PRELIMINARY STORMWATER DRAINAGE STUDY FOR LEE'S SUMMIT SENIOR LIVING COMMUNITY

SE Oldham Parkway
Lee Summit, Missouri

South Prairie Lee Watershed

Prepared for:

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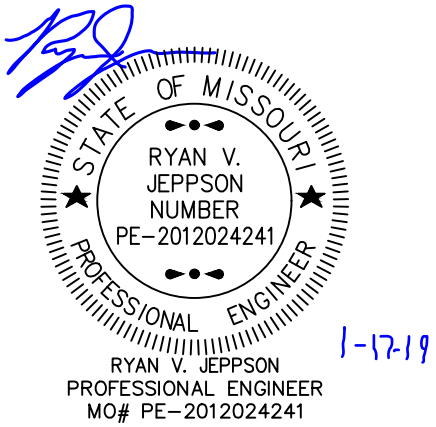

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1. GENERAL INFORMATION

The following stormwater report is for the Lee's Summit Senior Living Community located on the south side of Oldham Parkway approximately 0.4 miles east of Todd George Parkway. The proposed 157,515-sqft facility will be on a 10.45 acre± site that is currently vacant agricultural crop land. In the existing condition the site generally flows from south to the north towards Oldham Parkway. A subtle ridge line splits the site into two sub-drainage areas. The western onsite drainage area discharges to the Oldham Parkway drainage swale at the northwest corner of the site (POI #1). The swale drains to a 5'x5' RCB culvert that flows north underneath the Oldham Parkway, US Route 50, and Blue Parkway to the E. Fork Little Blue River through an unnamed tributary. The eastern onsite drainage area intercepts offsite runoff from approximately 5-acres of agricultural land from the east. Runoff continues to flow north and northeast to an existing 30" RCP culvert (POI #2) that discharges north underneath Oldham Parkway, US Route 50, and Blue Parkway. Storm water continues north to an existing wet detention facility located south of Shenandoah Drive.

Stormwater runoff from the proposed Lee's Summit Senior Living Community will be collected and conveyed through onsite storm sewer, that is routed to proposed bioretention and extended dry detention facilities. These facilities will discharge the water in compliance with the City of Lee Summit's design standards to the existing outfall locations previously discussed.

According the FEMA Flood Map Service Center the site is in an area of minimal flood hazard, Zone X, per map #29095C049G dated 01/20/2017. Zone X is the FEMA flood insurance rate zone that corresponds to "areas of 0.2% annual chance flood; areas of 1% chance flood with average depths less than 1 foot or within drainage areas of less than 1 square mile; and areas protected by levees from 1% annual chance flood." The FEMA FIRMette has been included in Appendix A.

Per the National Wetlands Inventory, the site has no "blue line" streams or wetlands located on site.

Soil data was taken from the USDA Natural Resources Conservation Service – Web Soil Survey of Jackson, County Missouri. The Web soil survey categorize soils on the proposed Lee's Summit Senior Living Community as:

TABLE 1. SITE SOIL CLASSIFICATION

Map Unit	Map Unit Name	Percent Slopes	Rating	Area in AOI (acres)	Percent of AOI
10000	**Arisburg Silt Loam**	1 to 5	C	15.9	85.9%
10082	**Arisburg-Urban land complex**	1 to 5	C	2.6	14.1%

*see Web Soil Survey pdf located in Appendix A

2. METHODOLOGY

This Preliminary Stormwater Drainage Study has been prepared to evaluate the hydrologic impact generated by the development of the Lee's Summit Senior Living Community. The base data for models prepared for this report have been obtained through topographic surveys, online maps, and aerial imagery.

The following method was used to study and model existing and proposed conditions for stormwater runoff:

- TR-55 Unit Hydrograph Method
  - 2-year, 10-year, 100-year Return Frequency Storms
  - 24-Hour SCS Type II Rainfall Distribution
  - SCS Runoff Curve Numbers Per SCS TR-55
  - SCS TR-55 Methods for determining Time of Concentration and Travel Time

Rainfall depth & duration data were taken from the National Oceanic and Atmospheric Administration (NOAA). A summary of the rainfall data used in the calculations are presented in Table 2.

TABLE 2. RAINFALL PRECIPITATION

Annual Exceedance Probability (AEP)	**Rainfall Depth** (inches)
1-year	3.71
10-year	5.66
100-year	9.25

*Preliminary Hydraflow reports have been provided in Appendix A

3. EXISTING CONDITIONS ANALYSIS

Existing conditions where modeled assuming straight row crop ground cover in good condition. This assumption was used to calculate existing condition flow rates and the level service required for proposed BMP implementation. Discharge from the proposed development will adhere to APWA and Lee's Summit discharge requirements. Refer to Figure 1 for existing condition sub-drainage area locations, runoff curve numbers, and sub-drainage area acreage.

In the existing condition the site generally flows from south to the north towards Oldham Parkway. A subtle ridge line splits the site into two sub-drainage areas. The western onsite drainage area (EX10) discharges to the Oldham Parkway drainage swale at the northwest corner of the site (POI #1). The swale drains to a 5'x5' RCB culvert that flows north underneath the Oldham Parkway, US Route 50, and Blue Parkway to the E. Fork Little Blue River through an unnamed tributary.

The eastern onsite drainage area (EX20) intercepts offsite runoff from approximately 5-acres of agricultural land from the east (OFF20). Runoff continues to flow north and northeast to an existing 30" RCP culvert (POI #2) that discharges north underneath Oldham Parkway, US Route 50, and Blue Parkway. Storm water continues north to an existing wet detention facility located south of Shenandoah Drive.

The following table(s), Table 3A & 3B, summarizes the results of the existing conditions analysis:

TABLE 3A. EXISTING CONDITIONS ANALYSIS SUMMARY POINT OF INTEREST #1

Subarea	Drainage Area (acres)	Curve Number	Tc (Minutes)	Existing $Q_{2\text{-year}}$ (cfs)	Existing $Q_{10\text{-year}}$ (cfs)	Existing $Q_{100\text{-year}}$ (cfs)
EX 10 (POI #1)	**3.98**	85	26.3	8.529	15.28	27.78

TABLE 3B. EXISTING CONDITIONS ANALYSIS SUMMARY POINT OF INTEREST #2

Subarea	Drainage Area (acres)	Curve Number	Tc (Minutes)	Existing $Q_{2\text{-year}}$ (cfs)	Existing $Q_{10\text{-year}}$ (cfs)	Existing $Q_{100\text{-year}}$ (cfs)
EX 20	**8.27**	85	25.1	17.72	31.75	57.71
OFF 20	**4.94**	85	28.9	9.875	17.72	32.26
PO1 #2				27.43	49.14	89.48

4. PROPOSED CONDITIONS ANALYSIS

The proposed conditions section of this analysis assumes completion of the Lee's Summit Senior Living Community. As in the existing conditions, the proposed conditions stormwater runoff model was created and ran for the 2, 10, and 100-year storm events. The complete output for the Hydraflow model has been included in Appendix A. Refer to Figure 2 for developed sub-drainage area locations, runoff curve numbers, and sub-drainage area acreage.

In the developed condition drainage area DEV 10 flows into Bio Detention Facility #1 before flowing into the proposed dry detention basin. Drainage area DEV 30 is conveyed into the dry detention basin through an underground storm sewer system. The detention facility discharges to Point of Interest #1, along with some of the existing flow from SE Oldham Parkway.

Point of Interest #2 accepts flow from the eastern half of the site. Drainage area DEV 20 is routed through Bio Detention Facility #2 before it is discharged to the point of interest. While drainage area DEV 21, which is the proposed public roadway to be constructed on the eastern edge of the site, is collected in an underground storm sewer system and conveyed to Point of Interest #2.

The following tables contain input data and summarize the computed results of the developed conditions analysis:

TABLE 4A. DEVELOPED CONDITIONS ANALYSIS SUMMARY POINT OF INTEREST #1

Subarea	Drainage Area (acres)	Curve Number	Tc (Minutes)	Developed $Q_{2\text{-year}}$ (cfs)	Developed $Q_{10\text{-year}}$ (cfs)	Developed $Q_{100\text{-year}}$ (cfs)
DEV 10	**3.09**	92	5	13.97	22.55	38.09
DEV 30	**4.17**	88	5	16.89	28.62	49.83
ALLOWABLE DISCHARGE	**7.26**			3.63	8.52	21.78
DA 11 (R/W)	**1.06**	87	5	4.161	7.144	12.58

TABLE 4B. DEVELOPED CONDITIONS ANALYSIS SUMMARY POINT OF INTEREST #2

Subarea	Drainage Area (acres)	Curve Number	Tc (Minutes)	Developed $Q_{2\text{-year}}$ (cfs)	Developed $Q_{10\text{-year}}$ (cfs)	Developed $Q_{100\text{-year}}$ (cfs)
DEV 20	**2.52**	90	5	10.82	17.87	30.66
ALLOWABLE DISCHARGE	**2.52**			1.26	5.04	7.56
DA 21 (R/W)	**1.78**	86	5	6.763	11.77	20.92
OFF 22 (R/W)	**0.56**	87	5	2.198	3.774	6.646
OFF 20	**4.94**	86	28.9	10.25	18.13	32.64

TABLE 5A. DRY DETENTION FACILITY SUMMARY

Return Frequency	Developed Q_{DEV} (cfs)	Detention Volume (cf)	WSE (ft)
2	2.326	11,278	1021.25
10	5.936	17,339	1021.90
100	14.34	30,074	1022.97

TABLE 5B. BIO DETENTION #1 FACILITY SUMMARY

Return Frequency	Developed Q_{DEV} (cfs)	Detention Volume (cf)	WSE (ft)
2	1.639	28,068	1019.49
10	5.936	43,201	1020.17
100	14.34	60,228	1020.78

TABLE 5C. BIO DETENTION #2 FACILITY SUMMARY

Return Frequency	Developed Q_{DEV} (cfs)	Detention Volume (cf)	WSE (ft)
2	0.688	11,609	1020.50
10	4.768	17,383	1021.10
100	6.002	30,251	1022.22

TABLE 6A. POINT OF INTEREST #1 SUMMARY

Return Frequency	Existing Q_{pre} (cfs)	Developed Q_{DEV} (cfs)
2	**8.529**	5.507
10	**15.28**	8.708
100	**27.78**	27.23

TABLE 6B. POINT OF INTEREST #2 SUMMARY

Return Frequency	Existing Q_{pre} (cfs)	Developed Q_{DEV} (cfs)
2	**27.43**	15.57
10	**49.14**	29.06
100	**89.48**	53.22

Water quality volume treatment calculations were determined using the 2012 APWA/MARC BMP manual level of surface calculations. The level of surface calculation considered all onsite development. Existing offsite right-of-way and proposed public right-of-way will not be

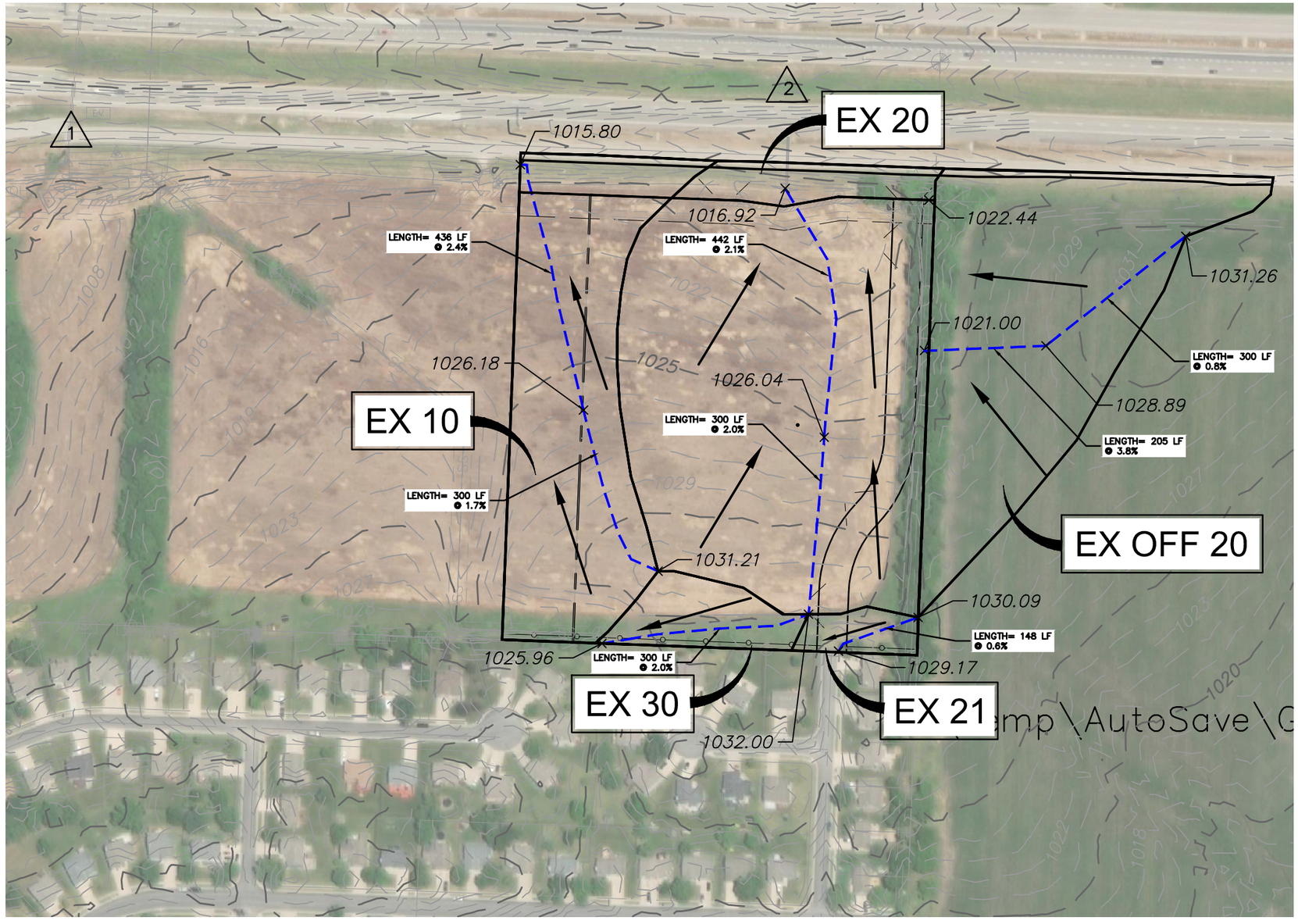
conveyed through onsite BMPs. Water quality level of service and water quality volume calculations are provided in Appendix B.

5. CONCLUSIONS & RECOMMENDATIONS

The Lee's Summit Senior Living Community has been evaluated in this report to show that the stormwater discharge from the site will remain within the acceptable levels. A new detention basin and two new biodetention basins are to be constructed to handle the increased runoff created from the development.

In conclusion, all peak discharges for the points of interest for all events area at or below the established limits. See Appendix C for City of Lee's Summit BMP Level of Service Worksheet.

It is therefore requested that Lee's Summit, Missouri approve this "Lee's Summit Senior Living Community Preliminary Stormwater Drainage Study." This study will be verified with the final construction documents for the construction with the development.



LEGEND

- DRAINAGE AREA BOUNDARY
- TC ROUTE
- FLOW DIRECTION
- 1 POINT OF INTEREST

SUMMARY TABLE			
SUBBASIN	AREA (AC)	CN	TC (MIN.)
EX 10	3.98	85	26.30
EX 20	8.27	85	25.10
EX 21	0.31	85	18.81
EX30	0.69	85	19.75
EX OFF 20	4.94	85	28.90

N

0’ 100’ 200’ 400’

SCALE IN FEET

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XREFS: C_PBASE_81450 V_XBOU_81450 V_TOPO_81450
USER: tdrake

PROJECT: 018-1450
DRAWN BY: TDD
DATE: 01/16/2019

EXISTING CONDITIONS DRAINAGE AREA MAP

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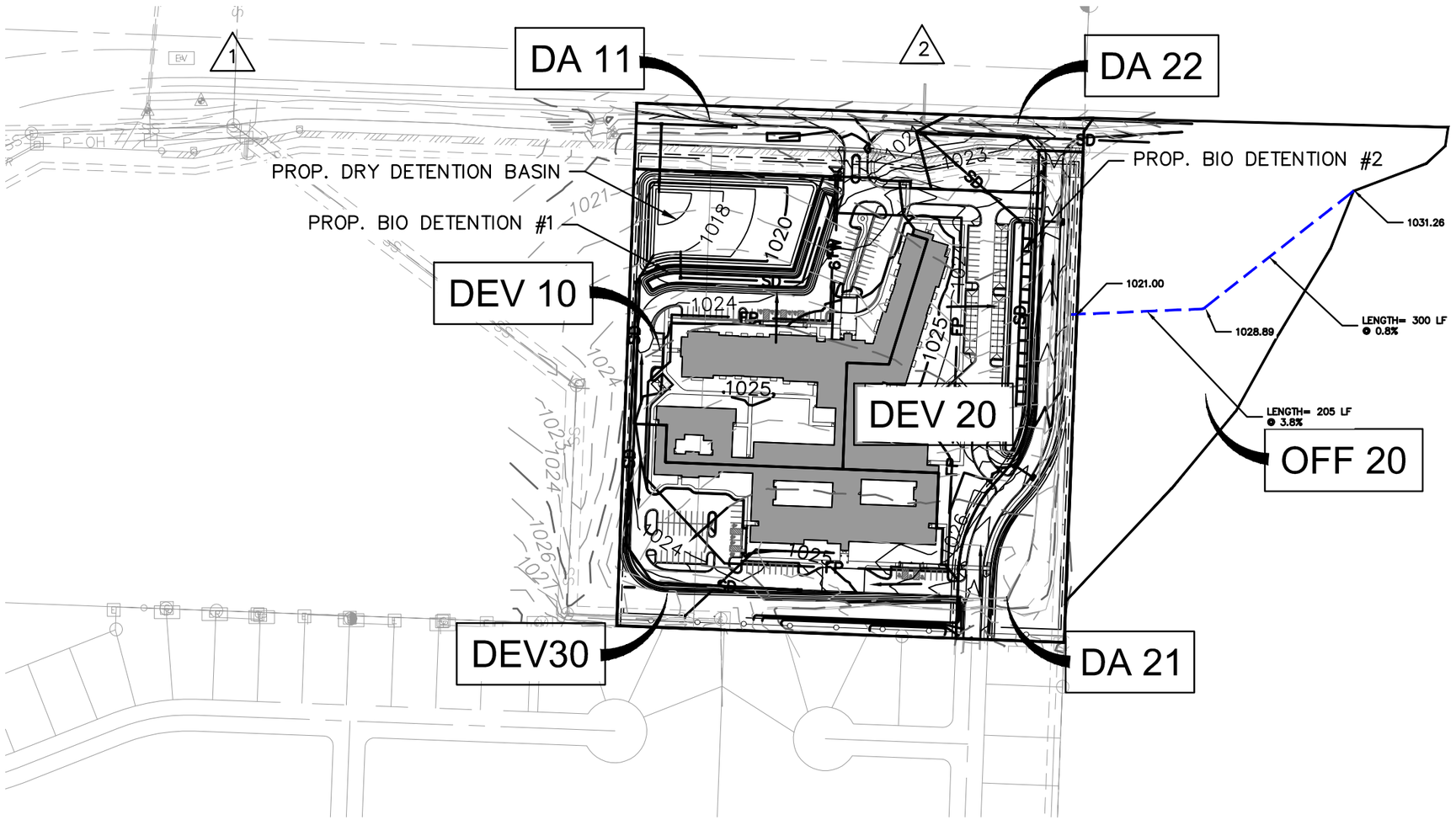
FIGURE
F-1

LEGEND

- DRAINAGE AREA BOUNDARY
- TC ROUTE
- FLOW DIRECTION
- 1 — POINT OF INTEREST

SUMMARY TABLE			
SUBBASIN	AREA (AC)	CN	TC (MIN.)
DEV 10	3.09	92	5.00
DA 11	1.06	87	5.00
DEV 30	4.17	88	5.00
DEV 20	2.52	90	5.00
DA 21	1.78	86	5.00
OFF DA 22	0.56	87	5.00
OFF 20	4.94	86	28.90



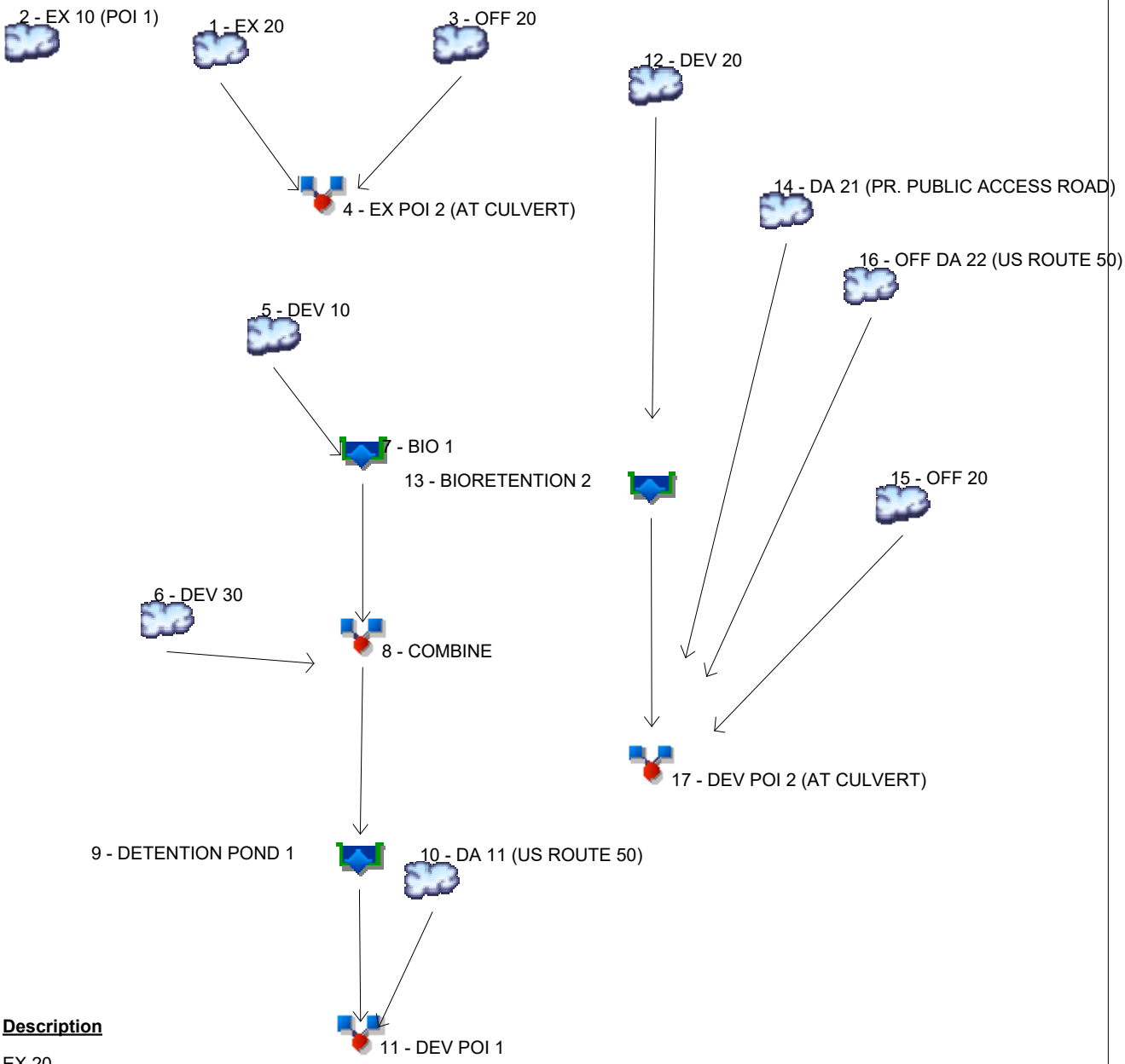
PROJECT: 018-1450 DRAWN BY: TDD DATE: 01/16/2019	DEVELOPED CONDITIONS DRAINAGE AREA MAP	olsson 550 St. Louis Street Springfield, MO 65806 TEL 417.890.8802 FAX 401.890.8805	FIGURE F-2

APPENDIX A

Hydrology & Detention Calculations

Hydraflow Table of Contents

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	EX 20
2	SCS Runoff	EX 10 (POI 1)
3	SCS Runoff	OFF 20
4	Combine	EX POI 2 (AT CULVERT)
5	SCS Runoff	DEV 10
6	SCS Runoff	DEV 30
7	Reservoir	BIO 1
8	Combine	COMBINE
9	Reservoir	DETENTION POND 1
10	SCS Runoff	DA 11 (US ROUTE 50)
11	Combine	DEV POI 1
12	SCS Runoff	DEV 20
13	Reservoir	BIORETENTION 2
14	SCS Runoff	DA 21 (PR. PUBLIC ACCESS ROAD)
15	SCS Runoff	OFF 20
16	SCS Runoff	OFF DA 22 (US ROUTE 50)
17	Combine	DEV POI 2 (AT CULVERT)

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	17.72	2	728	65,024	------	------	------	EX 20
2	SCS Runoff	8.529	2	728	31,293	------	------	------	EX 10 (POI 1)
3	SCS Runoff	9.875	2	730	39,458	------	------	------	OFF 20
4	Combine	27.43	2	730	104,481	1, 3	------	------	EX POI 2 (AT CULVERT)
5	SCS Runoff	13.97	2	716	29,845	------	------	------	DEV 10
6	SCS Runoff	16.89	2	716	34,924	------	------	------	DEV 30
7	Reservoir	2.326	2	726	29,832	5	1021.25	11,278	BIO 1
8	Combine	18.92	2	716	64,756	6, 7	------	------	COMBINE
9	Reservoir	1.639	2	860	64,753	8	1019.49	28,068	DETENTION POND 1
10	SCS Runoff	4.161	2	716	8,557	------	------	------	DA 11 (US ROUTE 50)
11	Combine	5.507	2	716	73,310	9, 10	------	------	DEV POI 1
12	SCS Runoff	10.82	2	716	22,684	------	------	------	DEV 20
13	Reservoir	0.688	2	756	22,668	12	1020.50	11,609	BIORETENTION 2
14	SCS Runoff	6.763	2	716	13,843	------	------	------	DA 21 (PR. PUBLIC ACCESS ROAD)
15	SCS Runoff	10.25	2	730	40,979	------	------	------	OFF 20
16	SCS Runoff	2.198	2	716	4,521	------	------	------	OFF DA 22 (US ROUTE 50)
17	Combine	15.57	2	718	82,010	13, 14, 15, 16	------	------	DEV POI 2 (AT CULVERT)

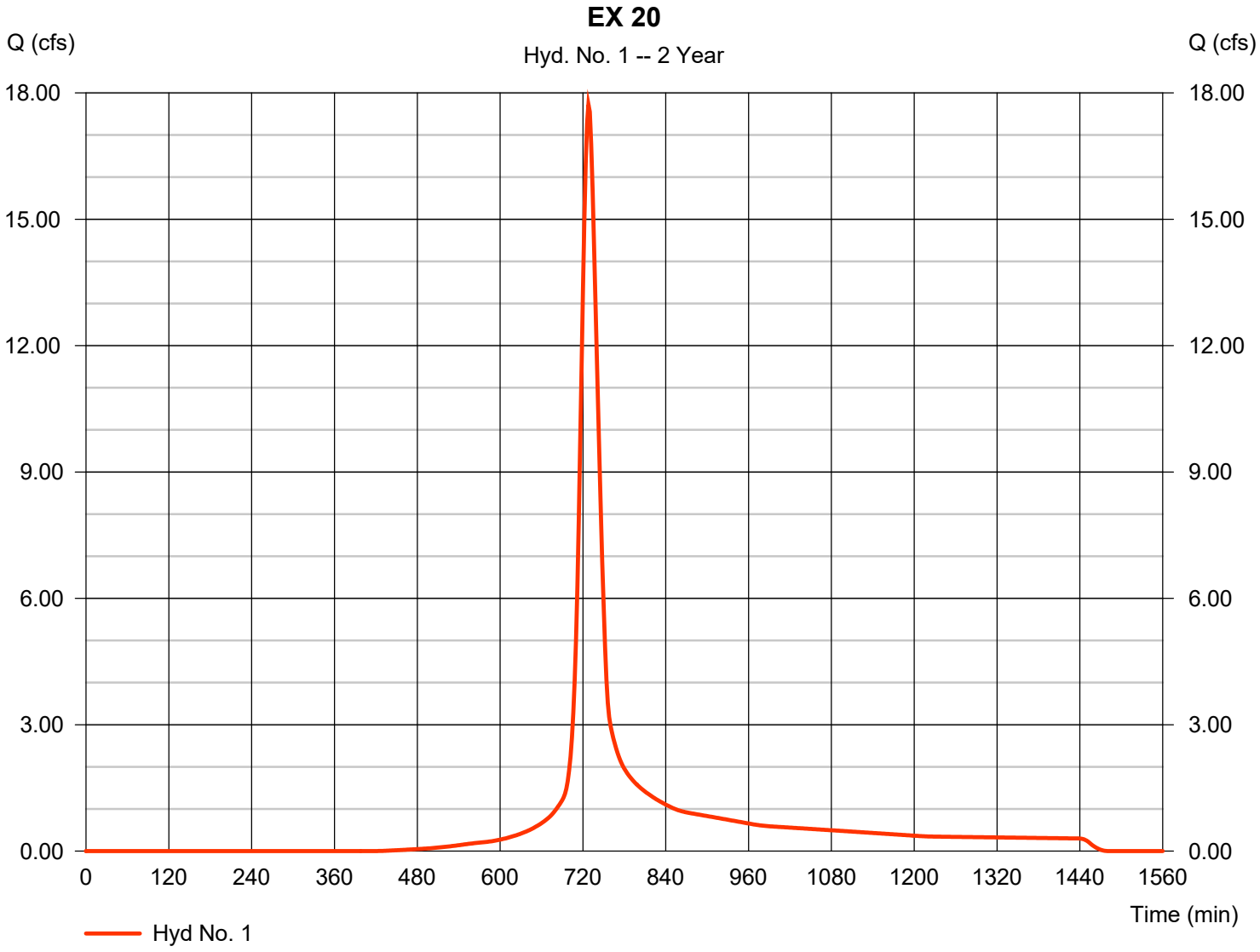
Hydrograph Report

Hyd. No. 1

EX 20

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.72 cfs
Storm frequency	=	2 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	65,024 cuft
Drainage area	=	8.270 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.10 min
Total precip.	=	3.71 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.110 x 98) + (8.160 x 85)] / 8.270



TR55 Tc Worksheet

Hyd. No. 1

EX 20

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.71		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 21.91**	**+**	**0.00**	**+**	**0.00**	**=**	**21.91**
Shallow Concentrated Flow							
Flow length (ft)	= 440.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 3.21**	**+**	**0.00**	**+**	**0.00**	**=**	**3.21**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 25.10 min

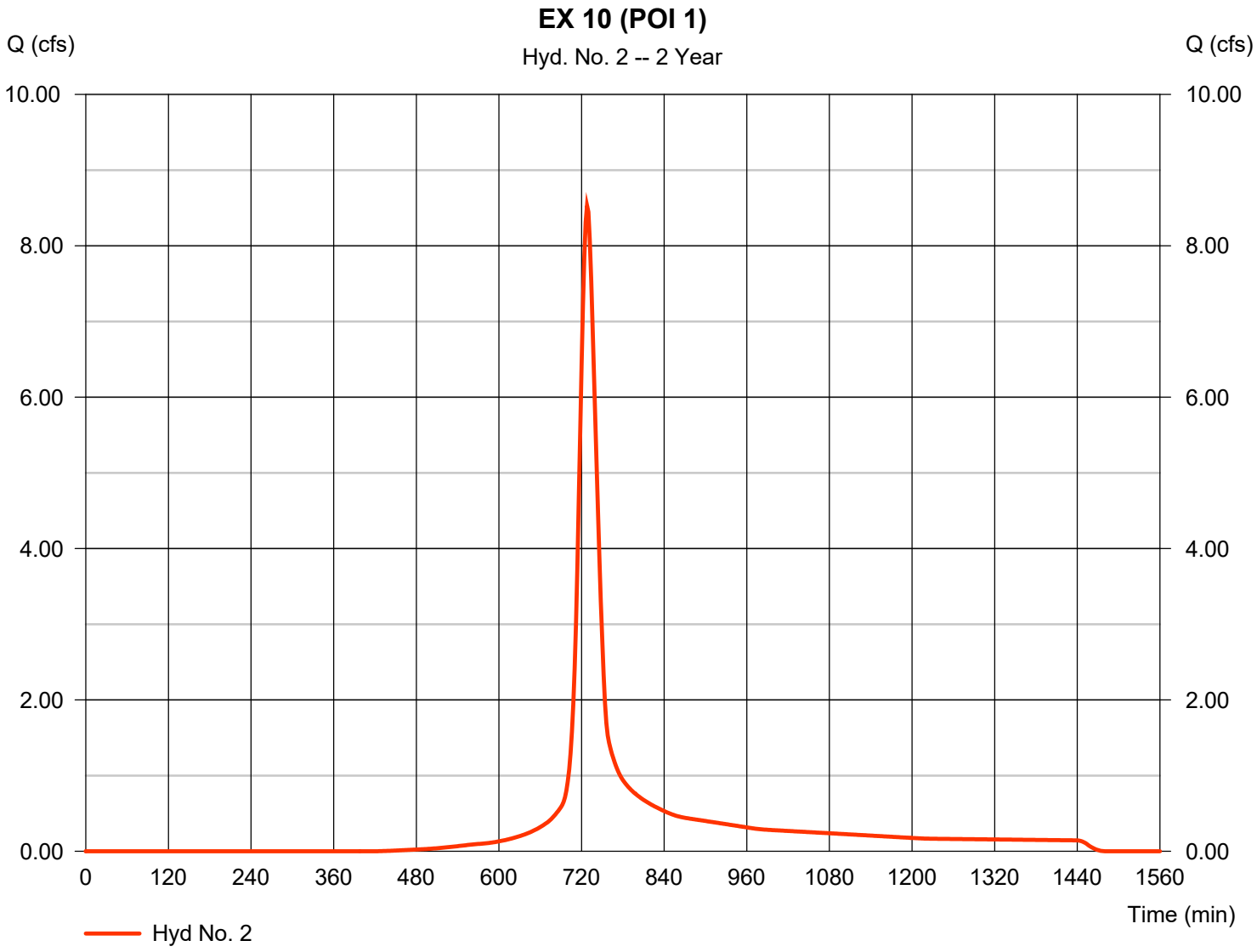
Hydrograph Report

Hyd. No. 2

EX 10 (POI 1)

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.529 cfs
Storm frequency	=	2 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	31,293 cuft
Drainage area	=	3.980 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	26.30 min
Total precip.	=	3.71 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 98) + (3.890 x 85)] / 3.980



TR55 Tc Worksheet

Hyd. No. 2

EX 10 (POI 1)

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.71		0.00		0.00		
Land slope (%)	= 1.70		0.00		0.00		
Travel Time (min)	**= 23.39**	**+**	**0.00**	**+**	**0.00**	**=**	**23.39**
Shallow Concentrated Flow							
Flow length (ft)	= 435.00		0.00		0.00		
Watercourse slope (%)	= 2.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.50		0.00		0.00		
Travel Time (min)	**= 2.90**	**+**	**0.00**	**+**	**0.00**	**=**	**2.90**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 26.30 min

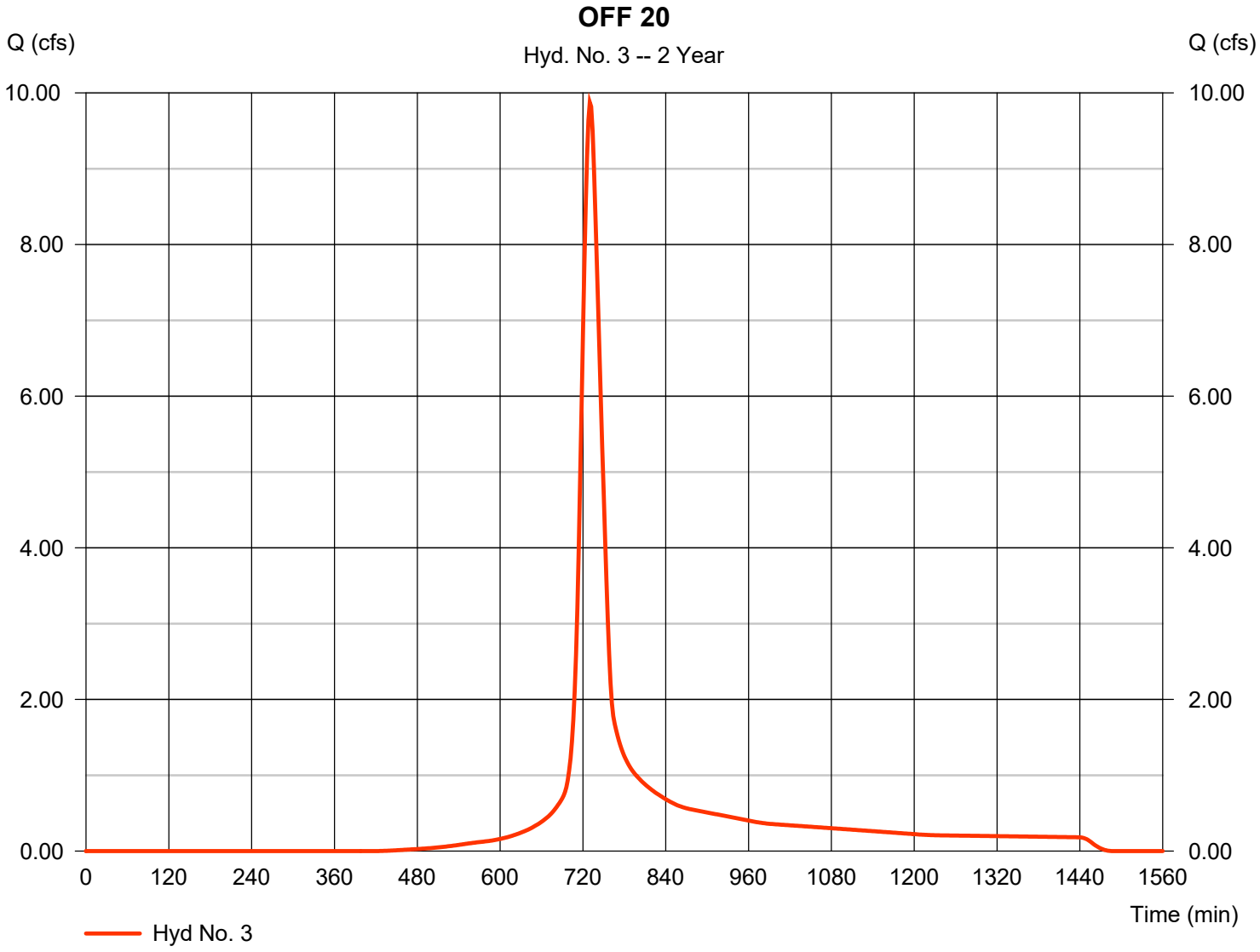
Hydrograph Report

Hyd. No. 3

OFF 20

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.875 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	39,458 cuft
Drainage area	=	4.940 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.90 min
Total precip.	=	3.71 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 98) + (4.800 x 85)] / 4.940



TR55 Tc Worksheet

Hyd. No. 3

OFF 20

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.71		0.00		0.00		
Land slope (%)	= 1.10		0.00		0.00		
Travel Time (min)	**= 27.83**	**+**	**0.00**	**+**	**0.00**	**=**	**27.83**
Shallow Concentrated Flow							
Flow length (ft)	= 205.00		0.00		0.00		
Watercourse slope (%)	= 3.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.15		0.00		0.00		
Travel Time (min)	**= 1.09**	**+**	**0.00**	**+**	**0.00**	**=**	**1.09**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

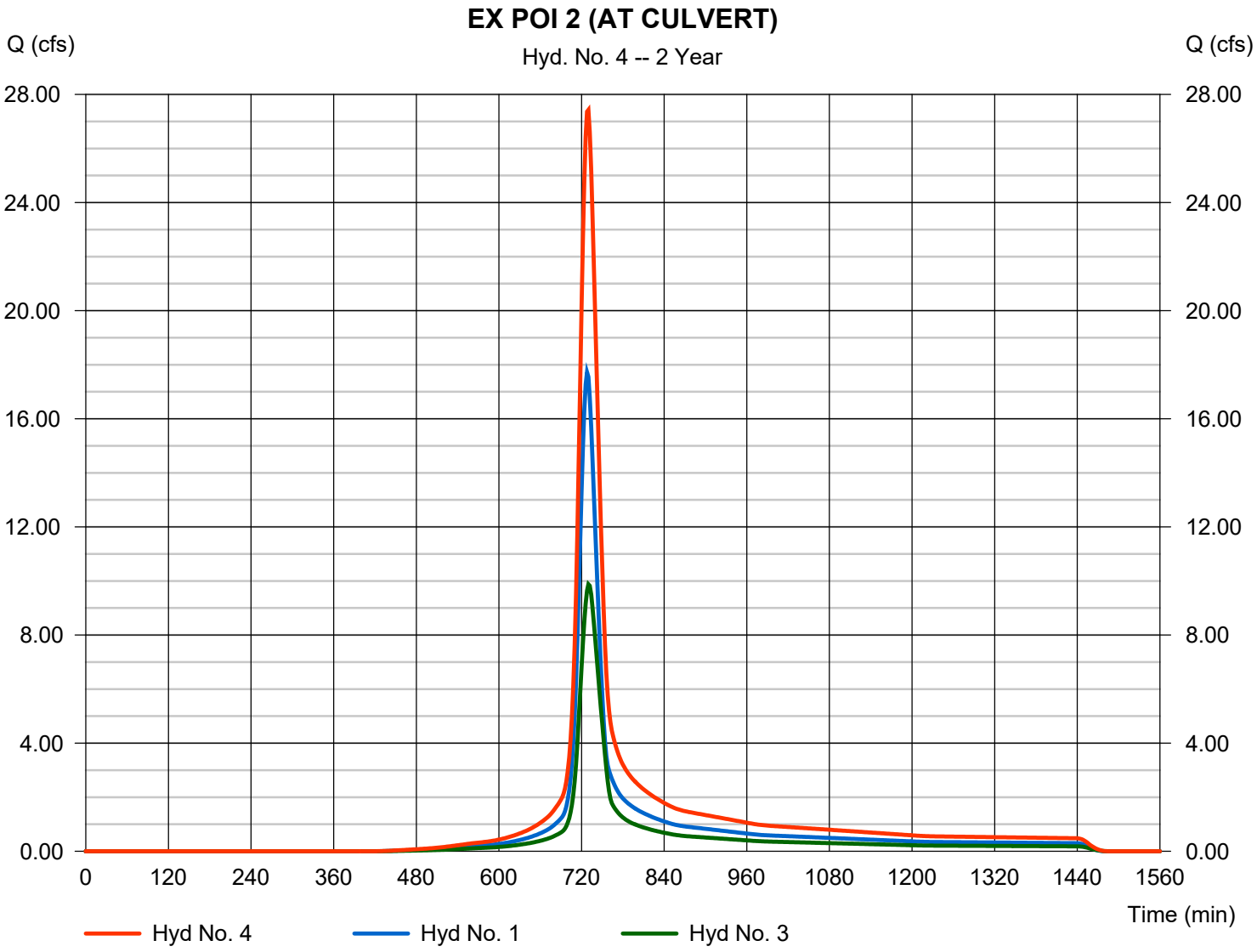
Total Travel Time, Tc ..... 28.90 min

Hydrograph Report

Hyd. No. 4

EX POI 2 (AT CULVERT)

Hydrograph type	=	Combine	Peak discharge	=	27.43 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	104,481 cuft
Inflow hyds.	=	1, 3	Contrib. drain. area	=	13.210 ac



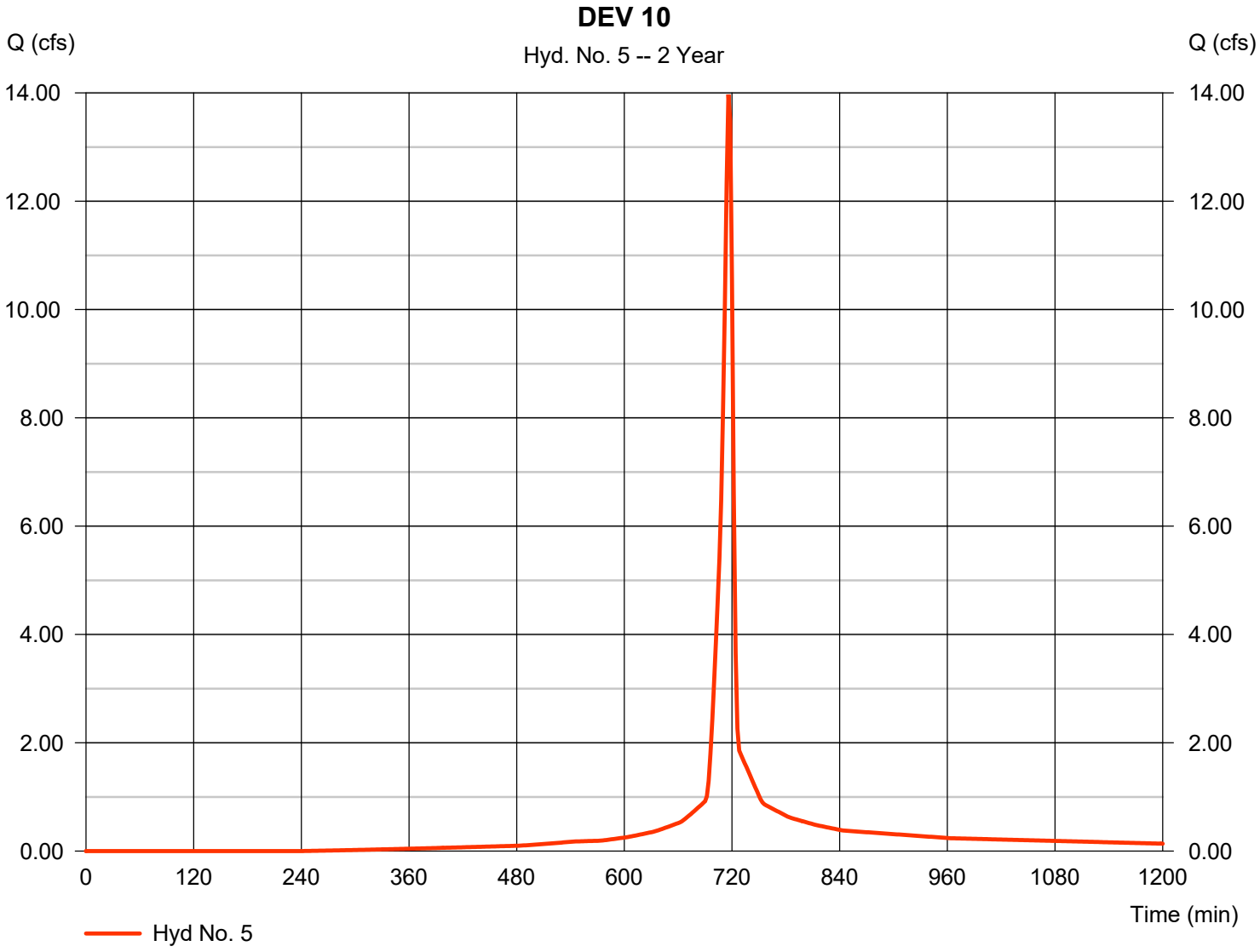
Hydrograph Report

Hyd. No. 5

DEV 10

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.97 cfs
Storm frequency	=	2 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	29,845 cuft
Drainage area	=	3.090 ac	Curve number	=	92*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.71 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.020 x 98) + (1.070 x 80)] / 3.090



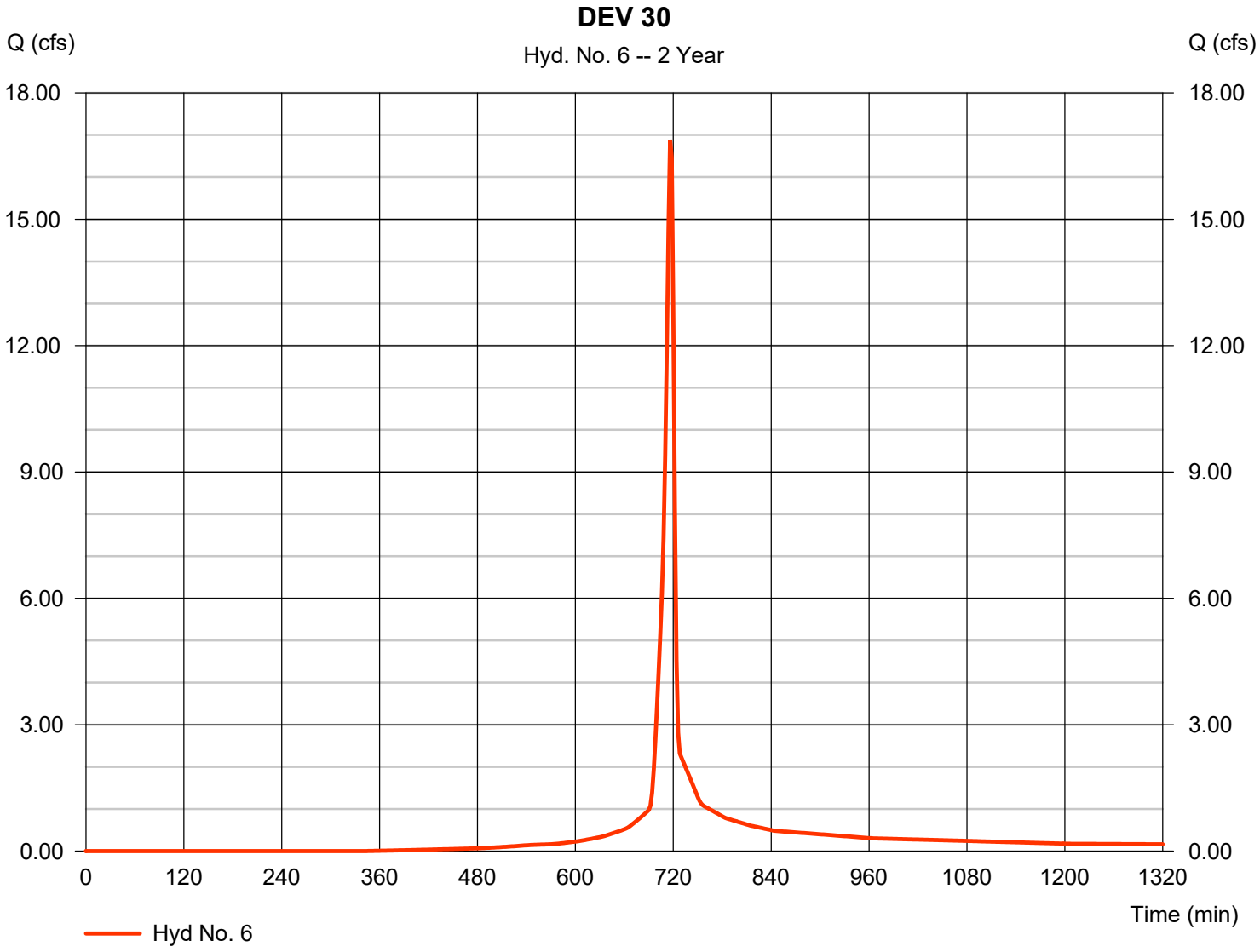
Hydrograph Report

Hyd. No. 6

DEV 30

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.89 cfs
Storm frequency	=	2 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	34,924 cuft
Drainage area	=	4.170 ac	Curve number	=	88*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.71 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.850 x 98) + (2.320 x 80)] / 4.170



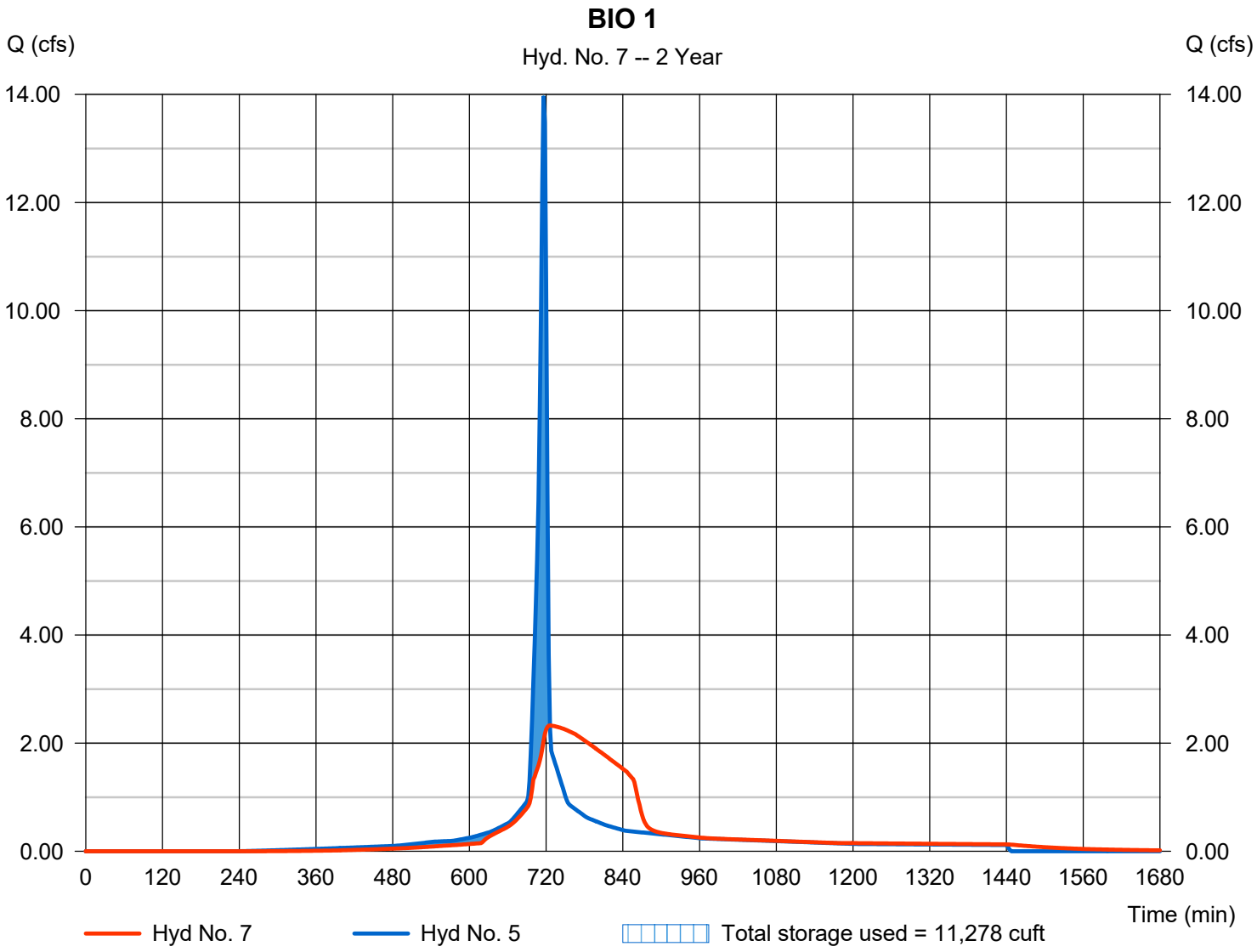
Hydrograph Report

Hyd. No. 7

BIO 1

Hydrograph type	=	Reservoir	Peak discharge	=	2.326 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	29,832 cuft
Inflow hyd. No.	=	5 - DEV 10	Max. Elevation	=	1021.25 ft
Reservoir name	=	BIORETENTION 1	Max. Storage	=	11,278 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - BIORETENTION 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1019.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1019.00	00	0	0
1.00	1020.00	5,796	1,932	1,932
2.00	1021.00	8,214	6,969	8,901
3.00	1022.00	10,869	9,510	18,411
4.00	1023.00	13,220	12,024	30,435
5.00	1024.00	13,220	13,219	43,653

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	8.00	0.00	0.00
Span (in)	= 12.00	8.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 1019.00	1019.00	0.00	0.00
Length (ft)	= 10.00	0.50	0.00	0.00
Slope (%)	= 2.00	1.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

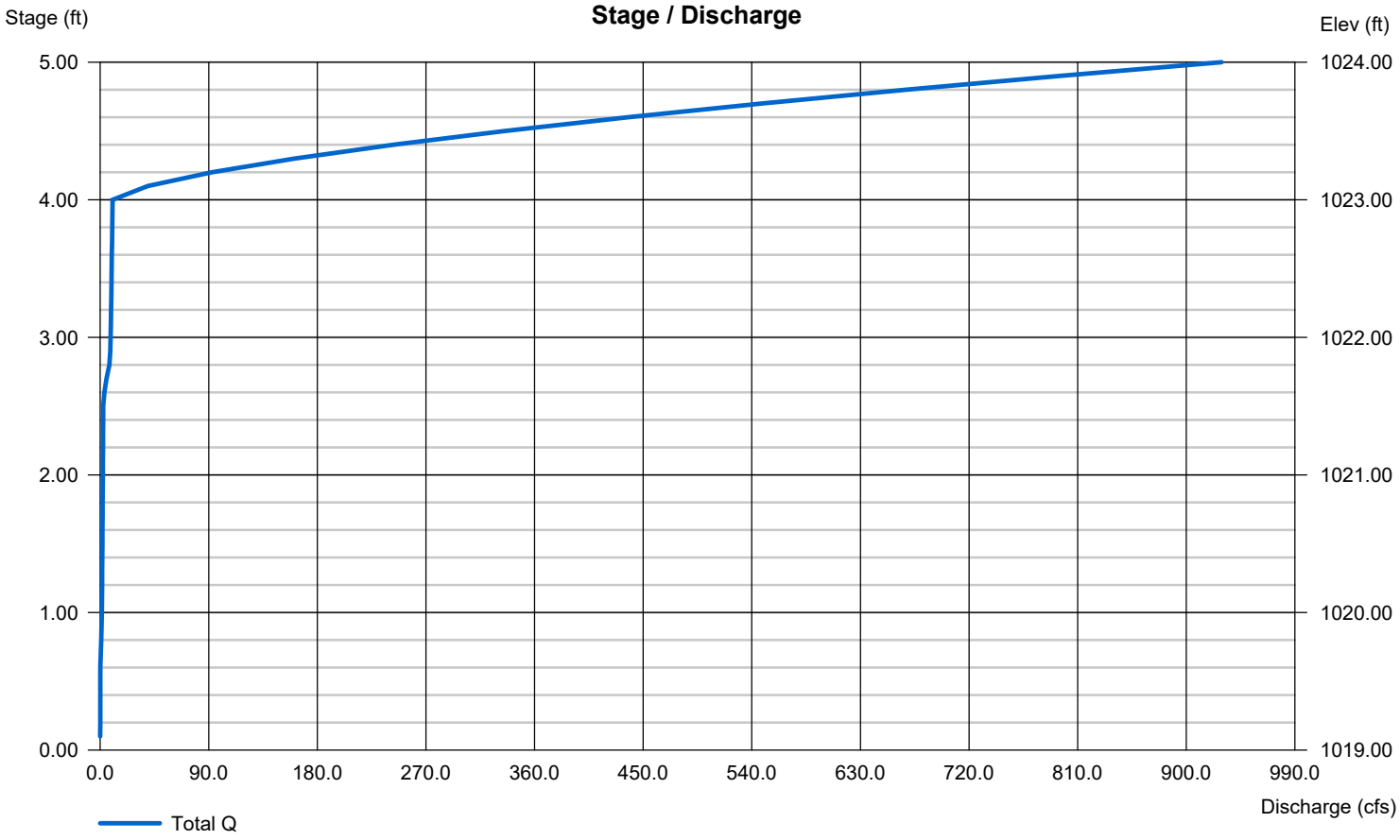
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 9.00	353.00	0.00	0.00
Crest El. (ft)	= 1021.50	1023.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= Rect	Broad	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

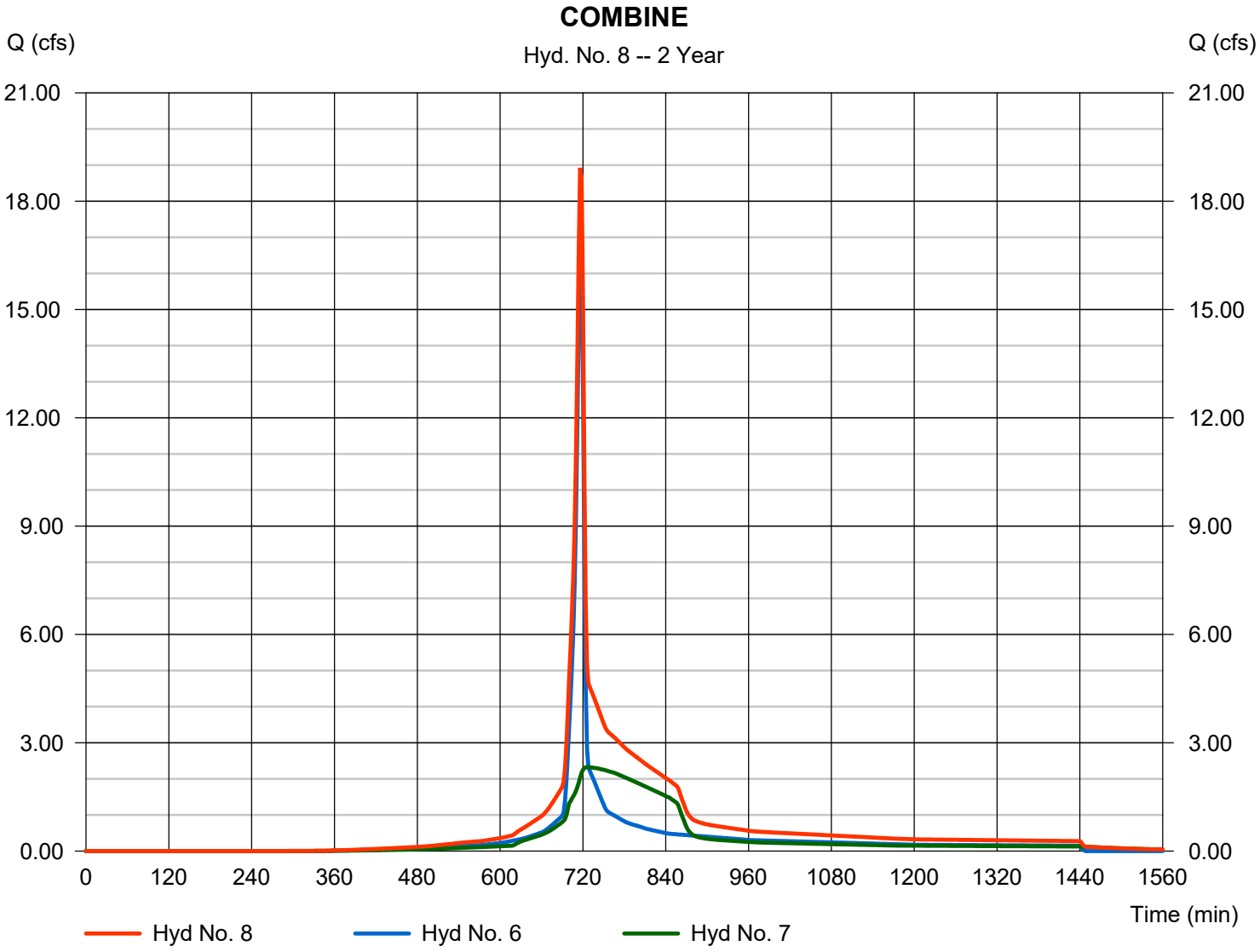


Hydrograph Report

Hyd. No. 8

COMBINE

Hydrograph type	= Combine	Peak discharge	= 18.92 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 64,756 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 4.170 ac



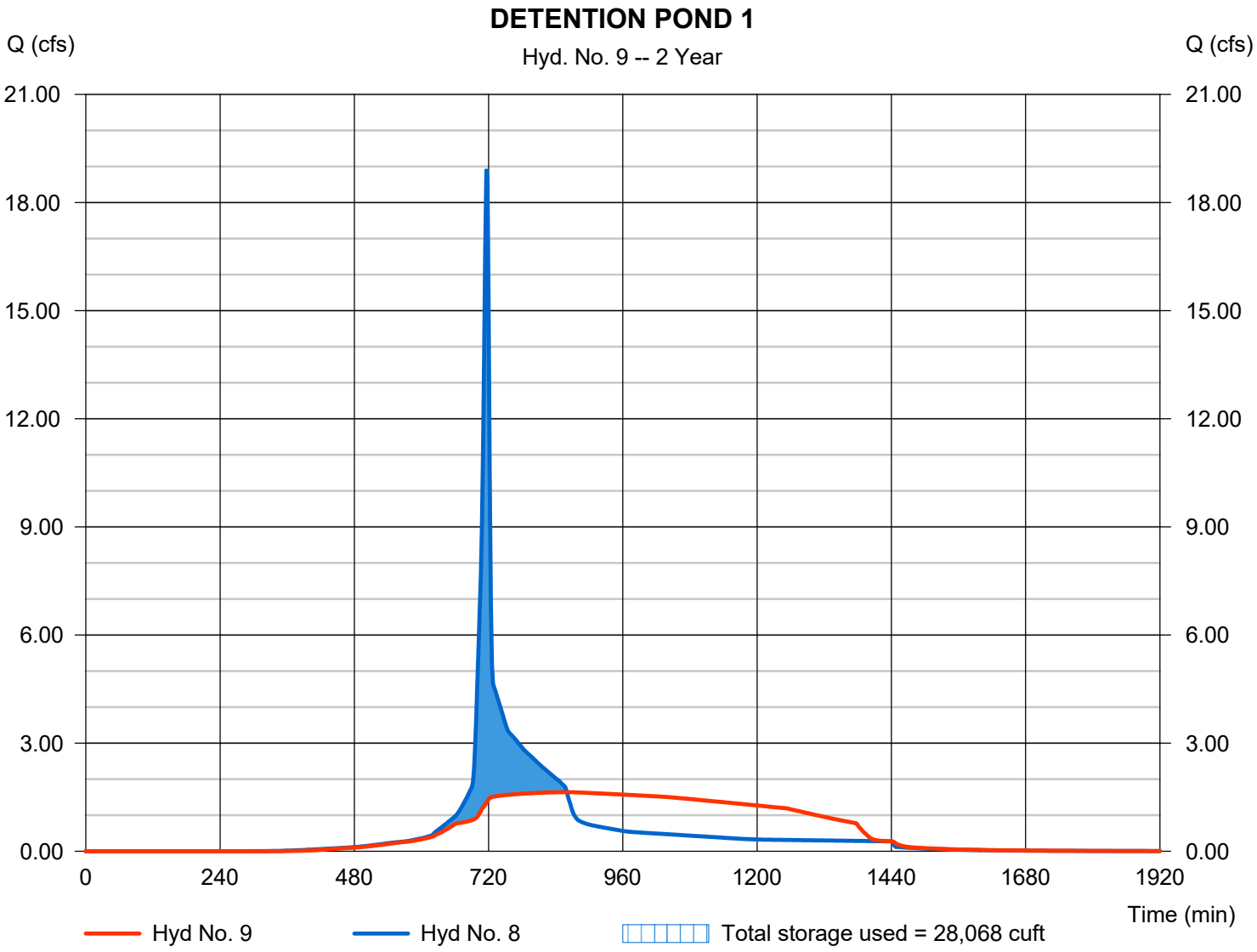
Hydrograph Report

Hyd. No. 9

DETENTION POND 1

Hydrograph type	=	Reservoir	Peak discharge	=	1.639 cfs
Storm frequency	=	2 yrs	Time to peak	=	860 min
Time interval	=	2 min	Hyd. volume	=	64,753 cuft
Inflow hyd. No.	=	8 - COMBINE	Max. Elevation	=	1019.49 ft
Reservoir name	=	DRY DETENTION 1	Max. Storage	=	28,068 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - DRY DETENTION 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1016.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1016.00	00	0	0
1.00	1017.00	2,042	681	681
2.00	1018.00	8,847	5,046	5,727
3.00	1019.00	16,278	12,374	18,100
4.00	1020.00	24,535	20,264	38,364
5.00	1021.00	31,558	27,970	66,334
6.00	1022.00	35,419	33,467	99,801

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 30.00	6.00	0.00	0.00
Span (in)	= 30.00	6.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 1016.00	1016.00	0.00	0.00
Length (ft)	= 200.00	0.50	0.00	0.00
Slope (%)	= 0.50	1.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

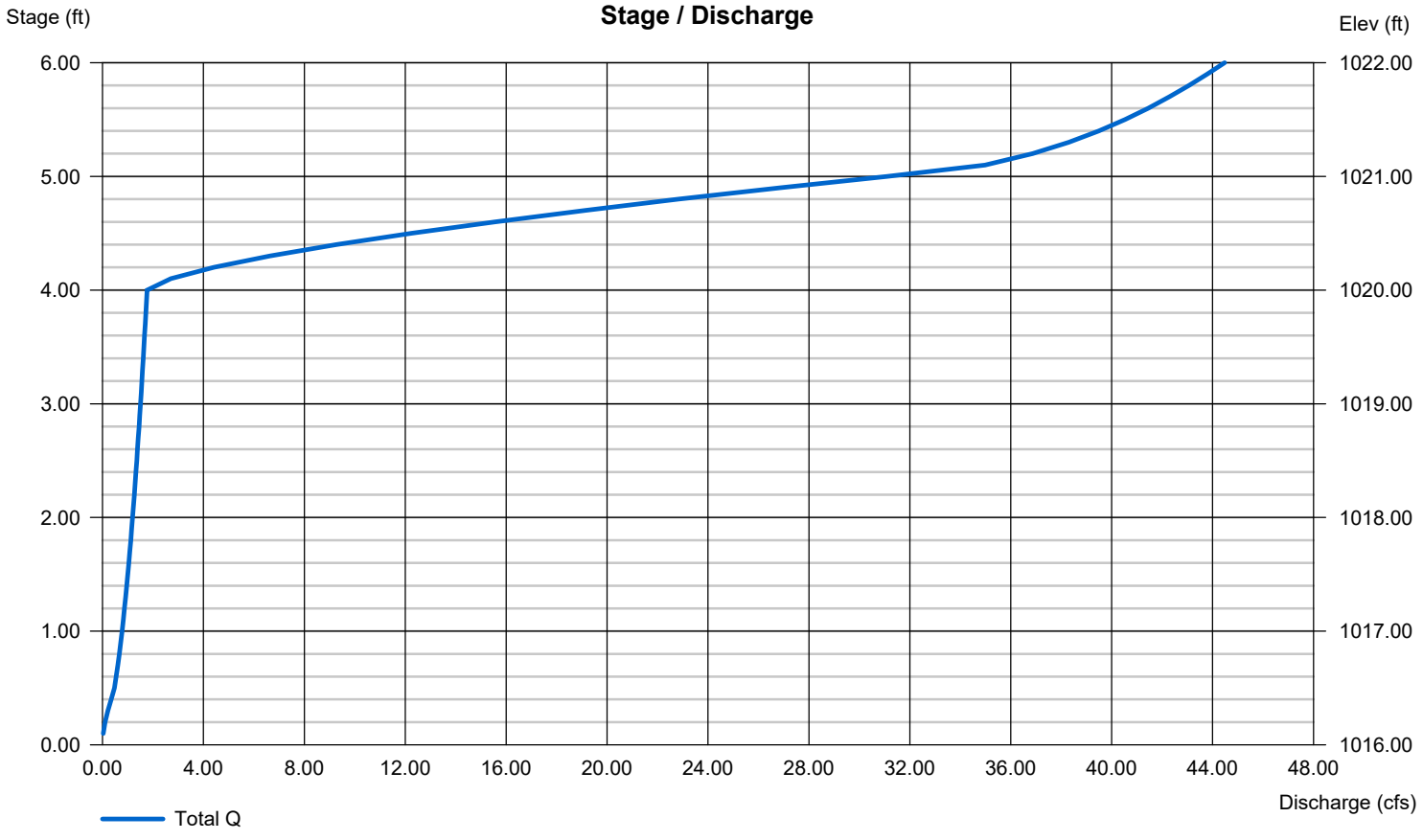
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 9.00	0.00	0.00	0.00
Crest El. (ft)	= 1020.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



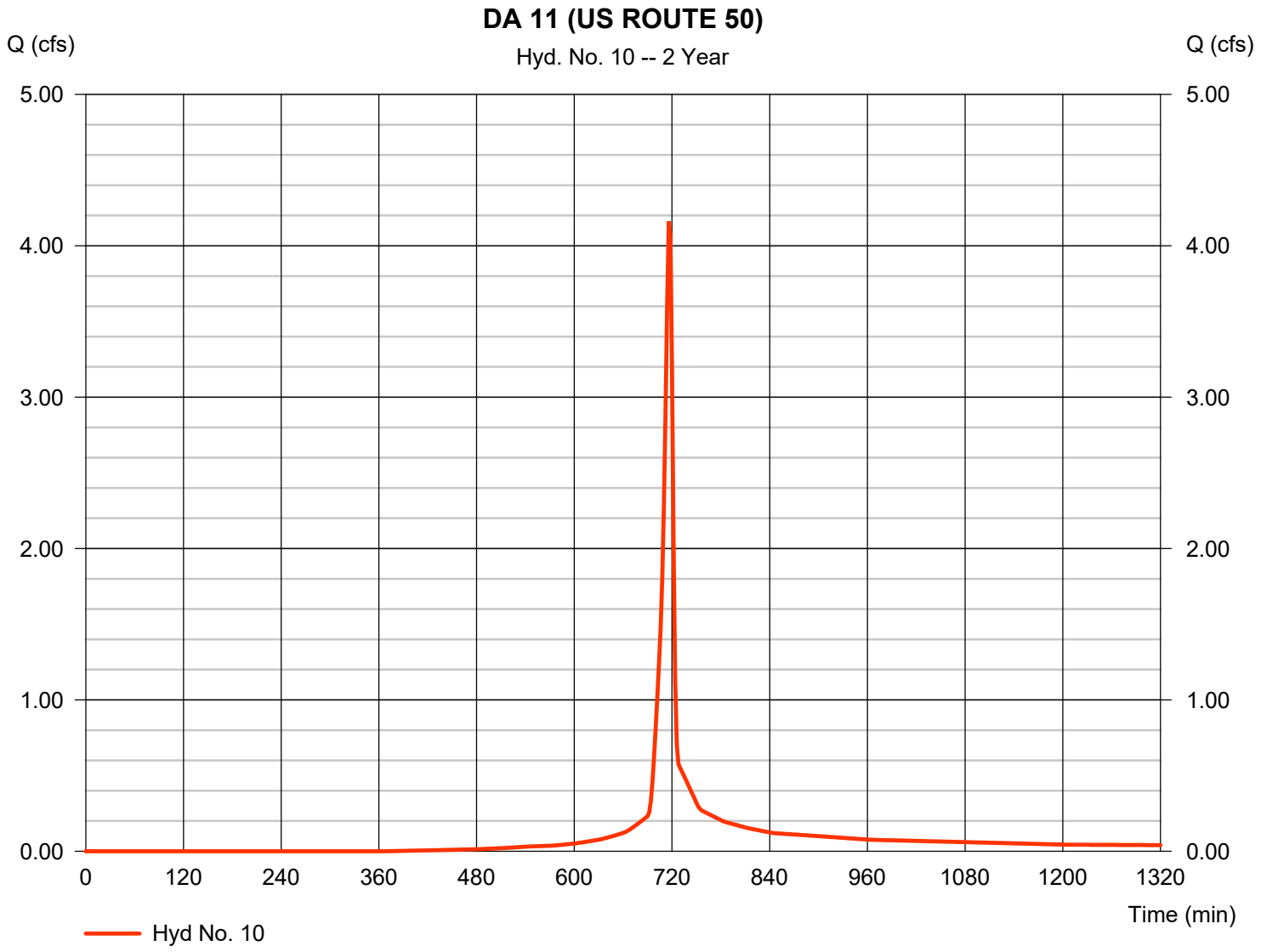
Hydrograph Report

Hyd. No. 10

DA 11 (US ROUTE 50)

Hydrograph type	= SCS Runoff	Peak discharge	= 4.161 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 8,557 cuft
Drainage area	= 1.060 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.400 x 98) + (0.660 x 80)] / 1.060

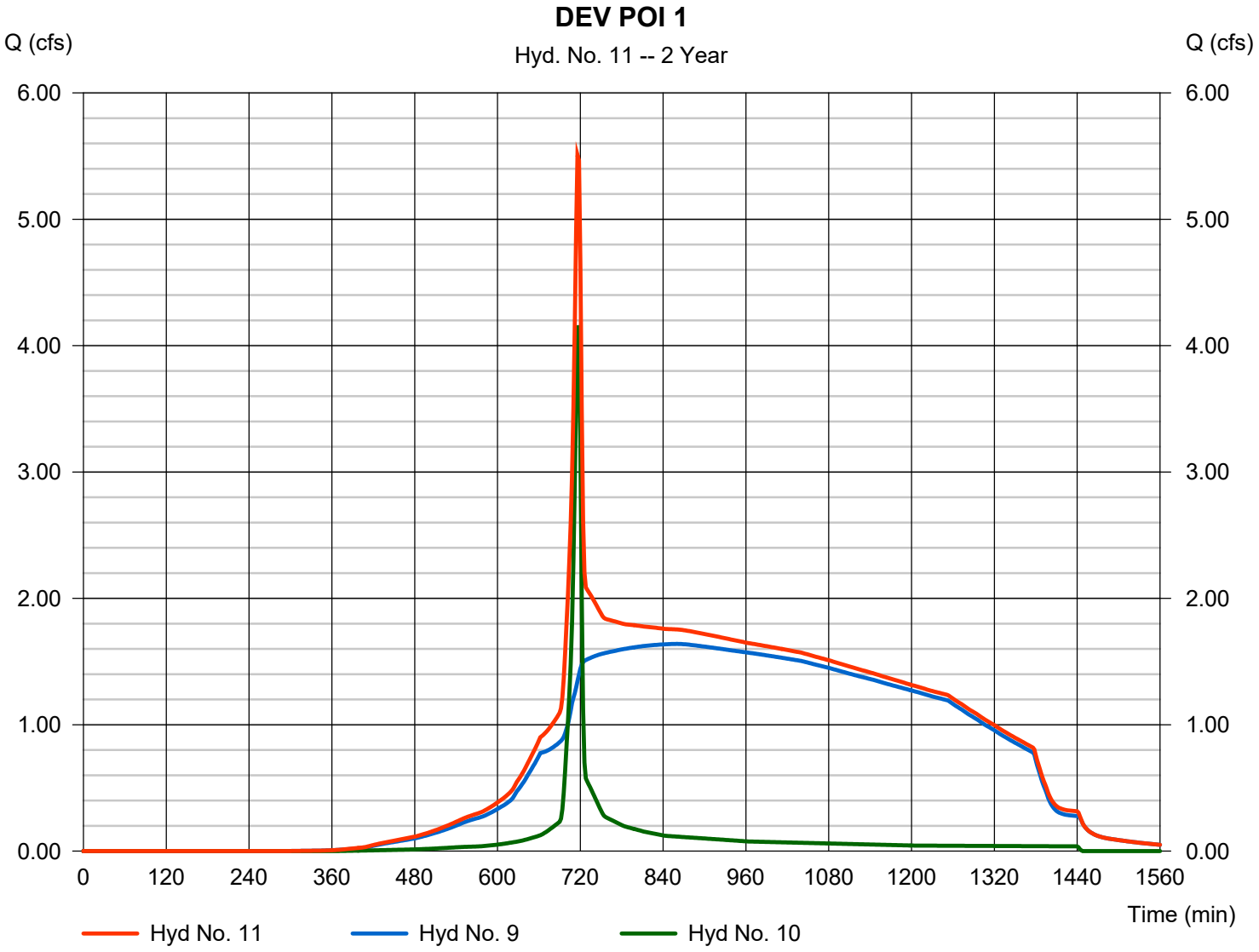


Hydrograph Report

Hyd. No. 11

DEV POI 1

Hydrograph type	=	Combine	Peak discharge	=	5.507 cfs
Storm frequency	=	2 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	73,310 cuft
Inflow hyds.	=	9, 10	Contrib. drain. area	=	1.060 ac



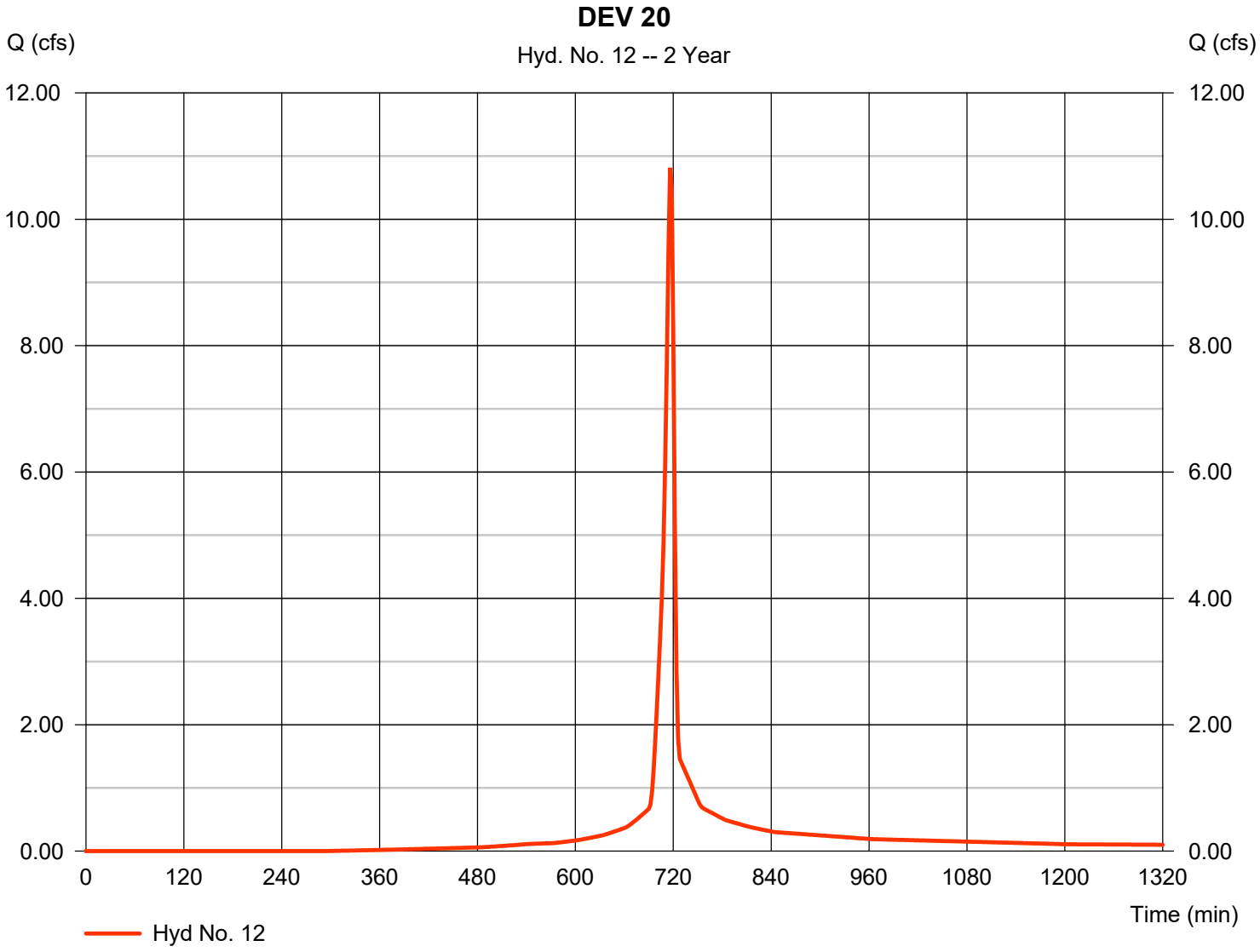
Hydrograph Report

Hyd. No. 12

DEV 20

Hydrograph type	=	SCS Runoff	Peak discharge	=	10.82 cfs
Storm frequency	=	2 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	22,684 cuft
Drainage area	=	2.520 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.71 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.340 x 98) + (1.180 x 80)] / 2.520



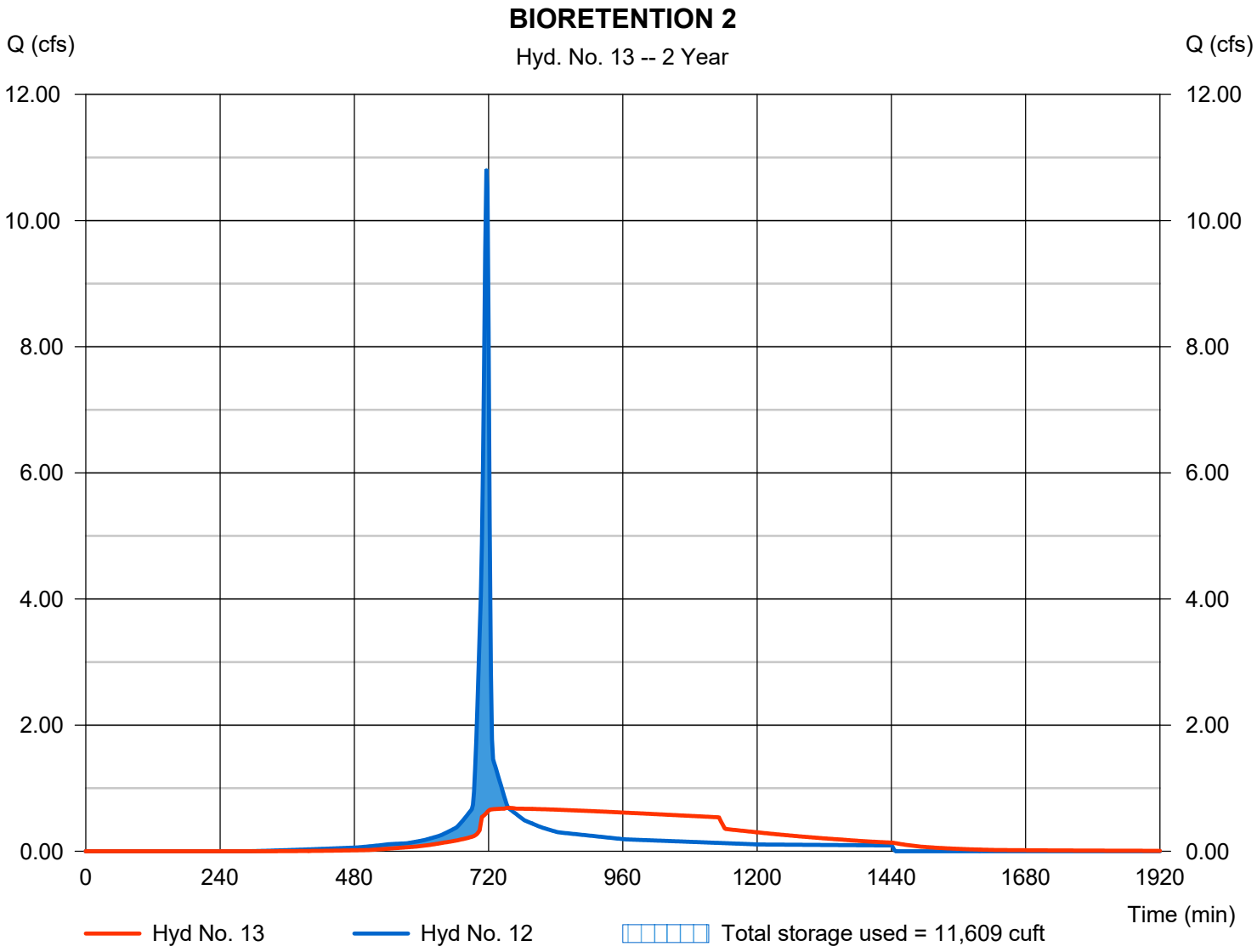
Hydrograph Report

Hyd. No. 13

BIORETENTION 2

Hydrograph type	=	Reservoir	Peak discharge	=	0.688 cfs
Storm frequency	=	2 yrs	Time to peak	=	756 min
Time interval	=	2 min	Hyd. volume	=	22,668 cuft
Inflow hyd. No.	=	12 - DEV 20	Max. Elevation	=	1020.50 ft
Reservoir name	=	BIORETENTION 2	Max. Storage	=	11,609 cuft

Storage Indication method used.



Pond No. 3 - BIORETENTION 2

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1017.50	n/a	0	0
1.00	1018.50	n/a	3,248	3,248
2.00	1019.50	n/a	203	3,451
3.00	1020.50	n/a	8,121	11,572
4.00	1021.50	n/a	9,629	21,201
5.00	1022.50	n/a	12,697	33,898

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	4.00	0.00	0.00
Span (in)	= 12.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 1017.50	1017.50	0.00	0.00
Length (ft)	= 100.00	0.50	0.00	0.00
Slope (%)	= 0.50	1.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

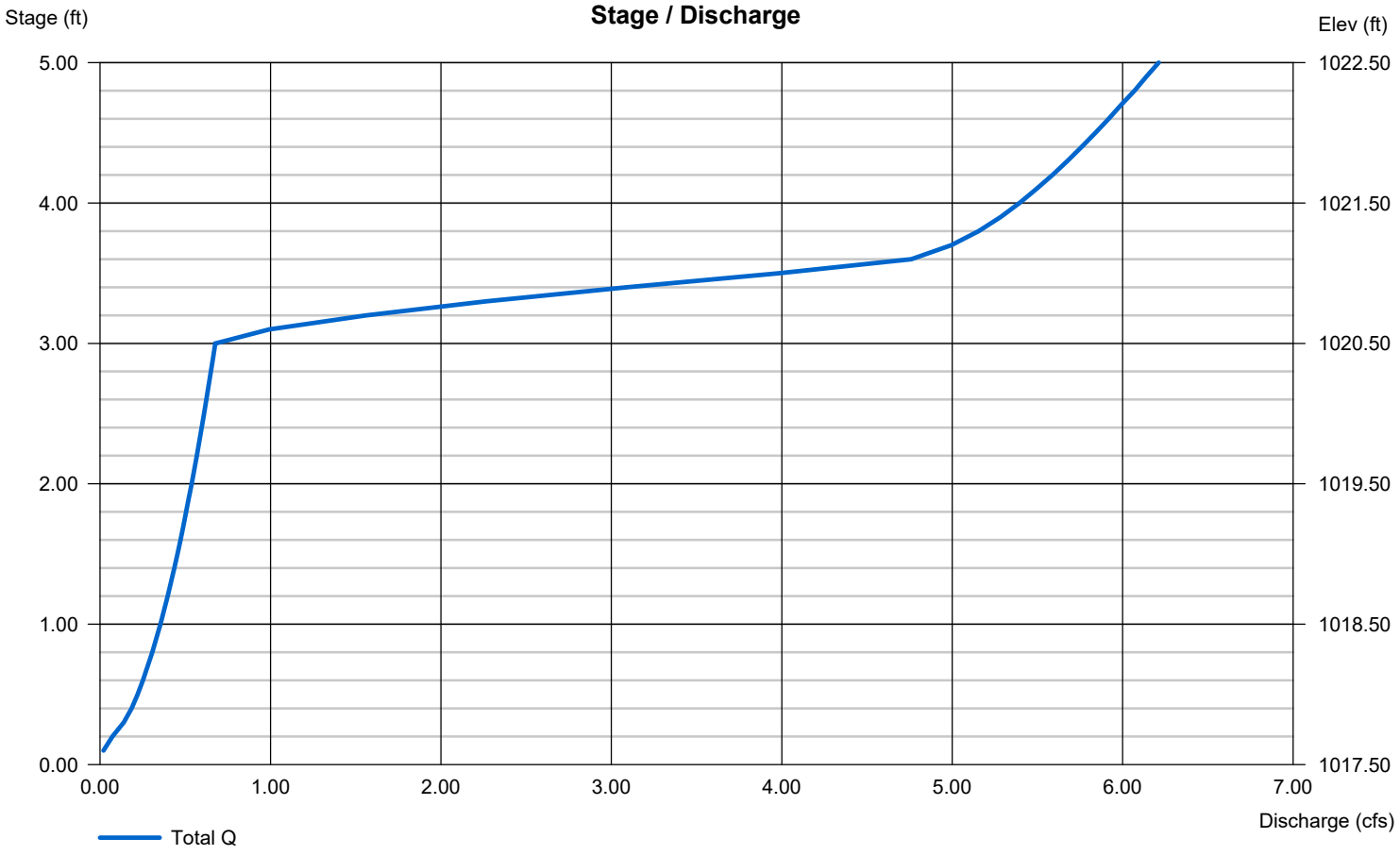
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.00	0.00	0.00	0.00
Crest El. (ft)	= 1020.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



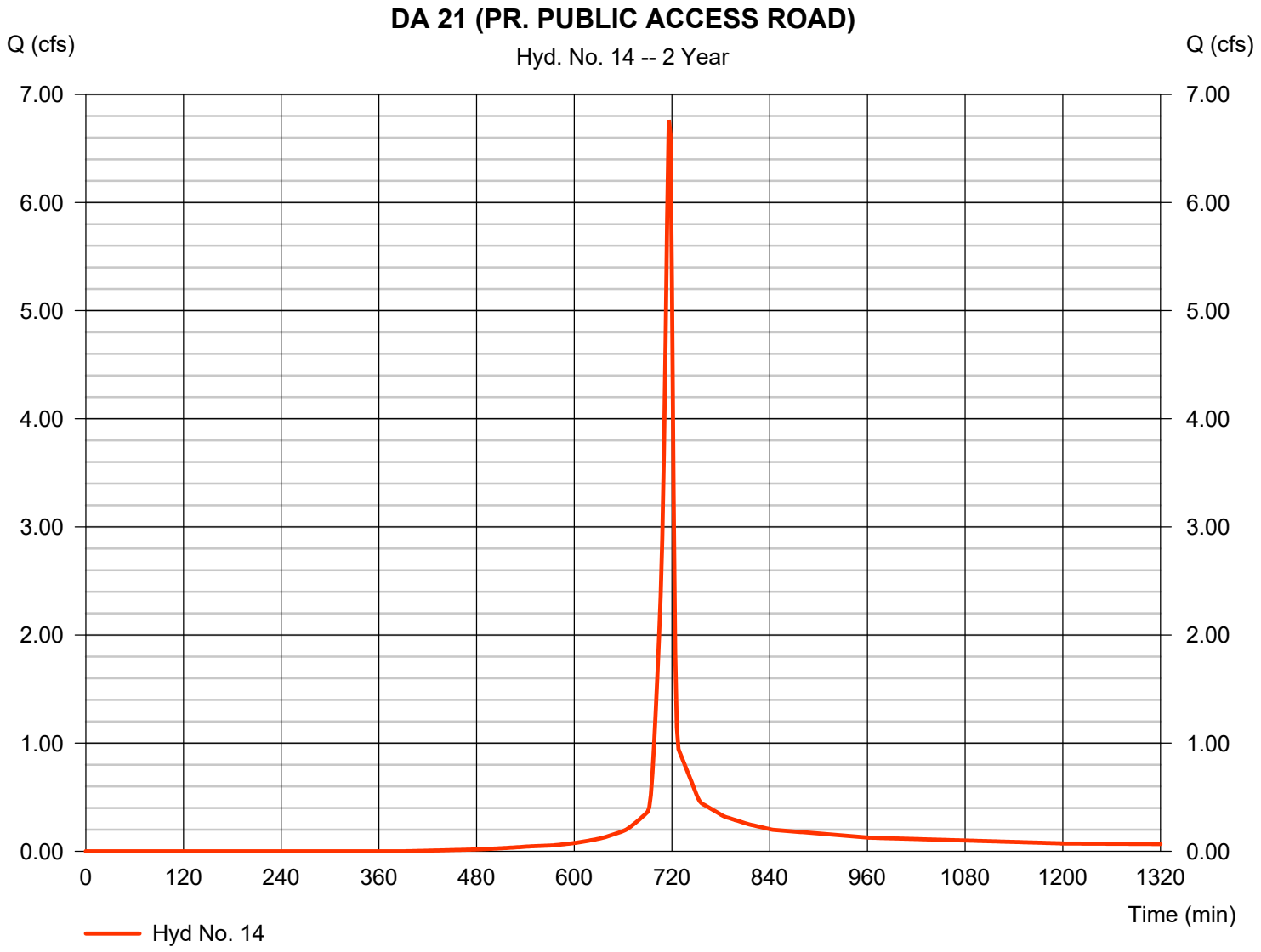
Hydrograph Report

Hyd. No. 14

DA 21 (PR. PUBLIC ACCESS ROAD)

Hydrograph type	= SCS Runoff	Peak discharge	= 6.763 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 13,843 cuft
Drainage area	= 1.780 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.630 x 98) + (1.150 x 80)] / 1.780



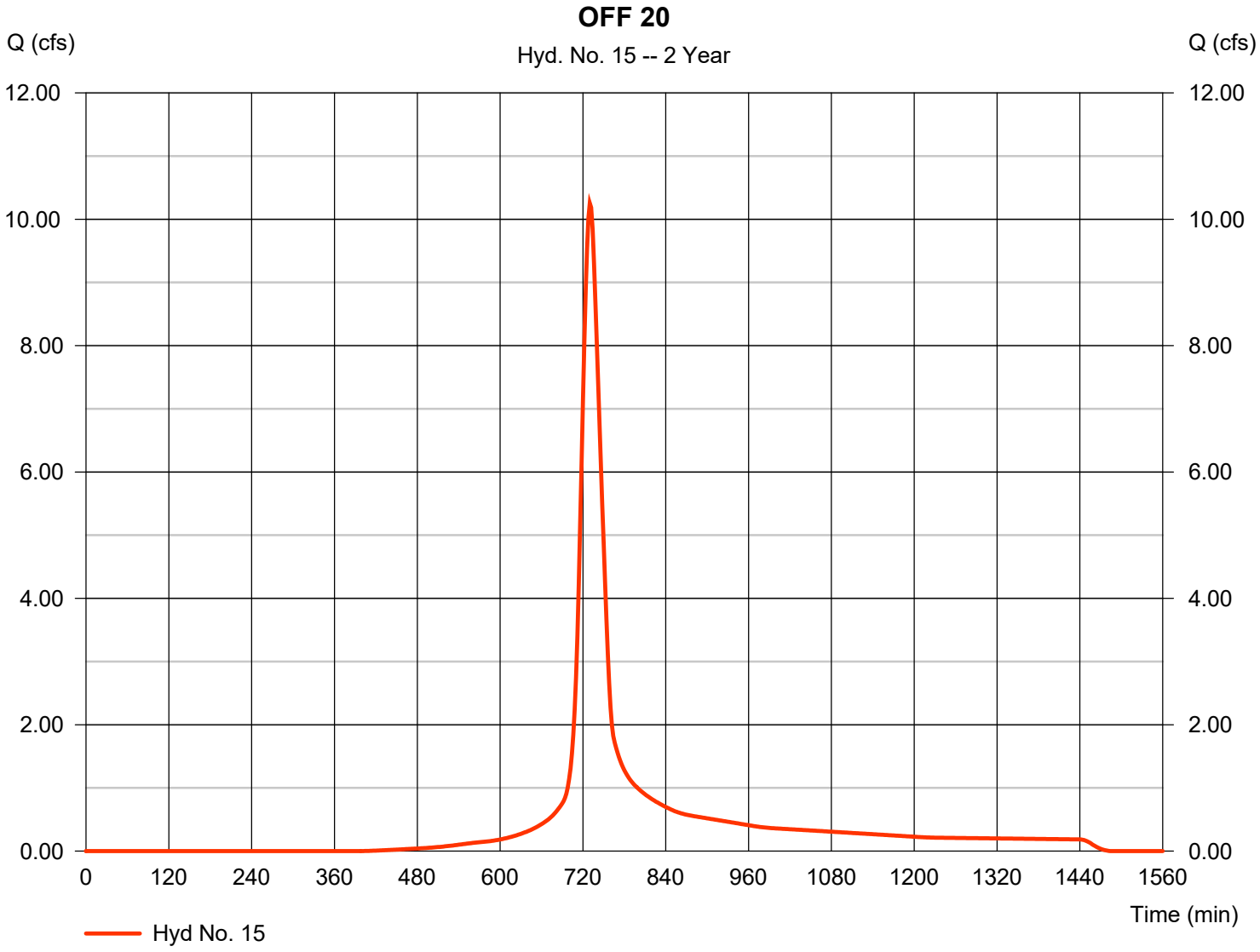
Hydrograph Report

Hyd. No. 15

OFF 20

Hydrograph type	=	SCS Runoff	Peak discharge	=	10.25 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	40,979 cuft
Drainage area	=	4.940 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.90 min
Total precip.	=	3.71 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.190 x 98) + (4.750 x 85)] / 4.940



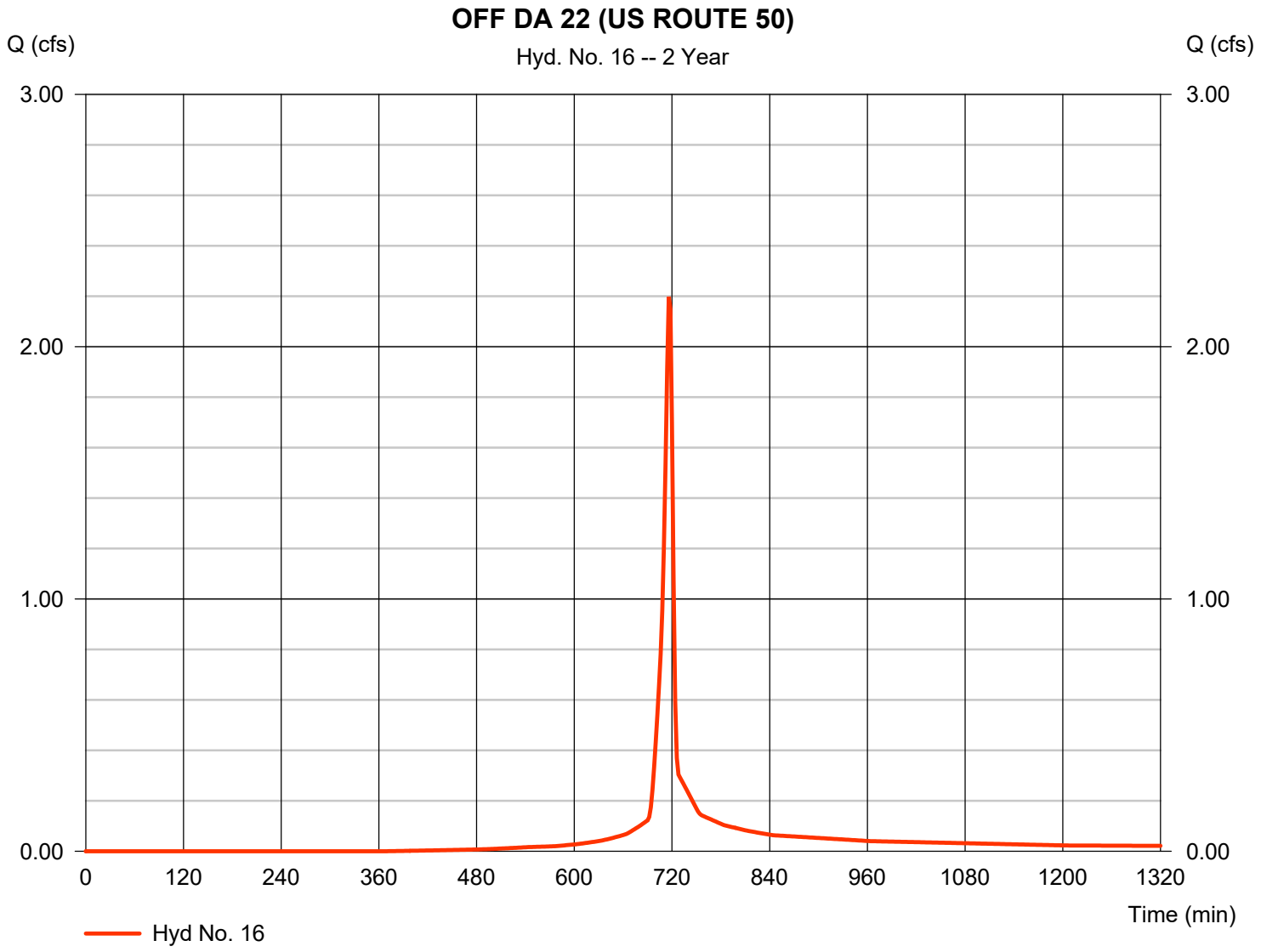
Hydrograph Report

Hyd. No. 16

OFF DA 22 (US ROUTE 50)

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.198 cfs
Storm frequency	=	2 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	4,521 cuft
Drainage area	=	0.560 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.71 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.210 x 98) + (0.350 x 80)] / 0.560

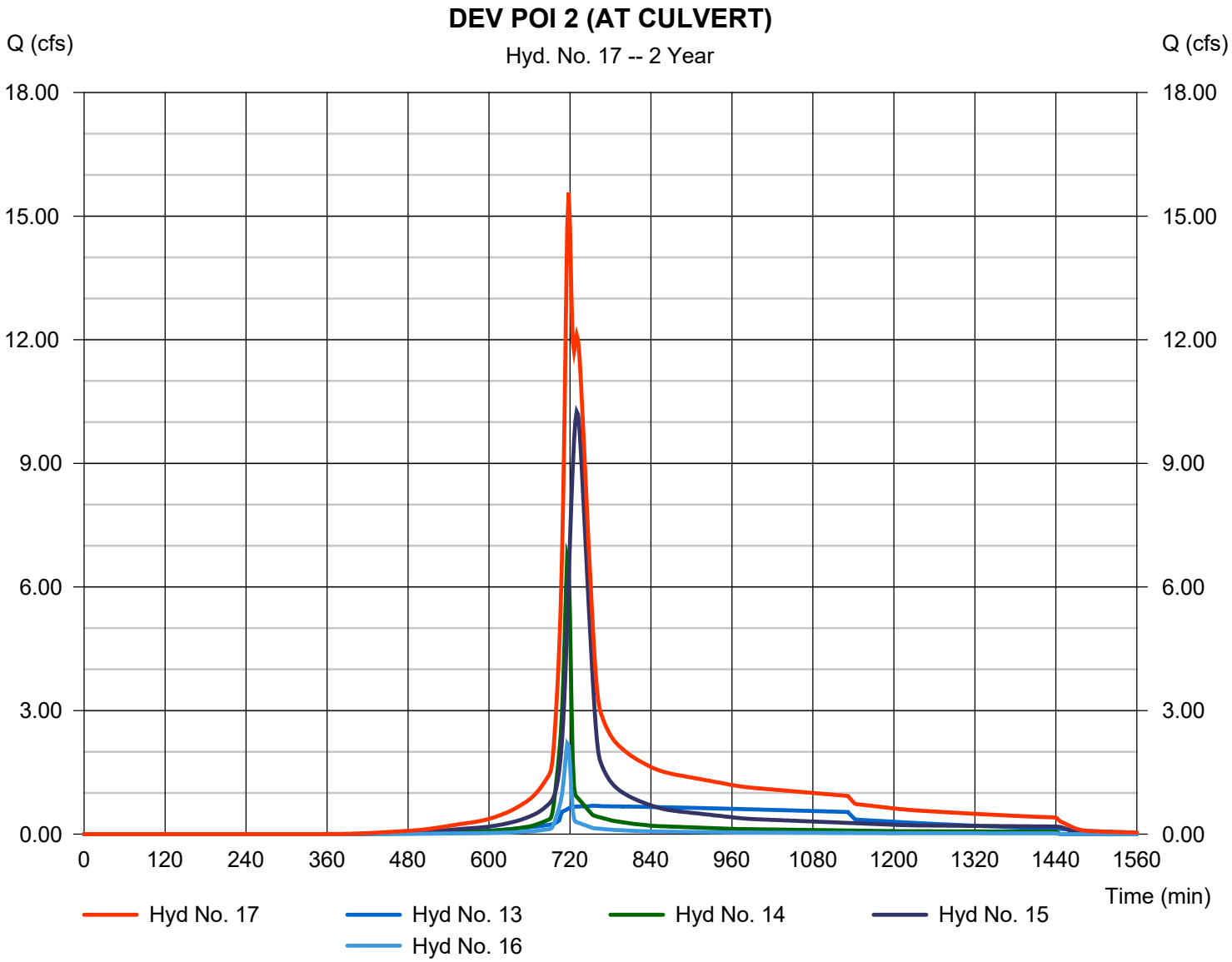


Hydrograph Report

Hyd. No. 17

DEV POI 2 (AT CULVERT)

Hydrograph type	=	Combine	Peak discharge	=	15.57 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	82,010 cuft
Inflow hyds.	=	13, 14, 15, 16	Contrib. drain. area	=	7.280 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	31.75	2	728	117,694	------	------	------	EX 20
2	SCS Runoff	15.28	2	728	56,641	------	------	------	EX 10 (POI 1)
3	SCS Runoff	17.72	2	730	71,419	------	------	------	OFF 20
4	Combine	49.14	2	728	189,112	1, 3	------	------	EX POI 2 (AT CULVERT)
5	SCS Runoff	22.55	2	716	49,797	------	------	------	DEV 10
6	SCS Runoff	28.62	2	716	61,008	------	------	------	DEV 30
7	Reservoir	8.272	2	722	49,784	5	1021.90	17,339	BIO 1
8	Combine	31.96	2	718	110,792	6, 7	------	------	COMBINE
9	Reservoir	3.953	2	768	110,790	8	1020.17	43,201	DETENTION POND 1
10	SCS Runoff	7.144	2	716	15,124	------	------	------	DA 11 (US ROUTE 50)
11	Combine	8.708	2	716	125,914	9, 10	------	------	DEV POI 1
12	SCS Runoff	17.87	2	716	38,722	------	------	------	DEV 20
13	Reservoir	4.768	2	724	38,705	12	1021.10	17,383	BIORETENTION 2
14	SCS Runoff	11.77	2	716	24,758	------	------	------	DA 21 (PR. PUBLIC ACCESS ROAD)
15	SCS Runoff	18.13	2	730	73,291	------	------	------	OFF 20
16	SCS Runoff	3.774	2	716	7,990	------	------	------	OFF DA 22 (US ROUTE 50)
17	Combine	29.06	2	718	144,745	13, 14, 15, 16	------	------	DEV POI 2 (AT CULVERT)

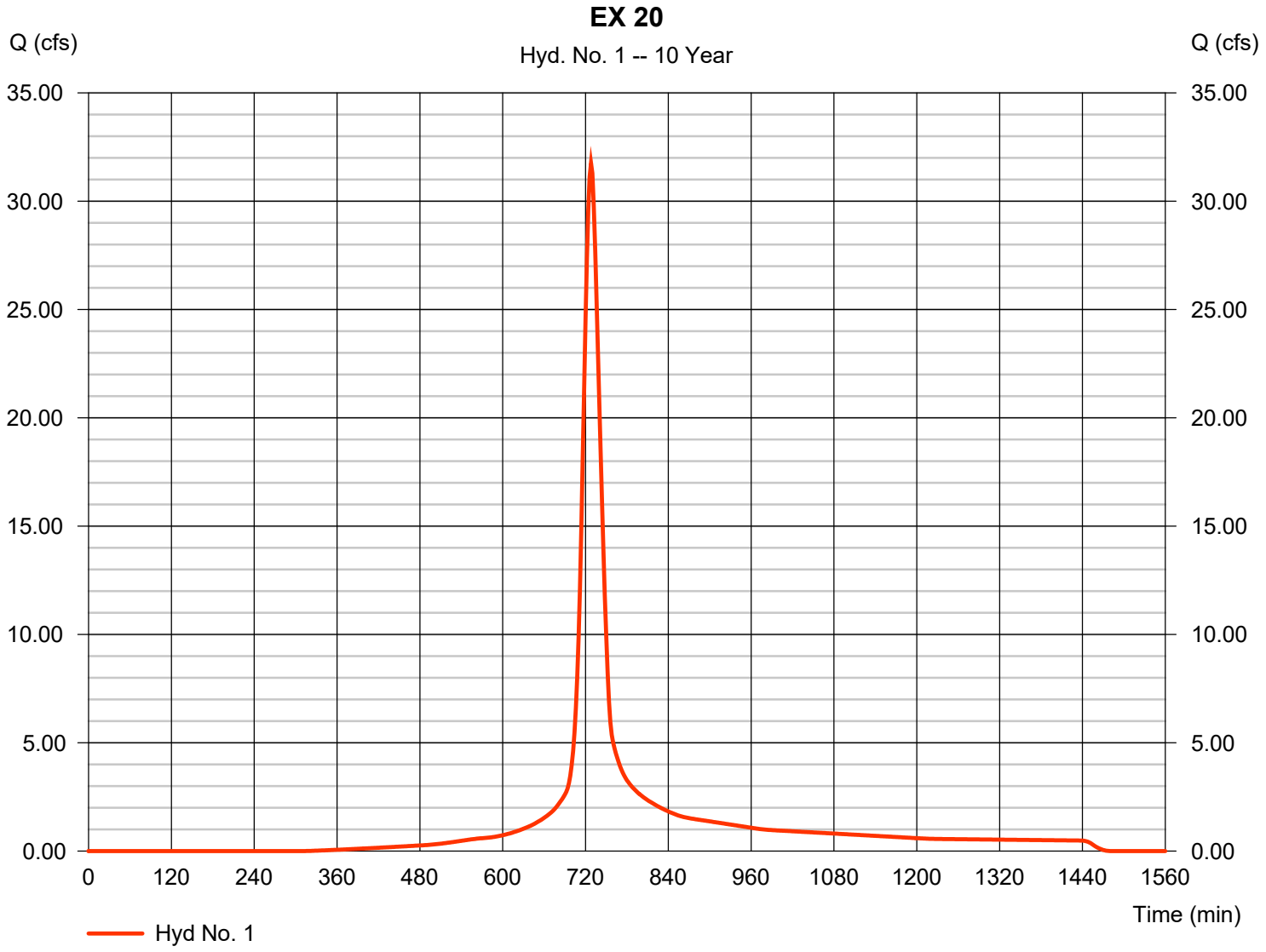
Hydrograph Report

Hyd. No. 1

EX 20

Hydrograph type	=	SCS Runoff	Peak discharge	=	31.75 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	117,694 cuft
Drainage area	=	8.270 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.10 min
Total precip.	=	5.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.110 x 98) + (8.160 x 85)] / 8.270



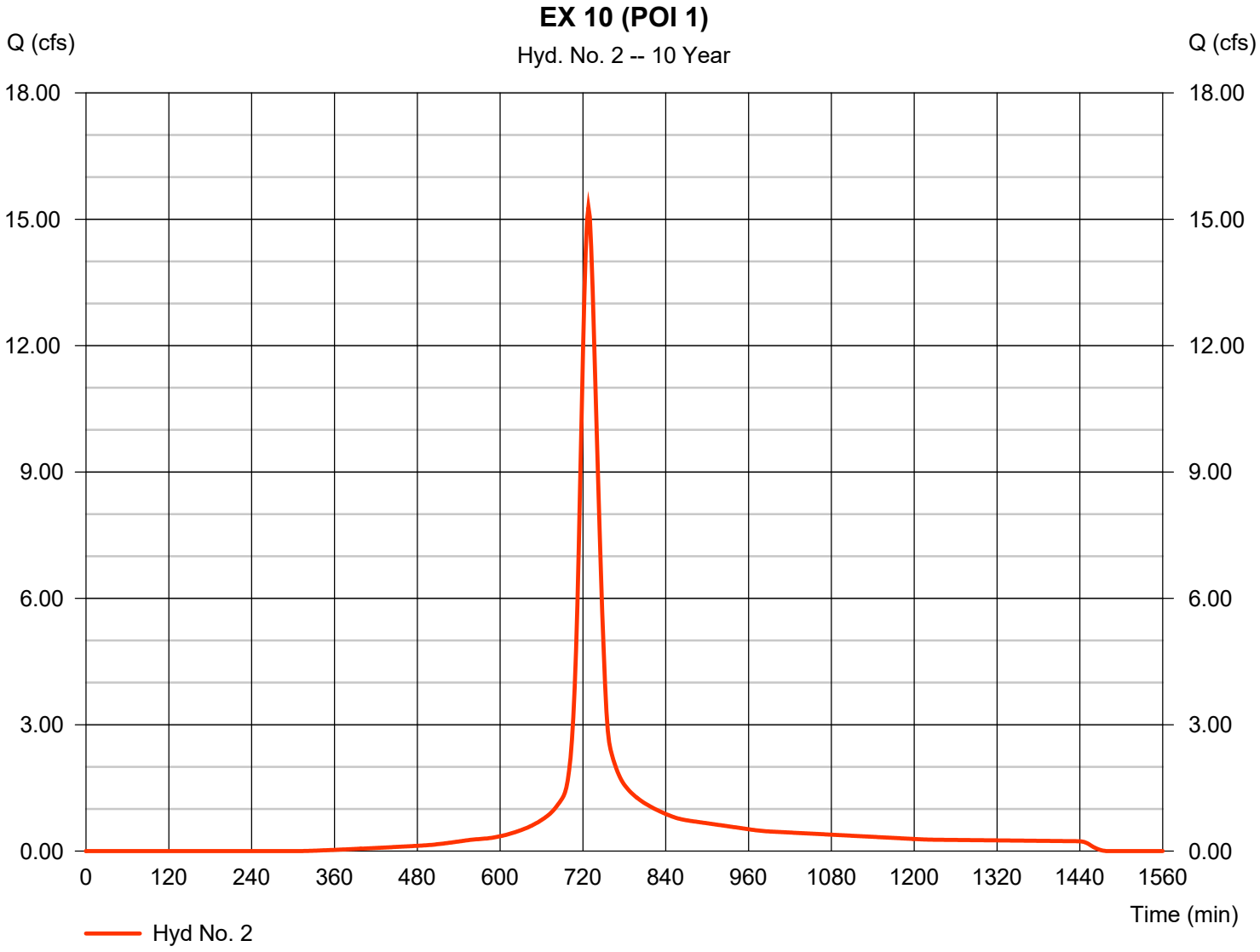
Hydrograph Report

Hyd. No. 2

EX 10 (POI 1)

Hydrograph type	=	SCS Runoff	Peak discharge	=	15.28 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	56,641 cuft
Drainage area	=	3.980 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	26.30 min
Total precip.	=	5.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.090 x 98) + (3.890 x 85)] / 3.980



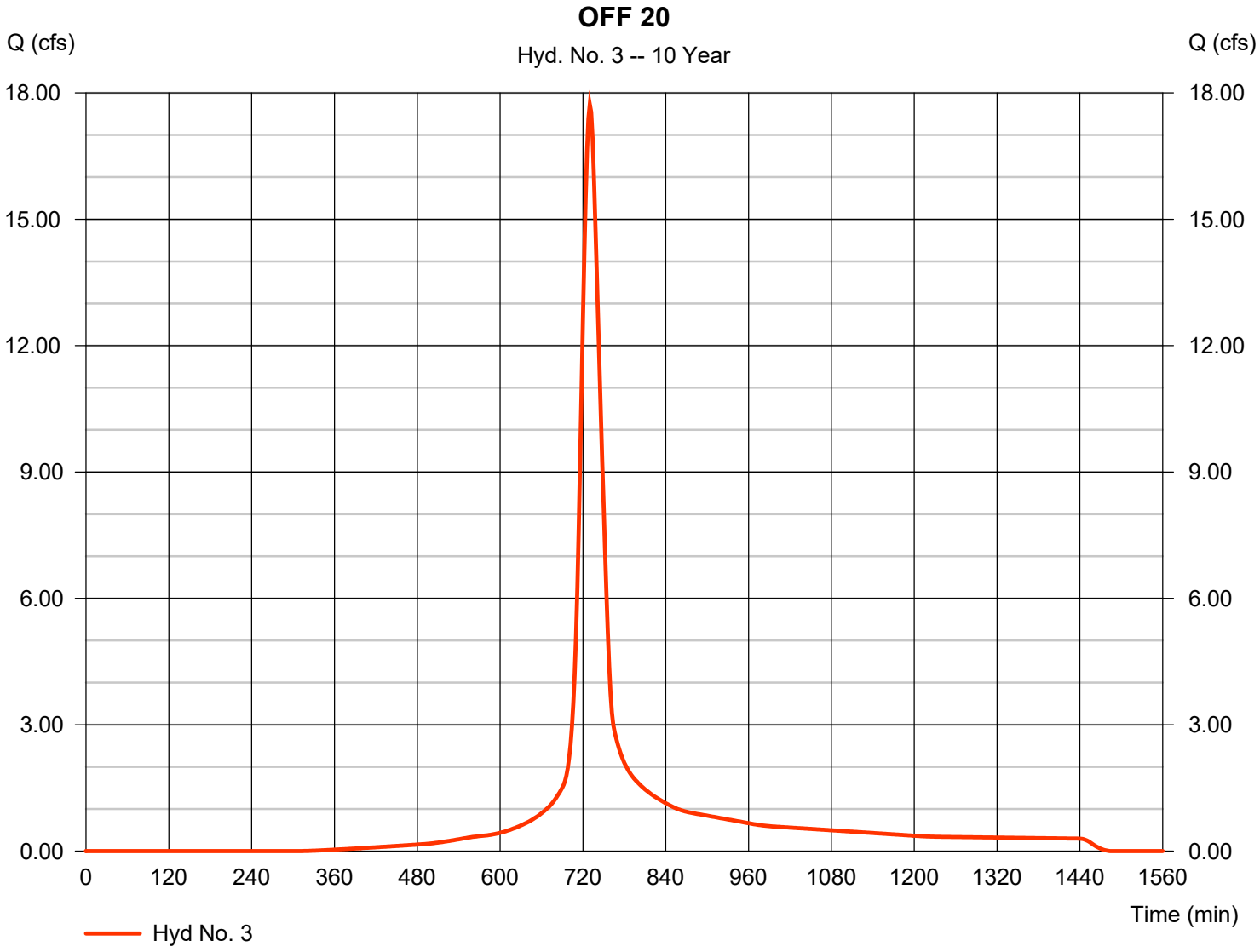
Hydrograph Report

Hyd. No. 3

OFF 20

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.72 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	71,419 cuft
Drainage area	=	4.940 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.90 min
Total precip.	=	5.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 98) + (4.800 x 85)] / 4.940

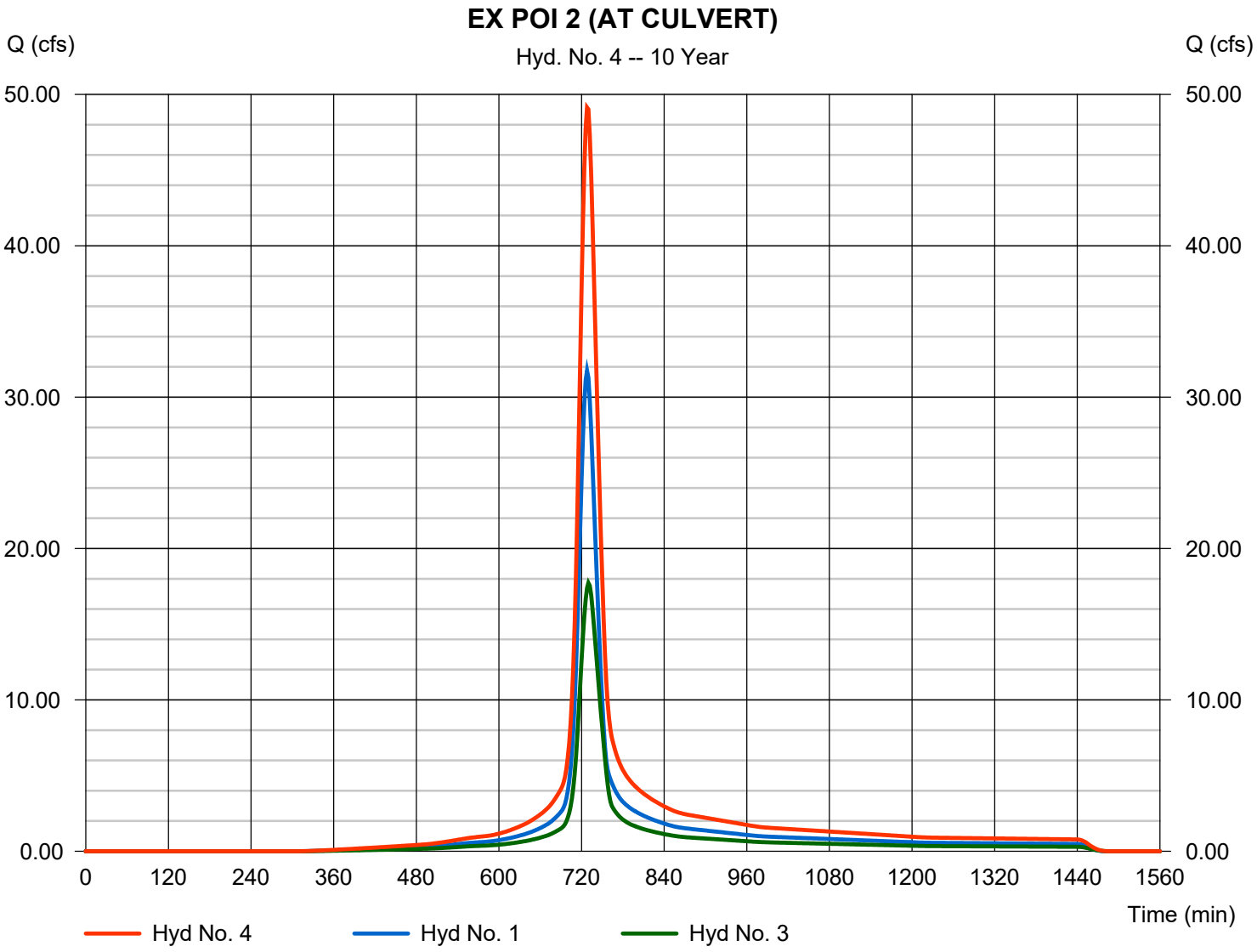


Hydrograph Report

Hyd. No. 4

EX POI 2 (AT CULVERT)

Hydrograph type	= Combine	Peak discharge	= 49.14 cfs
Storm frequency	= 10 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 189,112 cuft
Inflow hyds.	= 1, 3	Contrib. drain. area	= 13.210 ac



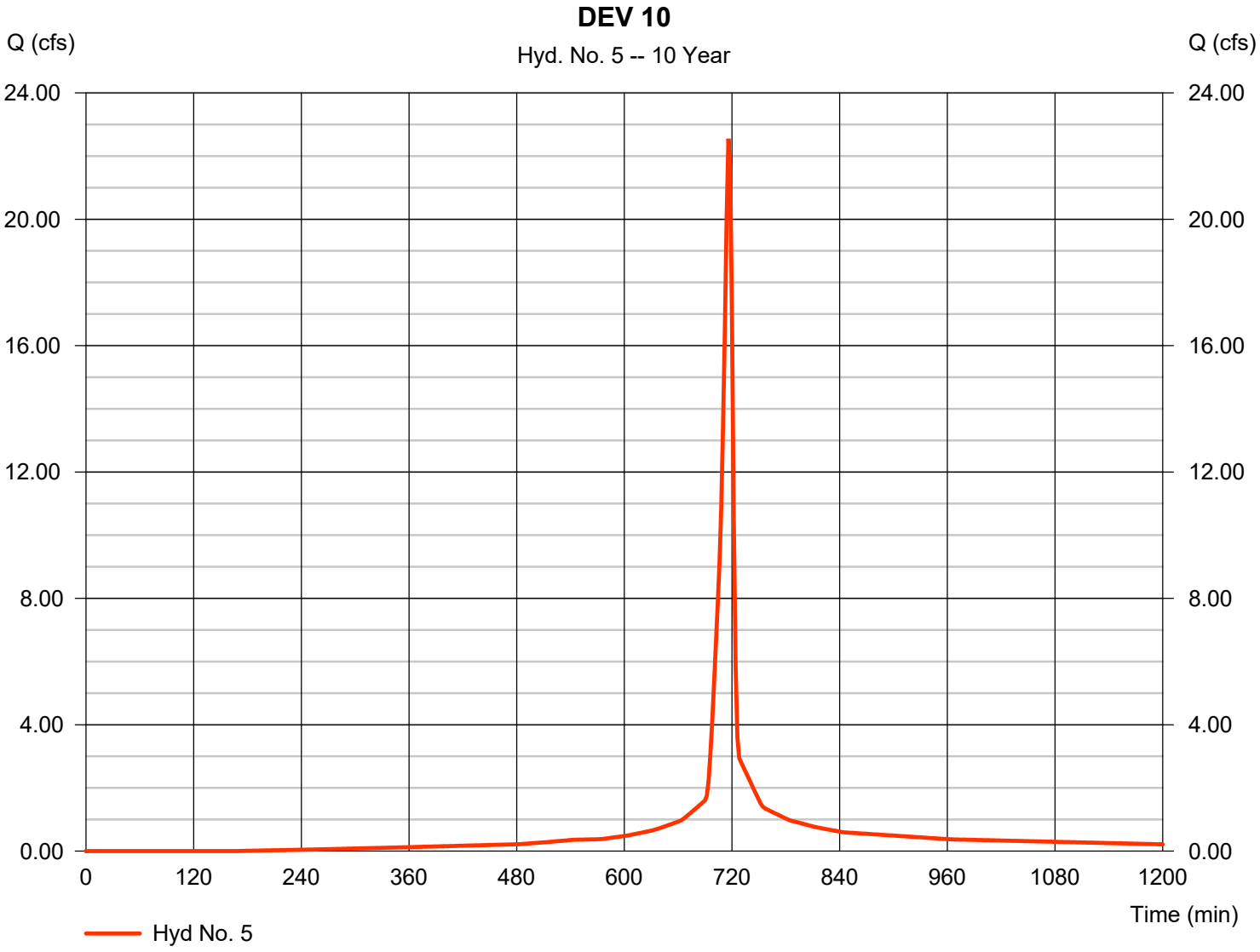
Hydrograph Report

Hyd. No. 5

DEV 10

Hydrograph type	=	SCS Runoff	Peak discharge	=	22.55 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	49,797 cuft
Drainage area	=	3.090 ac	Curve number	=	92*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.020 x 98) + (1.070 x 80)] / 3.090



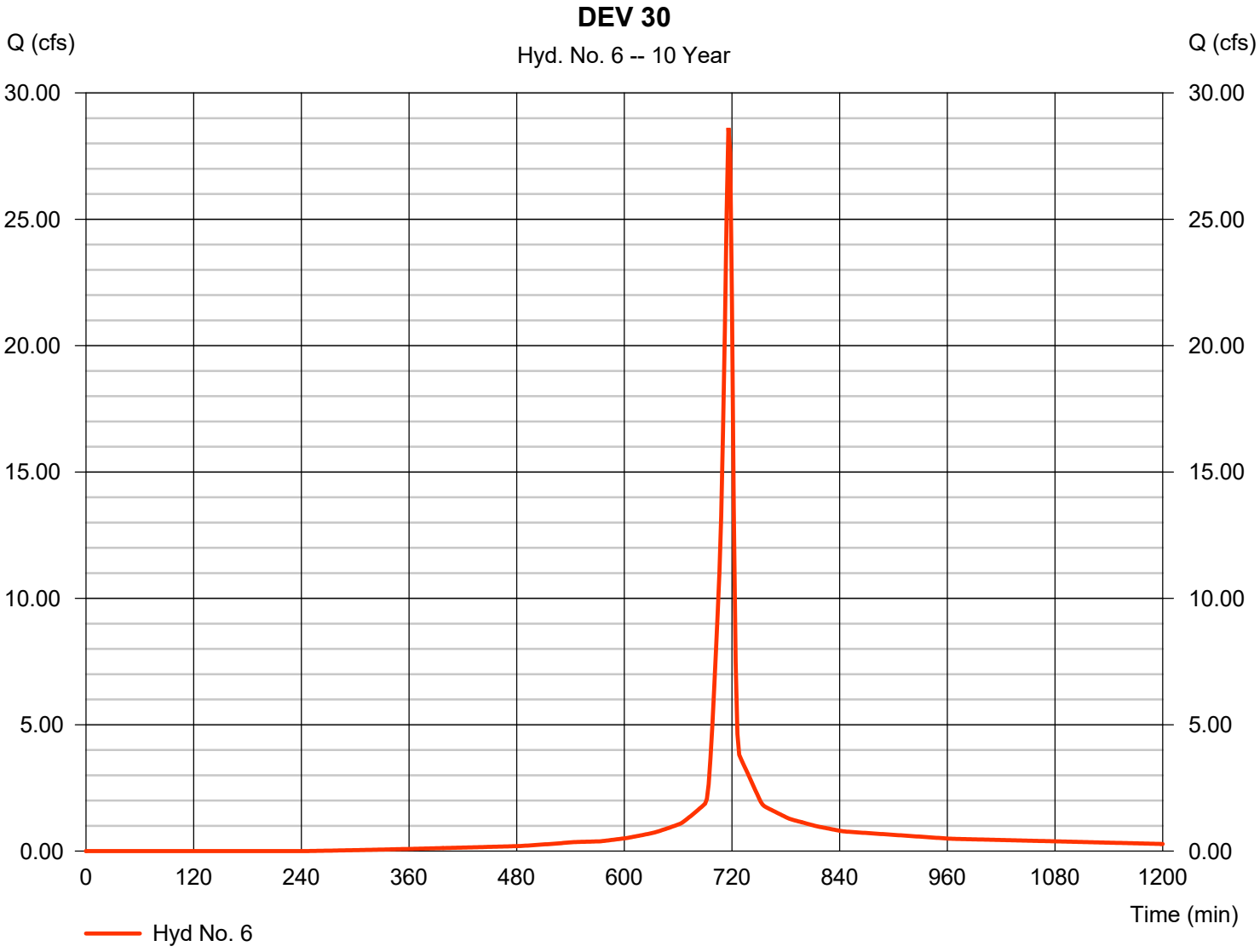
Hydrograph Report

Hyd. No. 6

DEV 30

Hydrograph type	=	SCS Runoff	Peak discharge	=	28.62 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	61,008 cuft
Drainage area	=	4.170 ac	Curve number	=	88*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.850 x 98) + (2.320 x 80)] / 4.170



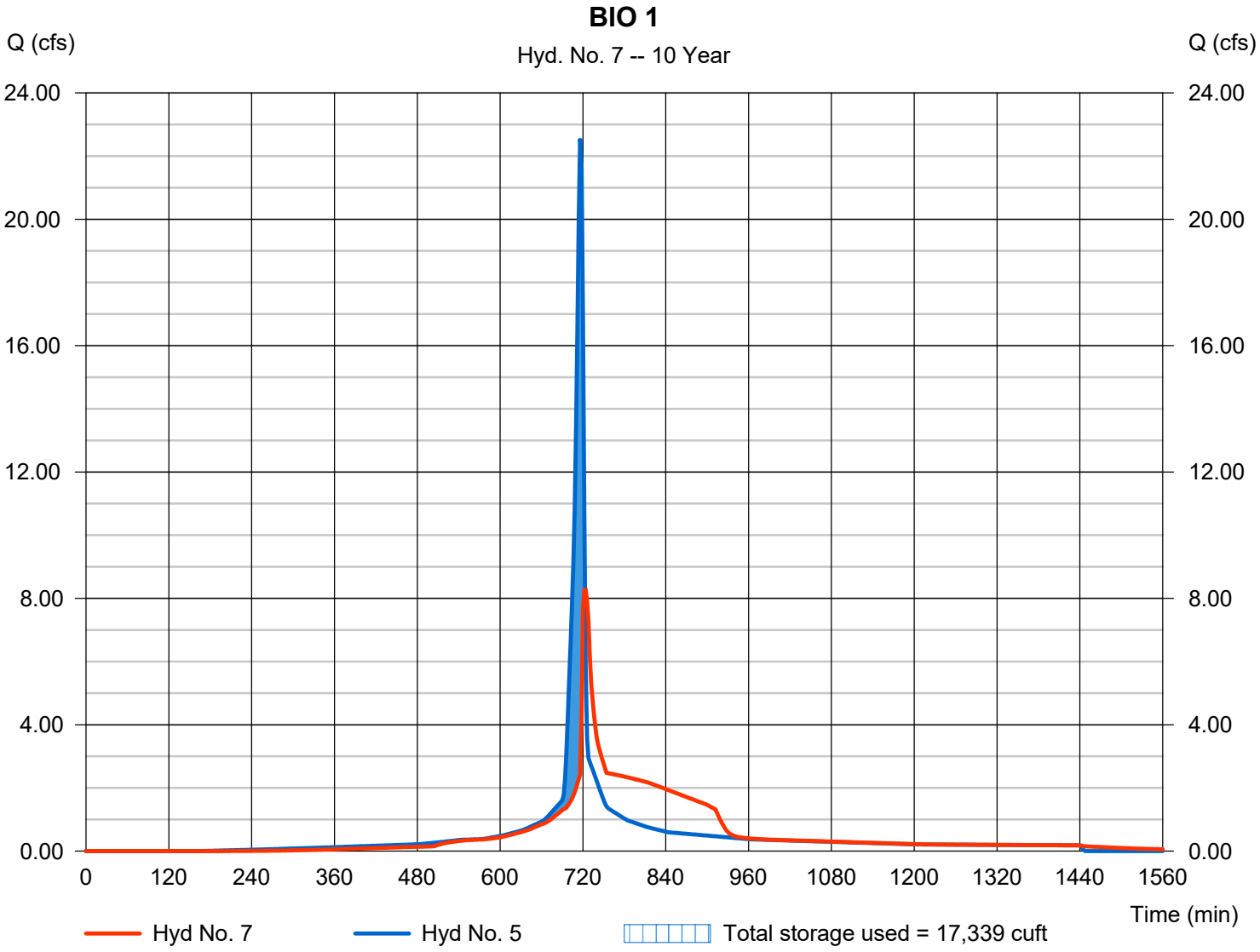
Hydrograph Report

Hyd. No. 7

BIO 1

Hydrograph type	=	Reservoir	Peak discharge	=	8.272 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	49,784 cuft
Inflow hyd. No.	=	5 - DEV 10	Max. Elevation	=	1021.90 ft
Reservoir name	=	BIORETENTION 1	Max. Storage	=	17,339 cuft

Storage Indication method used.

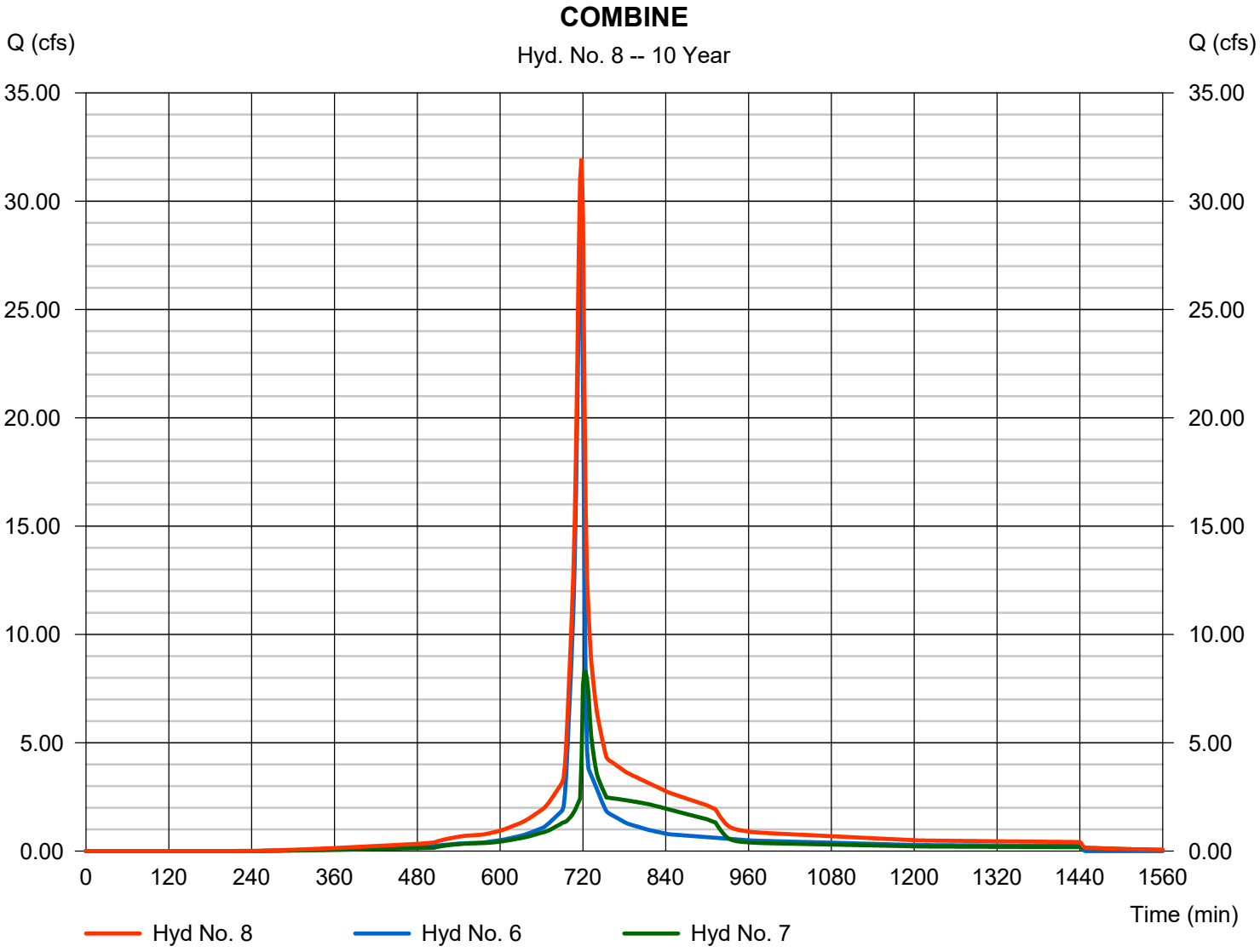


Hydrograph Report

Hyd. No. 8

COMBINE

Hydrograph type	=	Combine	Peak discharge	=	31.96 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	110,792 cuft
Inflow hyds.	=	6, 7	Contrib. drain. area	=	4.170 ac



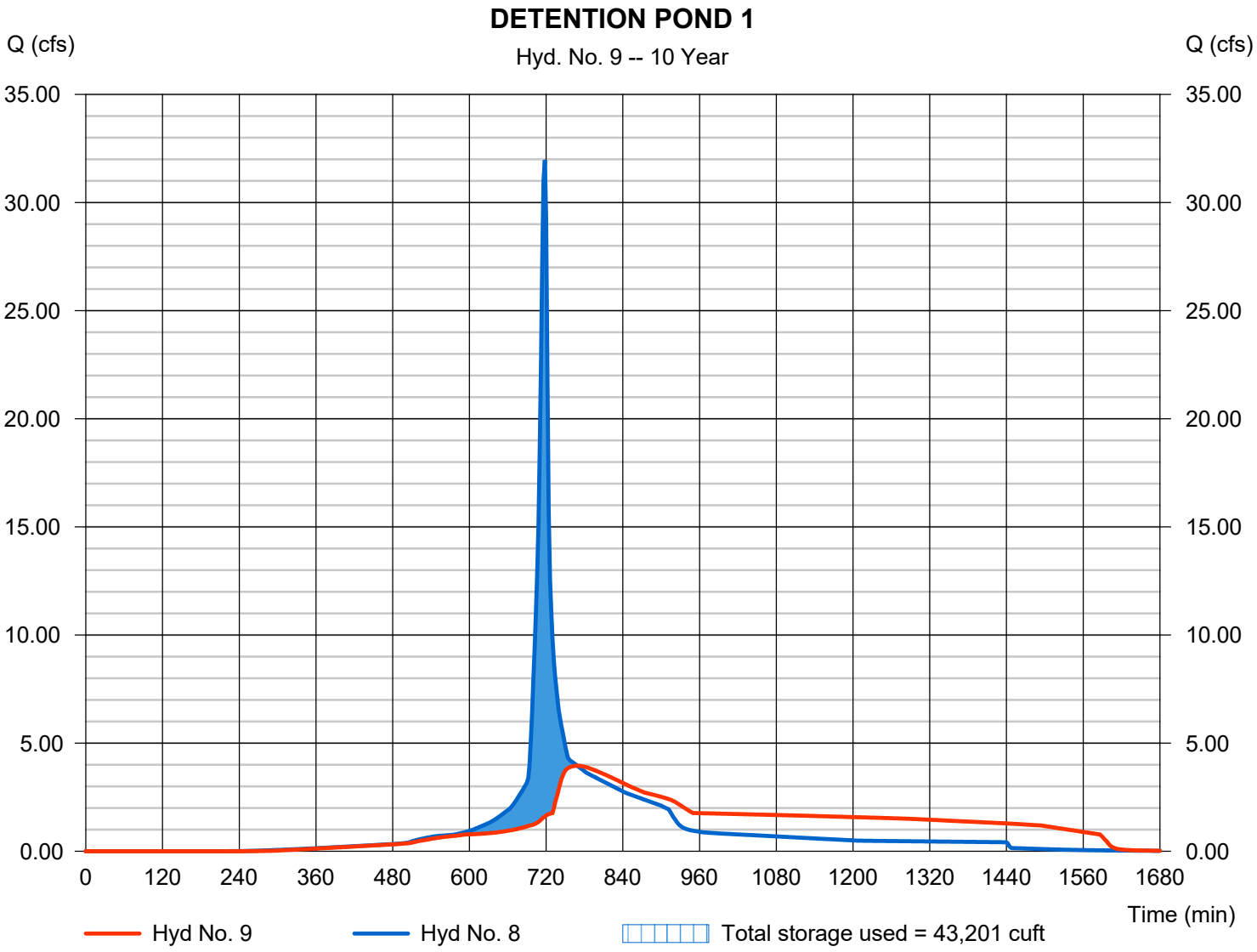
Hydrograph Report

Hyd. No. 9

DETENTION POND 1

Hydrograph type	=	Reservoir	Peak discharge	=	3.953 cfs
Storm frequency	=	10 yrs	Time to peak	=	768 min
Time interval	=	2 min	Hyd. volume	=	110,790 cuft
Inflow hyd. No.	=	8 - COMBINE	Max. Elevation	=	1020.17 ft
Reservoir name	=	DRY DETENTION 1	Max. Storage	=	43,201 cuft

Storage Indication method used.



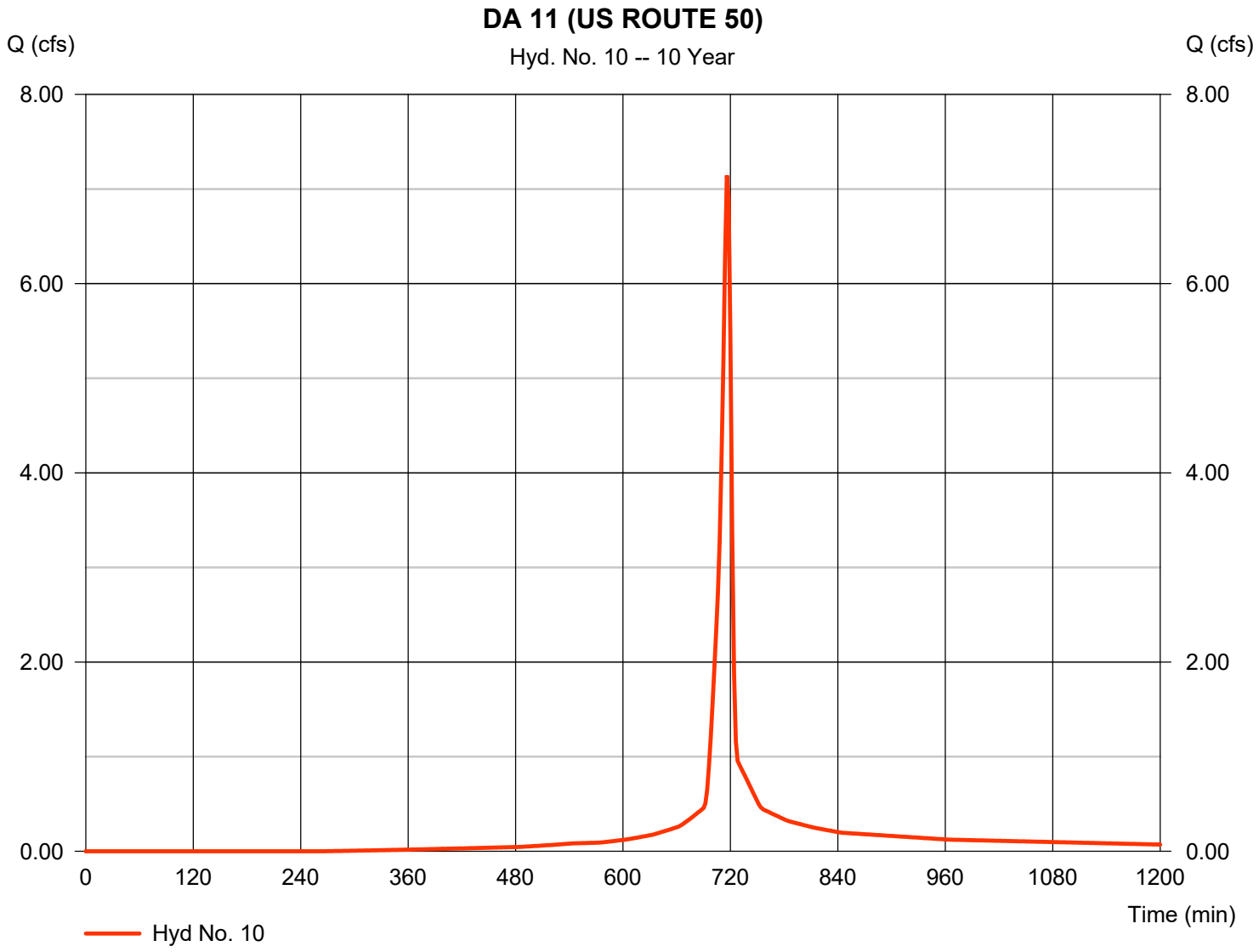
Hydrograph Report

Hyd. No. 10

DA 11 (US ROUTE 50)

Hydrograph type	= SCS Runoff	Peak discharge	= 7.144 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 15,124 cuft
Drainage area	= 1.060 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.66 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.400 x 98) + (0.660 x 80)] / 1.060

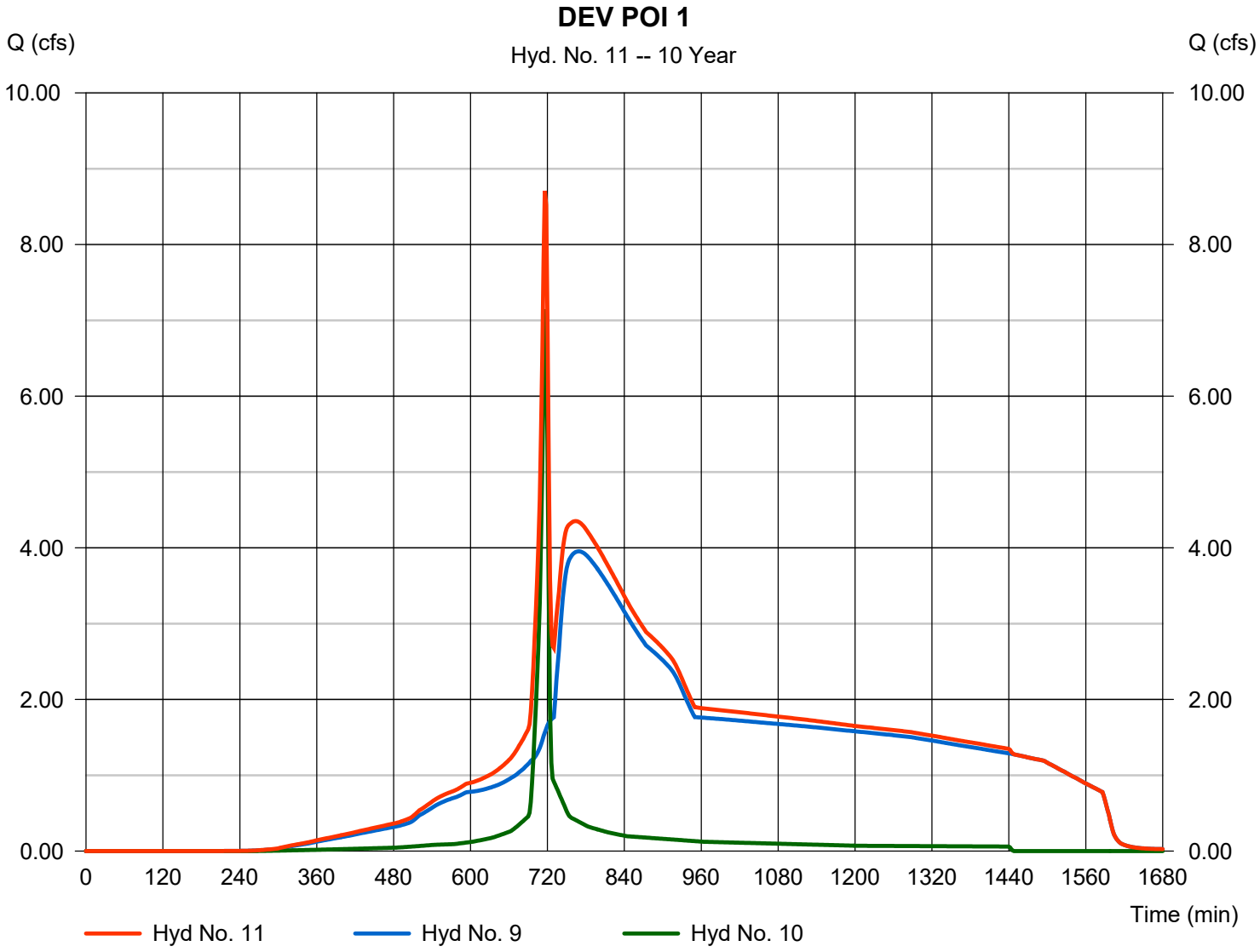


Hydrograph Report

Hyd. No. 11

DEV POI 1

Hydrograph type	=	Combine	Peak discharge	=	8.708 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	125,914 cuft
Inflow hyds.	=	9, 10	Contrib. drain. area	=	1.060 ac



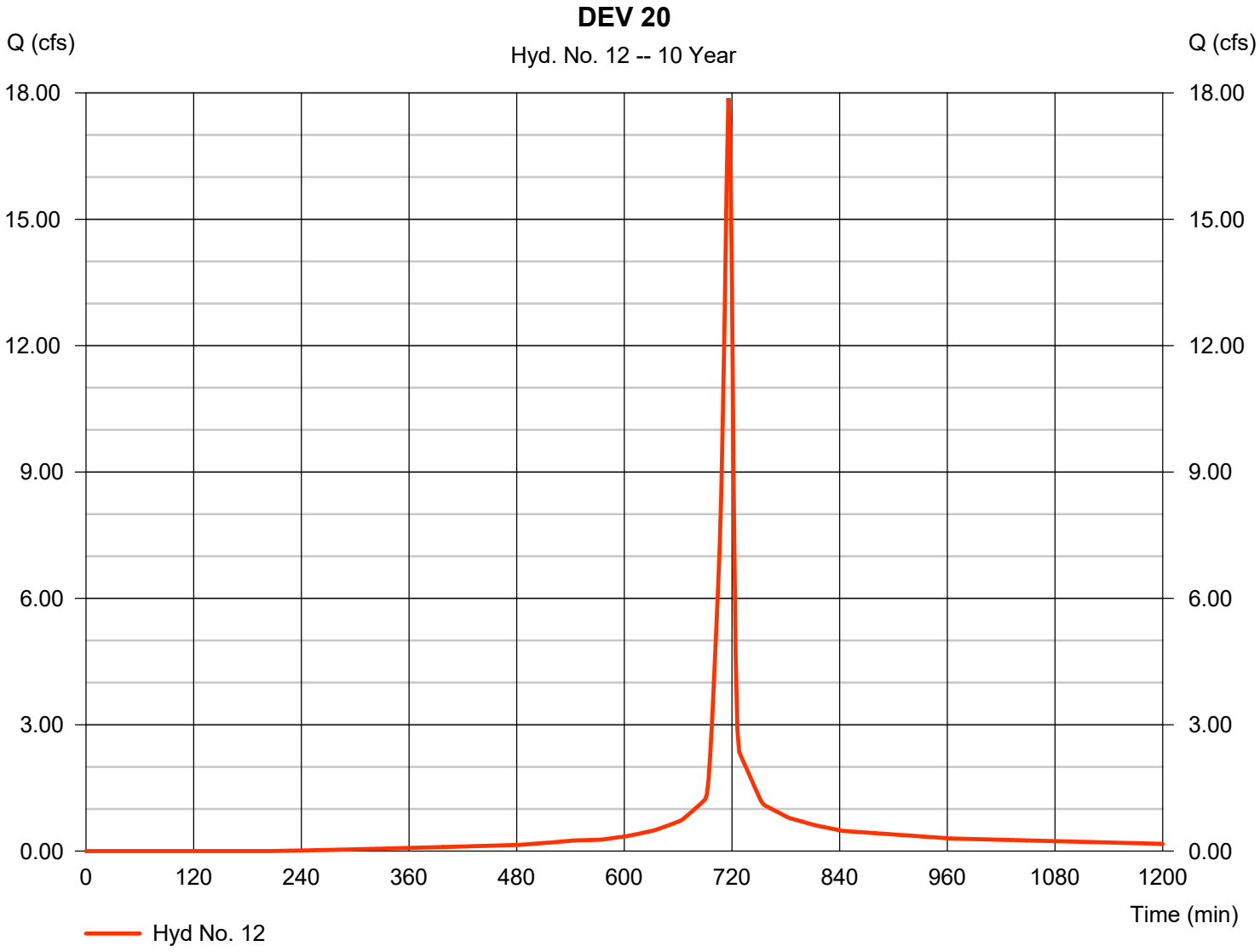
Hydrograph Report

Hyd. No. 12

DEV 20

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.87 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	38,722 cuft
Drainage area	=	2.520 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.340 x 98) + (1.180 x 80)] / 2.520



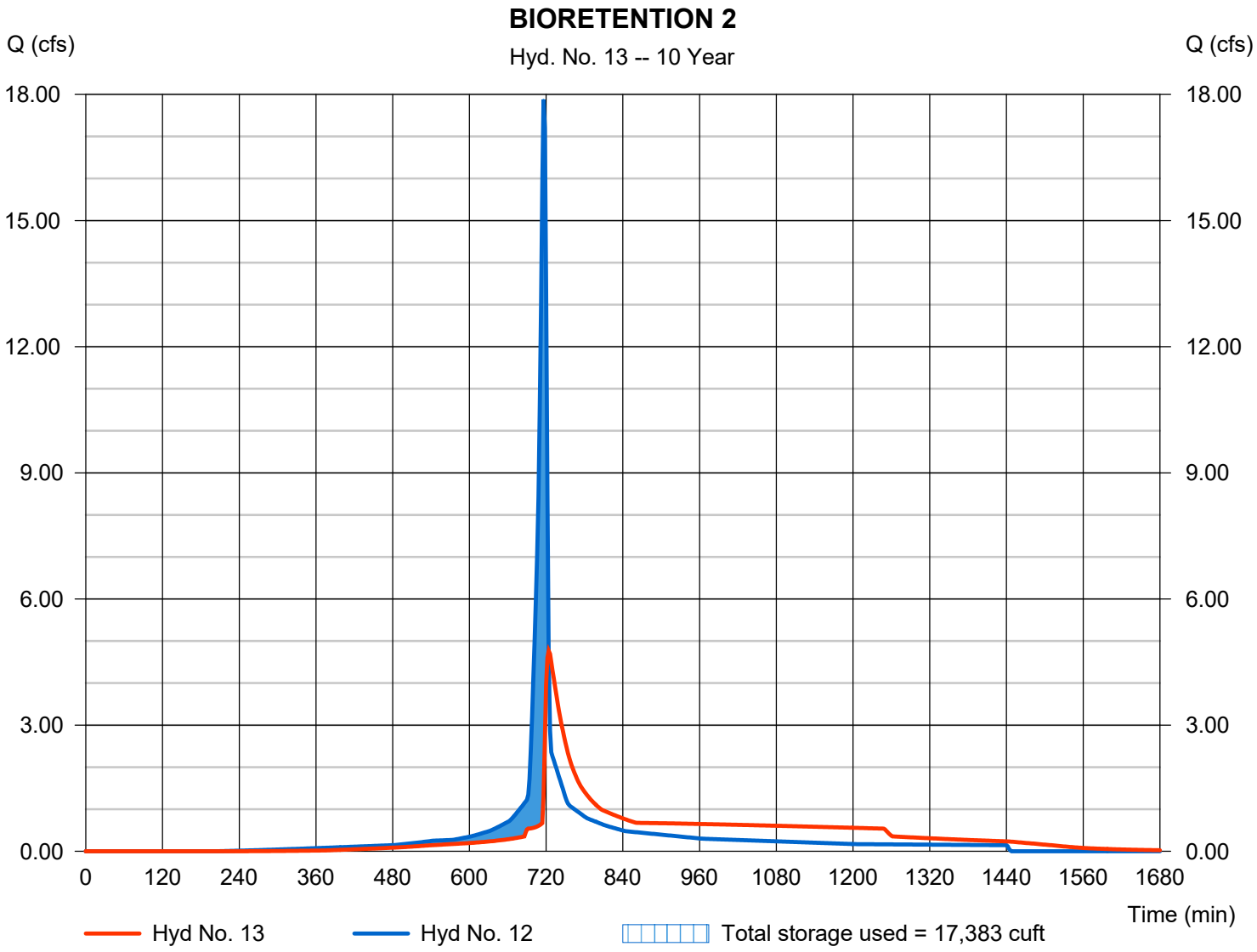
Hydrograph Report

Hyd. No. 13

BIORETENTION 2

Hydrograph type	=	Reservoir	Peak discharge	=	4.768 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	38,705 cuft
Inflow hyd. No.	=	12 - DEV 20	Max. Elevation	=	1021.10 ft
Reservoir name	=	BIORETENTION 2	Max. Storage	=	17,383 cuft

Storage Indication method used.



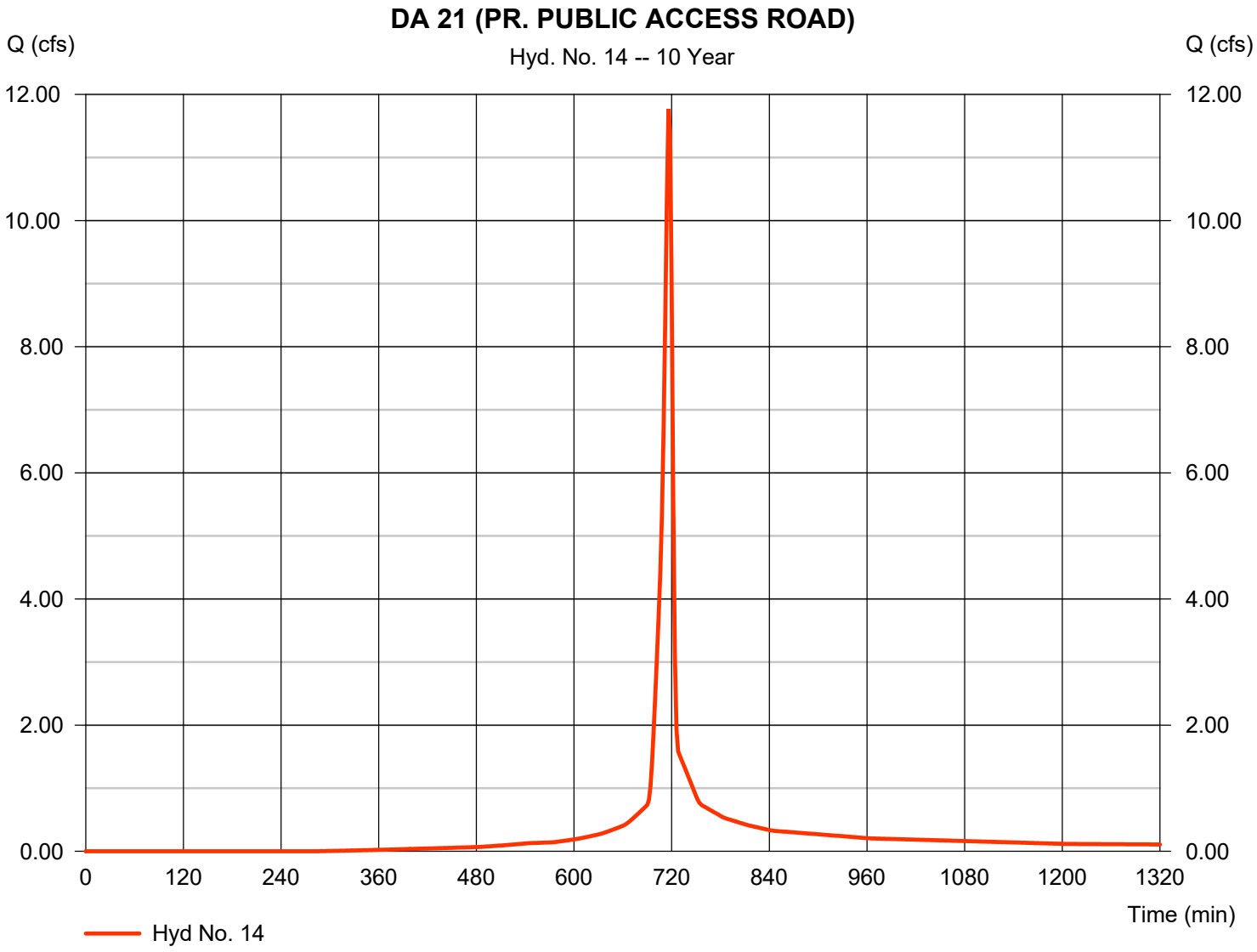
Hydrograph Report

Hyd. No. 14

DA 21 (PR. PUBLIC ACCESS ROAD)

Hydrograph type	= SCS Runoff	Peak discharge	= 11.77 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 24,758 cuft
Drainage area	= 1.780 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.66 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.630 x 98) + (1.150 x 80)] / 1.780



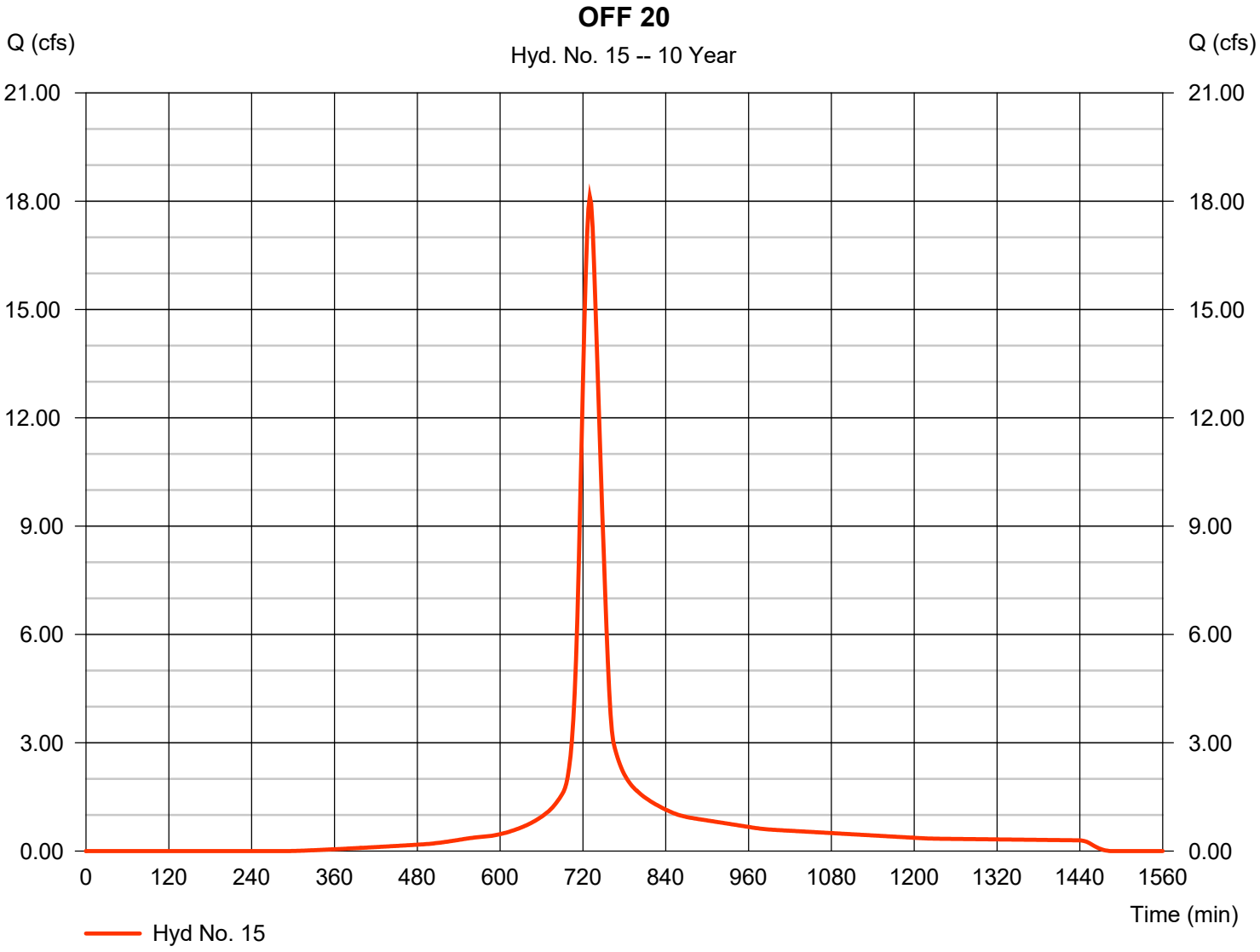
Hydrograph Report

Hyd. No. 15

OFF 20

Hydrograph type	=	SCS Runoff	Peak discharge	=	18.13 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	73,291 cuft
Drainage area	=	4.940 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.90 min
Total precip.	=	5.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.190 x 98) + (4.750 x 85)] / 4.940



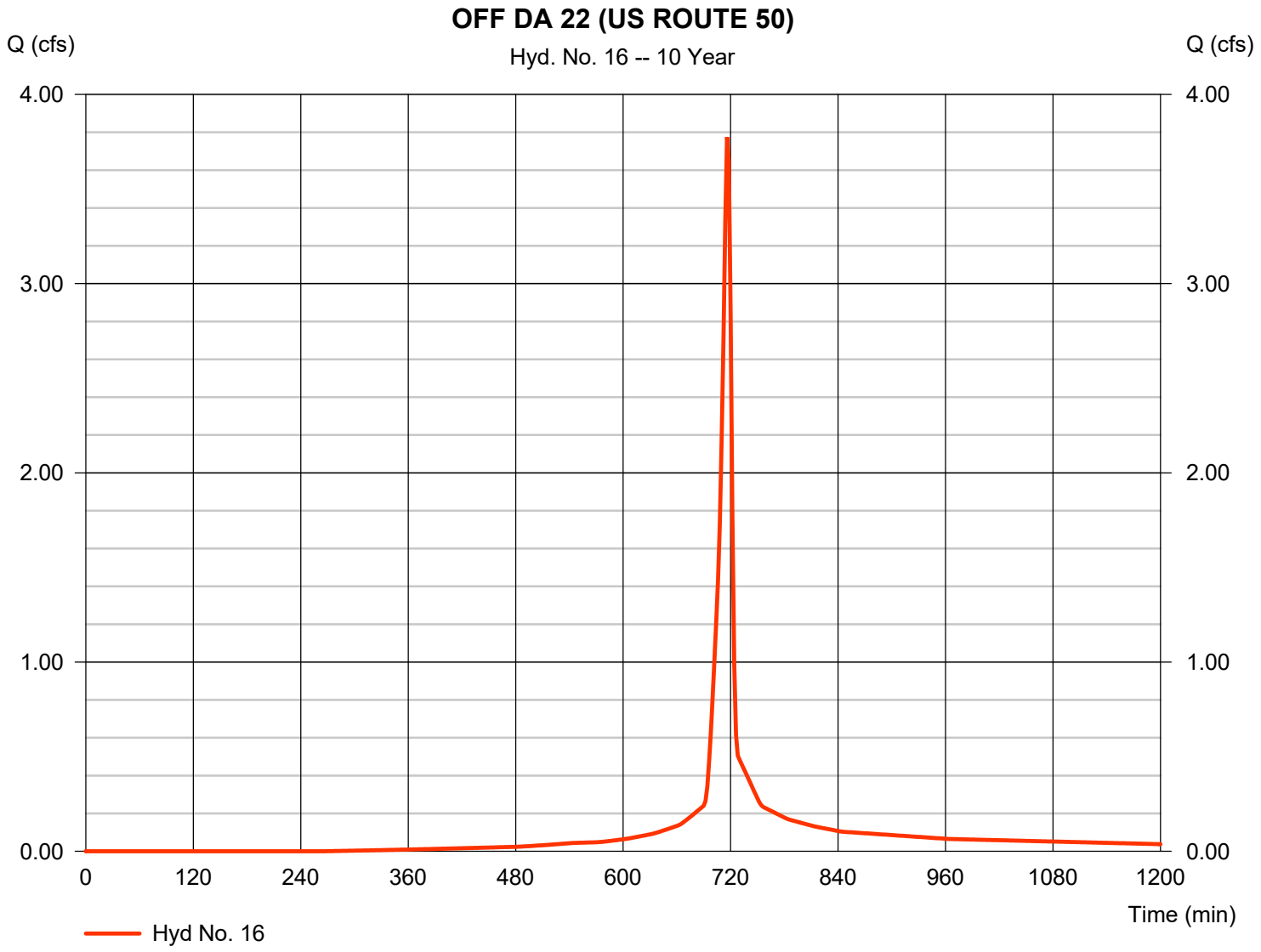
Hydrograph Report

Hyd. No. 16

OFF DA 22 (US ROUTE 50)

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.774 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	7,990 cuft
Drainage area	=	0.560 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.66 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.210 x 98) + (0.350 x 80)] / 0.560

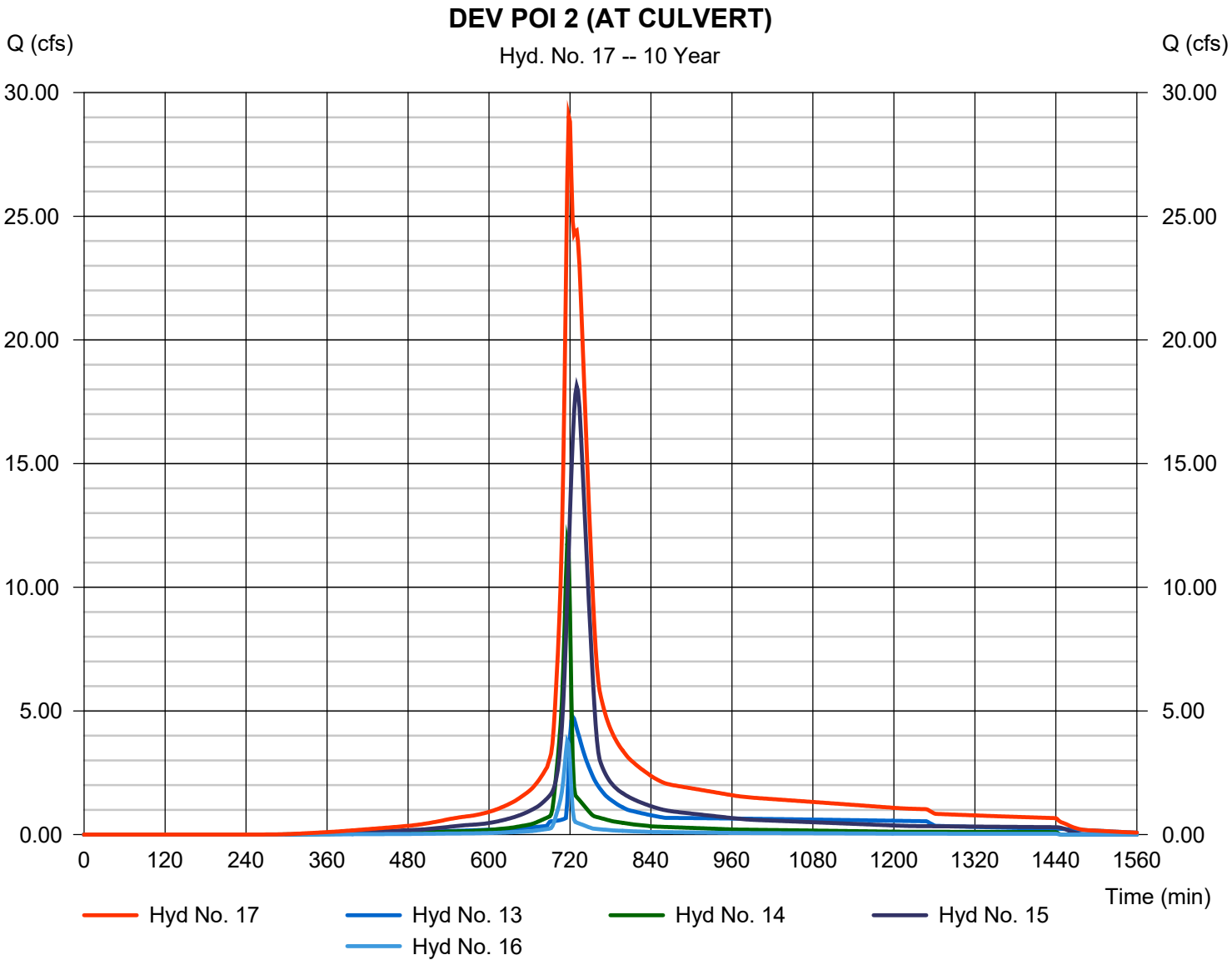


Hydrograph Report

Hyd. No. 17

DEV POI 2 (AT CULVERT)

Hydrograph type	=	Combine	Peak discharge	=	29.06 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	144,745 cuft
Inflow hyds.	=	13, 14, 15, 16	Contrib. drain. area	=	7.280 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	57.71	2	728	219,400	------	------	------	EX 20
2	SCS Runoff	27.78	2	728	105,588	------	------	------	EX 10 (POI 1)
3	SCS Runoff	32.26	2	730	133,137	------	------	------	OFF 20
4	Combine	89.48	2	728	352,537	1, 3	------	------	EX POI 2 (AT CULVERT)
5	SCS Runoff	38.09	2	716	87,096	------	------	------	DEV 10
6	SCS Runoff	49.93	2	716	110,597	------	------	------	DEV 30
7	Reservoir	10.22	2	724	87,083	5	1022.97	30,074	BIO 1
8	Combine	59.12	2	716	197,680	6, 7	------	------	COMBINE
9	Reservoir	22.15	2	724	197,678	8	1020.78	60,228	DETENTION POND 1
10	SCS Runoff	12.58	2	716	27,670	------	------	------	DA 11 (US ROUTE 50)
11	Combine	27.23	2	720	225,348	9, 10	------	------	DEV POI 1
12	SCS Runoff	30.66	2	716	68,937	------	------	------	DEV 20
13	Reservoir	6.002	2	726	68,920	12	1022.22	30,251	BIORETENTION 2
14	SCS Runoff	20.92	2	716	45,720	------	------	------	DA 21 (PR. PUBLIC ACCESS ROAD)
15	SCS Runoff	32.64	2	730	135,346	------	------	------	OFF 20
16	SCS Runoff	6.646	2	716	14,618	------	------	------	OFF DA 22 (US ROUTE 50)
17	Combine	53.22	2	718	264,605	13, 14, 15, 16	------	------	DEV POI 2 (AT CULVERT)

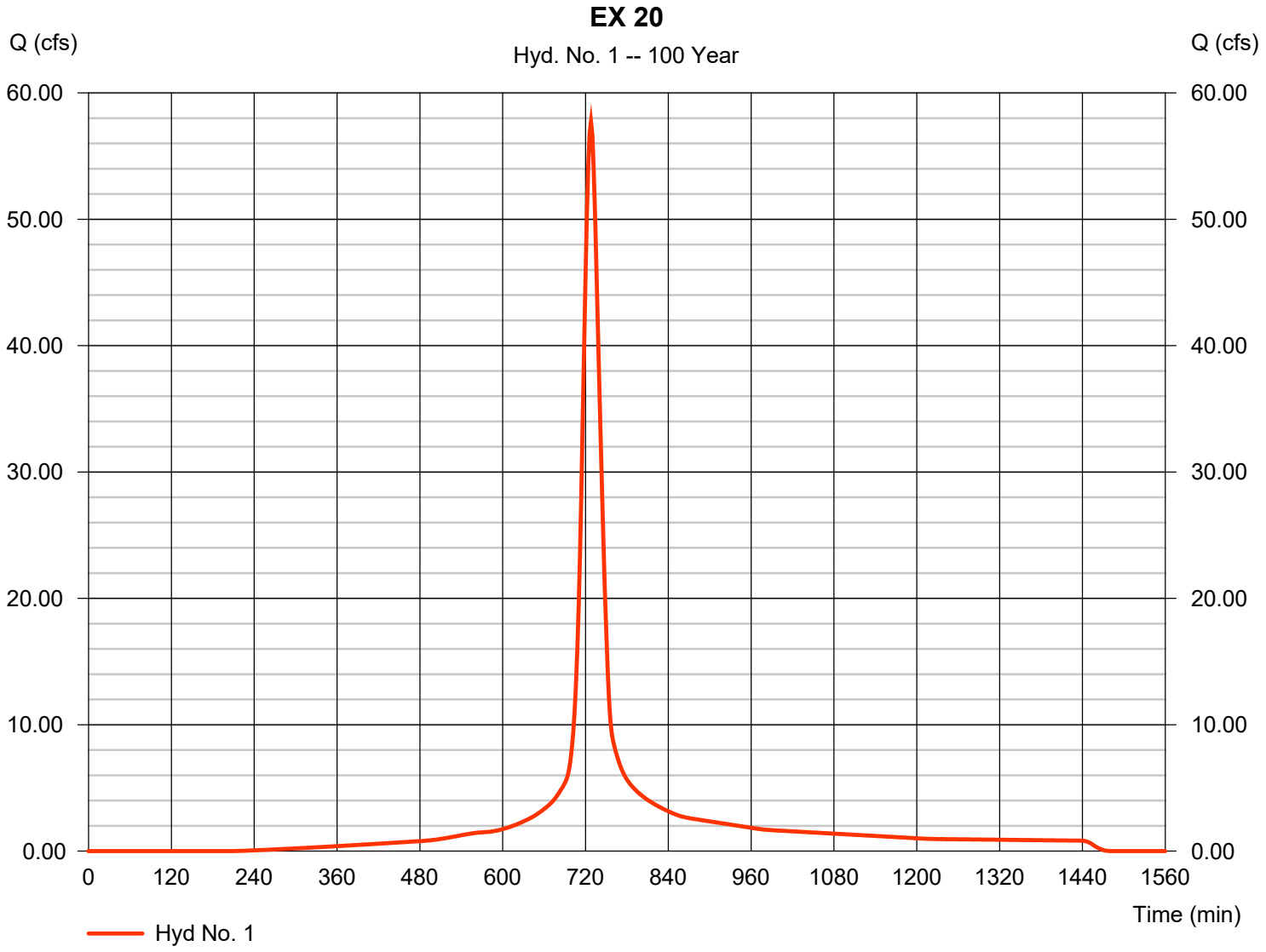
Hydrograph Report

Hyd. No. 1

EX 20

Hydrograph type	=	SCS Runoff	Peak discharge	=	57.71 cfs
Storm frequency	=	100 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	219,400 cuft
Drainage area	=	8.270 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.10 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.110 x 98) + (8.160 x 85)] / 8.270



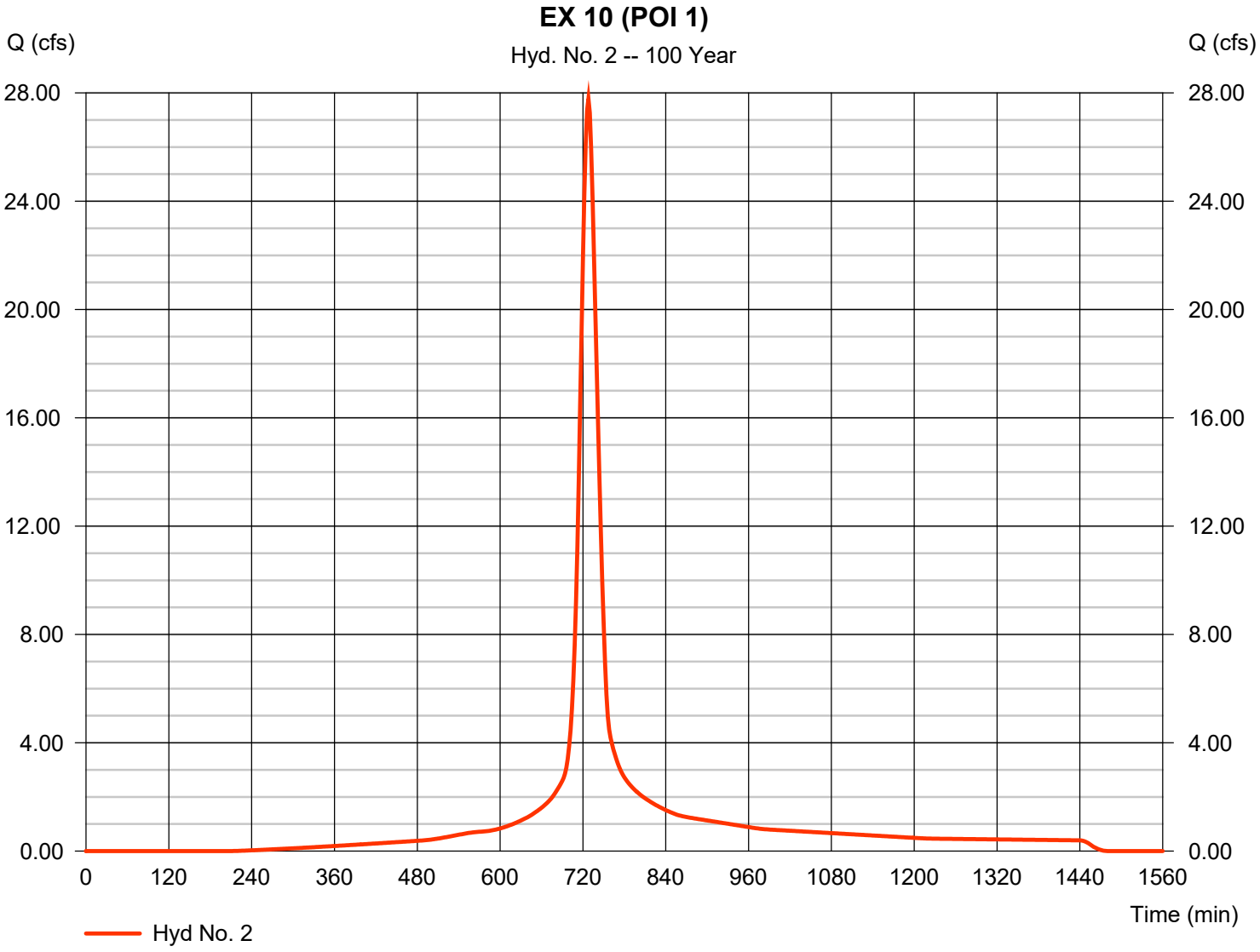
Hydrograph Report

Hyd. No. 2

EX 10 (POI 1)

Hydrograph type	= SCS Runoff	Peak discharge	= 27.78 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 105,588 cuft
Drainage area	= 3.980 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 26.30 min
Total precip.	= 9.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.090 x 98) + (3.890 x 85)] / 3.980



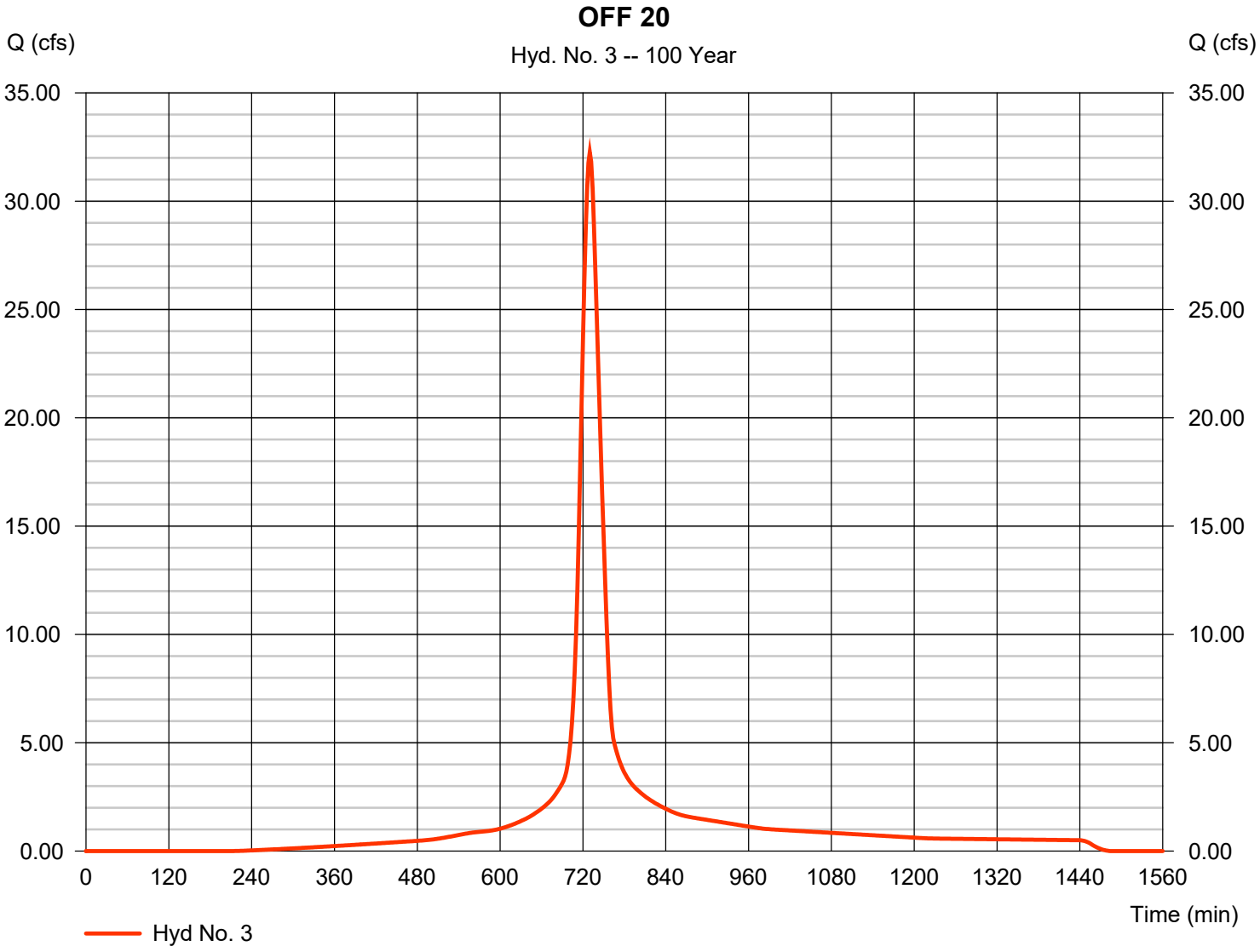
Hydrograph Report

Hyd. No. 3

OFF 20

Hydrograph type	=	SCS Runoff	Peak discharge	=	32.26 cfs
Storm frequency	=	100 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	133,137 cuft
Drainage area	=	4.940 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.90 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 98) + (4.800 x 85)] / 4.940

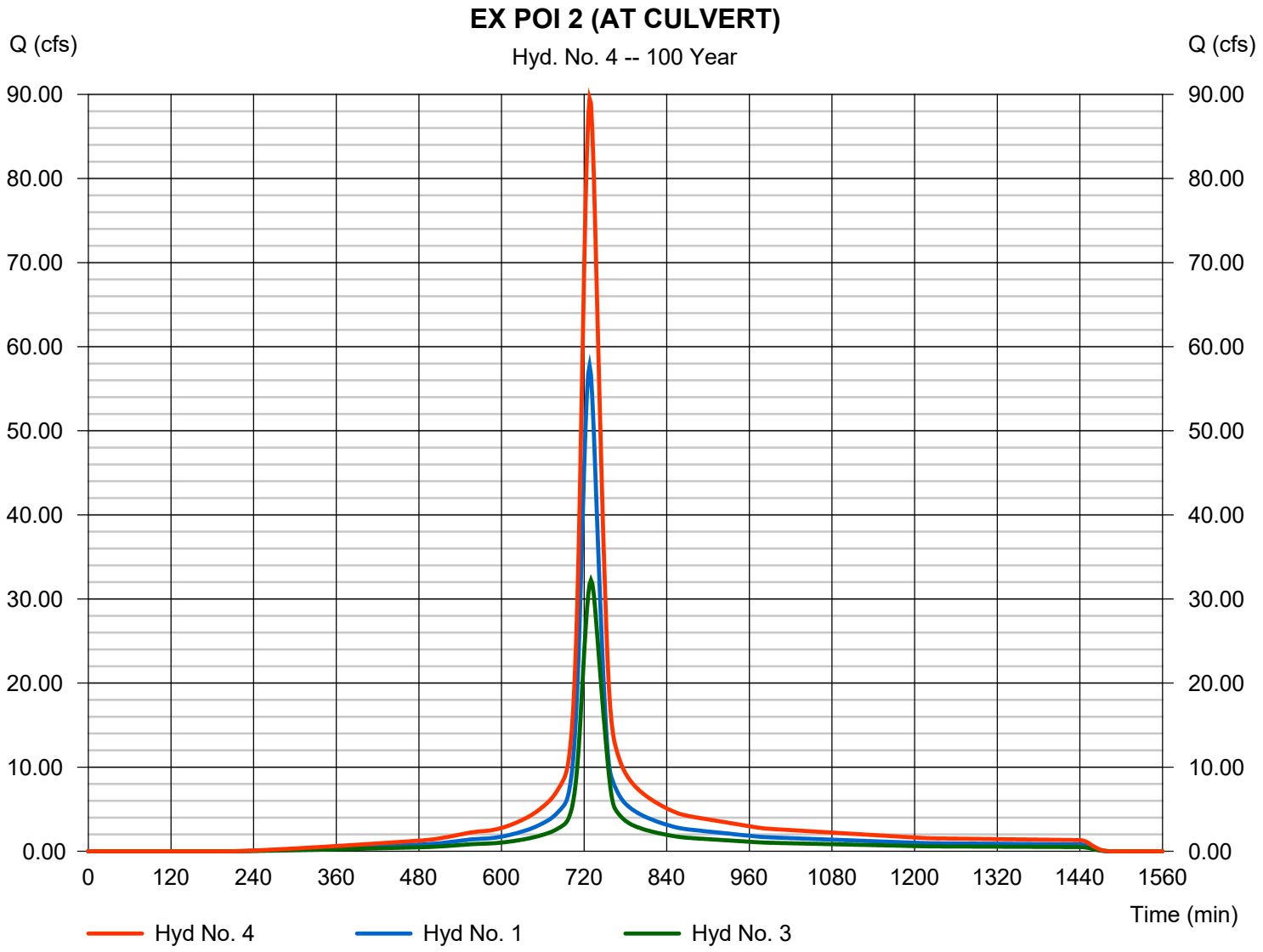


Hydrograph Report

Hyd. No. 4

EX POI 2 (AT CULVERT)

Hydrograph type	=	Combine	Peak discharge	=	89.48 cfs
Storm frequency	=	100 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	352,537 cuft
Inflow hyds.	=	1, 3	Contrib. drain. area	=	13.210 ac



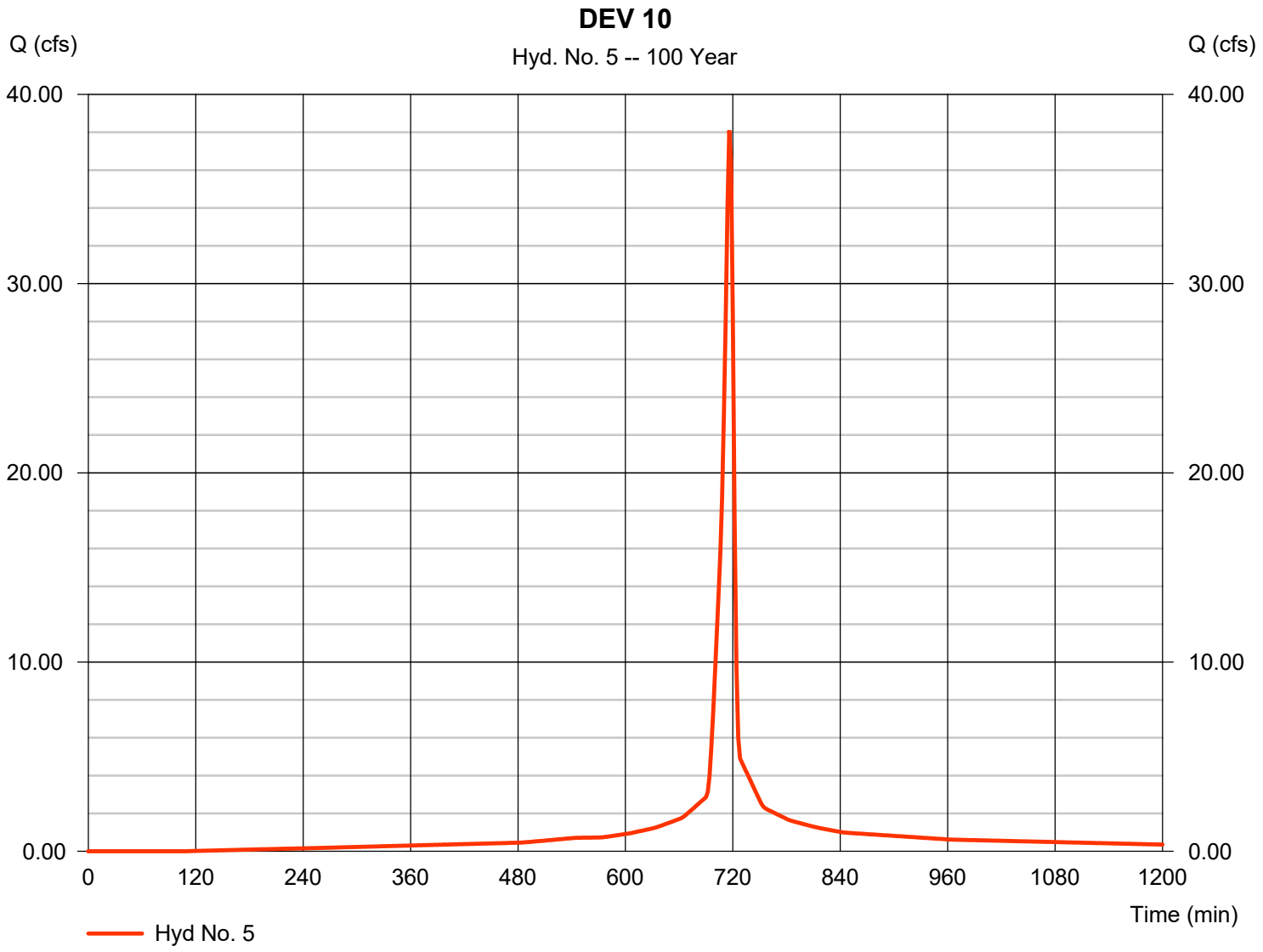
Hydrograph Report

Hyd. No. 5

DEV 10

Hydrograph type	=	SCS Runoff	Peak discharge	=	38.09 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	87,096 cuft
Drainage area	=	3.090 ac	Curve number	=	92*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.020 x 98) + (1.070 x 80)] / 3.090



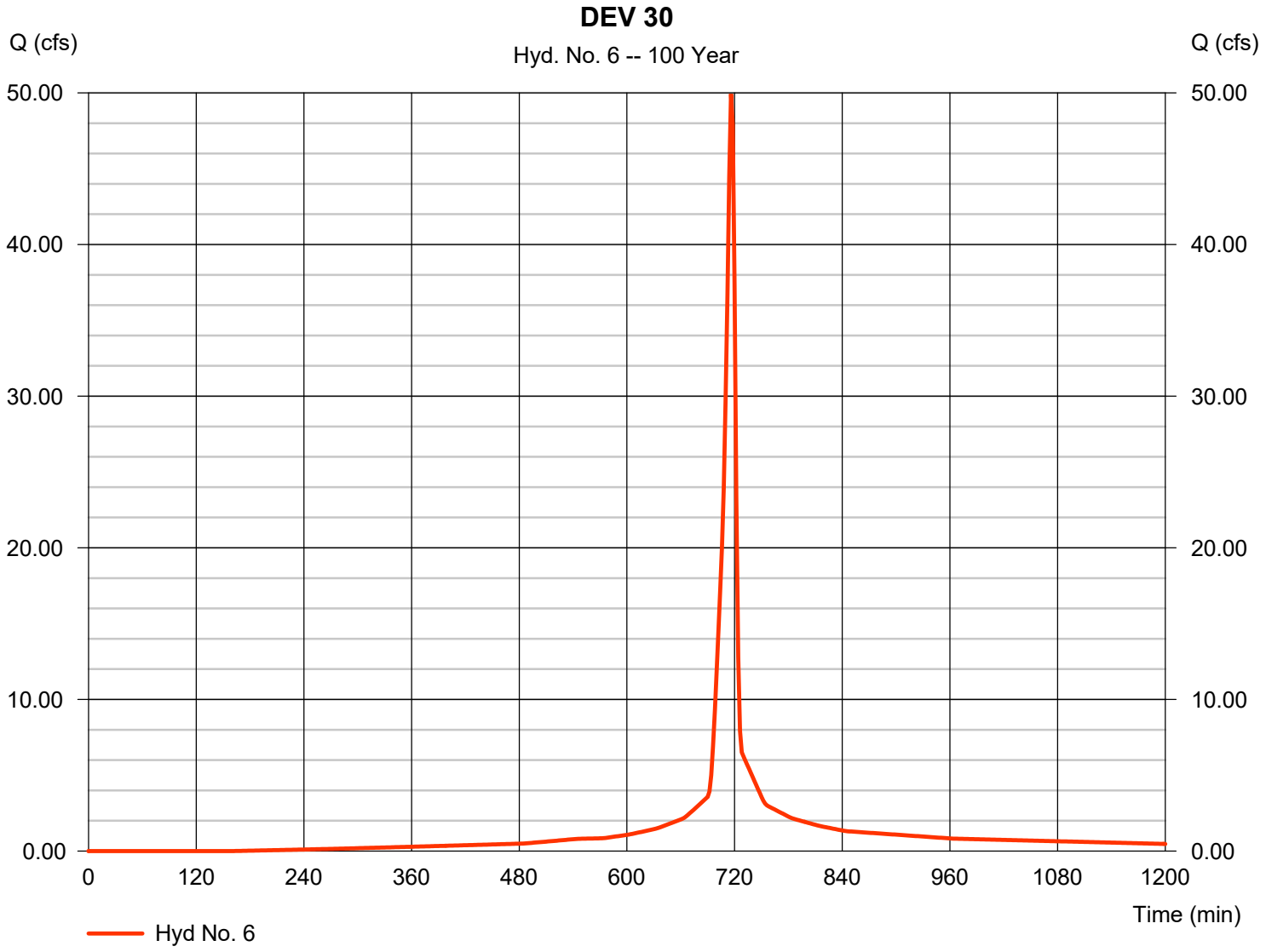
Hydrograph Report

Hyd. No. 6

DEV 30

Hydrograph type	=	SCS Runoff	Peak discharge	=	49.93 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	110,597 cuft
Drainage area	=	4.170 ac	Curve number	=	88*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.850 x 98) + (2.320 x 80)] / 4.170



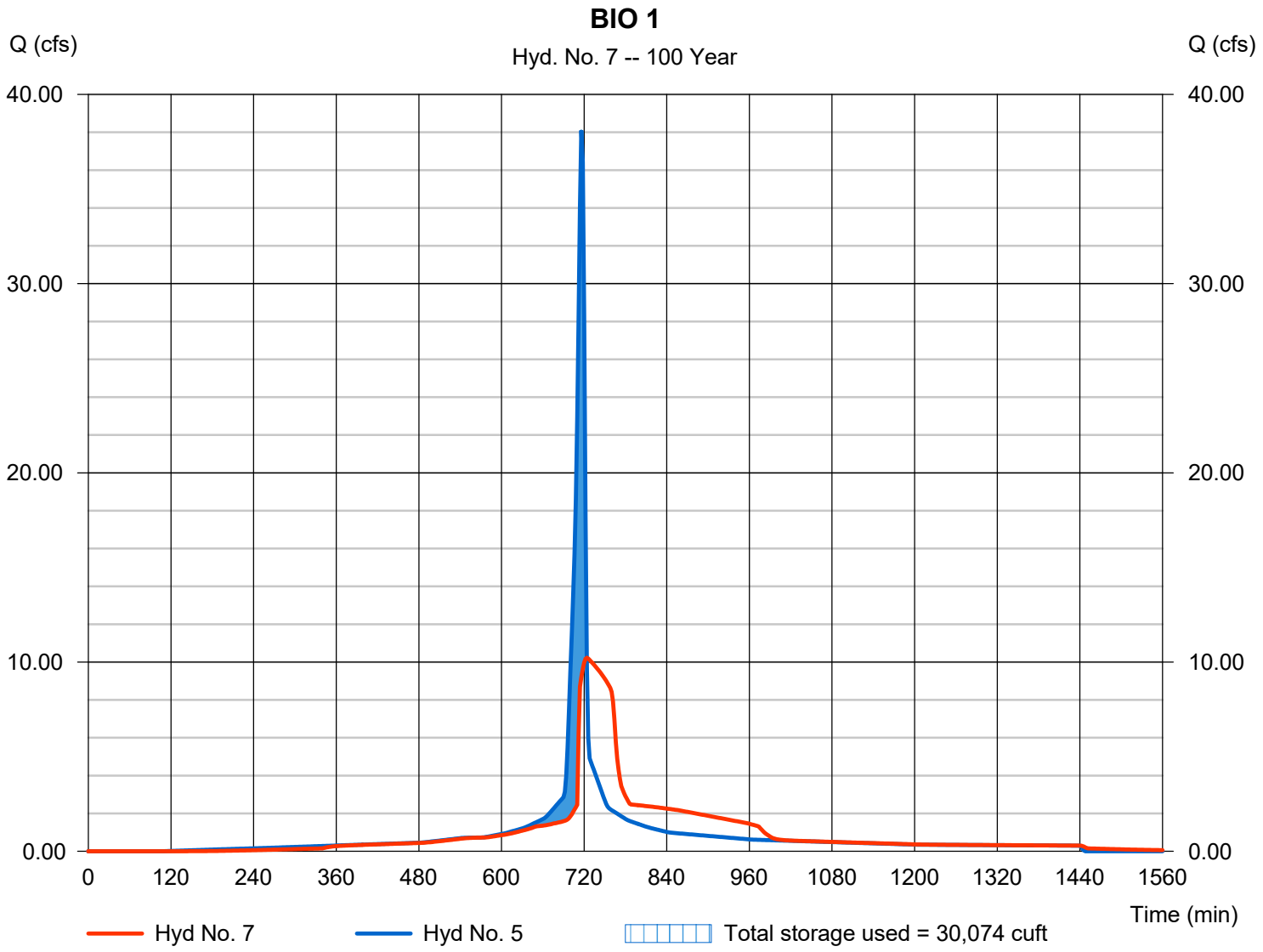
Hydrograph Report

Hyd. No. 7

BIO 1

Hydrograph type	=	Reservoir	Peak discharge	=	10.22 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	87,083 cuft
Inflow hyd. No.	=	5 - DEV 10	Max. Elevation	=	1022.97 ft
Reservoir name	=	BIORETENTION 1	Max. Storage	=	30,074 cuft

Storage Indication method used.

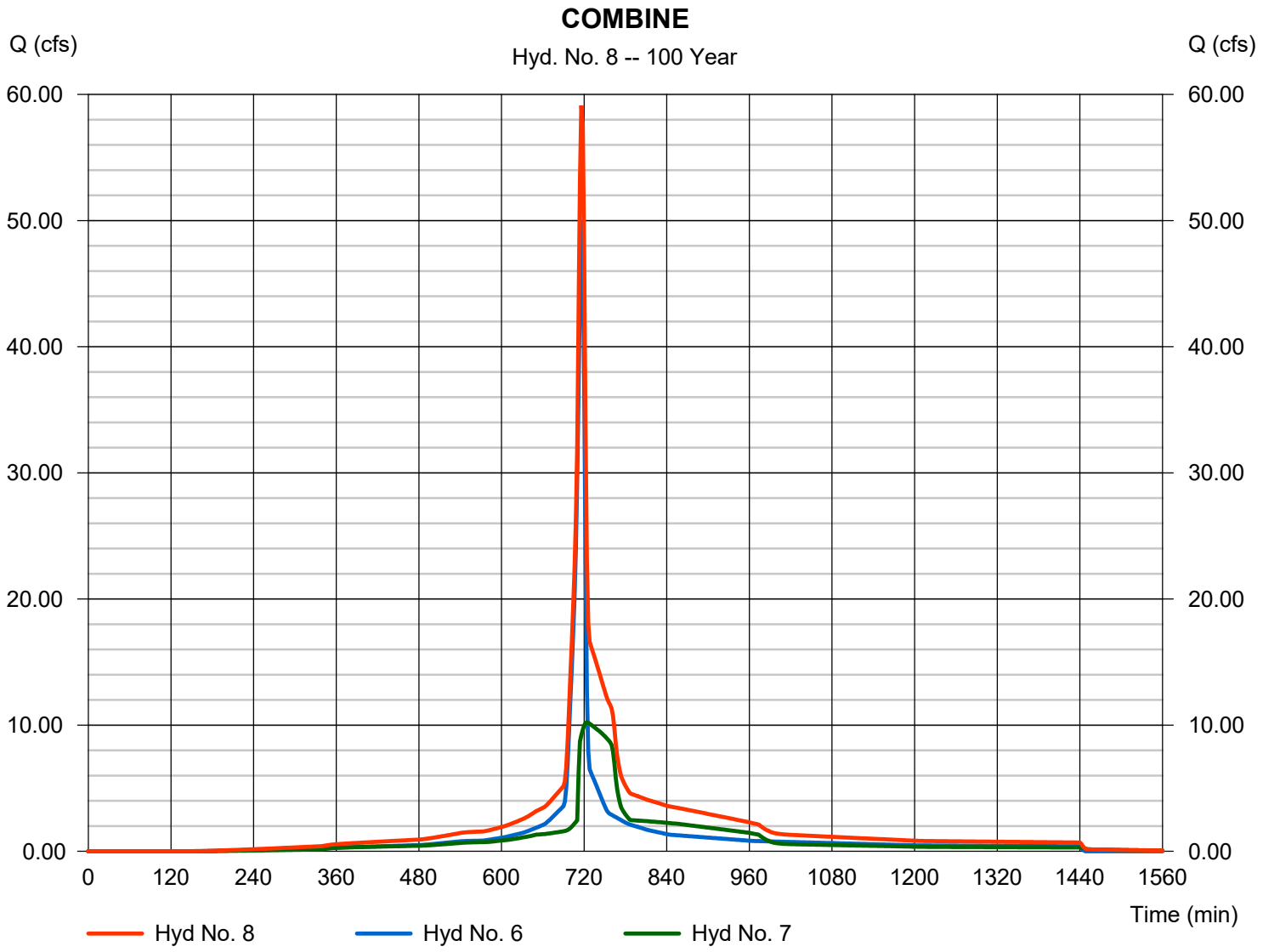


Hydrograph Report

Hyd. No. 8

COMBINE

Hydrograph type	=	Combine	Peak discharge	=	59.12 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	197,680 cuft
Inflow hyds.	=	6, 7	Contrib. drain. area	=	4.170 ac



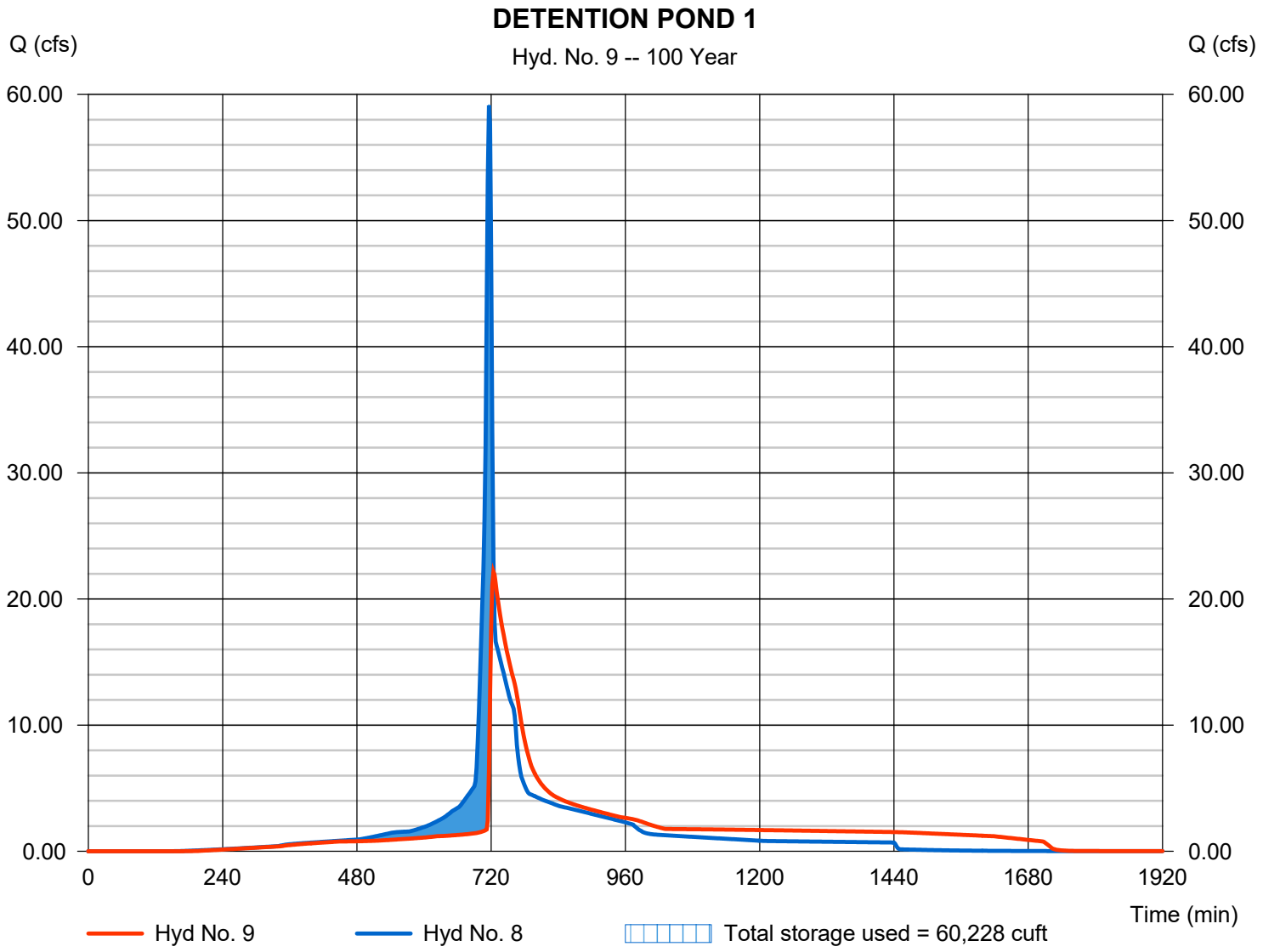
Hydrograph Report

Hyd. No. 9

DETENTION POND 1

Hydrograph type	=	Reservoir	Peak discharge	=	22.15 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	197,678 cuft
Inflow hyd. No.	=	8 - COMBINE	Max. Elevation	=	1020.78 ft
Reservoir name	=	DRY DETENTION 1	Max. Storage	=	60,228 cuft

Storage Indication method used.



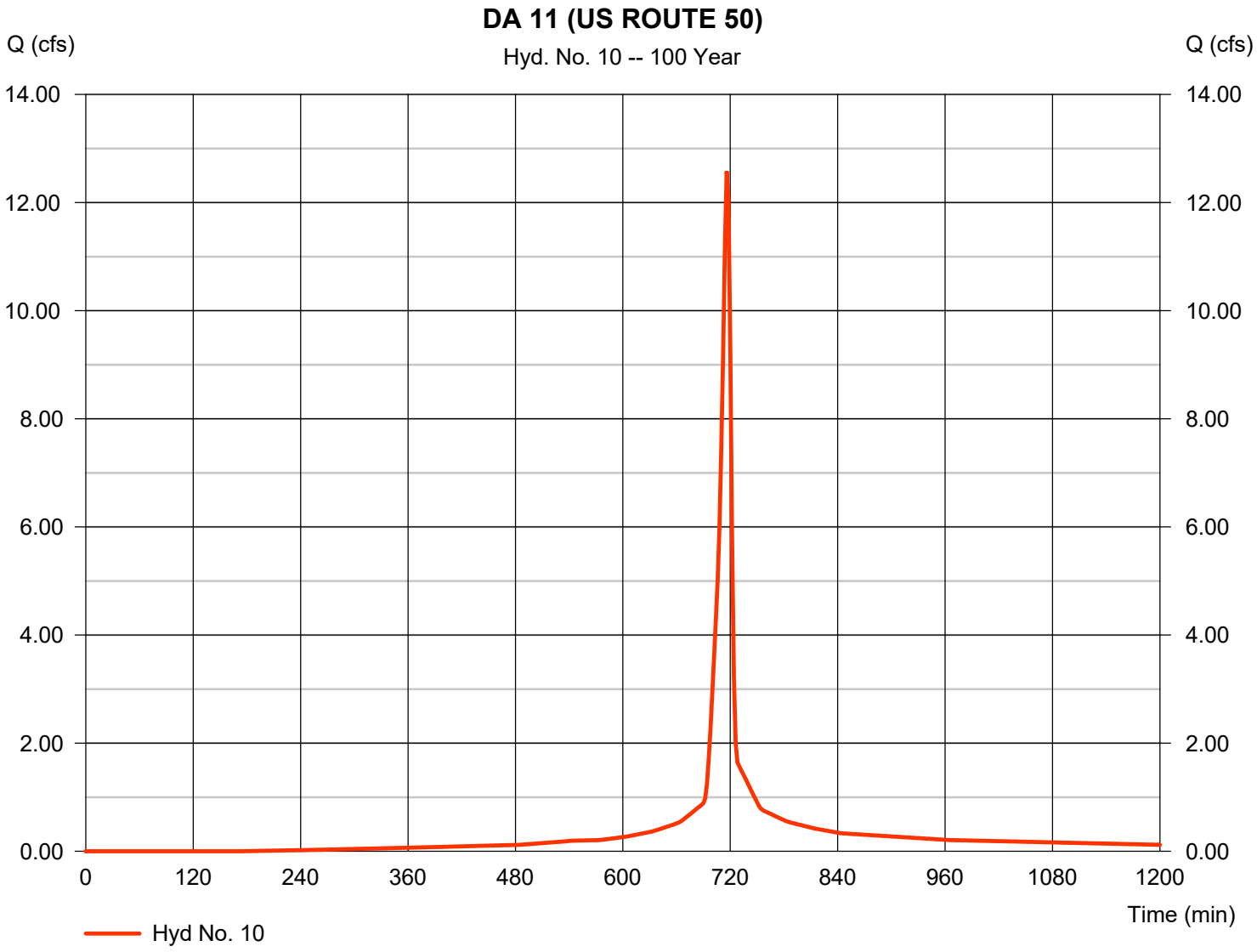
Hydrograph Report

Hyd. No. 10

DA 11 (US ROUTE 50)

Hydrograph type	= SCS Runoff	Peak discharge	= 12.58 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 27,670 cuft
Drainage area	= 1.060 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 9.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.400 x 98) + (0.660 x 80)] / 1.060

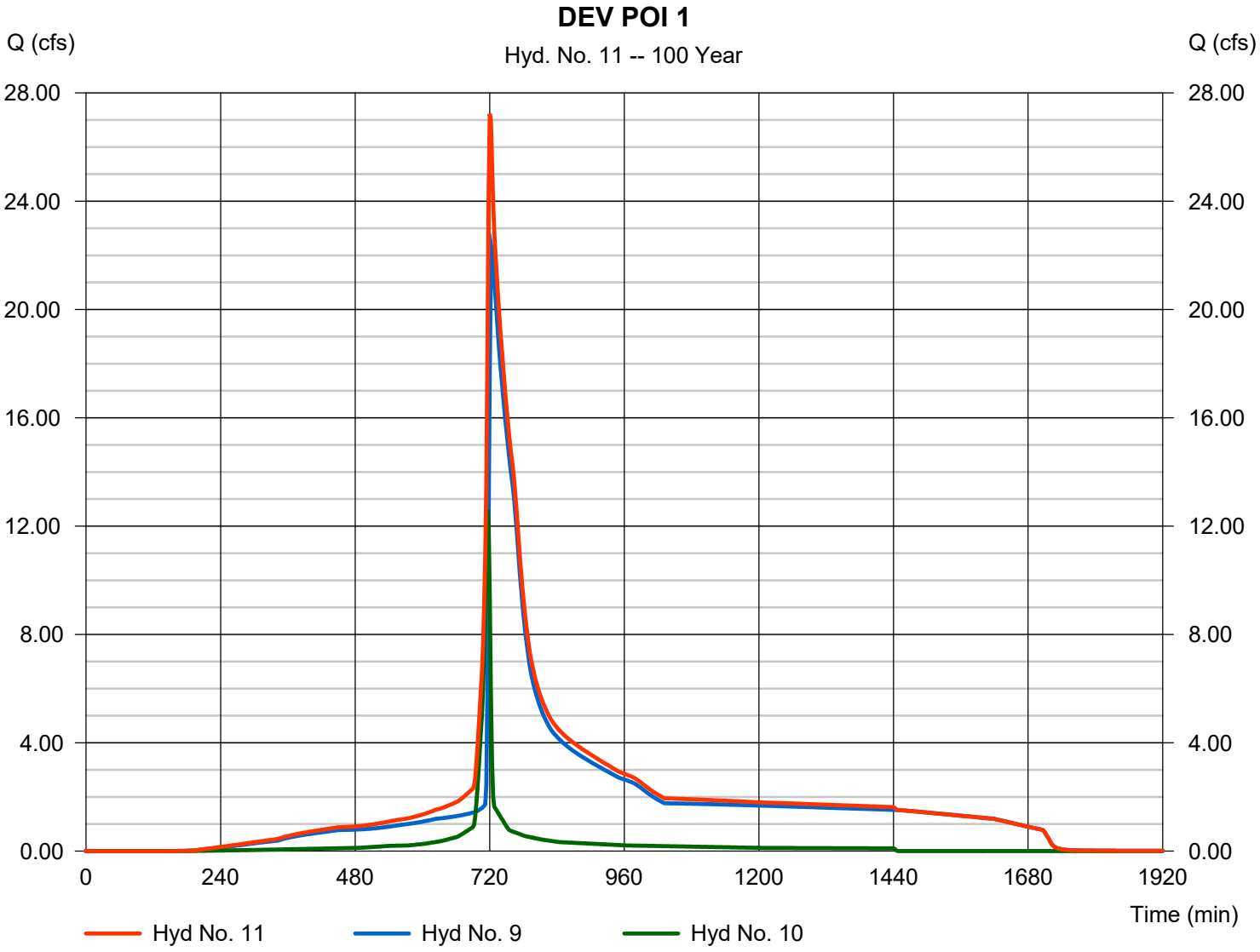


Hydrograph Report

Hyd. No. 11

DEV POI 1

Hydrograph type	= Combine	Peak discharge	= 27.23 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 225,348 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 1.060 ac



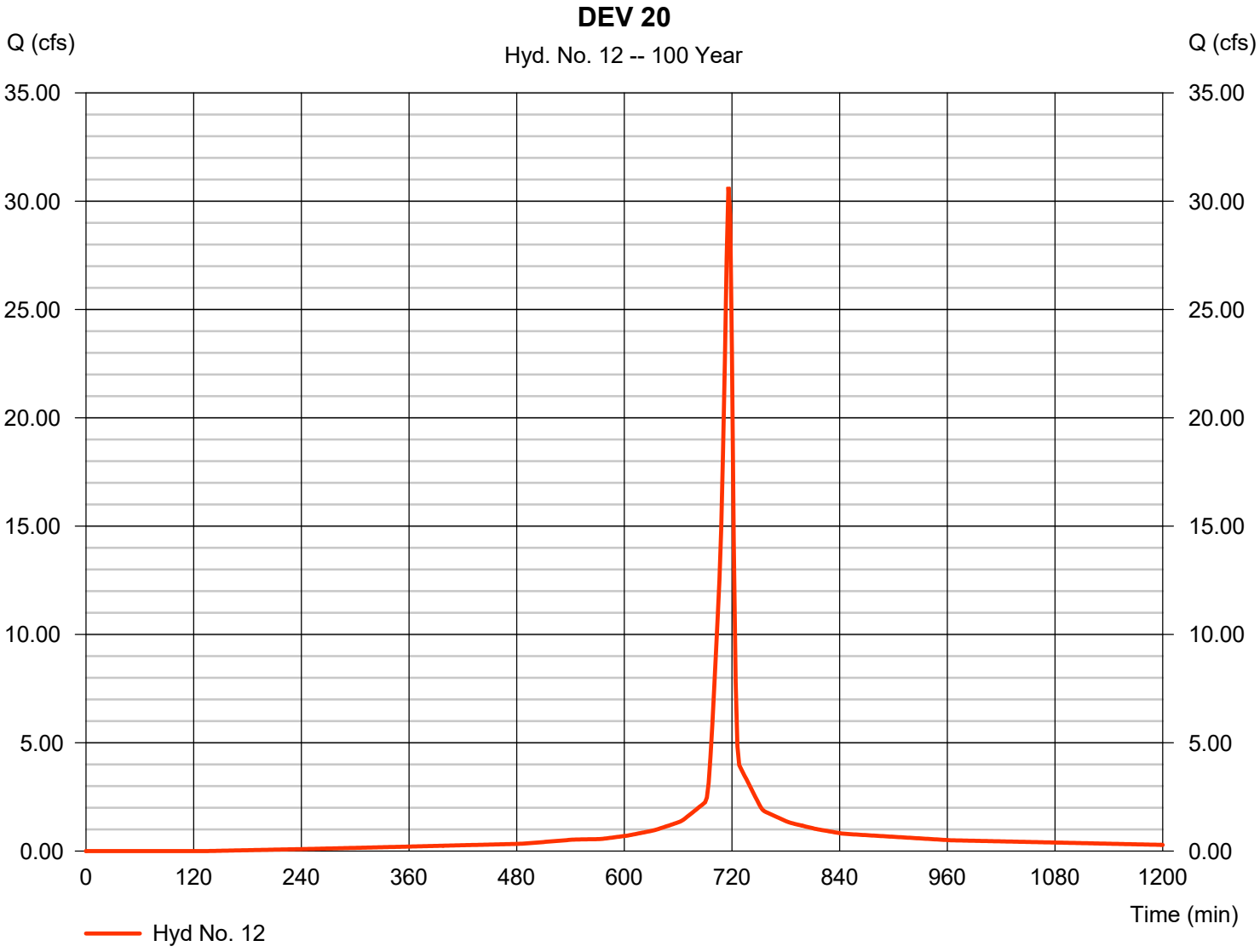
Hydrograph Report

Hyd. No. 12

DEV 20

Hydrograph type	=	SCS Runoff	Peak discharge	=	30.66 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	68,937 cuft
Drainage area	=	2.520 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.340 x 98) + (1.180 x 80)] / 2.520



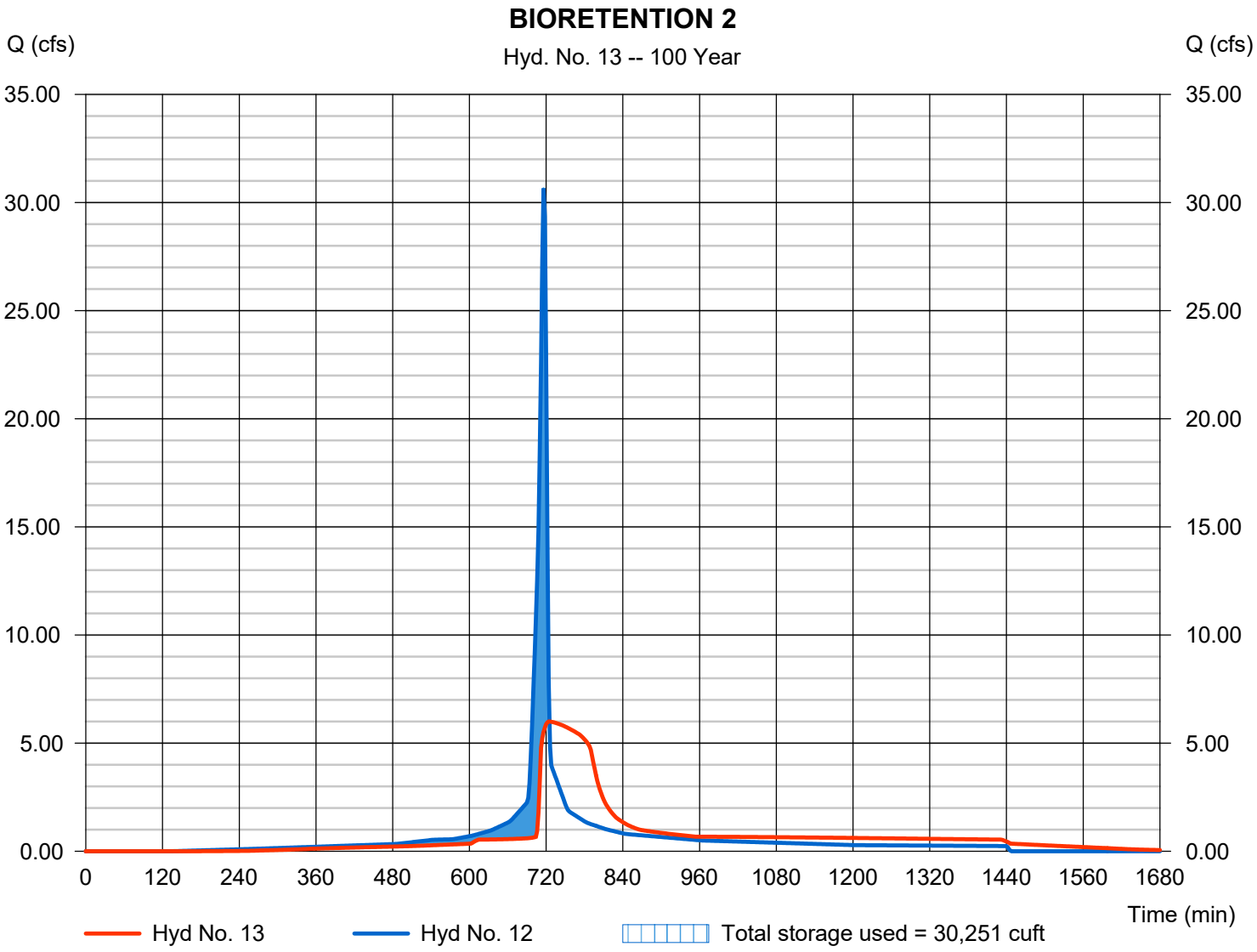
Hydrograph Report

Hyd. No. 13

BIORETENTION 2

Hydrograph type	=	Reservoir	Peak discharge	=	6.002 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	68,920 cuft
Inflow hyd. No.	=	12 - DEV 20	Max. Elevation	=	1022.22 ft
Reservoir name	=	BIORETENTION 2	Max. Storage	=	30,251 cuft

Storage Indication method used.



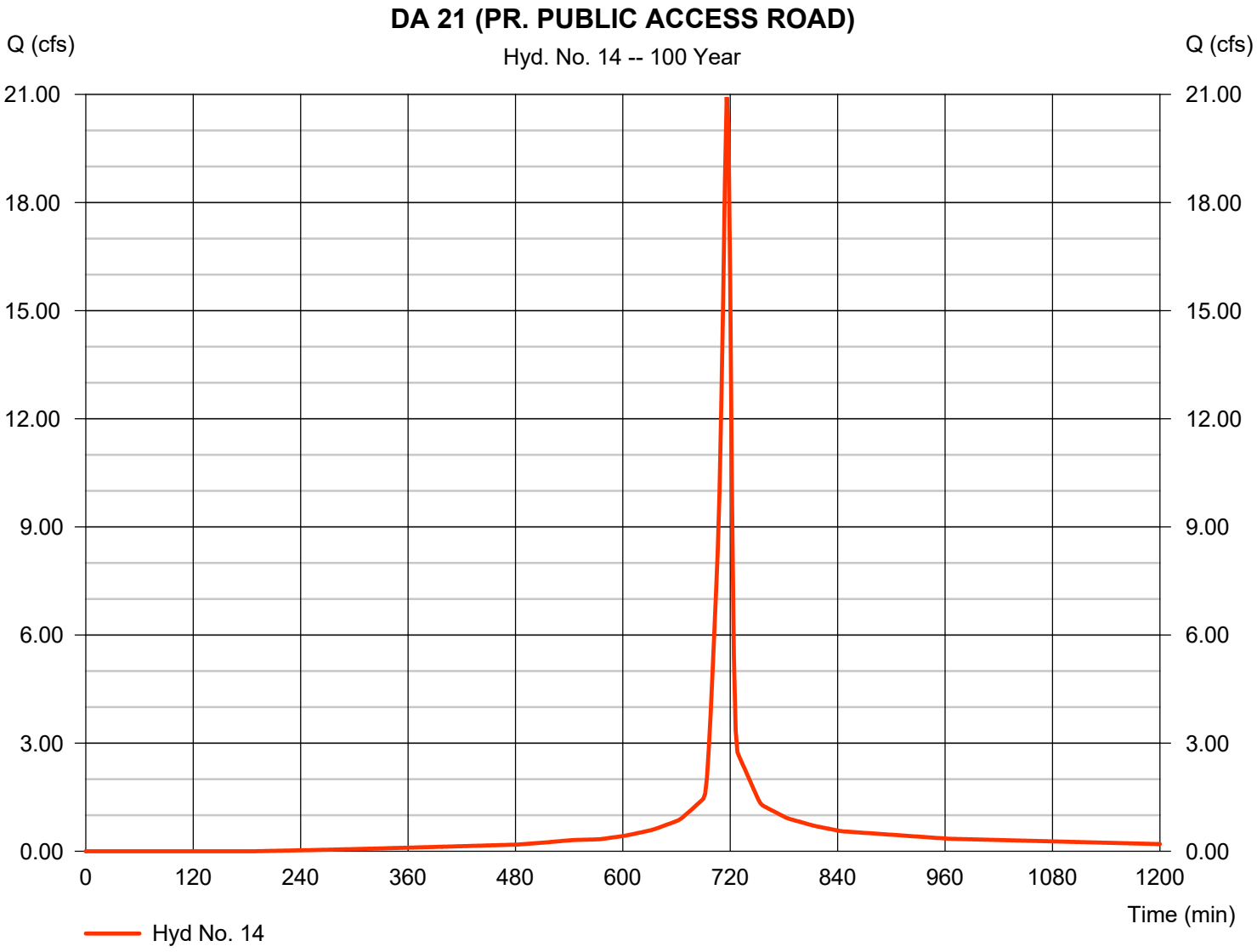
Hydrograph Report

Hyd. No. 14

DA 21 (PR. PUBLIC ACCESS ROAD)

Hydrograph type	= SCS Runoff	Peak discharge	= 20.92 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 45,720 cuft
Drainage area	= 1.780 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 9.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.630 x 98) + (1.150 x 80)] / 1.780



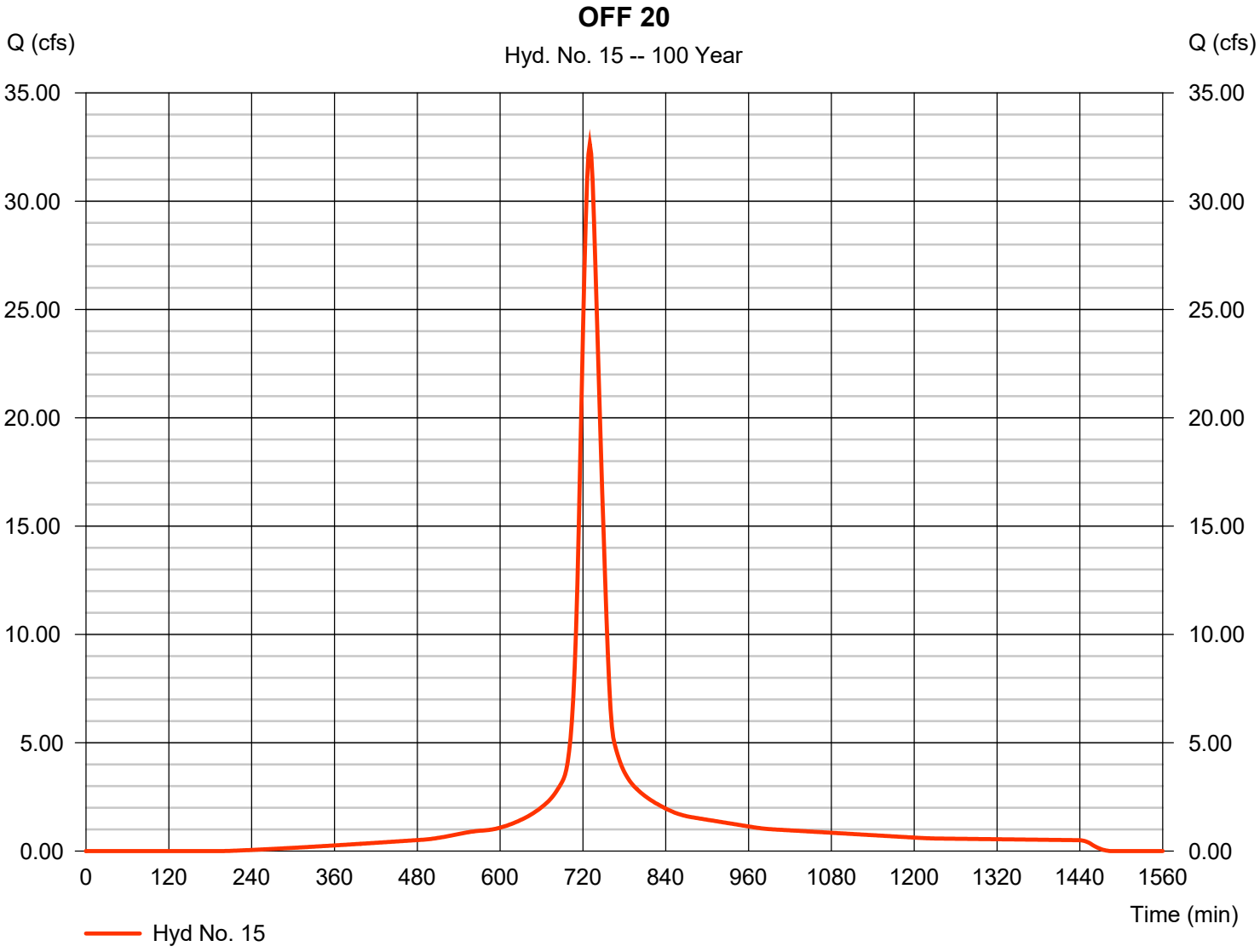
Hydrograph Report

Hyd. No. 15

OFF 20

Hydrograph type	=	SCS Runoff	Peak discharge	=	32.64 cfs
Storm frequency	=	100 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	135,346 cuft
Drainage area	=	4.940 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	28.90 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.190 x 98) + (4.750 x 85)] / 4.940



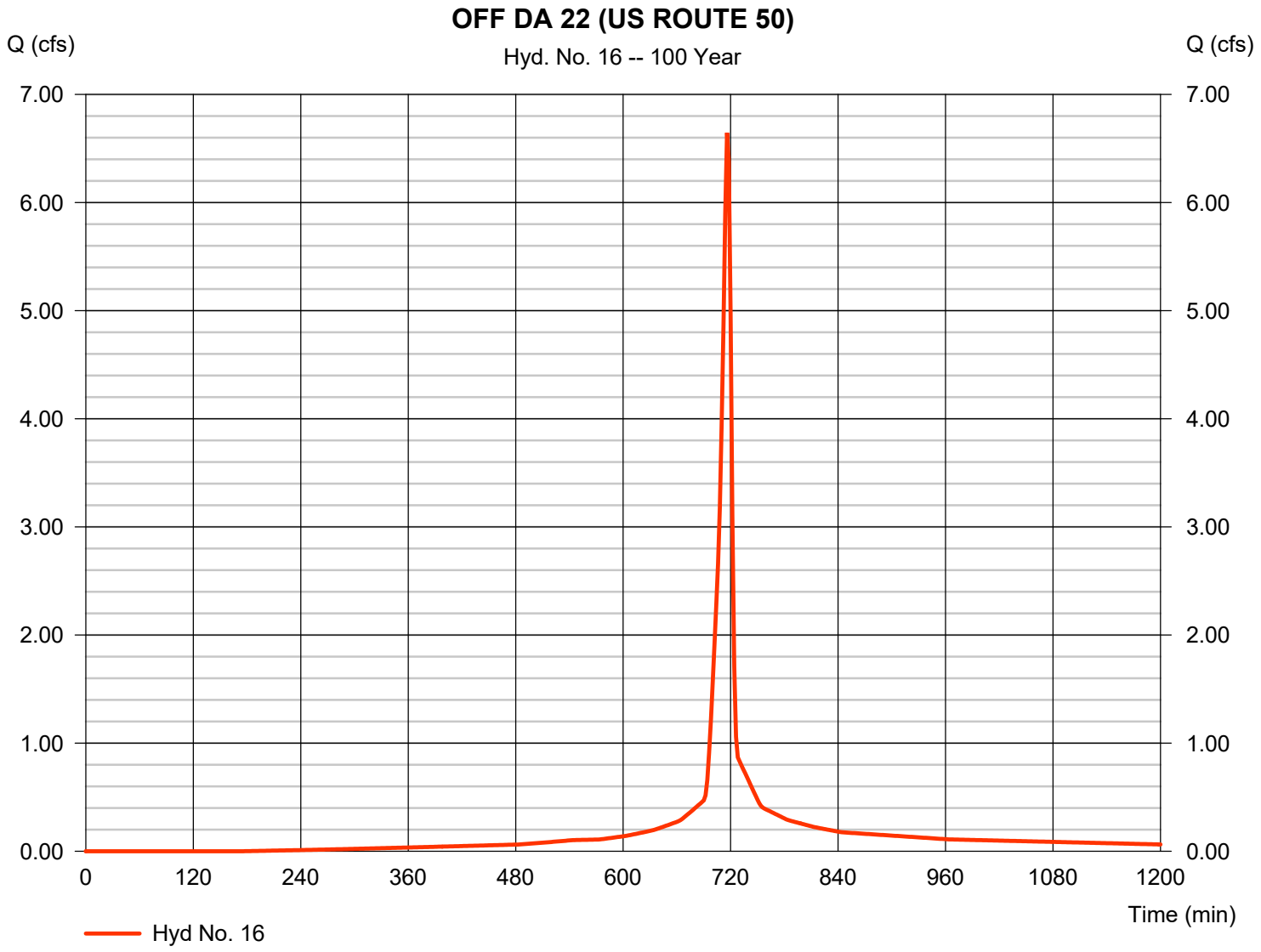
Hydrograph Report

Hyd. No. 16

OFF DA 22 (US ROUTE 50)

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.646 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	14,618 cuft
Drainage area	=	0.560 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.210 x 98) + (0.350 x 80)] / 0.560

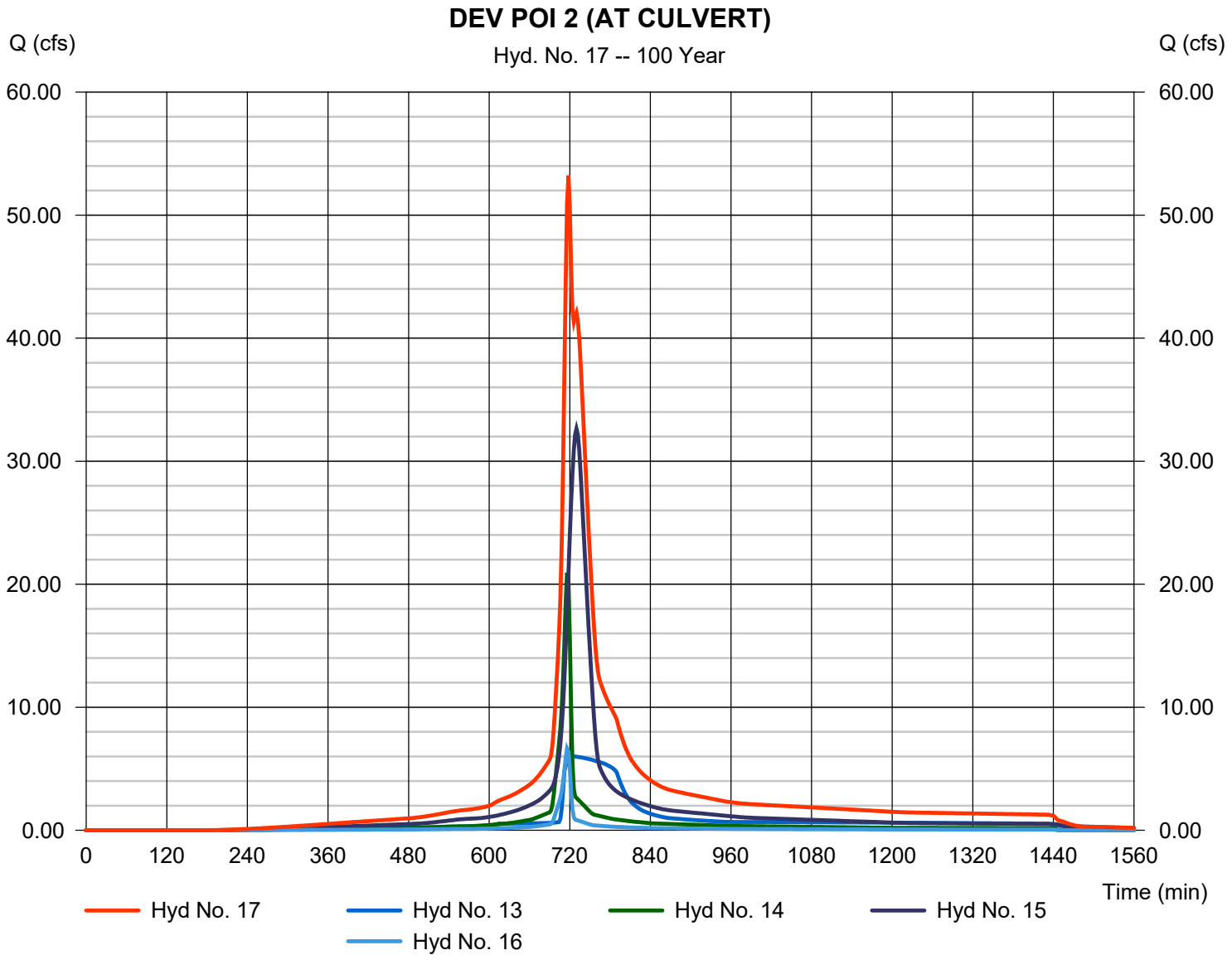


Hydrograph Report

Hyd. No. 17

DEV POI 2 (AT CULVERT)

Hydrograph type	=	Combine	Peak discharge	=	53.22 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	264,605 cuft
Inflow hyds.	=	13, 14, 15, 16	Contrib. drain. area	=	7.280 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	69.8703	13.1000	0.8658	--------
3	0.0000	0.0000	0.0000	--------
5	79.2597	14.6000	0.8369	--------
10	88.2351	15.5000	0.8279	--------
25	102.6072	16.5000	0.8217	--------
50	114.8193	17.2000	0.8199	--------
100	127.1596	17.8000	0.8186	--------

File name: SampleFHA.idf

Intensity = B / (Tc + D)^E

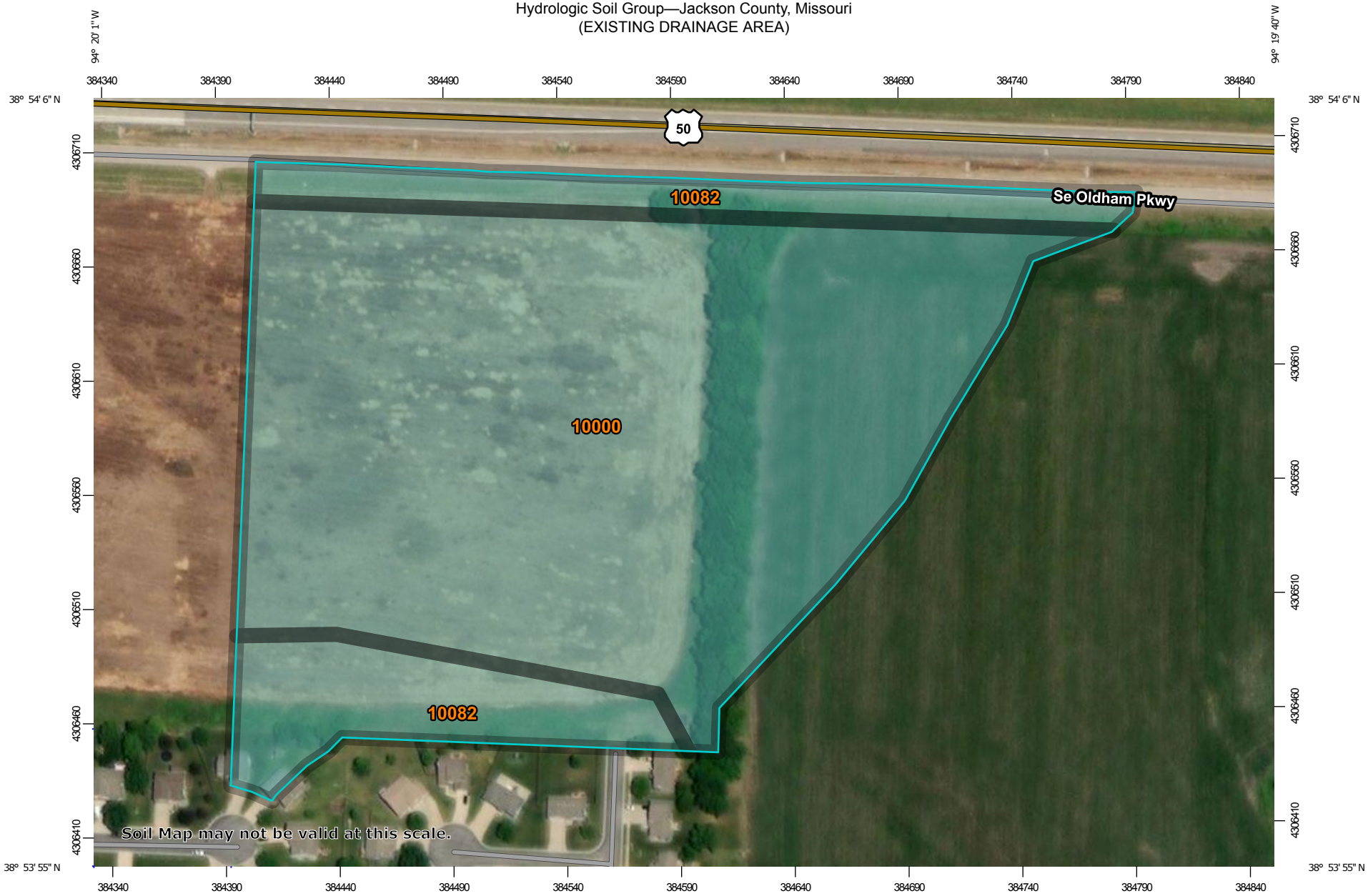
Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.69	4.61	3.89	3.38	2.99	2.69	2.44	2.24	2.07	1.93	1.81	1.70
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.57	5.43	4.65	4.08	3.65	3.30	3.02	2.79	2.59	2.42	2.27	2.15
10	7.24	6.04	5.21	4.59	4.12	3.74	3.43	3.17	2.95	2.77	2.60	2.46
25	8.25	6.95	6.03	5.34	4.80	4.38	4.02	3.73	3.48	3.26	3.07	2.91
50	9.04	7.65	6.66	5.92	5.34	4.87	4.49	4.16	3.88	3.65	3.44	3.25
100	9.83	8.36	7.30	6.50	5.87	5.36	4.94	4.59	4.29	4.03	3.80	3.60

Tc = time in minutes. Values may exceed 60.

18\1001-1500\018-1450\40-Design\Calcs\GNCV\Stormwater\HYDRAFLOW\Lees Summit MO Lat 38.9 Long 94.33.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.71	0.00	0.00	5.66	7.00	0.00	9.25
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Hydrologic Soil Group—Jackson County, Missouri
(EXISTING DRAINAGE AREA)



Map Scale: 1:2,370 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 19, Sep 13, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 11, 2017—Sep 22, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10000	Arisburg silt loam, 1 to 5 percent slopes	C	14.9	80.7%
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	C	3.6	19.3%
Totals for Area of Interest			**18.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA Atlas 14, Volume 8, Version 2
Location name: Lees Summit, Missouri, USA*
Latitude: 38.9004°, Longitude: -94.3314°
Elevation: 1024.15 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.415 (0.324-0.529)	0.484 (0.378-0.618)	0.599 (0.466-0.767)	0.696 (0.539-0.894)	0.832 (0.625-1.10)	0.938 (0.691-1.25)	1.05 (0.748-1.43)	1.16 (0.798-1.62)	1.31 (0.871-1.87)	1.42 (0.926-2.07)
10-min	0.607 (0.474-0.775)	0.709 (0.553-0.905)	0.877 (0.682-1.12)	1.02 (0.789-1.31)	1.22 (0.916-1.61)	1.37 (1.01-1.84)	1.53 (1.10-2.09)	1.70 (1.17-2.37)	1.92 (1.27-2.75)	2.08 (1.36-3.03)
15-min	0.740 (0.578-0.945)	0.864 (0.674-1.10)	1.07 (0.832-1.37)	1.24 (0.962-1.60)	1.49 (1.12-1.96)	1.68 (1.23-2.24)	1.87 (1.34-2.55)	2.07 (1.43-2.89)	2.34 (1.56-3.35)	2.54 (1.65-3.69)
30-min	1.02 (0.800-1.31)	1.20 (0.939-1.54)	1.50 (1.17-1.92)	1.75 (1.35-2.24)	2.09 (1.57-2.76)	2.36 (1.74-3.15)	2.63 (1.88-3.59)	2.91 (2.00-4.07)	3.28 (2.18-4.70)	3.57 (2.32-5.18)
60-min	1.34 (1.05-1.71)	1.57 (1.23-2.01)	1.97 (1.53-2.52)	2.30 (1.78-2.95)	2.76 (2.08-3.66)	3.13 (2.31-4.20)	3.51 (2.51-4.80)	3.90 (2.69-5.46)	4.43 (2.95-6.35)	4.83 (3.14-7.02)
2-hr	1.66 (1.30-2.10)	1.95 (1.53-2.47)	2.43 (1.91-3.09)	2.85 (2.22-3.63)	3.44 (2.61-4.53)	3.91 (2.90-5.20)	4.39 (3.16-5.97)	4.89 (3.40-6.81)	5.57 (3.74-7.94)	6.10 (4.00-8.80)
3-hr	1.87 (1.48-2.36)	2.20 (1.74-2.78)	2.76 (2.17-3.49)	3.24 (2.54-4.11)	3.93 (3.00-5.16)	4.48 (3.35-5.95)	5.06 (3.67-6.86)	5.66 (3.95-7.85)	6.48 (4.38-9.22)	7.13 (4.70-10.3)
6-hr	2.26 (1.80-2.82)	2.66 (2.12-3.34)	3.37 (2.67-4.22)	3.98 (3.14-5.01)	4.88 (3.76-6.37)	5.60 (4.22-7.39)	6.36 (4.65-8.57)	7.16 (5.05-9.89)	8.27 (5.63-11.7)	9.15 (6.07-13.1)
12-hr	2.66 (2.13-3.30)	3.16 (2.54-3.93)	4.04 (3.23-5.03)	4.81 (3.83-6.02)	5.94 (4.62-7.72)	6.86 (5.21-9.00)	7.83 (5.77-10.5)	8.86 (6.30-12.2)	10.3 (7.06-14.5)	11.4 (7.64-16.2)
24-hr	3.11 (2.51-3.82)	3.71 (2.99-4.57)	4.74 (3.82-5.86)	5.66 (4.54-7.02)	7.00 (5.48-9.03)	8.10 (6.20-10.5)	9.25 (6.88-12.3)	10.5 (7.51-14.3)	12.2 (8.44-17.0)	13.5 (9.14-19.1)
2-day	3.66 (2.98-4.47)	4.31 (3.50-5.26)	5.43 (4.41-6.66)	6.43 (5.19-7.91)	7.90 (6.24-10.1)	9.10 (7.03-11.8)	10.4 (7.77-13.7)	11.7 (8.47-15.9)	13.6 (9.50-18.9)	15.1 (10.3-21.2)
3-day	4.06 (3.33-4.94)	4.71 (3.85-5.73)	5.84 (4.76-7.12)	6.85 (5.55-8.38)	8.33 (6.61-10.6)	9.55 (7.41-12.3)	10.8 (8.16-14.3)	12.2 (8.87-16.5)	14.1 (9.92-19.5)	15.7 (10.7-21.9)
4-day	4.40 (3.61-5.33)	5.05 (4.14-6.12)	6.17 (5.05-7.50)	7.18 (5.84-8.76)	8.65 (6.89-11.0)	9.87 (7.68-12.7)	11.1 (8.42-14.6)	12.5 (9.12-16.8)	14.4 (10.2-19.9)	16.0 (10.9-22.2)
7-day	5.21 (4.30-6.27)	5.89 (4.86-7.10)	7.07 (5.82-8.53)	8.09 (6.62-9.80)	9.56 (7.64-12.0)	10.8 (8.41-13.7)	12.0 (9.11-15.6)	13.3 (9.74-17.7)	15.1 (10.7-20.6)	16.5 (11.4-22.9)
10-day	5.90 (4.89-7.07)	6.66 (5.52-7.99)	7.93 (6.55-9.53)	9.00 (7.40-10.9)	10.5 (8.43-13.1)	11.7 (9.20-14.8)	13.0 (9.87-16.7)	14.2 (10.5-18.9)	16.0 (11.3-21.7)	17.3 (12.0-23.9)
20-day	7.87 (6.58-9.35)	8.89 (7.43-10.6)	10.5 (8.78-12.6)	11.9 (9.85-14.2)	13.7 (11.0-16.8)	15.1 (11.9-18.7)	16.4 (12.5-20.9)	17.7 (13.1-23.2)	19.4 (13.9-26.1)	20.7 (14.5-28.3)
30-day	9.51 (7.99-11.3)	10.8 (9.03-12.7)	12.7 (10.7-15.1)	14.3 (11.9-17.1)	16.4 (13.2-19.9)	17.9 (14.1-22.1)	19.3 (14.9-24.5)	20.8 (15.4-27.0)	22.5 (16.1-30.1)	23.7 (16.7-32.4)
45-day	11.6 (9.80-13.7)	13.1 (11.1-15.5)	15.5 (13.0-18.3)	17.3 (14.5-20.6)	19.7 (15.9-23.8)	21.4 (17.0-26.3)	23.0 (17.7-28.9)	24.5 (18.2-31.6)	26.3 (18.9-34.9)	27.5 (19.4-37.3)
60-day	13.4 (11.4-15.7)	15.1 (12.8-17.8)	17.8 (15.0-21.0)	19.9 (16.7-23.5)	22.5 (18.2-27.0)	24.3 (19.3-29.7)	26.0 (20.1-32.5)	27.5 (20.5-35.4)	29.3 (21.1-38.7)	30.5 (21.6-41.3)

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

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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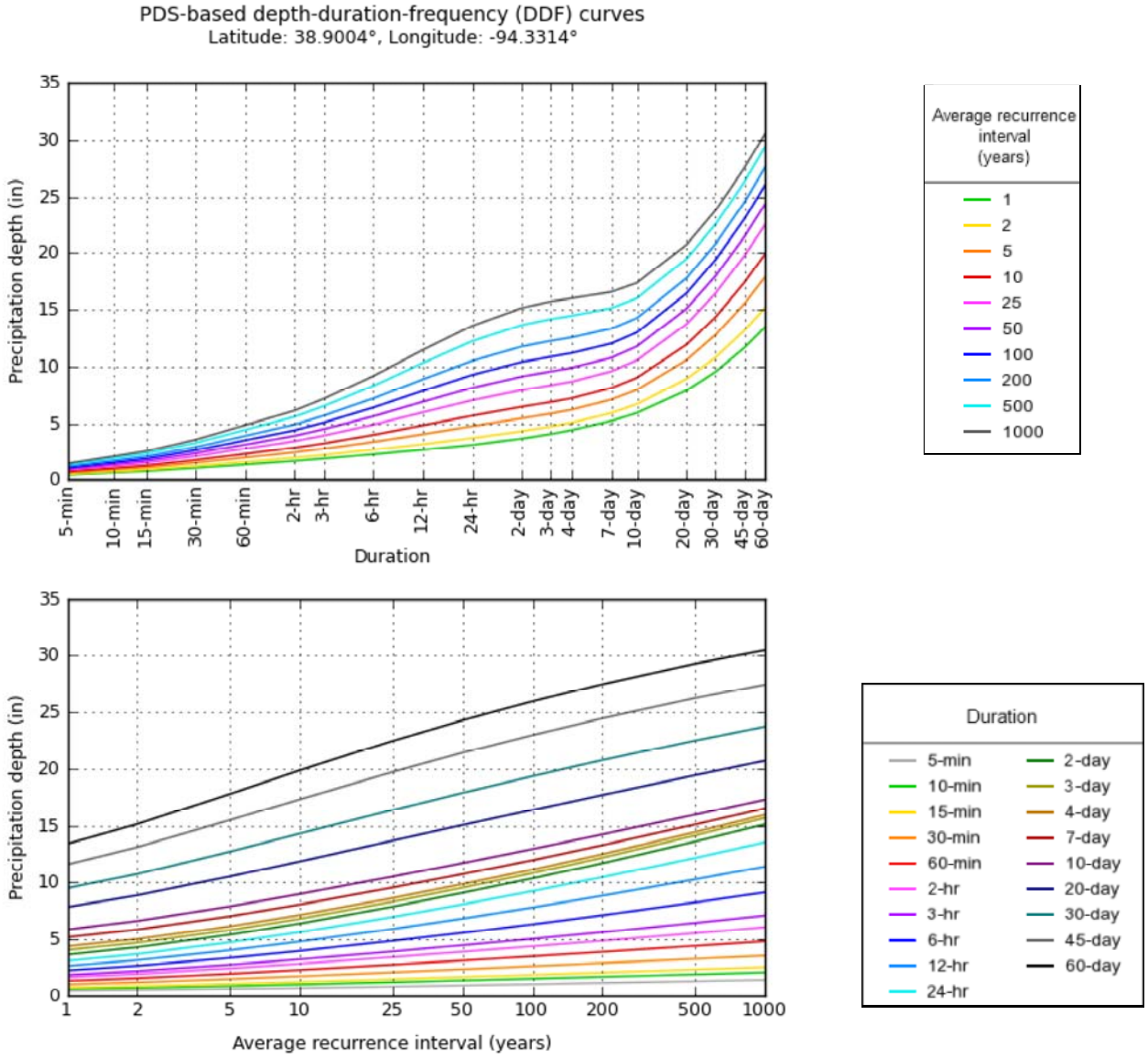
PF graphical



NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Mon Jan 7 21:25:41 2019

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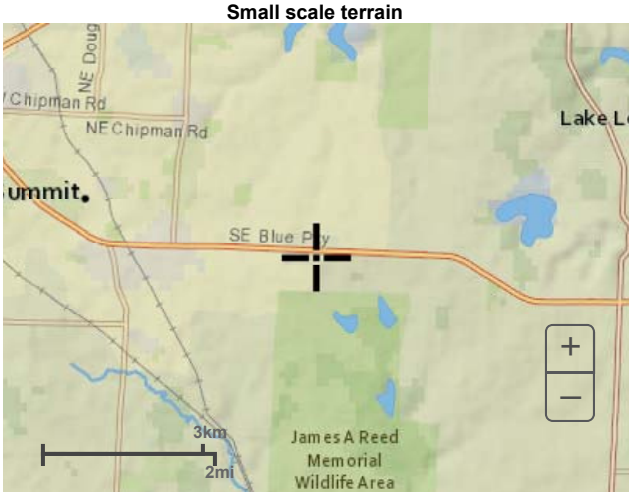
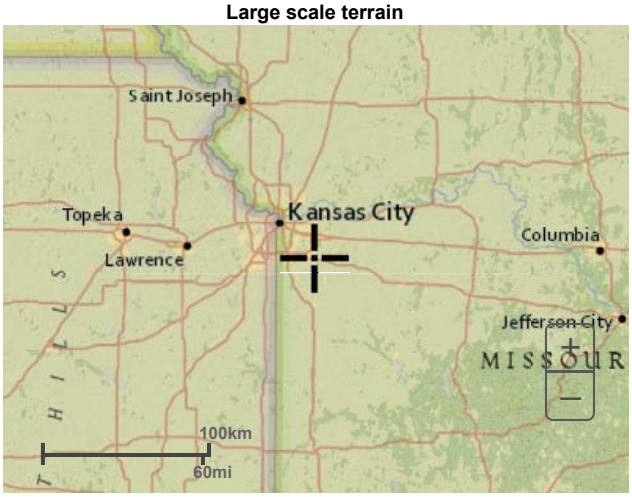
Maps & aerials

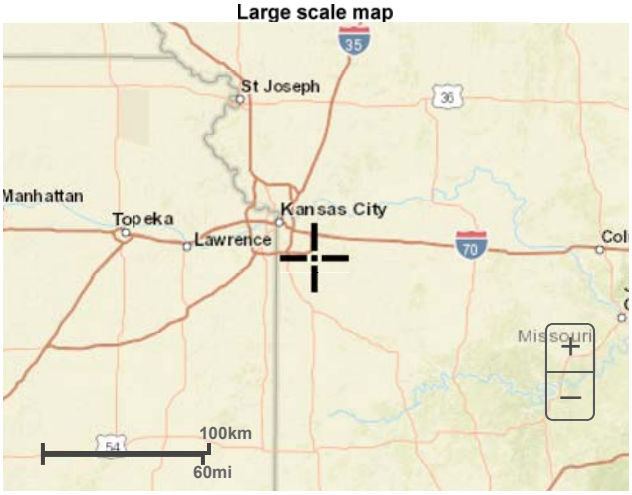
Small scale terrain



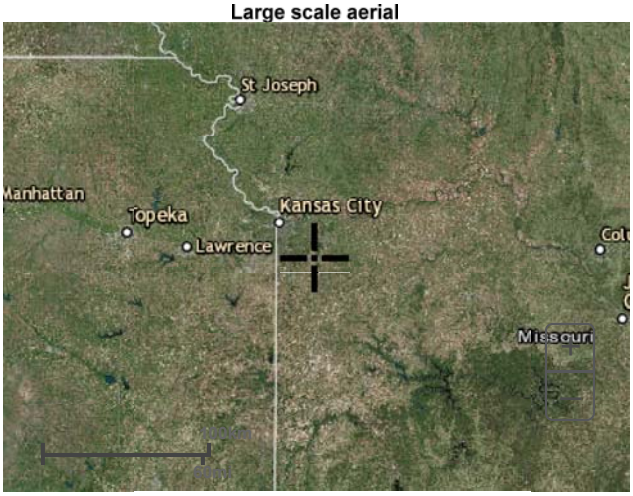
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
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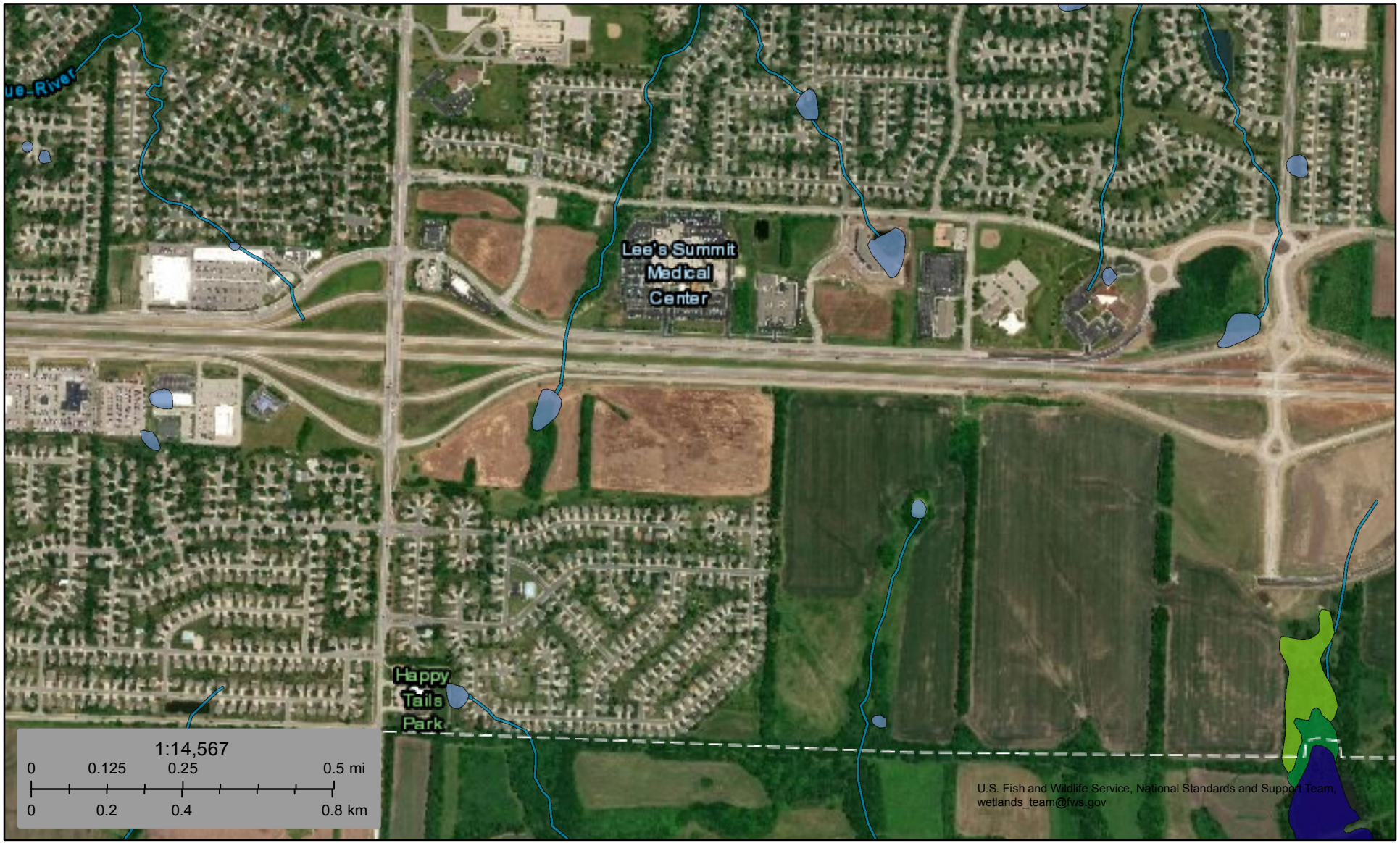
U.S. Fish and Wildlife Service
National Wetlands Inventory

Lee's Summit Senior Community Wetland I



January 15, 2019

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

APPENDIX B

Water Quality Calculations

DA 10 - Water Quality Volume Calculation Worksheet
Short Cut Method (Claytor and Schueler, 1996)
Date: 01/10/2019

Project Name: Lee's Summit Senior Living Facility
Description: DA 10 Water Quality Volume
Drainage Areas to Pond 1

$$WQV\ (ft^3) = (P/12)(R_v)(A*43{,}560)$$

Where

P = rainfall depth = 1.37 inches
R_v = volumetric runoff coefficient = 0.05 + 0.009I
I = percent impervious cover (in percent, e.g. 80% = 80)
A = total site area in acres

P=	1.37	inch
A=	3.09	acres
Impervious Area=	2.02	acres
I=	65	%
Rv=	0.635	

WQV=	**9758**	**cubic feet**
	0.224	ac-ft

DA 20 - Water Quality Volume Calculation Worksheet
Short Cut Method (Claytor and Schueler, 1996)
Date:

Project Name:
Description: DA 20 Water Quality Volume

$$WQV\ (ft^3) = (P/12)(R_v)(A*43{,}560)$$

Where

P = rainfall depth = 1 1.37 inches
R_v = volumetric runoff coefficient = 0.05 + 0.009I
I = percent impervious cover (in percent, e.g. 80% = 80)
A = total site area in acres

P=	1.37	inch
A=	2.52	acres
Impervious Area=	1.34	acres
I=	53	%
Rv=	0.527	

WQV=	**6604**	**cubic feet**
	0.152	ac-ft

DA 30 - Water Quality Volume Calculation Worksheet
Short Cut Method (Claytor and Schueler, 1996)
Date:

Project Name:
Description: **DA 30 Water Quality Volume**

$$WQV\ (ft^3) = (P/12)(R_v)(A*43{,}560)$$

Where

P = rainfall depth = 1 1.37 inches
R_v = volumetric runoff coefficient = 0.05 + 0.009I
I = percent impervious cover (in percent, e.g. 80% = 80)
A = total site area in acres

P=	1.37	inch
A=	4.17	acres
Impervious Area=	1.85	acres
I=	44	%
Rv=	0.446	

WQV=	**9249**	**cubic feet**
	0.212	ac-ft

APPENDIX C

APWA\MARC BMP Level of Service Calculations

WORKSHEET 1: REQUIRED LEVEL OF SERVICE - UNDEVELOPED SITE

Project: By: Date:
Location: Checked: Date:

1. Runoff Curve Number

A. Predevelopment CN

Cover Description	Soil HSG	CN from Table 1	Area (ac.)	Product of CN x Area
Straight Row Crops (GOOD)	C	85	9.78	
		Totals:		

Area-Weighted CN = total product/total area = 85 (Round to integer)

B. Postdevelopment CN

Cover Description	Soil HSG[1]	CN from Table 1	Area (ac.)	Product of CN x Area
PAVEMENT/ROOFS	NA	98	5.21	510.58
OPEN SPACE (TURF,GOOD)	D	80	4.57	365.6
		Totals:	9.78	876.18

[1] Postdevelopment CN is one HSG higher for all cover types except preserved vegetation, absent documentation showing how postdevelopment soil structure will be preserved.

Area-Weighted CN = total product/total area = 90 (Round to integer)

C. Level of Service (LS) Calculation

Predevelopment CN:	85
Postdevelopment CN:	90
Difference:	5
LS Required (see scale at right):	6

Change in CN	LS
17+	8
7 to 16	7
4 to 6	6
1 to 3	5
0	4
-7 to -1	3
-8 to -17	2
-18 to -21	1
-22 -	0

WORKSHEET 2: DEVELOP MITIGATION PACKAGE(S) THAT MEET THE REQUIRED LS

Project: By: Date:
Location: Checked: Date:
Sheet __ of __

1. Required LS (New Development, Wksht 1) or Total VR (Redevelopment, Wksht 1A): 6

Note: Various BMPs may alter CN of proposed development, and LS; recalculate both if applicable.

2. Proposed BMP Option Package No. ___

Cover/BMP Description	Treatment Area	VR from Table 4.4 or 4.6[1]	Product of VR x Area
Extended Dry Detention DA30	4.17	4.0	16.68
Bioretention 1 DA10	3.09	8.5	26.26
Bioretention 2 DA 20	2.52	8.5	21.42
Total[2]:	9.78	**Total:**	64.36
		***Weighted VR:**	6.58

= total product/total a

[1] VR calculated for final BMP only in Treatment Train.
[2] Total treatment area cannot exceed 100 percent of the actual site area.
* Blank In Redevelopment

Meets required LS (Yes/No)? YES (If No, or if additional options are being tested, proceed below.)

3. Proposed BMP Option Package No. ___

Cover/BMP Description	Treatment Area	VR from Table 4.4 or 4.6[1]	Product of VR x Area
Total[2]:		**Total:**	
		***Weighted VR:**	

= total product/total a

[1] VR calculated for final BMP only in Treatment Train.
[2] Total treatment area cannot exceed 100 percent of the actual site area.
* Blank In Redevelopment

Meets required LS (Yes/No)? (If No, or if additional options are being tested, move to next sheet.)

LEE'S SUMMIT SENIOR LIVING COMMUNITY

Lee's Summit, MO - 2019

January 2019

Olsson Project No. 018-1450