

PRELIMINARY STORMWATER MANAGEMENT REPORT

for

STOKES ESTATE 78 RESIDENTIAL LOTS

Residential Development
Westtown Township
Chester County, Pennsylvania

March 17, 2023
Revised March 24, 2025

Howell Job# 3868

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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 80 +/-acre combined tract is located in Westtown Township (Figure 1-1).

The proposed land development consists of constructing 75 residential dwelling units combined with three (3) existing dwellings (total 85 homes), access roads, stormwater management facilities, and public utilities. Two (2) access points to the parcel will be off Shiloh Road. 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 and residential with pastures for livestock, with a few hedgerows and mature trees scattered throughout, mostly along the existing driveway and near the existing residence and outbuildings. 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.

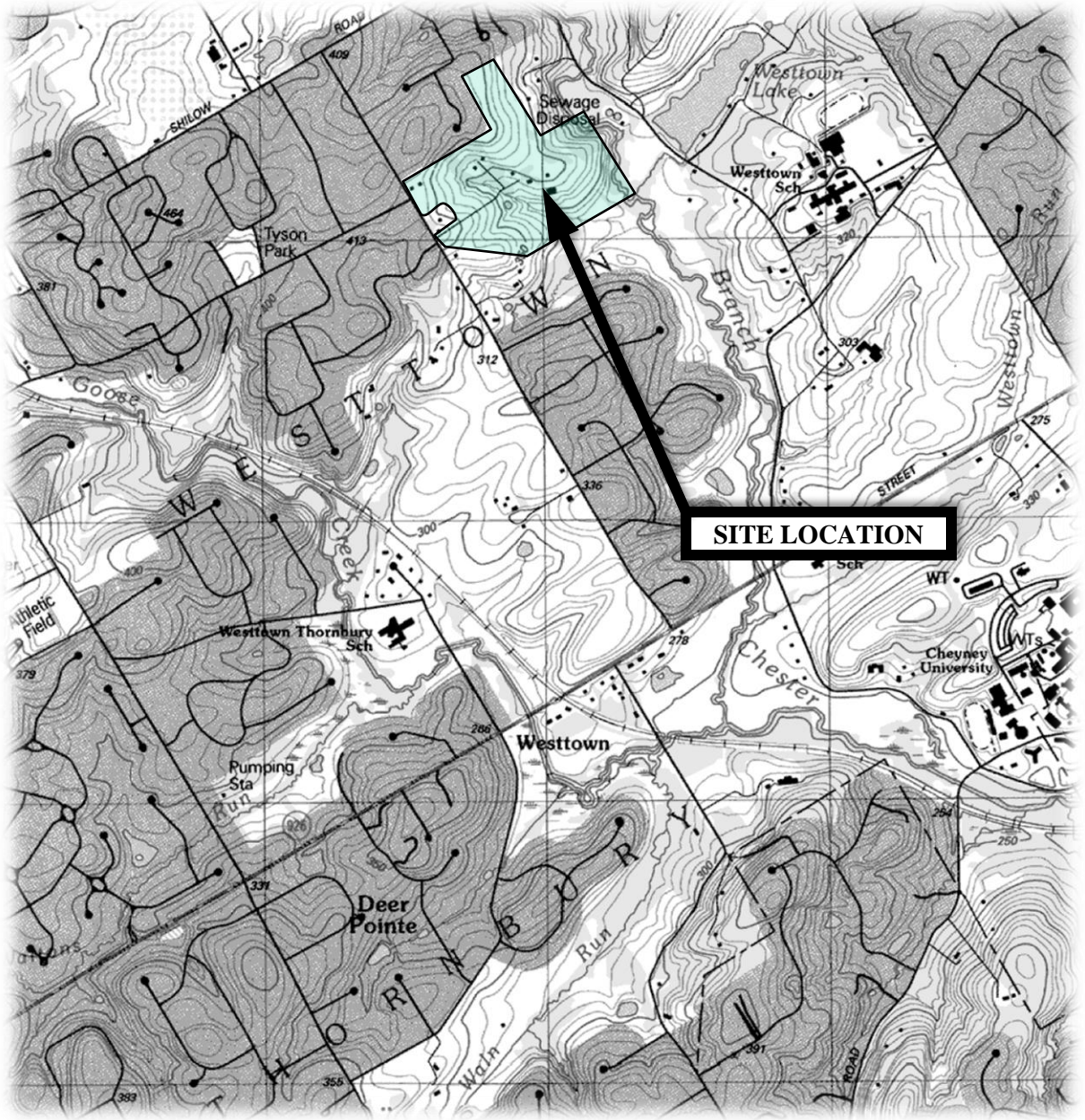
1.3 SOIL/GEOLOGIC LIMITATIONS:

Some groundwater and rock were encountered in a few locations during infiltration testing. 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



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 five (5) combination surface/subsurface infiltration basins strategically located throughout the site to control runoff.

The infiltration basins with stone beds 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. 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.

Howell Engineering 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/Beds
- Forebays
- Level Spreaders

4.0 CONCLUSIONS

Howell Engineering 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, Howell Engineering 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

General Information

- Instructions
- General**
- Volume
- Rate
- Quality

<p>Project Name: <input style="width: 90%;" type="text" value="Stokes Estate"/></p> <p>County: <input style="width: 90%;" type="text" value="Chester"/></p> <p>Project Type: <input style="width: 90%;" type="text" value="Single-Family Housing"/></p> <p>Area: <input style="width: 150px;" type="text" value="37.93"/> acres <i>(In Watershed)</i></p> <p>No. of Post-Construction Points of Analysis: <input style="width: 80px;" type="text" value="1"/></p>	<p>Application Type: <input style="width: 90%;" type="text" value="Individual NPDES Application"/></p> <p>Municipality: <input style="width: 90%;" type="text" value="Westtown Township"/></p> <p><input checked="" type="radio"/> New Project <input type="radio"/> Minor / Major Amendment</p> <p>Total Earth Disturbance: <input style="width: 150px;" type="text" value="37.93"/> acres <i>(In Watershed)</i></p> <p>at: <input style="width: 80px;" type="text" value="001"/></p>
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Point of Analysis (POA) No.	Drainage Area (DA) (acres)	Earth Disturbance in DA (acres)	Existing Impervious in DA (acres)	Proposed Impervious in DA (acres)	Receiving Waters	Ch. 93 Class	Structural SCM(s)
001	6.01	6.01	0.00	2.01	Discharge to Non-Surface Waters	TSF, MF	Yes
Undetained Areas	1.93	1.93	0.00	0.09	Discharge to Non-Surface Waters	TSF, MF	
Totals:	7.94	7.94		2.10			

Volume Management

Project: Stokes Estate

Instructions General **Volume** Rate Quality

2-Year / 24-Hour Storm Event (NOAA Atlas 14): inches Alternative 2-Year / 24-Hour Storm Event inches
Alternative Source:

Pre-Construction Conditions: No. Rows: Exempt from Meadow in Good Condition Automatically Calculate CN, Ia, Runoff and Volume

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Forested (Good Condition)	2.78	B	55	1.636	0.25	2,532
Pervious as Meadow	6.91	B	58	1.448	0.34	8,559
TOTAL (ACRES):		9.69			TOTAL (CF):	11,090

Post-Construction Conditions: No. Rows:

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	5.84	B	61	1.279	0.44	9,412
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	2.10	N/A	98	0.041	2.97	22,621
TOTAL (ACRES):		7.94			TOTAL (CF):	32,033

NET CHANGE IN VOLUME TO MANAGE (CF):

Non-Structural SCM Volume Credits:

Tree Planting Credit

Number of new deciduous trees that will be planted within disturbed area:

Number of new evergreen trees that will be planted within disturbed area:

CREDIT (CF):

CREDIT (CF):

Other (attach calculations):

Description:

--

CREDIT (CF):

--

Structural SCM Volume Credits:

No. Structural SCMs:

1

Start SCM Numbering at:

3

POA No.	SCM No.	SCM Name	MRC?	Discharge	Incremental SCM DA (acres)	Volume Routed to SCM (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegetated?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
001	3	Infiltration Basin		Off-Site	6.01	23,639	15,345	0.75	37	Yes	1.0	23,639	23,639	0

Totals: 23,639

INFILTRATION & ET CREDITS (CF): 23,639

NET CHANGE IN VOLUME TO MANAGE (CF): 20,942

TOTAL CREDITS (CF): 23,639

VOLUME REQUIREMENT SATISFIED

Rate Control

Project: Stokes Estate

- Instructions
- General
- Volume
- Rate
- Quality

Precipitation Amounts:

NOAA 2-Year 24-Hour Storm Event (in):	3.2
NOAA 10-Year 24-Hour Storm Event (in):	
NOAA 50-Year 24-Hour Storm Event (in):	
NOAA 100-Year 24-Hour Storm Event (in):	

Alternative 2-Year 24-Hour Storm Event (in):	
Alternative 10-Year 24-Hour Storm Event (in):	
Alternative 50-Year 24-Hour Storm Event (in):	
Alternative 100-Year 24-Hour Storm Event (in):	

Report Summary of Peak Rates Only

Attach model input and output data or other calculations to support the rates reported below.

	<i>Peak Discharge Rates (cfs)</i>			
	Pre-Construction	Post-Construction	Net Change	
2-Year Storm:	1.59	1.46	-0.13	<i>Rate Control Satisfied</i>
10-Year Storm:	10.37	4.37	-6.00	<i>Rate Control Satisfied</i>
50-Year Storm:	23.11	8.46	-14.65	<i>Rate Control Satisfied</i>
100-Year Storm:	30.11	13.88	-16.23	<i>Rate Control Satisfied</i>

Water Quality

Project: Stokes Estate

[PRINT](#)

- Instructions
- General
- Volume
- Rate
- Quality

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Forested (Good Condition)	Deciduous Forest/Evergreen Forest/Mixed Forest	2.78	B	2,532	45.0	0.13	1.05	7.11	0.02	0.17
Pervious as Meadow	Grassland/Herbaceous	6.91	B	8,559	48.8	0.22	2.30	26.08	0.12	1.23
TOTAL (ACRES):		9.69			TOTALS:			33.19	0.14	1.40

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	5.84	B	9,412	78.0	0.25	1.25	45.84	0.15	0.73
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	2.10	N/A	22,621	65.0	0.29	2.05	91.81	0.41	2.90
TOTAL (ACRES):		7.94			TOTALS:			137.65	0.56	3.63

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS): **104.46** **0.42** **2.24**

Characterize Undetained Areas (for Untreated Stormwater)

No. Rows:

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	1.84	B	61	1.279	0.44	2,965
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.09	N/A	98	0.041	2.97	969

Non-Structural SCM Water Quality Credits:

Pervious Undetained Area Credit

Other (attach calculations)

Description:

TSS	TP	TN

Structural SCM Water Quality Credits:

Use default SCM Outflows and Median SCM Outflow Concentrations

POA No.	SCM No.	SCM Name	MRC?	SCM DA (acres)	Vol. Routed to SCM (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN
001	3	Infiltration Basin		6.01	23,639	23,639		0	10.00	0.24	0.96	0.00	0.00	0.00

TSS	TP	TN
0.00	0.00	0.00
18.38	0.06	0.36
18.38	0.06	0.36
33.19	0.14	1.40

POLLUTANT LOADS FROM STRUCTURAL SCM (TREATED) OUTFLOWS (LBS):

POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):

NON-STRUCTURAL SCM WATER QUALITY CREDITS (LBS):

NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):

POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):

CERTIFICATION

I certify under penalty of law and subject to the penalties of 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify that the structure, function, and calculations contained in this spreadsheet have not been modified in comparison to the spreadsheet DEP has posted to its website or, if modifications were made, an explanation of the modifications made is attached to this spreadsheet.

Alexander Barlow

Spreadsheet User Name

3/20/2025

Date

General Information

- Instructions
- General**
- Volume
- Rate
- Quality

<p>Project Name: <input style="width: 90%;" type="text" value="Stokes Estate"/></p> <p>County: <input style="width: 90%;" type="text" value="Chester"/></p> <p>Project Type: <input style="width: 90%;" type="text" value="Single-Family Housing"/></p> <p>Area: <input style="width: 15%; text-align: center;" type="text" value="37.93"/> acres <i>(In Watershed)</i></p> <p>No. of Post-Construction Points of Analysis: <input style="width: 10%; text-align: center;" type="text" value="1"/></p>	<p>Application Type: <input style="width: 90%;" type="text" value="Individual NPDES Application"/></p> <p>Municipality: <input style="width: 90%;" type="text" value="Westtown Township"/></p> <p><input checked="" type="radio"/> New Project <input type="radio"/> Minor / Major Amendment</p> <p>Total Earth Disturbance: <input style="width: 15%; text-align: center;" type="text" value="37.93"/> acres <i>(In Watershed)</i></p> <p>at: <input style="width: 15%; text-align: center;" type="text" value="002"/></p>
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Point of Analysis (POA) No.	Drainage Area (DA) (acres)	Earth Disturbance in DA (acres)	Existing Impervious in DA (acres)	Proposed Impervious in DA (acres)	Receiving Waters	Ch. 93 Class	Structural SCM(s)
002	7.94	7.94	0.00	2.01	Discharge to Non-Surface Waters	TSF, MF	Yes
Undetained Areas	6.32	6.32	0.00	0.18	Discharge to Non-Surface Waters	TSF, MF	
Totals:	37.93	37.93		10.57			

Volume Management

Project: Stokes Estate

Instructions General **Volume** Rate Quality

2-Year / 24-Hour Storm Event (NOAA Atlas 14): inches Alternative 2-Year / 24-Hour Storm Event inches
 Alternative Source:

Pre-Construction Conditions: No. Rows: Exempt from Meadow in Good Condition Automatically Calculate CN, Ia, Runoff and Volume

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Forested (Good Condition)	19.67	B	55	1.636	0.25	17,913
Pervious as Meadow	8.57	C	71	0.817	0.88	27,317
TOTAL (ACRES):		28.24			TOTAL (CF):	45,230

Post-Construction Conditions: No. Rows:

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	18.23	B	61	1.279	0.44	29,379
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	3.29	C	74	0.703	1.04	12,391
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	8.47	N/A	98	0.041	2.97	91,239
TOTAL (ACRES):		29.99			TOTAL (CF):	133,009

IET CHANGE IN VOLUME TO MANAGE (CF):

Non-Structural SCM Volume Credits:

Tree Planting Credit

Number of new deciduous trees that will be planted within disturbed area:

Number of new evergreen trees that will be planted within disturbed area:

CREDIT (CF):

CREDIT (CF):

Other (attach calculations):

Description:

--

CREDIT (CF):

--

Structural SCM Volume Credits:

No. Structural SCMs:

4

Start SCM Numbering at:

1

POA No.	SCM No.	SCM Name	MRC?	Discharge	Incremental SCM DA (acres)	Volume Routed to SCM (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegetated?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
002	1	Infiltration Basin		Off-Site	11.43	40,739	15,549	1.71	18	Yes	1.0	40,739	35,895	4,774
002	2	Infiltration Basin		Off-Site	7.53	23,422	8,255	0.53	64	Yes	1.0	23,422	21,080	2,342
002	3	Infiltration Basin		Off-Site	4.93	22,090	5,537	0.70	49	Yes	1.0	22,090	14,244	1,700
002	4	Infiltration Bed		Off-Site	3.19	13,287	6,075	0.77	46	No	3.0	13,287	13,287	

Totals: 84,506 8,815

INFILTRATION & ET CREDITS (CF): 93,321

NET CHANGE IN VOLUME TO MANAGE (CF): 87,779

TOTAL CREDITS (CF): 93,321

VOLUME REQUIREMENT SATISFIED

Rate Control

Project: Stokes Estate

- Instructions
- General
- Volume
- Rate
- Quality

Precipitation Amounts:

NOAA 2-Year 24-Hour Storm Event (in):	3.2
NOAA 10-Year 24-Hour Storm Event (in):	
NOAA 50-Year 24-Hour Storm Event (in):	
NOAA 100-Year 24-Hour Storm Event (in):	

Alternative 2-Year 24-Hour Storm Event (in):	
Alternative 10-Year 24-Hour Storm Event (in):	
Alternative 50-Year 24-Hour Storm Event (in):	
Alternative 100-Year 24-Hour Storm Event (in):	

Report Summary of Peak Rates Only

Attach model input and output data or other calculations to support the rates reported below.

	<i>Peak Discharge Rates (cfs)</i>			
	Pre-Construction	Post-Construction	Net Change	
2-Year Storm:	7.80	3.46	-4.34	<i>Rate Control Satisfied</i>
10-Year Storm:	28.50	10.16	-18.34	<i>Rate Control Satisfied</i>
50-Year Storm:	57.16	42.49	-14.67	<i>Rate Control Satisfied</i>
100-Year Storm:	72.51	64.19	-8.32	<i>Rate Control Satisfied</i>

Water Quality

Project: Stokes Estate

[PRINT](#)

- Instructions
- General
- Volume
- Rate
- Quality

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Forested (Good Condition)	Deciduous Forest/Evergreen Forest/Mixed Forest	19.67	B	17,913	45.0	0.13	1.05	50.34	0.15	1.17
Pervious as Meadow	Grassland/Herbaceous	8.57	C	27,317	48.8	0.22	2.30	83.24	0.38	3.92
TOTAL (ACRES): 28.24					TOTALS: 133.57 0.52 5.10					

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	18.23	B	29,379	78.0	0.25	1.25	143.09	0.46	2.29
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	3.29	C	12,391	78.0	0.25	1.25	60.35	0.19	0.97
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	Residential	8.47	N/A	91,239	65.0	0.29	2.05	370.32	1.65	11.68

TOTAL (ACRES): 29.99

TOTALS: 573.76 2.30 14.94

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS): **440.18** **1.78** **9.84**

Characterize Undetained Areas (for Untreated Stormwater)

No. Rows:

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	3.85	B	61	1.279	0.44	6,205
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	0.45	C	74	0.703	1.04	1,695
Impervious Areas: Paved Parking Lots, Roofs, Driveways, Etc. (Excluding ROW)	0.09	N/A	98	0.041	2.97	969

Non-Structural SCM Water Quality Credits:

- Pervious Undetained Area Credit
- Other (attach calculations)

Description:

TSS	TP	TN

Structural SCM Water Quality Credits:

Use default SCM Outflows and Median SCM Outflow Concentrations

POA No.	SCM No.	SCM Name	MRC?	SCM DA (acres)	Vol. Routed to SCM (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN
002	1	Infiltration Basin		11.43	40,739	40,668		71	10.00	0.24	0.96	0.04	0.00	0.00
002	2	Infiltration Basin		7.53	23,422	23,422		0	10.00	0.24	0.96	0.00	0.00	0.00

002	3	Infiltration Basin		4.93	22,090	15,944		6,146	10.00	0.24	0.96	3.84	0.09	0.37
002	4	Infiltration Bed		3.19	13,287	13,287		0	22.00	0.10	2.38	0.00	0.00	0.00

POLLUTANT LOADS FROM STRUCTURAL SCM (TREATED) OUTFLOWS (LBS):

POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):

NON-STRUCTURAL SCM WATER QUALITY CREDITS (LBS):

NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):

POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):

TSS	TP	TN
3.88	0.09	0.37
42.41	0.14	0.74
46.29	0.23	1.11
133.57	0.52	5.10

WATER QUALITY REQUIREMENT SATISFIED

CERTIFICATION

I certify under penalty of law and subject to the penalties of 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify that the structure, function, and calculations contained in this spreadsheet have not been modified in comparison to the spreadsheet DEP has posted to its website or, if modifications were made, an explanation of the modifications made is attached to this spreadsheet.

Alexander Barlow

Spreadsheet User Name

3/20/2025

Date

APPENDIX B
TOWNSHIP POST DEVELOPMENT
FLOW REDUCTION SUMMARIES

Stormwater Summary

Peak Flow Reduction Requirements

DATE: 3/20/2025
BY: ACB
REV: 0

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: Stormwater Summary for POA1

1-year	Pre-Developed	0.60 cfs	Hydrograph 1
1-year	Off-Site	0.32 cfs	Hydrograph 2
1-year	Post-Developed	0.72 cfs	Hydrograph 9
2-year	Pre-Developed	2.29 cfs	Hydrograph 1
2-year	Off-Site	0.99 cfs	Hydrograph 2
2-year	Post-Developed	1.46 cfs	Hydrograph 9
5-year	Pre-Developed	7.15 cfs	Hydrograph 1
5-year	Off-Site	2.72 cfs	Hydrograph 2
5-year	Post-Developed	3.00 cfs	Hydrograph 9
10-year	Pre-Developed	12.13 cfs	Hydrograph 1
10-year	Off-Site	4.30 cfs	Hydrograph 2
10-year	Post-Developed	4.37 cfs	Hydrograph 9
25-year	Pre-Developed	20.24 cfs	Hydrograph 1
25-year	Off-Site	6.85 cfs	Hydrograph 2
25-year	Post-Developed	6.52 cfs	Hydrograph 9
50-year	Pre-Developed	27.82 cfs	Hydrograph 1
50-year	Off-Site	9.20 cfs	Hydrograph 2
50-year	Post-Developed	8.46 cfs	Hydrograph 9
100-year	Pre-Developed	36.49 cfs	Hydrograph 1
100-year	Off-Site	11.86 cfs	Hydrograph 2
100-year	Post-Developed	13.88 cfs	Hydrograph 9

Post-Developed 2-Year Flow = 1.46 cfs Pre-Developed 1 Year Flow + Off-Site 2-Year Flow = 1.59 cfs	OK
Post-Developed 5-Year Flow = 3.00 cfs 50% Pre-Developed 5-Year Flow + Off-Site 5-Year Flow = 6.29 cfs	OK
Post-Developed 10-Year Flow = 4.37 cfs 50% Pre-Developed 10-Year Flow + Off-Site 10-Year Flow = 10.37 cfs	OK
Post-Developed 25-Year Flow = 6.52 cfs 50% Pre-Developed 25-Year Flow + Off-Site 25-Year Flow = 16.97 cfs	OK
Post Developed 50 Year Flow = 8.46 cfs 50% Pre-Developed 50-Year Flow + Off-Site 50-Year Flow = 23.11 cfs	OK
Post Developed 100 Year Flow = 13.88 cfs 50% Pre-Developed 100-Year Flow + Off-Site 100-Year Flow = 30.11 cfs	OK

Note: Per the Westtown Township Stormwater Management Ordinance, only the area of the proposed regulated activity shall be subject to the peak flow rate control standards.

Stormwater Summary

Peak Flow Reduction Requirements

DATE: 3/20/2025
BY: ACB
REV: 0

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: Stormwater Summary for POA2

1-year	Pre-Developed	6.46 cfs	Hydrograph 2
1-year	Off-Site	0.72 cfs	Hydrograph 4
1-year	Post-Developed	1.75 cfs	Hydrograph 21
2-year	Pre-Developed	14.34 cfs	Hydrograph 2
2-year	Off-Site	1.33 cfs	Hydrograph 4
2-year	Post-Developed	3.46 cfs	Hydrograph 21
5-year	Pre-Developed	32.86 cfs	Hydrograph 2
5-year	Off-Site	2.58 cfs	Hydrograph 4
5-year	Post-Developed	7.01 cfs	Hydrograph 21
10-year	Pre-Developed	49.63 cfs	Hydrograph 2
10-year	Off-Site	3.69 cfs	Hydrograph 4
10-year	Post-Developed	10.16 cfs	Hydrograph 21
25-year	Pre-Developed	76.19 cfs	Hydrograph 2
25-year	Off-Site	5.40 cfs	Hydrograph 4
25-year	Post-Developed	30.64 cfs	Hydrograph 21
50-year	Pre-Developed	100.45 cfs	Hydrograph 2
50-year	Off-Site	6.93 cfs	Hydrograph 4
50-year	Post-Developed	42.49 cfs	Hydrograph 21
100-year	Pre-Developed	127.75 cfs	Hydrograph 2
100-year	Off-Site	8.64 cfs	Hydrograph 4
100-year	Post-Developed	64.19 cfs	Hydrograph 21

Post-Developed 2-Year Flow = 3.46 cfs Pre-Developed 1 Year Flow + Off-Site 2-Year Flow = 7.80 cfs	OK
Post-Developed 5-Year Flow = 7.01 cfs 50% Pre-Developed 5-Year Flow + Off-Site 5-Year Flow = 19.01 cfs	OK
Post-Developed 10-Year Flow = 10.16 cfs 50% Pre-Developed 10-Year Flow + Off-Site 10-Year Flow = 28.50 cfs	OK
Post-Developed 25-Year Flow = 30.64 cfs 50% Pre-Developed 25-Year Flow + Off-Site 25-Year Flow = 43.49 cfs	OK
Post Developed 50 Year Flow = 42.49 cfs 50% Pre-Developed 50-Year Flow + Off-Site 50-Year Flow = 57.16 cfs	OK
Post Developed 100 Year Flow = 64.19 cfs 50% Pre-Developed 100-Year Flow + Off-Site 100-Year Flow = 72.51 cfs	OK

Note: Per the Westtown Township Stormwater Management Ordinance, only the area of the proposed regulated activity shall be subject to the peak flow rate control standards.

APPENDIX C
SCS METHOD CURVE NUMBER (CN) CALCULATIONS



SOIL CONSERVATION SERVICE
 HYDROLOGIC DATA FOR WATERSHED
 RUNOFF COMPUTATIONS

DATE: 3/20/2025
 BY: ACB

JOB NO.: 3868 PROJECT: Stokes Estate
 DESCRIPTION: PREDEVELOPED AREA CHESTER CREEK POA01

TOWNSHIP: Westtown

Total Area: 9.69 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	6.91	400.78	
	Loam	B	Woods	Good	55	2.78	152.90	
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Woods	Good	70	0.00	0.00	

Total Area 9.69 553.68

Weighted Soil Complex Number $\frac{553.7}{9.7} = 57.1$

*SEE HYDRAFLOW REPORT FOR TIME OF CONCENTRATION



SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/20/2025
BY: ACB

JOB NO.: 3868 PROJECT: Stokes Estate
DESCRIPTION: PREDEVELOPED AREA UNT CHESTER CREEK POA002

TOWNSHIP: Westtown

Total Area: 28.24 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	19.67	1140.86	
	Loam	B	Woods	Good	55	0.00	0.00	
Ba	Baile Silt	C	Meadow	Good	71	8.57	608.47	
	Loam	C	Woods	Good	70	0.00	0.00	

Total Area 28.24 1749.33

Weighted Soil Complex Number $\frac{1749.3}{28.2} = 61.9$

*SEE HYDRAFLOW REPORT FOR TIME OF CONCENTRATION



SOIL CONSERVATION SERVICE
 HYDROLOGIC DATA FOR WATERSHED
 RUNOFF COMPUTATIONS

DATE: 3/20/2025
 BY: ACB

JOB NO.: 3868 PROJECT: Stokes Estate
 DESCRIPTION: OFFSITE POA2

TOWNSHIP: Westtown

Total Area: 2.53 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	2.53	146.74	
	Loam	B	Woods	Good	55	0.00	0.00	
Ba	Baile Silt	B	Impervious	N/A	98	0.00	0.00	
		C	Meadow	Good	71	0.00	0.00	
	Loam	C	Woods	Good	70	0.00	0.00	

Total Area 2.53 146.74

Weighted Soil Complex Number $\frac{146.7}{2.5} = 58.0$

ASSUMES 5 MINUTE TIME OF CONCENTRATION



SOIL CONSERVATION SERVICE
 HYDROLOGIC DATA FOR WATERSHED
 RUNOFF COMPUTATIONS

DATE: 3/20/2025
 BY: ACB

JOB NO.: 3868 PROJECT: Stokes Estate
 DESCRIPTION: OFFSITE POA2

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	0.76	44.08	
	Loam	B	Woods	Good	55	0.00	0.00	
Ba	Baile Silt	B	Impervious	N/A	98	0.00	0.00	
		C	Meadow	Good	71	0.73	51.83	
	Loam	C	Woods	Good	70	0.00	0.00	

Total Area 1.49 95.91

Weighted Soil Complex Number $\frac{95.9}{1.5} = 64.4$

ASSUMES 5 MINUTE TIME OF CONCENTRATION



SOIL CONSERVATION SERVICE
 HYDROLOGIC DATA FOR WATERSHED
 RUNOFF COMPUTATIONS

DATE: 3/20/2025
 BY: ACB

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

TOWNSHIP: Westtown

Total Area: 11.43 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	8.08	492.74	
Ba	Baile Silt	N/A	Impervious	N/A	98	3.05	299.31	
		C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.30	22.20	

Total Area 11.43 814.25

Weighted Soil Complex Number $\frac{814.3}{11.4} = 71.2$

ASSUMES 5 MINUTE TIME OF CONCENTRATION



SOIL CONSERVATION SERVICE
 HYDROLOGIC DATA FOR WATERSHED
 RUNOFF COMPUTATIONS

DATE: 3/20/2025
 BY: ACB

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

TOWNSHIP: Westtown

Total Area: 7.53 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	4.77	291.06	
Ba	Baile Silt	N/A	Impervious	N/A	98	1.86	182.32	
		C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.90	66.60	

Total Area 7.53 539.98

Weighted Soil Complex Number $\frac{540.0}{7.5} = 71.7$

ASSUMES 5 MINUTE TIME OF CONCENTRATION



SOIL CONSERVATION SERVICE
 HYDROLOGIC DATA FOR WATERSHED
 RUNOFF COMPUTATIONS

DATE: 3/20/2025
 BY: ACB

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

Total Area: 8.54 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Woods	Good	55	0.00	0.00	2.53 ac offsite included
	Loam	B	Lawn	Good	61	6.53	398.54	
		N/A	Impervious	N/A	98	2.01	196.91	
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.00	0.00	

Total Area 8.54 595.45

Weighted Soil Complex Number $\frac{595.4}{8.5} =$ 69.7

ASSUMES 5 MINUTE TIME OF CONCENTRATION



SOIL CONSERVATION SERVICE
 HYDROLOGIC DATA FOR WATERSHED
 RUNOFF COMPUTATIONS

DATE: 3/20/2025
 BY: ACB

JOB NO.: 3868 PROJECT: Stokes Estate
 DESCRIPTION: POST DEVELOPED BASIN 4

TOWNSHIP: Westtown

Total Area: 4.93 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	1.15	70.01	0.76 acres offsite
Ba	Baile Silt	N/A	Impervious	N/A	98	2.44	238.80	
		C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	1.35	99.90	0.73 acres offsite

Total Area 4.93 408.71

Weighted Soil Complex Number $\frac{408.7}{4.9} = 82.8$

ASSUMES 5 MINUTE TIME OF CONCENTRATION



SOIL CONSERVATION SERVICE
 HYDROLOGIC DATA FOR WATERSHED
 RUNOFF COMPUTATIONS

DATE: 3/20/2025
 BY: ACB

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

TOWNSHIP: Westtown

Total Area: 3.19 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	1.14	69.33	
Ba	Baile Silt	N/A	Impervious	N/A	98	1.03	101.41	
		C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	1.02	75.48	

Total Area 3.19 246.21

Weighted Soil Complex Number $\frac{246.2}{3.2} = 77.2$

ASSUMES 5 MINUTE TIME OF CONCENTRATION



SOIL CONSERVATION SERVICE
 HYDROLOGIC DATA FOR WATERSHED
 RUNOFF COMPUTATIONS

DATE: 3/20/2025
 BY: ACB

JOB NO.: 3868 PROJECT: Stokes Estate
 DESCRIPTION: POST DEVELOPED BYPASS POA1

TOWNSHIP: Westtown

Total Area: 1.93 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	1.84	112.41	
Ba	Baile Silt	N/A	Impervious	N/A	98	0.09	8.55	
		C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.00	0.00	

Total Area 1.93 120.96

Weighted Soil Complex Number $\frac{121.0}{1.9} = 62.7$

ASSUMES 5 MINUTE TIME OF CONCENTRATION



SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/20/2025
BY: ACB

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

TOWNSHIP: Westtown

Total Area: 4.39 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	3.85	235.02	
Ba	Baile Silt	N/A	Impervious	N/A	98	0.09	8.55	
		C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.45	33.30	

Total Area 4.39 276.87

Weighted Soil 276.9 = 63.1
Complex Number 4.4

ASSUMES 5 MINUTE TIME OF CONCENTRATION

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Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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	-----	0.599	2.286	-----	7.146	12.13	20.24	27.82	36.49	Pre Developed POA1
2	SCS Runoff	-----	6.463	14.34	-----	32.86	49.63	76.19	100.45	127.75	Pre Developed POA2
3	SCS Runoff	-----	0.320	0.994	-----	2.718	4.304	6.850	9.199	11.86	Offsite POA1
4	SCS Runoff	-----	0.723	1.332	-----	2.584	3.686	5.395	6.930	8.636	Offsite POA2
6	SCS Runoff	-----	7.411	11.57	-----	19.80	26.80	37.41	46.90	57.51	Post Basin 3
7	Reservoir	6	0.000	0.000	-----	0.130	0.428	1.356	3.638	11.27	Basin 3 Routed
8	SCS Runoff	-----	0.718	1.458	-----	3.000	4.371	6.518	8.459	10.63	Post Bypass POA1
9	Combine	7, 8	0.718	1.458	-----	3.000	4.371	6.518	8.459	13.88	Post Total POA1
11	SCS Runoff	-----	11.25	17.07	-----	28.45	38.05	52.51	65.61	79.97	Post Basin 1
12	Reservoir	11	0.000	0.000	-----	0.535	1.312	3.835	12.01	32.29	Basin 1 Upper Routed
13	Reservoir	12	0.000	0.000	-----	0.396	0.982	2.163	5.658	14.49	Basin 1 Lower Routed
14	SCS Runoff	-----	7.713	11.60	-----	19.17	25.55	35.17	43.84	53.34	Post Basin 2
15	Reservoir	14	0.000	0.000	-----	0.221	0.599	1.813	4.059	13.48	Basin 2 Routed
16	SCS Runoff	-----	9.988	13.25	-----	19.30	24.16	31.18	37.17	43.57	Post to Basin 4
17	Reservoir	16	0.000	0.237	-----	1.407	5.931	18.70	24.17	26.85	Basin 4 Routed
18	SCS Runoff	-----	4.761	6.643	-----	10.18	13.15	17.58	21.39	25.52	Post to Bed 1/Basin
19	Reservoir	18	0.000	0.000	-----	0.000	0.249	1.047	3.517	13.26	UG Bed 1/Basin Routed
20	SCS Runoff	-----	1.749	3.457	-----	7.008	10.16	15.08	19.52	24.47	Post Bypass POA2
21	Combine	13, 15, 17, 19, 20	1.749	3.457	-----	7.008	10.16	30.64	42.49	64.19	Post Total POA2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

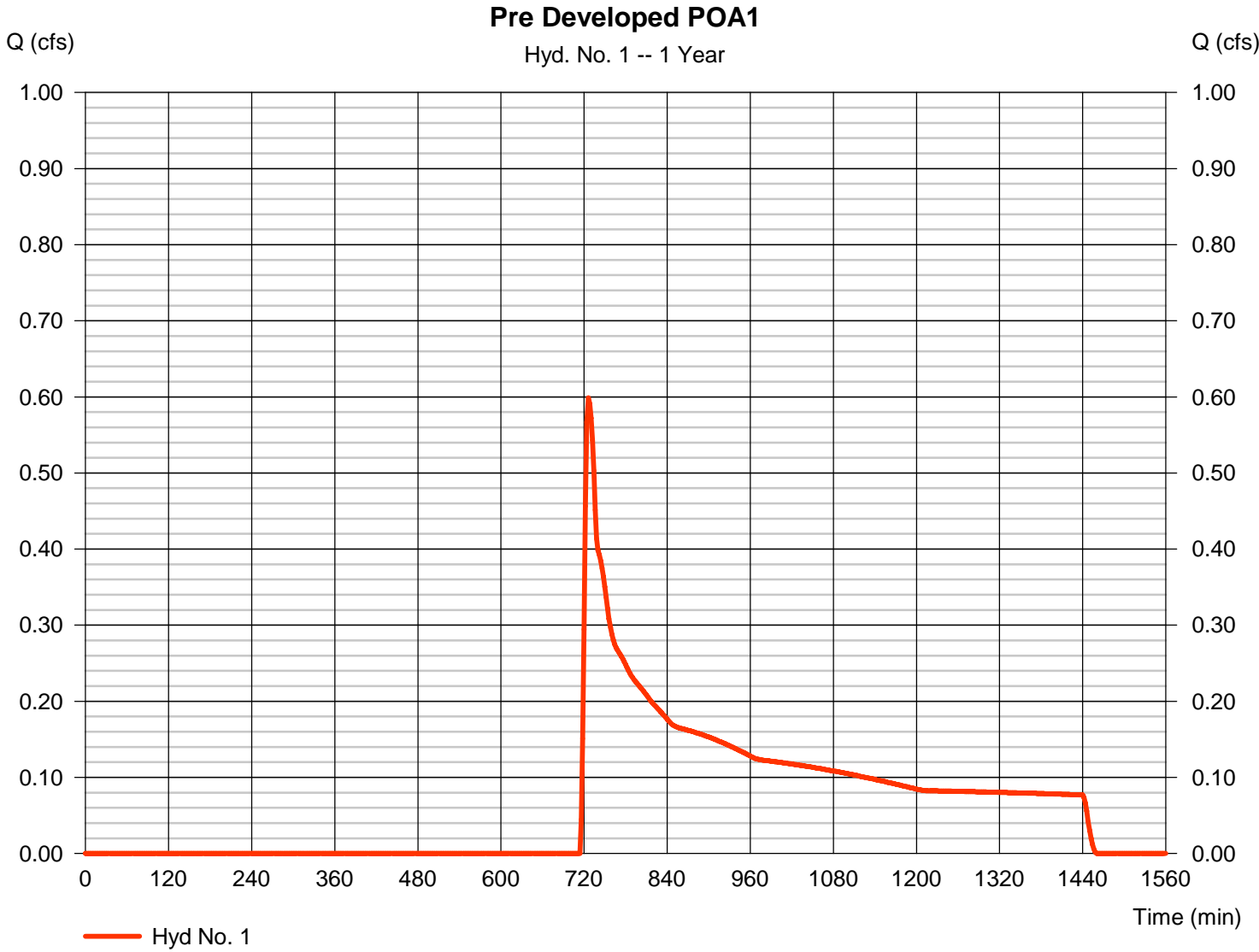
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.599	2	726	5,966	-----	-----	-----	Pre Developed POA1
2	SCS Runoff	6.463	2	724	29,900	-----	-----	-----	Pre Developed POA2
3	SCS Runoff	0.320	2	720	1,584	-----	-----	-----	Offsite POA1
4	SCS Runoff	0.723	2	718	1,809	-----	-----	-----	Offsite POA2
6	SCS Runoff	7.411	2	718	15,764	-----	-----	-----	Post Basin 3
7	Reservoir	0.000	2	n/a	0	6	316.79	15,764	Basin 3 Routed
8	SCS Runoff	0.718	2	718	2,007	-----	-----	-----	Post Bypass POA1
9	Combine	0.718	2	718	2,007	7, 8	-----	-----	Post Total POA1
11	SCS Runoff	11.25	2	718	23,432	-----	-----	-----	Post Basin 1
12	Reservoir	0.000	2	n/a	0	11	321.56	23,432	Basin 1 Upper Routed
13	Reservoir	0.000	2	n/a	0	12	302.00	0.000	Basin 1 Lower Routed
14	SCS Runoff	7.713	2	718	15,969	-----	-----	-----	Post Basin 2
15	Reservoir	0.000	2	n/a	0	14	307.54	15,969	Basin 2 Routed
16	SCS Runoff	9.988	2	718	20,075	-----	-----	-----	Post to Basin 4
17	Reservoir	0.000	2	n/a	0	16	347.75	20,075	Basin 4 Routed
18	SCS Runoff	4.761	2	718	9,541	-----	-----	-----	Post to Bed 1/Basin
19	Reservoir	0.000	2	n/a	0	18	339.48	9,541	UG Bed 1/Basin Routed
20	SCS Runoff	1.749	2	718	4,742	-----	-----	-----	Post Bypass POA2
21	Combine	1.749	2	718	4,742	13, 15, 17, 19, 20	-----	-----	Post Total POA2
SWM.gpw					Return Period: 1 Year			Monday, 03 / 24 / 2025	

Hydrograph Report

Hyd. No. 1

Pre Developed POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.599 cfs
Storm frequency	= 1 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 5,966 cuft
Drainage area	= 9.690 ac	Curve number	= 57.1
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. v2024

Hyd. No. 1

Pre Developed POA1

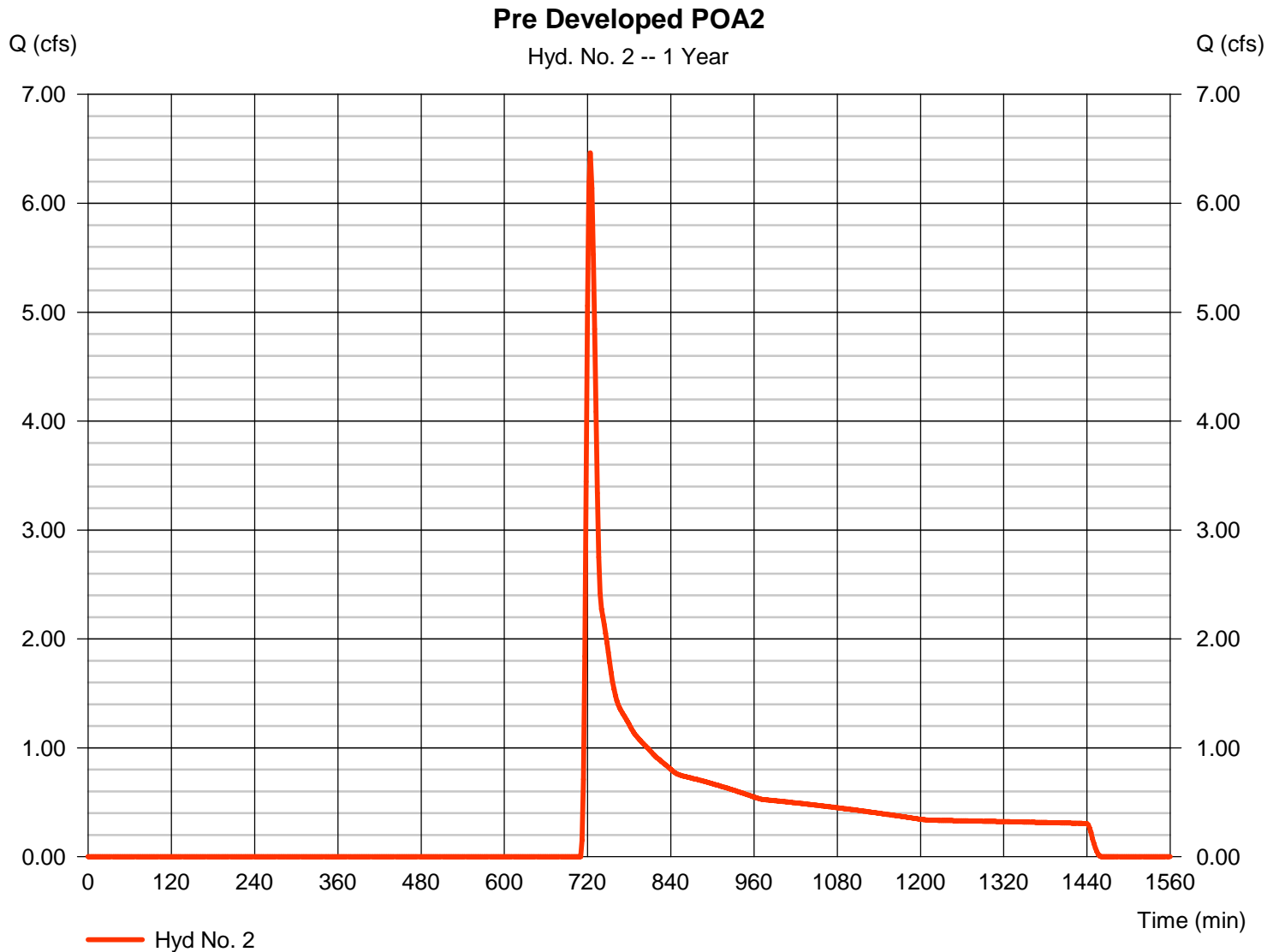
<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.20	0.00	0.00	
Land slope (%)	= 4.00	0.00	0.00	
Travel Time (min)	= 10.81	+ 0.00	+ 0.00	= 10.81
Shallow Concentrated Flow				
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	
Travel Time (min)	= 1.14	+ 0.00	+ 0.00	= 1.14
Channel Flow				
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	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				12.00 min

Hydrograph Report

Hyd. No. 2

Pre Developed POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 6.463 cfs
Storm frequency	= 1 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 29,900 cuft
Drainage area	= 28.240 ac	Curve number	= 61.9
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. v2024

Hyd. No. 2

Pre Developed POA2

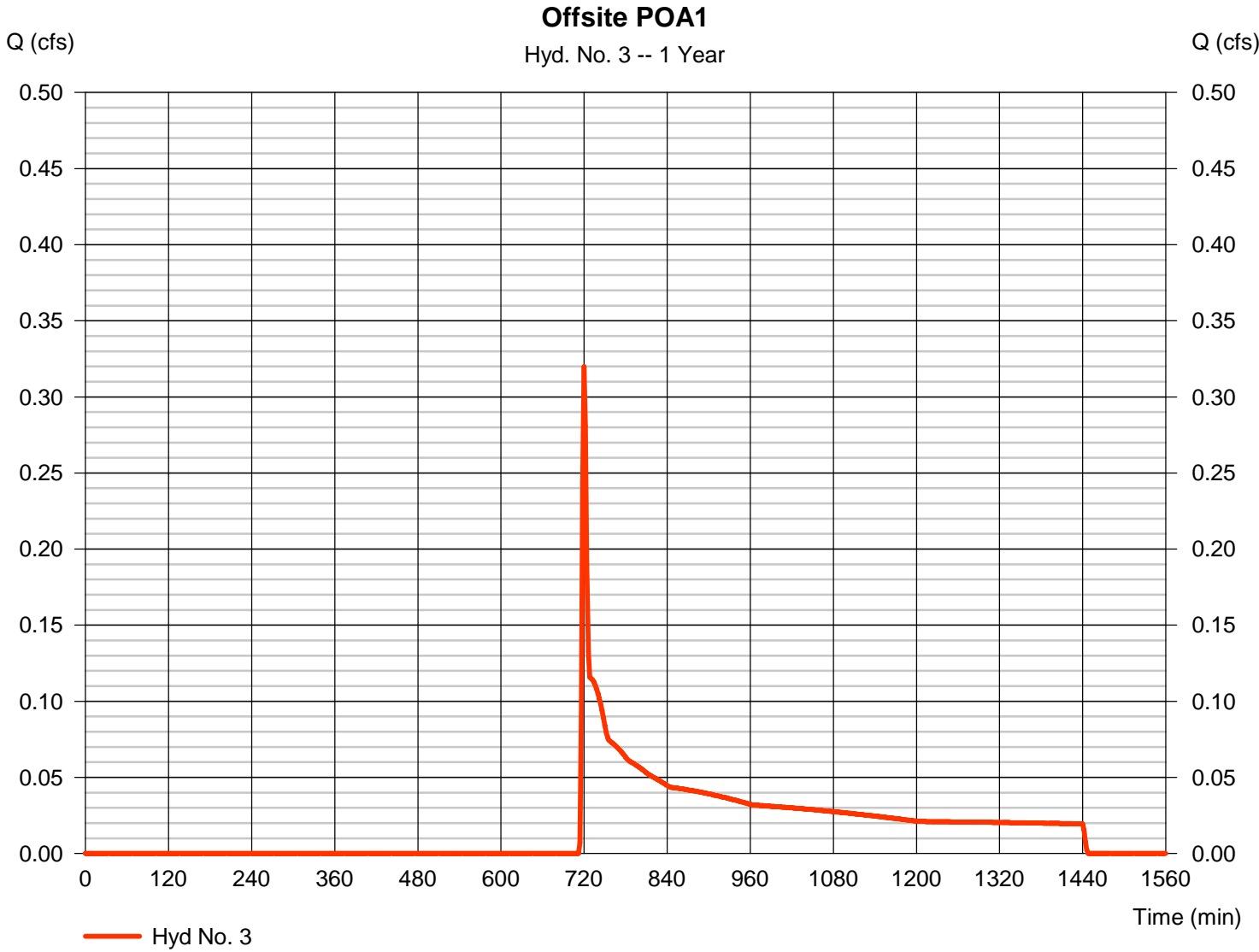
<u>Description</u>	<u>A</u>		<u>B</u>		<u>C</u>		<u>Totals</u>
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 7.00		0.00		0.00		
Travel Time (min)	= 8.65	+	0.00	+	0.00	=	8.65
Shallow Concentrated Flow							
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		
Travel Time (min)	= 3.31	+	0.00	+	0.00	=	3.31
Channel Flow							
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		
Travel Time (min)	= 0.00	+	0.00	+	0.00	=	0.00
Total Travel Time, Tc							12.00 min

Hydrograph Report

Hyd. No. 3

Offsite POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.320 cfs
Storm frequency	= 1 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 1,584 cuft
Drainage area	= 2.530 ac	Curve number	= 58
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

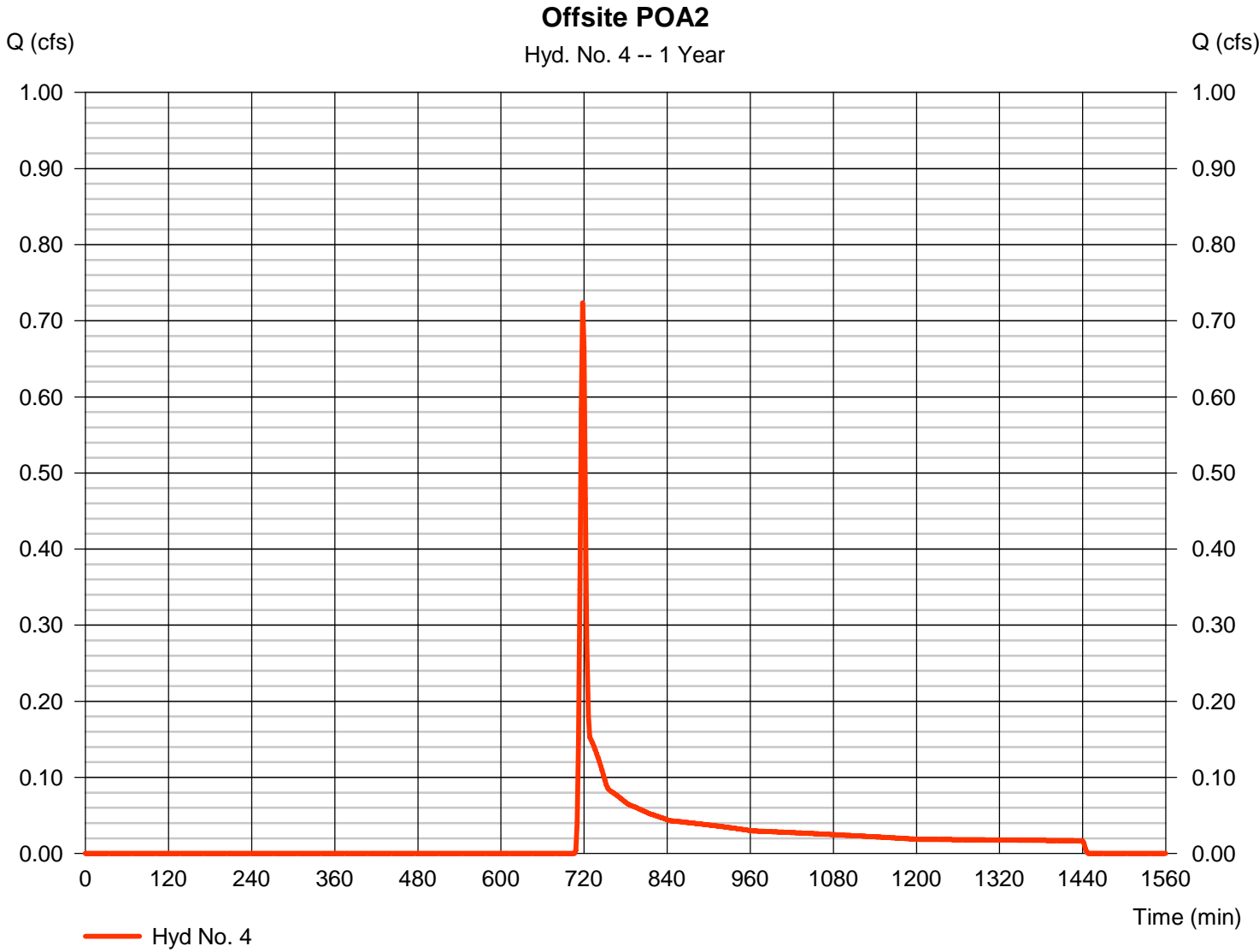


Hydrograph Report

Hyd. No. 4

Offsite POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.723 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,809 cuft
Drainage area	= 1.490 ac	Curve number	= 64.4
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

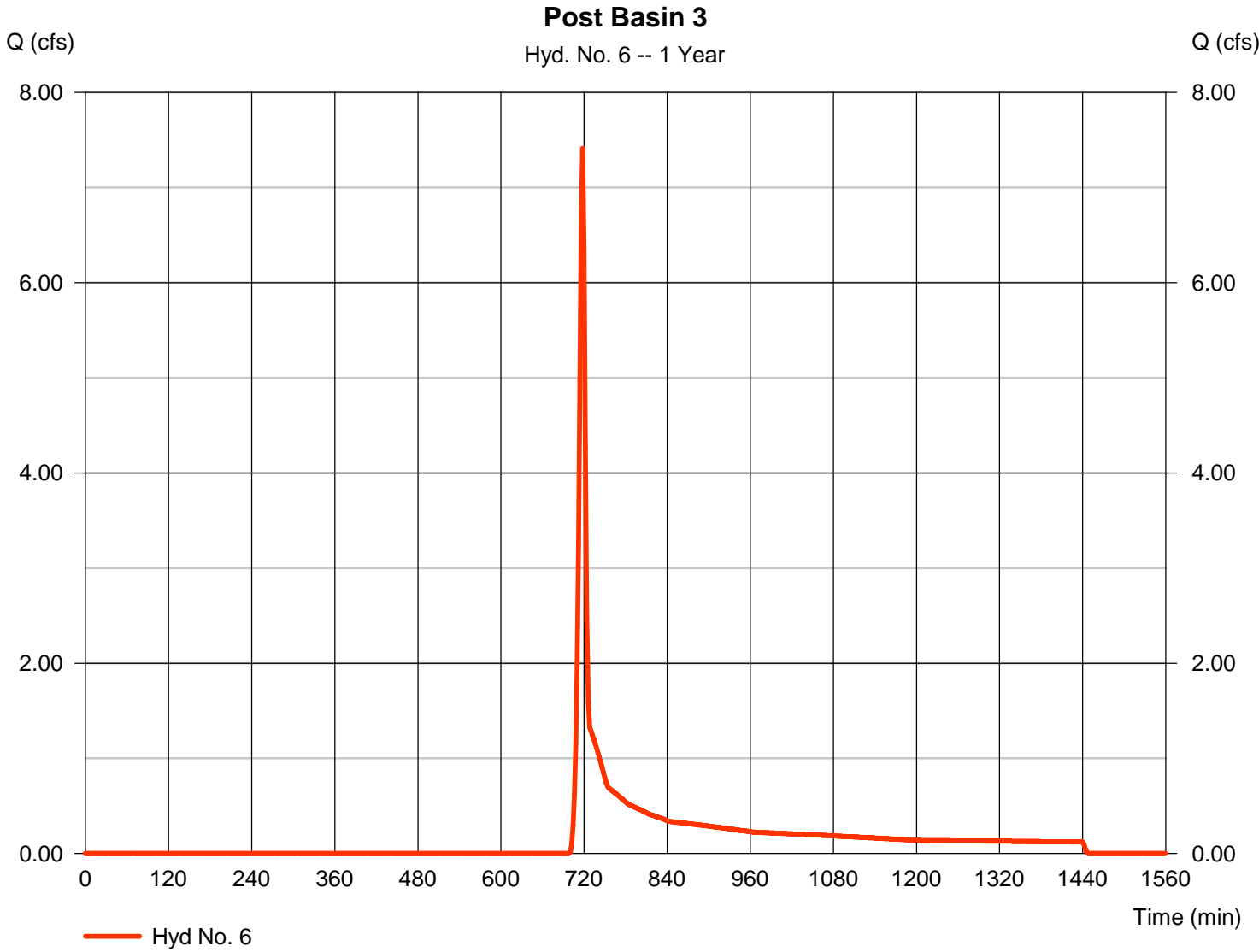


Hydrograph Report

Hyd. No. 6

Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 7.411 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 15,764 cuft
Drainage area	= 8.540 ac	Curve number	= 69.7
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. v2024

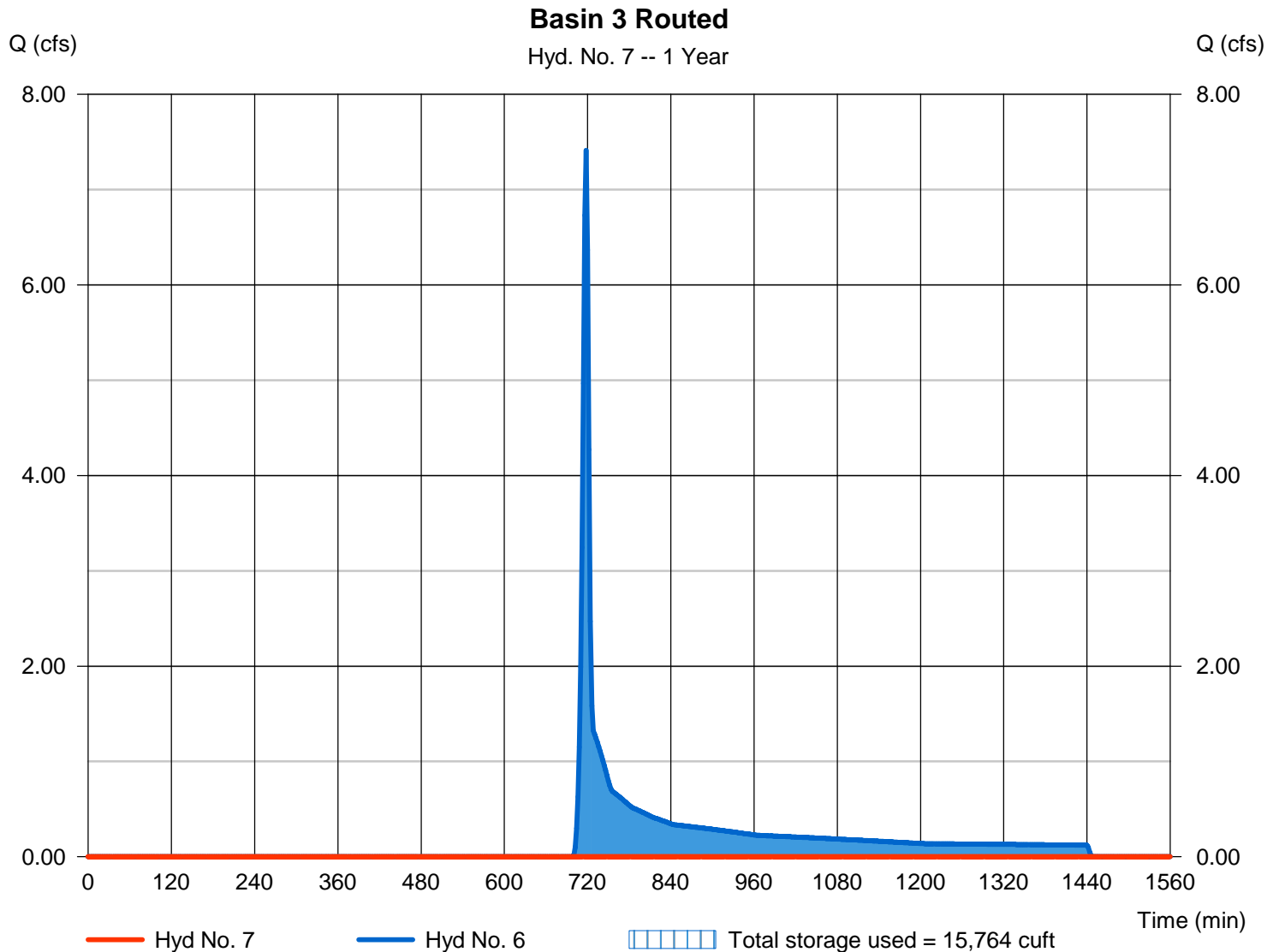
Monday, 03 / 24 / 2025

Hyd. No. 7

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.	= 6 - Post Basin 3	Max. Elevation	= 316.79 ft
Reservoir name	= Basin 3	Max. Storage	= 15,764 cuft

Storage Indication method used.



Pond Report

Pond No. 5 - Basin 3

Pond Data

Capacity = 106,179 cuft, Inlet Centerline Elevation = 318.00 ft, Side slope area = 0.00 sqft, Outlet Elevation = 316.00 ft, Depth = 2.00 ft, 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	2,280	0	0
0.20	314.20	2,280	181	181
0.40	314.40	2,280	181	363
0.60	314.60	2,280	181	544
0.80	314.80	2,280	181	726
1.00	314.99	2,280	181	907
1.19	315.19	2,280	181	1,089
1.39	315.39	2,280	181	1,270
1.59	315.59	2,280	181	1,452
1.79	315.79	2,280	181	1,633
1.99	315.99	2,280	181	1,815
2.00	316.00	15,345	88	1,903
4.00	318.00	19,665	35,010	36,913
6.00	320.00	24,211	43,876	80,789
7.00	321.00	26,570	25,390	106,179

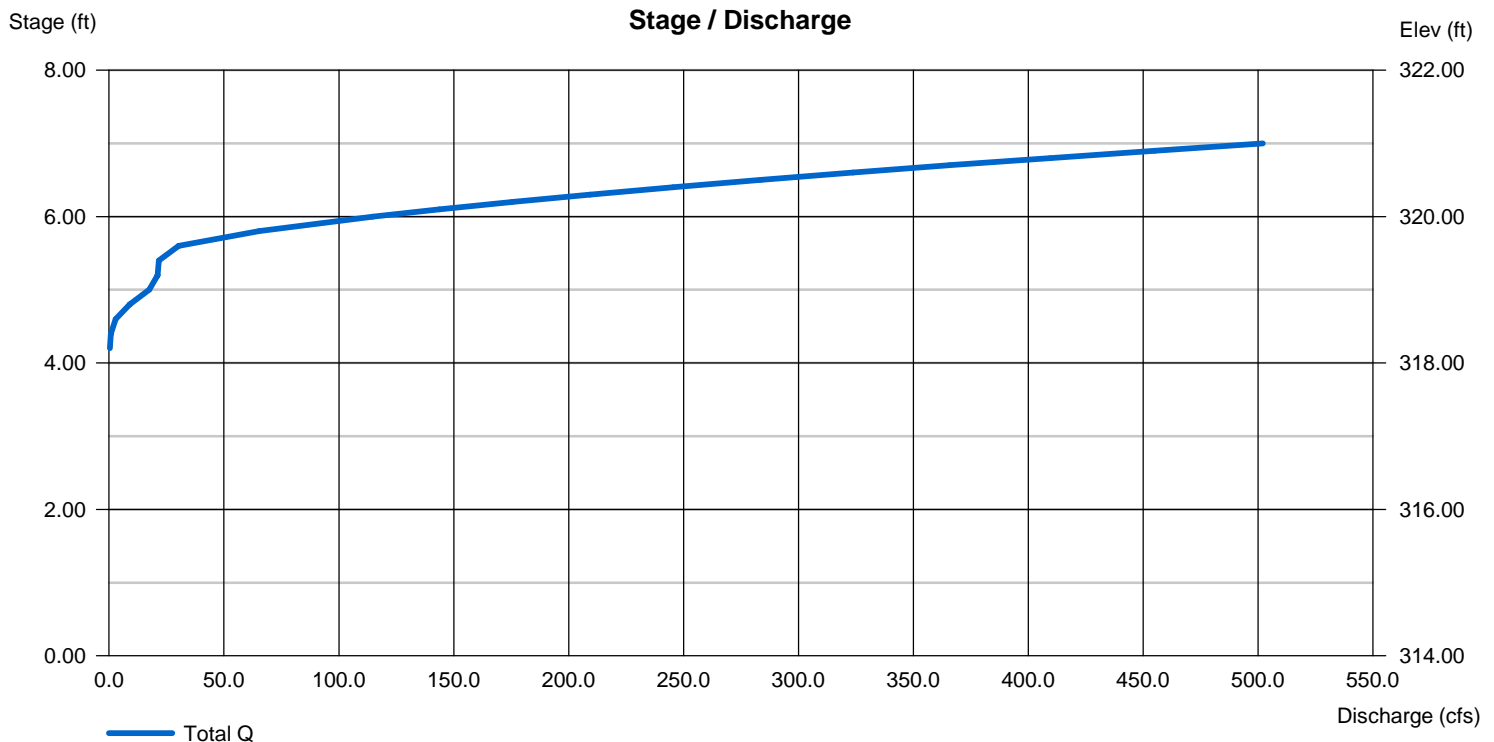
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 312.00	0.00	0.00	0.00
Length (ft)	= 78.06	0.00	0.00	0.00
Slope (%)	= 12.81	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	1.00	100.00	0.00
Crest El. (ft)	= 318.50	318.00	319.50	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

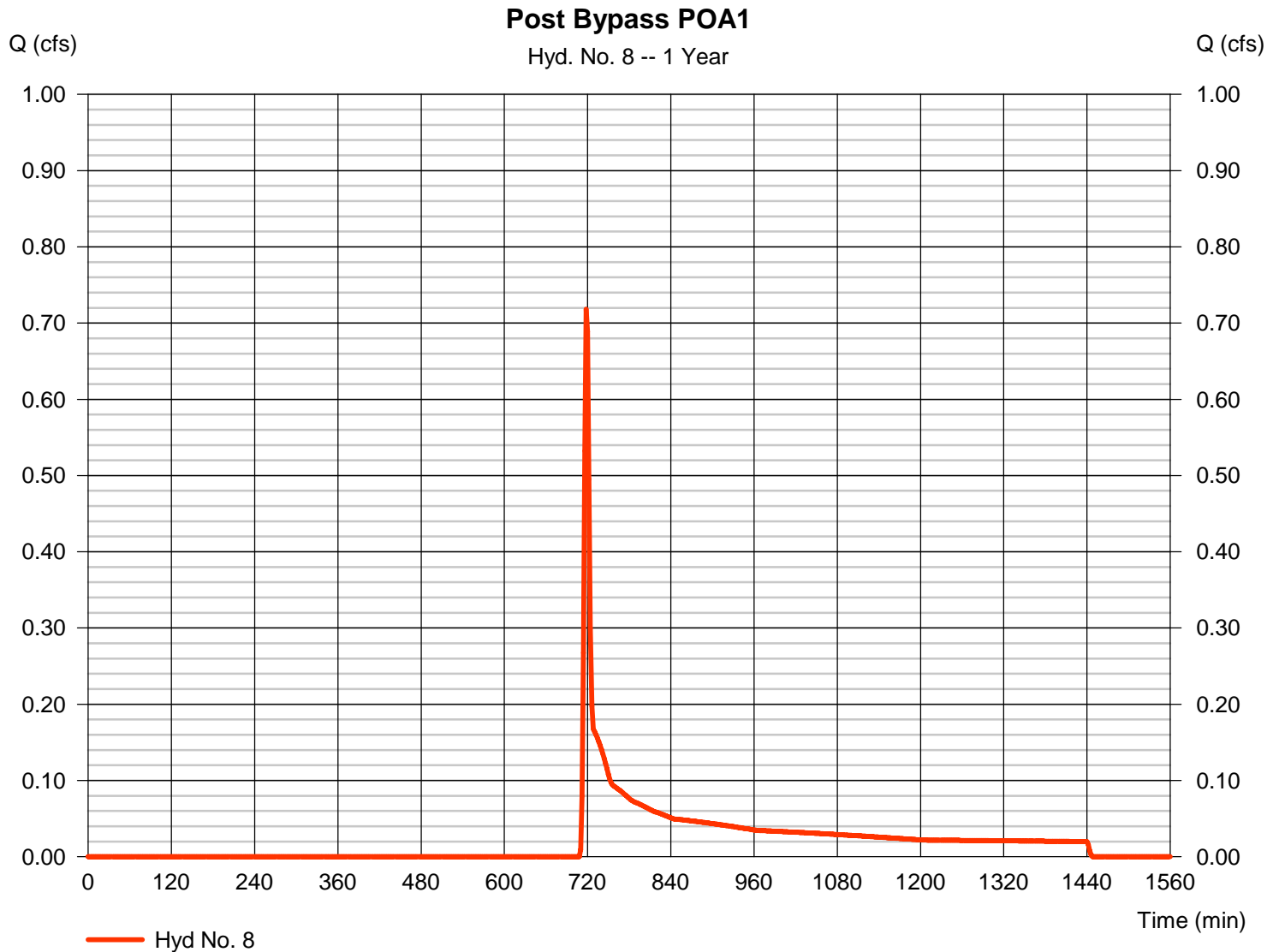
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Monday, 03 / 24 / 2025

Hyd. No. 8

Post Bypass POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.718 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,007 cuft
Drainage area	= 1.930 ac	Curve number	= 62.7
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. v2024

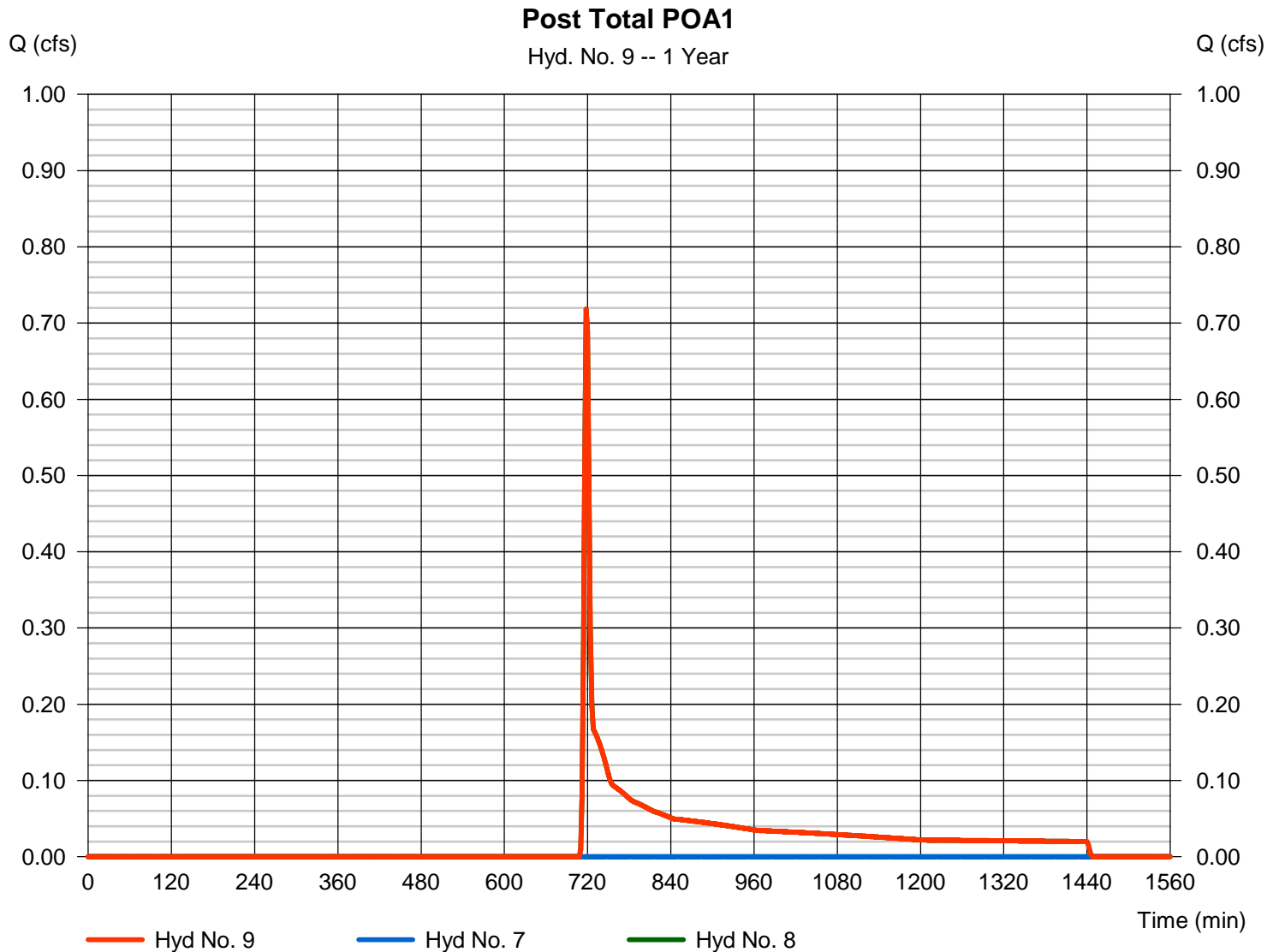
Monday, 03 / 24 / 2025

Hyd. No. 9

Post Total POA1

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 2 min
Inflow hyds. = 7, 8

Peak discharge = 0.718 cfs
Time to peak = 718 min
Hyd. volume = 2,007 cuft
Contrib. drain. area = 1.930 ac

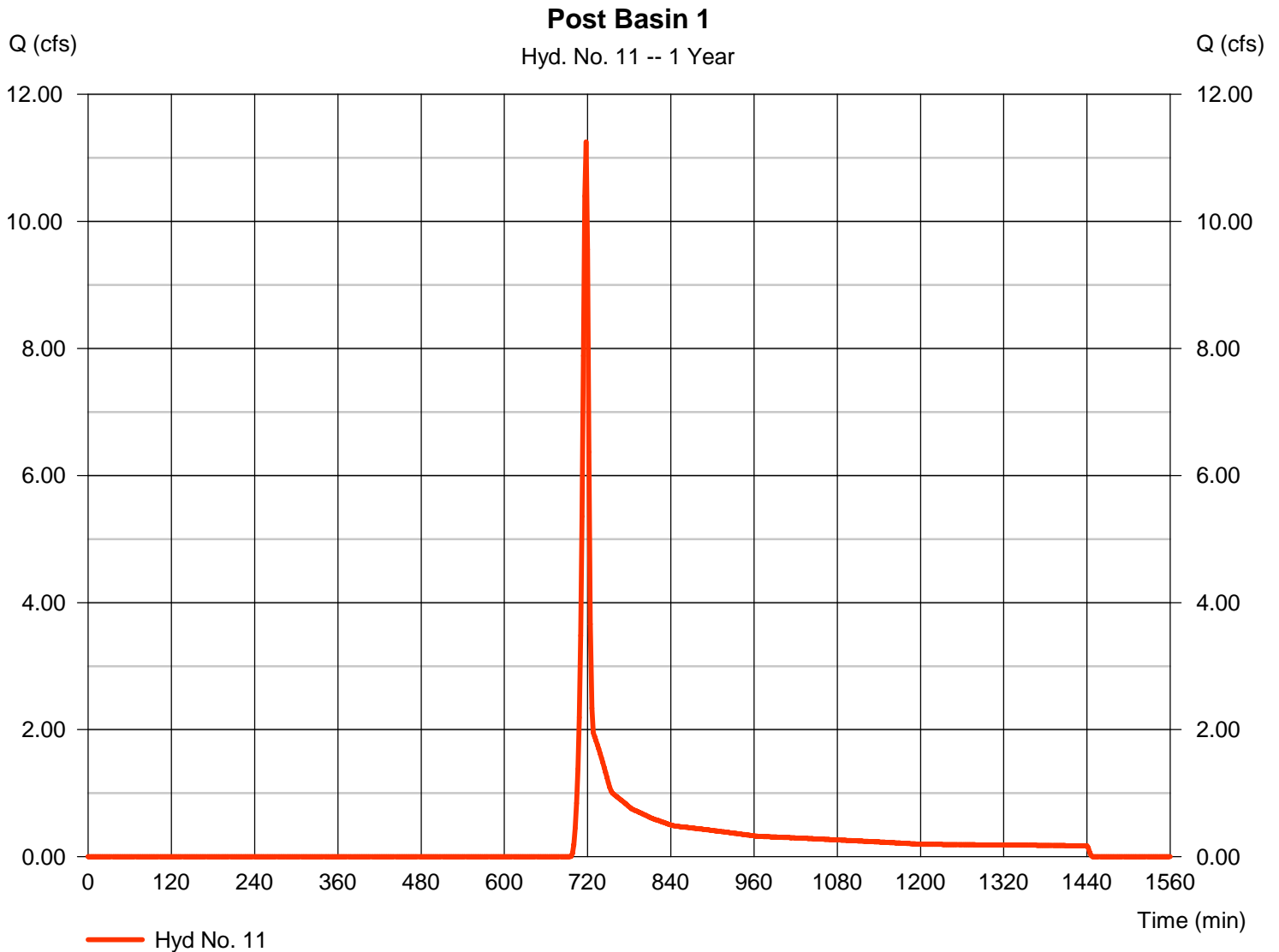


Hydrograph Report

Hyd. No. 11

Post Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 11.25 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 23,432 cuft
Drainage area	= 11.430 ac	Curve number	= 71.2
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. v2024

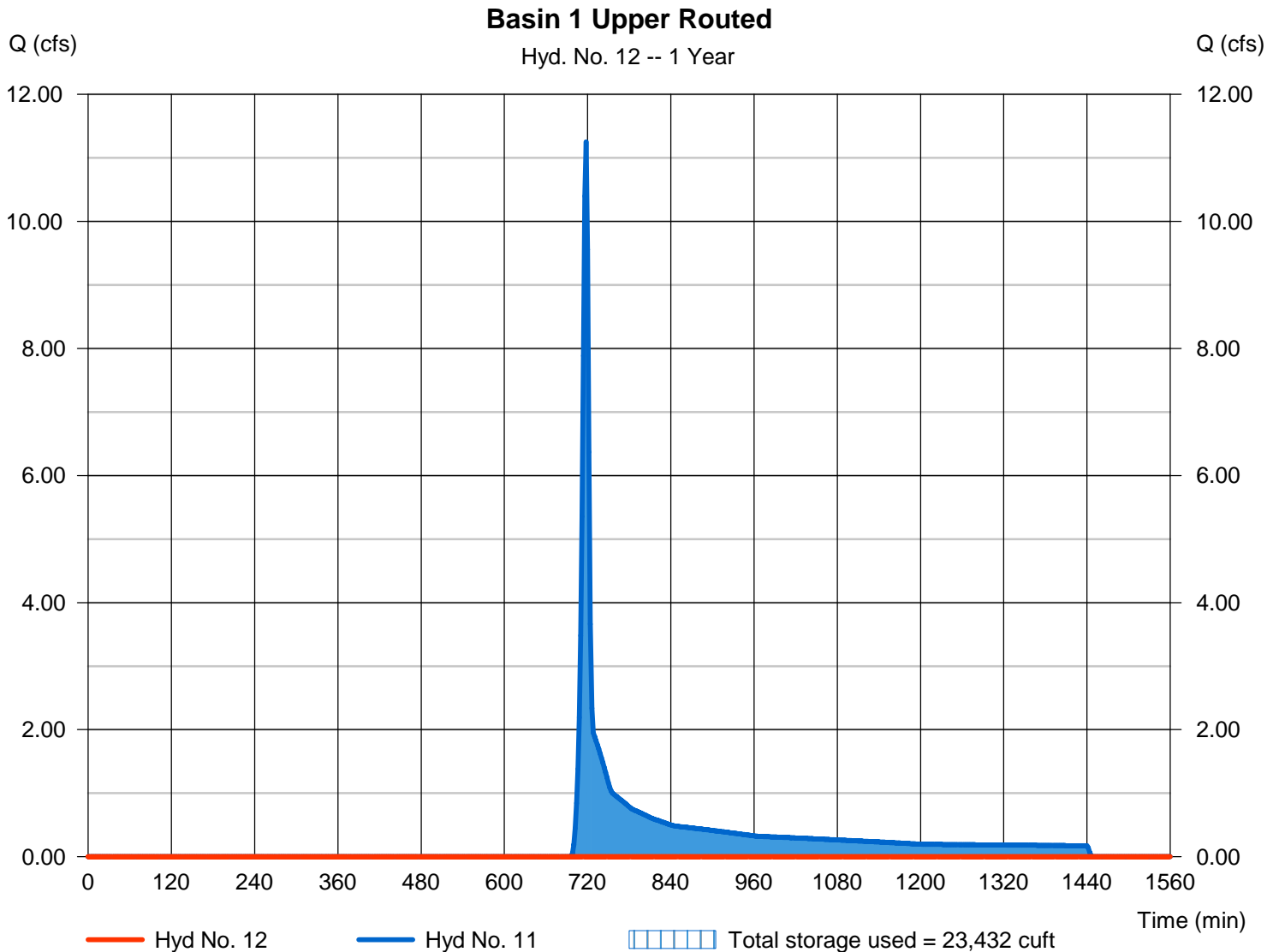
Monday, 03 / 24 / 2025

Hyd. No. 12

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.	= 11 - Post Basin 1	Max. Elevation	= 321.56 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 23,432 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 = 320.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	320.00	13,236	0	0
2.00	322.00	16,755	29,991	29,991
4.00	324.00	20,617	37,372	67,363
6.00	326.00	24,500	45,117	112,480

