Arcona

TETRA TECH, INC.

By: RH Date: 11/8/2016 Subject:: Arcona Road
Checked By: JB Date: 11/10/2016 PCSM Design and Evaluation

PURPOSE:

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

PCSM DESIGN REQUIREMENTS:

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

Act 167 Consistency

The PCSM design at the Arcona Road block valve has been designed for consistency with Cumberland County's approved Act 167 Plan. By designing in accordance with PADEP's Stormwater BMP Manual, the requirements outlined in Cumberland County's Act 167 Plan will be fulfilled.

Recommended Volume Control Guideline

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

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

This site will utilize 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); as necessary, provide additional peak rate control as required by applicable and approved Act 167 plan.
- Cumberland County's approved Act 167 plan establishes release rate requirements for various watersheds throughout the county. The Arcona Road block valve site is located in the Cedar Run watershed of the Yellow Breeches Creek. According to the Cumberland County

Stormwater Management Plan, the site is located in CR-05, which requires release rates to be 75% of their rates prior to construction. A summary of release rates is provided below.

Year Storm Event	Pre-Construction Release Rate (cfs)	Post-Construction Release Rate (cfs)	Decrease (%)	Is the Act 167 Requirement Met?
2-year	0.461	0.342	74.2%	Yes
10-year	3.029	2.241	74.0%	Yes
50-year	8.406	6.155	73.2%	Yes
100-year	11.87	9.553	80.5%	No

The Act 167 requirements have been met for every year storm event with the exception of the 100-year storm. However, since the peak discharges have not been increased for the 2-year through 100-year events, the design requirements at the Arcona Road block valve station are consistent with Cumberland County's approved Act 167 Plan.

This site will utilize an infiltration berm to manage the 2-year through 100-year peak rate increases. This BMP 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. Although the infiltration rates exceed 6 in/hr, an additional soil buffer in the form of soil amendment (which includes a mix of soil and compost), has been placed within 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 1.9:1.

The maximum drainage area loading ratio of 8:1 has not been met. The drainage area loading ratio for the site is 13.5:1. However, runoff from the site and upslope drainage area will be dispersed to a relatively long infiltration berm. The infiltration berm has been placed to maximize 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

The Arcona Road block valve is located within the vicinity of known depressions or sinkholes. 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 1.9:1 impervious loading ratio by directing stormwater runoff into a long infiltration berm. The 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

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

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

Non-discharge alternatives were also considered when determining the type of BMP proposed. Arcona Road block valve site utilizes an infiltration berm to manage stormwater. Stormwater runoff is infiltrated to

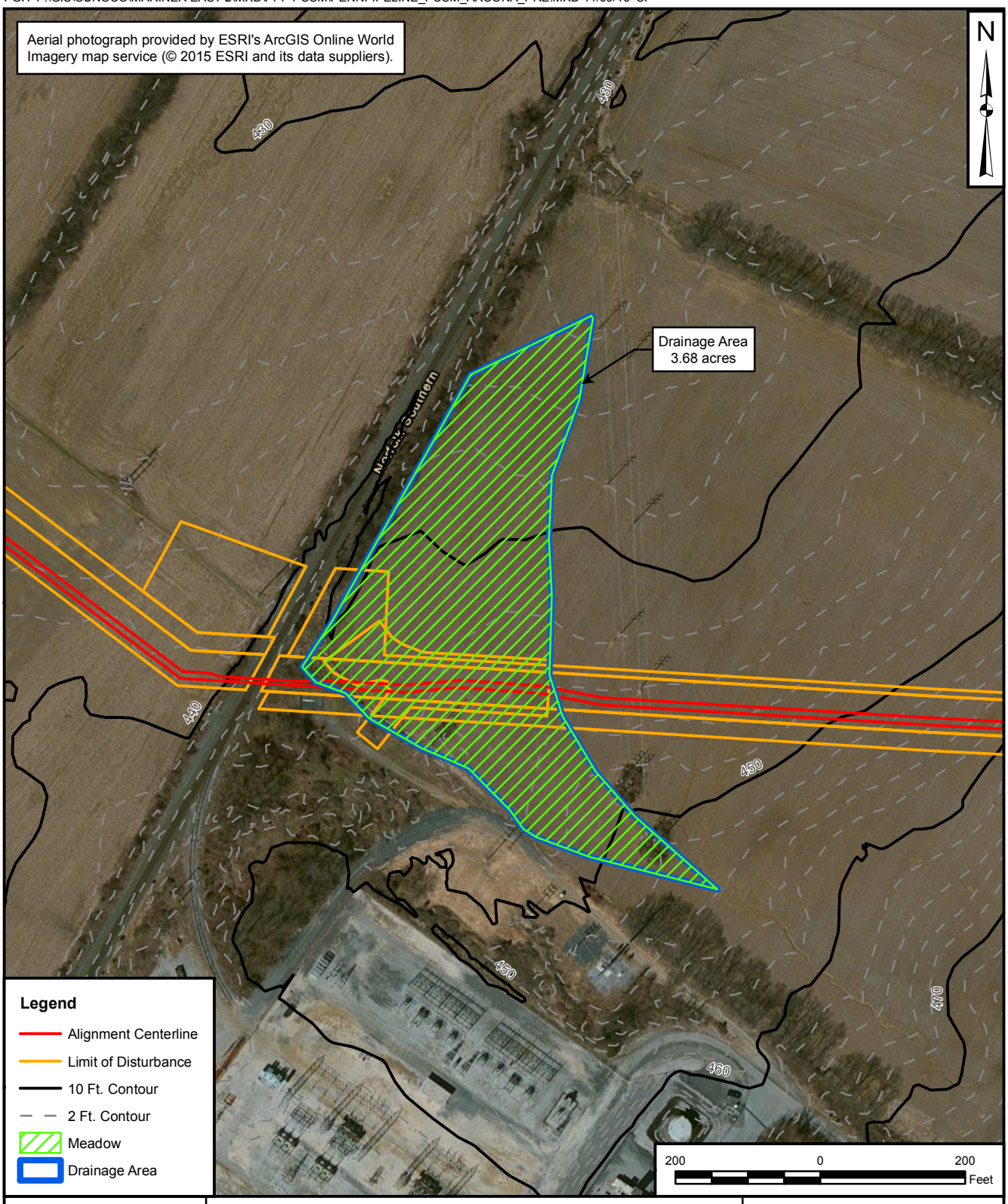
the maximum extent possible. Stormwater runoff is spread out to flow through areas that have been restored to meadow conditions, to an infiltration berm, or to undisturbed area. There will not be an increase in stormwater runoff rate or volume to prevent the physical degradation of the receiving water, such as scour, and stream bank destabilization. Stormwater runoff volume is not increasing throughout post-construction, and any post-construction stormwater discharge is managed so that it will not degrade the physical, chemical or biological characteristics of the receiving stream.

Runoff from the site will be managed by a downslope infiltration berm. Ponded runoff will be temporarily stored upslope of the berm until it infiltrates and filters through the soil media. Due to the design of the berm, which maintains a constant elevation through the entire berm length, the stormwater runoff will be released in sheet flow down a stabilized slope, without causing erosion, rather than concentrating the flow. Filtration through the existing vegetation and soil is an efficient way to remove suspended stormwater pollutants such as sediment, as the suspended particles are physically filtered from the stormwater as it flows through the vegetation and percolates into the soil.

The extent of the disturbed area will be minimized, and the duration of disturbance will be minimized by stabilizing disturbed areas as soon as practicable. Cut and fill for the project site has been minimized. Where possible based on the criteria listed above, sites were located in areas with shallow slopes to minimize the amount of cut and fill required. There is minimal cut and fill required at the Arcona Road block valve site. All of the block valve sites were graded towards the natural slope. No direct discharge to surface water occurs at the site. The site will be restored promptly with proper vegetative cover techniques.

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

PGH P:\GIS\SUNOCO\MARINER EAST 2\MXD\PPP PCSM\PENNPIPELINE_PCSM_ARCONA_PRE.MXD 11/09/16 SP



TETRA TECH

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

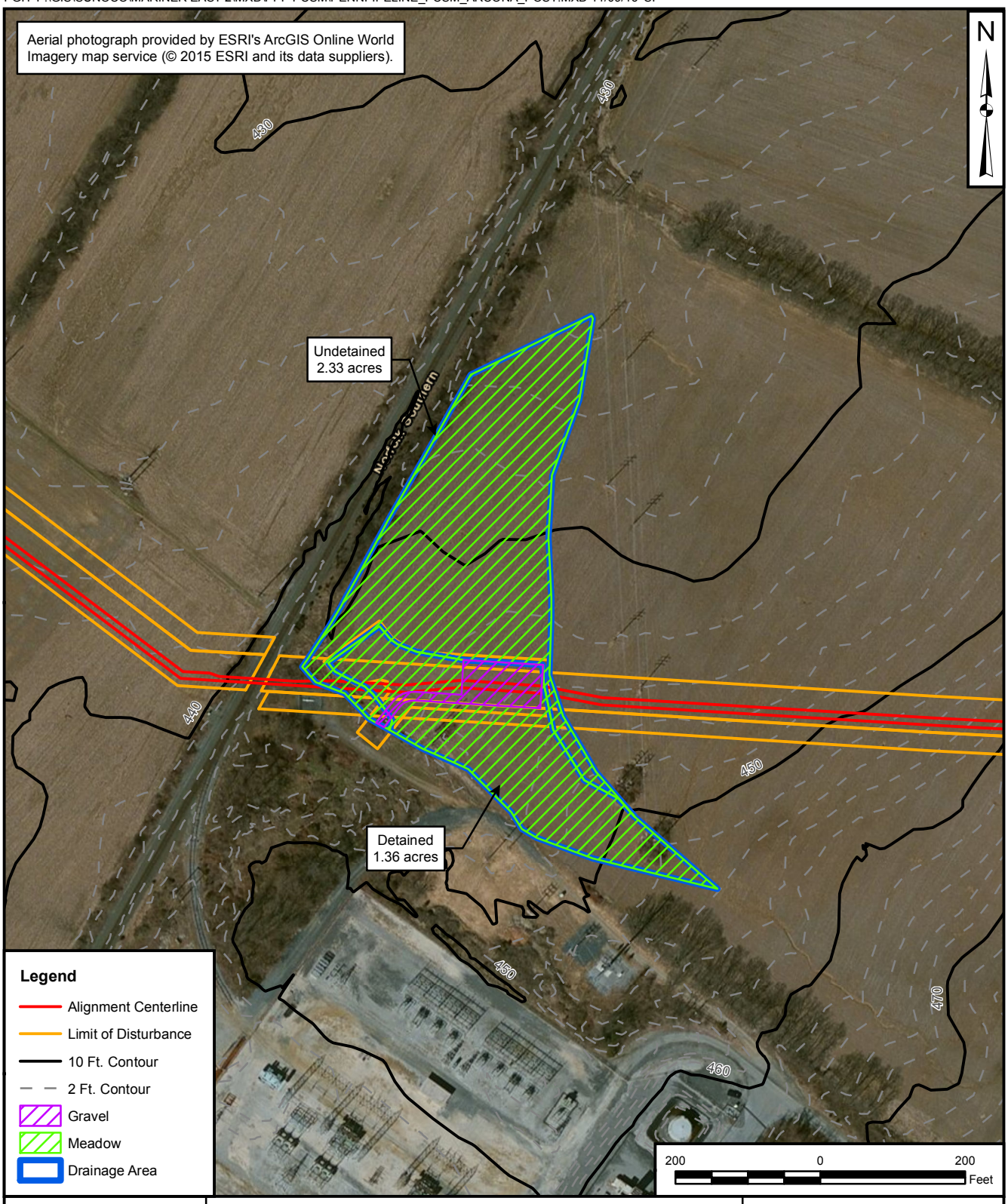
DRAWN BY: S. PAXTON 05/21/16
CHECKED BY: J. BRODY 11/09/16

APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE NUMBER	REV
1	0

PGH P:\GIS\SUNOCO\MARINER EAST 2\MXD\PPP PCSM\PENNPIPELINE_PCSM_ARCONA_POST.MXD 11/09/16 SP



TETRA TECH

POST-DEVELOPMENT DRAINAGE AREA MAP
ARCONA ROAD
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
CUMBERLAND 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: Monroe Twp, Pennsylvania, USA*
Latitude: 40.2029°, Longitude: -77.0442°
Elevation: 456.69 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	0.320 (0.286-0.358)	0.381 (0.340-0.427)	0.453 (0.404-0.508)	0.506 (0.451-0.566)	0.577 (0.512-0.644)	0.628 (0.555-0.701)	0.682 (0.600-0.759)	0.734 (0.642-0.816)	0.807 (0.700-0.898)	0.864 (0.744-0.962)
10-min	0.508 (0.455-0.569)	0.607 (0.542-0.681)	0.720 (0.643-0.808)	0.803 (0.716-0.899)	0.908 (0.806-1.01)	0.989 (0.873-1.10)	1.07 (0.941-1.19)	1.15 (1.00-1.28)	1.25 (1.09-1.40)	1.34 (1.15-1.49)
15-min	0.633 (0.567-0.709)	0.757 (0.677-0.851)	0.904 (0.808-1.01)	1.01 (0.900-1.13)	1.15 (1.02-1.28)	1.25 (1.10-1.39)	1.35 (1.19-1.50)	1.45 (1.26-1.61)	1.58 (1.37-1.76)	1.68 (1.44-1.87)
30-min	0.861 (0.771-0.964)	1.04 (0.930-1.17)	1.28 (1.14-1.43)	1.45 (1.29-1.63)	1.68 (1.49-1.88)	1.86 (1.64-2.07)	2.04 (1.79-2.27)	2.22 (1.94-2.47)	2.48 (2.15-2.75)	2.67 (2.30-2.98)
60-min	1.07 (0.958-1.20)	1.30 (1.16-1.46)	1.63 (1.46-1.83)	1.88 (1.68-2.10)	2.23 (1.98-2.48)	2.50 (2.21-2.79)	2.79 (2.46-3.11)	3.10 (2.71-3.44)	3.53 (3.06-3.92)	3.88 (3.34-4.31)
2-hr	1.24 (1.11-1.39)	1.51 (1.35-1.69)	1.91 (1.71-2.13)	2.23 (1.98-2.49)	2.71 (2.40-3.01)	3.12 (2.74-3.46)	3.58 (3.12-3.96)	4.08 (3.54-4.52)	4.85 (4.16-5.37)	5.51 (4.68-6.11)
3-hr	1.35 (1.21-1.53)	1.64 (1.47-1.85)	2.07 (1.85-2.34)	2.42 (2.16-2.73)	2.94 (2.60-3.29)	3.38 (2.97-3.79)	3.88 (3.39-4.34)	4.43 (3.84-4.94)	5.28 (4.52-5.89)	6.01 (5.09-6.71)
6-hr	1.67 (1.50-1.90)	2.02 (1.80-2.29)	2.53 (2.25-2.86)	2.96 (2.63-3.34)	3.61 (3.18-4.06)	4.17 (3.65-4.68)	4.81 (4.18-5.38)	5.53 (4.76-6.17)	6.63 (5.63-7.40)	7.60 (6.38-8.47)
12-hr	2.05 (1.81-2.34)	2.46 (2.18-2.81)	3.09 (2.73-3.53)	3.63 (3.20-4.14)	4.47 (3.90-5.06)	5.21 (4.51-5.88)	6.06 (5.20-6.83)	7.03 (5.97-7.89)	8.54 (7.15-9.58)	9.90 (8.17-11.1)
24-hr	2.40 (2.21-2.65)	2.89 (2.66-3.19)	3.63 (3.33-4.00)	4.28 (3.91-4.70)	5.30 (4.80-5.79)	6.23 (5.60-6.77)	7.32 (6.52-7.92)	8.60 (7.57-9.27)	10.6 (9.22-11.4)	12.5 (10.7-13.4)
2-day	2.78 (2.54-3.09)	3.34 (3.05-3.72)	4.19 (3.81-4.66)	4.93 (4.47-5.47)	6.08 (5.48-6.72)	7.14 (6.37-7.86)	8.36 (7.40-9.18)	9.79 (8.58-10.7)	12.1 (10.4-13.2)	14.1 (12.0-15.4)
3-day	2.96 (2.71-3.27)	3.55 (3.26-3.93)	4.44 (4.06-4.91)	5.21 (4.74-5.75)	6.41 (5.80-7.05)	7.51 (6.74-8.24)	8.77 (7.81-9.60)	10.2 (9.03-11.2)	12.6 (10.9-13.7)	14.7 (12.6-16.0)
4-day	3.14 (2.88-3.45)	3.76 (3.46-4.15)	4.68 (4.30-5.16)	5.49 (5.02-6.03)	6.75 (6.13-7.39)	7.88 (7.11-8.61)	9.19 (8.22-10.0)	10.7 (9.48-11.7)	13.1 (11.4-14.2)	15.3 (13.1-16.6)
7-day	3.66 (3.38-4.02)	4.38 (4.05-4.81)	5.41 (4.99-5.93)	6.31 (5.79-6.90)	7.68 (7.01-8.39)	8.92 (8.08-9.72)	10.3 (9.29-11.2)	12.0 (10.7-13.0)	14.5 (12.7-15.7)	16.8 (14.6-18.2)
10-day	4.22 (3.92-4.58)	5.03 (4.68-5.47)	6.14 (5.70-6.66)	7.08 (6.56-7.68)	8.51 (7.83-9.21)	9.77 (8.94-10.5)	11.2 (10.2-12.1)	12.8 (11.5-13.8)	15.2 (13.6-16.4)	17.4 (15.3-18.7)
20-day	5.74 (5.40-6.14)	6.79 (6.39-7.26)	8.04 (7.55-8.59)	9.08 (8.51-9.70)	10.6 (9.91-11.3)	11.9 (11.1-12.7)	13.4 (12.4-14.2)	14.9 (13.7-15.9)	17.3 (15.7-18.4)	19.3 (17.4-20.5)
30-day	7.11 (6.71-7.55)	8.36 (7.89-8.89)	9.74 (9.18-10.4)	10.9 (10.2-11.6)	12.5 (11.8-13.3)	13.9 (13.0-14.8)	15.4 (14.3-16.4)	17.0 (15.8-18.1)	19.4 (17.8-20.6)	21.4 (19.5-22.7)
45-day	8.95 (8.51-9.45)	10.5 (9.97-11.1)	12.0 (11.4-12.7)	13.3 (12.6-14.0)	15.0 (14.2-15.8)	16.4 (15.5-17.3)	17.9 (16.9-18.9)	19.5 (18.3-20.6)	21.7 (20.3-22.9)	23.6 (21.9-24.9)
60-day	10.7 (10.2-11.2)	12.5 (11.9-13.1)	14.2 (13.5-14.9)	15.5 (14.8-16.3)	17.4 (16.6-18.3)	19.0 (18.0-19.9)	20.6 (19.4-21.6)	22.3 (20.9-23.4)	24.6 (23.0-25.8)	26.5 (24.7-27.9)

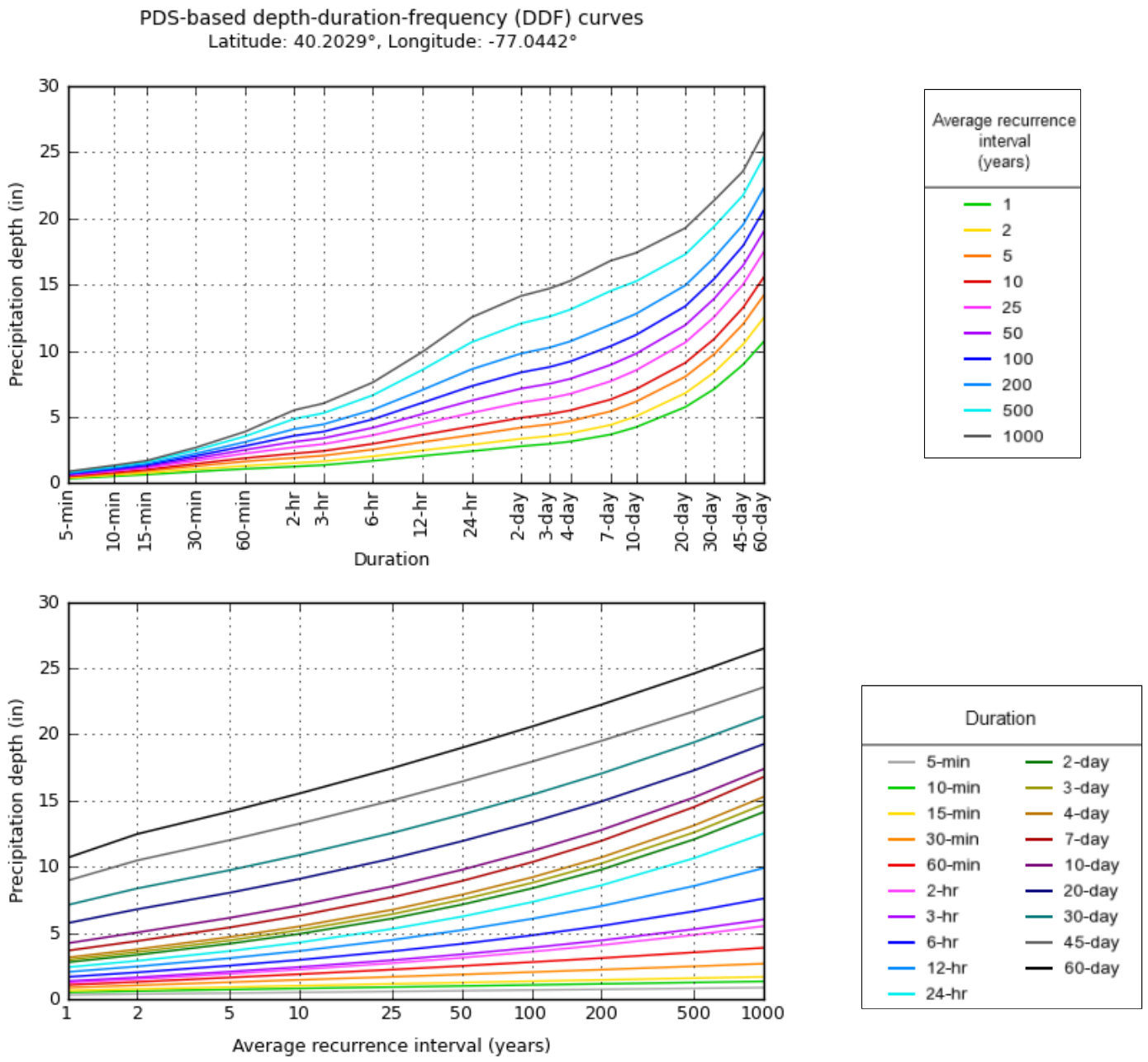
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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.

Back to Top

PF graphical



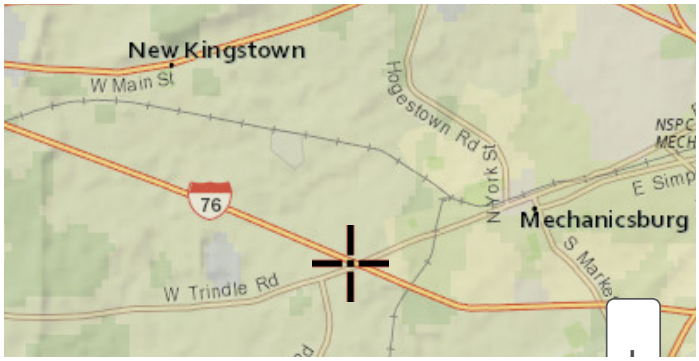
NOAA Atlas 14, Volume 2, Version 3

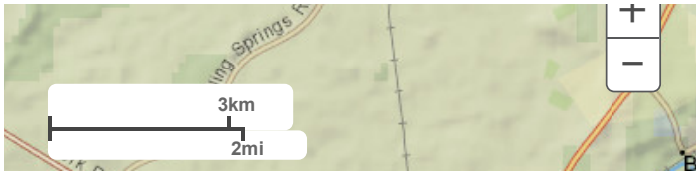
Created (GMT): Wed Sep 28 16:02:46 2016

Back to Top

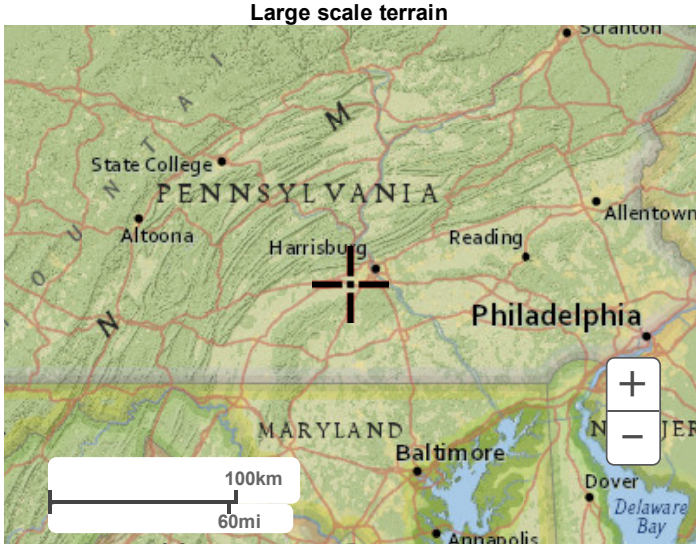
Maps & aerials

Small scale terrain

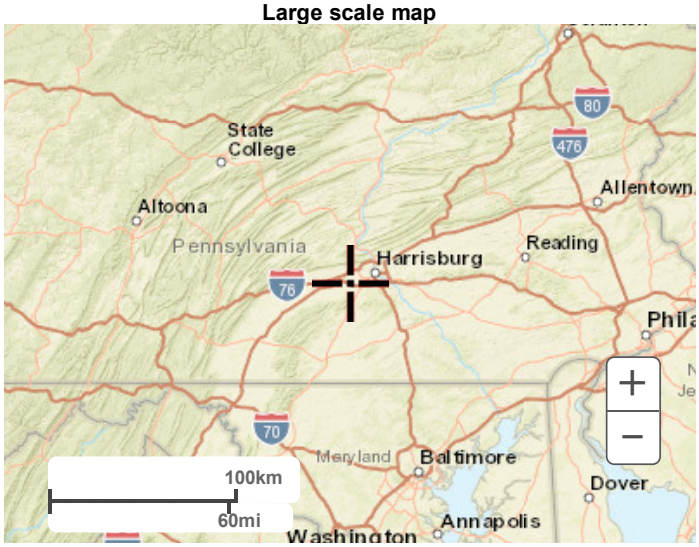




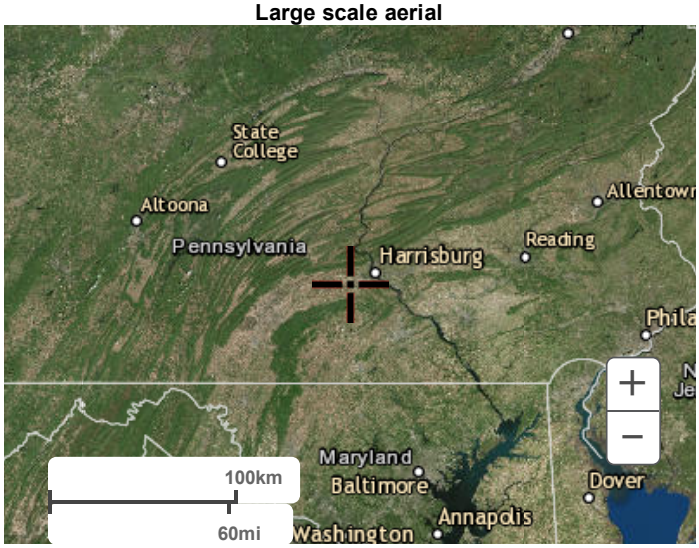
Large scale terrain



Large scale map



Large scale aerial



Back to Top

WORKSHEET 1. GENERAL SITE INFORMATION

Date: November 11, 2016

Project Name: Arcona Road

Municipality: Lower Allen

County: Cumberland

Total Area (acres): 3.68

Major River Basin: Susquehanna River

Watershed: Yellow Breeches Creek

Sub Basin: Cedar Run

Nearest Surface Water to Receive Runoff: Tributary #63068 to Cedar Run

Chapter 93 - Designated Water Use: Cold Water Fish (CWF)

Impaired according to Chapter 303(d) list?

YES	X
NO	

List Causes of Impairment:

Source Unknown - Pathogens, Agriculture - Nutrients ; Agriculture - Siltation ; Agriculture - Other Habitat Alterations

Is Project Subject to, or Part of:

Municipal Separate Storm Sewer System (MS4) Requirements

YES	X
NO	

Existing or Planned drinking water supply?

YES	
NO	X

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

Approved Act 167 Plan?

YES	X
NO	

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.

