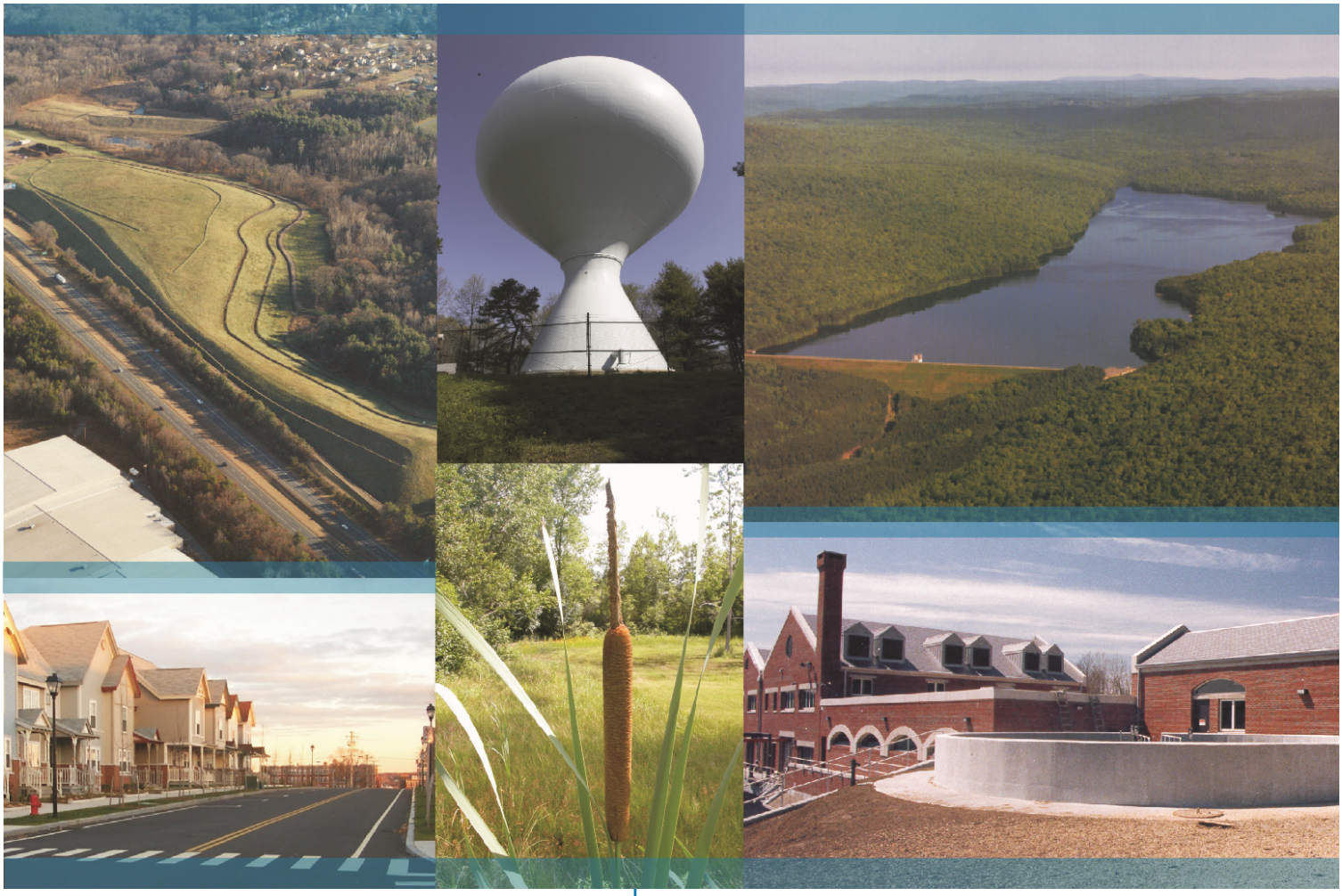

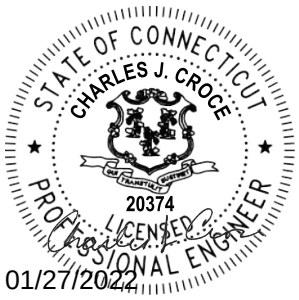

01/27/2022

01/27/2022

Tighe&Bond

The Frederick Gunn School
Center for Innovation and Active Citizenship
99 Green Hill Road
Washington, CT 06793

Stormwater Management Report

Prepared For:

Town of Washington,
Zoning Commission

January 2022

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Tighe&Bond

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Section 1
Introduction and Site Conditions

This project consists of a proposed Center for Innovation and Active Citizenship at The Frederick Gunn School in Washington, CT. Refer to Figure 1, Site Location Map, in **Appendix A**.

The project includes the demolition of the existing Math & Science Building, as well as construction of the new approximately 24,000 square foot building with accompanying site improvements. These site improvements include proposed sidewalks, stairs, patios, and driveway reconstruction. Additionally, the project will feature new site utilities to serve the proposed building including underground electric service, propane service, tel-data, domestic water, fire protection, site lighting, sanitary sewer, drainage and stormwater management systems.

1.1 Existing Conditions

The project site lies on the approximately 21.7-acre main campus parcel of the Frederick Gunn School, near the intersection of Green Hill Road (State Route 47) and Roxbury Road (State Route 199), in Washington, CT. The project limits is currently developed with two buildings: the existing Math & Science building and the Elizabeth Kempton Memorial Building. The site area also features various surface features consisting of parking, access drives, walkways, stairs, landscaping, and rock outcrops.

1.2 Proposed Conditions

The proposed work includes the construction of a new approximately 24,000 square foot Building, with a ground floor footprint of approximately 13,000 square feet. Accompanying site improvements include proposed sidewalks, patios, along with reconstruction of driveways and parking areas. The proposed work avoids disturbing existing native trees, rock outcroppings, and landscaping to extents feasible.

Utility improvements on-site include new drainage structures, piping, and stormwater management systems to treat, infiltrate, and release runoff off-site. Ultimately, the stormwater management design is proposed to reduce peak flows and volumes off-site in comparison to existing conditions.

Additional utility work includes proposed tel-data, fiber, electric services, including proposed a new generator and transformer. A buried propane tank is proposed along the driveway on the west side of the new building. Domestic water, fire protection, and a new hydrant is proposed to extend from the proposed building, following the existing driveways, to tap into the existing water system distribution line on campus to the west of the building. The building's sanitary service is proposed to connect to the existing on-campus sanitary sewer system, mimicking the connection of the existing building being demolished. A geothermal system is proposed in the lawn area north of the proposed building.

Section 2
Stormwater Management

2.1 Existing Site Hydrologic Analysis

In general, the project site consists of existing buildings and accompanying sidewalks, driveway, and parking lot which slopes from the northwest to the east, splitting around the existing Math & Science building. A portion of the runoff is directed into storm drainage structures and piping which drains off-site to the existing drainage system in State Route 47 (Green Hill Road) north/upstream of the intersection with State Route 199 (Roxbury Road). The remaining portion of the proposed site area drains to State Route 199 (Roxbury Road) via existing on-site piping which connects to the existing drainage system in State Route 199 (Roxbury Road), as well as by surface flow to the State Route 199 Right-of-Way.

For this project, two analysis design points were chosen downstream of the project area. The first point, Design Point 1, is located at an existing storm pipe which collects runoff from the northern and northeastern portion of the site. Design Point 2 is the property boundary at the southeast of corner of the site which includes runoff from storm drainage piping and also runoff from the site wall which passes through weeps in the wall. See "Existing Watershed Map," **EX-WS**, in **Appendix C** for the locations of the design points, and the corresponding watershed areas.

Impervious and pervious areas, weighted curve numbers, and times of concentration were calculated for each watershed and entered into a hydrologic model to determine the existing condition's peak flow and volume as part of the comparative hydrology analysis.

The soil types were identified and classified using the USDA Natural Resource Conservation Service, Online Web Soil Survey. Using this data, curve numbers, or CN values, were determined by evaluating land uses within the watershed, and then taking a weighted average. The calculated CN values are shown in **Appendix C**.

A breakdown of existing volumetric hydrographs, and existing watershed map are included in **Appendix C** of this report.

2.1.1 Floodplain Management

The Federal Emergency Management Agency's Flood Insurance Rate Map (FIRM) for the Town of Washington, effective September 30, 1992, shows that the site does not fall in a Flood Hazard Area, as shown on the figure in **Appendix A.**

2.2 Proposed Site Hydrologic Analysis

The proposed drainage system is designed to mimic the existing drainage watershed, provide stormwater quality measures, and reduce runoff peak flows and volumes leaving the site to less than those in the existing conditions. See "Proposed Watershed Map," **PR-WS**, in **Appendix D** for the locations of the design points, and the corresponding watershed areas.

There are two separate proposed stormwater management systems, correlating to the two separate design points. The first system is comprised of a series of yard drains, associated piping, and a bio-swale. Runoff from the eastern sidewalks, landscaped areas, rock outcrops, and existing buildings are captured by yard drains and directed into the bio-swale. Runoff will then filter through the soil media for water quality treatment, discharge to the on-site drainage system by means of an underdrain, with larger storm events entering the system through the yard drain grate withing the bio-swale, and ultimately discharged off-site to the existing drainage system in State Route 47, Design Point 1. This bio-swale is designed with an impermeable liner to mitigate the potential for groundwater to enter the basement of the adjacent existing building. The storage volume beneath the outlet of the bio-swale is 439 CF, greater than the required water quality volume (WQV). The bio-swale treats approximately 0.562 acres of the project area, most of the project area to the east of the building. The bio-swale is designed for the stormwater quality volume of the contributing watershed, and is not accounted for in the computations for mitigating for runoff peak flow and volume. Reduction in the proposed runoff peak flow and volume to Design Point 1 is achieved by nature of reducing the watershed area contributing to this design point in the proposed conditions.

The second proposed stormwater management system utilizes a series of proposed yard drains, manholes, associated piping, hydrodynamic separators, and infiltration chambers. The new yard drains are proposed to capture runoff from the northern and western patio, walkways, landscaped areas and rock outcrops. Runoff from the building roof is piped into the northern infiltration chamber system. The northern and southern infiltration systems are proposed at the same elevations, and interconnected with a proposed 18-inch diameter pipe, nearly flat at 0.1%, to effectively function as one collective system. Infiltration tests were performed at both stormwater management system locations. An infiltration rate of 0.98 feet/day (or 0.49 in/hr) was measured for the northern infiltration area, and an infiltration rate of 5.4 feet/day (or 2.7 in/hr) was measured for the southern infiltration area. The design utilizes half of the measured infiltration rates for each system, resulting in 0.25 in/hr for the northern system and 1.35 in/hr for the southern system. The geotechnical test report is included in **Appendix B** of this report. The infiltration chamber systems were sized to maintain the proposed runoff peak flow and volumes to below those in the existing conditions.

A breakdown of the proposed volumetric hydrographs, proposed watershed map, and calculations for the time of concentrations are included in **Appendix D** of this report.

Table 1 below depicts the reduction in peak flows from existing to the proposed site for the 2, 10, 25, and 100-year storm events.

TABLE 1
Stormwater Peak Runoff (CFS)

		Return Frequency (Years)			
Discharge Location	**Condition**	**2**	**10**	**25**	**100**
Total Runoff (Design Point 1)	Existing	1.64	3.12	4.05	5.48
	Proposed	1.62	3.02	3.90	5.25
	Change	-0.03	-0.10	-0.15	-0.23
Total Runoff (Design Point 2)	Existing	2.96	5.14	6.49	8.55
	Proposed	2.95	4.88	5.97	8.02
	Change	-0.02	-0.26	-0.52	-0.54

Table 2 below shows the reduction in volumetric runoff from existing to proposed site for the 2, 10, 25, and 100-year storm events.

TABLE 2
Stormwater Volumetric Runoff (Cu. Ft.)

		Return Frequency (Years)			
Discharge Location	**Condition**	**2**	**10**	**25**	**100**
Total Runoff (Design Point 1)	Existing	6,294	12,141	15,949	21,905
	Proposed	6,199	11,795	15,423	21,086
	Change	-95	-346	-526	-819
Total Runoff (Design Point 2)	Existing	10,341	18,496	23,695	31,746
	Proposed	9,646	17,643	22,736	30,620
	Change	-695	-853	-959	-1,126

A hydrodynamic separator stormwater quality unit is proposed at the northwest corner of the building, just upstream of the first stormwater management system. This structure is located to intercept surface runoff, as well as runoff from the roof, and treat the flow prior to infiltrating or discharging to the south. An additional hydrodynamic separator is proposed at the southwest corner of the building, capturing runoff from the southwestern patios and sidewalks. This water quality unit treats the contributing runoff prior to infiltrating and ultimately discharging to the storm piping and leaving the site. These structures are proposed to capture and treat approximately 0.627 acres of the project area, capturing the building's roof and the majority of the west portion of the site. The hydrodynamic separator models have been selected to exceed the water quality flow (WQF) rate for the contributing drainage area.

Water Quality Area figure and calculations are included in **Appendix E** of this report.

2.3 Method of Hydrology Analysis

The following storm drainage design criteria were used:

1. Design storm rainfall data was taken from NOAA Atlas 14 precipitation frequency estimates.
2. Minimum time of concentration = 5 minutes for paved, 10 minutes for grass.
3. For SCS peak flow calculations, Curve Number were as follows:
    a. Impervious (Pavement/Roof Areas) = 98
    b. Pervious (HSG B) = 80
4. Water Quality Volume/Flow Calculations based on the 2004 Connecticut Stormwater Quality Manual.
5. Watershed areas delineated using polylines in AutoCAD Civil 3D 2018.
6. Comparative hydrology analyzed using Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018, Version 2018.3 Modeling software.

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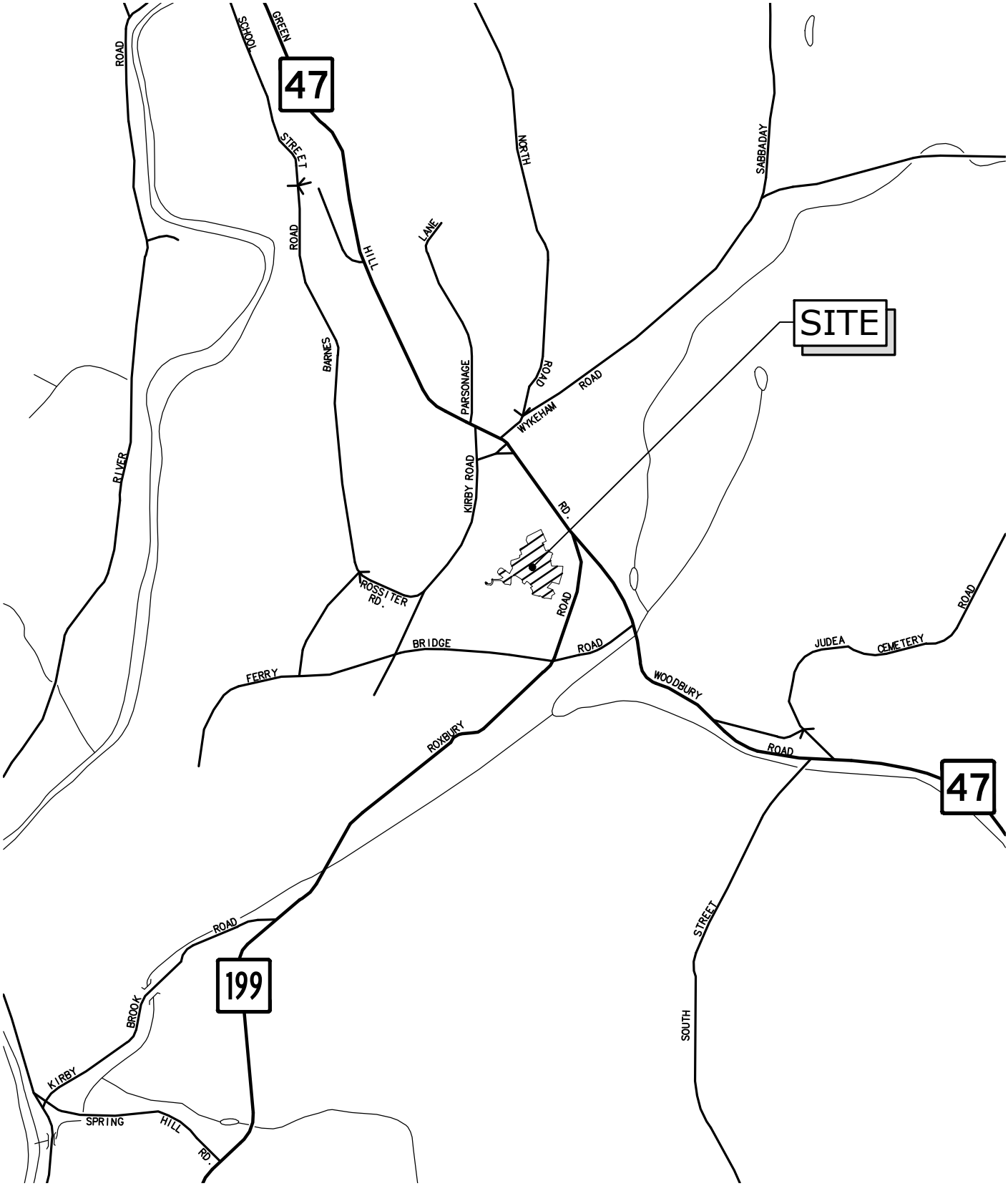
APPENDIX A



THE FREDERICK GUNN SCHOOL
SCIENCE, MATH AND TECHNOLOGY BUILDING
WASHINGTON, CT

SITE LOCATION MAP

NORTH

1" = 1000'

FIGURE 1

Tighe&Bond

Jan 25, 2022-9:03am Plotted By: AClark
Tighe & Bond, Inc. J:\G\G5012\G5012-002 Gunnery Math & Science\Drawings_Figures\AutoCAD\Figures\Figure 1 - Site Location Map.dwg

o determine if flood insurance is available in this community, contact your
nsurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE

1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

TOWN OF
WASHINGTON,
CONNECTICUT
LITCHFIELD COUNTY

PANEL 15 OF 15
(SEE MAP INDEX FOR PANELS NOT PRINTED)

PANEL LOCATION

COMMUNITY-PANEL NUMBER
090057 0015 C

MAP REVISED:
SEPTEMBER 30, 1992

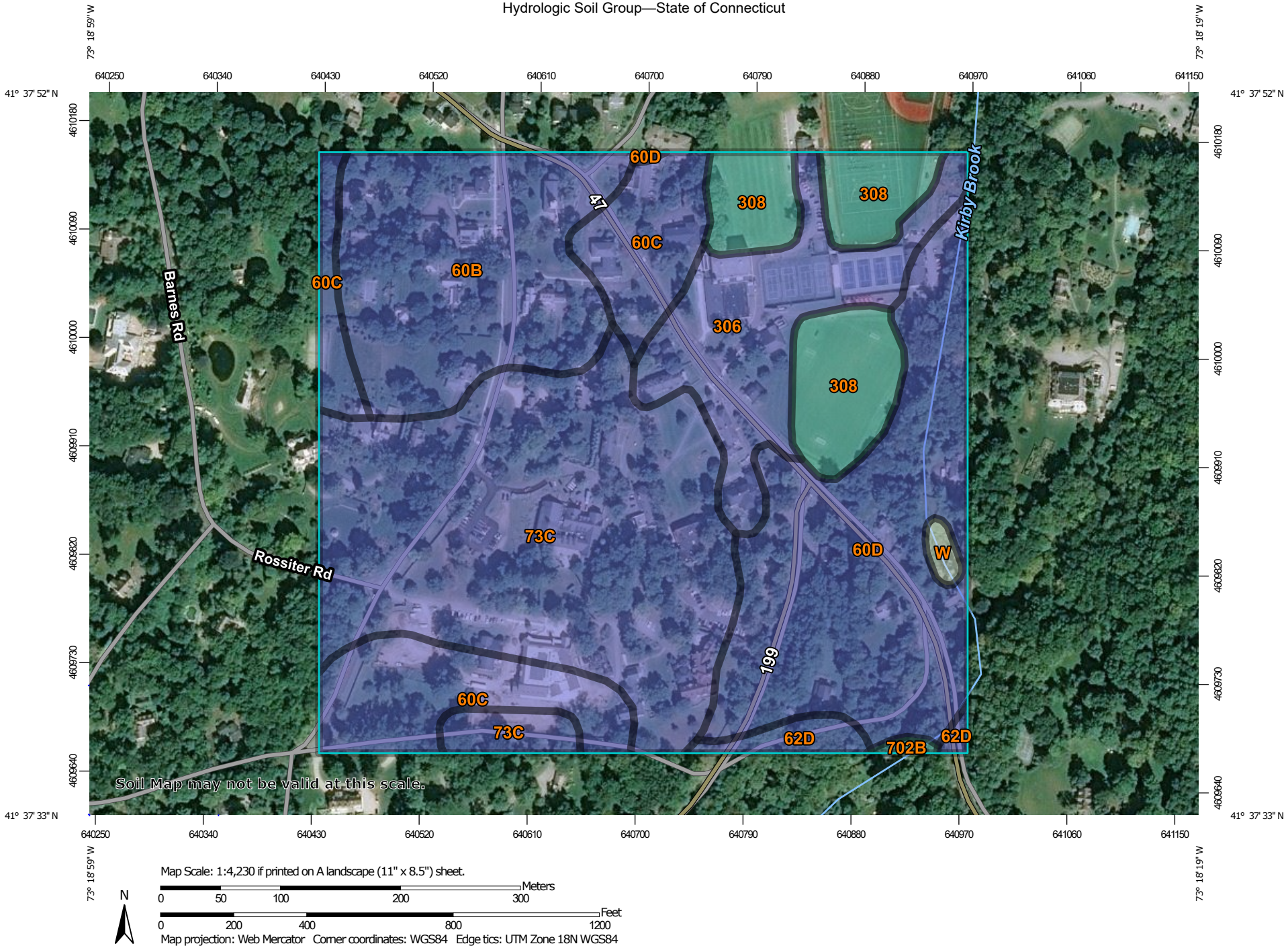
Federal Emergency Management Agency

ZONE X
ZONE AE
ZONE A
ZONE A
ZONE A
ZONE A
ZONE AE
ZONE X
ZONE A
ZONE A
ZONE AE
RM 12
RM 13
RM 14
RM15
RIVER ROAD
SHEPAUG RIVER
Kirby Brook
SCHOOL STREET
OLD NORTH ROAD
SABBATH DAY
RISE ROAD
WYKEHAM
ACCESS ROAD
JUDEA CEMETERY
EAST STREET ROAD
RIVER ROAD
472
467
461
456
451
447
443
441
436
435
433
199
47

This is an official FIRMette showing a portion of the above-referenced flood map created from the MSC FIRMette Web tool. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For additional information about how to make sure the map is current, please see the Flood Hazard Mapping Updates Overview Fact Sheet available on the FEMA Flood Map Service Center home page at https://msc.fema.gov.

APPENDIX B

Hydrologic Soil Group—State of Connecticut



Map Scale: 1:4,230 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:12,000.

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: State of Connecticut
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Aug 23, 2018—Sep 17, 2019

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
60B	Canton and Charlton fine sandy loams, 3 to 8 percent slopes	B	10.6	15.8%
60C	Canton and Charlton fine sandy loams, 8 to 15 percent slopes	B	8.3	12.5%
60D	Canton and Charlton soils, 15 to 25 percent slopes	B	13.3	19.8%
62D	Canton and Charlton fine sandy loams, 15 to 35 percent slopes, extremely stony	B	0.9	1.4%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	B	20.8	31.1%
306	Udorthents-Urban land complex	B	6.9	10.2%
308	Udorthents, smoothed	C	5.7	8.6%
702B	Tisbury silt loam, 3 to 8 percent slopes	C	0.1	0.2%
W	Water		0.3	0.4%
Totals for Area of Interest			**66.9**	**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 10, Version 3
Location name: Washington, Connecticut, USA*
Latitude: 41.6277°, Longitude: -73.3113°
Elevation: 713.35 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	0.357 (0.271-0.468)	0.421 (0.319-0.553)	0.525 (0.397-0.693)	0.612 (0.460-0.811)	0.731 (0.534-1.01)	0.822 (0.589-1.15)	0.915 (0.638-1.33)	1.01 (0.678-1.51)	1.15 (0.744-1.77)	1.26 (0.797-1.98)
10-min	0.506 (0.383-0.663)	0.596 (0.451-0.783)	0.744 (0.562-0.980)	0.867 (0.651-1.15)	1.04 (0.756-1.43)	1.17 (0.834-1.64)	1.30 (0.904-1.88)	1.44 (0.962-2.14)	1.63 (1.05-2.51)	1.78 (1.13-2.80)
15-min	0.595 (0.451-0.780)	0.701 (0.531-0.921)	0.875 (0.660-1.15)	1.02 (0.766-1.35)	1.22 (0.890-1.68)	1.37 (0.982-1.92)	1.53 (1.06-2.21)	1.69 (1.13-2.52)	1.92 (1.24-2.95)	2.10 (1.33-3.30)
30-min	0.816 (0.618-1.07)	0.961 (0.727-1.26)	1.20 (0.905-1.58)	1.39 (1.05-1.85)	1.66 (1.21-2.29)	1.87 (1.34-2.62)	2.08 (1.45-3.02)	2.31 (1.54-3.43)	2.62 (1.69-4.03)	2.86 (1.81-4.50)
60-min	1.04 (0.786-1.36)	1.22 (0.923-1.60)	1.52 (1.15-2.00)	1.77 (1.33-2.34)	2.11 (1.54-2.90)	2.37 (1.70-3.32)	2.64 (1.84-3.82)	2.92 (1.95-4.35)	3.32 (2.14-5.10)	3.63 (2.30-5.70)
2-hr	1.38 (1.05-1.79)	1.60 (1.22-2.08)	1.96 (1.49-2.56)	2.26 (1.71-2.97)	2.67 (1.97-3.67)	2.98 (2.16-4.18)	3.31 (2.34-4.82)	3.69 (2.48-5.47)	4.26 (2.76-6.53)	4.73 (3.00-7.39)
3-hr	1.59 (1.22-2.07)	1.85 (1.42-2.40)	2.27 (1.73-2.96)	2.62 (1.99-3.44)	3.10 (2.30-4.26)	3.46 (2.52-4.85)	3.85 (2.74-5.62)	4.31 (2.90-6.38)	5.03 (3.26-7.69)	5.64 (3.59-8.80)
6-hr	1.98 (1.53-2.56)	2.34 (1.80-3.03)	2.93 (2.25-3.80)	3.43 (2.61-4.46)	4.10 (3.06-5.61)	4.60 (3.37-6.44)	5.14 (3.70-7.53)	5.83 (3.93-8.59)	6.91 (4.50-10.5)	7.85 (5.01-12.2)
12-hr	2.37 (1.84-3.04)	2.89 (2.24-3.71)	3.75 (2.90-4.83)	4.46 (3.43-5.78)	5.44 (4.08-7.42)	6.16 (4.55-8.61)	6.95 (5.04-10.2)	7.96 (5.38-11.7)	9.54 (6.23-14.5)	10.9 (6.99-16.9)
24-hr	2.74 (2.14-3.49)	3.44 (2.68-4.38)	4.57 (3.55-5.84)	5.51 (4.26-7.09)	6.81 (5.14-9.24)	7.76 (5.77-10.8)	8.81 (6.43-12.8)	10.2 (6.89-14.8)	12.3 (8.05-18.6)	14.2 (9.09-21.8)
2-day	3.12 (2.45-3.94)	3.95 (3.09-4.99)	5.29 (4.14-6.72)	6.41 (4.99-8.19)	7.96 (6.04-10.8)	9.08 (6.80-12.6)	10.3 (7.60-15.1)	12.0 (8.15-17.4)	14.6 (9.59-22.0)	16.9 (10.9-26.0)
3-day	3.40 (2.68-4.29)	4.30 (3.39-5.42)	5.77 (4.53-7.29)	6.98 (5.45-8.88)	8.66 (6.60-11.7)	9.87 (7.42-13.7)	11.2 (8.30-16.4)	13.0 (8.90-18.9)	15.9 (10.5-23.9)	18.5 (12.0-28.4)
4-day	3.65 (2.89-4.58)	4.60 (3.63-5.78)	6.16 (4.84-7.77)	7.45 (5.83-9.45)	9.22 (7.05-12.4)	10.5 (7.92-14.5)	12.0 (8.86-17.4)	13.9 (9.48-20.1)	17.0 (11.2-25.4)	19.7 (12.7-30.1)
7-day	4.32 (3.43-5.39)	5.39 (4.27-6.73)	7.13 (5.64-8.94)	8.57 (6.74-10.8)	10.6 (8.10-14.1)	12.0 (9.07-16.5)	13.6 (10.1-19.6)	15.7 (10.8-22.6)	19.1 (12.6-28.5)	22.0 (14.3-33.5)
10-day	5.00 (3.99-6.22)	6.13 (4.88-7.63)	7.97 (6.32-9.96)	9.49 (7.49-11.9)	11.6 (8.91-15.4)	13.1 (9.93-17.9)	14.8 (11.0-21.2)	17.0 (11.7-24.4)	20.4 (13.5-30.3)	23.3 (15.1-35.4)
20-day	7.19 (5.77-8.89)	8.38 (6.72-10.4)	10.3 (8.25-12.8)	11.9 (9.48-14.9)	14.2 (10.9-18.5)	15.8 (11.9-21.2)	17.6 (12.9-24.6)	19.7 (13.6-28.1)	22.8 (15.2-33.8)	25.5 (16.6-38.5)
30-day	9.04 (7.28-11.1)	10.3 (8.26-12.6)	12.3 (9.83-15.2)	13.9 (11.1-17.3)	16.2 (12.5-21.0)	17.9 (13.5-23.8)	19.7 (14.4-27.2)	21.7 (15.1-30.8)	24.6 (16.4-36.3)	27.0 (17.6-40.7)
45-day	11.3 (9.16-13.9)	12.6 (10.2-15.5)	14.7 (11.8-18.1)	16.4 (13.1-20.3)	18.8 (14.5-24.2)	20.6 (15.6-27.1)	22.4 (16.4-30.6)	24.4 (17.0-34.5)	27.1 (18.1-39.7)	29.2 (19.0-43.9)
60-day	13.2 (10.7-16.2)	14.5 (11.8-17.8)	16.7 (13.5-20.5)	18.5 (14.8-22.9)	21.0 (16.3-26.9)	22.9 (17.3-30.0)	24.8 (18.1-33.7)	26.7 (18.7-37.7)	29.4 (19.7-43.0)	31.4 (20.5-47.0)

[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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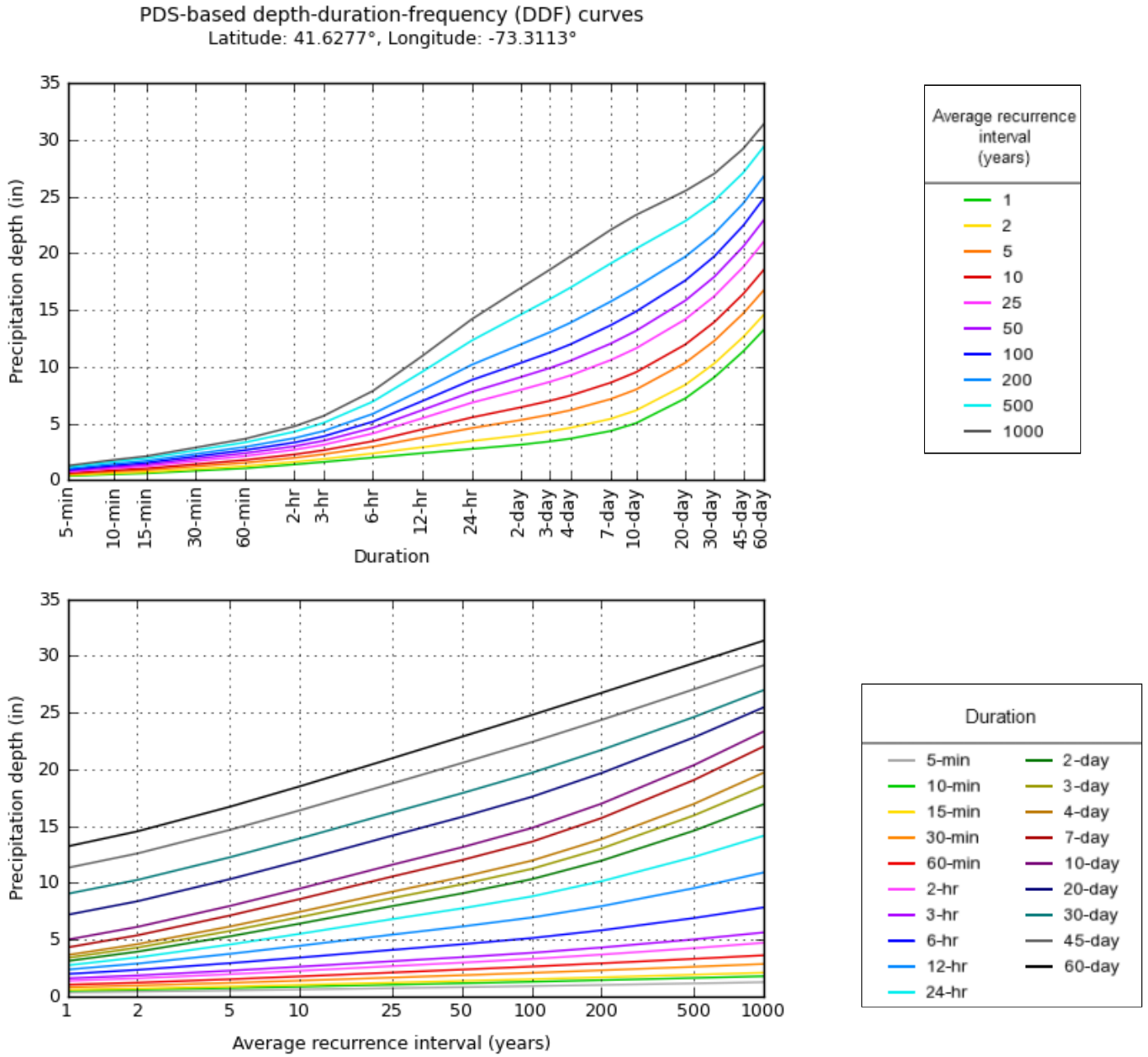
PF graphical



NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Tue Oct 12 20:15:38 2021

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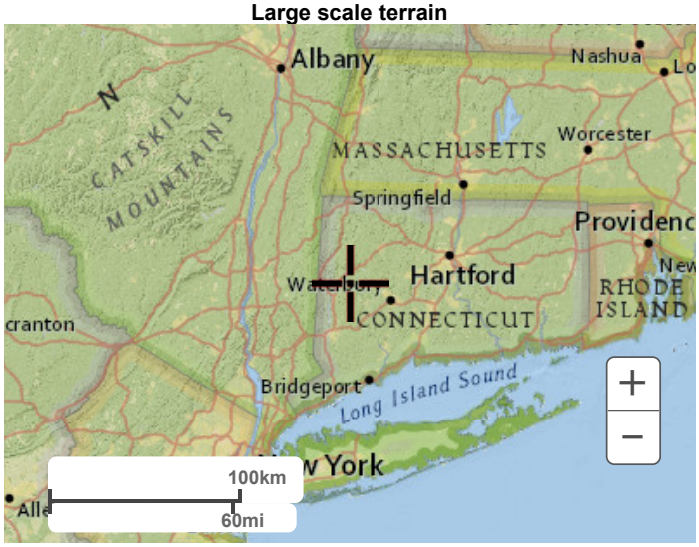
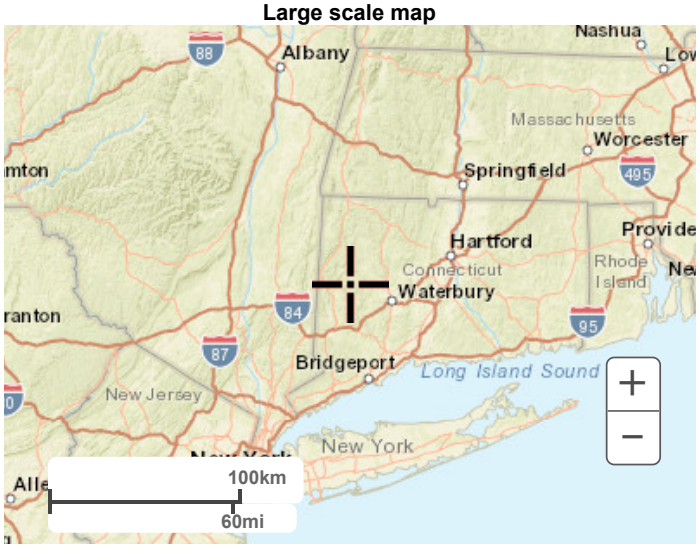
Maps & aerials

Small scale terrain

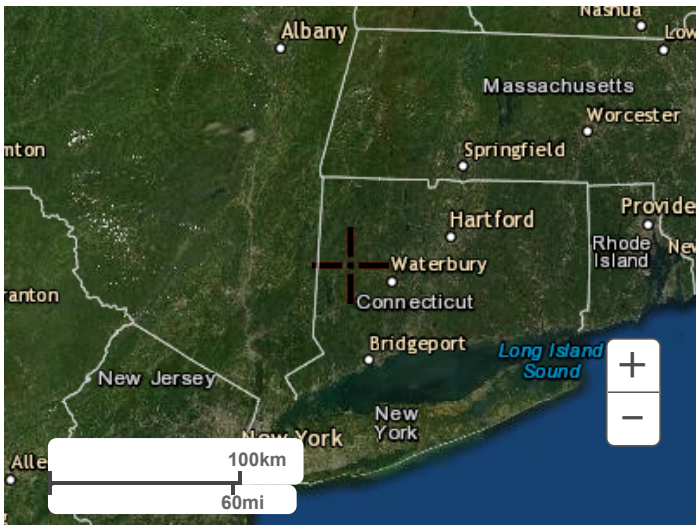
Large scale terrain



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
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

WELTI GEOTECHNICAL, P.C.

GEOTECHNICAL ENGINEERING

227 Williams Street · P.O. Box 397
Glastonbury, CT 06033-0397

(860) 633-4623 / FAX (860) 657-2514

November 25, 2021

Ms. Kate Turner, Project Manager
Colliers
135 New Road
Madison, CT 06442

Re: Rock Probes and Water Infiltration Tests, SM & T Center at Frederick Gunn School, 99 Green Hill Road, Washington, CT

Dear Kate:

Herewith are the data for rock probes and water infiltration tests performed at the above referenced site.

If you have any questions, please call our office.

Very truly yours,

Max Welti

Max Welti, P. E.
President, Welti Geotechnical, P.C.

ROCK PROBE LOCATION PLAN
+
ROCK PROBE DATA

P-1
P-2
P-3
P-4
P-5
P-6
P-7
BRINSMADE
TISCH SCHOOLHOUSE
SCIENCE BUILDING
BUILDING ADDITION
BUILDING ADDITION
BIO SWALE
BIO SWALE
BIO SWALE
DROP OFF
ENTRY DECK
PATIO LEVEL 696.00
BUS 685.00
TS 688.00
BS 688.00
TS 691.00
BS 691.00
TS 694.00
BS 694.00
TS 697.00
BS 697.00
TS 700.00
BS 700.00
TS 703.00
BS 703.00
TS 706.00
BS 706.00
TS 709.00
BS 709.00
TS 712.00
BS 712.00
TS 715.00
BS

The Frederick Gunn School
Green Hill Road, Washington, CT
Proposed Science, Math & Technology Center

Clarence Welti Associates, Inc.
Driller: T. Czmyr
Date: 11/15/21

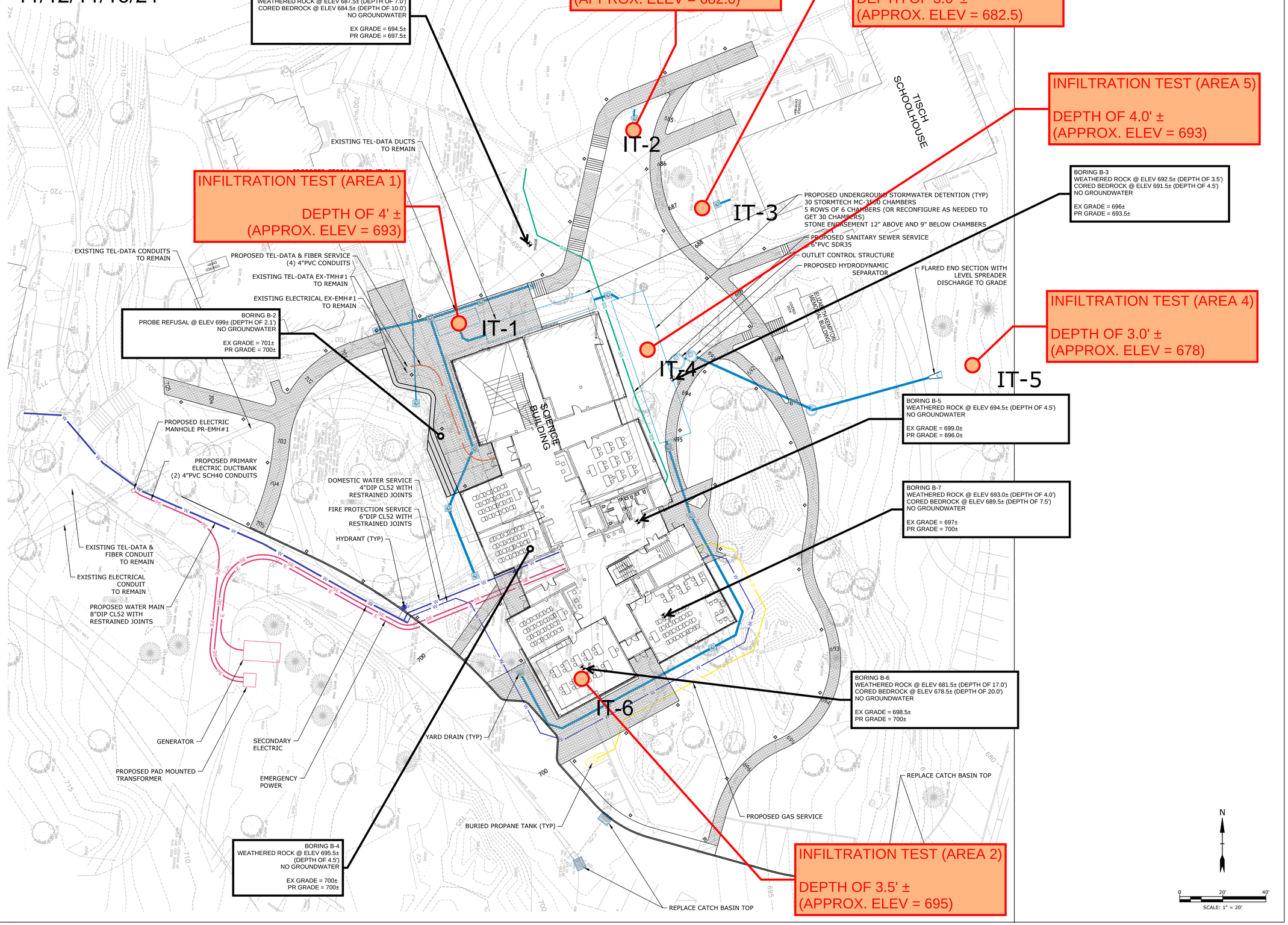
Rock Probes in Area of Proposed GSHE

Probe No.	Weathered Rock at (ft)	Auger Refusal on Hard Bedrock at (ft)	Groundwater at Completion of Probe
P-1	7.0	10.5	none
P-2	3.0	5.0	none
P-3	11.0	14.5	none
P-4	16.0	16.5	none
P-5	7.5	9.0	none
P-6	13.5	14.5	none
P-7	4.5	5.5	none

Note: The probes were taken with 4" diameter solid stem augers

INFILTRATION TEST LOCATION PLAN
+
INFILTRATION TEST RESULTS

INFILTRATION TEST LOCATIONS
CLARENCE WELTI ASSOCIATES, INC.
11/12/11/16/21



SASAKI
64 PLEASANT STREET WATERTOWN MA 02472 USA
P 617 926 3300 F 617 924 2748 W SASAKI.COM

No.	Description	Date
1	Schematic Design	08/06/21

DWG ISSUE & REVISION HISTORY

Stamp

Key Plan

Project Title:

CENTER FOR INNOVATION AND ACTIVE CITIZENSHIP

THE FREDERICK GUNN SCHOOL
99 Green Hill Road
Washington, CT 06793

Drawing Title:

SITE DRAINAGE AND UTILITY PLAN

Project No: 08323.00 Scale: 1" = 20'
Drawn By: AVC
Checked By: KMM
Approved By: CJC
Date: 10/18/21

Drawing No. C-100

Project Directory:

10/18/2021 5:39:01 PM

CLARENCE WELTI ASSOC., INC.
P.O. BOX 397
GLASTONBURY, CONN 06033

CLIENT
THE FREDERICK GUNN SCHOOL

PROJECT NAME
PROPOSED SM&T CENTER AT THE GUNN SCHOOL

LOCATION
99 GREEN HILL ROAD, WASHINGTON, CT

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	HSA			
SIZE I.D.	2.75"			
HAMMER WT.				
HAMMER FALL				

OFFSET
LINE & STA.
N. COORDINATE
E. COORDINATE

SURFACE ELEV.

HOLE NO. IT-1

GROUND WATER OBSERVATIONS
AT none FT. AFTER 0 HOURS
AT FT. AFTER HOURS

START DATE 11/15/21
FINISH DATE 11/15/21

DEPTH	SAMPLE NO.	SAMPLE BLOWS/6"	SAMPLE DEPTH	A	STRATUM DESCRIPTION + REMARKS	ELEV.
0					TOPSOIL 0.10	
					BR.FINE-MED.SAND, SOME SILT, TRACE GRAVEL	
					4.0	
5					BOTTOM OF BORING @ 4.0'	
					NOTE: PERFORMED INFILTRATION TEST AT 4.0'	
10						
15						
20						
25						
30						
35						

LEGEND: COL. A:
SAMPLE TYPE: D=DRY A=AUGER C=CORE U=UNDISTURBED PISTON S=SPLIT SPOON
PROPORTIONS USED: TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

DRILLER: T. CZMYR
INSPECTOR:

SHEET 1 OF 1

HOLE NO. **IT-1**

CLARENCE WELTI ASSOC., INC.
P.O. BOX 397
GLASTONBURY, CONN 06033

CLIENT
THE FREDERICK GUNN SCHOOL

PROJECT NAME
PROPOSED SM&T CENTER AT THE GUNN SCHOOL

LOCATION
99 GREEN HILL ROAD, WASHINGTON, CT

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	HSA			
SIZE I.D.	2.75"			
HAMMER WT.				
HAMMER FALL				

OFFSET
LINE & STA.
N. COORDINATE
E. COORDINATE

SURFACE ELEV.

HOLE NO. IT-2

GROUND WATER OBSERVATIONS
AT none FT. AFTER 0 HOURS
AT FT. AFTER HOURS

START DATE 11/16/21
FINISH DATE 11/16/21

DEPTH	SAMPLE NO.	SAMPLE BLOWS/6"	SAMPLE DEPTH	A	STRATUM DESCRIPTION + REMARKS	ELEV.
0					TOPSOIL 0.25	
					BR.FINE-MED.SAND, SOME SILT, TRACE GRAVEL	
					4.0	
5					BOTTOM OF BORING @ 4.0'	
					NOTE: PERFORMED INFILTRATION TEST AT 4.0'	
10						
15						
20						
25						
30						
35						

LEGEND: COL. A:
SAMPLE TYPE: D=DRY A=AUGER C=CORE U=UNDISTURBED PISTON S=SPLIT SPOON
PROPORTIONS USED: TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

DRILLER: T. CZMYR
INSPECTOR:

SHEET 1 OF 1

HOLE NO. **IT-2**

CLARENCE WELTI ASSOC., INC.
P.O. BOX 397
GLASTONBURY, CONN 06033

CLIENT
THE FREDERICK GUNN SCHOOL

PROJECT NAME
PROPOSED SM&T CENTER AT THE GUNN SCHOOL

LOCATION
99 GREEN HILL ROAD, WASHINGTON, CT

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	HSA			
SIZE I.D.	2.75"			
HAMMER WT.				
HAMMER FALL				

OFFSET
LINE & STA.
N. COORDINATE
E. COORDINATE

SURFACE ELEV.

HOLE NO. IT-3

GROUND WATER OBSERVATIONS
AT none FT. AFTER 0 HOURS
AT FT. AFTER HOURS

START DATE 11/16/21
FINISH DATE 11/16/21

DEPTH	SAMPLE NO.	SAMPLE BLOWS/6"	SAMPLE DEPTH	A	STRATUM DESCRIPTION + REMARKS	ELEV.
0					TOPSOIL 0.25	
					BR.FINE-CRS.SAND, SOME SILT, LITTLE GRAVEL	
					BOTTOM OF BORING @ 3.0' 3.0	
					NOTE: PERFORMED INFILTRATION TEST AT 3.0'	
5						
10						
15						
20						
25						
30						
35						

LEGEND: COL. A:
SAMPLE TYPE: D=DRY A=AUGER C=CORE U=UNDISTURBED PISTON S=SPLIT SPOON
PROPORTIONS USED: TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

DRILLER: T. CZMYR
INSPECTOR:

SHEET 1 OF 1

HOLE NO. **IT-3**

CLARENCE WELTI ASSOC., INC.
P.O. BOX 397
GLASTONBURY, CONN 06033

CLIENT
THE FREDERICK GUNN SCHOOL

PROJECT NAME
PROPOSED SM&T CENTER AT THE GUNN SCHOOL

LOCATION
99 GREEN HILL ROAD, WASHINGTON, CT

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	HSA			
SIZE I.D.	2.75"			
HAMMER WT.				
HAMMER FALL				

OFFSET
LINE & STA.
N. COORDINATE
E. COORDINATE

SURFACE ELEV.

HOLE NO. IT-4

GROUND WATER OBSERVATIONS
AT none FT. AFTER 0 HOURS
AT FT. AFTER HOURS

START DATE 11/15/21
FINISH DATE 11/15/21

DEPTH	SAMPLE NO.	SAMPLE BLOWS/6"	SAMPLE DEPTH	A	STRATUM DESCRIPTION + REMARKS	ELEV.
0					TOPSOIL 0.33	
					BR.FINE-MED.SAND AND SILT, TRACE GRAVEL	
					4.0	
5					BOTTOM OF BORING @ 4.0'	
					NOTE: PERFORMED INFILTRATION TEST AT 4.0'	
10						
15						
20						
25						
30						
35						

LEGEND: COL. A:
SAMPLE TYPE: D=DRY A=AUGER C=CORE U=UNDISTURBED PISTON S=SPLIT SPOON
PROPORTIONS USED: TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

DRILLER: T. CZMYR
INSPECTOR:

SHEET 1 OF 1

HOLE NO. **IT-4**

CLARENCE WELTI ASSOC., INC. P.O. BOX 397 GLASTONBURY, CONN 06033	CLIENT THE FREDERICK GUNN SCHOOL	PROJECT NAME PROPOSED SM&T CENTER AT THE GUNN SCHOOL LOCATION 99 GREEN HILL ROAD, WASHINGTON, CT

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	HSA			
SIZE I.D.	2.75"			
HAMMER WT.				
HAMMER FALL				

OFFSET
LINE & STA.
N. COORDINATE
E. COORDINATE

SURFACE ELEV.

HOLE NO. IT-5

GROUND WATER OBSERVATIONS
AT none FT. AFTER 0 HOURS
AT FT. AFTER HOURS

START DATE 11/16/21
FINISH DATE 11/16/21

DEPTH	SAMPLE NO.	SAMPLE BLOWS/6"	SAMPLE DEPTH	A	STRATUM DESCRIPTION + REMARKS	ELEV.
0					TOPSOIL 0.17 BR.FINE-MED.SAND, SOME SILT, TRACE GRAVEL, FEW COBBLES 2.5 BOTTOM OF BORING @ 2.5' (AUGER REFSUAL) NOTE: MADE 3 ADDTIONAL PROBES WITHIN 5 FOOT RADIUS AND ENCOUNTERED AUGER REFUSAL AT 1.5', 2.3' AND 2.8'. NO INFILTRATION TEST WAS TAKEN AT THIS LOCAITON.	
5						
10						
15						
20						
25						
30						
35						

LEGEND: COL. A:

SAMPLE TYPE: D=DRY A=AUGER C=CORE U=UNDISTURBED PISTON S=SPLIT SPOON

PROPORTIONS USED: TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

DRILLER: T. CZMYR
INSPECTOR:

SHEET 1 OF 1 | HOLE NO. **IT-5**

CLARENCE WELTI ASSOC., INC.
P.O. BOX 397
GLASTONBURY, CONN 06033

CLIENT
THE FREDERICK GUNN SCHOOL

PROJECT NAME
PROPOSED SM&T CENTER AT THE GUNN SCHOOL

LOCATION
99 GREEN HILL ROAD, WASHINGTON, CT

	AUGER	CASING	SAMPLER	CORE BAR.
TYPE	HSA			
SIZE I.D.	2.75"			
HAMMER WT.				
HAMMER FALL				

OFFSET
LINE & STA.
N. COORDINATE
E. COORDINATE

SURFACE ELEV.

HOLE NO. IT-6

GROUND WATER OBSERVATIONS
AT none FT. AFTER 0 HOURS
AT FT. AFTER HOURS

START DATE 11/12/21
FINISH DATE 11/12/21

DEPTH	SAMPLE NO.	SAMPLE BLOWS/6"	SAMPLE DEPTH	A	STRATUM DESCRIPTION + REMARKS	ELEV.
0					TOPSOIL 0.33	
					BR.FINE-MED.SAND, SOME SILT, TRACE GRAVEL	
					3.5	
					BOTTOM OF BORING @ 3.5'	
5					NOTE: PERFORMED INFILTRATION TEST AT 3.5'	
10						
15						
20						
25						
30						
35						

LEGEND: COL. A:
SAMPLE TYPE: D=DRY A=AUGER C=CORE U=UNDISTURBED PISTON S=SPLIT SPOON
PROPORTIONS USED: TRACE=0-10% LITTLE=10-20% SOME=20-35% AND=35-50%

DRILLER: T. CZMYR
INSPECTOR:

SHEET 1 OF 1

HOLE NO. **IT-6**

The Frederick Gunn School
Green Hill Road, Washington, CT
Proposed Science, Math & Technology Center

Welti Geotechnical, P.C.

Date: 11/12-16/21
M. Welti

Infiltration Tests (using ASTM D6391-11, Test Method B)

Test Location #	Infiltration Rate (feet/day)
IT-1	0.98
IT-2	5.94
IT-3	9.06
IT-4	0.17
IT-6	5.4

Note: No infiltration test was performed at location IT-5. Auger refusal on probable bedrock was encountered at 1.5 to 2.8 feet below the existing grade at that location.

WELTI GEOTECHNICAL, P.C
227 Williams Street
Glastonbury, CT 06033
(860) 633.4623

Project Gunn School
Subject Storm Water Infiltration
Calculated by CW Date 11/18/21
Sheet 1 of 2

Method "B" to determine K_1

1 increment = 0.308"

$$K_1 = R_T G \frac{\ln Z_1/Z_2}{(t_2 - t_1)}$$

1 cm/sec = 2834.65 = ft/DAY

$$G = \left(\frac{\pi d^2}{11D}\right) 1 + \left(\frac{D}{4b}\right)$$

d = 4" = 10 cm R_T = 1
d = D = 10 cm

b = 3' = 91 cm 4b = 364
(Rock @ 7' Test @ 4')

$$G = \frac{314}{110} \times (1 + .027) = 2.93$$

Location IT-1

Z_1 = 99" = 251 cm

Z_2 = 99" − (125 − 8) 0.308) = 63" = 160 cm

$\ln Z_1/Z_2$ = = 0.450

$$K_1 = 2.92 \times \frac{0.45}{63m} = .0208 \text{ cm/min} = .000347 \text{ cm/sec}$$

= 0.98 ft/day

IT-2

Z_1 = 108"

Z_2 = 108 − (120 × .308) = 71"

$\ln = Z_1/Z_2$ = 0.42

$$K_1 = 2.92 \times \frac{0.42}{9.75} = .125 \text{ cm/min} = .00209 \text{ cm/sec} = 5.94 \text{ ft/day}$$

IT-3 Z_1 = 98" = 248.9 cm

Z_2 = 98 − (118 × .308) = 61.6 ft

$\ln Z_1/Z_2$ = = 0.46

$$K_1 = 2.92 \times \frac{0.46}{7} = .19 \text{ cm/min} = .00321 \text{ cm/sec} = 9.06 \text{ ft/day}$$

WELTI GEOTECHNICAL, P.C
227 Williams Street
Glastonbury, CT 06033
(860) 633 4623

Project Gunn School
Subject Storm Water Infiltration
Calculated by CW Date 11/19/24
Sheet 2 of 2

IT-4

$Z_1 = 105'$

Z_2 105 − (5 × .308) = 97.3'

$\ln Z_1/Z_2 = .076$

$K_1 = 292 \times \frac{.076}{6.3} = 0.35 \text{ cm/min} = 0.00059 \text{ cm/s} = 0.166 \text{ ft/day}$

IT-6

$Z_1 = 108$

$Z_2 = 108 - (105 \times .308) = 75.6$

$\ln Z_1/Z_2 = 0.355$

$K_1 = 292 \times \frac{0.355}{9} = 0.1146 \text{ cm/min} = 0.00191 \text{ cm/s} = 5.4 \text{ ft/day}$

PRODUCT 204-1 NEBS Inc., Groton, Mass. 01471.

APPENDIX C

DESIGN POINT 1

PR WS-2B

DESIGN POINT 2

EX WS-1

EX WS-2A

A

B

C

D

SOLLEY HALL

BRINSMADE

TISCH SCHOOLHOUSE

SCIENCE BUILDING

STATE ROUTE 47

STATE ROUTE 199

GRAHAM HOUSE

COLLEGE OFFICE

BOURNE ADMINISTRATIVE BUILDING

BUXTON ALUMNI CENTER

N

0 60' 120'

SCALE: 1" = 60'

THE FREDERICK GUNN SCHOOL
CENTER FOR INNOVATION AND ACTIVE CITIZENSHIP
WASHINGTON, CT

EXISTING WATERSHED MAP

DATE:	01/24/2022
SCALE:	1"=60'
FIGURE:	EX-WS

Tighe&Bond

Jan 25, 2022-10:20am Plotted By: AClark
Tighe & Bond, Inc. J:\G\G5012\G5012-002 Gunnery Math & Science\Drawings_Figures\AutoCAD\Figures\G5012-02-EX-WS.dwg

Tighe&Bond
Consulting Engineers
Environmental Specialists

Project Name: **The Frederick Gunn School - Center for Innovation and Active Citizenship**
Project Number: **G5012-002**
Project Location: **Washington, CT**
Description: **Existing CN & Tc Calculations**
Prepared By: **AVC** Date: **January 24, 2022**

Designation: **EX WS-01**
Location:

Cover Type	Area, ac	CN	A x CN
Pavement/Roof	0.261	98	25.5596
Landscaped and Lawns	0.561	80	44.9073
	0.822		70.467

Weighted CN: 86

Time of Concentration

(computed in accordance with ConnDOT Drainage Manual, Sec. 6C)

Overland				
Segment		**Surface "n"**	**Flow Length (ft.)**	**Slope (ft/ft)**	**Time (min.)**
Segment A - B		0.24	150	0.086	10.85

Shallow Concentrated Flow					
Segment		**Slope (ft/ft)**	**V (ft/s)**	**Length (ft)**	**Time (min.)**
Segment B - C	paved	0.05	4.55	10	0.04
Segment C - D	unpaved	0.05	3.61	5	0.02
				0	

Total Tc = 10.9 Min.

Note: Overland time of concentration computed using "Kinematic Wave" equation
Gutter and pipe time of concentration computed using Manning's equation

Designation: **EX WS-02A**
Location:

Cover Type	Area, ac	CN	A x CN
Pavement/Roof	0.663	98	65.0139
Landscaped and Lawns	0.331	80	26.4995
	0.995		91.5134

Weighted CN: 92

Time of Concentration

(computed in accordance with ConnDOT Drainage Manual, Sec. 6C)

Overland				
Segment	**Surface "n"**	**Flow Length (ft.)**	**Slope (ft/ft)**	**Time (min.)**
Segment A - B	0.24	28	0.065	3.17
Segment A - B	0.015	5	0.02	0.14
Segment A - B	0.24	50	0.039	6.18

Total Tc = 9.5 Min.

Note: Overland time of concentration computed using "Kinematic Wave" equation
Gutter and pipe time of concentration computed using Manning's equation

Tighe&Bond
Consulting Engineers
Environmental Specialists

Project Name: **The Frederick Gunn School - Center for Innovation and Active Citizenship**
Project Number: **G5012-002**
Project Location: **Washington, CT**
Description: **Existing CN & Tc Calculations**
Prepared By: **AVC** Date: **January 24, 2022**

Designation: **EX WS-02B**
Location:

Cover Type	Area, ac	CN	A x CN
Pavement/Roof	0.058	98	5.7167
Landscaped and Lawns	0.077	80	6.1800
	0.136		11.897

Weighted CN: **88**

Time of Concentration

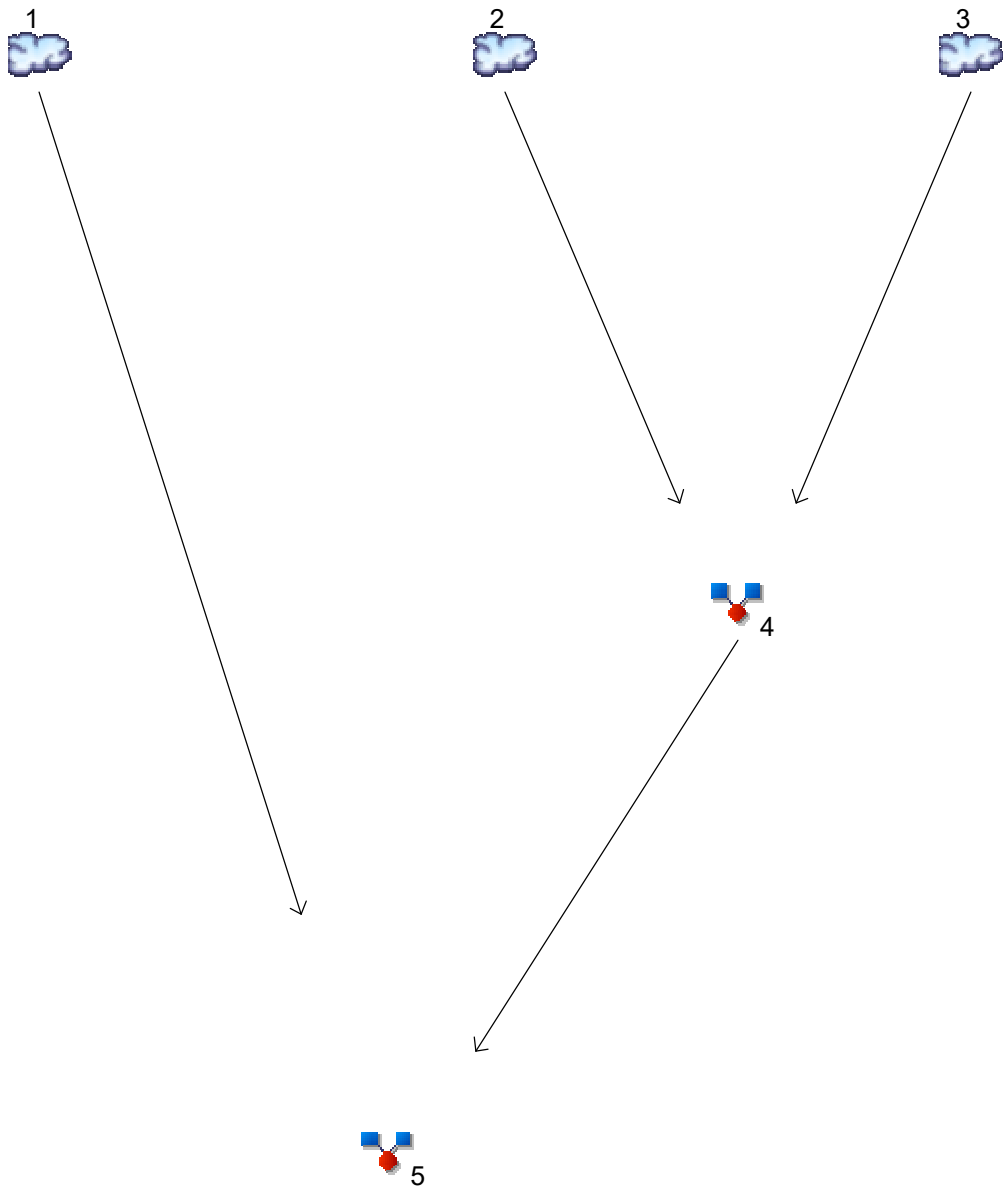
(computed in accordance with ConnDOT Drainage Manual, Sec. 6C)

Overland				
Segment	**Surface "n"**	**Flow Length (ft.)**	**Slope (ft/ft)**	**Time (min.)**
Segment A - B	0.24	18	0.02	3.56

Total Tc = 3.6 Min.
5 (min) Min.