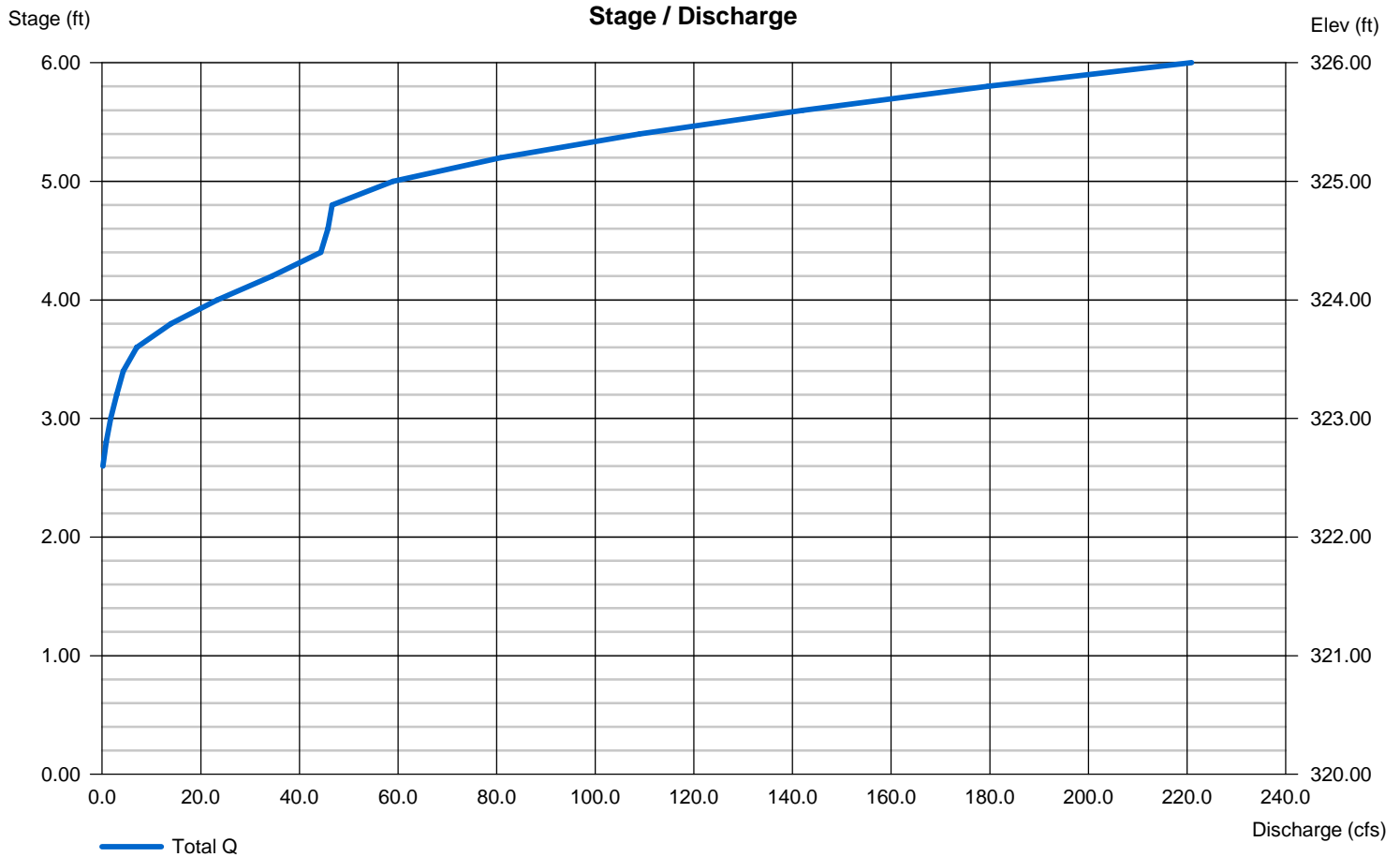
Culvert / Orifice Structures

	[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)	= 314.00	0.00	0.00	0.00
Length (ft)	= 80.53	0.00	0.00	0.00
Slope (%)	= 9.93	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)	= 323.50	322.50	324.80	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. v2024

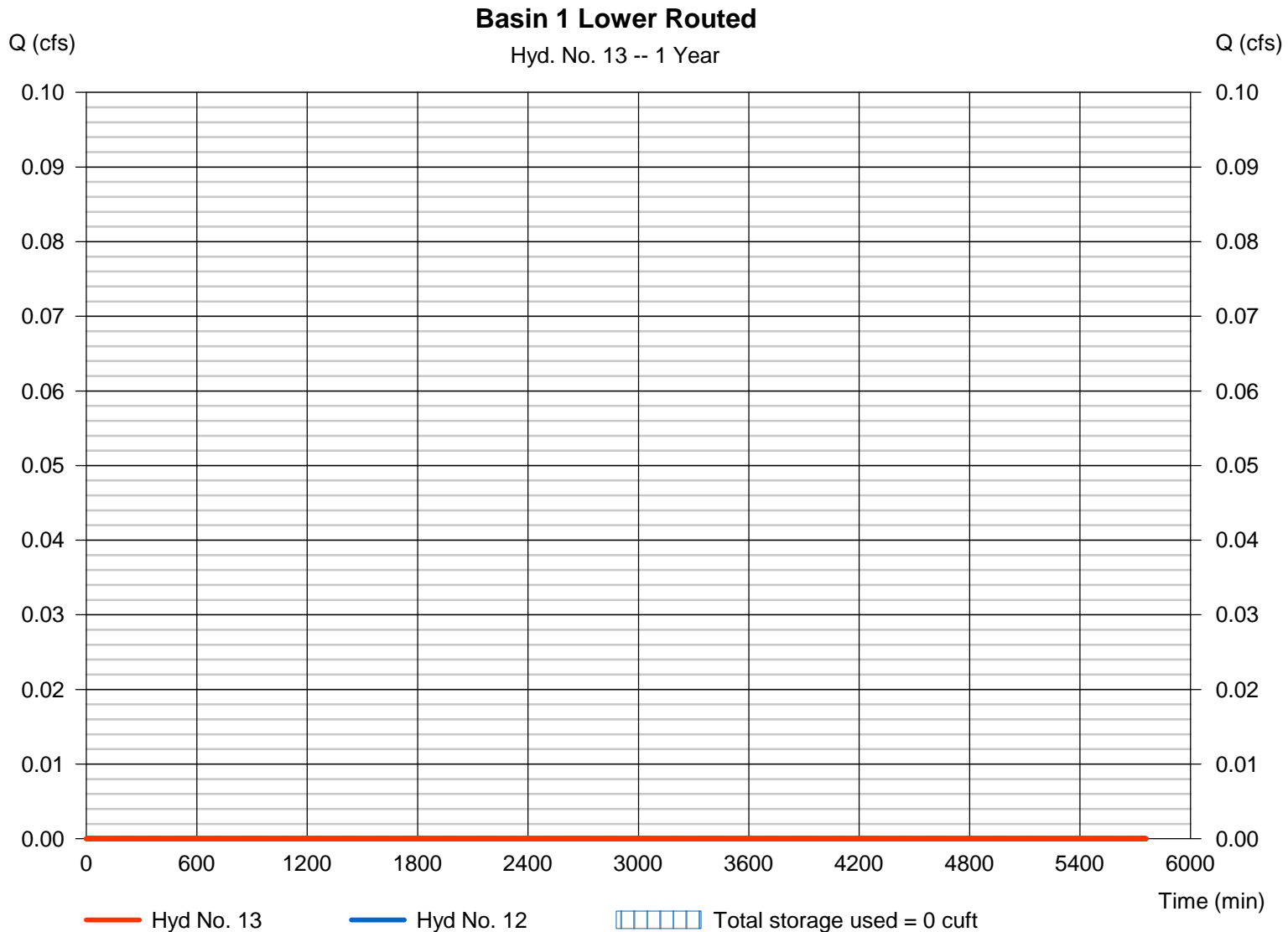
Monday, 03 / 24 / 2025

Hyd. No. 13

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.	= 12 - Basin 1 Upper Routed	Max. Elevation	= 302.00 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 = 302.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	302.00	2,215	0	0
2.00	304.00	3,972	6,187	6,187
4.00	306.00	10,535	14,507	20,694
6.00	308.00	14,870	25,405	46,099

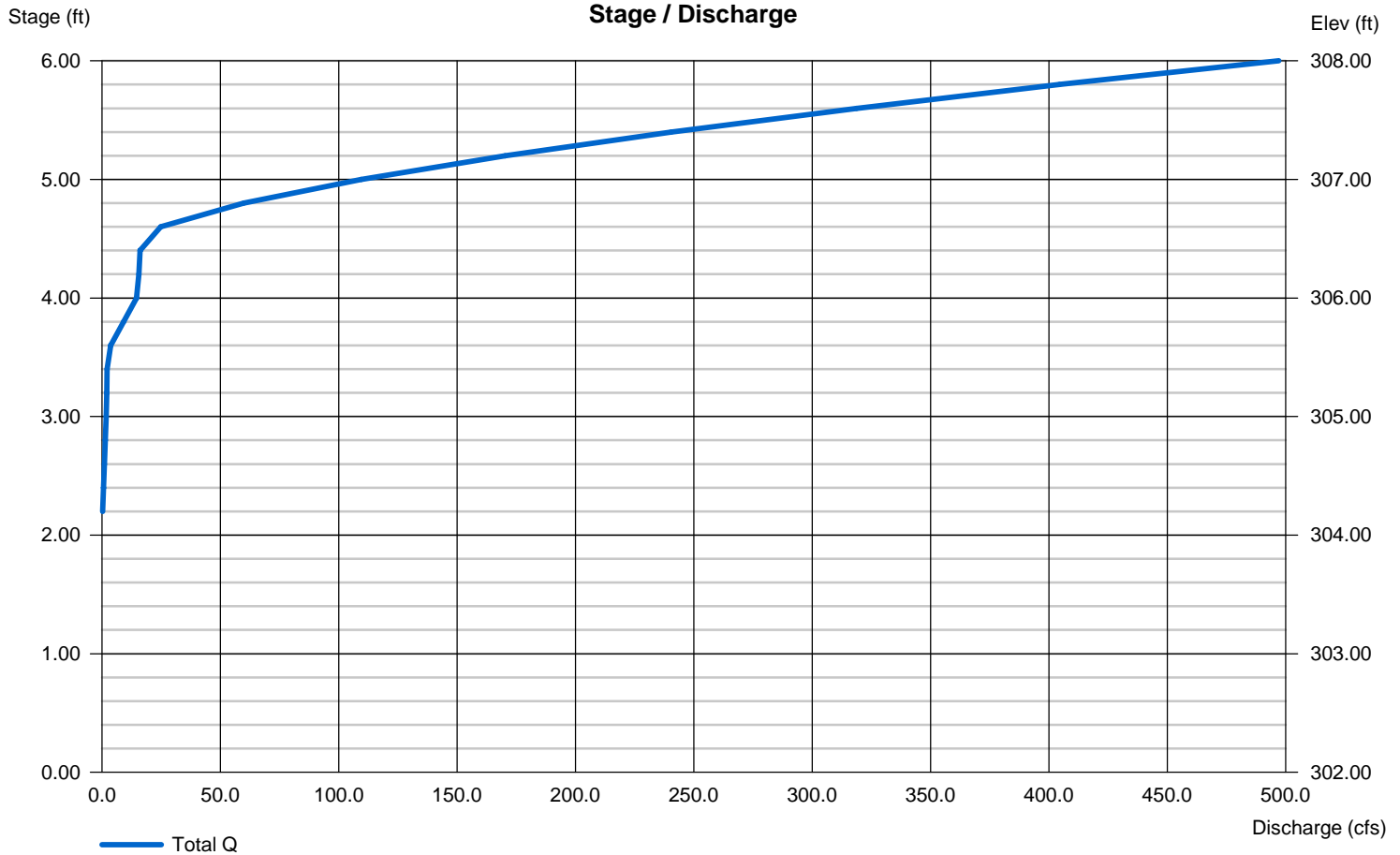
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	9.00	0.00	0.00
Span (in)	= 18.00	9.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 302.00	304.00	0.00	0.00
Length (ft)	= 41.01	0.00	0.00	0.00
Slope (%)	= 41.02	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)	= 305.50	306.50	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

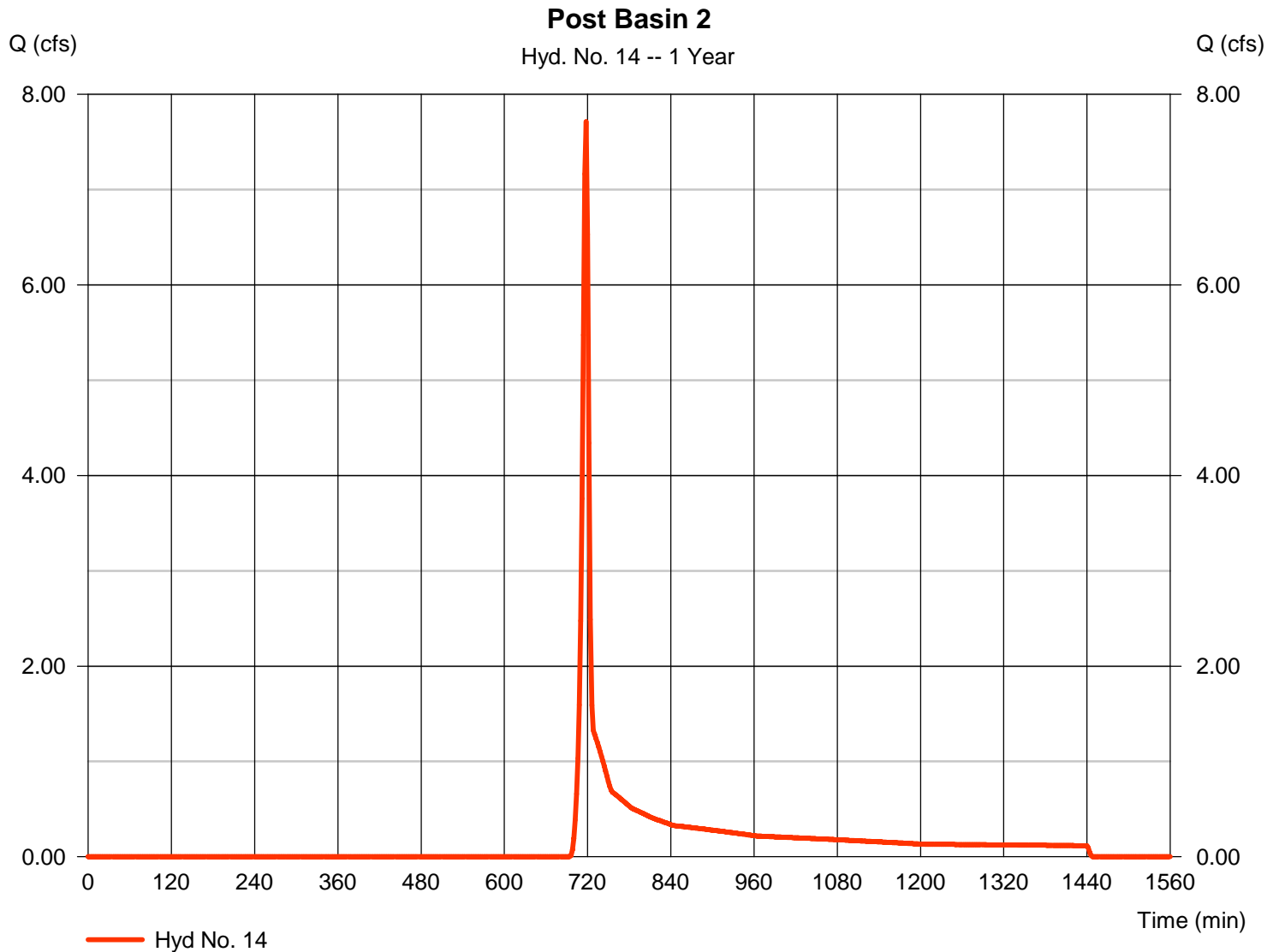
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 14

Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 7.713 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 15,969 cuft
Drainage area	= 7.530 ac	Curve number	= 71.7
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. v2024

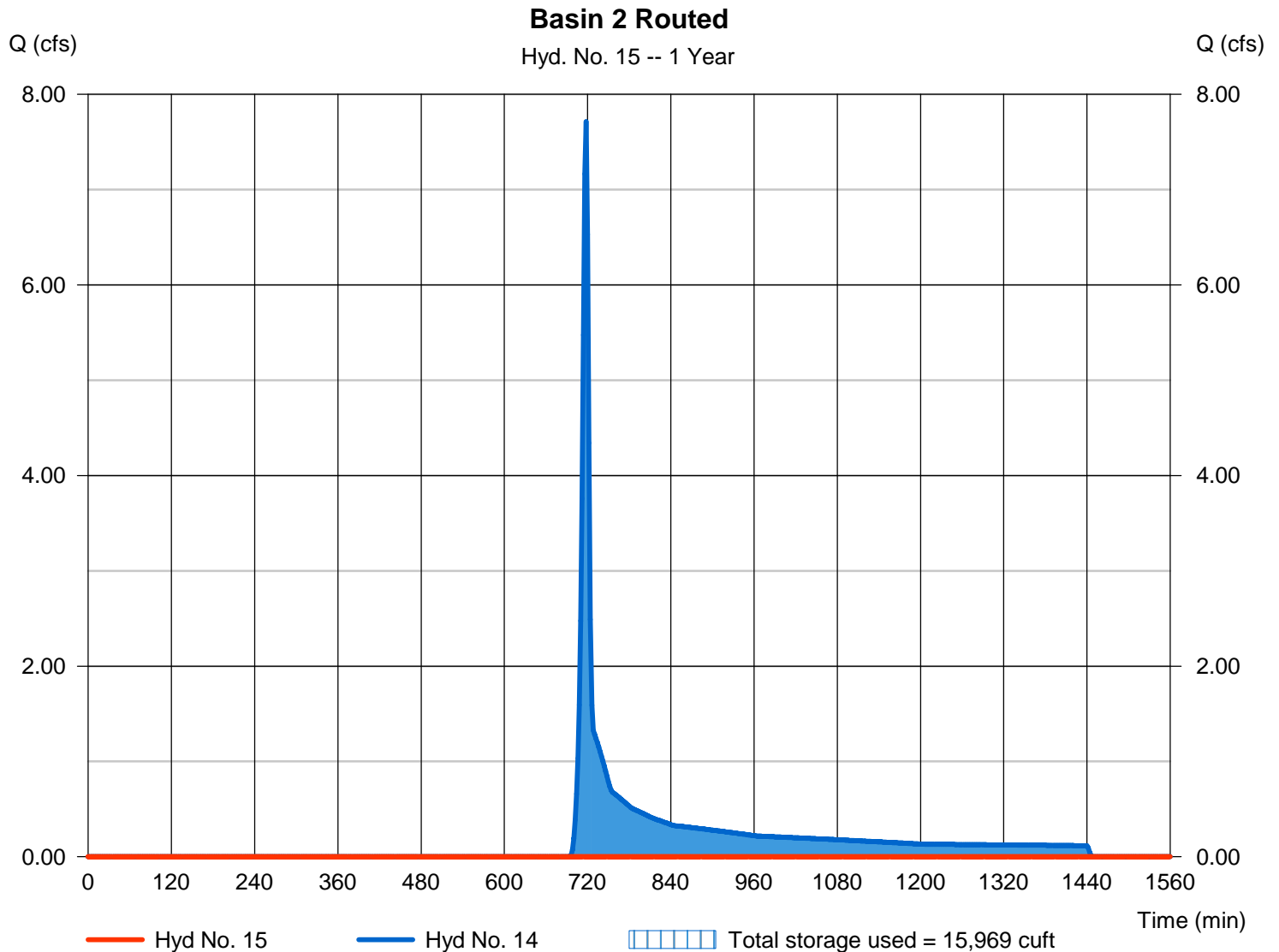
Monday, 03 / 24 / 2025

Hyd. No. 15

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.	= 14 - Post Basin 2	Max. Elevation	= 307.54 ft
Reservoir name	= Basin 2	Max. Storage	= 15,969 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 = 306.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	306.00	8,255	0	0
2.00	308.00	12,443	20,698	20,698
4.00	310.00	16,673	29,116	49,814
6.00	312.00	21,110	37,783	87,597

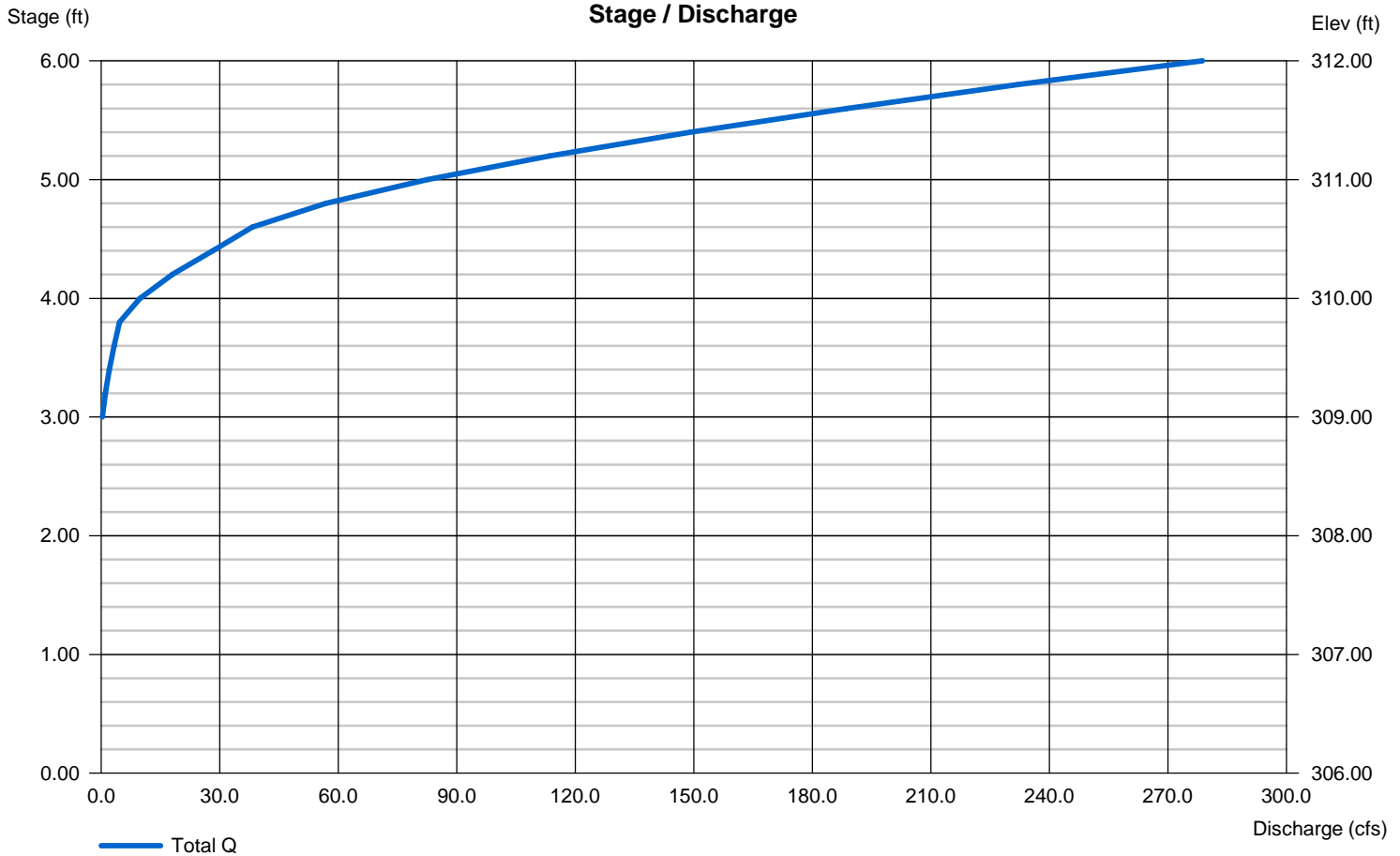
Culvert / Orifice Structures

	[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)	= 304.00	0.00	0.00	0.00
Length (ft)	= 66.28	0.00	0.00	0.00
Slope (%)	= 12.07	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)	= 309.80	308.85	310.50	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).



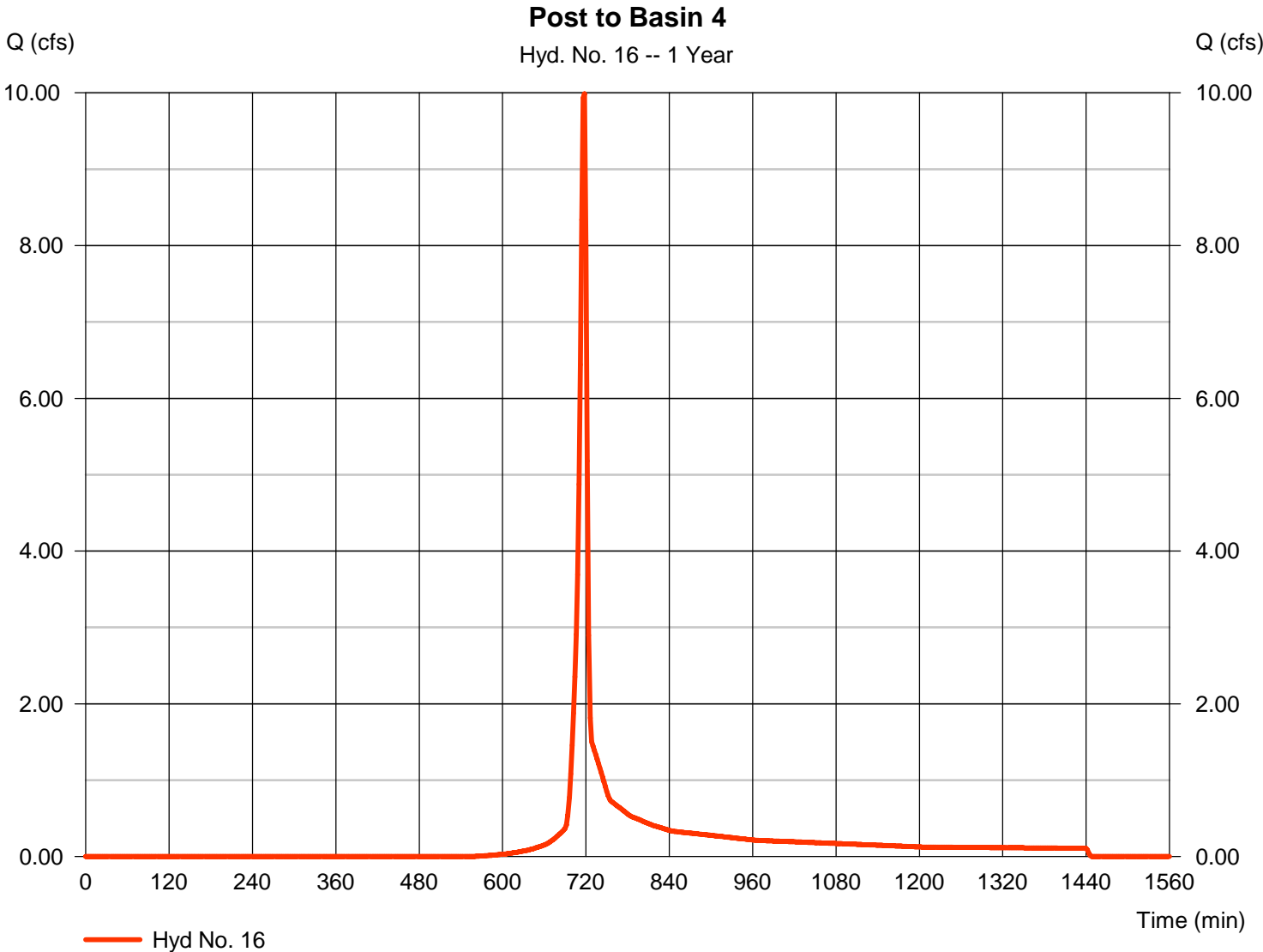
Hydrograph Report

Hyd. No. 16

Post to Basin 4

Hydrograph type	= SCS Runoff	Peak discharge	= 9.988 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 20,075 cuft
Drainage area	= 4.930 ac	Curve number	= 82.8*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.930



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

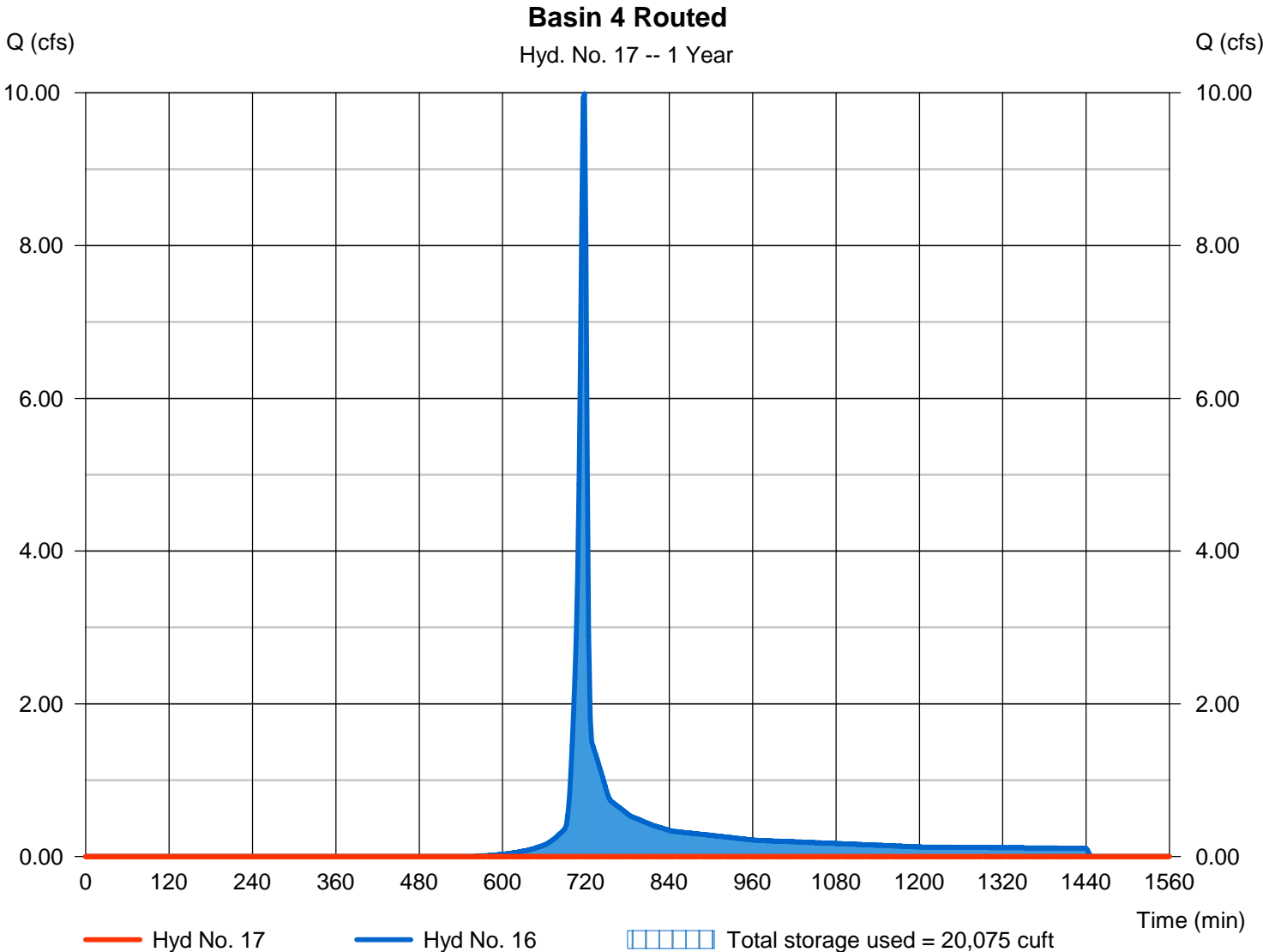
Monday, 03 / 24 / 2025

Hyd. No. 17

Basin 4 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.	= 16 - Post to Basin 4	Max. Elevation	= 347.75 ft
Reservoir name	= Basin 4	Max. Storage	= 20,075 cuft

Storage Indication method used.



Pond No. 7 - Basin 4

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 345.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	345.00	5,537	0	0
1.00	346.00	6,717	6,127	6,127
3.00	348.00	9,246	15,963	22,090
5.00	350.00	12,000	21,246	43,336

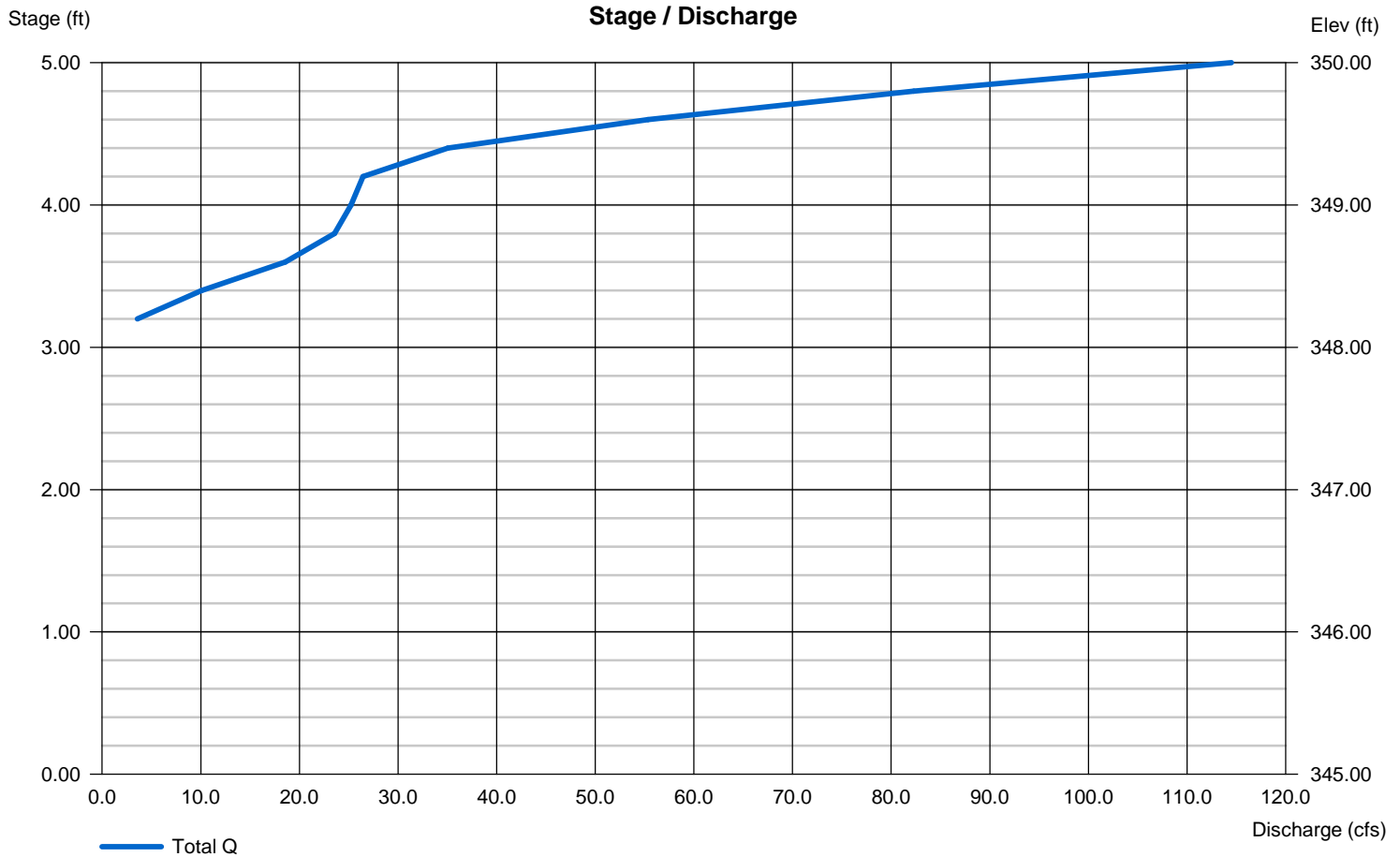
Culvert / Orifice Structures

	[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)	= 345.00	0.00	0.00	0.00
Length (ft)	= 36.53	0.00	0.00	0.00
Slope (%)	= 2.74	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	0.00	50.00	0.00
Crest El. (ft)	= 348.00	0.00	349.25	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	---	Broad	---
Multi-Stage	= Yes	No	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

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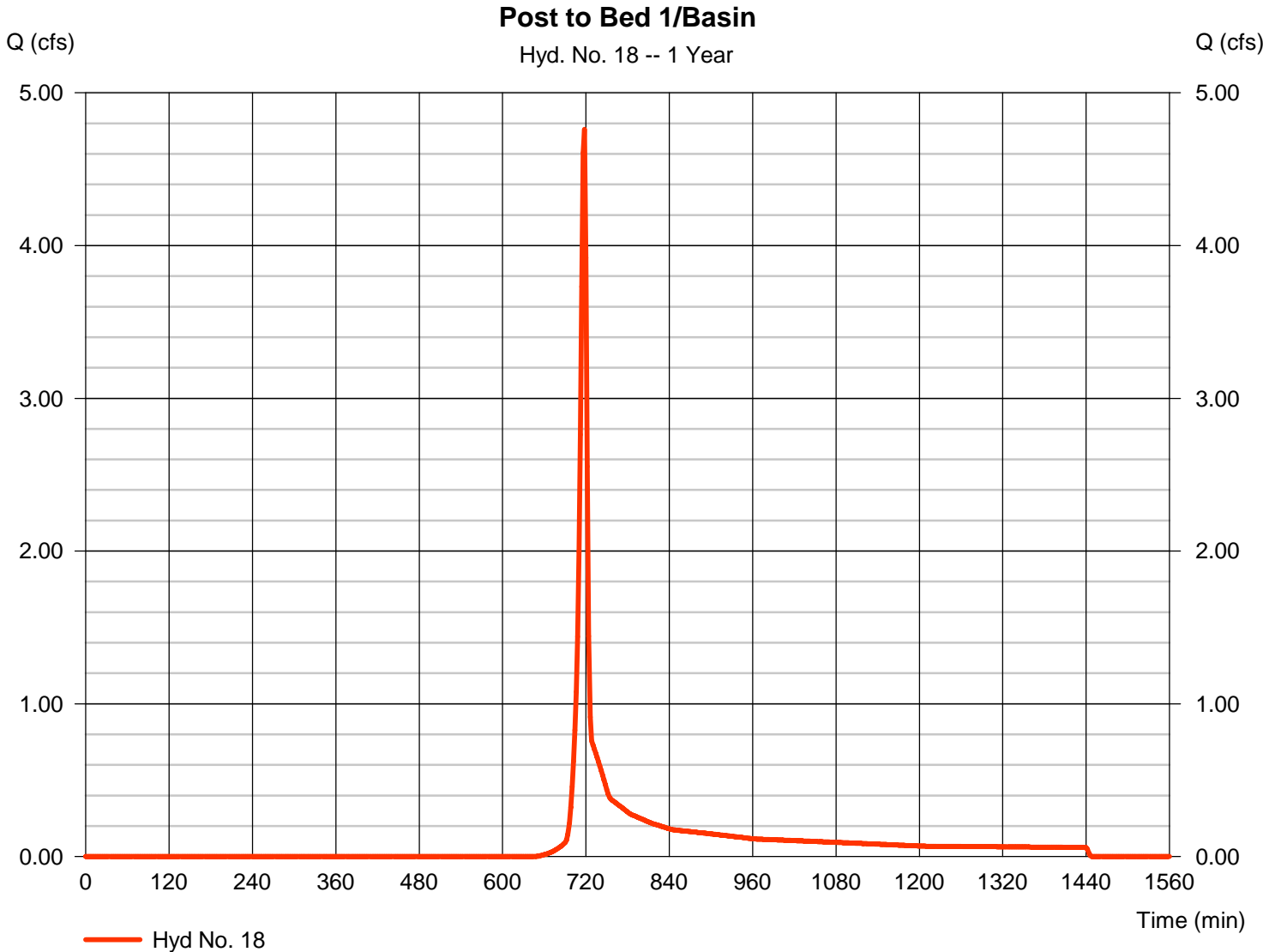
Monday, 03 / 24 / 2025

Hyd. No. 18

Post to Bed 1/Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 4.761 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 9,541 cuft
Drainage area	= 3.190 ac	Curve number	= 77.2*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 3.190



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

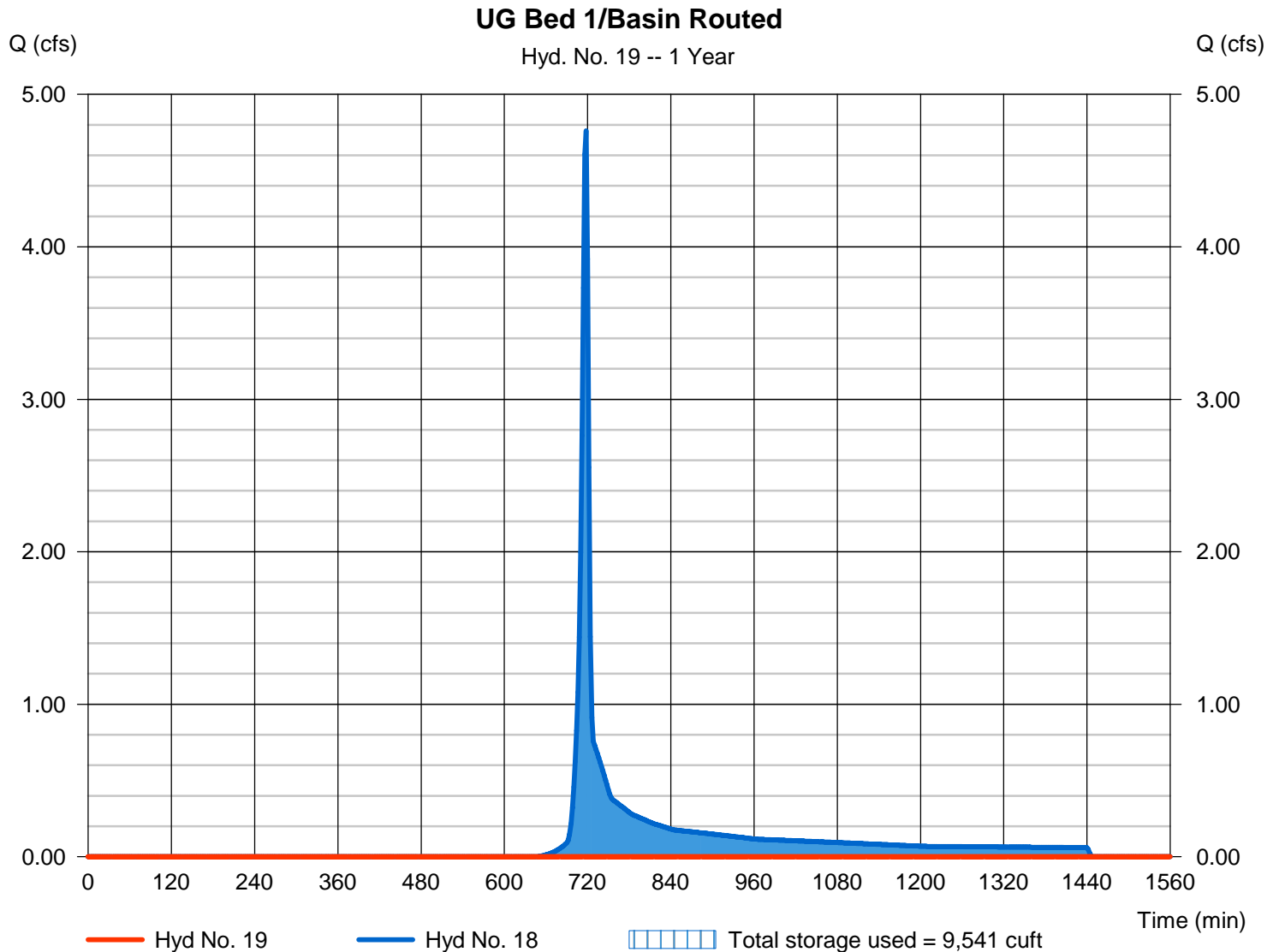
Monday, 03 / 24 / 2025

Hyd. No. 19

UG Bed 1/Basin 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.	= 18 - Post to Bed 1/Basin	Max. Elevation	= 339.48 ft
Reservoir name	= UG Bed 5/Basin	Max. Storage	= 9,541 cuft

Storage Indication method used.



Pond Report

Pond No. 6 - UG Bed 5/Basin

Pond Data

Capacity = 32,443 cuft, Inlet Elevation = 344.00 ft, Outlet Elevation = 336.00 ft, Depth = 8.00 ft, Bottom Elevation = 336.00 ft, Area = 6,945 sqft, Perimeter = 11,995 ft, Slope = 4.23%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	336.00	6,075	0	0
0.30	336.30	6,075	729	729
0.60	336.60	6,075	729	1,458
0.90	336.90	6,075	729	2,187
1.20	337.20	6,075	729	2,916
1.50	337.50	6,075	729	3,645
1.80	337.80	6,075	729	4,374
2.10	338.10	6,075	729	5,103
2.40	338.40	6,075	729	5,832
2.70	338.70	6,075	729	6,561
3.00	339.00	6,075	729	7,290
4.00	340.00	3,380	4,728	12,018
6.00	342.00	5,050	8,430	20,448
8.00	344.00	6,945	11,995	32,443

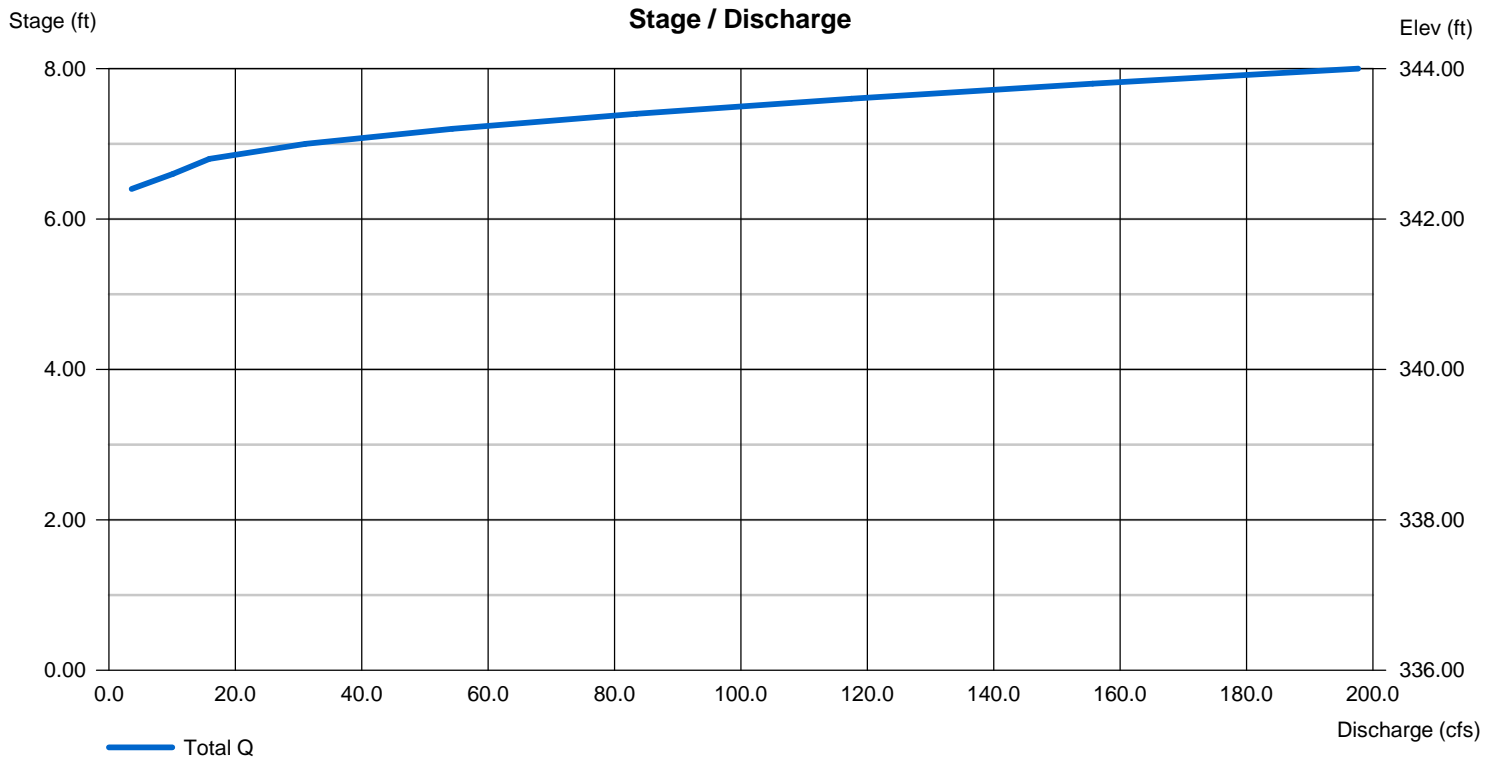
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	0.00	0.00	0.00
Span (in)	= 15.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 336.00	0.00	0.00	0.00
Length (ft)	= 47.13	0.00	0.00	0.00
Slope (%)	= 4.23	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	0.00	50.00	0.00
Crest El. (ft)	= 342.20	0.00	342.75	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	---	Broad	---
Multi-Stage	= Yes	No	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).

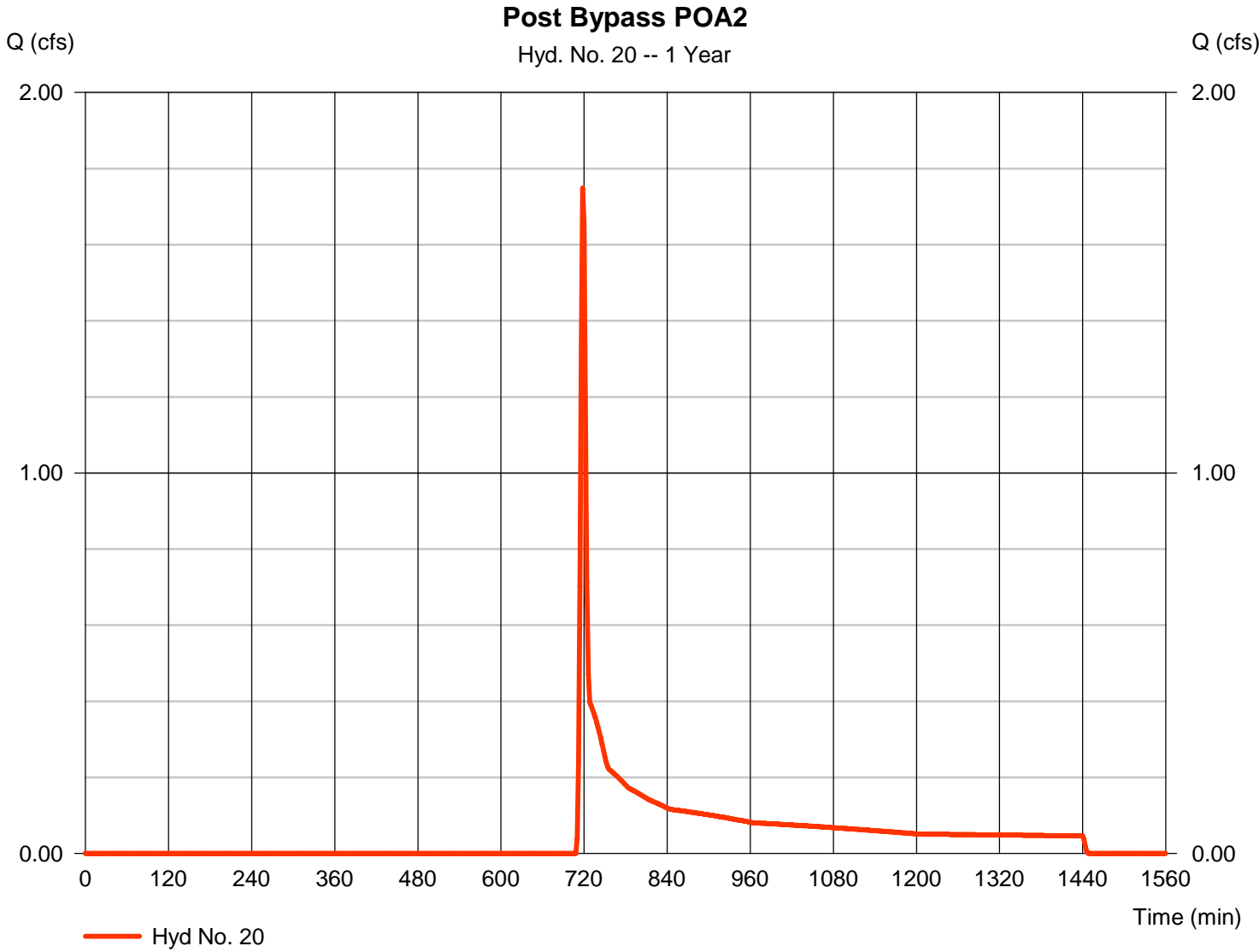


Hydrograph Report

Hyd. No. 20

Post Bypass POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.749 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 4,742 cuft
Drainage area	= 4.390 ac	Curve number	= 63.1
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



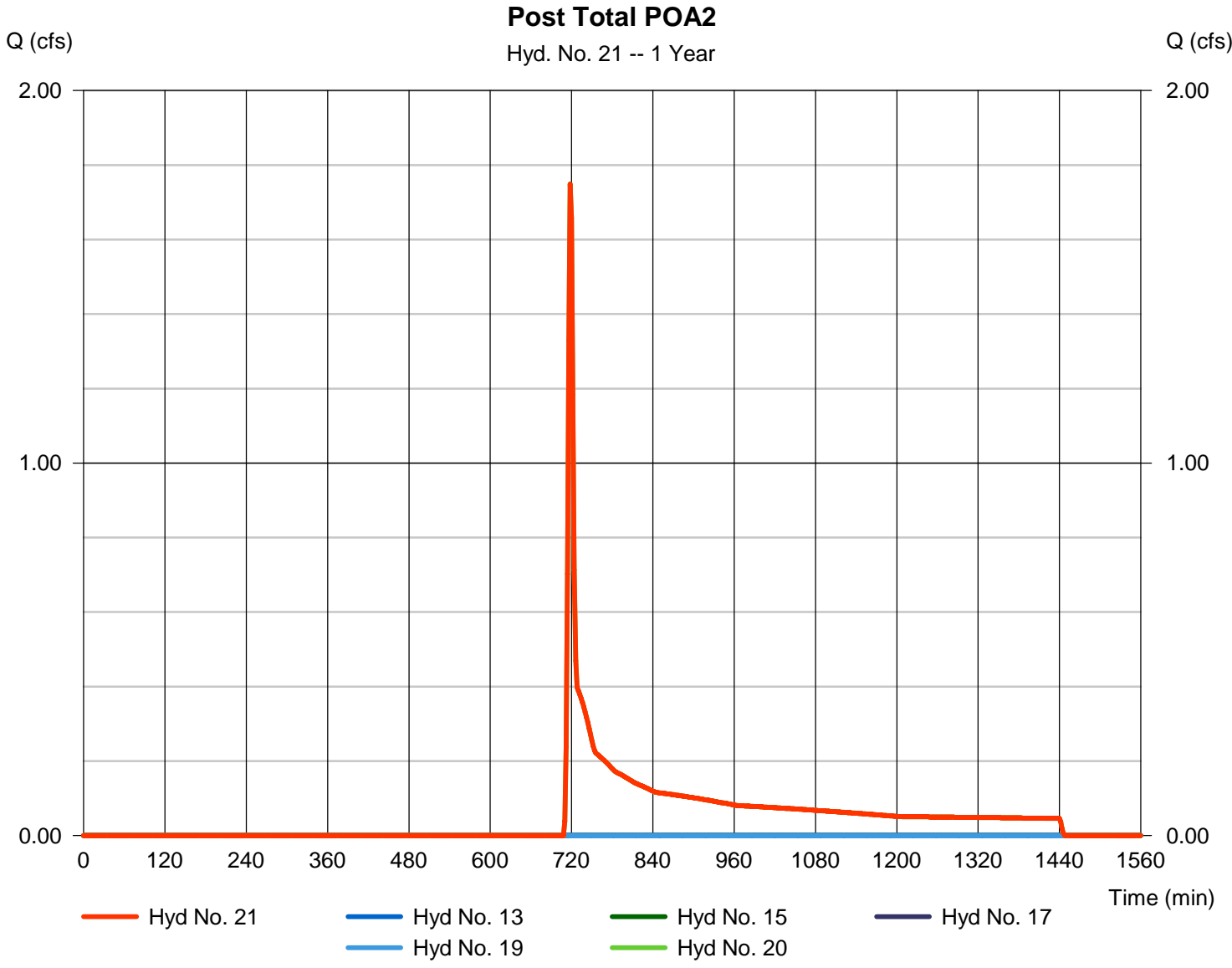
Hydrograph Report

Hyd. No. 21

Post Total POA2

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 2 min
Inflow hyds. = 13, 15, 17, 19, 20

Peak discharge = 1.749 cfs
Time to peak = 718 min
Hyd. volume = 4,742 cuft
Contrib. drain. area = 4.390 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

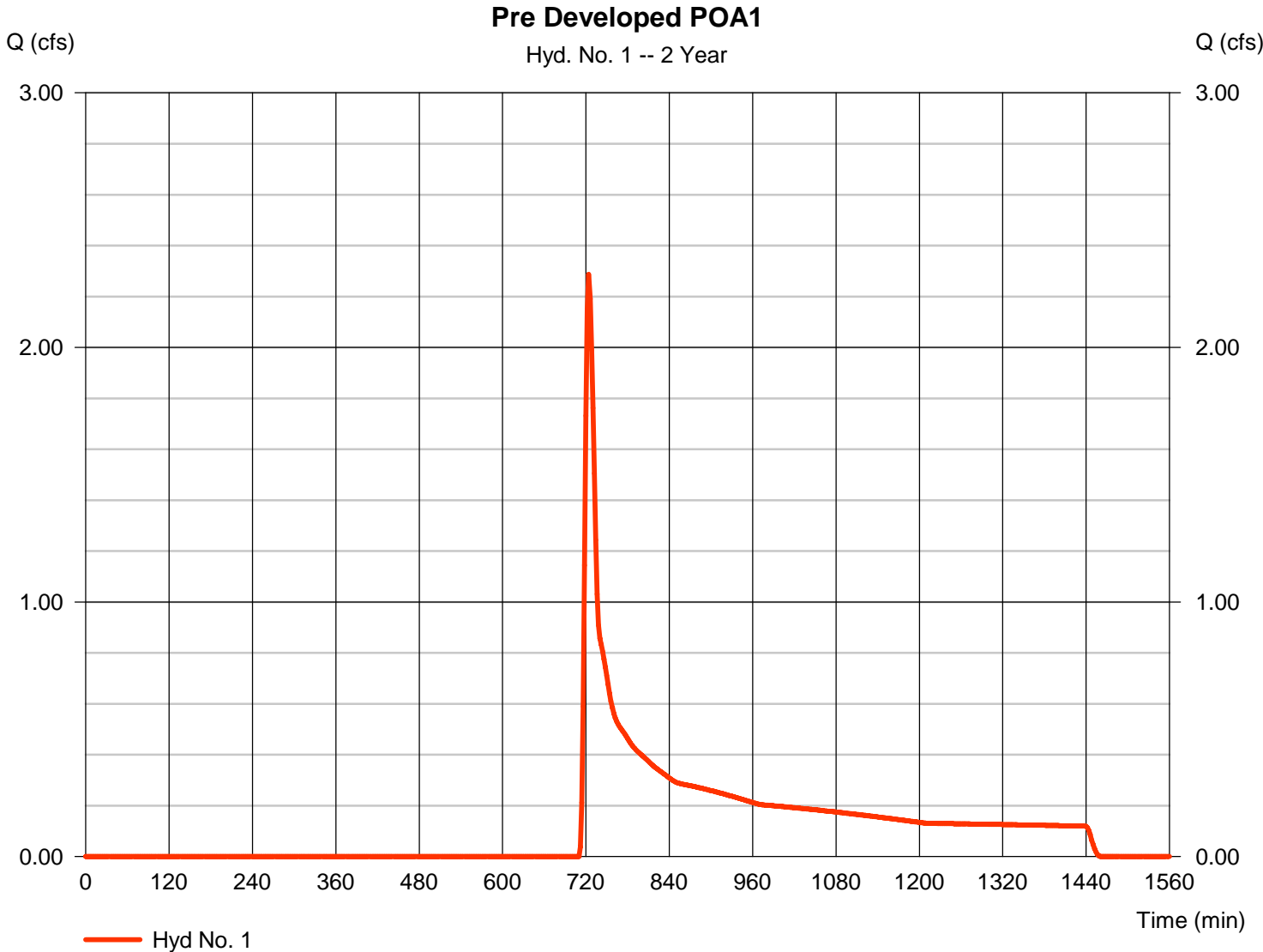
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.286	2	724	11,347	-----	-----	-----	Pre Developed POA1
2	SCS Runoff	14.34	2	722	50,433	-----	-----	-----	Pre Developed POA2
3	SCS Runoff	0.994	2	718	2,934	-----	-----	-----	Offsite POA1
4	SCS Runoff	1.332	2	718	2,917	-----	-----	-----	Offsite POA2
6	SCS Runoff	11.57	2	718	23,639	-----	-----	-----	Post Basin 3
7	Reservoir	0.000	2	n/a	0	6	317.24	23,639	Basin 3 Routed
8	SCS Runoff	1.458	2	718	3,334	-----	-----	-----	Post Bypass POA1
9	Combine	1.458	2	718	3,334	7, 8	-----	-----	Post Total POA1
11	SCS Runoff	17.07	2	718	34,552	-----	-----	-----	Post Basin 1
12	Reservoir	0.000	2	n/a	0	11	322.24	34,552	Basin 1 Upper Routed
13	Reservoir	0.000	2	n/a	0	12	302.00	0.000	Basin 1 Lower Routed
14	SCS Runoff	11.60	2	718	23,422	-----	-----	-----	Post Basin 2
15	Reservoir	0.000	2	n/a	0	14	308.19	23,422	Basin 2 Routed
16	SCS Runoff	13.25	2	716	26,757	-----	-----	-----	Post to Basin 4
17	Reservoir	0.237	2	1036	4,666	16	348.01	22,231	Basin 4 Routed
18	SCS Runoff	6.643	2	718	13,287	-----	-----	-----	Post to Bed 1/Basin
19	Reservoir	0.000	2	n/a	0	18	340.30	13,287	UG Bed 1/Basin Routed
20	SCS Runoff	3.457	2	718	7,815	-----	-----	-----	Post Bypass POA2
21	Combine	3.457	2	718	12,481	13, 15, 17, 19, 20	-----	-----	Post Total POA2
SWM.gpw					Return Period: 2 Year			Monday, 03 / 24 / 2025	

Hydrograph Report

Hyd. No. 1

Pre Developed POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 2.286 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 11,347 cuft
Drainage area	= 9.690 ac	Curve number	= 57.1
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

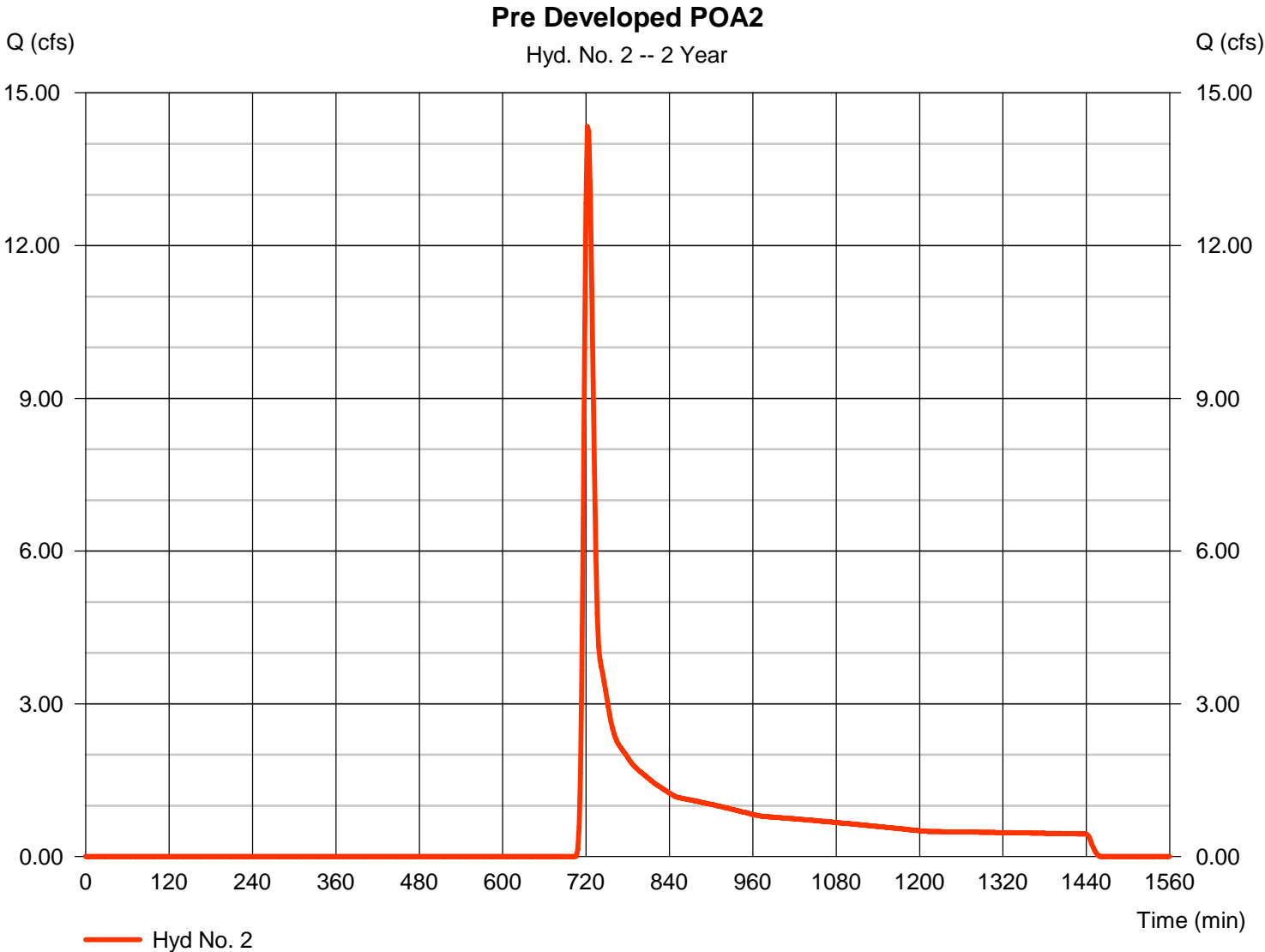


Hydrograph Report

Hyd. No. 2

Pre Developed POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 14.34 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 50,433 cuft
Drainage area	= 28.240 ac	Curve number	= 61.9
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

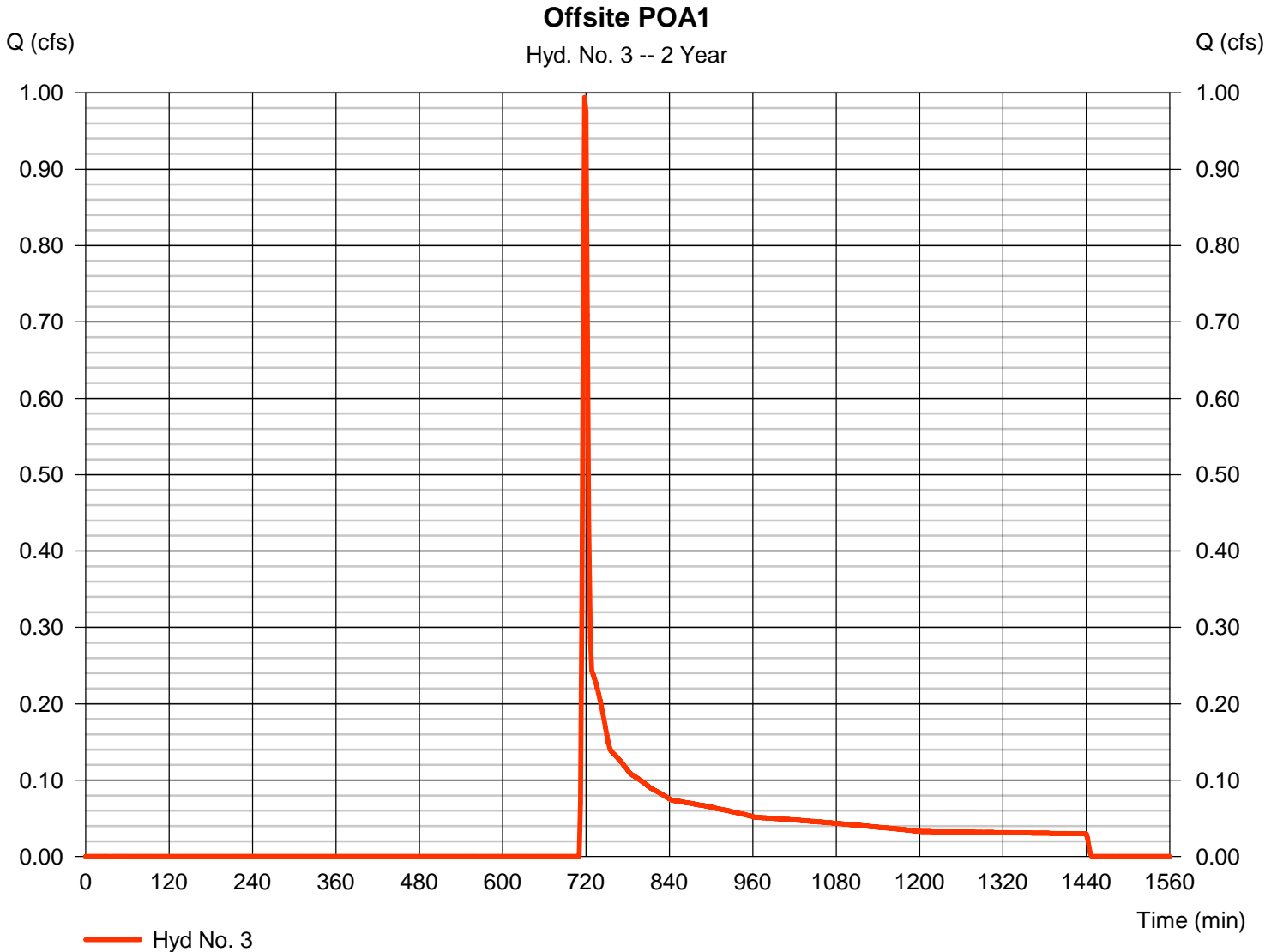


Hydrograph Report

Hyd. No. 3

Offsite POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.994 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,934 cuft
Drainage area	= 2.530 ac	Curve number	= 58
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

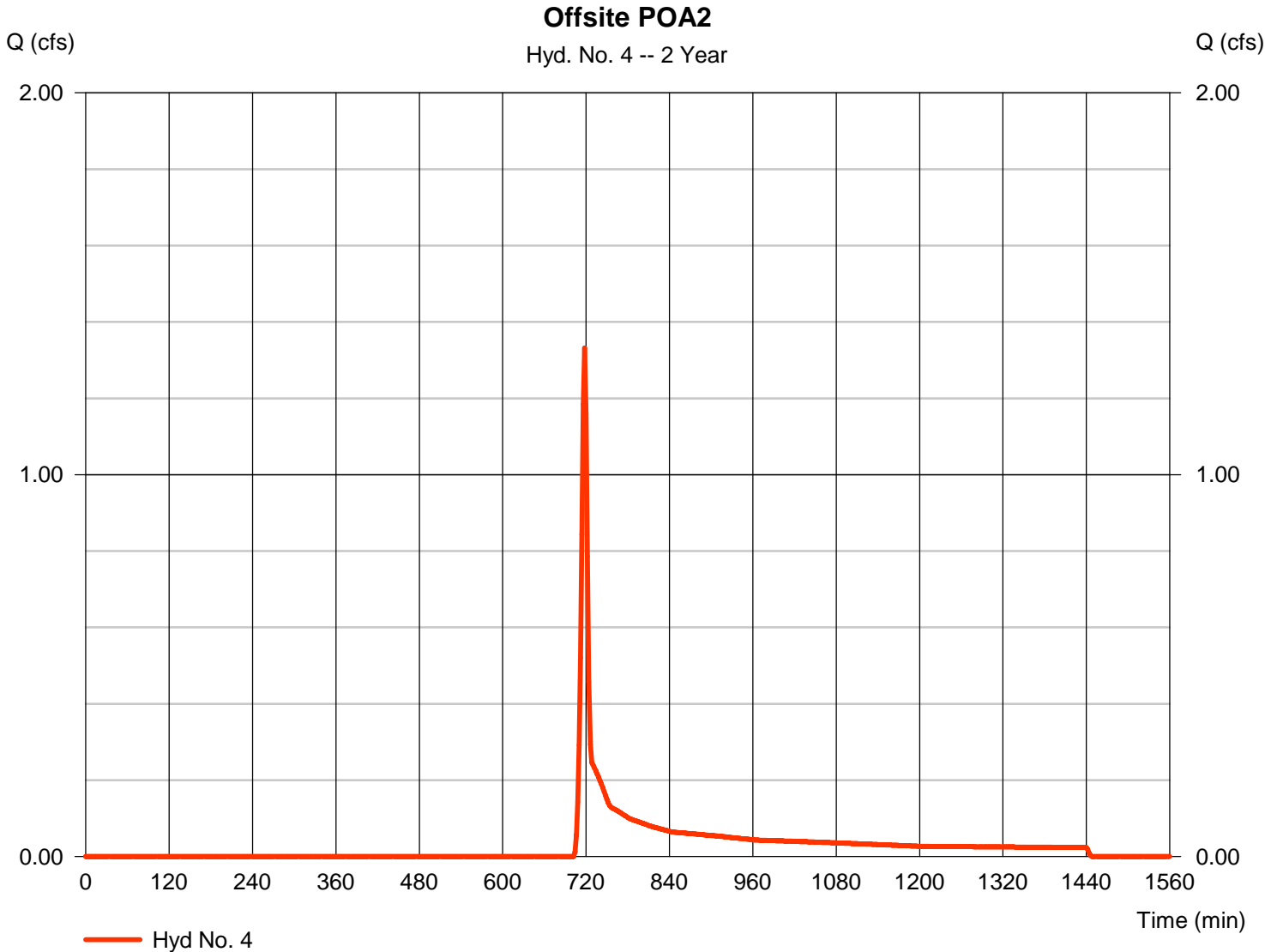


Hydrograph Report

Hyd. No. 4

Offsite POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.332 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,917 cuft
Drainage area	= 1.490 ac	Curve number	= 64.4
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

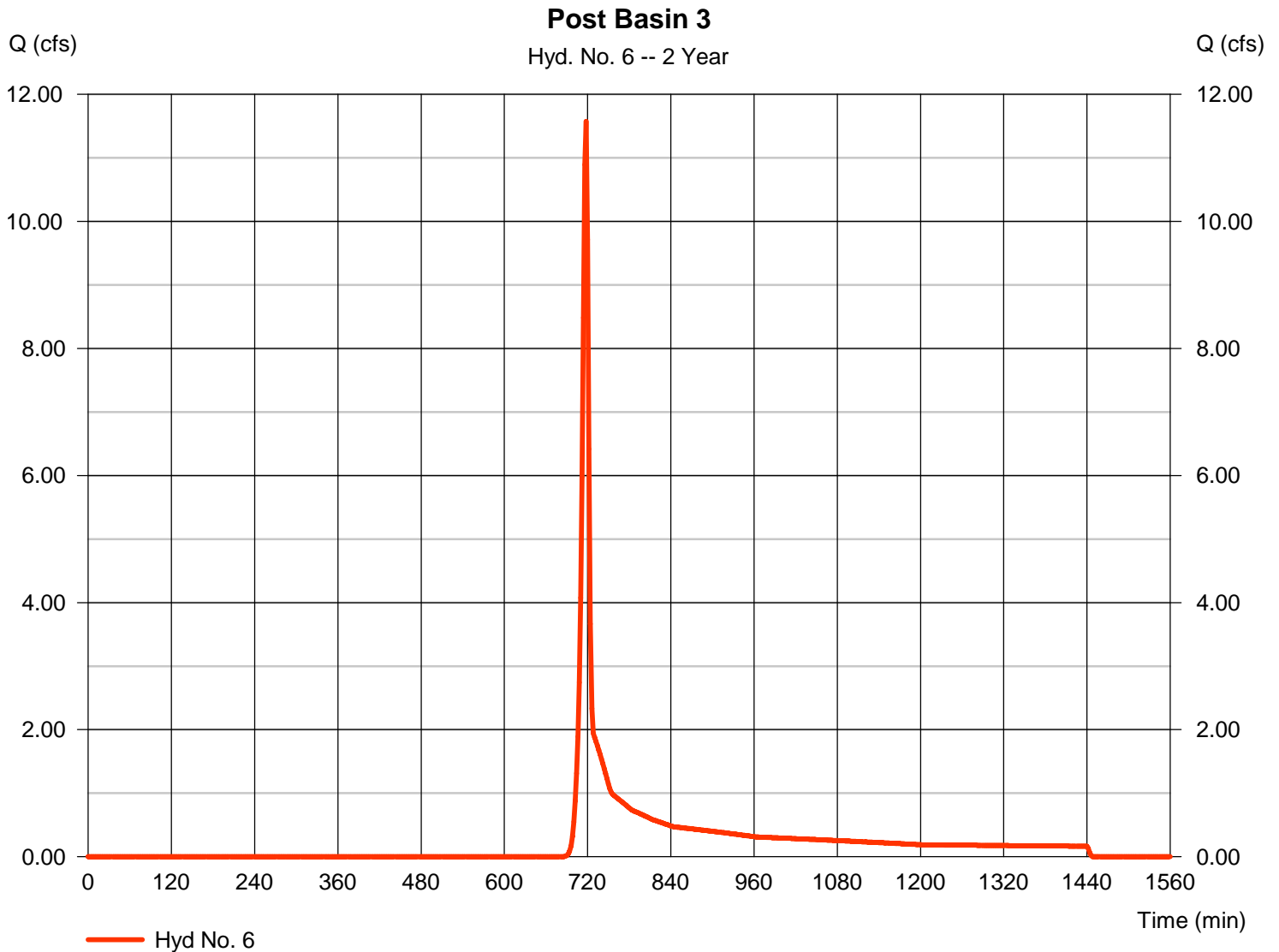
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 6

Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 11.57 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 23,639 cuft
Drainage area	= 8.540 ac	Curve number	= 69.7
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. v2024

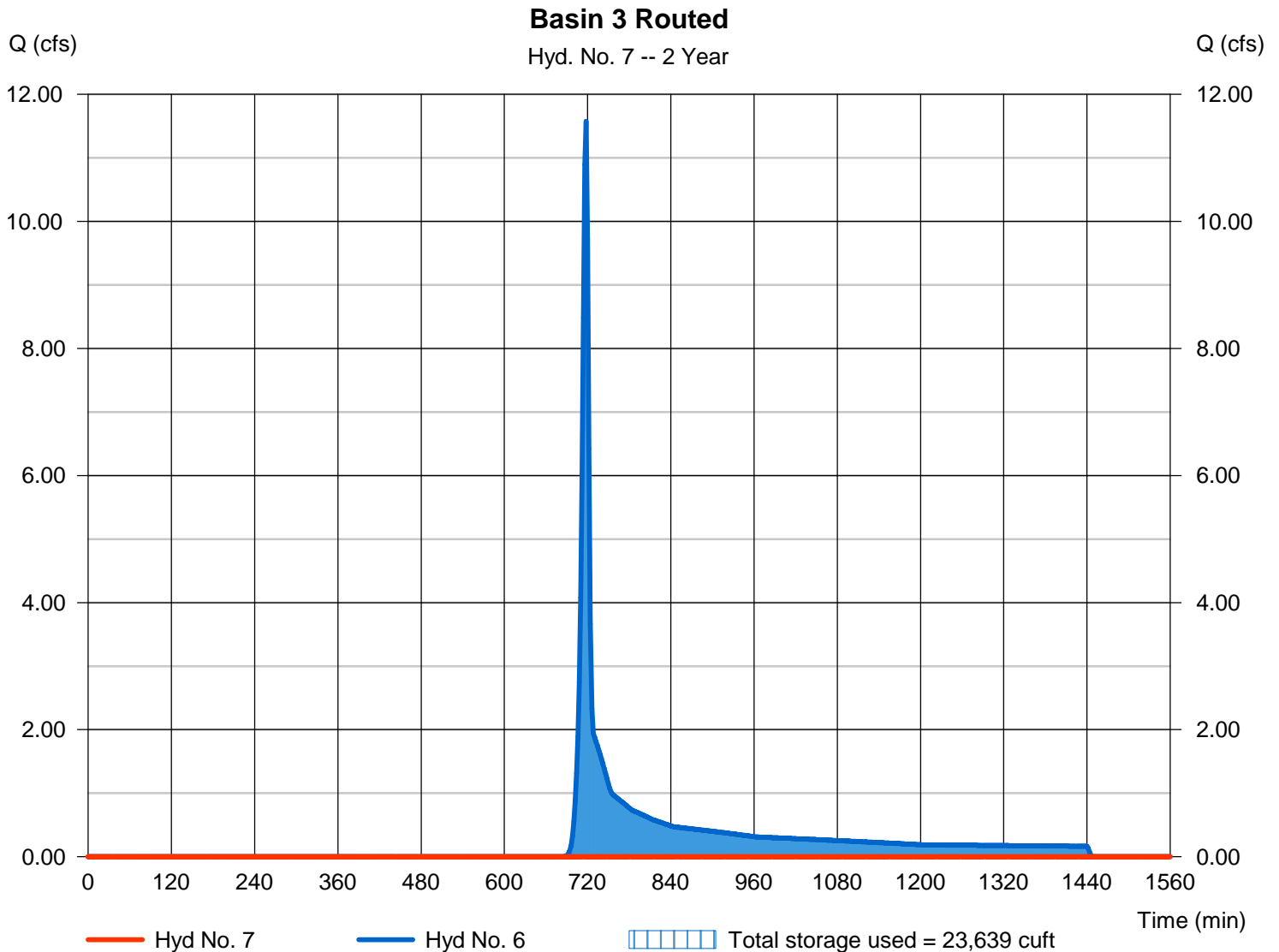
Monday, 03 / 24 / 2025

Hyd. No. 7

Basin 3 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.	= 6 - Post Basin 3	Max. Elevation	= 317.24 ft
Reservoir name	= Basin 3	Max. Storage	= 23,639 cuft

Storage Indication method used.