   0.00 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	N/A		
Natural Drainage Ways	N/A		
Steep Slopes, 15% - 25%	N/A		
Steep Slopes, over 25%	N/A		
Other:			
Other:			
TOTAL EXISTING:		**0.00**	**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
0.86	-	0	=	0.86

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: Arcona Road
Drainage Area: 3.68 acres
2-Year Rainfall: 2.89 in

Total Site Area: 0.86 acres
Protected Site Area: N/A acres
Managed Site Area: 0.86 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	37,462	0.86	58	7.24	1.45	0.24	747
Woods	B	0	0.00	55	8.18	1.64	0.17	0
TOTAL:		**37,462**	**0.86**					**747**

Developed Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[3] (ft^3)
Impervious - Gravel	B	8,276	0.19	85	1.76	0.35	1.50	1,032
Meadow	B	29,185	0.67	58	7.24	1.45	0.24	582
TOTAL:		**37,462**	**0.86**					**1,614**

2-Year Volume Increase (ft^3):	**867**

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: Arcona Road
SUB-BASIN:

Required Control Volume (ft^3) - *from Worksheet 4:* 867

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

Structural Volume Reqmt (ft^3) 867
(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	5,481	1,710
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): 1,710

Structural Volume Requirement (ft^3): 867

DIFFERENCE: -843

VOLUME CREDIT DETERMINATION

1 Detained area runoff volume from Hydraflow = 1,710 cf

2 Storage volume of the BMPs = 2,740 cf

3 Infiltrated volume within 72 hours after the 2-yr/24-hr event
(Infiltration Rate/12) x Infiltration Area x 72 hrs = 1,710 cf

Potential infiltrated volume = 52,728 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	

INFILTRATION BERM DEWATERING CALCULATION SITE NAME: ARCONA

STORAGE VOLUME	2,740	CF	
DESIGN INFILTRATION RATE	2.00	IN/HR	BASED ON A, IT-01, AND IT-02
INFILTRATION AREA	5,481	SF	

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

DEWATERING TIME = 3.0 HOURS

TIME OF CONCENTRATION ADJUSTMENT

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT 16.5 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 1,710 CF FOR 2-YR/24-HR EVENT
2,740 CF FOR ALL REMAINING EVENTS

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	0.382
10 YR/24 HR	1.564
50 YR/24 HR	3.746
100 YR/24 HR	5.147

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	0.382	74.607
10 YR/24 HR	1.564	29.199
50 YR/24 HR	3.746	12.191
100 YR/24 HR	5.147	8.872

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	0.382	74.607	91.107
10 YR/24 HR	1.564	29.199	45.699
50 YR/24 HR	3.746	12.191	28.691
100 YR/24 HR	5.147	8.872	25.372

UNDERDRAIN DISCHARGE Report

Label	Solve For	Friction Method	Roughness Coefficient
Circular Pipe - 1	Full Flow Capacity	Manning Formula	0.012

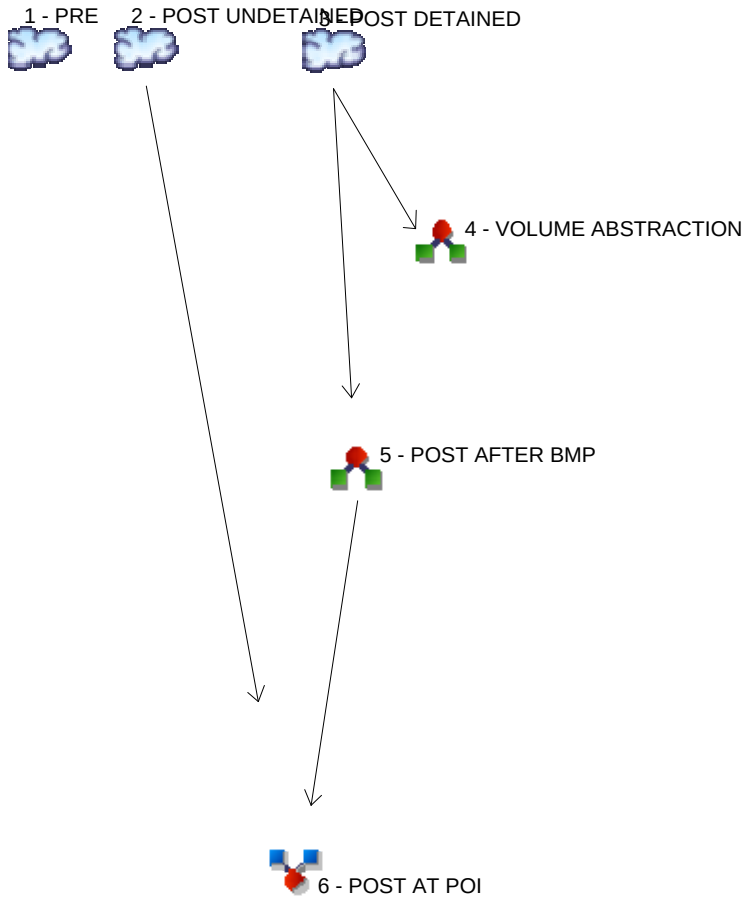
Channel Slope (ft/ft)	Normal Depth (ft)	Diameter (ft)	Discharge (ft^3/s)
0.00500	0.25	0.25	0.07

Flow Area (ft^2)	Wetted Perimeter (ft)	Hydraulic Radius (ft)	Top Width (ft)
0.05	0.79	0.06	0.00

Critical Depth (ft)	Percent Full (%)	Critical Slope (ft/ft)	Velocity (ft/s)
0.16	100.0	0.00961	1.38

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
4	Diversion1	VOLUME ABSTRACTION
5	Diversion2	POST AFTER 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	------	-------	0.461	-------	-------	3.029	-------	8.406	11.87	PRE
2	SCS Runoff	------	-------	0.342	-------	-------	2.241	-------	6.155	8.674	POST UNDETAINED
3	SCS Runoff	------	-------	0.382	-------	-------	1.564	-------	3.746	5.147	POST DETAINED
4	Diversion1	3	-------	0.382	-------	-------	1.564	-------	3.746	4.829	VOLUME ABSTRACTION
5	Diversion2	3	-------	0.000	-------	-------	0.127	-------	3.494	5.147	POST AFTER BMP
6	Combine	2, 5	-------	0.342	-------	-------	2.241	-------	8.451	13.82	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	0.461	2	726	3,123	------	------	------	PRE
2	SCS Runoff	0.342	2	724	2,086	------	------	------	POST UNDETAINED
3	SCS Runoff	0.382	2	726	1,710	------	------	------	POST DETAINED
4	Diversion1	0.382	2	726	1,710	3	------	------	VOLUME ABSTRACTION
5	Diversion2	0.000	2	n/a	0	3	------	------	POST AFTER BMP
6	Combine	0.342	2	724	2,086	2, 5	------	------	POST AT POI

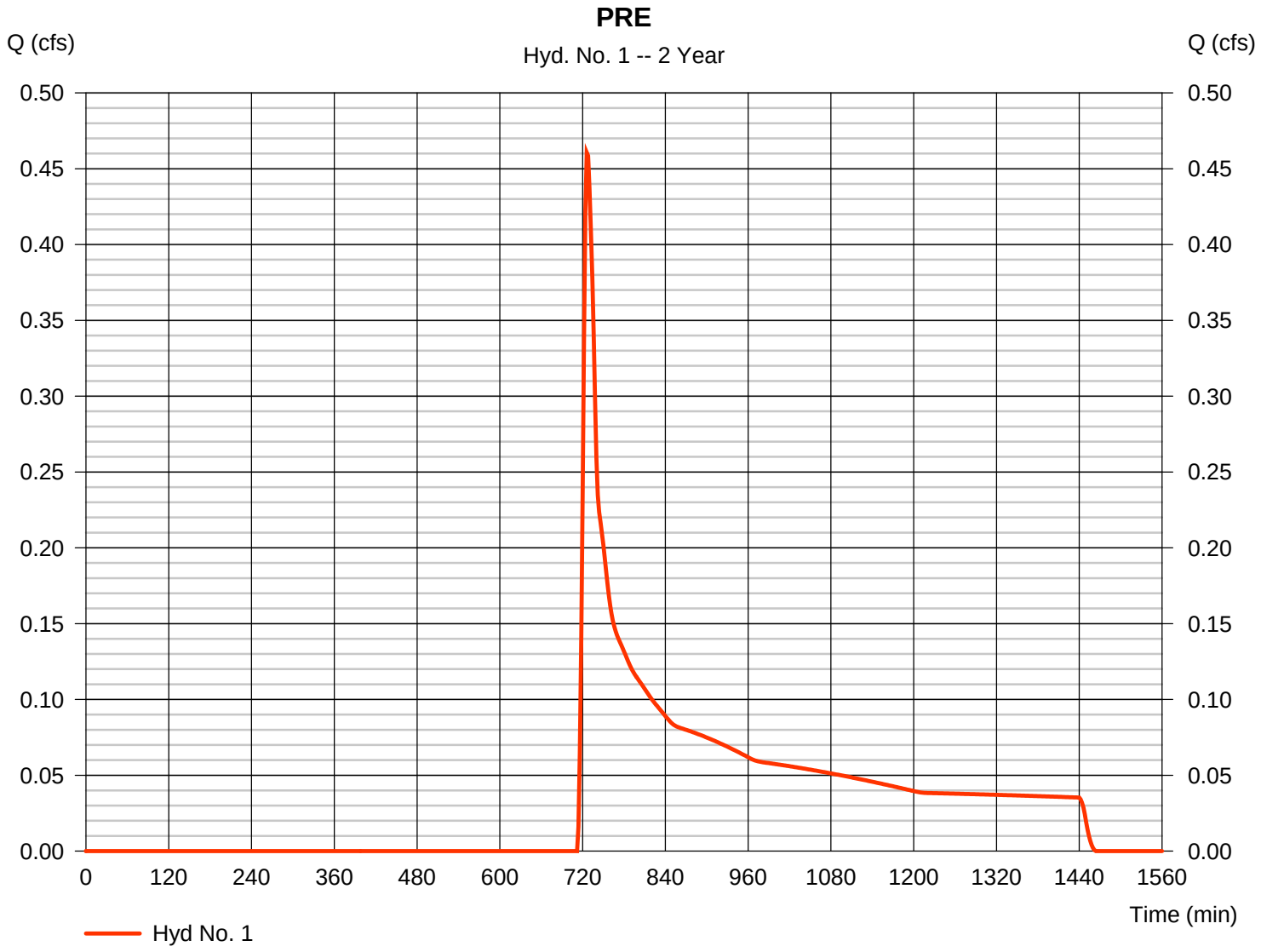
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.461 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	3,123 cuft
Drainage area	=	3.690 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	2.89 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.690 x 58)] / 3.690



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)	= 2.89		0.00		0.00		
Land slope (%)	= 2.47		0.00		0.00		
Travel Time (min)	**= 7.93**	**+**	**0.00**	**+**	**0.00**	**=**	**7.93**
Shallow Concentrated Flow							
Flow length (ft)	= 658.00		0.00		0.00		
Watercourse slope (%)	= 1.87		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.21		0.00		0.00		
Travel Time (min)	**= 4.97**	**+**	**0.00**	**+**	**0.00**	**=**	**4.97**
Channel Flow							
X sectional flow area (sqft)	= 16.00		0.00		0.00		
Wetted perimeter (ft)	= 28.00		0.00		0.00		
Channel slope (%)	= 1.45		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=8.22						
			0.00				
					0.00		
Flow length (ft)	({0})496.0		0.0		0.0		
Travel Time (min)	**= 1.01**	**+**	**0.00**	**+**	**0.00**	**=**	**1.01**

Total Travel Time, Tc ..... 13.90 min

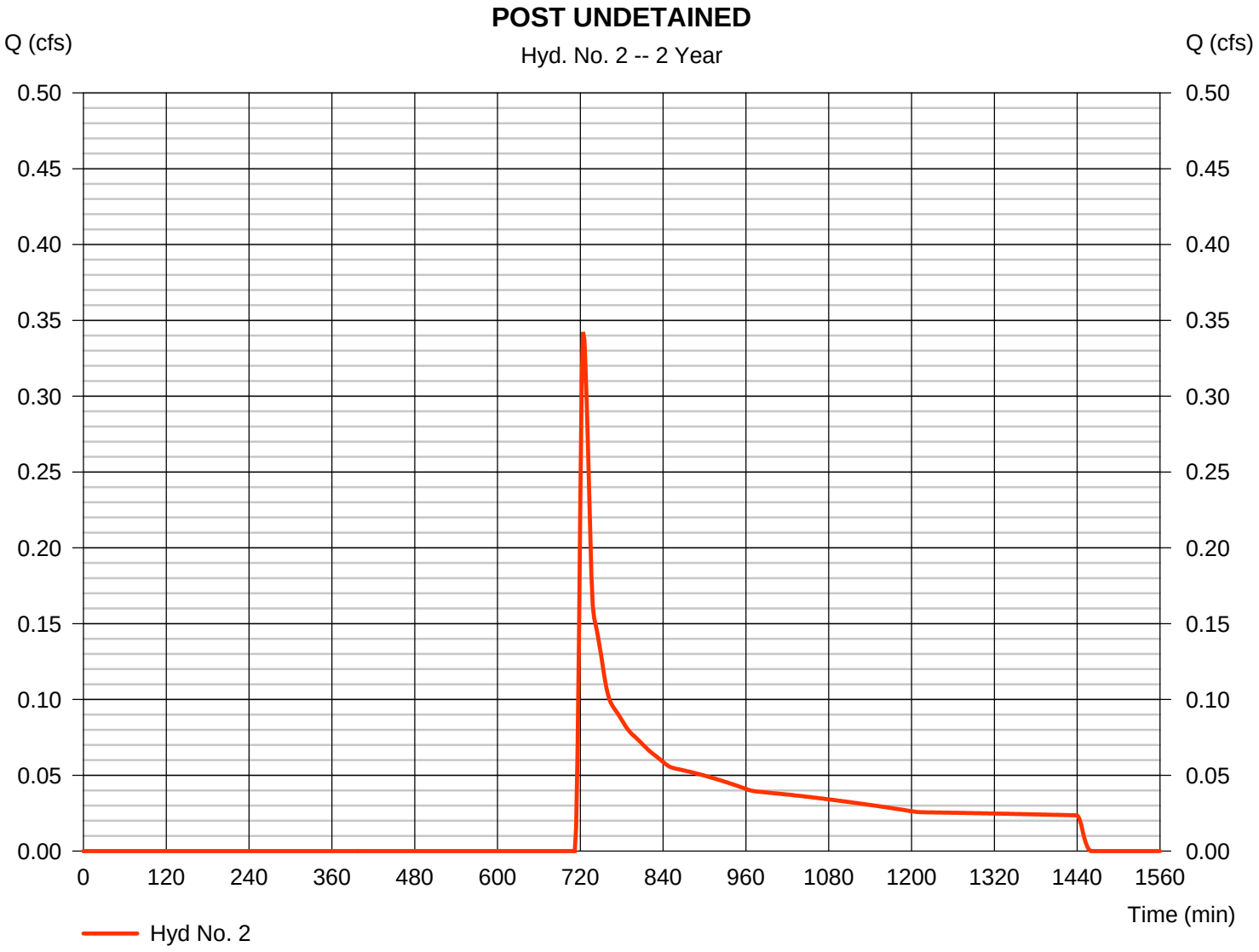
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.342 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	2,086 cuft
Drainage area	=	2.330 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.00 min
Total precip.	=	2.89 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.320 x 58) + (0.010 x 85)] / 2.330



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)	= 2.89		0.00		0.00		
Land slope (%)	= 2.40		0.00		0.00		
Travel Time (min)	**= 8.02**	**+**	**0.00**	**+**	**0.00**	**=**	**8.02**
Shallow Concentrated Flow							
Flow length (ft)	= 668.00		0.00		0.00		
Watercourse slope (%)	= 1.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.22		0.00		0.00		
Travel Time (min)	**= 5.01**	**+**	**0.00**	**+**	**0.00**	**=**	**5.01**
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 ..... 13.00 min

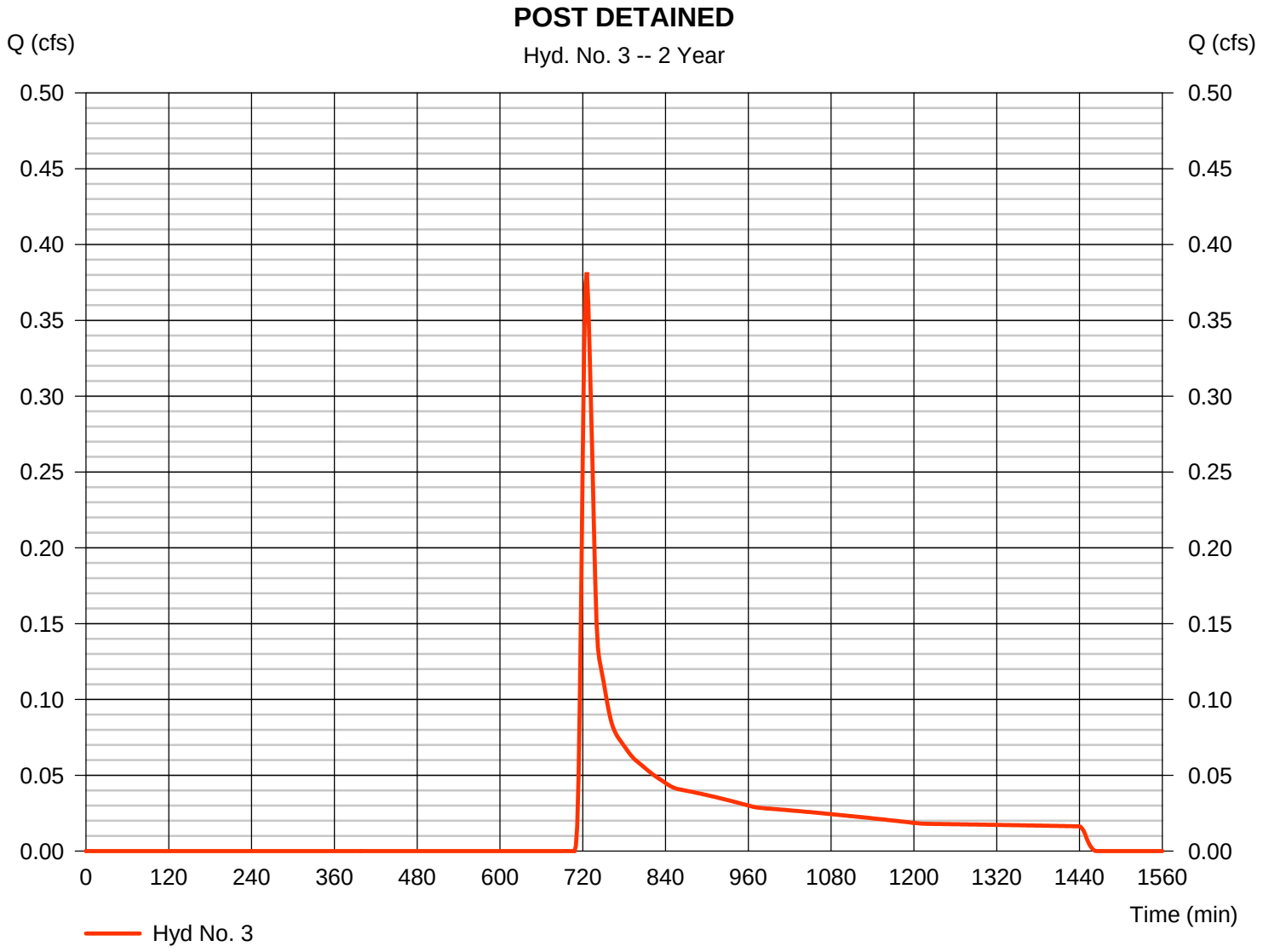
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 0.382 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 1,710 cuft
Drainage area	= 1.360 ac	Curve number	= 62*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.50 min
Total precip.	= 2.89 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.180 x 85) + (1.180 x 58)] / 1.360



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)	= 2.89		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 11.38**	**+**	**0.00**	**+**	**0.00**	**=**	**11.38**
Shallow Concentrated Flow							
Flow length (ft)	= 363.00		49.00		0.00		
Watercourse slope (%)	= 2.80		2.60		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=2.70		2.60		0.00		
Travel Time (min)	**= 2.24**	**+**	**0.31**	**+**	**0.00**	**=**	**2.55**
Channel Flow							
X sectional flow area (sqft)	= 0.05		0.00		0.00		
Wetted perimeter (ft)	= 0.79		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)	=1.38						
			0.00				
					0.00		
Flow length (ft)	({0})210.0		0.0		0.0		
Travel Time (min)	**= 2.53**	**+**	**0.00**	**+**	**0.00**	**=**	**2.53**

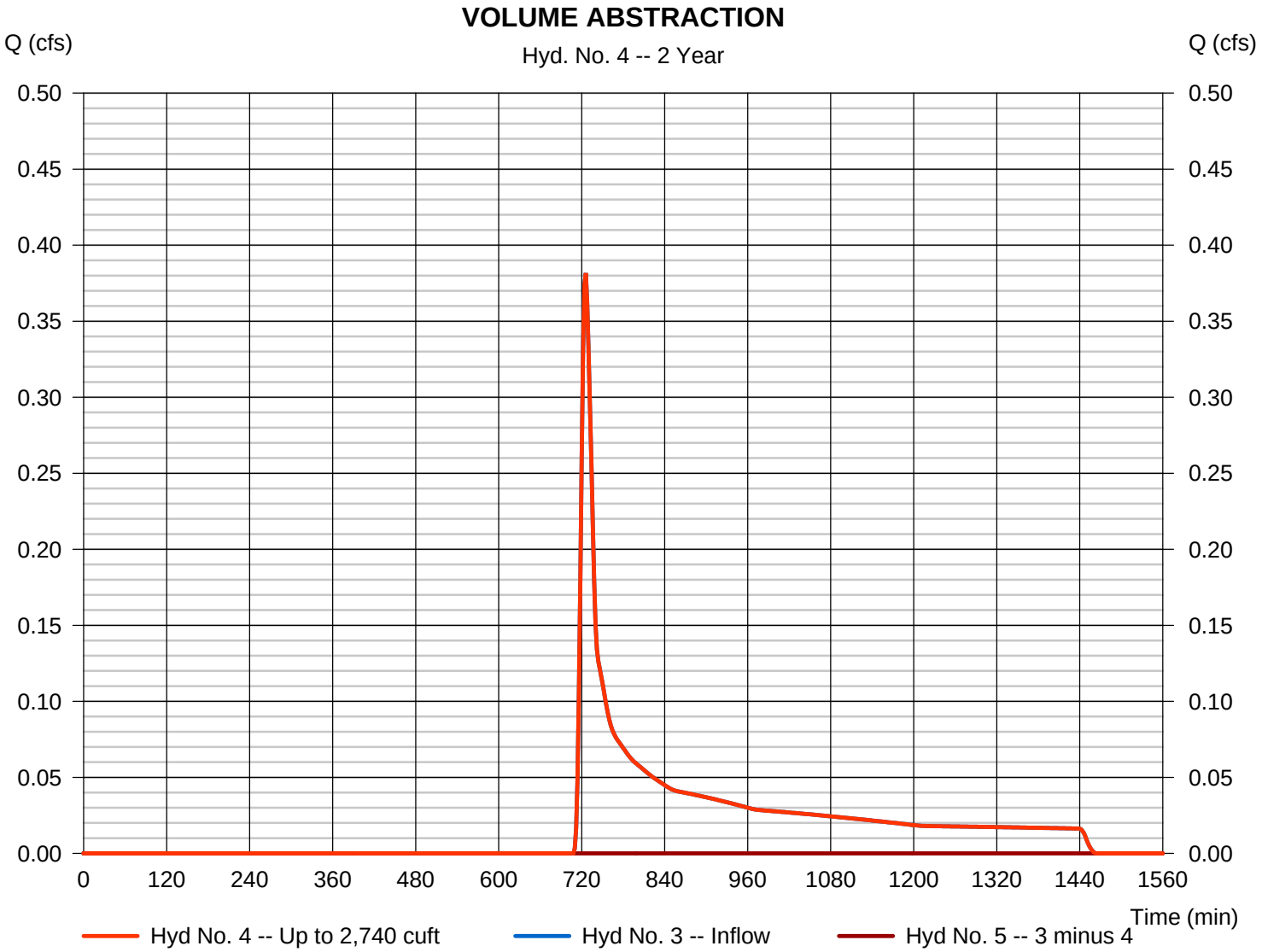
Total Travel Time, Tc ..... 16.50 min

Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.382 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 1,710 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

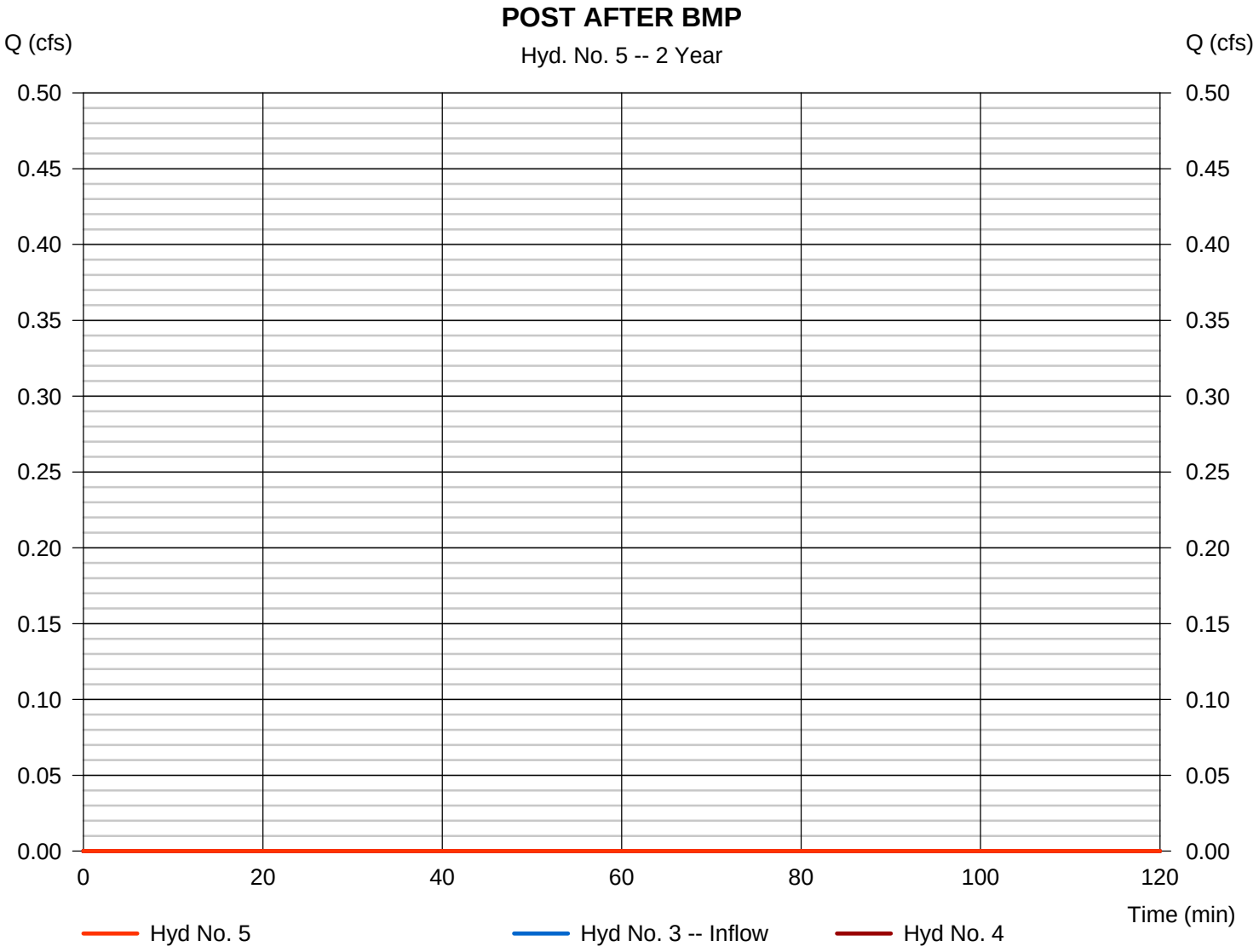


Hydrograph Report

Hyd. No. 5

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	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

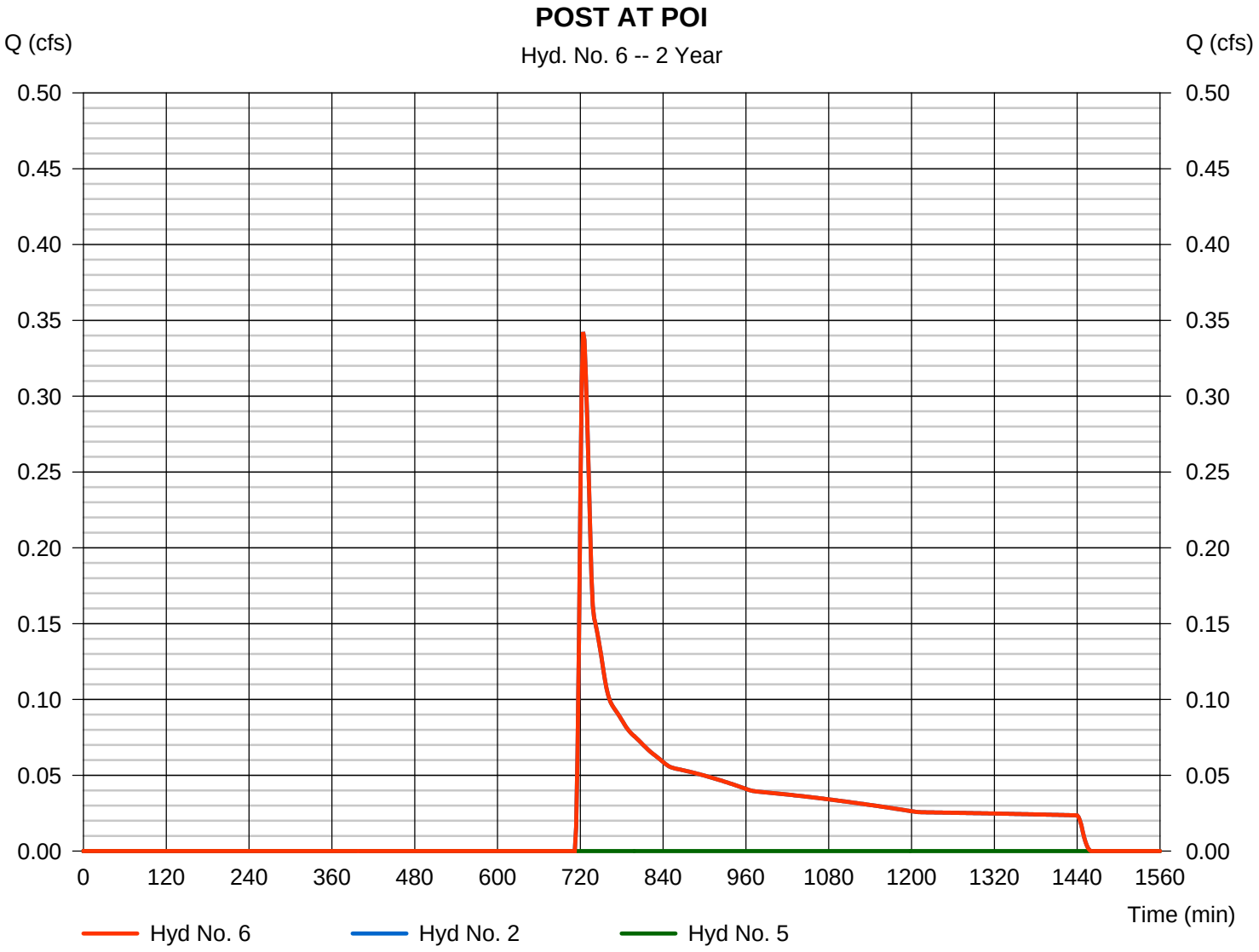


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	0.342 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	2,086 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	2.330 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	3.029	2	724	10,396	------	------	------	PRE
2	SCS Runoff	2.241	2	722	6,943	------	------	------	POST UNDETAINED
3	SCS Runoff	1.564	2	724	4,889	------	------	------	POST DETAINED
4	Diversion1	1.564	2	724	2,753	3	------	------	VOLUME ABSTRACTION
5	Diversion2	0.127	2	818	2,137	3	------	------	POST AFTER BMP
6	Combine	2.241	2	722	9,080	2, 5	------	------	POST AT POI

