Hares Valley

TETRA TECH, INC.

By: RH Date: 11/15/2016 Subject: Hares Valley
Checked By: JB Date: 11/18/2016 PCSM Design and Evaluation

PURPOSE:

The purpose of these calculations is to design a Post-Construction Stormwater Management (PCSM) Plan for the Hares Valley block valve as part of the Sunoco Pipeline L.P. Pennsylvania Pipeline Project. The site is located within Union Township, Huntingdon County, Pennsylvania. Permanent stormwater controls will be developed to satisfy PADEP requirements.

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

Huntingdon County does not have an approved Act 167 Stormwater Management Plan, therefore, the county has adopted the PADEP Chapter 102 regulations as their county-wide stormwater guidance.

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 five infiltration berms 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).

This site will utilize five infiltration berms to manage the two-year through 100-year peak rate increases. These berms will also help to increase the time of concentration for the drainage area encompassing the block valve.

Recommended Water Quality Control Guideline

Control Guideline 1 will provide water quality control and stream channel protection as well as flood control protection.

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 will utilize onsite infiltration to meet Volume Control Guideline 1.

Loading Ratio

Loading ratios have been considered for the design of infiltration BMPs. In general, the following Loading Ratio guidelines are recommended:

- Maximum Impervious Loading Ratio of 5:1 relating impervious drainage area to infiltration area.
- Maximum Drainage Area Loading Ratio of 8:1 relating total drainage area to infiltration area.

The maximum impervious loading ratio of 5:1 has been met. The impervious loading ratio for the site is 1.7:1.

The drainage area loading ratio for the site is 15.5:1. However, runoff from the site and upslope drainage area will be dispersed to an infiltration berm. The infiltration berm has been placed to maximum the loading ratio to the maximum extent practicable, and other infiltration design parameters from the PA Stormwater BMP Manual have been met.

Disturbed Area

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

Karst Topography

The Hares Valley block valve is not located in an area of karst terrain.

Special Protection Watershed

Hares Valley block valve is not located within a special protection watershed, so antidegradation requirements do not apply.

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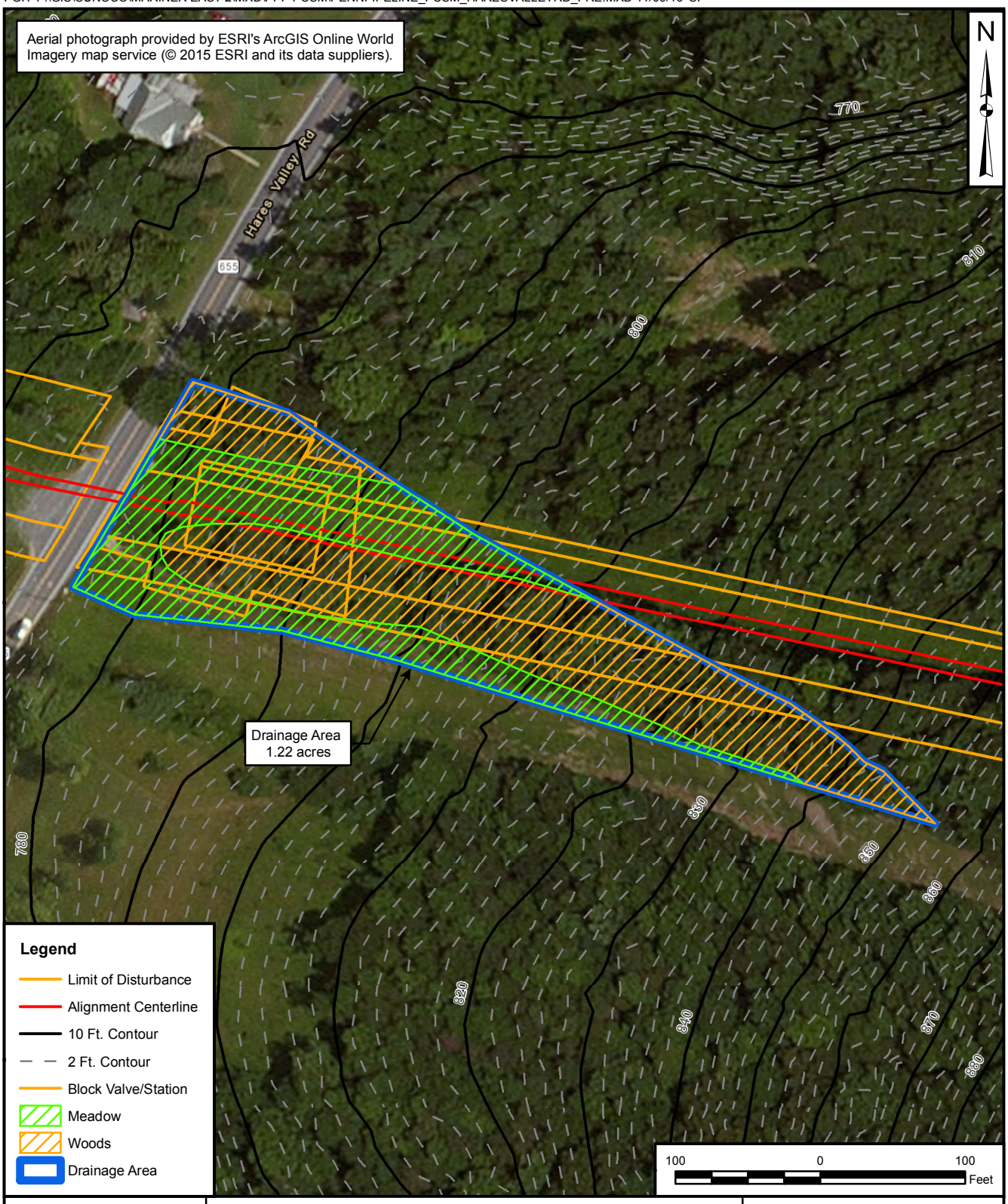

TETRA TECH

PRE-DEVELOPMENT DRAINAGE AREA MAP
HARES VALLEY ROAD
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PENNSYLVANIA

DRAWN BY: S. PAXTON 05/22/16
CHECKED BY: J. BRODY 11/09/16

APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE NUMBER	REV
1	0

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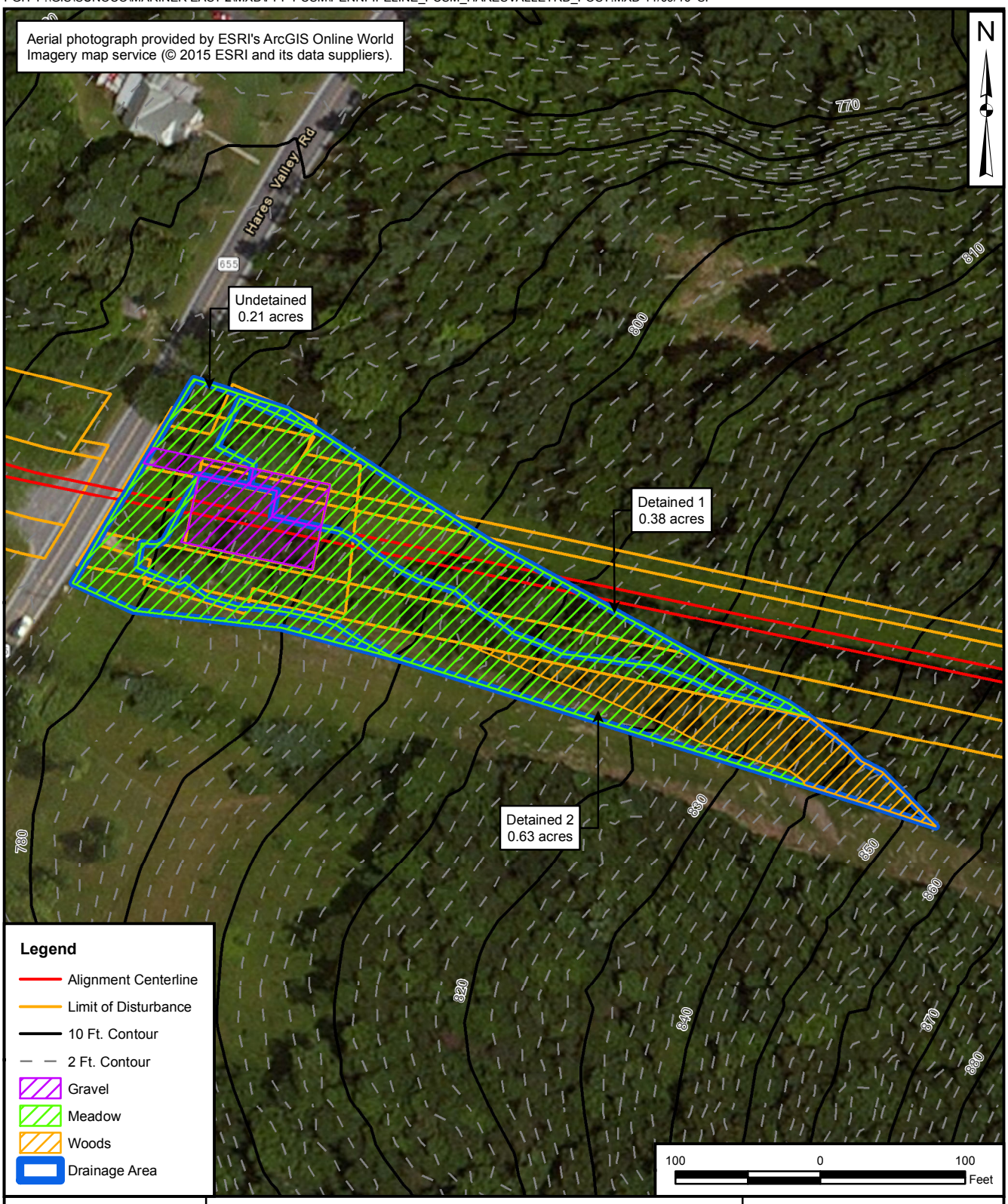

TETRA TECH

POST-DEVELOPMENT DRAINAGE AREA MAP
HARES VALLEY ROAD
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PENNSYLVANIA

DRAWN BY: S. PAXTON 05/22/16
CHECKED BY: J. BRODY 11/09/16

APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE NUMBER	REV
2	0

NOAA Atlas 14, Volume 2, Version 3
Location name: Union Twp, Pennsylvania, USA*
Latitude: 40.3506°, Longitude: -77.9699°
Elevation: 778.67 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	**0.313** (0.280-0.352)	**0.374** (0.336-0.419)	**0.456** (0.406-0.511)	**0.521** (0.463-0.582)	**0.607** (0.537-0.677)	**0.675** (0.594-0.751)	**0.745** (0.651-0.827)	**0.818** (0.711-0.908)	**0.921** (0.791-1.02)	**1.00** (0.853-1.11)
10-min	**0.487** (0.435-0.547)	**0.584** (0.524-0.655)	**0.709** (0.631-0.794)	**0.804** (0.715-0.898)	**0.929** (0.821-1.04)	**1.02** (0.900-1.14)	**1.12** (0.980-1.25)	**1.22** (1.06-1.35)	**1.35** (1.16-1.50)	**1.46** (1.24-1.61)
15-min	**0.597** (0.533-0.670)	**0.714** (0.641-0.801)	**0.871** (0.775-0.975)	**0.989** (0.880-1.10)	**1.15** (1.01-1.28)	**1.27** (1.11-1.41)	**1.39** (1.22-1.55)	**1.52** (1.32-1.69)	**1.69** (1.45-1.87)	**1.82** (1.55-2.01)
30-min	**0.790** (0.705-0.887)	**0.956** (0.857-1.07)	**1.19** (1.06-1.33)	**1.37** (1.22-1.53)	**1.62** (1.43-1.81)	**1.81** (1.59-2.01)	**2.01** (1.76-2.23)	**2.22** (1.93-2.46)	**2.50** (2.15-2.77)	**2.73** (2.33-3.02)
60-min	**0.964** (0.861-1.08)	**1.17** (1.05-1.31)	**1.50** (1.33-1.68)	**1.75** (1.55-1.95)	**2.10** (1.86-2.34)	**2.39** (2.10-2.65)	**2.69** (2.35-2.98)	**3.01** (2.61-3.34)	**3.46** (2.97-3.83)	**3.83** (3.27-4.24)
2-hr	**1.10** (0.979-1.26)	**1.34** (1.19-1.52)	**1.71** (1.51-1.94)	**2.00** (1.77-2.27)	**2.43** (2.13-2.74)	**2.78** (2.42-3.13)	**3.16** (2.73-3.55)	**3.57** (3.06-4.00)	**4.18** (3.54-4.67)	**4.68** (3.93-5.23)
3-hr	**1.19** (1.06-1.35)	**1.44** (1.29-1.64)	**1.82** (1.62-2.07)	**2.13** (1.89-2.42)	**2.58** (2.27-2.91)	**2.95** (2.58-3.32)	**3.36** (2.92-3.77)	**3.81** (3.28-4.26)	**4.46** (3.80-4.99)	**5.02** (4.22-5.59)
6-hr	**1.48** (1.34-1.67)	**1.79** (1.61-2.01)	**2.23** (2.01-2.50)	**2.60** (2.33-2.91)	**3.13** (2.79-3.49)	**3.58** (3.17-3.98)	**4.07** (3.57-4.51)	**4.59** (4.00-5.08)	**5.37** (4.62-5.93)	**6.03** (5.12-6.64)
12-hr	**1.84** (1.66-2.07)	**2.22** (1.99-2.49)	**2.75** (2.46-3.08)	**3.21** (2.86-3.58)	**3.87** (3.43-4.31)	**4.44** (3.90-4.92)	**5.06** (4.41-5.60)	**5.75** (4.96-6.34)	**6.77** (5.76-7.45)	**7.64** (6.42-8.40)
24-hr	**2.25** (2.05-2.48)	**2.70** (2.47-2.98)	**3.35** (3.06-3.70)	**3.90** (3.55-4.29)	**4.70** (4.25-5.15)	**5.37** (4.83-5.88)	**6.10** (5.46-6.67)	**6.90** (6.12-7.52)	**8.08** (7.07-8.79)	**9.07** (7.86-9.87)
2-day	**2.60** (2.38-2.85)	**3.12** (2.86-3.42)	**3.87** (3.54-4.25)	**4.51** (4.12-4.94)	**5.44** (4.93-5.94)	**6.24** (5.62-6.80)	**7.11** (6.36-7.73)	**8.07** (7.14-8.76)	**9.49** (8.28-10.3)	**10.7** (9.21-11.6)
3-day	**2.77** (2.55-3.02)	**3.32** (3.06-3.62)	**4.11** (3.78-4.48)	**4.77** (4.38-5.20)	**5.73** (5.23-6.23)	**6.55** (5.93-7.11)	**7.43** (6.69-8.05)	**8.39** (7.49-9.09)	**9.79** (8.63-10.6)	**11.0** (9.56-11.9)
4-day	**2.94** (2.72-3.20)	**3.52** (3.26-3.83)	**4.35** (4.01-4.72)	**5.03** (4.64-5.46)	**6.03** (5.52-6.53)	**6.86** (6.25-7.42)	**7.75** (7.02-8.38)	**8.71** (7.83-9.42)	**10.1** (8.98-10.9)	**11.3** (9.90-12.2)
7-day	**3.44** (3.20-3.72)	**4.11** (3.82-4.45)	**5.02** (4.66-5.43)	**5.75** (5.33-6.21)	**6.77** (6.25-7.31)	**7.60** (6.99-8.20)	**8.47** (7.75-9.14)	**9.38** (8.51-10.1)	**10.7** (9.58-11.5)	**11.7** (10.4-12.7)
10-day	**3.96** (3.69-4.27)	**4.71** (4.39-5.08)	**5.66** (5.28-6.10)	**6.43** (5.98-6.91)	**7.49** (6.94-8.05)	**8.35** (7.70-8.97)	**9.23** (8.47-9.93)	**10.1** (9.25-10.9)	**11.4** (10.3-12.3)	**12.4** (11.1-13.4)
20-day	**5.40** (5.08-5.75)	**6.36** (6.00-6.78)	**7.44** (7.00-7.92)	**8.27** (7.79-8.80)	**9.37** (8.80-9.96)	**10.2** (9.56-10.9)	**11.0** (10.3-11.7)	**11.8** (11.0-12.6)	**12.9** (12.0-13.8)	**13.7** (12.6-14.7)
30-day	**6.70** (6.33-7.08)	**7.85** (7.42-8.31)	**9.02** (8.52-9.54)	**9.92** (9.37-10.5)	**11.1** (10.4-11.7)	**12.0** (11.2-12.6)	**12.8** (12.0-13.5)	**13.6** (12.7-14.4)	**14.7** (13.7-15.5)	**15.4** (14.3-16.4)
45-day	**8.45** (8.01-8.92)	**9.89** (9.37-10.4)	**11.2** (10.6-11.8)	**12.2** (11.5-12.9)	**13.4** (12.7-14.1)	**14.3** (13.5-15.1)	**15.1** (14.3-15.9)	**15.9** (15.0-16.8)	**16.8** (15.8-17.8)	**17.4** (16.4-18.5)
60-day	**10.1** (9.65-10.7)	**11.8** (11.3-12.5)	**13.3** (12.6-14.0)	**14.4** (13.6-15.1)	**15.6** (14.8-16.4)	**16.5** (15.7-17.4)	**17.4** (16.5-18.3)	**18.1** (17.1-19.1)	**19.0** (17.9-20.0)	**19.6** (18.5-20.7)

[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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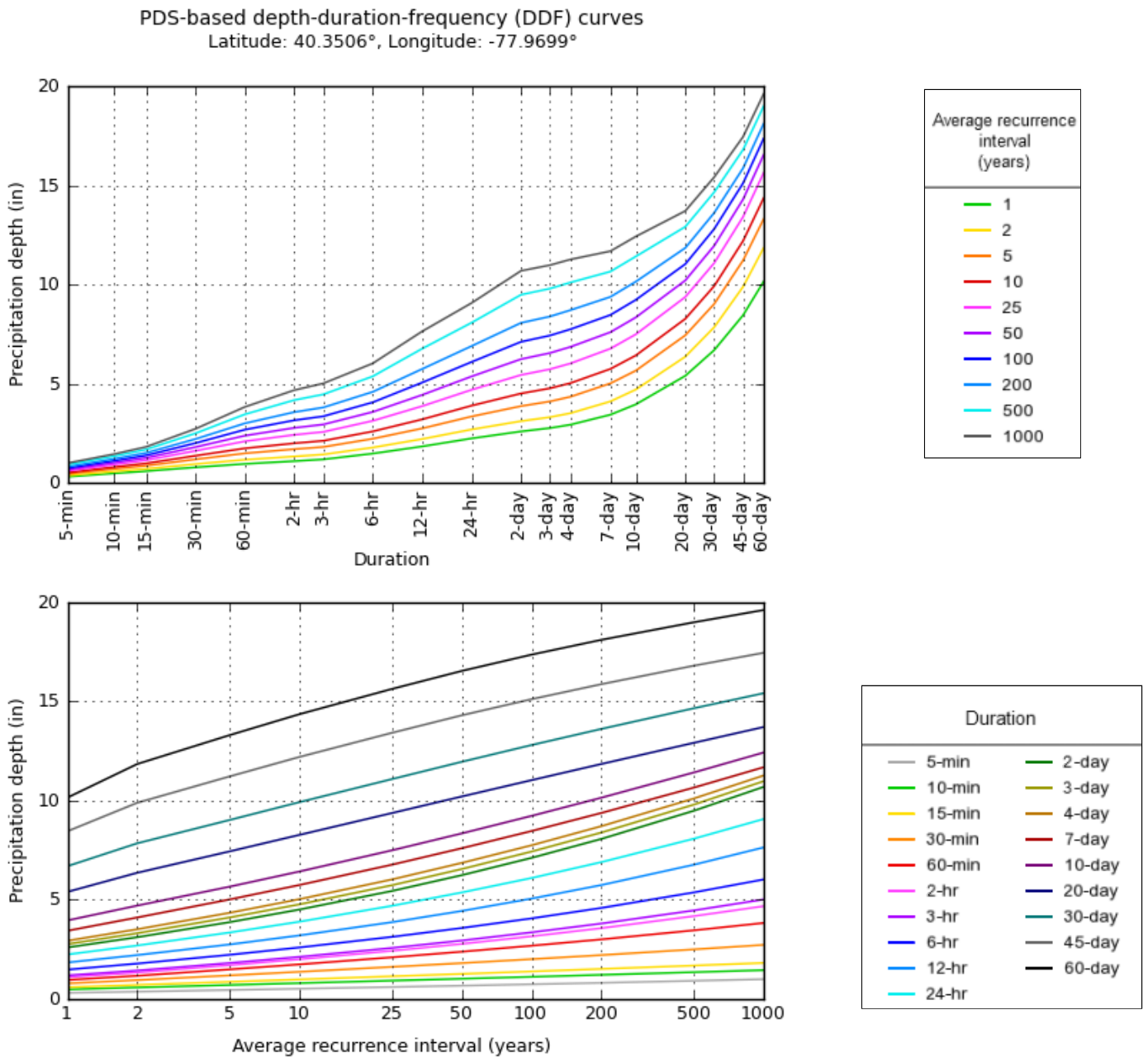
PF graphical



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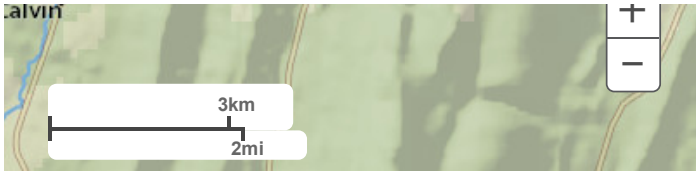
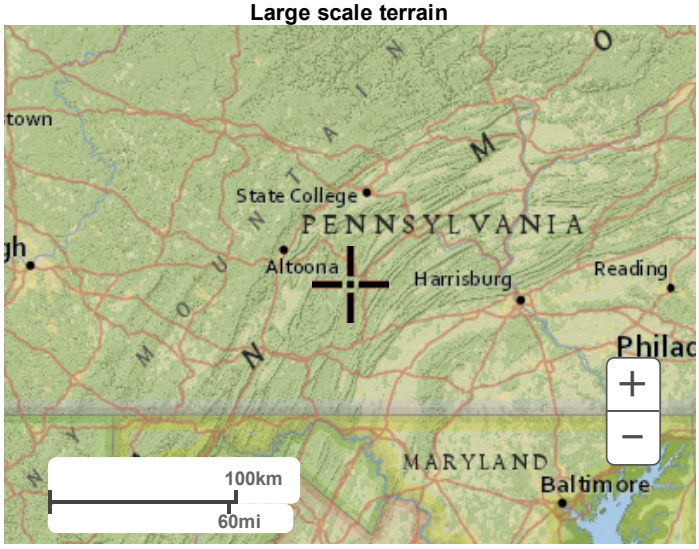
Maps & aerials

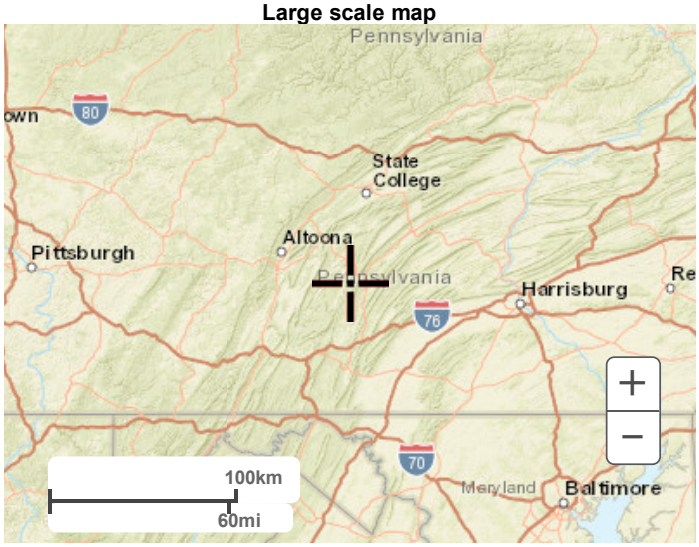
Small scale terrain



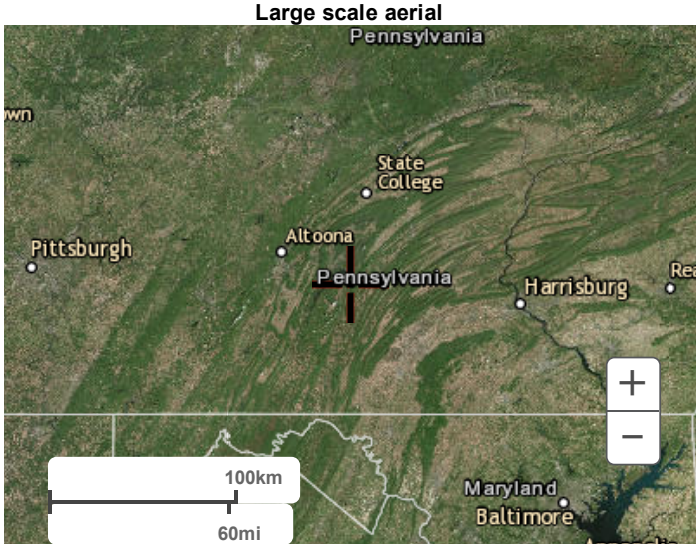
Large scale terrain



Large scale map



Large scale aerial



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WORKSHEET 1. GENERAL SITE INFORMATION

Date: November 11, 2016

Project Name: Hares Valley Road

Municipality: Union

County: Huntingdon

Total Area (acres): 1.22

Major River Basin: Juniata River

Watershed: Aughwick Creek

Sub Basin: Hares Valley Creek

Nearest Surface Water to Receive Runoff: Tributary #13276 to Hares Valley Creek

Chapter 93 - Designated Water Use: Trout Stocking Fish (TSF)

Impaired according to Chapter 303(d) list?	YES	
	NO	X
List Causes of Impairment:		

Is Project Subject to, or Part of:

Municipal Separate Storm Sewer System (MS4) Requirements	YES	
	NO	X
Existing or Planned drinking water supply?	YES	
	NO	X
If yes, distance from proposed discharge (miles):		
Approved Act 167 Plan?	YES	
	NO	X
Existing River Conservation Plan?	YES	X
	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 - 0.51 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	0.51	
Natural Drainage Ways	N/A		
Steep Slopes, 15% - 25%	N/A		
Steep Slopes, over 25%	N/A		
Other:			
Other:			
TOTAL EXISTING:		**0.51**	**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
0.83	-	0	=	0.83

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

For all other disconnected roof areas

Roof Area _____ ft^2 x 1/4" x 1/12 = _____ ft^3

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

For all other disconnected roof areas

Impervious Area _____ ft^2 x 1/4" x 1/12 = _____ ft^3

TOTAL NON-STRUCTURAL VOLUME CREDIT* _____ ft^3

**For use on Worksheet 5*

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

PROJECT: Hares Valley Road
Drainage Area: 1.22 acres
2-Year Rainfall: 2.70 in

Total Site Area: 0.83 acres
Protected Site Area: N/A acres
Managed Site Area: 0.83 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)
Meadow	B	7,405	0.17	58	7.24	1.45	0.18	114
Meadow	C	6,534	0.15	71	4.08	0.82	0.59	324
Woods	B	18,295	0.42	55	8.18	1.64	0.12	187
Woods	C	3,920	0.09	70	4.29	0.86	0.55	181
TOTAL:		**36,155**	**0.83**					**805**

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	3,049	0.07	89	1.24	0.25	1.63	414
Impervious - Gravel	C	2,178	0.05	91	0.99	0.20	1.79	325
Meadow	B	22,651	0.52	58	7.24	1.45	0.18	348
Meadow	C	8,276	0.19	71	4.08	0.82	0.59	410
Woods	B	-	0.00	55	8.18	1.64	0.12	0
Woods	C	-	0.00	77	2.99	0.60	0.87	0
TOTAL:		**36,155**	**0.83**					**1,498**

2-Year Volume Increase (ft^3):	**693**

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 x Area x 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: Hares Valley Road
SUB-BASIN:

Required Control Volume (ft^3) - *from Worksheet 4:* 693

Non-structural Volume Credit (ft^3) - *from Worksheet 3:* N/A
(maximum is 25% of required volume)

Structural Volume Reqmt (ft^3) 693
(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/Bioretention		
6.4.6	Dry Well/Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Berm	1,438	1,009
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:			
		Total Structural Volume (ft^3):	**1,009**
		Structural Volume Requirement (ft^3):	**693**
		DIFFERENCE:	**-316**

VOLUME CREDIT DETERMINATION DETAINED 1

1 Detained area runoff volume from Hydraflow = 356 cf
2 Storage volume of the BMPs = 1,516 cf
3 Infiltrated volume within 72 hours after the 2-yr/24-hr event
(Infiltration Rate/12) x Infiltration Area x 72 hrs = 356 cf

Potential infiltrated volume = 8,213 cf. Since this is greater than the storage volume, only the storage volume can be used and assumed to infiltrate within 72 hours.

VOLUME CREDIT DETERMINATION DETAINED 2

1 Detained area runoff volume from Hydraflow = 653 cf
2 Storage volume of the BMPs = 1,020 cf
3 Infiltrated volume within 72 hours after the 2-yr/24-hr event
(Infiltration Rate/12) x Infiltration Area x 72 hrs = 653 cf

Potential infiltrated volume = 11,105 cf. Since this is greater than the storage volume, only the storage volume can be used and assumed to infiltrate within 72 hours.

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		
NS BMP 5.5.4 - Cluster Uses at Each Site		
NS BMP 5.6.1 - Minimize Total Disturbed Area	X	
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native Species)	X	
NS BMP 5.9.1 - Street Sweeping / Vacuuming		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		

SECONDARY BMPs FOR NITRATE:

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

TIME OF CONCENTRATION ADJUSTMENT

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT 4.8 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 1,516 CF

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	0.103
10 YR/24 HR	0.460
50 YR/24 HR	1.025
100 YR/24 HR	1.339

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	0.103	245.307
10 YR/24 HR	0.460	54.928
50 YR/24 HR	1.025	24.650
100 YR/24 HR	1.339	18.870

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	0.103	245.307	250.107
10 YR/24 HR	0.460	54.928	59.728
50 YR/24 HR	1.025	24.650	29.450
100 YR/24 HR	1.339	18.870	23.670

TIME OF CONCENTRATION ADJUSTMENT

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT 5.6 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 1,020 CF

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	0.206
10 YR/24 HR	0.825
50 YR/24 HR	1.785
100 YR/24 HR	2.314

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	0.206	82.524
10 YR/24 HR	0.825	20.606
50 YR/24 HR	1.785	9.524
100 YR/24 HR	2.314	7.347

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	0.206	82.524	88.124
10 YR/24 HR	0.825	20.606	26.206
50 YR/24 HR	1.785	9.524	15.124
100 YR/24 HR	2.314	7.347	12.947

INFILTRATION BERM DEWATERING CALCULATION SITE NAME: Hares Valley

BERMS A - B

STORAGE VOLUME	1,516	CF	
DESIGN INFILTRATION RATE	0.9	IN/HR	BASED ON IT-02
INFILTRATION AREA	1,521	SF	

DEWATERING TIME = STORAGE VOLUME / ((DESIGN INFILTRATION RATE /12) * INFILTRATION AREA)

DEWATERING TIME = 13.3 HOURS

BERMS C - E

STORAGE VOLUME	1,020	CF	
DESIGN INFILTRATION RATE	1.4	IN/HR	BASED ON A AND IT-03
INFILTRATION AREA	544	SF	

DEWATERING TIME = STORAGE VOLUME / ((DESIGN INFILTRATION RATE /12) * INFILTRATION AREA)

DEWATERING TIME = 16.1 HOURS

Underdrain Discharge Report

Label	Solve For	Friction Method	Roughness Coefficient
UNDERDRAIN DETAINED 1	Full Flow Capacity	Manning Formula	0.012
UNDERDRAIN DETAINED 2	Full Flow Capacity	Manning Formula	0.012

Channel Slope (ft/ft)	Normal Depth (ft)	Diameter (ft)	Discharge (ft³/s)
0.01900	0.33	0.33	0.28
0.00500	0.33	0.33	0.15

Flow Area (ft²)	Wetted Perimeter (ft)	Hydraulic Radius (ft)	Top Width (ft)
0.09	1.05	0.08	0.00
0.09	1.05	0.08	0.00

Critical Depth (ft)	Percent Full (%)	Critical Slope (ft/ft)	Velocity (ft/s)
0.29	100.0	0.01708	3.26
0.21	100.0	0.00897	1.67

Velocity Head (ft)	Specific Energy (ft)	Froude Number	Maximum Discharge (ft³/s)
0.16	0.50	0.00	0.31
0.04	0.38	0.00	0.16

Discharge Full (ft³/s)	Slope Full (ft/ft)	Flow Type	Notes

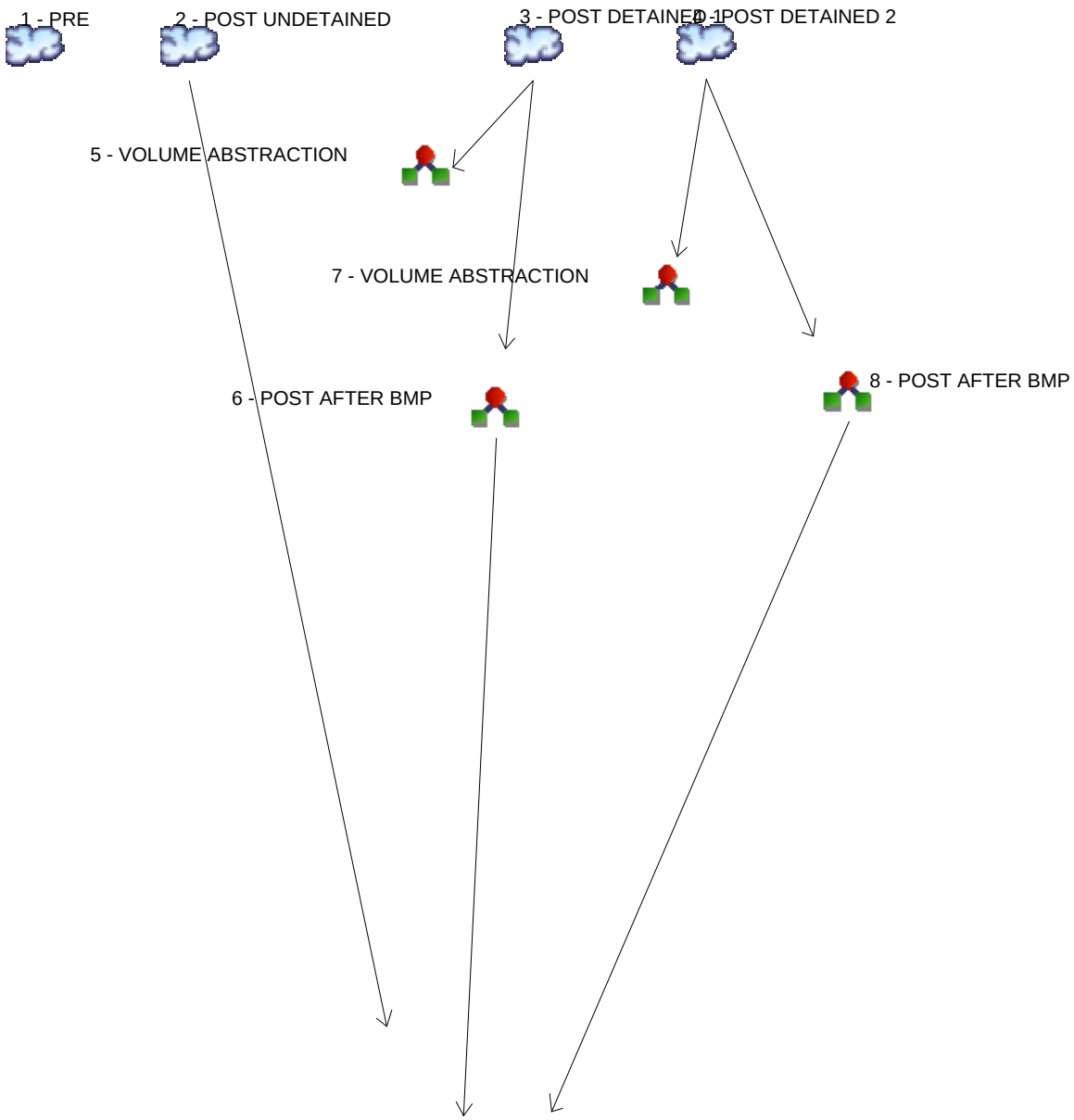
Underdrain Discharge Report

Discharge Full (ft³/s)	Slope Full (ft/ft)	Flow Type	Notes
0.28	0.01900	SubCritical	
0.15	0.00500	SubCritical	

Messages

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

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	0.243	-------	-------	1.283	-------	3.041	4.029	PRE
2	SCS Runoff	------	-------	0.203	-------	-------	0.474	-------	0.853	1.055	POST UNDETAINED
3	SCS Runoff	------	-------	0.103	-------	-------	0.460	-------	1.025	1.339	POST DETAINED 1
4	SCS Runoff	------	-------	0.206	-------	-------	0.825	-------	1.785	2.314	POST DETAINED 2
5	Diversion1	3	-------	0.103	-------	-------	0.460	-------	1.025	1.339	VOLUME ABSTRACTION
6	Diversion2	3	-------	0.000	-------	-------	0.000	-------	0.029	0.083	POST AFTER BMP
7	Diversion1	4	-------	0.206	-------	-------	0.825	-------	1.785	2.258	VOLUME ABSTRACTION
8	Diversion2	4	-------	0.000	-------	-------	0.037	-------	1.475	2.314	POST AFTER BMP
9	Combine	2, 6, 8	-------	0.203	-------	-------	0.474	-------	2.163	3.367	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	0.243	1	721	1,004	------	------	------	PRE
2	SCS Runoff	0.203	2	718	425	------	------	------	POST UNDETAINED
3	SCS Runoff	0.103	2	720	334	------	------	------	POST DETAINED 1
4	SCS Runoff	0.206	2	718	612	------	------	------	POST DETAINED 2
5	Diversion1	0.103	2	720	334	3	------	------	VOLUME ABSTRACTION
6	Diversion2	0.000	2	n/a	0	3	------	------	POST AFTER BMP
7	Diversion1	0.206	2	718	612	4	------	------	VOLUME ABSTRACTION
8	Diversion2	0.000	2	n/a	0	4	------	------	POST AFTER BMP
9	Combine	0.203	2	718	425	2, 6, 8	------	------	POST AT POI

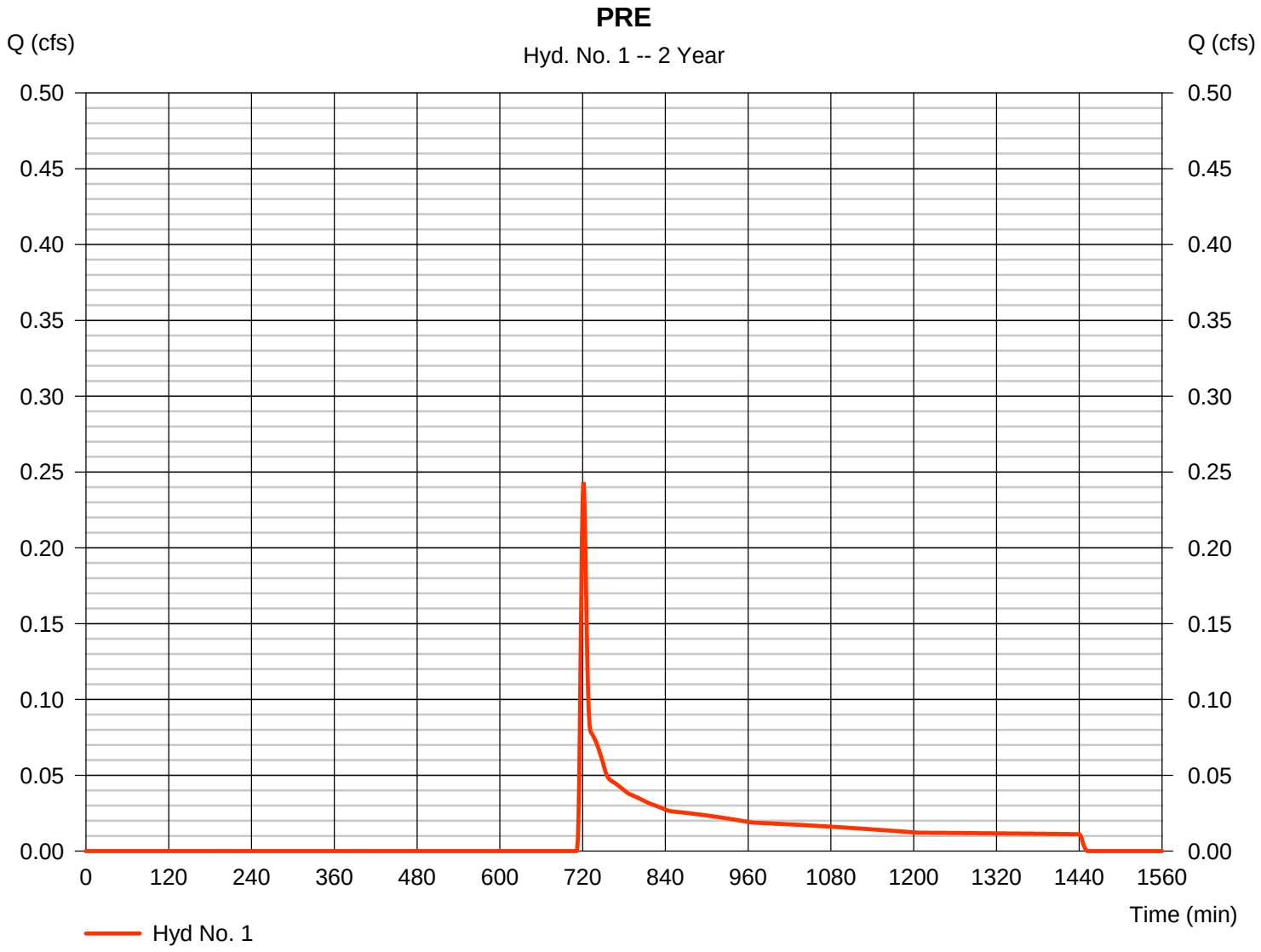
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.243 cfs
Storm frequency	=	2 yrs	Time to peak	=	721 min
Time interval	=	1 min	Hyd. volume	=	1,004 cuft
Drainage area	=	1.220 ac	Curve number	=	60*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.320 x 58) + (0.190 x 71) + (0.610 x 55) + (0.100 x 70)] / 1.220



TR55 Tc Worksheet

Hyd. No. 1

PRE

Description	A		B		C		Totals
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)	= 2.70		0.00		0.00		
Land slope (%)	= 4.23		0.00		0.00		
Travel Time (min)	**= 6.61**	**+**	**0.00**	**+**	**0.00**	**=**	**6.61**
Shallow Concentrated Flow							
Flow length (ft)	= 599.00		0.00		0.00		
Watercourse slope (%)	= 14.45		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.13		0.00		0.00		
Travel Time (min)	**= 1.63**	**+**	**0.00**	**+**	**0.00**	**=**	**1.63**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 8.20 min