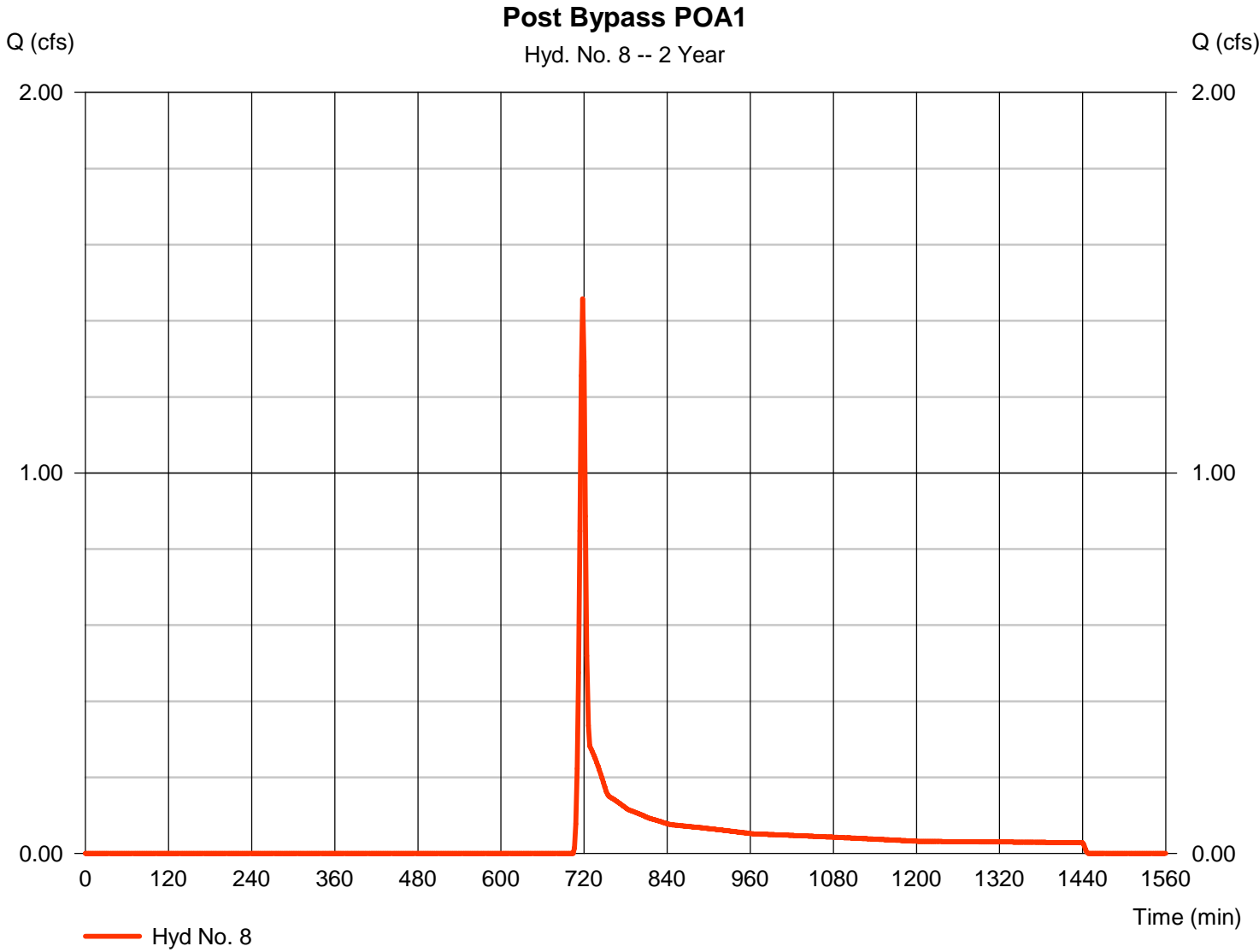


Hydrograph Report

Hyd. No. 8

Post Bypass POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.458 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 3,334 cuft
Drainage area	= 1.930 ac	Curve number	= 62.7
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. v2024

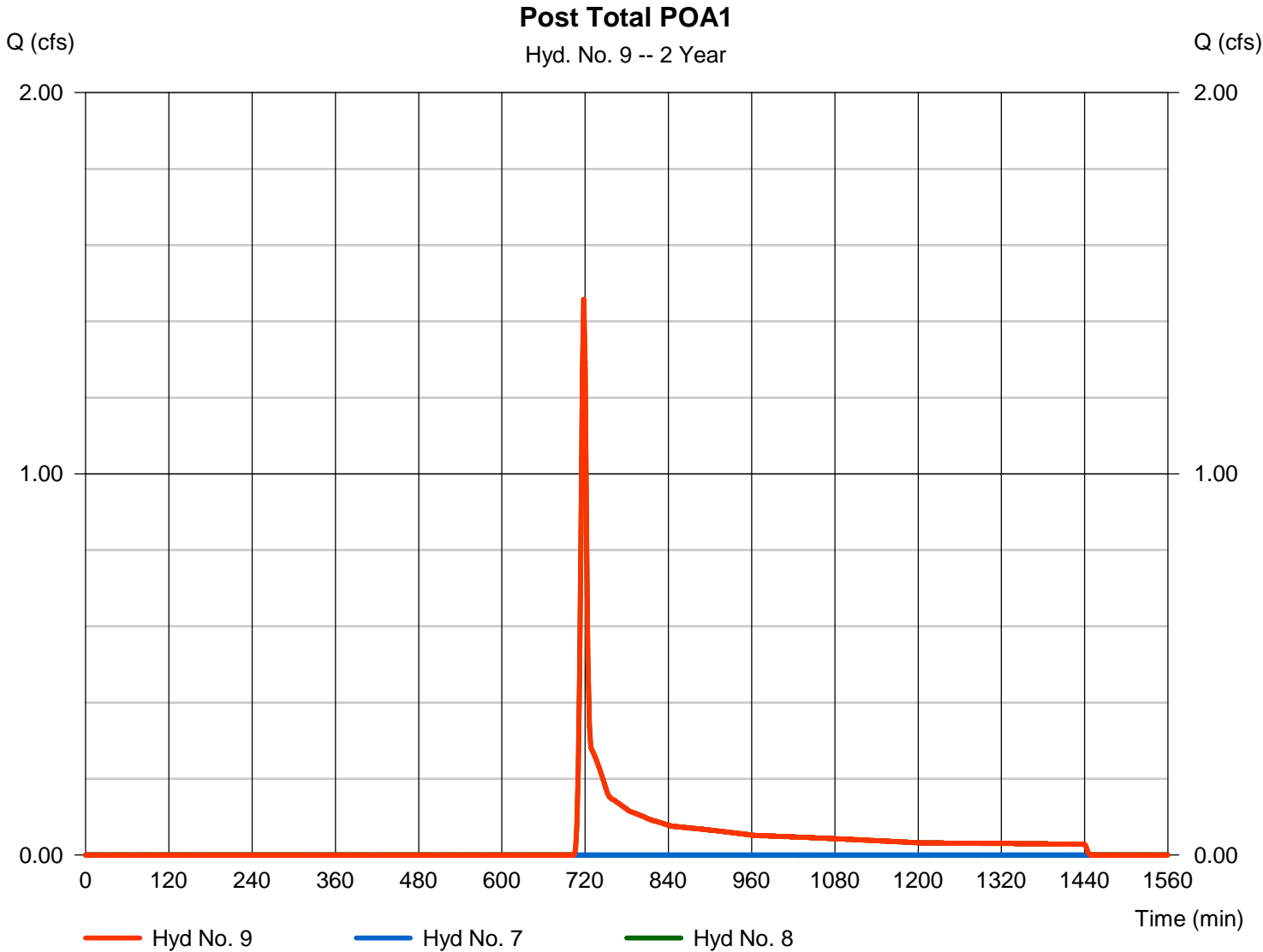
Monday, 03 / 24 / 2025

Hyd. No. 9

Post Total POA1

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 7, 8

Peak discharge = 1.458 cfs
Time to peak = 718 min
Hyd. volume = 3,334 cuft
Contrib. drain. area = 1.930 ac

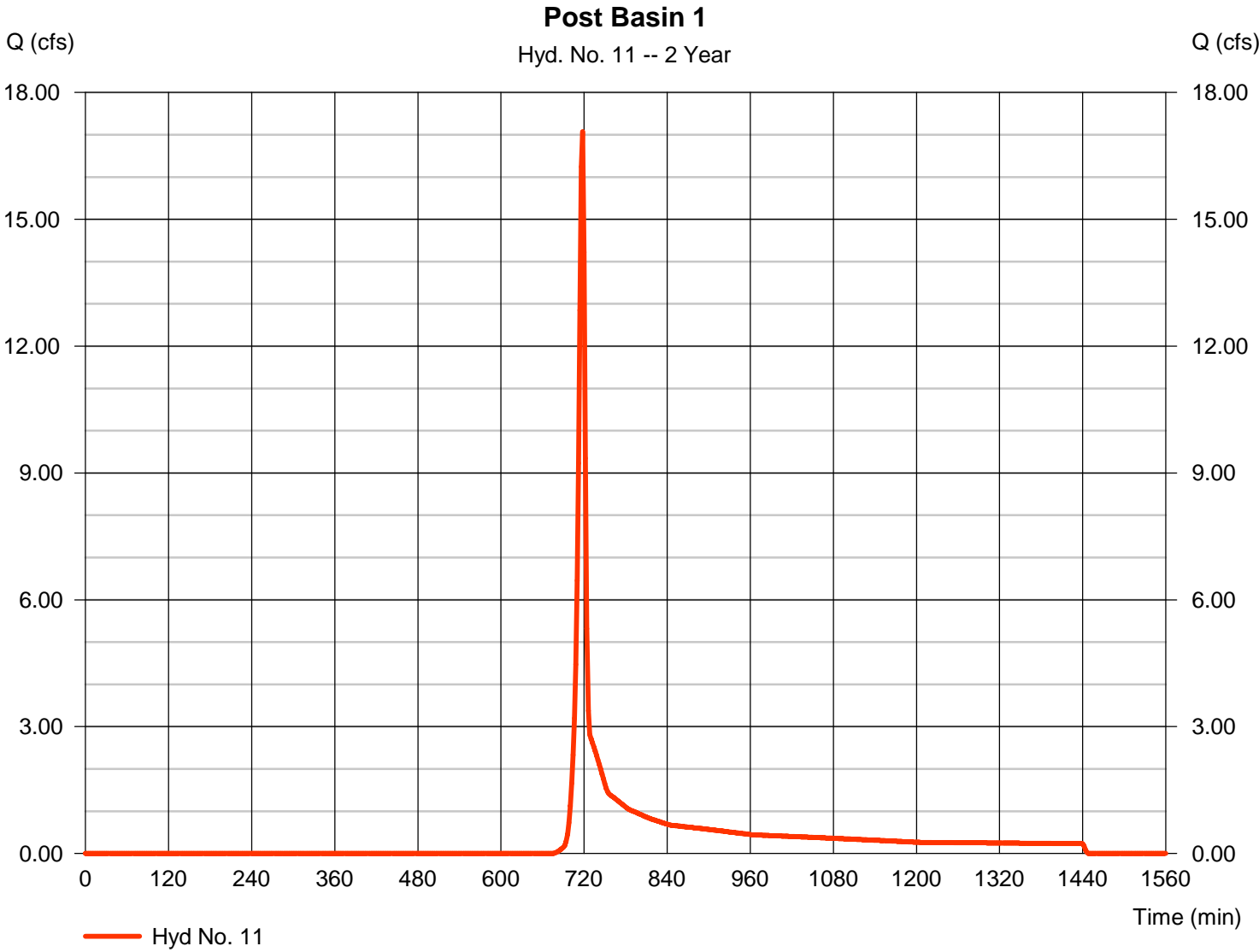


Hydrograph Report

Hyd. No. 11

Post Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 17.07 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 34,552 cuft
Drainage area	= 11.430 ac	Curve number	= 71.2
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. v2024

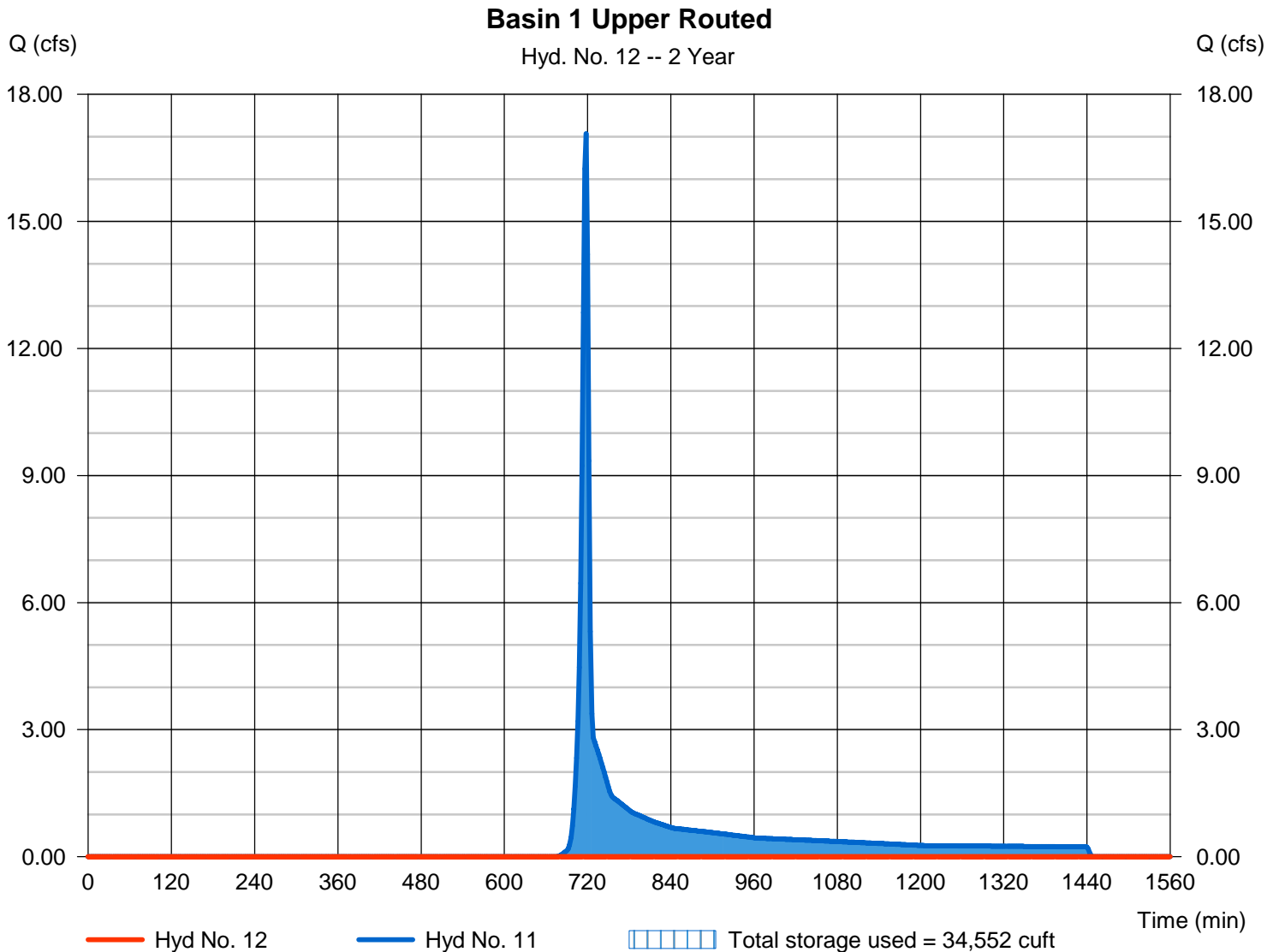
Monday, 03 / 24 / 2025

Hyd. No. 12

Basin 1 Upper 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.	= 11 - Post Basin 1	Max. Elevation	= 322.24 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 34,552 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

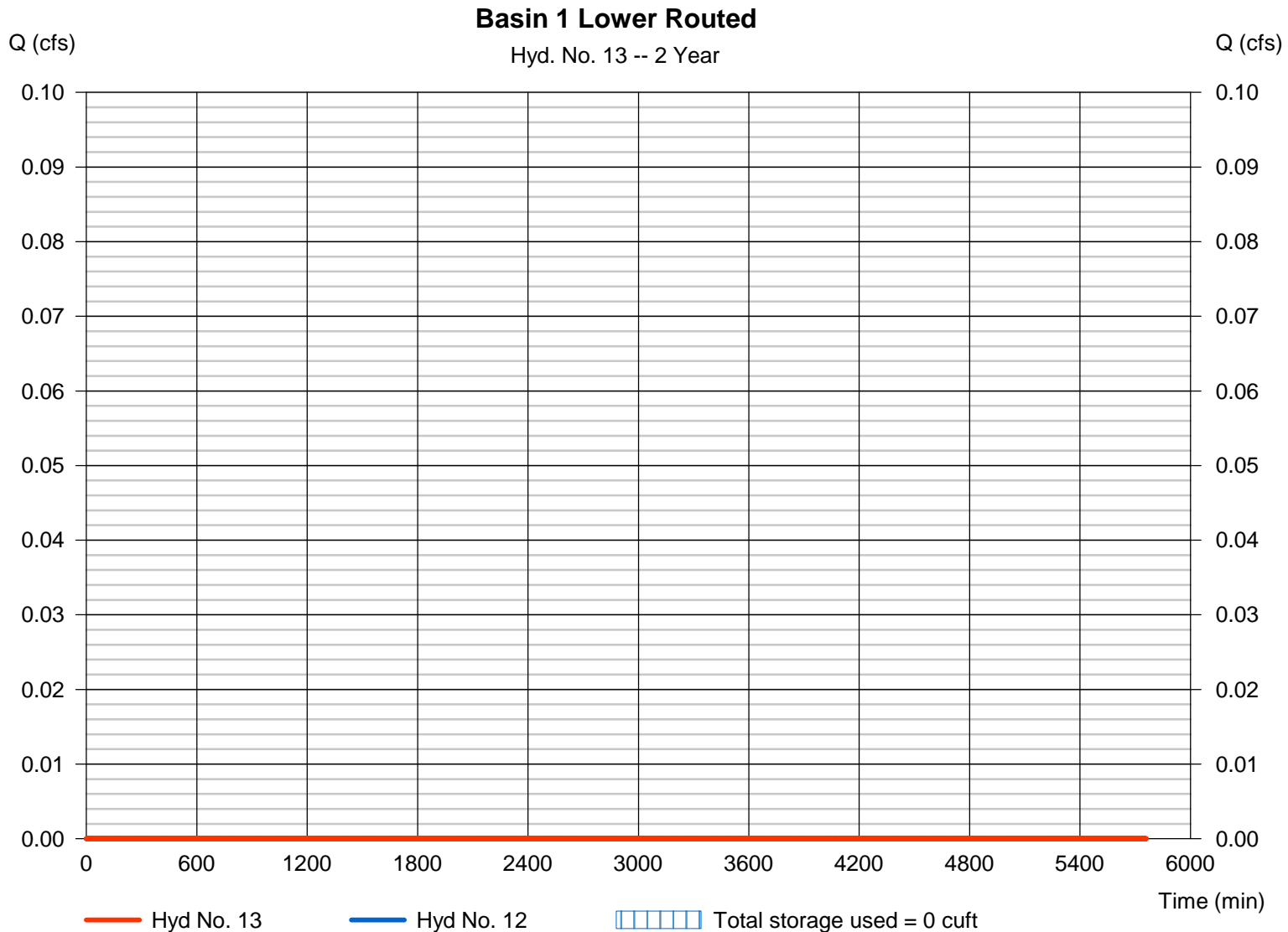
Monday, 03 / 24 / 2025

Hyd. No. 13

Basin 1 Lower 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 - Basin 1 Upper Routed	Max. Elevation	= 302.00 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 0 cuft

Storage Indication method used.

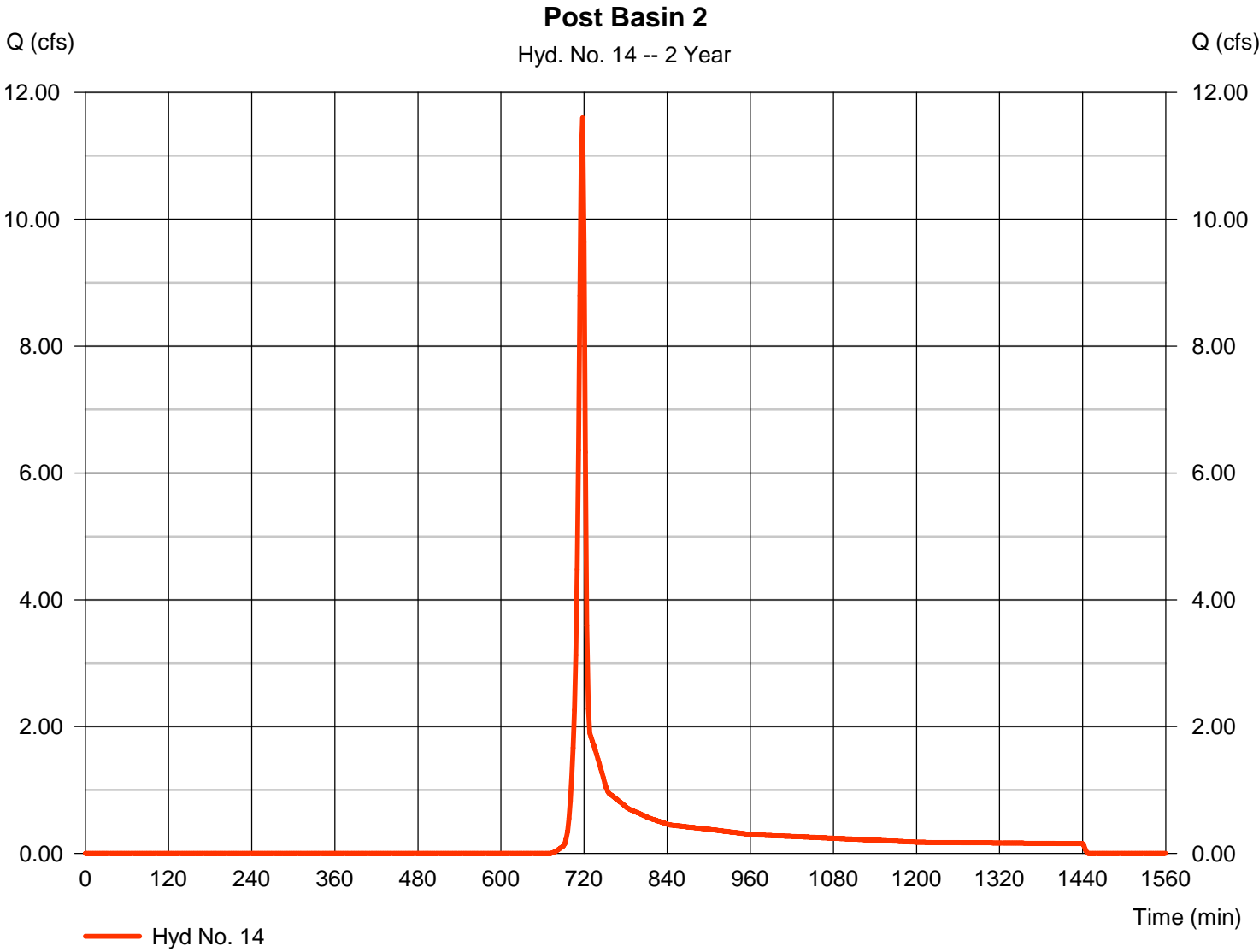


Hydrograph Report

Hyd. No. 14

Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 11.60 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 23,422 cuft
Drainage area	= 7.530 ac	Curve number	= 71.7
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. v2024

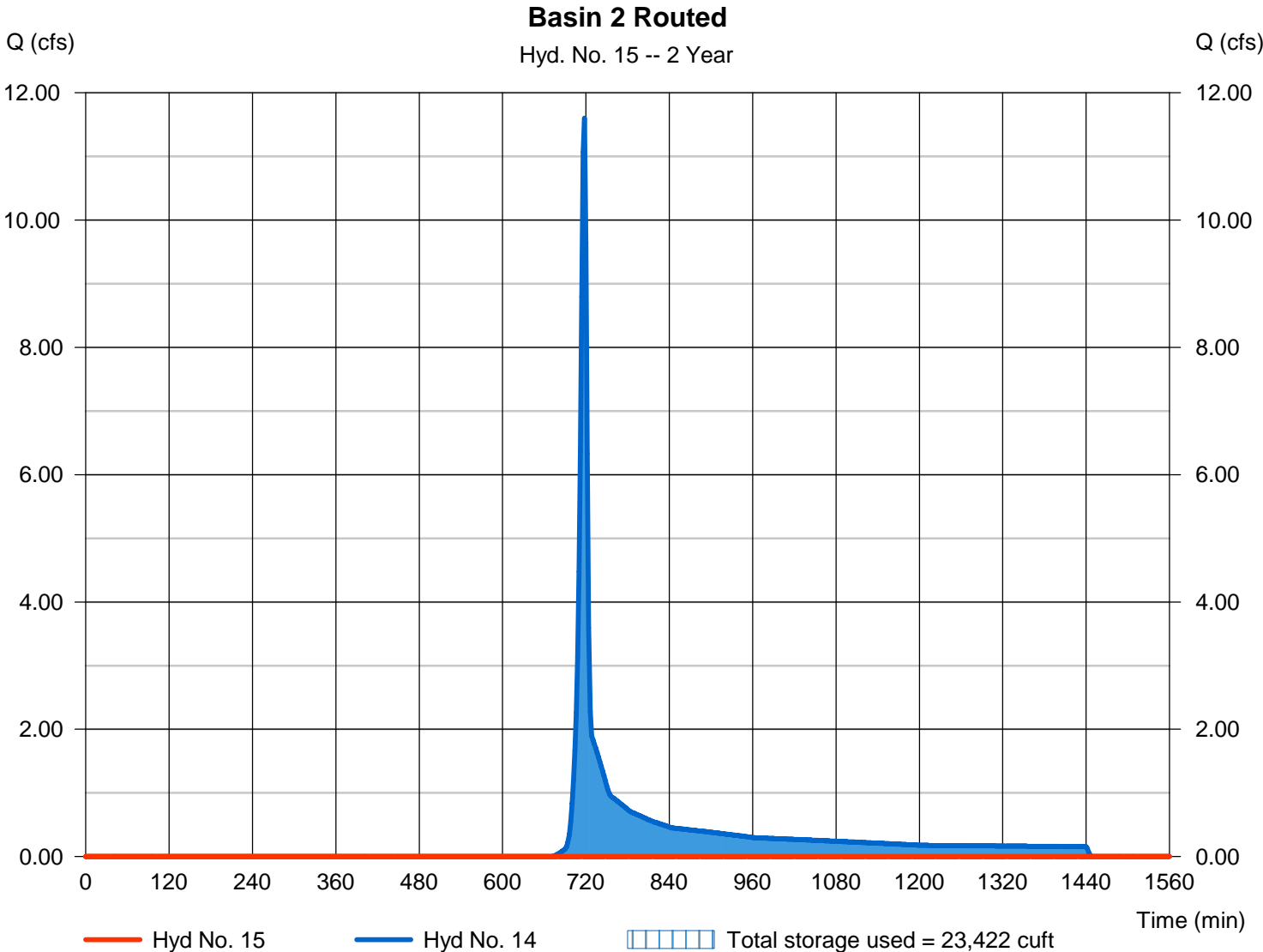
Monday, 03 / 24 / 2025

Hyd. No. 15

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.	= 14 - Post Basin 2	Max. Elevation	= 308.19 ft
Reservoir name	= Basin 2	Max. Storage	= 23,422 cuft

Storage Indication method used.



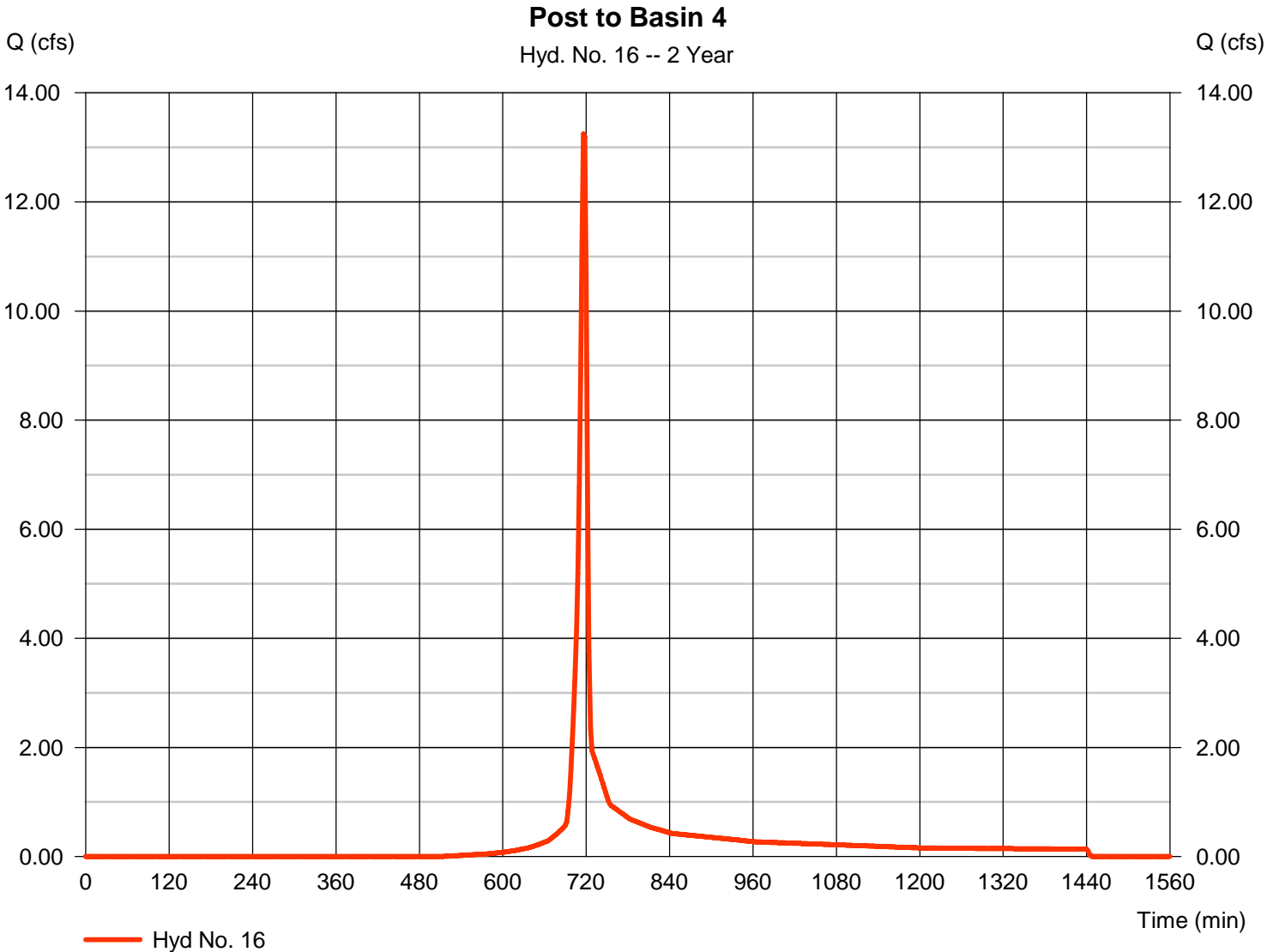
Hydrograph Report

Hyd. No. 16

Post to Basin 4

Hydrograph type	= SCS Runoff	Peak discharge	= 13.25 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 26,757 cuft
Drainage area	= 4.930 ac	Curve number	= 82.8*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.930



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

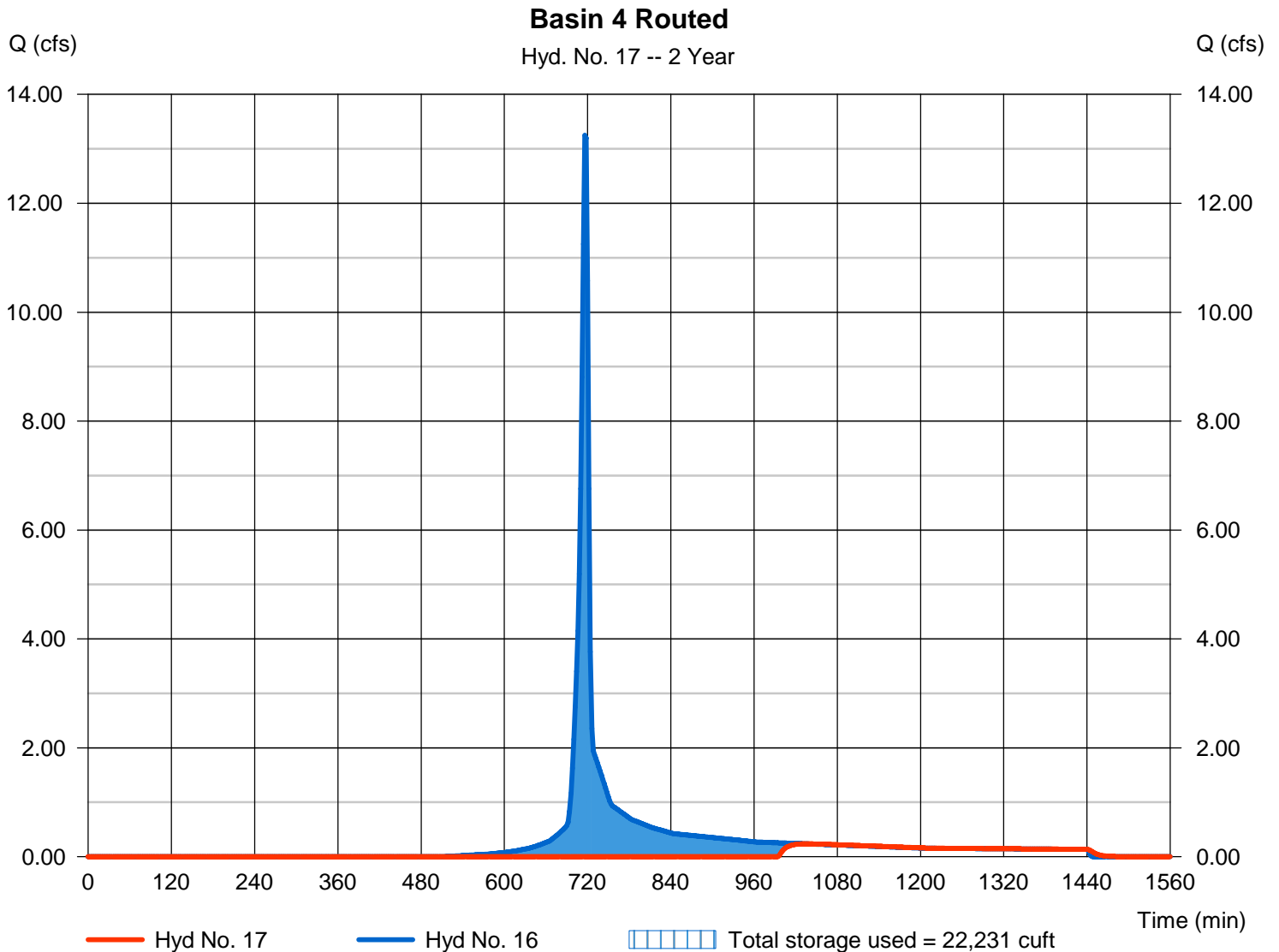
Monday, 03 / 24 / 2025

Hyd. No. 17

Basin 4 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.237 cfs
Storm frequency	= 2 yrs	Time to peak	= 1036 min
Time interval	= 2 min	Hyd. volume	= 4,666 cuft
Inflow hyd. No.	= 16 - Post to Basin 4	Max. Elevation	= 348.01 ft
Reservoir name	= Basin 4	Max. Storage	= 22,231 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

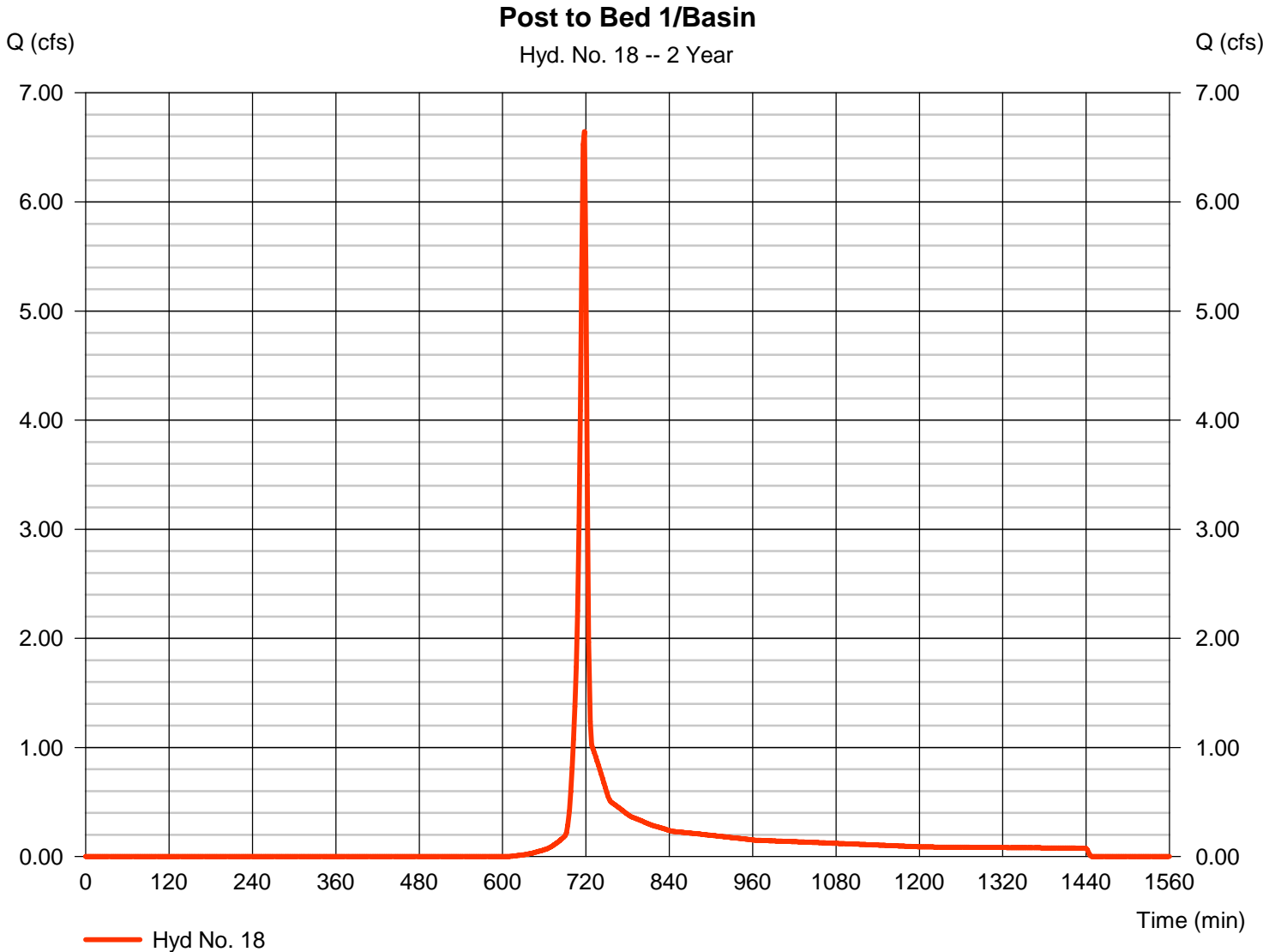
Monday, 03 / 24 / 2025

Hyd. No. 18

Post to Bed 1/Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 6.643 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 13,287 cuft
Drainage area	= 3.190 ac	Curve number	= 77.2*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 3.190



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

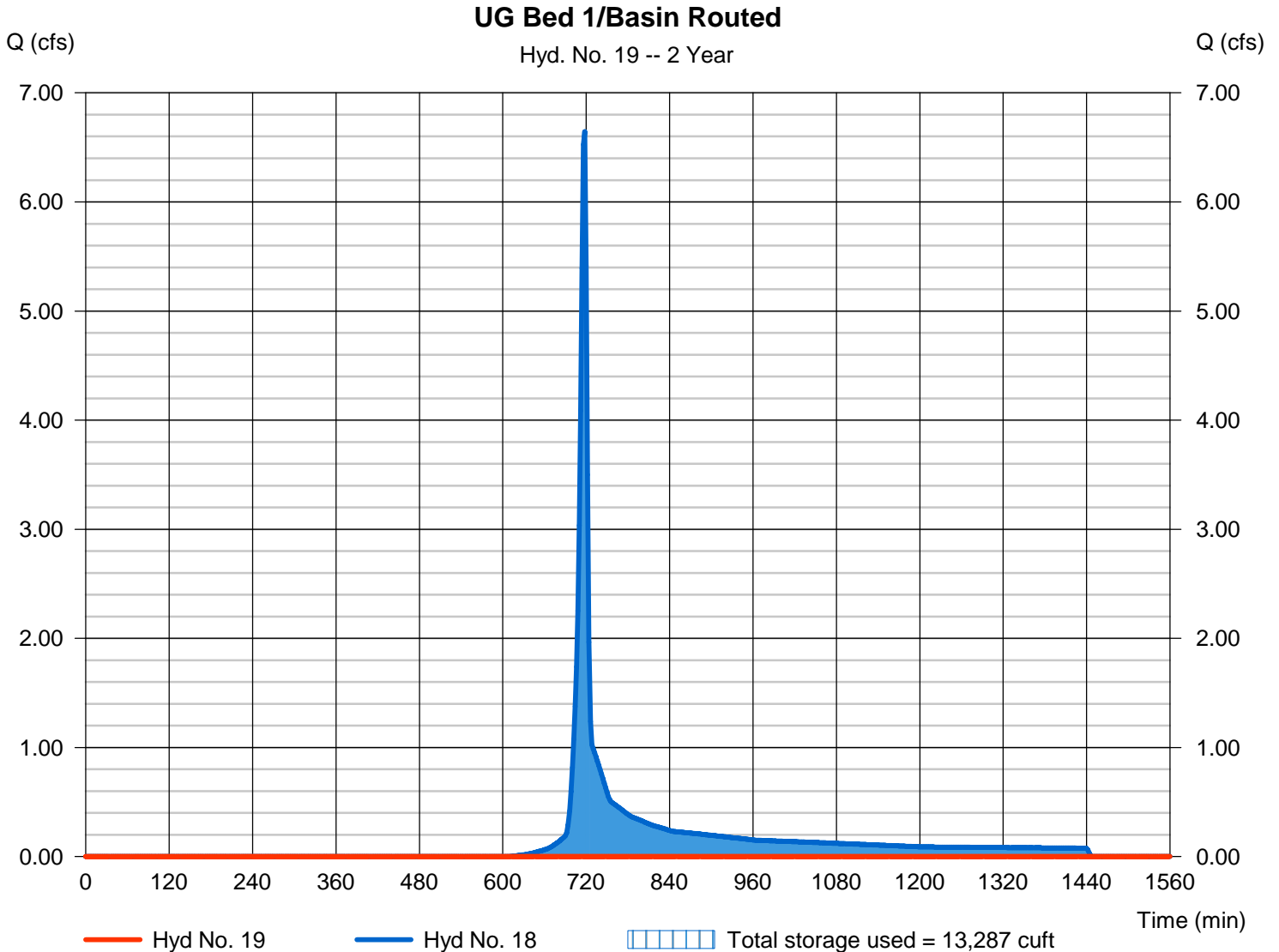
Monday, 03 / 24 / 2025

Hyd. No. 19

UG Bed 1/Basin 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.	= 18 - Post to Bed 1/Basin	Max. Elevation	= 340.30 ft
Reservoir name	= UG Bed 5/Basin	Max. Storage	= 13,287 cuft

Storage Indication method used.

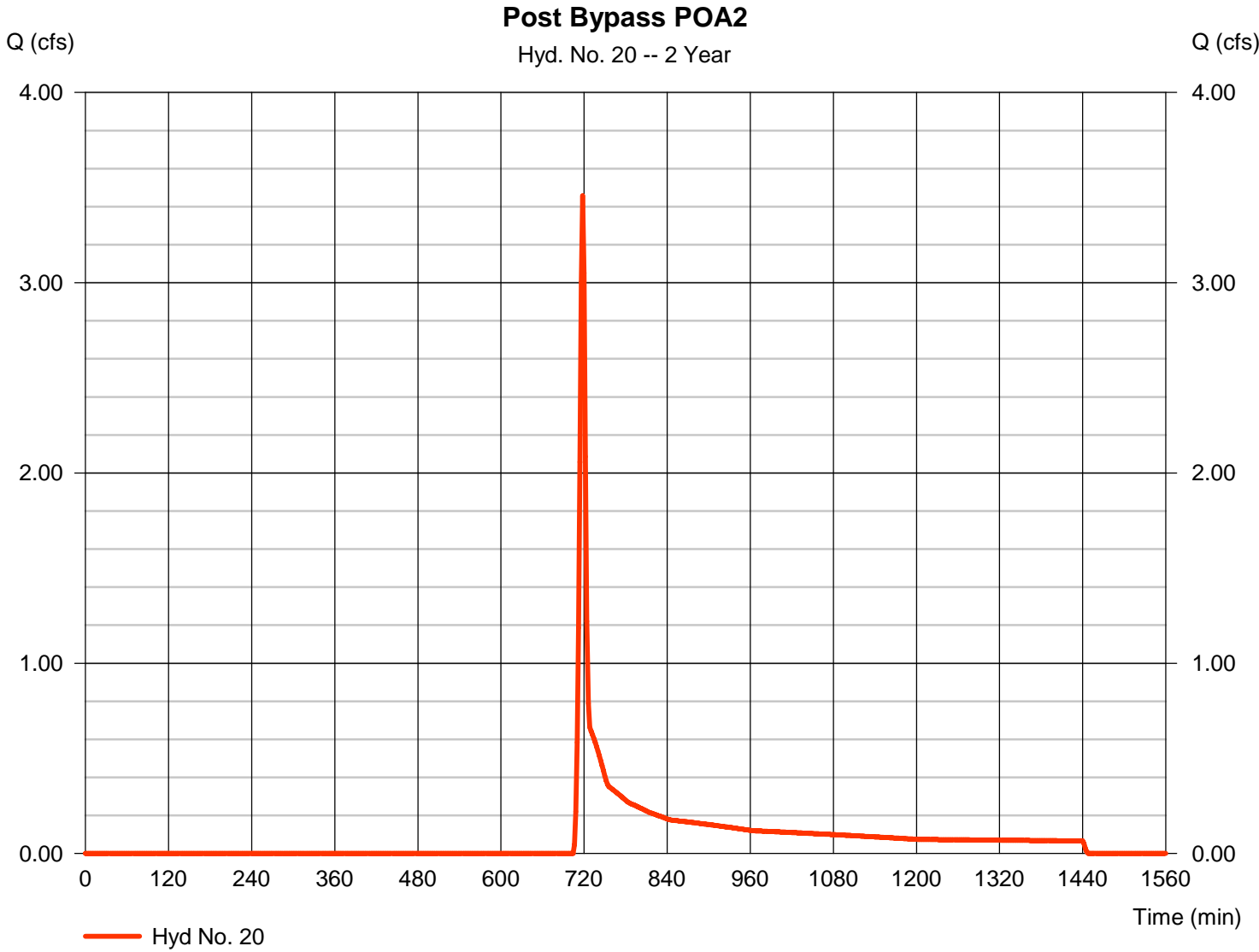


Hydrograph Report

Hyd. No. 20

Post Bypass POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 3.457 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 7,815 cuft
Drainage area	= 4.390 ac	Curve number	= 63.1
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. v2024

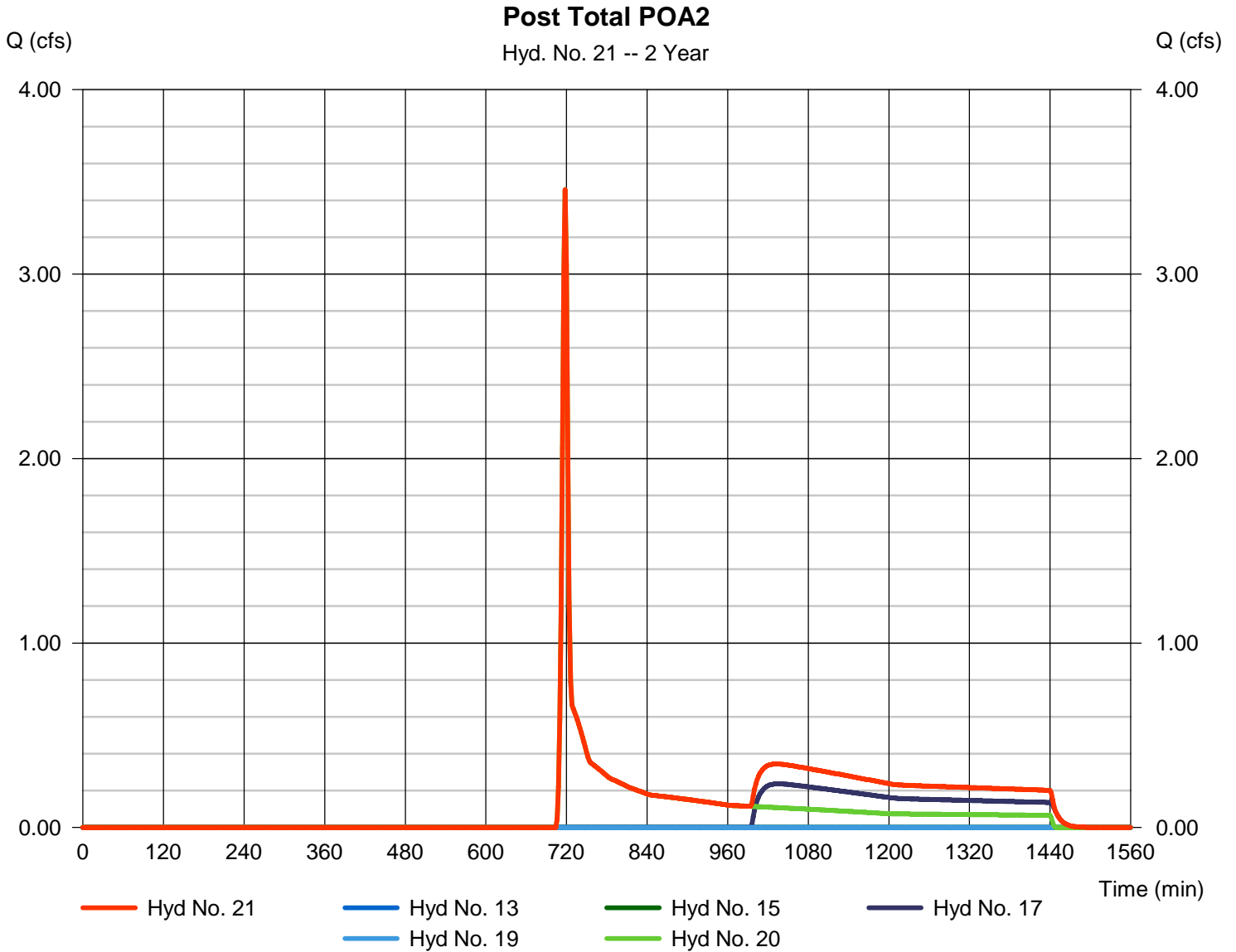
Monday, 03 / 24 / 2025

Hyd. No. 21

Post Total POA2

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 13, 15, 17, 19, 20

Peak discharge = 3.457 cfs
Time to peak = 718 min
Hyd. volume = 12,481 cuft
Contrib. drain. area = 4.390 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

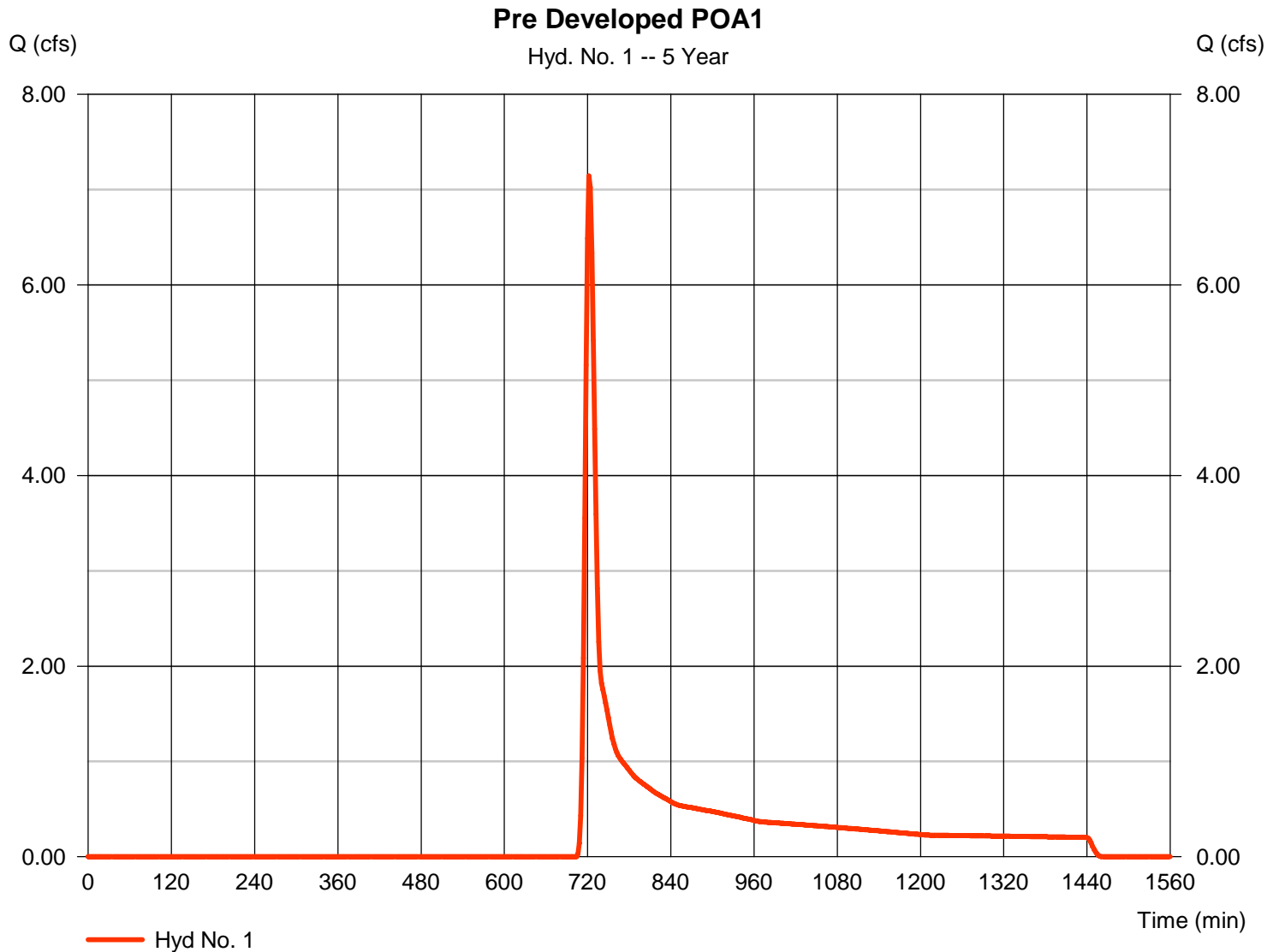
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	7.146	2	722	23,876	-----	-----	-----	Pre Developed POA1	
2	SCS Runoff	32.86	2	722	95,289	-----	-----	-----	Pre Developed POA2	
3	SCS Runoff	2.718	2	718	6,040	-----	-----	-----	Offsite POA1	
4	SCS Runoff	2.584	2	718	5,276	-----	-----	-----	Offsite POA2	
6	SCS Runoff	19.80	2	718	39,637	-----	-----	-----	Post Basin 3	
7	Reservoir	0.130	2	1444	2,710	6	318.09	38,829	Basin 3 Routed	
8	SCS Runoff	3.000	2	718	6,207	-----	-----	-----	Post Bypass POA1	
9	Combine	3.000	2	718	8,916	7, 8	-----	-----	Post Total POA1	
11	SCS Runoff	28.45	2	718	56,887	-----	-----	-----	Post Basin 1	
12	Reservoir	0.535	2	1078	19,398	11	322.71	43,331	Basin 1 Upper Routed	
13	Reservoir	0.396	2	1334	13,202	12	304.33	8,597	Basin 1 Lower Routed	
14	SCS Runoff	19.17	2	718	38,338	-----	-----	-----	Post Basin 2	
15	Reservoir	0.221	2	1440	5,983	14	308.95	34,563	Basin 2 Routed	
16	SCS Runoff	19.30	2	716	39,239	-----	-----	-----	Post to Basin 4	
17	Reservoir	1.407	2	752	17,148	16	348.08	22,926	Basin 4 Routed	
18	SCS Runoff	10.18	2	718	20,516	-----	-----	-----	Post to Bed 1/Basin	
19	Reservoir	0.000	2	n/a	0	18	342.01	20,516	UG Bed 1/Basin Routed	
20	SCS Runoff	7.008	2	718	14,449	-----	-----	-----	Post Bypass POA2	
21	Combine	7.008	2	718	50,782	13, 15, 17, 19, 20	-----	-----	Post Total POA2	
SWM.gpw					Return Period: 5 Year			Monday, 03 / 24 / 2025		

Hydrograph Report

Hyd. No. 1

Pre Developed POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 7.146 cfs
Storm frequency	= 5 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 23,876 cuft
Drainage area	= 9.690 ac	Curve number	= 57.1
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

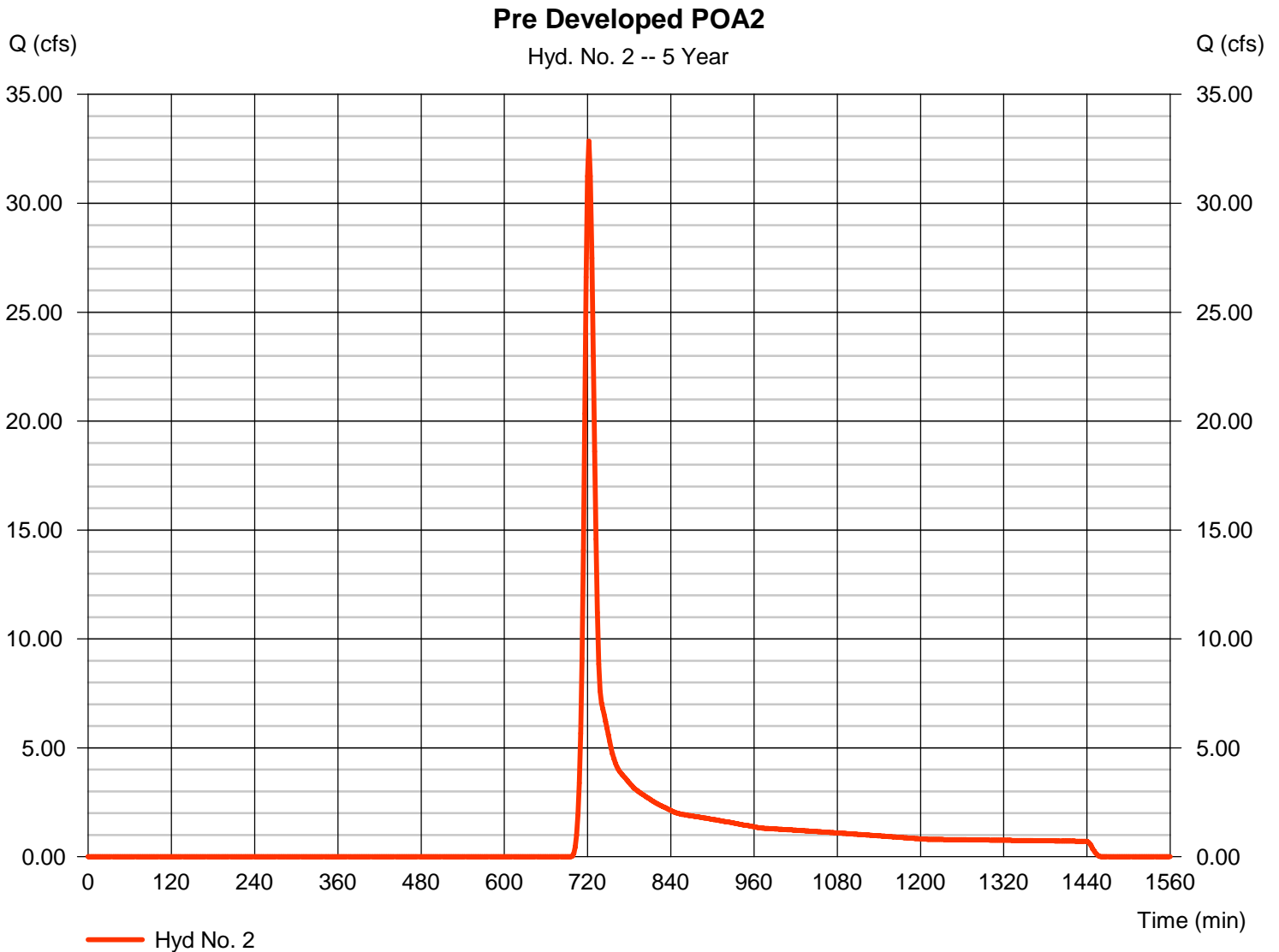


Hydrograph Report

Hyd. No. 2

Pre Developed POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 32.86 cfs
Storm frequency	= 5 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 95,289 cuft
Drainage area	= 28.240 ac	Curve number	= 61.9
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

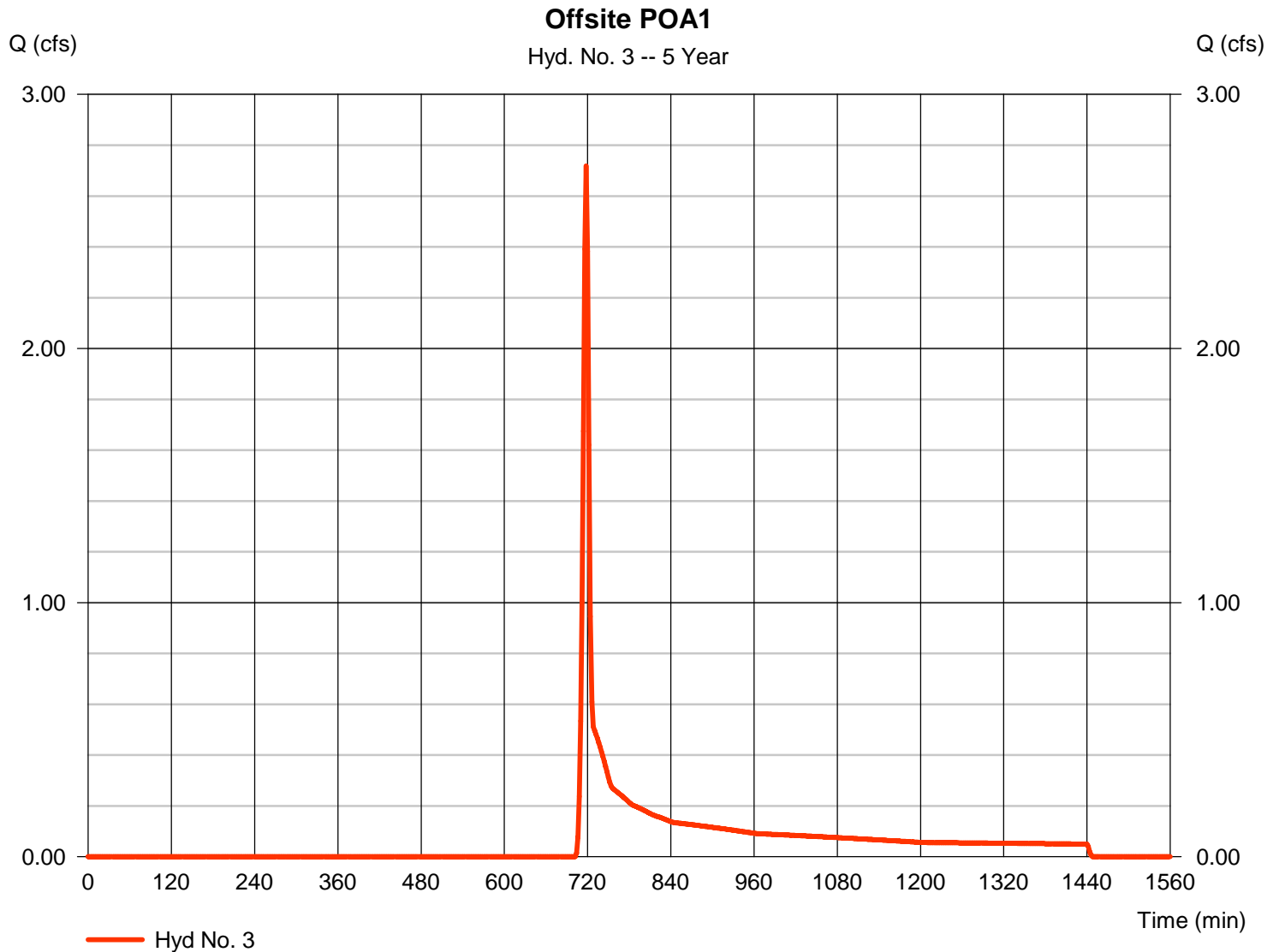
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Monday, 03 / 24 / 2025

Hyd. No. 3

Offsite POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 2.718 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 6,040 cuft
Drainage area	= 2.530 ac	Curve number	= 58
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

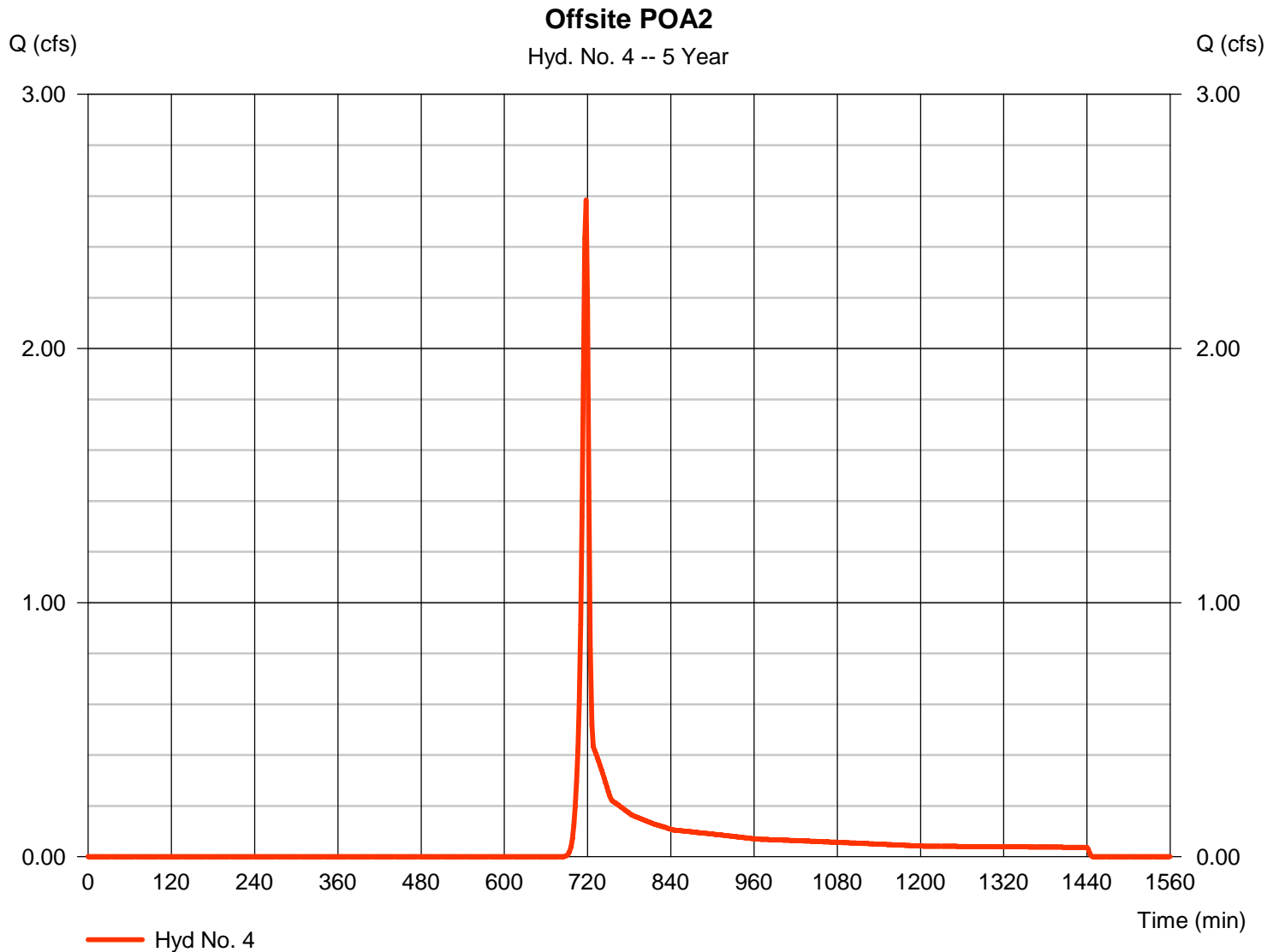
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 4

Offsite POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 2.584 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 5,276 cuft
Drainage area	= 1.490 ac	Curve number	= 64.4
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

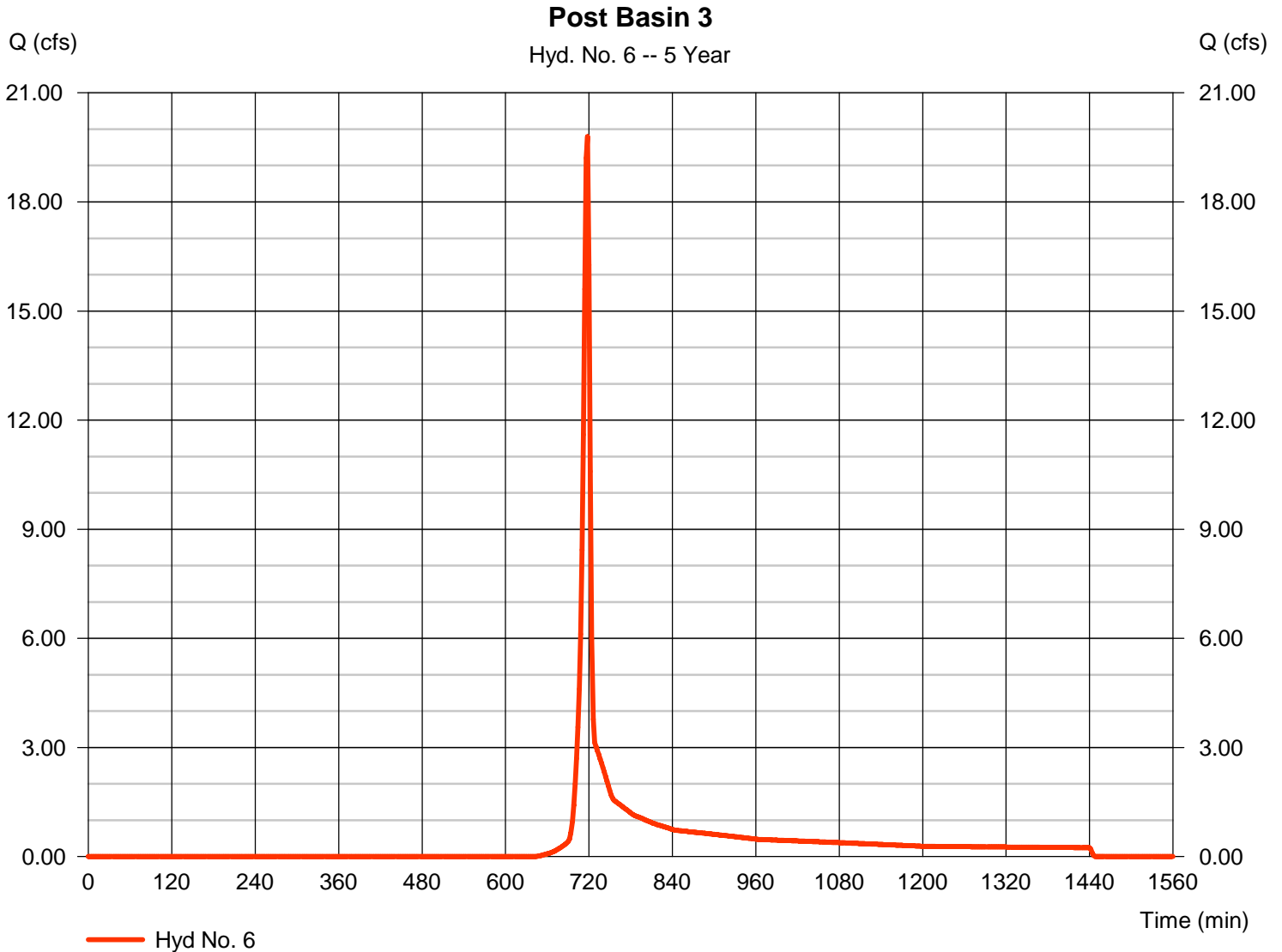
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Monday, 03 / 24 / 2025

Hyd. No. 6

Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 19.80 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 39,637 cuft
Drainage area	= 8.540 ac	Curve number	= 69.7
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. v2024

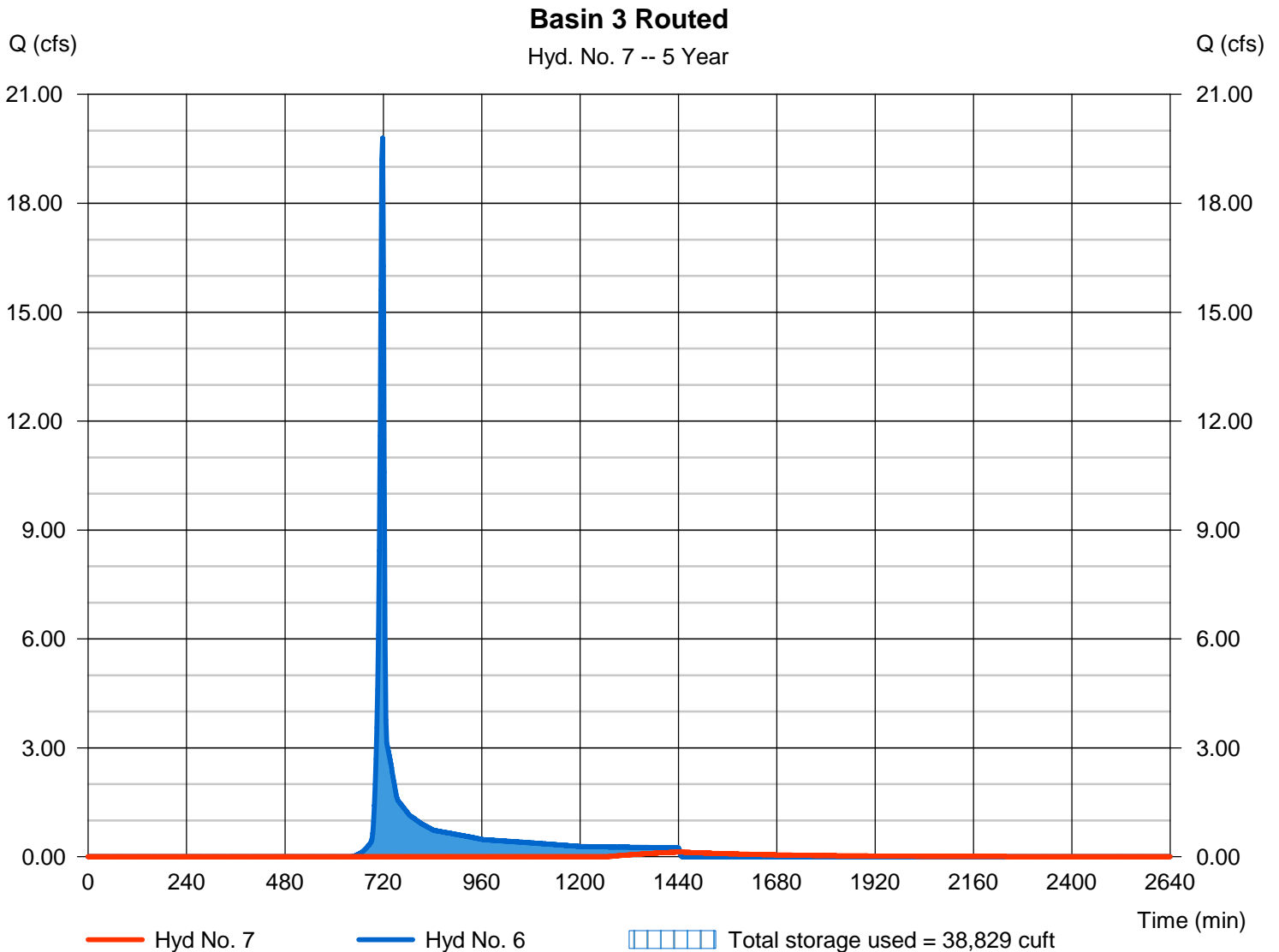
Monday, 03 / 24 / 2025

Hyd. No. 7

Basin 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.130 cfs
Storm frequency	= 5 yrs	Time to peak	= 1444 min
Time interval	= 2 min	Hyd. volume	= 2,710 cuft
Inflow hyd. No.	= 6 - Post Basin 3	Max. Elevation	= 318.09 ft
Reservoir name	= Basin 3	Max. Storage	= 38,829 cuft

Storage Indication method used.

