

Morgantown

TETRA TECH, INC.

By: RH Date: 11/11/2016 Subject: Morgantown Road
Checked By: JB Date: 11/14/2016 PCSM Design and Evaluation

PURPOSE:

The purpose of these calculations is to design a Post-Construction Stormwater Management (PCSM) Plan for the Morgantown Road block valve site as part of the Sunoco Pipeline L.P. Pennsylvania Pipeline Project. The site is located within New Morgan Township, Berks County, Pennsylvania. Permanent stormwater controls will be developed to satisfy PADEP and New Morgan Township's approved Act 167 Plan.

PCSM DESIGN REQUIREMENTS:

The PCSM design for this project follows the PA Department of Environmental Protection's (PADEP) Pennsylvania Stormwater Best Management Practices Manual (BMP Manual), December 2006; and the standard design criteria from PA Title 25, Chapter 102.8.(g)(2) and (3). The design criteria evaluated for the site are summarized below.

Act 167 Consistency

The Morgantown Road block valve site is located in Berks County, which does not have a county-wide Act 167 Plan adopted. However, New Morgan Township has enacted the Schuylkill River Act 167 Plan. According to the management plan and associated map, the Morgantown block valve site is located in Management District A. The rate requirements of that district are such that the proposed 2-year storm should be reduced to the 1-year storm. All other proposed storm events should be reduced to their original existing condition. By designing in accordance with PADEP's Stormwater BMP Manual, the requirements outlined in Spring Township's Act 167 Plan will be fulfilled.

Recommended Volume Control Guideline

Use of Control Guideline 1 is recommended where site conditions offer the opportunity to reduce the increase in runoff volume as follows:

- Do not increase the post-development total runoff volume for all storms equal to or less than the two-year/24-hour event;
- Existing (pre-development) non-forested pervious areas must be considered meadow (good condition) or its equivalent; and
- 20 percent of existing impervious area, when present, shall be considered meadow (good condition) or its equivalent.

This site will utilize two slow-release BMPs to manage the two-year/24-hour volume increase.

Recommended Peak Rate Control Guideline

The recommended control guideline for peak rate control is:

- Do not increase the peak rate of discharge for the 2-year through 100-year events (at minimum); as necessary, provide additional peak rate control as required by applicable and approved Act 167 plan.

- New Morgan Township's approved Act 167 Plan establishes release rate requirements in post-construction conditions to be at or better than the 1-year storm event. All other storm events should be at or better than their pre-construction release rate.

This site will utilize two slow-release BMPs to manage the two-year through 100-year peak rate increases. These BMPs, in conjunction with diversion channels and collection channels, will also help to increase the time of concentration within the drainage area.

Recommended Water Quality Control Guideline

Control Guideline 1 will provide water quality control and stream channel protection as well as flood control protection. The use of a slow-release BMP has been approved by PADEP as an appropriate way to meet the requirements of Control Guideline 1 when onsite infiltration is not feasible.

Infiltration

Infiltration rates for the PCSM BMPs have been determined from site infiltration testing conducted in accordance of the PA BMP Manual. Documentation for infiltration testing and design infiltration rates can be found in Attachment 5 of the Site Restoration/Post Construction Stormwater Management Plan. Infiltration test locations and recommended design rates are also labeled on the PCSM Plan Drawings in Attachment 6.

During the onsite infiltration tests, the depth to seasonal high groundwater and shallow bedrock or another confining layer were evaluated. The post-construction stormwater management facility for the site has been designed to maintain 2 feet of separation between the ponding elevation of the facility and the seasonal high water table and bedrock.

The post-construction stormwater management design utilizes two slow-release BMPs to manage runoff volume due to rapid infiltration onsite.

Loading Ratio

The loading ratio guidelines do not apply because the design does not propose an infiltration BMP.

Disturbed Area

To meet Standard Worksheet 10 guidelines, 90% of the disturbed area is contained by the proposed PCSM BMPs.

Karst Topography

Morgantown Road block valve site is not located within an area of karst terrain.

Special Protection Watershed

Morgantown Road block valve is located within a special protection watershed. The project site was designed to minimize the total amount of impervious area. The impervious area for the Morgantown Road block valve was limited to the amount that is required to safely construct and operate the block valve. In addition, the previously proposed gravel turn-around was eliminated, and replaced with a grass area.

Non-discharge alternatives were analyzed for this block valve site. The location of the Morgantown Road block valve site was evaluated by ASME B31.4 Valve Spacing 434.15.2(e) which states that mainline valves should not be more than 7.5 miles apart. The valve sites were located in such a way that they avoided environmentally sensitive areas (such as wetlands and floodplains), were close to an existing road, and close to power. Land owner preference was also accounted for while locating the block valve sites. Once all of these factors were taken into account, several block valve sites, including Morgantown Road, were located in special protection watersheds.

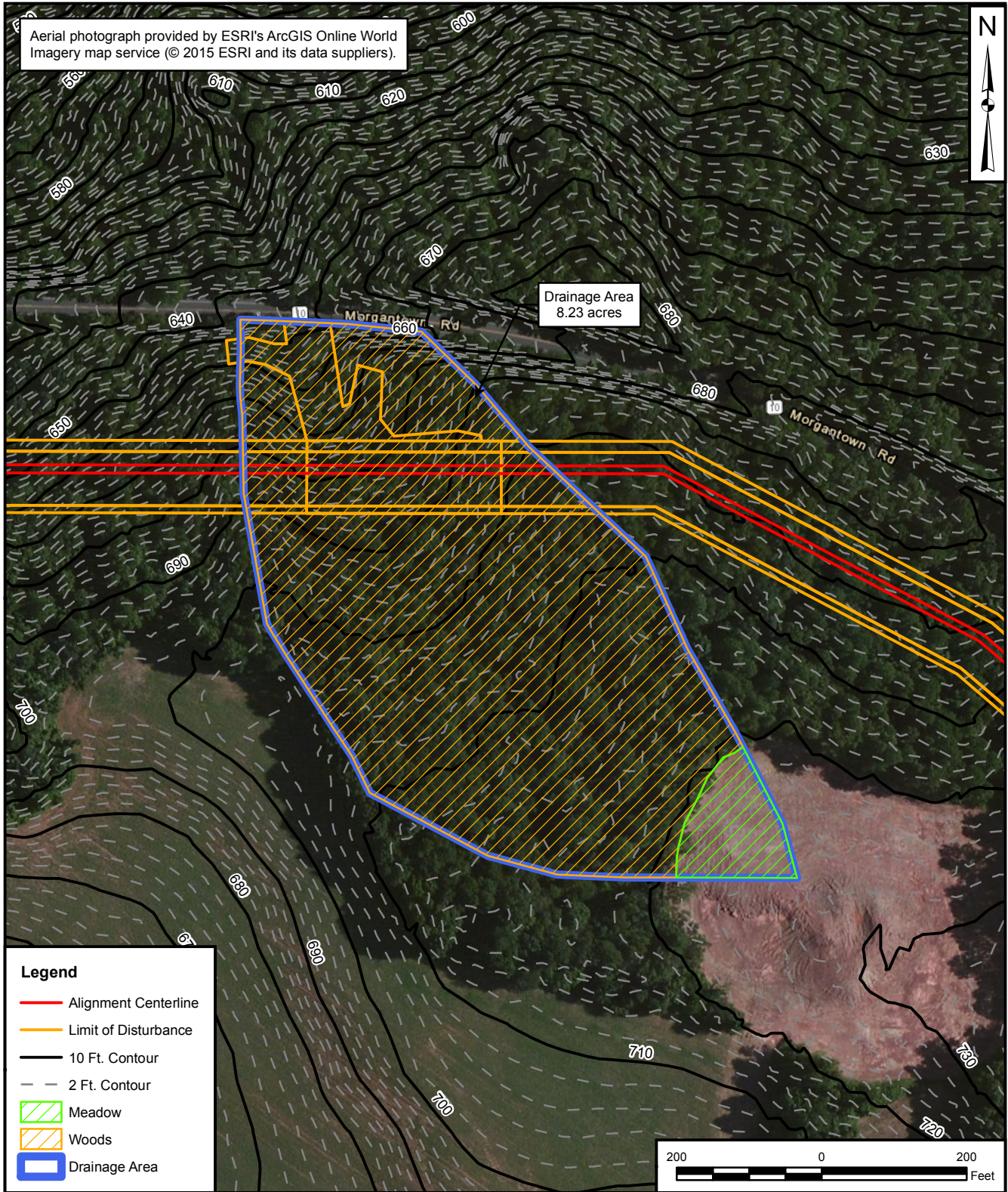
Non-discharge alternatives were also considered when determining the type of BMP proposed. Morgantown Road block valve site utilizes slow-release BMPs to manage stormwater. Stormwater runoff is infiltrated to the maximum extent possible. Stormwater runoff is spread out to flow through areas that have been restored to meadow conditions, to slow-release BMPs, or to undisturbed area. There will not be an increase in stormwater runoff rate or volume to prevent the physical degradation of the receiving water, such as scour, and stream bank destabilization. Stormwater runoff volume is not increasing throughout post-construction, and any post-construction stormwater discharge is managed so that it will not degrade the physical, chemical or biological characteristics of the receiving stream.

Runoff from the site will be managed by two slow-release BMPs. Pondered runoff will be temporarily stored upslope of the trench until it infiltrates and filters through the soil media. Due to the design of the slow-release BMPs the stormwater runoff will be released in sheet flow down a stabilized slope, without causing erosion, rather than concentrating the flow. Filtration through the existing vegetation and soil is an efficient way to remove suspended stormwater pollutants such as sediment, as the suspended particles are physically filtered from the stormwater as it flows through the vegetation and percolates into the soil.

The extent of the disturbed area will be minimized, and the duration of disturbance will be minimized by stabilizing disturbed areas as soon as practicable. Cut and fill for the project site has been minimized. Where possible based on the criteria listed above, sites were located in areas with shallow slopes to minimize the amount of cut and fill required. At Morgantown Road block valve site, the grading was done to tie into existing contours, which did lead to some cut and fill requirements. This was done so that the block valve site was graded towards the natural slope. No direct discharge to surface water occurs at the site. The site will be restored promptly with proper vegetative cover techniques.

Antidegradation requirements for the special protection watershed are met because the post-construction stormwater infiltration volume equals or exceeds the pre-construction stormwater infiltration volume, and post-construction stormwater discharge is pretreated via infiltration berms. The runoff is managed so that it will not degrade the physical, chemical, or biological characteristics of the receiving stream.

Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2015 ESRI and its data suppliers).



Legend

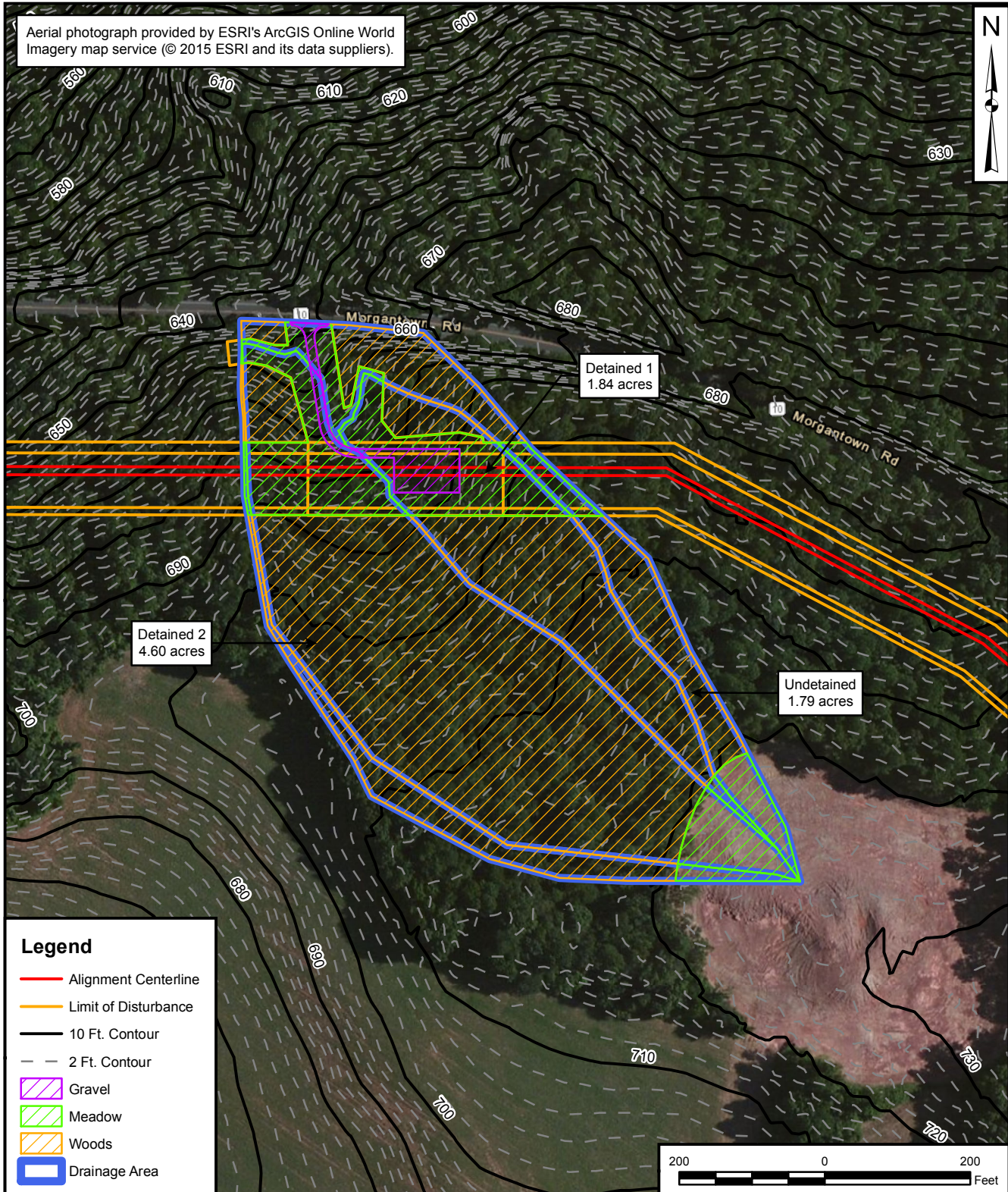
- Alignment Centerline
- Limit of Disturbance
- 10 Ft. Contour
- 2 Ft. Contour
- Meadow
- Woods
- Drainage Area



PRE-DEVELOPMENT DRAINAGE AREA MAP
MORGANTOWN ROAD
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
BERKS COUNTY, PENNSYLVANIA

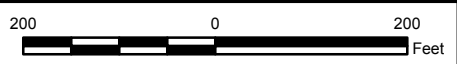
DRAWN BY: J. HERNING 03/8/16	
CHECKED BY: J. BRODY 11/09/16	
APPROVED BY:	
CONTRACT NUMBER: 112IC05958	
FIGURE NUMBER	1
REV	0

Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2015 ESRI and its data suppliers).



Legend

- Alignment Centerline
- Limit of Disturbance
- 10 Ft. Contour
- - 2 Ft. Contour
- Gravel
- Meadow
- Woods
- Drainage Area



POST-DEVELOPMENT DRAINAGE AREA MAP
MORGANTOWN ROAD
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
BERKS COUNTY, PENNSYLVANIA

DRAWN BY: J. HERNING 03/08/16	
CHECKED BY: J. BRODY 11/09/16	
APPROVED BY:	
CONTRACT NUMBER: 112IC05958	
FIGURE NUMBER	2
REV	0

NOAA Atlas 14, Volume 2, Version 3
Location name: Robeson Twp, Pennsylvania,
USA*



Latitude: 40.1887°, Longitude: -75.8815°

Elevation: 675.45 ft**

* source: ESRI Maps

** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&aerials](#)

PF tabular

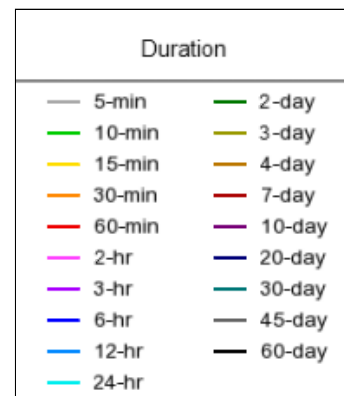
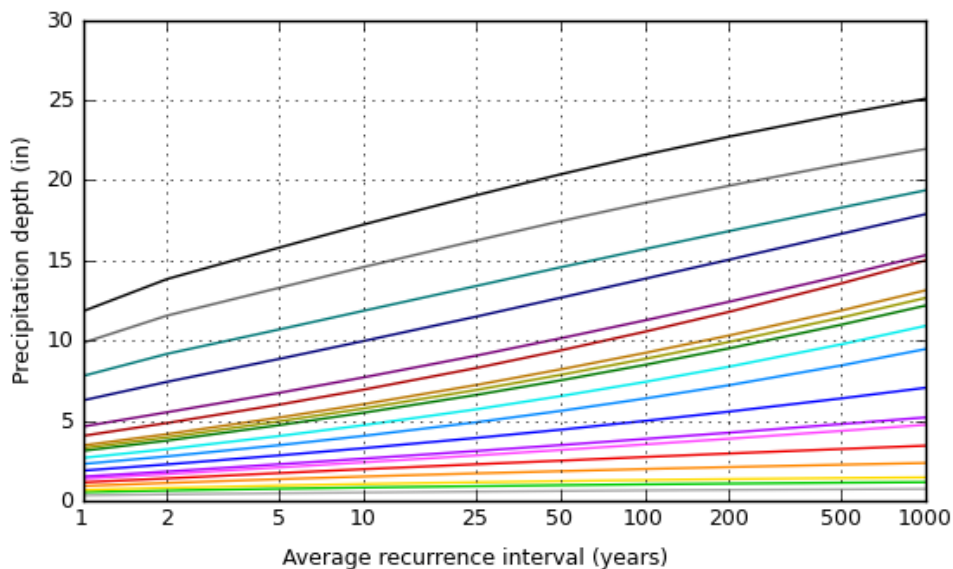
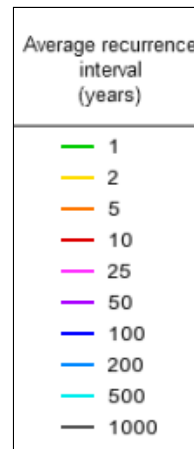
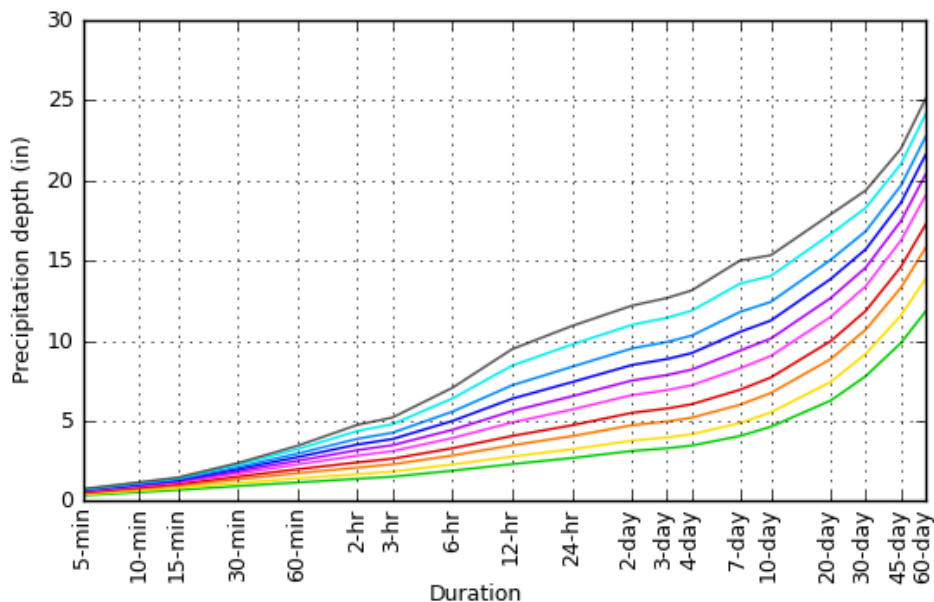
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.339 (0.308-0.373)	0.403 (0.366-0.444)	0.471 (0.427-0.519)	0.519 (0.471-0.571)	0.574 (0.518-0.631)	0.611 (0.548-0.671)	0.648 (0.579-0.711)	0.679 (0.604-0.746)	0.714 (0.631-0.785)	0.740 (0.650-0.815)
10-min	0.540 (0.491-0.595)	0.643 (0.585-0.710)	0.753 (0.683-0.830)	0.829 (0.751-0.912)	0.913 (0.824-1.00)	0.972 (0.872-1.07)	1.03 (0.919-1.13)	1.07 (0.957-1.18)	1.13 (0.997-1.24)	1.16 (1.02-1.28)
15-min	0.675 (0.613-0.744)	0.808 (0.735-0.892)	0.952 (0.864-1.05)	1.05 (0.950-1.15)	1.16 (1.04-1.27)	1.23 (1.10-1.35)	1.30 (1.16-1.43)	1.35 (1.21-1.49)	1.42 (1.25-1.56)	1.46 (1.28-1.61)
30-min	0.924 (0.839-1.02)	1.11 (1.01-1.23)	1.35 (1.23-1.49)	1.52 (1.37-1.67)	1.71 (1.54-1.88)	1.85 (1.66-2.03)	1.98 (1.77-2.18)	2.10 (1.87-2.31)	2.25 (1.99-2.48)	2.36 (2.07-2.60)
60-min	1.15 (1.05-1.27)	1.40 (1.27-1.54)	1.73 (1.57-1.91)	1.97 (1.79-2.17)	2.28 (2.05-2.50)	2.50 (2.25-2.75)	2.73 (2.44-3.00)	2.95 (2.63-3.25)	3.23 (2.86-3.55)	3.44 (3.02-3.79)
2-hr	1.38 (1.24-1.54)	1.67 (1.50-1.88)	2.08 (1.86-2.33)	2.40 (2.15-2.69)	2.83 (2.51-3.16)	3.17 (2.80-3.54)	3.52 (3.09-3.93)	3.88 (3.38-4.33)	4.36 (3.77-4.87)	4.74 (4.06-5.30)
3-hr	1.51 (1.35-1.70)	1.83 (1.64-2.06)	2.28 (2.04-2.57)	2.63 (2.35-2.96)	3.10 (2.75-3.48)	3.48 (3.06-3.89)	3.86 (3.38-4.32)	4.25 (3.69-4.75)	4.79 (4.12-5.35)	5.20 (4.44-5.83)
6-hr	1.88 (1.68-2.13)	2.27 (2.04-2.57)	2.83 (2.53-3.20)	3.28 (2.92-3.70)	3.92 (3.46-4.40)	4.43 (3.89-4.97)	4.98 (4.34-5.57)	5.57 (4.80-6.22)	6.39 (5.44-7.14)	7.05 (5.93-7.89)
12-hr	2.30 (2.05-2.61)	2.77 (2.47-3.15)	3.47 (3.09-3.93)	4.05 (3.60-4.58)	4.89 (4.30-5.50)	5.61 (4.88-6.27)	6.38 (5.50-7.13)	7.22 (6.15-8.05)	8.44 (7.07-9.42)	9.47 (7.81-10.6)
24-hr	2.68 (2.43-2.98)	3.22 (2.93-3.59)	4.04 (3.66-4.49)	4.72 (4.26-5.24)	5.70 (5.12-6.32)	6.53 (5.84-7.22)	7.41 (6.59-8.18)	8.37 (7.39-9.24)	9.76 (8.53-10.8)	10.9 (9.46-12.1)
2-day	3.11 (2.80-3.49)	3.76 (3.38-4.21)	4.72 (4.24-5.28)	5.50 (4.92-6.15)	6.60 (5.88-7.37)	7.51 (6.67-8.37)	8.48 (7.49-9.45)	9.51 (8.34-10.6)	11.0 (9.55-12.2)	12.2 (10.5-13.6)
3-day	3.28 (2.96-3.68)	3.96 (3.56-4.44)	4.96 (4.46-5.55)	5.76 (5.17-6.45)	6.91 (6.17-7.72)	7.85 (6.98-8.76)	8.85 (7.82-9.87)	9.91 (8.71-11.1)	11.4 (9.94-12.8)	12.7 (10.9-14.1)
4-day	3.45 (3.11-3.87)	4.16 (3.75-4.67)	5.19 (4.68-5.83)	6.03 (5.41-6.75)	7.22 (6.45-8.06)	8.19 (7.29-9.15)	9.22 (8.15-10.3)	10.3 (9.07-11.5)	11.9 (10.3-13.3)	13.1 (11.4-14.7)
7-day	4.05 (3.67-4.49)	4.86 (4.40-5.38)	6.00 (5.43-6.64)	6.94 (6.26-7.67)	8.28 (7.44-9.14)	9.38 (8.40-10.4)	10.5 (9.40-11.6)	11.8 (10.4-13.0)	13.6 (11.9-14.9)	15.0 (13.1-16.6)
10-day	4.63 (4.21-5.11)	5.53 (5.03-6.11)	6.73 (6.12-7.44)	7.70 (6.98-8.50)	9.05 (8.18-9.98)	10.1 (9.13-11.2)	11.3 (10.1-12.4)	12.4 (11.1-13.7)	14.0 (12.4-15.5)	15.3 (13.5-17.0)
20-day	6.26 (5.79-6.81)	7.42 (6.86-8.08)	8.85 (8.18-9.62)	9.97 (9.21-10.8)	11.5 (10.6-12.5)	12.7 (11.6-13.7)	13.9 (12.7-15.0)	15.0 (13.7-16.3)	16.7 (15.1-18.1)	17.9 (16.2-19.5)
30-day	7.78 (7.25-8.38)	9.17 (8.55-9.88)	10.7 (9.96-11.5)	11.9 (11.0-12.8)	13.4 (12.4-14.4)	14.6 (13.5-15.7)	15.7 (14.5-16.9)	16.8 (15.5-18.2)	18.3 (16.8-19.7)	19.4 (17.7-20.9)
45-day	9.85 (9.26-10.5)	11.6 (10.9-12.3)	13.3 (12.5-14.2)	14.6 (13.7-15.6)	16.2 (15.2-17.3)	17.4 (16.3-18.6)	18.6 (17.4-19.8)	19.7 (18.4-21.0)	21.0 (19.5-22.4)	22.0 (20.4-23.5)
60-day	11.8 (11.1-12.6)	13.8 (13.1-14.7)	15.8 (14.9-16.8)	17.2 (16.3-18.3)	19.1 (18.0-20.3)	20.4 (19.2-21.7)	21.6 (20.3-23.0)	22.7 (21.3-24.2)	24.1 (22.6-25.7)	25.1 (23.5-26.7)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves
 Latitude: 40.1887°, Longitude: -75.8815°

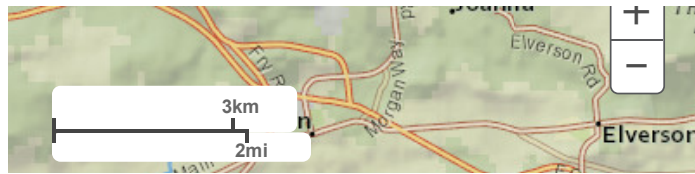


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Maps & aerials

Small scale terrain





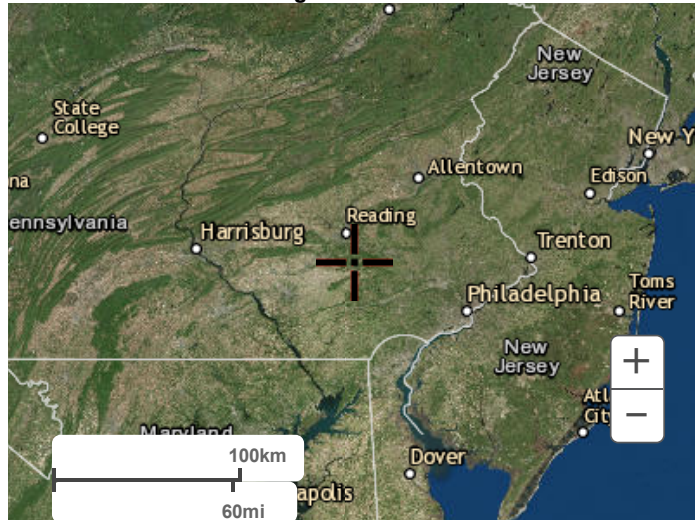
Large scale terrain



Large scale map



Large scale aerial



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1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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WORKSHEET 1. GENERAL SITE INFORMATION

Date: November 11, 2016

Project Name: Morgantown Road

Municipality: New Morgan

County: Berks

Total Area (acres): 8.23

Major River Basin: Delaware

Watershed: Lower Delaware

Sub Basin: Schuylkill

Nearest Surface Water to Receive Runoff: Hay Creek

Chapter 93 - Designated Water Use: Exceptional Value (EV)

Impaired according to Chapter 303(d) list? YES
List Causes of Impairment: NO
Source Unknown - Pathogens

Is Project Subject to, or Part of:

Municipal Separate Storm Sewer System (MS4) Requirements YES
NO

Existing or Planned drinking water supply? YES
NO

If yes, distance from proposed discharge (miles): _____

Approved Act 167 Plan? YES
NO

Existing River Conservation Plan? YES
NO

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

See pre-development drainage area map

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

Woodlands – 1.43 acres

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

0.00 acres

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? Yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	N/A		
Floodplains	N/A		
Riparian Areas	N/A		
Wetlands	N/A		
Woodlands	Yes	1.43	0.00
Natural Drainage Ways	N/A		
Steep Slopes, 15% - 25%	N/A		
Steep Slopes, over 25%	N/A		
Other:			
Other:			
TOTAL EXISTING:		1.43	0.00

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2)	0.00 Ac.
1.2 Area of Riparian Forest Buffer Protection	0.00 Ac.
3.1 Area of Minimum Disturbance/Reduced Grading	0.00 Ac
TOTAL	0.00 Ac

Site Area	Minus	Protected Area	=	Stormwater Management Area
1.43	-	0	=	1.43
				This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction (See Chapter 8, page 22 – SW BMP Manual)

Lawn	_____ ft ²	x 1/4" x 1/12	=	_____ ft ³

Meadow	_____ ft ²	x 1/3" x 1/12	=	_____ ft ³

3.3 Protect Existing Trees (See Chapter 8, page 23 – SW BMP Manual)

For Trees within 100 feet of impervious area:

Tree Canopy	_____ ft ²	x 1/2" x 1/12	=	_____ ft ³

5.1 Disconnect Roof Leaders to Vegetated Areas (See Chapter 8 page 25 – SW BMP Manual)

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area	_____ ft ²	x 1/3" x 1/12	=	_____ ft ³
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For all other disconnected roof areas

Roof Area	_____ ft ²	x 1/4" x 1/12	=	_____ ft ³
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5.2 Disconnect Non-Roof impervious to Vegetated Areas (See Chapter 8, page 26 – SW BMP Manual)

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area	_____ ft ²	x 1/3" x 1/12	=	_____ ft ³
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For all other disconnected roof areas

Impervious Area	_____ ft ²	x 1/4" x 1/12	=	_____ ft ³
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TOTAL NON-STRUCTURAL VOLUME CREDIT* _____ ft³

**For use on Worksheet 5*

WORKSHEET 4. CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: Morgantown Road
 Drainage Area: 8.23 acres
 2-Year Rainfall: 3.22 in

Total Site Area: 1.43 acres
 Protected Site Area: N/A acres
 Managed Site Area: 1.43 acres

Existing Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff ¹ (in)	Runoff Volume ³ (ft ³)
Woods	B	62,291	1.43	55	8.18	1.64	0.26	1,333
TOTAL:		62,291	1.43					1,333

Developed Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff ¹ (in)	Runoff Volume ³ (ft ³)
Impervious-Gravel	B	8,712	0.20	85	1.76	0.35	1.77	1,288
Meadow	B	53,579	1.23	58	7.24	1.45	0.35	1,555
Woods	B	0	0.00	55	8.18	1.64	0.26	0
TOTAL:		62,291	1.43					2,843

2-Year Volume Increase (ft ³):	1,510
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2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = $Q = (P - 0.2S)^2 / (P + 0.8S)$ where
 P = 2-Year Rainfall (in)
 S = $(1000/CN) - 10$

2. Runoff Volume (CF) = $Q \times \text{Area} \times 1/12$
 Q = Runoff (in)
 Area = Land use area (sq. ft.)

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

Worksheet 5. Structural BMP Volume Credits

PROJECT: Morgantown Road
 SUB-BASIN: _____

Required Control Volume (ft³) - from Worksheet 4: 1,510
 Non-structural Volume Credit (ft³) - from Worksheet 3: N/A
 (maximum is 25% of required volume)
 Structural Volume Reqmt (ft³): 1,510
 (Required Control Volume minus Non-structural Credit)

Proposed BMPs from PA Stormwater Best Management Practices Manual Chapter 6	Area (ft ²)	Volume Reduction Permanently Removed (ft ³)
6.4.1 Porous Pavement		
6.4.2 Infiltration Basin		
6.4.3 Infiltration Bed		
6.4.4 Infiltration Trench		
6.4.5 Rain Garden/Bioretenion		
6.4.6 Dry Well/Seepage Pit		
6.4.7 Constructed Filter		
6.4.8 Vegetated Swale		
6.4.9 Vegetated Filter Strip		
6.4.10 Berm		
6.5.1 Vegetated Roof		
6.5.2 Capture and Re-Use		
6.6.1 Constructed Wetlands		
6.6.2 Wet Pond/Retention Basin		
6.7.1 Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2 Landscape Restoration/Reforestation		
6.7.3 Soil Amendment		
6.8.1 Level Spreader		
6.8.2 Special Storage Areas		
Other: Slow Release Concept	504	2,421
Total Structural Volume (ft³):		2,421
Structural Volume Requirement (ft³):		1,510
DIFFERENCE:		-911

VOLUME CREDIT DETERMINATION - BERM A

- 1 Detained area runoff volume from Hydraflow = 1,855 cf
- 2 Storage volume of the BMP = 1,485 cf
- 3 Infiltrated volume within 72 hours after the 2-yr/24-hr event
Based on flow rate of slow release dewatering = 2,333 cf

VOLUME CREDIT DETERMINATION - BERM B

- 1 Detained area runoff volume from Hydraflow = 2,323 cf
- 2 Storage volume of the BMP = 936 cf
- 3 Infiltrated volume within 72 hours after the 2-yr/24-hr event
Based on flow rate of slow release dewatering = 2,074 cf

WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or the

PRIMARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.5.4 - Cluster Uses at Each Site	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.1 - Minimize Total Disturbed Area	<input checked="" type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native Species)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.9.1 - Street Sweeping / Vacuuming	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.1 - Riparian Buffer Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.2 - Landscape Restoration	<input type="checkbox"/>	<input type="checkbox"/>

SECONDARY BMPs FOR NITRATE:

NS BMP 5.4.1 - Protect Sensitive / Special Value Features	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.2 - Minimize Soil Compaction	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.5 - Rain Garden / Bioretention	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.8 - Vegetated Swale	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.9 - Vegetated Filter Strip	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.6.1 - Constructed Wetland	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.1 - Riparian Buffer Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.2 - Landscape Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.3 - Soils Amendment/Restoration	<input checked="" type="checkbox"/>	<input type="checkbox"/>

TIME OF CONCENTRATION ADJUSTMENT - BERM A

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT 9.7 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 1,485 CF

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	0.633
10 YR/24 HR	2.744
50 YR/24 HR	6.042
100 YR/24 HR	7.828

ADDITIONAL RESIDENCE TIME (MIN) = (STRUCTURAL VOLUME PROVIDED BY BMP / RATE OF RUNOFF TO BMP) / 60

Storm Event	Q (CFS)	Additional Residence Time (min.)
2 YR/24 HR	0.633	39.100
10 YR/24 HR	2.744	9.020
50 YR/24 HR	6.042	4.096
100 YR/24 HR	7.828	3.162

ADJUSTED TC = POST CONSTRUCTION TC TO BMP BEFORE ADJUSTMENT + ADDITIONAL RESIDENCE TIME

Storm Event	Q (CFS)	Additional Residence Time (min.)	Adjusted Time of Concentration (min.)
2 YR/24 HR	0.633	39.100	48.800
10 YR/24 HR	2.744	9.020	18.720
50 YR/24 HR	6.042	4.096	13.796
100 YR/24 HR	7.828	3.162	12.862

TIME OF CONCENTRATION ADJUSTMENT - BERM B

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT 10 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 936 CF

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	0.881
10 YR/24 HR	5.064
50 YR/24 HR	12.18
100 YR/24 HR	16.1

ADDITIONAL RESIDENCE TIME (MIN) = (STRUCTURAL VOLUME PROVIDED BY BMP / RATE OF RUNOFF TO BMP) / 60

Storm Event	Q (CFS)	Additional Residence Time (min.)
2 YR/24 HR	0.881	17.707
10 YR/24 HR	5.064	3.081
50 YR/24 HR	12.180	1.281
100 YR/24 HR	16.100	0.969

ADJUSTED TC = POST CONSTRUCTION TC TO BMP BEFORE ADJUSTMENT + ADDITIONAL RESIDENCE TIME

Storm Event	Q (CFS)	Additional Residence Time (min.)	Adjusted Time of Concentration (min.)
2 YR/24 HR	0.881	17.707	27.707
10 YR/24 HR	5.064	3.081	13.081
50 YR/24 HR	12.180	1.281	11.281
100 YR/24 HR	16.100	0.969	10.969

Underdrain Dewatering Rate Calculation

Project: Morgantown

BMP: A

Filter Media				
Layer	Media	Thickness - T (ft)	Min. Infiltration Rate - K (ft/min) ¹	Flow Rate (cfs) ²
1	Clean Gravel	N/A	2	N/A
2	Coarse Sand	N/A	0.02	N/A
3	Fine Sand	2	0.002	0.00900
4	Other ³	N/A	N/A	N/A
Minimum Flow Rate (cfs)				0.009

1. From Principles of Geotechnical Engineering Third Edition, Braja Das, 1994

2. $Q=KA(Hm+T)/T$

A = Area (square feet) = 270

Hm = Head above media (feet) = 2

3. Infiltration rate measured in field or laboratory

Perforated Pipe				
Pipe	Perforation Area (square inch) ⁴	# Perforations per Foot N	Pipe Length - L (ft)	Flow Rate (cfs) ⁵
1	1.00	1	90	4.42
2	N/A	N/A	N/A	N/A
Total Flow Rate (cfs)				4.42

4. Reference: [PVC: certainteed.com](http://PVC.certainteed.com) [HDPE: ads-pipe.com](http://HDPE.ads-pipe.com)

5. $Q= N*L*cAo\sqrt{2GH}$

c = Orifice Coefficient = 0.6

Ao= Perforation Area (sq. ft.) 0.007

G= Grav. Accel. (ft/sec²) 32.2

H= Average Head (ft) = 3.5

Pipe Discharge				
Pipe	Pipe Diameter - D (in)	Pipe Roughness Coefficient -n	Pipe Slope - S ⁶	Flow Rate (cfs) ⁷
1	4	0.012	0.003703704	0.09
2	N/A	N/A	N/A	N/A
Total Flow Rate (cfs)				0.09

6. For flat pipe, use hydraulic grade (pipe diameter/pipe length) for the pipe slope

7. From Manning's equation (attach separate calculation worksheet)

Limiting flow rate from combined underdrain system - Ql (cfs) =	0.009
Detained volume based on 2-year/24-hour storm (cu-ft) =	1,485
Total Dewatering Volume including volume in voids(cu-ft) =	1,701
Dewatering Time (sec) = 2HA/Ql =	189,000
Dewatering Time (hrs) =	52.50

Underdrain Dewatering Rate Calculation

Project: Morgantown

BMP: B

Filter Media				
Layer	Media	Thickness - T (ft)	Min. Infiltration Rate - K (ft/min) ¹	Flow Rate (cfs) ²
1	Clean Gravel	N/A	2	N/A
2	Coarse Sand	N/A	0.02	N/A
3	Fine Sand	2	0.002	0.00780
4	Other ³	N/A	N/A	N/A
Minimum Flow Rate (cfs)				0.008

1. From Principles of Geotechnical Engineering Third Edition, Braja Das, 1994

2. $Q=KA(Hm+T)/T$

A = Area (square feet) = 234

Hm = Head above media (feet) = 2

3. Infiltration rate measured in field or laboratory

Perforated Pipe				
Pipe	Perforation Area (square inch) ⁴	# Perforations per Foot N	Pipe Length - L (ft)	Flow Rate (cfs) ⁵
1	1.00	1	78	3.83
2	N/A	N/A	N/A	N/A
Total Flow Rate (cfs)				3.83

4. Reference: [PVC: certainteed.com](http://PVC.certainteed.com) [HDPE: ads-pipe.com](http://HDPE.ads-pipe.com)

5. $Q= N*L*cAo\sqrt{2GH}$

c = Orifice Coefficient = 0.6

Ao= Perforation Area (sq. ft.) 0.007

G= Grav. Accel. (ft/sec²) 32.2

H= Average Head (ft) = 3.5

Pipe Discharge				
Pipe	Pipe Diameter - D (in)	Pipe Roughness Coefficient -n	Pipe Slope - S ⁶	Flow Rate (cfs) ⁷
1	4	0.012	0.004273504	0.09
2	N/A	N/A	N/A	N/A
Total Flow Rate (cfs)				0.09

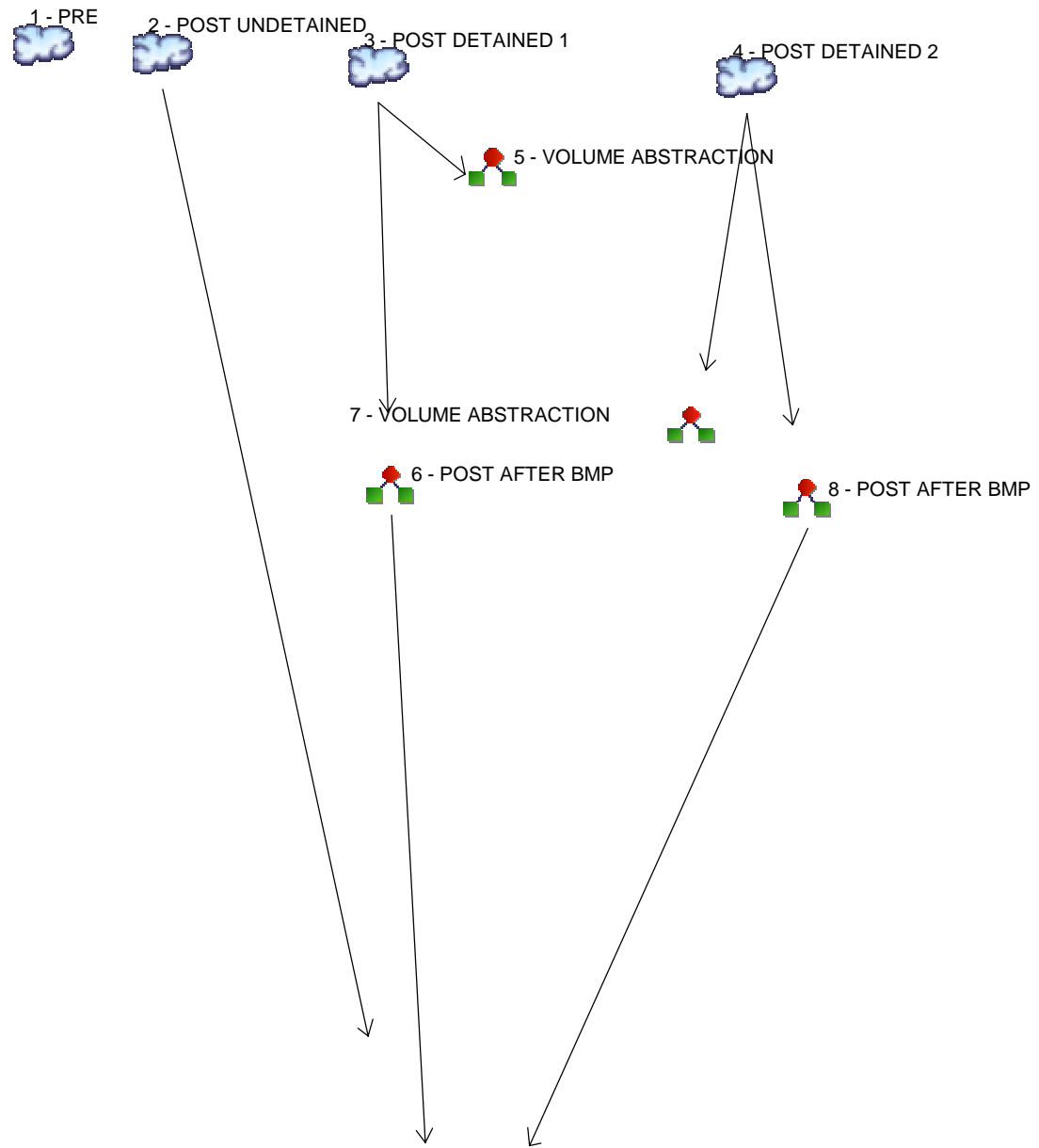
6. For flat pipe, use hydraulic grade (pipe diameter/pipe length) for the pipe slope