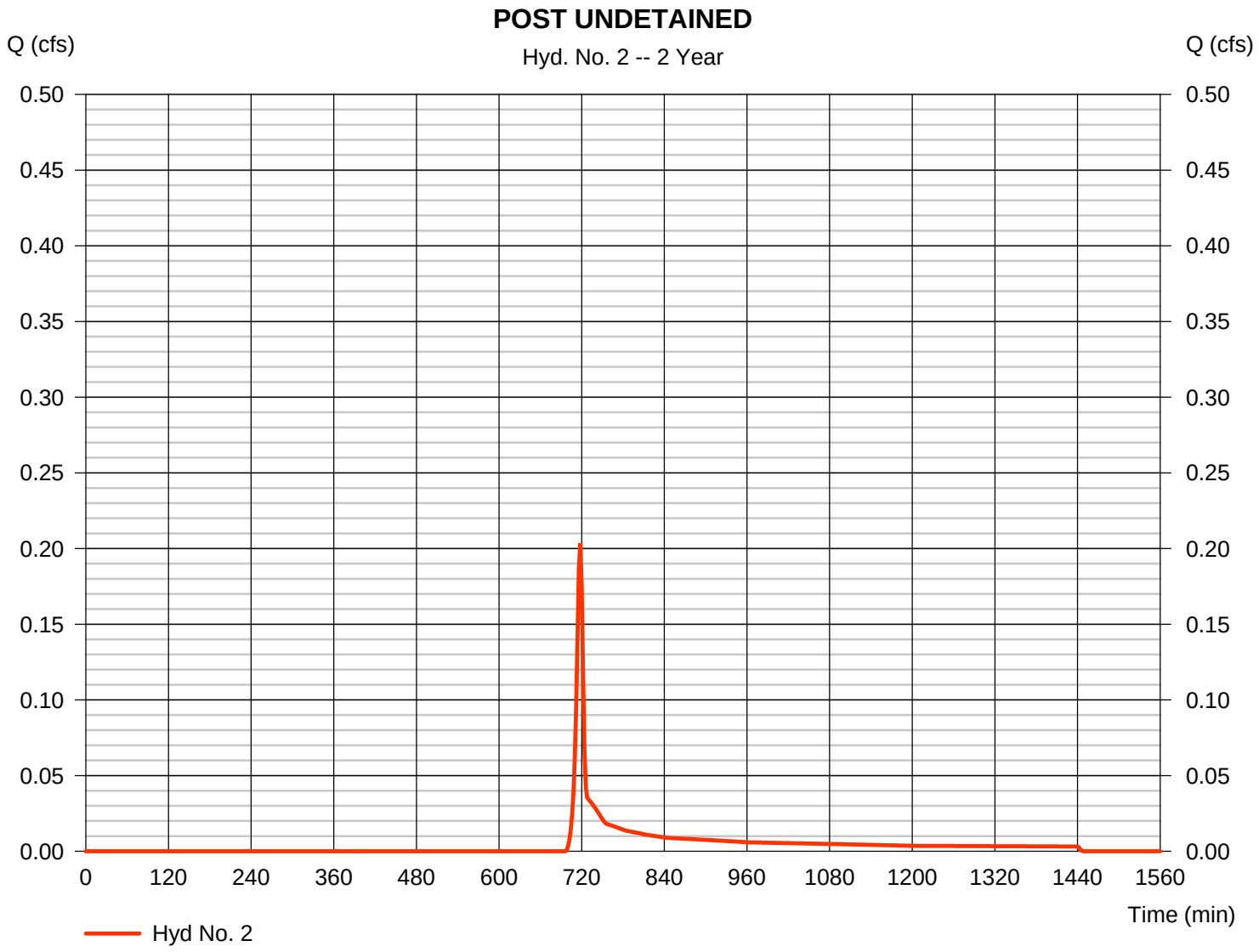
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 0.203 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 425 cuft
Drainage area	= 0.210 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.30 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.020 x 89) + (0.030 x 58) + (0.160 x 71)] / 0.210



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED

Description	A		B		C		Totals
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)	= 2.70		0.00		0.00		
Land slope (%)	= 10.00		0.00		0.00		
Travel Time (min)	**= 4.69**	**+**	**0.00**	**+**	**0.00**	**=**	**4.69**
Shallow Concentrated Flow							
Flow length (ft)	= 160.00		0.00		0.00		
Watercourse slope (%)	= 8.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.59		0.00		0.00		
Travel Time (min)	**= 0.58**	**+**	**0.00**	**+**	**0.00**	**=**	**0.58**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 5.30 min

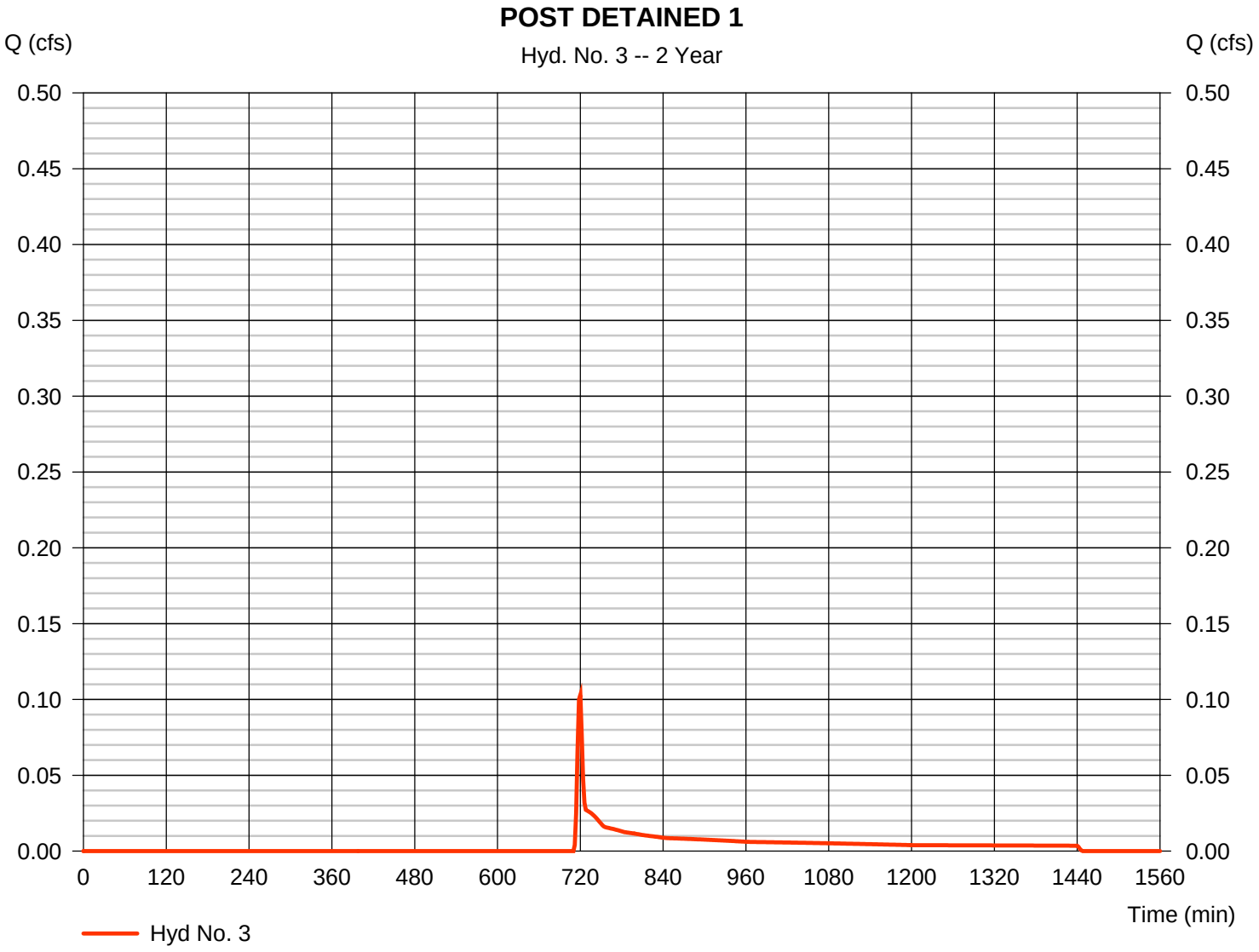
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.103 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 334 cuft
Drainage area	= 0.380 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.80 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.030 x 71) + (0.320 x 58)] / 0.380



TR55 Tc Worksheet

Hyd. No. 3

POST DETAINED 1

Description	A		B		C		Totals
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)	= 2.70		2.70		0.00		
Land slope (%)	= 18.00		0.00		0.00		
Travel Time (min)	**= 3.71**	**+**	**0.00**	**+**	**0.00**	**=**	**3.71**
Shallow Concentrated Flow							
Flow length (ft)	= 341.00		0.00		0.00		
Watercourse slope (%)	= 12.40		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=7.16		0.00		0.00		
Travel Time (min)	**= 0.79**	**+**	**0.00**	**+**	**0.00**	**=**	**0.79**
Channel Flow							
X sectional flow area (sqft)	= 0.09		0.00		0.00		
Wetted perimeter (ft)	= 1.05		0.00		0.00		
Channel slope (%)	= 1.90		0.00		0.00		
Manning's n-value	= 0.012		0.015		0.015		
Velocity (ft/s)	=3.30						
			0.00				
					0.00		
Flow length (ft)	({0})53.0		0.0		0.0		
Travel Time (min)	**= 0.27**	**+**	**0.00**	**+**	**0.00**	**=**	**0.27**

Total Travel Time, Tc ..... 4.80 min

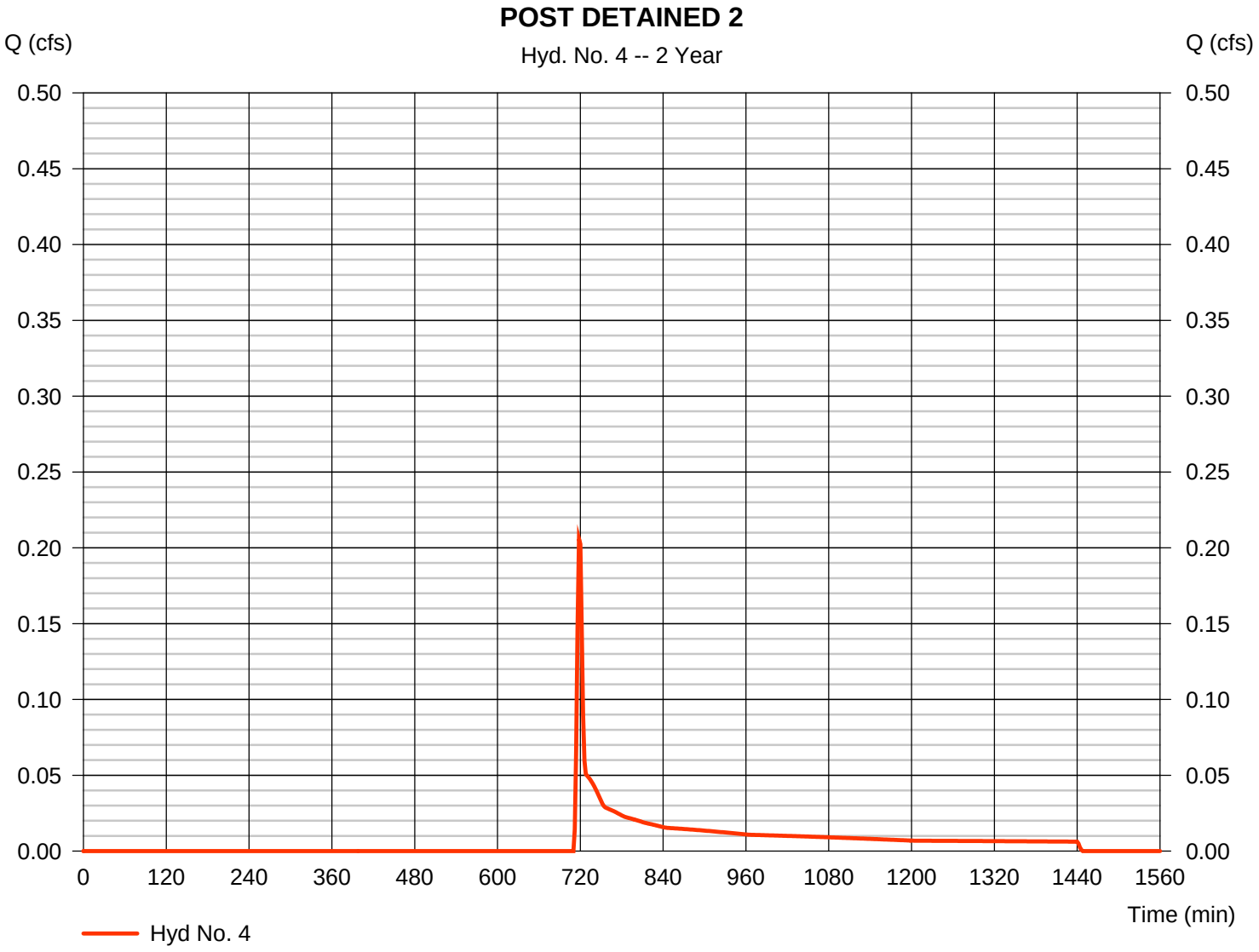
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.206 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 612 cuft
Drainage area	= 0.630 ac	Curve number	= 62*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.60 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.050 x 85) + (0.030 x 89) + (0.180 x 55) + (0.330 x 58) + (0.040 x 71)] / 0.630



TR55 Tc Worksheet

Hyd. No. 4

POST DETAINED 2

Description	A		B		C		Totals
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)	= 2.70		0.00		0.00		
Land slope (%)	= 16.00		0.00		0.00		
Travel Time (min)	**= 3.88**	**+**	**0.00**	**+**	**0.00**	**=**	**3.88**
Shallow Concentrated Flow							
Flow length (ft)	= 452.00		0.00		0.00		
Watercourse slope (%)	= 13.70		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=5.97		0.00		0.00		
Travel Time (min)	**= 1.26**	**+**	**0.00**	**+**	**0.00**	**=**	**1.26**
Channel Flow							
X sectional flow area (sqft)	= 0.09		0.00		0.00		
Wetted perimeter (ft)	= 1.05		0.00		0.00		
Channel slope (%)	= 0.50		0.00		0.00		
Manning's n-value	= 0.012		0.015		0.015		
Velocity (ft/s)	=1.69						
			0.00				
					0.00		
Flow length (ft)	({0})51.0		0.0		0.0		
Travel Time (min)	**= 0.50**	**+**	**0.00**	**+**	**0.00**	**=**	**0.50**

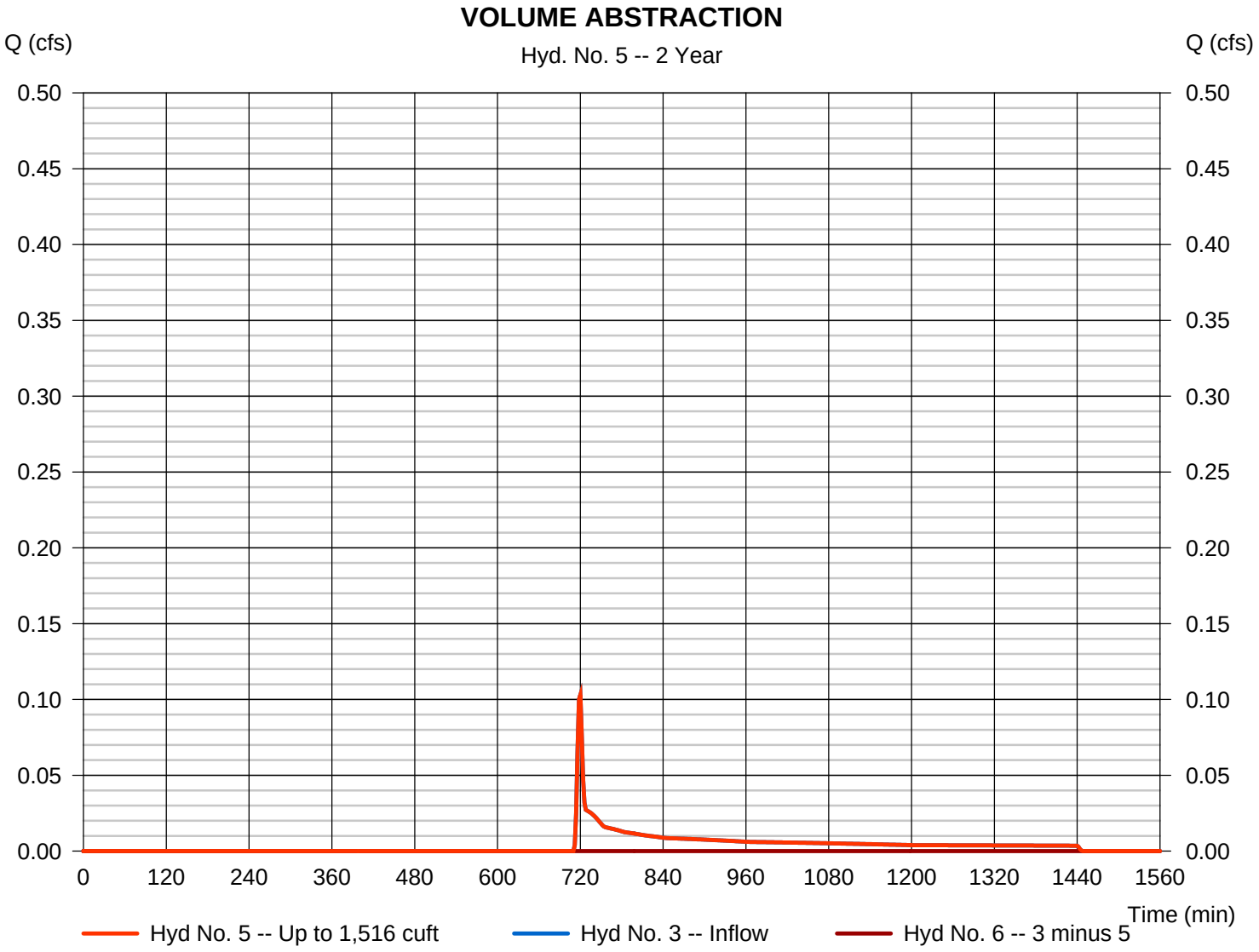
Total Travel Time, Tc ..... 5.60 min

Hydrograph Report

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.103 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 334 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

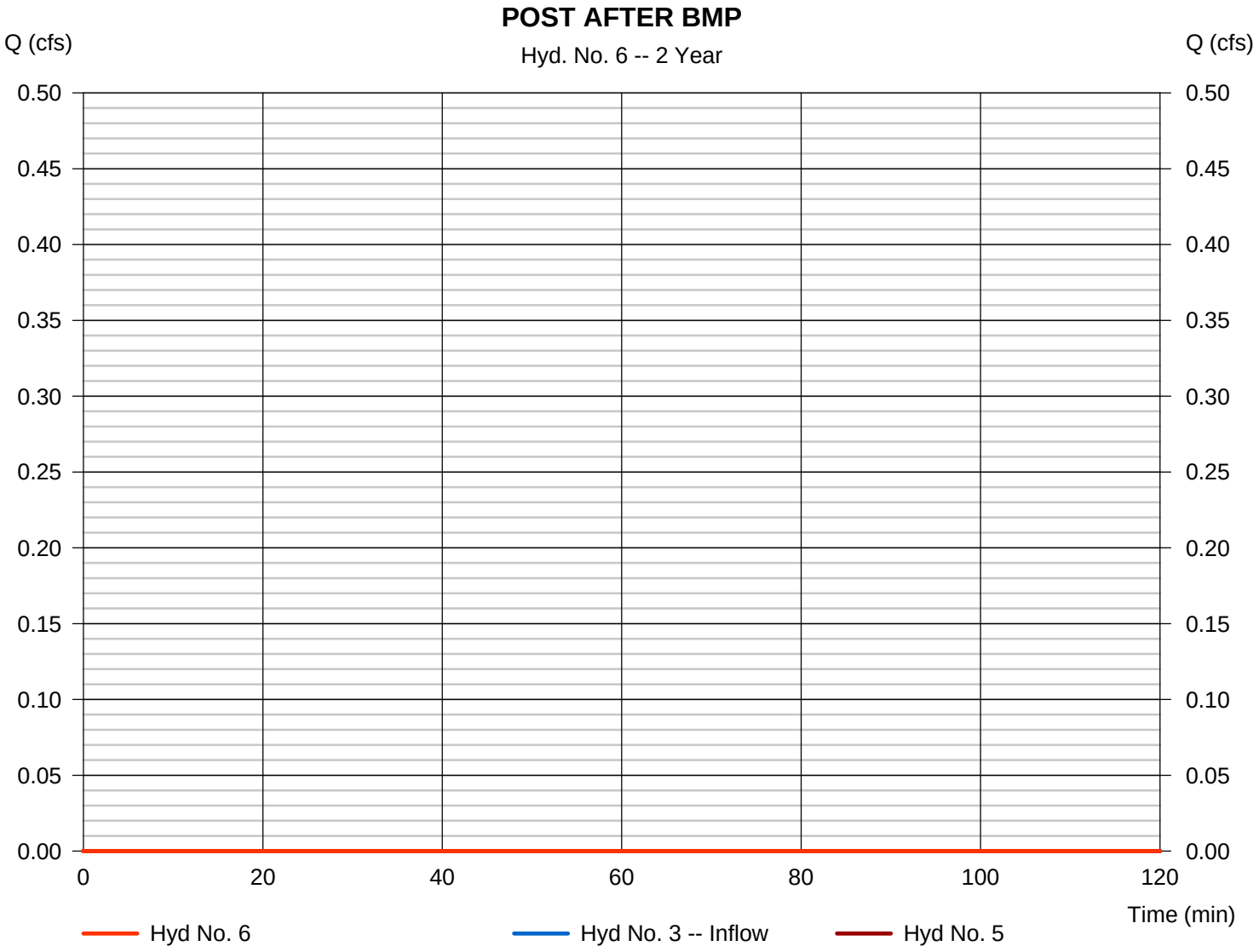


Hydrograph Report

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

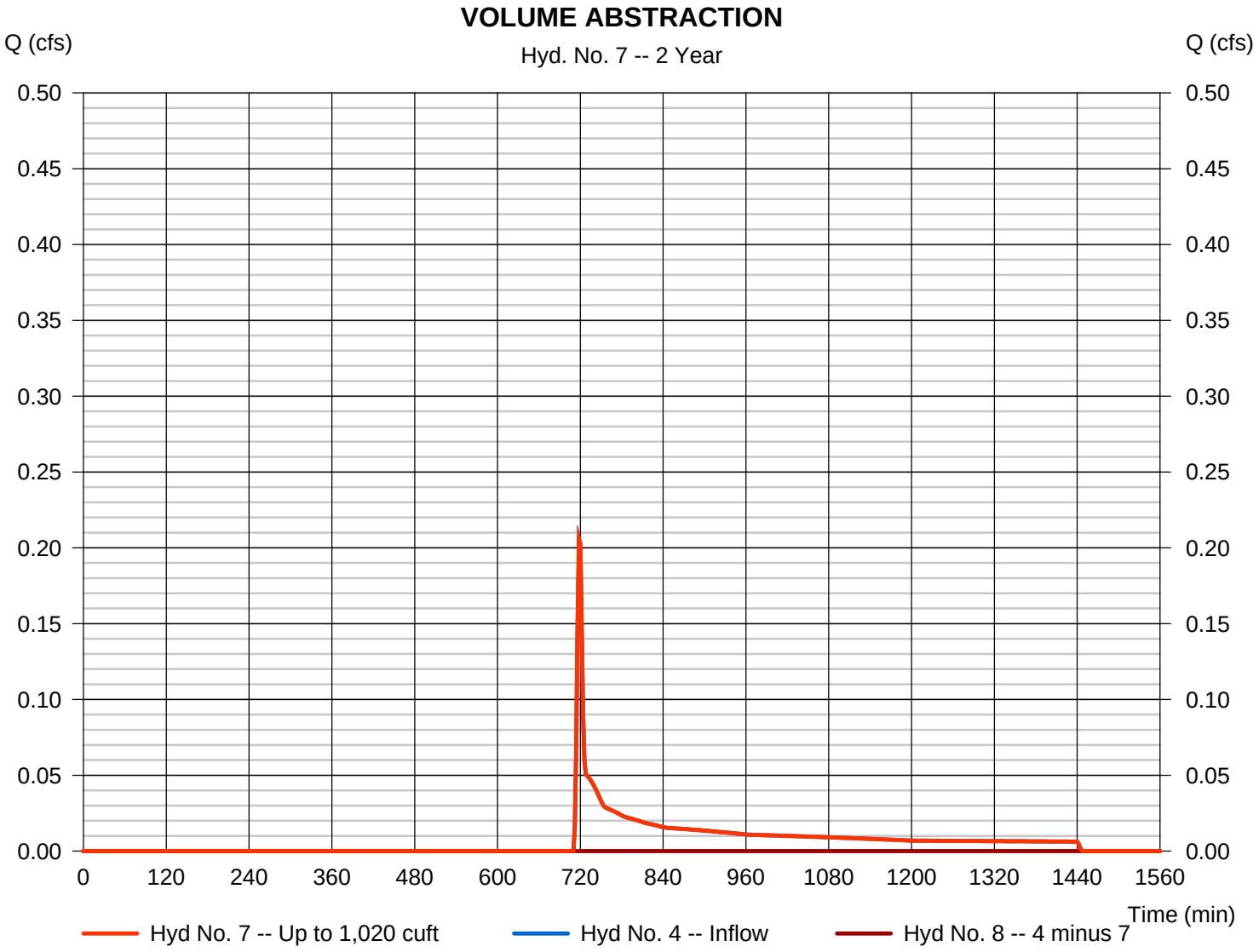


Hydrograph Report

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.206 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 612 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

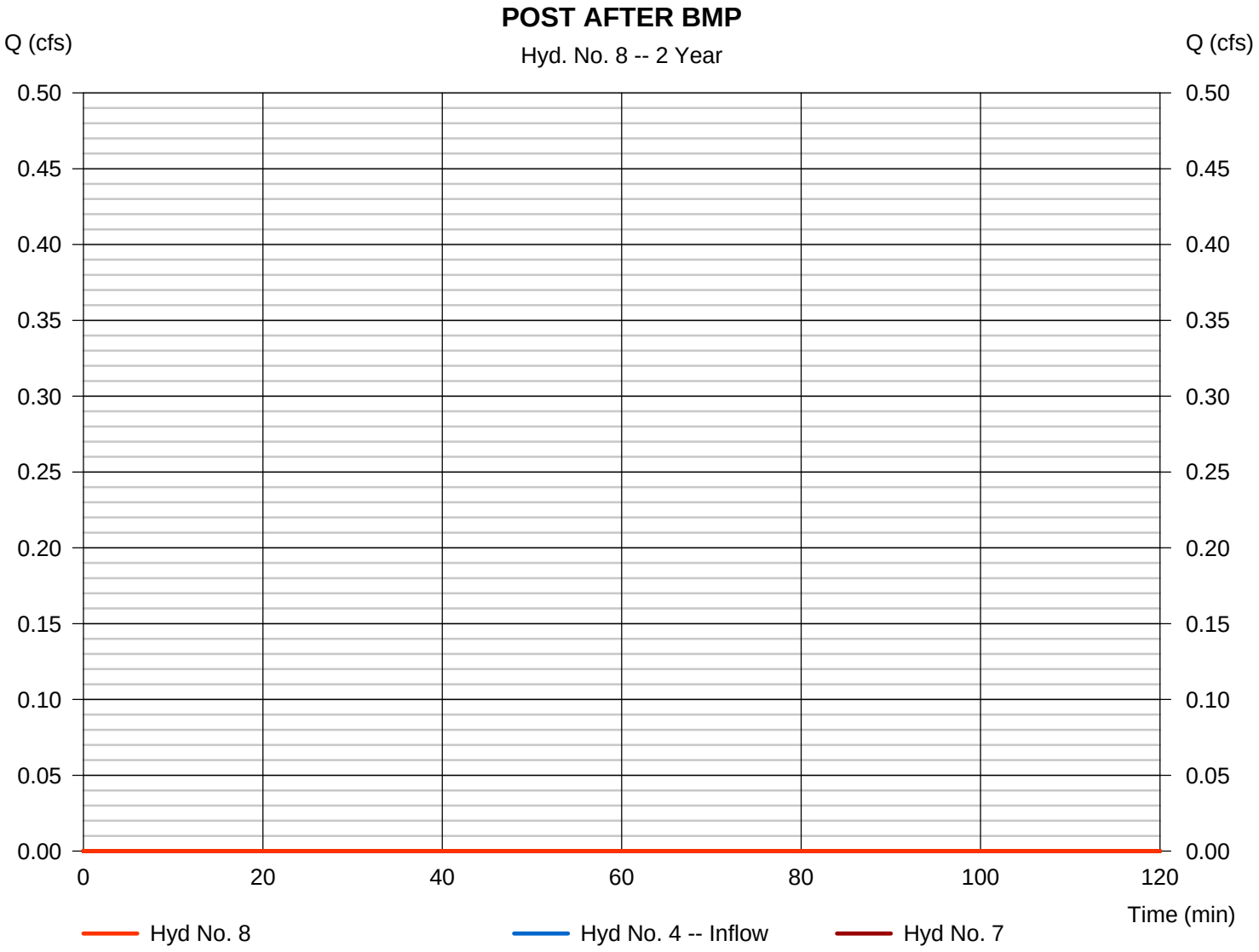


Hydrograph Report

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

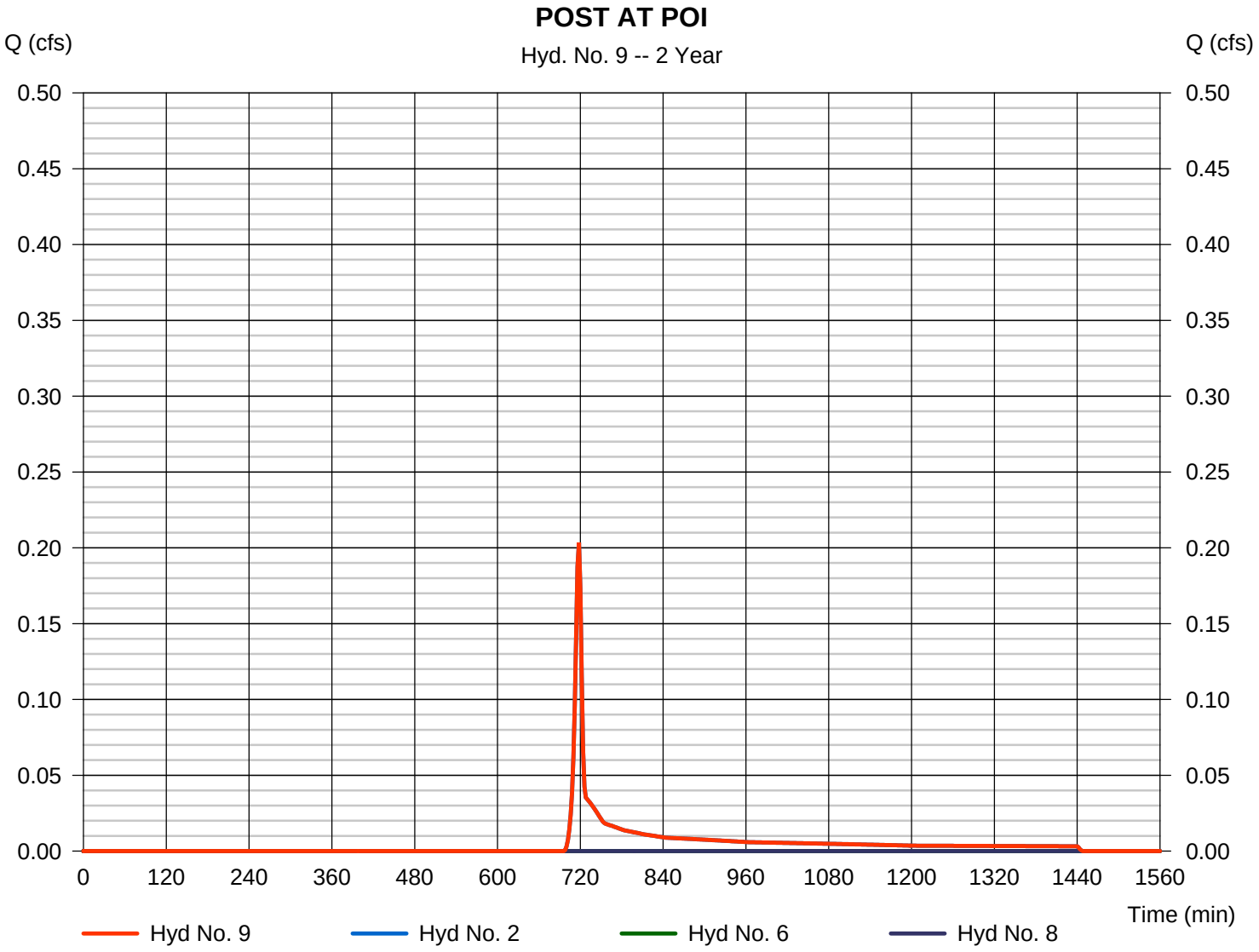


Hydrograph Report

Hyd. No. 9

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.203 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 425 cuft
Inflow hyds.	= 2, 6, 8	Contrib. drain. area	= 0.210 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	1.283	1	719	3,081	------	------	------	PRE
2	SCS Runoff	0.474	2	718	948	------	------	------	POST UNDETAINED
3	SCS Runoff	0.460	2	718	986	------	------	------	POST DETAINED 1
4	SCS Runoff	0.825	2	718	1,741	------	------	------	POST DETAINED 2
5	Diversion1	0.460	2	718	986	3	------	------	VOLUME ABSTRACTION
6	Diversion2	0.000	2	n/a	0	3	------	------	POST AFTER BMP
7	Diversion1	0.825	2	718	1,023	4	------	------	VOLUME ABSTRACTION
8	Diversion2	0.037	2	842	718	4	------	------	POST AFTER BMP
9	Combine	0.474	2	718	1,666	2, 6, 8	------	------	POST AT POI

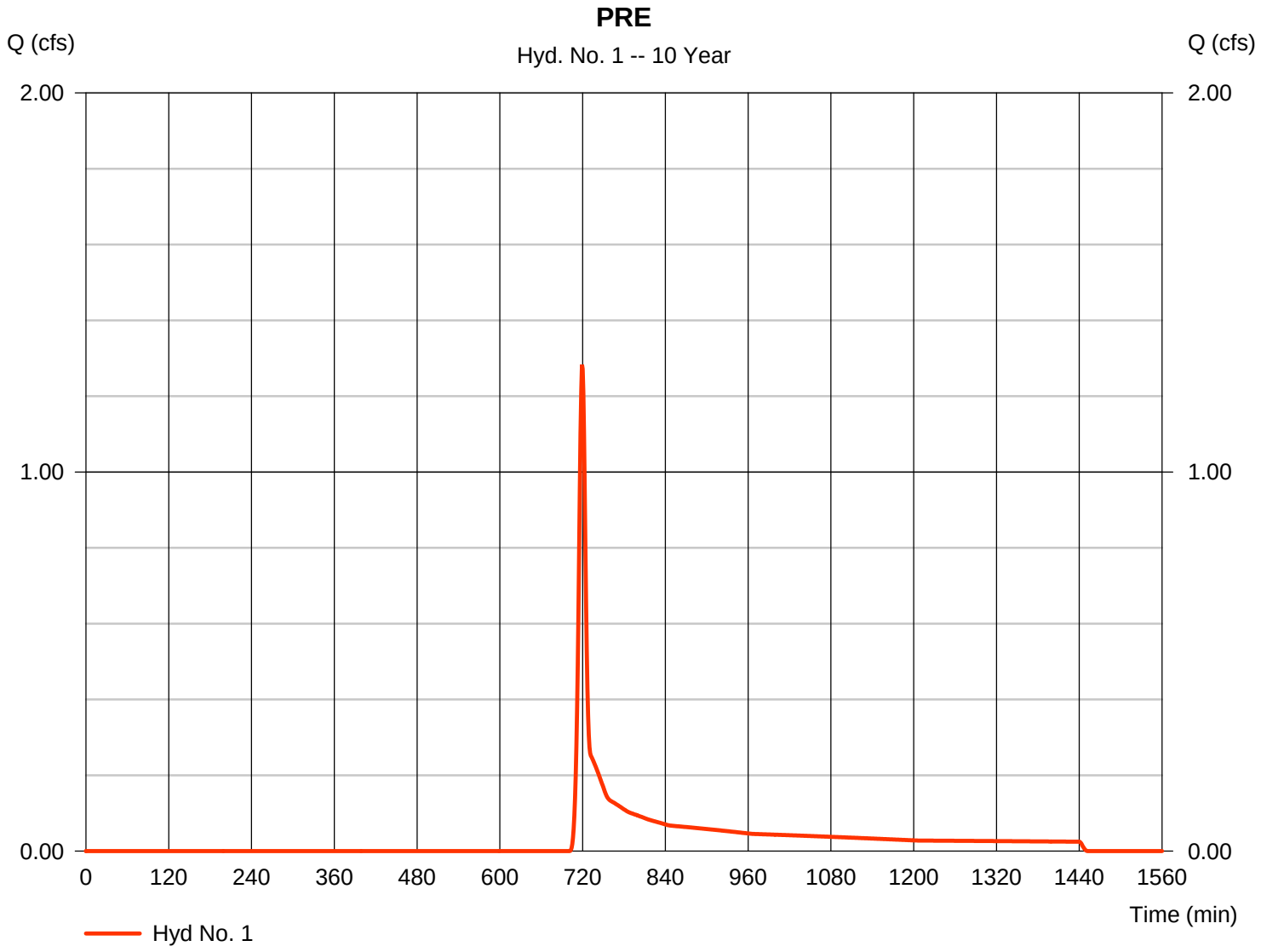
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.283 cfs
Storm frequency	=	10 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	3,081 cuft
Drainage area	=	1.220 ac	Curve number	=	60*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	3.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.320 x 58) + (0.190 x 71) + (0.610 x 55) + (0.100 x 70)] / 1.220



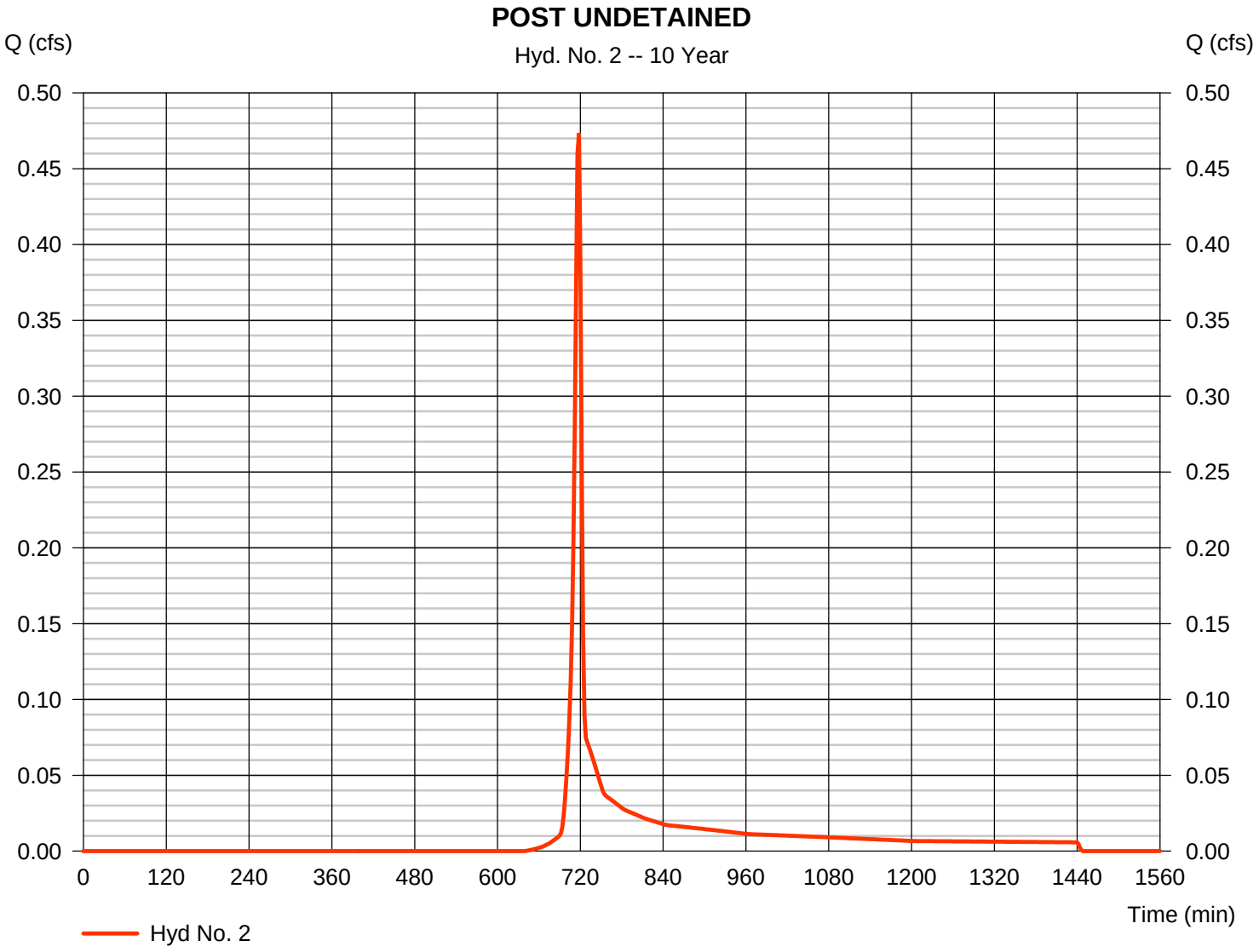
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.474 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	948 cuft
Drainage area	=	0.210 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.30 min
Total precip.	=	3.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.020 x 89) + (0.030 x 58) + (0.160 x 71)] / 0.210



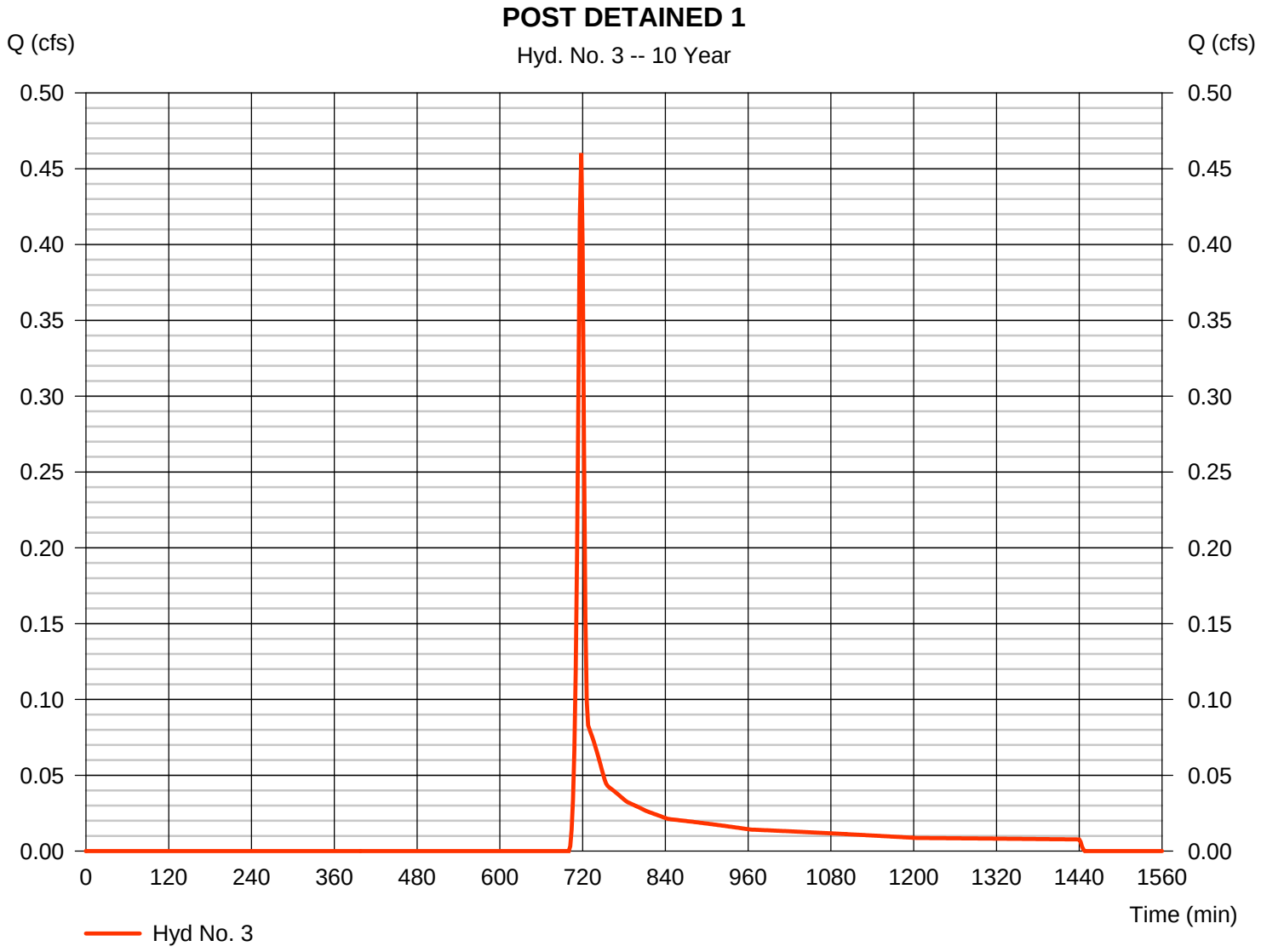
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.460 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 986 cuft
Drainage area	= 0.380 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.80 min
Total precip.	= 3.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.030 x 71) + (0.320 x 58)] / 0.380