Note: Overland time of concentration computed using "Kinematic Wave" equation
Gutter and pipe time of concentration computed using Manning's equation

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	EX WS-01
2	SCS Runoff	EX WS-02A
3	SCS Runoff	EX WS-02B
4	Combine	TOTAL WS-2
5	Combine	TOTAL

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	1.642	-------	-------	3.121	4.053	4.732	5.479	EX WS-01
2	SCS Runoff	------	-------	2.656	-------	-------	4.582	5.777	6.645	7.601	EX WS-02A
3	SCS Runoff	------	-------	0.340	-------	-------	0.622	0.798	0.926	1.067	EX WS-02B
4	Combine	2, 3	-------	2.963	-------	-------	5.139	6.490	7.471	8.551	TOTAL WS-2
5	Combine	1, 4	-------	4.520	-------	-------	8.122	10.37	12.01	13.81	TOTAL

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

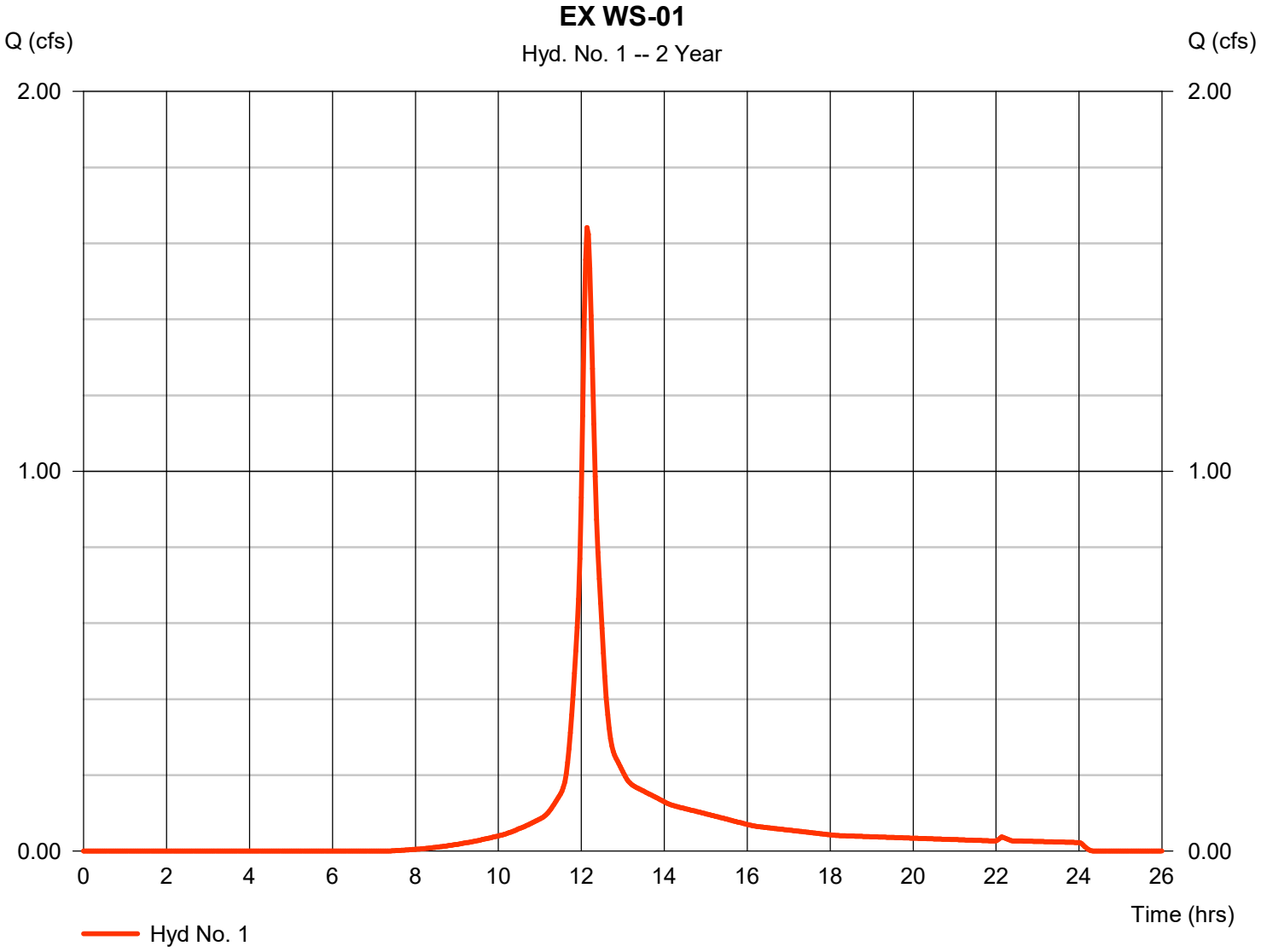
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.642	2	728	6,294	------	------	------	EX WS-01
2	SCS Runoff	2.656	2	726	9,316	------	------	------	EX WS-02A
3	SCS Runoff	0.340	2	724	1,025	------	------	------	EX WS-02B
4	Combine	2.963	2	726	10,341	2, 3	------	------	TOTAL WS-2
5	Combine	4.520	2	726	16,635	1, 4	------	------	TOTAL

Hydrograph Report

Hyd. No. 1

EX WS-01

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.642 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	6,294 cuft
Drainage area	=	0.822 ac	Curve number	=	86
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.90 min
Total precip.	=	3.44 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

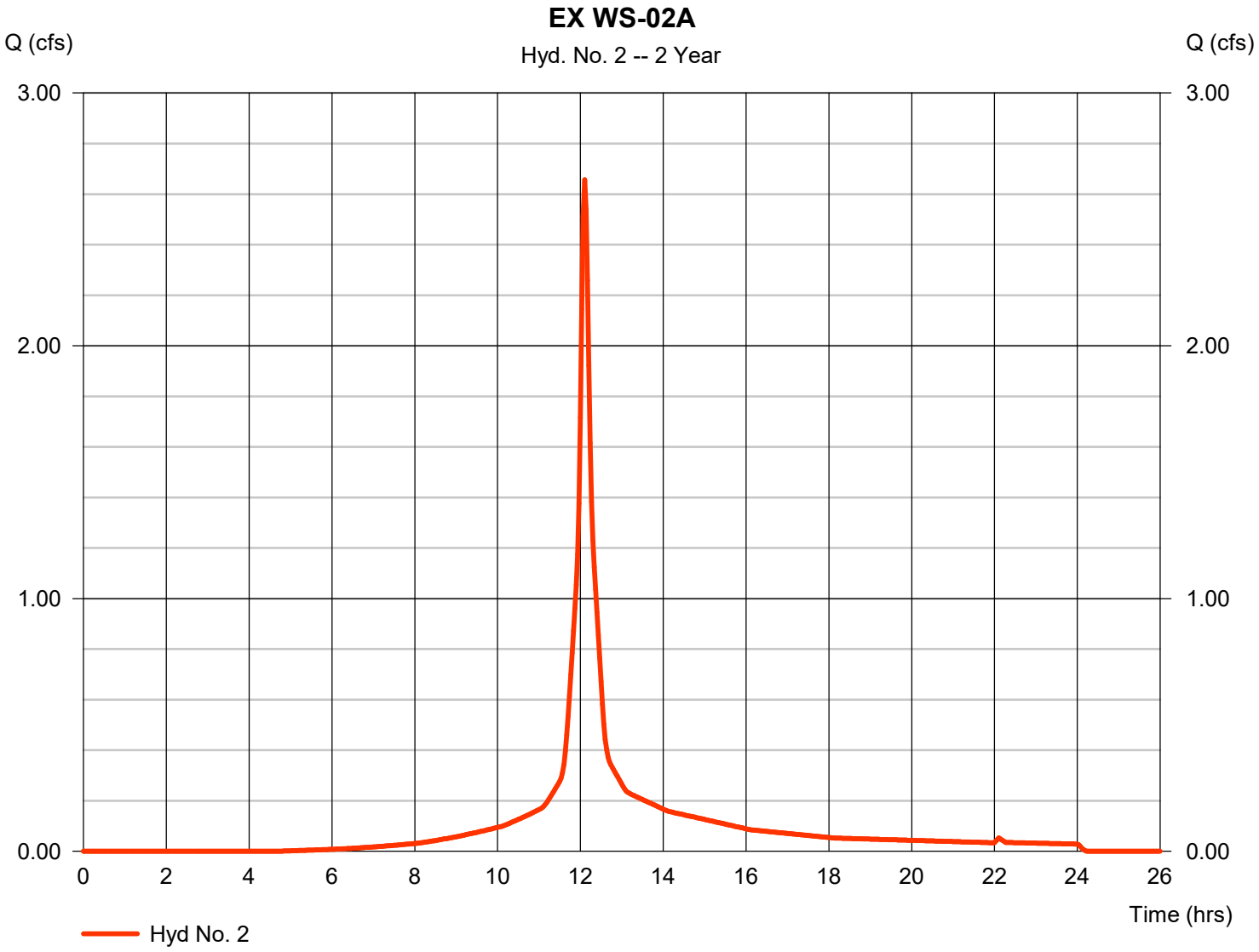


Hydrograph Report

Hyd. No. 2

EX WS-02A

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.656 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	9,316 cuft
Drainage area	=	0.995 ac	Curve number	=	92
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	9.50 min
Total precip.	=	3.44 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

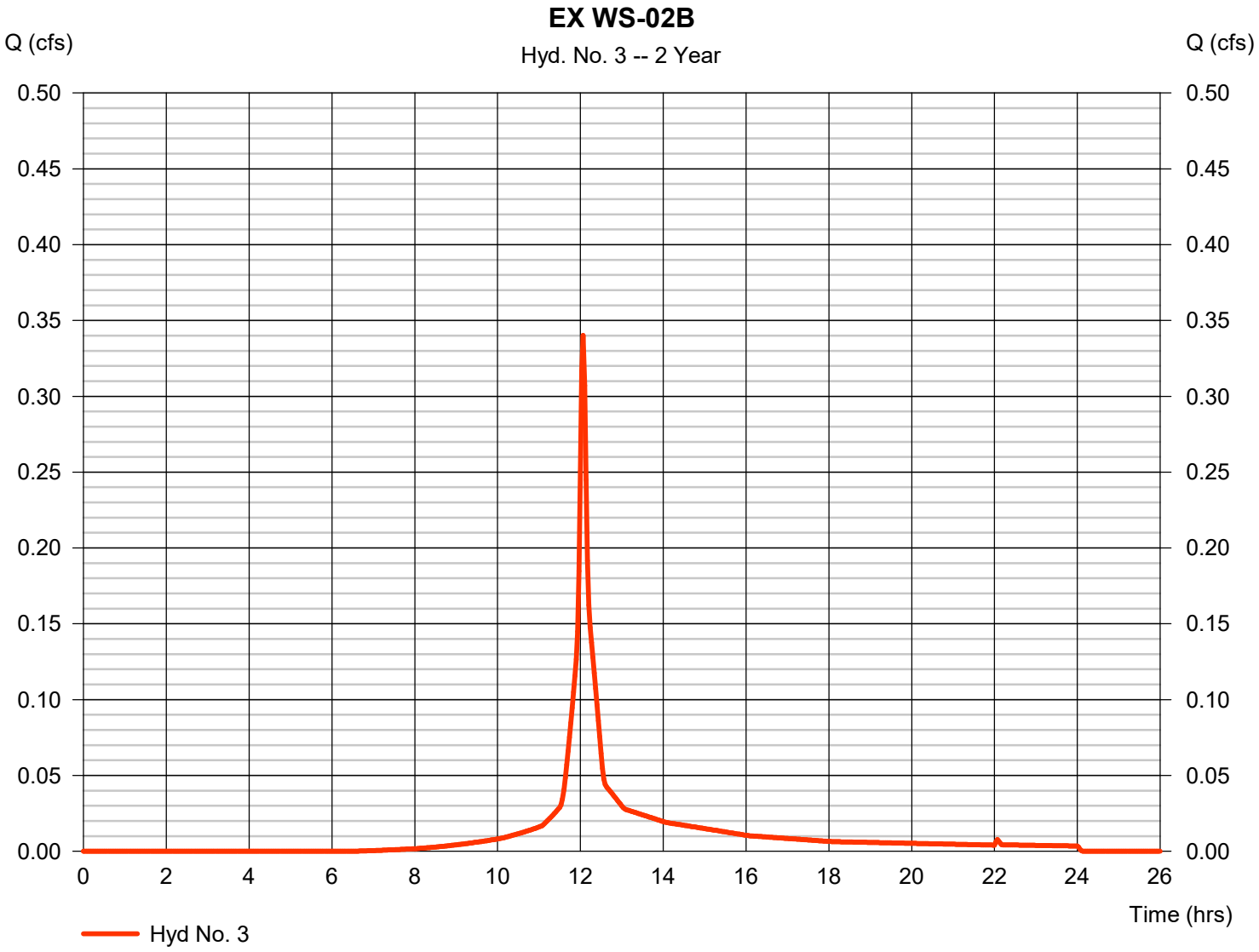


Hydrograph Report

Hyd. No. 3

EX WS-02B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.340 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	1,025 cuft
Drainage area	=	0.136 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.44 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

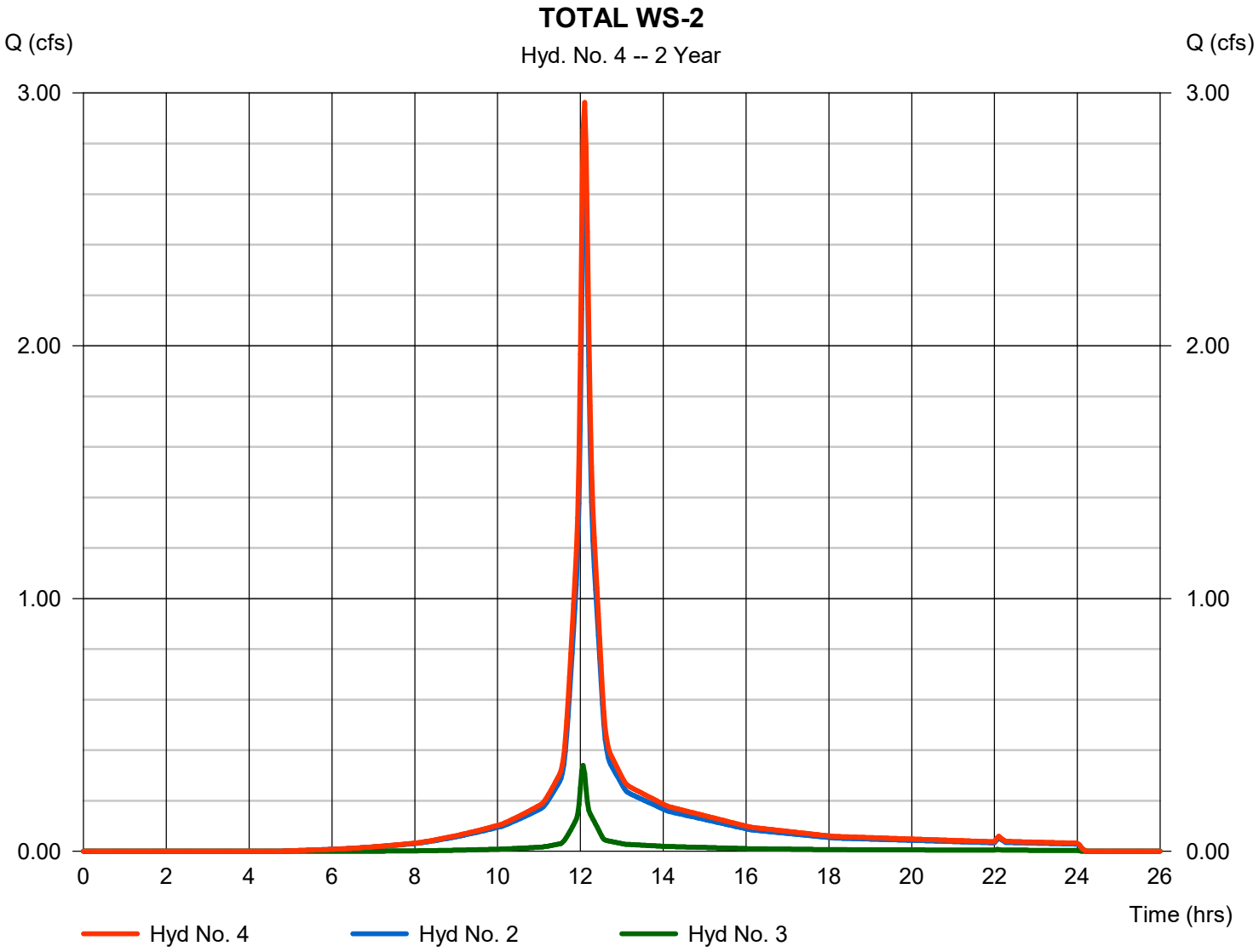


Hydrograph Report

Hyd. No. 4

TOTAL WS-2

Hydrograph type	= Combine	Peak discharge	= 2.963 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 10,341 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 1.131 ac

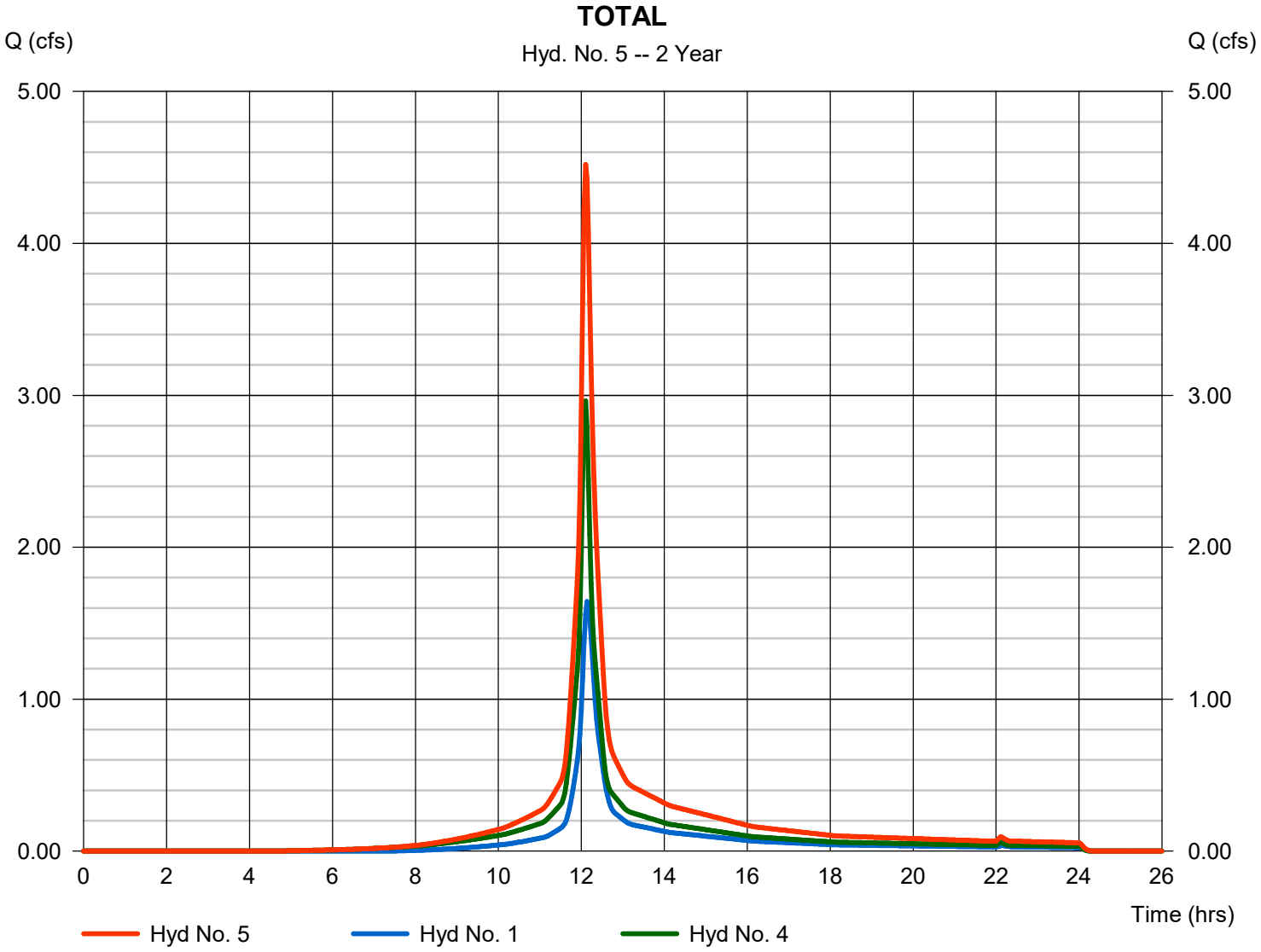


Hydrograph Report

Hyd. No. 5

TOTAL

Hydrograph type	= Combine	Peak discharge	= 4.520 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 16,635 cuft
Inflow hyds.	= 1, 4	Contrib. drain. area	= 0.822 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

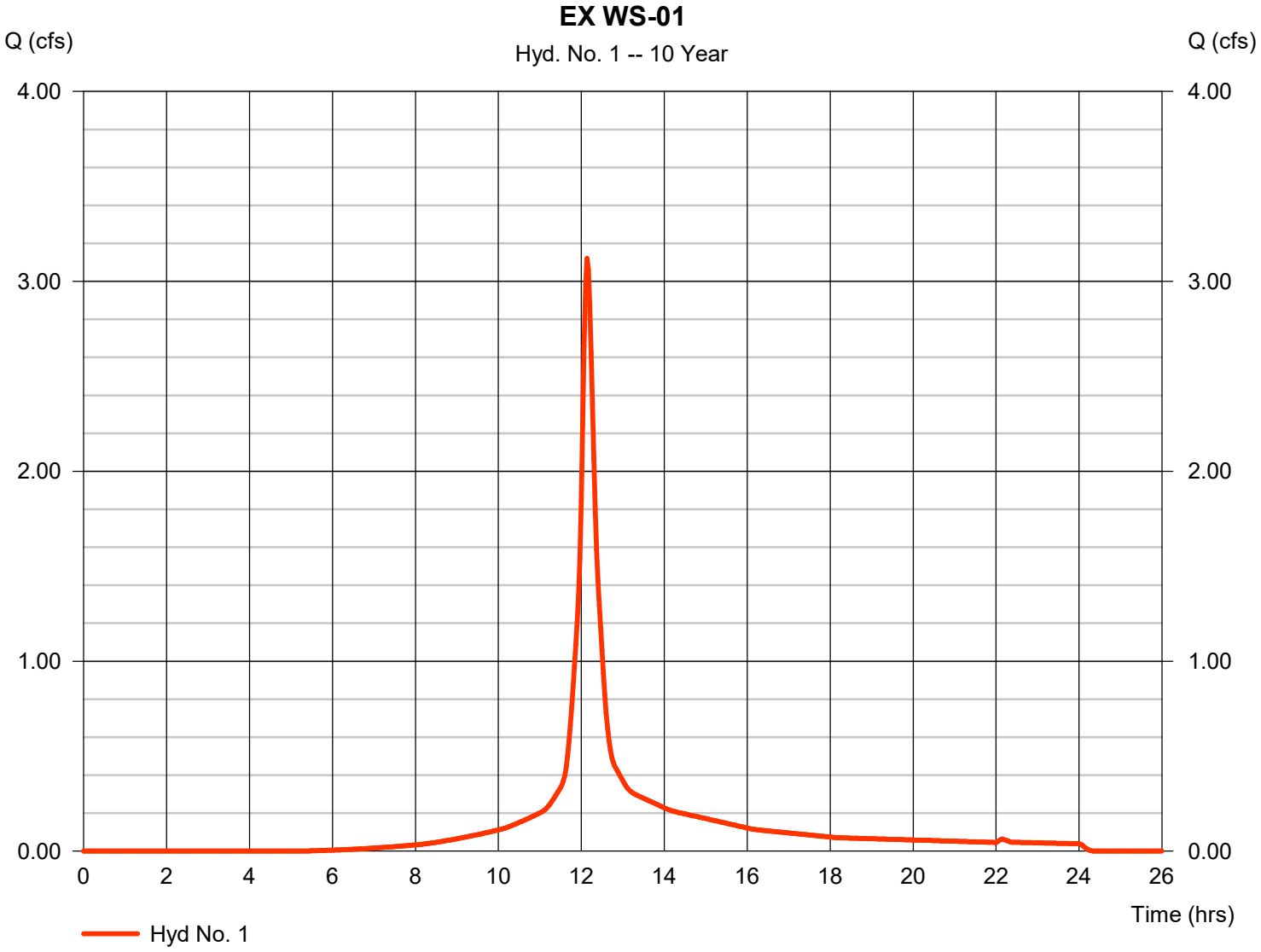
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3.121	2	728	12,141	------	------	------	EX WS-01
2	SCS Runoff	4.582	2	726	16,573	------	------	------	EX WS-02A
3	SCS Runoff	0.622	2	724	1,923	------	------	------	EX WS-02B
4	Combine	5.139	2	726	18,496	2, 3	------	------	TOTAL WS-2
5	Combine	8.122	2	726	30,637	1, 4	------	------	TOTAL

Hydrograph Report

Hyd. No. 1

EX WS-01

Hydrograph type	= SCS Runoff	Peak discharge	= 3.121 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 12,141 cuft
Drainage area	= 0.822 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.90 min
Total precip.	= 5.51 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

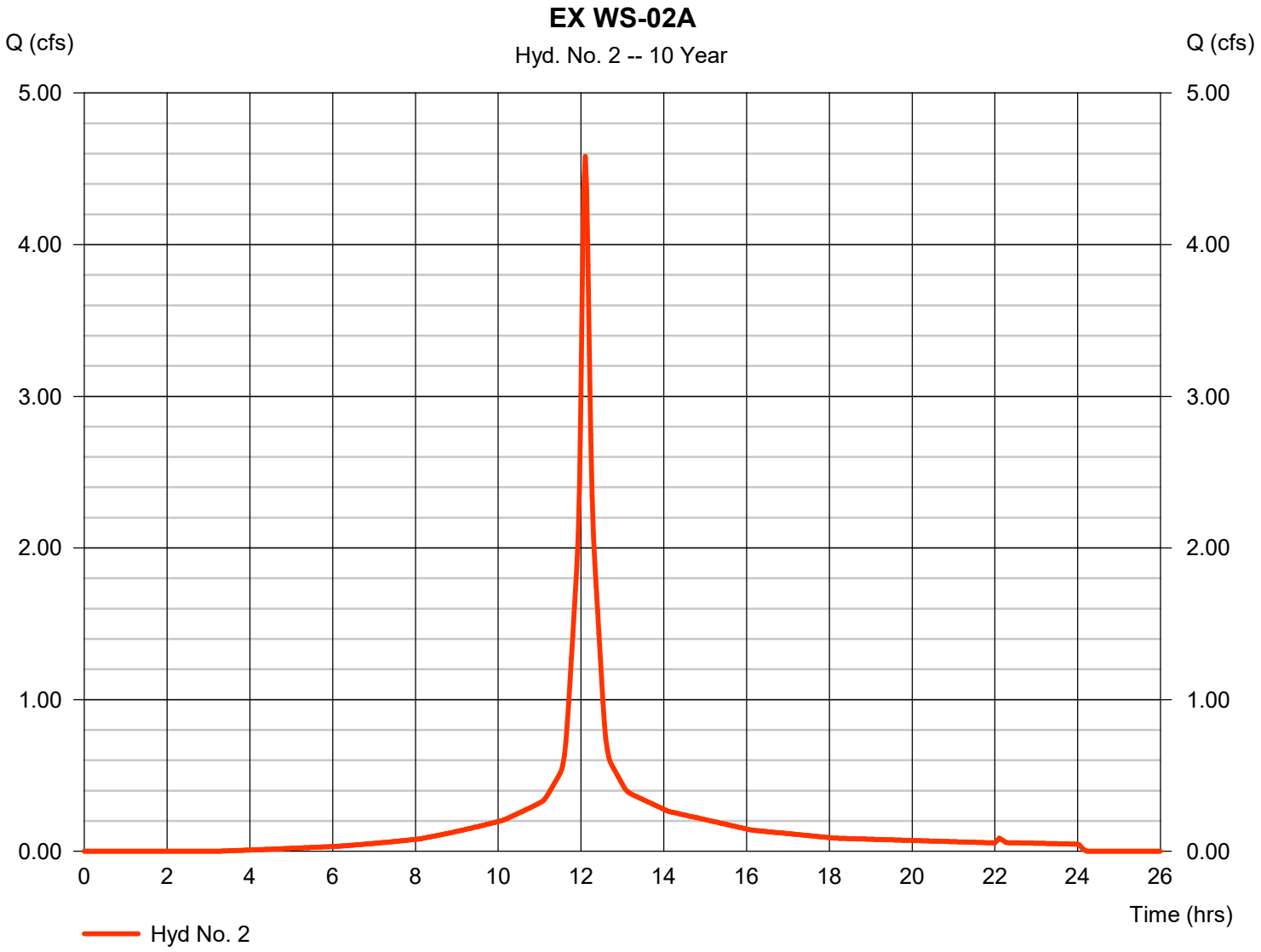


Hydrograph Report

Hyd. No. 2

EX WS-02A

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.582 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	16,573 cuft
Drainage area	=	0.995 ac	Curve number	=	92
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	9.50 min
Total precip.	=	5.51 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

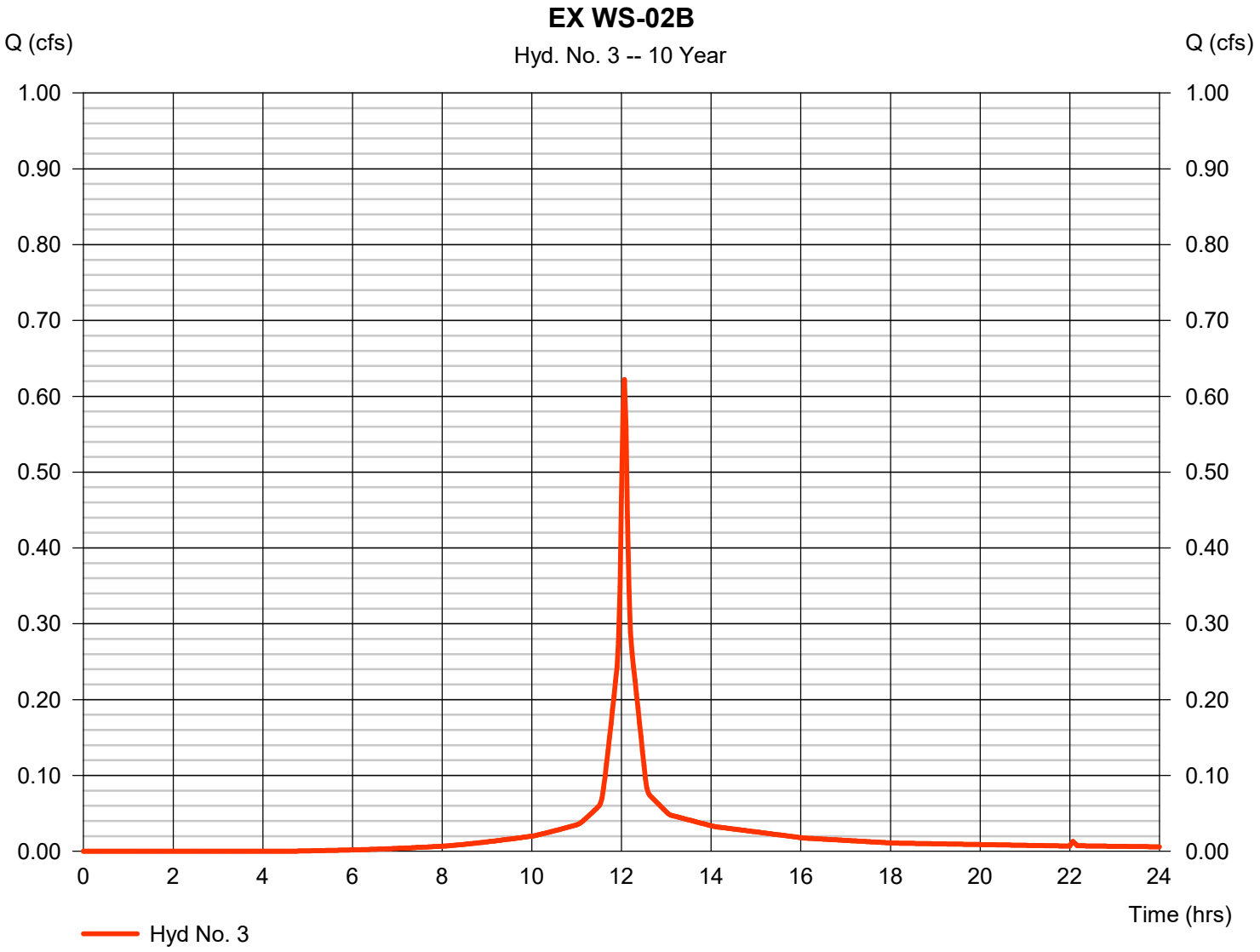


Hydrograph Report

Hyd. No. 3

EX WS-02B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.622 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	1,923 cuft
Drainage area	=	0.136 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.51 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