7. From Manning's equation (attach separate calculation worksheet)

Limiting flow rate from combined underdrain system - Ql (cfs) =	0.008
Detained volume based on 2-year/24-hour storm (cu-ft) =	936
Total Dewatering Volume including volume in voids(cu-ft) =	1,123
Dewatering Time (sec) = 2HA/Ql =	144,000
Dewatering Time (hrs) =	40.00

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED 1
4	SCS Runoff	POST DETAINED 2
5	Diversion1	VOLUME ABSTRACTION
6	Diversion2	POST AFTER BMP
7	Diversion1	VOLUME ABSTRACTION
8	Diversion2	POST AFTER BMP
9	Combine	POST AT POI



Hydrograph Return Period Recap

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	1.490	-----	-----	9.557	-----	23.26	30.82	PRE
2	SCS Runoff	-----	-----	0.413	-----	-----	2.274	-----	5.332	7.008	POST UNDETAINED
3	SCS Runoff	-----	-----	0.633	-----	-----	2.744	-----	6.042	7.828	POST DETAINED 1
4	SCS Runoff	-----	-----	0.881	-----	-----	5.064	-----	12.18	16.10	POST DETAINED 2
5	Diversion1	3	-----	0.633	-----	-----	2.744	-----	3.874	2.915	VOLUME ABSTRACTION
6	Diversion2	3	-----	0.040	-----	-----	2.028	-----	6.042	7.828	POST AFTER BMP
7	Diversion1	4	-----	0.881	-----	-----	3.912	-----	2.351	1.491	VOLUME ABSTRACTION
8	Diversion2	4	-----	0.346	-----	-----	5.064	-----	12.18	16.10	POST AFTER BMP
9	Combine	2, 6, 8	-----	0.471	-----	-----	8.625	-----	23.27	30.70	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.490	2	722	7,671	-----	-----	-----	PRE
2	SCS Runoff	0.413	2	722	1,855	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	0.633	2	722	2,323	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	0.881	2	724	4,915	-----	-----	-----	POST DETAINED 2
5	Diversion1	0.633	2	722	1,489	3	-----	-----	VOLUME ABSTRACTION
6	Diversion2	0.040	2	970	834	3	-----	-----	POST AFTER BMP
7	Diversion1	0.881	2	724	960	4	-----	-----	VOLUME ABSTRACTION
8	Diversion2	0.346	2	744	3,955	4	-----	-----	POST AFTER BMP
9	Combine	0.471	2	744	6,644	2, 6, 8	-----	-----	POST AT POI
Morgantown.gpw					Return Period: 2 Year			Tuesday, 11 / 1 / 2016	

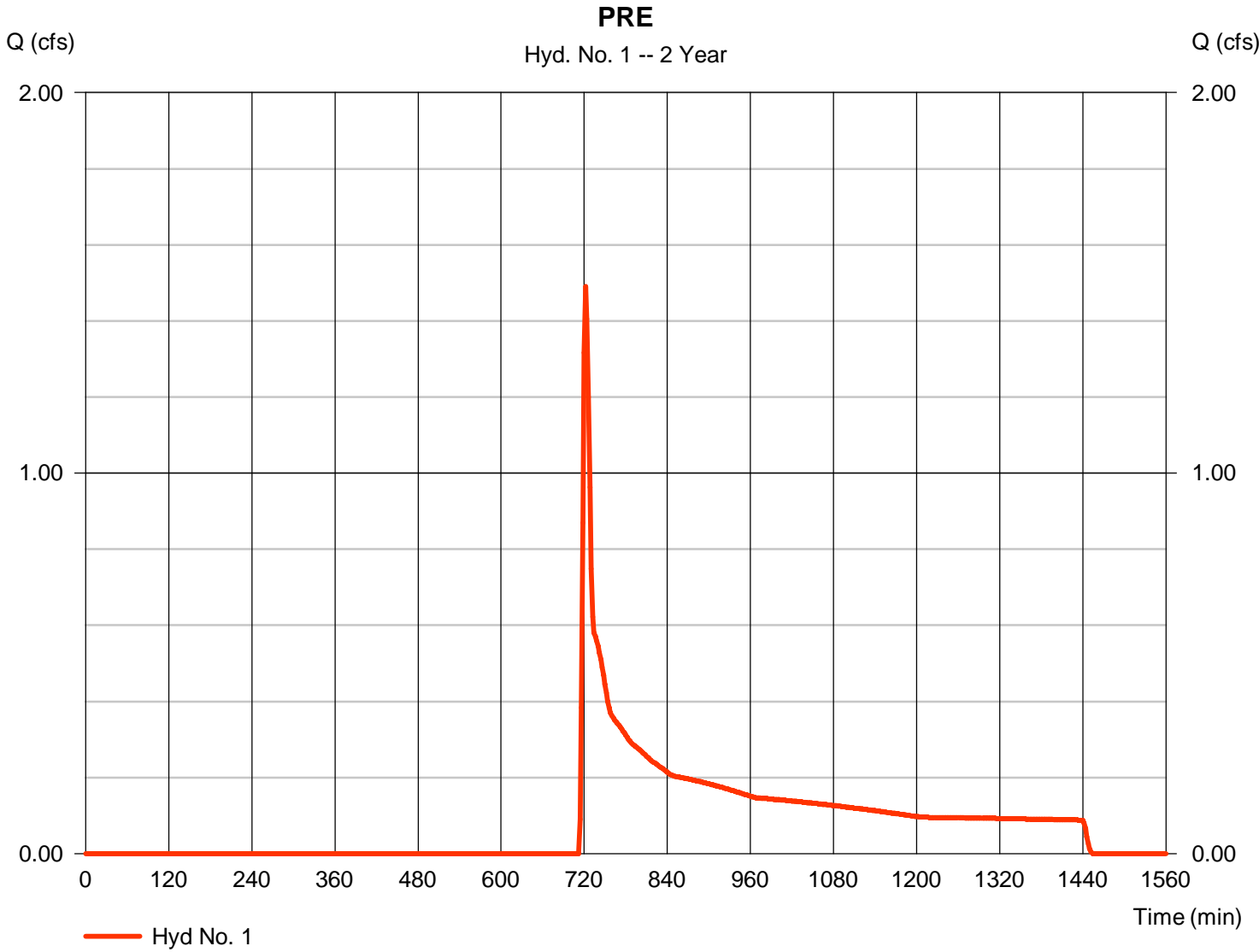
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 1.490 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 7,671 cuft
Drainage area	= 8.230 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 3.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.780 x 55) + (0.450 x 58)] / 8.230



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE

<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)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.22		0.00		0.00		
Land slope (%)	= 4.00		0.00		0.00		
Travel Time (min)	= 6.19	+	0.00	+	0.00	=	6.19
Shallow Concentrated Flow							
Flow length (ft)	= 751.00		0.00		0.00		
Watercourse slope (%)	= 10.30		0.00		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=5.18		0.00		0.00		
Travel Time (min)	= 2.42	+	0.00	+	0.00	=	2.42
Channel Flow							
X sectional flow area (sqft)	= 3.00		0.00		0.00		
Wetted perimeter (ft)	= 6.32		0.00		0.00		
Channel slope (%)	= 6.20		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=7.51		0.00		0.00		
Flow length (ft)	{{0}}71.0		0.0		0.0		
Travel Time (min)	= 0.16	+	0.00	+	0.00	=	0.16
Total Travel Time, Tc							8.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

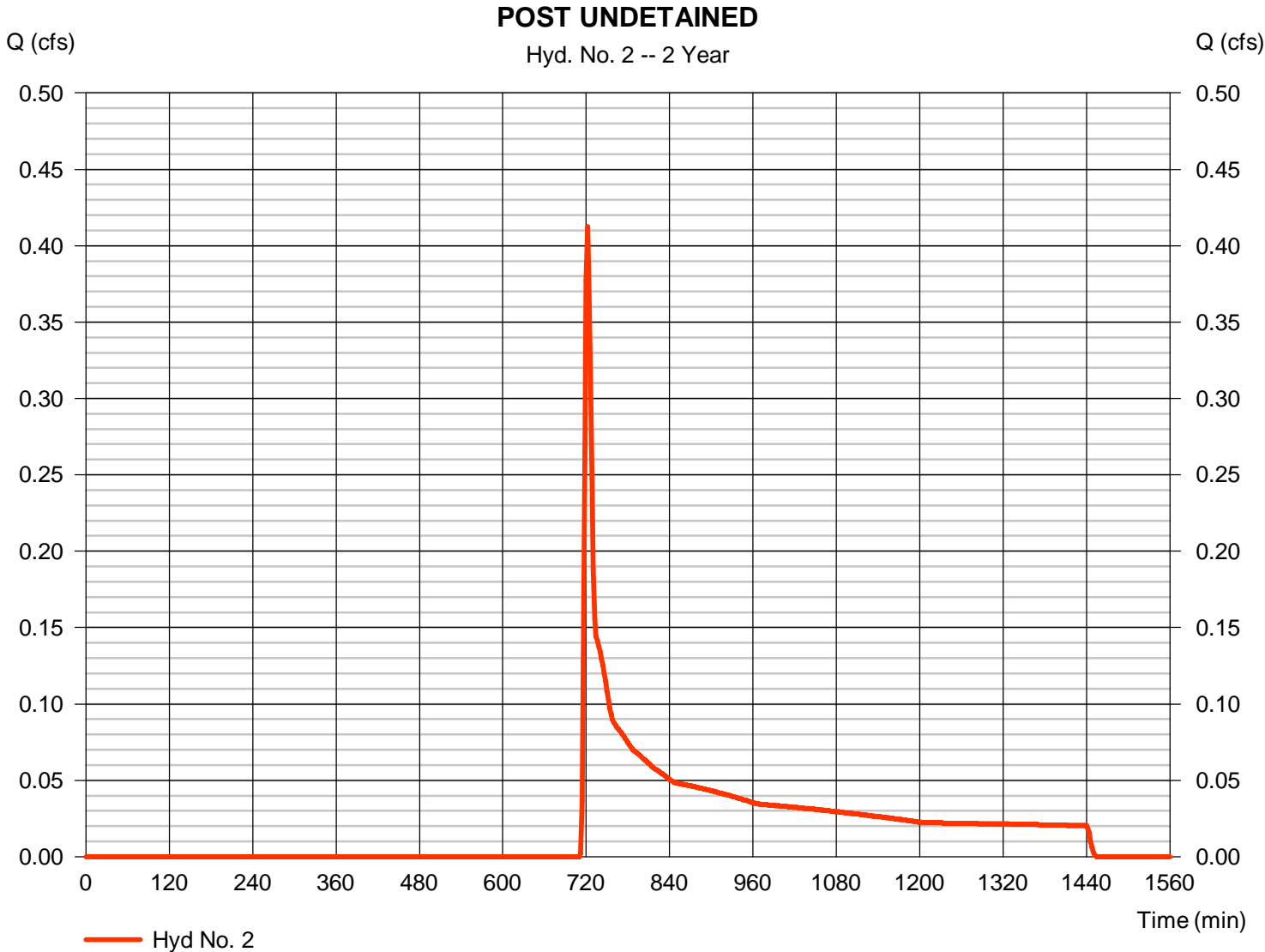
Tuesday, 11 / 1 / 2016

Hyd. No. 2

POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 0.413 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 1,855 cuft
Drainage area	= 1.790 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 3.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.430 x 58) + (1.330 x 55)] / 1.790



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDETAINED

<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)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.22	0.00	0.00	
Land slope (%)	= 4.00	0.00	0.00	
Travel Time (min)	= 6.19	+	0.00	+
			0.00	= 6.19
Shallow Concentrated Flow				
Flow length (ft)	= 751.00	0.00	0.00	
Watercourse slope (%)	= 10.30	0.00	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=5.18	0.00	0.00	
Travel Time (min)	= 2.42	+	0.00	+
			0.00	= 2.42
Channel Flow				
X sectional flow area (sqft)	= 3.00	0.00	0.00	
Wetted perimeter (ft)	= 6.32	0.00	0.00	
Channel slope (%)	= 6.20	0.00	0.00	
Manning's n-value	= 0.030	0.015	0.015	
Velocity (ft/s)	=7.51	0.00		
			0.00	
			0.00	
Flow length (ft)	{{0}}71.0	0.0	0.0	
Travel Time (min)	= 0.16	+	0.00	+
			0.00	= 0.16
Total Travel Time, Tc				8.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

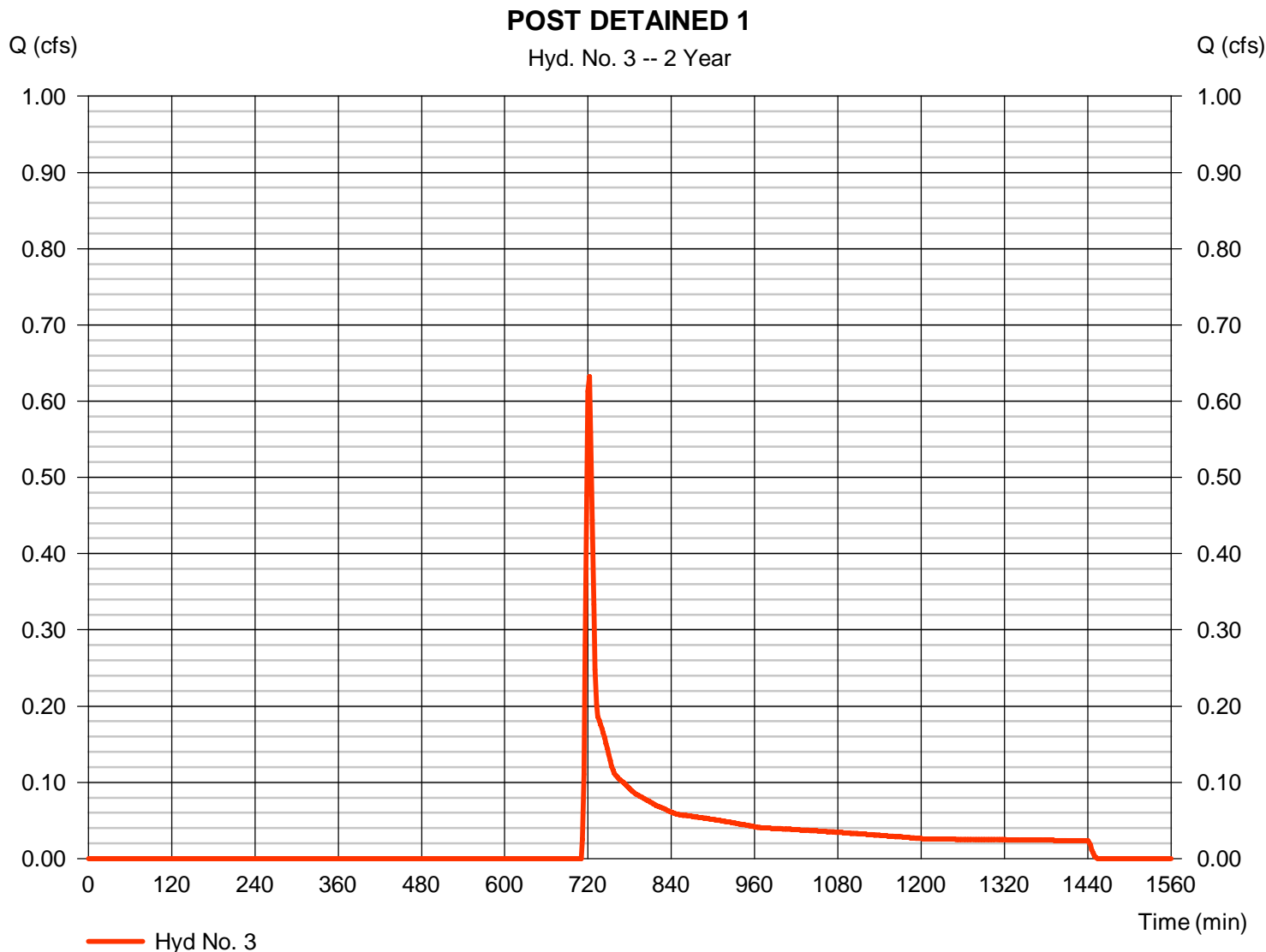
Tuesday, 11 / 1 / 2016

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.633 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 2,323 cuft
Drainage area	= 1.840 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 3.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.140 x 85) + (0.460 x 58) + (1.240 x 55)] / 1.840



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 3

POST DETAINED 1

<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)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.22	0.00	0.00	
Land slope (%)	= 4.00	0.00	0.00	
Travel Time (min)	= 6.19	+ 0.00	+ 0.00	= 6.19
Shallow Concentrated Flow				
Flow length (ft)	= 621.00	94.00	80.00	
Watercourse slope (%)	= 6.60	5.30	11.30	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=4.15	4.68	5.42	
Travel Time (min)	= 2.50	+ 0.33	+ 0.25	= 3.08
Channel Flow				
X sectional flow area (sqft)	= 3.00	0.00	0.00	
Wetted perimeter (ft)	= 6.32	0.00	0.00	
Channel slope (%)	= 6.20	0.00	0.00	
Manning's n-value	= 0.030	0.015	0.015	
Velocity (ft/s)	=7.51	0.00	0.00	
Flow length (ft)	209.0	0.0	0.0	
Travel Time (min)	= 0.46	+ 0.00	+ 0.00	= 0.46
Total Travel Time, Tc				9.70 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

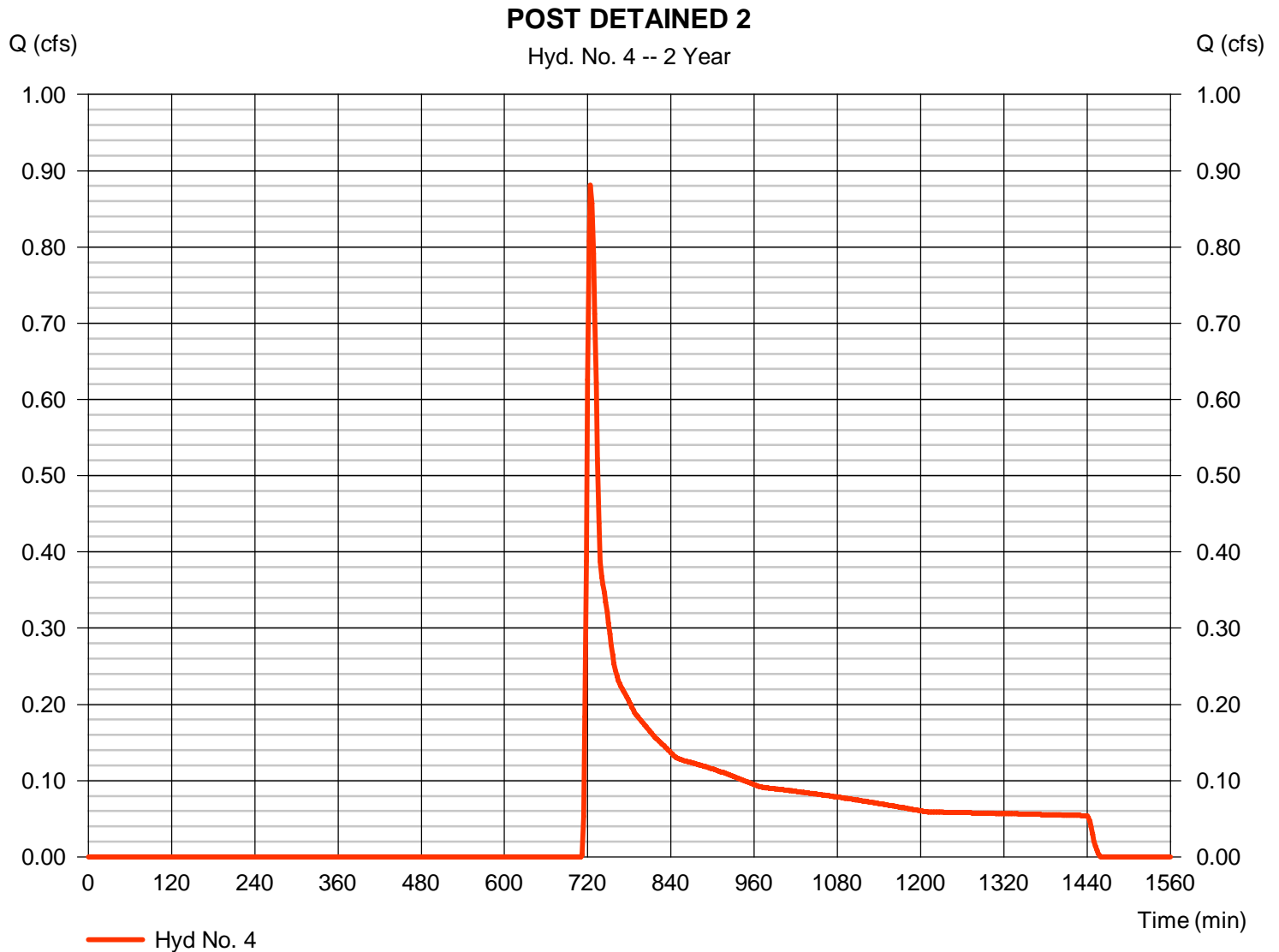
Tuesday, 11 / 1 / 2016

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.881 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 4,915 cuft
Drainage area	= 4.600 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.040 x 85) + (0.750 x 58) + (3.810 x 55)] / 4.600



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 4

POST DETAINED 2

<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)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.22	0.00	0.00	
Land slope (%)	= 4.00	0.00	0.00	
Travel Time (min)	= 6.19	+ 0.00	+ 0.00	= 6.19
Shallow Concentrated Flow				
Flow length (ft)	= 784.00	110.00	72.00	
Watercourse slope (%)	= 6.00	13.60	12.50	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=3.95	7.50	5.70	
Travel Time (min)	= 3.31	+ 0.24	+ 0.21	= 3.76
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	= 0.030	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				10.00 min

Hydrograph Report

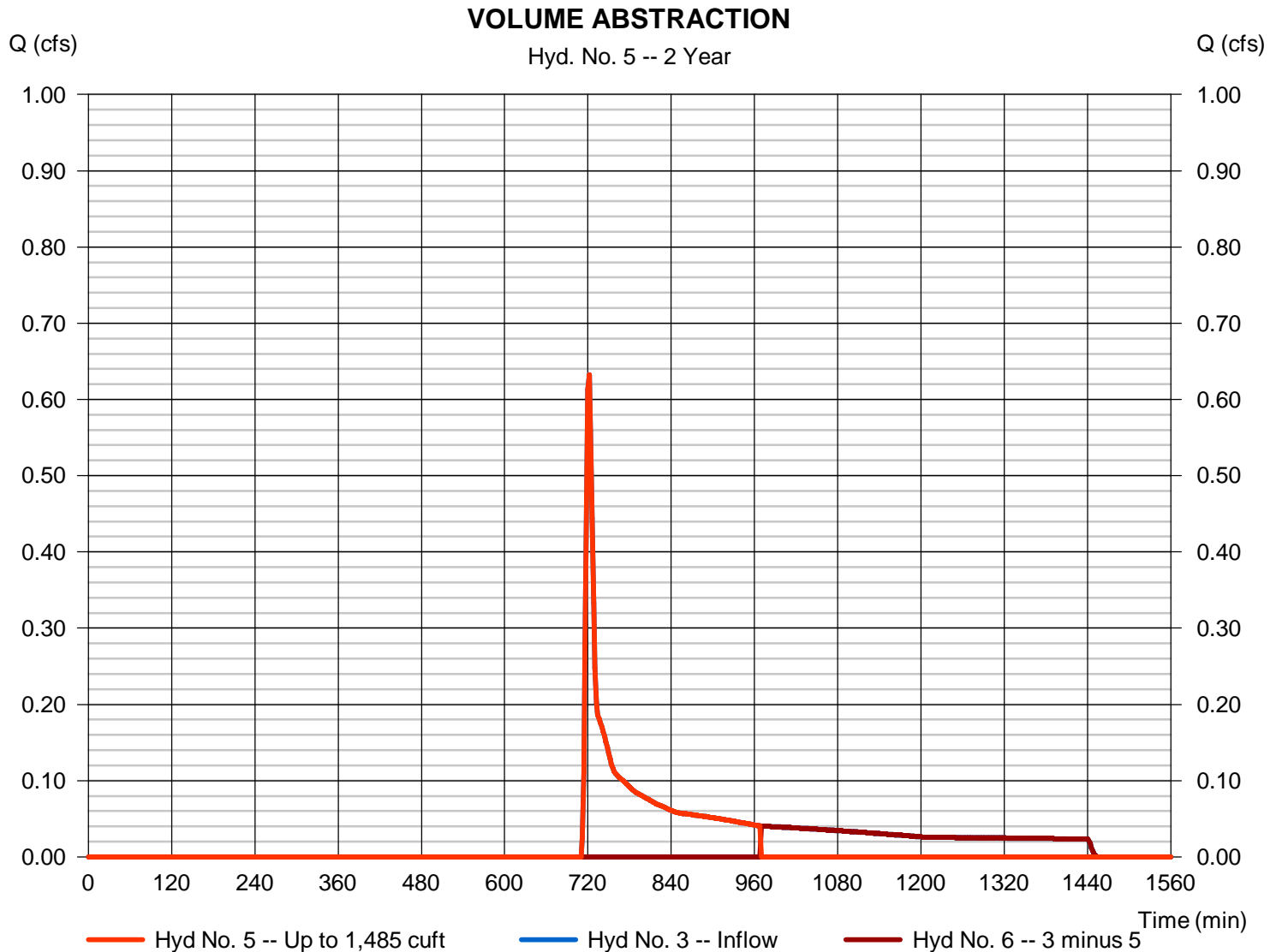
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.633 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 1,489 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

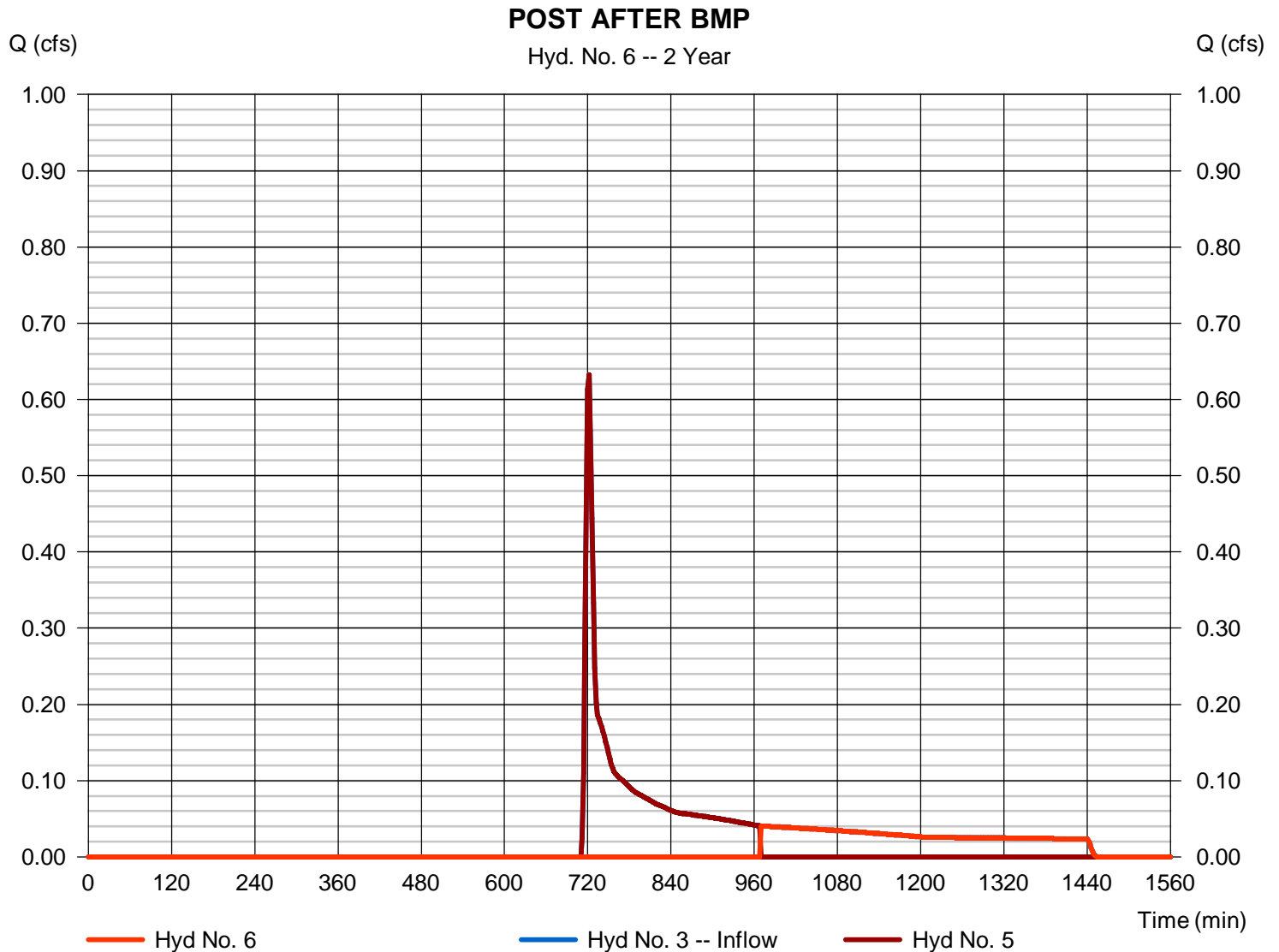
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.040 cfs
Storm frequency	= 2 yrs	Time to peak	= 970 min
Time interval	= 2 min	Hyd. volume	= 834 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

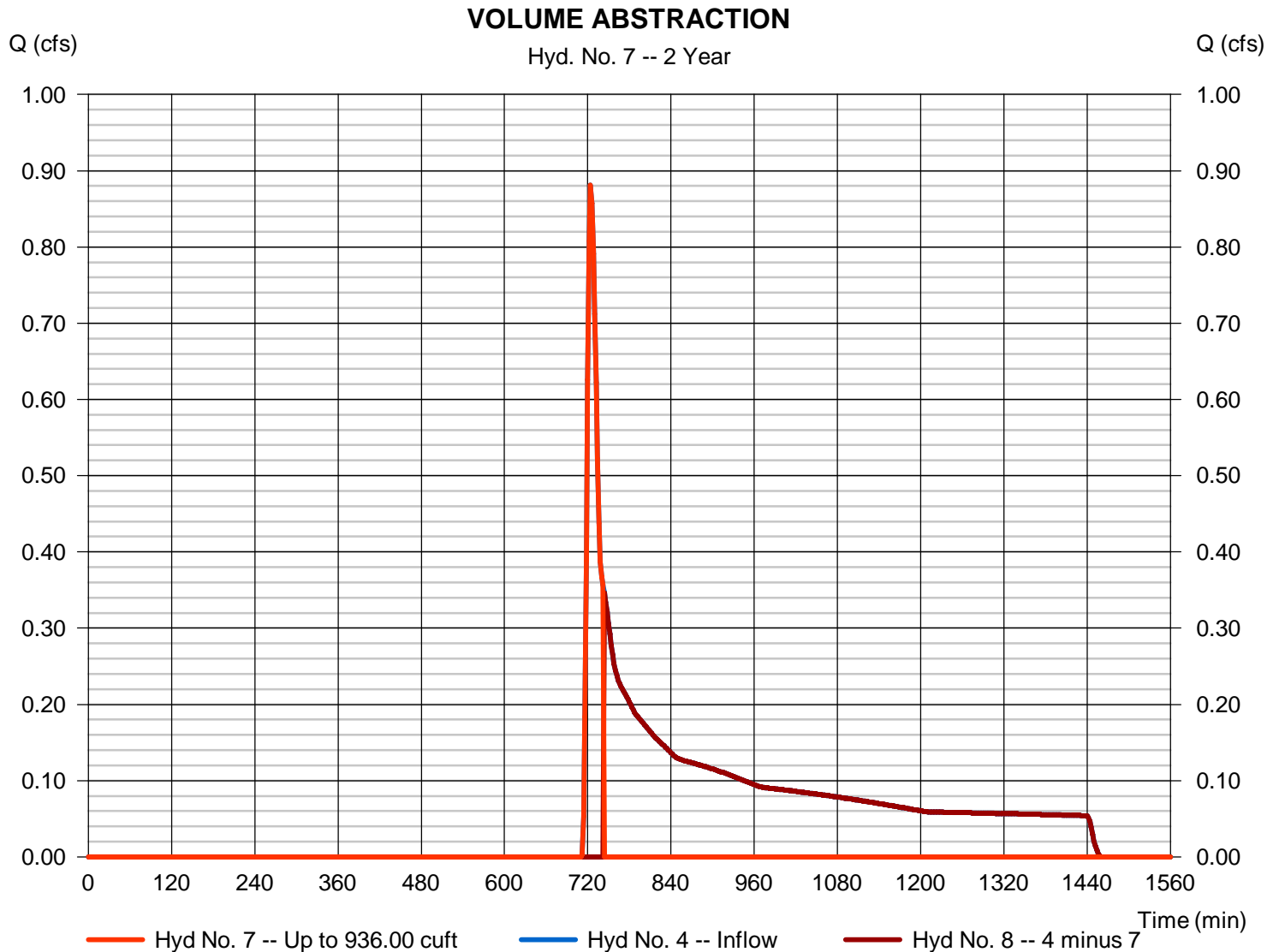
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.881 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 960 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

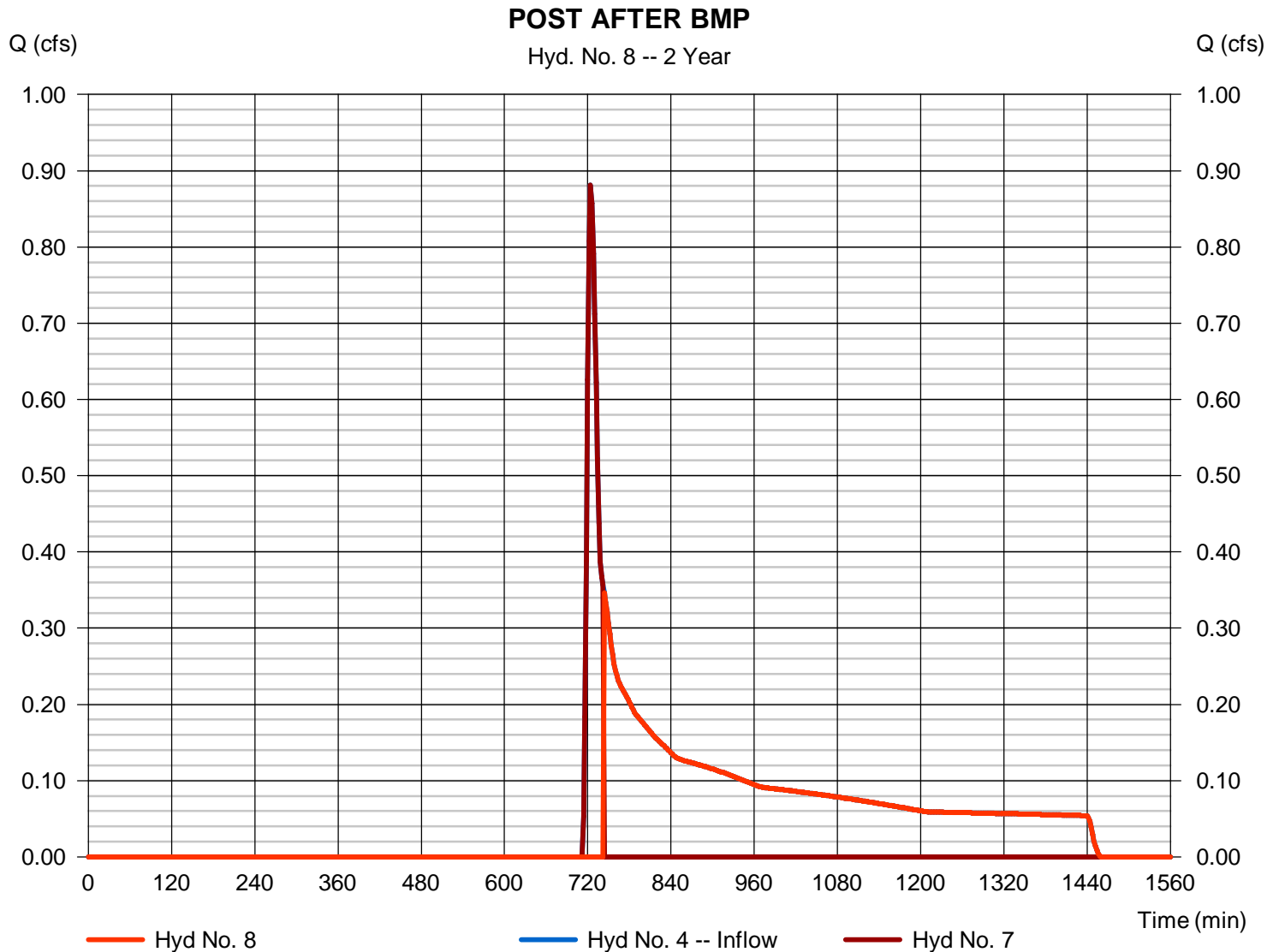
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.346 cfs
Storm frequency	= 2 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 3,955 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

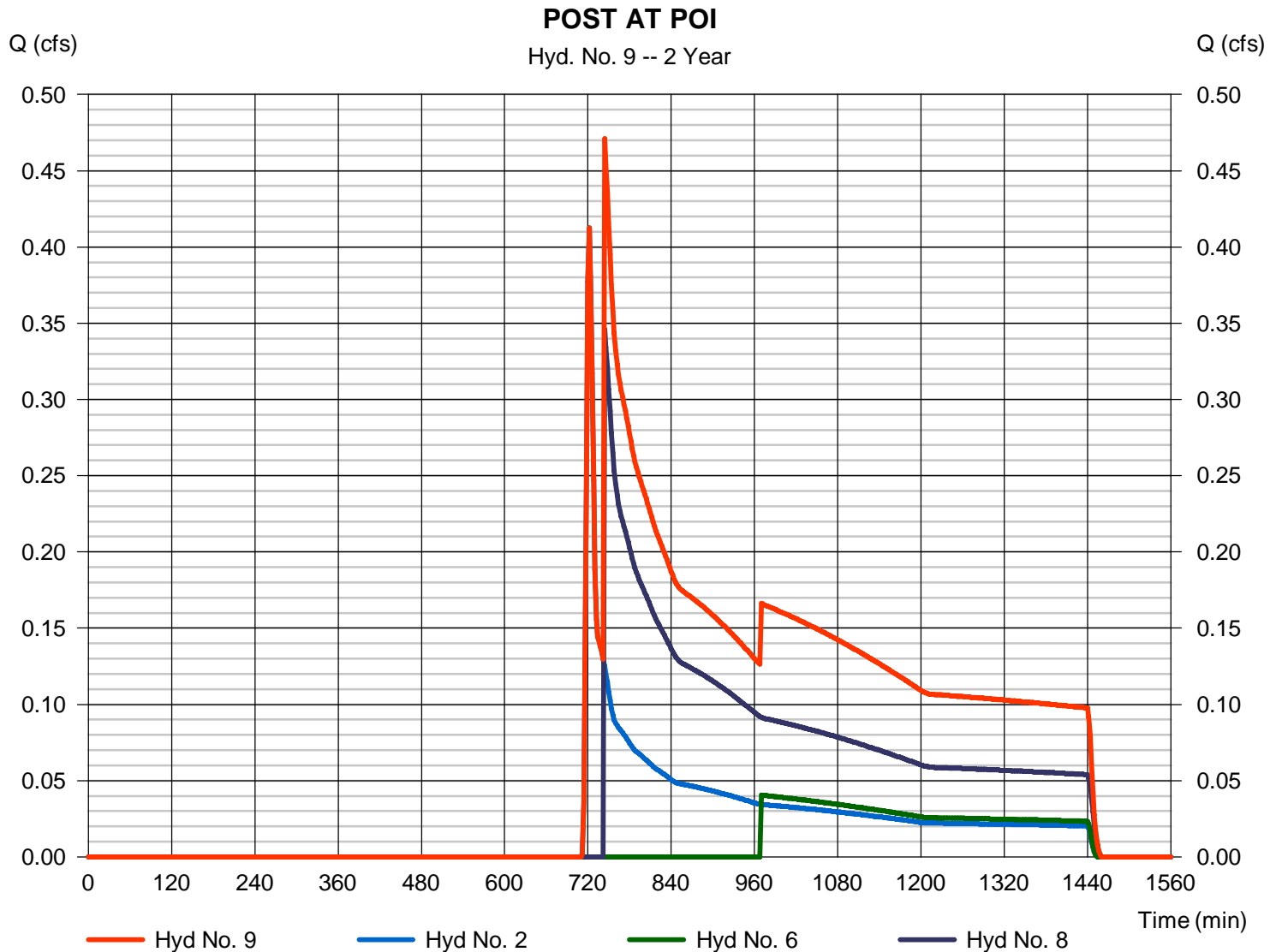
Tuesday, 11 / 1 / 2016

Hyd. No. 9

POST AT POI

Hydrograph type = Combine
 Storm frequency = 2 yrs
 Time interval = 2 min
 Inflow hyds. = 2, 6, 8

Peak discharge = 0.471 cfs
 Time to peak = 744 min
 Hyd. volume = 6,644 cuft
 Contrib. drain. area = 1.790 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	9.557	2	720	25,212	-----	-----	-----	PRE
2	SCS Runoff	2.274	2	720	5,853	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	2.744	2	720	6,801	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	5.064	2	722	15,510	-----	-----	-----	POST DETAINED 2
5	Diversion1	2.744	2	720	1,633	3	-----	-----	VOLUME ABSTRACTION
6	Diversion2	2.028	2	724	5,167	3	-----	-----	POST AFTER BMP
7	Diversion1	3.912	2	718	1,293	4	-----	-----	VOLUME ABSTRACTION
8	Diversion2	5.064	2	722	14,217	4	-----	-----	POST AFTER BMP
9	Combine	8.625	2	724	25,238	2, 6, 8	-----	-----	POST AT POI
Morgantown.gpw					Return Period: 10 Year			Tuesday, 11 / 1 / 2016	

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

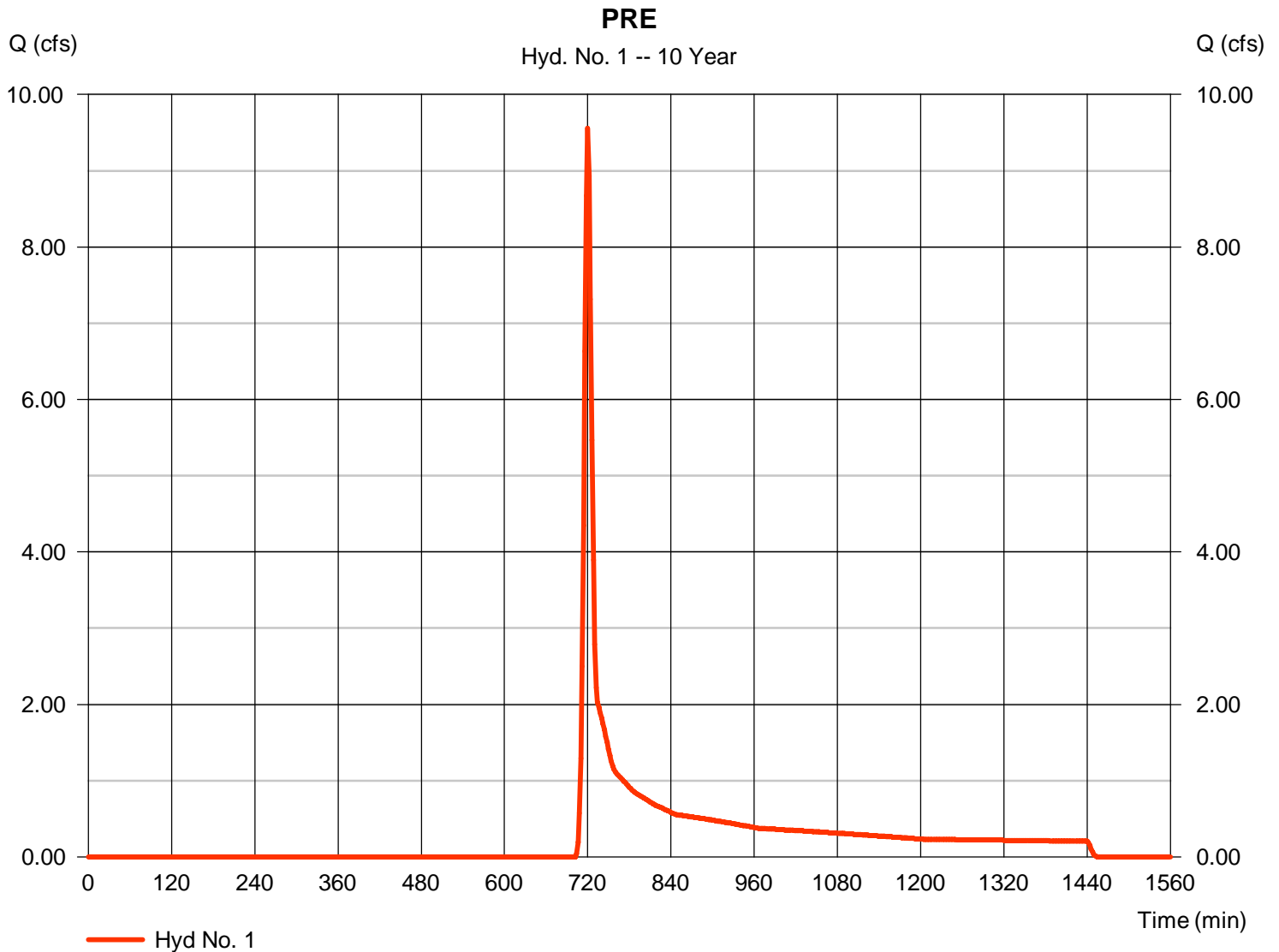
Tuesday, 11 / 1 / 2016

Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 9.557 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 25,212 cuft
Drainage area	= 8.230 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 4.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.780 x 55) + (0.450 x 58)] / 8.230



