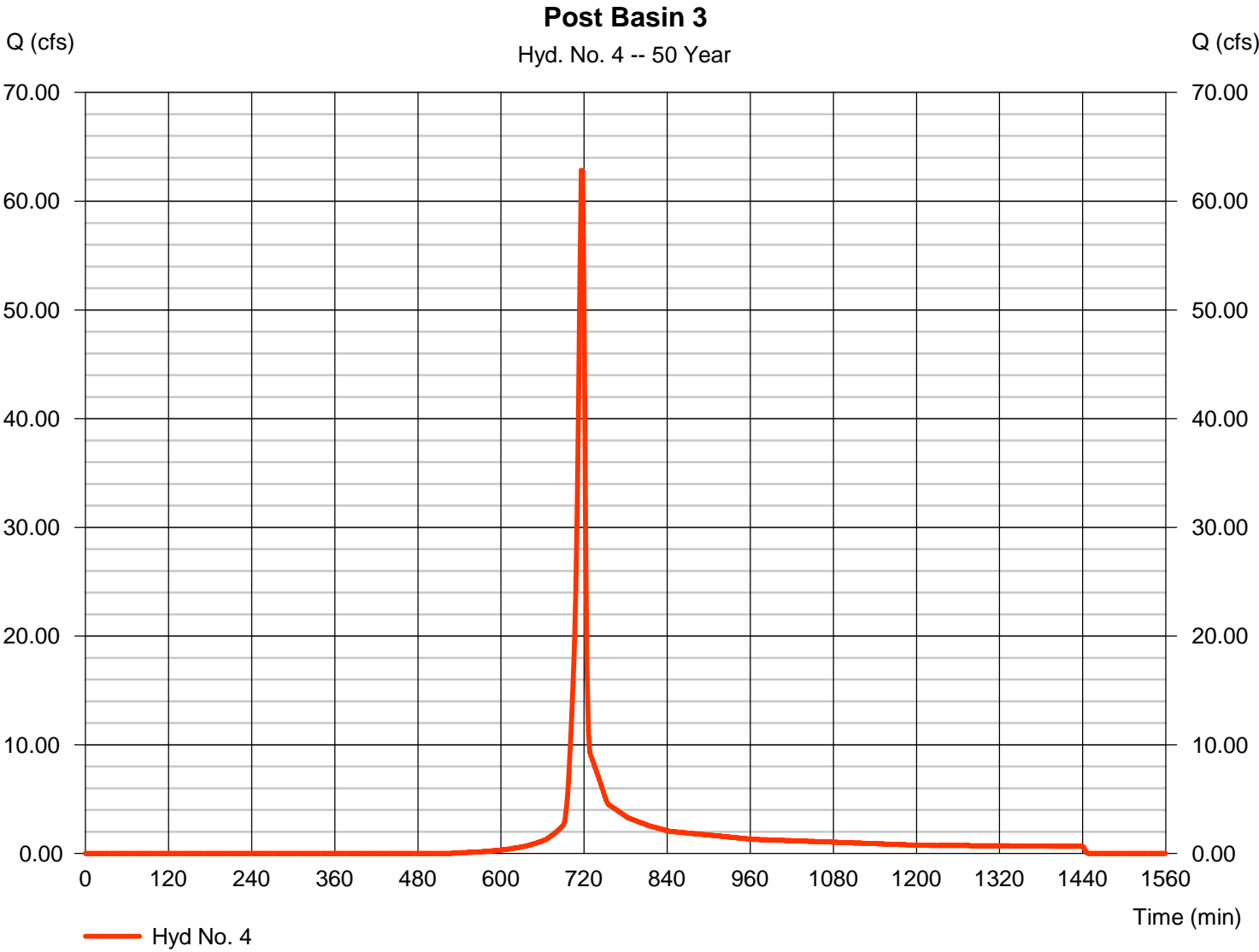


# Hydrograph Report

## Hyd. No. 4

### Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 62.85 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 126,892 cuft
Drainage area	= 11.730 ac	Curve number	= 68.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

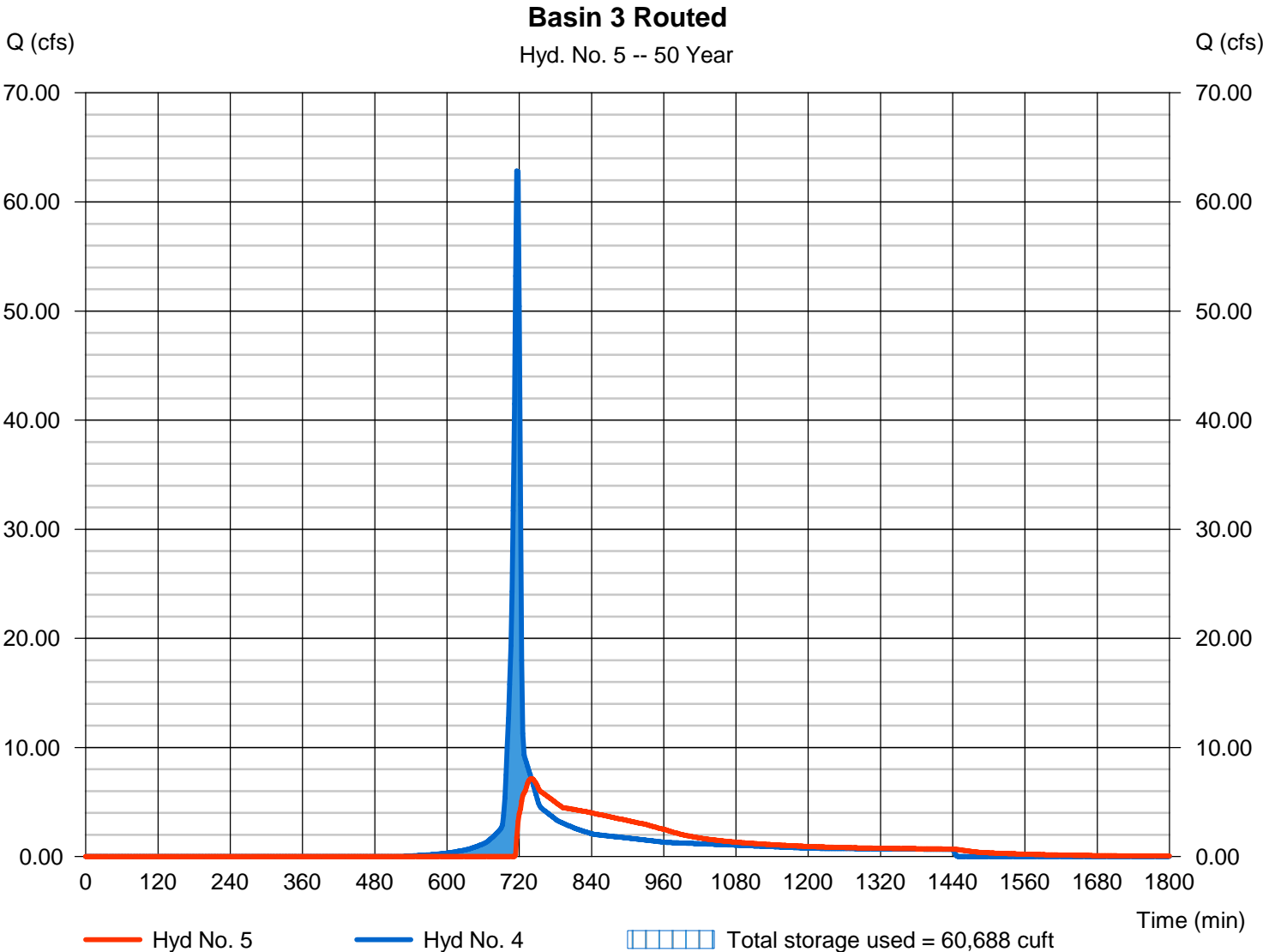
Friday, 04 / 30 / 2021

## Hyd. No. 5

Basin 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 7.143 cfs
Storm frequency	= 50 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 100,020 cuft
Inflow hyd. No.	= 4 - Post Basin 3	Max. Elevation	= 317.04 ft
Reservoir name	= Basin 3	Max. Storage	= 60,688 cuft

Storage Indication method used.

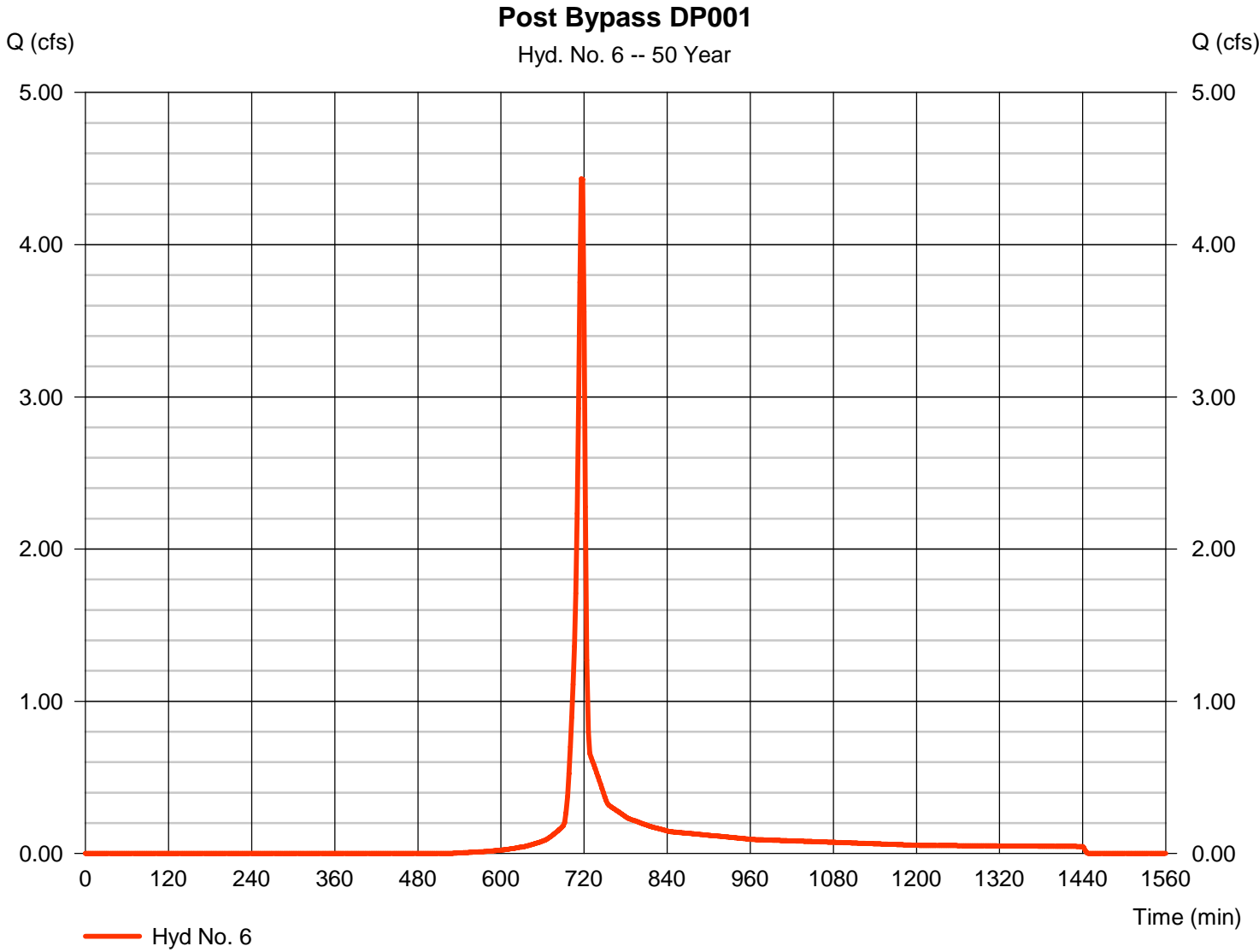


# Hydrograph Report

## Hyd. No. 6

Post Bypass DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 4.433 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 8,951 cuft
Drainage area	= 0.830 ac	Curve number	= 68.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

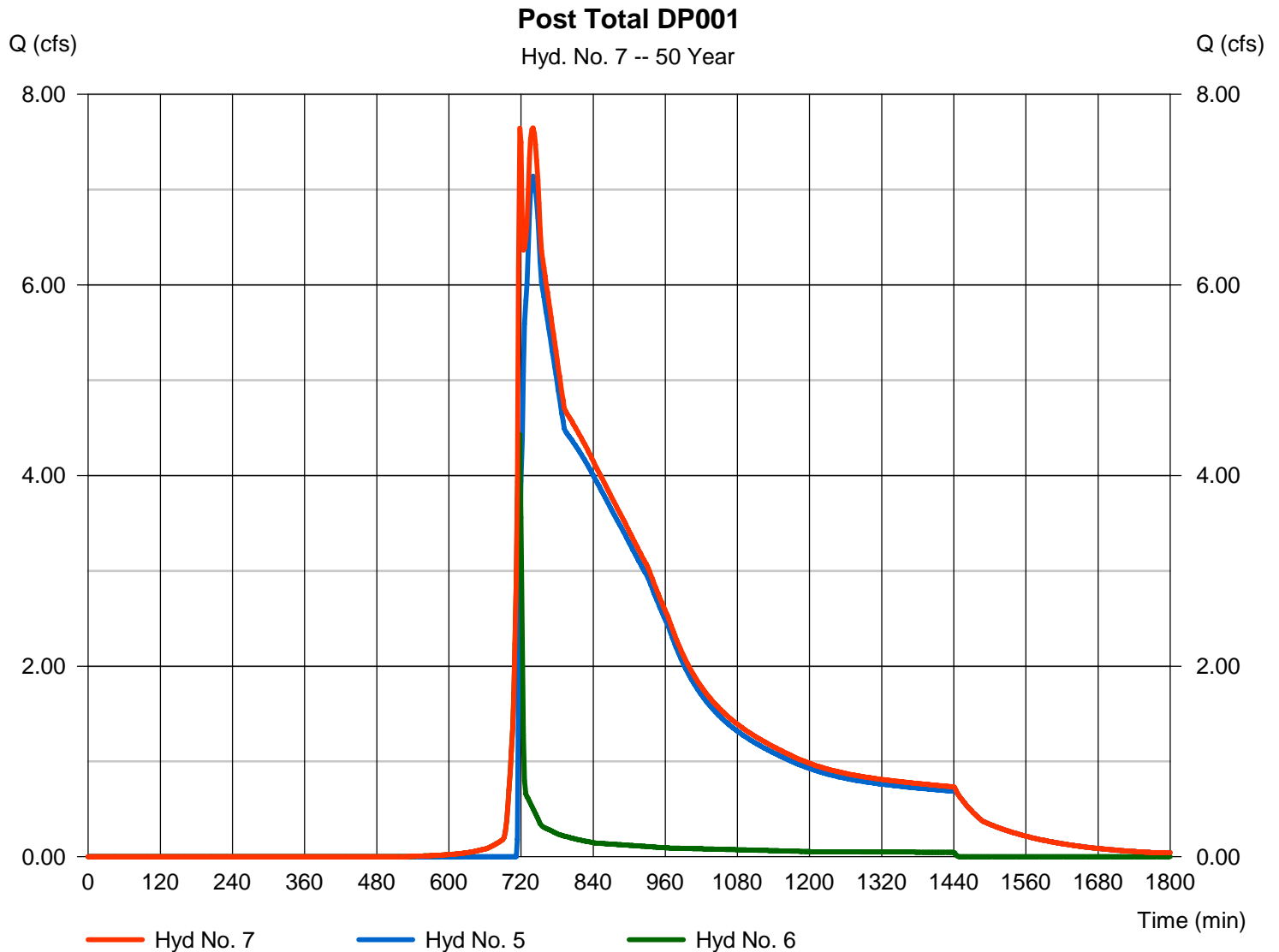
Friday, 04 / 30 / 2021

## Hyd. No. 7

Post Total DP001

Hydrograph type = Combine  
Storm frequency = 50 yrs  
Time interval = 2 min  
Inflow hyds. = 5, 6

Peak discharge = 7.648 cfs  
Time to peak = 740 min  
Hyd. volume = 108,971 cuft  
Contrib. drain. area = 0.830 ac