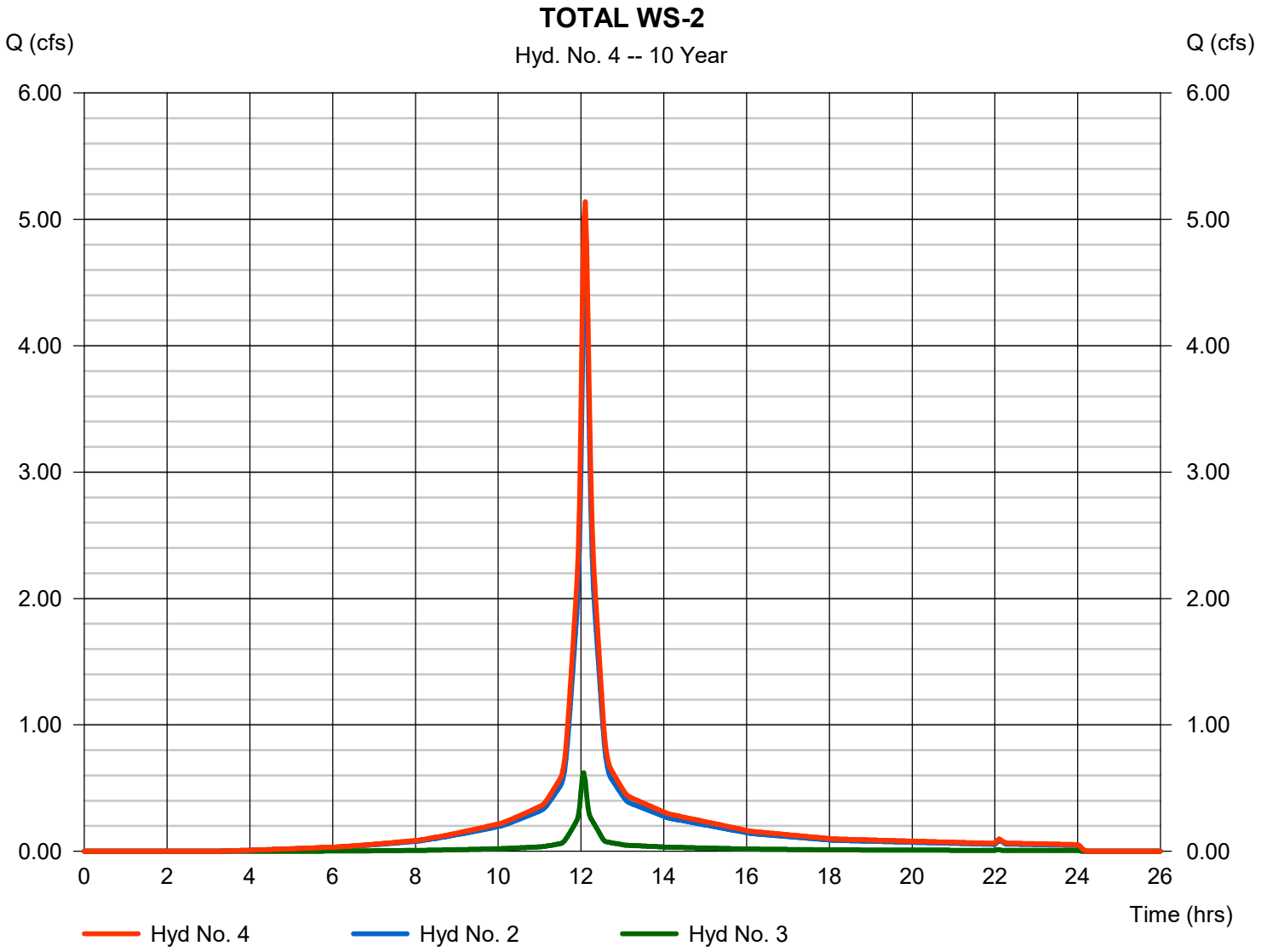


Hydrograph Report

Hyd. No. 4

TOTAL WS-2

Hydrograph type	= Combine	Peak discharge	= 5.139 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 18,496 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 1.131 ac

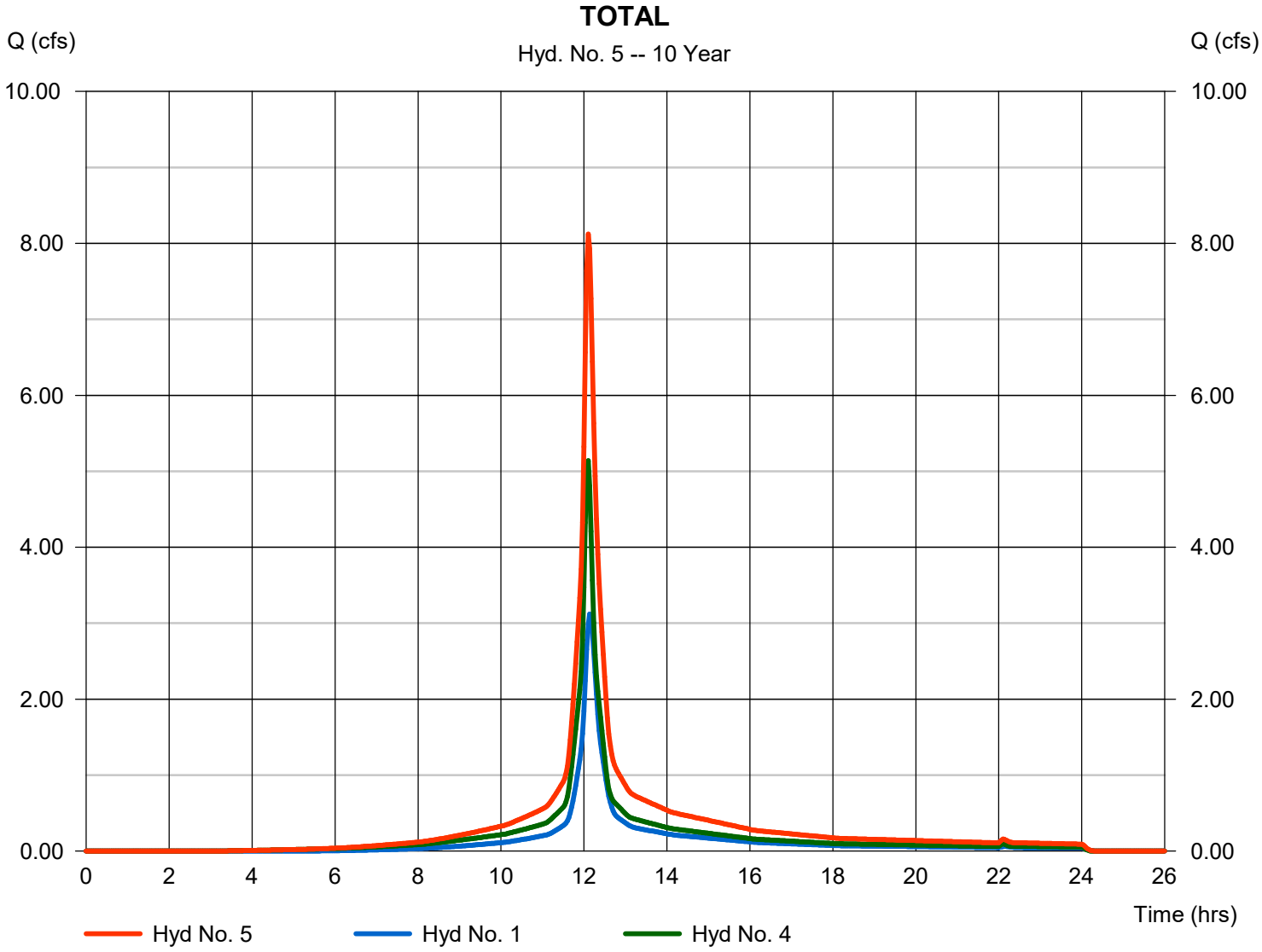


Hydrograph Report

Hyd. No. 5

TOTAL

Hydrograph type	= Combine	Peak discharge	= 8.122 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 30,637 cuft
Inflow hyds.	= 1, 4	Contrib. drain. area	= 0.822 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

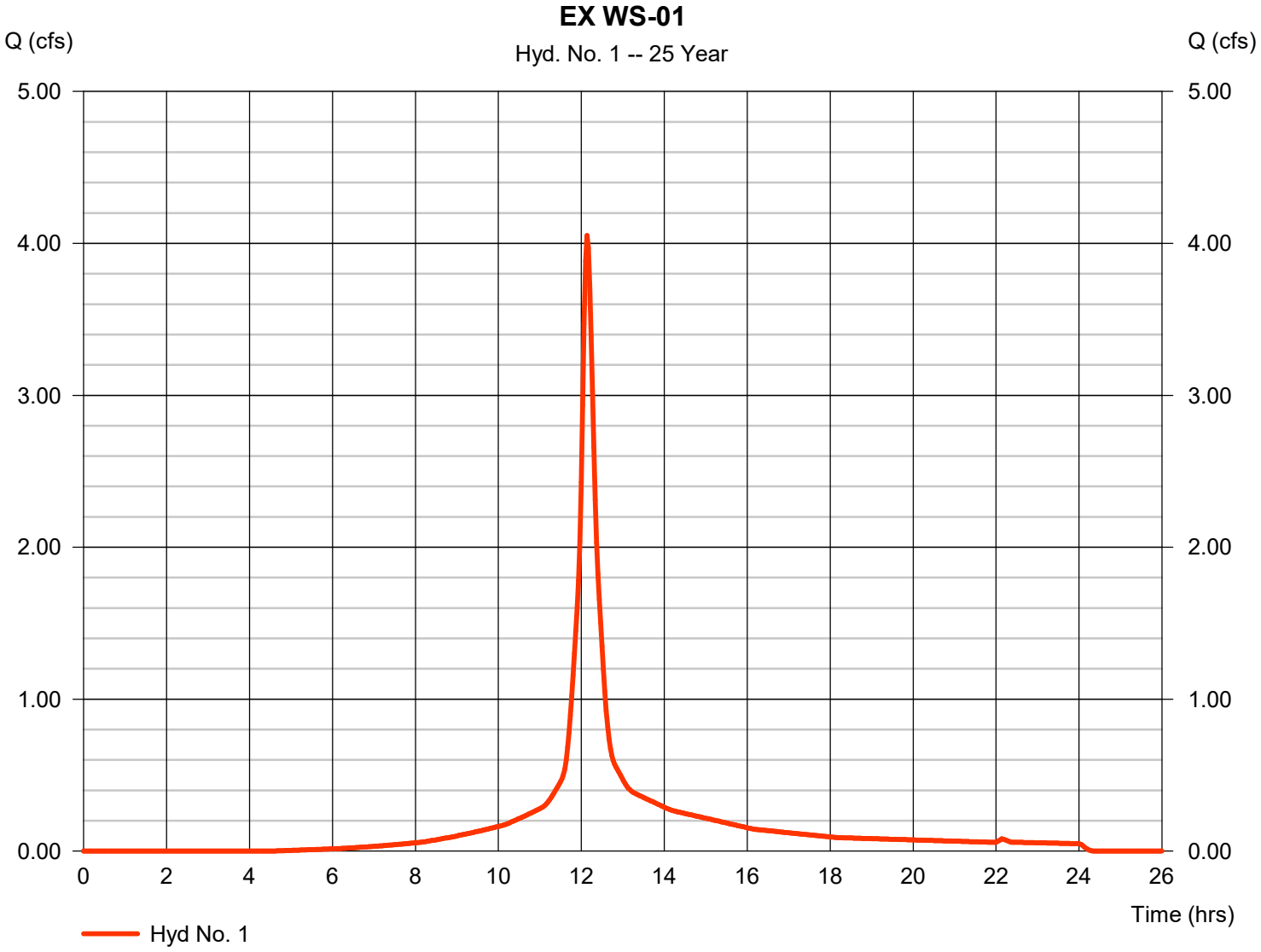
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.053	2	728	15,949	------	------	------	EX WS-01
2	SCS Runoff	5.777	2	726	21,192	------	------	------	EX WS-02A
3	SCS Runoff	0.798	2	724	2,503	------	------	------	EX WS-02B
4	Combine	6.490	2	726	23,695	2, 3	------	------	TOTAL WS-2
5	Combine	10.37	2	726	39,644	1, 4	------	------	TOTAL

Hydrograph Report

Hyd. No. 1

EX WS-01

Hydrograph type	= SCS Runoff	Peak discharge	= 4.053 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 15,949 cuft
Drainage area	= 0.822 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.90 min
Total precip.	= 6.81 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

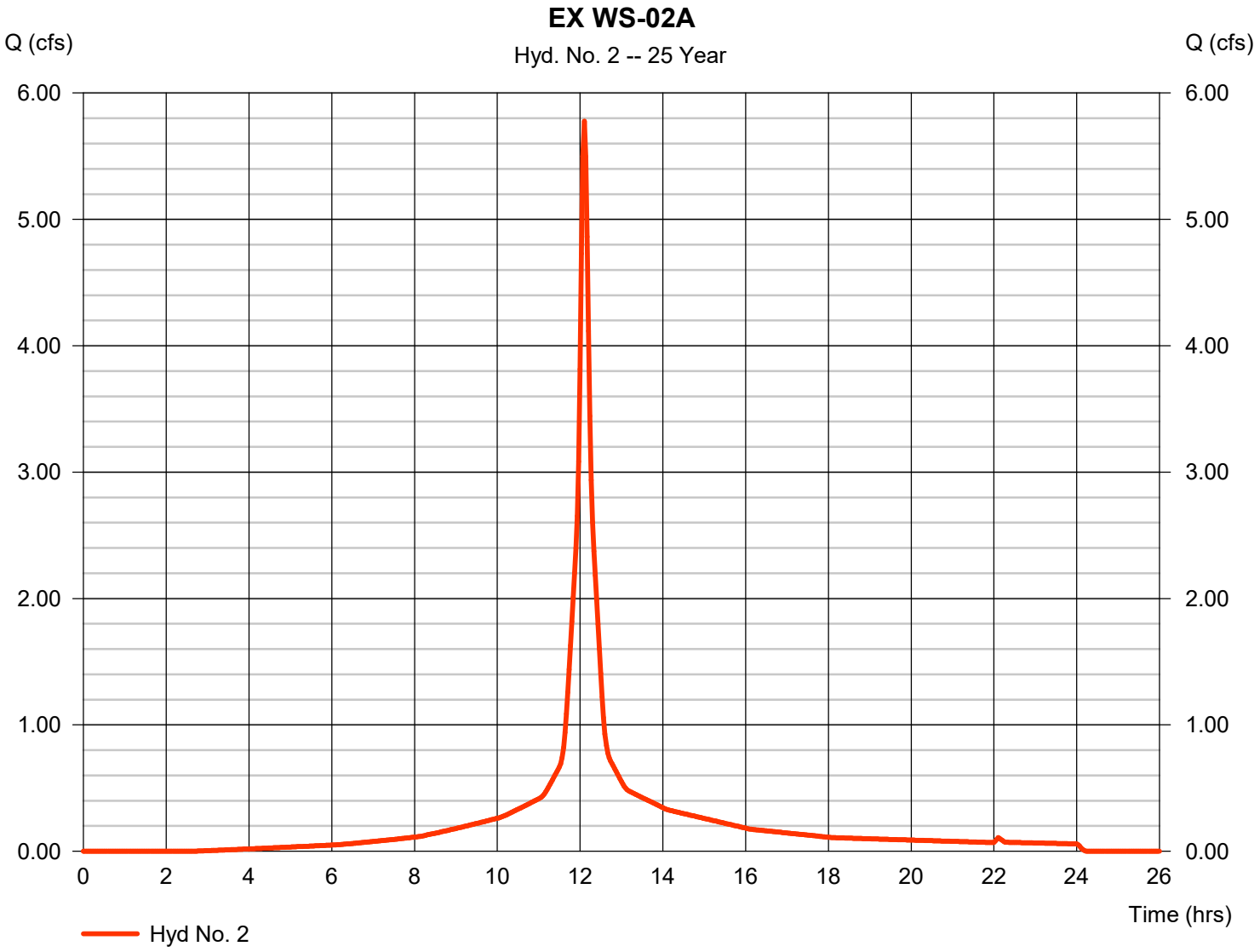


Hydrograph Report

Hyd. No. 2

EX WS-02A

Hydrograph type	= SCS Runoff	Peak discharge	= 5.777 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 21,192 cuft
Drainage area	= 0.995 ac	Curve number	= 92
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.50 min
Total precip.	= 6.81 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

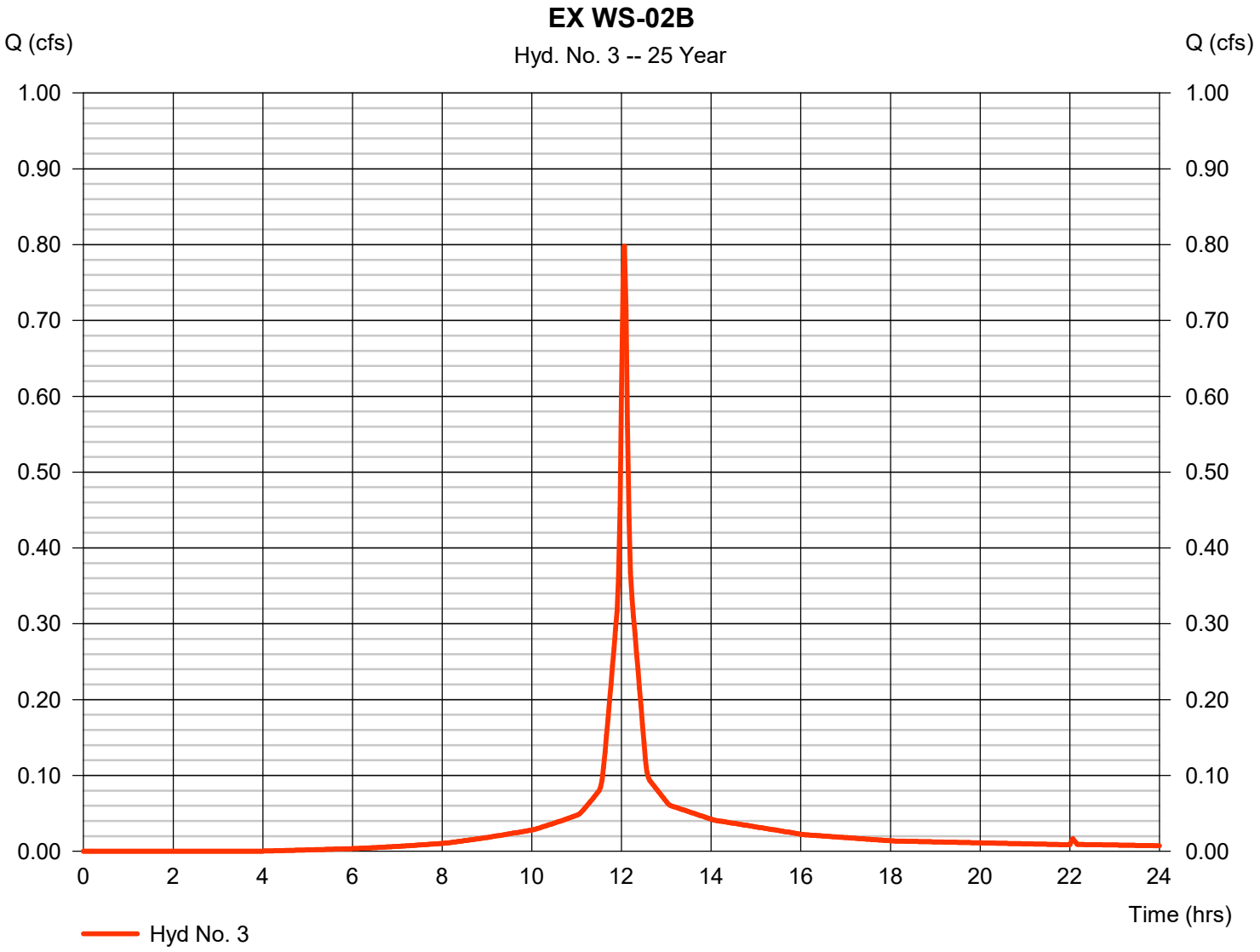


Hydrograph Report

Hyd. No. 3

EX WS-02B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.798 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	2,503 cuft
Drainage area	=	0.136 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

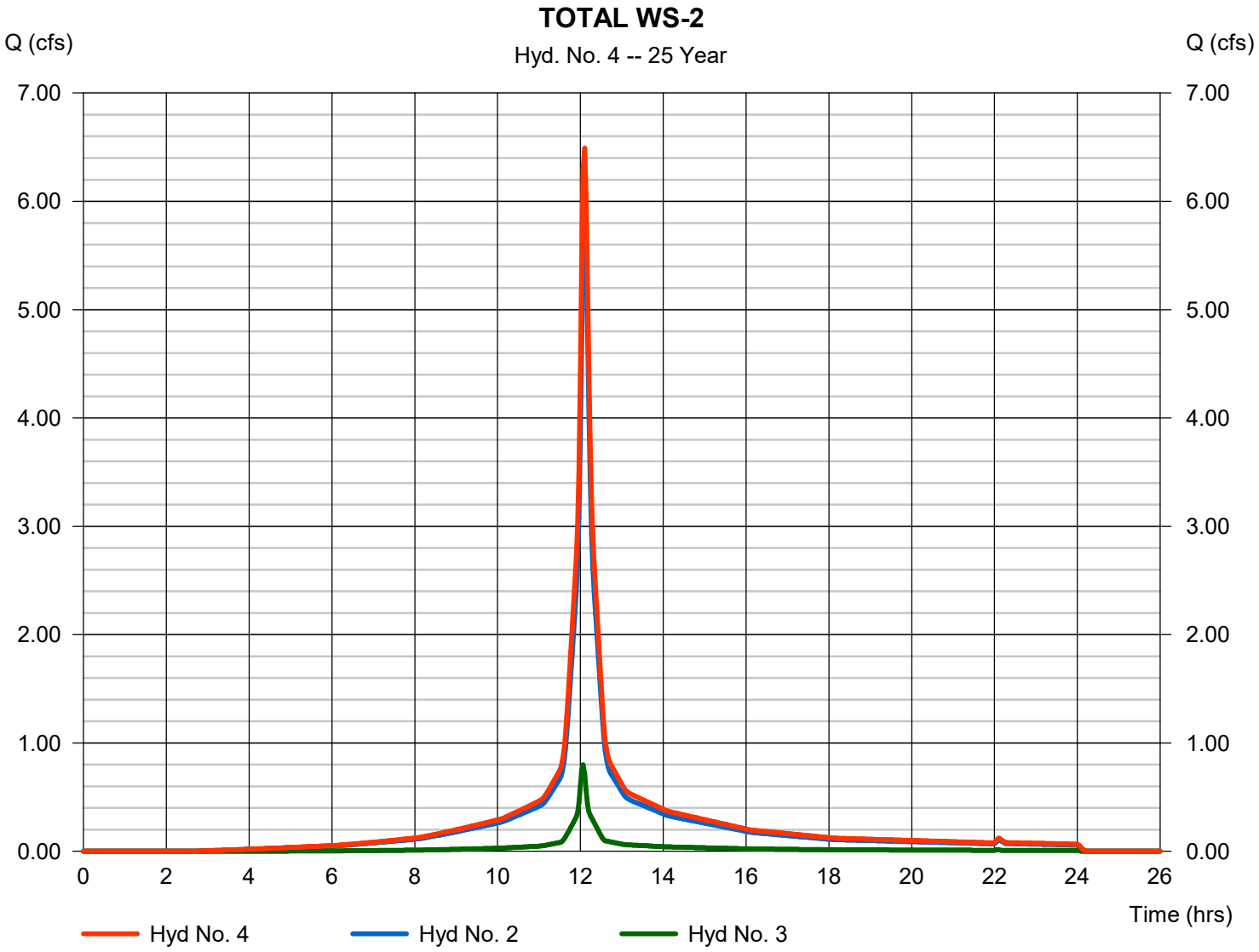


Hydrograph Report

Hyd. No. 4

TOTAL WS-2

Hydrograph type	= Combine	Peak discharge	= 6.490 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 23,695 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 1.131 ac

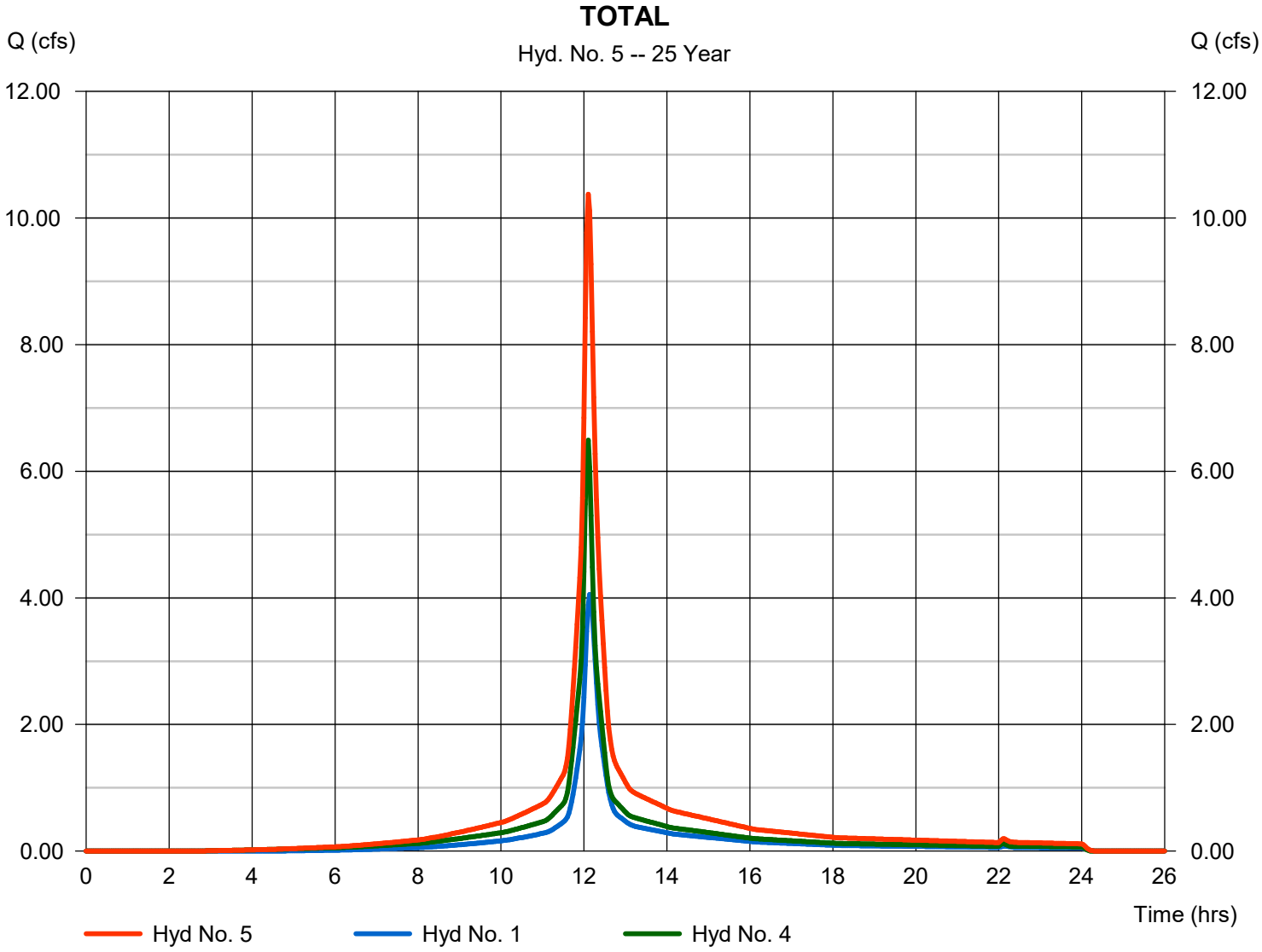


Hydrograph Report

Hyd. No. 5

TOTAL

Hydrograph type	= Combine	Peak discharge	= 10.37 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 39,644 cuft
Inflow hyds.	= 1, 4	Contrib. drain. area	= 0.822 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

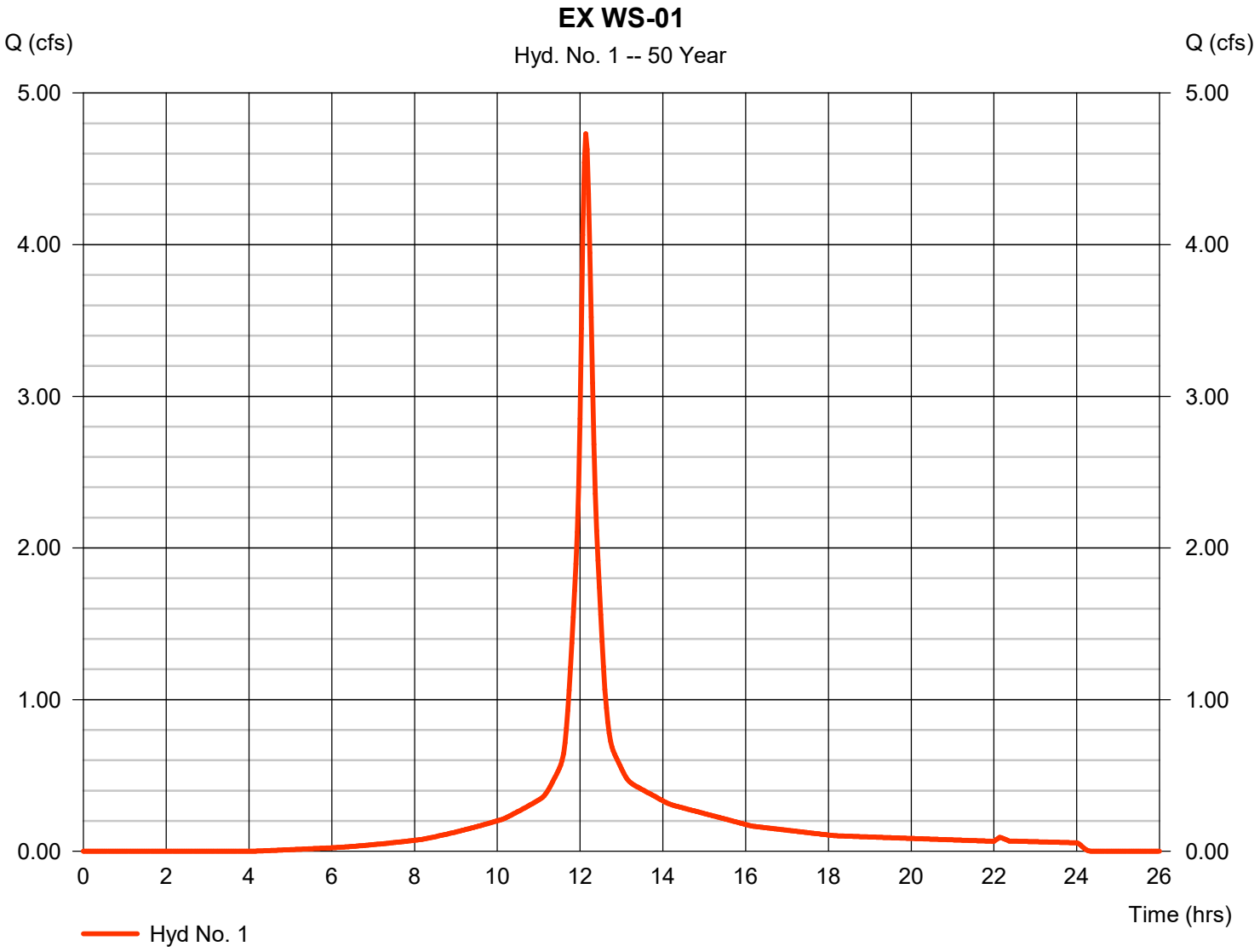
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.732	2	728	18,767	------	------	------	EX WS-01
2	SCS Runoff	6.645	2	726	24,582	------	------	------	EX WS-02A
3	SCS Runoff	0.926	2	724	2,931	------	------	------	EX WS-02B
4	Combine	7.471	2	726	27,513	2, 3	------	------	TOTAL WS-2
5	Combine	12.01	2	726	46,281	1, 4	------	------	TOTAL