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

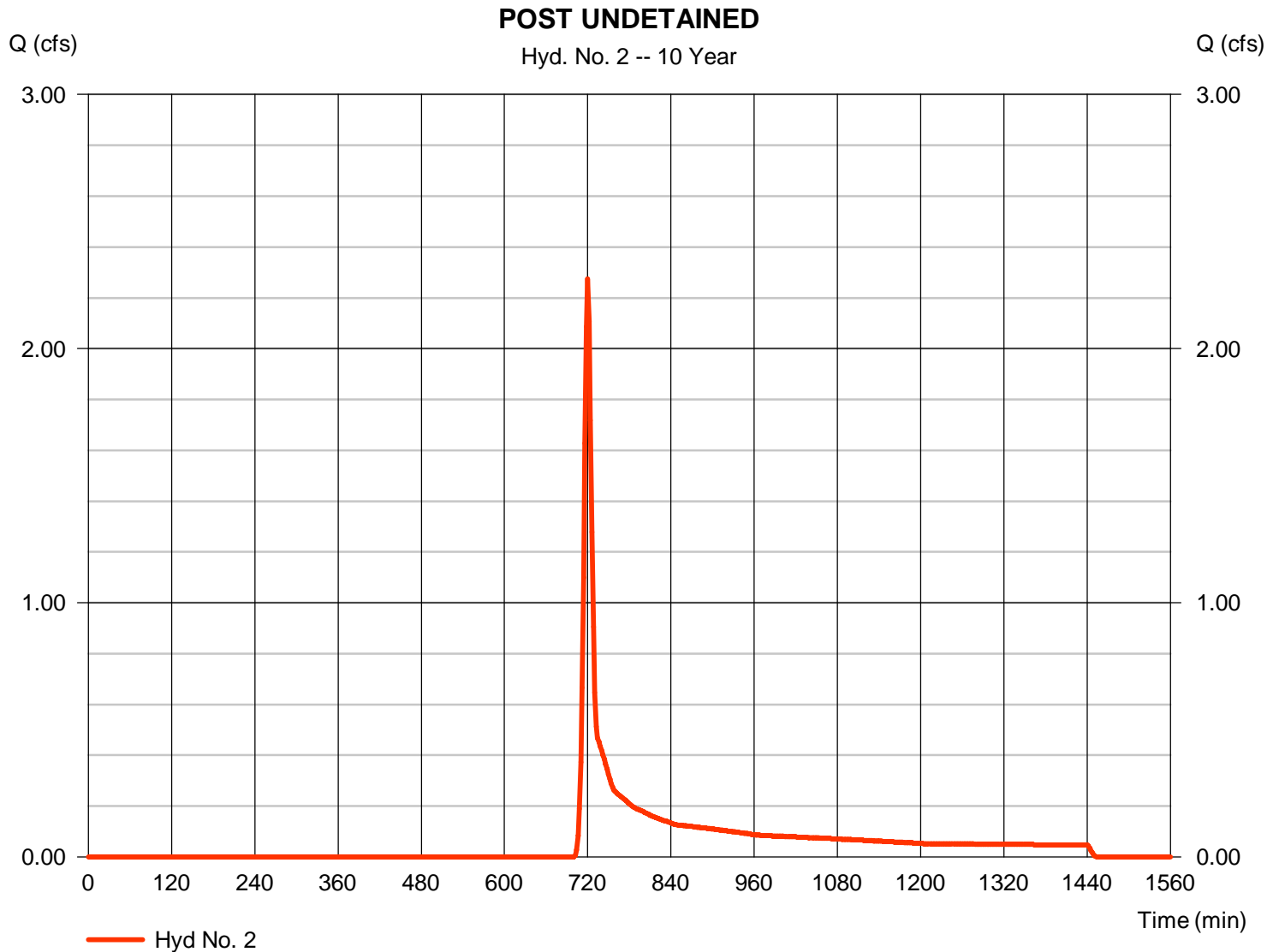
Tuesday, 11 / 1 / 2016

Hyd. No. 2

POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 2.274 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 5,853 cuft
Drainage area	= 1.790 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 4.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.430 x 58) + (1.330 x 55)] / 1.790



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

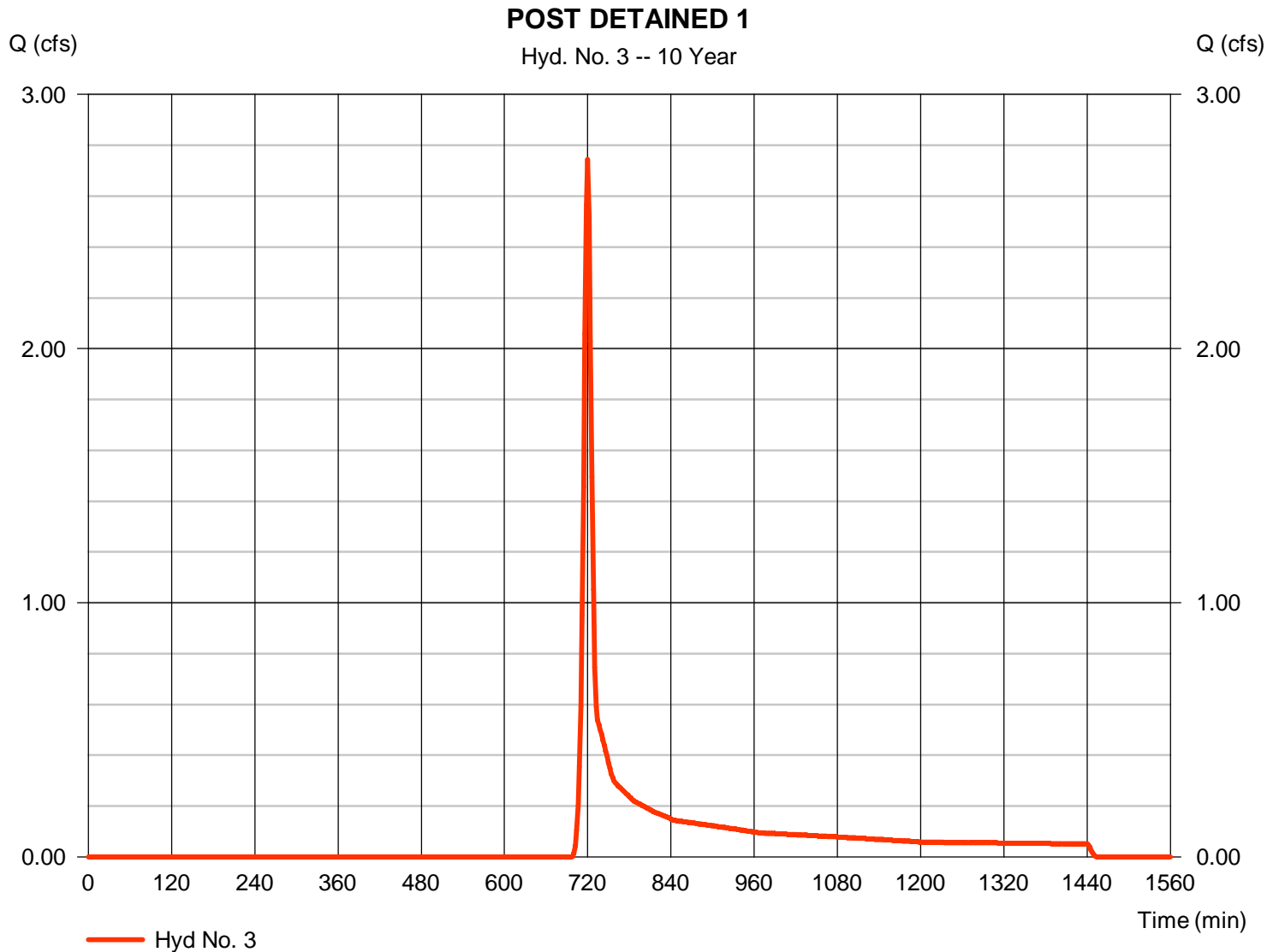
Tuesday, 11 / 1 / 2016

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 2.744 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 6,801 cuft
Drainage area	= 1.840 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 4.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.140 x 85) + (0.460 x 58) + (1.240 x 55)] / 1.840



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

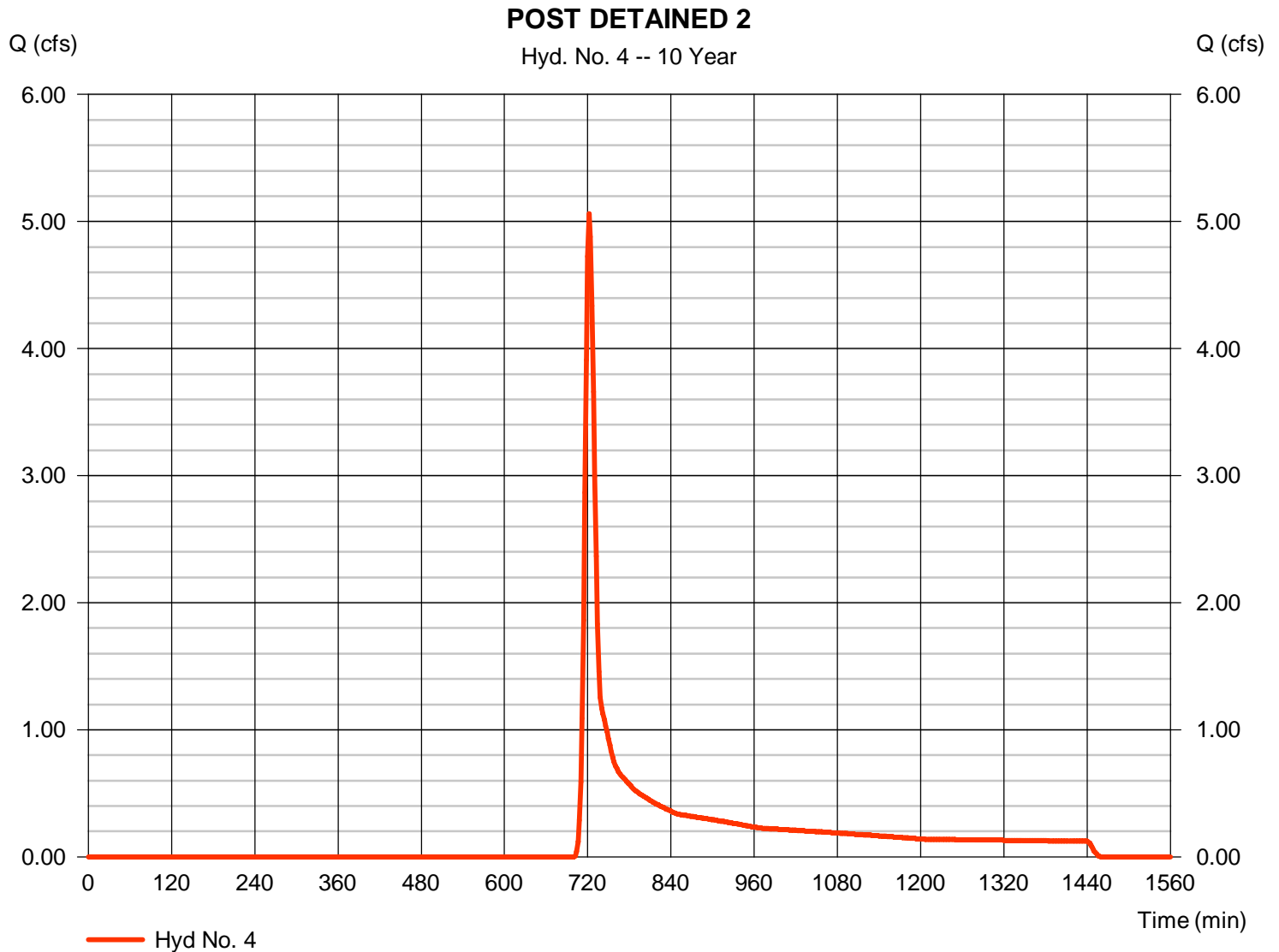
Tuesday, 11 / 1 / 2016

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 5.064 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 15,510 cuft
Drainage area	= 4.600 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.00 min
Total precip.	= 4.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.040 x 85) + (0.750 x 58) + (3.810 x 55)] / 4.600



Hydrograph Report

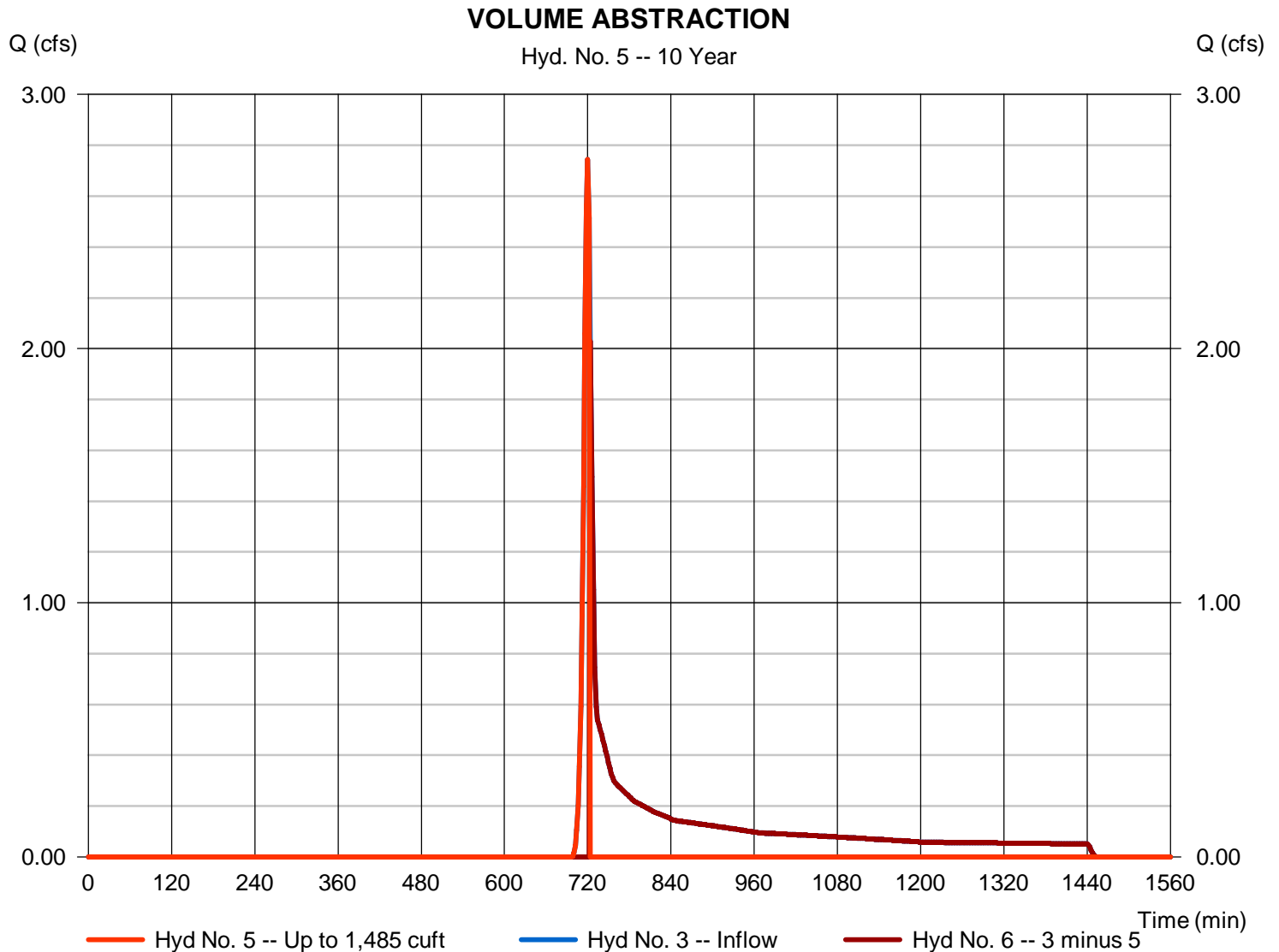
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 2.744 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 1,633 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

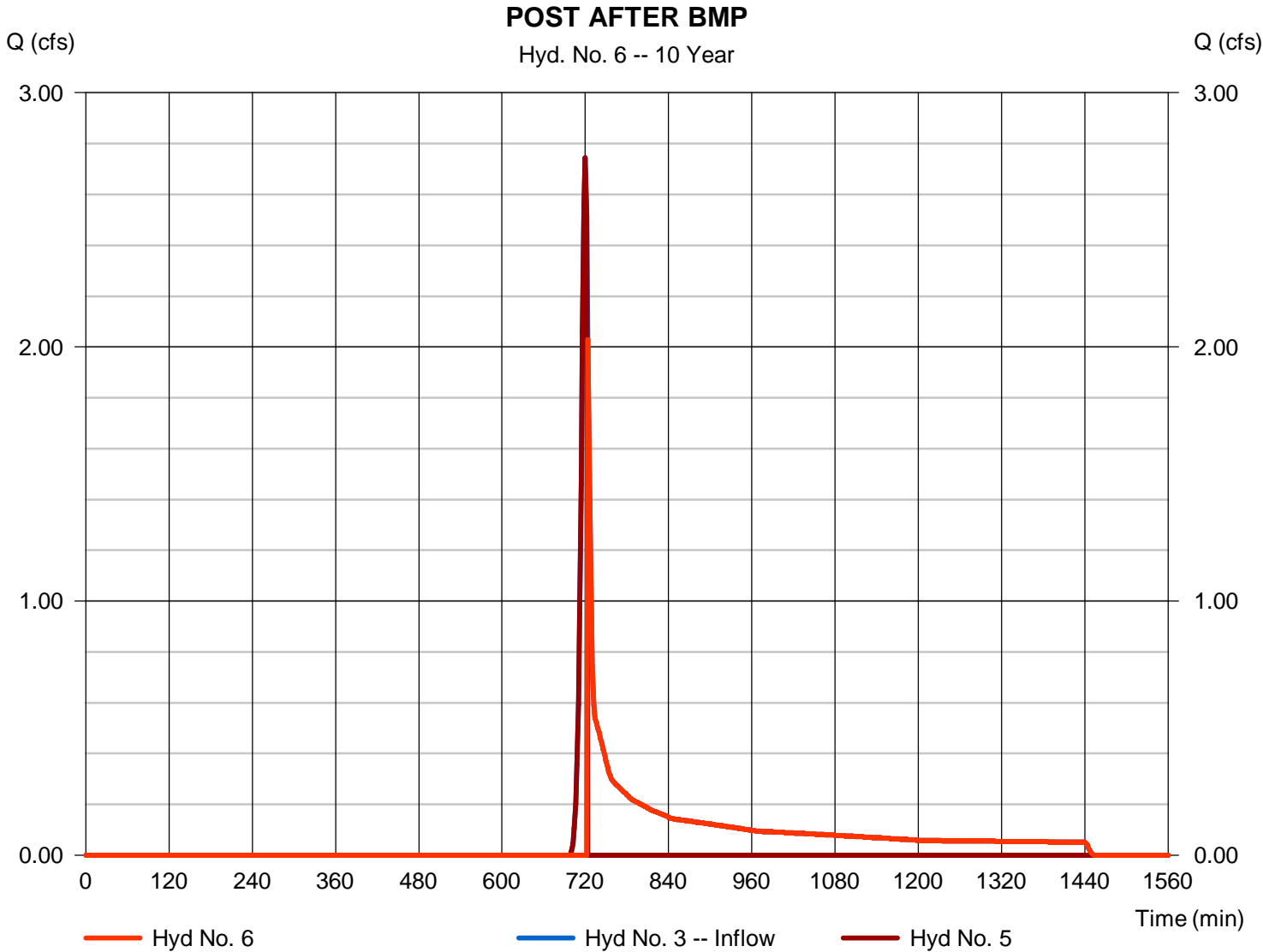
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 2.028 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 5,167 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

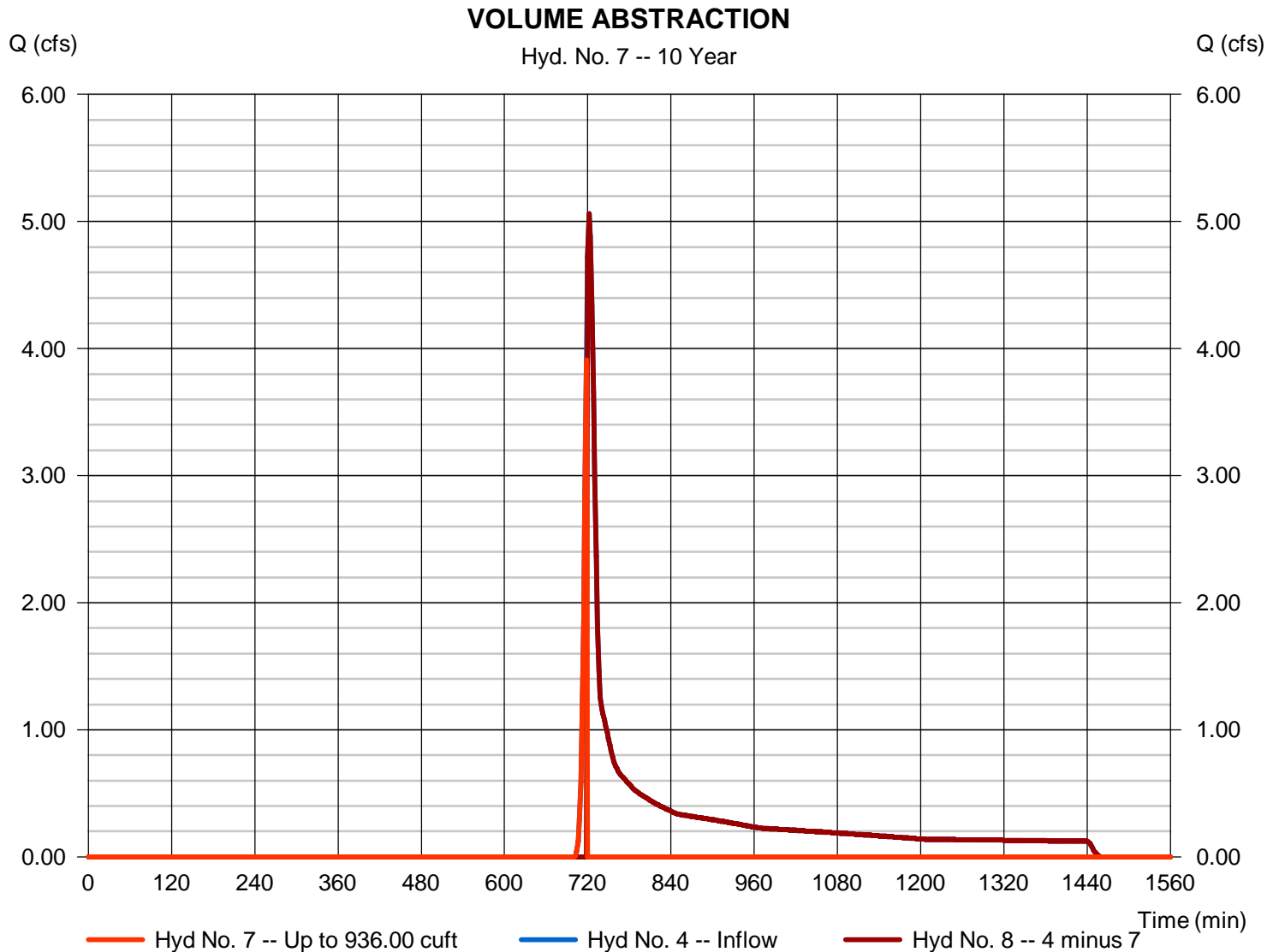
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 3.912 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,293 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

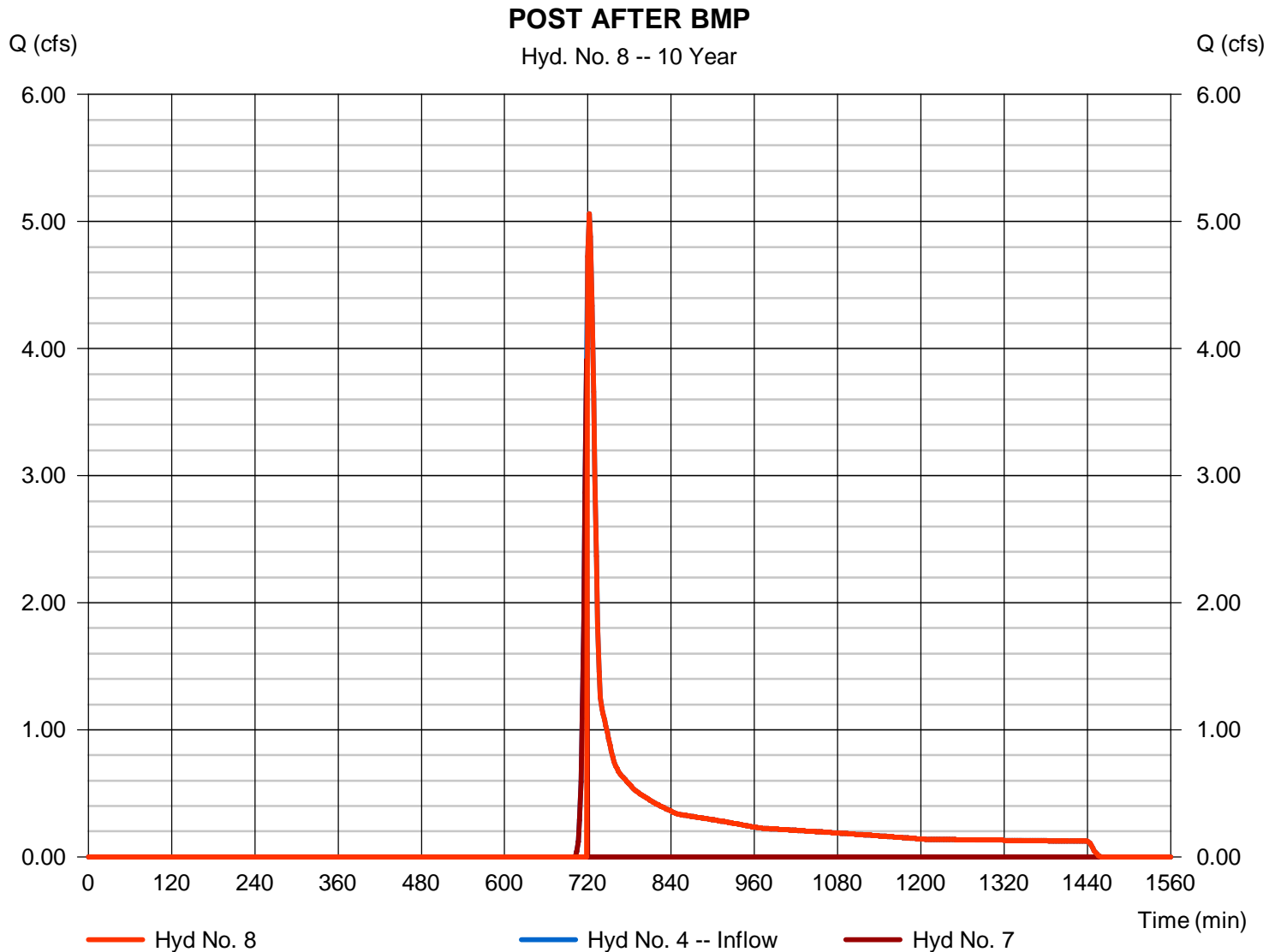
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 5.064 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 14,217 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

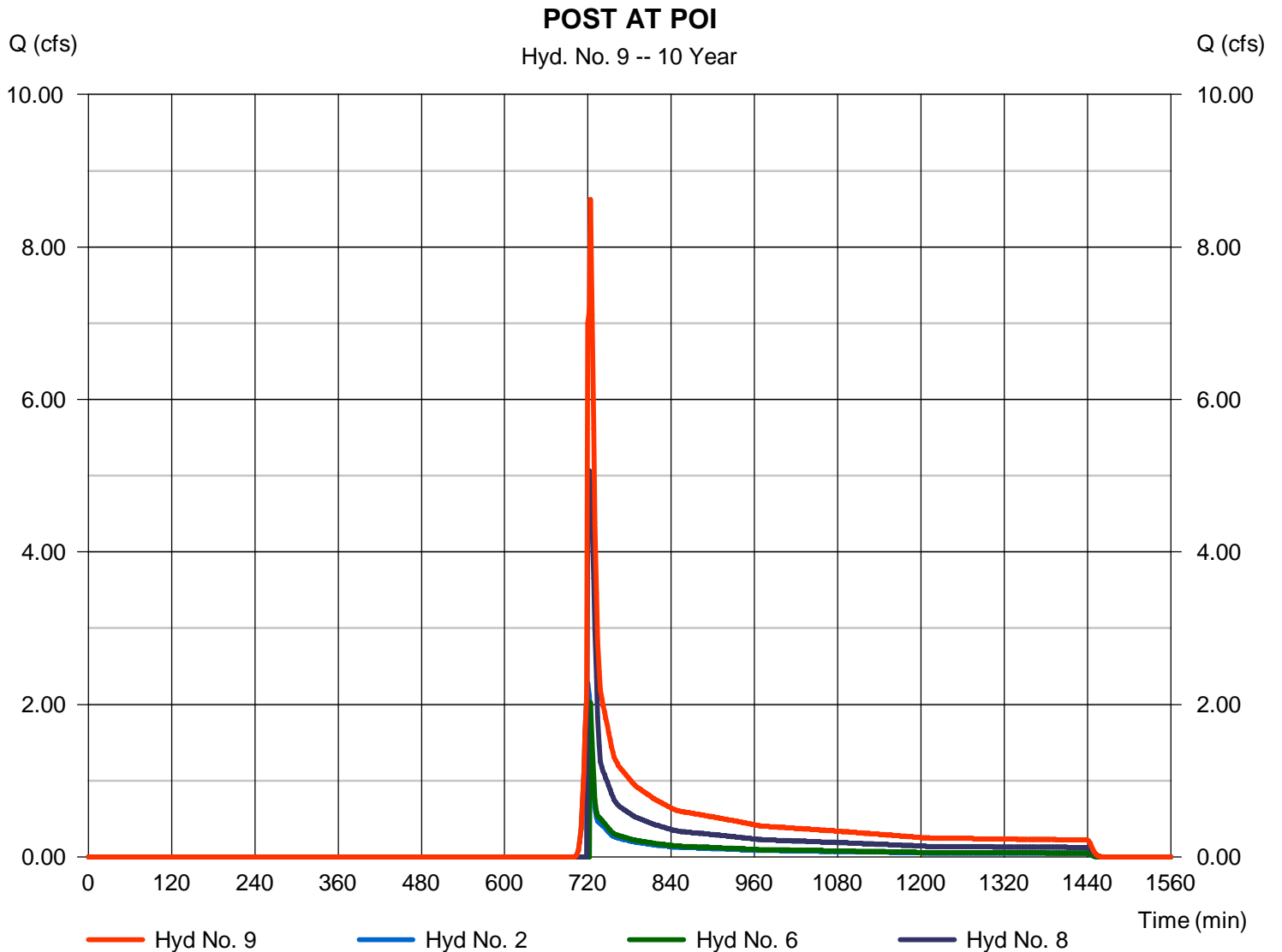
Tuesday, 11 / 1 / 2016

Hyd. No. 9

POST AT POI

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 8.625 cfs
Time to peak = 724 min
Hyd. volume = 25,238 cuft
Contrib. drain. area = 1.790 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	23.26	2	720	54,716	-----	-----	-----	PRE	
2	SCS Runoff	5.332	2	720	12,466	-----	-----	-----	POST UNDETAINED	
3	SCS Runoff	6.042	2	720	13,997	-----	-----	-----	POST DETAINED 1	
4	SCS Runoff	12.18	2	722	33,037	-----	-----	-----	POST DETAINED 2	
5	Diversion1	3.874	2	714	1,798	3	-----	-----	VOLUME ABSTRACTION	
6	Diversion2	6.042	2	720	12,198	3	-----	-----	POST AFTER BMP	
7	Diversion1	2.351	2	708	1,002	4	-----	-----	VOLUME ABSTRACTION	
8	Diversion2	12.18	2	722	32,035	4	-----	-----	POST AFTER BMP	
9	Combine	23.27	2	720	56,699	2, 6, 8	-----	-----	POST AT POI	
Morgantown.gpw					Return Period: 50 Year			Tuesday, 11 / 1 / 2016		

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

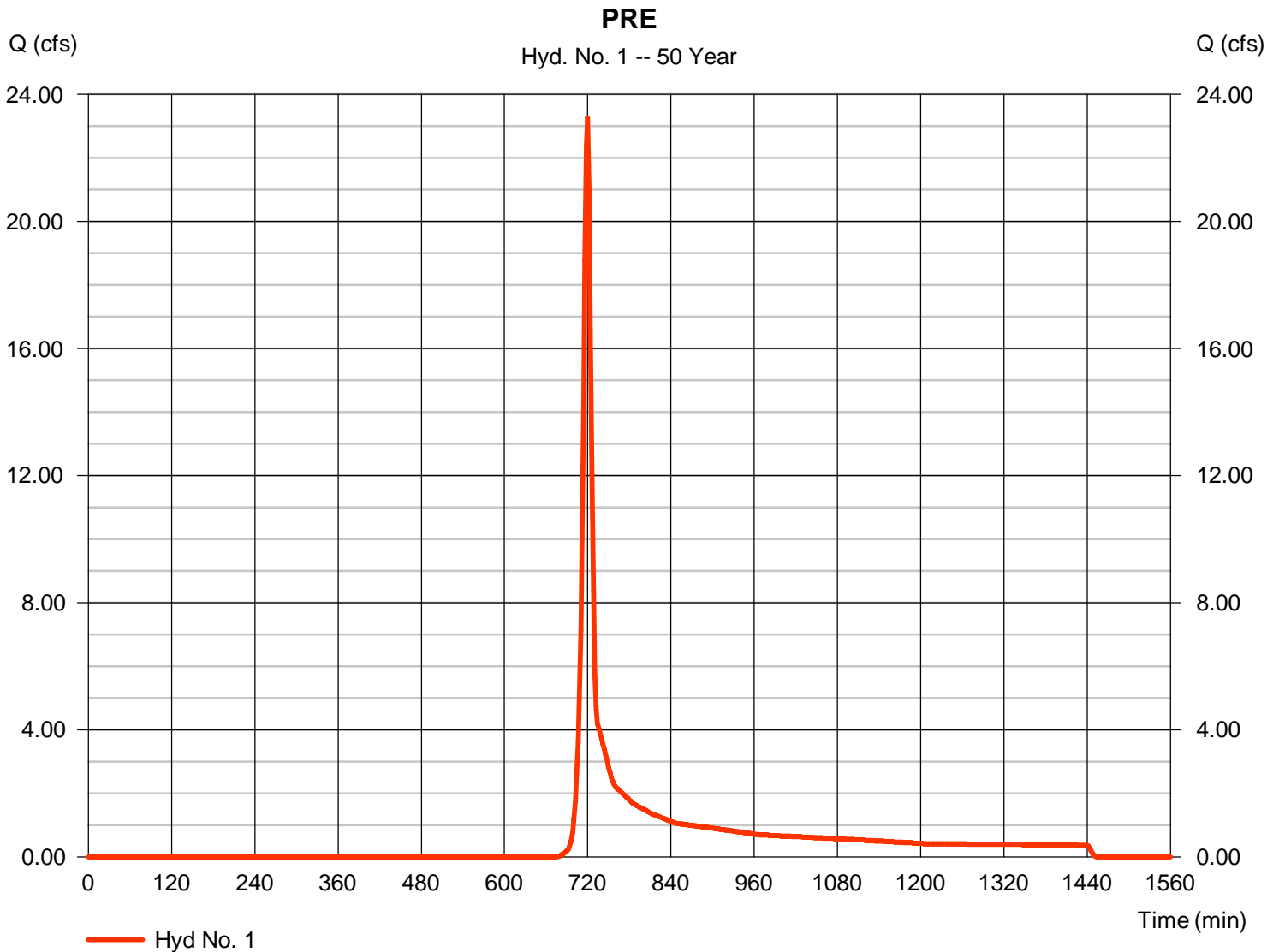
Tuesday, 11 / 1 / 2016

Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 23.26 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 54,716 cuft
Drainage area	= 8.230 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 6.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.780 x 55) + (0.450 x 58)] / 8.230



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

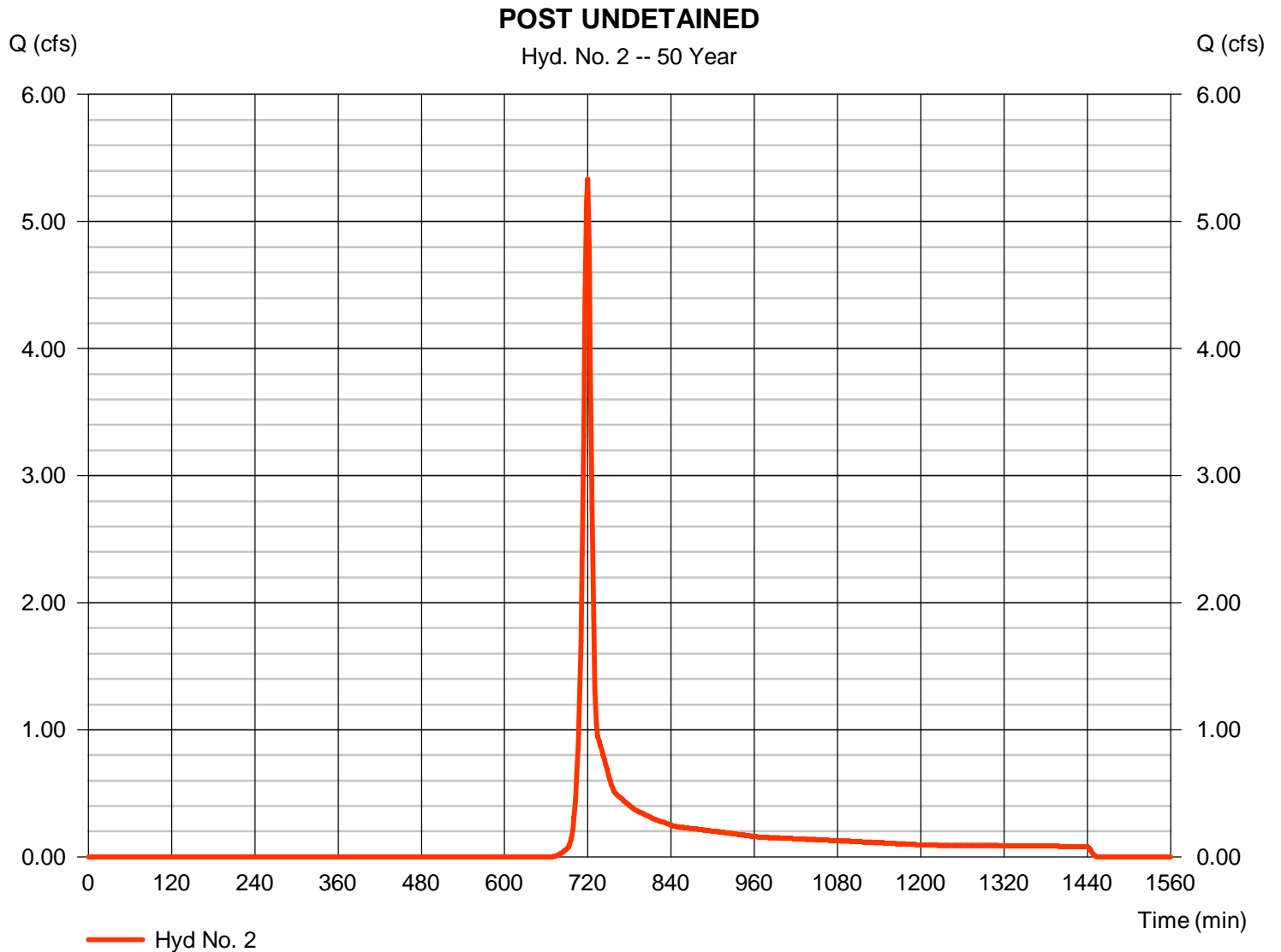
Tuesday, 11 / 1 / 2016

Hyd. No. 2

POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 5.332 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 12,466 cuft
Drainage area	= 1.790 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 6.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.430 x 58) + (1.330 x 55)] / 1.790



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

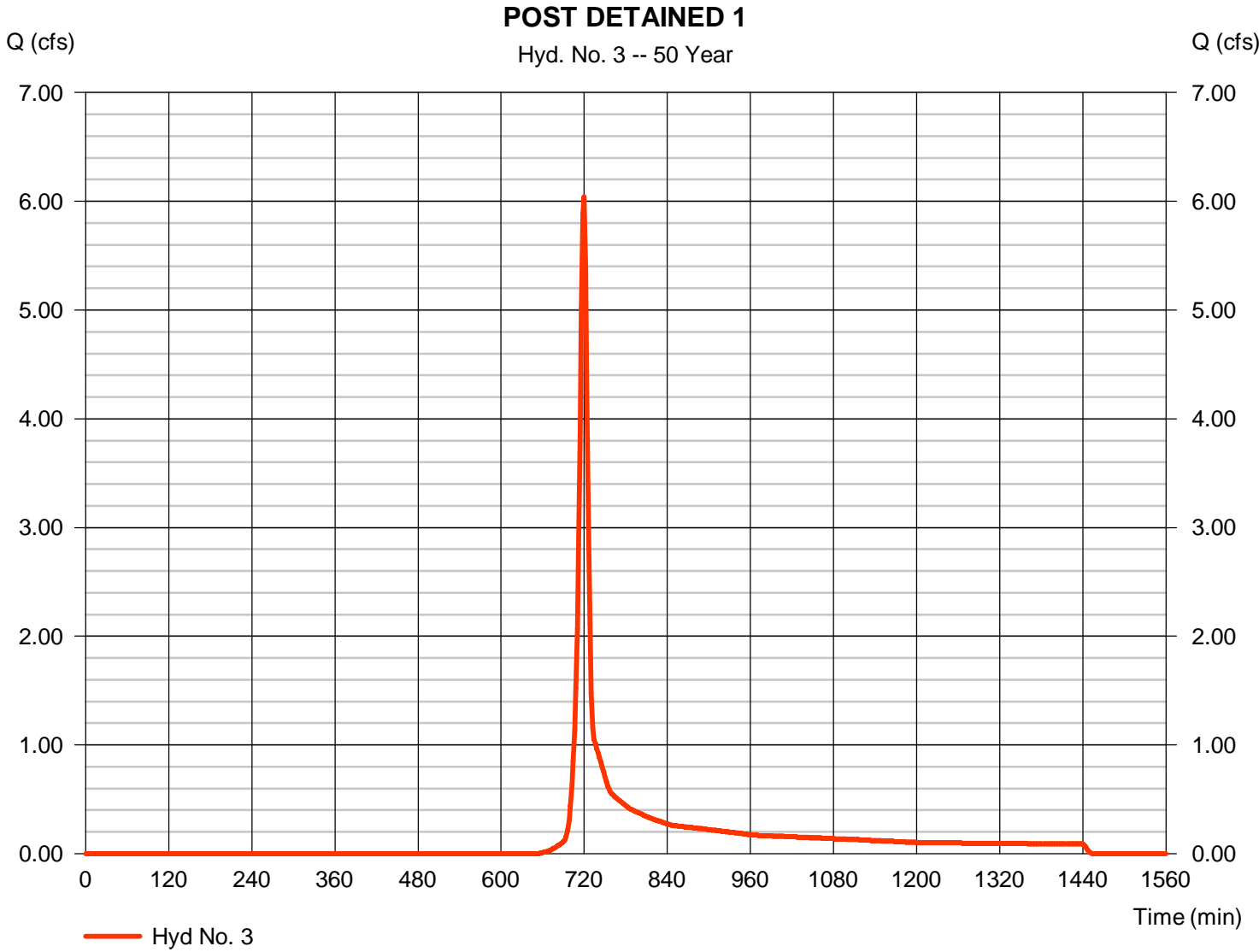
Tuesday, 11 / 1 / 2016

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 6.042 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 13,997 cuft
Drainage area	= 1.840 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 6.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.140 x 85) + (0.460 x 58) + (1.240 x 55)] / 1.840