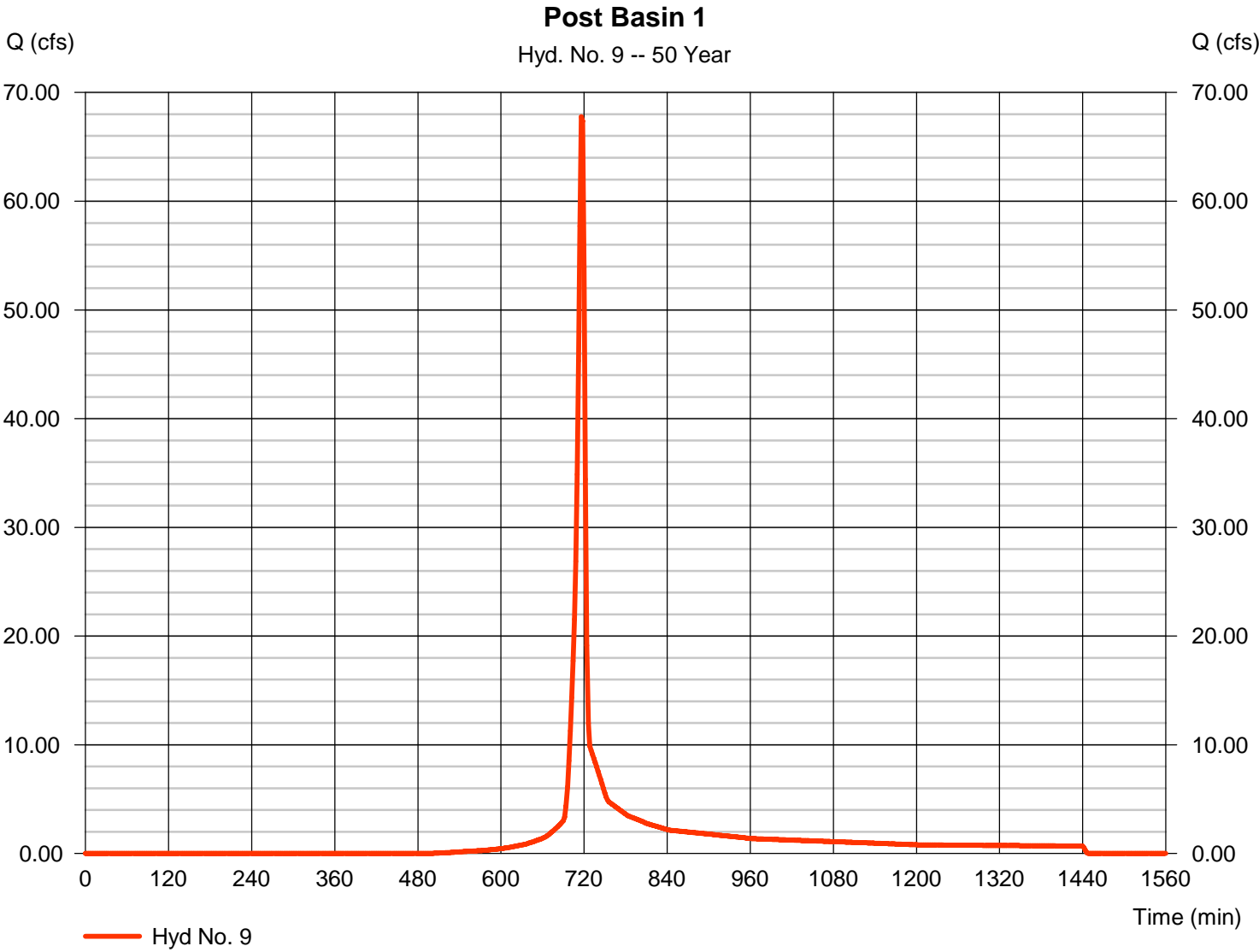


# Hydrograph Report

## Hyd. No. 9

### Post Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 67.77 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 136,963 cuft
Drainage area	= 11.910 ac	Curve number	= 70.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

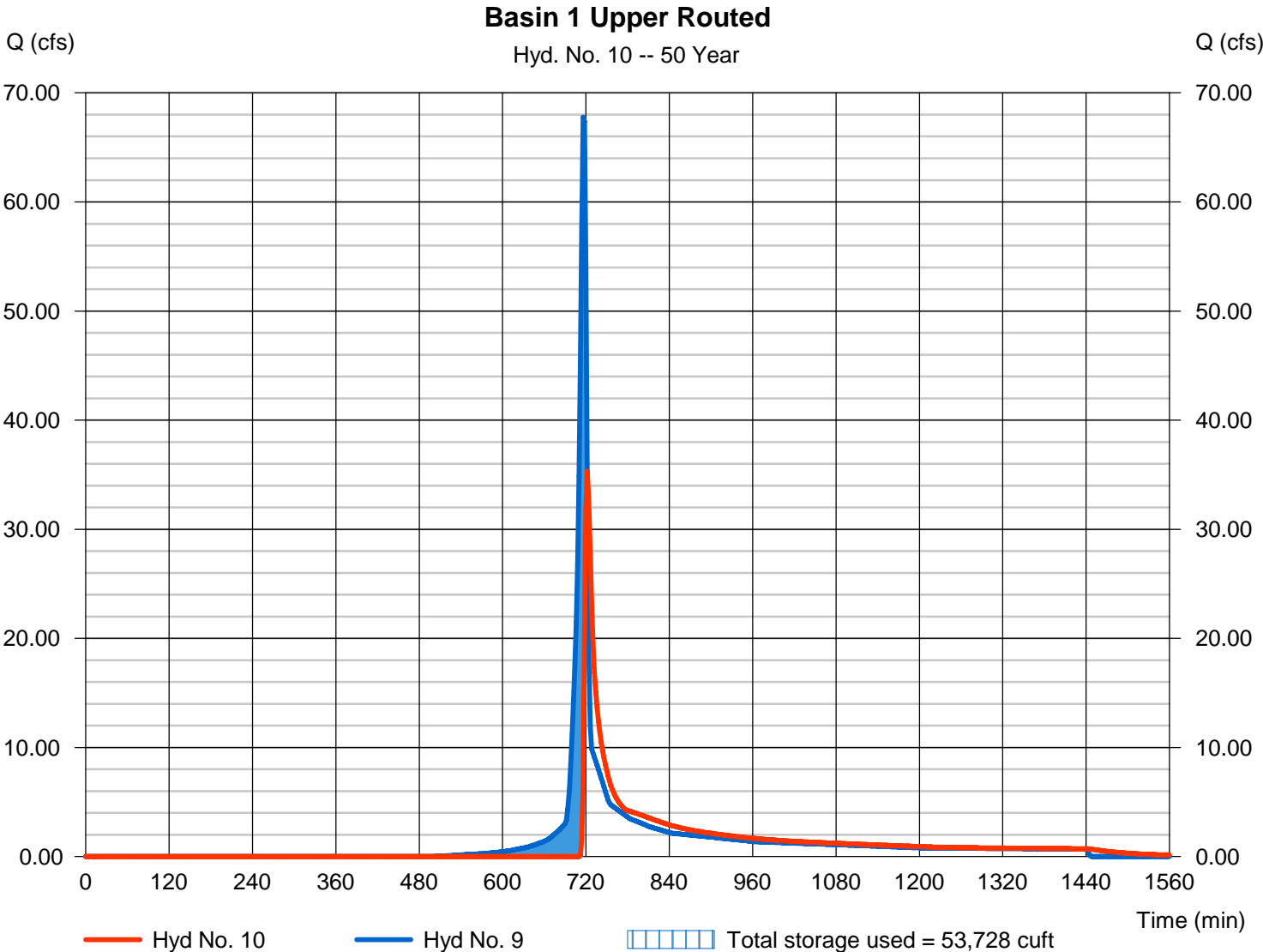
Friday, 04 / 30 / 2021

## Hyd. No. 10

Basin 1 Upper Routed

Hydrograph type	= Reservoir	Peak discharge	= 35.31 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 109,753 cuft
Inflow hyd. No.	= 9 - Post Basin 1	Max. Elevation	= 318.54 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 53,728 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

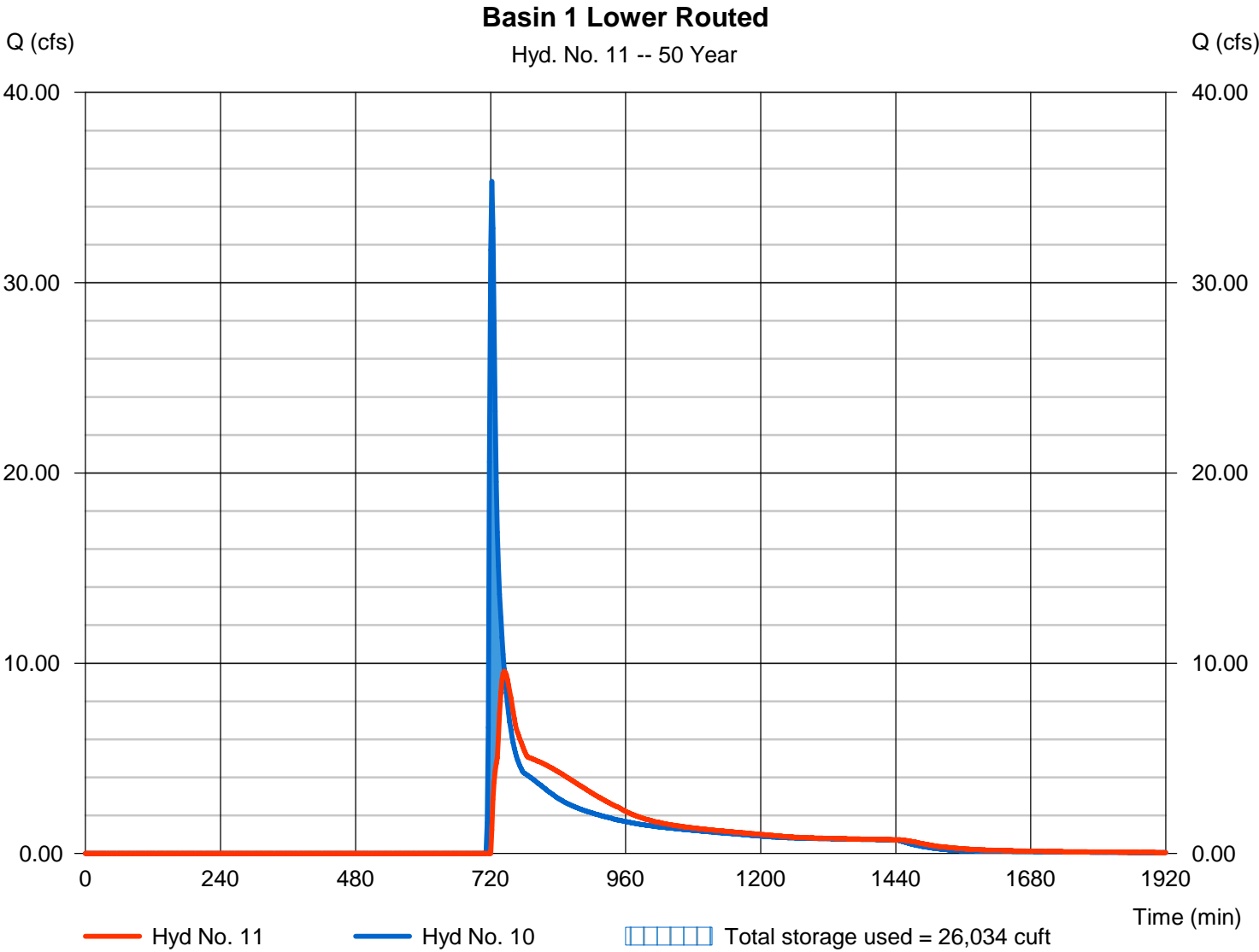
Friday, 04 / 30 / 2021

## Hyd. No. 11

### Basin 1 Lower Routed

Hydrograph type	= Reservoir	Peak discharge	= 9.583 cfs
Storm frequency	= 50 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 103,663 cuft
Inflow hyd. No.	= 10 - Basin 1 Upper Routed	Max. Elevation	= 302.11 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 26,034 cuft

Storage Indication method used.

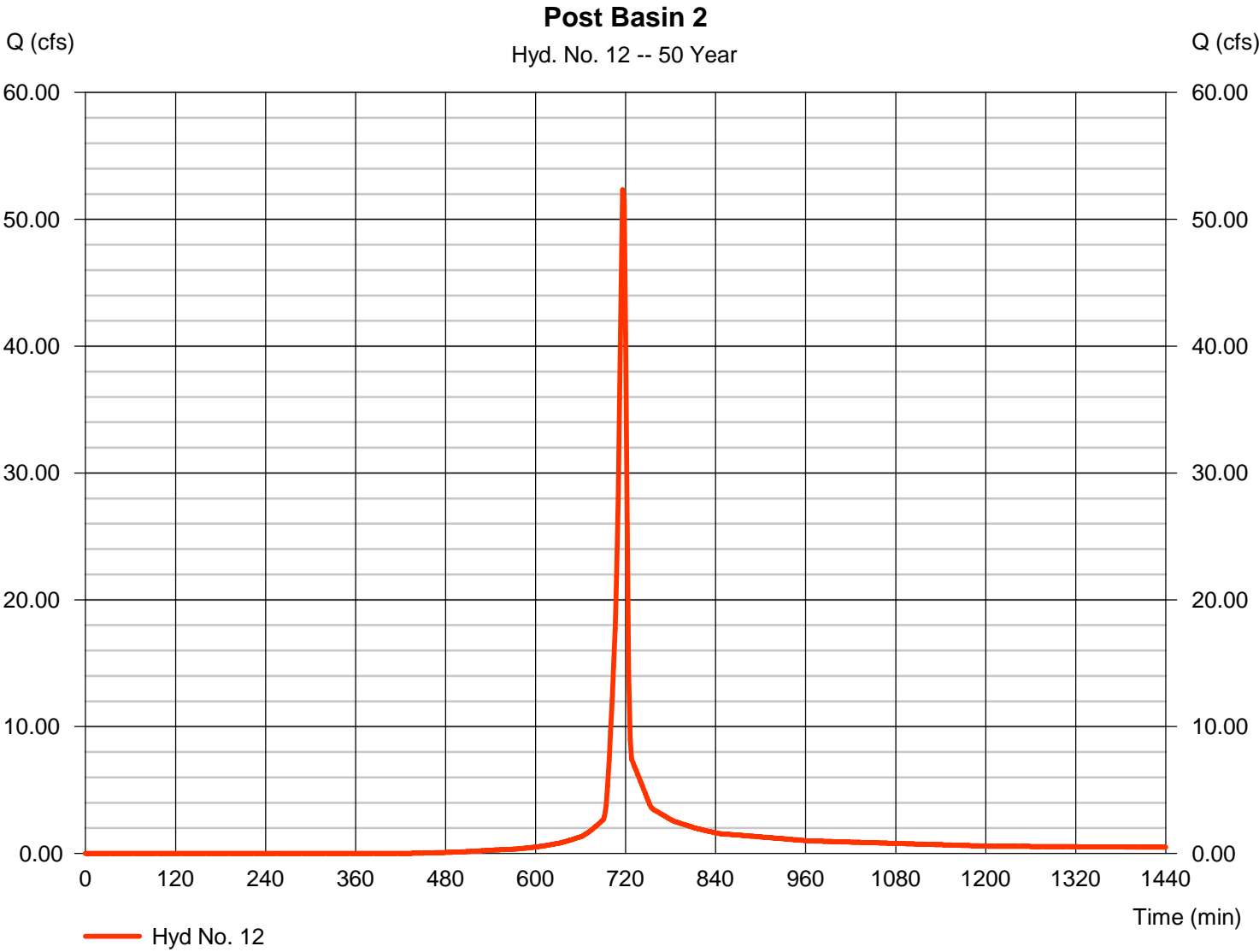


# Hydrograph Report

## Hyd. No. 12

### Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 52.34 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 106,494 cuft
Drainage area	= 8.170 ac	Curve number	= 75.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

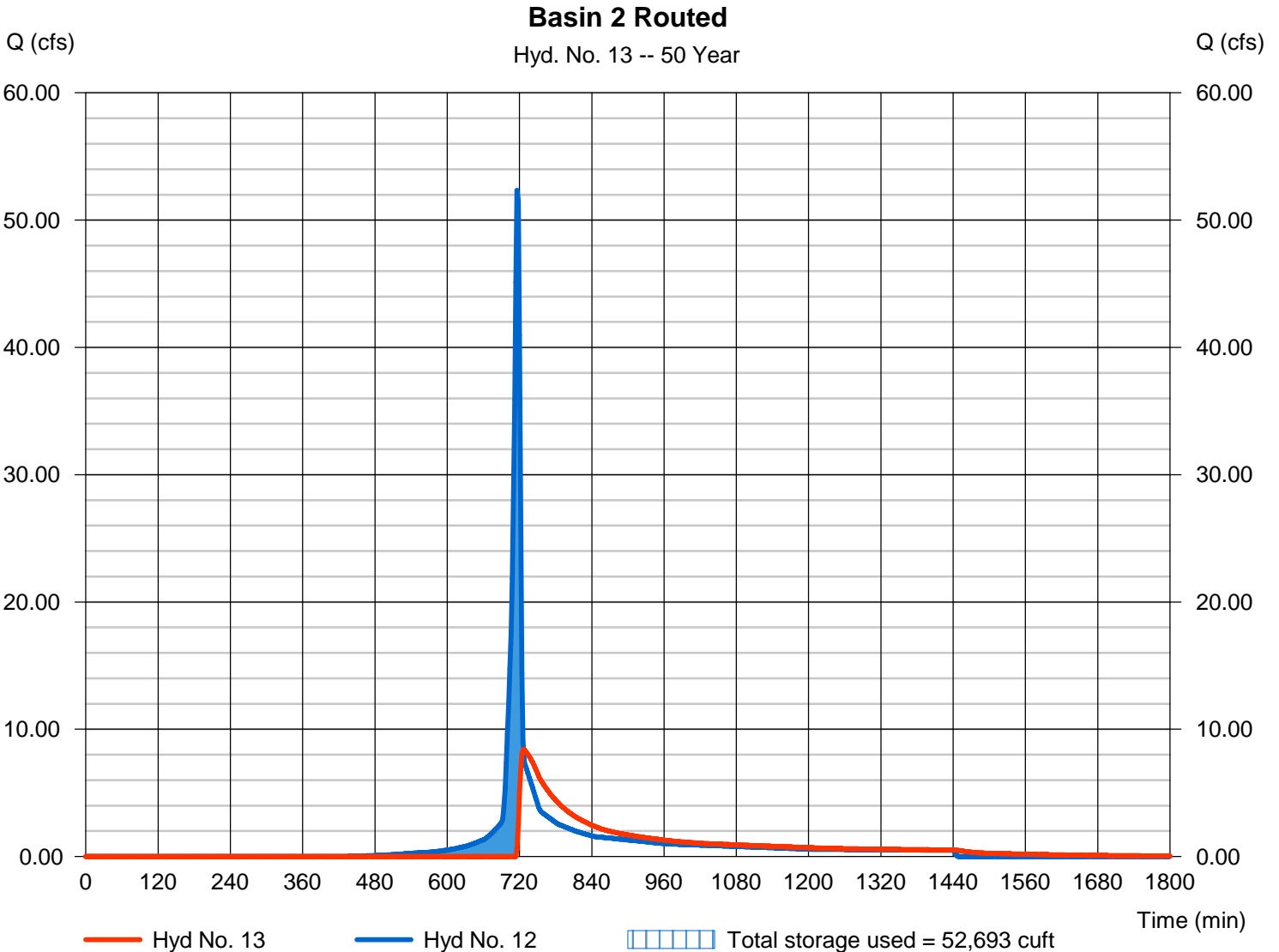
Friday, 04 / 30 / 2021

## Hyd. No. 13

Basin 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 8.399 cfs
Storm frequency	= 50 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 74,139 cuft
Inflow hyd. No.	= 12 - Post Basin 2	Max. Elevation	= 308.15 ft
Reservoir name	= Basin 2	Max. Storage	= 52,693 cuft

Storage Indication method used.