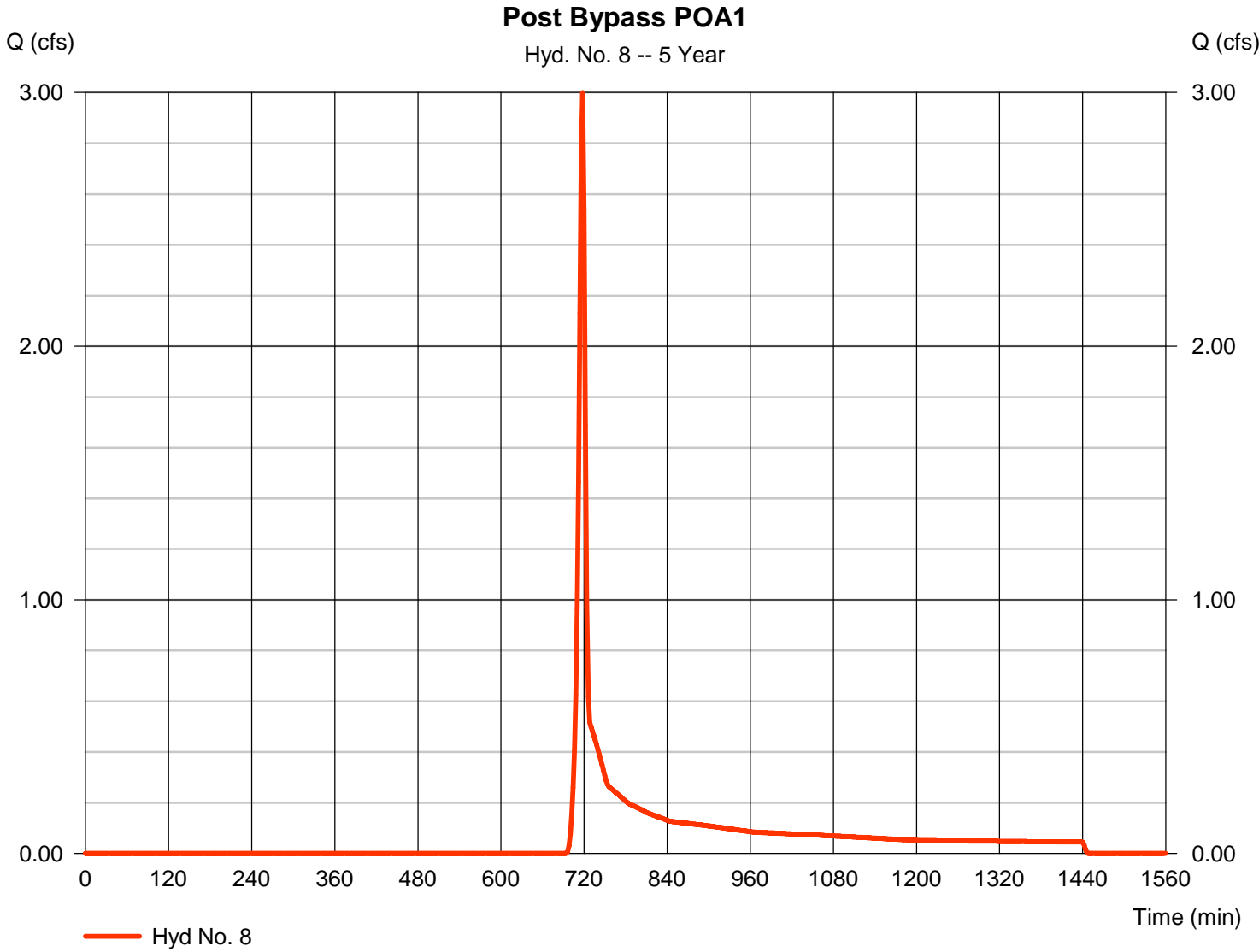


Hydrograph Report

Hyd. No. 8

Post Bypass POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 3.000 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 6,207 cuft
Drainage area	= 1.930 ac	Curve number	= 62.7
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. v2024

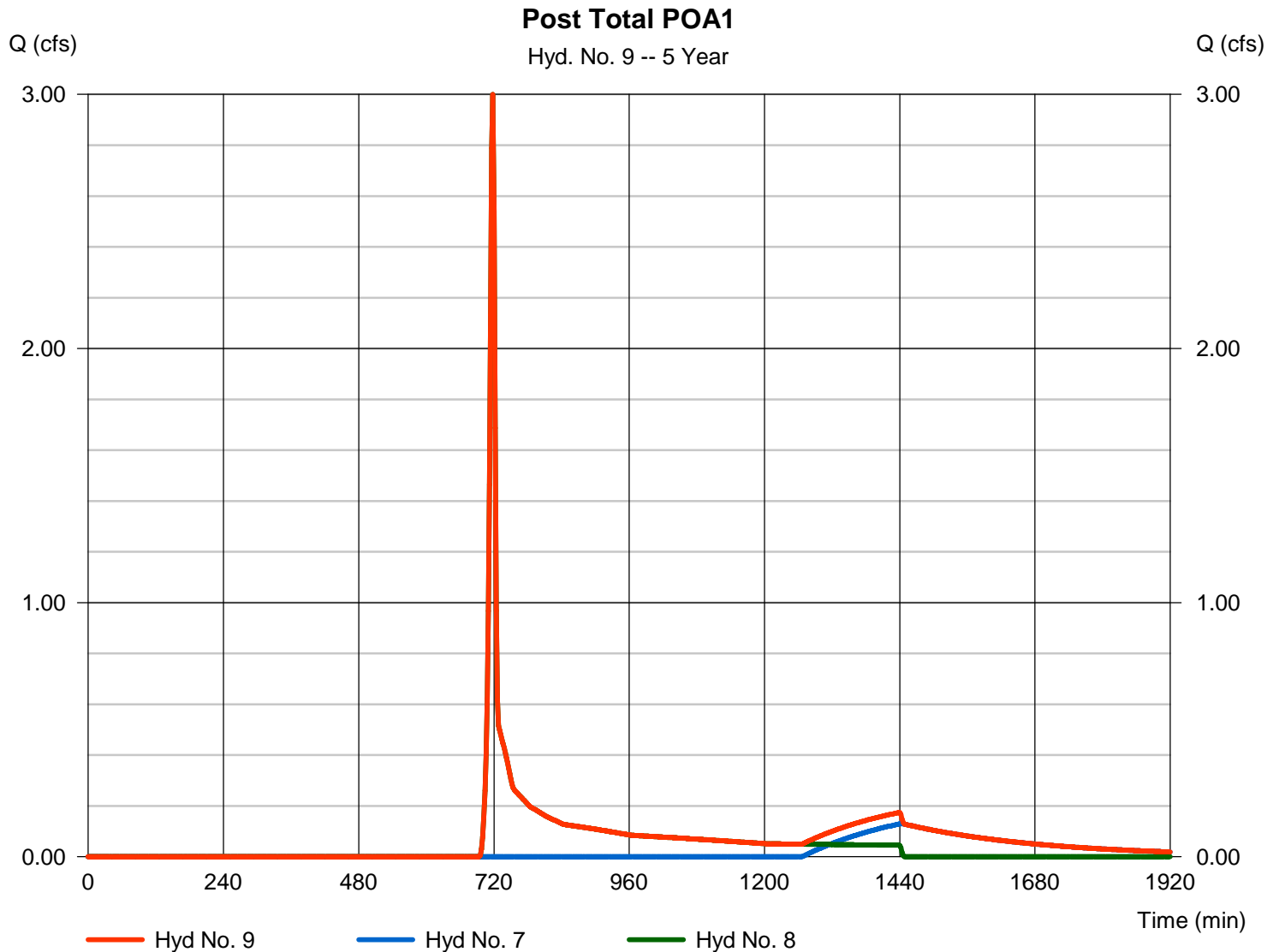
Monday, 03 / 24 / 2025

Hyd. No. 9

Post Total POA1

Hydrograph type = Combine
Storm frequency = 5 yrs
Time interval = 2 min
Inflow hyds. = 7, 8

Peak discharge = 3.000 cfs
Time to peak = 718 min
Hyd. volume = 8,916 cuft
Contrib. drain. area = 1.930 ac



Hydrograph Report

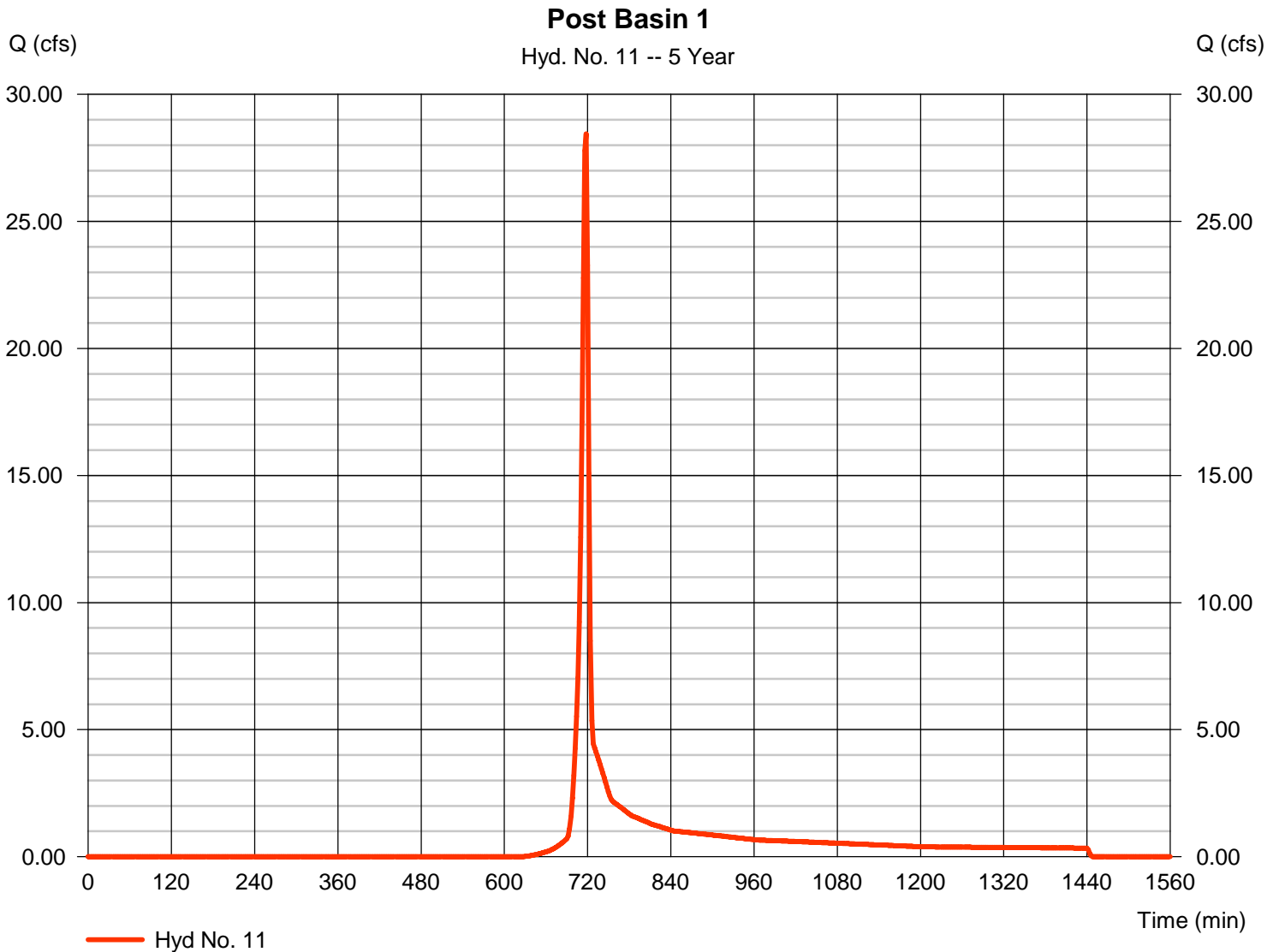
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Monday, 03 / 24 / 2025

Hyd. No. 11

Post Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 28.45 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 56,887 cuft
Drainage area	= 11.430 ac	Curve number	= 71.2
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. v2024

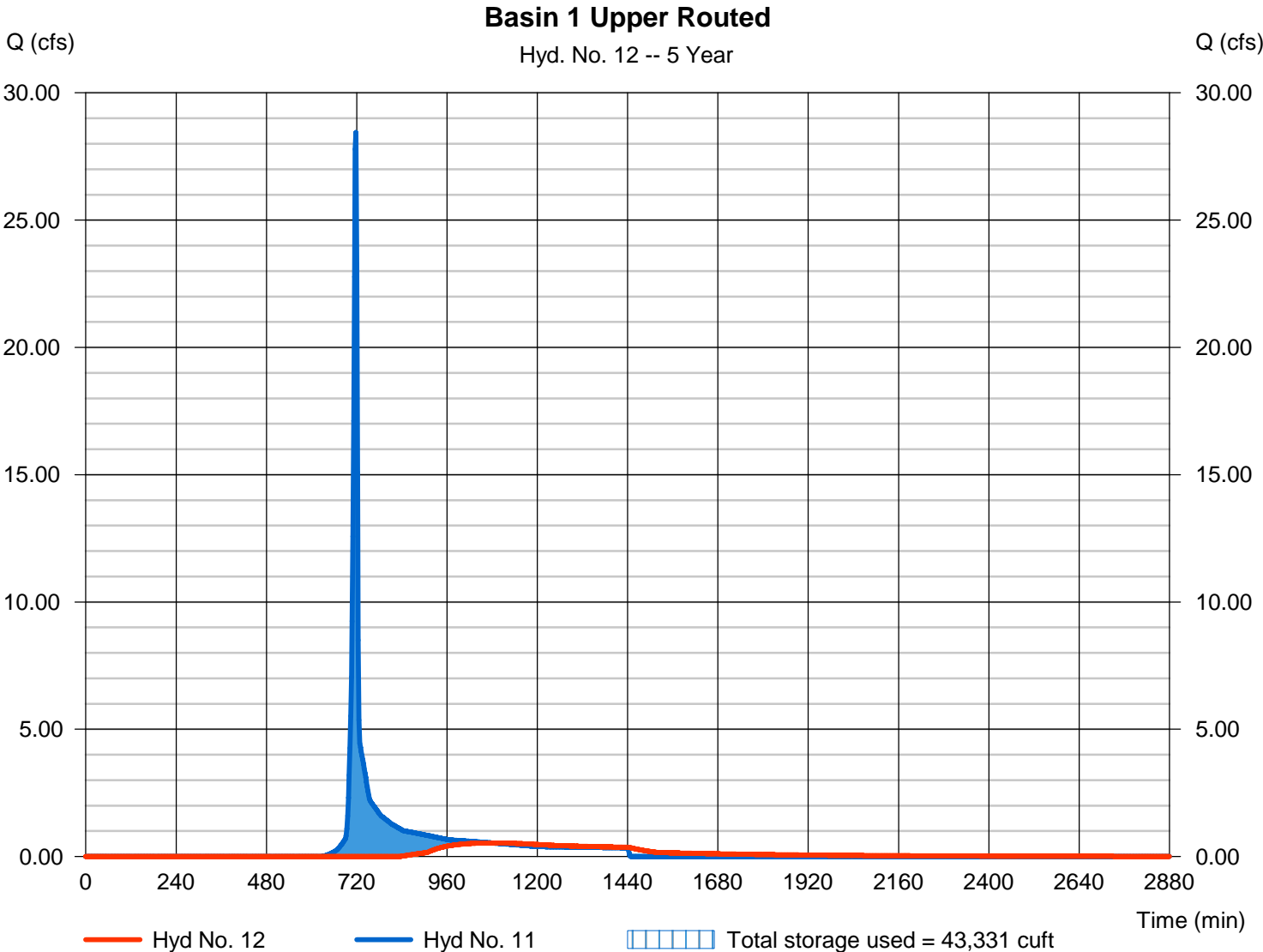
Monday, 03 / 24 / 2025

Hyd. No. 12

Basin 1 Upper Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.535 cfs
Storm frequency	= 5 yrs	Time to peak	= 1078 min
Time interval	= 2 min	Hyd. volume	= 19,398 cuft
Inflow hyd. No.	= 11 - Post Basin 1	Max. Elevation	= 322.71 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 43,331 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

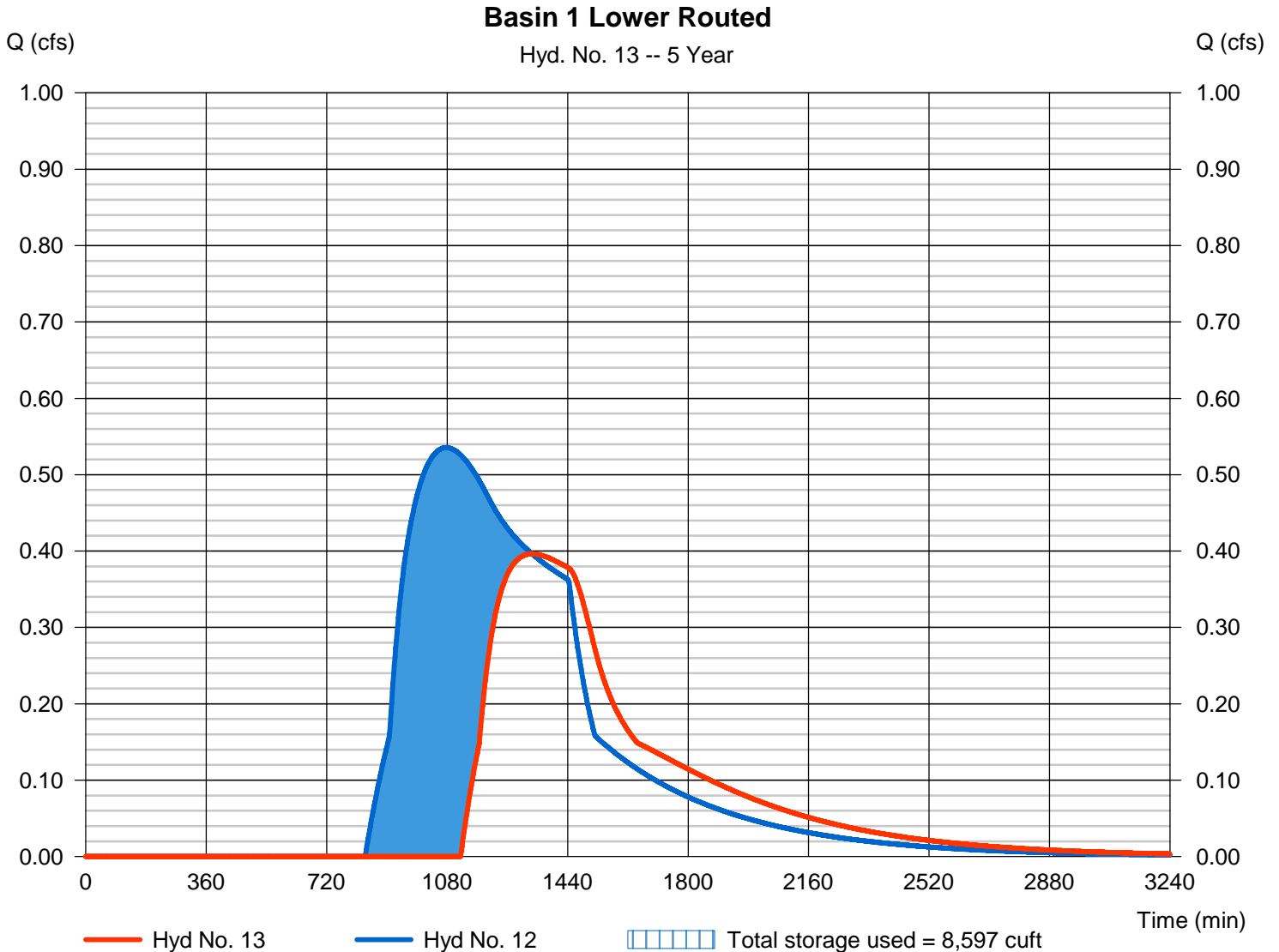
Monday, 03 / 24 / 2025

Hyd. No. 13

Basin 1 Lower Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.396 cfs
Storm frequency	= 5 yrs	Time to peak	= 1334 min
Time interval	= 2 min	Hyd. volume	= 13,202 cuft
Inflow hyd. No.	= 12 - Basin 1 Upper Routed	Max. Elevation	= 304.33 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 8,597 cuft

Storage Indication method used.



Hydrograph Report

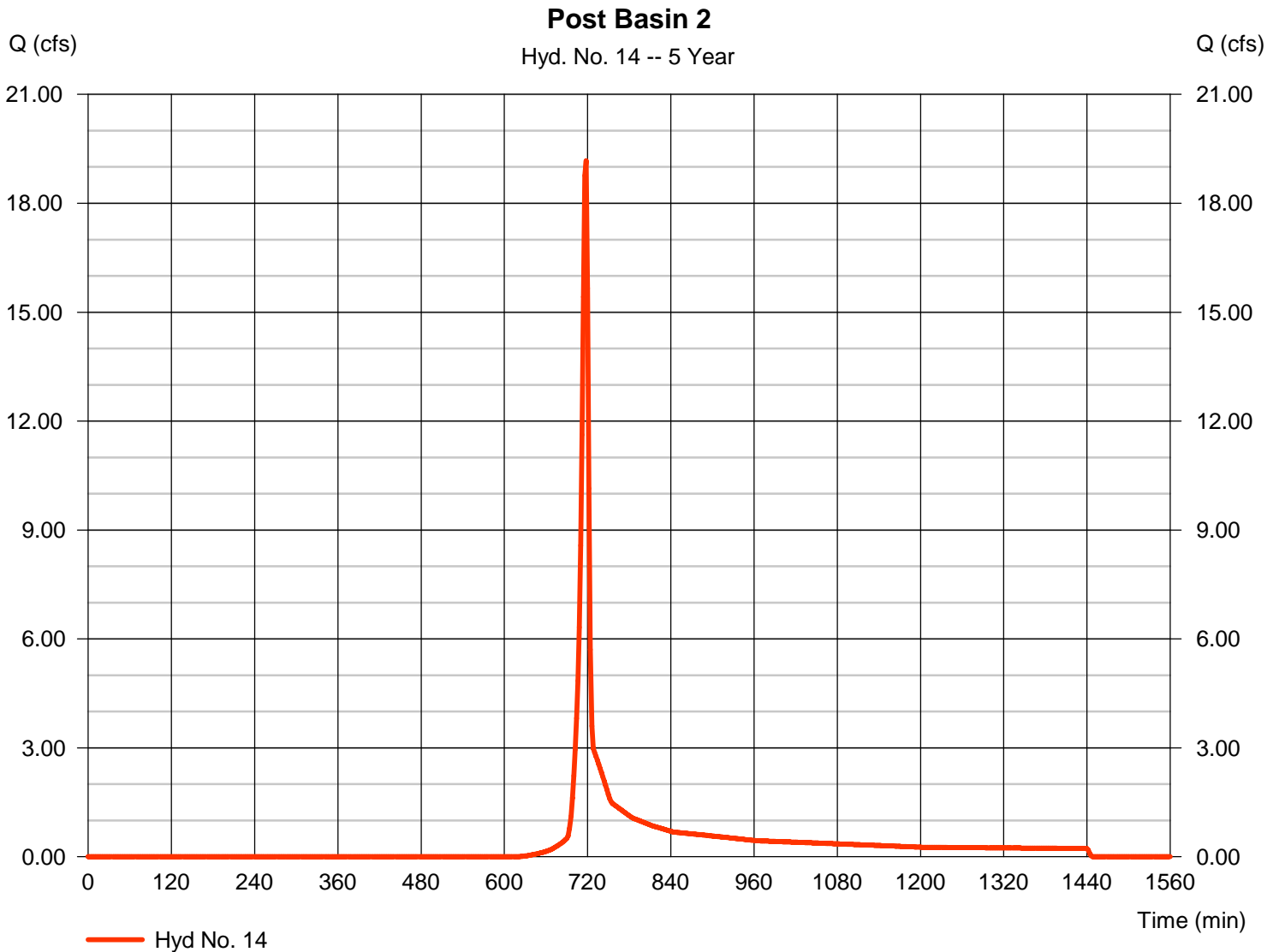
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Hyd. No. 14

Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 19.17 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 38,338 cuft
Drainage area	= 7.530 ac	Curve number	= 71.7
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. v2024

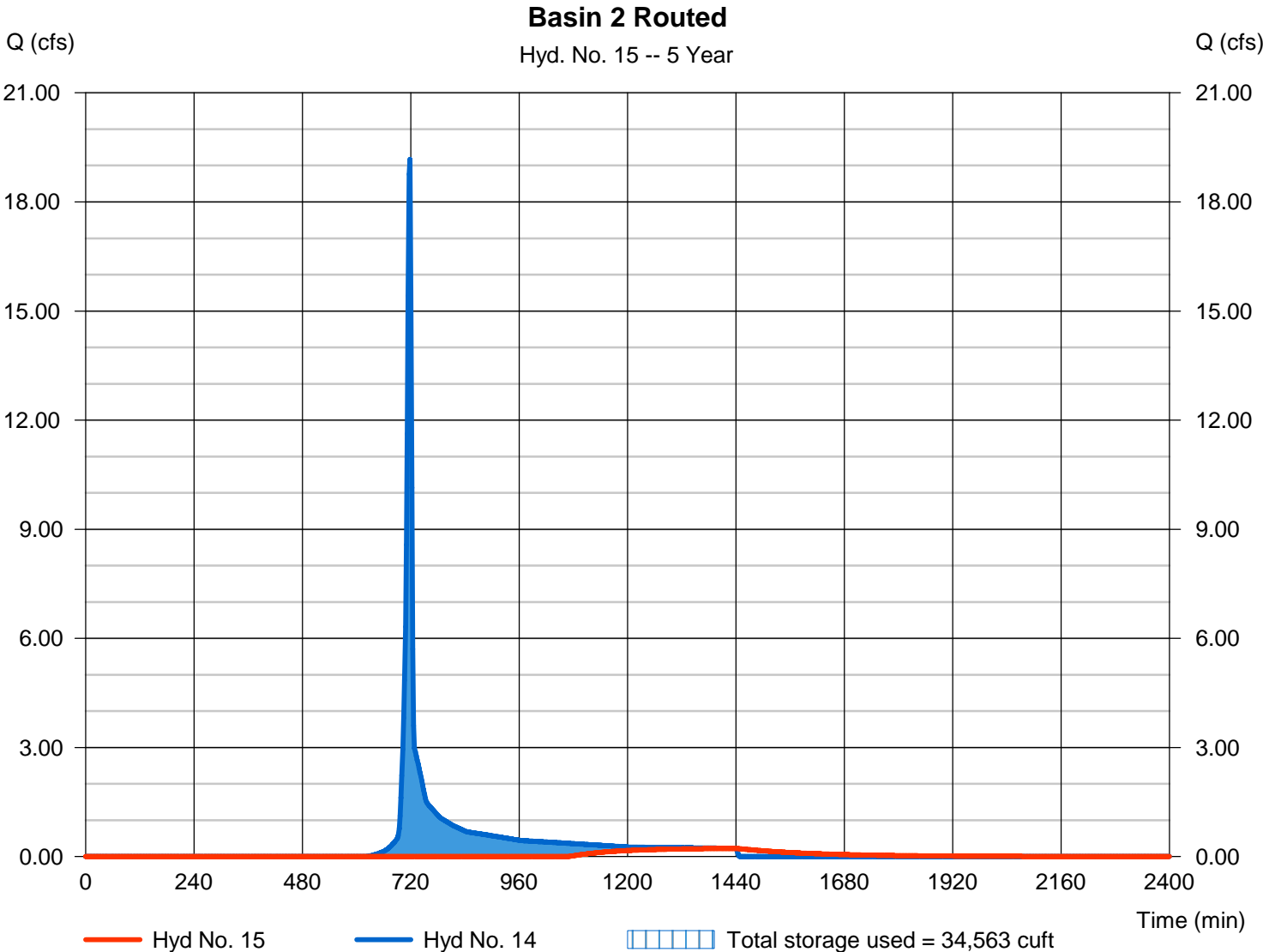
Monday, 03 / 24 / 2025

Hyd. No. 15

Basin 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.221 cfs
Storm frequency	= 5 yrs	Time to peak	= 1440 min
Time interval	= 2 min	Hyd. volume	= 5,983 cuft
Inflow hyd. No.	= 14 - Post Basin 2	Max. Elevation	= 308.95 ft
Reservoir name	= Basin 2	Max. Storage	= 34,563 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

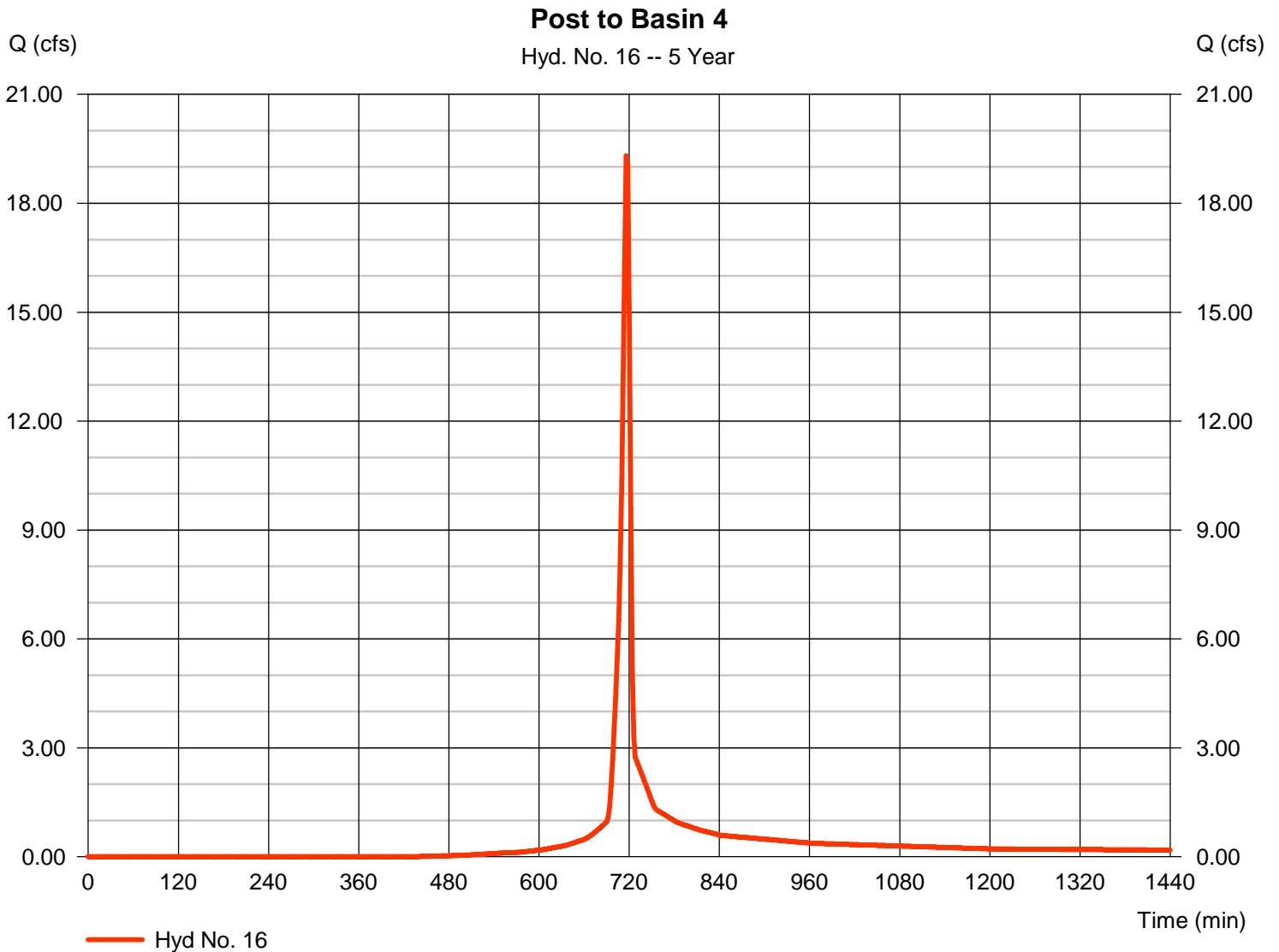
Monday, 03 / 24 / 2025

Hyd. No. 16

Post to Basin 4

Hydrograph type	= SCS Runoff	Peak discharge	= 19.30 cfs
Storm frequency	= 5 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 39,239 cuft
Drainage area	= 4.930 ac	Curve number	= 82.8*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.930



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

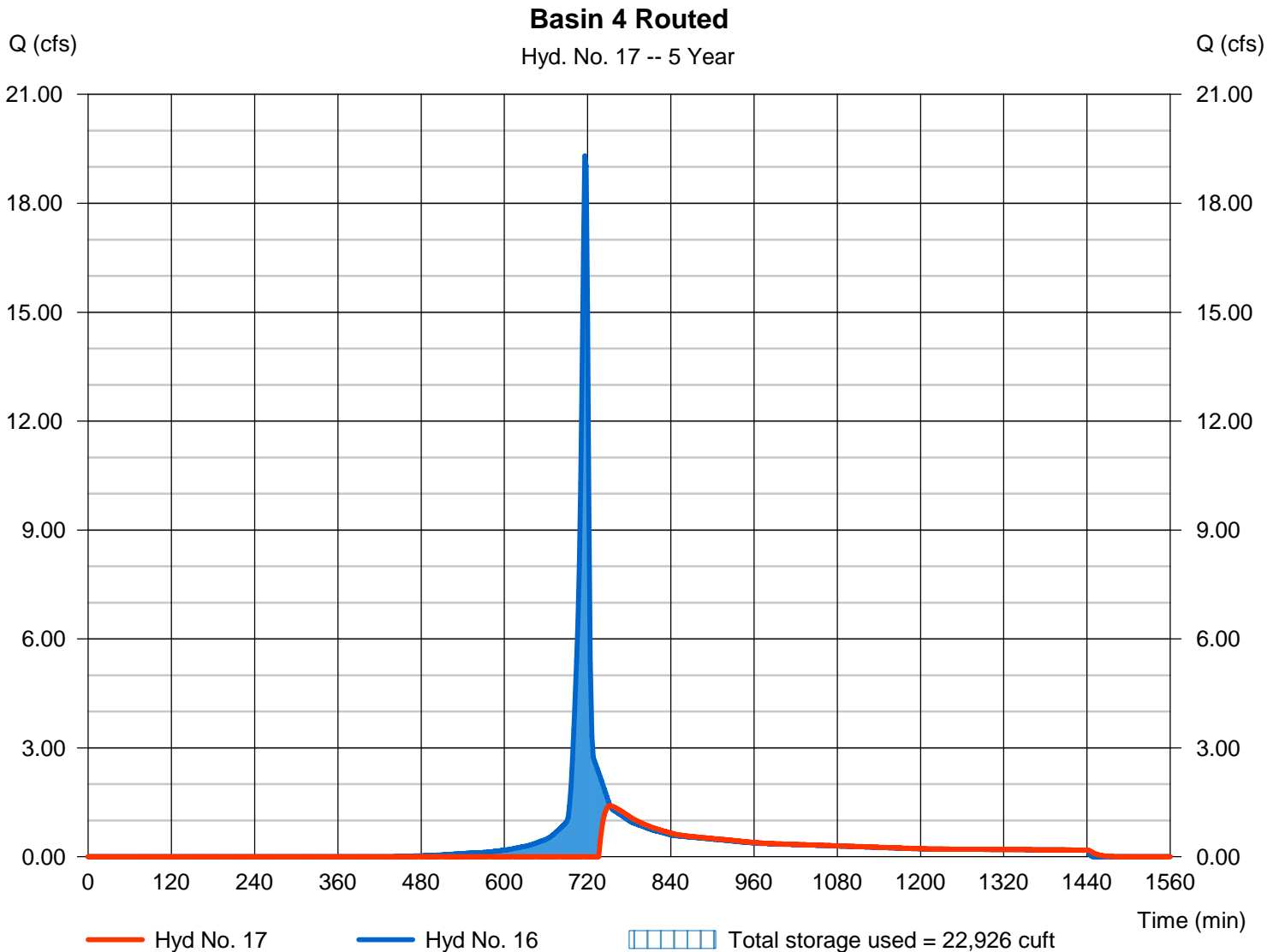
Monday, 03 / 24 / 2025

Hyd. No. 17

Basin 4 Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.407 cfs
Storm frequency	= 5 yrs	Time to peak	= 752 min
Time interval	= 2 min	Hyd. volume	= 17,148 cuft
Inflow hyd. No.	= 16 - Post to Basin 4	Max. Elevation	= 348.08 ft
Reservoir name	= Basin 4	Max. Storage	= 22,926 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

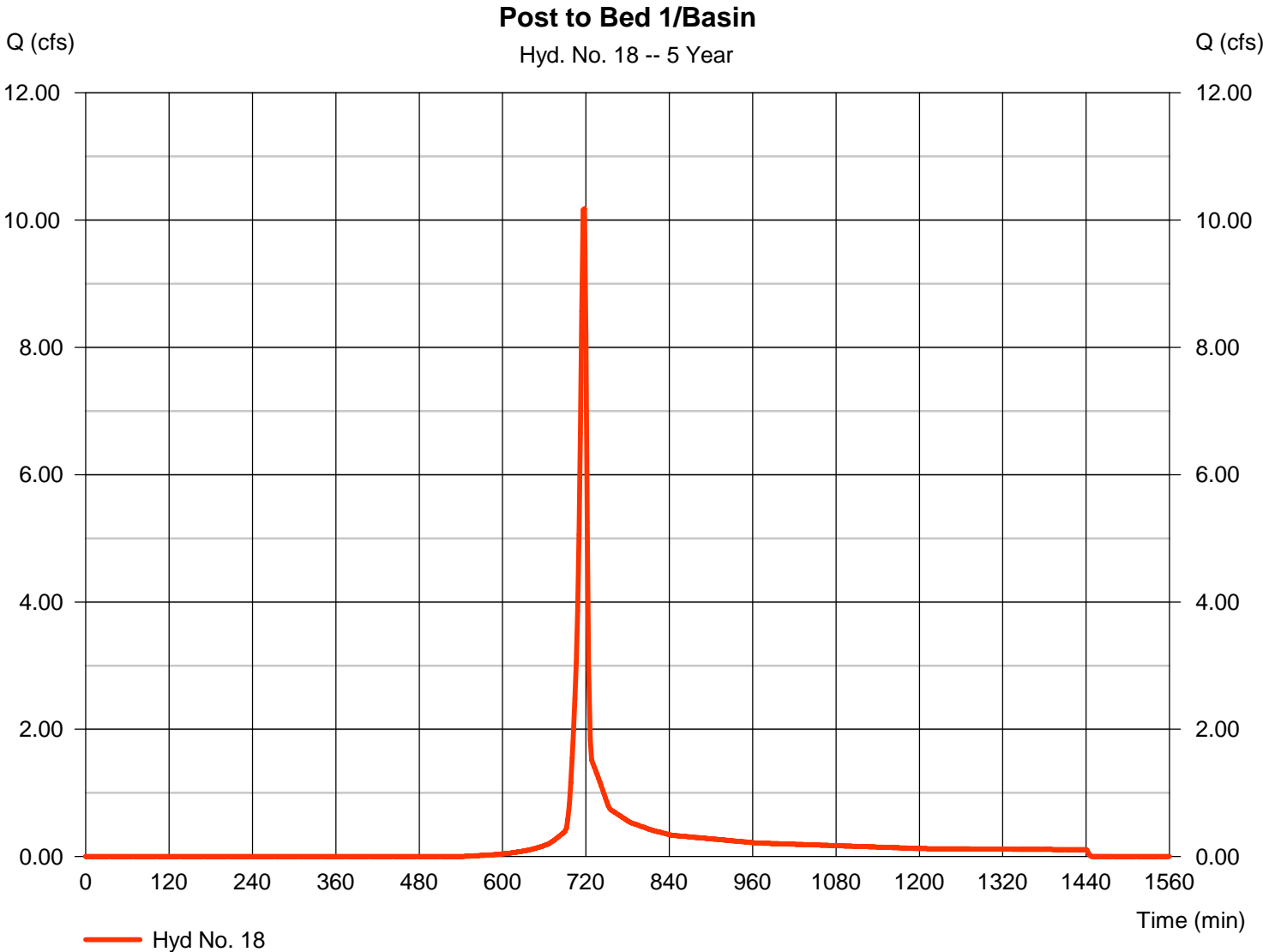
Monday, 03 / 24 / 2025

Hyd. No. 18

Post to Bed 1/Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 10.18 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 20,516 cuft
Drainage area	= 3.190 ac	Curve number	= 77.2*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 3.190



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

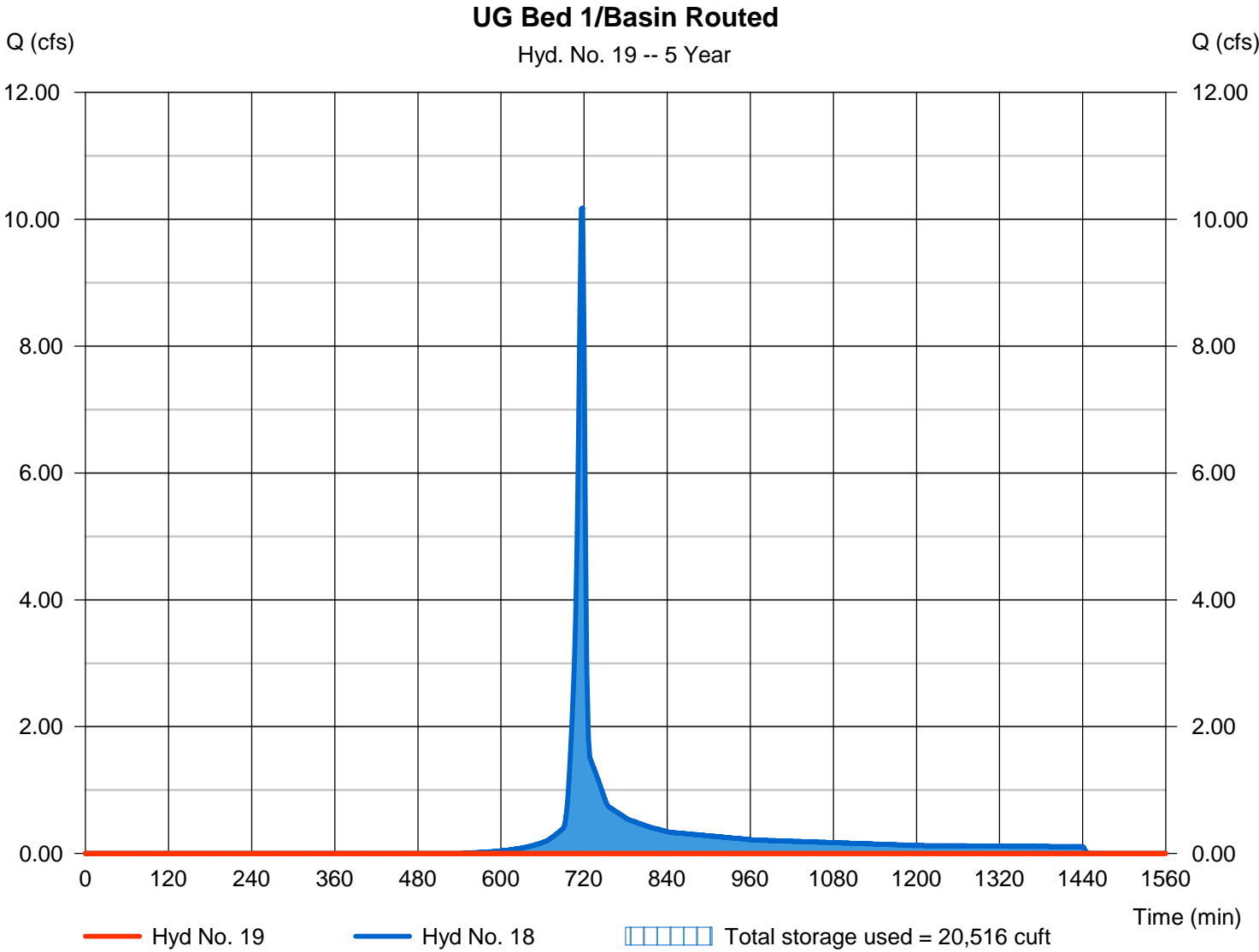
Monday, 03 / 24 / 2025

Hyd. No. 19

UG Bed 1/Basin Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 5 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 18 - Post to Bed 1/Basin	Max. Elevation	= 342.01 ft
Reservoir name	= UG Bed 5/Basin	Max. Storage	= 20,516 cuft

Storage Indication method used.

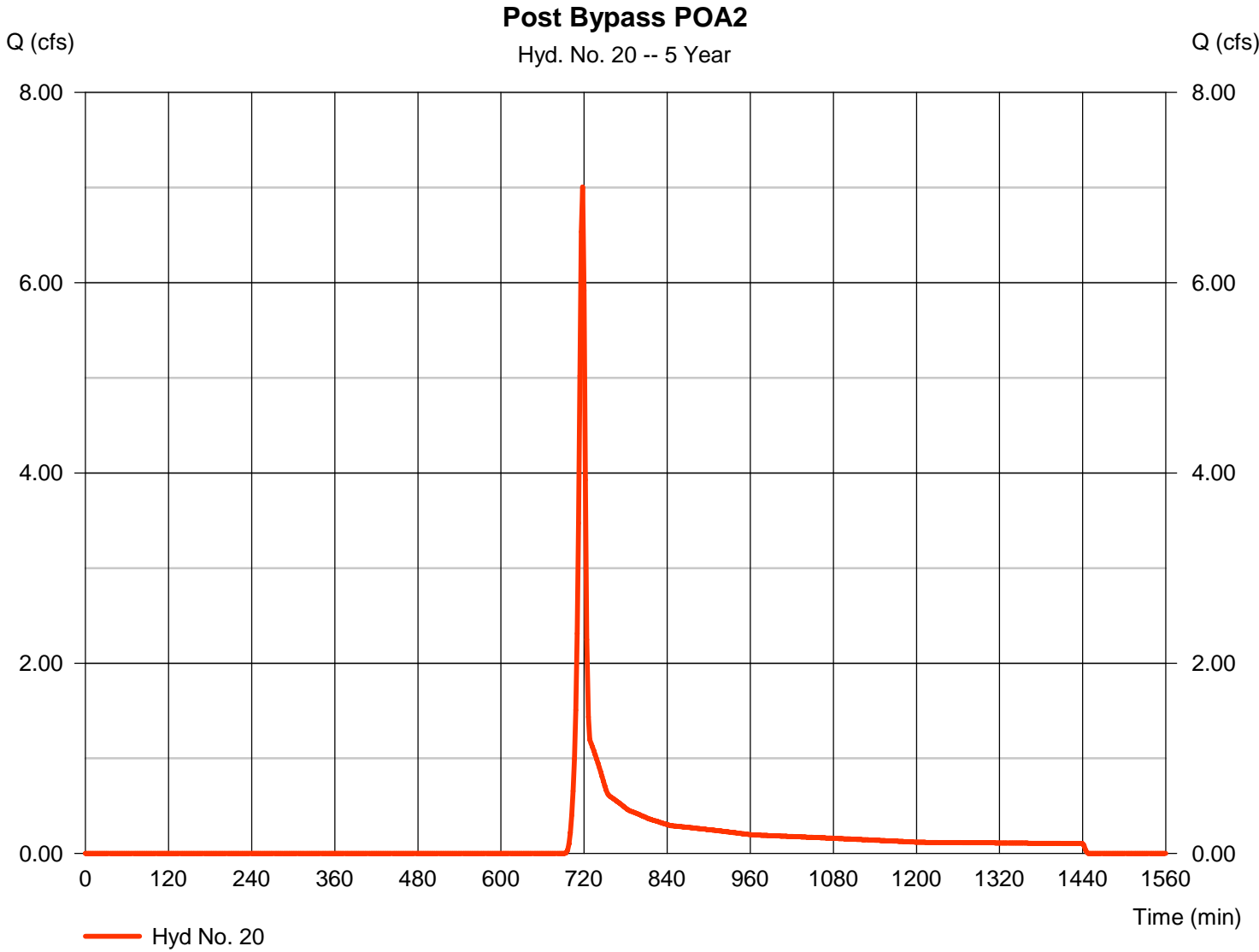


Hydrograph Report

Hyd. No. 20

Post Bypass POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 7.008 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 14,449 cuft
Drainage area	= 4.390 ac	Curve number	= 63.1
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. v2024

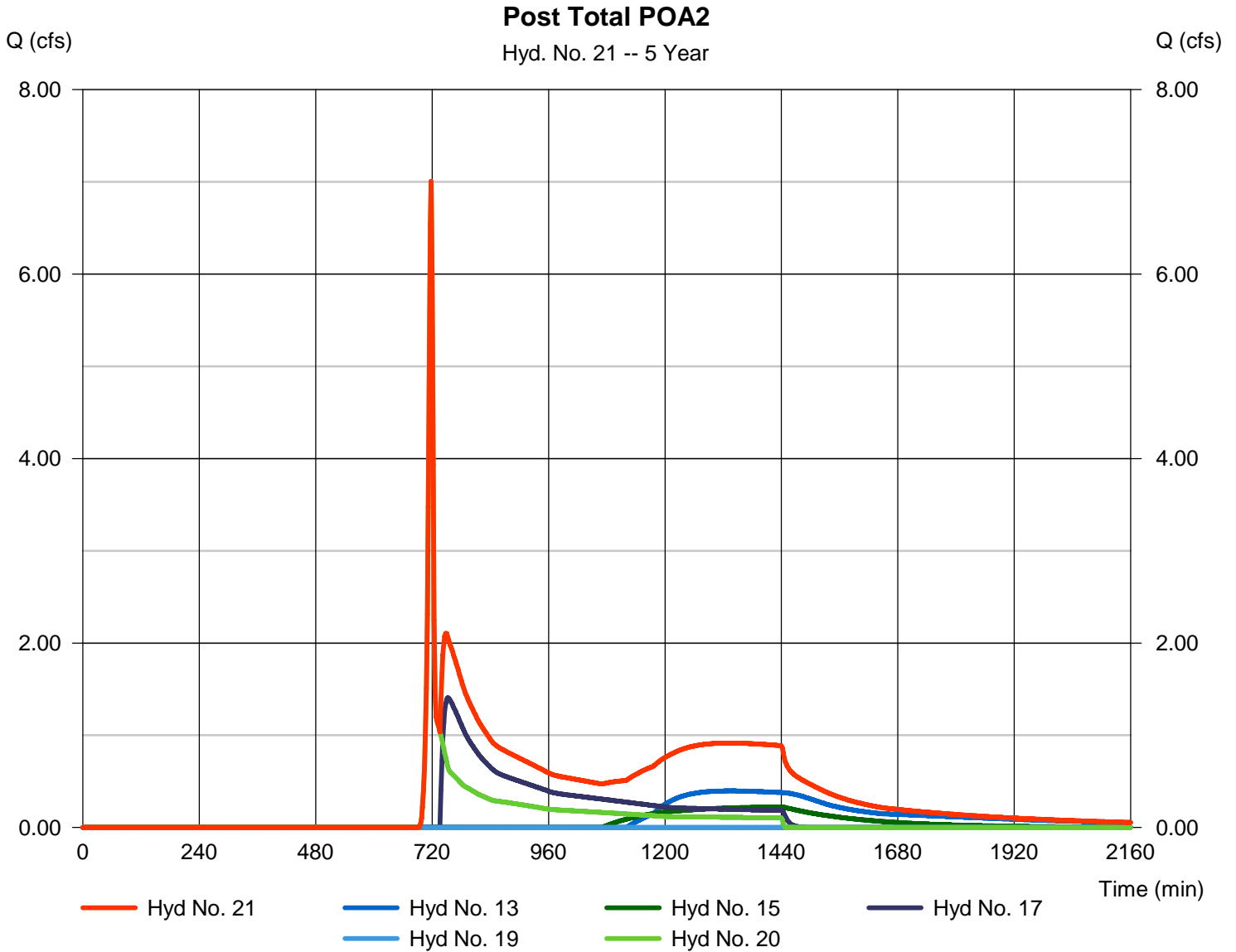
Monday, 03 / 24 / 2025

Hyd. No. 21

Post Total POA2

Hydrograph type = Combine
Storm frequency = 5 yrs
Time interval = 2 min
Inflow hyds. = 13, 15, 17, 19, 20

Peak discharge = 7.008 cfs
Time to peak = 718 min
Hyd. volume = 50,782 cuft
Contrib. drain. area = 4.390 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

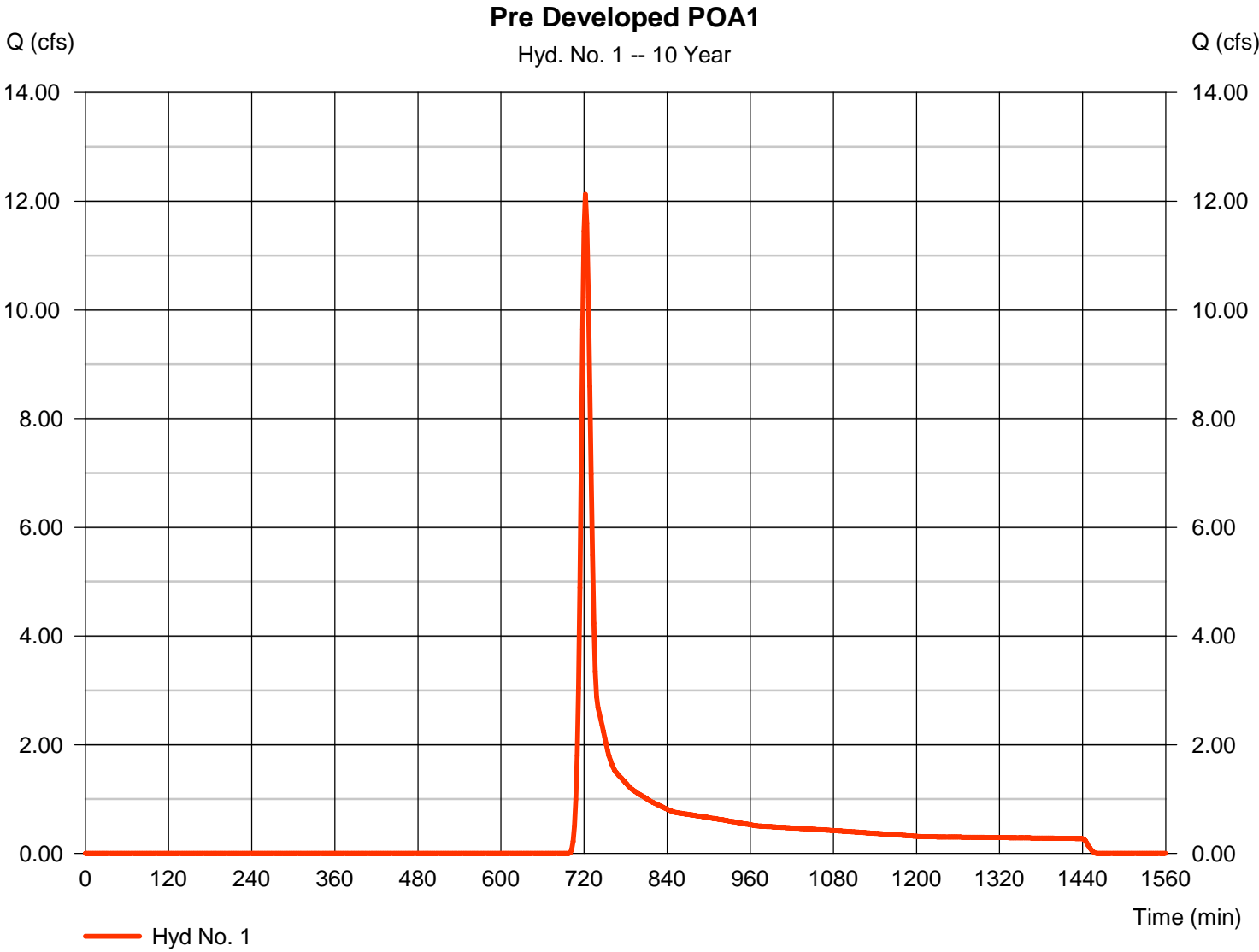
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	12.13	2	722	35,919	-----	-----	-----	Pre Developed POA1	
2	SCS Runoff	49.63	2	722	136,580	-----	-----	-----	Pre Developed POA2	
3	SCS Runoff	4.304	2	718	8,993	-----	-----	-----	Offsite POA1	
4	SCS Runoff	3.686	2	718	7,407	-----	-----	-----	Offsite POA2	
6	SCS Runoff	26.80	2	718	53,611	-----	-----	-----	Post Basin 3	
7	Reservoir	0.428	2	1134	16,683	6	318.25	42,348	Basin 3 Routed	
8	SCS Runoff	4.371	2	718	8,835	-----	-----	-----	Post Bypass POA1	
9	Combine	4.371	2	718	25,518	7, 8	-----	-----	Post Total POA1	
11	SCS Runoff	38.05	2	718	76,229	-----	-----	-----	Post Basin 1	
12	Reservoir	1.312	2	842	38,740	11	322.90	46,883	Basin 1 Upper Routed	
13	Reservoir	0.982	2	988	32,544	12	304.59	10,485	Basin 1 Lower Routed	
14	SCS Runoff	25.55	2	718	51,219	-----	-----	-----	Post Basin 2	
15	Reservoir	0.599	2	948	18,864	14	309.08	36,463	Basin 2 Routed	
16	SCS Runoff	24.16	2	716	49,462	-----	-----	-----	Post to Basin 4	
17	Reservoir	5.931	2	724	27,372	16	348.27	24,981	Basin 4 Routed	
18	SCS Runoff	13.15	2	716	26,584	-----	-----	-----	Post to Bed 1/Basin	
19	Reservoir	0.249	2	998	4,937	18	342.21	21,731	UG Bed 1/Basin Routed	
20	SCS Runoff	10.16	2	718	20,497	-----	-----	-----	Post Bypass POA2	
21	Combine	10.16	2	718	104,214	13, 15, 17, 19, 20	-----	-----	Post Total POA2	
SWM.gpw					Return Period: 10 Year			Monday, 03 / 24 / 2025		

Hydrograph Report

Hyd. No. 1

Pre Developed POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 12.13 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 35,919 cuft
Drainage area	= 9.690 ac	Curve number	= 57.1
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

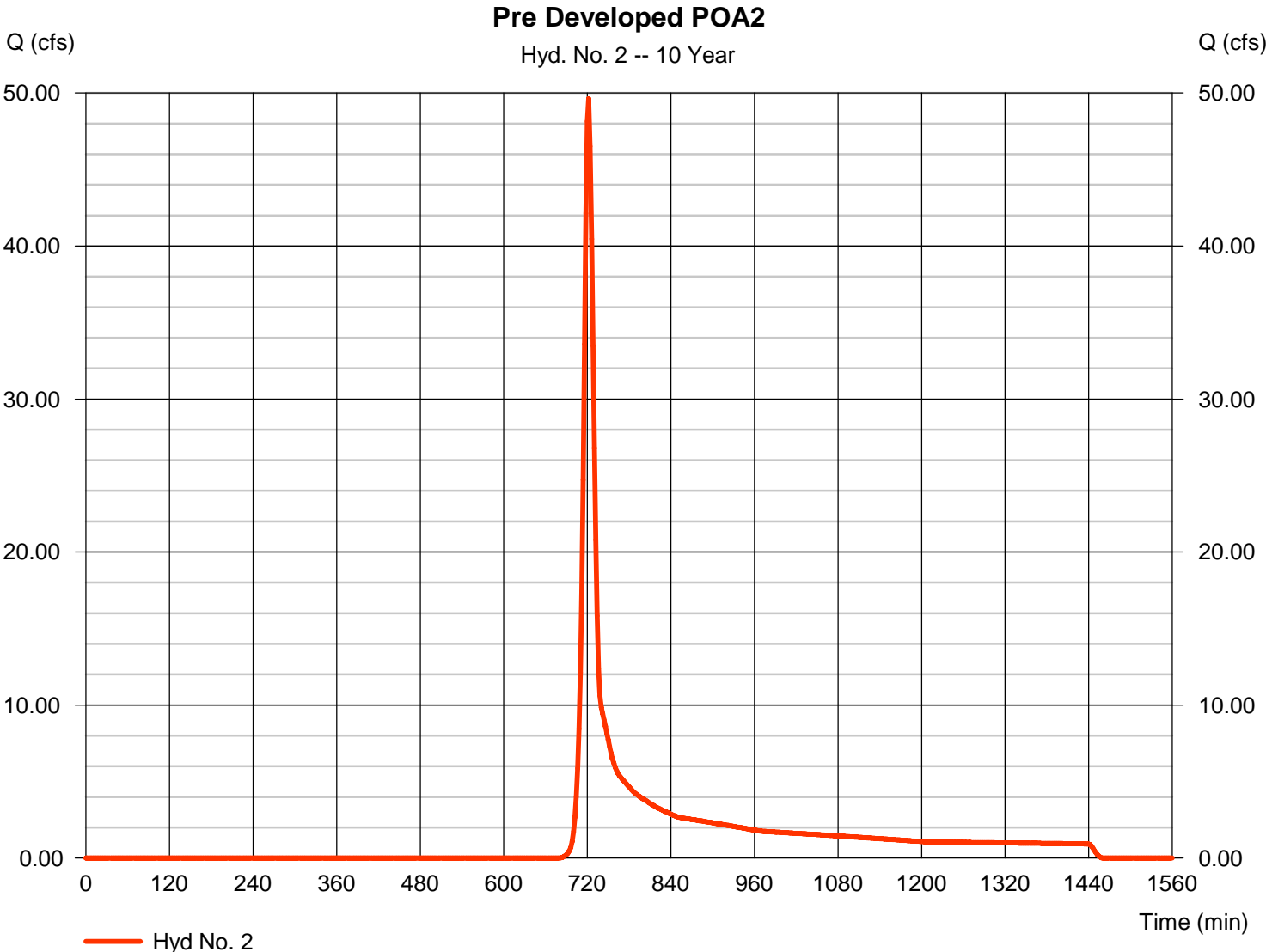


Hydrograph Report

Hyd. No. 2

Pre Developed POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 49.63 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 136,580 cuft
Drainage area	= 28.240 ac	Curve number	= 61.9
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

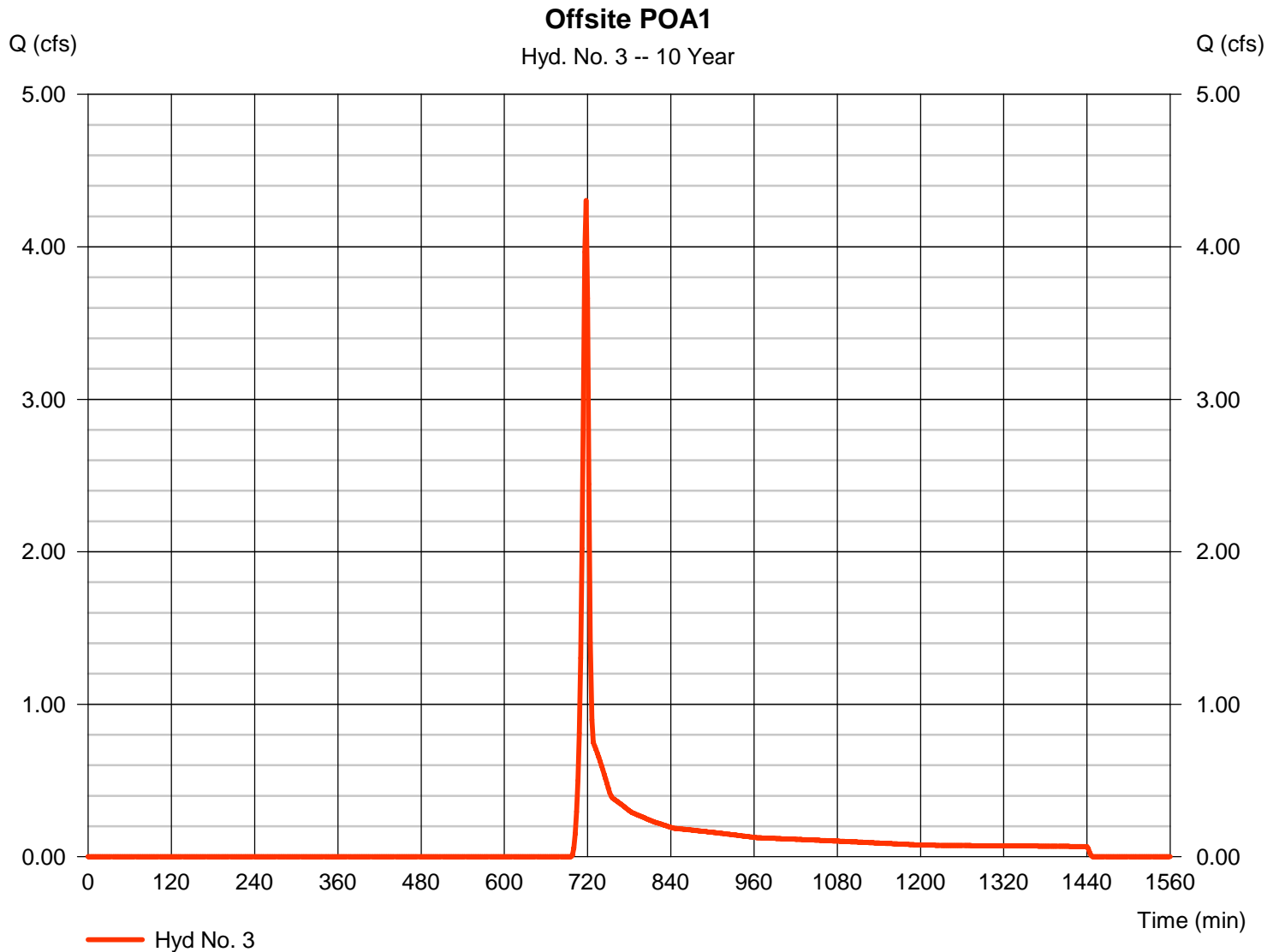
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 3

Offsite POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.304 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 8,993 cuft
Drainage area	= 2.530 ac	Curve number	= 58
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

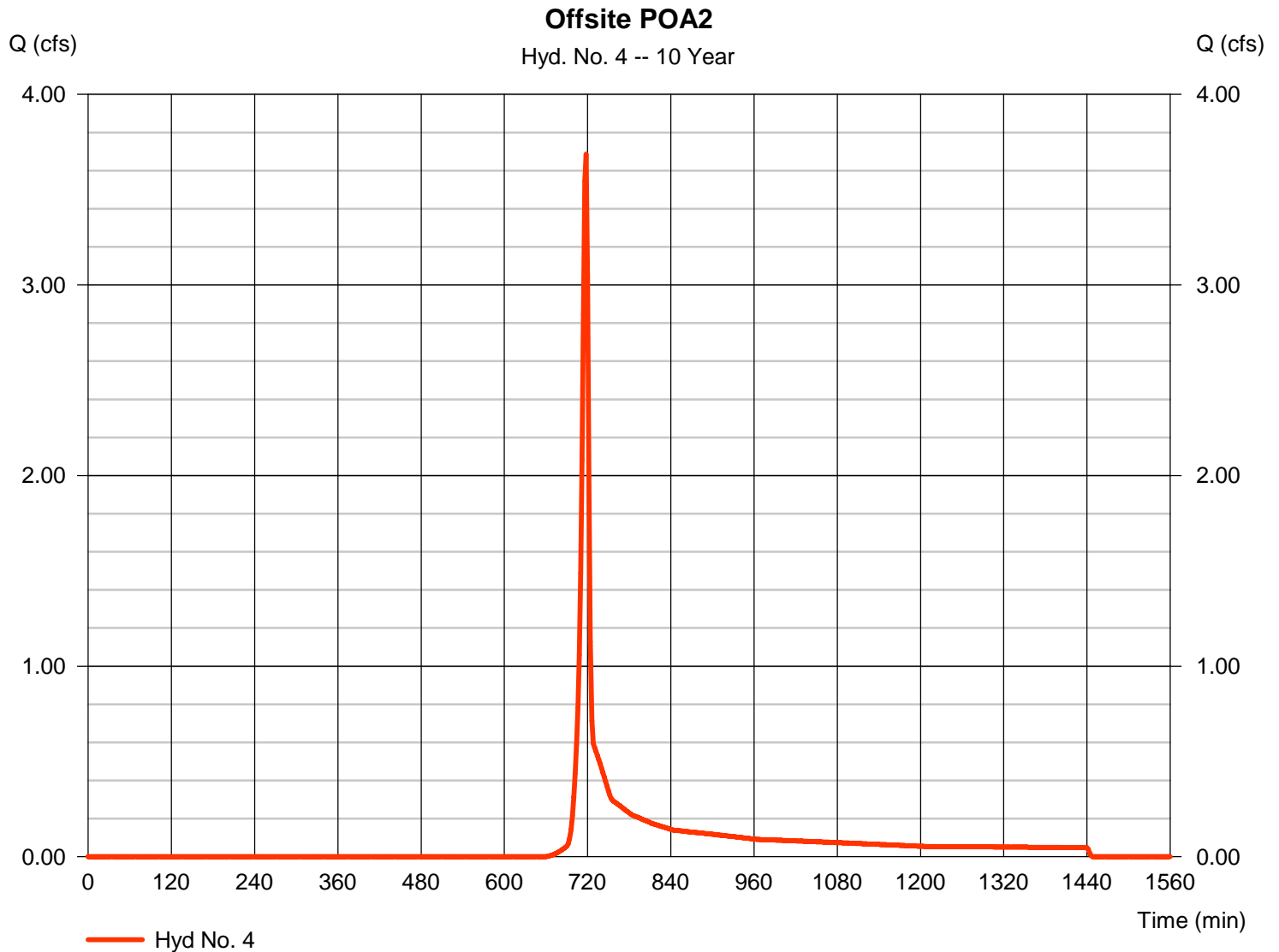
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 4

Offsite POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 3.686 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 7,407 cuft
Drainage area	= 1.490 ac	Curve number	= 64.4
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

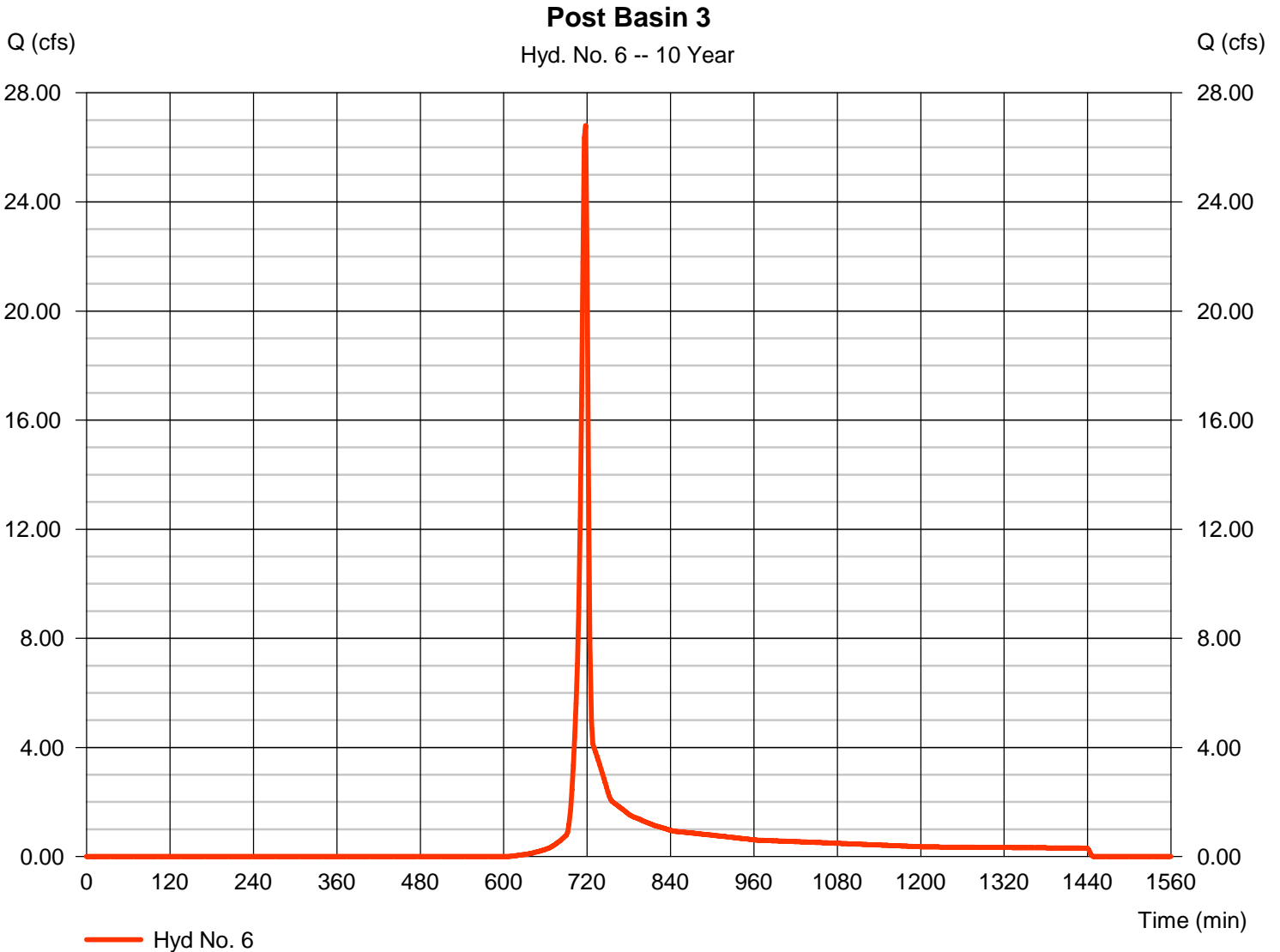
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 6

Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 26.80 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 53,611 cuft
Drainage area	= 8.540 ac	Curve number	= 69.7
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. v2024

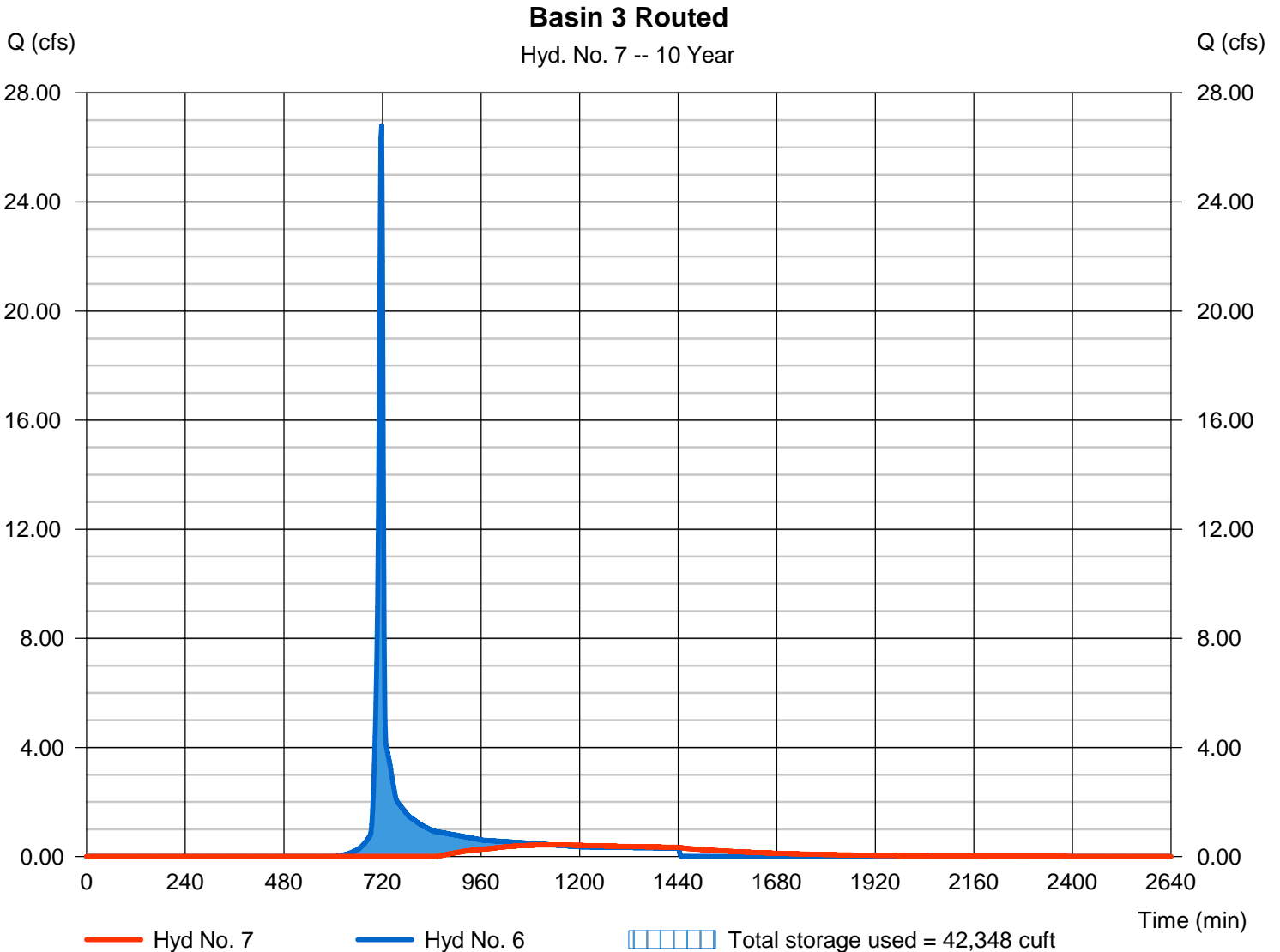
Monday, 03 / 24 / 2025

Hyd. No. 7

Basin 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.428 cfs
Storm frequency	= 10 yrs	Time to peak	= 1134 min
Time interval	= 2 min	Hyd. volume	= 16,683 cuft
Inflow hyd. No.	= 6 - Post Basin 3	Max. Elevation	= 318.25 ft
Reservoir name	= Basin 3	Max. Storage	= 42,348 cuft

Storage Indication method used.