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

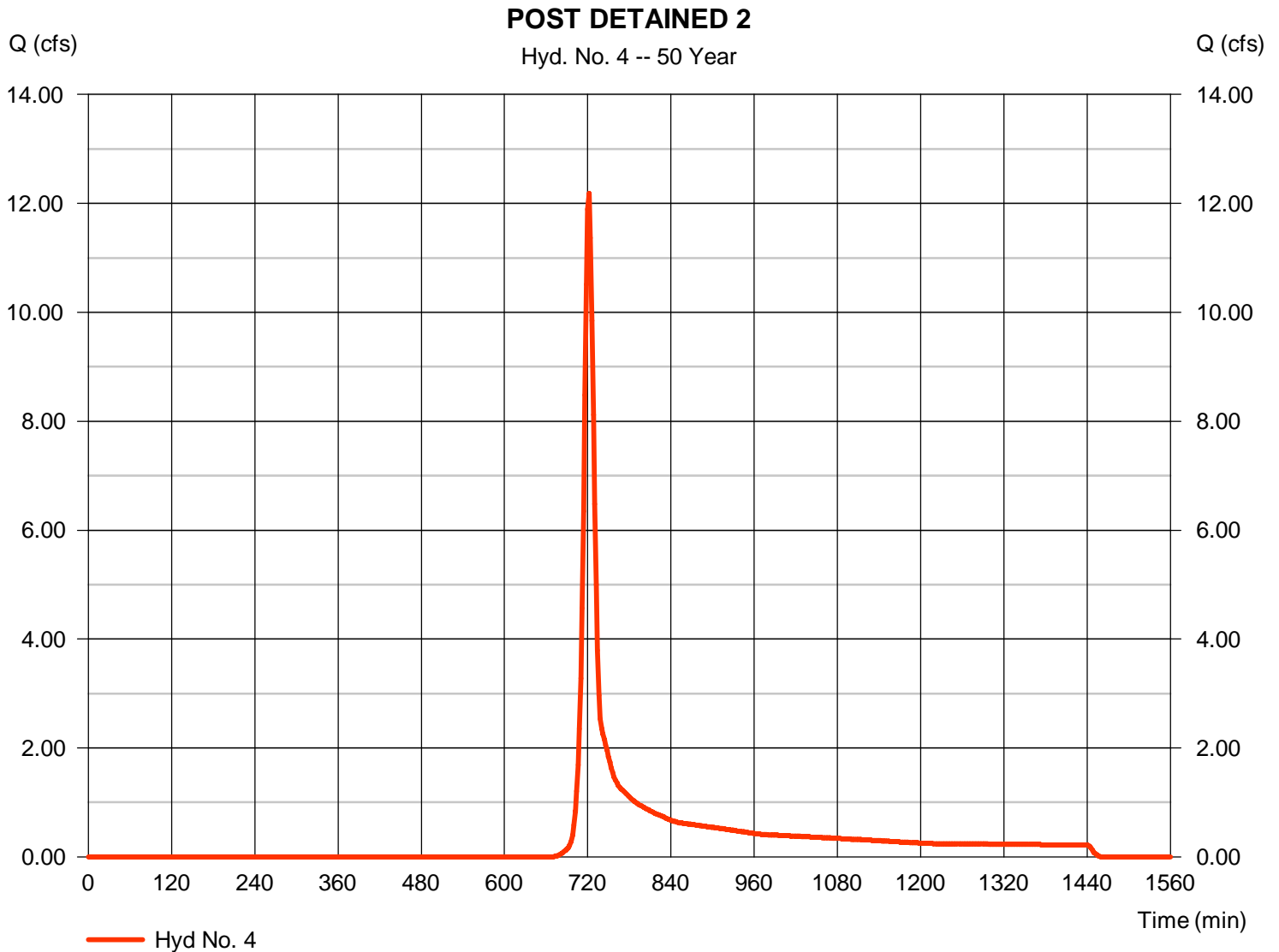
Tuesday, 11 / 1 / 2016

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 12.18 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 33,037 cuft
Drainage area	= 4.600 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.040 x 85) + (0.750 x 58) + (3.810 x 55)] / 4.600



Hydrograph Report

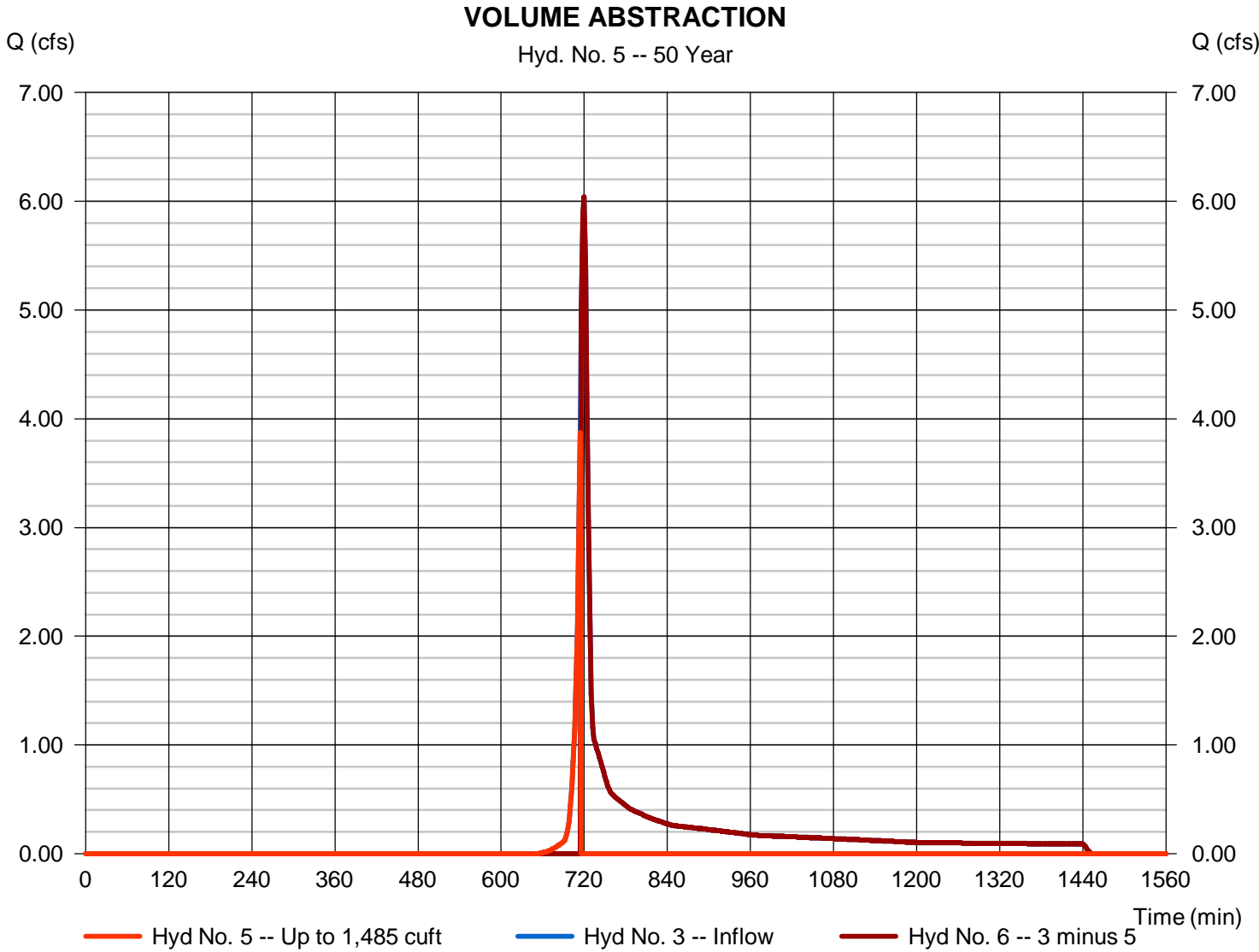
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 3.874 cfs
Storm frequency	= 50 yrs	Time to peak	= 714 min
Time interval	= 2 min	Hyd. volume	= 1,798 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

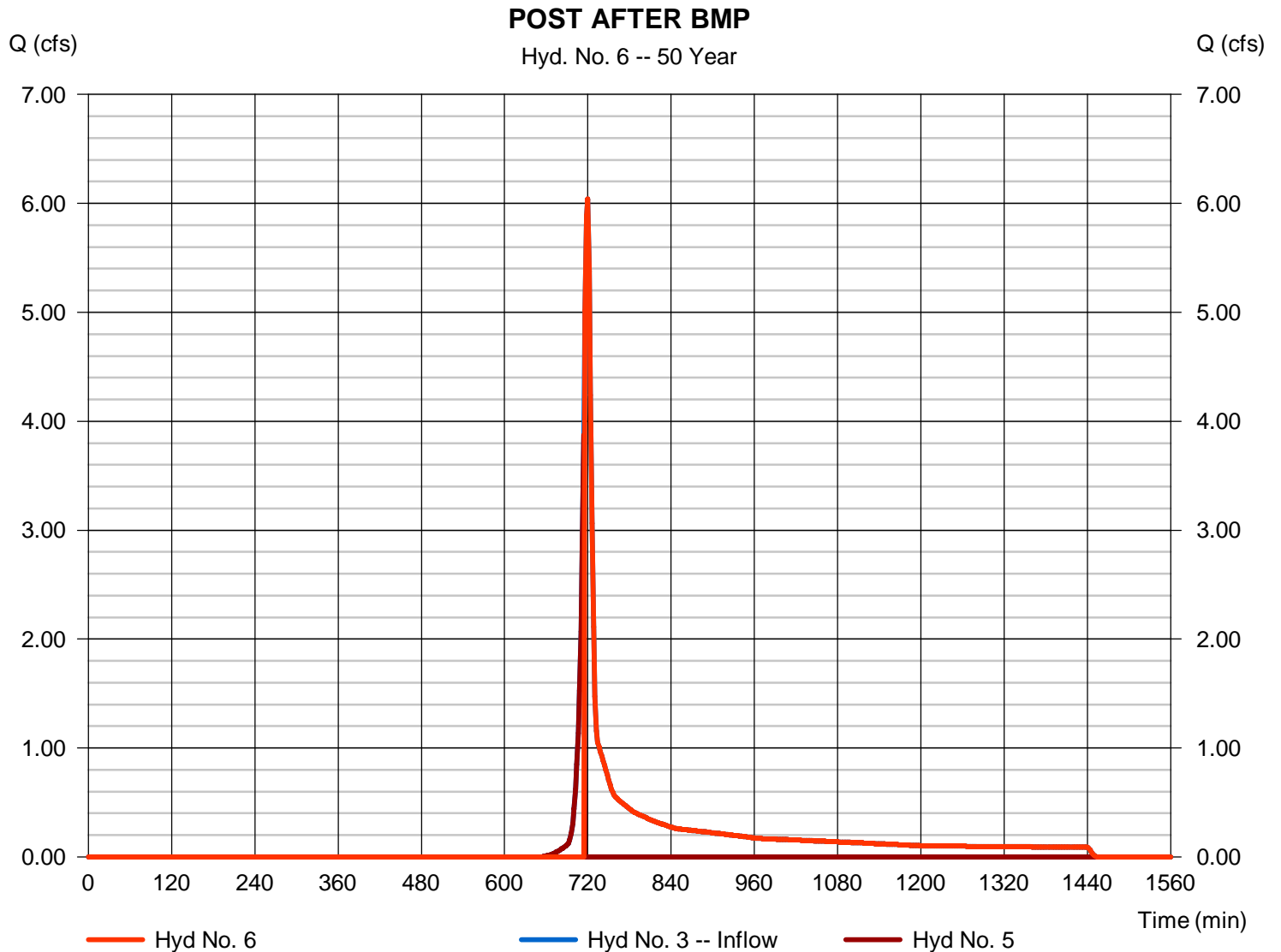
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 6.042 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 12,198 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

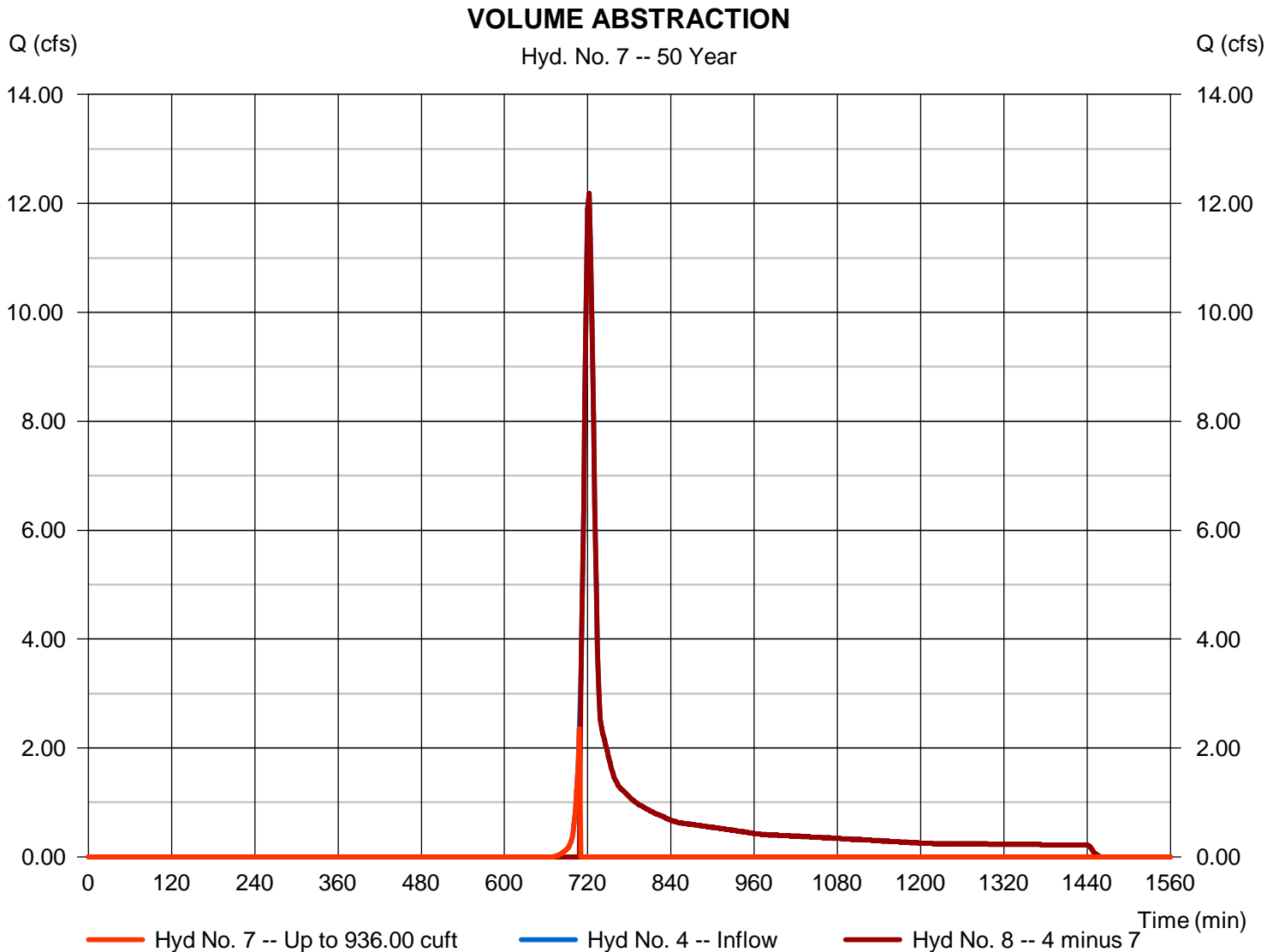
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 2.351 cfs
Storm frequency	= 50 yrs	Time to peak	= 708 min
Time interval	= 2 min	Hyd. volume	= 1,002 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

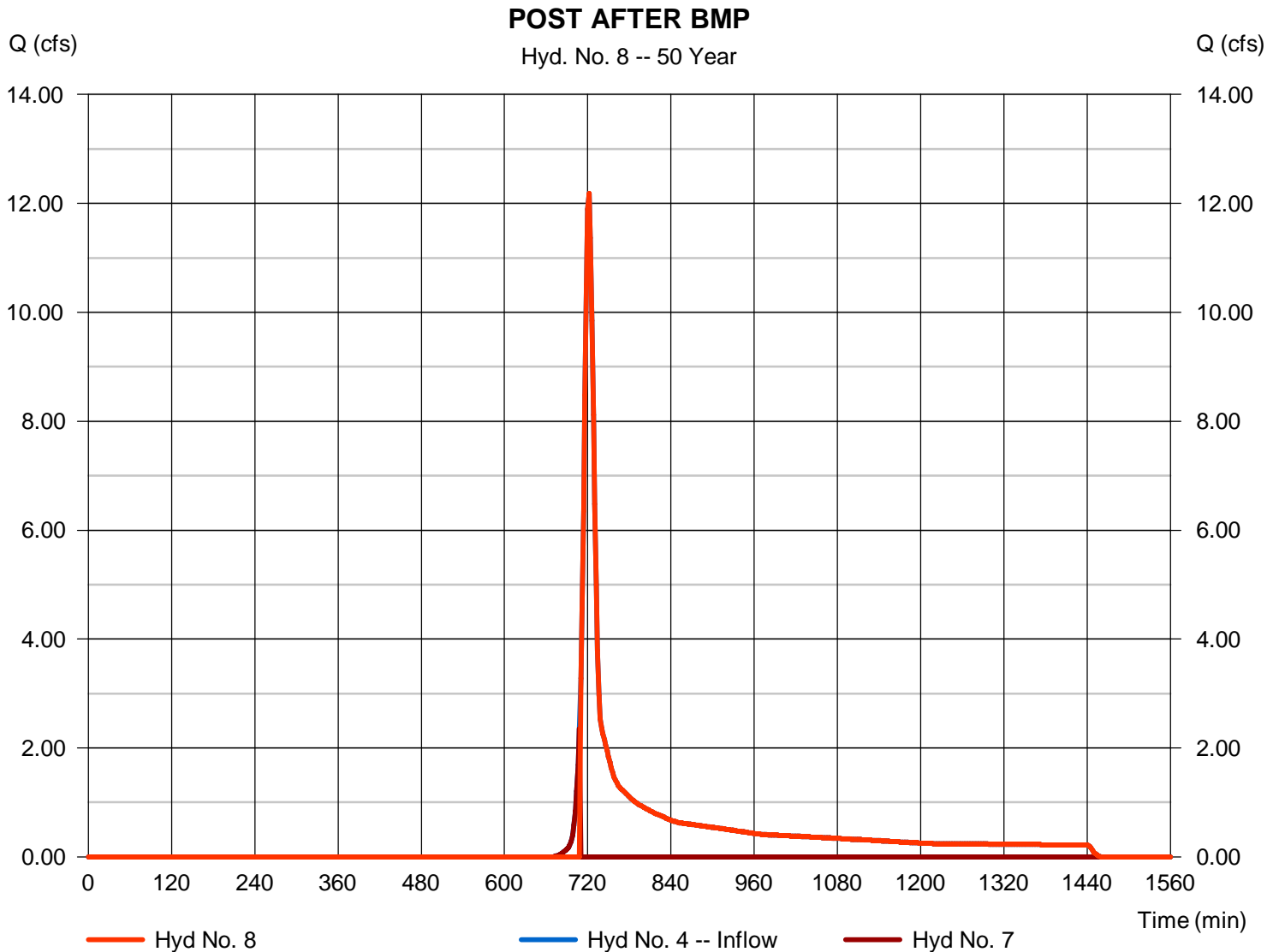
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 12.18 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 32,035 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

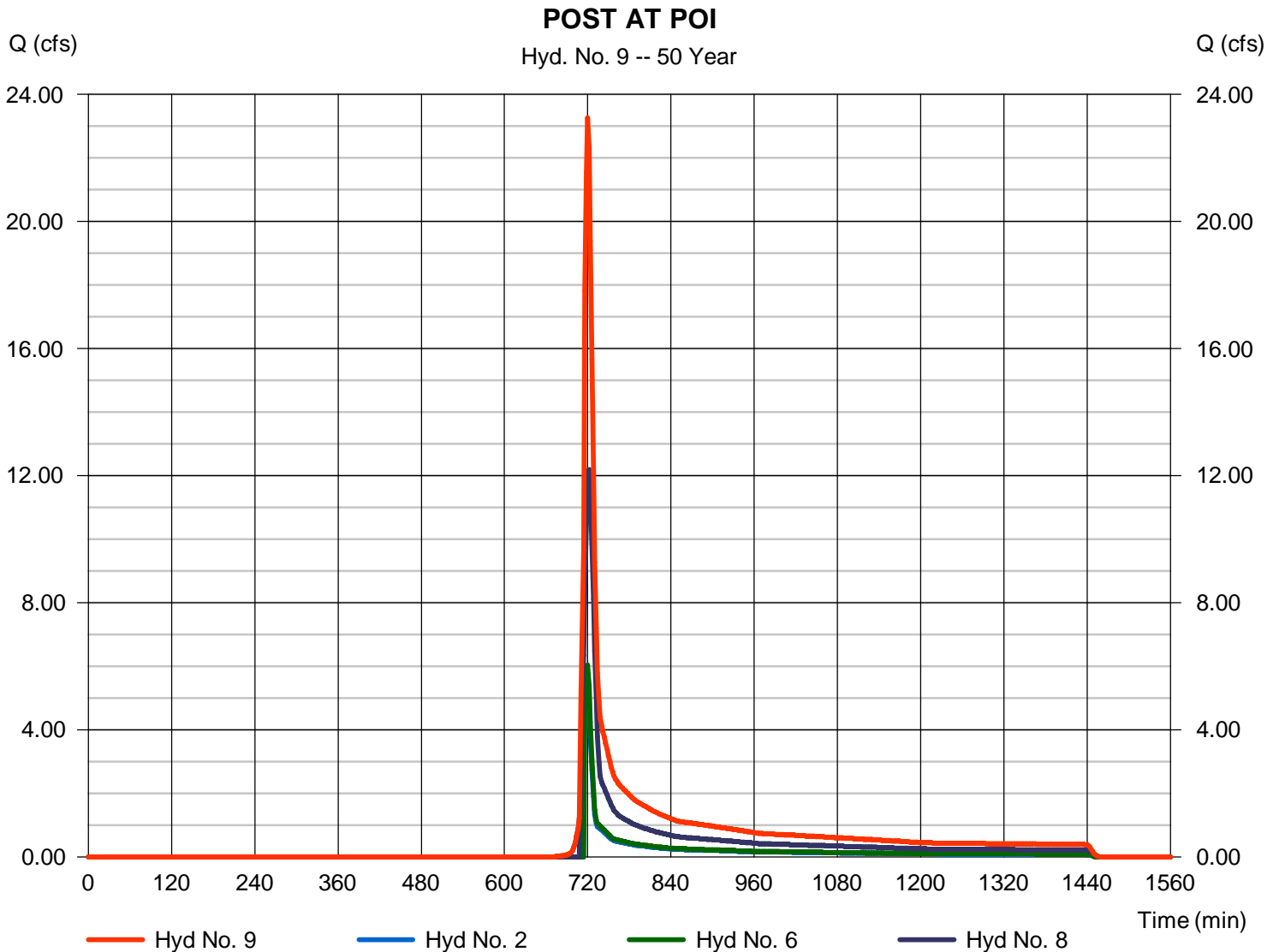
Tuesday, 11 / 1 / 2016

Hyd. No. 9

POST AT POI

Hydrograph type = Combine
Storm frequency = 50 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 23.27 cfs
Time to peak = 720 min
Hyd. volume = 56,699 cuft
Contrib. drain. area = 1.790 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	30.82	2	720	71,361	-----	-----	-----	PRE	
2	SCS Runoff	7.008	2	720	16,173	-----	-----	-----	POST UNDETAINED	
3	SCS Runoff	7.828	2	720	17,980	-----	-----	-----	POST DETAINED 1	
4	SCS Runoff	16.10	2	722	42,860	-----	-----	-----	POST DETAINED 2	
5	Diversion1	2.915	2	710	1,625	3	-----	-----	VOLUME ABSTRACTION	
6	Diversion2	7.828	2	720	16,355	3	-----	-----	POST AFTER BMP	
7	Diversion1	1.491	2	702	942	4	-----	-----	VOLUME ABSTRACTION	
8	Diversion2	16.10	2	722	41,918	4	-----	-----	POST AFTER BMP	
9	Combine	30.70	2	720	74,446	2, 6, 8	-----	-----	POST AT POI	
Morgantown.gpw					Return Period: 100 Year			Tuesday, 11 / 1 / 2016		

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

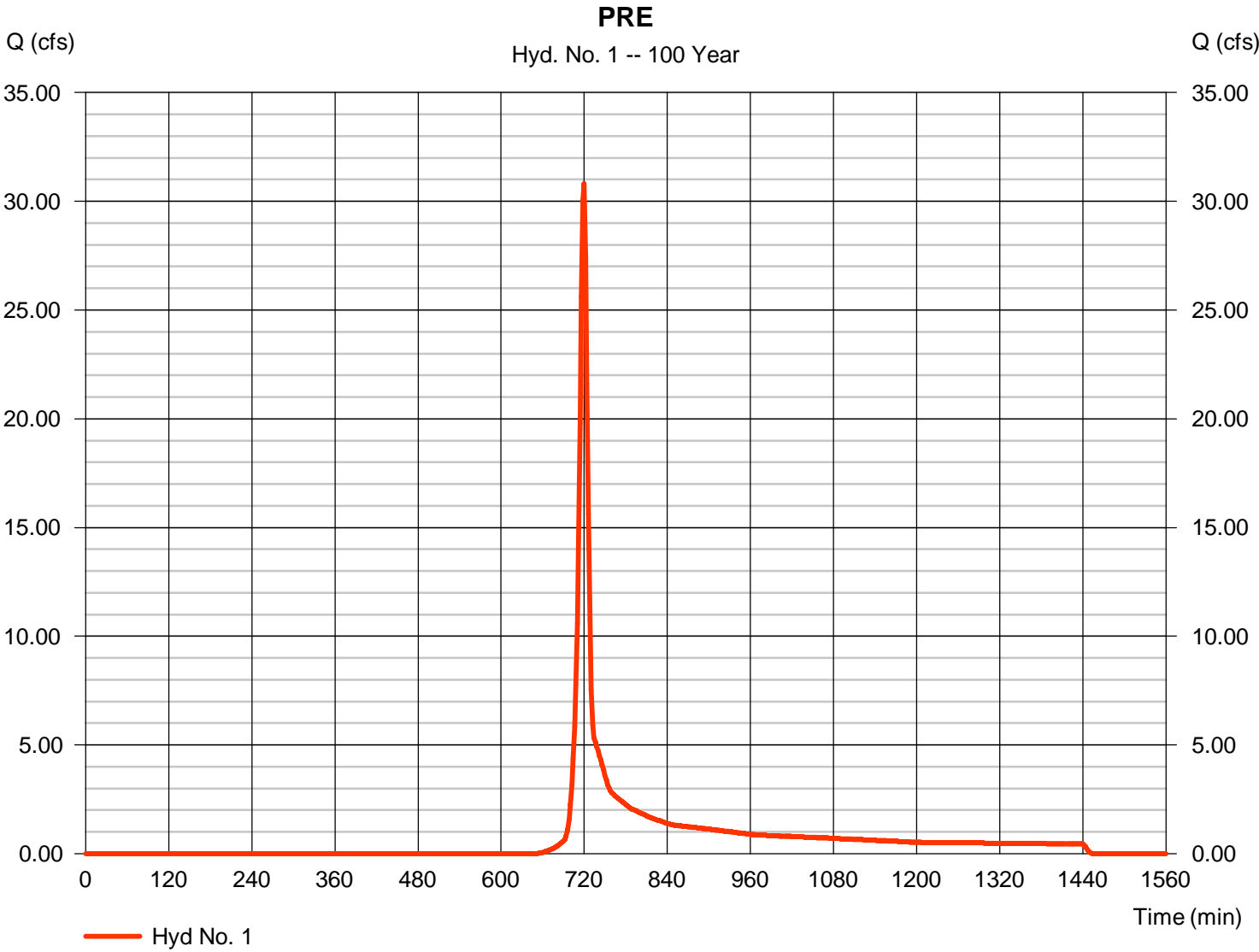
Tuesday, 11 / 1 / 2016

Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 30.82 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 71,361 cuft
Drainage area	= 8.230 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 7.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.780 x 55) + (0.450 x 58)] / 8.230



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

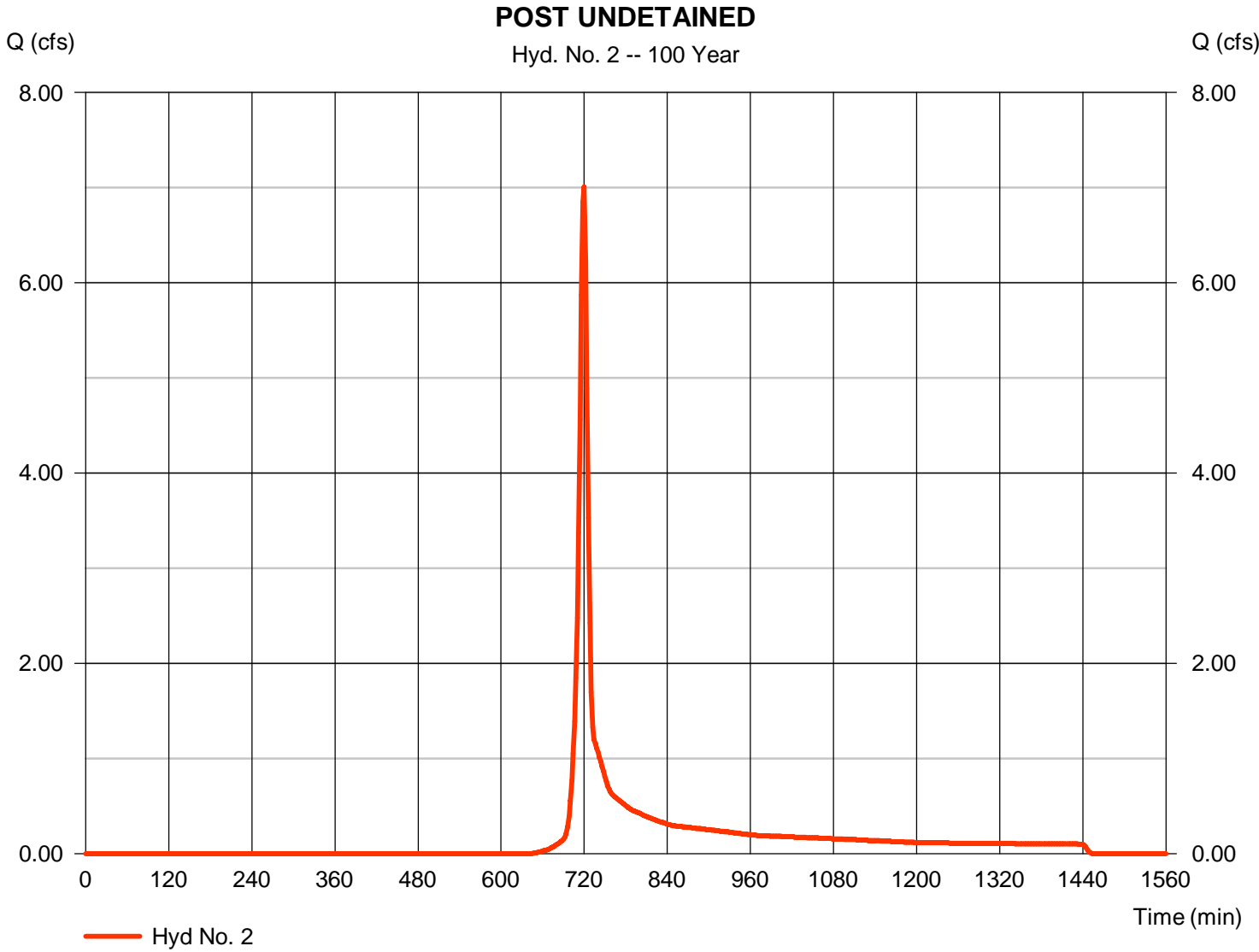
Tuesday, 11 / 1 / 2016

Hyd. No. 2

POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 7.008 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 16,173 cuft
Drainage area	= 1.790 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 7.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.430 x 58) + (1.330 x 55)] / 1.790



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

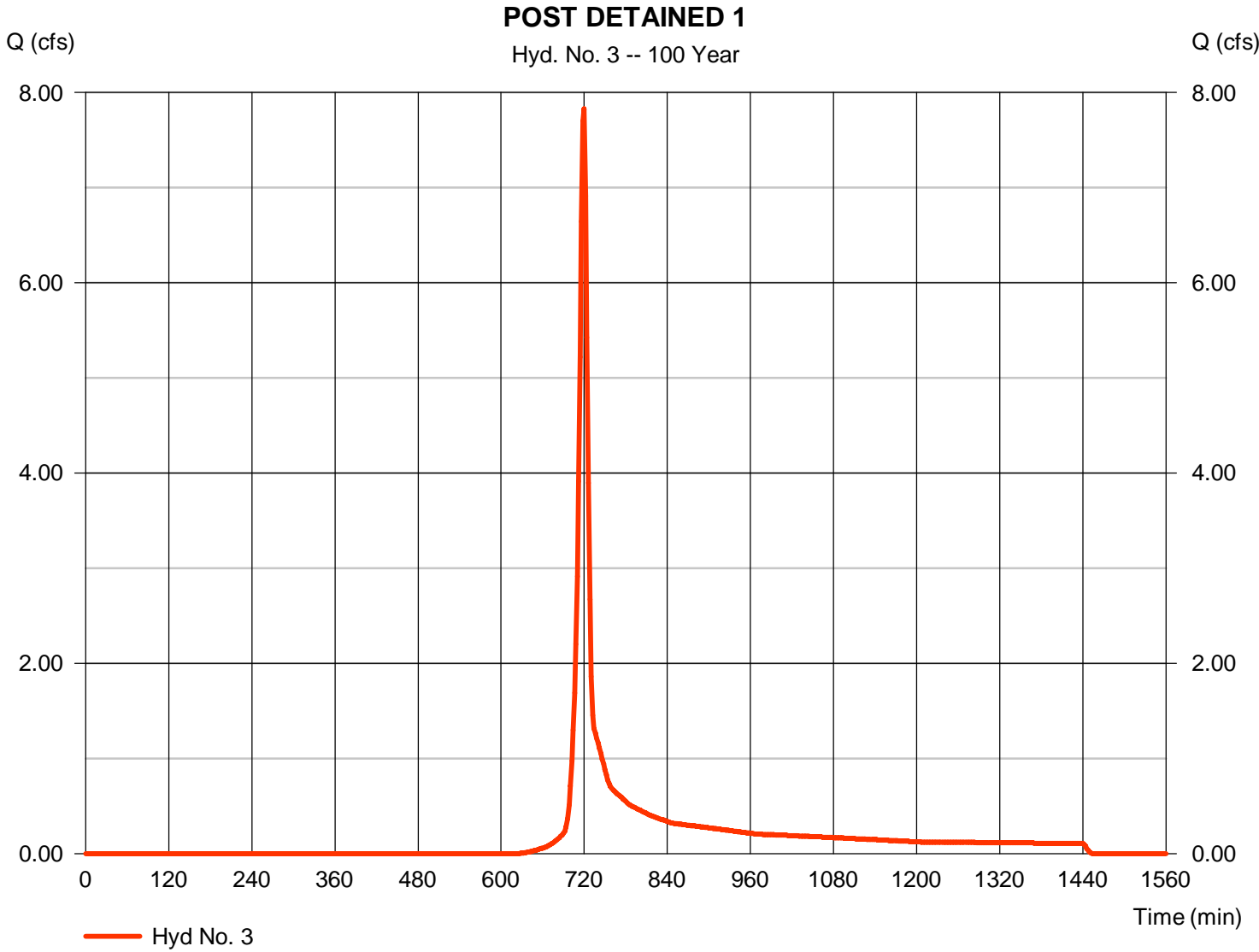
Tuesday, 11 / 1 / 2016

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 7.828 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 17,980 cuft
Drainage area	= 1.840 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 7.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.140 x 85) + (0.460 x 58) + (1.240 x 55)] / 1.840



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

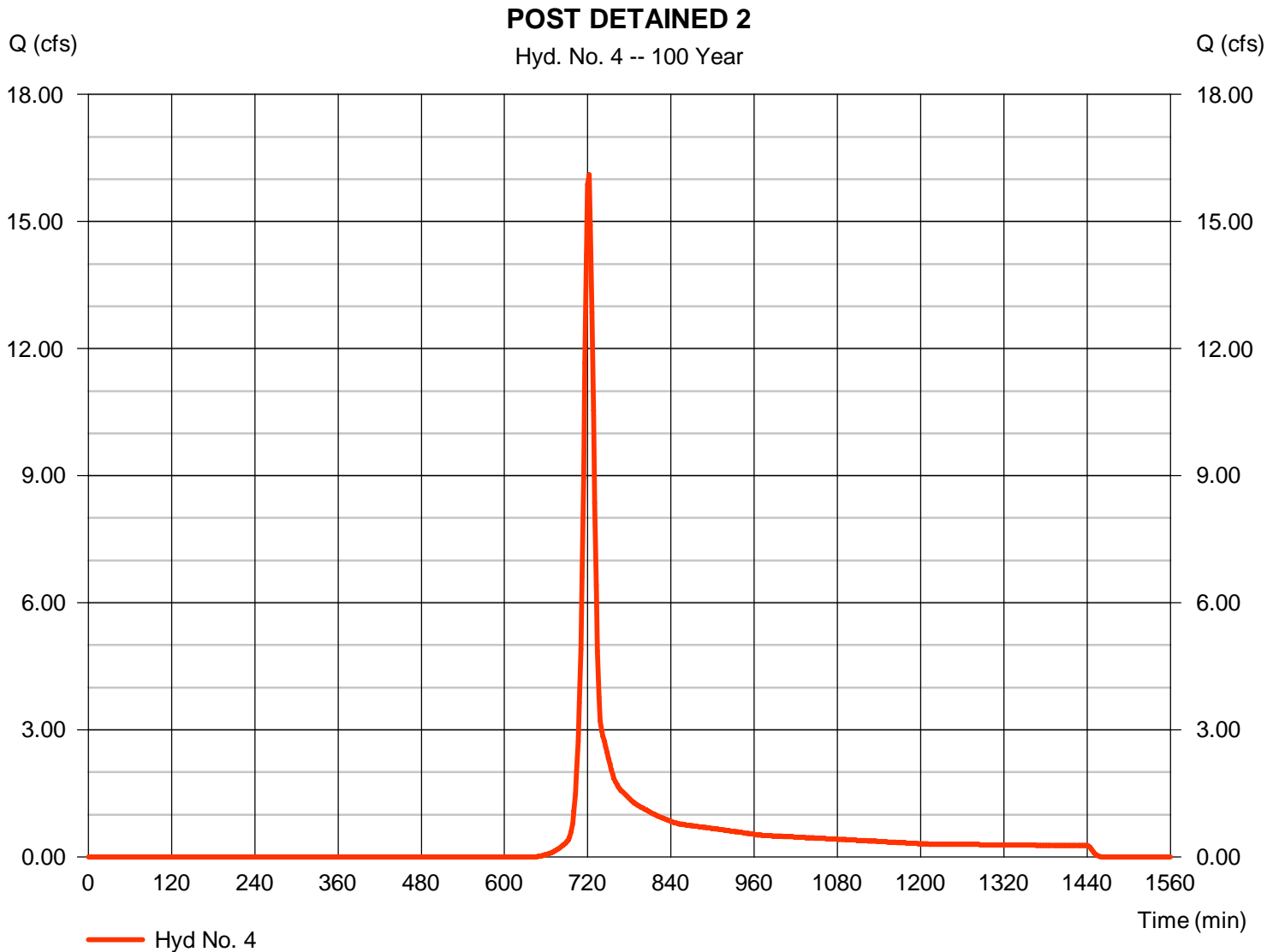
Tuesday, 11 / 1 / 2016

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 16.10 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 42,860 cuft
Drainage area	= 4.600 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.00 min
Total precip.	= 7.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.040 x 85) + (0.750 x 58) + (3.810 x 55)] / 4.600



Hydrograph Report

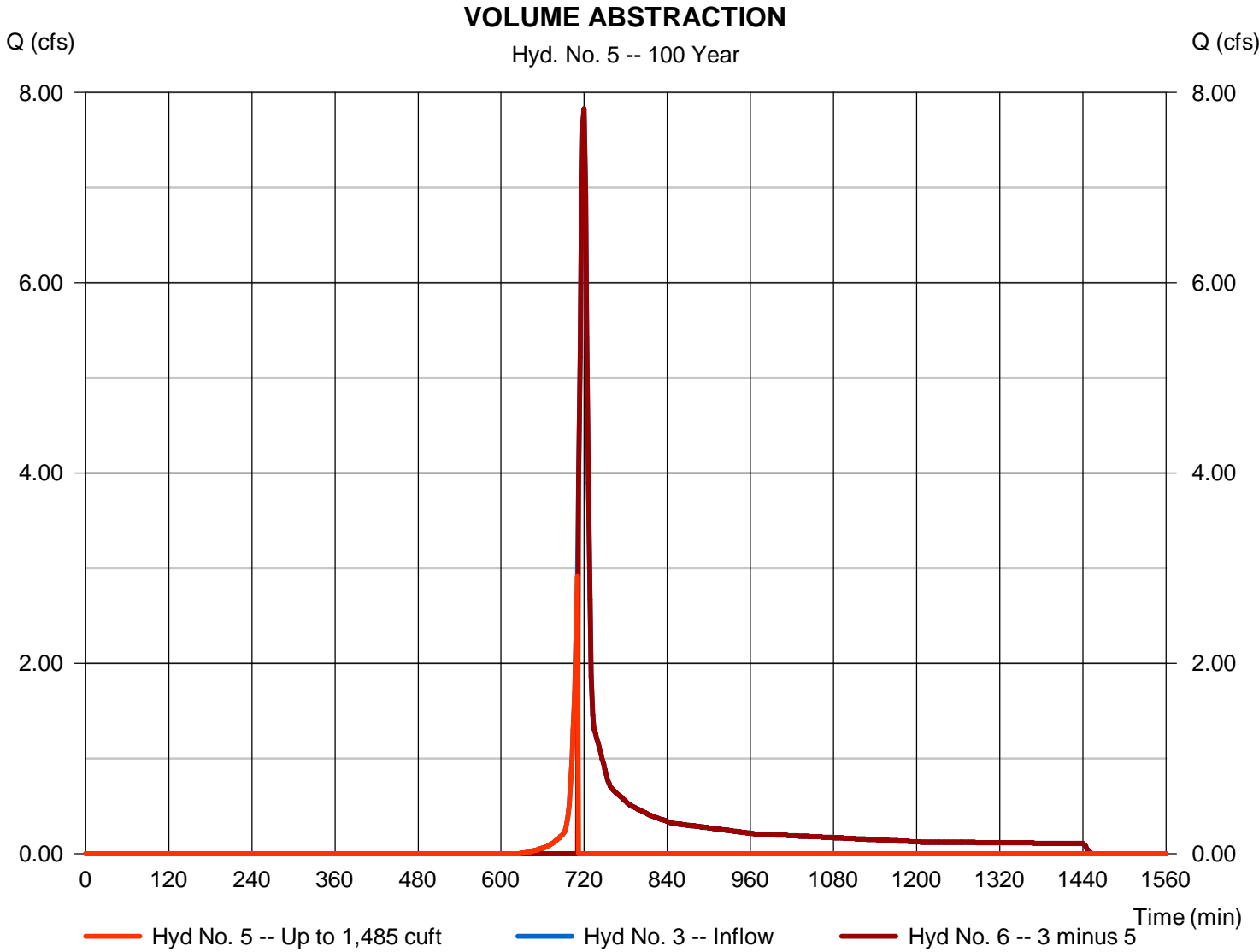
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 2.915 cfs
Storm frequency	= 100 yrs	Time to peak	= 710 min
Time interval	= 2 min	Hyd. volume	= 1,625 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