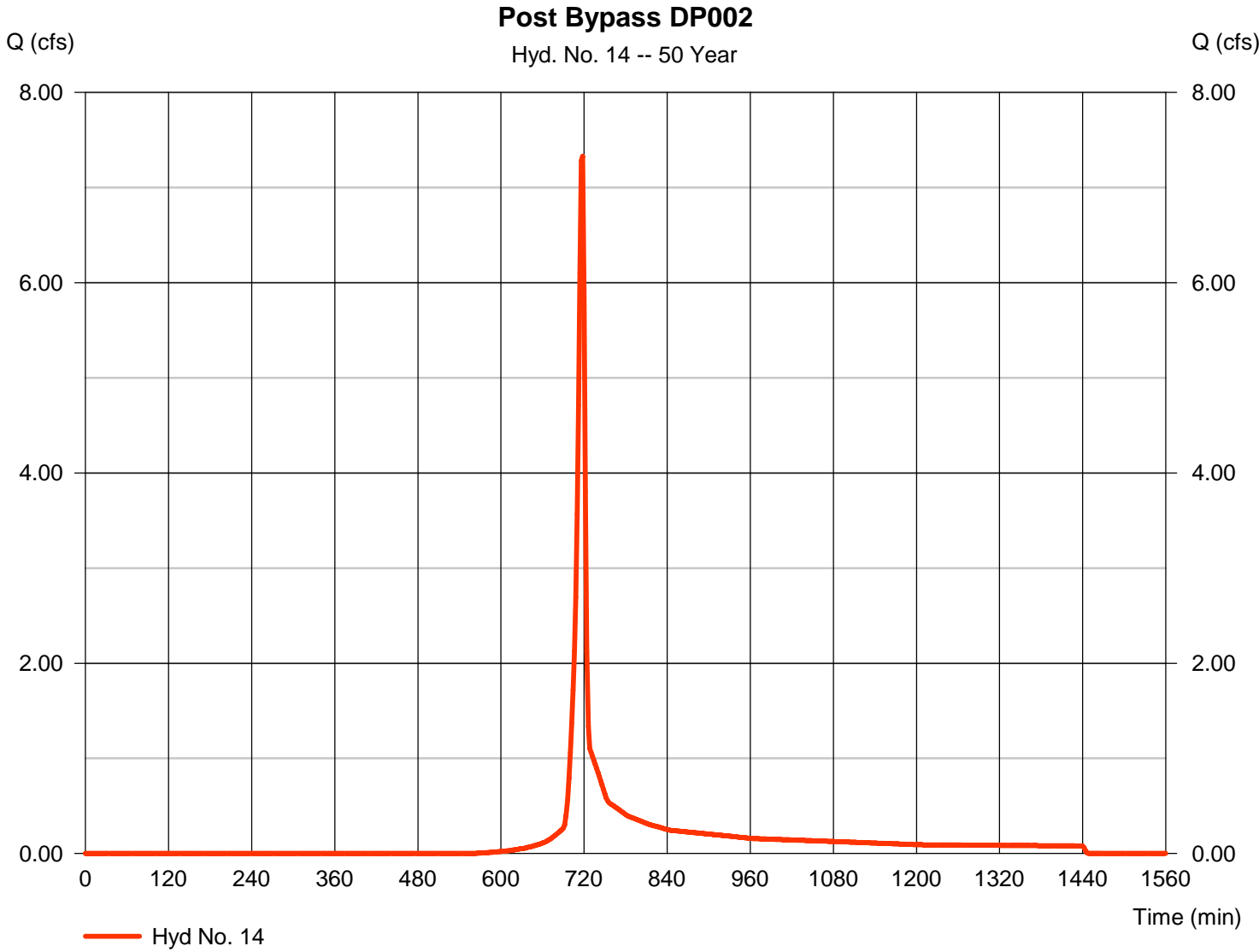


# Hydrograph Report

## Hyd. No. 14

Post Bypass DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 7.327 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 14,721 cuft
Drainage area	= 1.490 ac	Curve number	= 66.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

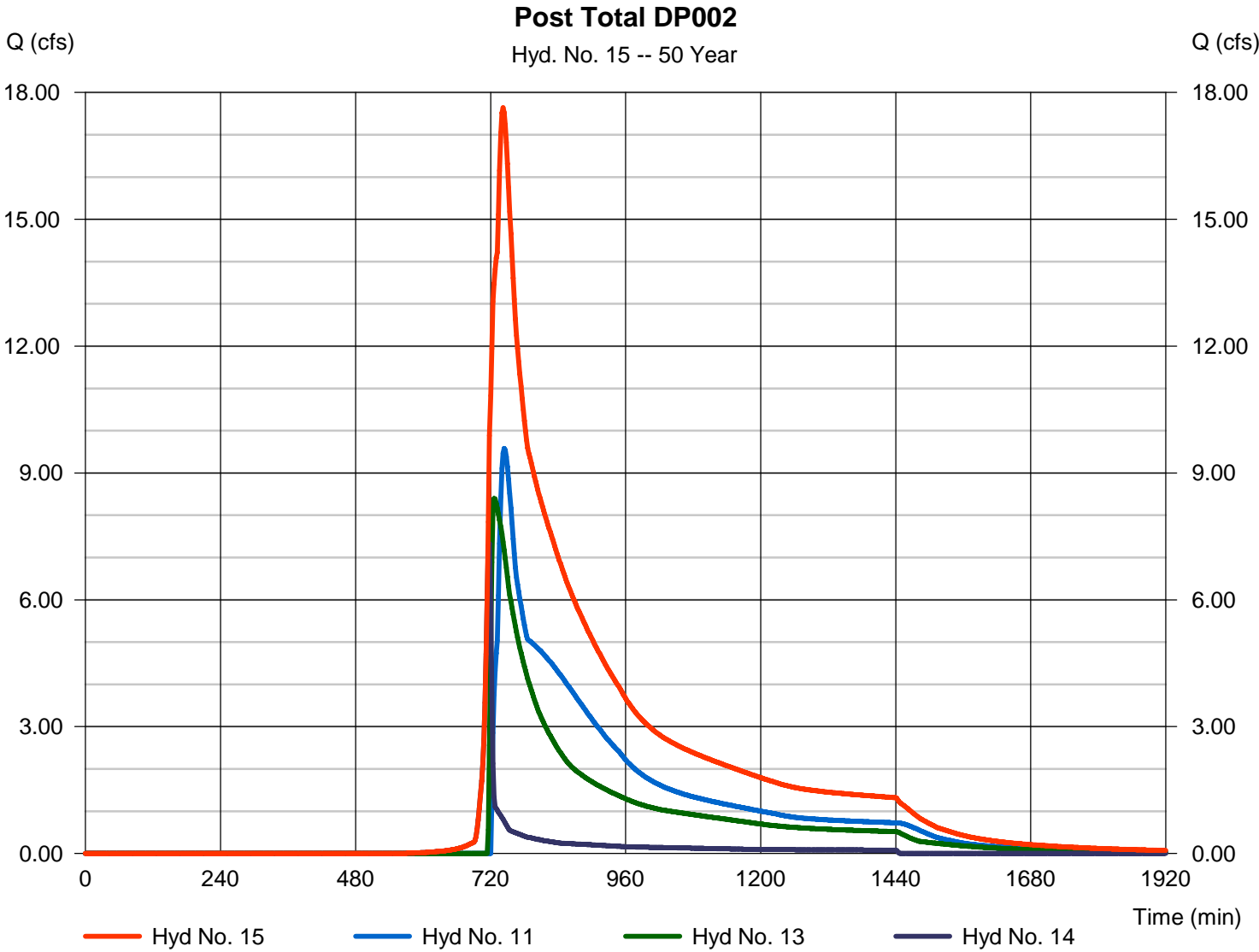
Friday, 04 / 30 / 2021

## Hyd. No. 15

Post Total DP002

Hydrograph type = Combine  
Storm frequency = 50 yrs  
Time interval = 2 min  
Inflow hyds. = 11, 13, 14

Peak discharge = 17.64 cfs  
Time to peak = 742 min  
Hyd. volume = 192,524 cuft  
Contrib. drain. area = 1.490 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

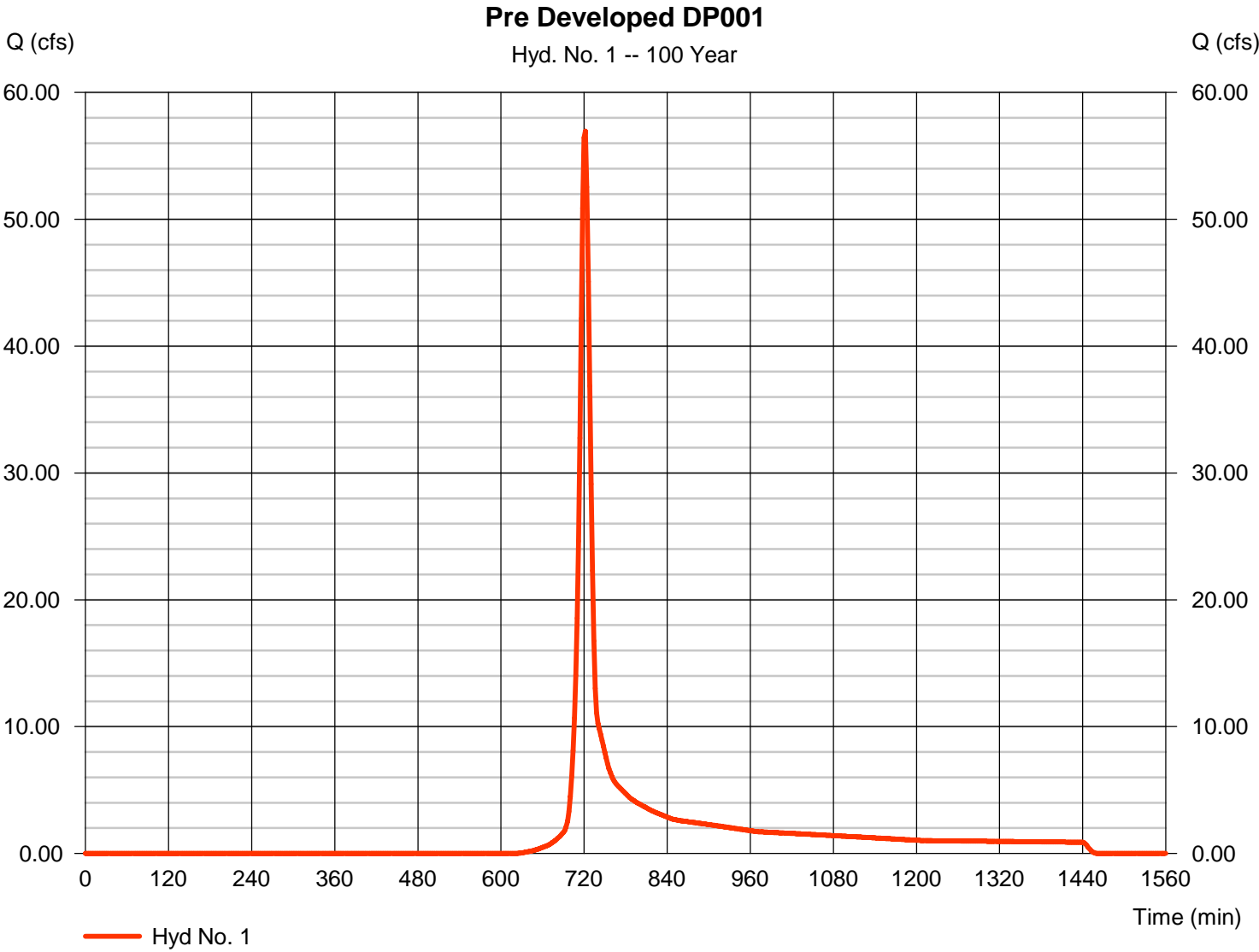
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	56.95	2	722	150,266	-----	-----	-----	Pre Developed DP001
2	SCS Runoff	83.36	2	722	219,188	-----	-----	-----	Pre Developed DP002
4	SCS Runoff	77.33	2	716	156,368	-----	-----	-----	Post Basin 3
5	Reservoir	21.02	2	724	129,495	4	317.55	69,683	Basin 3 Routed
6	SCS Runoff	5.457	2	716	11,033	-----	-----	-----	Post Bypass DP001
7	Combine	22.88	2	722	140,529	5, 6	-----	-----	Post Total DP001
9	SCS Runoff	82.71	2	716	167,675	-----	-----	-----	Post Basin 1
10	Reservoir	41.97	2	722	140,465	9	318.99	62,434	Basin 1 Upper Routed
11	Reservoir	23.11	2	734	134,375	10	302.52	32,024	Basin 1 Lower Routed
12	SCS Runoff	62.84	2	716	128,634	-----	-----	-----	Post Basin 2
13	Reservoir	22.93	2	724	96,279	12	308.54	60,047	Basin 2 Routed
14	SCS Runoff	9.073	2	716	18,318	-----	-----	-----	Post Bypass DP002
15	Combine	38.12	2	732	248,973	11, 13, 14	-----	-----	Post Total DP002
SWM.gpw					Return Period: 100 Year			Friday, 04 / 30 / 2021	

# Hydrograph Report

## Hyd. No. 1

Pre Developed DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 56.95 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 150,266 cuft
Drainage area	= 14.570 ac	Curve number	= 58
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 7.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



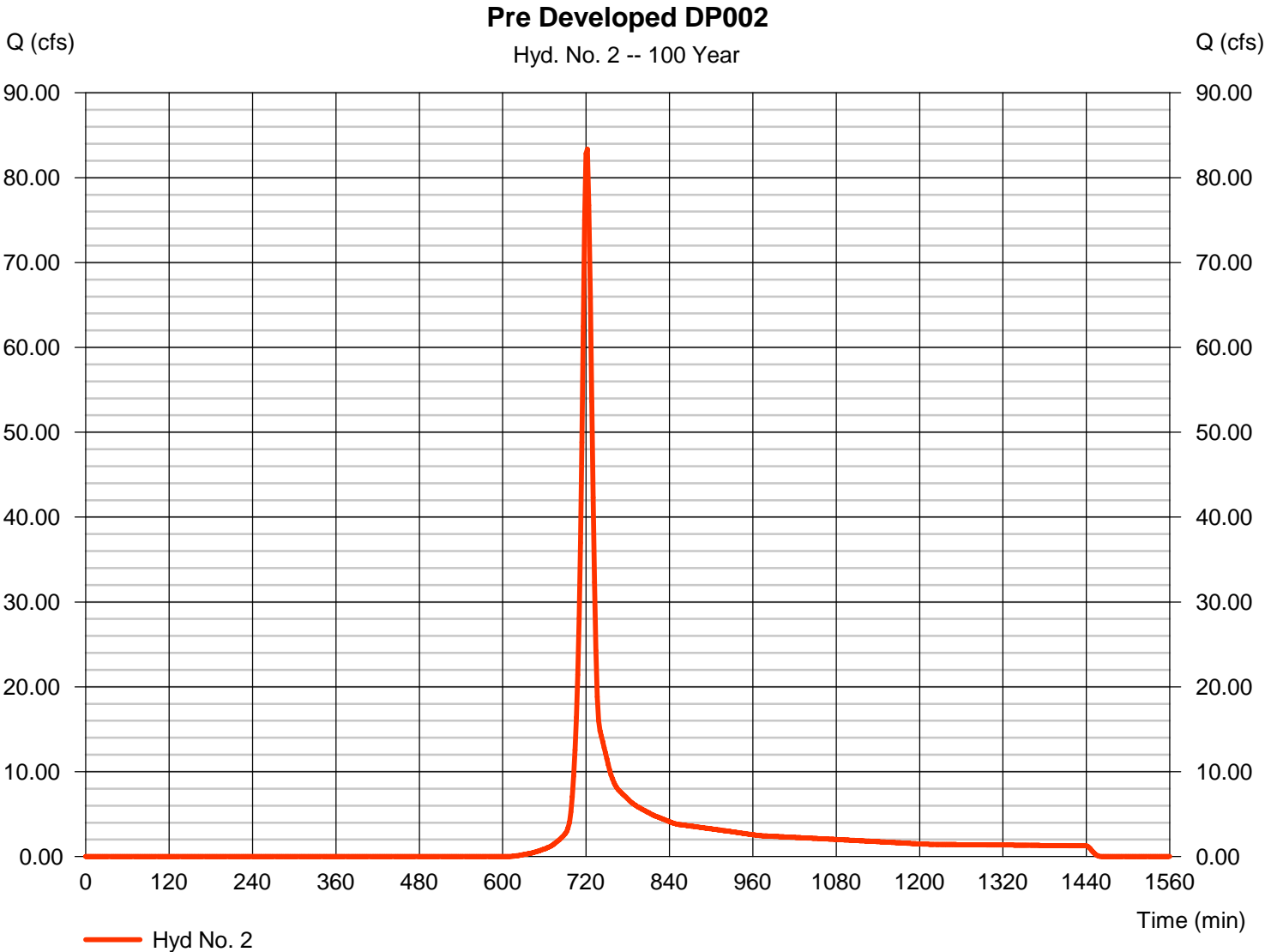
# Hydrograph Report

## Hyd. No. 2

Pre Developed DP002

Hydrograph type = SCS Runoff  
Storm frequency = 100 yrs  
Time interval = 2 min  
Drainage area = 20.260 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 7.50 in  
Storm duration = 24 hrs

