Charger

TETRA TECH, INC.

By: RH Date: 1/30/2017 Subject: Charger Highway
Checked By: JB Date: 2/1/2017 PCSM Design and Evaluation

PURPOSE:

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

PCSM DESIGN REQUIREMENTS:

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

Act 167 Consistency

Blair 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.

Due to the presence of rapid surface infiltration rates and shallow bedrock surrounding the Charger Highway block valve site, it is not possible to infiltrate the 2-year/24-hour stormwater runoff volume increase. Volume reducing BMPs in the PADEP Stormwater BMP Manual were analyzed on a case-by-case basis but did not meet their respective requirements. As a result, two slow-release BMPs have been proposed.

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. The Blair County does not have an approved Act 167 Plan. Therefore, no additional peak rate control is required under the Act 167 Plan.

This site will utilize two slow release trenches to manage the two-year through 100-year peak rate increases. These BMPs 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. Due to the presence of shallow bedrock, as well as rapid infiltration at the site, it is not possible to maintain 2 feet of separation between a volume-reducing BMP and bedrock.

The post-construction stormwater management design utilizes two slow-release BMPs to manage runoff volume due to rapid infiltration onsite and due to the presence of shallow bedrock.

Loading Ratio

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

Disturbed Area

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

Karst Topography

The Charger Highway block valve site 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 managed using a slow-release BMP. This type of BMP will mimic the normal baseflow hydrology. This BMP will collect, store and filter captured runoff through a water quality media and slowly release the treated volume through an underdrain. Utilization of a slow-release BMP will reduce the risks associated with karst topography.

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

The Charger Highway block valve site is not located within a special protection watershed, so antidegradation requirements do not apply.

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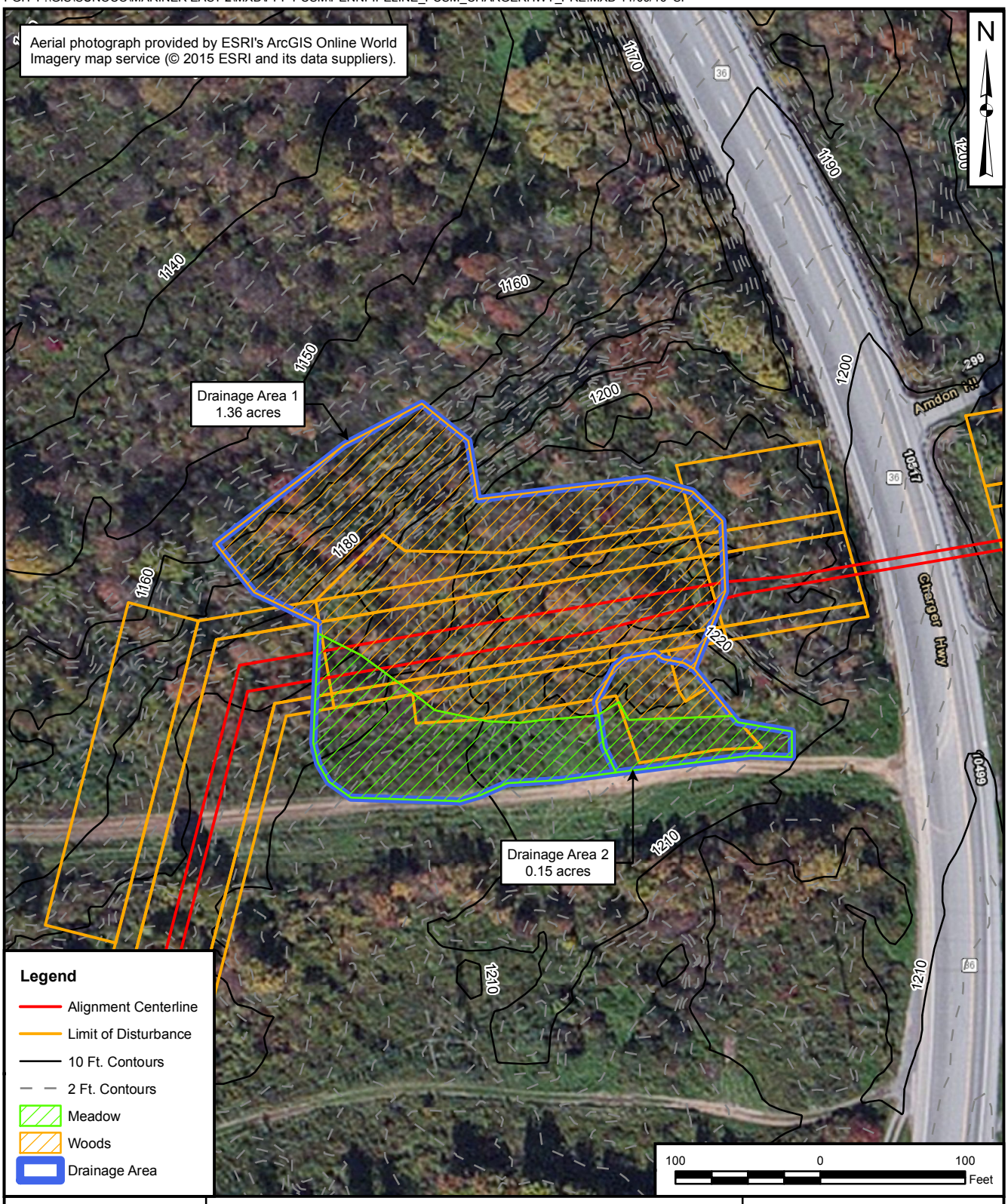

TETRA TECH

PRE-DEVELOPMENT DRAINAGE AREA MAP
CHARGER HIGHWAY
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
BLAIR COUNTY, PENNSYLVANIA

DRAWN BY: J. HERNING 03/02/16
CHECKED BY: J. BRODY 11/09/16

APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE NUMBER	REV
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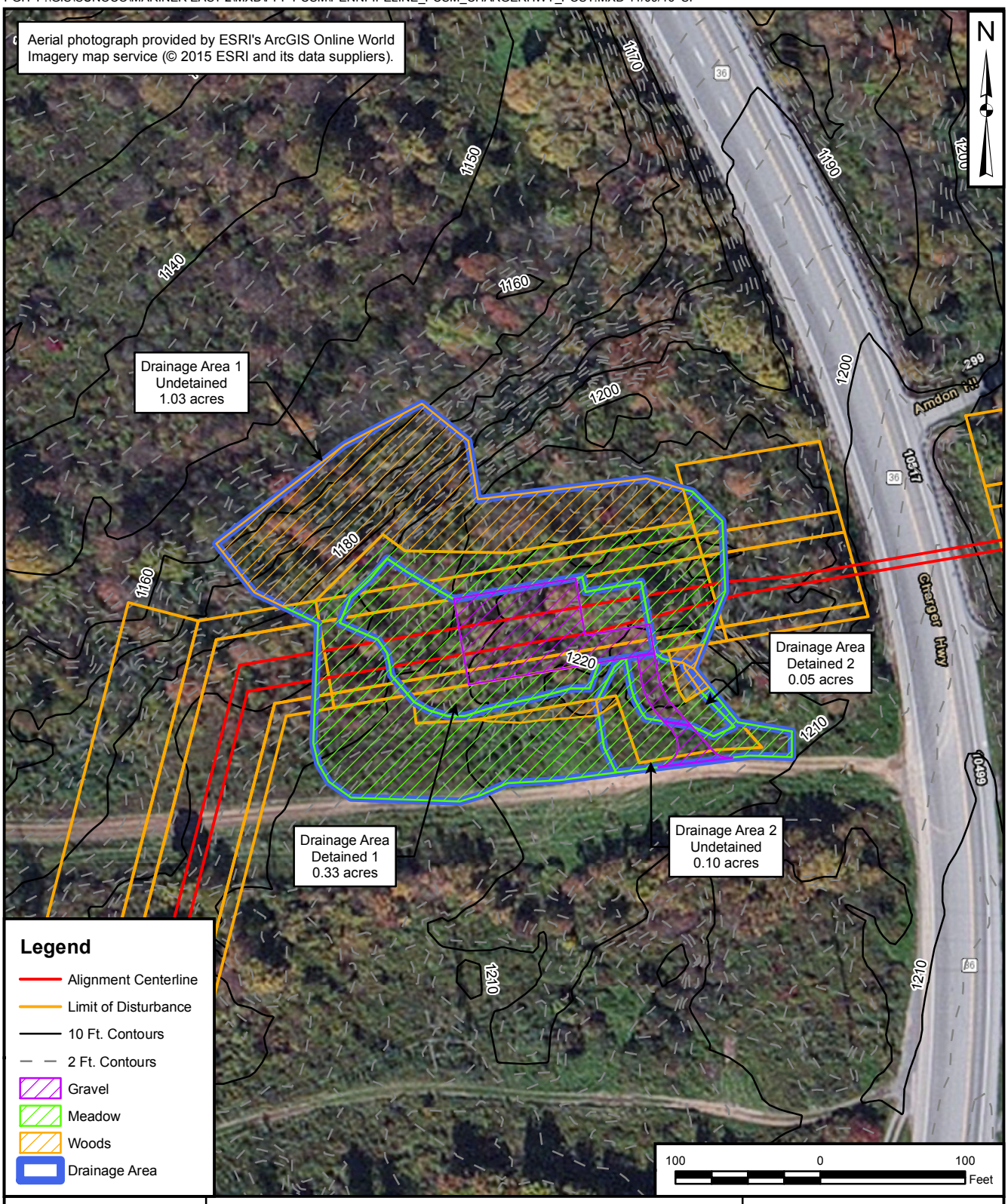

TETRA TECH

POST-DEVELOPMENT DRAINAGE AREA MAP
CHARGER HIGHWAY
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
BLAIR COUNTY, PENNSYLVANIA

DRAWN BY: J. HERNING 03/02/16
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: Blair Twp, Pennsylvania, USA*
Latitude: 40.4117°, Longitude: -78.3992°
Elevation: 1215.34 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	**0.306** (0.278-0.339)	**0.366** (0.332-0.406)	**0.447** (0.404-0.494)	**0.510** (0.459-0.564)	**0.592** (0.529-0.652)	**0.657** (0.584-0.723)	**0.722** (0.638-0.793)	**0.789** (0.693-0.865)	**0.882** (0.767-0.964)	**0.951** (0.820-1.04)
10-min	**0.475** (0.431-0.527)	**0.572** (0.518-0.634)	**0.694** (0.627-0.768)	**0.787** (0.708-0.870)	**0.906** (0.810-0.998)	**0.997** (0.885-1.10)	**1.09** (0.961-1.19)	**1.18** (1.03-1.29)	**1.30** (1.13-1.42)	**1.38** (1.19-1.51)
15-min	**0.582** (0.529-0.646)	**0.699** (0.634-0.775)	**0.853** (0.770-0.943)	**0.968** (0.871-1.07)	**1.12** (1.00-1.23)	**1.23** (1.10-1.36)	**1.35** (1.19-1.48)	**1.47** (1.29-1.60)	**1.62** (1.41-1.77)	**1.73** (1.49-1.89)
30-min	**0.771** (0.699-0.855)	**0.936** (0.848-1.04)	**1.17** (1.05-1.29)	**1.34** (1.21-1.49)	**1.58** (1.41-1.74)	**1.76** (1.57-1.94)	**1.95** (1.72-2.14)	**2.14** (1.88-2.34)	**2.40** (2.09-2.62)	**2.59** (2.24-2.83)
60-min	**0.941** (0.854-1.04)	**1.15** (1.04-1.27)	**1.47** (1.32-1.62)	**1.71** (1.54-1.89)	**2.05** (1.83-2.26)	**2.32** (2.06-2.55)	**2.61** (2.30-2.86)	**2.90** (2.55-3.18)	**3.31** (2.88-3.62)	**3.64** (3.14-3.98)
2-hr	**1.08** (0.973-1.21)	**1.31** (1.18-1.46)	**1.67** (1.50-1.86)	**1.96** (1.75-2.18)	**2.37** (2.10-2.62)	**2.70** (2.38-2.98)	**3.06** (2.67-3.37)	**3.43** (2.98-3.78)	**3.97** (3.40-4.37)	**4.40** (3.74-4.84)
3-hr	**1.17** (1.06-1.30)	**1.41** (1.28-1.57)	**1.79** (1.61-1.98)	**2.09** (1.88-2.31)	**2.53** (2.25-2.78)	**2.88** (2.56-3.17)	**3.27** (2.87-3.58)	**3.68** (3.21-4.02)	**4.26** (3.67-4.66)	**4.74** (4.04-5.17)
6-hr	**1.46** (1.33-1.63)	**1.76** (1.60-1.96)	**2.21** (1.99-2.44)	**2.57** (2.31-2.84)	**3.09** (2.75-3.40)	**3.52** (3.11-3.86)	**3.97** (3.49-4.36)	**4.46** (3.89-4.89)	**5.17** (4.45-5.64)	**5.74** (4.89-6.26)
12-hr	**1.80** (1.63-2.01)	**2.16** (1.96-2.41)	**2.69** (2.44-2.99)	**3.13** (2.82-3.47)	**3.77** (3.37-4.17)	**4.31** (3.82-4.75)	**4.89** (4.31-5.38)	**5.52** (4.81-6.06)	**6.43** (5.54-7.05)	**7.19** (6.12-7.87)
24-hr	**2.22** (2.03-2.43)	**2.66** (2.44-2.92)	**3.30** (3.03-3.62)	**3.83** (3.50-4.19)	**4.60** (4.18-5.01)	**5.24** (4.73-5.70)	**5.91** (5.31-6.42)	**6.65** (5.93-7.21)	**7.70** (6.80-8.35)	**8.56** (7.49-9.30)
2-day	**2.50** (2.30-2.73)	**3.00** (2.76-3.28)	**3.71** (3.40-4.06)	**4.30** (3.94-4.70)	**5.15** (4.69-5.62)	**5.86** (5.31-6.38)	**6.62** (5.95-7.19)	**7.42** (6.63-8.07)	**8.59** (7.58-9.33)	**9.54** (8.34-10.4)
3-day	**2.65** (2.44-2.89)	**3.17** (2.93-3.46)	**3.91** (3.60-4.26)	**4.52** (4.16-4.92)	**5.40** (4.95-5.87)	**6.13** (5.58-6.65)	**6.91** (6.25-7.49)	**7.73** (6.95-8.38)	**8.90** (7.91-9.66)	**9.86** (8.68-10.7)
4-day	**2.80** (2.59-3.04)	**3.34** (3.10-3.63)	**4.11** (3.80-4.46)	**4.74** (4.38-5.14)	**5.65** (5.20-6.12)	**6.40** (5.86-6.92)	**7.19** (6.54-7.78)	**8.04** (7.26-8.70)	**9.22** (8.24-9.99)	**10.2** (9.02-11.1)
7-day	**3.30** (3.07-3.55)	**3.94** (3.67-4.24)	**4.78** (4.45-5.15)	**5.46** (5.08-5.87)	**6.39** (5.92-6.87)	**7.14** (6.59-7.67)	**7.91** (7.27-8.49)	**8.70** (7.95-9.36)	**9.79** (8.87-10.5)	**10.6** (9.57-11.5)
10-day	**3.89** (3.64-4.17)	**4.62** (4.32-4.96)	**5.53** (5.17-5.93)	**6.26** (5.85-6.71)	**7.26** (6.76-7.78)	**8.06** (7.48-8.63)	**8.86** (8.19-9.50)	**9.69** (8.91-10.4)	**10.8** (9.88-11.6)	**11.7** (10.6-12.6)
20-day	**5.33** (5.04-5.64)	**6.28** (5.94-6.64)	**7.33** (6.93-7.76)	**8.14** (7.68-8.60)	**9.19** (8.66-9.71)	**9.99** (9.39-10.6)	**10.8** (10.1-11.4)	**11.5** (10.8-12.2)	**12.5** (11.6-13.2)	**13.2** (12.2-14.0)
30-day	**6.65** (6.30-7.01)	**7.79** (7.38-8.21)	**8.94** (8.47-9.42)	**9.82** (9.31-10.3)	**11.0** (10.4-11.5)	**11.8** (11.1-12.4)	**12.6** (11.9-13.3)	**13.4** (12.6-14.1)	**14.3** (13.4-15.1)	**15.0** (14.0-15.8)
45-day	**8.42** (8.00-8.86)	**9.84** (9.36-10.4)	**11.2** (10.6-11.7)	**12.1** (11.5-12.7)	**13.3** (12.6-14.0)	**14.2** (13.4-14.9)	**14.9** (14.2-15.7)	**15.7** (14.8-16.5)	**16.5** (15.6-17.4)	**17.0** (16.1-18.0)
60-day	**10.1** (9.68-10.6)	**11.8** (11.3-12.3)	**13.2** (12.7-13.8)	**14.3** (13.6-14.9)	**15.5** (14.8-16.2)	**16.4** (15.7-17.1)	**17.2** (16.4-18.0)	**17.8** (17.0-18.7)	**18.6** (17.8-19.5)	**19.1** (18.2-20.1)

[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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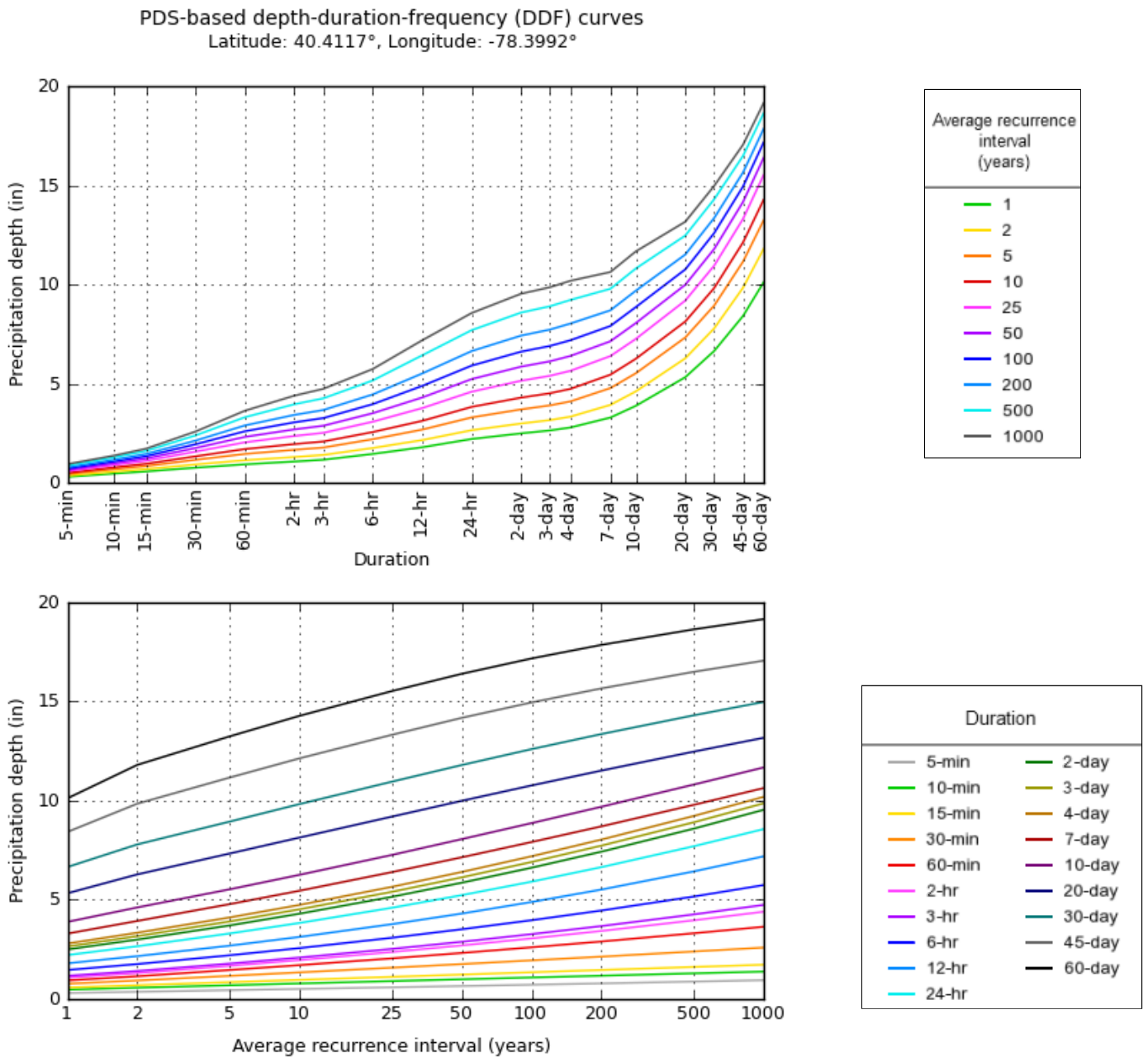
PF graphical



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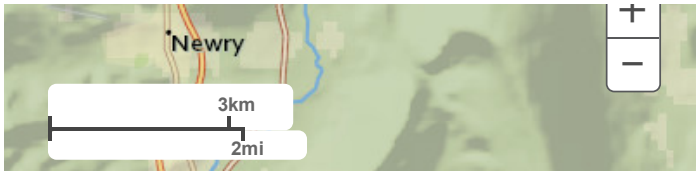
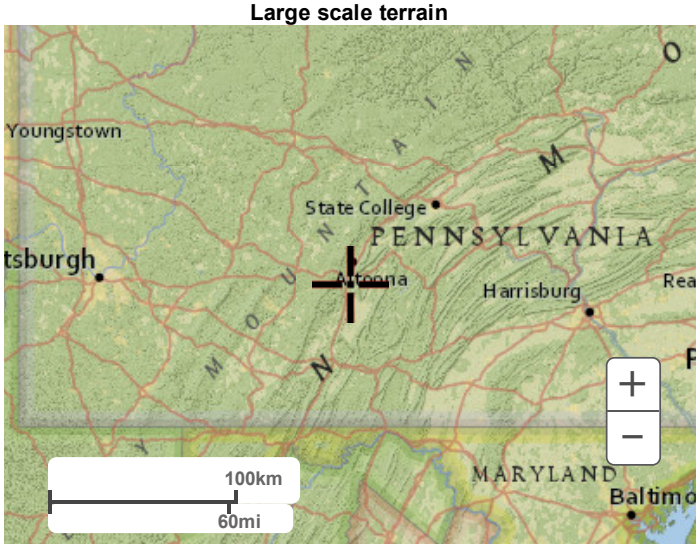
Maps & aerials

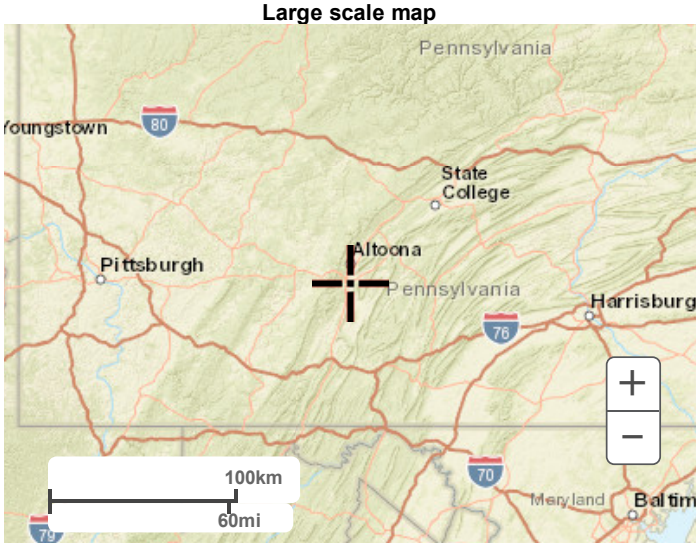
Small scale terrain



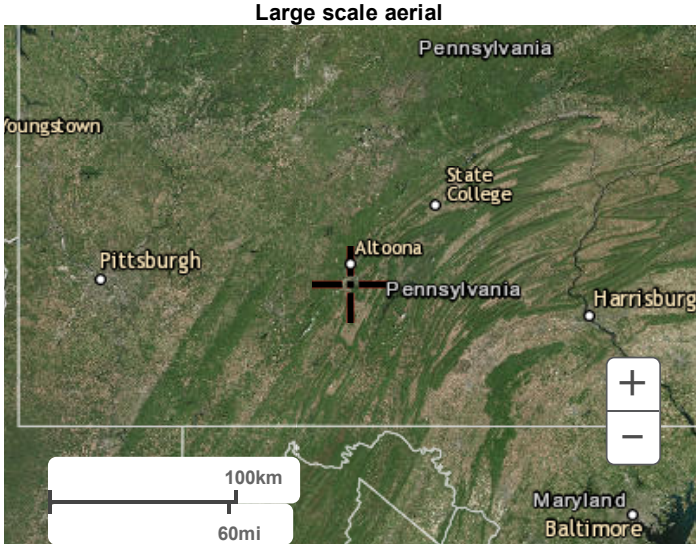
Large scale terrain



Large scale map



Large scale aerial



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WORKSHEET 1. GENERAL SITE INFORMATION

Date: November 11, 2016

Project Name: Charger

Municipality: Blair

County: Blair

Total Area (acres): DA1 - 1.36; DA2 - 0.15

Major River Basin: Susquehanna River

Watershed: Frankstown Branch Juniata River

Sub Basin: Little Juniata River

Nearest Surface Water to Receive Runoff: Tributary #16332 to Beaverdam Branch

Chapter 93 - Designated Water Use: Warm Water Fishes (WWF)

Impaired according to Chapter 303(d) list?	YES	X
	NO	

List Causes of Impairment:

Metals; pH; Organic Enrichment/Low D.O.

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	X
	NO	
Existing River Conservation Plan?	YES	
	NO	X

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 – 0.62 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	0.62	0
Natural Drainage Ways	N/A		
Steep Slopes, 15% - 25%	N/A		
Steep Slopes, over 25%	N/A		
Other:			
Other:			
TOTAL EXISTING:		**0.62**	**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
0.67	-	0	=	0.67

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: Charger
Drainage Area: 1.36 acres DA1
2-Year Rainfall: 2.66 in

Total Site Area: 0.67 acres
Protected Site Area: N/A acres
Managed Site Area: 0.67 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	436	0.01	58	7.24	1.45	0.17	6
Meadow	C	0	0.00	71	4.08	0.82	0.57	0
Meadow	D	1,742	0.04	78	2.82	0.56	0.89	130
Woods	B	436	0.01	55	8.18	1.64	0.11	4
Woods	C	14,810	0.34	70	4.29	0.86	0.53	659
Woods	D	11,761	0.27	77	2.99	0.60	0.84	826
TOTAL:		**29,185**	**0.67**					**1,625**

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	0	0.00	85	1.76	0.35	1.31	0
Impervious-Gravel	C	4,356	0.10	89	1.24	0.25	1.60	579
Impervious-Gravel	D	1,742	0.04	91	0.99	0.20	1.76	255
Meadow	B	436	0.01	58	7.24	1.45	0.17	6
Meadow	C	10,890	0.25	71	4.08	0.82	0.57	520
Meadow	D	11,761	0.27	78	2.82	0.56	0.89	876
TOTAL:		**29,185**	**0.67**					**2,236**

2-Year Volume Increase (ft^3):	**612**

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: Charger
SUB-BASIN: DA1

Required Control Volume (ft^3) - *from Worksheet 4:* 612

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

Structural Volume Reqmt (ft^3): 612
(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		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-Use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond/Retention Basin		
6.7.1	Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2	Landscape Restoration/Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other:	Slow Release Concept	168	840
		Total Structural Volume (ft^3):	**840**
		Structural Volume Requirement (ft^3):	**612**
		DIFFERENCE:	**-228**

VOLUME CREDIT DETERMINATION DA 1

1 Detained area runoff volume from Hydraflow = 1124 cf

2 Storage volume of the BMP = 840 cf

WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

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

PRIMARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		
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	

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 - 0.05 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	0.05	
Natural Drainage Ways	N/A		
Steep Slopes, 15% - 25%	N/A		
Steep Slopes, over 25%	N/A		
Other:			
Other:			
TOTAL EXISTING:		**0.05**	**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
0.10	-	0	=	0.10

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: Charger
Drainage Area: 0.15 acres DA2
2-Year Rainfall: 2.66 in

Total Site Area: 0.10 acres
Protected Site Area: N/A acres
Managed Site Area: 0.10 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	0	0.00	58	7.24	1.45	0.17	0
Meadow	C	2,178	0.05	71	4.08	0.82	0.57	104
Meadow	D	0	0.00	78	2.82	0.56	0.89	0
Woods	B	0	0.00	55	8.18	1.64	0.11	0
Woods	C	2,178	0.05	70	4.29	0.86	0.53	97
Woods	D	0	0.00	77	2.99	0.60	0.84	0
TOTAL:		**4,356**	**0.10**					**201**

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	0	0.00	85	1.76	0.35	1.31	0
Impervious-Gravel	C	871	0.02	89	1.24	0.25	1.60	116
Impervious-Gravel	D	0	0.00	91	0.99	0.20	1.76	0
Meadow	B	0	0.00	58	7.24	1.45	0.17	0
Meadow	C	3,485	0.08	71	4.08	0.82	0.57	166
Meadow	D	0	0.00	78	2.82	0.56	0.89	0
TOTAL:		**4,356**	**0.10**					**282**

2-Year Volume Increase (ft^3):	**81**

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: Charger
SUB-BASIN: DA2

Required Control Volume (ft^3) - *from Worksheet 4:* 81

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

Structural Volume Reqmt (ft^3): 81
(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		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-Use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond/Retention Basin		
6.7.1	Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2	Landscape Restoration/Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
Other:	Slow Release Concept	48	130
		Total Structural Volume (ft^3):	**130**
		Structural Volume Requirement (ft^3):	**81**
		DIFFERENCE:	**-49**

VOLUME CREDIT DETERMINATION DA 1

1 Detained area runoff volume from Hydraflow = 135 cf

2 Storage volume of the BMP = 130 cf

WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

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

PRIMARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers		
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 DETAINED 1

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT 7.2 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 840 CF

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	0.523
10 YR/24 HR	0.996
50 YR/24 HR	1.617
100 YR/24 HR	1.918

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	0.523	26.769
10 YR/24 HR	0.996	14.056
50 YR/24 HR	1.617	8.658
100 YR/24 HR	1.918	7.299

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	0.523	26.769	33.969
10 YR/24 HR	0.996	14.056	21.256
50 YR/24 HR	1.617	8.658	15.858
100 YR/24 HR	1.918	7.299	14.499

Underdrain Dewatering Rate Calculation

Project: Charger DA1 **BMP:** 1

Filter Media				
Layer	**Media**	**Thickness - T (ft)**	**Min. Infiltration Rate - K (ft/min)[1]**	**Flow Rate (cfs)[2]**
1	Clean Gravel	N/A	2	N/A
2	Coarse Sand	1	0.02	0.06
3	Fine Sand	1	0.002	0.00560
4	Other[3]	N/A	N/A	N/A
			Minimum Flow Rate (cfs)	**0.006**

1. From Principles of Geotechnical Engineering Third Edition, Braja Das, 1994
2. Q=KA(Hm+T/T)
   A = Area (square feet) = 168
   Hm = Head above media (feet) = 1
3. Infiltration rate measured in field or laboratory

Perforated Pipe				
Pipe	**Perforation Area (square inch)[4]**	**# Perforations per Foot - N**	**Pipe Length - L (ft)**	**Flow Rate (cfs)[5]**
1	1.00	1	56	2.33
2	N/A	N/A	N/A	N/A
			Total Flow Rate (cfs)	**2.33**

4. Reference: PVC: certainteed.com HDPE: ads-pipe.com
5. Q= N*L*cAov(2GH)
   c = Orifice Coefficient = 0.6
   Ao= Perforation Area (sq. ft.) 0.007
   G= Grav. Accel. (ft/sec^2) 32.2
   H= Average Head (ft) = 2.5

Pipe Discharge				
Pipe	**Pipe Diameter - D (in)**	**Pipe Roughness Coefficient -n**	**Pipe Slope - S[6]**	**Flow Rate (cfs)[7]**
1	4	0.012	0.005952381	0.16
2	N/A	N/A	N/A	N/A
			Total Flow Rate (cfs)	**0.16**

6. For flat pipe, use hydraulic grade (pipe diameter/pipe length) for the pipe slope
7. From Manning's equation (attach separate calculation worksheet)

Limiting flow rate from combined underdrain system - Ql (cfs) =	**0.006**
Detained volume based on 2-year/24-hour storm (cu-ft) =	**840**
Total Dewatering Volume including volume in voids(cu-ft) =	**974**
Dewatering Time (sec) = 2HA/Ql =	**174,000**
Dewatering Time (hrs) =	**48.33**

TIME OF CONCENTRATION ADJUSTMENT DETAINED 2

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT 7.1 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 130 CF

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	0.058
10 YR/24 HR	0.122
50 YR/24 HR	0.21
100 YR/24 HR	0.254

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	0.058	37.356
10 YR/24 HR	0.122	17.760
50 YR/24 HR	0.210	10.317
100 YR/24 HR	0.254	8.530

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	0.058	37.356	44.456
10 YR/24 HR	0.122	17.760	24.860
50 YR/24 HR	0.210	10.317	17.417
100 YR/24 HR	0.254	8.530	15.630

Underdrain Dewatering Rate Calculation

Project: Charger DA2 **BMP:** 2

Filter Media				
Layer	**Media**	**Thickness - T (ft)**	**Min. Infiltration Rate - K (ft/min)[1]**	**Flow Rate (cfs)[2]**
1	Clean Gravel	N/A	2	N/A
2	Coarse Sand	N/A	0.02	N/A
3	Fine Sand	2	0.002	0.00080
4	Other[3]	N/A	N/A	N/A
			Minimum Flow Rate (cfs)	**0.001**

1. From Principles of Geotechnical Engineering Third Edition, Braja Das, 1994
2. Q=KA(Hm+T/T)
   A = Area (square feet) = 48
   Hm = Head above media (feet) = 1
3. Infiltration rate measured in field or laboratory

Perforated Pipe				
Pipe	**Perforation Area (square inch)[4]**	**# Perforations per Foot - N**	**Pipe Length - L (ft)**	**Flow Rate (cfs)[5]**
1	1.00	1	16	0.66
2	N/A	N/A	N/A	N/A
			Total Flow Rate (cfs)	**0.66**

4. Reference: PVC: certainteed.com HDPE: ads-pipe.com
5. Q= N*L*cAov(2GH)
   c = Orifice Coefficient = 0.6
   Ao= Perforation Area (sq. ft.) 0.007
   G= Grav. Accel. (ft/sec^2) 32.2
   H= Average Head (ft) = 2.5

Pipe Discharge				
Pipe	**Pipe Diameter - D (in)**	**Pipe Roughness Coefficient -n**	**Pipe Slope - S[6]**	**Flow Rate (cfs)[7]**
1	4	0.012	0.020833333	0.30
2	N/A	N/A	N/A	N/A
			Total Flow Rate (cfs)	**0.30**

6. For flat pipe, use hydraulic grade (pipe diameter/pipe length) for the pipe slope
7. From Manning's equation (attach separate calculation worksheet)

Limiting flow rate from combined underdrain system - Ql (cfs) =	**0.001**
Detained volume based on 2-year/24-hour storm (cu-ft) =	**130**
Total Dewatering Volume including volume in voids(cu-ft) =	**168**
Dewatering Time (sec) = 2HA/Ql =	**210,500**
Dewatering Time (hrs) =	**58.47**

Underdrain Report

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

Channel Slope (ft/ft)	Normal Depth (ft)	Diameter (ft)	Discharge (ft³/s)
0.17500	0.33	0.33	0.86
0.00595	0.33	0.33	0.16
0.02080	0.33	0.33	0.30

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

Critical Depth (ft)	Percent Full (%)	Critical Slope (ft/ft)	Velocity (ft/s)
0.33	100.0	0.16749	9.88
0.22	100.0	0.00938	1.82
0.30	100.0	0.01838	3.41

Velocity Head (ft)	Specific Energy (ft)	Froude Number	Maximum Discharge (ft³/s)
1.52	1.85	0.00	0.93
0.05	0.38	0.00	0.17

Underdrain Report

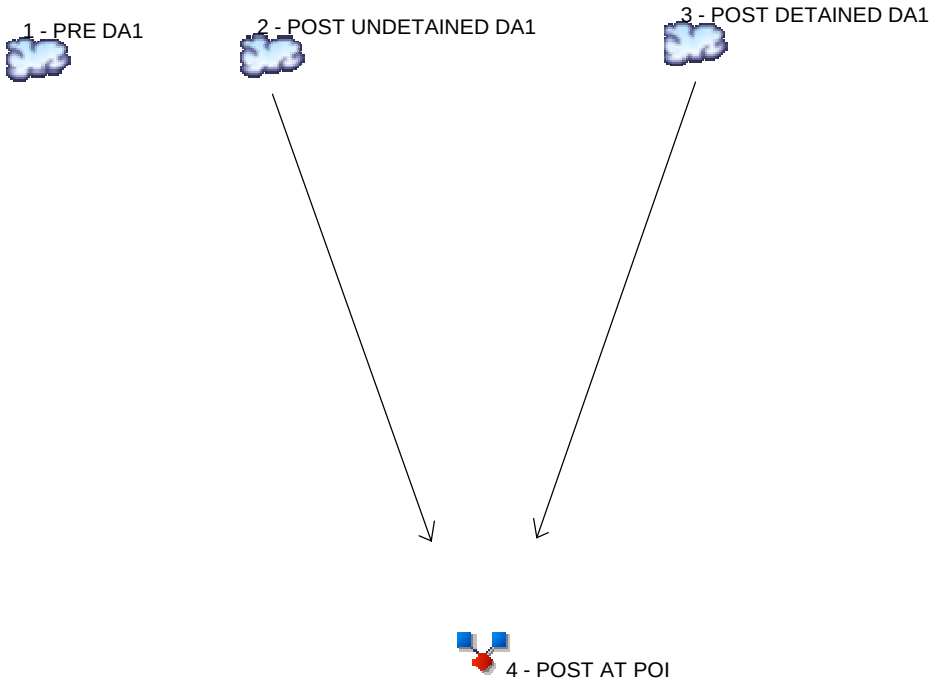
Velocity Head (ft)	Specific Energy (ft)	Froude Number	Maximum Discharge (ft³/s)
0.18	0.51	0.00	0.32

Discharge Full (ft³/s)	Slope Full (ft/ft)	Flow Type	Notes
0.86	0.17500	SubCritical	
0.16	0.00595	SubCritical	
0.30	0.02080	SubCritical	

Messages

Watershed Model Schematic

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



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE DA1
2	SCS Runoff	POST UNDETAINED DA1
3	SCS Runoff	POST DETAINED DA1
4	Combine	POST AT POI

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	1.348	-------	-------	3.025	-------	5.326	6.505	PRE DA1
2	SCS Runoff	------	-------	1.021	-------	-------	2.291	-------	4.033	4.926	POST UNDETAINED DA1
3	SCS Runoff	------	-------	0.523	-------	-------	0.996	-------	1.617	1.918	POST DETAINED DA1
4	Combine	2, 3	-------	1.544	-------	-------	3.282	-------	5.650	6.845	POST AT POI

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.348	2	720	3,240	------	------	------	PRE DA1
2	SCS Runoff	1.021	2	720	2,454	------	------	------	POST UNDETAINED DA1
3	SCS Runoff	0.523	2	720	1,199	------	------	------	POST DETAINED DA1
4	Combine	1.544	2	720	3,653	2, 3	------	------	POST AT POI

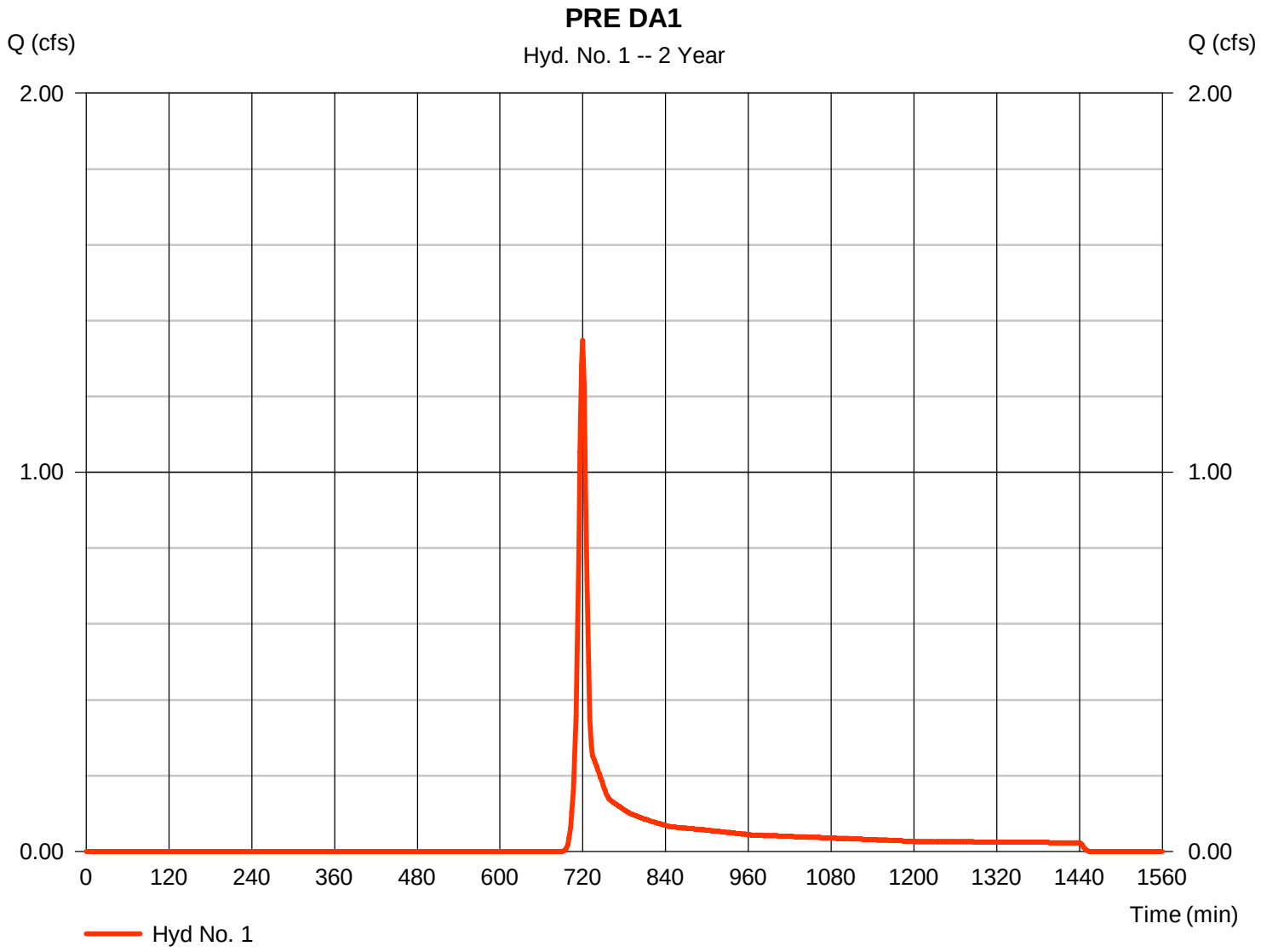
Hydrograph Report

Hyd. No. 1

PRE DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.348 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	3,240 cuft
Drainage area	=	1.360 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	2.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 58) + (0.150 x 71) + (0.040 x 78) + (0.010 x 55) + (0.390 x 70) + (0.670 x 77)] / 1.360



TR55 Tc Worksheet

Hyd. No. 1

PRE DA1

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)	= 2.66		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 7.64**	**+**	**0.00**	**+**	**0.00**	**=**	**7.64**
Shallow Concentrated Flow							
Flow length (ft)	= 209.00		0.00		0.00		
Watercourse slope (%)	= 14.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.21		0.00		0.00		
Travel Time (min)	**= 0.56**	**+**	**0.00**	**+**	**0.00**	**=**	**0.56**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

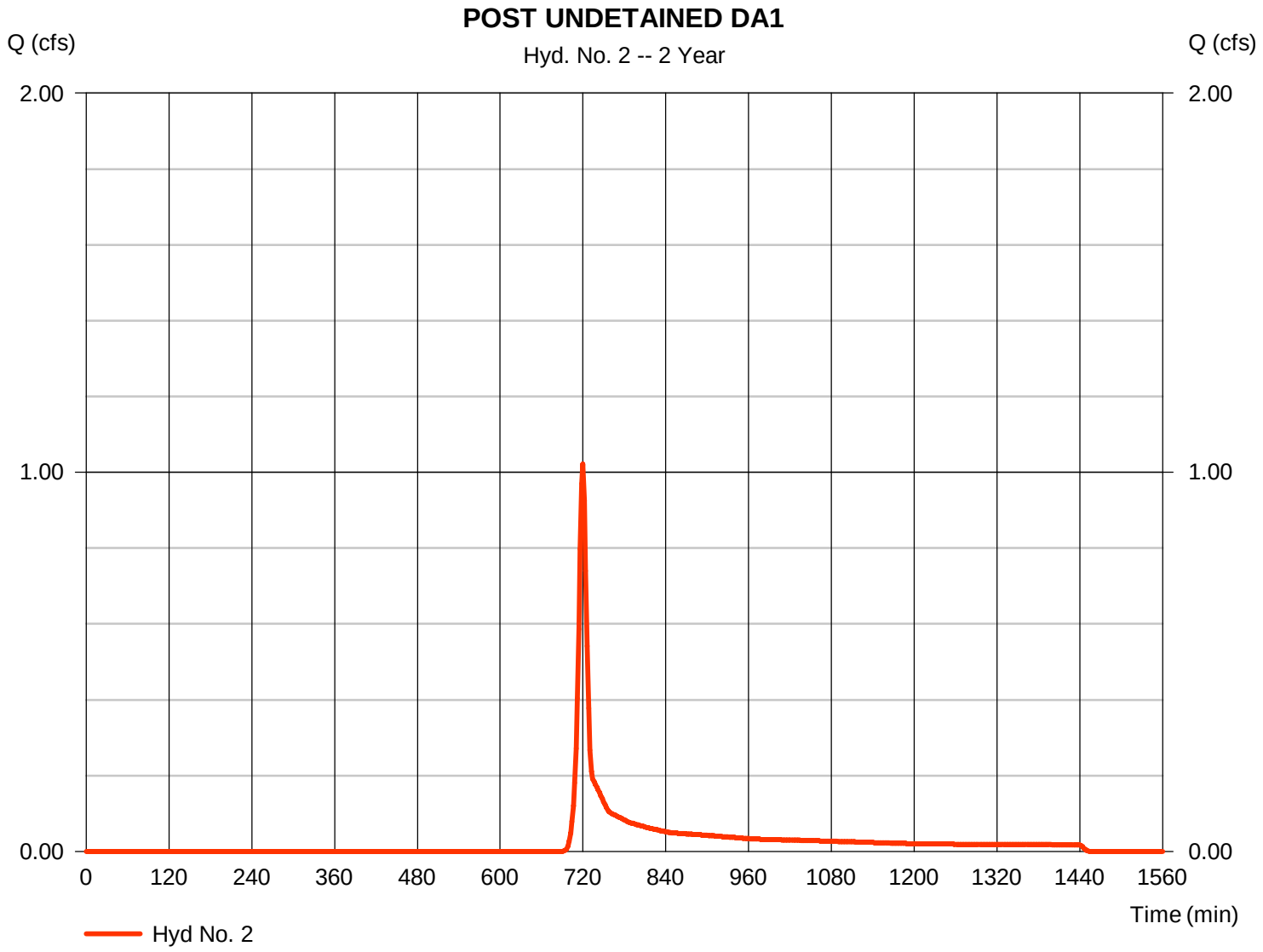
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.021 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	2,454 cuft
Drainage area	=	1.030 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	2.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 58) + (0.320 x 71) + (0.160 x 78) + (0.050 x 70) + (0.400 x 77)] / 1.030



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED DA1

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)	= 2.66		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 7.64**	**+**	**0.00**	**+**	**0.00**	**=**	**7.64**
Shallow Concentrated Flow							
Flow length (ft)	= 209.00		0.00		0.00		
Watercourse slope (%)	= 14.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.21		0.00		0.00		
Travel Time (min)	**= 0.56**	**+**	**0.00**	**+**	**0.00**	**=**	**0.56**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

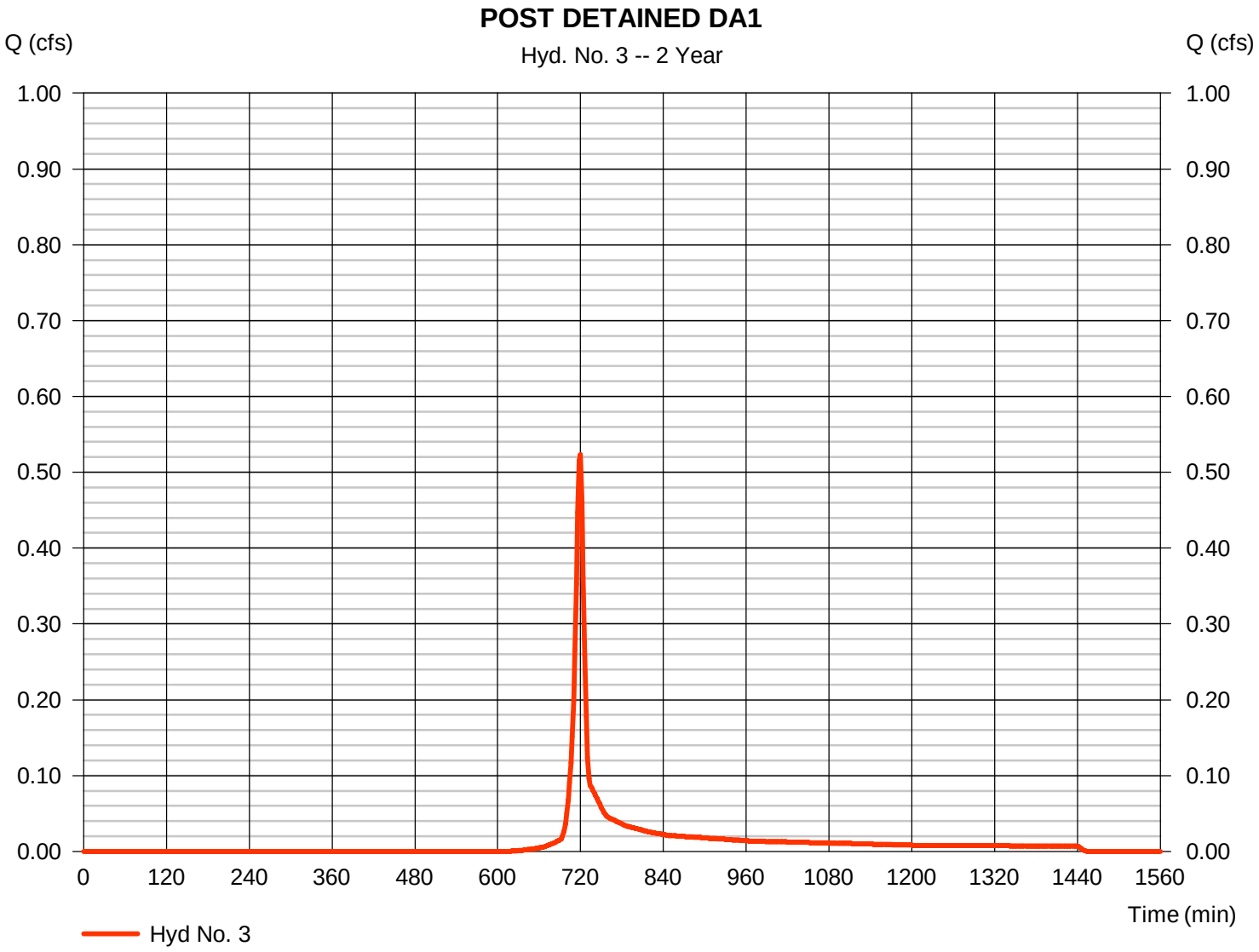
Hydrograph Report

Hyd. No. 3

POST DETAINED DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.523 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 1,199 cuft
Drainage area	= 0.330 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.20 min
Total precip.	= 2.66 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.100 x 89) + (0.030 x 91) + (0.010 x 58) + (0.080 x 71) + (0.110 x 78)] / 0.330



TR55 Tc Worksheet

Hyd. No. 3

POST DETAINED DA1

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)	= 2.66		0.00		0.00		
Land slope (%)	= 4.00		0.00		0.00		
Travel Time (min)	**= 6.81**	**+**	**0.00**	**+**	**0.00**	**=**	**6.81**
Shallow Concentrated Flow							
Flow length (ft)	= 27.00		0.00		0.00		
Watercourse slope (%)	= 5.20		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=4.64		0.00		0.00		
Travel Time (min)	**= 0.10**	**+**	**0.00**	**+**	**0.00**	**=**	**0.10**
Channel Flow							
X sectional flow area (sqft)	= 0.09		0.00		0.00		
Wetted perimeter (ft)	= 1.05		0.00		0.00		
Channel slope (%)	= 17.50		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=8.01						
			0.00				
					0.00		
Flow length (ft)	({0})117.0		0.0		0.0		
Travel Time (min)	**= 0.24**	**+**	**0.00**	**+**	**0.00**	**=**	**0.24**

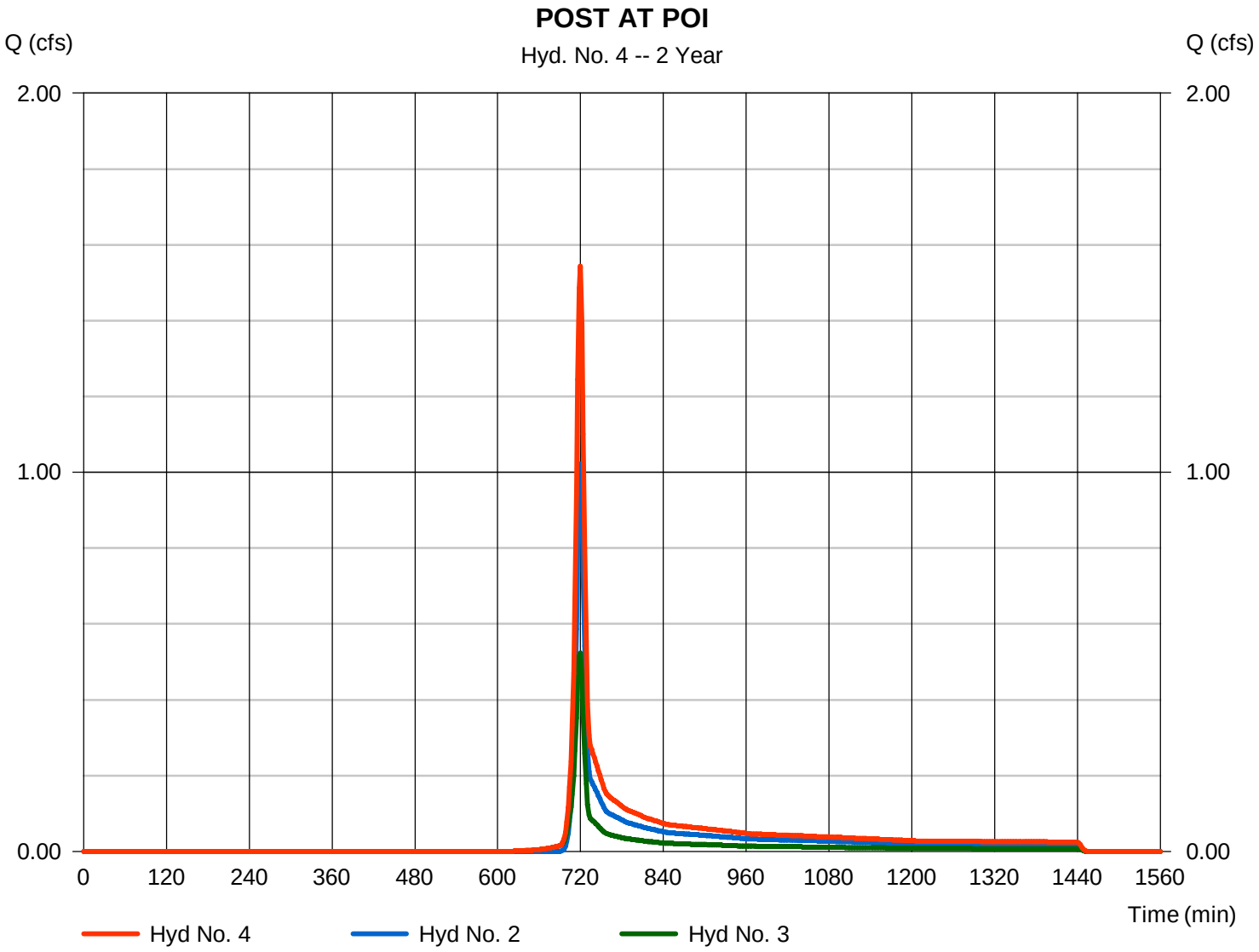
Total Travel Time, Tc ..... 7.20 min

Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 1.544 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 3,653 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 1.360 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	3.025	2	720	6,944	------	------	------	PRE DA1
2	SCS Runoff	2.291	2	720	5,259	------	------	------	POST UNDETAINED DA1
3	SCS Runoff	0.996	2	718	2,278	------	------	------	POST DETAINED DA1
4	Combine	3.282	2	720	7,538	2, 3	------	------	POST AT POI

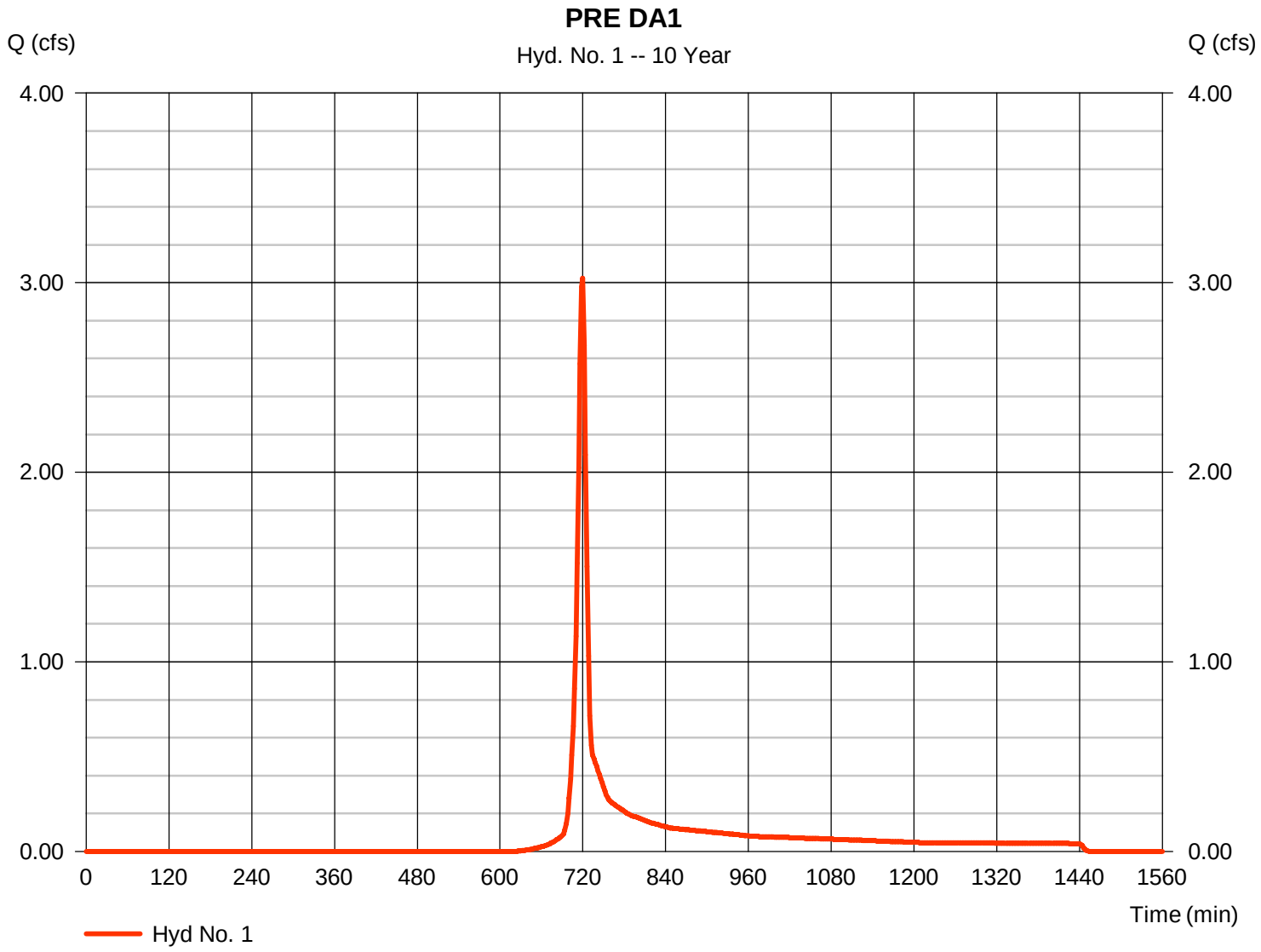
Hydrograph Report

Hyd. No. 1

PRE DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.025 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	6,944 cuft
Drainage area	=	1.360 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	3.83 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 58) + (0.150 x 71) + (0.040 x 78) + (0.010 x 55) + (0.390 x 70) + (0.670 x 77)] / 1.360



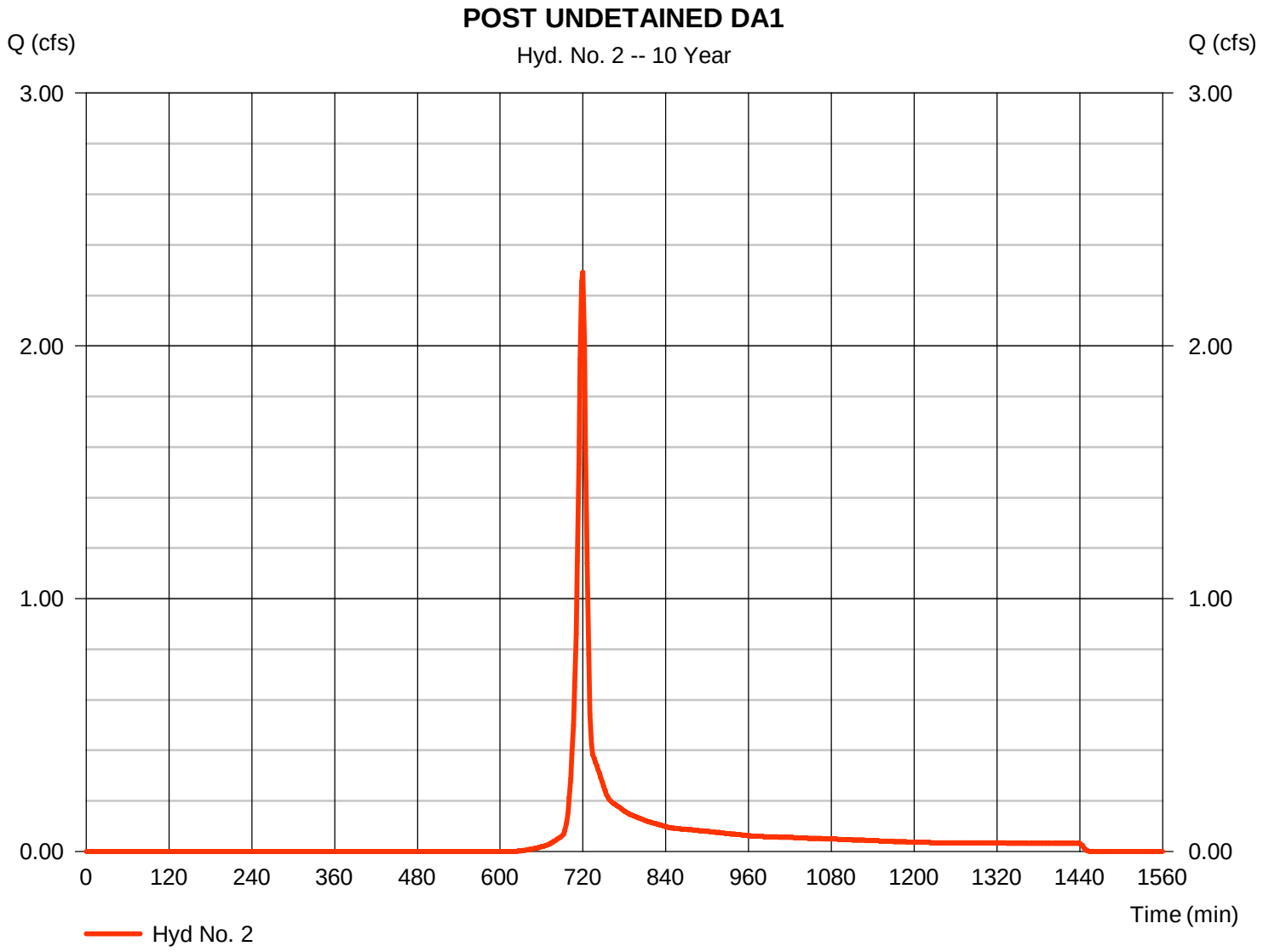
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.291 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	5,259 cuft
Drainage area	=	1.030 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	3.83 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 58) + (0.320 x 71) + (0.160 x 78) + (0.050 x 70) + (0.400 x 77)] / 1.030



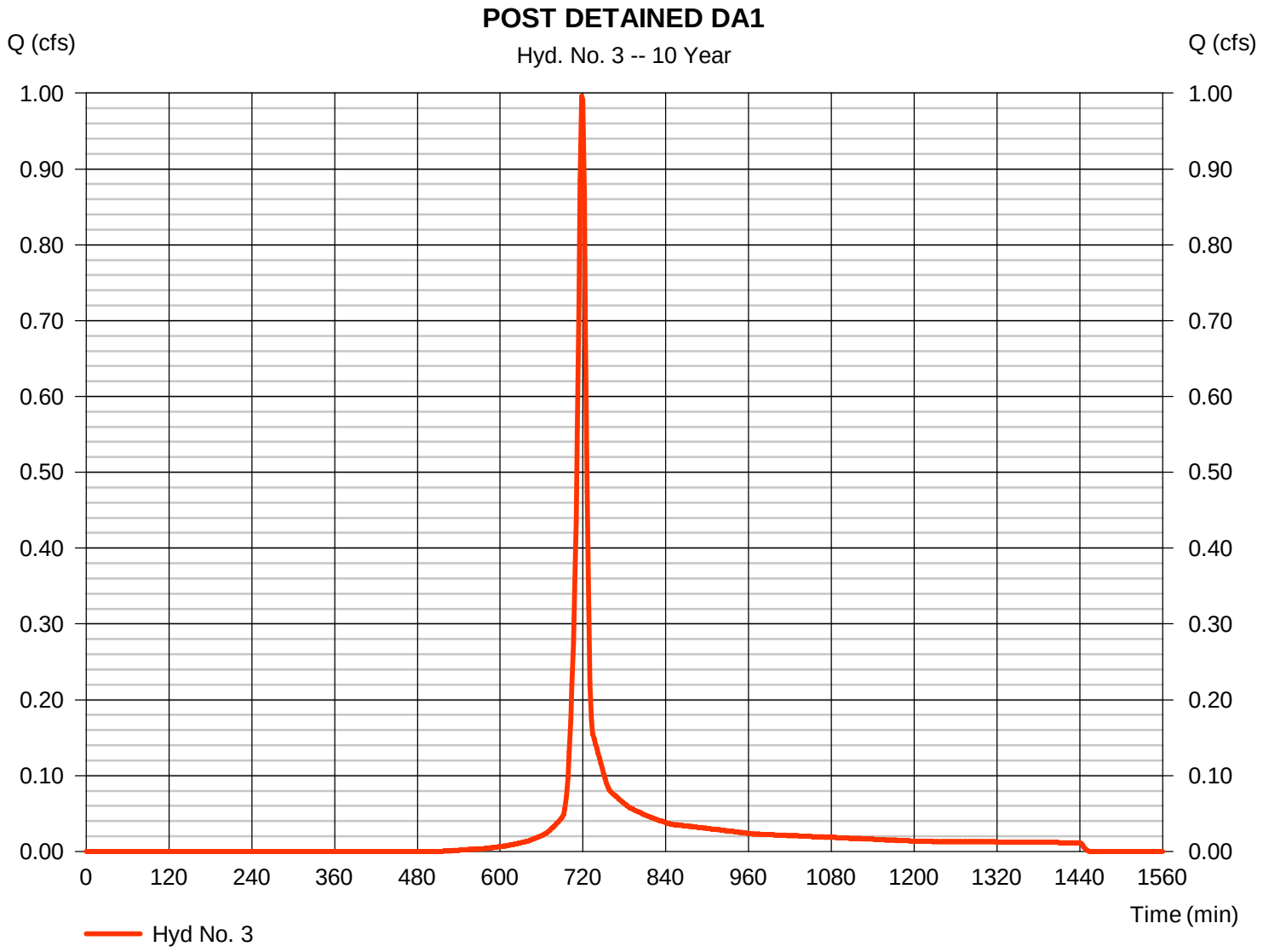
Hydrograph Report

Hyd. No. 3

POST DETAINED DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.996 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,278 cuft
Drainage area	= 0.330 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.20 min
Total precip.	= 3.83 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.100 x 89) + (0.030 x 91) + (0.010 x 58) + (0.080 x 71) + (0.110 x 78)] / 0.330

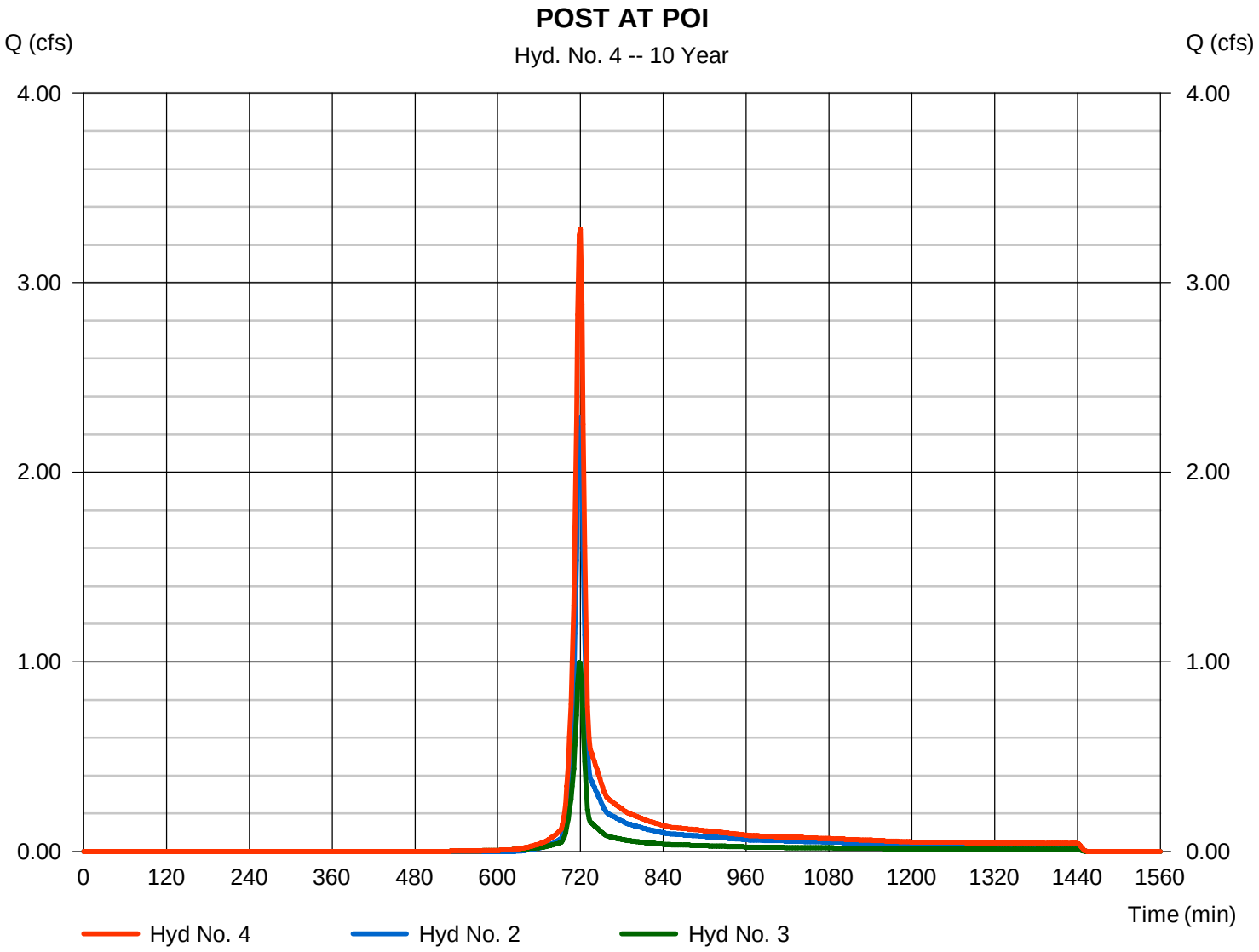


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	3.282 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	7,538 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	1.360 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	5.326	2	718	12,195	------	------	------	PRE DA1
2	SCS Runoff	4.033	2	718	9,236	------	------	------	POST UNDETAINED DA1
3	SCS Runoff	1.617	2	718	3,717	------	------	------	POST DETAINED DA1
4	Combine	5.650	2	718	12,953	2, 3	------	------	POST AT POI

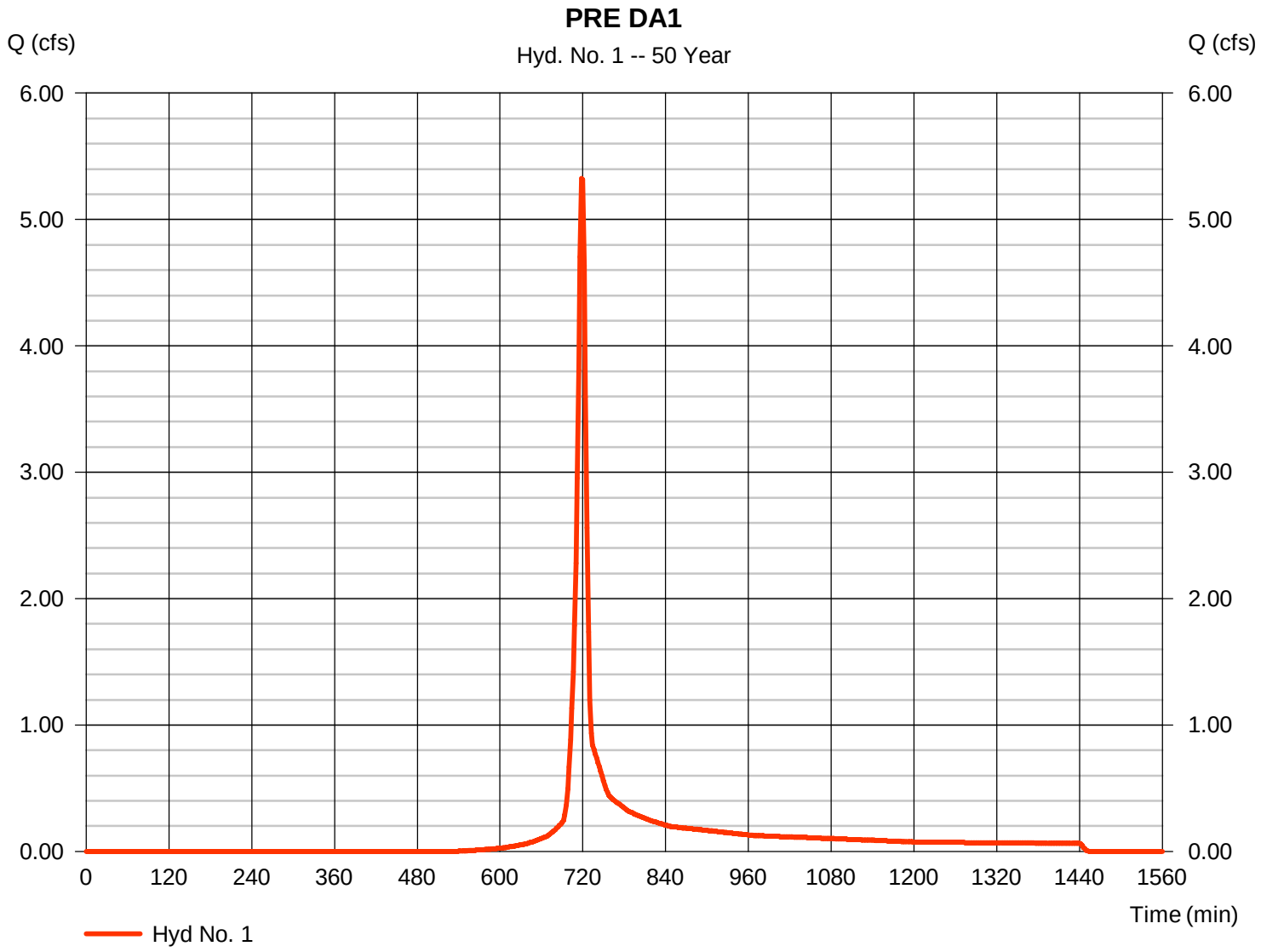
Hydrograph Report

Hyd. No. 1

PRE DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.326 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	12,195 cuft
Drainage area	=	1.360 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	5.24 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 58) + (0.150 x 71) + (0.040 x 78) + (0.010 x 55) + (0.390 x 70) + (0.670 x 77)] / 1.360



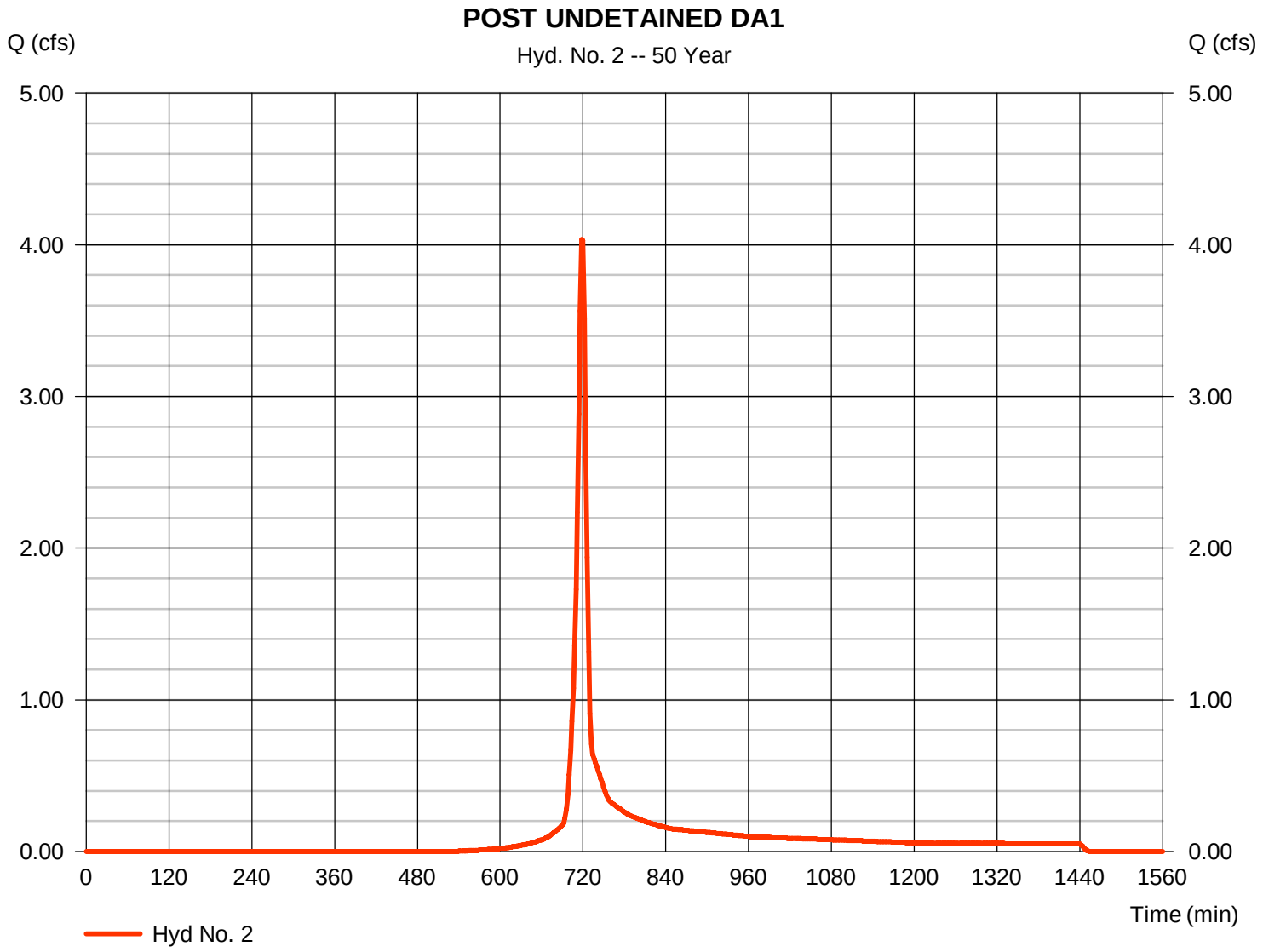
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.033 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 9,236 cuft
Drainage area	= 1.030 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.20 min
Total precip.	= 5.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.100 x 58) + (0.320 x 71) + (0.160 x 78) + (0.050 x 70) + (0.400 x 77)] / 1.030



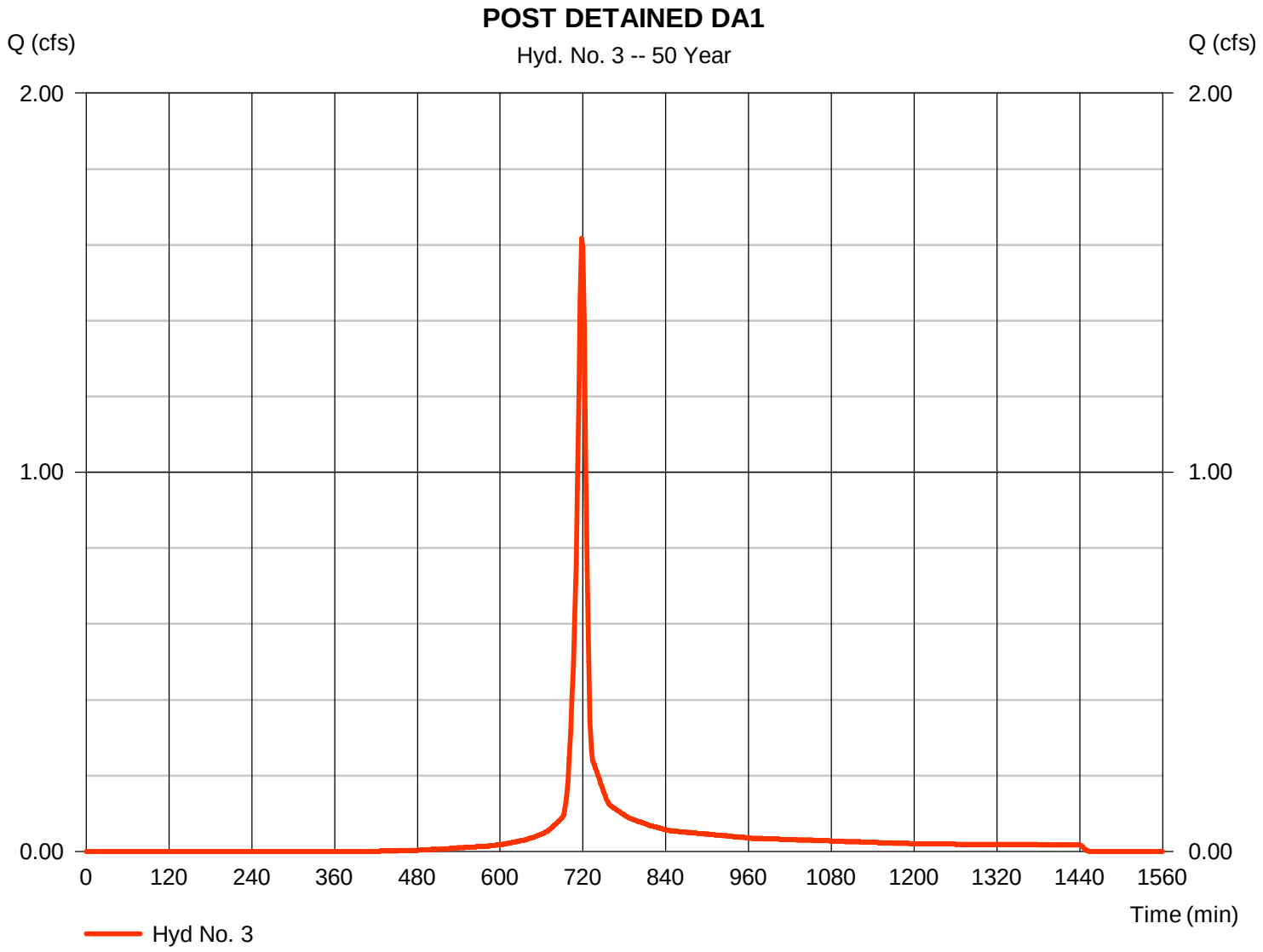
Hydrograph Report

Hyd. No. 3

POST DETAINED DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.617 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 3,717 cuft
Drainage area	= 0.330 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.20 min
Total precip.	= 5.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.100 x 89) + (0.030 x 91) + (0.010 x 58) + (0.080 x 71) + (0.110 x 78)] / 0.330

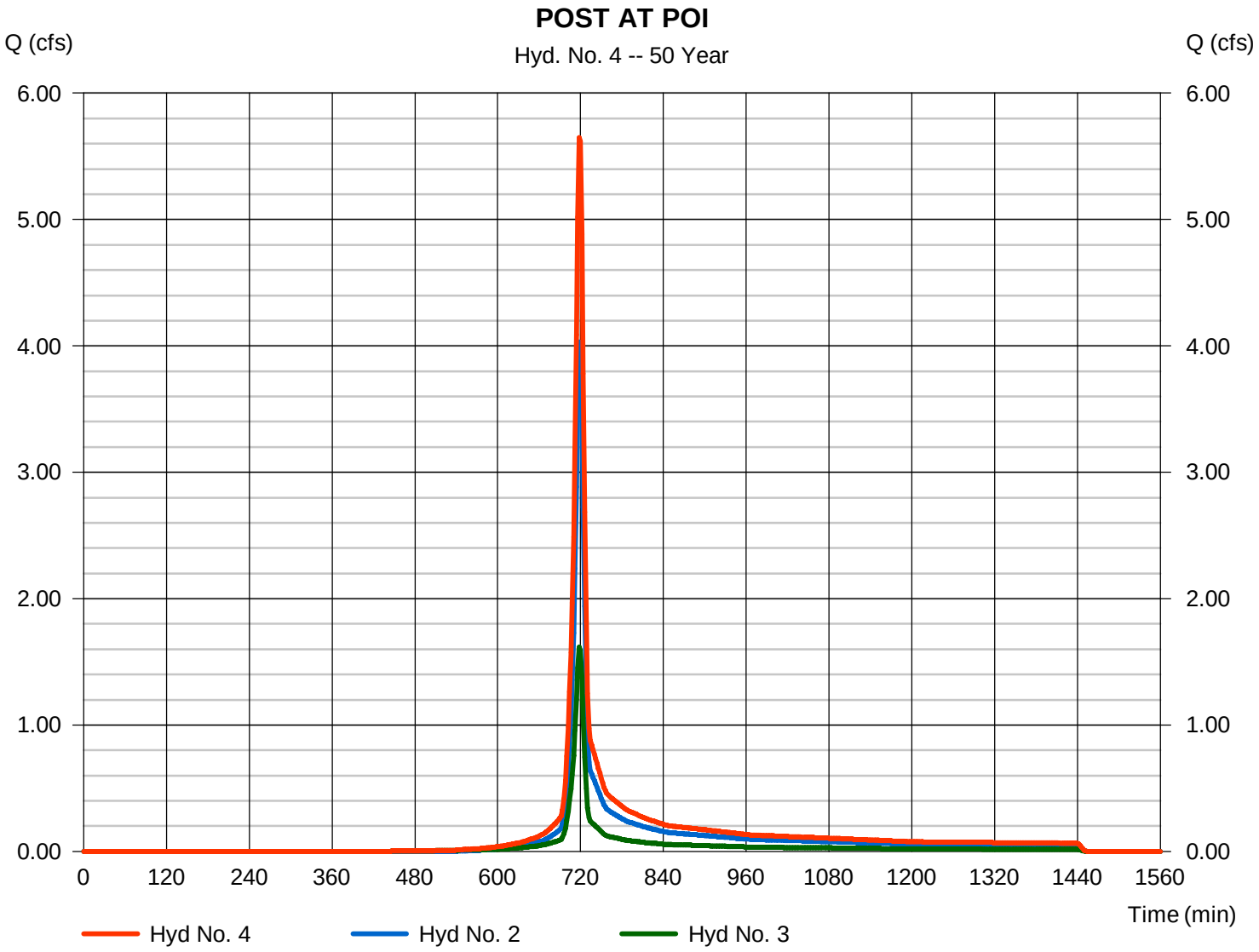


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 5.650 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 12,953 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 1.360 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	6.505	2	718	14,880	------	------	------	PRE DA1
2	SCS Runoff	4.926	2	718	11,269	------	------	------	POST UNDETAINED DA1
3	SCS Runoff	1.918	2	718	4,432	------	------	------	POST DETAINED DA1
4	Combine	6.845	2	718	15,702	2, 3	------	------	POST AT POI

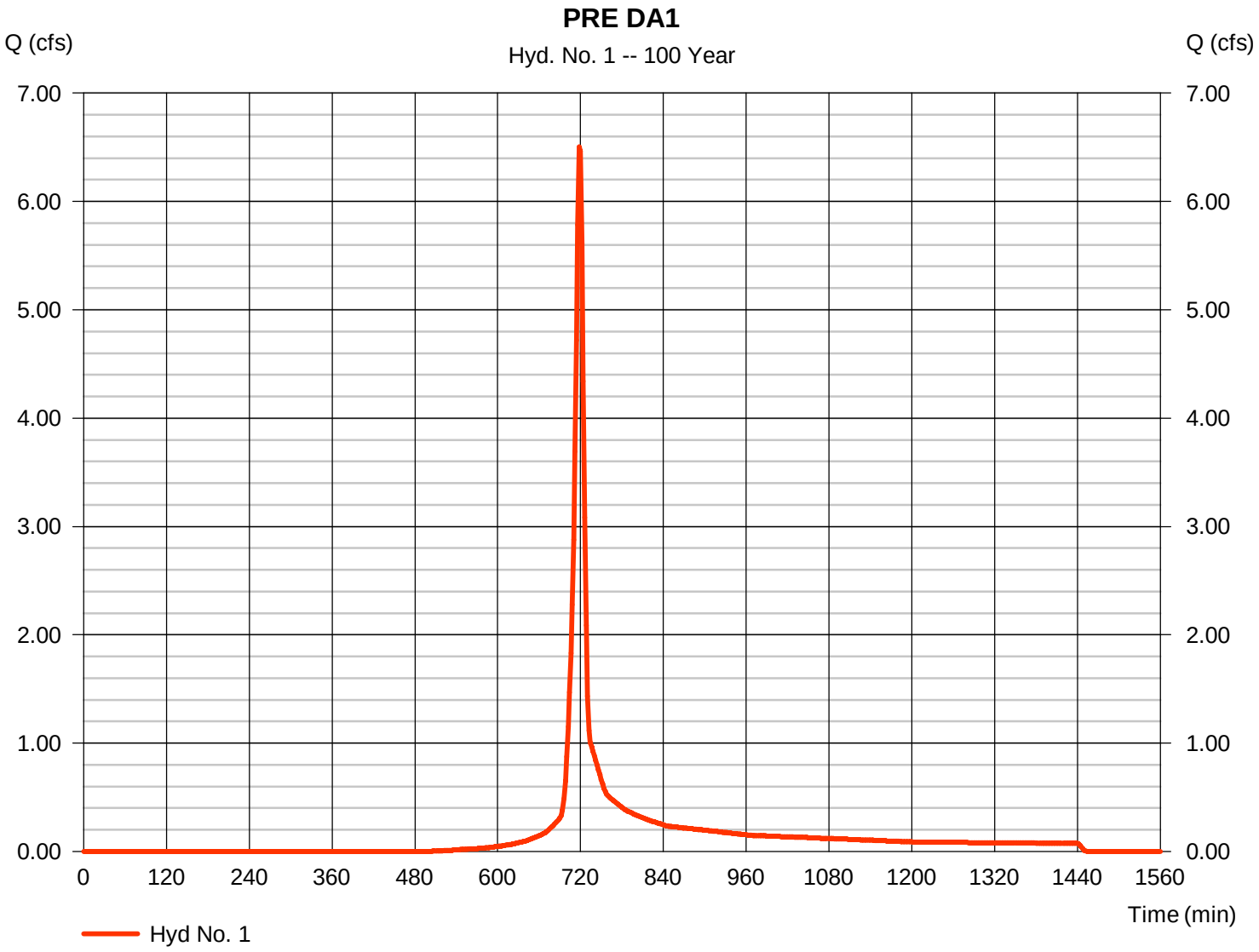
Hydrograph Report

Hyd. No. 1

PRE DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.505 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	14,880 cuft
Drainage area	=	1.360 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	5.91 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 58) + (0.150 x 71) + (0.040 x 78) + (0.010 x 55) + (0.390 x 70) + (0.670 x 77)] / 1.360



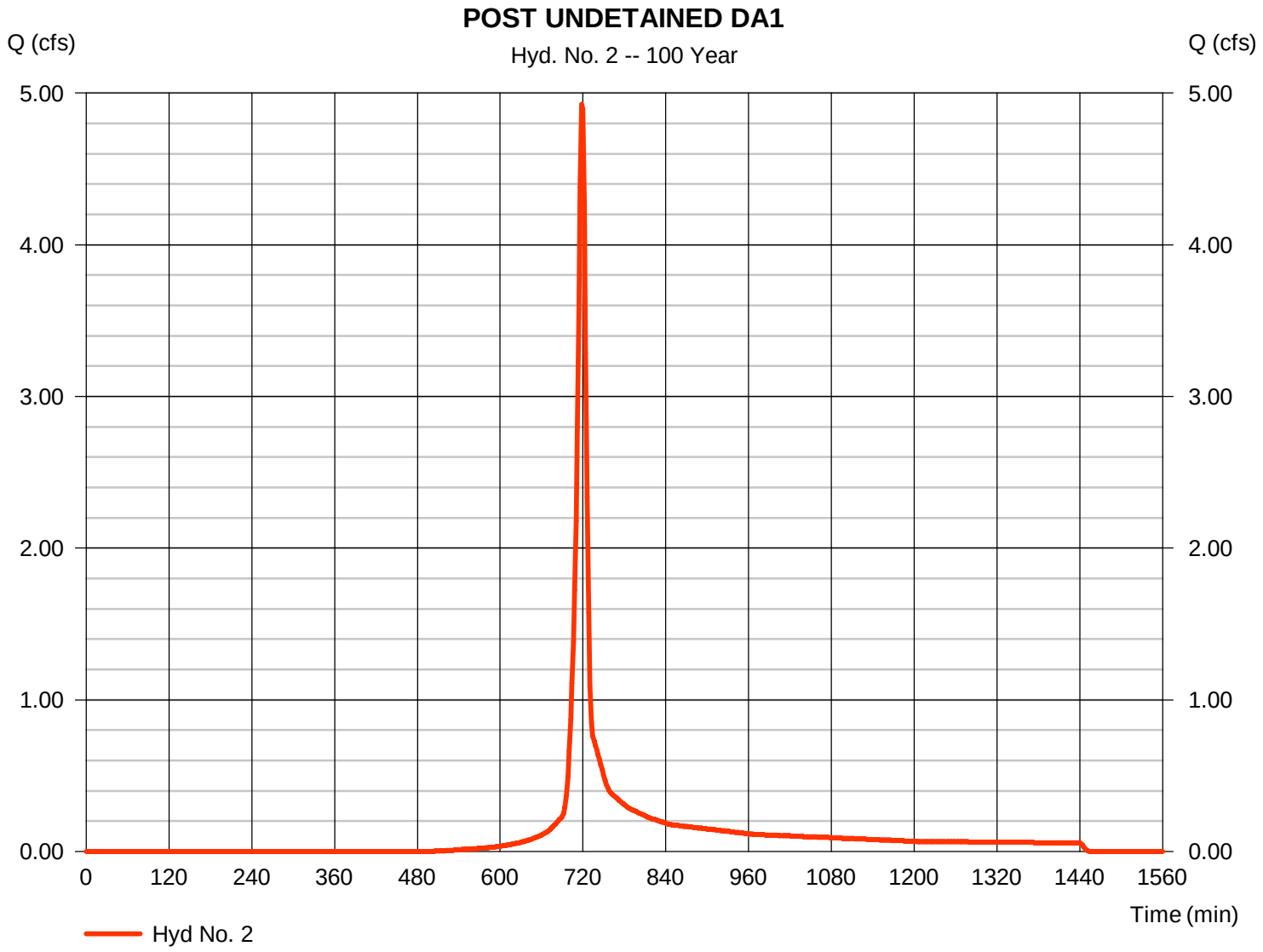
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.926 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 11,269 cuft
Drainage area	= 1.030 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.20 min
Total precip.	= 5.91 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.100 x 58) + (0.320 x 71) + (0.160 x 78) + (0.050 x 70) + (0.400 x 77)] / 1.030



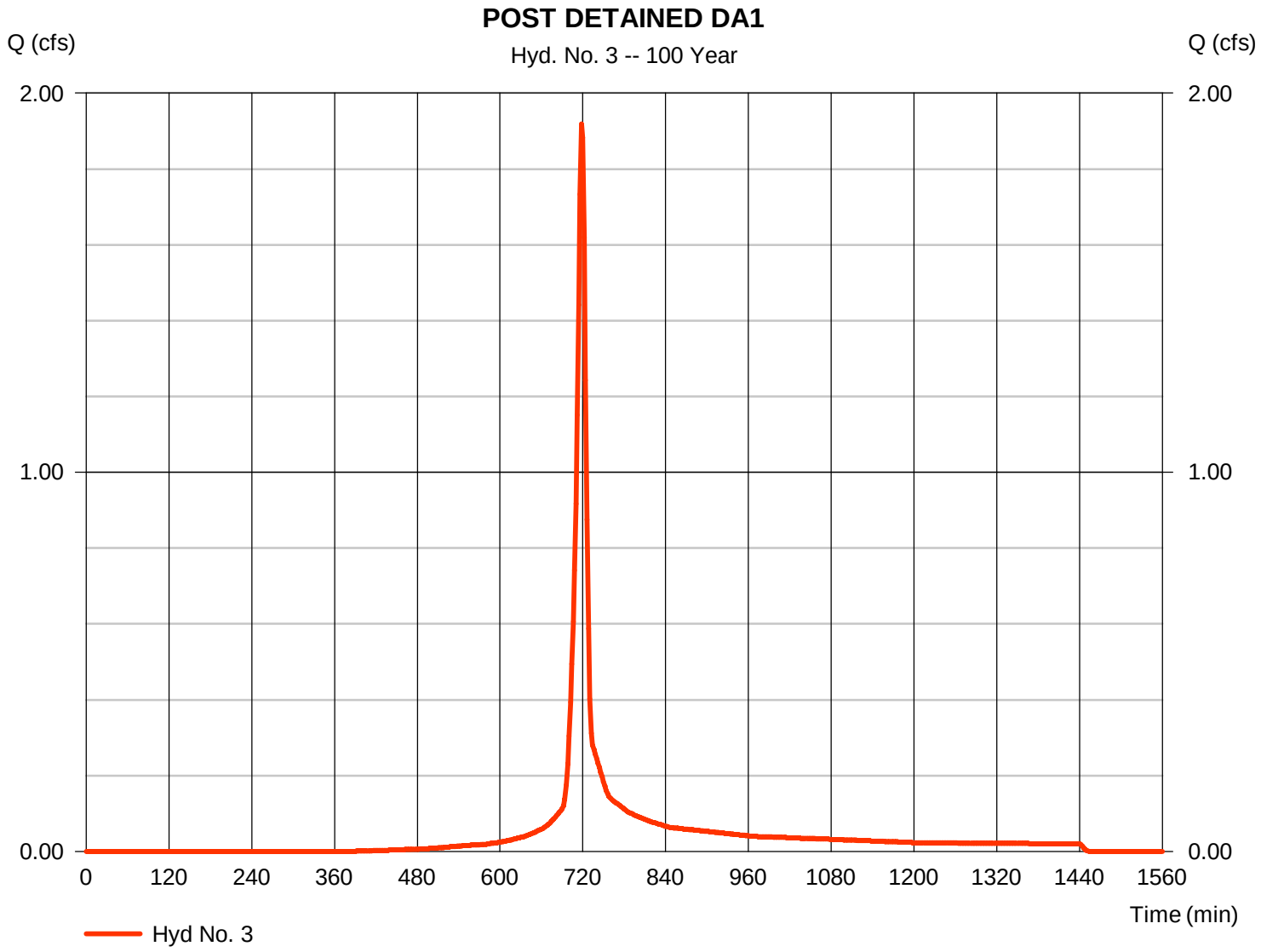
Hydrograph Report

Hyd. No. 3

POST DETAINED DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.918 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 4,432 cuft
Drainage area	= 0.330 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.20 min
Total precip.	= 5.91 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.100 x 89) + (0.030 x 91) + (0.010 x 58) + (0.080 x 71) + (0.110 x 78)] / 0.330

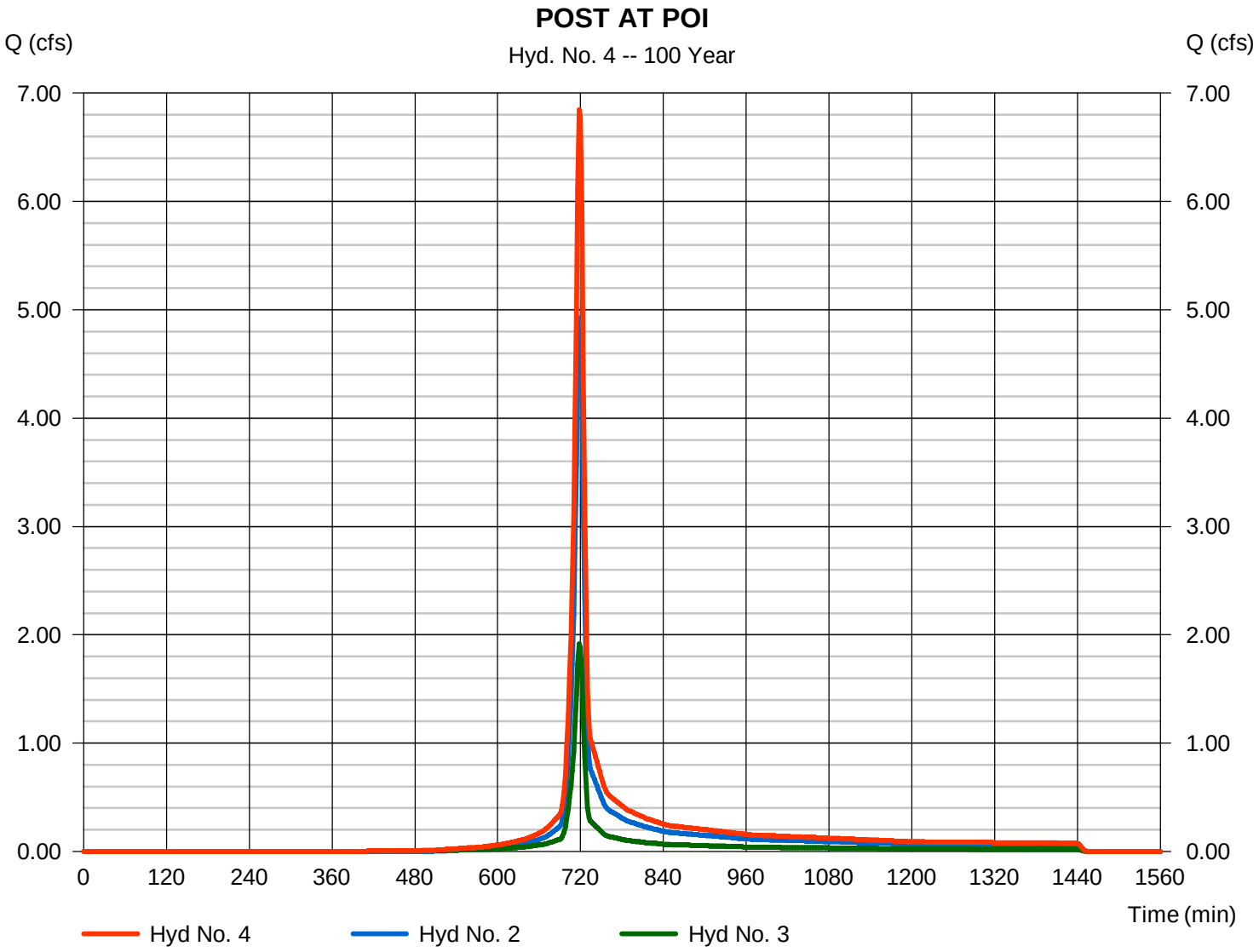


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	6.845 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	15,702 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	1.360 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.9938	10.0000	0.8826	--------
2	46.8600	10.1000	0.8723	--------
3	0.0000	0.0000	0.0000	--------
5	47.4204	9.3000	0.8196	--------
10	26589.4199	47.3998	2.1160	--------
25	53942.1797	51.5998	2.2139	--------
50	69308.7266	52.6998	2.2395	--------
100	106327.6016	55.1997	2.2977	--------

File name: Charger 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	3.66	2.84	2.33	1.99	1.73	1.54	1.39	1.27	1.16	1.08	1.00	0.94
2	4.39	3.42	2.82	2.40	2.10	1.87	1.69	1.54	1.42	1.32	1.23	1.15
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	5.36	4.19	3.47	2.98	2.62	2.34	2.12	1.94	1.80	1.67	1.56	1.47
10	6.12	5.04	4.23	3.59	3.09	2.68	2.35	2.07	1.84	1.65	1.48	1.34
25	7.10	5.89	4.95	4.22	3.63	3.16	2.77	2.45	2.17	1.94	1.75	1.58
50	7.88	6.54	5.51	4.70	4.05	3.52	3.09	2.73	2.42	2.17	1.95	1.76
100	8.66	7.21	6.09	5.20	4.48	3.90	3.42	3.02	2.69	2.40	2.16	1.95

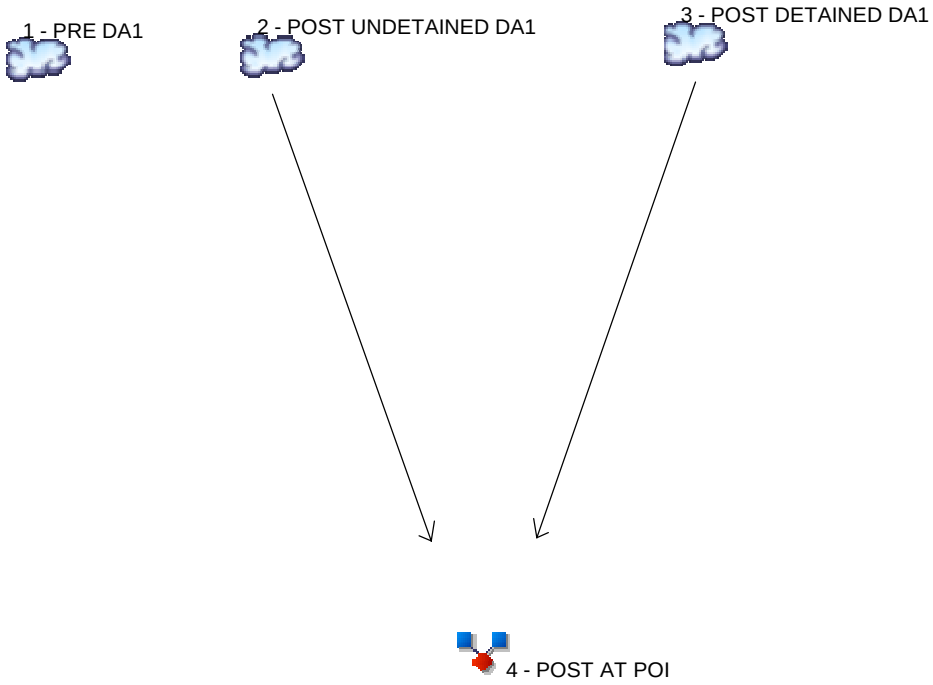
Tc = time in minutes. Values may exceed 60.

hase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Charger\Hydraflow Rev 1\Charger Precip.pc

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	2.22	2.66	0.00	3.30	3.83	4.60	5.24	5.91
SCS 6-Hr	1.46	1.76	0.00	2.21	2.57	3.09	3.52	3.97
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 DA1
2	SCS Runoff	POST UNDETAINED DA1
3	SCS Runoff	POST DETAINED DA1
4	Combine	POST AT POI

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	1.348	-------	-------	-------	-------	-------	-------	PRE DA1
2	SCS Runoff	------	-------	1.021	-------	-------	-------	-------	-------	-------	POST UNDETAINED DA1
3	SCS Runoff	------	-------	0.251	-------	-------	-------	-------	-------	-------	POST DETAINED DA1
4	Combine	2, 3	-------	1.151	-------	-------	-------	-------	-------	-------	POST AT POI

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.348	2	720	3,240	------	------	------	PRE DA1
2	SCS Runoff	1.021	2	720	2,454	------	------	------	POST UNDETAINED DA1
3	SCS Runoff	0.251	2	736	1,186	------	------	------	POST DETAINED DA1
4	Combine	1.151	2	720	3,639	2, 3	------	------	POST AT POI

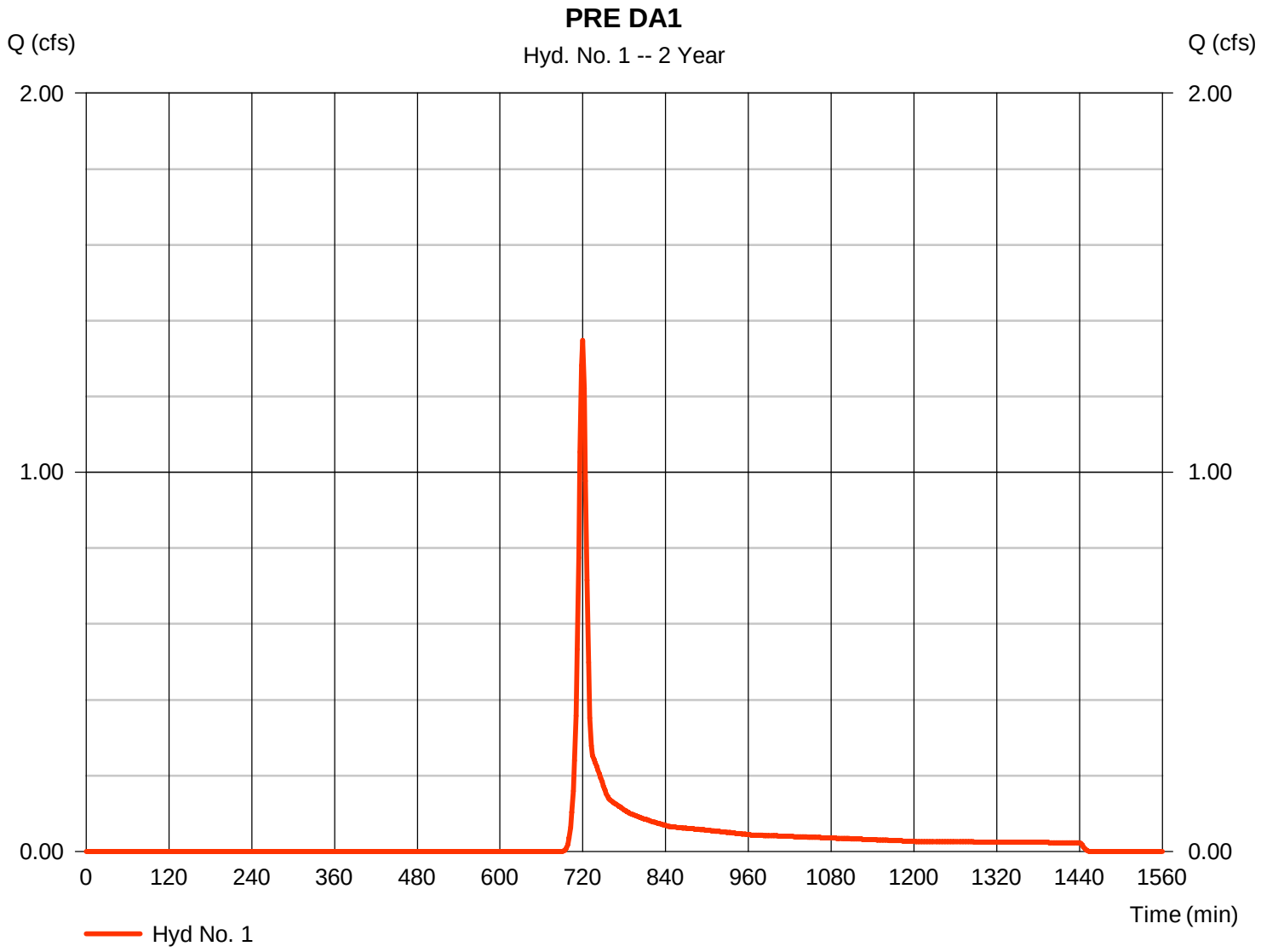
Hydrograph Report

Hyd. No. 1

PRE DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.348 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	3,240 cuft
Drainage area	=	1.360 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	2.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 58) + (0.150 x 71) + (0.040 x 78) + (0.010 x 55) + (0.390 x 70) + (0.670 x 77)] / 1.360



TR55 Tc Worksheet

Hyd. No. 1

PRE DA1

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)	= 2.66		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 7.64**	**+**	**0.00**	**+**	**0.00**	**=**	**7.64**
Shallow Concentrated Flow							
Flow length (ft)	= 209.00		0.00		0.00		
Watercourse slope (%)	= 14.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.21		0.00		0.00		
Travel Time (min)	**= 0.56**	**+**	**0.00**	**+**	**0.00**	**=**	**0.56**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

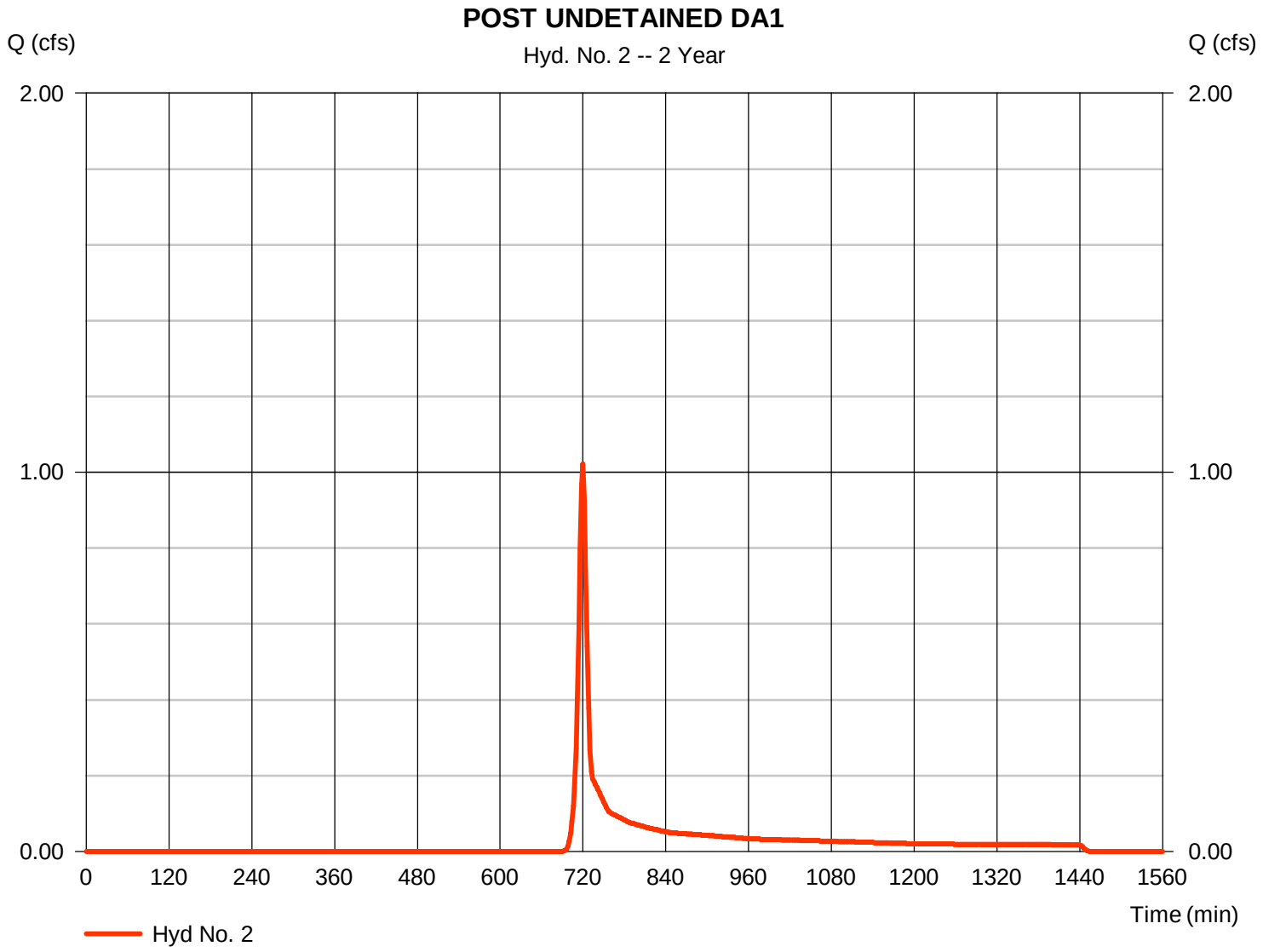
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.021 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	2,454 cuft
Drainage area	=	1.030 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	2.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 58) + (0.320 x 71) + (0.160 x 78) + (0.050 x 70) + (0.400 x 77)] / 1.030



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED DA1

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)	= 2.66		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 7.64**	**+**	**0.00**	**+**	**0.00**	**=**	**7.64**
Shallow Concentrated Flow							
Flow length (ft)	= 209.00		0.00		0.00		
Watercourse slope (%)	= 14.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.21		0.00		0.00		
Travel Time (min)	**= 0.56**	**+**	**0.00**	**+**	**0.00**	**=**	**0.56**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

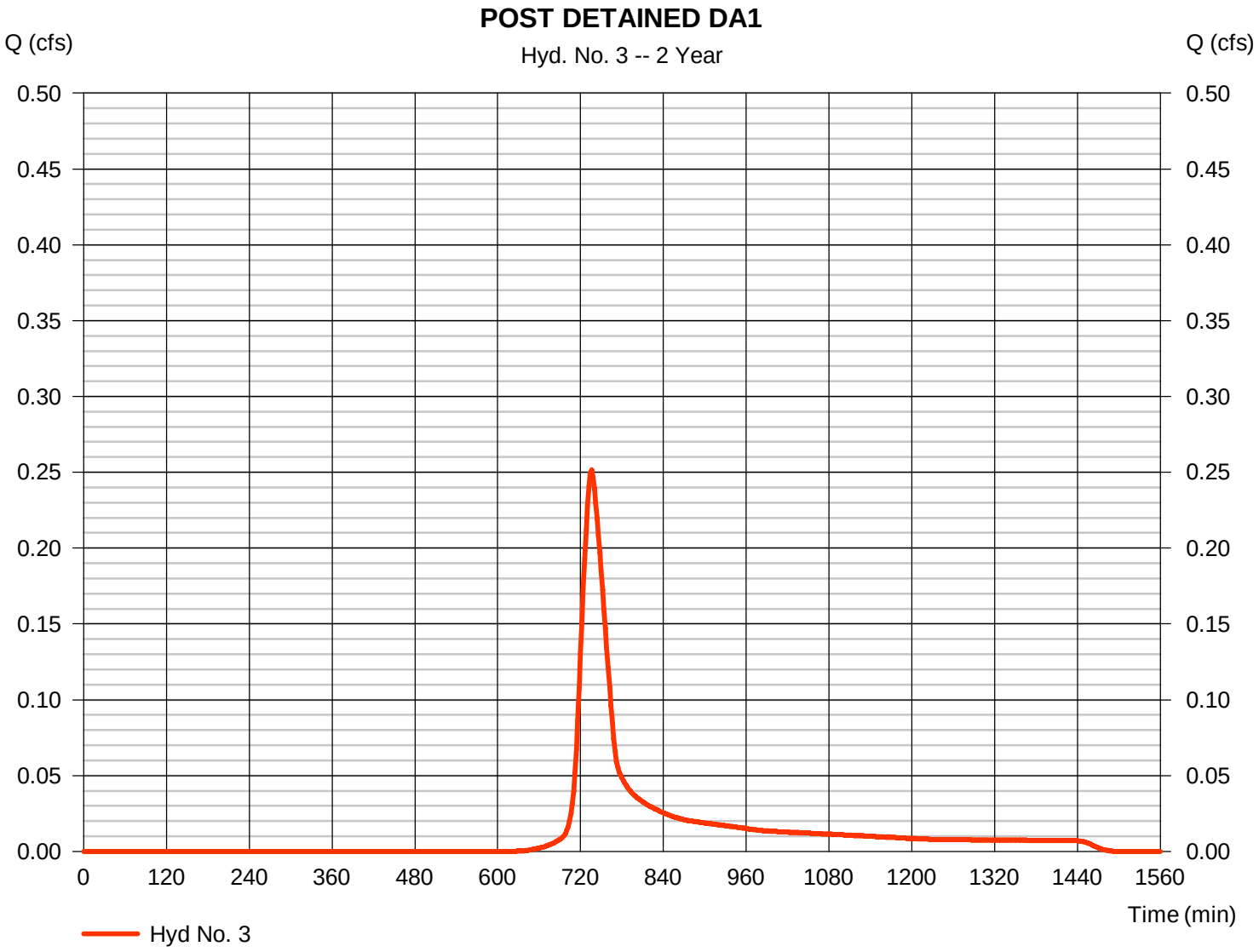
Hydrograph Report

Hyd. No. 3

POST DETAINED DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.251 cfs
Storm frequency	= 2 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 1,186 cuft
Drainage area	= 0.330 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 33.97 min
Total precip.	= 2.66 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.100 x 89) + (0.030 x 91) + (0.010 x 58) + (0.080 x 71) + (0.110 x 78)] / 0.330

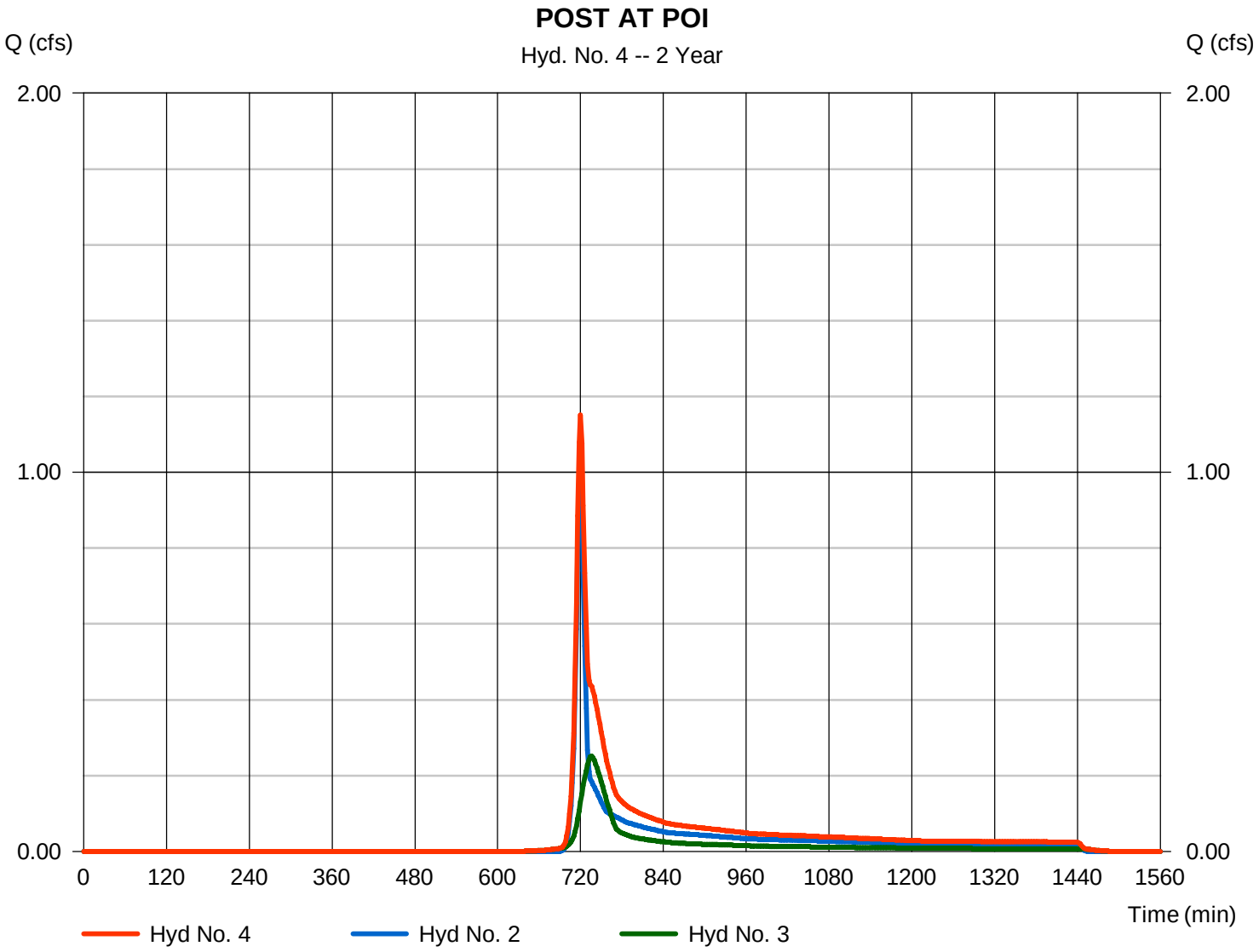


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 1.151 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 3,639 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 1.360 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.9938	10.0000	0.8826	--------
2	46.8600	10.1000	0.8723	--------
3	0.0000	0.0000	0.0000	--------
5	47.4204	9.3000	0.8196	--------
10	26589.4199	47.3998	2.1160	--------
25	53942.1797	51.5998	2.2139	--------
50	69308.7266	52.6998	2.2395	--------
100	106327.6016	55.1997	2.2977	--------

File name: Charger IDF.IDF

Intensity = B / (Tc + D)^E

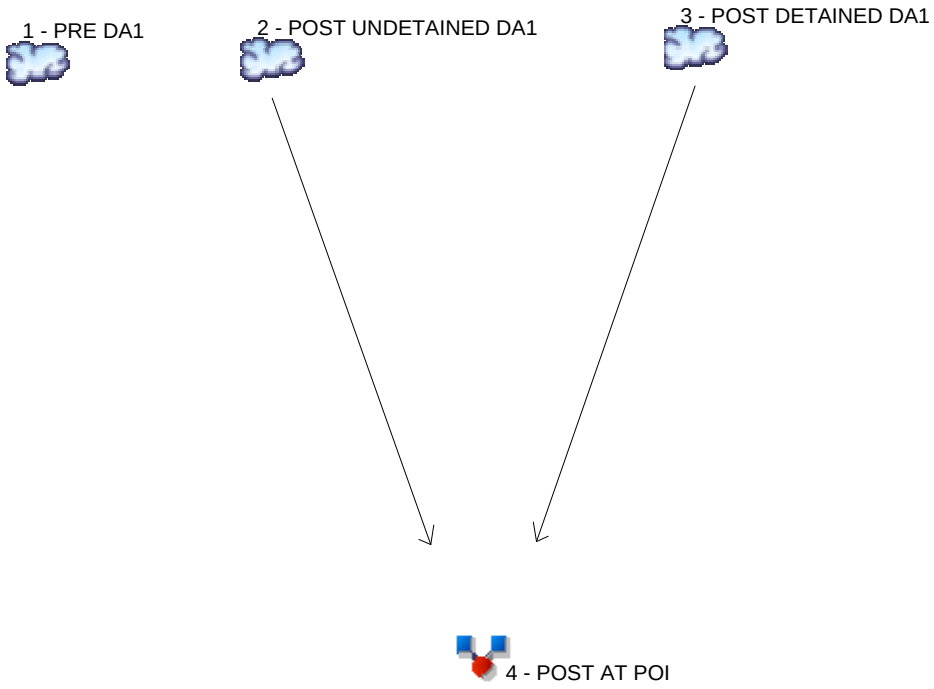
Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.66	2.84	2.33	1.99	1.73	1.54	1.39	1.27	1.16	1.08	1.00	0.94
2	4.39	3.42	2.82	2.40	2.10	1.87	1.69	1.54	1.42	1.32	1.23	1.15
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.36	4.19	3.47	2.98	2.62	2.34	2.12	1.94	1.80	1.67	1.56	1.47
10	6.12	5.04	4.23	3.59	3.09	2.68	2.35	2.07	1.84	1.65	1.48	1.34
25	7.10	5.89	4.95	4.22	3.63	3.16	2.77	2.45	2.17	1.94	1.75	1.58
50	7.88	6.54	5.51	4.70	4.05	3.52	3.09	2.73	2.42	2.17	1.95	1.76
100	8.66	7.21	6.09	5.20	4.48	3.90	3.42	3.02	2.69	2.40	2.16	1.95

Tc = time in minutes. Values may exceed 60.

hase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Charger\Hydraflow Rev 1\Charger Precip.pc

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	2.22	2.66	0.00	3.30	3.83	4.60	5.24	5.91
SCS 6-Hr	1.46	1.76	0.00	2.21	2.57	3.09	3.52	3.97
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



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE DA1
2	SCS Runoff	POST UNDETAINED DA1
3	SCS Runoff	POST DETAINED DA1
4	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	------	-------	-------	-------	-------	3.025	-------	-------	-------	PRE DA1
2	SCS Runoff	------	-------	-------	-------	-------	2.291	-------	-------	-------	POST UNDETAINED DA1
3	SCS Runoff	------	-------	-------	-------	-------	0.668	-------	-------	-------	POST DETAINED DA1
4	Combine	2, 3	-------	-------	-------	-------	2.823	-------	-------	-------	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	3.025	2	720	6,944	------	------	------	PRE DA1
2	SCS Runoff	2.291	2	720	5,259	------	------	------	POST UNDETAINED DA1
3	SCS Runoff	0.668	2	726	2,319	------	------	------	POST DETAINED DA1
4	Combine	2.823	2	720	7,579	2, 3	------	------	POST AT POI

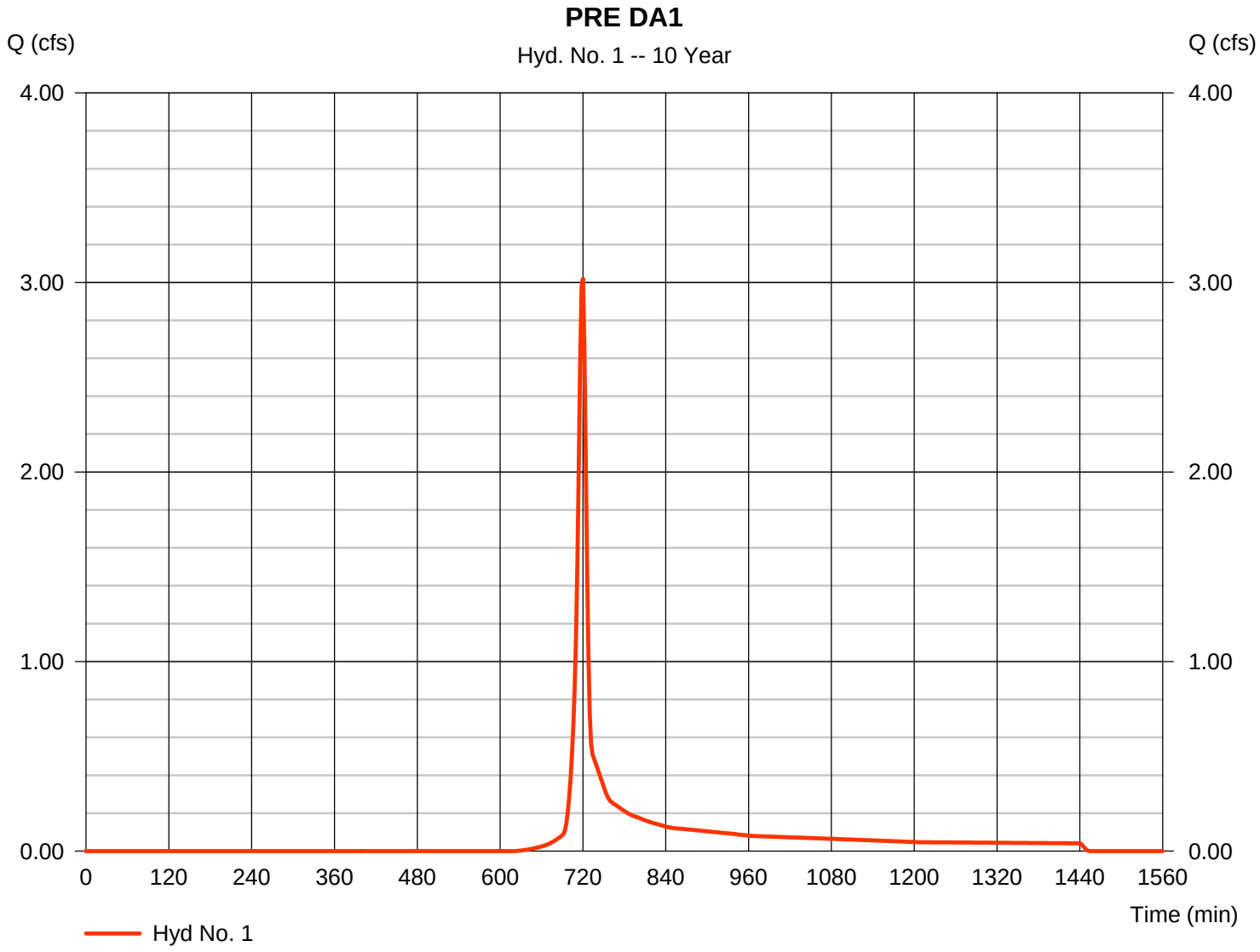
Hydrograph Report

Hyd. No. 1

PRE DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.025 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	6,944 cuft
Drainage area	=	1.360 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	3.83 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 58) + (0.150 x 71) + (0.040 x 78) + (0.010 x 55) + (0.390 x 70) + (0.670 x 77)] / 1.360



TR55 Tc Worksheet

Hyd. No. 1

PRE DA1

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)	= 2.66		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 7.64**	**+**	**0.00**	**+**	**0.00**	**=**	**7.64**
Shallow Concentrated Flow							
Flow length (ft)	= 209.00		0.00		0.00		
Watercourse slope (%)	= 14.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.21		0.00		0.00		
Travel Time (min)	**= 0.56**	**+**	**0.00**	**+**	**0.00**	**=**	**0.56**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

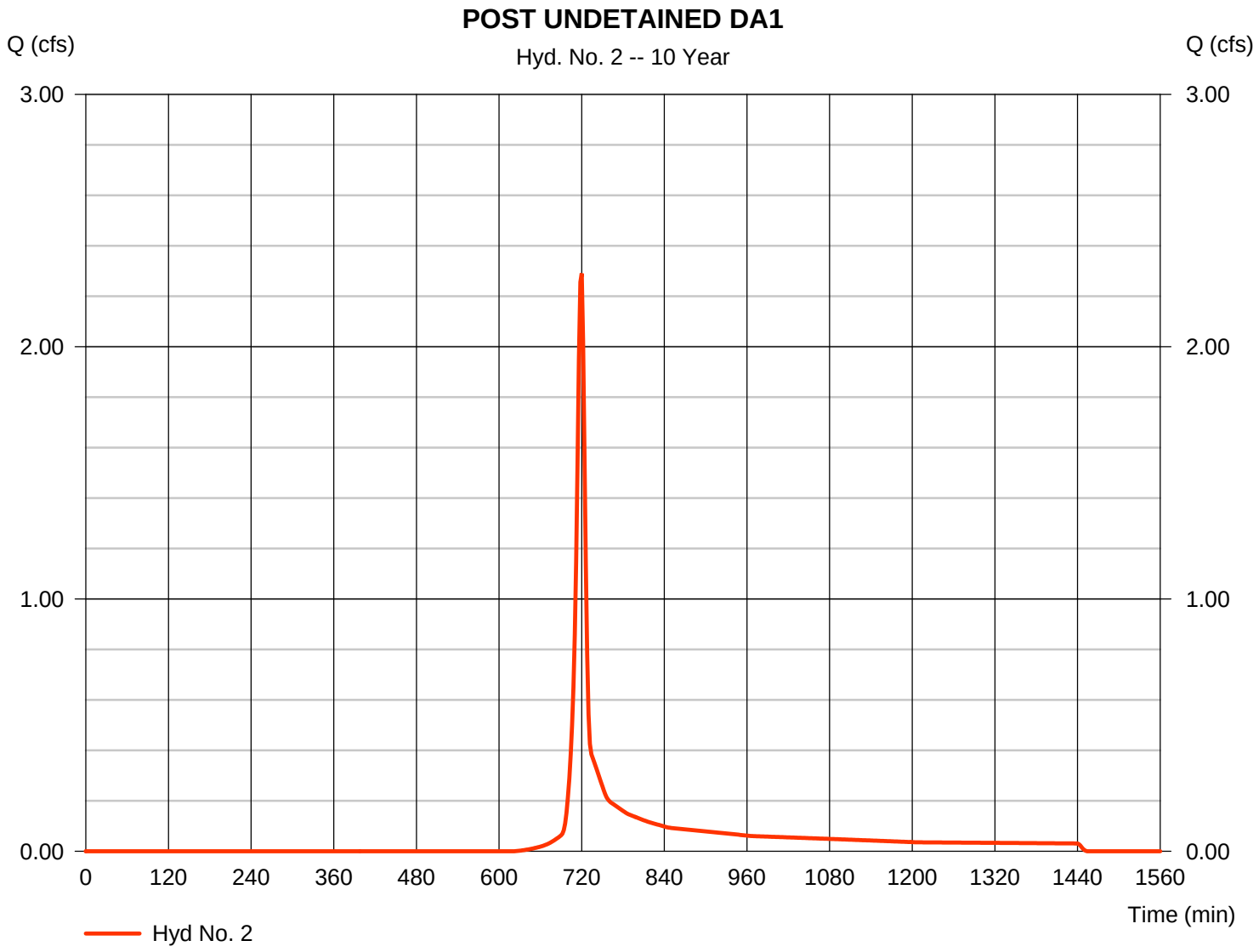
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.291 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	5,259 cuft
Drainage area	=	1.030 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	3.83 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 58) + (0.320 x 71) + (0.160 x 78) + (0.050 x 70) + (0.400 x 77)] / 1.030



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED DA1

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)	= 2.66		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 7.64**	**+**	**0.00**	**+**	**0.00**	**=**	**7.64**
Shallow Concentrated Flow							
Flow length (ft)	= 209.00		0.00		0.00		
Watercourse slope (%)	= 14.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.21		0.00		0.00		
Travel Time (min)	**= 0.56**	**+**	**0.00**	**+**	**0.00**	**=**	**0.56**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

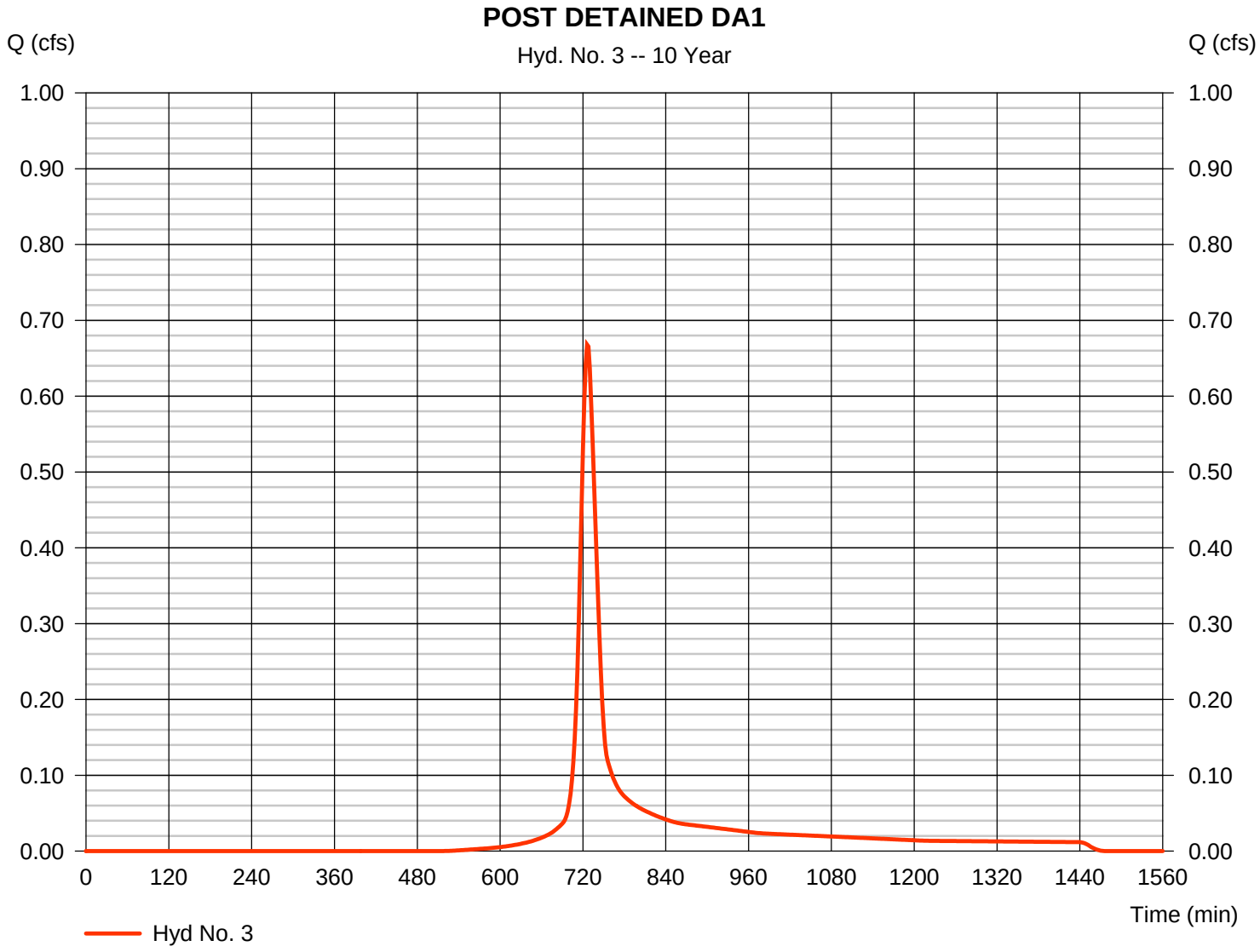
Hydrograph Report

Hyd. No. 3

POST DETAINED DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.668 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	2,319 cuft
Drainage area	=	0.330 ac	Curve number	=	80*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	21.26 min
Total precip.	=	3.83 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 89) + (0.030 x 91) + (0.010 x 58) + (0.080 x 71) + (0.110 x 78)] / 0.330

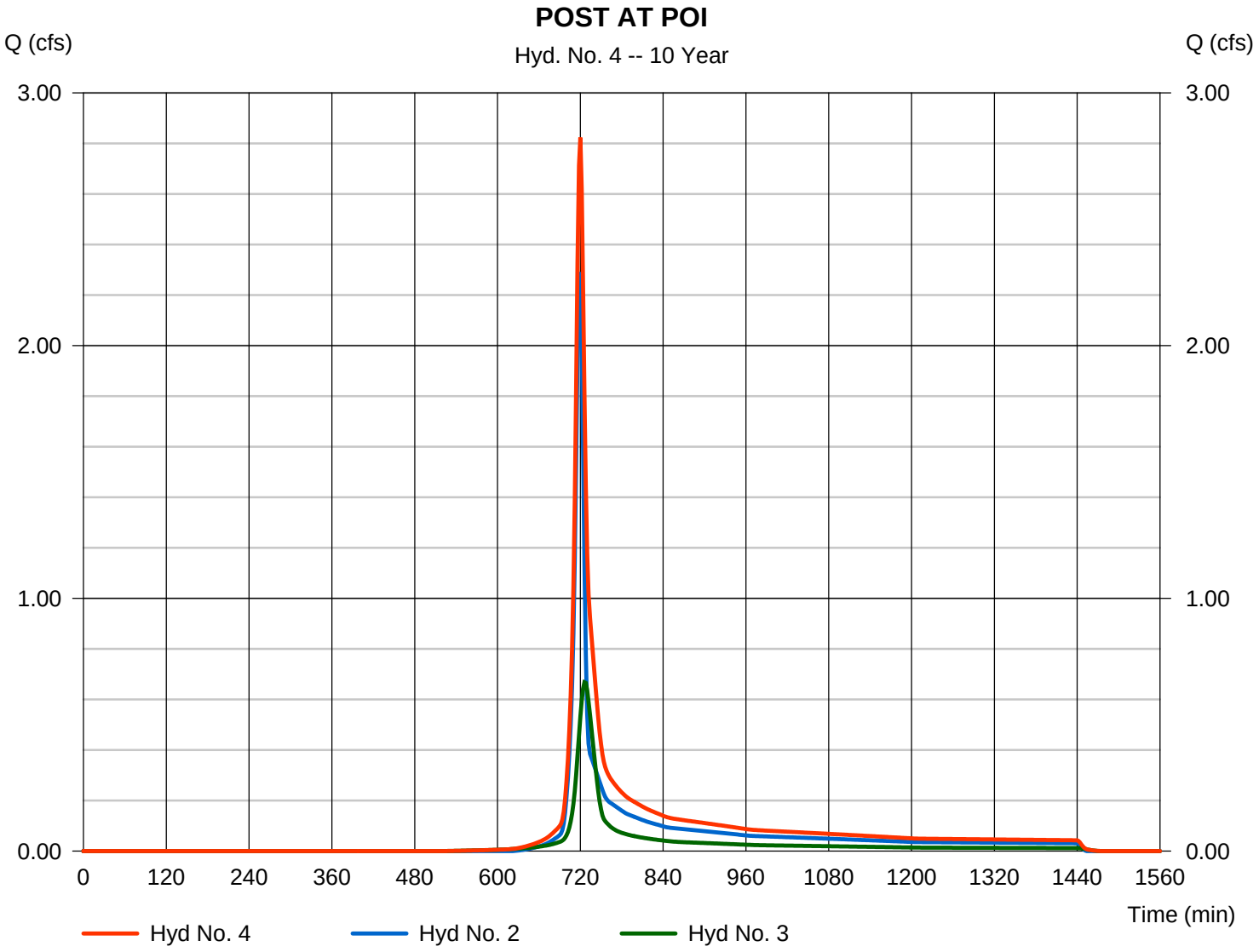


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	2.823 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	7,579 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	1.360 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.9938	10.0000	0.8826	--------
2	46.8600	10.1000	0.8723	--------
3	0.0000	0.0000	0.0000	--------
5	47.4204	9.3000	0.8196	--------
10	26589.4199	47.3998	2.1160	--------
25	53942.1797	51.5998	2.2139	--------
50	69308.7266	52.6998	2.2395	--------
100	106327.6016	55.1997	2.2977	--------

File name: Charger 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	3.66	2.84	2.33	1.99	1.73	1.54	1.39	1.27	1.16	1.08	1.00	0.94
2	4.39	3.42	2.82	2.40	2.10	1.87	1.69	1.54	1.42	1.32	1.23	1.15
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	5.36	4.19	3.47	2.98	2.62	2.34	2.12	1.94	1.80	1.67	1.56	1.47
10	6.12	5.04	4.23	3.59	3.09	2.68	2.35	2.07	1.84	1.65	1.48	1.34
25	7.10	5.89	4.95	4.22	3.63	3.16	2.77	2.45	2.17	1.94	1.75	1.58
50	7.88	6.54	5.51	4.70	4.05	3.52	3.09	2.73	2.42	2.17	1.95	1.76
100	8.66	7.21	6.09	5.20	4.48	3.90	3.42	3.02	2.69	2.40	2.16	1.95

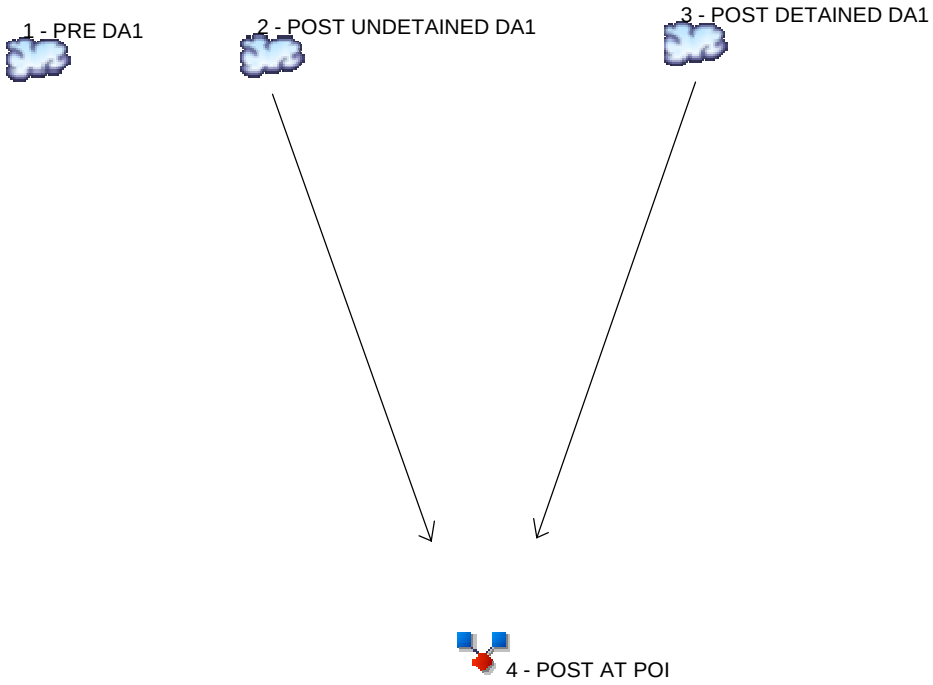
Tc = time in minutes. Values may exceed 60.

Phase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Charger\Hydraflow Rev 1\Charger 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	2.22	2.66	0.00	3.30	3.83	4.60	5.24	5.91
SCS 6-Hr	1.46	1.76	0.00	2.21	2.57	3.09	3.52	3.97
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 DA1
2	SCS Runoff	POST UNDETAINED DA1
3	SCS Runoff	POST DETAINED DA1
4	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	------	-------	-------	-------	-------	-------	-------	5.326	-------	PRE DA1
2	SCS Runoff	------	-------	-------	-------	-------	-------	-------	4.033	-------	POST UNDETAINED DA1
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	1.291	-------	POST DETAINED DA1
4	Combine	2, 3	-------	-------	-------	-------	-------	-------	5.263	-------	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	5.326	2	718	12,195	------	------	------	PRE DA1
2	SCS Runoff	4.033	2	718	9,236	------	------	------	POST UNDETAINED DA1
3	SCS Runoff	1.291	2	722	3,624	------	------	------	POST DETAINED DA1
4	Combine	5.263	2	720	12,860	2, 3	------	------	POST AT POI

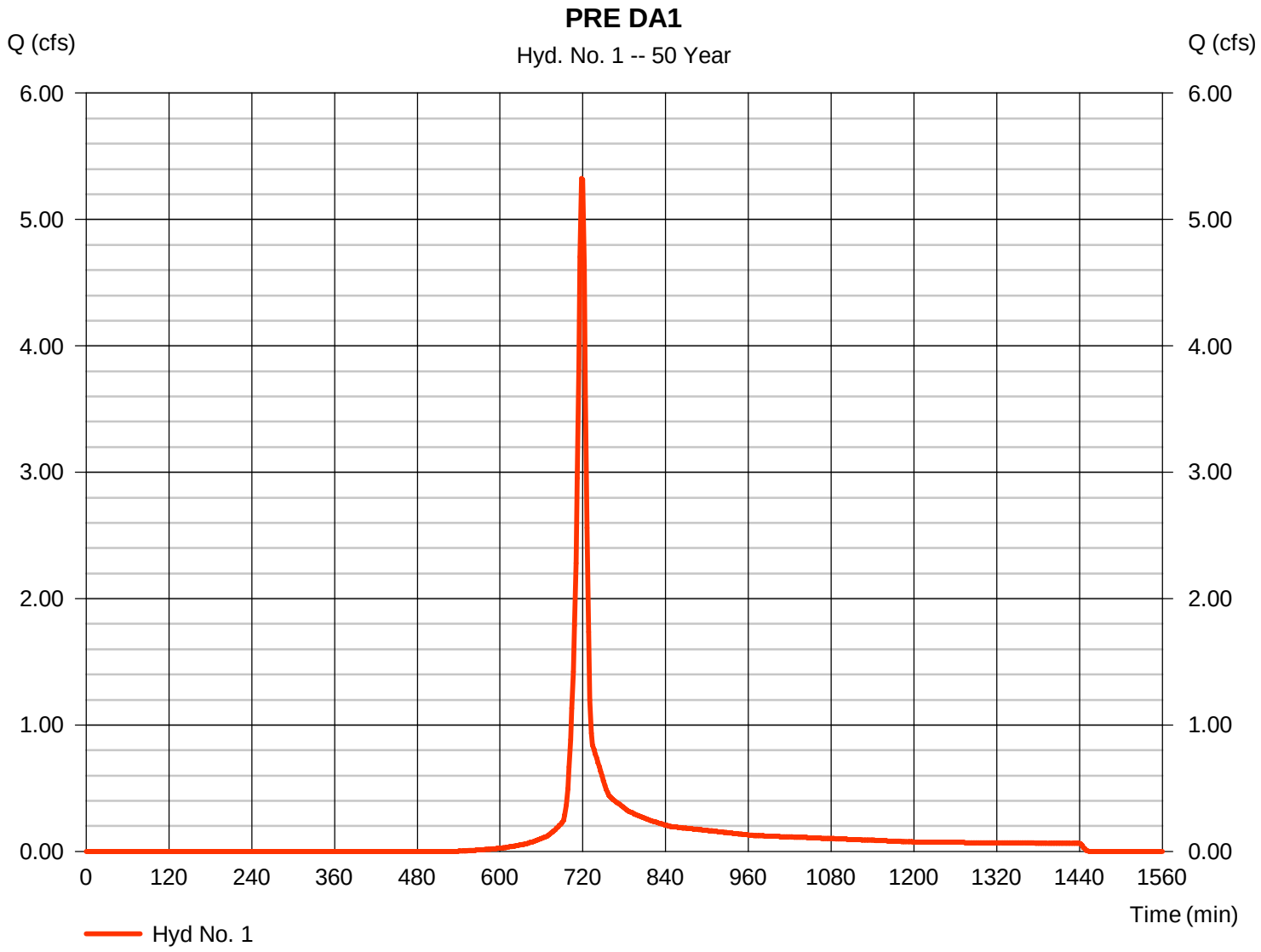
Hydrograph Report

Hyd. No. 1

PRE DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.326 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	12,195 cuft
Drainage area	=	1.360 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	5.24 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 58) + (0.150 x 71) + (0.040 x 78) + (0.010 x 55) + (0.390 x 70) + (0.670 x 77)] / 1.360



TR55 Tc Worksheet

Hyd. No. 1

PRE DA1

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)	= 2.66		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 7.64**	**+**	**0.00**	**+**	**0.00**	**=**	**7.64**
Shallow Concentrated Flow							
Flow length (ft)	= 209.00		0.00		0.00		
Watercourse slope (%)	= 14.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.21		0.00		0.00		
Travel Time (min)	**= 0.56**	**+**	**0.00**	**+**	**0.00**	**=**	**0.56**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

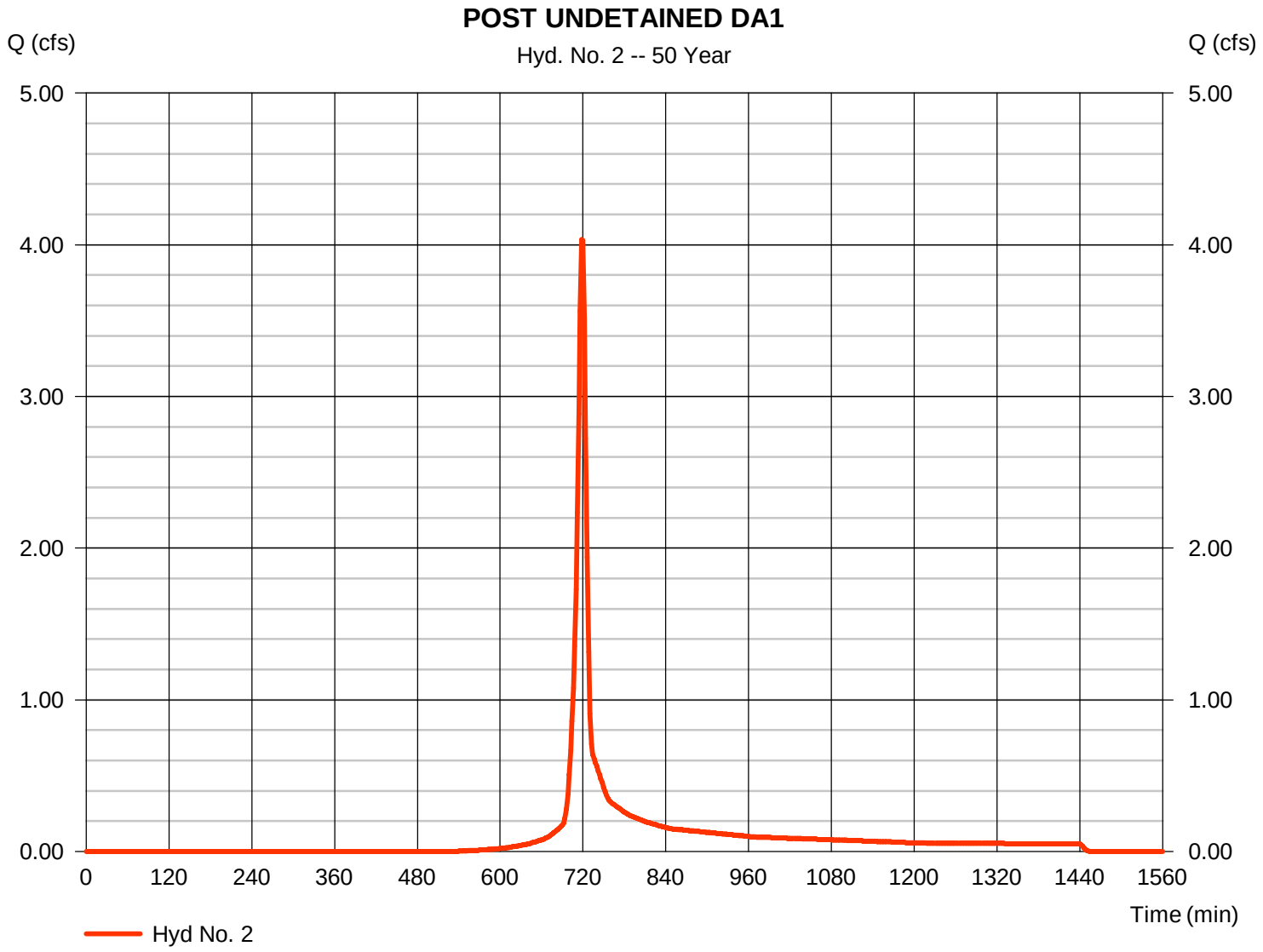
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.033 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 9,236 cuft
Drainage area	= 1.030 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.20 min
Total precip.	= 5.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.100 x 58) + (0.320 x 71) + (0.160 x 78) + (0.050 x 70) + (0.400 x 77)] / 1.030



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED DA1

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)	= 2.66		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 7.64**	**+**	**0.00**	**+**	**0.00**	**=**	**7.64**
Shallow Concentrated Flow							
Flow length (ft)	= 209.00		0.00		0.00		
Watercourse slope (%)	= 14.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.21		0.00		0.00		
Travel Time (min)	**= 0.56**	**+**	**0.00**	**+**	**0.00**	**=**	**0.56**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

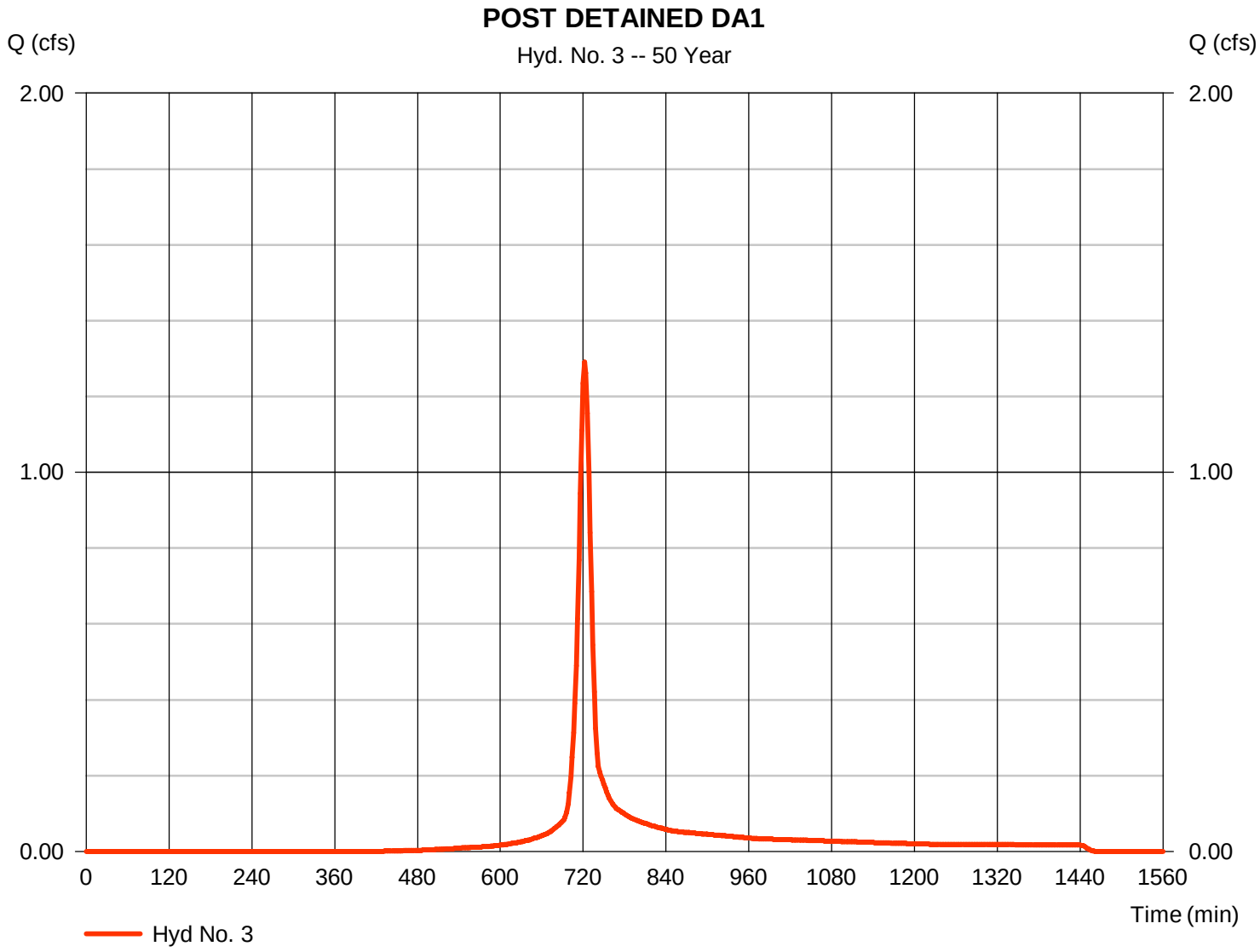
Hydrograph Report

Hyd. No. 3

POST DETAINED DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.291 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 3,624 cuft
Drainage area	= 0.330 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.86 min
Total precip.	= 5.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.100 x 89) + (0.030 x 91) + (0.010 x 58) + (0.080 x 71) + (0.110 x 78)] / 0.330

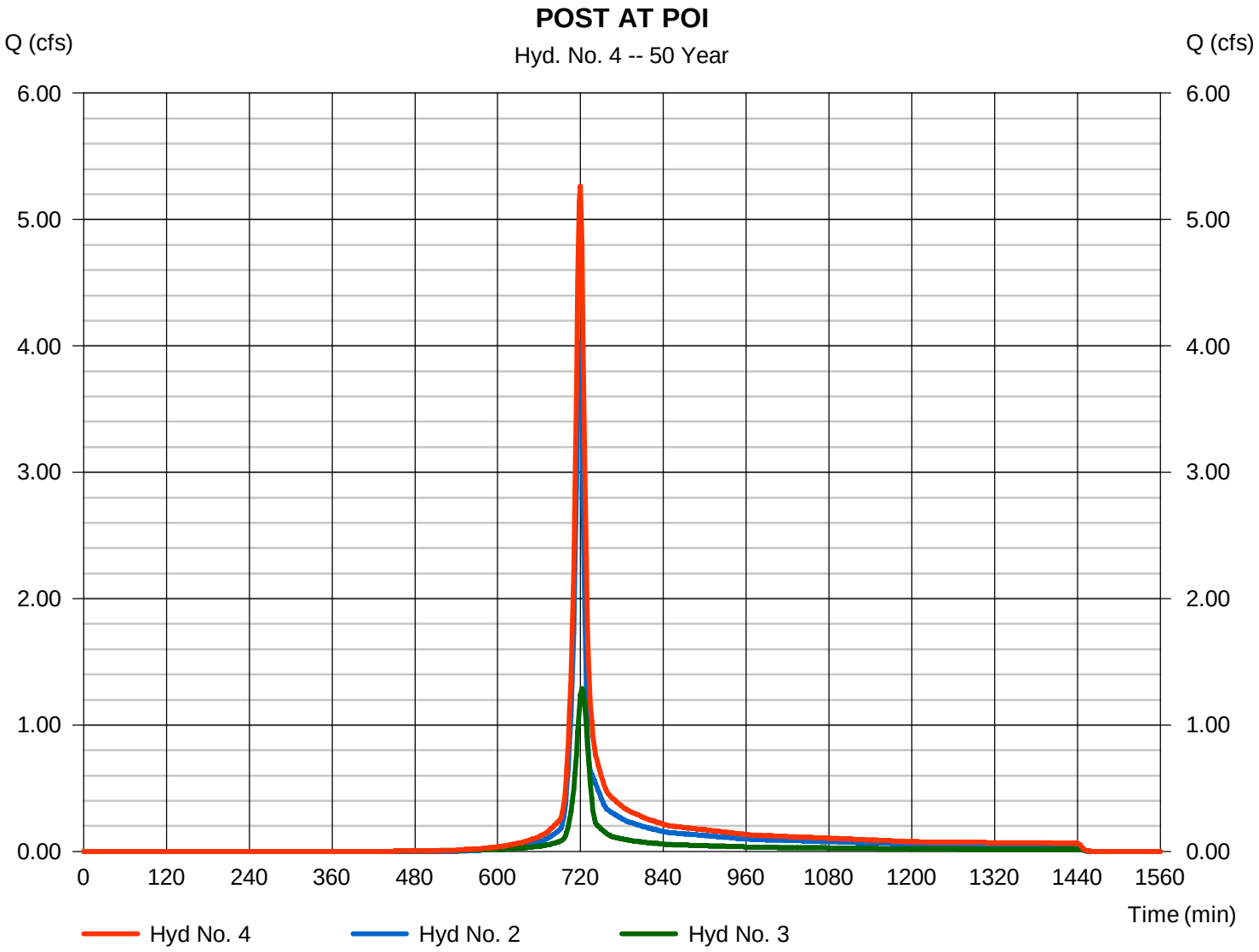


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	5.263 cfs
Storm frequency	=	50 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	12,860 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	1.360 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.9938	10.0000	0.8826	--------
2	46.8600	10.1000	0.8723	--------
3	0.0000	0.0000	0.0000	--------
5	47.4204	9.3000	0.8196	--------
10	26589.4199	47.3998	2.1160	--------
25	53942.1797	51.5998	2.2139	--------
50	69308.7266	52.6998	2.2395	--------
100	106327.6016	55.1997	2.2977	--------

File name: Charger 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	3.66	2.84	2.33	1.99	1.73	1.54	1.39	1.27	1.16	1.08	1.00	0.94
2	4.39	3.42	2.82	2.40	2.10	1.87	1.69	1.54	1.42	1.32	1.23	1.15
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	5.36	4.19	3.47	2.98	2.62	2.34	2.12	1.94	1.80	1.67	1.56	1.47
10	6.12	5.04	4.23	3.59	3.09	2.68	2.35	2.07	1.84	1.65	1.48	1.34
25	7.10	5.89	4.95	4.22	3.63	3.16	2.77	2.45	2.17	1.94	1.75	1.58
50	7.88	6.54	5.51	4.70	4.05	3.52	3.09	2.73	2.42	2.17	1.95	1.76
100	8.66	7.21	6.09	5.20	4.48	3.90	3.42	3.02	2.69	2.40	2.16	1.95

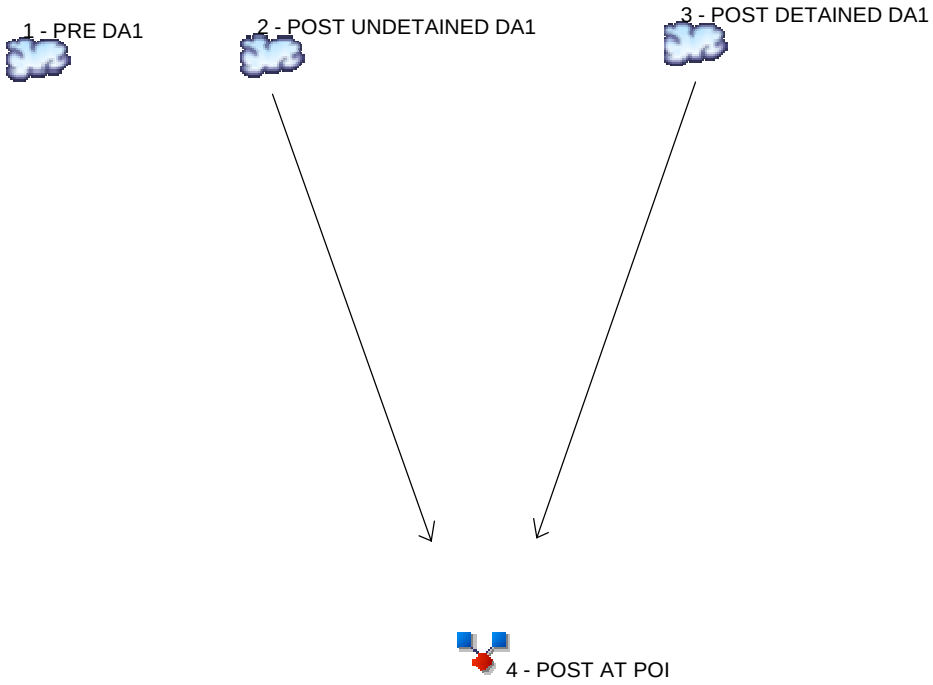
Tc = time in minutes. Values may exceed 60.

hase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Charger\Hydraflow Rev 1\Charger Precip.pc

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	2.22	2.66	0.00	3.30	3.83	4.60	5.24	5.91
SCS 6-Hr	1.46	1.76	0.00	2.21	2.57	3.09	3.52	3.97
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 DA1
2	SCS Runoff	POST UNDETAINED DA1
3	SCS Runoff	POST DETAINED DA1
4	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	------	-------	-------	-------	-------	-------	-------	-------	6.505	PRE DA1
2	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	4.926	POST UNDETAINED DA1
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	1.534	POST DETAINED DA1
4	Combine	2, 3	-------	-------	-------	-------	-------	-------	-------	6.368	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	6.505	2	718	14,880	------	------	------	PRE DA1
2	SCS Runoff	4.926	2	718	11,269	------	------	------	POST UNDETAINED DA1
3	SCS Runoff	1.534	2	722	4,322	------	------	------	POST DETAINED DA1
4	Combine	6.368	2	720	15,591	2, 3	------	------	POST AT POI

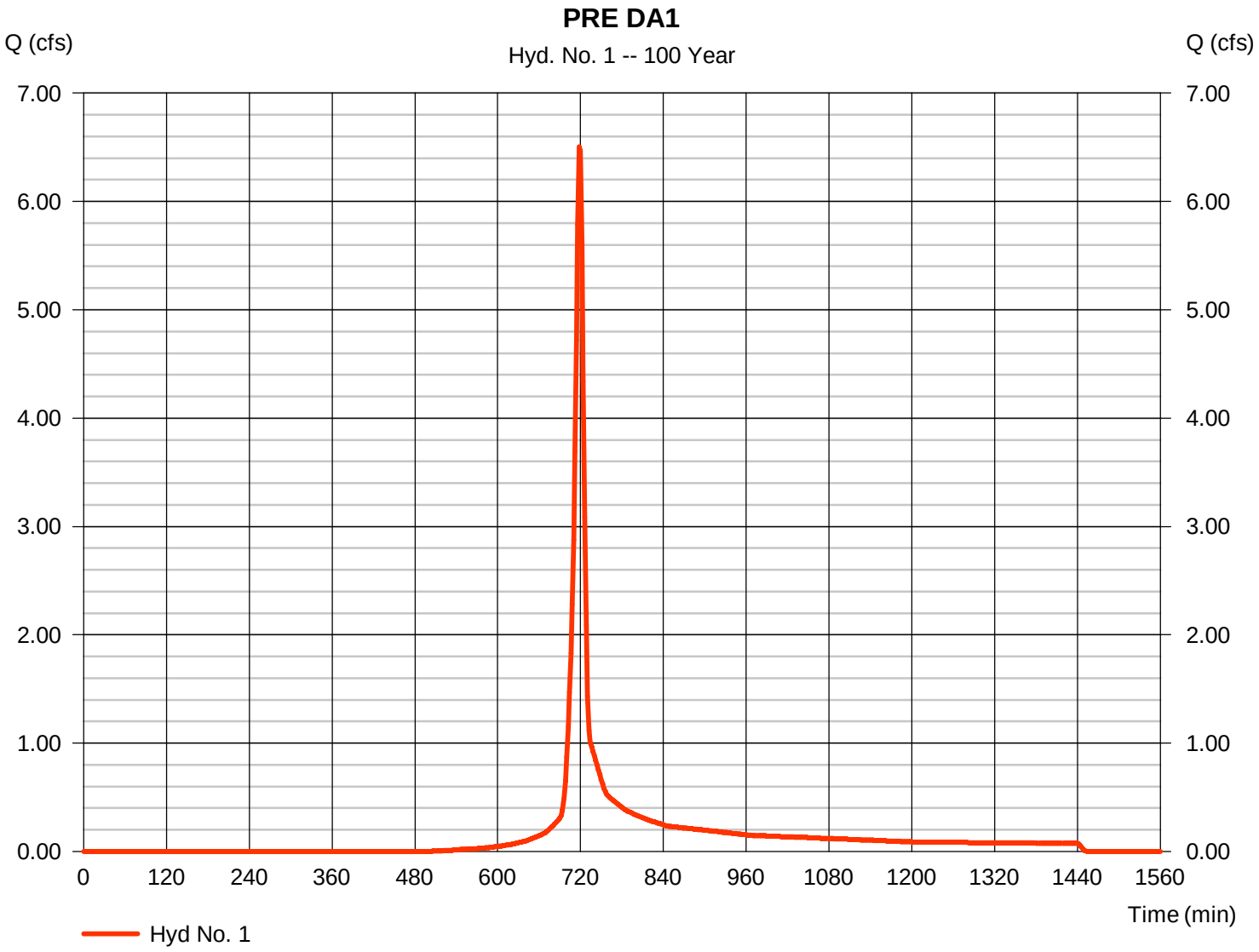
Hydrograph Report

Hyd. No. 1

PRE DA1

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.505 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	14,880 cuft
Drainage area	=	1.360 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.20 min
Total precip.	=	5.91 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.100 x 58) + (0.150 x 71) + (0.040 x 78) + (0.010 x 55) + (0.390 x 70) + (0.670 x 77)] / 1.360



TR55 Tc Worksheet

Hyd. No. 1

PRE DA1

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)	= 2.66		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 7.64**	**+**	**0.00**	**+**	**0.00**	**=**	**7.64**
Shallow Concentrated Flow							
Flow length (ft)	= 209.00		0.00		0.00		
Watercourse slope (%)	= 14.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.21		0.00		0.00		
Travel Time (min)	**= 0.56**	**+**	**0.00**	**+**	**0.00**	**=**	**0.56**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

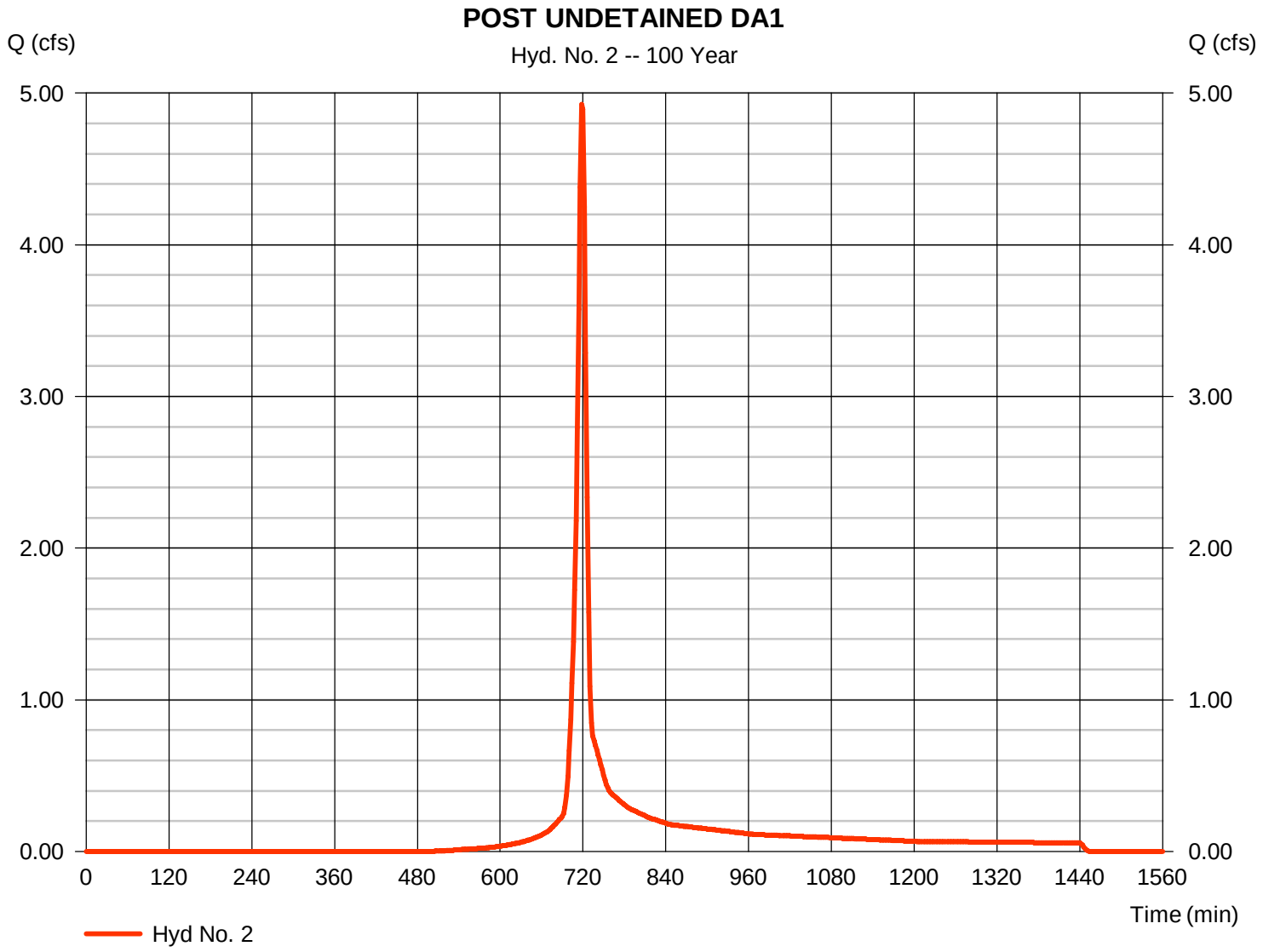
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.926 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 11,269 cuft
Drainage area	= 1.030 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.20 min
Total precip.	= 5.91 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.100 x 58) + (0.320 x 71) + (0.160 x 78) + (0.050 x 70) + (0.400 x 77)] / 1.030



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED DA1

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)	= 2.66		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 7.64**	**+**	**0.00**	**+**	**0.00**	**=**	**7.64**
Shallow Concentrated Flow							
Flow length (ft)	= 209.00		0.00		0.00		
Watercourse slope (%)	= 14.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=6.21		0.00		0.00		
Travel Time (min)	**= 0.56**	**+**	**0.00**	**+**	**0.00**	**=**	**0.56**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

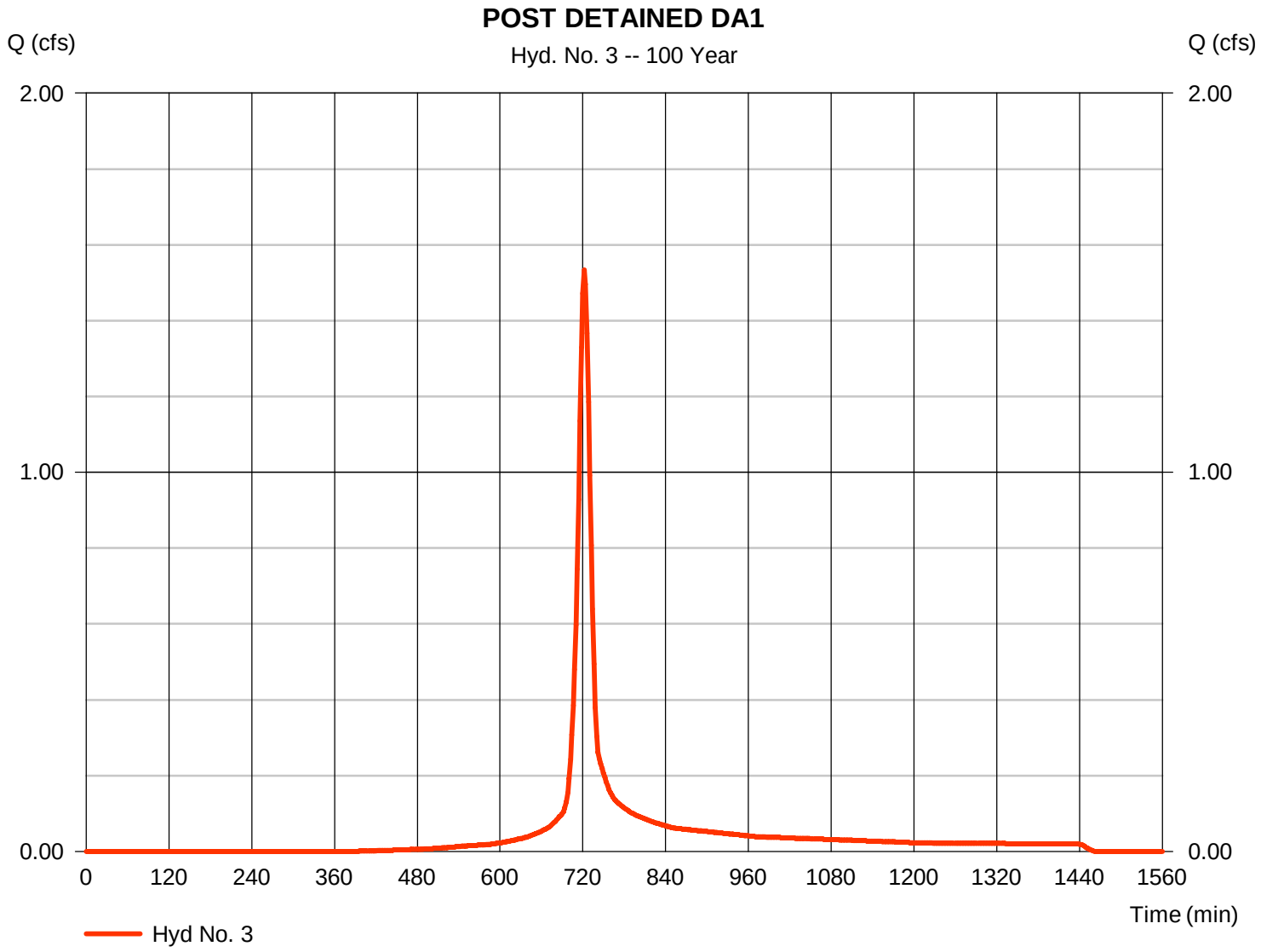
Hydrograph Report

Hyd. No. 3

POST DETAINED DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.534 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 4,322 cuft
Drainage area	= 0.330 ac	Curve number	= 80*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.50 min
Total precip.	= 5.91 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.100 x 89) + (0.030 x 91) + (0.010 x 58) + (0.080 x 71) + (0.110 x 78)] / 0.330

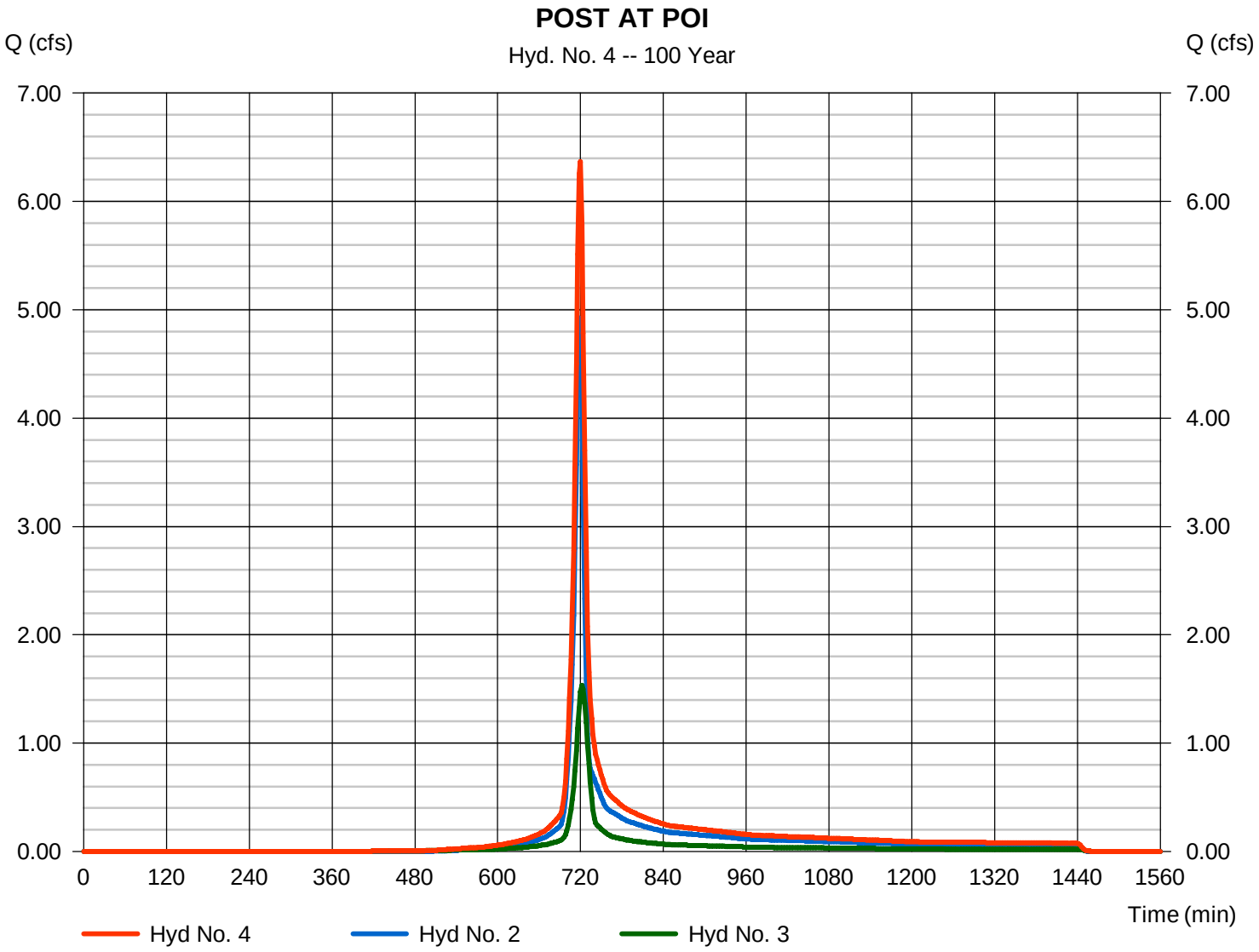


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	6.368 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	15,591 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	1.360 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.9938	10.0000	0.8826	--------
2	46.8600	10.1000	0.8723	--------
3	0.0000	0.0000	0.0000	--------
5	47.4204	9.3000	0.8196	--------
10	26589.4199	47.3998	2.1160	--------
25	53942.1797	51.5998	2.2139	--------
50	69308.7266	52.6998	2.2395	--------
100	106327.6016	55.1997	2.2977	--------

File name: Charger 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	3.66	2.84	2.33	1.99	1.73	1.54	1.39	1.27	1.16	1.08	1.00	0.94
2	4.39	3.42	2.82	2.40	2.10	1.87	1.69	1.54	1.42	1.32	1.23	1.15
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	5.36	4.19	3.47	2.98	2.62	2.34	2.12	1.94	1.80	1.67	1.56	1.47
10	6.12	5.04	4.23	3.59	3.09	2.68	2.35	2.07	1.84	1.65	1.48	1.34
25	7.10	5.89	4.95	4.22	3.63	3.16	2.77	2.45	2.17	1.94	1.75	1.58
50	7.88	6.54	5.51	4.70	4.05	3.52	3.09	2.73	2.42	2.17	1.95	1.76
100	8.66	7.21	6.09	5.20	4.48	3.90	3.42	3.02	2.69	2.40	2.16	1.95

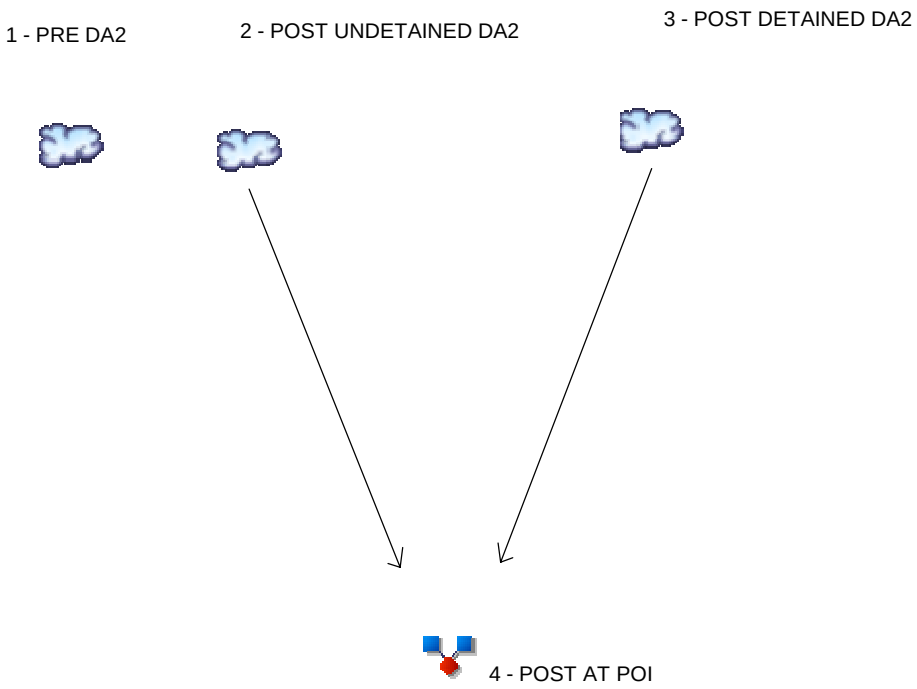
Tc = time in minutes. Values may exceed 60.

hase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Charger\Hydraflow Rev 1\Charger Precip.pc

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	2.22	2.66	0.00	3.30	3.83	4.60	5.24	5.91
SCS 6-Hr	1.46	1.76	0.00	2.21	2.57	3.09	3.52	3.97
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 DA2
2	SCS Runoff	POST UNDETAINED DA2
3	SCS Runoff	POST DETAINED DA2
4	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	------	-------	0.126	-------	-------	0.302	-------	0.547	0.672	PRE DA2
2	SCS Runoff	------	-------	0.099	-------	-------	0.222	-------	0.392	0.478	POST UNDETAINED DA2
3	SCS Runoff	------	-------	0.058	-------	-------	0.122	-------	0.210	0.254	POST DETAINED DA2
4	Combine	2, 3	-------	0.157	-------	-------	0.345	-------	0.601	0.732	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	0.126	2	720	312	------	------	------	PRE DA2
2	SCS Runoff	0.099	2	720	238	------	------	------	POST UNDETAINED DA2
3	SCS Runoff	0.058	2	720	135	------	------	------	POST DETAINED DA2
4	Combine	0.157	2	720	374	2, 3	------	------	POST AT POI

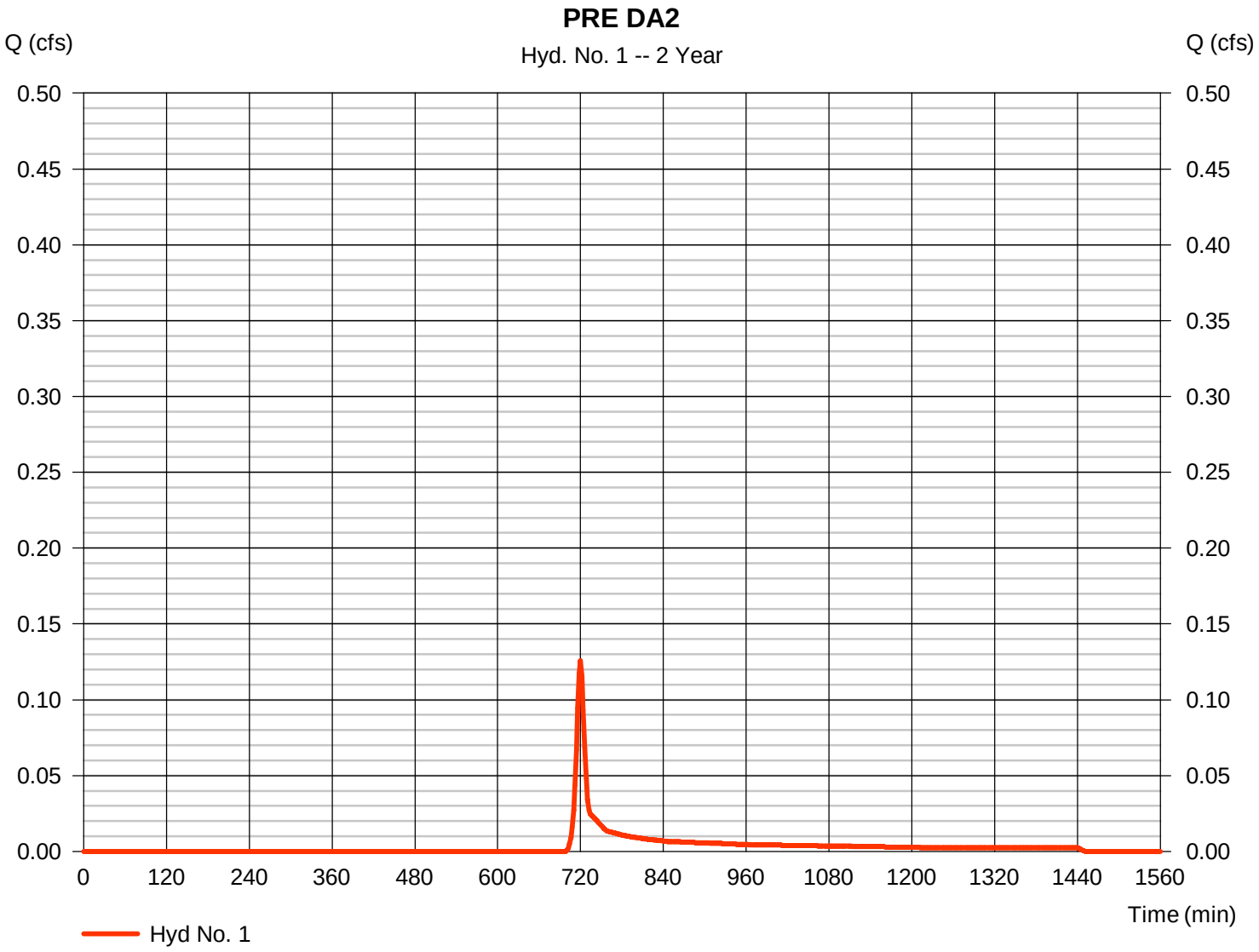
Hydrograph Report

Hyd. No. 1

PRE DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.126 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	312 cuft
Drainage area	=	0.150 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	2.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 71) + (0.060 x 70)] / 0.150



TR55 Tc Worksheet

Hyd. No. 1

PRE DA2

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)	= 2.66		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 8.22**	**+**	**0.00**	**+**	**0.00**	**=**	**8.22**
Shallow Concentrated Flow							
Flow length (ft)	= 31.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 0.22**	**+**	**0.00**	**+**	**0.00**	**=**	**0.22**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

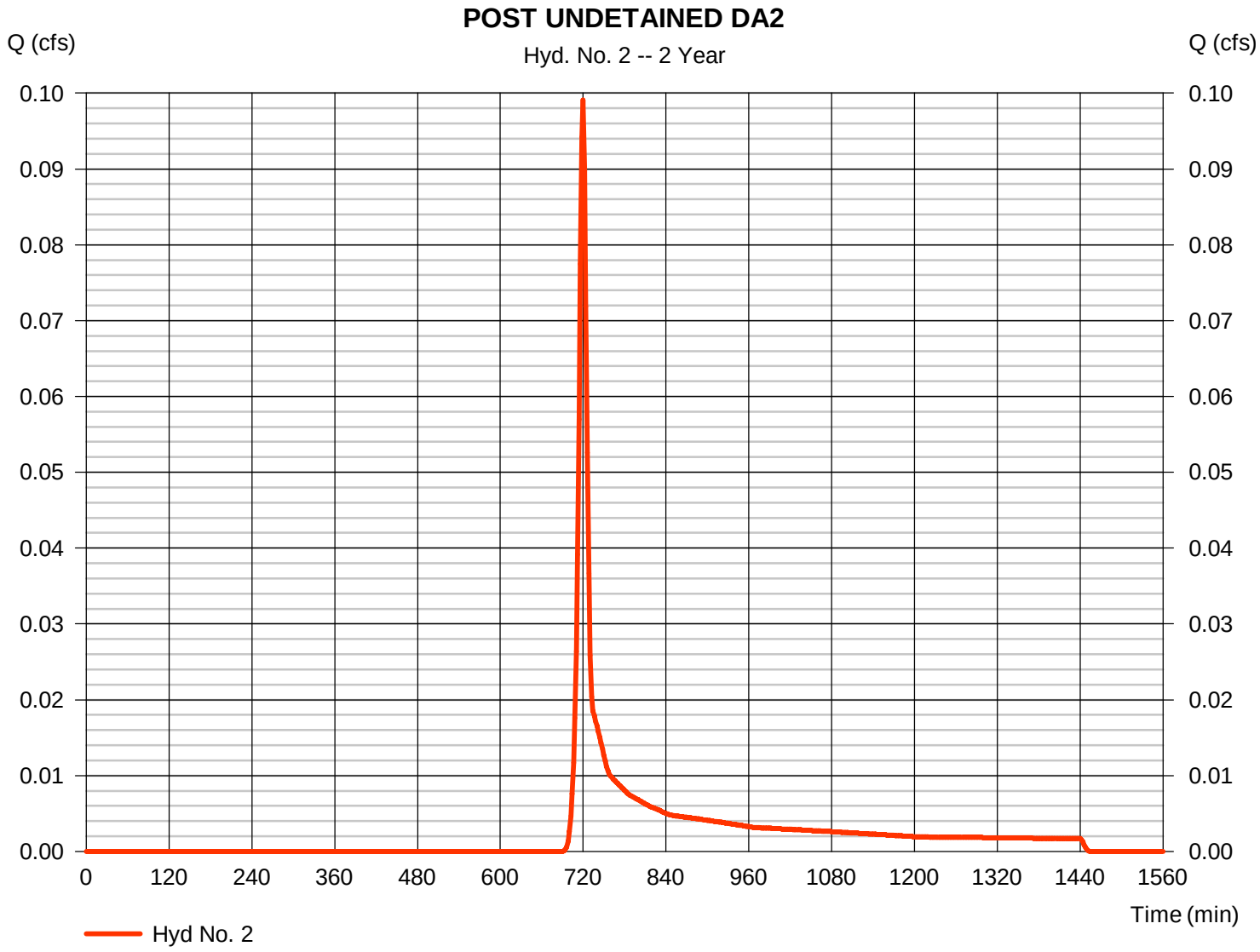
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.099 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 238 cuft
Drainage area	= 0.100 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.40 min
Total precip.	= 2.66 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.070 x 71) + (0.020 x 70)] / 0.100



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED DA2

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)	= 2.66		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 8.22**	**+**	**0.00**	**+**	**0.00**	**=**	**8.22**
Shallow Concentrated Flow							
Flow length (ft)	= 31.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 0.22**	**+**	**0.00**	**+**	**0.00**	**=**	**0.22**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

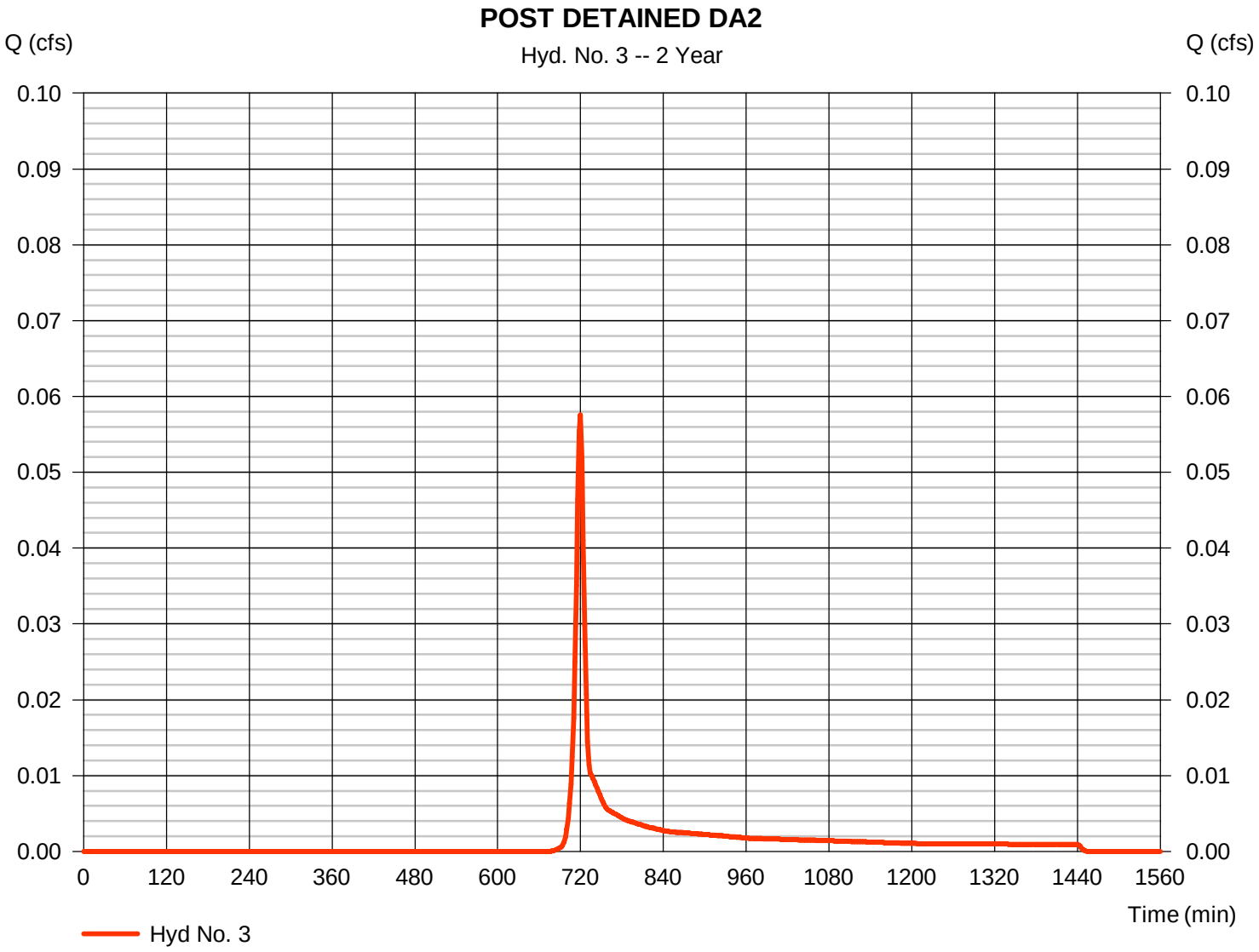
Hydrograph Report

Hyd. No. 3

POST DETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.058 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 135 cuft
Drainage area	= 0.050 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.10 min
Total precip.	= 2.66 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.040 x 71)] / 0.050



TR55 Tc Worksheet

Hyd. No. 3

POST DETAINED DA2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 40.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.66		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 6.88**	**+**	**0.00**	**+**	**0.00**	**=**	**6.88**
Shallow Concentrated Flow							
Flow length (ft)	= 41.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=3.02		0.00		0.00		
Travel Time (min)	**= 0.23**	**+**	**0.00**	**+**	**0.00**	**=**	**0.23**
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**

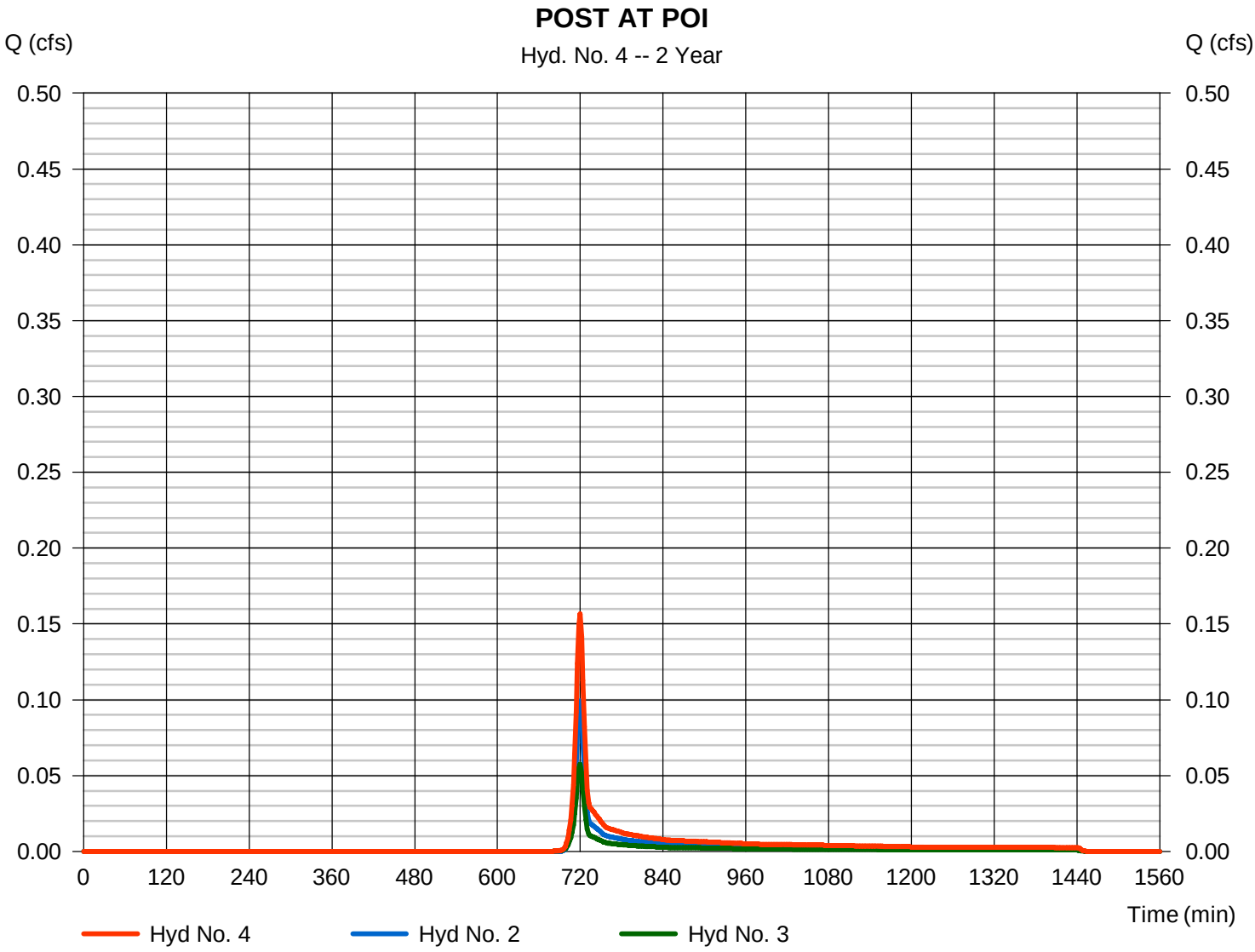
Total Travel Time, Tc ..... 7.10 min

Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.157 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 374 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.150 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	0.302	2	720	696	------	------	------	PRE DA2
2	SCS Runoff	0.222	2	720	511	------	------	------	POST UNDETAINED DA2
3	SCS Runoff	0.122	2	720	280	------	------	------	POST DETAINED DA2
4	Combine	0.345	2	720	790	2, 3	------	------	POST AT POI

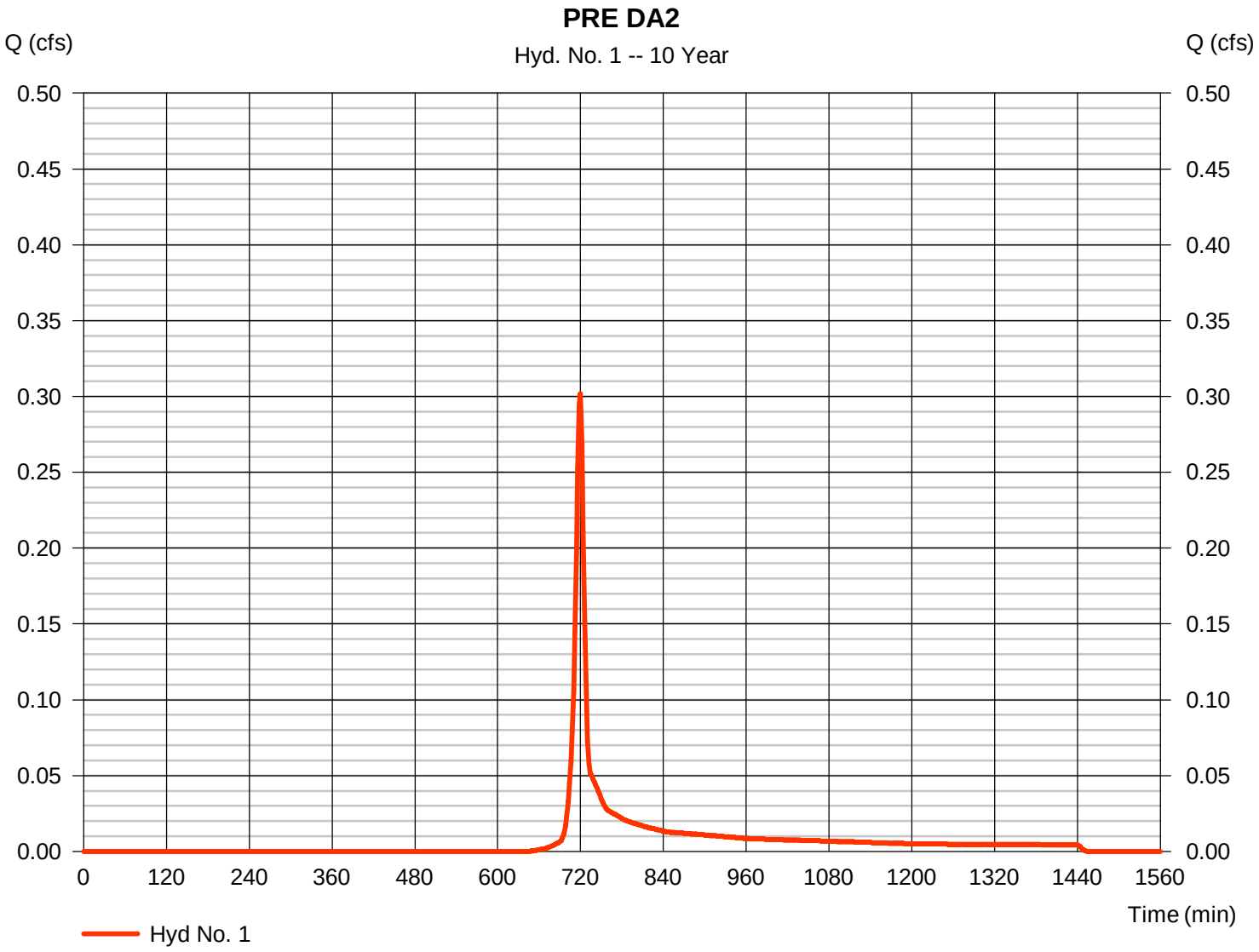
Hydrograph Report

Hyd. No. 1

PRE DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.302 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	696 cuft
Drainage area	=	0.150 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	3.83 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 71) + (0.060 x 70)] / 0.150



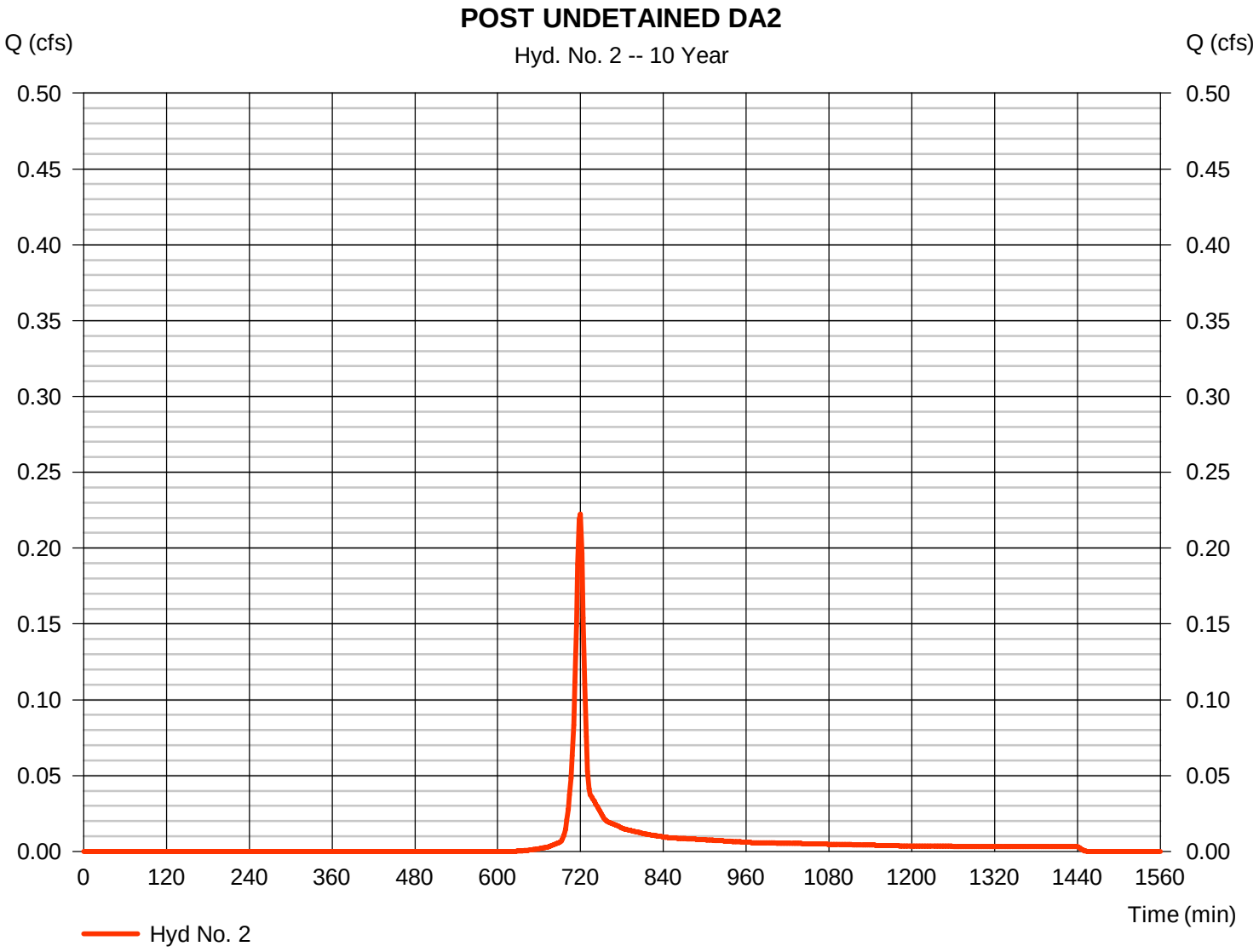
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.222 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 511 cuft
Drainage area	= 0.100 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.40 min
Total precip.	= 3.83 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.070 x 71) + (0.020 x 70)] / 0.100



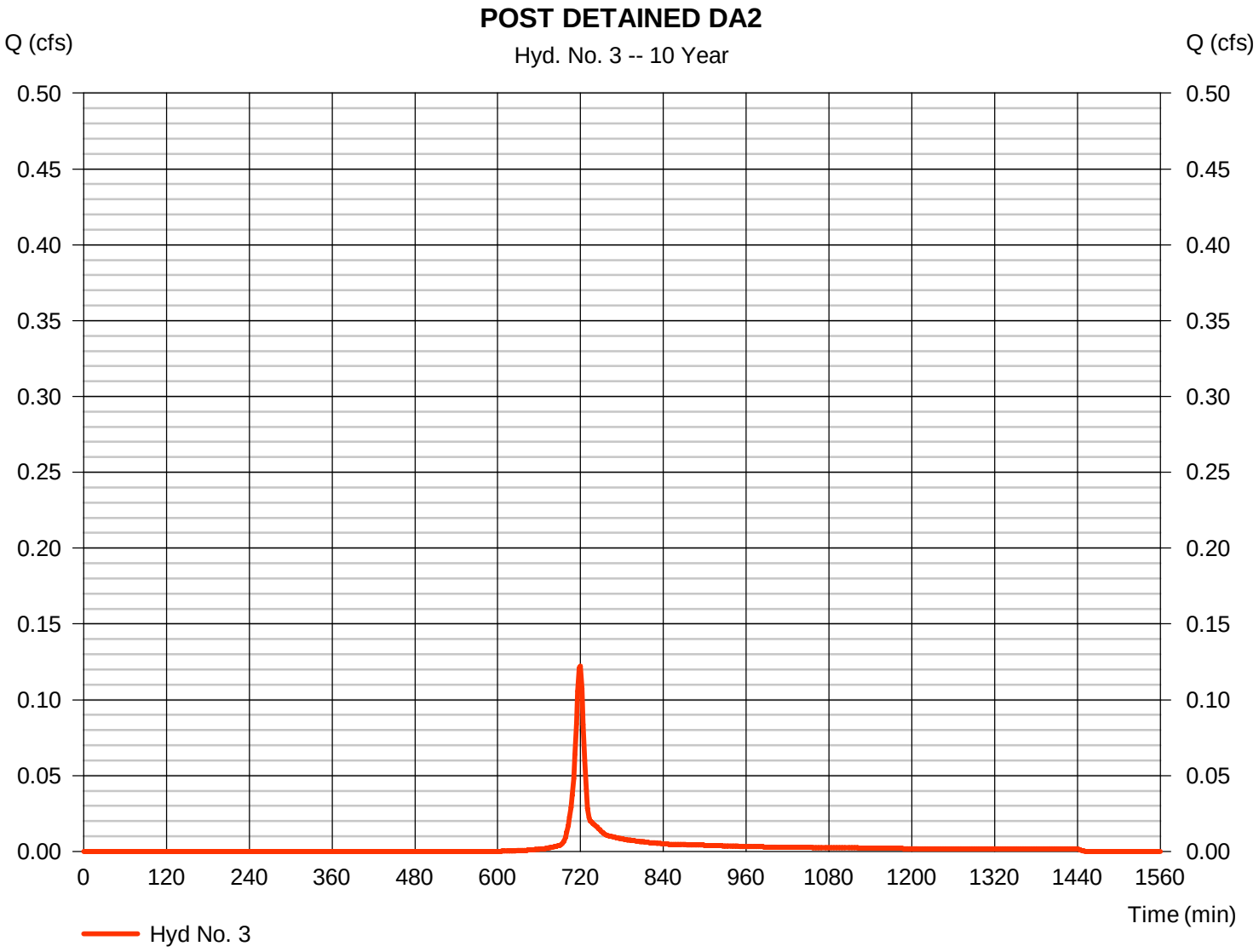
Hydrograph Report

Hyd. No. 3

POST DETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.122 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 280 cuft
Drainage area	= 0.050 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.10 min
Total precip.	= 3.83 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.040 x 71)] / 0.050

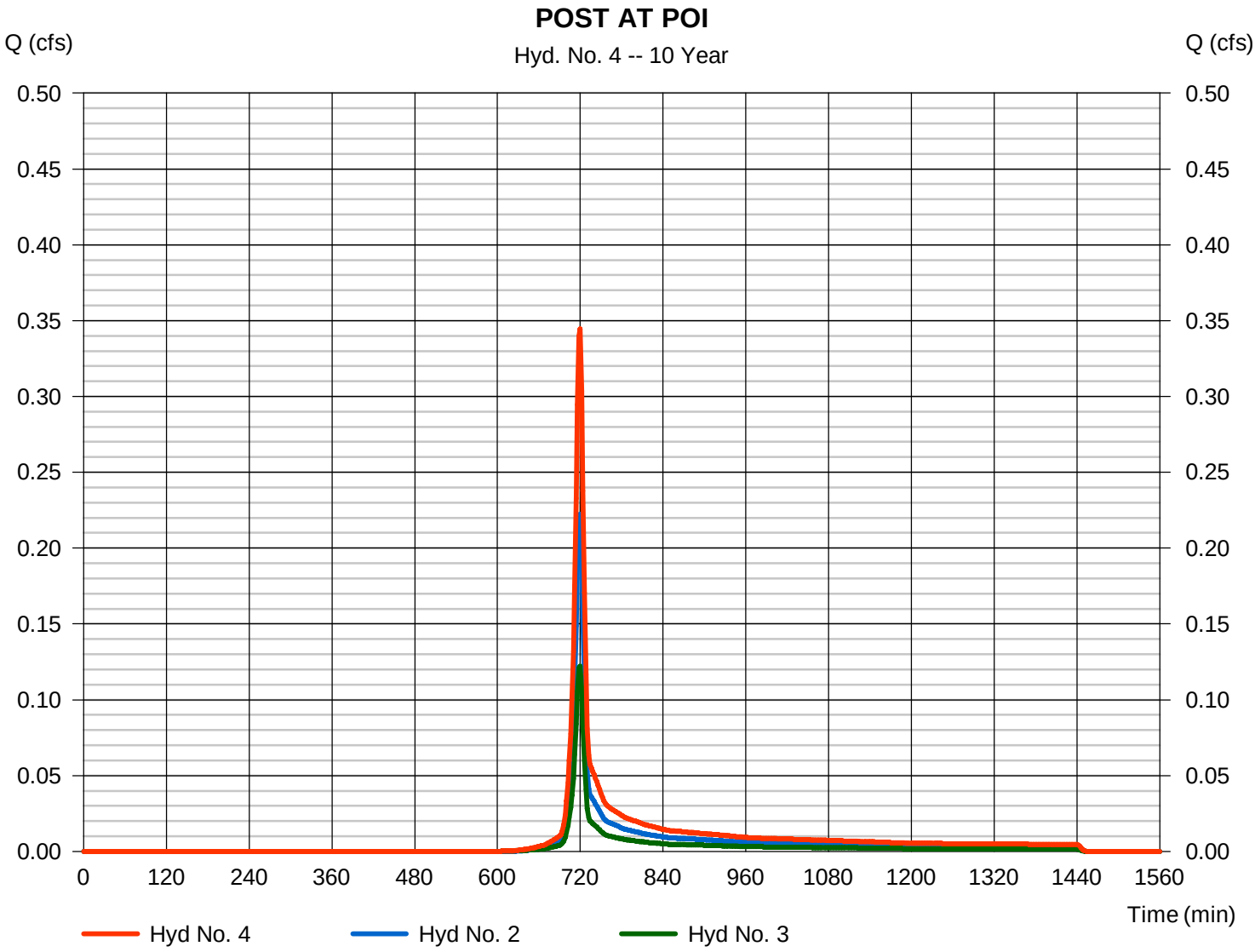


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.345 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 790 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.150 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	0.547	2	720	1,252	------	------	------	PRE DA2
2	SCS Runoff	0.392	2	718	897	------	------	------	POST UNDETAINED DA2
3	SCS Runoff	0.210	2	718	480	------	------	------	POST DETAINED DA2
4	Combine	0.601	2	718	1,377	2, 3	------	------	POST AT POI

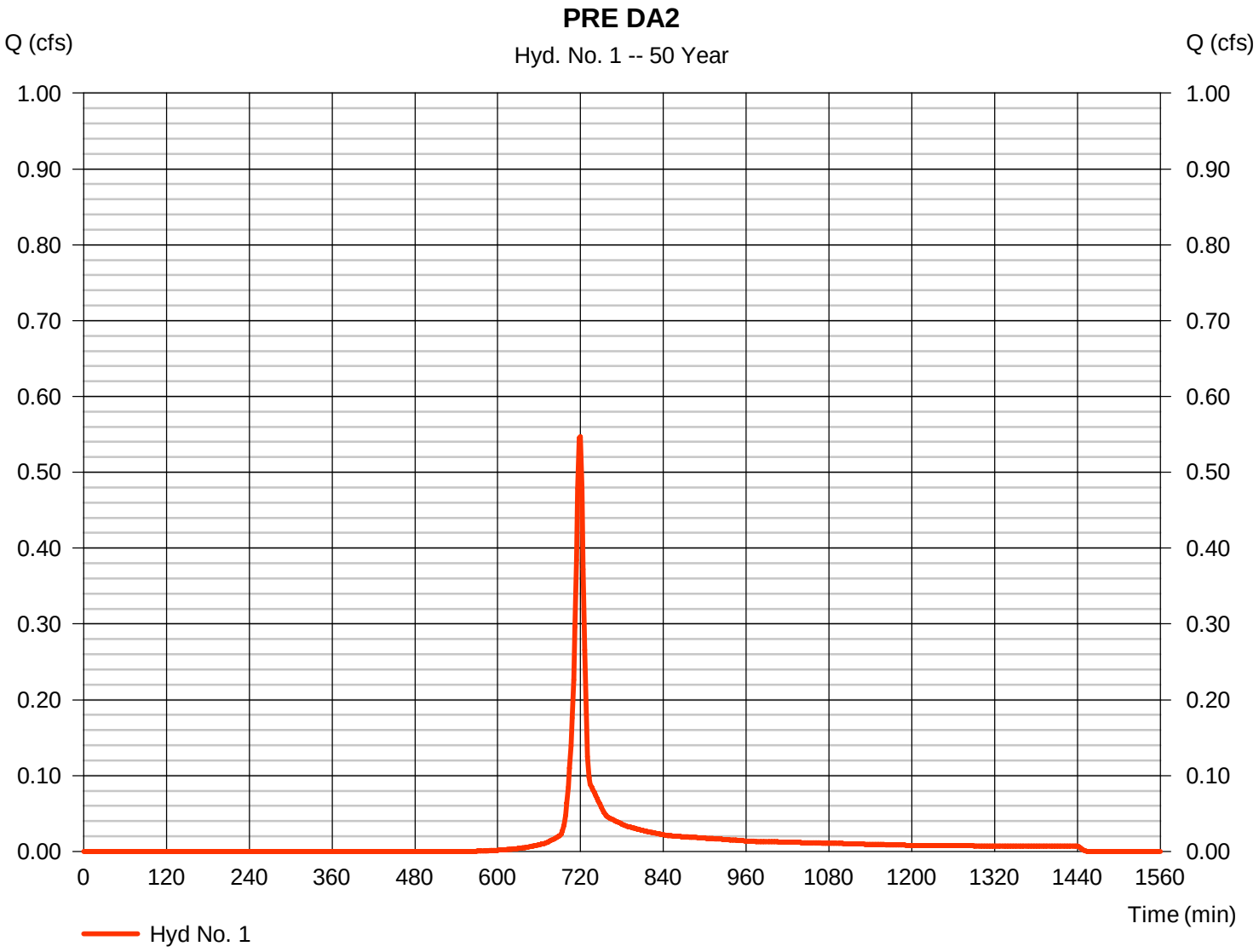
Hydrograph Report

Hyd. No. 1

PRE DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.547 cfs
Storm frequency	=	50 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	1,252 cuft
Drainage area	=	0.150 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	5.24 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 71) + (0.060 x 70)] / 0.150



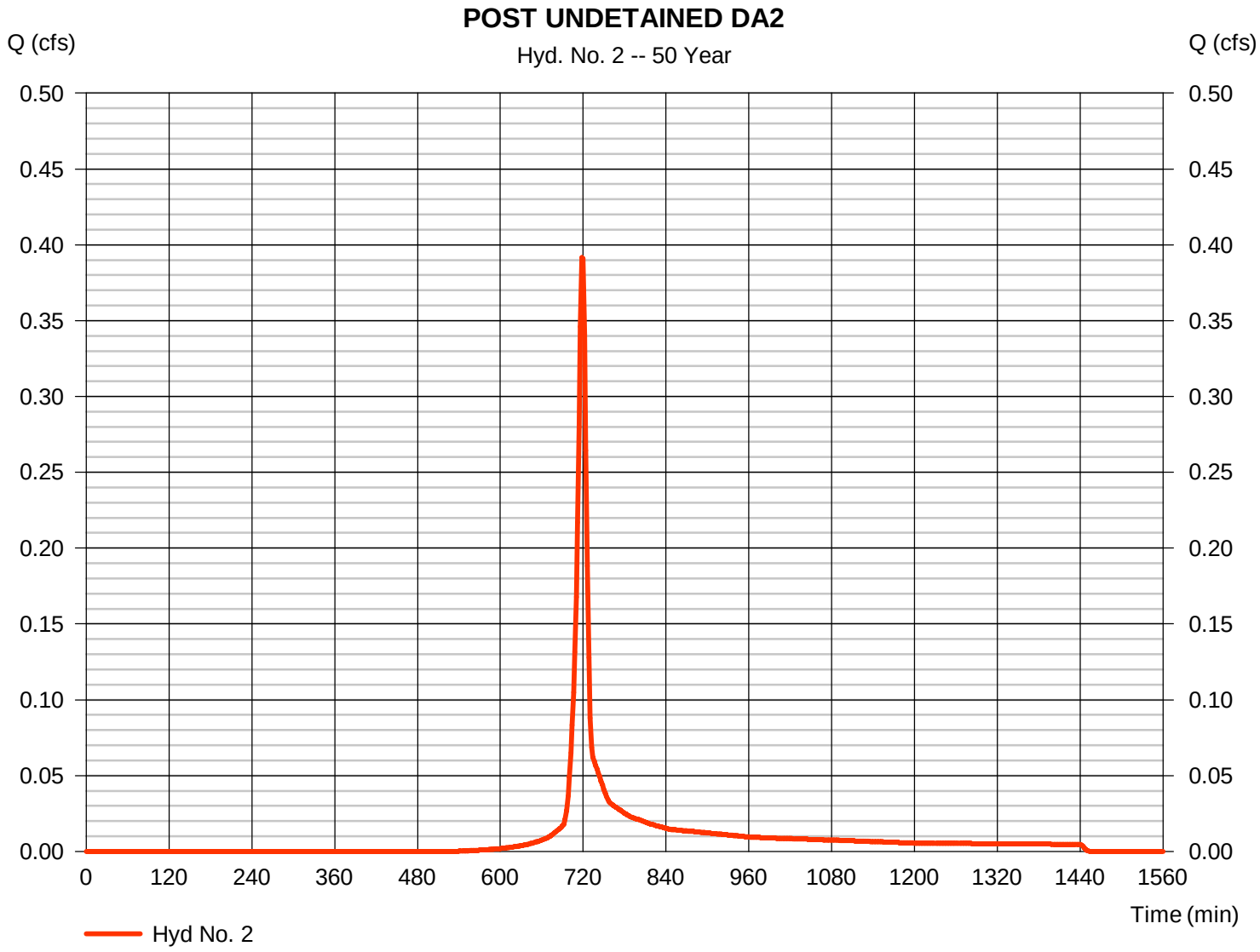
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.392 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 897 cuft
Drainage area	= 0.100 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.40 min
Total precip.	= 5.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.070 x 71) + (0.020 x 70)] / 0.100



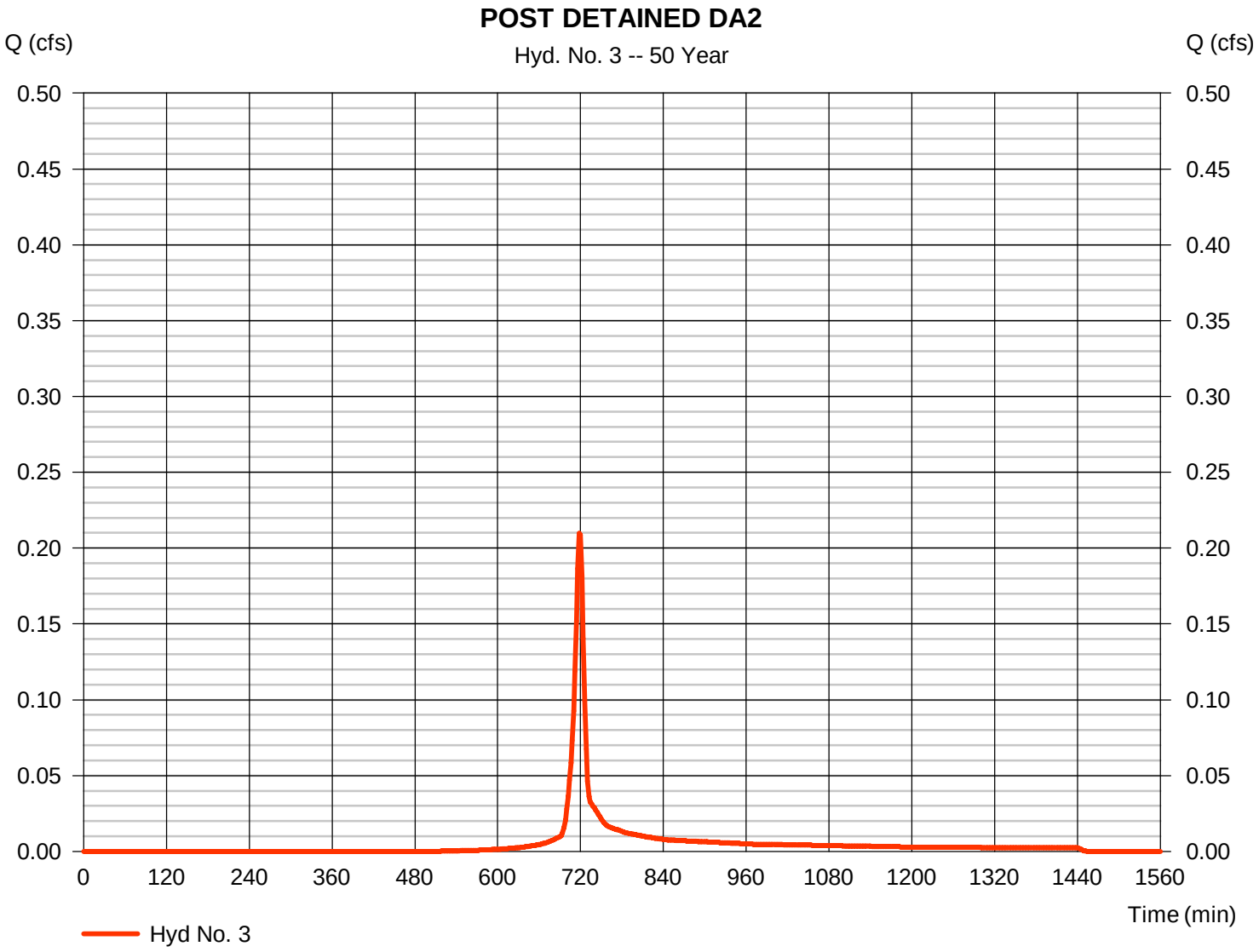
Hydrograph Report

Hyd. No. 3

POST DETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.210 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 480 cuft
Drainage area	= 0.050 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.10 min
Total precip.	= 5.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.040 x 71)] / 0.050

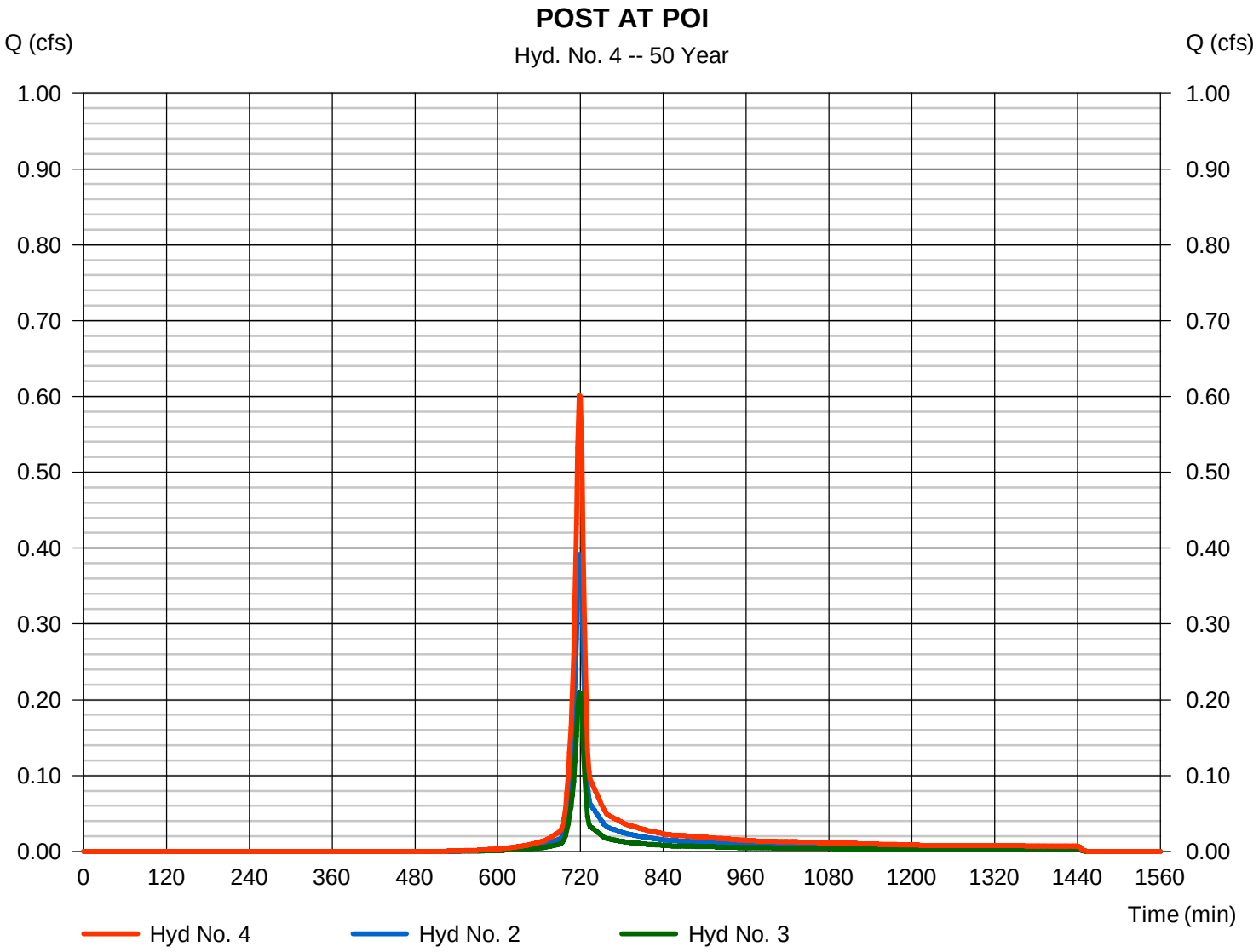


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	0.601 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	1,377 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	0.150 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	0.672	2	718	1,539	------	------	------	PRE DA2
2	SCS Runoff	0.478	2	718	1,094	------	------	------	POST UNDETAINED DA2
3	SCS Runoff	0.254	2	718	582	------	------	------	POST DETAINED DA2
4	Combine	0.732	2	718	1,676	2, 3	------	------	POST AT POI

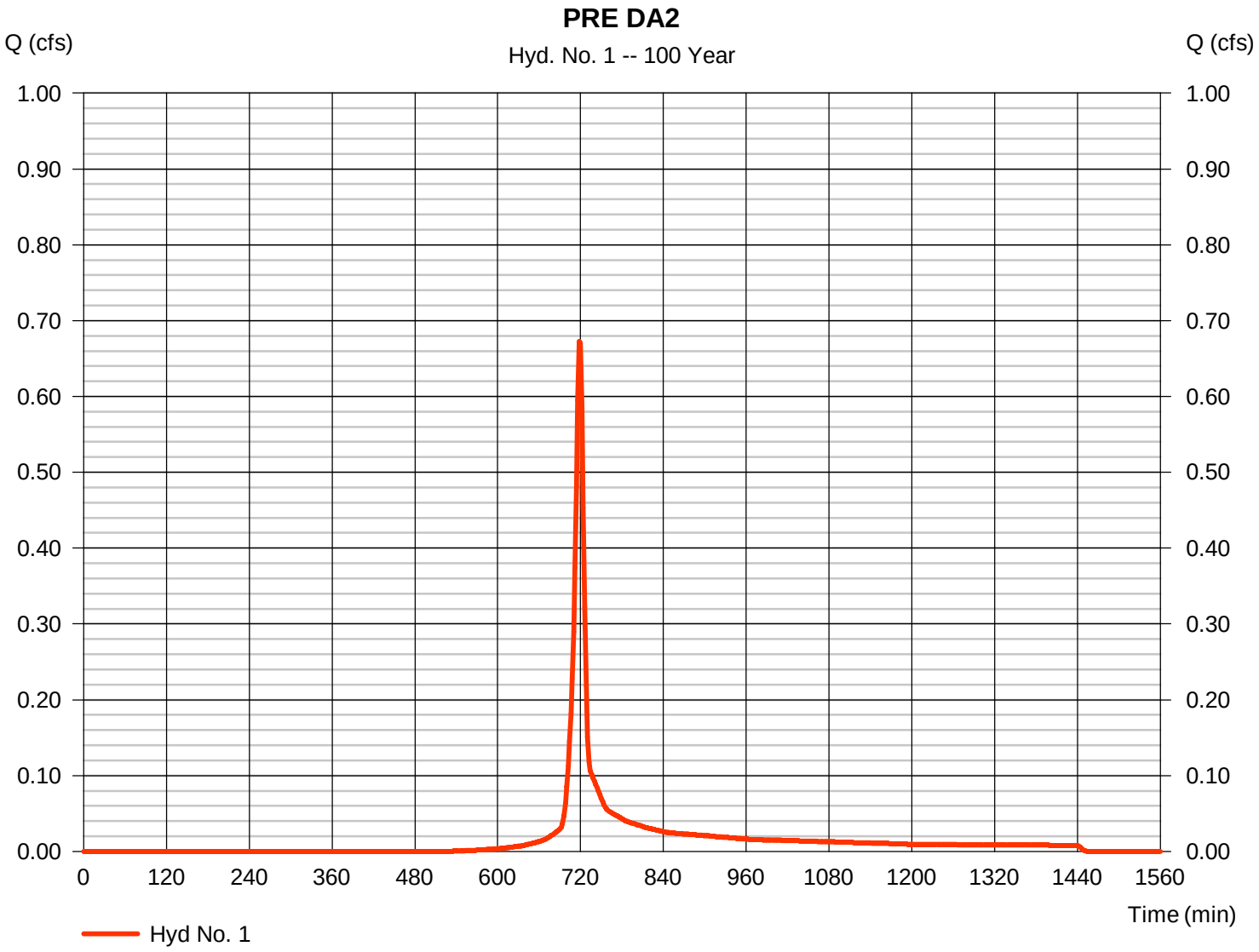
Hydrograph Report

Hyd. No. 1

PRE DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.672 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,539 cuft
Drainage area	= 0.150 ac	Curve number	= 71*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.40 min
Total precip.	= 5.91 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.090 x 71) + (0.060 x 70)] / 0.150



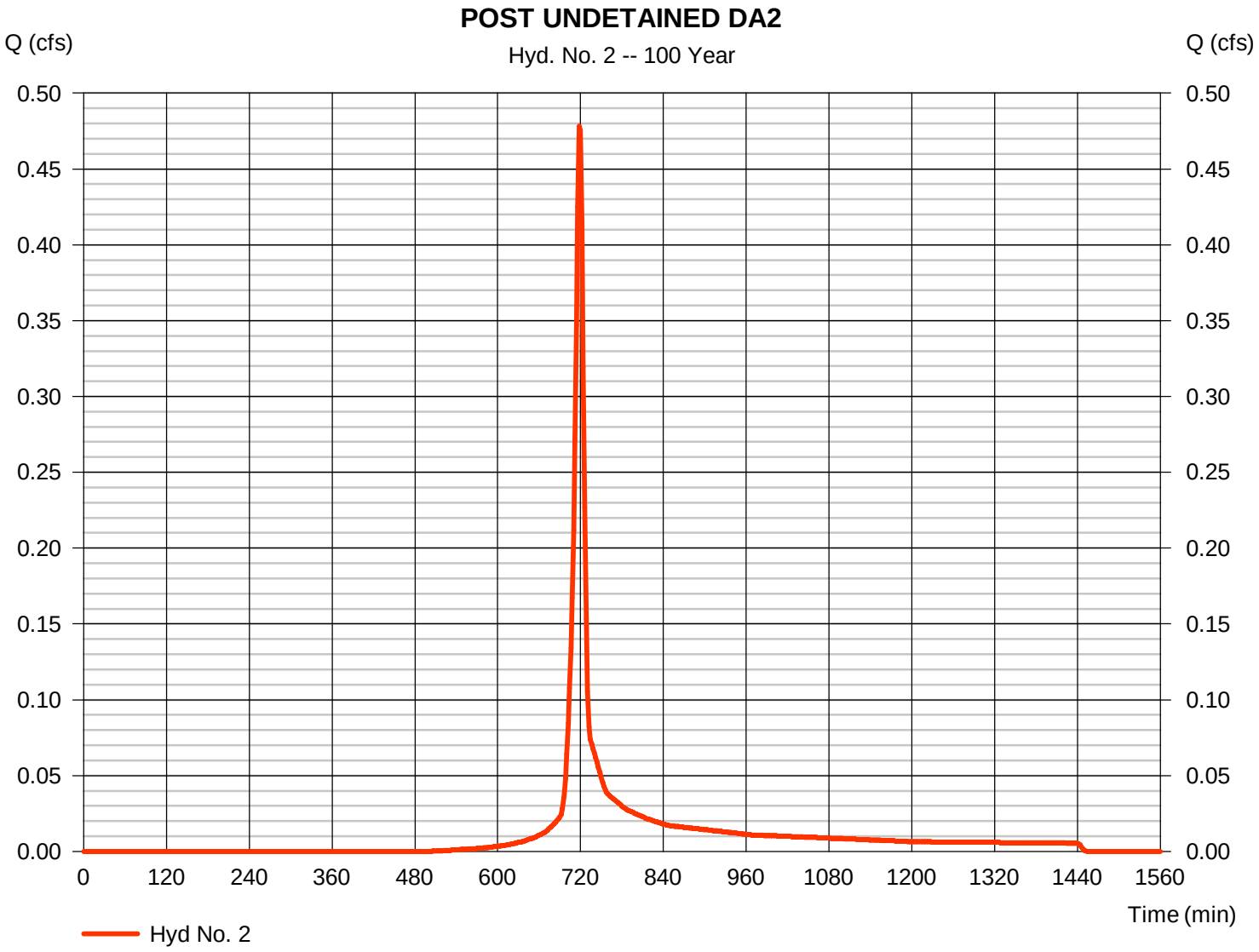
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.478 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,094 cuft
Drainage area	= 0.100 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.40 min
Total precip.	= 5.91 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.070 x 71) + (0.020 x 70)] / 0.100



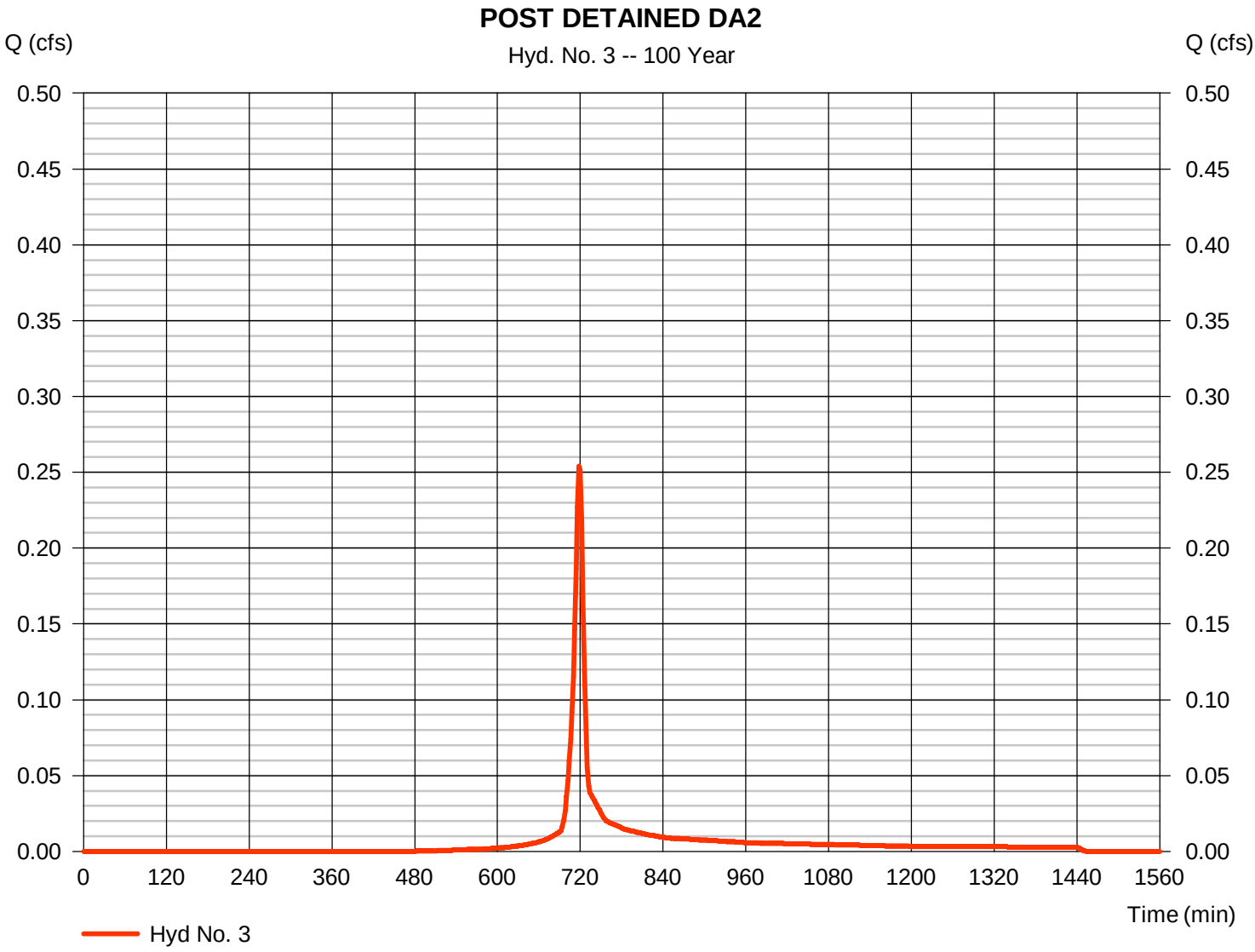
Hydrograph Report

Hyd. No. 3

POST DETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.254 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 582 cuft
Drainage area	= 0.050 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.10 min
Total precip.	= 5.91 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.040 x 71)] / 0.050

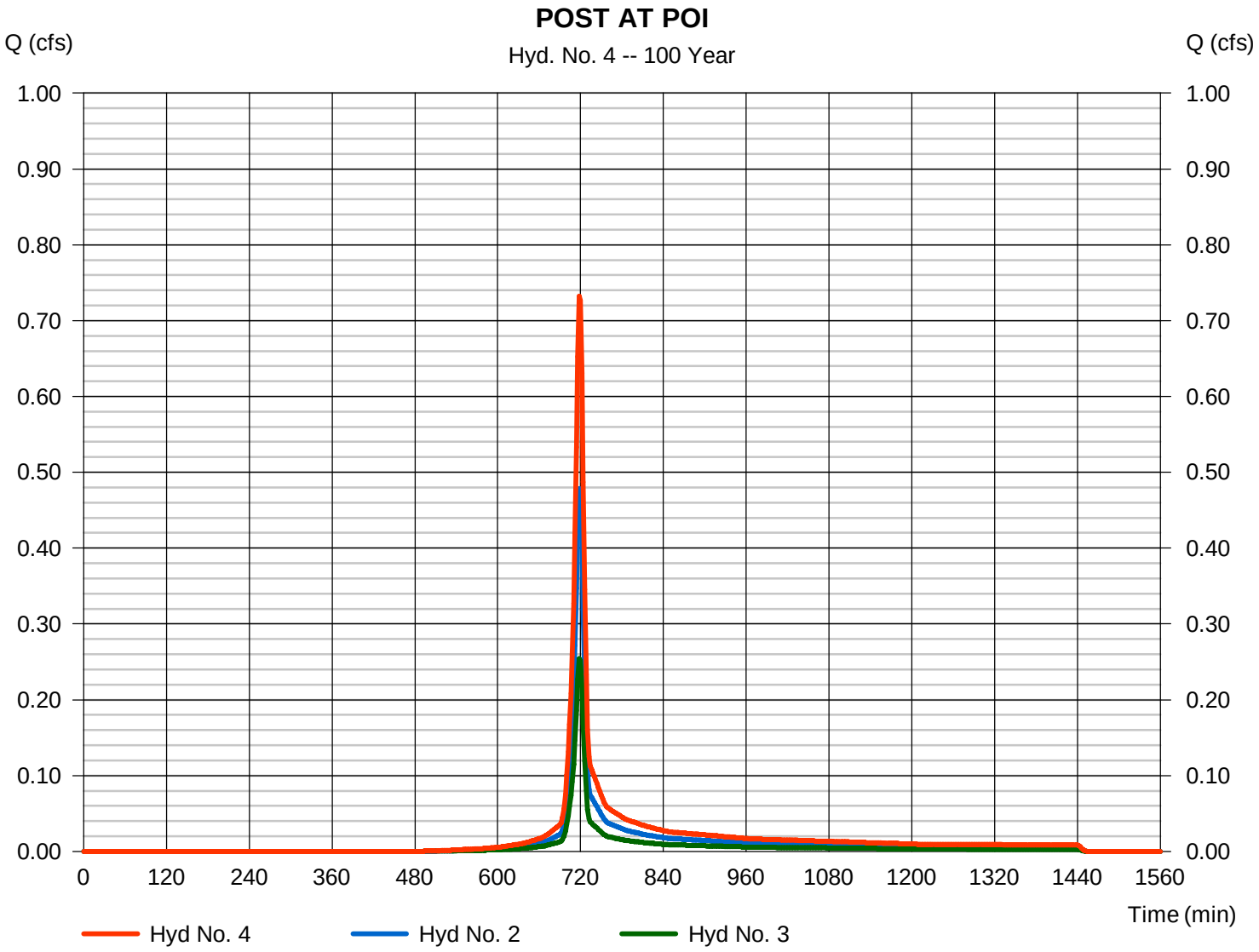


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	0.732 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	1,676 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	0.150 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.9938	10.0000	0.8826	--------
2	46.8600	10.1000	0.8723	--------
3	0.0000	0.0000	0.0000	--------
5	47.4204	9.3000	0.8196	--------
10	26589.4199	47.3998	2.1160	--------
25	53942.1797	51.5998	2.2139	--------
50	69308.7266	52.6998	2.2395	--------
100	106327.6016	55.1997	2.2977	--------

File name: Charger 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	3.66	2.84	2.33	1.99	1.73	1.54	1.39	1.27	1.16	1.08	1.00	0.94
2	4.39	3.42	2.82	2.40	2.10	1.87	1.69	1.54	1.42	1.32	1.23	1.15
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	5.36	4.19	3.47	2.98	2.62	2.34	2.12	1.94	1.80	1.67	1.56	1.47
10	6.12	5.04	4.23	3.59	3.09	2.68	2.35	2.07	1.84	1.65	1.48	1.34
25	7.10	5.89	4.95	4.22	3.63	3.16	2.77	2.45	2.17	1.94	1.75	1.58
50	7.88	6.54	5.51	4.70	4.05	3.52	3.09	2.73	2.42	2.17	1.95	1.76
100	8.66	7.21	6.09	5.20	4.48	3.90	3.42	3.02	2.69	2.40	2.16	1.95

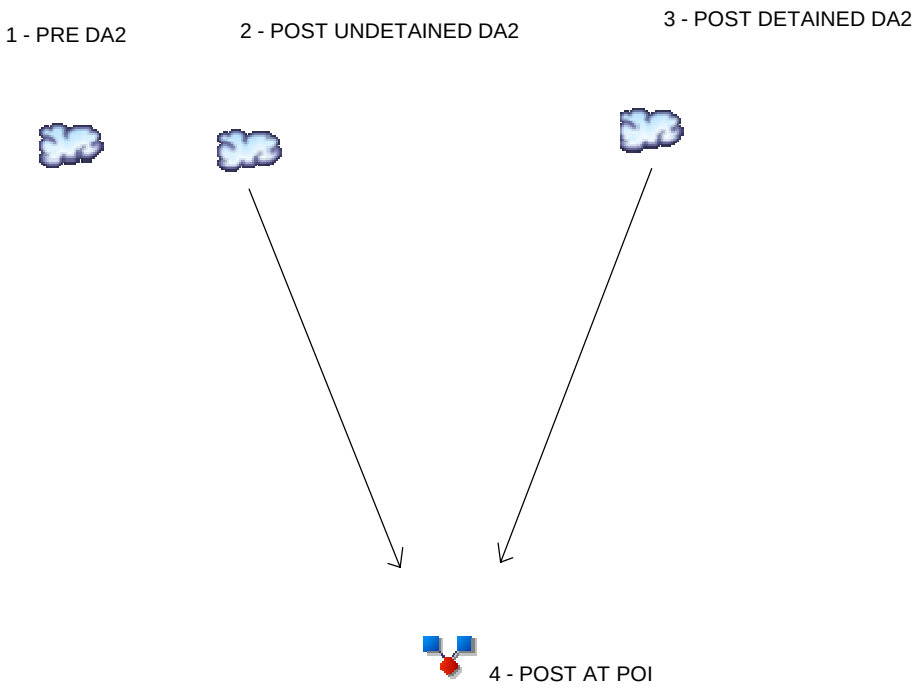
Tc = time in minutes. Values may exceed 60.

hase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Charger\Hydraflow Rev 1\Charger Precip.pc

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	2.22	2.66	0.00	3.30	3.83	4.60	5.24	5.91
SCS 6-Hr	1.46	1.76	0.00	2.21	2.57	3.09	3.52	3.97
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 DA2
2	SCS Runoff	POST UNDETAINED DA2
3	SCS Runoff	POST DETAINED DA2
4	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	------	-------	0.126	-------	-------	-------	-------	-------	-------	PRE DA2
2	SCS Runoff	------	-------	0.099	-------	-------	-------	-------	-------	-------	POST UNDETAINED DA2
3	SCS Runoff	------	-------	0.022	-------	-------	-------	-------	-------	-------	POST DETAINED DA2
4	Combine	2, 3	-------	0.107	-------	-------	-------	-------	-------	-------	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	0.126	2	720	312	------	------	------	PRE DA2
2	SCS Runoff	0.099	2	720	238	------	------	------	POST UNDETAINED DA2
3	SCS Runoff	0.022	2	742	134	------	------	------	POST DETAINED DA2
4	Combine	0.107	2	720	372	2, 3	------	------	POST AT POI

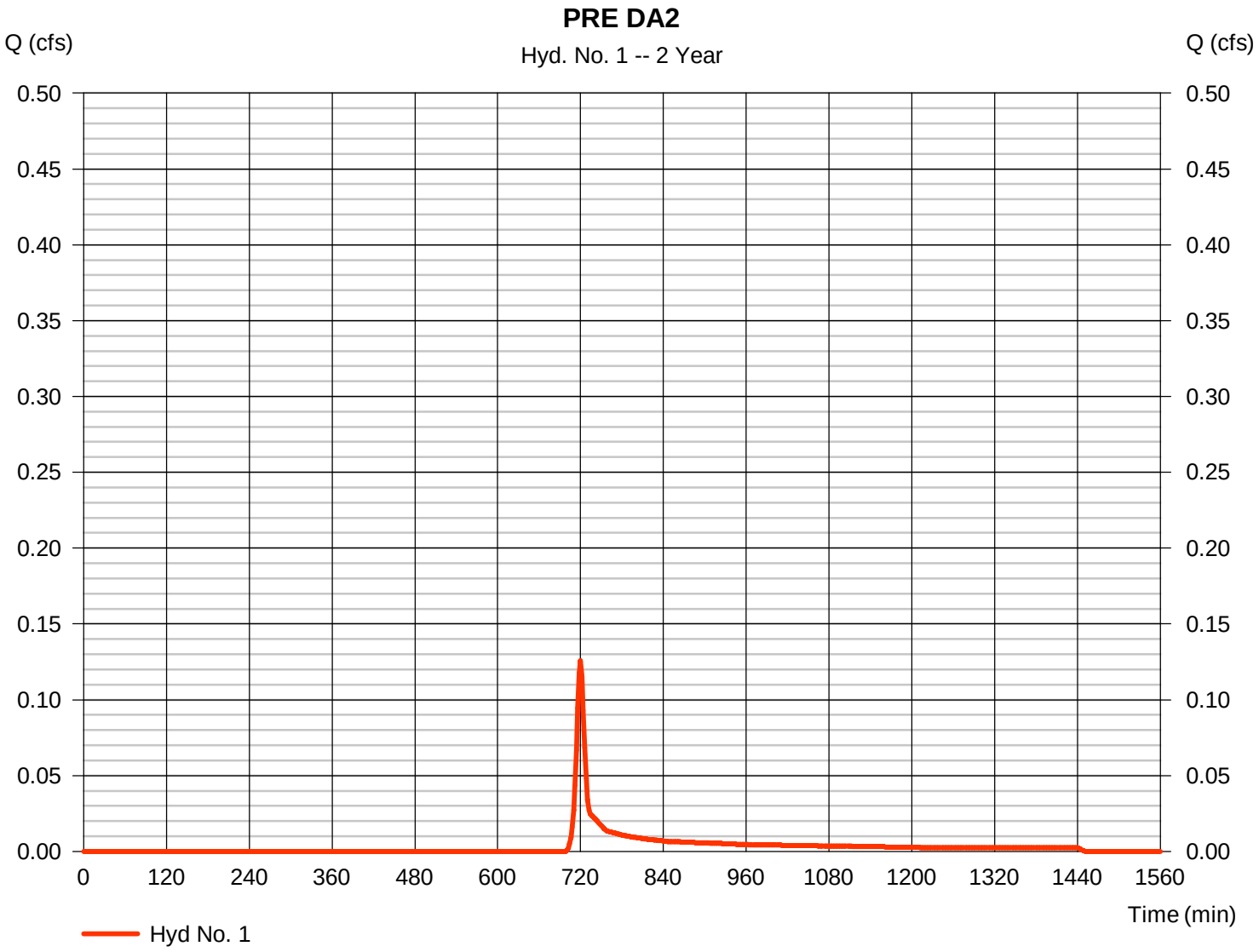
Hydrograph Report

Hyd. No. 1

PRE DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.126 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	312 cuft
Drainage area	=	0.150 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	2.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 71) + (0.060 x 70)] / 0.150



TR55 Tc Worksheet

Hyd. No. 1

PRE DA2

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)	= 2.66		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 8.22**	**+**	**0.00**	**+**	**0.00**	**=**	**8.22**
Shallow Concentrated Flow							
Flow length (ft)	= 31.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 0.22**	**+**	**0.00**	**+**	**0.00**	**=**	**0.22**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

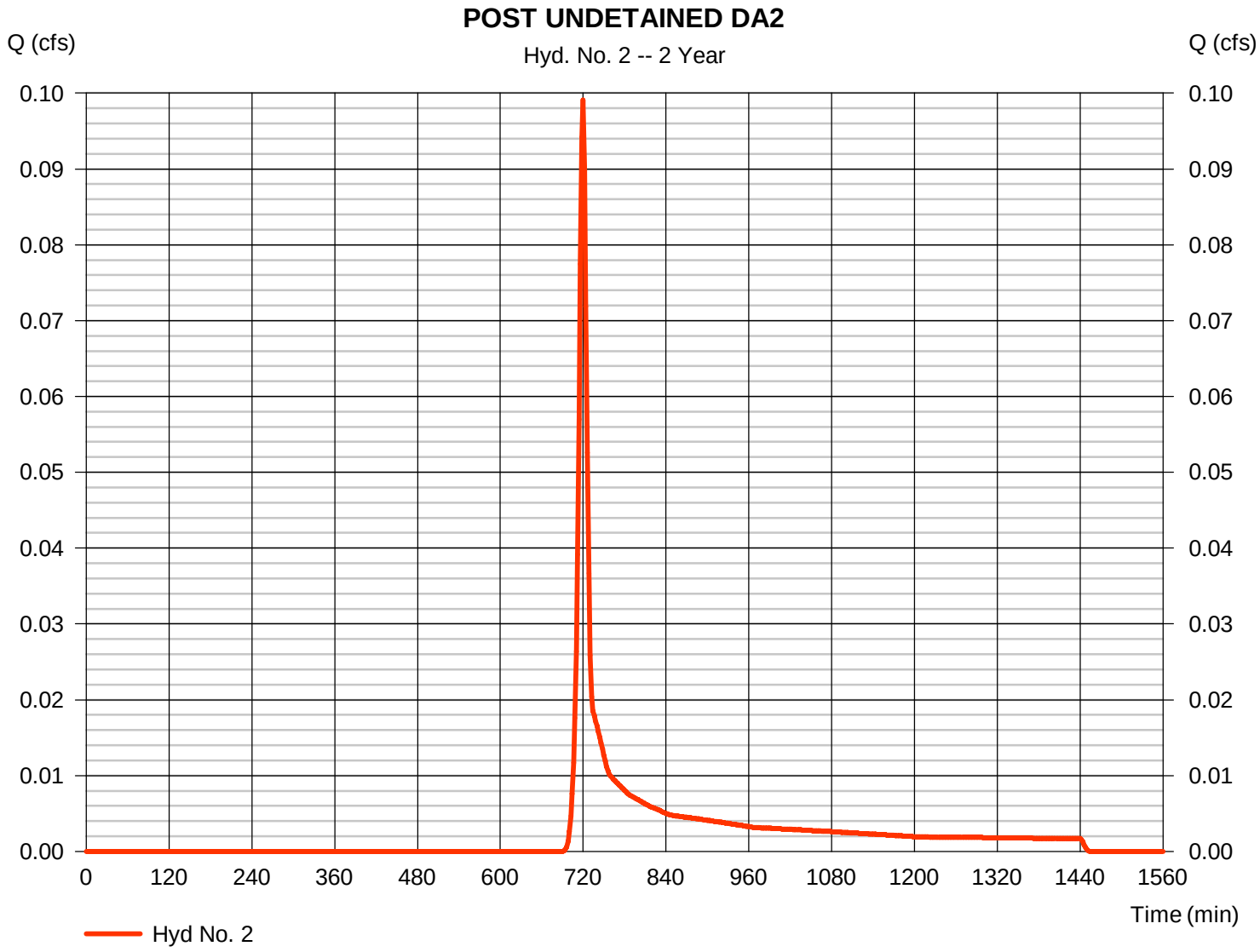
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.099 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 238 cuft
Drainage area	= 0.100 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.40 min
Total precip.	= 2.66 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.070 x 71) + (0.020 x 70)] / 0.100



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED DA2

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)	= 2.66		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 8.22**	**+**	**0.00**	**+**	**0.00**	**=**	**8.22**
Shallow Concentrated Flow							
Flow length (ft)	= 31.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 0.22**	**+**	**0.00**	**+**	**0.00**	**=**	**0.22**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

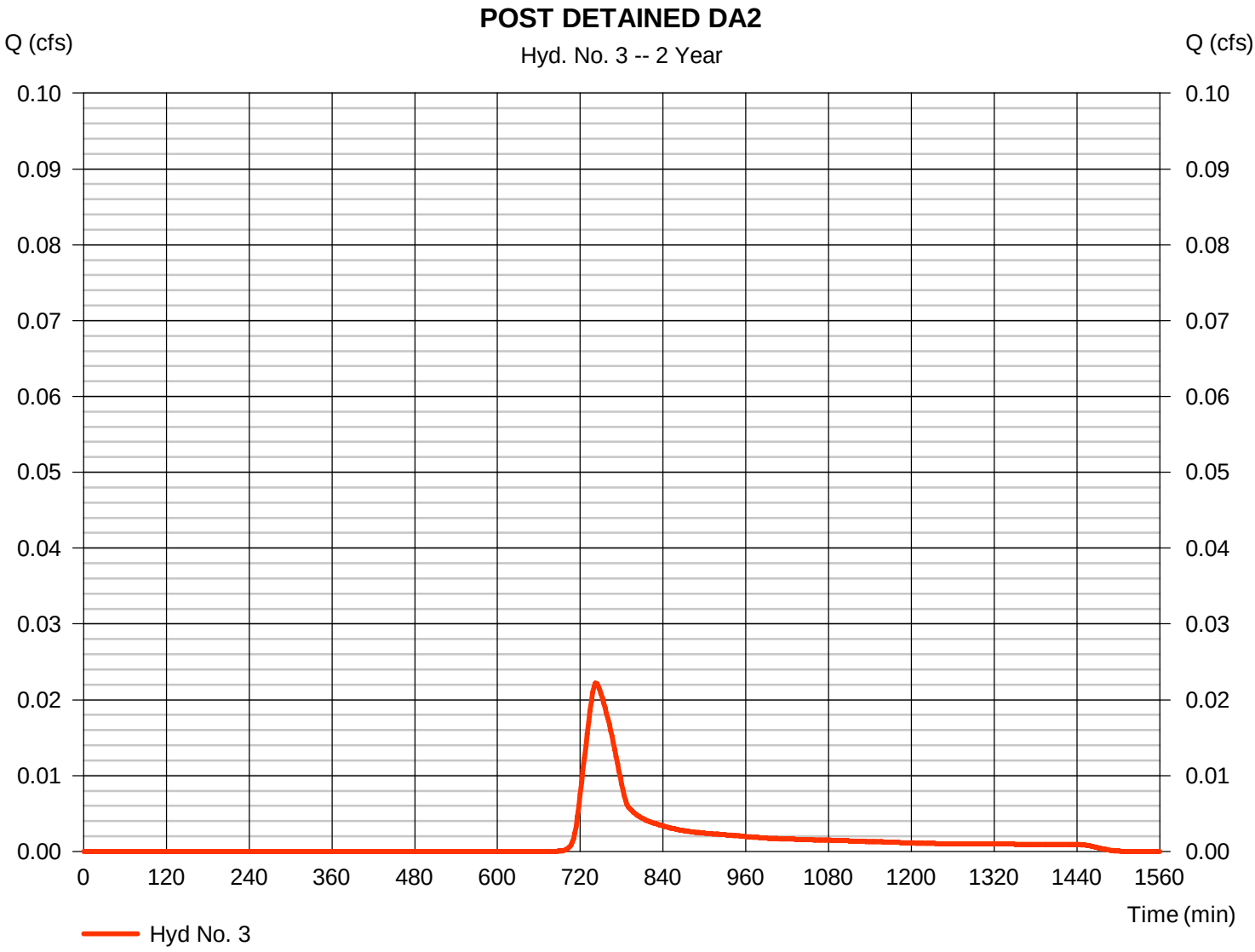
Hydrograph Report

Hyd. No. 3

POST DETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.022 cfs
Storm frequency	= 2 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 134 cuft
Drainage area	= 0.050 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 44.46 min
Total precip.	= 2.66 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.040 x 71)] / 0.050

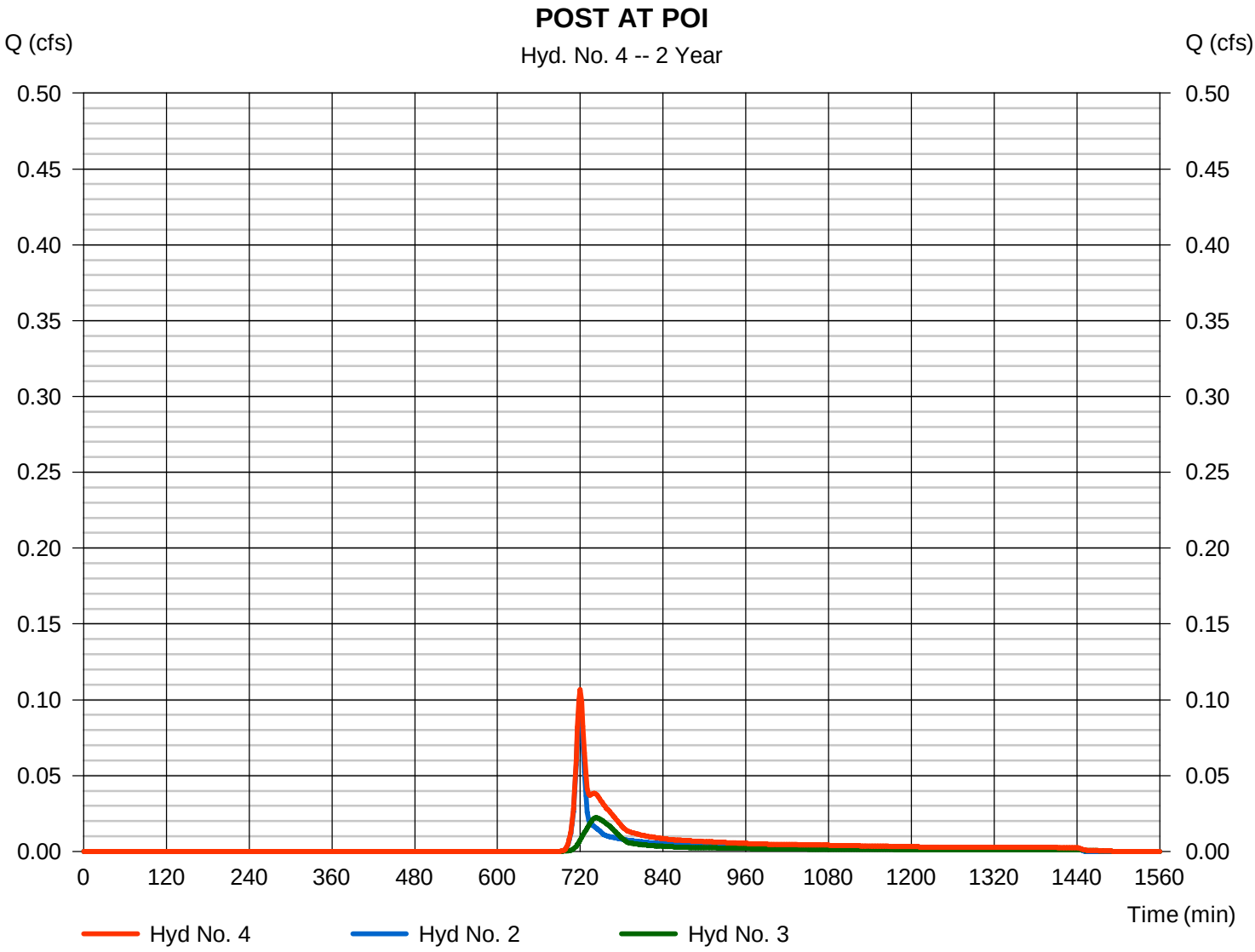


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.107 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 372 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.150 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.9938	10.0000	0.8826	--------
2	46.8600	10.1000	0.8723	--------
3	0.0000	0.0000	0.0000	--------
5	47.4204	9.3000	0.8196	--------
10	26589.4199	47.3998	2.1160	--------
25	53942.1797	51.5998	2.2139	--------
50	69308.7266	52.6998	2.2395	--------
100	106327.6016	55.1997	2.2977	--------

File name: Charger 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	3.66	2.84	2.33	1.99	1.73	1.54	1.39	1.27	1.16	1.08	1.00	0.94
2	4.39	3.42	2.82	2.40	2.10	1.87	1.69	1.54	1.42	1.32	1.23	1.15
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	5.36	4.19	3.47	2.98	2.62	2.34	2.12	1.94	1.80	1.67	1.56	1.47
10	6.12	5.04	4.23	3.59	3.09	2.68	2.35	2.07	1.84	1.65	1.48	1.34
25	7.10	5.89	4.95	4.22	3.63	3.16	2.77	2.45	2.17	1.94	1.75	1.58
50	7.88	6.54	5.51	4.70	4.05	3.52	3.09	2.73	2.42	2.17	1.95	1.76
100	8.66	7.21	6.09	5.20	4.48	3.90	3.42	3.02	2.69	2.40	2.16	1.95

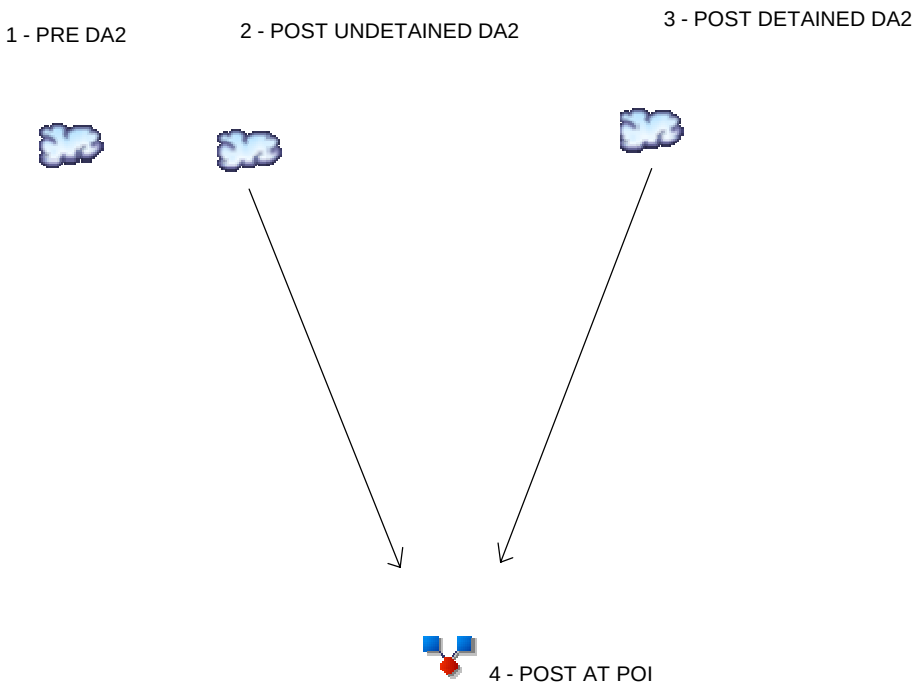
Tc = time in minutes. Values may exceed 60.

hase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Charger\Hydraflow Rev 1\Charger Precip.pc

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	2.22	2.66	0.00	3.30	3.83	4.60	5.24	5.91
SCS 6-Hr	1.46	1.76	0.00	2.21	2.57	3.09	3.52	3.97
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 DA2
2	SCS Runoff	POST UNDETAINED DA2
3	SCS Runoff	POST DETAINED DA2
4	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	------	-------	-------	-------	-------	0.302	-------	-------	-------	PRE DA2
2	SCS Runoff	------	-------	-------	-------	-------	0.222	-------	-------	-------	POST UNDETAINED DA2
3	SCS Runoff	------	-------	-------	-------	-------	0.073	-------	-------	-------	POST DETAINED DA2
4	Combine	2, 3	-------	-------	-------	-------	0.274	-------	-------	-------	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	0.302	2	720	696	------	------	------	PRE DA2
2	SCS Runoff	0.222	2	720	511	------	------	------	POST UNDETAINED DA2
3	SCS Runoff	0.073	2	730	275	------	------	------	POST DETAINED DA2
4	Combine	0.274	2	720	786	2, 3	------	------	POST AT POI

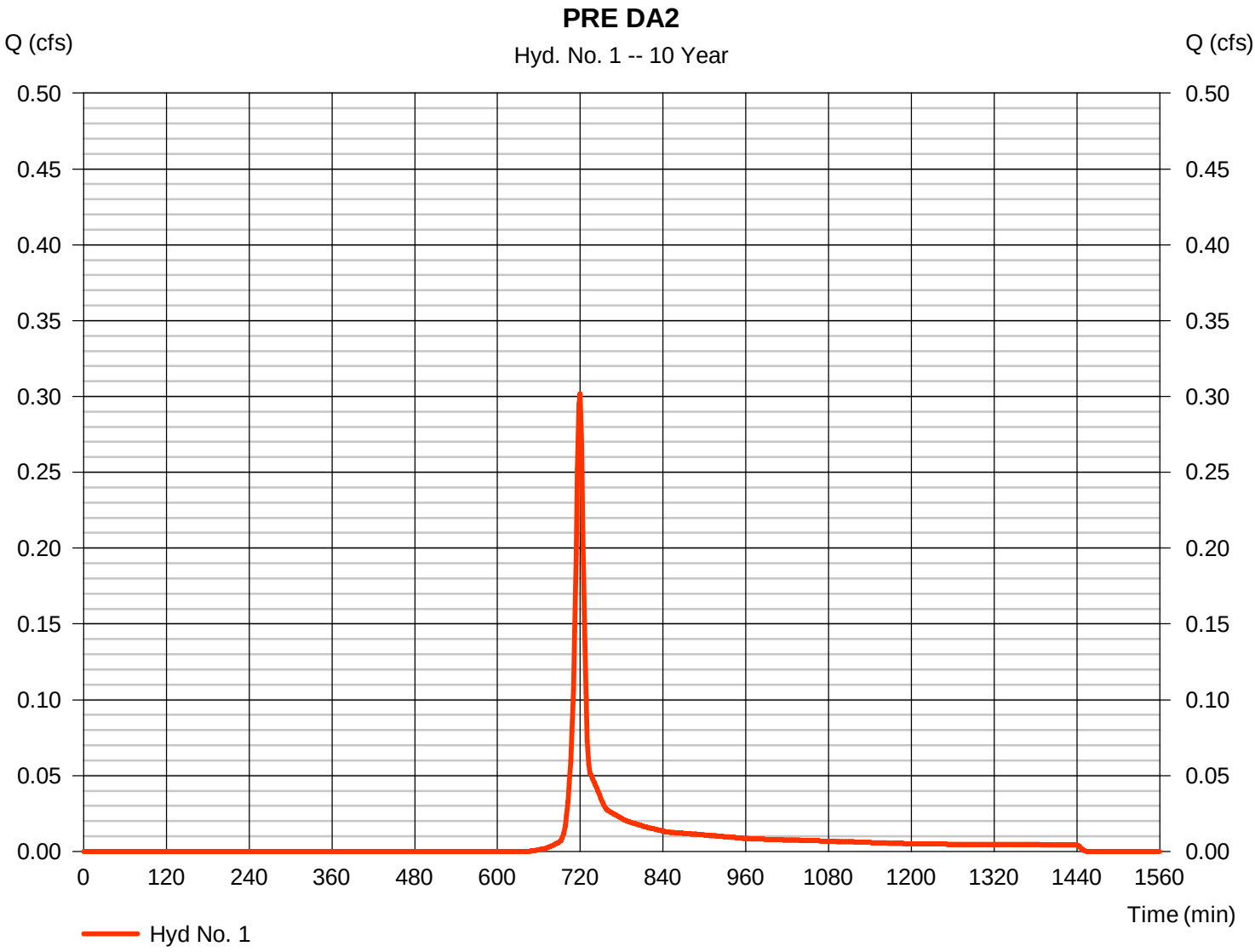
Hydrograph Report

Hyd. No. 1

PRE DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.302 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	696 cuft
Drainage area	=	0.150 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	3.83 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 71) + (0.060 x 70)] / 0.150



TR55 Tc Worksheet

Hyd. No. 1

PRE DA2

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)	= 2.66		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 8.22**	**+**	**0.00**	**+**	**0.00**	**=**	**8.22**
Shallow Concentrated Flow							
Flow length (ft)	= 31.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 0.22**	**+**	**0.00**	**+**	**0.00**	**=**	**0.22**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

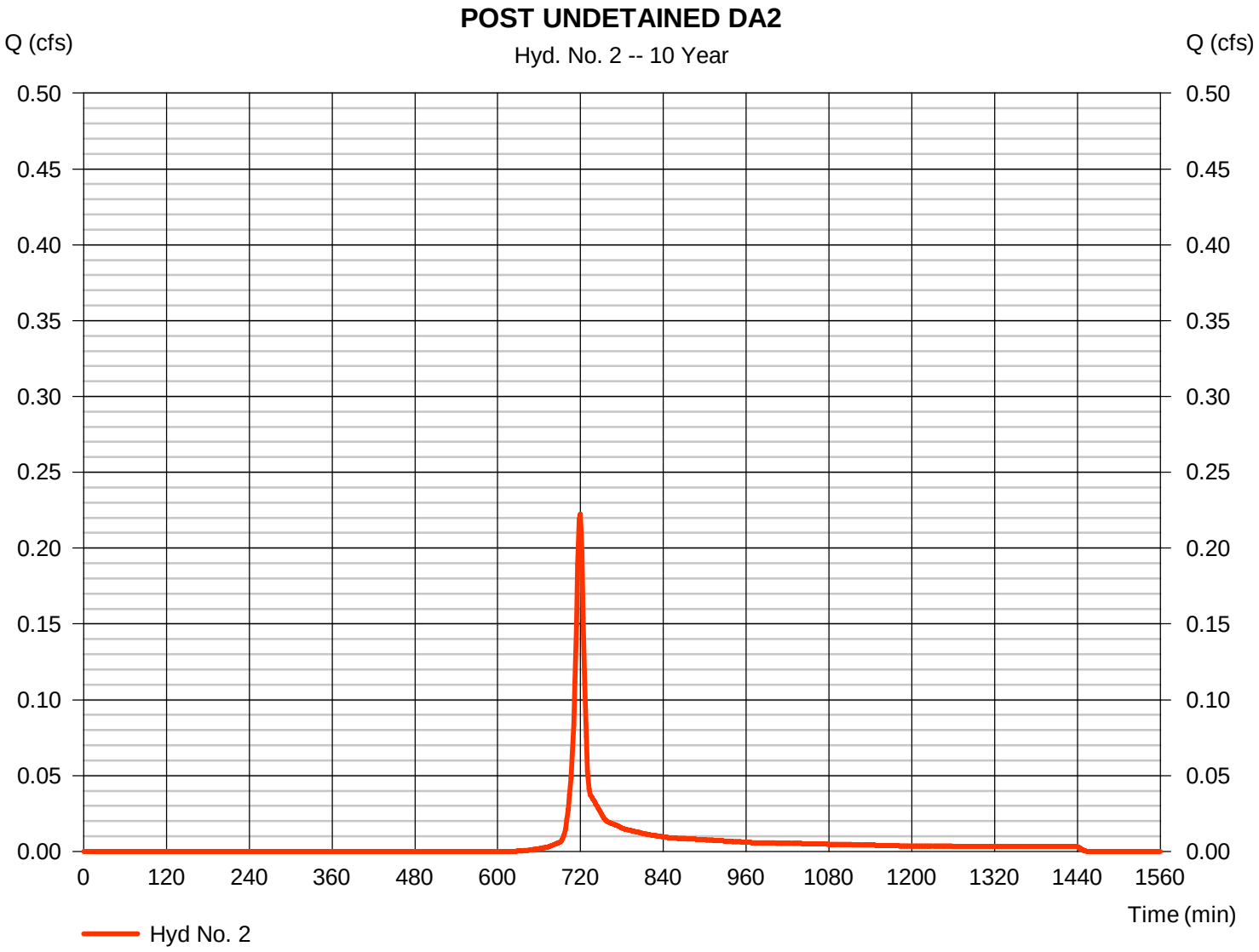
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.222 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 511 cuft
Drainage area	= 0.100 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.40 min
Total precip.	= 3.83 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.070 x 71) + (0.020 x 70)] / 0.100



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED DA2

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)	= 2.66		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 8.22**	**+**	**0.00**	**+**	**0.00**	**=**	**8.22**
Shallow Concentrated Flow							
Flow length (ft)	= 31.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 0.22**	**+**	**0.00**	**+**	**0.00**	**=**	**0.22**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

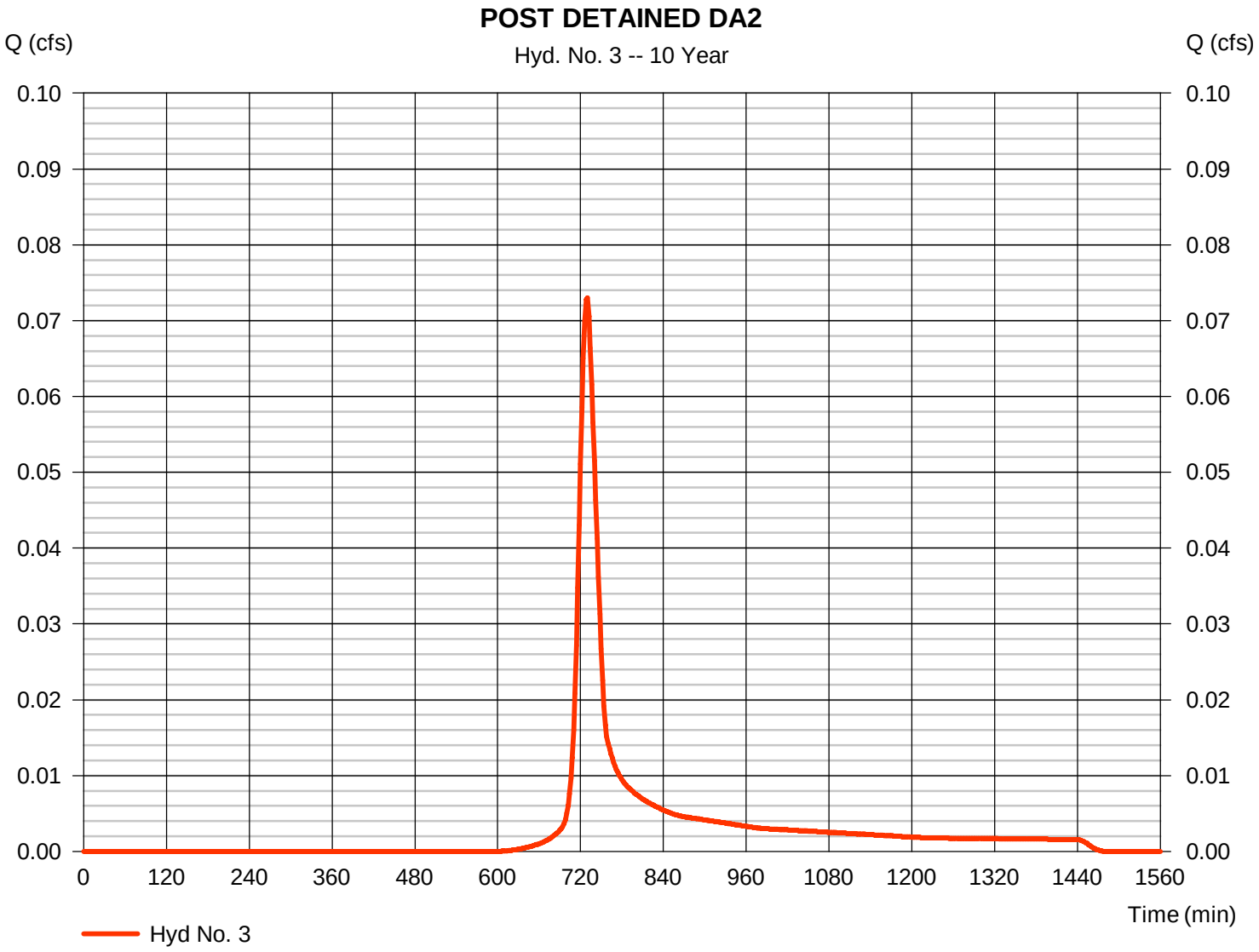
Hydrograph Report

Hyd. No. 3

POST DETAINED DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.073 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	275 cuft
Drainage area	=	0.050 ac	Curve number	=	75*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	24.90 min
Total precip.	=	3.83 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.010 x 89) + (0.040 x 71)] / 0.050

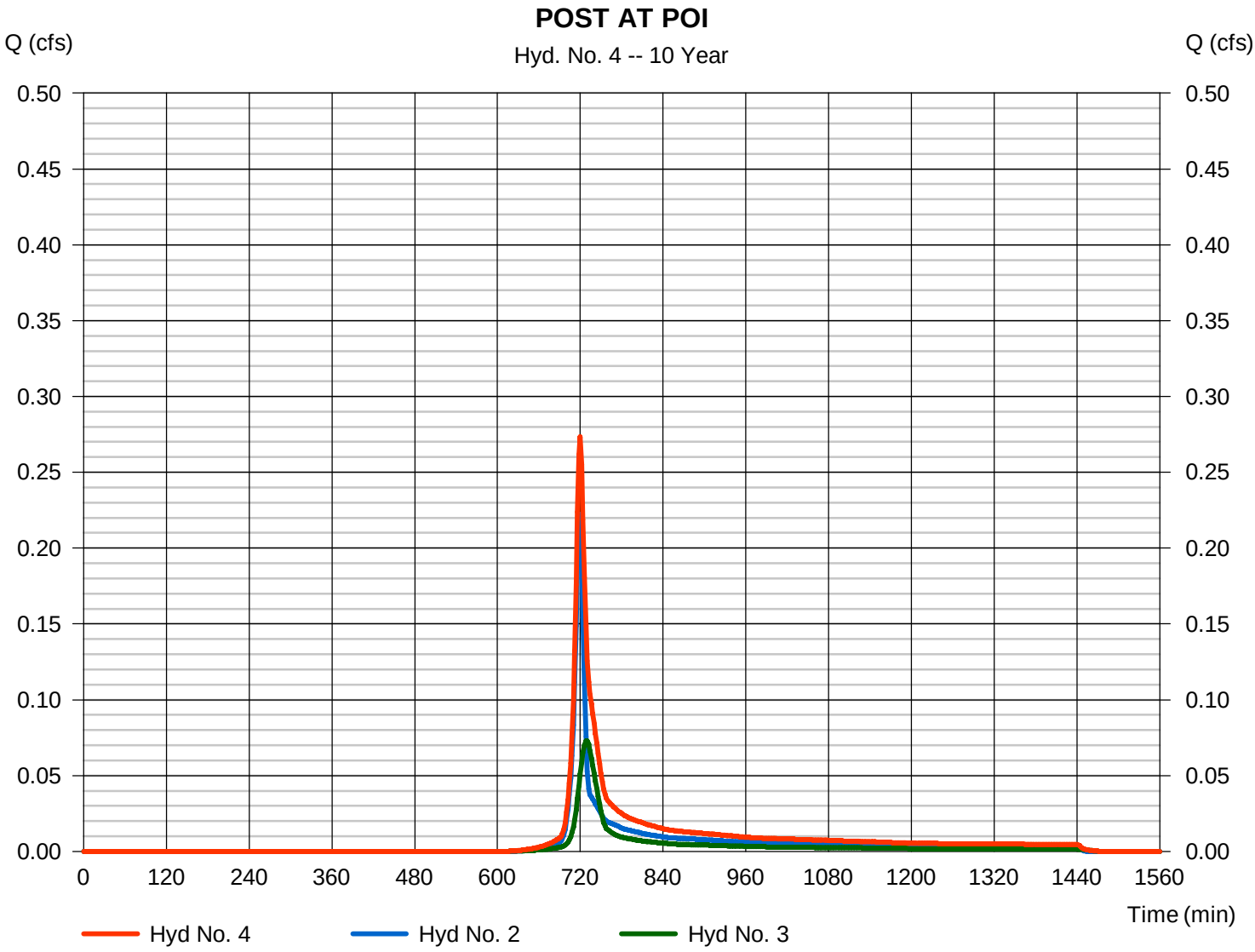


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.274 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 786 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.150 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.9938	10.0000	0.8826	--------
2	46.8600	10.1000	0.8723	--------
3	0.0000	0.0000	0.0000	--------
5	47.4204	9.3000	0.8196	--------
10	26589.4199	47.3998	2.1160	--------
25	53942.1797	51.5998	2.2139	--------
50	69308.7266	52.6998	2.2395	--------
100	106327.6016	55.1997	2.2977	--------

File name: Charger 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	3.66	2.84	2.33	1.99	1.73	1.54	1.39	1.27	1.16	1.08	1.00	0.94
2	4.39	3.42	2.82	2.40	2.10	1.87	1.69	1.54	1.42	1.32	1.23	1.15
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	5.36	4.19	3.47	2.98	2.62	2.34	2.12	1.94	1.80	1.67	1.56	1.47
10	6.12	5.04	4.23	3.59	3.09	2.68	2.35	2.07	1.84	1.65	1.48	1.34
25	7.10	5.89	4.95	4.22	3.63	3.16	2.77	2.45	2.17	1.94	1.75	1.58
50	7.88	6.54	5.51	4.70	4.05	3.52	3.09	2.73	2.42	2.17	1.95	1.76
100	8.66	7.21	6.09	5.20	4.48	3.90	3.42	3.02	2.69	2.40	2.16	1.95

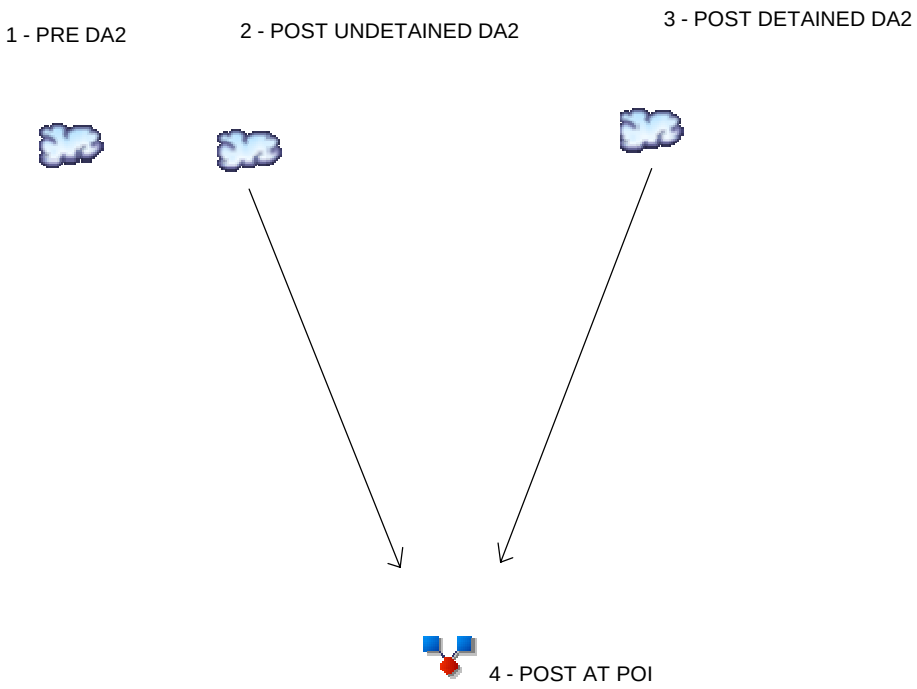
Tc = time in minutes. Values may exceed 60.

hase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Charger\Hydraflow Rev 1\Charger Precip.pc

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	2.22	2.66	0.00	3.30	3.83	4.60	5.24	5.91
SCS 6-Hr	1.46	1.76	0.00	2.21	2.57	3.09	3.52	3.97
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 DA2
2	SCS Runoff	POST UNDETAINED DA2
3	SCS Runoff	POST DETAINED DA2
4	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	------	-------	-------	-------	-------	-------	-------	0.547	-------	PRE DA2
2	SCS Runoff	------	-------	-------	-------	-------	-------	-------	0.392	-------	POST UNDETAINED DA2
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	0.153	-------	POST DETAINED DA2
4	Combine	2, 3	-------	-------	-------	-------	-------	-------	0.525	-------	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	0.547	2	720	1,252	------	------	------	PRE DA2
2	SCS Runoff	0.392	2	718	897	------	------	------	POST UNDETAINED DA2
3	SCS Runoff	0.153	2	724	480	------	------	------	POST DETAINED DA2
4	Combine	0.525	2	720	1,377	2, 3	------	------	POST AT POI

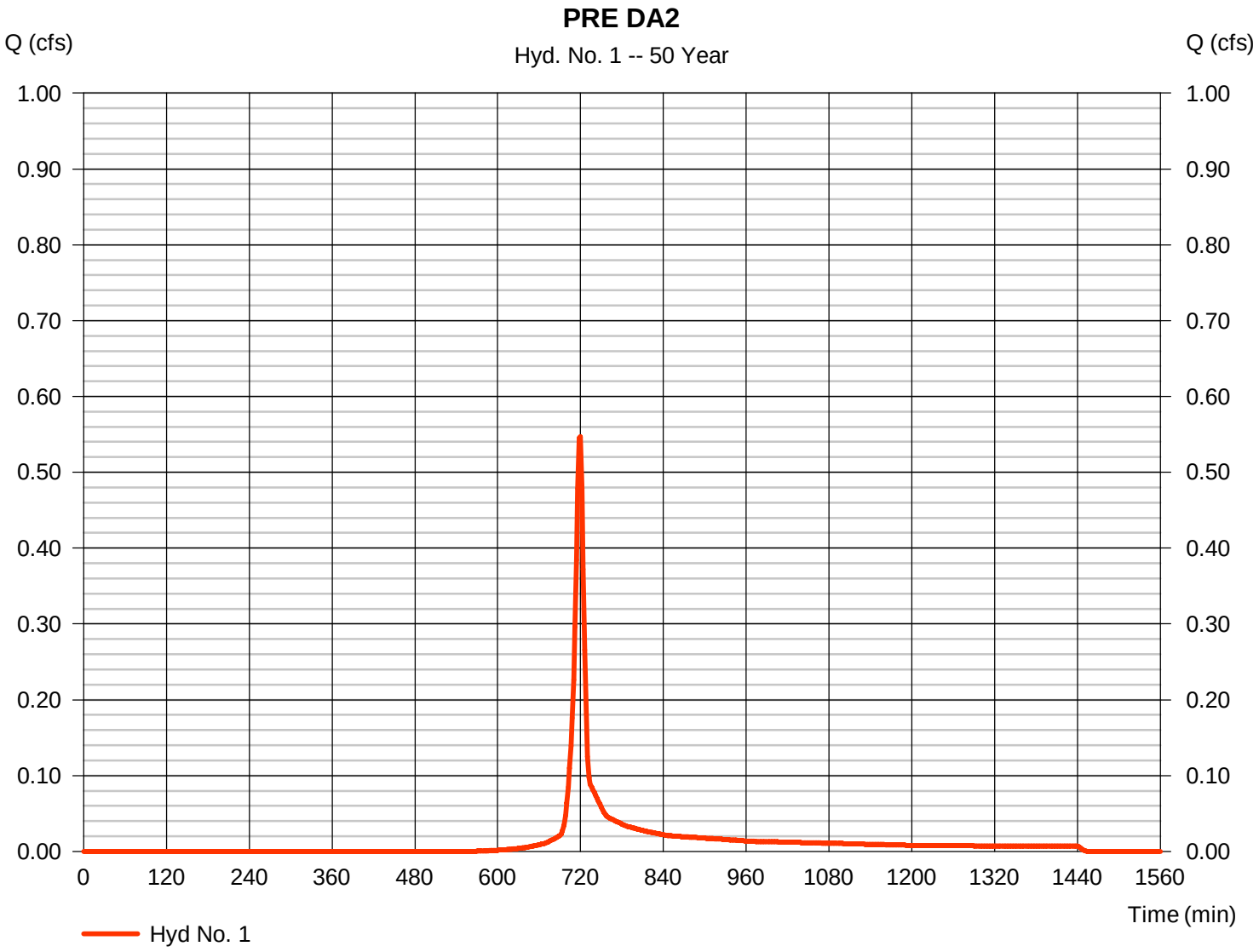
Hydrograph Report

Hyd. No. 1

PRE DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.547 cfs
Storm frequency	=	50 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	1,252 cuft
Drainage area	=	0.150 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	5.24 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 71) + (0.060 x 70)] / 0.150



TR55 Tc Worksheet

Hyd. No. 1

PRE DA2

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)	= 2.66		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 8.22**	**+**	**0.00**	**+**	**0.00**	**=**	**8.22**
Shallow Concentrated Flow							
Flow length (ft)	= 31.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 0.22**	**+**	**0.00**	**+**	**0.00**	**=**	**0.22**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

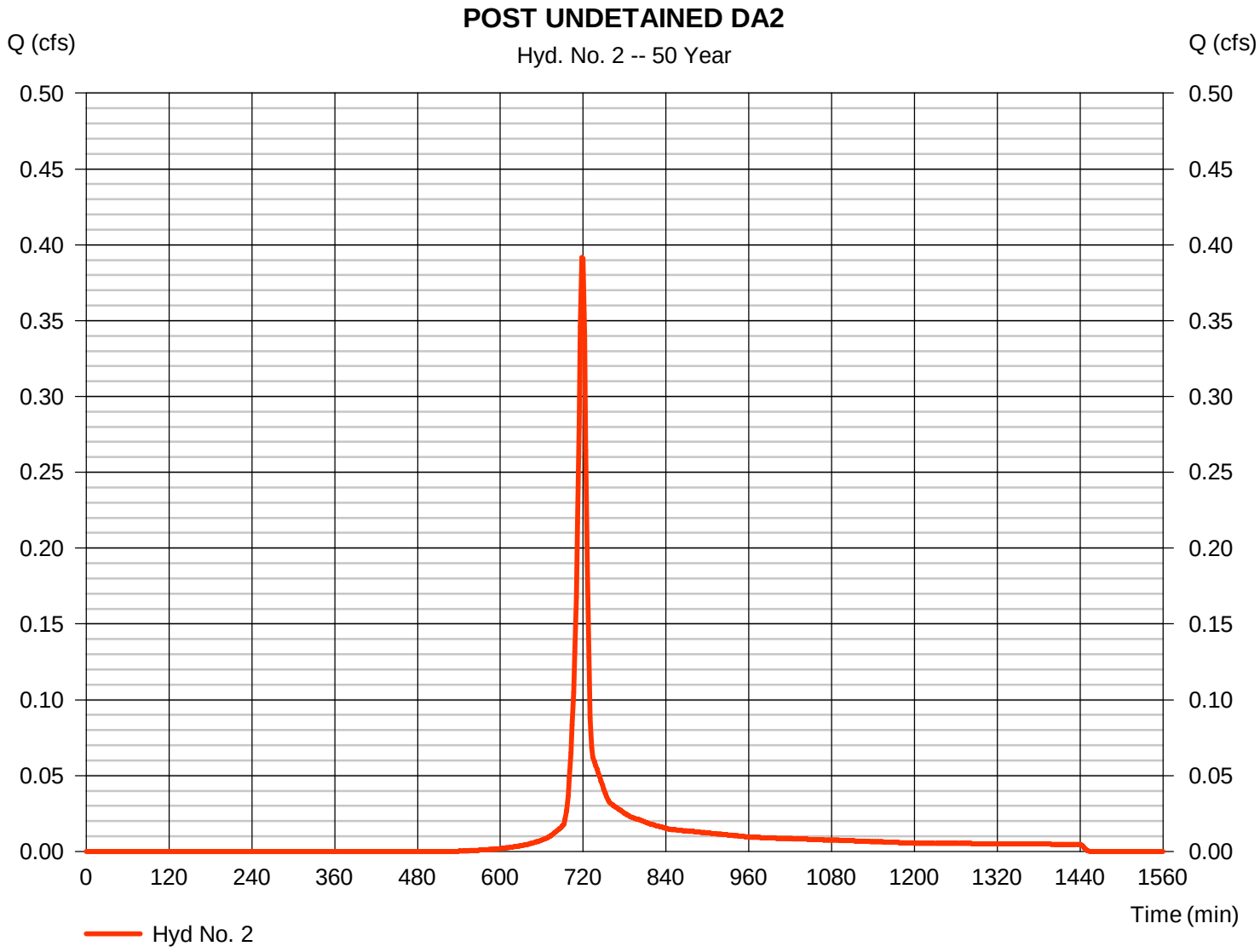
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.392 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 897 cuft
Drainage area	= 0.100 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.40 min
Total precip.	= 5.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.070 x 71) + (0.020 x 70)] / 0.100



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED DA2

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)	= 2.66		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 8.22**	**+**	**0.00**	**+**	**0.00**	**=**	**8.22**
Shallow Concentrated Flow							
Flow length (ft)	= 31.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 0.22**	**+**	**0.00**	**+**	**0.00**	**=**	**0.22**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

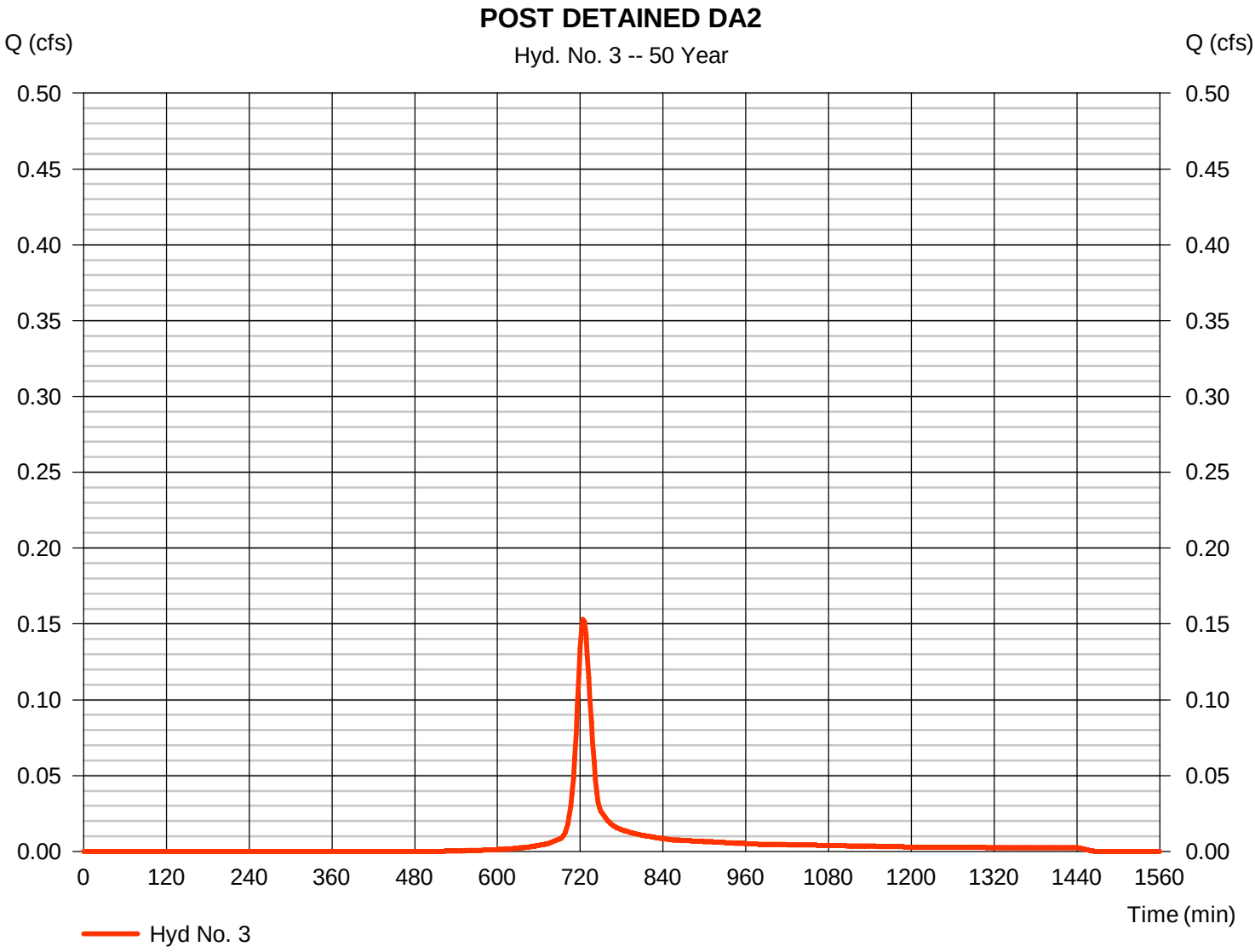
Hydrograph Report

Hyd. No. 3

POST DETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.153 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 480 cuft
Drainage area	= 0.050 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 17.42 min
Total precip.	= 5.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.040 x 71)] / 0.050

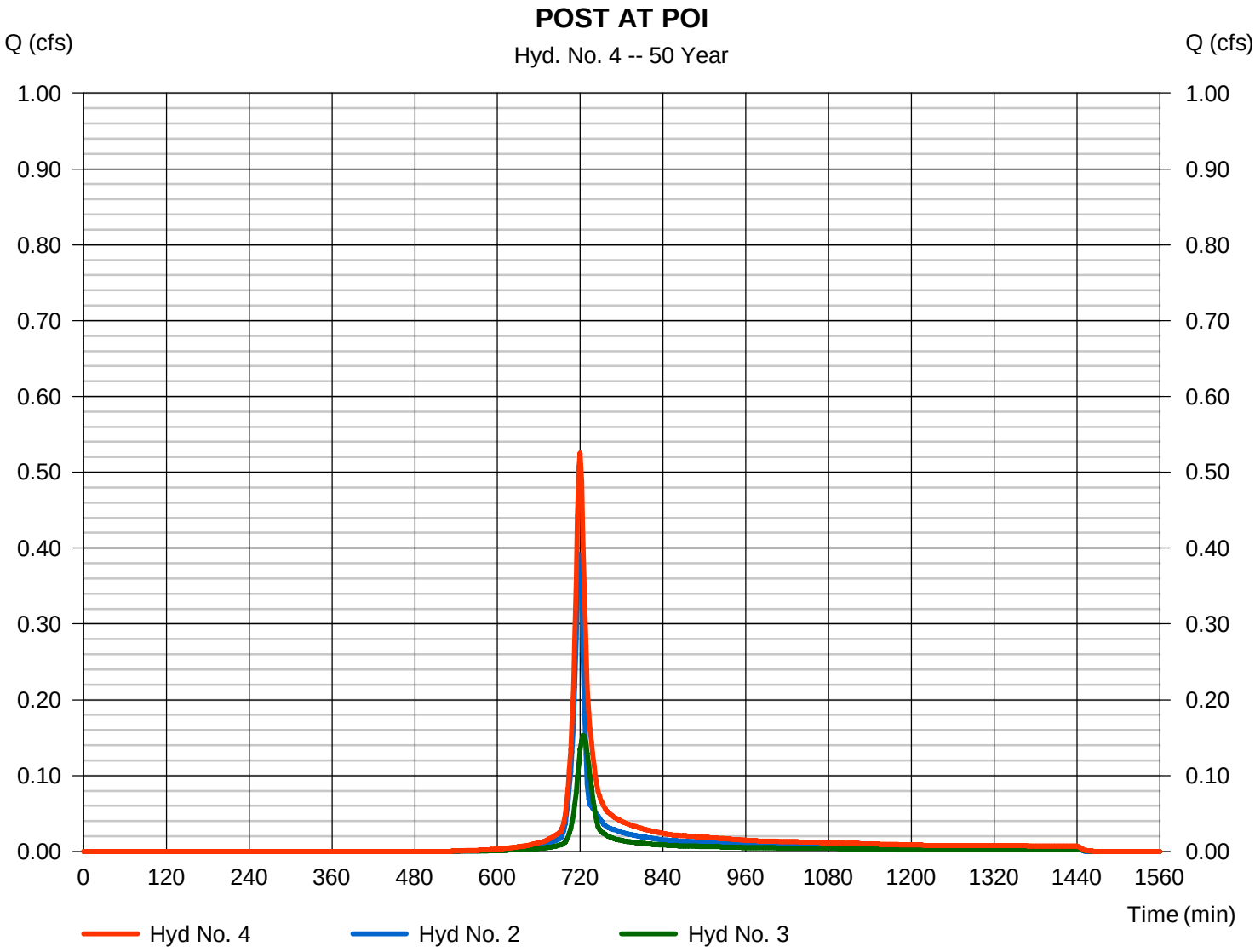


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.525 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 1,377 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.150 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.9938	10.0000	0.8826	--------
2	46.8600	10.1000	0.8723	--------
3	0.0000	0.0000	0.0000	--------
5	47.4204	9.3000	0.8196	--------
10	26589.4199	47.3998	2.1160	--------
25	53942.1797	51.5998	2.2139	--------
50	69308.7266	52.6998	2.2395	--------
100	106327.6016	55.1997	2.2977	--------

File name: Charger 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	3.66	2.84	2.33	1.99	1.73	1.54	1.39	1.27	1.16	1.08	1.00	0.94
2	4.39	3.42	2.82	2.40	2.10	1.87	1.69	1.54	1.42	1.32	1.23	1.15
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	5.36	4.19	3.47	2.98	2.62	2.34	2.12	1.94	1.80	1.67	1.56	1.47
10	6.12	5.04	4.23	3.59	3.09	2.68	2.35	2.07	1.84	1.65	1.48	1.34
25	7.10	5.89	4.95	4.22	3.63	3.16	2.77	2.45	2.17	1.94	1.75	1.58
50	7.88	6.54	5.51	4.70	4.05	3.52	3.09	2.73	2.42	2.17	1.95	1.76
100	8.66	7.21	6.09	5.20	4.48	3.90	3.42	3.02	2.69	2.40	2.16	1.95

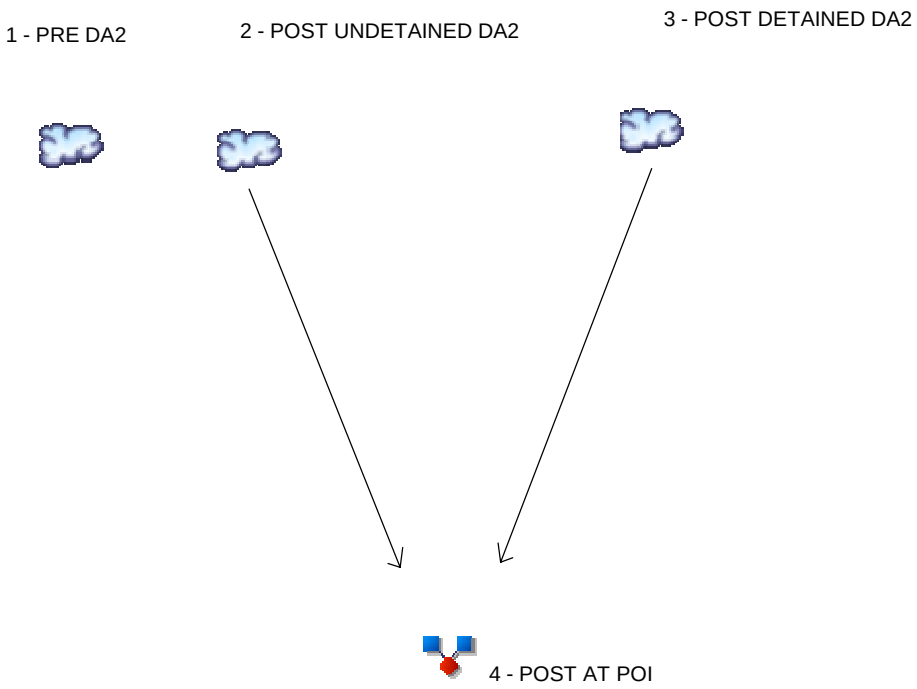
Tc = time in minutes. Values may exceed 60.

hase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Charger\Hydraflow Rev 1\Charger Precip.pc

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	2.22	2.66	0.00	3.30	3.83	4.60	5.24	5.91
SCS 6-Hr	1.46	1.76	0.00	2.21	2.57	3.09	3.52	3.97
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 DA2
2	SCS Runoff	POST UNDETAINED DA2
3	SCS Runoff	POST DETAINED DA2
4	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	------	-------	-------	-------	-------	-------	-------	-------	0.672	PRE DA2
2	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	0.478	POST UNDETAINED DA2
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	0.156	POST DETAINED DA2
4	Combine	2, 3	-------	-------	-------	-------	-------	-------	-------	0.591	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	0.672	2	718	1,539	------	------	------	PRE DA2
2	SCS Runoff	0.478	2	718	1,094	------	------	------	POST UNDETAINED DA2
3	SCS Runoff	0.156	2	728	573	------	------	------	POST DETAINED DA2
4	Combine	0.591	2	720	1,667	2, 3	------	------	POST AT POI

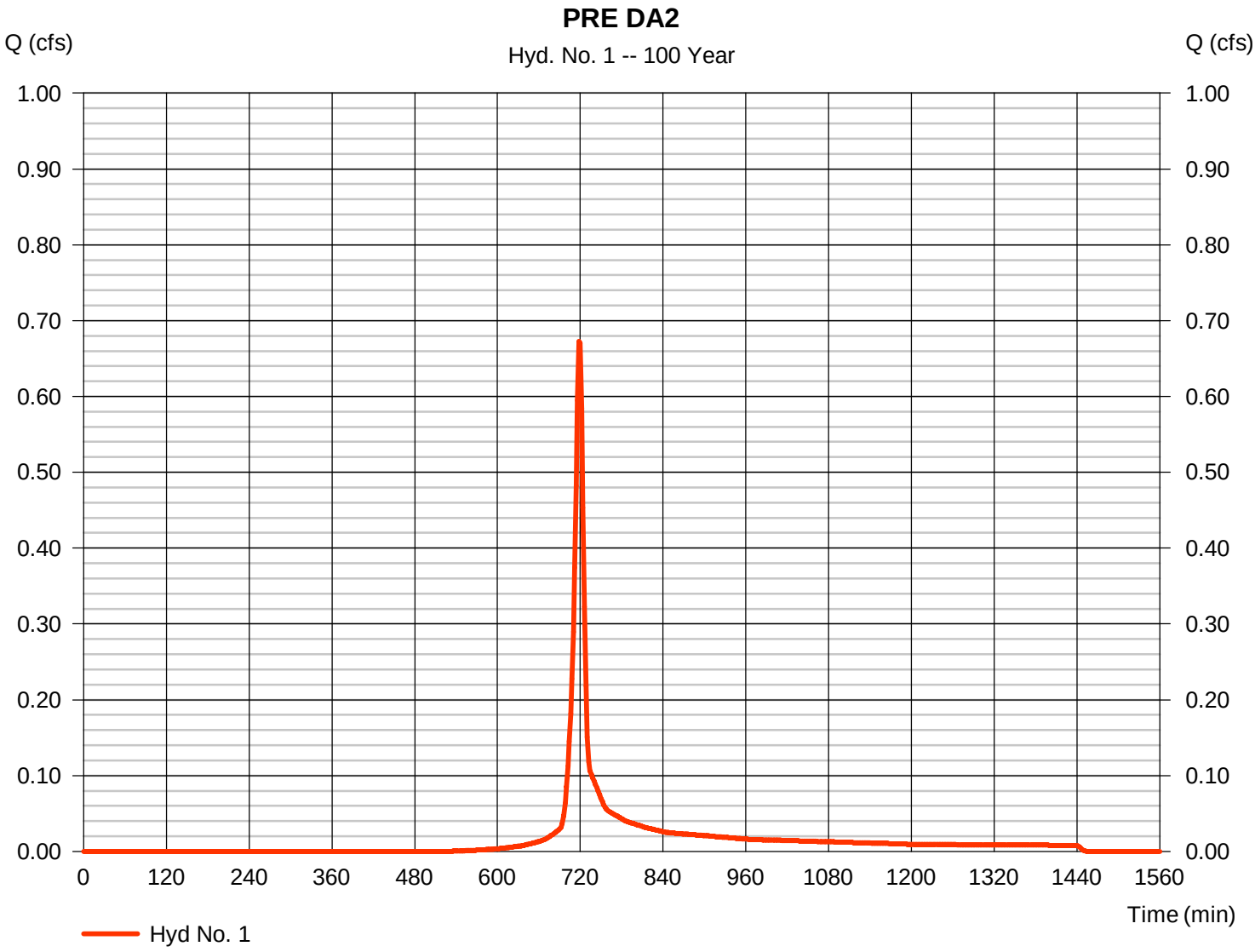
Hydrograph Report

Hyd. No. 1

PRE DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.672 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	1,539 cuft
Drainage area	=	0.150 ac	Curve number	=	71*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	5.91 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 71) + (0.060 x 70)] / 0.150



TR55 Tc Worksheet

Hyd. No. 1

PRE DA2

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)	= 2.66		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 8.22**	**+**	**0.00**	**+**	**0.00**	**=**	**8.22**
Shallow Concentrated Flow							
Flow length (ft)	= 31.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 0.22**	**+**	**0.00**	**+**	**0.00**	**=**	**0.22**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

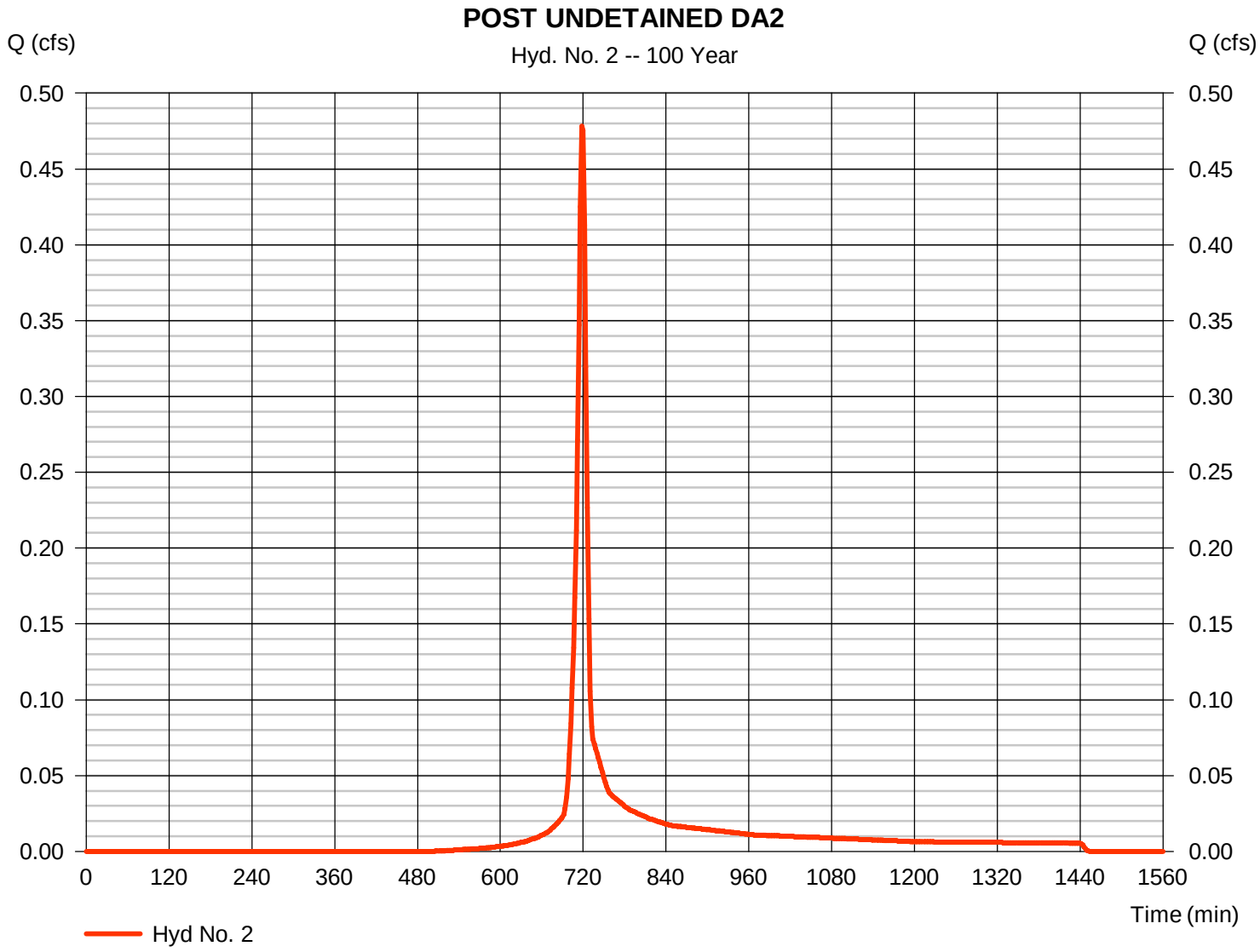
Hydrograph Report

Hyd. No. 2

POST UNDETAINED DA2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.478 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	1,094 cuft
Drainage area	=	0.100 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	5.91 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.010 x 89) + (0.070 x 71) + (0.020 x 70)] / 0.100



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED DA2

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)	= 2.66		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 8.22**	**+**	**0.00**	**+**	**0.00**	**=**	**8.22**
Shallow Concentrated Flow							
Flow length (ft)	= 31.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 0.22**	**+**	**0.00**	**+**	**0.00**	**=**	**0.22**
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	= 0.035		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

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

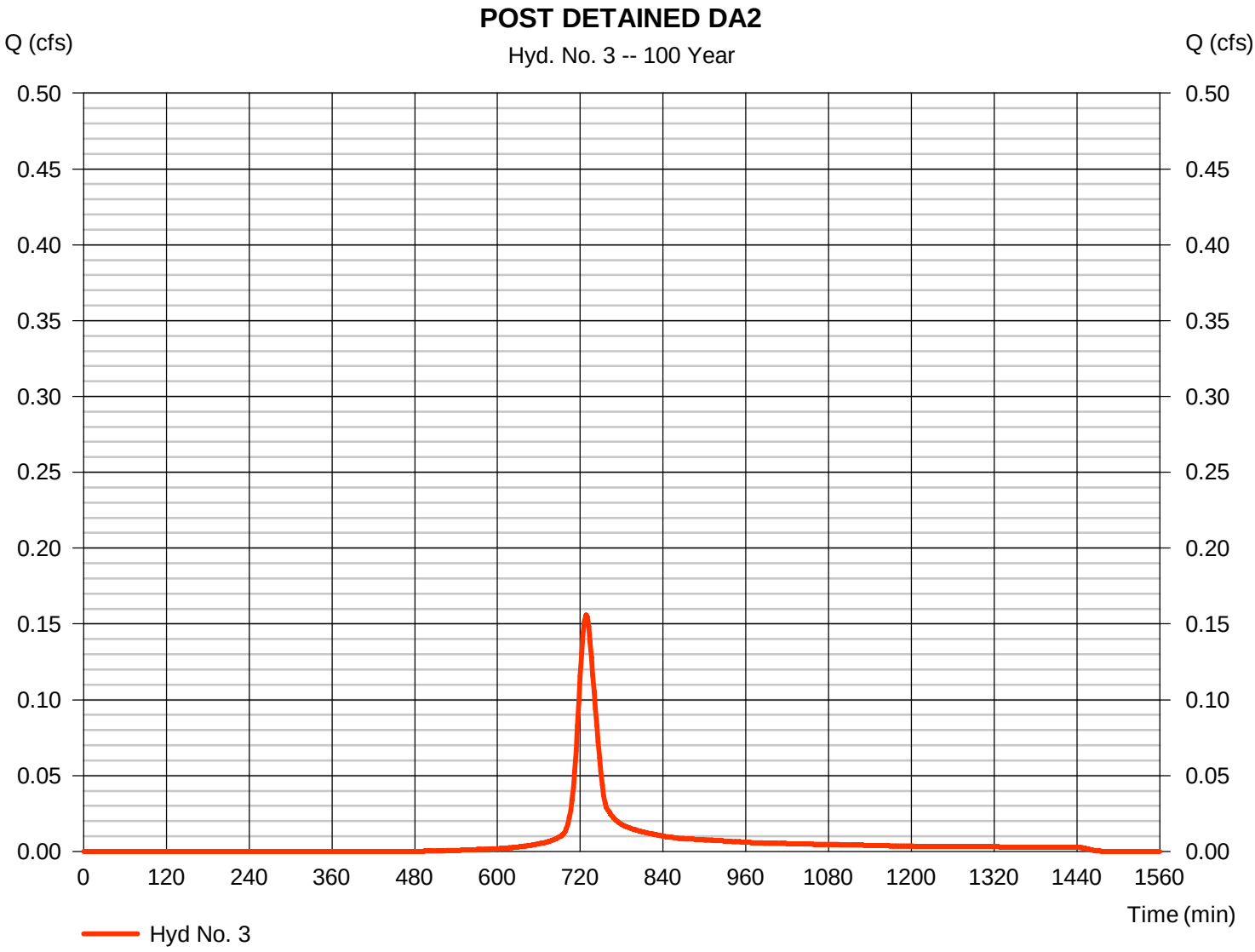
Hydrograph Report

Hyd. No. 3

POST DETAINED DA2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.156 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 573 cuft
Drainage area	= 0.050 ac	Curve number	= 75*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 24.90 min
Total precip.	= 5.91 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 89) + (0.040 x 71)] / 0.050

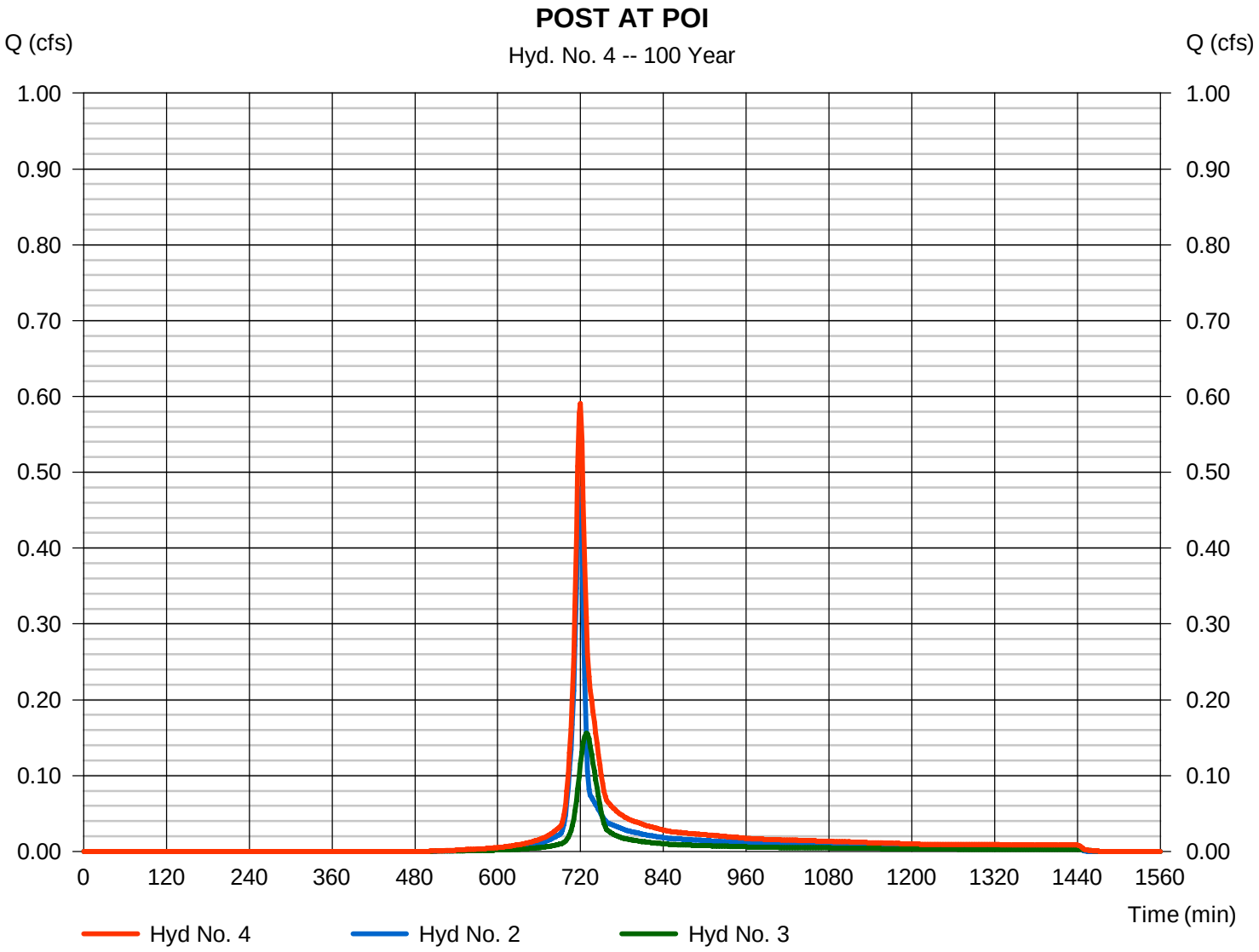


Hydrograph Report

Hyd. No. 4

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	0.591 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	1,667 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	0.150 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.9938	10.0000	0.8826	--------
2	46.8600	10.1000	0.8723	--------
3	0.0000	0.0000	0.0000	--------
5	47.4204	9.3000	0.8196	--------
10	26589.4199	47.3998	2.1160	--------
25	53942.1797	51.5998	2.2139	--------
50	69308.7266	52.6998	2.2395	--------
100	106327.6016	55.1997	2.2977	--------

File name: Charger 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	3.66	2.84	2.33	1.99	1.73	1.54	1.39	1.27	1.16	1.08	1.00	0.94
2	4.39	3.42	2.82	2.40	2.10	1.87	1.69	1.54	1.42	1.32	1.23	1.15
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	5.36	4.19	3.47	2.98	2.62	2.34	2.12	1.94	1.80	1.67	1.56	1.47
10	6.12	5.04	4.23	3.59	3.09	2.68	2.35	2.07	1.84	1.65	1.48	1.34
25	7.10	5.89	4.95	4.22	3.63	3.16	2.77	2.45	2.17	1.94	1.75	1.58
50	7.88	6.54	5.51	4.70	4.05	3.52	3.09	2.73	2.42	2.17	1.95	1.76
100	8.66	7.21	6.09	5.20	4.48	3.90	3.42	3.02	2.69	2.40	2.16	1.95

Tc = time in minutes. Values may exceed 60.

hase 2)\ESCGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Charger\Hydraflow Rev 1\Charger Precip.pc

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	2.22	2.66	0.00	3.30	3.83	4.60	5.24	5.91
SCS 6-Hr	1.46	1.76	0.00	2.21	2.57	3.09	3.52	3.97
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