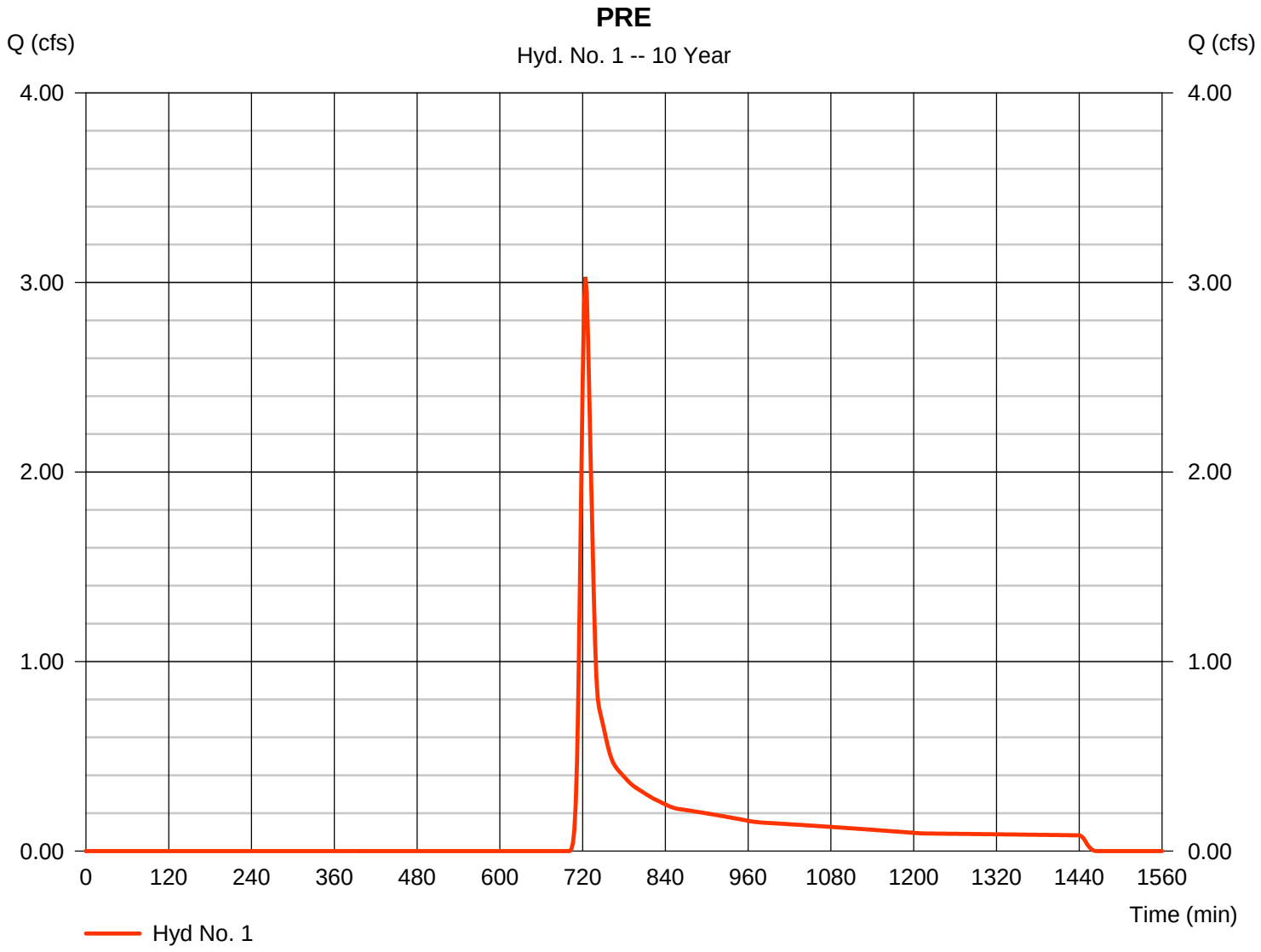
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.029 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	10,396 cuft
Drainage area	=	3.690 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	4.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.690 x 58)] / 3.690



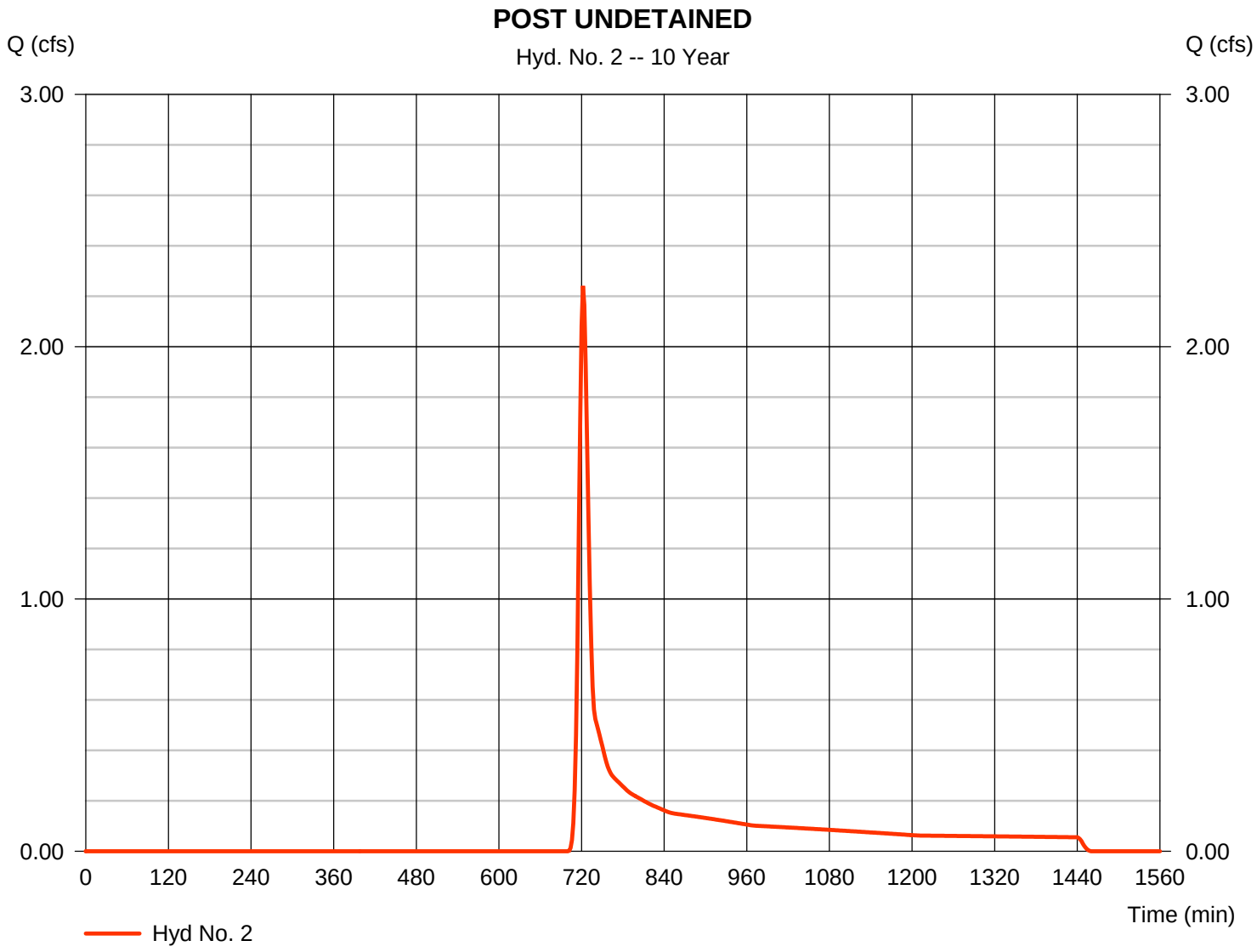
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.241 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	6,943 cuft
Drainage area	=	2.330 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.00 min
Total precip.	=	4.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.320 x 58) + (0.010 x 85)] / 2.330



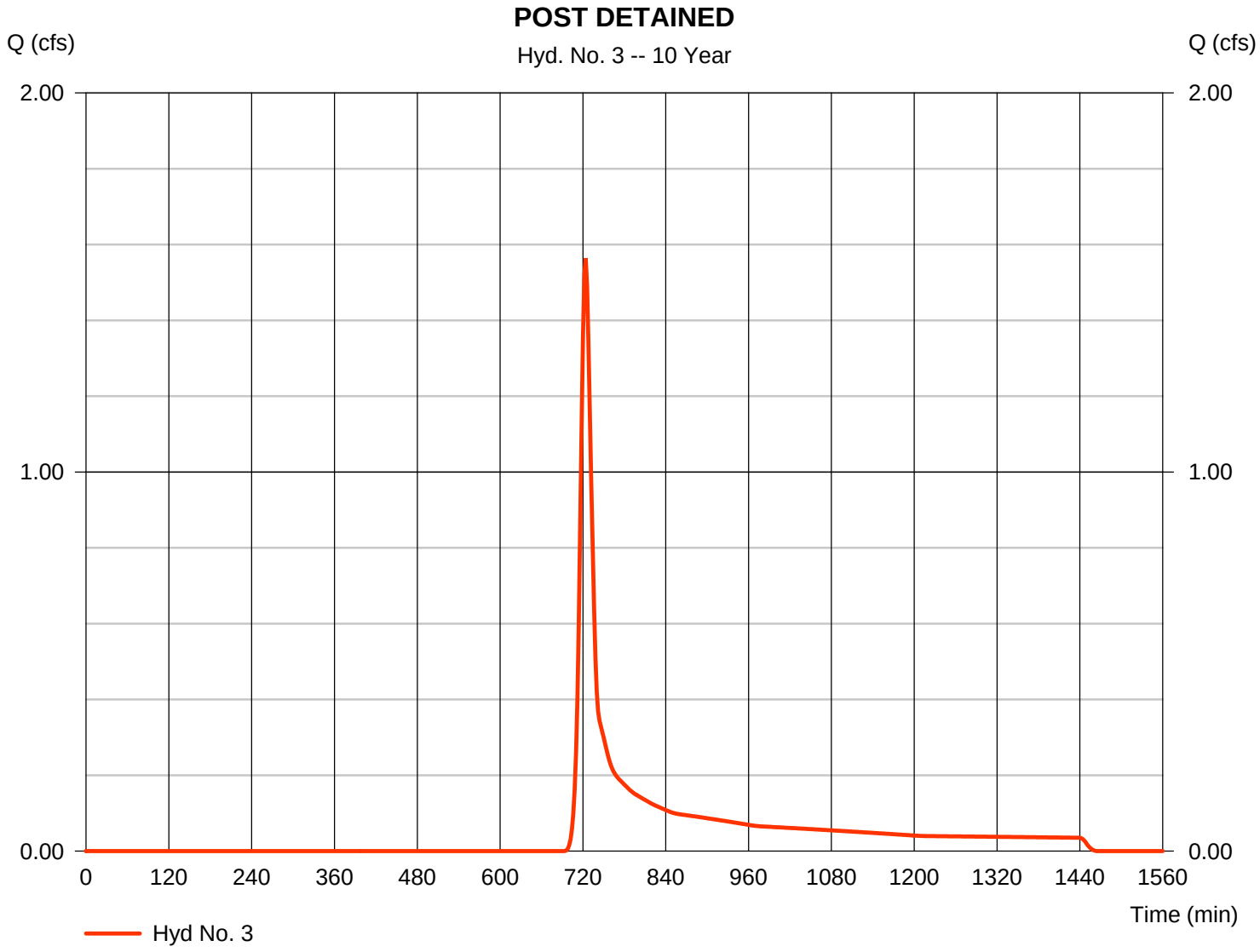
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.564 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	4,889 cuft
Drainage area	=	1.360 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	16.50 min
Total precip.	=	4.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.180 x 85) + (1.180 x 58)] / 1.360

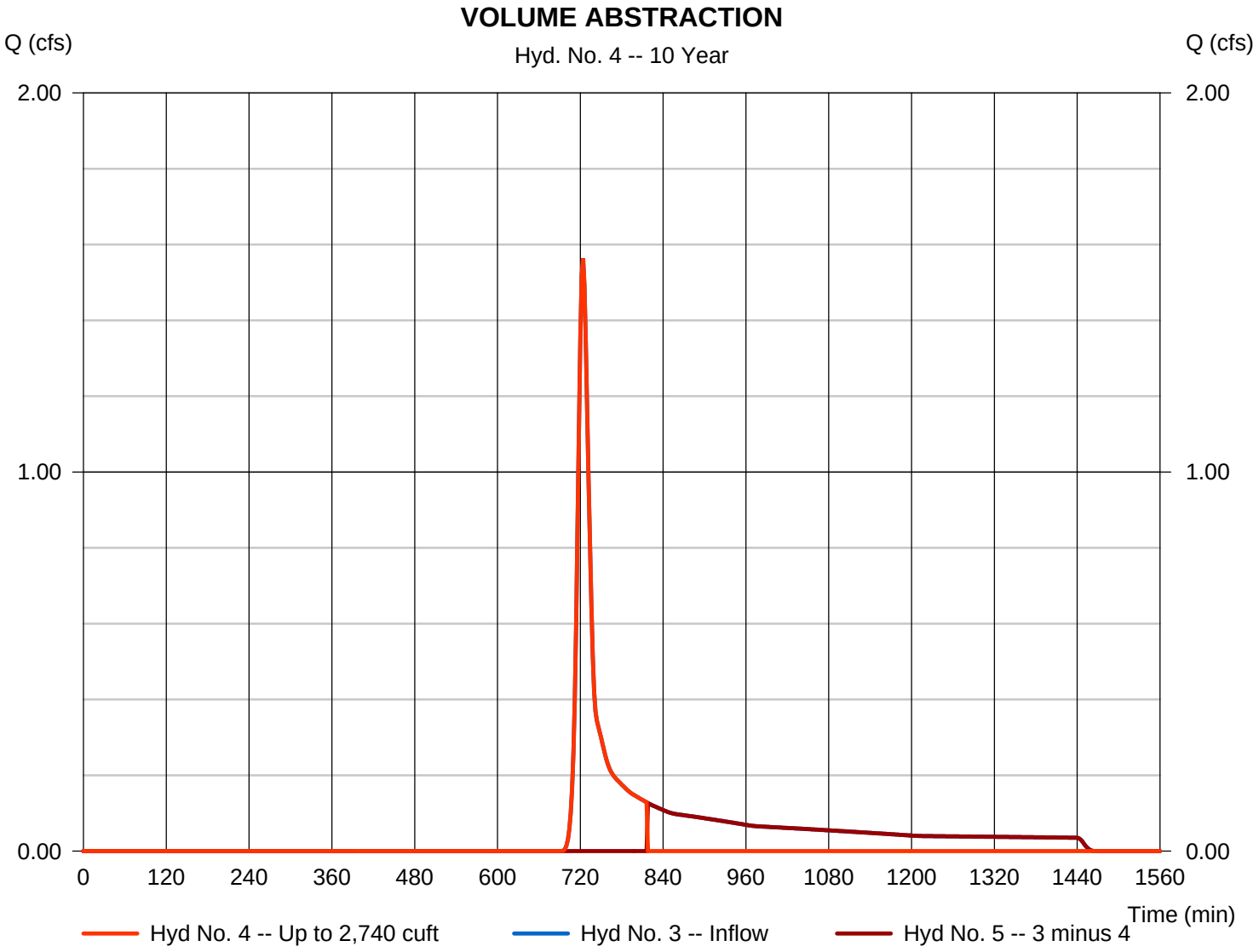


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.564 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 2,753 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

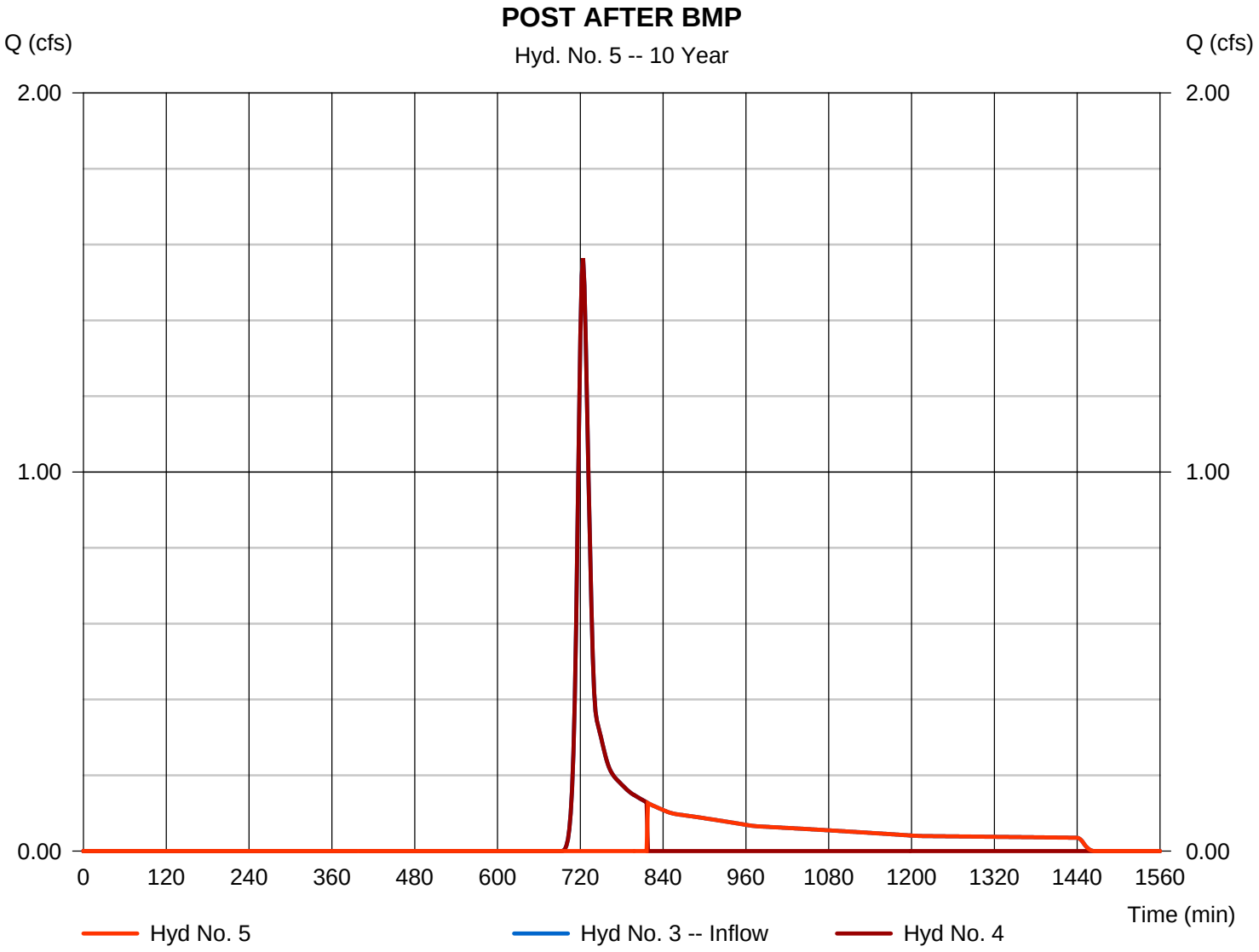


Hydrograph Report

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.127 cfs
Storm frequency	= 10 yrs	Time to peak	= 818 min
Time interval	= 2 min	Hyd. volume	= 2,137 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

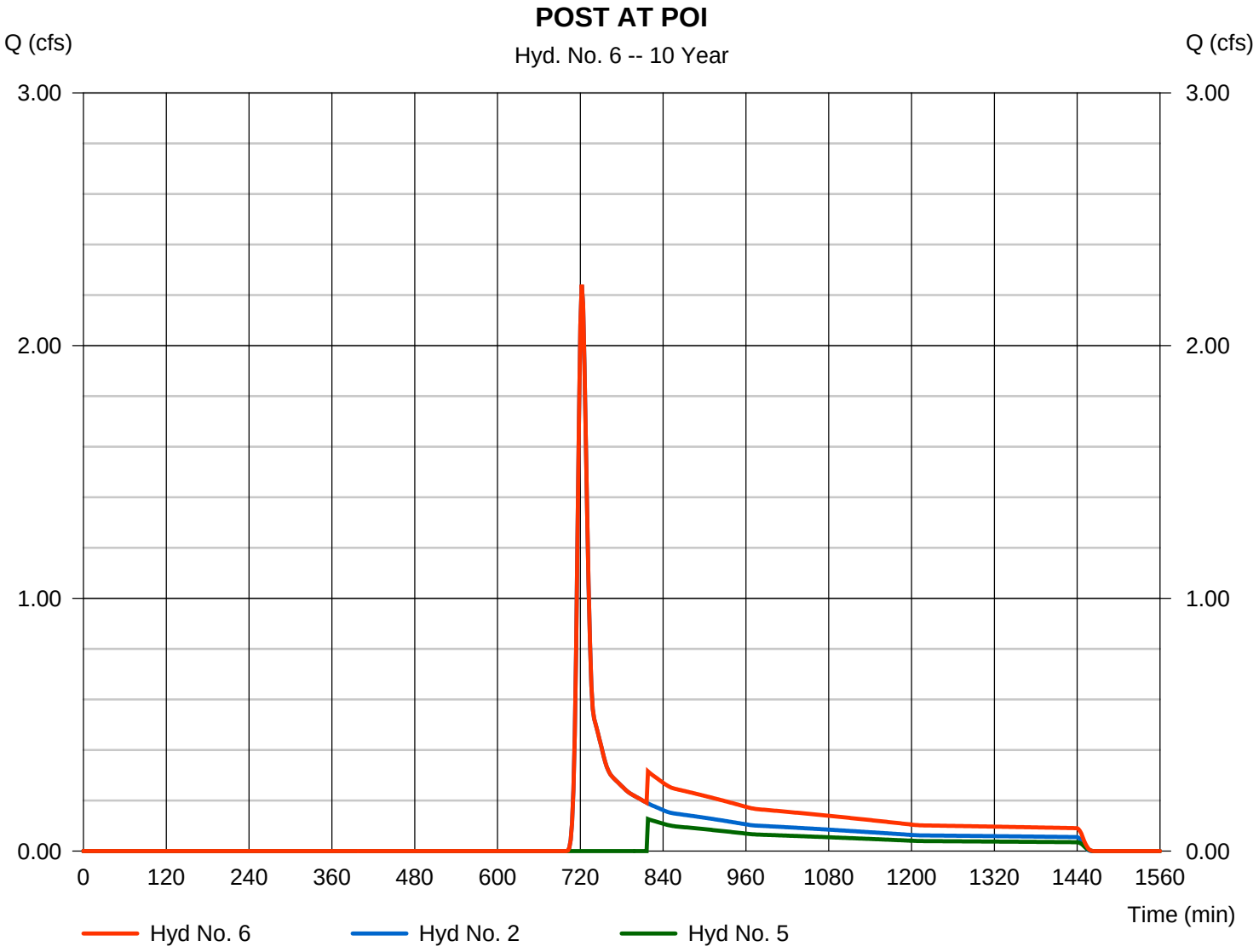


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	2.241 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	9,080 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	2.330 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	8.406	2	724	24,836	------	------	------	PRE
2	SCS Runoff	6.155	2	722	16,587	------	------	------	POST UNDETAINED
3	SCS Runoff	3.746	2	724	10,827	------	------	------	POST DETAINED
4	Diversion1	3.746	2	724	3,002	3	------	------	VOLUME ABSTRACTION
5	Diversion2	3.494	2	726	7,825	3	------	------	POST AFTER BMP
6	Combine	8.451	2	726	24,412	2, 5	------	------	POST AT POI

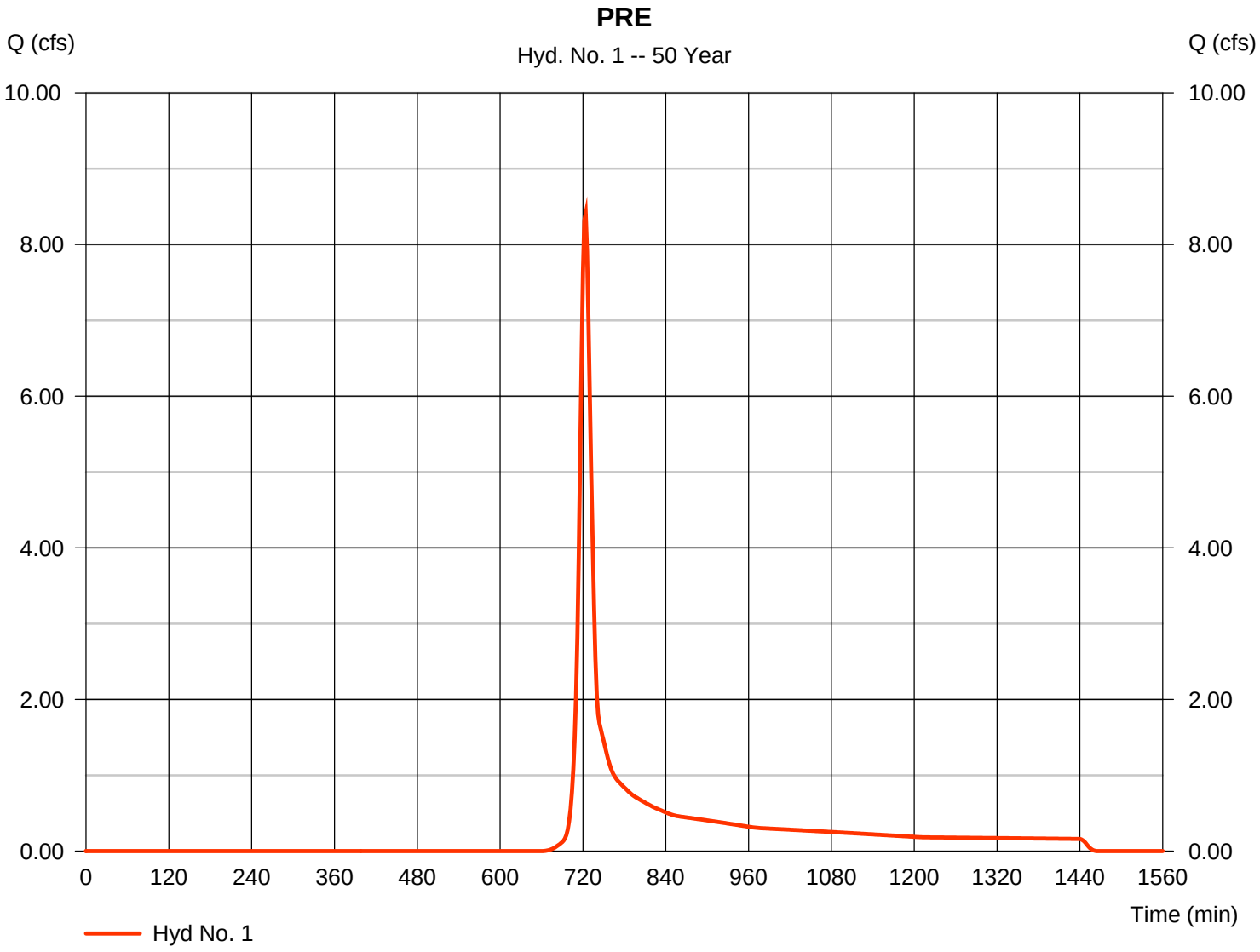
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.406 cfs
Storm frequency	=	50 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	24,836 cuft
Drainage area	=	3.690 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	6.23 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.690 x 58)] / 3.690



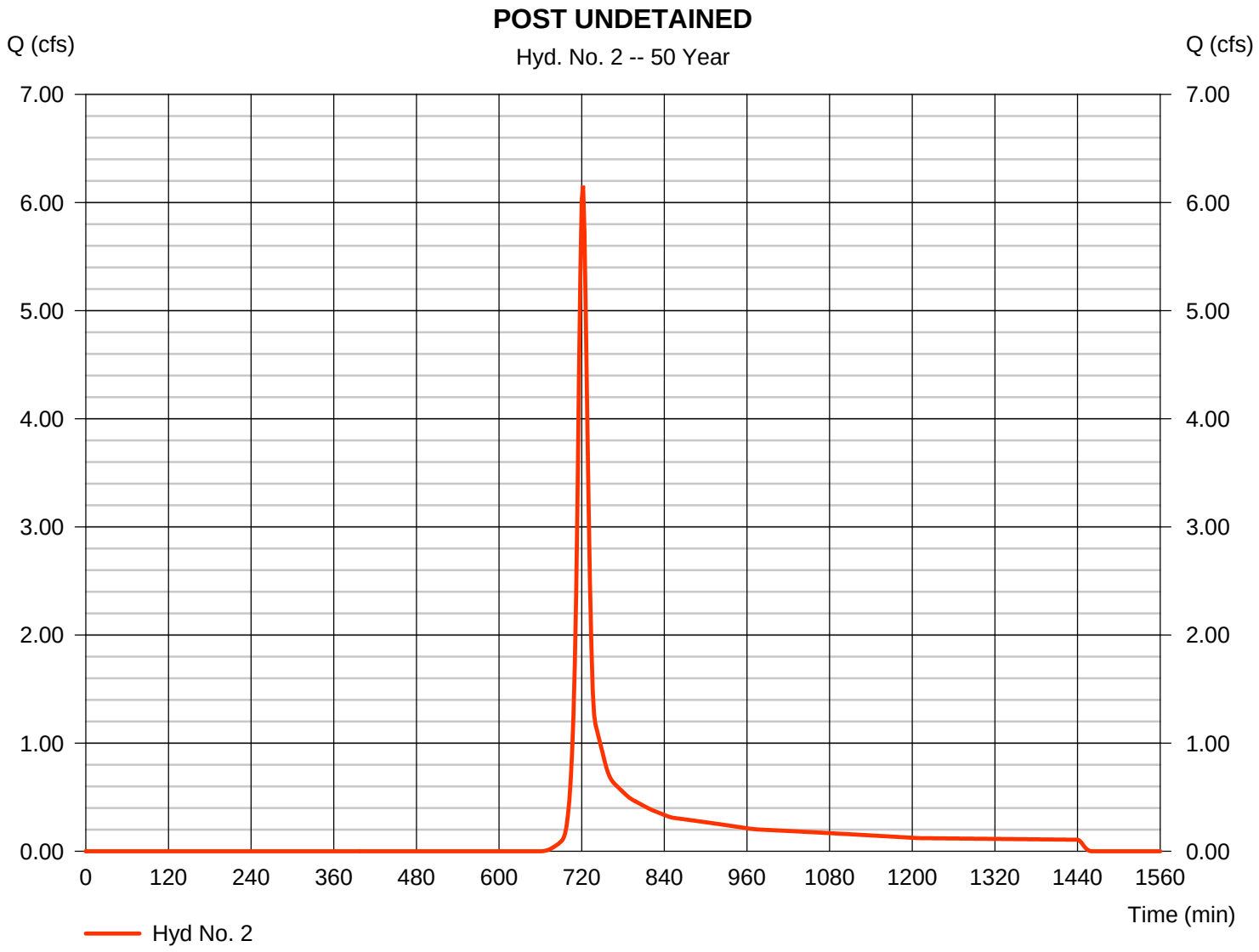
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.155 cfs
Storm frequency	=	50 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	16,587 cuft
Drainage area	=	2.330 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.00 min
Total precip.	=	6.23 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.320 x 58) + (0.010 x 85)] / 2.330