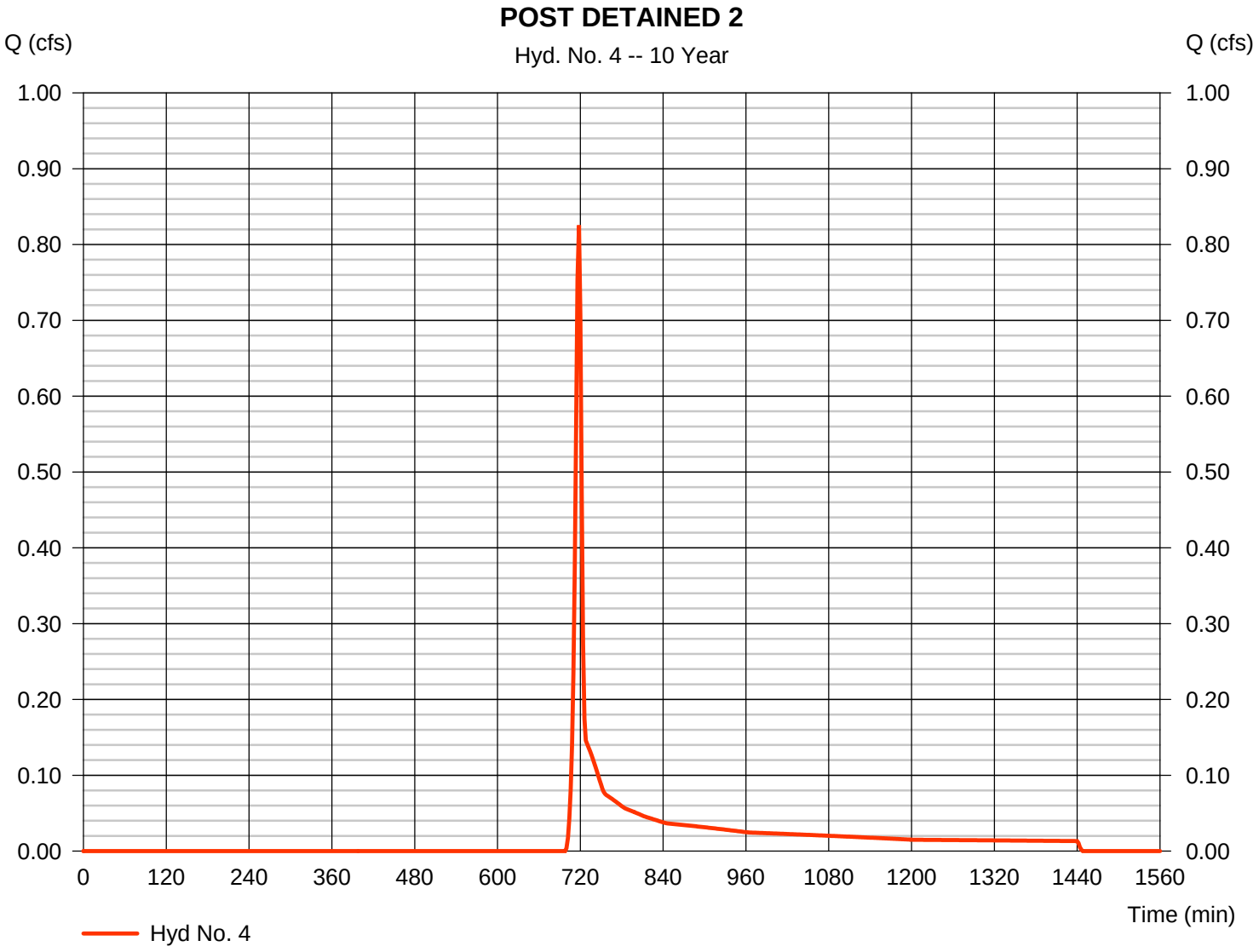
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.825 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	1,741 cuft
Drainage area	=	0.630 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.60 min
Total precip.	=	3.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.050 x 85) + (0.030 x 89) + (0.180 x 55) + (0.330 x 58) + (0.040 x 71)] / 0.630

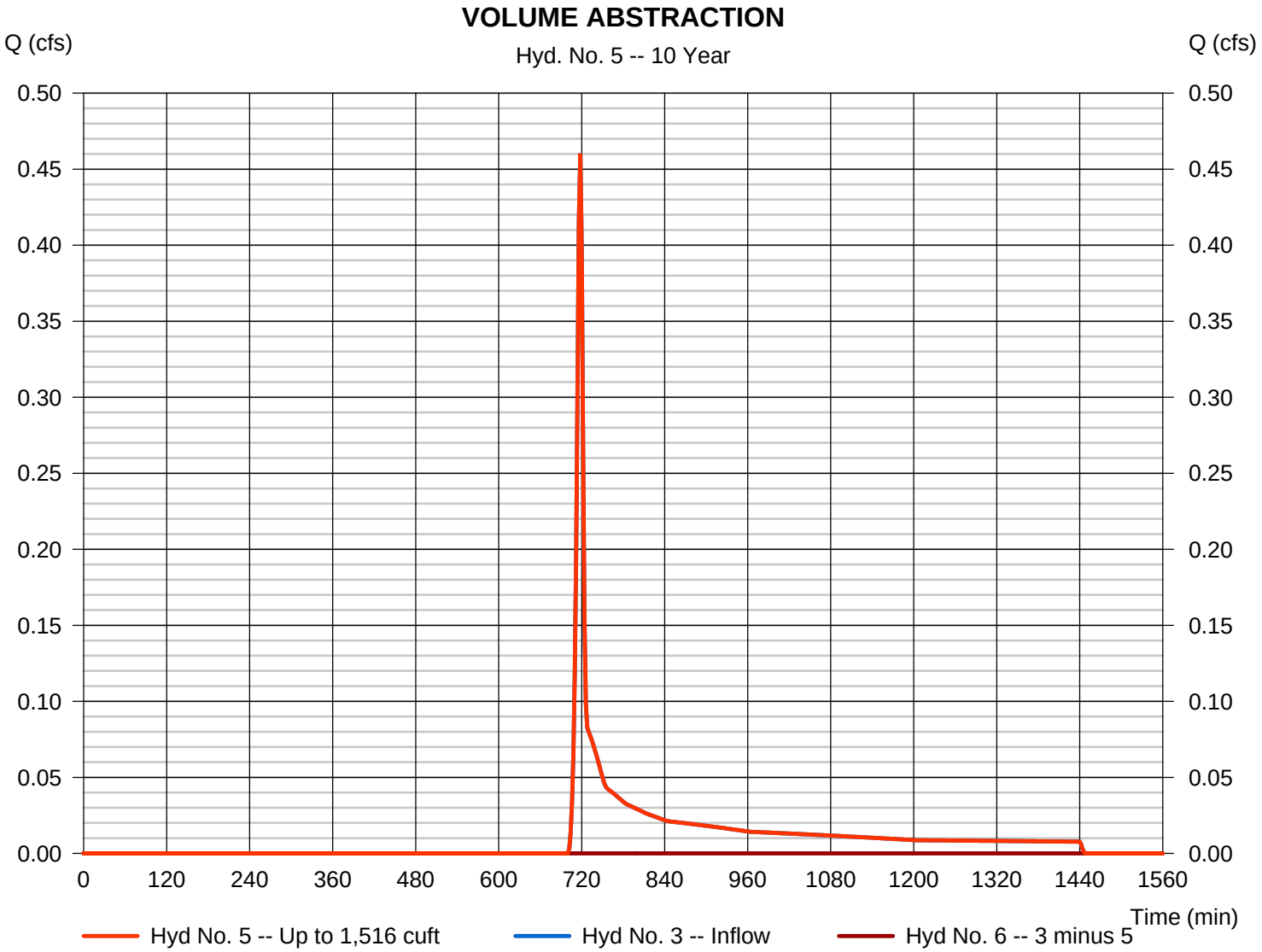


Hydrograph Report

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.460 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 986 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

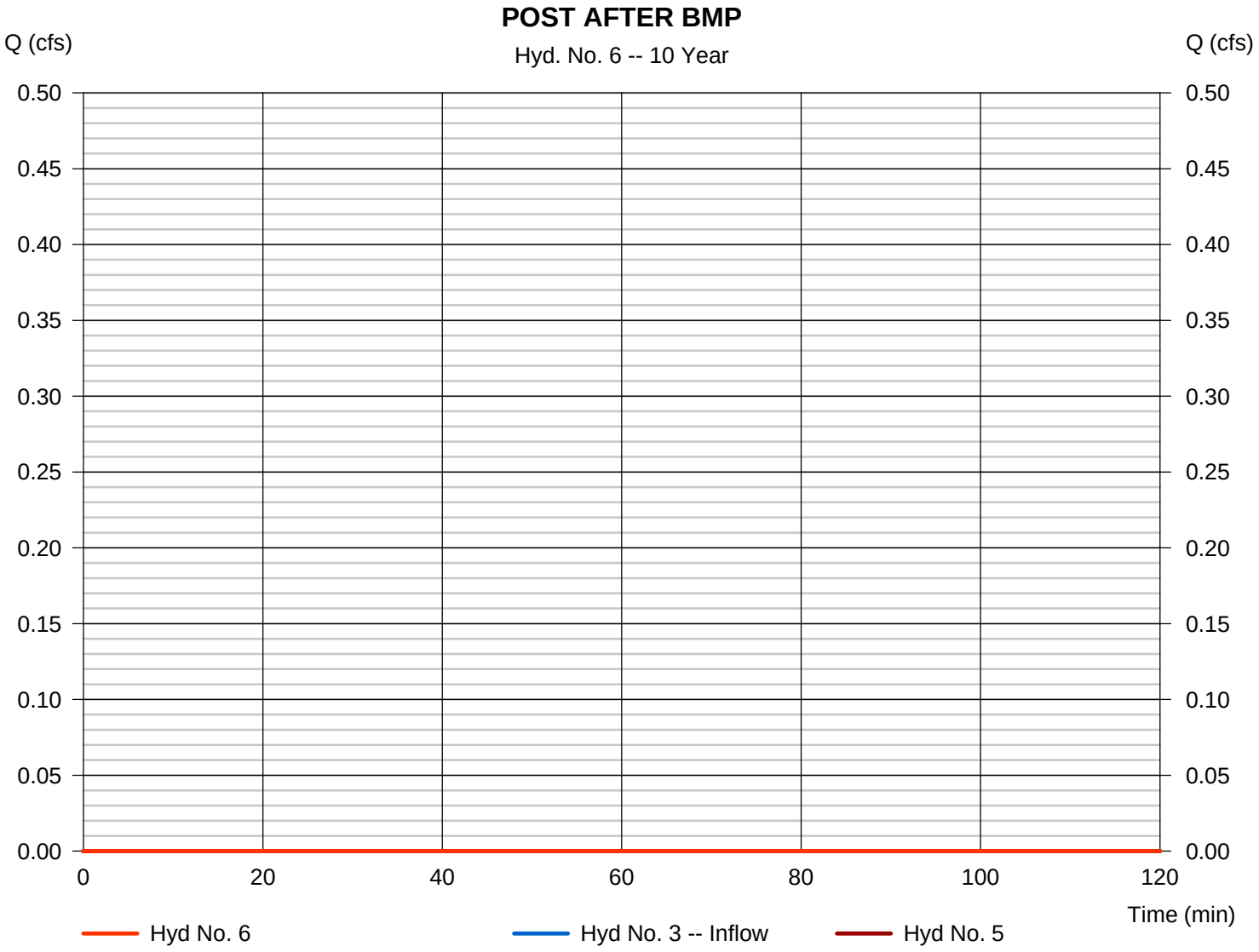


Hydrograph Report

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

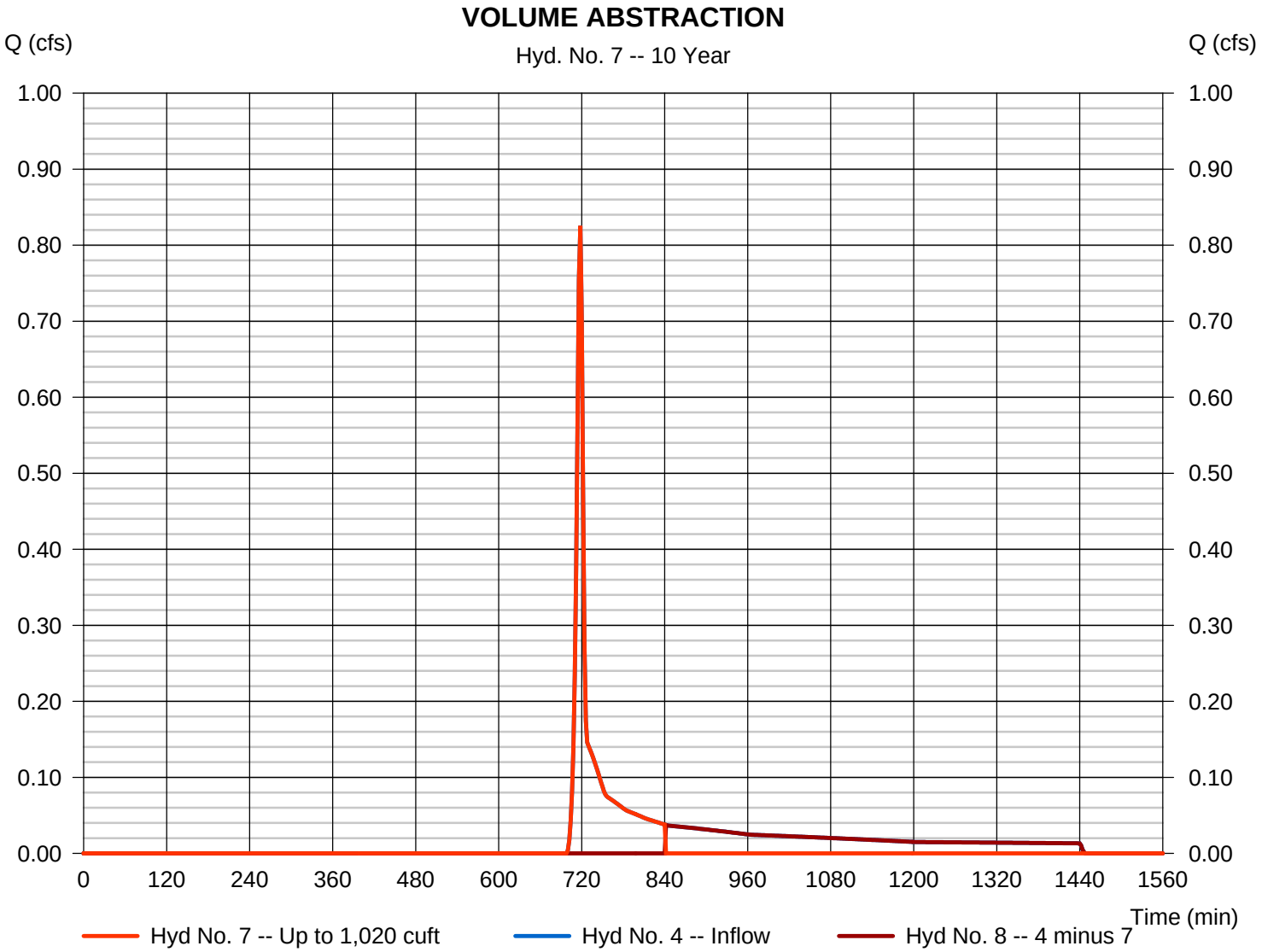


Hydrograph Report

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.825 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,023 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

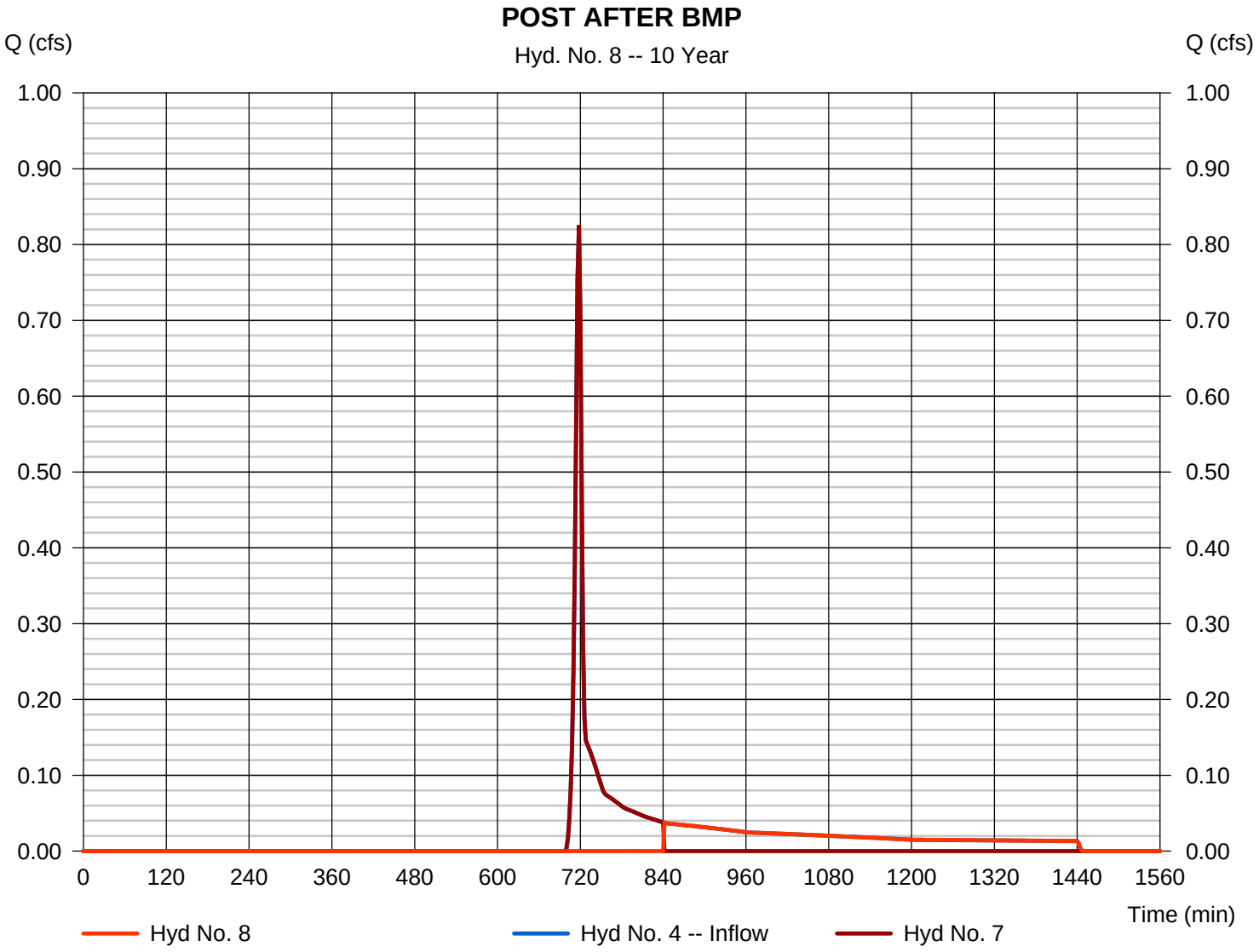


Hydrograph Report

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.037 cfs
Storm frequency	= 10 yrs	Time to peak	= 842 min
Time interval	= 2 min	Hyd. volume	= 718 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

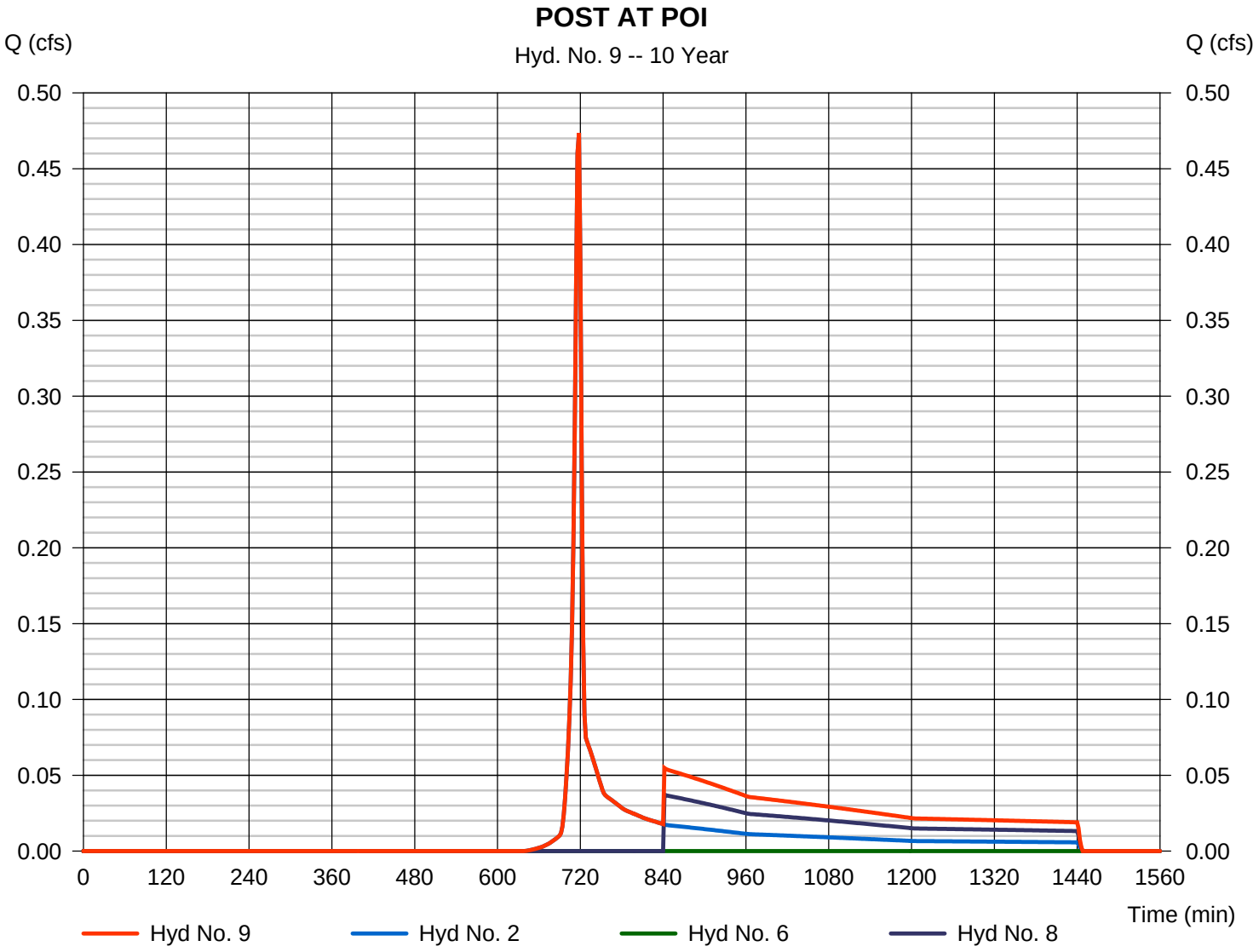


Hydrograph Report

Hyd. No. 9

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	0.474 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	1,666 cuft
Inflow hyds.	=	2, 6, 8	Contrib. drain. area	=	0.210 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	3.041	1	719	6,574	------	------	------	PRE
2	SCS Runoff	0.853	2	718	1,715	------	------	------	POST UNDETAINED
3	SCS Runoff	1.025	2	718	2,065	------	------	------	POST DETAINED 1
4	SCS Runoff	1.785	2	718	3,584	------	------	------	POST DETAINED 2
5	Diversion1	1.025	2	718	1,518	3	------	------	VOLUME ABSTRACTION
6	Diversion2	0.029	2	938	547	3	------	------	POST AFTER BMP
7	Diversion1	1.785	2	718	1,040	4	------	------	VOLUME ABSTRACTION
8	Diversion2	1.475	2	720	2,544	4	------	------	POST AFTER BMP
9	Combine	2.163	2	720	4,806	2, 6, 8	------	------	POST AT POI

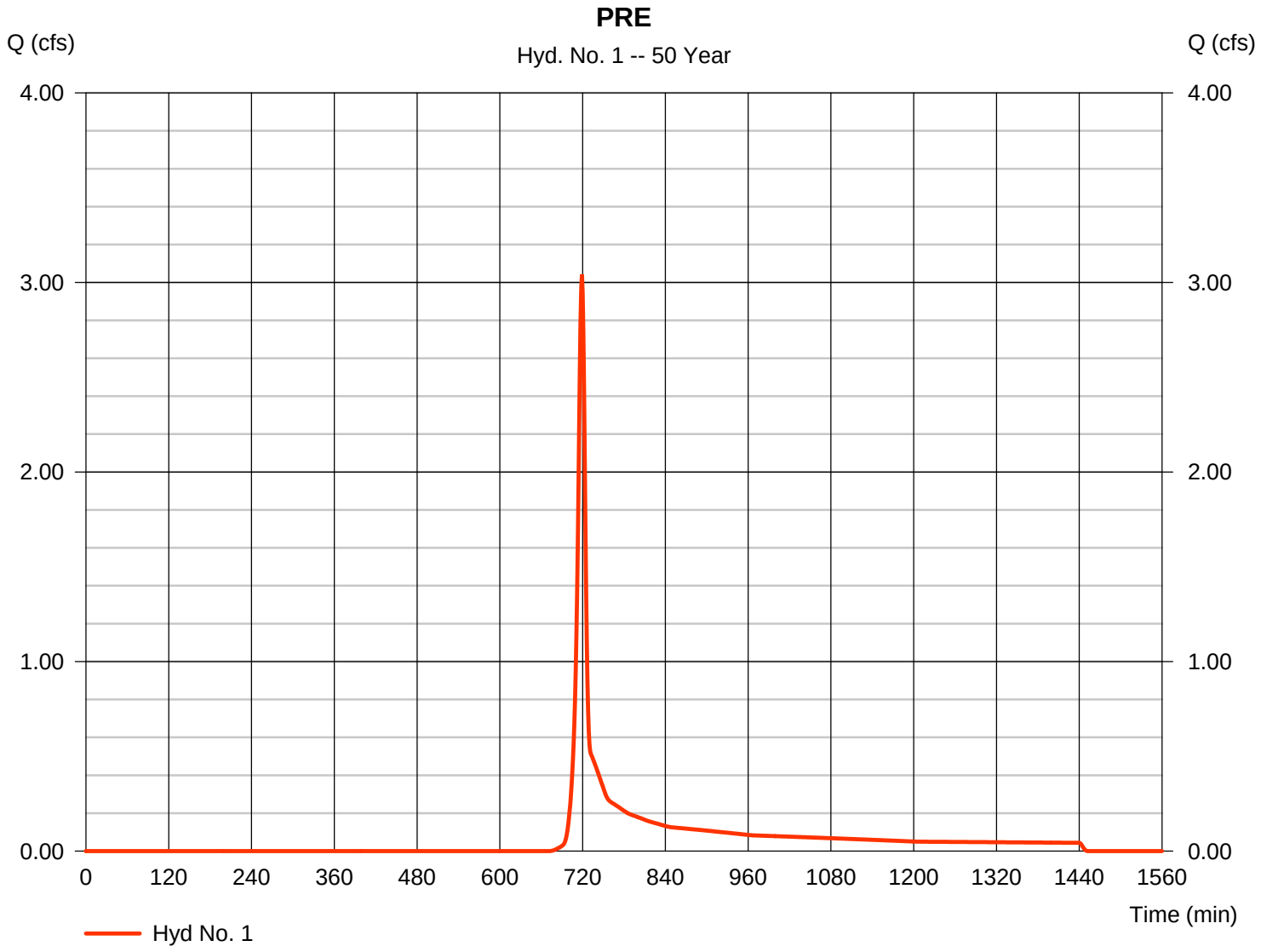
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.041 cfs
Storm frequency	=	50 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	6,574 cuft
Drainage area	=	1.220 ac	Curve number	=	60*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	5.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.320 x 58) + (0.190 x 71) + (0.610 x 55) + (0.100 x 70)] / 1.220



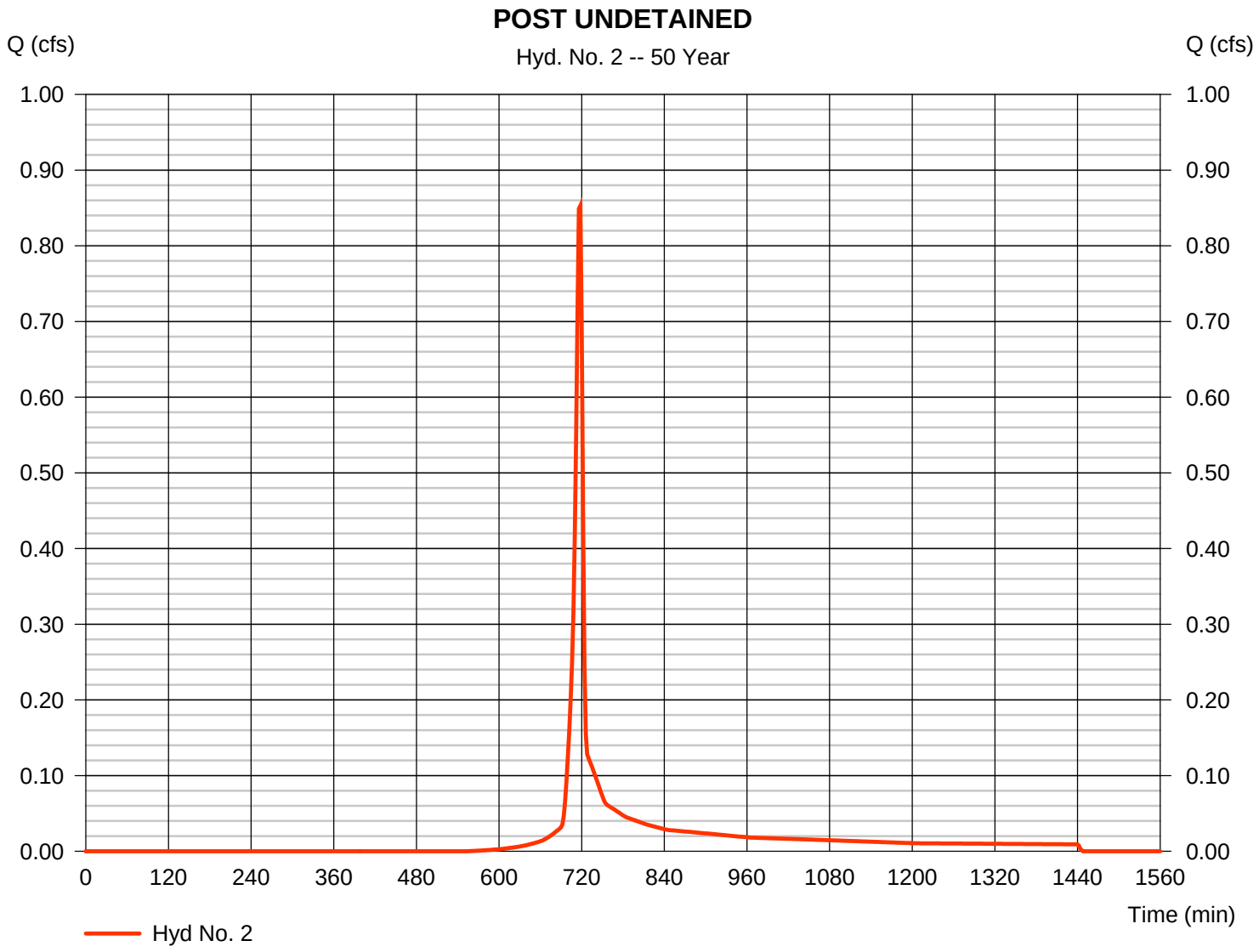
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 0.853 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,715 cuft
Drainage area	= 0.210 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.30 min
Total precip.	= 5.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.020 x 89) + (0.030 x 58) + (0.160 x 71)] / 0.210



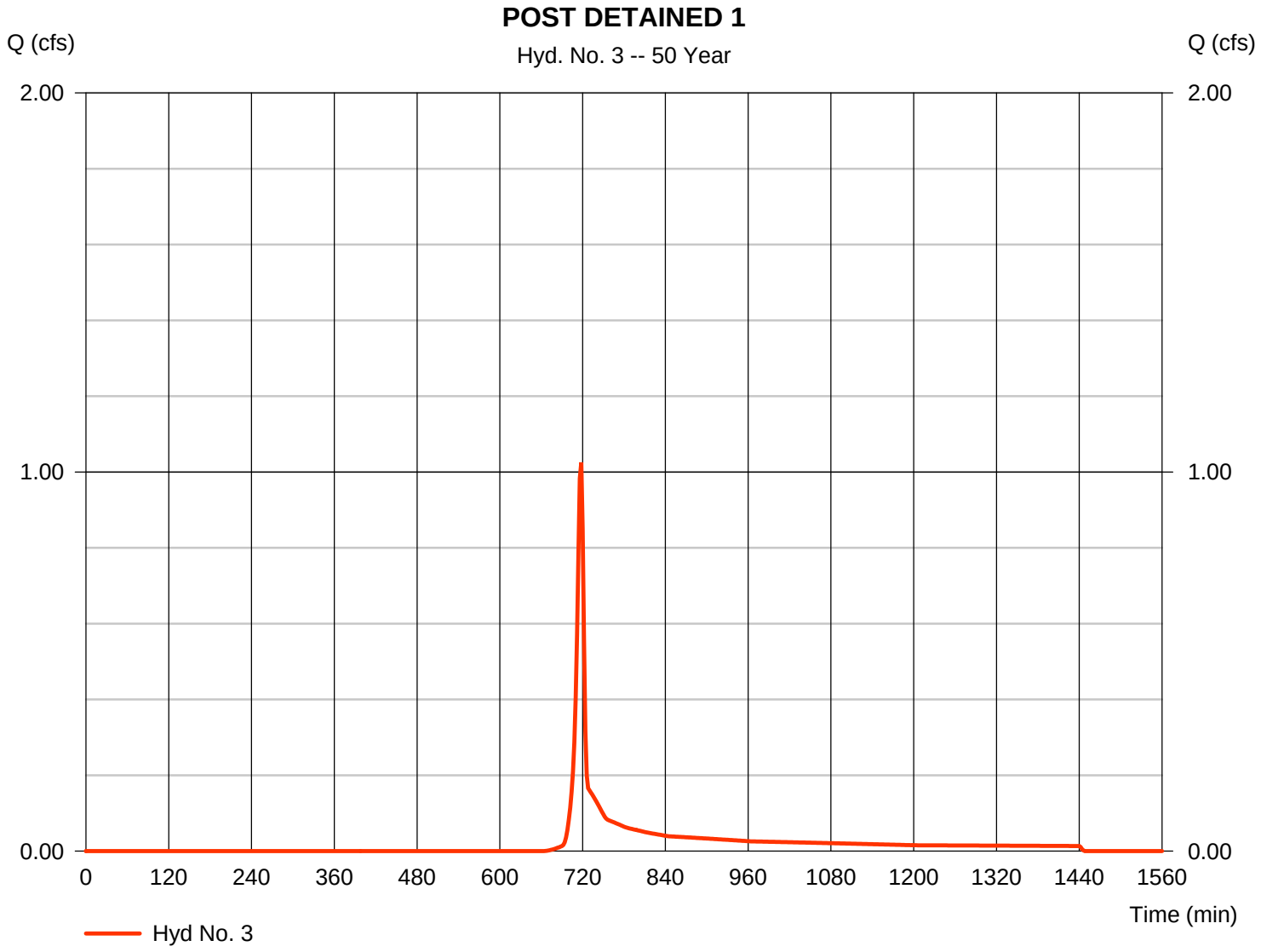
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.025 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	2,065 cuft
Drainage area	=	0.380 ac	Curve number	=	61*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	4.80 min
Total precip.	=	5.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.030 x 85) + (0.030 x 71) + (0.320 x 58)] / 0.380



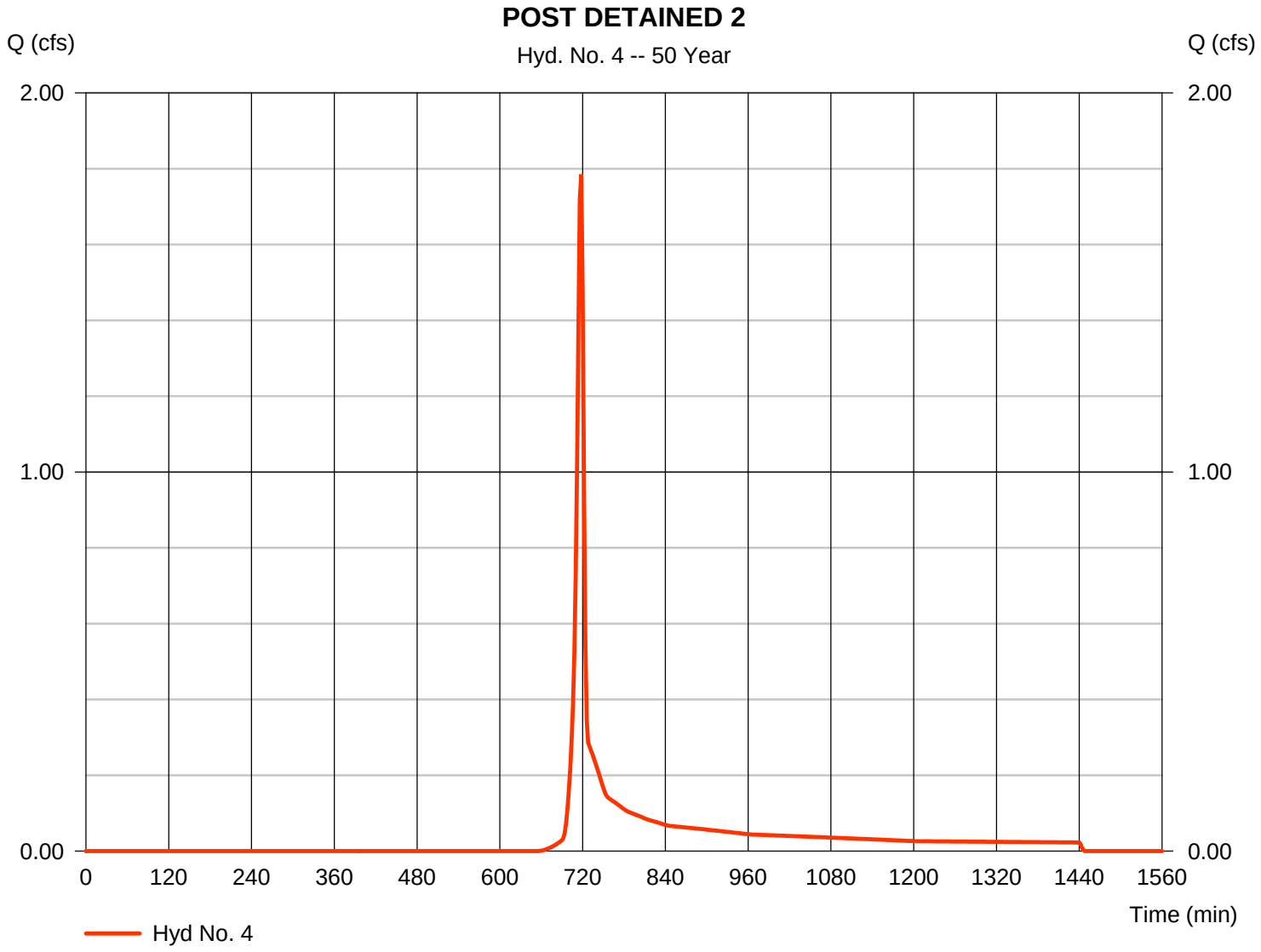
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.785 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	3,584 cuft
Drainage area	=	0.630 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.60 min
Total precip.	=	5.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.050 x 85) + (0.030 x 89) + (0.180 x 55) + (0.330 x 58) + (0.040 x 71)] / 0.630

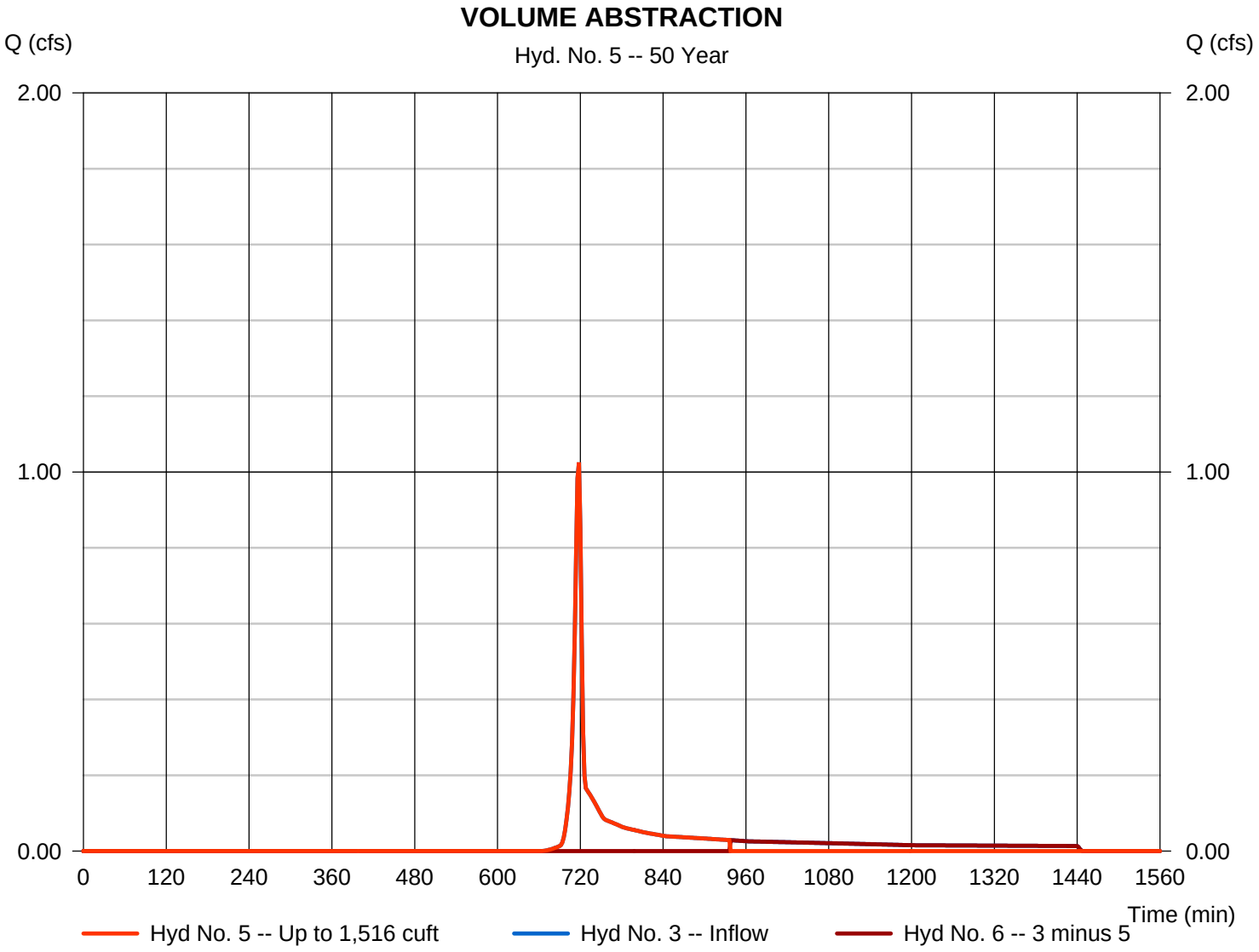


Hydrograph Report

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.025 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,518 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

