Happy Hills Road

TETRA TECH, INC.

By: RH Date: 11/14/2016 Subject: Happy Hills Road
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 Happy Hills Road 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 designed 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 an infiltration berm 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 an infiltration berm to manage the 2-year through 100-year peak rate increases. The infiltration berm will increase the post-construction 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. Although the infiltration rate slightly exceeded 10 in/hr, an additional soil buffer in the form of soil amendment (which includes a mix of soil and compost), has been placed upslope of the ponding area as a pre-treatment to increase the cation exchange capacity.

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 2.2:1.

The drainage area loading ratio for the site is 9.0:1. However, runoff from the site and upslope drainage area will be dispersed to a soil amendment area and then a relatively long infiltration berm. The infiltration berm and soil amendment have 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 detained by the proposed PCSM BMPs.

Karst Topography

Happy Hills Road block valve is located in an area of karst terrain. Several design principles were incorporated to minimize the risk of sinkholes to the maximum extent practicable, including reducing the proposed impervious area to the maximum extent practicable.

Stormwater runoff from the site is being spread out over a relatively large area. The site will achieve a 2.2:1 impervious loading ratio by directing stormwater runoff into an area of soil amendment and a long infiltration berm. The soil amendment area and infiltration berm will avoid concentrating stormwater runoff and will encourage relatively shallow and broad ponding areas. Additional post-construction inspection and maintenance will be required onsite as documented in the Sinkhole Repair Plan in Attachment 2. In areas of known karst terrain, stormwater BMPs shall be inspected at regular intervals of at least once every quarter for the first two years following installation and then at regular periods thereafter. Inspections shall also be made after every storm event greater than 1 inch during the establishment period. Inspections shall consist of an examination of any noticeable subsidence, surface depressions, or sinkholes. Inspections shall include an evaluation of all inlet and outlet structures and document any areas to be cleaned, maintained, or repaired.

Special Protection Watershed

Happy Hills Road block valve is not located within a special protection watershed, so antidegradation requirements do not apply.

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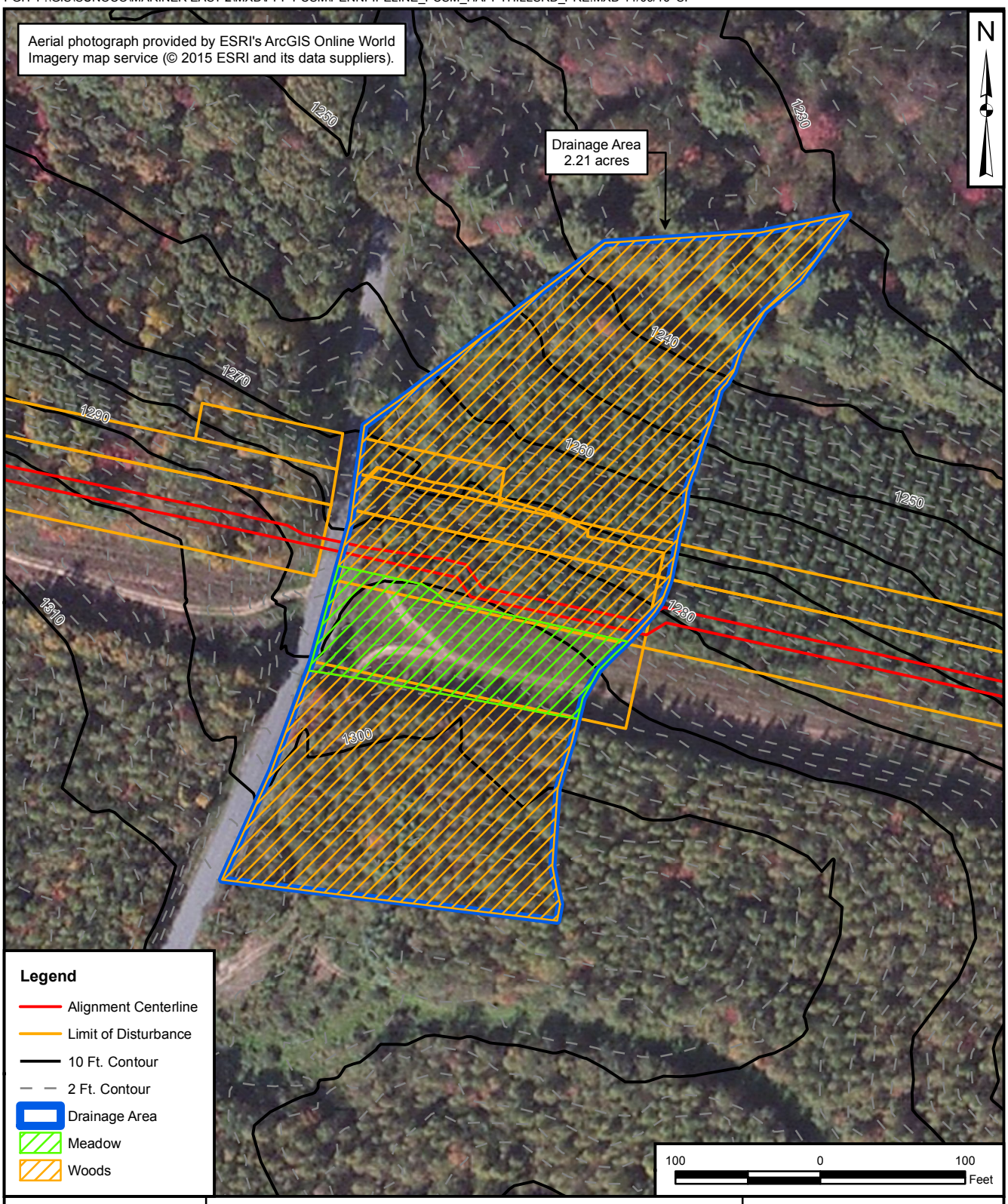

TETRA TECH

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

DRAWN BY: S. PAXTON 05/21/16
CHECKED BY: J. BRODY 11/09/16

APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE NUMBER	REV
1	0

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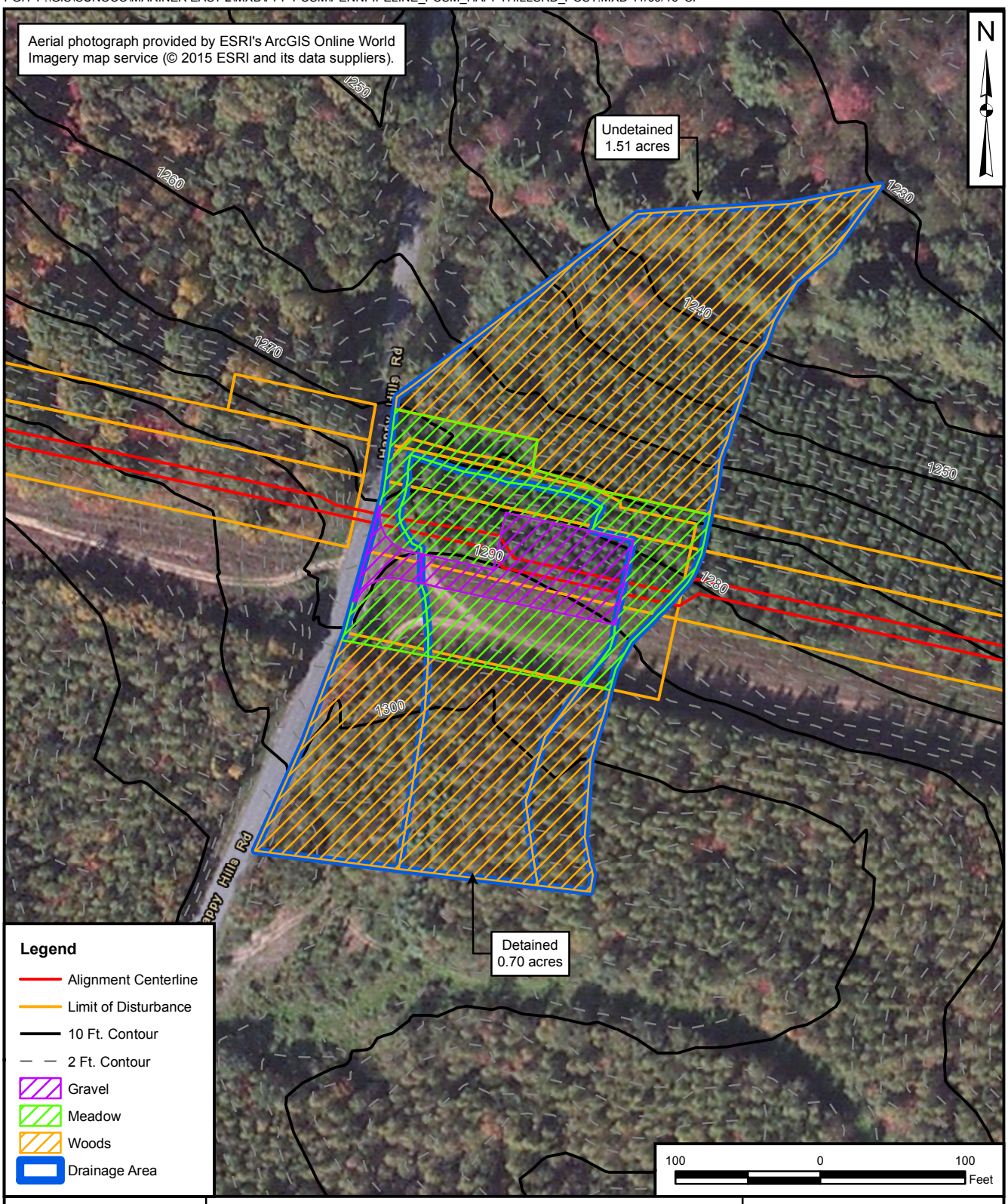

TETRA TECH

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

DRAWN BY: S. PAXTON 05/21/16
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: 40.3606°, Longitude: -78.0276°
Elevation: 1269.74 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	**0.315** (0.281-0.354)	**0.377** (0.337-0.422)	**0.459** (0.409-0.514)	**0.524** (0.465-0.586)	**0.611** (0.539-0.681)	**0.678** (0.595-0.755)	**0.747** (0.652-0.830)	**0.820** (0.710-0.910)	**0.920** (0.789-1.02)	**0.998** (0.849-1.10)
10-min	**0.490** (0.436-0.550)	**0.588** (0.525-0.659)	**0.713** (0.635-0.799)	**0.809** (0.718-0.904)	**0.934** (0.824-1.04)	**1.03** (0.903-1.14)	**1.13** (0.981-1.25)	**1.22** (1.06-1.36)	**1.35** (1.16-1.50)	**1.45** (1.24-1.61)
15-min	**0.600** (0.535-0.675)	**0.719** (0.642-0.806)	**0.876** (0.780-0.981)	**0.995** (0.884-1.11)	**1.15** (1.02-1.29)	**1.27** (1.12-1.42)	**1.40** (1.22-1.55)	**1.52** (1.32-1.69)	**1.69** (1.45-1.87)	**1.82** (1.54-2.01)
30-min	**0.794** (0.708-0.893)	**0.963** (0.860-1.08)	**1.20** (1.07-1.34)	**1.38** (1.23-1.54)	**1.63** (1.44-1.82)	**1.82** (1.60-2.02)	**2.02** (1.76-2.24)	**2.22** (1.93-2.46)	**2.50** (2.15-2.77)	**2.72** (2.31-3.01)
60-min	**0.970** (0.864-1.09)	**1.18** (1.05-1.32)	**1.50** (1.34-1.69)	**1.76** (1.56-1.97)	**2.11** (1.86-2.36)	**2.40** (2.10-2.67)	**2.70** (2.35-3.00)	**3.01** (2.61-3.35)	**3.46** (2.97-3.83)	**3.82** (3.25-4.23)
2-hr	**1.11** (0.980-1.27)	**1.35** (1.19-1.53)	**1.72** (1.51-1.96)	**2.01** (1.77-2.29)	**2.44** (2.13-2.77)	**2.79** (2.42-3.15)	**3.17** (2.73-3.57)	**3.57** (3.05-4.02)	**4.16** (3.52-4.68)	**4.65** (3.89-5.22)
3-hr	**1.20** (1.06-1.37)	**1.45** (1.29-1.66)	**1.83** (1.62-2.09)	**2.14** (1.90-2.44)	**2.59** (2.28-2.94)	**2.96** (2.58-3.35)	**3.37** (2.92-3.80)	**3.81** (3.27-4.28)	**4.45** (3.78-4.99)	**4.99** (4.19-5.58)
6-hr	**1.50** (1.35-1.69)	**1.80** (1.62-2.03)	**2.25** (2.02-2.54)	**2.63** (2.35-2.95)	**3.16** (2.81-3.53)	**3.61** (3.18-4.02)	**4.09** (3.58-4.55)	**4.61** (4.00-5.12)	**5.38** (4.61-5.95)	**6.02** (5.10-6.65)
12-hr	**1.86** (1.67-2.10)	**2.24** (2.00-2.52)	**2.78** (2.48-3.12)	**3.24** (2.88-3.62)	**3.91** (3.45-4.37)	**4.47** (3.92-4.98)	**5.09** (4.43-5.66)	**5.77** (4.97-6.39)	**6.78** (5.75-7.49)	**7.63** (6.40-8.43)
24-hr	**2.25** (2.05-2.48)	**2.70** (2.46-2.98)	**3.35** (3.06-3.70)	**3.90** (3.55-4.29)	**4.69** (4.24-5.15)	**5.36** (4.82-5.88)	**6.08** (5.43-6.65)	**6.86** (6.08-7.50)	**8.01** (7.01-8.74)	**8.96** (7.77-9.78)
2-day	**2.60** (2.38-2.85)	**3.12** (2.85-3.42)	**3.87** (3.54-4.24)	**4.51** (4.11-4.93)	**5.43** (4.92-5.93)	**6.21** (5.59-6.77)	**7.07** (6.31-7.69)	**8.00** (7.08-8.69)	**9.37** (8.18-10.2)	**10.5** (9.08-11.5)
3-day	**2.76** (2.54-3.02)	**3.31** (3.05-3.62)	**4.10** (3.77-4.48)	**4.76** (4.37-5.19)	**5.72** (5.21-6.22)	**6.53** (5.91-7.08)	**7.39** (6.65-8.02)	**8.34** (7.44-9.04)	**9.71** (8.56-10.5)	**10.9** (9.46-11.8)
4-day	**2.93** (2.71-3.19)	**3.51** (3.25-3.82)	**4.34** (4.00-4.71)	**5.02** (4.63-5.45)	**6.01** (5.51-6.51)	**6.84** (6.23-7.40)	**7.72** (7.00-8.35)	**8.68** (7.80-9.39)	**10.1** (8.93-10.9)	**11.2** (9.84-12.2)
7-day	**3.44** (3.19-3.72)	**4.10** (3.81-4.44)	**5.01** (4.65-5.42)	**5.74** (5.32-6.19)	**6.76** (6.24-7.29)	**7.58** (6.96-8.17)	**8.44** (7.71-9.10)	**9.34** (8.47-10.1)	**10.6** (9.53-11.5)	**11.6** (10.4-12.6)
10-day	**3.95** (3.68-4.26)	**4.70** (4.38-5.07)	**5.65** (5.26-6.08)	**6.41** (5.95-6.90)	**7.47** (6.91-8.03)	**8.31** (7.66-8.94)	**9.19** (8.42-9.89)	**10.1** (9.20-10.9)	**11.3** (10.2-12.2)	**12.3** (11.1-13.3)
20-day	**5.38** (5.07-5.73)	**6.35** (5.98-6.76)	**7.42** (6.99-7.90)	**8.25** (7.76-8.78)	**9.34** (8.77-9.93)	**10.2** (9.52-10.8)	**11.0** (10.3-11.7)	**11.8** (11.0-12.6)	**12.8** (11.9-13.7)	**13.6** (12.5-14.5)
30-day	**6.69** (6.32-7.08)	**7.83** (7.40-8.30)	**9.01** (8.50-9.53)	**9.90** (9.34-10.5)	**11.1** (10.4-11.7)	**11.9** (11.2-12.6)	**12.8** (12.0-13.5)	**13.6** (12.7-14.4)	**14.6** (13.6-15.5)	**15.3** (14.2-16.3)
45-day	**8.44** (7.99-8.91)	**9.88** (9.35-10.4)	**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** (14.2-15.9)	**15.8** (14.9-16.7)	**16.7** (15.7-17.7)	**17.3** (16.3-18.4)
60-day	**10.1** (9.64-10.7)	**11.8** (11.2-12.4)	**13.3** (12.6-14.0)	**14.3** (13.6-15.1)	**15.6** (14.8-16.4)	**16.5** (15.7-17.3)	**17.3** (16.4-18.2)	**18.0** (17.1-19.0)	**18.9** (17.9-19.9)	**19.5** (18.4-20.6)

[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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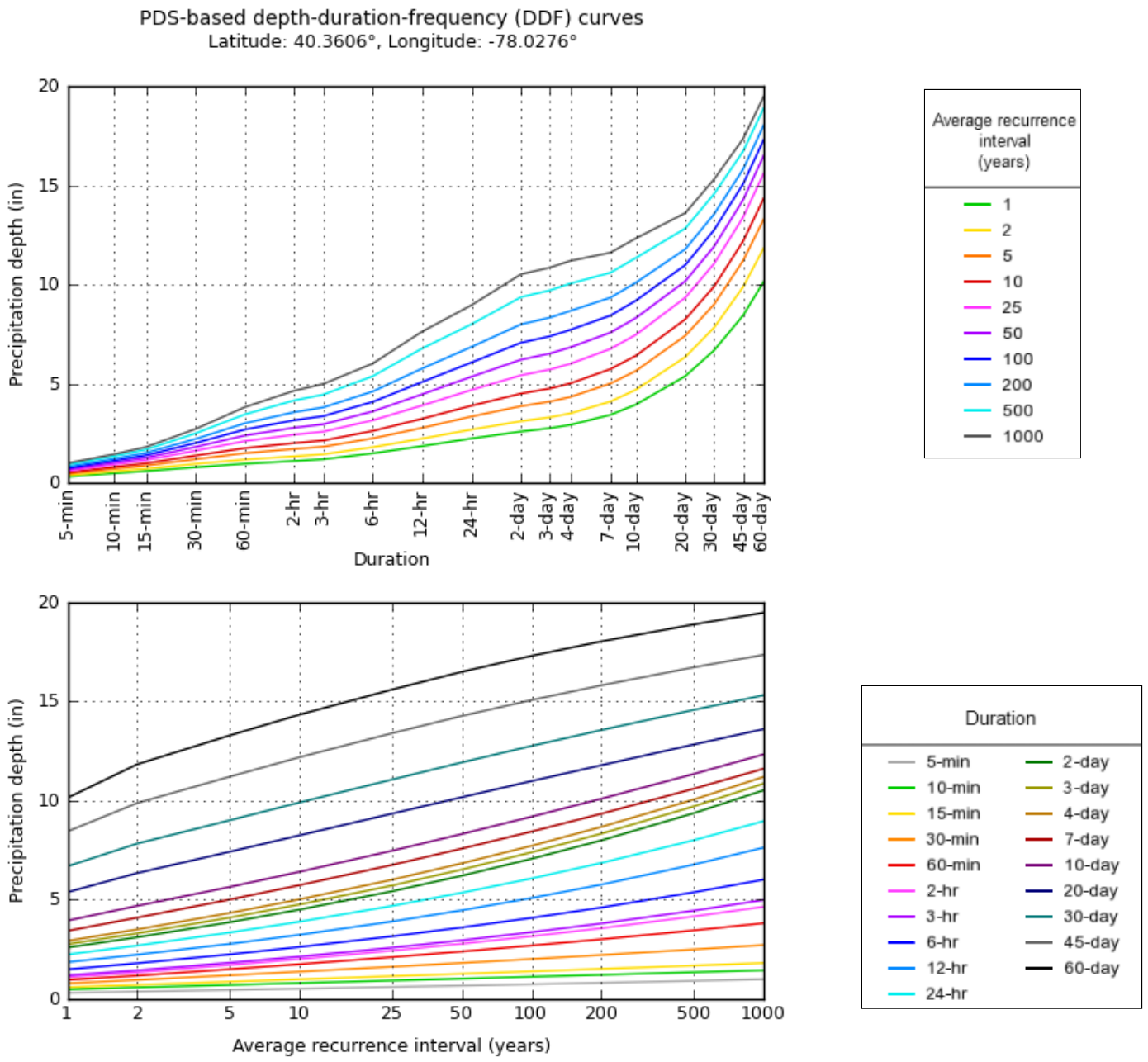
PF graphical



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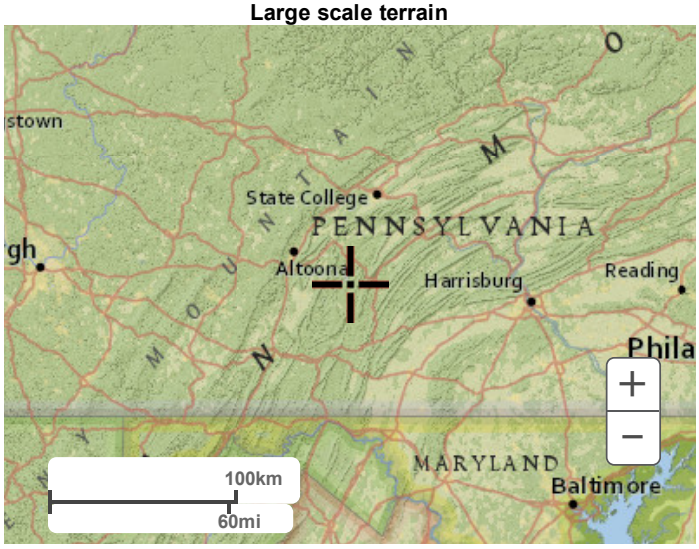
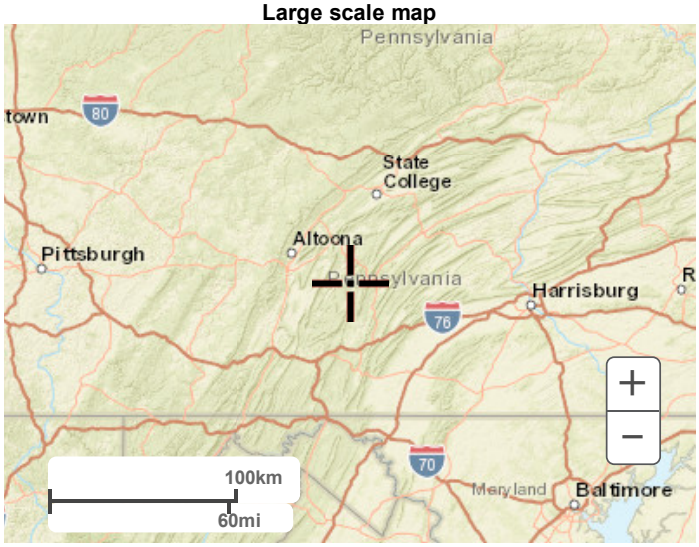
Maps & aerials

Small scale terrain

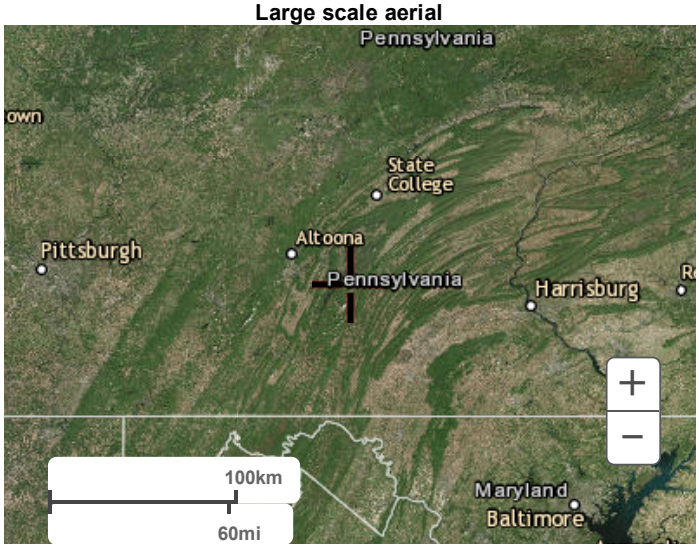
Large scale terrain



Large scale map



Large scale aerial



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WORKSHEET 1. GENERAL SITE INFORMATION

Date: November 11, 2016

Project Name: Happy Hills Road

Municipality: Union

County: Huntington

Total Area (acres): 2.21

Major River Basin: Susquehanna River

Watershed: Raystown Branch Juniata River

Sub Basin: Great Trough Creek

Nearest Surface Water to Receive Runoff: Tributary #13585 of Little Trough Creek

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

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

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 - 0.41 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	0.41	
Natural Drainage Ways	N/A		
Steep Slopes, 15% - 25%	N/A		
Steep Slopes, over 25%	N/A		
Other:			
Other:			
TOTAL EXISTING:		**0.41**	**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
0.69	-	0	=	0.69

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: Happy Hills Road
Drainage Area: 2.21 acres
2-Year Rainfall: 2.70 in

Total Site Area: 0.690 acres
Protected Site Area: N/A acres
Managed Site Area: 0.690 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	D	12,197	0.28	78	2.82	0.56	0.92	936
Woods	D	17,860	0.41	77	2.99	0.60	0.87	1,293
TOTAL:		**30,056**	**0.69**					**2,228**

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)
Meadow	D	22,216	0.51	78	2.82	0.56	0.92	1,704
Impervious - Gravel	D	7,841	0.18	91	0.99	0.20	1.79	1,172
TOTAL:		**30,056**	**0.69**					**2,876**

2-Year Volume Increase (ft^3):	**647**

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: Happy Hills Road
SUB-BASIN:

Required Control Volume (ft^3) - *from Worksheet 4:* 647

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

Structural Volume Reqmt (ft^3) 647
(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	1,123	1,575
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): **1,575**

Structural Volume Requirement (ft^3): **647**

VOLUME CREDIT DETERMINATION **DIFFERENCE:** **-928**

1 Detained area runoff volume from Hydraflow = 2,475 cf

2 Storage volume of the BMP = 1,575 cf

3 Infiltrated volume within 72 hours after the 2-yr/24-hr event
(Infiltration Rate/12) x Infiltration Area x 72 hrs = 1,575 cf

Potential infiltrated volume = 25604 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 8.4 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 1,575 CF

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	1.087
10 YR/24 HR	2.115
50 YR/24 HR	3.475
100 YR/24 HR	4.163

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	1.087	24.149
10 YR/24 HR	2.115	12.411
50 YR/24 HR	3.475	7.554
100 YR/24 HR	4.163	6.306

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	1.087	24.149	32.549
10 YR/24 HR	2.115	12.411	20.811
50 YR/24 HR	3.475	7.554	15.954
100 YR/24 HR	4.163	6.306	14.706

INFILTRATION BERM DEWATERING CALCULATION SITE NAME: Happy Hills Road

STORAGE VOLUME	1,575	CF	
DESIGN INFILTRATION RATE	3.8	IN/HR	BASED ON IT-A
INFILTRATION AREA	1,123	SF	

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

DEWATERING TIME = 4.4 HOURS

Worksheet for Circular Pipe - 1

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.012	
Channel Slope	0.09000	ft/ft
Normal Depth	0.33	ft
Diameter	0.33	ft
Discharge	0.60	ft³/s

Results

Discharge	0.60	ft³/s
Normal Depth	0.33	ft
Flow Area	0.09	ft²
Wetted Perimeter	1.04	ft
Hydraulic Radius	0.08	ft
Top Width	0.00	ft
Critical Depth	0.33	ft
Percent Full	100.0	%
Critical Slope	0.08389	ft/ft
Velocity	7.04	ft/s
Velocity Head	0.77	ft
Specific Energy	1.10	ft
Froude Number	0.00	
Maximum Discharge	0.65	ft³/s
Discharge Full	0.60	ft³/s
Slope Full	0.09000	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

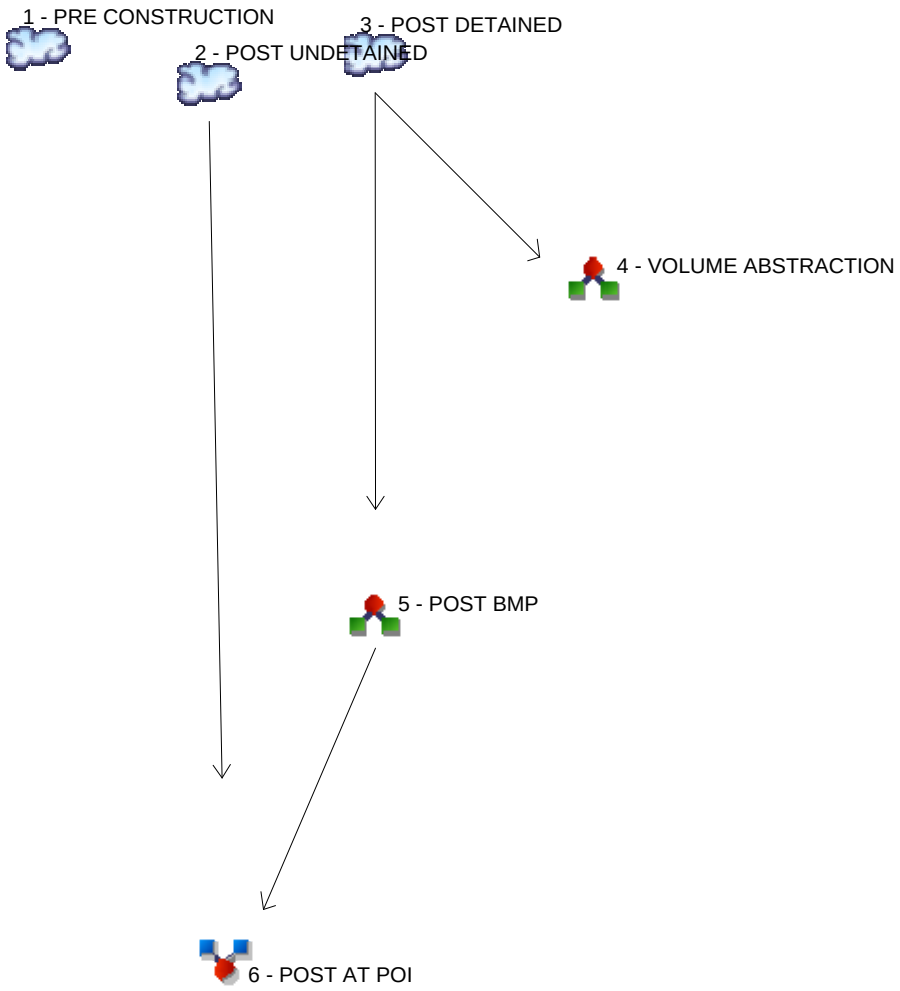
Worksheet for Circular Pipe - 1

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.33	ft
Critical Depth	0.33	ft
Channel Slope	0.09000	ft/ft
Critical Slope	0.08389	ft/ft