Hydrograph Report

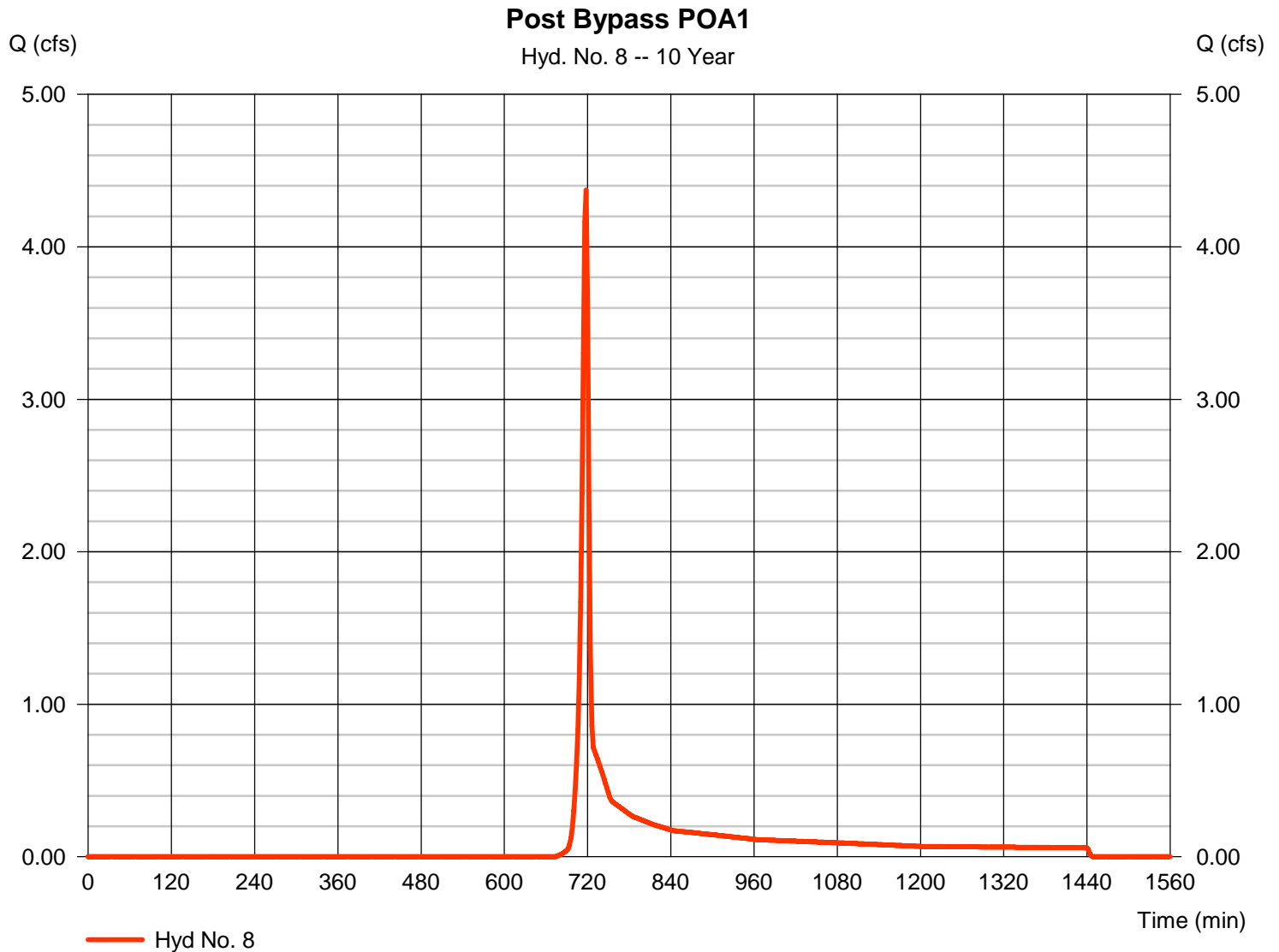
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 8

Post Bypass POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.371 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 8,835 cuft
Drainage area	= 1.930 ac	Curve number	= 62.7
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. v2024

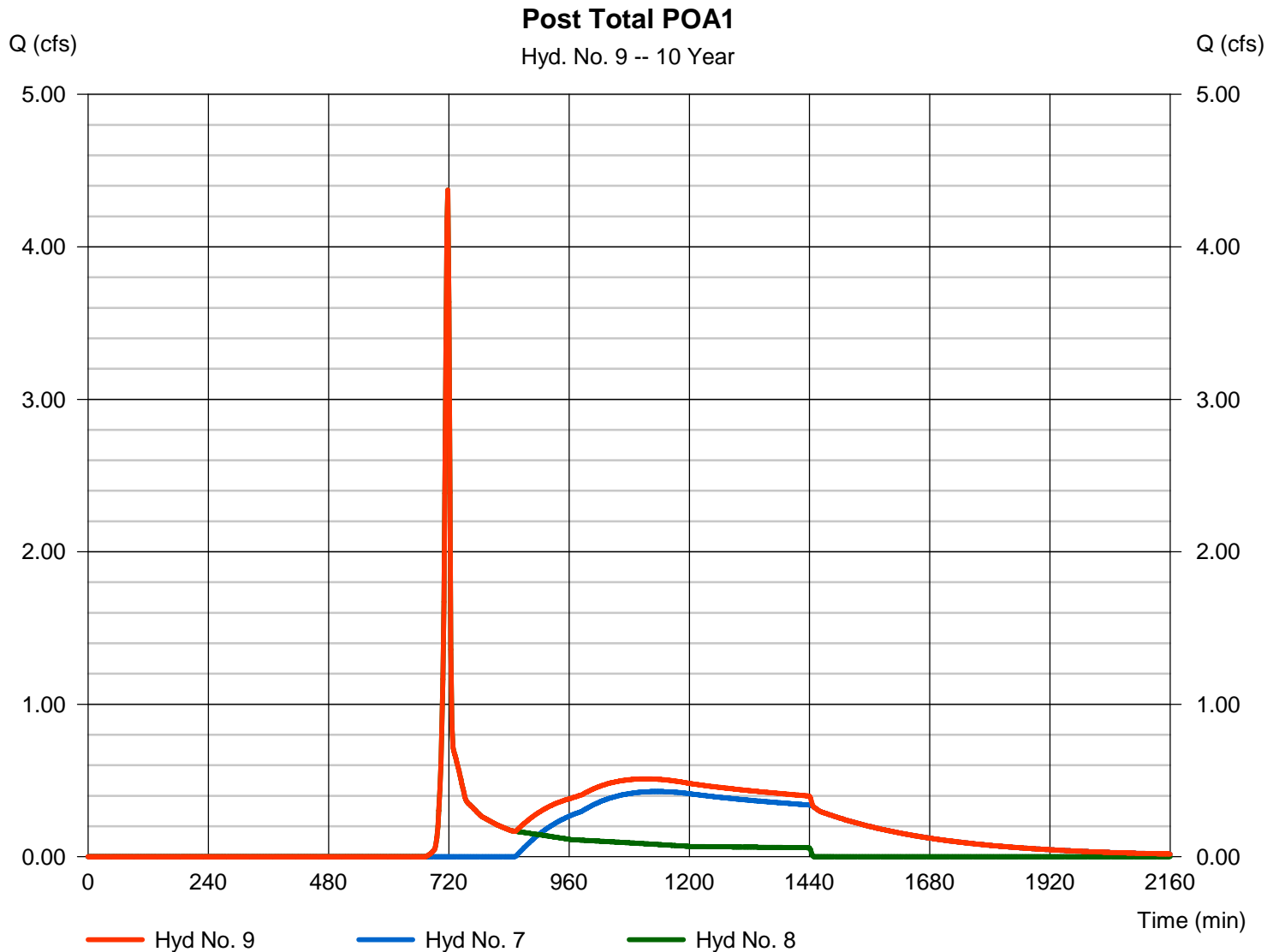
Monday, 03 / 24 / 2025

Hyd. No. 9

Post Total POA1

Hydrograph type = Combine
 Storm frequency = 10 yrs
 Time interval = 2 min
 Inflow hyds. = 7, 8

Peak discharge = 4.371 cfs
 Time to peak = 718 min
 Hyd. volume = 25,518 cuft
 Contrib. drain. area = 1.930 ac



Hydrograph Report

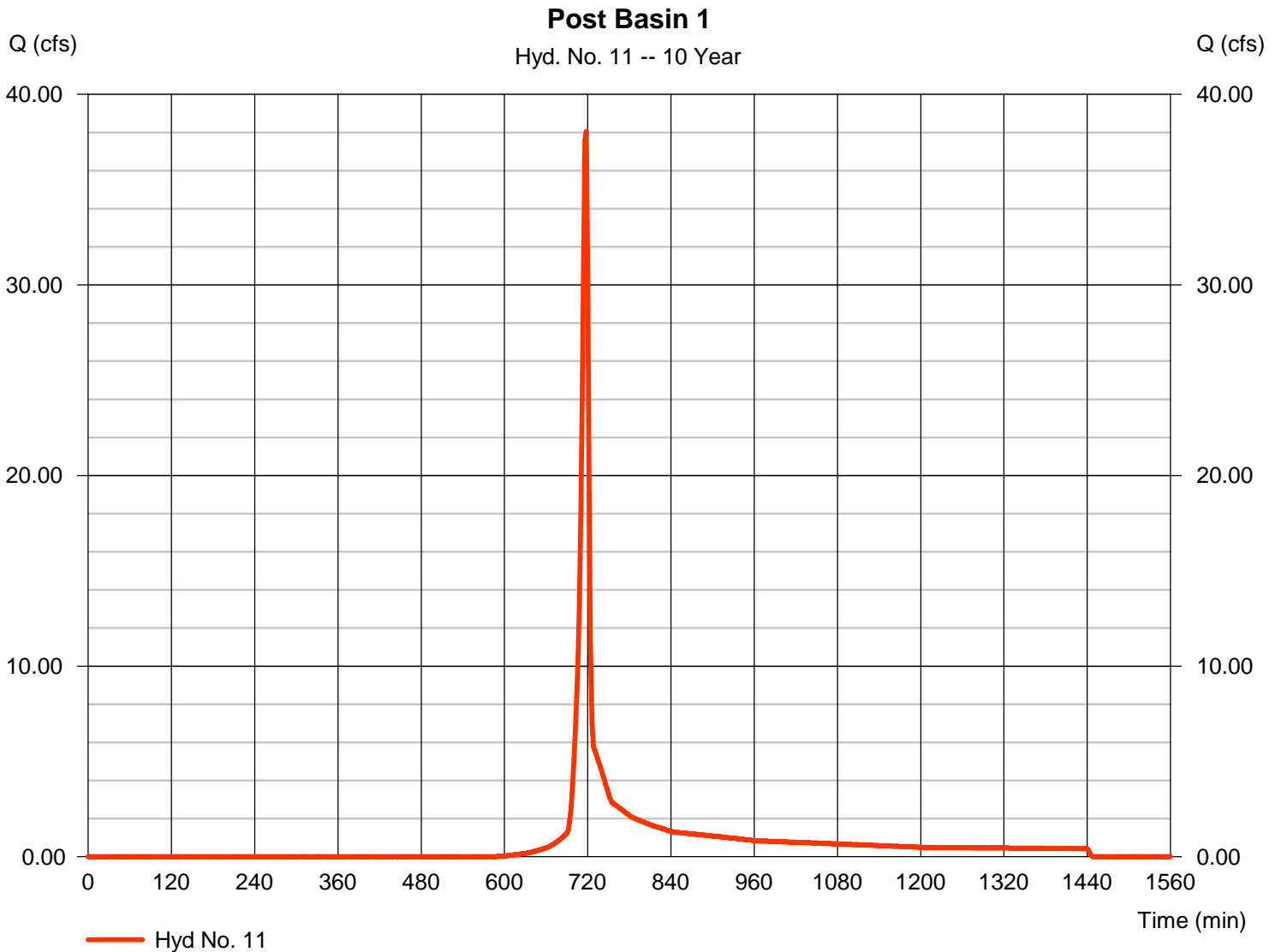
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 11

Post Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 38.05 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 76,229 cuft
Drainage area	= 11.430 ac	Curve number	= 71.2
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. v2024

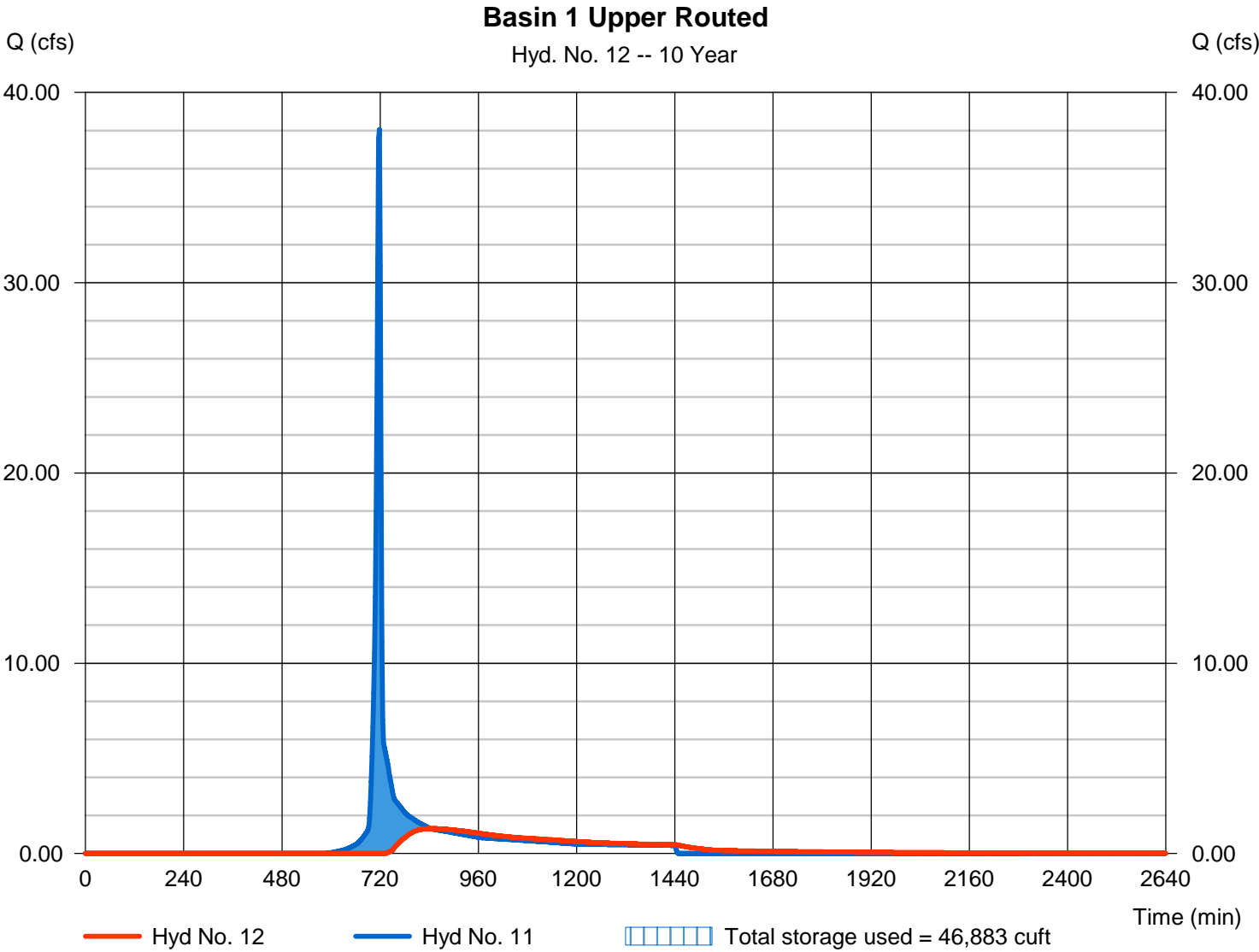
Monday, 03 / 24 / 2025

Hyd. No. 12

Basin 1 Upper Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.312 cfs
Storm frequency	= 10 yrs	Time to peak	= 842 min
Time interval	= 2 min	Hyd. volume	= 38,740 cuft
Inflow hyd. No.	= 11 - Post Basin 1	Max. Elevation	= 322.90 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 46,883 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

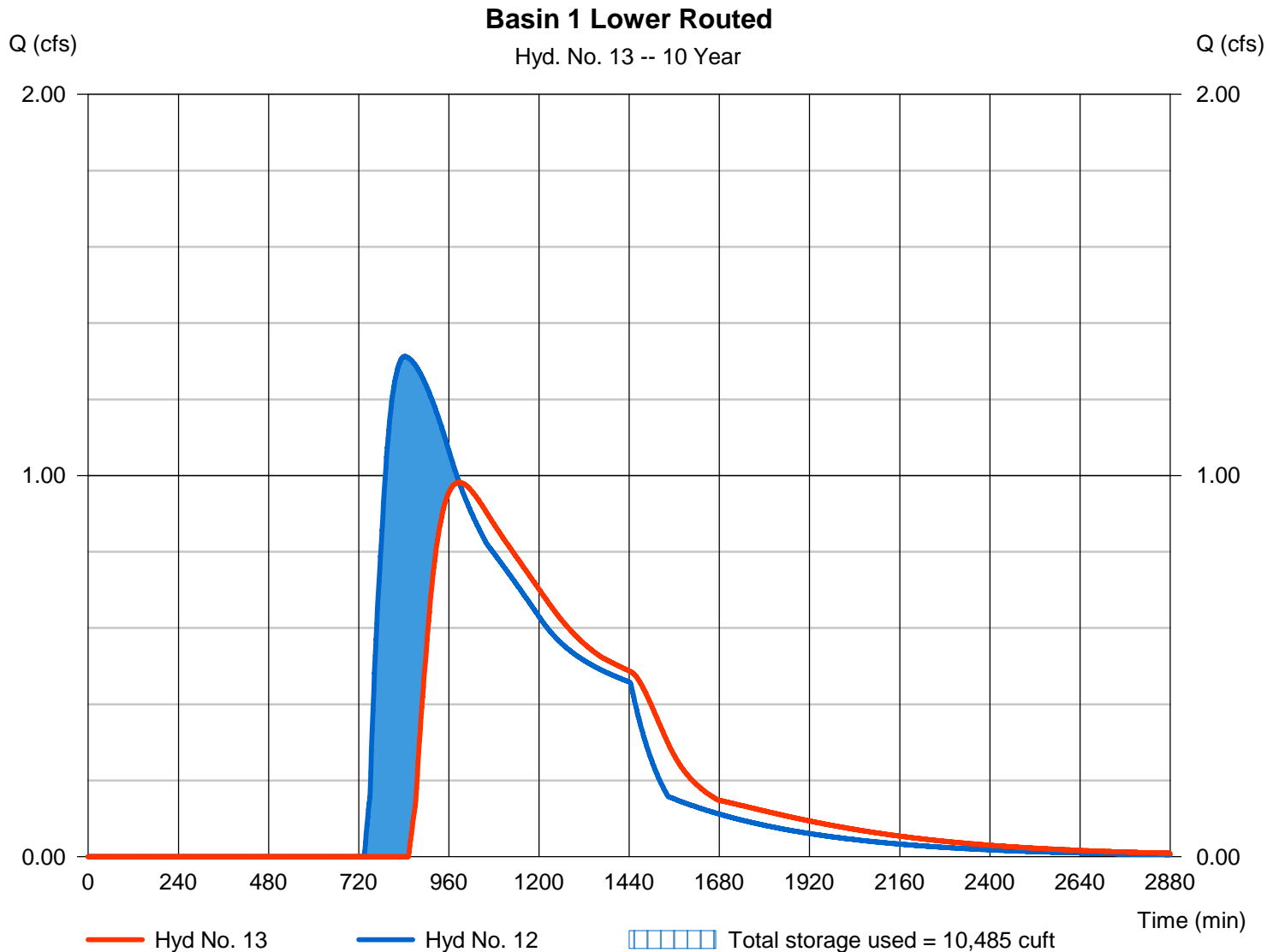
Monday, 03 / 24 / 2025

Hyd. No. 13

Basin 1 Lower Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.982 cfs
Storm frequency	= 10 yrs	Time to peak	= 988 min
Time interval	= 2 min	Hyd. volume	= 32,544 cuft
Inflow hyd. No.	= 12 - Basin 1 Upper Routed	Max. Elevation	= 304.59 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 10,485 cuft

Storage Indication method used.

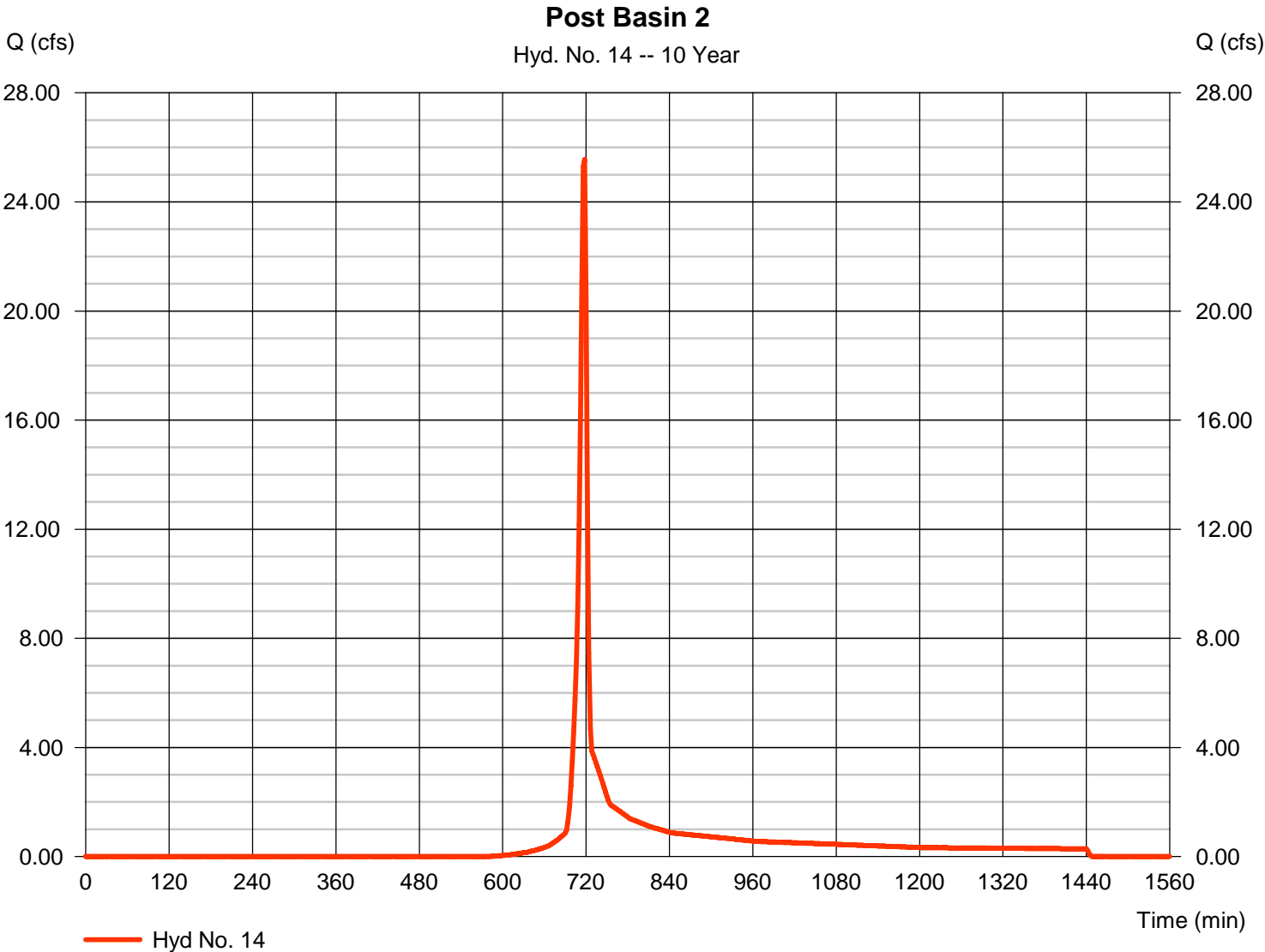


Hydrograph Report

Hyd. No. 14

Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 25.55 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 51,219 cuft
Drainage area	= 7.530 ac	Curve number	= 71.7
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. v2024

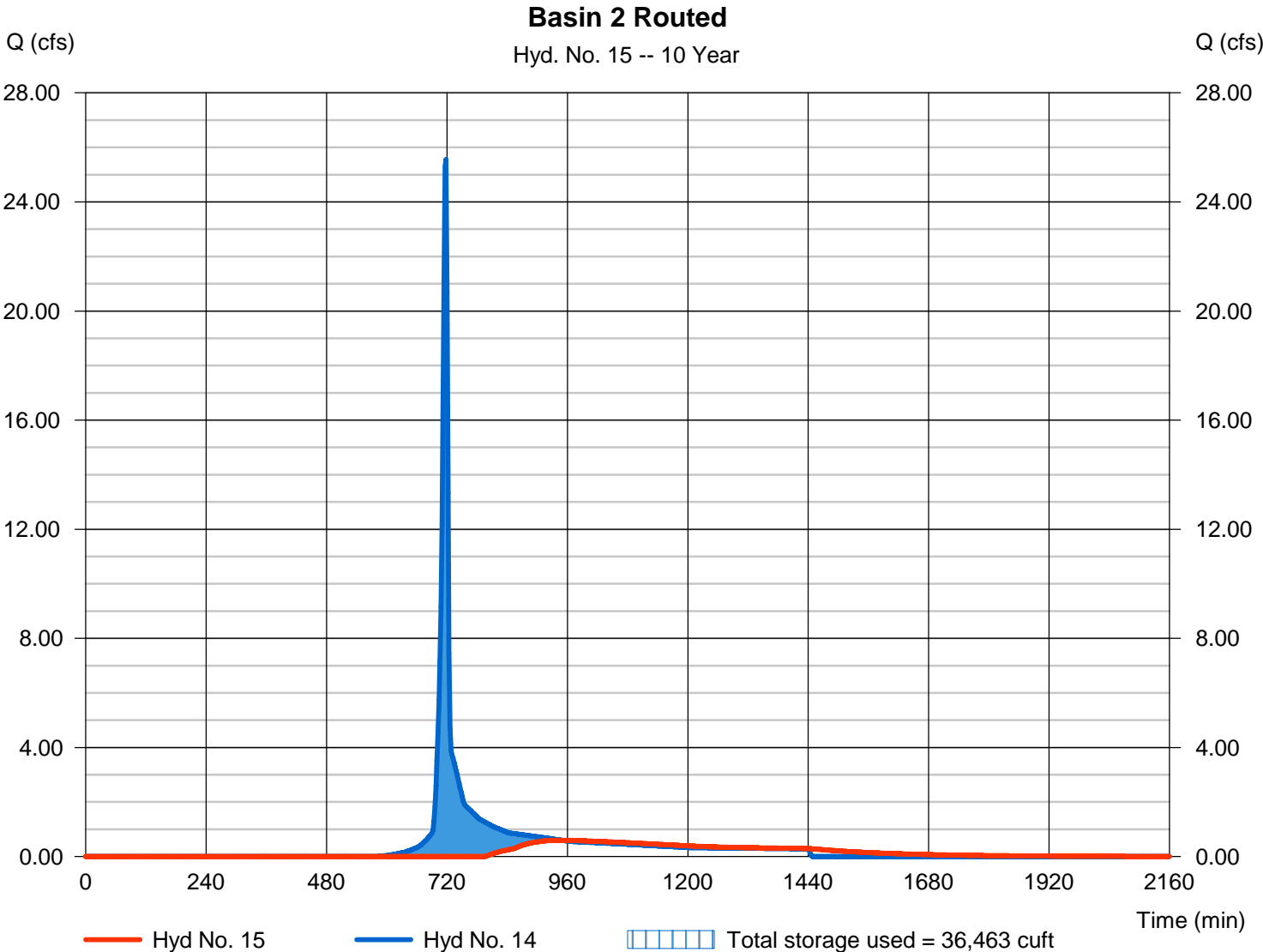
Monday, 03 / 24 / 2025

Hyd. No. 15

Basin 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.599 cfs
Storm frequency	= 10 yrs	Time to peak	= 948 min
Time interval	= 2 min	Hyd. volume	= 18,864 cuft
Inflow hyd. No.	= 14 - Post Basin 2	Max. Elevation	= 309.08 ft
Reservoir name	= Basin 2	Max. Storage	= 36,463 cuft

Storage Indication method used.



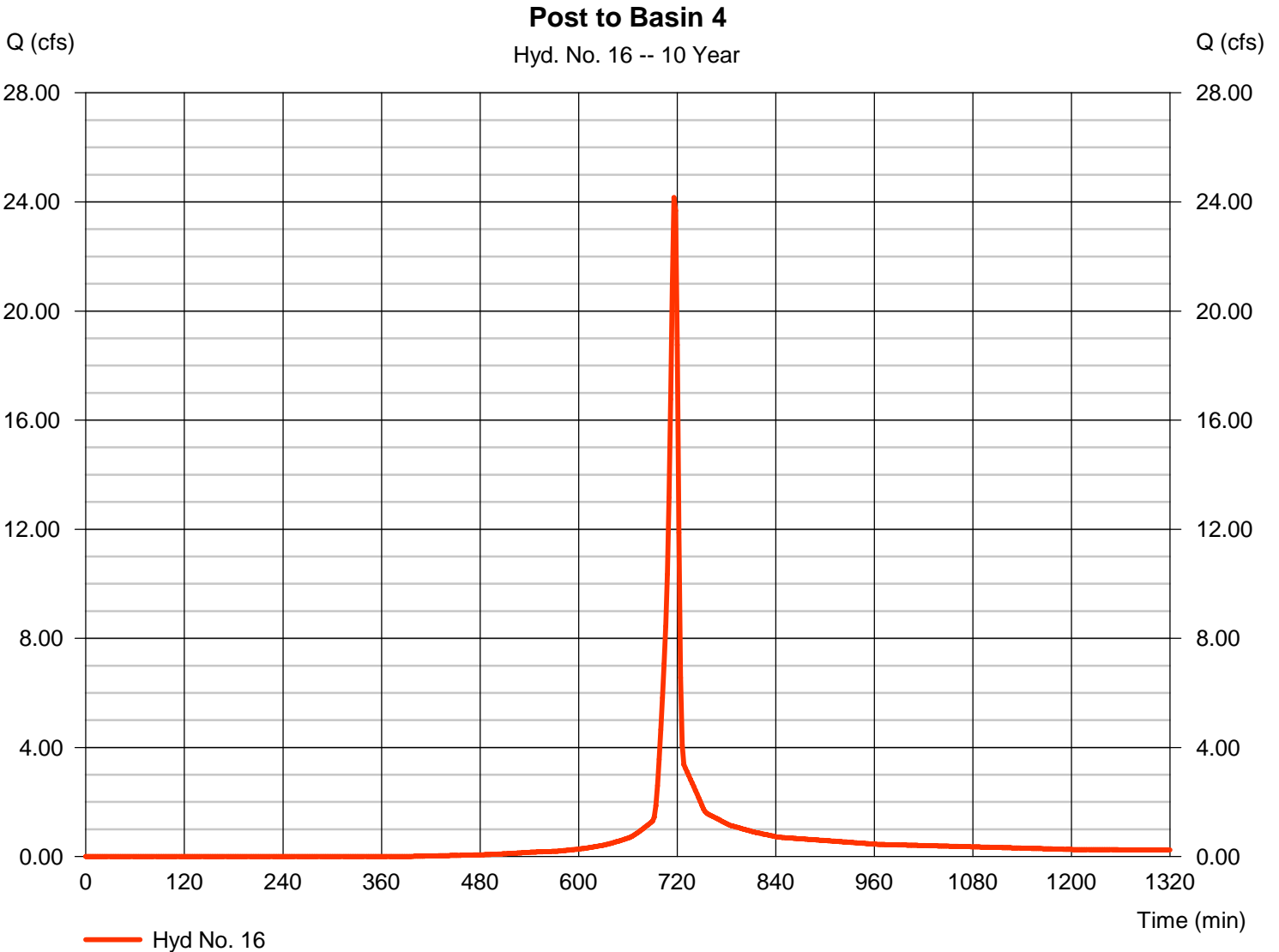
Hydrograph Report

Hyd. No. 16

Post to Basin 4

Hydrograph type	= SCS Runoff	Peak discharge	= 24.16 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 49,462 cuft
Drainage area	= 4.930 ac	Curve number	= 82.8*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.930



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

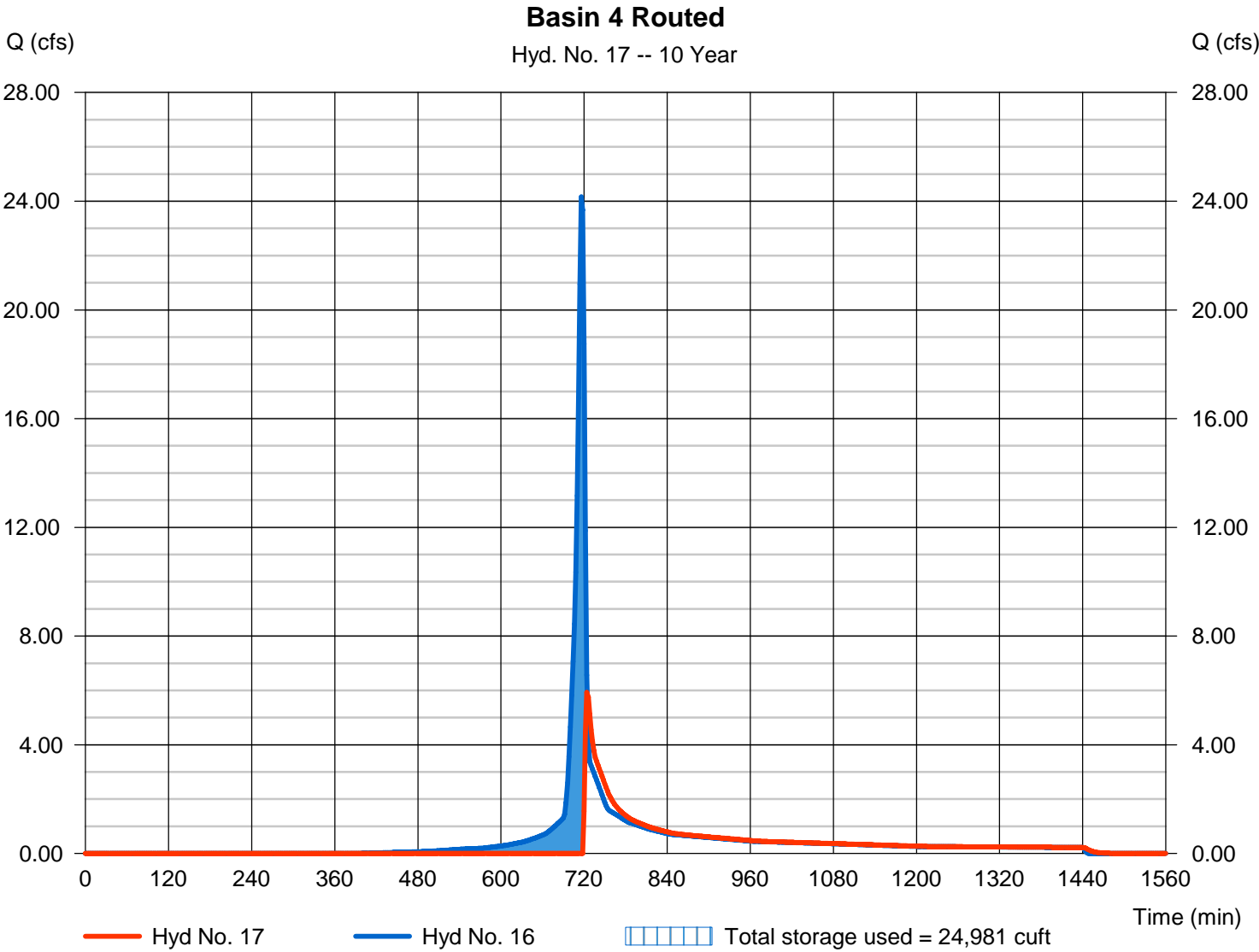
Monday, 03 / 24 / 2025

Hyd. No. 17

Basin 4 Routed

Hydrograph type	= Reservoir	Peak discharge	= 5.931 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 27,372 cuft
Inflow hyd. No.	= 16 - Post to Basin 4	Max. Elevation	= 348.27 ft
Reservoir name	= Basin 4	Max. Storage	= 24,981 cuft

Storage Indication method used.



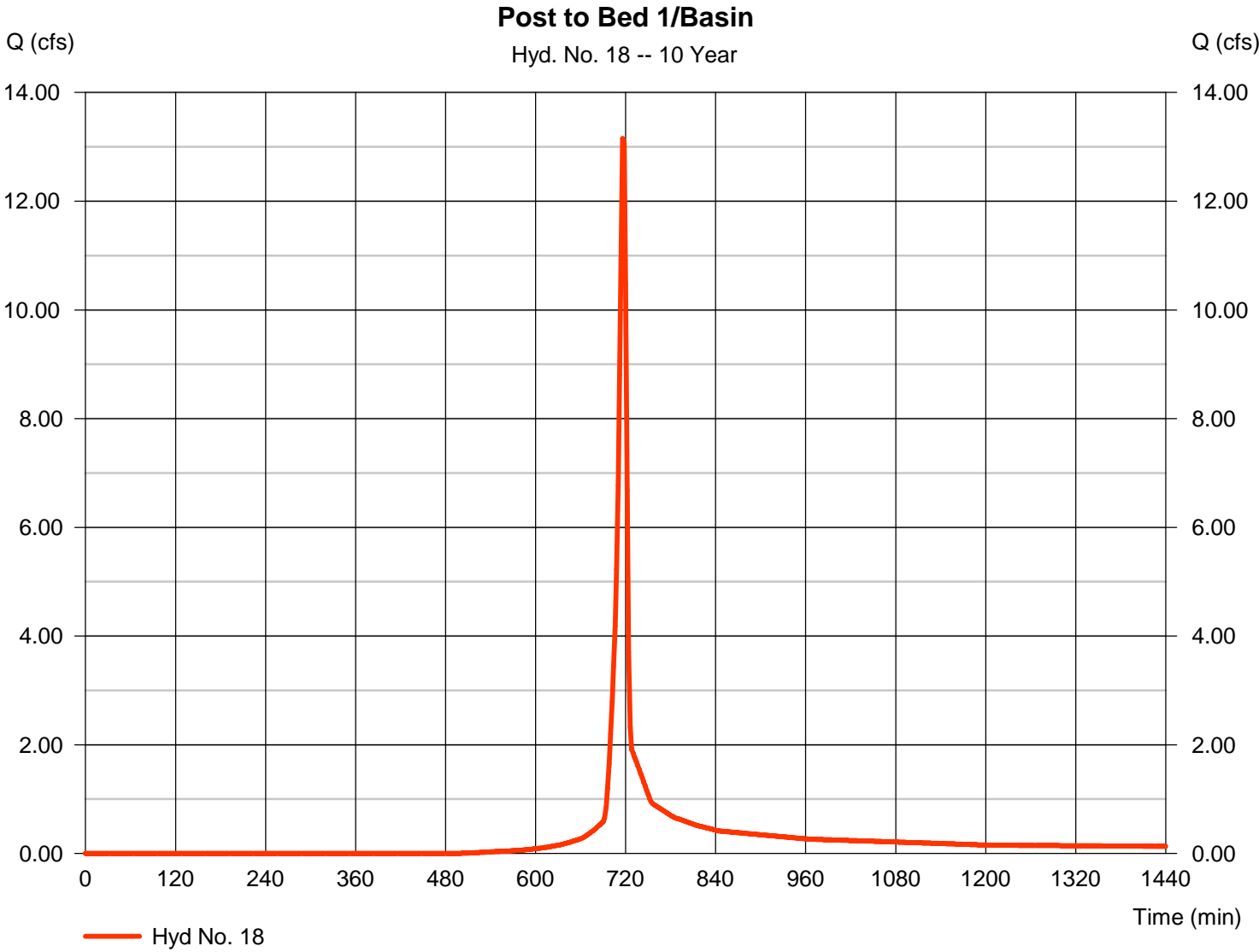
Hydrograph Report

Hyd. No. 18

Post to Bed 1/Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 13.15 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 26,584 cuft
Drainage area	= 3.190 ac	Curve number	= 77.2*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 3.190



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

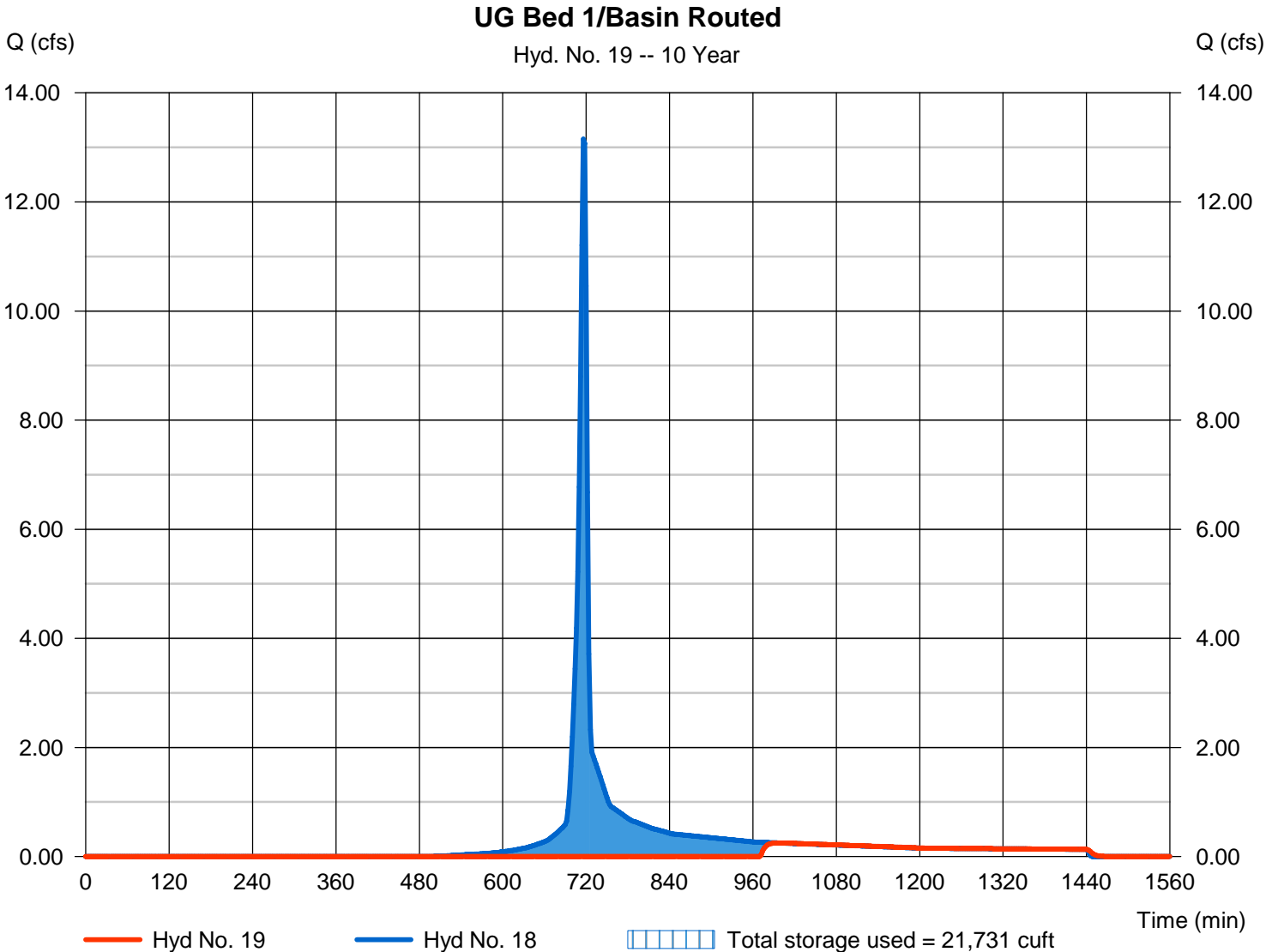
Monday, 03 / 24 / 2025

Hyd. No. 19

UG Bed 1/Basin Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.249 cfs
Storm frequency	= 10 yrs	Time to peak	= 998 min
Time interval	= 2 min	Hyd. volume	= 4,937 cuft
Inflow hyd. No.	= 18 - Post to Bed 1/Basin	Max. Elevation	= 342.21 ft
Reservoir name	= UG Bed 5/Basin	Max. Storage	= 21,731 cuft

Storage Indication method used.

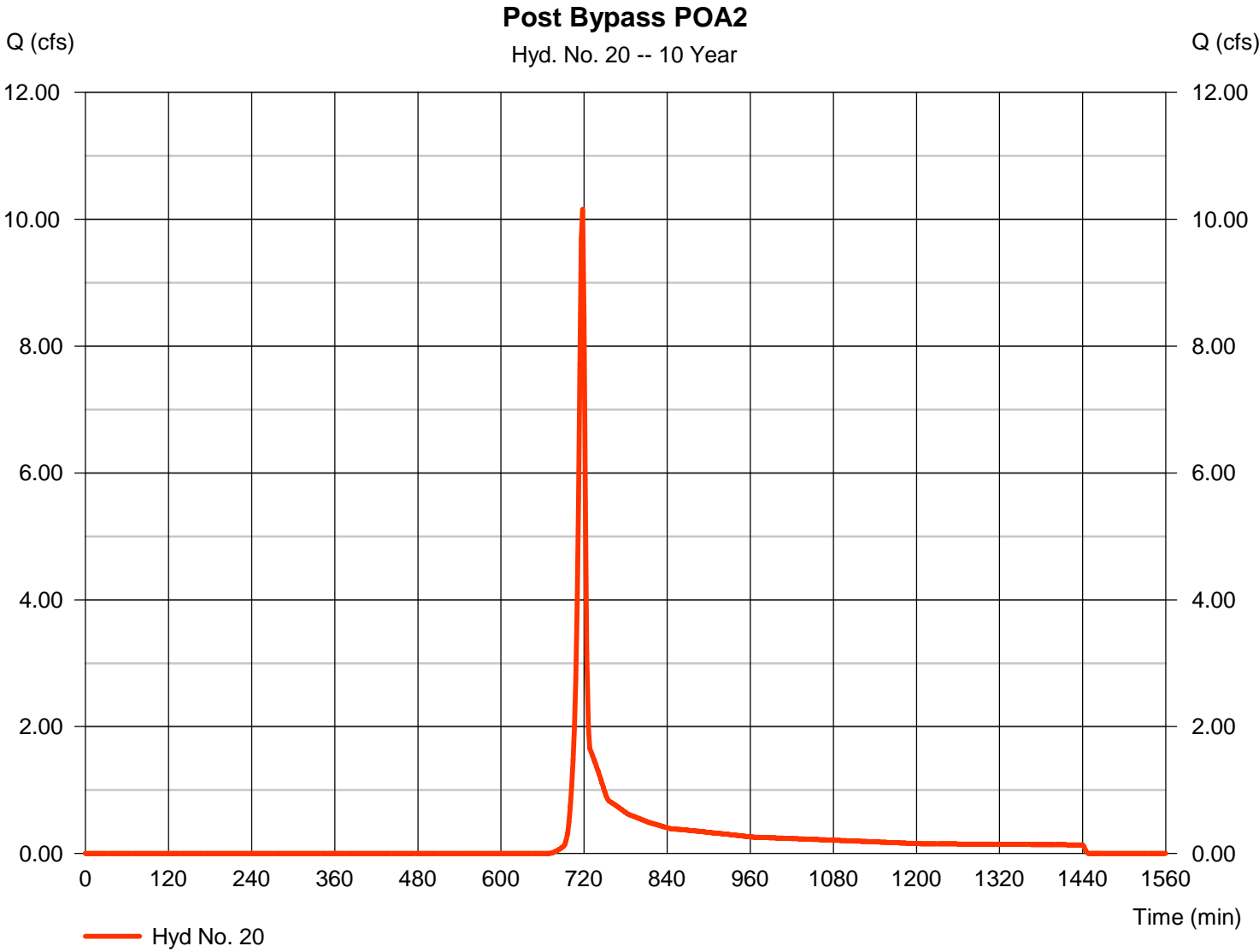


Hydrograph Report

Hyd. No. 20

Post Bypass POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 10.16 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 20,497 cuft
Drainage area	= 4.390 ac	Curve number	= 63.1
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. v2024

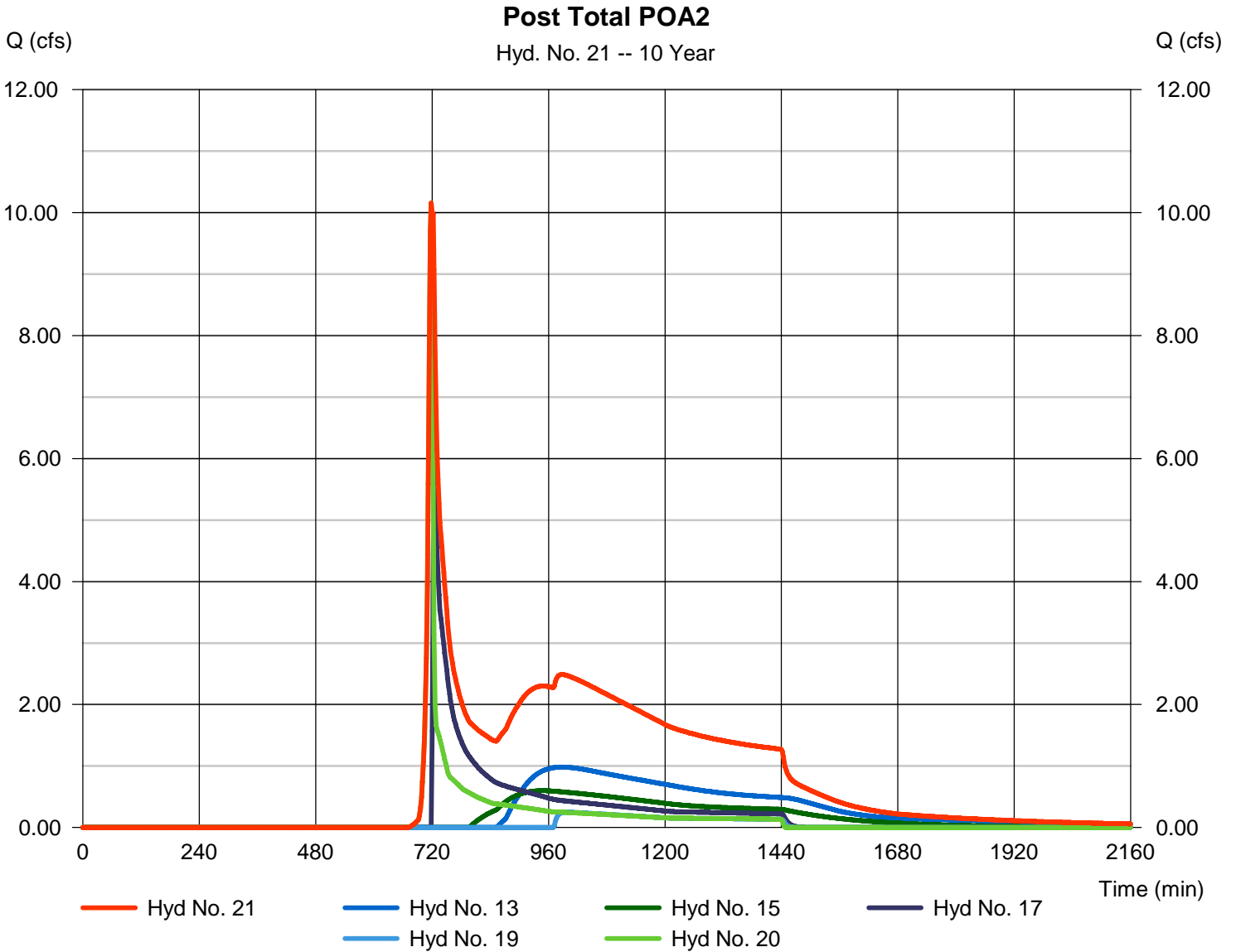
Monday, 03 / 24 / 2025

Hyd. No. 21

Post Total POA2

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 13, 15, 17, 19, 20

Peak discharge = 10.16 cfs
Time to peak = 718 min
Hyd. volume = 104,214 cuft
Contrib. drain. area = 4.390 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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	20.24	2	722	55,858	-----	-----	-----	Pre Developed POA1
2	SCS Runoff	76.19	2	722	202,955	-----	-----	-----	Pre Developed POA2
3	SCS Runoff	6.850	2	718	13,855	-----	-----	-----	Offsite POA1
4	SCS Runoff	5.395	2	718	10,788	-----	-----	-----	Offsite POA2
6	SCS Runoff	37.41	2	718	75,246	-----	-----	-----	Post Basin 3
7	Reservoir	1.356	2	832	38,319	6	318.45	46,832	Basin 3 Routed
8	SCS Runoff	6.518	2	718	13,041	-----	-----	-----	Post Bypass POA1
9	Combine	6.518	2	718	51,360	7, 8	-----	-----	Post Total POA1
11	SCS Runoff	52.51	2	718	105,990	-----	-----	-----	Post Basin 1
12	Reservoir	3.835	2	754	68,501	11	323.34	54,951	Basin 1 Upper Routed
13	Reservoir	2.163	2	872	62,304	12	305.40	16,351	Basin 1 Lower Routed
14	SCS Runoff	35.17	2	716	70,997	-----	-----	-----	Post Basin 2
15	Reservoir	1.813	2	786	38,643	14	309.36	40,426	Basin 2 Routed
16	SCS Runoff	31.18	2	716	64,570	-----	-----	-----	Post to Basin 4
17	Reservoir	18.70	2	722	42,480	16	348.61	28,519	Basin 4 Routed
18	SCS Runoff	17.58	2	716	35,714	-----	-----	-----	Post to Bed 1/Basin
19	Reservoir	1.047	2	768	14,067	18	342.26	21,999	UG Bed 1/Basin Routed
20	SCS Runoff	15.08	2	718	30,159	-----	-----	-----	Post Bypass POA2
21	Combine	30.64	2	720	187,653	13, 15, 17, 19, 20	-----	-----	Post Total POA2

Hydrograph Report

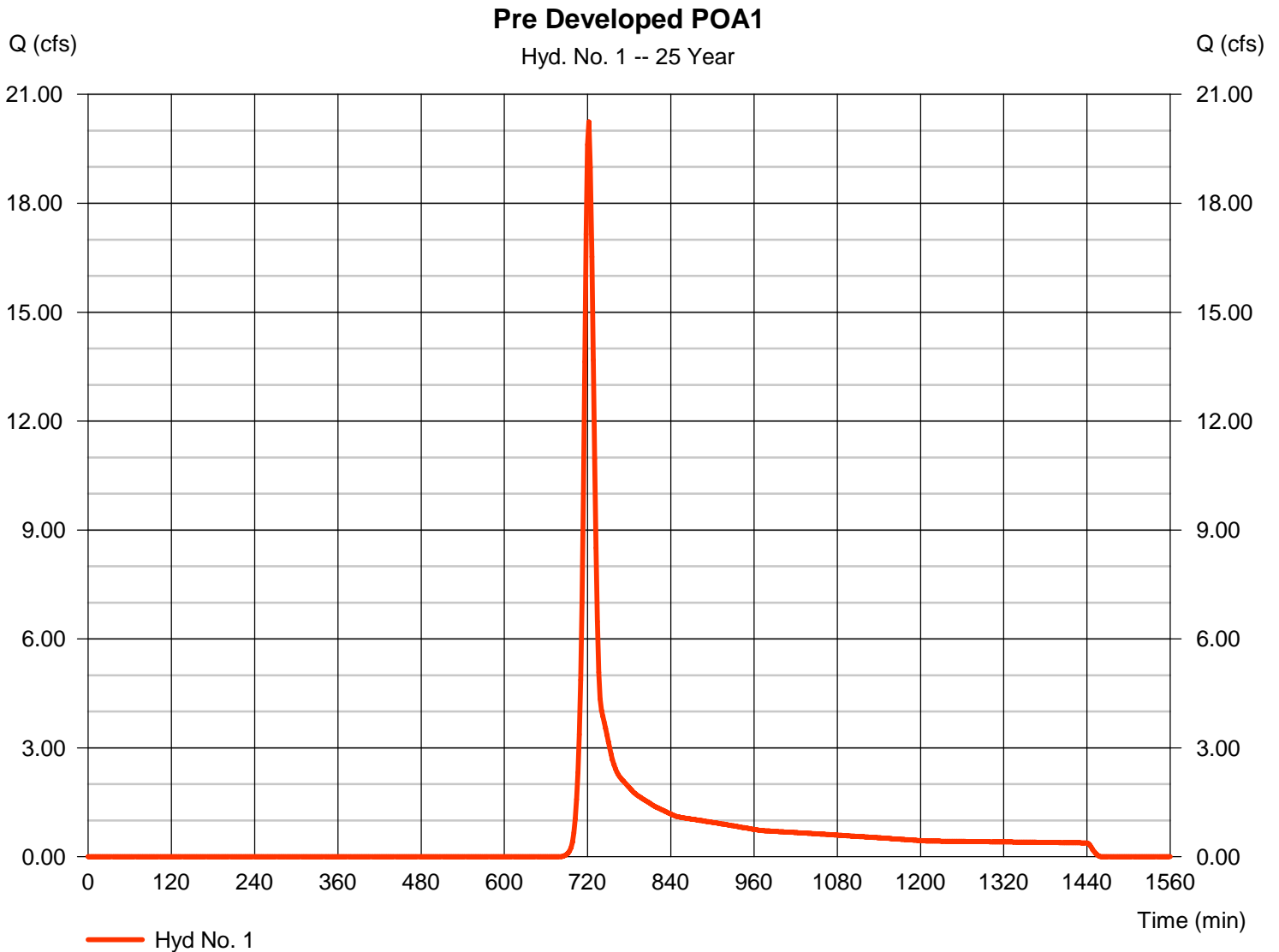
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 1

Pre Developed POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 20.24 cfs
Storm frequency	= 25 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 55,858 cuft
Drainage area	= 9.690 ac	Curve number	= 57.1
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

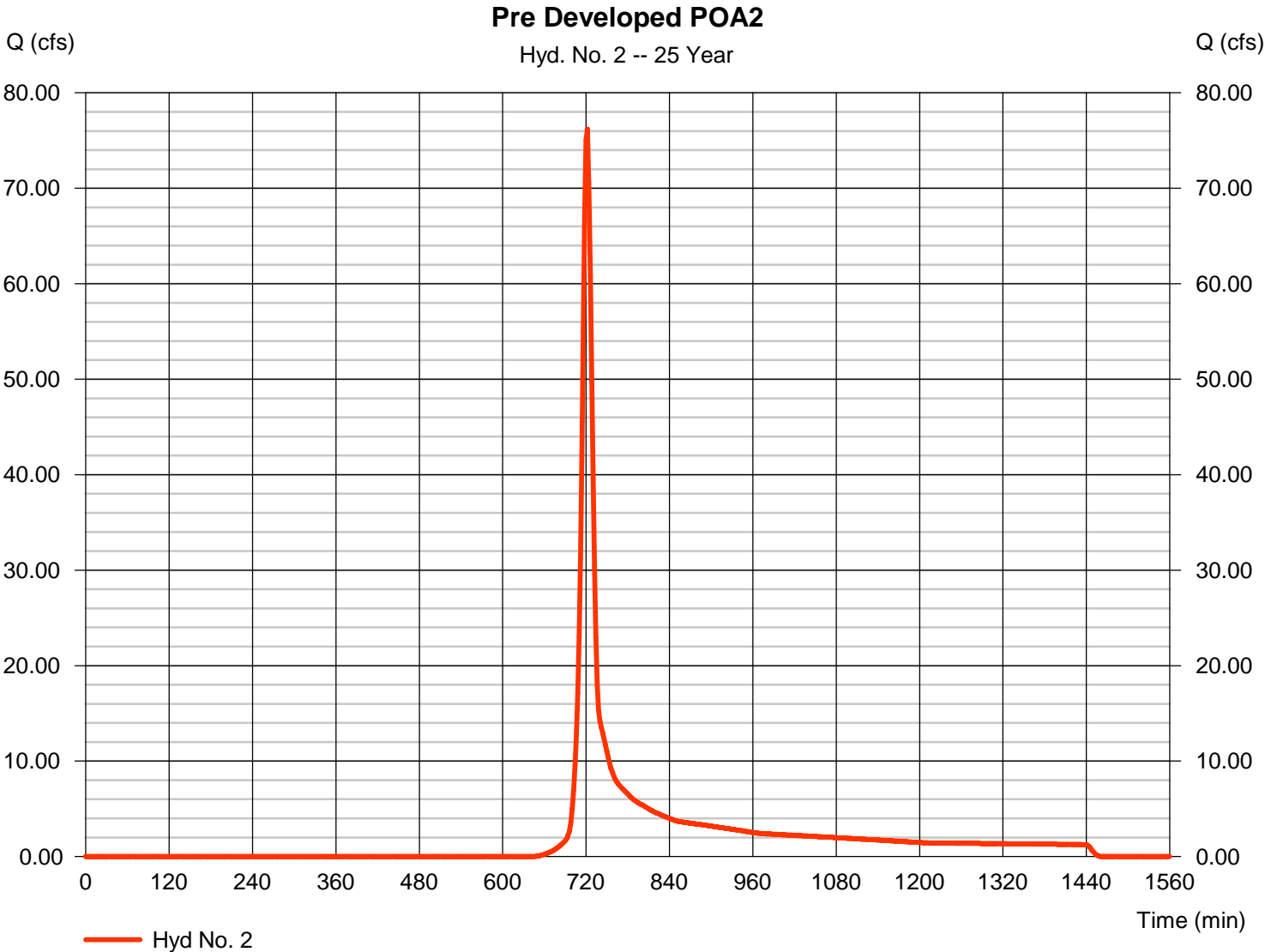


Hydrograph Report

Hyd. No. 2

Pre Developed POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 76.19 cfs
Storm frequency	= 25 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 202,955 cuft
Drainage area	= 28.240 ac	Curve number	= 61.9
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

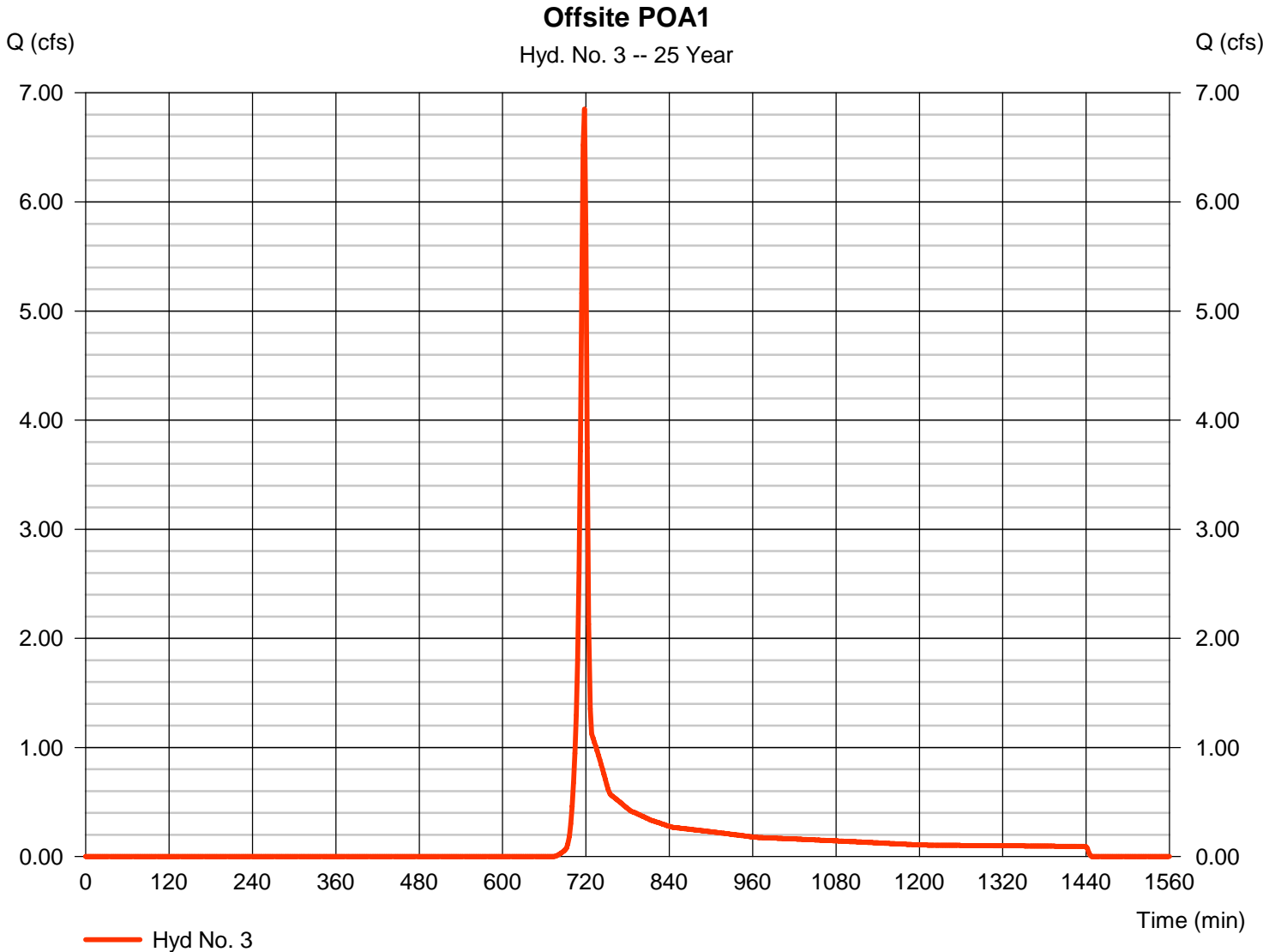


Hydrograph Report

Hyd. No. 3

Offsite POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 6.850 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 13,855 cuft
Drainage area	= 2.530 ac	Curve number	= 58
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

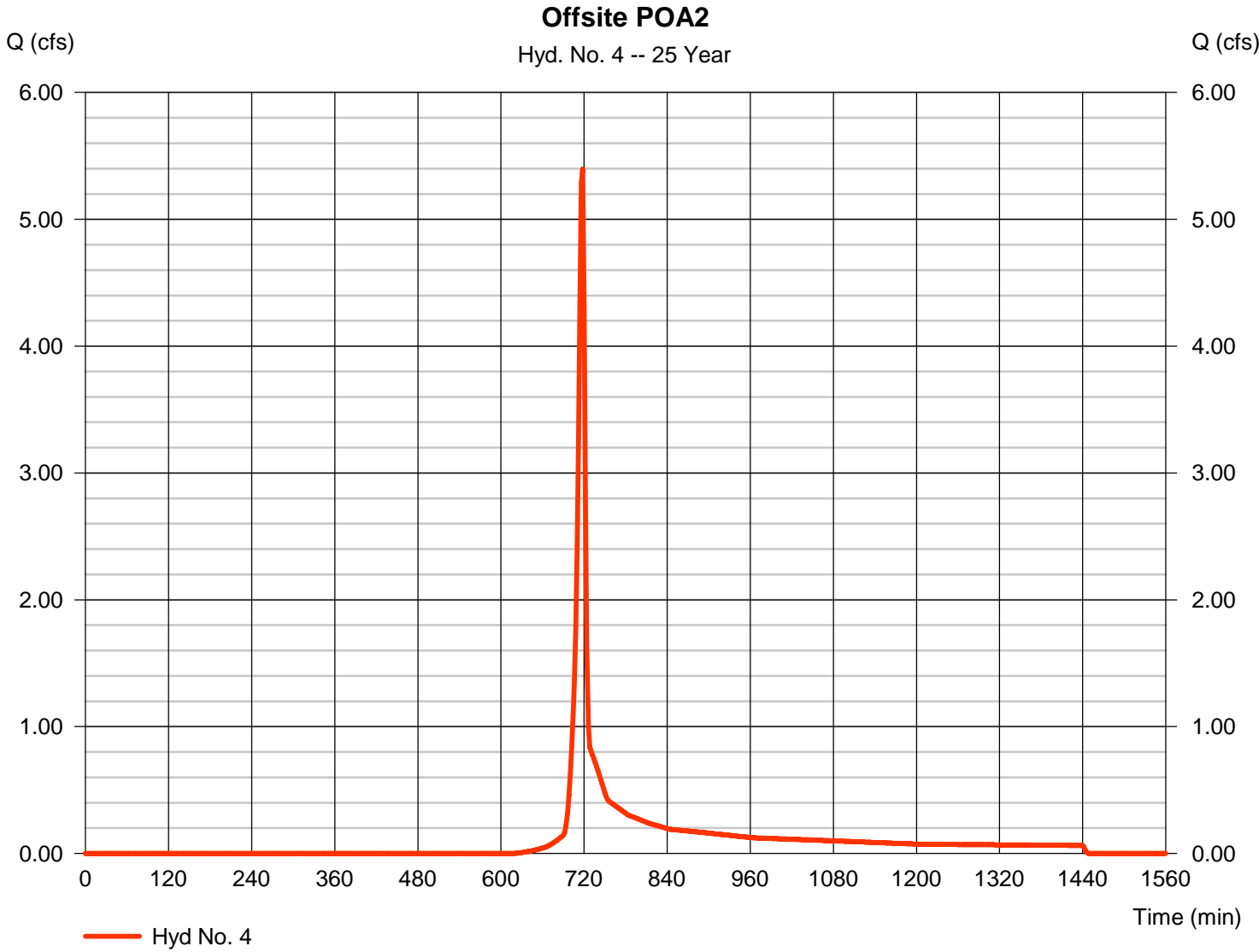
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 4

Offsite POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 5.395 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 10,788 cuft
Drainage area	= 1.490 ac	Curve number	= 64.4
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

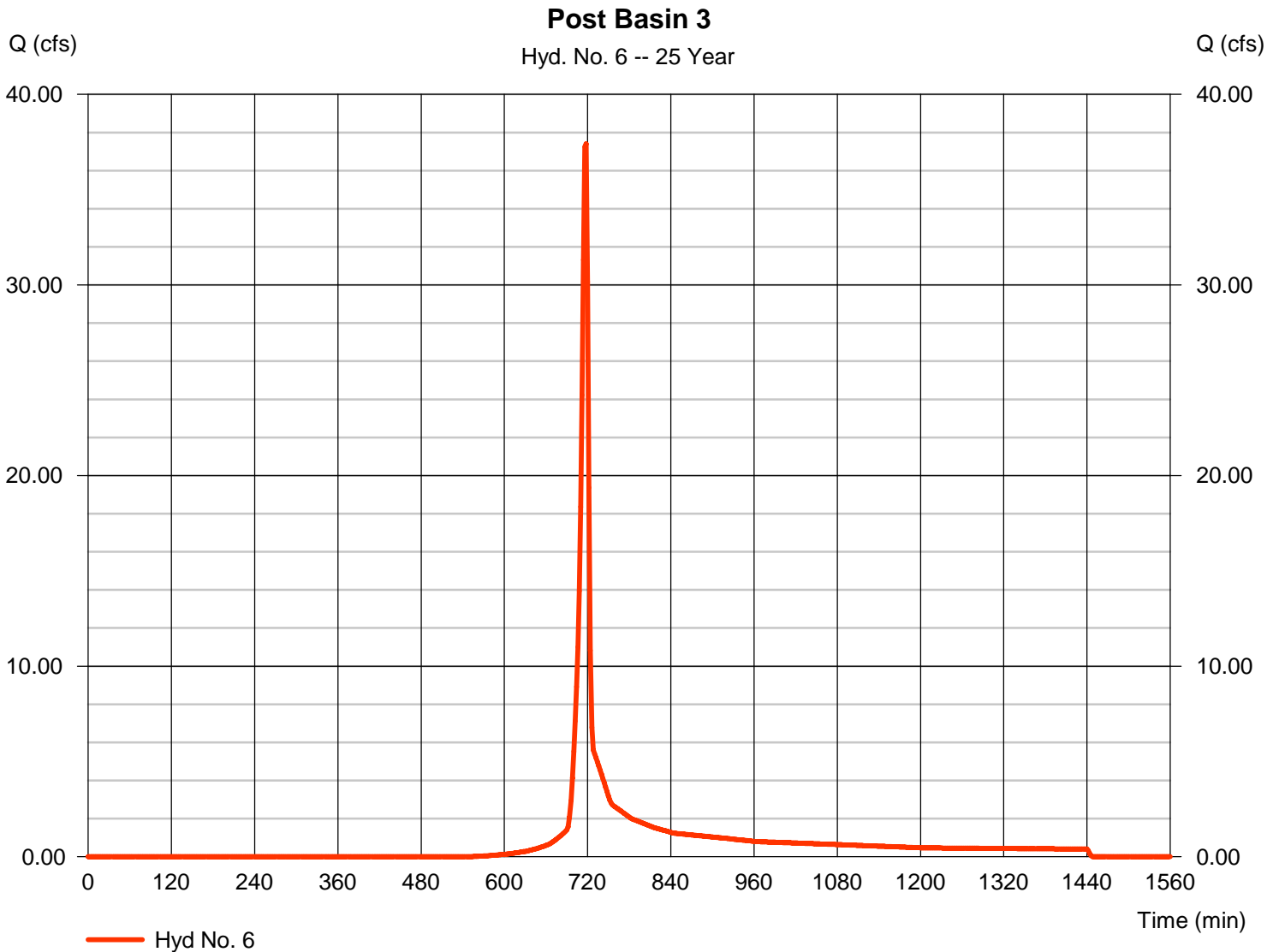


Hydrograph Report

Hyd. No. 6

Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 37.41 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 75,246 cuft
Drainage area	= 8.540 ac	Curve number	= 69.7
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. v2024

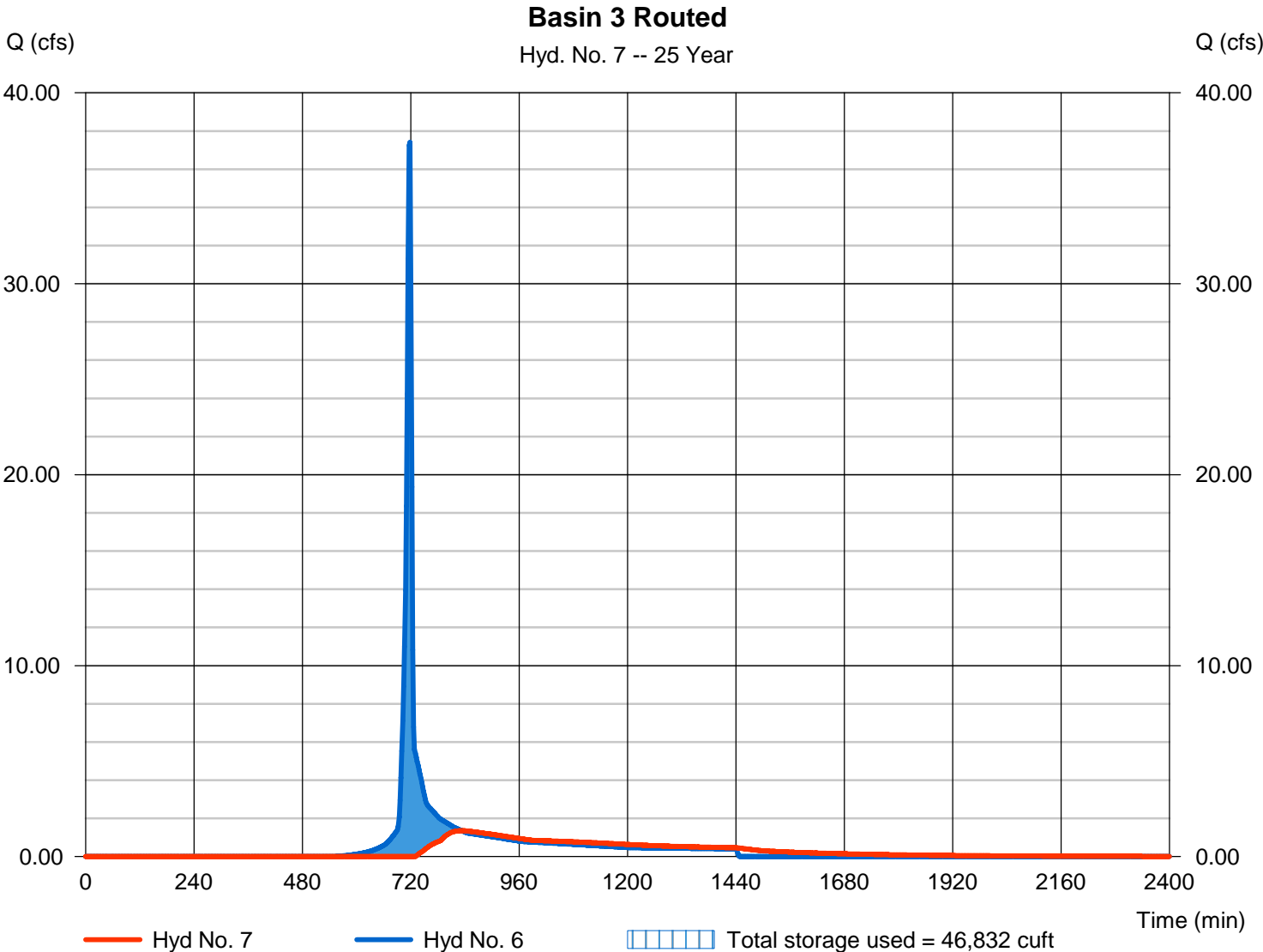
Monday, 03 / 24 / 2025

Hyd. No. 7

Basin 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.356 cfs
Storm frequency	= 25 yrs	Time to peak	= 832 min
Time interval	= 2 min	Hyd. volume	= 38,319 cuft
Inflow hyd. No.	= 6 - Post Basin 3	Max. Elevation	= 318.45 ft
Reservoir name	= Basin 3	Max. Storage	= 46,832 cuft

Storage Indication method used.