Hydrograph Report

Hyd. No. 1

EX WS-01

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.732 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	18,767 cuft
Drainage area	=	0.822 ac	Curve number	=	86
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.90 min
Total precip.	=	7.76 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

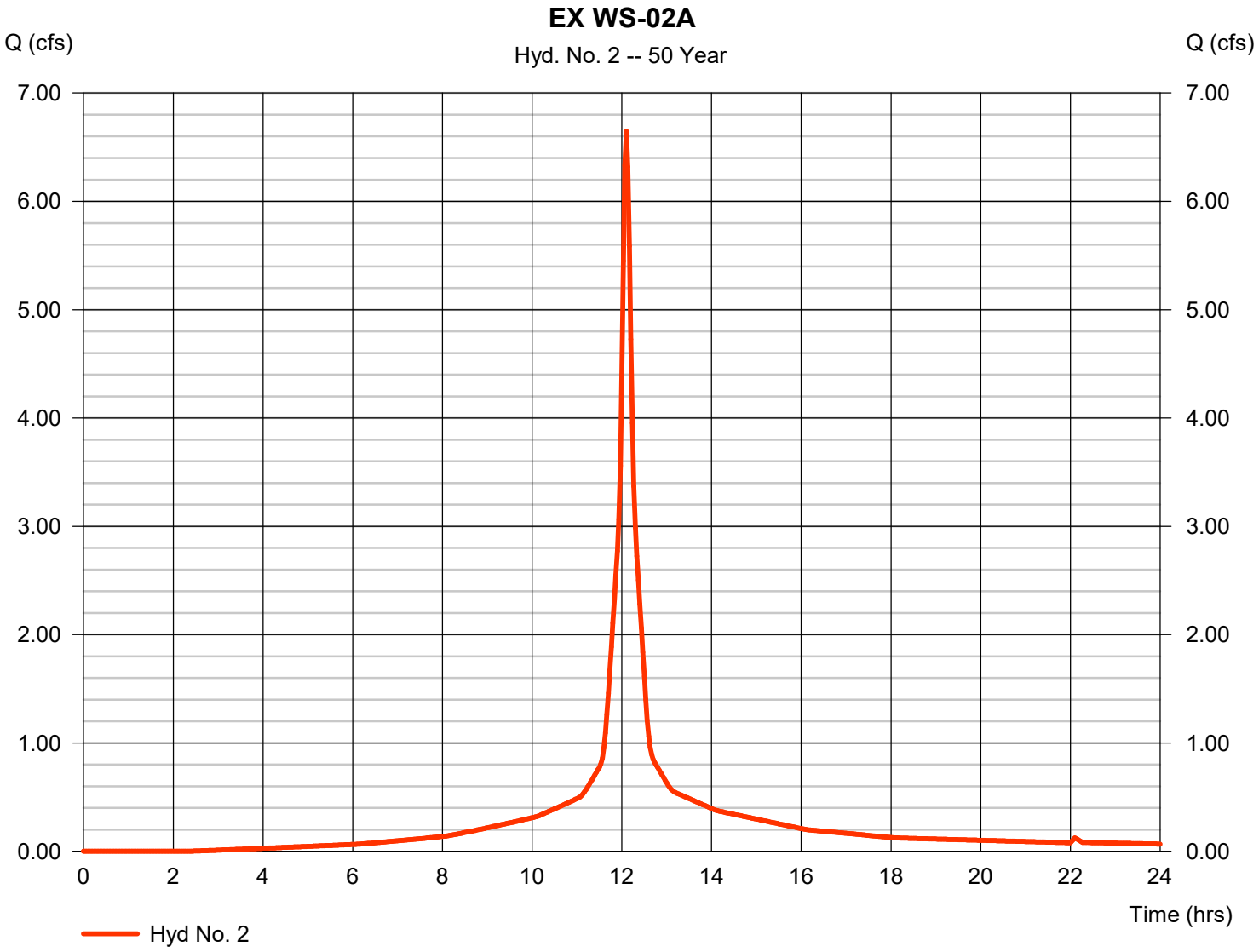


Hydrograph Report

Hyd. No. 2

EX WS-02A

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.645 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	24,582 cuft
Drainage area	=	0.995 ac	Curve number	=	92
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	9.50 min
Total precip.	=	7.76 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

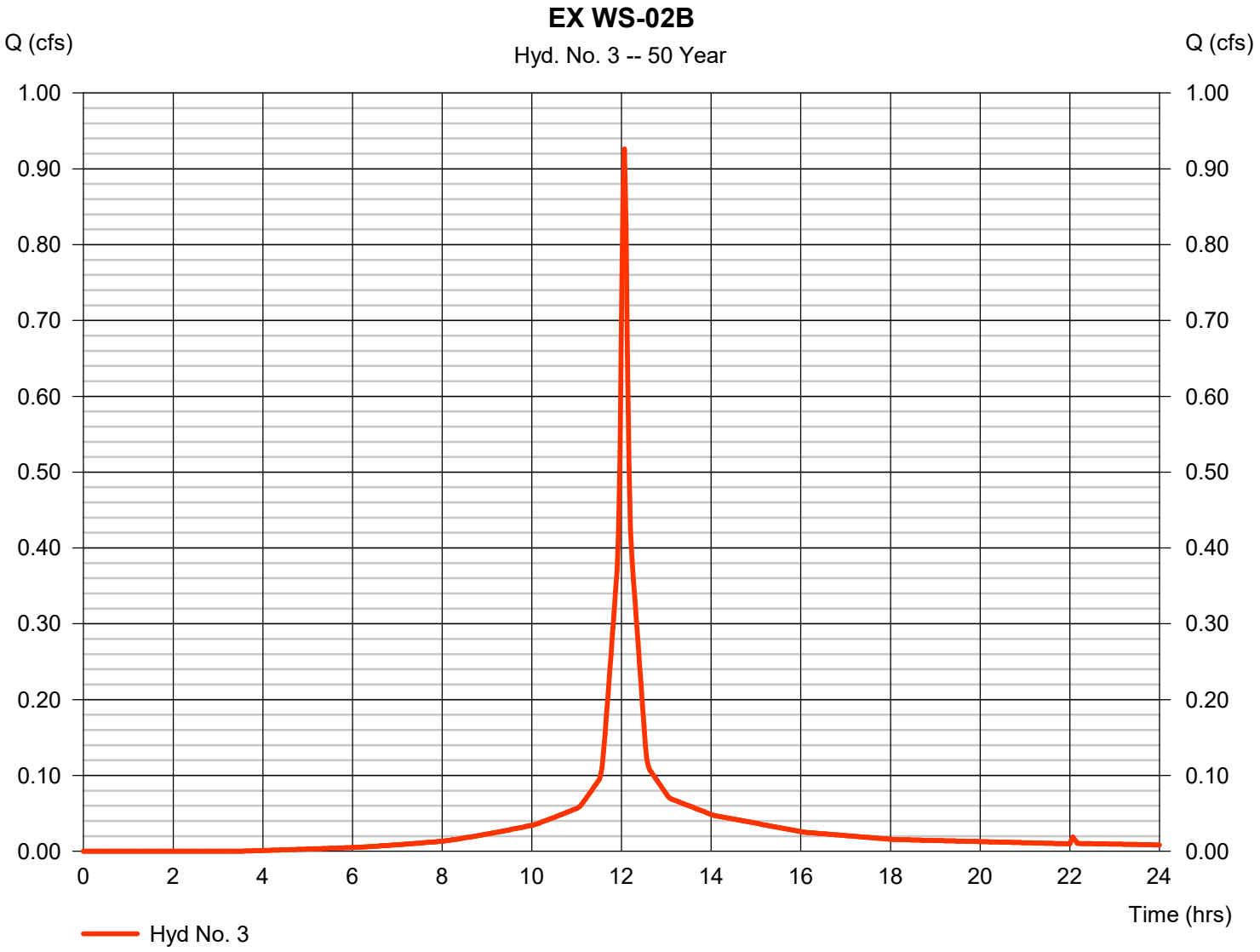


Hydrograph Report

Hyd. No. 3

EX WS-02B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.926 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	2,931 cuft
Drainage area	=	0.136 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.76 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

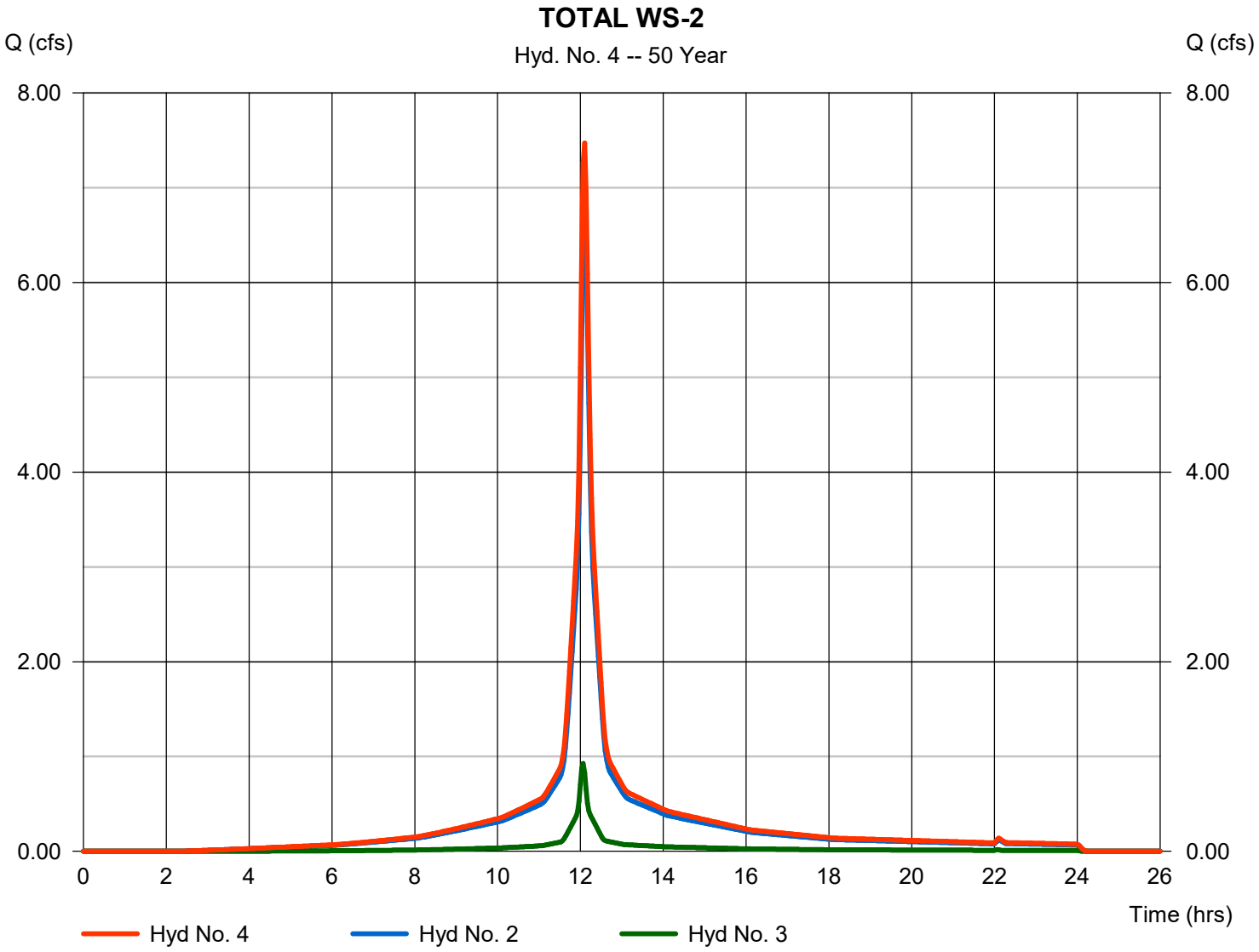


Hydrograph Report

Hyd. No. 4

TOTAL WS-2

Hydrograph type	= Combine	Peak discharge	= 7.471 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 27,513 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 1.131 ac

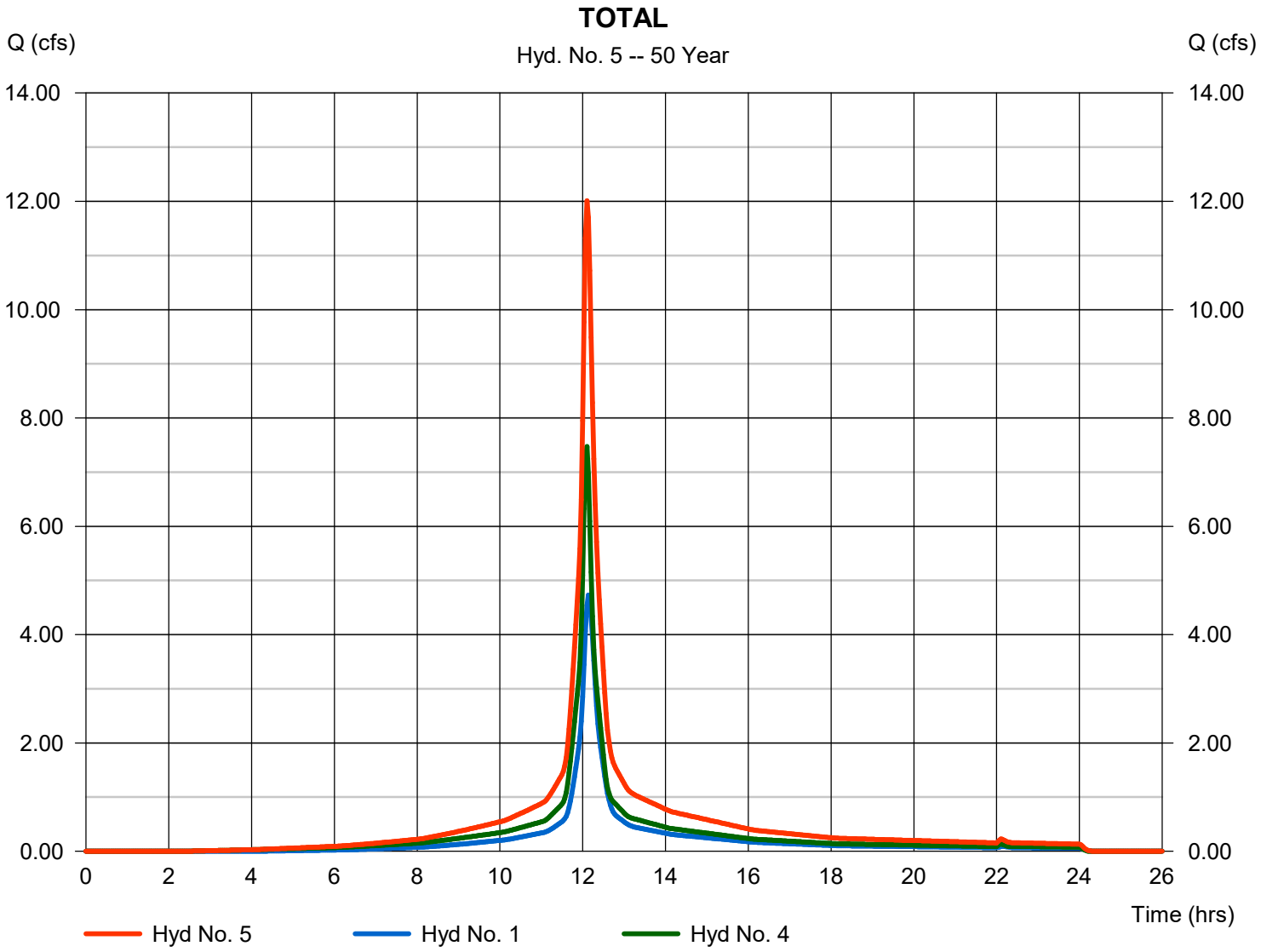


Hydrograph Report

Hyd. No. 5

TOTAL

Hydrograph type	= Combine	Peak discharge	= 12.01 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 46,281 cuft
Inflow hyds.	= 1, 4	Contrib. drain. area	= 0.822 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

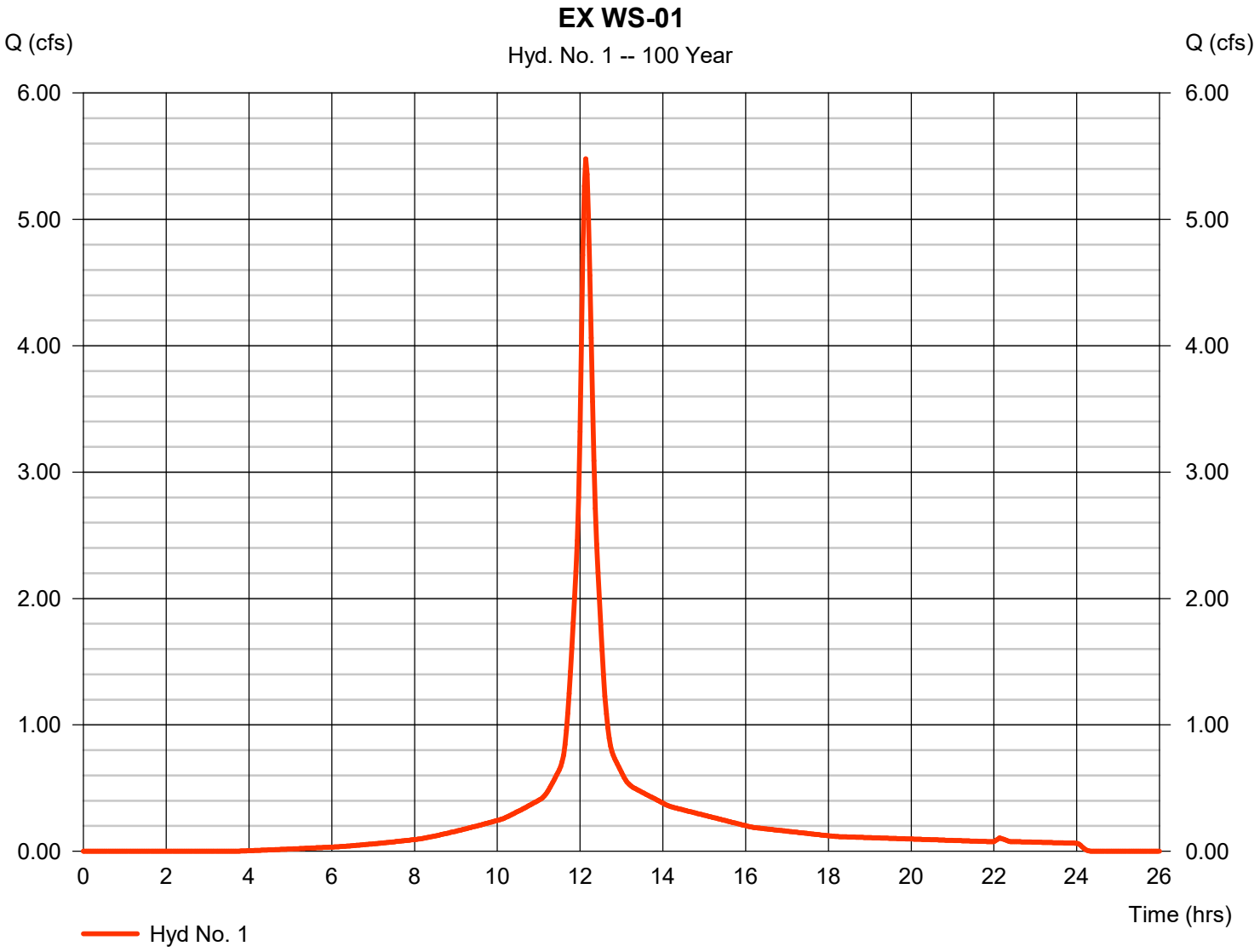
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	5.479	2	728	21,905	------	------	------	EX WS-01
2	SCS Runoff	7.601	2	726	28,339	------	------	------	EX WS-02A
3	SCS Runoff	1.067	2	724	3,407	------	------	------	EX WS-02B
4	Combine	8.551	2	726	31,746	2, 3	------	------	TOTAL WS-2
5	Combine	13.81	2	726	53,650	1, 4	------	------	TOTAL

Hydrograph Report

Hyd. No. 1

EX WS-01

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.479 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	21,905 cuft
Drainage area	=	0.822 ac	Curve number	=	86
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.90 min
Total precip.	=	8.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

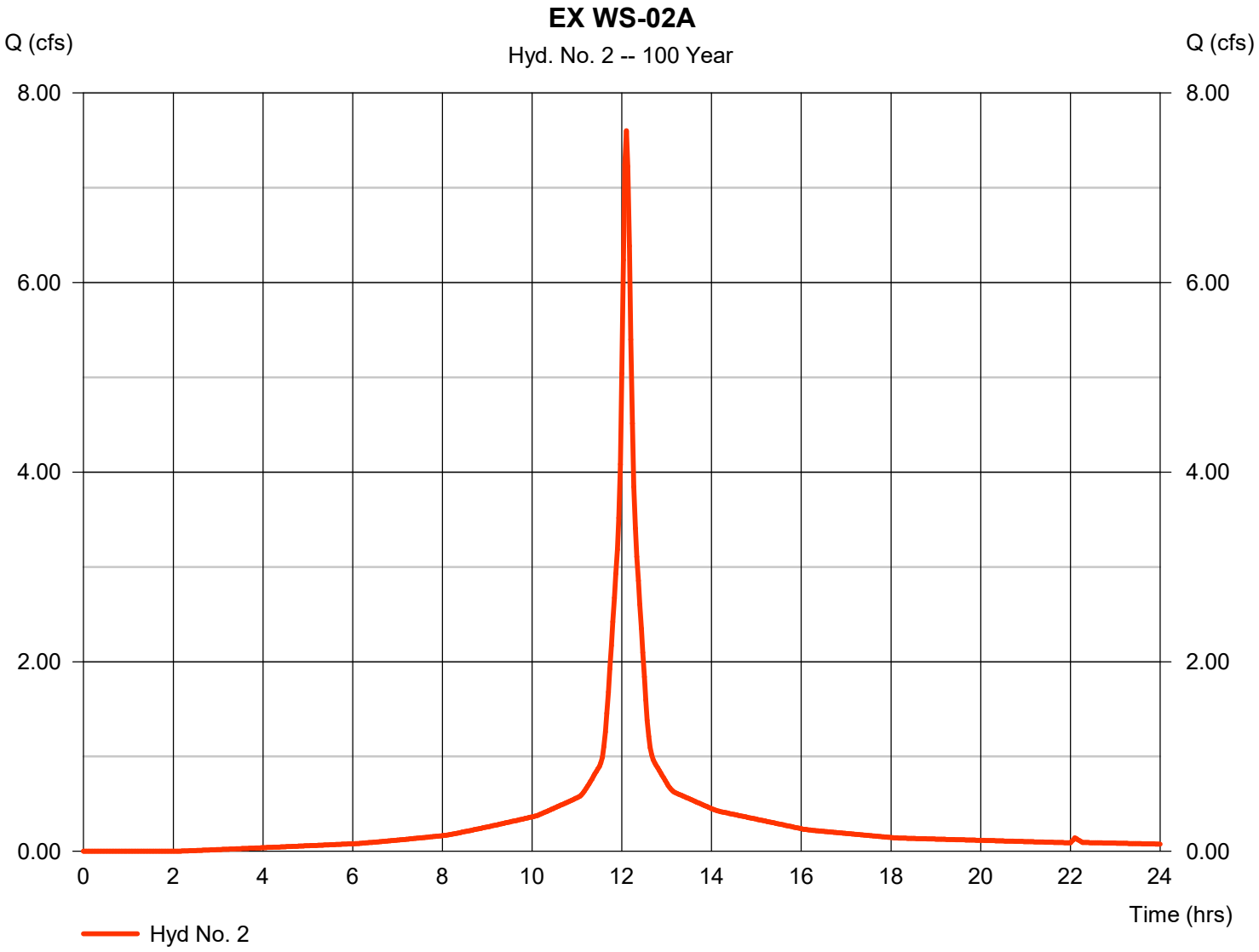


Hydrograph Report

Hyd. No. 2

EX WS-02A

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.601 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	28,339 cuft
Drainage area	=	0.995 ac	Curve number	=	92
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	9.50 min
Total precip.	=	8.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

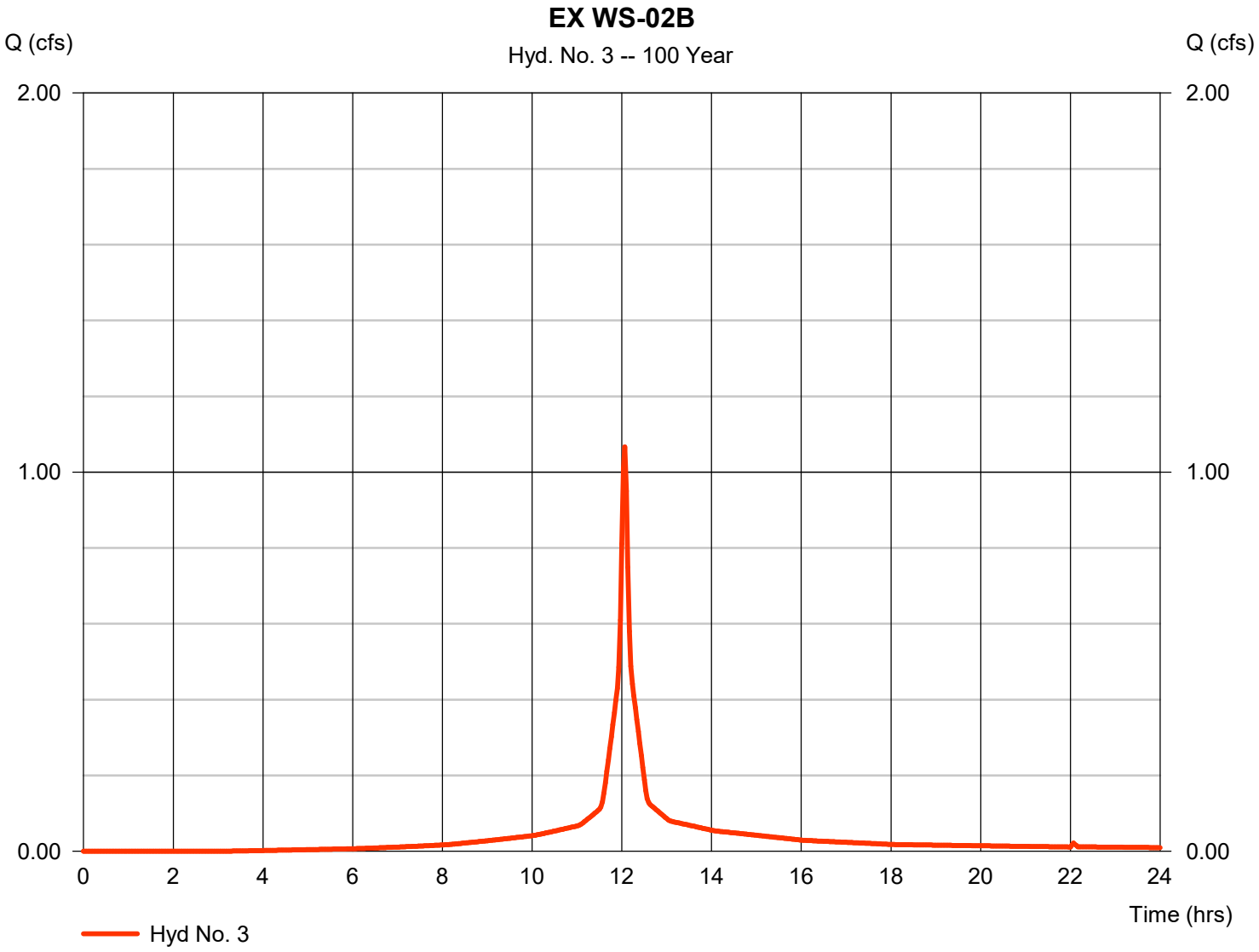


Hydrograph Report

Hyd. No. 3

EX WS-02B

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.067 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	3,407 cuft
Drainage area	=	0.136 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

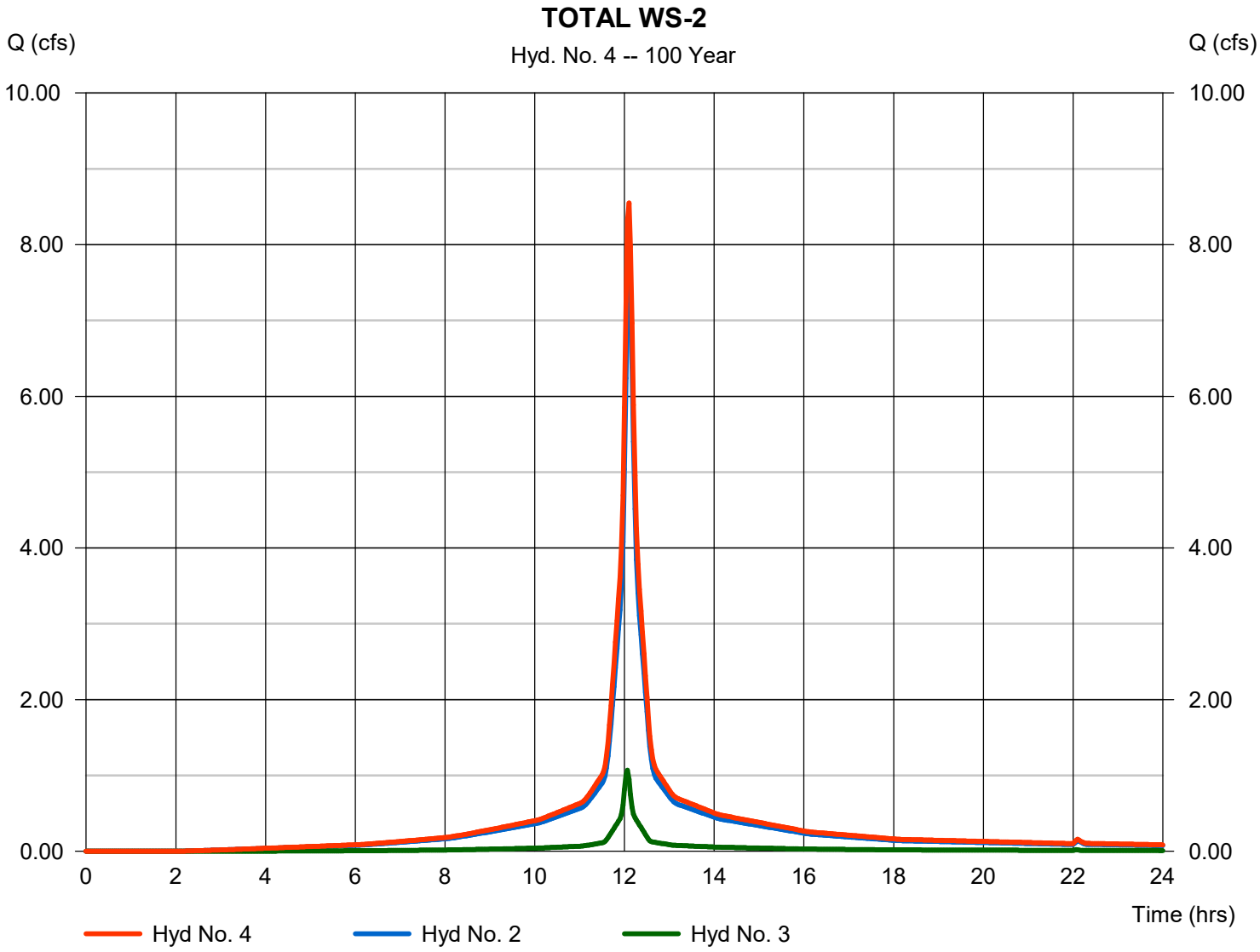


Hydrograph Report

Hyd. No. 4

TOTAL WS-2

Hydrograph type	= Combine	Peak discharge	= 8.551 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 31,746 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 1.131 ac