Watershed Model Schematic

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



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE CONSTRUCTION
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED
4	Diversion1	VOLUME ABSTRACTION
5	Diversion2	POST BMP
6	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	------	-------	3.106	-------	-------	6.560	-------	11.22	13.61	PRE CONSTRUCTION
2	SCS Runoff	------	-------	2.270	-------	-------	4.679	-------	7.900	9.543	POST UNDETAINED
3	SCS Runoff	------	-------	1.087	-------	-------	2.115	-------	3.475	4.163	POST DETAINED
4	Diversion1	3	-------	1.087	-------	-------	2.115	-------	1.914	1.509	VOLUME ABSTRACTION
5	Diversion2	3	-------	0.054	-------	-------	2.026	-------	3.475	4.163	POST BMP
6	Combine	2, 5	-------	2.270	-------	-------	5.602	-------	11.29	13.61	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	3.106	1	718	6,373	------	------	------	PRE CONSTRUCTION
2	SCS Runoff	2.270	1	718	4,627	------	------	------	POST UNDETAINED
3	SCS Runoff	1.087	1	720	2,475	------	------	------	POST DETAINED
4	Diversion1	1.087	1	720	1,576	3	------	------	VOLUME ABSTRACTION
5	Diversion2	0.054	1	820	899	3	------	------	POST BMP
6	Combine	2.270	1	718	5,526	2, 5	------	------	POST AT POI

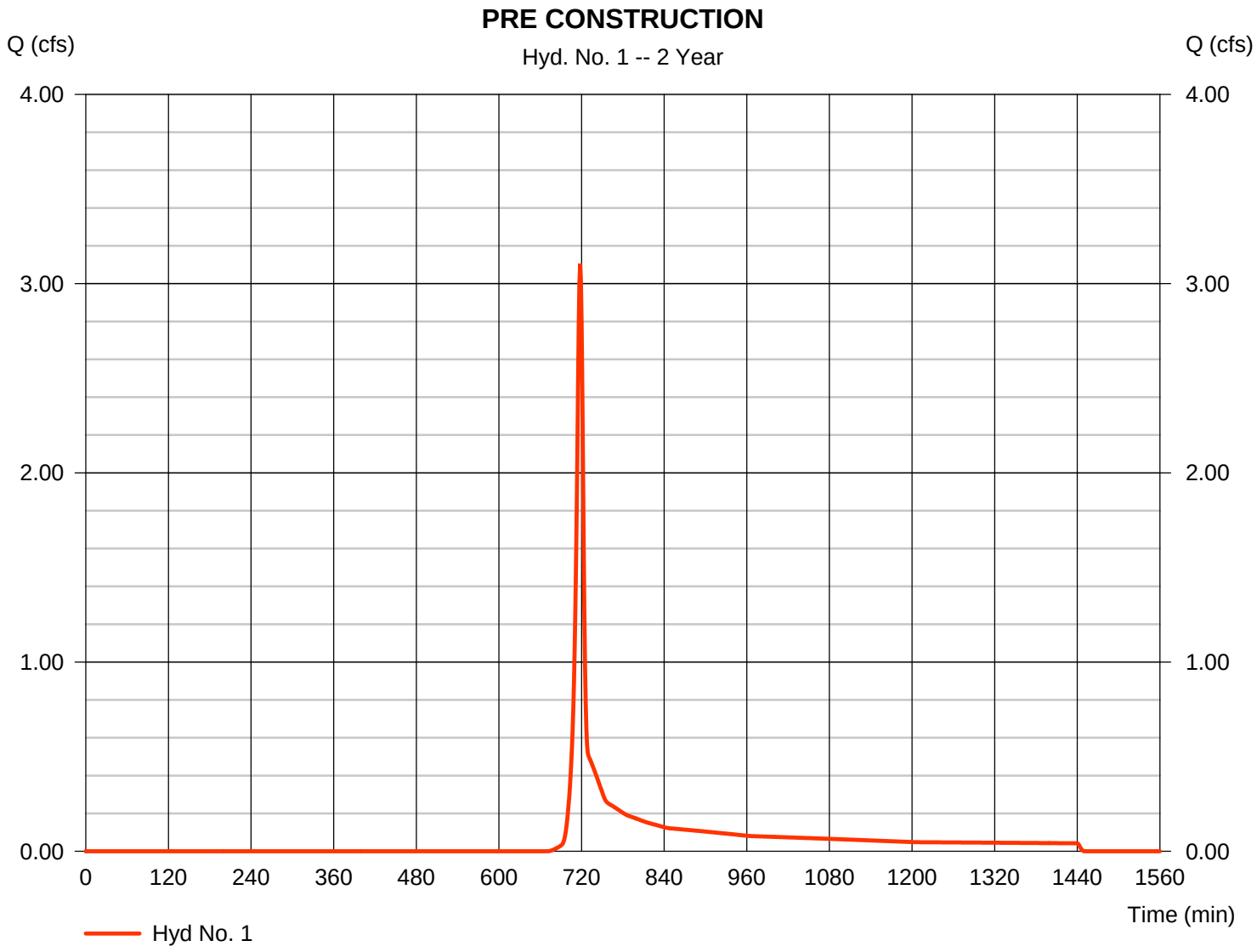
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.106 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	6,373 cuft
Drainage area	=	2.210 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.165 x 55) + (1.754 x 77) + (0.292 x 78)] / 2.210



TR55 Tc Worksheet

Hyd. No. 1

PRE CONSTRUCTION

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 (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.12**	**+**	**0.00**	**+**	**0.00**	**=**	**5.12**
Shallow Concentrated Flow							
Flow length (ft)	= 507.00		0.00		0.00		
Watercourse slope (%)	= 14.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.12		0.00		0.00		
Travel Time (min)	**= 1.38**	**+**	**0.00**	**+**	**0.00**	**=**	**1.38**
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 ..... 6.50 min

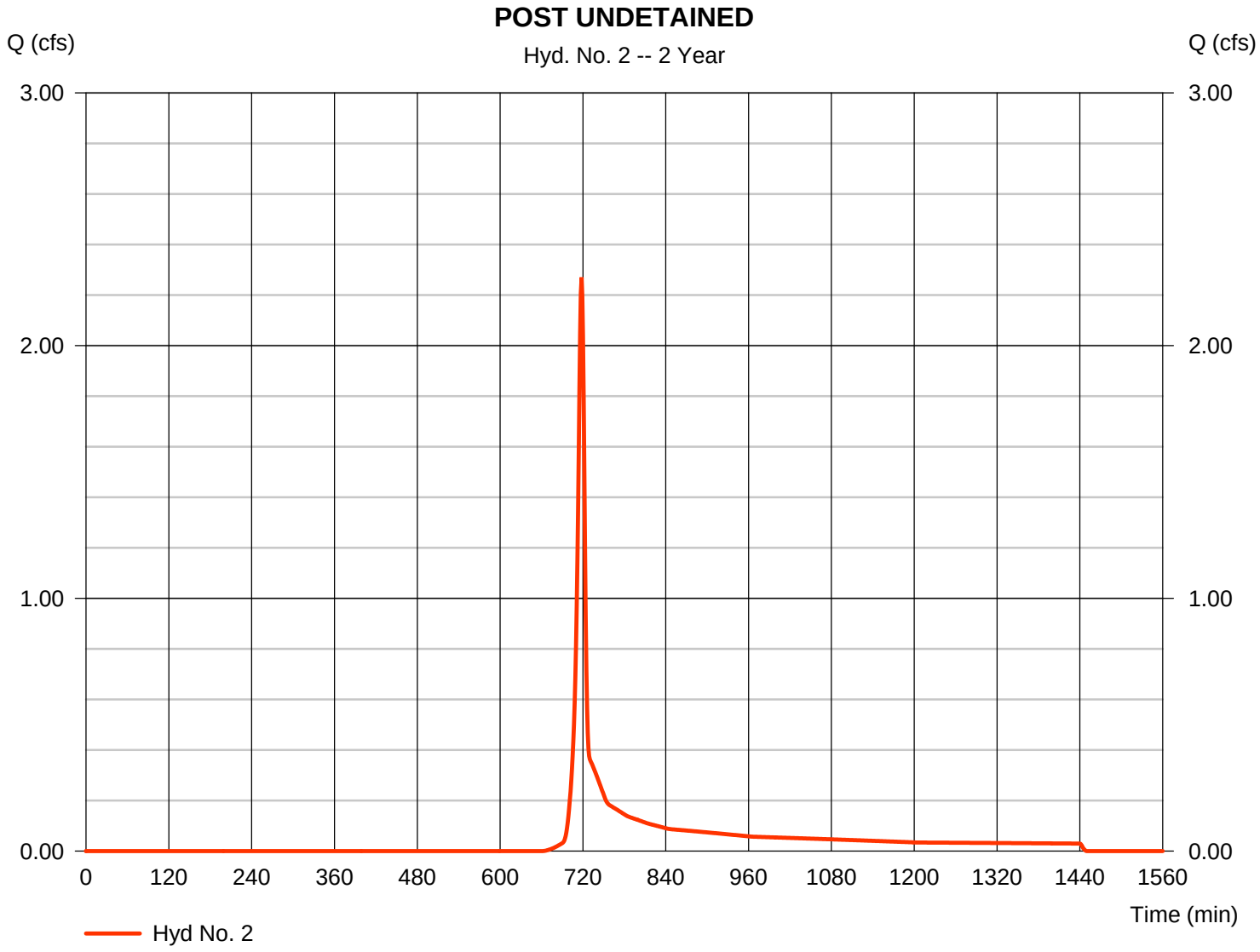
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.270 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	4,627 cuft
Drainage area	=	1.510 ac	Curve number	=	76*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.016 x 98) + (0.126 x 55) + (1.079 x 77) + (0.265 x 78) + (0.024 x 91)] / 1.510



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 (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.12**	**+**	**0.00**	**+**	**0.00**	**=**	**5.12**
Shallow Concentrated Flow							
Flow length (ft)	= 507.00		0.00		0.00		
Watercourse slope (%)	= 14.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.12		0.00		0.00		
Travel Time (min)	**= 1.38**	**+**	**0.00**	**+**	**0.00**	**=**	**1.38**
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 ..... 6.50 min

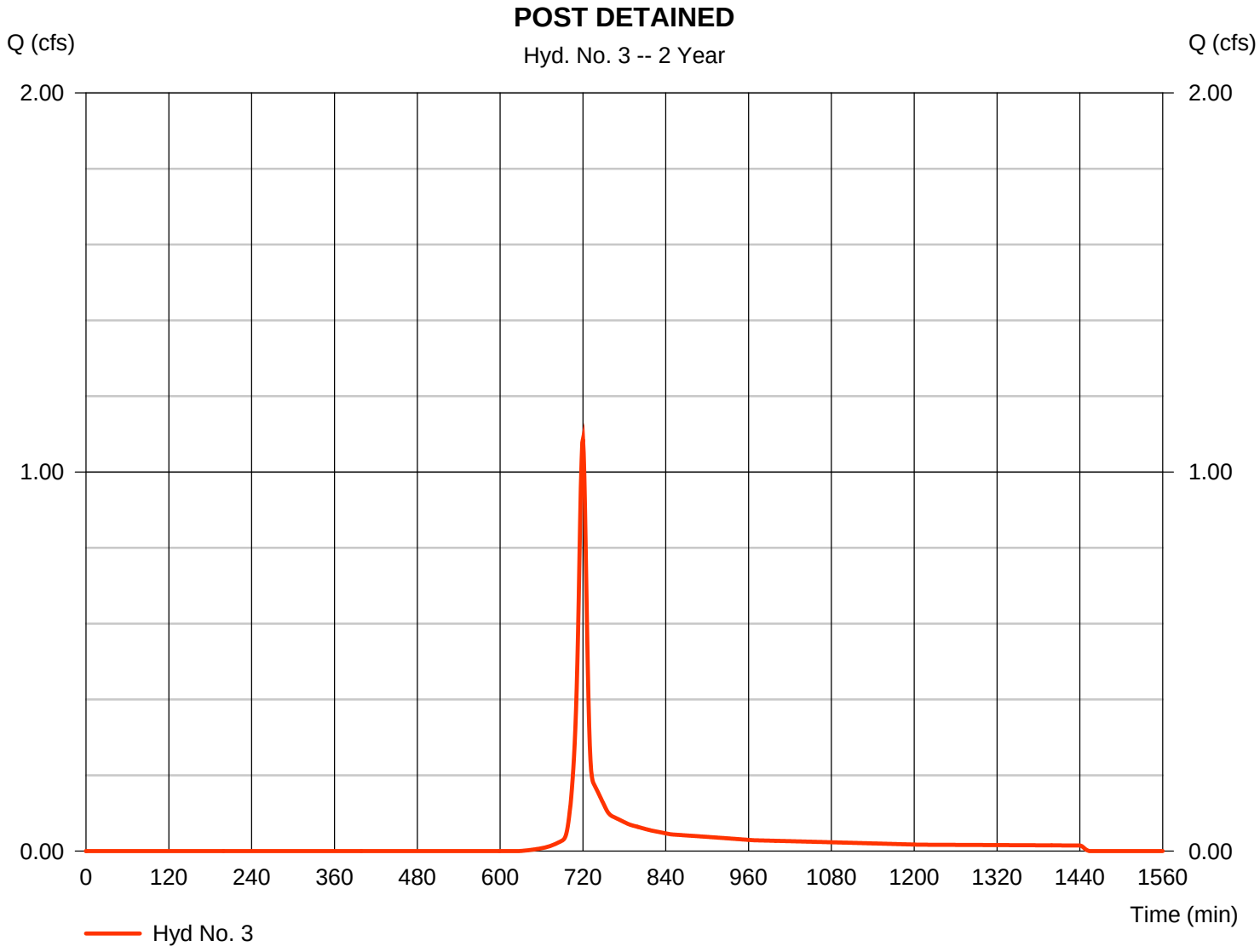
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.087 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	1 min	Hyd. volume	=	2,475 cuft
Drainage area	=	0.700 ac	Curve number	=	79*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.147 x 91) + (0.039 x 55) + (0.255 x 77) + (0.261 x 78)] / 0.700



TR55 Tc Worksheet

Hyd. No. 3

POST DETAINED

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 (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 7.59**	**+**	**0.00**	**+**	**0.00**	**=**	**7.59**
Shallow Concentrated Flow							
Flow length (ft)	= 157.00		16.00		0.00		
Watercourse slope (%)	= 9.60		12.50		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=5.00		7.19		0.00		
Travel Time (min)	**= 0.52**	**+**	**0.04**	**+**	**0.00**	**=**	**0.56**
Channel Flow							
X sectional flow area (sqft)	= 0.09		0.00		0.00		
Wetted perimeter (ft)	= 1.04		0.00		0.00		
Channel slope (%)	= 9.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=5.78						
			0.00				
					0.00		
Flow length (ft)	({0})100.0		0.0		0.0		
Travel Time (min)	**= 0.29**	**+**	**0.00**	**+**	**0.00**	**=**	**0.29**

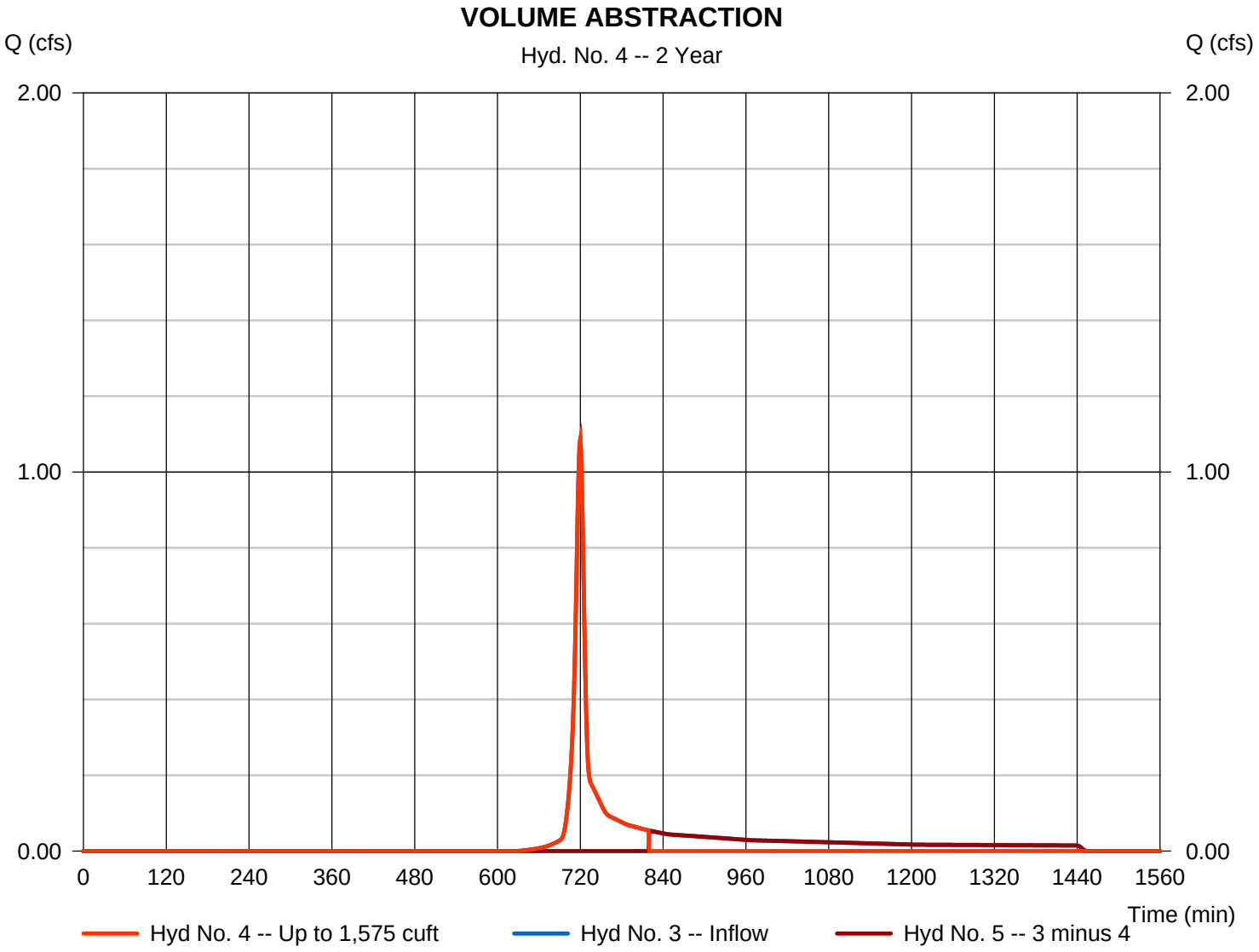
Total Travel Time, Tc ..... 8.40 min

Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.087 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 1 min	Hyd. volume	= 1,576 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

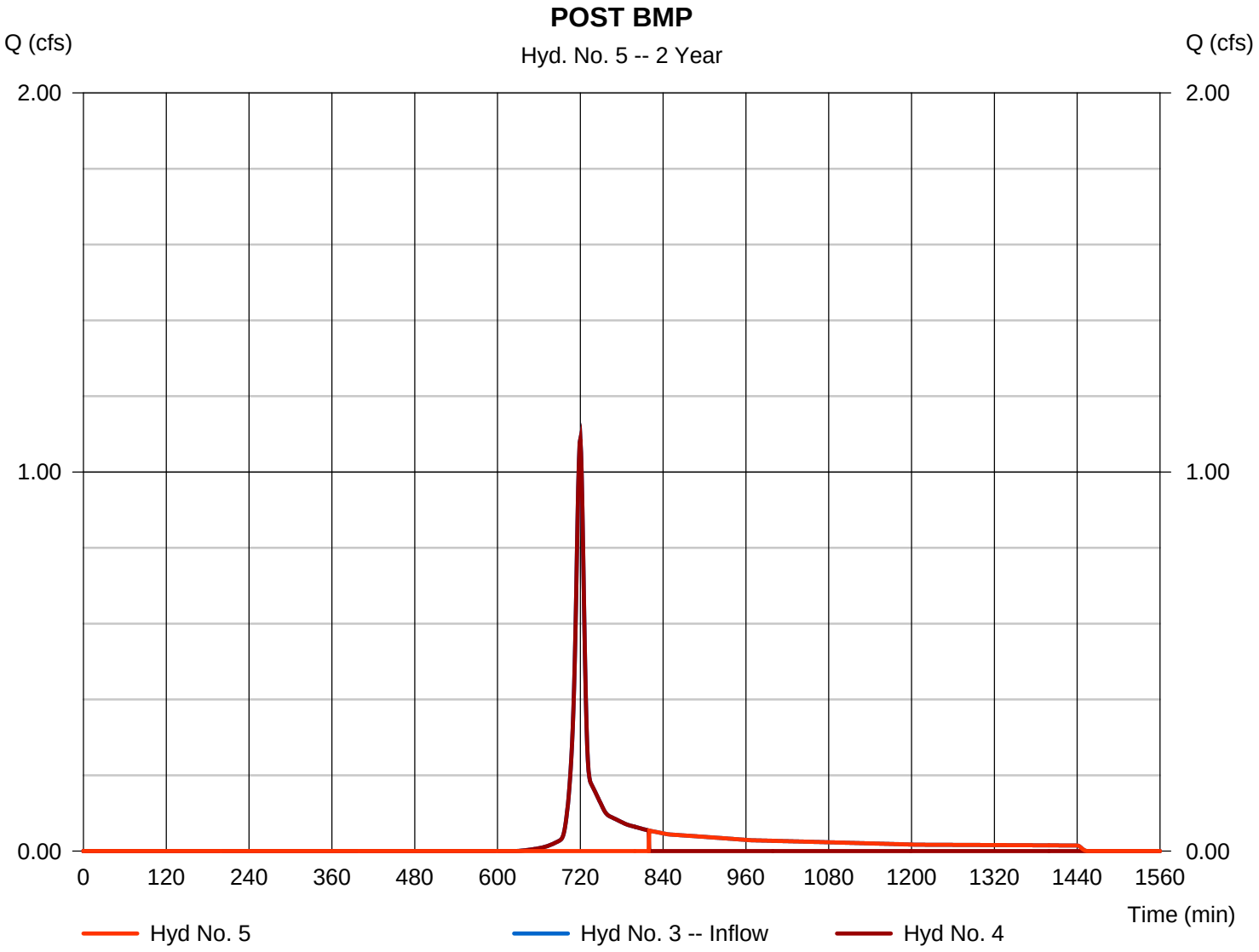


Hydrograph Report

Hyd. No. 5

POST BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.054 cfs
Storm frequency	= 2 yrs	Time to peak	= 820 min
Time interval	= 1 min	Hyd. volume	= 899 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

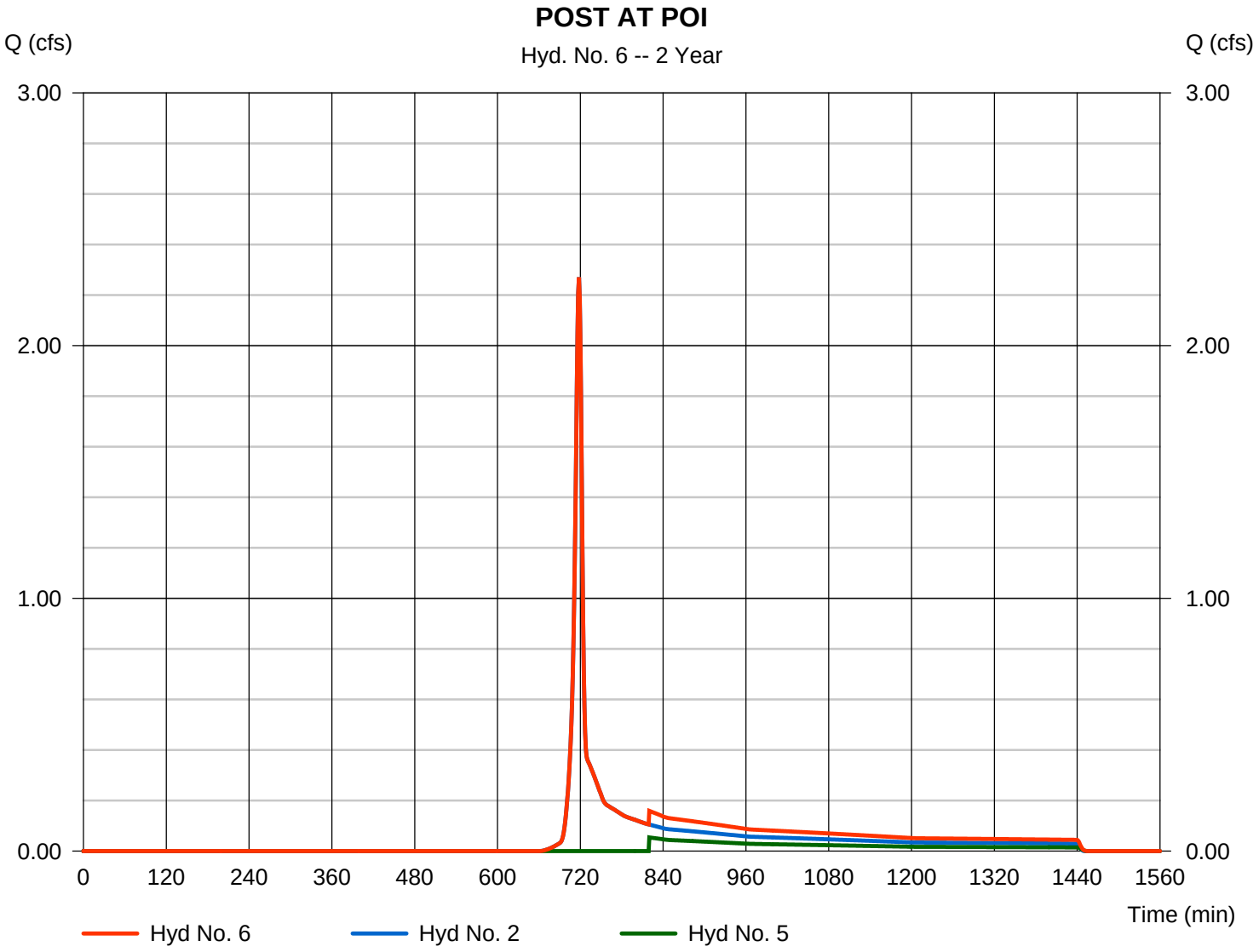


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	2.270 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	5,526 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	1.510 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	6.560	1	718	13,171	------	------	------	PRE CONSTRUCTION
2	SCS Runoff	4.679	1	718	9,396	------	------	------	POST UNDETAINED
3	SCS Runoff	2.115	1	719	4,784	------	------	------	POST DETAINED
4	Diversion1	2.115	1	719	1,606	3	------	------	VOLUME ABSTRACTION
5	Diversion2	2.026	1	721	3,178	3	------	------	POST BMP
6	Combine	5.602	1	721	12,574	2, 5	------	------	POST AT POI

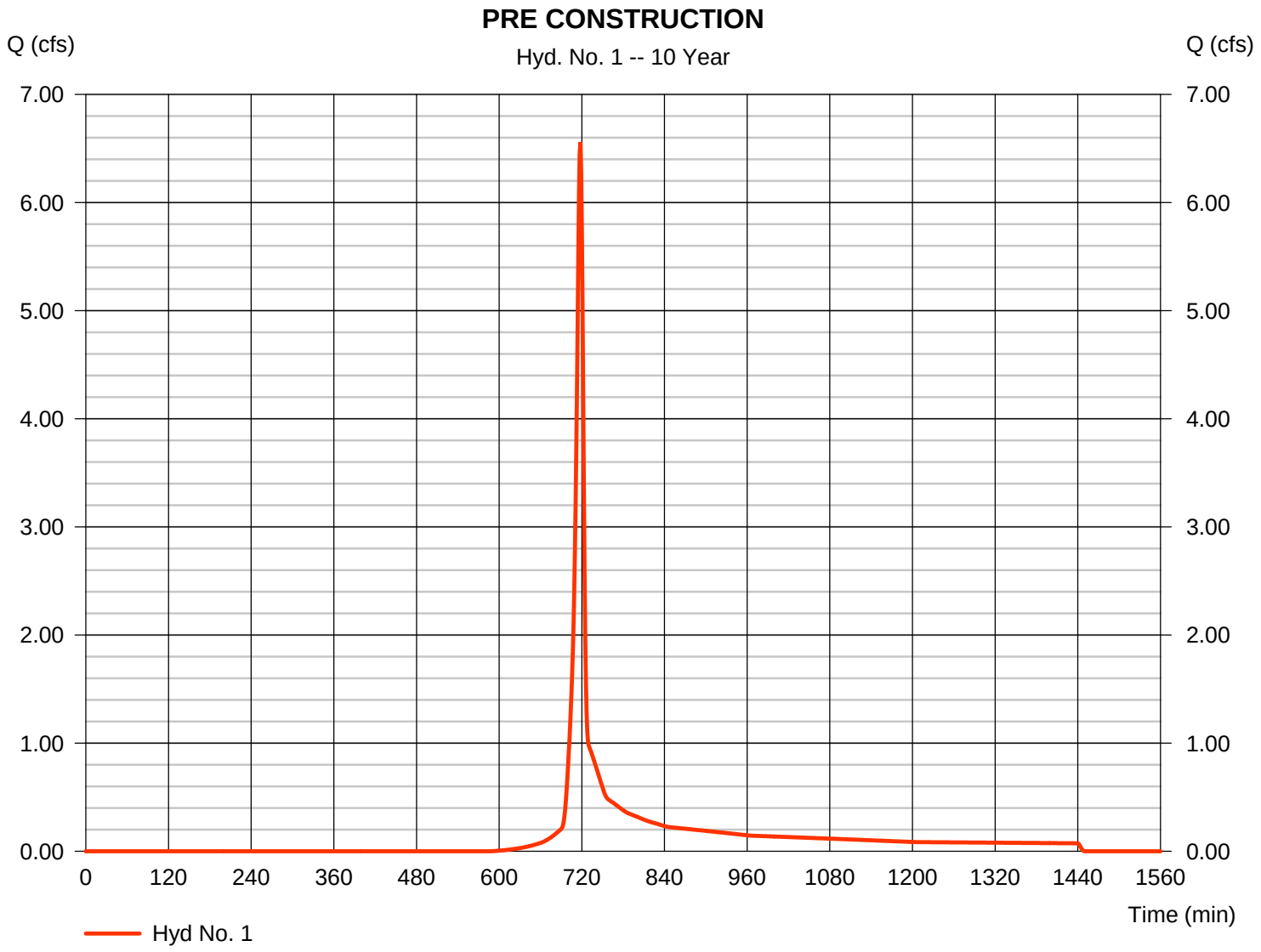
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.560 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	13,171 cuft
Drainage area	=	2.210 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	3.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.165 x 55) + (1.754 x 77) + (0.292 x 78)] / 2.210