Peak discharge = 83.36 cfs  
Time to peak = 722 min  
Hyd. volume = 219,188 cuft  
Curve number = 59.3  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 12.00 min  
Distribution = Type II  
Shape factor = 484

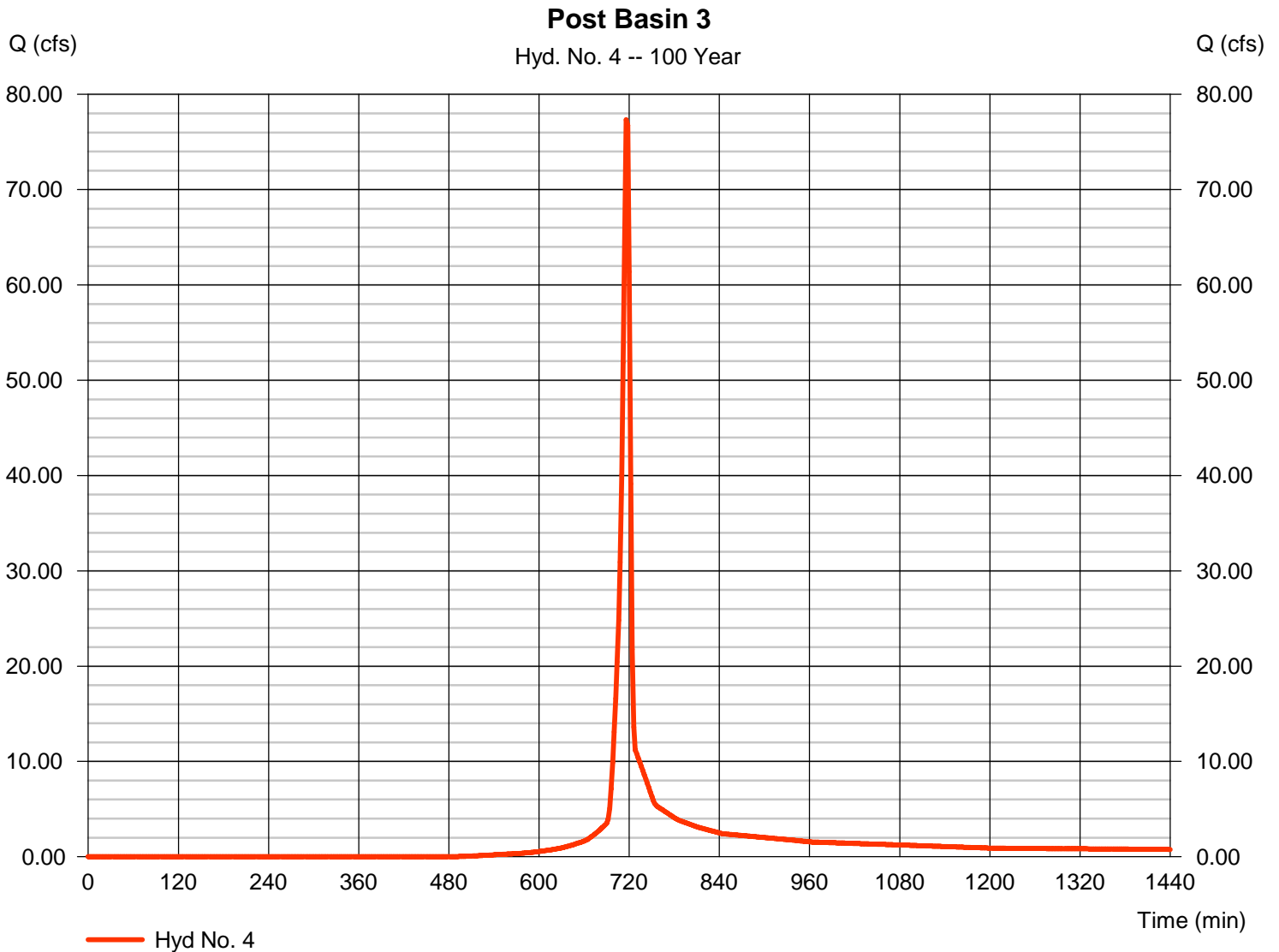


# Hydrograph Report

## Hyd. No. 4

### Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 77.33 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 156,368 cuft
Drainage area	= 11.730 ac	Curve number	= 68.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

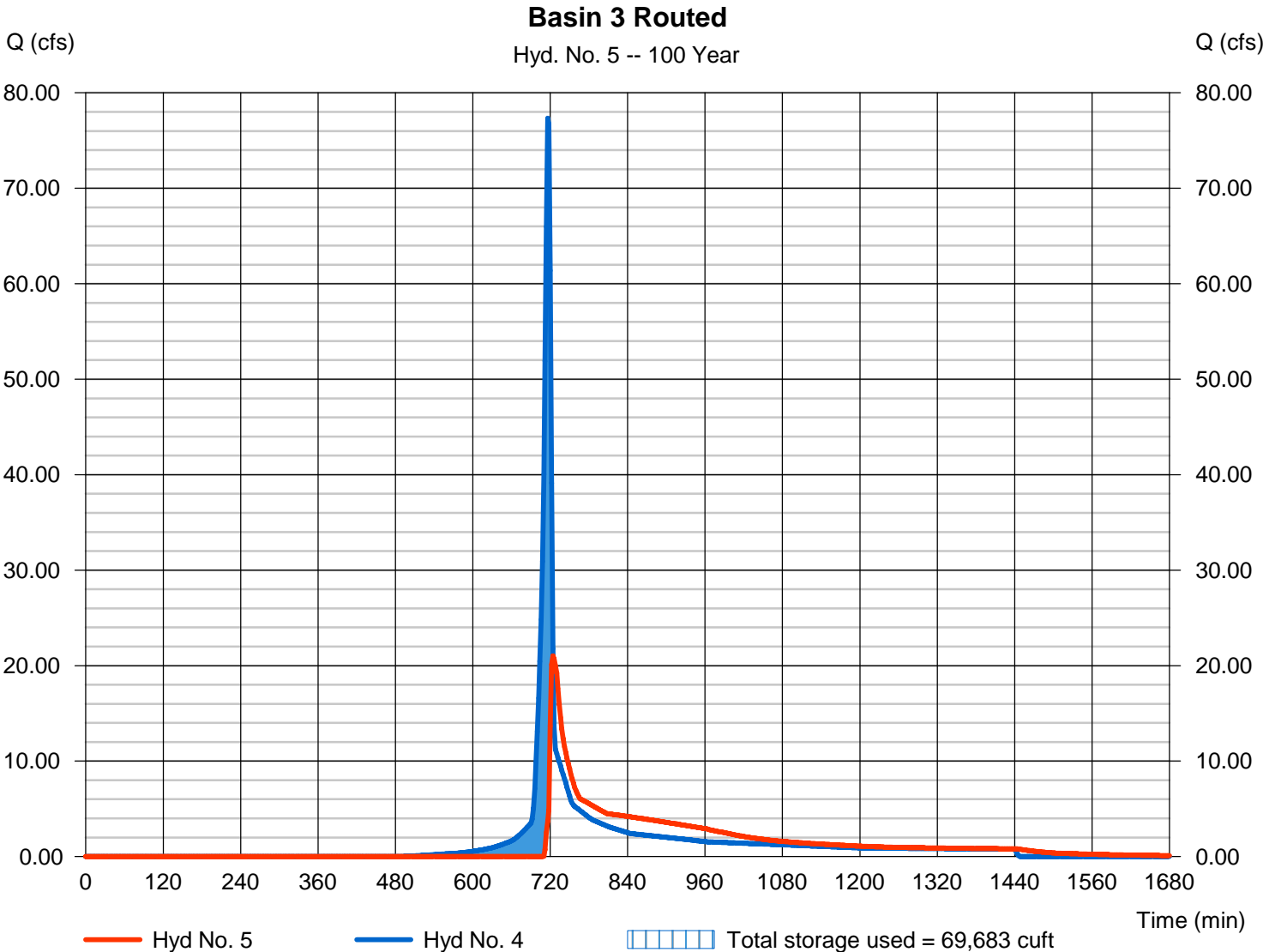
Friday, 04 / 30 / 2021

## Hyd. No. 5

Basin 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 21.02 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 129,495 cuft
Inflow hyd. No.	= 4 - Post Basin 3	Max. Elevation	= 317.55 ft
Reservoir name	= Basin 3	Max. Storage	= 69,683 cuft

Storage Indication method used.



# Hydrograph Report

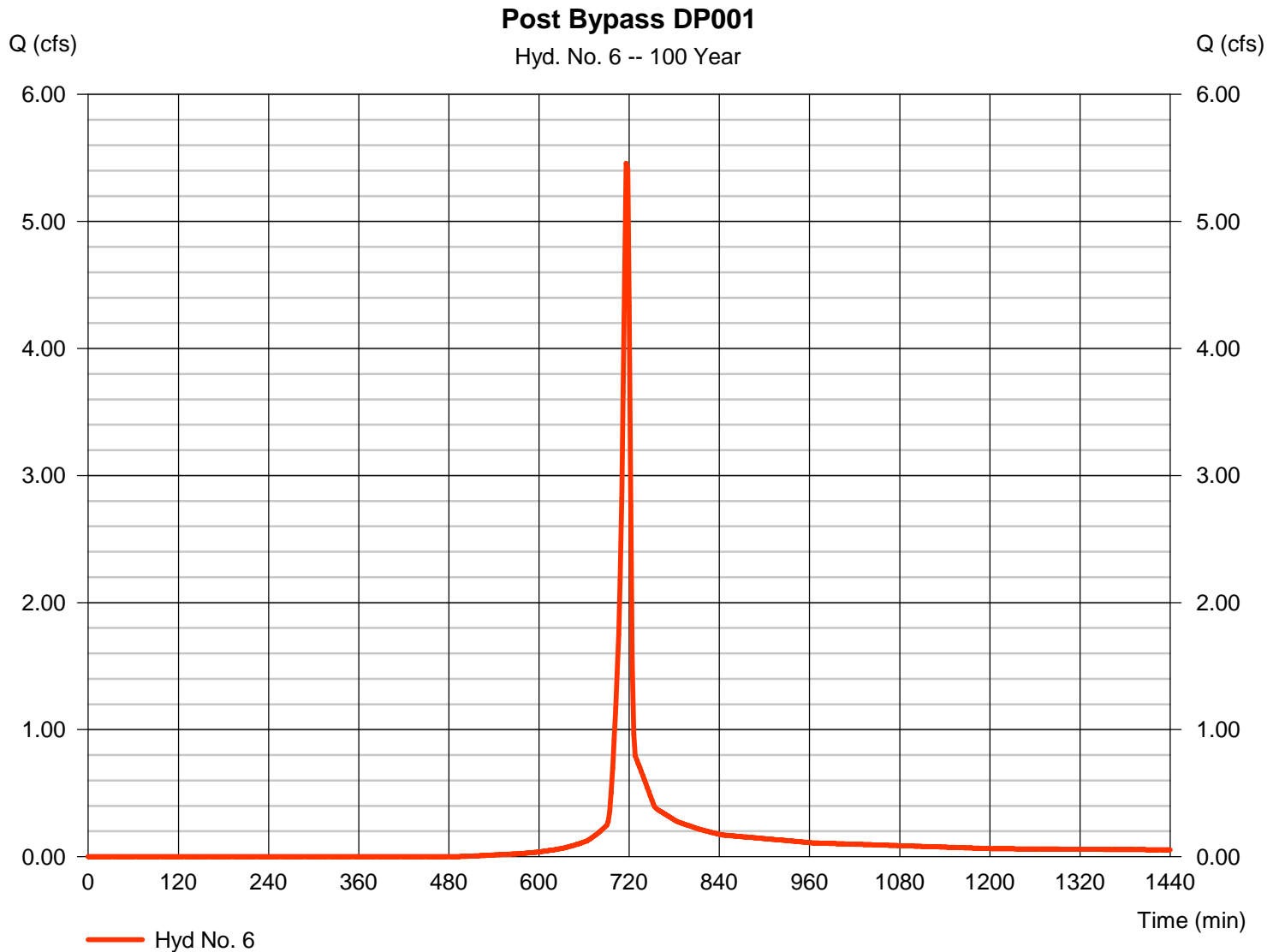
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Friday, 04 / 30 / 2021

## Hyd. No. 6

Post Bypass DP001

Hydrograph type	= SCS Runoff	Peak discharge	= 5.457 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 11,033 cuft
Drainage area	= 0.830 ac	Curve number	= 68.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

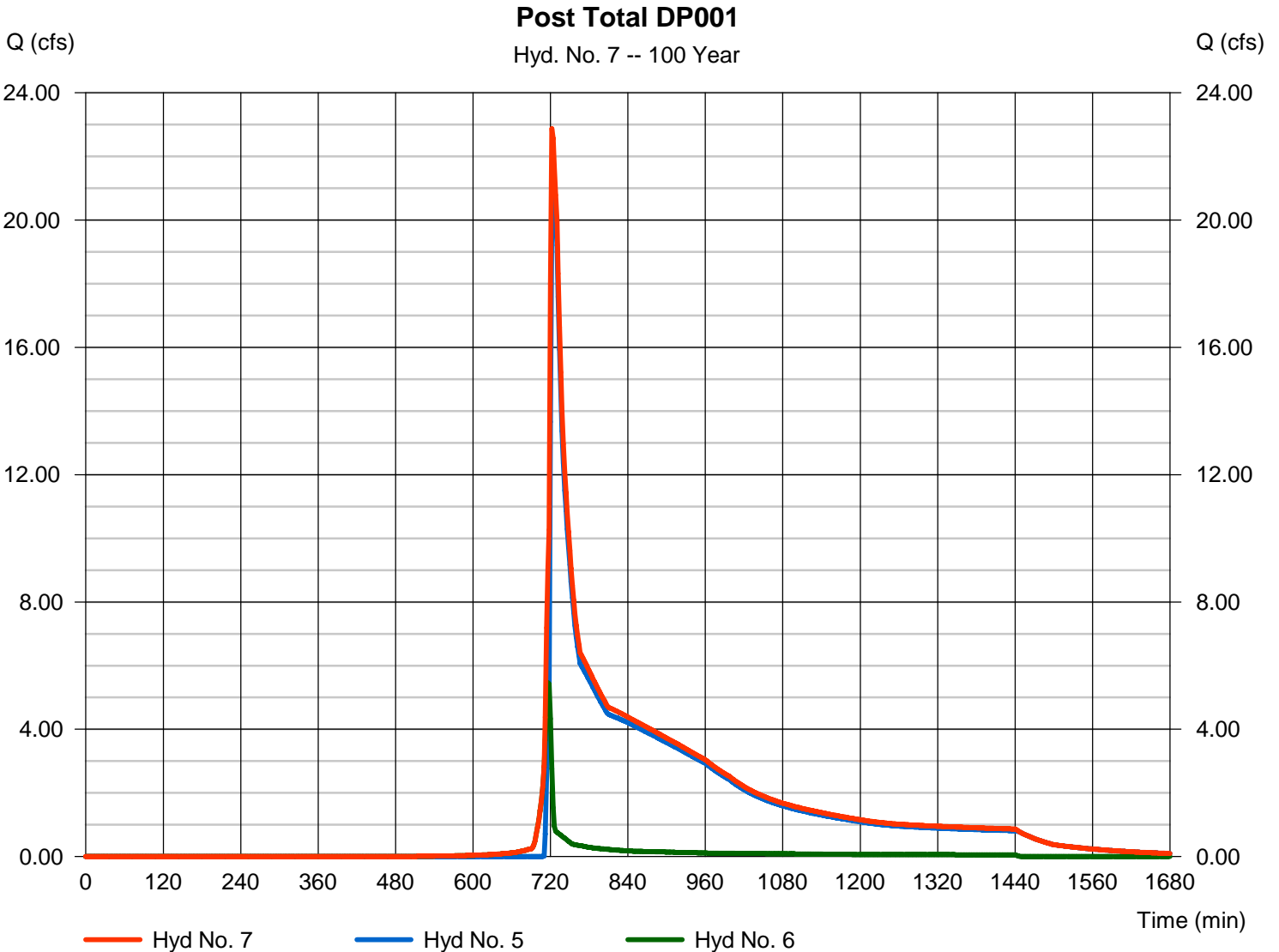
Friday, 04 / 30 / 2021

## Hyd. No. 7

Post Total DP001

Hydrograph type = Combine  
Storm frequency = 100 yrs  
Time interval = 2 min  
Inflow hyds. = 5, 6

Peak discharge = 22.88 cfs  
Time to peak = 722 min  
Hyd. volume = 140,529 cuft  
Contrib. drain. area = 0.830 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