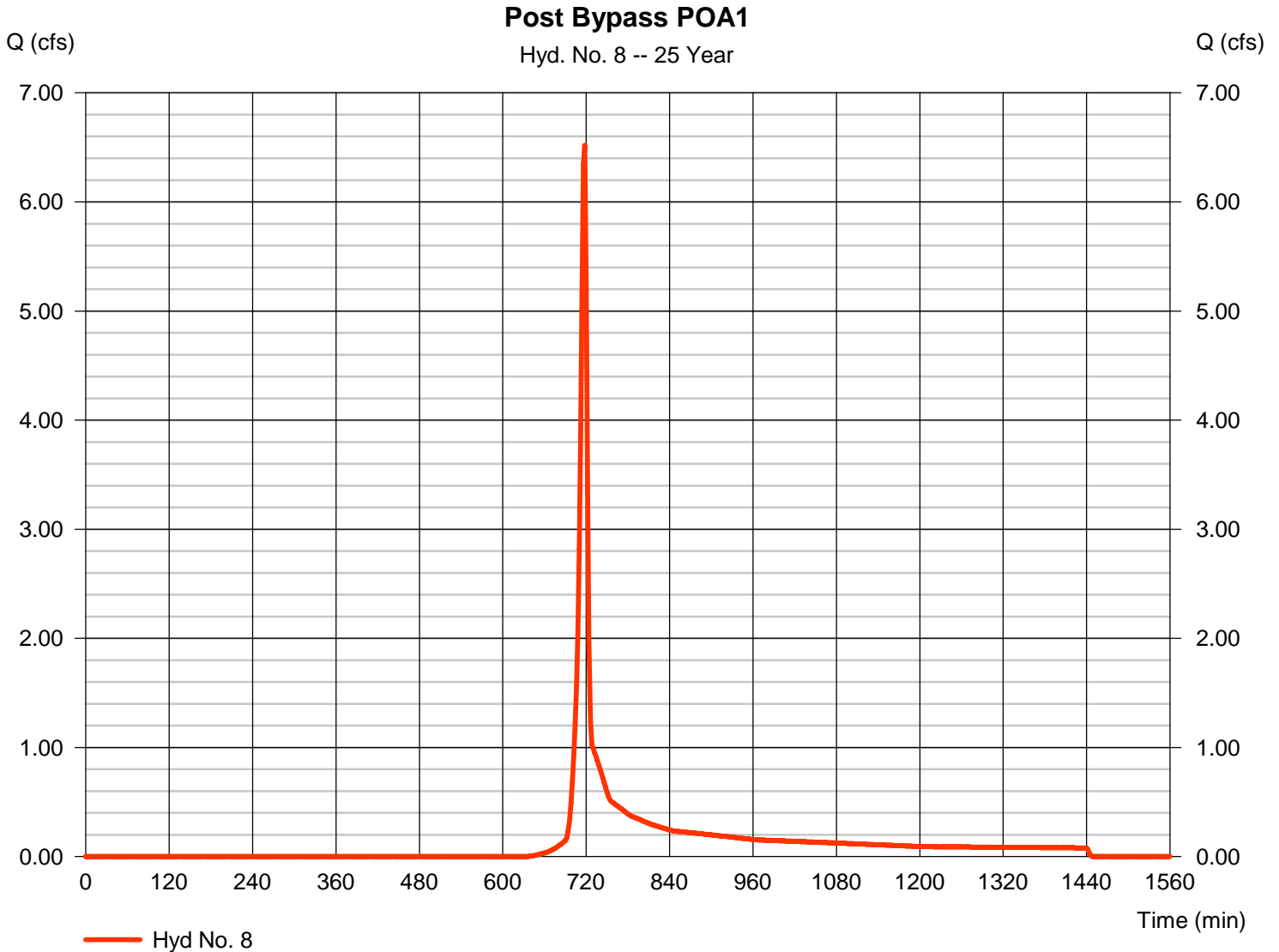


Hydrograph Report

Hyd. No. 8

Post Bypass POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 6.518 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 13,041 cuft
Drainage area	= 1.930 ac	Curve number	= 62.7
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

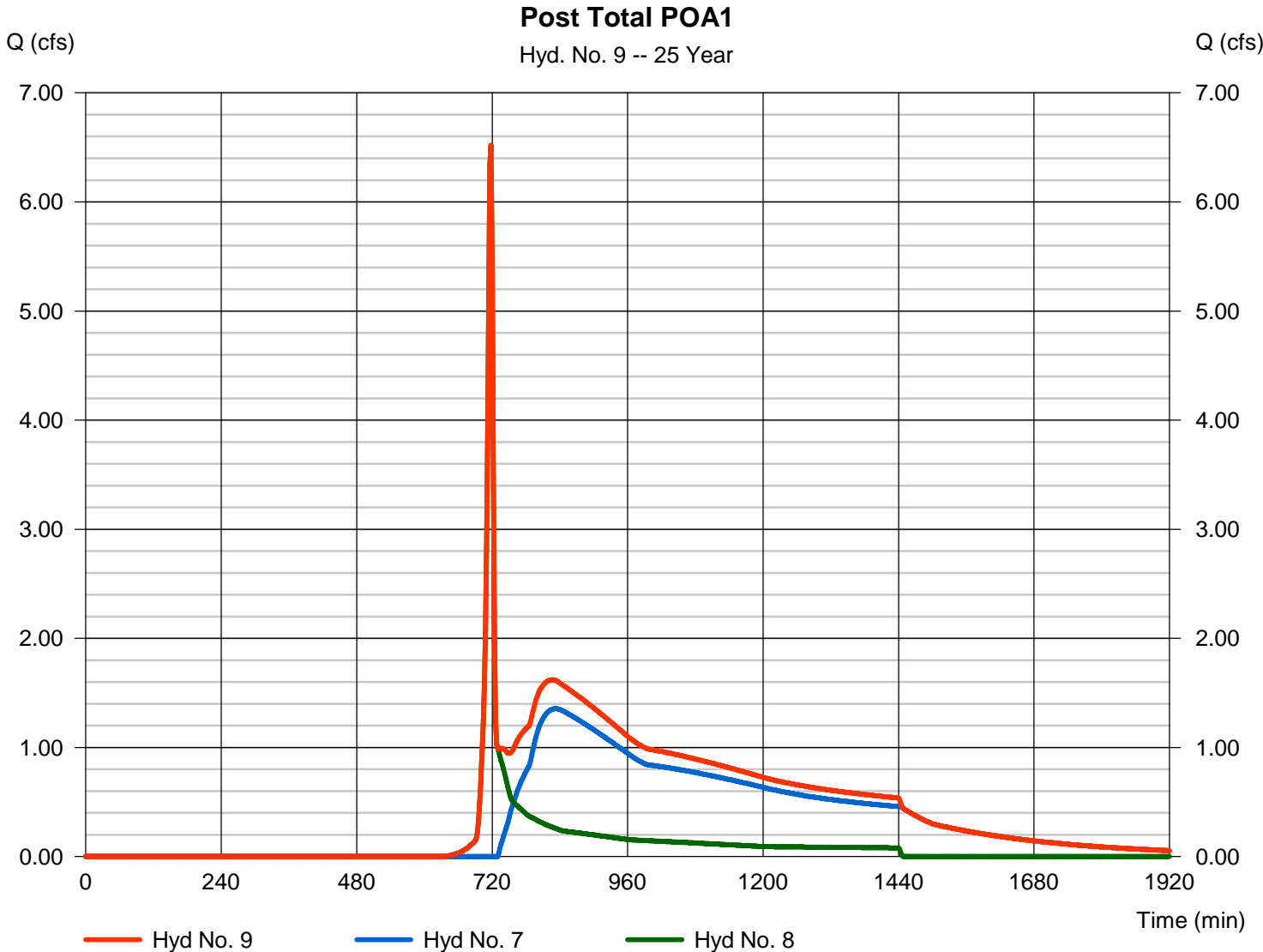
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 9

Post Total POA1

Hydrograph type	= Combine	Peak discharge	= 6.518 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 51,360 cuft
Inflow hyds.	= 7, 8	Contrib. drain. area	= 1.930 ac



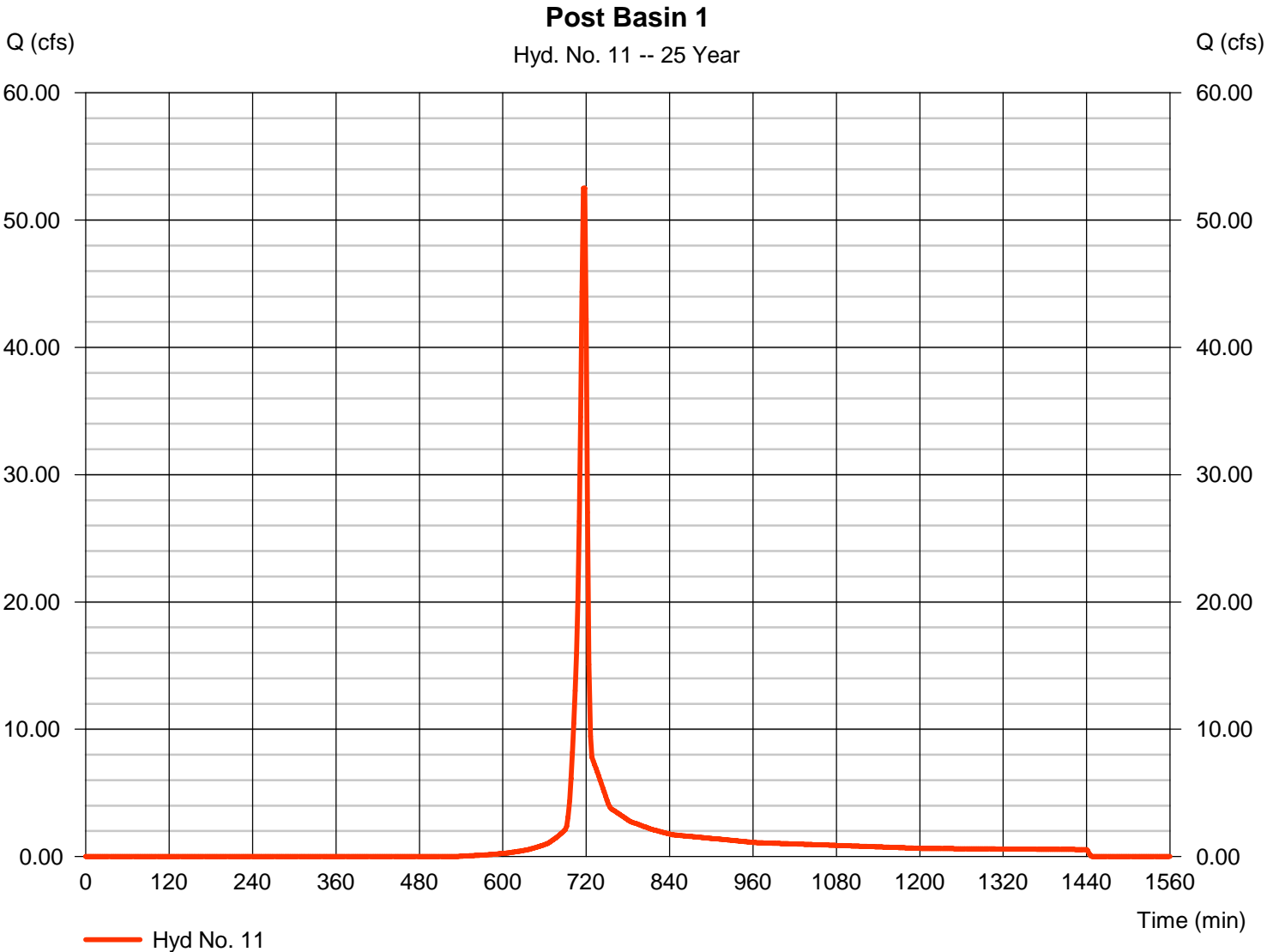
Hydrograph Report

Hyd. No. 11

Post Basin 1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 11.430 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.76 in
Storm duration = 24 hrs

Peak discharge = 52.51 cfs
Time to peak = 718 min
Hyd. volume = 105,990 cuft
Curve number = 71.2
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. v2024

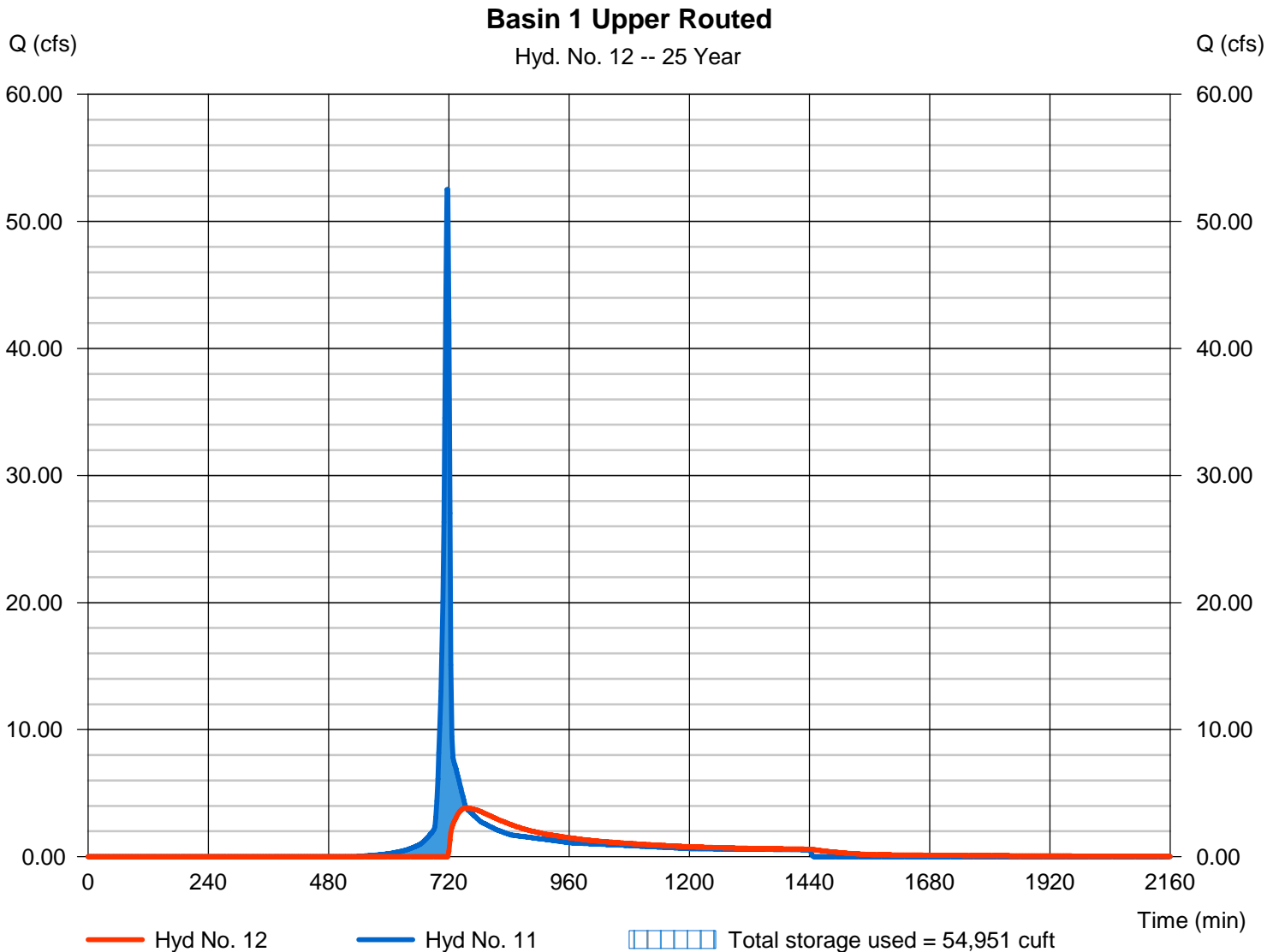
Monday, 03 / 24 / 2025

Hyd. No. 12

Basin 1 Upper Routed

Hydrograph type	= Reservoir	Peak discharge	= 3.835 cfs
Storm frequency	= 25 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 68,501 cuft
Inflow hyd. No.	= 11 - Post Basin 1	Max. Elevation	= 323.34 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 54,951 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

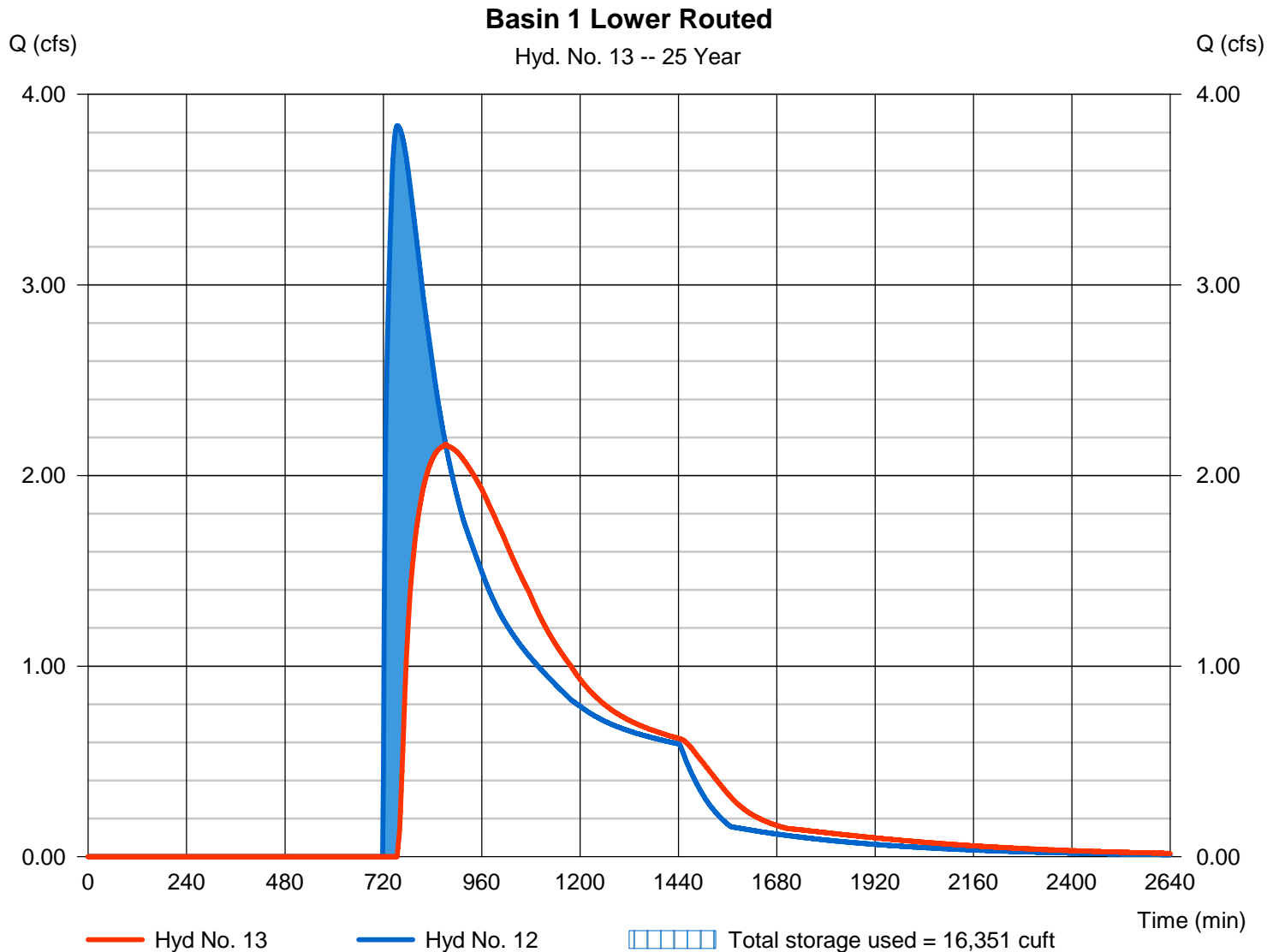
Monday, 03 / 24 / 2025

Hyd. No. 13

Basin 1 Lower Routed

Hydrograph type	= Reservoir	Peak discharge	= 2.163 cfs
Storm frequency	= 25 yrs	Time to peak	= 872 min
Time interval	= 2 min	Hyd. volume	= 62,304 cuft
Inflow hyd. No.	= 12 - Basin 1 Upper Routed	Max. Elevation	= 305.40 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 16,351 cuft

Storage Indication method used.



Hydrograph Report

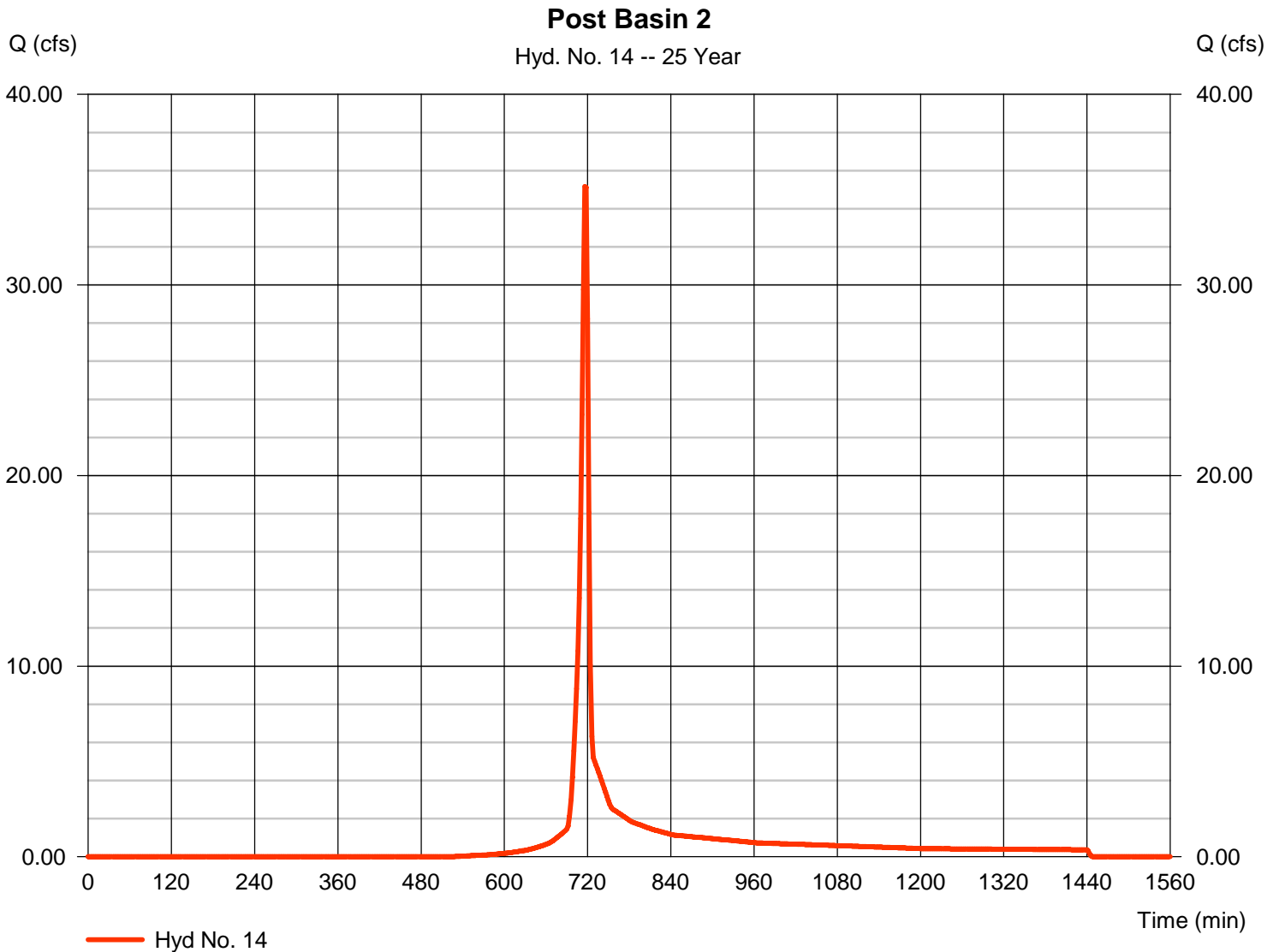
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Monday, 03 / 24 / 2025

Hyd. No. 14

Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 35.17 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 70,997 cuft
Drainage area	= 7.530 ac	Curve number	= 71.7
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. v2024

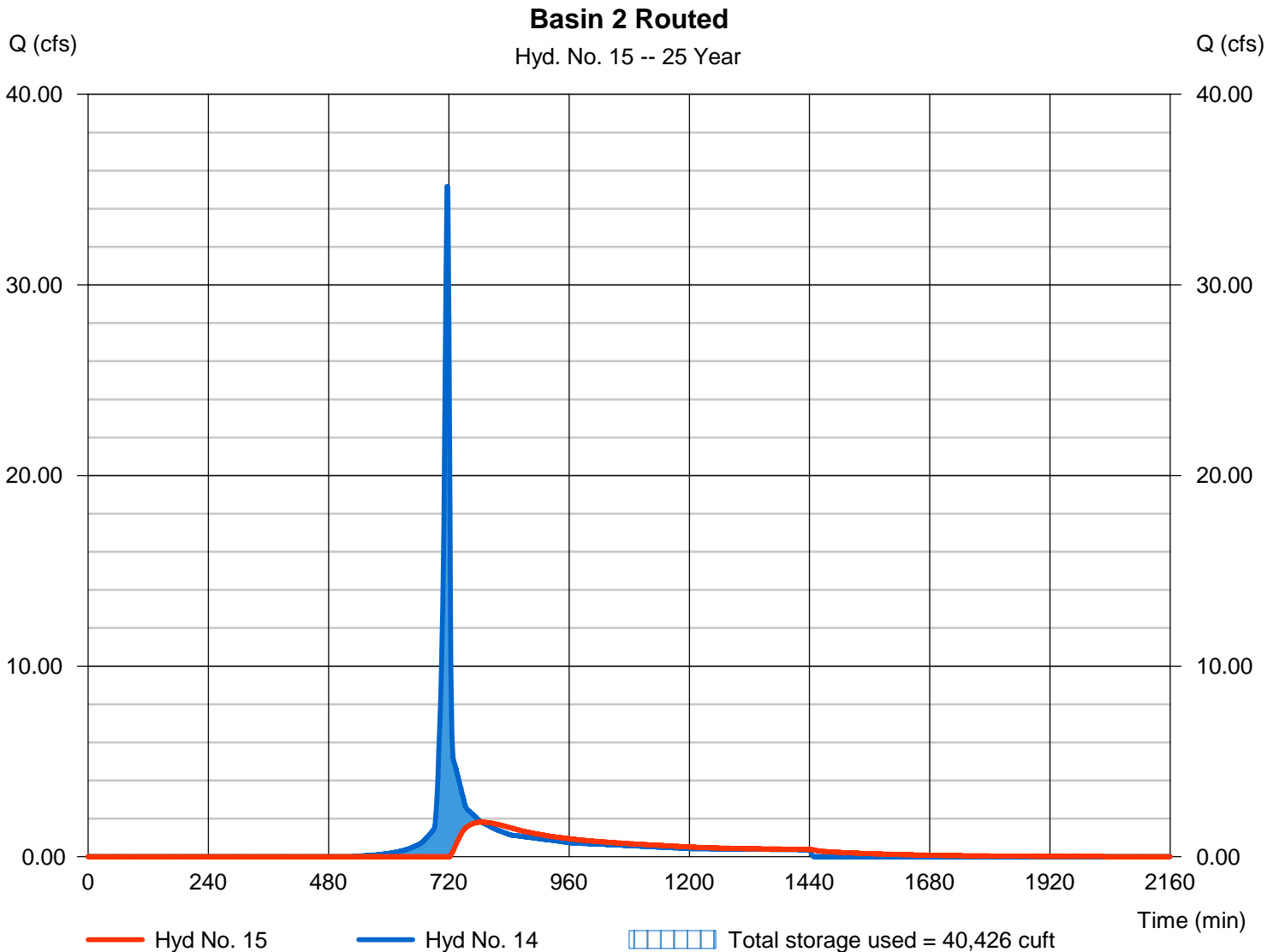
Monday, 03 / 24 / 2025

Hyd. No. 15

Basin 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.813 cfs
Storm frequency	= 25 yrs	Time to peak	= 786 min
Time interval	= 2 min	Hyd. volume	= 38,643 cuft
Inflow hyd. No.	= 14 - Post Basin 2	Max. Elevation	= 309.36 ft
Reservoir name	= Basin 2	Max. Storage	= 40,426 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

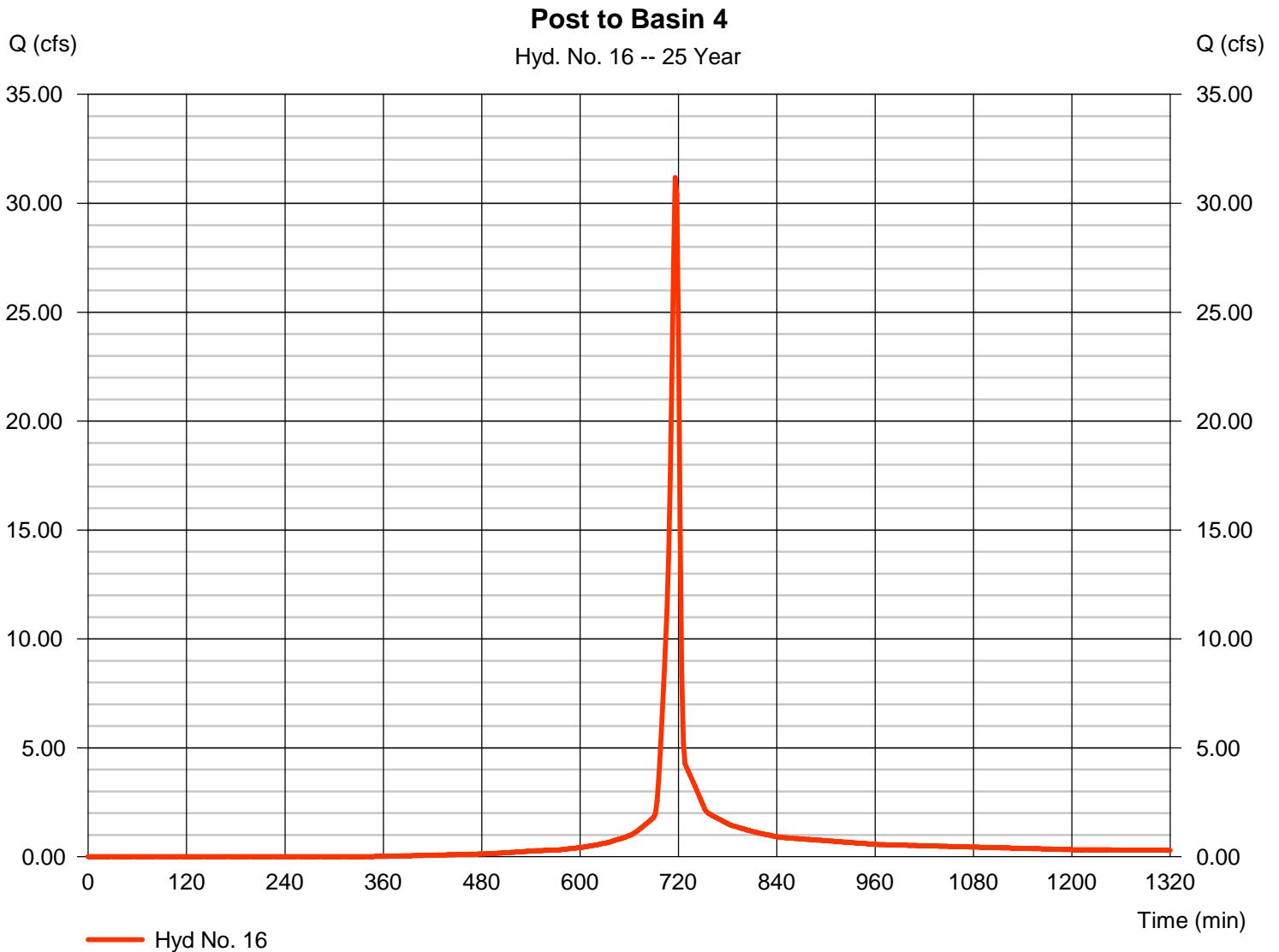
Monday, 03 / 24 / 2025

Hyd. No. 16

Post to Basin 4

Hydrograph type	= SCS Runoff	Peak discharge	= 31.18 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 64,570 cuft
Drainage area	= 4.930 ac	Curve number	= 82.8*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.930



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

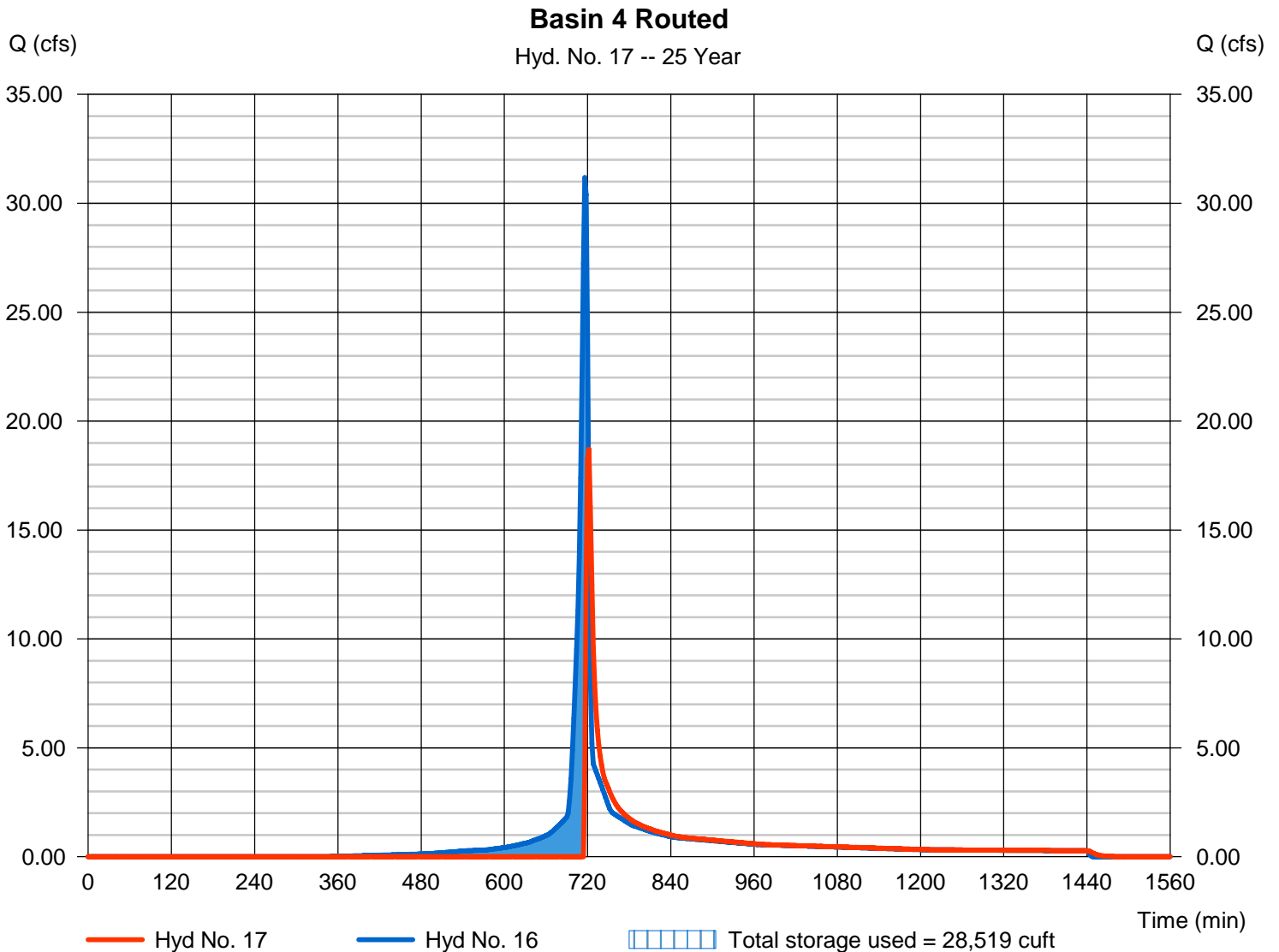
Monday, 03 / 24 / 2025

Hyd. No. 17

Basin 4 Routed

Hydrograph type	= Reservoir	Peak discharge	= 18.70 cfs
Storm frequency	= 25 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 42,480 cuft
Inflow hyd. No.	= 16 - Post to Basin 4	Max. Elevation	= 348.61 ft
Reservoir name	= Basin 4	Max. Storage	= 28,519 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

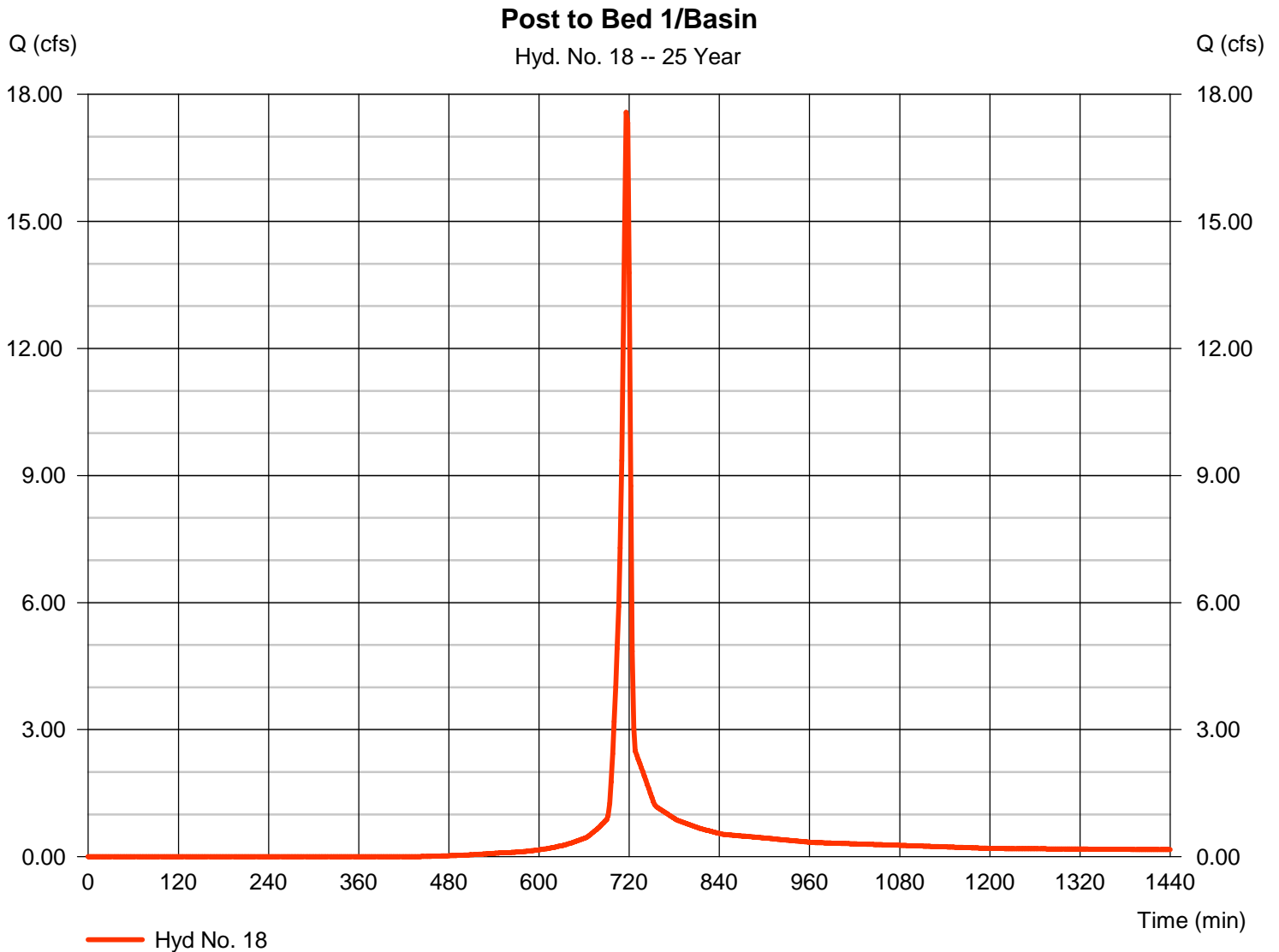
Monday, 03 / 24 / 2025

Hyd. No. 18

Post to Bed 1/Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 17.58 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 35,714 cuft
Drainage area	= 3.190 ac	Curve number	= 77.2*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 3.190



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

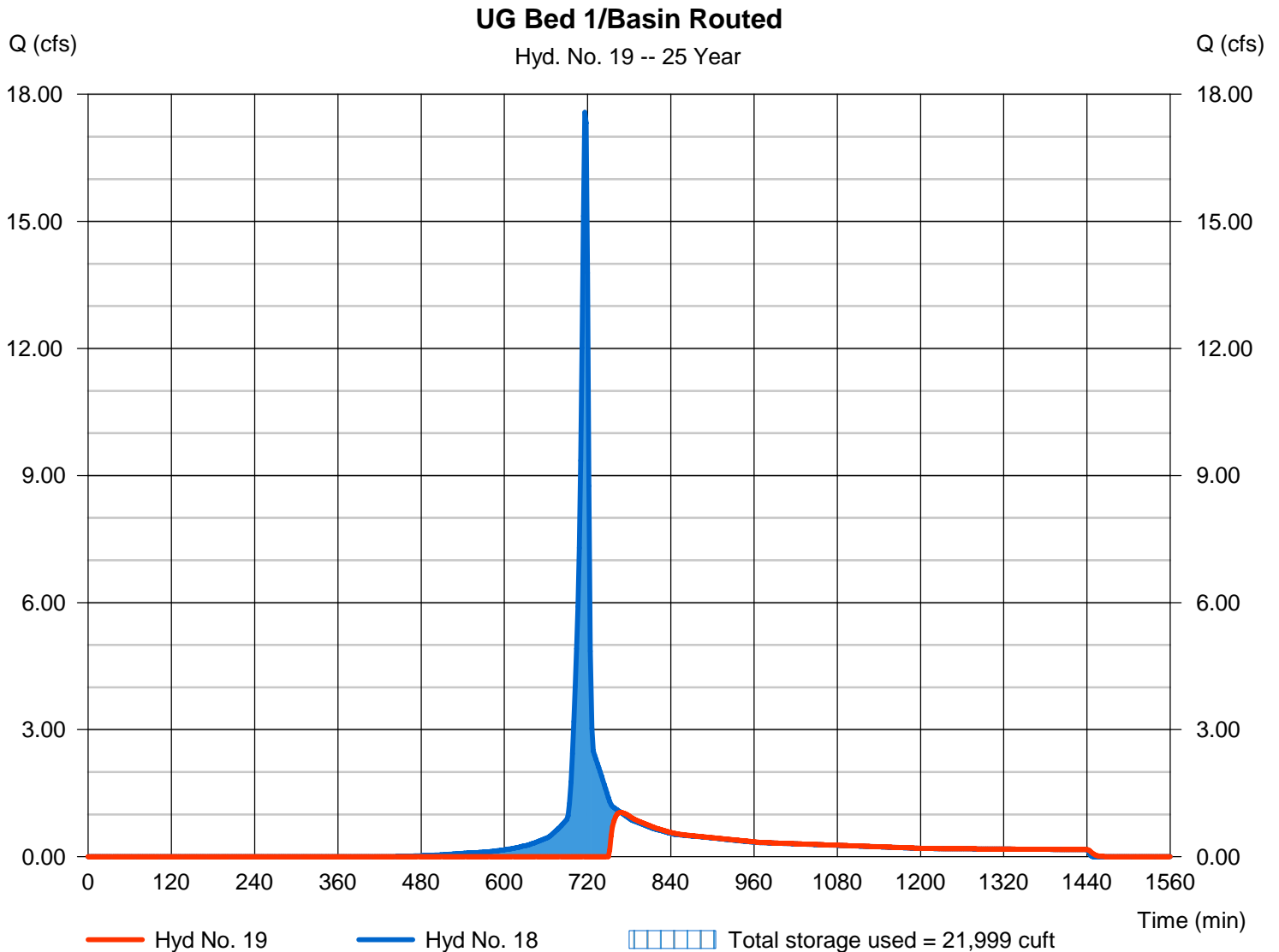
Monday, 03 / 24 / 2025

Hyd. No. 19

UG Bed 1/Basin Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.047 cfs
Storm frequency	= 25 yrs	Time to peak	= 768 min
Time interval	= 2 min	Hyd. volume	= 14,067 cuft
Inflow hyd. No.	= 18 - Post to Bed 1/Basin	Max. Elevation	= 342.26 ft
Reservoir name	= UG Bed 5/Basin	Max. Storage	= 21,999 cuft

Storage Indication method used.



Hydrograph Report

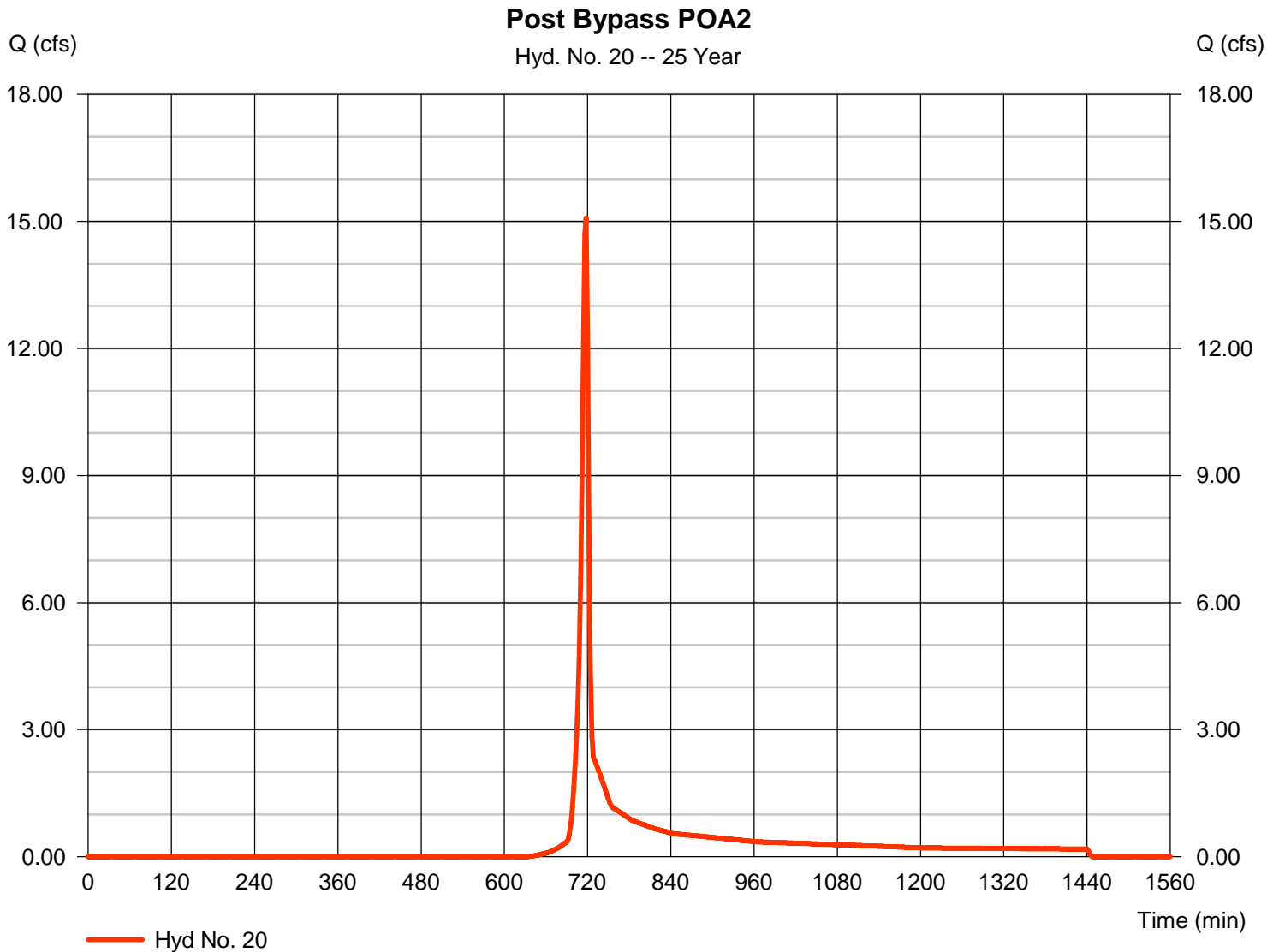
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Hyd. No. 20

Post Bypass POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 15.08 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 30,159 cuft
Drainage area	= 4.390 ac	Curve number	= 63.1
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. v2024

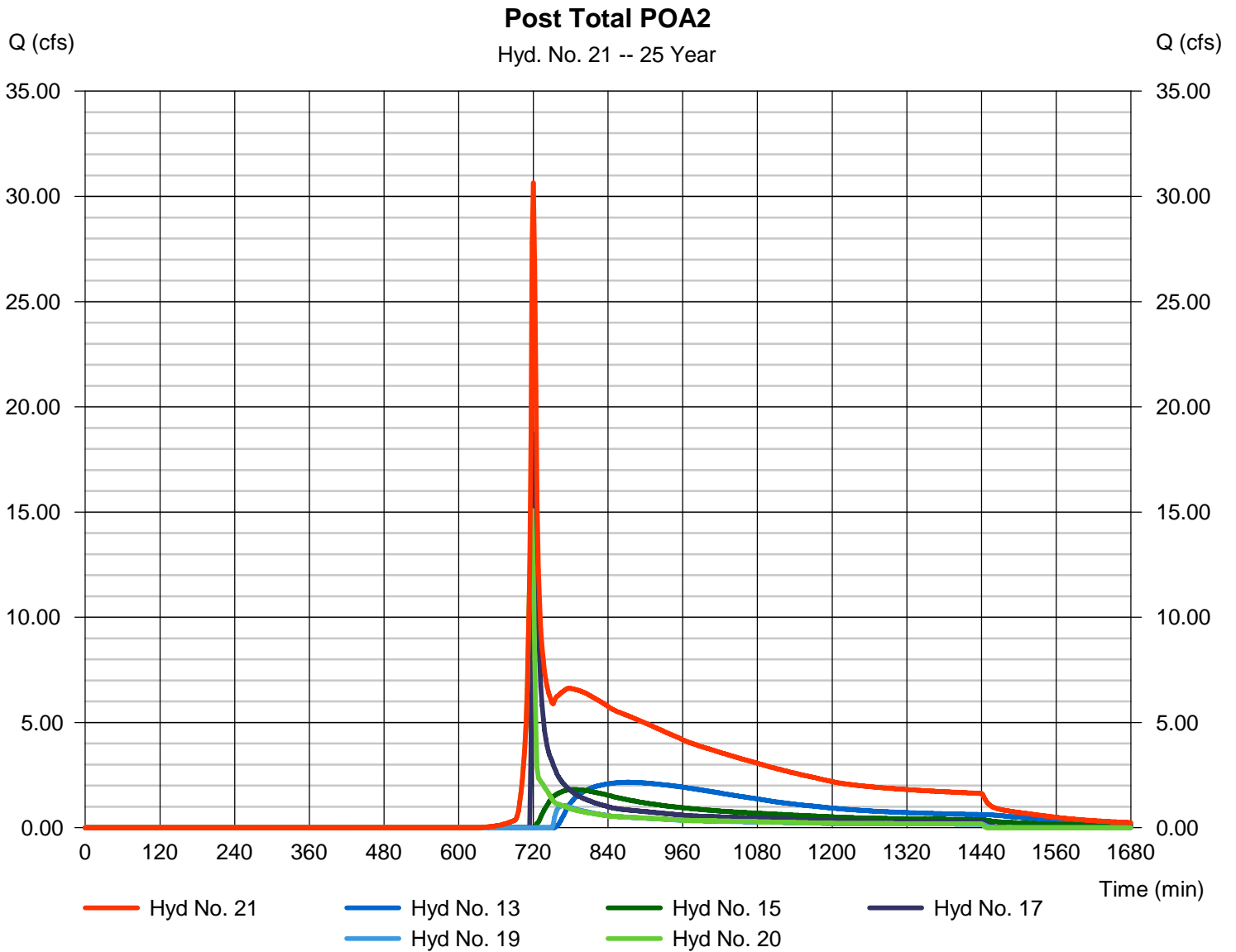
Monday, 03 / 24 / 2025

Hyd. No. 21

Post Total POA2

Hydrograph type = Combine
 Storm frequency = 25 yrs
 Time interval = 2 min
 Inflow hyds. = 13, 15, 17, 19, 20

Peak discharge = 30.64 cfs
 Time to peak = 720 min
 Hyd. volume = 187,653 cuft
 Contrib. drain. area = 4.390 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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	27.82	2	722	74,740	-----	-----	-----	Pre Developed POA1	
2	SCS Runoff	100.45	2	722	264,432	-----	-----	-----	Pre Developed POA2	
3	SCS Runoff	9.199	2	718	18,438	-----	-----	-----	Offsite POA1	
4	SCS Runoff	6.930	2	718	13,888	-----	-----	-----	Offsite POA2	
6	SCS Runoff	46.90	2	716	94,703	-----	-----	-----	Post Basin 3	
7	Reservoir	3.638	2	752	57,776	6	318.63	50,667	Basin 3 Routed	
8	SCS Runoff	8.459	2	718	16,924	-----	-----	-----	Post Bypass POA1	
9	Combine	8.459	2	718	74,700	7, 8	-----	-----	Post Total POA1	
11	SCS Runoff	65.61	2	716	132,622	-----	-----	-----	Post Basin 1	
12	Reservoir	12.01	2	726	95,133	11	323.74	62,571	Basin 1 Upper Routed	
13	Reservoir	5.658	2	768	88,936	12	305.67	18,331	Basin 1 Lower Routed	
14	SCS Runoff	43.84	2	716	88,669	-----	-----	-----	Post Basin 2	
15	Reservoir	4.059	2	746	56,315	14	309.72	45,707	Basin 2 Routed	
16	SCS Runoff	37.17	2	716	77,672	-----	-----	-----	Post to Basin 4	
17	Reservoir	24.17	2	720	55,581	16	348.87	31,341	Basin 4 Routed	
18	SCS Runoff	21.39	2	716	43,740	-----	-----	-----	Post to Bed 1/Basin	
19	Reservoir	3.517	2	726	22,093	18	342.40	22,827	UG Bed 1/Basin Routed	
20	SCS Runoff	19.52	2	718	39,063	-----	-----	-----	Post Bypass POA2	
21	Combine	42.49	2	718	261,988	13, 15, 17, 19, 20	-----	-----	Post Total POA2	
SWM.gpw					Return Period: 50 Year			Monday, 03 / 24 / 2025		

Hydrograph Report

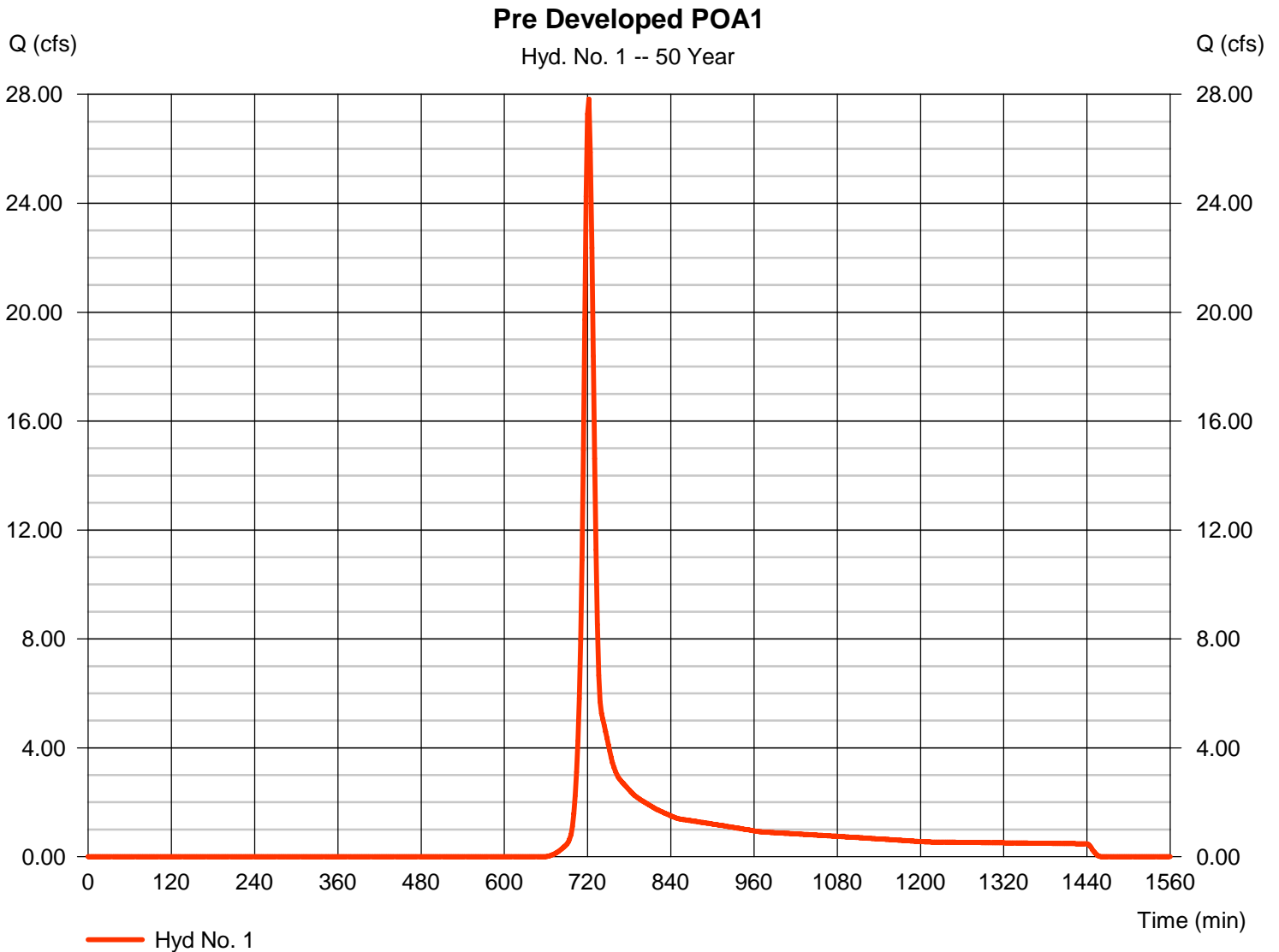
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 1

Pre Developed POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 27.82 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 74,740 cuft
Drainage area	= 9.690 ac	Curve number	= 57.1
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

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

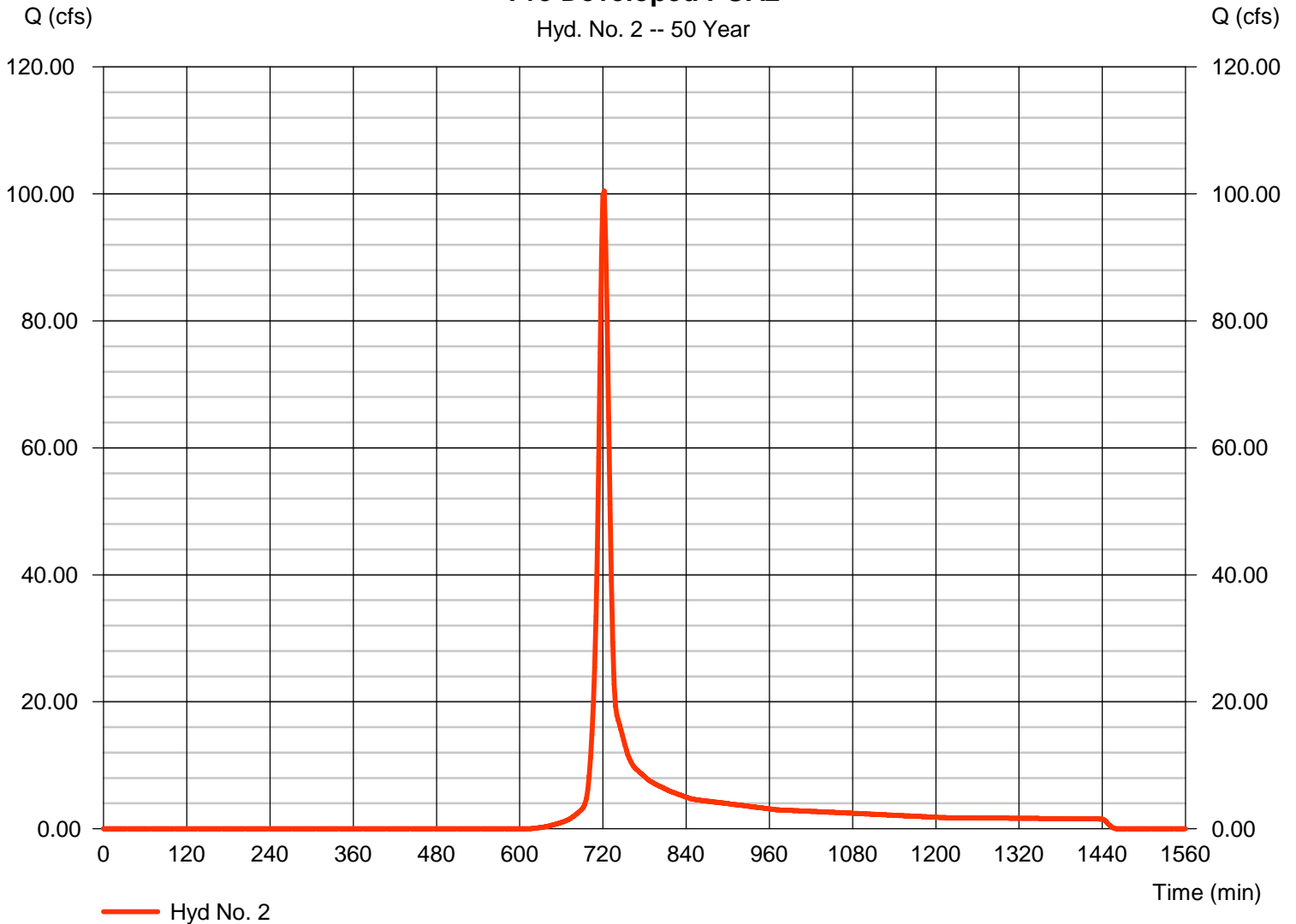
Hyd. No. 2

Pre Developed POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 100.45 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 264,432 cuft
Drainage area	= 28.240 ac	Curve number	= 61.9
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

Pre Developed POA2

Hyd. No. 2 -- 50 Year



Hydrograph Report

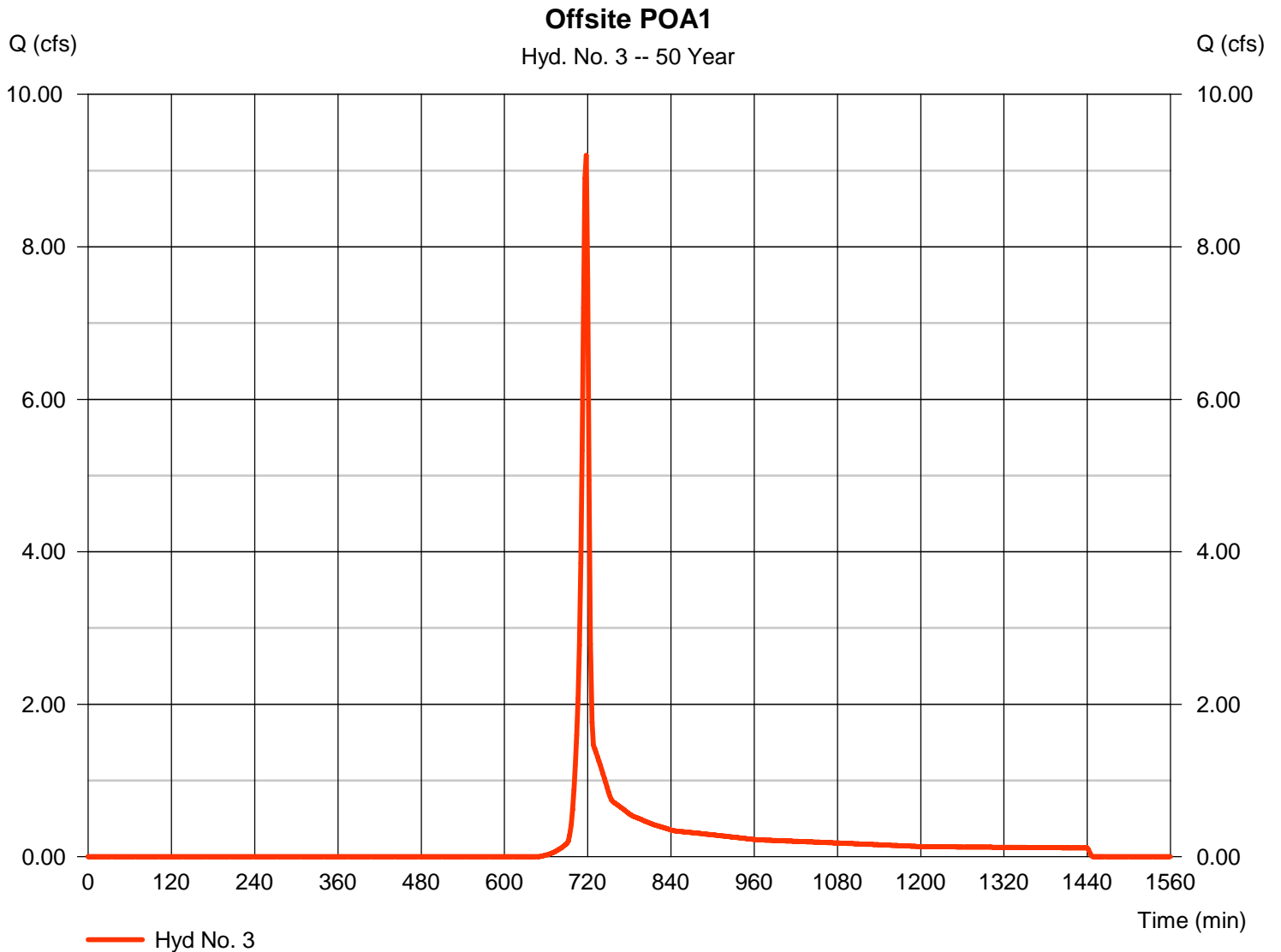
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 3

Offsite POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 9.199 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 18,438 cuft
Drainage area	= 2.530 ac	Curve number	= 58
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

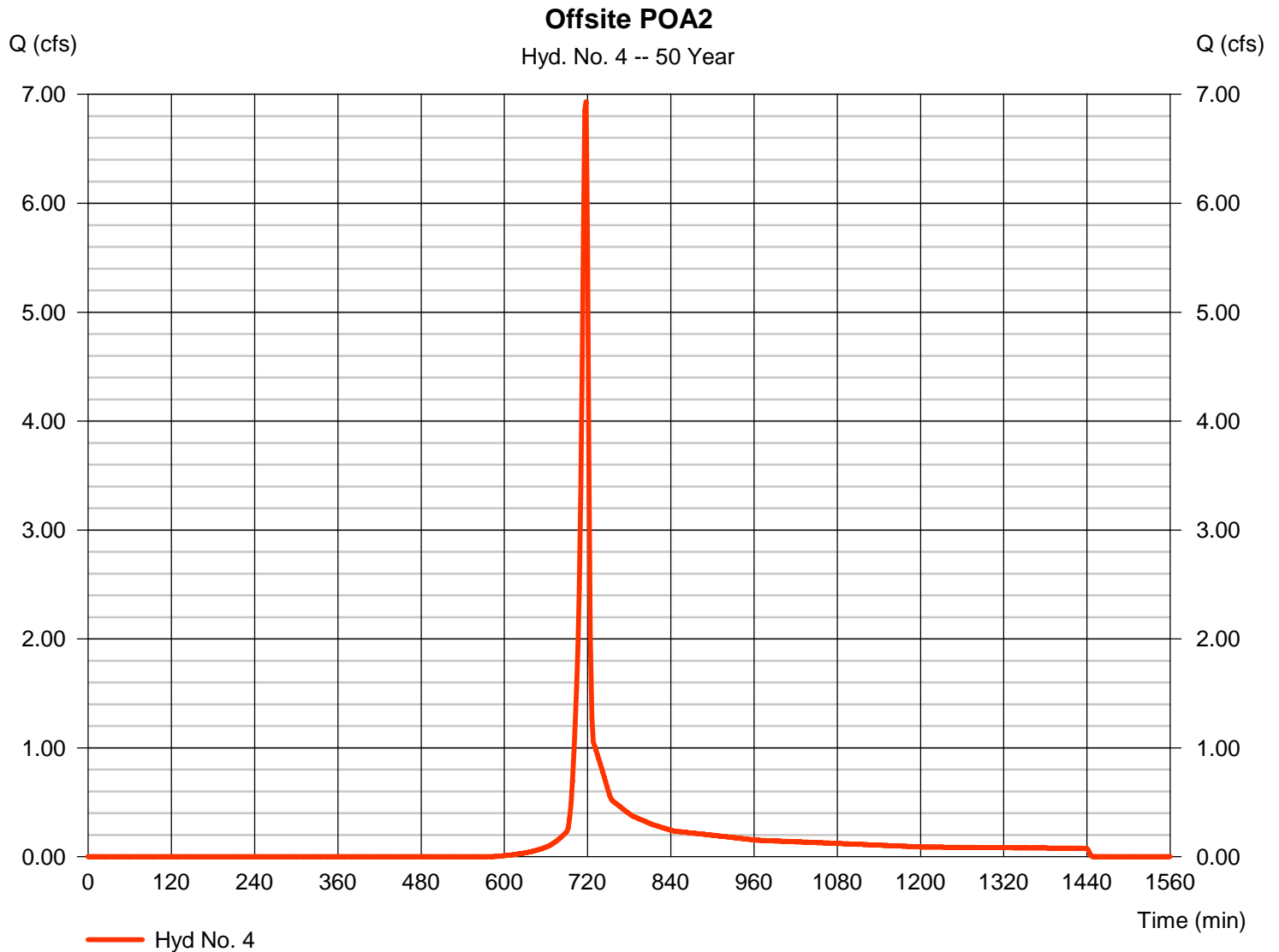
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Monday, 03 / 24 / 2025

Hyd. No. 4

Offsite POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 6.930 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 13,888 cuft
Drainage area	= 1.490 ac	Curve number	= 64.4
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

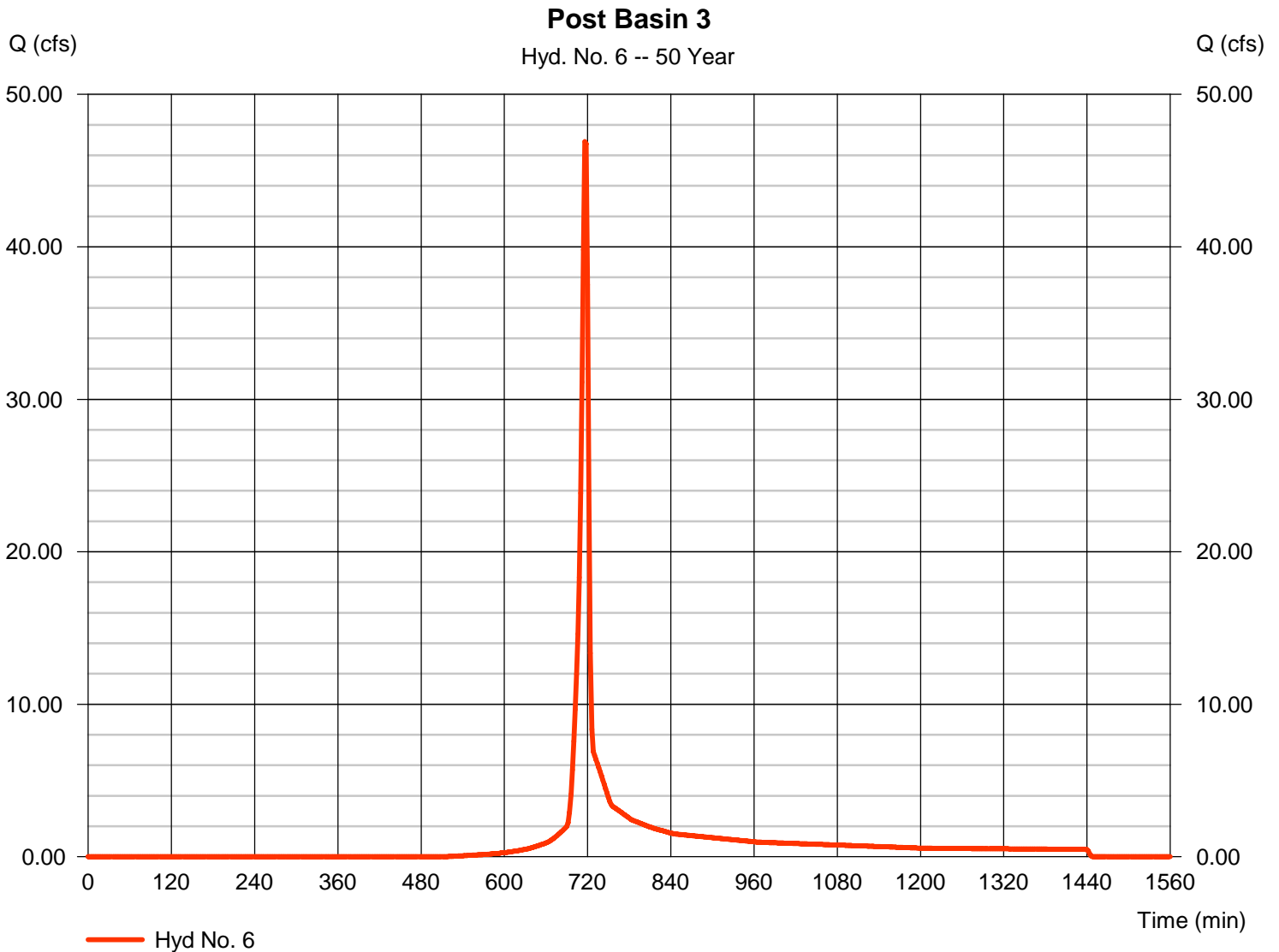
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Monday, 03 / 24 / 2025

Hyd. No. 6

Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 46.90 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 94,703 cuft
Drainage area	= 8.540 ac	Curve number	= 69.7
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. v2024

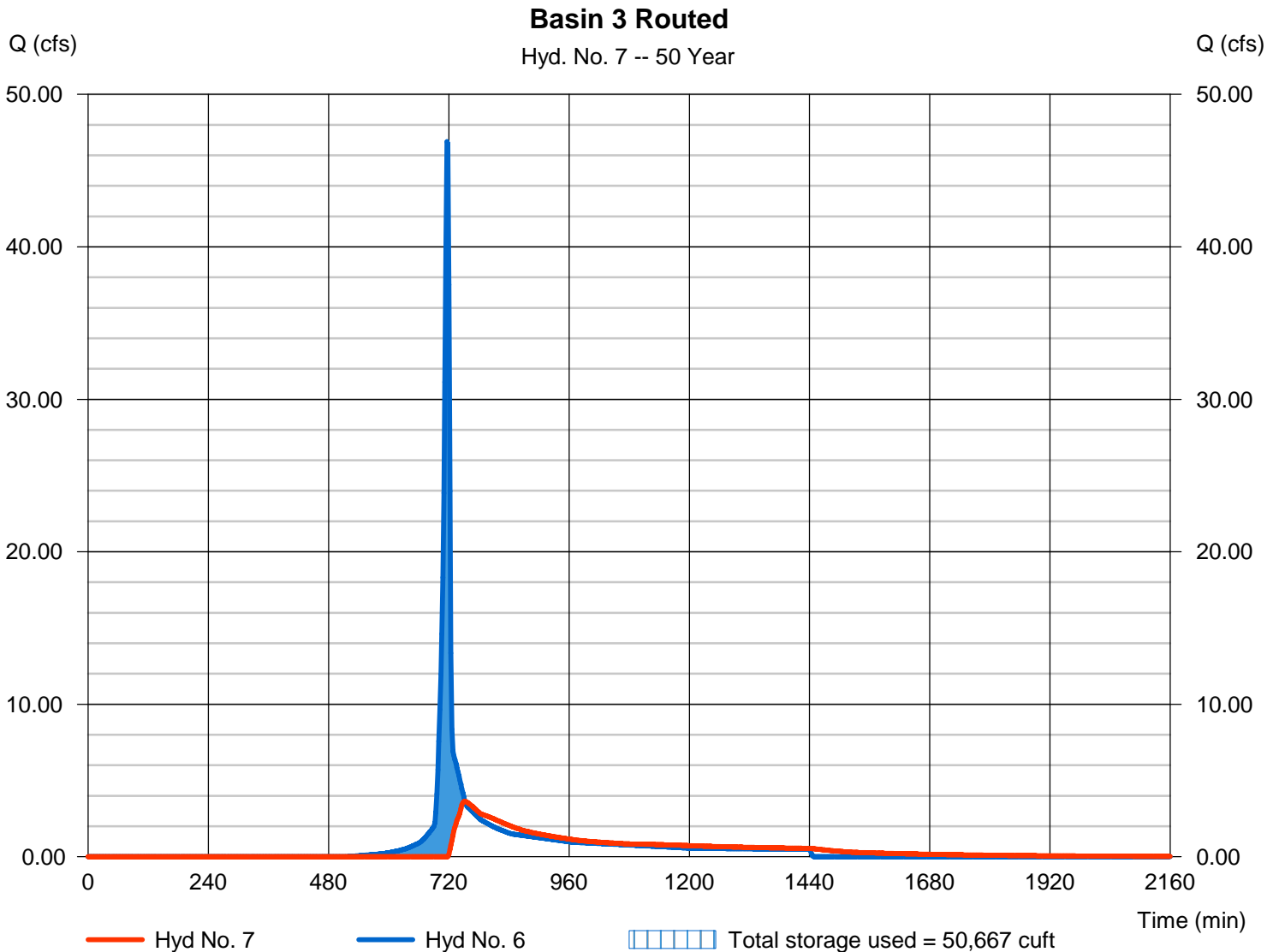
Monday, 03 / 24 / 2025

Hyd. No. 7

Basin 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 3.638 cfs
Storm frequency	= 50 yrs	Time to peak	= 752 min
Time interval	= 2 min	Hyd. volume	= 57,776 cuft
Inflow hyd. No.	= 6 - Post Basin 3	Max. Elevation	= 318.63 ft
Reservoir name	= Basin 3	Max. Storage	= 50,667 cuft

Storage Indication method used.



Hydrograph Report

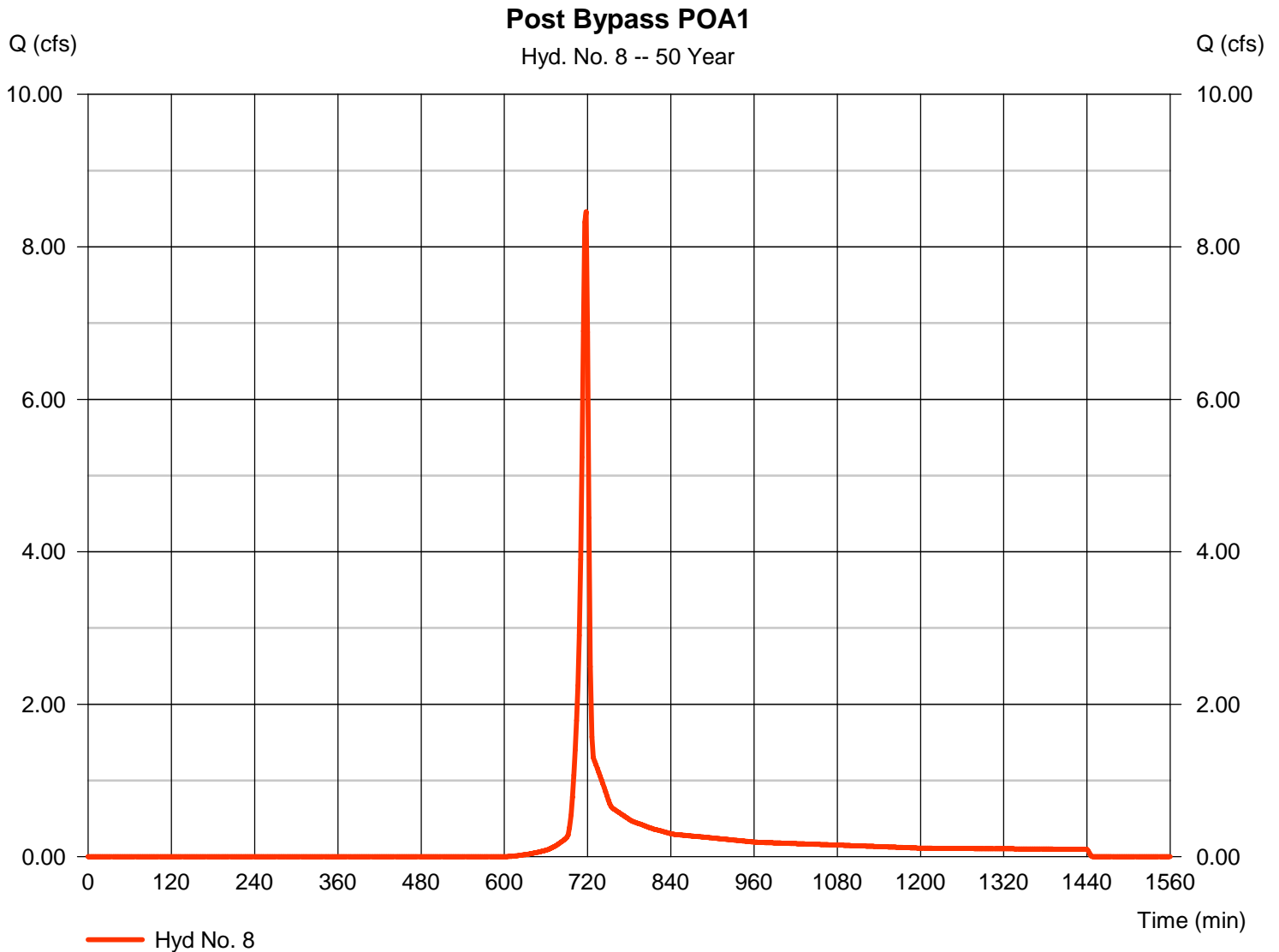
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Monday, 03 / 24 / 2025

Hyd. No. 8

Post Bypass POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 8.459 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 16,924 cuft
Drainage area	= 1.930 ac	Curve number	= 62.7
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. v2024

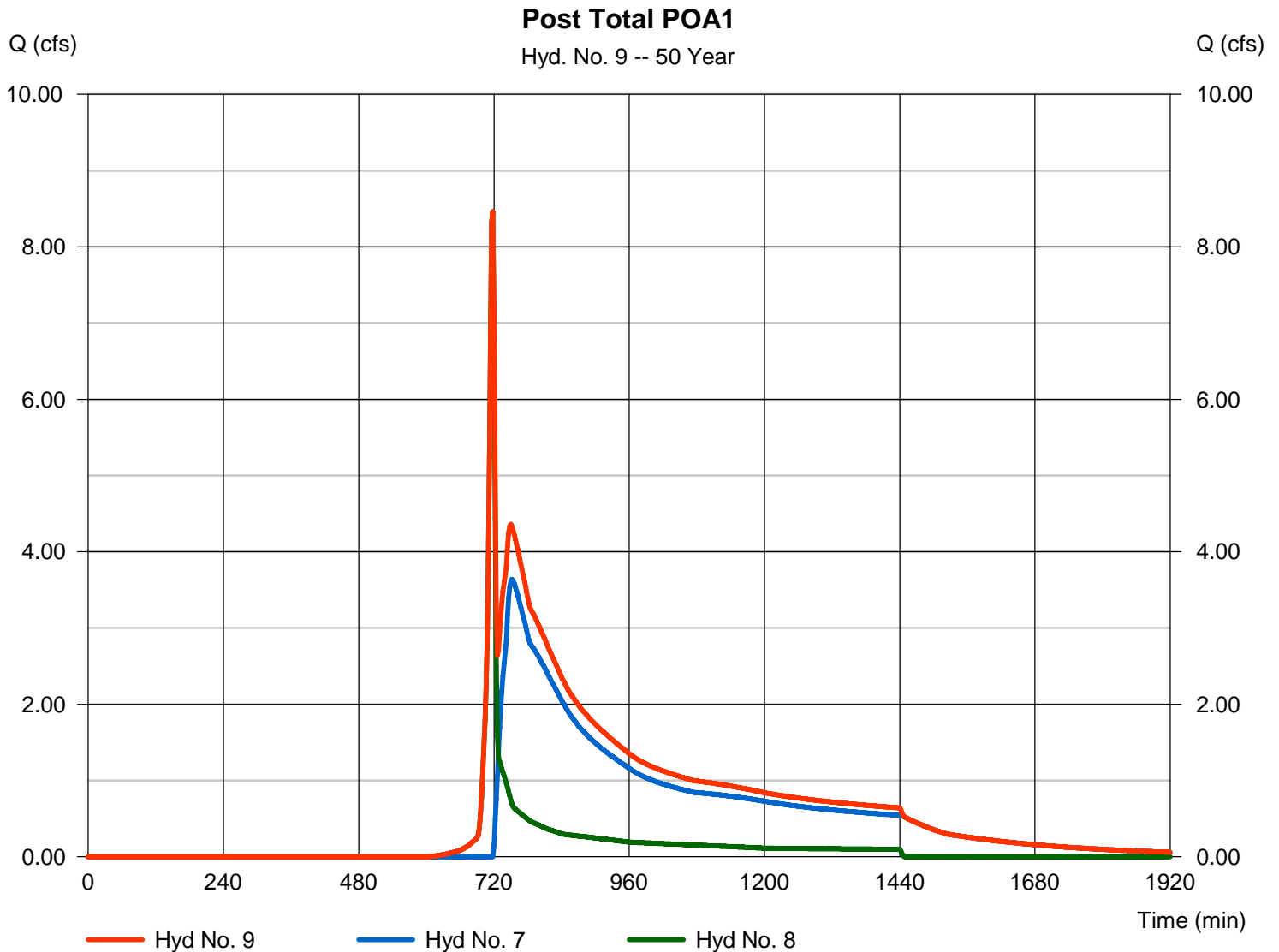
Monday, 03 / 24 / 2025

Hyd. No. 9

Post Total POA1

Hydrograph type = Combine
 Storm frequency = 50 yrs
 Time interval = 2 min
 Inflow hyds. = 7, 8

Peak discharge = 8.459 cfs
 Time to peak = 718 min
 Hyd. volume = 74,700 cuft
 Contrib. drain. area = 1.930 ac



Hydrograph Report

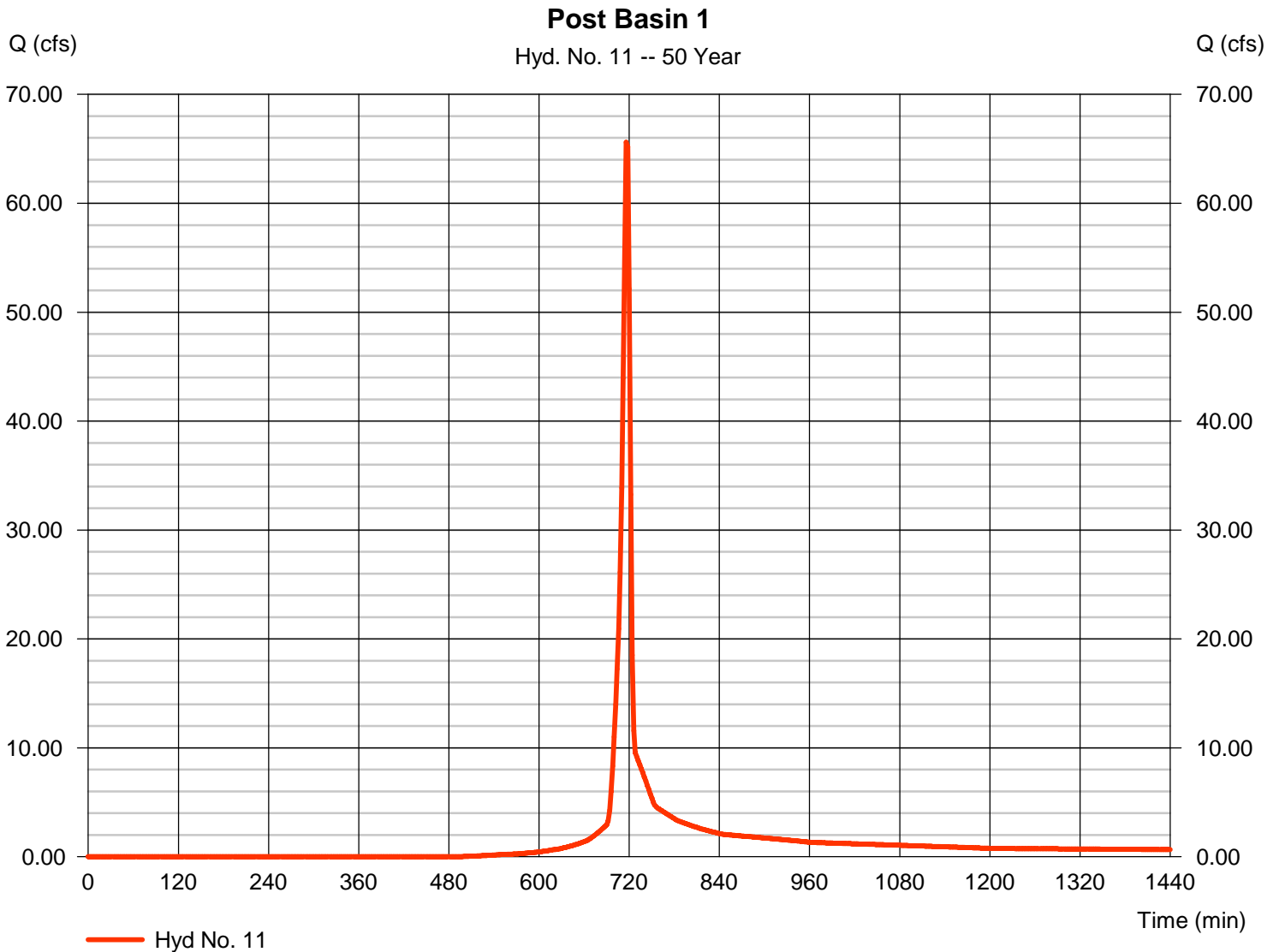
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Monday, 03 / 24 / 2025

Hyd. No. 11

Post Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 65.61 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 132,622 cuft
Drainage area	= 11.430 ac	Curve number	= 71.2
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. v2024

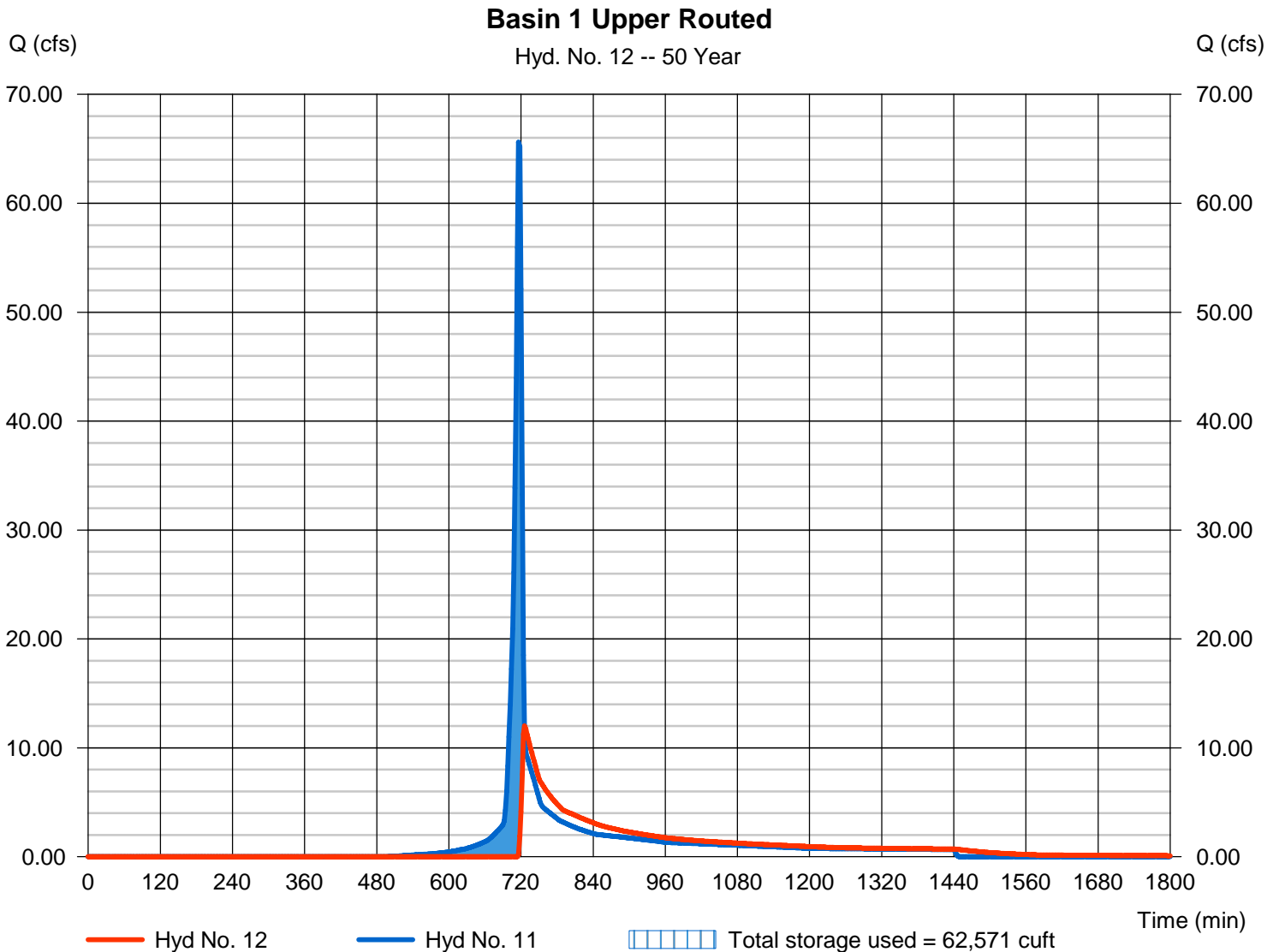
Monday, 03 / 24 / 2025

Hyd. No. 12

Basin 1 Upper Routed

Hydrograph type	= Reservoir	Peak discharge	= 12.01 cfs
Storm frequency	= 50 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 95,133 cuft
Inflow hyd. No.	= 11 - Post Basin 1	Max. Elevation	= 323.74 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 62,571 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

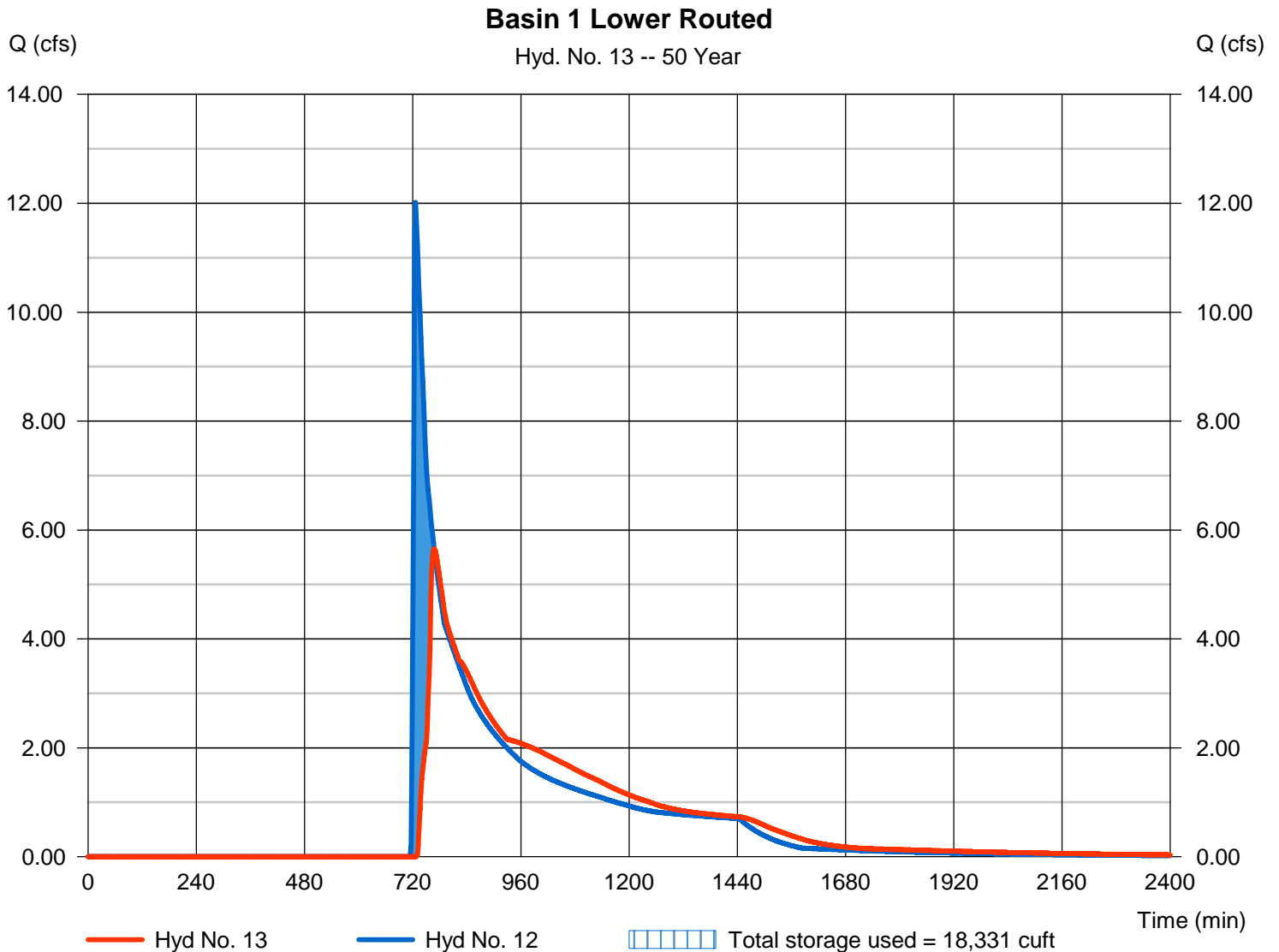
Monday, 03 / 24 / 2025

Hyd. No. 13

Basin 1 Lower Routed

Hydrograph type	= Reservoir	Peak discharge	= 5.658 cfs
Storm frequency	= 50 yrs	Time to peak	= 768 min
Time interval	= 2 min	Hyd. volume	= 88,936 cuft
Inflow hyd. No.	= 12 - Basin 1 Upper Routed	Max. Elevation	= 305.67 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 18,331 cuft

Storage Indication method used.