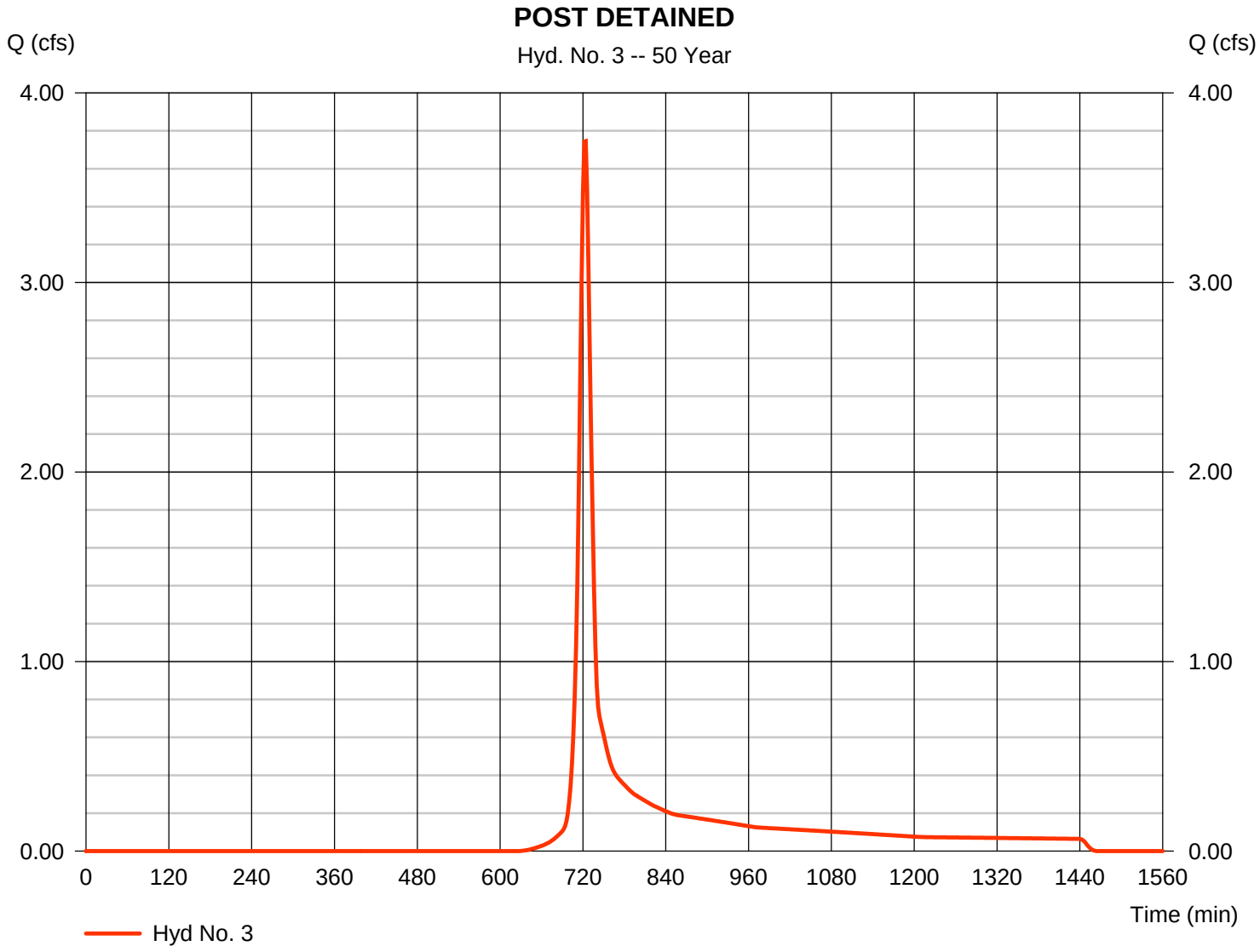
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.746 cfs
Storm frequency	=	50 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	10,827 cuft
Drainage area	=	1.360 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	16.50 min
Total precip.	=	6.23 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.180 x 85) + (1.180 x 58)] / 1.360

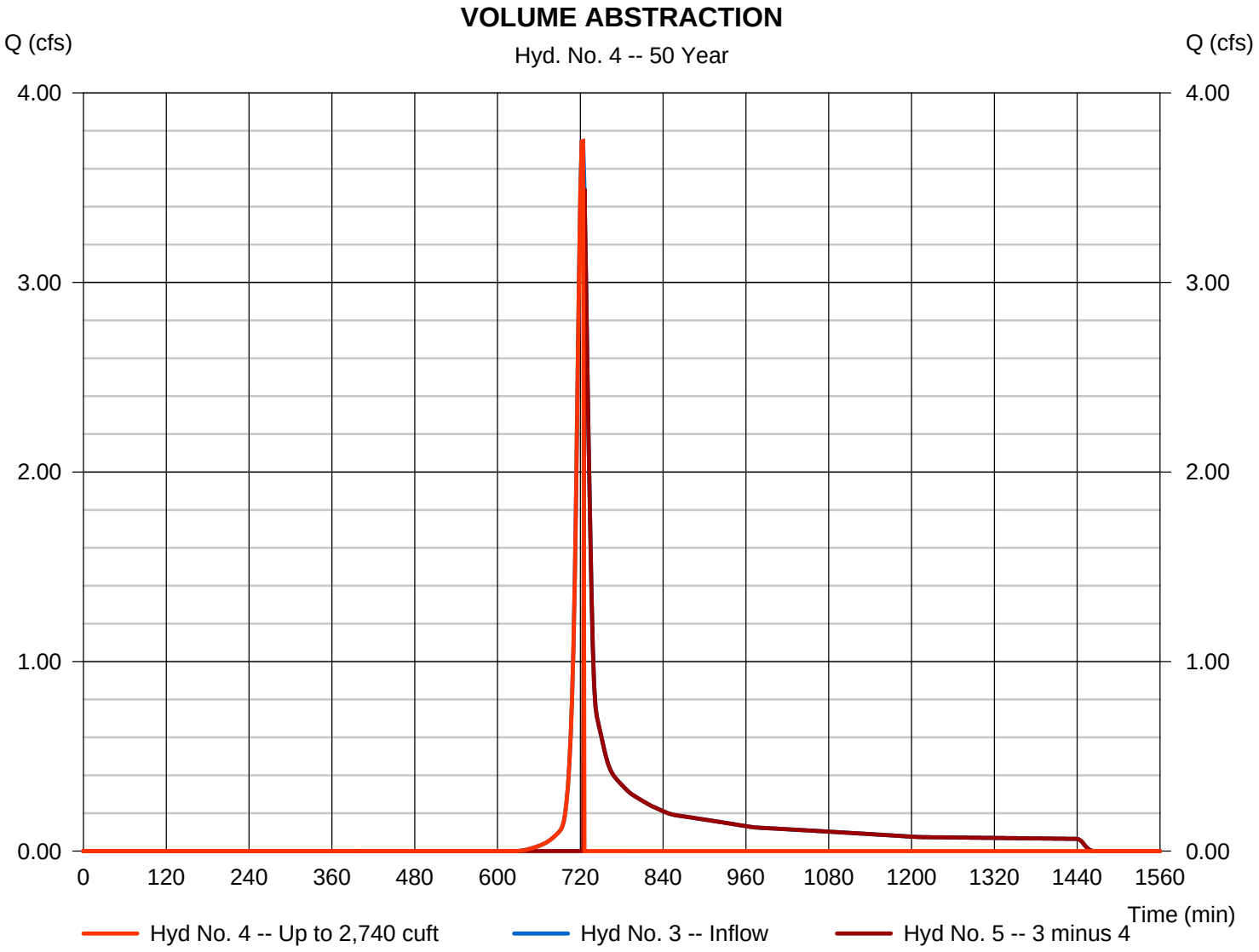


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 3.746 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 3,002 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

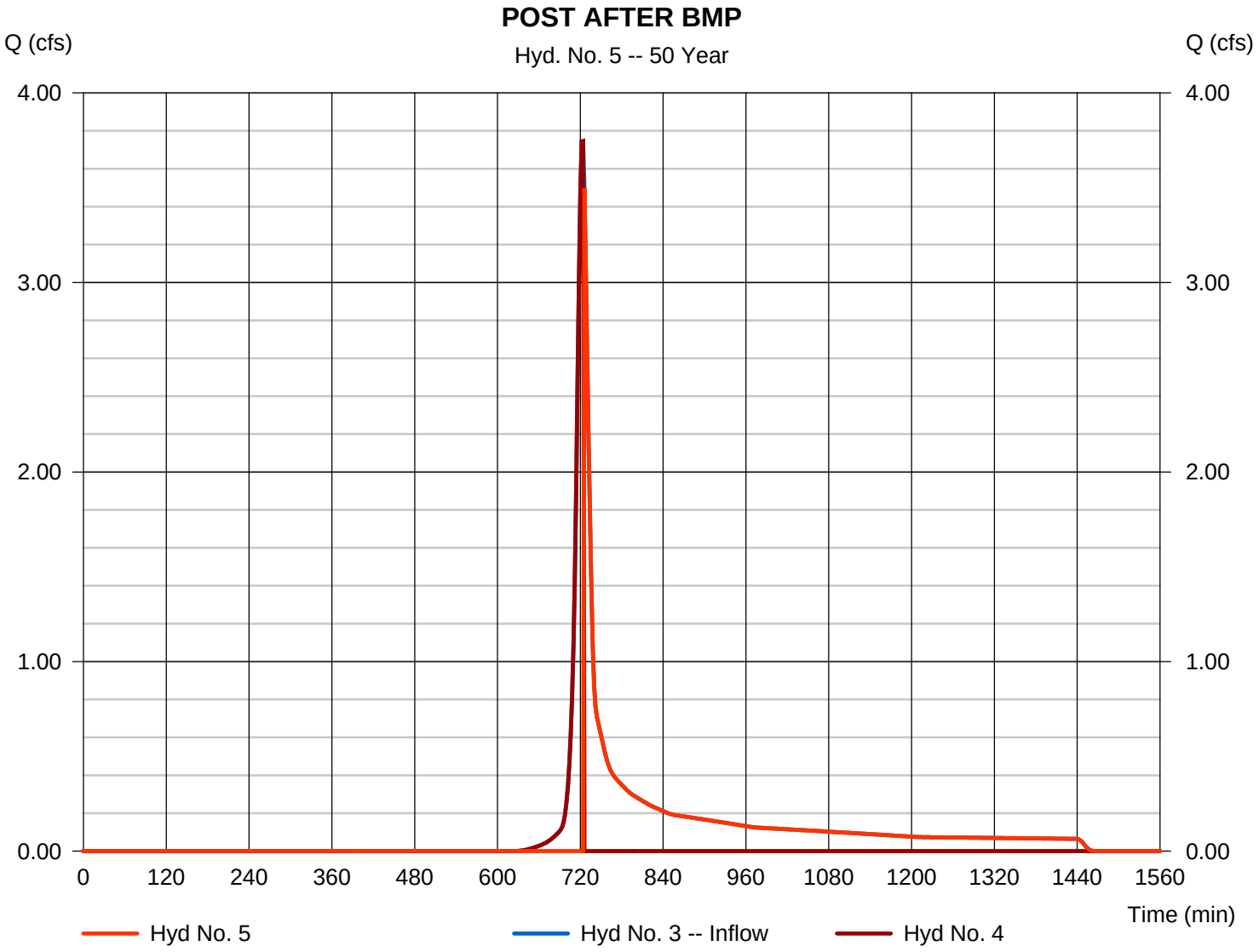


Hydrograph Report

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 3.494 cfs
Storm frequency	= 50 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 7,825 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

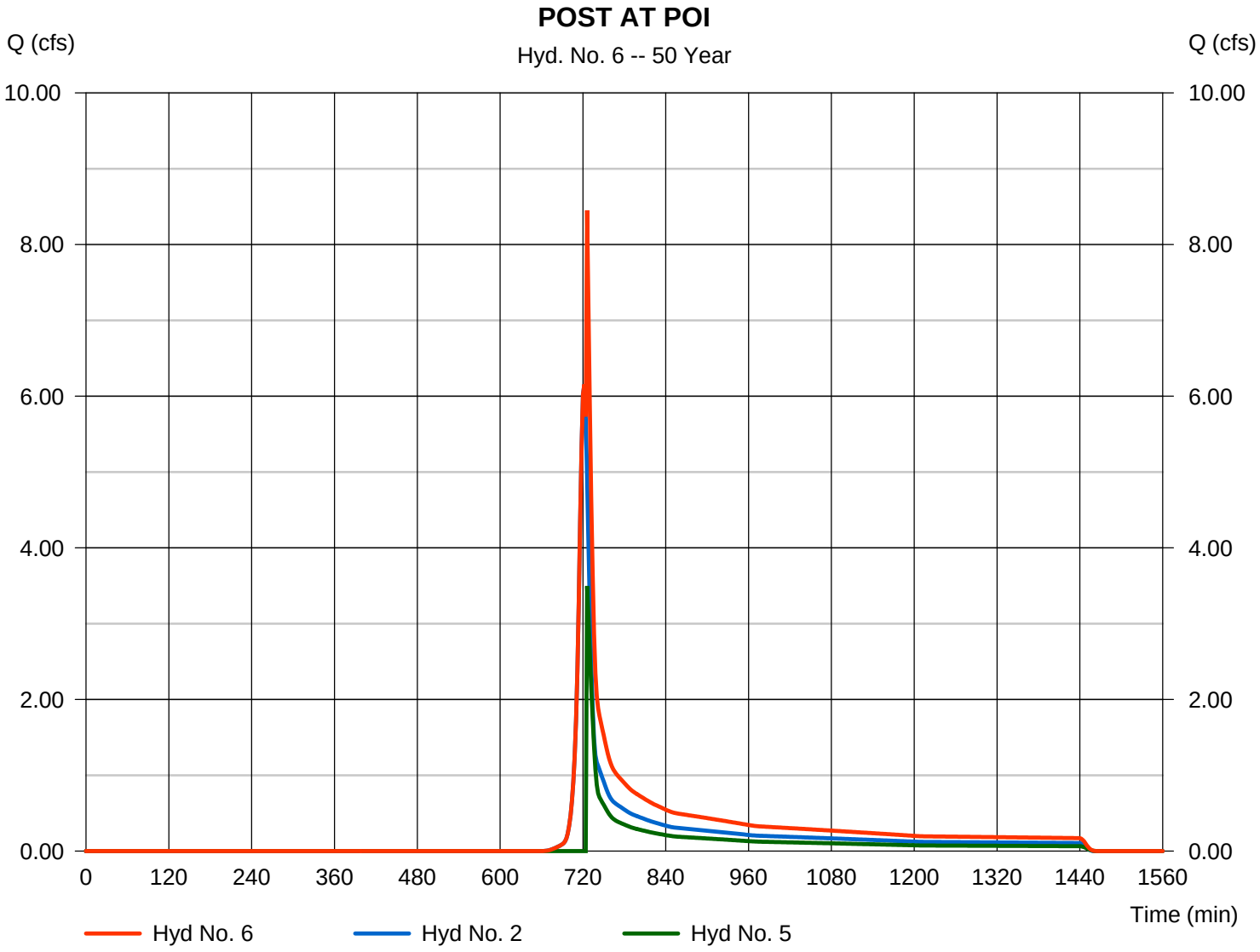


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	8.451 cfs
Storm frequency	=	50 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	24,412 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	2.330 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	11.87	2	724	34,337	------	------	------	PRE
2	SCS Runoff	8.674	2	722	22,933	------	------	------	POST UNDETAINED
3	SCS Runoff	5.147	2	722	14,625	------	------	------	POST DETAINED
4	Diversion1	4.829	2	720	3,244	3	------	------	VOLUME ABSTRACTION
5	Diversion2	5.147	2	722	11,381	3	------	------	POST AFTER BMP
6	Combine	13.82	2	722	34,314	2, 5	------	------	POST AT POI

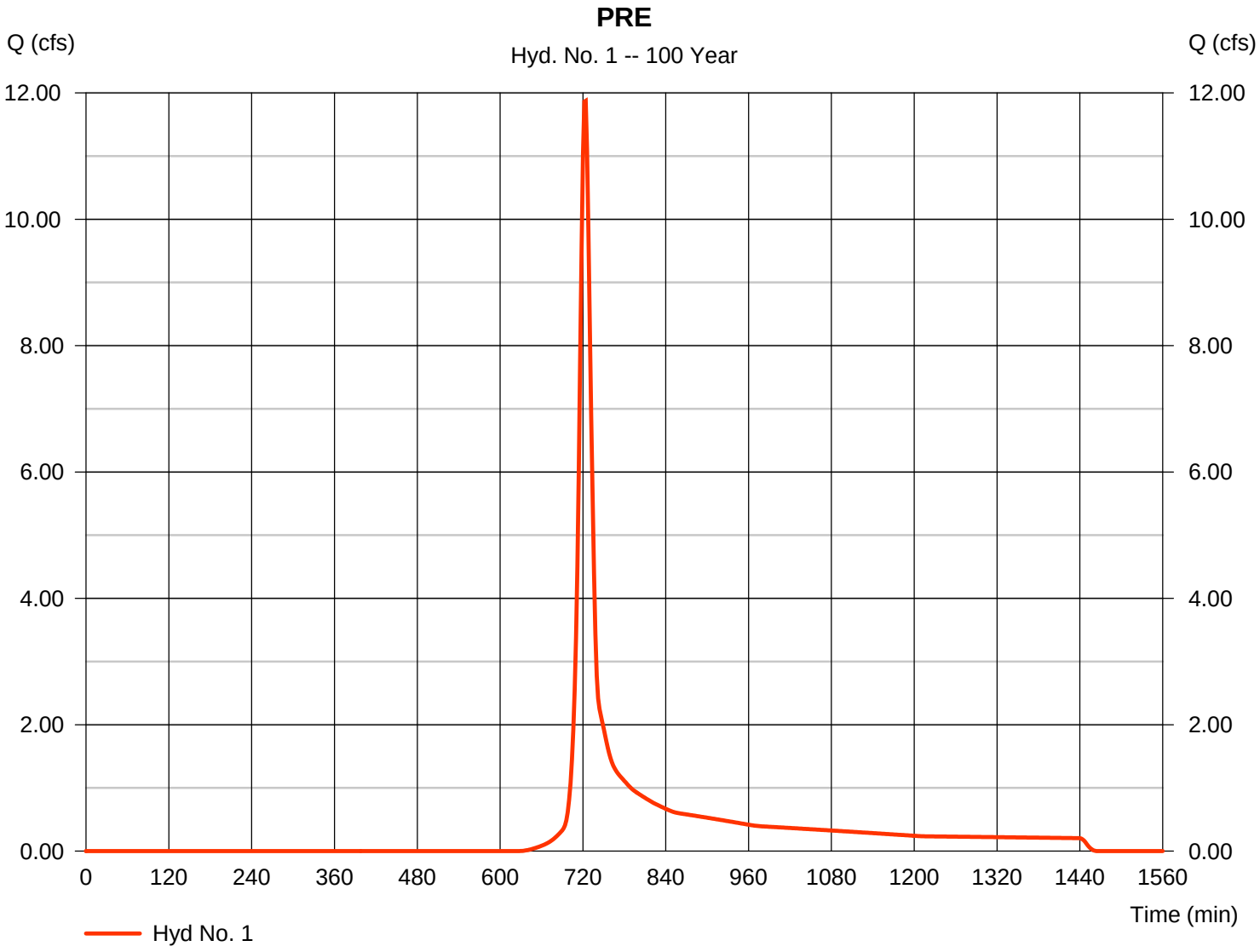
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.87 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	34,337 cuft
Drainage area	=	3.690 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	7.32 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.690 x 58)] / 3.690



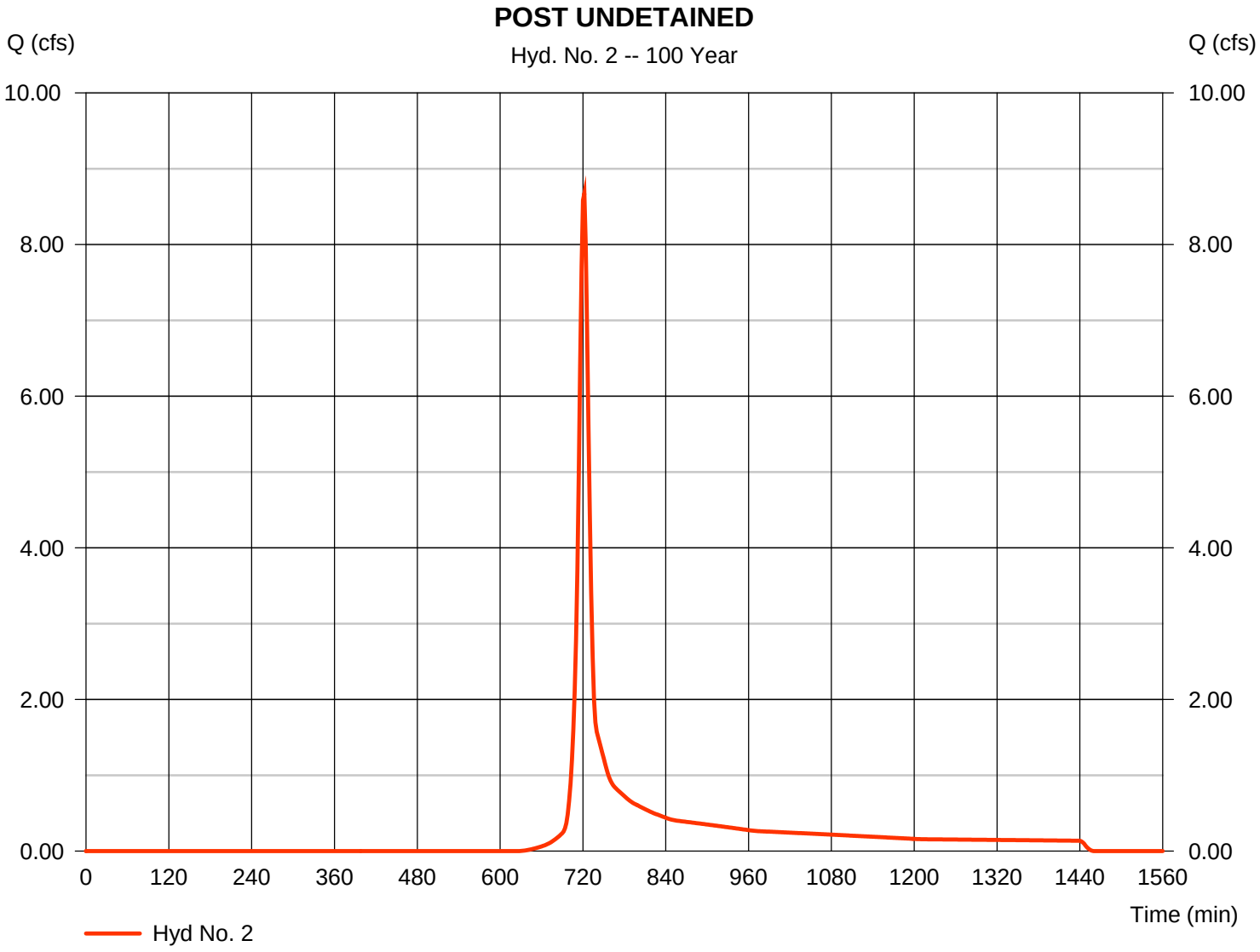
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.674 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	22,933 cuft
Drainage area	=	2.330 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.00 min
Total precip.	=	7.32 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.320 x 58) + (0.010 x 85)] / 2.330



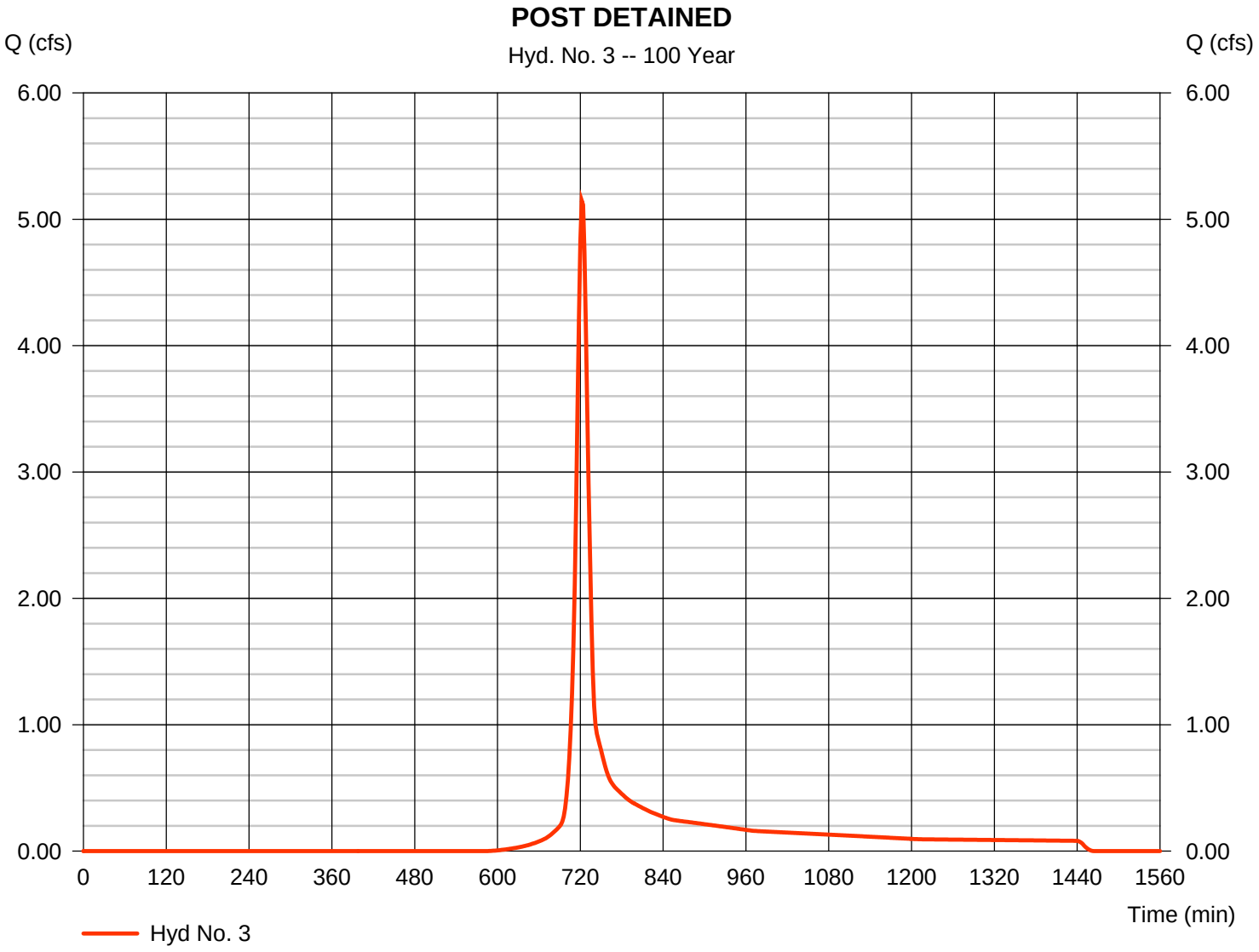
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.147 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	14,625 cuft
Drainage area	=	1.360 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	16.50 min
Total precip.	=	7.32 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.180 x 85) + (1.180 x 58)] / 1.360

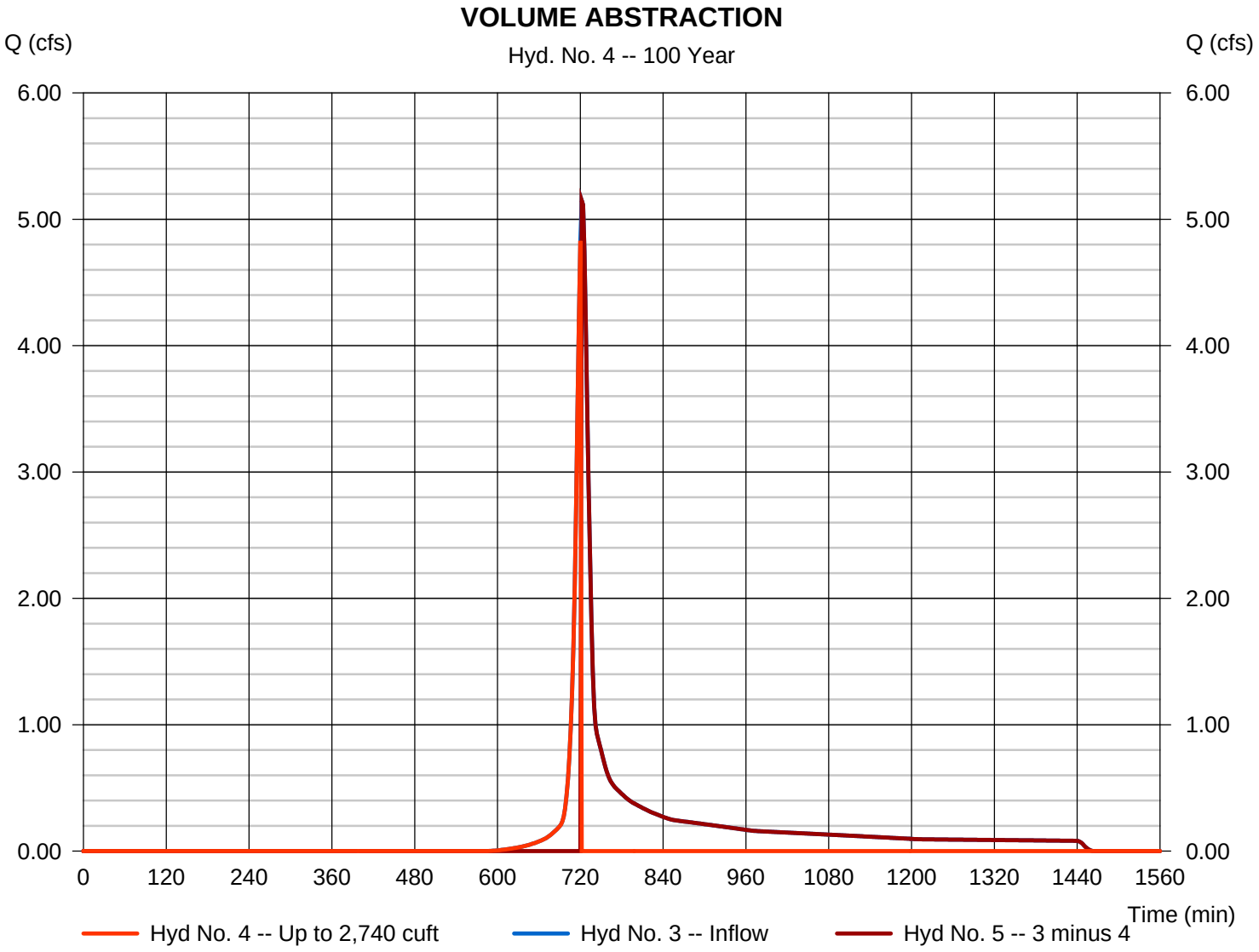


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 4.829 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 3,244 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

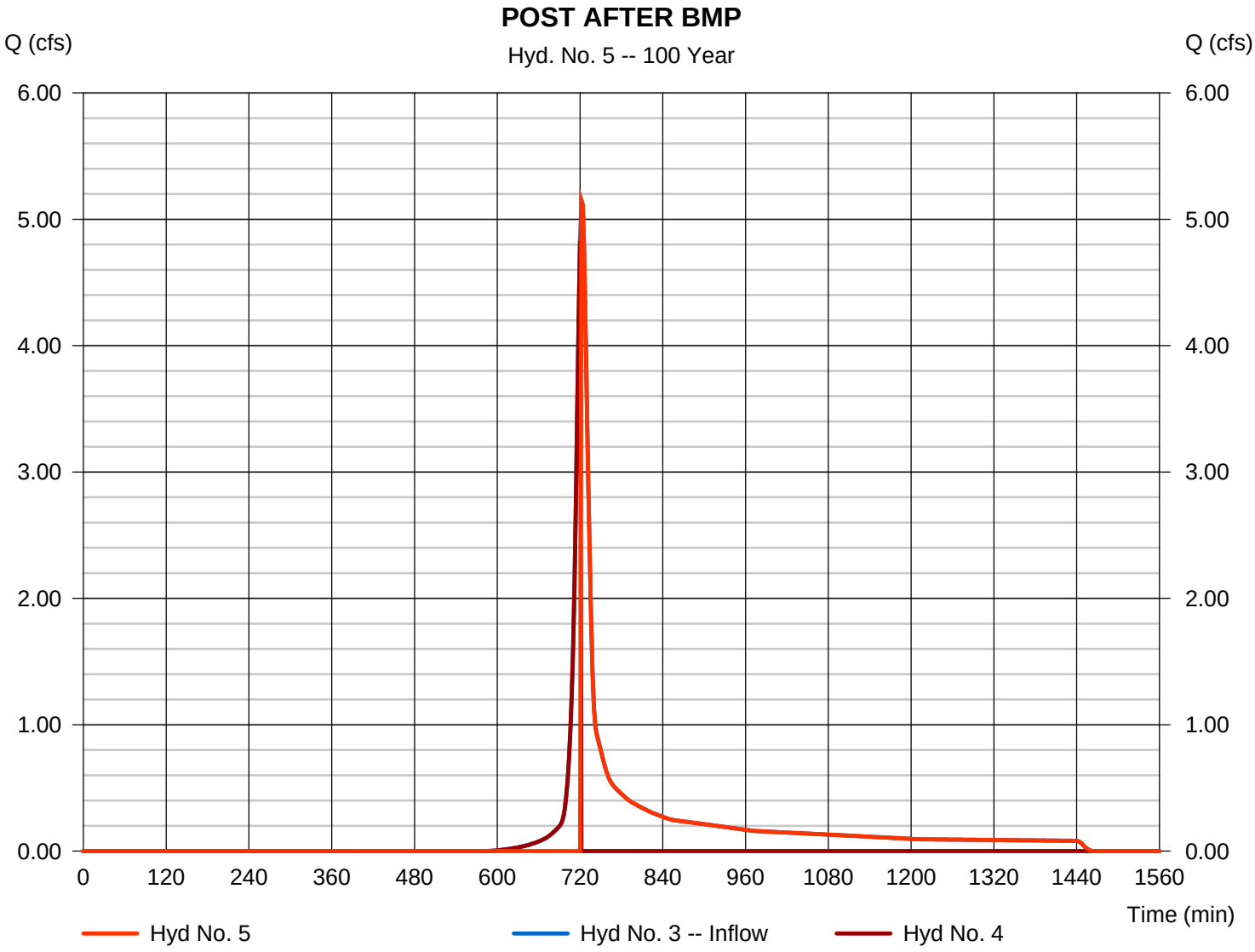


Hydrograph Report

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 5.147 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 11,381 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