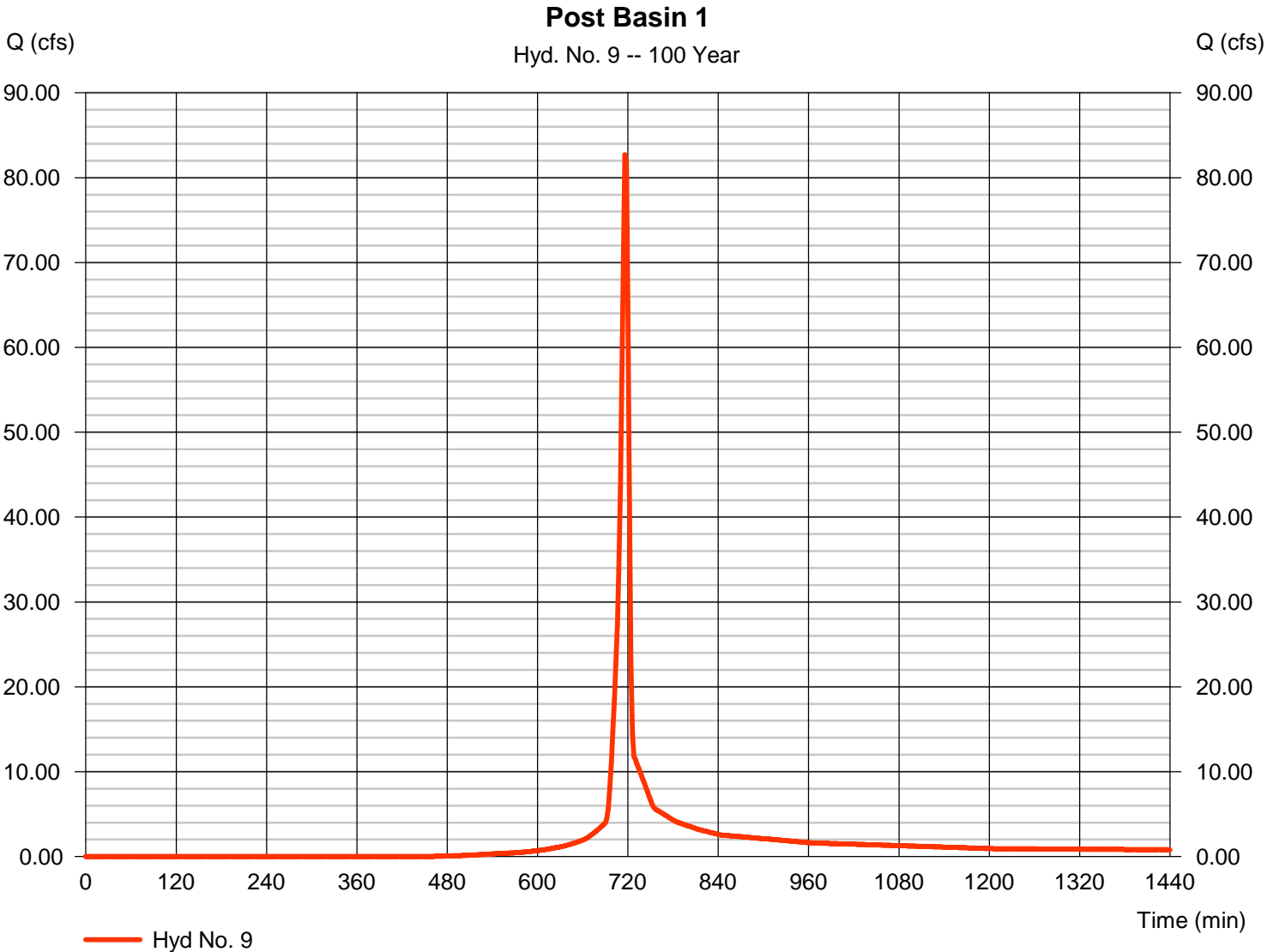
Friday, 04 / 30 / 2021

## Hyd. No. 9

Post Basin 1

Hydrograph type = SCS Runoff  
Storm frequency = 100 yrs  
Time interval = 2 min  
Drainage area = 11.910 ac  
Basin Slope = 0.0 %  
Tc method = User  
Total precip. = 7.50 in  
Storm duration = 24 hrs

Peak discharge = 82.71 cfs  
Time to peak = 716 min  
Hyd. volume = 167,675 cuft  
Curve number = 70.9  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 5.00 min  
Distribution = Type II  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

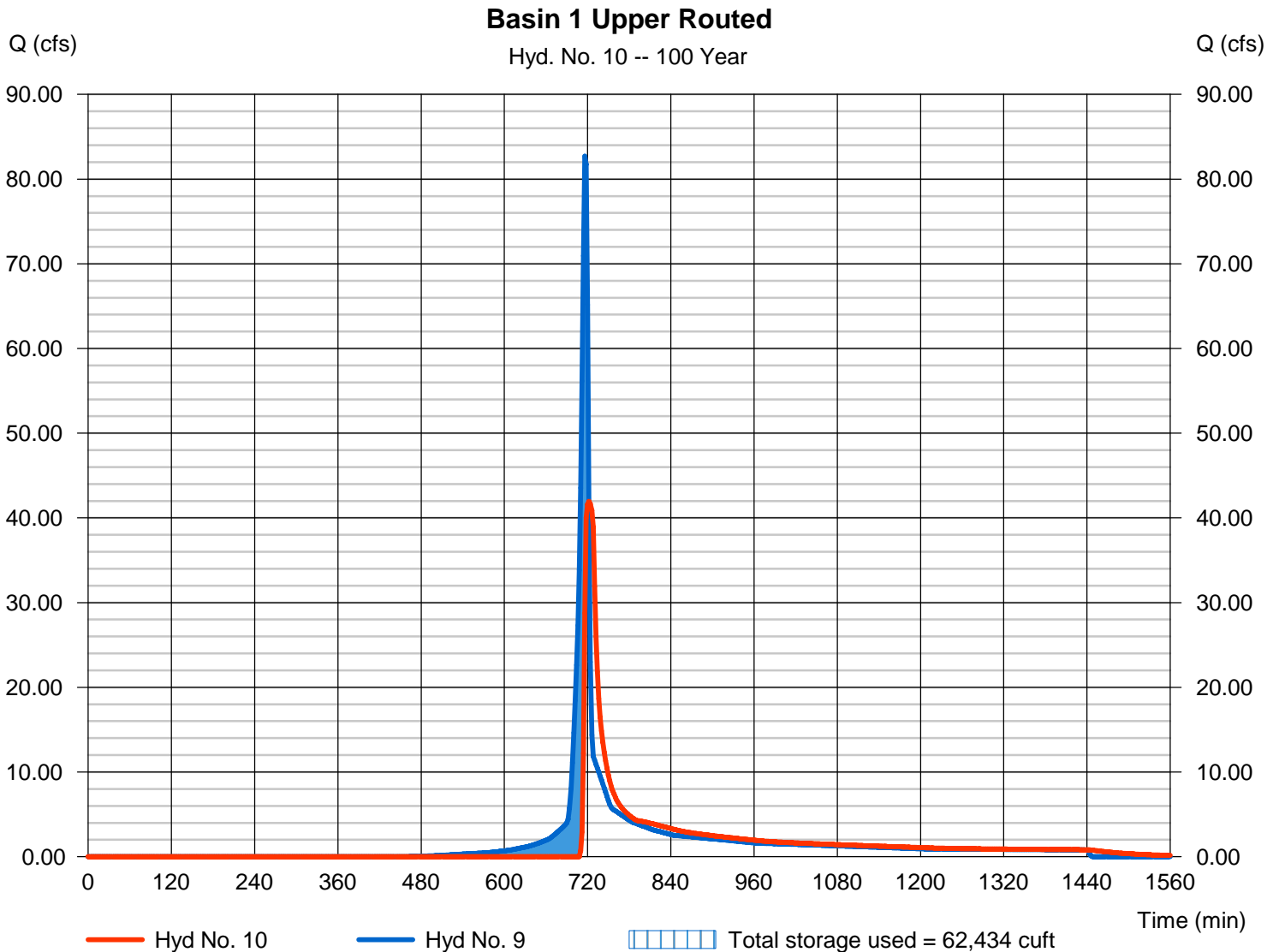
Friday, 04 / 30 / 2021

## Hyd. No. 10

Basin 1 Upper Routed

Hydrograph type	= Reservoir	Peak discharge	= 41.97 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 140,465 cuft
Inflow hyd. No.	= 9 - Post Basin 1	Max. Elevation	= 318.99 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 62,434 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

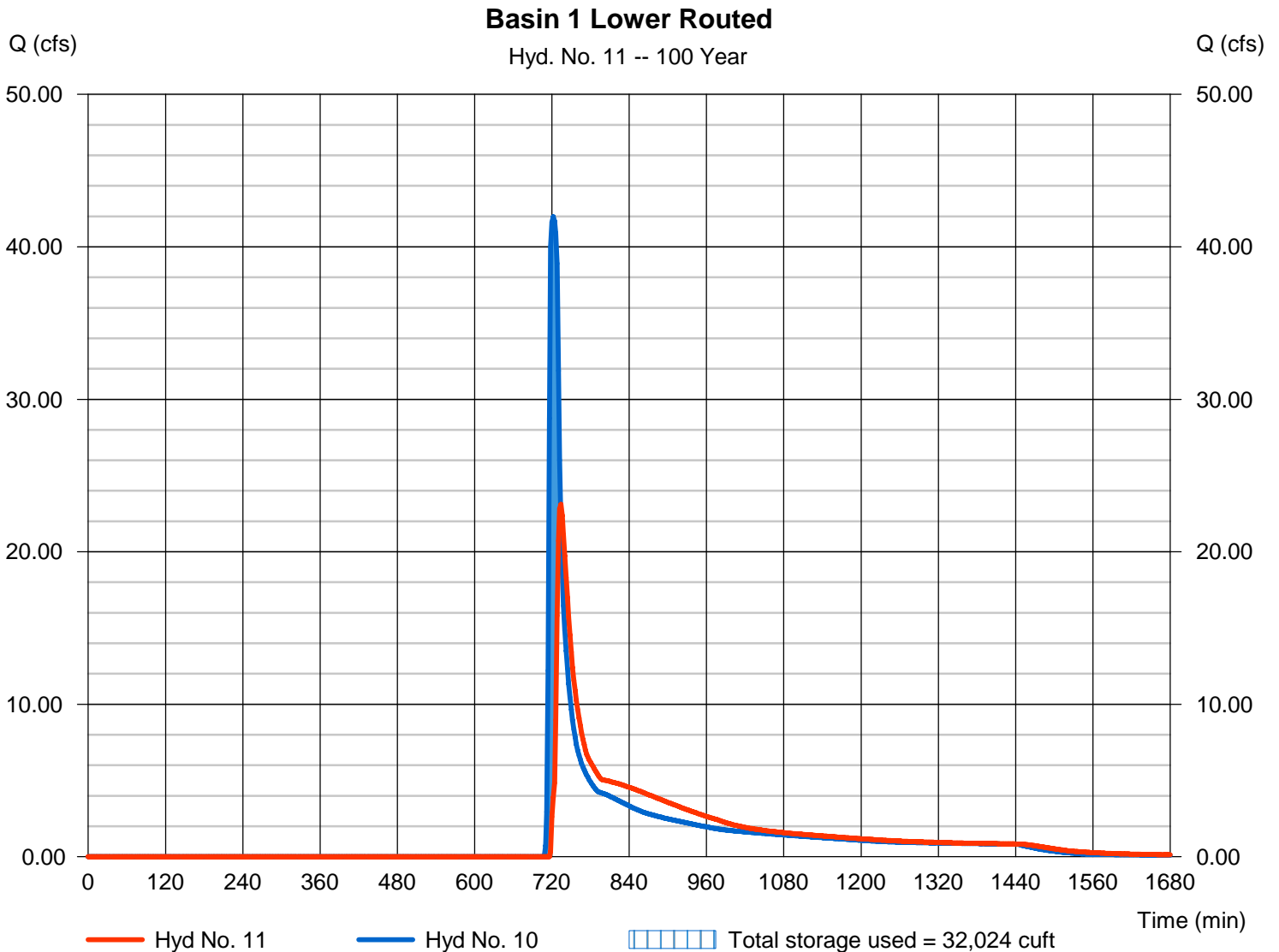
Friday, 04 / 30 / 2021

## Hyd. No. 11

### Basin 1 Lower Routed

Hydrograph type	= Reservoir	Peak discharge	= 23.11 cfs
Storm frequency	= 100 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 134,375 cuft
Inflow hyd. No.	= 10 - Basin 1 Upper Routed	Max. Elevation	= 302.52 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 32,024 cuft

Storage Indication method used.



# Hydrograph Report

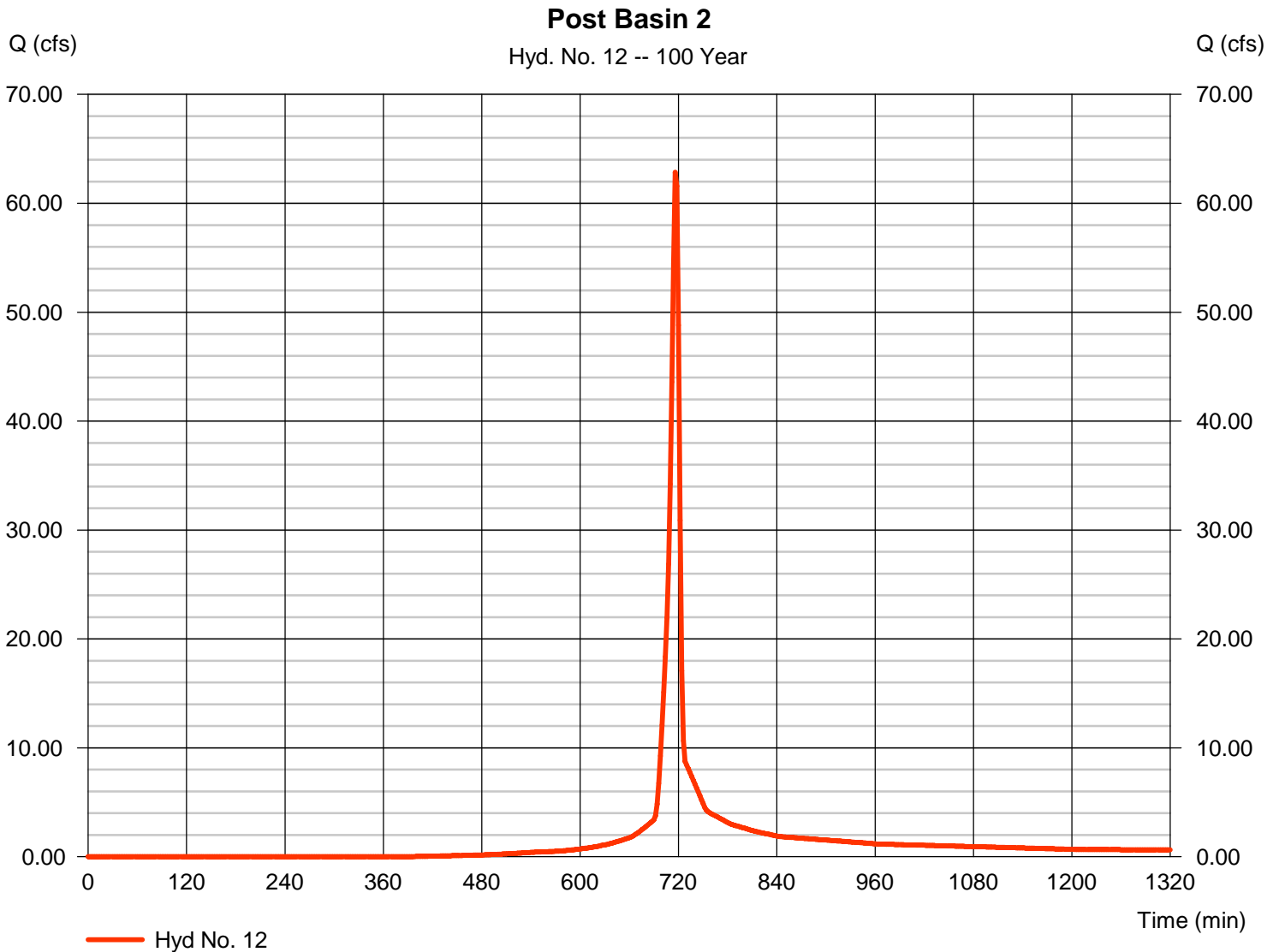
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 12

Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 62.84 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 128,634 cuft
Drainage area	= 8.170 ac	Curve number	= 75.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