Hydrograph Report

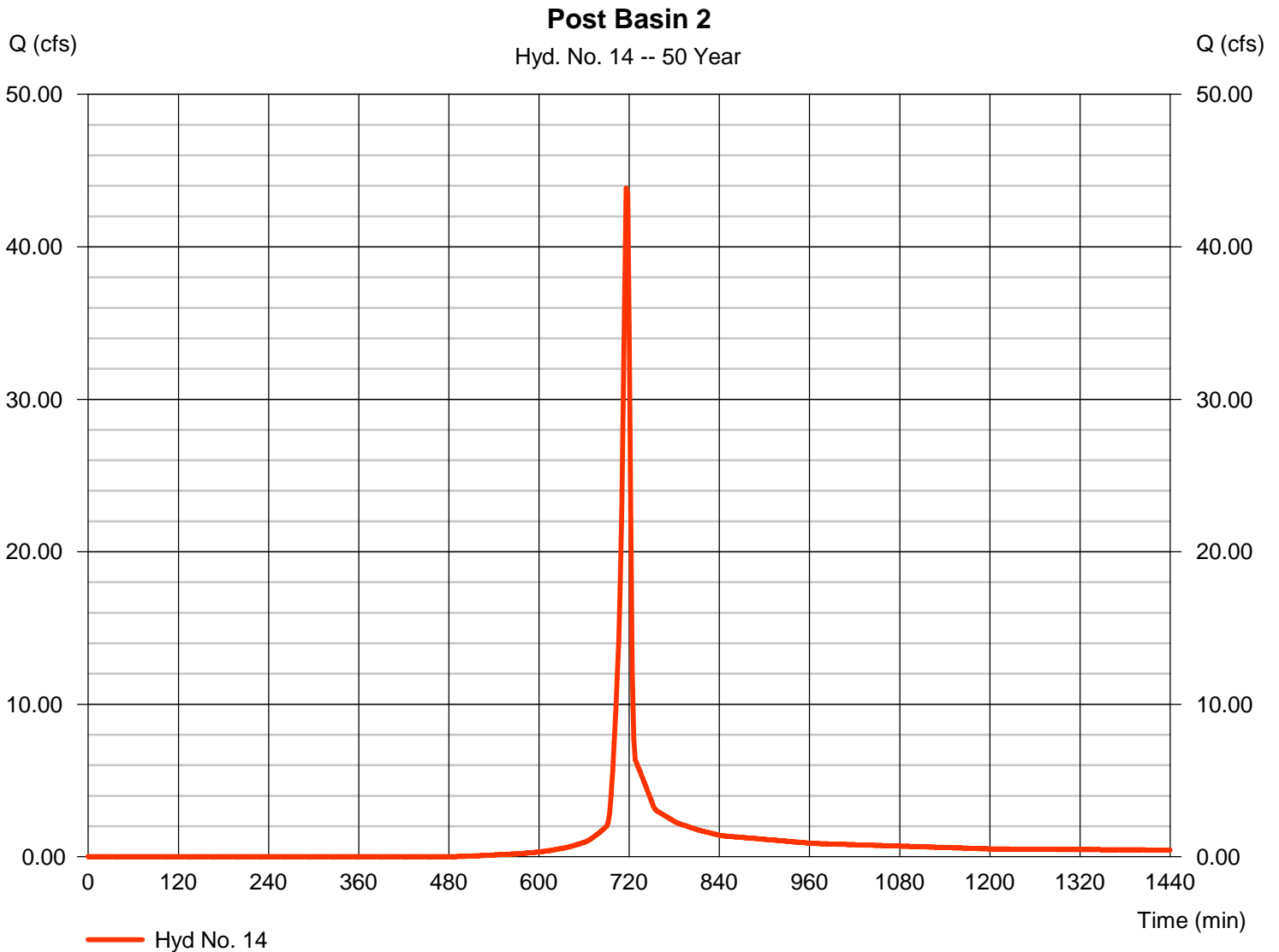
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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Hyd. No. 14

Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 43.84 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 88,669 cuft
Drainage area	= 7.530 ac	Curve number	= 71.7
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. v2024

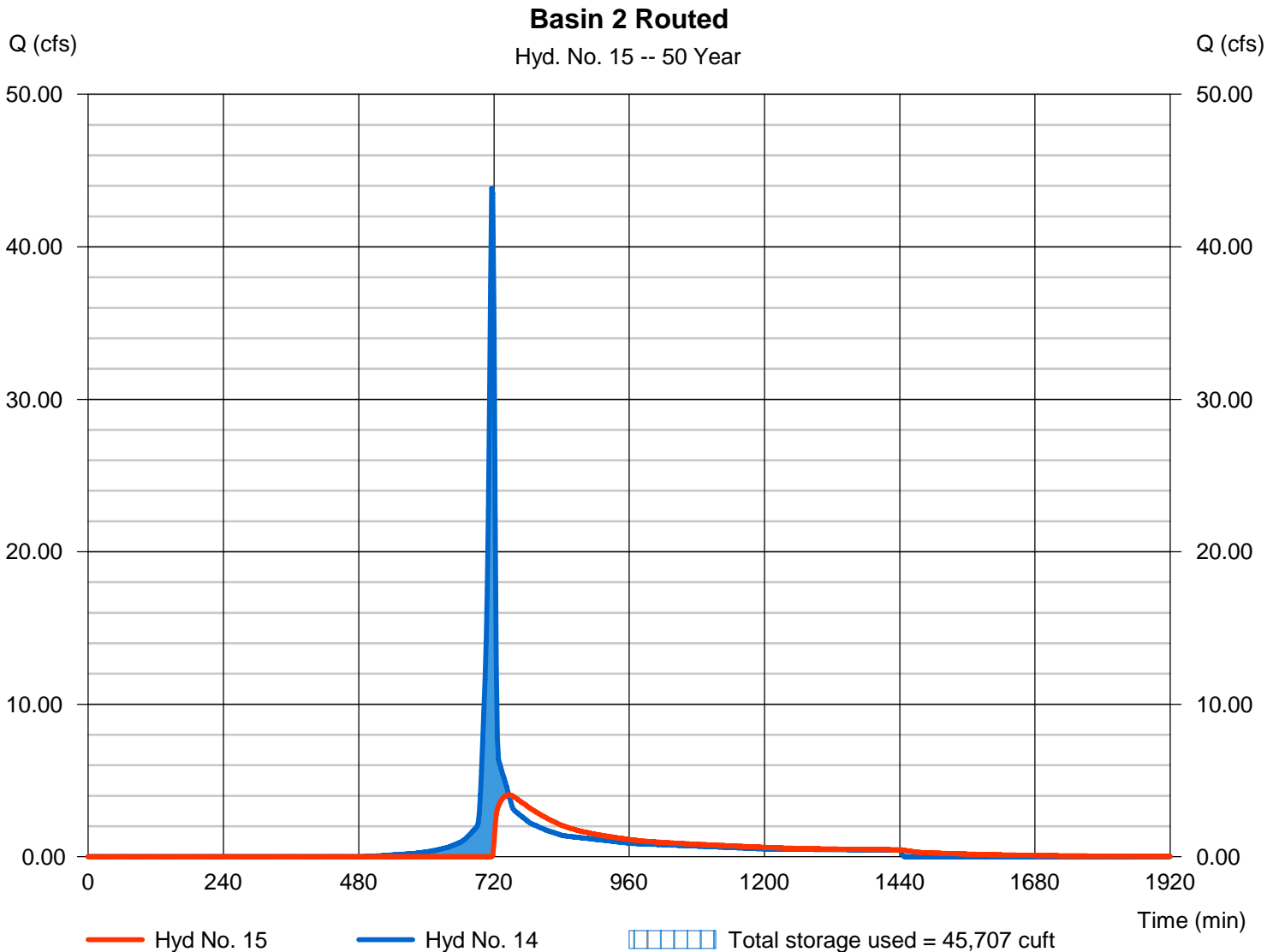
Monday, 03 / 24 / 2025

Hyd. No. 15

Basin 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 4.059 cfs
Storm frequency	= 50 yrs	Time to peak	= 746 min
Time interval	= 2 min	Hyd. volume	= 56,315 cuft
Inflow hyd. No.	= 14 - Post Basin 2	Max. Elevation	= 309.72 ft
Reservoir name	= Basin 2	Max. Storage	= 45,707 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

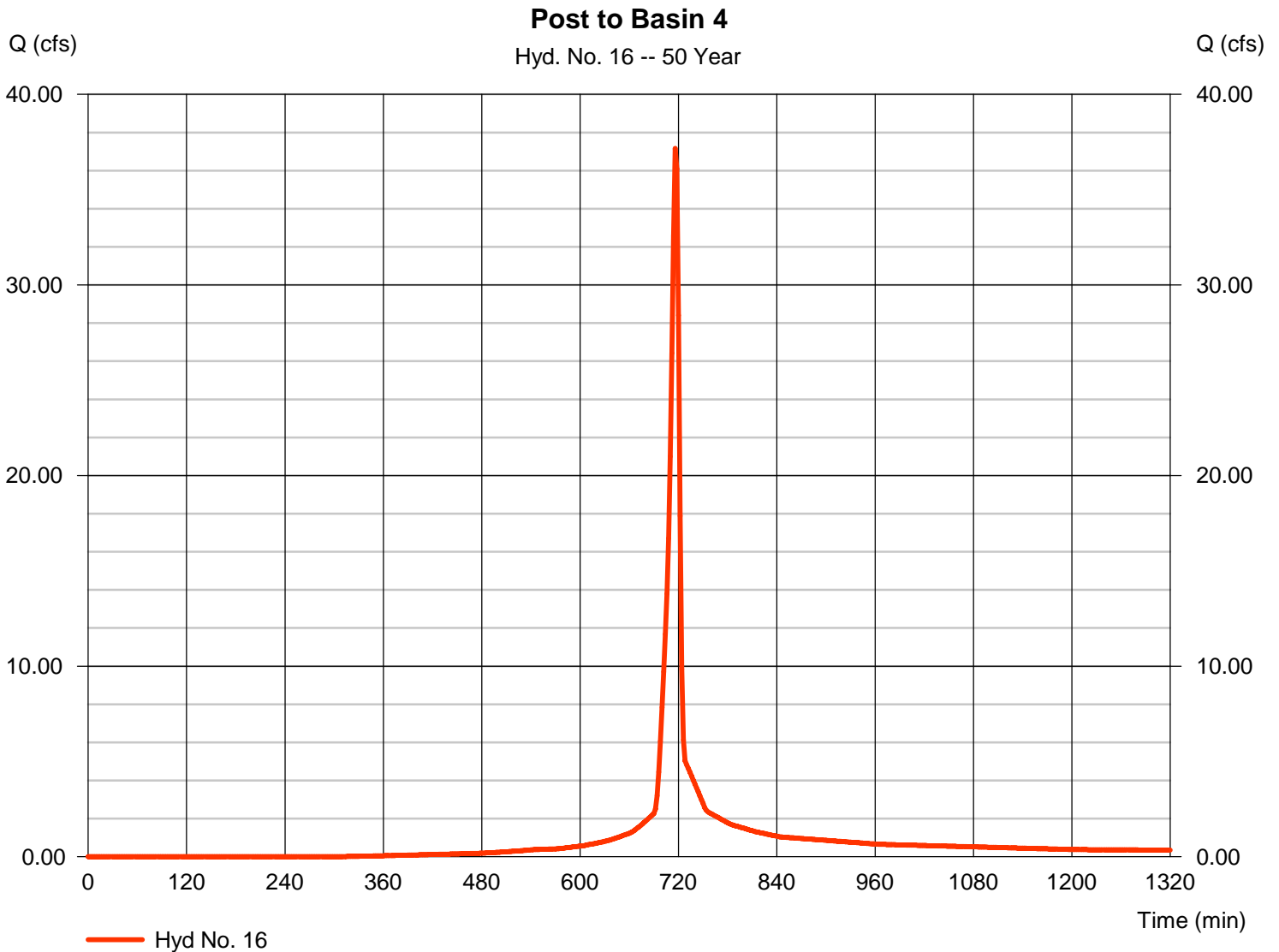
Monday, 03 / 24 / 2025

Hyd. No. 16

Post to Basin 4

Hydrograph type	= SCS Runoff	Peak discharge	= 37.17 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 77,672 cuft
Drainage area	= 4.930 ac	Curve number	= 82.8*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.930



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

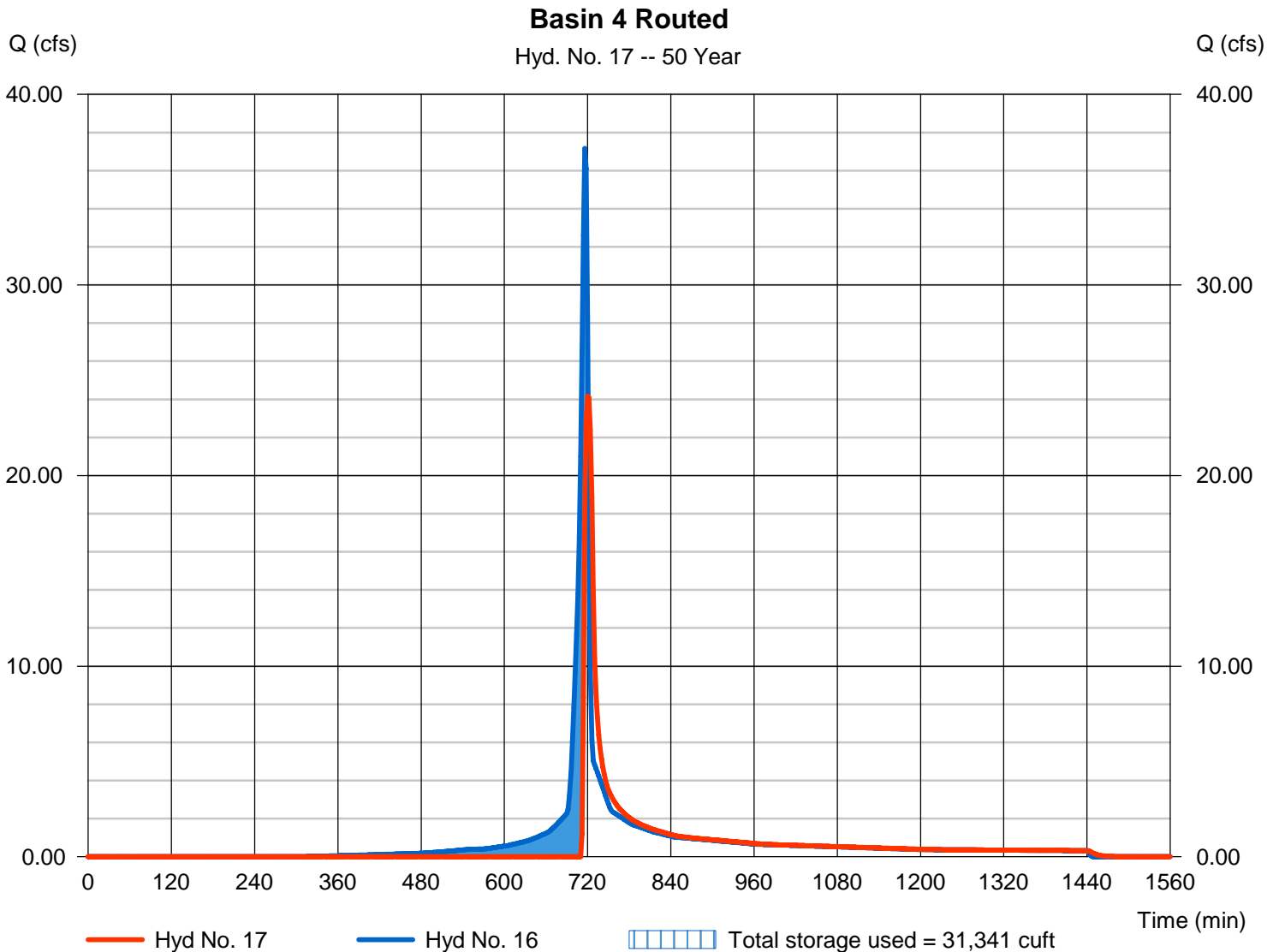
Monday, 03 / 24 / 2025

Hyd. No. 17

Basin 4 Routed

Hydrograph type	= Reservoir	Peak discharge	= 24.17 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 55,581 cuft
Inflow hyd. No.	= 16 - Post to Basin 4	Max. Elevation	= 348.87 ft
Reservoir name	= Basin 4	Max. Storage	= 31,341 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

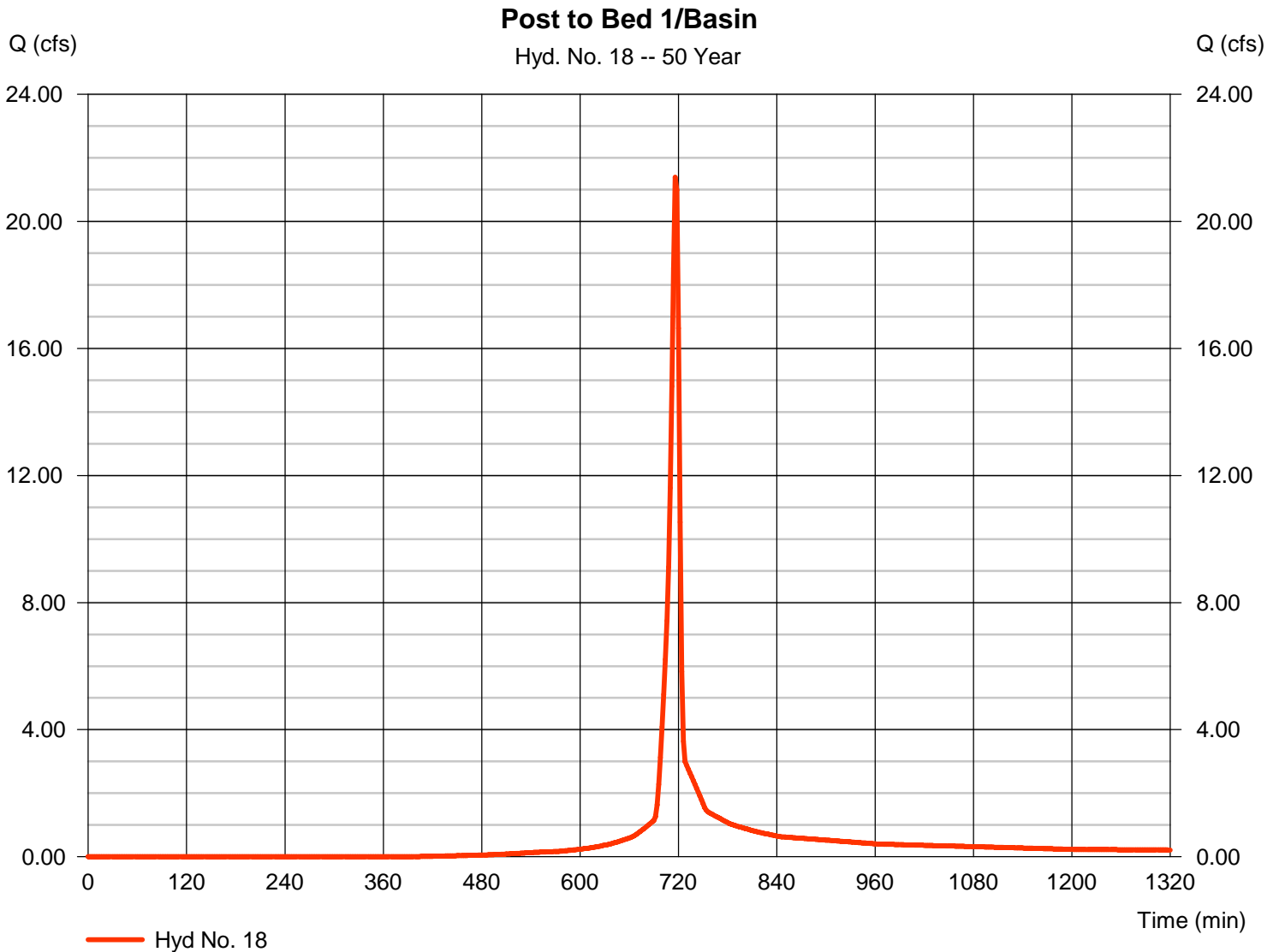
Monday, 03 / 24 / 2025

Hyd. No. 18

Post to Bed 1/Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 21.39 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 43,740 cuft
Drainage area	= 3.190 ac	Curve number	= 77.2*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 3.190



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

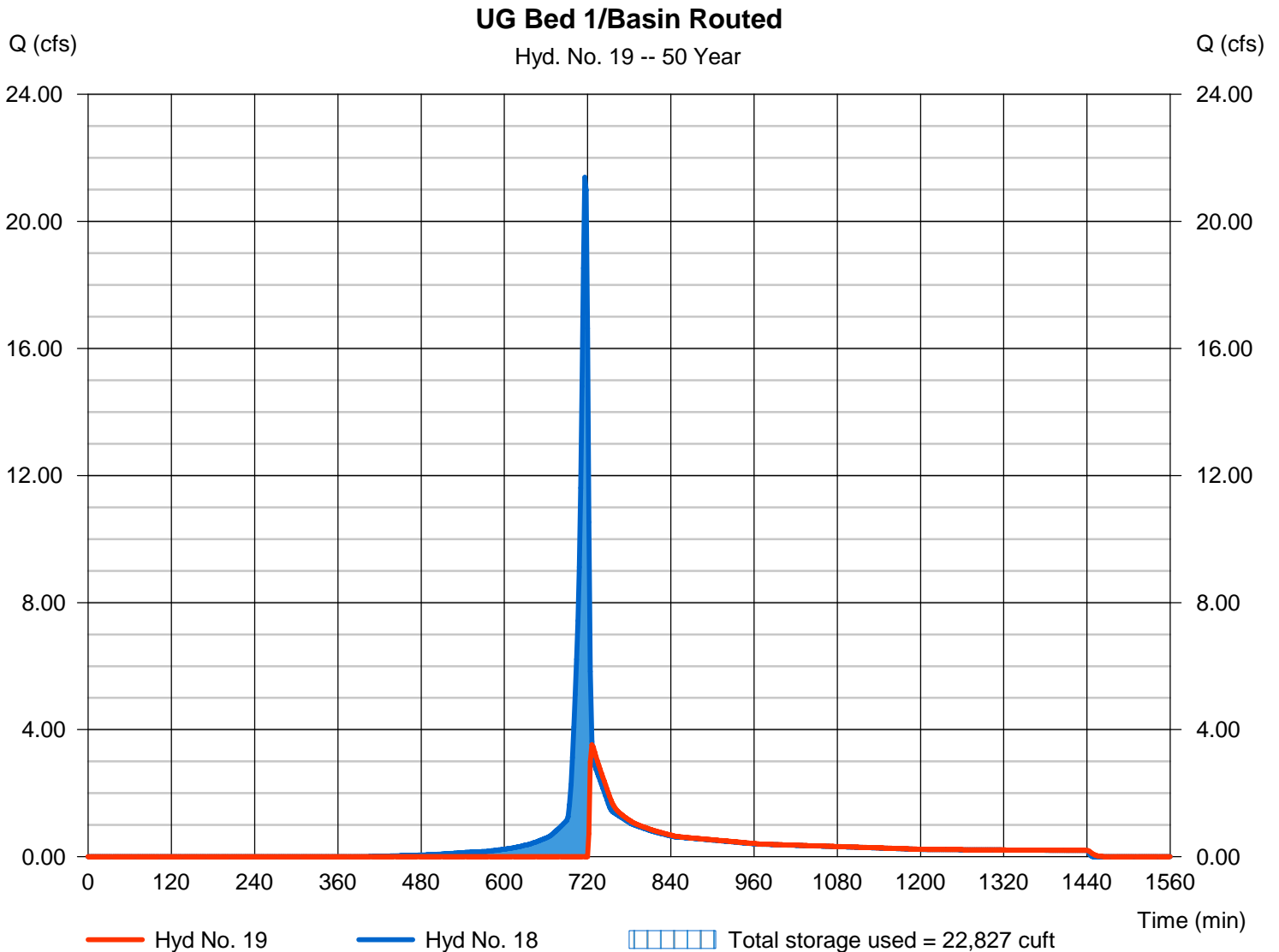
Monday, 03 / 24 / 2025

Hyd. No. 19

UG Bed 1/Basin Routed

Hydrograph type	= Reservoir	Peak discharge	= 3.517 cfs
Storm frequency	= 50 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 22,093 cuft
Inflow hyd. No.	= 18 - Post to Bed 1/Basin	Max. Elevation	= 342.40 ft
Reservoir name	= UG Bed 5/Basin	Max. Storage	= 22,827 cuft

Storage Indication method used.



Hydrograph Report

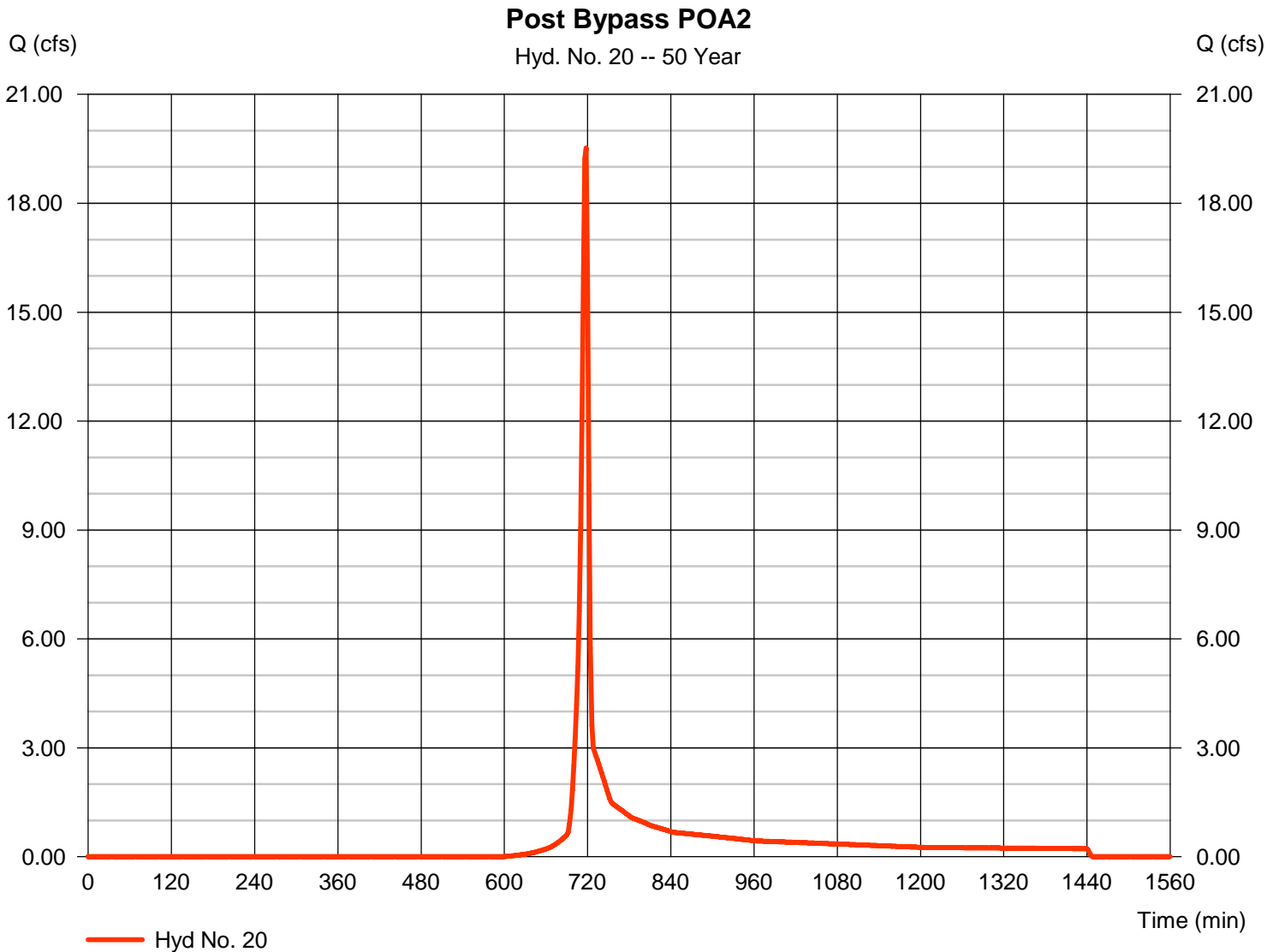
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 20

Post Bypass POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 19.52 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 39,063 cuft
Drainage area	= 4.390 ac	Curve number	= 63.1
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 Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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	36.49	2	722	96,571	-----	-----	-----	Pre Developed POA1
2	SCS Runoff	127.75	2	722	334,399	-----	-----	-----	Pre Developed POA2
3	SCS Runoff	11.86	2	718	23,721	-----	-----	-----	Offsite POA1
4	SCS Runoff	8.636	2	718	17,390	-----	-----	-----	Offsite POA2
6	SCS Runoff	57.51	2	716	116,392	-----	-----	-----	Post Basin 3
7	Reservoir	11.27	2	726	79,464	6	318.85	55,661	Basin 3 Routed
8	SCS Runoff	10.63	2	718	21,333	-----	-----	-----	Post Bypass POA1
9	Combine	13.88	2	724	100,798	7, 8	-----	-----	Post Total POA1
11	SCS Runoff	79.97	2	716	162,206	-----	-----	-----	Post Basin 1
12	Reservoir	32.29	2	722	124,717	11	324.16	70,992	Basin 1 Upper Routed
13	Reservoir	14.49	2	736	118,520	12	306.00	20,720	Basin 1 Lower Routed
14	SCS Runoff	53.34	2	716	108,277	-----	-----	-----	Post Basin 2
15	Reservoir	13.48	2	724	75,923	14	310.09	51,538	Basin 2 Routed
16	SCS Runoff	43.57	2	716	91,911	-----	-----	-----	Post to Basin 4
17	Reservoir	26.85	2	722	69,820	16	349.21	34,935	Basin 4 Routed
18	SCS Runoff	25.52	2	716	52,547	-----	-----	-----	Post to Bed 1/Basin
19	Reservoir	13.26	2	722	30,899	18	342.71	24,703	UG Bed 1/Basin Routed
20	SCS Runoff	24.47	2	718	49,161	-----	-----	-----	Post Bypass POA2
21	Combine	64.19	2	722	344,323	13, 15, 17, 19, 20	-----	-----	Post Total POA2
SWM.gpw					Return Period: 100 Year			Monday, 03 / 24 / 2025	

Hydrograph Report

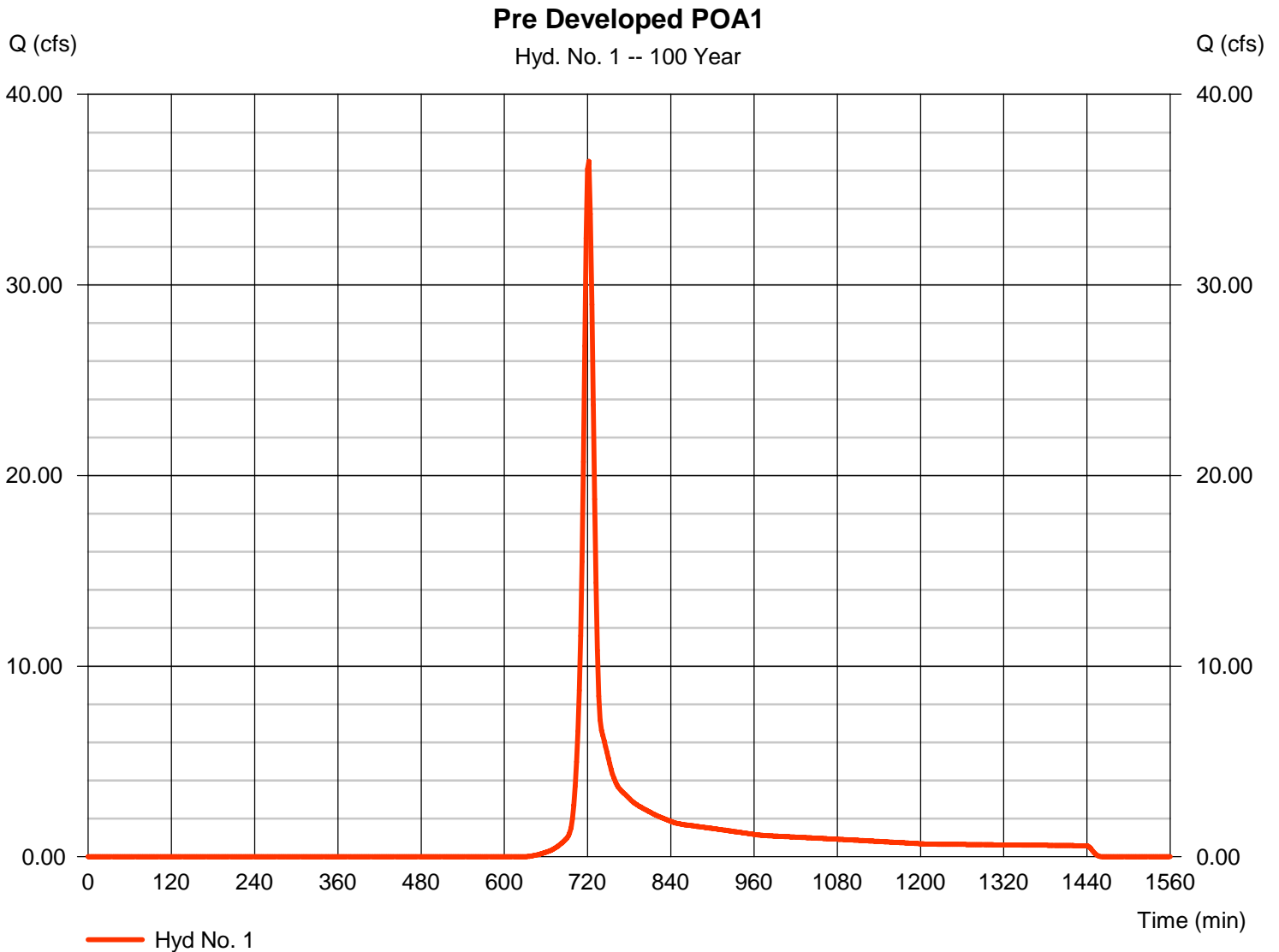
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 1

Pre Developed POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 36.49 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 96,571 cuft
Drainage area	= 9.690 ac	Curve number	= 57.1
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

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

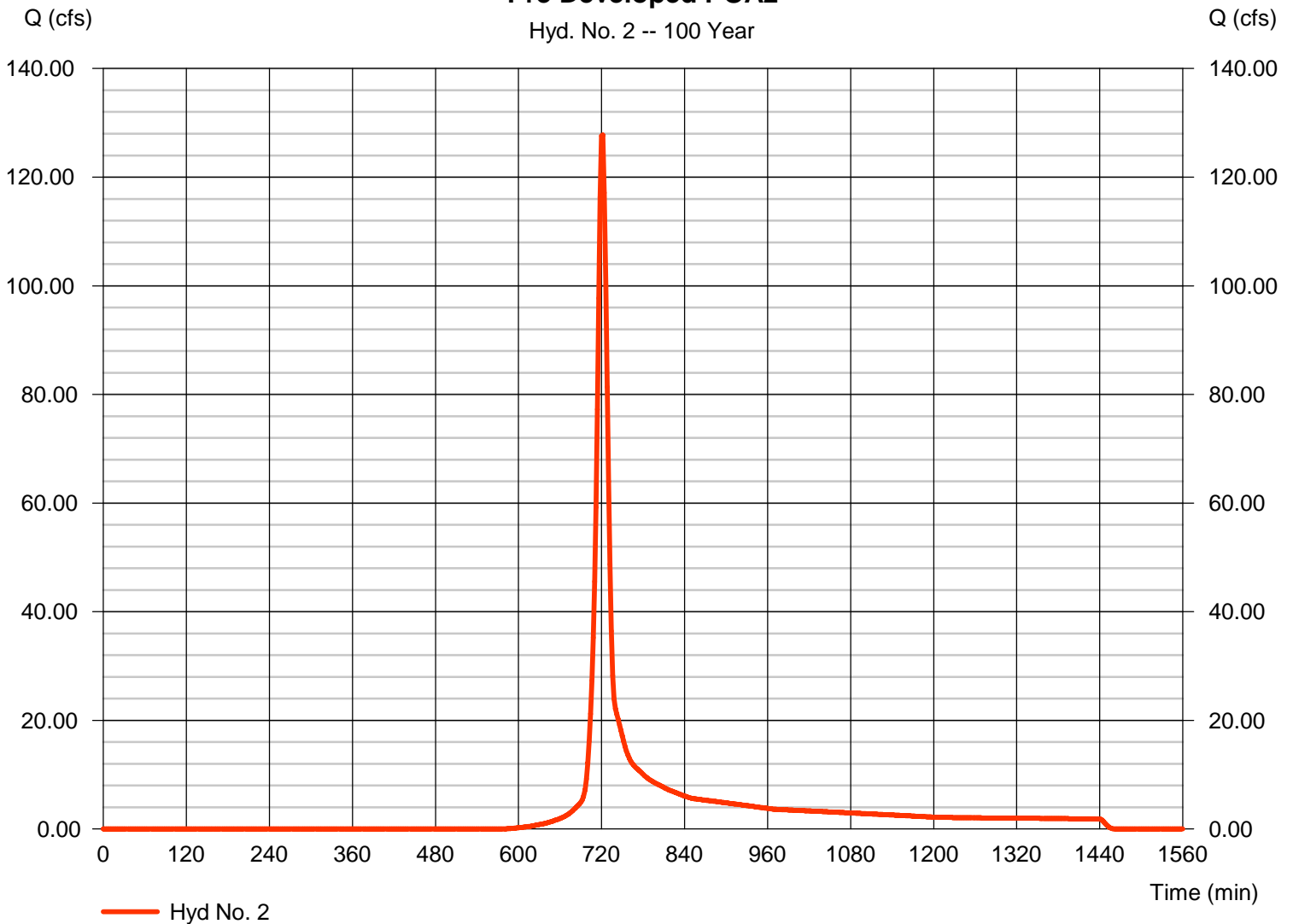
Hyd. No. 2

Pre Developed POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 127.75 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 334,399 cuft
Drainage area	= 28.240 ac	Curve number	= 61.9
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

Pre Developed POA2

Hyd. No. 2 -- 100 Year



Hydrograph Report

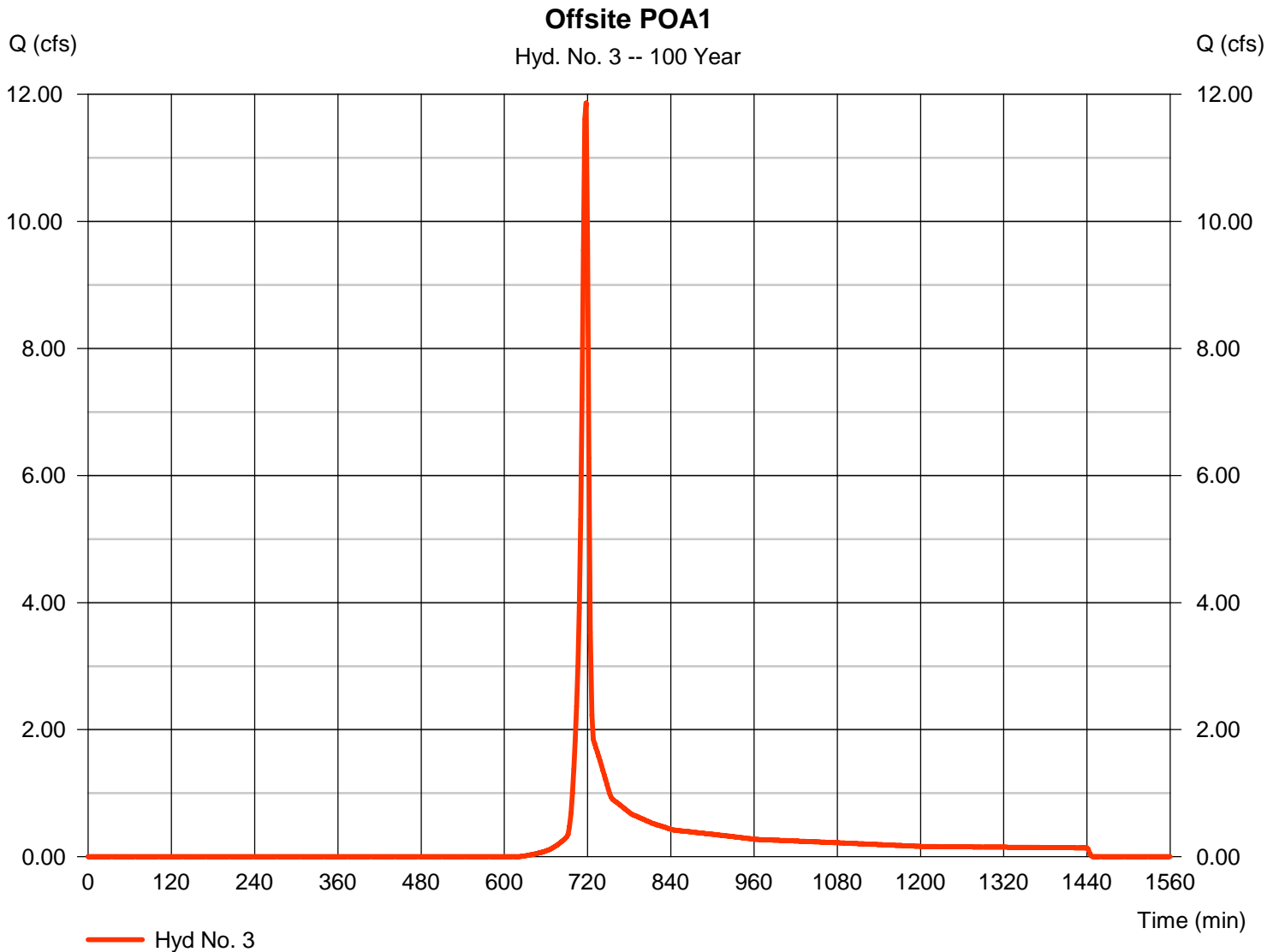
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 3

Offsite POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 11.86 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 23,721 cuft
Drainage area	= 2.530 ac	Curve number	= 58
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

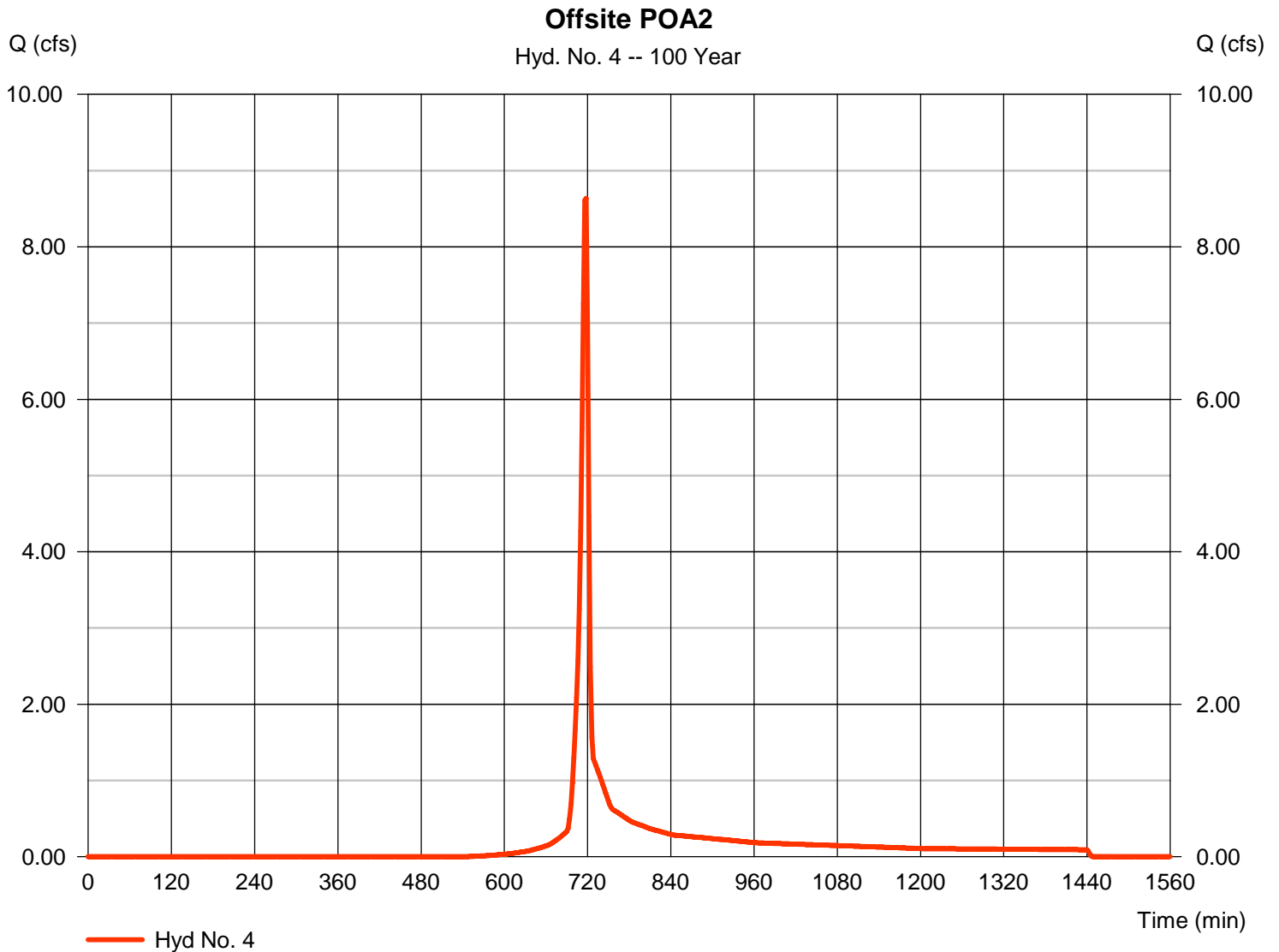
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 4

Offsite POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 8.636 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 17,390 cuft
Drainage area	= 1.490 ac	Curve number	= 64.4
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

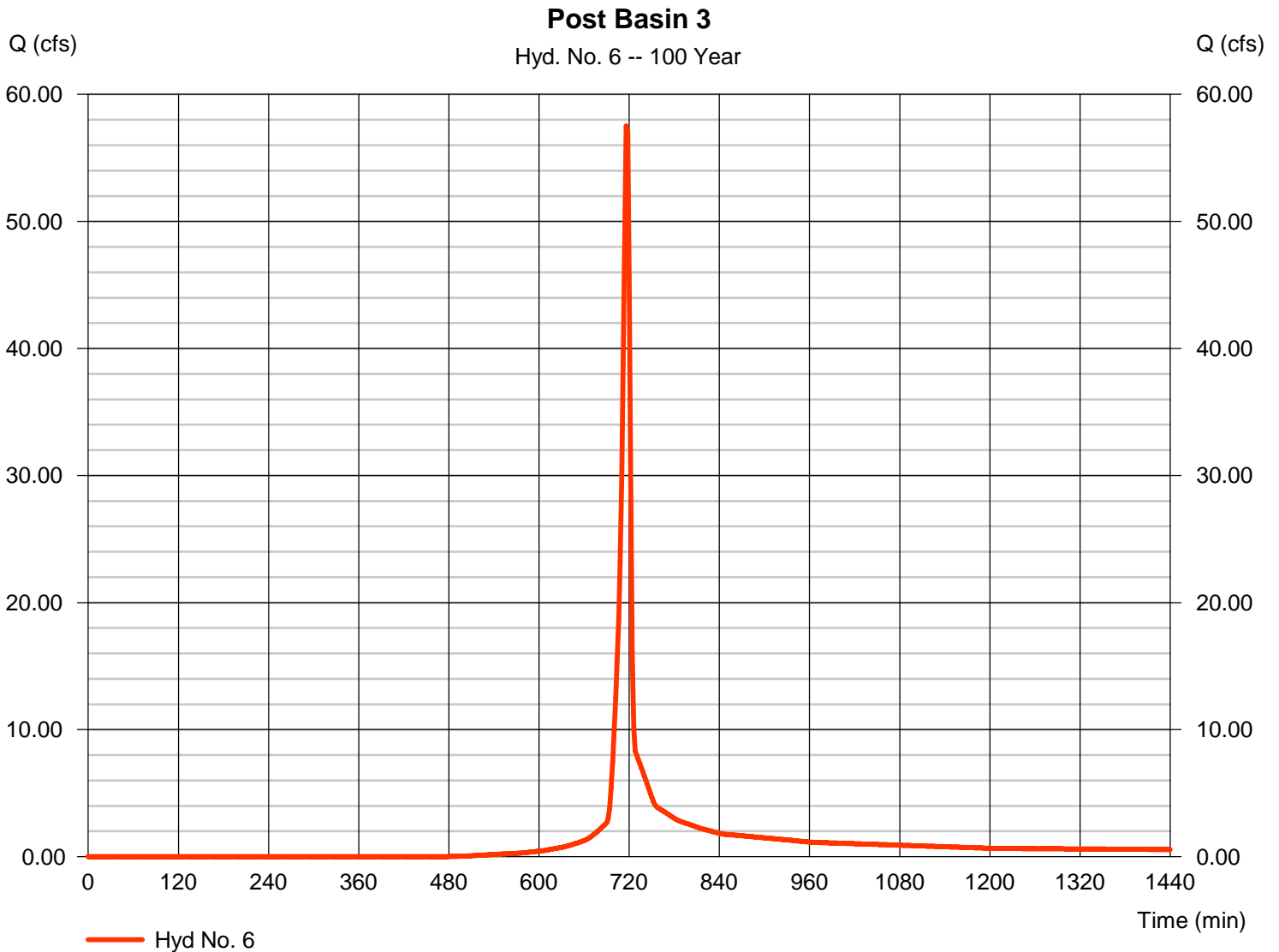
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 6

Post Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 57.51 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 116,392 cuft
Drainage area	= 8.540 ac	Curve number	= 69.7
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. v2024

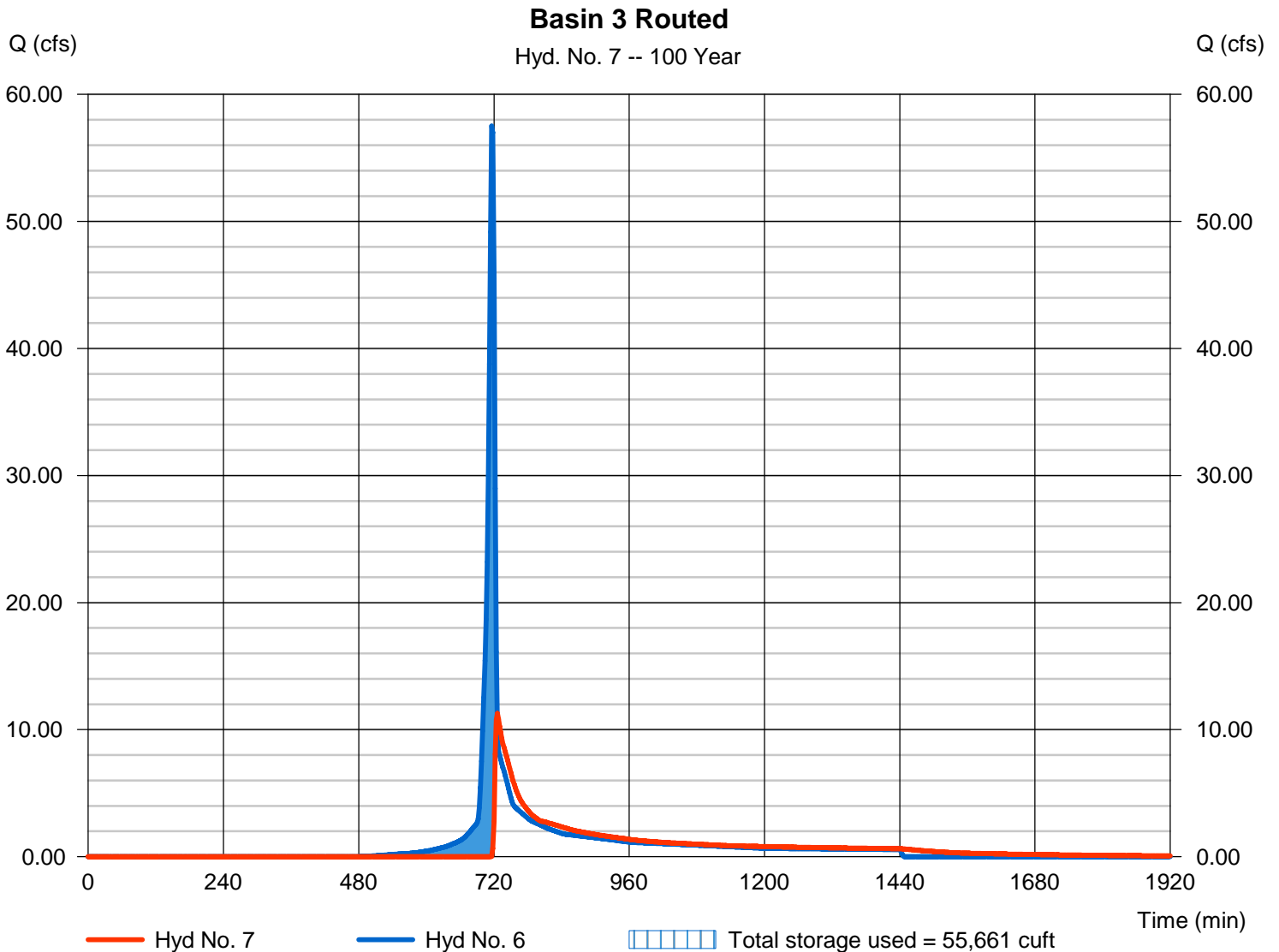
Monday, 03 / 24 / 2025

Hyd. No. 7

Basin 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 11.27 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 79,464 cuft
Inflow hyd. No.	= 6 - Post Basin 3	Max. Elevation	= 318.85 ft
Reservoir name	= Basin 3	Max. Storage	= 55,661 cuft

Storage Indication method used.



Hydrograph Report

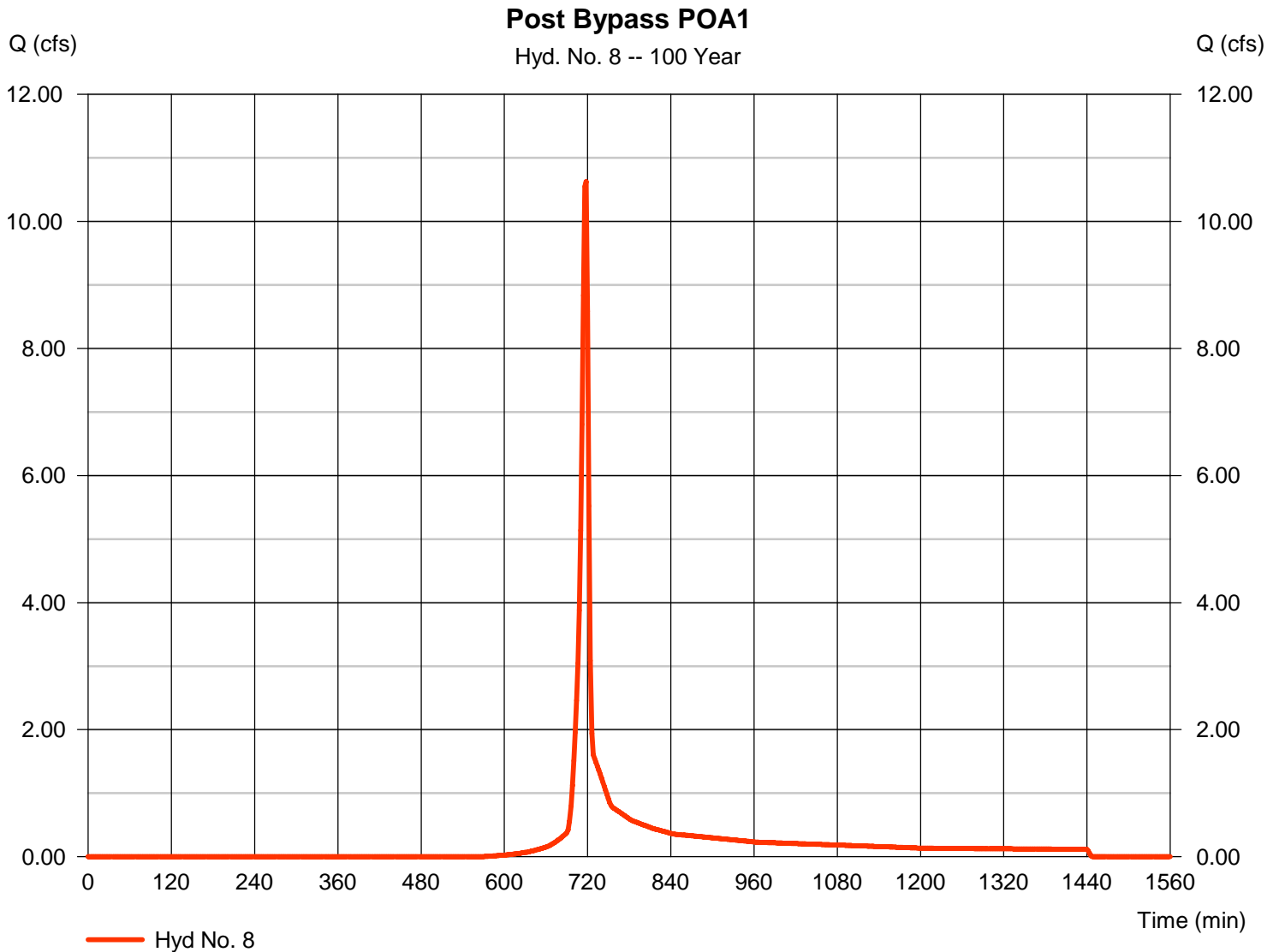
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 8

Post Bypass POA1

Hydrograph type	= SCS Runoff	Peak discharge	= 10.63 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 21,333 cuft
Drainage area	= 1.930 ac	Curve number	= 62.7
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. v2024

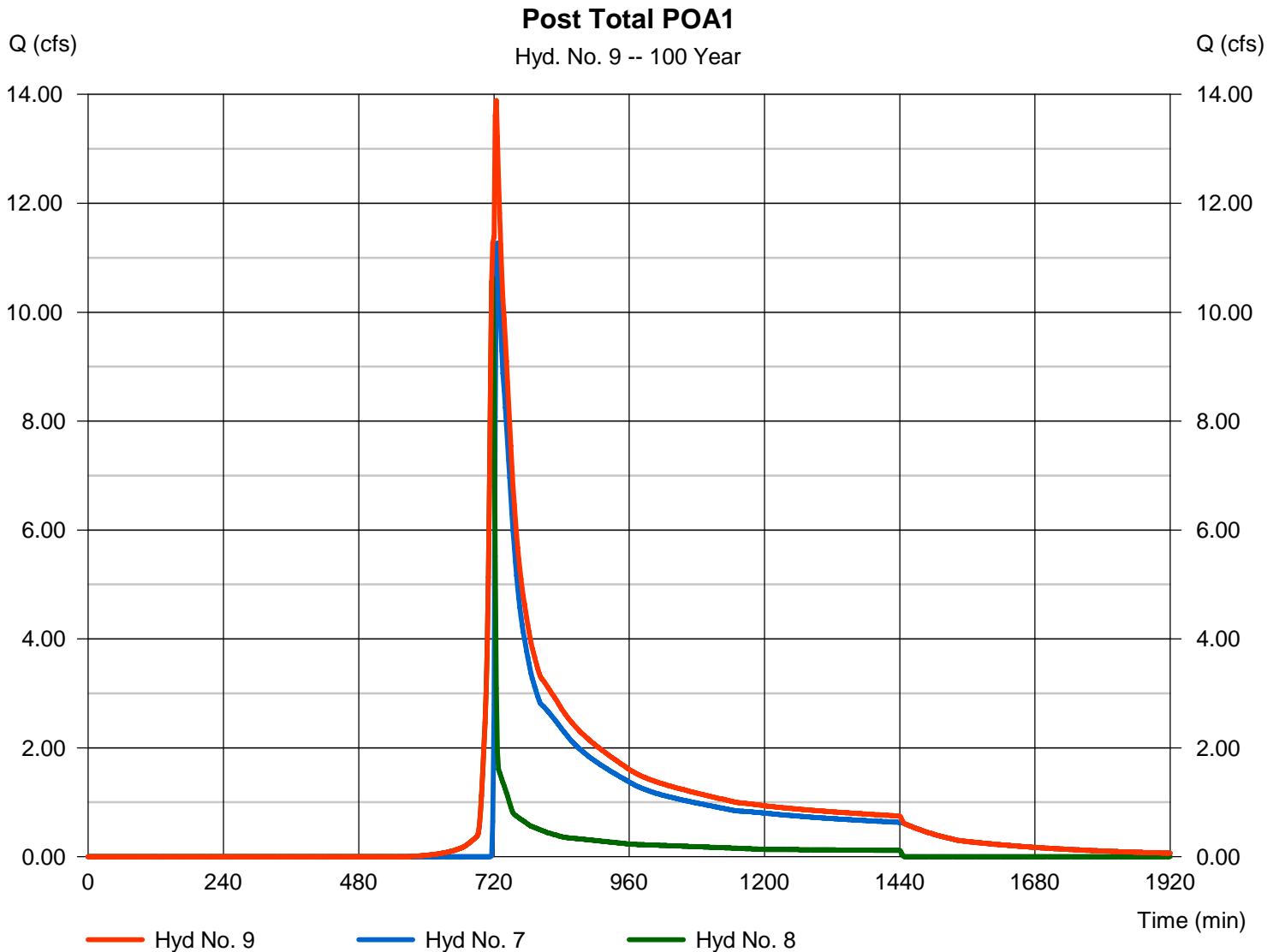
Monday, 03 / 24 / 2025

Hyd. No. 9

Post Total POA1

Hydrograph type = Combine
 Storm frequency = 100 yrs
 Time interval = 2 min
 Inflow hyds. = 7, 8

Peak discharge = 13.88 cfs
 Time to peak = 724 min
 Hyd. volume = 100,798 cuft
 Contrib. drain. area = 1.930 ac



Hydrograph Report

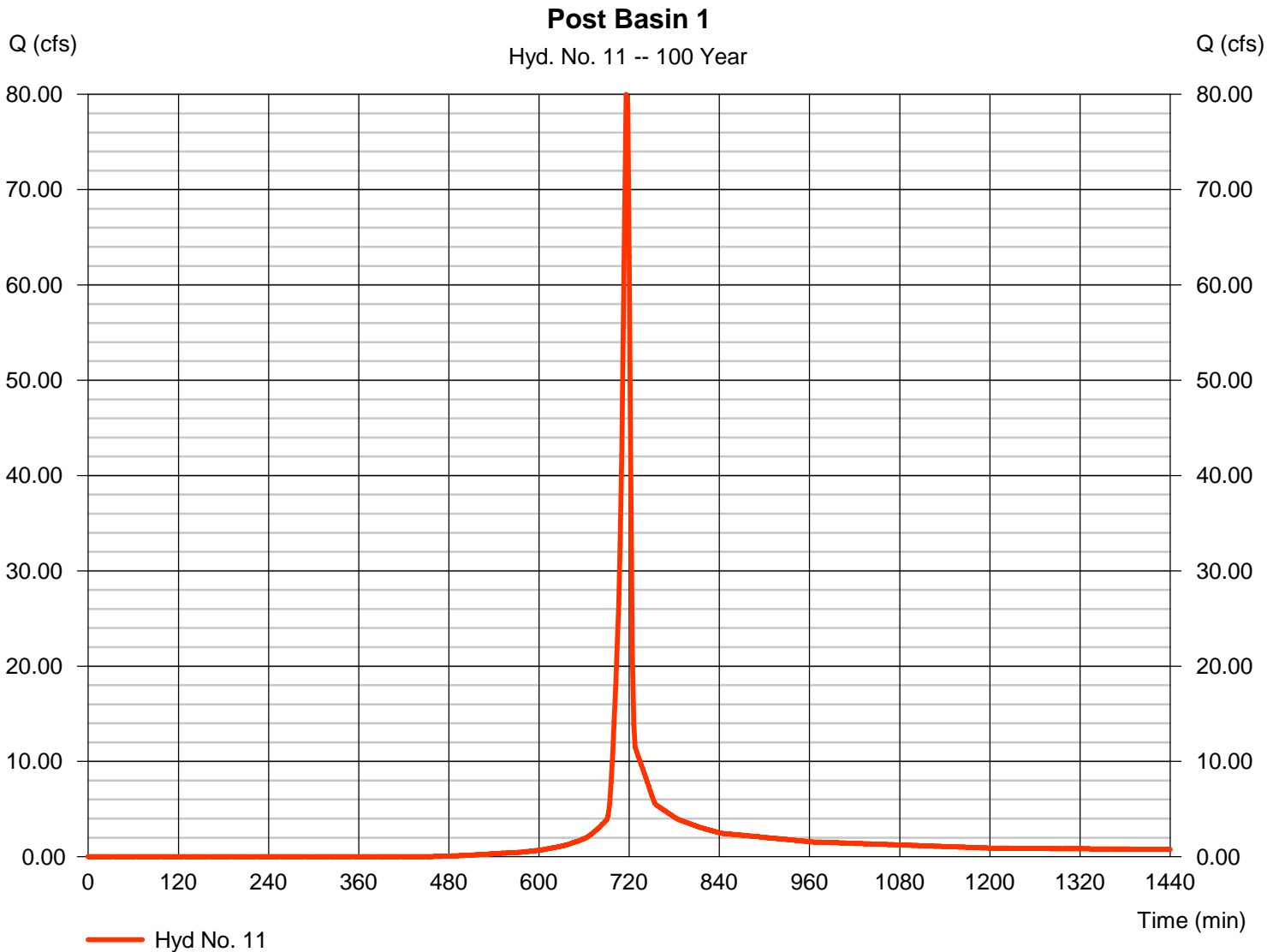
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 11

Post Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 79.97 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 162,206 cuft
Drainage area	= 11.430 ac	Curve number	= 71.2
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. v2024

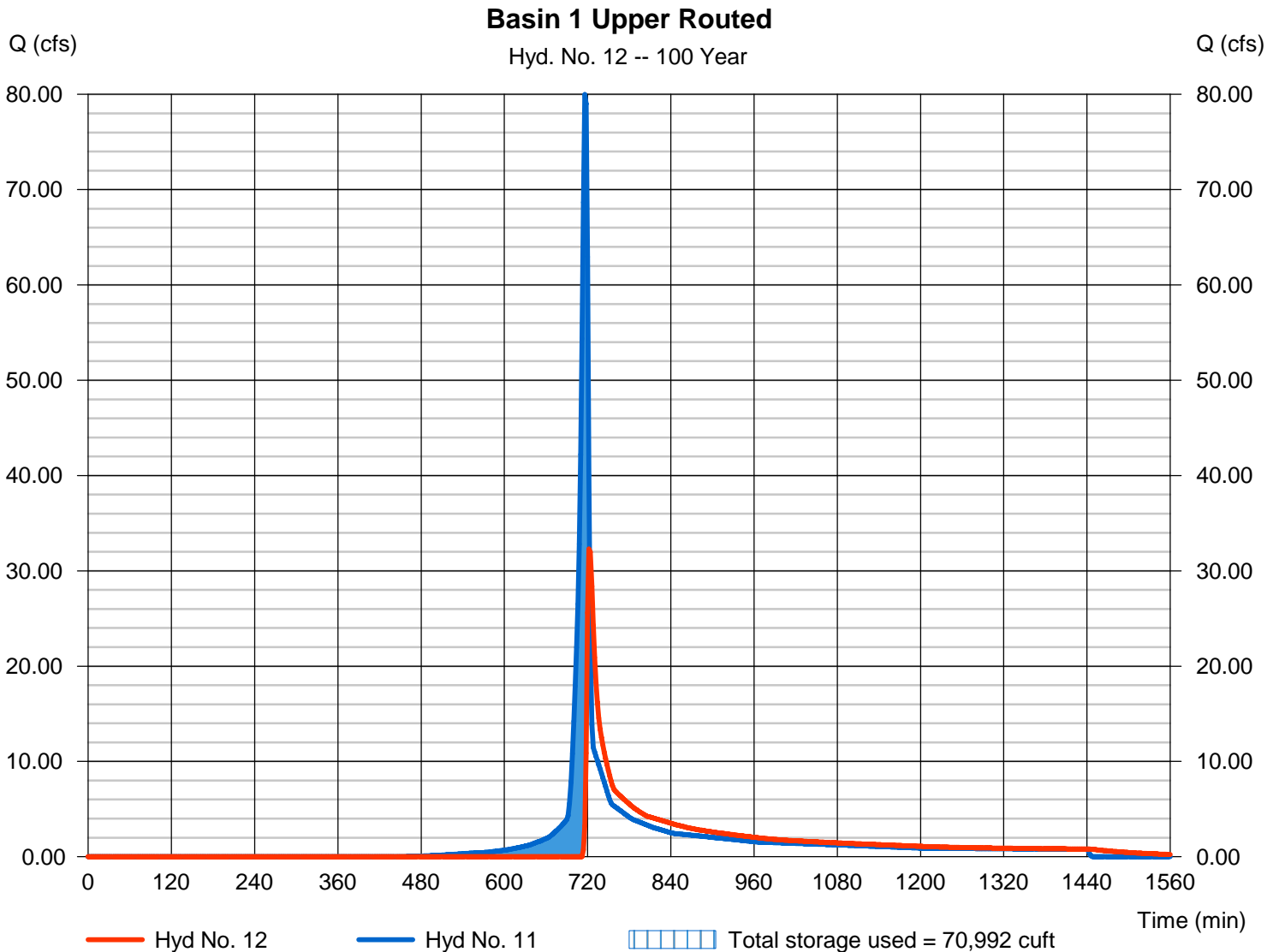
Monday, 03 / 24 / 2025

Hyd. No. 12

Basin 1 Upper Routed

Hydrograph type	= Reservoir	Peak discharge	= 32.29 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 124,717 cuft
Inflow hyd. No.	= 11 - Post Basin 1	Max. Elevation	= 324.16 ft
Reservoir name	= Basin 1 Upper	Max. Storage	= 70,992 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

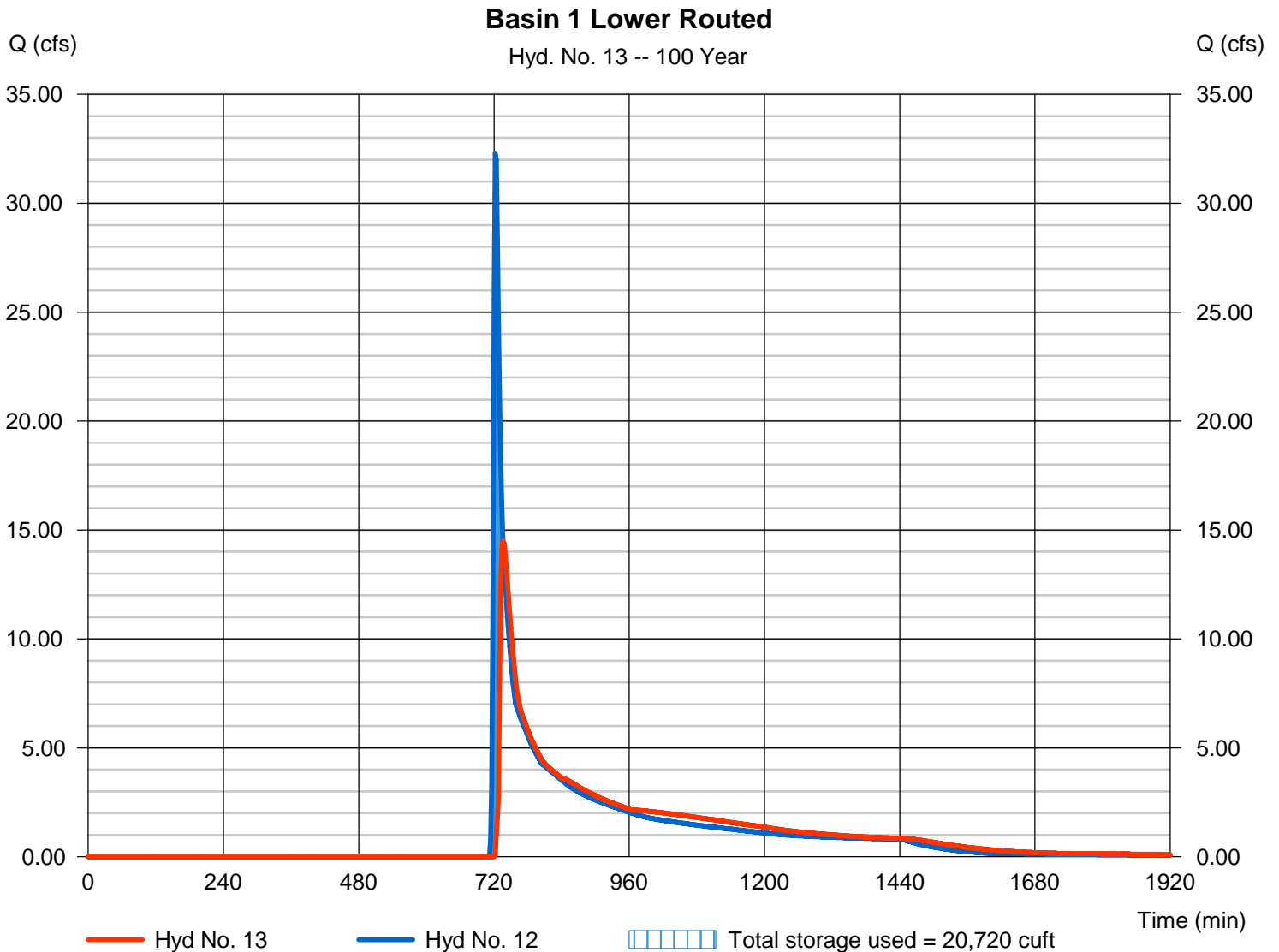
Monday, 03 / 24 / 2025

Hyd. No. 13

Basin 1 Lower Routed

Hydrograph type	= Reservoir	Peak discharge	= 14.49 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 118,520 cuft
Inflow hyd. No.	= 12 - Basin 1 Upper Routed	Max. Elevation	= 306.00 ft
Reservoir name	= Basin 1 Lower	Max. Storage	= 20,720 cuft

Storage Indication method used.