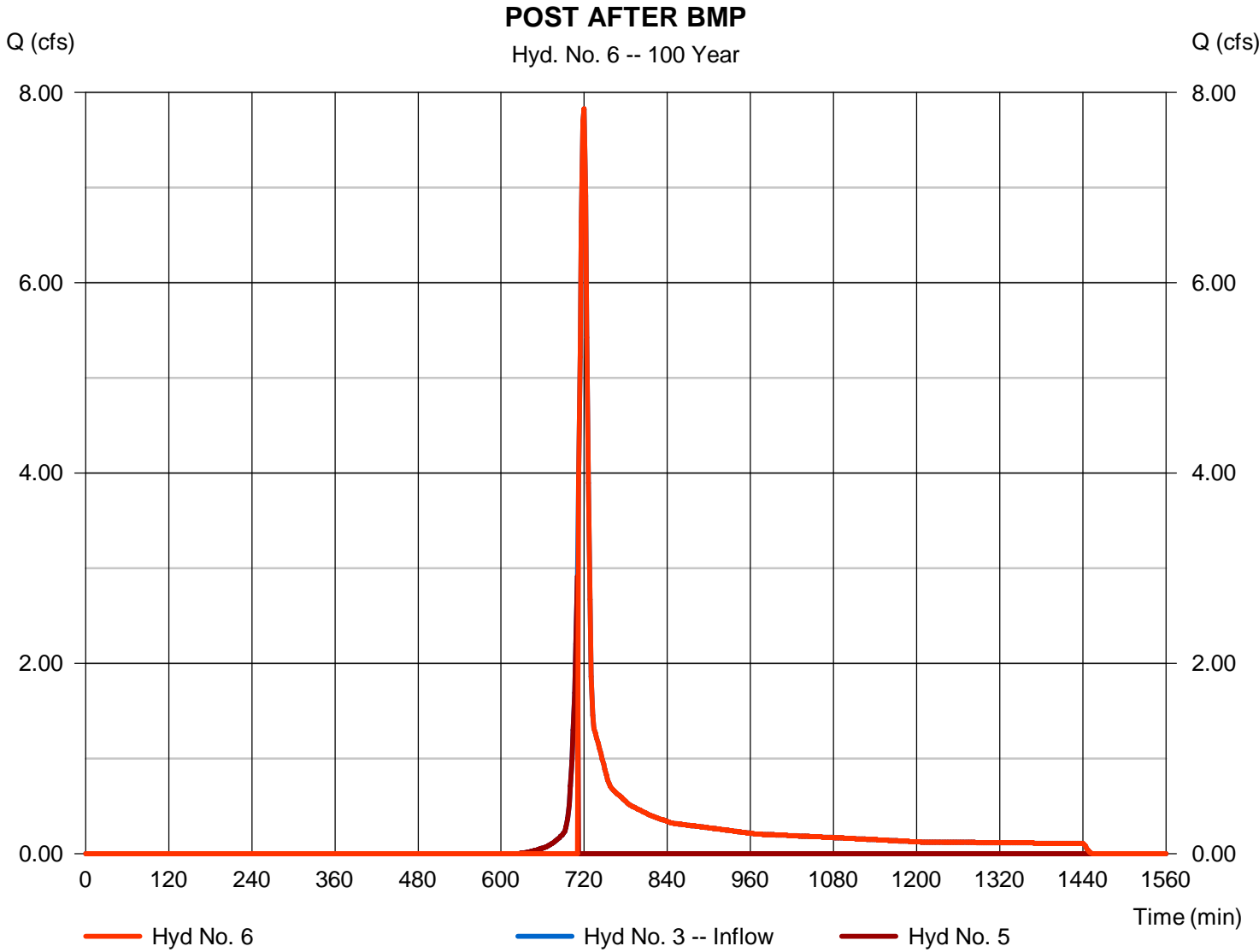
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 7.828 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 16,355 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

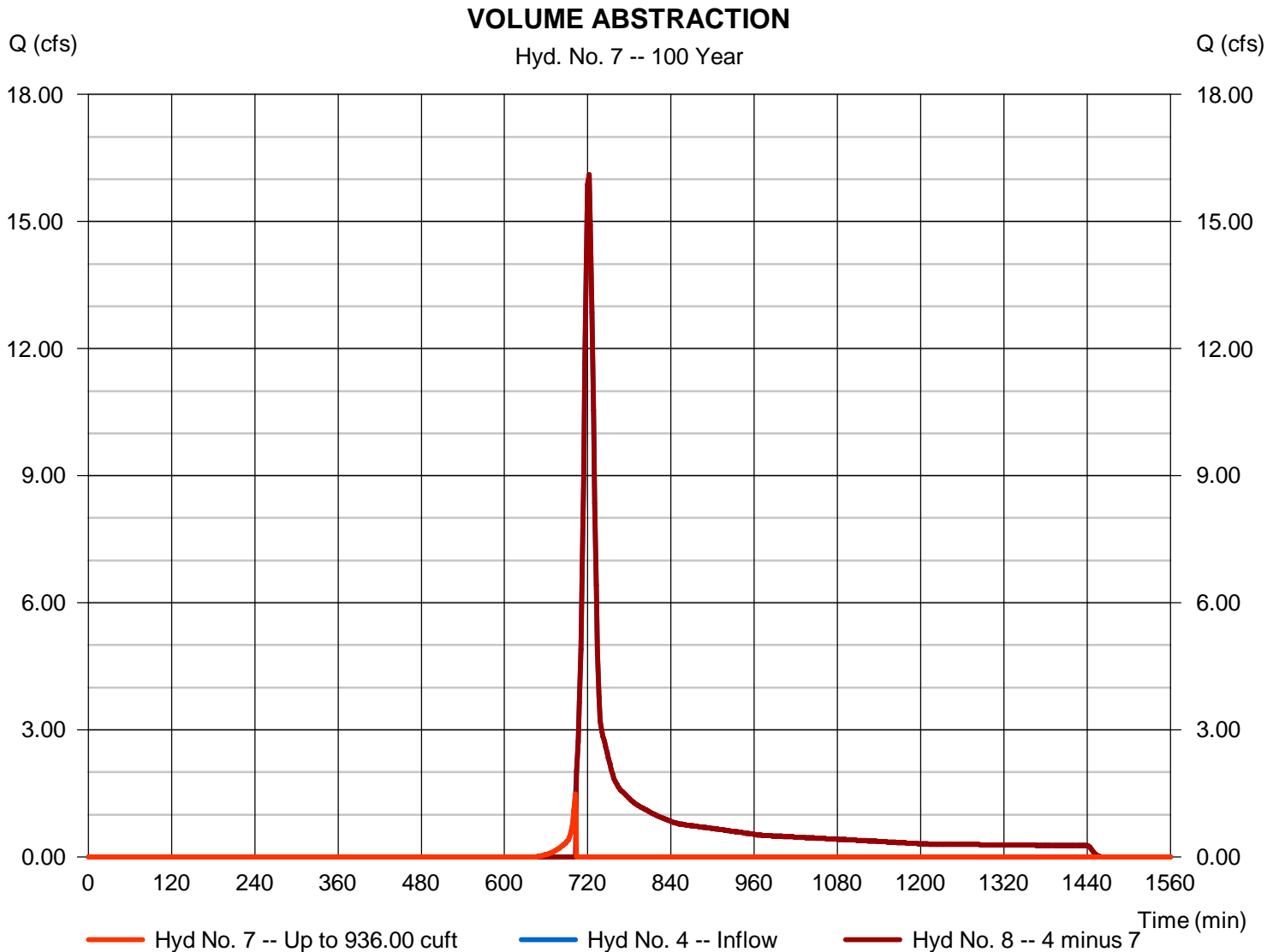
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.491 cfs
Storm frequency	= 100 yrs	Time to peak	= 702 min
Time interval	= 2 min	Hyd. volume	= 942 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

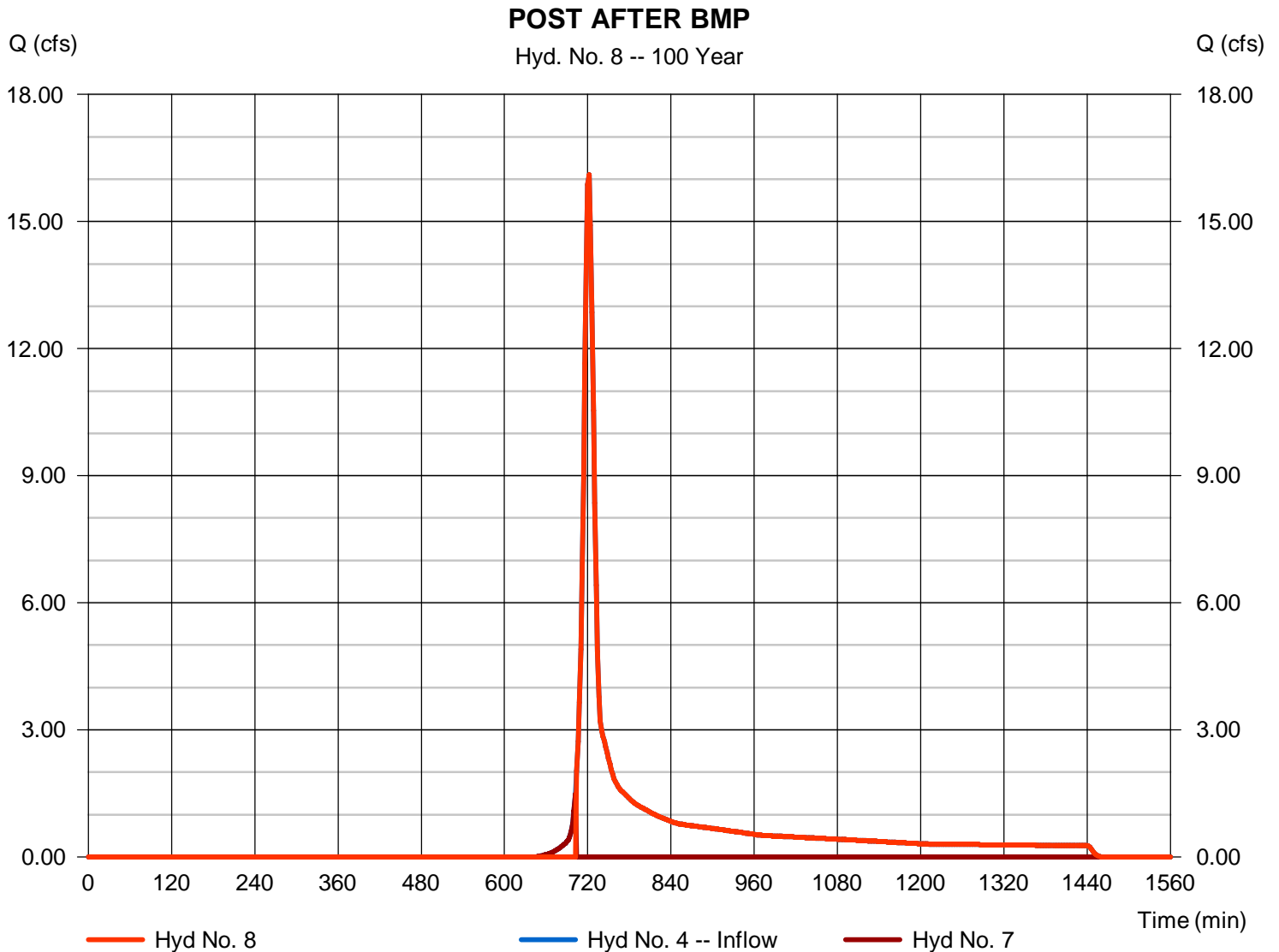
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 16.10 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 41,918 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

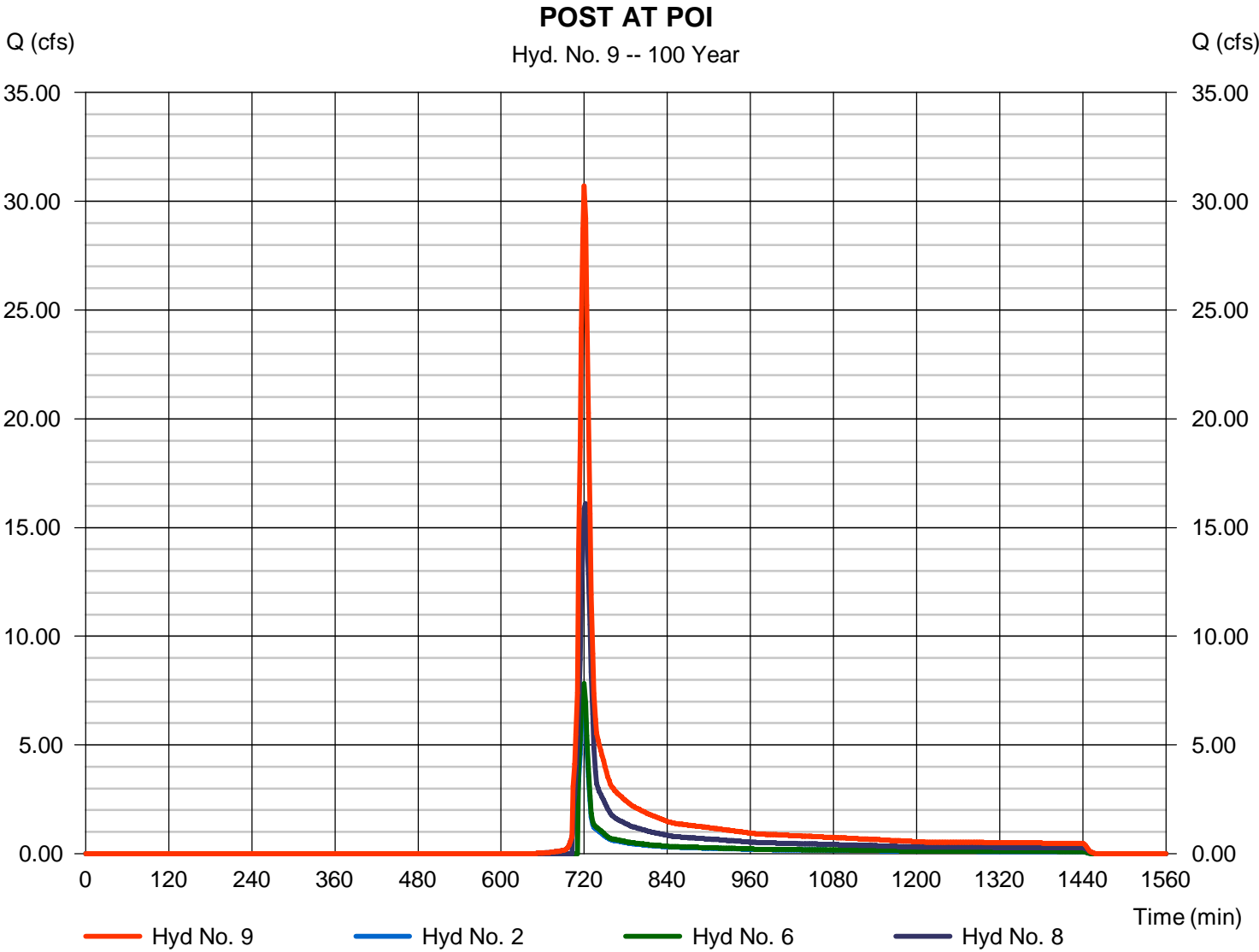
Tuesday, 11 / 1 / 2016

Hyd. No. 9

POST AT POI

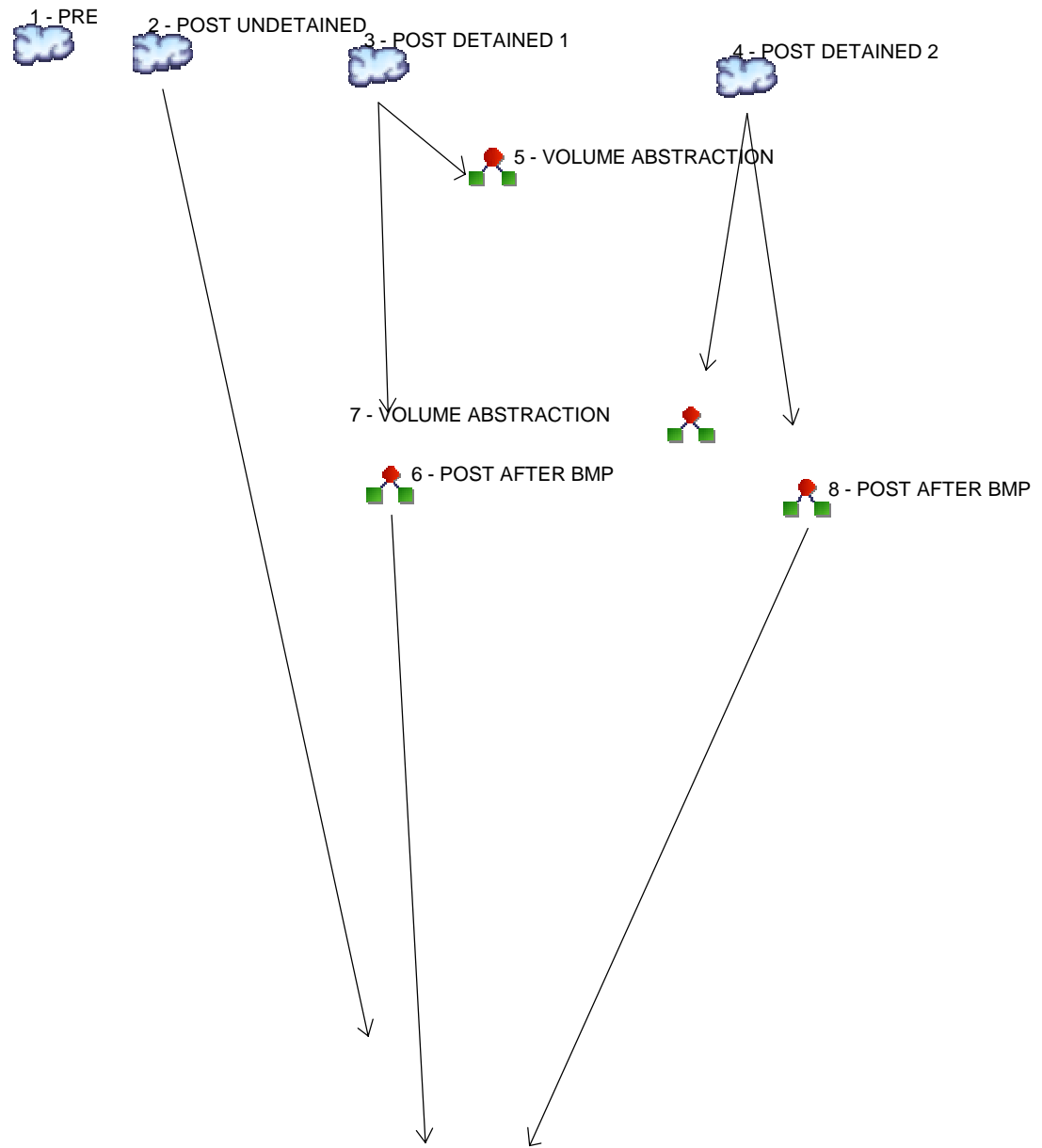
Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 30.70 cfs
Time to peak = 720 min
Hyd. volume = 74,446 cuft
Contrib. drain. area = 1.790 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED 1
4	SCS Runoff	POST DETAINED 2
5	Diversion1	VOLUME ABSTRACTION
6	Diversion2	POST AFTER BMP
7	Diversion1	VOLUME ABSTRACTION
8	Diversion2	POST AFTER BMP
9	Combine	POST AT POI



Hydrograph Return Period Recap

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	1.490	-----	-----	-----	-----	-----	-----	PRE
2	SCS Runoff	-----	-----	0.413	-----	-----	-----	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	-----	-----	0.217	-----	-----	-----	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	-----	-----	0.512	-----	-----	-----	-----	-----	-----	POST DETAINED 2
5	Diversion1	3	-----	0.217	-----	-----	-----	-----	-----	-----	VOLUME ABSTRACTION
6	Diversion2	3	-----	0.041	-----	-----	-----	-----	-----	-----	POST AFTER BMP
7	Diversion1	4	-----	0.512	-----	-----	-----	-----	-----	-----	VOLUME ABSTRACTION
8	Diversion2	4	-----	0.364	-----	-----	-----	-----	-----	-----	POST AFTER BMP
9	Combine	2, 6, 8	-----	0.454	-----	-----	-----	-----	-----	-----	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.490	2	722	7,671	-----	-----	-----	PRE
2	SCS Runoff	0.413	2	722	1,855	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	0.217	2	754	2,323	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	0.512	2	738	4,766	-----	-----	-----	POST DETAINED 2
5	Diversion1	0.217	2	754	1,490	3	-----	-----	VOLUME ABSTRACTION
6	Diversion2	0.041	2	1000	833	3	-----	-----	POST AFTER BMP
7	Diversion1	0.512	2	738	948	4	-----	-----	VOLUME ABSTRACTION
8	Diversion2	0.364	2	758	3,819	4	-----	-----	POST AFTER BMP
9	Combine	0.454	2	758	6,506	2, 6, 8	-----	-----	POST AT POI

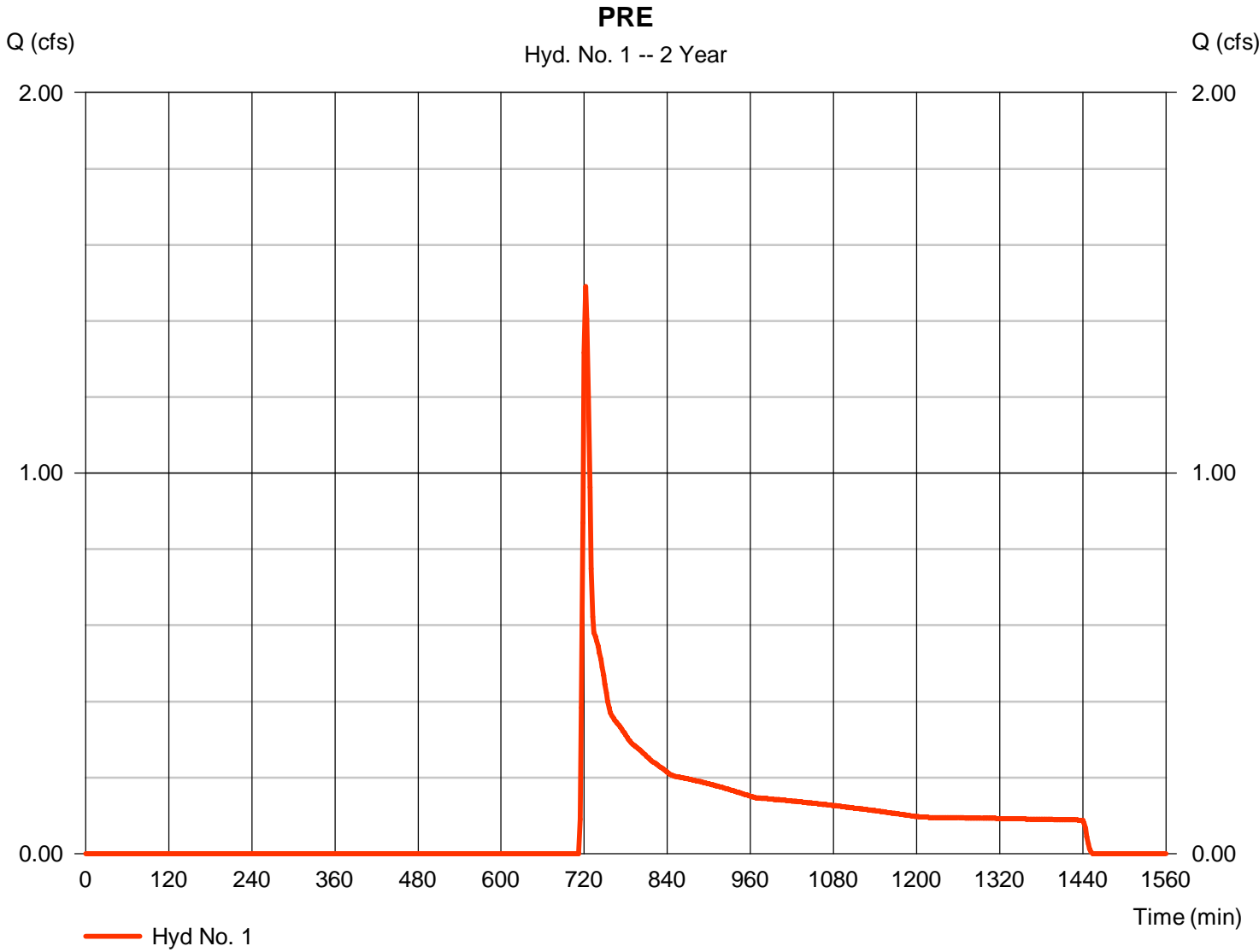
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 1.490 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 7,671 cuft
Drainage area	= 8.230 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 3.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.780 x 55) + (0.450 x 58)] / 8.230



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE

<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)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.22		0.00		0.00		
Land slope (%)	= 4.00		0.00		0.00		
Travel Time (min)	= 6.19	+	0.00	+	0.00	=	6.19
Shallow Concentrated Flow							
Flow length (ft)	= 751.00		0.00		0.00		
Watercourse slope (%)	= 10.30		0.00		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=5.18		0.00		0.00		
Travel Time (min)	= 2.42	+	0.00	+	0.00	=	2.42
Channel Flow							
X sectional flow area (sqft)	= 3.00		0.00		0.00		
Wetted perimeter (ft)	= 6.32		0.00		0.00		
Channel slope (%)	= 6.20		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=7.51		0.00		0.00		
Flow length (ft)	{{0}}71.0		0.0		0.0		
Travel Time (min)	= 0.16	+	0.00	+	0.00	=	0.16
Total Travel Time, Tc							8.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

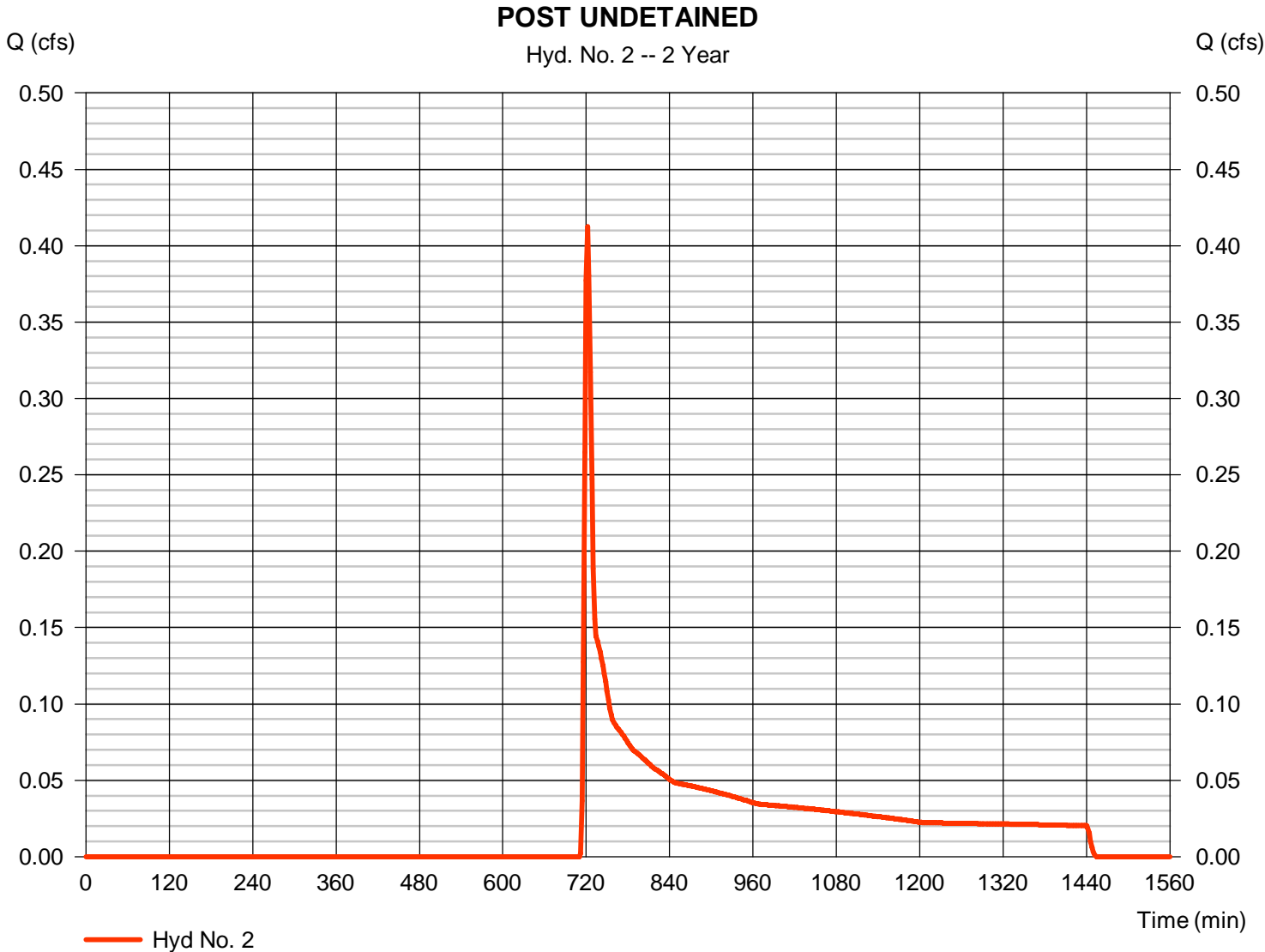
Tuesday, 11 / 1 / 2016

Hyd. No. 2

POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 0.413 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 1,855 cuft
Drainage area	= 1.790 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 3.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.430 x 58) + (1.330 x 55)] / 1.790



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDETAINED

<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)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.22		0.00		0.00		
Land slope (%)	= 4.00		0.00		0.00		
Travel Time (min)	= 6.19	+	0.00	+	0.00	=	6.19
Shallow Concentrated Flow							
Flow length (ft)	= 751.00		0.00		0.00		
Watercourse slope (%)	= 10.30		0.00		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=5.18		0.00		0.00		
Travel Time (min)	= 2.42	+	0.00	+	0.00	=	2.42
Channel Flow							
X sectional flow area (sqft)	= 3.00		0.00		0.00		
Wetted perimeter (ft)	= 6.32		0.00		0.00		
Channel slope (%)	= 6.20		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=7.51		0.00		0.00		
Flow length (ft)	{{0}}71.0		0.0		0.0		
Travel Time (min)	= 0.16	+	0.00	+	0.00	=	0.16
Total Travel Time, Tc							8.80 min

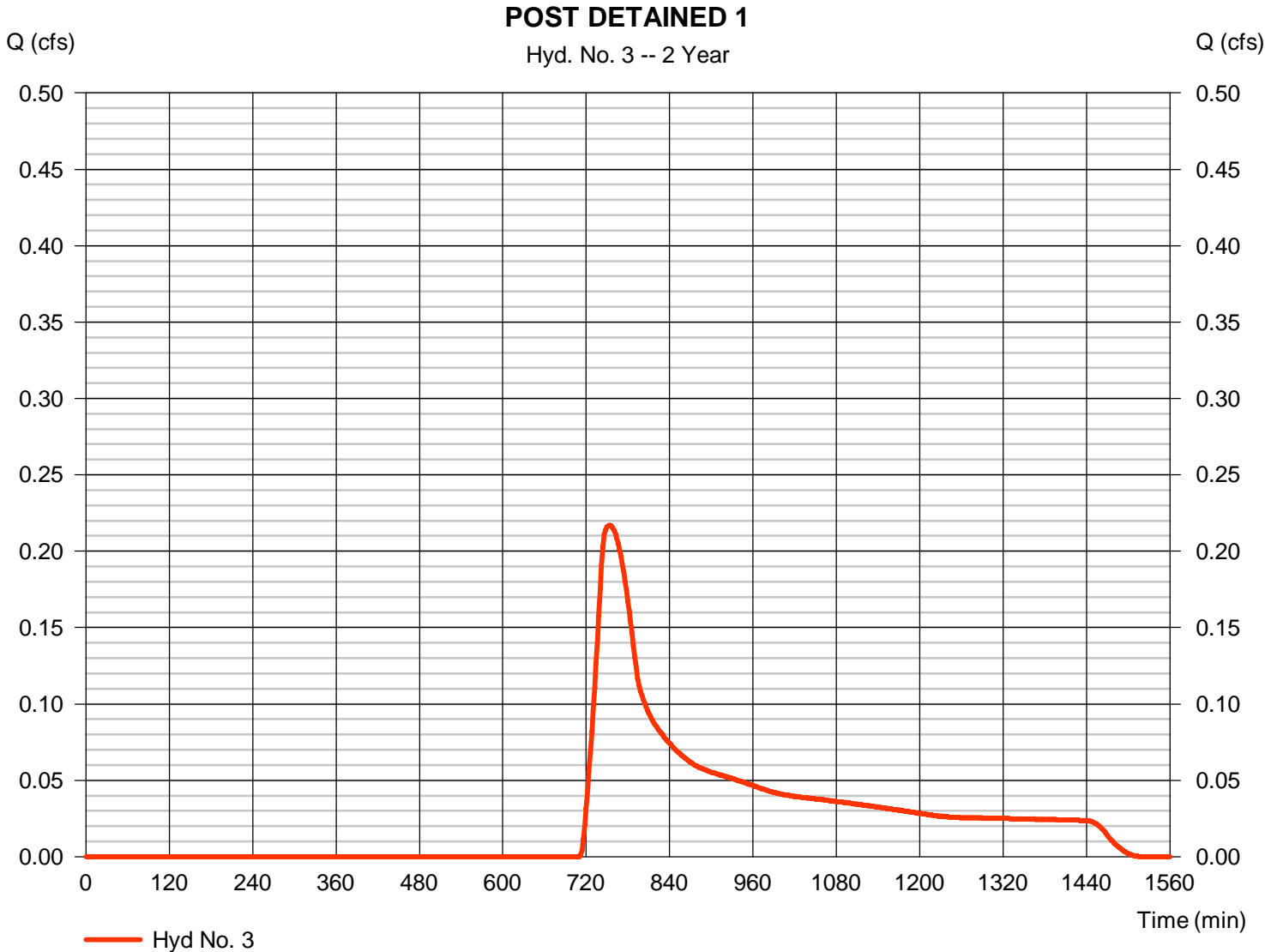
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.217 cfs
Storm frequency	= 2 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 2,323 cuft
Drainage area	= 1.840 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 48.80 min
Total precip.	= 3.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.140 x 85) + (0.460 x 58) + (1.240 x 55)] / 1.840



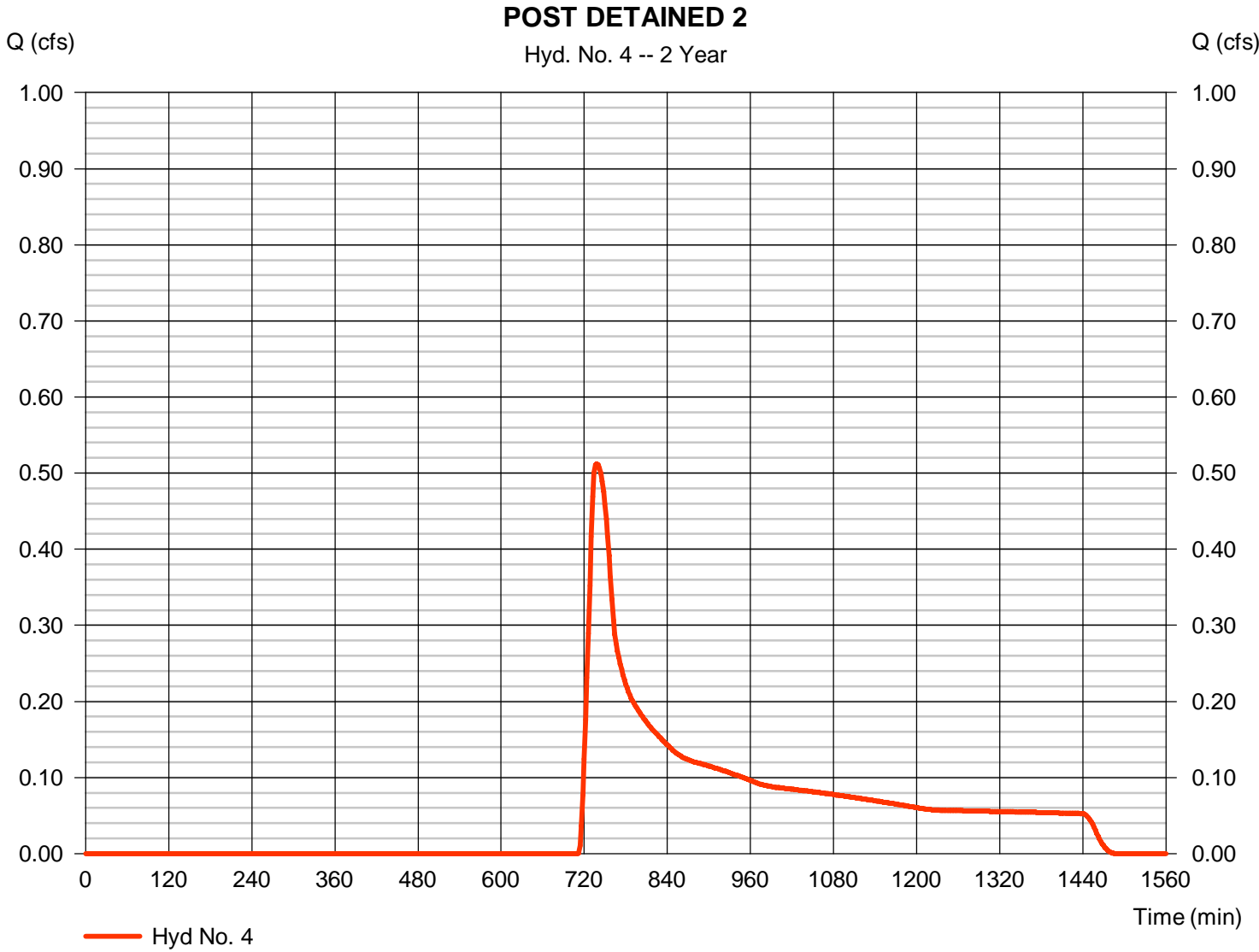
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.512 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 4,766 cuft
Drainage area	= 4.600 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.70 min
Total precip.	= 3.22 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.040 x 85) + (0.750 x 58) + (3.810 x 55)] / 4.600



Hydrograph Report

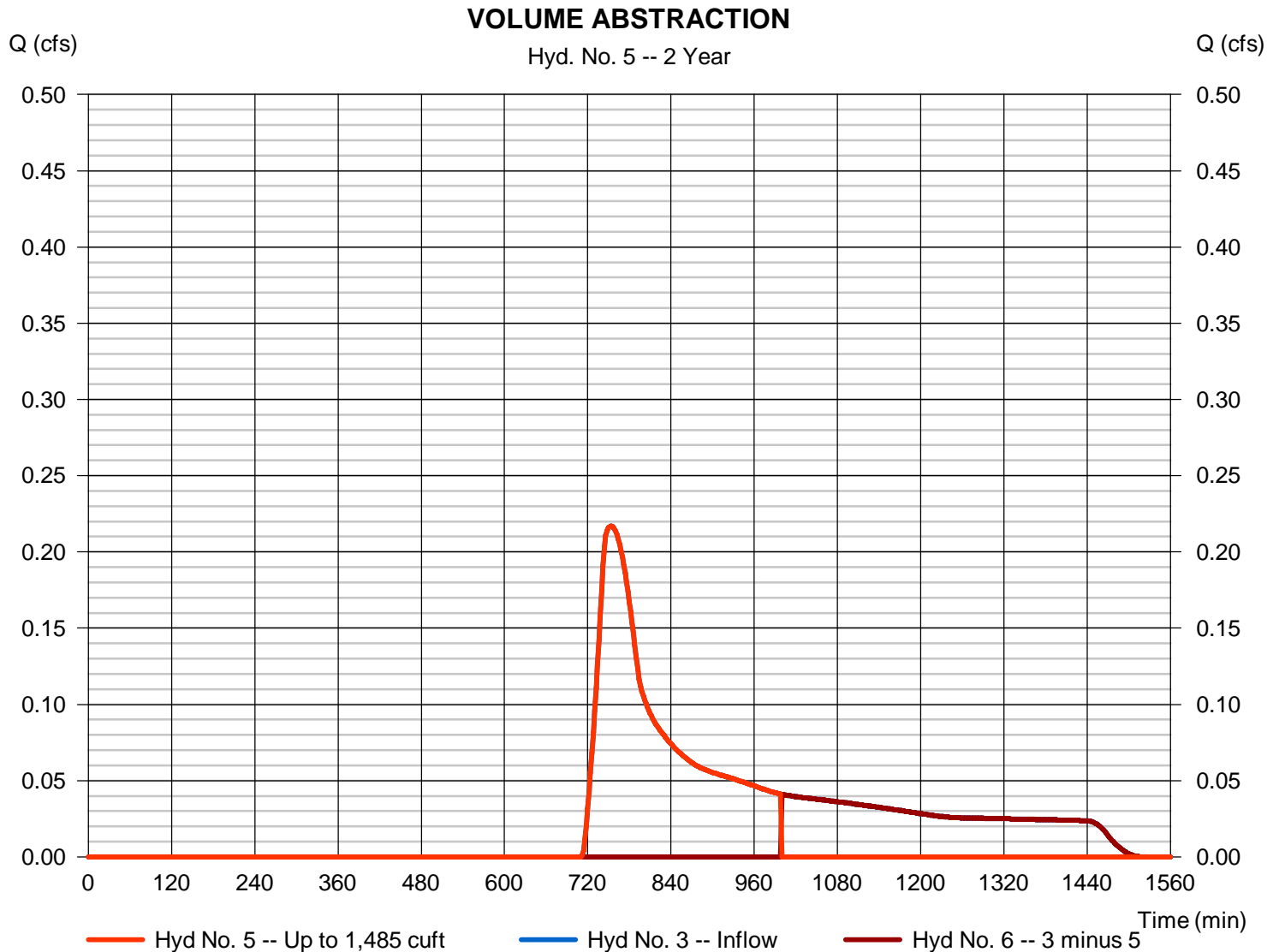
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.217 cfs
Storm frequency	= 2 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 1,490 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

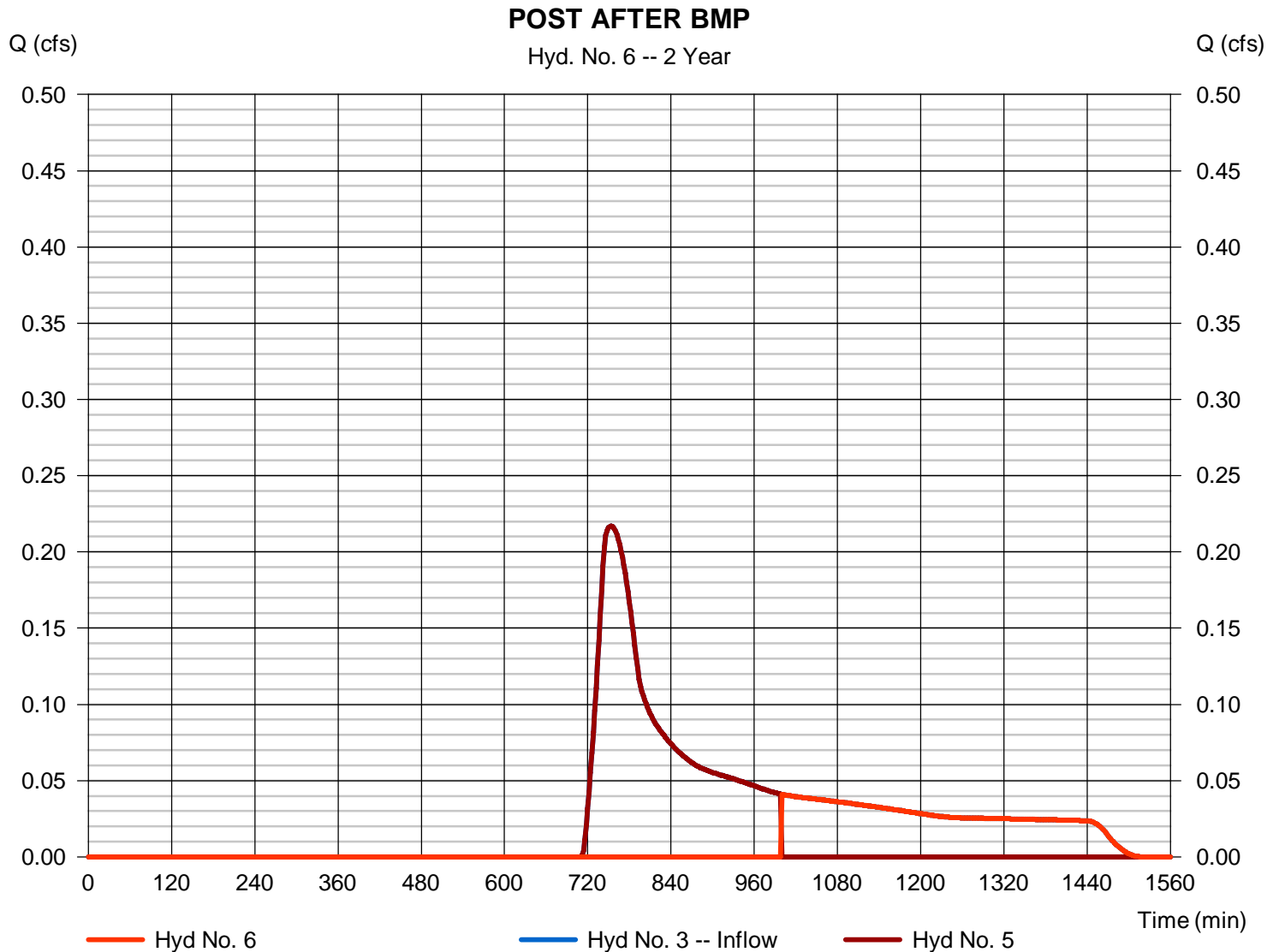
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.041 cfs
Storm frequency	= 2 yrs	Time to peak	= 1000 min
Time interval	= 2 min	Hyd. volume	= 833 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