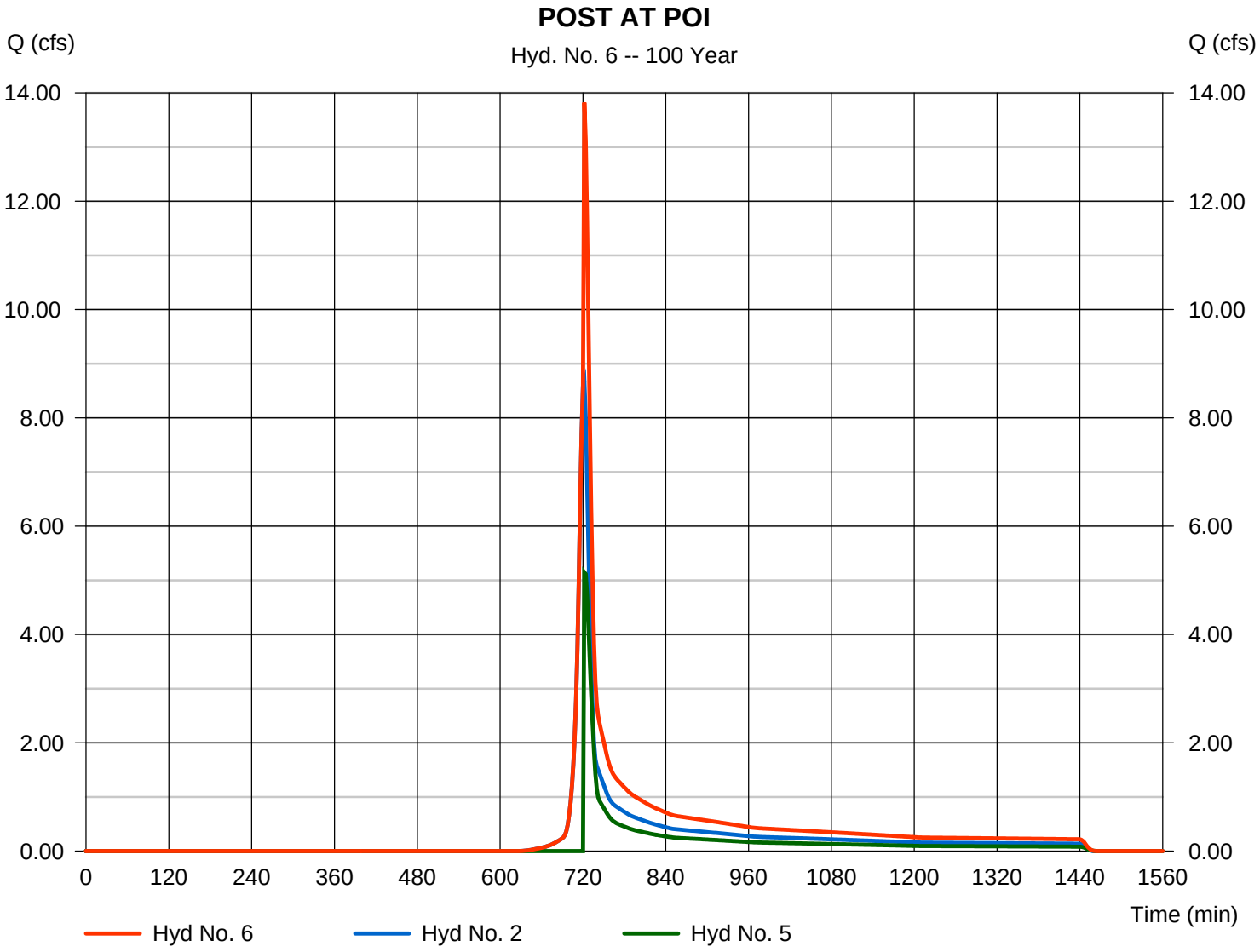


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	13.82 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	34,314 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	2.330 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	45.9138	11.8000	0.8796	--------
2	54.5808	12.1000	0.8736	--------
3	0.0000	0.0000	0.0000	--------
5	59.9618	12.3000	0.8422	--------
10	55.6073	11.3000	0.7938	--------
25	49.4111	9.8000	0.7297	--------
50	49.3823	9.5000	0.7034	--------
100	44.7550	8.3000	0.6570	--------

File name: Arcona 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	3.84	3.05	2.55	2.19	1.93	1.72	1.56	1.43	1.31	1.22	1.14	1.07
2	4.57	3.65	3.06	2.64	2.32	2.08	1.89	1.73	1.59	1.48	1.38	1.30
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	5.44	4.39	3.70	3.21	2.85	2.56	2.33	2.14	1.98	1.85	1.73	1.63
10	6.07	4.91	4.15	3.61	3.21	2.90	2.65	2.44	2.27	2.12	1.99	1.88
25	6.92	5.59	4.75	4.15	3.71	3.36	3.08	2.85	2.66	2.50	2.35	2.23
50	7.53	6.11	5.21	4.57	4.09	3.72	3.42	3.17	2.97	2.79	2.63	2.50
100	8.17	6.63	5.66	4.98	4.47	4.08	3.76	3.50	3.28	3.10	2.93	2.79

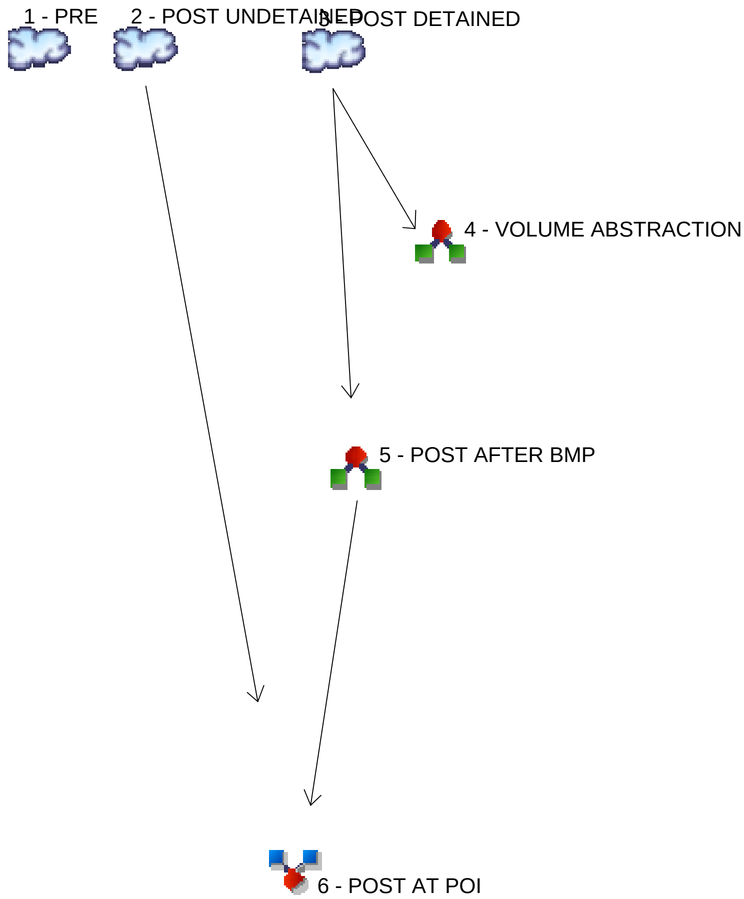
Tc = time in minutes. Values may exceed 60.

st Phase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Arcona\Hydraflow Rev 1\Arcona 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	2.40	2.89	0.00	3.63	4.28	5.30	6.23	7.32
SCS 6-Hr	1.67	2.02	0.00	2.53	2.96	3.61	4.17	4.81
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
4	Diversion1	VOLUME ABSTRACTION
5	Diversion2	POST AFTER BMP
6	Combine	POST AT POI

Hydrograph Return Period Recap

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

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	0.461	-------	-------	-------	-------	-------	-------	PRE
2	SCS Runoff	------	-------	0.342	-------	-------	-------	-------	-------	-------	POST UNDETAINED
3	SCS Runoff	------	-------	0.123	-------	-------	-------	-------	-------	-------	POST DETAINED
4	Diversion1	3	-------	0.123	-------	-------	-------	-------	-------	-------	VOLUME ABSTRACTION
5	Diversion2	3	-------	0.000	-------	-------	-------	-------	-------	-------	POST AFTER BMP
6	Combine	2, 5	-------	0.342	-------	-------	-------	-------	-------	-------	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	0.461	2	726	3,123	------	------	------	PRE
2	SCS Runoff	0.342	2	724	2,086	------	------	------	POST UNDETAINED
3	SCS Runoff	0.123	2	786	1,754	------	------	------	POST DETAINED
4	Diversion1	0.123	2	786	1,754	3	------	------	VOLUME ABSTRACTION
5	Diversion2	0.000	2	n/a	0	3	------	------	POST AFTER BMP
6	Combine	0.342	2	724	2,086	2, 5	------	------	POST AT POI

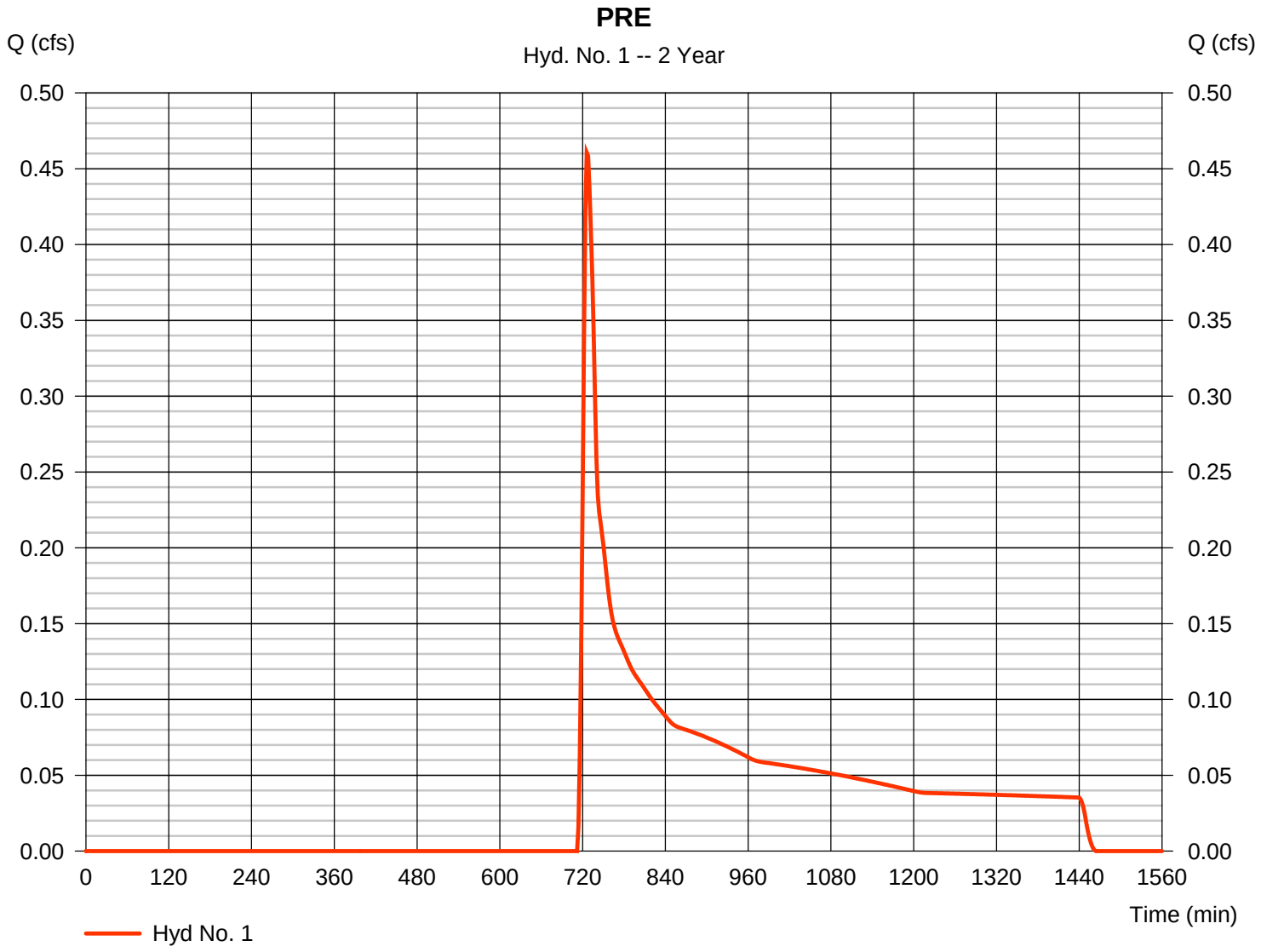
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.461 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	3,123 cuft
Drainage area	=	3.690 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	2.89 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.690 x 58)] / 3.690



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)	= 2.89		0.00		0.00		
Land slope (%)	= 2.47		0.00		0.00		
Travel Time (min)	**= 7.93**	**+**	**0.00**	**+**	**0.00**	**=**	**7.93**
Shallow Concentrated Flow							
Flow length (ft)	= 658.00		0.00		0.00		
Watercourse slope (%)	= 1.87		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.21		0.00		0.00		
Travel Time (min)	**= 4.97**	**+**	**0.00**	**+**	**0.00**	**=**	**4.97**
Channel Flow							
X sectional flow area (sqft)	= 16.00		0.00		0.00		
Wetted perimeter (ft)	= 28.00		0.00		0.00		
Channel slope (%)	= 1.45		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=8.22						
			0.00				
					0.00		
Flow length (ft)	({0})496.0		0.0		0.0		
Travel Time (min)	**= 1.01**	**+**	**0.00**	**+**	**0.00**	**=**	**1.01**

Total Travel Time, Tc ..... 13.90 min

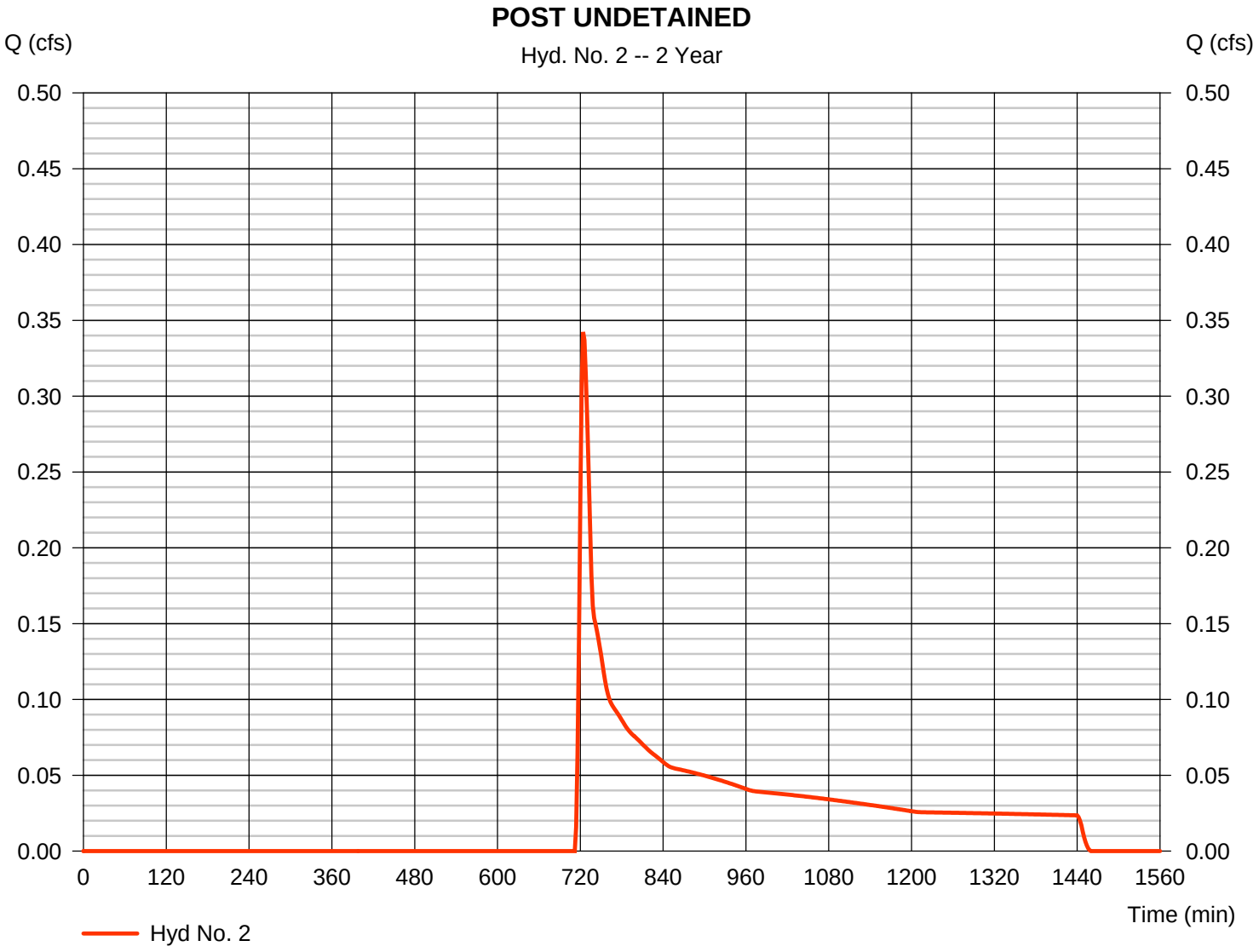
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.342 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	2,086 cuft
Drainage area	=	2.330 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.00 min
Total precip.	=	2.89 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.320 x 58) + (0.010 x 85)] / 2.330



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)	= 2.89		0.00		0.00		
Land slope (%)	= 2.40		0.00		0.00		
Travel Time (min)	**= 8.02**	**+**	**0.00**	**+**	**0.00**	**=**	**8.02**
Shallow Concentrated Flow							
Flow length (ft)	= 668.00		0.00		0.00		
Watercourse slope (%)	= 1.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.22		0.00		0.00		
Travel Time (min)	**= 5.01**	**+**	**0.00**	**+**	**0.00**	**=**	**5.01**
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 ..... 13.00 min

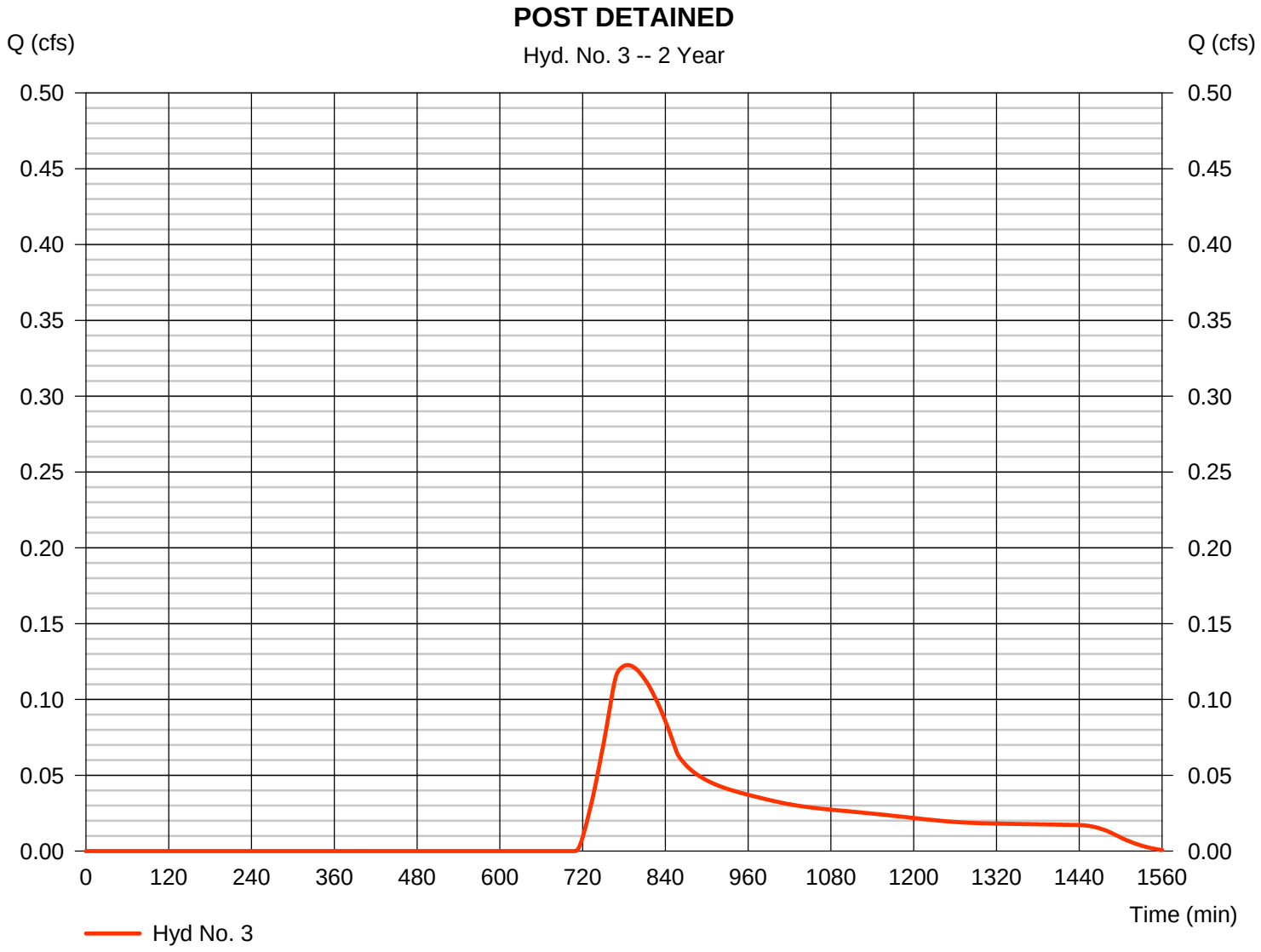
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 0.123 cfs
Storm frequency	= 2 yrs	Time to peak	= 786 min
Time interval	= 2 min	Hyd. volume	= 1,754 cuft
Drainage area	= 1.360 ac	Curve number	= 62*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 91.11 min
Total precip.	= 2.89 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.180 x 85) + (1.180 x 58)] / 1.360

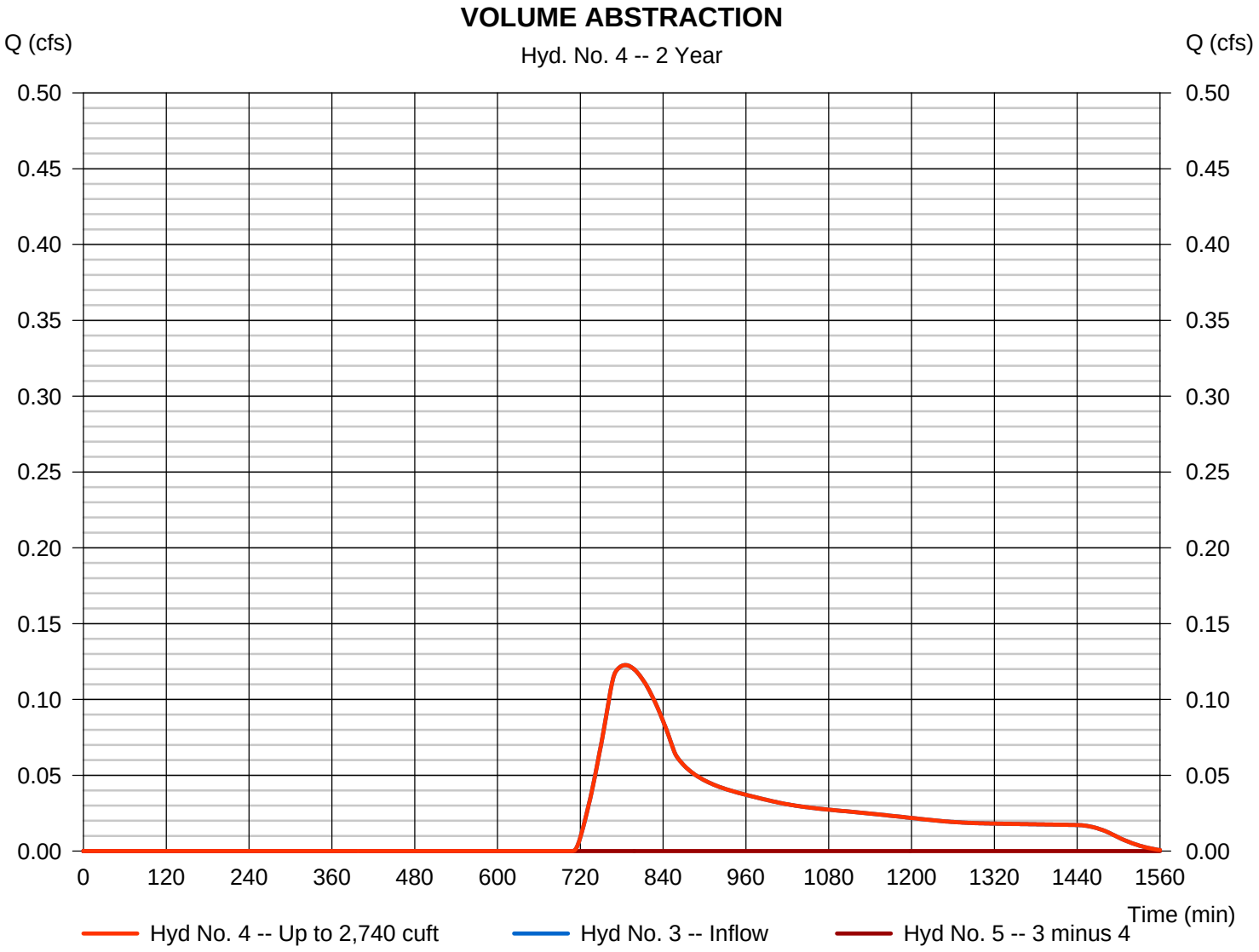


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.123 cfs
Storm frequency	= 2 yrs	Time to peak	= 786 min
Time interval	= 2 min	Hyd. volume	= 1,754 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

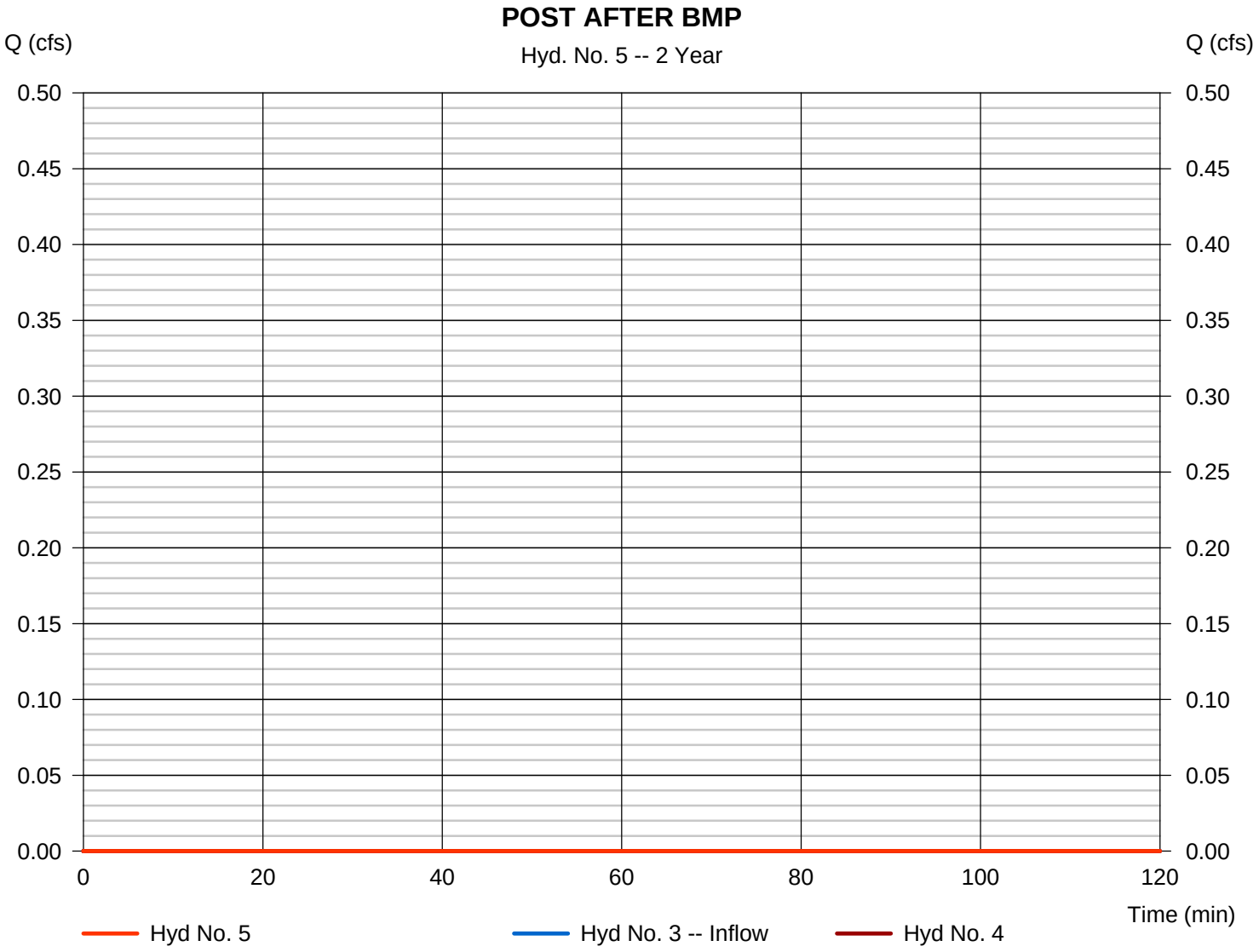


Hydrograph Report

Hyd. No. 5

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	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