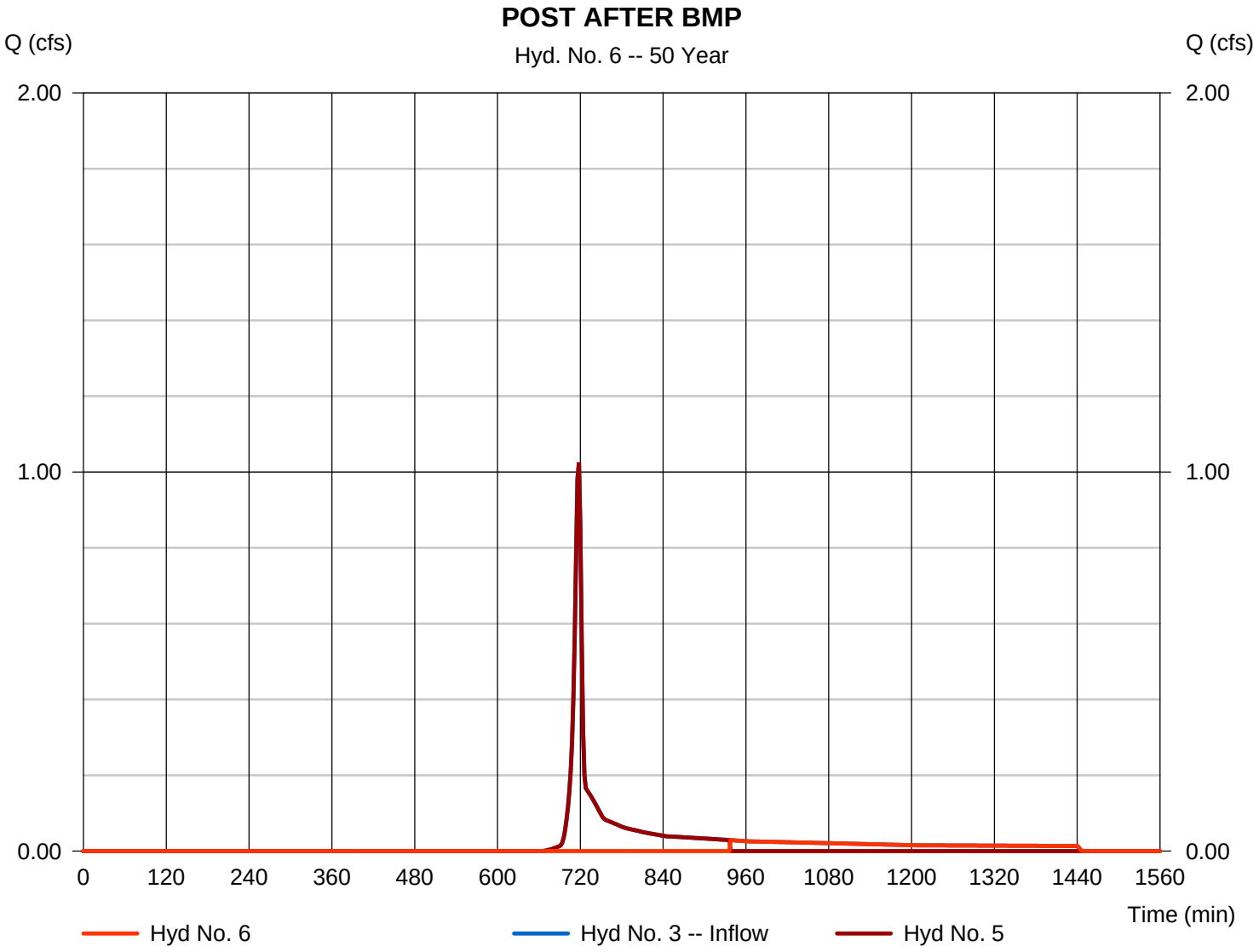


Hydrograph Report

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.029 cfs
Storm frequency	= 50 yrs	Time to peak	= 938 min
Time interval	= 2 min	Hyd. volume	= 547 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

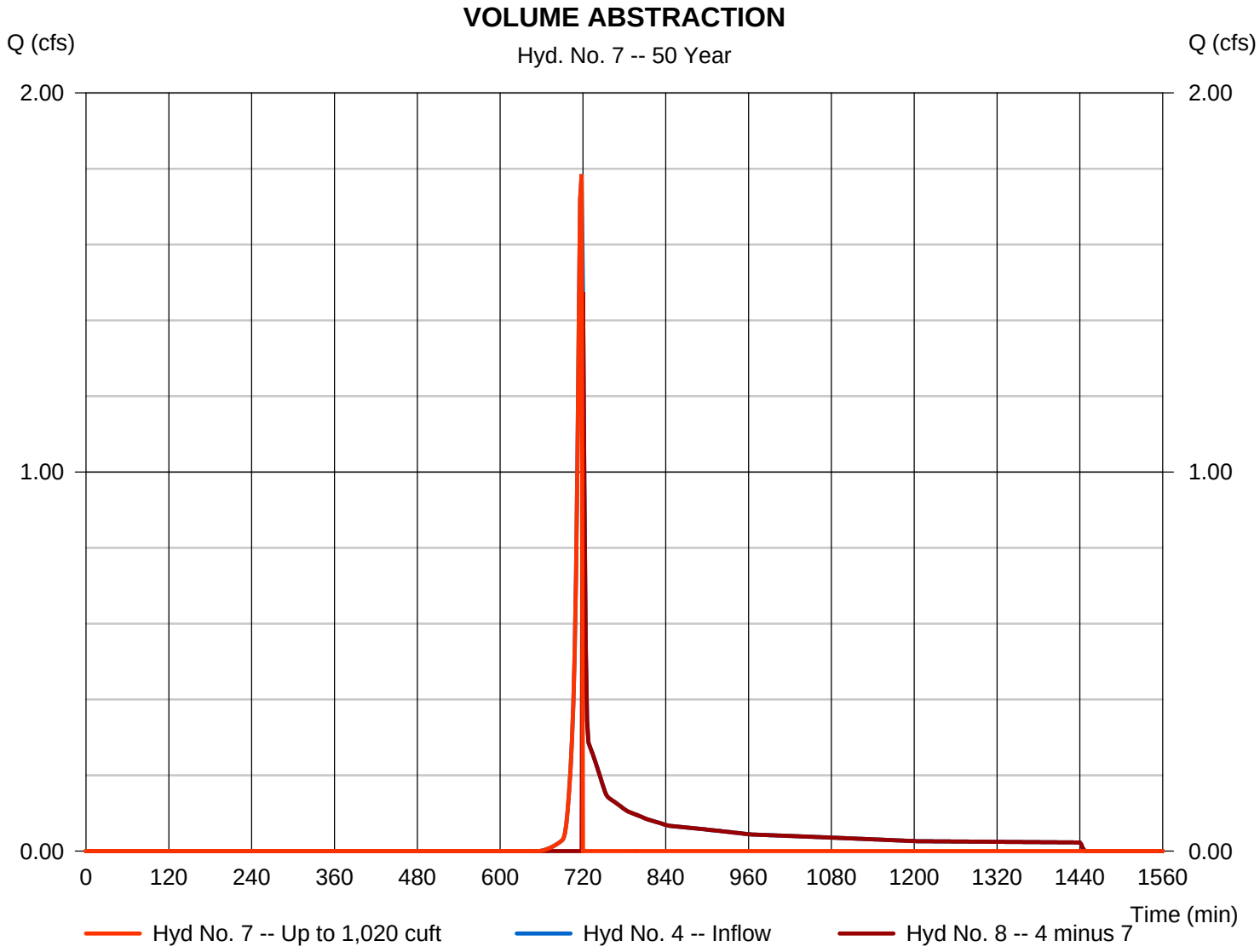


Hydrograph Report

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.785 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,040 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

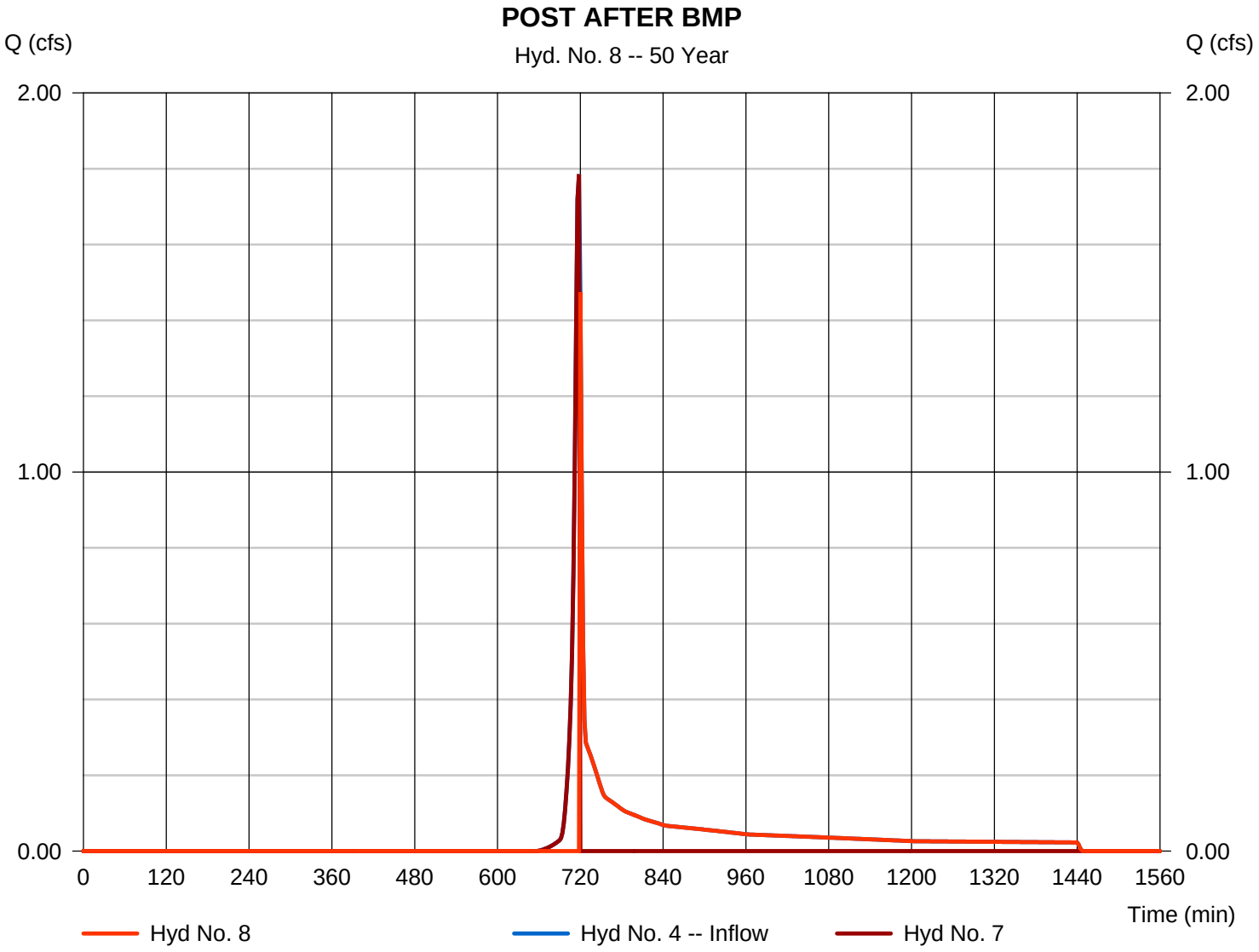


Hydrograph Report

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 1.475 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 2,544 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

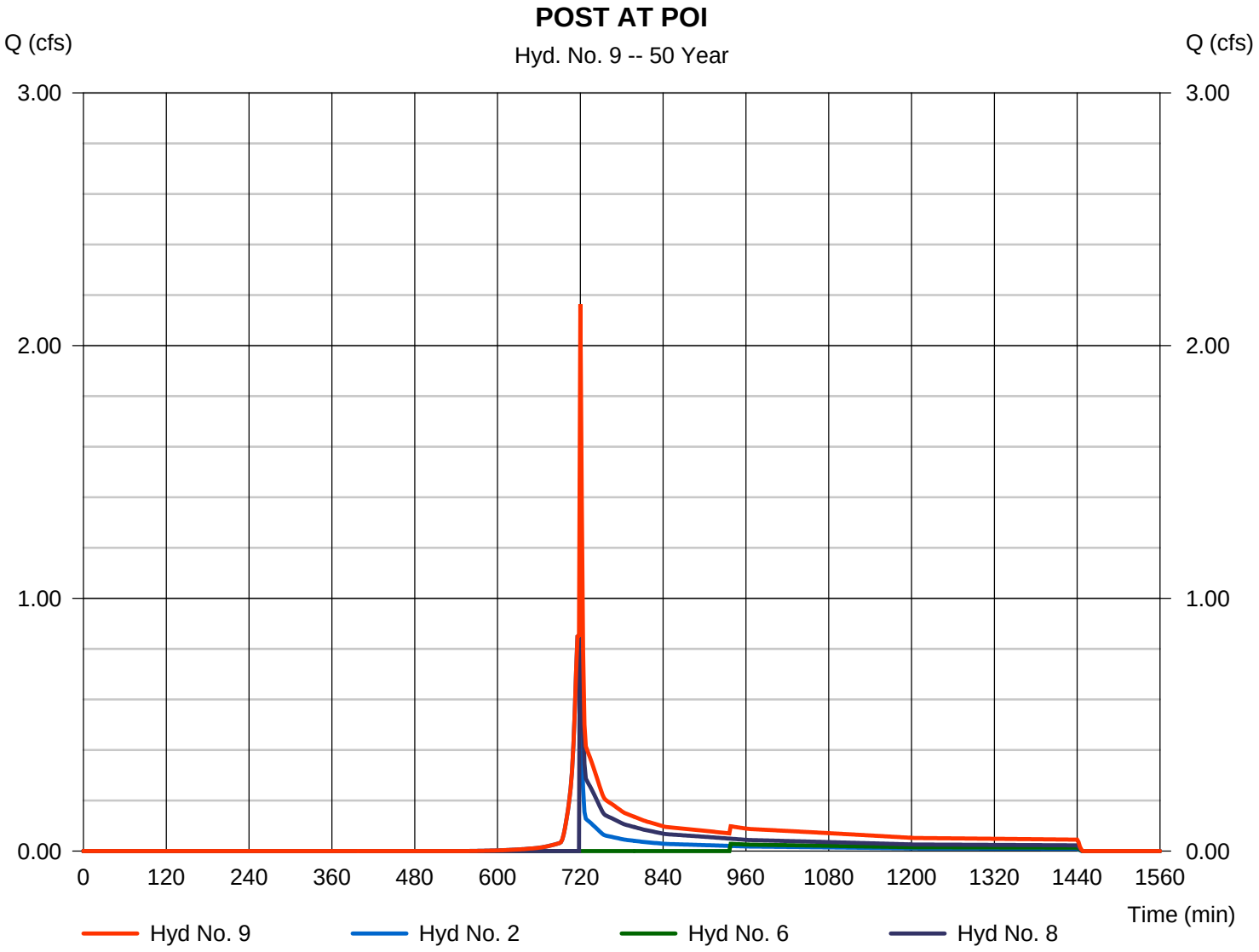


Hydrograph Report

Hyd. No. 9

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 2.163 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 4,806 cuft
Inflow hyds.	= 2, 6, 8	Contrib. drain. area	= 0.210 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	4.029	1	719	8,581	------	------	------	PRE
2	SCS Runoff	1.055	2	716	2,129	------	------	------	POST UNDETAINED
3	SCS Runoff	1.339	2	718	2,680	------	------	------	POST DETAINED 1
4	SCS Runoff	2.314	2	718	4,629	------	------	------	POST DETAINED 2
5	Diversion1	1.339	2	718	1,517	3	------	------	VOLUME ABSTRACTION
6	Diversion2	0.083	2	778	1,164	3	------	------	POST AFTER BMP
7	Diversion1	2.258	2	716	1,190	4	------	------	VOLUME ABSTRACTION
8	Diversion2	2.314	2	718	3,439	4	------	------	POST AFTER BMP
9	Combine	3.367	2	718	6,732	2, 6, 8	------	------	POST AT POI

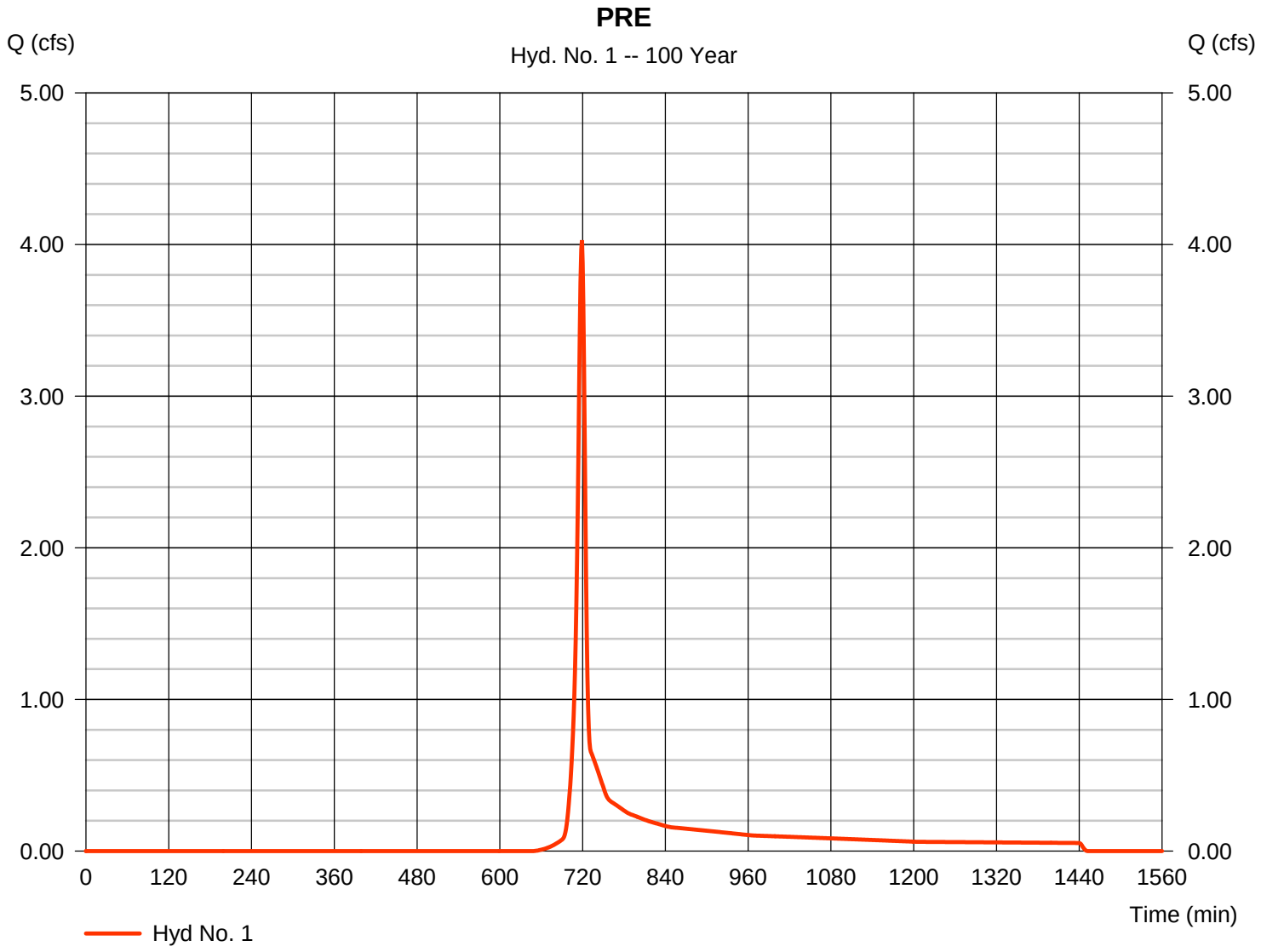
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.029 cfs
Storm frequency	=	100 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	8,581 cuft
Drainage area	=	1.220 ac	Curve number	=	60*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	6.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.320 x 58) + (0.190 x 71) + (0.610 x 55) + (0.100 x 70)] / 1.220



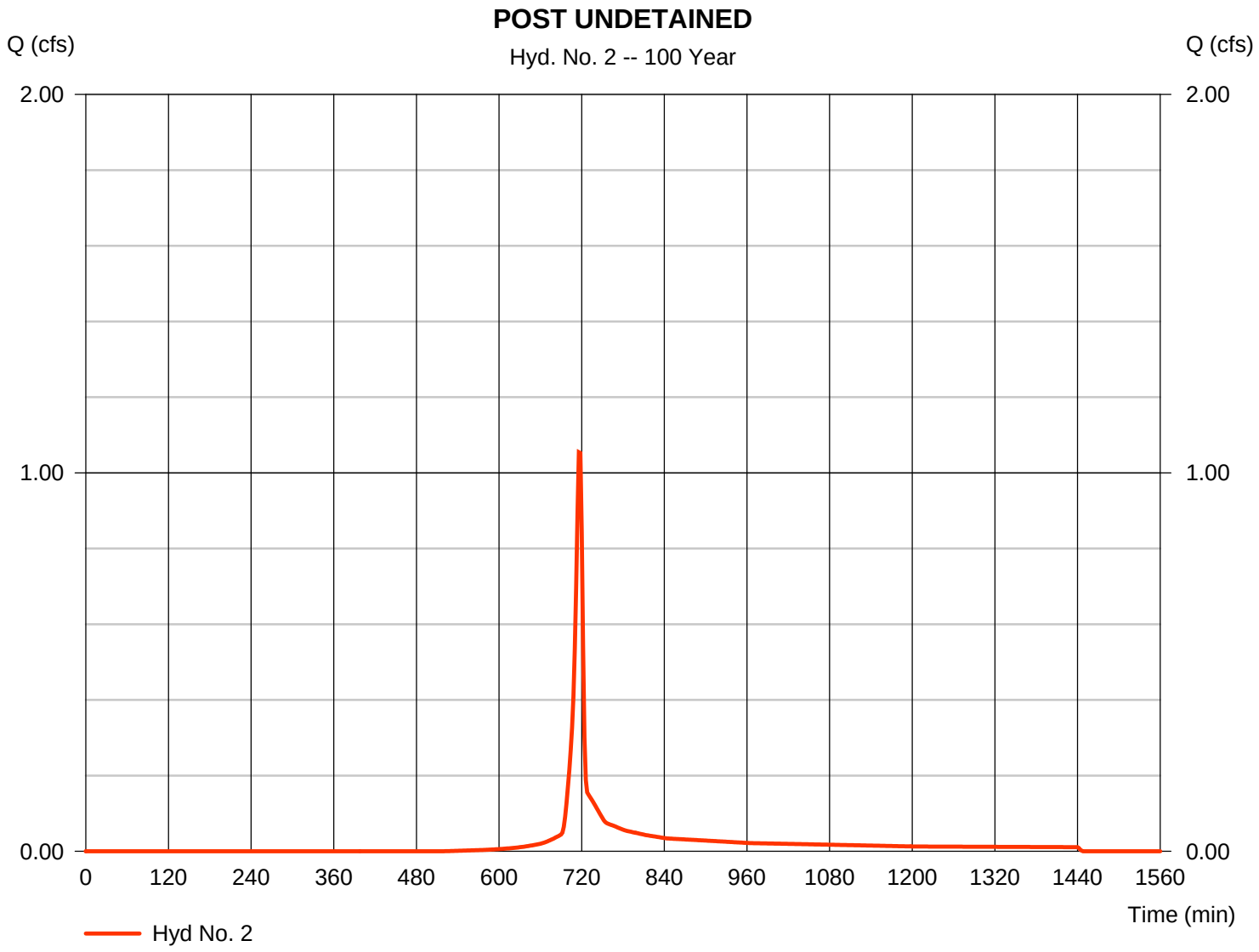
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.055 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	2,129 cuft
Drainage area	=	0.210 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.30 min
Total precip.	=	6.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.020 x 89) + (0.030 x 58) + (0.160 x 71)] / 0.210



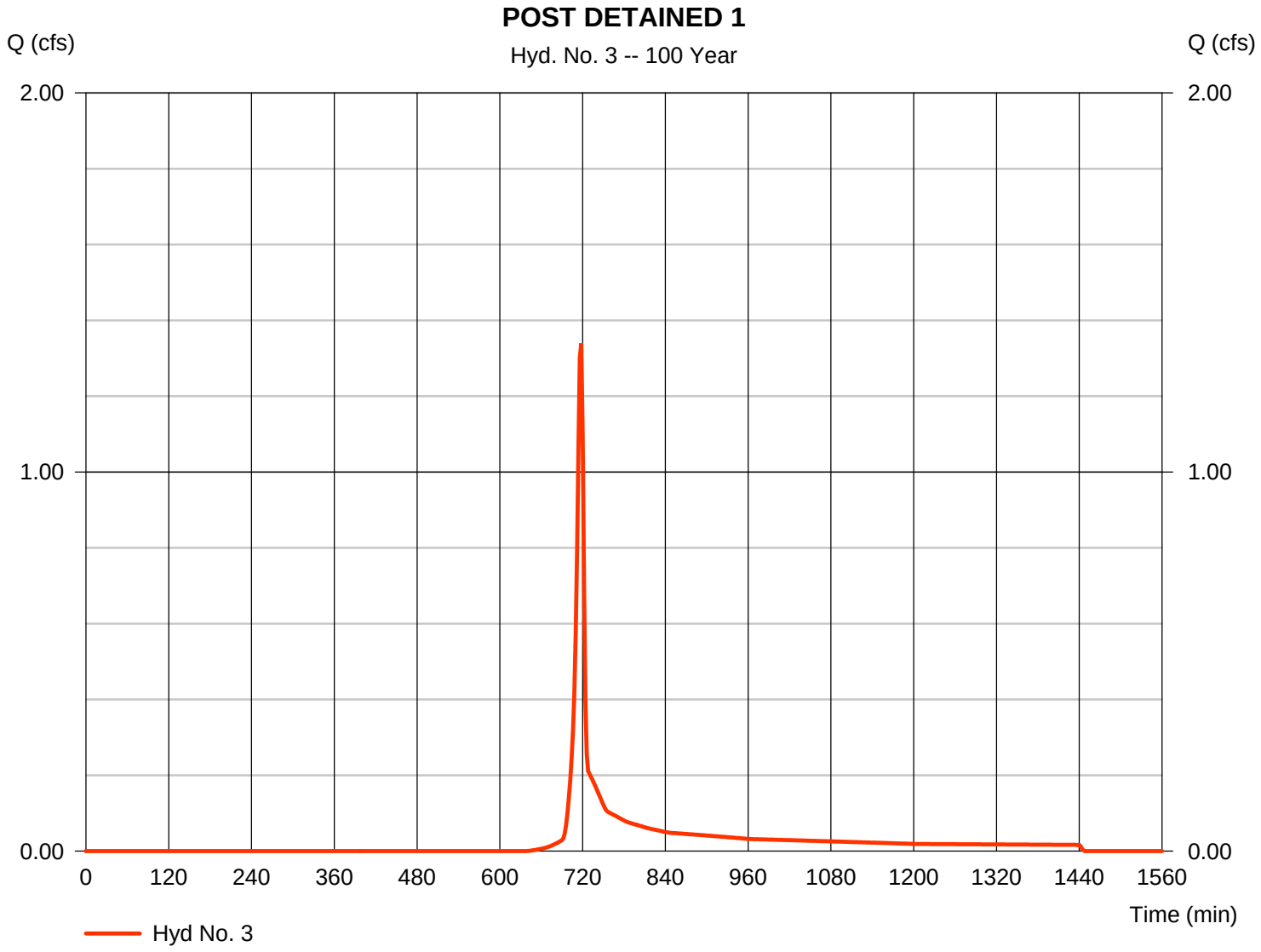
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.339 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	2,680 cuft
Drainage area	=	0.380 ac	Curve number	=	61*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	4.80 min
Total precip.	=	6.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.030 x 85) + (0.030 x 71) + (0.320 x 58)] / 0.380



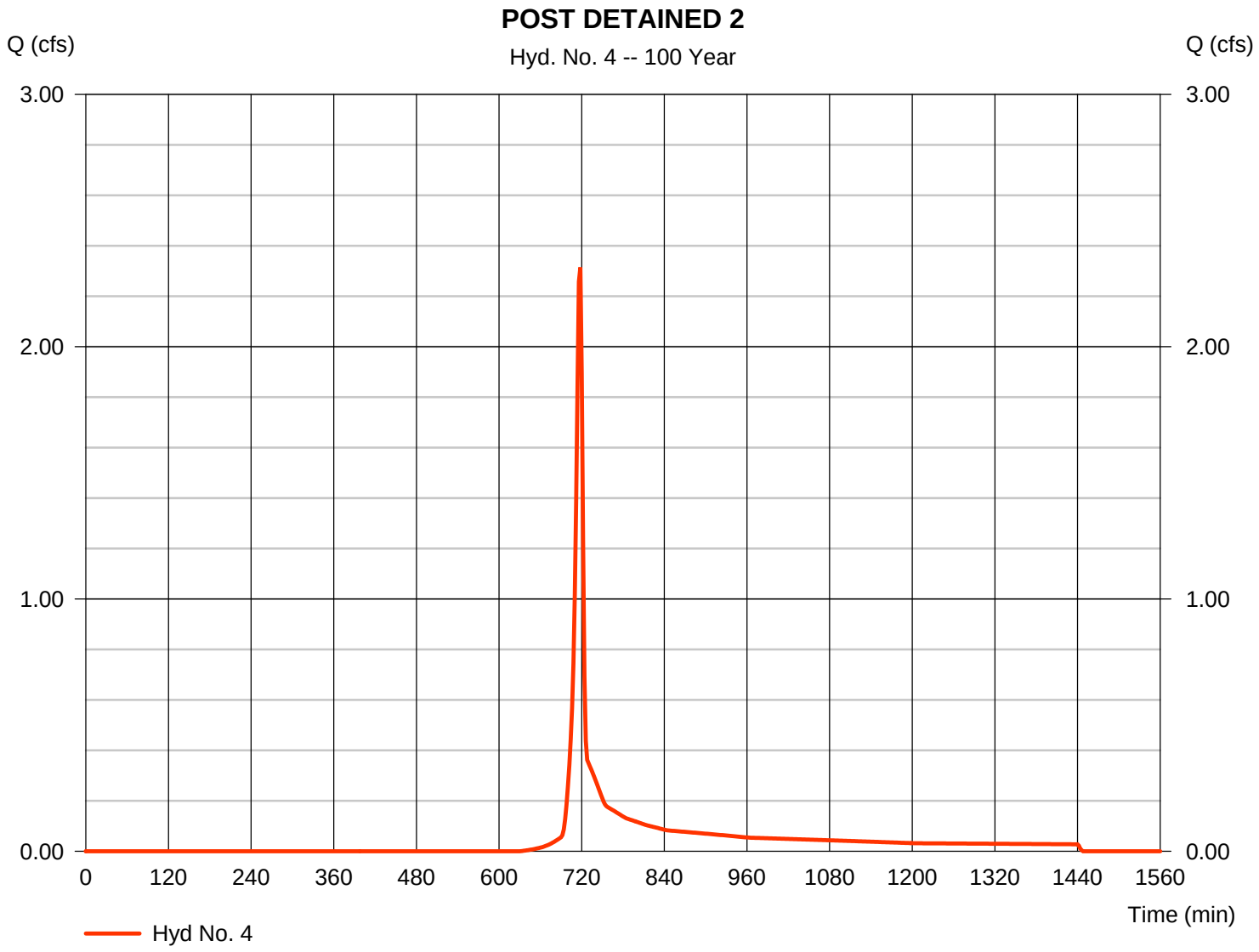
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.314 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	4,629 cuft
Drainage area	=	0.630 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.60 min
Total precip.	=	6.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.050 x 85) + (0.030 x 89) + (0.180 x 55) + (0.330 x 58) + (0.040 x 71)] / 0.630

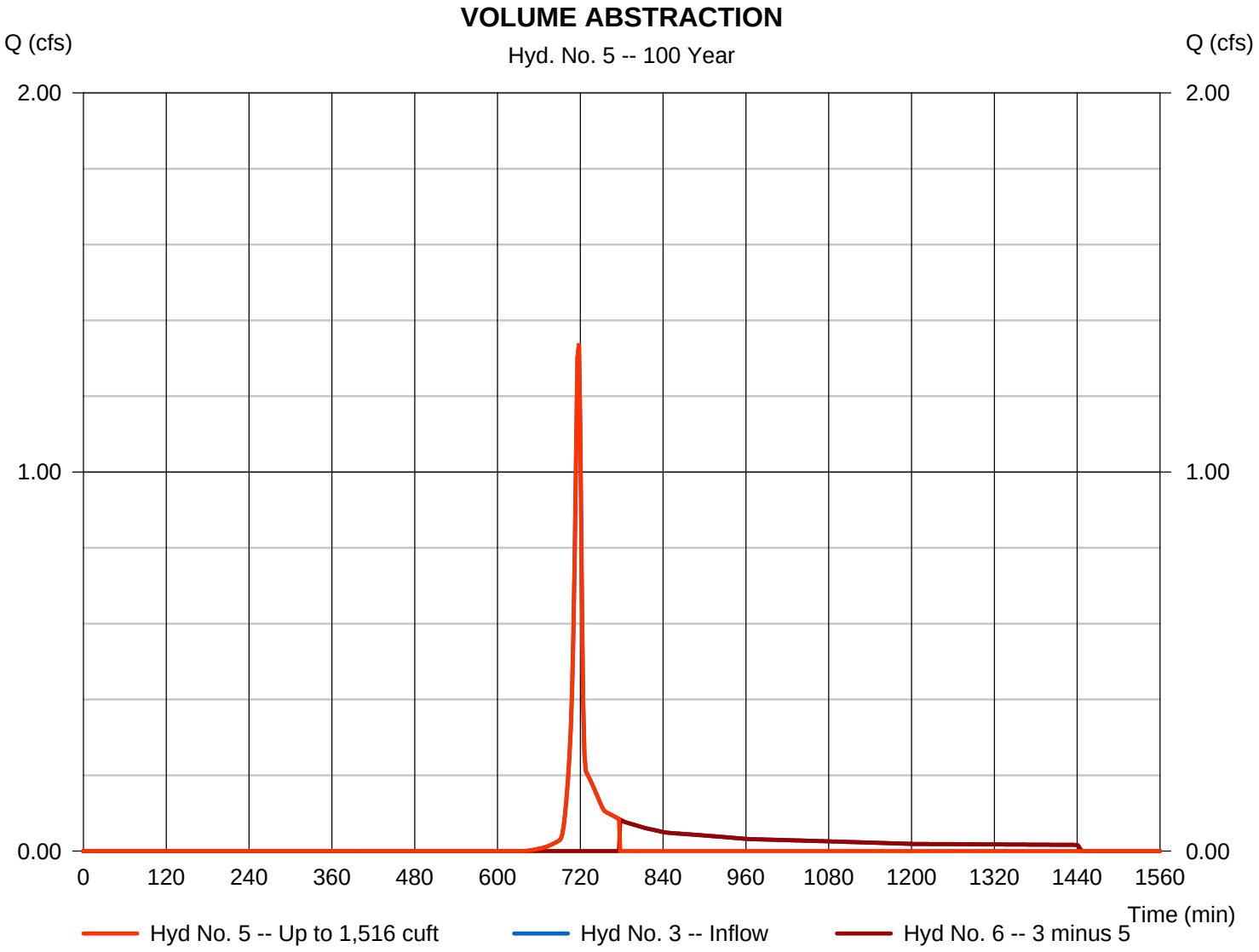


Hydrograph Report

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.339 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,517 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

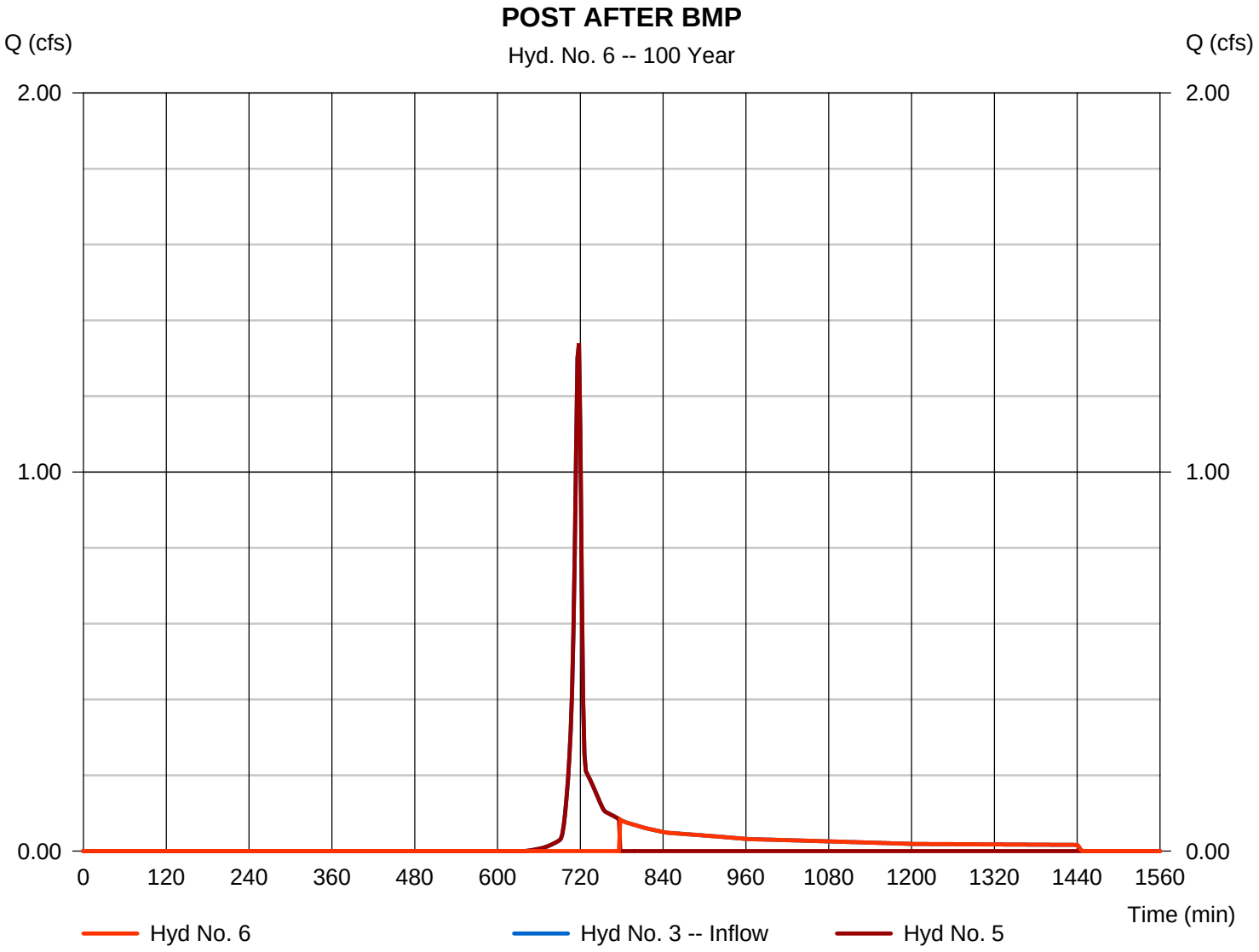


Hydrograph Report

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.083 cfs
Storm frequency	= 100 yrs	Time to peak	= 778 min
Time interval	= 2 min	Hyd. volume	= 1,164 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

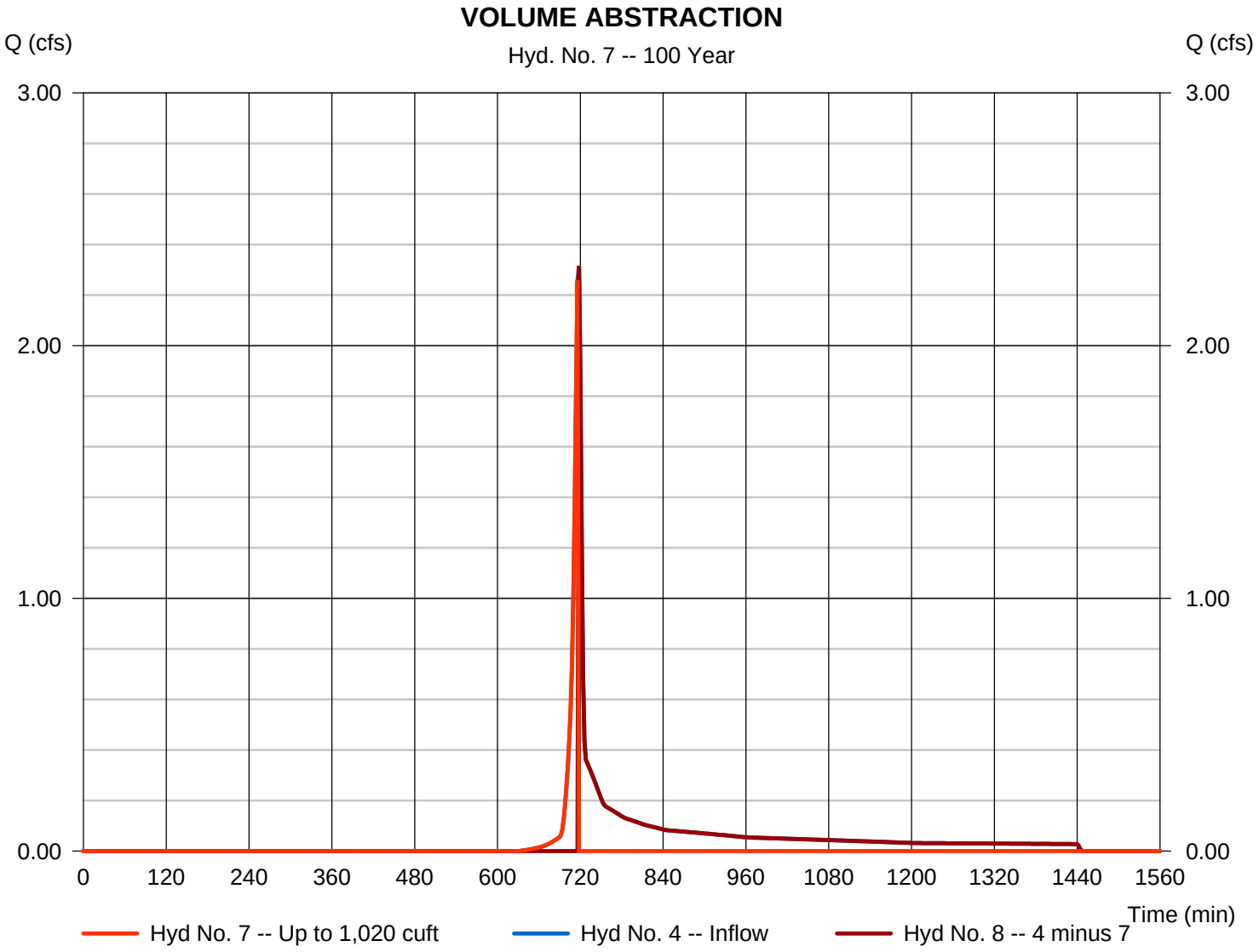


Hydrograph Report

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 2.258 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,190 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

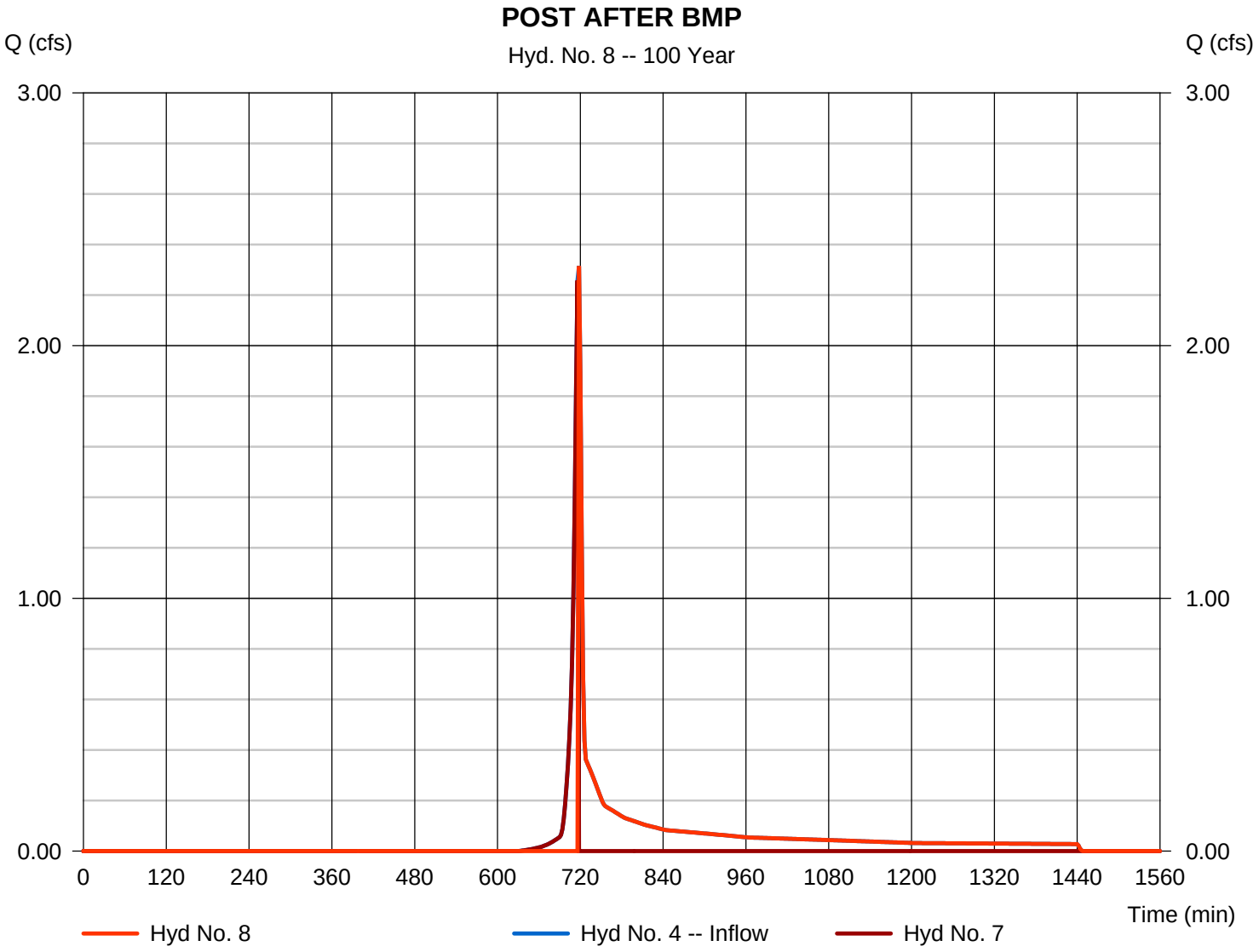


Hydrograph Report

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 2.314 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 3,439 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