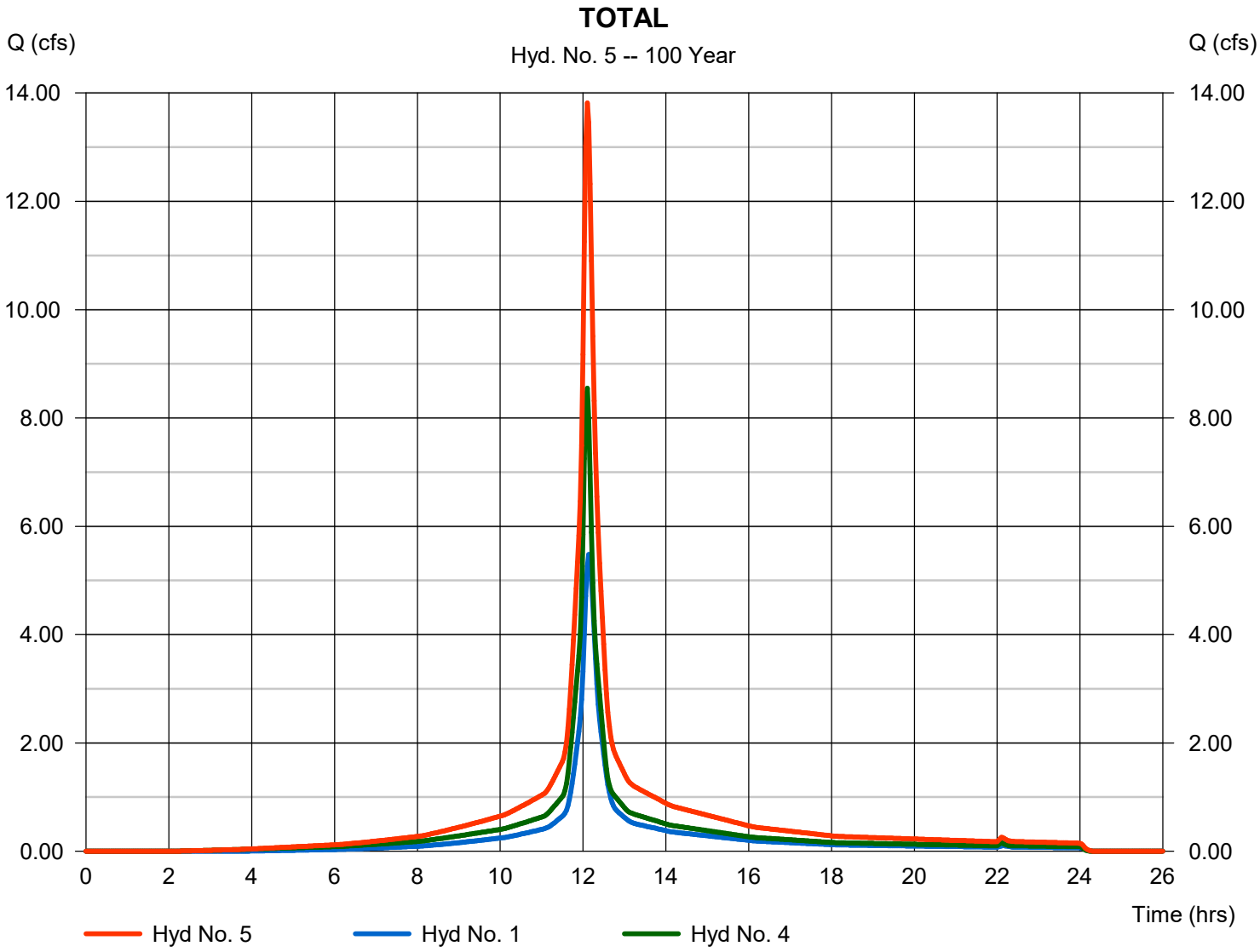


Hydrograph Report

Hyd. No. 5

TOTAL

Hydrograph type	= Combine	Peak discharge	= 13.81 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 53,650 cuft
Inflow hyds.	= 1, 4	Contrib. drain. area	= 0.822 ac



IDF Report..... 33

APPENDIX D

DESIGN POINT 1

PR WS-1

PR WS-2A

PR WS-2B

PR WS-2C

PR WS-2D

DESIGN POINT 2

N

0 60' 120'

SCALE: 1" = 60'

THE FREDERICK GUNN SCHOOL
CENTER FOR INNOVATION AND ACTIVE CITIZENSHIP
WASHINGTON, CT

PROPOSED WATERSHED MAP

DATE:	01/24/2022
SCALE:	1"=60'
FIGURE:	PR-WS

Tighe&Bond

Jan 27, 2022-12:59pm Plotted By: KMcCutchan
Tighe & Bond, Inc. \\tighebond.com\data\Data\Projects\G\G5012\G5012-002 Gunnery Math & Science\Drawings_Figures\AutoCAD\Figures\G5012-02-PR-WS.dwg

Tighe&Bond
Consulting Engineers
Environmental Specialists

Project Name: **The Frederick Gunn School - Center for Innovation and Active Citizenship**
Project Number: **G5012-002**
Project Location: **Washington, CT**
Description: **Proposed CN & Tc Calculations**
Prepared By: **AVC** Date: **January 24, 2022**

Designation: **PR WS-01**
Location:

Cover Type	Area, ac	CN	A x CN
Pavement/Roof	0.283	98	27.7397
Landscaped and Lawns	0.495	80	39.6198
	0.778		67.360

Weighted CN: 87

Time of Concentration

(computed in accordance with ConnDOT Drainage Manual, Sec. 6C)

Overland				
Segment	**Surface "n"**	**Flow Length (ft.)**	**Slope (ft/ft)**	**Time (min.)**
Segment A - B	0.24	125	0.086	9.37
Segment B - C	0.015	10	0.05	0.17
Segment C - D	0.24	5	0.05	0.89

Total Tc = 10.4 Min.

Note: Overland time of concentration computed using "Kinematic Wave" equation
Gutter and pipe time of concentration computed using Manning's equation

Designation: **PR WS-02A**
Location:

Cover Type	Area, ac	CN	A x CN
Pavement/Roof	0.379	98	37.1032
Landscaped and Lawns	0.112	80	8.9219
	0.490		46.025

Weighted CN: 94

Time of Concentration

(computed in accordance with ConnDOT Drainage Manual, Sec. 6C)

Overland				
Segment	**Surface "n"**	**Flow Length (ft.)**	**Slope (ft/ft)**	**Time (min.)**
Segment A - B	0.24	45	0.195	2.98
Segment B - C	0.015	24	0.049	0.34

Total Tc = 3.3 Min.
5 (min) Min.

Note: Overland time of concentration computed using "Kinematic Wave" equation
Gutter and pipe time of concentration computed using Manning's equation

Tighe&Bond
Consulting Engineers
Environmental Specialists

Project Name: **The Frederick Gunn School - Center for Innovation and Active Citizenship**
Project Number: **G5012-002**
Project Location: **Washington, CT**
Description: **Proposed CN & Tc Calculations**
Prepared By: **AVC** Date: **January 24, 2022**

Designation: **PR WS-02B**
Location:

Cover Type	Area, ac	CN	A x CN
Pavement/Roof	0.076	98	7.4062
Landscaped and Lawns	0.060	80	4.7750
	0.135		12.1813

Weighted CN: **90**

Time of Concentration

(computed in accordance with ConnDOT Drainage Manual, Sec. 6C)

Overland				
Segment	**Surface "n"**	**Flow Length (ft.)**	**Slope (ft/ft)**	**Time (min.)**
Segment A - B	0.24	26	0.2	1.9

Total Tc = 1.9 Min.

Note: Overland time of concentration computed using "Kinematic Wave" equation **5 (min) Min.**
Gutter and pipe time of concentration computed using Manning's equation

Designation: **PR WS-02C**
Location:

Cover Type	Area, ac	CN	A x CN
Pavement/Roof	0.314	98	30.7836
Landscaped and Lawns	0.099	80	7.9376
	0.413		38.721

Weighted CN: **94**

Time of Concentration

(computed in accordance with ConnDOT Drainage Manual, Sec. 6C)

Overland				
Segment	**Surface "n"**	**Flow Length (ft.)**	**Slope (ft/ft)**	**Time (min.)**
Segment A - B	0.24	45	0.111	3.74

Shallow Concentrated Flow					
Segment		**Slope (ft/ft)**	**V (ft/s)**	**Length (ft)**	**Time (min.)**
Segment B - C	paved	0.053	4.68	150	0.53

Total Tc = 4.3 Min.
5 (min) Min.

Note: Overland time of concentration computed using "Kinematic Wave" equation
Gutter and pipe time of concentration computed using Manning's equation

Tighe&Bond
Consulting Engineers
Environmental Specialists

Project Name: **The Frederick Gunn School - Center for Innovation and Active Citizenship**
Project Number: **G5012-002**
Project Location: **Washington, CT**
Description: **Proposed CN & Tc Calculations**
Prepared By: **AVC** Date: **January 24, 2022**

Designation: **PR WS-02D**
Location:

Cover Type	Area, ac	CN	A x CN
Pavement/Roof	0.069	98	6.7201
Landscaped and Lawns	0.067	80	5.3609
	0.136		12.081

Weighted CN: **89**

Time of Concentration

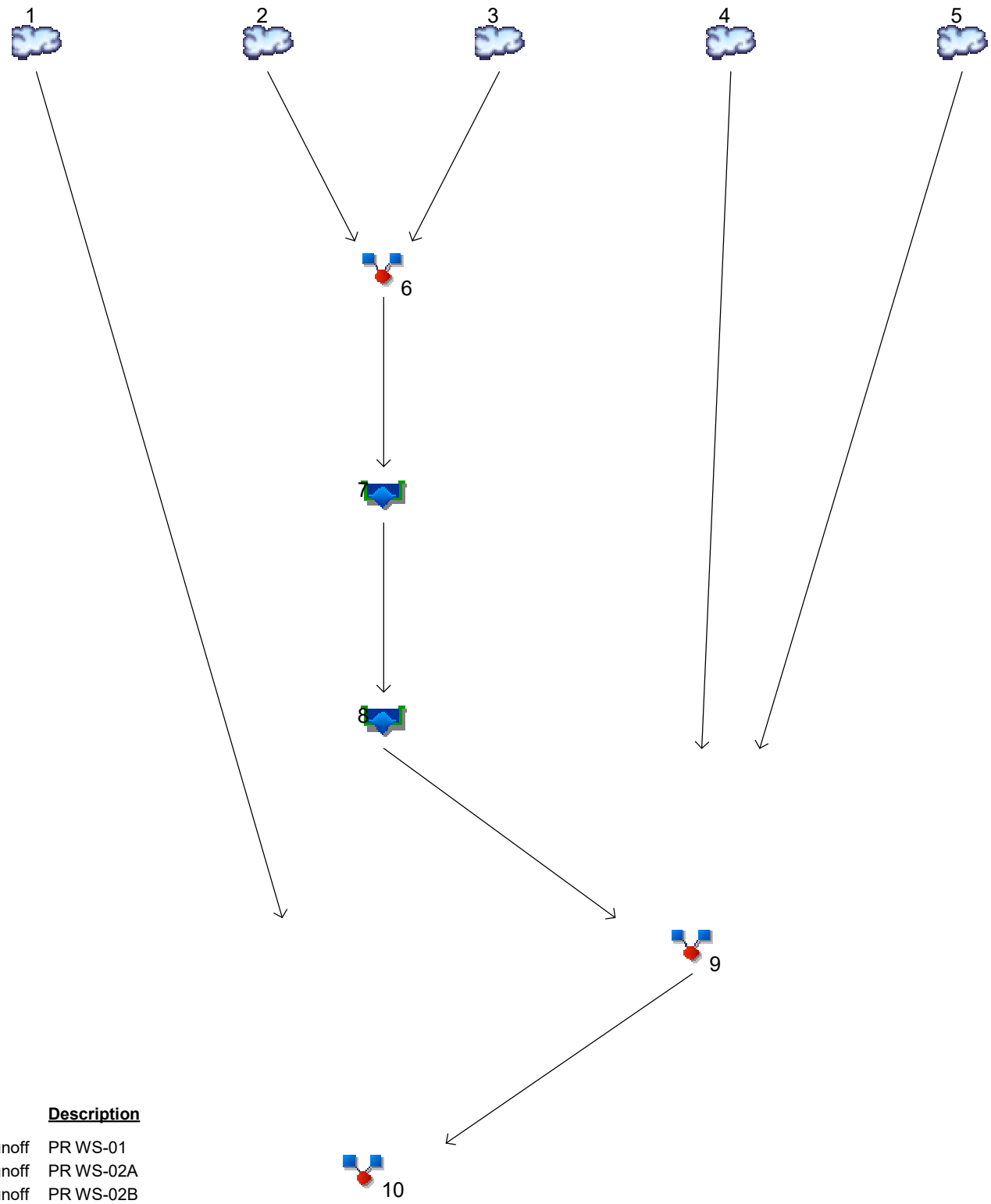
(computed in accordance with ConnDOT Drainage Manual, Sec. 6C)

Overland				
Segment	**Surface "n"**	**Flow Length (ft.)**	**Slope (ft/ft)**	**Time (min.)**
Segment A - B	0.24	18	0.02	3.56

Total Tc = 3.6 Min.
5 (min) Min.

Note: Overland time of concentration computed using "Kinematic Wave" equation
Gutter and pipe time of concentration computed using Manning's equation

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	PR WS-01
2	SCS Runoff	PR WS-02A
3	SCS Runoff	PR WS-02B
4	SCS Runoff	PR WS-02C
5	SCS Runoff	PR WS-02D
6	Combine	TO-INFILTRATION
7	Reservoir	NORTHERN CHAMBERS
8	Reservoir	SOUTHERN CHAMBERS
9	Combine	WS2-TOTAL
10	Combine	TOTAL

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	1.615	-------	-------	3.019	3.899	4.540	5.245	PR WS-01
2	SCS Runoff	------	-------	1.469	-------	-------	2.464	3.081	3.531	4.026	PR WS-02A
3	SCS Runoff	------	-------	0.361	-------	-------	0.640	0.814	0.940	1.079	PR WS-02B
4	SCS Runoff	------	-------	1.238	-------	-------	2.077	2.597	2.976	3.393	PR WS-02C
5	SCS Runoff	------	-------	0.352	-------	-------	0.634	0.810	0.937	1.077	PR WS-02D
6	Combine	2, 3,	-------	1.830	-------	-------	3.104	3.896	4.471	5.105	TO-INFILTRATION
7	Reservoir	6	-------	1.602	-------	-------	2.682	3.084	3.967	4.653	NORTHERN CHAMBERS
8	Reservoir	7	-------	1.560	-------	-------	2.565	3.015	3.649	4.275	SOUTHERN CHAMBERS
9	Combine	4, 5, 8	-------	2.948	-------	-------	4.875	5.970	6.879	8.015	WS2-TOTAL
10	Combine	1, 9	-------	4.483	-------	-------	7.687	9.639	11.24	13.06	TOTAL

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

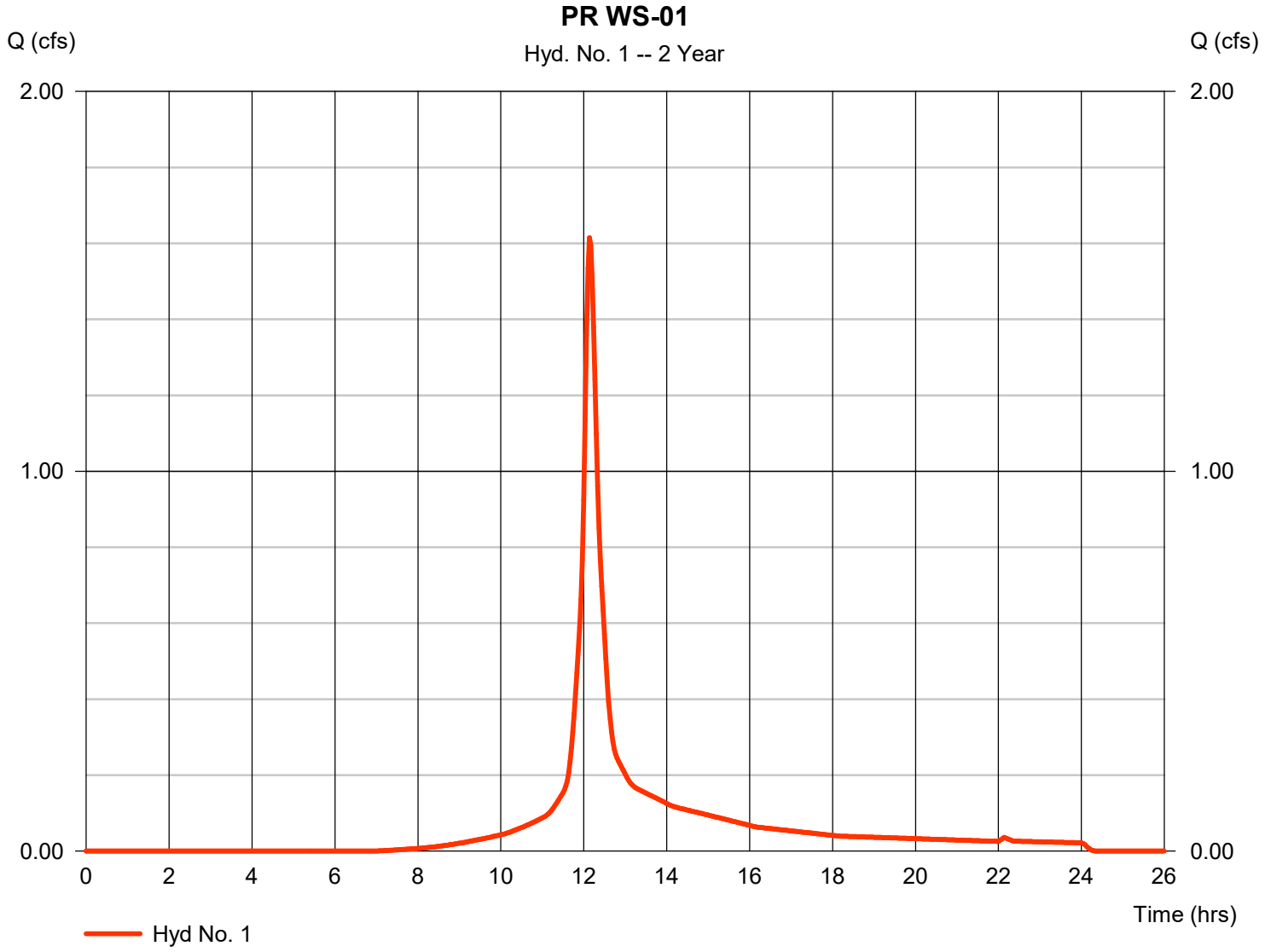
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.615	2	728	6,199	------	------	------	PR WS-01
2	SCS Runoff	1.469	2	724	4,631	------	------	------	PR WS-02A
3	SCS Runoff	0.361	2	724	1,099	------	------	------	PR WS-02B
4	SCS Runoff	1.238	2	724	3,903	------	------	------	PR WS-02C
5	SCS Runoff	0.352	2	724	1,065	------	------	------	PR WS-02D
6	Combine	1.830	2	724	5,730	2, 3,	------	------	TO-INFILTRATION
7	Reservoir	1.602	2	726	5,069	6	694.56	835	NORTHERN CHAMBERS
8	Reservoir	1.560	2	728	4,677	7	694.37	211	SOUTHERN CHAMBERS
9	Combine	2.948	2	726	9,646	4, 5, 8	------	------	WS2-TOTAL
10	Combine	4.483	2	726	15,845	1, 9	------	------	TOTAL

Hydrograph Report

Hyd. No. 1

PR WS-01

Hydrograph type	= SCS Runoff	Peak discharge	= 1.615 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 6,199 cuft
Drainage area	= 0.778 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.40 min
Total precip.	= 3.44 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

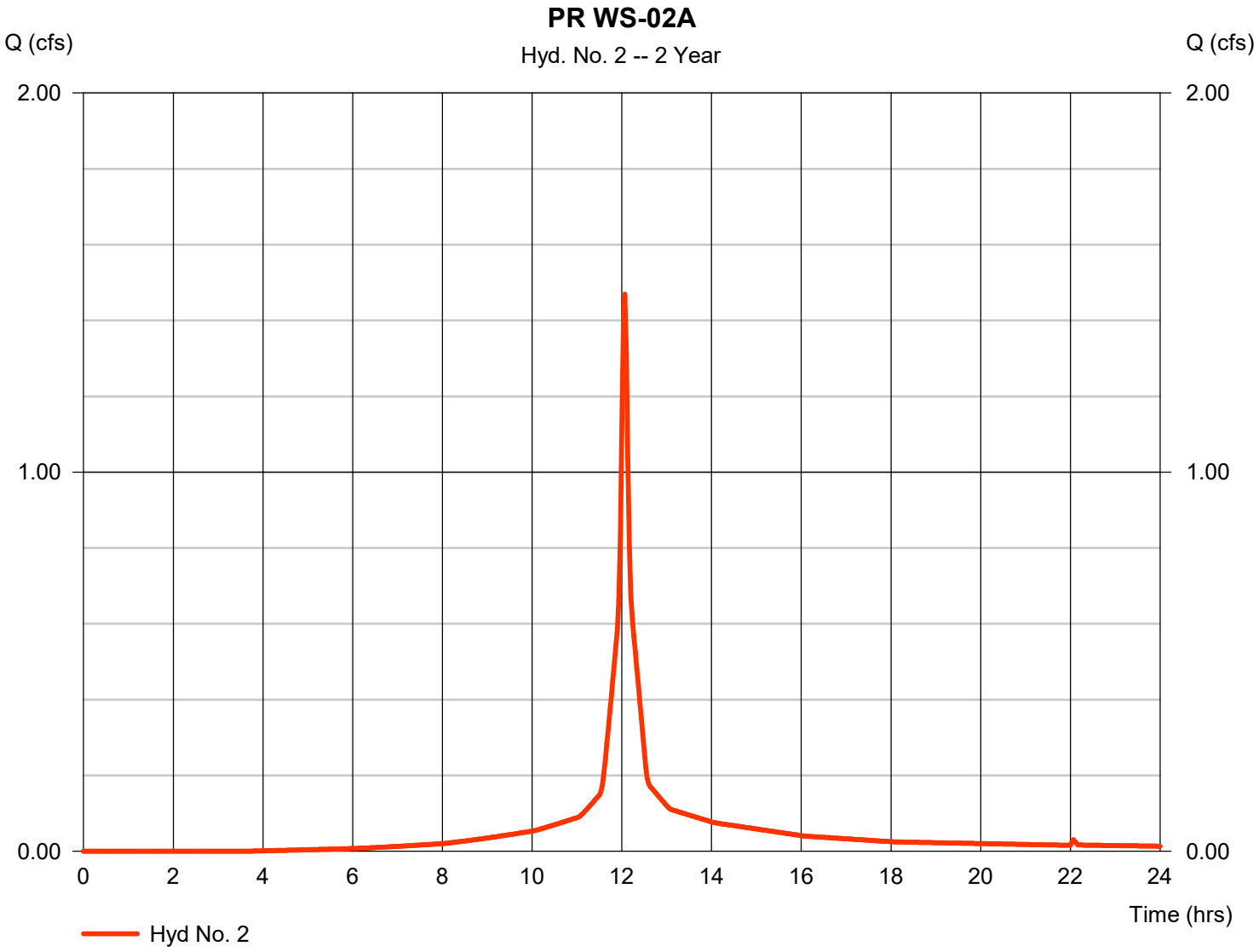


Hydrograph Report

Hyd. No. 2

PR WS-02A

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.469 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	4,631 cuft
Drainage area	=	0.490 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.44 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

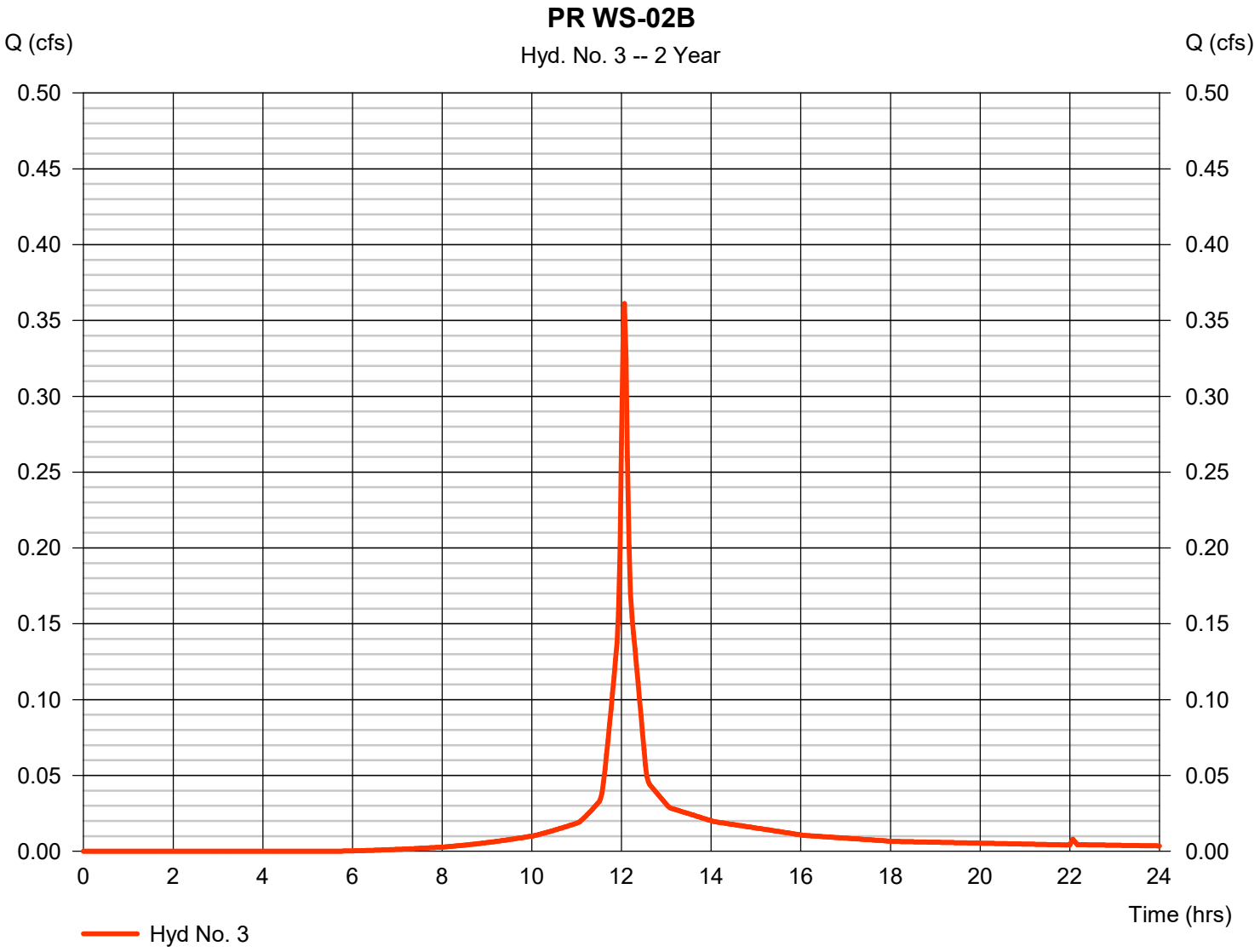


Hydrograph Report

Hyd. No. 3

PR WS-02B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.361 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	1,099 cuft
Drainage area	=	0.135 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.44 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

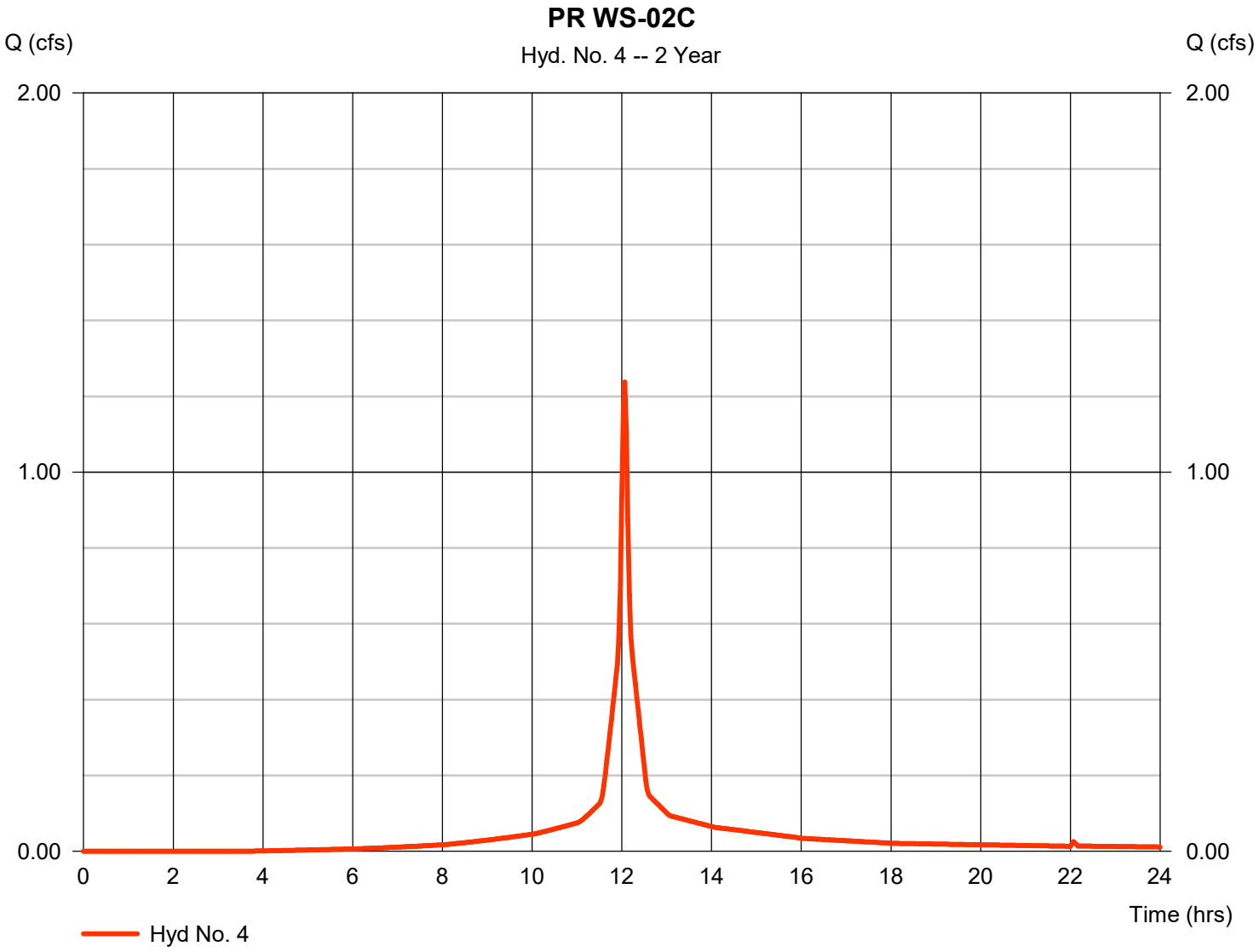


Hydrograph Report

Hyd. No. 4

PR WS-02C

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.238 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	3,903 cuft
Drainage area	=	0.413 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.44 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