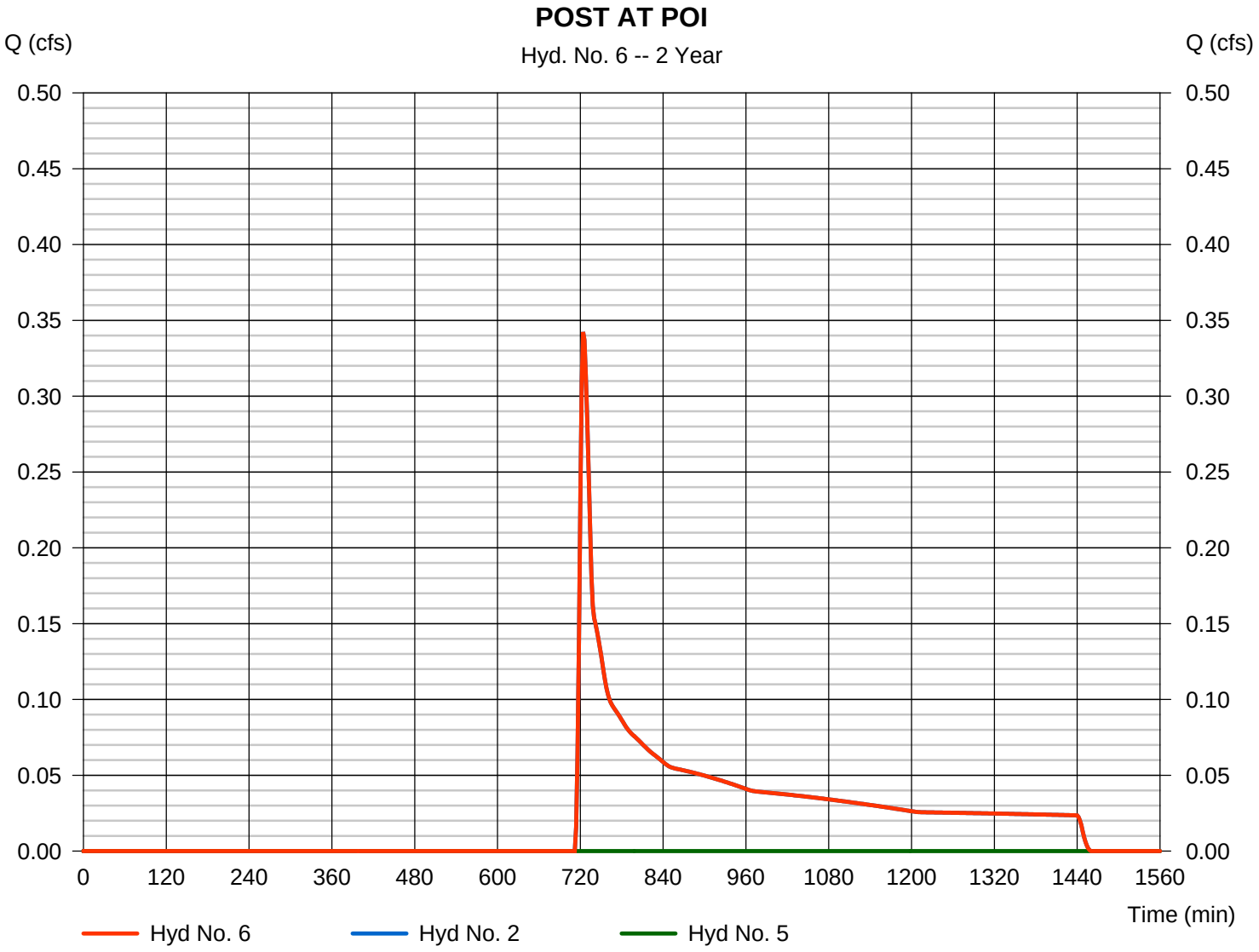


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	0.342 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	2,086 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	2.330 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	45.9138	11.8000	0.8796	--------
2	54.5808	12.1000	0.8736	--------
3	0.0000	0.0000	0.0000	--------
5	59.9618	12.3000	0.8422	--------
10	55.6073	11.3000	0.7938	--------
25	49.4111	9.8000	0.7297	--------
50	49.3823	9.5000	0.7034	--------
100	44.7550	8.3000	0.6570	--------

File name: Arcona 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	3.84	3.05	2.55	2.19	1.93	1.72	1.56	1.43	1.31	1.22	1.14	1.07
2	4.57	3.65	3.06	2.64	2.32	2.08	1.89	1.73	1.59	1.48	1.38	1.30
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	5.44	4.39	3.70	3.21	2.85	2.56	2.33	2.14	1.98	1.85	1.73	1.63
10	6.07	4.91	4.15	3.61	3.21	2.90	2.65	2.44	2.27	2.12	1.99	1.88
25	6.92	5.59	4.75	4.15	3.71	3.36	3.08	2.85	2.66	2.50	2.35	2.23
50	7.53	6.11	5.21	4.57	4.09	3.72	3.42	3.17	2.97	2.79	2.63	2.50
100	8.17	6.63	5.66	4.98	4.47	4.08	3.76	3.50	3.28	3.10	2.93	2.79

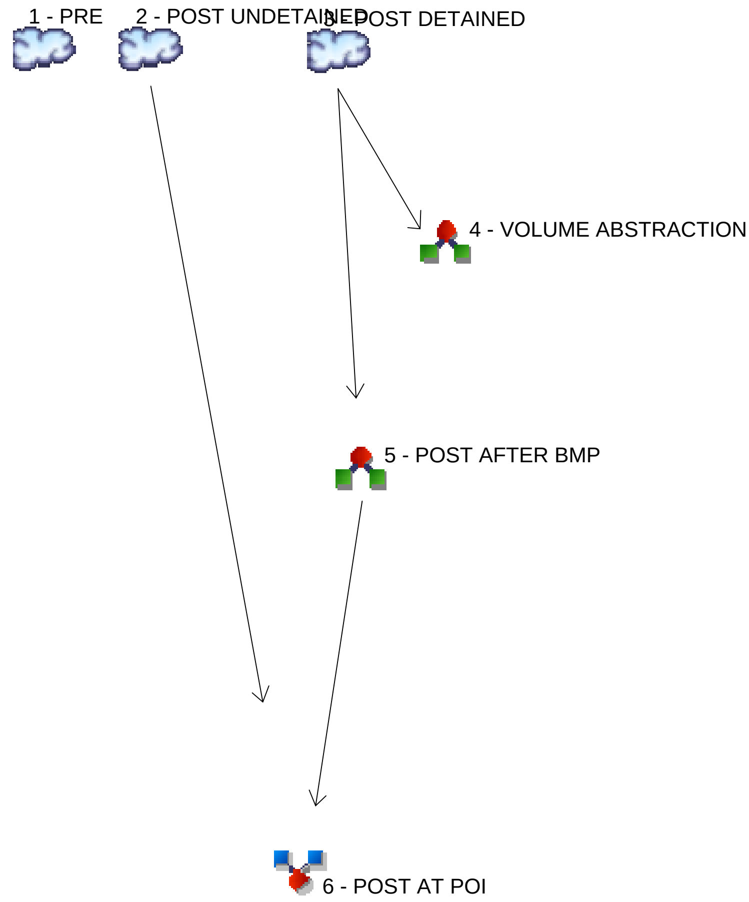
Tc = time in minutes. Values may exceed 60.

st Phase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Arcona\Hydraflow Rev 1\Arcona 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	2.40	2.89	0.00	3.63	4.28	5.30	6.23	7.32
SCS 6-Hr	1.67	2.02	0.00	2.53	2.96	3.61	4.17	4.81
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
4	Diversion1	VOLUME ABSTRACTION
5	Diversion2	POST AFTER BMP
6	Combine	POST AT POI

Project: \\nuss010fp2\shared\Marcellus_M-Z - Mark Sladic\Sunoco Logistics (SXL)\112IC05958 (Mariner East Phase 2)\ESCGP-2\P

Tuesday, 11 / 8 / 2016

Hydrograph Return Period Recap

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

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	-------	-------	-------	3.029	-------	-------	-------	PRE
2	SCS Runoff	------	-------	-------	-------	-------	2.241	-------	-------	-------	POST UNDETAINED
3	SCS Runoff	------	-------	-------	-------	-------	0.772	-------	-------	-------	POST DETAINED
4	Diversion1	3	-------	-------	-------	-------	0.772	-------	-------	-------	VOLUME ABSTRACTION
5	Diversion2	3	-------	-------	-------	-------	0.136	-------	-------	-------	POST AFTER BMP
6	Combine	2, 5	-------	-------	-------	-------	2.241	-------	-------	-------	POST AT POI

Hydrograph Summary Report

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	3.029	2	724	10,396	------	------	------	PRE
2	SCS Runoff	2.241	2	722	6,943	------	------	------	POST UNDETAINED
3	SCS Runoff	0.772	2	744	4,970	------	------	------	POST DETAINED
4	Diversion1	0.772	2	744	2,744	3	------	------	VOLUME ABSTRACTION
5	Diversion2	0.136	2	834	2,226	3	------	------	POST AFTER BMP
6	Combine	2.241	2	722	9,169	2, 5	------	------	POST AT POI

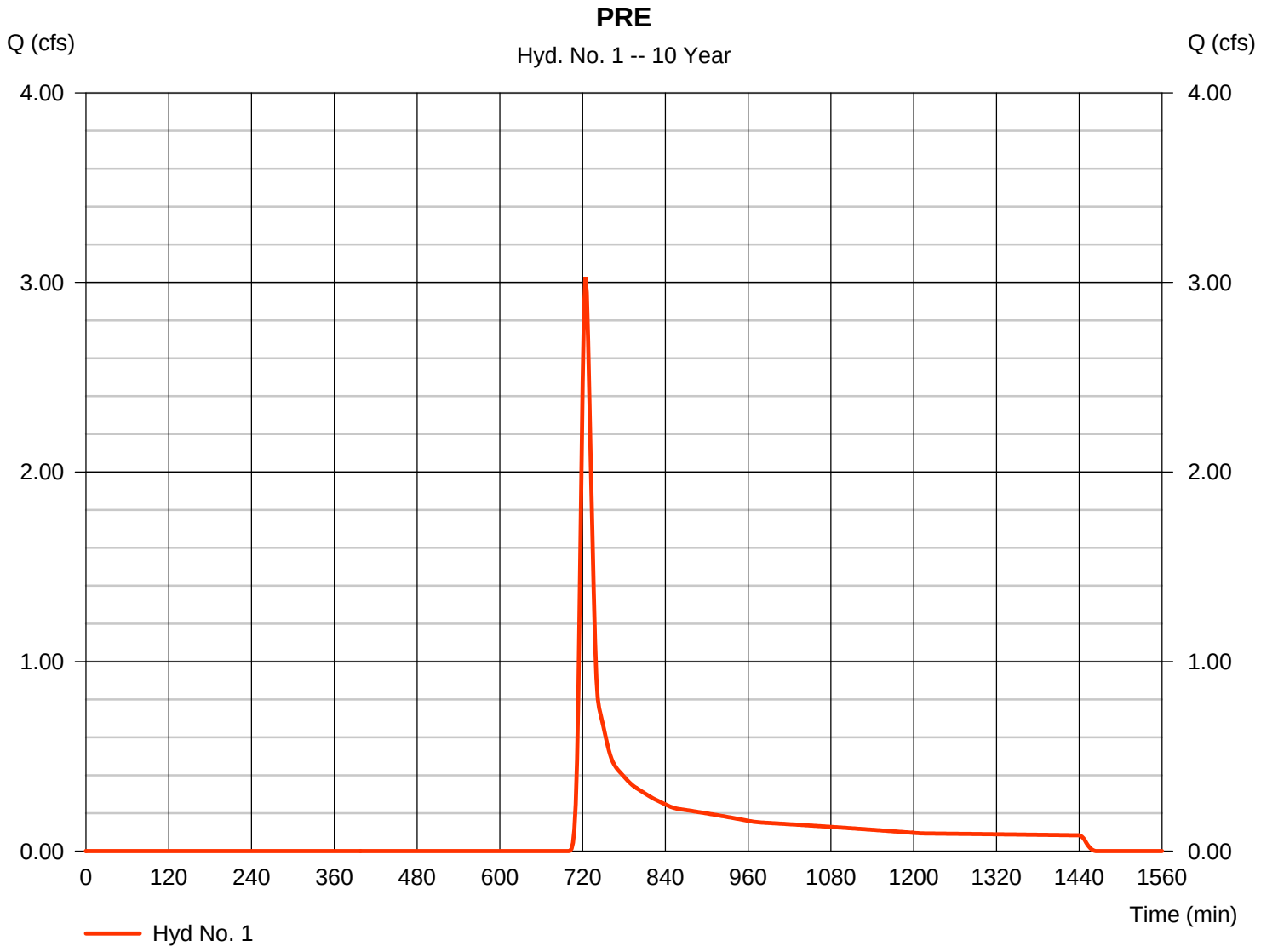
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.029 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	10,396 cuft
Drainage area	=	3.690 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	4.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.690 x 58)] / 3.690



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)	= 2.89		0.00		0.00		
Land slope (%)	= 2.47		0.00		0.00		
Travel Time (min)	**= 7.93**	**+**	**0.00**	**+**	**0.00**	**=**	**7.93**
Shallow Concentrated Flow							
Flow length (ft)	= 658.00		0.00		0.00		
Watercourse slope (%)	= 1.87		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.21		0.00		0.00		
Travel Time (min)	**= 4.97**	**+**	**0.00**	**+**	**0.00**	**=**	**4.97**
Channel Flow							
X sectional flow area (sqft)	= 16.00		0.00		0.00		
Wetted perimeter (ft)	= 28.00		0.00		0.00		
Channel slope (%)	= 1.45		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=8.22						
			0.00				
					0.00		
Flow length (ft)	({0})496.0		0.0		0.0		
Travel Time (min)	**= 1.01**	**+**	**0.00**	**+**	**0.00**	**=**	**1.01**

Total Travel Time, Tc ..... 13.90 min

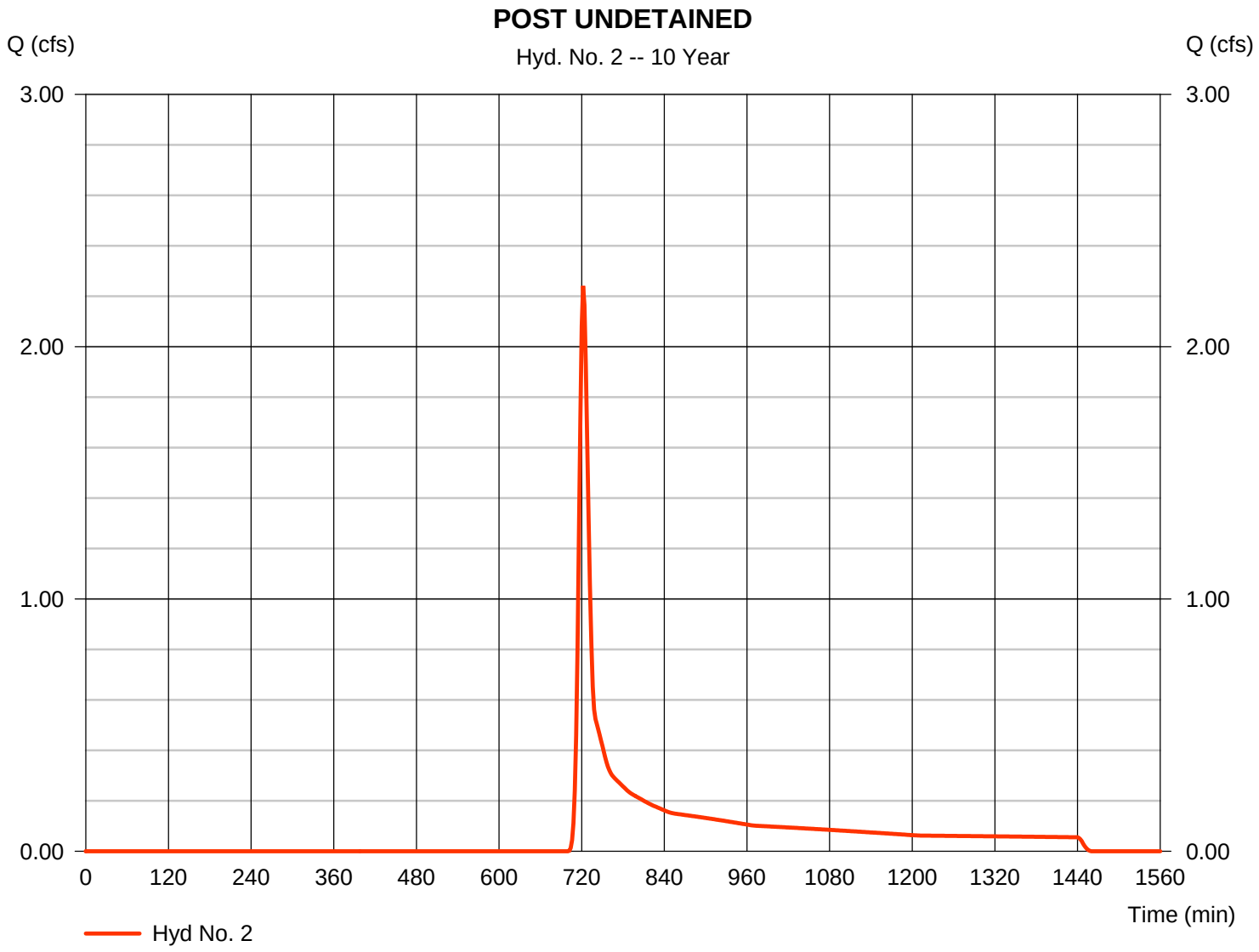
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.241 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	6,943 cuft
Drainage area	=	2.330 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.00 min
Total precip.	=	4.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.320 x 58) + (0.010 x 85)] / 2.330



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)	= 2.89		0.00		0.00		
Land slope (%)	= 2.40		0.00		0.00		
Travel Time (min)	**= 8.02**	**+**	**0.00**	**+**	**0.00**	**=**	**8.02**
Shallow Concentrated Flow							
Flow length (ft)	= 668.00		0.00		0.00		
Watercourse slope (%)	= 1.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.22		0.00		0.00		
Travel Time (min)	**= 5.01**	**+**	**0.00**	**+**	**0.00**	**=**	**5.01**
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 ..... 13.00 min

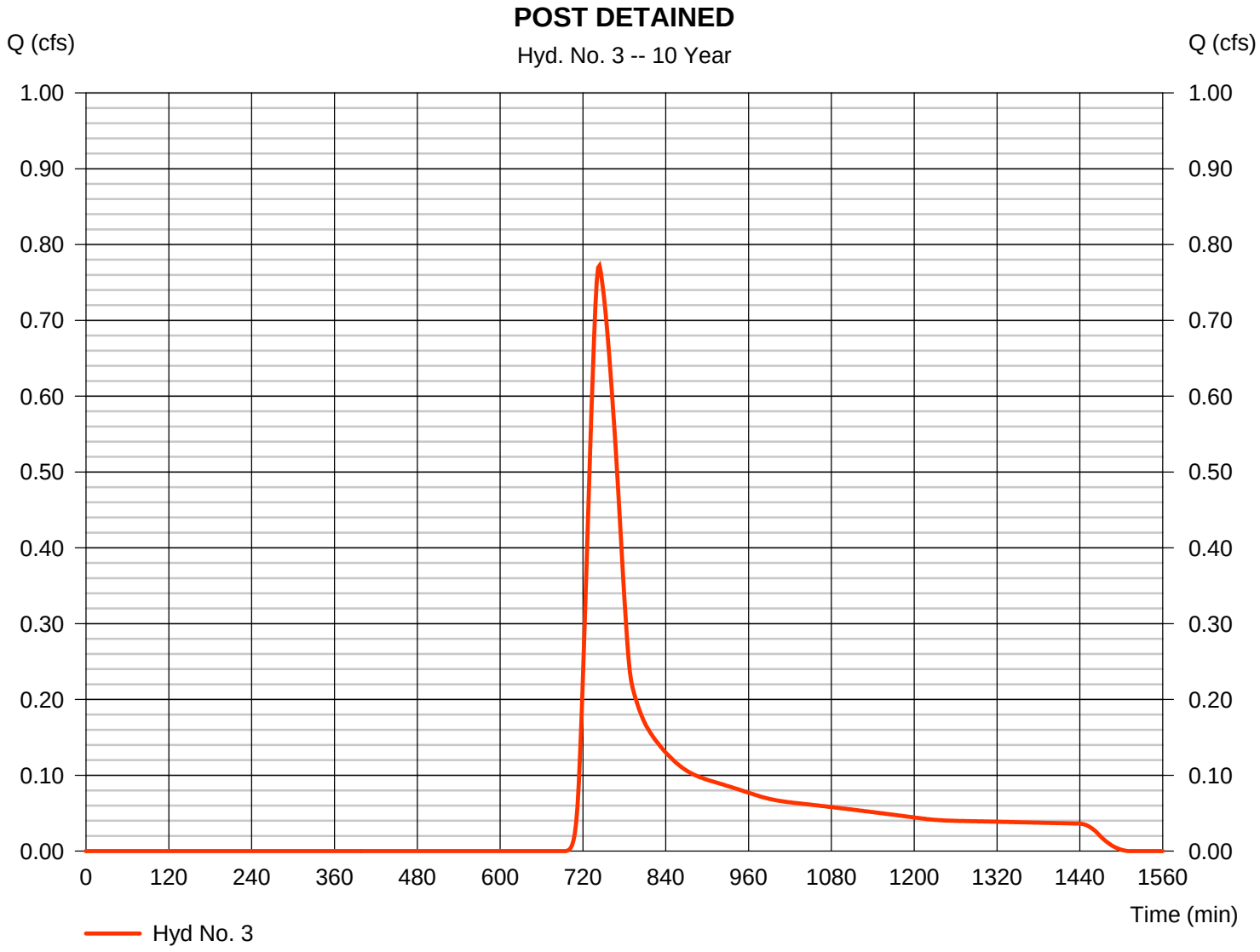
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.772 cfs
Storm frequency	=	10 yrs	Time to peak	=	744 min
Time interval	=	2 min	Hyd. volume	=	4,970 cuft
Drainage area	=	1.360 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	45.70 min
Total precip.	=	4.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.180 x 85) + (1.180 x 58)] / 1.360

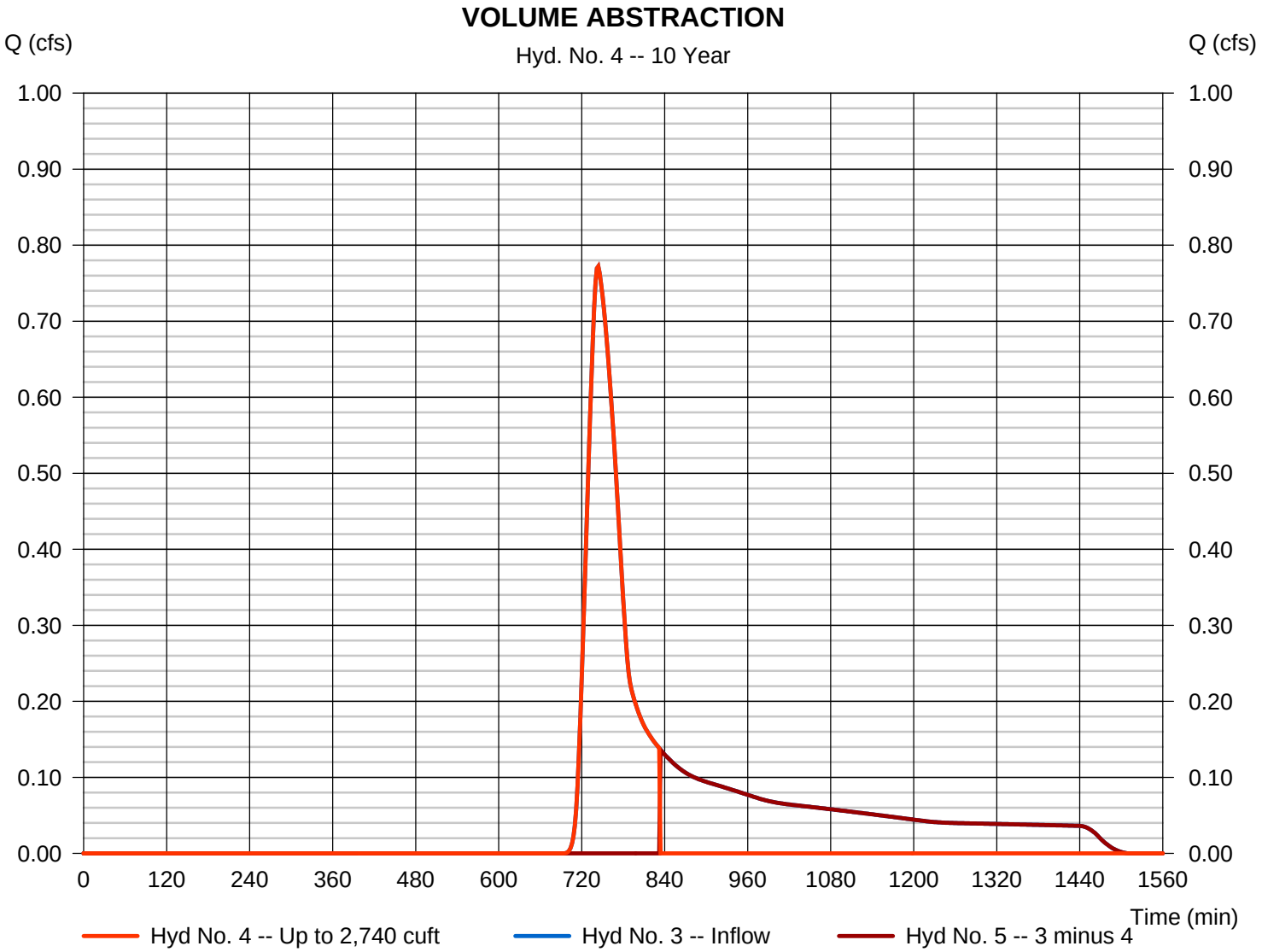


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.772 cfs
Storm frequency	= 10 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 2,744 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

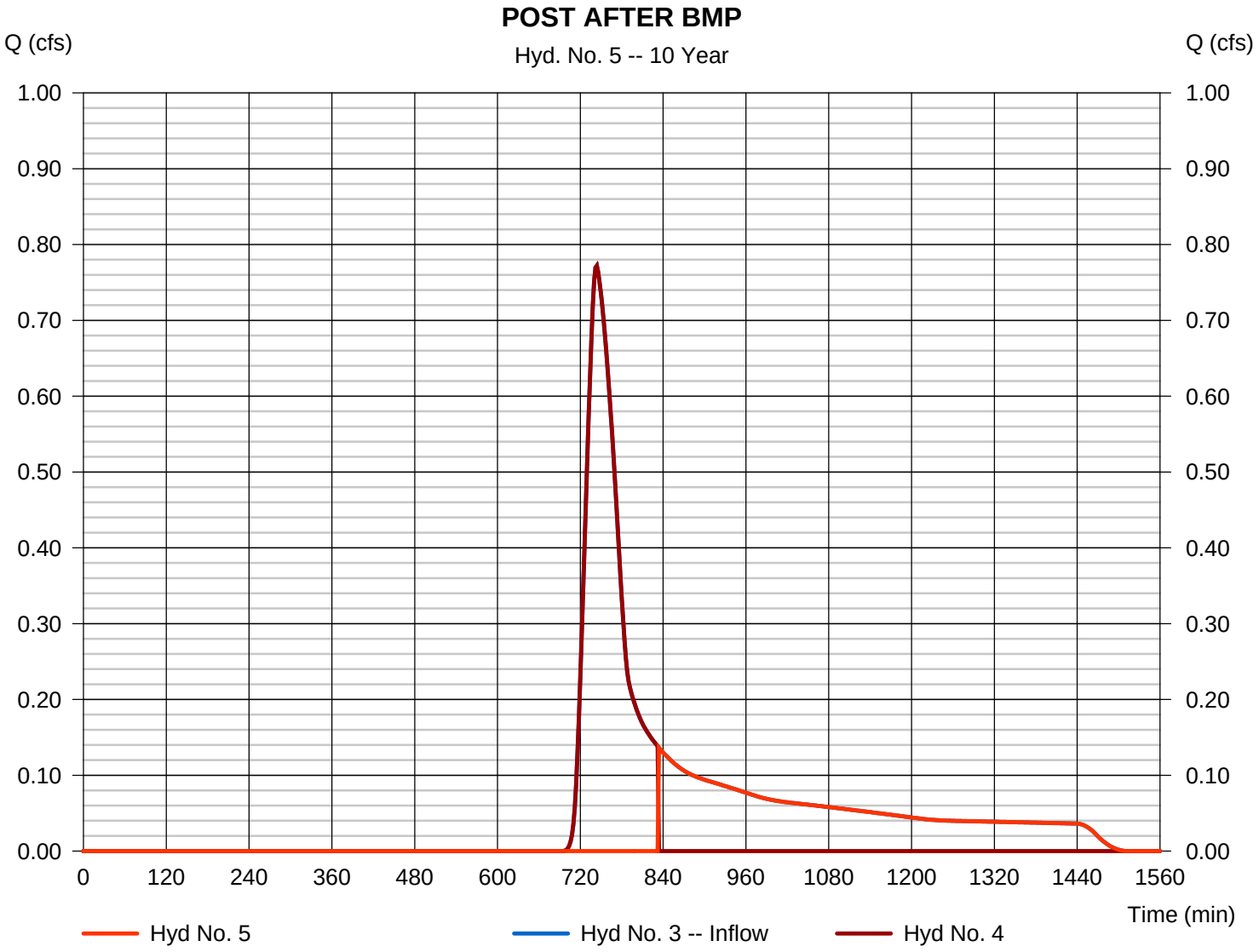


Hydrograph Report

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.136 cfs
Storm frequency	= 10 yrs	Time to peak	= 834 min
Time interval	= 2 min	Hyd. volume	= 2,226 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