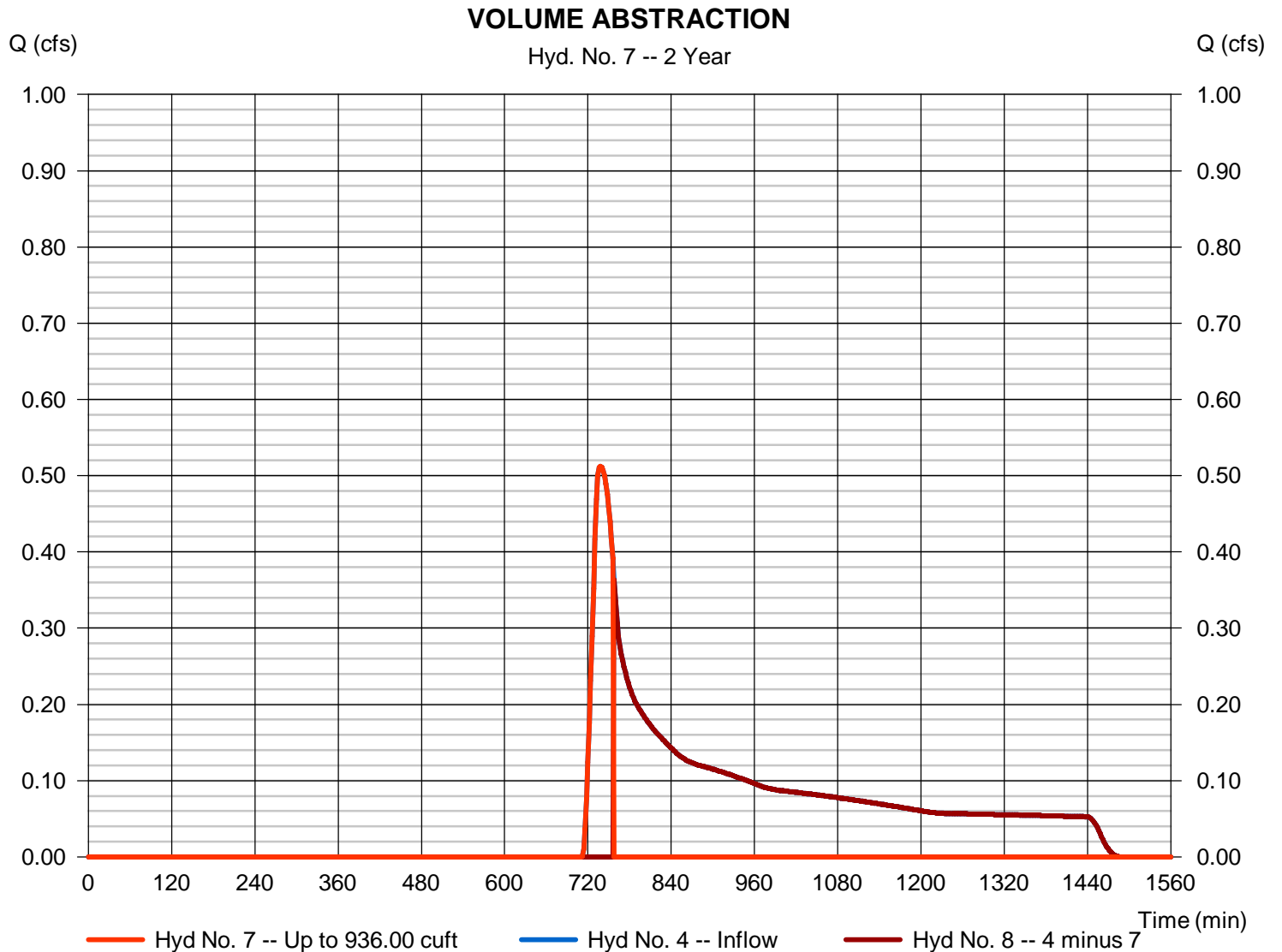
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.512 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 948 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

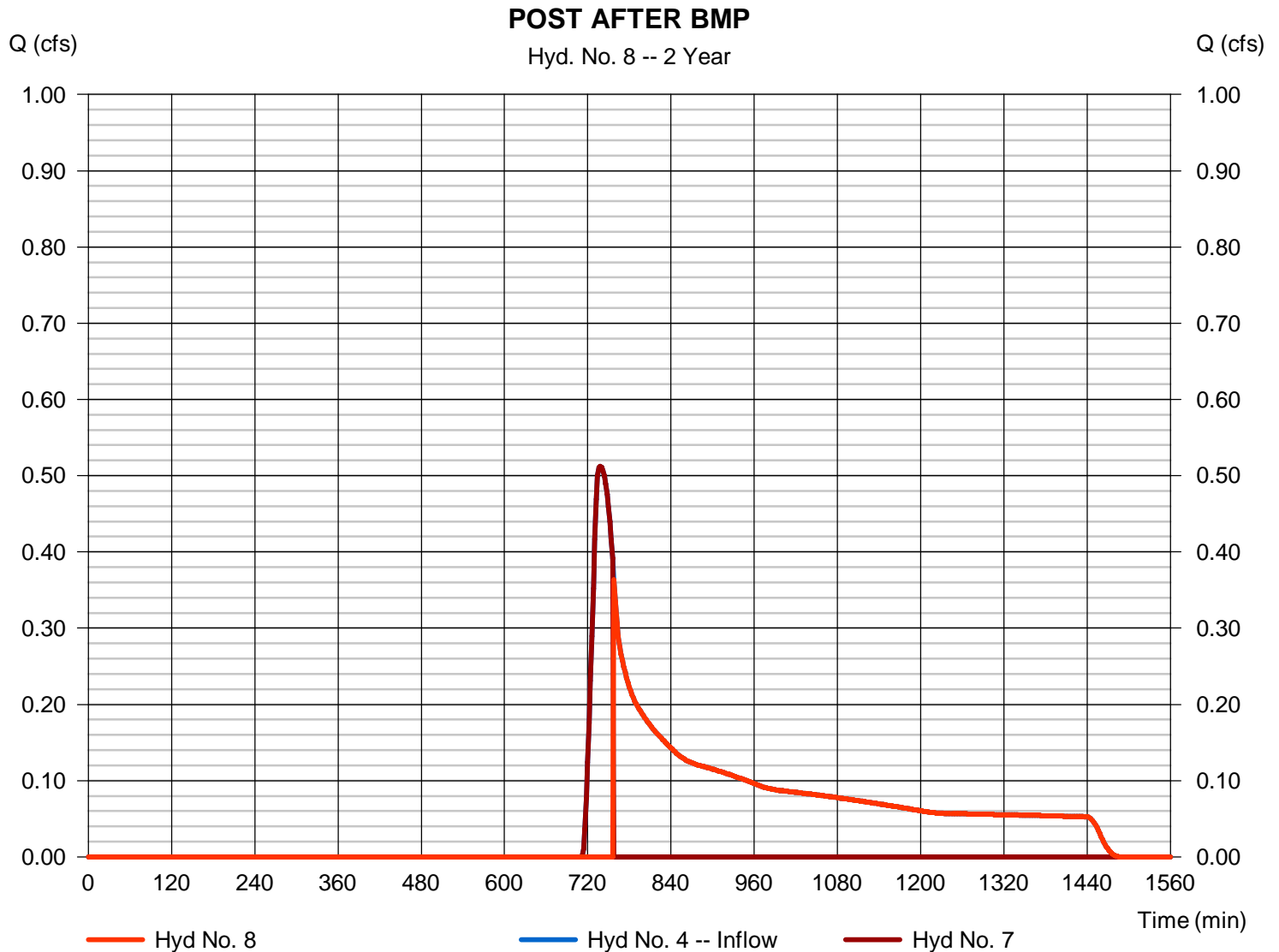
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.364 cfs
Storm frequency	= 2 yrs	Time to peak	= 758 min
Time interval	= 2 min	Hyd. volume	= 3,819 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

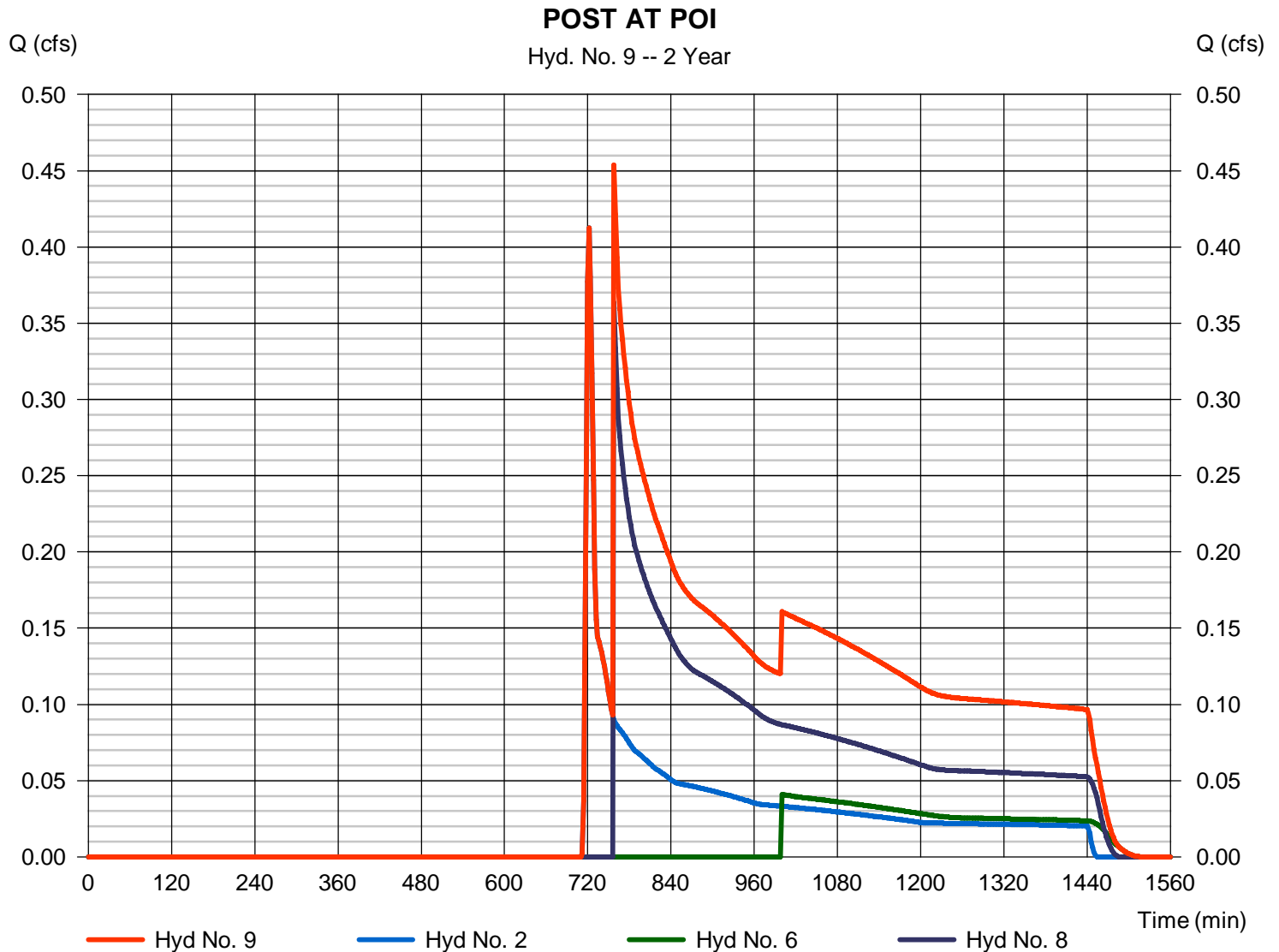
Tuesday, 11 / 1 / 2016

Hyd. No. 9

POST AT POI

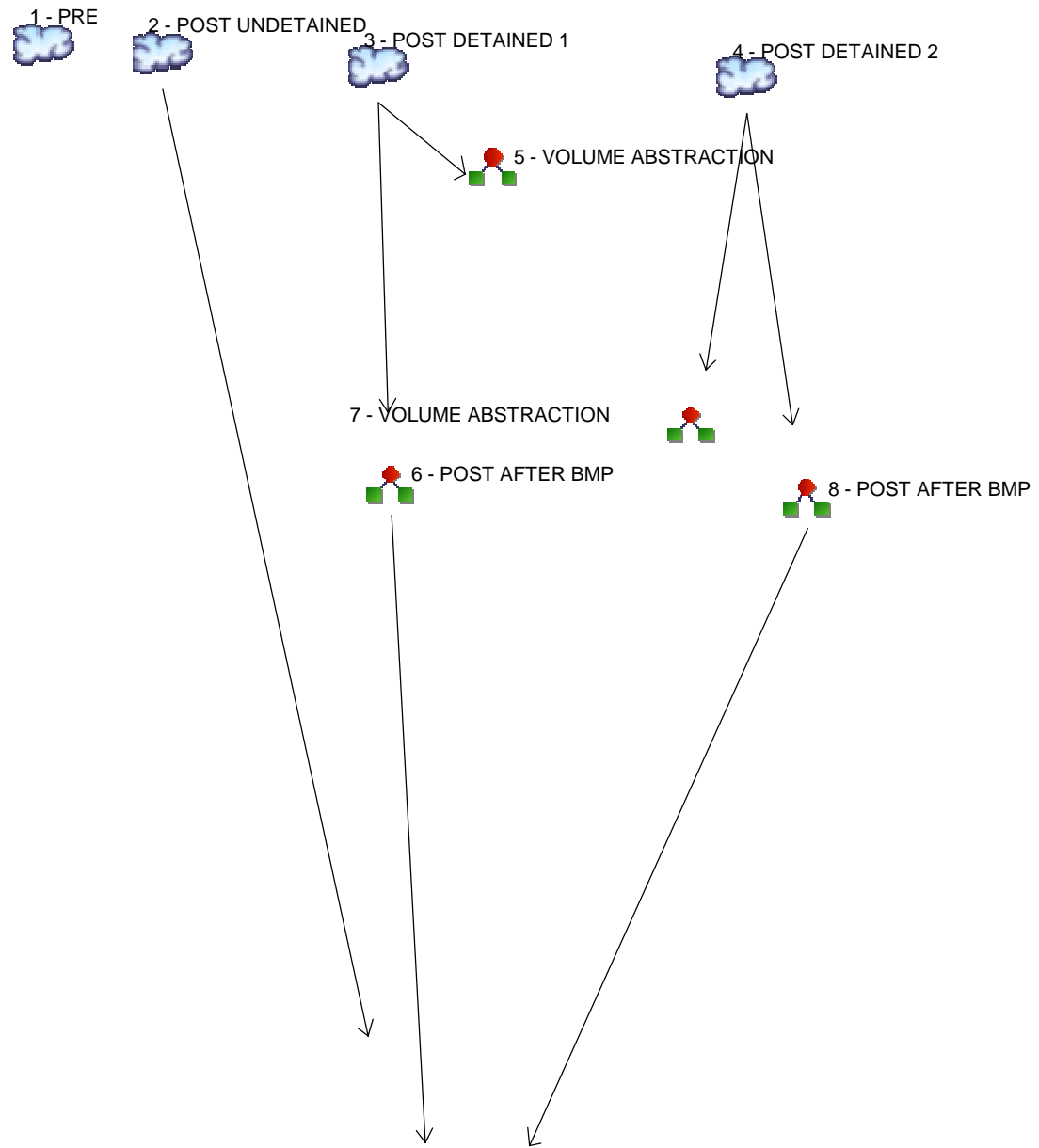
Hydrograph type = Combine
 Storm frequency = 2 yrs
 Time interval = 2 min
 Inflow hyds. = 2, 6, 8

Peak discharge = 0.454 cfs
 Time to peak = 758 min
 Hyd. volume = 6,506 cuft
 Contrib. drain. area = 1.790 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED 1
4	SCS Runoff	POST DETAINED 2
5	Diversion1	VOLUME ABSTRACTION
6	Diversion2	POST AFTER BMP
7	Diversion1	VOLUME ABSTRACTION
8	Diversion2	POST AFTER BMP
9	Combine	POST AT POI



Hydrograph Return Period Recap

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	-----	-----	-----	-----	-----	9.557	-----	-----	-----	PRE
2	SCS Runoff	-----	-----	-----	-----	-----	2.274	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	-----	-----	-----	-----	-----	1.844	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	-----	-----	-----	-----	-----	5.064	-----	-----	-----	POST DETAINED 2
5	Diversion1	3	-----	-----	-----	-----	1.844	-----	-----	-----	VOLUME ABSTRACTION
6	Diversion2	3	-----	-----	-----	-----	1.538	-----	-----	-----	POST AFTER BMP
7	Diversion1	4	-----	-----	-----	-----	3.912	-----	-----	-----	VOLUME ABSTRACTION
8	Diversion2	4	-----	-----	-----	-----	5.064	-----	-----	-----	POST AFTER BMP
9	Combine	2, 6, 8	-----	-----	-----	-----	7.173	-----	-----	-----	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	9.557	2	720	25,212	-----	-----	-----	PRE
2	SCS Runoff	2.274	2	720	5,853	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	1.844	2	726	6,801	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	5.064	2	722	15,510	-----	-----	-----	POST DETAINED 2
5	Diversion1	1.844	2	726	1,577	3	-----	-----	VOLUME ABSTRACTION
6	Diversion2	1.538	2	732	5,223	3	-----	-----	POST AFTER BMP
7	Diversion1	3.912	2	718	1,293	4	-----	-----	VOLUME ABSTRACTION
8	Diversion2	5.064	2	722	14,217	4	-----	-----	POST AFTER BMP
9	Combine	7.173	2	722	25,293	2, 6, 8	-----	-----	POST AT POI

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

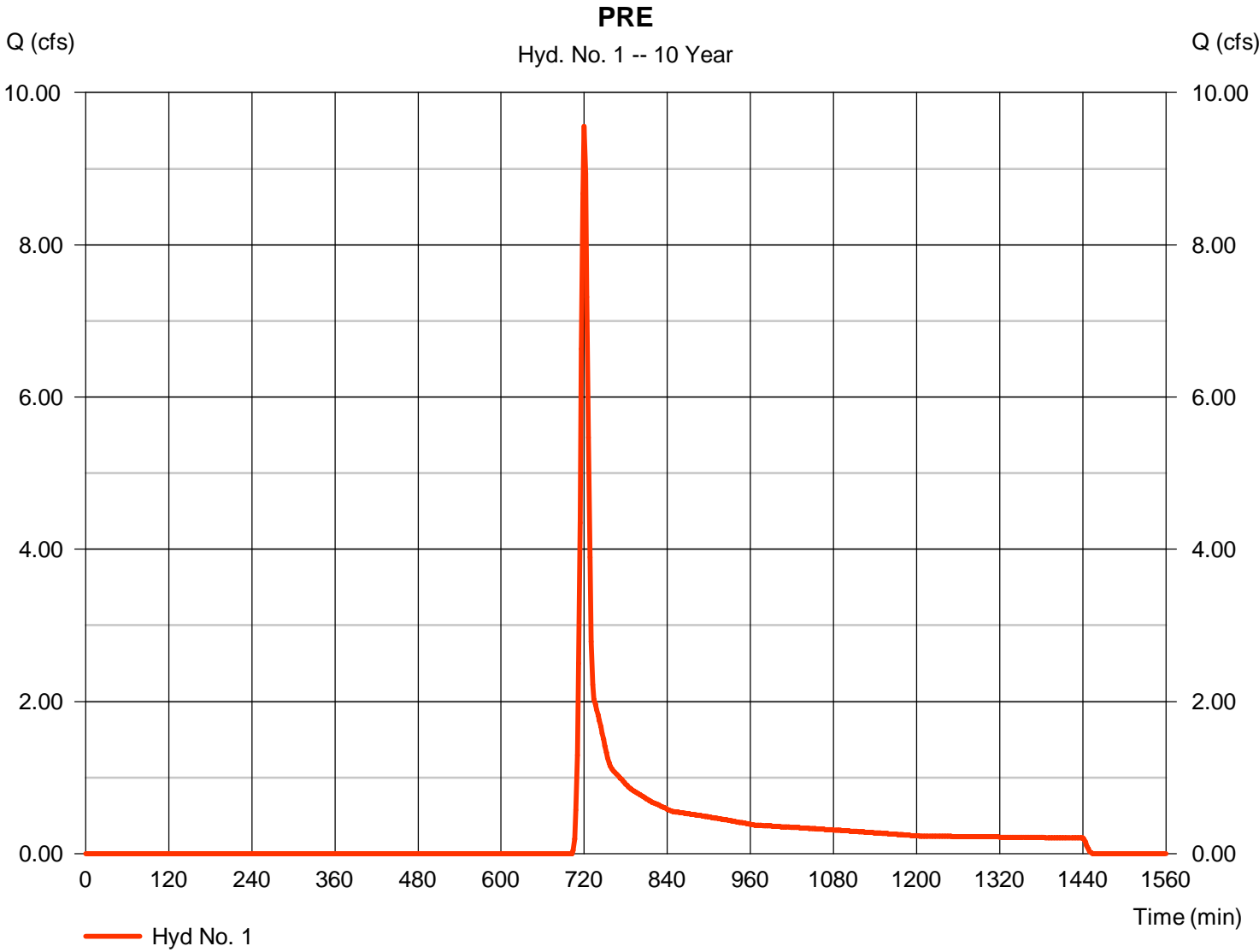
Tuesday, 11 / 1 / 2016

Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 9.557 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 25,212 cuft
Drainage area	= 8.230 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 4.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.780 x 55) + (0.450 x 58)] / 8.230



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE

<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)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.22	0.00	0.00	
Land slope (%)	= 4.00	0.00	0.00	
Travel Time (min)	= 6.19	+	0.00	+
				0.00
				= 6.19
Shallow Concentrated Flow				
Flow length (ft)	= 751.00	0.00	0.00	
Watercourse slope (%)	= 10.30	0.00	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=5.18	0.00	0.00	
Travel Time (min)	= 2.42	+	0.00	+
				0.00
				= 2.42
Channel Flow				
X sectional flow area (sqft)	= 3.00	0.00	0.00	
Wetted perimeter (ft)	= 6.32	0.00	0.00	
Channel slope (%)	= 6.20	0.00	0.00	
Manning's n-value	= 0.030	0.015	0.015	
Velocity (ft/s)	=7.51	0.00		
				0.00
				0.00
Flow length (ft)	71.0	0.0	0.0	
Travel Time (min)	= 0.16	+	0.00	+
				0.00
				= 0.16
Total Travel Time, Tc				8.80 min

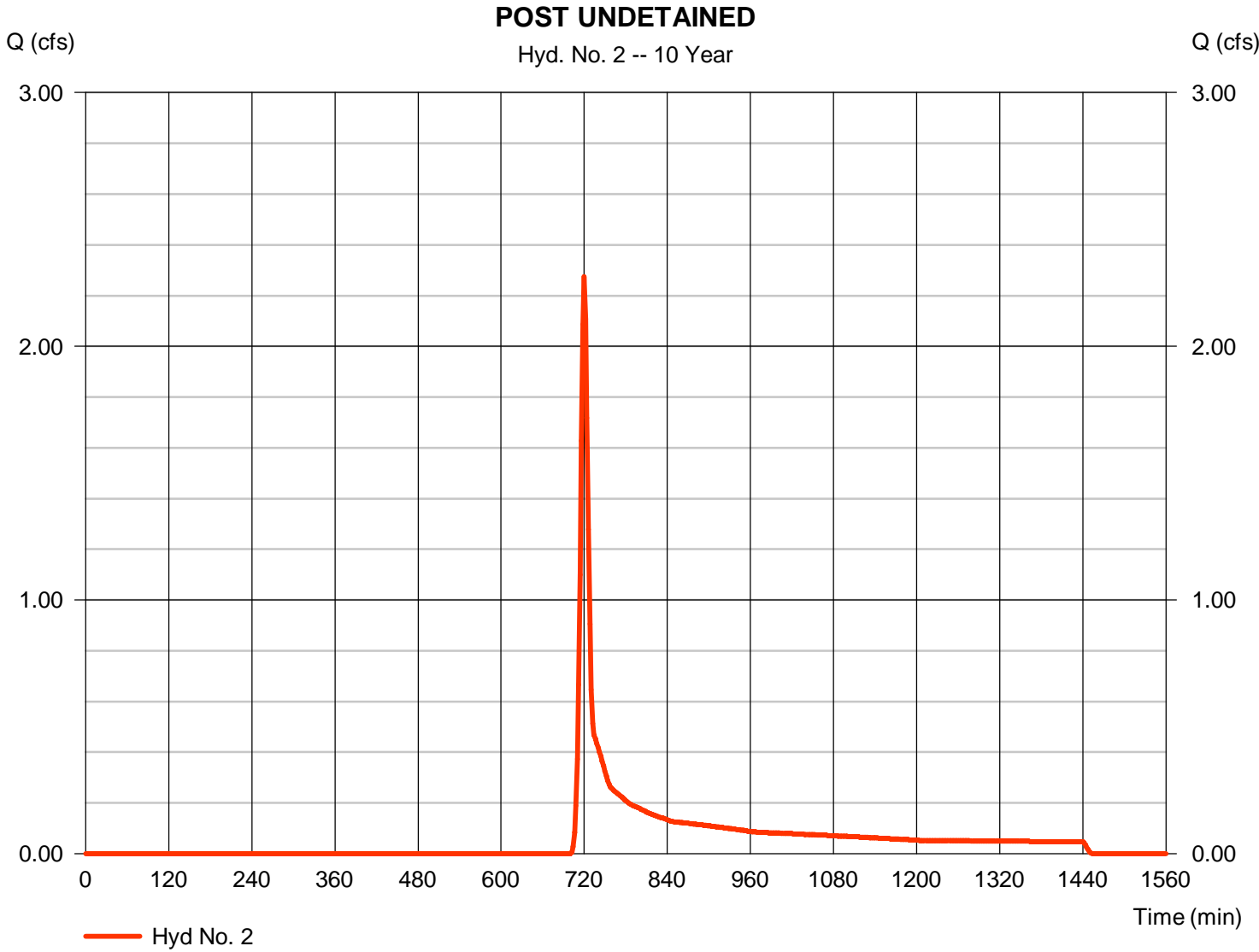
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 2.274 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 5,853 cuft
Drainage area	= 1.790 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 4.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.030 \times 85) + (0.430 \times 58) + (1.330 \times 55)] / 1.790$



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDETAINED

<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)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.22	0.00	0.00	
Land slope (%)	= 4.00	0.00	0.00	
Travel Time (min)	= 6.19	+	0.00	+
			0.00	= 6.19
Shallow Concentrated Flow				
Flow length (ft)	= 751.00	0.00	0.00	
Watercourse slope (%)	= 10.30	0.00	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=5.18	0.00	0.00	
Travel Time (min)	= 2.42	+	0.00	+
			0.00	= 2.42
Channel Flow				
X sectional flow area (sqft)	= 3.00	0.00	0.00	
Wetted perimeter (ft)	= 6.32	0.00	0.00	
Channel slope (%)	= 6.20	0.00	0.00	
Manning's n-value	= 0.030	0.015	0.015	
Velocity (ft/s)	=7.51	0.00		
			0.00	
			0.00	
Flow length (ft)	71.0	0.0	0.0	
Travel Time (min)	= 0.16	+	0.00	+
			0.00	= 0.16
Total Travel Time, Tc				8.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

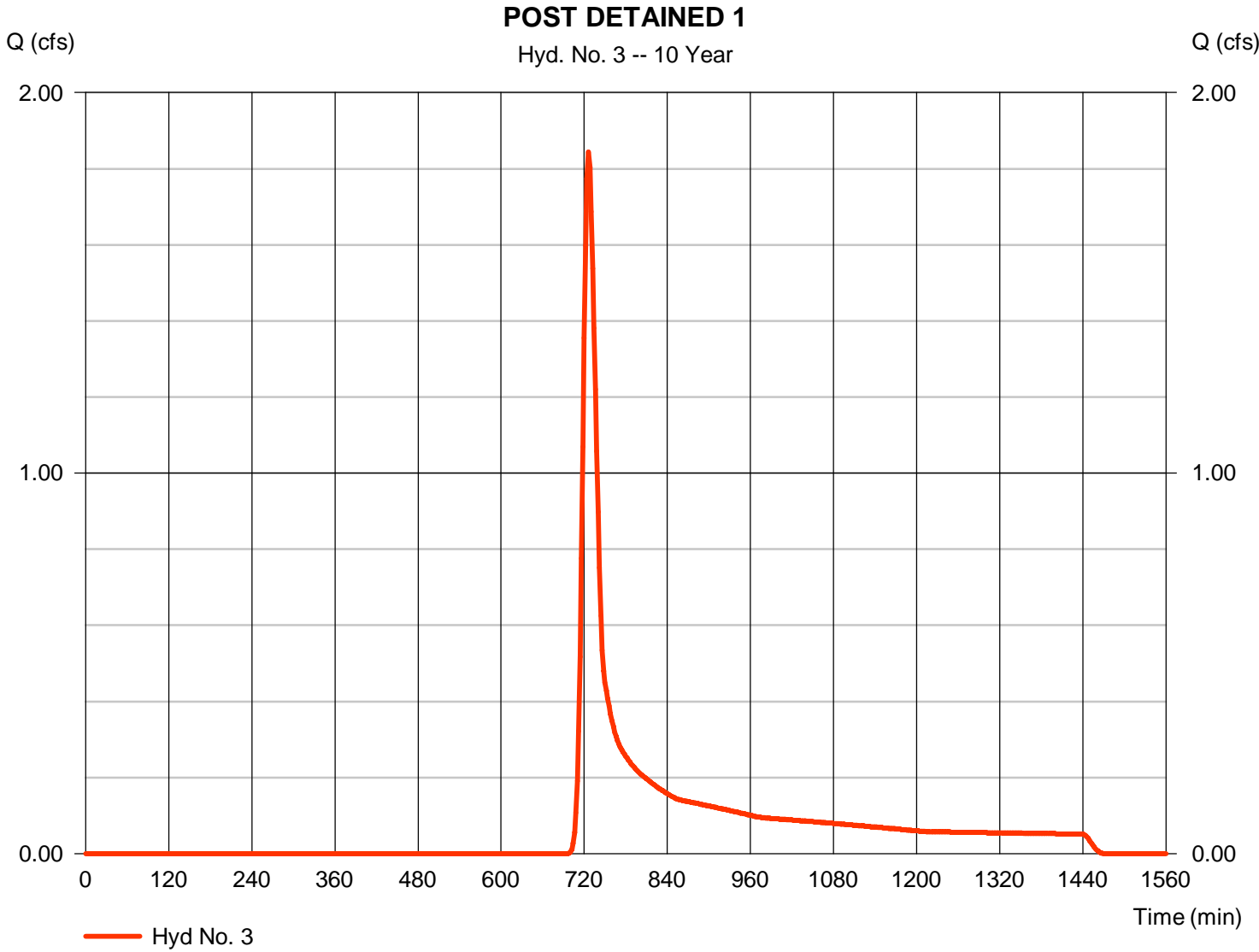
Tuesday, 11 / 1 / 2016

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.844 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 6,801 cuft
Drainage area	= 1.840 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 18.70 min
Total precip.	= 4.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.140 x 85) + (0.460 x 58) + (1.240 x 55)] / 1.840



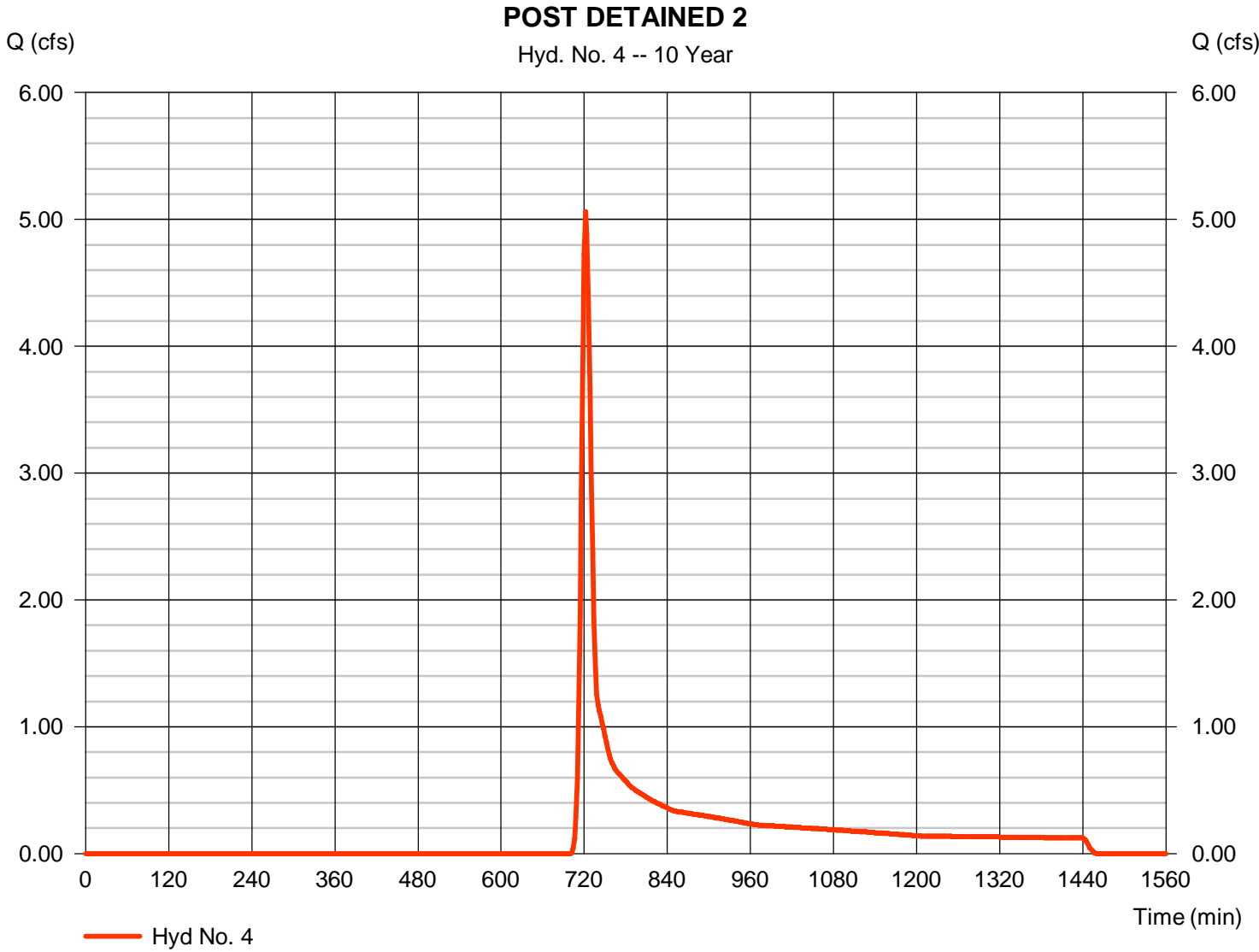
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 5.064 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 15,510 cuft
Drainage area	= 4.600 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.10 min
Total precip.	= 4.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.040 x 85) + (0.750 x 58) + (3.810 x 55)] / 4.600



Hydrograph Report

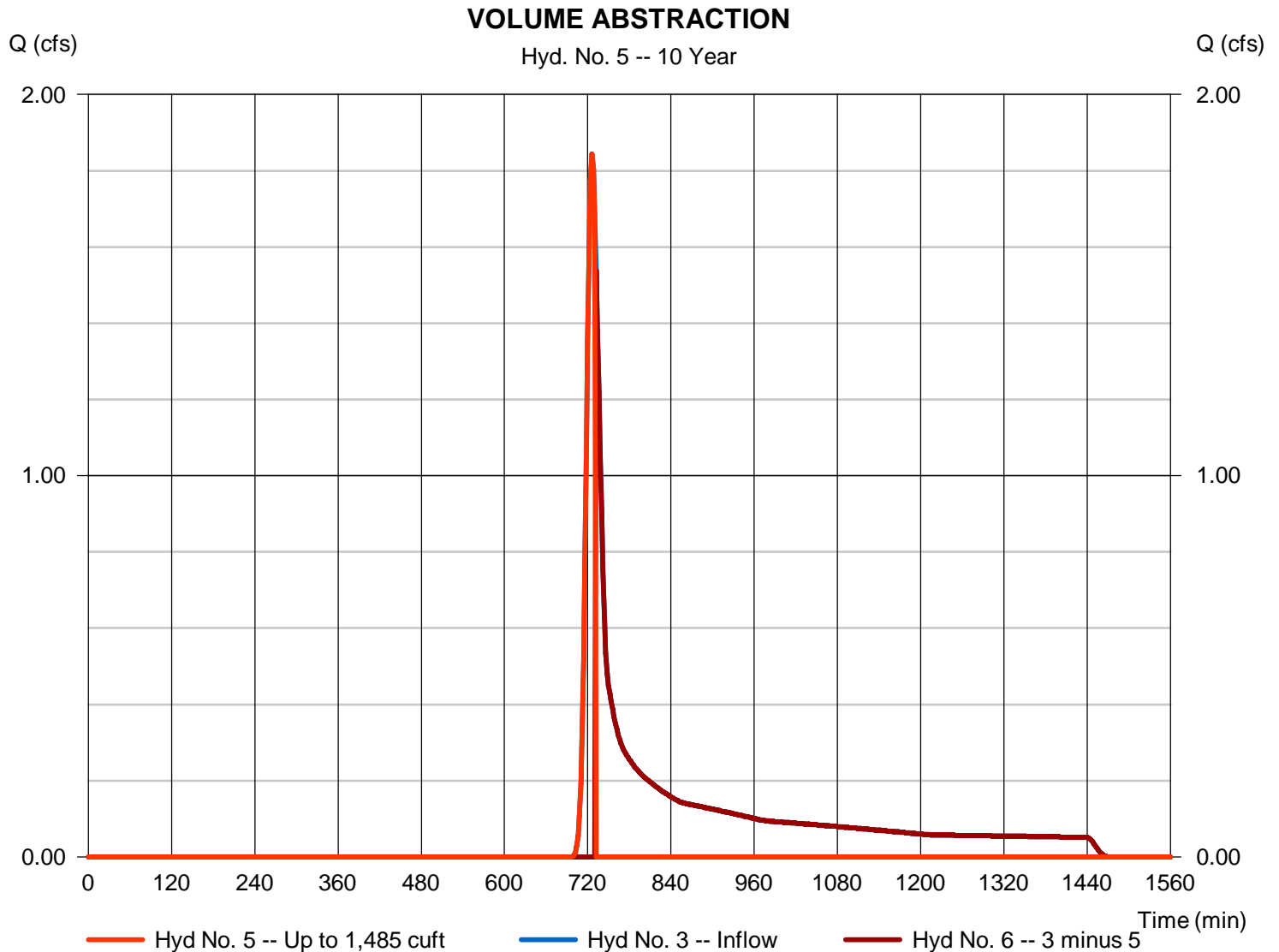
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.844 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 1,577 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

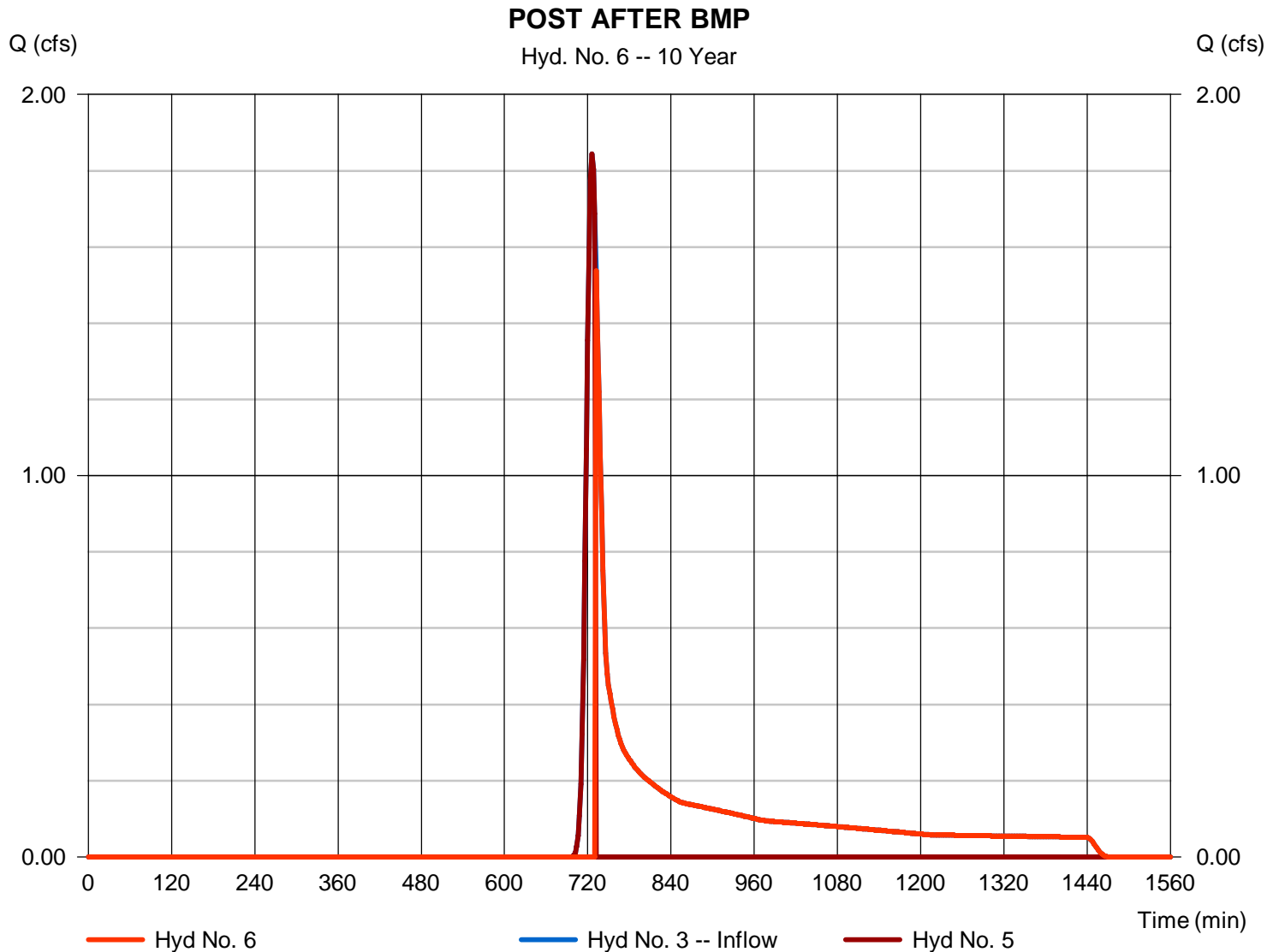
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 1.538 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 5,223 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

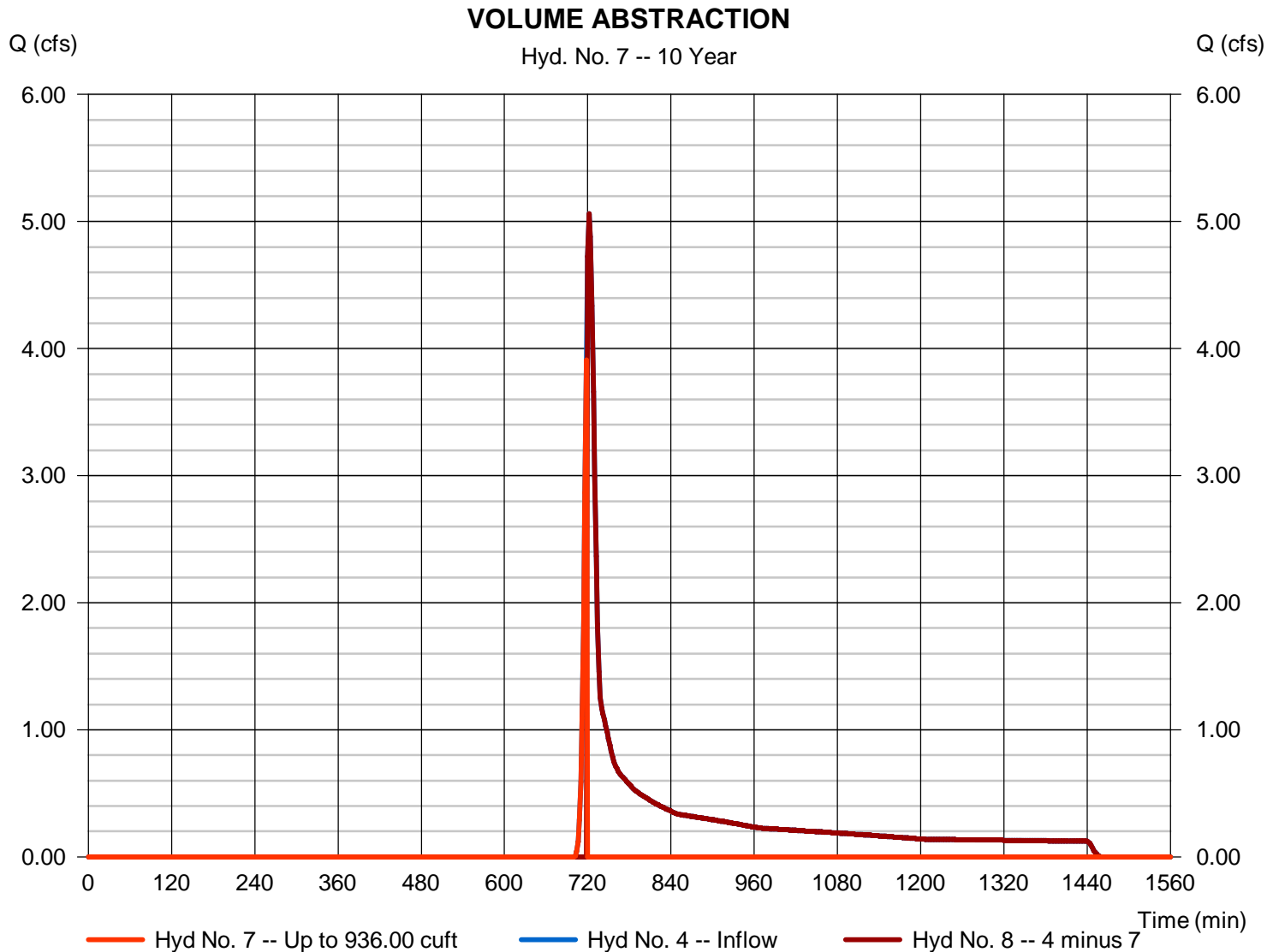
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 3.912 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,293 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