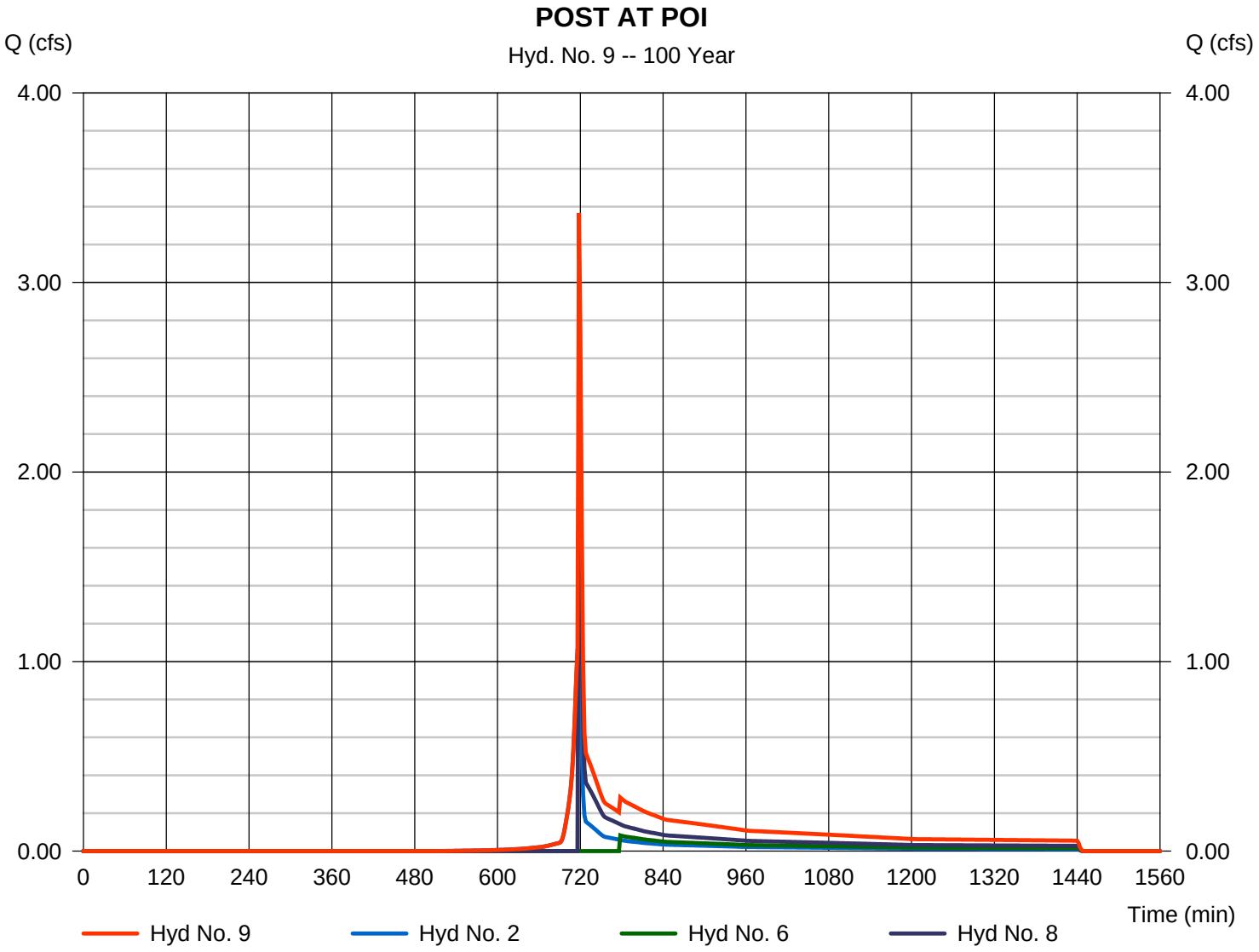


Hydrograph Report

Hyd. No. 9

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	3.367 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	6,732 cuft
Inflow hyds.	=	2, 6, 8	Contrib. drain. area	=	0.210 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	41.3805	10.1000	0.8846	--------
2	50.3642	10.4000	0.8844	--------
3	0.0000	0.0000	0.0000	--------
5	45.7628	8.9000	0.8075	--------
10	45.5204	8.1000	0.7720	--------
25	47.3122	7.6000	0.7392	--------
50	43.0390	6.3000	0.6892	--------
100	41.7827	5.5000	0.6559	--------

File name: Hares Valley IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.75	2.91	2.39	2.04	1.78	1.58	1.42	1.30	1.19	1.10	1.03	0.96
2	4.49	3.50	2.88	2.46	2.15	1.91	1.72	1.57	1.45	1.34	1.25	1.17
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.46	4.26	3.53	3.03	2.66	2.38	2.16	1.98	1.83	1.70	1.59	1.50
10	6.25	4.87	4.03	3.47	3.05	2.74	2.49	2.29	2.12	1.98	1.86	1.75
25	7.27	5.68	4.72	4.07	3.60	3.24	2.95	2.72	2.53	2.36	2.22	2.10
50	8.09	6.29	5.23	4.52	4.01	3.62	3.31	3.06	2.85	2.68	2.52	2.39
100	8.94	6.92	5.76	4.99	4.44	4.02	3.69	3.42	3.19	3.00	2.83	2.69

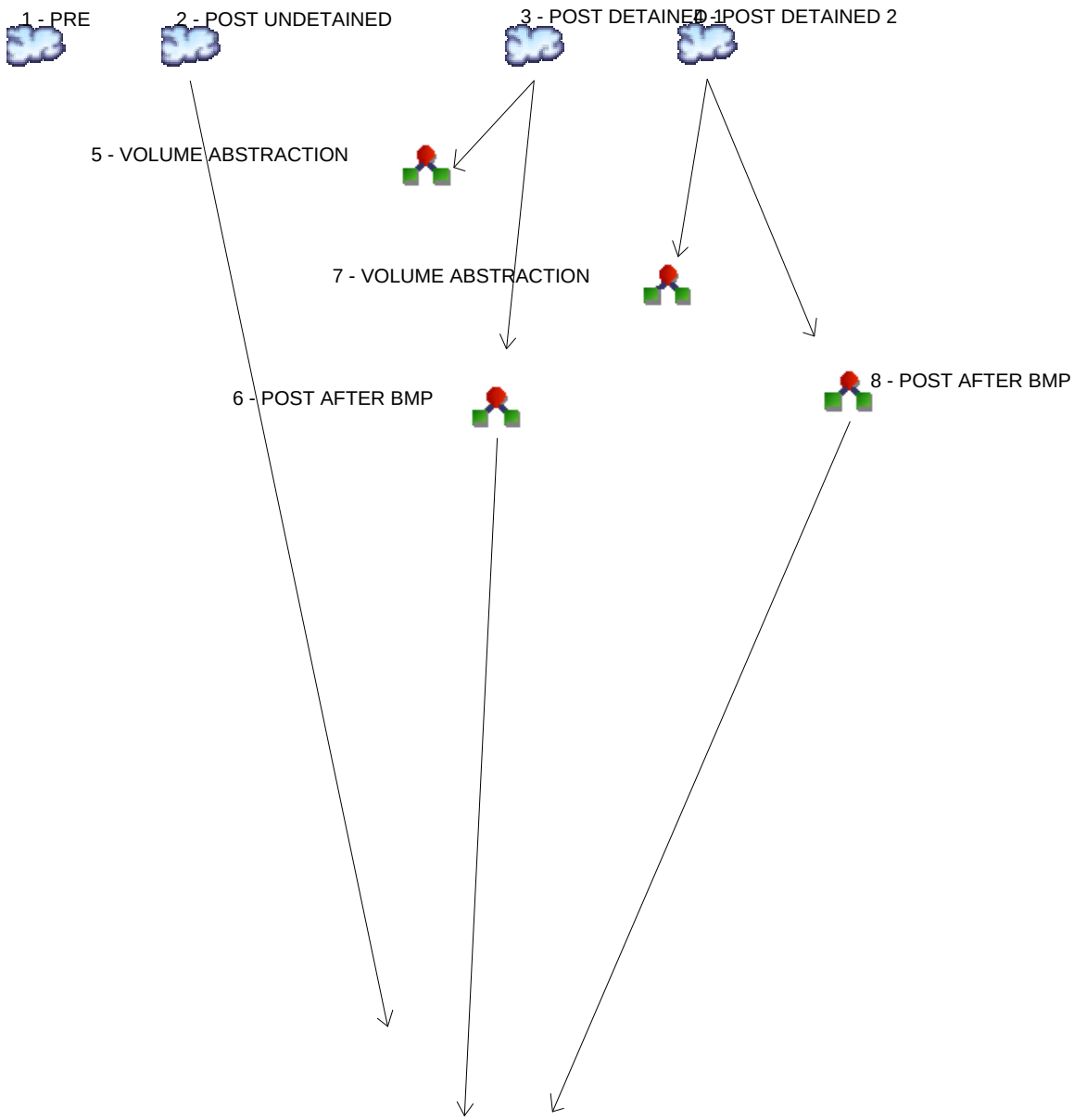
Tc = time in minutes. Values may exceed 60.

\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Hares Valley Road (PA 655)\Hydraflow Rev 1\Hares Valley Precip.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.25	2.70	0.00	3.35	3.90	4.70	5.37	6.10
SCS 6-Hr	1.48	1.79	0.00	2.23	2.60	3.13	3.58	4.07
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	0.243	-------	-------	-------	-------	-------	-------	PRE
2	SCS Runoff	------	-------	0.203	-------	-------	-------	-------	-------	-------	POST UNDETAINED
3	SCS Runoff	------	-------	0.012	-------	-------	-------	-------	-------	-------	POST DETAINED 1
4	SCS Runoff	------	-------	0.042	-------	-------	-------	-------	-------	-------	POST DETAINED 2
5	Diversion1	3	-------	0.012	-------	-------	-------	-------	-------	-------	VOLUME ABSTRACTION
6	Diversion2	3	-------	0.000	-------	-------	-------	-------	-------	-------	POST AFTER BMP
7	Diversion1	4	-------	0.042	-------	-------	-------	-------	-------	-------	VOLUME ABSTRACTION
8	Diversion2	4	-------	0.000	-------	-------	-------	-------	-------	-------	POST AFTER BMP
9	Combine	2, 6, 8	-------	0.203	-------	-------	-------	-------	-------	-------	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	0.243	1	721	1,004	------	------	------	PRE
2	SCS Runoff	0.203	2	718	425	------	------	------	POST UNDETAINED
3	SCS Runoff	0.012	2	938	356	------	------	------	POST DETAINED 1
4	SCS Runoff	0.042	2	790	653	------	------	------	POST DETAINED 2
5	Diversion1	0.012	2	938	356	3	------	------	VOLUME ABSTRACTION
6	Diversion2	0.000	2	n/a	0	3	------	------	POST AFTER BMP
7	Diversion1	0.042	2	790	653	4	------	------	VOLUME ABSTRACTION
8	Diversion2	0.000	2	n/a	0	4	------	------	POST AFTER BMP
9	Combine	0.203	2	718	425	2, 6, 8	------	------	POST AT POI

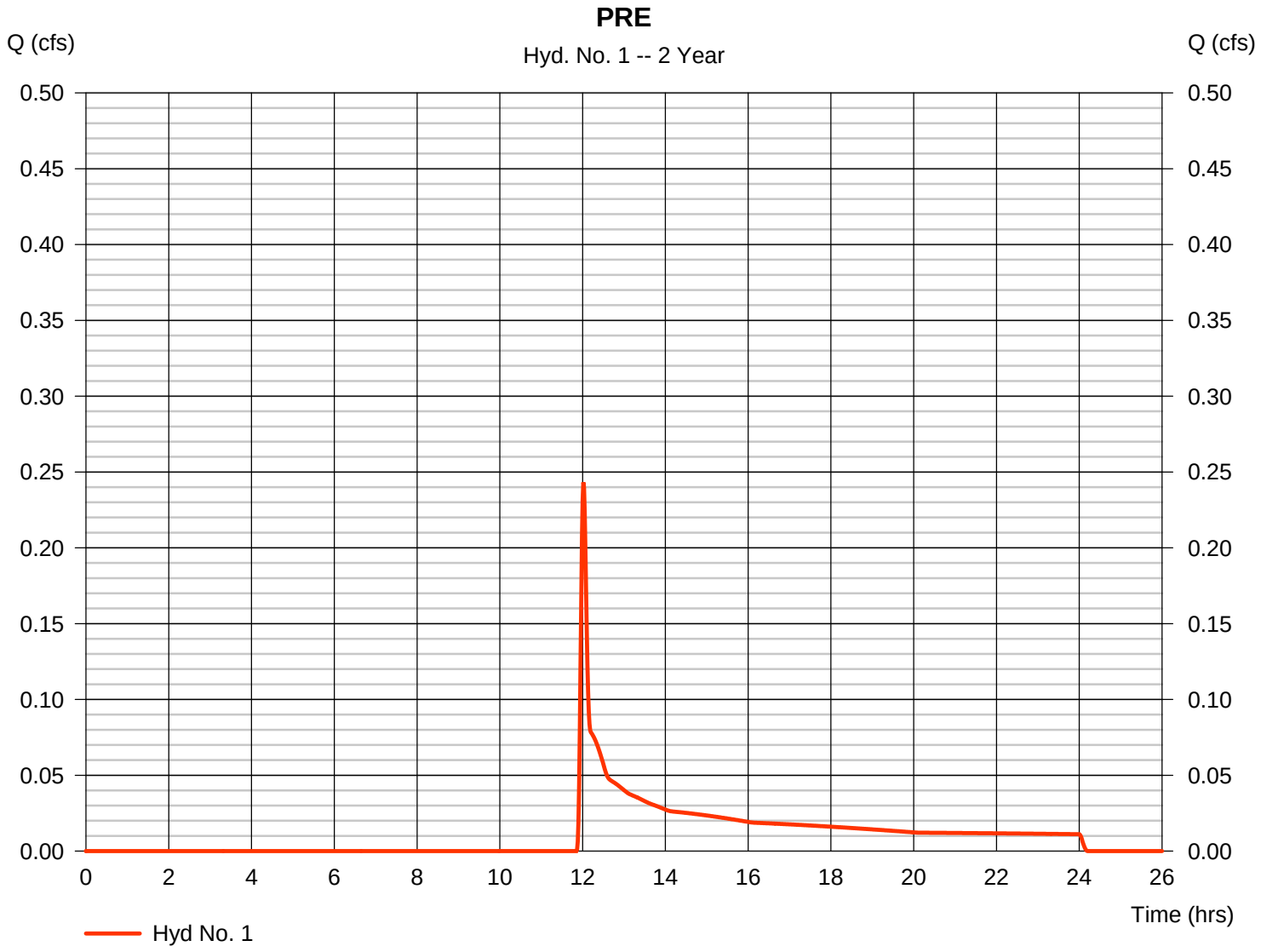
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.243 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.02 hrs
Time interval	=	1 min	Hyd. volume	=	1,004 cuft
Drainage area	=	1.220 ac	Curve number	=	60*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.320 x 58) + (0.190 x 71) + (0.610 x 55) + (0.100 x 70)] / 1.220



TR55 Tc Worksheet

Hyd. No. 1

PRE

Description	A		B		C		Totals
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)	= 2.70		0.00		0.00		
Land slope (%)	= 4.23		0.00		0.00		
Travel Time (min)	**= 6.61**	**+**	**0.00**	**+**	**0.00**	**=**	**6.61**
Shallow Concentrated Flow							
Flow length (ft)	= 599.00		0.00		0.00		
Watercourse slope (%)	= 14.45		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.13		0.00		0.00		
Travel Time (min)	**= 1.63**	**+**	**0.00**	**+**	**0.00**	**=**	**1.63**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 8.20 min

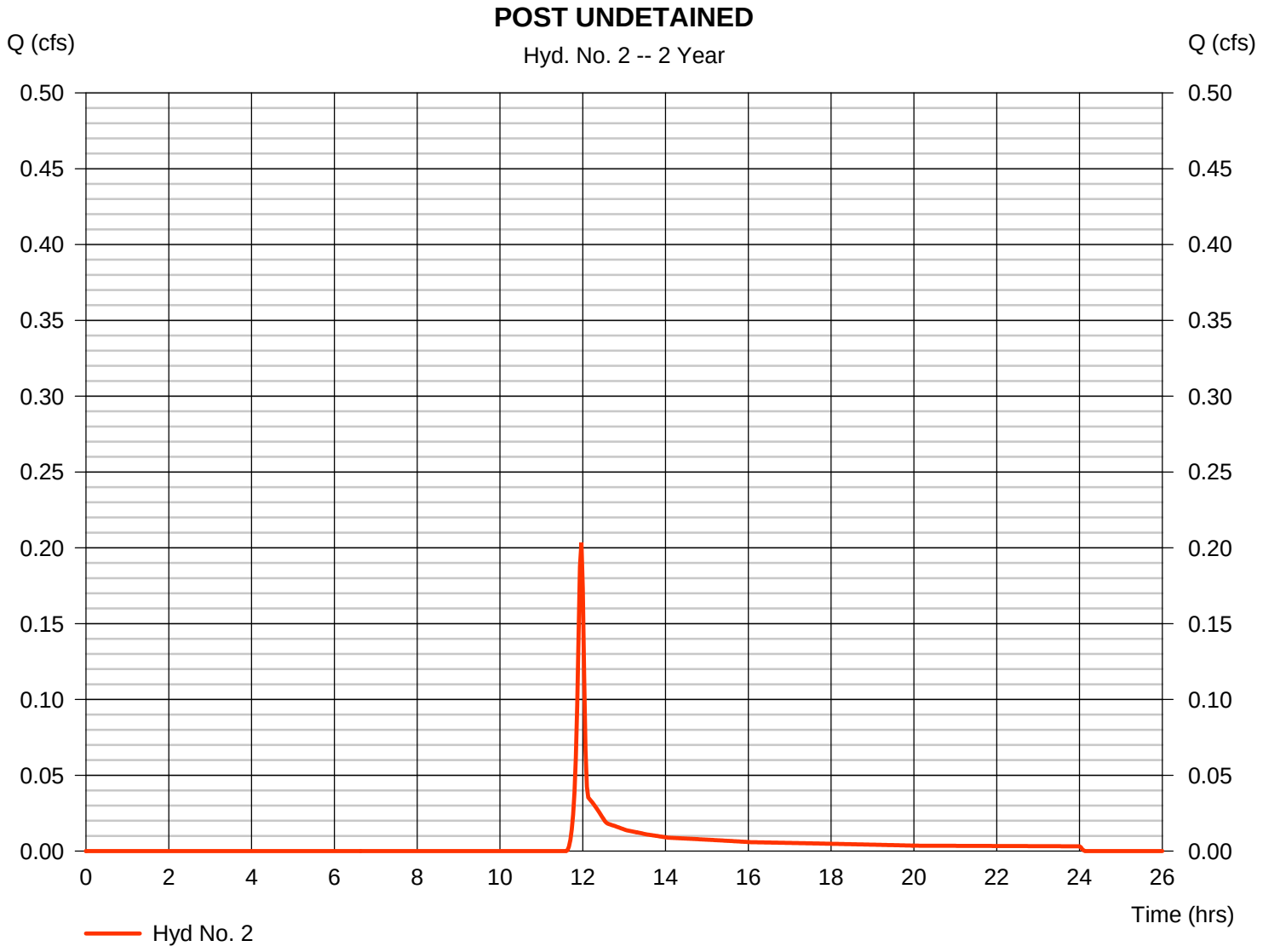
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.203 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	425 cuft
Drainage area	=	0.210 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.30 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.020 x 89) + (0.030 x 58) + (0.160 x 71)] / 0.210



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED

Description	A		B		C		Totals
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)	= 2.70		0.00		0.00		
Land slope (%)	= 10.00		0.00		0.00		
Travel Time (min)	**= 4.69**	**+**	**0.00**	**+**	**0.00**	**=**	**4.69**
Shallow Concentrated Flow							
Flow length (ft)	= 160.00		0.00		0.00		
Watercourse slope (%)	= 8.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.59		0.00		0.00		
Travel Time (min)	**= 0.58**	**+**	**0.00**	**+**	**0.00**	**=**	**0.58**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 5.30 min

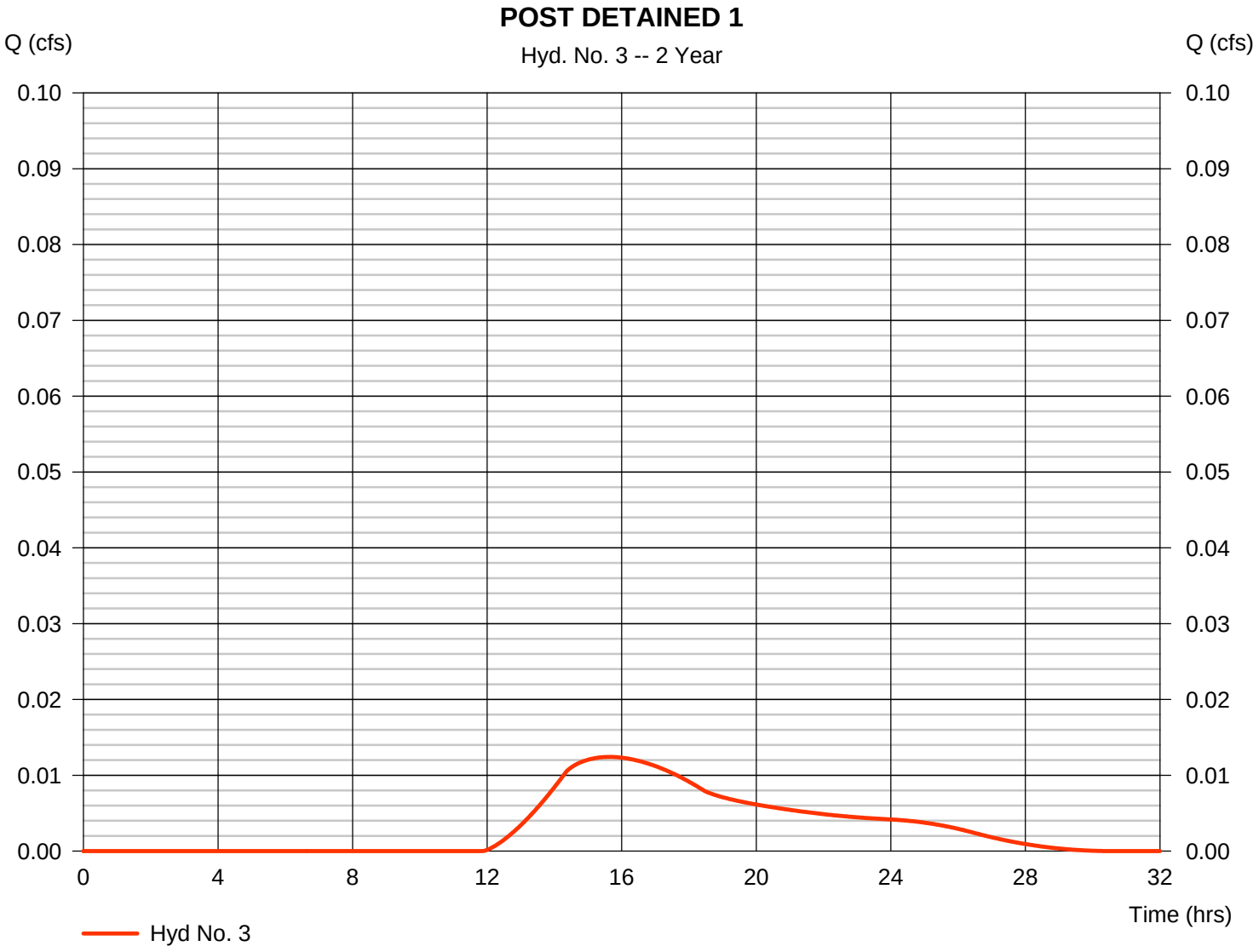
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.012 cfs
Storm frequency	= 2 yrs	Time to peak	= 15.63 hrs
Time interval	= 2 min	Hyd. volume	= 356 cuft
Drainage area	= 0.380 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 250.10 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.030 x 71) + (0.320 x 58)] / 0.380



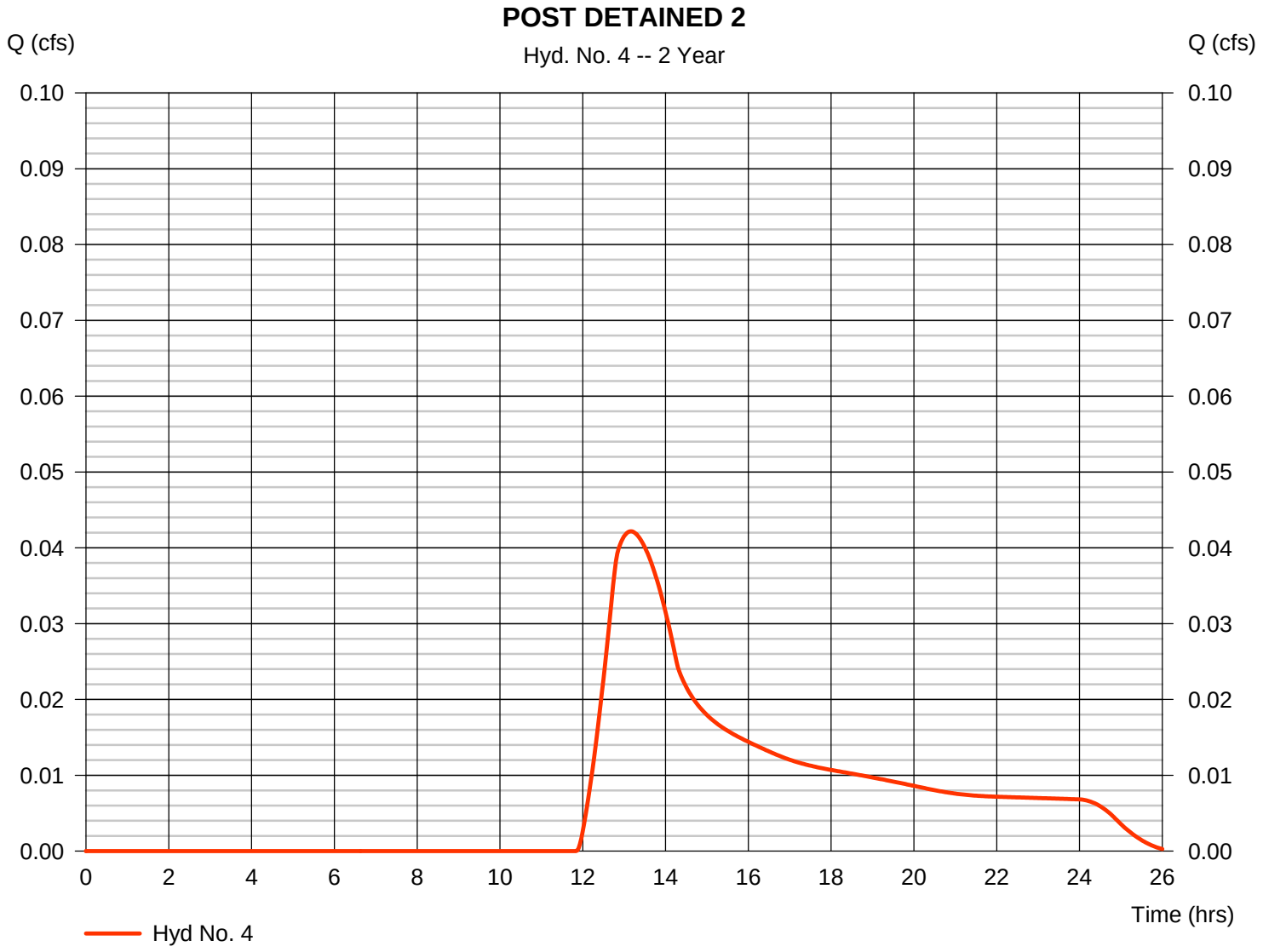
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.042 cfs
Storm frequency	=	2 yrs	Time to peak	=	13.17 hrs
Time interval	=	2 min	Hyd. volume	=	653 cuft
Drainage area	=	0.630 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	88.12 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.050 x 85) + (0.030 x 89) + (0.180 x 55) + (0.330 x 58) + (0.040 x 71)] / 0.630

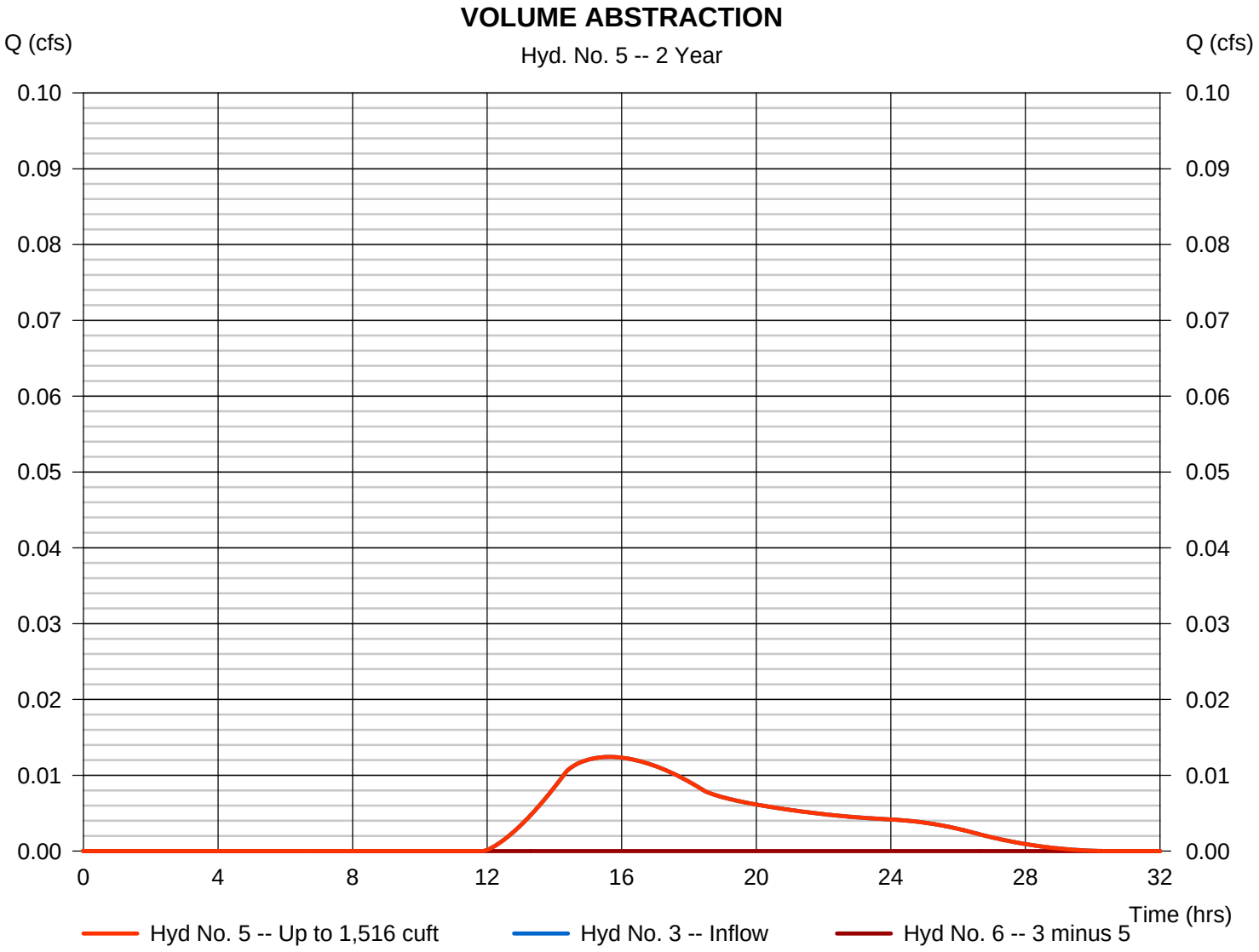


Hydrograph Report

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.012 cfs
Storm frequency	= 2 yrs	Time to peak	= 15.63 hrs
Time interval	= 2 min	Hyd. volume	= 356 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

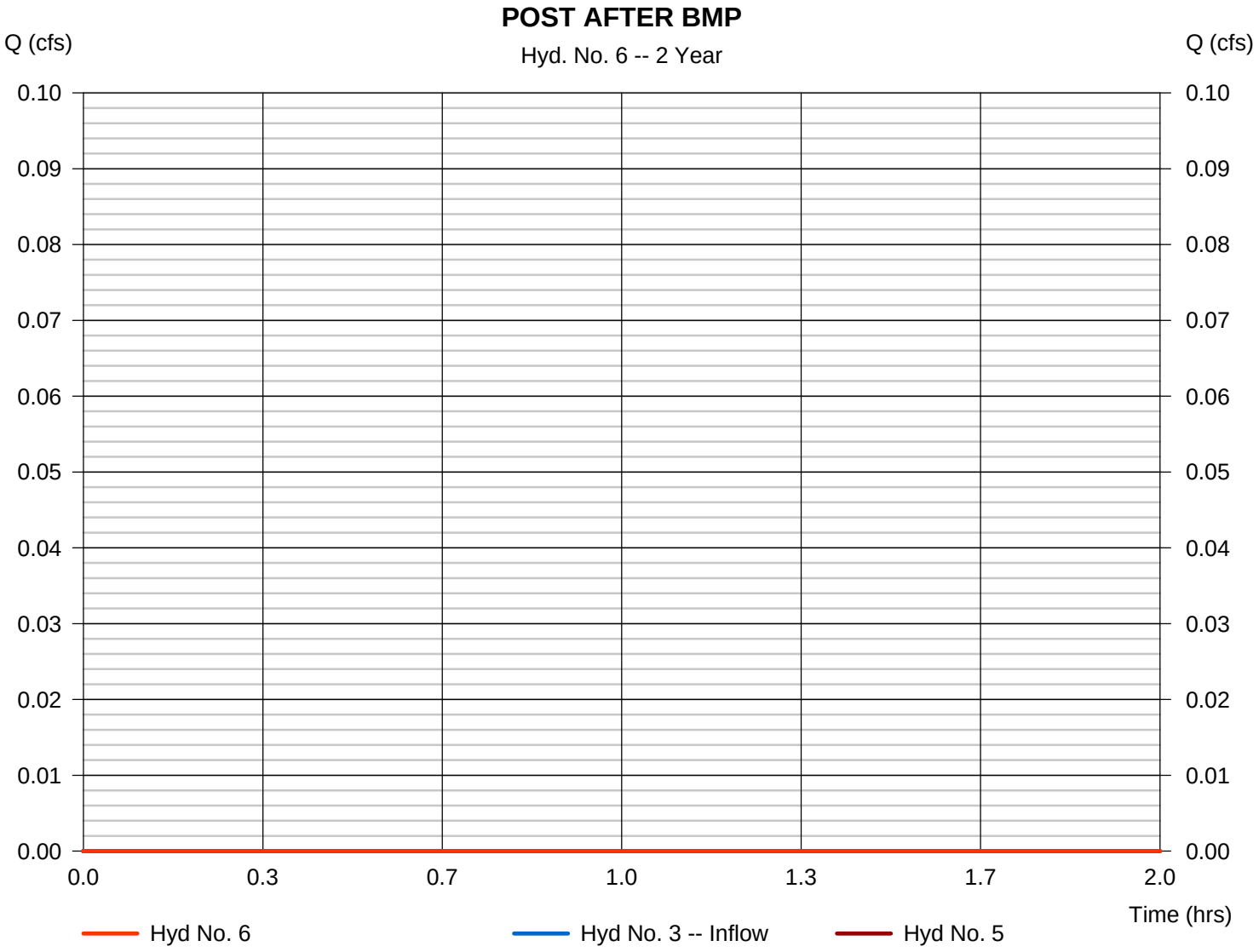


Hydrograph Report

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

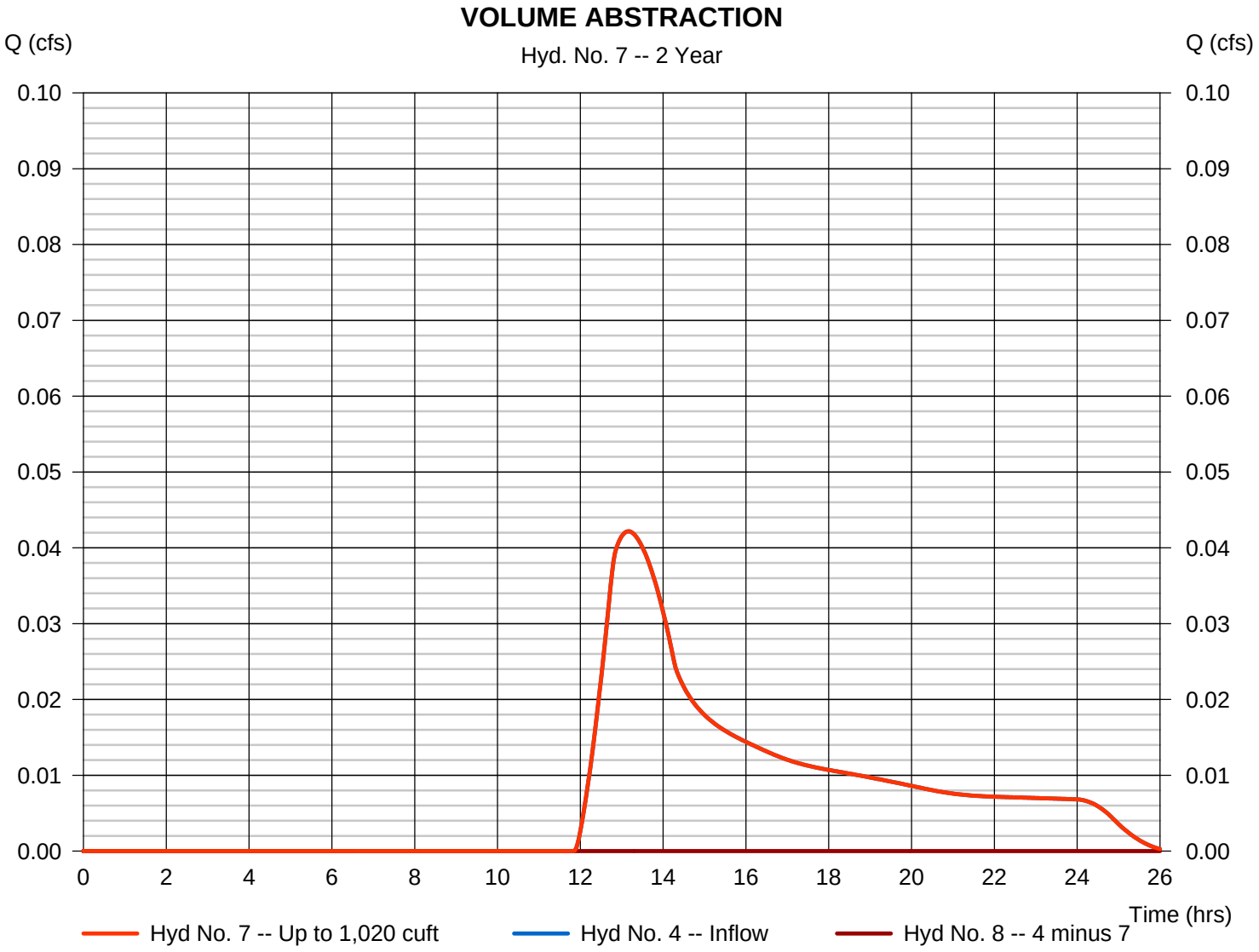


Hydrograph Report

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.042 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.17 hrs
Time interval	= 2 min	Hyd. volume	= 653 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

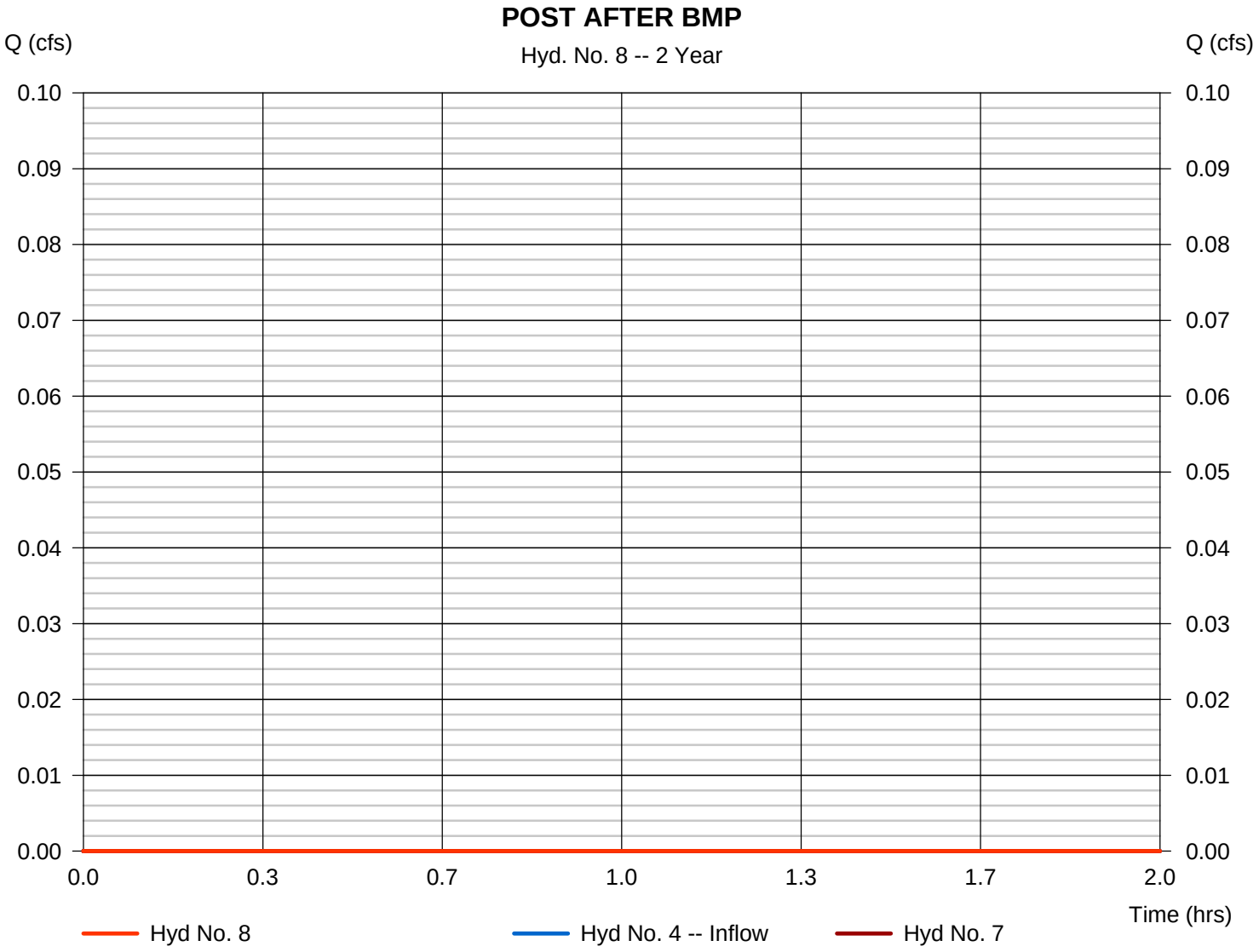


Hydrograph Report

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

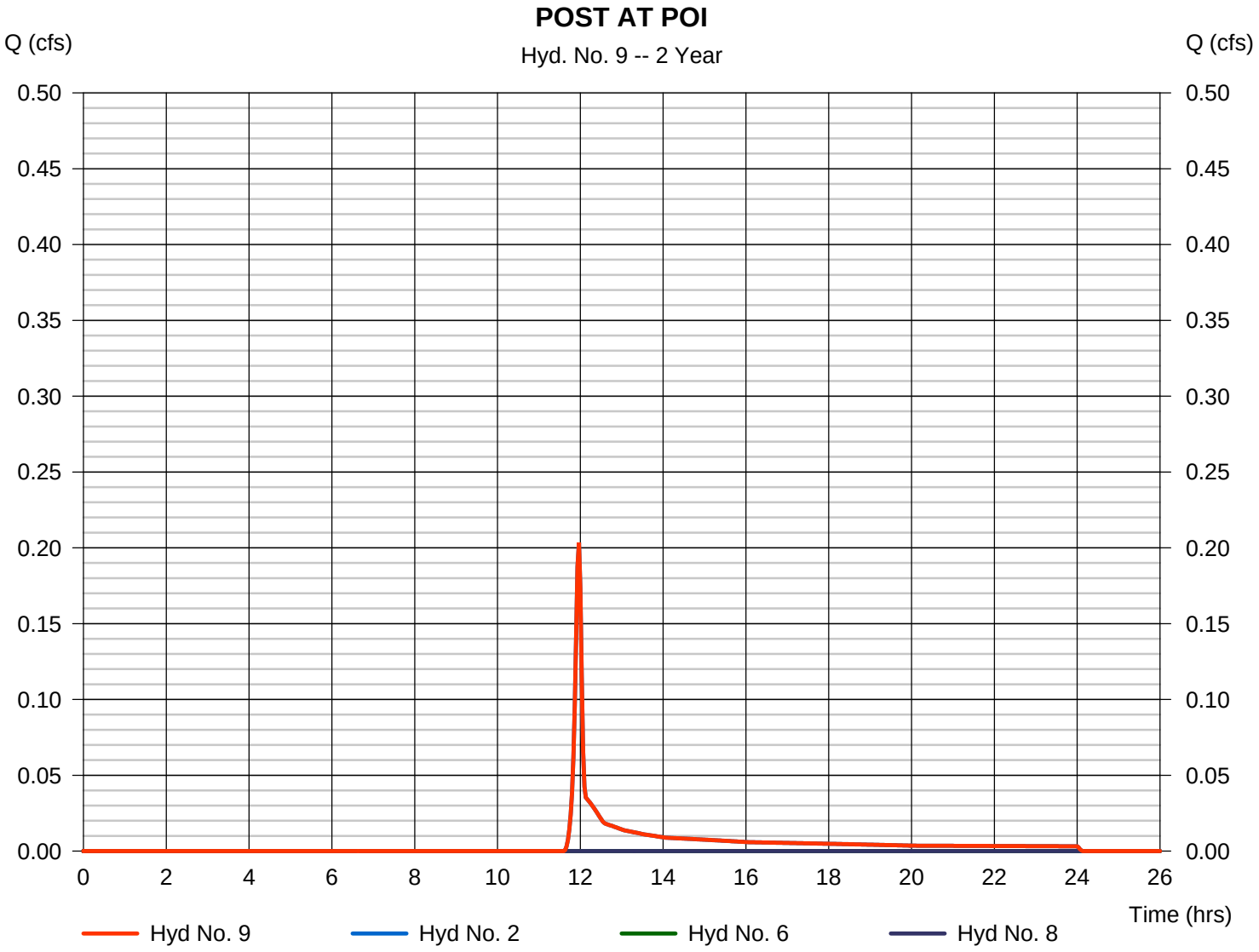


Hydrograph Report

Hyd. No. 9

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.203 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 425 cuft
Inflow hyds.	= 2, 6, 8	Contrib. drain. area	= 0.210 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	41.3805	10.1000	0.8846	--------
2	50.3642	10.4000	0.8844	--------
3	0.0000	0.0000	0.0000	--------
5	45.7628	8.9000	0.8075	--------
10	45.5204	8.1000	0.7720	--------
25	47.3122	7.6000	0.7392	--------
50	43.0390	6.3000	0.6892	--------
100	41.7827	5.5000	0.6559	--------