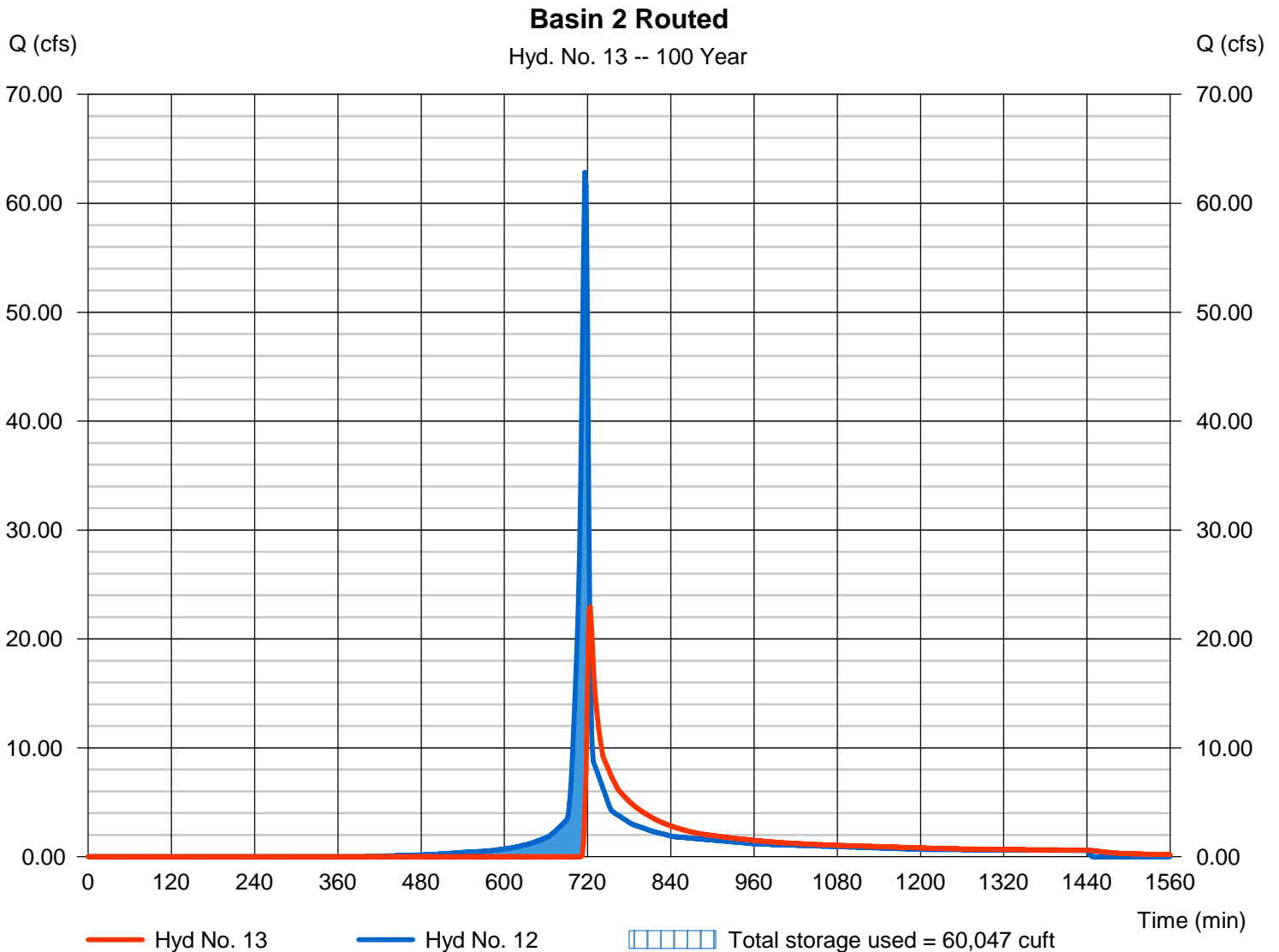
Friday, 04 / 30 / 2021

## Hyd. No. 13

Basin 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 22.93 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 96,279 cuft
Inflow hyd. No.	= 12 - Post Basin 2	Max. Elevation	= 308.54 ft
Reservoir name	= Basin 2	Max. Storage	= 60,047 cuft

Storage Indication method used.



# Hydrograph Report

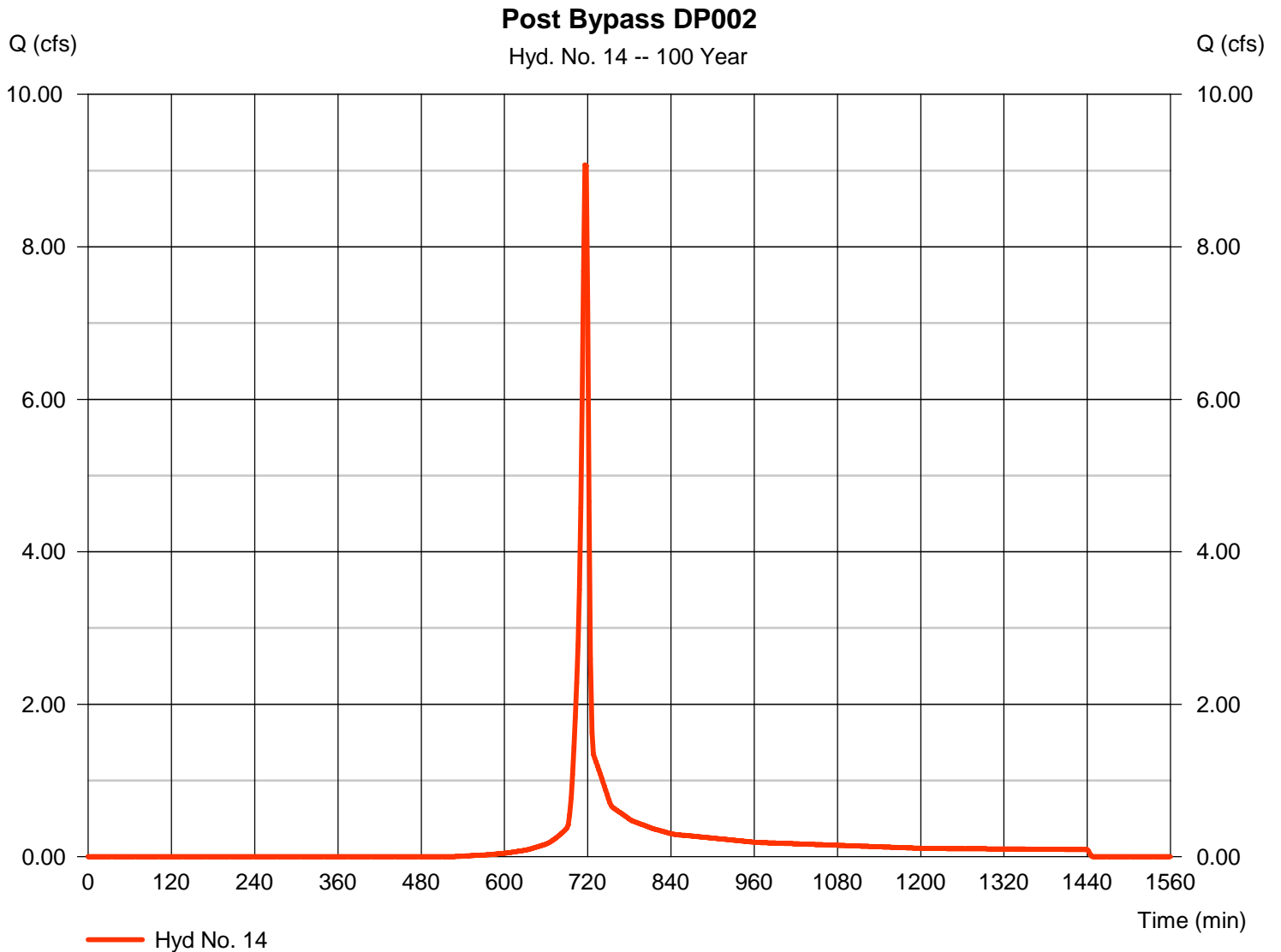
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Friday, 04 / 30 / 2021

## Hyd. No. 14

Post Bypass DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 9.073 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 18,318 cuft
Drainage area	= 1.490 ac	Curve number	= 66.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

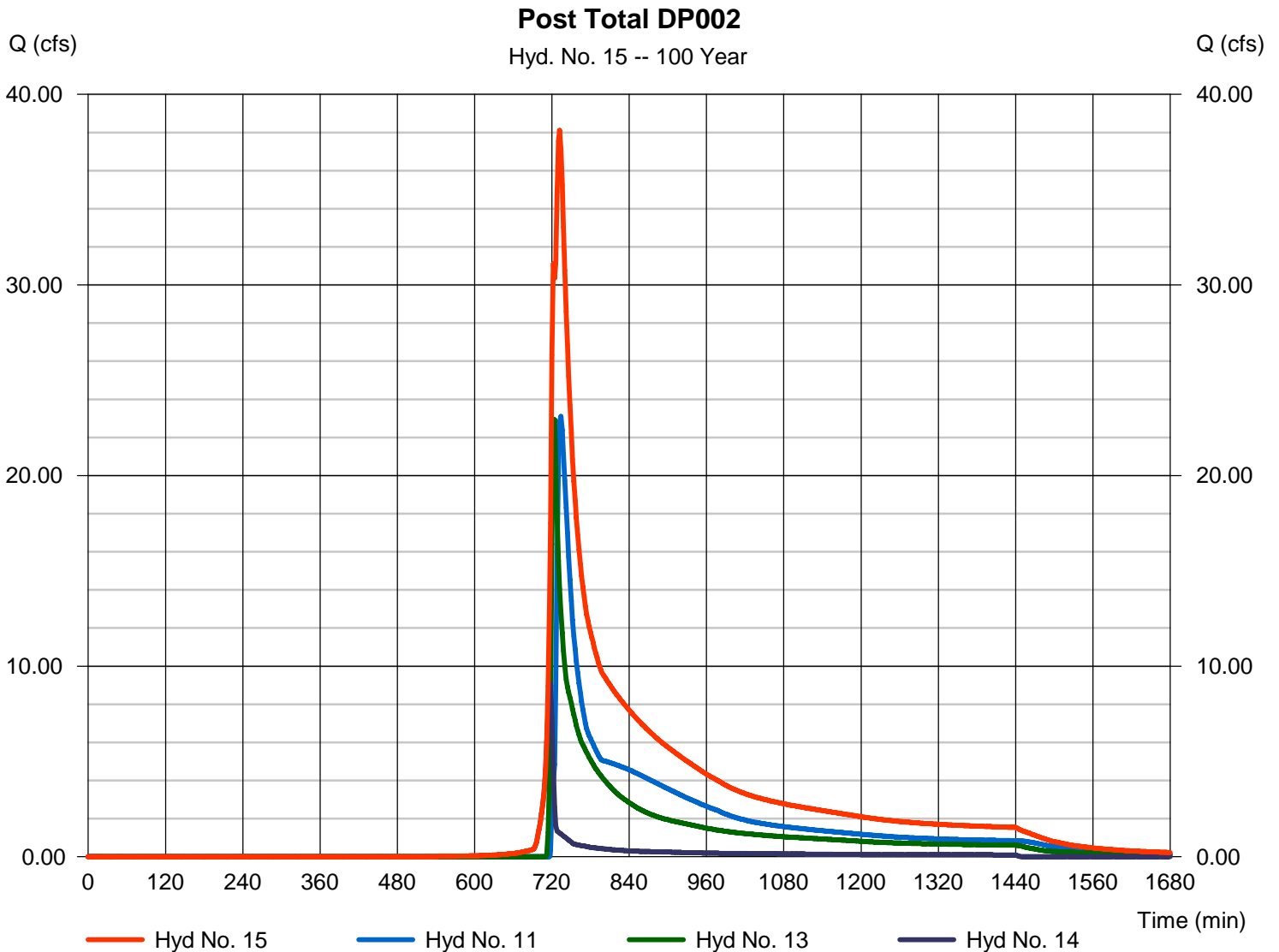
Friday, 04 / 30 / 2021

## Hyd. No. 15

Post Total DP002

Hydrograph type = Combine  
 Storm frequency = 100 yrs  
 Time interval = 2 min  
 Inflow hyds. = 11, 13, 14

Peak discharge = 38.12 cfs  
 Time to peak = 732 min  
 Hyd. volume = 248,973 cuft  
 Contrib. drain. area = 1.490 ac





**APPENDIX E**  
**USDA NRCS SOIL REPORT**



United States  
Department of  
Agriculture

**NRCS**

Natural  
Resources  
Conservation  
Service

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

# Custom Soil Resource Report for **Chester County, Pennsylvania**

## Stokes



# Preface

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

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

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist ([http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2\\_053951](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951)).

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

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

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

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# How Soil Surveys Are Made

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

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

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

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

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

## Custom Soil Resource Report

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

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

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

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

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

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

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

## Custom Soil Resource Report

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



# Soil Map

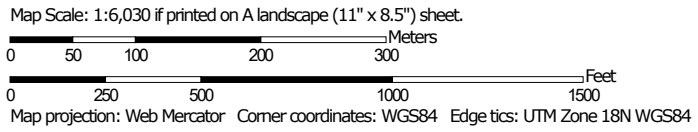
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The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce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

# Custom Soil Resource Report Soil Map




Soil Map may not be valid at this scale.



### MAP LEGEND

**Area of Interest (AOI)**

 Area of Interest (AOI)




















**Soils**







 Soil Map Unit Polygons

 Soil Map Unit Lines


 Soil Map Unit Points

**Special Point Features**






-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features


**Water Features**

 Streams and Canals

**Transportation**

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

**Background**

 Aerial Photography

### MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: Chester County, Pennsylvania  
 Survey Area Data: Version 13, Jun 5, 2020

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

Date(s) aerial images were photographed: May 26, 2019—Jul 10, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ba	Baile silt loam	11.2	16.9%
Co	Codorus silt loam	1.1	1.6%
GdB	Gladstone gravelly loam, 3 to 8 percent slopes	6.0	9.1%
GdC	Gladstone gravelly loam, 8 to 15 percent slopes	32.3	49.0%
GfD	Gladstone gravelly loam, 8 to 25 percent slopes, very bouldery	5.5	8.4%
Ha	Hatboro silt loam	6.0	9.1%
MaD	Manor loam, 15 to 25 percent slopes	3.8	5.8%
UrIB	Urban land-Gladstone complex, 0 to 8 percent slopes	0.1	0.1%
<b>Totals for Area of Interest</b>		<b>66.0</b>	<b>100.0%</b>

## Map Unit Descriptions

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

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

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

## Custom Soil Resource Report

descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

## Chester County, Pennsylvania

### Ba—Baile silt loam

#### Map Unit Setting

*National map unit symbol:* pjb7  
*Elevation:* 200 to 2,000 feet  
*Mean annual precipitation:* 35 to 55 inches  
*Mean annual air temperature:* 45 to 61 degrees F  
*Frost-free period:* 110 to 235 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

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

#### Description of Baile

##### Setting

*Landform:* Depressions  
*Landform position (two-dimensional):* Footslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Linear, concave  
*Across-slope shape:* Concave, linear  
*Parent material:* Local alluvium over residuum weathered from mica schist

##### Typical profile

*Ap - 0 to 10 inches:* silt loam  
*Btg - 10 to 40 inches:* silt loam  
*Cg - 40 to 60 inches:* loam

##### Properties and qualities

*Slope:* 0 to 3 percent  
*Depth to restrictive feature:* 60 to 99 inches to lithic bedrock  
*Drainage class:* Poorly drained  
*Runoff class:* Very high  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)  
*Depth to water table:* About 0 to 6 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* High (about 11.0 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 5w  
*Hydrologic Soil Group:* C/D  
*Hydric soil rating:* Yes

#### Minor Components

##### Glenville

*Percent of map unit:* 9 percent  
*Landform:* Hillslopes  
*Landform position (two-dimensional):* Footslope, backslope

## Custom Soil Resource Report

*Landform position (three-dimensional):* Side slope, head slope  
*Down-slope shape:* Linear, concave  
*Across-slope shape:* Concave, linear  
*Hydric soil rating:* No

### **Manor**

*Percent of map unit:* 2 percent  
*Landform:* Hills  
*Landform position (two-dimensional):* Shoulder, backslope  
*Landform position (three-dimensional):* Side slope, nose slope  
*Down-slope shape:* Linear, convex  
*Across-slope shape:* Convex, linear  
*Hydric soil rating:* No

### **Chester**

*Percent of map unit:* 2 percent  
*Landform:* Hills  
*Landform position (two-dimensional):* Summit, shoulder  
*Landform position (three-dimensional):* Interfluve  
*Down-slope shape:* Linear, convex  
*Across-slope shape:* Convex, linear  
*Hydric soil rating:* No

### **Glenelg**

*Percent of map unit:* 2 percent  
*Landform:* Hillslopes  
*Landform position (two-dimensional):* Summit, shoulder, backslope  
*Landform position (three-dimensional):* Interfluve, side slope  
*Down-slope shape:* Linear, convex  
*Across-slope shape:* Convex, linear  
*Hydric soil rating:* No

## **Co—Codus silt loam**

### **Map Unit Setting**

*National map unit symbol:* pjfx  
*Elevation:* 200 to 2,000 feet  
*Mean annual precipitation:* 35 to 50 inches  
*Mean annual air temperature:* 45 to 57 degrees F  
*Frost-free period:* 120 to 220 days  
*Farmland classification:* All areas are prime farmland

### **Map Unit Composition**

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

### **Description of Codorus**

#### **Setting**

*Landform:* Flood plains

## Custom Soil Resource Report

*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Tread  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Alluvium derived from gneiss and/or alluvium derived from mica schist

### Typical profile

*Ap - 0 to 12 inches:* silt loam  
*Bw - 12 to 48 inches:* silt loam  
*C - 48 to 60 inches:* silt loam

### Properties and qualities

*Slope:* 0 to 3 percent  
*Depth to restrictive feature:* 72 to 99 inches to lithic bedrock  
*Drainage class:* Moderately well drained  
*Runoff class:* Low  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)  
*Depth to water table:* About 18 to 36 inches  
*Frequency of flooding:* OccasionalNone  
*Frequency of ponding:* None  
*Available water capacity:* Moderate (about 8.5 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 2w  
*Hydrologic Soil Group:* C  
*Hydric soil rating:* No

### Minor Components

#### Hatboro

*Percent of map unit:* 8 percent  
*Landform:* Flood plains  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Tread  
*Down-slope shape:* Concave, linear  
*Across-slope shape:* Concave, linear  
*Hydric soil rating:* Yes

#### Glenville

*Percent of map unit:* 4 percent  
*Landform:* Hillslopes  
*Landform position (two-dimensional):* Footslope, backslope  
*Landform position (three-dimensional):* Side slope, head slope  
*Down-slope shape:* Linear, concave  
*Across-slope shape:* Concave, linear  
*Hydric soil rating:* No