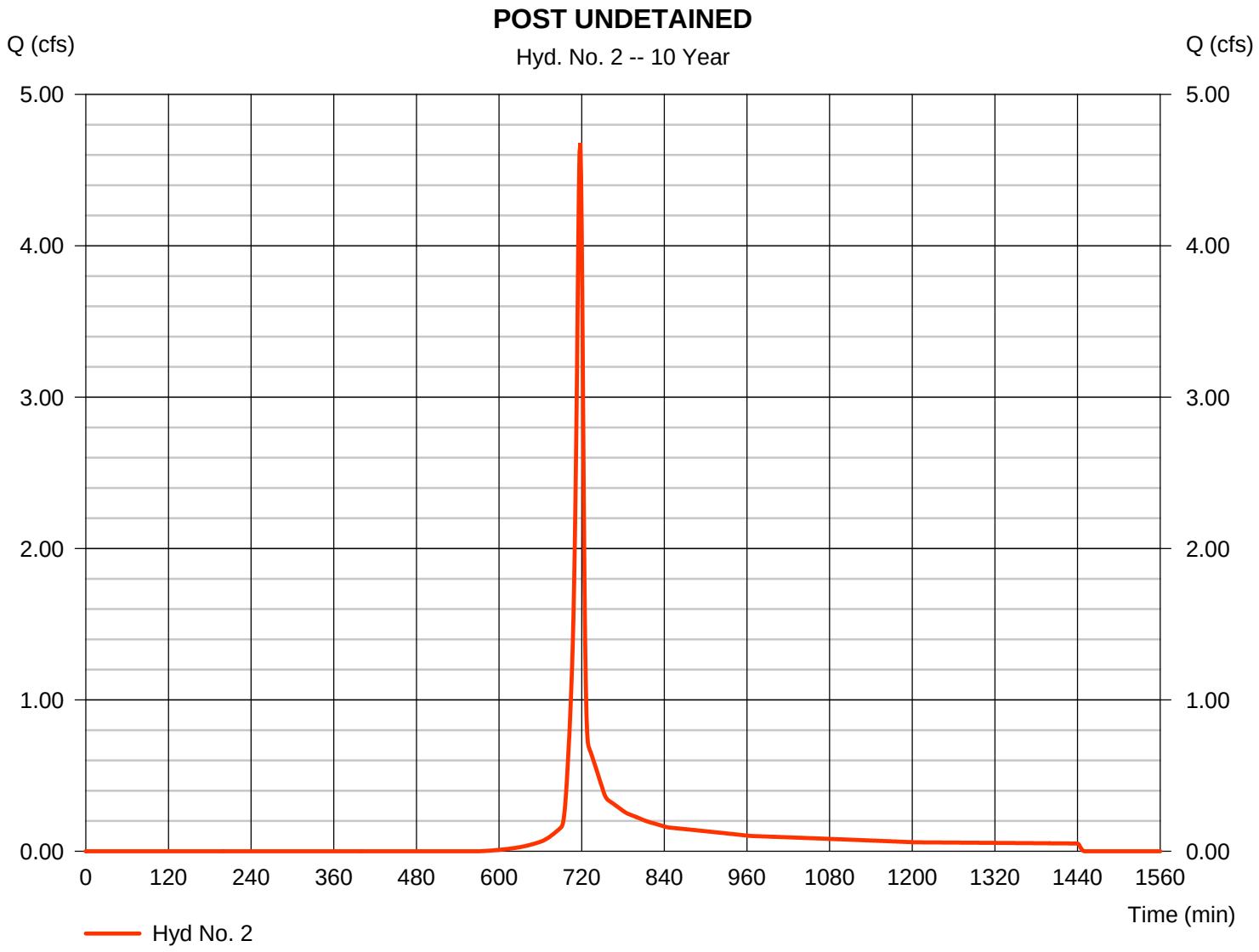
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.679 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	9,396 cuft
Drainage area	=	1.510 ac	Curve number	=	76*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	3.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.016 x 98) + (0.126 x 55) + (1.079 x 77) + (0.265 x 78) + (0.024 x 91)] / 1.510



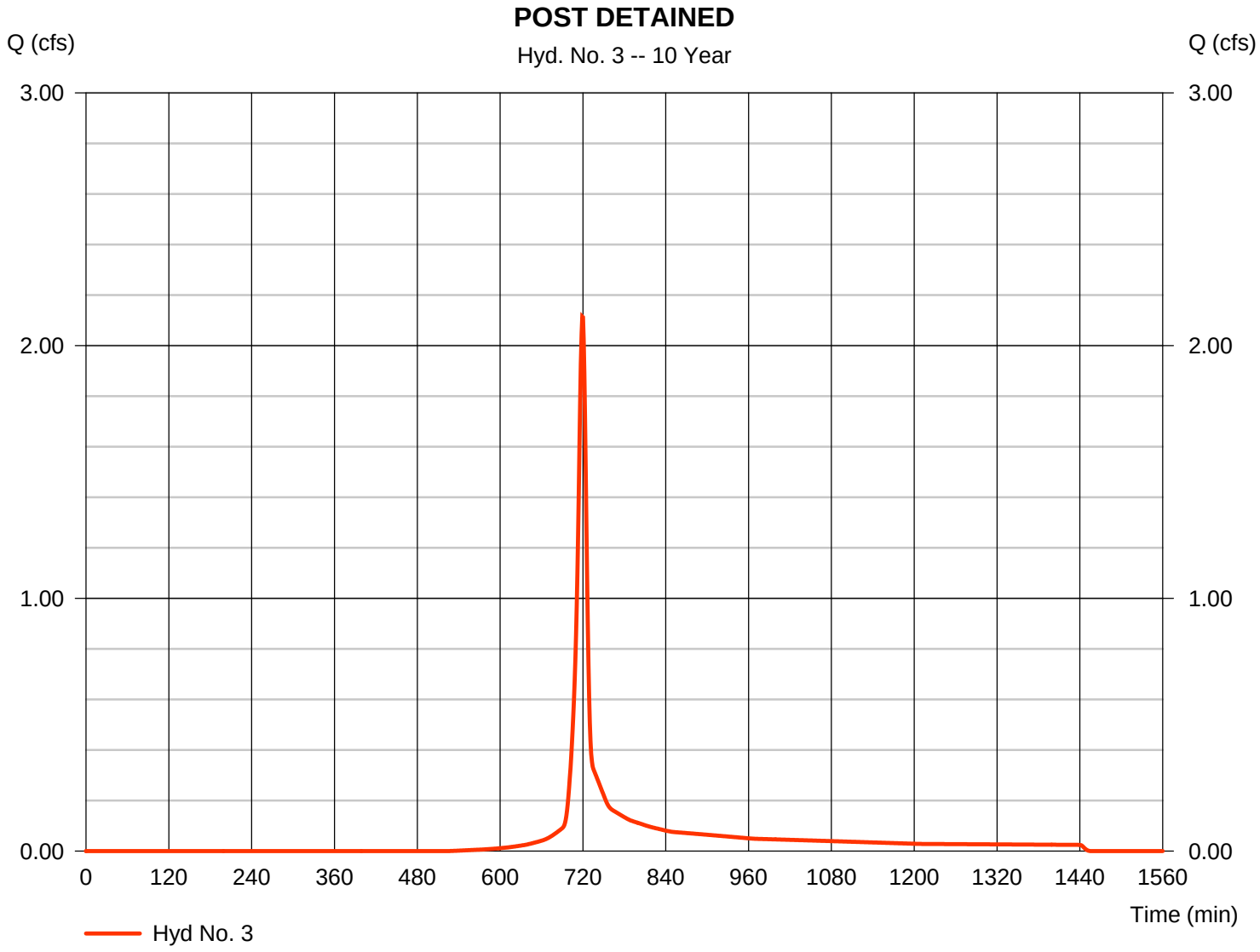
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.115 cfs
Storm frequency	=	10 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	4,784 cuft
Drainage area	=	0.700 ac	Curve number	=	79*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	3.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.147 x 91) + (0.039 x 55) + (0.255 x 77) + (0.261 x 78)] / 0.700

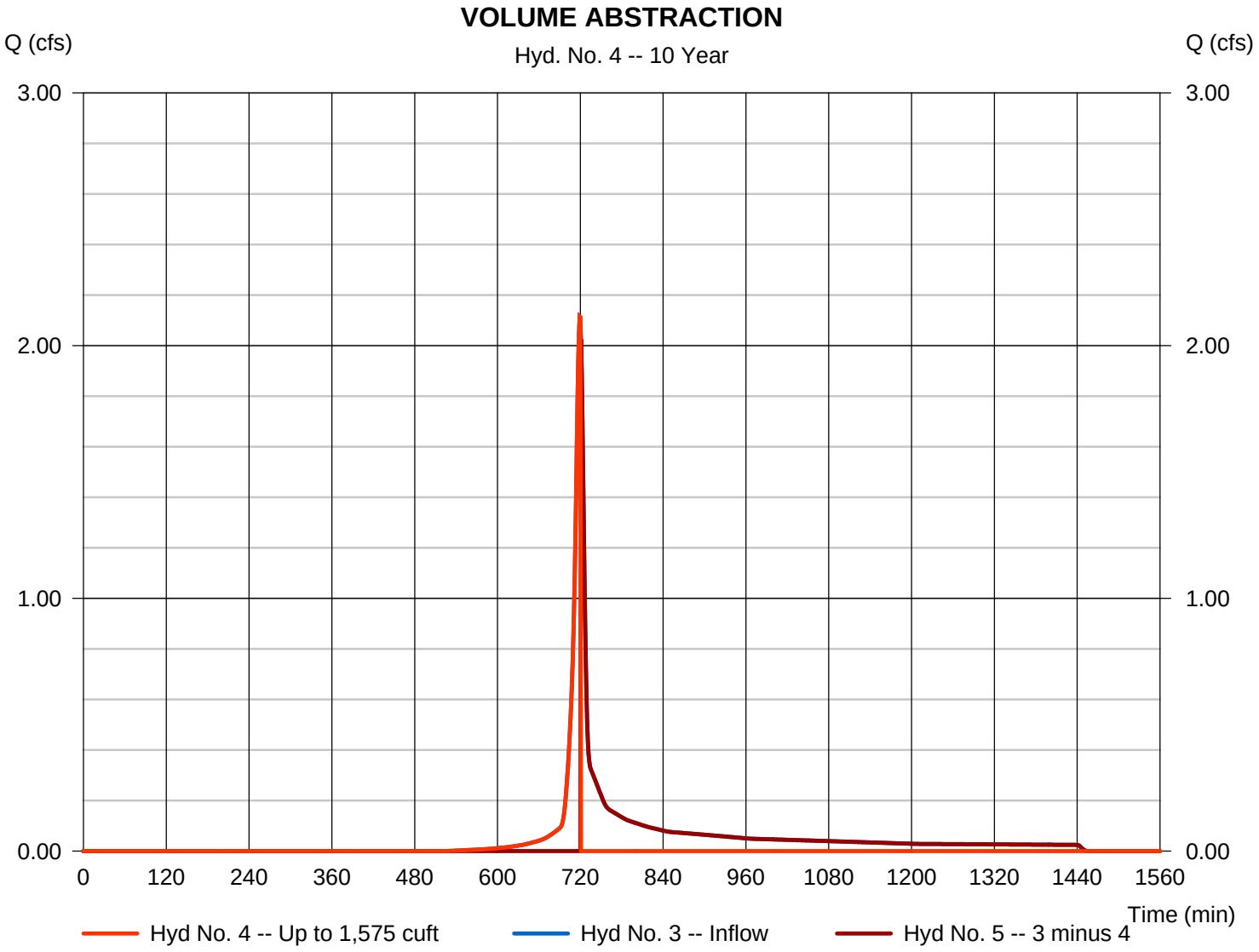


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 2.115 cfs
Storm frequency	= 10 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 1,606 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

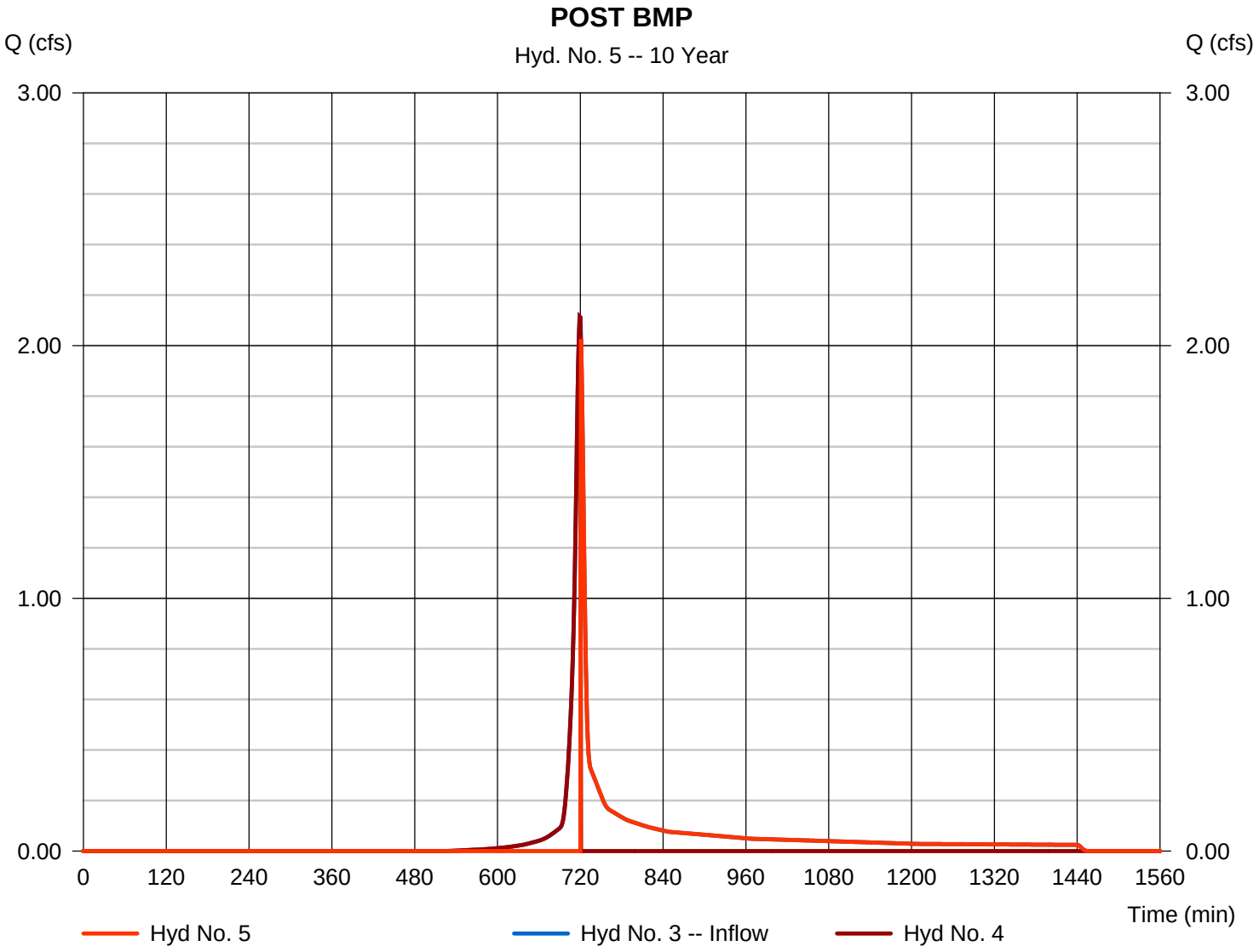


Hydrograph Report

Hyd. No. 5

POST BMP

Hydrograph type	= Diversion2	Peak discharge	= 2.026 cfs
Storm frequency	= 10 yrs	Time to peak	= 721 min
Time interval	= 1 min	Hyd. volume	= 3,178 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

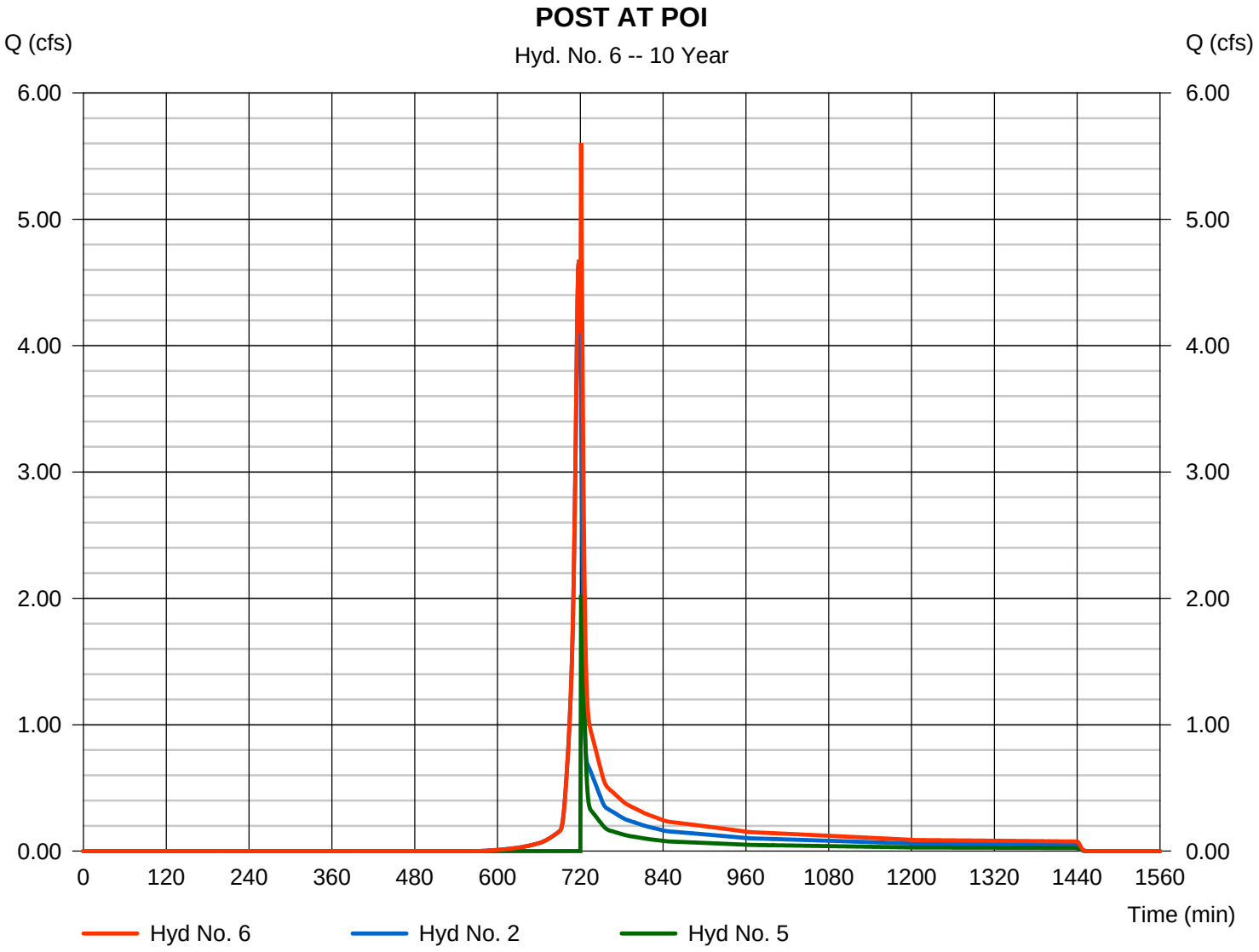


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	5.602 cfs
Storm frequency	=	10 yrs	Time to peak	=	721 min
Time interval	=	1 min	Hyd. volume	=	12,574 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	1.510 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	11.22	1	718	22,703	------	------	------	PRE CONSTRUCTION
2	SCS Runoff	7.900	1	718	16,025	------	------	------	POST UNDETAINED
3	SCS Runoff	3.475	1	719	7,913	------	------	------	POST DETAINED
4	Diversion1	1.914	1	712	1,582	3	------	------	VOLUME ABSTRACTION
5	Diversion2	3.475	1	719	6,331	3	------	------	POST BMP
6	Combine	11.29	1	718	22,356	2, 5	------	------	POST AT POI

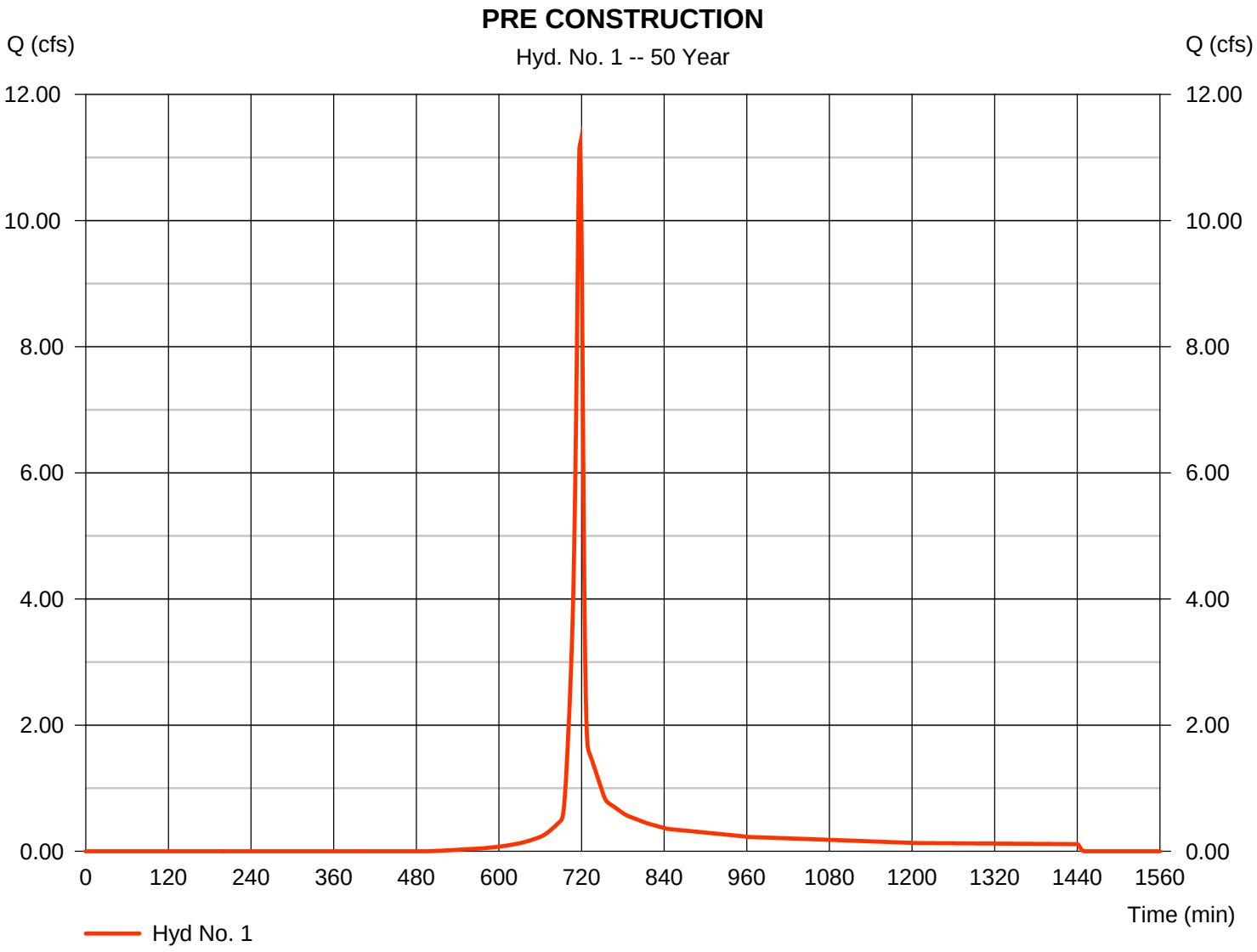
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.22 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	22,703 cuft
Drainage area	=	2.210 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	5.36 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.165 x 55) + (1.754 x 77) + (0.292 x 78)] / 2.210



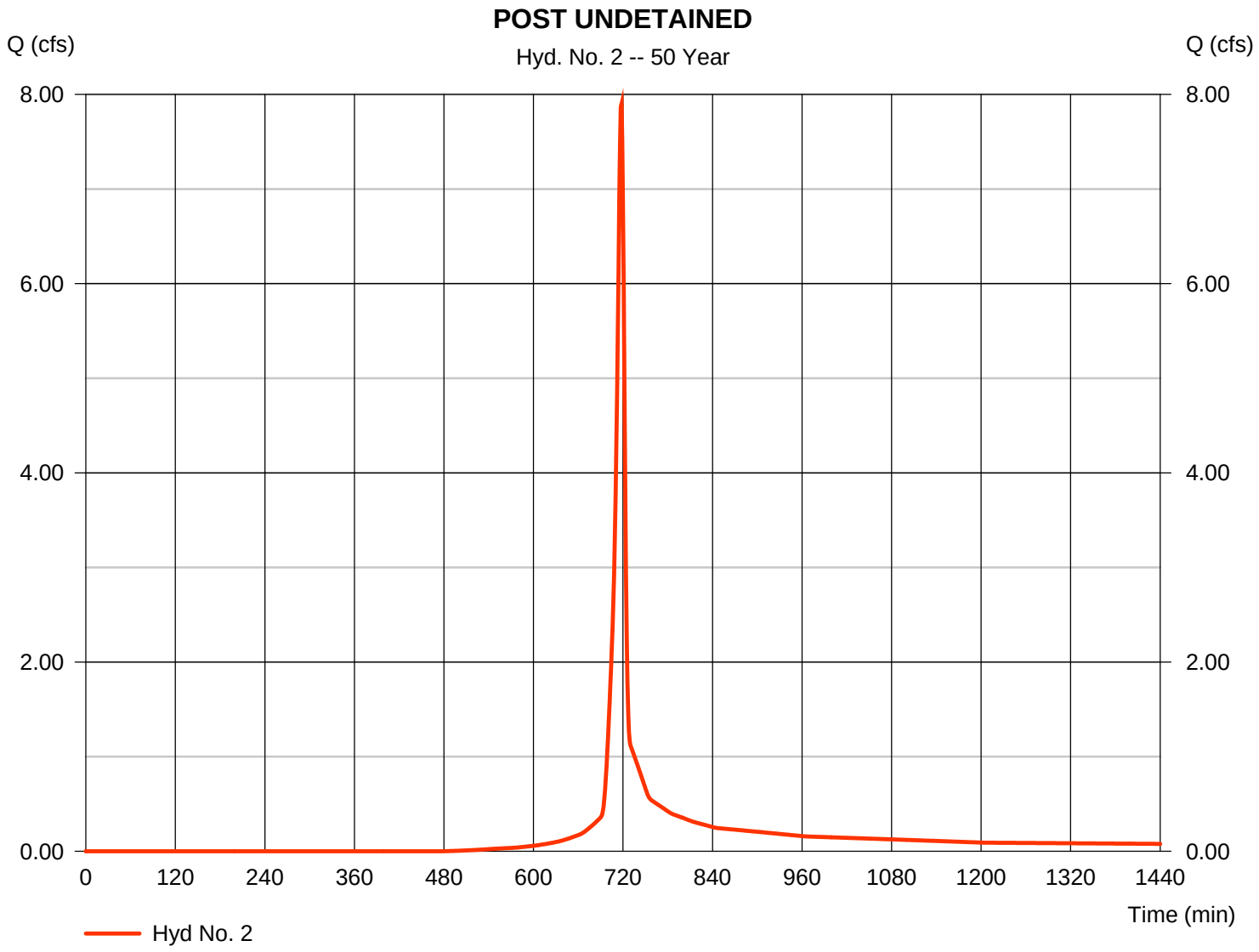
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.900 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	16,025 cuft
Drainage area	=	1.510 ac	Curve number	=	76*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	5.36 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.016 x 98) + (0.126 x 55) + (1.079 x 77) + (0.265 x 78) + (0.024 x 91)] / 1.510



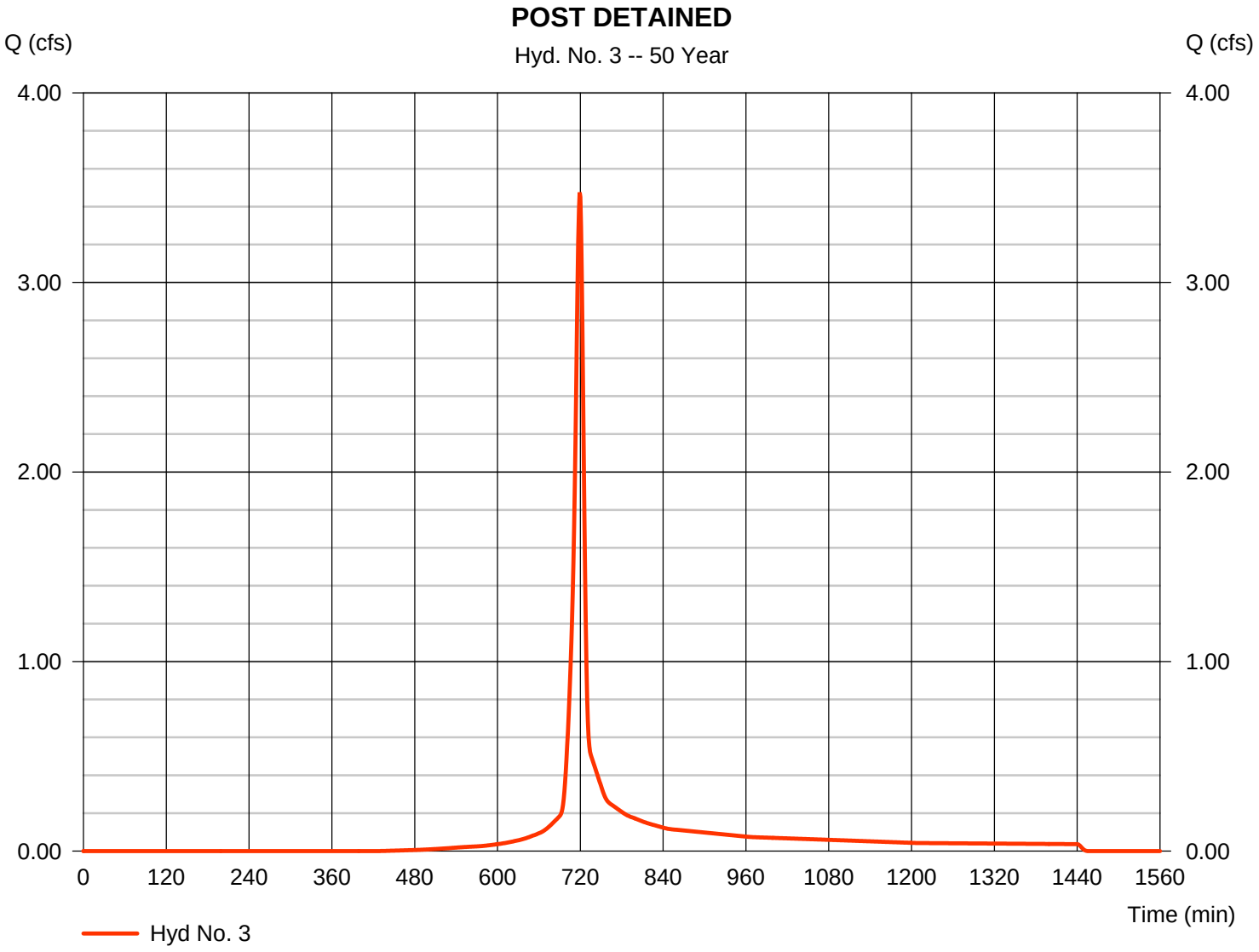
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.475 cfs
Storm frequency	=	50 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	7,913 cuft
Drainage area	=	0.700 ac	Curve number	=	79*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	5.36 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.147 x 91) + (0.039 x 55) + (0.255 x 77) + (0.261 x 78)] / 0.700