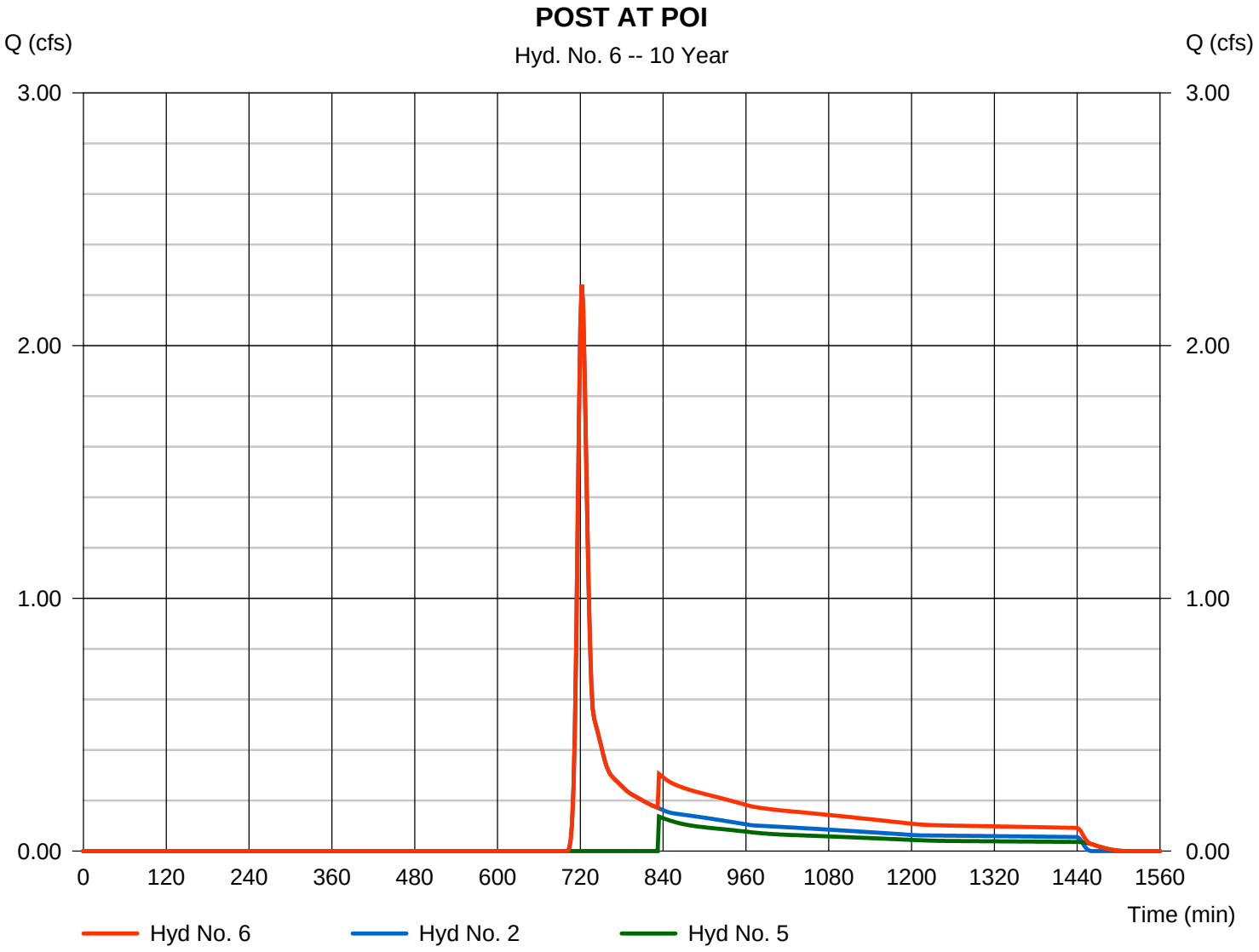


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	2.241 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	9,169 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	2.330 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	45.9138	11.8000	0.8796	--------
2	54.5808	12.1000	0.8736	--------
3	0.0000	0.0000	0.0000	--------
5	59.9618	12.3000	0.8422	--------
10	55.6073	11.3000	0.7938	--------
25	49.4111	9.8000	0.7297	--------
50	49.3823	9.5000	0.7034	--------
100	44.7550	8.3000	0.6570	--------

File name: Arcona 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	3.84	3.05	2.55	2.19	1.93	1.72	1.56	1.43	1.31	1.22	1.14	1.07
2	4.57	3.65	3.06	2.64	2.32	2.08	1.89	1.73	1.59	1.48	1.38	1.30
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	5.44	4.39	3.70	3.21	2.85	2.56	2.33	2.14	1.98	1.85	1.73	1.63
10	6.07	4.91	4.15	3.61	3.21	2.90	2.65	2.44	2.27	2.12	1.99	1.88
25	6.92	5.59	4.75	4.15	3.71	3.36	3.08	2.85	2.66	2.50	2.35	2.23
50	7.53	6.11	5.21	4.57	4.09	3.72	3.42	3.17	2.97	2.79	2.63	2.50
100	8.17	6.63	5.66	4.98	4.47	4.08	3.76	3.50	3.28	3.10	2.93	2.79

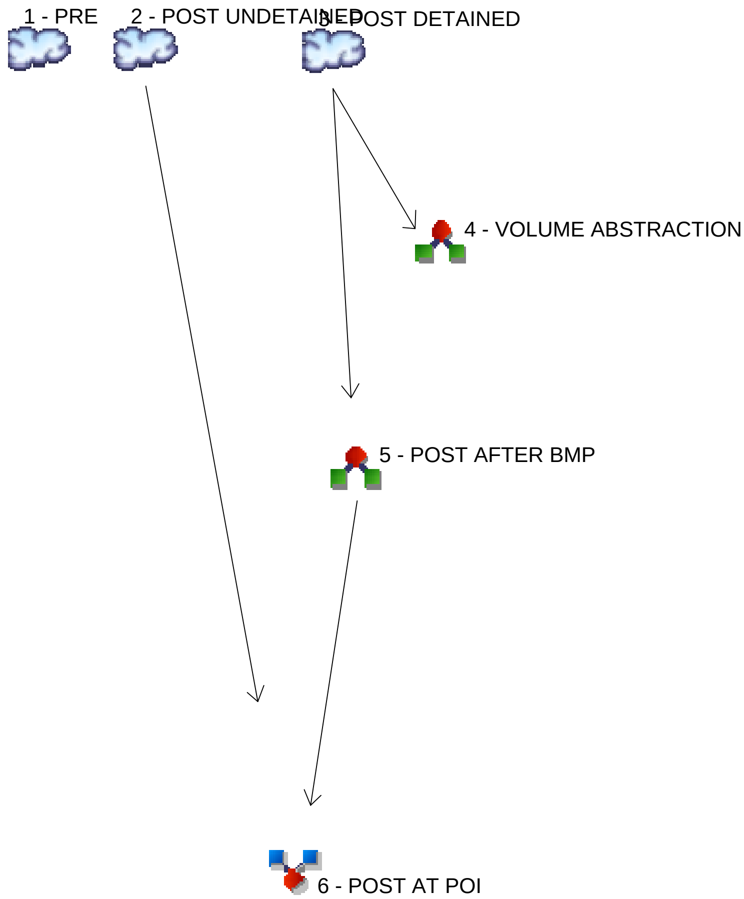
Tc = time in minutes. Values may exceed 60.

st Phase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Arcona\Hydraflow Rev 1\Arcona 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	2.40	2.89	0.00	3.63	4.28	5.30	6.23	7.32
SCS 6-Hr	1.67	2.02	0.00	2.53	2.96	3.61	4.17	4.81
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
4	Diversion1	VOLUME ABSTRACTION
5	Diversion2	POST AFTER BMP
6	Combine	POST AT POI

Hydrograph Return Period Recap

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

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	-------	-------	-------	-------	-------	8.406	-------	PRE
2	SCS Runoff	------	-------	-------	-------	-------	-------	-------	6.155	-------	POST UNDETAINED
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	2.658	-------	POST DETAINED
4	Diversion1	3	-------	-------	-------	-------	-------	-------	2.658	-------	VOLUME ABSTRACTION
5	Diversion2	3	-------	-------	-------	-------	-------	-------	2.485	-------	POST AFTER BMP
6	Combine	2, 5	-------	-------	-------	-------	-------	-------	6.155	-------	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	8.406	2	724	24,836	------	------	------	PRE
2	SCS Runoff	6.155	2	722	16,587	------	------	------	POST UNDETAINED
3	SCS Runoff	2.658	2	732	11,104	------	------	------	POST DETAINED
4	Diversion1	2.658	2	732	3,017	3	------	------	VOLUME ABSTRACTION
5	Diversion2	2.485	2	736	8,088	3	------	------	POST AFTER BMP
6	Combine	6.155	2	722	24,675	2, 5	------	------	POST AT POI

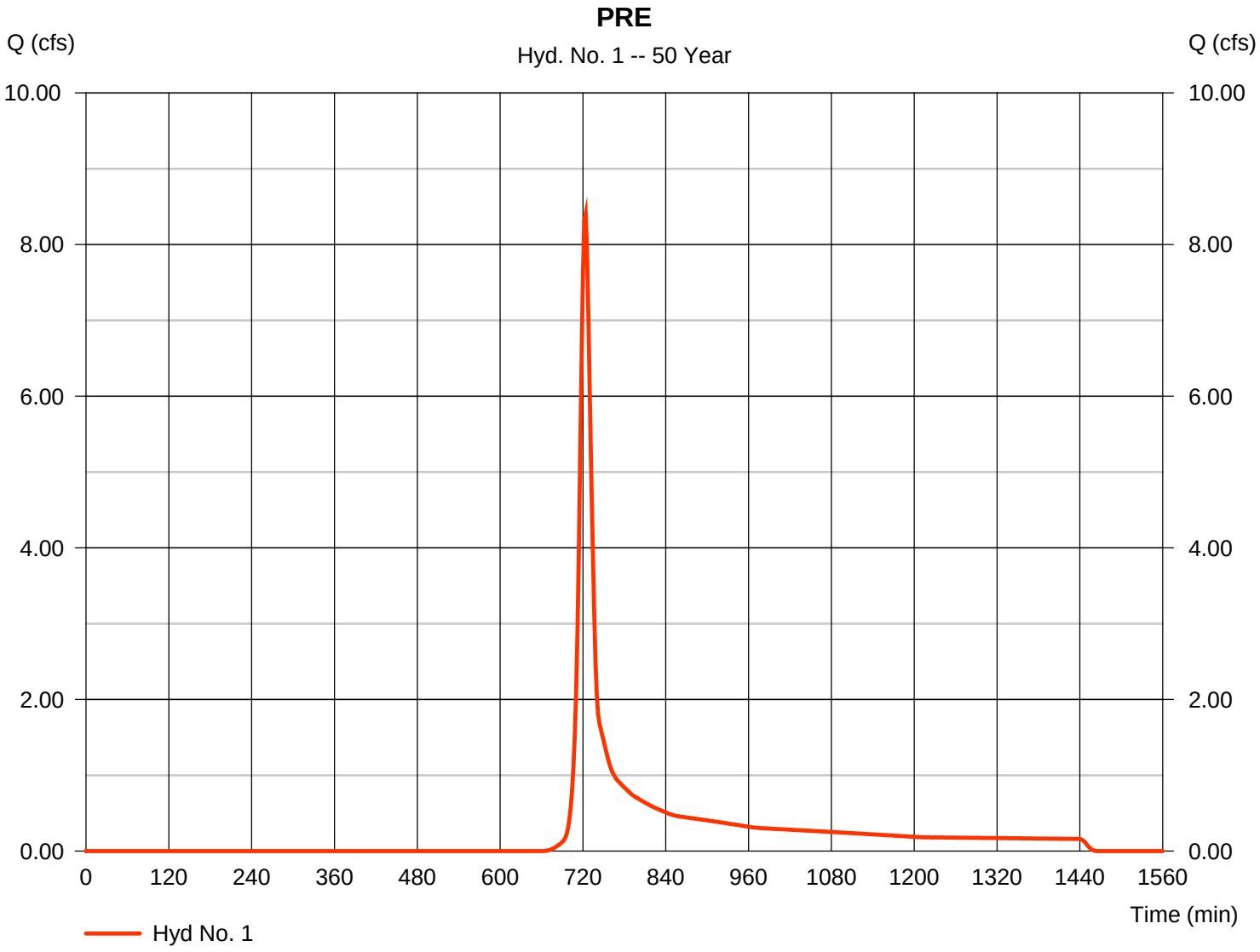
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.406 cfs
Storm frequency	=	50 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	24,836 cuft
Drainage area	=	3.690 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	6.23 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.690 x 58)] / 3.690



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)	= 2.89		0.00		0.00		
Land slope (%)	= 2.47		0.00		0.00		
Travel Time (min)	**= 7.93**	**+**	**0.00**	**+**	**0.00**	**=**	**7.93**
Shallow Concentrated Flow							
Flow length (ft)	= 658.00		0.00		0.00		
Watercourse slope (%)	= 1.87		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.21		0.00		0.00		
Travel Time (min)	**= 4.97**	**+**	**0.00**	**+**	**0.00**	**=**	**4.97**
Channel Flow							
X sectional flow area (sqft)	= 16.00		0.00		0.00		
Wetted perimeter (ft)	= 28.00		0.00		0.00		
Channel slope (%)	= 1.45		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=8.22						
			0.00				
					0.00		
Flow length (ft)	({0})496.0		0.0		0.0		
Travel Time (min)	**= 1.01**	**+**	**0.00**	**+**	**0.00**	**=**	**1.01**

Total Travel Time, Tc ..... 13.90 min

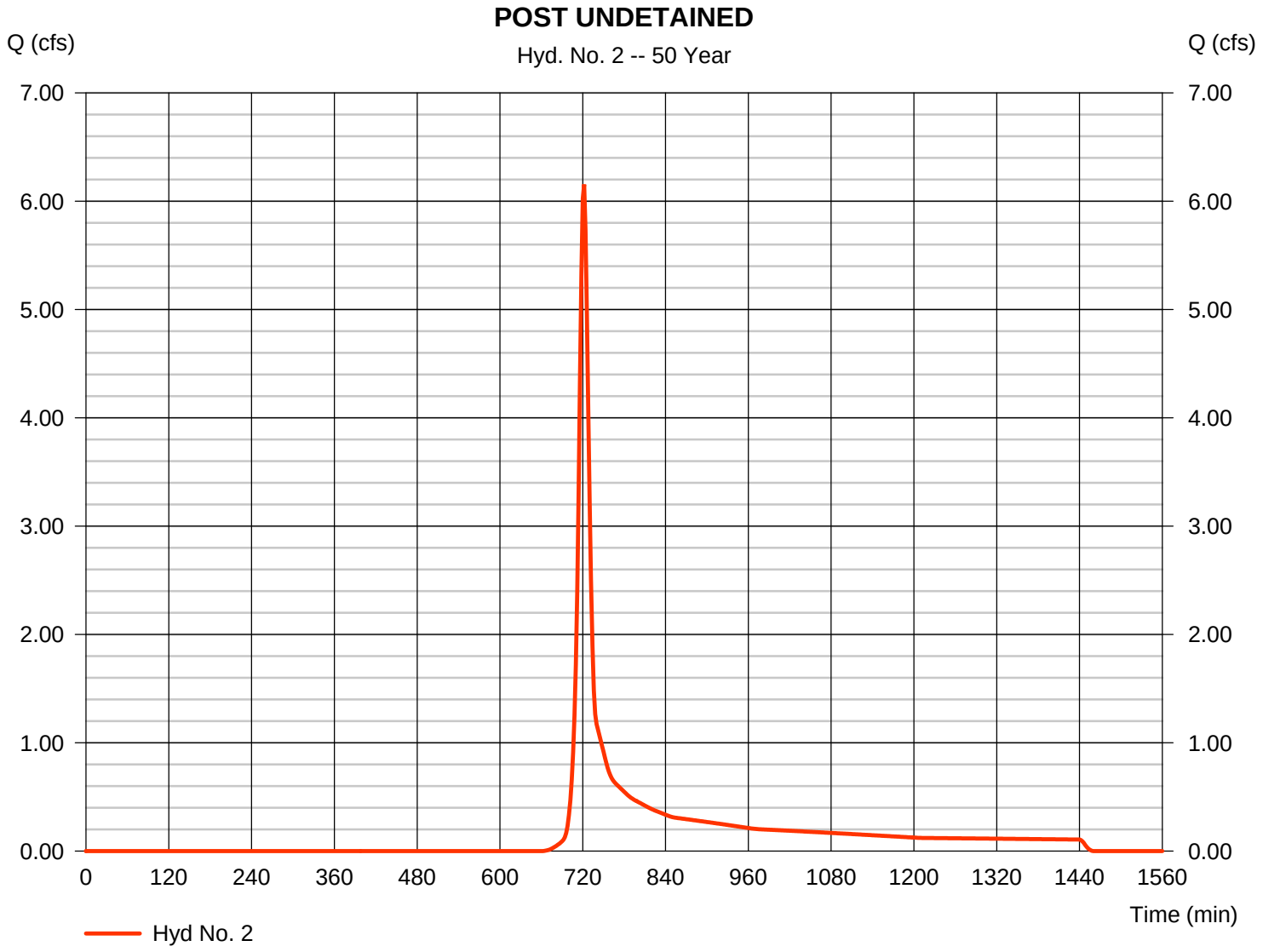
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.155 cfs
Storm frequency	=	50 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	16,587 cuft
Drainage area	=	2.330 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.00 min
Total precip.	=	6.23 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.320 x 58) + (0.010 x 85)] / 2.330



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)	= 2.89		0.00		0.00		
Land slope (%)	= 2.40		0.00		0.00		
Travel Time (min)	**= 8.02**	**+**	**0.00**	**+**	**0.00**	**=**	**8.02**
Shallow Concentrated Flow							
Flow length (ft)	= 668.00		0.00		0.00		
Watercourse slope (%)	= 1.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.22		0.00		0.00		
Travel Time (min)	**= 5.01**	**+**	**0.00**	**+**	**0.00**	**=**	**5.01**
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 ..... 13.00 min

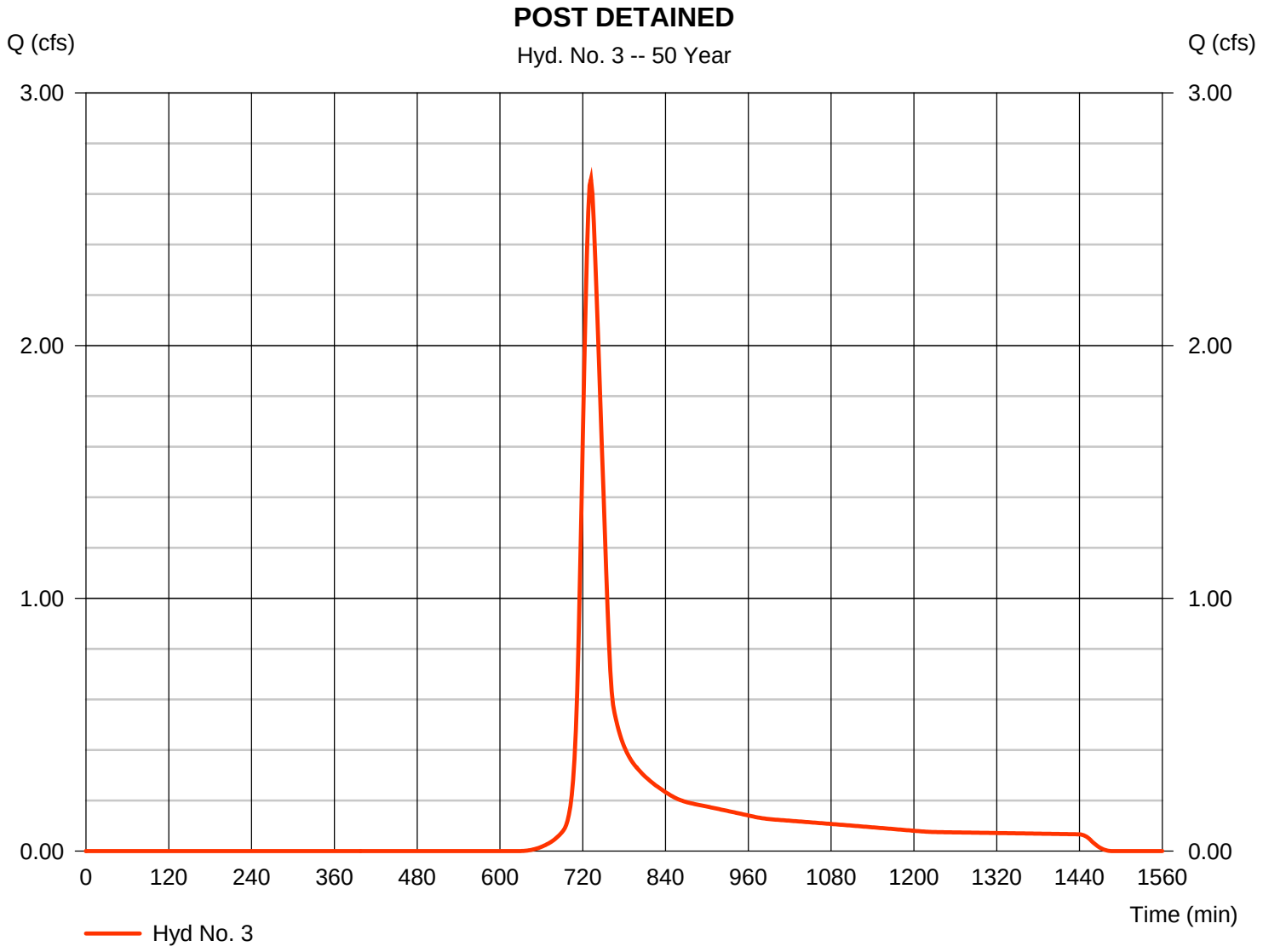
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.658 cfs
Storm frequency	=	50 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	11,104 cuft
Drainage area	=	1.360 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.69 min
Total precip.	=	6.23 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.180 x 85) + (1.180 x 58)] / 1.360

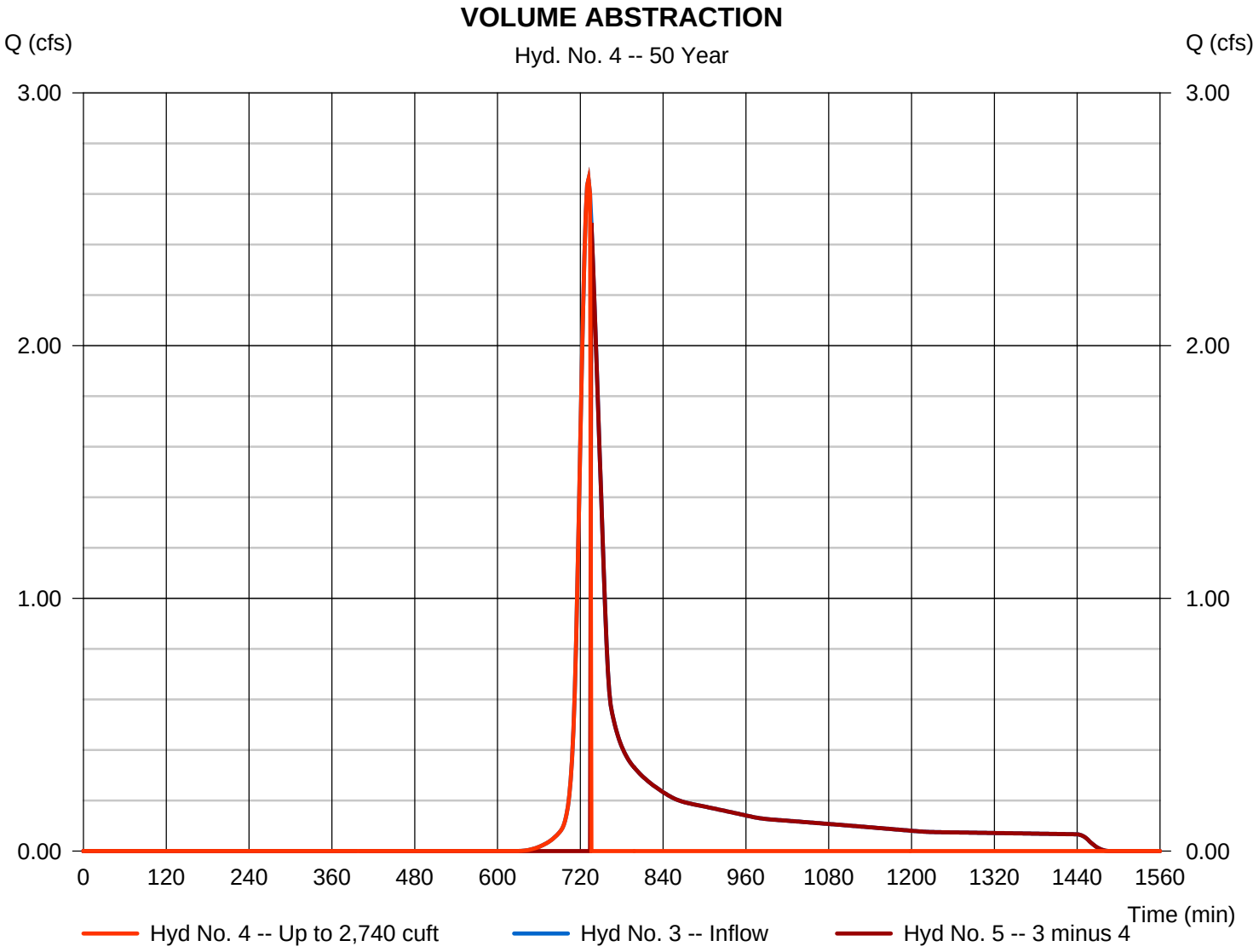


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 2.658 cfs
Storm frequency	= 50 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 3,017 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

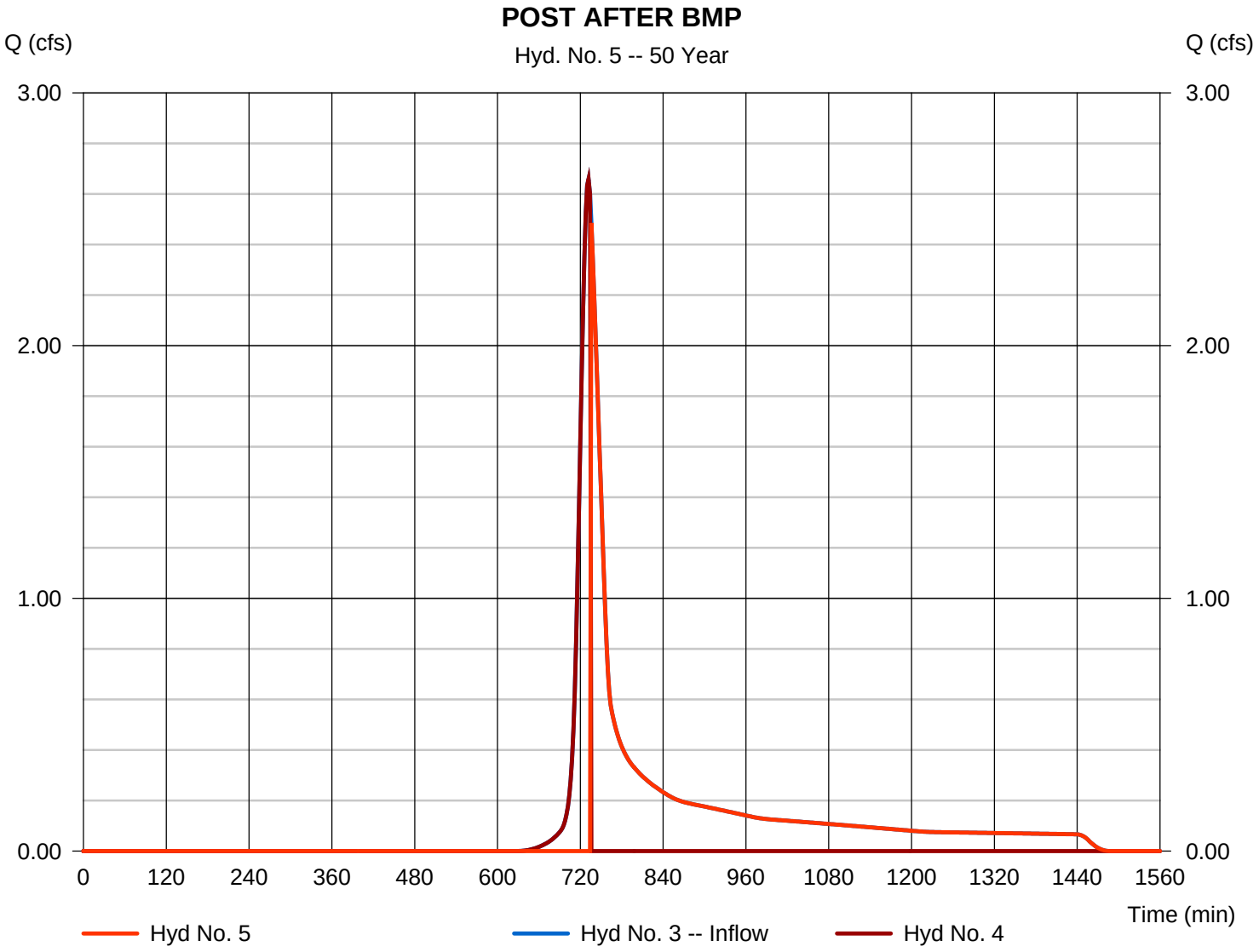


Hydrograph Report

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 2.485 cfs
Storm frequency	= 50 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 8,088 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

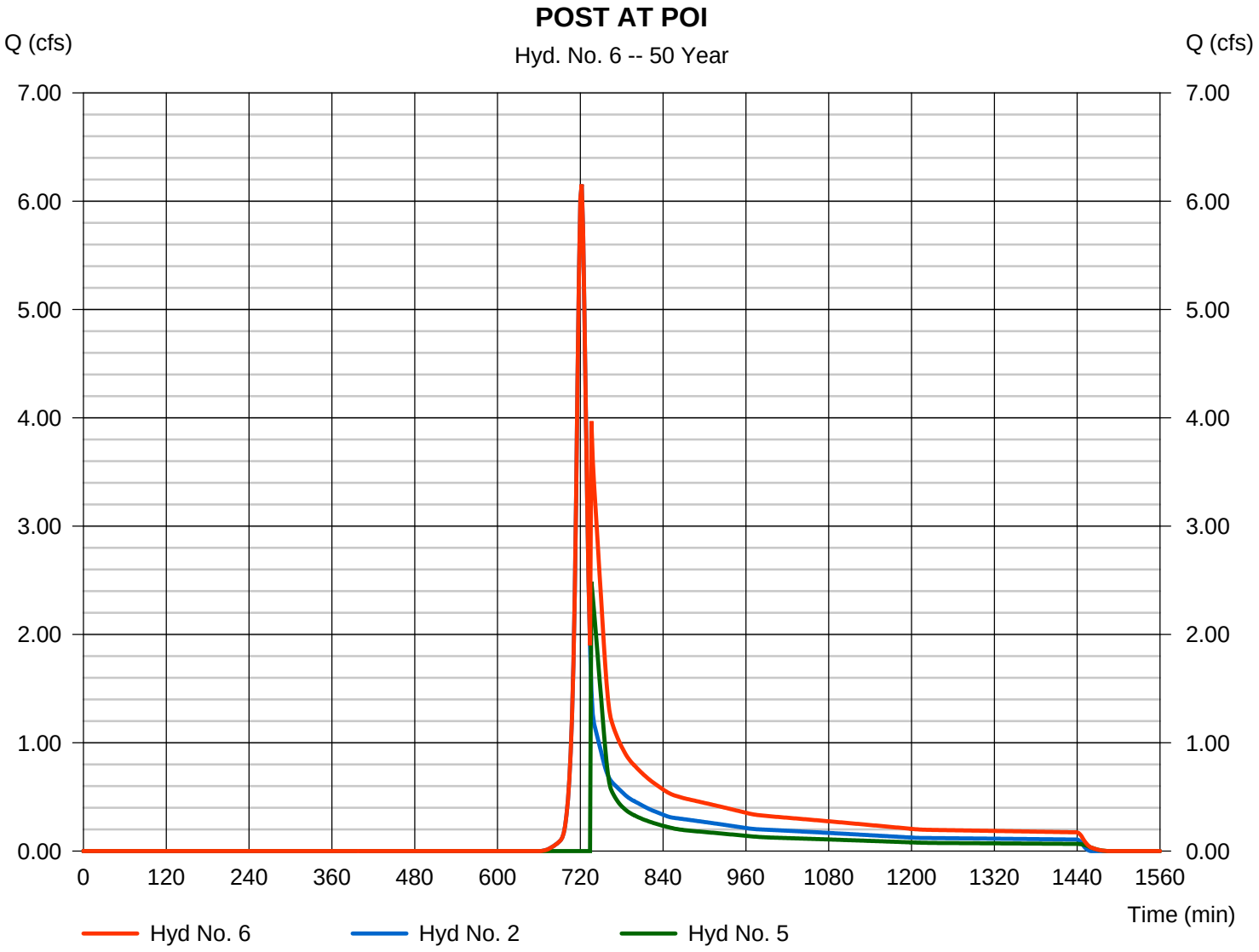


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	6.155 cfs
Storm frequency	=	50 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	24,675 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	2.330 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	45.9138	11.8000	0.8796	--------
2	54.5808	12.1000	0.8736	--------
3	0.0000	0.0000	0.0000	--------
5	59.9618	12.3000	0.8422	--------
10	55.6073	11.3000	0.7938	--------
25	49.4111	9.8000	0.7297	--------
50	49.3823	9.5000	0.7034	--------
100	44.7550	8.3000	0.6570	--------

