STORMWATER ANALYSIS

FOR

STANISLAV OLEKSENKO

SUBDIVISION OF PROPERTY
AT
#11 CONE ROAD
EAST HAMPTON, CONNECTICUT

PREPARED BY

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JANUARY 25, 2020

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PROJECT NARRATIVE

The property fronts along Cone Road and contains 14.766 acres with an existing single family residential dwelling. The eastern part of the site contains extensive wetland areas including a brook corridor that runs north / south thru the property with considerable ground elevation change on the area located west of the brook corridor.

The project proposes to subdivide the parcel into four lots, all to be served by an individual on-site well and subsurface sewage disposal system. The three new lots will be accessed by a shared private driveway, 460 ft long terminating in a large circular turnaround. All the driveways for the new lots will connect to this circular turnaround. Because of the large lots and long driveways, a central storm water collection system throughout the site is not feasible. Each lot will have its own detention basin to collect and store surface water runoff from their respective impervious surface areas (roofs & driveways). A catch basin system with an oil / particle separator and detention basin are located at the low point in the lower section of the of main access driveway which collects all the runoff from the access drive and uphill driveway.

STORMWATER ANALYSIS & METHODOLOGY

The analysis uses the SCS TR-55 program by Intellisolve to generate the various runoff hydrographs and times of concentration using the current NOAA rainfall frequency tables for the East Hampton area for this site. The results of peak flow rates for the 2, 10, and 100 year events have been computed for this analysis for pre & post conditions, the results of which are shown on the following sheets labeled "Hydrograph Summary Report". Time of concentration, Tc, have been determined for each watershed using the TR-55 method. Note that throughout this analysis, basin ID numbers are used for design reference including watersheds.

The water quality volumes (WQV) from runoff of a one inch rainfall of the impervious developed areas have been computed and are significantly lower than computed volumes determined for the 100 year rainfall event sizing of the detention basins.

The design data for the individual catch basins, pipes and the oil / particle separator are shown in table form on the "Site Plan" where they appear. All storm drain pipes use a smooth interior high density polyethylene pipe (HDPE) except where specifically noted otherwise. "V" shaped rip-rap swales are used along the driveways to direct runoff to specific detention basins and are sized for typical applications. Design nomographs were used to determine the capacity and resulting headwater for culverts with "entrance control".

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	0.24	6	756	2,399	----	------	------	Ex. Conditions- Basin #1 Area
2	SCS Runoff	0.88	6	732	4,765	----	------	------	Dev. Condition - Basin #1 Area
3	SCS Runoff	0.03	6	744	289	----	------	------	Ex. Condition- Basin #2 Area
4	SCS Runoff	0.29	6	732	1,279	----	------	------	Dev. Condition- Basin #2 Area
5	SCS Runoff	0.05	6	744	448	----	------	------	Ex. Condition- Basin #3
6	SCS Runoff	0.41	6	732	1,782	----	------	------	Dev. ConditionBasin #3 Area
7	SCS Runoff	0.05	6	744	397	----	------	------	Ex. Condition-Basin #4
8	SCS Runoff	0.34	6	732	1,497	----	------	------	Dev. Condition Basin #4
9	SCS Runoff	0.06	6	744	526	----	------	------	Ex. Condition -Basin #5
10	SCS Runoff	0.32	6	732	1,502	----	------	------	Dev. Condition- Basin #5
11	SCS Runoff	0.08	6	756	821	----	------	------	Ex. Condition-Basin #6
12	SCS Runoff	0.33	6	732	1,737	----	------	------	Dev. Condition Basin #6
13	SCS Runoff	0.11	6	744	820	----	------	------	12 in. Driveway Culvert

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	1.36	6	744	8,478	----	------	------	Ex. Conditions- Basin #1 Area
2	SCS Runoff	2.83	6	732	12,642	----	------	------	Dev. Condition - Basin #1 Area
3	SCS Runoff	0.20	6	732	1,023	----	------	------	Ex. Condition- Basin #2 Area
4	SCS Runoff	0.62	6	732	2,660	----	------	------	Dev. Condition- Basin #2 Area
5	SCS Runoff	0.31	6	732	1,582	----	------	------	Ex. Condition- Basin #3
6	SCS Runoff	0.90	6	732	3,823	----	------	------	Dev. ConditionBasin #3 Area
7	SCS Runoff	0.27	6	732	1,402	----	------	------	Ex. Condition-Basin #4
8	SCS Runoff	0.76	6	732	3,265	----	------	------	Dev. Condition Basin #4
9	SCS Runoff	0.36	6	732	1,858	----	------	------	Ex. Condition -Basin #5
10	SCS Runoff	0.83	6	732	3,580	----	------	------	Dev. Condition- Basin #5
11	SCS Runoff	0.47	6	744	2,900	----	------	------	Ex. Condition-Basin #6
12	SCS Runoff	1.02	6	732	4,503	----	------	------	Dev. Condition Basin #6
13	SCS Runoff	0.55	6	732	2,683	----	------	------	12 in. Driveway Culvert

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	4.09	6	738	22,313	----	------	------	Ex. Conditions- Basin #1 Area
2	SCS Runoff	6.65	6	732	28,455	----	------	------	Dev. Condition - Basin #1 Area
3	SCS Runoff	0.61	6	732	2,692	----	------	------	Ex. Condition- Basin #2 Area
4	SCS Runoff	1.18	6	732	5,105	----	------	------	Dev. Condition- Basin #2 Area
5	SCS Runoff	0.94	6	732	4,164	----	------	------	Ex. Condition- Basin #3
6	SCS Runoff	1.74	6	732	7,497	----	------	------	Dev. ConditionBasin #3 Area
7	SCS Runoff	0.84	6	732	3,690	----	------	------	Ex. Condition-Basin #4
8	SCS Runoff	1.51	6	732	6,474	----	------	------	Dev. Condition Basin #4
9	SCS Runoff	1.11	6	732	4,891	----	------	------	Ex. Condition -Basin #5
10	SCS Runoff	1.77	6	732	7,532	----	------	------	Dev. Condition- Basin #5
11	SCS Runoff	1.40	6	738	7,634	----	------	------	Ex. Condition-Basin #6
12	SCS Runoff	2.34	6	732	9,990	----	------	------	Dev. Condition Basin #6
13	SCS Runoff	1.55	6	732	6,783	----	------	------	12 in. Driveway Culvert

WATERSHED DATA

Project: Oleksenko - 11 Cone Rd Subdiv. Sht No: 1/2
Description: Stormwater Analysis - Watershed Areas Date: 1-22-20

Note - All Soils are Hydr. Group "B"

Basin #1

		RCN
Ex. Conditions - Woods	2.157 ac	55
		Tc = 22.7 min
Proposed Conditions:-		
Woods -	1.326 ac.	55
Pvmt -	0.396 ac.	98
Lawn/Drive Embankment -	0.435 ac.	60
	2.157 ac	
		Tc = 17.6 min.

Basin #2

Ex. Conditions - Woods	0.278 ac	55
		Tc = min
Proposed Conditions -		
Pvmt. -	0.127 ac.	98
Drive Embankment -	0.151 ac.	58
	0.278 ac.	
		Tc = min.

Basin #3

Ex. Conditions - Woods -	0.431 ac.	55
		Tc = min
Proposed Conditions		
Pvmt / Roof	0.166 ac.	98
Lawn -	0.265 ac.	61
	0.431 ac.	Tc = min.

Project: Oleksenko - 11 Cone Rd Sht No: 2/2

Description: Watershed Areas Date: 1-22-2020

Basin #4 RCN

Ex. Conditions - Woods - 0.381 ac. 55

Proposed Conditions Tc= min.

Pvmt/Roof - 0.139 ac. 98

Lawn - 0.242 ac. 61

0.381 ac.

Tc= min.

Basin #5

Ex. Conditions - Woods 0.505 ac 98

Proposed Conditions Tc= min.

Pvmt. - 0.140 ac. 98

Drive Embankment - 0.365 ac. 58

0.505 ac

Tc= min.

Basin #6

Ex. Conditions - Woods - 0.739 ac 55

Proposed Conditions Tc= min.

Pvmt - 0.132 ac. 98

Woods - 0.294 ac.

Drive Embankment - 0.083 ac. Tc= min.

Lawn - 0.23 ac.

0.739 ac.

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NOAA Atlas 14, Volume 10, Version 3
Location name: East Hampton, Connecticut, USA*
Latitude: 41.5707°, Longitude: -72.5367°
Elevation: 461.51 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

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	0.334 (0.260-0.417)	0.405 (0.315-0.507)	0.522 (0.404-0.655)	0.619 (0.476-0.782)	0.752 (0.561-0.990)	0.852 (0.623-1.15)	0.957 (0.680-1.33)	1.07 (0.724-1.53)	1.24 (0.805-1.83)	1.38 (0.874-2.07)
10-min	0.473 (0.368-0.591)	0.574 (0.446-0.718)	0.739 (0.573-0.928)	0.876 (0.675-1.11)	1.07 (0.794-1.40)	1.21 (0.883-1.62)	1.36 (0.963-1.89)	1.52 (1.02-2.17)	1.76 (1.14-2.59)	1.96 (1.24-2.93)
15-min	0.556 (0.433-0.696)	0.675 (0.525-0.845)	0.870 (0.674-1.09)	1.03 (0.794-1.30)	1.25 (0.934-1.65)	1.42 (1.04-1.91)	1.60 (1.13-2.22)	1.79 (1.21-2.55)	2.07 (1.34-3.05)	2.30 (1.46-3.45)
30-min	0.760 (0.592-0.951)	0.922 (0.717-1.15)	1.19 (0.919-1.49)	1.41 (1.08-1.78)	1.71 (1.27-2.25)	1.94 (1.42-2.60)	2.17 (1.54-3.03)	2.44 (1.64-3.48)	2.82 (1.83-4.15)	3.14 (1.98-4.70)
60-min	0.964 (0.750-1.21)	1.17 (0.909-1.46)	1.50 (1.17-1.89)	1.78 (1.37-2.25)	2.16 (1.61-2.85)	2.45 (1.79-3.30)	2.75 (1.96-3.84)	3.09 (2.08-4.40)	3.57 (2.32-5.26)	3.97 (2.51-5.96)
2-hr	1.28 (1.00-1.59)	1.54 (1.20-1.91)	1.96 (1.53-2.44)	2.31 (1.79-2.89)	2.79 (2.10-3.65)	3.15 (2.32-4.21)	3.53 (2.53-4.91)	3.98 (2.69-5.61)	4.63 (3.01-6.76)	5.18 (3.29-7.70)
3-hr	1.49 (1.18-1.85)	1.79 (1.41-2.21)	2.27 (1.79-2.82)	2.67 (2.09-3.34)	3.23 (2.44-4.21)	3.64 (2.70-4.85)	4.08 (2.94-5.65)	4.60 (3.12-6.46)	5.37 (3.50-7.81)	6.02 (3.83-8.92)
6-hr	1.91 (1.52-2.34)	2.29 (1.82-2.81)	2.90 (2.30-3.58)	3.42 (2.69-4.23)	4.12 (3.14-5.34)	4.65 (3.47-6.16)	5.21 (3.79-7.18)	5.88 (4.01-8.20)	6.90 (4.51-9.94)	7.76 (4.95-11.4)
12-hr	2.36 (1.90-2.88)	2.85 (2.29-3.47)	3.64 (2.91-4.45)	4.30 (3.41-5.29)	5.20 (4.00-6.69)	5.88 (4.42-7.73)	6.60 (4.82-9.02)	7.46 (5.11-10.3)	8.77 (5.75-12.5)	9.88 (6.32-14.4)
24-hr	2.78 (2.25-3.36)	3.38 (2.74-4.10)	4.38 (3.53-5.32)	5.20 (4.17-6.35)	6.34 (4.91-8.11)	7.18 (5.45-9.39)	8.09 (5.97-11.0)	9.21 (6.32-12.6)	10.9 (7.18-15.5)	12.4 (7.95-17.9)
2-day	3.12 (2.55-3.74)	3.85 (3.15-4.63)	5.06 (4.12-6.10)	6.06 (4.90-7.34)	7.44 (5.82-9.47)	8.45 (6.48-11.0)	9.56 (7.14-13.0)	11.0 (7.56-14.9)	13.2 (8.71-18.5)	15.1 (9.75-21.7)
3-day	3.38 (2.78-4.05)	4.19 (3.44-5.02)	5.52 (4.51-6.62)	6.61 (5.37-7.98)	8.12 (6.39-10.3)	9.23 (7.11-12.0)	10.4 (7.84-14.2)	12.0 (8.30-16.3)	14.5 (9.59-20.3)	16.7 (10.8-23.7)
4-day	3.63 (3.00-4.33)	4.49 (3.70-5.35)	5.89 (4.84-7.05)	7.06 (5.76-8.49)	8.66 (6.83-11.0)	9.84 (7.60-12.7)	11.1 (8.37-15.1)	12.8 (8.86-17.3)	15.4 (10.2-21.5)	17.8 (11.5-25.2)
7-day	4.31 (3.59-5.11)	5.27 (4.38-6.25)	6.84 (5.66-8.14)	8.15 (6.69-9.74)	9.94 (7.88-12.5)	11.3 (8.74-14.4)	12.7 (9.57-17.0)	14.5 (10.1-19.5)	17.4 (11.6-24.1)	19.9 (12.9-28.0)
10-day	5.00 (4.18-5.90)	6.02 (5.02-7.11)	7.68 (6.39-9.10)	9.06 (7.48-10.8)	11.0 (8.72-13.7)	12.4 (9.61-15.7)	13.9 (10.5-18.4)	15.8 (11.0-21.0)	18.7 (12.4-25.7)	21.2 (13.7-29.6)
20-day	7.18 (6.06-8.41)	8.28 (6.97-9.70)	10.1 (8.44-11.8)	11.6 (9.62-13.7)	13.6 (10.9-16.7)	15.1 (11.8-18.9)	16.7 (12.6-21.7)	18.6 (13.1-24.5)	21.2 (14.2-28.9)	23.4 (15.2-32.5)
30-day	9.03 (7.66-10.5)	10.2 (8.61-11.9)	12.0 (10.1-14.1)	13.5 (11.3-15.9)	15.7 (12.6-19.1)	17.3 (13.5-21.4)	18.9 (14.2-24.2)	20.7 (14.6-27.1)	23.0 (15.5-31.2)	24.9 (16.2-34.4)
45-day	11.3 (9.67-13.2)	12.5 (10.7-14.5)	14.4 (12.2-16.8)	16.0 (13.5-18.8)	18.2 (14.7-22.0)	19.9 (15.6-24.5)	21.6 (16.1-27.2)	23.3 (16.5-30.3)	25.4 (17.1-34.1)	26.9 (17.6-36.9)
60-day	13.3 (11.4-15.3)	14.5 (12.4-16.8)	16.5 (14.0-19.1)	18.1 (15.3-21.2)	20.4 (16.5-24.5)	22.2 (17.4-27.1)	23.9 (17.8-29.9)	25.5 (18.1-33.1)	27.4 (18.5-36.7)	28.7 (18.8-39.3)

[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

$$T_t = \frac{0.007\ (nL)^{0.8}}{(P_2)^{0.5}\ s^{0.4}} \qquad \text{[Eq. 3-3]}$$

Table 3-1.—Roughness coefficients (Manning's n) for sheet flow

Surface description	n[1]
Smooth surfaces (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses[2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods:[3]	
Light underbrush	0.40
Dense underbrush	0.80

[1]The n values are a composite of information compiled by Engman (1986).
[2]Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3]When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

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TR55 Tc Worksheet

Hyd. No. 2

Dev. Condition - Basin #1 Area

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.350		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.38		0.00		0.00		
Land slope (%)	= 6.67		0.00		0.00		
Travel Time (min)	**= 16.04**	**+**	**0.00**	**+**	**0.00**	**=**	**16.04**
Shallow Concentrated Flow							
Flow length (ft)	= 578.00		0.00		0.00		
Watercourse slope (%)	= 9.34		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 6.21		0.00		0.00		
Travel Time (min)	**= 1.55**	**+**	**0.00**	**+**	**0.00**	**=**	**1.55**
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 17.59 min

TR55 Tc Worksheet

Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

Ex. Conditions- Basin #1 Area

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.600	0.011	0.011	
Flow length (ft)	= 120.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.38	0.00	0.00	
Land slope (%)	= 6.67	0.00	0.00	
Travel Time (min)	**= 20.65**	**+ 0.00**	**+ 0.00**	**= 20.65**
Shallow Concentrated Flow				
Flow length (ft)	= 608.00	0.00	0.00	
Watercourse slope (%)	= 9.34	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 4.93	0.00	0.00	
Travel Time (min)	**= 2.06**	**+ 0.00**	**+ 0.00**	**= 2.06**
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	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... 22.71 min

TR55 Tc Worksheet

Hyd. No. 3

Ex. Condition- Basin #2 Area

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.600		0.011		0.011		
Flow length (ft)	=	100.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.38		0.00		0.00		
Land slope (%)	=	8.00		0.00		0.00		
Travel Time (min)	=	**16.60**	+	**0.00**	+	**0.00**	=	**16.60**
Shallow Concentrated Flow								
Flow length (ft)	=	160.00		80.00		0.00		
Watercourse slope (%)	=	5.00		1.50		0.00		
Surface description	=	Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=	3.61		1.98		0.00		
Travel Time (min)	=	**0.74**	+	**0.67**	+	**0.00**	=	**1.41**
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		
Travel Time (min)	=	**0.00**	+	**0.00**	+	**0.00**	=	**0.00**

Total Travel Time, Tc ..... 18.01 min

TR55 Tc Worksheet

Hyd. No. 4

Dev. Condition- Basin #2 Area

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.38		0.00		0.00		
Land slope (%)	= 6.00		0.00		0.00		
Travel Time (min)	**= 0.44**	**+**	**0.00**	**+**	**0.00**	**=**	**0.44**
Shallow Concentrated Flow							
Flow length (ft)	= 310.00		0.00		0.00		
Watercourse slope (%)	= 8.71		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 6.00		0.00		0.00		
Travel Time (min)	**= 0.86**	**+**	**0.00**	**+**	**0.00**	**=**	**0.86**
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 1.30 min

TR55 Tc Worksheet

Hyd. No. 5

Ex. Condition- Basin #3

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.600		0.011		0.011		
Flow length (ft)	= 120.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.38		0.00		0.00		
Land slope (%)	= 11.30		0.00		0.00		
Travel Time (min)	**= 16.73**	**+**	**0.00**	**+**	**0.00**	**=**	**16.73**
Shallow Concentrated Flow							
Flow length (ft)	= 280.00		0.00		0.00		
Watercourse slope (%)	= 6.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 3.95		0.00		0.00		
Travel Time (min)	**= 1.18**	**+**	**0.00**	**+**	**0.00**	**=**	**1.18**
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 17.91 min

TR55 Tc Worksheet

Hyd. No. 6

Dev. ConditionBasin #3 Area

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.350		0.011		0.011		
Flow length (ft)	= 70.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.38		0.00		0.00		
Land slope (%)	= 14.30		0.00		0.00		
Travel Time (min)	**= 6.43**	**+**	**0.00**	**+**	**0.00**	**=**	**6.43**
Shallow Concentrated Flow							
Flow length (ft)	= 105.00		295.00		0.00		
Watercourse slope (%)	= 3.81		5.42		0.00		
Surface description	= Paved		Unpaved		Paved		
Average velocity (ft/s)	= 3.97		3.76		0.00		
Travel Time (min)	**= 0.44**	**+**	**1.31**	**+**	**0.00**	**=**	**1.75**
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 8.18 min

TR55 Tc Worksheet

Hyd. No. 7

Ex. Condition-Basin #4

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.600		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.38		0.00		0.00		
Land slope (%)	= 11.00		0.00		0.00		
Travel Time (min)	**= 14.61**	**+**	**0.00**	**+**	**0.00**	**=**	**14.61**
Shallow Concentrated Flow							
Flow length (ft)	= 140.00		0.00		0.00		
Watercourse slope (%)	= 13.60		0.00		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	= 5.95		0.00		0.00		
Travel Time (min)	**= 0.39**	**+**	**0.00**	**+**	**0.00**	**=**	**0.39**
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 15.01 min

TR55 Tc Worksheet

Hyd. No. 8

Dev. Condition Basin #4

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.38		0.00		0.00		
Land slope (%)	= 12.00		0.00		0.00		
Travel Time (min)	**= 0.58**	**+**	**0.00**	**+**	**0.00**	**=**	**0.58**
Shallow Concentrated Flow							
Flow length (ft)	= 125.00		35.00		0.00		
Watercourse slope (%)	= 14.40		5.70		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	= 6.12		3.85		0.00		
Travel Time (min)	**= 0.34**	**+**	**0.15**	**+**	**0.00**	**=**	**0.49**
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 1.07 min

TR55 Tc Worksheet

Hyd. No. 9

Ex. Condition -Basin #5

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.600		0.011		0.011		
Flow length (ft)	= 120.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.38		0.00		0.00		
Land slope (%)	= 14.10		0.00		0.00		
Travel Time (min)	**= 15.31**	**+**	**0.00**	**+**	**0.00**	**=**	**15.31**
Shallow Concentrated Flow							
Flow length (ft)	= 260.00		0.00		0.00		
Watercourse slope (%)	= 6.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 4.11		0.00		0.00		
Travel Time (min)	**= 1.05**	**+**	**0.00**	**+**	**0.00**	**=**	**1.05**
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 16.36 min

TR55 Tc Worksheet

Hyd. No. 10

Dev. Condition- Basin #5

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.350		0.011		0.011		
Flow length (ft)	= 30.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.38		0.00		0.00		
Land slope (%)	= 20.00		0.00		0.00		
Travel Time (min)	**= 2.85**	**+**	**0.00**	**+**	**0.00**	**=**	**2.85**
Shallow Concentrated Flow							
Flow length (ft)	= 140.00		20.00		230.00		
Watercourse slope (%)	= 5.71		30.00		6.95		
Surface description	= Paved		Unpaved		Unpaved		
Average velocity (ft/s)	= 4.86		8.84		4.25		
Travel Time (min)	**= 0.48**	**+**	**0.04**	**+**	**0.90**	**=**	**1.42**
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 4.27 min

TR55 Tc Worksheet

Hyd. No. 11

Ex. Condition-Basin #6

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.600		0.011		0.011		
Flow length (ft)	= 120.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.38		0.00		0.00		
Land slope (%)	= 5.00		0.00		0.00		
Travel Time (min)	**= 23.18**	**+**	**0.00**	**+**	**0.00**	**=**	**23.18**
Shallow Concentrated Flow							
Flow length (ft)	= 140.00		0.00		0.00		
Watercourse slope (%)	= 14.30		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 6.10		0.00		0.00		
Travel Time (min)	**= 0.38**	**+**	**0.00**	**+**	**0.00**	**=**	**0.38**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 23.56 min

TR55 Tc Worksheet

Hyd. No. 12

Dev. Condition Basin #6

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.350		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.38		0.00		0.00		
Land slope (%)	= 10.00		0.00		0.00		
Travel Time (min)	**= 5.67**	**+**	**0.00**	**+**	**0.00**	**=**	**5.67**
Shallow Concentrated Flow							
Flow length (ft)	= 242.00		0.00		0.00		
Watercourse slope (%)	= 8.30		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 4.65		0.00		0.00		
Travel Time (min)	**= 0.87**	**+**	**0.00**	**+**	**0.00**	**=**	**0.87**
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 6.53 min

TR55 Tc Worksheet

Hyd. No. 13

12 in. Driveway Culvert

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.480		0.011		0.011		
Flow length (ft)	= 120.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.38		0.00		0.00		
Land slope (%)	= 6.70		0.00		0.00		
Travel Time (min)	**= 17.25**	**+**	**0.00**	**+**	**0.00**	**=**	**17.25**
Shallow Concentrated Flow							
Flow length (ft)	= 260.00		0.00		0.00		
Watercourse slope (%)	= 12.30		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 5.66		0.00		0.00		
Travel Time (min)	**= 0.77**	**+**	**0.00**	**+**	**0.00**	**=**	**0.77**
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		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 18.01 min

PRE & POST DEVELOPMENT

RUNOFF HYDROGRAPHS

FRANK C. MAGNOTTA, P.E.

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	0.24	6	756	2,399	---	-----	-----	Ex. Conditions- Basin #1 Area
2	SCS Runoff	0.88	6	732	4,765	---	-----	-----	Dev. Condition - Basin #1 Area
3	SCS Runoff	0.03	6	744	289	---	-----	-----	Ex. Condition- Basin #2 Area
4	SCS Runoff	0.29	6	732	1,279	---	-----	-----	Dev. Condition- Basin #2 Area
5	SCS Runoff	0.05	6	744	448	---	-----	-----	Ex. Condition- Basin #3
6	SCS Runoff	0.41	6	732	1,782	---	-----	-----	Dev. ConditionBasin #3 Area
7	SCS Runoff	0.05	6	744	397	---	-----	-----	Ex. Condition-Basin #4
8	SCS Runoff	0.34	6	732	1,497	---	-----	-----	Dev. Condition Basin #4
9	SCS Runoff	0.06	6	744	526	---	-----	-----	Ex. Condition -Basin #5
10	SCS Runoff	0.32	6	732	1,502	---	-----	-----	Dev. Condition- Basin #5
11	SCS Runoff	0.08	6	756	821	---	-----	-----	Ex. Condition-Basin #6
12	SCS Runoff	0.33	6	732	1,737	---	-----	-----	Dev. Condition Basin #6
13	SCS Runoff	0.11	6	744	820	---	-----	-----	12 in. Driveway Culvert

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	1.36	6	744	8,478	----	------	------	Ex. Conditions- Basin #1 Area
2	SCS Runoff	2.83	6	732	12,642	----	------	------	Dev. Condition - Basin #1 Area
3	SCS Runoff	0.20	6	732	1,023	----	------	------	Ex. Condition- Basin #2 Area
4	SCS Runoff	0.62	6	732	2,660	----	------	------	Dev. Condition- Basin #2 Area
5	SCS Runoff	0.31	6	732	1,582	----	------	------	Ex. Condition- Basin #3
6	SCS Runoff	0.90	6	732	3,823	----	------	------	Dev. ConditionBasin #3 Area
7	SCS Runoff	0.27	6	732	1,402	----	------	------	Ex. Condition-Basin #4
8	SCS Runoff	0.76	6	732	3,265	----	------	------	Dev. Condition Basin #4
9	SCS Runoff	0.36	6	732	1,858	----	------	------	Ex. Condition -Basin #5
10	SCS Runoff	0.83	6	732	3,580	----	------	------	Dev. Condition- Basin #5
11	SCS Runoff	0.47	6	744	2,900	----	------	------	Ex. Condition-Basin #6
12	SCS Runoff	1.02	6	732	4,503	----	------	------	Dev. Condition Basin #6
13	SCS Runoff	0.55	6	732	2,683	----	------	------	12 in. Driveway Culvert

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	4.09	6	738	22,313	---	----	----	Ex. Conditions- Basin #1 Area
2	SCS Runoff	6.65	6	732	28,455	---	----	----	Dev. Condition - Basin #1 Area
3	SCS Runoff	0.61	6	732	2,692	---	----	----	Ex. Condition- Basin #2 Area
4	SCS Runoff	1.18	6	732	5,105	---	----	----	Dev. Condition- Basin #2 Area
5	SCS Runoff	0.94	6	732	4,164	---	----	----	Ex. Condition- Basin #3
6	SCS Runoff	1.74	6	732	7,497	---	----	----	Dev. ConditionBasin #3 Area
7	SCS Runoff	0.84	6	732	3,690	---	----	----	Ex. Condition-Basin #4
8	SCS Runoff	1.51	6	732	6,474	---	----	----	Dev. Condition Basin #4
9	SCS Runoff	1.11	6	732	4,891	---	----	----	Ex. Condition -Basin #5
10	SCS Runoff	1.77	6	732	7,532	---	----	----	Dev. Condition- Basin #5
11	SCS Runoff	1.40	6	738	7,634	---	----	----	Ex. Condition-Basin #6
12	SCS Runoff	2.34	6	732	9,990	---	----	----	Dev. Condition Basin #6
13	SCS Runoff	1.55	6	732	6,783	---	----	----	12 in. Driveway Culvert

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

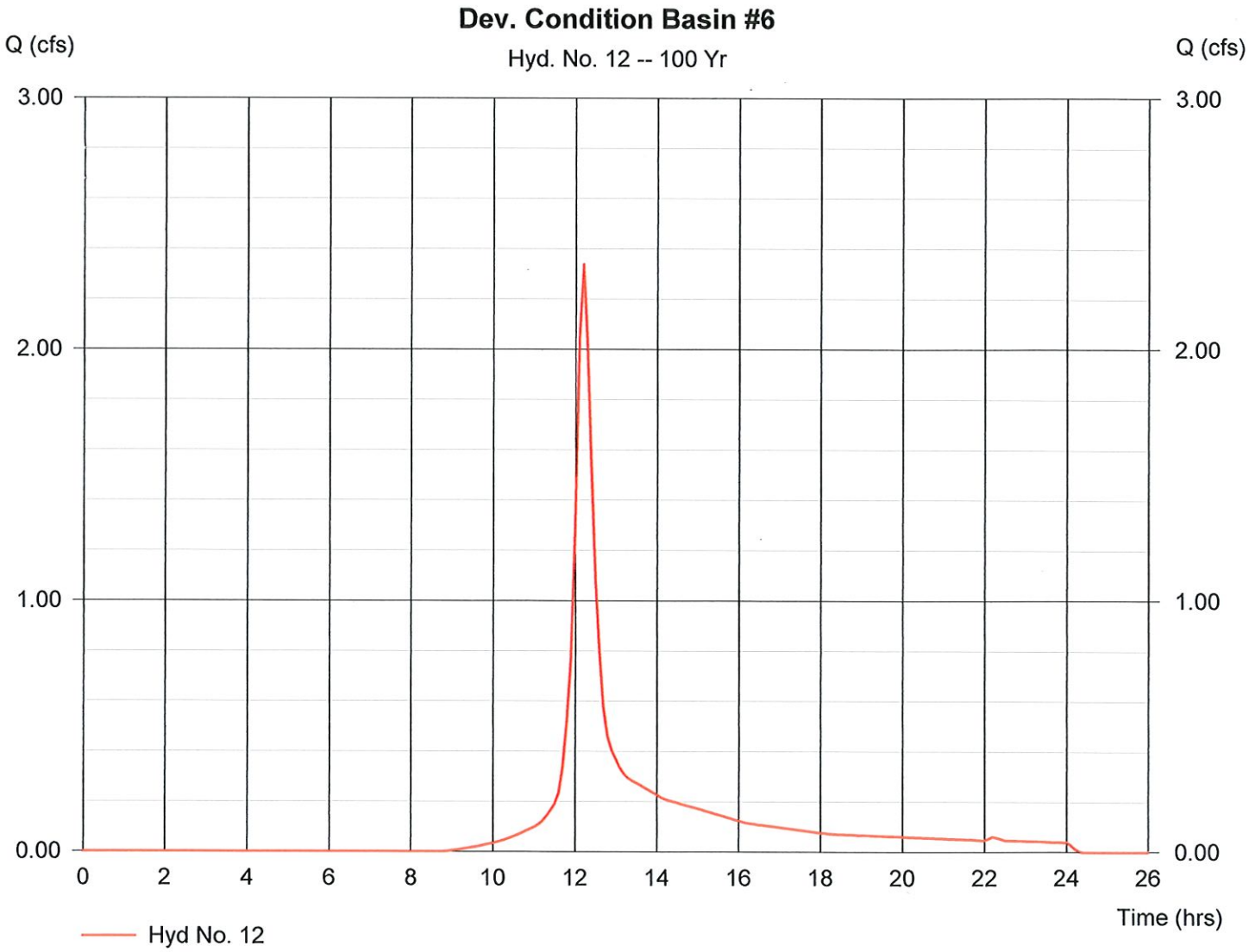
Wednesday, Jan 22 2020, 7:45 PM

Hyd. No. 12

Dev. Condition Basin #6

Hydrograph type	= SCS Runoff	Peak discharge	= 2.34 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.74 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 9,990 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

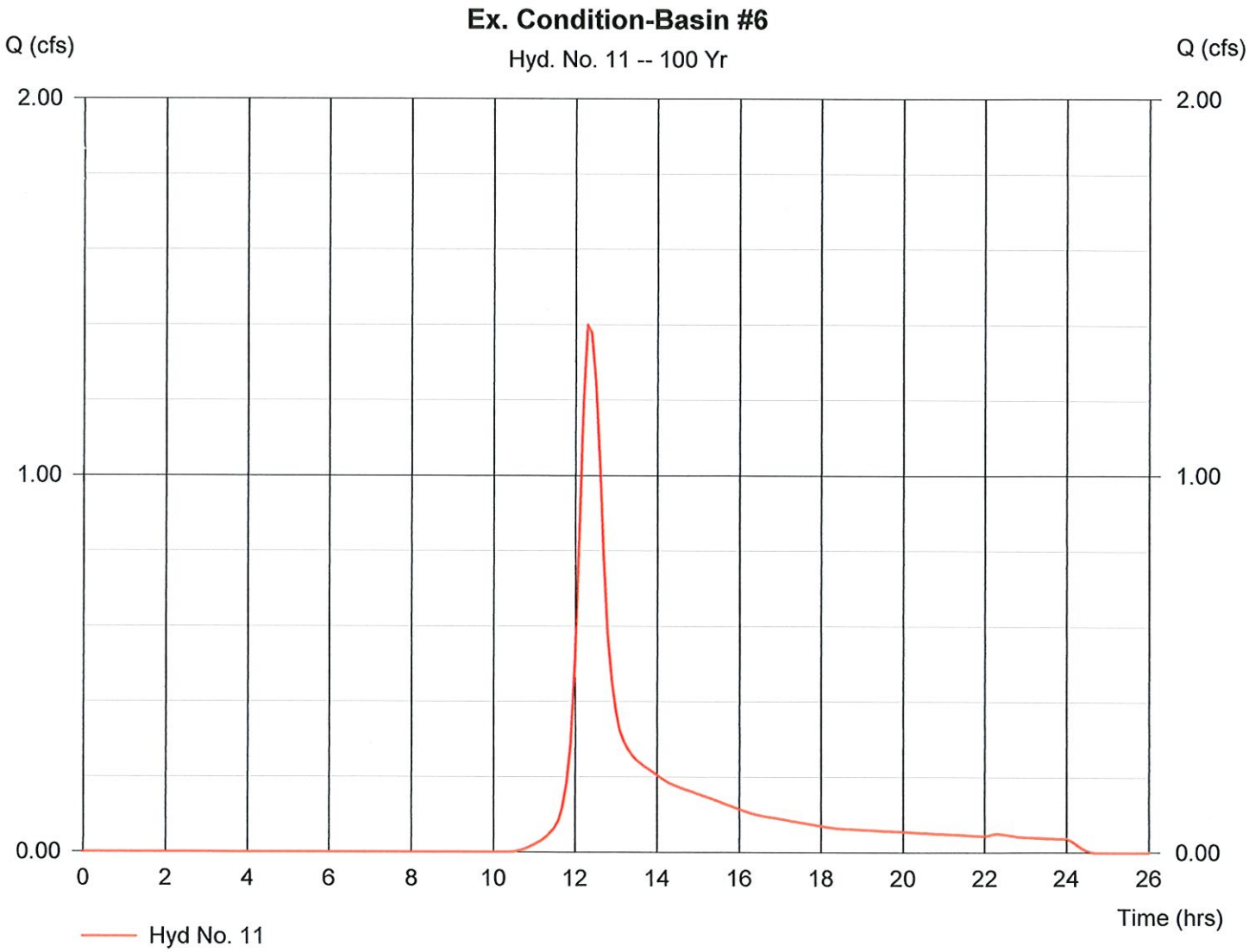
Wednesday, Jan 22 2020, 7:45 PM

Hyd. No. 11

Ex. Condition-Basin #6

Hydrograph type	= SCS Runoff	Peak discharge	= 1.40 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.74 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 23.6 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 7,634 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

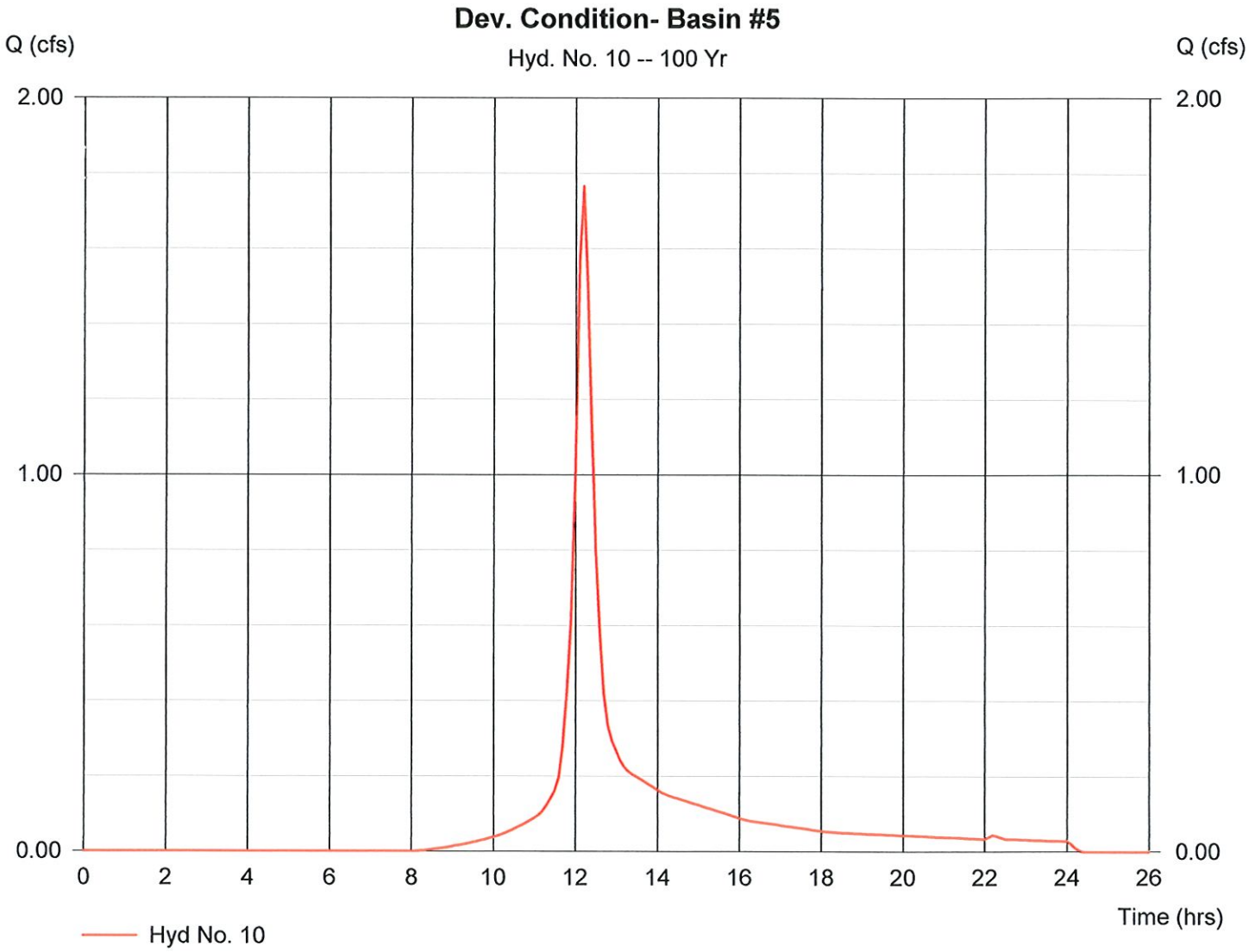
Wednesday, Jan 22 2020, 7:45 PM

Hyd. No. 10

Dev. Condition- Basin #5

Hydrograph type	= SCS Runoff	Peak discharge	= 1.77 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.50 ac	Curve number	= 69
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 7,532 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

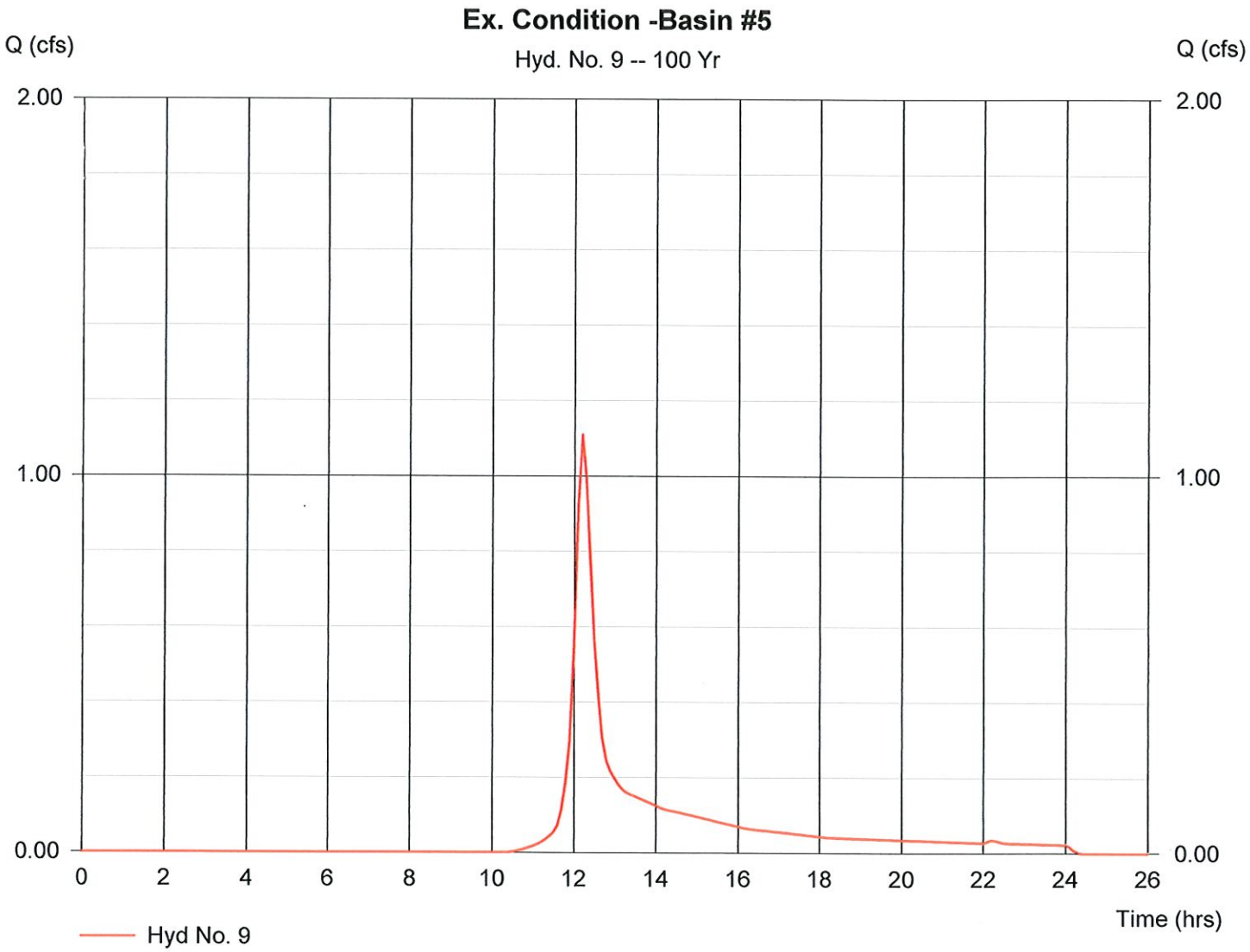
Wednesday, Jan 22 2020, 7:45 PM

Hyd. No. 9

Ex. Condition -Basin #5

Hydrograph type	= SCS Runoff	Peak discharge	= 1.11 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.51 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.4 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,891 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

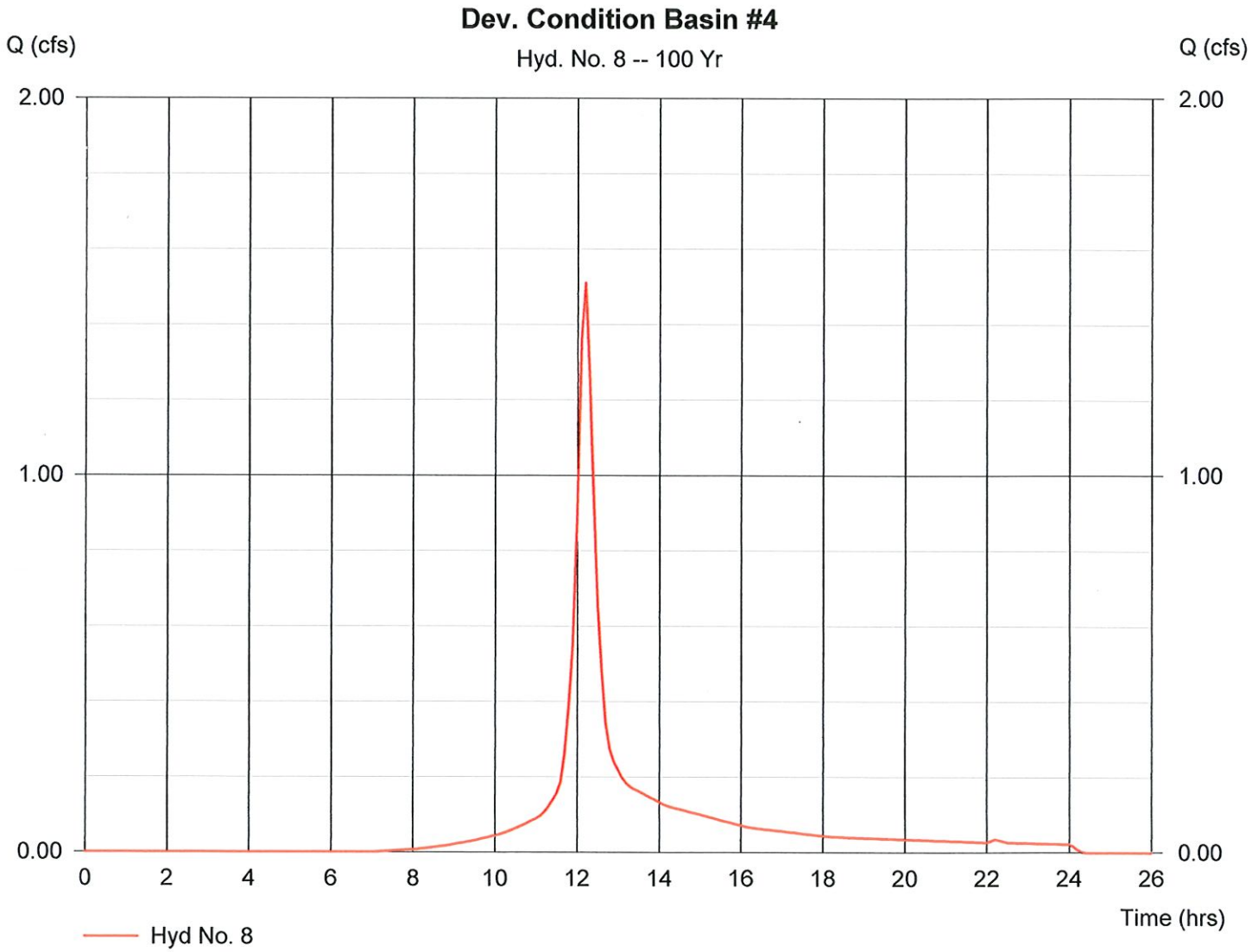
Wednesday, Jan 22 2020, 7:45 PM

Hyd. No. 8

Dev. Condition Basin #4

Hydrograph type	= SCS Runoff	Peak discharge	= 1.51 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.38 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,474 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

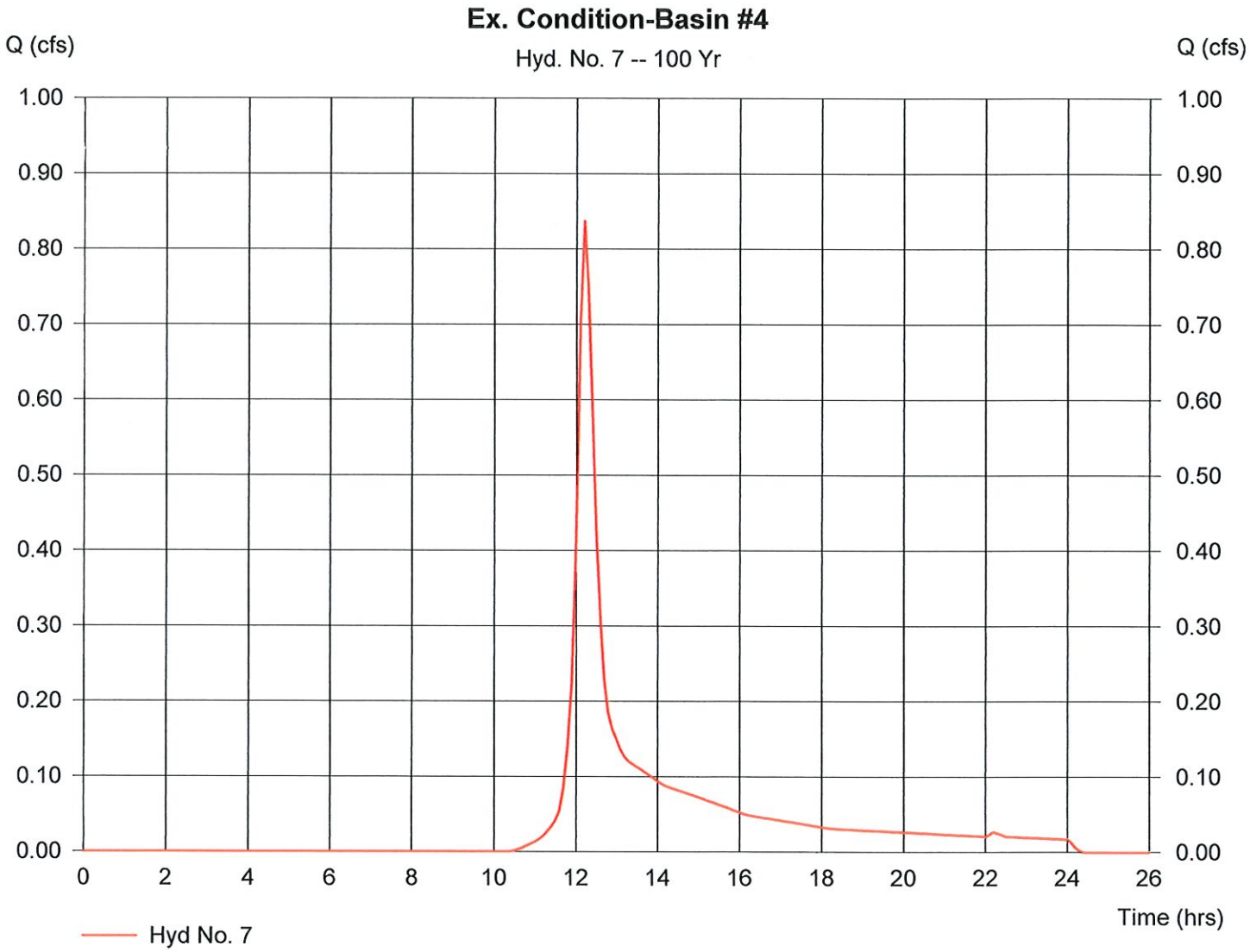
Wednesday, Jan 22 2020, 7:45 PM

Hyd. No. 7

Ex. Condition-Basin #4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.84 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.38 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.00567 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,690 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

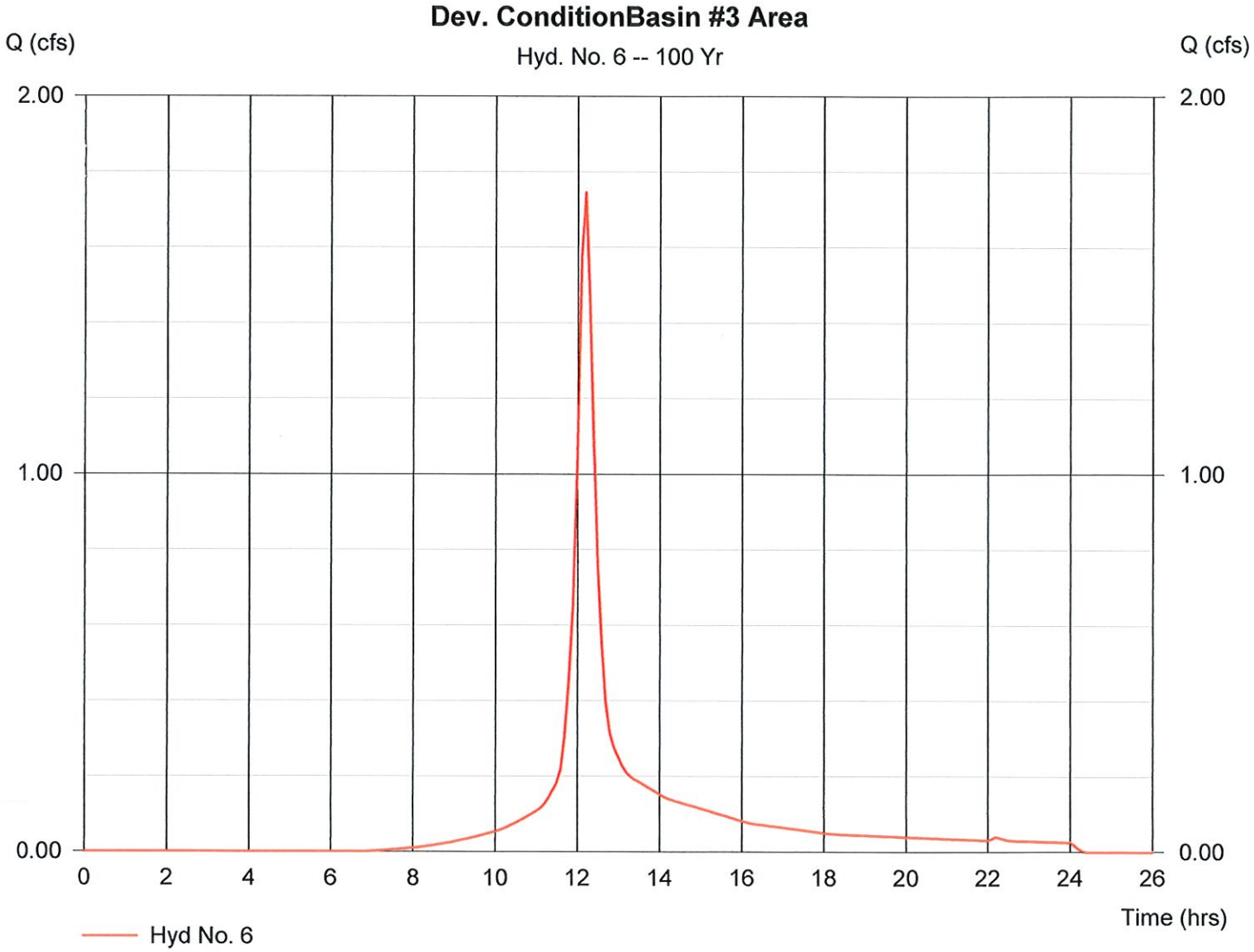
Wednesday, Jan 22 2020, 7:45 PM

Hyd. No. 6

Dev. ConditionBasin #3 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 1.74 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.43 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 7,497 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

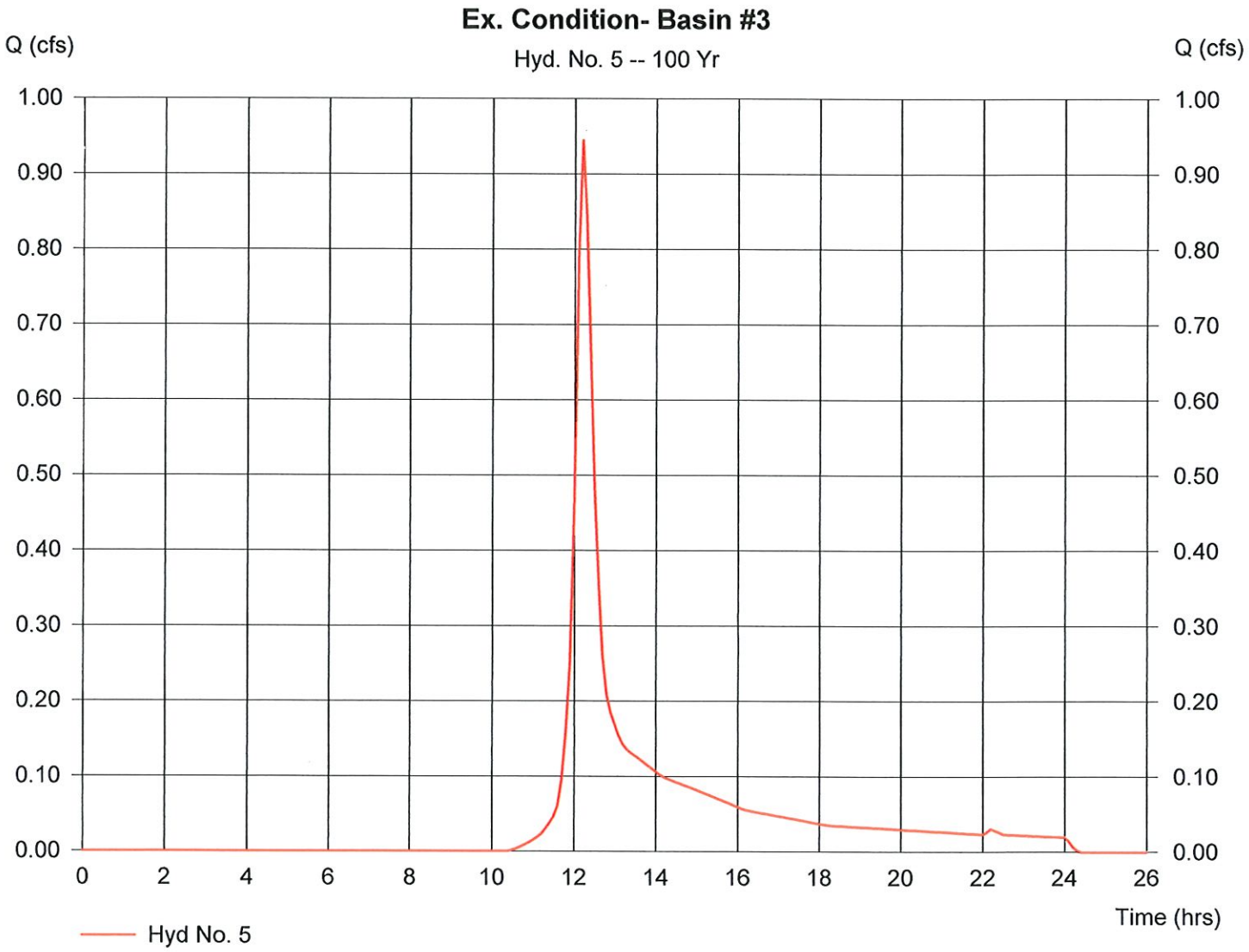
Wednesday, Jan 22 2020, 7:45 PM

Hyd. No. 5

Ex. Condition- Basin #3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.94 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.43 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.9 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,164 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

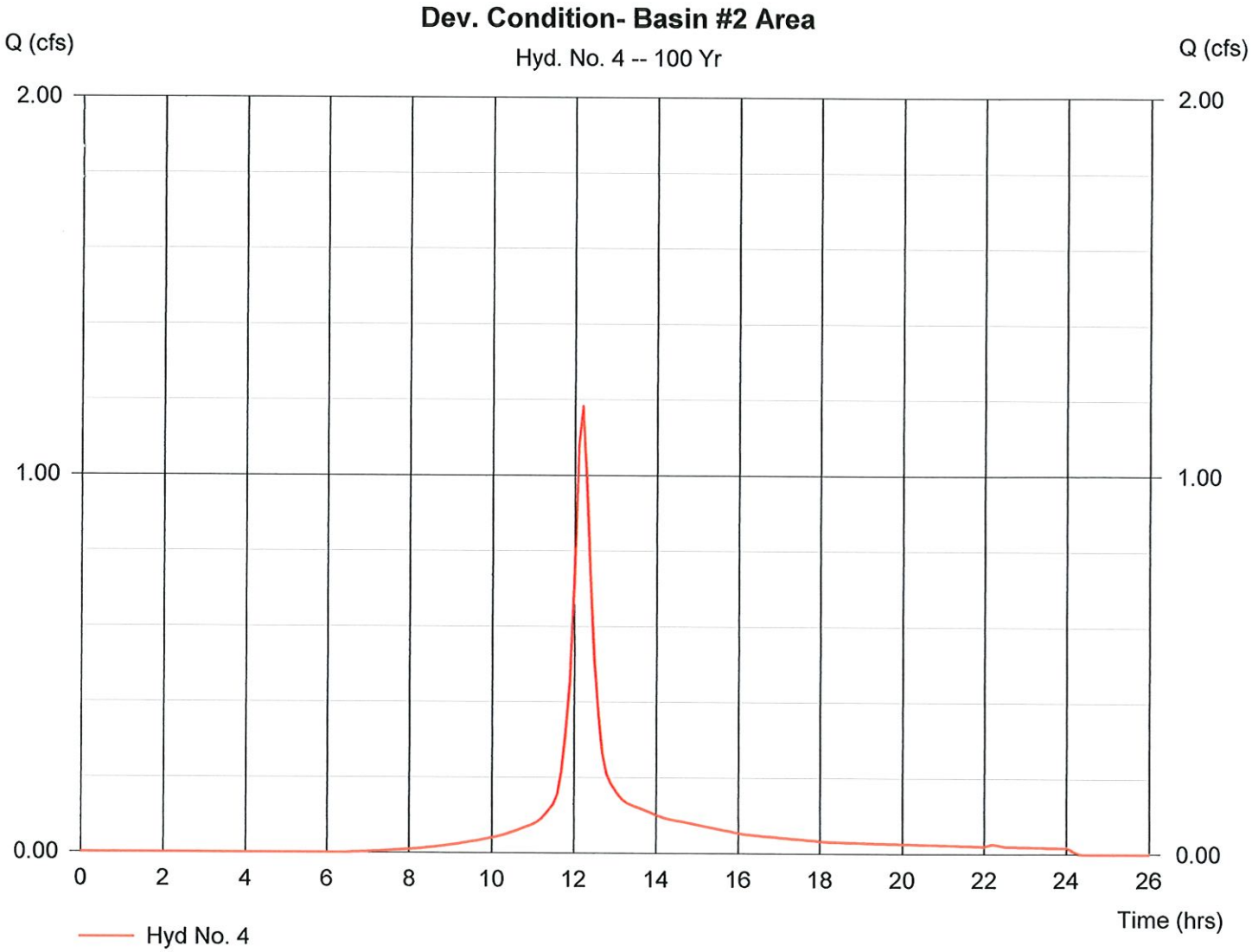
Wednesday, Jan 22 2020, 7:45 PM

Hyd. No. 4

Dev. Condition- Basin #2 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 1.18 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.28 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 5,105 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

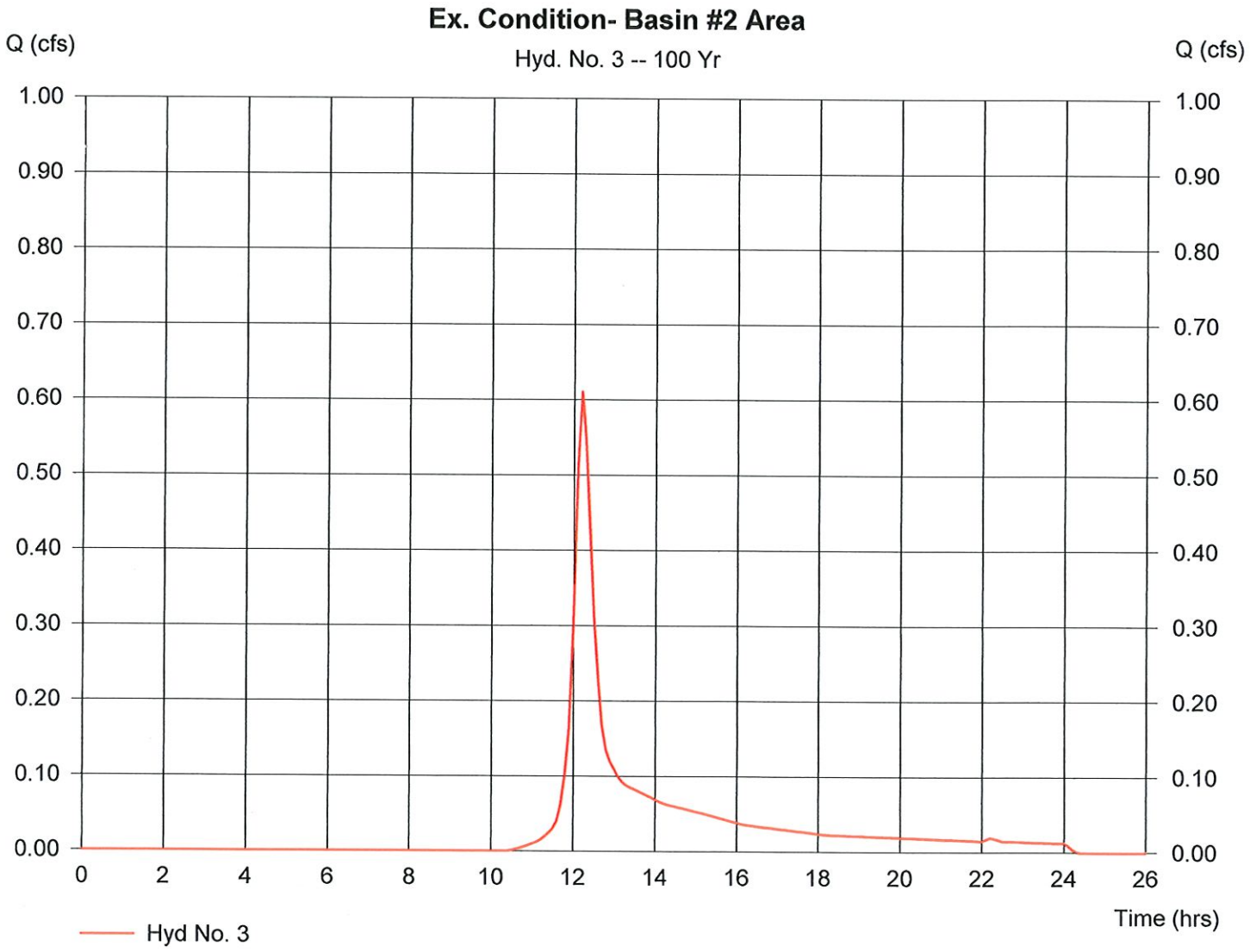
Wednesday, Jan 22 2020, 7:45 PM

Hyd. No. 3

Ex. Condition- Basin #2 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.61 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.28 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,692 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

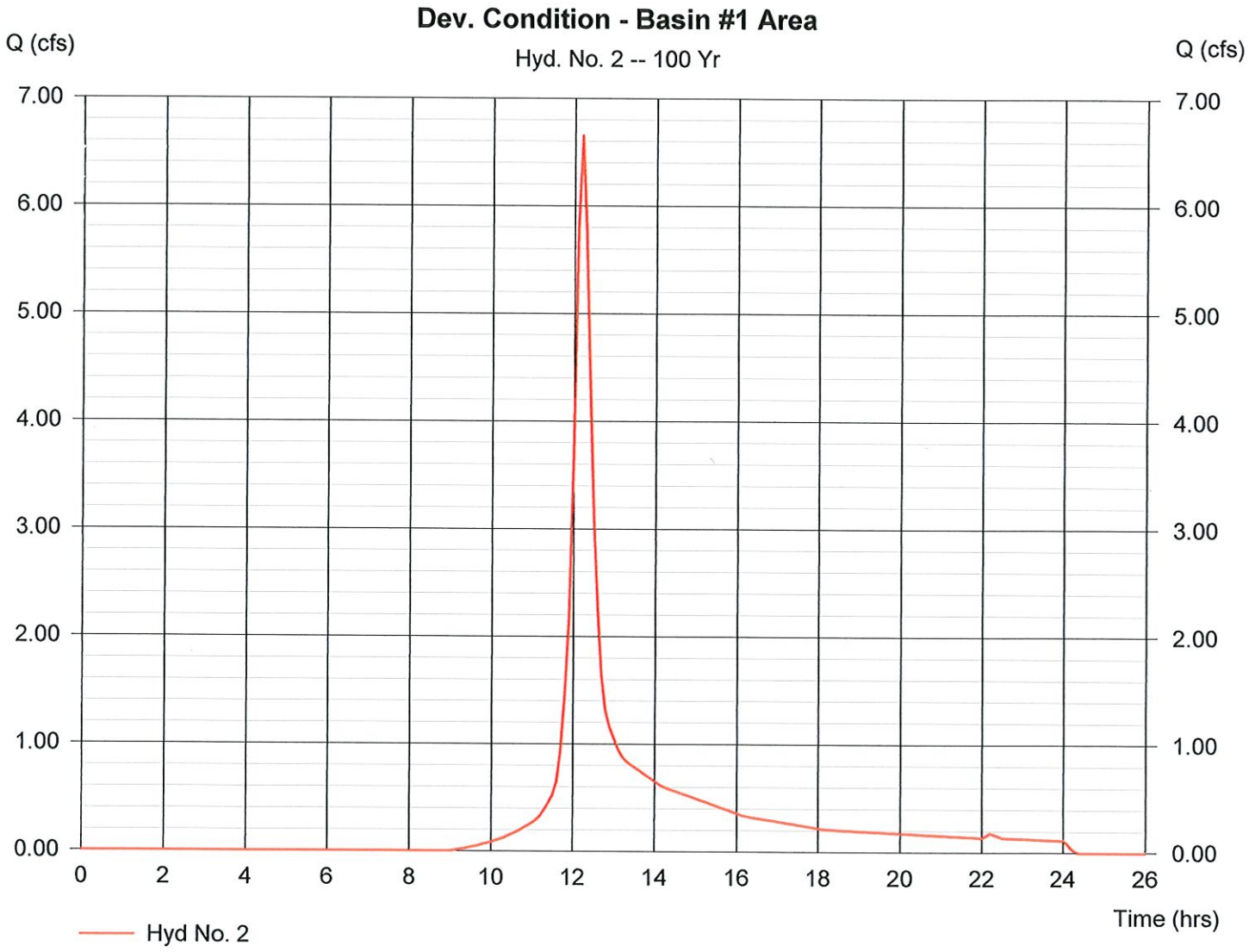
Wednesday, Jan 22 2020, 7:45 PM

Hyd. No. 2

Dev. Condition - Basin #1 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 6.65 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 2.17 ac	Curve number	= 64
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.6 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 28,455 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

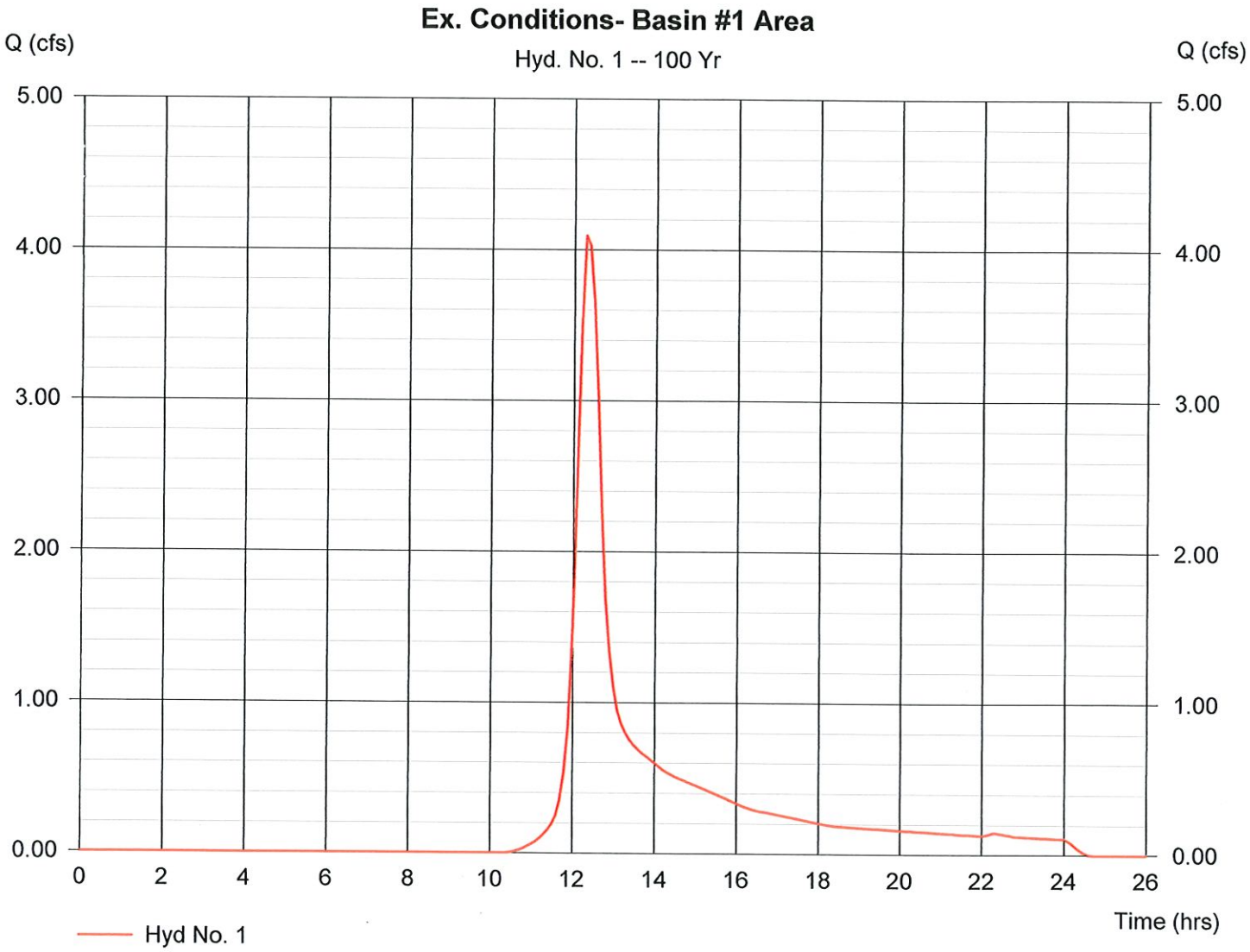
Wednesday, Jan 22 2020, 7:45 PM

Hyd. No. 1

Ex. Conditions- Basin #1 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 4.09 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 2.16 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 22.7 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 22,313 cuft



DETENTION BASIN DESIGN

FRANK C. MAGNOTTA, P.E.

STORM WATER DETENTION BASIN DESIGNS

Because of the very small watershed areas for the individual driveways, hydrographs were not routed thru these basins. The detention volume specified for each basin was the difference in the respective total discharge volume between the pre and post development 100 year rainfall event. These volumes are shown on the "Site Plans". The overflow from these basins is facilitated by covering the entire basin berm with rip-rap to function as a long level lip spreader.

The routing of the post development runoff was done through basin #1and used the exfiltration option with the routing portion of this analysis. The USDA natural resources website shows the entire proposed development covered by 73C Charlton-Hatfield complex, 0-15 % slopes, classified as a hydrologic group "B" with typical permeability rates from 0.14 to 14.7 inches per hour. The permeability test results and soil profile descriptions in the test pits excavated for the existing and proposed houses confirm the presence of a well drained soil. The exfiltration option in the TR-55 program is used to the calculate the 24 hour exfiltration capacity of basin #1 and combine that with the storage/storage volume to determine the total discharge capacity of this basin at various depths. A conservative permeability rate of 3 inches per hour is used in this analysis and is confirmed by actual permeability tests conducted for similar soils as shown on the attached list of tests performed by Richard Snarski, New England Environmental Services.

The respective 2, 10 &100 year hydrographs were routed thru basin #1 with the results shown for the design criteria and 100 year water level.

Basin #1

4' dia. concrete riser manhole, 12 LF overflow spillway crest elev. = 420.0'
5 inch dia. port at elevation 415.5' and an 8 inch dia. port at elev.= 417.4'
25 LF of 12" dia. discharge pipe from the riser manhole to grade.
Top of basin berm elev. = 420.5', 100 year water surface elev. = 419.87'
Except for a slight increase for the 2 year event, (0.26 CFS), the 10 & 100 year event flows out of the basin are equal to or less than the pre-development peak discharge rates.

The computer results of watershed and routing hydrographs for basin #1 are attached to this section.

NEW ENGLAND ENVIRONMENTAL SERVICES

PERMEABILITY TEST RESULTS

(Reeves Site, Spithead Road, Waterford)

TEST HOLE #	SAMPLE DEPTH (INCHES)	PERMEABILITY (FEET/DAY)	HAND TEXTURE
100	60	212	Medium to very coarse sand & gravel (loose)
100	104	42	Fine to medium sand (loose)
102	65	54	Gravelly loamy sand (fi
103	51	345	Very coarse sand & gravel (loose)
104	25	1.1	Very fine sandy loam (friable)
106	23	4.6	Very fine sandy loam (friable)
107	45	45	Gravelly loamy sand (fi
109	50	18	Gravelly loamy sand (fi
110	58	76	Medium sand (loose)
112	58	23	Fine sandy loam (friable)
113	76	258(R)	Medium to very coarse sands (loose)
114	56	88(R)	Fine to very coarse sand & gravel (loose)
115	61	34(E)	Fine to very coarse sand & gravel (loose)

NOTES: a) The permeability tests were conducted by the Falling Head Method.

b) The samples were saturated in a vacuum for 33 hours prior to testing.

c) The reported permeability values are the average of three runs.

Rt 354, Salem, Connecticut 06415 (203) 859-2428

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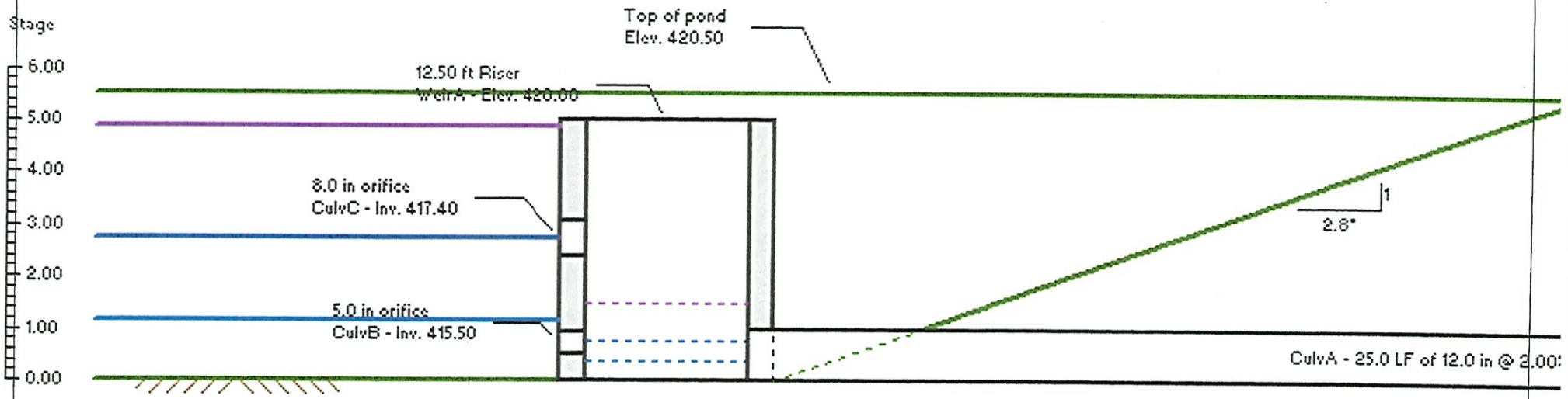
Detention Basin #1



Section

NTS

(100 yr)
(10 yr)
(2 yr)

* Side slope estimated average from contours

Schematic only. Not for construction.

Pond Report

Hydraflow Hydrographs by Intelisolve

Thursday, Jan 23 2020, 12:37 PM

Pond No. 1 - Detention Basin #1

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	415.00	285	0	0
1.00	416.00	900	593	593
5.00	420.00	2,100	6,000	6,593
5.50	420.50	2,110	1,053	7,645

Culvert / Orifice Structures

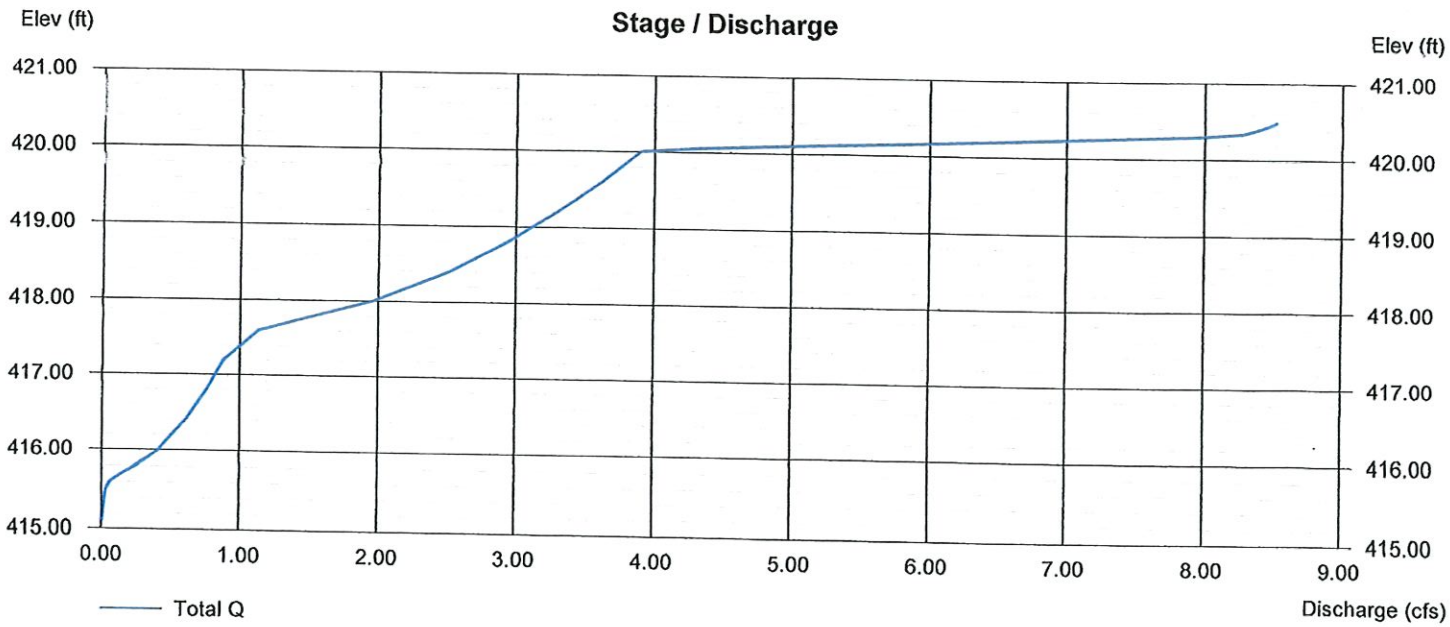
	[A]	[B]	[C]	[D]
Rise (in)	= 12.00	5.00	8.00	0.00
Span (in)	= 12.00	5.00	8.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 415.00	415.50	417.40	0.00
Length (ft)	= 25.00	2.00	0.00	0.00
Slope (%)	= 2.00	0.00	0.00	0.00
N-Value	= .013	.013	.013	.000
Orif. Coeff.	= 0.60	0.60	0.60	0.00
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.50	0.00	0.00	0.00
Crest El. (ft)	= 420.00	0.00	0.00	0.00
Weir Coeff.	= 3.00	0.00	0.00	0.00
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 3.000 in/hr (Contour) **Tailwater Elev. =** 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Jan 23 2020, 12:37 PM

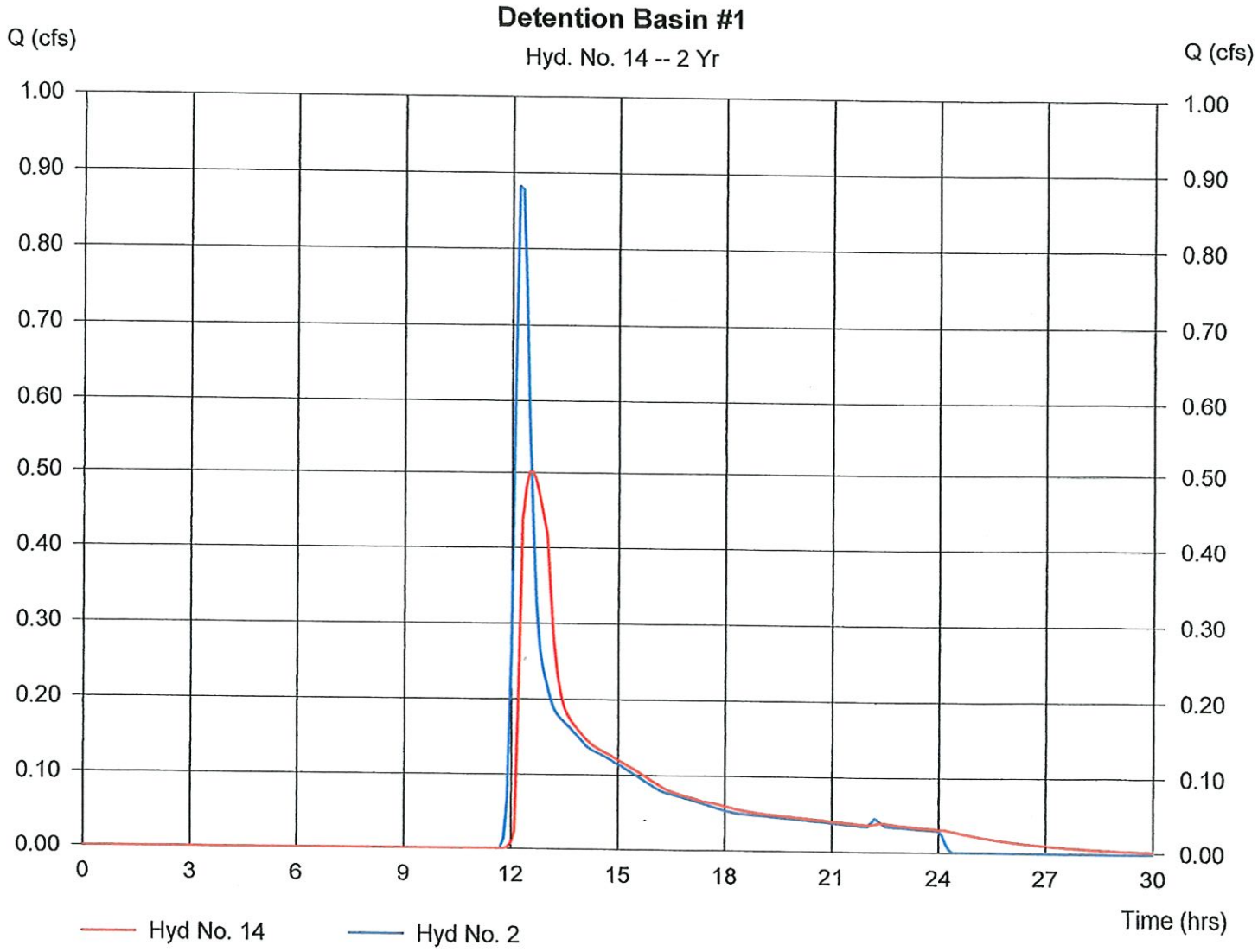
Hyd. No. 14

Detention Basin #1

Hydrograph type	= Reservoir	Peak discharge	= 0.50 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Inflow hyd. No.	= 2	Max. Elevation	= 416.17 ft
Reservoir name	= Detention Basin #1	Max. Storage	= 845 cuft

Storage Indication method used.

Hydrograph Volume = 4,755 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Jan 23 2020, 12:37 PM

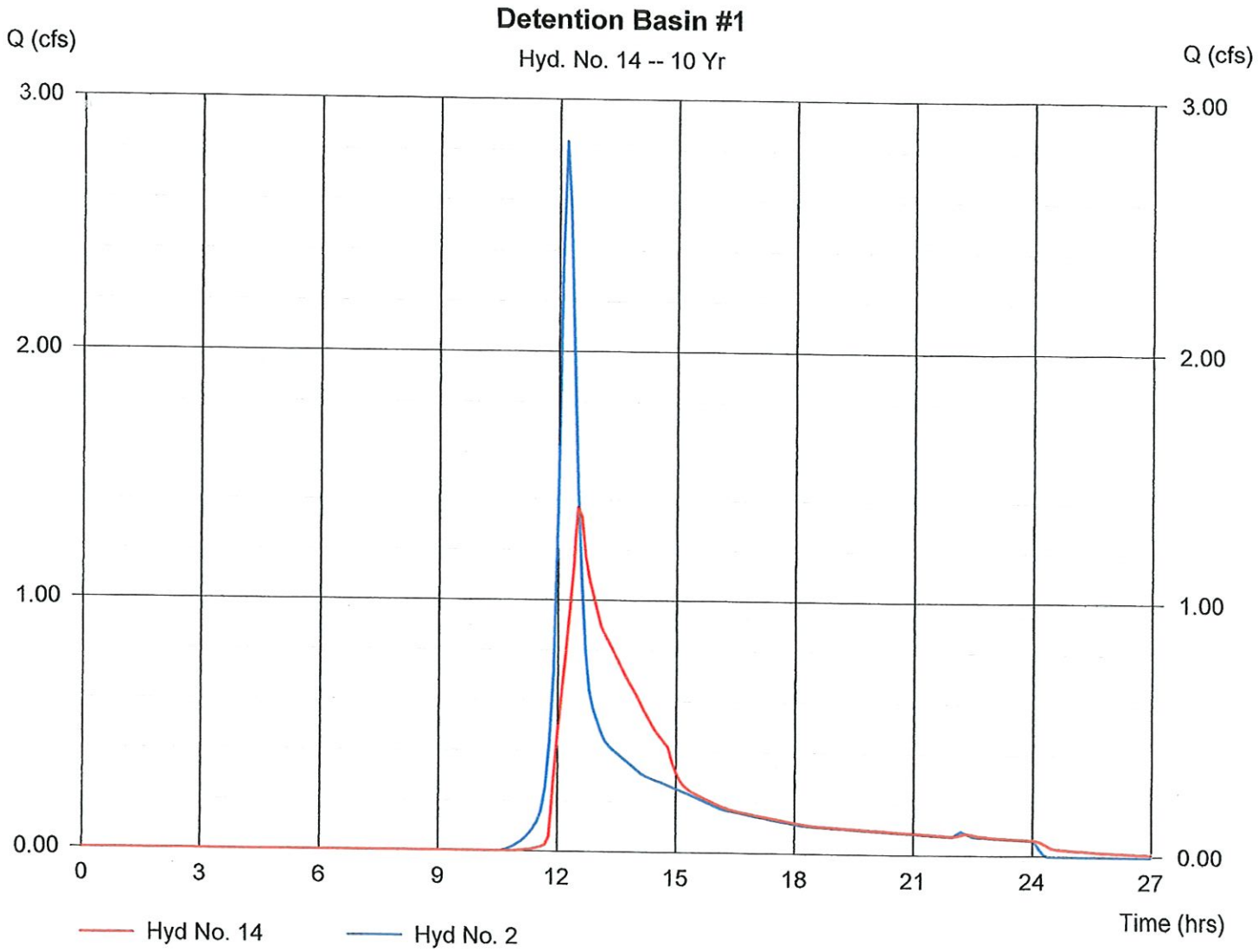
Hyd. No. 14

Detention Basin #1

Hydrograph type	= Reservoir	Peak discharge	= 1.37 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Inflow hyd. No.	= 2	Max. Elevation	= 417.71 ft
Reservoir name	= Detention Basin #1	Max. Storage	= 3,163 cuft

Storage Indication method used.

Hydrograph Volume = 12,633 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Thursday, Jan 23 2020, 12:37 PM

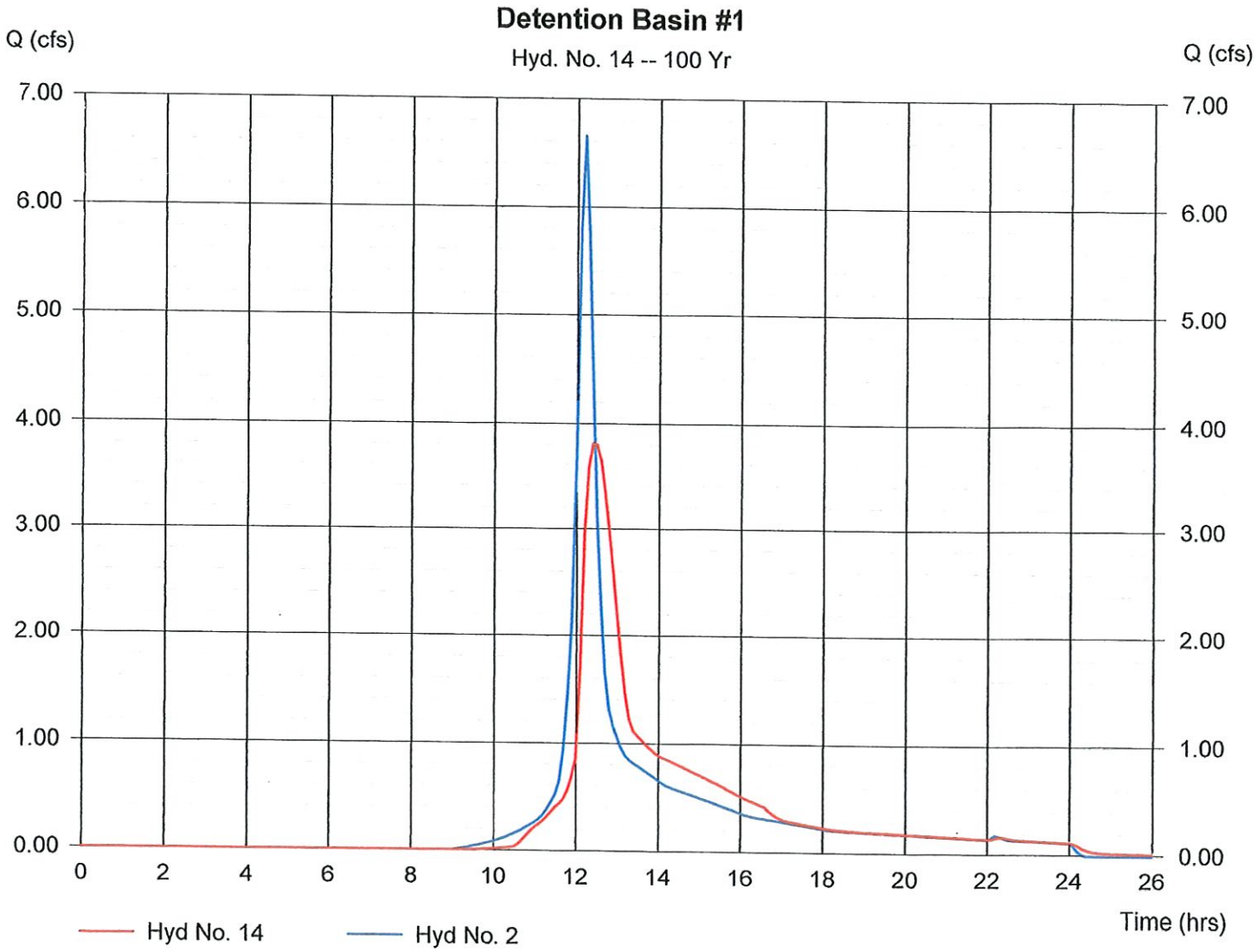
Hyd. No. 14

Detention Basin #1

Hydrograph type	= Reservoir	Peak discharge	= 3.81 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 2	Max. Elevation	= 419.87 ft
Reservoir name	= Detention Basin #1	Max. Storage	= 6,391 cuft

Storage Indication method used.

Hydrograph Volume = 28,445 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

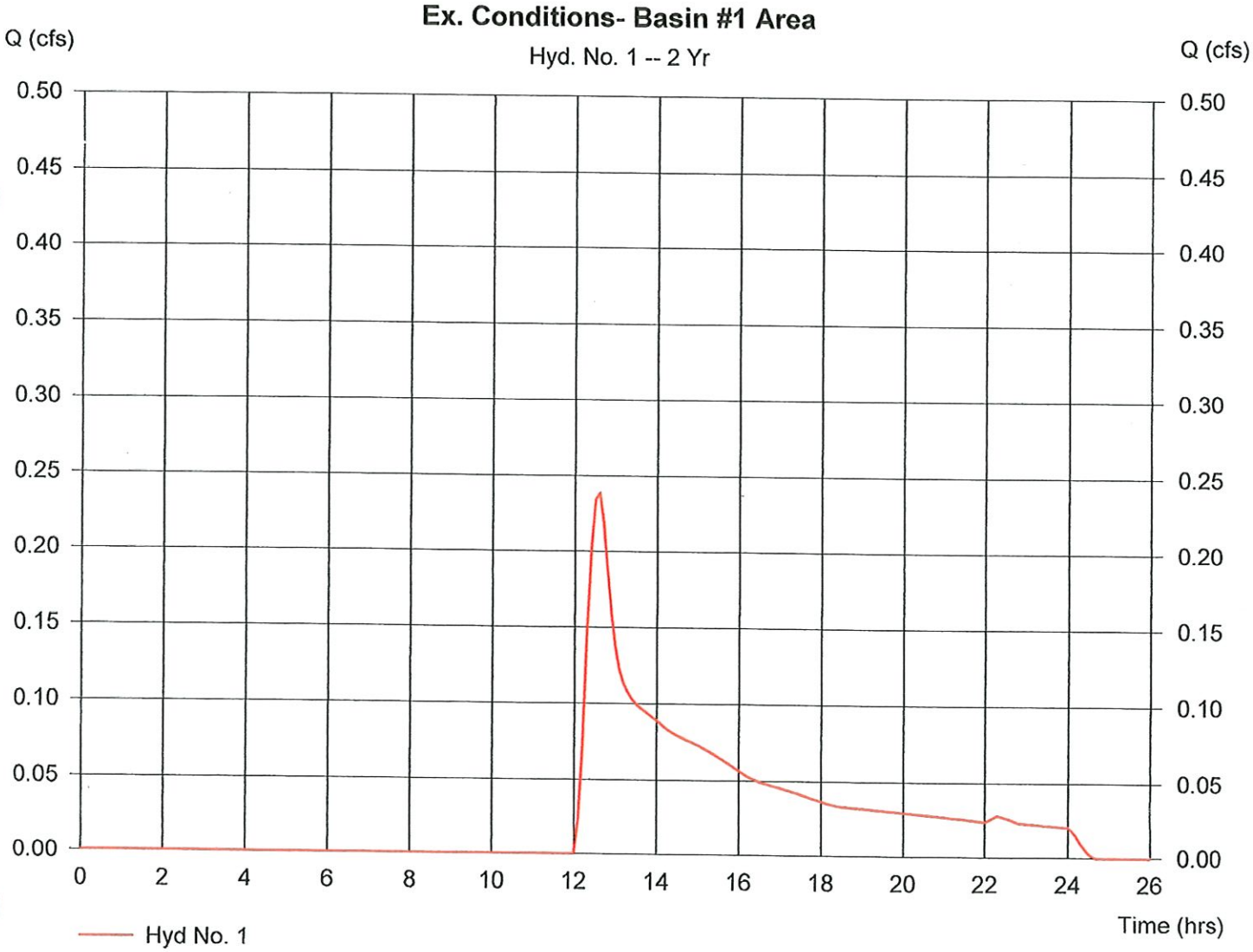
Thursday, Jan 23 2020, 12:47 PM

Hyd. No. 1

Ex. Conditions- Basin #1 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.24 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 2.16 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 22.7 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,399 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

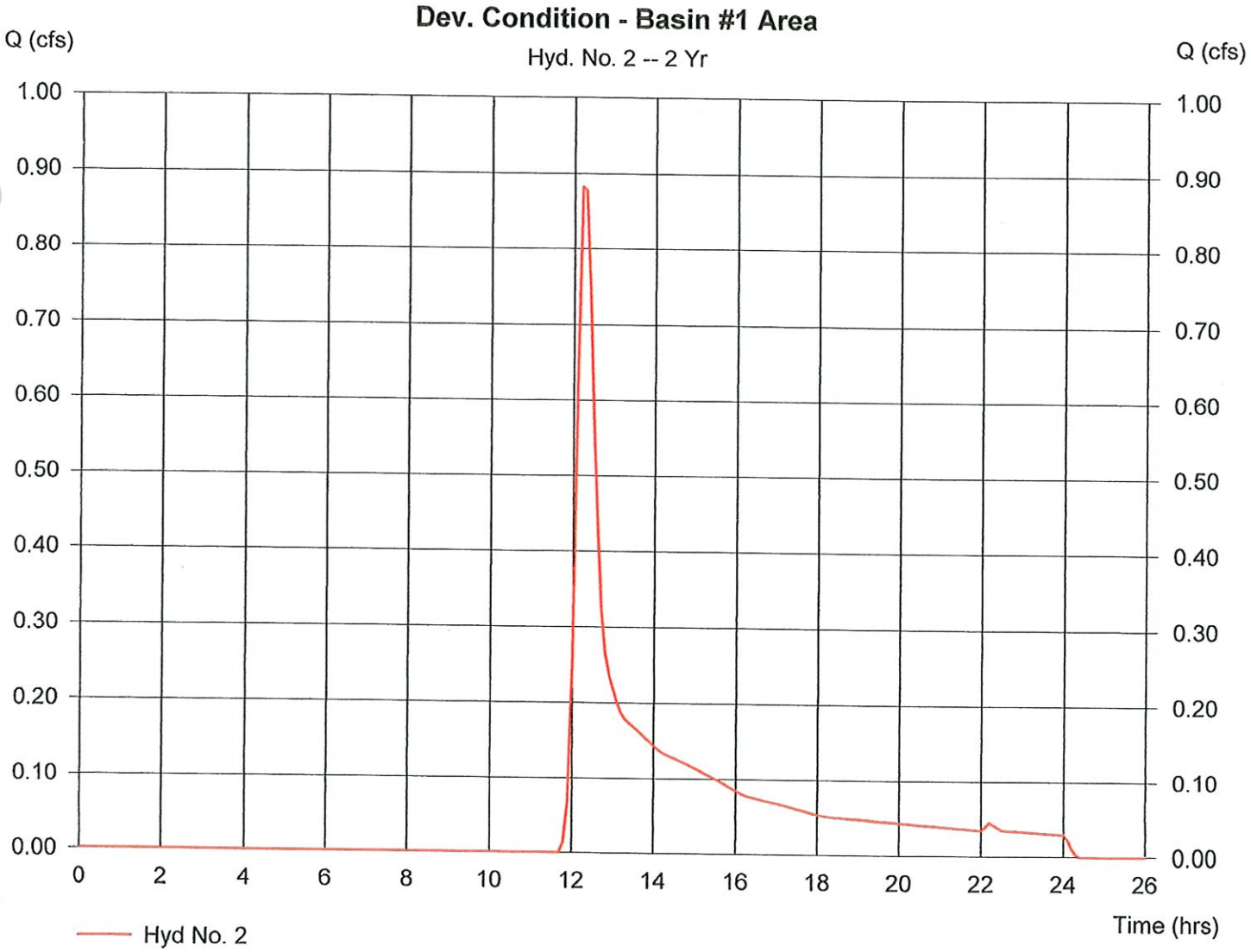
Thursday, Jan 23 2020, 12:47 PM

Hyd. No. 2

Dev. Condition - Basin #1 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.88 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 2.17 ac	Curve number	= 64
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.6 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,765 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

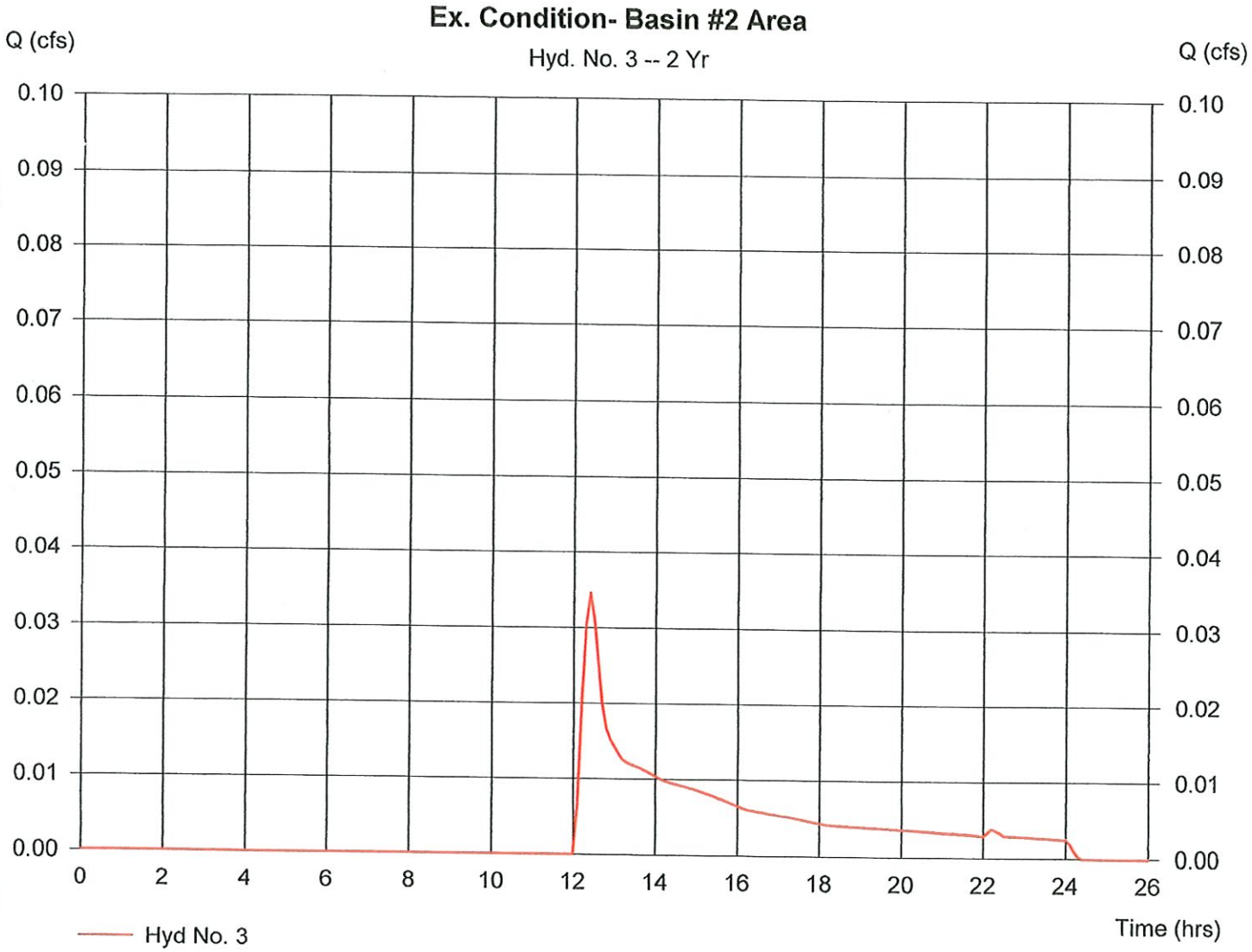
Thursday, Jan 23 2020, 12:47 PM

Hyd. No. 3

Ex. Condition- Basin #2 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.03 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 0.28 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 289 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

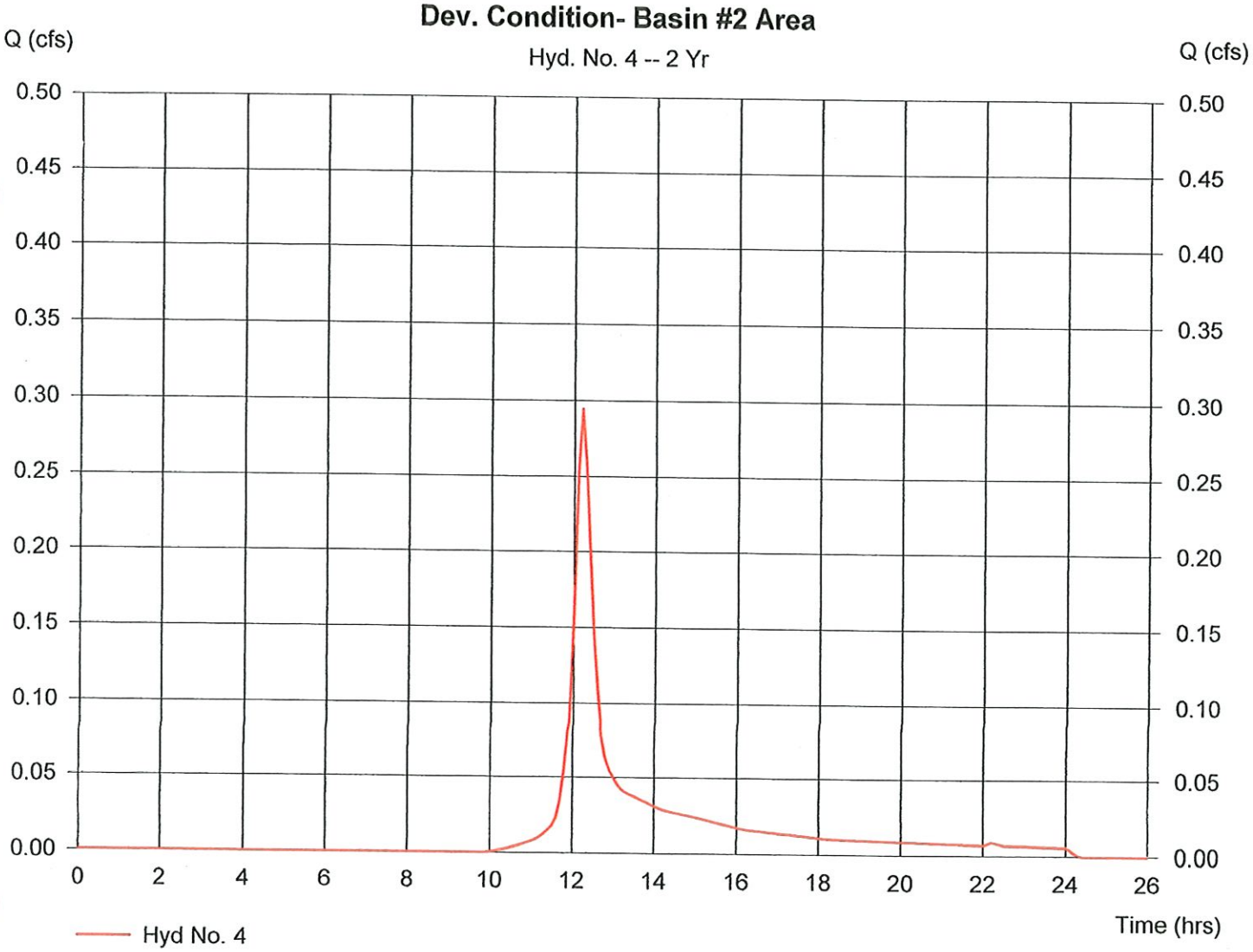
Thursday, Jan 23 2020, 12:47 PM

Hyd. No. 4

Dev. Condition- Basin #2 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.29 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 0.28 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,279 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

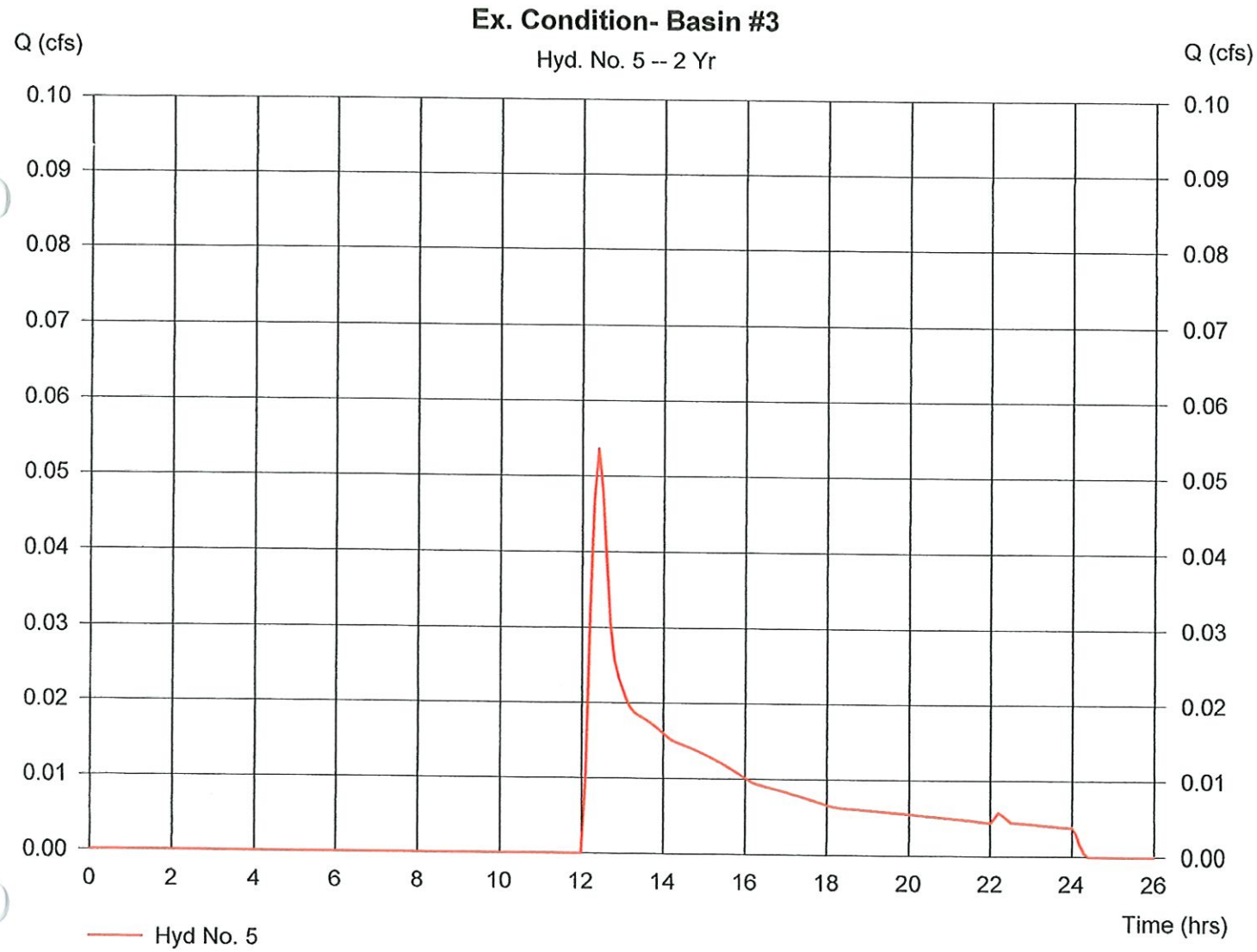
Thursday, Jan 23 2020, 12:47 PM

Hyd. No. 5

Ex. Condition- Basin #3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.05 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 0.43 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.9 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 448 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

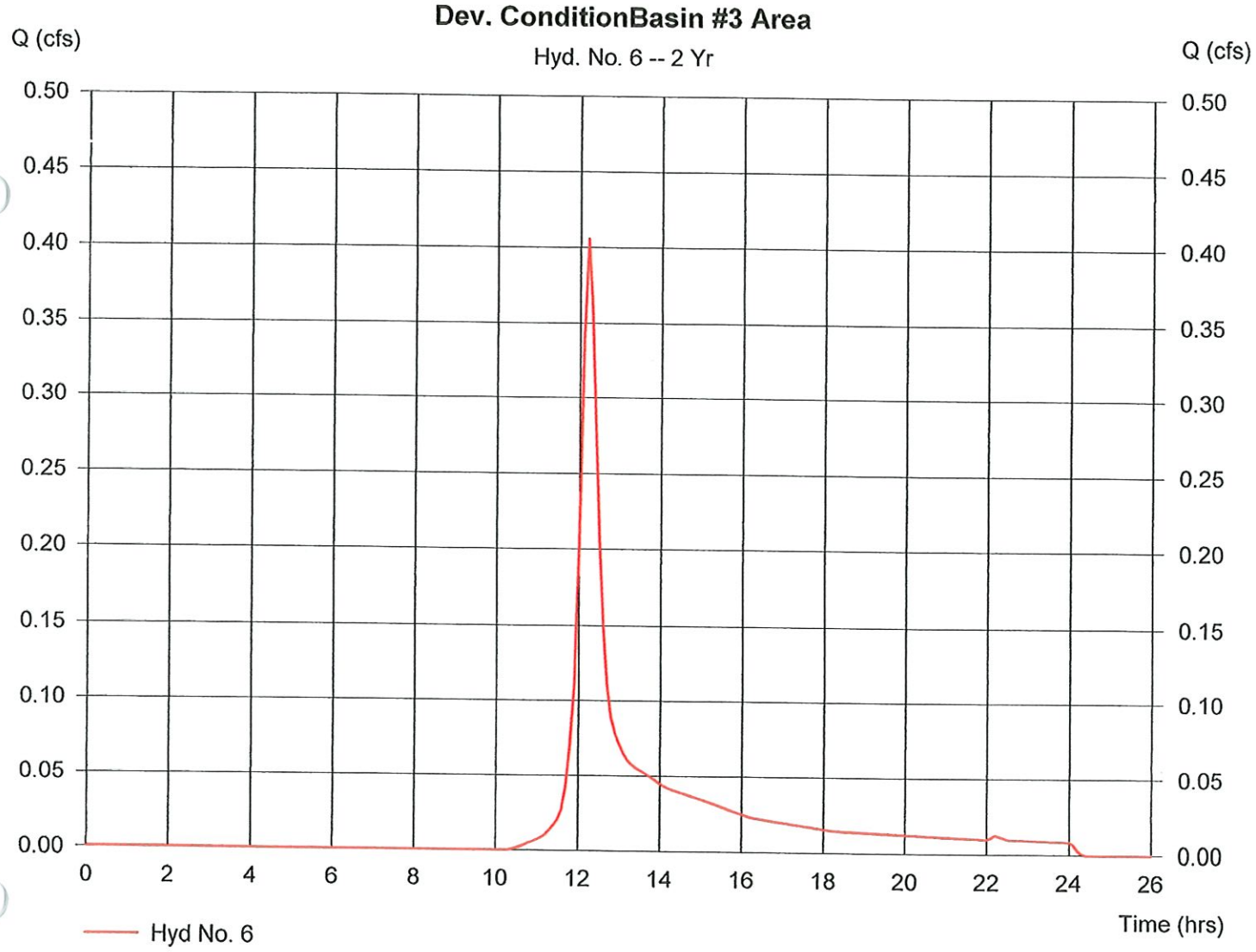
Thursday, Jan 23 2020, 12:47 PM

Hyd. No. 6

Dev. ConditionBasin #3 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.41 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 0.43 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,782 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

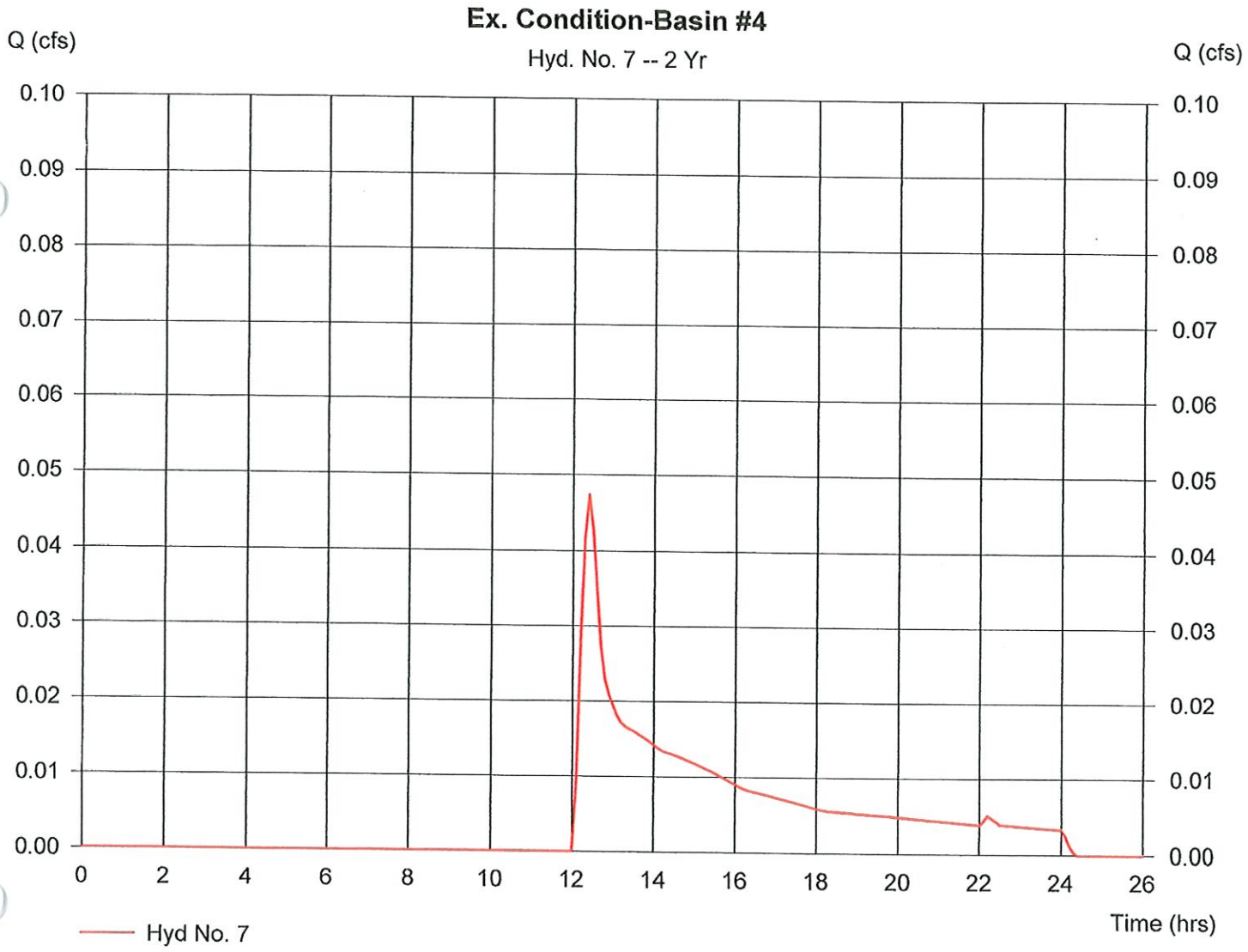
Thursday, Jan 23 2020, 12:47 PM

Hyd. No. 7

Ex. Condition-Basin #4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.05 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 0.38 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.00567 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 397 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

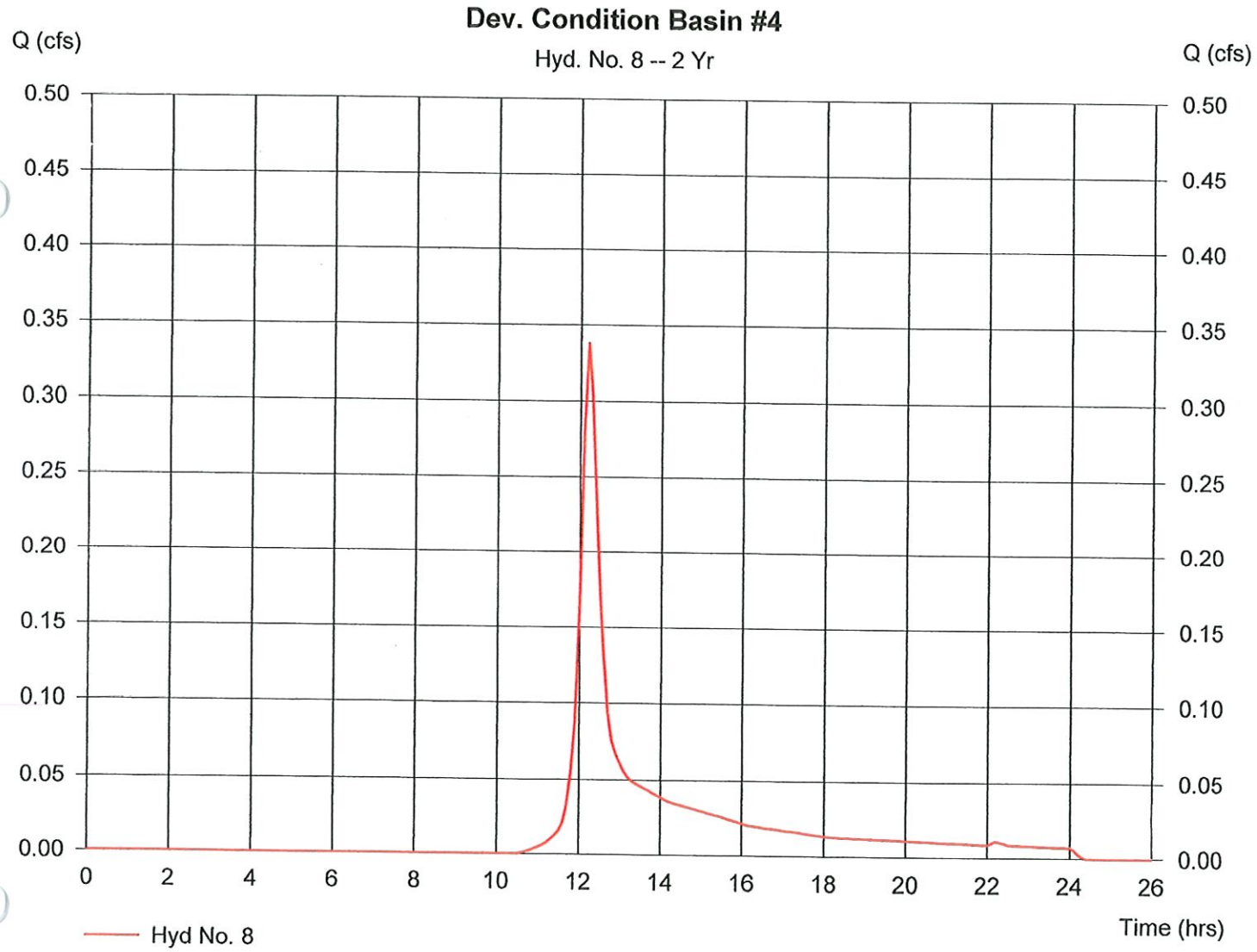
Thursday, Jan 23 2020, 12:47 PM

Hyd. No. 8

Dev. Condition Basin #4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.34 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 0.38 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,497 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

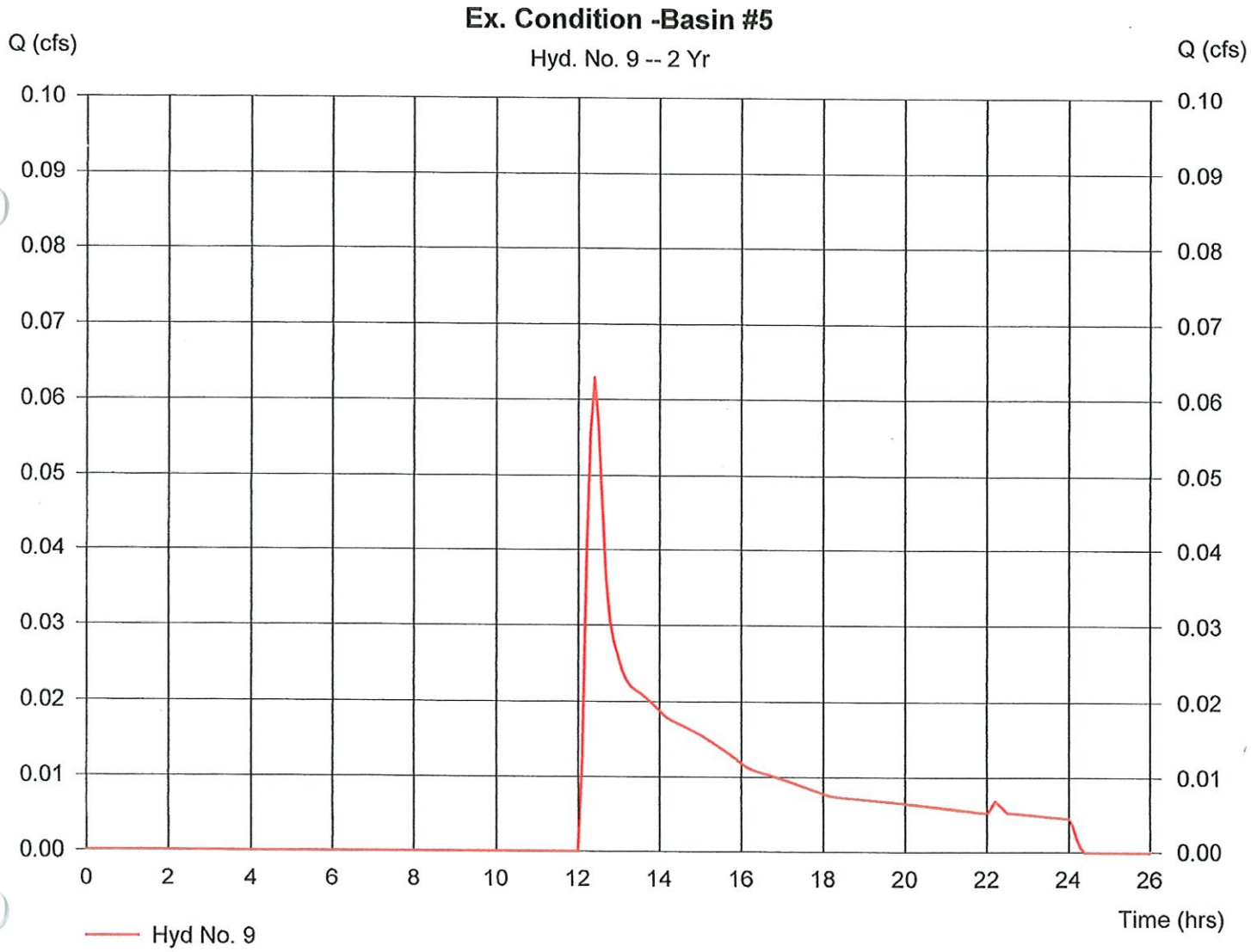
Thursday, Jan 23 2020, 12:47 PM

Hyd. No. 9

Ex. Condition -Basin #5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.06 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 0.51 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.4 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 526 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

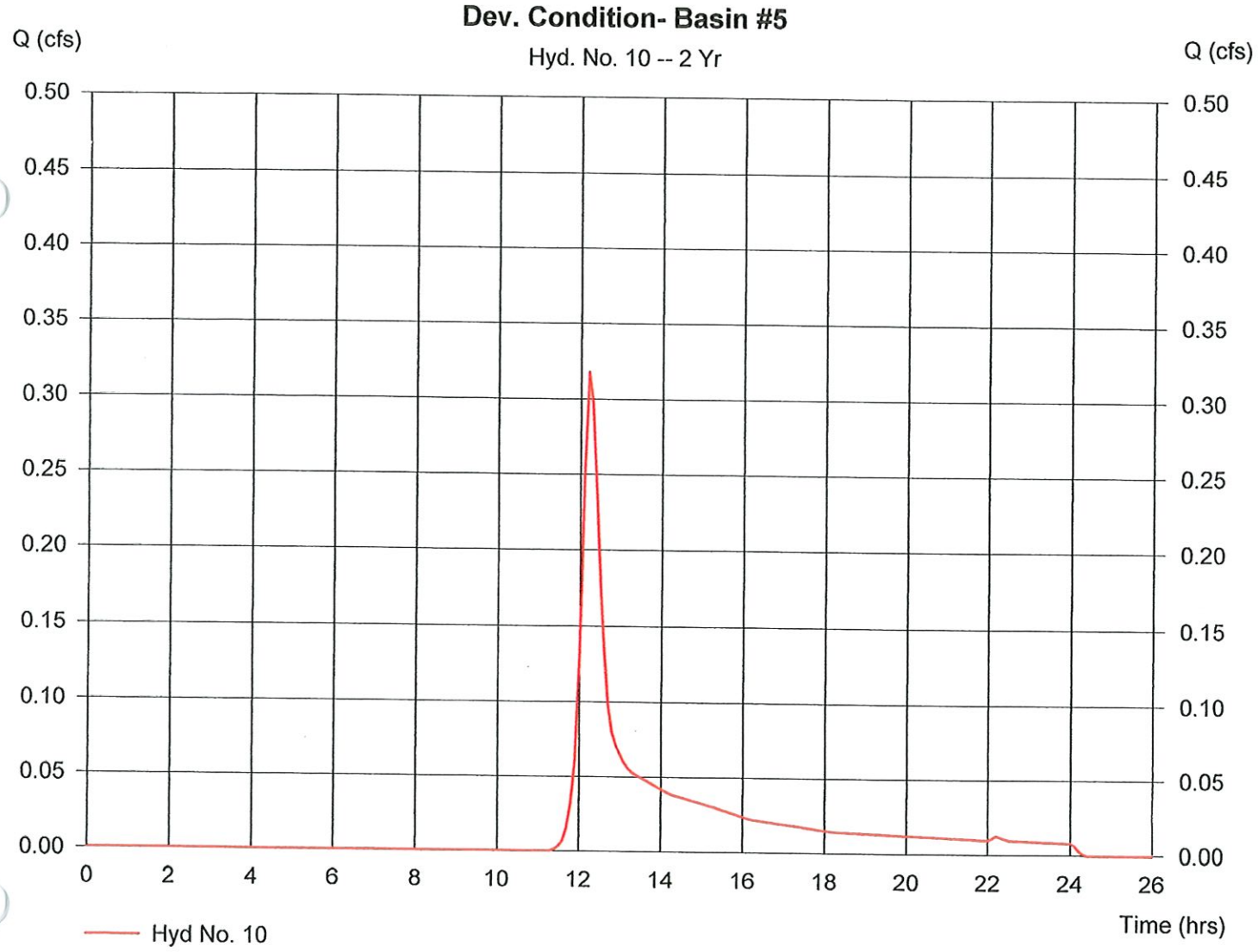
Friday, Jan 24 2020, 10:52 AM

Hyd. No. 10

Dev. Condition- Basin #5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.32 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 0.50 ac	Curve number	= 69
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,502 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

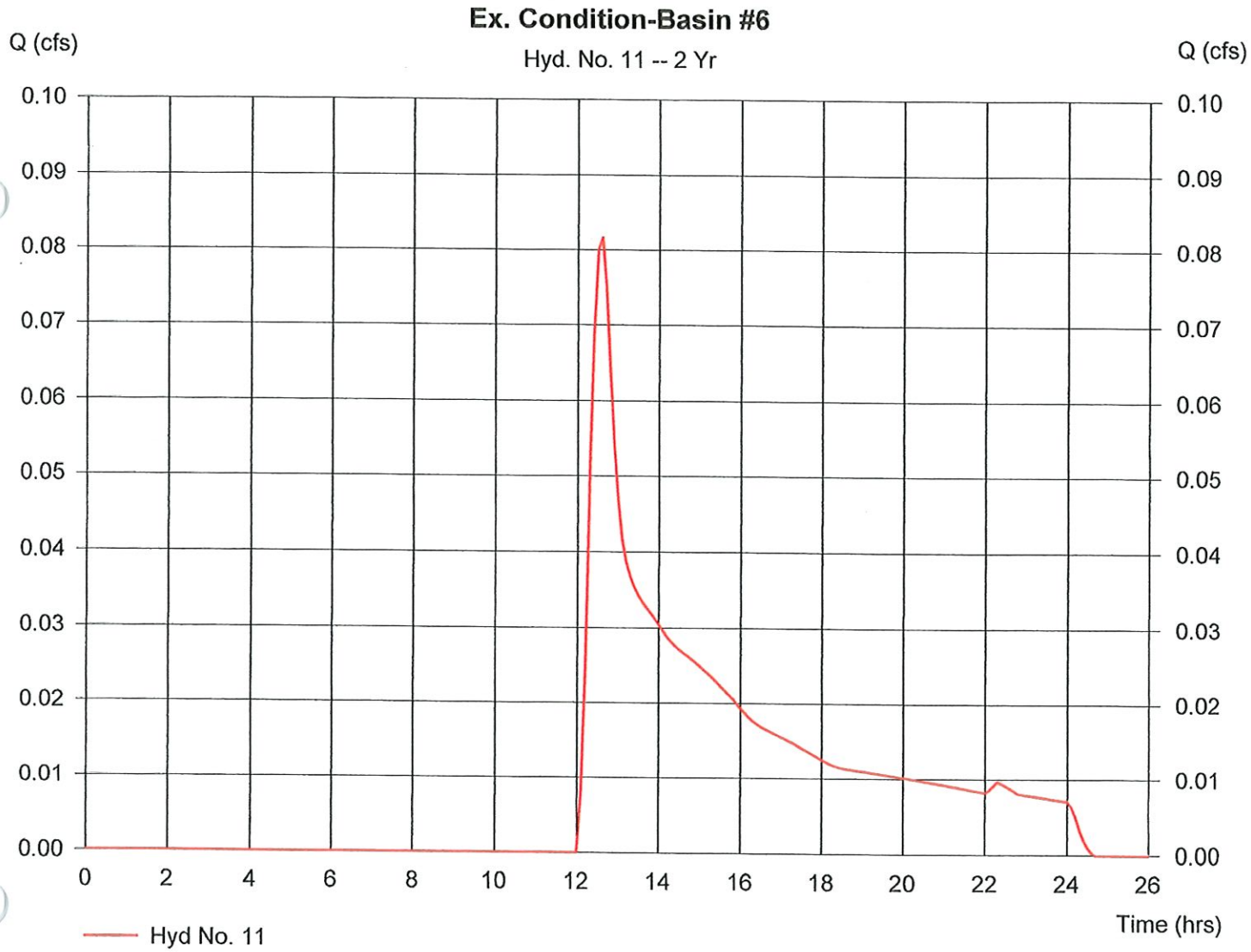
Friday, Jan 24 2020, 10:52 AM

Hyd. No. 11

Ex. Condition-Basin #6

Hydrograph type	= SCS Runoff	Peak discharge	= 0.08 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 0.74 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 23.56006 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 821 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

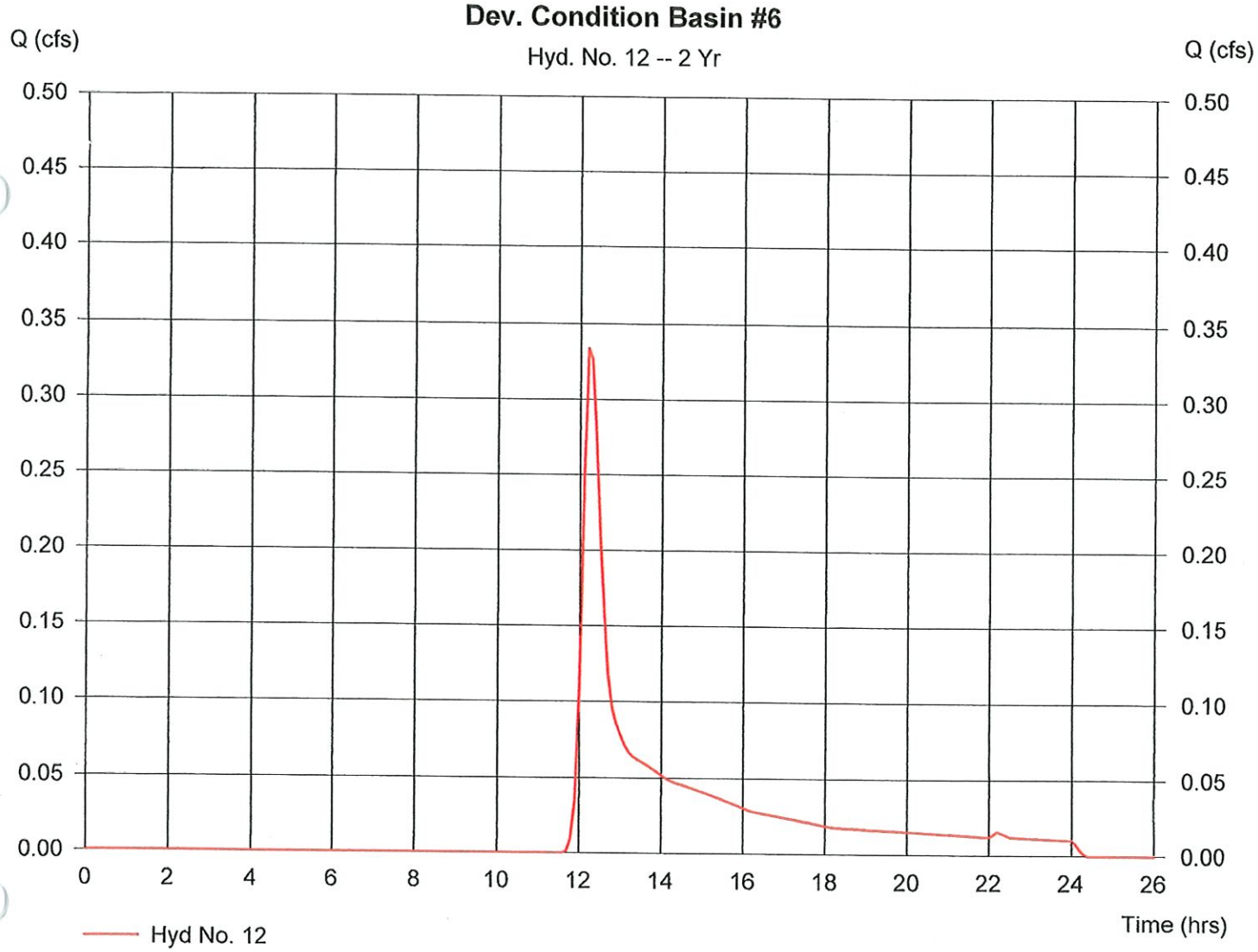
Thursday, Jan 23 2020, 12:47 PM

Hyd. No. 12

Dev. Condition Basin #6

Hydrograph type	= SCS Runoff	Peak discharge	= 0.33 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 0.74 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 3.38 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,737 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

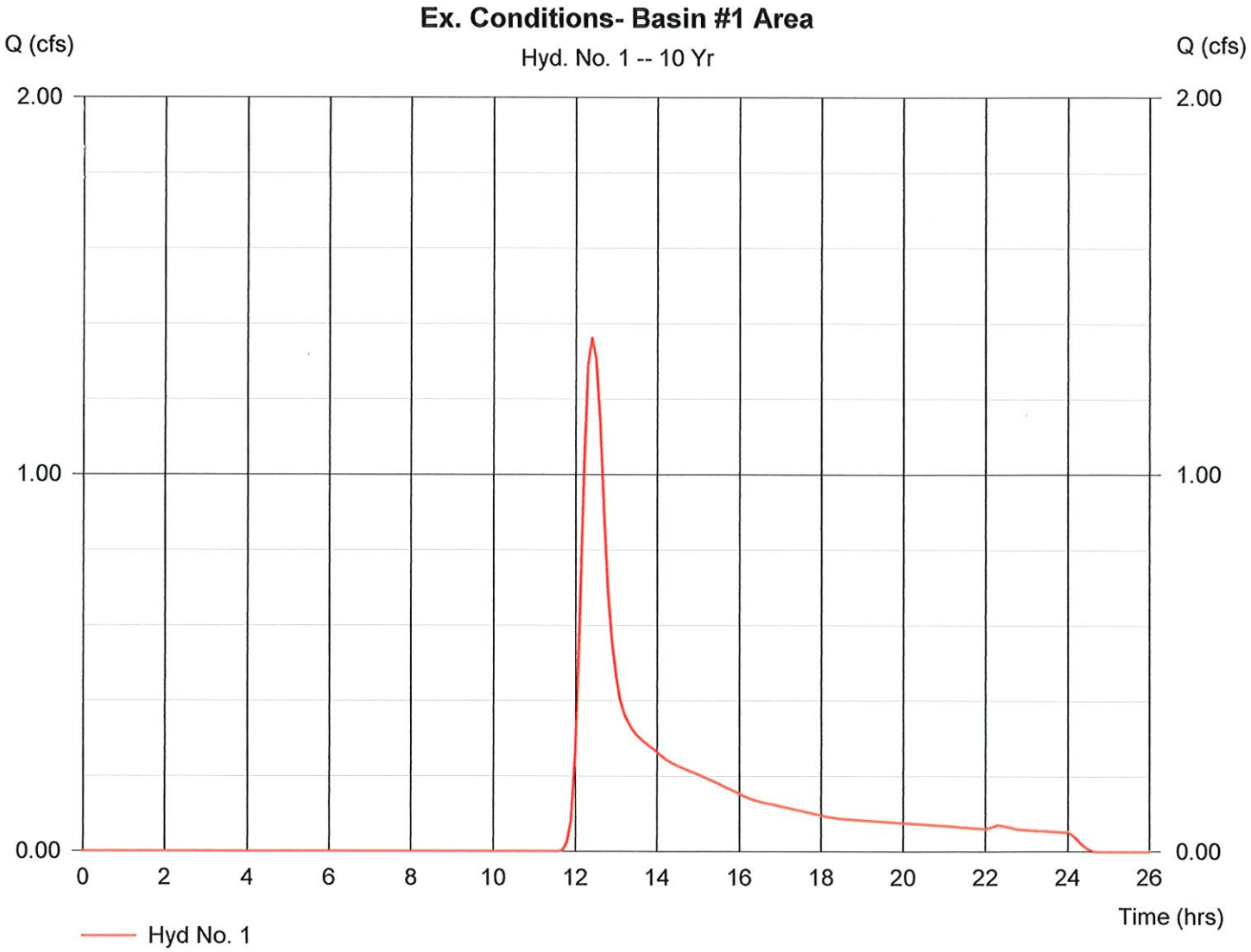
Thursday, Jan 23 2020, 12:51 PM

Hyd. No. 1

Ex. Conditions- Basin #1 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 1.36 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 2.16 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 22.7 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 8,478 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

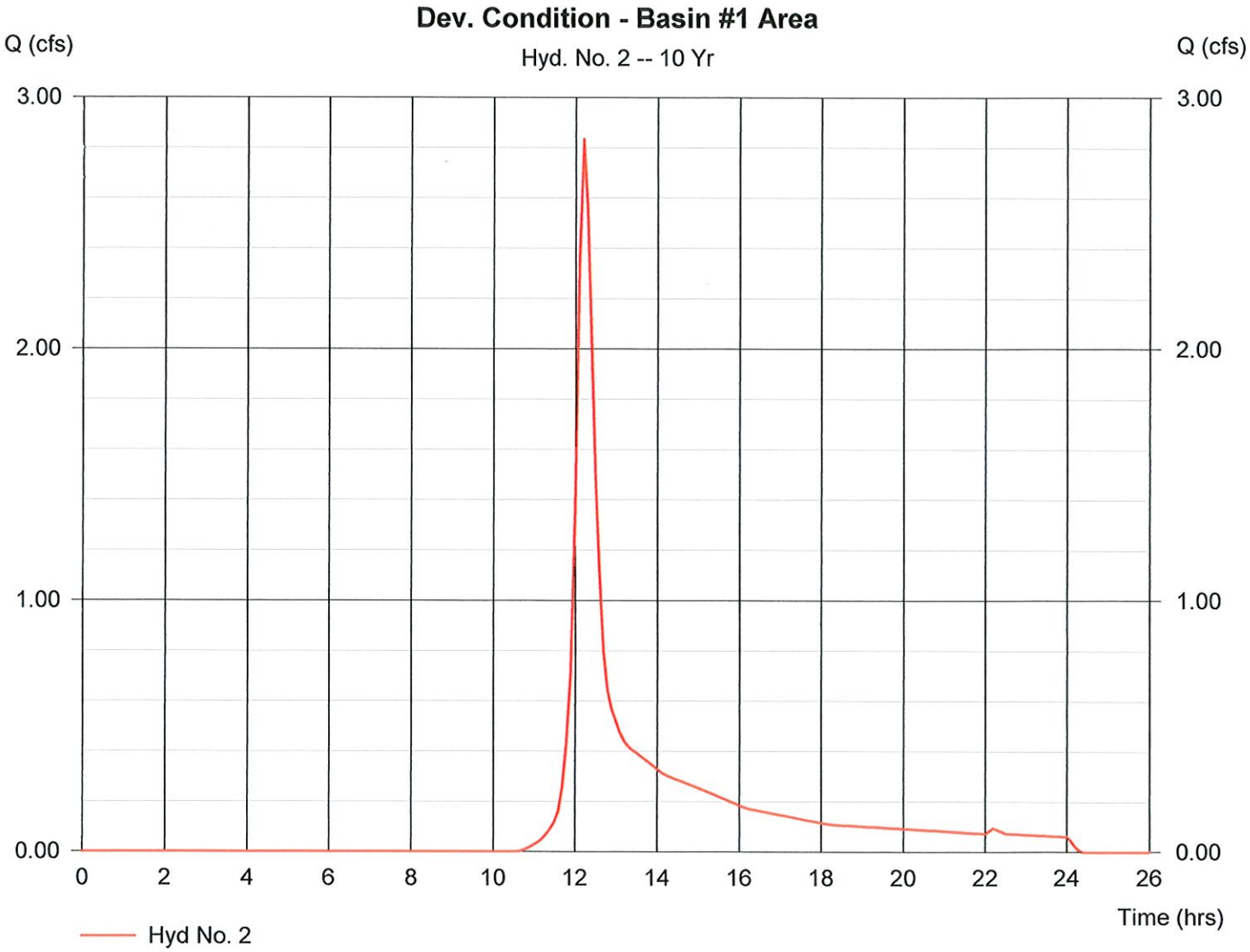
Thursday, Jan 23 2020, 12:51 PM

Hyd. No. 2

Dev. Condition - Basin #1 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 2.83 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 2.17 ac	Curve number	= 64
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.6 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 12,642 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

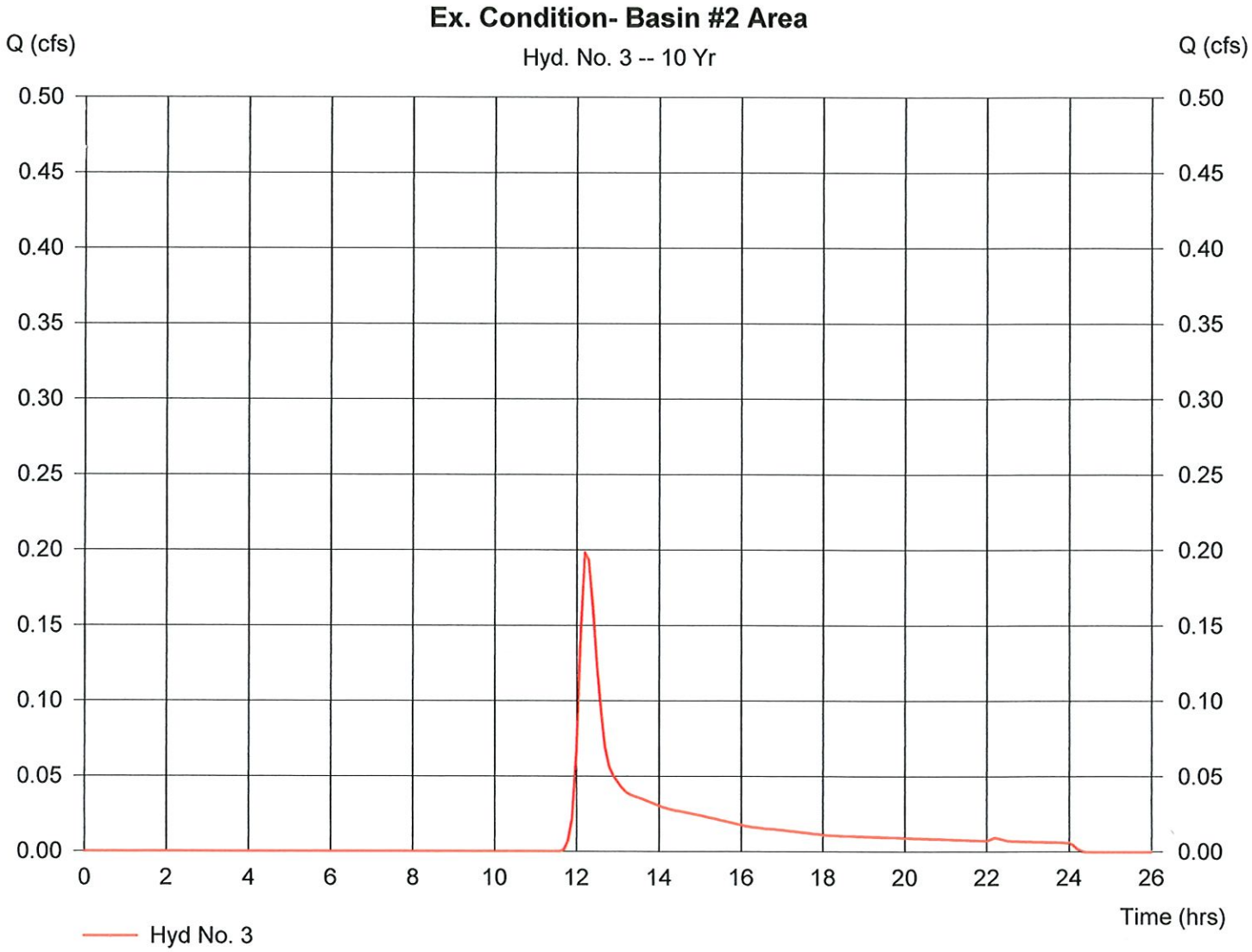
Thursday, Jan 23 2020, 12:51 PM

Hyd. No. 3

Ex. Condition- Basin #2 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.20 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 0.28 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,023 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

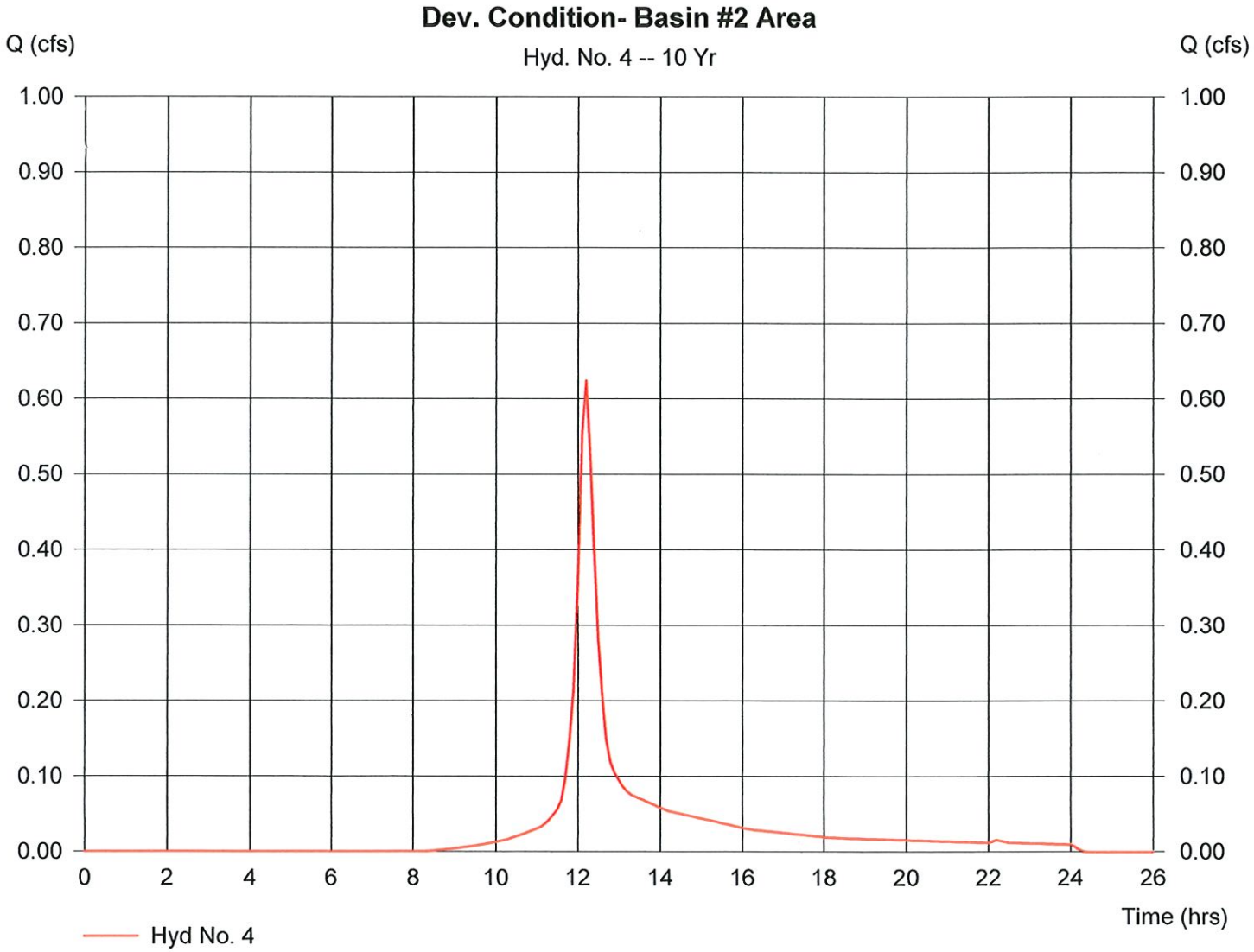
Thursday, Jan 23 2020, 12:51 PM

Hyd. No. 4

Dev. Condition- Basin #2 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.62 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 0.28 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,660 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

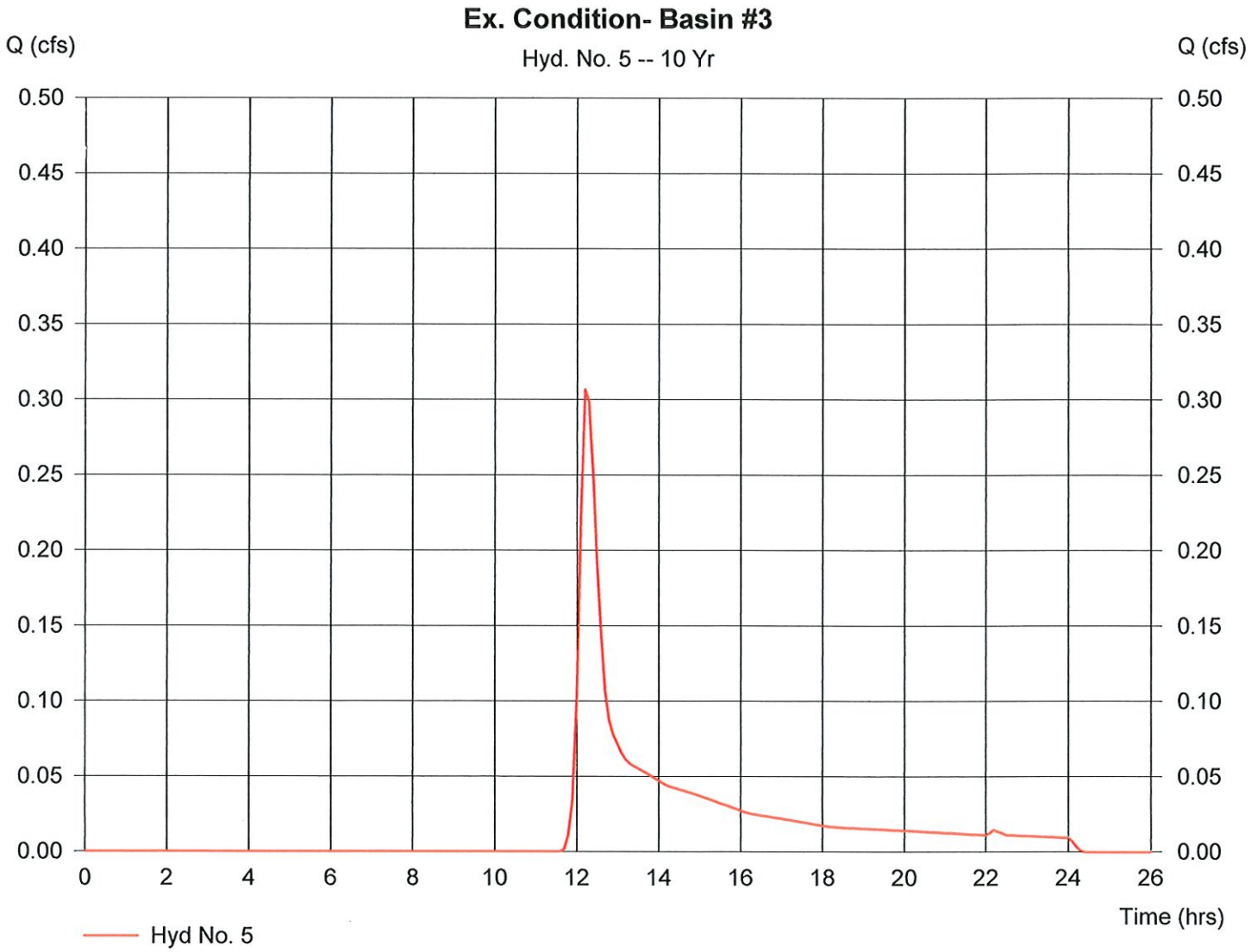
Thursday, Jan 23 2020, 12:51 PM

Hyd. No. 5

Ex. Condition- Basin #3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.31 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 0.43 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.9 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,582 cuft



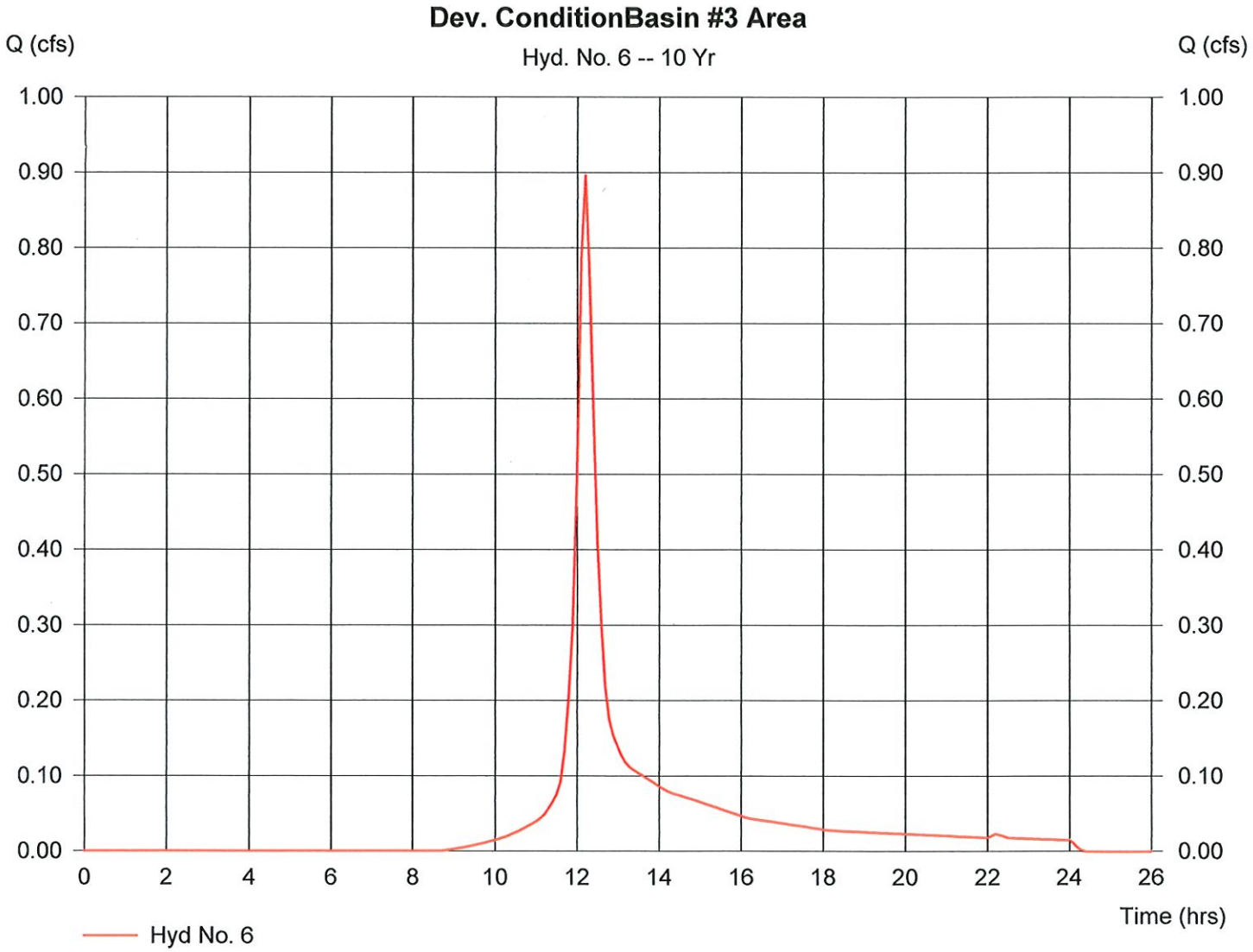
Hydrograph Plot

Hyd. No. 6

Dev. ConditionBasin #3 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.90 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 0.43 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,823 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

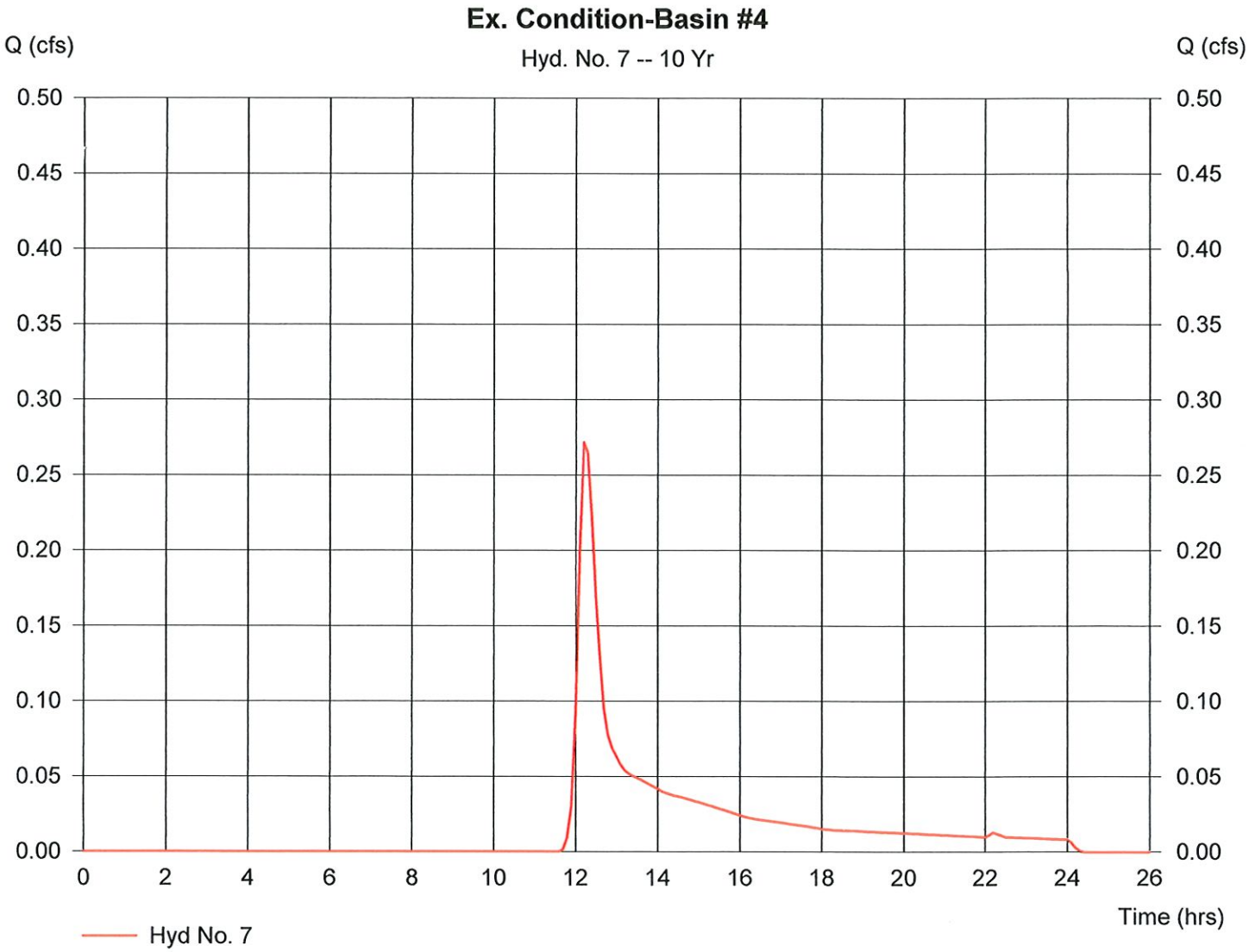
Thursday, Jan 23 2020, 12:51 PM

Hyd. No. 7

Ex. Condition-Basin #4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.27 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 0.38 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.00567 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,402 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

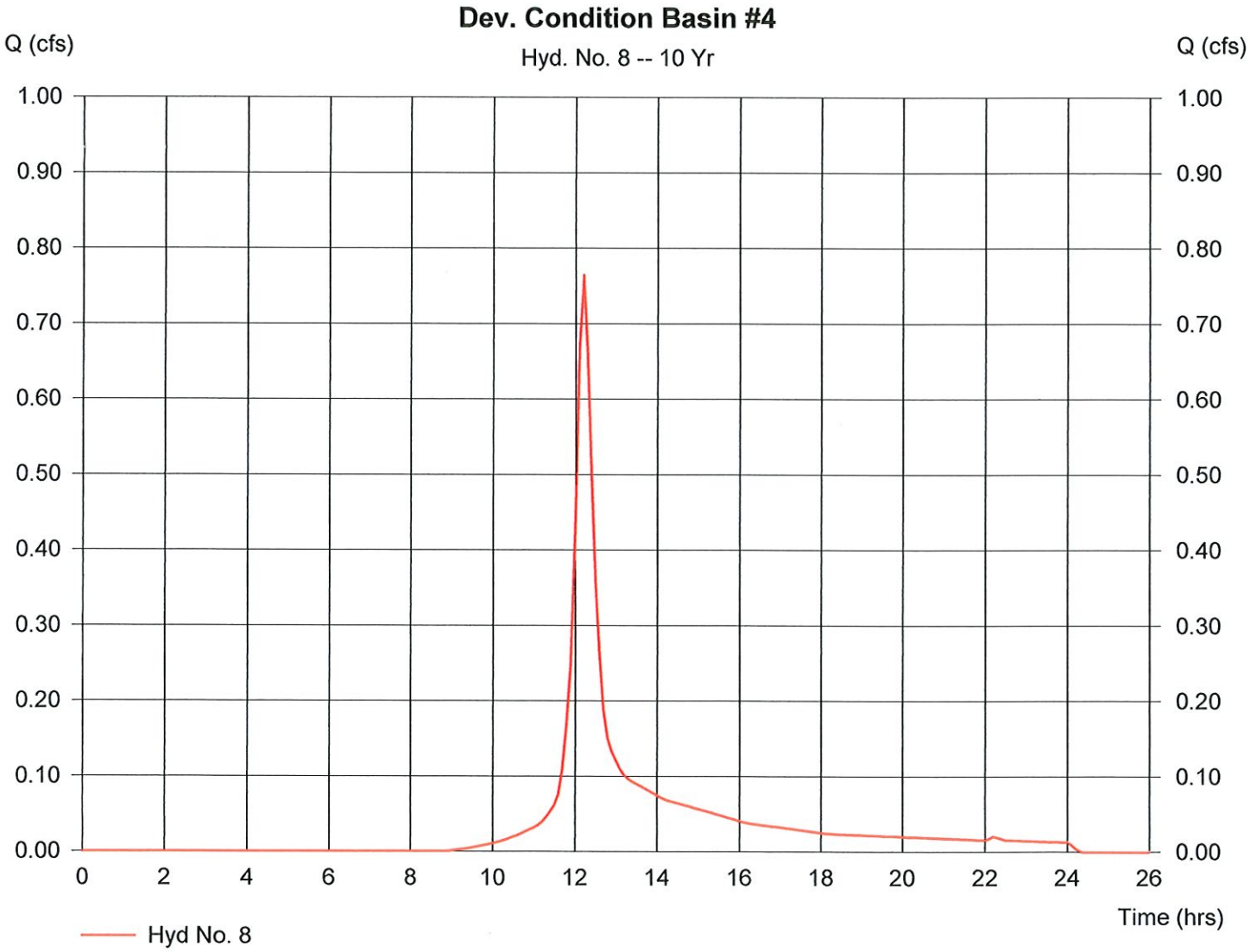
Thursday, Jan 23 2020, 12:51 PM

Hyd. No. 8

Dev. Condition Basin #4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.76 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 0.38 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,265 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

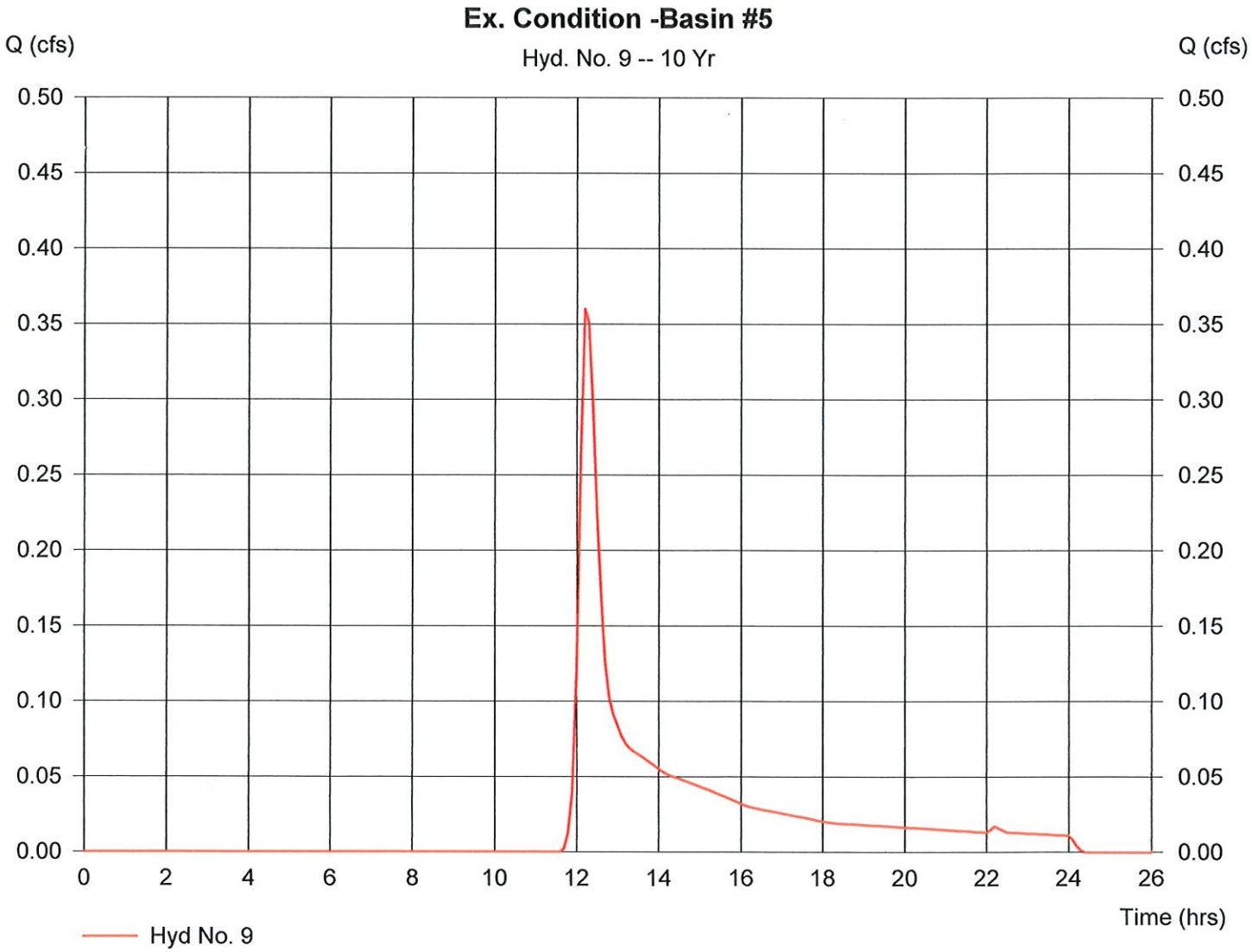
Thursday, Jan 23 2020, 12:51 PM

Hyd. No. 9

Ex. Condition -Basin #5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.36 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 0.51 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.4 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 1,858 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

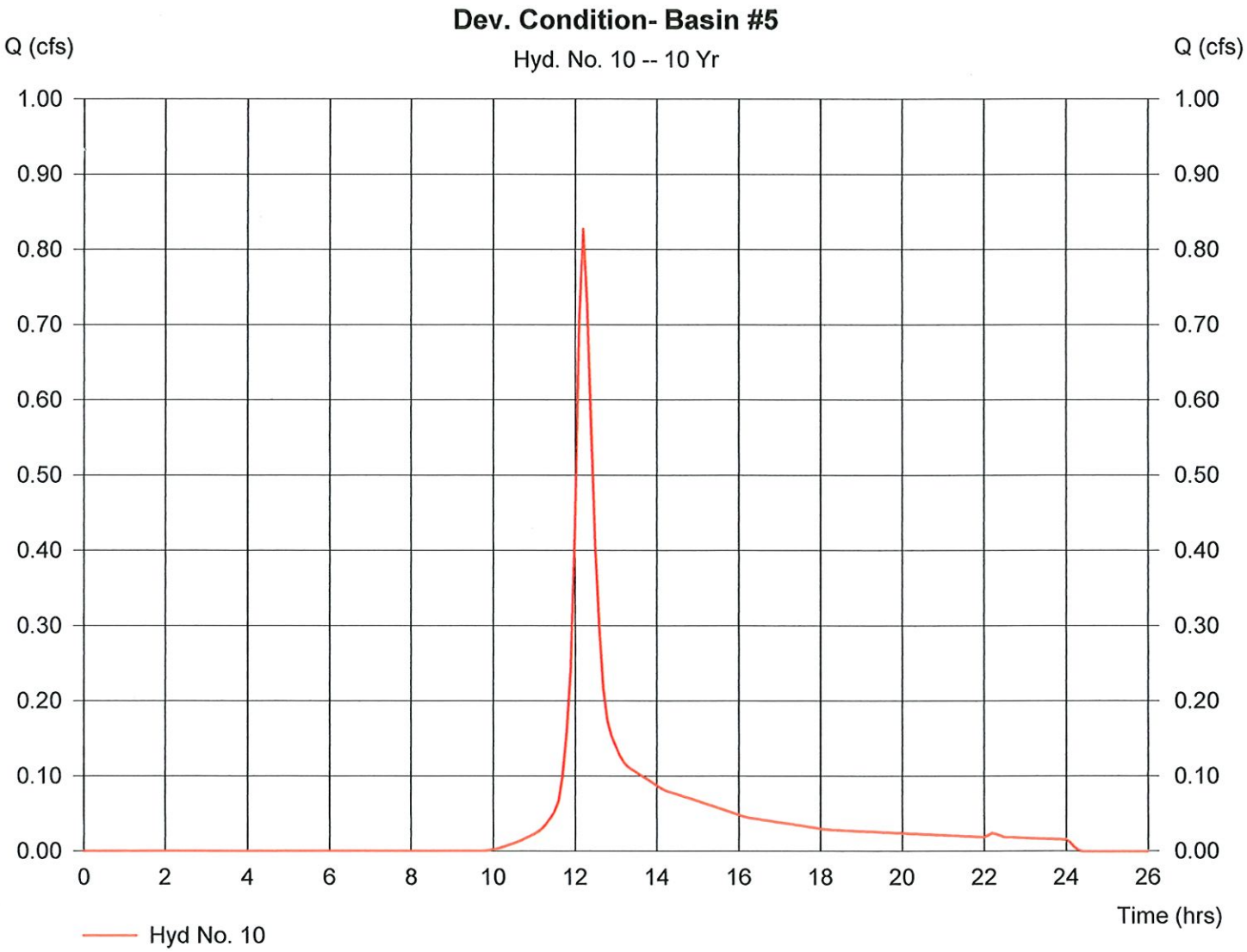
Thursday, Jan 23 2020, 12:51 PM

Hyd. No. 10

Dev. Condition- Basin #5

Hydrograph type	= SCS Runoff	Peak discharge	= 0.83 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 0.50 ac	Curve number	= 69
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,580 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

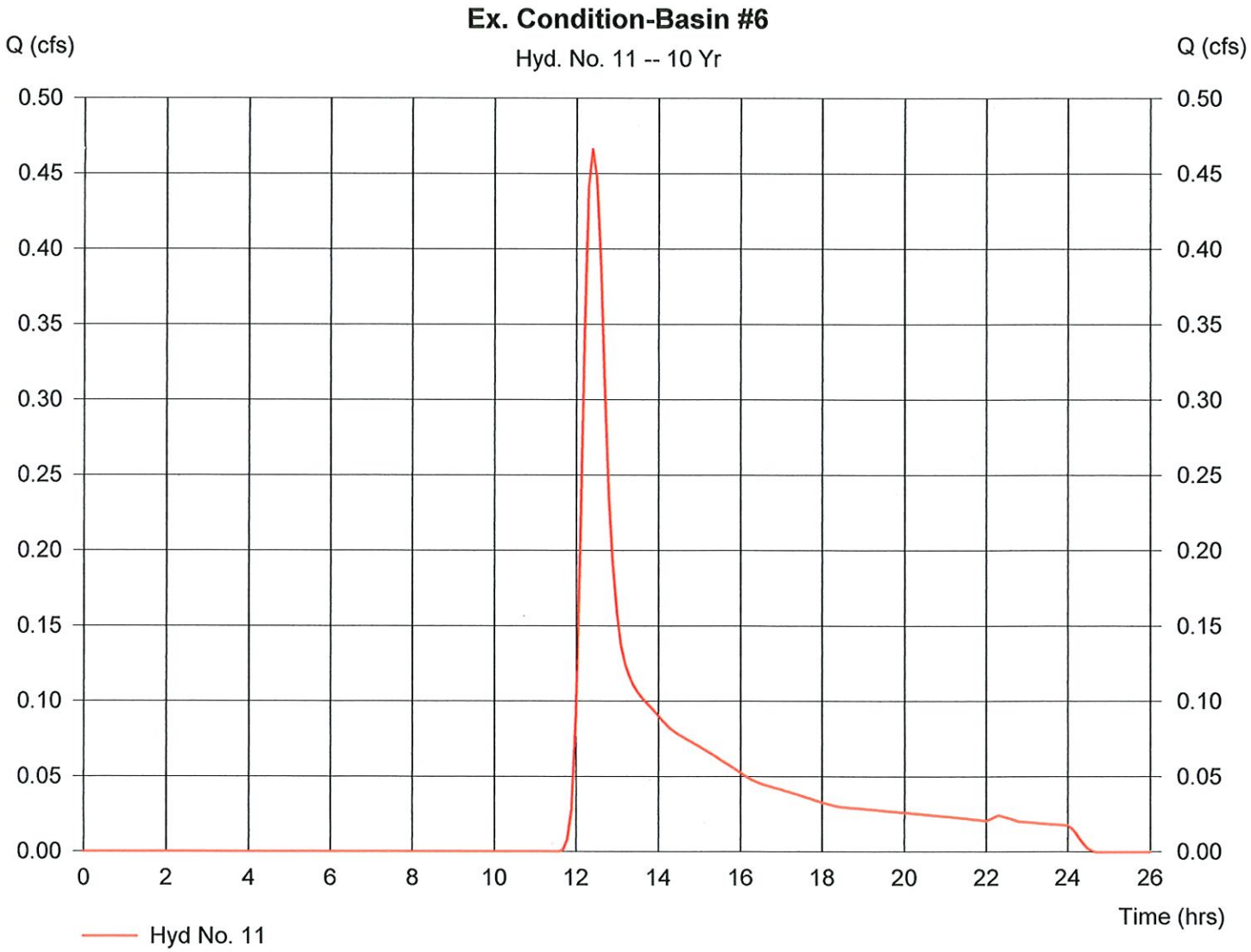
Thursday, Jan 23 2020, 12:51 PM

Hyd. No. 11

Ex. Condition-Basin #6

Hydrograph type	= SCS Runoff	Peak discharge	= 0.47 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 0.74 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 23.6 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,900 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

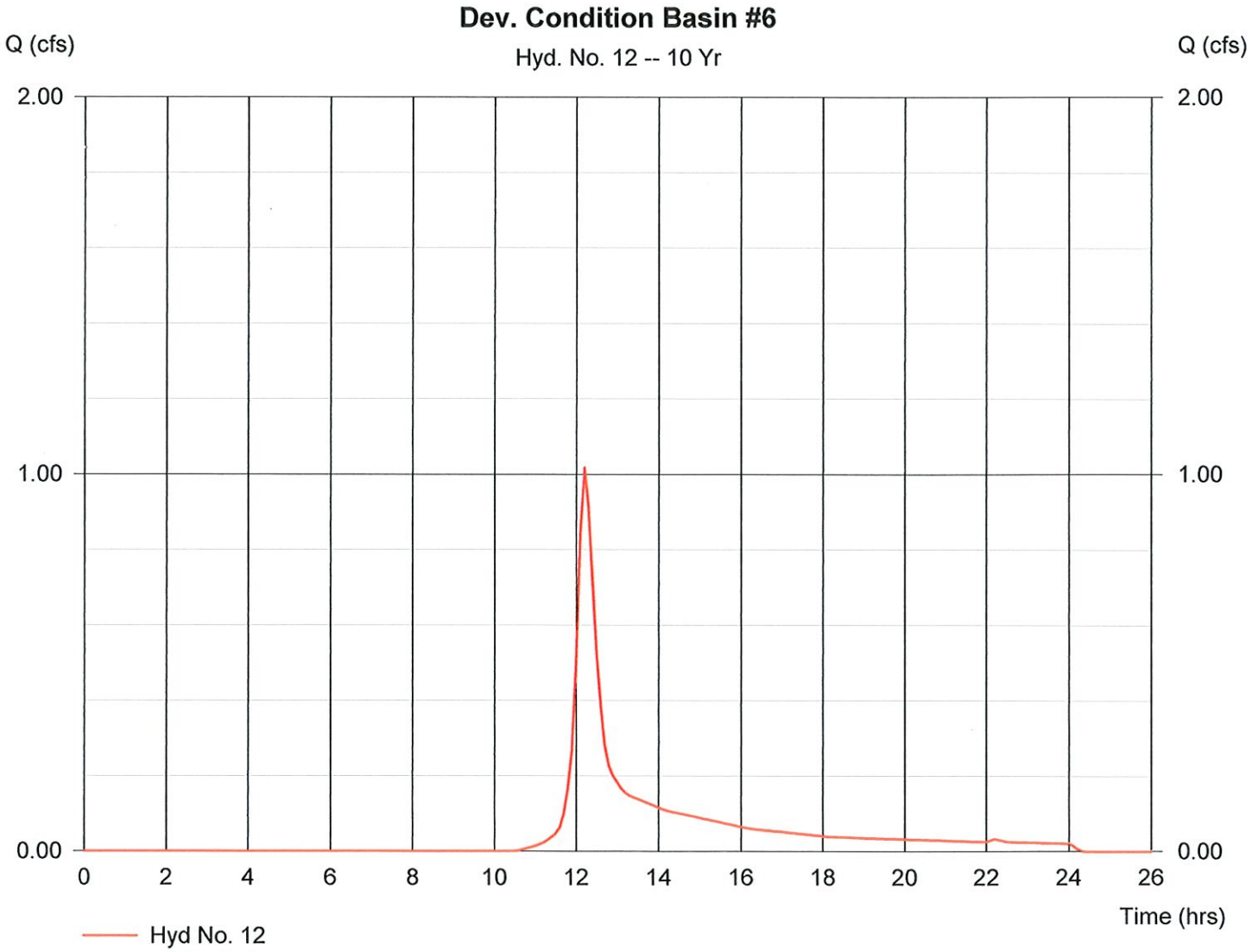
Thursday, Jan 23 2020, 12:51 PM

Hyd. No. 12

Dev. Condition Basin #6

Hydrograph type	= SCS Runoff	Peak discharge	= 1.02 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 0.74 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 5.20 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,503 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

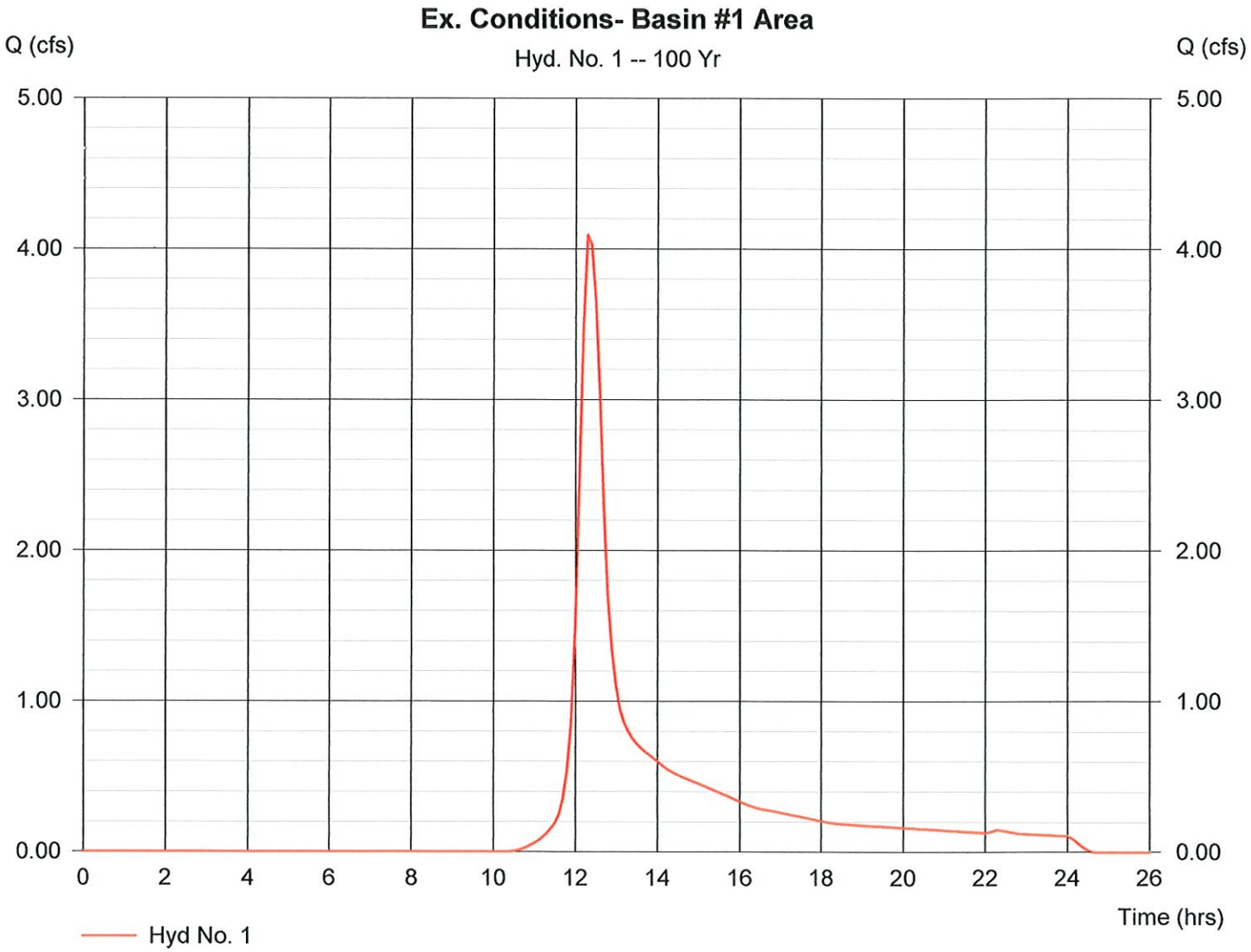
Thursday, Jan 23 2020, 12:56 PM

Hyd. No. 1

Ex. Conditions- Basin #1 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 4.09 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 2.16 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 22.7 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 22,313 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

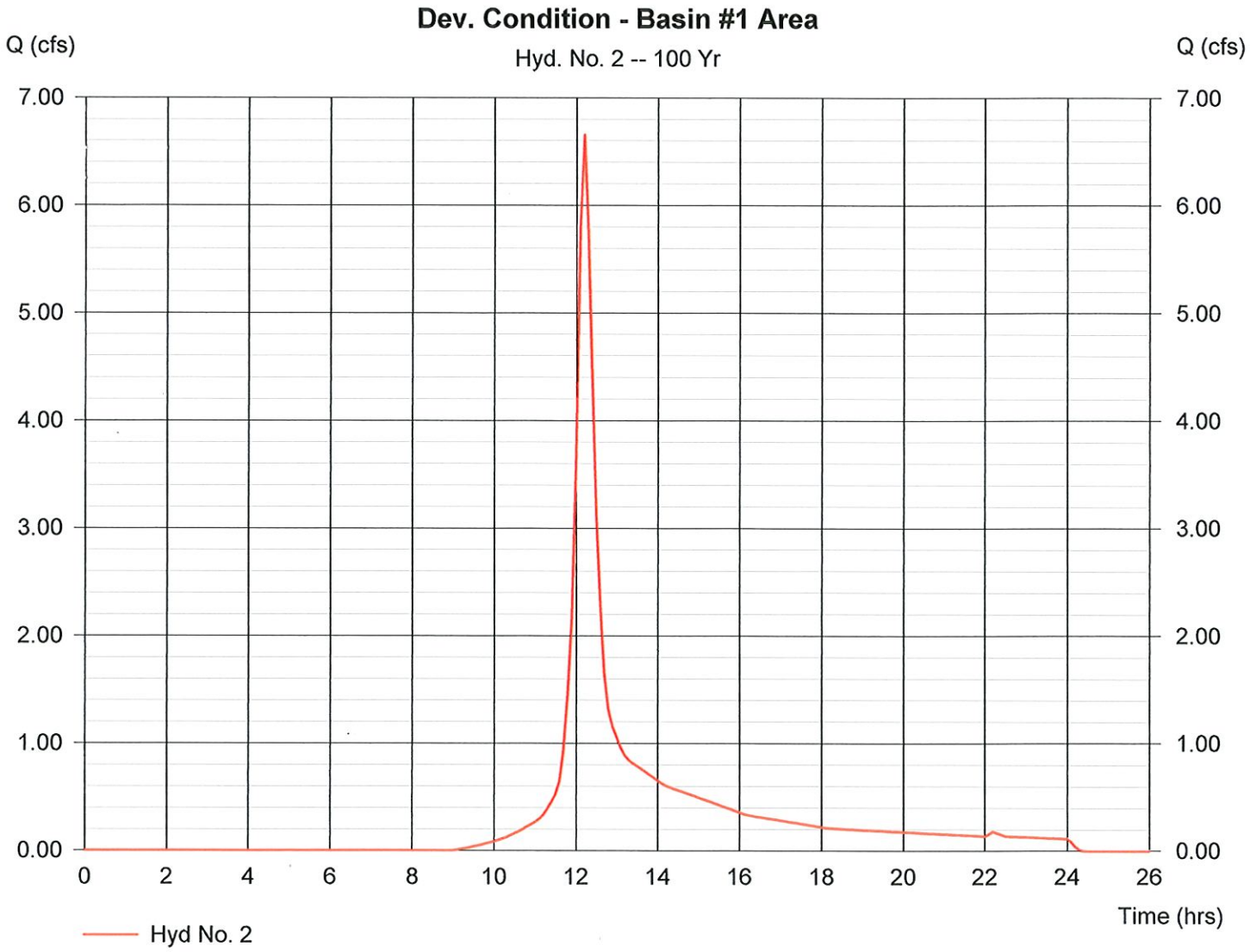
Thursday, Jan 23 2020, 12:56 PM

Hyd. No. 2

Dev. Condition - Basin #1 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 6.65 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 2.17 ac	Curve number	= 64
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.6 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 28,455 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

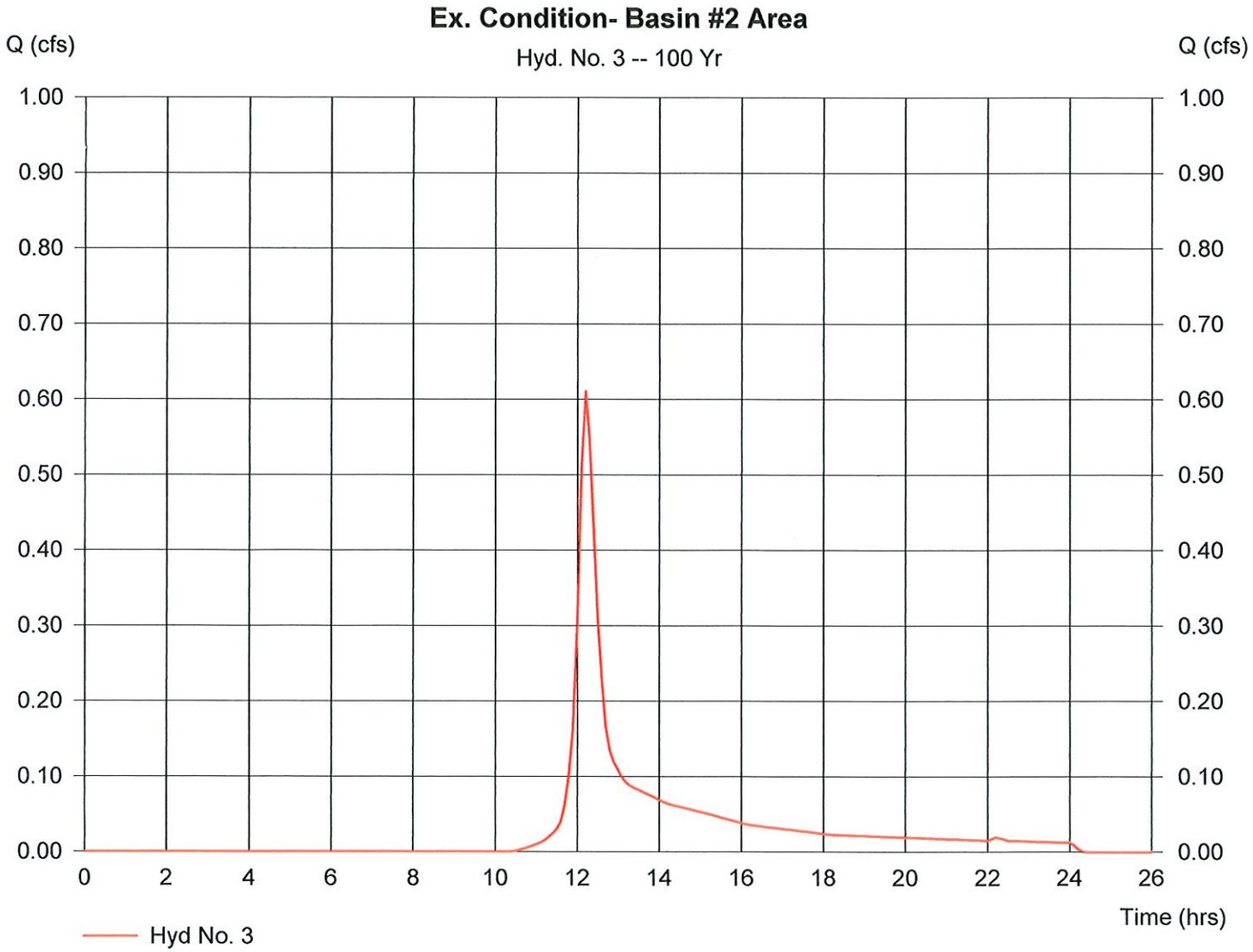
Thursday, Jan 23 2020, 12:56 PM

Hyd. No. 3

Ex. Condition- Basin #2 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 0.61 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.28 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 2,692 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

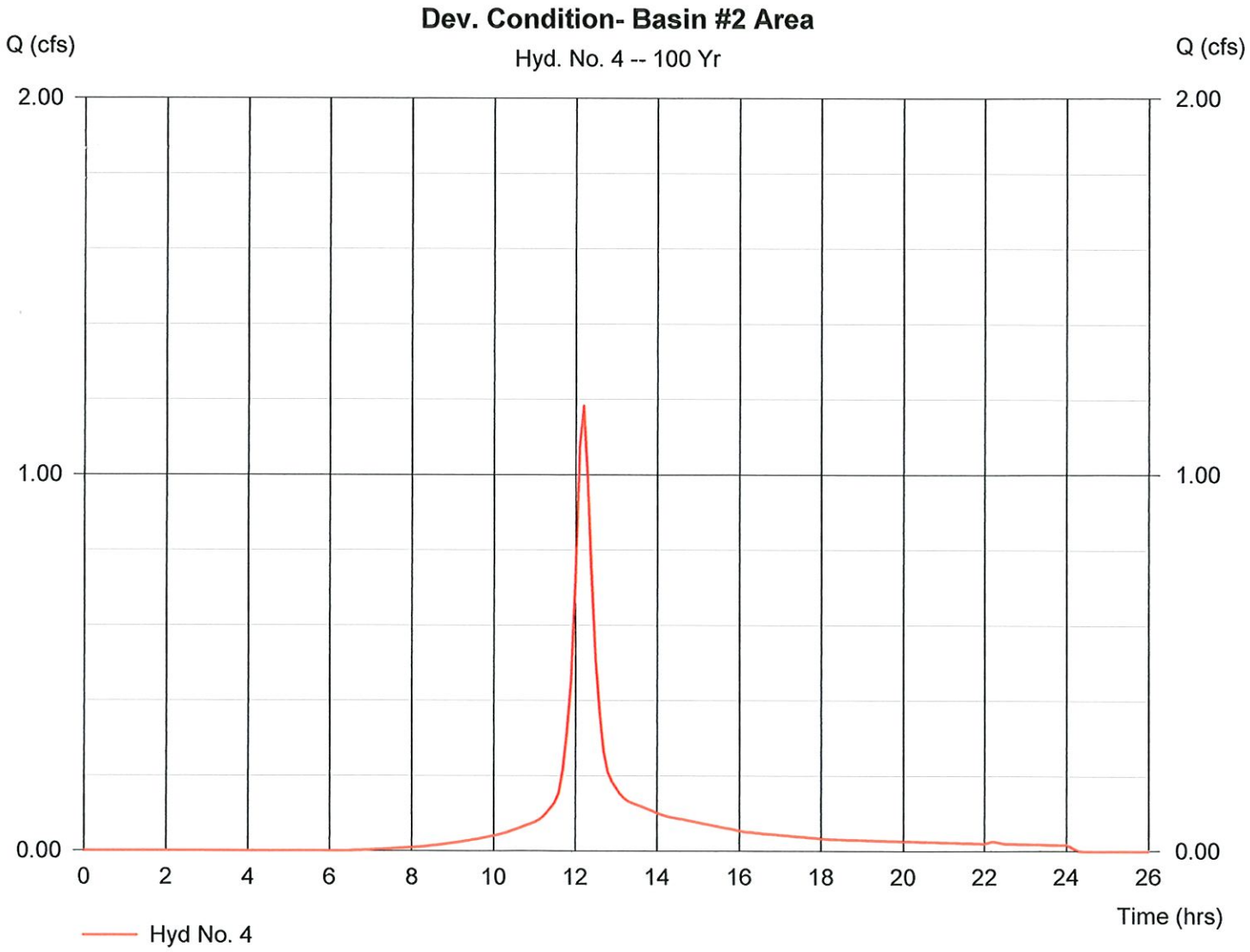
Thursday, Jan 23 2020, 12:56 PM

Hyd. No. 4

Dev. Condition- Basin #2 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 1.18 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.28 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 5,105 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

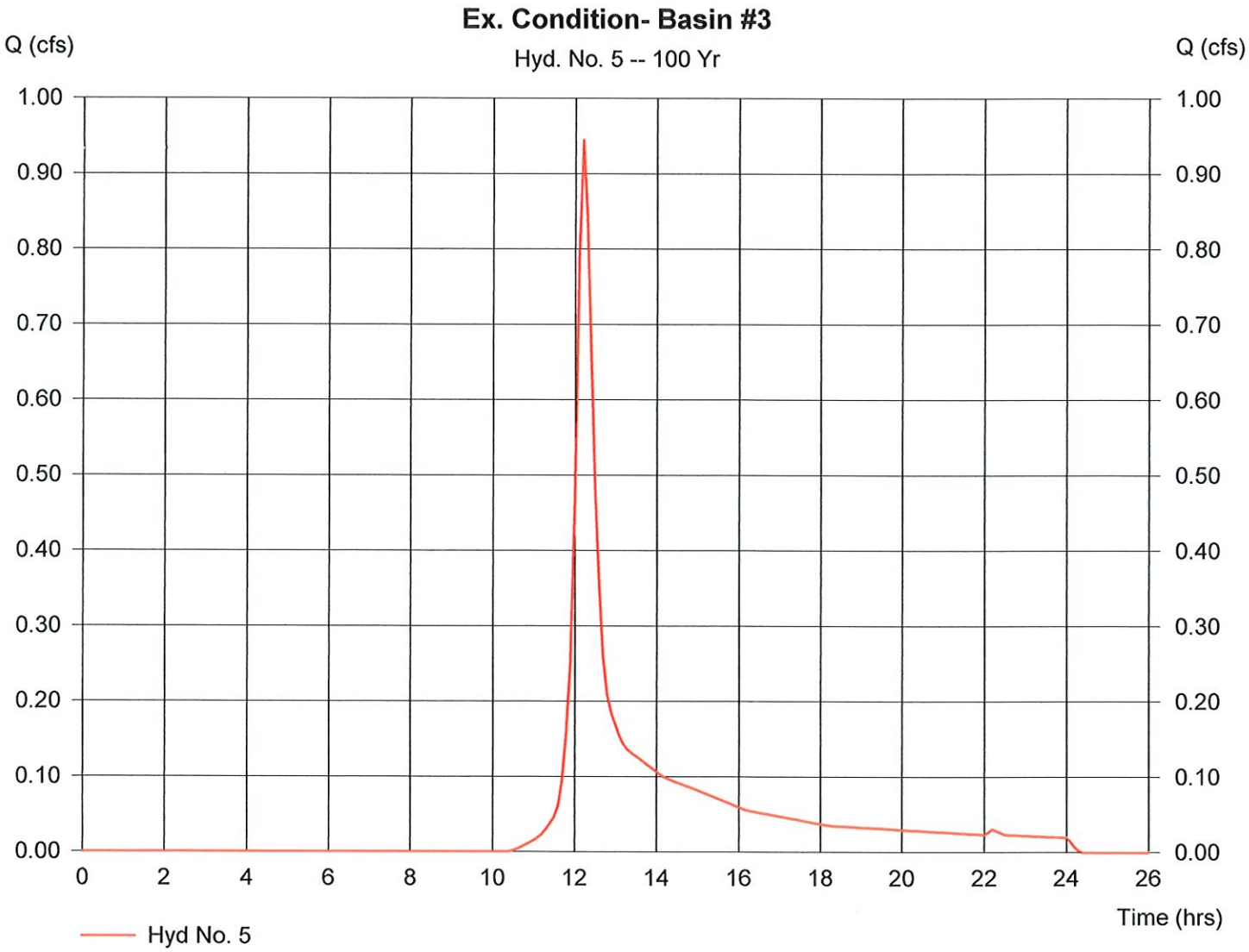
Thursday, Jan 23 2020, 12:56 PM

Hyd. No. 5

Ex. Condition- Basin #3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.94 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.43 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.9 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,164 cuft



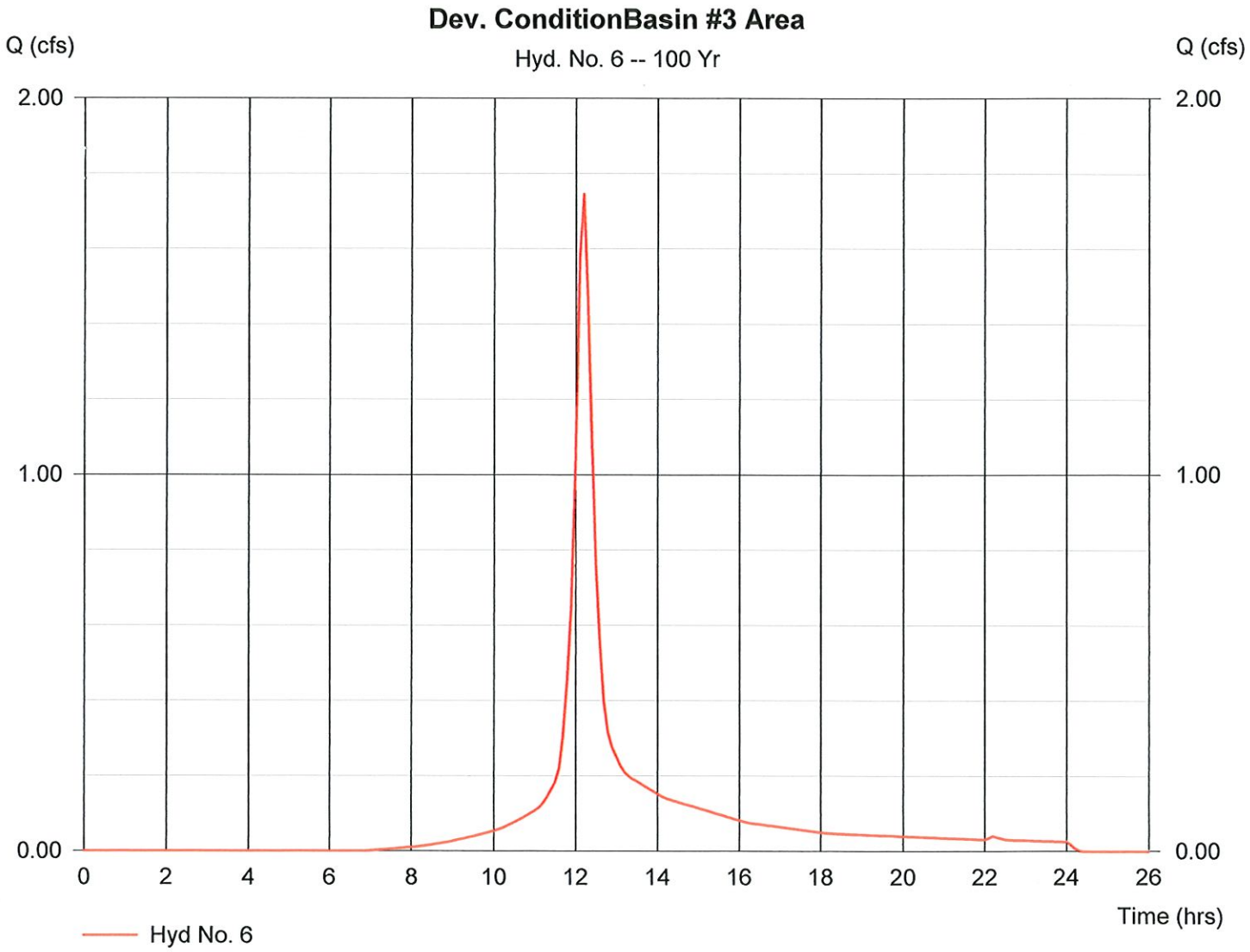
Hydrograph Plot

Hyd. No. 6

Dev. ConditionBasin #3 Area

Hydrograph type	= SCS Runoff	Peak discharge	= 1.74 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.43 ac	Curve number	= 75
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 7,497 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

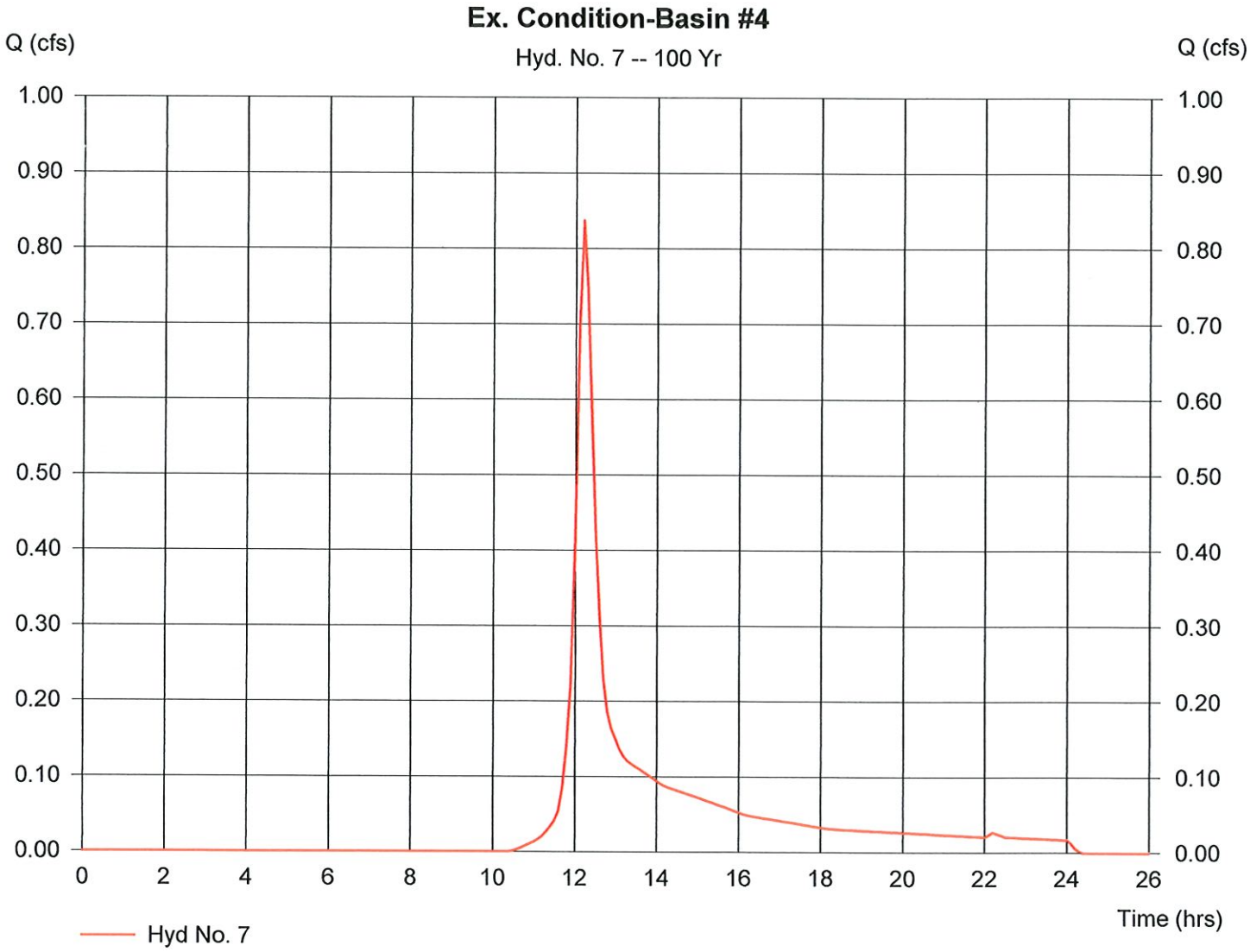
Thursday, Jan 23 2020, 12:56 PM

Hyd. No. 7

Ex. Condition-Basin #4

Hydrograph type	= SCS Runoff	Peak discharge	= 0.84 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.38 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.00567 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 3,690 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

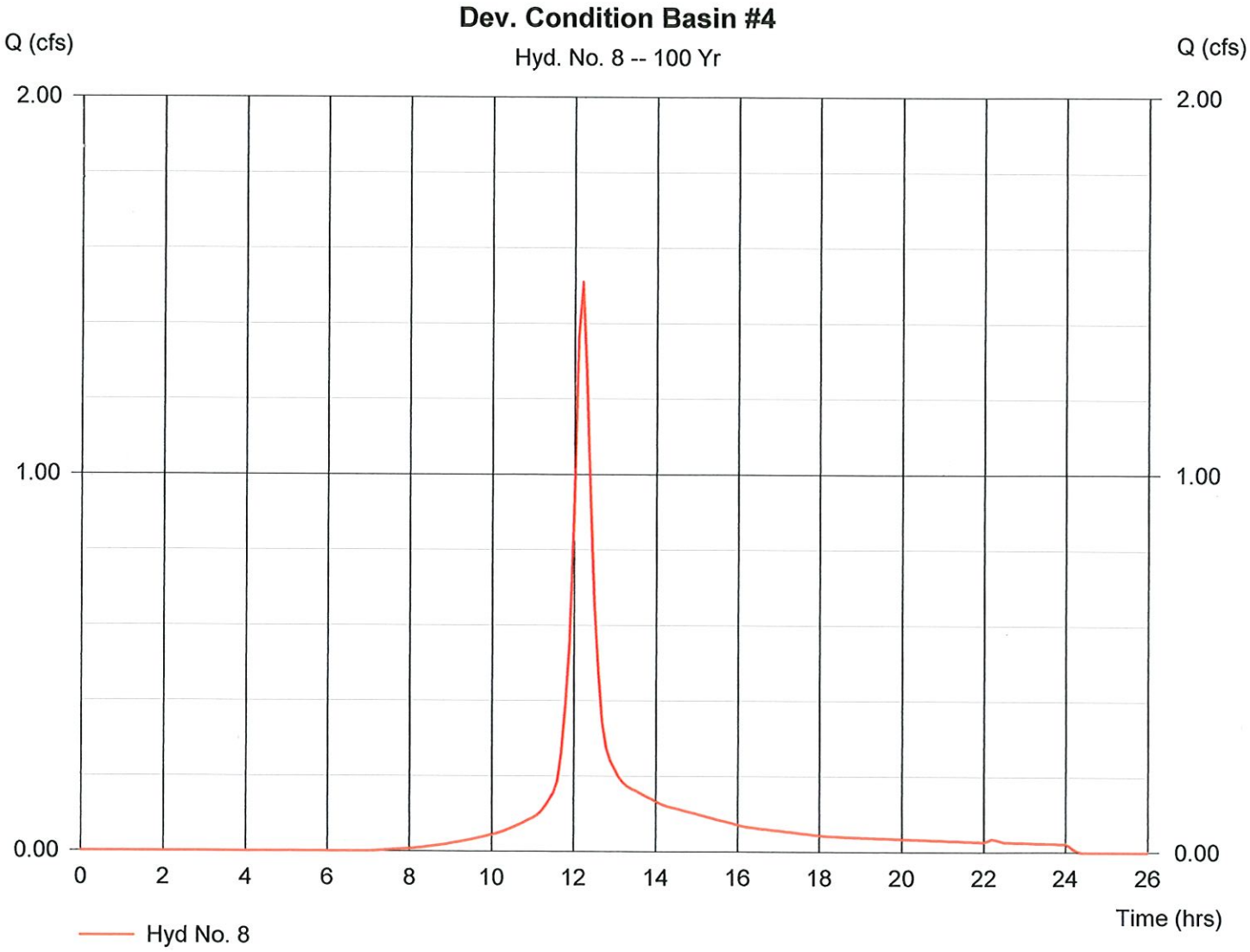
Thursday, Jan 23 2020, 12:56 PM

Hyd. No. 8

Dev. Condition Basin #4

Hydrograph type	= SCS Runoff	Peak discharge	= 1.51 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.38 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,474 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

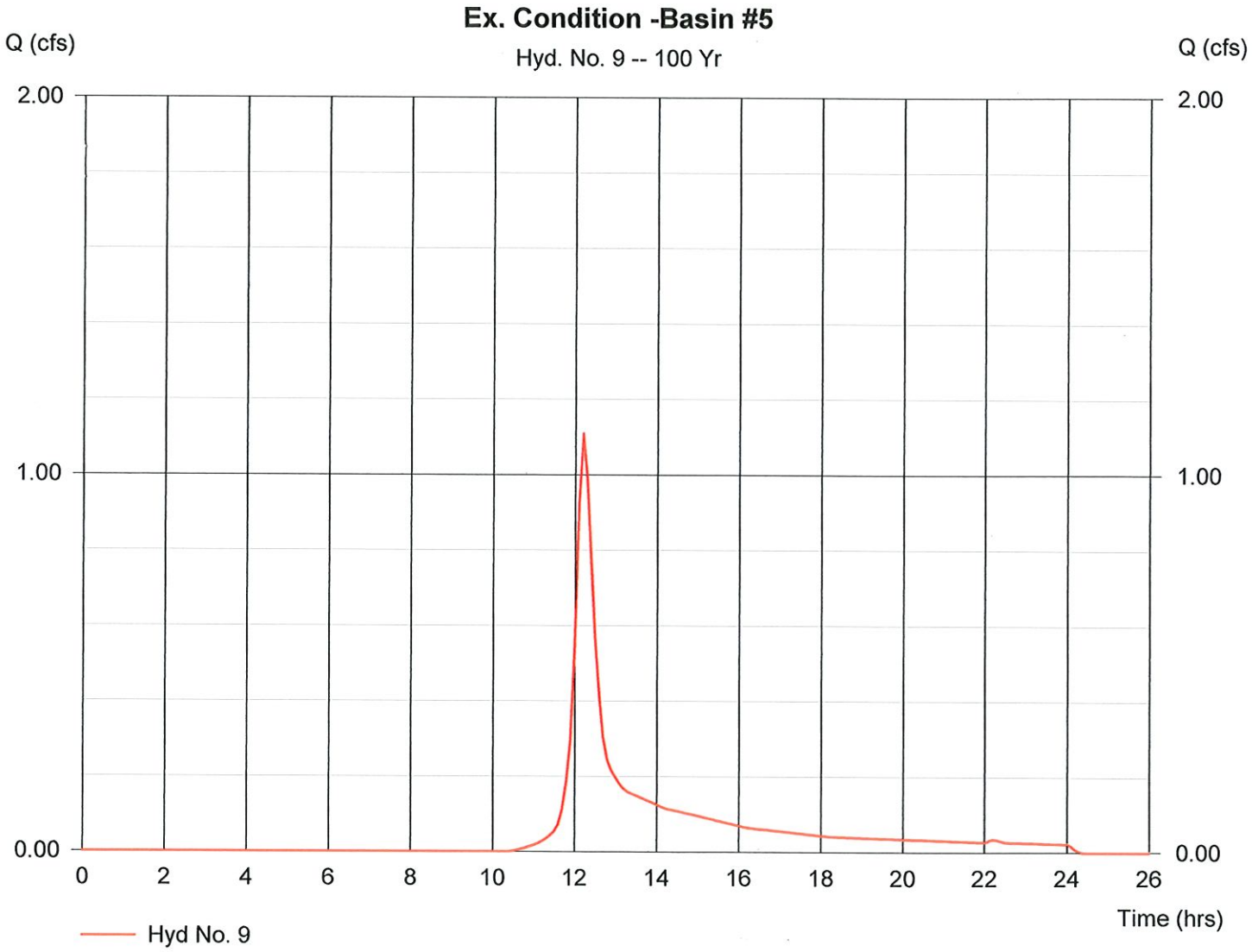
Thursday, Jan 23 2020, 12:56 PM

Hyd. No. 9

Ex. Condition -Basin #5

Hydrograph type	= SCS Runoff	Peak discharge	= 1.11 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.51 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 16.4 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,891 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

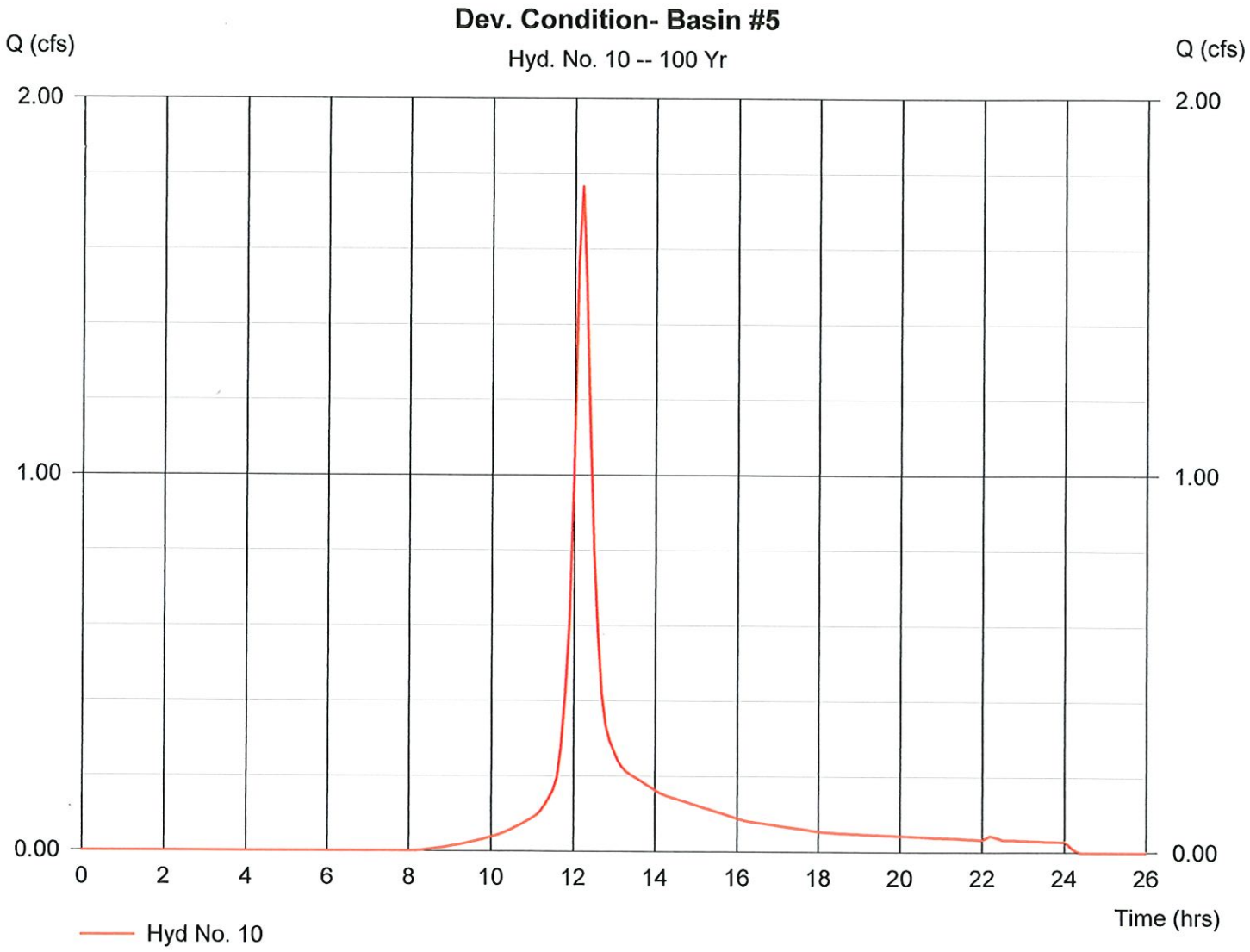
Thursday, Jan 23 2020, 12:56 PM

Hyd. No. 10

Dev. Condition- Basin #5

Hydrograph type	= SCS Runoff	Peak discharge	= 1.77 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.50 ac	Curve number	= 69
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 7,532 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

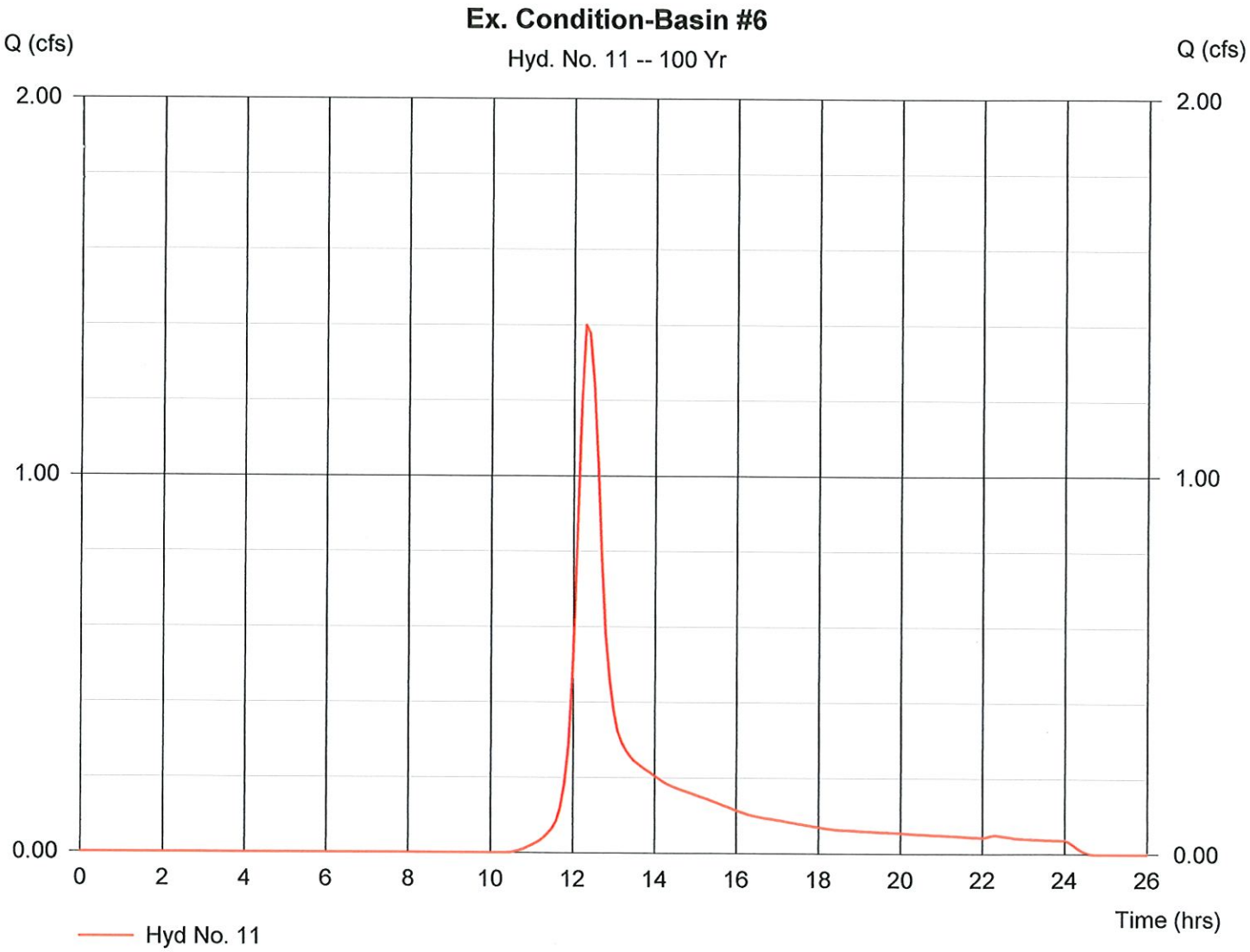
Thursday, Jan 23 2020, 12:56 PM

Hyd. No. 11

Ex. Condition-Basin #6

Hydrograph type	= SCS Runoff	Peak discharge	= 1.40 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.74 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 23.6 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 7,634 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

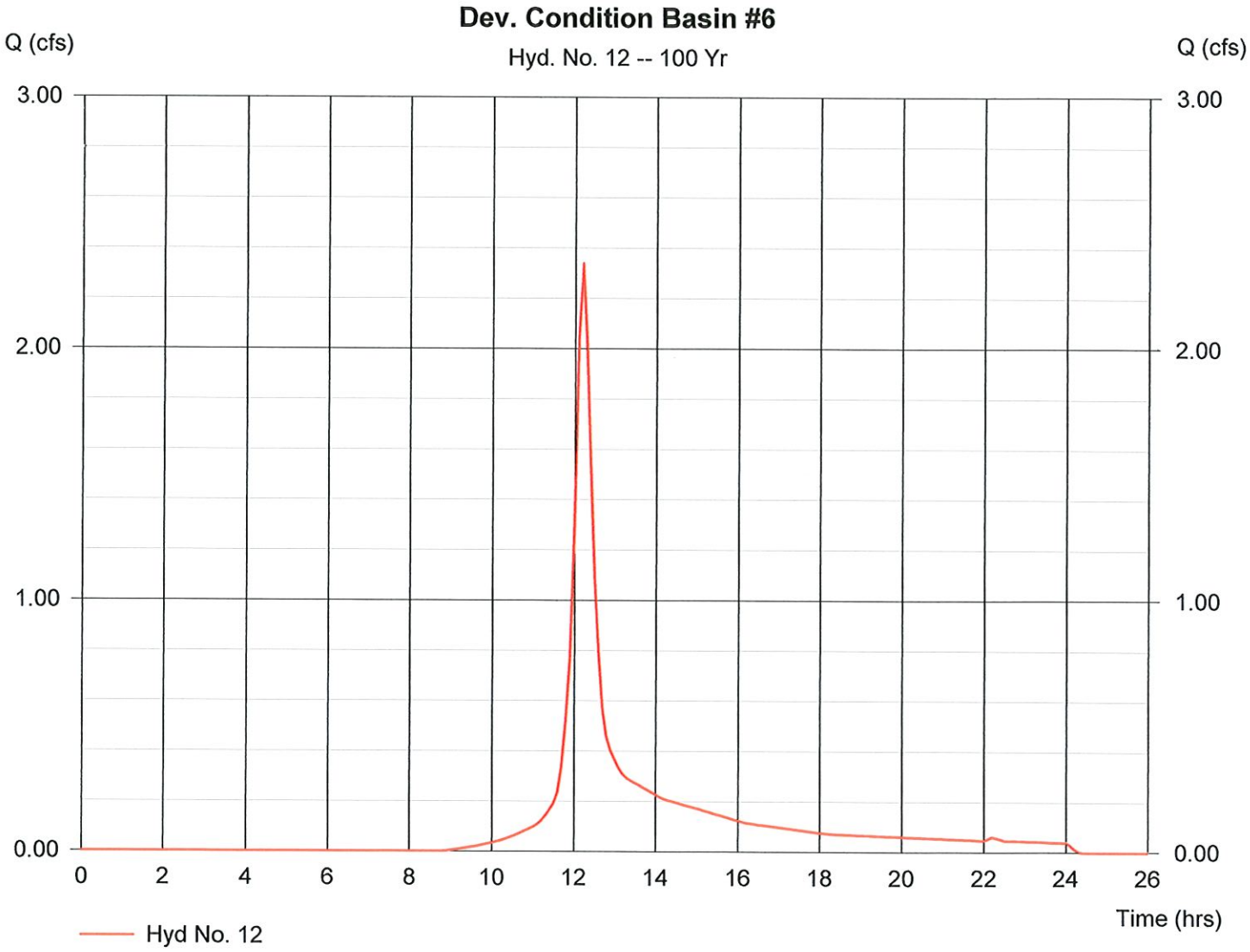
Thursday, Jan 23 2020, 12:56 PM

Hyd. No. 12

Dev. Condition Basin #6

Hydrograph type	= SCS Runoff	Peak discharge	= 2.34 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.74 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 9,990 cuft



STORMWATER DRAINAGE SYSTEM DESIGN

FRANK C. MAGNOTTA, P.E.

STORM WATER DRAINAGE SYSTEM DESIGN

The main access driveway has two locations where catch basins and a culvert are used. One other location along a private driveway has a 12" culvert crossing. All storm drain pipes use a smooth interior high density polyethylene pipe (HDPE) except where specifically noted otherwise. Where catch basins and culverts are used, pipe sizing criteria uses the TR-55 100 year peak flow rates at each location. The minimum pipe size used for driveway culvert and catch basin connections is 12" high density polyethylene pipe (Smooth HDPE).

The access driveway near the entrance off Cone Road crosses an intermittent watercourse created by a storm water discharge from a 24" pipe discharging water from a Town catch basin. Because of a shallow clearance at this location, 2-18" RCP culverts are used under the driveway with a total capacity equaling the existing 24" pipe. A total cover of 21 inches is provided over the class V 18" RCP within the road pavement limits. Rip-rap stilling basins are used on both ends of the new culverts with a level lip spreader provided at the outlet end of the stilling basin.

Two type "C" catch basins with double type II inlets are used at the sag in the access driveway to collect and direct runoff coming down the driveway into basin #1. An oil/particle separator is used between CB #2 and basin #1.

A 12" culvert is used under the driveway on lot #3.

Attached to this section are culvert nomographs and the hydraulic sheets for all proposed drainage pipes analyzing for the full flow capacity of the proposed pipes showing size, slope, velocity and flow rate. The design data for the individual catch basins, pipes and the oil / particle separator are shown in table form on the "Site Plan" where they appear.

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	4.09	6	738	22,313	----	-----	-----	Ex. Conditions- Basin #1 Area
2	SCS Runoff	6.65	6	732	28,455	----	-----	------	Dev. Condition - Basin #1 Area
3	SCS Runoff	0.61	6	732	2,692	----	------	------	Ex. Condition- Basin #2 Area
4	SCS Runoff	1.18	6	732	5,105	----	-----	-----	Dev. Condition- Basin #2 Area
5	SCS Runoff	0.94	6	732	4,164	----	------	------	Ex. Condition- Basin #3
6	SCS Runoff	1.74	6	732	7,497	----	-----	-----	Dev. ConditionBasin #3 Area
7	SCS Runoff	0.84	6	732	3,690	----	-----	------	Ex. Condition-Basin #4
8	SCS Runoff	1.51	6	732	6,474	----	------	------	Dev. Condition Basin #4
9	SCS Runoff	1.11	6	732	4,891	----	------	------	Ex. Condition -Basin #5
10	SCS Runoff	1.77	6	732	7,532	----	-----	-----	Dev. Condition- Basin #5
11	SCS Runoff	1.40	6	738	7,634	----	-----	-----	Ex. Condition-Basin #6
12	SCS Runoff	2.34	6	732	9,990	----	-----	------	Dev. Condition Basin #6
13	SCS Runoff	1.55	6	732	6,783	----	------	------	12 in. Driveway Culvert

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

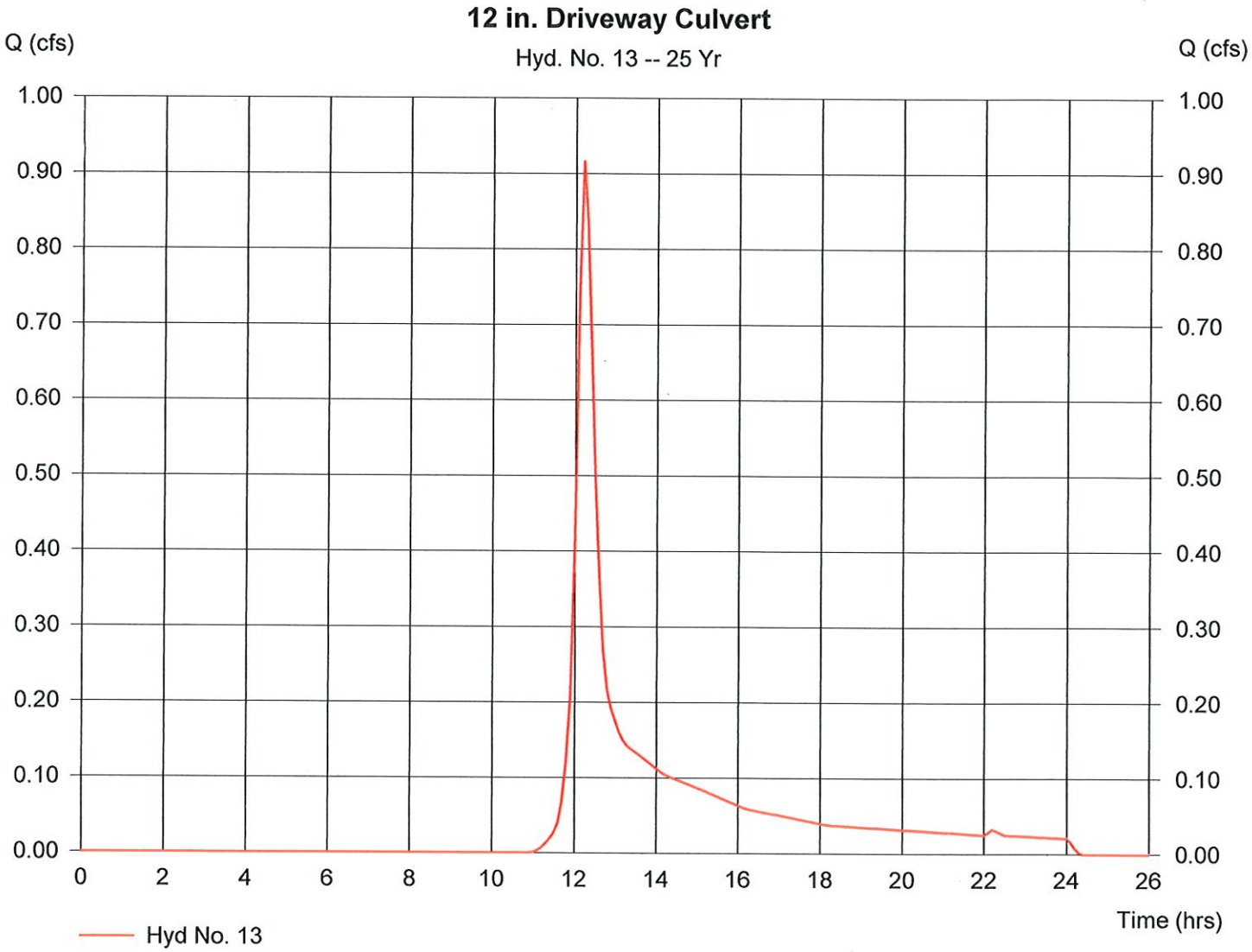
Friday, Jan 24 2020, 9:54 AM

Hyd. No. 13

12 in. Driveway Culvert

Hydrograph type	= SCS Runoff	Peak discharge	= 0.92 cfs
Storm frequency	= 25 yrs	Time interval	= 6 min
Drainage area	= 0.65 ac	Curve number	= 57
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18 min
Total precip.	= 6.34 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,172 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

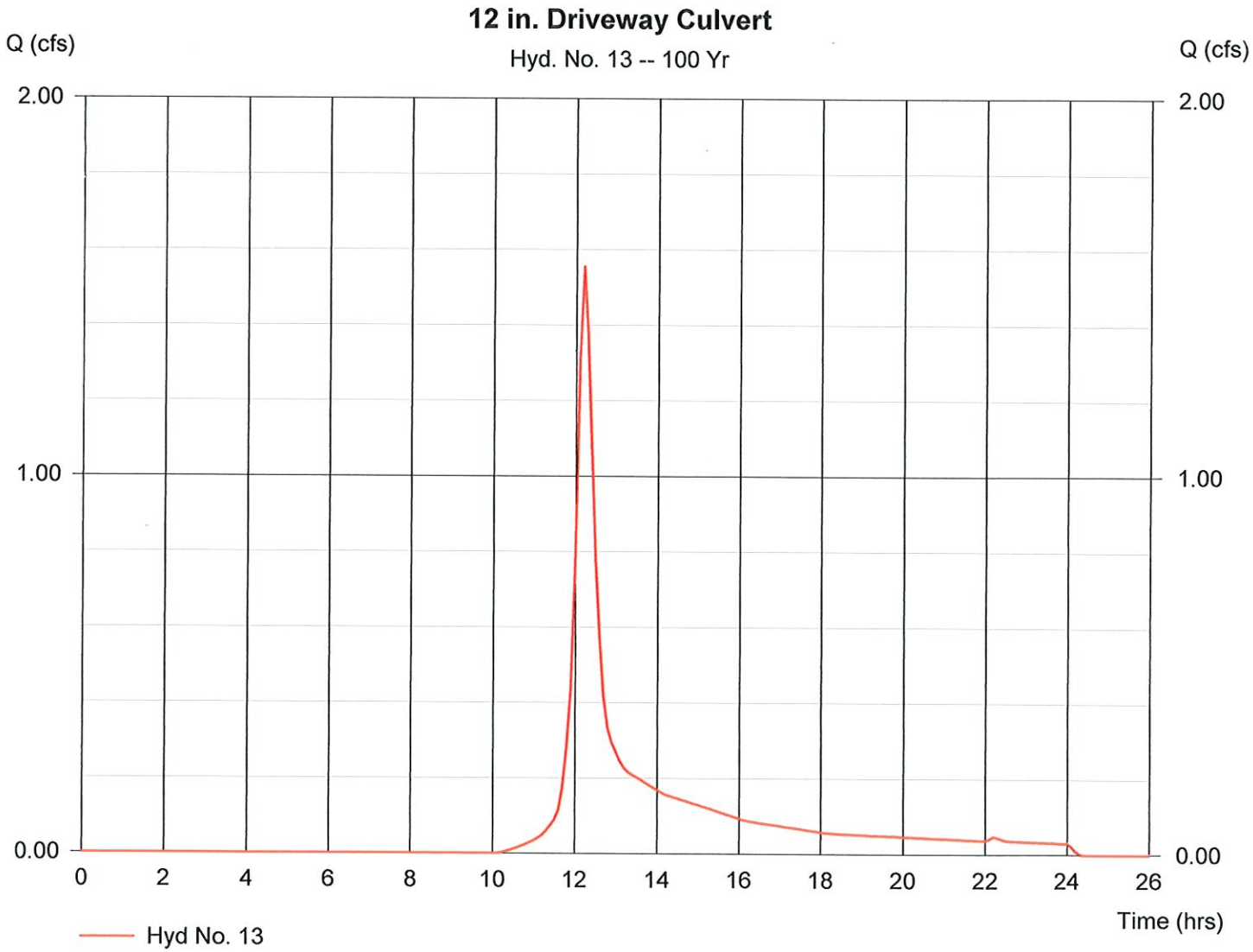
Friday, Jan 24 2020, 9:54 AM

Hyd. No. 13

12 in. Driveway Culvert

Hydrograph type	= SCS Runoff	Peak discharge	= 1.55 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.65 ac	Curve number	= 57
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,783 cuft



To use scale (2) or (3), project horizontally to scale (1), then use straight inclined line through D and Q scales, or reverse as illustrated.

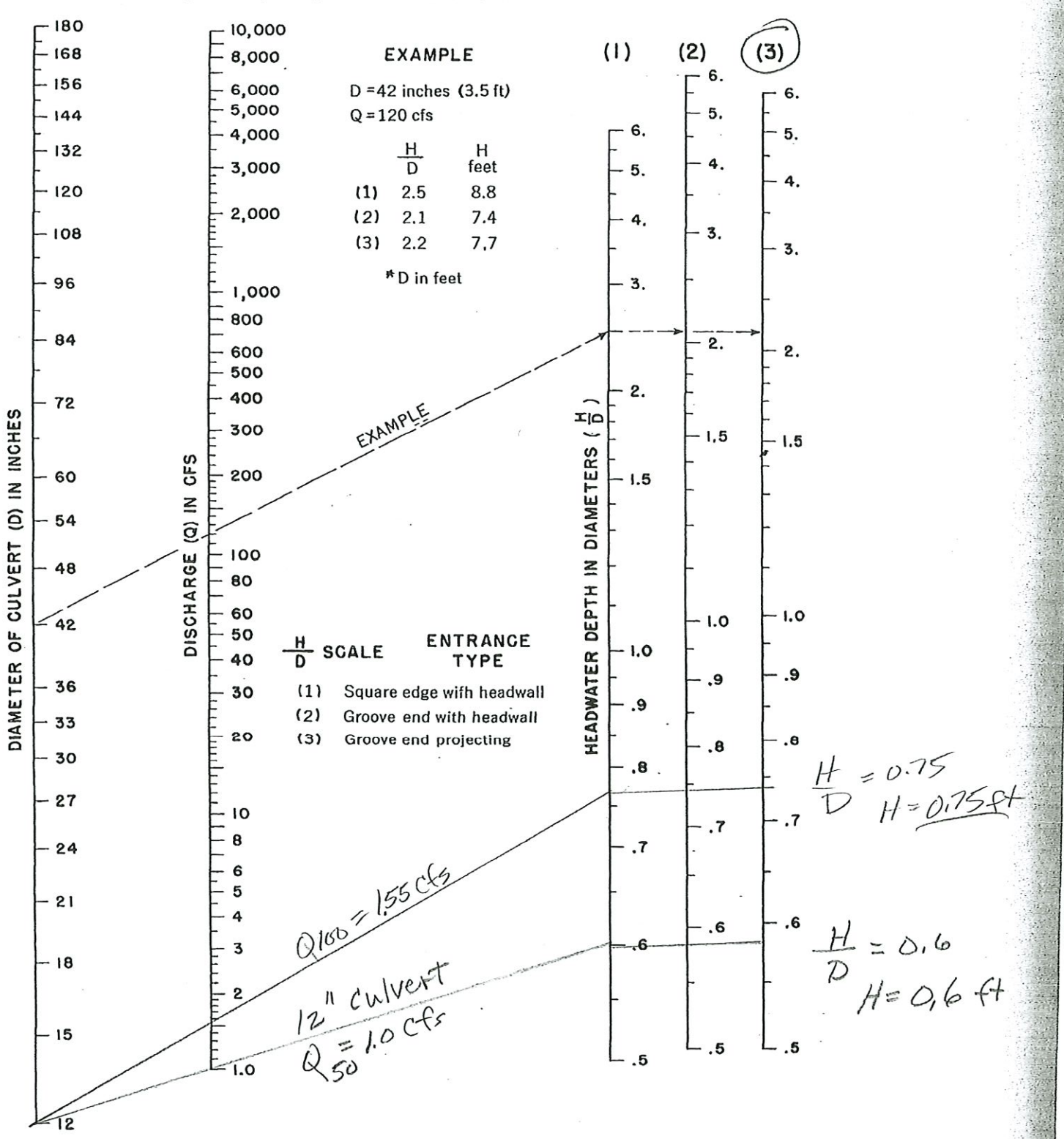


Figure B–8. Headwater depth for concrete pipe culverts with entrance control. (U.S. Bureau of Public Roads.) 288–D–2908.

— 12" Driveway Culvert —

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

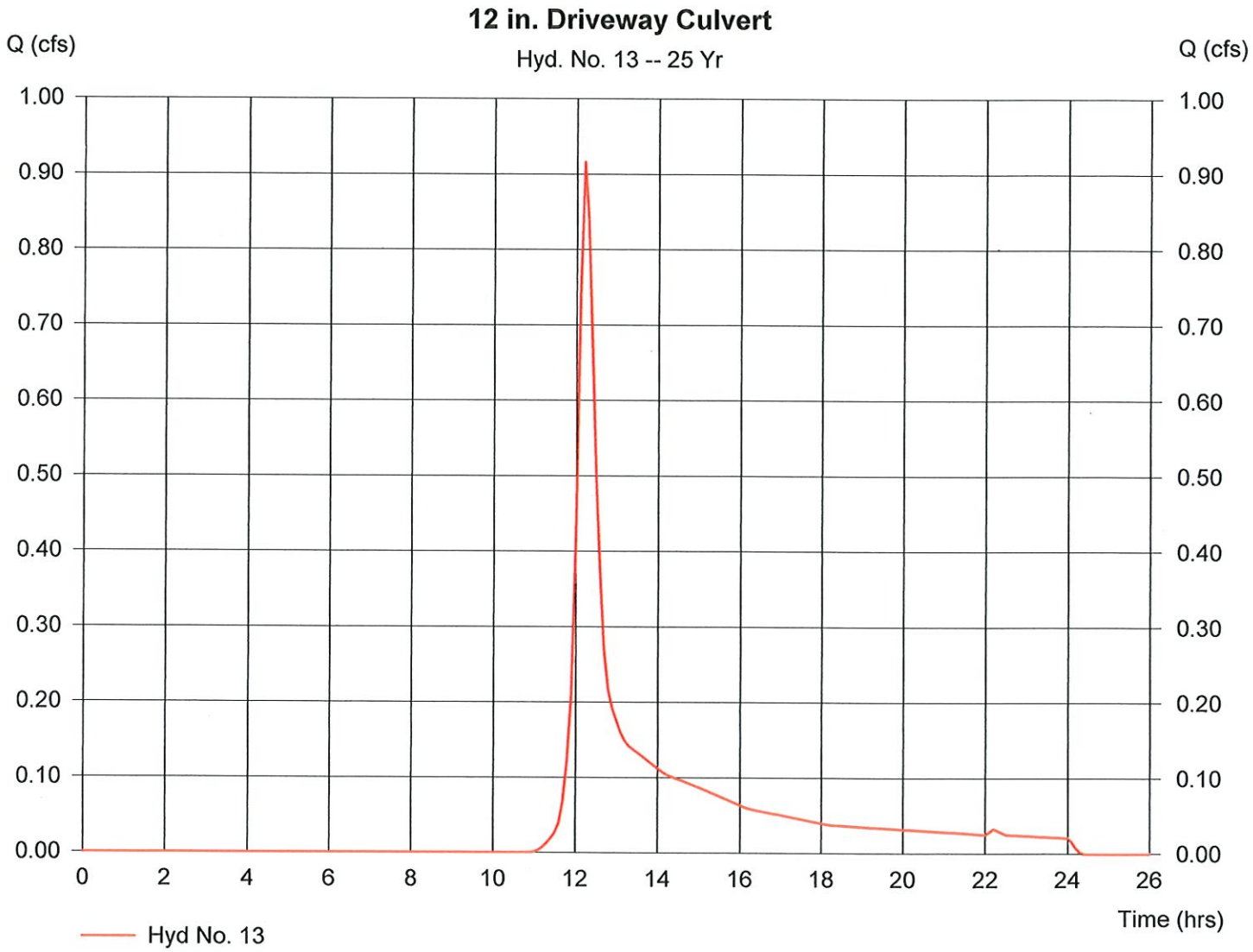
Friday, Jan 24 2020, 9:54 AM

Hyd. No. 13

12 in. Driveway Culvert

Hydrograph type	= SCS Runoff	Peak discharge	= 0.92 cfs
Storm frequency	= 25 yrs	Time interval	= 6 min
Drainage area	= 0.65 ac	Curve number	= 57
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18 min
Total precip.	= 6.34 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 4,172 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

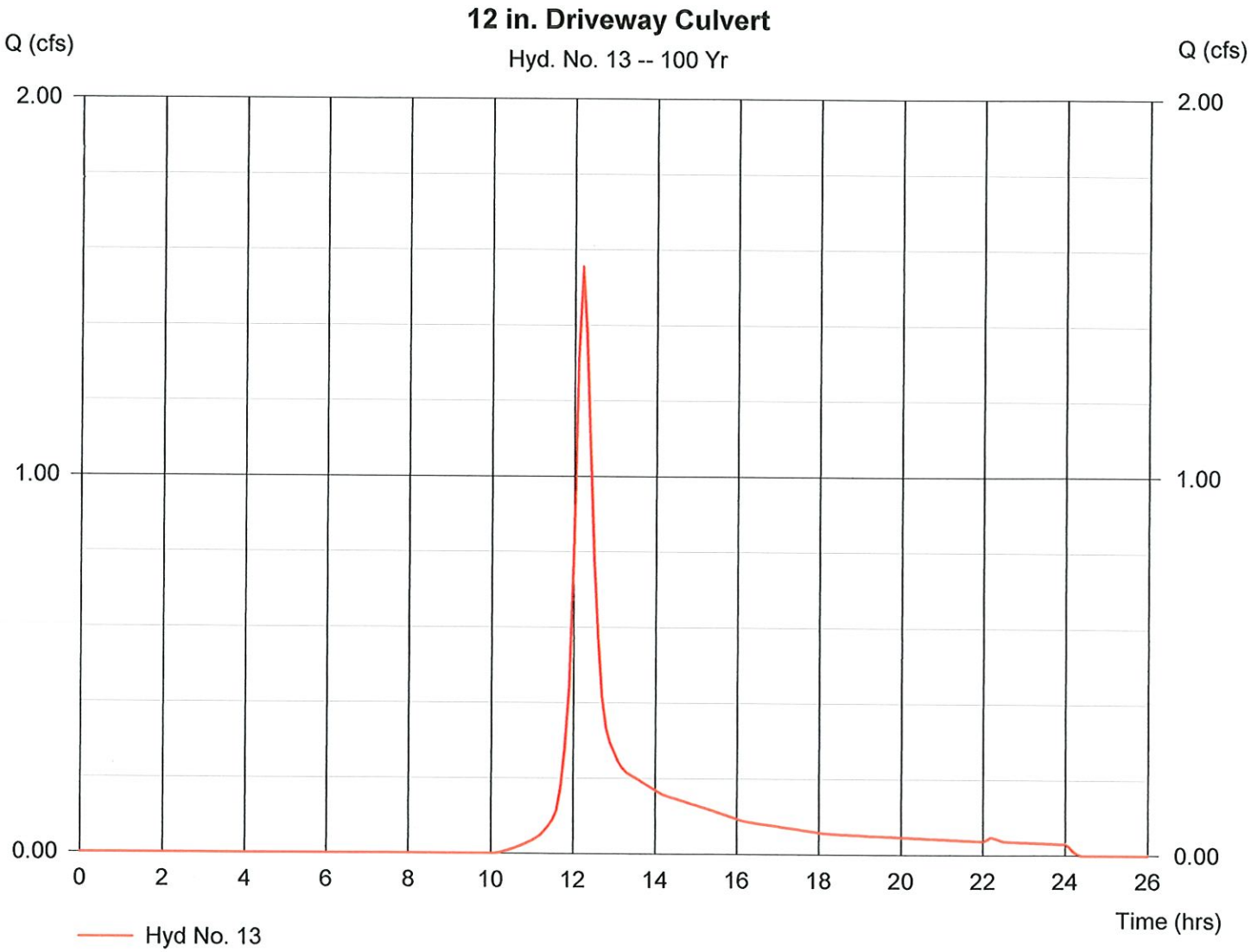
Friday, Jan 24 2020, 9:54 AM

Hyd. No. 13

12 in. Driveway Culvert

Hydrograph type	= SCS Runoff	Peak discharge	= 1.55 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 0.65 ac	Curve number	= 57
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18 min
Total precip.	= 8.09 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 6,783 cuft



To use scale (2) or (3), project horizontally to scale (1), then use straight inclined line through D and Q scales, or reverse as illustrated.

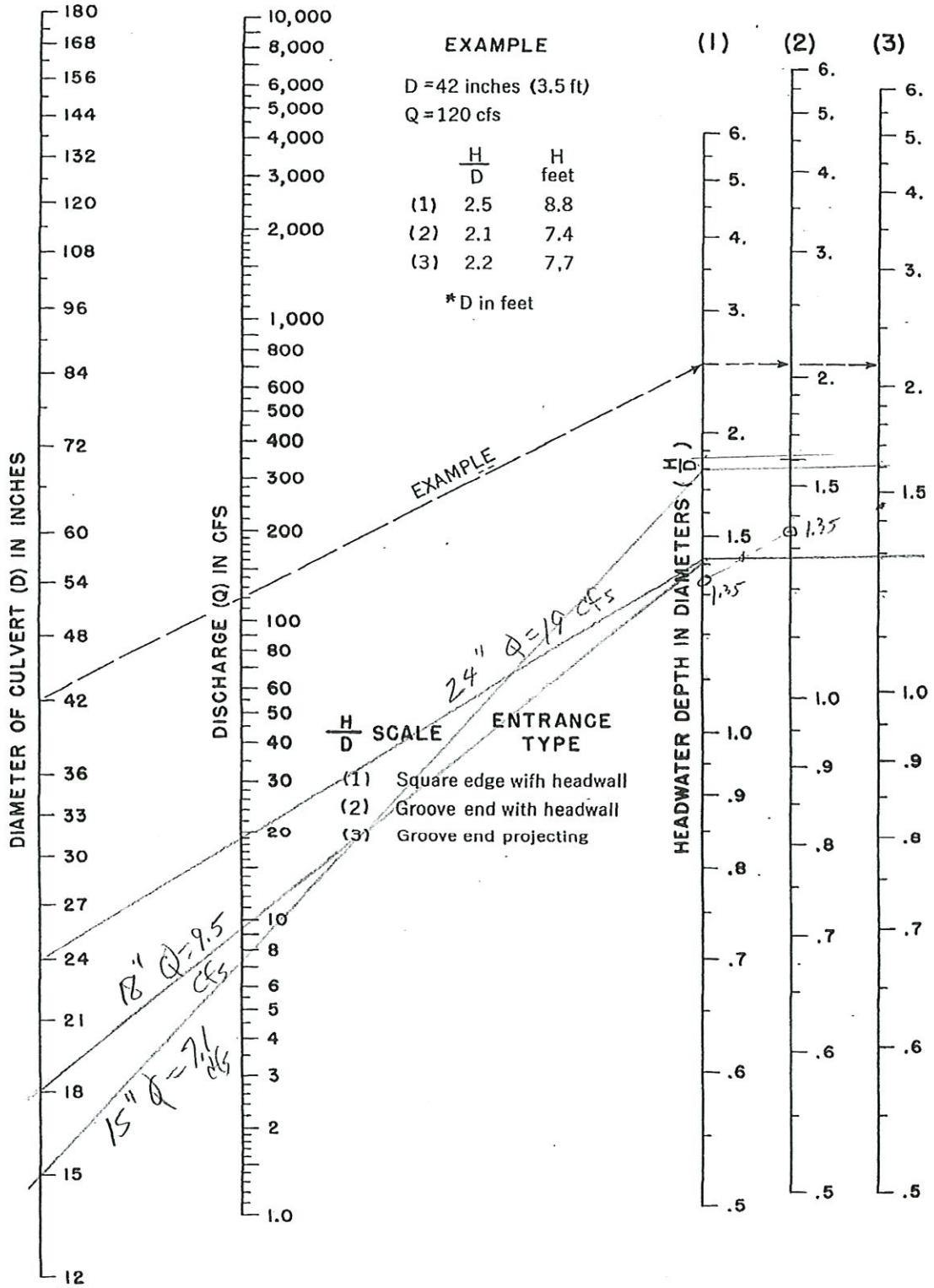


Figure 8–8. Headwater depth for concrete pipe culverts with entrance control. (U.S. Bureau of Public Roads.) 288–D–2908.

Twin 18" RCP Driveway Access

Worksheet for Circular Pipe - CB #1 → CB #2 X-Pipe

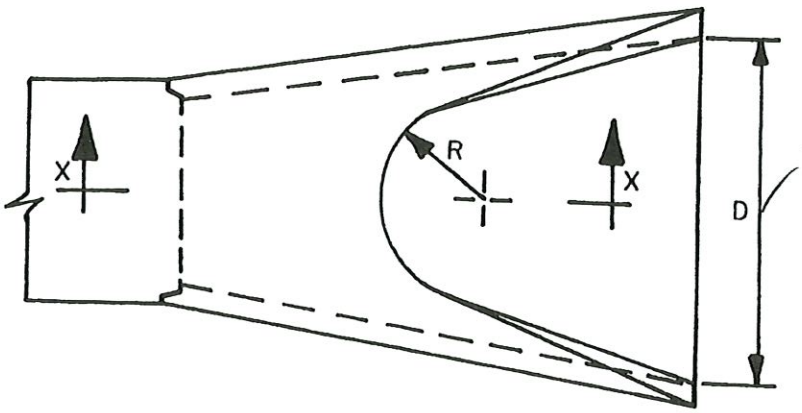
Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Full Flow Capacity	
Input Data		
Roughness Coefficient:	0.012	
Channel Slope:	0.01100	ft/ft
Diameter:	1.25	ft
Results		
Discharge:	7.34	ft^3/s
Normal Depth:	1.25	ft
Flow Area:	1.23	ft^2
Wetted Perimeter:	3.93	ft
Top Width:	0.00	ft
Critical Depth:	1.08	ft
Percent Full:	100.0	%
Critical Slope:	0.01012	ft/ft
Velocity:	5.98	ft/s
Velocity Head:	0.56	ft
Specific Energy:	1.81	ft
Froude Number:	0.00	
Maximum Discharge:	7.89	ft^3/s
Discharge Full:	7.34	ft^3/s
Slope Full:	0.01100	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s

Worksheet for Circular Pipe - CB #2 – O/P Separator

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Full Flow Capacity	
Input Data		
Roughness Coefficient:	0.024 – corrugated	
Channel Slope:	0.06250	ft/ft
Diameter:	1.25	ft
Results		
Discharge:	8.75	ft^3/s
Normal Depth:	1.25	ft
Flow Area:	1.23	ft^2
Wetted Perimeter:	3.93	ft
Top Width:	0.00	ft
Critical Depth:	1.15	ft
Percent Full:	100.0	%
Critical Slope:	0.05433	ft/ft
Velocity:	7.13	ft/s
Velocity Head:	0.79	ft
Specific Energy:	2.04	ft
Froude Number:	0.00	
Maximum Discharge:	9.41	ft^3/s
Discharge Full:	8.75	ft^3/s
Slope Full:	0.06250	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s

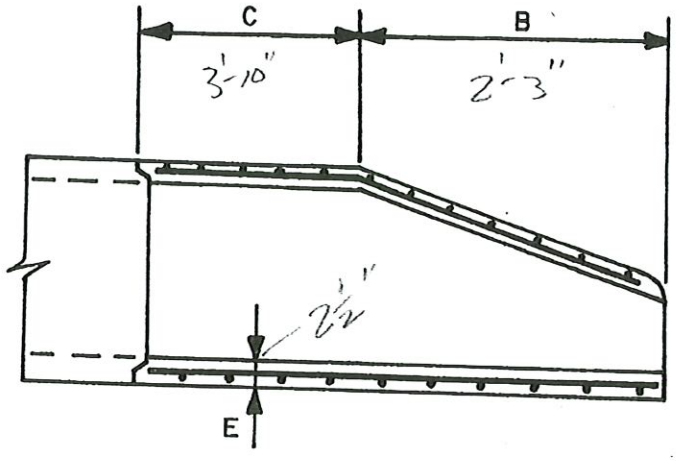
Worksheet for Circular Pipe - o/P — Basin

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Full Flow Capacity	
Input Data		
Roughness Coefficient:	0.024 — corrugated	
Channel Slope:	0.10000	ft/ft
Diameter:	1.25	ft
Results		
Discharge:	11.06	ft^3/s
Normal Depth:	1.25	ft
Flow Area:	1.23	ft^2
Wetted Perimeter:	3.93	ft
Top Width:	0.00	ft
Critical Depth:	1.20	ft
Percent Full:	100.0	%
Critical Slope:	0.08738	ft/ft
Velocity:	9.02	ft/s
Velocity Head:	1.26	ft
Specific Energy:	2.51	ft
Froude Number:	0.00	
Maximum Discharge:	11.90	ft^3/s
Discharge Full:	11.06	ft^3/s
Slope Full:	0.10000	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s

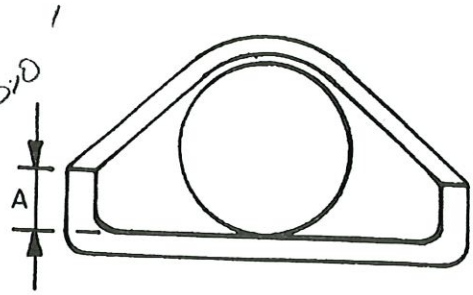


PLAN

Scale: None



SECTION X-X



END VIEW

Dia.	A	B	C	D	E	R
12"	4"	2'-0"	4'-0 7/8"	2'-0"	2"	9"
15"	6"	2'-3"	3'-10"	2'-6"	2¼"	11"
18"	9"	2'-3"	3'-10"	3'-0"	2½"	12"
24"	9½"	3'-7½"	2'-6"	4'-0"	3"	14"
30"	12"	4'-6"	1'-7 3/4"	5'-0"	3½"	15"
36"	15"	5'-3"	2'-10 3/4"	6'-0"	4"	20"
42"	21"	5'-3"	2'-11"	6'-6"	4½"	22"
48"	24"	6'-0"	2'-2"	7'-0"	5"	22"
54"	27"	5'-5"	2'-11"	7'-6"	5½"	24"
60"	30"	5'-0"	3'-3"	8'-0"	6"	24"

Note.

Joints may be furnished with either Bell & Spigot or Tongue & Groove ends.

Culvert End Sections shall conform to Connecticut Department of Transportation Standard Specification M.08.01-22

Field PRECAST CORP.

REINFORCED CONCRETE

DATE: 5-77

SURFACE WATER SWALE DESIGNS

FRANK C. MAGNOTTA, P.E.

SURFACE WATER SWALE DESIGNS

A "V" shaped rip-rap swale design with 1:1 side slopes is used throughout this project to convey water along driveways in a cut and other locations to direct runoff to specific basins. A review of the water depths created by various flow rates and swale slopes, indicates that the resulting depths range from 10" to 12". When using 25 year flow rates the depths range from 9" to 10". A 12" minimum depth of flow is specified for all 25 year designs and provides a 2" to 3" freeboard with enough depth to handle 100year flow requirements. Attached to this section are two sheets showing example hydraulic data for triangular rip-rap channels.

Worksheet for Triangular Channel -

Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient:	0.069 – Rip-Rap	
Channel Slope:	0.02000 2 %	ft/ft
Left Side Slope:	1.00 Side Slope 1:1	ft/ft (H:V)
Right Side Slope:	1.00	ft/ft (H:V)
Discharge:	1.74 –	ft³/s
Results		
Normal Depth:	1.05 – 12"	ft
Flow Area:	1.11	ft²
Wetted Perimeter:	2.97	ft
Top Width:	2.10	ft
Critical Depth:	0.72	ft
Critical Slope:	0.15508	ft/ft
Velocity:	1.57	ft/s
Velocity Head:	0.04	ft
Specific Energy:	1.09	ft
Froude Number:	0.38	
Flow Type:	Subcritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	1.05	ft
Critical Depth:	0.72	ft
Channel Slope:	0.02000	ft/ft
Critical Slope:	0.15508	ft/ft

Worksheet for Triangular Channel -

Project Description		
Flow Element:	Triangular Channel	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	
Input Data		
Roughness Coefficient:	0.069 – Rip Rap	
Channel Slope:	0.10000 – 10 %o	ft/ft
Left Side Slope:	1.00 – 1:1 side slopes	ft/ft (H:V)
Right Side Slope:	1.00 –	ft/ft (H:V)
Discharge:	2.34	ft^3/s
Results		
Normal Depth:	0.87 – 10"	ft
Flow Area:	0.75	ft^2
Wetted Perimeter:	2.46	ft
Top Width:	1.74	ft
Critical Depth:	0.81	ft
Critical Slope:	0.14909	ft/ft
Velocity:	3.10	ft/s
Velocity Head:	0.15	ft
Specific Energy:	1.02	ft
Froude Number:	0.83	
Flow Type:	Subcritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	0.87	ft
Critical Depth:	0.81	ft
Channel Slope:	0.10000	ft/ft
Critical Slope:	0.14909	ft/ft