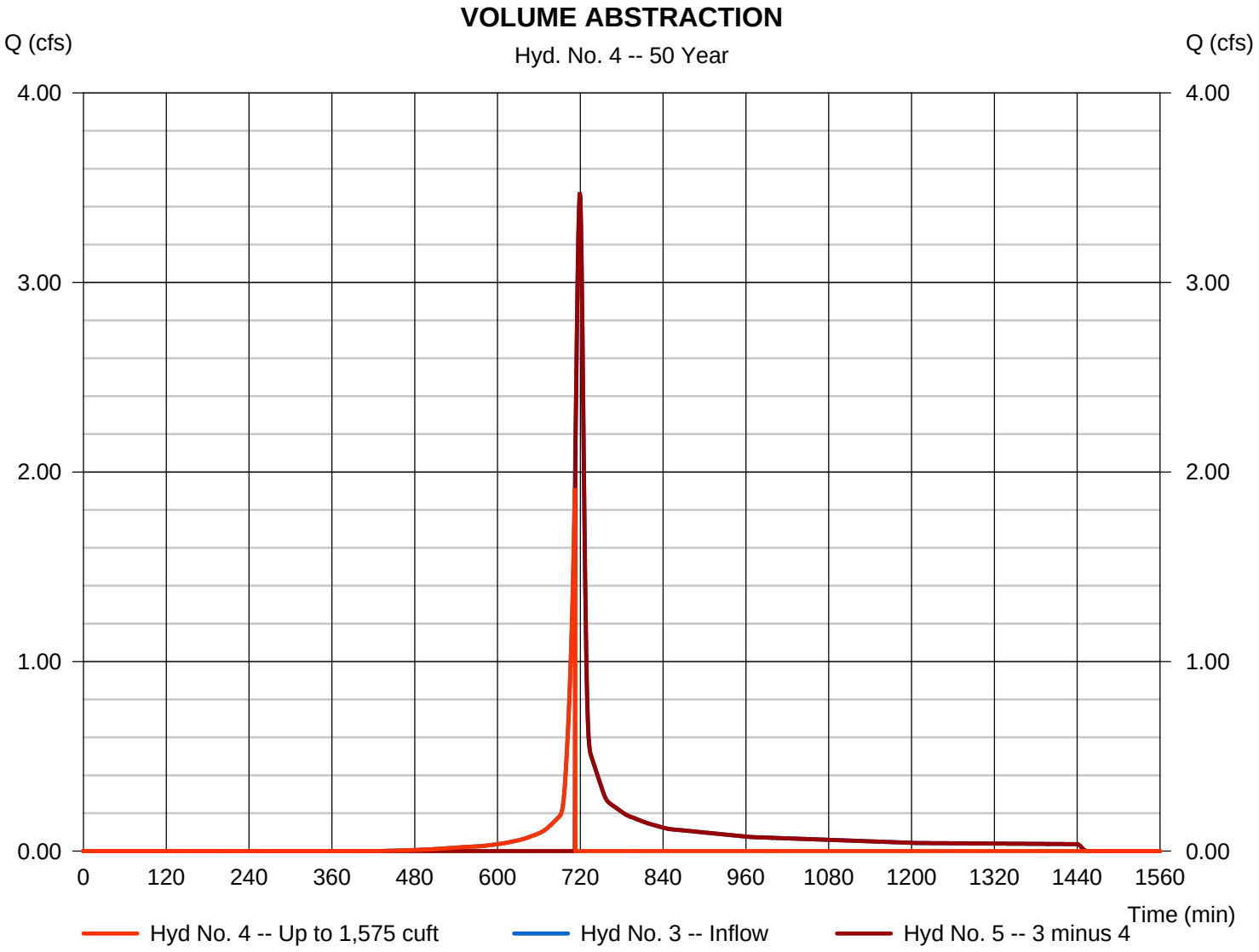


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.914 cfs
Storm frequency	= 50 yrs	Time to peak	= 712 min
Time interval	= 1 min	Hyd. volume	= 1,582 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

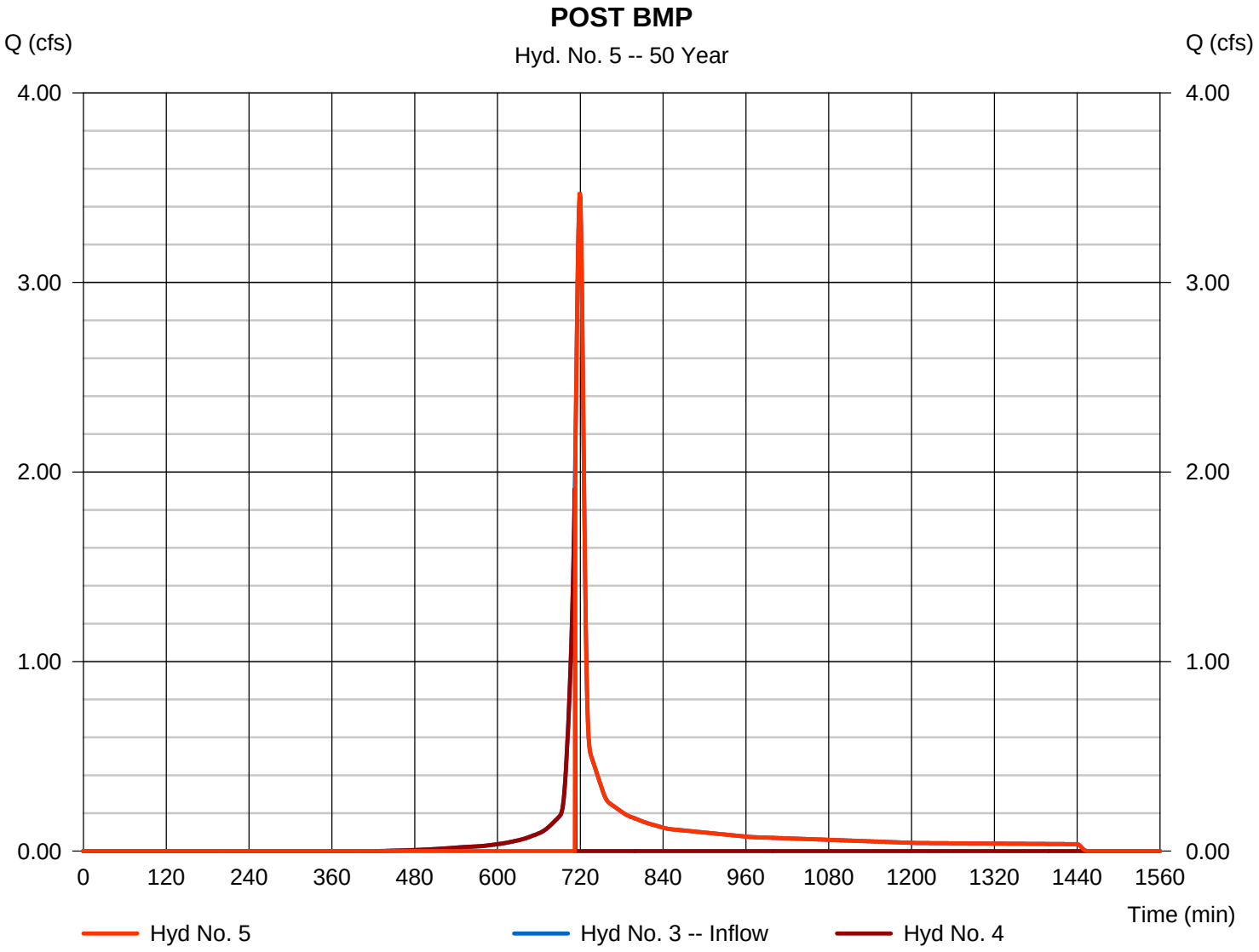


Hydrograph Report

Hyd. No. 5

POST BMP

Hydrograph type	= Diversion2	Peak discharge	= 3.475 cfs
Storm frequency	= 50 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 6,331 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

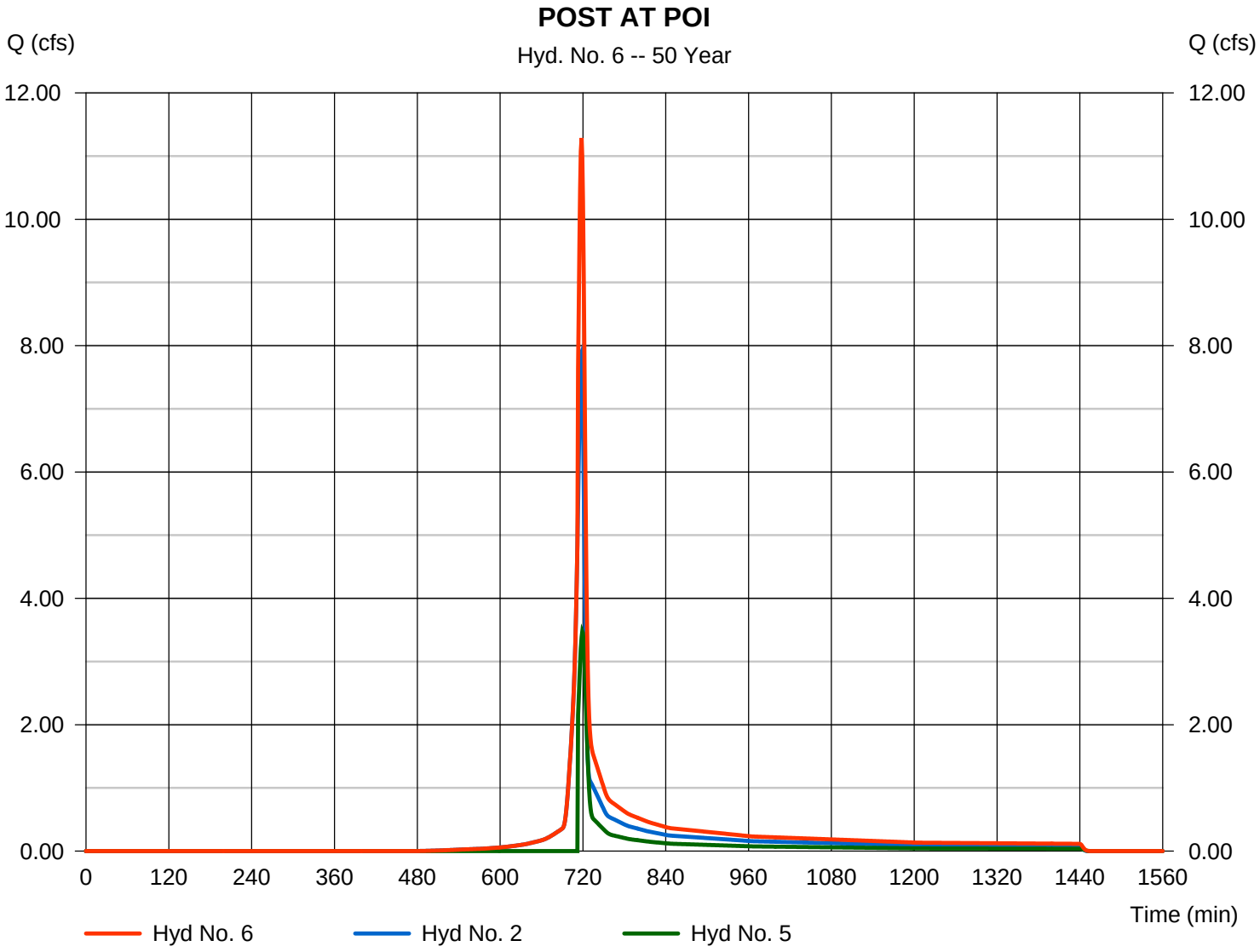


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	11.29 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	22,356 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	1.510 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	13.61	1	718	27,717	------	------	------	PRE CONSTRUCTION
2	SCS Runoff	9.543	1	718	19,497	------	------	------	POST UNDETAINED
3	SCS Runoff	4.163	1	719	9,532	------	------	------	POST DETAINED
4	Diversion1	1.509	1	708	1,576	3	------	------	VOLUME ABSTRACTION
5	Diversion2	4.163	1	719	7,955	3	------	------	POST BMP
6	Combine	13.61	1	718	27,453	2, 5	------	------	POST AT POI

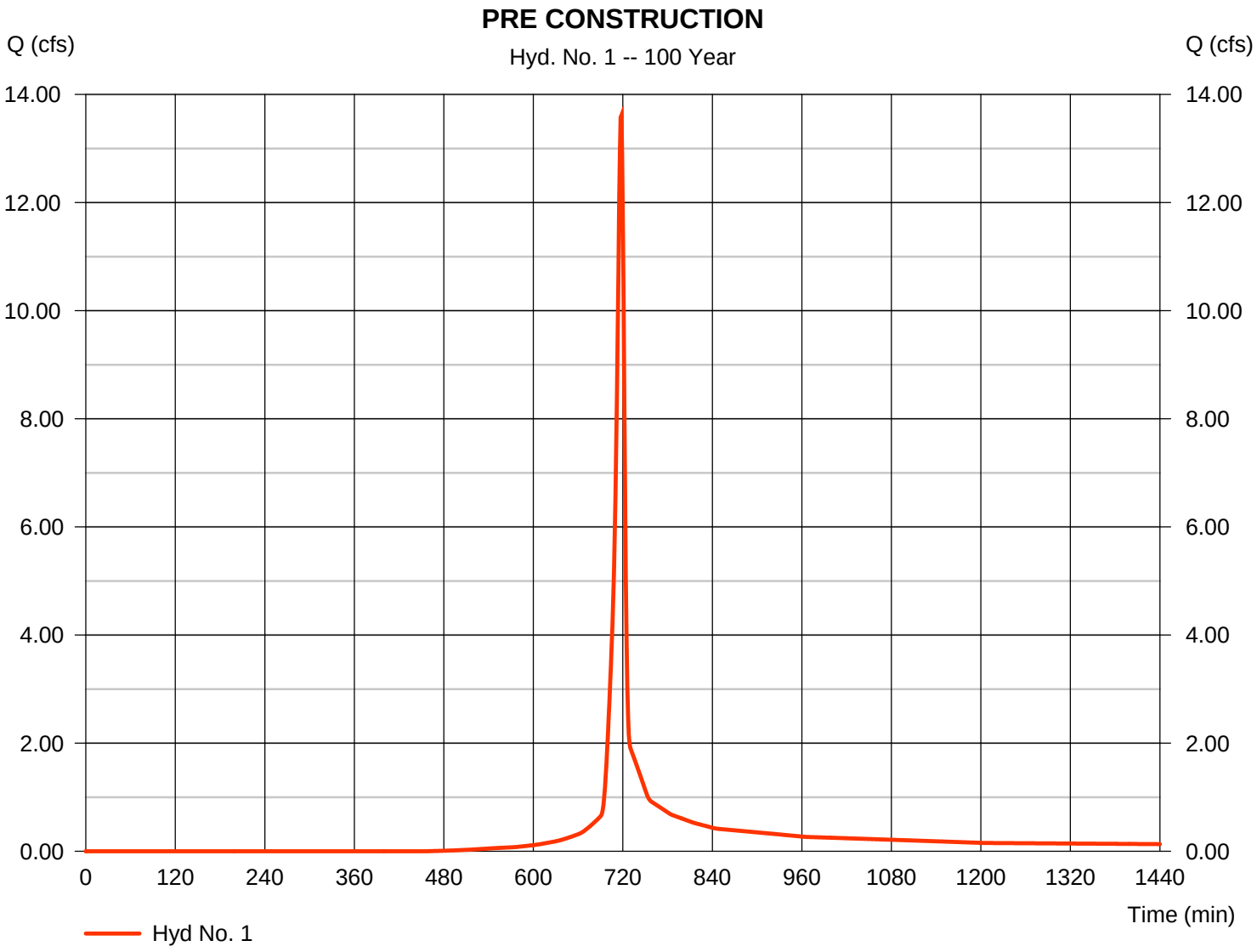
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.61 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	27,717 cuft
Drainage area	=	2.210 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	6.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.165 x 55) + (1.754 x 77) + (0.292 x 78)] / 2.210



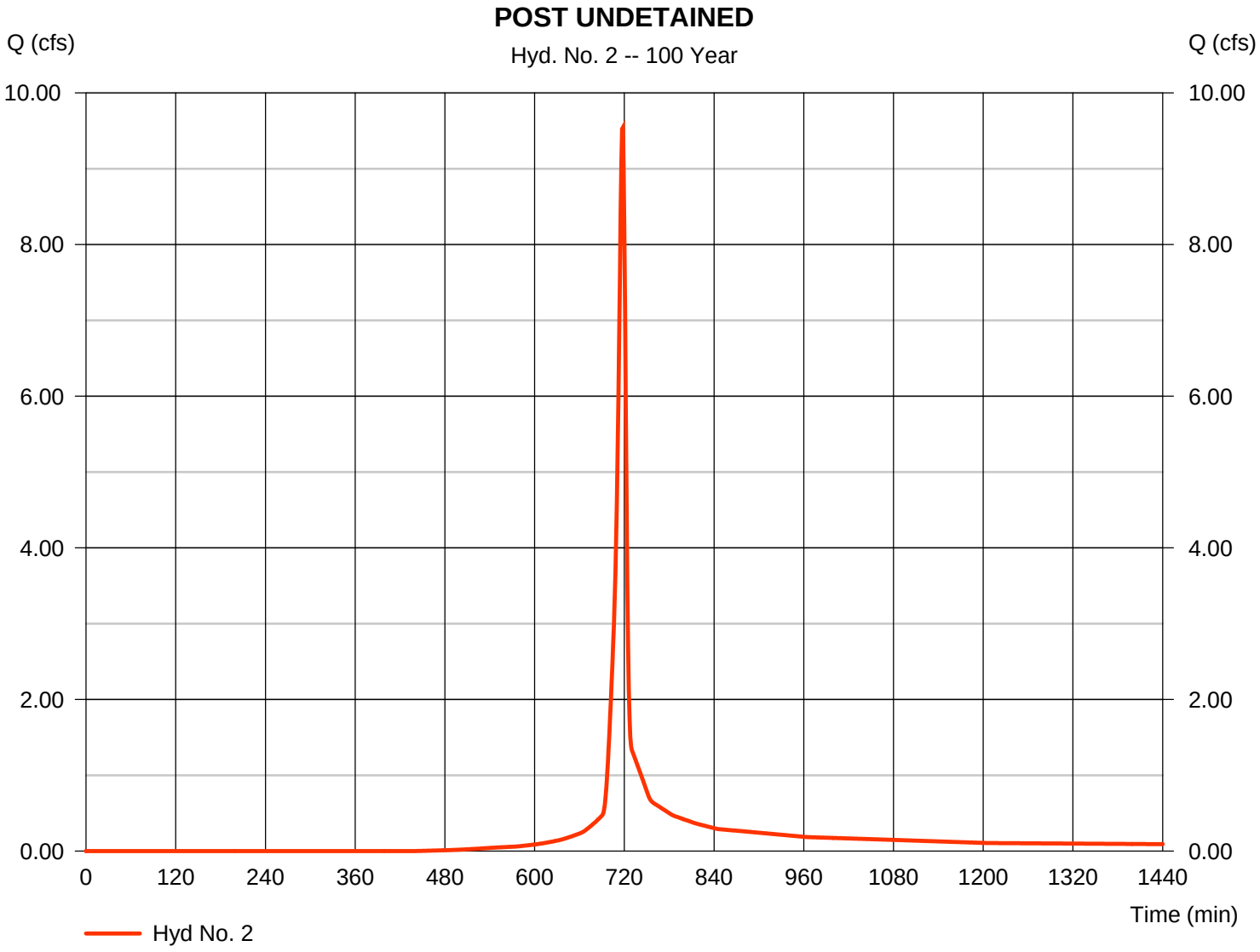
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.543 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	19,497 cuft
Drainage area	=	1.510 ac	Curve number	=	76*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	6.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.016 x 98) + (0.126 x 55) + (1.079 x 77) + (0.265 x 78) + (0.024 x 91)] / 1.510



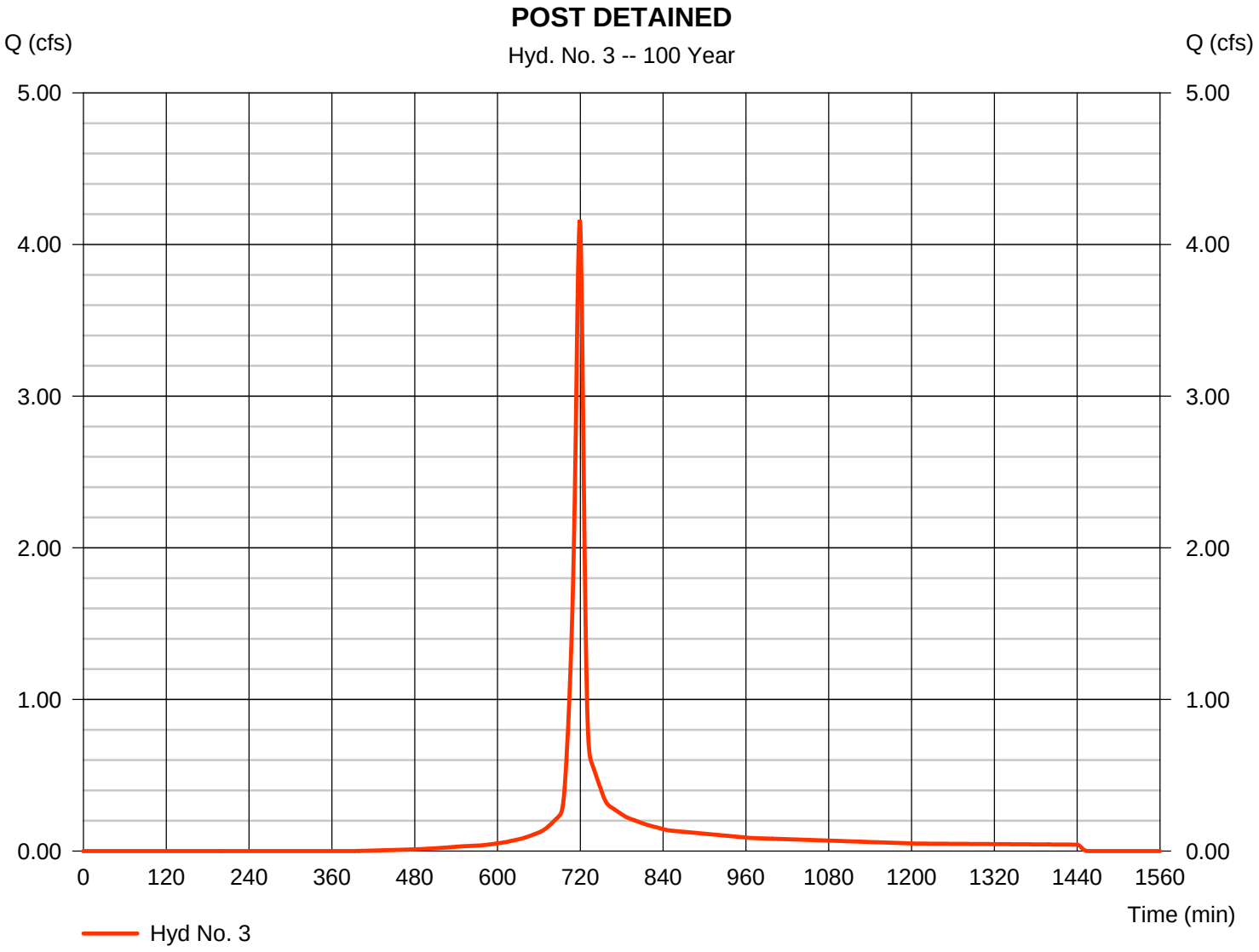
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.163 cfs
Storm frequency	=	100 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	9,532 cuft
Drainage area	=	0.700 ac	Curve number	=	79*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	6.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.147 x 91) + (0.039 x 55) + (0.255 x 77) + (0.261 x 78)] / 0.700

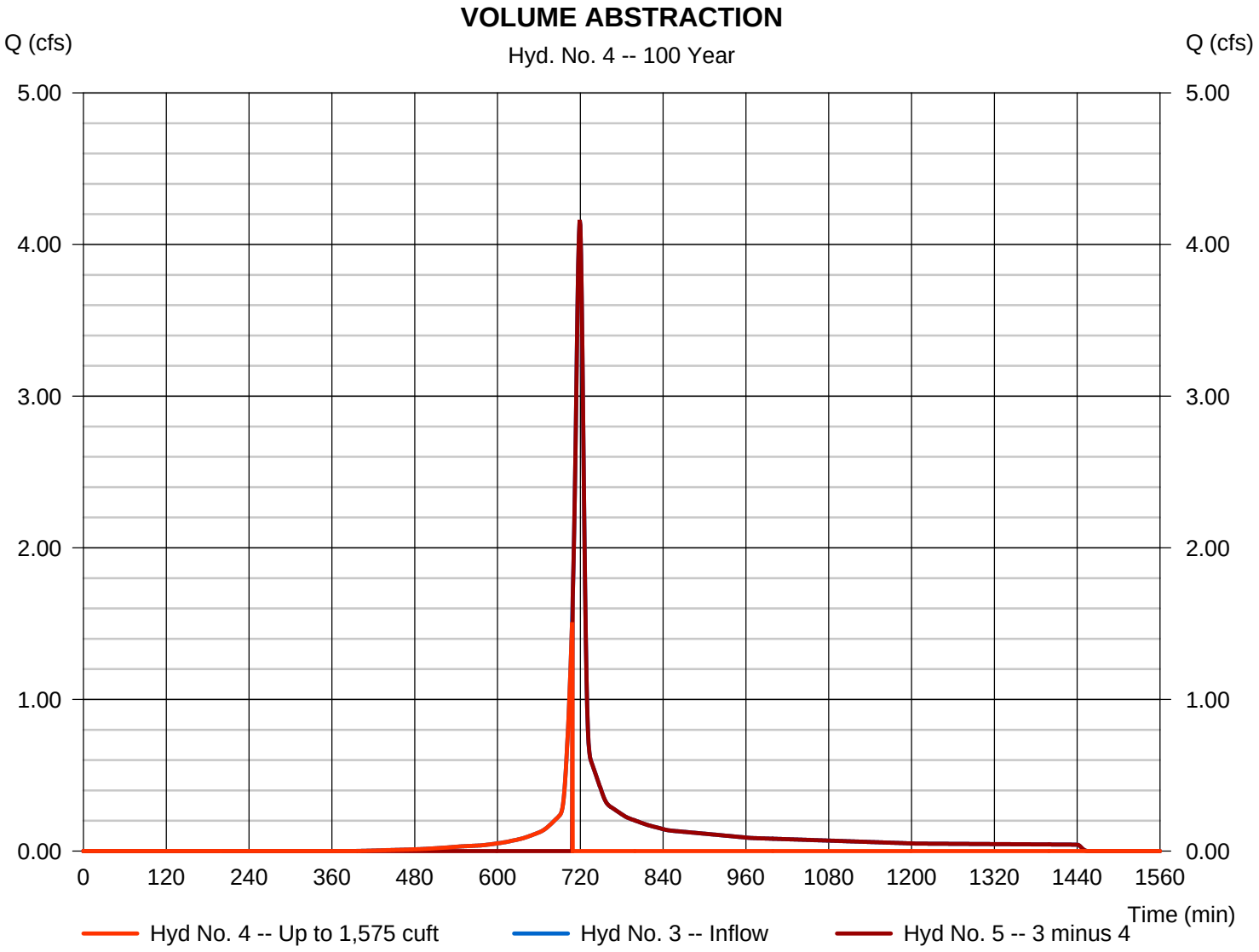


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.509 cfs
Storm frequency	= 100 yrs	Time to peak	= 708 min
Time interval	= 1 min	Hyd. volume	= 1,576 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

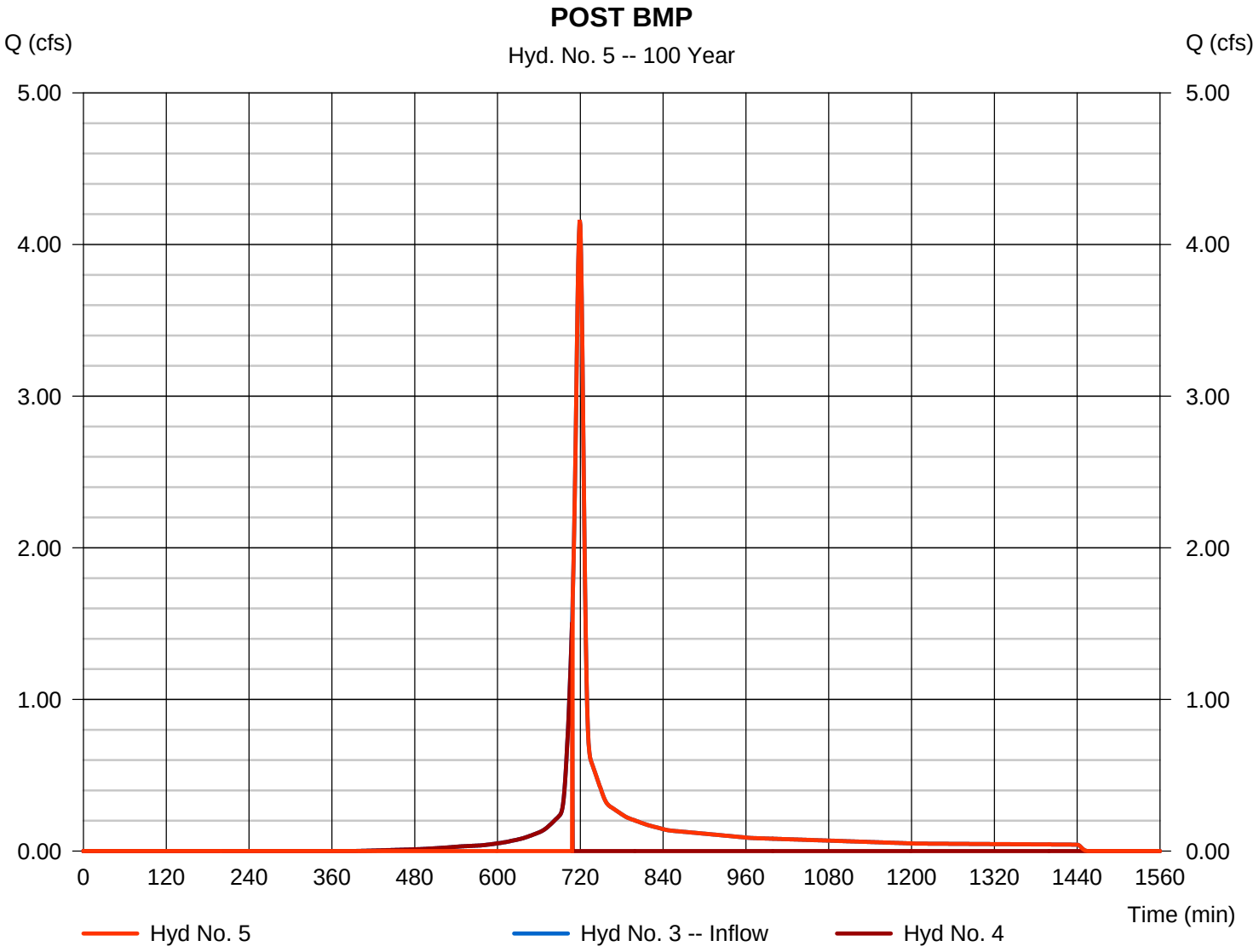


Hydrograph Report

Hyd. No. 5

POST BMP

Hydrograph type	= Diversion2	Peak discharge	= 4.163 cfs
Storm frequency	= 100 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 7,955 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

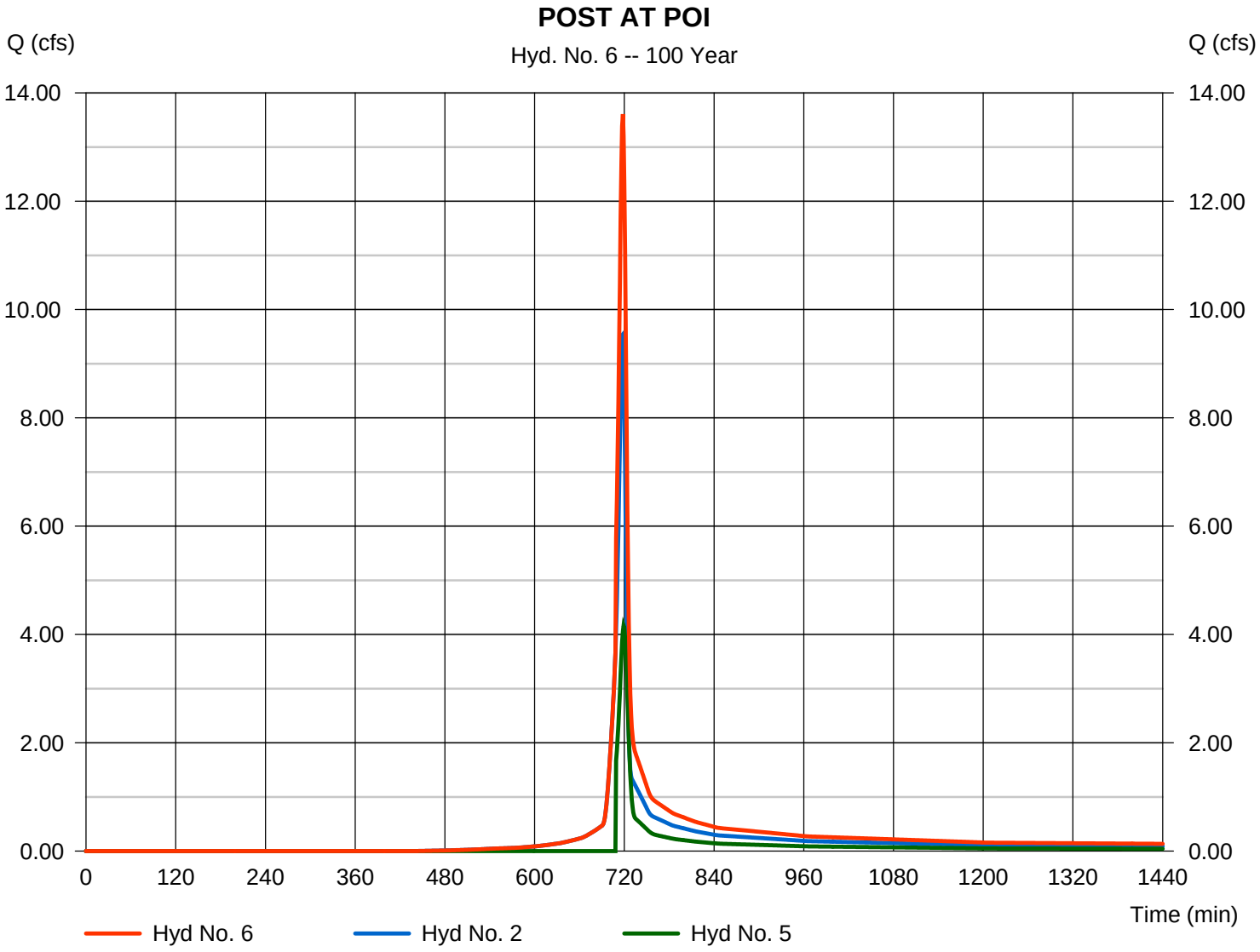


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	13.61 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	27,453 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	1.510 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	40.5844	9.9000	0.8792	--------
2	49.9040	10.3000	0.8805	--------
3	0.0000	0.0000	0.0000	--------
5	51.9125	9.7000	0.8350	--------
10	47.0214	8.3000	0.7778	--------
25	48.3751	7.7000	0.7431	--------
50	44.2417	6.5000	0.6943	--------
100	42.8775	5.7000	0.6607	--------

File name: Raystown East 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	3.78	2.93	2.40	2.05	1.79	1.59	1.43	1.30	1.20	1.11	1.04	0.97
2	4.52	3.52	2.90	2.48	2.16	1.93	1.74	1.58	1.46	1.35	1.26	1.18
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	5.50	4.31	3.57	3.06	2.69	2.40	2.17	1.99	1.84	1.71	1.60	1.50
10	6.28	4.90	4.06	3.49	3.08	2.76	2.51	2.30	2.13	1.99	1.87	1.76
25	7.32	5.72	4.75	4.10	3.62	3.26	2.97	2.74	2.54	2.38	2.23	2.11
50	8.12	6.32	5.26	4.55	4.03	3.64	3.33	3.08	2.87	2.69	2.53	2.40
100	8.96	6.95	5.79	5.02	4.46	4.04	3.70	3.43	3.20	3.01	2.84	2.70

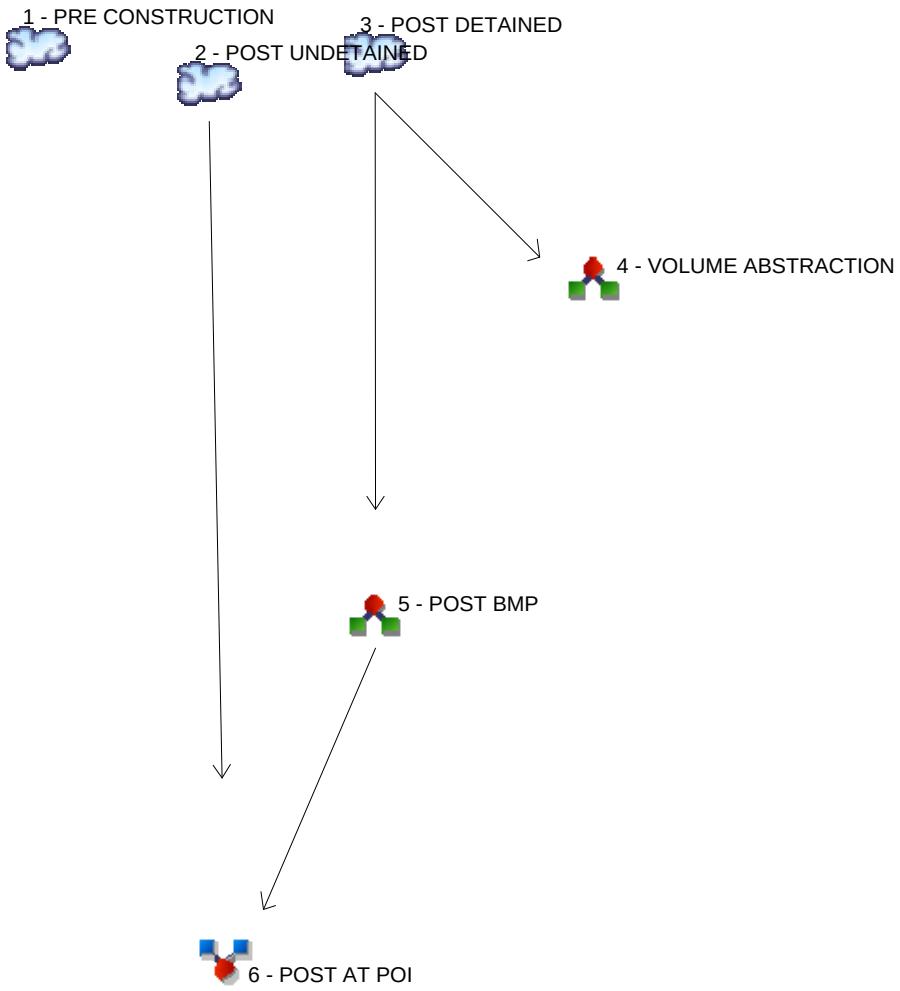
Tc = time in minutes. Values may exceed 60.

RO\07 PCSM\Attach 4 Stormwater Calcs\Happy Hills (Raystown Lake East)\Hydraflow Rev 1\Raystown East 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	4.69	5.36	6.08
SCS 6-Hr	1.50	1.80	0.00	2.25	2.63	3.16	3.61	4.09
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 CONSTRUCTION
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED
4	Diversion1	VOLUME ABSTRACTION
5	Diversion2	POST BMP
6	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	------	-------	3.106	-------	-------	-------	-------	-------	-------	PRE CONSTRUCTION
2	SCS Runoff	------	-------	2.122	-------	-------	-------	-------	-------	-------	POST UNDETAINED
3	SCS Runoff	------	-------	0.551	-------	-------	-------	-------	-------	-------	POST DETAINED
4	Diversion1	3	-------	0.551	-------	-------	-------	-------	-------	-------	VOLUME ABSTRACTION
5	Diversion2	3	-------	0.052	-------	-------	-------	-------	-------	-------	POST BMP
6	Combine	2, 5	-------	2.122	-------	-------	-------	-------	-------	-------	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	3.106	1	718	6,373	------	------	------	PRE CONSTRUCTION
2	SCS Runoff	2.122	1	718	4,355	------	------	------	POST UNDETAINED
3	SCS Runoff	0.551	1	734	2,460	------	------	------	POST DETAINED
4	Diversion1	0.551	1	734	1,578	3	------	------	VOLUME ABSTRACTION
5	Diversion2	0.052	1	841	882	3	------	------	POST BMP
6	Combine	2.122	1	718	5,237	2, 5	------	------	POST AT POI

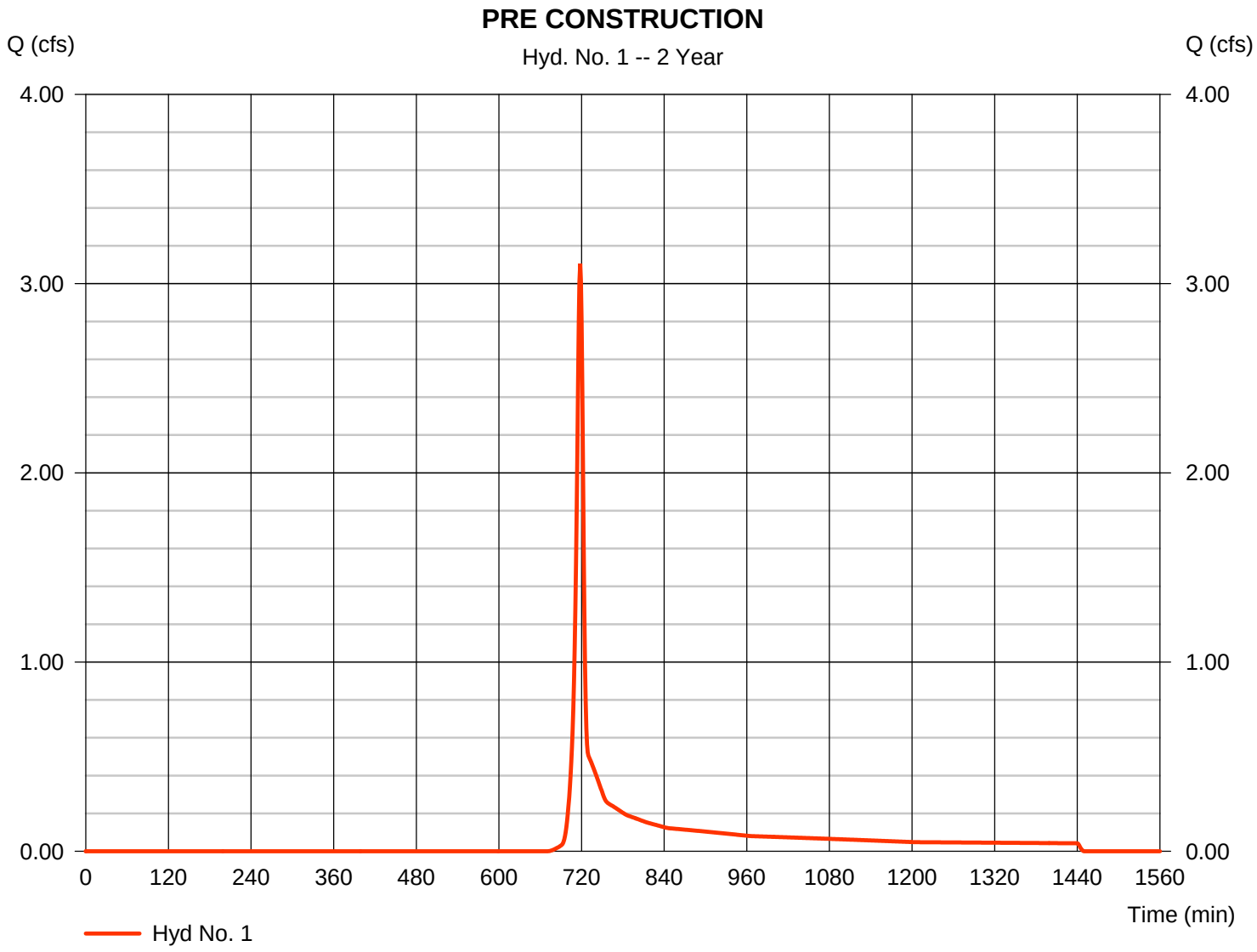
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.106 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	6,373 cuft
Drainage area	=	2.210 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.165 x 55) + (1.754 x 77) + (0.292 x 78)] / 2.210



TR55 Tc Worksheet

Hyd. No. 1

PRE CONSTRUCTION

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 (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.12**	**+**	**0.00**	**+**	**0.00**	**=**	**5.12**
Shallow Concentrated Flow							
Flow length (ft)	= 507.00		0.00		0.00		
Watercourse slope (%)	= 14.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.12		0.00		0.00		
Travel Time (min)	**= 1.38**	**+**	**0.00**	**+**	**0.00**	**=**	**1.38**
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 ..... 6.50 min

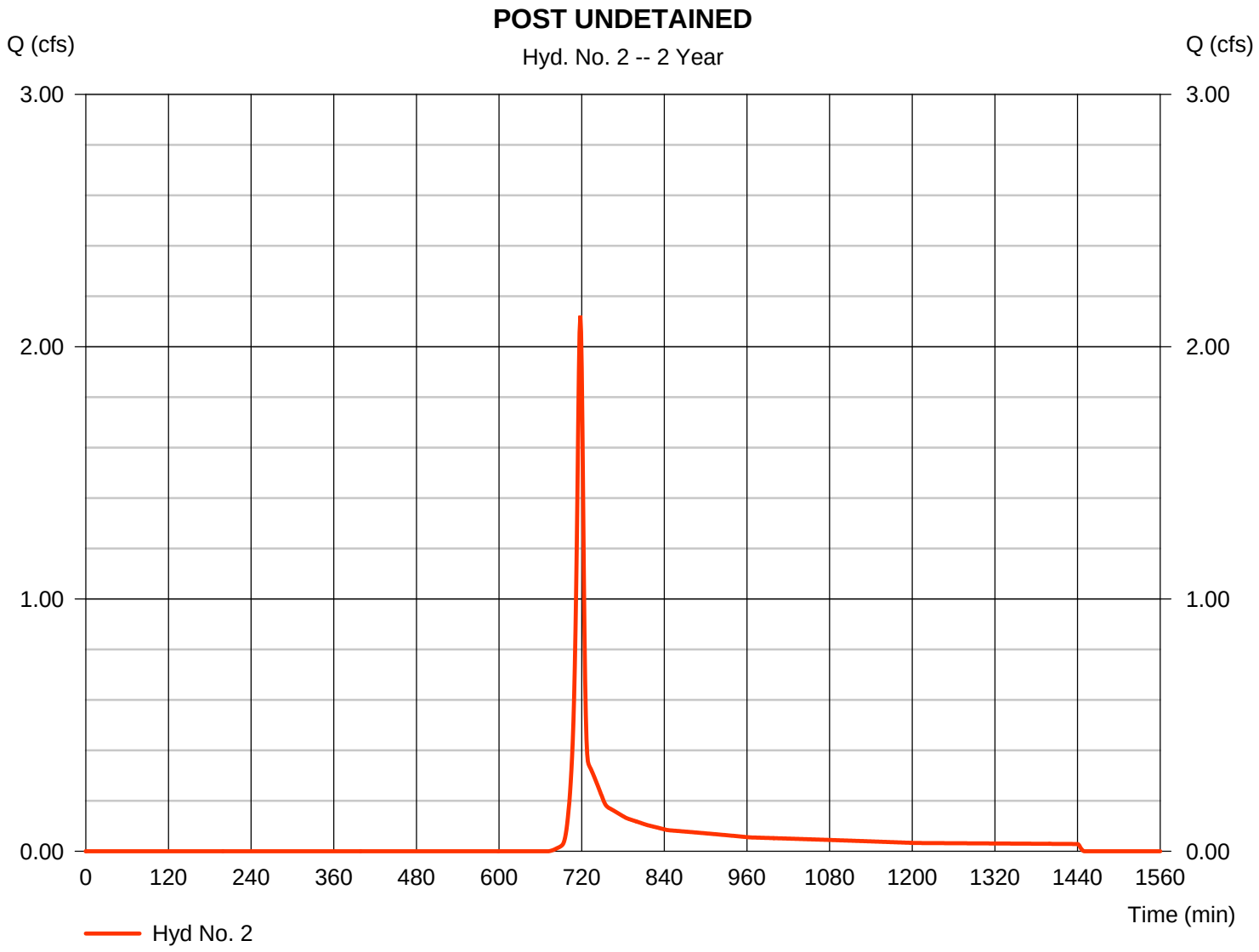
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.122 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	4,355 cuft
Drainage area	=	1.510 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = + (0.140 x 55) + (1.090 x 77) + (0.260 x 78) + (0.020 x 91)] / 1.510



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 (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.12**	**+**	**0.00**	**+**	**0.00**	**=**	**5.12**
Shallow Concentrated Flow							
Flow length (ft)	= 507.00		0.00		0.00		
Watercourse slope (%)	= 14.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.12		0.00		0.00		
Travel Time (min)	**= 1.38**	**+**	**0.00**	**+**	**0.00**	**=**	**1.38**
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 ..... 6.50 min

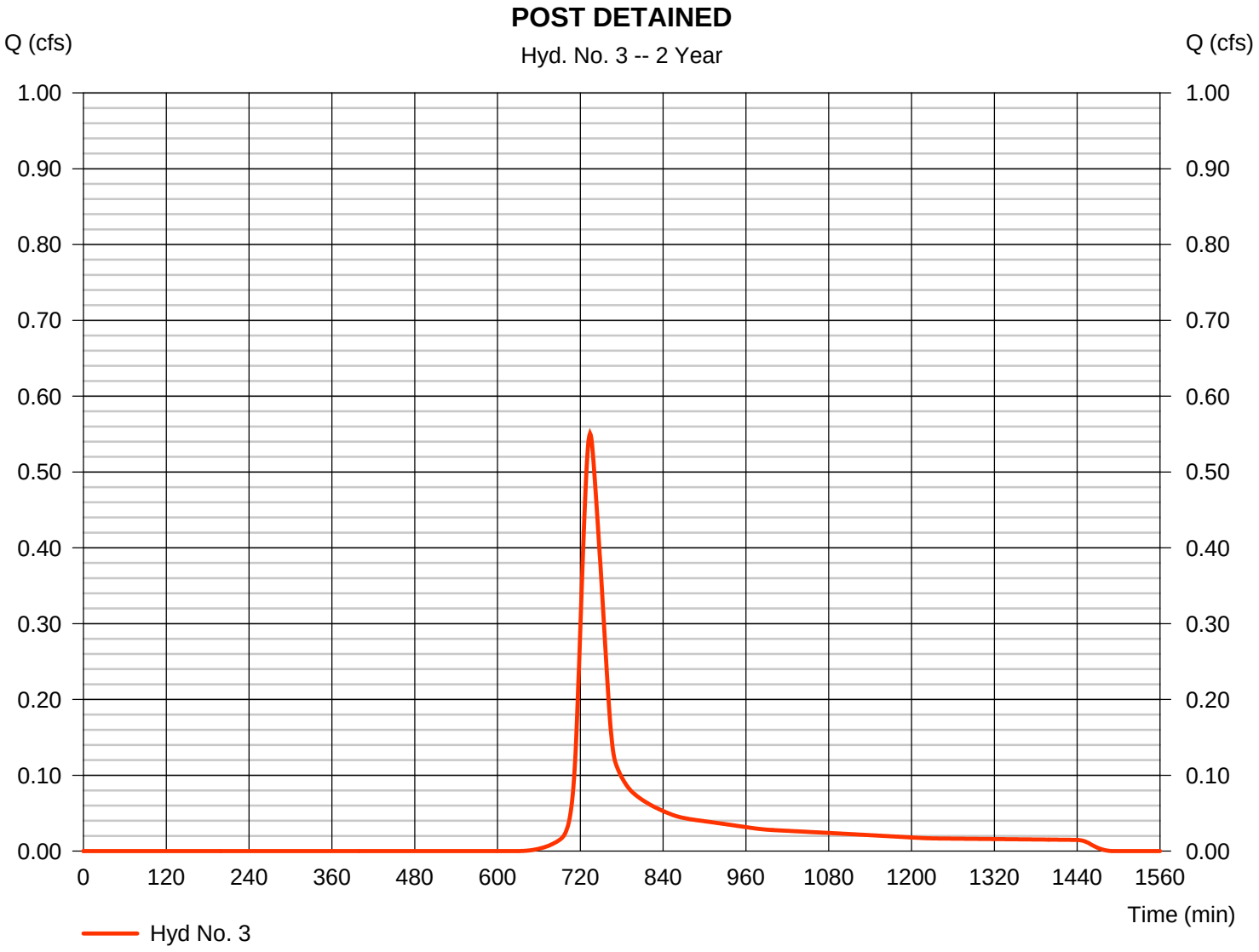
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.551 cfs
Storm frequency	=	2 yrs	Time to peak	=	734 min
Time interval	=	1 min	Hyd. volume	=	2,460 cuft
Drainage area	=	0.700 ac	Curve number	=	79*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	32.50 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.147 x 91) + (0.039 x 55) + (0.255 x 77) + (0.261 x 78)] / 0.700

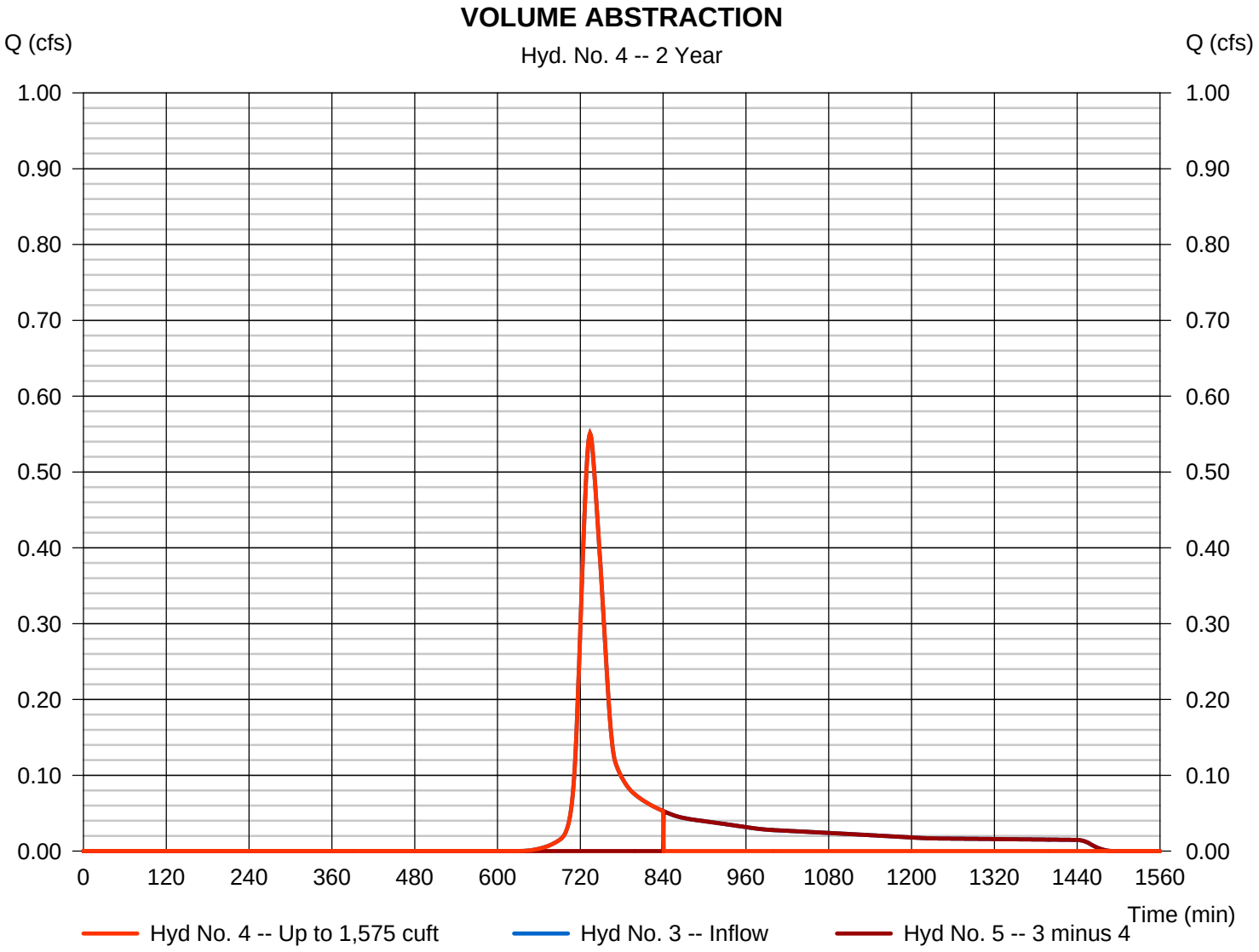


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.551 cfs
Storm frequency	= 2 yrs	Time to peak	= 734 min
Time interval	= 1 min	Hyd. volume	= 1,578 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

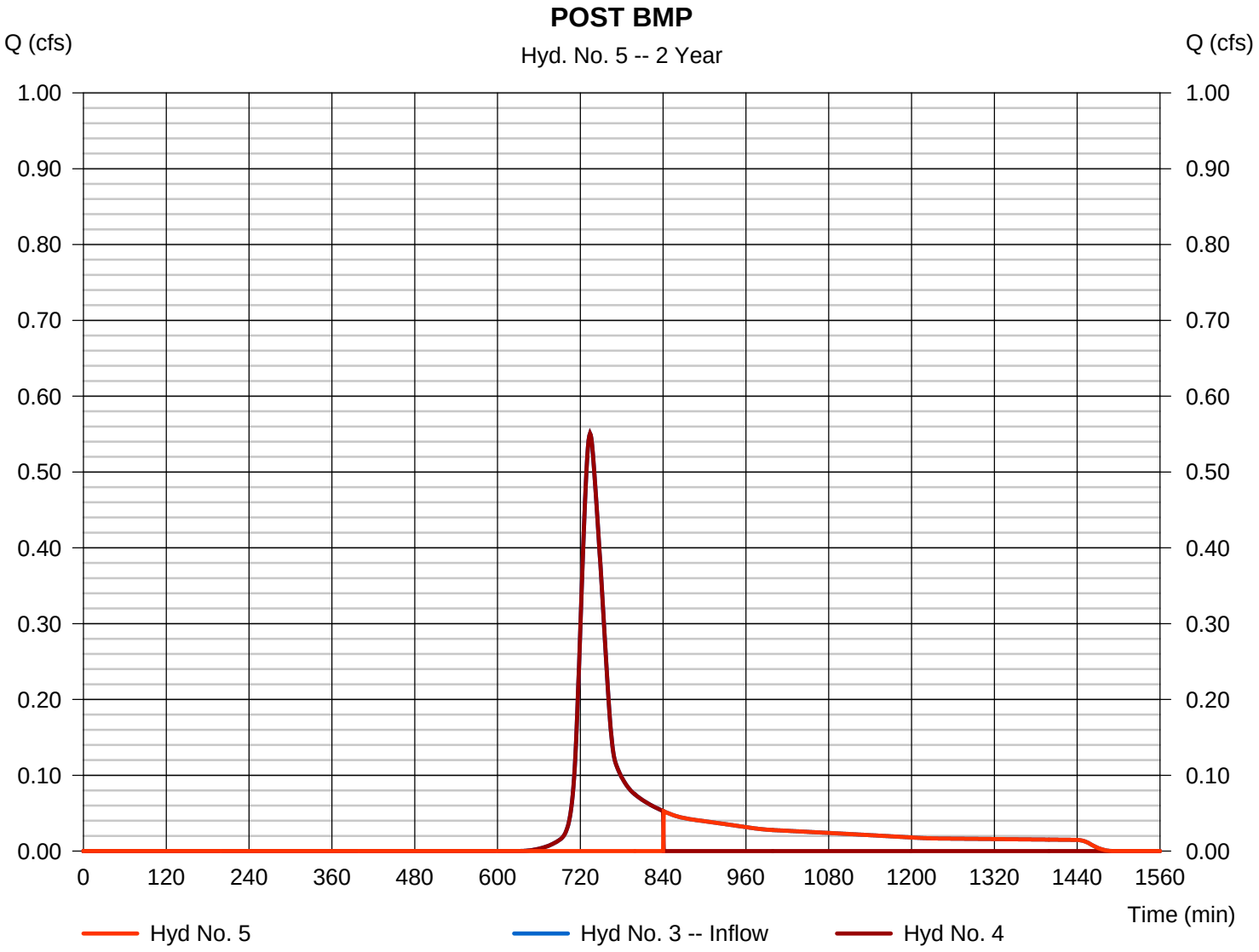


Hydrograph Report

Hyd. No. 5

POST BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.052 cfs
Storm frequency	= 2 yrs	Time to peak	= 841 min
Time interval	= 1 min	Hyd. volume	= 882 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

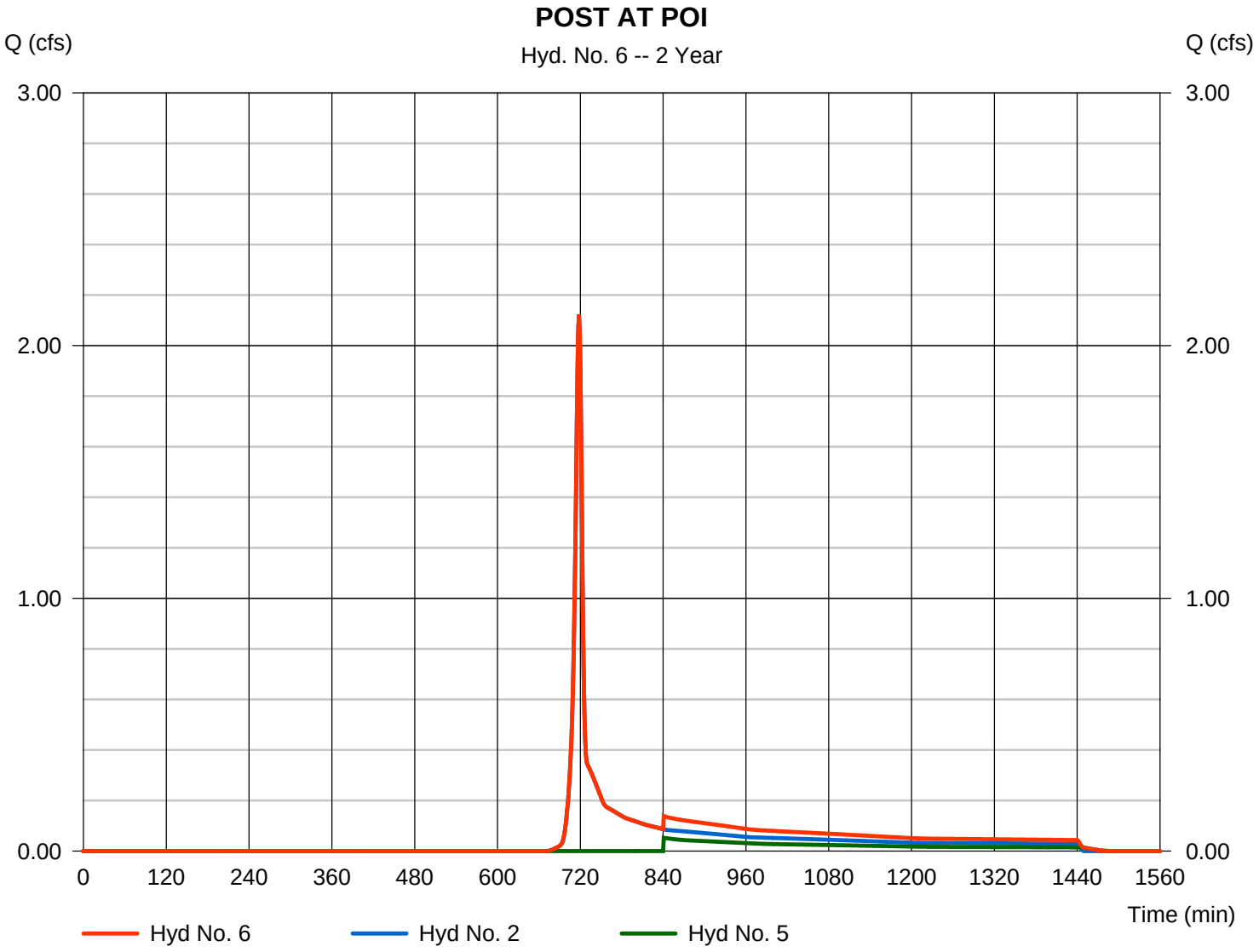


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	2.122 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	5,237 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	1.510 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	40.5844	9.9000	0.8792	--------
2	49.9040	10.3000	0.8805	--------
3	0.0000	0.0000	0.0000	--------
5	51.9125	9.7000	0.8350	--------
10	47.0214	8.3000	0.7778	--------
25	48.3751	7.7000	0.7431	--------
50	44.2417	6.5000	0.6943	--------
100	42.8775	5.7000	0.6607	--------

File name: Raystown East 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	3.78	2.93	2.40	2.05	1.79	1.59	1.43	1.30	1.20	1.11	1.04	0.97
2	4.52	3.52	2.90	2.48	2.16	1.93	1.74	1.58	1.46	1.35	1.26	1.18
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	5.50	4.31	3.57	3.06	2.69	2.40	2.17	1.99	1.84	1.71	1.60	1.50
10	6.28	4.90	4.06	3.49	3.08	2.76	2.51	2.30	2.13	1.99	1.87	1.76
25	7.32	5.72	4.75	4.10	3.62	3.26	2.97	2.74	2.54	2.38	2.23	2.11
50	8.12	6.32	5.26	4.55	4.03	3.64	3.33	3.08	2.87	2.69	2.53	2.40
100	8.96	6.95	5.79	5.02	4.46	4.04	3.70	3.43	3.20	3.01	2.84	2.70

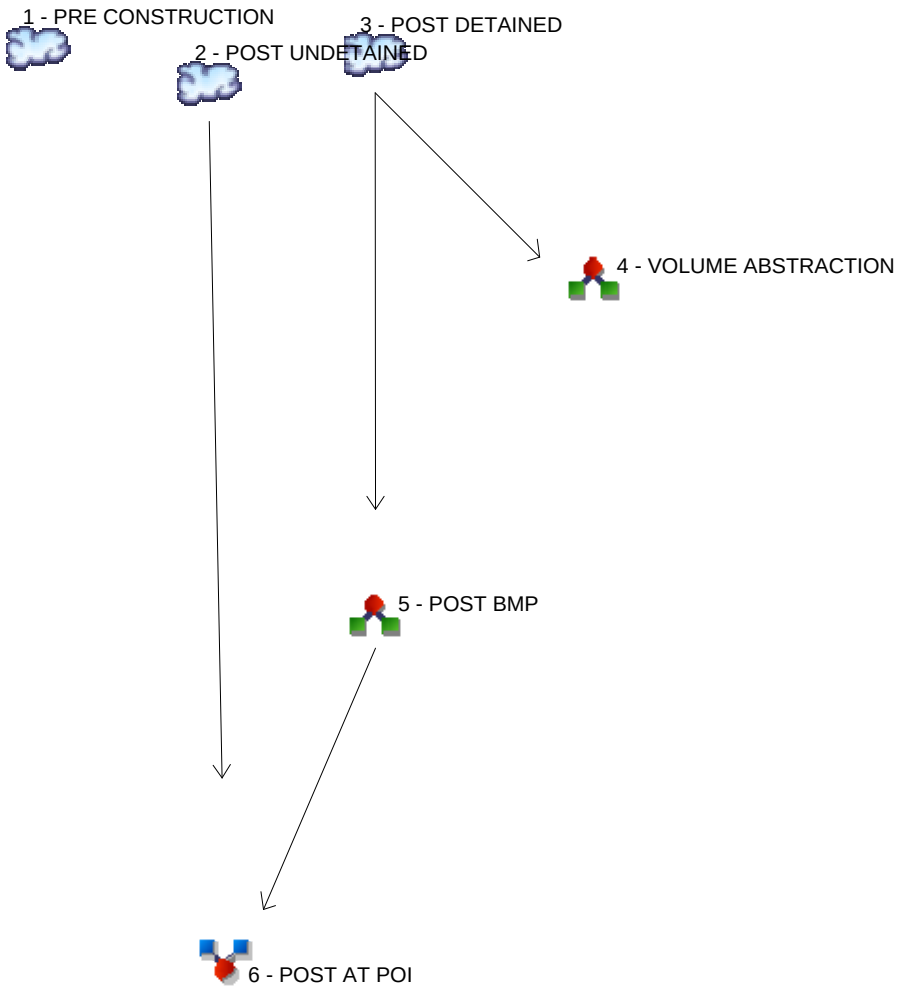
Tc = time in minutes. Values may exceed 60.

RO\07 PCSM\Attach 4 Stormwater Calcs\Happy Hills (Raystown Lake East)\Hydraflow Rev 1\Raystown East 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	4.69	5.36	6.08
SCS 6-Hr	1.50	1.80	0.00	2.25	2.63	3.16	3.61	4.09
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 CONSTRUCTION
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED
4	Diversion1	VOLUME ABSTRACTION
5	Diversion2	POST BMP
6	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	------	-------	-------	-------	-------	6.560	-------	-------	-------	PRE CONSTRUCTION
2	SCS Runoff	------	-------	-------	-------	-------	4.482	-------	-------	-------	POST UNDETAINED
3	SCS Runoff	------	-------	-------	-------	-------	1.463	-------	-------	-------	POST DETAINED
4	Diversion1	3	-------	-------	-------	-------	1.463	-------	-------	-------	VOLUME ABSTRACTION
5	Diversion2	3	-------	-------	-------	-------	1.353	-------	-------	-------	POST BMP
6	Combine	2, 5	-------	-------	-------	-------	4.482	-------	-------	-------	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	6.560	1	718	13,171	------	------	------	PRE CONSTRUCTION
2	SCS Runoff	4.482	1	718	8,999	------	------	------	POST UNDETAINED
3	SCS Runoff	1.463	1	726	4,830	------	------	------	POST DETAINED
4	Diversion1	1.463	1	726	1,616	3	------	------	VOLUME ABSTRACTION
5	Diversion2	1.353	1	730	3,214	3	------	------	POST BMP
6	Combine	4.482	1	718	12,213	2, 5	------	------	POST AT POI

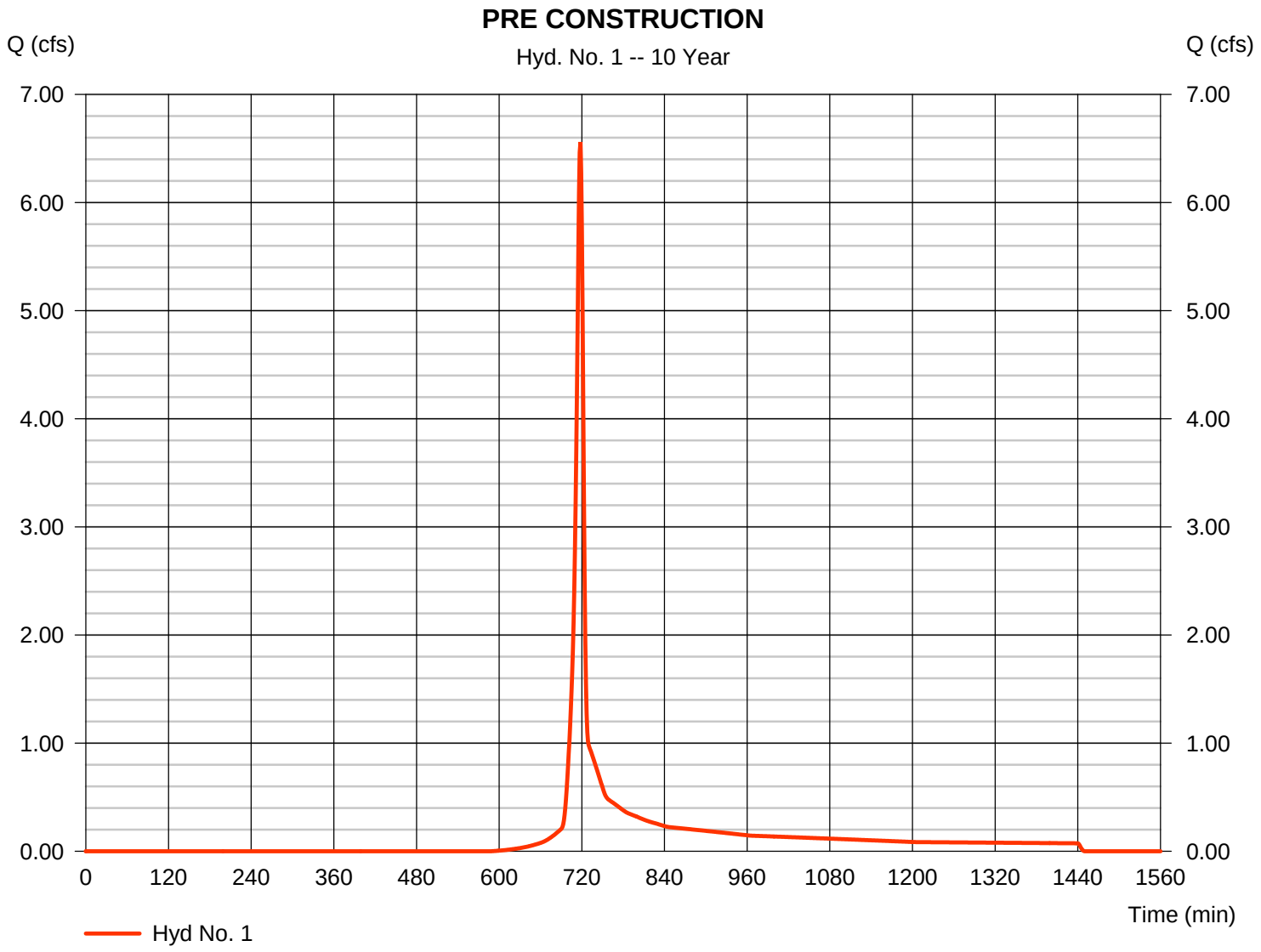
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.560 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	13,171 cuft
Drainage area	=	2.210 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	3.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.165 x 55) + (1.754 x 77) + (0.292 x 78)] / 2.210



TR55 Tc Worksheet

Hyd. No. 1

PRE CONSTRUCTION

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 (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.12**	**+**	**0.00**	**+**	**0.00**	**=**	**5.12**
Shallow Concentrated Flow							
Flow length (ft)	= 507.00		0.00		0.00		
Watercourse slope (%)	= 14.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.12		0.00		0.00		
Travel Time (min)	**= 1.38**	**+**	**0.00**	**+**	**0.00**	**=**	**1.38**
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 ..... 6.50 min

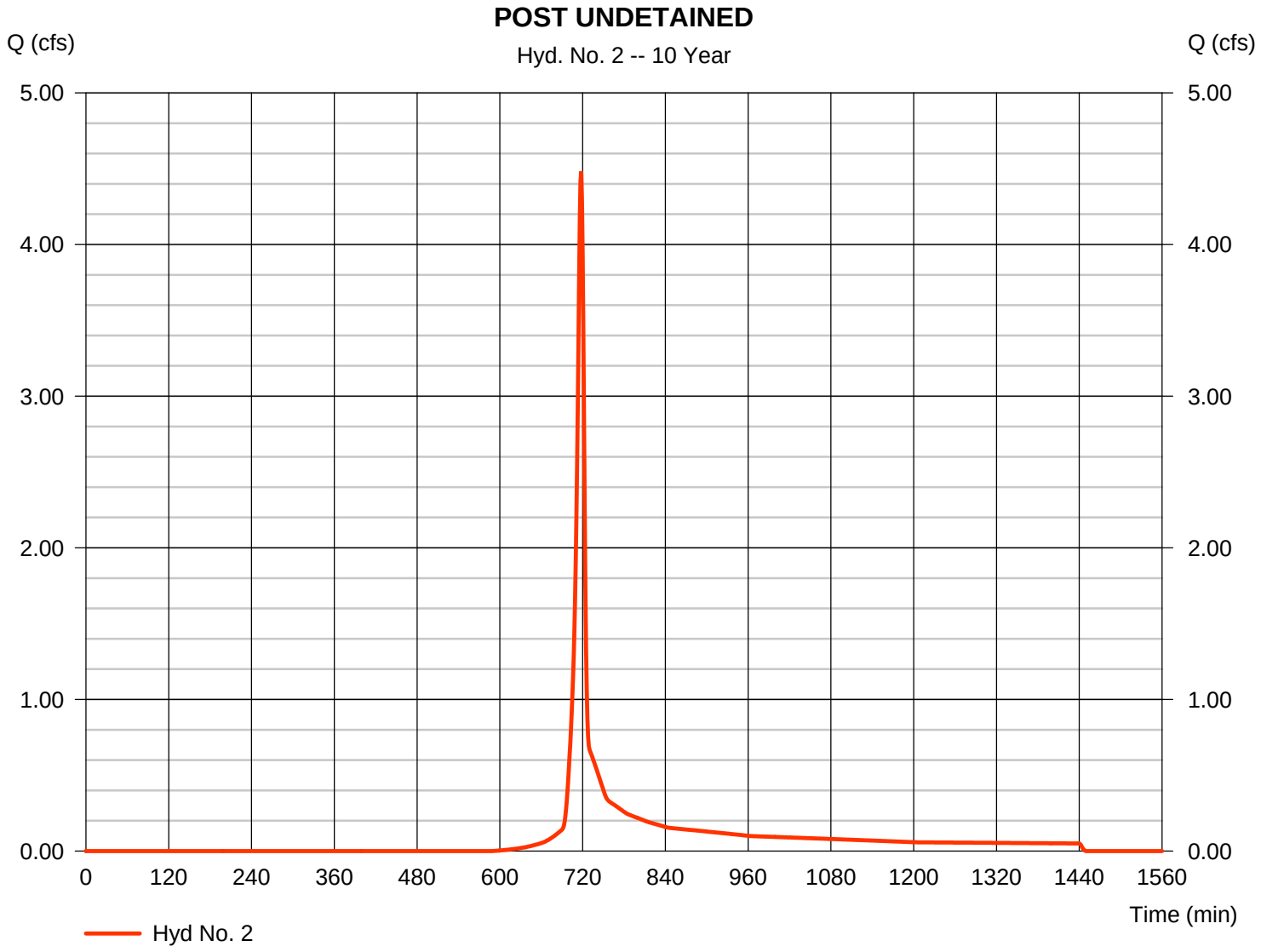
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.482 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	8,999 cuft
Drainage area	=	1.510 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	3.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = + (0.140 x 55) + (1.090 x 77) + (0.260 x 78) + (0.020 x 91)] / 1.510



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 (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.12**	**+**	**0.00**	**+**	**0.00**	**=**	**5.12**
Shallow Concentrated Flow							
Flow length (ft)	= 507.00		0.00		0.00		
Watercourse slope (%)	= 14.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.12		0.00		0.00		
Travel Time (min)	**= 1.38**	**+**	**0.00**	**+**	**0.00**	**=**	**1.38**
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 ..... 6.50 min

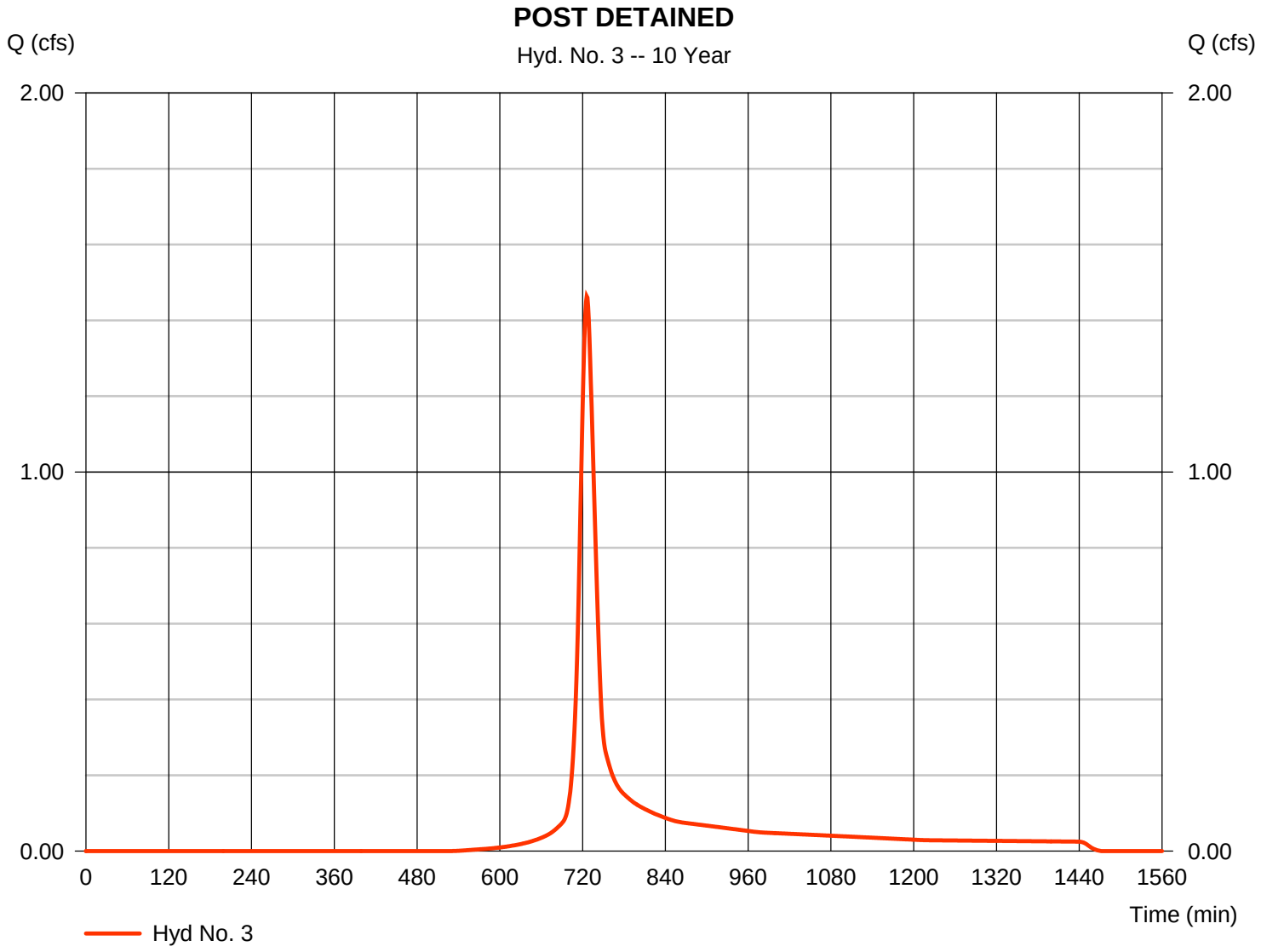
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.463 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	4,830 cuft
Drainage area	=	0.700 ac	Curve number	=	79*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	20.81 min
Total precip.	=	3.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.147 x 91) + (0.039 x 55) + (0.255 x 77) + (0.261 x 78)] / 0.700

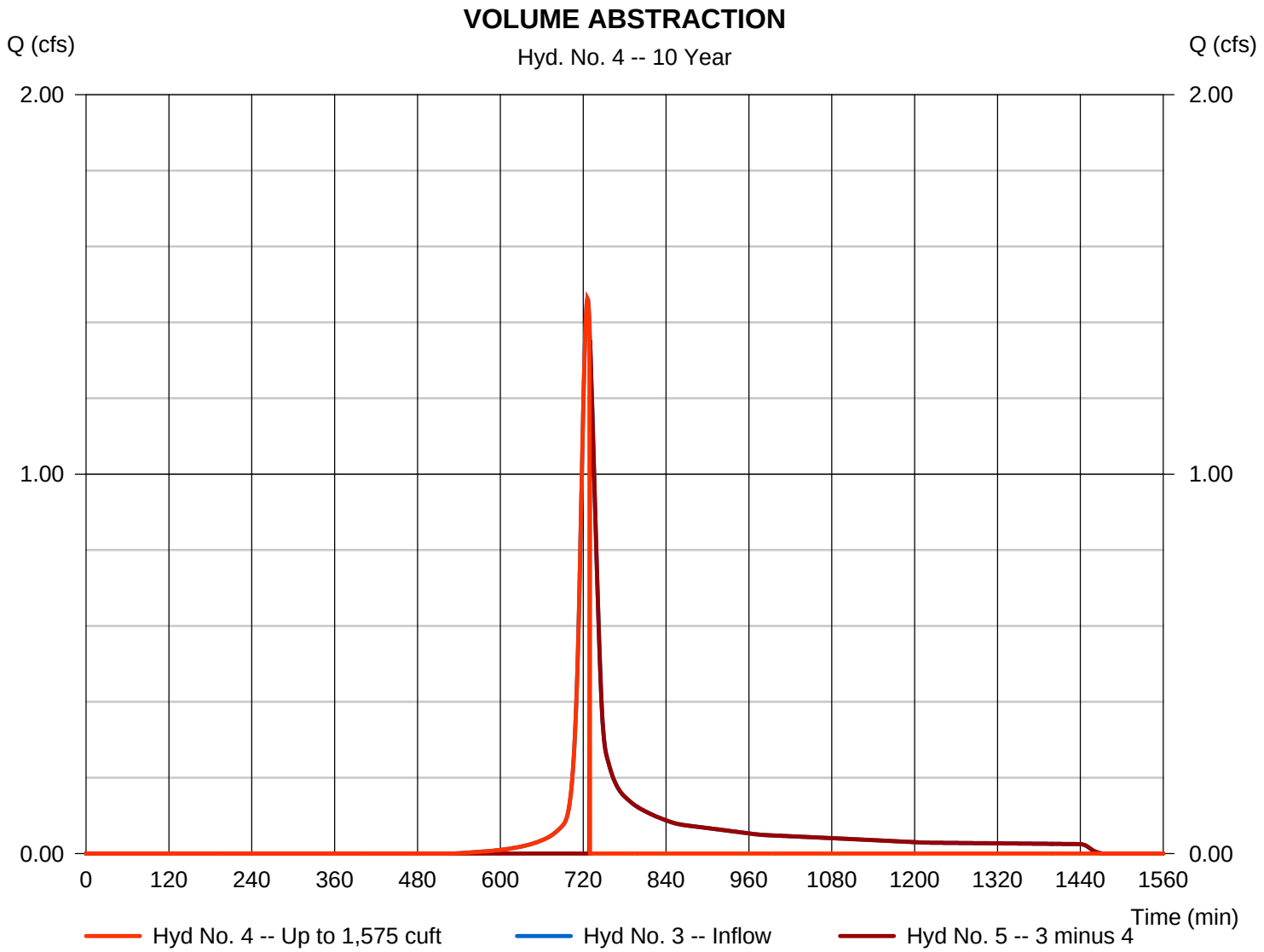


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.463 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 1,616 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

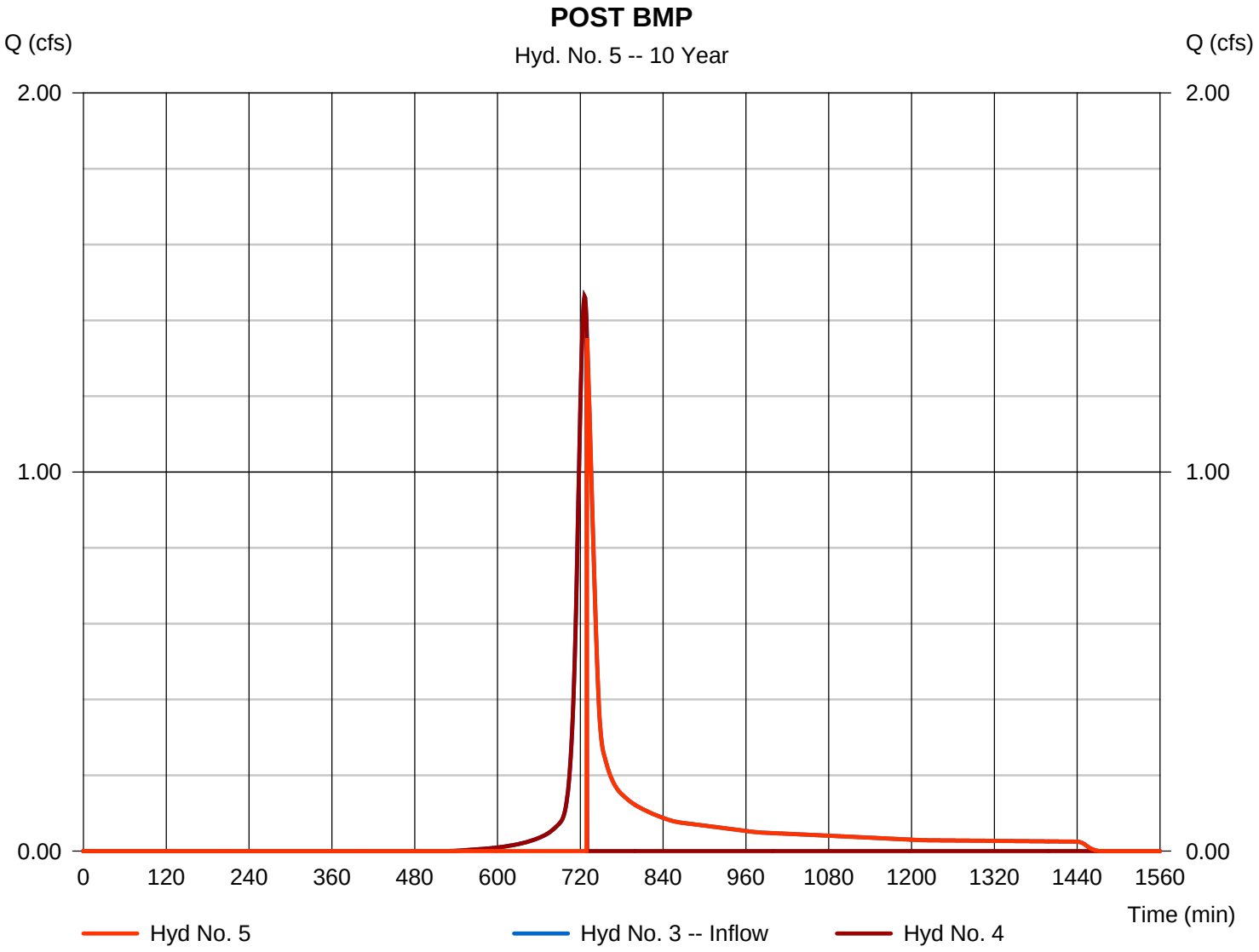


Hydrograph Report

Hyd. No. 5

POST BMP

Hydrograph type	= Diversion2	Peak discharge	= 1.353 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 1 min	Hyd. volume	= 3,214 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

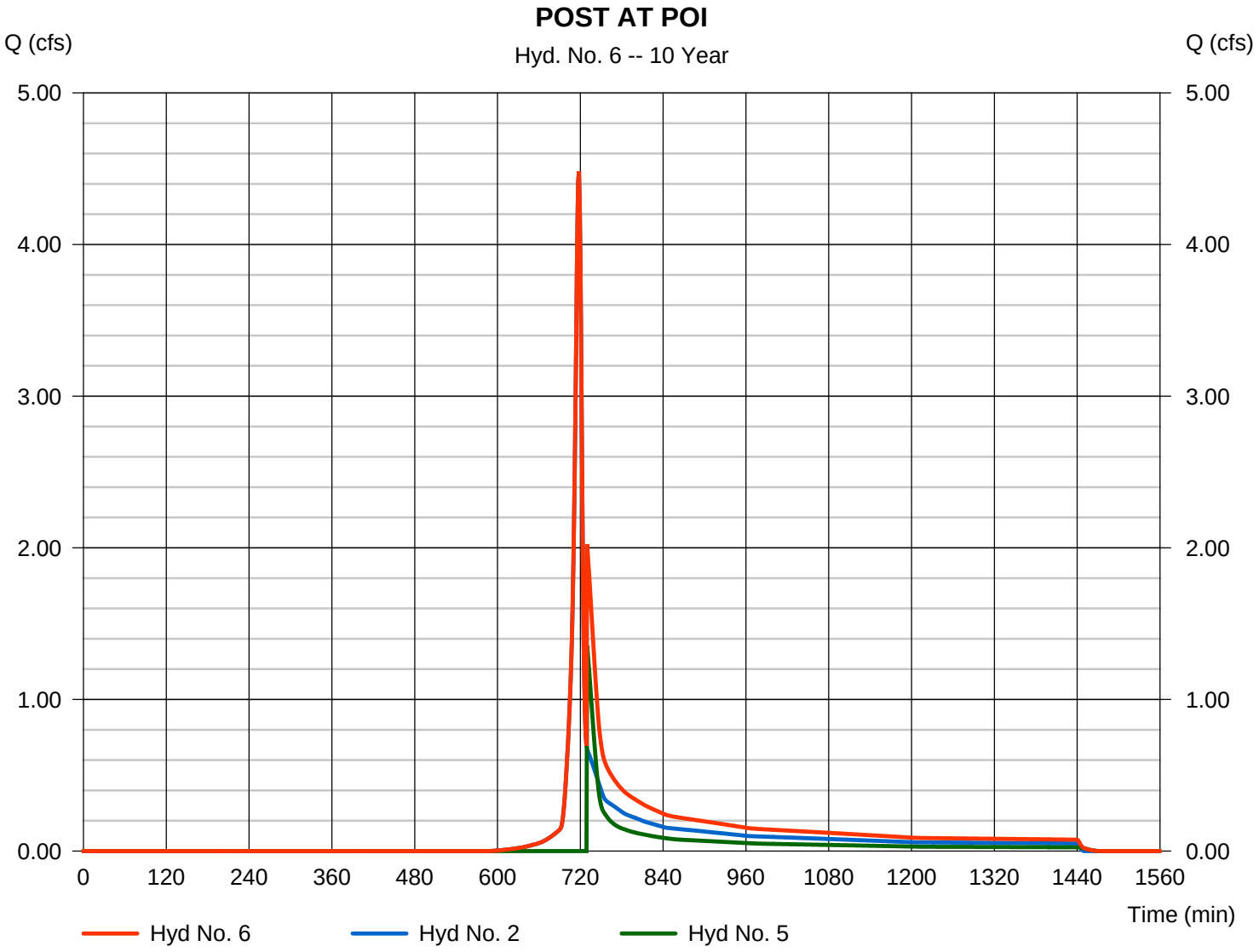


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	4.482 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	12,213 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	1.510 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	40.5844	9.9000	0.8792	--------
2	49.9040	10.3000	0.8805	--------
3	0.0000	0.0000	0.0000	--------
5	51.9125	9.7000	0.8350	--------
10	47.0214	8.3000	0.7778	--------
25	48.3751	7.7000	0.7431	--------
50	44.2417	6.5000	0.6943	--------
100	42.8775	5.7000	0.6607	--------

File name: Raystown East 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	3.78	2.93	2.40	2.05	1.79	1.59	1.43	1.30	1.20	1.11	1.04	0.97
2	4.52	3.52	2.90	2.48	2.16	1.93	1.74	1.58	1.46	1.35	1.26	1.18
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	5.50	4.31	3.57	3.06	2.69	2.40	2.17	1.99	1.84	1.71	1.60	1.50
10	6.28	4.90	4.06	3.49	3.08	2.76	2.51	2.30	2.13	1.99	1.87	1.76
25	7.32	5.72	4.75	4.10	3.62	3.26	2.97	2.74	2.54	2.38	2.23	2.11
50	8.12	6.32	5.26	4.55	4.03	3.64	3.33	3.08	2.87	2.69	2.53	2.40
100	8.96	6.95	5.79	5.02	4.46	4.04	3.70	3.43	3.20	3.01	2.84	2.70

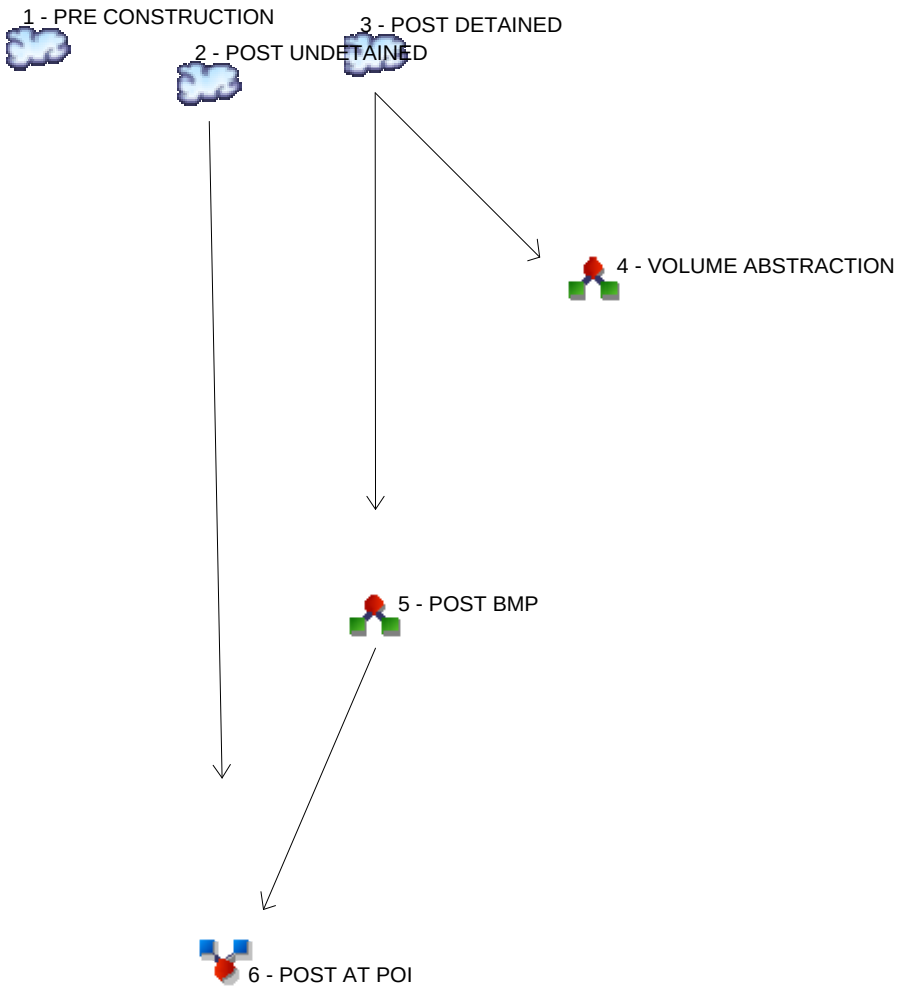
Tc = time in minutes. Values may exceed 60.

RO\07 PCSM\Attach 4 Stormwater Calcs\Happy Hills (Raystown Lake East)\Hydraflow Rev 1\Raystown East 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	4.69	5.36	6.08
SCS 6-Hr	1.50	1.80	0.00	2.25	2.63	3.16	3.61	4.09
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 CONSTRUCTION
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED
4	Diversion1	VOLUME ABSTRACTION
5	Diversion2	POST BMP
6	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	------	-------	-------	-------	-------	-------	-------	11.22	-------	PRE CONSTRUCTION
2	SCS Runoff	------	-------	-------	-------	-------	-------	-------	7.667	-------	POST UNDETAINED
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	2.806	-------	POST DETAINED
4	Diversion1	3	-------	-------	-------	-------	-------	-------	1.938	-------	VOLUME ABSTRACTION
5	Diversion2	3	-------	-------	-------	-------	-------	-------	2.806	-------	POST BMP
6	Combine	2, 5	-------	-------	-------	-------	-------	-------	9.979	-------	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	11.22	1	718	22,703	------	------	------	PRE CONSTRUCTION
2	SCS Runoff	7.667	1	718	15,512	------	------	------	POST UNDETAINED
3	SCS Runoff	2.806	1	723	8,012	------	------	------	POST DETAINED
4	Diversion1	1.938	1	716	1,607	3	------	------	VOLUME ABSTRACTION
5	Diversion2	2.806	1	723	6,405	3	------	------	POST BMP
6	Combine	9.979	1	718	21,917	2, 5	------	------	POST AT POI

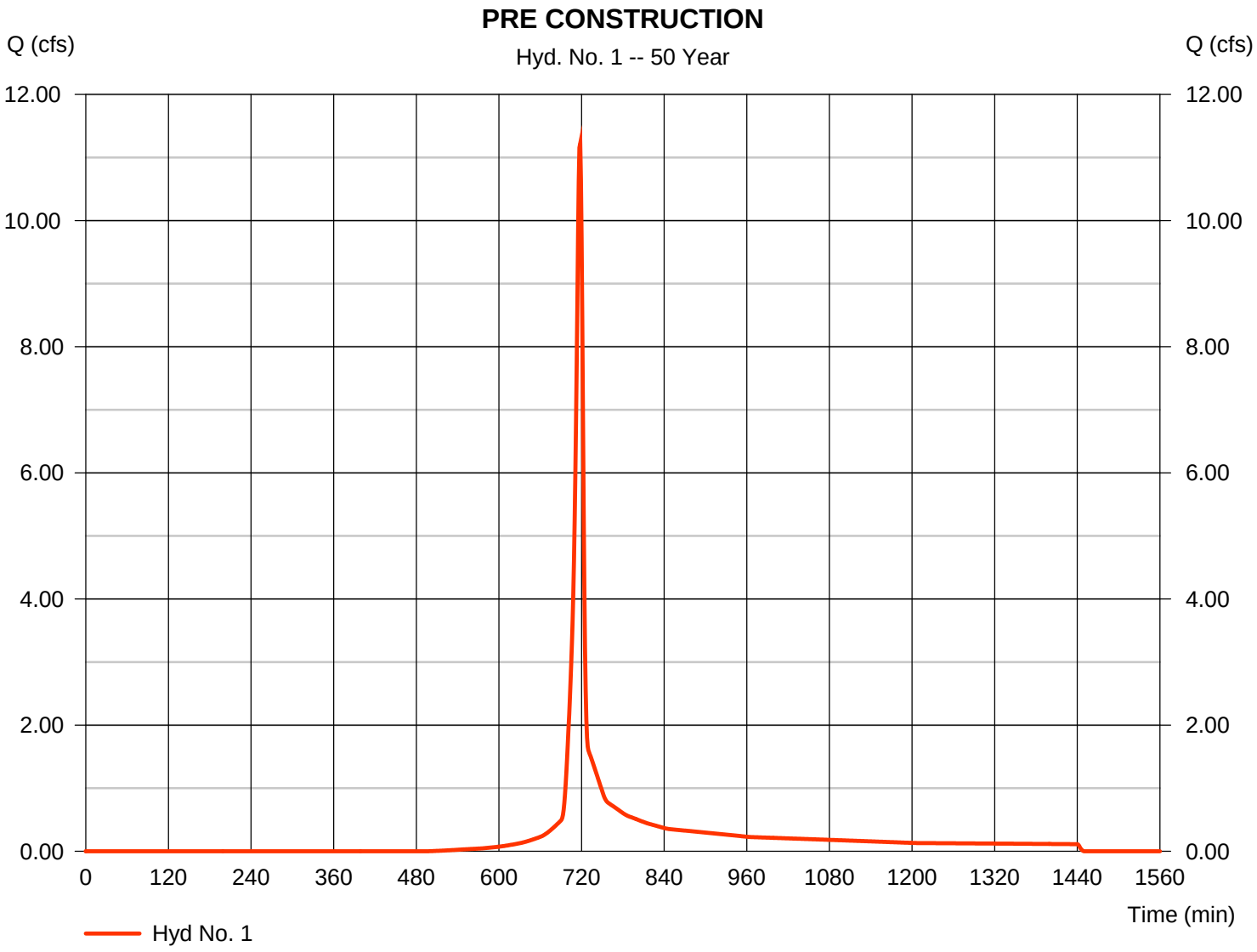
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.22 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	22,703 cuft
Drainage area	=	2.210 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	5.36 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.165 x 55) + (1.754 x 77) + (0.292 x 78)] / 2.210



TR55 Tc Worksheet

Hyd. No. 1

PRE CONSTRUCTION

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 (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.12**	**+**	**0.00**	**+**	**0.00**	**=**	**5.12**
Shallow Concentrated Flow							
Flow length (ft)	= 507.00		0.00		0.00		
Watercourse slope (%)	= 14.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.12		0.00		0.00		
Travel Time (min)	**= 1.38**	**+**	**0.00**	**+**	**0.00**	**=**	**1.38**
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 ..... 6.50 min

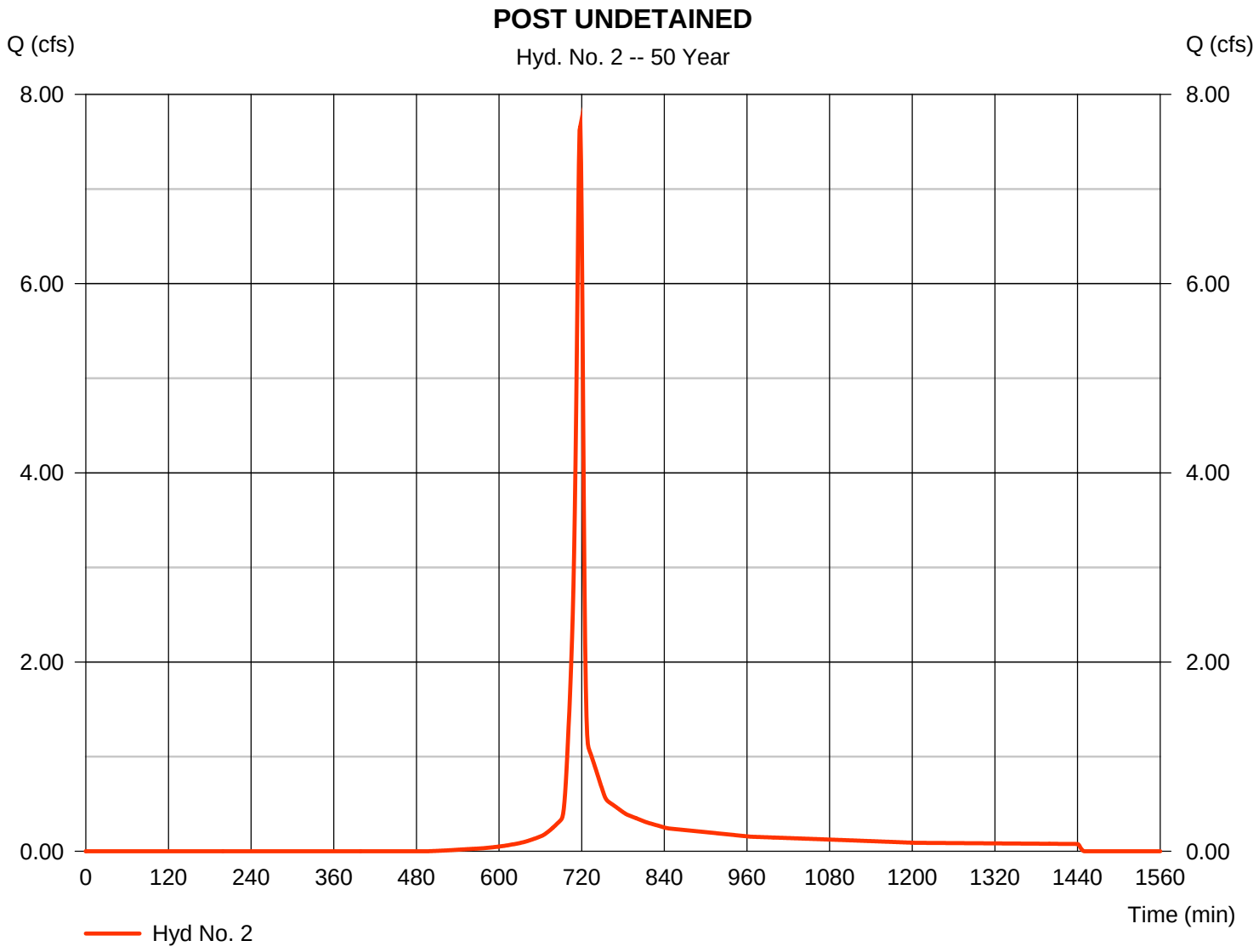
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.667 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	15,512 cuft
Drainage area	=	1.510 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	5.36 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = + (0.140 x 55) + (1.090 x 77) + (0.260 x 78) + (0.020 x 91)] / 1.510



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 (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.12**	**+**	**0.00**	**+**	**0.00**	**=**	**5.12**
Shallow Concentrated Flow							
Flow length (ft)	= 507.00		0.00		0.00		
Watercourse slope (%)	= 14.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.12		0.00		0.00		
Travel Time (min)	**= 1.38**	**+**	**0.00**	**+**	**0.00**	**=**	**1.38**
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 ..... 6.50 min

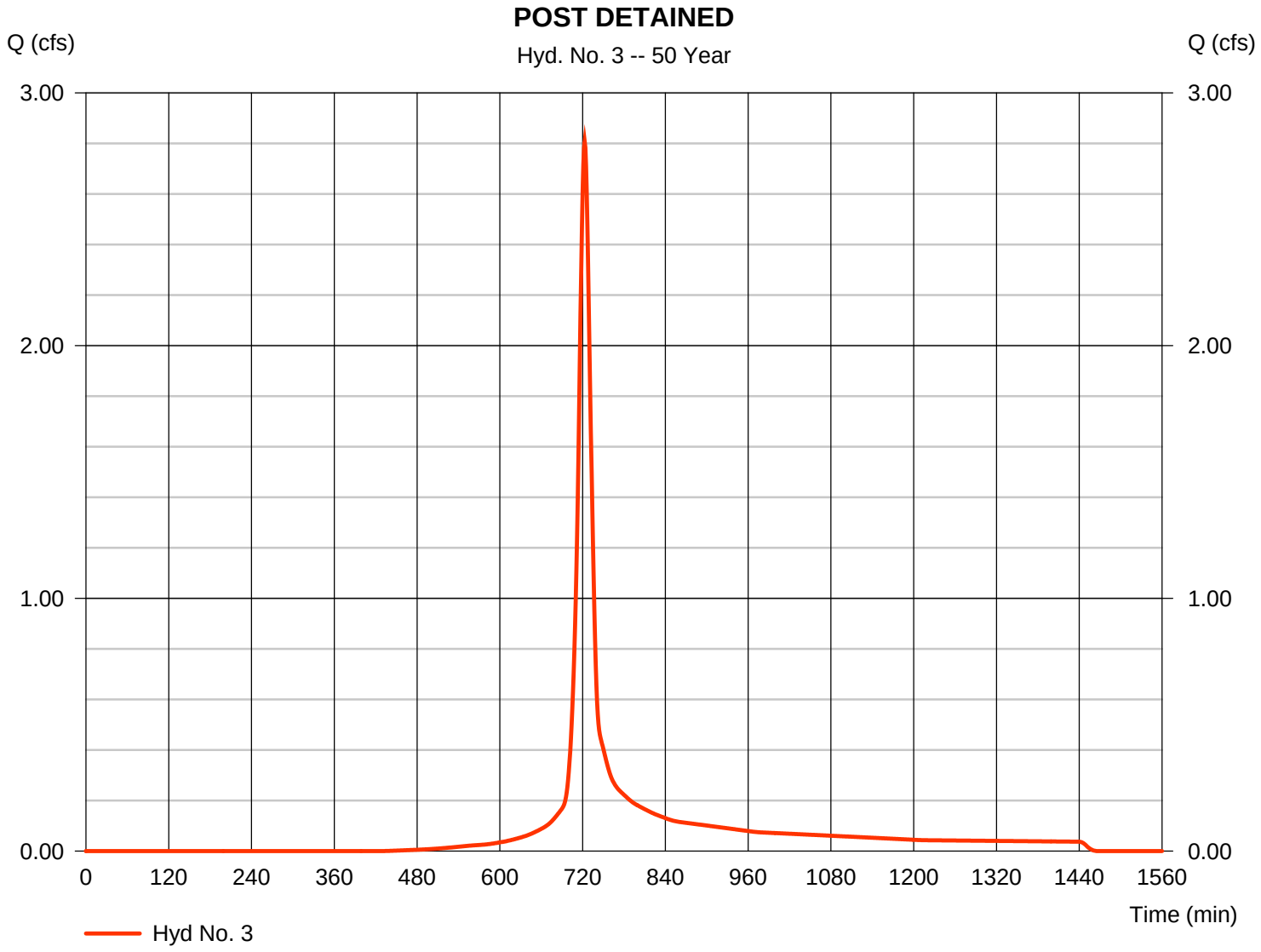
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.806 cfs
Storm frequency	=	50 yrs	Time to peak	=	723 min
Time interval	=	1 min	Hyd. volume	=	8,012 cuft
Drainage area	=	0.700 ac	Curve number	=	79*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.95 min
Total precip.	=	5.36 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.147 x 91) + (0.039 x 55) + (0.255 x 77) + (0.261 x 78)] / 0.700

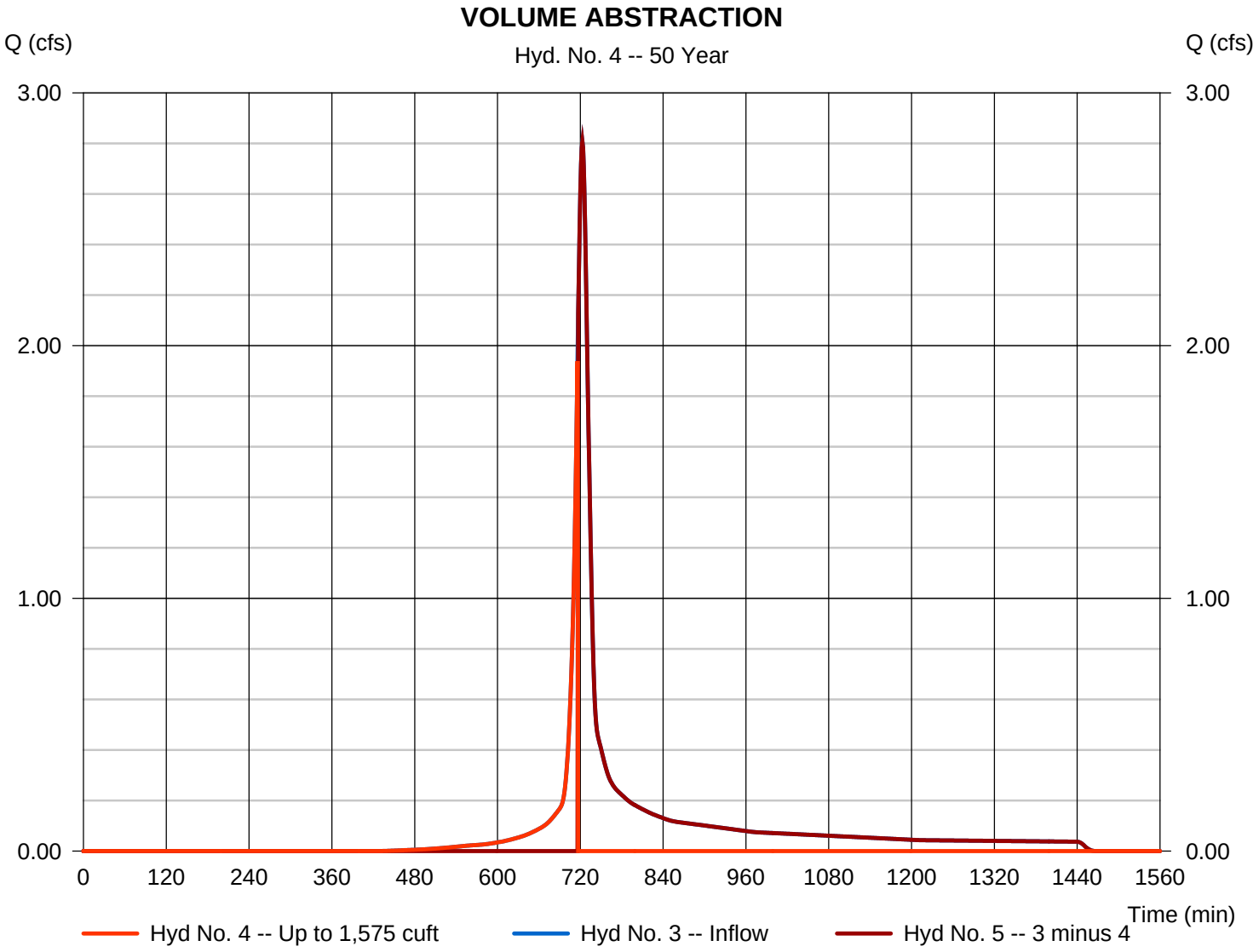


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.938 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 1 min	Hyd. volume	= 1,607 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

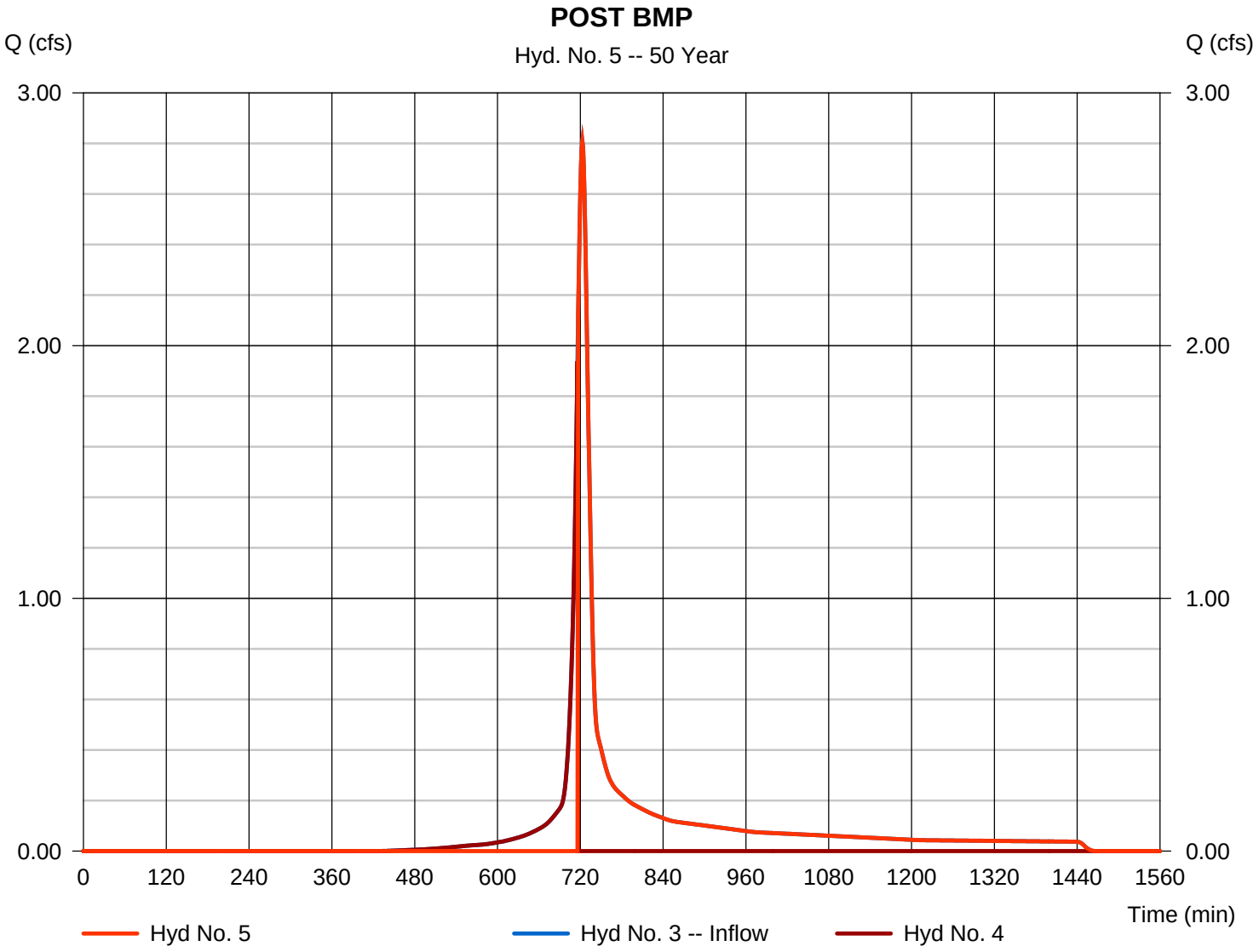


Hydrograph Report

Hyd. No. 5

POST BMP

Hydrograph type	= Diversion2	Peak discharge	= 2.806 cfs
Storm frequency	= 50 yrs	Time to peak	= 723 min
Time interval	= 1 min	Hyd. volume	= 6,405 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

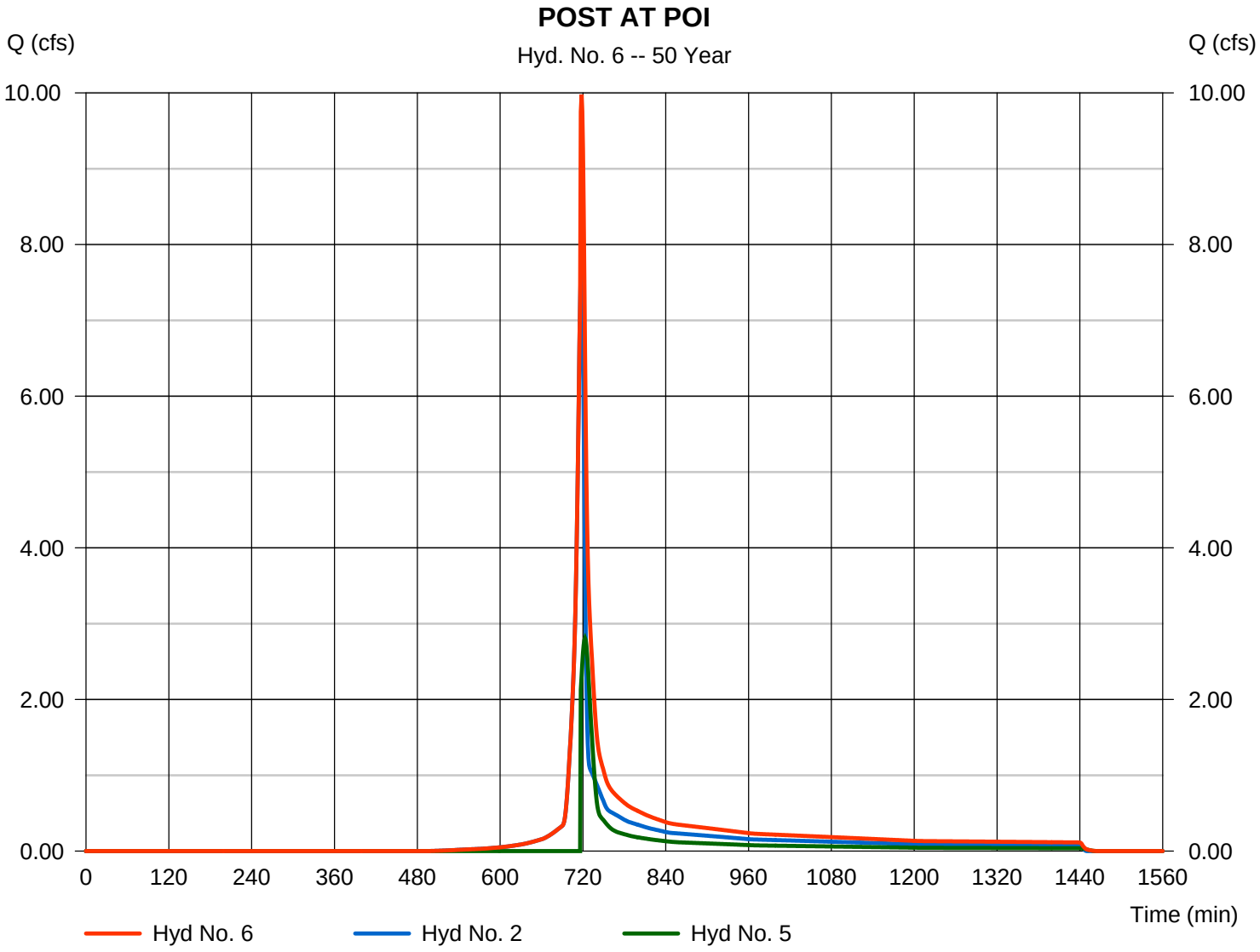


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	9.979 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	21,917 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	1.510 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	40.5844	9.9000	0.8792	--------
2	49.9040	10.3000	0.8805	--------
3	0.0000	0.0000	0.0000	--------
5	51.9125	9.7000	0.8350	--------
10	47.0214	8.3000	0.7778	--------
25	48.3751	7.7000	0.7431	--------
50	44.2417	6.5000	0.6943	--------
100	42.8775	5.7000	0.6607	--------

File name: Raystown East 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	3.78	2.93	2.40	2.05	1.79	1.59	1.43	1.30	1.20	1.11	1.04	0.97
2	4.52	3.52	2.90	2.48	2.16	1.93	1.74	1.58	1.46	1.35	1.26	1.18
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	5.50	4.31	3.57	3.06	2.69	2.40	2.17	1.99	1.84	1.71	1.60	1.50
10	6.28	4.90	4.06	3.49	3.08	2.76	2.51	2.30	2.13	1.99	1.87	1.76
25	7.32	5.72	4.75	4.10	3.62	3.26	2.97	2.74	2.54	2.38	2.23	2.11
50	8.12	6.32	5.26	4.55	4.03	3.64	3.33	3.08	2.87	2.69	2.53	2.40
100	8.96	6.95	5.79	5.02	4.46	4.04	3.70	3.43	3.20	3.01	2.84	2.70

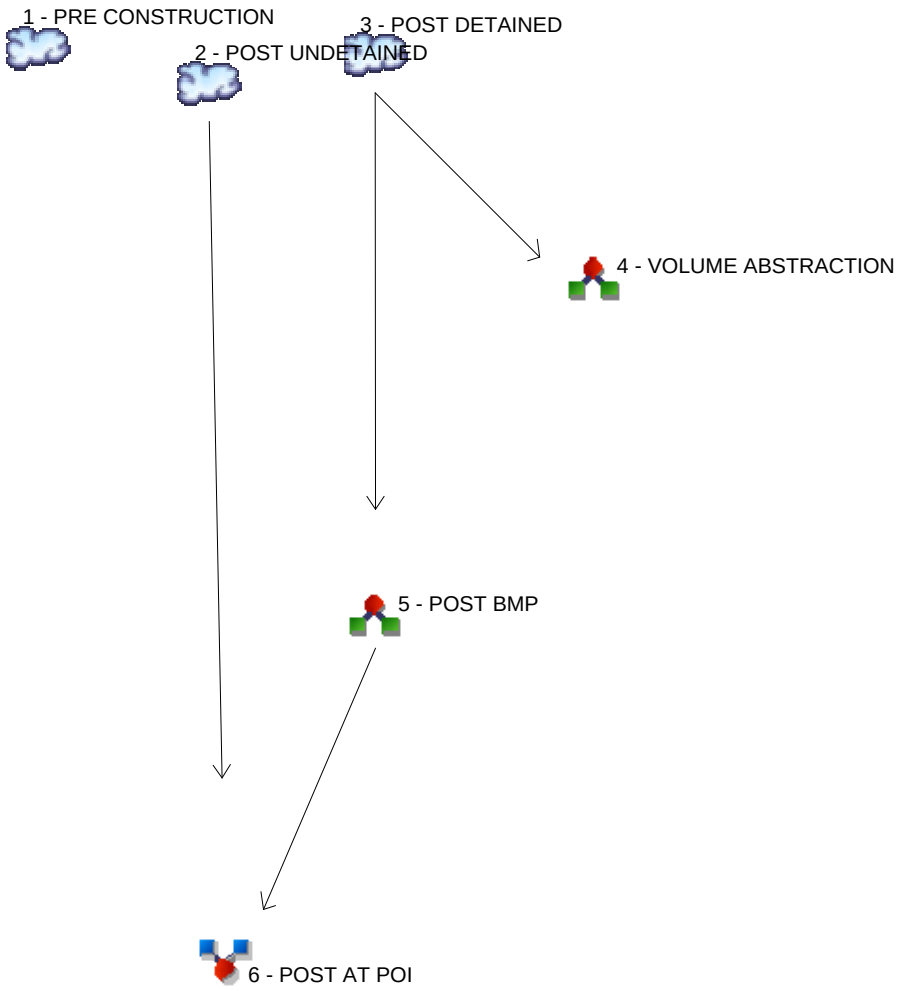
Tc = time in minutes. Values may exceed 60.