File name: Arcona 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	3.84	3.05	2.55	2.19	1.93	1.72	1.56	1.43	1.31	1.22	1.14	1.07
2	4.57	3.65	3.06	2.64	2.32	2.08	1.89	1.73	1.59	1.48	1.38	1.30
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	5.44	4.39	3.70	3.21	2.85	2.56	2.33	2.14	1.98	1.85	1.73	1.63
10	6.07	4.91	4.15	3.61	3.21	2.90	2.65	2.44	2.27	2.12	1.99	1.88
25	6.92	5.59	4.75	4.15	3.71	3.36	3.08	2.85	2.66	2.50	2.35	2.23
50	7.53	6.11	5.21	4.57	4.09	3.72	3.42	3.17	2.97	2.79	2.63	2.50
100	8.17	6.63	5.66	4.98	4.47	4.08	3.76	3.50	3.28	3.10	2.93	2.79

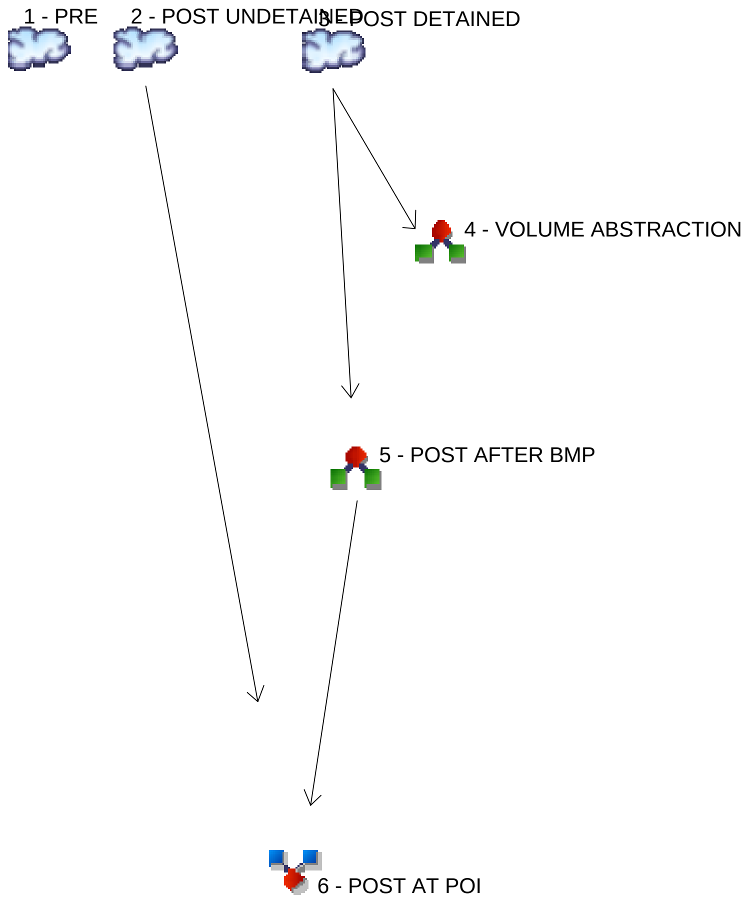
Tc = time in minutes. Values may exceed 60.

st Phase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Arcona\Hydraflow Rev 1\Arcona 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	2.40	2.89	0.00	3.63	4.28	5.30	6.23	7.32
SCS 6-Hr	1.67	2.02	0.00	2.53	2.96	3.61	4.17	4.81
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
4	Diversion1	VOLUME ABSTRACTION
5	Diversion2	POST AFTER 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	------	-------	-------	-------	-------	-------	-------	-------	11.87	PRE
2	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	8.674	POST UNDETAINED
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	3.931	POST DETAINED
4	Diversion1	3	-------	-------	-------	-------	-------	-------	-------	3.775	VOLUME ABSTRACTION
5	Diversion2	3	-------	-------	-------	-------	-------	-------	-------	3.931	POST AFTER BMP
6	Combine	2, 5	-------	-------	-------	-------	-------	-------	-------	9.553	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	11.87	2	724	34,337	------	------	------	PRE
2	SCS Runoff	8.674	2	722	22,933	------	------	------	POST UNDETAINED
3	SCS Runoff	3.931	2	730	14,766	------	------	------	POST DETAINED
4	Diversion1	3.775	2	726	3,179	3	------	------	VOLUME ABSTRACTION
5	Diversion2	3.931	2	730	11,586	3	------	------	POST AFTER BMP
6	Combine	9.553	2	728	34,519	2, 5	------	------	POST AT POI

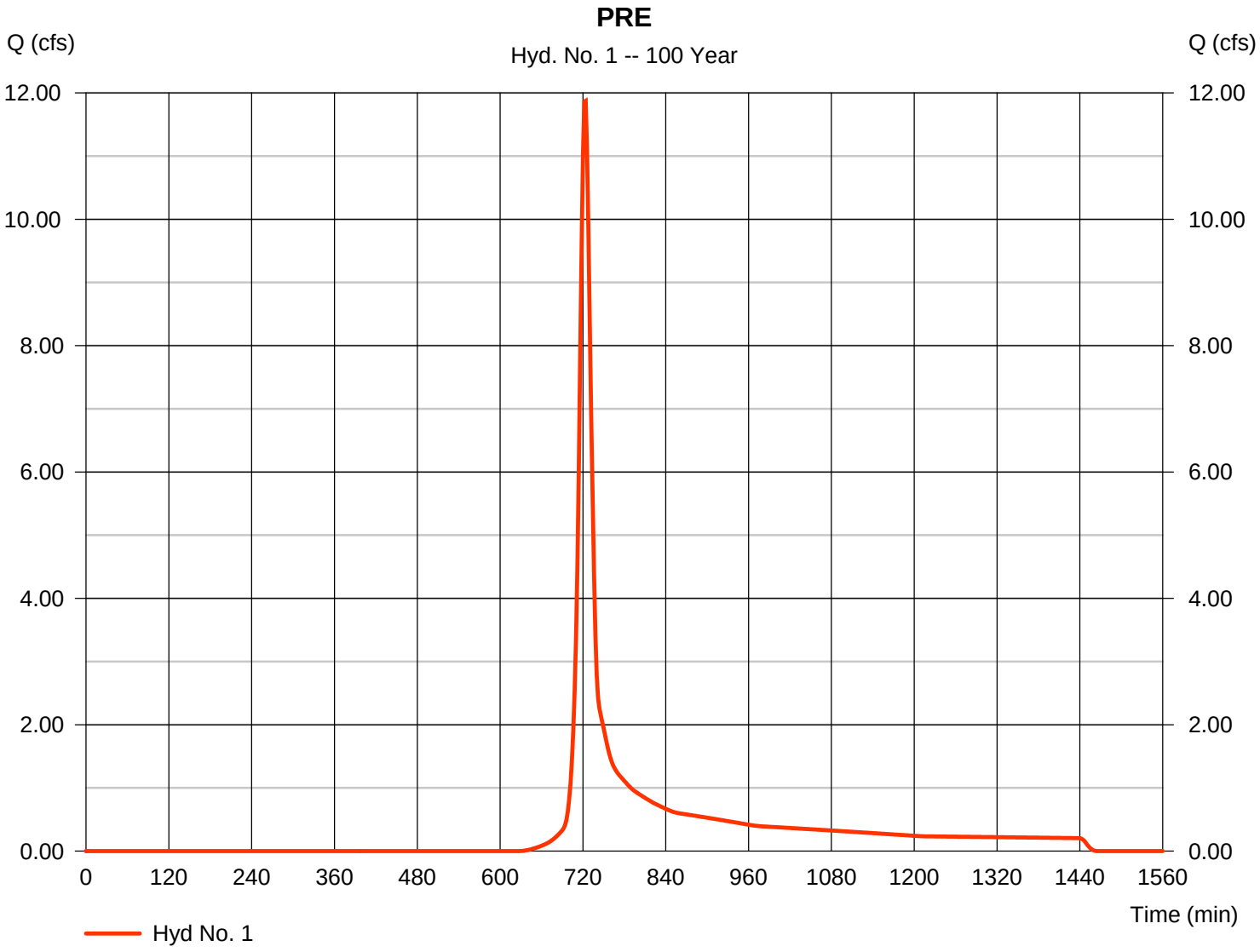
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.87 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	34,337 cuft
Drainage area	=	3.690 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	7.32 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.690 x 58)] / 3.690



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)	= 2.89		0.00		0.00		
Land slope (%)	= 2.47		0.00		0.00		
Travel Time (min)	**= 7.93**	**+**	**0.00**	**+**	**0.00**	**=**	**7.93**
Shallow Concentrated Flow							
Flow length (ft)	= 658.00		0.00		0.00		
Watercourse slope (%)	= 1.87		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.21		0.00		0.00		
Travel Time (min)	**= 4.97**	**+**	**0.00**	**+**	**0.00**	**=**	**4.97**
Channel Flow							
X sectional flow area (sqft)	= 16.00		0.00		0.00		
Wetted perimeter (ft)	= 28.00		0.00		0.00		
Channel slope (%)	= 1.45		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=8.22						
			0.00				
					0.00		
Flow length (ft)	({0})496.0		0.0		0.0		
Travel Time (min)	**= 1.01**	**+**	**0.00**	**+**	**0.00**	**=**	**1.01**

Total Travel Time, Tc ..... 13.90 min

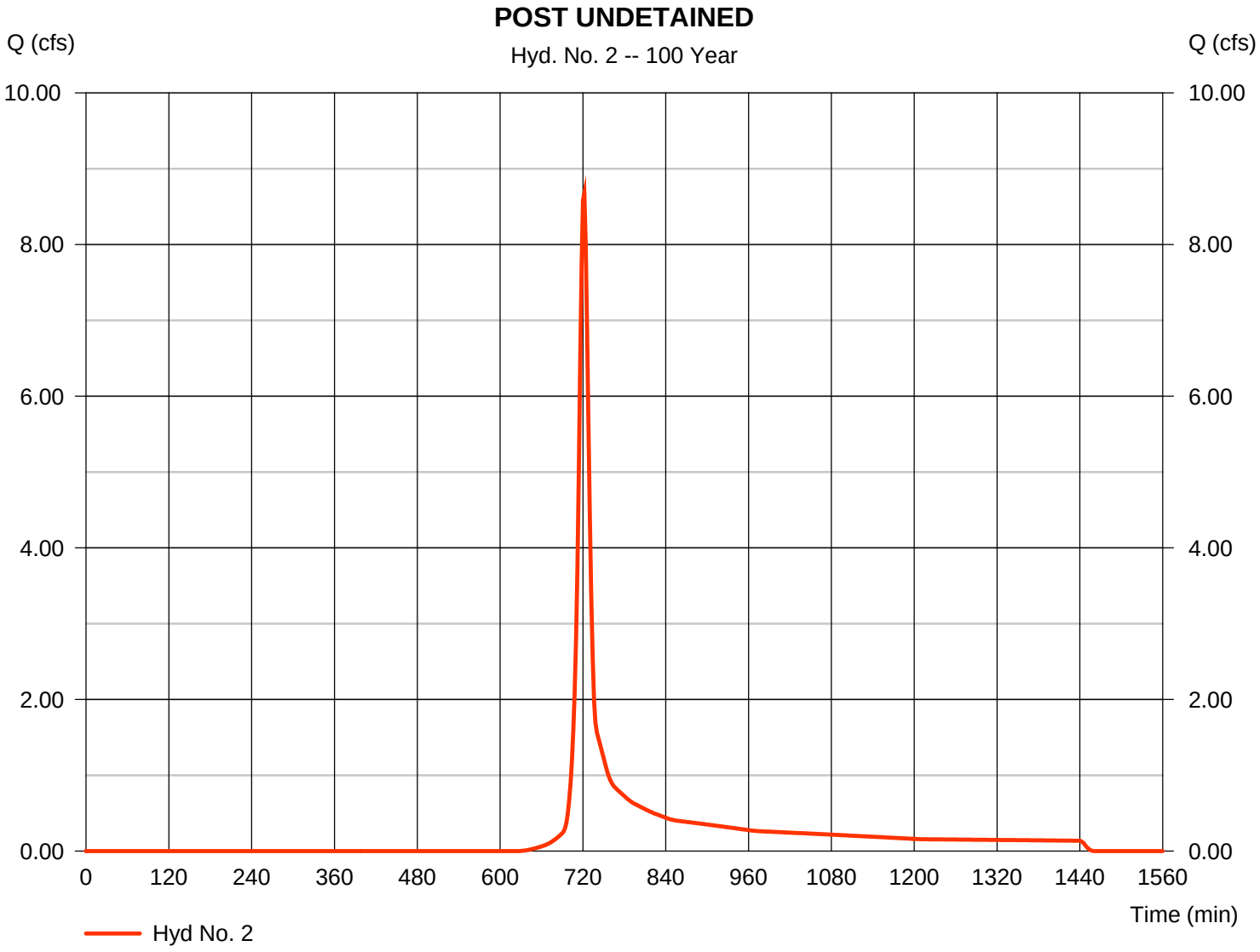
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.674 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	22,933 cuft
Drainage area	=	2.330 ac	Curve number	=	58*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.00 min
Total precip.	=	7.32 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.320 x 58) + (0.010 x 85)] / 2.330



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)	= 2.89		0.00		0.00		
Land slope (%)	= 2.40		0.00		0.00		
Travel Time (min)	**= 8.02**	**+**	**0.00**	**+**	**0.00**	**=**	**8.02**
Shallow Concentrated Flow							
Flow length (ft)	= 668.00		0.00		0.00		
Watercourse slope (%)	= 1.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.22		0.00		0.00		
Travel Time (min)	**= 5.01**	**+**	**0.00**	**+**	**0.00**	**=**	**5.01**
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 ..... 13.00 min

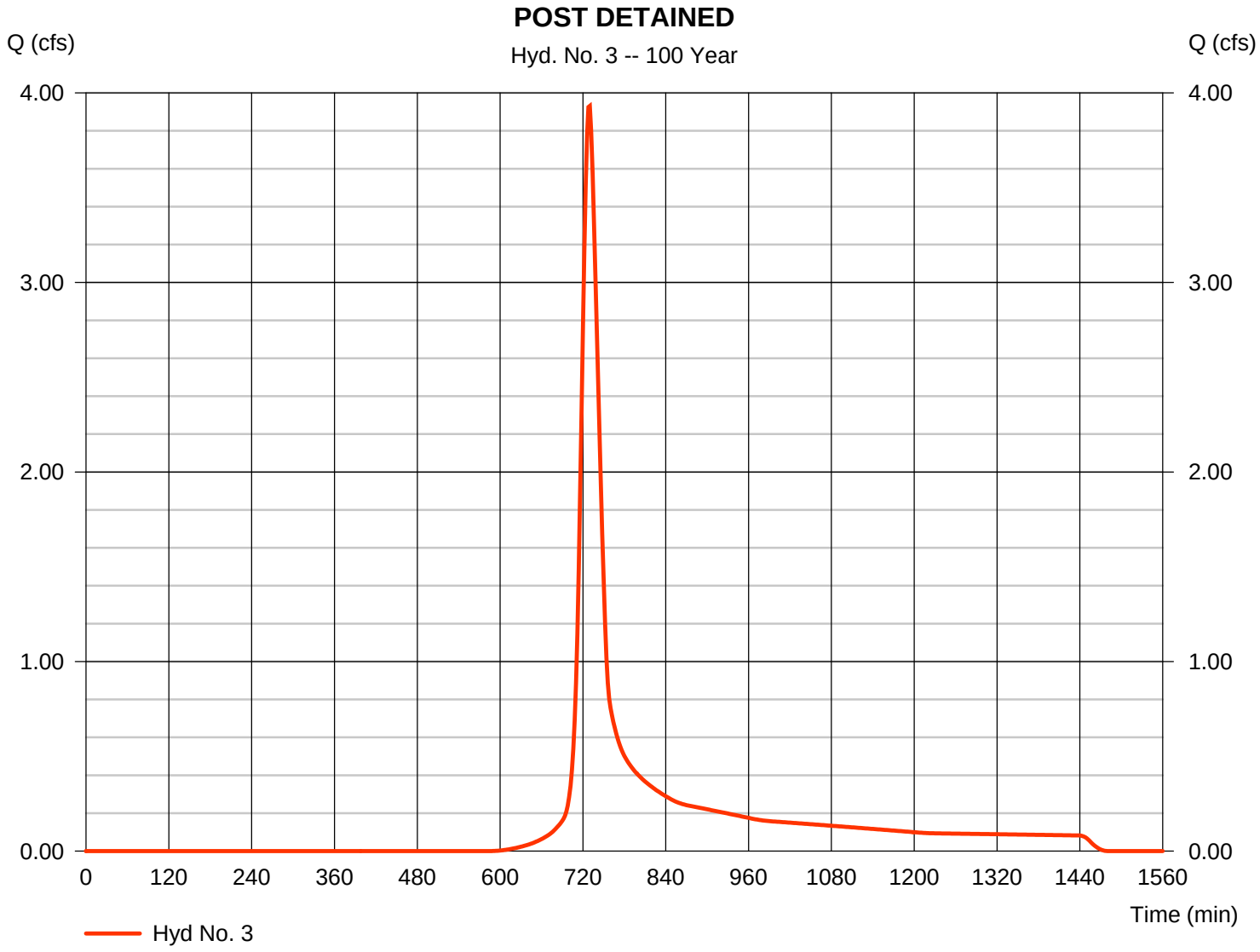
Hydrograph Report

Hyd. No. 3

POST DETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.931 cfs
Storm frequency	=	100 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	14,766 cuft
Drainage area	=	1.360 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.37 min
Total precip.	=	7.32 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.180 x 85) + (1.180 x 58)] / 1.360

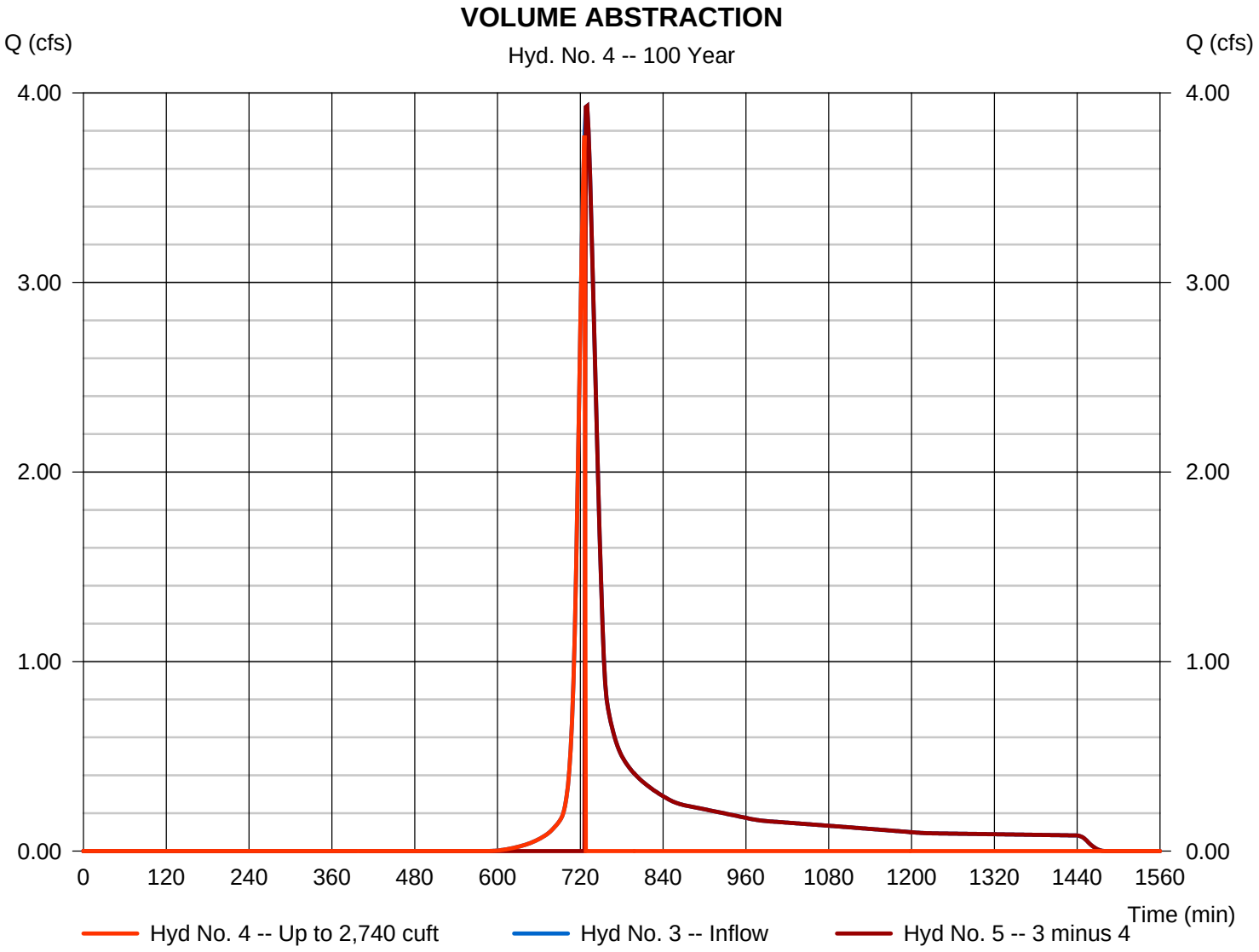


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 3.775 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 3,179 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

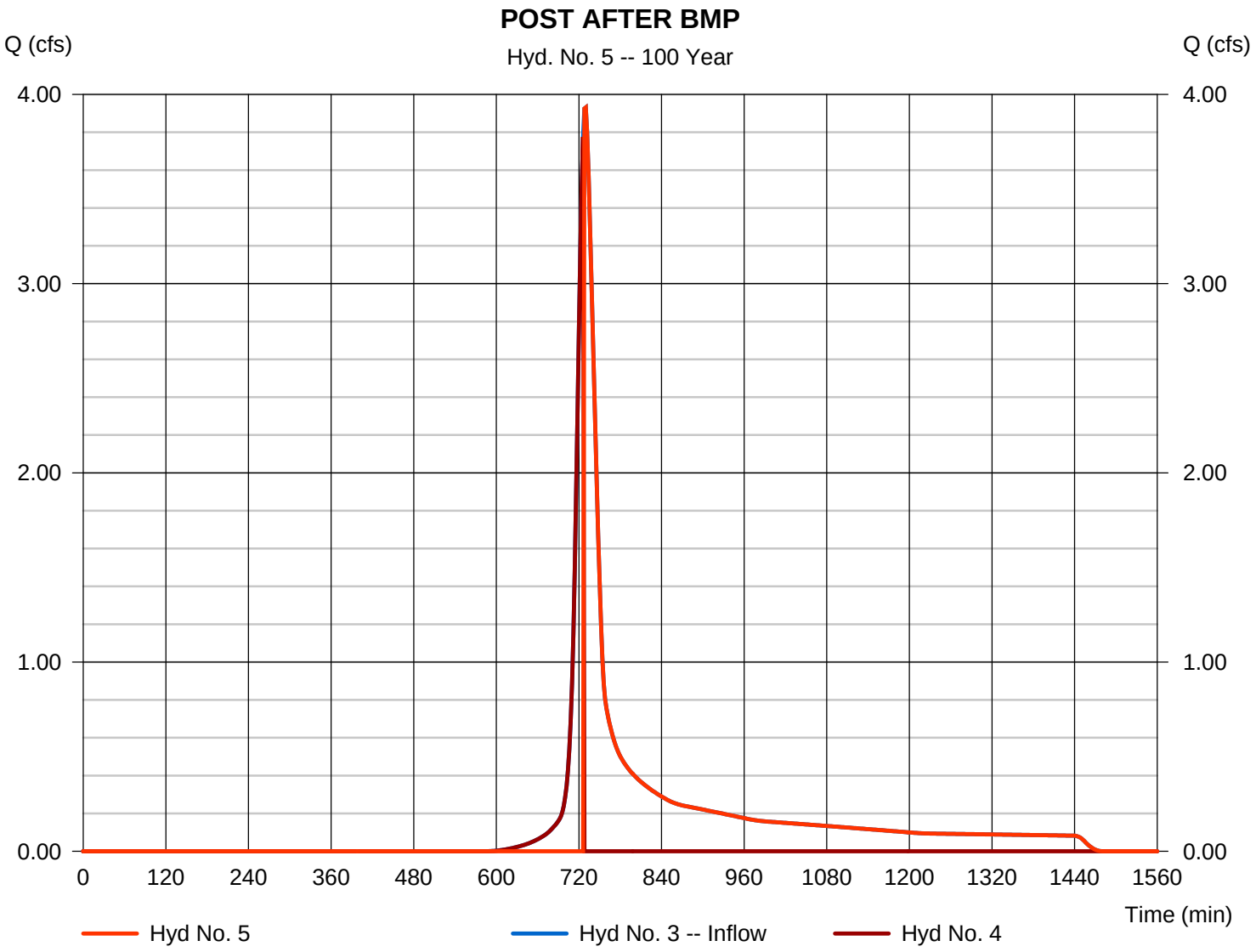


Hydrograph Report

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 3.931 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 11,586 cuft
Inflow hydrograph	= 3 - POST DETAINED	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 2,740 cuft

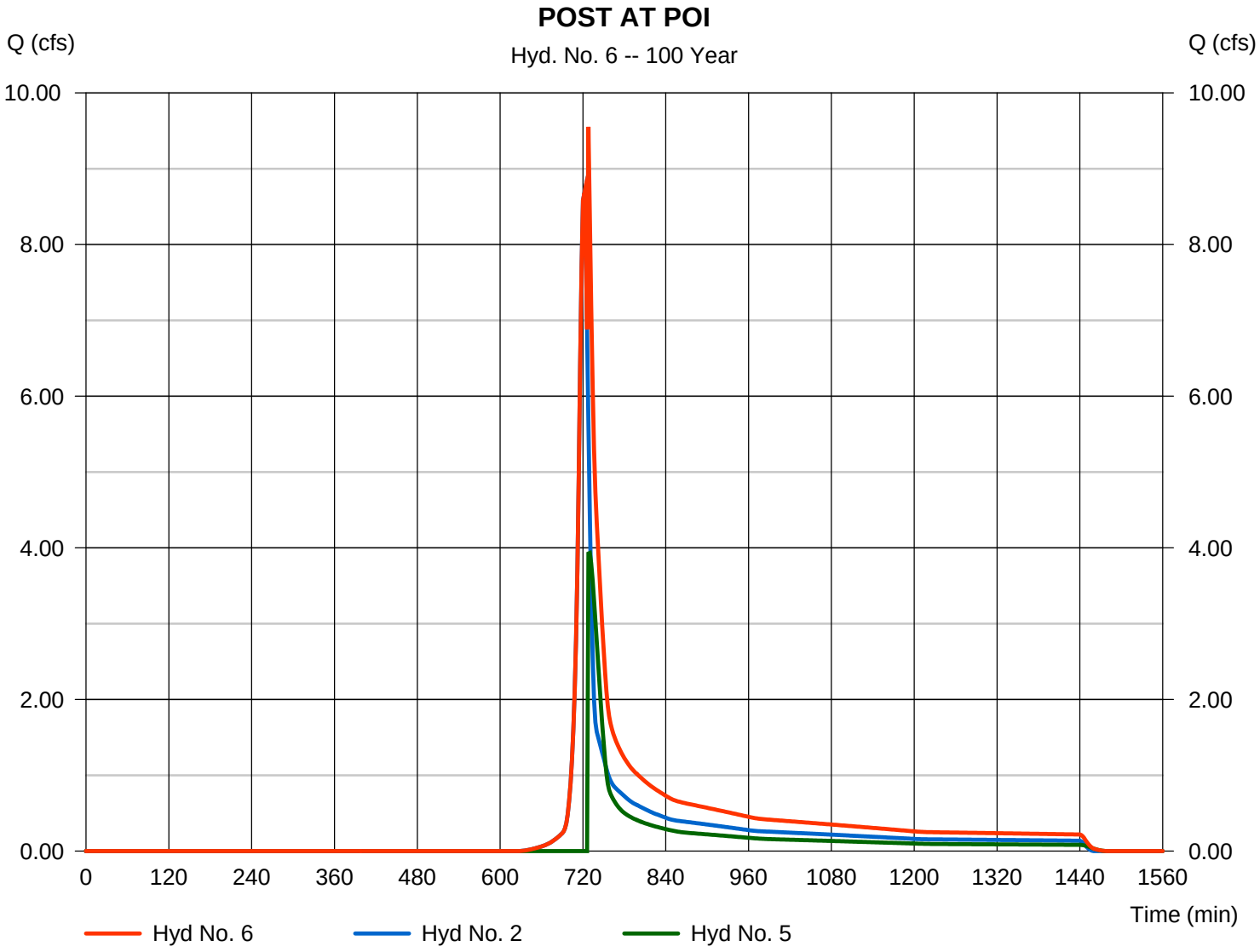


Hydrograph Report

Hyd. No. 6

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	9.553 cfs
Storm frequency	=	100 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	34,519 cuft
Inflow hyds.	=	2, 5	Contrib. drain. area	=	2.330 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	45.9138	11.8000	0.8796	--------
2	54.5808	12.1000	0.8736	--------
3	0.0000	0.0000	0.0000	--------
5	59.9618	12.3000	0.8422	--------
10	55.6073	11.3000	0.7938	--------
25	49.4111	9.8000	0.7297	--------
50	49.3823	9.5000	0.7034	--------
100	44.7550	8.3000	0.6570	--------

File name: Arcona 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	3.84	3.05	2.55	2.19	1.93	1.72	1.56	1.43	1.31	1.22	1.14	1.07
2	4.57	3.65	3.06	2.64	2.32	2.08	1.89	1.73	1.59	1.48	1.38	1.30
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	5.44	4.39	3.70	3.21	2.85	2.56	2.33	2.14	1.98	1.85	1.73	1.63
10	6.07	4.91	4.15	3.61	3.21	2.90	2.65	2.44	2.27	2.12	1.99	1.88
25	6.92	5.59	4.75	4.15	3.71	3.36	3.08	2.85	2.66	2.50	2.35	2.23
50	7.53	6.11	5.21	4.57	4.09	3.72	3.42	3.17	2.97	2.79	2.63	2.50
100	8.17	6.63	5.66	4.98	4.47	4.08	3.76	3.50	3.28	3.10	2.93	2.79

Tc = time in minutes. Values may exceed 60.

st Phase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Arcona\Hydraflow Rev 1\Arcona 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	2.40	2.89	0.00	3.63	4.28	5.30	6.23	7.32
SCS 6-Hr	1.67	2.02	0.00	2.53	2.96	3.61	4.17	4.81
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