File name: Hares Valley IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.75	2.91	2.39	2.04	1.78	1.58	1.42	1.30	1.19	1.10	1.03	0.96
2	4.49	3.50	2.88	2.46	2.15	1.91	1.72	1.57	1.45	1.34	1.25	1.17
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.46	4.26	3.53	3.03	2.66	2.38	2.16	1.98	1.83	1.70	1.59	1.50
10	6.25	4.87	4.03	3.47	3.05	2.74	2.49	2.29	2.12	1.98	1.86	1.75
25	7.27	5.68	4.72	4.07	3.60	3.24	2.95	2.72	2.53	2.36	2.22	2.10
50	8.09	6.29	5.23	4.52	4.01	3.62	3.31	3.06	2.85	2.68	2.52	2.39
100	8.94	6.92	5.76	4.99	4.44	4.02	3.69	3.42	3.19	3.00	2.83	2.69

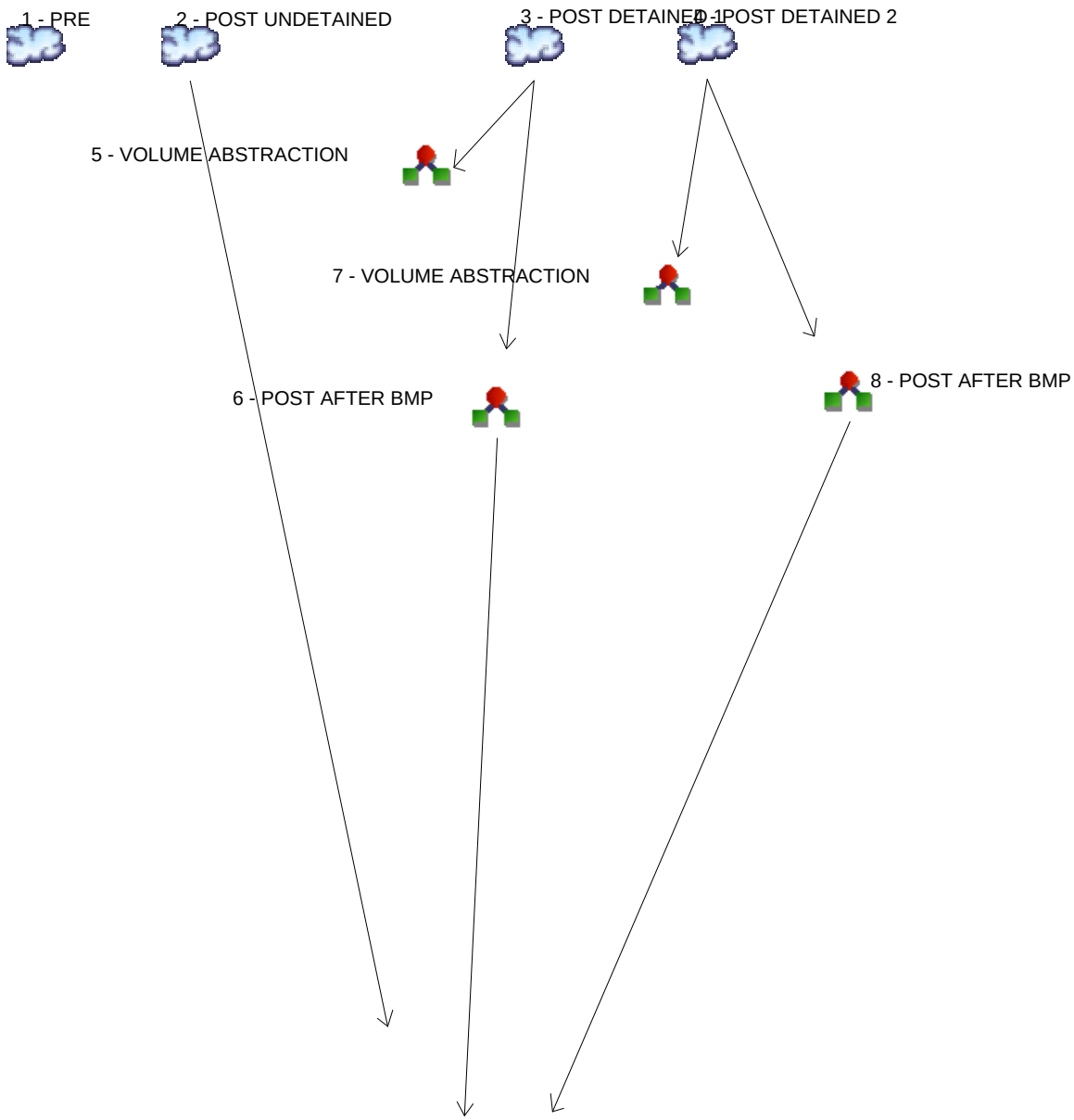
Tc = time in minutes. Values may exceed 60.

\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Hares Valley Road (PA 655)\Hydraflow Rev 1\Hares Valley Precip.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.25	2.70	0.00	3.35	3.90	4.70	5.37	6.10
SCS 6-Hr	1.48	1.79	0.00	2.23	2.60	3.13	3.58	4.07
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

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	------	-------	-------	-------	-------	1.283	-------	-------	-------	PRE
2	SCS Runoff	------	-------	-------	-------	-------	0.474	-------	-------	-------	POST UNDETAINED
3	SCS Runoff	------	-------	-------	-------	-------	0.123	-------	-------	-------	POST DETAINED 1
4	SCS Runoff	------	-------	-------	-------	-------	0.405	-------	-------	-------	POST DETAINED 2
5	Diversion1	3	-------	-------	-------	-------	0.123	-------	-------	-------	VOLUME ABSTRACTION
6	Diversion2	3	-------	-------	-------	-------	0.000	-------	-------	-------	POST AFTER BMP
7	Diversion1	4	-------	-------	-------	-------	0.405	-------	-------	-------	VOLUME ABSTRACTION
8	Diversion2	4	-------	-------	-------	-------	0.046	-------	-------	-------	POST AFTER BMP
9	Combine	2, 6, 8	-------	-------	-------	-------	0.474	-------	-------	-------	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	1.283	1	719	3,081	------	------	------	PRE
2	SCS Runoff	0.474	2	718	948	------	------	------	POST UNDETAINED
3	SCS Runoff	0.123	2	752	1,051	------	------	------	POST DETAINED 1
4	SCS Runoff	0.405	2	730	1,829	------	------	------	POST DETAINED 2
5	Diversion1	0.123	2	752	1,051	3	------	------	VOLUME ABSTRACTION
6	Diversion2	0.000	2	n/a	0	3	------	------	POST AFTER BMP
7	Diversion1	0.405	2	730	1,021	4	------	------	VOLUME ABSTRACTION
8	Diversion2	0.046	2	836	808	4	------	------	POST AFTER BMP
9	Combine	0.474	2	718	1,755	2, 6, 8	------	------	POST AT POI

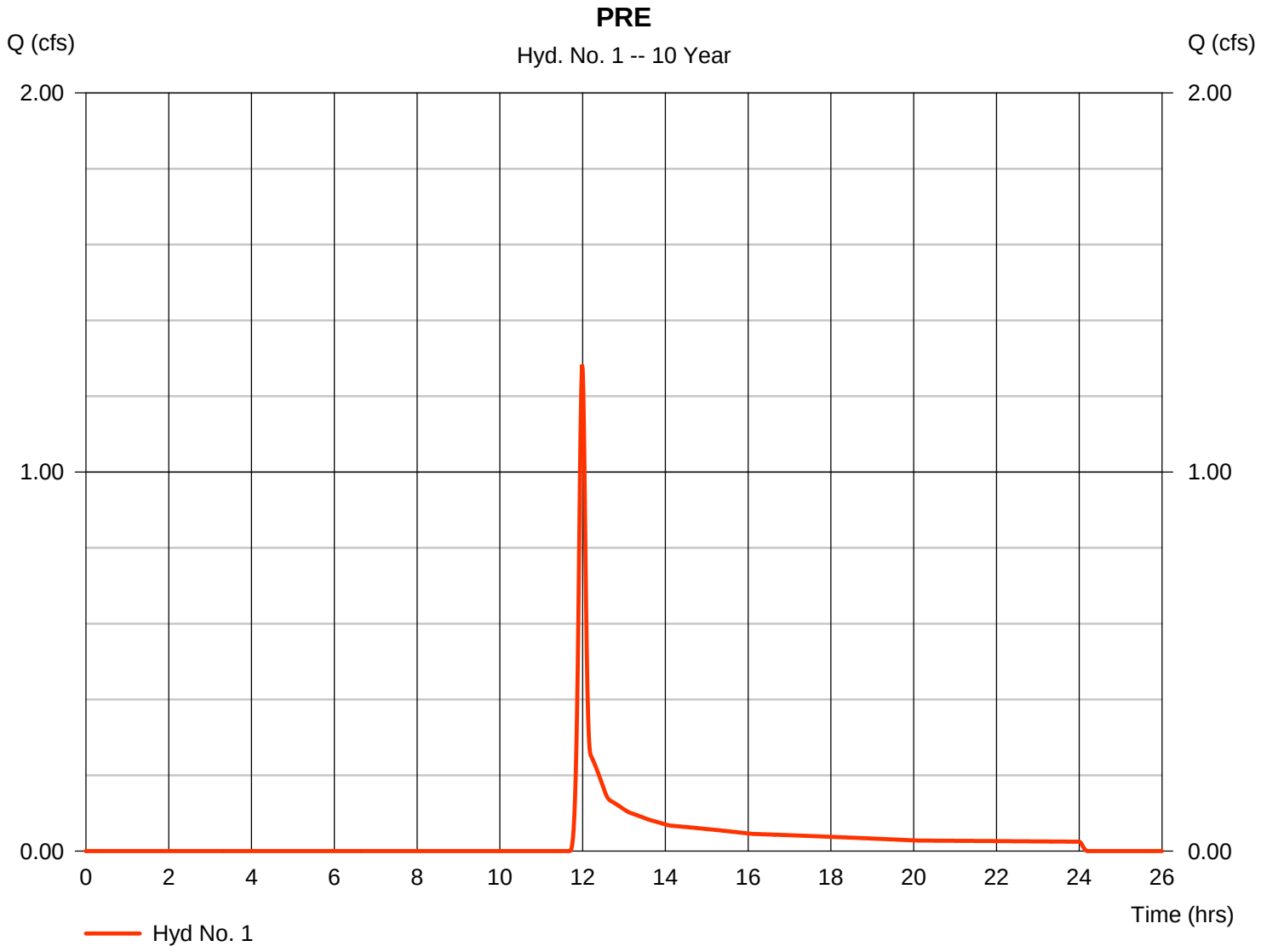
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.283 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.98 hrs
Time interval	=	1 min	Hyd. volume	=	3,081 cuft
Drainage area	=	1.220 ac	Curve number	=	60*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	3.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.320 x 58) + (0.190 x 71) + (0.610 x 55) + (0.100 x 70)] / 1.220



TR55 Tc Worksheet

Hyd. No. 1

PRE

Description	A		B		C		Totals
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)	= 2.70		0.00		0.00		
Land slope (%)	= 4.23		0.00		0.00		
Travel Time (min)	**= 6.61**	**+**	**0.00**	**+**	**0.00**	**=**	**6.61**
Shallow Concentrated Flow							
Flow length (ft)	= 599.00		0.00		0.00		
Watercourse slope (%)	= 14.45		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.13		0.00		0.00		
Travel Time (min)	**= 1.63**	**+**	**0.00**	**+**	**0.00**	**=**	**1.63**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 8.20 min

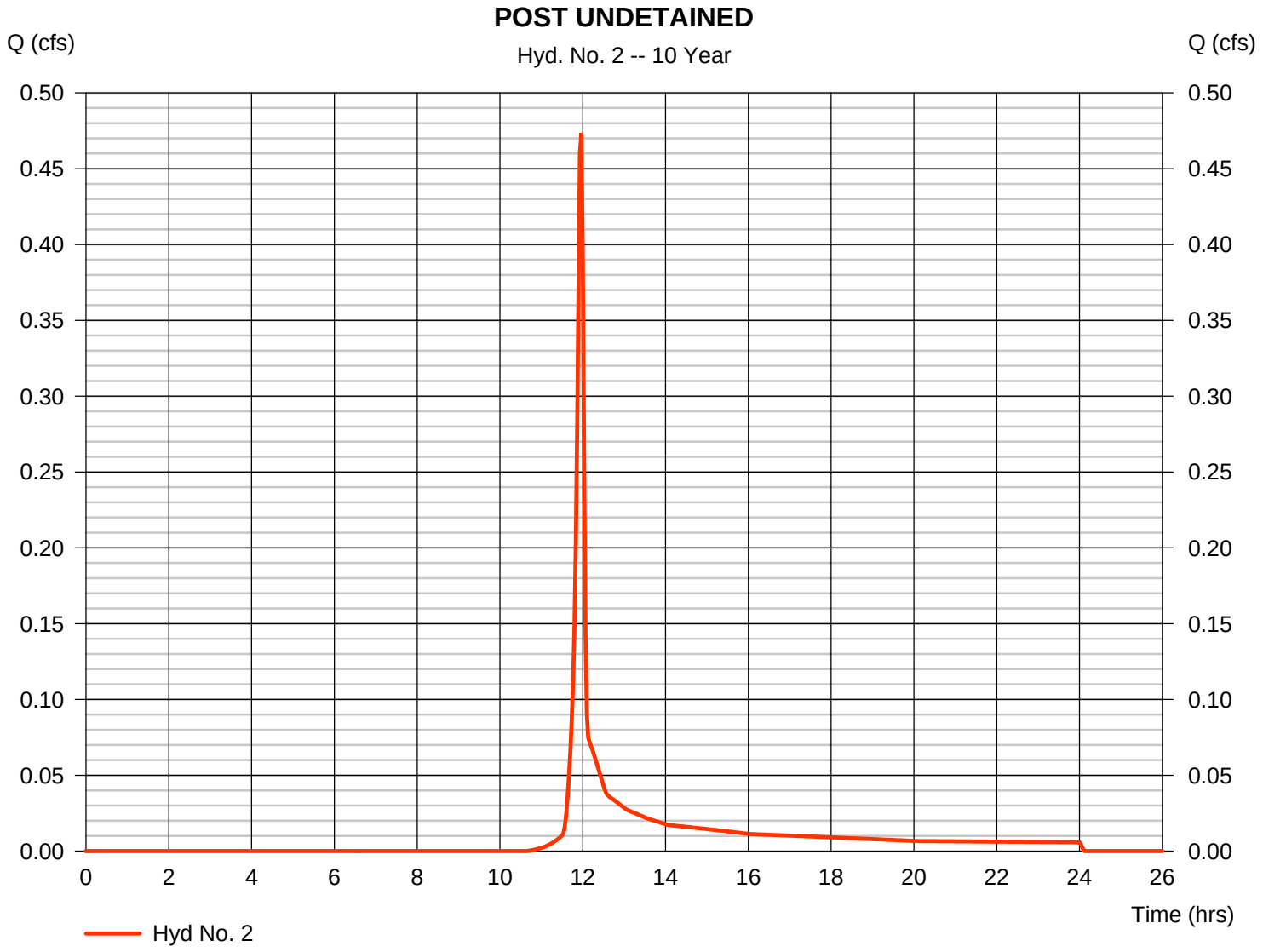
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.474 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	948 cuft
Drainage area	=	0.210 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.30 min
Total precip.	=	3.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.020 x 89) + (0.030 x 58) + (0.160 x 71)] / 0.210



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED

Description	A		B		C		Totals
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)	= 2.70		0.00		0.00		
Land slope (%)	= 10.00		0.00		0.00		
Travel Time (min)	**= 4.69**	**+**	**0.00**	**+**	**0.00**	**=**	**4.69**
Shallow Concentrated Flow							
Flow length (ft)	= 160.00		0.00		0.00		
Watercourse slope (%)	= 8.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.59		0.00		0.00		
Travel Time (min)	**= 0.58**	**+**	**0.00**	**+**	**0.00**	**=**	**0.58**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 5.30 min

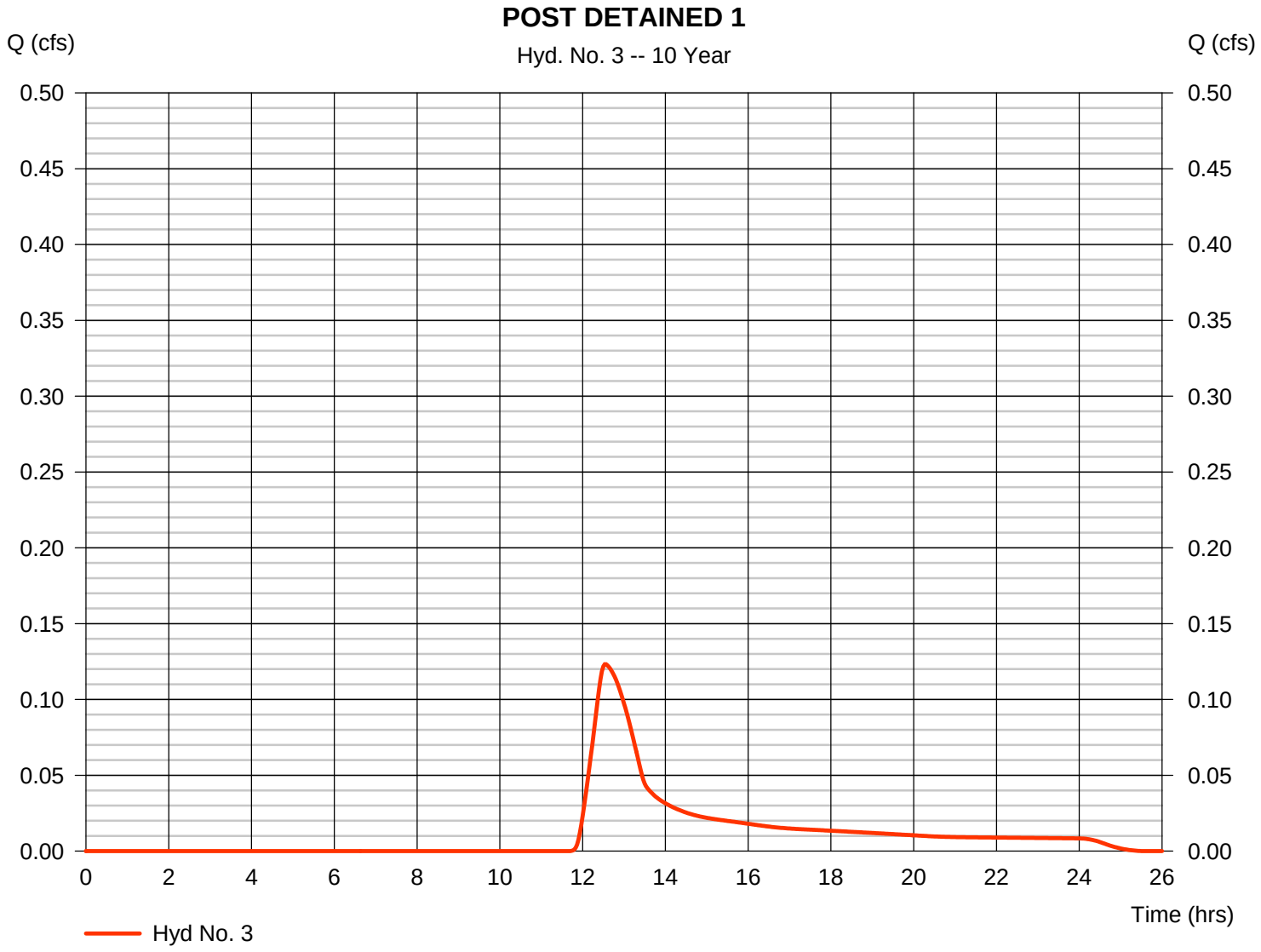
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.123 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.53 hrs
Time interval	= 2 min	Hyd. volume	= 1,051 cuft
Drainage area	= 0.380 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 59.73 min
Total precip.	= 3.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.030 x 71) + (0.320 x 58)] / 0.380



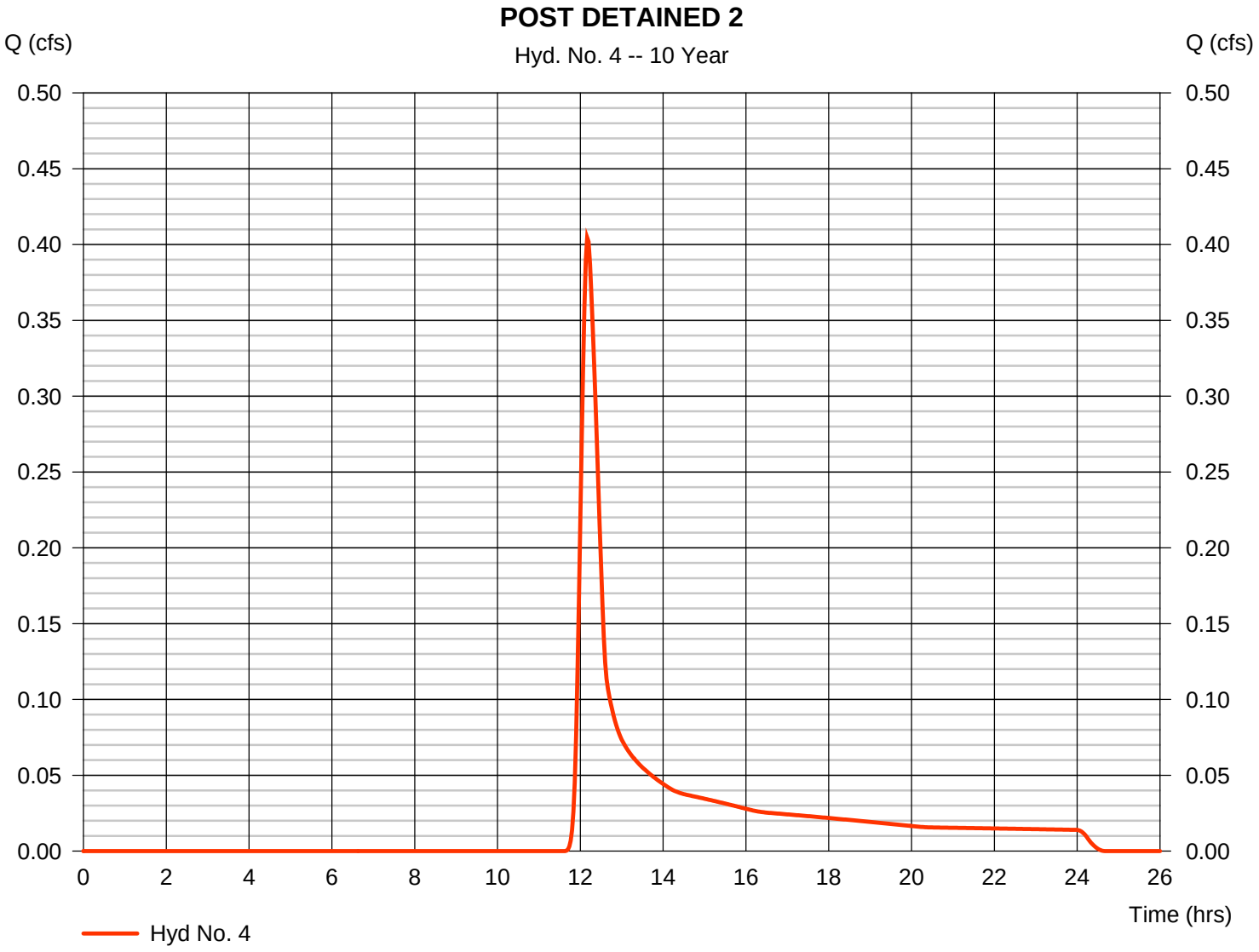
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.405 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	1,829 cuft
Drainage area	=	0.630 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	26.21 min
Total precip.	=	3.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.050 x 85) + (0.030 x 89) + (0.180 x 55) + (0.330 x 58) + (0.040 x 71)] / 0.630

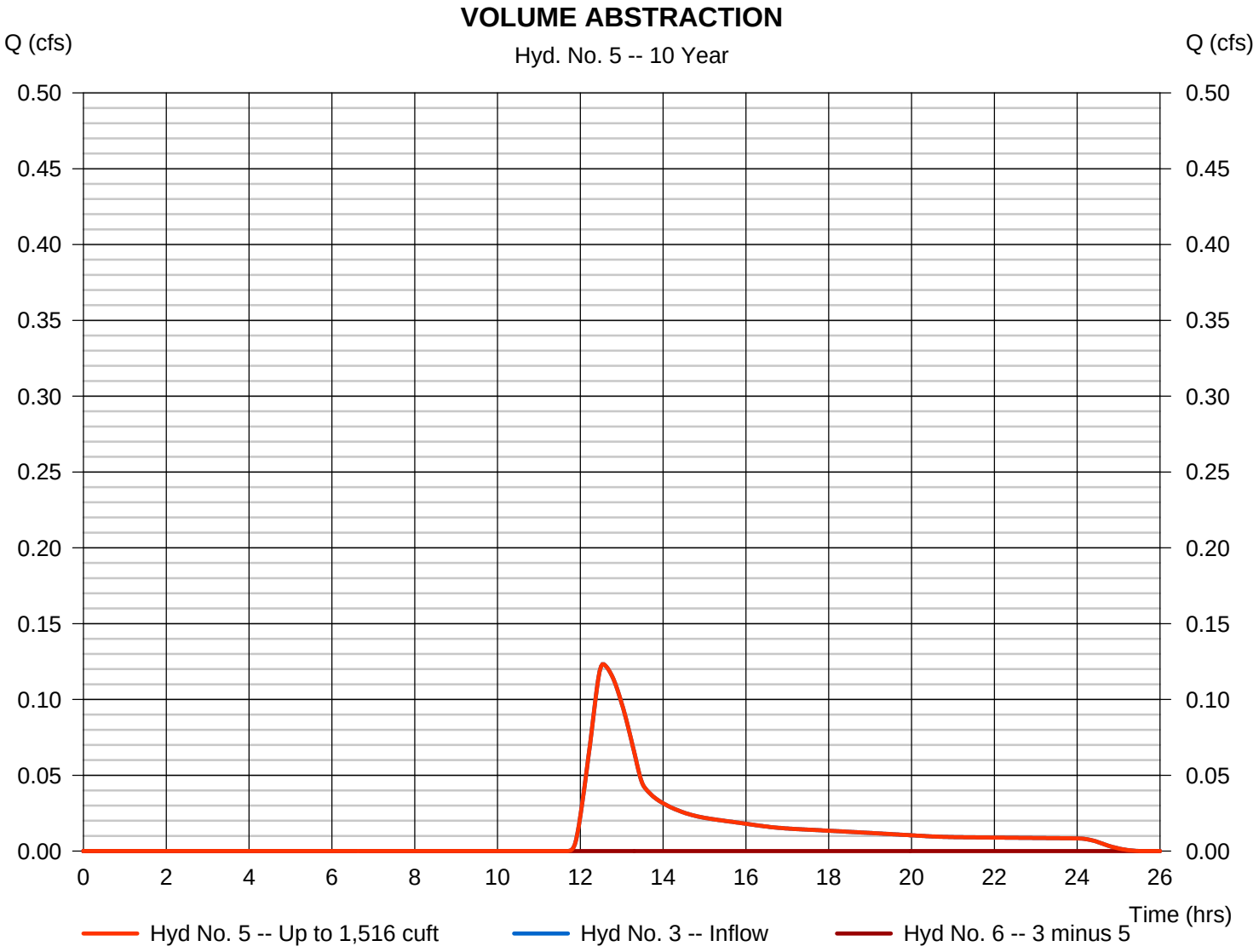


Hydrograph Report

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.123 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.53 hrs
Time interval	= 2 min	Hyd. volume	= 1,051 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

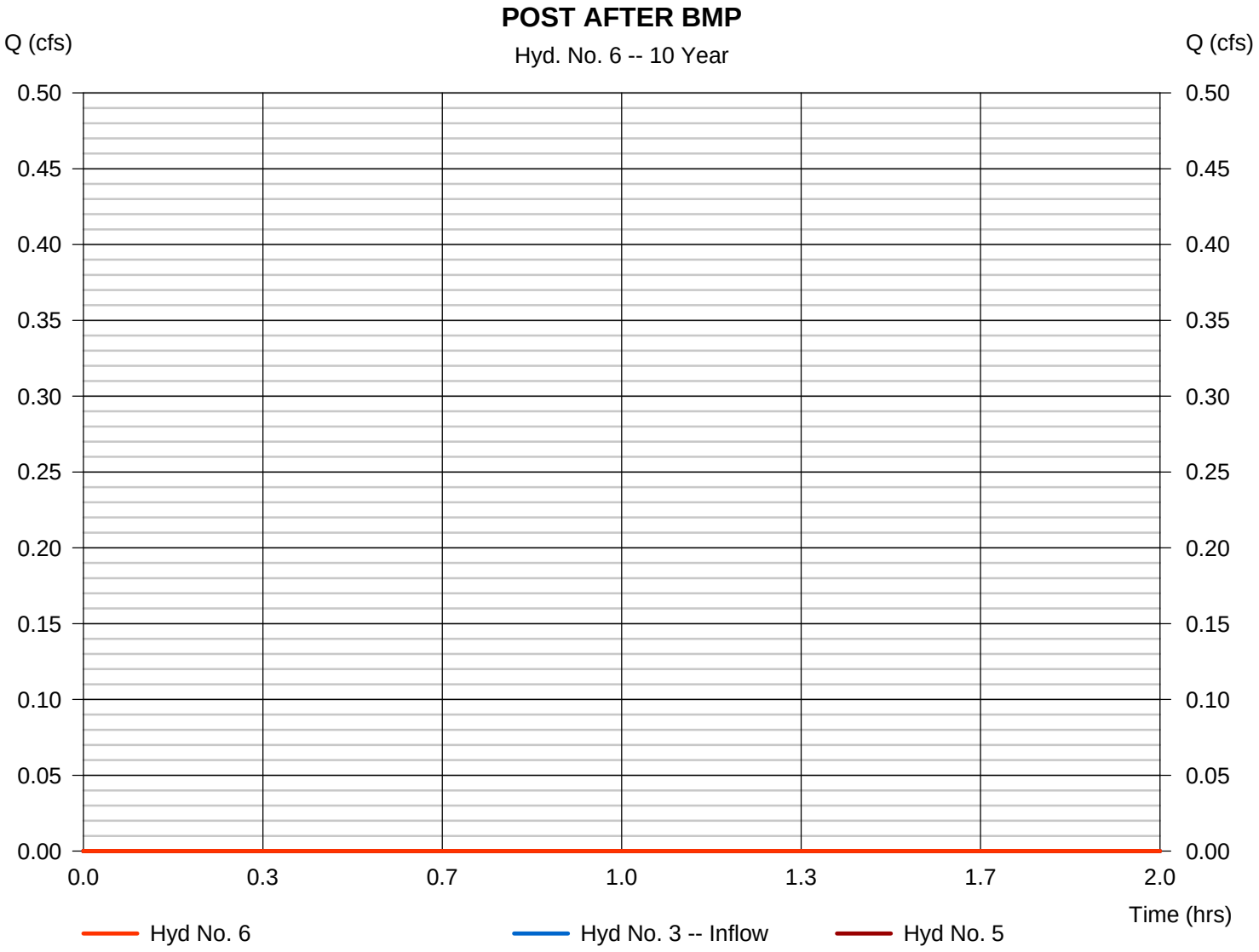


Hydrograph Report

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

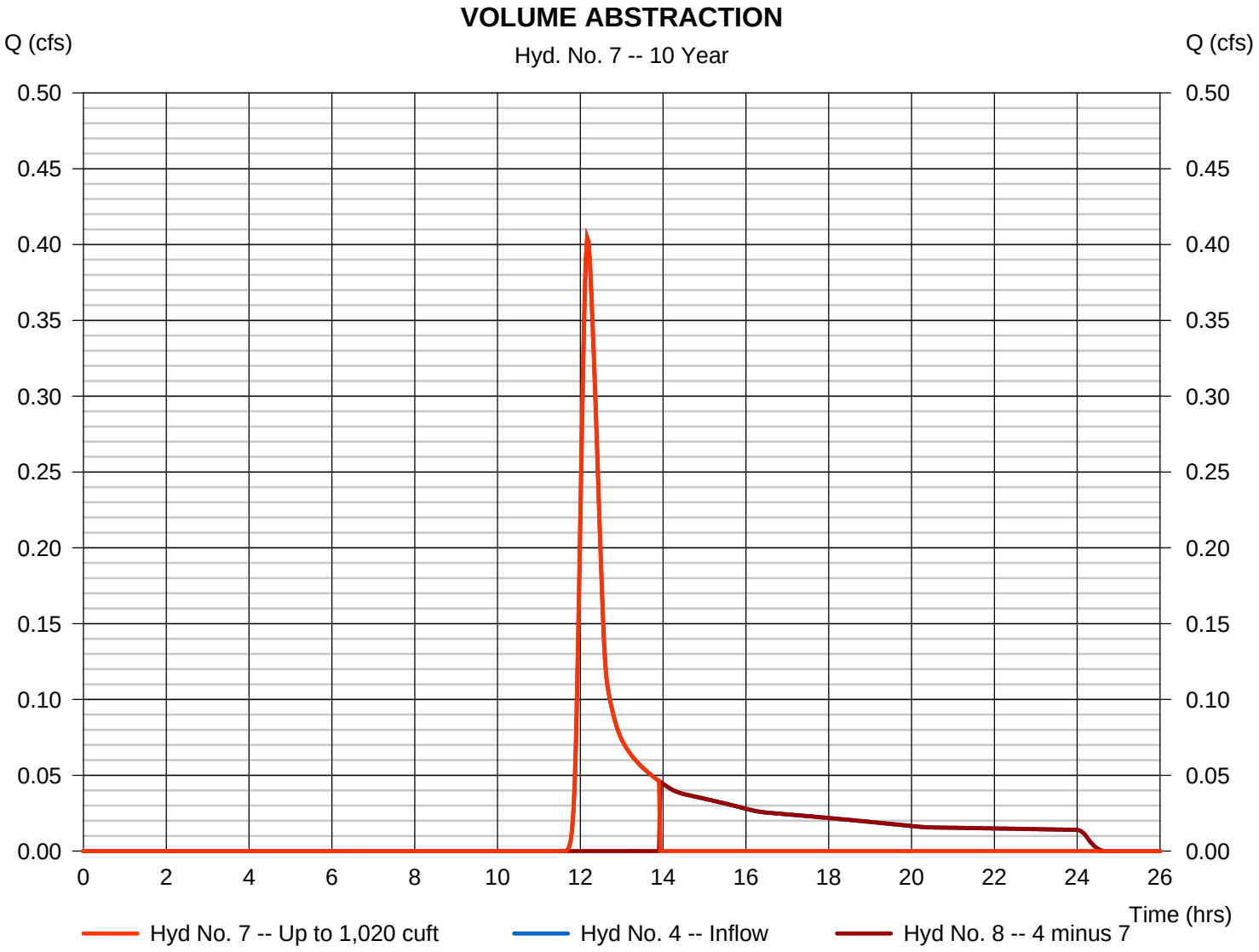


Hydrograph Report

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.405 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 1,021 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

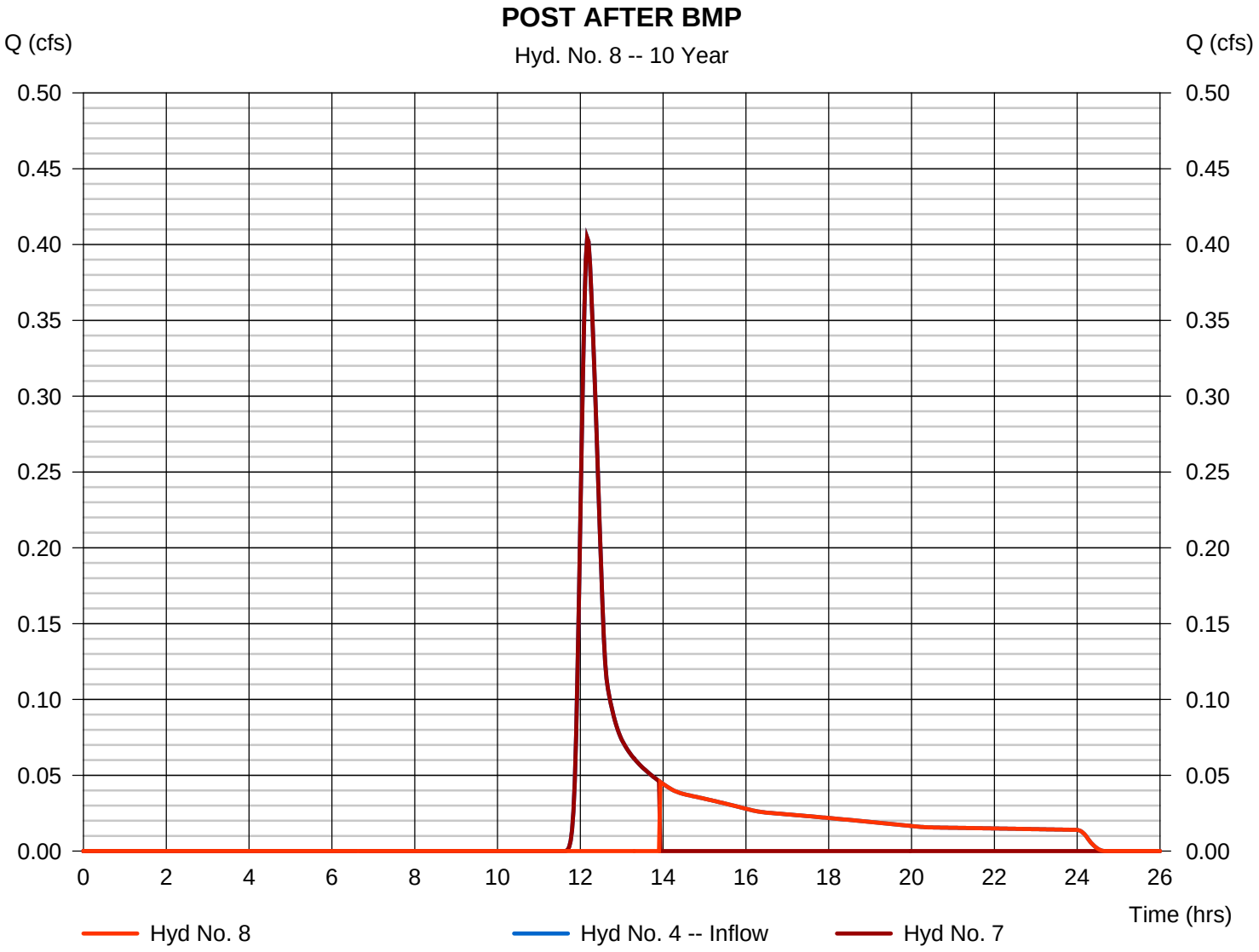


Hydrograph Report

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.046 cfs
Storm frequency	= 10 yrs	Time to peak	= 13.93 hrs
Time interval	= 2 min	Hyd. volume	= 808 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

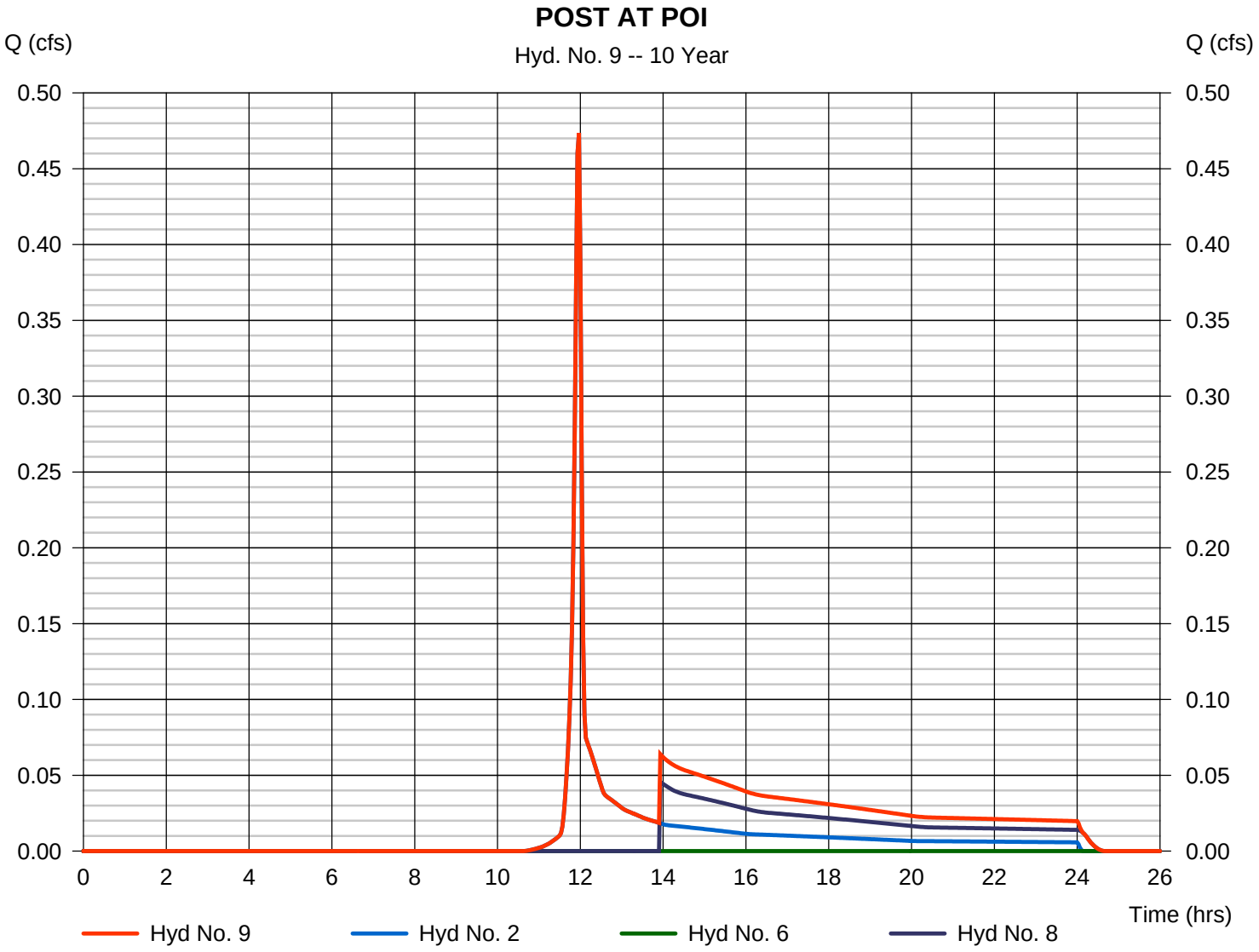


Hydrograph Report

Hyd. No. 9

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	0.474 cfs
Storm frequency	=	10 yrs	Time to peak	=	11.97 hrs
Time interval	=	2 min	Hyd. volume	=	1,755 cuft
Inflow hyds.	=	2, 6, 8	Contrib. drain. area	=	0.210 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	41.3805	10.1000	0.8846	--------
2	50.3642	10.4000	0.8844	--------
3	0.0000	0.0000	0.0000	--------
5	45.7628	8.9000	0.8075	--------
10	45.5204	8.1000	0.7720	--------
25	47.3122	7.6000	0.7392	--------
50	43.0390	6.3000	0.6892	--------
100	41.7827	5.5000	0.6559	--------

File name: Hares Valley IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.75	2.91	2.39	2.04	1.78	1.58	1.42	1.30	1.19	1.10	1.03	0.96
2	4.49	3.50	2.88	2.46	2.15	1.91	1.72	1.57	1.45	1.34	1.25	1.17
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.46	4.26	3.53	3.03	2.66	2.38	2.16	1.98	1.83	1.70	1.59	1.50
10	6.25	4.87	4.03	3.47	3.05	2.74	2.49	2.29	2.12	1.98	1.86	1.75
25	7.27	5.68	4.72	4.07	3.60	3.24	2.95	2.72	2.53	2.36	2.22	2.10
50	8.09	6.29	5.23	4.52	4.01	3.62	3.31	3.06	2.85	2.68	2.52	2.39
100	8.94	6.92	5.76	4.99	4.44	4.02	3.69	3.42	3.19	3.00	2.83	2.69

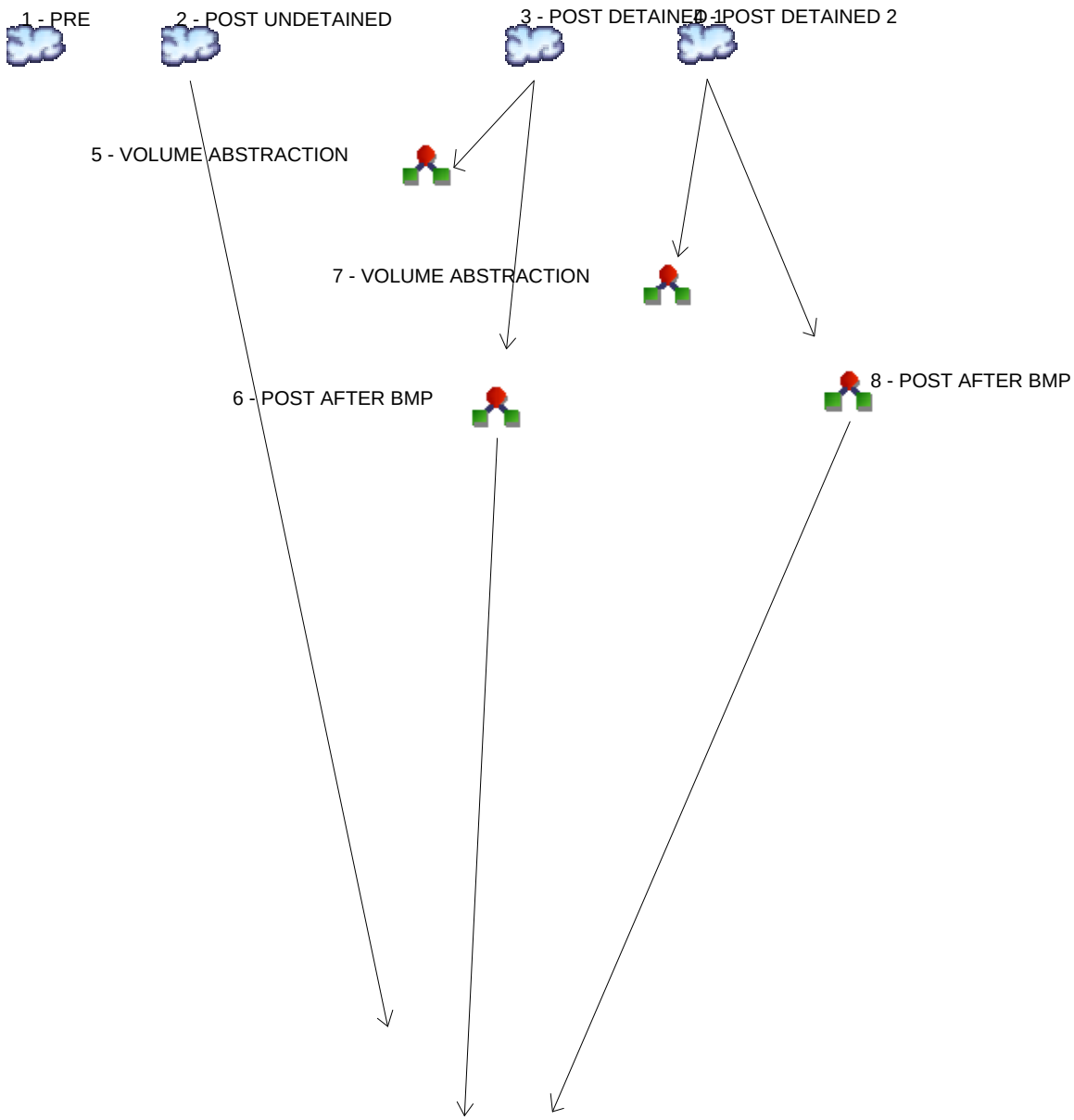
Tc = time in minutes. Values may exceed 60.