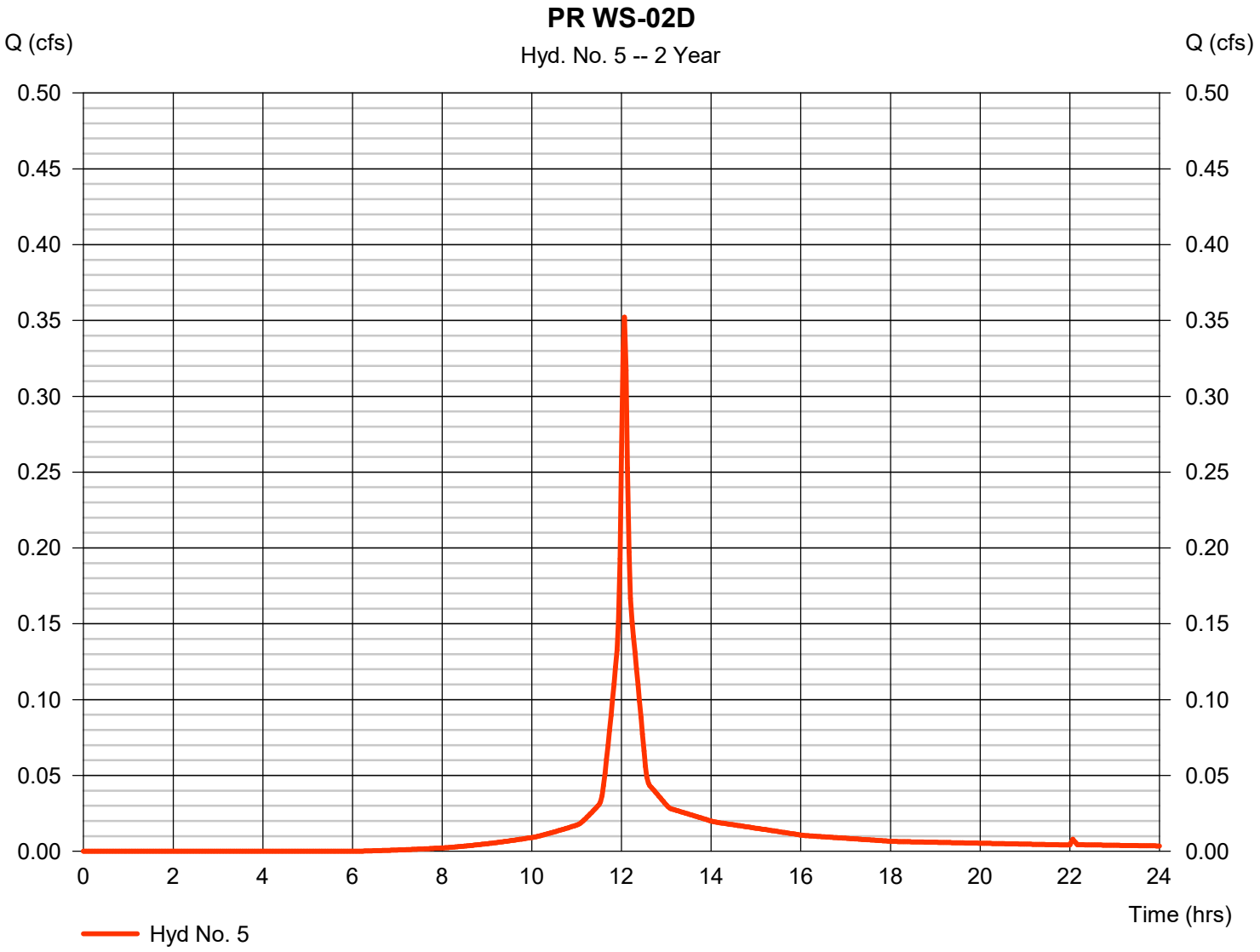


Hydrograph Report

Hyd. No. 5

PR WS-02D

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.352 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	1,065 cuft
Drainage area	=	0.136 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.44 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

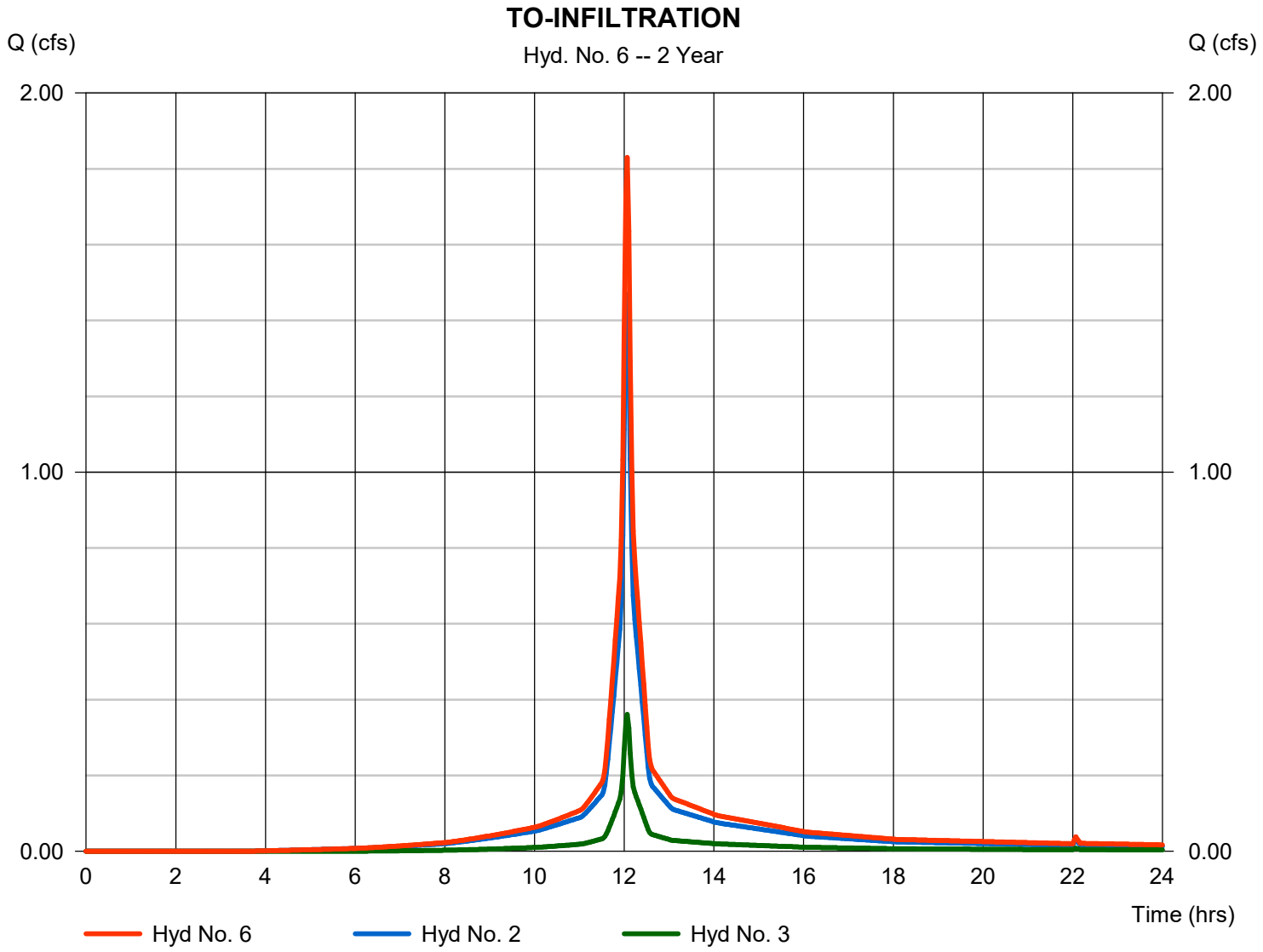


Hydrograph Report

Hyd. No. 6

TO-INFILTRATION

Hydrograph type	=	Combine	Peak discharge	=	1.830 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	5,730 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	0.625 ac



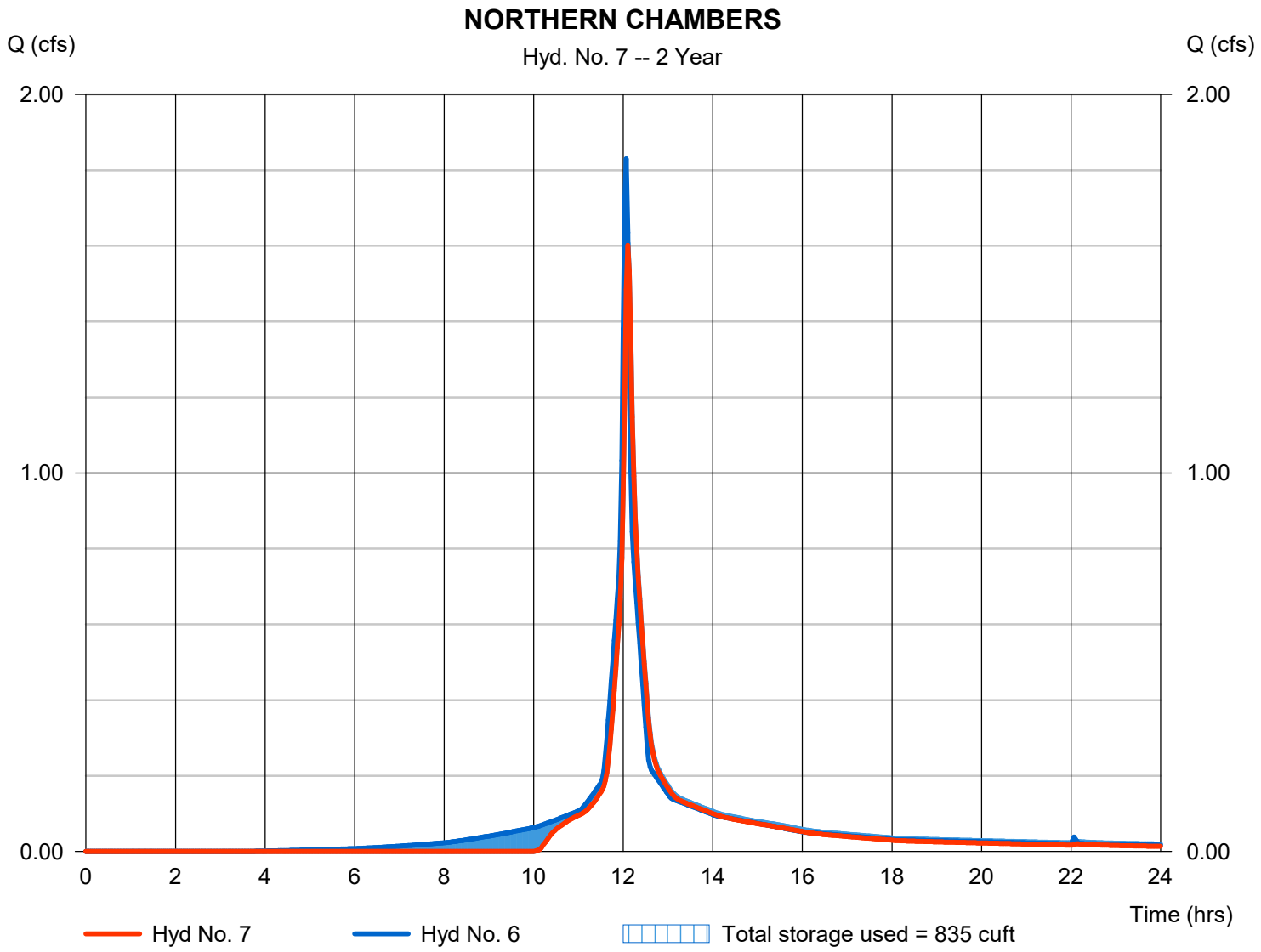
Hydrograph Report

Hyd. No. 7

NORTHERN CHAMBERS

Hydrograph type	=	Reservoir	Peak discharge	=	1.602 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	5,069 cuft
Inflow hyd. No.	=	6 - TO-INFILTRATION	Max. Elevation	=	694.56 ft
Reservoir name	=	CHAMBERS	Max. Storage	=	835 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 2 - CHAMBERS

Pond Data

UG Chambers -Invert elev. = 693.50 ft, Rise x Span = 3.75 x 5.42 ft, Barrel Len = 48.72 ft, No. Barrels = 2, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 692.75 ft, Width = 7.17 ft, Height = 5.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	692.75	n/a	0	0
0.55	693.30	n/a	154	154
1.10	693.85	n/a	264	418
1.65	694.40	n/a	325	744
2.20	694.95	n/a	319	1,063
2.75	695.50	n/a	308	1,371
3.30	696.05	n/a	292	1,663
3.85	696.60	n/a	268	1,931
4.40	697.15	n/a	228	2,158
4.95	697.70	n/a	159	2,317
5.50	698.25	n/a	154	2,471

Culvert / Orifice Structures

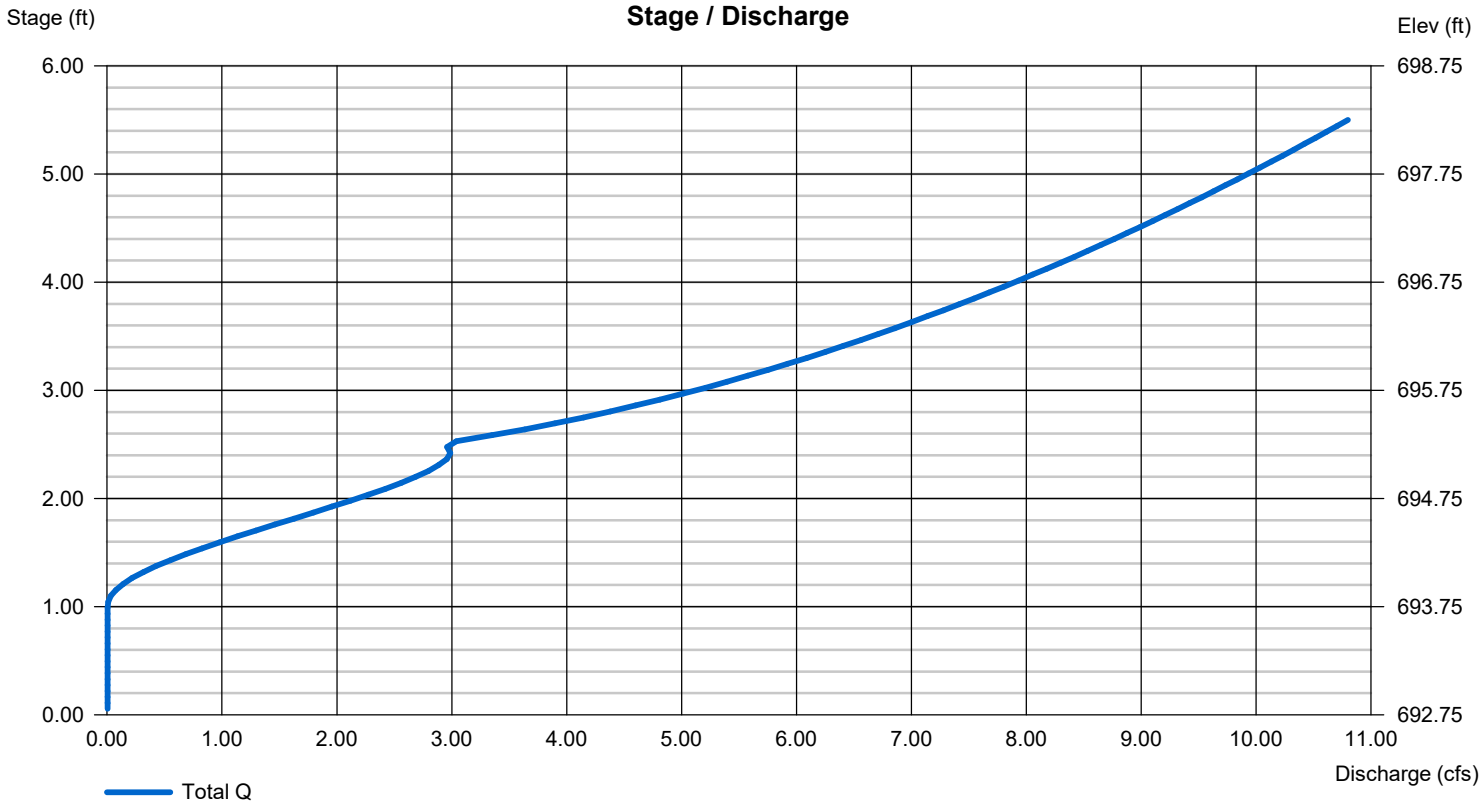
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	Inactive	Inactive	Inactive
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 693.75	0.00	0.00	0.00
Length (ft)	= 225.00	0.00	0.00	0.00
Slope (%)	= 0.10	1.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

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

Exfil.(in/hr) = 0.250 (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

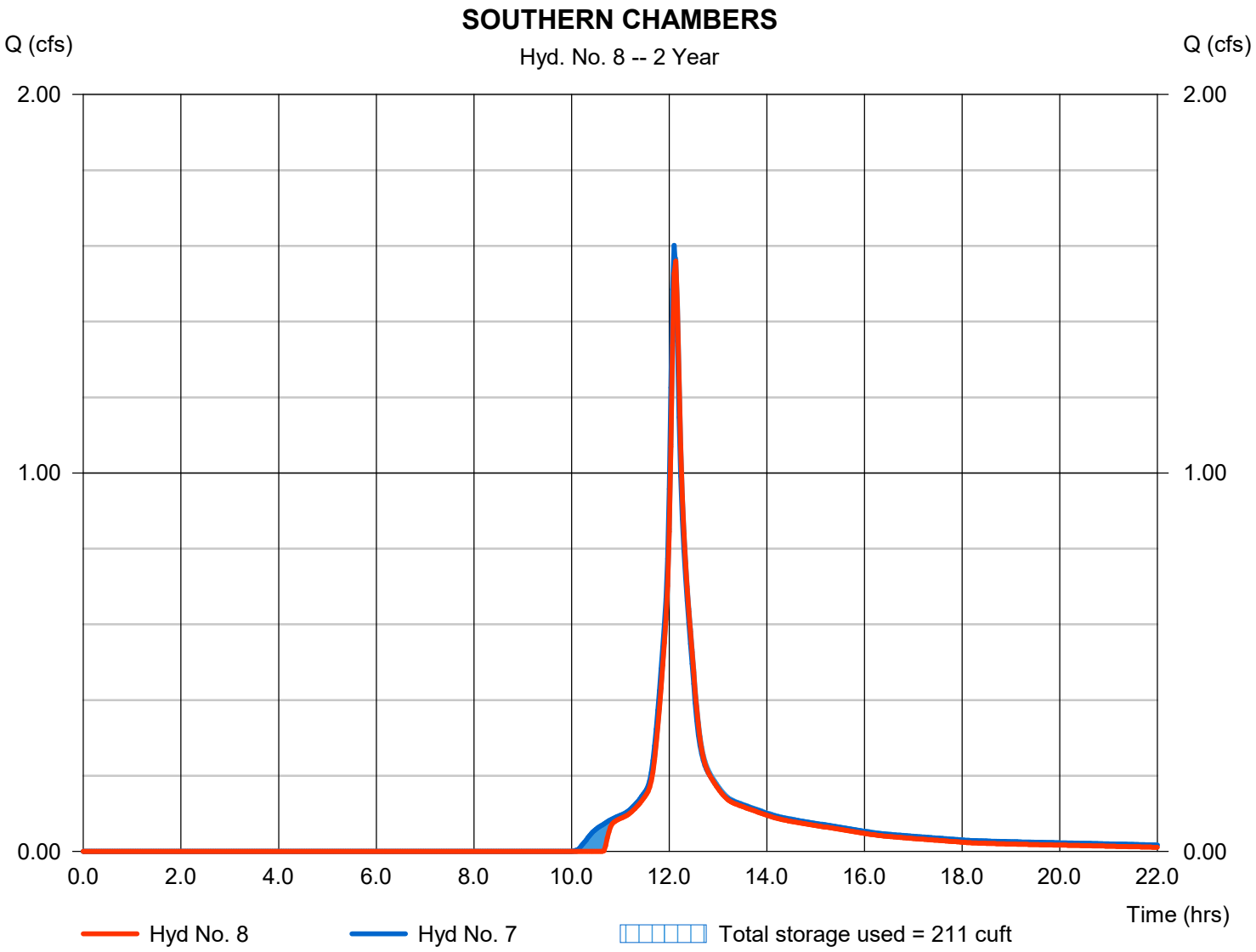
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Tuesday, 01 / 25 / 2022

Hyd. No. 8

SOUTHERN CHAMBERS

Hydrograph type	=	Reservoir	Peak discharge	=	1.560 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	4,677 cuft
Inflow hyd. No.	=	7 - NORTHERN CHAMBERS	Max. Elevation	=	694.37 ft
Reservoir name	=	Chambers-2	Max. Storage	=	211 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 4 - Chambers-2

Pond Data

UG Chambers -Invert elev. = 693.50 ft, Rise x Span = 3.75 x 6.00 ft, Barrel Len = 27.21 ft, No. Barrels = 1, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 692.75 ft, Width = 7.17 ft, Height = 5.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	692.75	n/a	0	0
0.55	693.30	n/a	43	43
1.10	693.85	n/a	77	120
1.65	694.40	n/a	96	216
2.20	694.95	n/a	94	310
2.75	695.50	n/a	91	401
3.30	696.05	n/a	86	487
3.85	696.60	n/a	78	565
4.40	697.15	n/a	66	630
4.95	697.70	n/a	44	675
5.50	698.25	n/a	43	718

Culvert / Orifice Structures

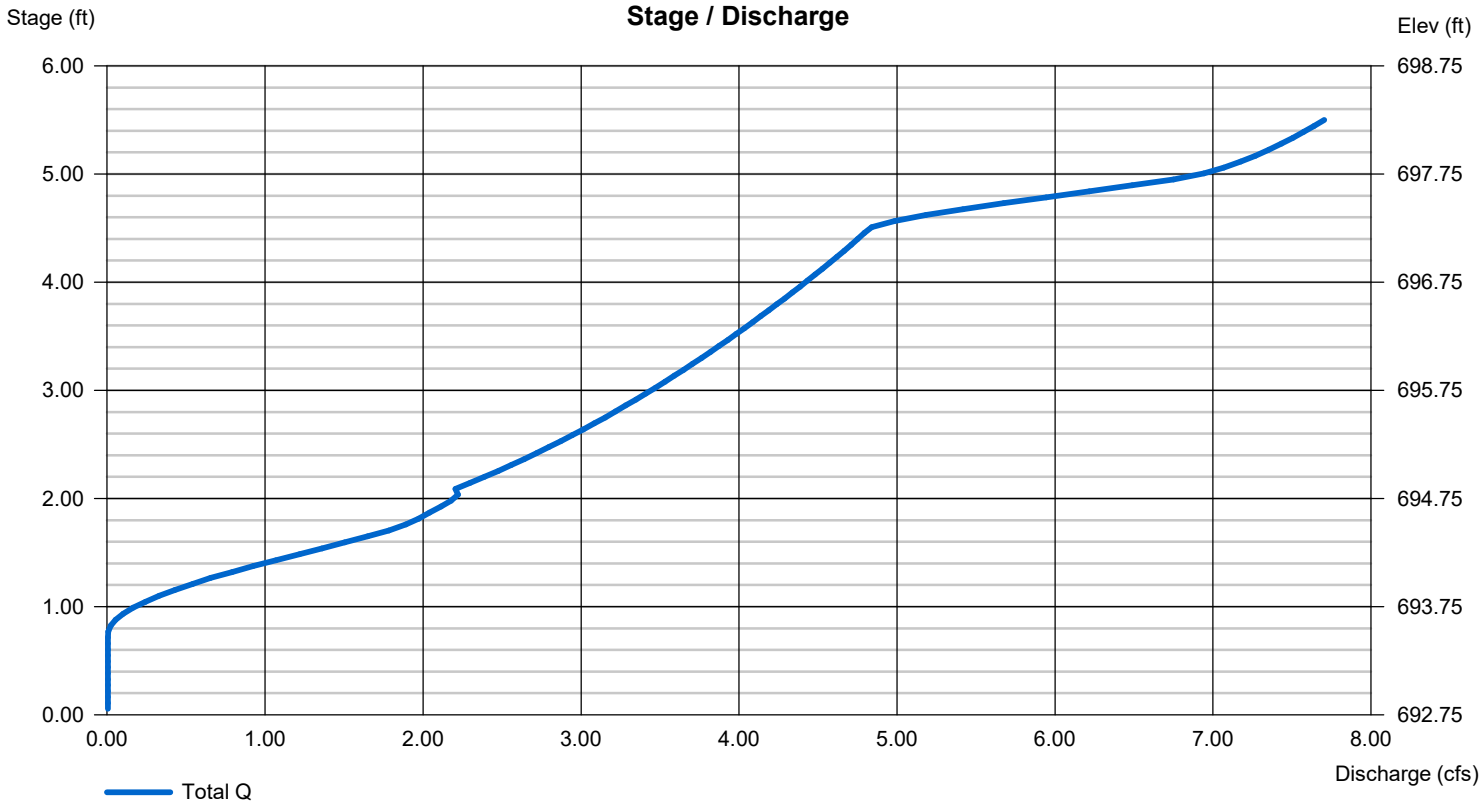
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	12.00	Inactive	0.00
Span (in)	= 12.00	12.00	0.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 693.50	693.50	696.00	0.00
Length (ft)	= 29.00	0.50	0.50	0.00
Slope (%)	= 1.00	1.00	1.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 697.25	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) = 1.350 (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).

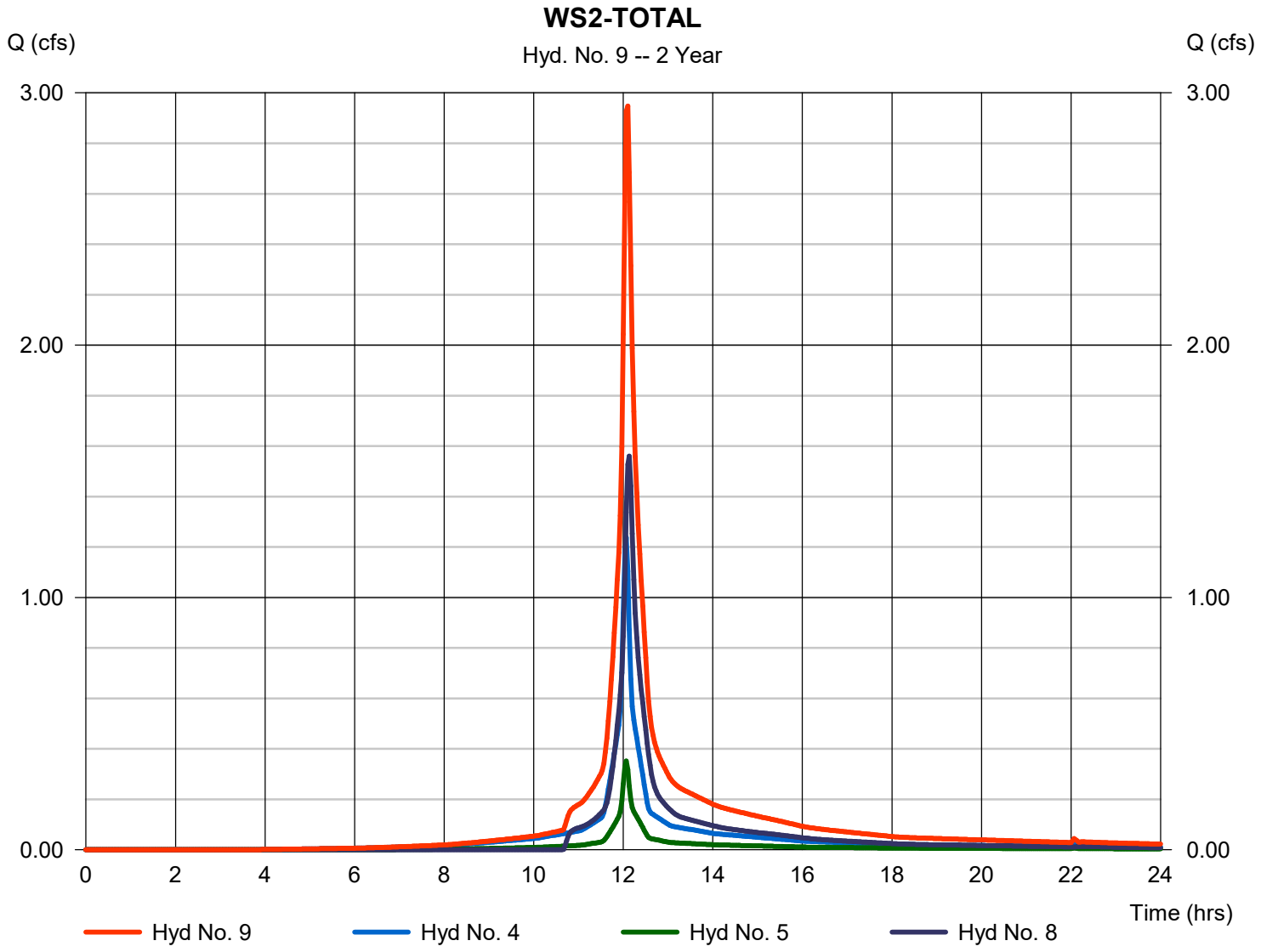


Hydrograph Report

Hyd. No. 9

WS2-TOTAL

Hydrograph type	=	Combine	Peak discharge	=	2.948 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	9,646 cuft
Inflow hyds.	=	4, 5, 8	Contrib. drain. area	=	0.549 ac

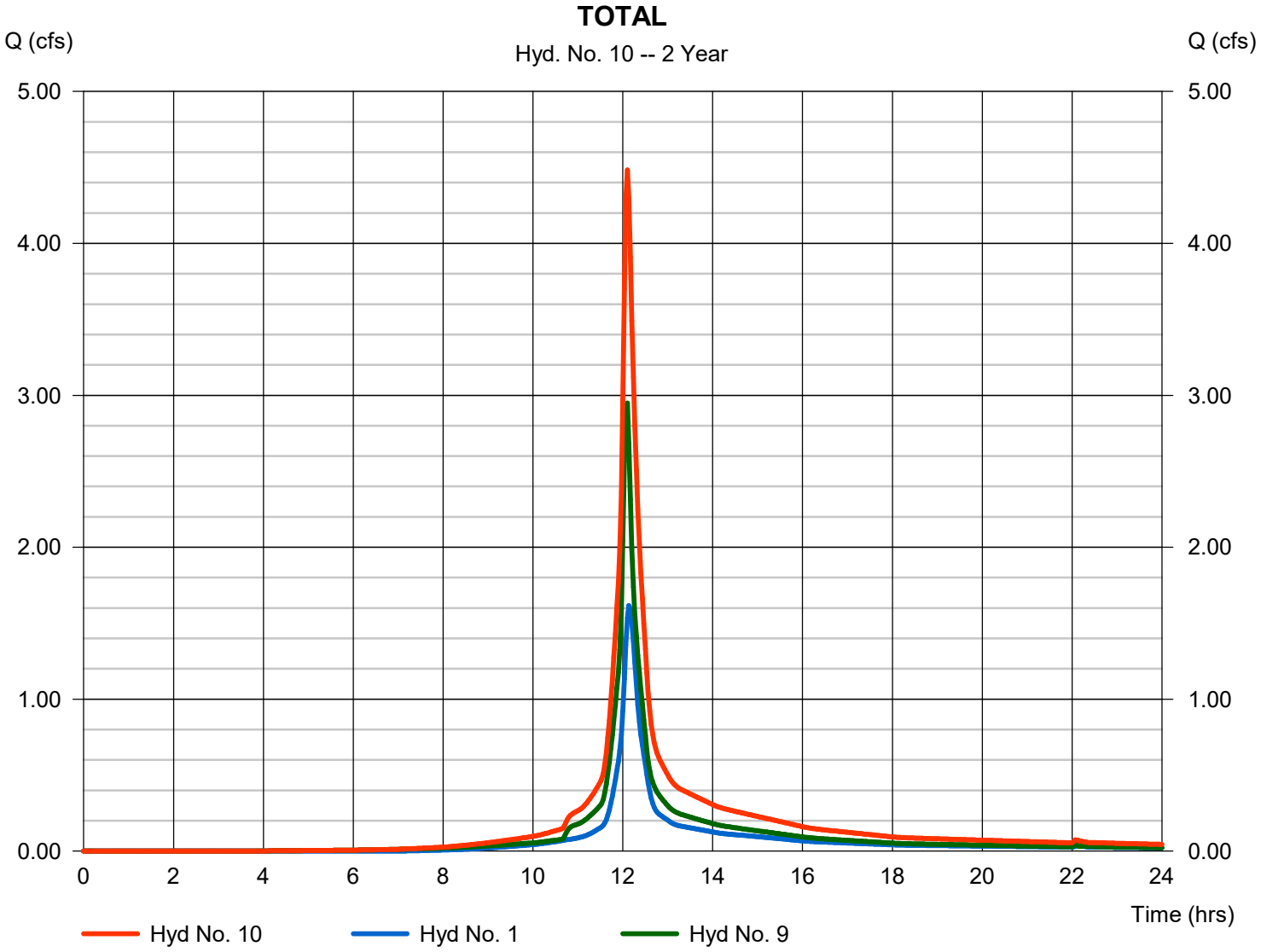


Hydrograph Report

Hyd. No. 10

TOTAL

Hydrograph type	= Combine	Peak discharge	= 4.483 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 15,845 cuft
Inflow hyds.	= 1, 9	Contrib. drain. area	= 0.778 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