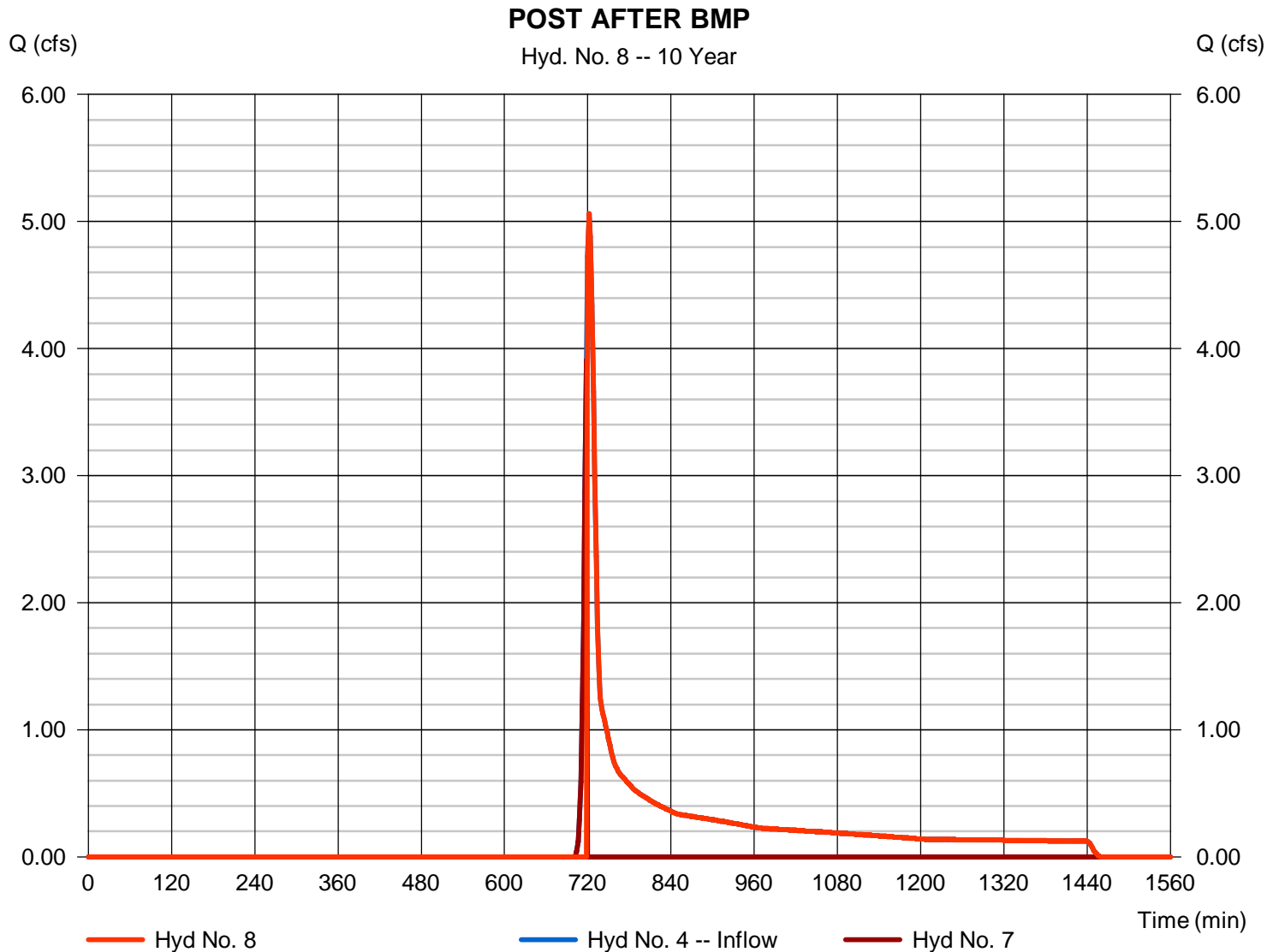
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 5.064 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 14,217 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

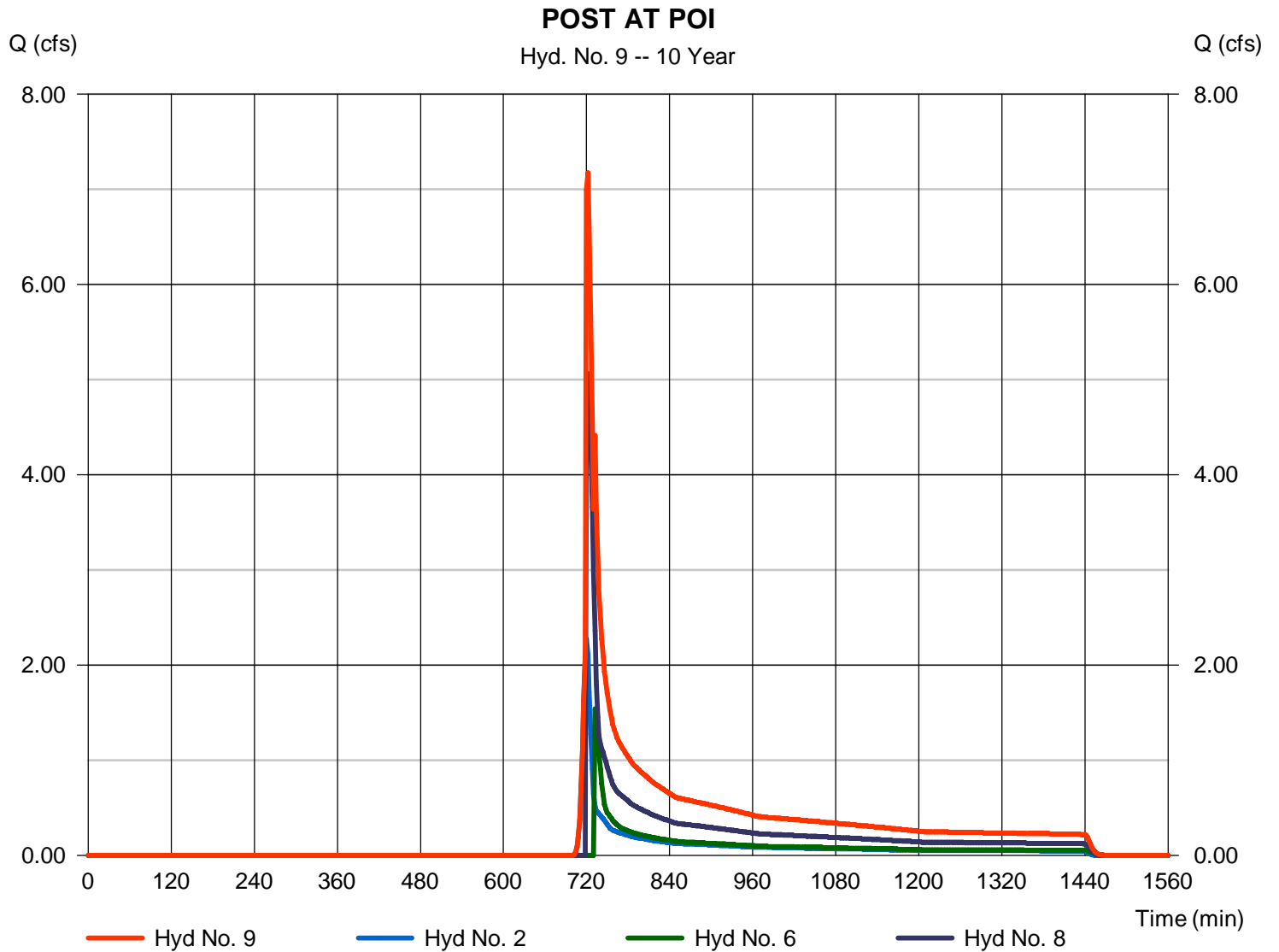
Tuesday, 11 / 1 / 2016

Hyd. No. 9

POST AT POI

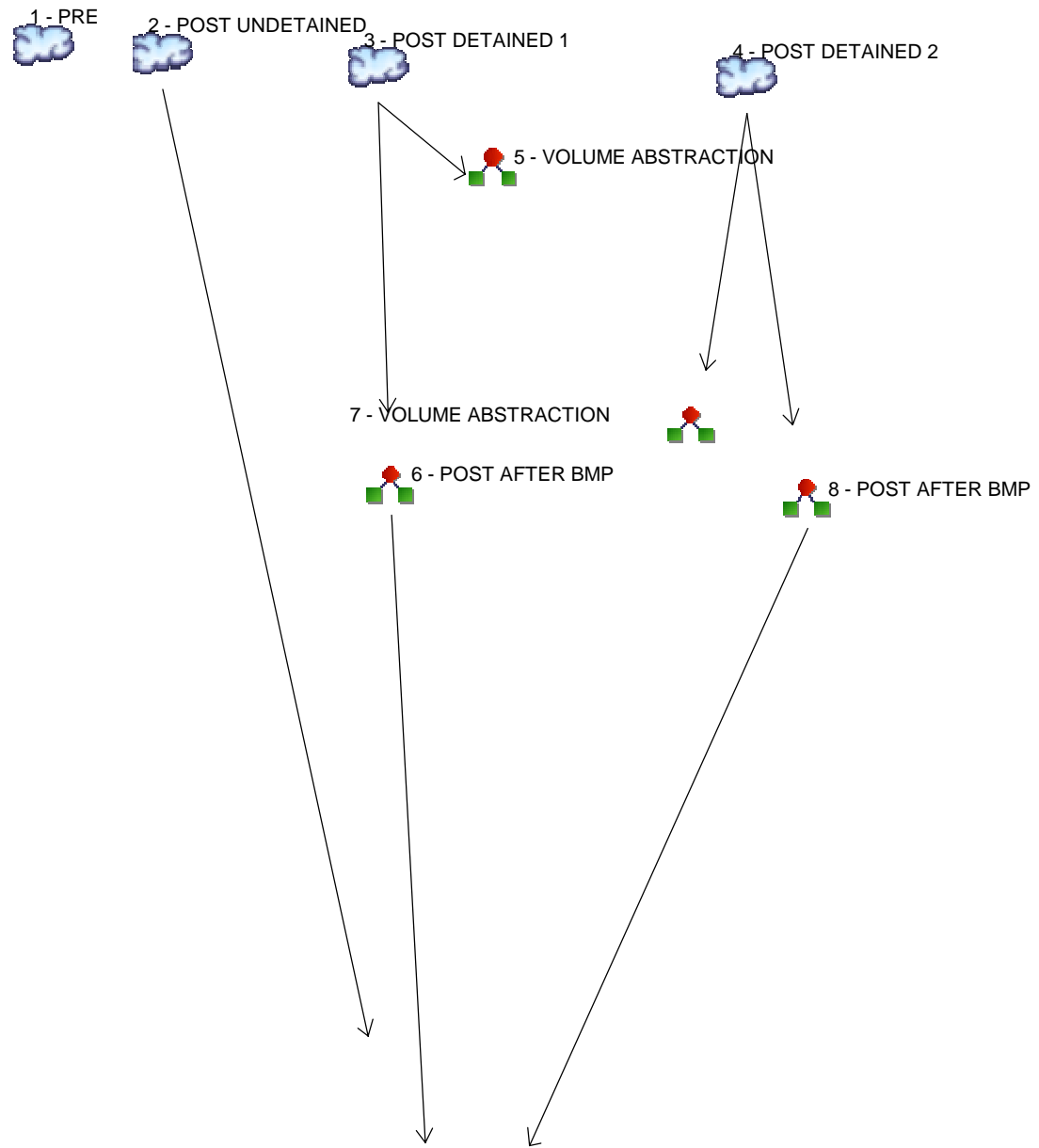
Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 7.173 cfs
Time to peak = 722 min
Hyd. volume = 25,293 cuft
Contrib. drain. area = 1.790 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED 1
4	SCS Runoff	POST DETAINED 2
5	Diversion1	VOLUME ABSTRACTION
6	Diversion2	POST AFTER BMP
7	Diversion1	VOLUME ABSTRACTION
8	Diversion2	POST AFTER BMP
9	Combine	POST AT POI



Hydrograph Return Period Recap

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	-----	-----	-----	-----	-----	-----	-----	23.26	-----	PRE
2	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	5.332	-----	POST UNDETAINED
3	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	4.654	-----	POST DETAINED 1
4	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	12.18	-----	POST DETAINED 2
5	Diversion1	3	-----	-----	-----	-----	-----	-----	3.657	-----	VOLUME ABSTRACTION
6	Diversion2	3	-----	-----	-----	-----	-----	-----	4.654	-----	POST AFTER BMP
7	Diversion1	4	-----	-----	-----	-----	-----	-----	2.351	-----	VOLUME ABSTRACTION
8	Diversion2	4	-----	-----	-----	-----	-----	-----	12.18	-----	POST AFTER BMP
9	Combine	2, 6, 8	-----	-----	-----	-----	-----	-----	21.57	-----	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	23.26	2	720	54,716	-----	-----	-----	PRE
2	SCS Runoff	5.332	2	720	12,466	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	4.654	2	724	13,647	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	12.18	2	722	33,037	-----	-----	-----	POST DETAINED 2
5	Diversion1	3.657	2	718	1,841	3	-----	-----	VOLUME ABSTRACTION
6	Diversion2	4.654	2	724	11,805	3	-----	-----	POST AFTER BMP
7	Diversion1	2.351	2	708	1,002	4	-----	-----	VOLUME ABSTRACTION
8	Diversion2	12.18	2	722	32,035	4	-----	-----	POST AFTER BMP
9	Combine	21.57	2	722	56,306	2, 6, 8	-----	-----	POST AT POI

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

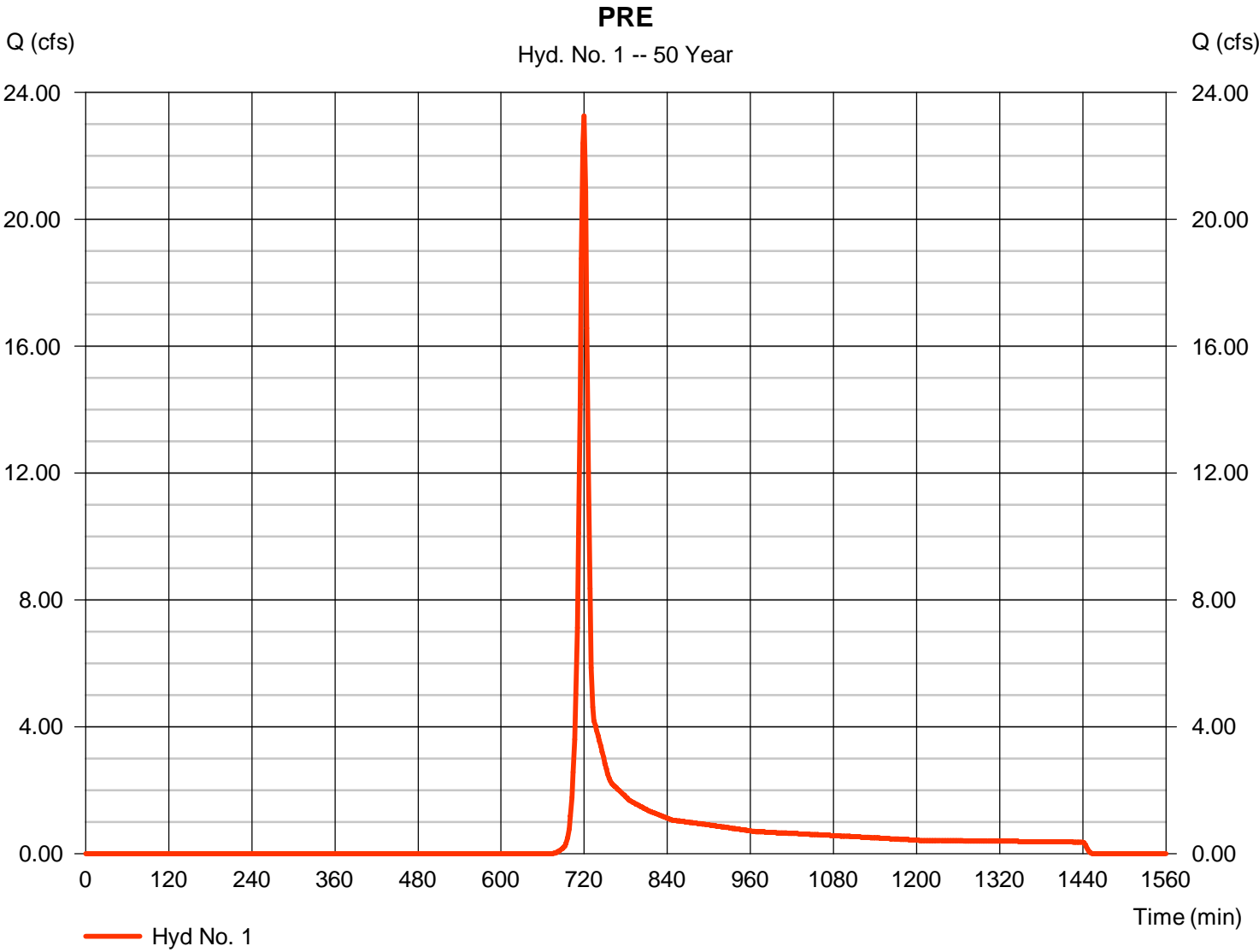
Tuesday, 11 / 1 / 2016

Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 23.26 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 54,716 cuft
Drainage area	= 8.230 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 6.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.780 x 55) + (0.450 x 58)] / 8.230



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE

<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)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.22		0.00		0.00		
Land slope (%)	= 4.00		0.00		0.00		
Travel Time (min)	= 6.19	+	0.00	+	0.00	=	6.19
Shallow Concentrated Flow							
Flow length (ft)	= 751.00		0.00		0.00		
Watercourse slope (%)	= 10.30		0.00		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=5.18		0.00		0.00		
Travel Time (min)	= 2.42	+	0.00	+	0.00	=	2.42
Channel Flow							
X sectional flow area (sqft)	= 3.00		0.00		0.00		
Wetted perimeter (ft)	= 6.32		0.00		0.00		
Channel slope (%)	= 6.20		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=7.51		0.00		0.00		
Flow length (ft)	{{0}}71.0		0.0		0.0		
Travel Time (min)	= 0.16	+	0.00	+	0.00	=	0.16
Total Travel Time, Tc							8.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

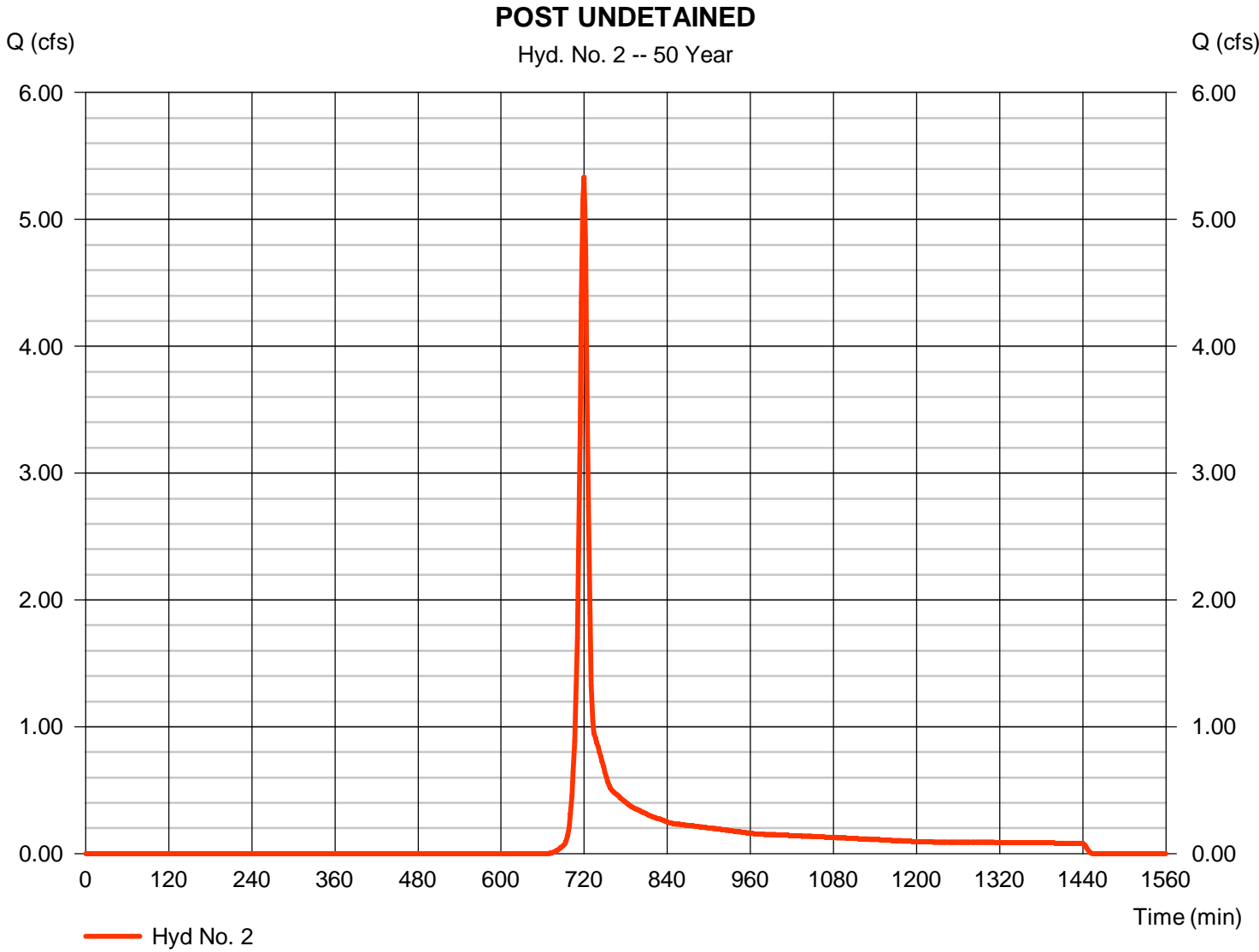
Tuesday, 11 / 1 / 2016

Hyd. No. 2

POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 5.332 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 12,466 cuft
Drainage area	= 1.790 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 6.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.430 x 58) + (1.330 x 55)] / 1.790



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDETAINED

<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)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.22		0.00		0.00		
Land slope (%)	= 4.00		0.00		0.00		
Travel Time (min)	= 6.19	+	0.00	+	0.00	=	6.19
Shallow Concentrated Flow							
Flow length (ft)	= 751.00		0.00		0.00		
Watercourse slope (%)	= 10.30		0.00		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=5.18		0.00		0.00		
Travel Time (min)	= 2.42	+	0.00	+	0.00	=	2.42
Channel Flow							
X sectional flow area (sqft)	= 3.00		0.00		0.00		
Wetted perimeter (ft)	= 6.32		0.00		0.00		
Channel slope (%)	= 6.20		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=7.51		0.00		0.00		
Flow length (ft)	{{0}}71.0		0.0		0.0		
Travel Time (min)	= 0.16	+	0.00	+	0.00	=	0.16
Total Travel Time, Tc							8.80 min

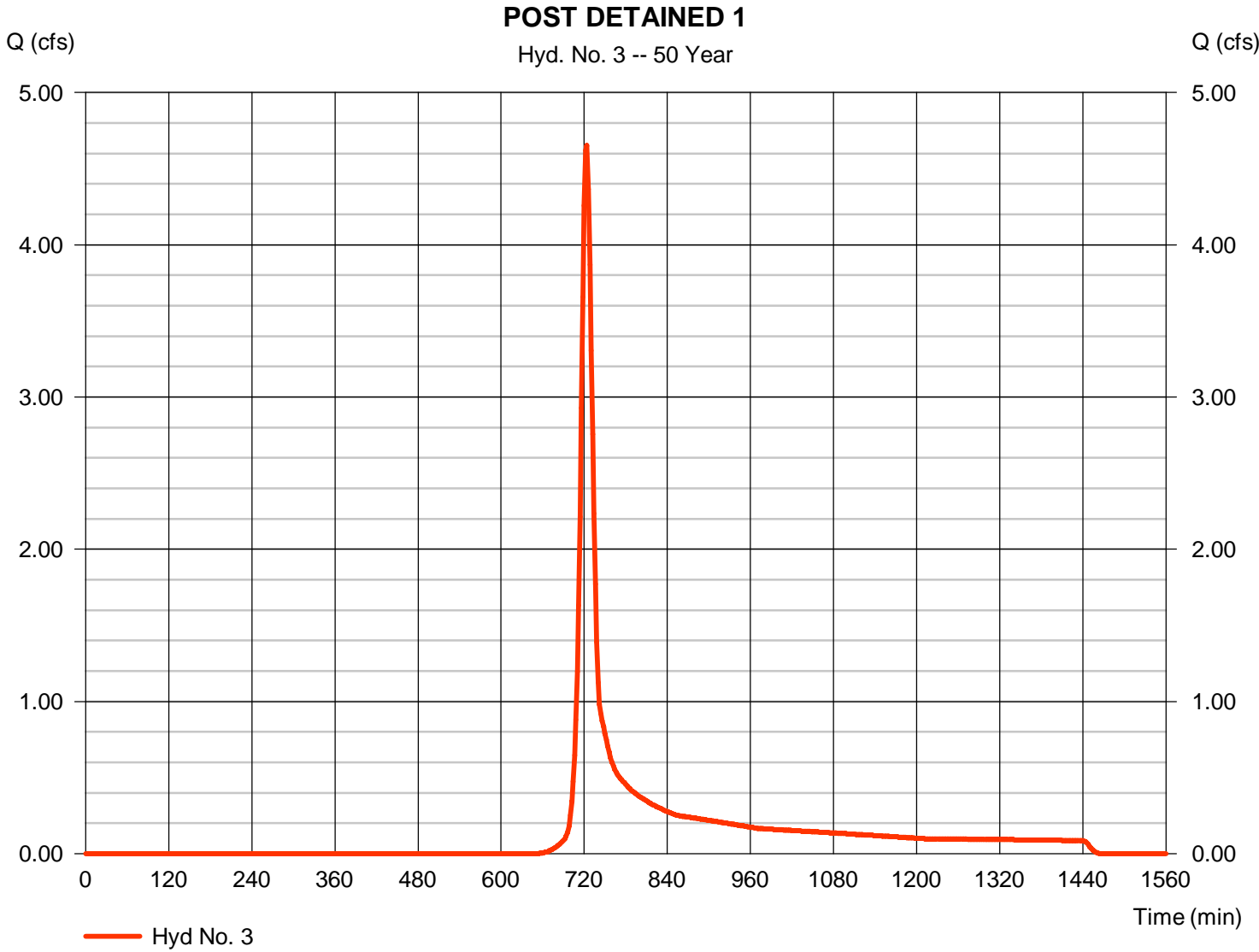
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.654 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 13,647 cuft
Drainage area	= 1.840 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.80 min
Total precip.	= 6.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.140 x 85) + (0.460 x 58) + (1.240 x 55)] / 1.840



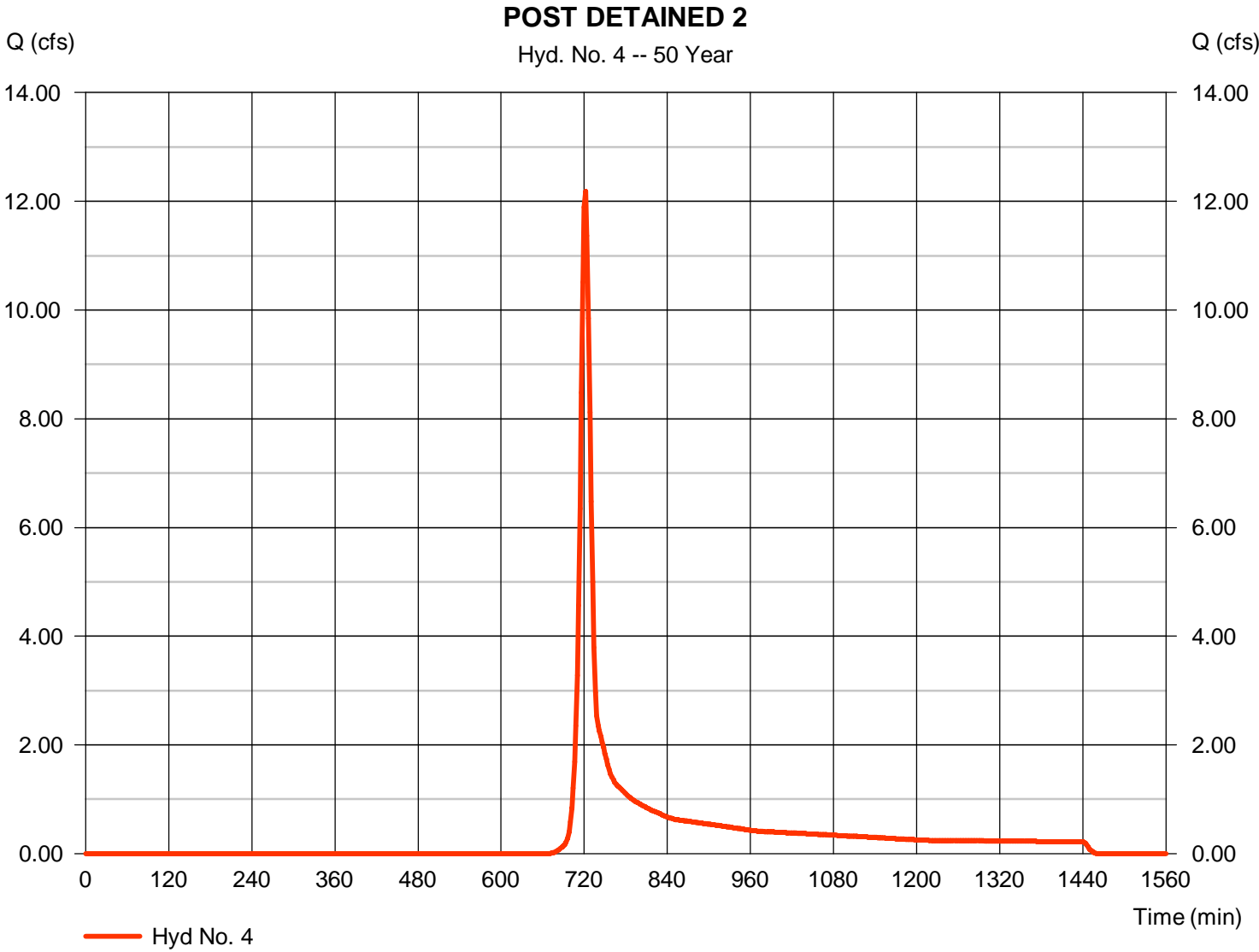
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 12.18 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 33,037 cuft
Drainage area	= 4.600 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 11.30 min
Total precip.	= 6.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.040 x 85) + (0.750 x 58) + (3.810 x 55)] / 4.600



Hydrograph Report

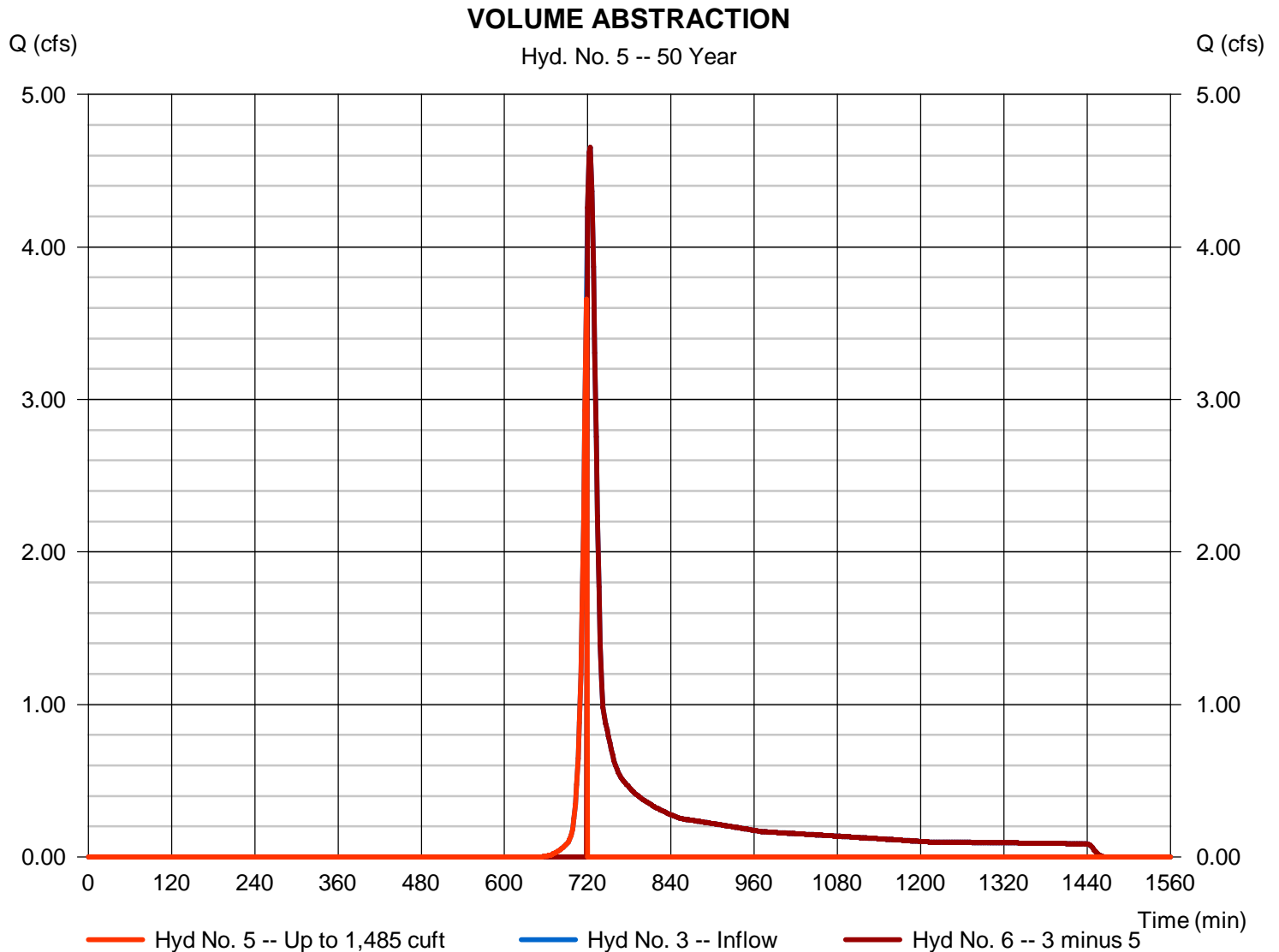
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 3.657 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,841 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

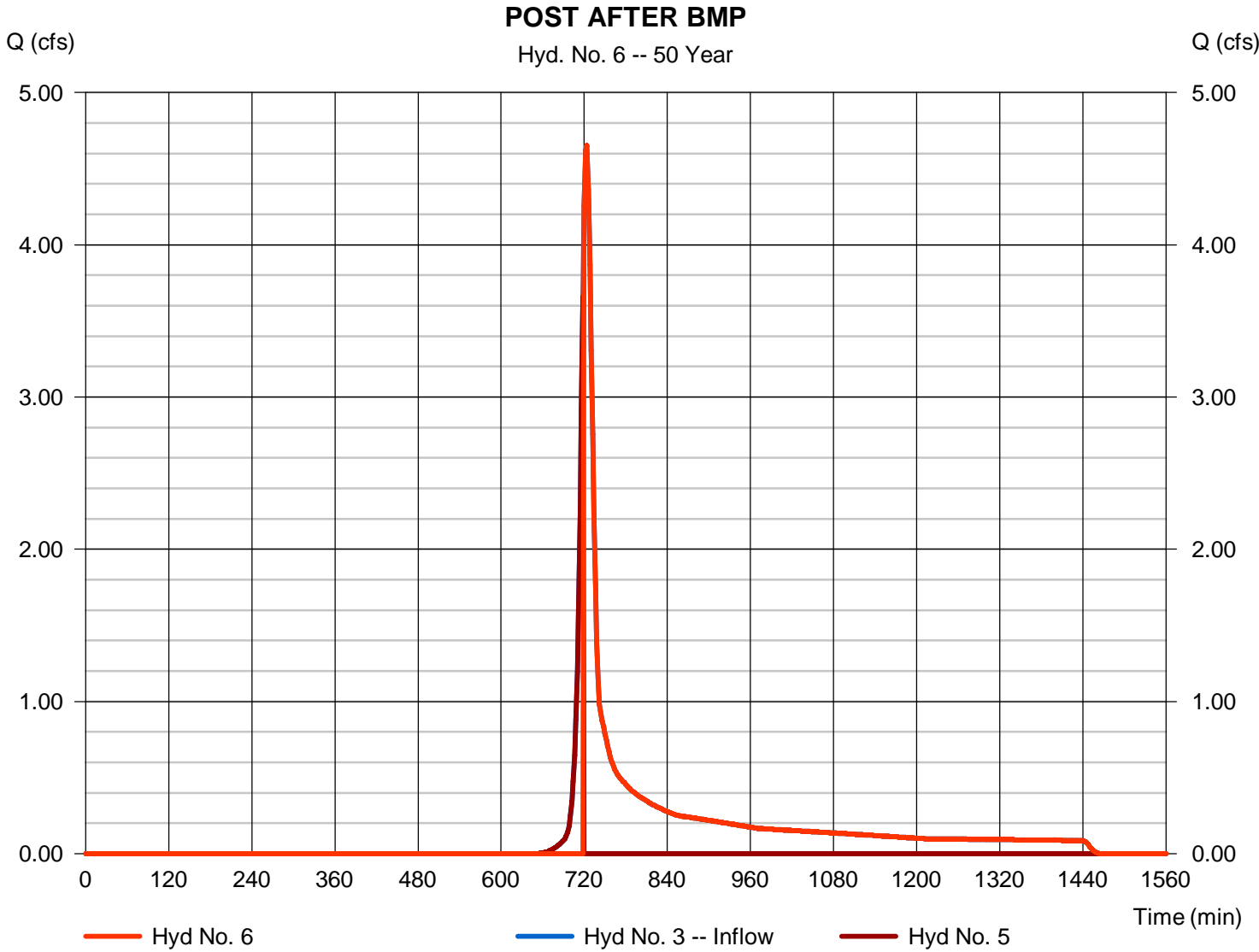
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 4.654 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 11,805 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

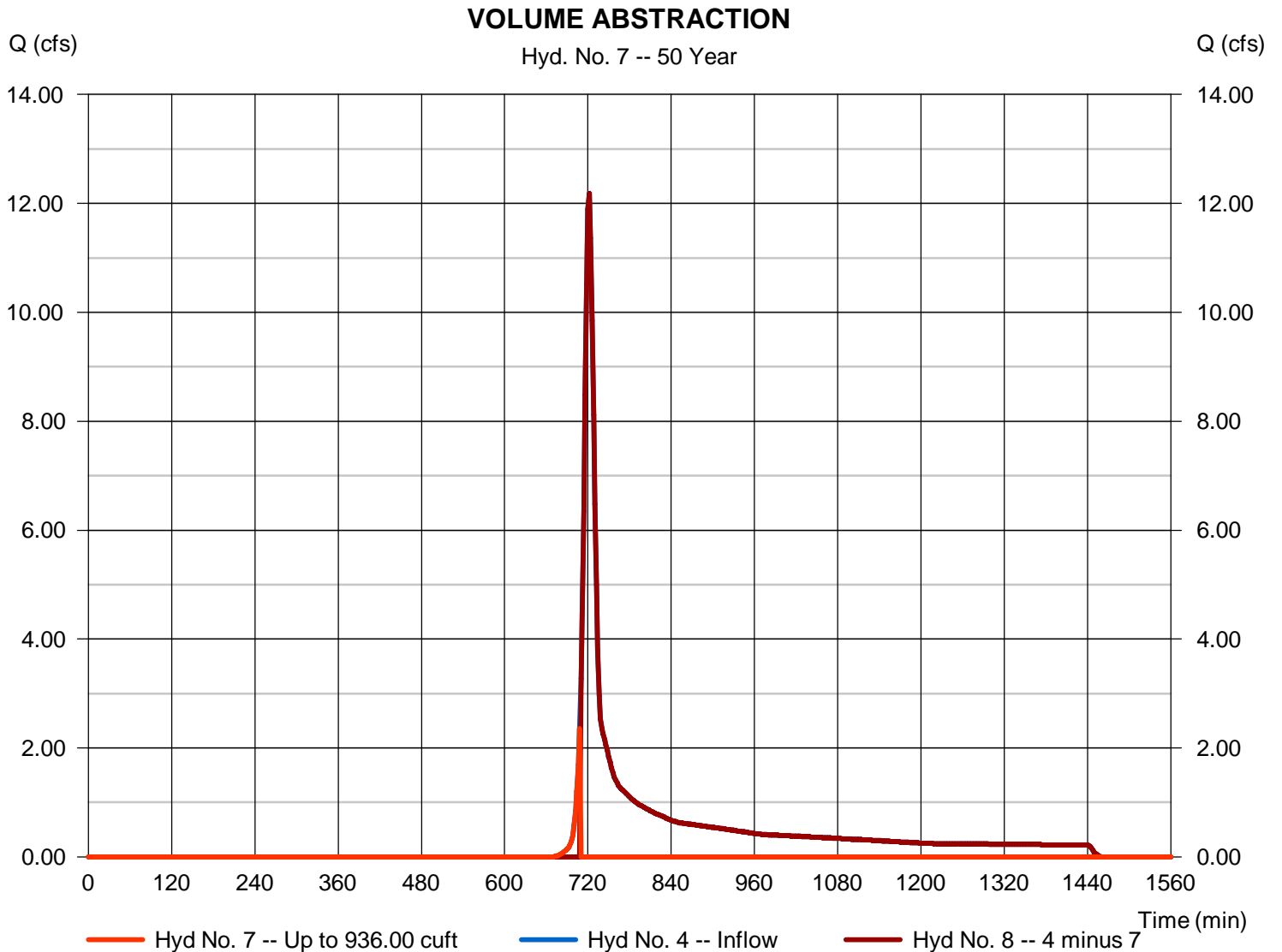
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 2.351 cfs
Storm frequency	= 50 yrs	Time to peak	= 708 min
Time interval	= 2 min	Hyd. volume	= 1,002 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

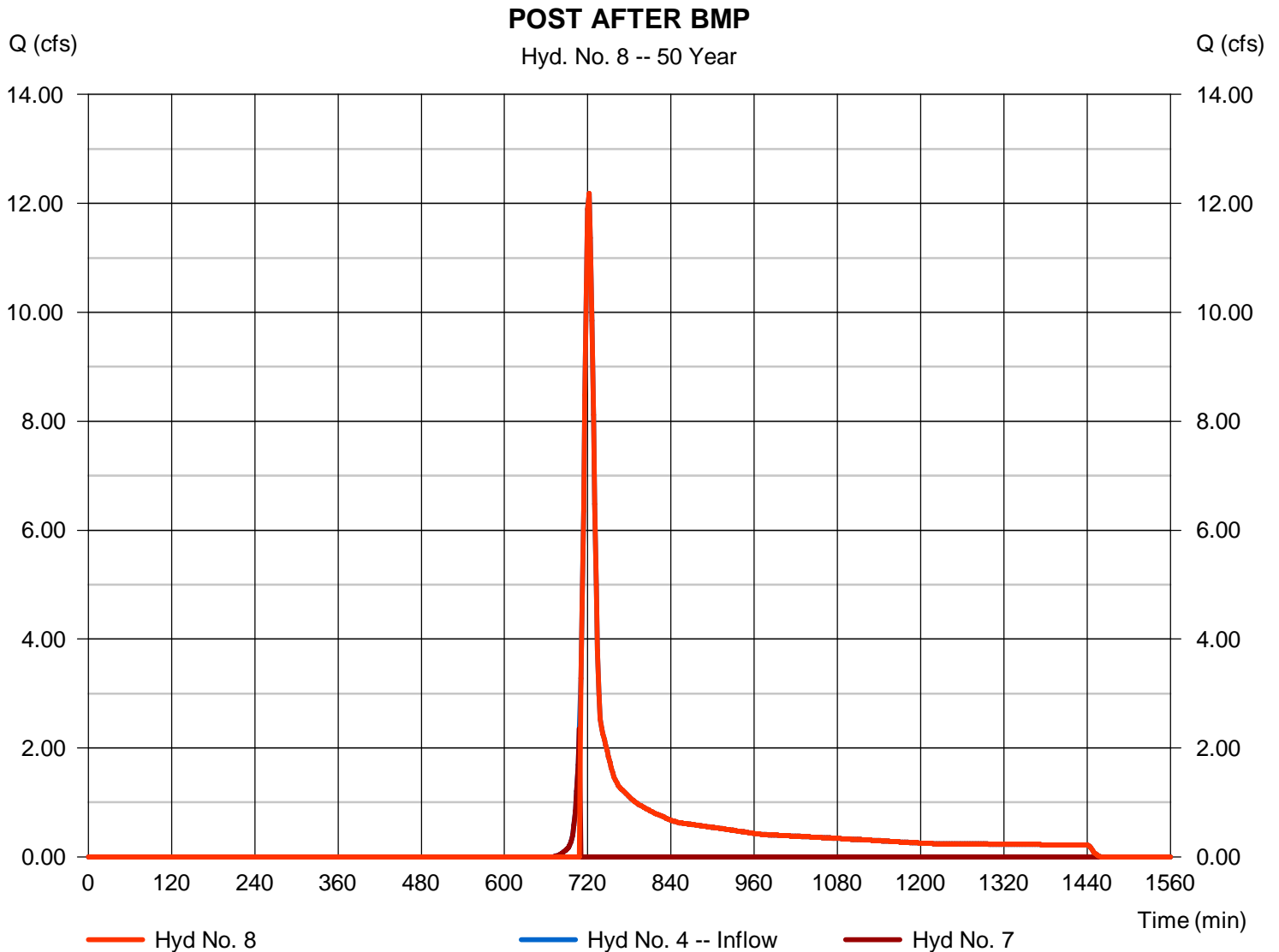
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 12.18 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 32,035 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