#### Baile

*Percent of map unit:* 3 percent  
*Landform:* Depressions  
*Landform position (two-dimensional):* Footslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Linear, concave  
*Across-slope shape:* Concave, linear



*Hydric soil rating:* Yes

## **GdB—Gladstone gravelly loam, 3 to 8 percent slopes**

### **Map Unit Setting**

*National map unit symbol:* 2v7gk  
*Elevation:* 250 to 1,200 feet  
*Mean annual precipitation:* 30 to 64 inches  
*Mean annual air temperature:* 46 to 79 degrees F  
*Frost-free period:* 131 to 178 days  
*Farmland classification:* All areas are prime farmland

### **Map Unit Composition**

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

### **Description of Gladstone**

#### **Setting**

*Landform:* Hills  
*Landform position (two-dimensional):* Shoulder  
*Landform position (three-dimensional):* Side slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Convex  
*Parent material:* Loamy colluvium derived from granite and gneiss and/or loamy residuum weathered from granite and gneiss

#### **Typical profile**

*Ap - 0 to 10 inches:* gravelly loam  
*Bt1 - 10 to 22 inches:* sandy clay loam  
*Bt2 - 22 to 37 inches:* loam  
*C - 37 to 66 inches:* sandy loam  
*R - 66 to 76 inches:* bedrock

#### **Properties and qualities**

*Slope:* 3 to 8 percent  
*Depth to restrictive feature:* 60 to 80 inches to lithic bedrock  
*Drainage class:* Well drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately low (0.00 to 0.06 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* Moderate (about 8.4 inches)

#### **Interpretive groups**

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 2e  
*Hydrologic Soil Group:* B  
*Hydric soil rating:* No

**Minor Components**

**Califon**

*Percent of map unit: 5 percent*  
*Landform: Flats*  
*Landform position (two-dimensional): Footslope*  
*Landform position (three-dimensional): Base slope*  
*Down-slope shape: Concave*  
*Across-slope shape: Linear*  
*Hydric soil rating: No*

**Annandale**

*Percent of map unit: 5 percent*  
*Landform: Hills*  
*Landform position (two-dimensional): Summit*  
*Landform position (three-dimensional): Interfluve*  
*Down-slope shape: Convex*  
*Across-slope shape: Linear*  
*Hydric soil rating: No*

**Parker**

*Percent of map unit: 5 percent*  
*Landform: Hills*  
*Landform position (two-dimensional): Shoulder*  
*Landform position (three-dimensional): Side slope*  
*Down-slope shape: Convex*  
*Across-slope shape: Linear*  
*Hydric soil rating: No*

**GdC—Gladstone gravelly loam, 8 to 15 percent slopes**

**Map Unit Setting**

*National map unit symbol: 2v7gl*  
*Elevation: 250 to 1,200 feet*  
*Mean annual precipitation: 30 to 64 inches*  
*Mean annual air temperature: 46 to 79 degrees F*  
*Frost-free period: 170 to 240 days*  
*Farmland classification: Farmland of statewide importance*

**Map Unit Composition**

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

**Description of Gladstone**

**Setting**

*Landform: Hillslopes*  
*Landform position (two-dimensional): Shoulder*  
*Landform position (three-dimensional): Side slope*

## Custom Soil Resource Report

*Down-slope shape:* Linear

*Across-slope shape:* Convex

*Parent material:* Loamy colluvium derived from granite and gneiss and/or loamy residuum weathered from granite and gneiss

### Typical profile

*Ap - 0 to 10 inches:* gravelly loam

*Bt1 - 10 to 22 inches:* gravelly sandy clay loam

*Bt2 - 22 to 37 inches:* gravelly loam

*C - 37 to 66 inches:* gravelly sandy loam

*R - 66 to 76 inches:* bedrock

### Properties and qualities

*Slope:* 8 to 15 percent

*Depth to restrictive feature:* 65 to 67 inches to lithic bedrock

*Drainage class:* Well drained

*Capacity of the most limiting layer to transmit water (Ksat):* Very low to high (0.00 to 5.95 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Moderate (about 6.1 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 3e

*Hydrologic Soil Group:* B

*Hydric soil rating:* No

### Minor Components

#### Parker

*Percent of map unit:* 5 percent

*Landform:* Hillslopes

*Landform position (two-dimensional):* Shoulder

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Convex

*Across-slope shape:* Linear

*Hydric soil rating:* No

#### Califon

*Percent of map unit:* 5 percent

*Landform:* Flats

*Landform position (two-dimensional):* Footslope

*Landform position (three-dimensional):* Base slope

*Down-slope shape:* Concave

*Across-slope shape:* Linear

*Hydric soil rating:* No

#### Annandale

*Percent of map unit:* 5 percent

*Landform:* Hillslopes

*Landform position (two-dimensional):* Summit

*Landform position (three-dimensional):* Interfluve

*Down-slope shape:* Convex

*Across-slope shape:* Linear

*Hydric soil rating:* No

## **GfD—Gladstone gravelly loam, 8 to 25 percent slopes, very bouldery**

### **Map Unit Setting**

*National map unit symbol:* wphh  
*Elevation:* 200 to 1,200 feet  
*Mean annual precipitation:* 40 to 48 inches  
*Mean annual air temperature:* 45 to 55 degrees F  
*Frost-free period:* 150 to 190 days  
*Farmland classification:* Not prime farmland

### **Map Unit Composition**

*Gladstone, very bouldery, and similar soils:* 90 percent  
*Minor components:* 10 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### **Description of Gladstone, Very Bouldery**

#### **Setting**

*Landform:* Hillslopes  
*Landform position (two-dimensional):* Summit, shoulder  
*Landform position (three-dimensional):* Nose slope, side slope  
*Down-slope shape:* Linear, convex  
*Across-slope shape:* Linear, convex  
*Parent material:* Local colluvium and residuum weathered from granite and gneiss

#### **Typical profile**

*A - 0 to 10 inches:* gravelly loam  
*Bt - 10 to 42 inches:* gravelly clay loam  
*C - 42 to 68 inches:* very gravelly loam  
*R - 68 to 78 inches:* bedrock

#### **Properties and qualities**

*Slope:* 8 to 25 percent  
*Surface area covered with cobbles, stones or boulders:* 1.6 percent  
*Depth to restrictive feature:* 60 to 100 inches to lithic bedrock  
*Drainage class:* Well drained  
*Runoff class:* Low  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to high (0.00 to 6.00 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* Moderate (about 6.9 inches)

#### **Interpretive groups**

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 6s  
*Hydrologic Soil Group:* A  
*Hydric soil rating:* No

## Minor Components

### Cokesbury

*Percent of map unit:* 5 percent  
*Landform:* Depressions  
*Landform position (two-dimensional):* Toeslope, footslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Hydric soil rating:* Yes

### Califon

*Percent of map unit:* 5 percent  
*Landform:* Hills  
*Landform position (two-dimensional):* Backslope, footslope  
*Landform position (three-dimensional):* Head slope  
*Down-slope shape:* Concave, linear  
*Across-slope shape:* Concave, linear  
*Hydric soil rating:* No

## Ha—Hatboro silt loam

### Map Unit Setting

*National map unit symbol:* 1lwqq  
*Elevation:* 200 to 800 feet  
*Mean annual precipitation:* 36 to 50 inches  
*Mean annual air temperature:* 48 to 57 degrees F  
*Frost-free period:* 140 to 200 days  
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Hatboro and similar soils:* 95 percent  
*Minor components:* 5 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Hatboro

#### Setting

*Landform:* Flood plains  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Tread  
*Down-slope shape:* Concave, linear  
*Across-slope shape:* Concave, linear  
*Parent material:* Alluvium derived from metamorphic and sedimentary rock

#### Typical profile

*Ap - 0 to 9 inches:* silt loam  
*Bg - 9 to 44 inches:* silt loam  
*Cg - 44 to 56 inches:* sandy clay loam  
*C - 56 to 70 inches:* stratified gravelly sand to clay

## Custom Soil Resource Report

### Properties and qualities

*Slope:* 0 to 3 percent  
*Depth to restrictive feature:* 60 to 99 inches to lithic bedrock  
*Drainage class:* Poorly drained  
*Runoff class:* Very high  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high  
(0.60 to 2.00 in/hr)  
*Depth to water table:* About 0 to 6 inches  
*Frequency of flooding:* FrequentNone  
*Frequency of ponding:* None  
*Available water capacity:* High (about 9.7 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 4w  
*Hydrologic Soil Group:* B/D  
*Hydric soil rating:* Yes

### Minor Components

#### Glenville

*Percent of map unit:* 5 percent  
*Landform:* Hillslopes  
*Landform position (two-dimensional):* Footslope, backslope  
*Landform position (three-dimensional):* Side slope, head slope  
*Down-slope shape:* Linear, concave  
*Across-slope shape:* Concave, linear  
*Hydric soil rating:* No

## MaD—Manor loam, 15 to 25 percent slopes

### Map Unit Setting

*National map unit symbol:* 2tmcg  
*Elevation:* 250 to 1,000 feet  
*Mean annual precipitation:* 40 to 55 inches  
*Mean annual air temperature:* 48 to 57 degrees F  
*Frost-free period:* 150 to 192 days  
*Farmland classification:* Not prime farmland

### Map Unit Composition

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

### Description of Manor

#### Setting

*Landform:* Hillslopes  
*Landform position (two-dimensional):* Shoulder, backslope, summit  
*Landform position (three-dimensional):* Side slope

## Custom Soil Resource Report

*Down-slope shape:* Convex  
*Across-slope shape:* Convex  
*Parent material:* Residuum weathered from mica schist

### Typical profile

*A1 - 0 to 2 inches:* loam  
*A2 - 2 to 6 inches:* sandy loam  
*Bw1 - 6 to 13 inches:* fine sandy loam  
*Bw2 - 13 to 22 inches:* fine sandy loam  
*C1 - 22 to 30 inches:* fine sandy loam  
*C2 - 30 to 44 inches:* channery coarse sand  
*C3 - 44 to 53 inches:* loamy sand  
*C4 - 53 to 83 inches:* channery loamy sand  
*Cr - 83 to 108 inches:* bedrock  
*R - 108 to 138 inches:* bedrock

### Properties and qualities

*Slope:* 15 to 25 percent  
*Surface area covered with cobbles, stones or boulders:* 0.0 percent  
*Depth to restrictive feature:* 59 to 100 inches to paralithic bedrock; 100 to 128 inches to lithic bedrock  
*Drainage class:* Well drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low (0.01 to 0.07 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water capacity:* Moderate (about 8.0 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 4e  
*Hydrologic Soil Group:* B  
*Hydric soil rating:* No

### Minor Components

#### Glenville

*Percent of map unit:* 5 percent  
*Landform:* Drainageways, swales  
*Landform position (two-dimensional):* Footslope, backslope  
*Landform position (three-dimensional):* Base slope, head slope, interfluvium  
*Down-slope shape:* Linear  
*Across-slope shape:* Concave  
*Hydric soil rating:* No

#### Mt. airy

*Percent of map unit:* 5 percent  
*Landform:* Hillslopes  
*Landform position (two-dimensional):* Backslope, summit, shoulder  
*Landform position (three-dimensional):* Nose slope  
*Down-slope shape:* Convex  
*Across-slope shape:* Convex  
*Hydric soil rating:* No

#### Blocktown

*Percent of map unit:* 5 percent

## Custom Soil Resource Report

*Landform:* Hillslopes  
*Landform position (two-dimensional):* Backslope  
*Landform position (three-dimensional):* Side slope  
*Down-slope shape:* Convex  
*Across-slope shape:* Convex  
*Hydric soil rating:* No

### UrIB—Urban land-Gladstone complex, 0 to 8 percent slopes

#### Map Unit Setting

*National map unit symbol:* 1r3cq  
*Elevation:* 200 to 1,200 feet  
*Mean annual precipitation:* 36 to 48 inches  
*Mean annual air temperature:* 44 to 57 degrees F  
*Frost-free period:* 130 to 190 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Urban land:* 65 percent  
*Gladstone and similar soils:* 25 percent  
*Minor components:* 10 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Urban Land

##### Setting

*Landform:* Hills  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Pavement, buildings and other artificially covered areas

##### Typical profile

*C - 0 to 6 inches:* variable

##### Properties and qualities

*Slope:* 0 to 8 percent  
*Depth to restrictive feature:* 10 to 100 inches to lithic bedrock  
*Available water capacity:* Very low (about 0.0 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 8s  
*Hydric soil rating:* No

#### Description of Gladstone

##### Setting

*Landform:* Hillslopes  
*Landform position (two-dimensional):* Summit, shoulder  
*Landform position (three-dimensional):* Nose slope, side slope  
*Down-slope shape:* Linear, convex



## Custom Soil Resource Report

*Across-slope shape:* Linear, convex

*Parent material:* Local colluvium and residuum weathered from granite and gneiss

### Typical profile

*A - 0 to 10 inches:* gravelly loam

*C - 10 to 42 inches:* gravelly clay loam

*2Ap - 42 to 68 inches:* gravelly loam

*R - 68 to 78 inches:* bedrock

### Properties and qualities

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* 60 to 100 inches to lithic bedrock

*Drainage class:* Well drained

*Runoff class:* Very low

*Capacity of the most limiting layer to transmit water (Ksat):* Very low to high (0.00 to 6.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water capacity:* Moderate (about 6.9 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2e

*Hydrologic Soil Group:* A

*Hydric soil rating:* No

### Minor Components

#### Cokesbury

*Percent of map unit:* 5 percent

*Landform:* Depressions

*Landform position (two-dimensional):* Toeslope, footslope

*Landform position (three-dimensional):* Base slope

*Down-slope shape:* Concave

*Across-slope shape:* Concave

*Hydric soil rating:* Yes

#### Califon

*Percent of map unit:* 5 percent

*Landform:* Hills

*Landform position (two-dimensional):* Backslope, footslope

*Landform position (three-dimensional):* Head slope

*Down-slope shape:* Concave, linear

*Across-slope shape:* Concave, linear

*Hydric soil rating:* No

**APPENDIX E**  
**STORMWATER INFILTRATION TESTING REPORT**

# **STORMWATER INFILTRATION REPORT**

**FOR**

**1013 SHILOH ROAD  
WESTTOWN TOWNSHIP  
CHESTER COUNTY**

**PREPARED FOR:**

**Keystone Custom Homes**

**PREPARED BY:**

**D.L. Howell & Associates, Inc.  
1250 Wrights Lane  
West Chester, PA 19380**

**March 2021**



**DLHowell**

Civil Engineering & Land Planning  
[www.DLHowell.com](http://www.DLHowell.com)

**Stormwater Infiltration Test Report**  
**1013 Shiloh Road**  
**Westtown Township**  
**Chester County**

On Monday and Tuesday, March 22-23, 2021, D.L. Howell and Associates, Inc. performed hydraulic conductivity tests for the proposed stormwater management areas for the property located at 1013 Shiloh Road in Westtown Township, Chester County. The purpose of the hydraulic conductivity testing was to determine site suitability for the proposed stormwater infiltration areas associated with proposed improvements at the site (see development plan).

Testing was conducted in general accordance with the Pennsylvania Department of Environmental Protection (PADEP)'s Pennsylvania Stormwater Best Management Practices Manual specifications, in a cased, sealed, borehole utilizing the falling head method designed to measure the vertical hydraulic conductivity of the soil. An approximate five-inch diameter borehole was hand dug to the depth of the proposed bottom elevation of the infiltration structure and a 3-inch diameter PVC casing was installed. A mixture of bentonite and soil was placed around the annulus of the casing and packed to seal the casing in place. The casing was presoaked immediately prior to the start of the test to simulate field saturated conditions. A measured amount of water was poured into the sealed casing to begin the 30-minute presoak. After the final 30-minute presoaking period, the water in the casing was adjusted to a known depth and consecutively re-adjusted after each reading and the drop of the water column is measured. The test continued until the readings became stabilized or for a maximum of eight readings. A stabilized rate of drop means a difference of ¼ inch or less of drop between the highest and lowest readings of four consecutive readings.

Within the site, four hydraulic conductivity tests were conducted at the elevations associated with the proposed bottom of the infiltration structures. One deep test pit was excavated at each infiltration test location to identify limiting conditions such as mottling, depth of bedrock, and depth of groundwater. Testing was to be conducted within the footprint of the proposed infiltration structures.

- Infiltration Test 3-23-1 was conducted at approximately  $\pm 5.0$  feet below existing grade, which corresponds to an approximate infiltration elevation of 317.0. One deep test pit was excavated at this location to a depth of 7.0 feet below existing grade. During excavation, rock was encountered at a depth of approximately 7.0 feet below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-23-1: an infiltration rate of 1.50 inches per hour shall be used.

- Infiltration Test 3-23-2 was conducted at approximately  $\pm 4.0$  feet below existing grade, which corresponds to an approximate infiltration elevation of 314.0. One deep test pit was excavated at this location to a depth of 6.0 feet below existing grade. No limiting conditions were identified at the time of excavation.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-23-2: an infiltration rate of 1.14 inches per hour shall be used.

- Infiltration Test 3-23-3 was conducted at approximately  $\pm 3.5$  feet below existing grade, which corresponds to an approximate infiltration elevation of 303.5. One deep test pit was excavated at this location to a depth of 5.5 feet below existing grade. During excavation, rock was encountered at a depth of approximately 5.5 feet below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-23-3: an infiltration rate of 1.68 inches per hour shall be used.