RO\07 PCSM\Attach 4 Stormwater Calcs\Happy Hills (Raystown Lake East)\Hydraflow Rev 1\Raystown East 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	4.69	5.36	6.08
SCS 6-Hr	1.50	1.80	0.00	2.25	2.63	3.16	3.61	4.09
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 CONSTRUCTION
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED
4	Diversion1	VOLUME ABSTRACTION
5	Diversion2	POST BMP
6	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	------	-------	-------	-------	-------	-------	-------	-------	13.61	PRE CONSTRUCTION
2	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	9.299	POST UNDETAINED
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	3.523	POST DETAINED
4	Diversion1	3	-------	-------	-------	-------	-------	-------	-------	1.513	VOLUME ABSTRACTION
5	Diversion2	3	-------	-------	-------	-------	-------	-------	-------	3.523	POST BMP
6	Combine	2, 5	-------	-------	-------	-------	-------	-------	-------	12.37	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	13.61	1	718	27,717	------	------	------	PRE CONSTRUCTION
2	SCS Runoff	9.299	1	718	18,938	------	------	------	POST UNDETAINED
3	SCS Runoff	3.523	1	722	9,532	------	------	------	POST DETAINED
4	Diversion1	1.513	1	711	1,576	3	------	------	VOLUME ABSTRACTION
5	Diversion2	3.523	1	722	7,955	3	------	------	POST BMP
6	Combine	12.37	1	718	26,893	2, 5	------	------	POST AT POI

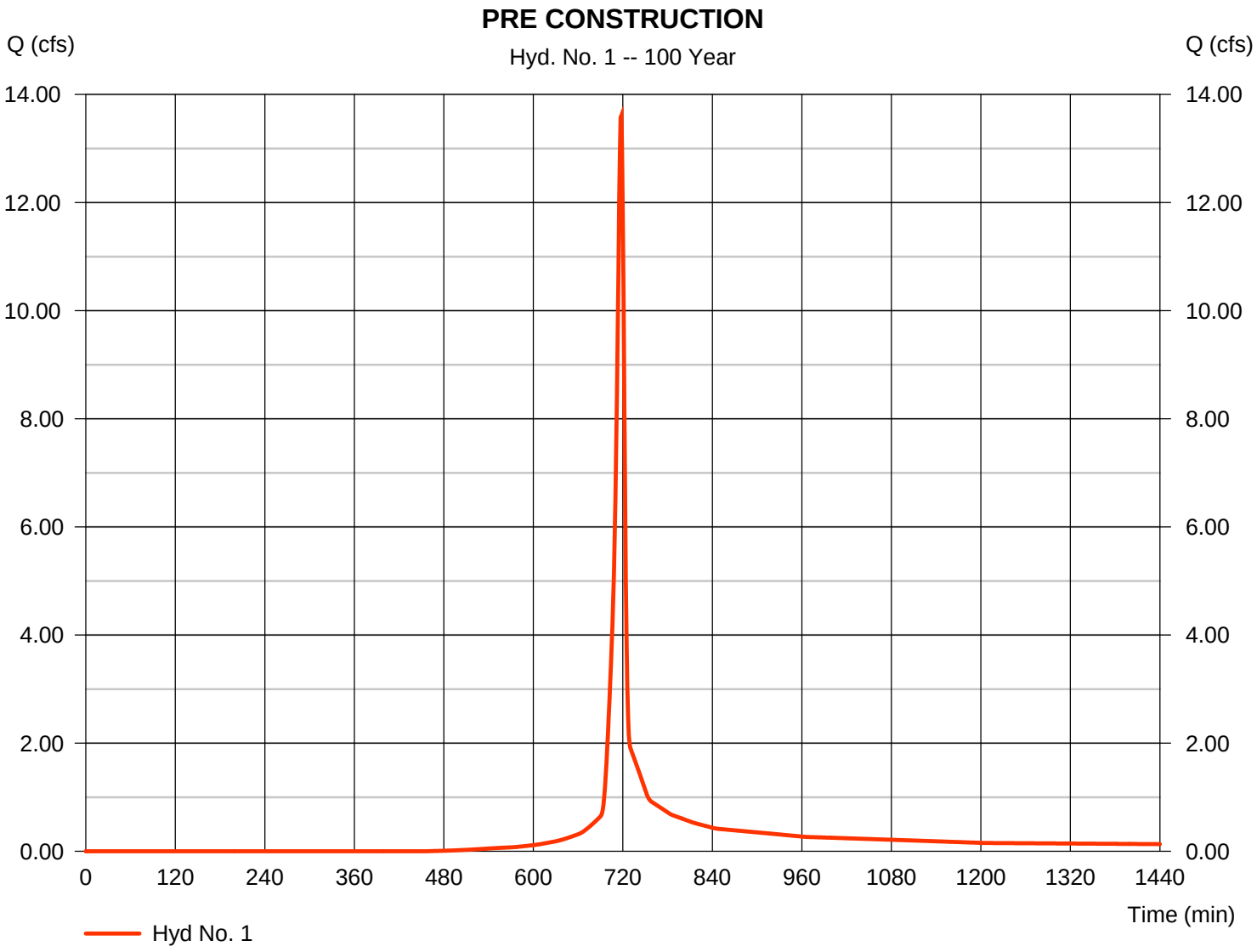
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.61 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	27,717 cuft
Drainage area	=	2.210 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	6.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.165 x 55) + (1.754 x 77) + (0.292 x 78)] / 2.210



TR55 Tc Worksheet

Hyd. No. 1

PRE CONSTRUCTION

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 (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.12**	**+**	**0.00**	**+**	**0.00**	**=**	**5.12**
Shallow Concentrated Flow							
Flow length (ft)	= 507.00		0.00		0.00		
Watercourse slope (%)	= 14.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.12		0.00		0.00		
Travel Time (min)	**= 1.38**	**+**	**0.00**	**+**	**0.00**	**=**	**1.38**
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 ..... 6.50 min

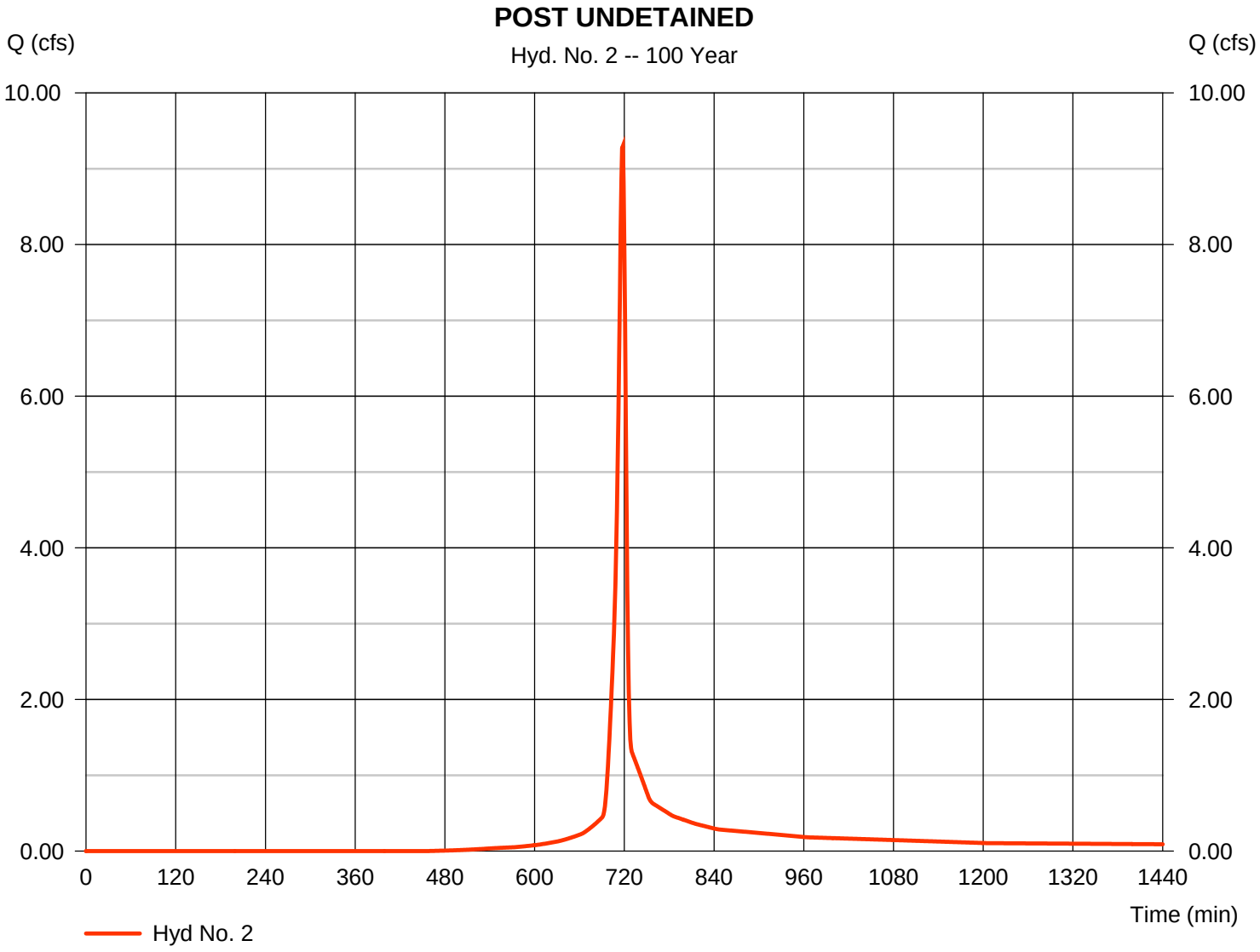
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.299 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	1 min	Hyd. volume	=	18,938 cuft
Drainage area	=	1.510 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	6.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = + (0.140 x 55) + (1.090 x 77) + (0.260 x 78) + (0.020 x 91)] / 1.510



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 (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.12**	**+**	**0.00**	**+**	**0.00**	**=**	**5.12**
Shallow Concentrated Flow							
Flow length (ft)	= 507.00		0.00		0.00		
Watercourse slope (%)	= 14.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.12		0.00		0.00		
Travel Time (min)	**= 1.38**	**+**	**0.00**	**+**	**0.00**	**=**	**1.38**
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 ..... 6.50 min

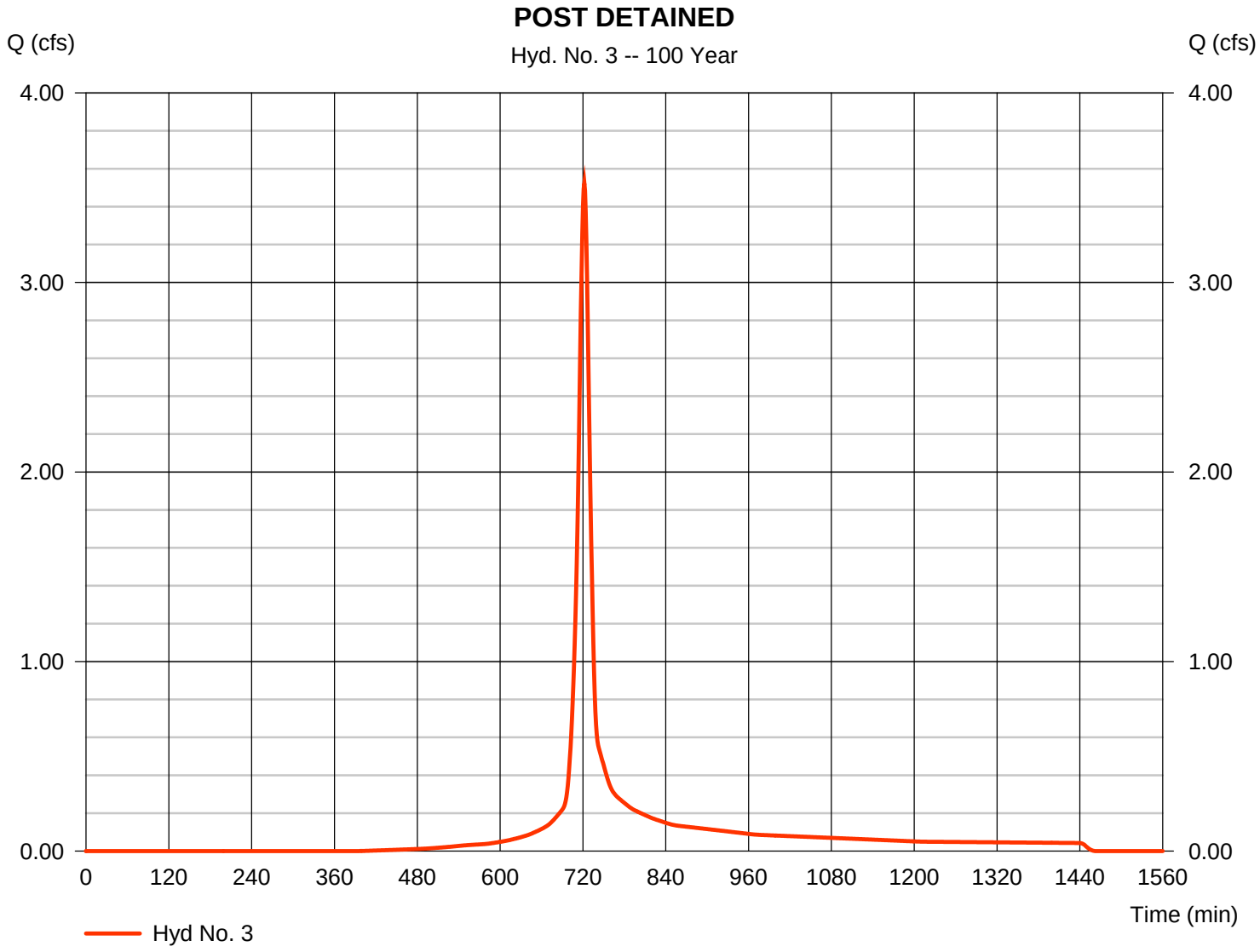
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.523 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	1 min	Hyd. volume	=	9,532 cuft
Drainage area	=	0.700 ac	Curve number	=	79*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	14.71 min
Total precip.	=	6.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.147 x 91) + (0.039 x 55) + (0.255 x 77) + (0.261 x 78)] / 0.700

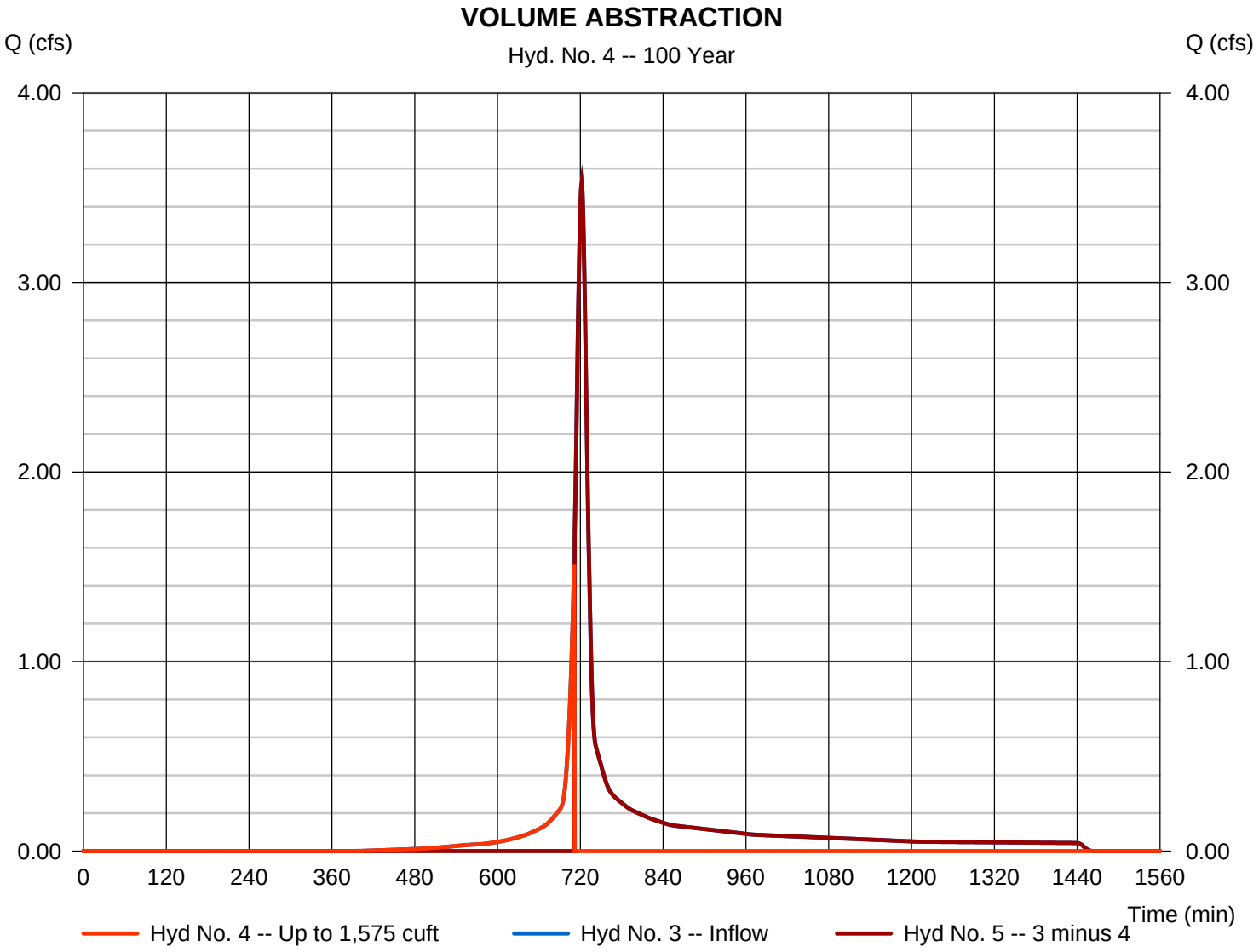


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.513 cfs
Storm frequency	= 100 yrs	Time to peak	= 711 min
Time interval	= 1 min	Hyd. volume	= 1,576 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

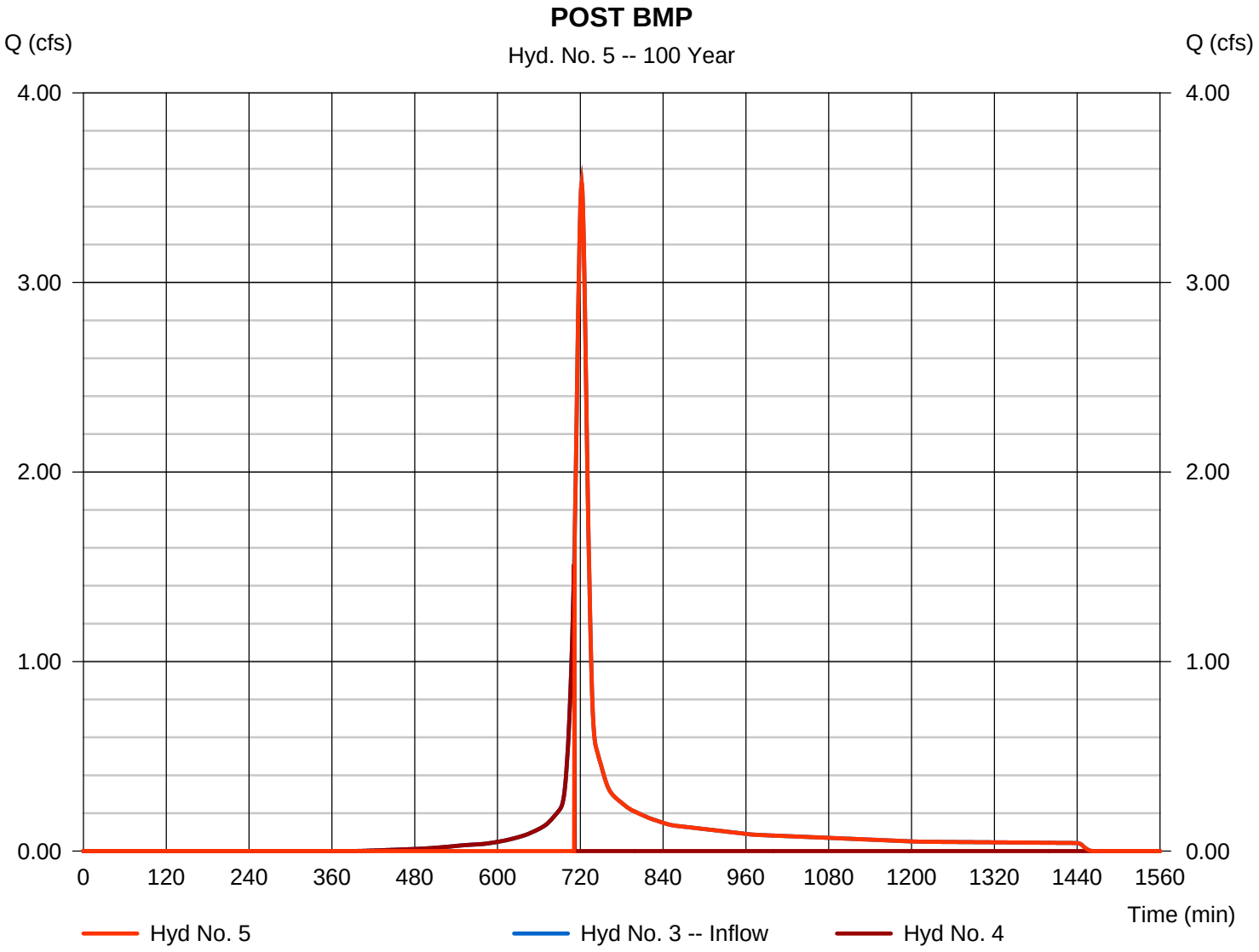


Hydrograph Report

Hyd. No. 5

POST BMP

Hydrograph type	= Diversion2	Peak discharge	= 3.523 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 1 min	Hyd. volume	= 7,955 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,575 cuft

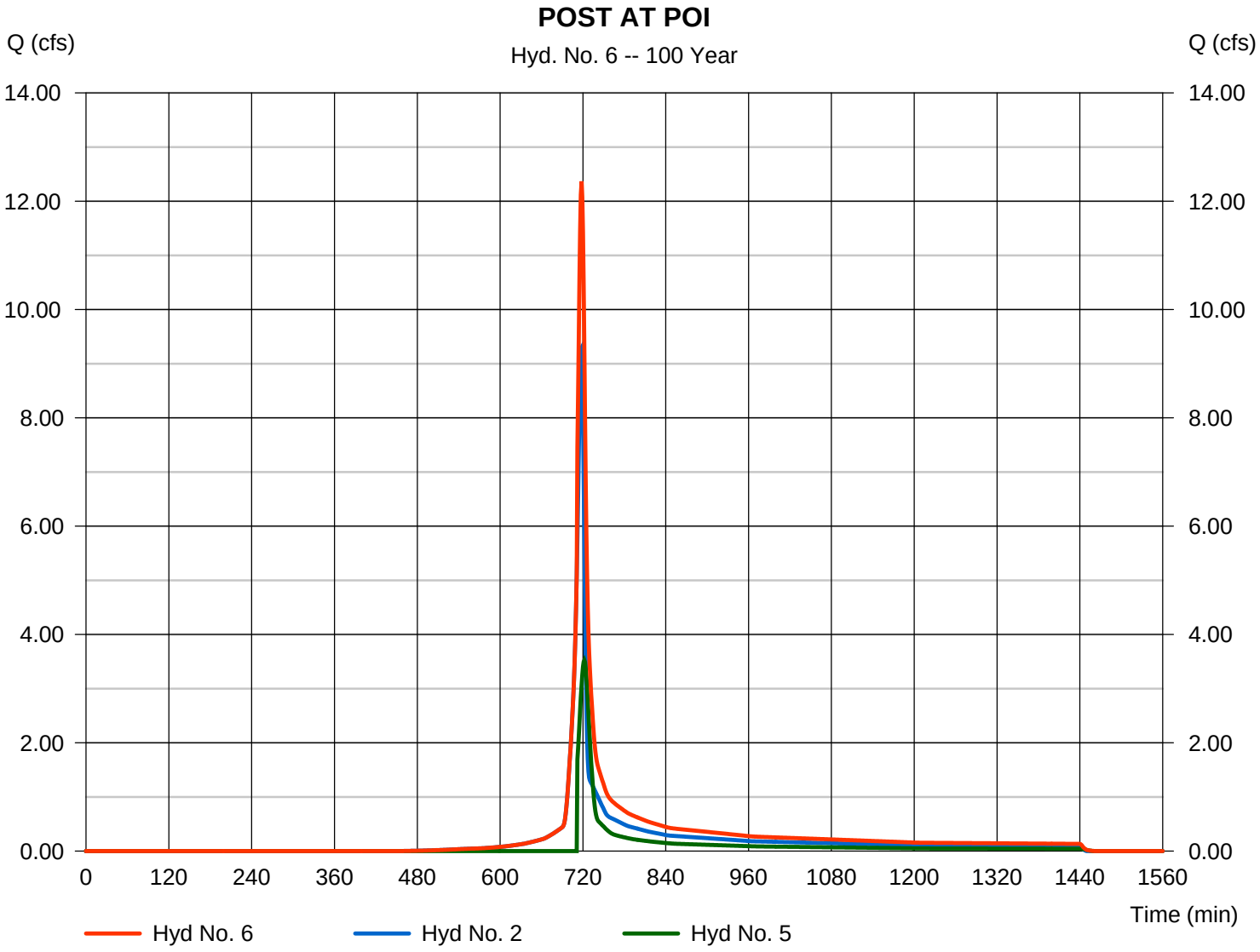


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 12.37 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 1 min	Hyd. volume	= 26,893 cuft
Inflow hyds.	= 2, 5	Contrib. drain. area	= 1.510 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	40.5844	9.9000	0.8792	--------
2	49.9040	10.3000	0.8805	--------
3	0.0000	0.0000	0.0000	--------
5	51.9125	9.7000	0.8350	--------
10	47.0214	8.3000	0.7778	--------
25	48.3751	7.7000	0.7431	--------
50	44.2417	6.5000	0.6943	--------
100	42.8775	5.7000	0.6607	--------

File name: Raystown East 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	3.78	2.93	2.40	2.05	1.79	1.59	1.43	1.30	1.20	1.11	1.04	0.97
2	4.52	3.52	2.90	2.48	2.16	1.93	1.74	1.58	1.46	1.35	1.26	1.18
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	5.50	4.31	3.57	3.06	2.69	2.40	2.17	1.99	1.84	1.71	1.60	1.50
10	6.28	4.90	4.06	3.49	3.08	2.76	2.51	2.30	2.13	1.99	1.87	1.76
25	7.32	5.72	4.75	4.10	3.62	3.26	2.97	2.74	2.54	2.38	2.23	2.11
50	8.12	6.32	5.26	4.55	4.03	3.64	3.33	3.08	2.87	2.69	2.53	2.40
100	8.96	6.95	5.79	5.02	4.46	4.04	3.70	3.43	3.20	3.01	2.84	2.70

Tc = time in minutes. Values may exceed 60.

RO\07 PCSM\Attach 4 Stormwater Calcs\Happy Hills (Raystown Lake East)\Hydraflow Rev 1\Raystown East 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	4.69	5.36	6.08
SCS 6-Hr	1.50	1.80	0.00	2.25	2.63	3.16	3.61	4.09
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