\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Hares Valley Road (PA 655)\Hydraflow Rev 1\Hares Valley Precip.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.25	2.70	0.00	3.35	3.90	4.70	5.37	6.10
SCS 6-Hr	1.48	1.79	0.00	2.23	2.60	3.13	3.58	4.07
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

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	------	-------	-------	-------	-------	-------	-------	3.041	-------	PRE
2	SCS Runoff	------	-------	-------	-------	-------	-------	-------	0.853	-------	POST UNDETAINED
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	0.505	-------	POST DETAINED 1
4	SCS Runoff	------	-------	-------	-------	-------	-------	-------	1.266	-------	POST DETAINED 2
5	Diversion1	3	-------	-------	-------	-------	-------	-------	0.505	-------	VOLUME ABSTRACTION
6	Diversion2	3	-------	-------	-------	-------	-------	-------	0.037	-------	POST AFTER BMP
7	Diversion1	4	-------	-------	-------	-------	-------	-------	1.266	-------	VOLUME ABSTRACTION
8	Diversion2	4	-------	-------	-------	-------	-------	-------	1.055	-------	POST AFTER BMP
9	Combine	2, 6, 8	-------	-------	-------	-------	-------	-------	1.183	-------	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	3.041	1	719	6,574	------	------	------	PRE
2	SCS Runoff	0.853	2	718	1,715	------	------	------	POST UNDETAINED
3	SCS Runoff	0.505	2	732	2,202	------	------	------	POST DETAINED 1
4	SCS Runoff	1.266	2	724	3,728	------	------	------	POST DETAINED 2
5	Diversion1	0.505	2	732	1,518	3	------	------	VOLUME ABSTRACTION
6	Diversion2	0.037	2	906	684	3	------	------	POST AFTER BMP
7	Diversion1	1.266	2	724	1,067	4	------	------	VOLUME ABSTRACTION
8	Diversion2	1.055	2	728	2,660	4	------	------	POST AFTER BMP
9	Combine	1.183	2	728	5,059	2, 6, 8	------	------	POST AT POI

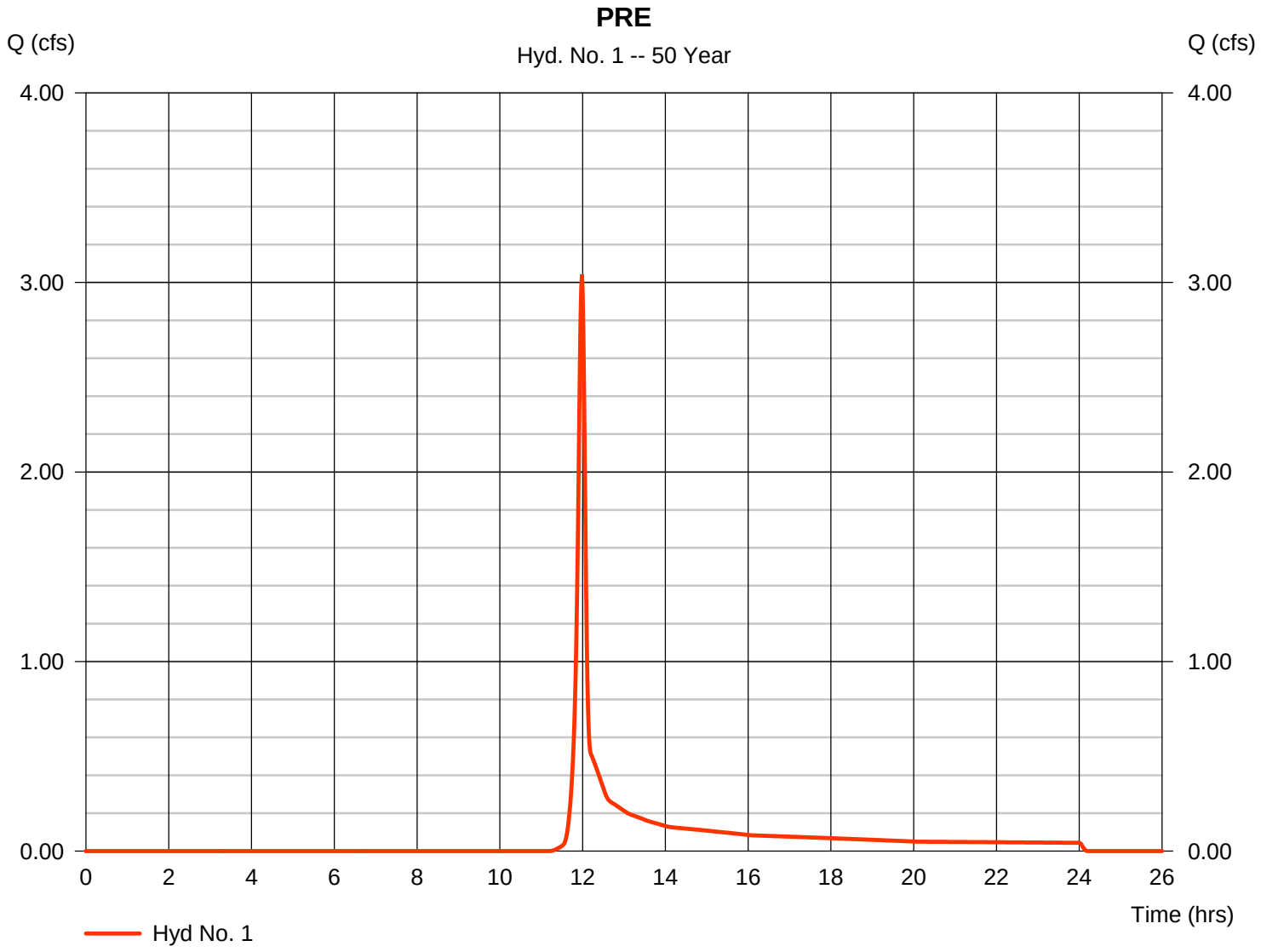
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.041 cfs
Storm frequency	=	50 yrs	Time to peak	=	11.98 hrs
Time interval	=	1 min	Hyd. volume	=	6,574 cuft
Drainage area	=	1.220 ac	Curve number	=	60*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	5.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.320 x 58) + (0.190 x 71) + (0.610 x 55) + (0.100 x 70)] / 1.220



TR55 Tc Worksheet

Hyd. No. 1

PRE

Description	A		B		C		Totals
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)	= 2.70		0.00		0.00		
Land slope (%)	= 4.23		0.00		0.00		
Travel Time (min)	**= 6.61**	**+**	**0.00**	**+**	**0.00**	**=**	**6.61**
Shallow Concentrated Flow							
Flow length (ft)	= 599.00		0.00		0.00		
Watercourse slope (%)	= 14.45		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.13		0.00		0.00		
Travel Time (min)	**= 1.63**	**+**	**0.00**	**+**	**0.00**	**=**	**1.63**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 8.20 min

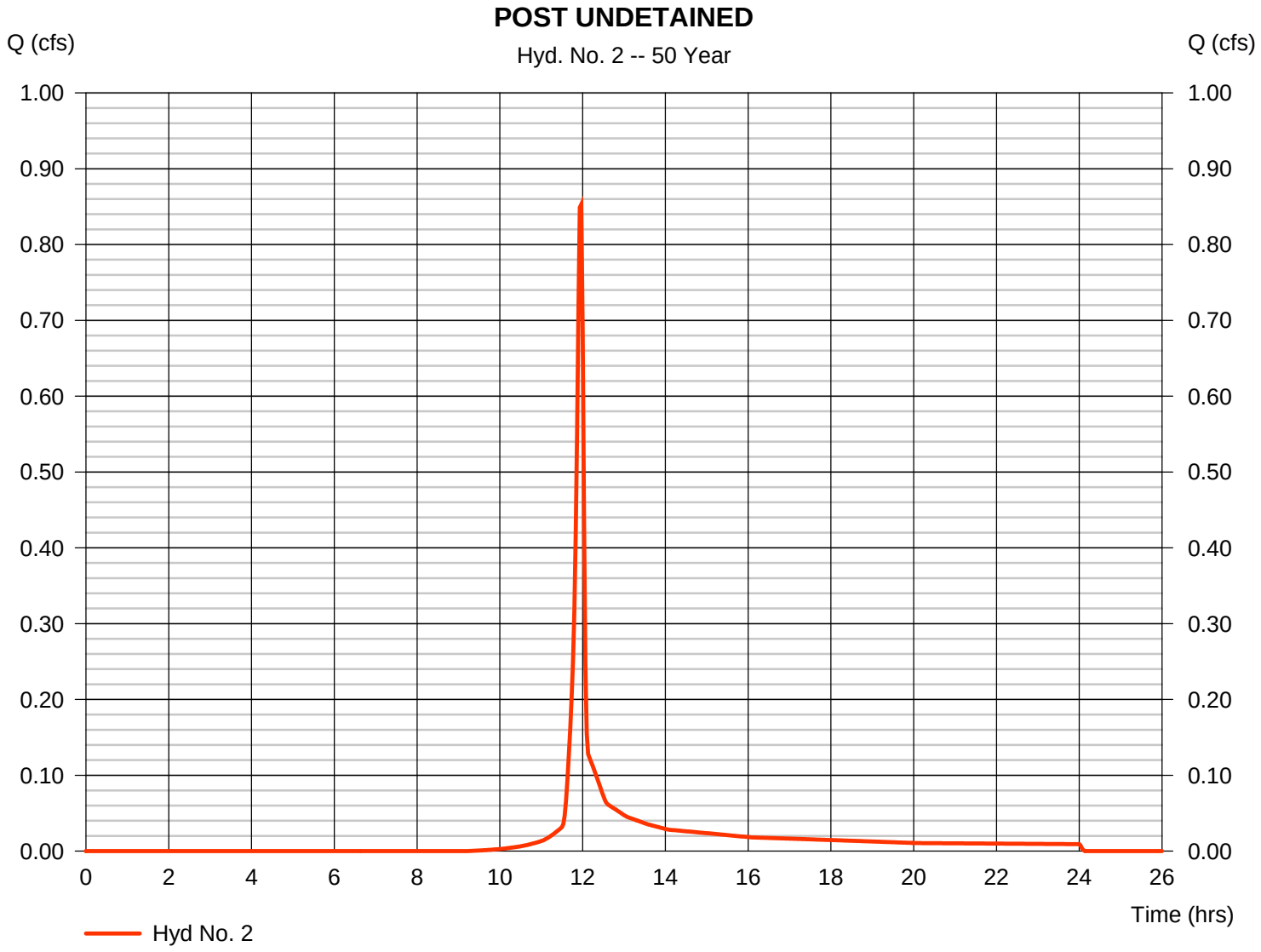
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 0.853 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 1,715 cuft
Drainage area	= 0.210 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.30 min
Total precip.	= 5.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.020 x 89) + (0.030 x 58) + (0.160 x 71)] / 0.210



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED

Description	A		B		C		Totals
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)	= 2.70		0.00		0.00		
Land slope (%)	= 10.00		0.00		0.00		
Travel Time (min)	**= 4.69**	**+**	**0.00**	**+**	**0.00**	**=**	**4.69**
Shallow Concentrated Flow							
Flow length (ft)	= 160.00		0.00		0.00		
Watercourse slope (%)	= 8.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.59		0.00		0.00		
Travel Time (min)	**= 0.58**	**+**	**0.00**	**+**	**0.00**	**=**	**0.58**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 5.30 min

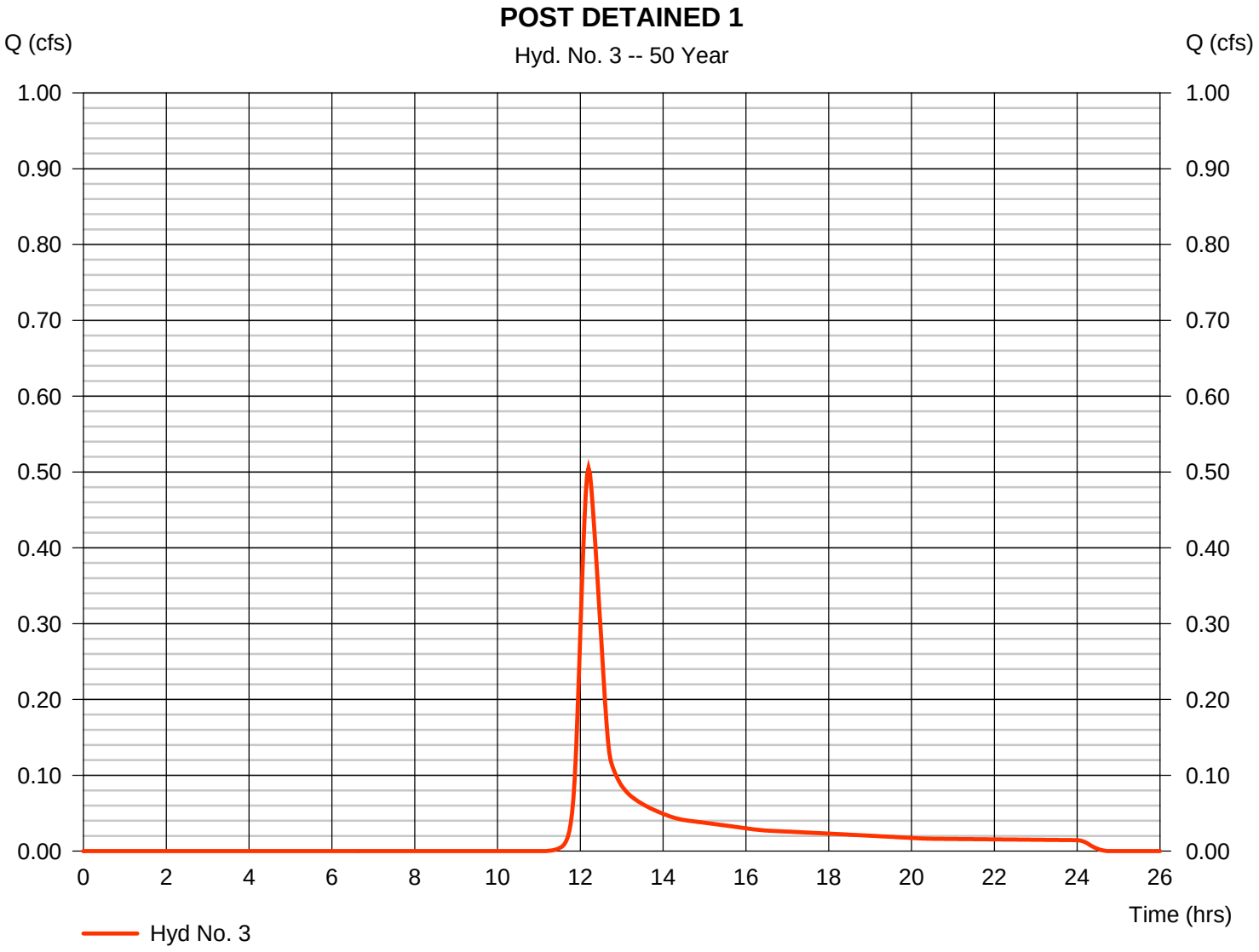
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.505 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 2,202 cuft
Drainage area	= 0.380 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 29.45 min
Total precip.	= 5.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.030 x 71) + (0.320 x 58)] / 0.380



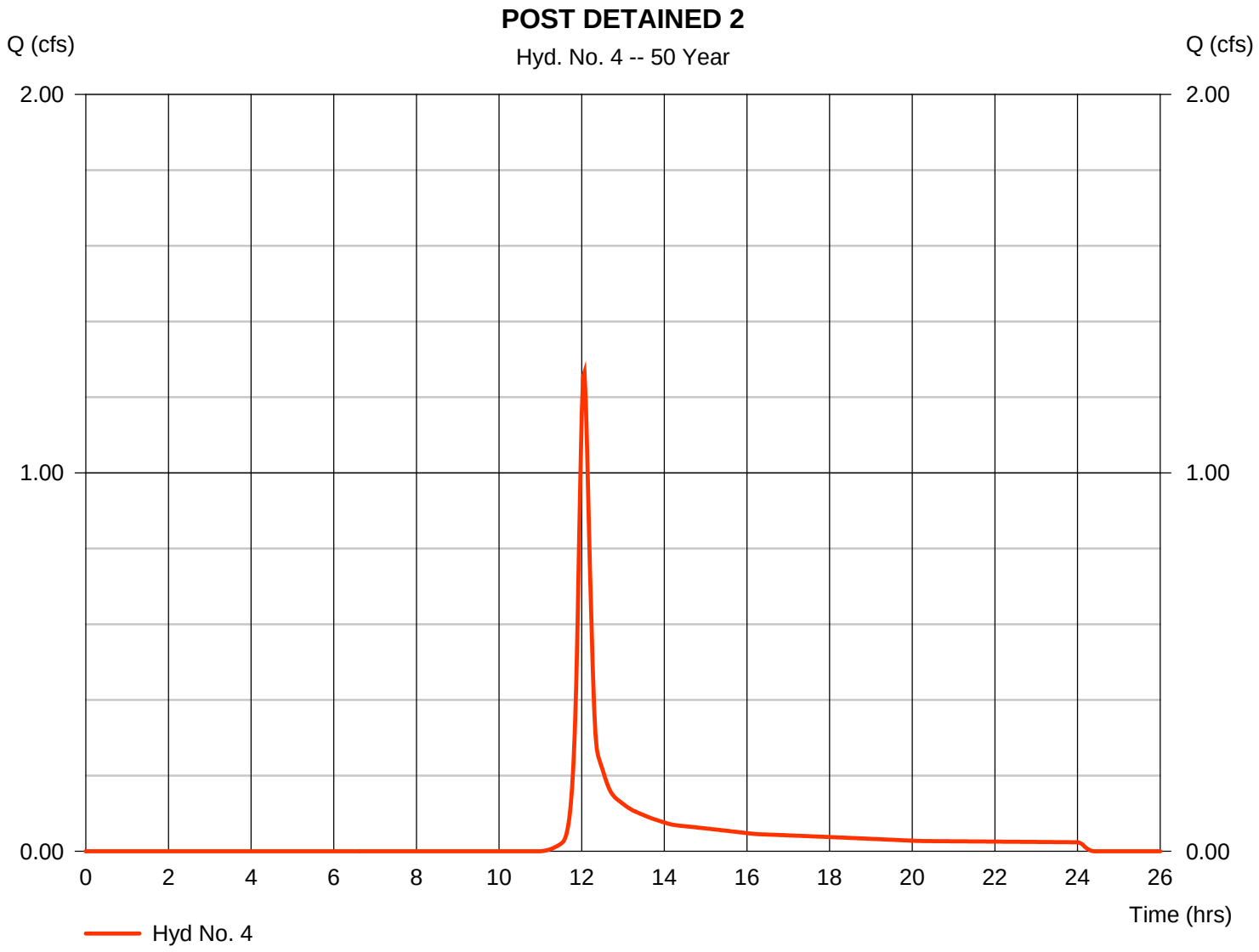
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.266 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	3,728 cuft
Drainage area	=	0.630 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.12 min
Total precip.	=	5.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.050 x 85) + (0.030 x 89) + (0.180 x 55) + (0.330 x 58) + (0.040 x 71)] / 0.630

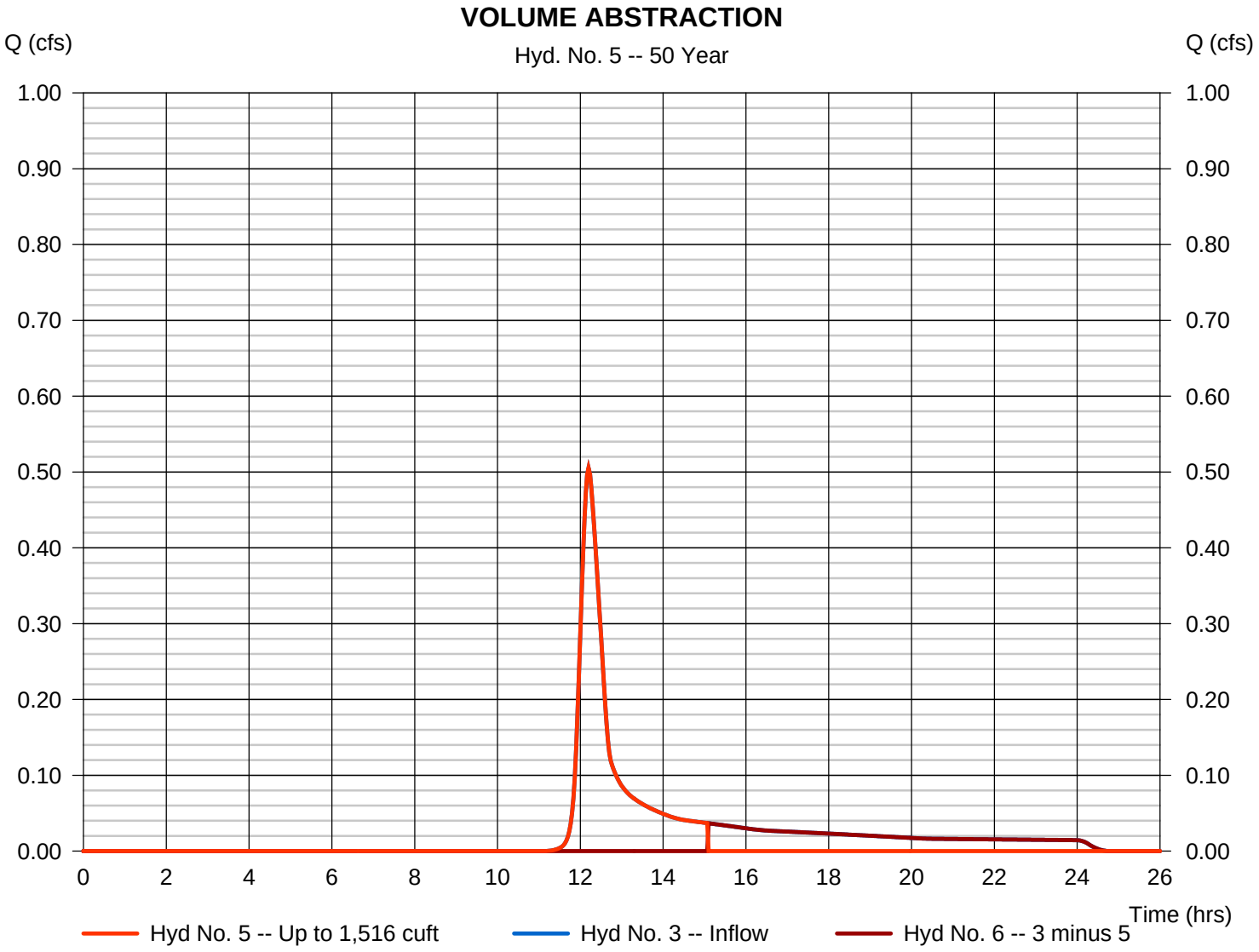


Hydrograph Report

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.505 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 1,518 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

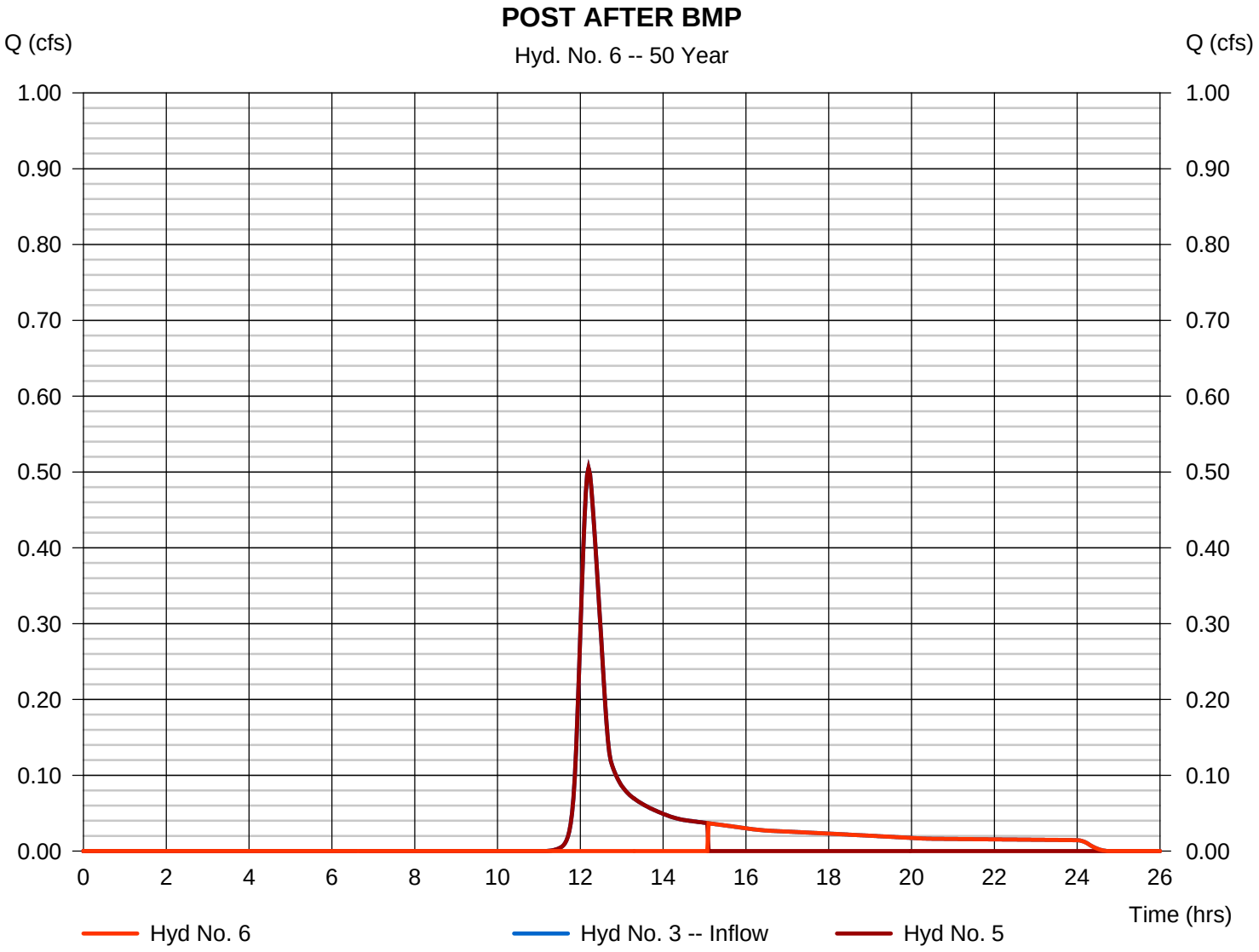


Hydrograph Report

Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.037 cfs
Storm frequency	= 50 yrs	Time to peak	= 15.10 hrs
Time interval	= 2 min	Hyd. volume	= 684 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

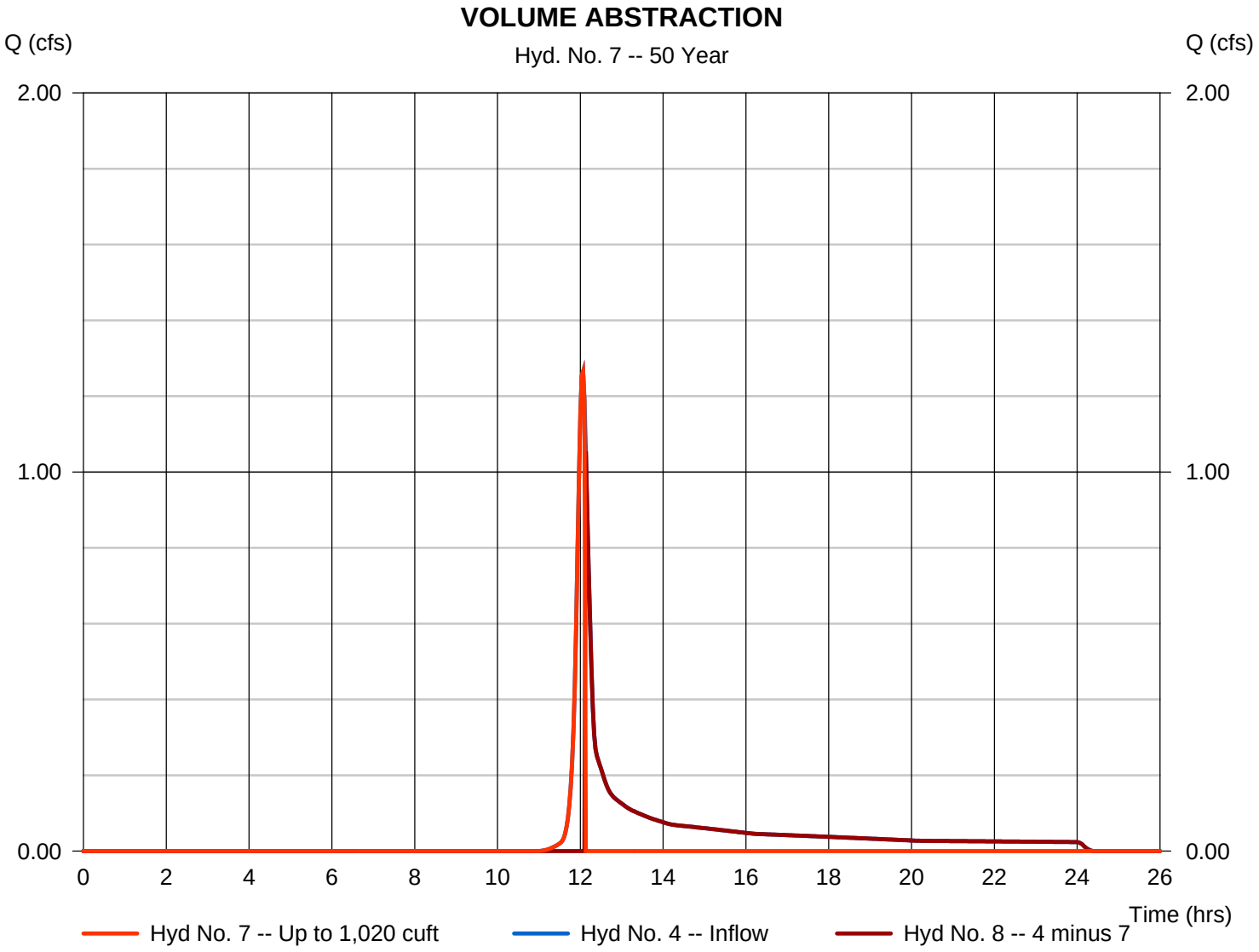


Hydrograph Report

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.266 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,067 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

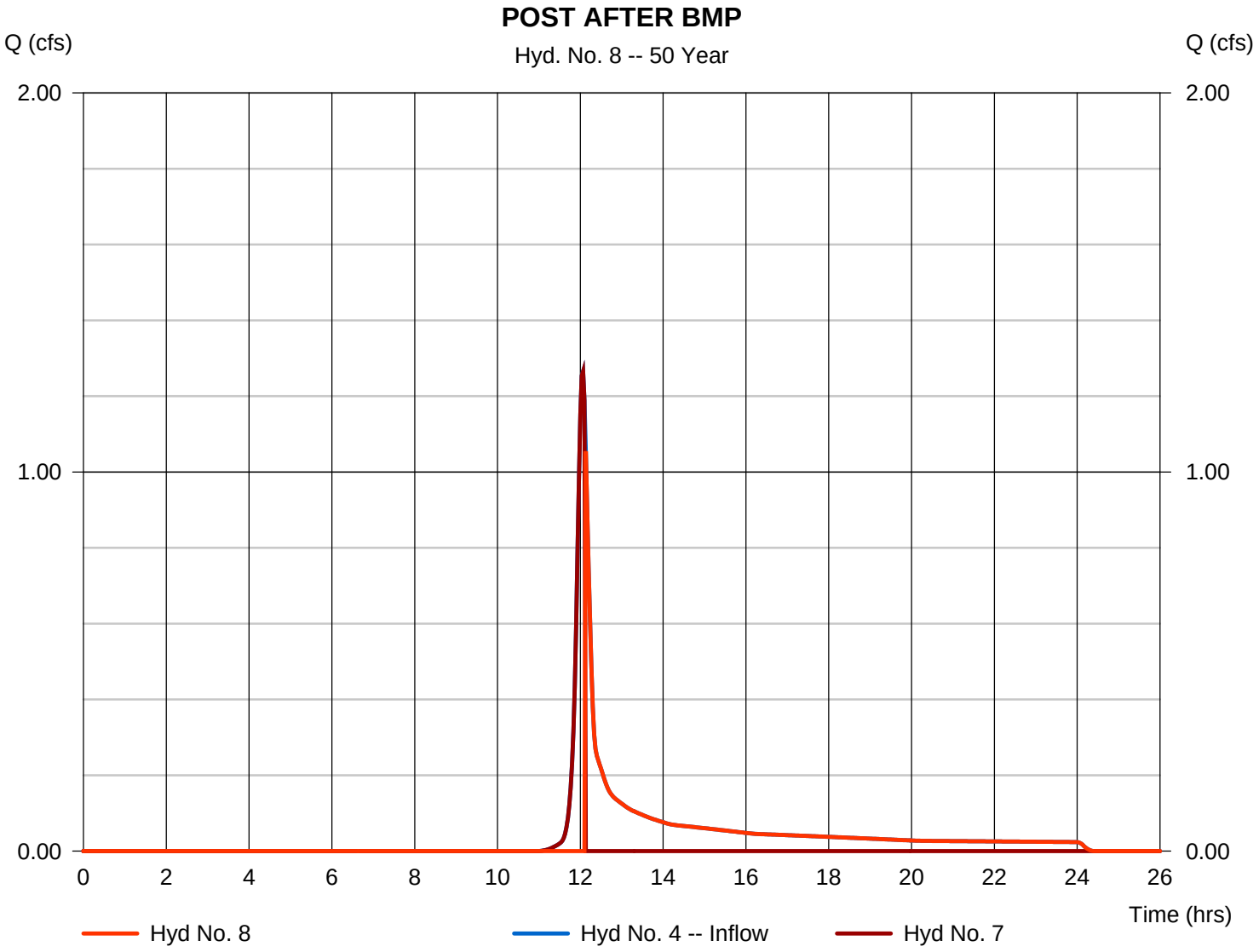


Hydrograph Report

Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 1.055 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 2,660 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

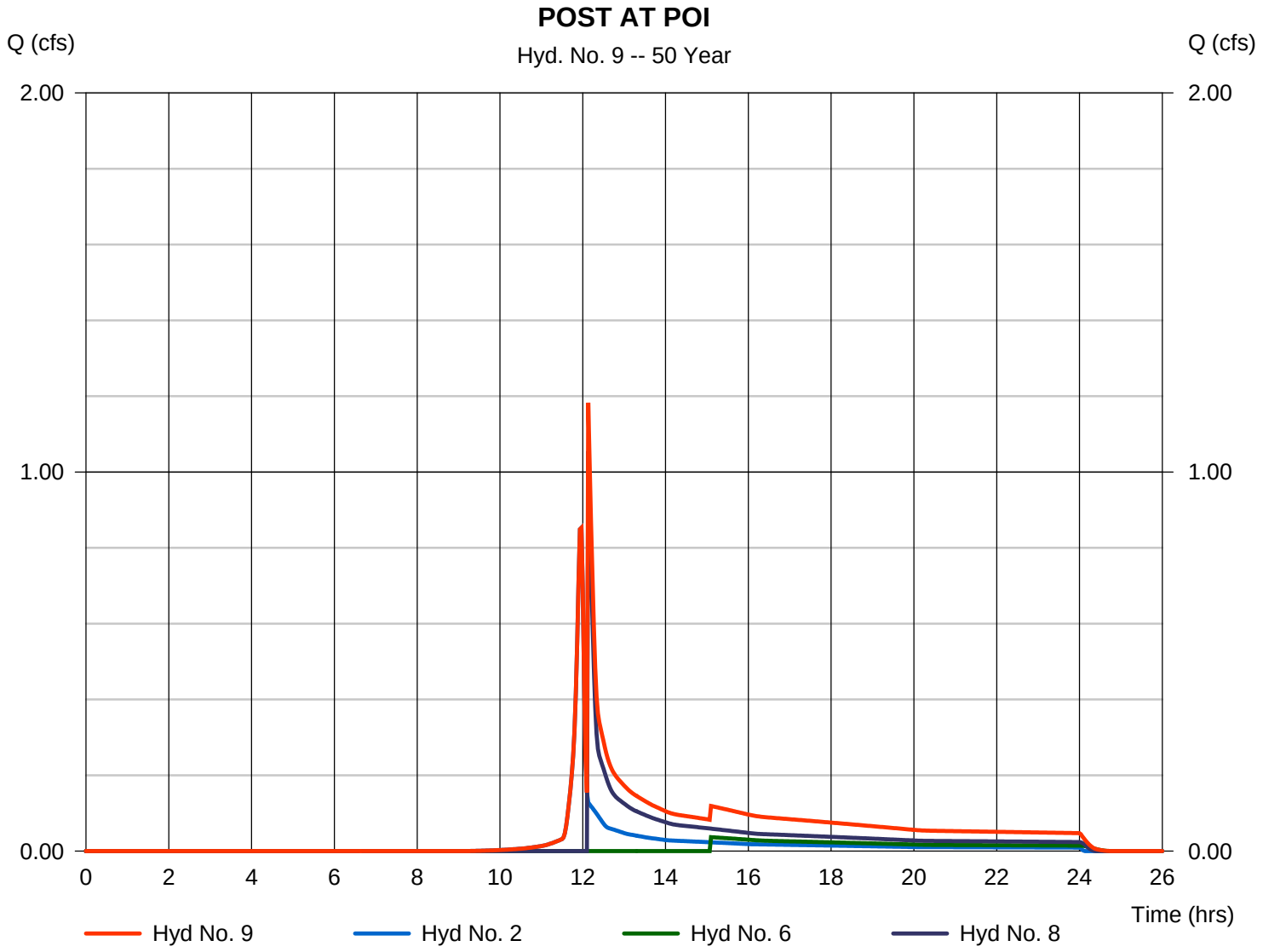


Hydrograph Report

Hyd. No. 9

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	1.183 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	5,059 cuft
Inflow hyds.	=	2, 6, 8	Contrib. drain. area	=	0.210 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	41.3805	10.1000	0.8846	--------
2	50.3642	10.4000	0.8844	--------
3	0.0000	0.0000	0.0000	--------
5	45.7628	8.9000	0.8075	--------
10	45.5204	8.1000	0.7720	--------
25	47.3122	7.6000	0.7392	--------
50	43.0390	6.3000	0.6892	--------
100	41.7827	5.5000	0.6559	--------

File name: Hares Valley IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.75	2.91	2.39	2.04	1.78	1.58	1.42	1.30	1.19	1.10	1.03	0.96
2	4.49	3.50	2.88	2.46	2.15	1.91	1.72	1.57	1.45	1.34	1.25	1.17
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.46	4.26	3.53	3.03	2.66	2.38	2.16	1.98	1.83	1.70	1.59	1.50
10	6.25	4.87	4.03	3.47	3.05	2.74	2.49	2.29	2.12	1.98	1.86	1.75
25	7.27	5.68	4.72	4.07	3.60	3.24	2.95	2.72	2.53	2.36	2.22	2.10
50	8.09	6.29	5.23	4.52	4.01	3.62	3.31	3.06	2.85	2.68	2.52	2.39
100	8.94	6.92	5.76	4.99	4.44	4.02	3.69	3.42	3.19	3.00	2.83	2.69

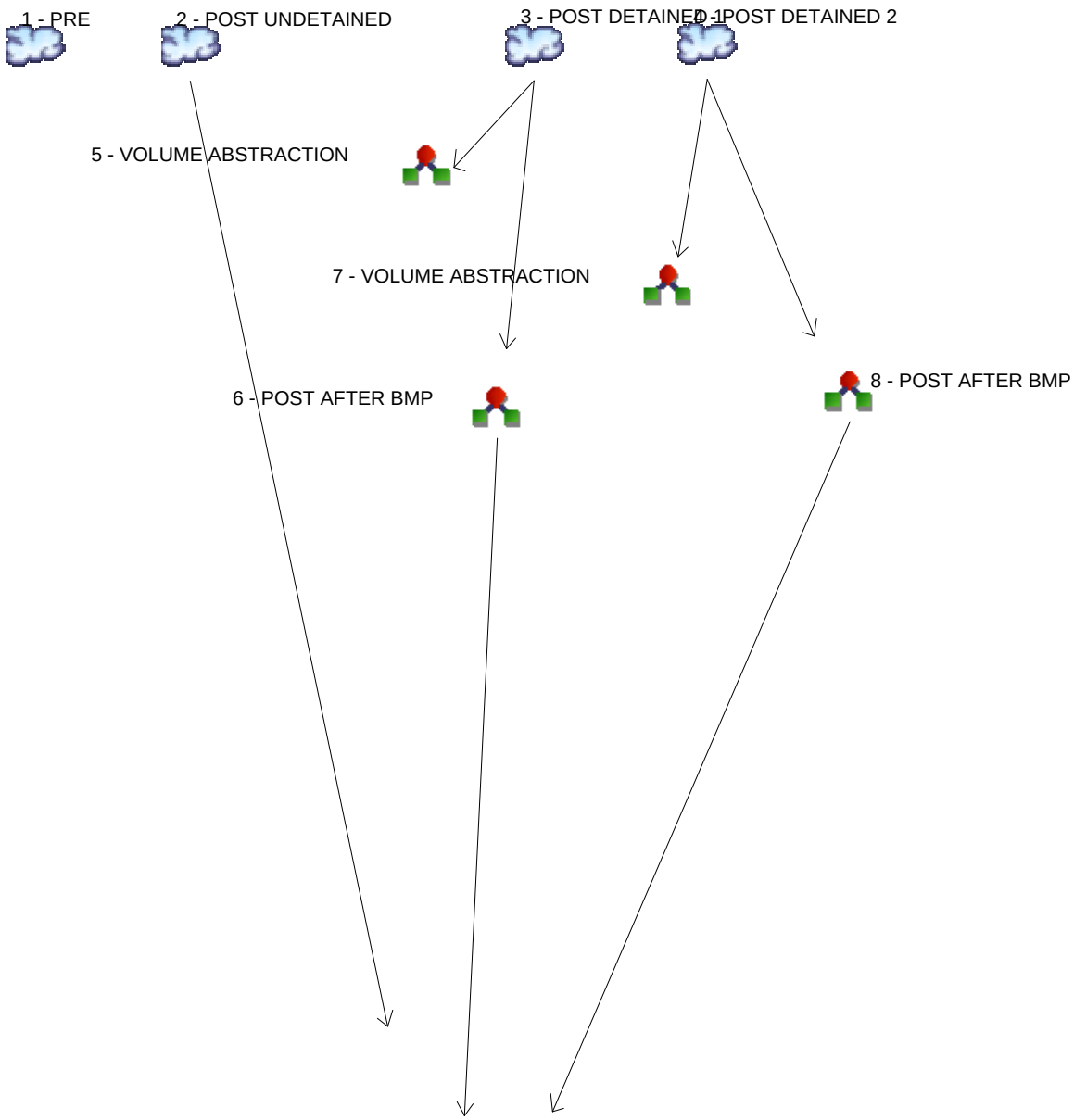
Tc = time in minutes. Values may exceed 60.