- Infiltration Test 3-23-4 was conducted at approximately  $\pm 5.0$  feet below existing grade, which corresponds to an approximate infiltration elevation of 298.0. One deep test pit was excavated at this location to a depth of 7.0 feet below existing grade. During excavation, groundwater was encountered at a depth of approximately 7.0 feet below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-23-4: an infiltration rate of 1.96 inches per hour shall be used.

- Infiltration Test 3-22-5 was conducted at approximately  $\pm 6.0$  feet below existing grade, which corresponds to an approximate infiltration elevation of 334.0. One deep test pit was excavated at this location to a depth of 8.0 feet below existing grade. No limiting conditions were encountered at the time of excavation.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-22-5: an infiltration rate of 2.81 inches per hour shall be used.

- Infiltration Test 3-22-6 was conducted at approximately  $\pm 2.0$  feet below existing grade, which corresponds to an approximate infiltration elevation of 306.0. One

deep test pit was excavated at this location to a depth of 6.0 feet below existing grade. No limiting conditions were encountered at the time of excavation.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-22-6: an infiltration rate of 2.93 inches per hour shall be used.

- Infiltration Test 3-22-7 was conducted at approximately  $\pm 2.0$  feet below existing grade, which corresponds to an approximate infiltration elevation of 336.0. One deep test pit was excavated at this location to a depth of 4.0 feet below existing grade. During excavation, rock was encountered at a depth of approximately 4.0 feet below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-22-7: an infiltration rate of 0.88 inches per hour shall be used.

- Infiltration Test 3-22-8 was conducted at approximately  $\pm 2.0$  feet below existing grade, which corresponds to an approximate infiltration elevation of 314.0. One deep test pit was excavated at this location to a depth of 4.0 feet below existing grade. During excavation, rock was encountered at a depth of approximately 4.0 feet below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-22-8: an infiltration rate of 0.43 inches per hour shall be used.

Please reference plan drawings for exact locations and visual representation of infiltration tests and test pits. Results of the hydraulic conductivity testing and soil horizon descriptions can be found in the enclosed attachments.

### **Hydraulic Conductivity Calculation**

Coefficient of Permeability:  $K = [A/(F*D*t)] \times \ln(h1 / h2)$

Where:

- K = permeability (inches per hour)
- A = cross sectional area of cased hole
- F = shape factor (2.75 constant of flat bottom)
- D = cased hole diameter
- t = time for head change from h1 to h2
- h1 = initial height of water column in casing
- h2 = final height of water column in casing

\*Reference *Soil Hydraulic Conductivity Analysis Form* for infiltration testing data and *Soil Morphology Form* for soil profile data.



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## Stormwater Infiltration Testing &

## Hydraulic Conductivity Calculations

JOB NO.: 3868  
LOCATION: 1013 Shiloh Road  
MUNICIPALITY: Westtown Township, Chester County, Pa.  
DESCRIPTION: Stormwater Infiltration Testing

DATE: 3/22/2021  
BY: DD

### Field Test Results

WEATHER CONDITIONS: SUNNY      TEMPERATURE: 62 °F  
PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
<b>Test 3-22-5</b>	72									
Time(min.)		30	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
Drop(inches)		15.00	14.75	14.75	14.50	14.50	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
<b>Test 3-22-6</b>	24									
Time(min.)		30	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
Drop(inches)		15.25	15.00	14.75	14.75	14.75	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

### Determination of Hydraulic Conductivity (Kv)

$$Kv = [ A/(F*D*t) ] * \ln(h1/h2)$$

- Kv* = Vertical Permeability
- A* = Cross-sectional area of cased hole
- F* = shape factor (2.75 constant for flat bottom)
- D* = cased hole diameter
- t* = time for head to change from h1 to h2
- h1* = initial height of water column in casing
- h2* = final height of water column in casing

#### Test 3-22-5 Results

<b>2.8062</b>	(in/hour)
7.06858	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
3.50	(Inches)

#### Test 3-22-6 Results

<b>2.93319</b>	(in/hour)
7.06858	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
3.25	(Inches)





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## Stormwater Infiltration Testing &

## Hydraulic Conductivity Calculations

JOB NO.: 3868  
LOCATION: 1013 Shiloh Road  
MUNICIPALITY: Westtown Township, Chester County, Pa.  
DESCRIPTION: Stormwater Infiltration Testing

DATE: 3/22/2021  
BY: DD

### Field Test Results

WEATHER CONDITIONS: SUNNY      TEMPERATURE: 62 °F  
PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
<b>Test 3-22-7</b>	24									
Time(min.)		30	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
Drop(inches)		7.25	7.25	7.25	7.25	7.25	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
<b>Test 3-22-8</b>	24									
Time(min.)		30	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
Drop(inches)		4.25	4.00	4.00	4.00	4.00	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

### Determination of Hydraulic Conductivity (Kv)

$$Kv = [ A/(F*D*t) ] * \ln(h1/h2)$$

- Kv* = Vertical Permeability
- A* = Cross-sectional area of cased hole
- F* = shape factor (2.75 constant for flat bottom)
- D* = cased hole diameter
- t* = time for head to change from *h1* to *h2*
- h1* = initial height of water column in casing
- h2* = final height of water column in casing

#### Test 3-22-7 Results

<b>0.8833</b>	(in/hour)
7.06858	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
10.75	(Inches)

#### Test 3-22-8 Results

<b>0.43065</b>	(in/hour)
7.06858	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
14.00	(Inches)



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Stormwater Infiltration Testing &

Hydraulic Conductivity Calculations

JOB NO.: 3868  
 LOCATION: 1013 Shiloh Road  
 MUNICIPALITY: Westtown Township, Chester County, Pa.  
 DESCRIPTION: Stormwater Infiltration Testing

DATE: 3/23/2021  
 BY: DD

**Field Test Results**

WEATHER CONDITIONS: SUNNY      TEMPERATURE: 64 °F  
 PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
<b>Test 3-23-1</b>	60									
Time(min.)		30	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
Drop(inches)		11.75	10.50	10.50	10.50	10.50	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
<b>Test 3-23-2</b>	48									
Time(min.)		30	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
Drop(inches)		10.50	8.75	8.75	8.75	8.75	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

**Determination of Hydraulic Conductivity (Kv)**

$$Kv = [ A/(F*D*t) ] * \ln(h1/h2)$$

- Kv = Vertical Permeability*
- A = Cross-sectional area of cased hole*
- F = shape factor (2.75 constant for flat bottom)*
- D = cased hole diameter*
- t = time for head to change from h1 to h2*
- h1 = initial height of water column in casing*
- h2 = final height of water column in casing*

**Test 3-23-1 Results**

<b>1.5002</b>	(in/hour)
7.06858	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
7.50	(Inches)

**Test 3-23-2 Results**

<b>1.14082</b>	(in/hour)
7.06858	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
9.25	(Inches)



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## Stormwater Infiltration Testing &

## Hydraulic Conductivity Calculations

JOB NO.: 3868  
LOCATION: 1013 Shiloh Road  
MUNICIPALITY: Westtown Township, Chester County, Pa.  
DESCRIPTION: Stormwater Infiltration Testing

DATE: 3/23/2021  
BY: DD

### Field Test Results

WEATHER CONDITIONS: SUNNY      TEMPERATURE: 64 °F  
PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
<b>Test 3-23-3</b>	42									
Time(min.)		30	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
Drop(inches)		11.75	11.25	11.25	11.25	11.25	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
<b>Test 3-23-4</b>	60									
Time(min.)		30	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
Drop(inches)		12.25	12.25	12.25	12.25	12.25	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

### Determination of Hydraulic Conductivity (Kv)

$$Kv = [ A/(F*D*t) ] * \ln(h1/h2)$$

- Kv* = Vertical Permeability
- A* = Cross-sectional area of cased hole
- F* = shape factor (2.75 constant for flat bottom)
- D* = cased hole diameter
- t* = time for head to change from *h1* to *h2*
- h1* = initial height of water column in casing
- h2* = final height of water column in casing

#### Test 3-23-3 Results

<b>1.68075</b>	(in/hour)
7.06858	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
6.75	(Inches)

#### Test 3-23-4 Results

<b>1.95551</b>	(in/hour)
7.06858	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
5.75	(Inches)

### Soil Morphology Form



PIT NUMBER: TP 3-23-1 DLH NUMBER: 3868 INVESTIGATOR: DWD  
 DATE: 3/23/2021 STATE: PA COUNTY: CHESTER  
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES  
 SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD  
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrinct	Topo				A	S	C			
	0	11	A	W	10 YR 4/2	SILT LOAM	0				GRAN	FRI	
	11	46	A	W	10 YR 5/6	SILTY CLAY	0				MA	FIRM	
	46	84			VAR	SANDY SILT	0				GRAN	LO	

COMMENTS: This Deep Test Pit was conducted at Test 3-23-1. During excavation, rock was encountered at a depth of approximately 84 inches below existing grade.

SOIL TYPE: LIMITING CONDITION: Rock Type: Water <b>Rock</b> Mottling Depth: ~84"	Soil Drainage Class: Excessively Drained      Somewhat Poorly Drained <b>Well Drained</b> Poorly Drained Moderately Well Drained      Very Poorly Drained	Soil Scientist Signature:
-------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------

WEATHER: 64° Sunny METHOD: Excavator  
 SLOPE: \_\_\_\_\_ EXCAVATION DEPTH: 84"  
 COVER: Meadow LANDSCAPE POSITION: SW

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast  
 Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

### Soil Morphology Form



PIT NUMBER: TP 3-23-2 DLH NUMBER: 3868 INVESTIGATOR: DWD  
 DATE: 3/23/2021 STATE: PA COUNTY: CHESTER  
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES  
 SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD  
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrinct	Topo				A	S	C			
	0	9	A	W	10 YR 4/2	SILT LOAM	0				GRAN	FRI	
	9	35	A	IR	10 YR 5/6	SILTY CLAY	0				MA	FIRM	
	35	72			VAR	SANDY SILT	0				GRAN	FRI	

COMMENTS: This Deep Test Pit was conducted at Test 3-23-2. No limiting conditions were identified at the time of excavation.

SOIL TYPE: LIMITING CONDITION: Type: Water Rock Mottling Depth: +72"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained <b>Well Drained</b> Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature:
-------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------

WEATHER: 64° Sunny METHOD: Excavator  
 SLOPE: \_\_\_\_\_ EXCAVATION DEPTH: 72"  
 COVER: Meadow LANDSCAPE POSITION: S

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast  
 Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

### Soil Morphology Form



PIT NUMBER: TP 3-23-3 DLH NUMBER: 3868 INVESTIGATOR: DWD  
 DATE: 3/23/2021 STATE: PA COUNTY: CHESTER  
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES  
 SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD  
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrinct	Topo				A	S	C			
	0	11	A	W	10 YR 4/2	SILT LOAM	0				GRAN	FRI	
	11	47	A	W	10 YR 5/6	SILTY CLAY	0				MA	FIRM	
	47	66			10 YR 3/4	STONY SILT	<20				GRAN	LO	

COMMENTS: This Deep Test Pit was conducted at Test 3-23-1. During excavation, rock was encountered at a depth of approximately 66 inches below existing grade.

SOIL TYPE: LIMITING CONDITION: Rock Type: Water <b>Rock</b> Mottling Depth: ~66"	Soil Drainage Class: Excessively Drained      Somewhat Poorly Drained <b>Well Drained</b> Poorly Drained Moderately Well Drained      Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 64° Sunny METHOD: Excavator  
 SLOPE: \_\_\_\_\_ EXCAVATION DEPTH: 66"  
 COVER: Meadow LANDSCAPE POSITION: S

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast  
 Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

### Soil Morphology Form



PIT NUMBER: TP 3-23-4 DLH NUMBER: 3868 INVESTIGATOR: DWD  
 DATE: 3/23/2021 STATE: PA COUNTY: CHESTER  
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES  
 SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD  
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrinct	Topo				A	S	C			
	0	8	A	W	10 YR 4/2	SILT LOAM	0				GRAN	FRI	
	8	31	A	W	10 YR 4/4	SILTY CLAY	0				MA	FIRM	
	31	47	G	W	10 YR 6/4	SILT LOAM	0				MA	FRI	
	47	84			VAR	SANDY SILT					GRAN	LO	

COMMENTS: This Deep Test Pit was conducted at Test 3-23-4. During excavation, groundwater was encountered at a depth of approximately 84 inches below existing grade.

SOIL TYPE: LIMITING CONDITION: Groundwater Type: <b>Water</b> <b>Rock</b> Mottling Depth: ~84"	Soil Drainage Class: Excessively Drained      Somewhat Poorly Drained <b>Well Drained</b> Poorly Drained Moderately Well Drained      Very Poorly Drained	Soil Scientist Signature:
---------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------

WEATHER: 64° Sunny METHOD: Excavator  
 SLOPE: \_\_\_\_\_ EXCAVATION DEPTH: 84"  
 COVER: Meadow LANDSCAPE POSITION: S

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast  
 Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

### Soil Morphology Form



PIT NUMBER: TP 3-22-1 DLH NUMBER: 3868 INVESTIGATOR: DWD  
 DATE: 3/22/2021 STATE: PA COUNTY: CHESTER  
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES  
 SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD  
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrinct	Topo				A	S	C			
	0	5	A	W	10 YR 4/2	SILT LOAM	0				SBK	FRI	
	5	50	A	W	7.5 YR 4/3	SILTY CLAY	0				MA	FIRM	
	50	96			VAR	SILT LOAM	0				GRAN	FRI	

COMMENTS: This Deep Test Pit was conducted at Test 3-22-5. No limiting conditions were identified at the time of excavation.

SOIL TYPE: LIMITING CONDITION: Type: Water Rock Mottling Depth: +96"	Soil Drainage Class: Excessively Drained      Somewhat Poorly Drained Well Drained <b>Poorly Drained</b> Moderately Well Drained      Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 62° Sunny METHOD: Excavator  
 SLOPE: \_\_\_\_\_ EXCAVATION DEPTH: 96"  
 COVER: Meadow LANDSCAPE POSITION: SW

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast  
 Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse



### Soil Morphology Form



PIT NUMBER: TP 3-22-6 DLH NUMBER: 3868 INVESTIGATOR: DWD  
 DATE: 3/22/2021 STATE: PA COUNTY: CHESTER  
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES  
 SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD  
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrinct	Topo				A	S	C			
	0	7	A	W	10 YR 4/2	SILT LOAM	0				MA	FRI	
	7	35	A	W	10 YR 4/3	SILTY CLAY	0				MA	FIRM	
	35	72			VAR	SANDY SILT	0				GRAN	FRI	

COMMENTS: This Deep Test Pit was conducted at Test 3-22-6. No limiting conditions were identified at the time of excavation.

SOIL TYPE: LIMITING CONDITION: Rock Type: Water <b>Rock</b> Mottling Depth: ~84"	Soil Drainage Class: Excessively Drained      Somewhat Poorly Drained Well Drained <b>Poorly Drained</b> Moderately Well Drained      Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 62° Sunny METHOD: Excavator  
 SLOPE: \_\_\_\_\_ EXCAVATION DEPTH: 84"  
 COVER: Meadow LANDSCAPE POSITION: SW

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast  
 Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

### Soil Morphology Form



PIT NUMBER: TP 3-22-7 DLH NUMBER: 3868 INVESTIGATOR: DWD  
 DATE: 3/22/2021 STATE: PA COUNTY: CHESTER  
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES  
 SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD  
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrinct	Topo				A	S	C			
	0	4	A	W	10 YR 4/2	SILT LOAM	0				GRAN	FRI	
	4	48			10 YR 5/4	STONY SILT	<20				GRAN	FRI	

COMMENTS: This Deep Test Pit was conducted at Test 3-22-7. During excavation, rock was encountered at a depth of approximately 48 inches below existing grade.

SOIL TYPE: LIMITING CONDITION: Rock Type: Water <b>Rock</b> Mottling Depth: ~48"	Soil Drainage Class: Excessively Drained      Somewhat Poorly Drained Well Drained                  Poorly Drained <b>Moderately Well Drained</b> Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 62° Sunny METHOD: Excavator  
 SLOPE: \_\_\_\_\_ EXCAVATION DEPTH: 48"  
 COVER: Meadow LANDSCAPE POSITION: NE

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast  
 Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

### Soil Morphology Form



PIT NUMBER: TP 3-22-8      DLH NUMBER: 3868      INVESTIGATOR: DWD  
 DATE: 3/22/2021      STATE: PA      COUNTY: CHESTER  
 MUNICIPALITY: WESTTOWN TOWNSHIP      CLIENT: KEYSTONE CUSTOM HOMES  
 SUBDIVISION: STOKES ESTATE      SITE LOCATION: 1013 SHILOH ROAD  
 MORPHOLOGIC DETERMINATION:      SEWAGE      **STORMWATER**      SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrnct	Topo				A	S	C			
	0	3	A	W	10 YR 3/1	SILT LOAM	0				GRAN	FRI	
	3	11	A	W	2.5 Y 5/3	SILTY CLAY	0				MA	FRI	
	11	31	G	W	10 YR 5/6	SILTY CLAY	0				MA	FRI	
	31	48			10 YR 4/4	STONY SILT	<20				GRAN	FRI	

COMMENTS: This Deep Test Pit was conducted at Test 3-22-8. During excavation, rock was encountered at a depth of approximately 48 inches below existing grade.

SOIL TYPE: LIMITING CONDITION: Rock Type: Water <b>Rock</b> Mottling Depth: ~48"	Soil Drainage Class: Excessively Drained      Somewhat Poorly Drained Well Drained              Poorly Drained <b>Moderately Well Drained</b> Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 62° Sunny      METHOD: Excavator  
 SLOPE: \_\_\_\_\_      EXCAVATION DEPTH: 48"  
 COVER: Woodlands      LANDSCAPE POSITION: NE

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast  
 Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse