

**Sinclair Road**

## TETRA TECH, INC.

By: RH Date: 11/16/2016 Subject: Sinclair Road  
Checked By: JB Date: 11/18/2016 PCSM Design and Evaluation

### PURPOSE:

The purpose of these calculations is to design a Post-Construction Stormwater Management (PCSM) Plan for the Sinclair Road block valve site as part of the Sunoco Pipeline L.P. Pennsylvania Pipeline Project. The site is located within Heidelberg Township, Lebanon 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

The Sinclair Road block valve is located in Heidelberg Township, Lebanon County, Pennsylvania. Although Lebanon County has not enacted an Act 167 plan, Heidelberg Township is within Cocalico Creek, which does have an enacted Act 167 Plan, based upon the Lebanon County Stormwater Ordinance. By designing in accordance with PADEP's Stormwater BMP Manual, the requirements outlined in the Stormwater Ordinance will be fulfilled.

#### Recommended Volume Control Guideline

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

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

This site will utilize two infiltration berms to manage the two-year/24-hour volume increase.

#### Recommended Peak Rate Control Guideline

The recommended control guideline for peak rate control is:

- Do not increase the peak rate of discharge for the 2-year through 100-year events (at minimum); as necessary, provide additional peak rate control as required by applicable and approved Act 167 plan.
- The Cocalico Creek Stormwater Ordinance requires detention facilities to meet 50% release rates where the post-development hydrograph peaks are greater than the pre-development.

When BMPs are accounted for, the post-development hydrograph peaks have been reduced from pre-development rates. However, if BMPs are not included, the post-development rates are not less than the pre-development rates. Therefore, the 50% release rate reduction applies.

- The Lebanon County Stormwater Ordinance has recommended specific curve numbers for rate calculations. The rate calculations for this site were determined using the NCRS recommended curve numbers, which follows the requirements set for the in the PADEP manual.

This site will utilize two infiltration berms to manage the 2-year through 100-year peak rate increases. The 50% reduction of release rates have not been met. However, PADEP requirements have been met. This BMP will also help to increase the time of concentration for the drainage area encompassing the block valve.

### **Recommended Water Quality Control Guideline**

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

### **Infiltration**

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

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

Due to site constraints, the proposed infiltration berm is located over both the existing and the proposed pipeline. Infiltration over the existing pipe will not be a problem, because infiltration tests were performed post-construction of the now-existing pipeline. To ensure that infiltration will continue to occur, post-construction infiltration tests will be performed in the area of the proposed berm. Tilling and scarifying of the soil will be performed if the post-construction infiltration rate is deemed too low. Soil amendments can also be added post-construction. This method will ensure that any compaction that does occur during construction will be remedied, thus ensuring that the infiltration berm will work as designed.

The post-construction stormwater management design will utilize onsite infiltration to meet Volume Control Guideline 1.

### **Loading Ratio**

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

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

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

The maximum drainage area loading ratio of 8:1 has not been met. The drainage area loading ratio for the site is 41:1. However, runoff from the site and upslope drainage area will be dispersed to a relatively long infiltration berm. The infiltration berm has been placed to maximize the loading ratio to the maximum extent practicable, and other infiltration design parameters from the PA Stormwater BMP Manual have been met.

### **Disturbed Area**

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

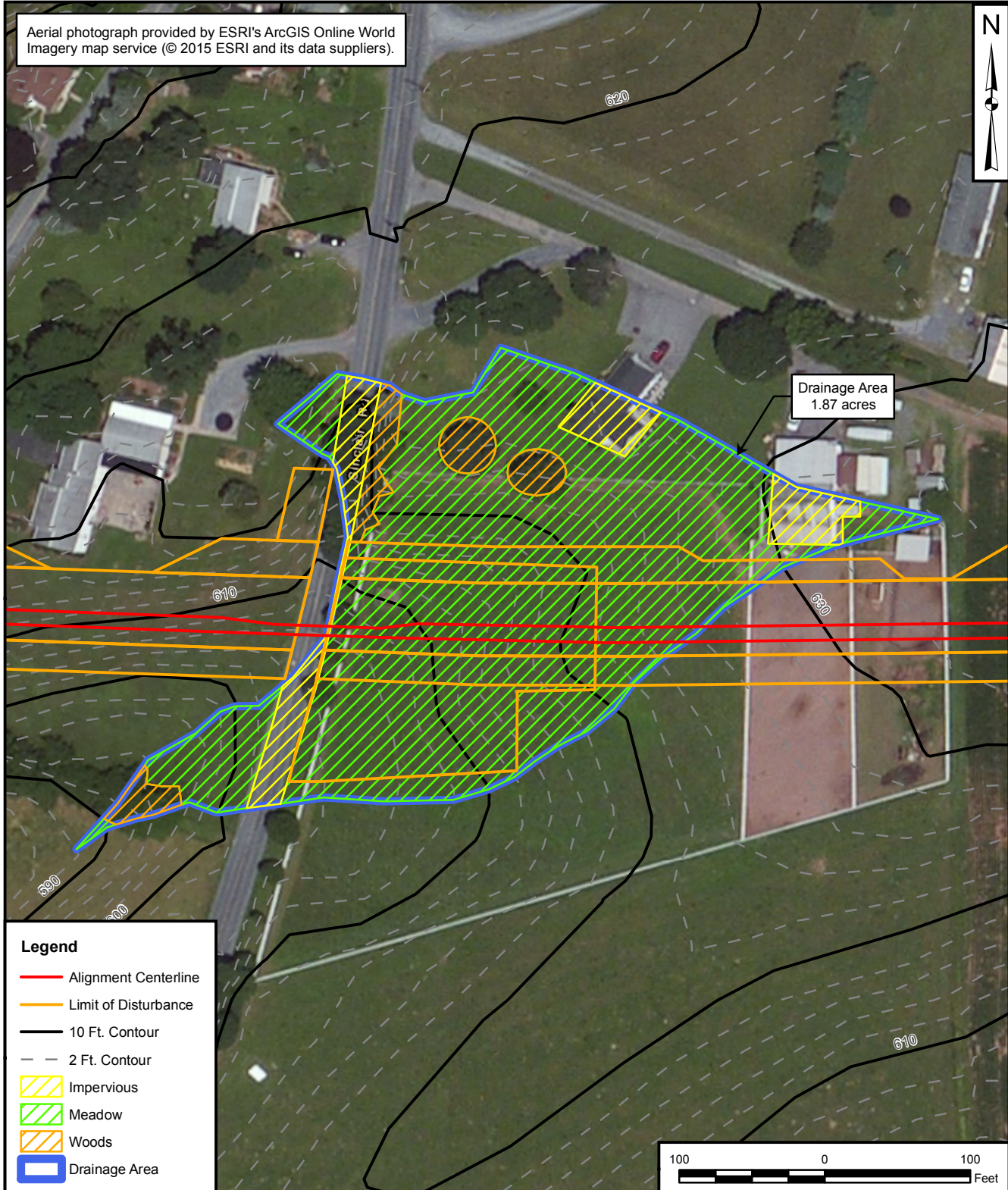
### **Karst Topography**

The Sinclair Road block valve site is not located in an area of known karst terrain.

### **Special Protection Watershed**

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

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



**Legend**

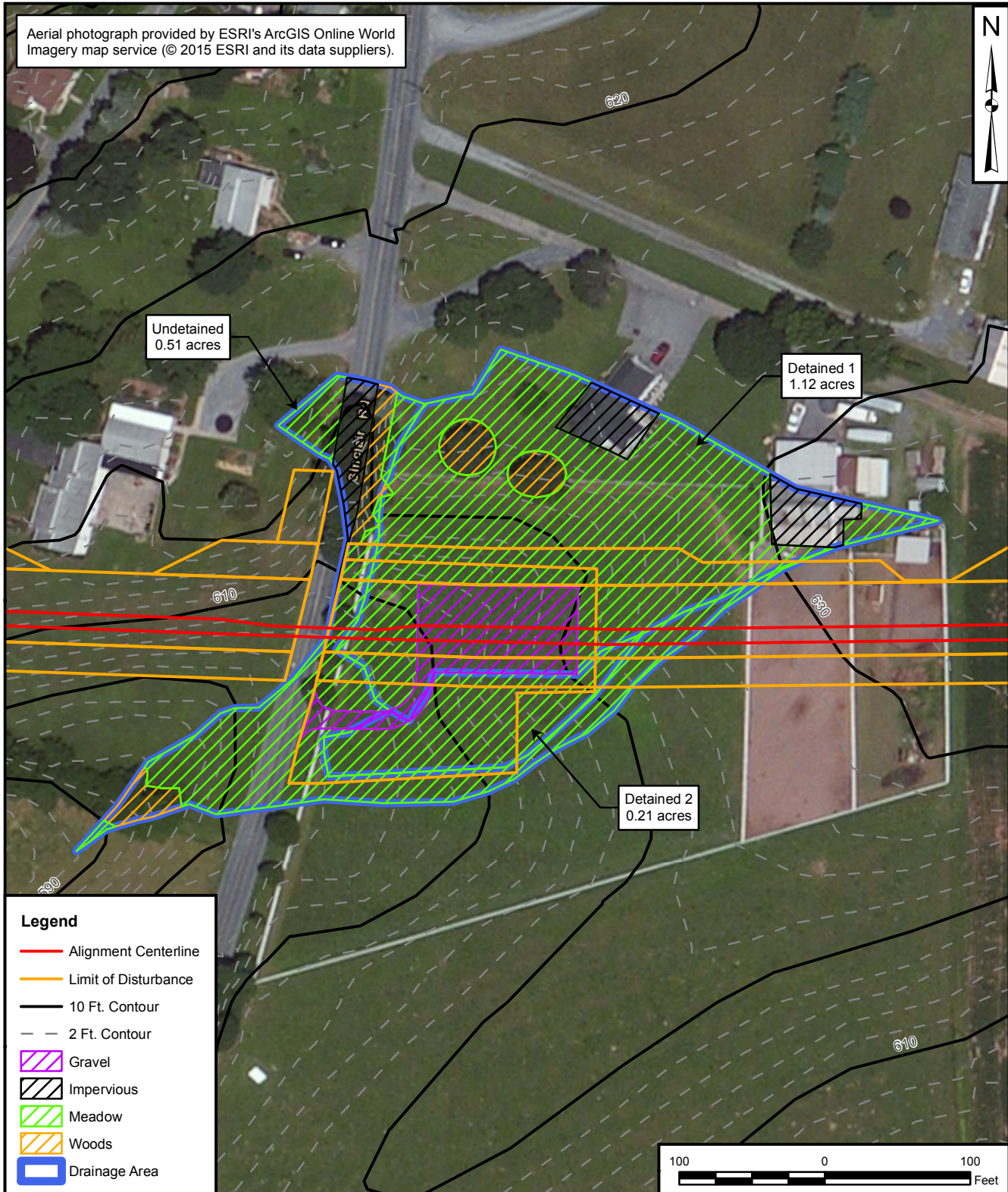
- Alignment Centerline
- Limit of Disturbance
- 10 Ft. Contour
- 2 Ft. Contour
- Impervious
- Meadow
- Woods
- Drainage Area



**PRE-DEVELOPMENT DRAINAGE AREA MAP**  
**SINCLAIR ROAD**  
**PENNSYLVANIA PIPELINE PROJECT**  
**SUNOCO LOGISTICS, L.P.**  
**LEBANON COUNTY, PENNSYLVANIA**

DRAWN BY: J. HERNING 05/04/15	
CHECKED BY: J. BRODY 11/09/16	
APPROVED BY:	
CONTRACT NUMBER: 112IC05958	
FIGURE NUMBER	REV
1	0

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



**Legend**

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



**POST-DEVELOPMENT DRAINAGE AREA MAP**  
**SINCLAIR ROAD**  
**PENNSYLVANIA PIPELINE PROJECT**  
**SUNOCO LOGISTICS, L.P.**  
**LEBANON COUNTY, PENNSYLVANIA**

DRAWN BY: J. HERNING 05/04/15	
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: Heidelberg Twp, Pennsylvania,**  
**USA\***

**Latitude: 40.2854°, Longitude: -76.3°**  
**Elevation: 607.89 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**

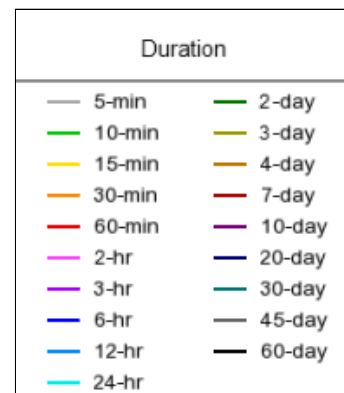
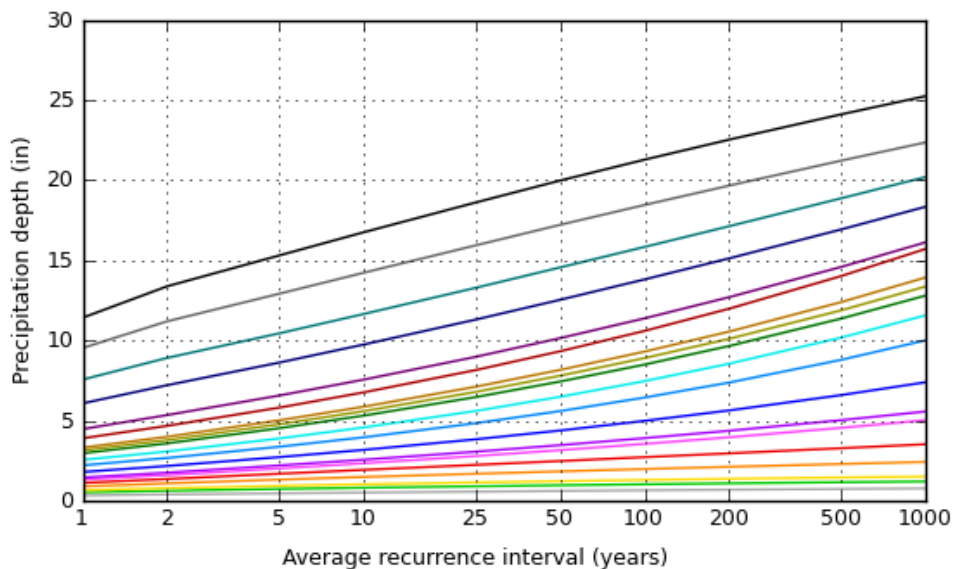
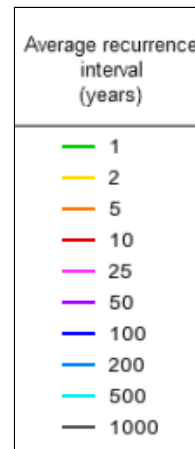
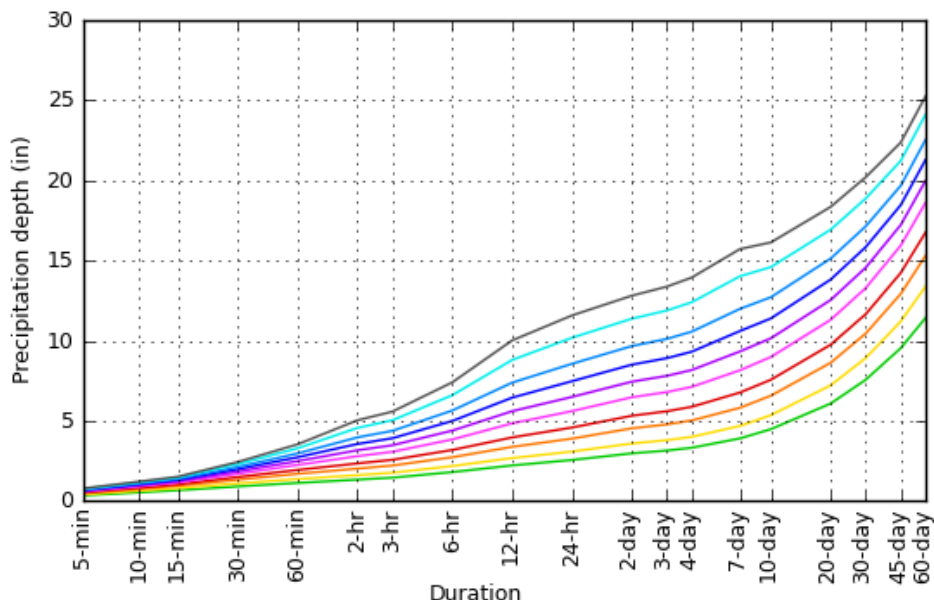
<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
<b>Duration</b>	<b>Average recurrence interval (years)</b>									
	<b>1</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	<b>100</b>	<b>200</b>	<b>500</b>	<b>1000</b>
<b>5-min</b>	<b>0.332</b> (0.300-0.367)	<b>0.395</b> (0.358-0.437)	<b>0.464</b> (0.420-0.515)	<b>0.514</b> (0.464-0.568)	<b>0.571</b> (0.514-0.630)	<b>0.613</b> (0.549-0.675)	<b>0.654</b> (0.583-0.720)	<b>0.693</b> (0.615-0.765)	<b>0.738</b> (0.651-0.815)	<b>0.773</b> (0.677-0.855)
<b>10-min</b>	<b>0.529</b> (0.479-0.585)	<b>0.630</b> (0.571-0.698)	<b>0.740</b> (0.669-0.819)	<b>0.817</b> (0.737-0.903)	<b>0.905</b> (0.814-0.999)	<b>0.970</b> (0.868-1.07)	<b>1.03</b> (0.921-1.14)	<b>1.09</b> (0.968-1.20)	<b>1.16</b> (1.02-1.28)	<b>1.21</b> (1.06-1.33)
<b>15-min</b>	<b>0.660</b> (0.597-0.730)	<b>0.789</b> (0.715-0.875)	<b>0.934</b> (0.844-1.03)	<b>1.03</b> (0.931-1.14)	<b>1.15</b> (1.03-1.26)	<b>1.23</b> (1.10-1.35)	<b>1.30</b> (1.16-1.44)	<b>1.37</b> (1.22-1.51)	<b>1.45</b> (1.28-1.60)	<b>1.51</b> (1.32-1.67)
<b>30-min</b>	<b>0.901</b> (0.815-0.996)	<b>1.09</b> (0.985-1.21)	<b>1.32</b> (1.19-1.46)	<b>1.49</b> (1.34-1.64)	<b>1.69</b> (1.52-1.86)	<b>1.84</b> (1.64-2.02)	<b>1.98</b> (1.77-2.19)	<b>2.12</b> (1.88-2.34)	<b>2.30</b> (2.03-2.54)	<b>2.43</b> (2.13-2.69)
<b>60-min</b>	<b>1.12</b> (1.01-1.24)	<b>1.36</b> (1.23-1.51)	<b>1.69</b> (1.53-1.87)	<b>1.93</b> (1.74-2.13)	<b>2.24</b> (2.01-2.47)	<b>2.48</b> (2.22-2.73)	<b>2.72</b> (2.43-3.00)	<b>2.96</b> (2.63-3.27)	<b>3.28</b> (2.89-3.62)	<b>3.53</b> (3.09-3.90)
<b>2-hr</b>	<b>1.33</b> (1.20-1.48)	<b>1.61</b> (1.45-1.79)	<b>2.02</b> (1.82-2.24)	<b>2.34</b> (2.10-2.60)	<b>2.79</b> (2.50-3.10)	<b>3.16</b> (2.81-3.50)	<b>3.55</b> (3.15-3.94)	<b>3.96</b> (3.48-4.40)	<b>4.55</b> (3.96-5.05)	<b>5.03</b> (4.34-5.60)
<b>3-hr</b>	<b>1.45</b> (1.30-1.62)	<b>1.76</b> (1.58-1.97)	<b>2.21</b> (1.99-2.47)	<b>2.56</b> (2.30-2.86)	<b>3.06</b> (2.73-3.41)	<b>3.47</b> (3.08-3.86)	<b>3.91</b> (3.45-4.34)	<b>4.37</b> (3.83-4.86)	<b>5.03</b> (4.35-5.59)	<b>5.57</b> (4.78-6.21)
<b>6-hr</b>	<b>1.80</b> (1.61-2.02)	<b>2.17</b> (1.95-2.44)	<b>2.73</b> (2.44-3.06)	<b>3.18</b> (2.83-3.56)	<b>3.83</b> (3.40-4.28)	<b>4.39</b> (3.87-4.88)	<b>4.99</b> (4.36-5.54)	<b>5.64</b> (4.89-6.27)	<b>6.59</b> (5.64-7.33)	<b>7.40</b> (6.25-8.24)
<b>12-hr</b>	<b>2.21</b> (1.99-2.50)	<b>2.67</b> (2.40-3.02)	<b>3.37</b> (3.02-3.80)	<b>3.96</b> (3.52-4.45)	<b>4.84</b> (4.27-5.41)	<b>5.60</b> (4.90-6.24)	<b>6.44</b> (5.58-7.17)	<b>7.38</b> (6.32-8.20)	<b>8.79</b> (7.39-9.76)	<b>10.0</b> (8.30-11.1)
<b>24-hr</b>	<b>2.55</b> (2.34-2.81)	<b>3.08</b> (2.83-3.39)	<b>3.89</b> (3.56-4.28)	<b>4.58</b> (4.18-5.02)	<b>5.60</b> (5.08-6.13)	<b>6.49</b> (5.84-7.09)	<b>7.47</b> (6.67-8.14)	<b>8.56</b> (7.56-9.30)	<b>10.2</b> (8.87-11.0)	<b>11.6</b> (9.96-12.5)
<b>2-day</b>	<b>2.97</b> (2.73-3.26)	<b>3.58</b> (3.29-3.94)	<b>4.53</b> (4.15-4.97)	<b>5.31</b> (4.86-5.82)	<b>6.47</b> (5.87-7.06)	<b>7.44</b> (6.71-8.11)	<b>8.50</b> (7.62-9.25)	<b>9.66</b> (8.59-10.5)	<b>11.4</b> (9.97-12.4)	<b>12.8</b> (11.1-13.9)
<b>3-day</b>	<b>3.14</b> (2.89-3.44)	<b>3.79</b> (3.49-4.15)	<b>4.77</b> (4.39-5.22)	<b>5.59</b> (5.12-6.11)	<b>6.79</b> (6.18-7.40)	<b>7.80</b> (7.07-8.49)	<b>8.91</b> (8.01-9.67)	<b>10.1</b> (9.02-11.0)	<b>11.9</b> (10.5-12.9)	<b>13.4</b> (11.7-14.5)
<b>4-day</b>	<b>3.32</b> (3.06-3.62)	<b>4.00</b> (3.69-4.37)	<b>5.02</b> (4.62-5.48)	<b>5.87</b> (5.39-6.40)	<b>7.12</b> (6.50-7.73)	<b>8.17</b> (7.42-8.87)	<b>9.31</b> (8.41-10.1)	<b>10.6</b> (9.46-11.4)	<b>12.4</b> (11.0-13.4)	<b>13.9</b> (12.2-15.1)
<b>7-day</b>	<b>3.90</b> (3.61-4.25)	<b>4.68</b> (4.33-5.10)	<b>5.81</b> (5.37-6.33)	<b>6.76</b> (6.24-7.35)	<b>8.15</b> (7.48-8.84)	<b>9.33</b> (8.52-10.1)	<b>10.6</b> (9.62-11.5)	<b>12.0</b> (10.8-13.0)	<b>14.0</b> (12.5-15.2)	<b>15.7</b> (13.9-17.0)
<b>10-day</b>	<b>4.47</b> (4.16-4.84)	<b>5.35</b> (4.98-5.79)	<b>6.57</b> (6.10-7.10)	<b>7.56</b> (7.01-8.16)	<b>8.98</b> (8.29-9.68)	<b>10.1</b> (9.33-10.9)	<b>11.4</b> (10.4-12.3)	<b>12.7</b> (11.6-13.7)	<b>14.6</b> (13.1-15.7)	<b>16.1</b> (14.4-17.4)
<b>20-day</b>	<b>6.08</b> (5.71-6.48)	<b>7.21</b> (6.78-7.70)	<b>8.62</b> (8.10-9.20)	<b>9.75</b> (9.14-10.4)	<b>11.3</b> (10.6-12.0)	<b>12.5</b> (11.7-13.4)	<b>13.8</b> (12.8-14.7)	<b>15.1</b> (14.0-16.1)	<b>16.9</b> (15.6-18.1)	<b>18.4</b> (16.8-19.6)
<b>30-day</b>	<b>7.56</b> (7.13-8.03)	<b>8.92</b> (8.42-9.47)	<b>10.4</b> (9.86-11.1)	<b>11.7</b> (11.0-12.4)	<b>13.3</b> (12.5-14.1)	<b>14.6</b> (13.7-15.4)	<b>15.8</b> (14.8-16.8)	<b>17.1</b> (16.0-18.2)	<b>18.9</b> (17.5-20.1)	<b>20.2</b> (18.6-21.5)
<b>45-day</b>	<b>9.54</b> (9.05-10.1)	<b>11.2</b> (10.6-11.8)	<b>12.9</b> (12.3-13.6)	<b>14.2</b> (13.5-15.0)	<b>15.9</b> (15.1-16.8)	<b>17.2</b> (16.3-18.1)	<b>18.5</b> (17.4-19.4)	<b>19.7</b> (18.5-20.7)	<b>21.2</b> (19.9-22.4)	<b>22.4</b> (20.9-23.6)
<b>60-day</b>	<b>11.4</b> (10.9-12.0)	<b>13.4</b> (12.7-14.1)	<b>15.3</b> (14.6-16.1)	<b>16.8</b> (15.9-17.6)	<b>18.6</b> (17.7-19.6)	<b>20.0</b> (18.9-21.0)	<b>21.3</b> (20.2-22.4)	<b>22.5</b> (21.3-23.7)	<b>24.1</b> (22.7-25.4)	<b>25.3</b> (23.7-26.6)

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

[Back to Top](#)

### PF graphical

PDS-based depth-duration-frequency (DDF) curves  
 Latitude: 40.2854°, Longitude: -76.3000°



[Back to Top](#)

### Maps & aerials

Small scale terrain



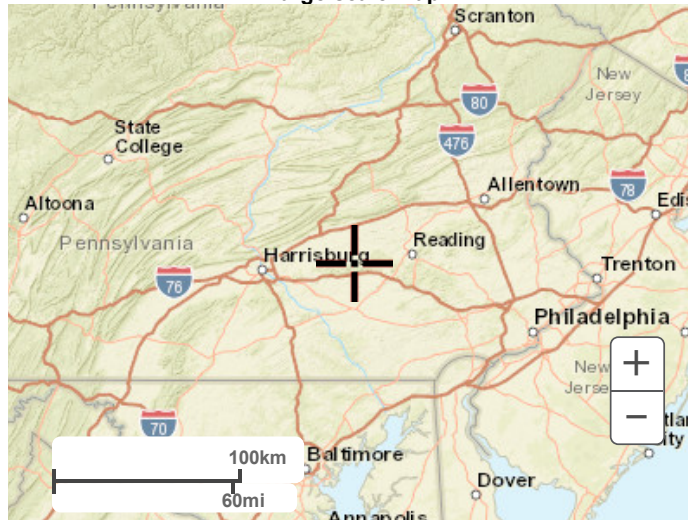




Large scale terrain



Large scale map



Large scale aerial



[Back to Top](#)

**WORKSHEET 1. GENERAL SITE INFORMATION**

**Date:** November 11, 2016

**Project Name:** Sinclair Road

**Municipality:** Heidelberg

**County:** Lebanon

**Total Area (acres):** 1.84

**Major River Basin:** Susquehanna River

**Watershed:** Conestoga River

**Sub Basin:** Hammer Creek

**Nearest Surface Water to Receive Runoff:** Tributary #07680 to Hammer Creek

**Chapter 93 - Designated Water Use:** Cold Water Fishes (CWF)

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

***Is Project Subject to, or Part of:***

**Municipal Separate Storm Sewer System (MS4) Requirements** YES   
NO

**Existing or Planned drinking water supply?** YES   
NO

**If yes, distance from proposed discharge (miles):** \_\_\_\_\_

**Approved Act 167 Plan?** YES   
NO

**Existing River Conservation Plan?** YES   
NO

## Worksheet 2. Sensitive Natural Resources

### INSTRUCTIONS

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

See pre-development drainage area map

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

0.00 acres

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

0.00 acres

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

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

## 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.
<b>TOTAL</b>	<b>0.00 Ac</b>

Site Area	Minus	Protected Area	=	Stormwater Management Area
0.80	-	0	=	0.80
				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 <sup>2</sup>	x 1/4" x 1/12	=	_____ ft <sup>3</sup>
	_____			
Meadow	_____ ft <sup>2</sup>	x 1/3" x 1/12	=	_____ ft <sup>3</sup>

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

*For Trees within 100 feet of impervious area:*

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

#### 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 <sup>2</sup>	x 1/3" x 1/12	=	_____ ft <sup>3</sup>
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*For all other disconnected roof areas*

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

*For Runoff directed to areas protected under 5.8.1 and 5.8.2*

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

Impervious Area	_____ ft <sup>2</sup>	x 1/4" x 1/12	=	_____ ft <sup>3</sup>
-----------------	-----------------------	---------------	---	-----------------------

**TOTAL NON-STRUCTURAL VOLUME CREDIT\*** \_\_\_\_\_ ft<sup>3</sup>

*\*For use on Worksheet 5*

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

PROJECT: Sinclair Road  
 Drainage Area: 1.84 acres  
 2-Year Rainfall: 3.08 in

Total Site Area: 0.80 acres  
 Protected Site Area: N/A acres  
 Managed Site Area: 0.80 acres

Existing Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	la (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>3</sup> (ft <sup>3</sup> )
Impervious	B	131	0.00	98	0.20	0.04	2.85	31
Woods	B	0	0.00	55	8.18	1.64	0.22	0
Meadow	B	34,674	0.80	58	7.24	1.45	0.30	867
<b>TOTAL:</b>		<b>34,805</b>	<b>0.80</b>					<b>898</b>

Developed Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	la (0.2*S)	Q Runoff <sup>1</sup> (in)	Runoff Volume <sup>3</sup> (ft <sup>3</sup> )
Impervious - Gravel	B	7,928	0.18	85	1.76	0.35	1.66	1,094
Meadow	B	26,877	0.62	58	7.24	1.45	0.30	672
<b>TOTAL:</b>		<b>34,805</b>	<b>0.80</b>					<b>1,766</b>

<b>2-Year Volume Increase (ft<sup>3</sup>):</b>	<b>868</b>
---	------------

**2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume**

- Runoff (in) =  $Q = (P - 0.2S) / (P + 0.8S)$  where  
 P = 2-Year Rainfall (in)  
 S =  $(1000/CN) - 10$
- Runoff Volume (CF) =  $Q \times \text{Area} \times 1/12$   
 Q = Runoff (in)  
 Area = Land use area (sq. ft.)

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

Worksheet 5. Structural BMP Volume Credits

PROJECT: Sinclair Road  
 SUB-BASIN: \_\_\_\_\_

Required Control Volume (ft<sup>3</sup>) - from Worksheet 4: 868  
 Non-structural Volume Credit (ft<sup>3</sup>) - from Worksheet 3: N/A  
 (maximum is 25% of required volume)  
 Structural Volume Reqmt (ft<sup>3</sup>) 868  
 (Required Control Volume minus Non-structural Credit)

Proposed BMPs from PA Stormwater Best Management Practices Manual Chapter 6	Area (ft <sup>2</sup> )	Volume Reduction Permanently Removed (ft <sup>3</sup> )
6.4.1 Porous Pavement		
6.4.2 Infiltration Basin		
6.4.3 Infiltration Bed		
6.4.4 Infiltration Trench		
6.4.5 Rain Garden/Bioretenion		
6.4.6 Dry Well/Seepage Pit		
6.4.7 Constructed Filter		
6.4.8 Vegetated Swale		
6.4.9 Vegetated Filter Strip		
6.4.10 Berm	1,418	1,316
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:		
<b>Total Structural Volume (ft<sup>3</sup>):</b>		<b>1,316</b>
<b>Structural Volume Requirement (ft<sup>3</sup>):</b>		<b>868</b>
<b>VOLUME CREDIT DETERMINATION</b>		<b>DIFFERENCE: -448</b>

- 1 Detained area runoff volume from Hydraflow = 2,277 cf
- 2 Storage volume of the BMP = 1,316 cf
- 3 Infiltrated volume within 72 hours after the 2-yr/24-hr event  
 (Infiltration Rate/12) x Infiltration Area x 72 hrs = 1,316 cf

Potential infiltrated volume = 20164 cf. Since this is greater than the storage volume, only the storage volume can be used and assumed to infiltrate within 72 hours.

## WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

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

**PRIMARY BMPs FOR NITRATE:**

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

**SECONDARY BMPs FOR NITRATE:**

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

INFILTRATION BERM DEWATERING CALCULATION

SITE NAME: Sinclair Road

---

STORAGE VOLUME 1,316 CF  
DESIGN INFILTRATION RATE 2.37 IN/HR BASED ON IT-01 AND IT-02  
INFILTRATION AREA 1418 SF

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

<b>DEWATERING TIME =</b>	<b>4.7 HOURS</b>
--------------------------	------------------



**TIME OF CONCENTRATION ADJUSTMENT**

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT 12.4 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 1,316 CF

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	0.716
10 YR/24 HR	2.144
50 YR/24 HR	4.345
100 YR/24 HR	5.591

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

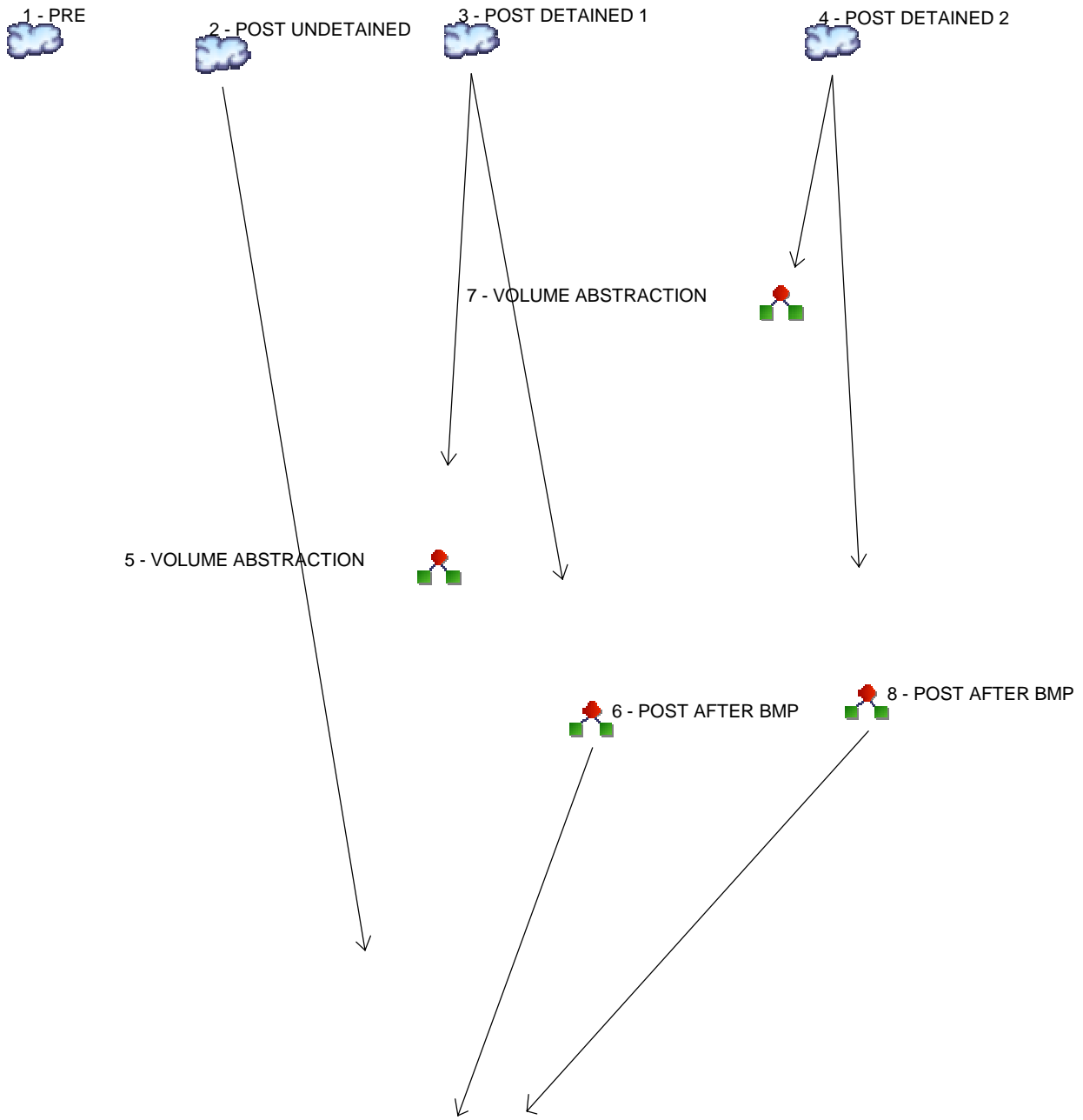
Storm Event	Q (CFS)	Additional Residence Time (min.)
2 YR/24 HR	0.716	30.633
10 YR/24 HR	2.144	10.230
50 YR/24 HR	4.345	5.048
100 YR/24 HR	5.591	3.923

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	0.716	30.633	43.033
10 YR/24 HR	2.144	10.230	22.630
50 YR/24 HR	4.345	5.048	17.448
100 YR/24 HR	5.591	3.923	16.323

# Watershed Model Schematic

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



**Legend**

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



# Hydrograph Return Period Recap

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

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	0.705	-----	-----	2.918	-----	6.523	8.577	PRE
2	SCS Runoff	-----	-----	0.270	-----	-----	0.951	-----	2.031	2.640	POST UNDETAINED
3	SCS Runoff	-----	-----	0.716	-----	-----	2.144	-----	4.345	5.591	POST DETAINED 1
4	SCS Runoff	-----	-----	0.080	-----	-----	0.343	-----	0.770	1.014	POST DETAINED 2
5	Diversion1	3	-----	0.716	-----	-----	2.144	-----	2.619	1.641	VOLUME ABSTRACTION
6	Diversion2	3	-----	0.049	-----	-----	1.998	-----	4.345	5.591	POST AFTER BMP
7	Diversion1	4	-----	0.080	-----	-----	0.343	-----	0.237	0.209	VOLUME ABSTRACTION
8	Diversion2	4	-----	0.006	-----	-----	0.292	-----	0.770	1.014	POST AFTER BMP
9	Combine	2, 6, 8	-----	0.270	-----	-----	2.413	-----	6.751	8.781	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	0.705	2	722	2,422	-----	-----	-----	PRE	
2	SCS Runoff	0.270	2	718	687	-----	-----	-----	POST UNDETAINED	
3	SCS Runoff	0.716	2	722	2,277	-----	-----	-----	POST DETAINED 1	
4	SCS Runoff	0.080	2	718	236	-----	-----	-----	POST DETAINED 2	
5	Diversion1	0.716	2	722	1,317	3	-----	-----	VOLUME ABSTRACTION	
6	Diversion2	0.049	2	860	960	3	-----	-----	POST AFTER BMP	
7	Diversion1	0.080	2	718	118	4	-----	-----	VOLUME ABSTRACTION	
8	Diversion2	0.006	2	858	118	4	-----	-----	POST AFTER BMP	
9	Combine	0.270	2	718	1,764	2, 6, 8	-----	-----	POST AT POI	
Schaefferstown.gpw					Return Period: 2 Year			Friday, 10 / 21 / 2016		

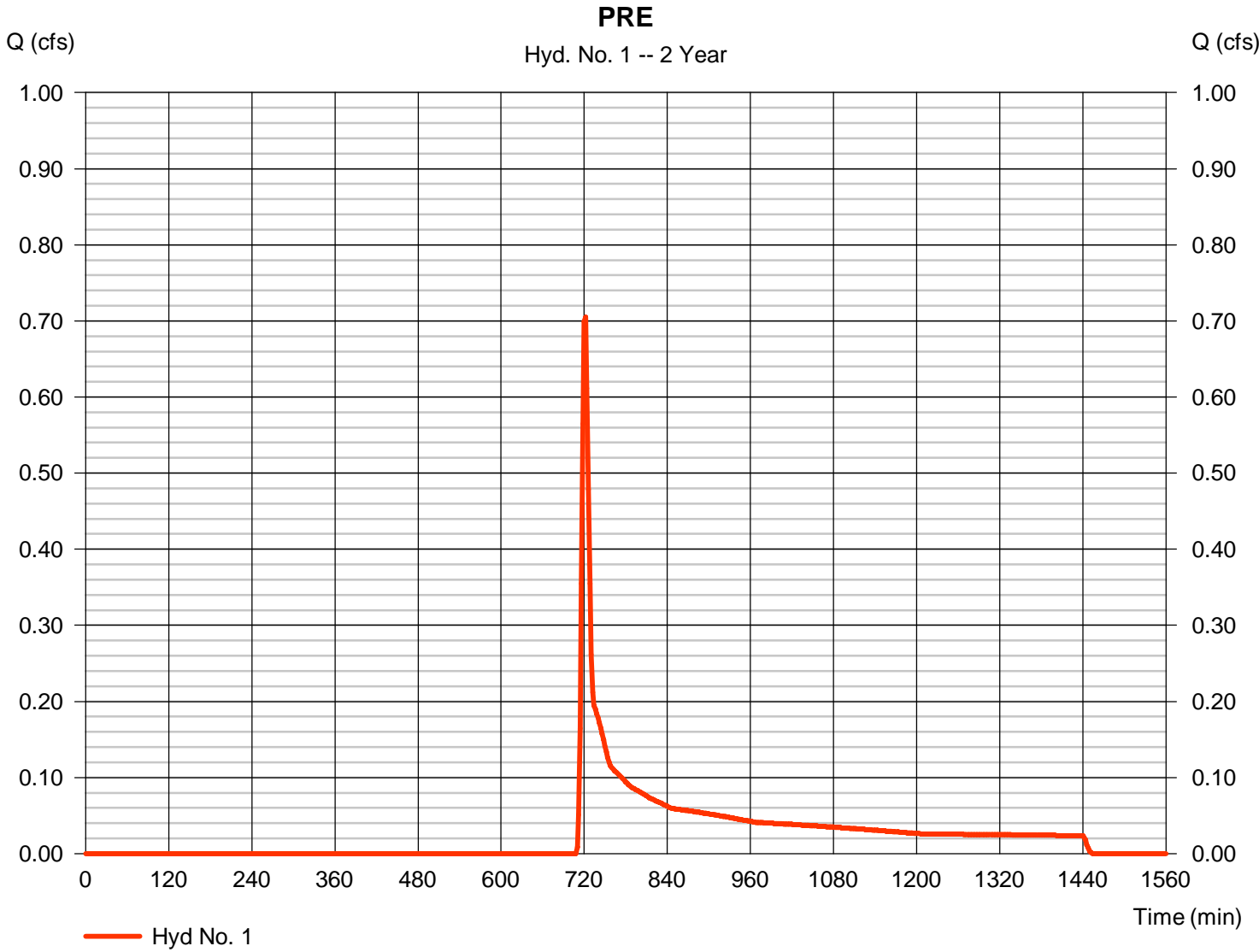
# Hydrograph Report

## Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 0.705 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 2,422 cuft
Drainage area	= 1.840 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 3.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.090 x 98) + (0.070 x 55) + (1.680 x 58)] / 1.840



# TR55 Tc Worksheet

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

## Hyd. No. 1

PRE

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 2.60	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 7.52</b>	<b>+</b>	<b>0.00</b>	<b>+</b>
			<b>0.00</b>	<b>= 7.52</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 360.00	220.00	0.00	
Watercourse slope (%)	= 7.30	8.70	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=4.36	4.76	0.00	
<b>Travel Time (min)</b>	<b>= 1.38</b>	<b>+</b>	<b>0.77</b>	<b>+</b>
			<b>0.00</b>	<b>= 2.15</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b>	<b>0.00</b>	<b>+</b>
			<b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>9.70 min</b>

# Hydrograph Report

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

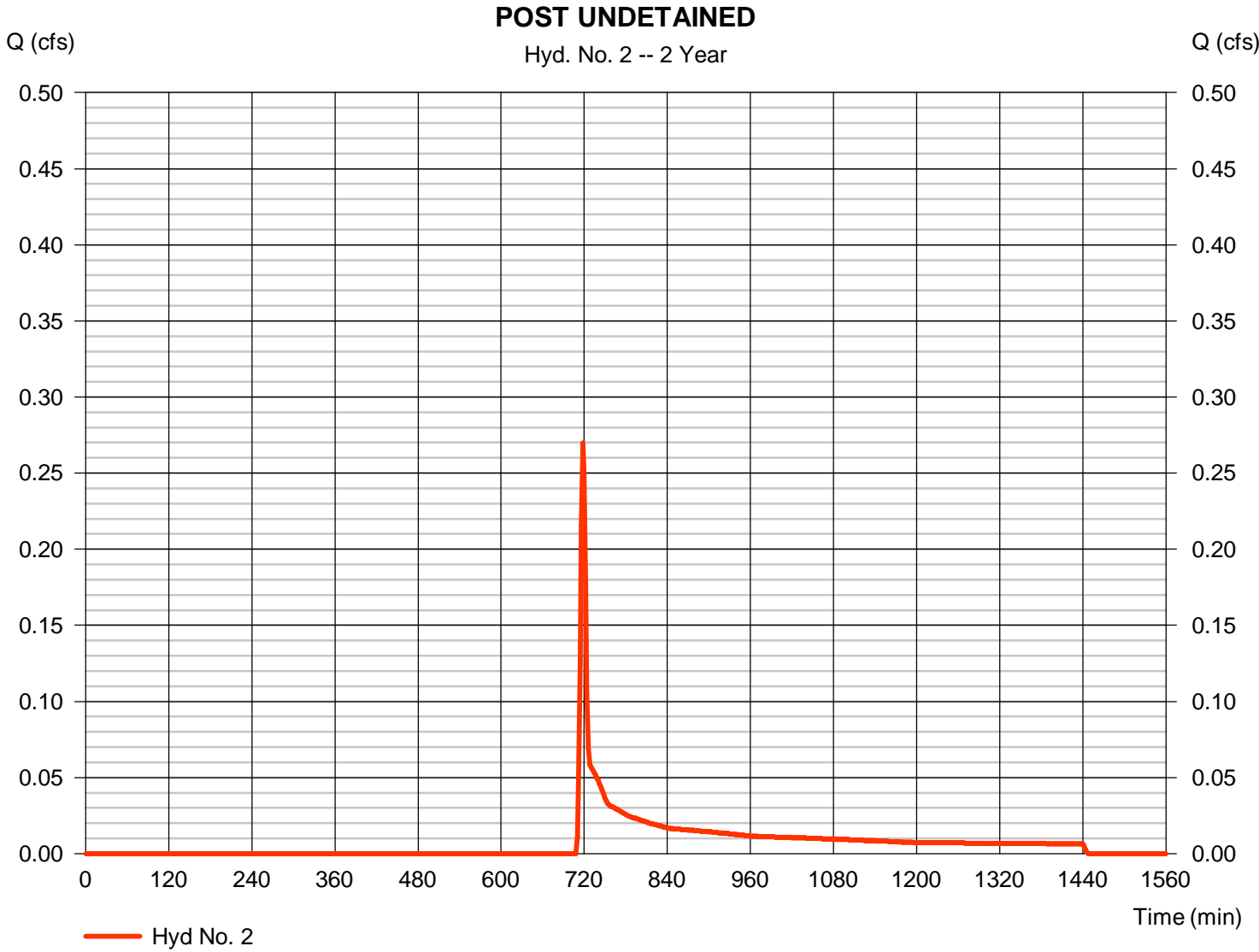
Friday, 10 / 21 / 2016

## Hyd. No. 2

### POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 0.270 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 687 cuft
Drainage area	= 0.510 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.20 min
Total precip.	= 3.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.050 x 55) + (0.410 x 58) + (0.040 x 98) + (0.010 x 85)] / 0.510



# TR55 Tc Worksheet

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

## Hyd. No. 2

POST UNDETAINED

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 4.08</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 4.08</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 187.00	172.00	0.00	
Watercourse slope (%)	= 9.10	8.70	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.87	6.00	0.00	
<b>Travel Time (min)</b>	<b>= 0.64</b>	<b>+</b> <b>0.48</b>	<b>+</b> <b>0.00</b>	<b>= 1.12</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>5.20 min</b>



# Hydrograph Report

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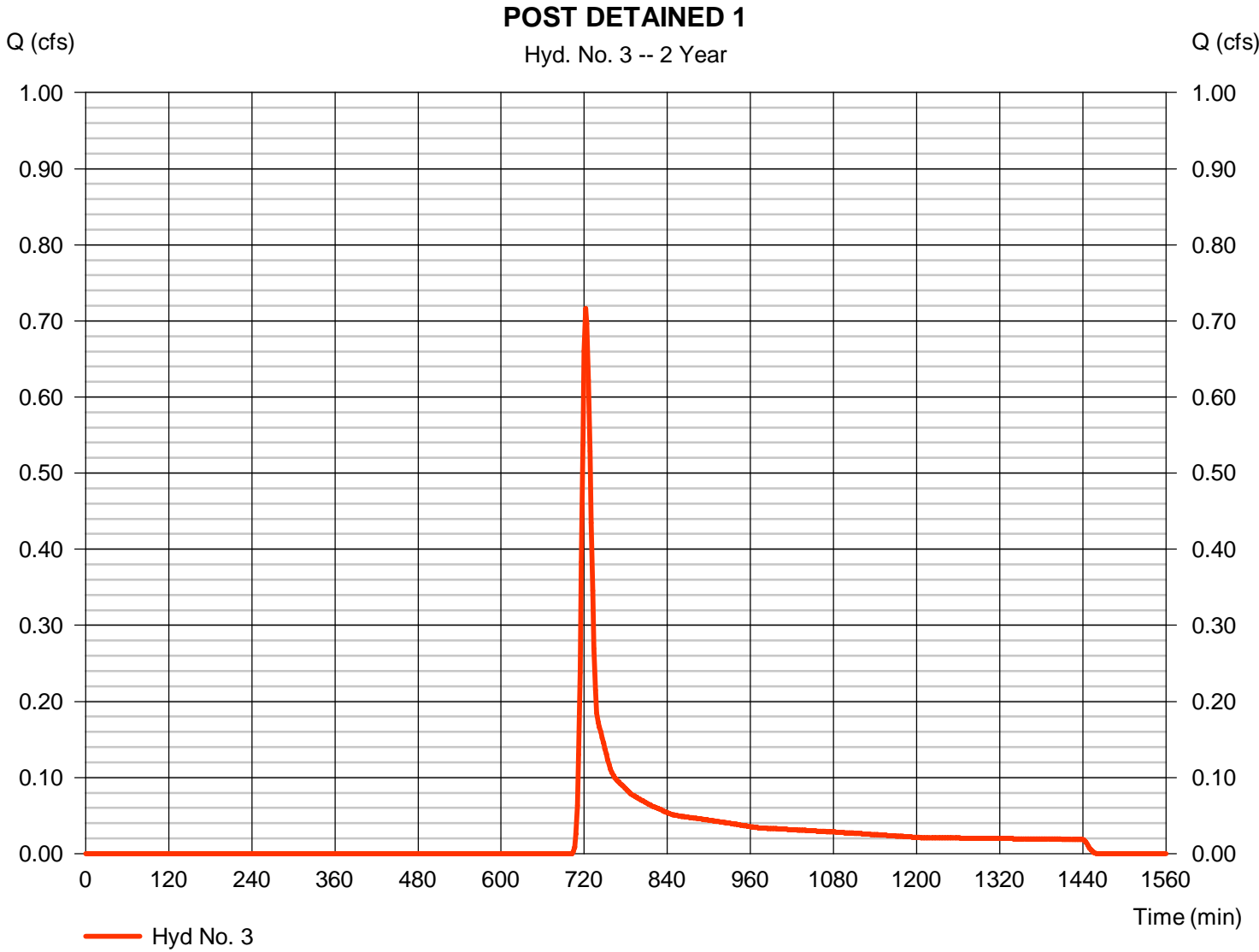
Friday, 10 / 21 / 2016

## Hyd. No. 3

### POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.716 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 2,277 cuft
Drainage area	= 1.120 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.40 min
Total precip.	= 3.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (0.160 x 85) + (0.050 x 55) + (0.830 x 58)] / 1.120



# TR55 Tc Worksheet

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

## Hyd. No. 3

POST DETAINED 1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 1.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 11.02</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 11.02</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 360.00	0.00	0.00	
Watercourse slope (%)	= 7.30	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.36	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 1.38</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 1.38</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>12.40 min</b>

# Hydrograph Report

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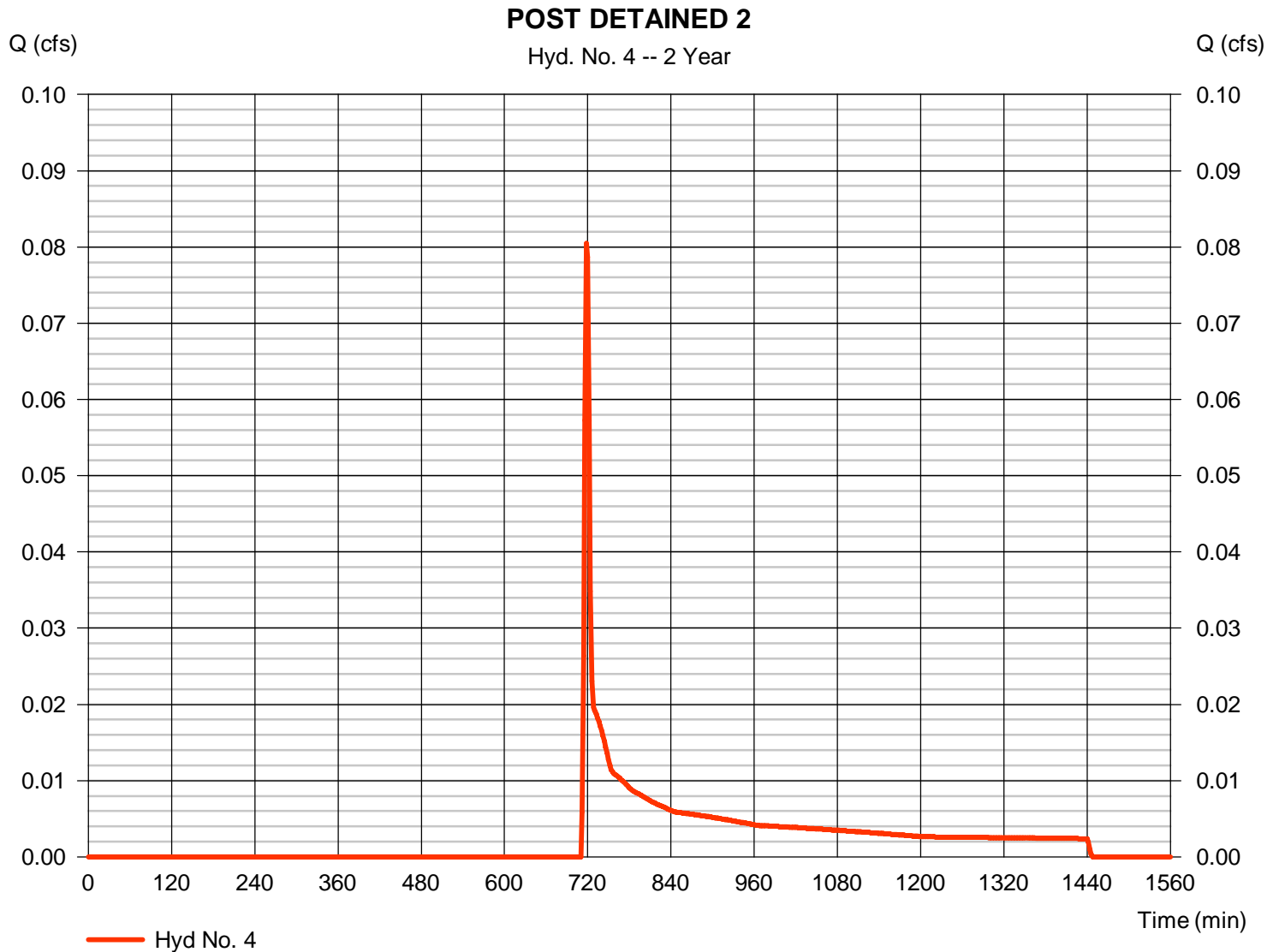
Friday, 10 / 21 / 2016

## Hyd. No. 4

### POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.080 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 236 cuft
Drainage area	= 0.210 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.60 min
Total precip.	= 3.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.010 x 85) + (0.200 x 58)] / 0.210



# TR55 Tc Worksheet

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

## Hyd. No. 4

POST DETAINED 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 5.38</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 5.38</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 78.00	0.00	0.00	
Watercourse slope (%)	= 10.30	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=5.18	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 0.25</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.25</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>5.60 min</b>

# Hydrograph Report

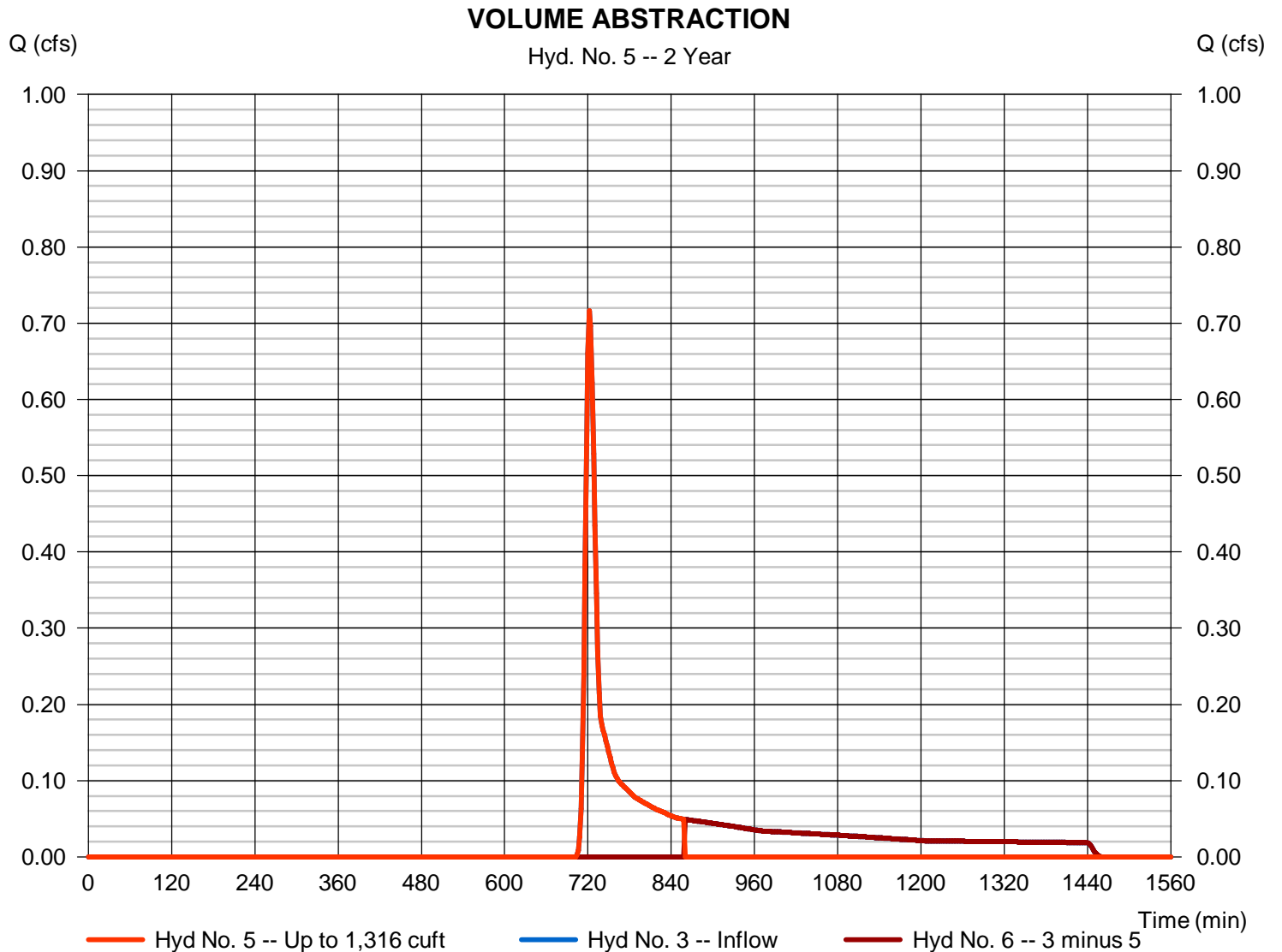
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Friday, 10 / 21 / 2016

## Hyd. No. 5

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.716 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 1,317 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

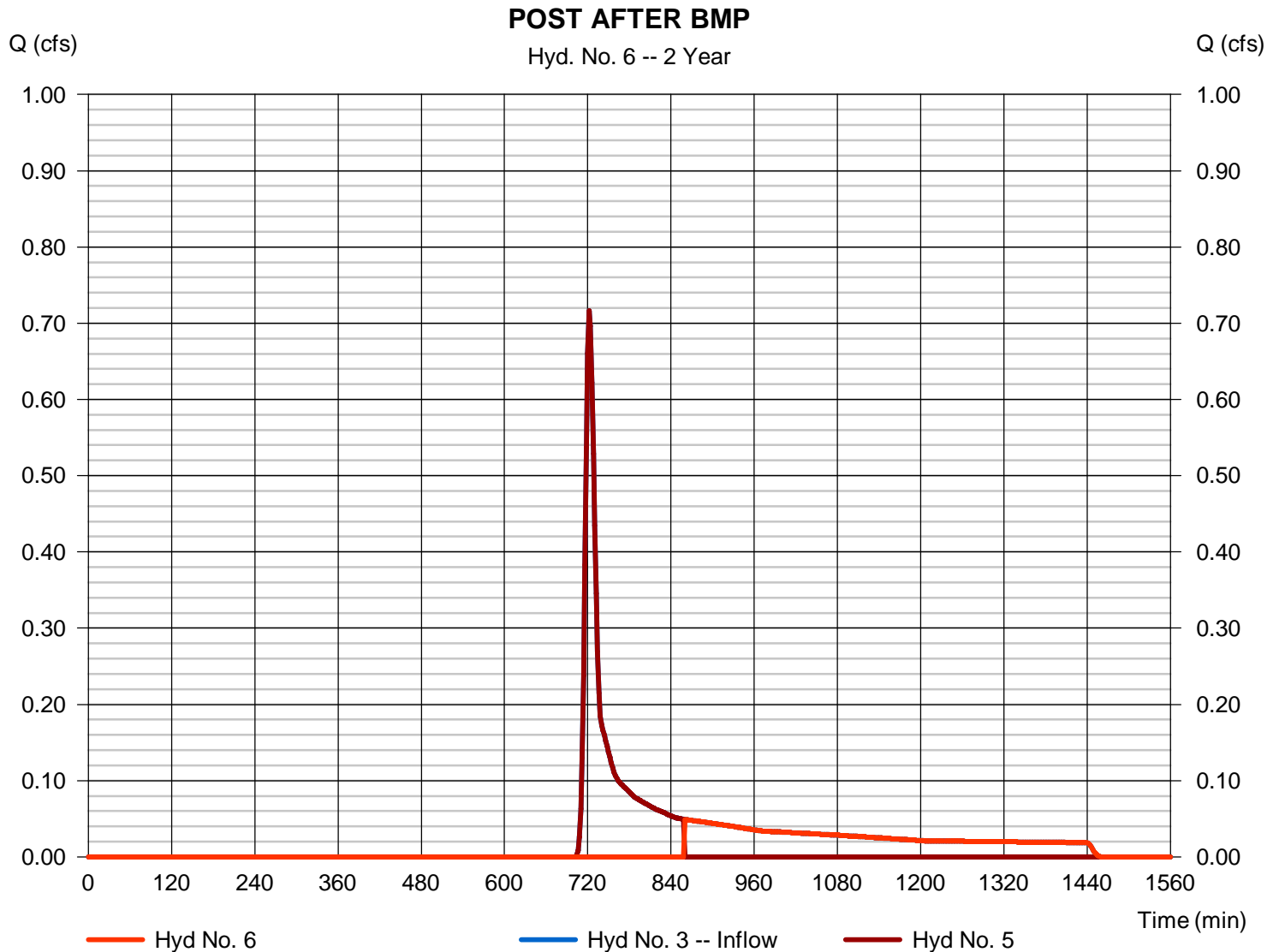
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Friday, 10 / 21 / 2016

## Hyd. No. 6

### POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.049 cfs
Storm frequency	= 2 yrs	Time to peak	= 860 min
Time interval	= 2 min	Hyd. volume	= 960 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

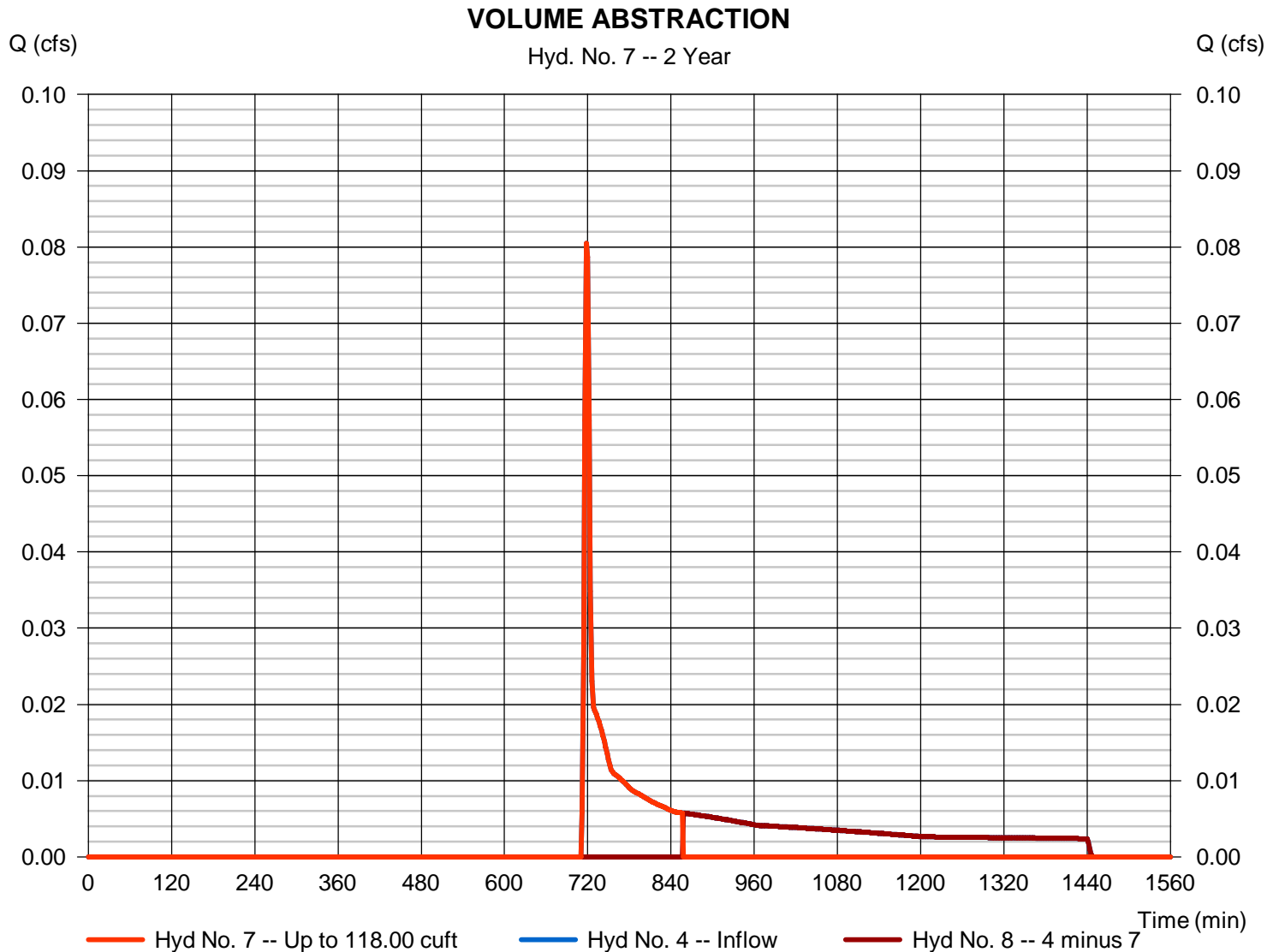
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 7

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.080 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 118 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

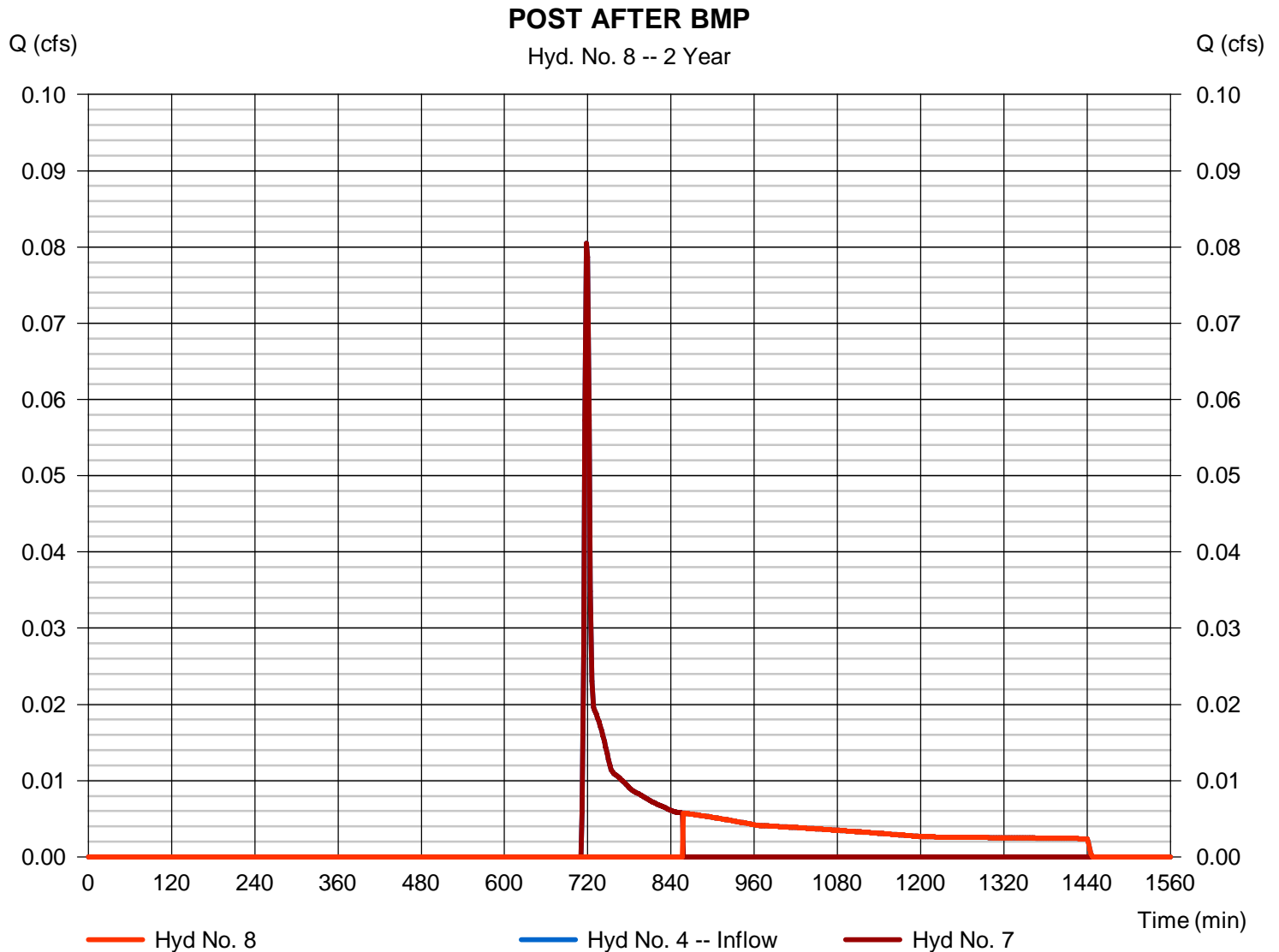
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.006 cfs
Storm frequency	= 2 yrs	Time to peak	= 858 min
Time interval	= 2 min	Hyd. volume	= 118 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft





# Hydrograph Report

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

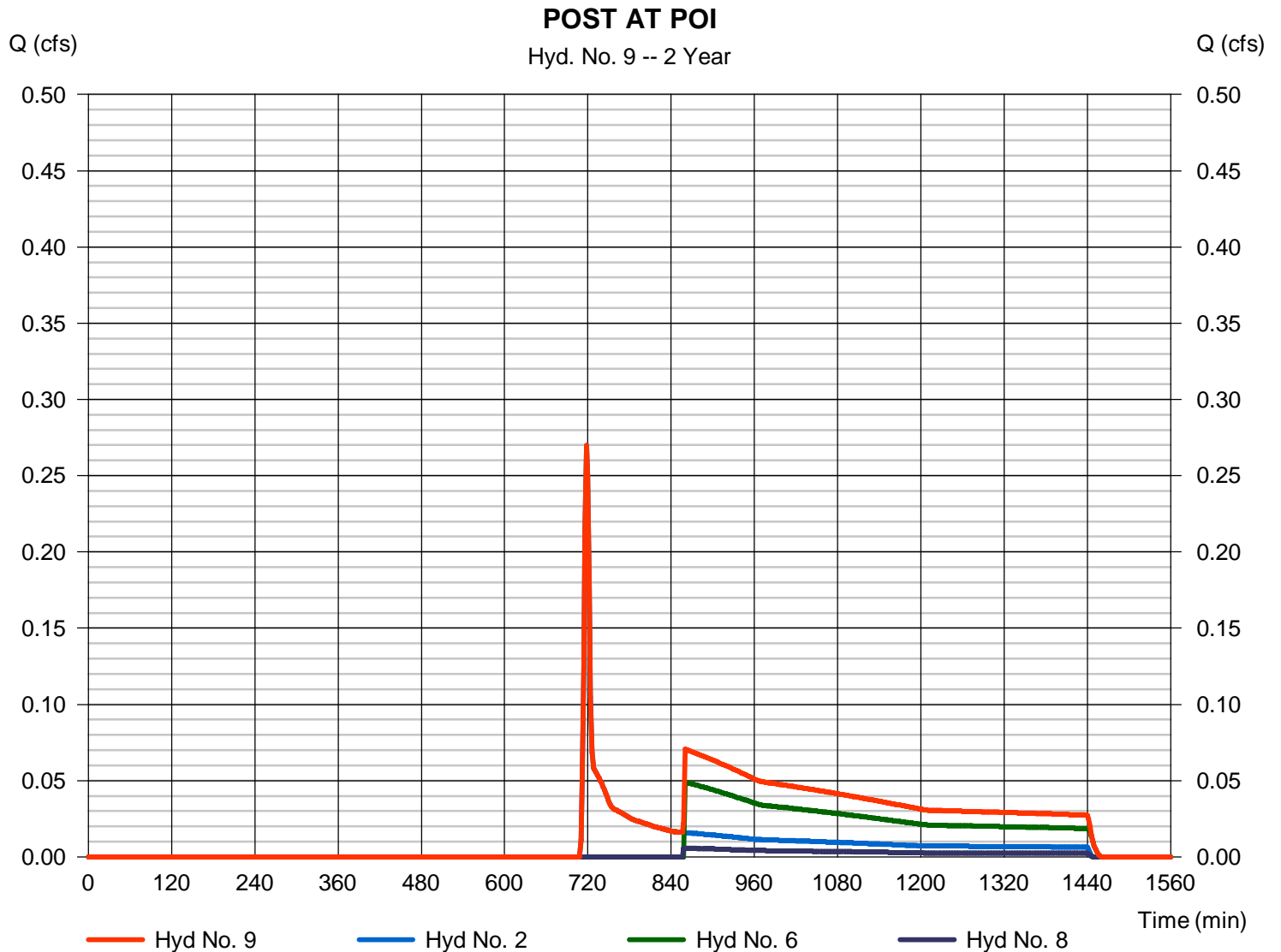
Friday, 10 / 21 / 2016

## Hyd. No. 9

POST AT POI

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

Peak discharge = 0.270 cfs  
 Time to peak = 718 min  
 Hyd. volume = 1,764 cuft  
 Contrib. drain. area = 0.510 ac



# Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	2.918	2	720	7,102	-----	-----	-----	PRE	
2	SCS Runoff	0.951	2	718	1,951	-----	-----	-----	POST UNDETAINED	
3	SCS Runoff	2.144	2	722	5,789	-----	-----	-----	POST DETAINED 1	
4	SCS Runoff	0.343	2	718	717	-----	-----	-----	POST DETAINED 2	
5	Diversion1	2.144	2	722	1,409	3	-----	-----	VOLUME ABSTRACTION	
6	Diversion2	1.998	2	724	4,380	3	-----	-----	POST AFTER BMP	
7	Diversion1	0.343	2	718	157	4	-----	-----	VOLUME ABSTRACTION	
8	Diversion2	0.292	2	720	560	4	-----	-----	POST AFTER BMP	
9	Combine	2.413	2	724	6,892	2, 6, 8	-----	-----	POST AT POI	
Schaefferstown.gpw					Return Period: 10 Year			Friday, 10 / 21 / 2016		

# Hydrograph Report

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

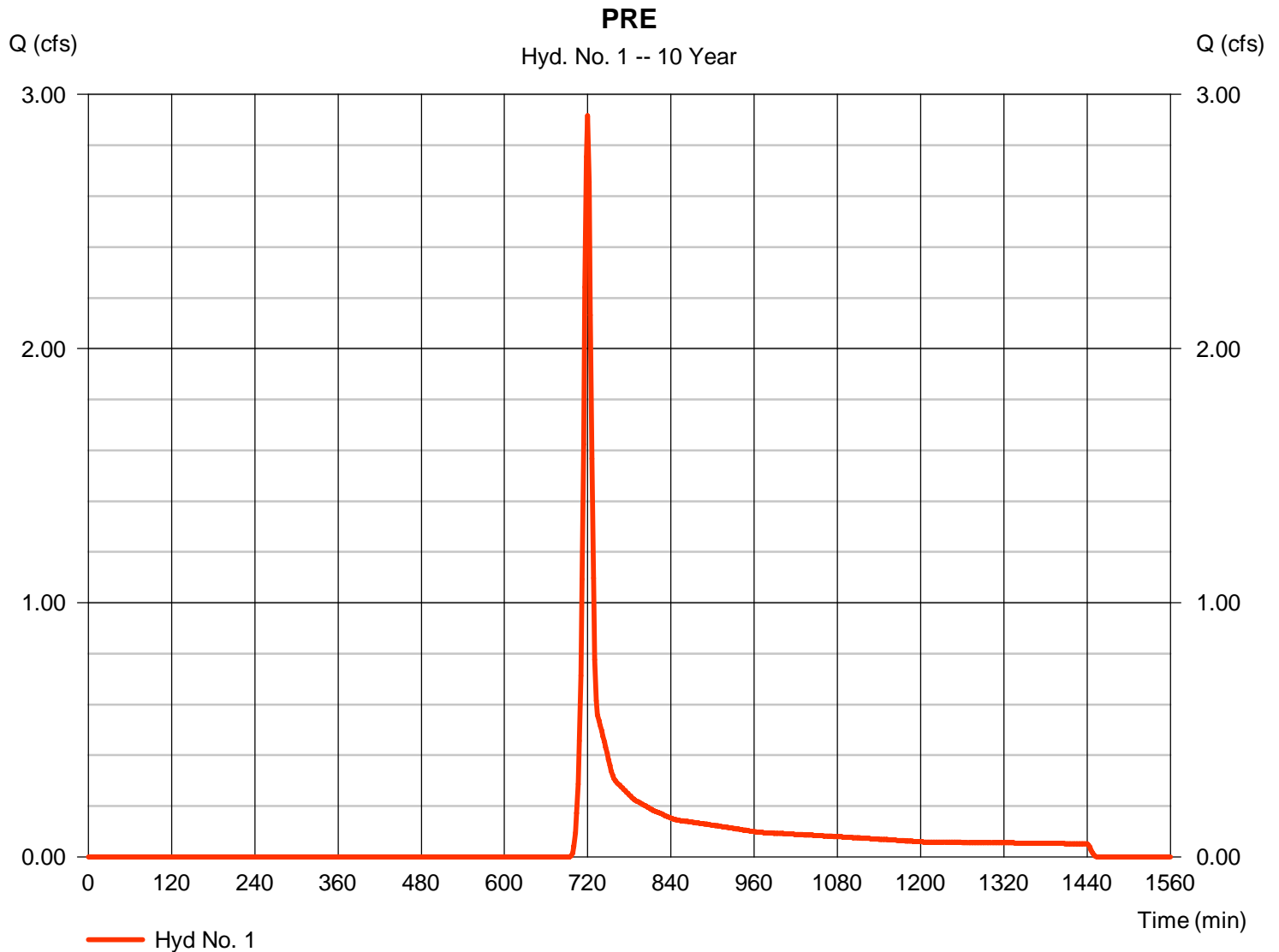
Friday, 10 / 21 / 2016

## Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 2.918 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 7,102 cuft
Drainage area	= 1.840 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 4.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.090 x 98) + (0.070 x 55) + (1.680 x 58)] / 1.840



# Hydrograph Report

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

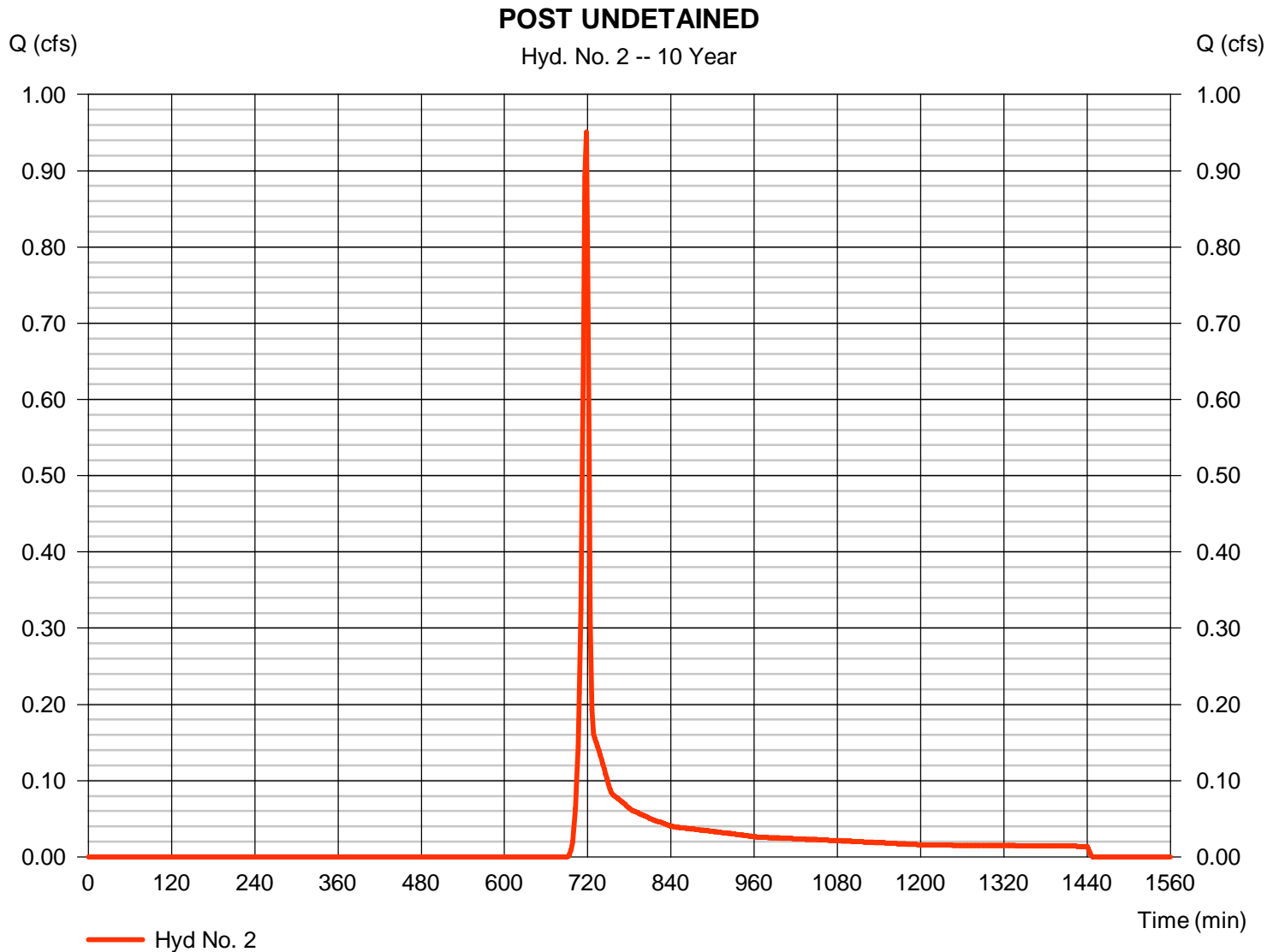
Friday, 10 / 21 / 2016

## Hyd. No. 2

### POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 0.951 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,951 cuft
Drainage area	= 0.510 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.20 min
Total precip.	= 4.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.050 x 55) + (0.410 x 58) + (0.040 x 98) + (0.010 x 85)] / 0.510



# Hydrograph Report

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

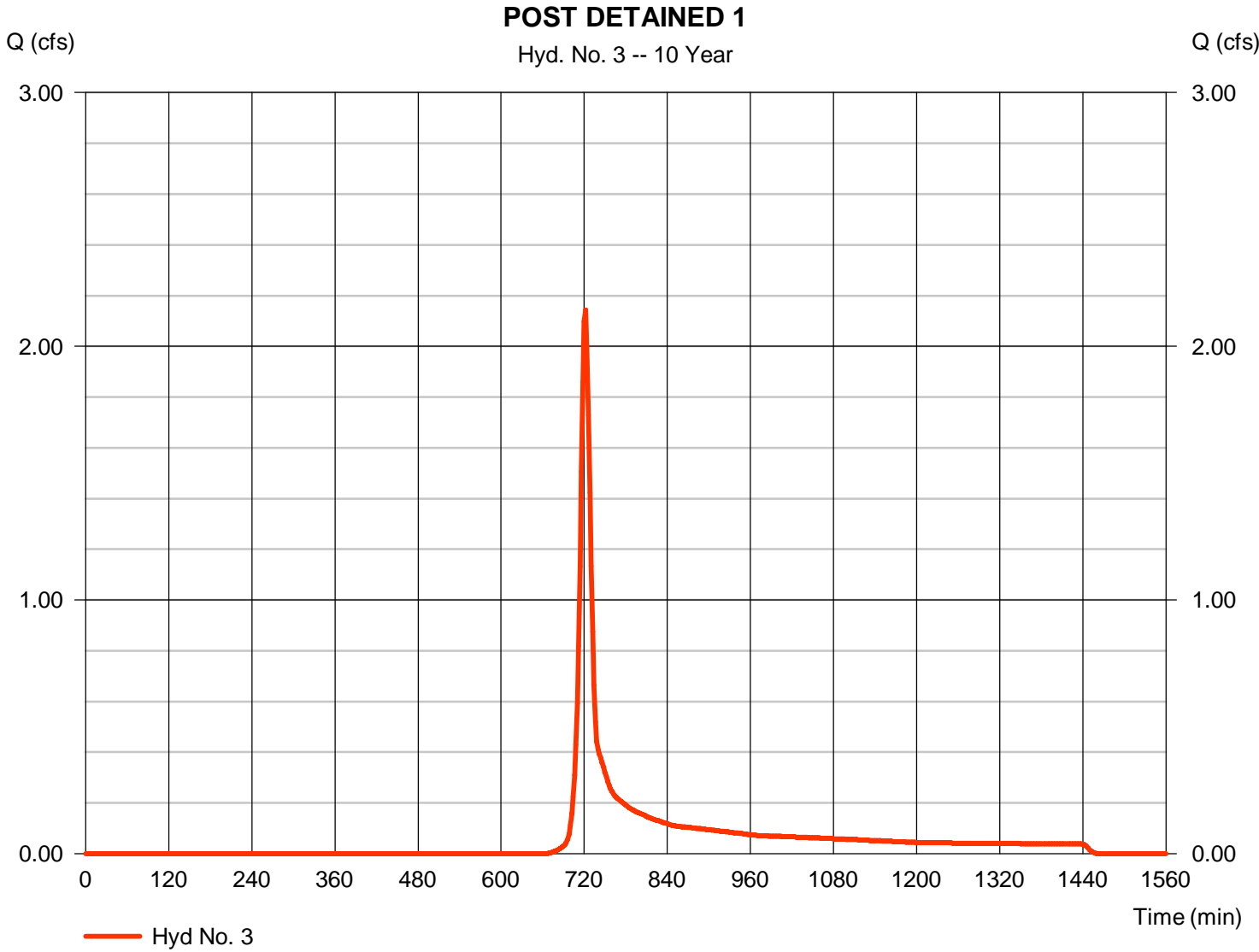
Friday, 10 / 21 / 2016

## Hyd. No. 3

### POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 2.144 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 5,789 cuft
Drainage area	= 1.120 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.40 min
Total precip.	= 4.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (0.160 x 85) + (0.050 x 55) + (0.830 x 58)] / 1.120



# Hydrograph Report

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

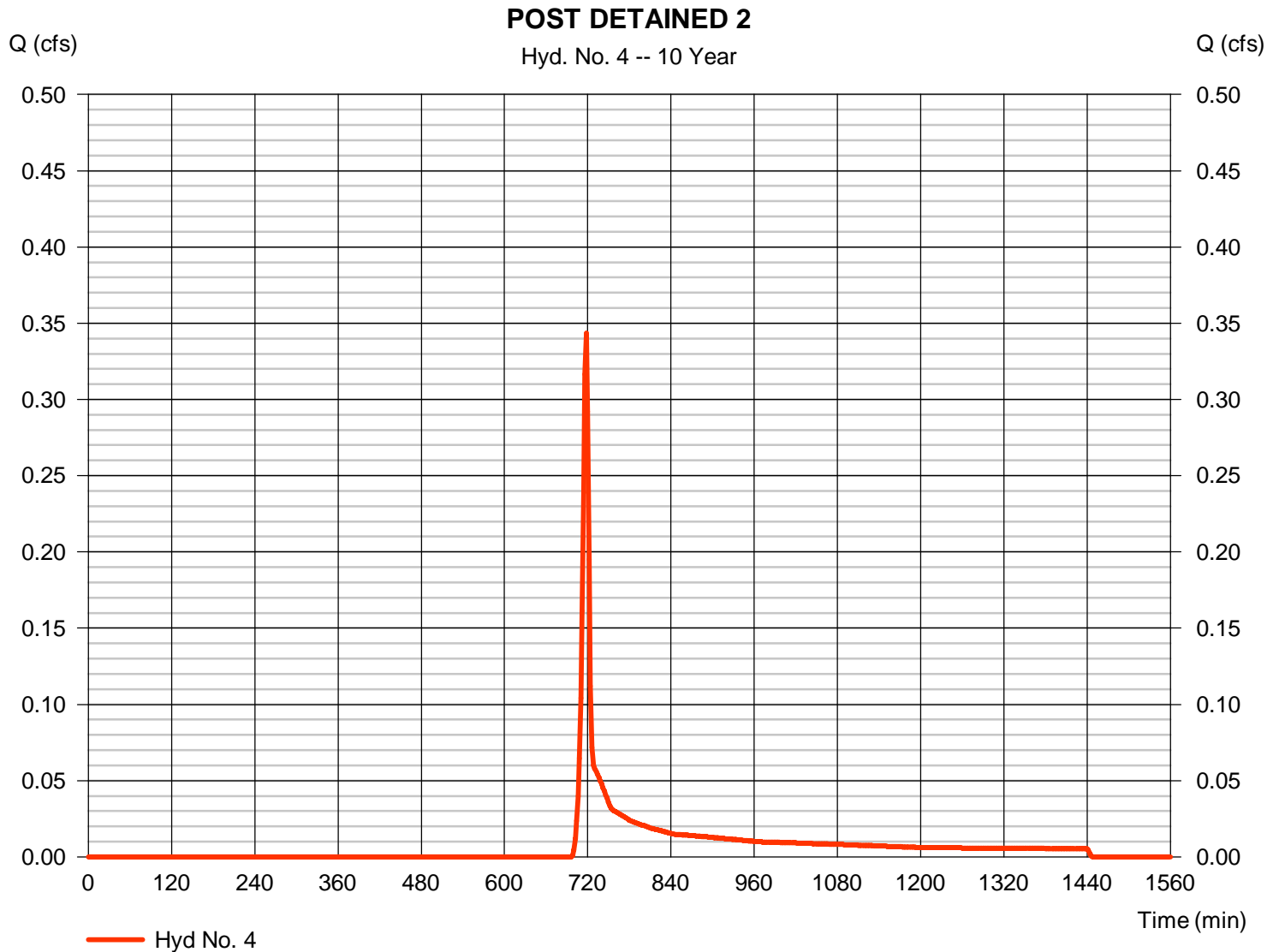
Friday, 10 / 21 / 2016

## Hyd. No. 4

### POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.343 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 717 cuft
Drainage area	= 0.210 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.60 min
Total precip.	= 4.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.010 x 85) + (0.200 x 58)] / 0.210



# Hydrograph Report

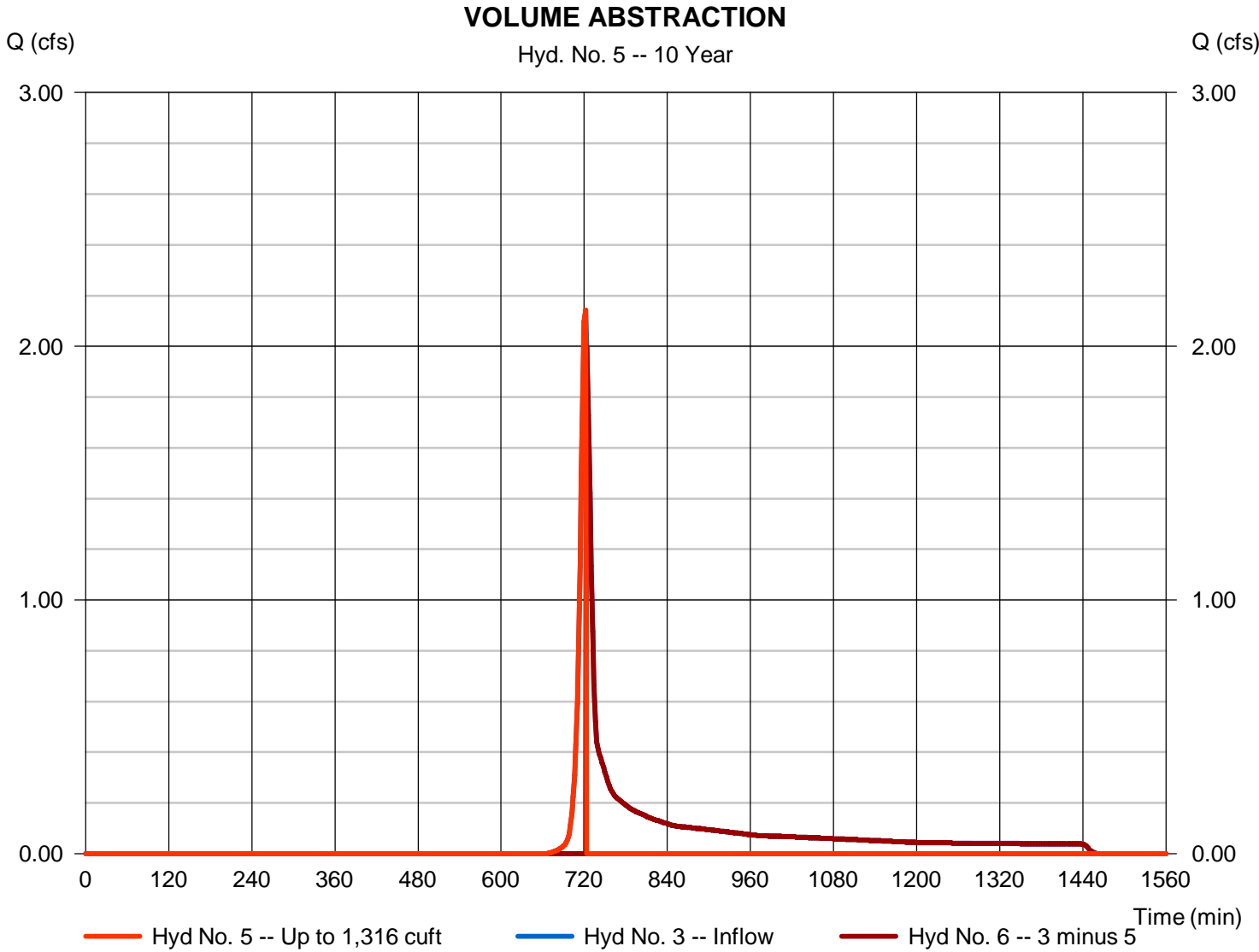
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 5

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 2.144 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 1,409 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

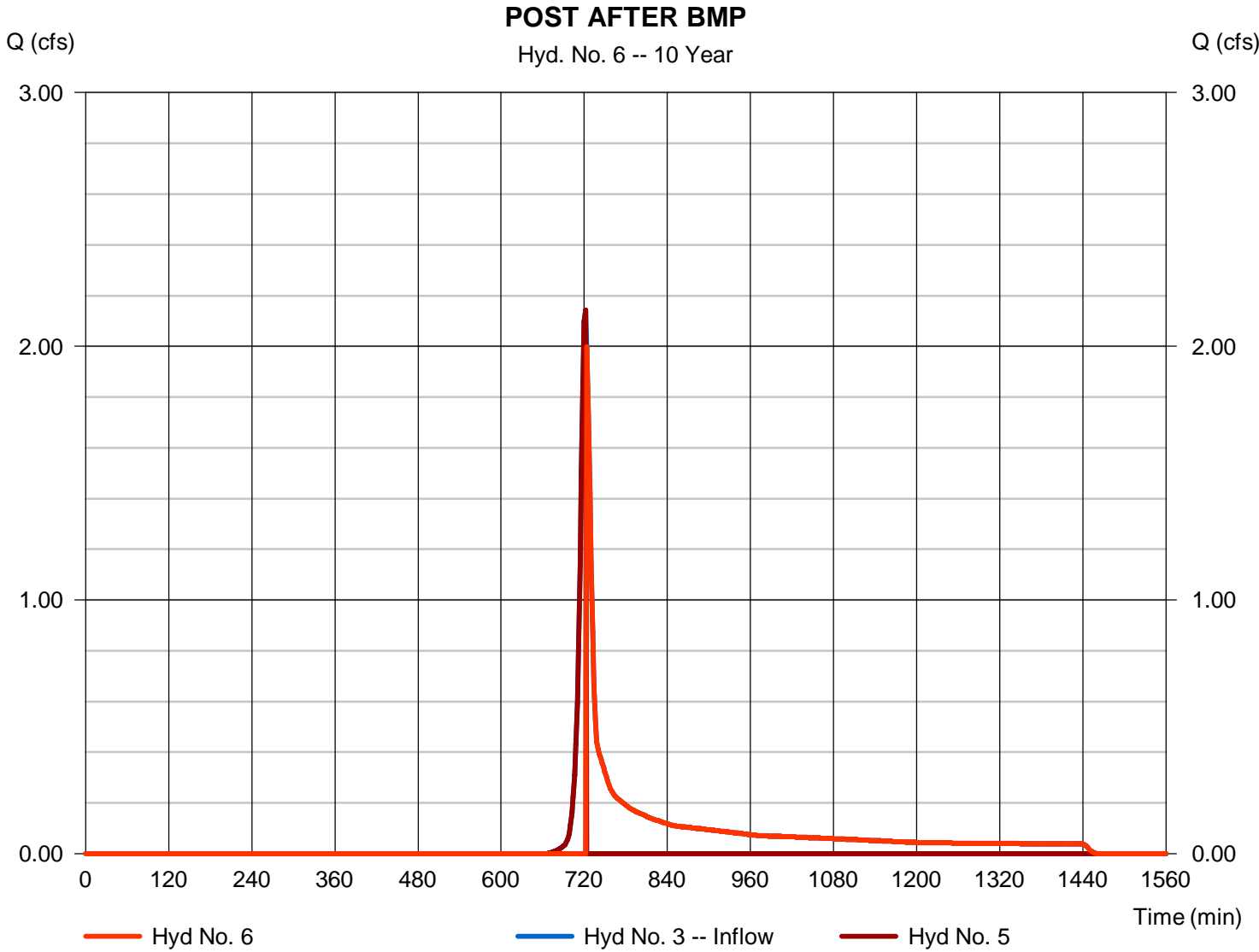
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 1.998 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 4,380 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft





# Hydrograph Report

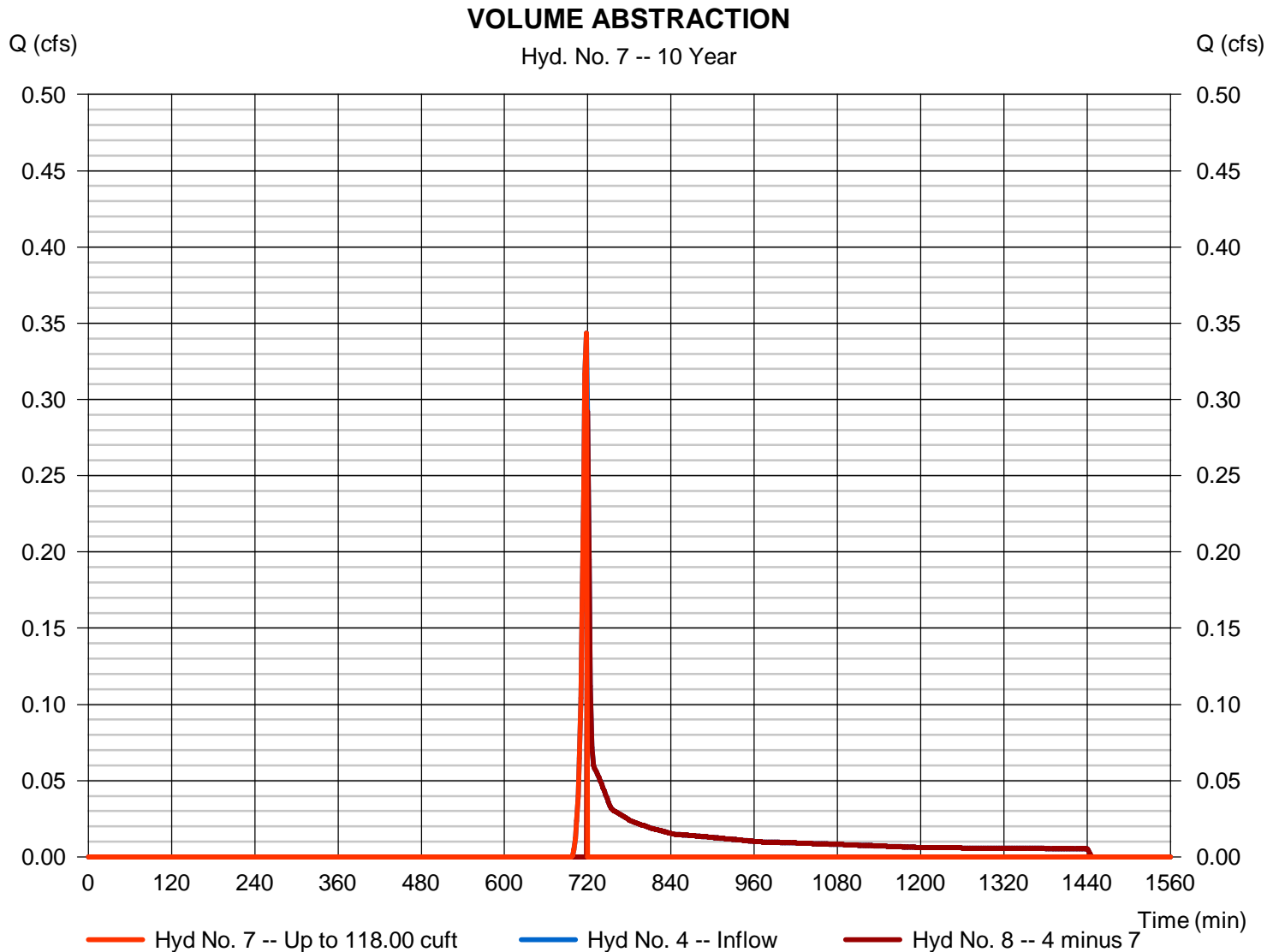
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 7

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.343 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 157 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

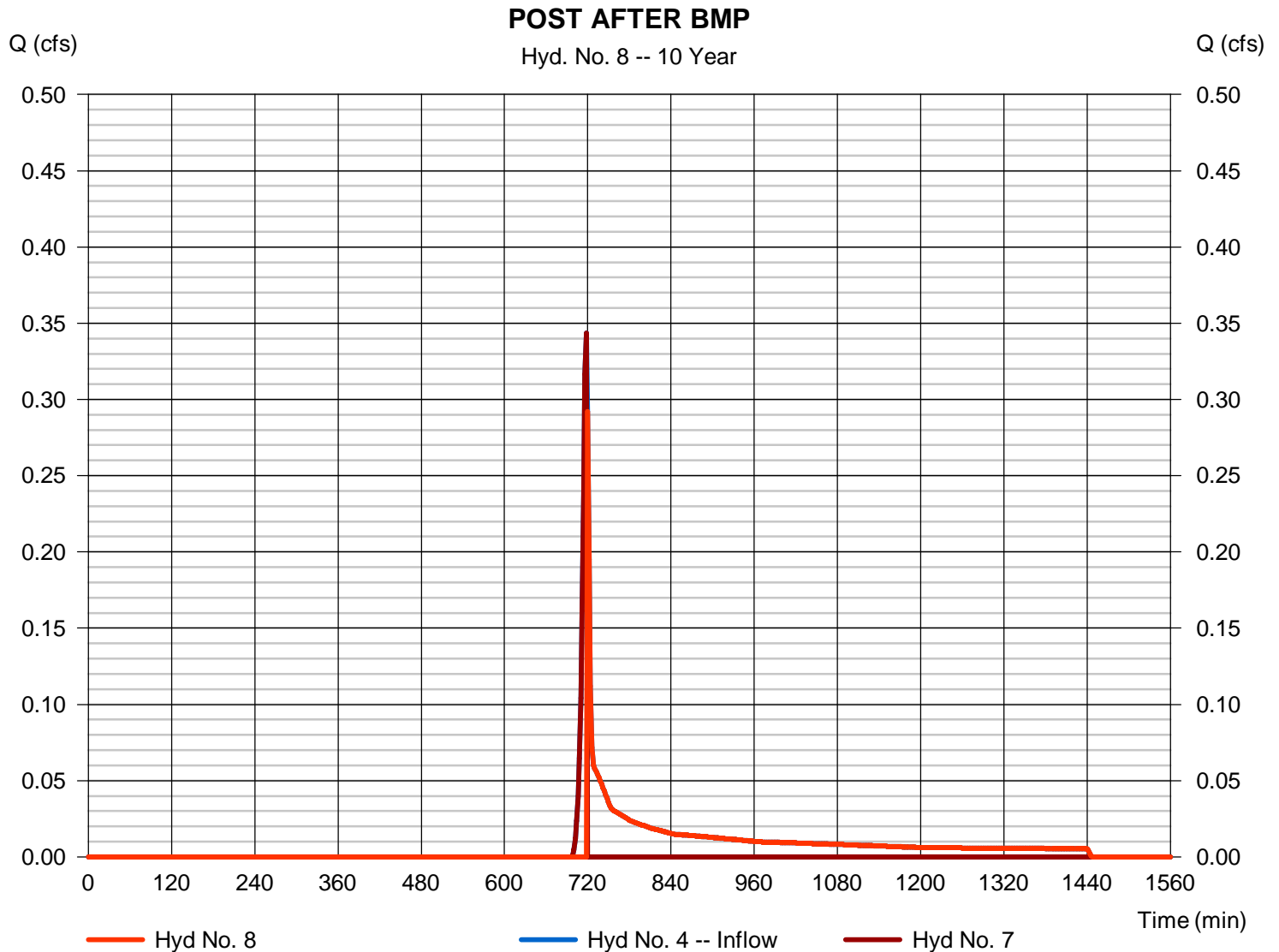
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 8

### POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.292 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 560 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

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

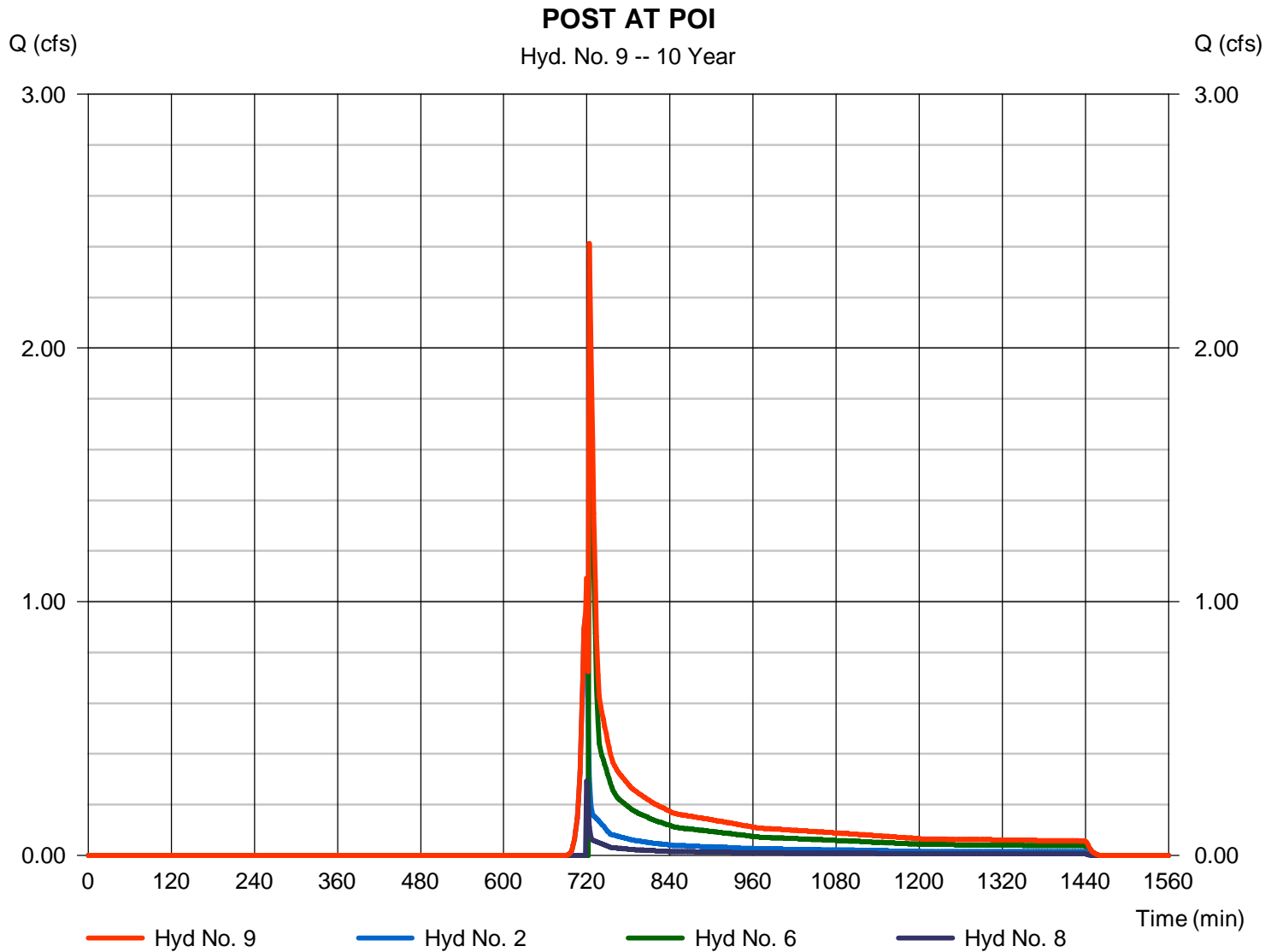
Friday, 10 / 21 / 2016

## Hyd. No. 9

POST AT POI

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

Peak discharge = 2.413 cfs  
Time to peak = 724 min  
Hyd. volume = 6,892 cuft  
Contrib. drain. area = 0.510 ac



# Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	6.523	2	720	15,022	-----	-----	-----	PRE
2	SCS Runoff	2.031	2	718	4,062	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	4.345	2	722	11,377	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	0.770	2	718	1,543	-----	-----	-----	POST DETAINED 2
5	Diversion1	2.619	2	714	1,611	3	-----	-----	VOLUME ABSTRACTION
6	Diversion2	4.345	2	722	9,766	3	-----	-----	POST AFTER BMP
7	Diversion1	0.237	2	708	121	4	-----	-----	VOLUME ABSTRACTION
8	Diversion2	0.770	2	718	1,422	4	-----	-----	POST AFTER BMP
9	Combine	6.751	2	718	15,250	2, 6, 8	-----	-----	POST AT POI
Schaefferstown.gpw					Return Period: 50 Year			Friday, 10 / 21 / 2016	

# Hydrograph Report

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

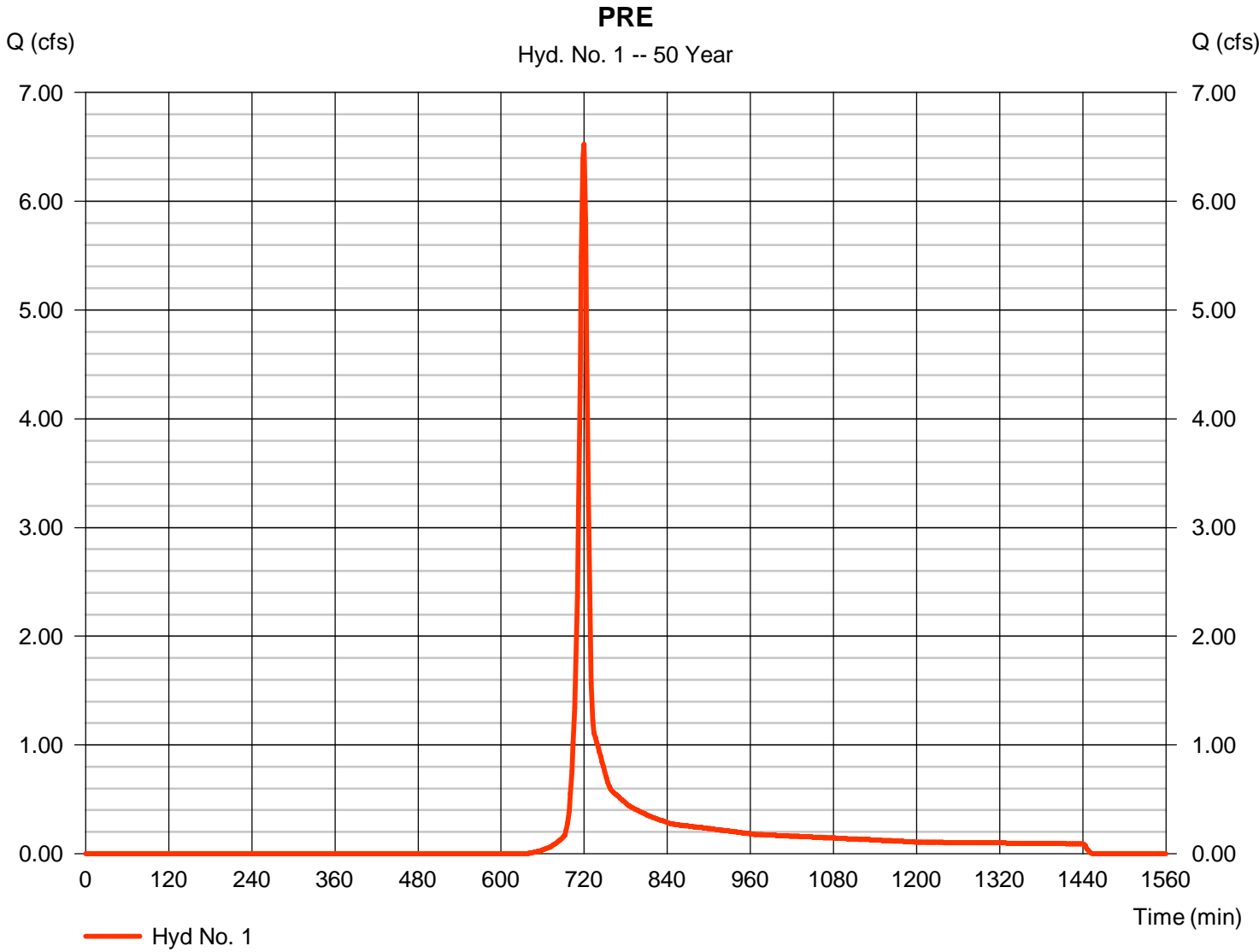
Friday, 10 / 21 / 2016

## Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 6.523 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 15,022 cuft
Drainage area	= 1.840 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 6.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.090 x 98) + (0.070 x 55) + (1.680 x 58)] / 1.840



# Hydrograph Report

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

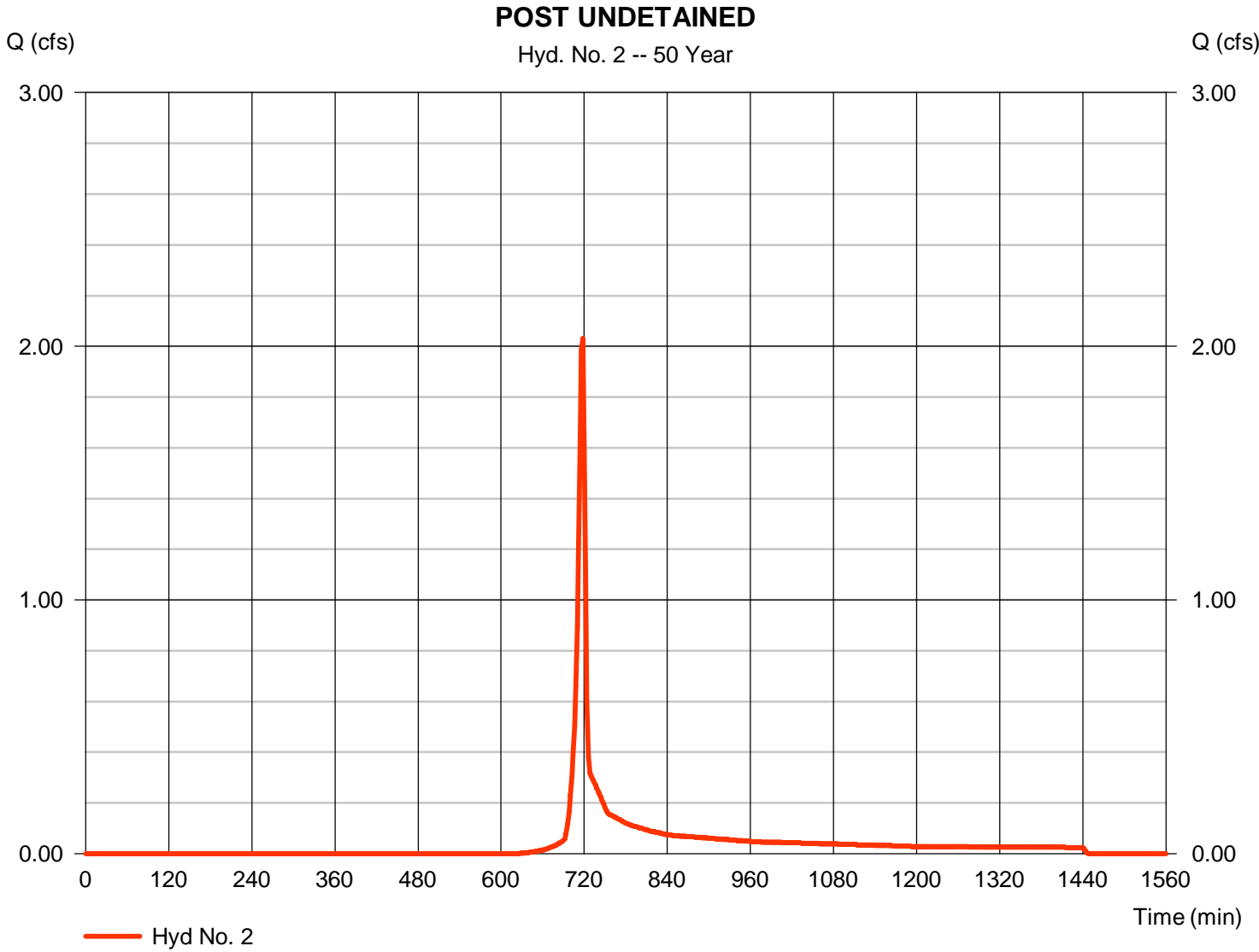
Friday, 10 / 21 / 2016

## Hyd. No. 2

### POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 2.031 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 4,062 cuft
Drainage area	= 0.510 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.20 min
Total precip.	= 6.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.050 x 55) + (0.410 x 58) + (0.040 x 98) + (0.010 x 85)] / 0.510



# Hydrograph Report

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

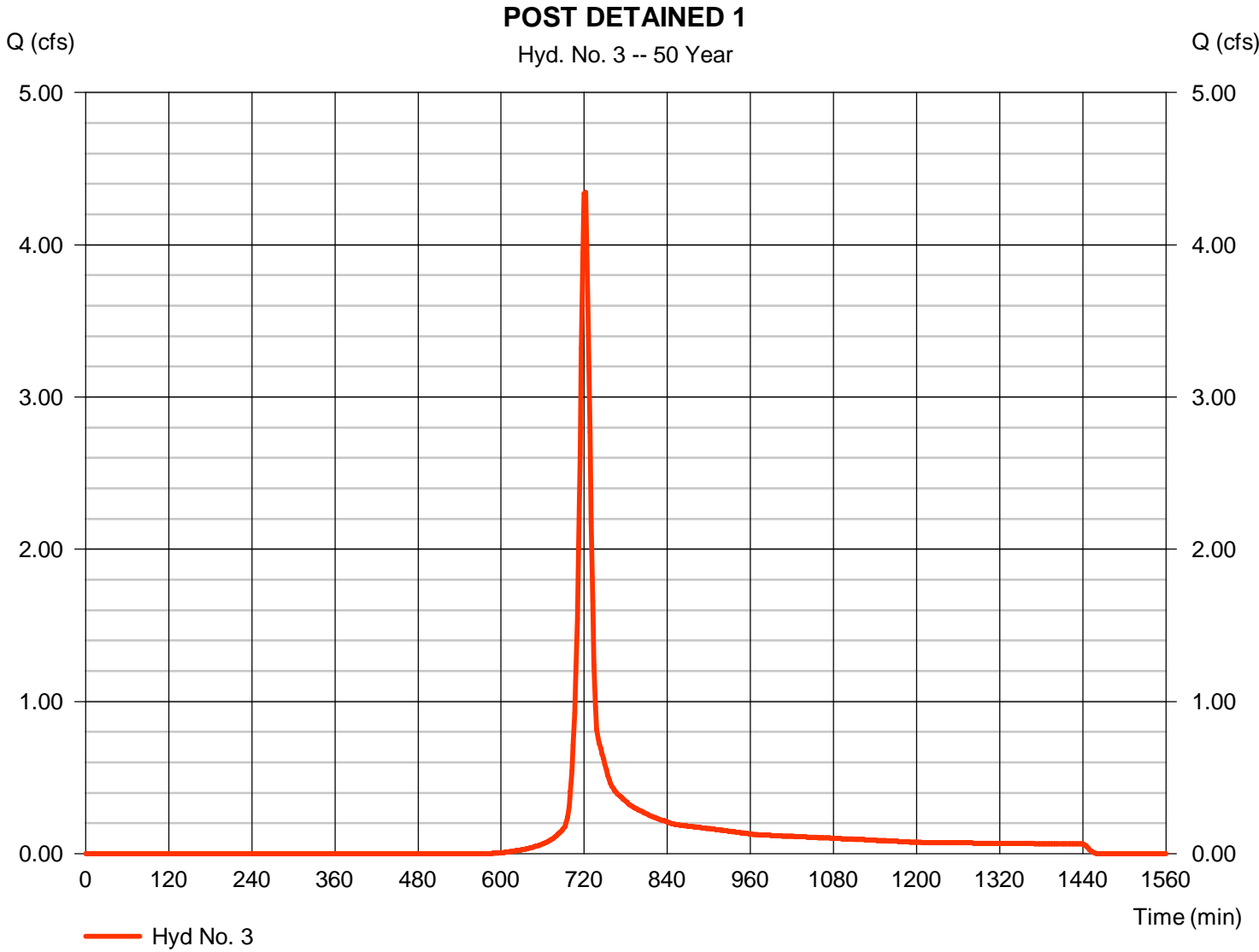
Friday, 10 / 21 / 2016

## Hyd. No. 3

### POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.345 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 11,377 cuft
Drainage area	= 1.120 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.40 min
Total precip.	= 6.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (0.160 x 85) + (0.050 x 55) + (0.830 x 58)] / 1.120



# Hydrograph Report

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

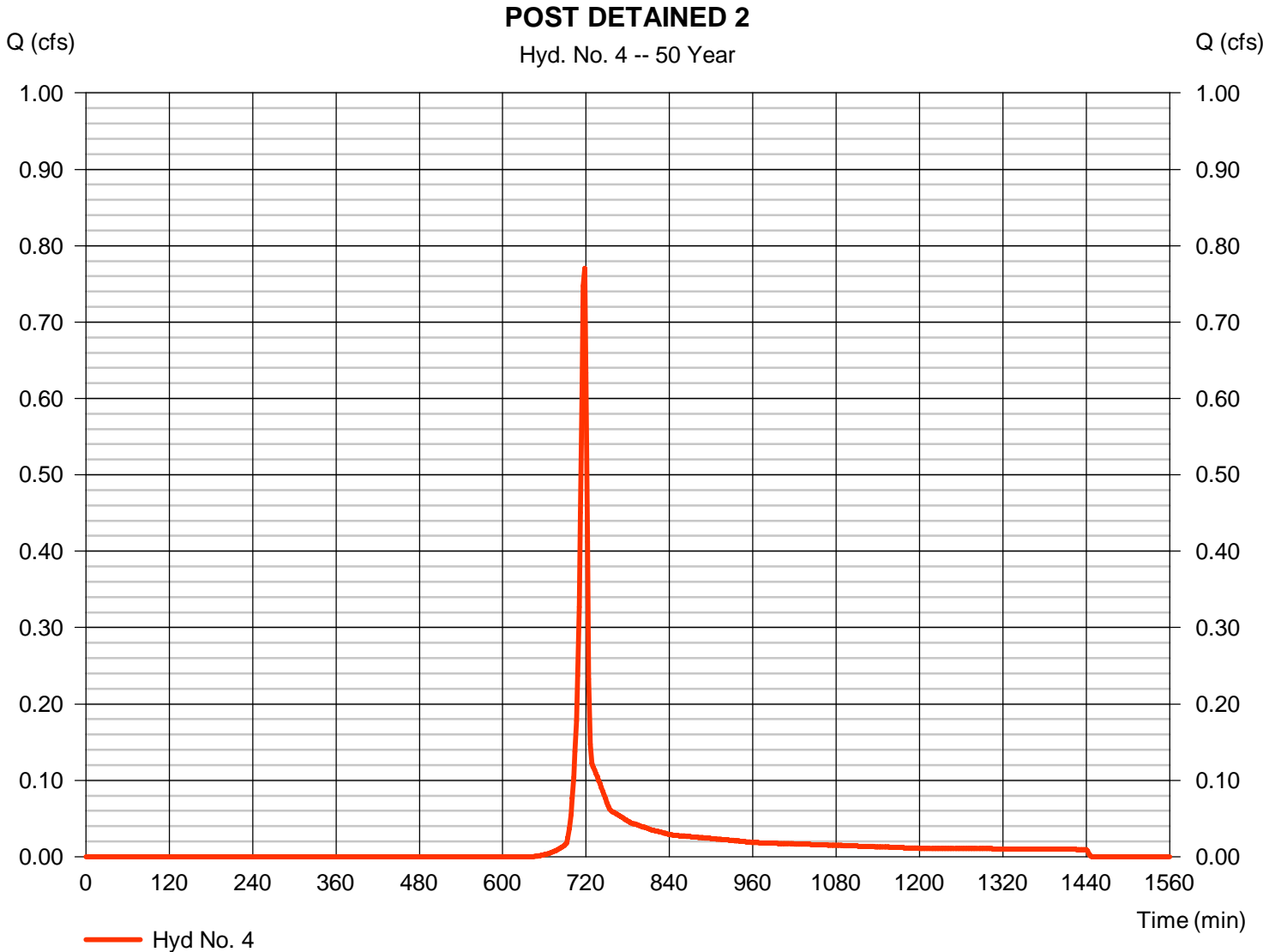
Friday, 10 / 21 / 2016

## Hyd. No. 4

### POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.770 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,543 cuft
Drainage area	= 0.210 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.60 min
Total precip.	= 6.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.010 x 85) + (0.200 x 58)] / 0.210





# Hydrograph Report

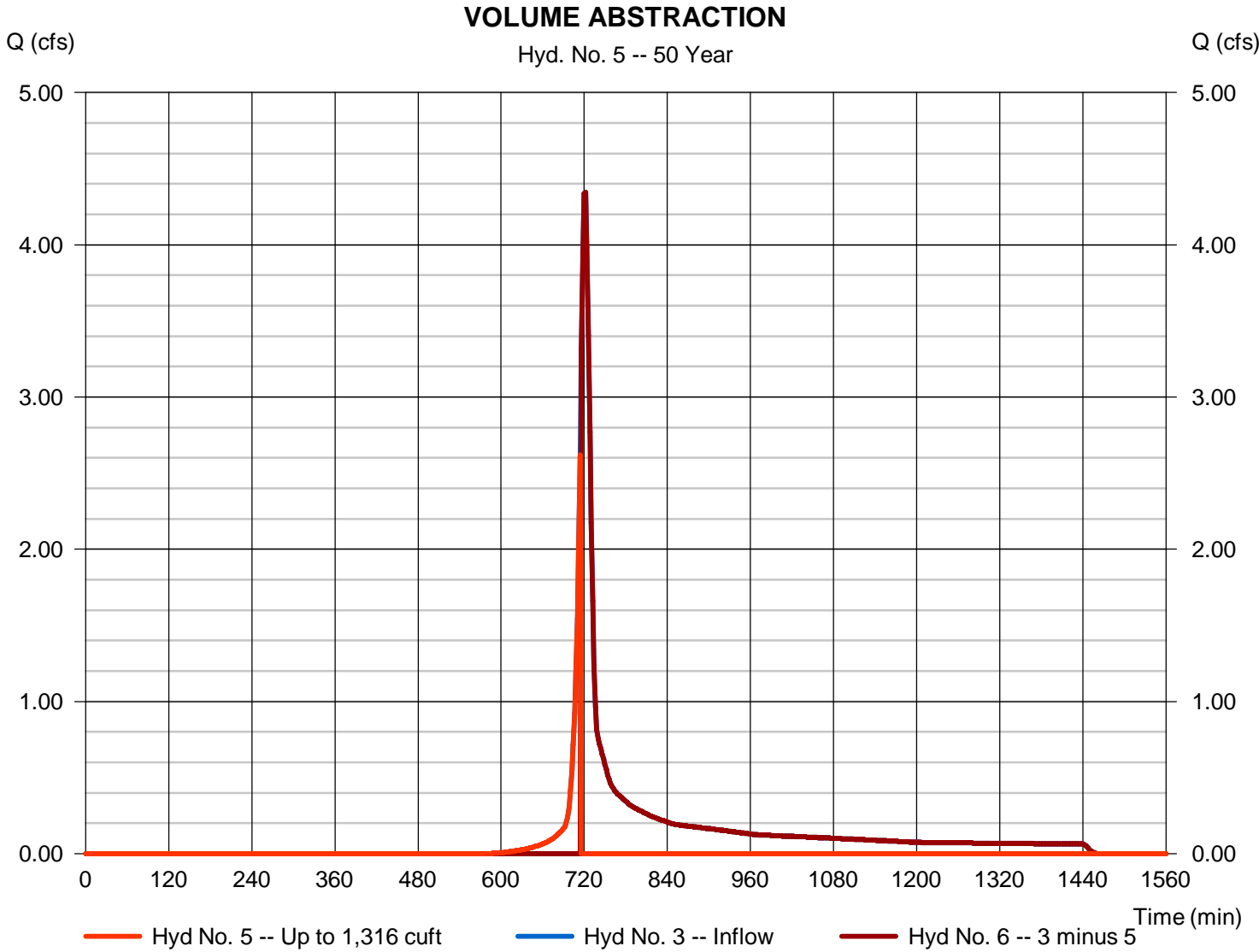
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 5

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 2.619 cfs
Storm frequency	= 50 yrs	Time to peak	= 714 min
Time interval	= 2 min	Hyd. volume	= 1,611 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

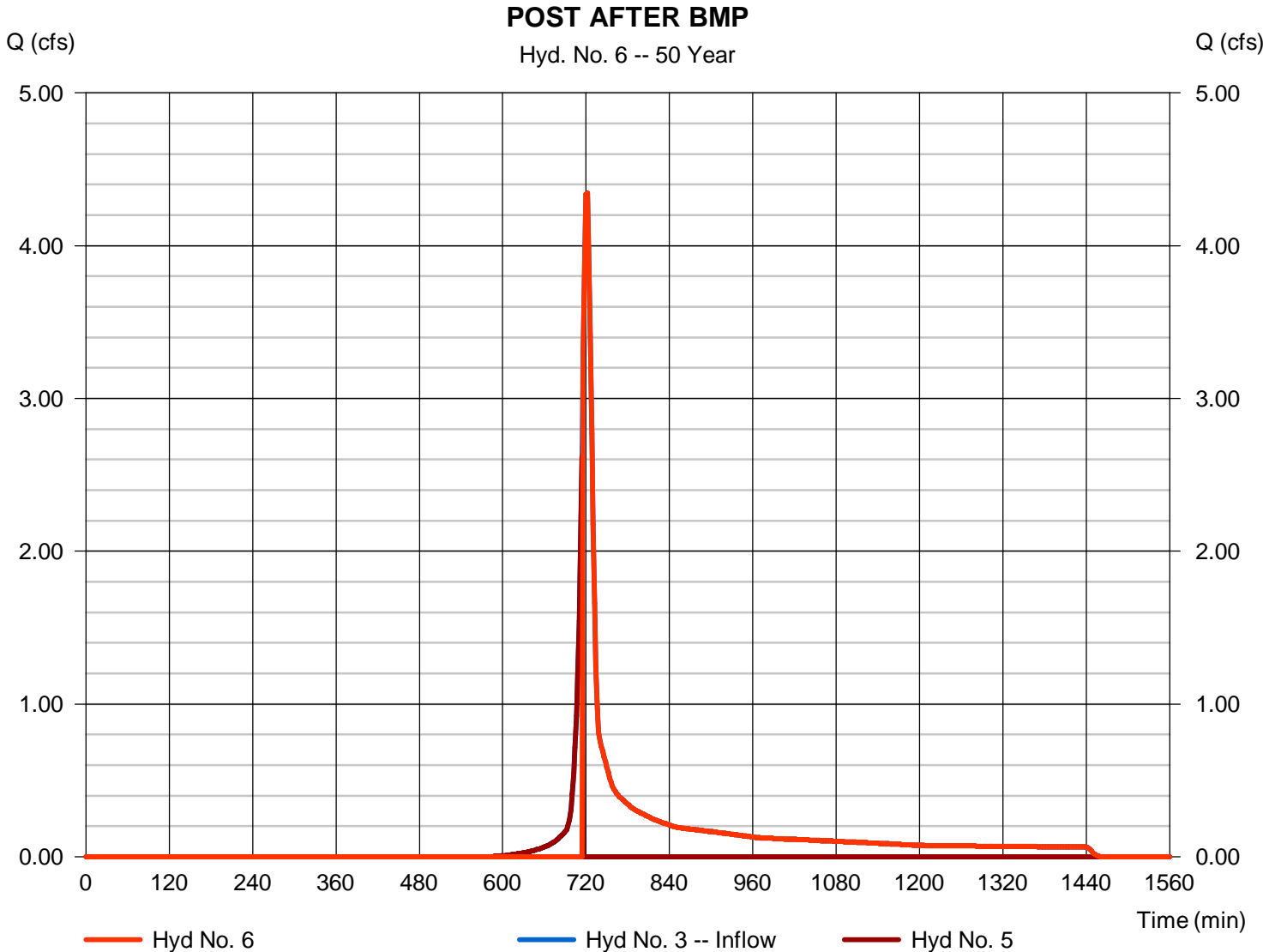
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 6

### POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 4.345 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 9,766 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

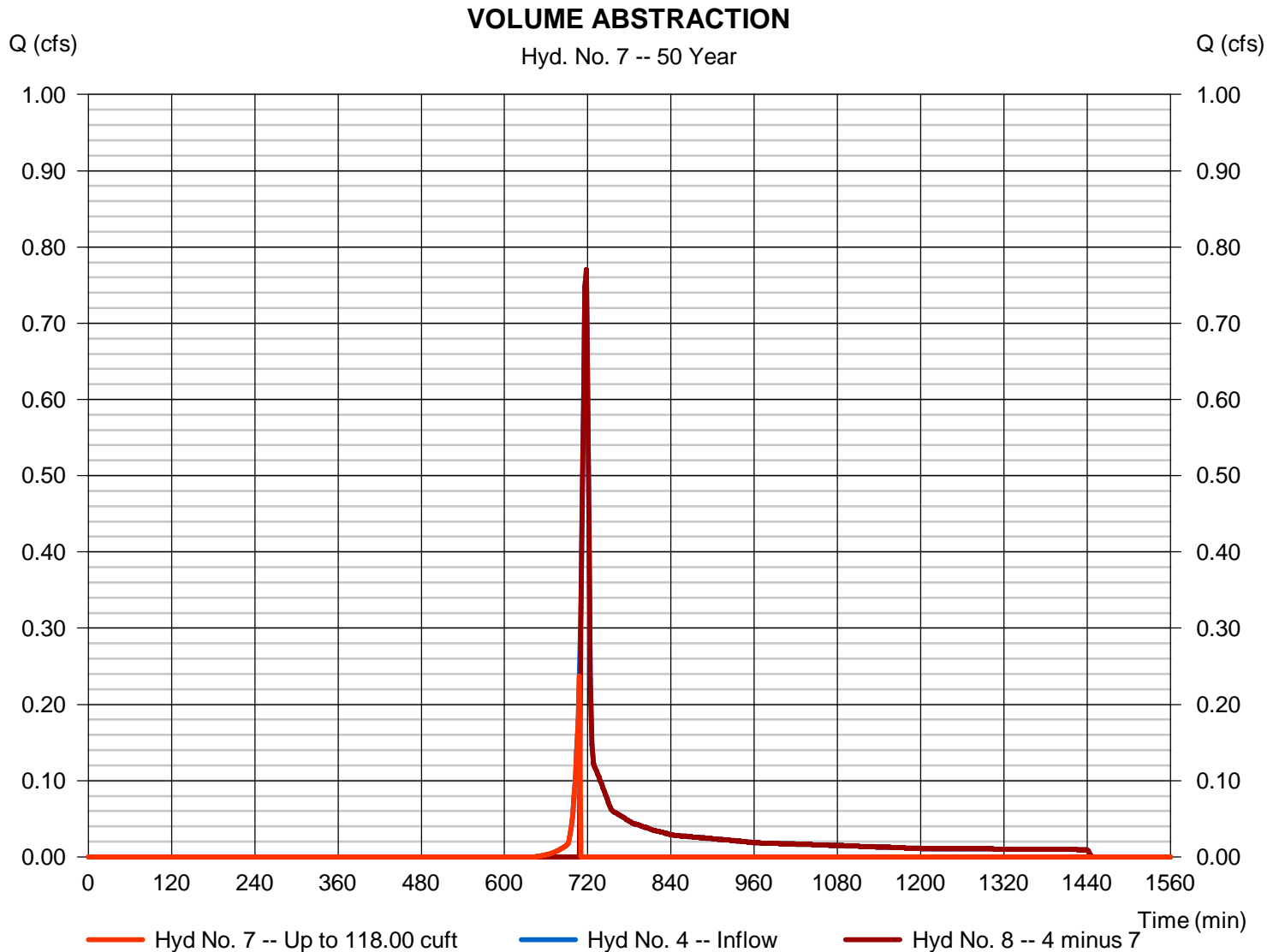
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 7

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.237 cfs
Storm frequency	= 50 yrs	Time to peak	= 708 min
Time interval	= 2 min	Hyd. volume	= 121 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

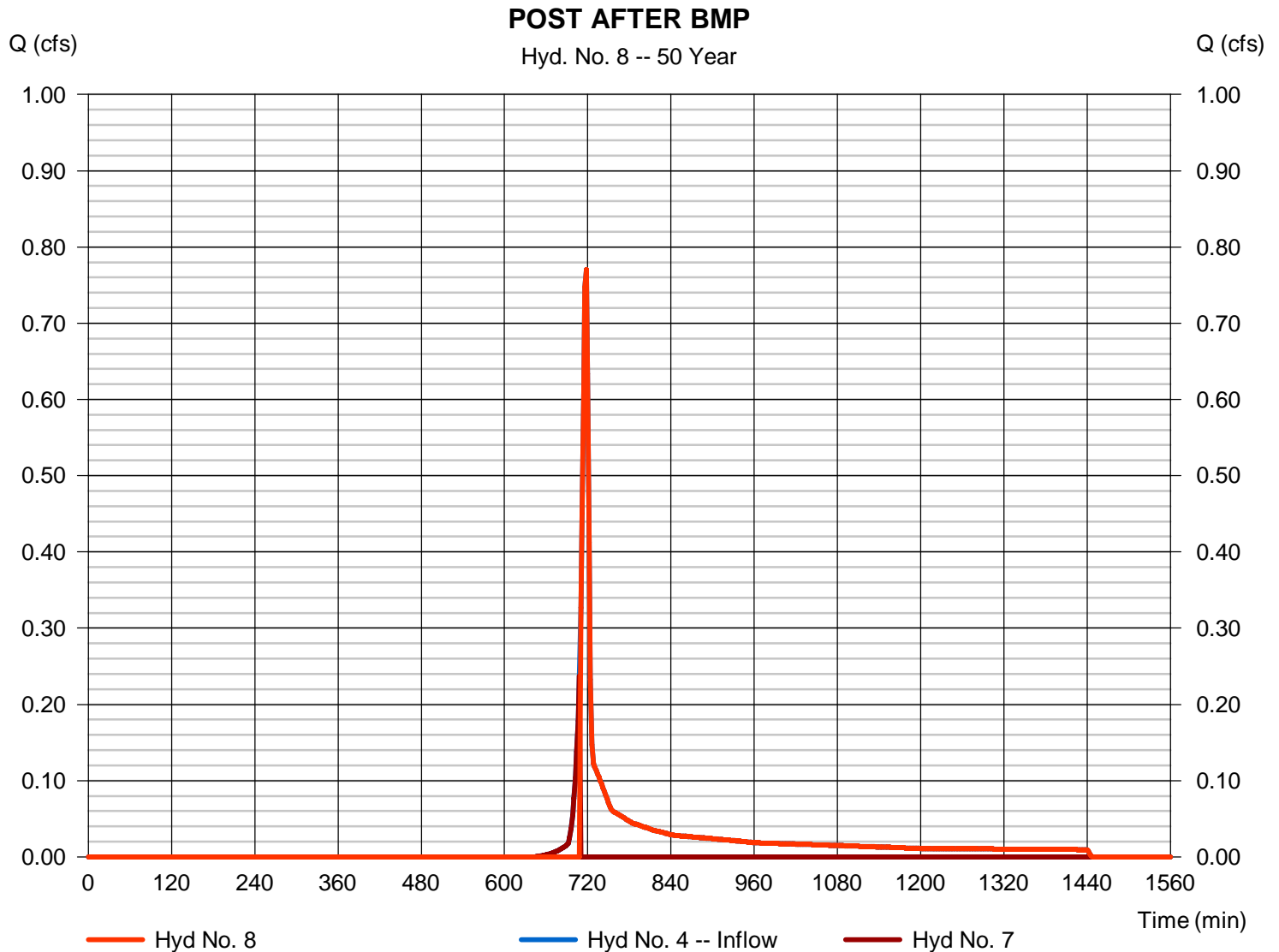
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 8

### POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.770 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,422 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

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

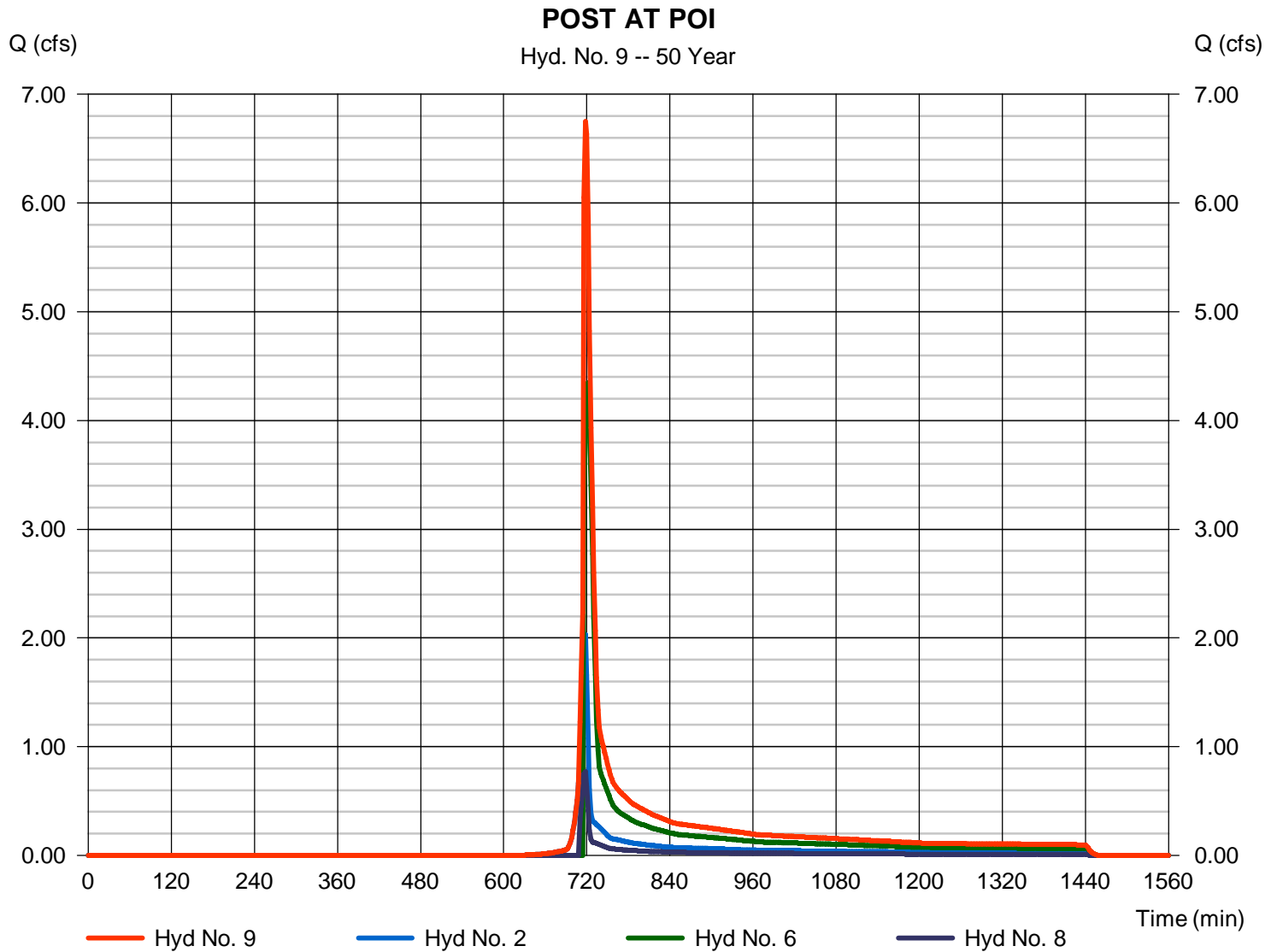
Friday, 10 / 21 / 2016

## Hyd. No. 9

POST AT POI

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

Peak discharge = 6.751 cfs  
 Time to peak = 718 min  
 Hyd. volume = 15,250 cuft  
 Contrib. drain. area = 0.510 ac



# Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	8.577	2	720	19,646	-----	-----	-----	PRE
2	SCS Runoff	2.640	2	718	5,287	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	5.591	2	720	14,550	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	1.014	2	718	2,028	-----	-----	-----	POST DETAINED 2
5	Diversion1	1.641	2	708	1,373	3	-----	-----	VOLUME ABSTRACTION
6	Diversion2	5.591	2	720	13,176	3	-----	-----	POST AFTER BMP
7	Diversion1	0.209	2	704	131	4	-----	-----	VOLUME ABSTRACTION
8	Diversion2	1.014	2	718	1,897	4	-----	-----	POST AFTER BMP
9	Combine	8.781	2	718	20,360	2, 6, 8	-----	-----	POST AT POI
Schaefferstown.gpw					Return Period: 100 Year			Friday, 10 / 21 / 2016	

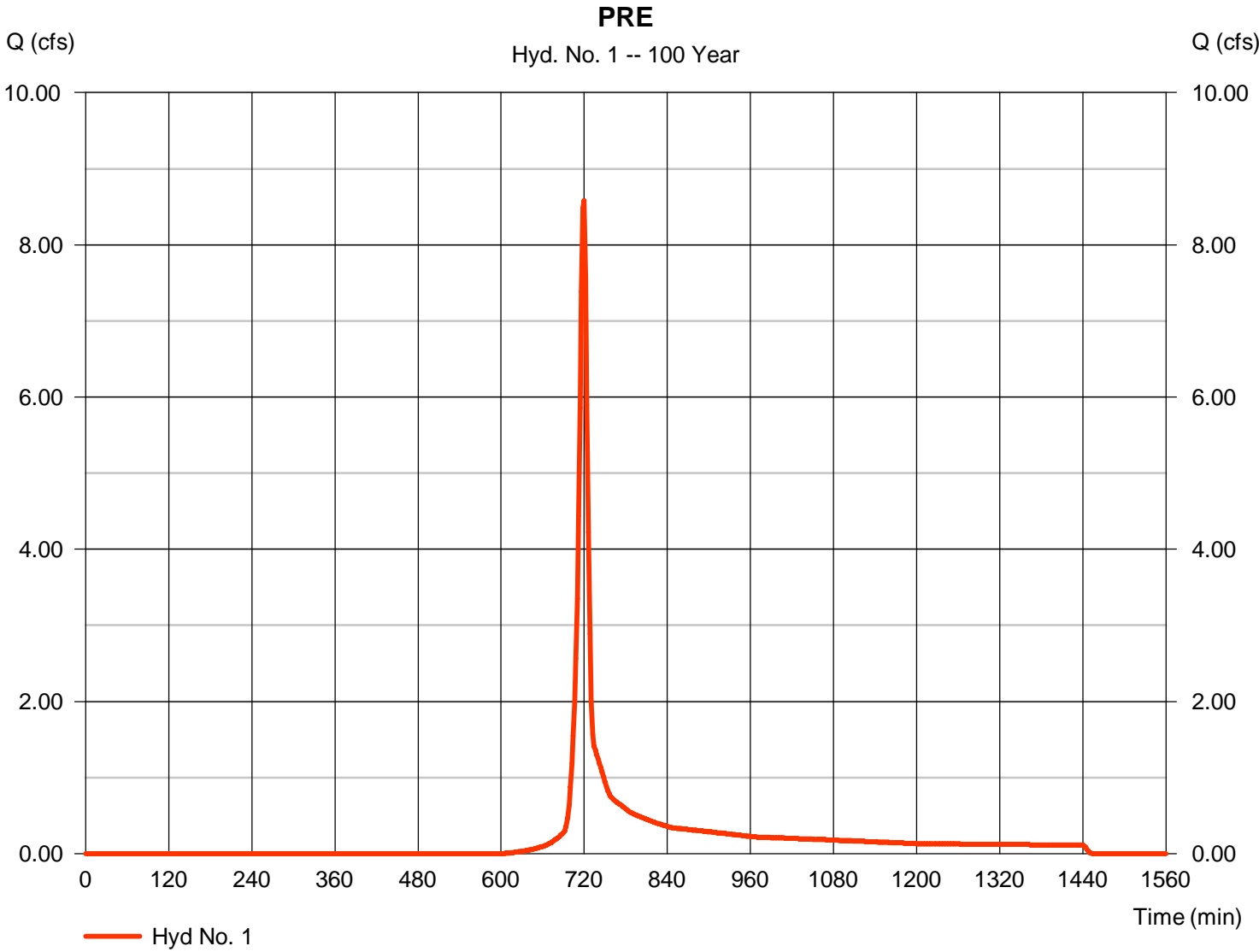
# Hydrograph Report

## Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 8.577 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 19,646 cuft
Drainage area	= 1.840 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 7.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.090 x 98) + (0.070 x 55) + (1.680 x 58)] / 1.840



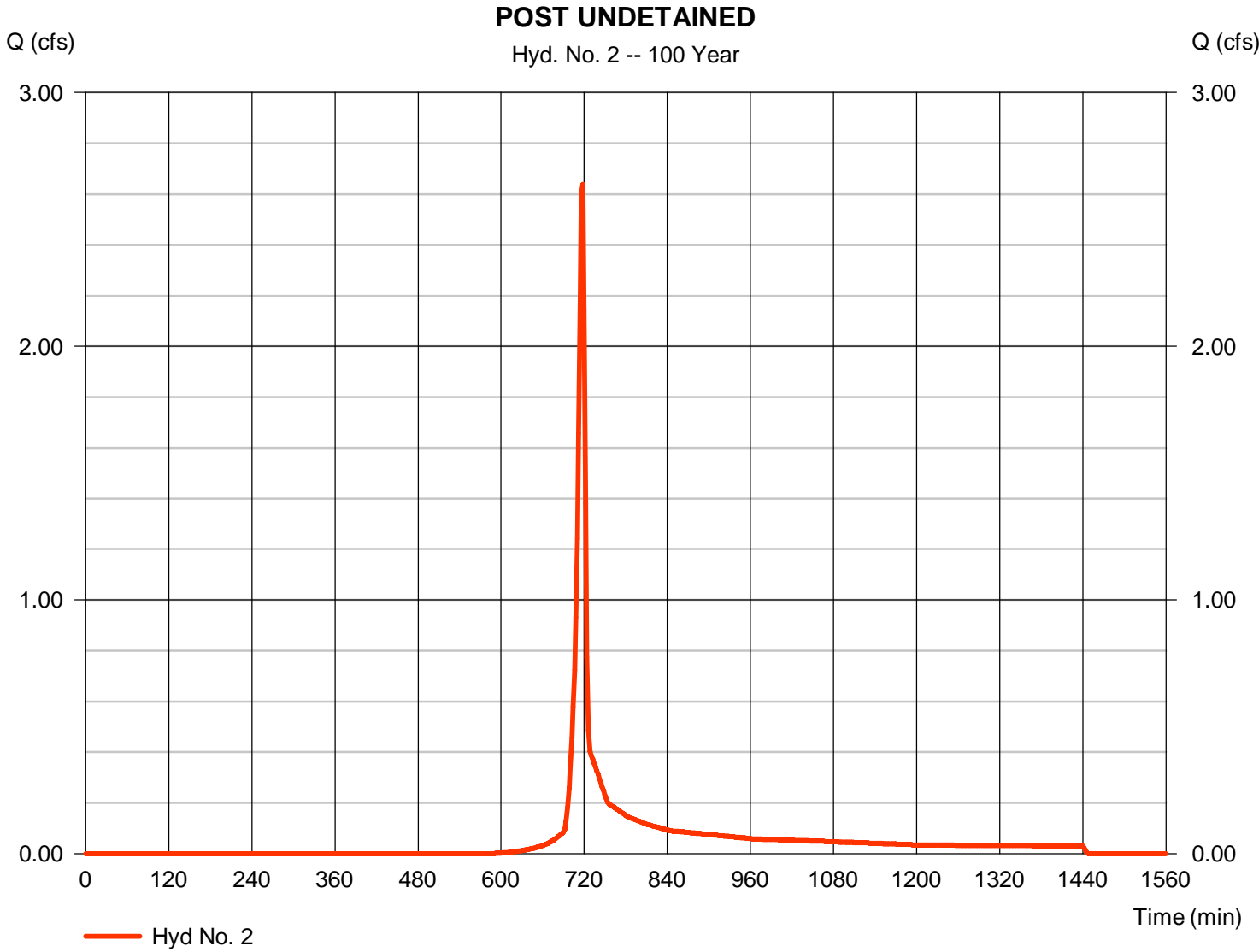
# Hydrograph Report

## Hyd. No. 2

### POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 2.640 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 5,287 cuft
Drainage area	= 0.510 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.20 min
Total precip.	= 7.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.050 x 55) + (0.410 x 58) + (0.040 x 98) + (0.010 x 85)] / 0.510





# Hydrograph Report

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

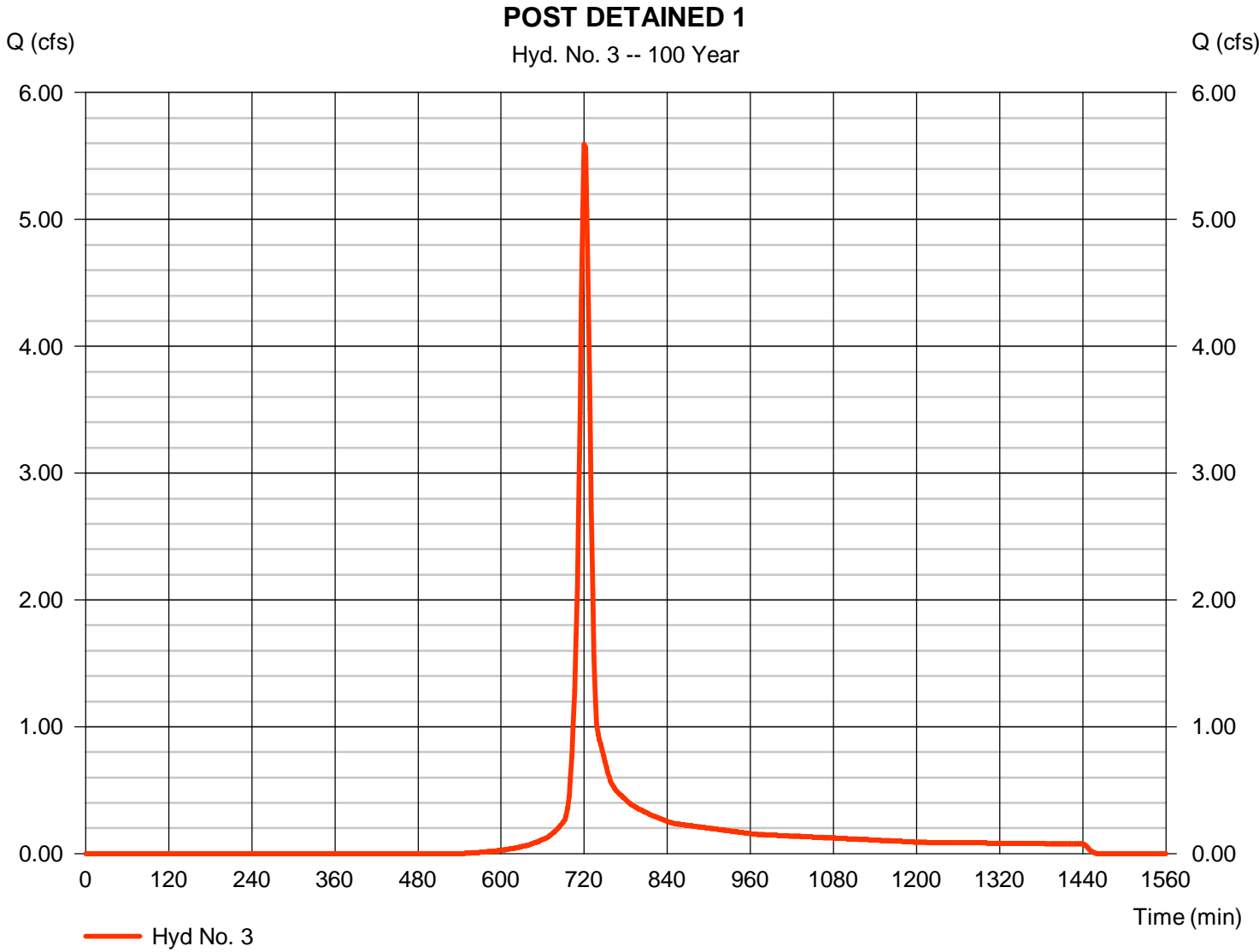
Friday, 10 / 21 / 2016

## Hyd. No. 3

### POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 5.591 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 14,550 cuft
Drainage area	= 1.120 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.40 min
Total precip.	= 7.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (0.160 x 85) + (0.050 x 55) + (0.830 x 58)] / 1.120



# Hydrograph Report

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

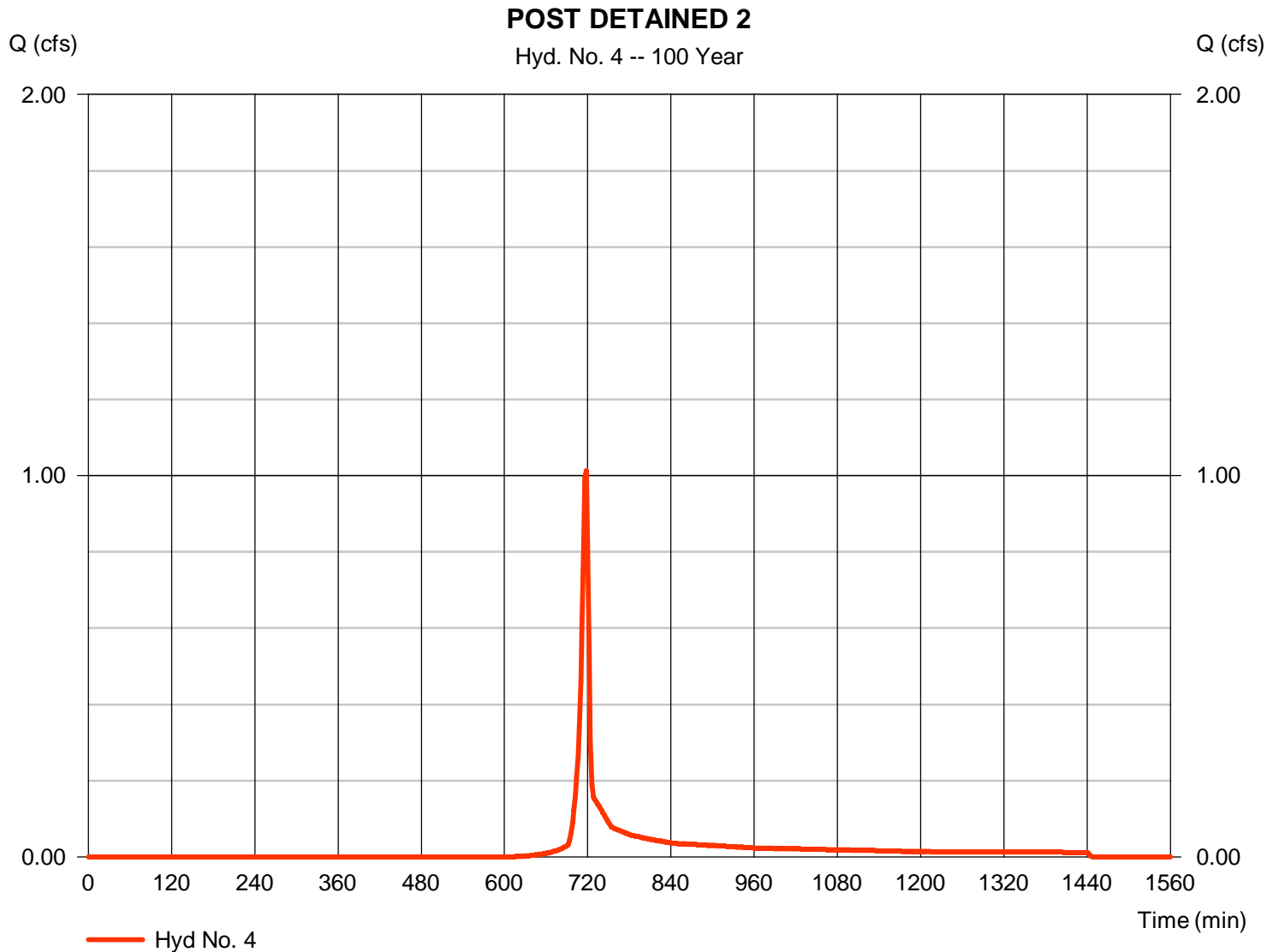
Friday, 10 / 21 / 2016

## Hyd. No. 4

### POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.014 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,028 cuft
Drainage area	= 0.210 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.60 min
Total precip.	= 7.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.010 x 85) + (0.200 x 58)] / 0.210



# Hydrograph Report

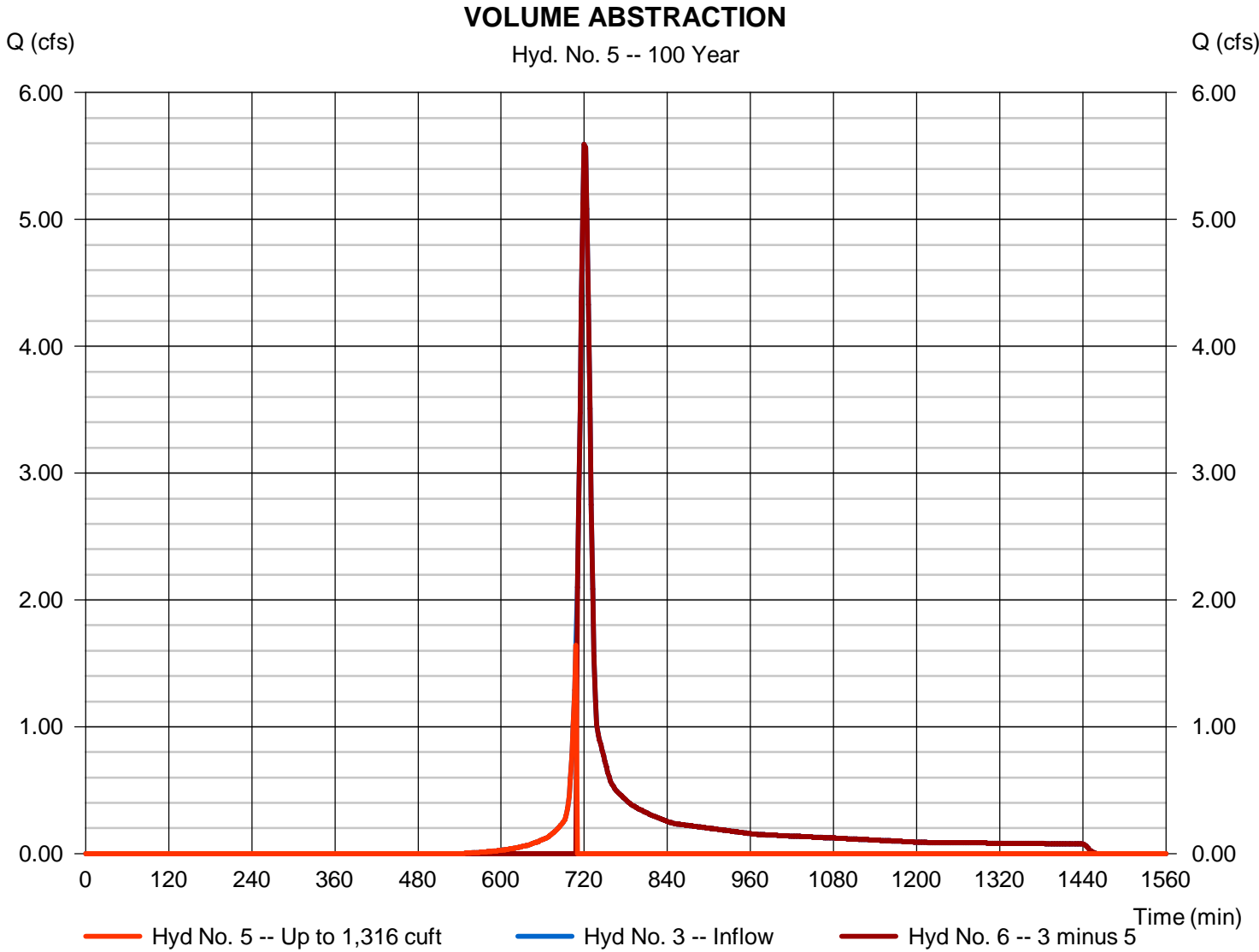
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Friday, 10 / 21 / 2016

## Hyd. No. 5

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.641 cfs
Storm frequency	= 100 yrs	Time to peak	= 708 min
Time interval	= 2 min	Hyd. volume	= 1,373 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

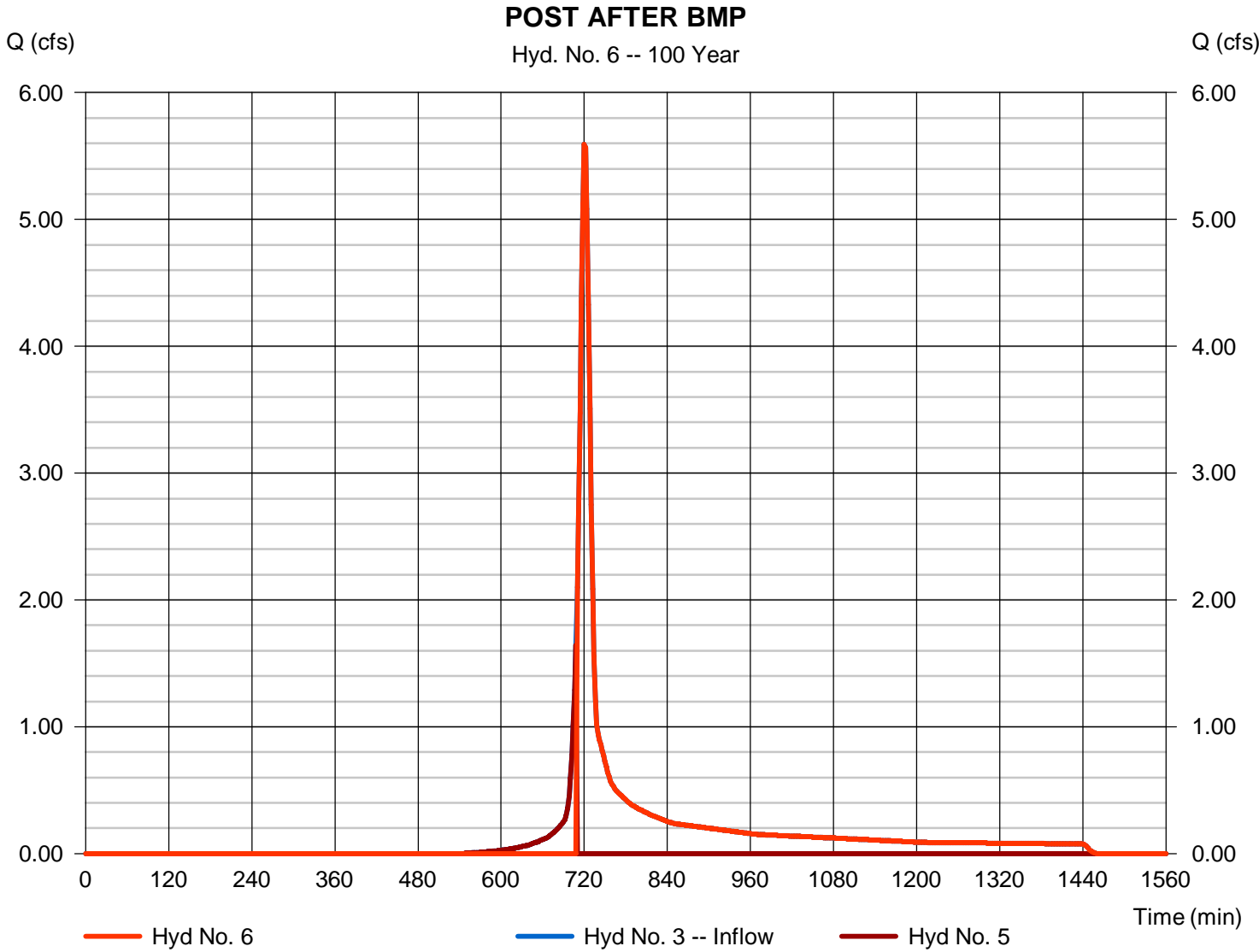
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Friday, 10 / 21 / 2016

## Hyd. No. 6

### POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 5.591 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 13,176 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

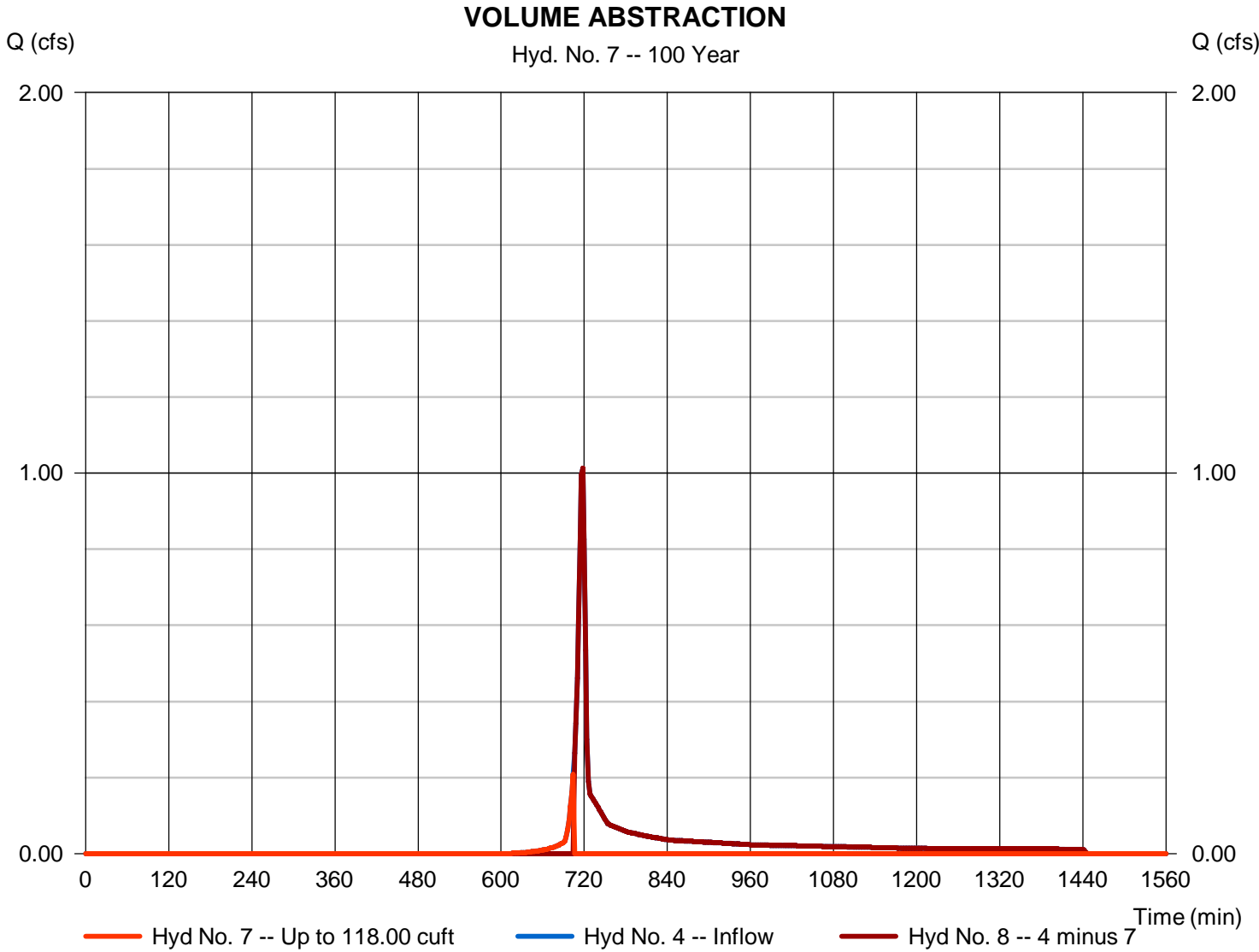
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Friday, 10 / 21 / 2016

## Hyd. No. 7

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.209 cfs
Storm frequency	= 100 yrs	Time to peak	= 704 min
Time interval	= 2 min	Hyd. volume	= 131 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

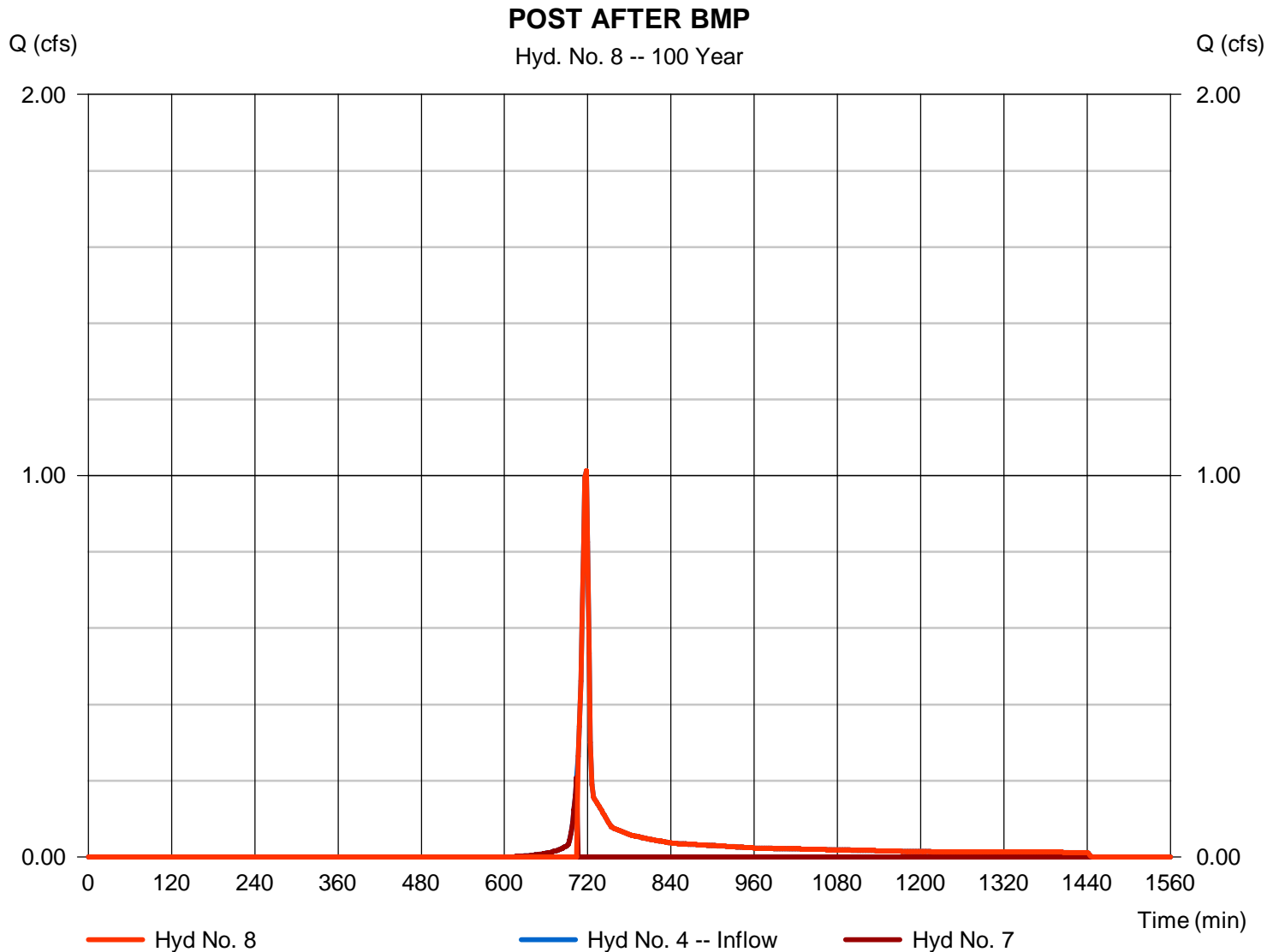
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Friday, 10 / 21 / 2016

## Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 1.014 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,897 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

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

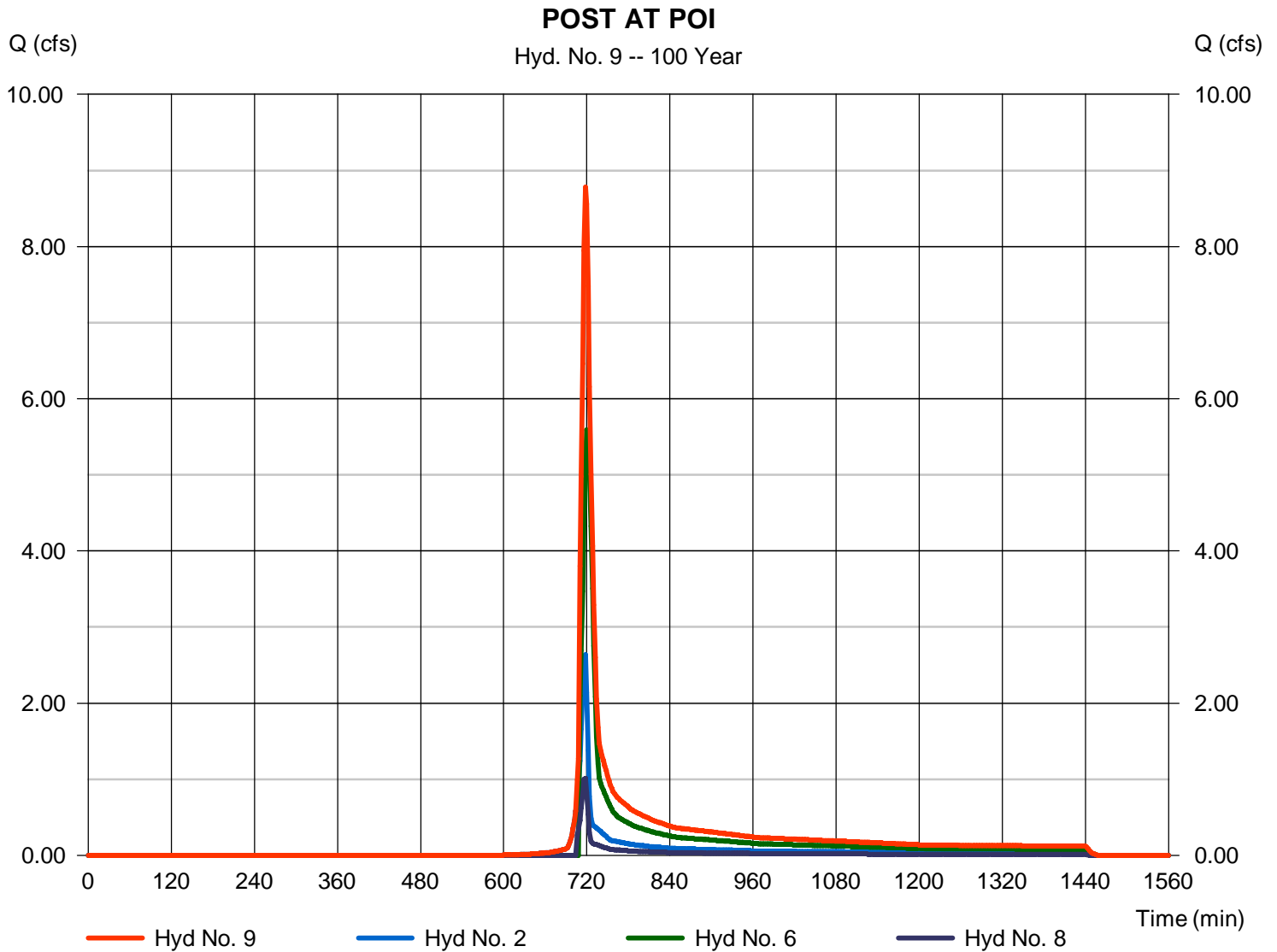
Friday, 10 / 21 / 2016

## Hyd. No. 9

POST AT POI

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

Peak discharge = 8.781 cfs  
 Time to peak = 718 min  
 Hyd. volume = 20,360 cuft  
 Contrib. drain. area = 0.510 ac

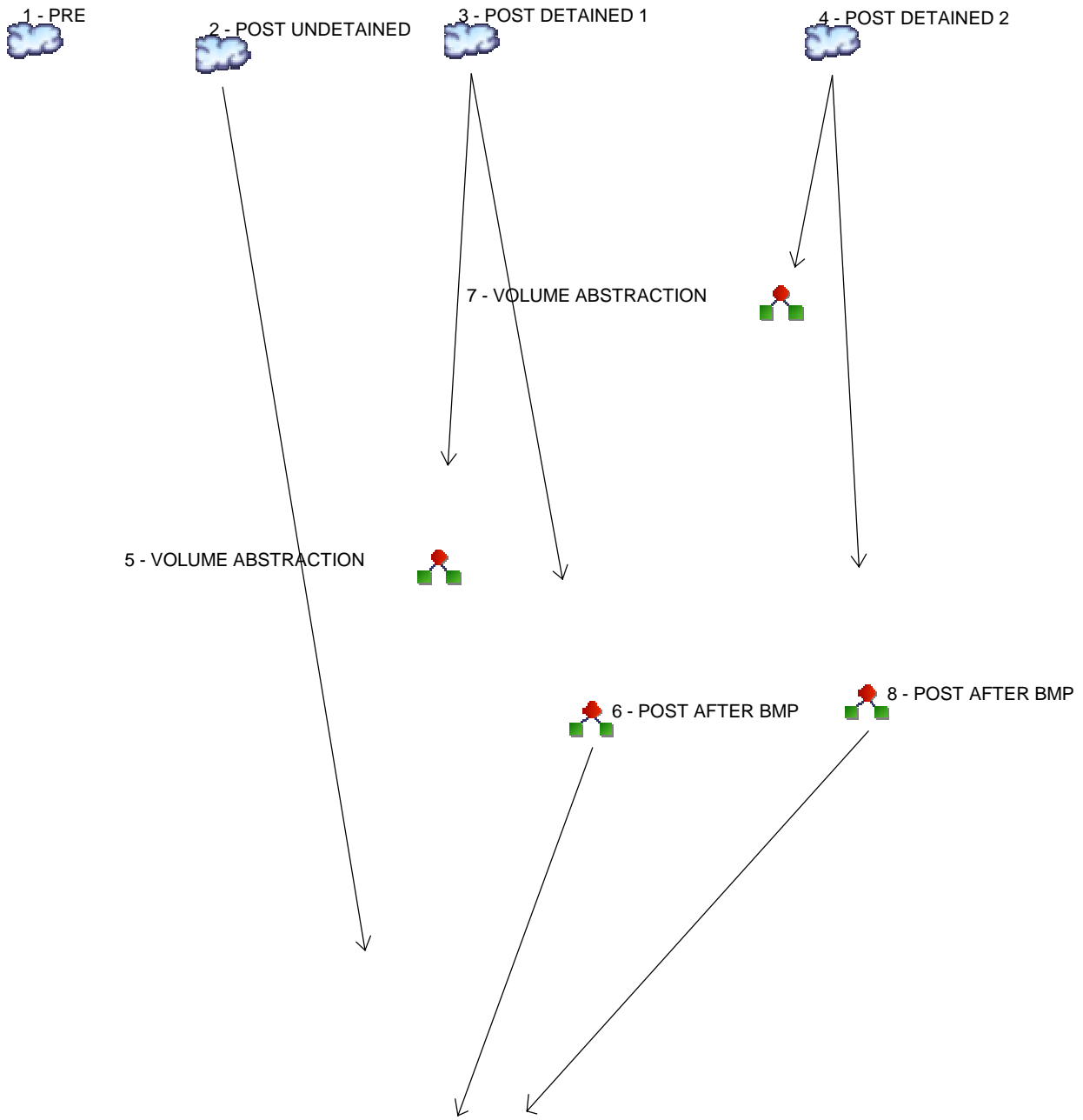






# Watershed Model Schematic

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



**Legend**

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



# Hydrograph Return Period Recap

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

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	0.705	-----	-----	-----	-----	-----	-----	PRE
2	SCS Runoff	-----	-----	0.270	-----	-----	-----	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	-----	-----	0.313	-----	-----	-----	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	-----	-----	0.080	-----	-----	-----	-----	-----	-----	POST DETAINED 2
5	Diversion1	3	-----	0.313	-----	-----	-----	-----	-----	-----	VOLUME ABSTRACTION
6	Diversion2	3	-----	0.047	-----	-----	-----	-----	-----	-----	POST AFTER BMP
7	Diversion1	4	-----	0.080	-----	-----	-----	-----	-----	-----	VOLUME ABSTRACTION
8	Diversion2	4	-----	0.006	-----	-----	-----	-----	-----	-----	POST AFTER BMP
9	Combine	2, 6, 8	-----	0.270	-----	-----	-----	-----	-----	-----	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	0.705	2	722	2,422	-----	-----	-----	PRE
2	SCS Runoff	0.270	2	718	687	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	0.313	2	742	2,229	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	0.080	2	718	236	-----	-----	-----	POST DETAINED 2
5	Diversion1	0.313	2	742	1,317	3	-----	-----	VOLUME ABSTRACTION
6	Diversion2	0.047	2	892	912	3	-----	-----	POST AFTER BMP
7	Diversion1	0.080	2	718	118	4	-----	-----	VOLUME ABSTRACTION
8	Diversion2	0.006	2	858	118	4	-----	-----	POST AFTER BMP
9	Combine	0.270	2	718	1,716	2, 6, 8	-----	-----	POST AT POI

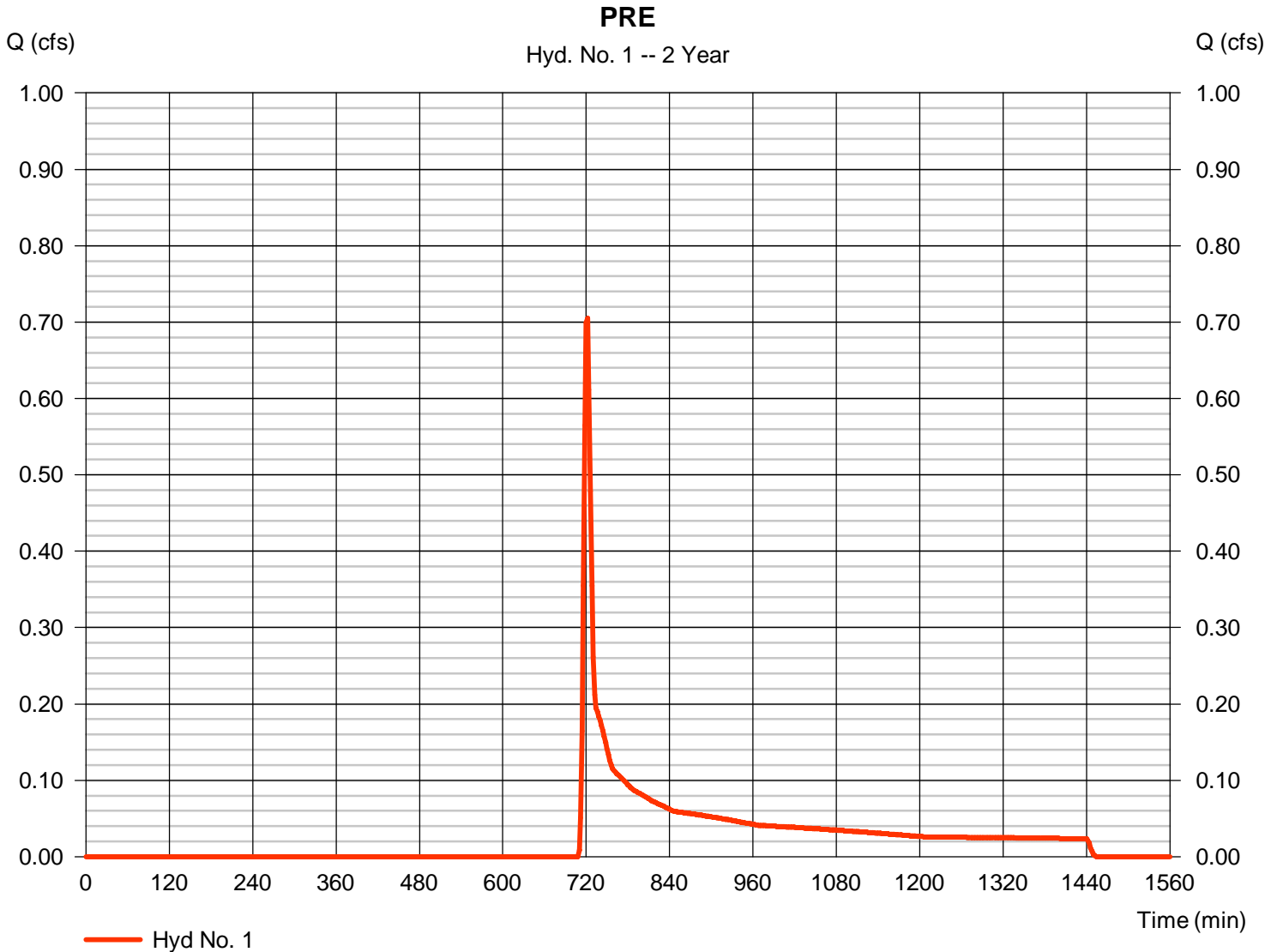
# Hydrograph Report

## Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 0.705 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 2,422 cuft
Drainage area	= 1.840 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 3.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.090 x 98) + (0.070 x 55) + (1.680 x 58)] / 1.840



# TR55 Tc Worksheet

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

## Hyd. No. 1

PRE

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 2.60	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 7.52</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 7.52</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 360.00	220.00	0.00	
Watercourse slope (%)	= 7.30	8.70	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=4.36	4.76	0.00	
<b>Travel Time (min)</b>	<b>= 1.38</b>	<b>+</b> <b>0.77</b>	<b>+</b> <b>0.00</b>	<b>= 2.15</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>9.70 min</b>

# Hydrograph Report

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

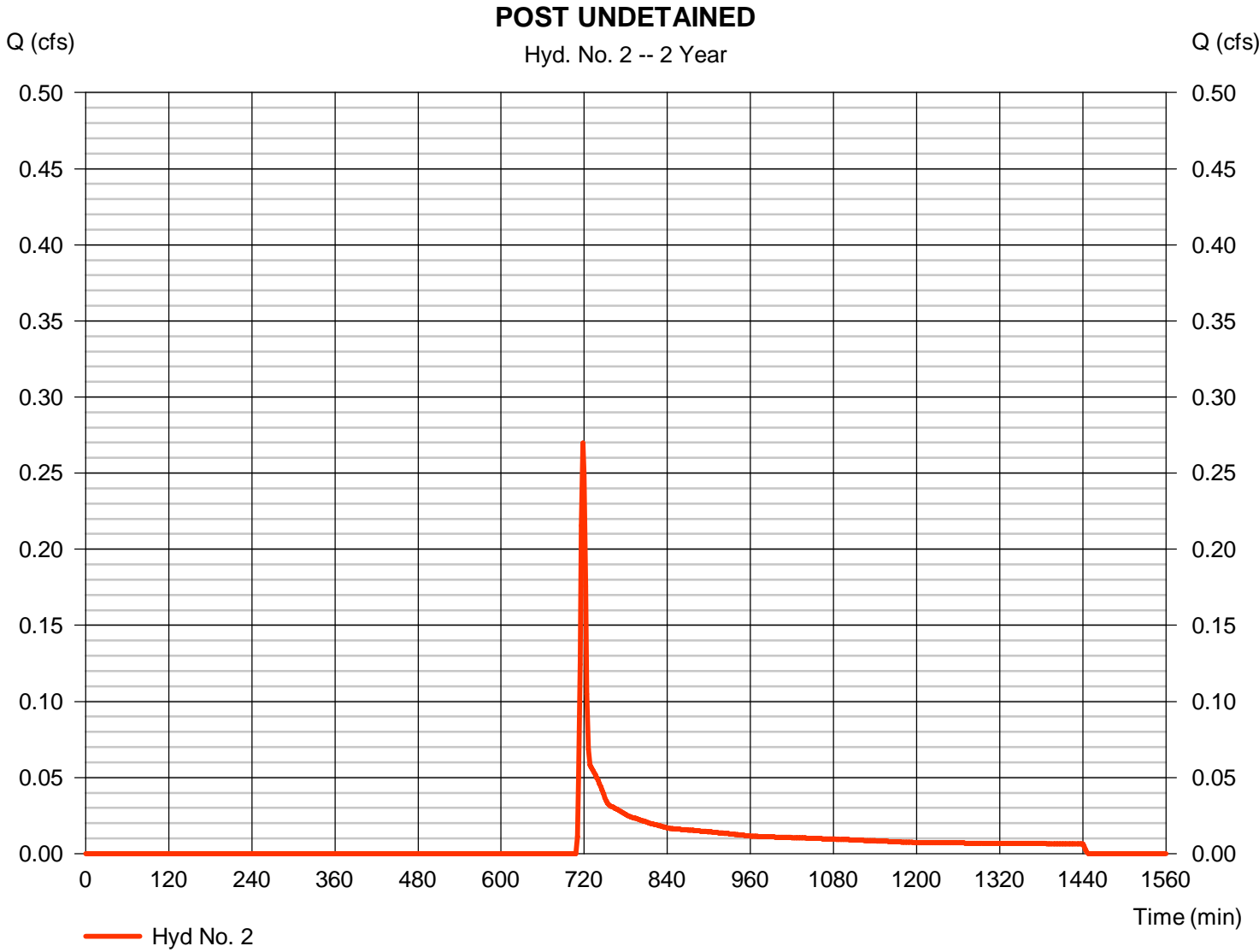
Friday, 10 / 21 / 2016

## Hyd. No. 2

### POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 0.270 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 687 cuft
Drainage area	= 0.510 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.20 min
Total precip.	= 3.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.050 x 55) + (0.410 x 58) + (0.040 x 98) + (0.010 x 85)] / 0.510



# TR55 Tc Worksheet

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

## Hyd. No. 2

POST UNDETAINED

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 4.08</b>	<b>+</b>	<b>0.00</b>	<b>+</b>
			<b>0.00</b>	<b>= 4.08</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 187.00	172.00	0.00	
Watercourse slope (%)	= 9.10	8.70	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.87	6.00	0.00	
<b>Travel Time (min)</b>	<b>= 0.64</b>	<b>+</b>	<b>0.48</b>	<b>+</b>
			<b>0.00</b>	<b>= 1.12</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b>	<b>0.00</b>	<b>+</b>
			<b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>5.20 min</b>

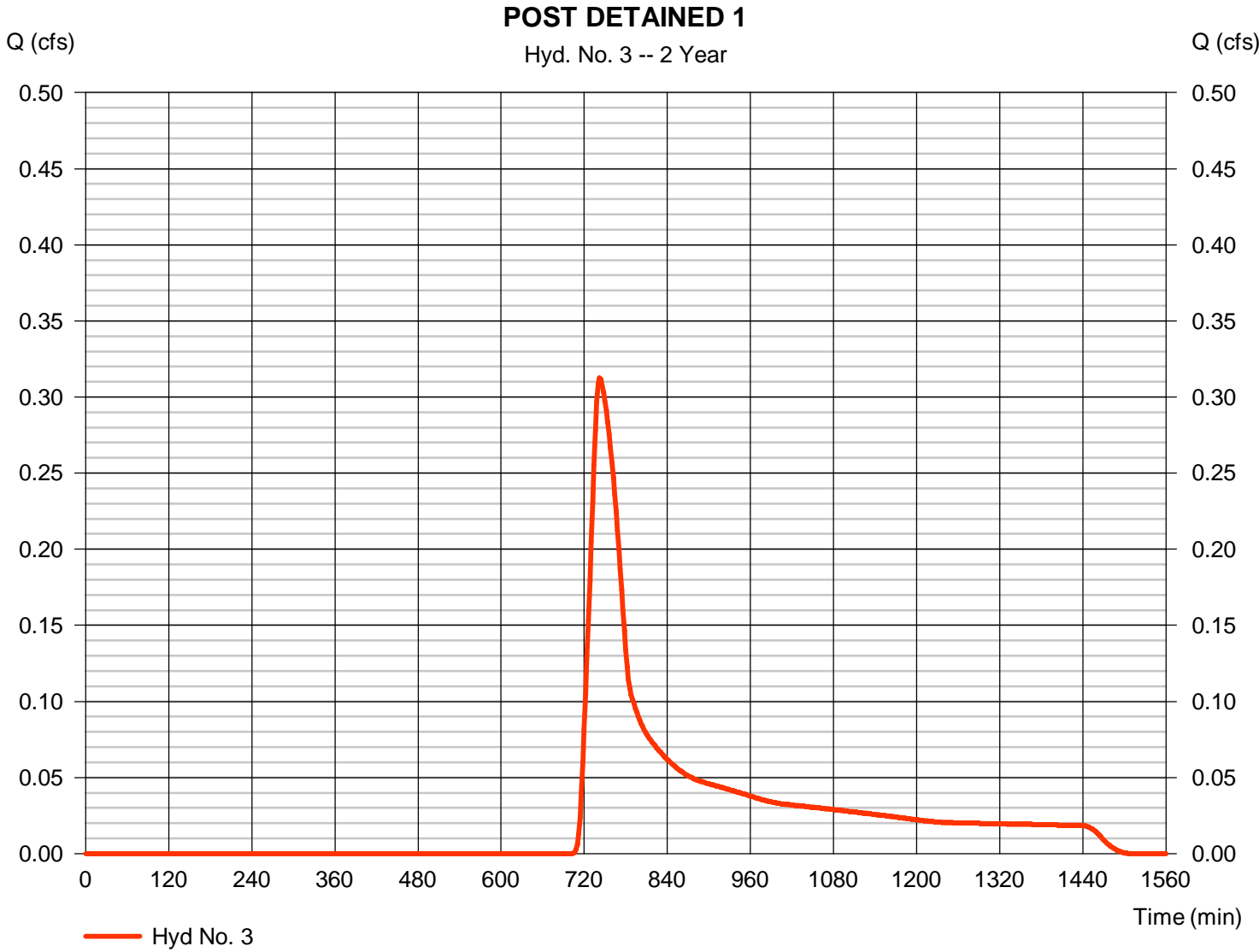
# Hydrograph Report

## Hyd. No. 3

### POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.313 cfs
Storm frequency	= 2 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 2,229 cuft
Drainage area	= 1.120 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 43.03 min
Total precip.	= 3.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (0.160 x 85) + (0.050 x 55) + (0.830 x 58)] / 1.120





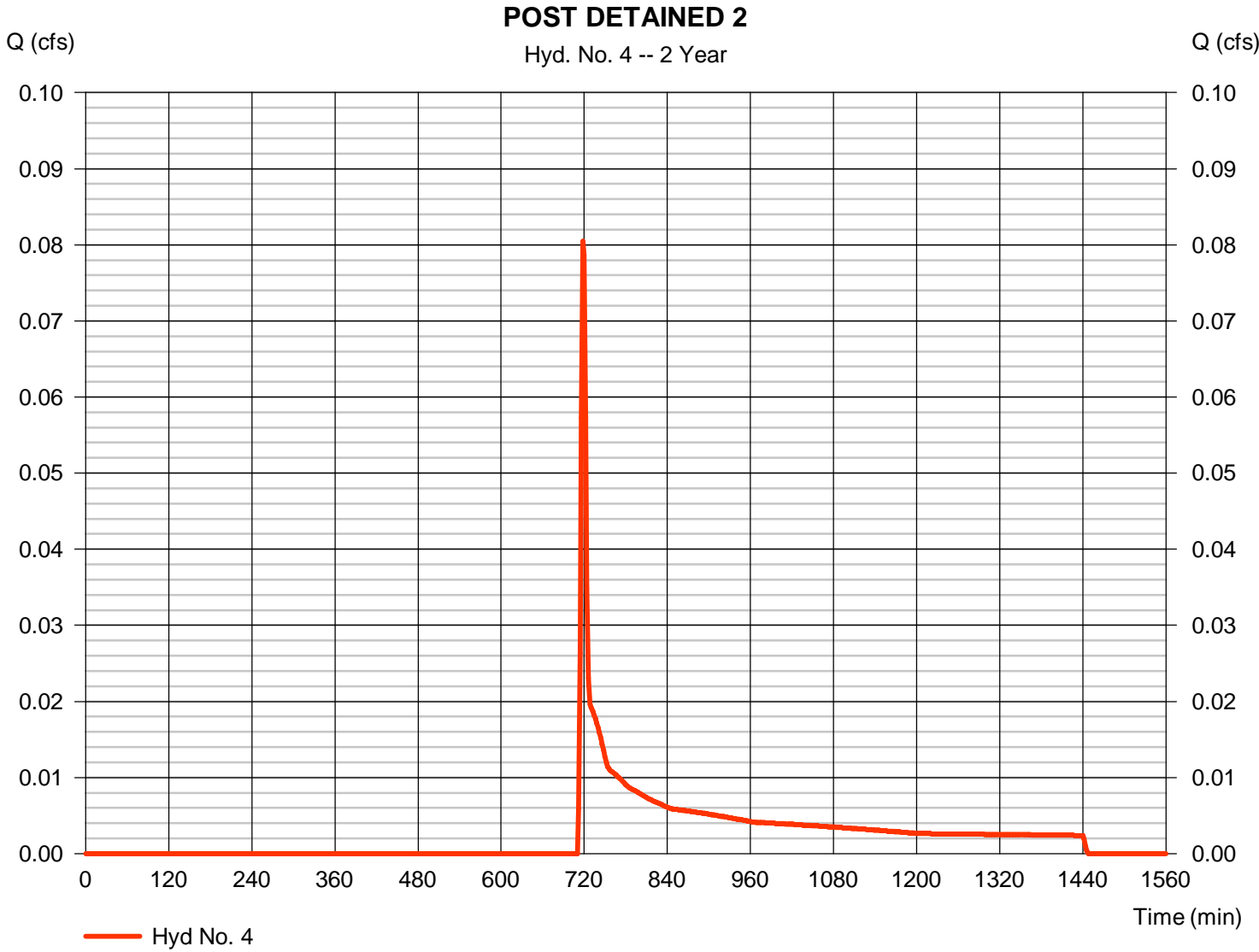
# Hydrograph Report

## Hyd. No. 4

### POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.080 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 236 cuft
Drainage area	= 0.210 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.60 min
Total precip.	= 3.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.010 x 85) + (0.200 x 58)] / 0.210



# TR55 Tc Worksheet

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

## Hyd. No. 4

POST DETAINED 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 5.38</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 5.38</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 78.00	0.00	0.00	
Watercourse slope (%)	= 10.30	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=5.18	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 0.25</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.25</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>5.60 min</b>

# Hydrograph Report

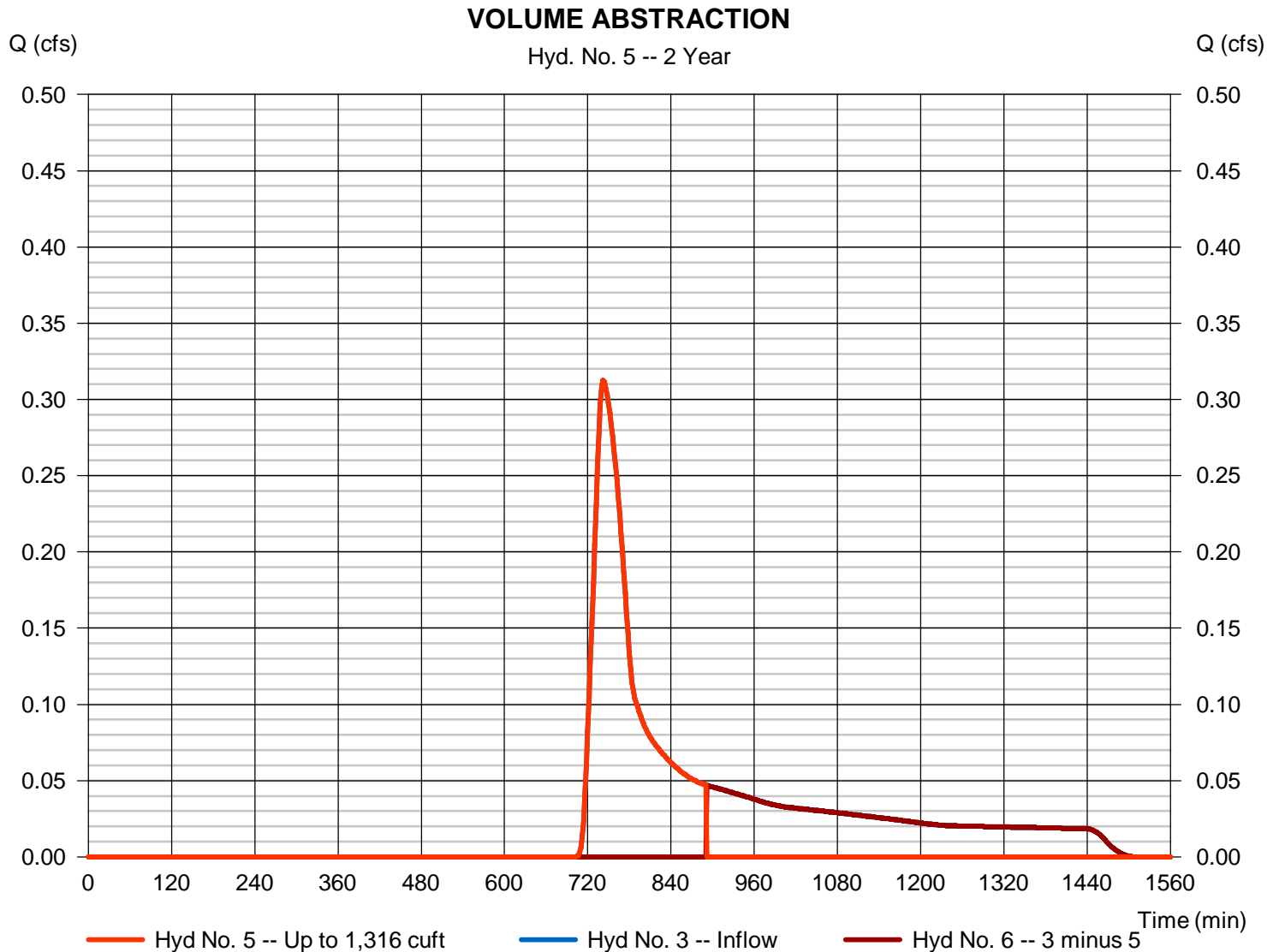
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Friday, 10 / 21 / 2016

## Hyd. No. 5

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.313 cfs
Storm frequency	= 2 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 1,317 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

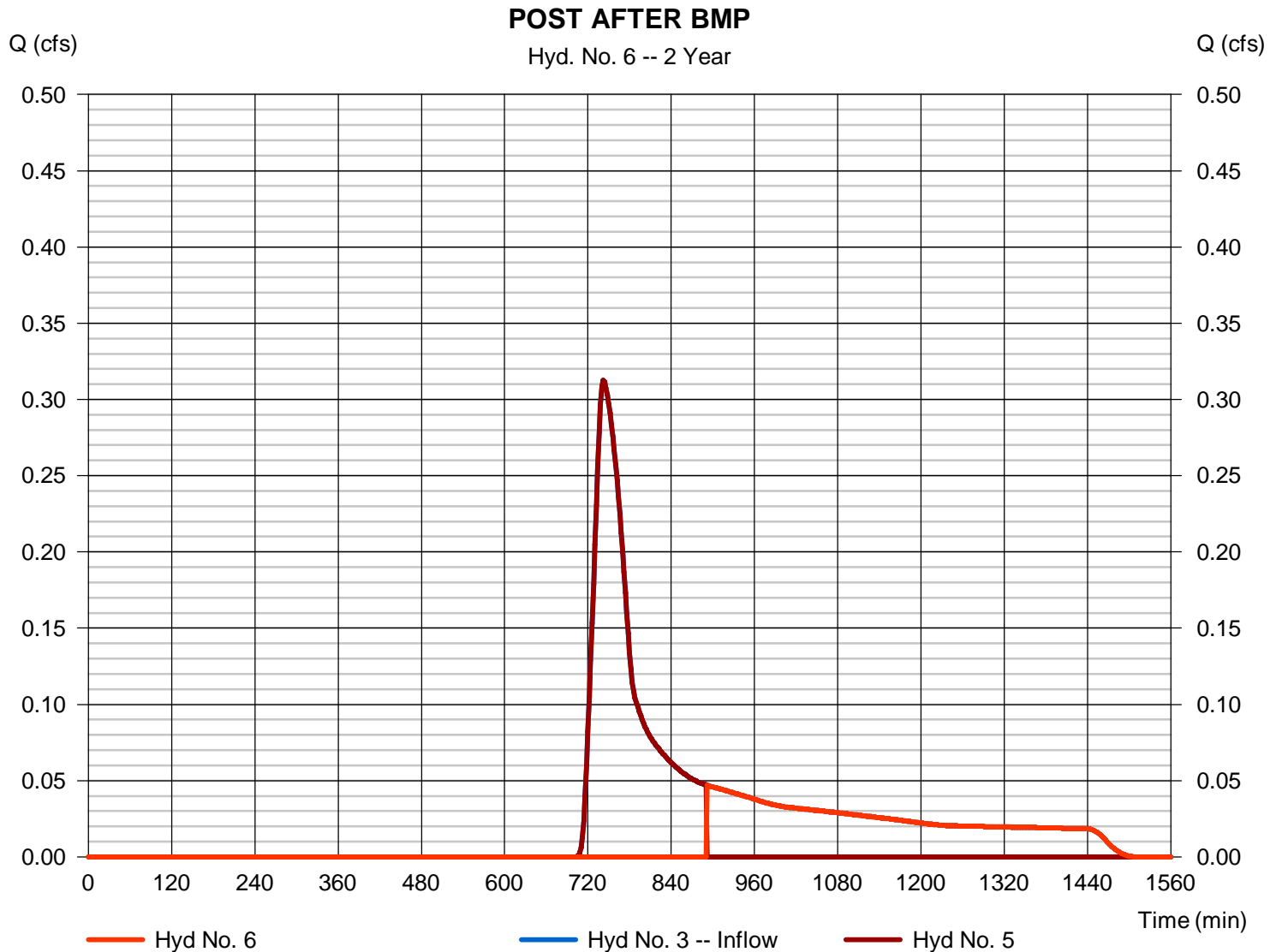
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Friday, 10 / 21 / 2016

## Hyd. No. 6

### POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.047 cfs
Storm frequency	= 2 yrs	Time to peak	= 892 min
Time interval	= 2 min	Hyd. volume	= 912 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

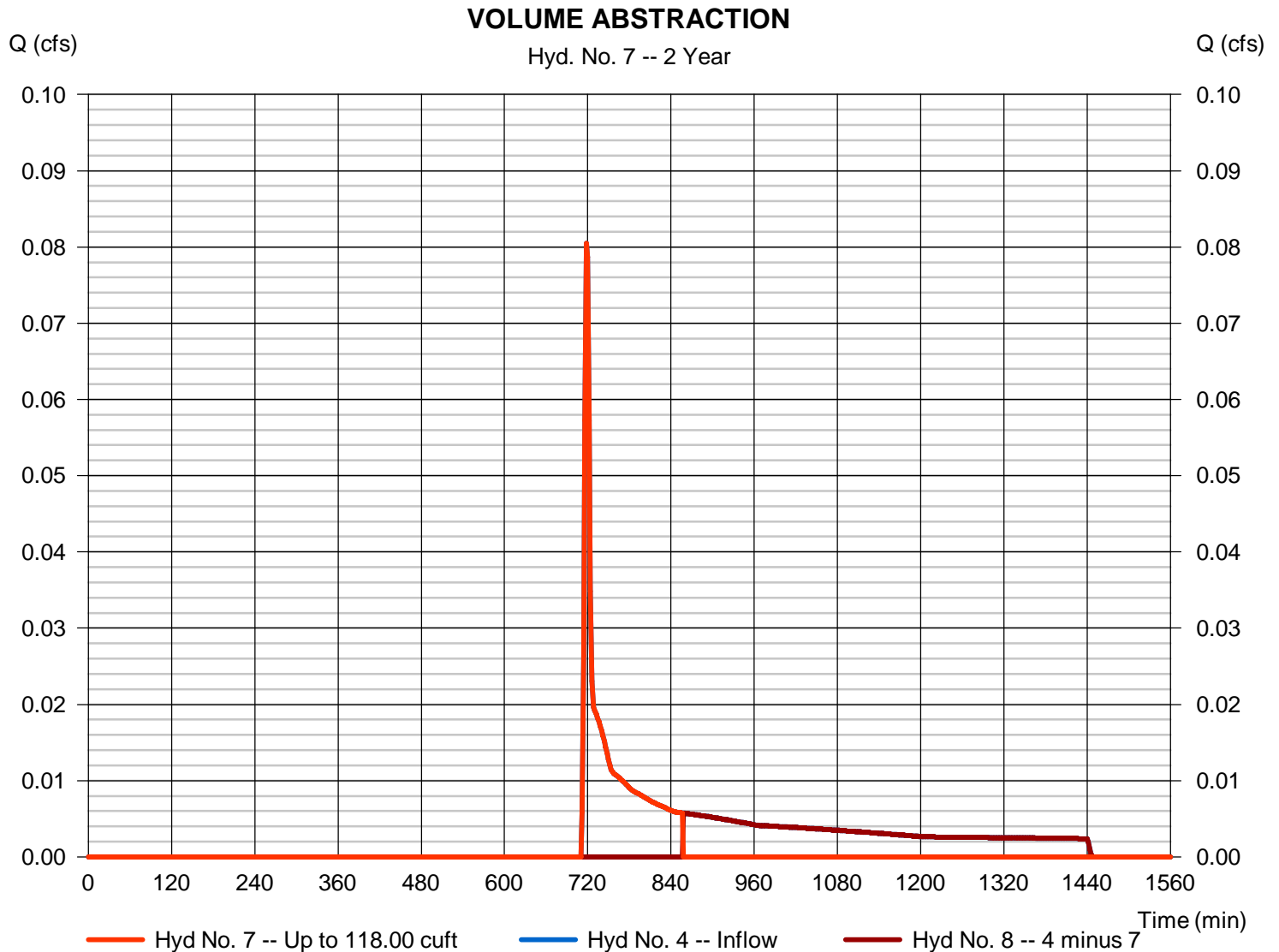
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Friday, 10 / 21 / 2016

## Hyd. No. 7

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.080 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 118 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

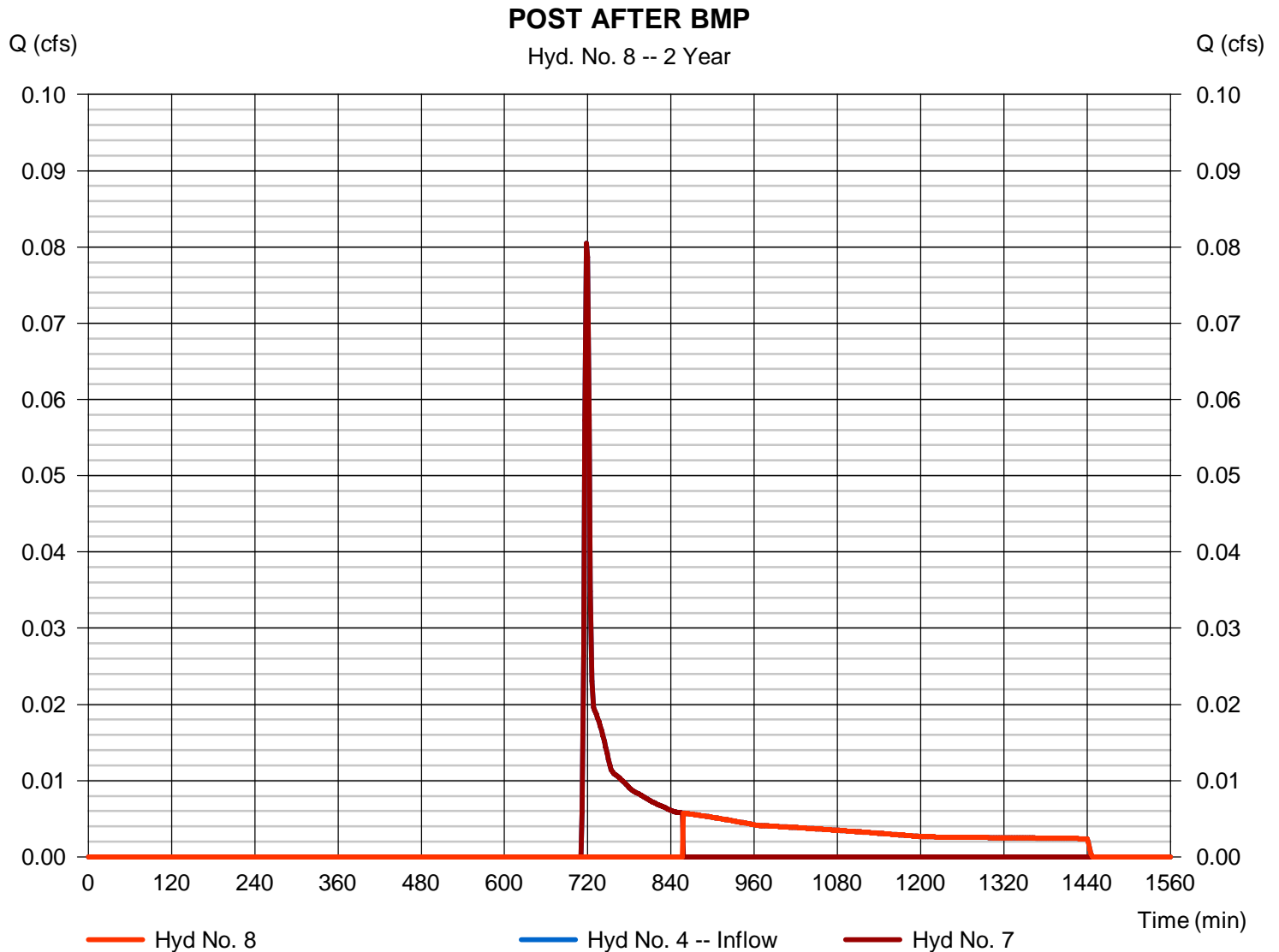
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Friday, 10 / 21 / 2016

## Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.006 cfs
Storm frequency	= 2 yrs	Time to peak	= 858 min
Time interval	= 2 min	Hyd. volume	= 118 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

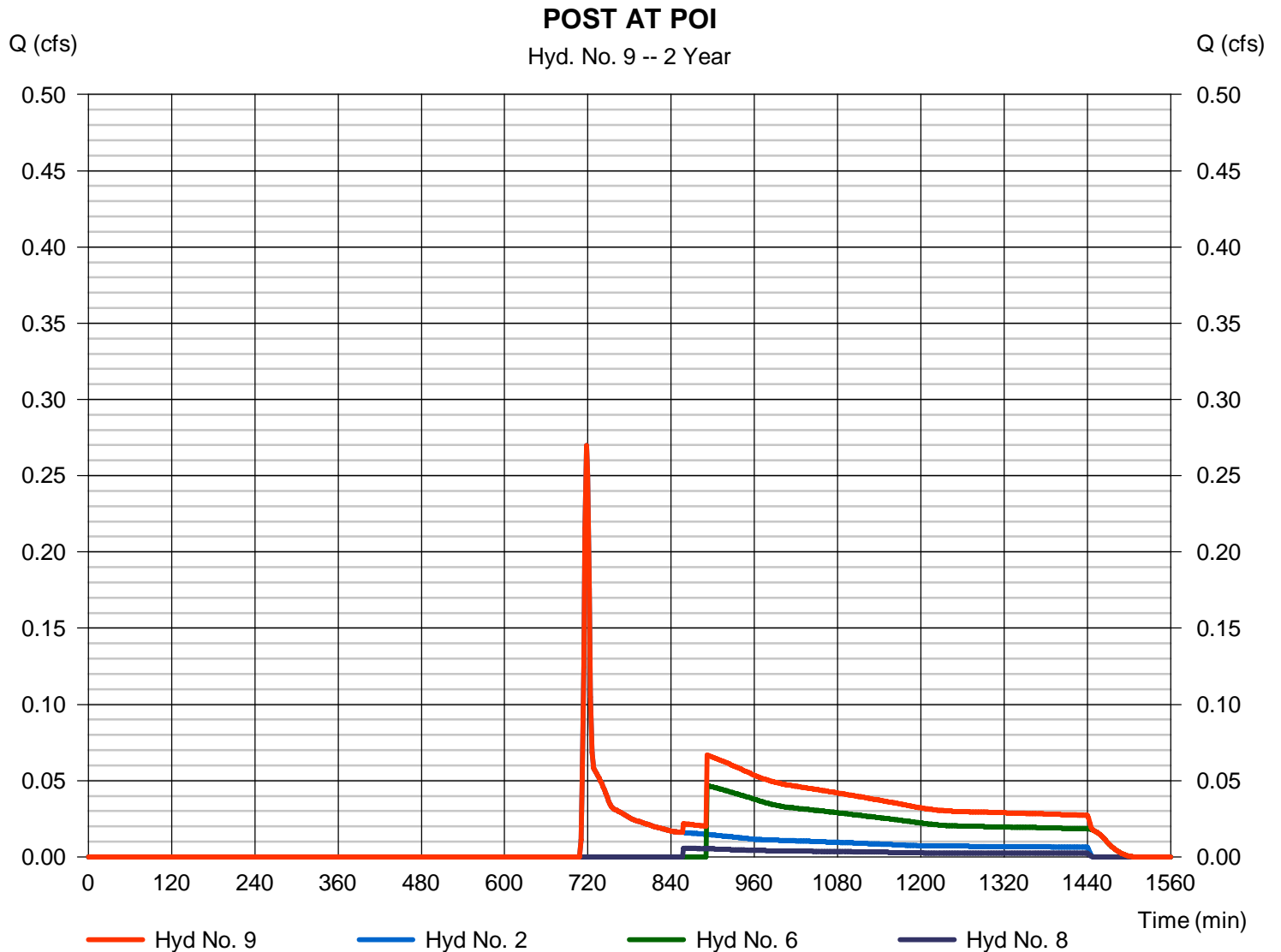
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Friday, 10 / 21 / 2016

## Hyd. No. 9

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.270 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,716 cuft
Inflow hyds.	= 2, 6, 8	Contrib. drain. area	= 0.510 ac

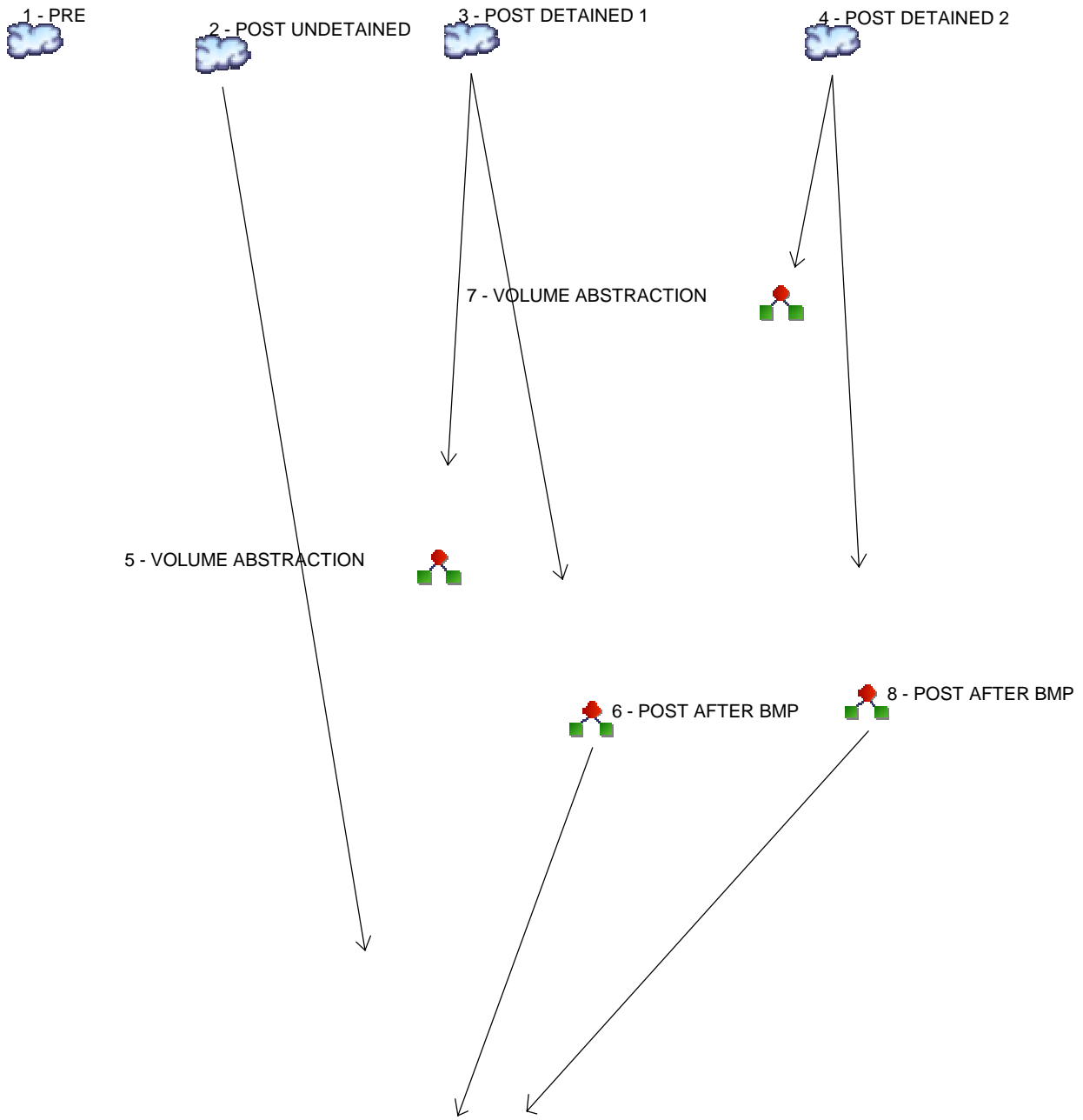






# Watershed Model Schematic

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



**Legend**

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



# Hydrograph Return Period Recap

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

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	-----	-----	-----	2.918	-----	-----	-----	PRE
2	SCS Runoff	-----	-----	-----	-----	-----	0.951	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	-----	-----	-----	-----	-----	1.538	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	-----	-----	-----	-----	-----	0.343	-----	-----	-----	POST DETAINED 2
5	Diversion1	3	-----	-----	-----	-----	1.538	-----	-----	-----	VOLUME ABSTRACTION
6	Diversion2	3	-----	-----	-----	-----	1.407	-----	-----	-----	POST AFTER BMP
7	Diversion1	4	-----	-----	-----	-----	0.343	-----	-----	-----	VOLUME ABSTRACTION
8	Diversion2	4	-----	-----	-----	-----	0.292	-----	-----	-----	POST AFTER BMP
9	Combine	2, 6, 8	-----	-----	-----	-----	1.614	-----	-----	-----	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	2.918	2	720	7,102	-----	-----	-----	PRE
2	SCS Runoff	0.951	2	718	1,951	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	1.538	2	728	5,714	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	0.343	2	718	717	-----	-----	-----	POST DETAINED 2
5	Diversion1	1.538	2	728	1,430	3	-----	-----	VOLUME ABSTRACTION
6	Diversion2	1.407	2	732	4,283	3	-----	-----	POST AFTER BMP
7	Diversion1	0.343	2	718	157	4	-----	-----	VOLUME ABSTRACTION
8	Diversion2	0.292	2	720	560	4	-----	-----	POST AFTER BMP
9	Combine	1.614	2	732	6,795	2, 6, 8	-----	-----	POST AT POI

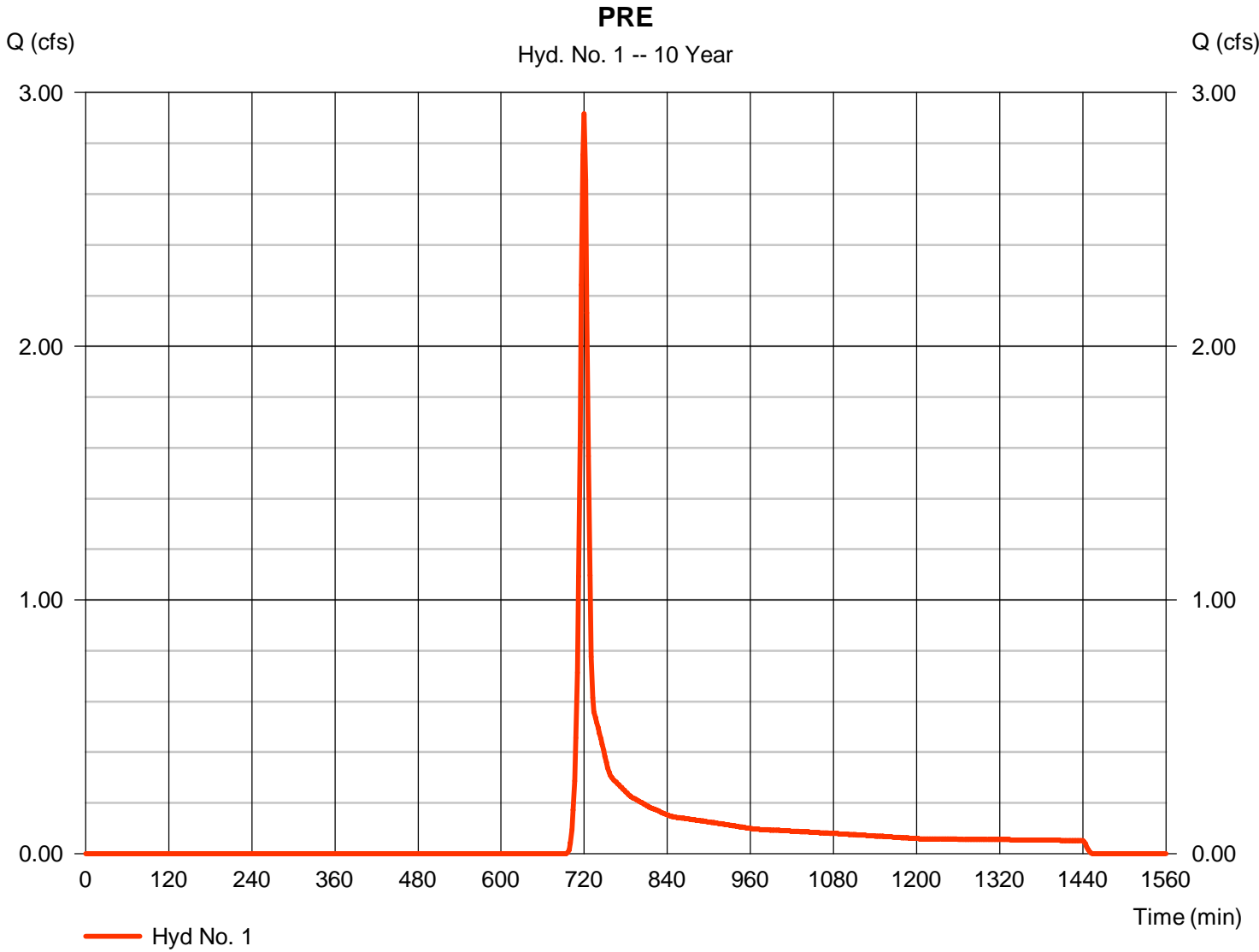
# Hydrograph Report

## Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 2.918 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 7,102 cuft
Drainage area	= 1.840 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 4.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.090 x 98) + (0.070 x 55) + (1.680 x 58)] / 1.840



# TR55 Tc Worksheet

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

## Hyd. No. 1

PRE

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 2.60	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 7.52</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 7.52</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 360.00	220.00	0.00	
Watercourse slope (%)	= 7.30	8.70	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=4.36	4.76	0.00	
<b>Travel Time (min)</b>	<b>= 1.38</b>	<b>+</b> <b>0.77</b>	<b>+</b> <b>0.00</b>	<b>= 2.15</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>9.70 min</b>

# Hydrograph Report

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

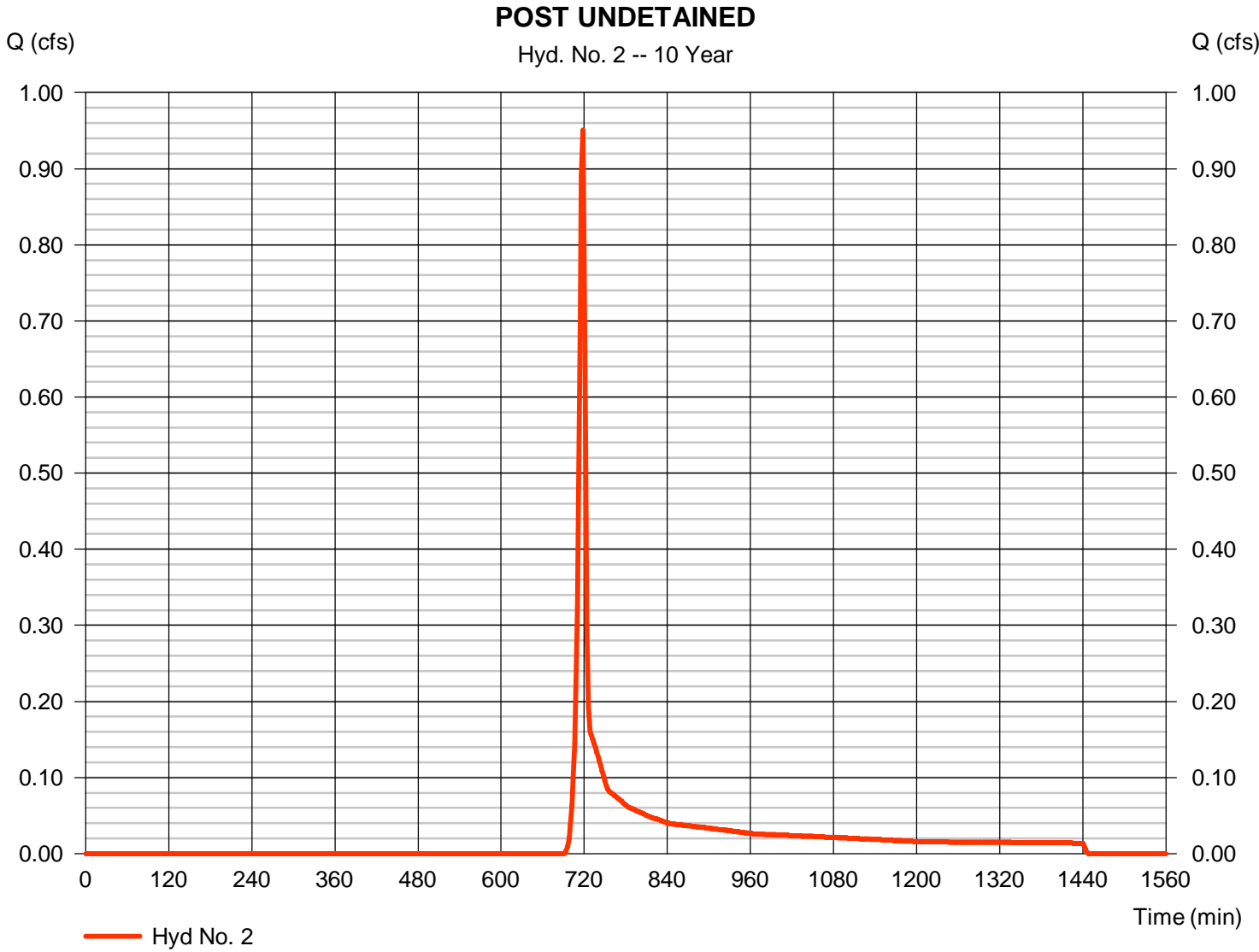
Friday, 10 / 21 / 2016

## Hyd. No. 2

### POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 0.951 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,951 cuft
Drainage area	= 0.510 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.20 min
Total precip.	= 4.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.050 x 55) + (0.410 x 58) + (0.040 x 98) + (0.010 x 85)] / 0.510



# TR55 Tc Worksheet

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

## Hyd. No. 2

POST UNDETAINED

<u>Description</u>	<u>A</u>		<u>B</u>		<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>						
Manning's n-value	= 0.240		0.011		0.011	
Flow length (ft)	= 50.0		0.0		0.0	
Two-year 24-hr precip. (in)	= 3.08		0.00		0.00	
Land slope (%)	= 12.00		0.00		0.00	
<b>Travel Time (min)</b>	<b>= 4.08</b>	<b>+</b>	<b>0.00</b>	<b>+</b>	<b>0.00</b>	<b>= 4.08</b>
<b>Shallow Concentrated Flow</b>						
Flow length (ft)	= 187.00		172.00		0.00	
Watercourse slope (%)	= 9.10		8.70		0.00	
Surface description	= Unpaved		Paved		Paved	
Average velocity (ft/s)	=4.87		6.00		0.00	
<b>Travel Time (min)</b>	<b>= 0.64</b>	<b>+</b>	<b>0.48</b>	<b>+</b>	<b>0.00</b>	<b>= 1.12</b>
<b>Channel Flow</b>						
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b>	<b>0.00</b>	<b>+</b>	<b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>						<b>5.20 min</b>

# Hydrograph Report

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

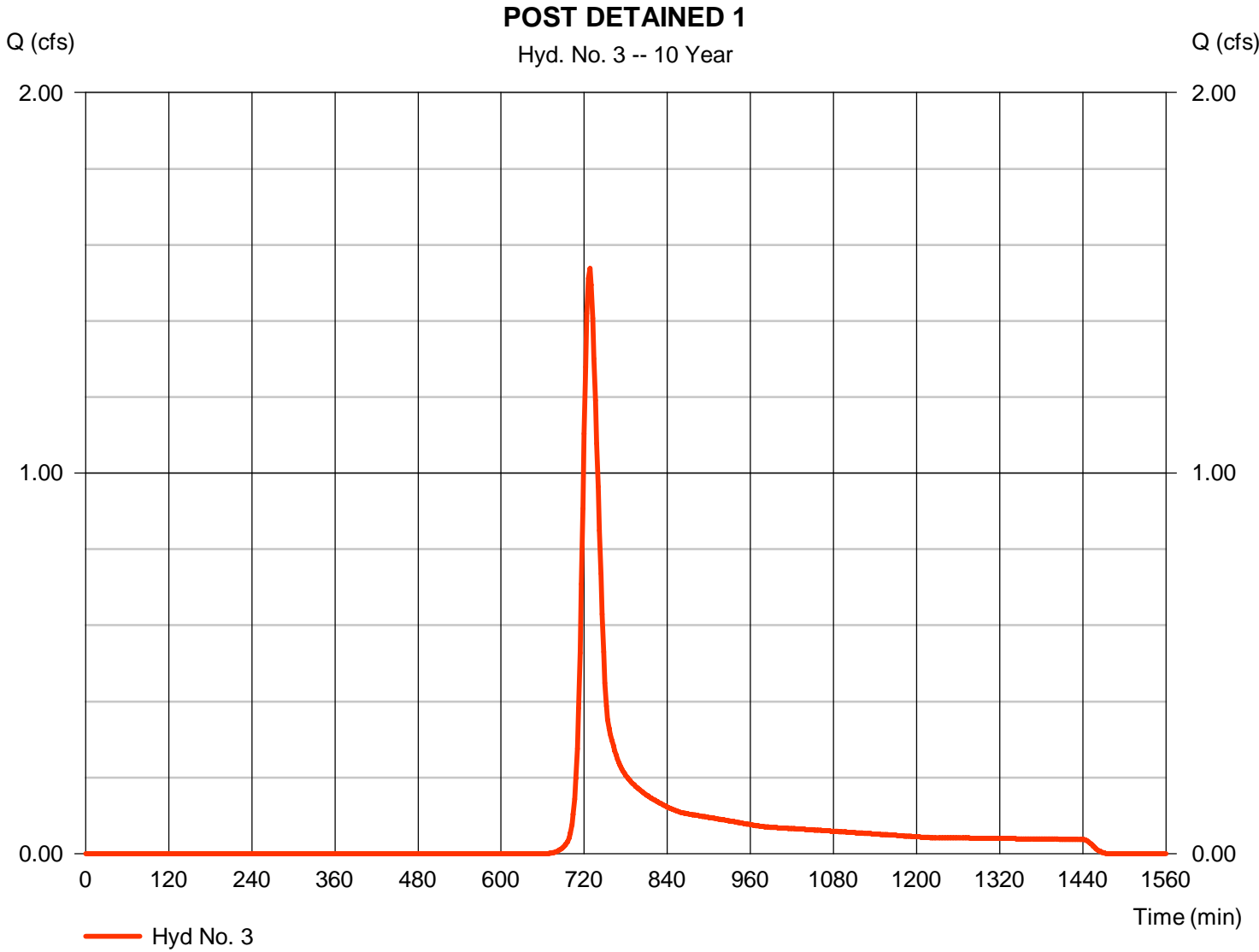
Friday, 10 / 21 / 2016

## Hyd. No. 3

### POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.538 cfs
Storm frequency	= 10 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 5,714 cuft
Drainage area	= 1.120 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 22.60 min
Total precip.	= 4.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (0.160 x 85) + (0.050 x 55) + (0.830 x 58)] / 1.120





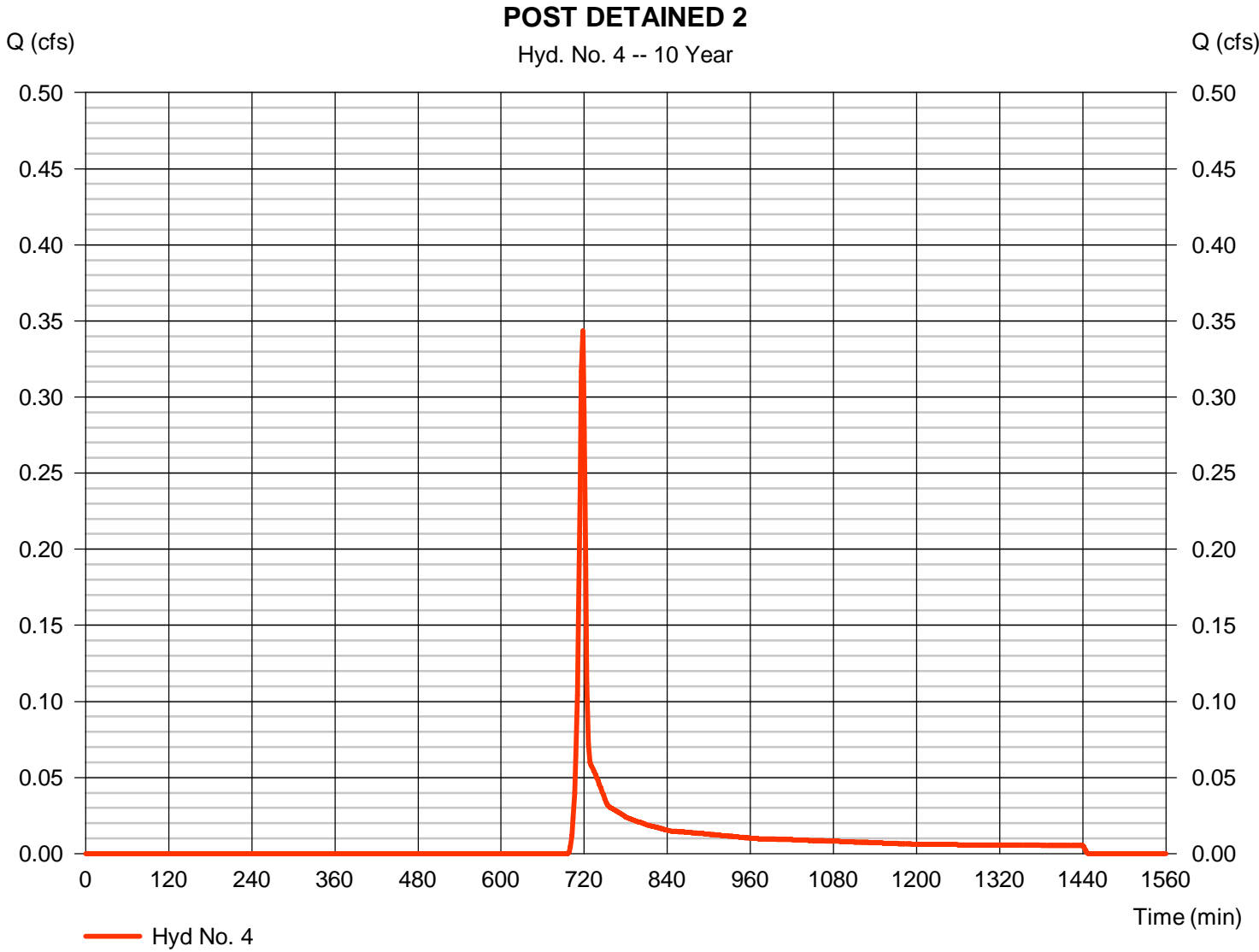
# Hydrograph Report

## Hyd. No. 4

### POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.343 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 717 cuft
Drainage area	= 0.210 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.60 min
Total precip.	= 4.58 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.010 x 85) + (0.200 x 58)] / 0.210



# TR55 Tc Worksheet

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

## Hyd. No. 4

POST DETAINED 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 5.38</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 5.38</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 78.00	0.00	0.00	
Watercourse slope (%)	= 10.30	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=5.18	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 0.25</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.25</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>5.60 min</b>

# Hydrograph Report

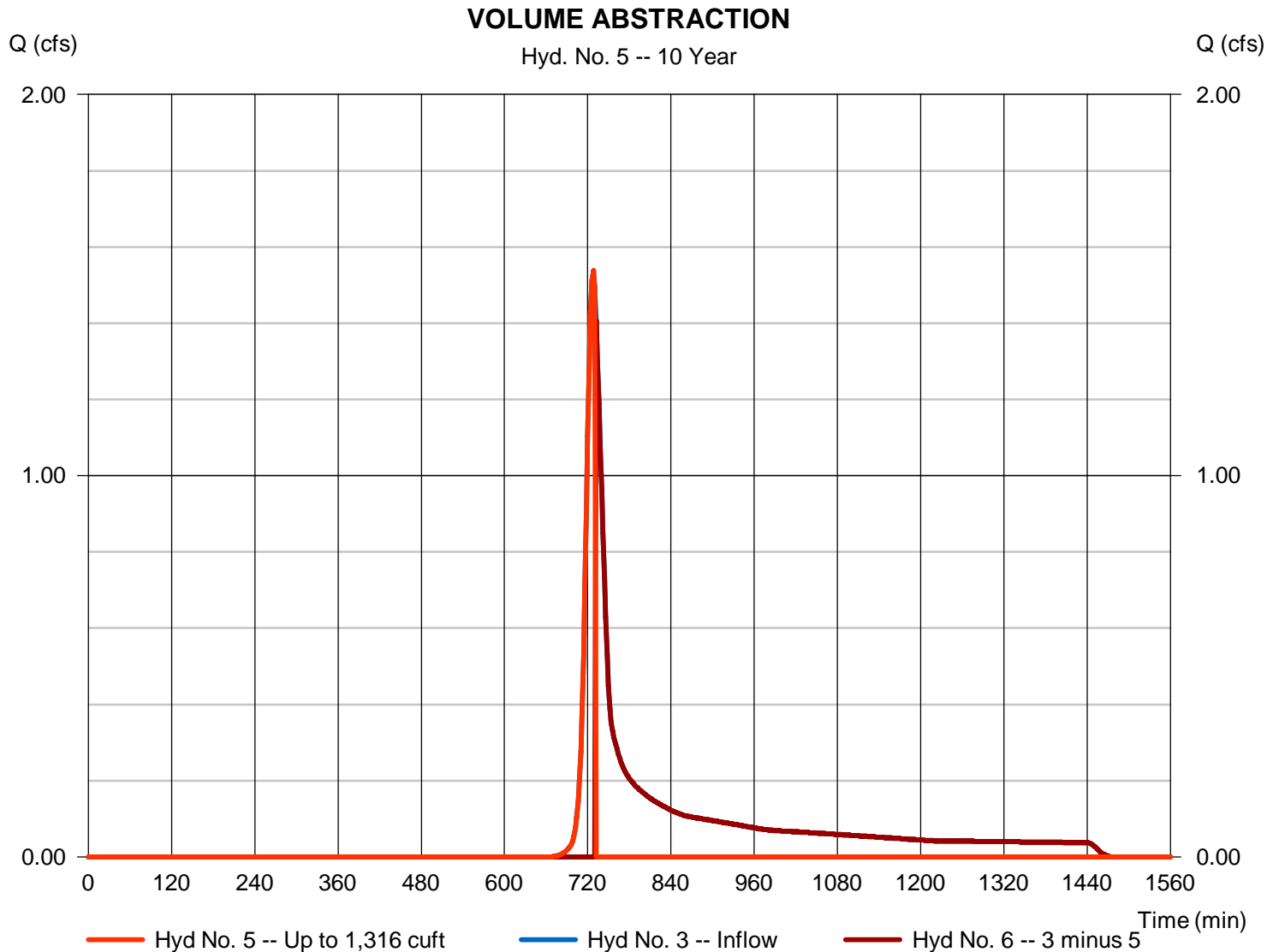
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Friday, 10 / 21 / 2016

## Hyd. No. 5

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.538 cfs
Storm frequency	= 10 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 1,430 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

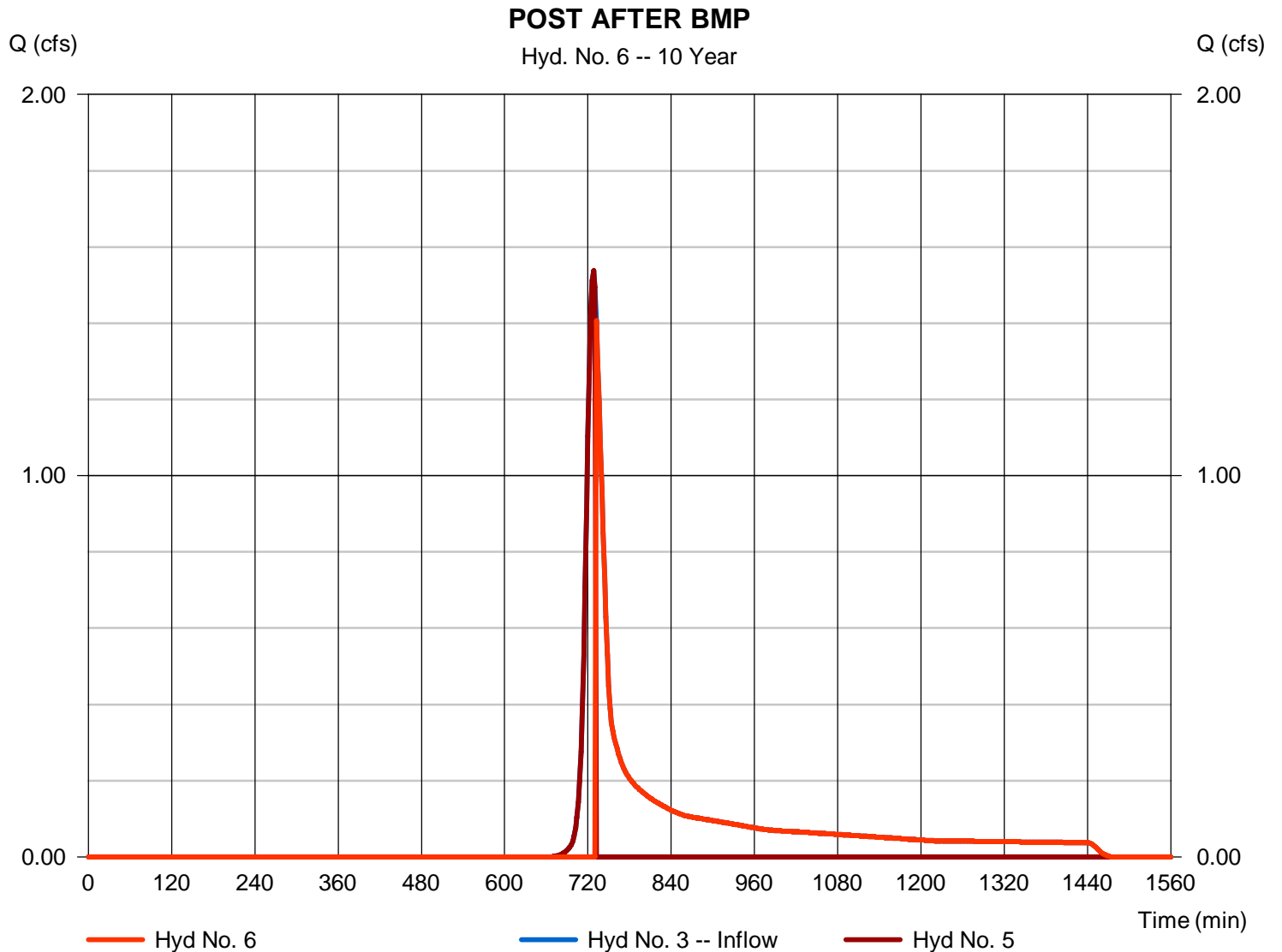
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 6

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 1.407 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 4,283 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

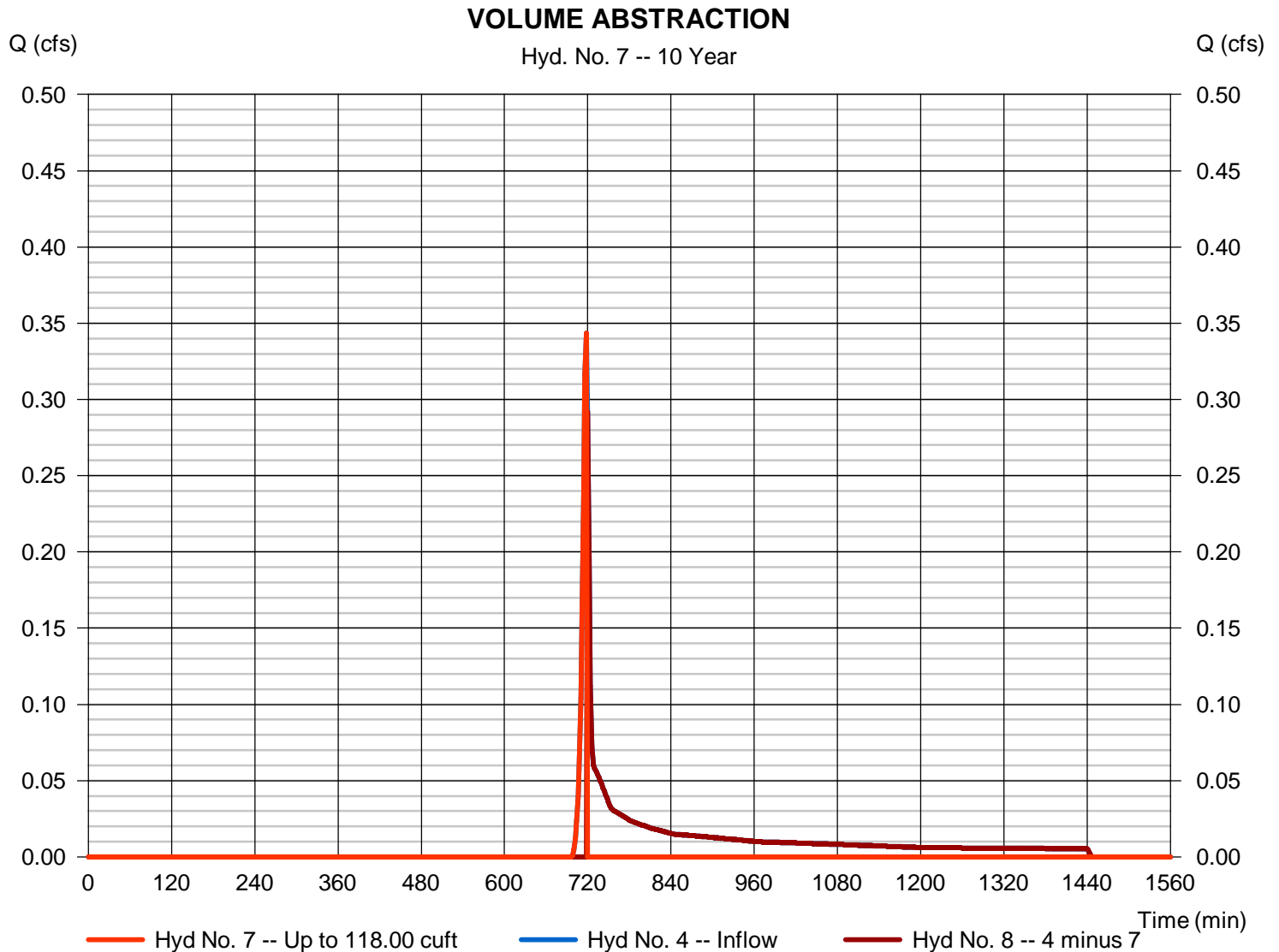
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 7

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.343 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 157 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

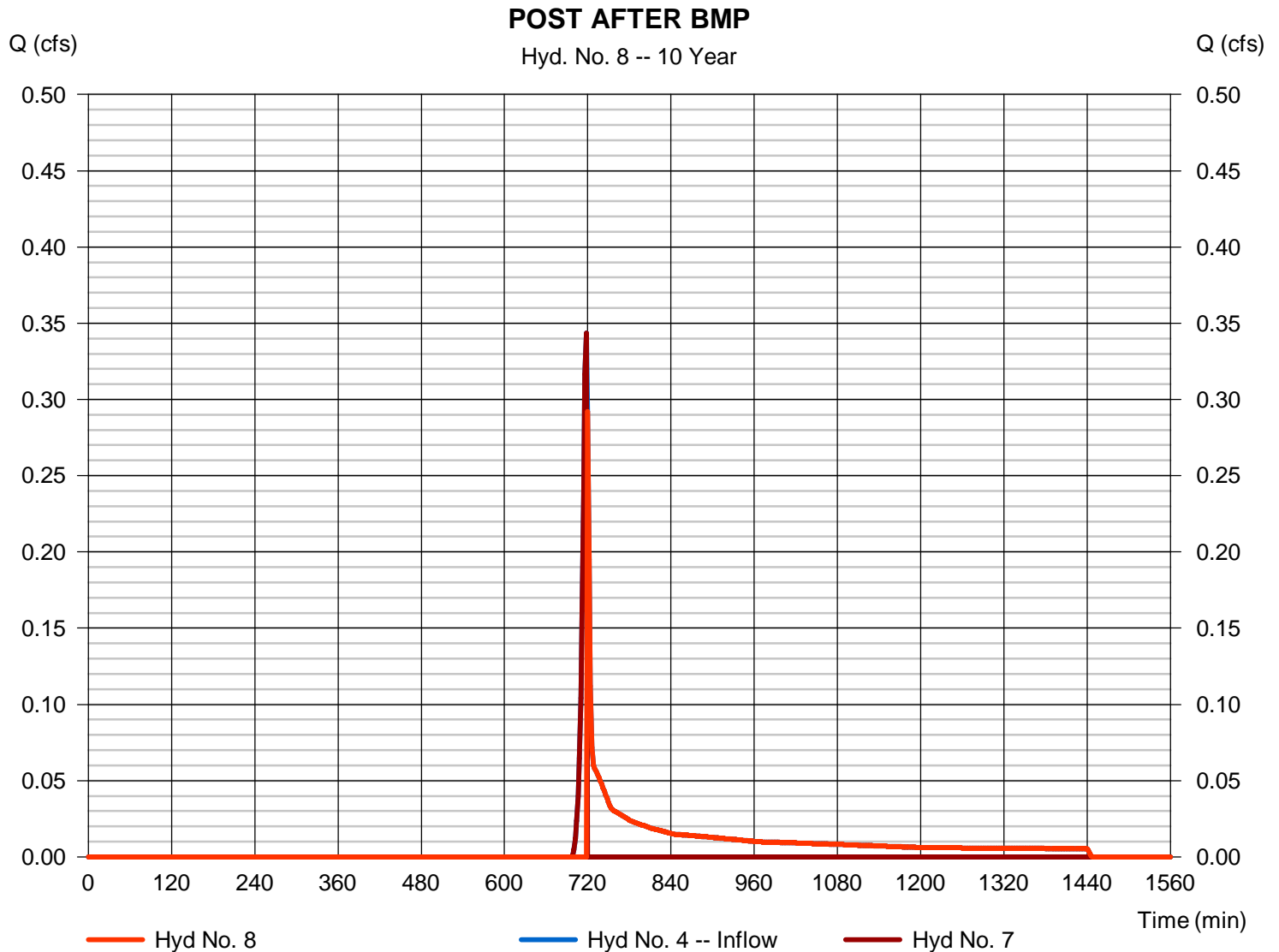
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 8

### POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.292 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 560 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

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

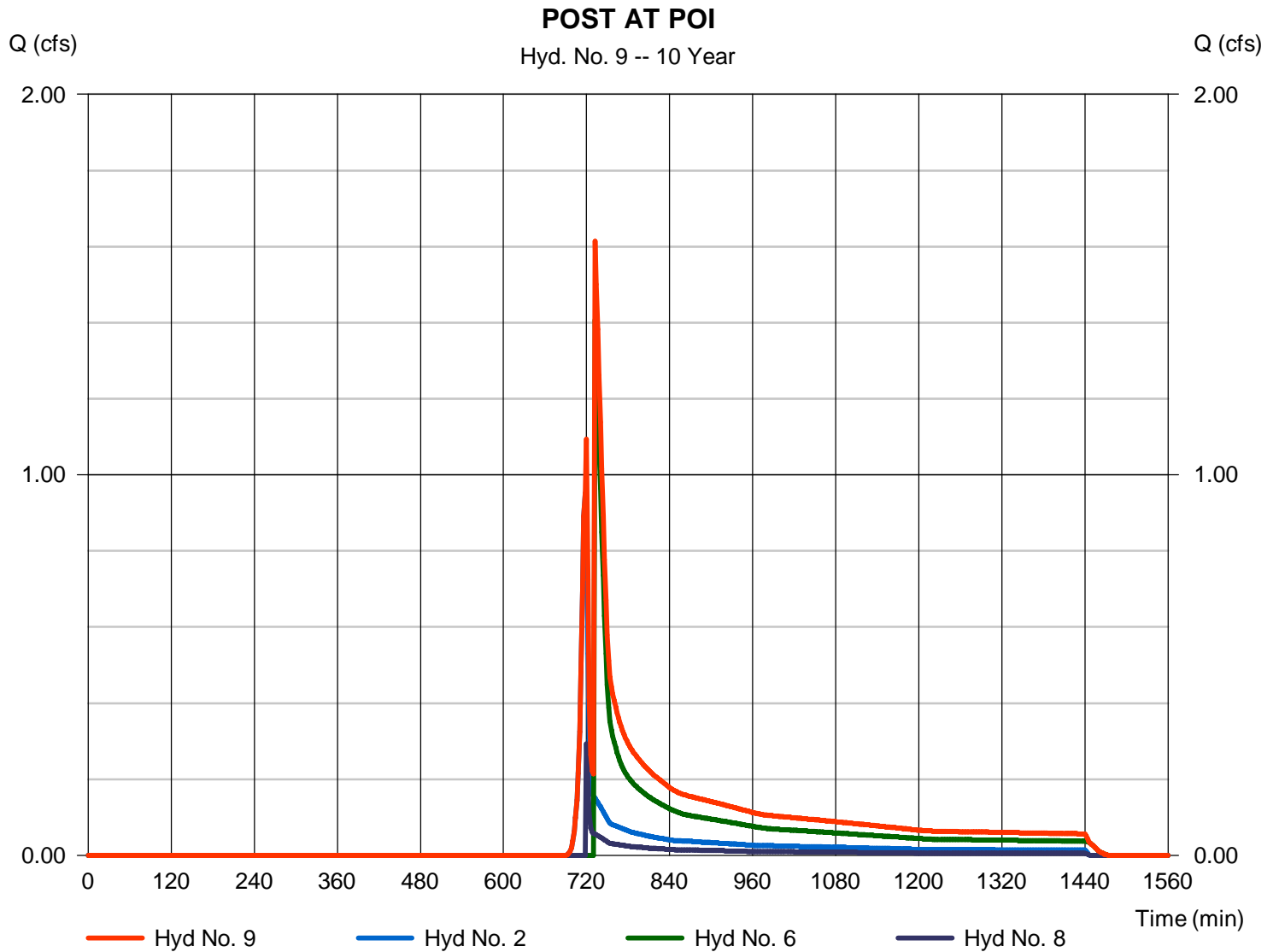
Friday, 10 / 21 / 2016

## Hyd. No. 9

POST AT POI

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

Peak discharge = 1.614 cfs  
 Time to peak = 732 min  
 Hyd. volume = 6,795 cuft  
 Contrib. drain. area = 0.510 ac

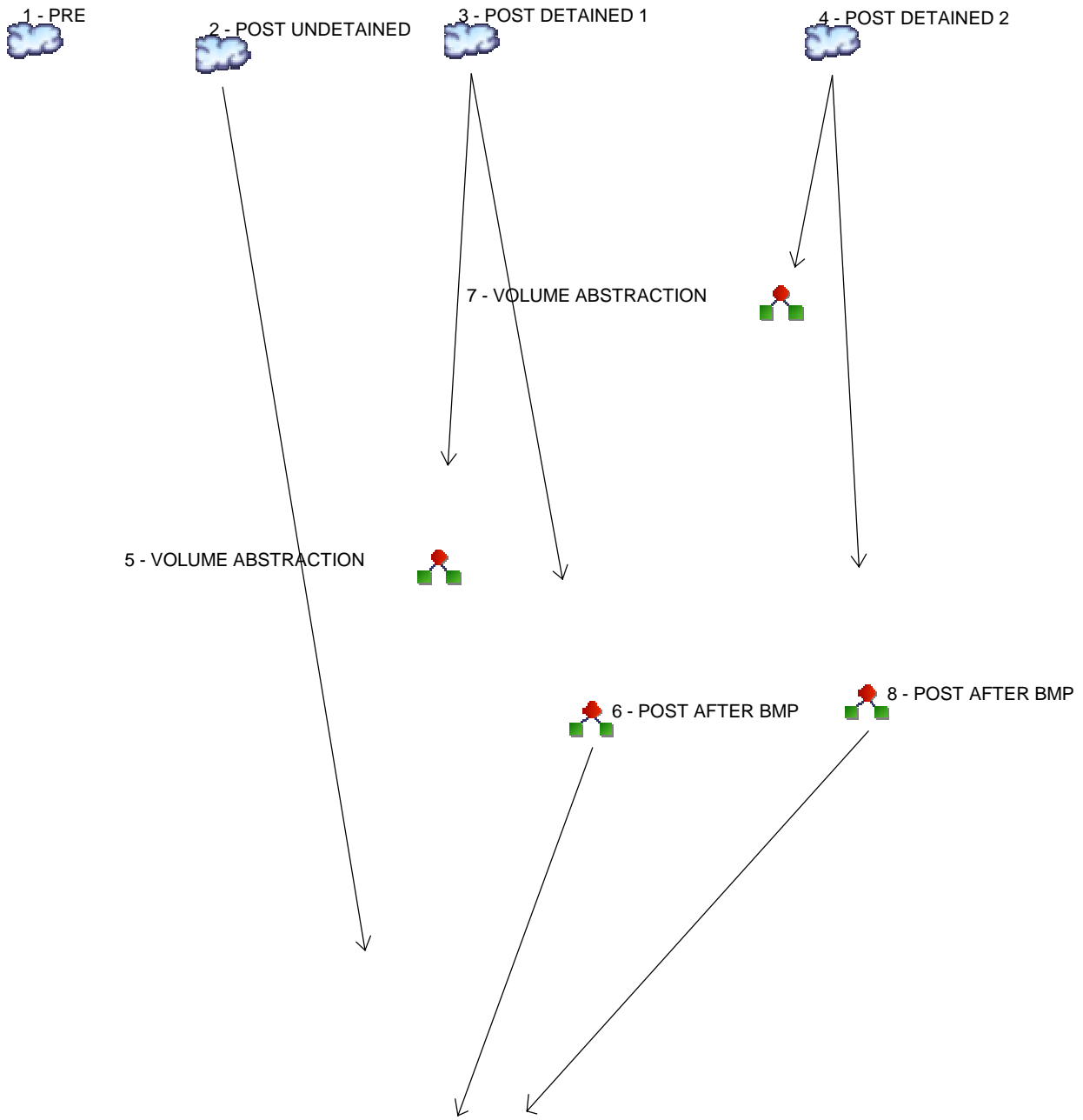






# Watershed Model Schematic

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



**Legend**

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



# Hydrograph Return Period Recap

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

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description	
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr		
1	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	6.523	-----	PRE
2	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	2.031	-----	POST UNDETAINED
3	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	3.464	-----	POST DETAINED 1
4	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	0.770	-----	POST DETAINED 2
5	Diversion1	3	-----	-----	-----	-----	-----	-----	-----	2.082	-----	VOLUME ABSTRACTION
6	Diversion2	3	-----	-----	-----	-----	-----	-----	-----	3.464	-----	POST AFTER BMP
7	Diversion1	4	-----	-----	-----	-----	-----	-----	-----	0.237	-----	VOLUME ABSTRACTION
8	Diversion2	4	-----	-----	-----	-----	-----	-----	-----	0.770	-----	POST AFTER BMP
9	Combine	2, 6, 8	-----	-----	-----	-----	-----	-----	-----	5.353	-----	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	6.523	2	720	15,022	-----	-----	-----	PRE
2	SCS Runoff	2.031	2	718	4,062	-----	-----	-----	POST UNDETAINED
3	SCS Runoff	3.464	2	724	11,033	-----	-----	-----	POST DETAINED 1
4	SCS Runoff	0.770	2	718	1,543	-----	-----	-----	POST DETAINED 2
5	Diversion1	2.082	2	716	1,344	3	-----	-----	VOLUME ABSTRACTION
6	Diversion2	3.464	2	724	9,689	3	-----	-----	POST AFTER BMP
7	Diversion1	0.237	2	708	121	4	-----	-----	VOLUME ABSTRACTION
8	Diversion2	0.770	2	718	1,422	4	-----	-----	POST AFTER BMP
9	Combine	5.353	2	718	15,172	2, 6, 8	-----	-----	POST AT POI

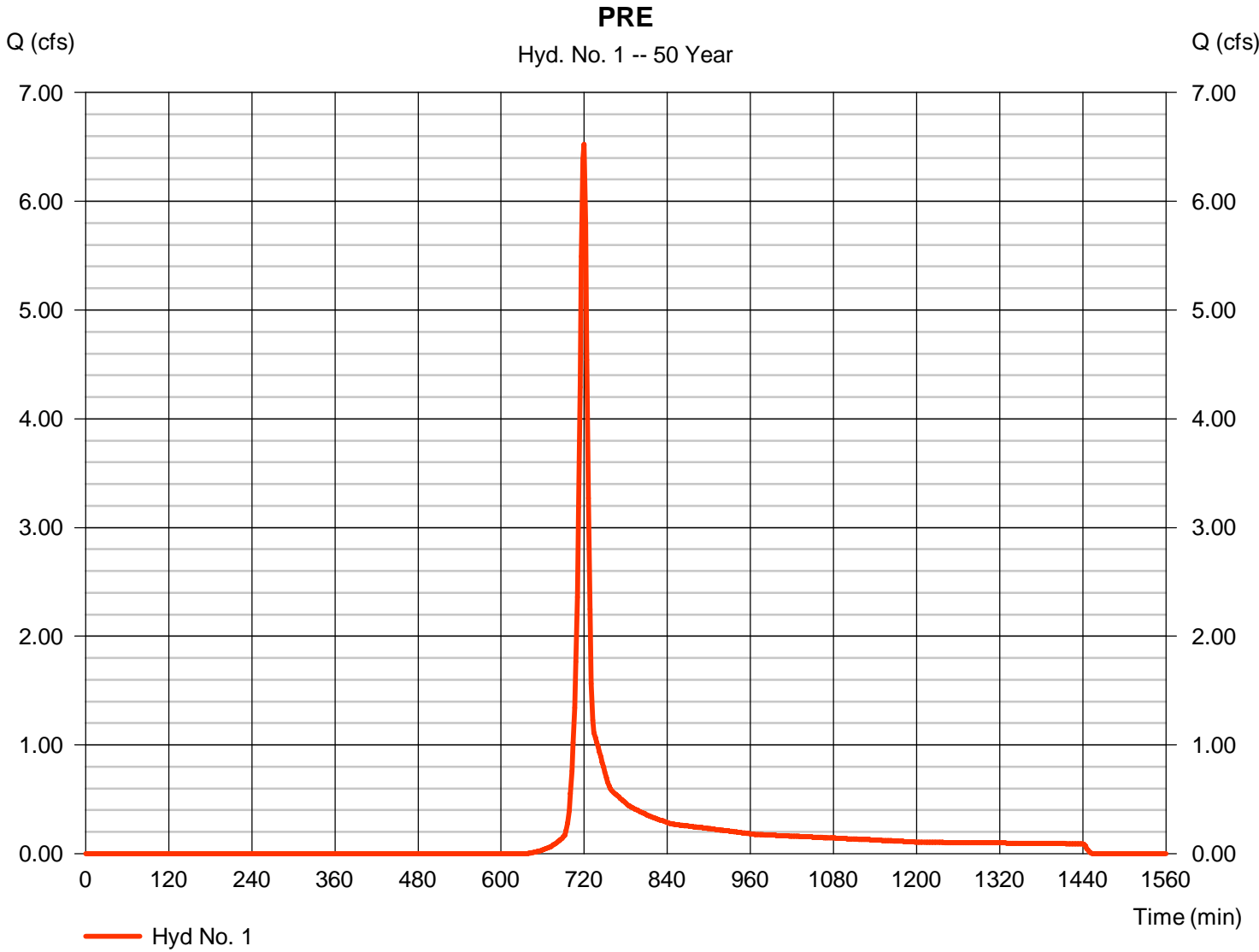
# Hydrograph Report

## Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 6.523 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 15,022 cuft
Drainage area	= 1.840 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 6.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.090 x 98) + (0.070 x 55) + (1.680 x 58)] / 1.840



# TR55 Tc Worksheet

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

## Hyd. No. 1

PRE

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 2.60	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 7.52</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 7.52</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 360.00	220.00	0.00	
Watercourse slope (%)	= 7.30	8.70	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=4.36	4.76	0.00	
<b>Travel Time (min)</b>	<b>= 1.38</b>	<b>+</b> <b>0.77</b>	<b>+</b> <b>0.00</b>	<b>= 2.15</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>9.70 min</b>

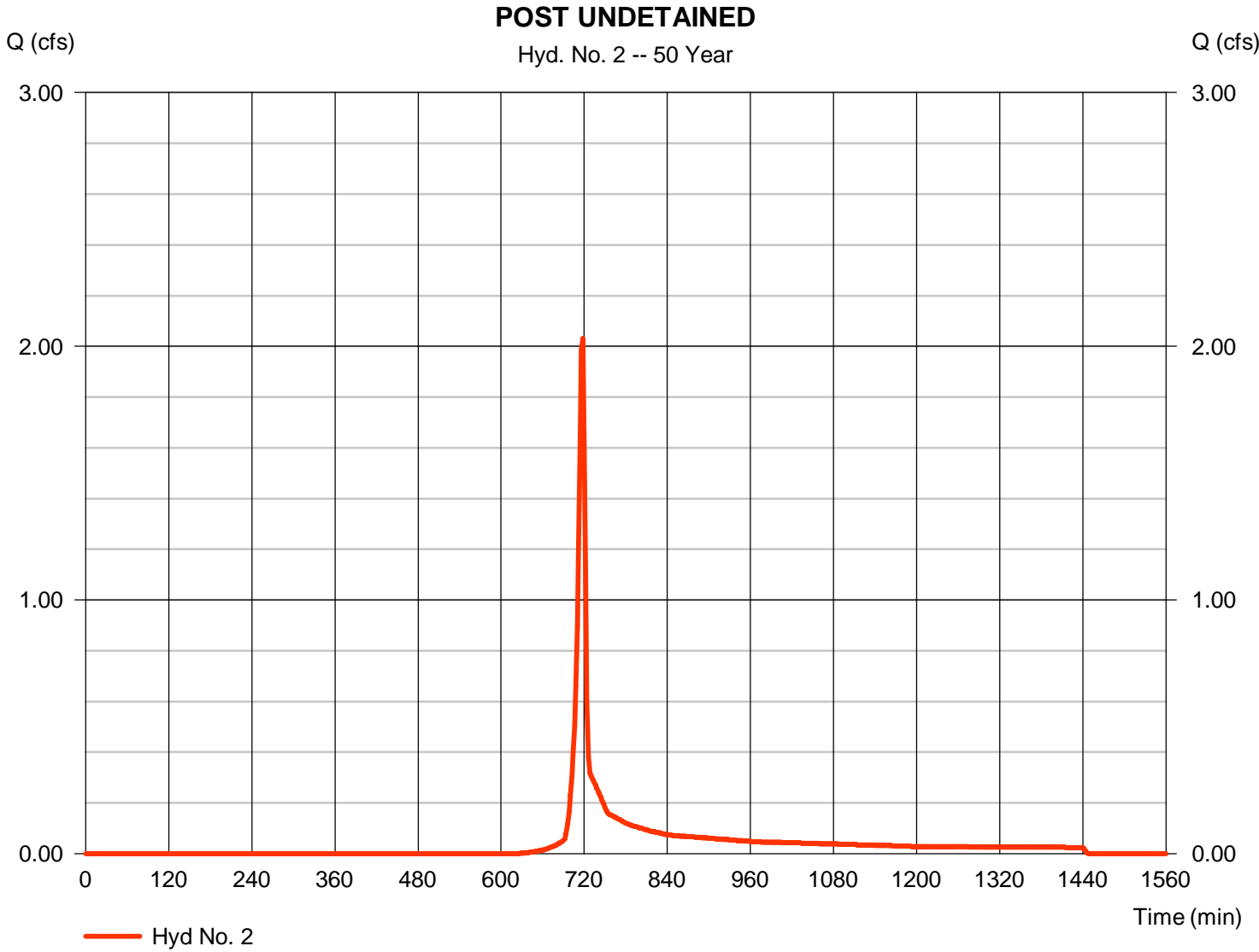
# Hydrograph Report

## Hyd. No. 2

### POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 2.031 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 4,062 cuft
Drainage area	= 0.510 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.20 min
Total precip.	= 6.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.050 x 55) + (0.410 x 58) + (0.040 x 98) + (0.010 x 85)] / 0.510



# TR55 Tc Worksheet

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

## Hyd. No. 2

POST UNDETAINED

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 4.08</b>	<b>+</b>	<b>0.00</b>	<b>+</b>
			<b>0.00</b>	<b>= 4.08</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 187.00	172.00	0.00	
Watercourse slope (%)	= 9.10	8.70	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.87	6.00	0.00	
<b>Travel Time (min)</b>	<b>= 0.64</b>	<b>+</b>	<b>0.48</b>	<b>+</b>
			<b>0.00</b>	<b>= 1.12</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b>	<b>0.00</b>	<b>+</b>
			<b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc</b> .....				<b>5.20 min</b>

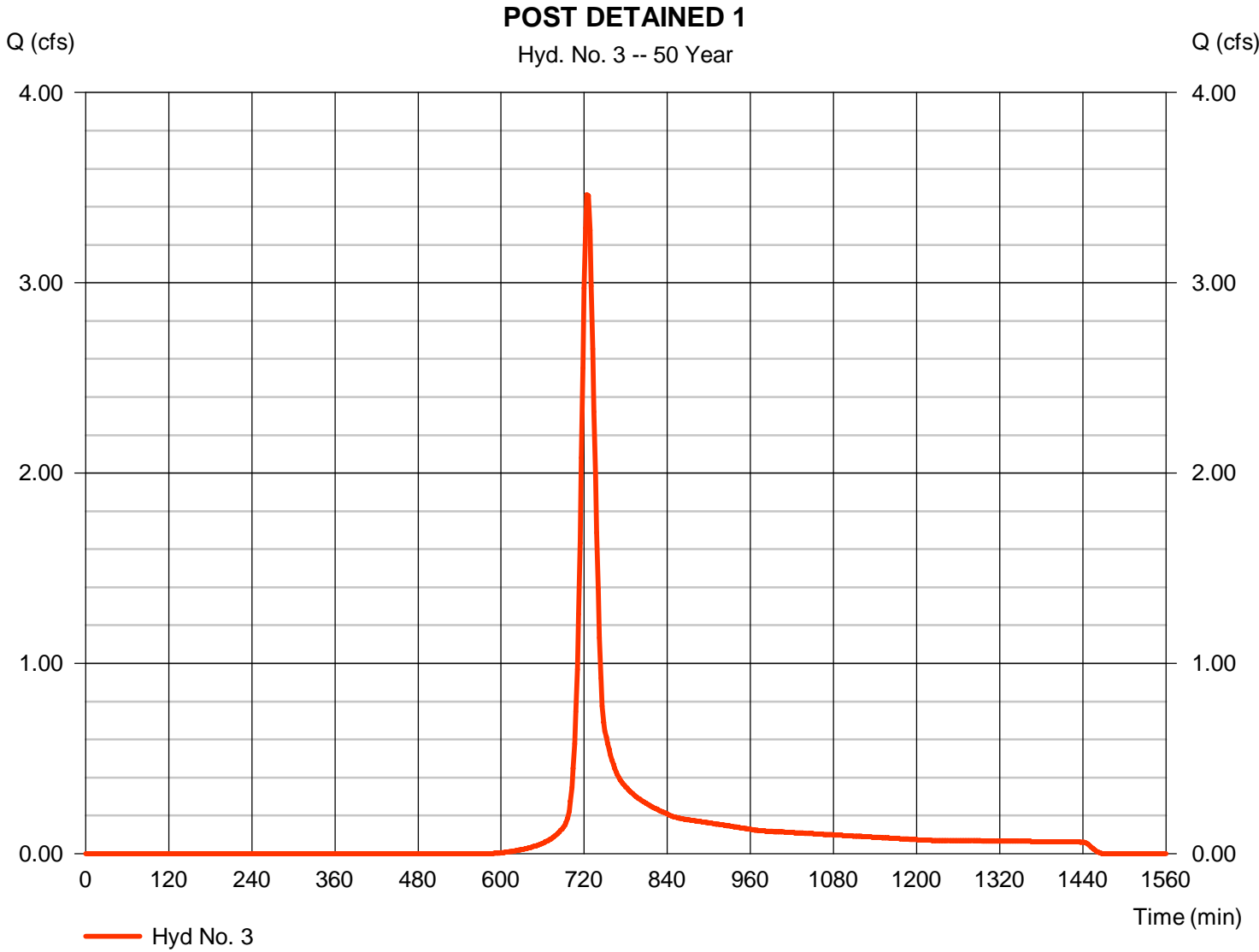
# Hydrograph Report

## Hyd. No. 3

### POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 3.464 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 11,033 cuft
Drainage area	= 1.120 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 17.50 min
Total precip.	= 6.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (0.160 x 85) + (0.050 x 55) + (0.830 x 58)] / 1.120





# Hydrograph Report

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

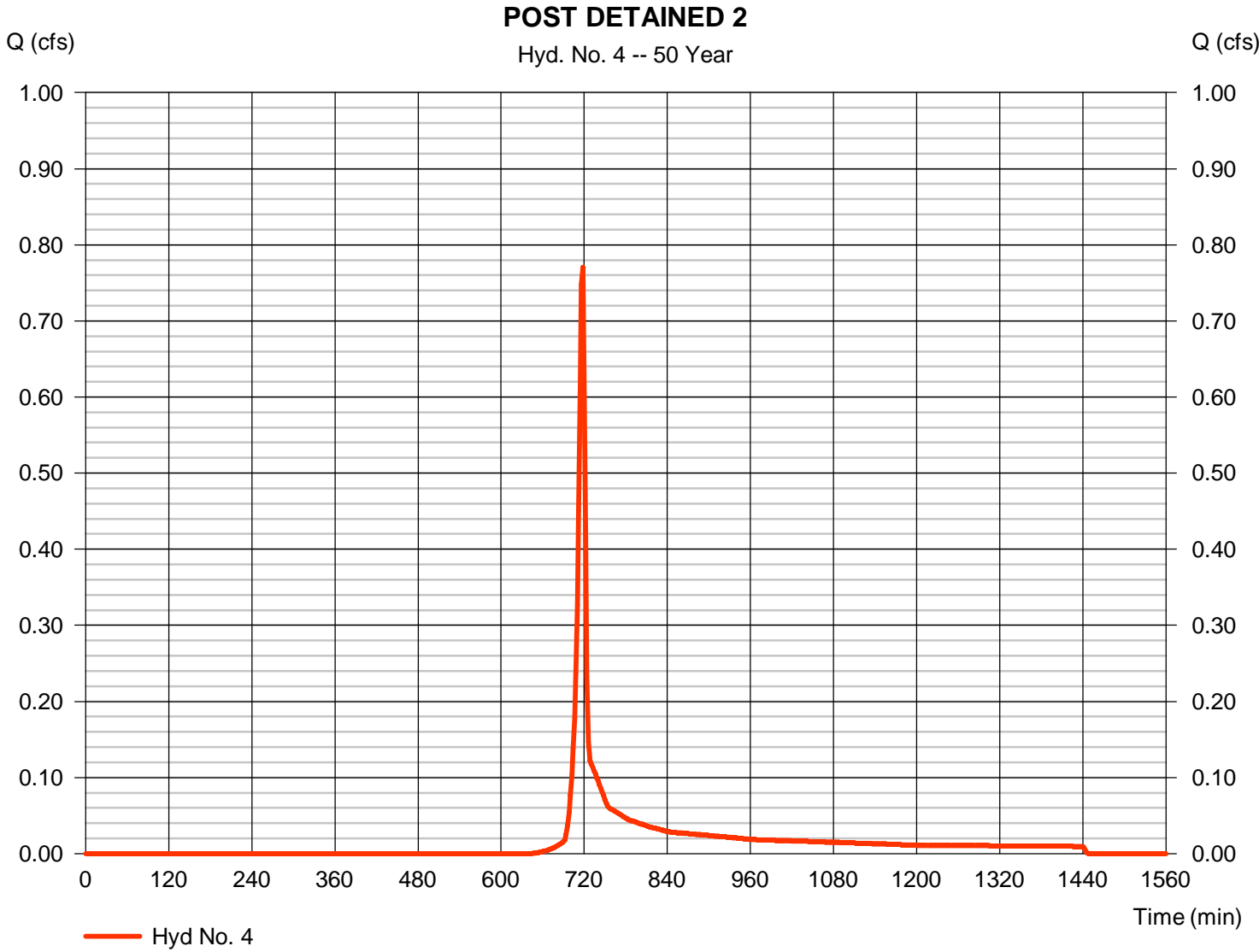
Friday, 10 / 21 / 2016

## Hyd. No. 4

### POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.770 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,543 cuft
Drainage area	= 0.210 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.60 min
Total precip.	= 6.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.010 x 85) + (0.200 x 58)] / 0.210



# TR55 Tc Worksheet

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

## Hyd. No. 4

POST DETAINED 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 5.38</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 5.38</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 78.00	0.00	0.00	
Watercourse slope (%)	= 10.30	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=5.18	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 0.25</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.25</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>5.60 min</b>

# Hydrograph Report

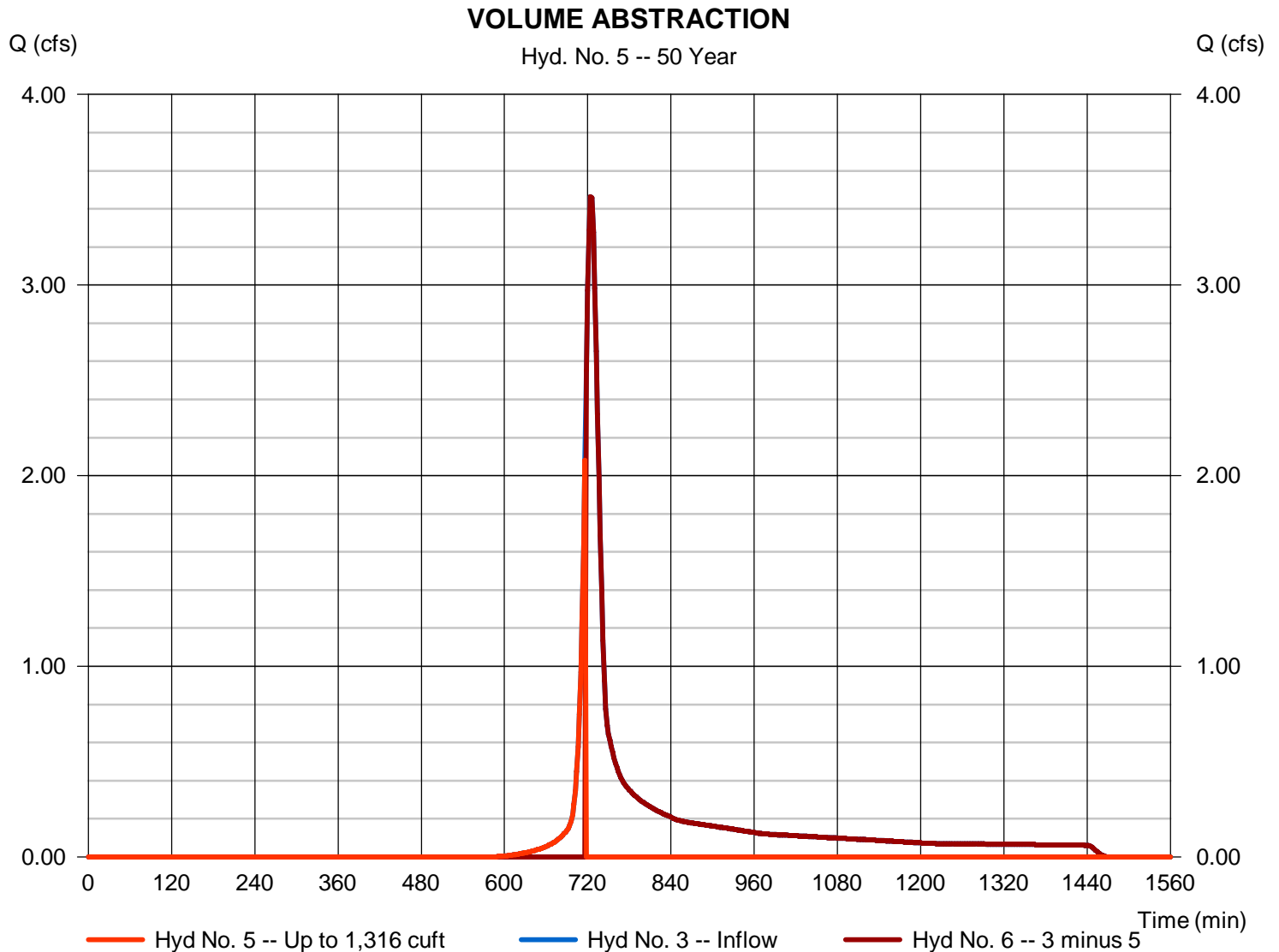
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Friday, 10 / 21 / 2016

## Hyd. No. 5

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 2.082 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,344 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

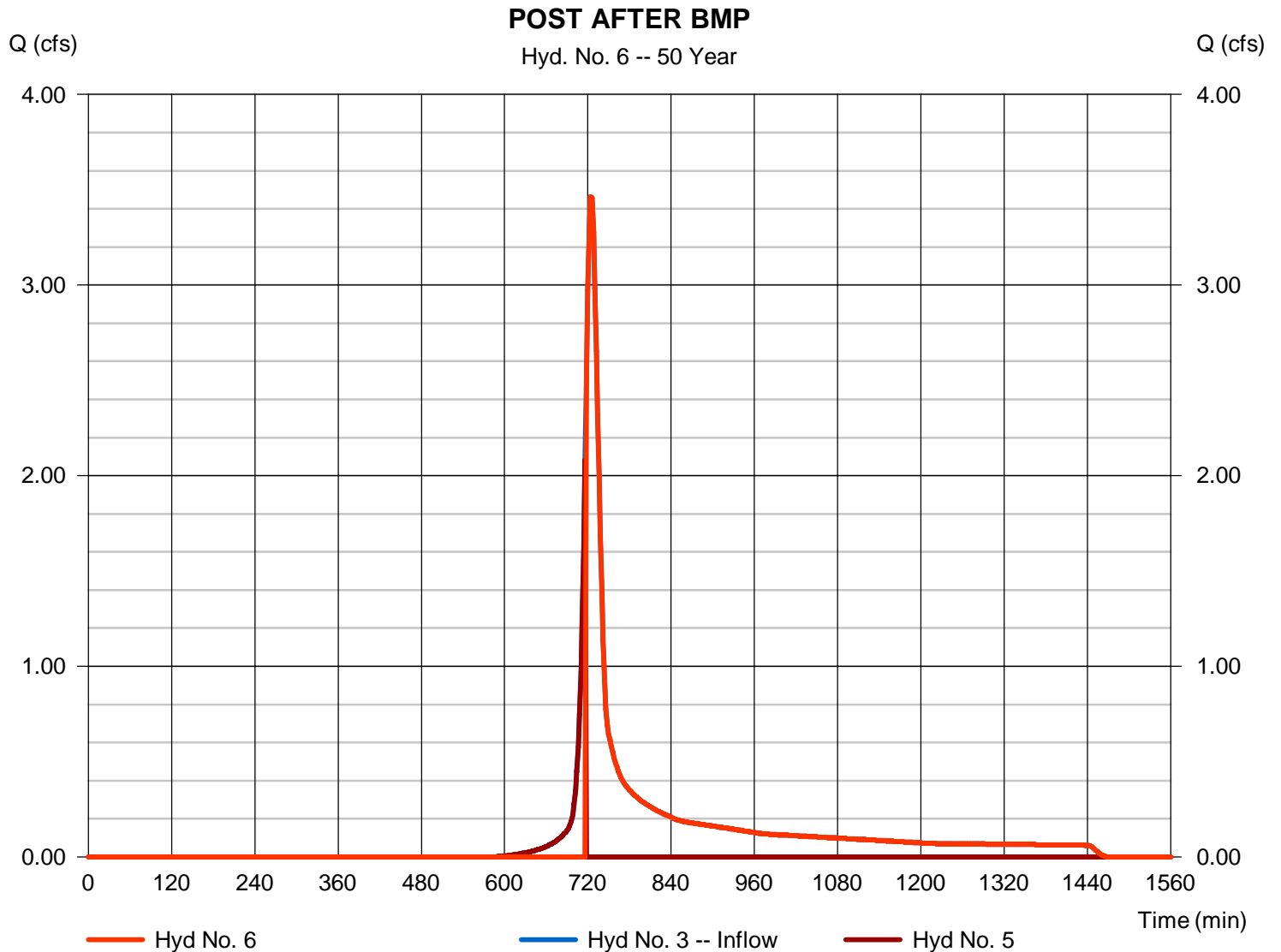
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 6

### POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 3.464 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 9,689 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

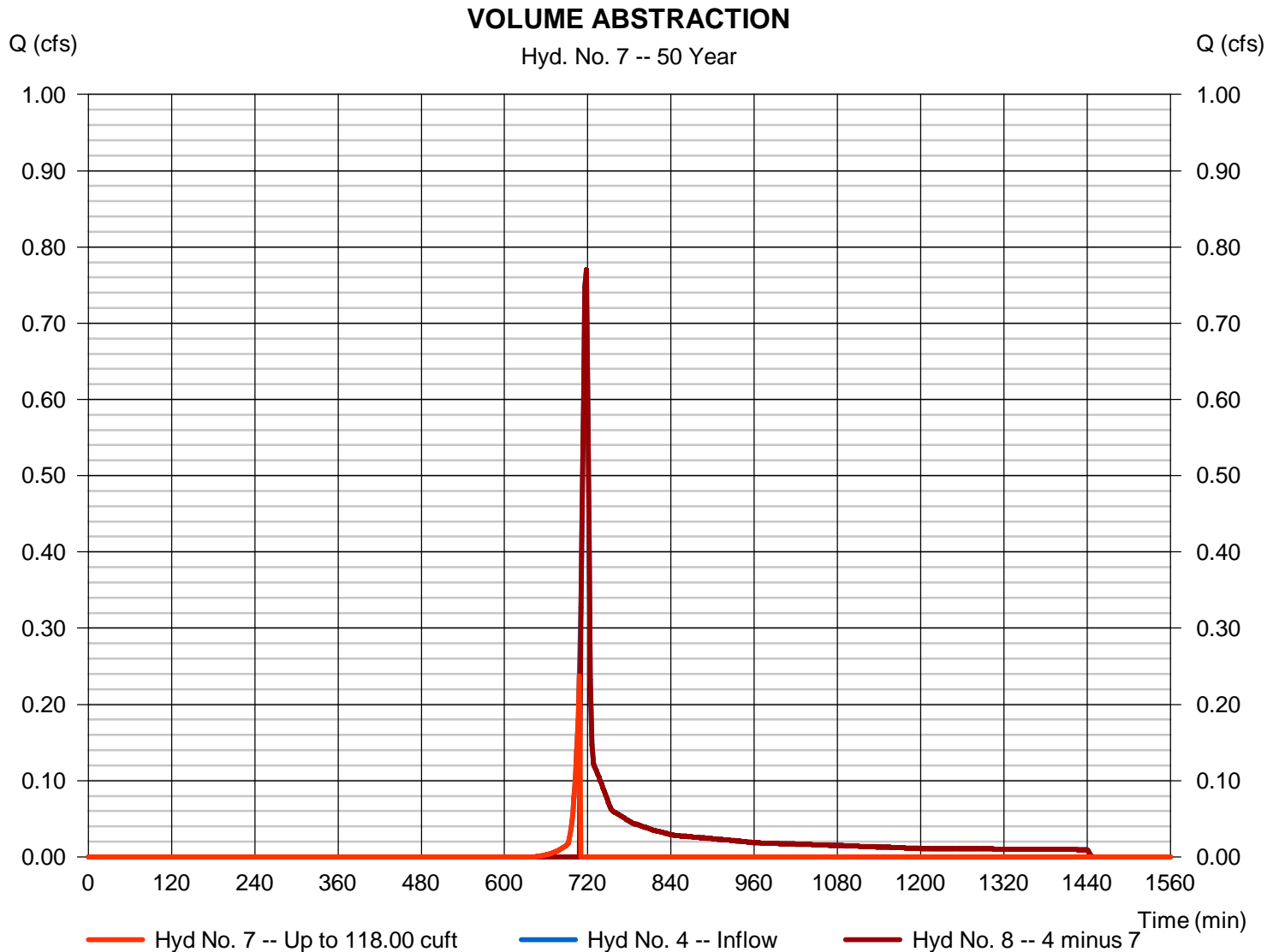
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 7

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.237 cfs
Storm frequency	= 50 yrs	Time to peak	= 708 min
Time interval	= 2 min	Hyd. volume	= 121 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

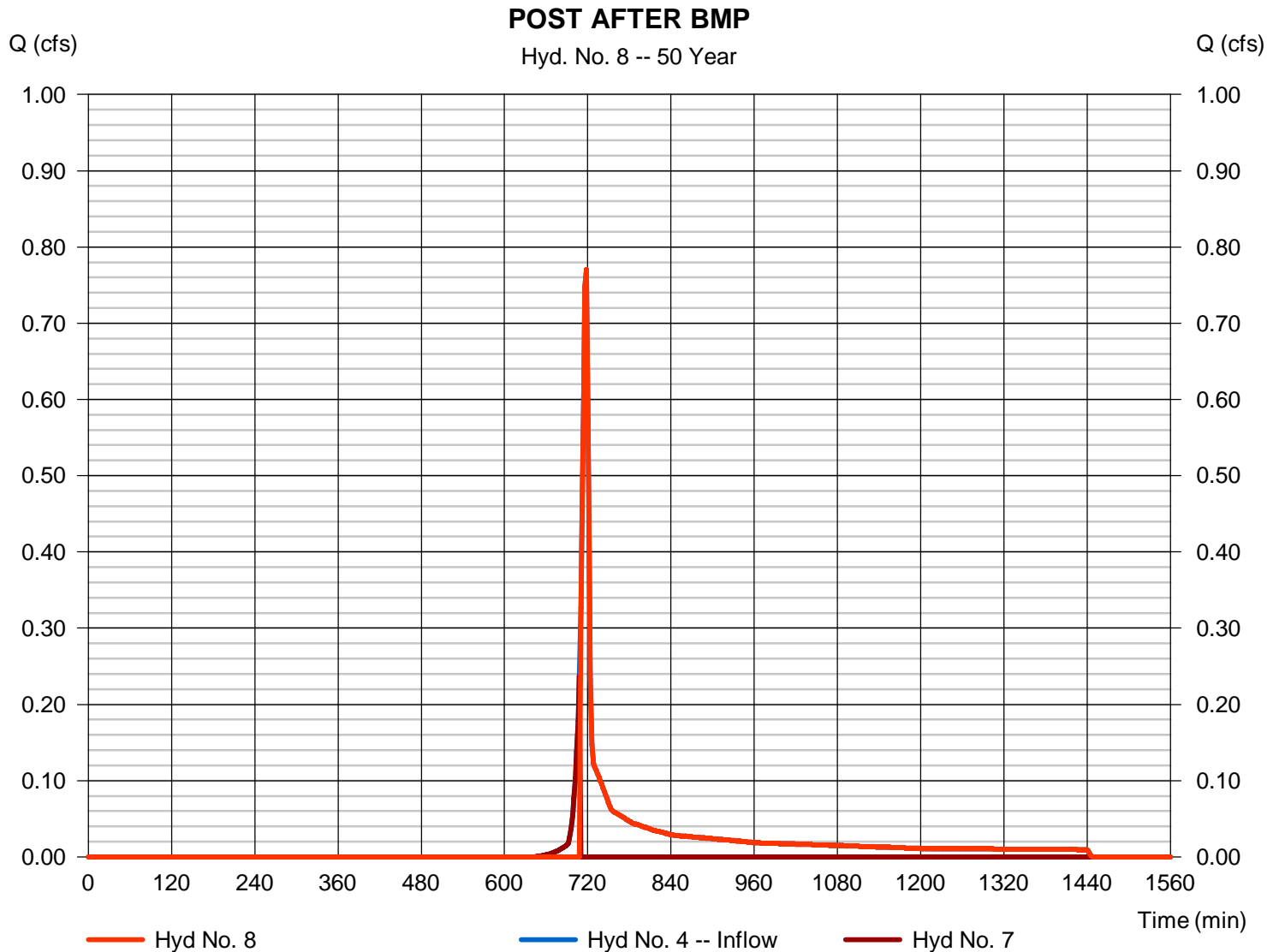
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Friday, 10 / 21 / 2016

## Hyd. No. 8

### POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.770 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,422 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

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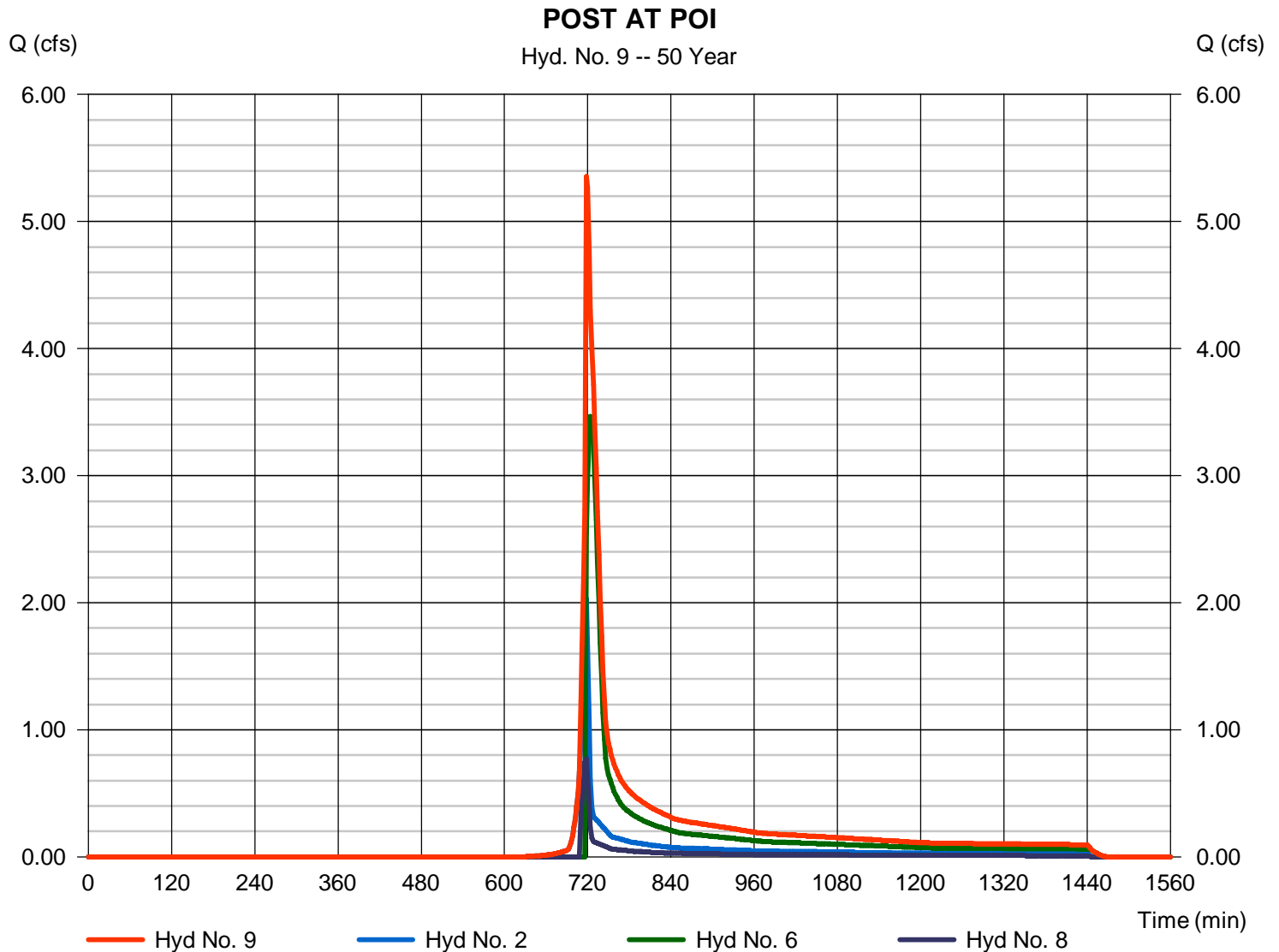
Friday, 10 / 21 / 2016

## Hyd. No. 9

POST AT POI

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

Peak discharge = 5.353 cfs  
Time to peak = 718 min  
Hyd. volume = 15,172 cuft  
Contrib. drain. area = 0.510 ac

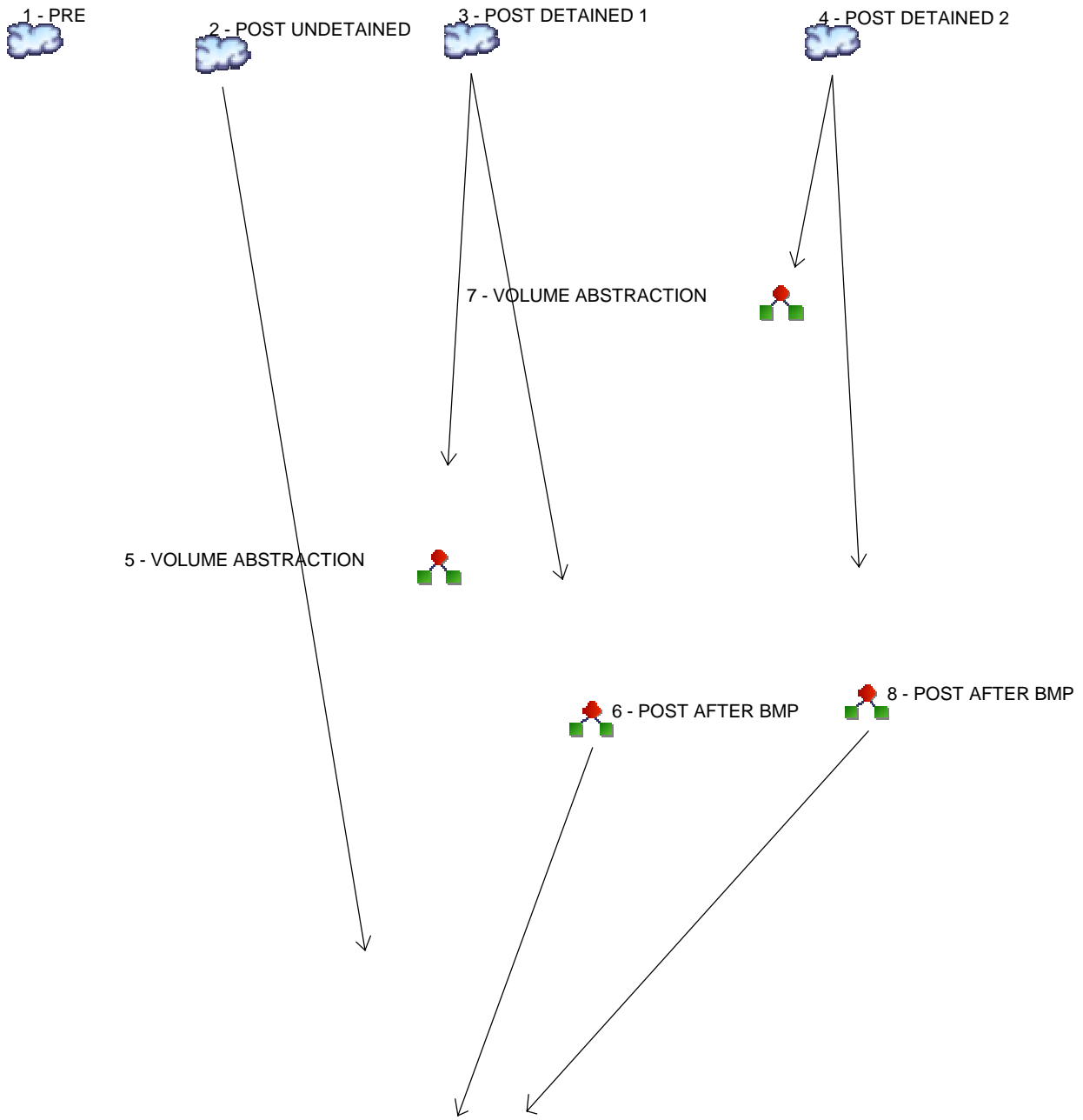






# Watershed Model Schematic

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



**Legend**

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



# Hydrograph Return Period Recap

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

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	8.577	PRE
2	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	2.640	POST UNDETAINED
3	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	4.885	POST DETAINED 1
4	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	1.014	POST DETAINED 2
5	Diversion1	3	-----	-----	-----	-----	-----	-----	-----	1.641	VOLUME ABSTRACTION
6	Diversion2	3	-----	-----	-----	-----	-----	-----	-----	4.885	POST AFTER BMP
7	Diversion1	4	-----	-----	-----	-----	-----	-----	-----	0.209	VOLUME ABSTRACTION
8	Diversion2	4	-----	-----	-----	-----	-----	-----	-----	1.014	POST AFTER BMP
9	Combine	2, 6, 8	-----	-----	-----	-----	-----	-----	-----	7.739	POST AT POI



# Hydrograph Report

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

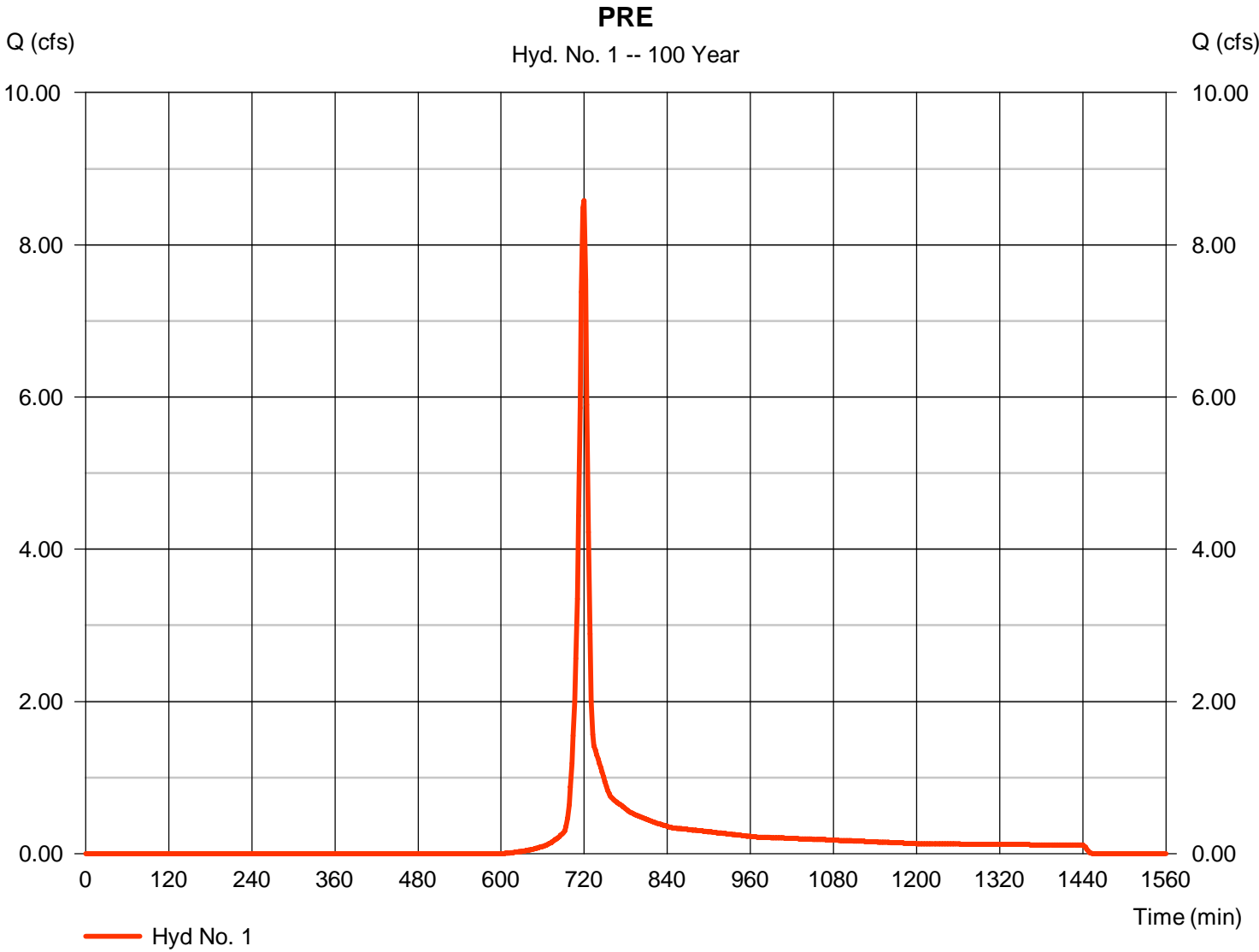
Friday, 10 / 21 / 2016

## Hyd. No. 1

PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 8.577 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 19,646 cuft
Drainage area	= 1.840 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.70 min
Total precip.	= 7.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.090 x 98) + (0.070 x 55) + (1.680 x 58)] / 1.840



# TR55 Tc Worksheet

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

## Hyd. No. 1

PRE

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 2.60	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 7.52</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 7.52</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 360.00	220.00	0.00	
Watercourse slope (%)	= 7.30	8.70	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=4.36	4.76	0.00	
<b>Travel Time (min)</b>	<b>= 1.38</b>	<b>+</b> <b>0.77</b>	<b>+</b> <b>0.00</b>	<b>= 2.15</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>9.70 min</b>

# Hydrograph Report

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

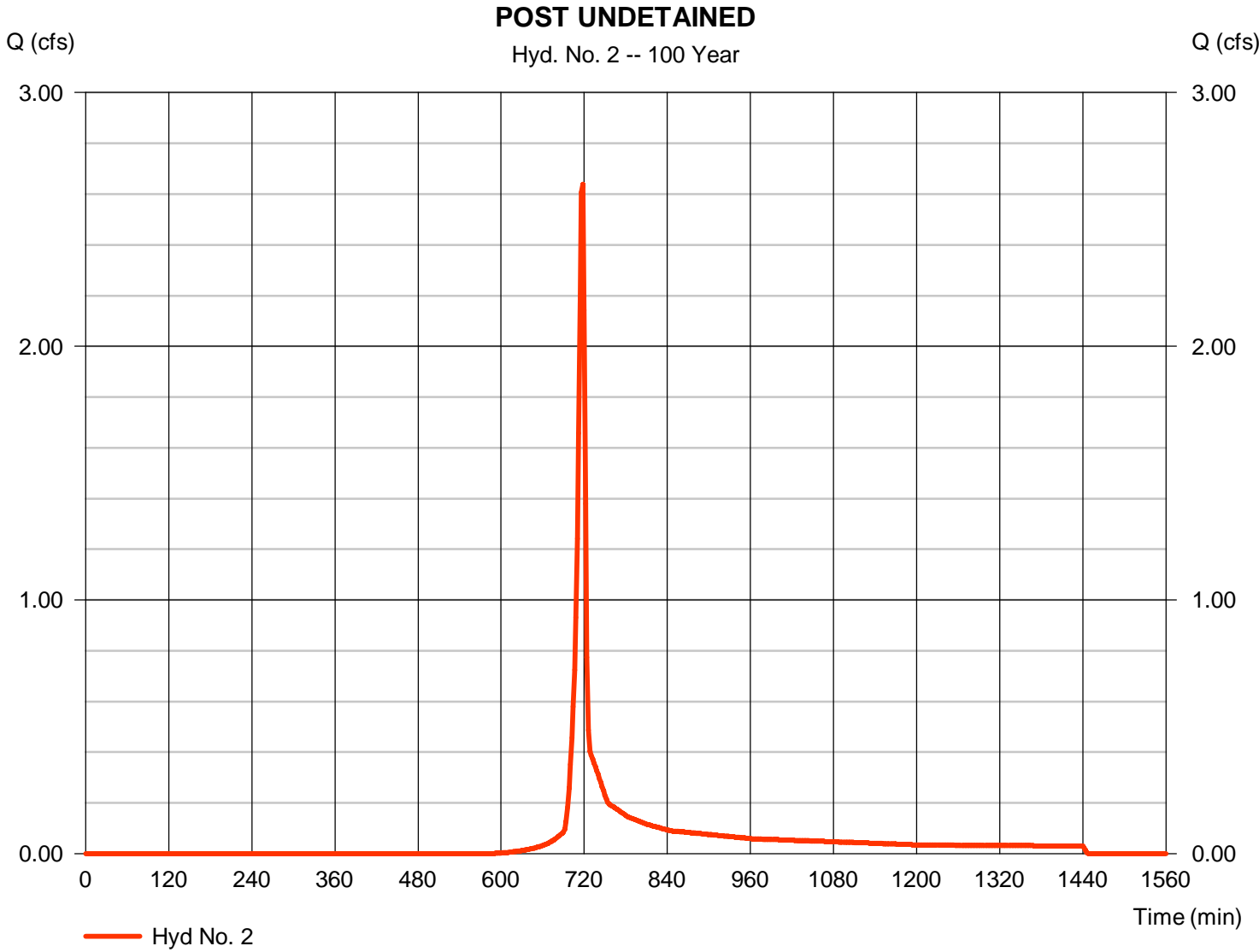
Friday, 10 / 21 / 2016

## Hyd. No. 2

### POST UNDETAINED

Hydrograph type	= SCS Runoff	Peak discharge	= 2.640 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 5,287 cuft
Drainage area	= 0.510 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.20 min
Total precip.	= 7.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.050 x 55) + (0.410 x 58) + (0.040 x 98) + (0.010 x 85)] / 0.510



# TR55 Tc Worksheet

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

## Hyd. No. 2

POST UNDETAINED

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 4.08</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 4.08</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 187.00	172.00	0.00	
Watercourse slope (%)	= 9.10	8.70	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.87	6.00	0.00	
<b>Travel Time (min)</b>	<b>= 0.64</b>	<b>+</b> <b>0.48</b>	<b>+</b> <b>0.00</b>	<b>= 1.12</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b> <b>0.00</b>	<b>+</b> <b>0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>5.20 min</b>

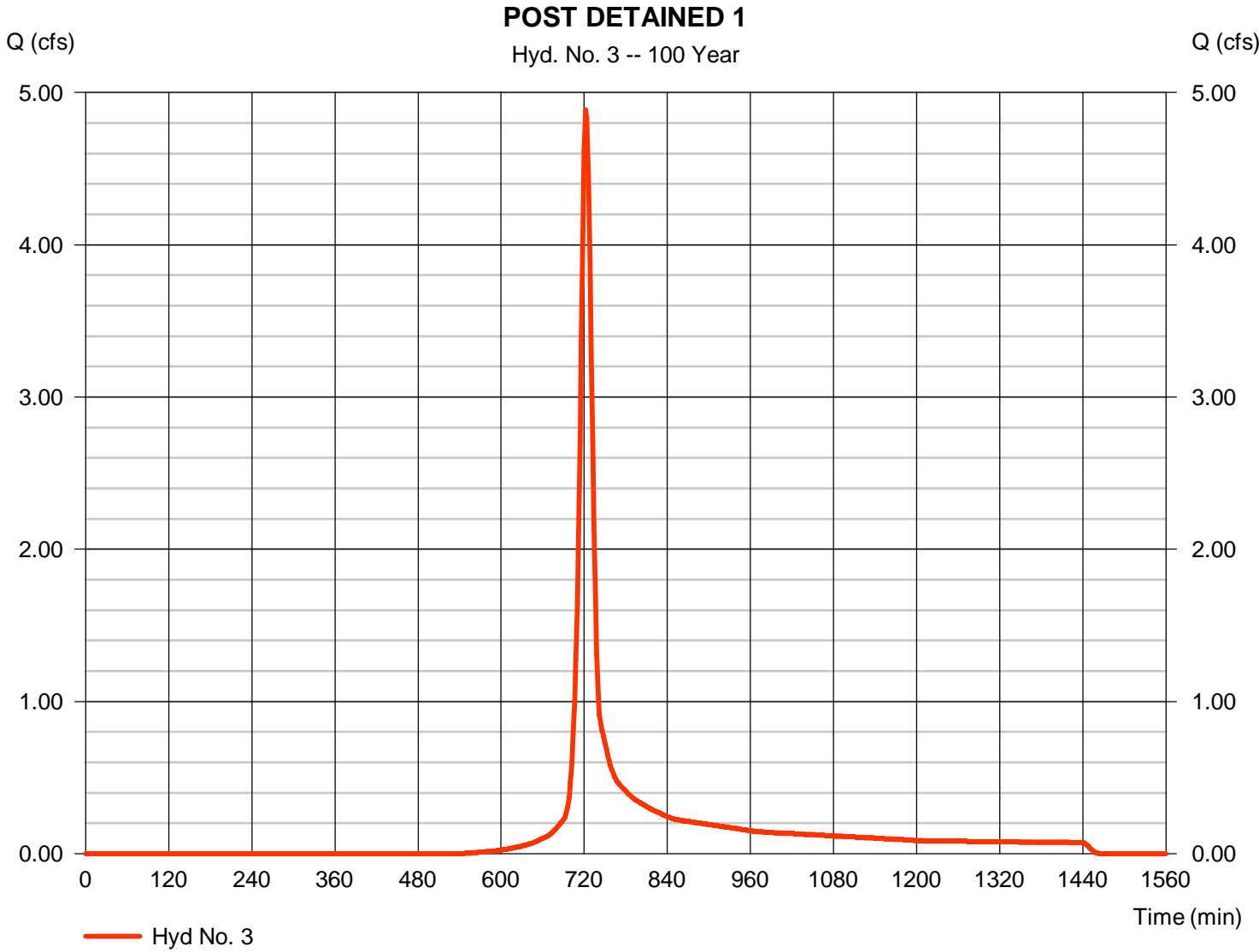
# Hydrograph Report

## Hyd. No. 3

### POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.885 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 13,756 cuft
Drainage area	= 1.120 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 16.30 min
Total precip.	= 7.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.080 x 98) + (0.160 x 85) + (0.050 x 55) + (0.830 x 58)] / 1.120





# Hydrograph Report

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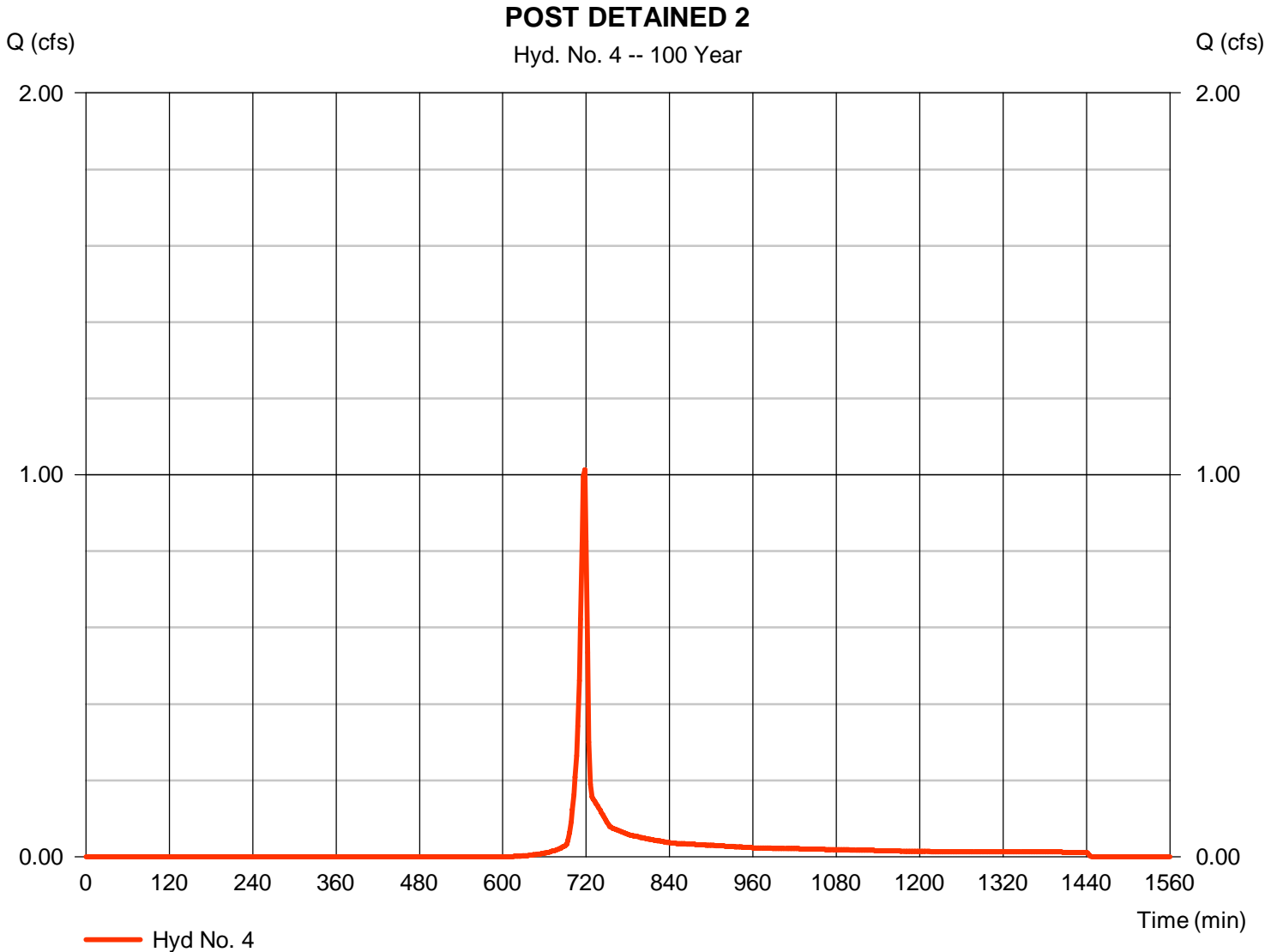
Friday, 10 / 21 / 2016

## Hyd. No. 4

### POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.014 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,028 cuft
Drainage area	= 0.210 ac	Curve number	= 59*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.60 min
Total precip.	= 7.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(0.010 x 85) + (0.200 x 58)] / 0.210



# TR55 Tc Worksheet

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

## Hyd. No. 4

POST DETAINED 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.08	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 5.38</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 5.38</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 78.00	0.00	0.00	
Watercourse slope (%)	= 10.30	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=5.18	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 0.25</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.25</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>5.60 min</b>

# Hydrograph Report

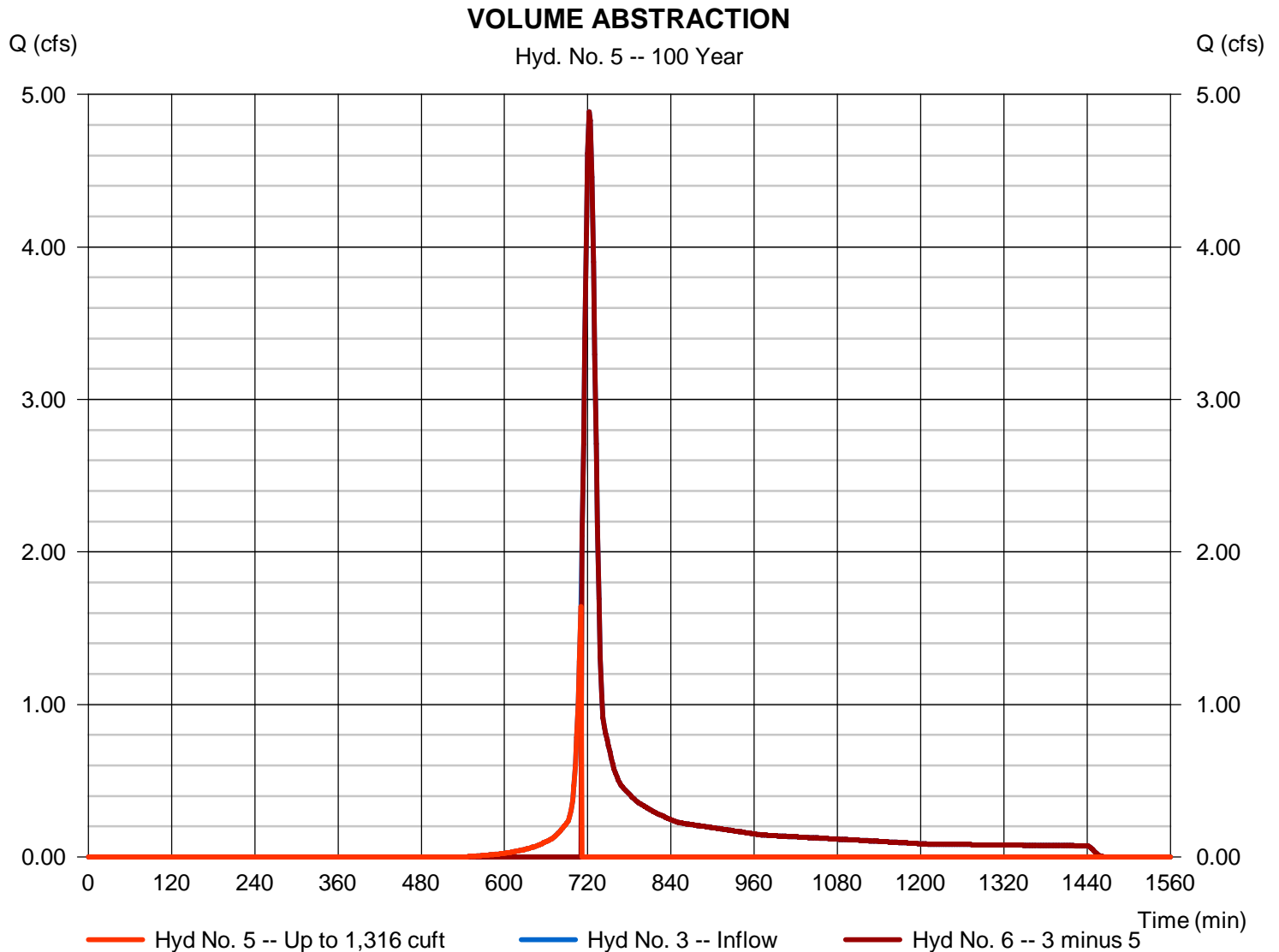
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Friday, 10 / 21 / 2016

## Hyd. No. 5

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 1.641 cfs
Storm frequency	= 100 yrs	Time to peak	= 710 min
Time interval	= 2 min	Hyd. volume	= 1,347 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 6
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

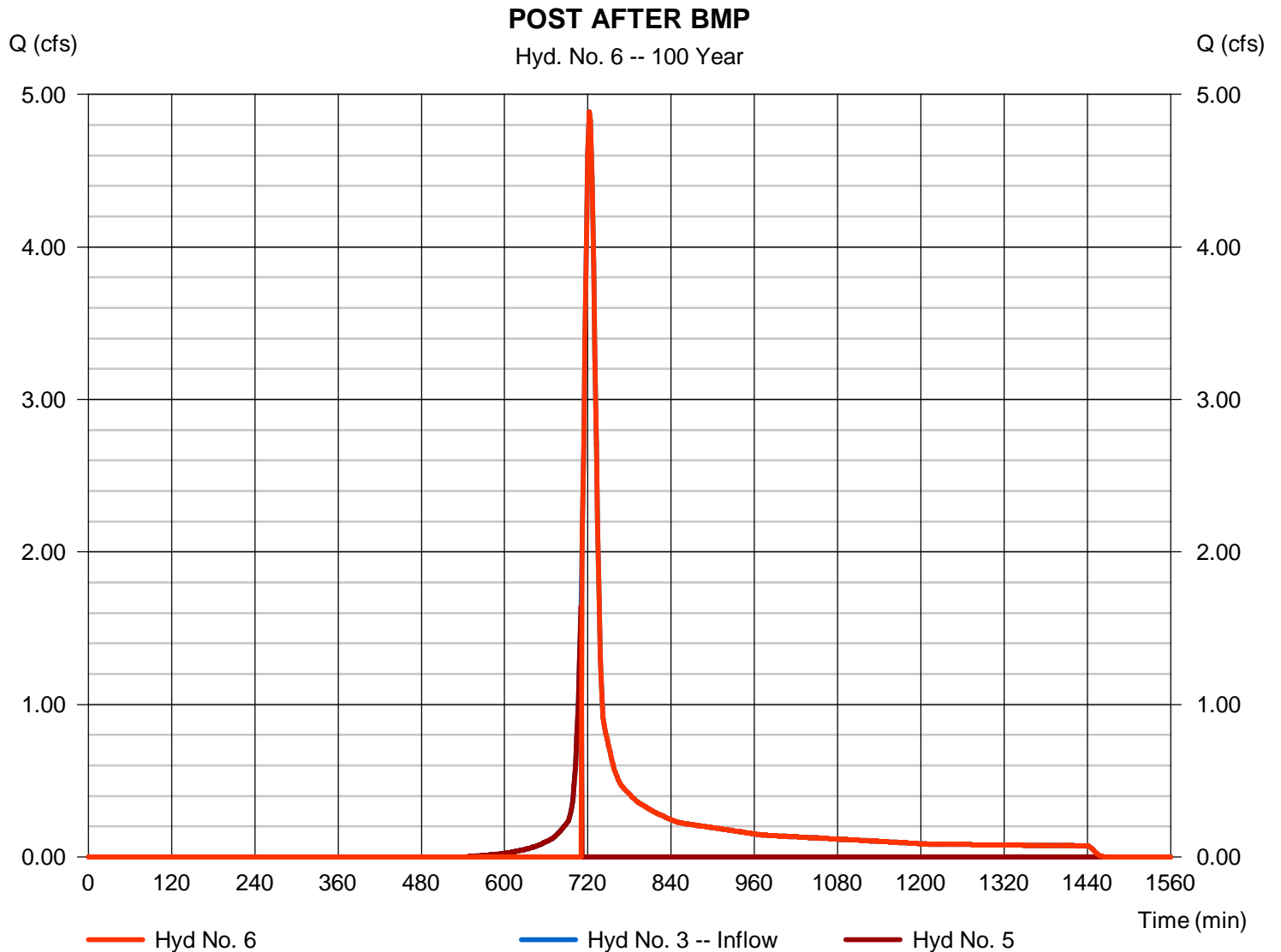
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 6

### POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 4.885 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 12,409 cuft
Inflow hydrograph	= 3 - POST DETAINED 1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,316 cuft



# Hydrograph Report

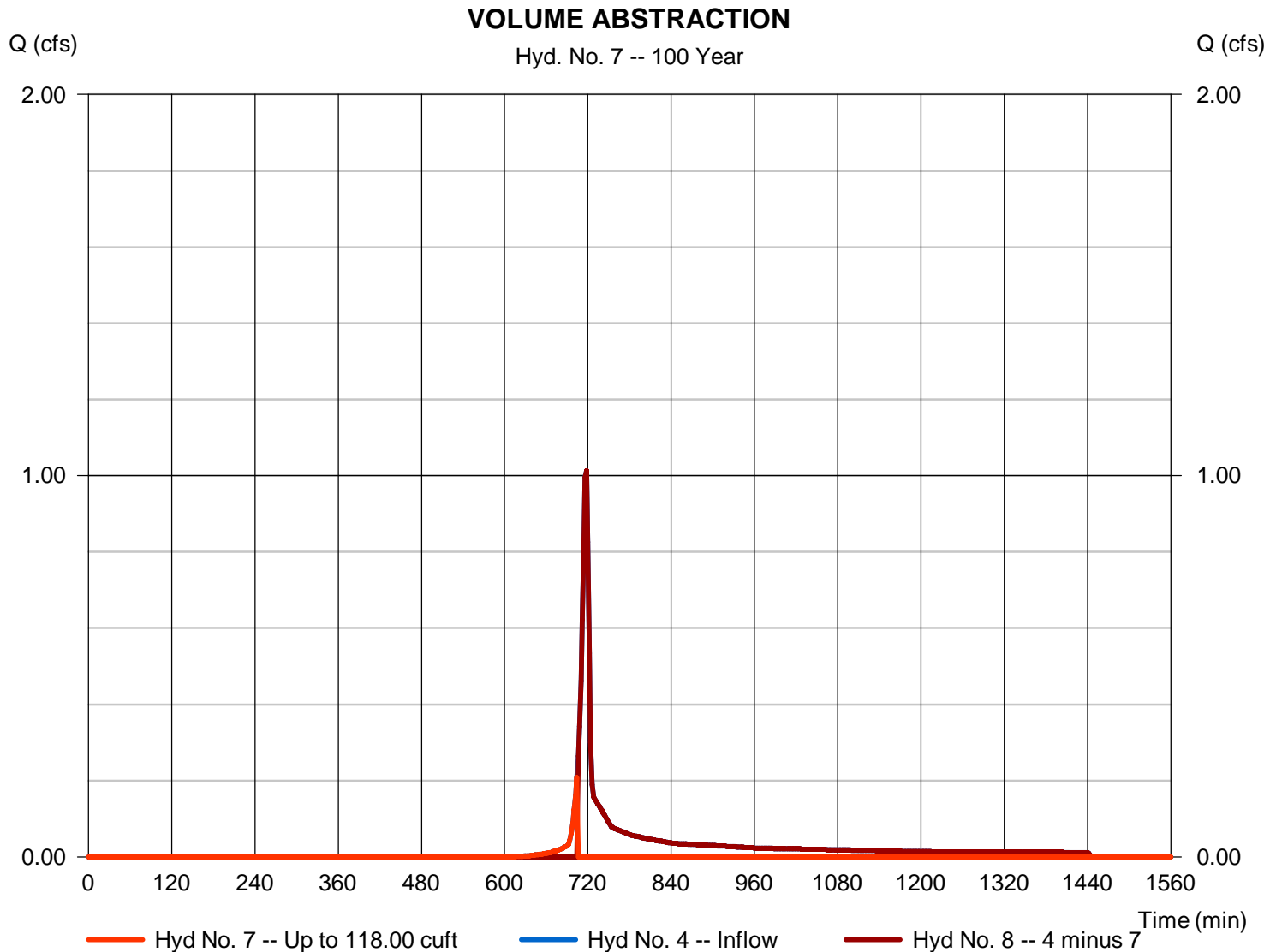
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Friday, 10 / 21 / 2016

## Hyd. No. 7

### VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.209 cfs
Storm frequency	= 100 yrs	Time to peak	= 704 min
Time interval	= 2 min	Hyd. volume	= 131 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 8
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

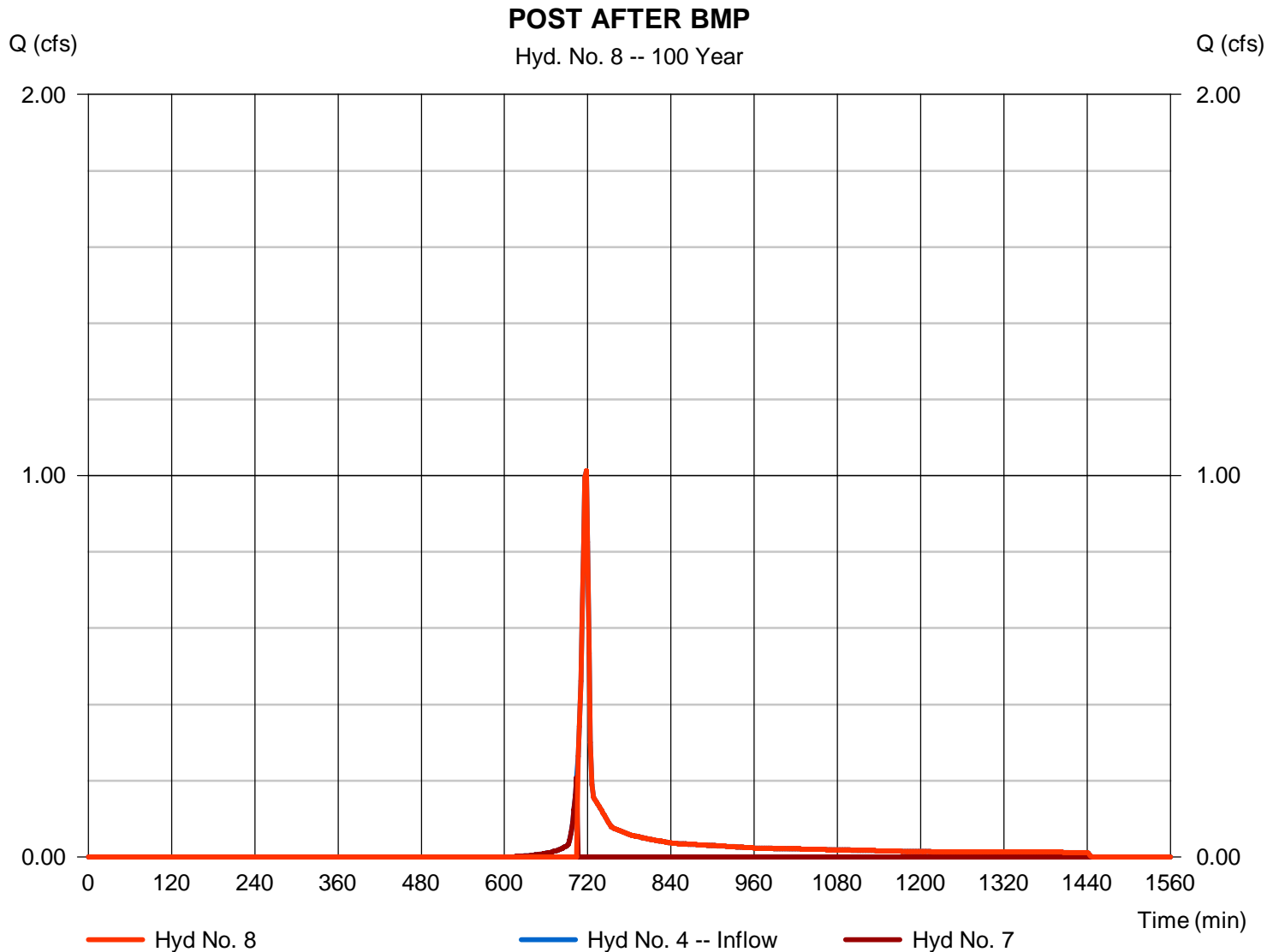
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 10 / 21 / 2016

## Hyd. No. 8

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 1.014 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,897 cuft
Inflow hydrograph	= 4 - POST DETAINED 2	2nd diverted hyd.	= 7
Diversion method	= First Flush Volume	Volume Up To	= 118.00 cuft



# Hydrograph Report

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

Friday, 10 / 21 / 2016

## Hyd. No. 9

POST AT POI

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

Peak discharge = 7.739 cfs  
 Time to peak = 718 min  
 Hyd. volume = 19,592 cuft  
 Contrib. drain. area = 0.510 ac