\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Hares Valley Road (PA 655)\Hydraflow Rev 1\Hares Valley Precip.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.25	2.70	0.00	3.35	3.90	4.70	5.37	6.10
SCS 6-Hr	1.48	1.79	0.00	2.23	2.60	3.13	3.58	4.07
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

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	------	-------	-------	-------	-------	-------	-------	-------	4.029	PRE
2	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	1.055	POST UNDETAINED
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	0.728	POST DETAINED 1
4	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	1.924	POST DETAINED 2
5	Diversion1	3	-------	-------	-------	-------	-------	-------	-------	0.728	VOLUME ABSTRACTION
6	Diversion2	3	-------	-------	-------	-------	-------	-------	-------	0.101	POST AFTER BMP
7	Diversion1	4	-------	-------	-------	-------	-------	-------	-------	1.902	VOLUME ABSTRACTION
8	Diversion2	4	-------	-------	-------	-------	-------	-------	-------	1.924	POST AFTER BMP
9	Combine	2, 6, 8	-------	-------	-------	-------	-------	-------	-------	2.464	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	4.029	1	719	8,581	------	------	------	PRE
2	SCS Runoff	1.055	2	716	2,129	------	------	------	POST UNDETAINED
3	SCS Runoff	0.728	2	730	2,814	------	------	------	POST DETAINED 1
4	SCS Runoff	1.924	2	722	5,092	------	------	------	POST DETAINED 2
5	Diversion1	0.728	2	730	1,518	3	------	------	VOLUME ABSTRACTION
6	Diversion2	0.101	2	780	1,296	3	------	------	POST AFTER BMP
7	Diversion1	1.902	2	720	1,171	4	------	------	VOLUME ABSTRACTION
8	Diversion2	1.924	2	722	3,921	4	------	------	POST AFTER BMP
9	Combine	2.464	2	722	7,347	2, 6, 8	------	------	POST AT POI

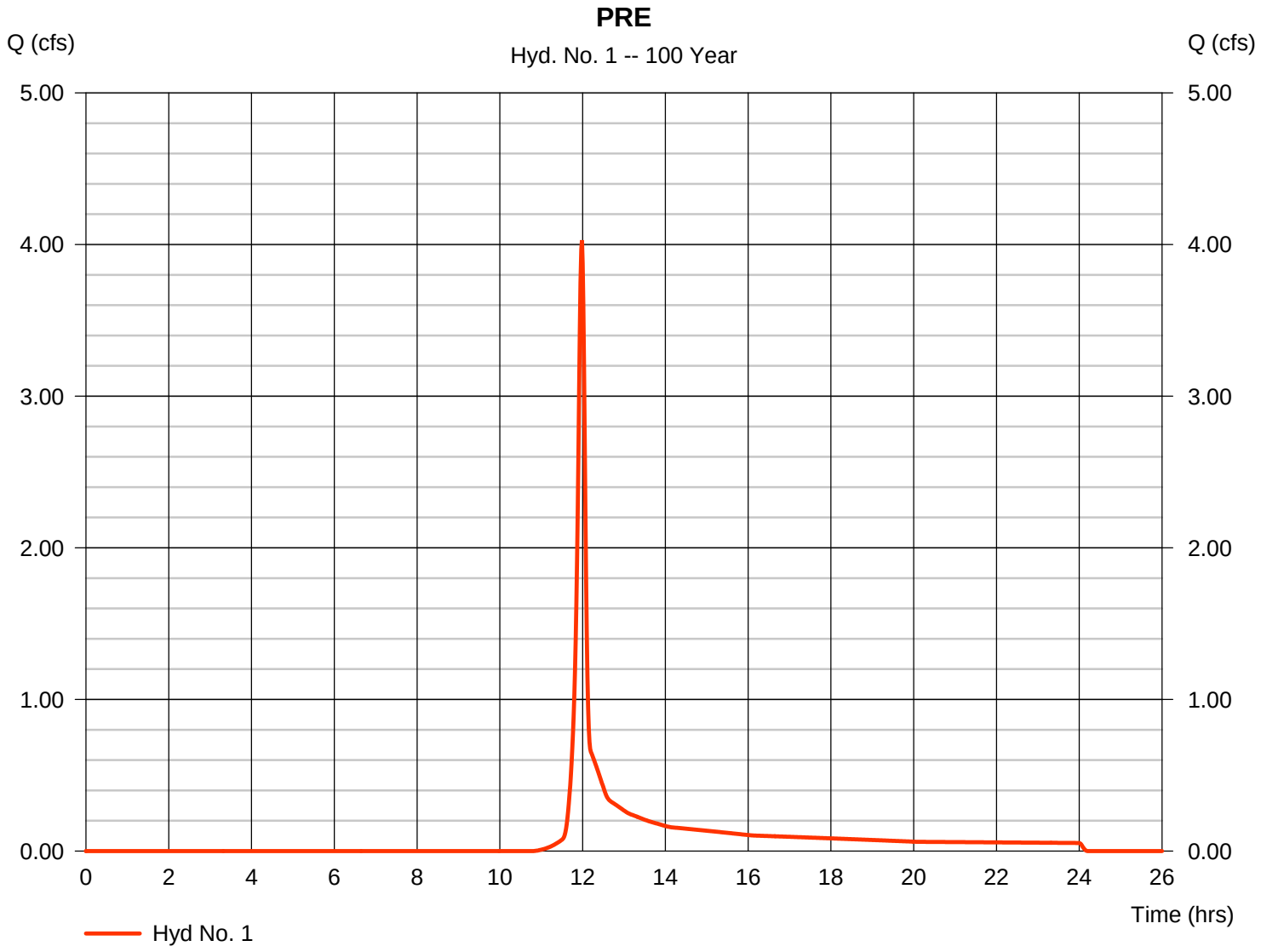
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.029 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.98 hrs
Time interval	=	1 min	Hyd. volume	=	8,581 cuft
Drainage area	=	1.220 ac	Curve number	=	60*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	6.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.320 x 58) + (0.190 x 71) + (0.610 x 55) + (0.100 x 70)] / 1.220



TR55 Tc Worksheet

Hyd. No. 1

PRE

Description	A		B		C		Totals
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)	= 2.70		0.00		0.00		
Land slope (%)	= 4.23		0.00		0.00		
Travel Time (min)	**= 6.61**	**+**	**0.00**	**+**	**0.00**	**=**	**6.61**
Shallow Concentrated Flow							
Flow length (ft)	= 599.00		0.00		0.00		
Watercourse slope (%)	= 14.45		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.13		0.00		0.00		
Travel Time (min)	**= 1.63**	**+**	**0.00**	**+**	**0.00**	**=**	**1.63**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 8.20 min

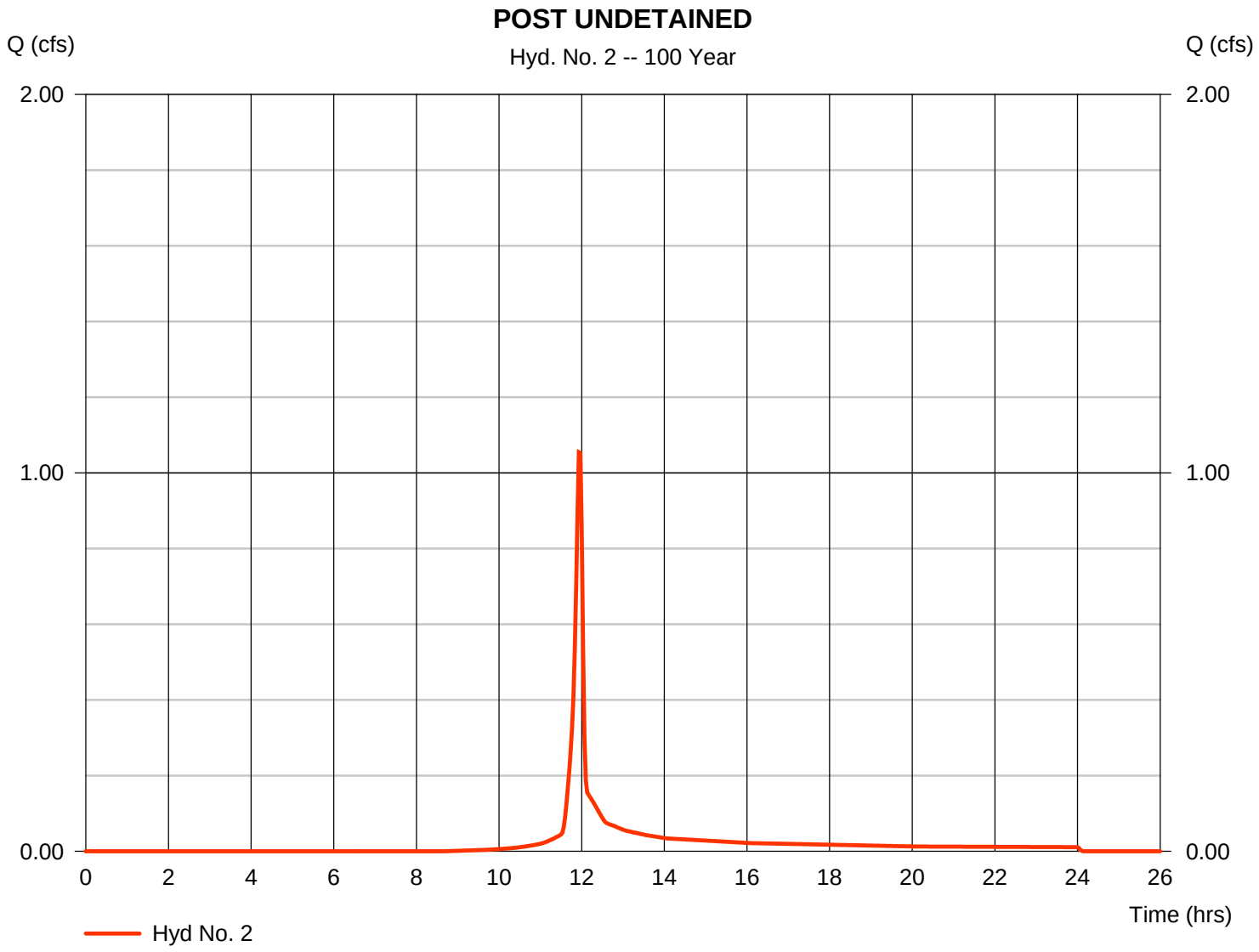
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.055 cfs
Storm frequency	=	100 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	2,129 cuft
Drainage area	=	0.210 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.30 min
Total precip.	=	6.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.020 x 89) + (0.030 x 58) + (0.160 x 71)] / 0.210



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED

Description	A		B		C		Totals
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)	= 2.70		0.00		0.00		
Land slope (%)	= 10.00		0.00		0.00		
Travel Time (min)	**= 4.69**	**+**	**0.00**	**+**	**0.00**	**=**	**4.69**
Shallow Concentrated Flow							
Flow length (ft)	= 160.00		0.00		0.00		
Watercourse slope (%)	= 8.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.59		0.00		0.00		
Travel Time (min)	**= 0.58**	**+**	**0.00**	**+**	**0.00**	**=**	**0.58**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 5.30 min

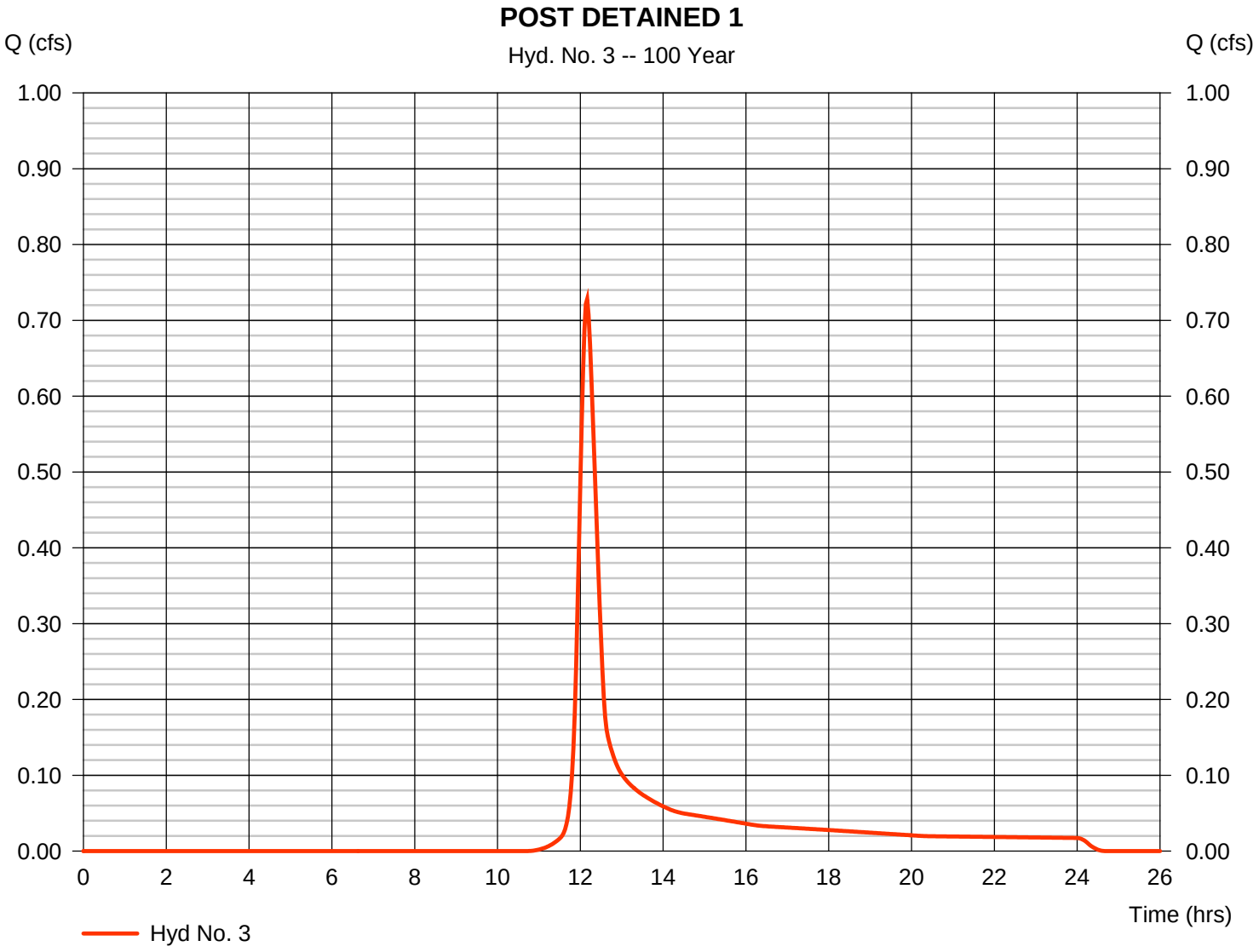
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.728 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 2,814 cuft
Drainage area	= 0.380 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 23.67 min
Total precip.	= 6.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 85) + (0.030 x 71) + (0.320 x 58)] / 0.380



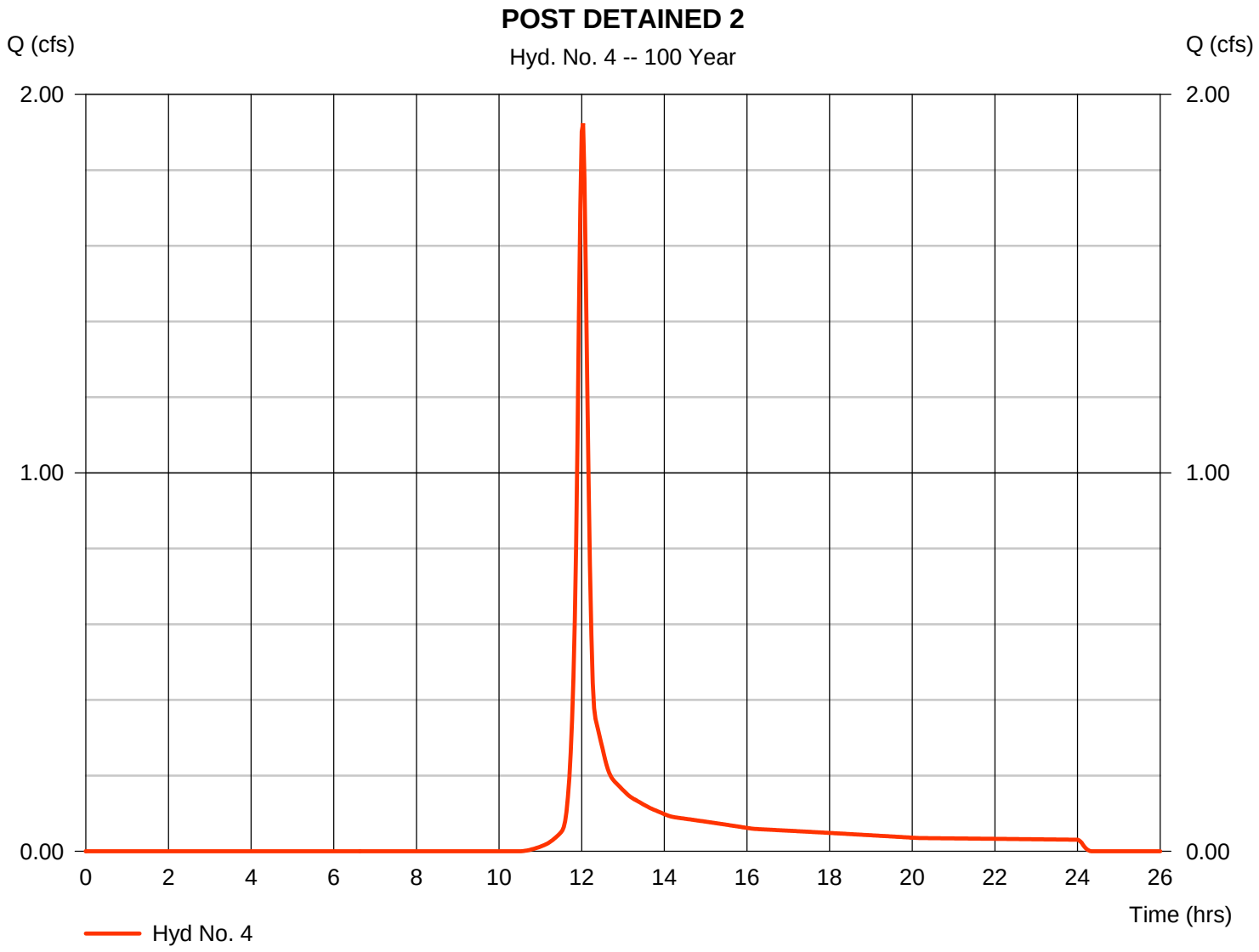
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.924 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.03 hrs
Time interval	=	2 min	Hyd. volume	=	5,092 cuft
Drainage area	=	0.630 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	12.95 min
Total precip.	=	6.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.050 x 85) + (0.030 x 89) + (0.180 x 55) + (0.330 x 58) + (0.040 x 71)] / 0.630

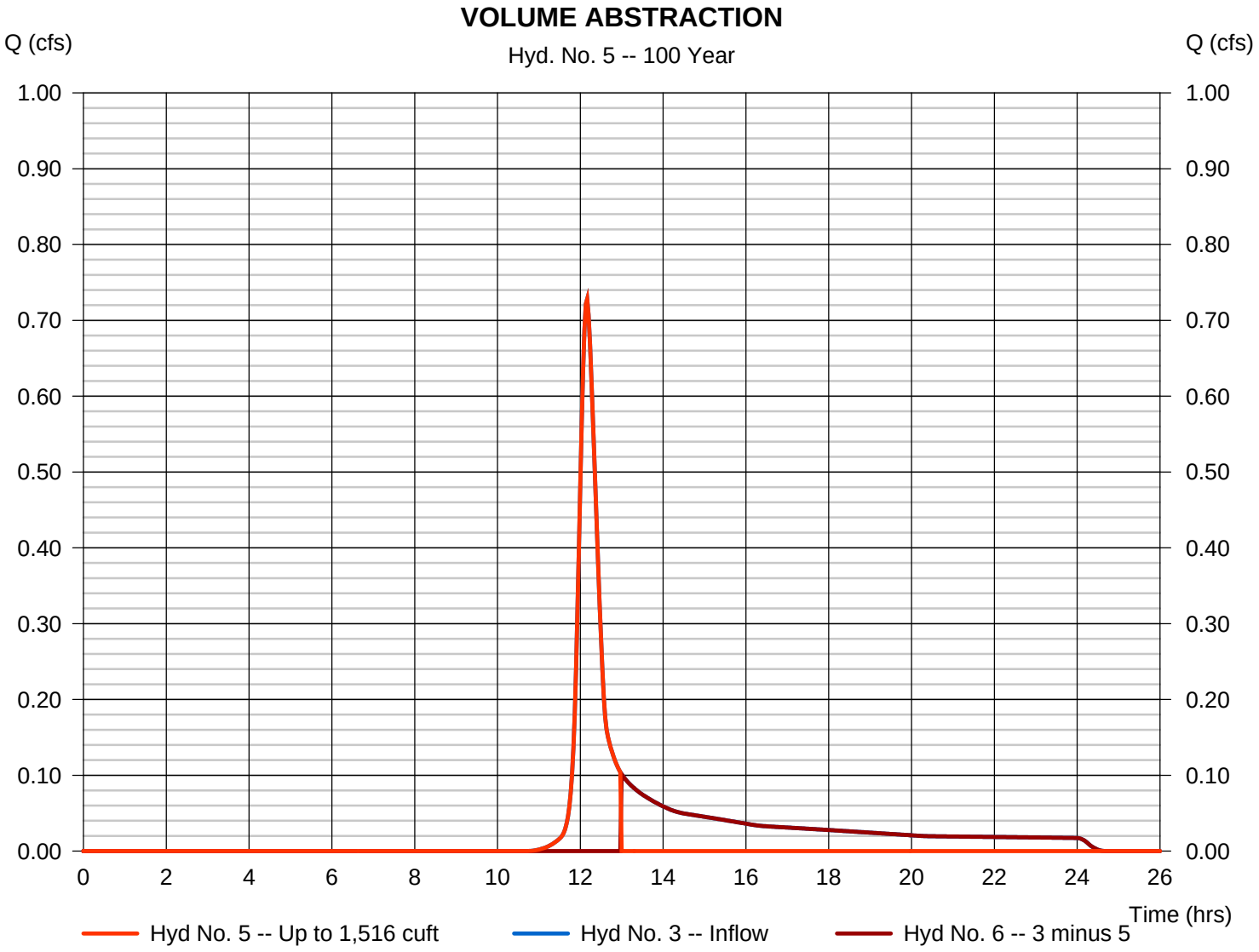


Hydrograph Report

Hyd. No. 5

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.728 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 1,518 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,516 cuft

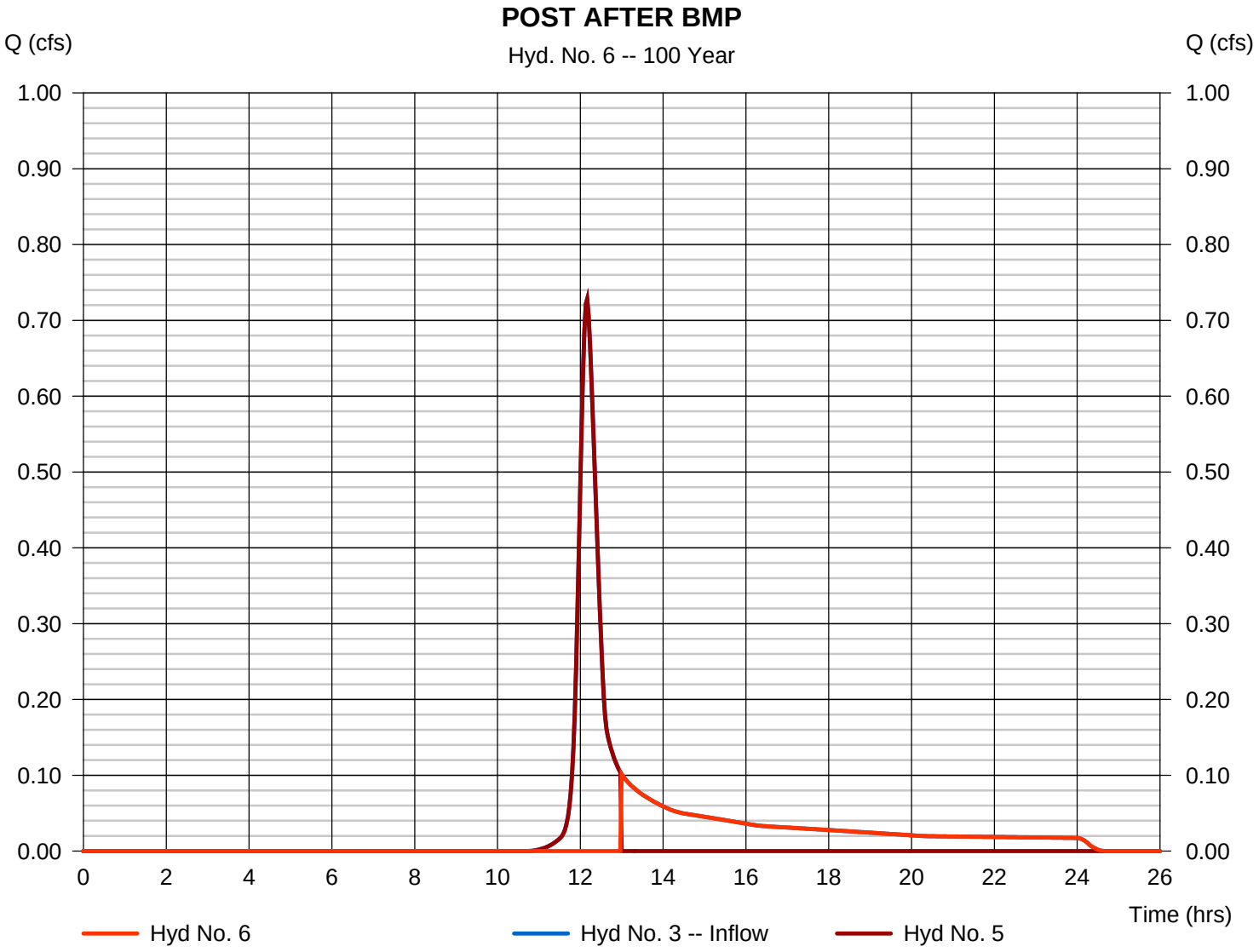


Hydrograph Report

Hyd. No. 6

POST AFTER BMP

Hydrograph type	=	Diversion2	Peak discharge	=	0.101 cfs
Storm frequency	=	100 yrs	Time to peak	=	13.00 hrs
Time interval	=	2 min	Hyd. volume	=	1,296 cuft
Inflow hydrograph	=	3 - POST DETAINED 1	2nd diverted hyd.	=	5
Diversion method	=	First Flush Volume	Volume Up To	=	1,516 cuft

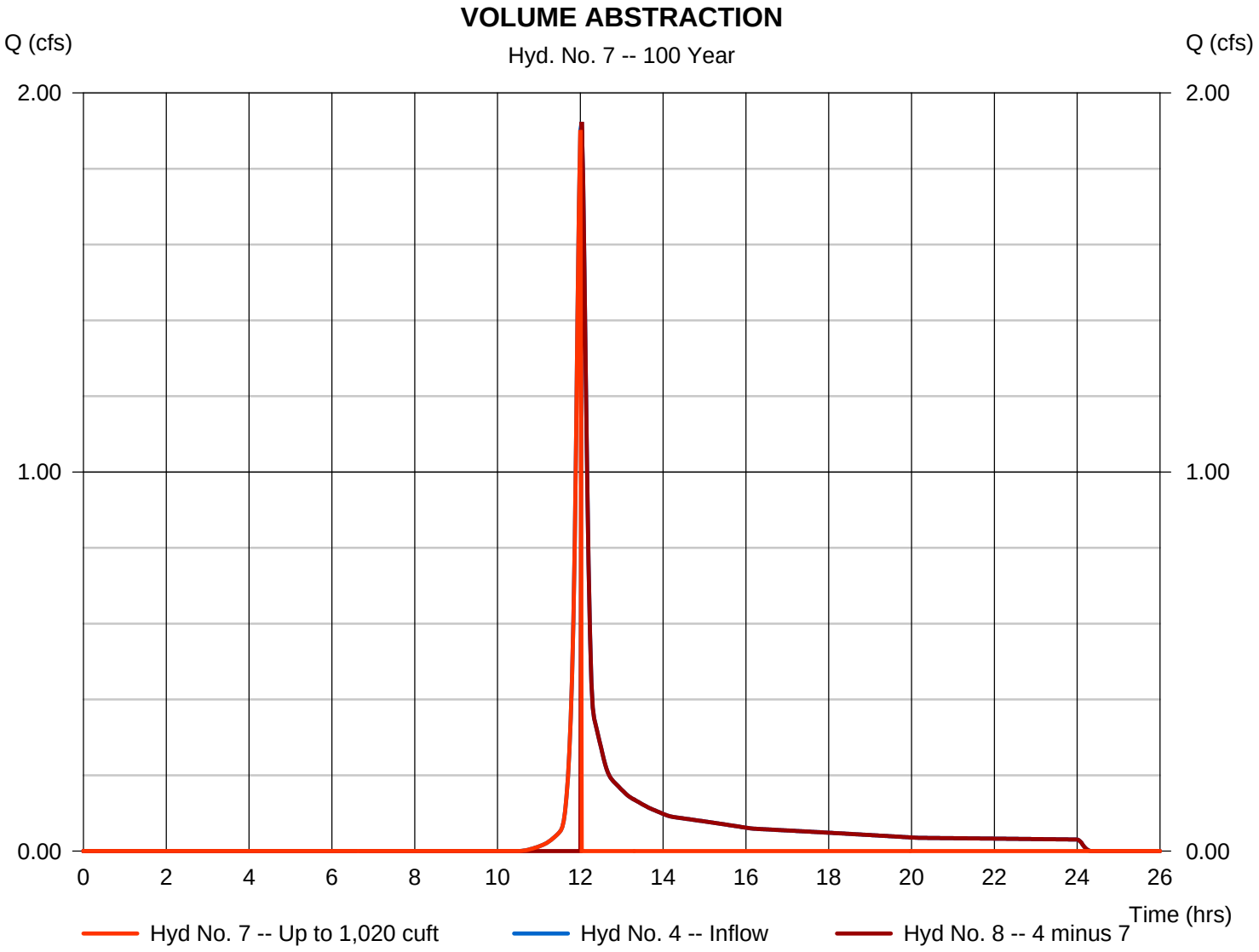


Hydrograph Report

Hyd. No. 7

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.902 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,171 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

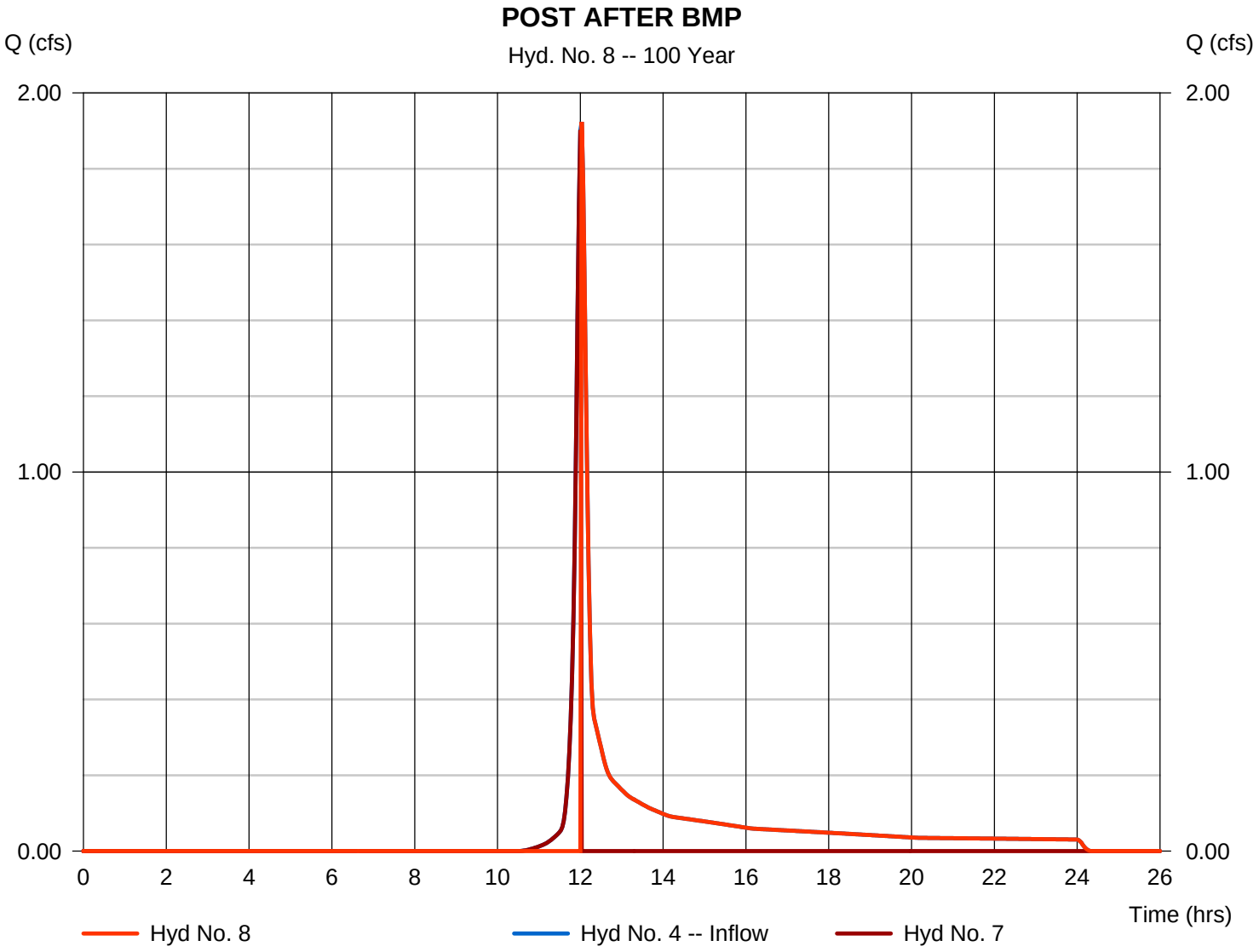


Hydrograph Report

Hyd. No. 8

POST AFTER BMP

Hydrograph type	=	Diversion2	Peak discharge	=	1.924 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.03 hrs
Time interval	=	2 min	Hyd. volume	=	3,921 cuft
Inflow hydrograph	=	4 - POST DETAINED 2	2nd diverted hyd.	=	7
Diversion method	=	First Flush Volume	Volume Up To	=	1,020 cuft

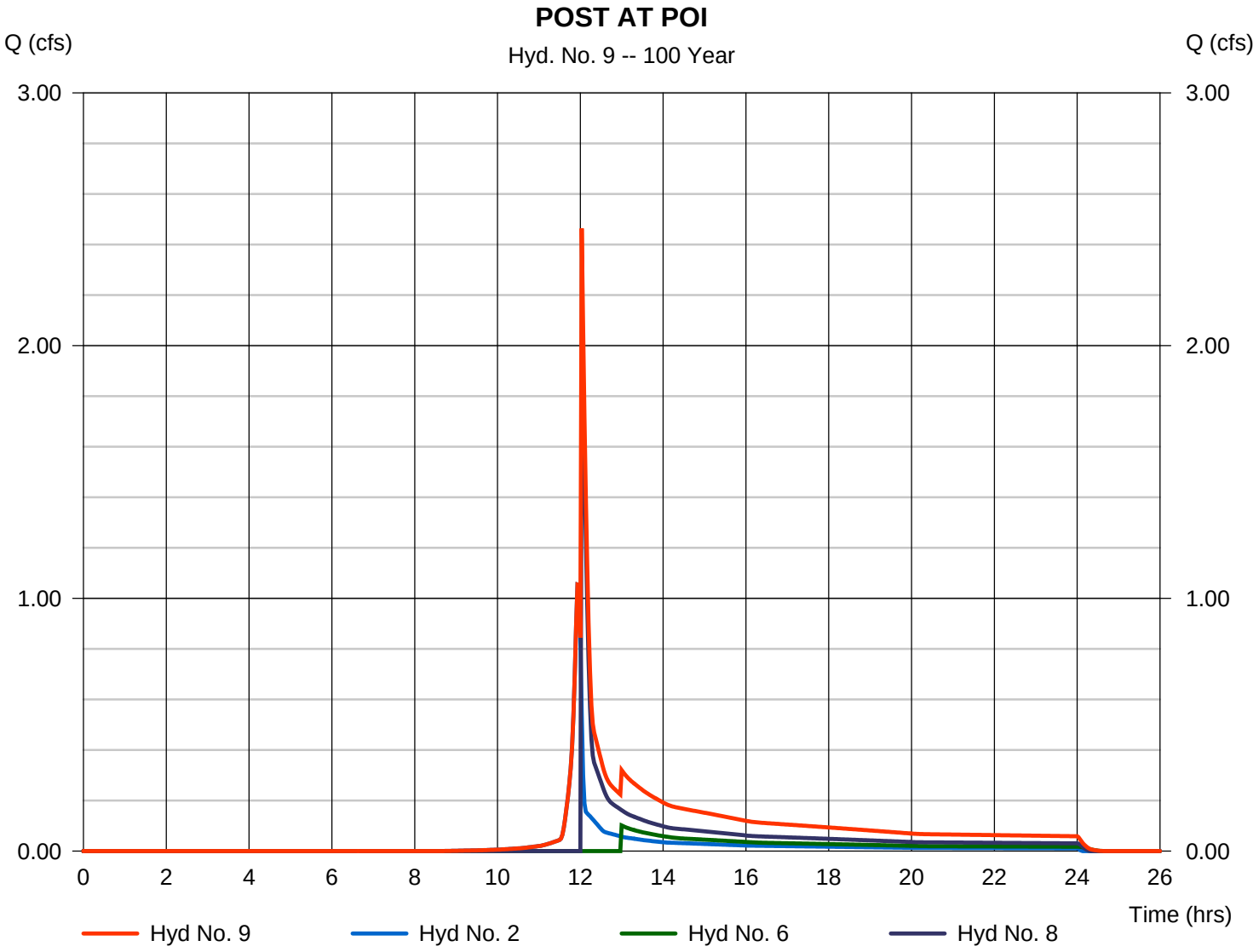


Hydrograph Report

Hyd. No. 9

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	2.464 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.03 hrs
Time interval	=	2 min	Hyd. volume	=	7,347 cuft
Inflow hyds.	=	2, 6, 8	Contrib. drain. area	=	0.210 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	41.3805	10.1000	0.8846	--------
2	50.3642	10.4000	0.8844	--------
3	0.0000	0.0000	0.0000	--------
5	45.7628	8.9000	0.8075	--------
10	45.5204	8.1000	0.7720	--------
25	47.3122	7.6000	0.7392	--------
50	43.0390	6.3000	0.6892	--------
100	41.7827	5.5000	0.6559	--------

File name: Hares Valley IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.75	2.91	2.39	2.04	1.78	1.58	1.42	1.30	1.19	1.10	1.03	0.96
2	4.49	3.50	2.88	2.46	2.15	1.91	1.72	1.57	1.45	1.34	1.25	1.17
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.46	4.26	3.53	3.03	2.66	2.38	2.16	1.98	1.83	1.70	1.59	1.50
10	6.25	4.87	4.03	3.47	3.05	2.74	2.49	2.29	2.12	1.98	1.86	1.75
25	7.27	5.68	4.72	4.07	3.60	3.24	2.95	2.72	2.53	2.36	2.22	2.10
50	8.09	6.29	5.23	4.52	4.01	3.62	3.31	3.06	2.85	2.68	2.52	2.39
100	8.94	6.92	5.76	4.99	4.44	4.02	3.69	3.42	3.19	3.00	2.83	2.69

Tc = time in minutes. Values may exceed 60.

\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Hares Valley Road (PA 655)\Hydraflow Rev 1\Hares Valley Precip.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.25	2.70	0.00	3.35	3.90	4.70	5.37	6.10
SCS 6-Hr	1.48	1.79	0.00	2.23	2.60	3.13	3.58	4.07
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00