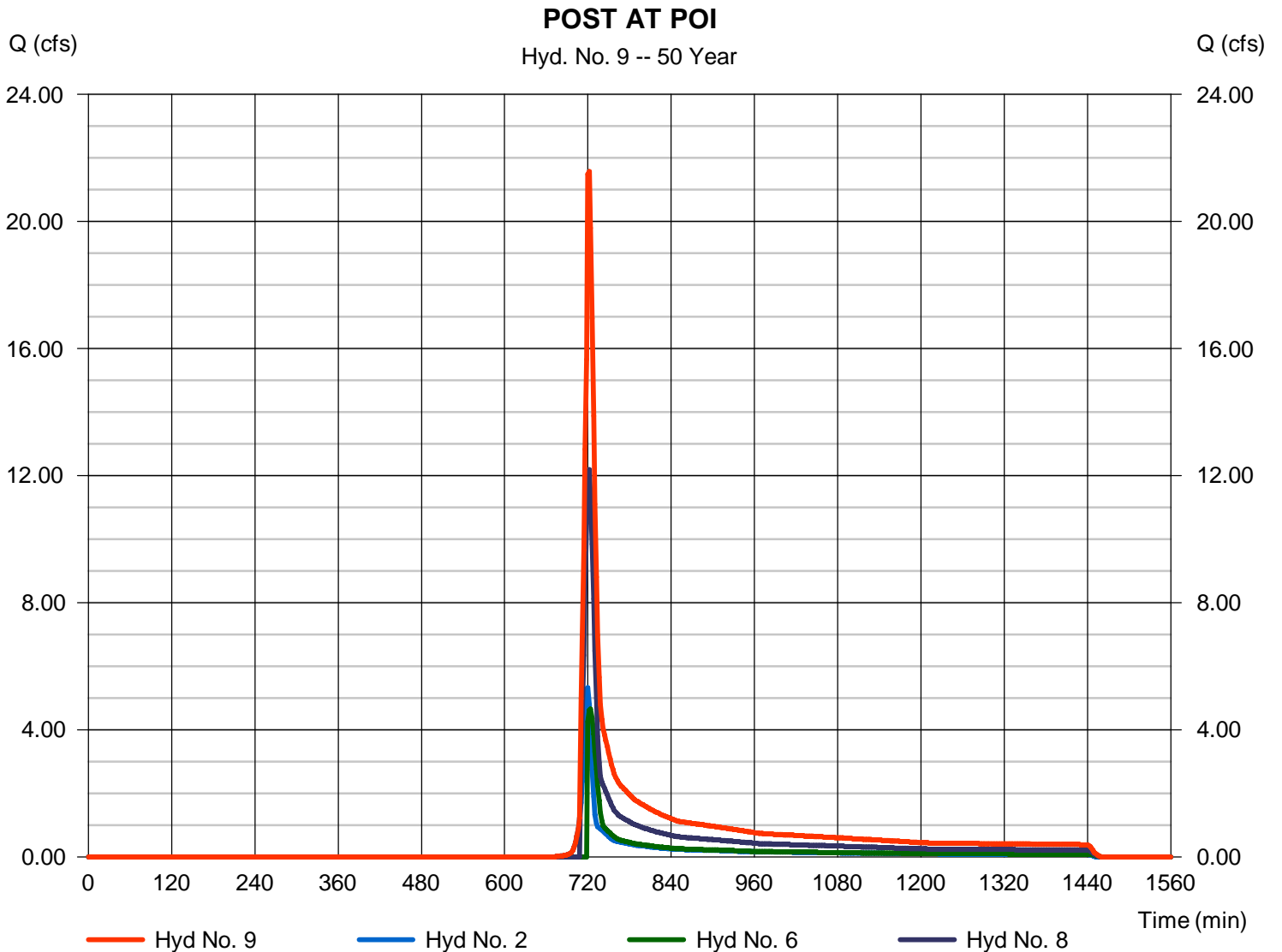
Tuesday, 11 / 1 / 2016

Hyd. No. 9

POST AT POI

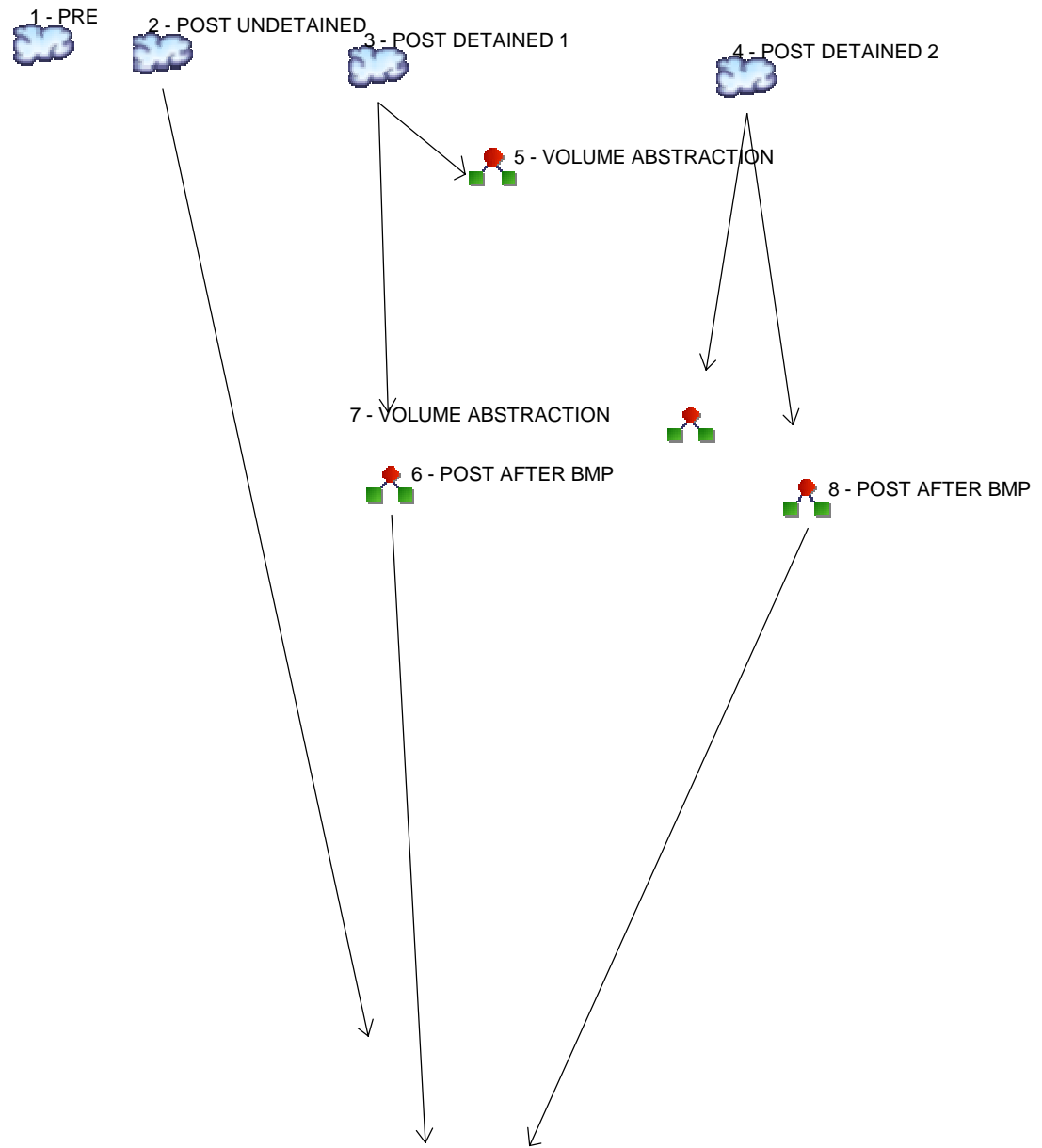
Hydrograph type = Combine
 Storm frequency = 50 yrs
 Time interval = 2 min
 Inflow hyds. = 2, 6, 8

Peak discharge = 21.57 cfs
 Time to peak = 722 min
 Hyd. volume = 56,306 cuft
 Contrib. drain. area = 1.790 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED 1
4	SCS Runoff	POST DETAINED 2
5	Diversion1	VOLUME ABSTRACTION
6	Diversion2	POST AFTER BMP
7	Diversion1	VOLUME ABSTRACTION
8	Diversion2	POST AFTER BMP
9	Combine	POST AT POI



Hydrograph Return Period Recap

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	-----	-----	-----	-----	-----	-----	-----	-----	30.82	PRE
2	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	7.008	POST UNDETAINED
3	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	7.021	POST DETAINED 1
4	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	16.10	POST DETAINED 2
5	Diversion1	3	-----	-----	-----	-----	-----	-----	-----	3.019	VOLUME ABSTRACTION
6	Diversion2	3	-----	-----	-----	-----	-----	-----	-----	7.021	POST AFTER BMP
7	Diversion1	4	-----	-----	-----	-----	-----	-----	-----	1.491	VOLUME ABSTRACTION
8	Diversion2	4	-----	-----	-----	-----	-----	-----	-----	16.10	POST AFTER BMP
9	Combine	2, 6, 8	-----	-----	-----	-----	-----	-----	-----	29.83	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	30.82	2	720	71,361	-----	-----	-----	PRE	
2	SCS Runoff	7.008	2	720	16,173	-----	-----	-----	POST UNDETAINED	
3	SCS Runoff	7.021	2	722	18,542	-----	-----	-----	POST DETAINED 1	
4	SCS Runoff	16.10	2	722	42,860	-----	-----	-----	POST DETAINED 2	
5	Diversion1	3.019	2	712	1,668	3	-----	-----	VOLUME ABSTRACTION	
6	Diversion2	7.021	2	722	16,874	3	-----	-----	POST AFTER BMP	
7	Diversion1	1.491	2	702	942	4	-----	-----	VOLUME ABSTRACTION	
8	Diversion2	16.10	2	722	41,918	4	-----	-----	POST AFTER BMP	
9	Combine	29.83	2	720	74,965	2, 6, 8	-----	-----	POST AT POI	
Morgantown.gpw					Return Period: 100 Year			Tuesday, 11 / 1 / 2016		

Hydrograph Report

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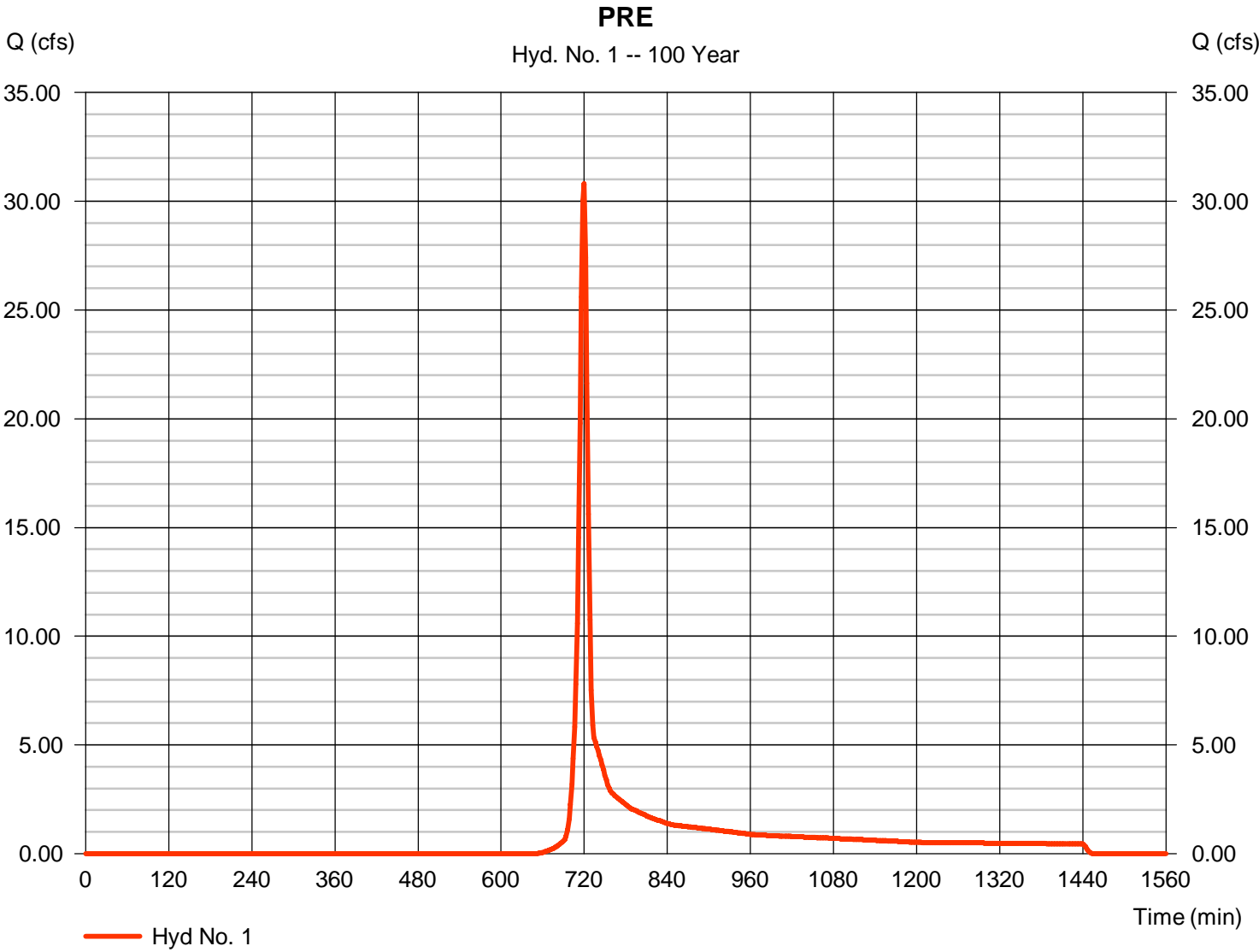
Tuesday, 11 / 1 / 2016

Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 30.82 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 71,361 cuft
Drainage area	= 8.230 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 7.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.780 x 55) + (0.450 x 58)] / 8.230



TR55 Tc Worksheet

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Hyd. No. 1

PRE

<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)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.22		0.00		0.00		
Land slope (%)	= 4.00		0.00		0.00		
Travel Time (min)	= 6.19	+	0.00	+	0.00	=	6.19
Shallow Concentrated Flow							
Flow length (ft)	= 751.00		0.00		0.00		
Watercourse slope (%)	= 10.30		0.00		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=5.18		0.00		0.00		
Travel Time (min)	= 2.42	+	0.00	+	0.00	=	2.42
Channel Flow							
X sectional flow area (sqft)	= 3.00		0.00		0.00		
Wetted perimeter (ft)	= 6.32		0.00		0.00		
Channel slope (%)	= 6.20		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=7.51		0.00		0.00		
Flow length (ft)	{{0}}71.0		0.0		0.0		
Travel Time (min)	= 0.16	+	0.00	+	0.00	=	0.16
Total Travel Time, Tc							8.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

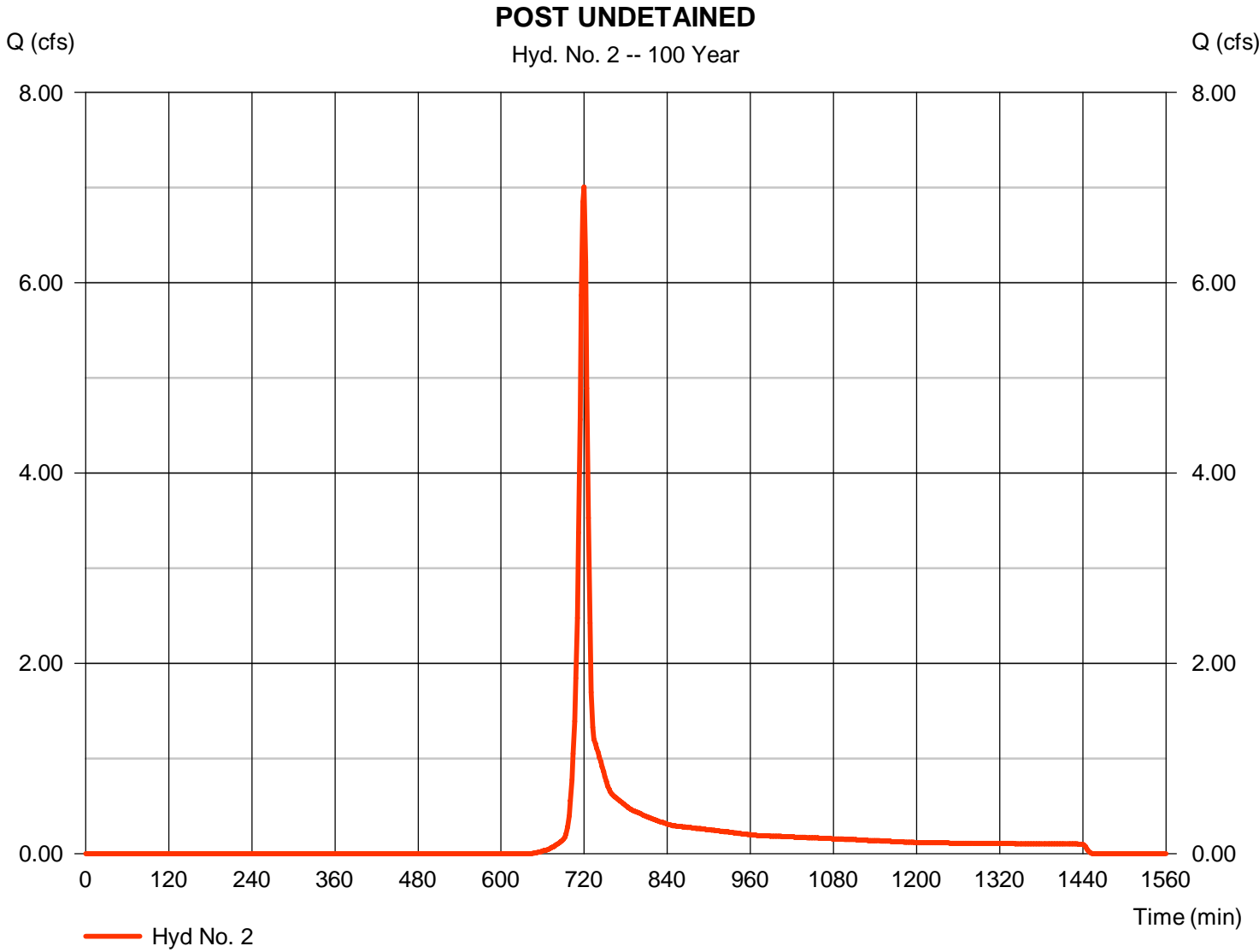
Tuesday, 11 / 1 / 2016

Hyd. No. 2

POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 7.008 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 16,173 cuft
Drainage area	= 1.790 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.80 min
Total precip.	= 7.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.430 x 58) + (1.330 x 55)] / 1.790



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDETAINED

<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)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.22	0.00	0.00	
Land slope (%)	= 4.00	0.00	0.00	
Travel Time (min)	= 6.19	+ 0.00	+ 0.00	= 6.19
Shallow Concentrated Flow				
Flow length (ft)	= 751.00	0.00	0.00	
Watercourse slope (%)	= 10.30	0.00	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=5.18	0.00	0.00	
Travel Time (min)	= 2.42	+ 0.00	+ 0.00	= 2.42
Channel Flow				
X sectional flow area (sqft)	= 3.00	0.00	0.00	
Wetted perimeter (ft)	= 6.32	0.00	0.00	
Channel slope (%)	= 6.20	0.00	0.00	
Manning's n-value	= 0.030	0.015	0.015	
Velocity (ft/s)	=7.51	0.00	0.00	
Flow length (ft)	{{0}}71.0	0.0	0.0	
Travel Time (min)	= 0.16	+ 0.00	+ 0.00	= 0.16
Total Travel Time, Tc				8.80 min

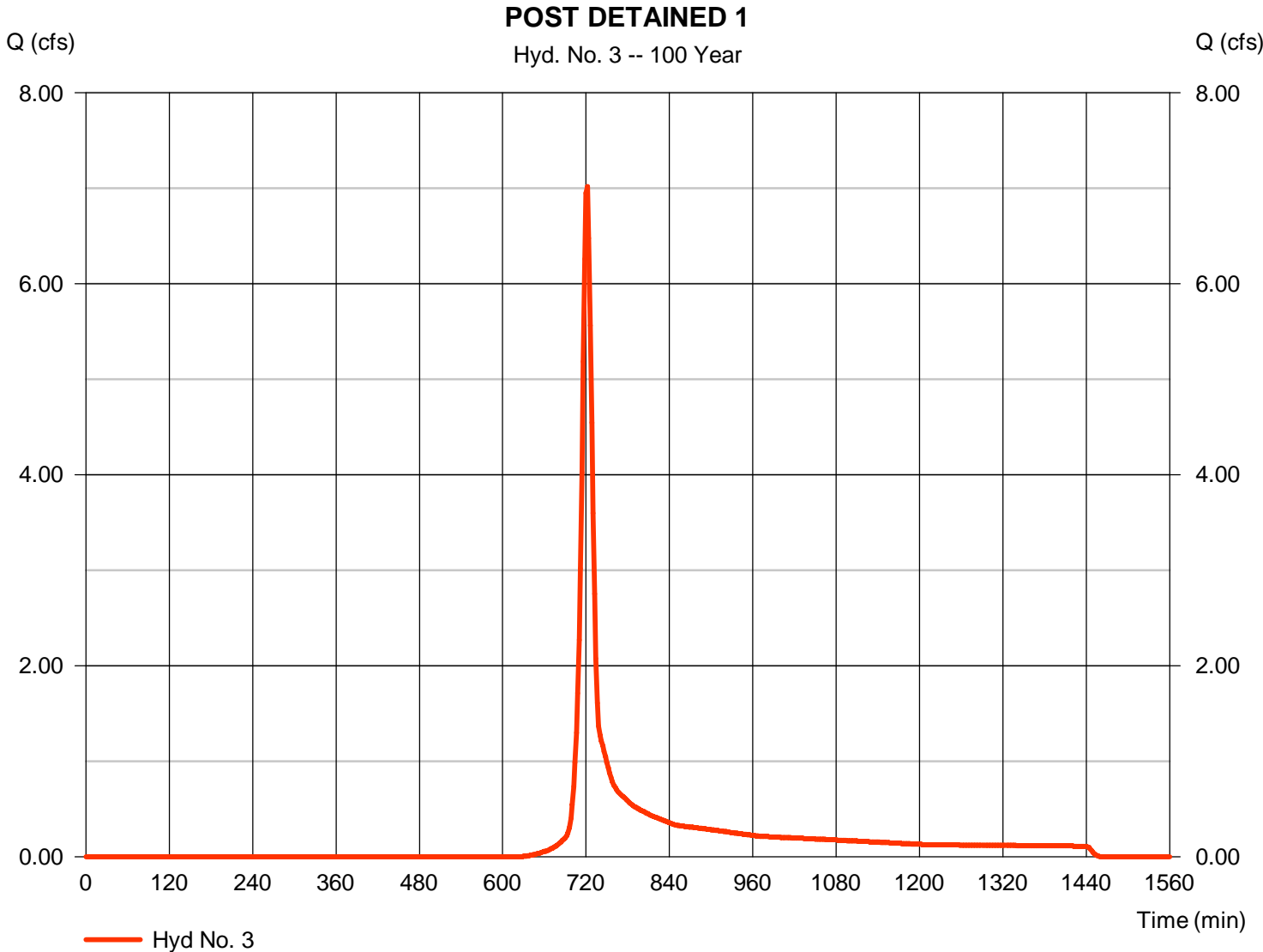
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 7.021 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 18,542 cuft
Drainage area	= 1.840 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 12.90 min
Total precip.	= 7.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.140 x 85) + (0.460 x 58) + (1.240 x 55)] / 1.840



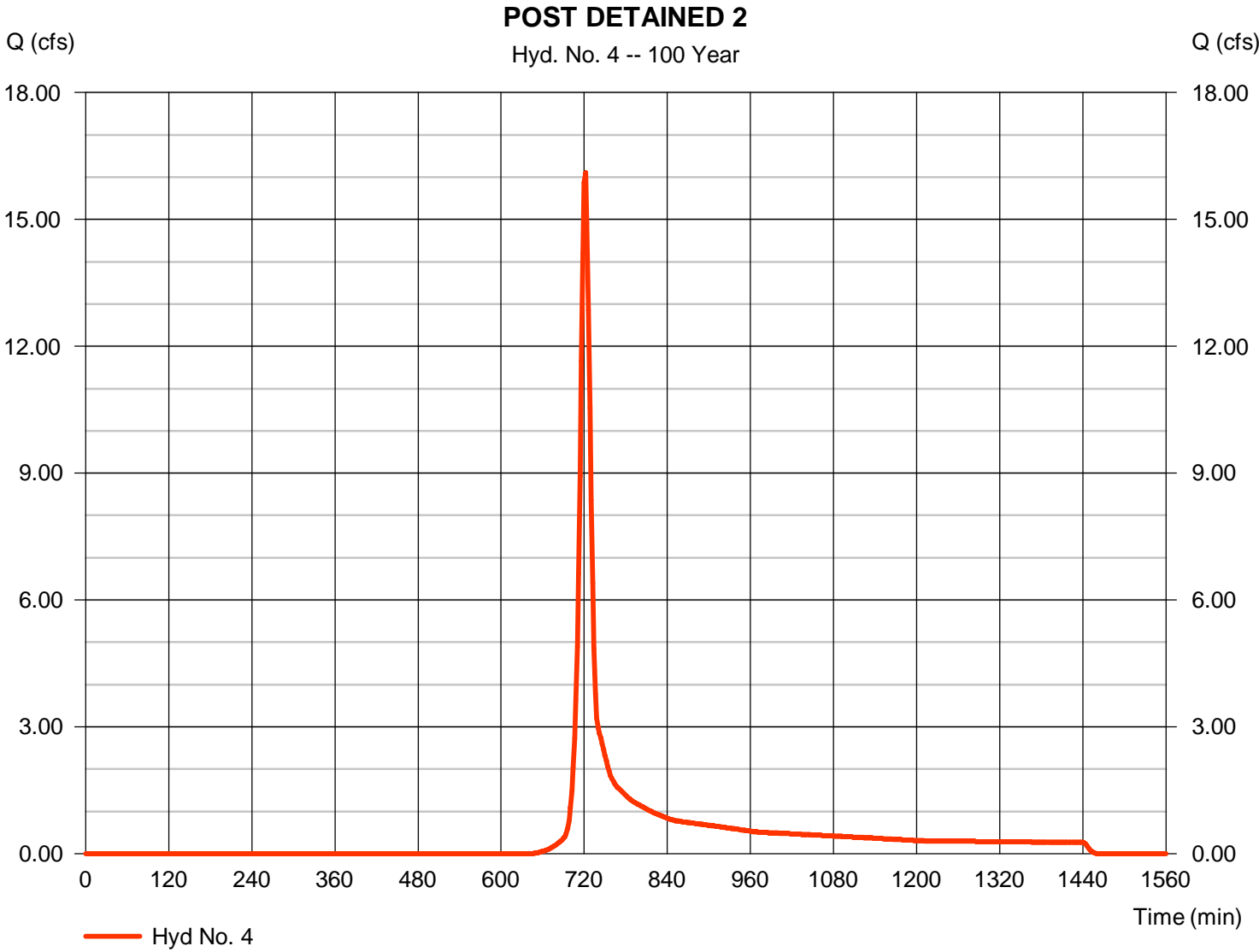
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 16.10 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 42,860 cuft
Drainage area	= 4.600 ac	Curve number	= 56*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 11.00 min
Total precip.	= 7.41 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.040 x 85) + (0.750 x 58) + (3.810 x 55)] / 4.600



Hydrograph Report

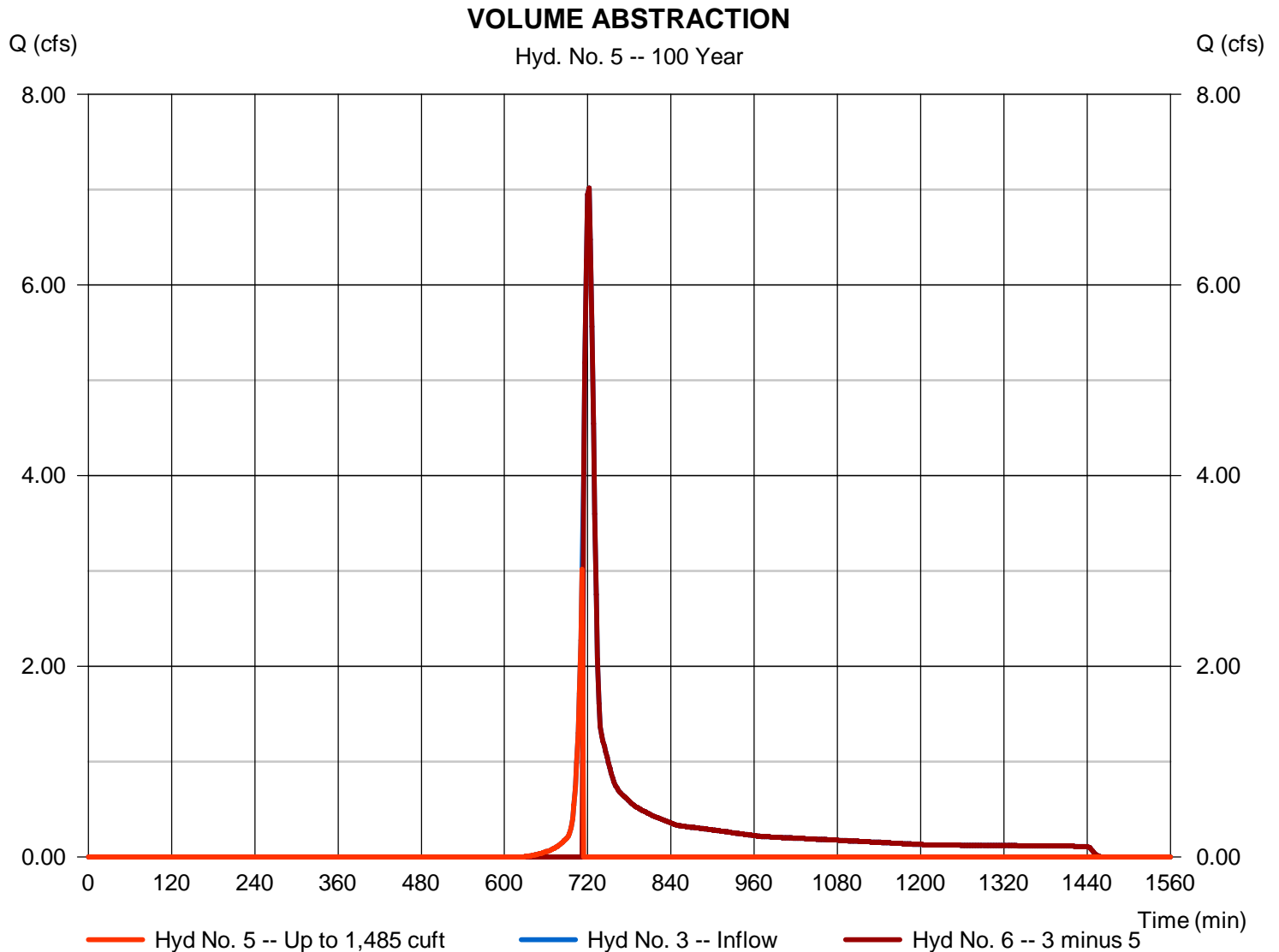
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Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 3.019 cfs
Storm frequency	= 100 yrs	Time to peak	= 712 min
Time interval	= 2 min	Hyd. volume	= 1,668 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

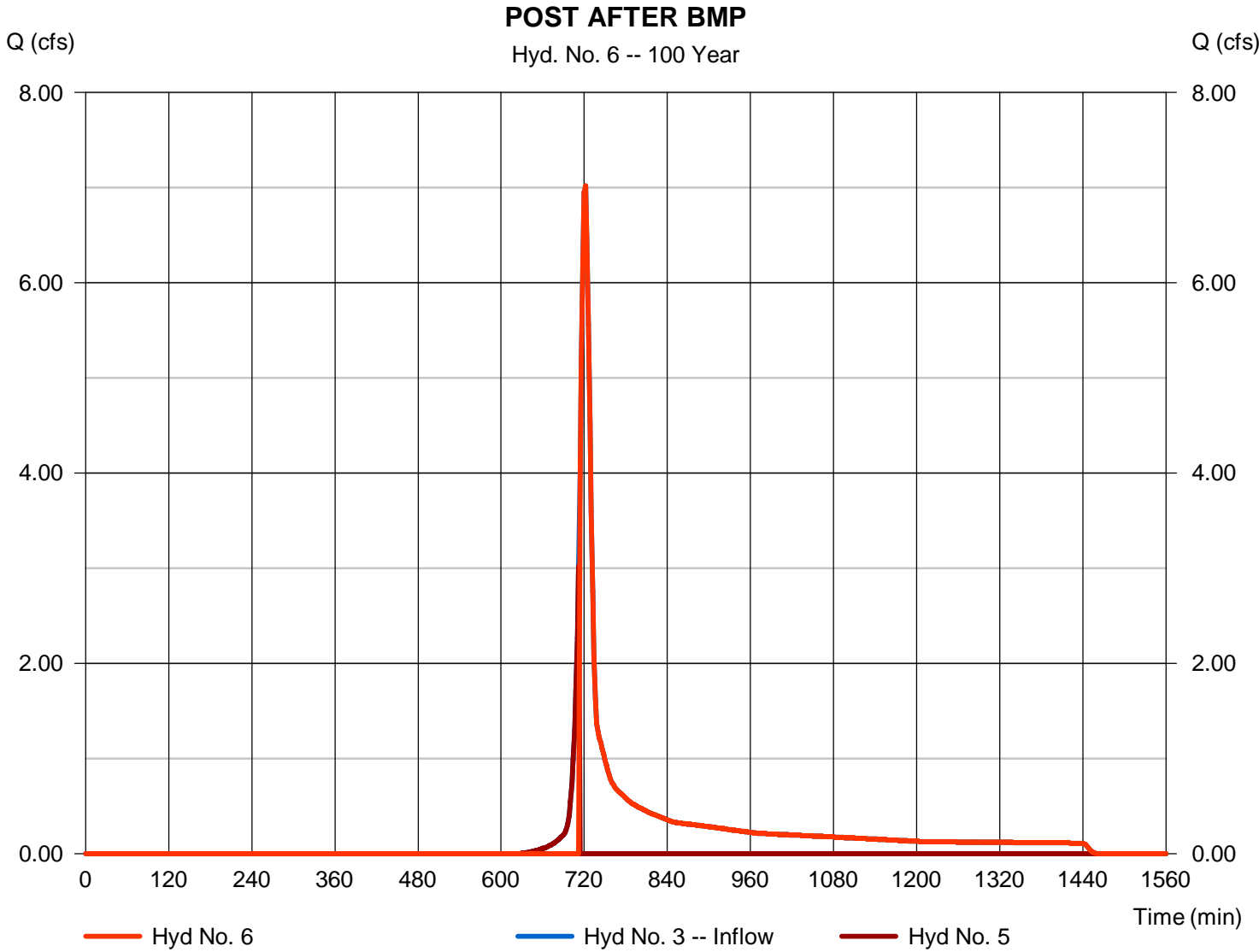
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Tuesday, 11 / 1 / 2016

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 7.021 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 16,874 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,485 cuft



Hydrograph Report

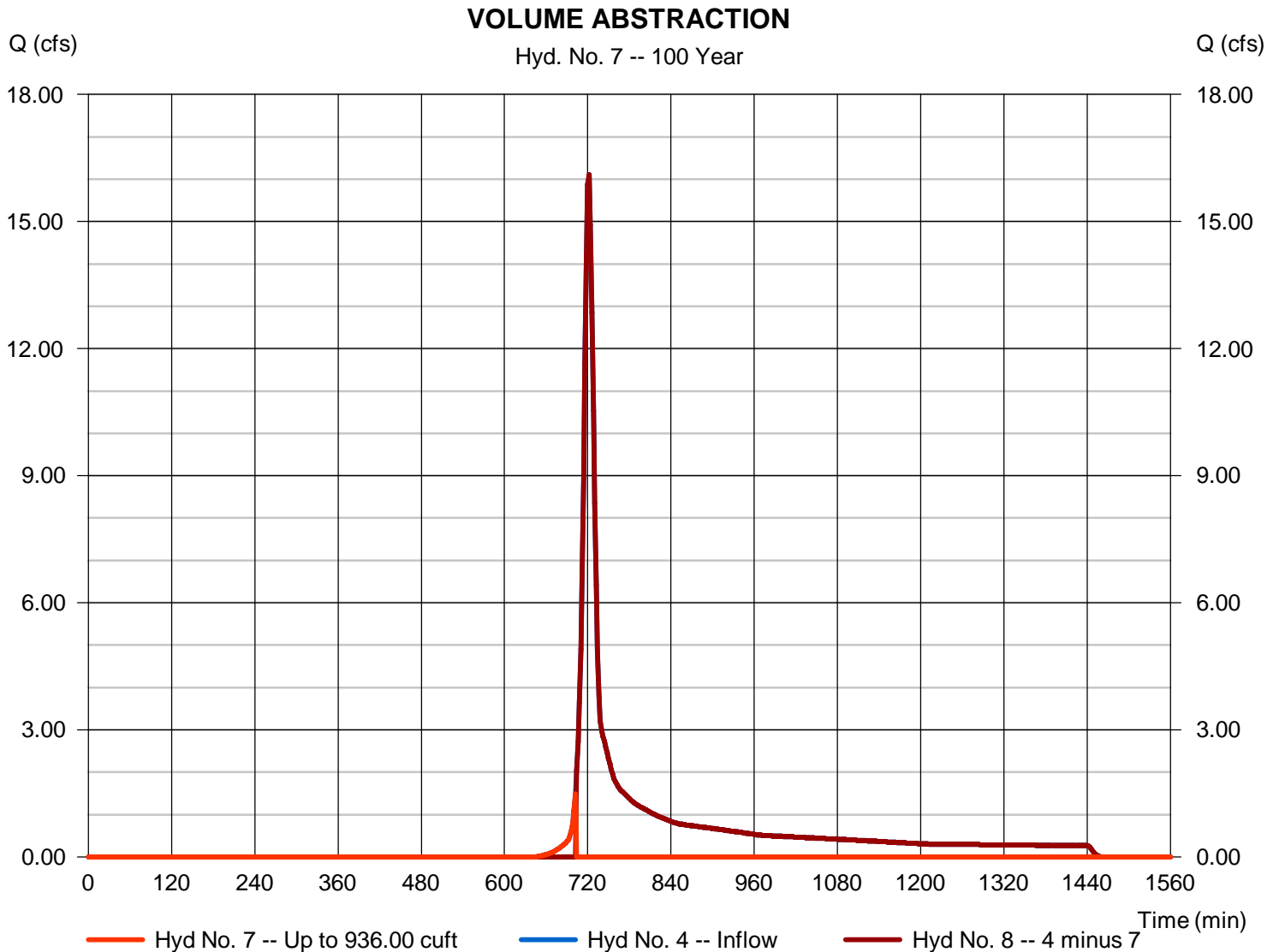
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Tuesday, 11 / 1 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.491 cfs
Storm frequency	= 100 yrs	Time to peak	= 702 min
Time interval	= 2 min	Hyd. volume	= 942 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

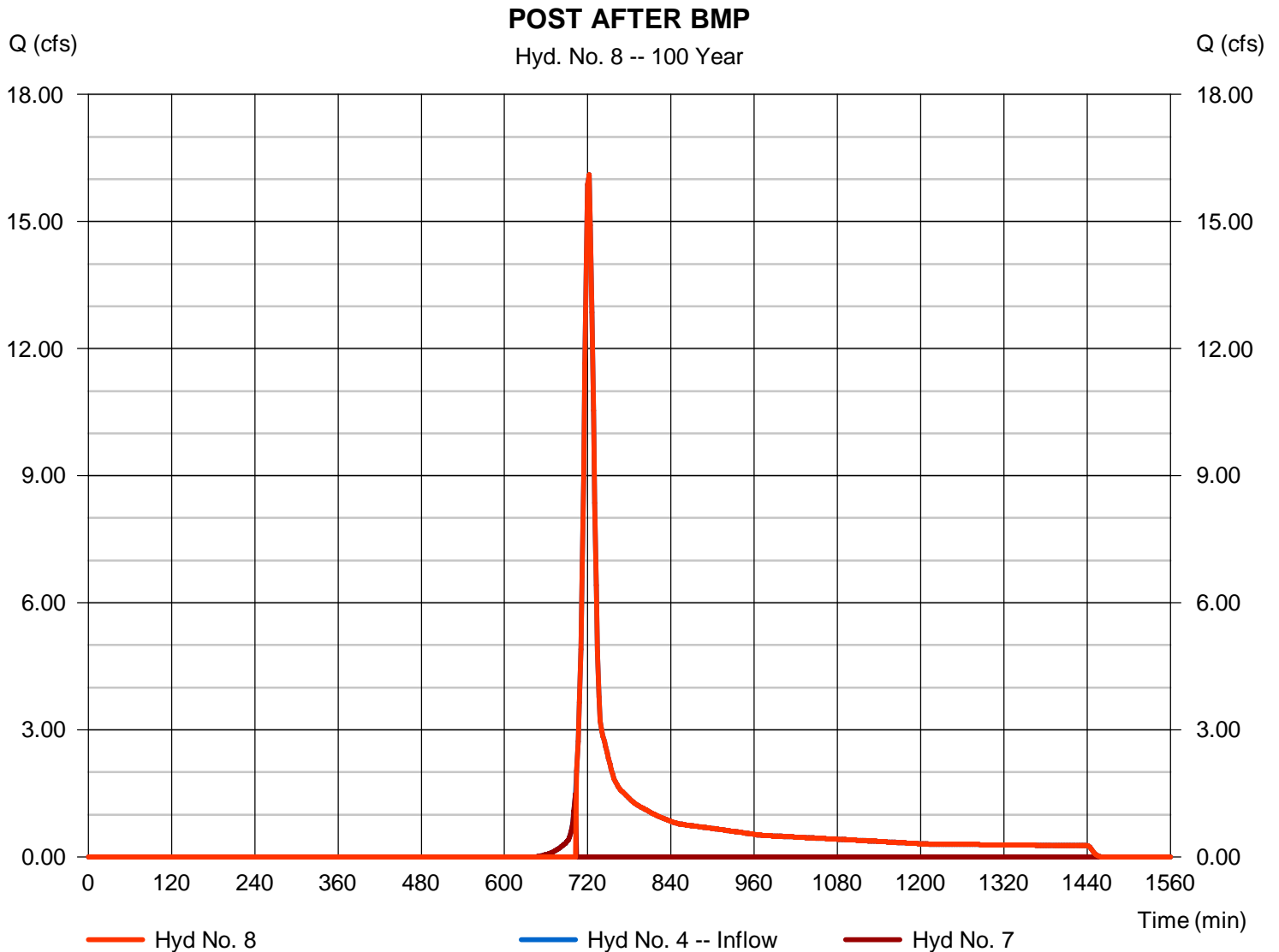
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Tuesday, 11 / 1 / 2016

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 16.10 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 41,918 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 936.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Tuesday, 11 / 1 / 2016

Hyd. No. 9

POST AT POI

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 29.83 cfs
Time to peak = 720 min
Hyd. volume = 74,965 cuft
Contrib. drain. area = 1.790 ac