Hydrograph Report

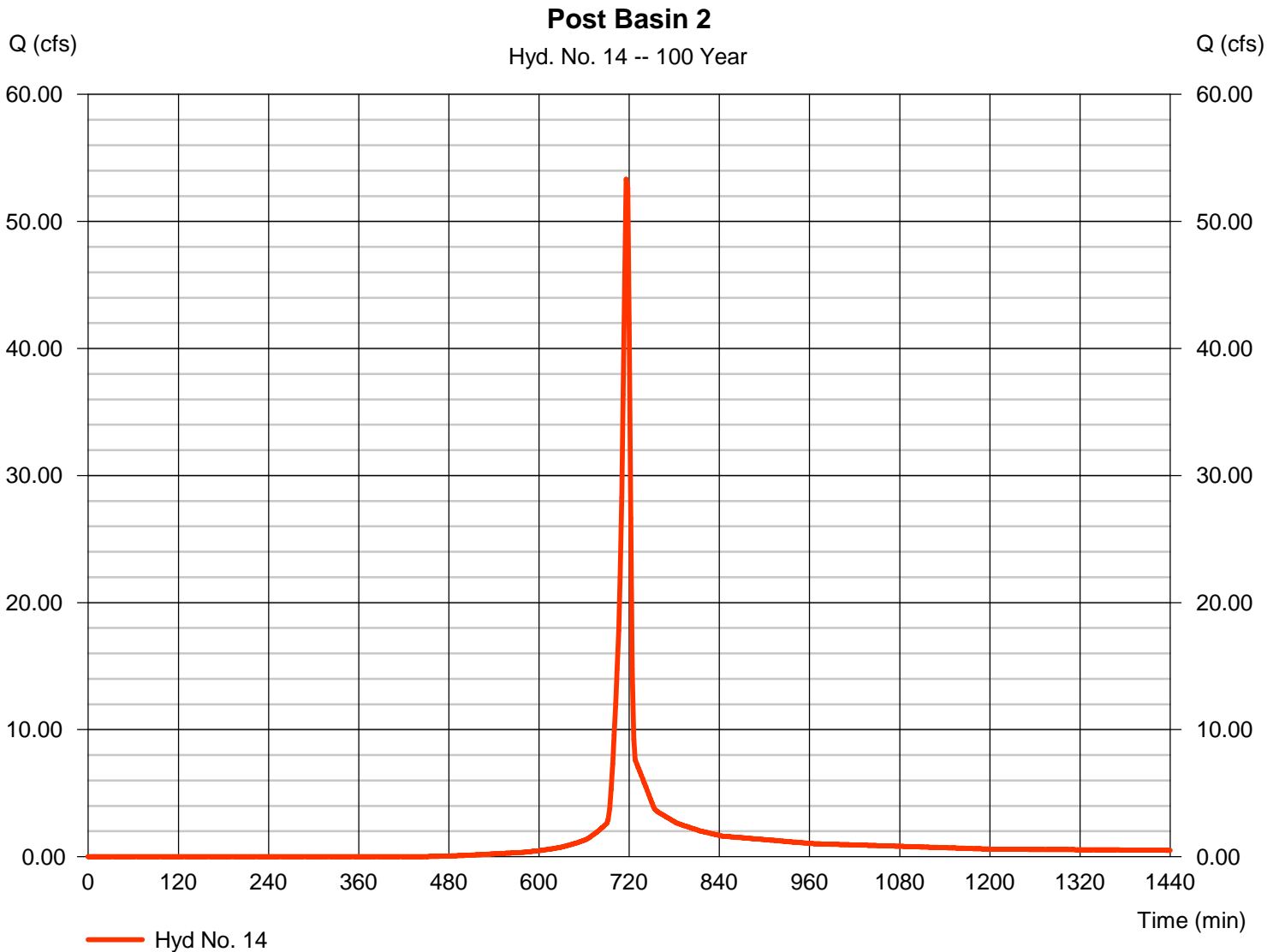
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 14

Post Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 53.34 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 108,277 cuft
Drainage area	= 7.530 ac	Curve number	= 71.7
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. v2024

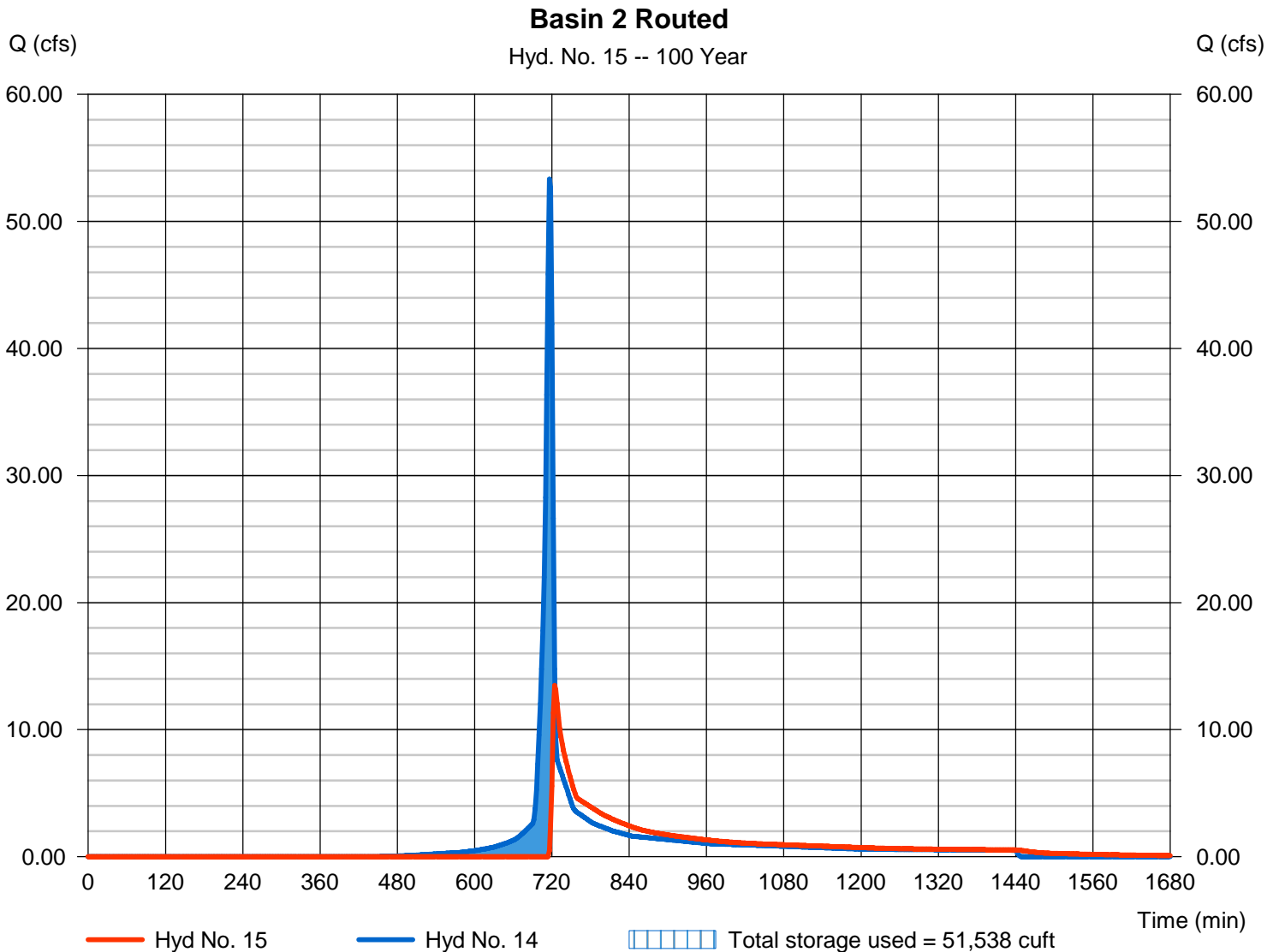
Monday, 03 / 24 / 2025

Hyd. No. 15

Basin 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 13.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 75,923 cuft
Inflow hyd. No.	= 14 - Post Basin 2	Max. Elevation	= 310.09 ft
Reservoir name	= Basin 2	Max. Storage	= 51,538 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

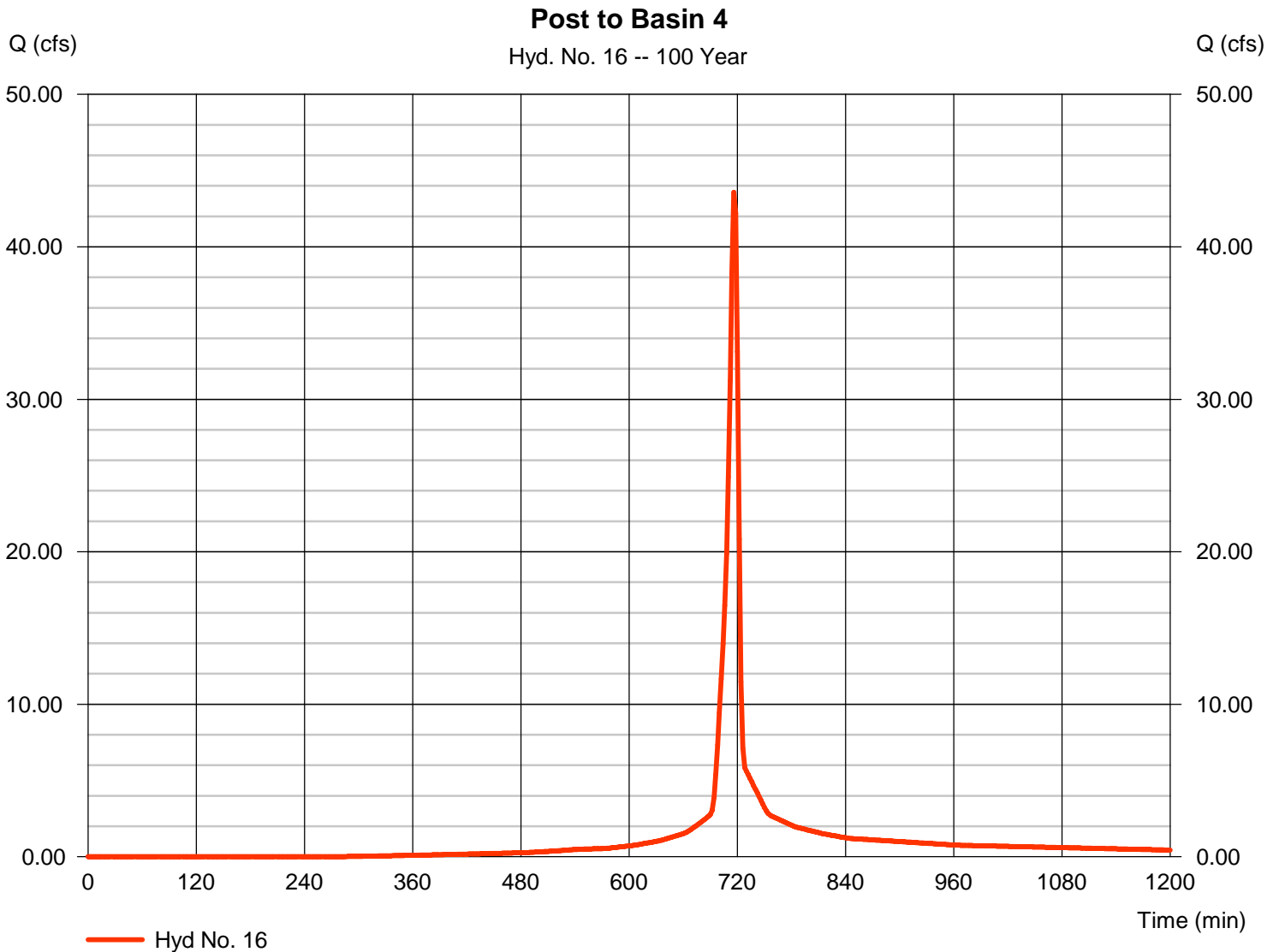
Monday, 03 / 24 / 2025

Hyd. No. 16

Post to Basin 4

Hydrograph type	= SCS Runoff	Peak discharge	= 43.57 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 91,911 cuft
Drainage area	= 4.930 ac	Curve number	= 82.8*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.930



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

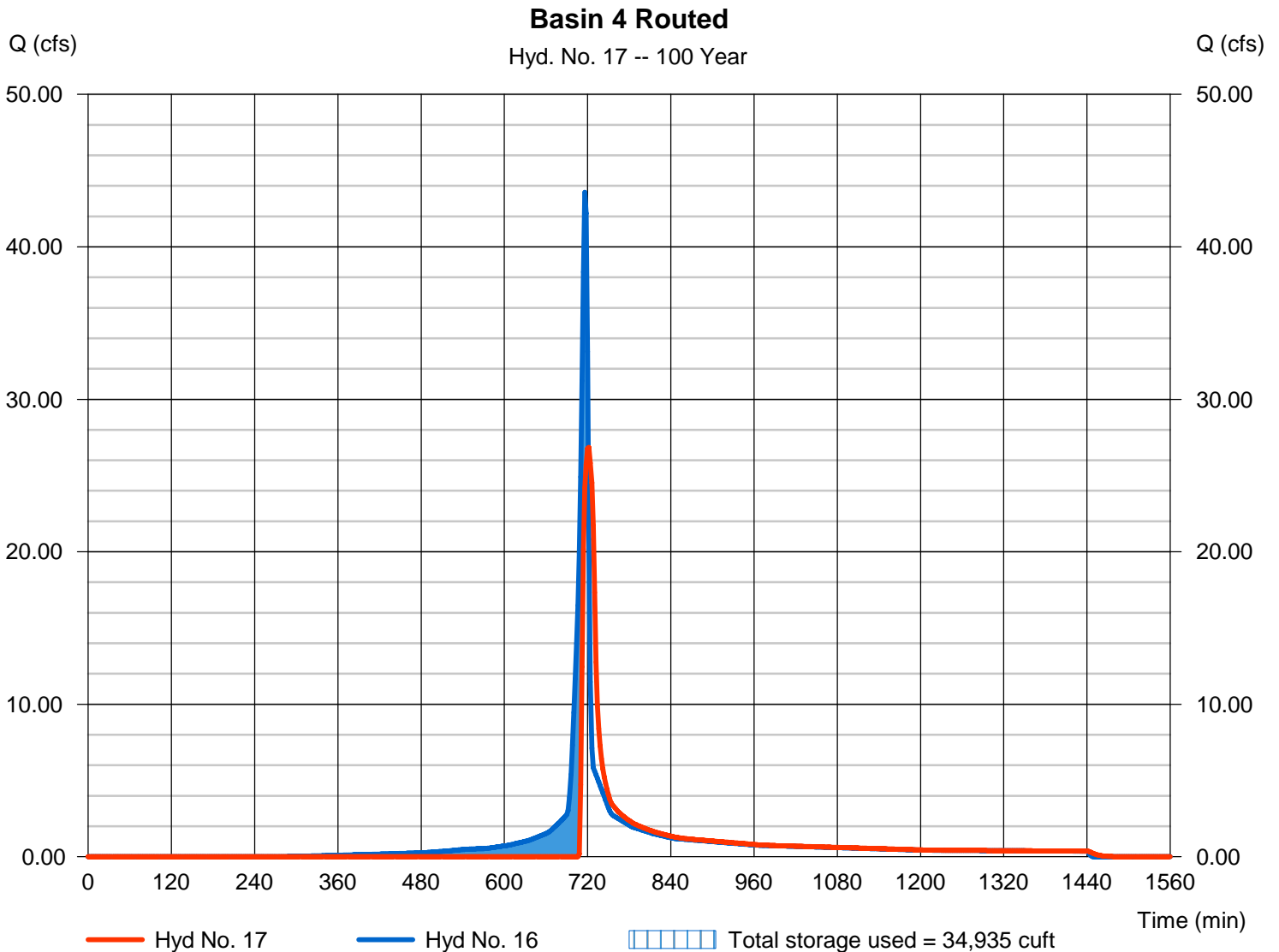
Monday, 03 / 24 / 2025

Hyd. No. 17

Basin 4 Routed

Hydrograph type	= Reservoir	Peak discharge	= 26.85 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 69,820 cuft
Inflow hyd. No.	= 16 - Post to Basin 4	Max. Elevation	= 349.21 ft
Reservoir name	= Basin 4	Max. Storage	= 34,935 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

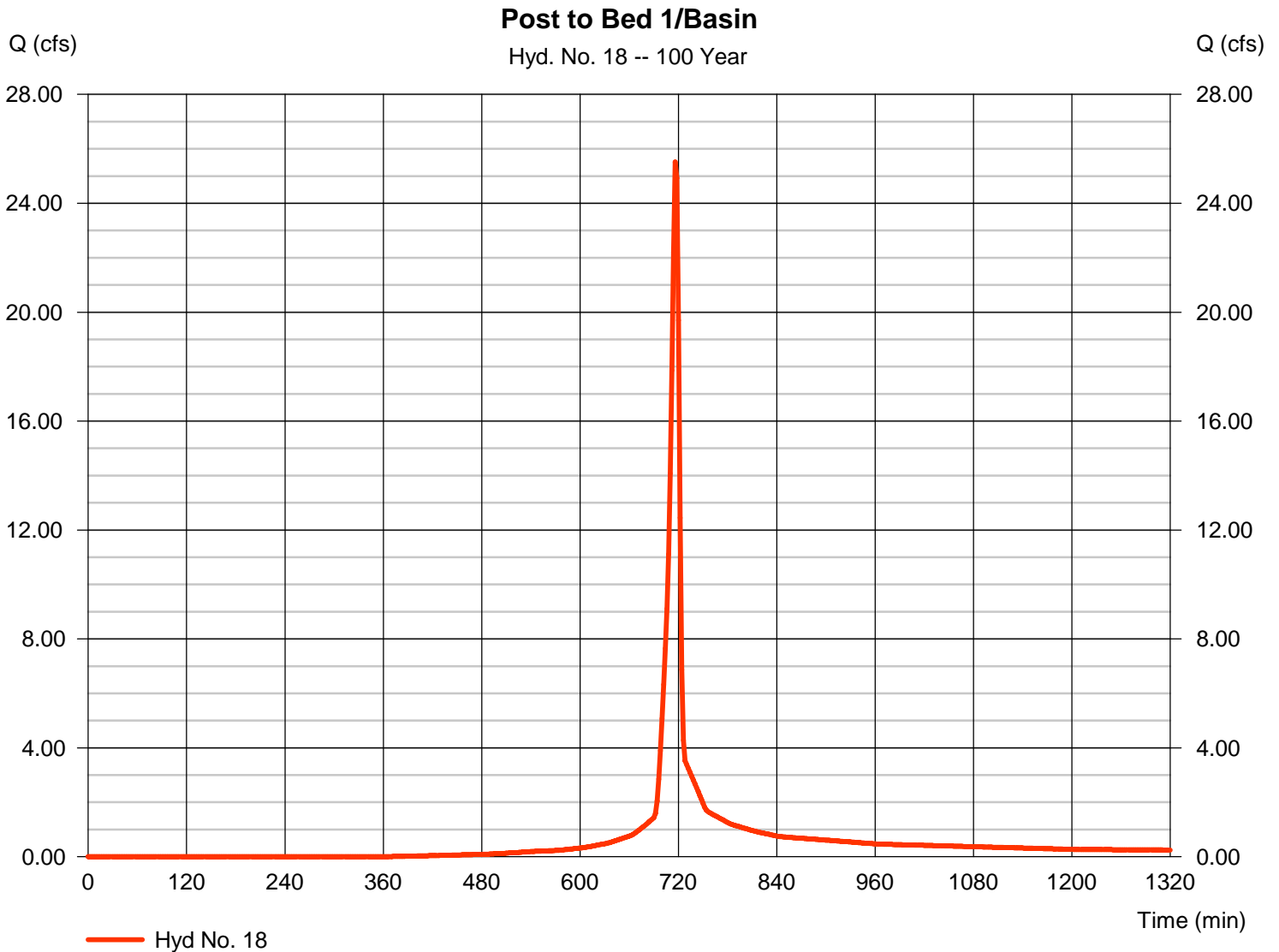
Monday, 03 / 24 / 2025

Hyd. No. 18

Post to Bed 1/Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 25.52 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 52,547 cuft
Drainage area	= 3.190 ac	Curve number	= 77.2*
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

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 3.190



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

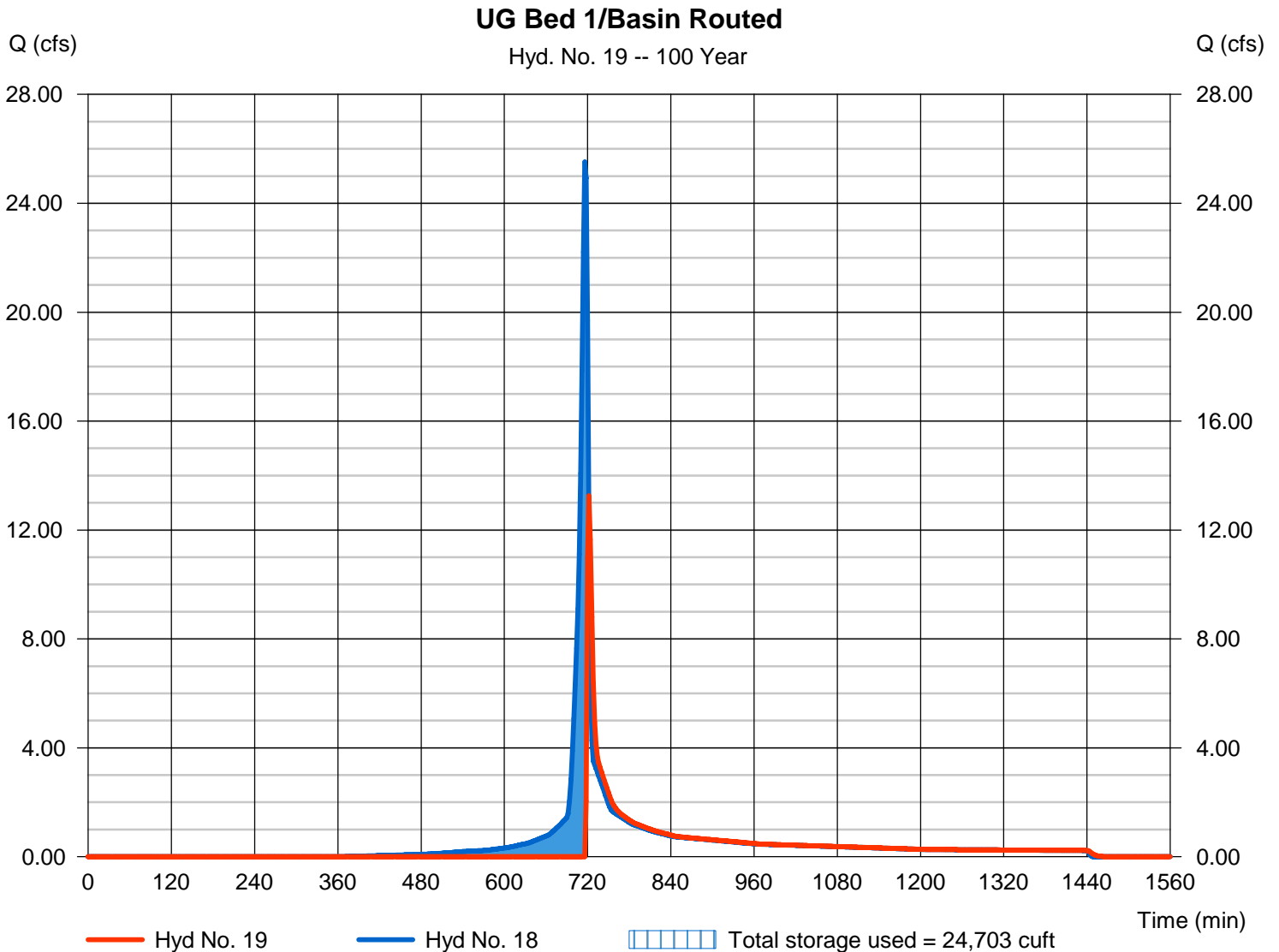
Monday, 03 / 24 / 2025

Hyd. No. 19

UG Bed 1/Basin Routed

Hydrograph type	= Reservoir	Peak discharge	= 13.26 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 30,899 cuft
Inflow hyd. No.	= 18 - Post to Bed 1/Basin	Max. Elevation	= 342.71 ft
Reservoir name	= UG Bed 5/Basin	Max. Storage	= 24,703 cuft

Storage Indication method used.



Hydrograph Report

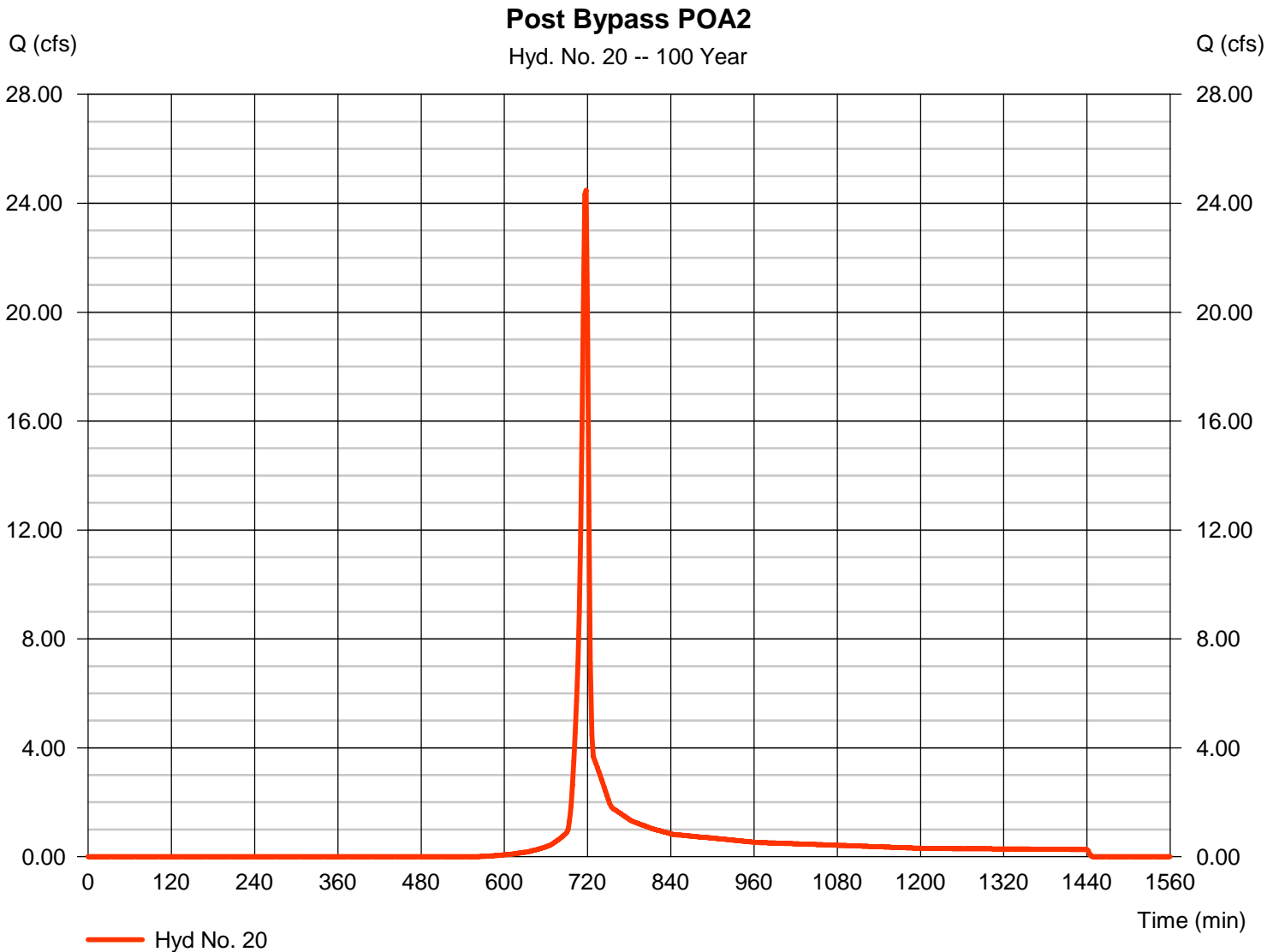
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Monday, 03 / 24 / 2025

Hyd. No. 20

Post Bypass POA2

Hydrograph type	= SCS Runoff	Peak discharge	= 24.47 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 49,161 cuft
Drainage area	= 4.390 ac	Curve number	= 63.1
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



Project: Stokes Estate

Prepared by: ACB

Location: Westtown Township

Checked by:

Outfall =	Basin 1 L	Basin 2	Basin 3	Basin 4	Basin 5
L (ft) =	60	80	77	46	33
Q (100-yr CFS) =	14.49	13.48	11.27	26.85	25.52
Soil Series =	Gladstone Silt Loam	Gladstone Silt Loam	Gladstone Silt Loam	Gladstone Silt Loam	Gladstone Silt Loam
Erosion K-Factor	0.37	0.37	0.37	0.37	0.37
Soil Classification¹ =	Erosion Resistant	Erosion Resistant	Erosion Resistant	Erosion Resistant	Erosion Resistant
Channel Lining =	Established Vegetative Cover	Established Vegetative Cover	Established Vegetative Cover	Established Vegetative Cover	Established Vegetative Cover
Max Permissible Velocity =	2 fps	2 fps	2 fps	2 fps	2 fps

$$CLH^{1.5} \quad v = \frac{Q}{A}$$

C =	3.1	3.1	3.1	3.1	3.1
L (ft) =	60	80	77	46	33
H (ft) =	0.18	0.14	0.13	0.33	0.40
A (sqft) =	10.9	11.5	10.1	15.1	13.1

Actual Velocity (fps) (Q/A) =	1.32	1.17	1.12	1.78	1.95
Max Permissible Velocity³ =	2 fps	2 fps	2 fps	2 fps	2 fps
Vel_{max} >= Vel_{act}	OK	OK	OK	OK	OK

1. The PA DEP Erosion and Sediment Control Program Manual describes any soil with a K-Factor equal to or less than 0.37 as being "erosion resistant"

Stokes Estate - ANTI-SEEP COLLAR DESIGN

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA



DLHowell

Civil Engineering & Land Planning
www.DLHowell.com

JOB NO.: 3868
DATE: 3/20/2025

BY: ACB

BMP 1 LOWER

100-Year Water Surface Elevation:	306
Discharge Pipe Invert Elevation:	302
y, Distance from Upstream Invert of Principal Spillway Riser to Top of Dewatering:	4
Z, Horizontal Component of Upstream Embankment Slope:	3
Pipe Slope (ft./ft.)	0.0975
Pipe Diameter (ft.)	1.5

Length of Pipe in Saturated Zone, Ls:

Ls: 45.9 feet

Increase in Flow Path, LF:

LF: 52.8 feet

Minimum Collar Projection:

of collars: 2

Vmin: 1.72 feet

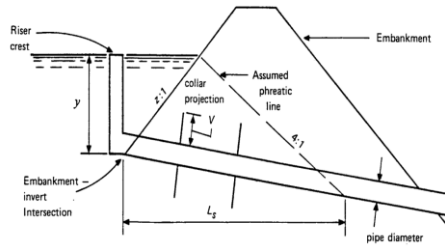
Maximum Collar Spacing:

X: 45.90 feet

Minimum Collar Spacing:

Xmin: 8.75 feet

USE COLLAR SIZE (ft.): 5 ft. X 5 ft.



EPA - 625/3-76-006

Stokes Estate - ANTI-SEEP COLLAR DESIGN

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA



DLHowell

Civil Engineering & Land Planning
www.DLHowell.com

JOB NO.: 3868
DATE: 3/20/2025

BY: ACB

BMP 1 UPPER

100-Year Water Surface Elevation:	324.16
Discharge Pipe Invert Elevation:	320
y, Distance from Upstream Invert of Principal Spillway Riser to Top of Dewatering:	4.16
Z, Horizontal Component of Upstream Embankment Slope:	3
Pipe Slope (ft./ft.)	0.0993
Pipe Diameter (ft.)	2

Length of Pipe in Saturated Zone, Ls:

Ls: 48.3 feet

Increase in Flow Path, LF:

LF: 55.6 feet

Minimum Collar Projection:

of collars: 2

Vmin: 1.81 feet

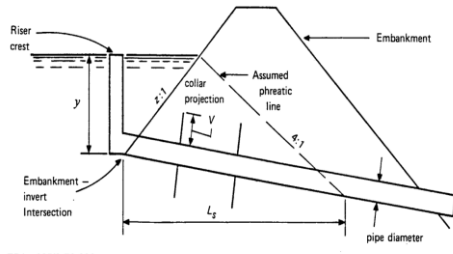
Maximum Collar Spacing:

X: 48.31 feet

Minimum Collar Spacing:

Xmin: 10.00 feet

USE COLLAR SIZE (ft.): 6 ft. X 6 ft.



EPA - 625/3-76-006

Stokes Estate - ANTI-SEEP COLLAR DESIGN

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA



DLHowell

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JOB NO.: 3868
DATE: 3/20/2025

BY: ACB

BMP 2

100-Year Water Surface Elevation:	310.09
Discharge Pipe Invert Elevation:	304
y, Distance from Upstream Invert of Principal Spillway Riser to Top of Dewatering:	6.09
Z, Horizontal Component of Upstream Embankment Slope:	3
Pipe Slope (ft./ft.)	0.0993
Pipe Diameter (ft.)	2

Length of Pipe in Saturated Zone, Ls:

Ls: 70.7 feet

Increase in Flow Path, LF:

LF: 81.3 feet

Minimum Collar Projection:

of collars: 2

Vmin: 2.65 feet

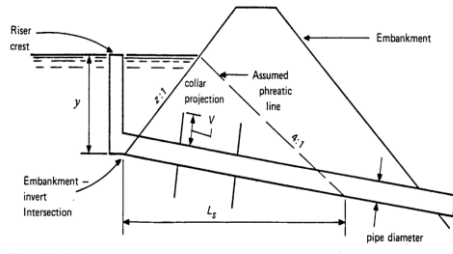
Maximum Collar Spacing:

X: 70.72 feet

Minimum Collar Spacing:

Xmin: 15.00 feet

USE COLLAR SIZE (ft.): 8 ft. X 8 ft.



EPA - 625/3-76-006

Stokes Estate - ANTI-SEEP COLLAR DESIGN

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA



DLHowell

Civil Engineering & Land Planning
www.DLHowell.com

JOB NO.: 3868
DATE: 3/20/2025

BY: ACB

BMP 3

100-Year Water Surface Elevation:	318.85
Discharge Pipe Invert Elevation:	312
y, Distance from Upstream Invert of Principal Spillway Riser to Top of Dewatering:	6.85
Z, Horizontal Component of Upstream Embankment Slope:	3
Pipe Slope (ft./ft.)	0.1281
Pipe Diameter (ft.)	1.5

Length of Pipe in Saturated Zone, Ls:

Ls: 98.3 feet

Increase in Flow Path, LF:

LF: 113.1 feet

Minimum Collar Projection:

of collars: 2

Vmin: 3.69 feet

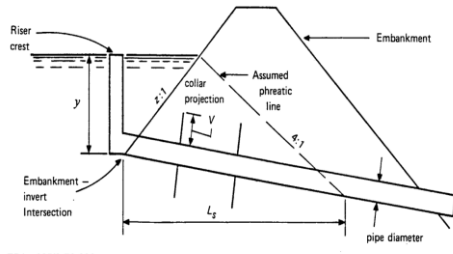
Maximum Collar Spacing:

X: 98.34 feet

Minimum Collar Spacing:

Xmin: 18.75 feet

USE COLLAR SIZE (ft.): 9 ft. X 9 ft.



EPA - 625/3-76-006

Stokes Estate - ANTI-SEEP COLLAR DESIGN

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA



JOB NO.: 3868
DATE: 3/20/2025

BY: ACB

BMP 4

100-Year Water Surface Elevation:	349.21
Discharge Pipe Invert Elevation:	345
y, Distance from Upstream Invert of Principal Spillway Riser to Top of Dewatering:	4.21
Z, Horizontal Component of Upstream Embankment Slope:	3
Pipe Slope (ft./ft.)	0.1281
Pipe Diameter (ft.)	2

Length of Pipe in Saturated Zone, Ls:

Ls: 60.4 feet

Increase in Flow Path, LF:

LF: 69.5 feet

Minimum Collar Projection:

of collars: 2

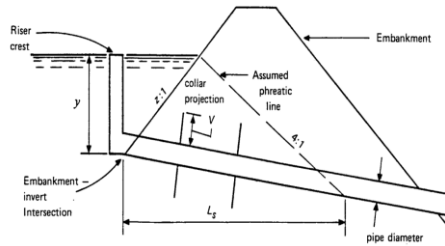
Vmin: 2.27 feet

Maximum Collar Spacing:

X: 60.44 feet

Minimum Collar Spacing:

Xmin: 12.50 feet



EPA - 625/3-76-006

USE COLLAR SIZE (ft.): 7 ft. X 7 ft.

Stokes Estate - ANTI-SEEP COLLAR DESIGN

WESTTOWN TOWNSHIP, CHESTER COUNTY, PA



DLHowell

Civil Engineering & Land Planning
www.DLHowell.com

JOB NO.: 3868
DATE: 3/20/2025

BY: ACB

BMP 5

100-Year Water Surface Elevation:	<u>342.71</u>
Discharge Pipe Invert Elevation:	<u>336</u>
y, Distance from Upstream Invert of Principal Spillway Riser to Top of Dewatering:	<u>6.71</u>
Z, Horizontal Component of Upstream Embankment Slope:	<u>3</u>
Pipe Slope (ft./ft.)	<u>0.1281</u>
Pipe Diameter (ft.)	<u>1.25</u>

Length of Pipe in Saturated Zone, Ls:

Ls: 96.3 feet

Increase in Flow Path, LF:

LF: 110.8 feet

Minimum Collar Projection:

of collars: 2

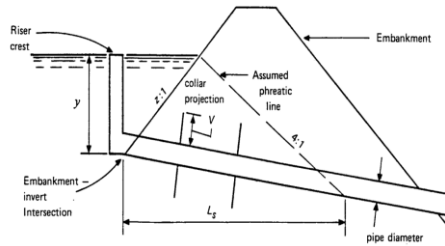
Vmin: 3.61 feet

Maximum Collar Spacing:

X: 96.33 feet

Minimum Collar Spacing:

Xmin: 19.38 feet



EPA - 625/3-76-006

USE COLLAR SIZE (ft.): 9 ft. X 9 ft.

APPENDIX E
USDA NRCS SOIL REPORT



United States
Department of
Agriculture

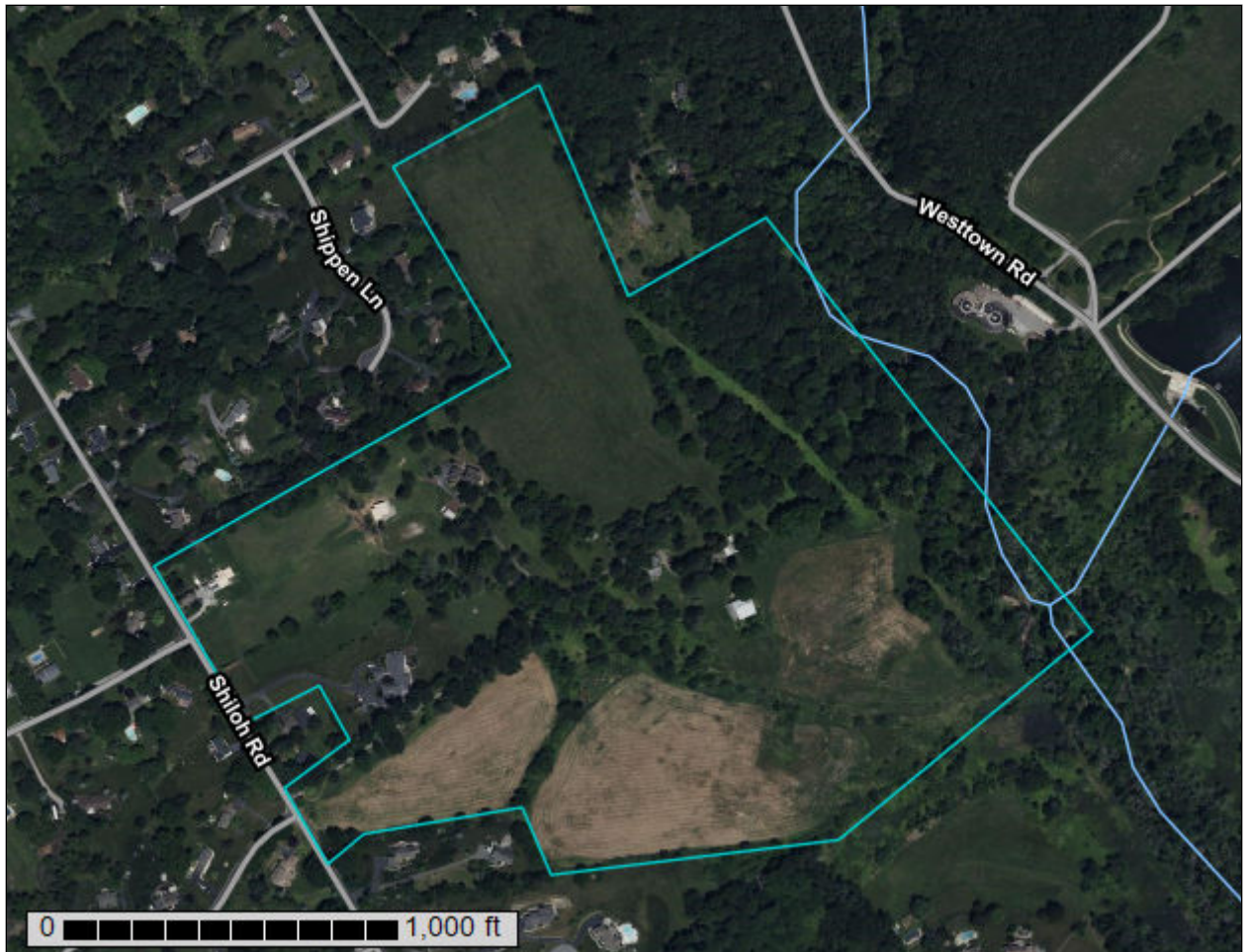
NRCS

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 Estate (+)



Preface

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

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

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

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

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

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

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Ha—Hatboro silt loam.....	22
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How Soil Surveys Are Made

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

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

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

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

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

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

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 Scale: 1:6,080 if printed on A landscape (11" x 8.5") sheet.
0 50 100 200 300 Meters
0 250 500 1000 1500 Feet
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)


Soils


 Soil Map Unit Polygons


 Soil Map Unit Lines


 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit


 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water


 Perennial Water

 Rock Outcrop


 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole

 Slide or Slip


 Sodic Spot


 Spoil Area

 Stony Spot


 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals


Transportation

 Rails


 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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 15, Sep 6, 2022

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

Date(s) aerial images were photographed: Jun 5, 2022—Jul 4, 2022

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	17.0	21.1%
CaB	Califon loam, 3 to 8 percent slopes	2.1	2.6%
Co	Codorus silt loam	0.1	0.2%
GdB	Gladstone gravelly loam, 3 to 8 percent slopes	6.1	7.6%
GdC	Gladstone gravelly loam, 8 to 15 percent slopes	39.4	48.9%
GfD	Gladstone gravelly loam, 8 to 25 percent slopes, very bouldery	5.6	7.0%
Ha	Hatboro silt loam	5.0	6.2%
MaD	Manor loam, 15 to 25 percent slopes	3.7	4.6%
UrIB	Urban land-Gladstone complex, 0 to 8 percent slopes	1.5	1.9%
Totals for Area of Interest		80.6	100.0%

Map Unit Descriptions

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

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

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

Custom Soil Resource Report

are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

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: Concave, linear
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 supply, 0 to 60 inches: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F148XY030PA - Hydric, Piedmont - felsic, Riparian Zone, Swamp Meadow-Shrub-Forest
Hydric soil rating: Yes

Minor Components

Glenville

Percent of map unit: 9 percent

Custom Soil Resource Report

Landform: Hillslopes
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

Manor

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

CaB—Califon loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: yrhl
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

Califon and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Califon

Setting

Landform: Hills

Landform position (two-dimensional): Backslope, footslope

Landform position (three-dimensional): Head slope

Down-slope shape: Concave, linear

Across-slope shape: Concave, linear

Parent material: Colluvium derived from granite and gneiss

Typical profile

Ap - 0 to 9 inches: loam

Bt - 9 to 23 inches: clay loam

Bx - 23 to 38 inches: sandy loam

Cx - 38 to 57 inches: sandy loam

C - 57 to 60 inches: sandy loam

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: 20 to 30 inches to fragipan; 72 to 99 inches to lithic bedrock

Drainage class: Moderately well 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 6 to 36 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: D

Ecological site: F148XY024PA - Moist, Piedmont - felsic, Upland, Mixed Oak - Hardwood - Conifer Forest

Hydric soil rating: No

Minor Components

Gladstone

Percent of map unit: 10 percent

Landform: Hillslopes

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Nose slope, side slope

Down-slope shape: Convex, linear

Across-slope shape: Linear, convex

Hydric soil rating: No

Hatboro

Percent of map unit: 4 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Tread

Down-slope shape: Concave, linear

Across-slope shape: Concave, linear

Custom Soil Resource Report

Hydric soil rating: Yes

Baile

Percent of map unit: 4 percent

Landform: Depressions

Landform position (two-dimensional): Foothlope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave, linear

Across-slope shape: Concave, linear

Hydric soil rating: Yes

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

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: NoneOccasional

Custom Soil Resource Report

Frequency of ponding: None

Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: C

Ecological site: F148XY027PA - Moist, Piedmont - felsic, Riparian Zone, Ecotonal
Meadow-Shrub-Forest

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): Backslope, footslope

Landform position (three-dimensional): Head slope, side slope

Down-slope shape: Concave, linear

Across-slope shape: Linear, concave

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: Concave, linear

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 supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: B

Ecological site: F148XY024PA - Moist, Piedmont - felsic, Upland, Mixed Oak - Hardwood - Conifer Forest

Hydric soil rating: No

Minor Components

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

Annandale

Percent of map unit: 5 percent

Landform: Hills

Custom Soil Resource Report

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
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

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
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

Custom Soil Resource Report

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 supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F148XY024PA - Moist, Piedmont - felsic, Upland, Mixed Oak - Hardwood - Conifer Forest
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

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

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

Custom Soil Resource Report

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: Convex, linear
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 supply, 0 to 60 inches: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F148XY024PA - Moist, Piedmont - felsic, Upland, Mixed Oak - Hardwood - Conifer Forest
Hydric soil rating: No

Minor Components

Cokesbury

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Footslope, toeslope
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

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: NoneFrequent
Frequency of ponding: None

Custom Soil Resource Report

Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4w

Hydrologic Soil Group: B/D

Ecological site: F130AY008PA - Poorly To Somewhat Poorly Drained Floodplains

And Toeslopes, F148XY030PA - Hydric, Piedmont - felsic, Riparian Zone,

Swamp Meadow-Shrub-Forest

Hydric soil rating: Yes

Minor Components

Glenville

Percent of map unit: 5 percent

Landform: Hillslopes

Landform position (two-dimensional): Backslope, footslope

Landform position (three-dimensional): Head slope, side slope

Down-slope shape: Concave, linear

Across-slope shape: Linear, concave

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): Summit, shoulder, backslope

Landform position (three-dimensional): Side slope

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

Custom Soil Resource Report

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 supply, 0 to 60 inches: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F148XY024PA - Moist, Piedmont - felsic, Upland, Mixed Oak - Hardwood - Conifer Forest
Hydric soil rating: No

Minor Components

Mt. airy

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

Glenville

Percent of map unit: 5 percent
Landform: Swales, drainageways
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Interfluve, head slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Blocktown

Percent of map unit: 5 percent
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 supply, 0 to 60 inches: 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: Convex, linear
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

Custom Soil Resource Report

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 supply, 0 to 60 inches: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: A

Ecological site: F148XY024PA - Moist, Piedmont - felsic, Upland, Mixed Oak - Hardwood - Conifer Forest

Hydric soil rating: No

Minor Components

Cokesbury

Percent of map unit: 5 percent

Landform: Depressions

Landform position (two-dimensional): Footslope, toeslope

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



DLHowell

Civil Engineering & Land Planning
www.DLHowell.com

STORMWATER STRUCTURE DEWATERING CALCULATIONS

DATE: 3/20/2025
BY: ACB

JOB NO.: 3868 PROJECT: Stokes Estate
DESCRIPTION: DEWATERING CALCULATION
TOWNSHIP: Westtown

BASIN	<input type="text" value="1 Upper"/>		TP 1-30-3 & TP 1-30-4
PERC. RATE	<input type="text" value="1.713"/>	IN/HR	Hydraulic Conductivity Rate - Geometric Mean Factor of Safety
	<input type="text" value="1"/>		
DESIGN RATE	<input type="text" value="1.71"/>	IN/HR	
BOTTOM AREA	<input type="text" value="13235"/>	FT	
	<input type="text" value="0.5248"/>	CFS	DESIGN INFIL. RATE CONVERTED TO CFS

Water Surface Elevation (ft)	Storage Volume (cu. Ft)	Incremental Storage Volume (Cu. Ft)	Discharge (cfs)	Average Discharge (cfs)	Time (hrs)	Accumulated Time (hrs)
322.50	34552		0.5248			0.00
		34552		0.525	18.29	
320.00	0		0.5248			18.29

Therefore total dewatering time is 18.29 HRS
= 0.76 DAYS



DLHowell

Civil Engineering & Land Planning
www.DLHowell.com

STORMWATER STRUCTURE DEWATERING CALCULATIONS

DATE: 3/20/2025

BY: ACB

JOB NO.: 3868

PROJECT: Stokes Estate

DESCRIPTION:

DEWATERING CALCULATION

TOWNSHIP: Westtown

BASIN	3		TP 1-29-1 & TP 1-29-2
PERC. RATE	0.748	IN/HR	Hydraulic Conductivity Rate - Geometric Mean Factor of Safety
	1		
DESIGN RATE	0.75	IN/HR	
BOTTOM AREA	15345	FT	
	0.2657	CFS	DESIGN INFIL. RATE CONVERTED TO CFS

Water Surface Surface Elevation (ft)	Storage Volume (cu. Ft)	Incremental Storage Volume (Cu. Ft)	Discharge (cfs)	Average Discharge (cfs)	Time (hrs)	Accumulated Time (hrs)
318.00	23639		0.2657			0.00
316.00	1903	21736	0.2657	0.266	22.72	22.72
314.00	0	1903	0.0000	0.133	3.98	26.70

Therefore total dewatering time is 22.72 HRS
= 0.95 DAYS



Civil Engineering & Land Planning
 www.DLHowell.com

STORMWATER STRUCTURE DEWATERING CALCULATIONS

DATE: 3/20/2025
 BY: ACB

JOB NO.: 3868 **PROJECT:** Stokes Estate
DESCRIPTION: DEWATERING CALCULATION
TOWNSHIP: Westtown

BASIN	<input type="text" value="5"/>		TP 2-2-3
PERC. RATE	<input type="text" value="0.77"/>	IN/HR	Hydraulic Conductivity Rate - Geometric Mean Factor of Safety
	<input type="text" value="1"/>		
DESIGN RATE	<input type="text" value="0.77"/>	IN/HR	
BOTTOM AREA	<input type="text" value="6075"/>	FT	
	<input type="text" value="0.1083"/>	CFS	DESIGN INFIL. RATE CONVERTED TO CFS

Water Surface Surface Elevation (ft)	Storage Volume (cu. Ft)	Incremental Storage Volume (Cu. Ft)	Discharge (cfs)	Average Discharge (cfs)	Time (hrs)	Accumulated Time (hrs)
340.00	13287		0.1083			0.00
		5997		0.108	15.38	
340.00	12018	12018	0.1083	0.108	30.83	15.38
339.00	7290	7290	0.1083	0.108	18.70	46.21
336.00	0		0.1083			64.92

Therefore total dewatering time is 46.21 HRS
 = 1.93 DAYS

STORMWATER INFILTRATION REPORT

FOR

1013 SHILOH ROAD
WESTTOWN TOWNSHIP
CHESTER COUNTY

PREPARED FOR:

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

PREPARED BY:

Prepared by:

HOWELL ENGINEERING

1250 Wrights Lane, West Chester, PA 19380
Phone: 610-918-9002 Fax: 610-918-9003

January & February 2025

Stormwater Infiltration Test Report
1013 Shiloh Road
Westtown Township
Chester County

Howell Engineering 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). The tests were performed on the following dates: 1/29/2025, 1/30/2025, and 2/5/2025.

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 reading 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, nine hydraulic conductivity tests were conducted at the elevation associated with the proposed bottom of the infiltration structure. One deep test pit was excavated at each infiltration test 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 structure.

- Infiltration Test 1-29-1 was conducted at approximately ± 7.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 312.0. One deep test pit was excavated at this location to a depth of 9.0 feet below existing grade. Coarse fragments were encountered from 50-108 inches below the existing grade. However, no limiting conditions were identified at the time of excavation.
- Infiltration Test 1-29-2 was conducted at approximately ± 3.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 312.0. 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, Howell Engineering recommends the following infiltration rate for the soils underlying Tests 1-29-1 & 1-29-2: an infiltration rate of 0.748 inches per hour shall be used.

- Infiltration Test 1-30-1 was conducted at approximately ± 4.0 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 identified at the time of excavation.
- Infiltration Test 1-30-2 was conducted at approximately ± 4.0 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 identified at the time of excavation.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Tests 1-30-1 & 1-30-2: an infiltration rate of 0.532 inches per hour shall be used.

- Infiltration Test 1-30-3 was conducted at approximately ± 4.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 320.0. 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.
- Infiltration Test 1-30-4 was conducted at approximately ± 4.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 320.0. 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, Howell Engineering recommends the following infiltration rate for the soils underlying Tests 1-30-3 & 1-30-4: an infiltration rate of 1.713 inches per hour shall be used.

- Infiltration Test 2-5-1 was conducted at approximately ± 7.5 feet below existing grade, which corresponds to an approximate infiltration elevation of 345.0. One deep test pit was excavated at this location to a depth of 9.5 feet below existing grade. Coarse fragments were encountered from 60-102 inches below the existing grade. However, no limiting conditions were identified at the time of excavation.
- Infiltration Test 2-5-2 was conducted at approximately ± 5.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 345.0. One deep test pit was excavated at this location to a depth of 7.0 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, Howell Engineering recommends the following infiltration rate for the soils underlying Tests 2-5-1 & 2-5-2: an infiltration rate of 0.704 inches per hour shall be used.

- Infiltration Test 2-5-3 was conducted at approximately \pm 4.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 338.0. One deep test pit was excavated at this location to a depth of 6.0 feet below existing grade. Redoximorphic features were encountered approximately 12-56 inches below the existing grade at the time of excavation.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 2-5-3: an infiltration rate of 0.704 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.

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

DATE: 1/29/2025
 BY: CS

Field Test Results

WEATHER CONDITIONS: SUNNY TEMPERATURE: 55 °F
 PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
TP 1-29-1	84									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		7.25	7.25	6.75	6.75	6.75	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

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
TP 1-29-2	36									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		7.50	6.25	6.25	6.00	6.00	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

Detemination of Hydraulic Conductivity (Kv)

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

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

TP 1-29-1 Results

0.805396	(in./hour)
7.068583	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
11.25	(Inches)

TP 1-29-2 Results

0.6948	(in./hour)
7.0686	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
12.00	(Inches)

Average Permeability	0.75 (in./hr)
Geometric Mean	0.748 (in./hr)

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

DATE: 1/30/2025
 BY: CS

Field Test Results

WEATHER CONDITIONS: SUNNY TEMPERATURE: 43 °F
 PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
TP 1-30-1	48									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		11.50	9.50	9.50	9.25	9.25	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
TP 1-30-2	48									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		3.00	2.50	2.25	2.25	2.25	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

Detemination of Hydraulic Conductivity (Kv)

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

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

TP 1-30-1 Results

1.236048	(in/hour)
7.068583	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
8.75	(Inches)

TP 1-30-2 Results

0.2288	(in/hour)
7.0686	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
15.75	(Inches)

Average Permeability	0.732 (in./hr)
Geometric Mean	0.532 (in./hr)

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

DATE: 1/30/2025
 BY: CS

Field Test Results

WEATHER CONDITIONS: SUNNY TEMPERATURE: 43 °F
 PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
TP 1-30-3	48									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		12.00	11.25	11.00	11.00	11.00	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

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
TP 1-30-4	48									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		15.25	12.00	12.00	11.75	11.75	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

Detemination of Hydraulic Conductivity (Kv)

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

- 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

TP 1-30-3 Results

1.618426	(in./hour)
7.068583	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
7.00	(Inches)

TP 1-30-4 Results

1.8126	(in./hour)
7.0686	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
6.25	(Inches)

Average Permeability	1.716 (in./hr)
Geometric Mean	1.713 (in./hr)

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

DATE: 2/5/2025
 BY: CS

Field Test Results

WEATHER CONDITIONS: SUNNY TEMPERATURE: 35 °F
 PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
TP 2-5-1	90									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		4.00	3.50	3.50	3.50	3.50	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
TP 2-5-2	60									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		11.00	9.75	9.75	9.75	9.75	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)

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

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

TP 2-5-1 Results

0.370519	(in/hour)
7.068583	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
14.50	(Inches)

TP 2-5-2 Results

1.3369	(in/hour)
7.0686	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
8.25	(Inches)

Average Permeability	0.854 (in./hr)
Geometric Mean	0.704 (in./hr)

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

DATE: 2/5/2025
 BY: CS

Field Test Results

WEATHER CONDITIONS: SUNNY TEMPERATURE: 35 °F
 PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
TP 2-5-3	48									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		0.50	0.50	0.50	0.50	0.50	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
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)							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)

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

- 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

TP 2-5-3 Results

0.048274	(in./hour)		(in./hour)
7.068583	(Sq.in.)	7.0686	(Sq.in.)
2.75	(Units)	2.75	(Units)
3	(Inches)	3	(Inches)
0.5	(hrs.)	0.5	(hrs.)
18	(Inches)	18	(Inches)
17.50	(Inches)		(Inches)

Test Permeability **0.048 (in./hr)**

Soil Morphology Form



PIT NUMBER: TP1-30-1 JOB NUMBER: 3868 INVESTIGATOR: CRS
 DATE: 1/30/2025 STATE: PA COUNTY: CHESTER
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
 SUBDIVISION: N/A SITE LOCATION: 1013 SHILOH ROAD
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrct	Topo				A	S	C			
	0	10	A	S	10 YR 4/4	SILT	0				GRAN	FRI	
	10	27	A	W	10 YR 6/6	LOAMY SAND	0				GRAN	LO	
	27	72			10 YR 7/3	SAND	0				GRAN	LO	

COMMENTS: This Deep Test Pit was conducted at Test 1-30-1.

SOIL TYPE: LIMITING CONDITION: Type: Water Rock Mottling Depth: "	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 43° SUNNY METHOD: Excavator
 SLOPE: _____ EXCAVATION DEPTH: 72"
 COVER: FIELD LANDSCAPE POSITION: NW

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

1250 Wrights Lane
West Chester, PA 19380

P: (610) 918-9002
 F: (610) 918-9003

Soil Morphology Form



PIT NUMBER: TP1-30-4 JOB NUMBER: 3868 INVESTIGATOR: CRS
 DATE: 1/30/2025 STATE: PA COUNTY: CHESTER
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
 SUBDIVISION: N/A 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	8			10 YR 4/4	SILTY CLAY	0				MA	FIRM	
	8	35			7.5 YR 4/6	SILT	0				GRAN	LO	
	35	72			2.5 Y 5/4	LOAMY SAND	10				GRAN	LO	

COMMENTS: This Deep Test Pit was conducted at Test 1-30-4.

SOIL TYPE:	Soil Drainage Class:	Soil Scientist Signature:
LIMITING CONDITION:	Excessively Drained Somewhat Poorly Drained	
Type: Water Rock Mottling	Well Drained Poorly Drained	
Depth: "	Moderately Well Drained Very Poorly Drained	

WEATHER: 43° SUNNY METHOD: Excavator
 SLOPE: _____ EXCAVATION DEPTH: 72"
 COVER: FIELD 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

1250 Wrights Lane
 West Chester, PA 19380

P: (610) 918-9002
 F: (610) 918-9003

Soil Morphology Form



PIT NUMBER: TP2-5-1 JOB NUMBER: 3868 INVESTIGATOR: CRS
 DATE: 2/5/2025 STATE: PA COUNTY: CHESTER
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
 SUBDIVISION: N/A 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	10	G	W	10 YR 4/4	SILT	0				GRAN	FRI	
	10	70	A	W	10 YR 3/6	SANDY CLAY LOAM	30				GRAN	FRI	
	70	114			10 YR 3/3	LOAMY SAND	30				GRAN	LO	

COMMENTS: This Deep Test Pit was conducted at Test 1-5-1.

SOIL TYPE: LIMITING CONDITION: Type: Water Rock Mottling Depth: "	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature: _____
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WEATHER: 36° SUNNY METHOD: Excavator
 SLOPE: _____ EXCAVATION DEPTH: 114"
 COVER: LAWN 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: TP2-5-2 JOB NUMBER: 3868 INVESTIGATOR: CRS
 DATE: 2/5/2025 STATE: PA COUNTY: CHESTER
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
 SUBDIVISION: N/A 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	12	G	W	10 YR 4/4	SILT	0				GRAN	FRI	
	12	37	G	W	10 YR 3/4	LOAMY SAND	0				GRAN	LO	
	37	84			10 YR 5/8	LOAMY SAND	15				GRAN	FRI	

COMMENTS: This Deep Test Pit was conducted at Test 1-5-2.

SOIL TYPE: LIMITING CONDITION: Type: Water Rock Mottling Depth: "	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 36° SUNNY METHOD: Excavator
 SLOPE: _____ EXCAVATION DEPTH: 114"
 COVER: LAWN 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

STORMWATER INFILTRATION REPORT

FOR

**1007 & 1011 SHILOH ROAD
WESTTOWN TOWNSHIP
CHESTER COUNTY**

PREPARED FOR:

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

PREPARED BY:

**Howell Engineering
1250 Wrights Lane
West Chester, PA 19380**

March 2023

Stormwater Infiltration Test Report
1007 & 1011 Shiloh Road
Westtown Township
Chester County

On Wednesday-Thursday, March 8-9, 2023, Howell Engineering performed hydraulic conductivity tests for the proposed stormwater management areas for the properties located at 1007 and 1011 Shiloh Road in Westtown Township, Chester County. The purpose of the hydraulic conductivity testing was to determine site suitability for the proposed stormwater infiltration area 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.

On lot 1007 Shiloh Road (Obrien property), two hydraulic conductivity tests were conducted within the proposed infiltration areas at the elevations associated with the proposed bottom of the infiltration structures. One deep test pit was excavated at each infiltration test 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 structure.

- Infiltration Test 3-9-1 was conducted at approximately ± 3.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 377.0. One deep test pit was excavated at this location to a depth of 5.0 feet below existing grade. During excavation, rock was encountered at a depth of approximately 61 inches below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 3-9-1: an infiltration rate of 0.175 inches per hour shall be used.

- Infiltration Test 3-9-2 was conducted at approximately ± 8.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 342.0. One deep test pit was excavated at this location to a depth of 10.0 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, Howell Engineering recommends the following infiltration rate for the soils underlying Test 3-9-2: an infiltration rate of 2.376 inches per hour shall be used.

On lot 1011 Shiloh Road (Galilea property), three hydraulic conductivity tests were conducted within the proposed infiltration areas at the elevations associated with the proposed bottom of the infiltration structures. One deep test pit was excavated at each infiltration test 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 3-8-1 was conducted at approximately ± 8.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 364.0. One deep test pit was excavated at this location to a depth of 10.0 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, Howell Engineering recommends the following infiltration rate for the soils underlying Test 3-8-1: an infiltration rate of 4.855 inches per hour shall be used.

- Infiltration Test 3-8-2 was conducted at approximately ± 4.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 362.0. 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, Howell Engineering recommends the following infiltration rate for the soils underlying Test 3-8-2: an infiltration rate of 0.284 inches per hour shall be used.

- Infiltration Test 3-8-3 was conducted at approximately ± 4.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 357.0. One deep test pit was excavated at this location to a depth of 6.0 feet below existing grade. During excavation, redoximorphic features were identified from approximately 41-72 inches below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 3-8-3: an infiltration rate of 0.123 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.

Soil Morphology Form



PIT NUMBER: TP 3-9-1 JOB NUMBER: 3868 INVESTIGATOR: DWD
 DATE: 3/9/2023 STATE: PA COUNTY: CHESTER
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
 SUBDIVISION: N/A SITE LOCATION: 1007 SHILOH RD
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrnct	Topo				A	S	C			
	0	10	A	W	10 YR 4/2	SILT LOAM	0				GRAN	FRI	
	10	37	A	W	7.5 YR 4/4	SILTY CLAY	0				MA	VFIRM	
	37	61			7.5 YR 4/6	STONY SILT	<20				GRAN	FRI	

COMMENTS: This Deep Test Pit was conducted at Test 3-9-1. During excavation, rock was encountered at a depth of approximately 61 inches below existing grade.

SOIL TYPE: LIMITING CONDITION: Rock Type: Water Rock Mottling Depth: approx. 61"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 48° Mostly Sunny METHOD: Excavator
 SLOPE: _____ EXCAVATION DEPTH: 61"
 COVER: Lawn LANDSCAPE POSITION: N

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 3-9-2 JOB NUMBER: 3868 INVESTIGATOR: DWD
 DATE: 3/9/2023 STATE: PA COUNTY: CHESTER
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
 SUBDIVISION: N/A SITE LOCATION: 1007 SHILOH RD
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrnct	Topo				A	S	C			
	0	6	A	W	10 YR 4/2	SILT LOAM	0				SBK	FRI	
	6	24	G	S	10 YR 4/6	SILT LOAM	0				MA	FRI	
	24	57	G	S	10 YR 4/3	SILT LOAM	0				GRAN	FRI	
	57	120			VAR	SANDY SILT	0				GRAN	LO	some large rock

COMMENTS: This Deep Test Pit was conducted at Test 3-9-2. No limiting conditions were identified at the time of excavation.

SOIL TYPE: LIMITING CONDITION: Type: Water Rock Mottling Depth: +120"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 48° Mostly Sunny METHOD: Excavator
 SLOPE: _____ EXCAVATION DEPTH: 120"
 COVER: Lawn LANDSCAPE POSITION: E

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 3-8-1 JOB NUMBER: 3868 INVESTIGATOR: DWD
 DATE: 3/8/2023 STATE: PA COUNTY: CHESTER
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
 SUBDIVISION: N/A SITE LOCATION: 1011 SHILOH RD
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrnct	Topo				A	S	C			
	0	4	A	W	10 YR 4/2	SILT LOAM	0				SBK	FIRM	
	4	33	G	S	7.5 YR 4/4	SILTY CLAY	0				MA	FRI	
	33	59	A	C	VAR	SILTY CLAY	0				MA	FRI	
	59	120			VAR	SANDY SILT	0				GRAN	LO	

COMMENTS: This Deep Test Pit was conducted at Test 3-8-1. No limiting conditions were identified at the time of excavation.

SOIL TYPE: LIMITING CONDITION: Type: Water Rock Mottling Depth: +120"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 48° Mostly Sunny METHOD: Excavator
 SLOPE: _____ EXCAVATION DEPTH: 120"
 COVER: Pasture LANDSCAPE POSITION: N

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 3-8-2 JOB NUMBER: 3868 INVESTIGATOR: DWD
 DATE: 3/8/2023 STATE: PA COUNTY: CHESTER
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
 SUBDIVISION: N/A SITE LOCATION: 1011 SHILOH RD
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrnct	Topo				A	S	C			
	0	7	A	W	10 YR 5/2	SILT LOAM	0				SBK	FIRM	
	7	45	G	S	10 YR 5/8	SILTY CLAY	0				MA	VFIRM	
	45	72			10 YR 3/3	SILT LOAM	0				GRAN	FRI	

COMMENTS: This Deep Test Pit was conducted at Test 3-8-2. 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 Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 48° Mostly Sunny METHOD: Excavator
 SLOPE: _____ EXCAVATION DEPTH: 72"
 COVER: Pasture LANDSCAPE POSITION: N

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 3-8-3 JOB NUMBER: 3868 INVESTIGATOR: DWD
 DATE: 3/8/2023 STATE: PA COUNTY: CHESTER
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
 SUBDIVISION: N/A SITE LOCATION: 1011 SHILOH RD
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrnct	Topo				A	S	C			
	0	13	A	W	10 YR 4/2	SILT LOAM	0				MA	FRI	
	13	41	G	S	10 YR 5/6	SILTY CLAY	0				MA	FIRM	
	41	72			10 YR 6/4	SILTY CLAY	0	f	c	d	MA	FIRM	

COMMENTS: This Deep Test Pit was conducted at Test 3-8-3. During excavation, redoximorphic features were identified at approximatley 41-72 inches below exiting grade.

SOIL TYPE: LIMITING CONDITION: Redox Type: Water Rock Mottling Depth: approx 41-72"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 48° Mostly Sunny METHOD: Excavator
 SLOPE: _____ EXCAVATION DEPTH: 72"
 COVER: Pasture LANDSCAPE POSITION: SE

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

JOB NO.: 3868
 LOCATION: 1011 Shiloh Road
 MUNICIPALITY: Westtown Township, Chester County, Pa.
 DESCRIPTION: Stormwater Infiltration Testing

DATE: 3/8/2023
 BY: DWD

Field Test Results

WEATHER CONDITIONS: Mostly Sunny TEMPERATURE: 48 °F
 PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-8-1	96									
Time(min.)		30	10	10	10	10	10	10	10	10
Drop(inches)		18.00	11.50	11.00	11.00	11.00	11.00	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	18	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-8-2	48									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		3.50	3.00	2.75	2.75	2.75	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

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-8-3	48									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		1.50	1.50	1.25	1.25	1.25	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)

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

	Test 3-8-1 Results	Test 3-8-2 Results	Test 3-8-3 Results
Kv = Vertical Permeability	4.85528 (in/hour)	0.2841 (in/hour)	0.12333 (in/hour)
A = Cross-sectional area of cased hole	7.06858 (Sq.in.)	7.06858 (Sq.in.)	7.06858 (Sq.in.)
F = shape factor (2.75 constant for flat bottom)	2.75 (Units)	2.75 (Units)	2.75 (Units)
D = cased hole diameter	3 (Inches)	3 (Inches)	3 (Inches)
t = time for head to change from h1 to h2	0.16667 (hrs.)	0.5 (hrs.)	0.5 (hrs.)
h1 = initial height of water column in casing	18 (Inches)	18 (Inches)	18 (Inches)
h2 = final height of water column in casing	7.00 (Inches)	15.25 (Inches)	16.75 (Inches)



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Stormwater Infiltration Testing &

Hydraulic Conductivity Calculations

JOB NO.: 3868
 LOCATION: 1007 Shiloh Road
 MUNICIPALITY: Westtown Township, Chester County, Pa.
 DESCRIPTION: Stormwater Infiltration Testing

DATE: 3/9/2023
 BY: DWD

Field Test Results

WEATHER CONDITIONS: SUNNY TEMPERATURE: 48 °F
 PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-9-1	36									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		2.50	2.00	1.75	1.75	1.75	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

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-9-2	96									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		13.50	13.50	13.50	13.50	13.50	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

Determination of Hydraulic Conductivity (Kv)

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

- 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 3-9-1 Results

Test 3-9-2 Results

0.17526	(in/hour)
7.06858	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
16.25	(Inches)

2.375548	(in/hour)
7.068583	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
4.50	(Inches)

STORMWATER INFILTRATION REPORT

FOR

**1007, 1011, 1013 SHILOH ROAD
WESTTOWN TOWNSHIP
CHESTER COUNTY**

PREPARED FOR:

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

PREPARED BY:

**Howell Engineering
1250 Wrights Lane
West Chester, PA 19380**

February 2023

**Stormwater Infiltration Test Report
1007, 1011, 1013 Shiloh Road
Westtown Township
Chester County**

On Wednesday-Thursday, February 1-2, 2023, Howell Engineering performed hydraulic conductivity tests for the proposed stormwater management areas for the properties located at 1107, 1011, and 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 area 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.

On lot 1007 Shiloh Road (O'Brien property), one hydraulic conductivity test was conducted within the proposed infiltration area at the elevation associated with the proposed bottom of the infiltration structure. One deep test pit was excavated at this infiltration test 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 structure.

- Infiltration Test 2-1-1 was conducted at approximately ± 6.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 336.50. One deep test pit was excavated at this location to a depth of 9.0 feet below existing grade. During excavation, redoximorphic features were identified between 6-54 inches below existing grade. It is the opinion of Howell Engineering the observed redox was a result of variable permeability within that specific soil horizon and not an indication of a seasonably high water table.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 2-1-1: an infiltration rate of 0.15 inches per hour shall be used.

On lot 1011 Shiloh Road (Galilea property), one hydraulic conductivity test was conducted within the proposed infiltration area at the elevation associated with the proposed bottom of the infiltration structure. One deep test pit was excavated at this infiltration test 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 structure.

- Infiltration Test 2-2-1 was conducted at approximately ± 4.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 332.2. One deep test pit was excavated at this location to a depth of 76 inches below existing grade. During excavation, groundwater was encountered at a depth of approximately 76 inches below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 2-2-1: an infiltration rate of 0.20 inches per hour shall be used.

- A second infiltration test (2-2-2) was proposed on this property. During excavation, groundwater was encountered at a depth of approximately 26 inches below existing grade. AS a result of the groundwater encountered, no infiltration testing was conducted at this location.

On lot 1013 Shiloh Road (Stokes property), one hydraulic conductivity test was conducted within the proposed infiltration area at the elevation associated with the proposed bottom of the infiltration structure. One deep test pit was excavated at this infiltration test 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 structure.

- Infiltration Test 2-2-3 was conducted at approximately ± 7.0 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 9.0 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, Howell Engineering recommends the following infiltration rate for the soils underlying Test 2-2-3: an infiltration rate of 0.77 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.

Soil Morphology Form



PIT NUMBER: TP 2-1-1 JOB NUMBER: 3868 INVESTIGATOR: DWD
 DATE: 2/1/2023 STATE: PA COUNTY: CHESTER
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
 SUBDIVISION: N/A SITE LOCATION: 1007 SHILOH RD
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrnct	Topo				A	S	C			
	0	6	G	S	10 YR 4/2	SILT LOAM	0				GRAN	FRI	
	6	54	A	W	10 YR 6/4	SILTY CLAY	0				MA	VFIRM	
	54	88	A	W	10 YR 4/3	STONY SILT	<20				GRAN	FIRM	
	88	108			10 YR 5/4	SILT LOAM	0				GRAN	LO	

COMMENTS: This Deep Test Pit was conducted at Test 2-1-1. Redoximorphic (redox) features were encountered from approximately 6-54 inches below existing grade.

SOIL TYPE: LIMITING CONDITION: Type: Water Rock Mottling Depth: +108"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 41° Mostly Sunny METHOD: Excavator
 SLOPE: _____ EXCAVATION DEPTH: 108"
 COVER: Lawn LANDSCAPE POSITION: N

REDOX – Redoximorphic 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 2-2-1 JOB NUMBER: 3868 INVESTIGATOR: DWD
 DATE: 2/2/2023 STATE: PA COUNTY: CHESTER
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
 SUBDIVISION: N/A SITE LOCATION: 1011 SHILOH RD
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	Distrinct	Topo				A	S	C			
	0	6	G	S	10 YR 4/2	SILT LOAM	0				GRAN	FRI	
	6	20	A	W	10 YR 4/4	SILTY CLAY	0				MA	FRI	
	20	48	A	W	2.5 Y 6/4	SILTY CLAY	0				MA	FIRM	
	48	76			10 YR 5/1	SANDY SILT	0				GRAN	FRI	

COMMENTS: This Deep Test Pit was conducted at Test 2-2-1. Groundwater was encountered at approximately 76 inches below existing grade.

SOIL TYPE: LIMITING CONDITION: Groundwater Type: Water Rock Mottling Depth: ~76"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 43° Mostly Sunny METHOD: Excavator
 SLOPE: _____ EXCAVATION DEPTH: 76"
 COVER: Lawn LANDSCAPE POSITION: E

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 2-2-3 JOB NUMBER: 3868 INVESTIGATOR: DWD
 DATE: 2/2/2023 STATE: PA COUNTY: CHESTER
 MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
 SUBDIVISION: N/A SITE LOCATION: 1013 SHILOH RD
 MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES
	Upper	Lower	District	Topo				A	S	C			
	0	7	G	S	10 YR 4/3	SILT LOAM	0				GRAN	FRI	
	7	35	A	W	10 YR 5/4	SILTY CLAY	0				MA	FRI	
	35	108			VAR	SANDY SILT	0				GRAN	FRI	

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

SOIL TYPE: LIMITING CONDITION: Type: Water Rock Mottling Depth: +108"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature:
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WEATHER: 43° Mostly Sunny METHOD: Excavator
 SLOPE: _____ EXCAVATION DEPTH: 108"
 COVER: Lawn LANDSCAPE POSITION: W

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

JOB NO.: 3868
 LOCATION: 1011-1013 Shiloh Road
 MUNICIPALITY: Westtown Township, Chester County, Pa.
 DESCRIPTION: Stormwater Infiltration Testing

DATE: 2/2/2023
 BY: DWD

Field Test Results

WEATHER CONDITIONS: SUNNY TEMPERATURE: 43 °F
 PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 2-2-1	48									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		2.50	2.00	2.00	2.00	2.00	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

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 2-2-3	84									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		8.75	6.50	6.50	6.50	6.50	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

Determination of Hydraulic Conductivity (Kv)

$$Kv = \left[\frac{A}{F \cdot D \cdot t} \right] \cdot \ln(h1/h2)$$

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 2-2-1 Results

0.201833	(in/hour)
7.068583	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
16.00	(Inches)

Test 2-2-3 Results

0.767733	(in/hour)
7.068583	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
11.50	(Inches)

JOB NO.: 3868
 LOCATION: 1007 Shiloh Road
 MUNICIPALITY: Westtown Township, Chester County, Pa.
 DESCRIPTION: Stormwater Infiltration Testing

DATE: 2/1/2023
 BY: DWD

Field Test Results

WEATHER CONDITIONS: SUNNY TEMPERATURE: 41 °F
 PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 2-1-1	72									
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)		1.50	1.50	1.50	1.50	1.50	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	18	18	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test										
Time(min.)		30	30	30	30	30	30	30	30	30
Drop(inches)			n/a	n/a	n/a	n/a	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

Detemination 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 2-1-1 Results

0.1491	(in/hour)
7.06858	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
16.50	(Inches)

Test Results

	(in/hour)
7.0686	(Sq.in.)
2.75	(Units)
3	(Inches)
0.5	(hrs.)
18	(Inches)
	(Inches)

Test Permeability **0.15 (in./hr)**

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

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 ± 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 ± 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 ± 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 ± 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 ± 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 ± 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 ± 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 ± 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.

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	Distrct	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 Rock Mottling Depth: ~84"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	Soil Scientist Signature:
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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 3-23-3 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	Distrnct	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 Rock Mottling Depth: ~66"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained 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	Distrnct	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:	Soil Drainage Class:	Soil Scientist Signature:
LIMITING CONDITION: Groundwater Type: Water Rock Mottling Depth: ~84"	Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained Very Poorly Drained	

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

1250 Wrights Lane
West Chester, PA 19380

P: (610) 918-9002
F: (610) 918-9003

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	Distrnct	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 Poorly Drained 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	Distrnct	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 Rock Mottling Depth: ~84"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained 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	Distrnct	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 Rock Mottling Depth: ~48"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained 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 Rock Mottling Depth: ~48"	Soil Drainage Class: Excessively Drained Somewhat Poorly Drained Well Drained Poorly Drained Moderately Well Drained 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



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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
Test 3-22-5	72									
Time(min.)		30	30	30	30	30	30	30	30	30
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
Test 3-22-6	24									
Time(min.)		30	30	30	30	30	30	30	30	30
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

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

Test 3-22-6 Results

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



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
Test 3-22-7	24									
Time(min.)		30	30	30	30	30	30	30	30	30
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
Test 3-22-8	24									
Time(min.)		30	30	30	30	30	30	30	30	30
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)

$$K_v = [A / (F * D * t)] * \ln(h_1 / h_2)$$

- 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

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

Test 3-22-8 Results

0.43065	(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
Test 3-23-1	60									
Time(min.)		30	30	30	30	30	30	30	30	30
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
Test 3-23-2	48									
Time(min.)		30	30	30	30	30	30	30	30	30
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)

$$K_v = [A / (F * D * t)] * \ln(h_1 / h_2)$$

- 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

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

Test 3-23-2 Results

1.14082	(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
Test 3-23-3	42									
Time(min.)		30	30	30	30	30	30	30	30	30
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
Test 3-23-4	60									
Time(min.)		30	30	30	30	30	30	30	30	30
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

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

Test 3-23-4 Results

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