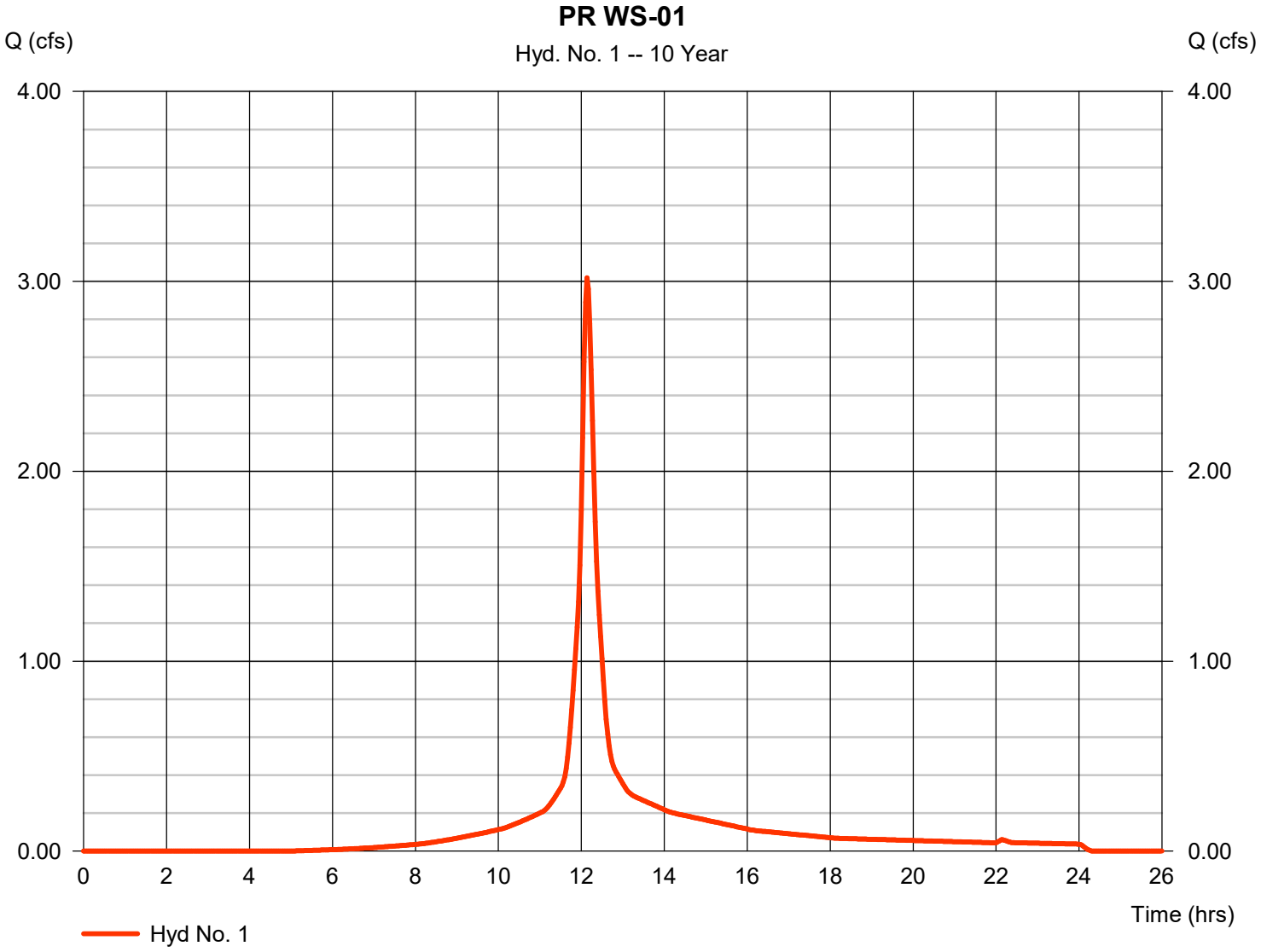
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3.019	2	728	11,795	------	------	------	PR WS-01
2	SCS Runoff	2.464	2	724	8,024	------	------	------	PR WS-02A
3	SCS Runoff	0.640	2	724	2,007	------	------	------	PR WS-02B
4	SCS Runoff	2.077	2	724	6,763	------	------	------	PR WS-02C
5	SCS Runoff	0.634	2	724	1,973	------	------	------	PR WS-02D
6	Combine	3.104	2	724	10,031	2, 3,	------	------	TO-INFILTRATION
7	Reservoir	2.682	2	726	9,343	6	694.95	1,063	NORTHERN CHAMBERS
8	Reservoir	2.565	2	728	8,908	7	695.07	330	SOUTHERN CHAMBERS
9	Combine	4.875	2	724	17,643	4, 5, 8	------	------	WS2-TOTAL
10	Combine	7.687	2	726	29,438	1, 9	------	------	TOTAL

Hydrograph Report

Hyd. No. 1

PR WS-01

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.019 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	11,795 cuft
Drainage area	=	0.778 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.40 min
Total precip.	=	5.51 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

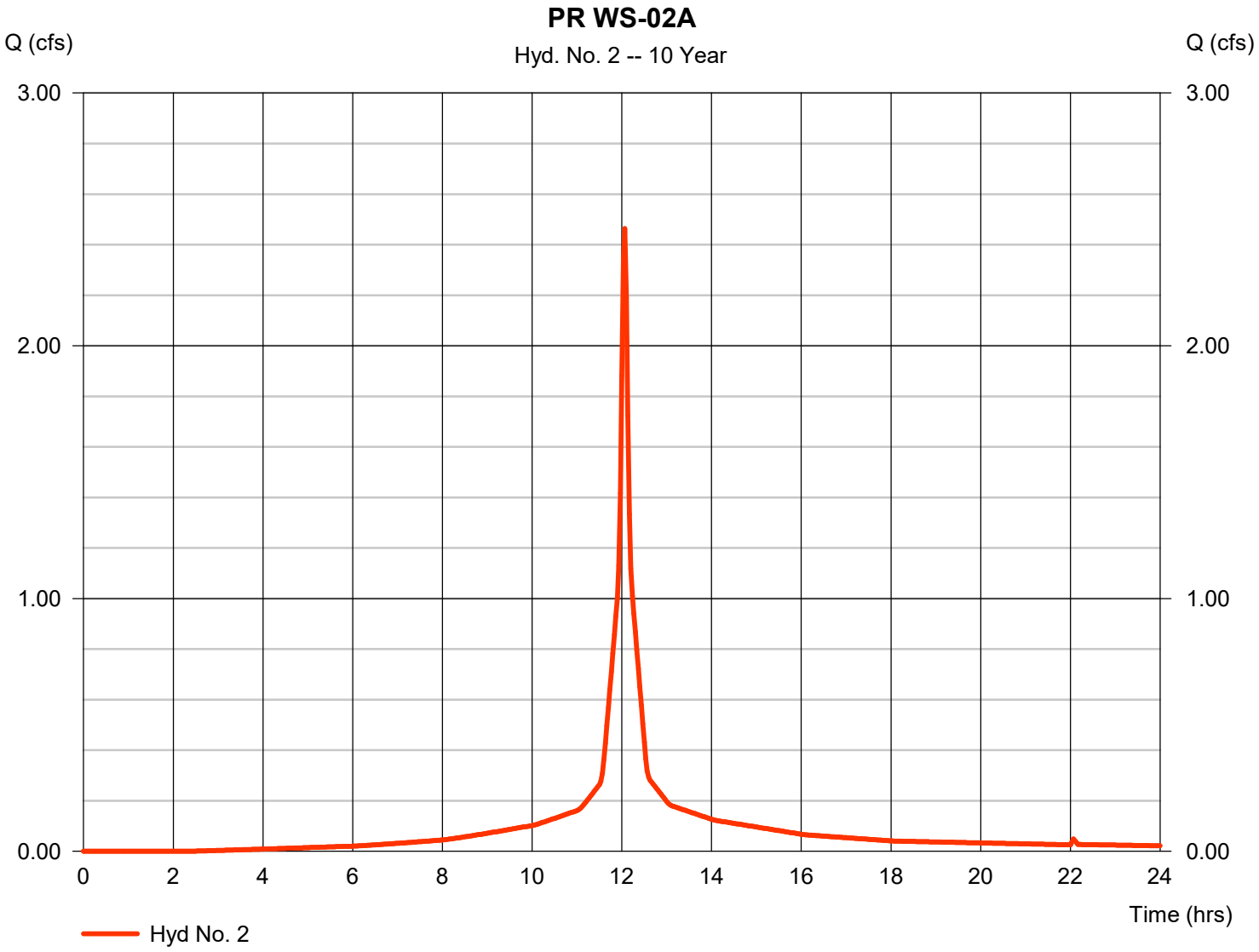


Hydrograph Report

Hyd. No. 2

PR WS-02A

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.464 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	8,024 cuft
Drainage area	=	0.490 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.51 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

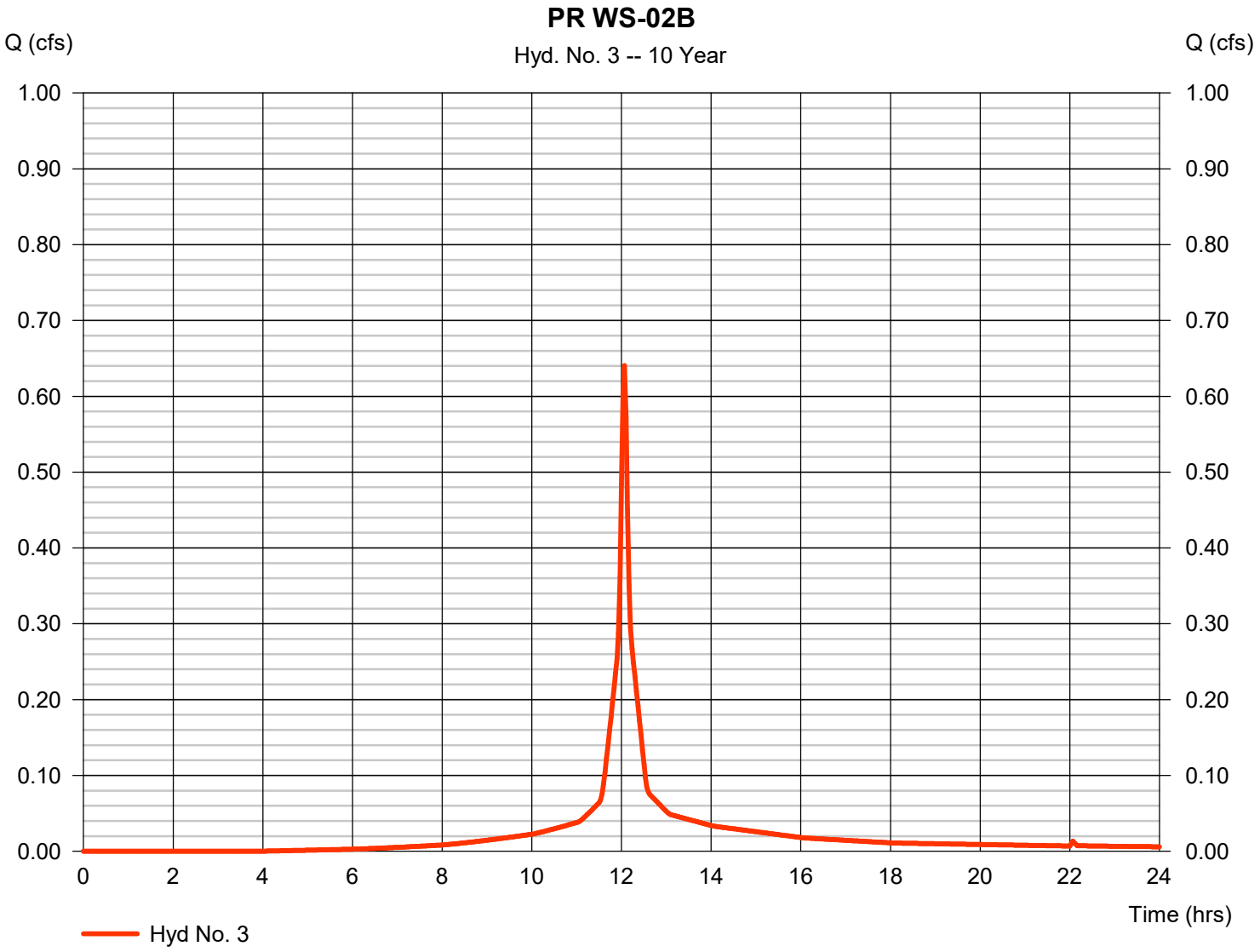


Hydrograph Report

Hyd. No. 3

PR WS-02B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.640 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	2,007 cuft
Drainage area	=	0.135 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.51 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

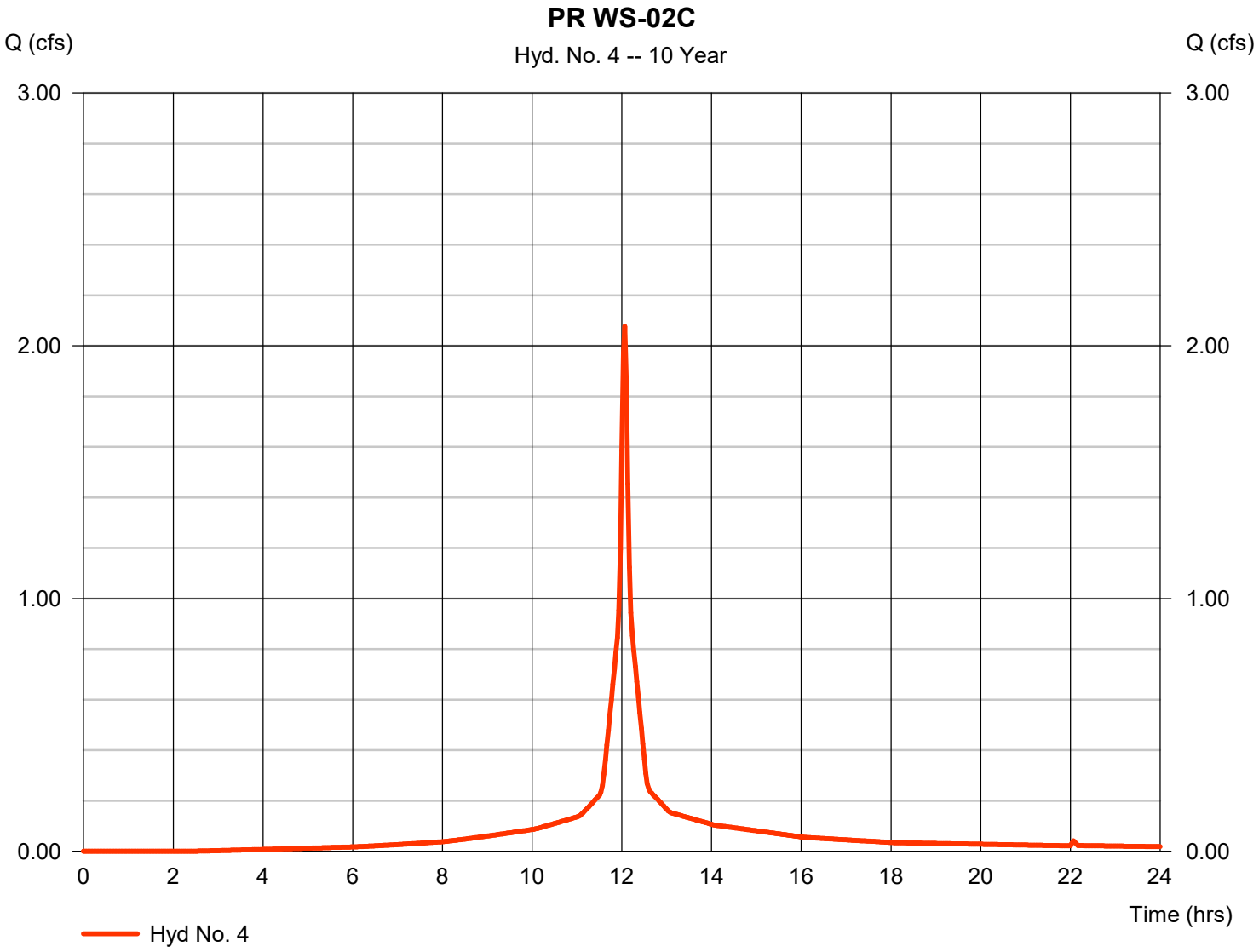


Hydrograph Report

Hyd. No. 4

PR WS-02C

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.077 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	6,763 cuft
Drainage area	=	0.413 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.51 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

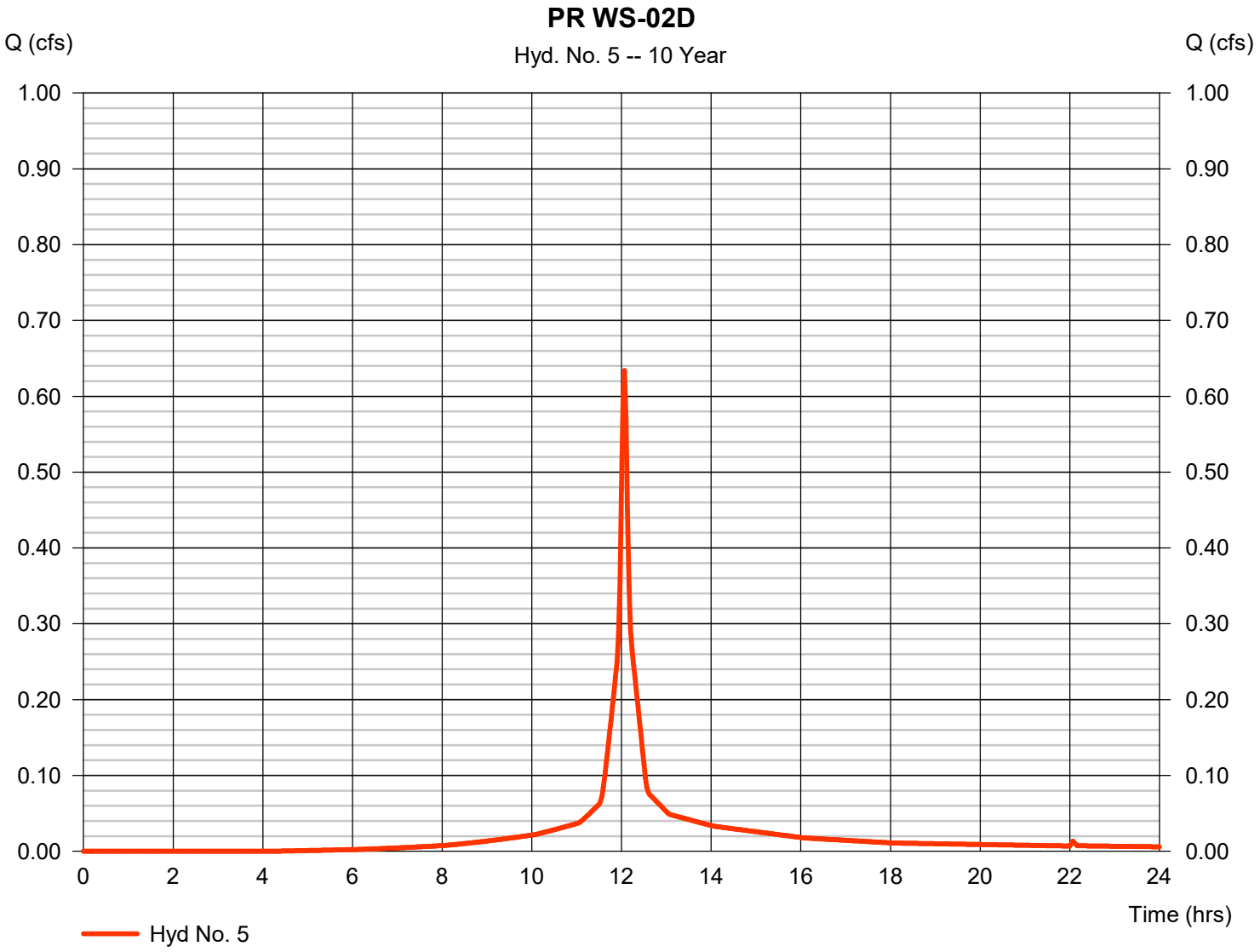


Hydrograph Report

Hyd. No. 5

PR WS-02D

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.634 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	1,973 cuft
Drainage area	=	0.136 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.51 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

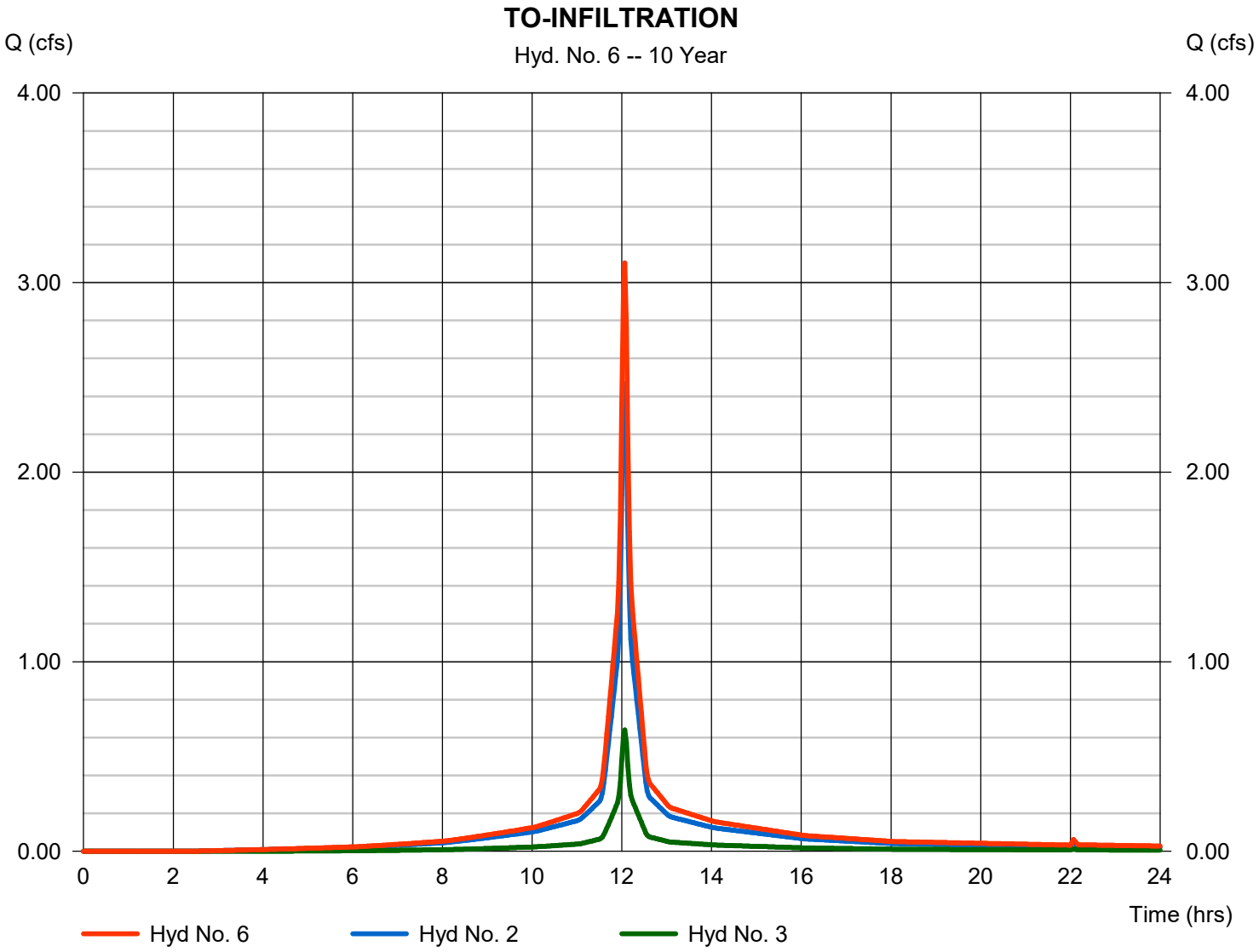


Hydrograph Report

Hyd. No. 6

TO-INFILTRATION

Hydrograph type	= Combine	Peak discharge	= 3.104 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 10,031 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.625 ac



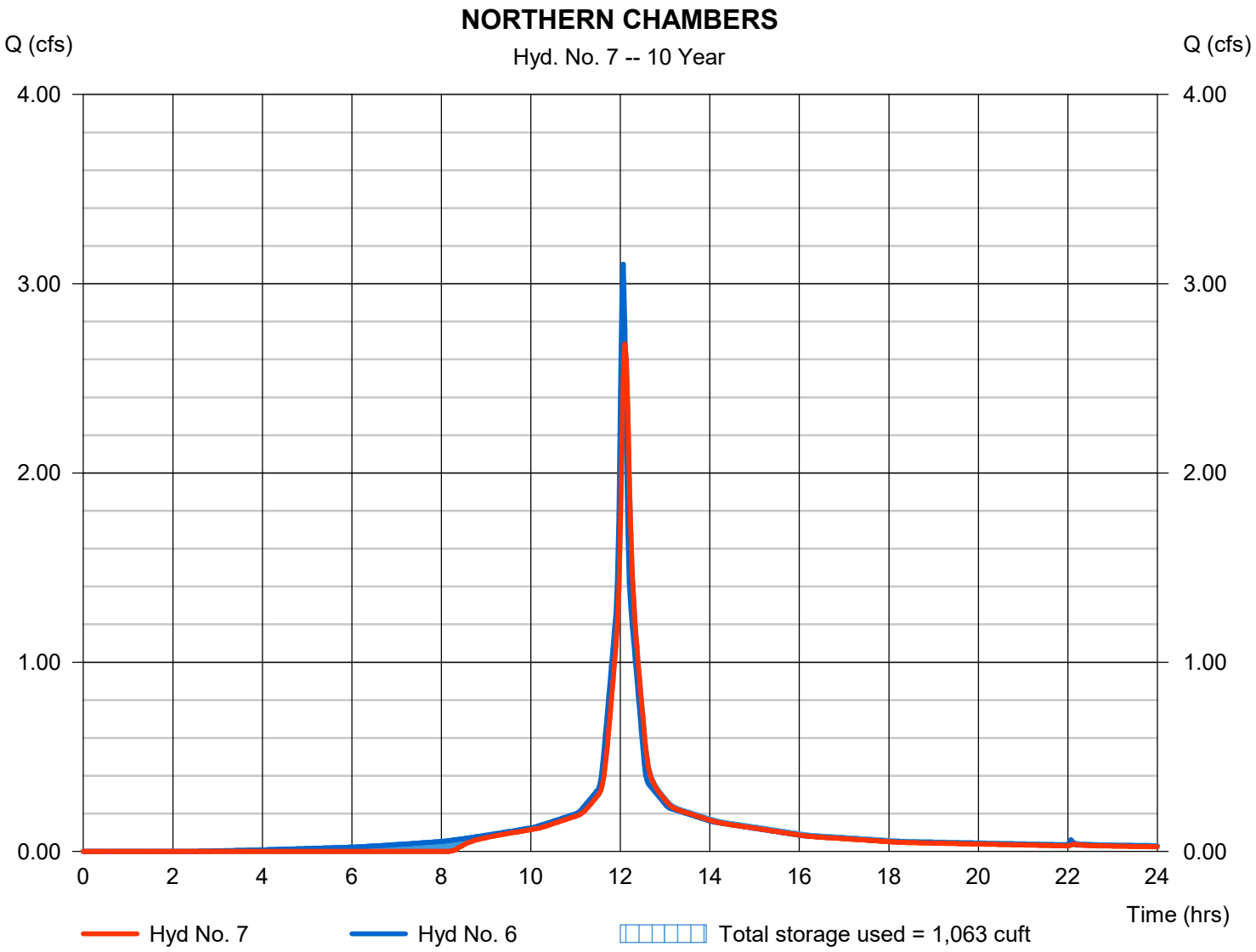
Hydrograph Report

Hyd. No. 7

NORTHERN CHAMBERS

Hydrograph type	=	Reservoir	Peak discharge	=	2.682 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	9,343 cuft
Inflow hyd. No.	=	6 - TO-INFILTRATION	Max. Elevation	=	694.95 ft
Reservoir name	=	CHAMBERS	Max. Storage	=	1,063 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



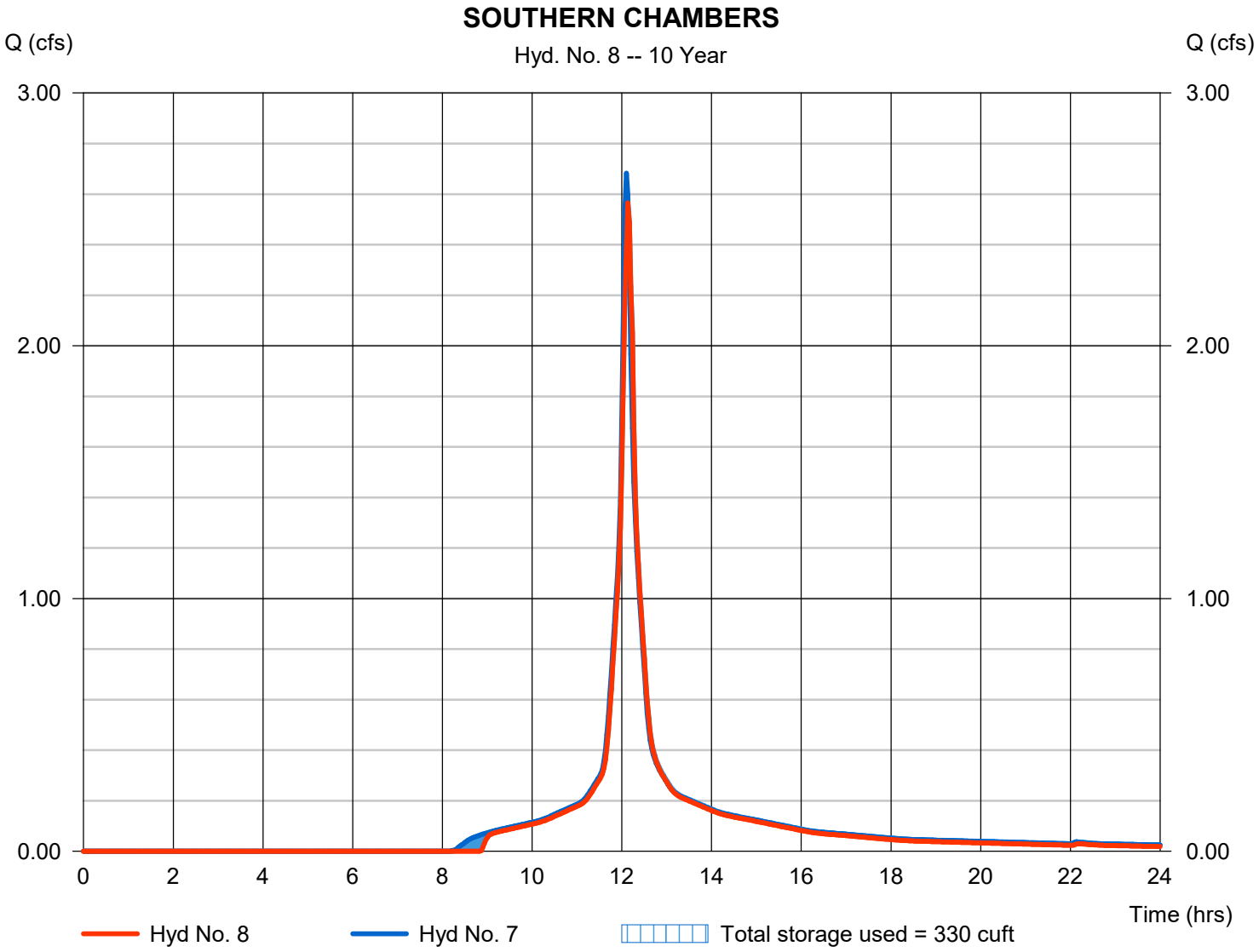
Hydrograph Report

Hyd. No. 8

SOUTHERN CHAMBERS

Hydrograph type	=	Reservoir	Peak discharge	=	2.565 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	8,908 cuft
Inflow hyd. No.	=	7 - NORTHERN CHAMBERS	Max. Elevation	=	695.07 ft
Reservoir name	=	Chambers-2	Max. Storage	=	330 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

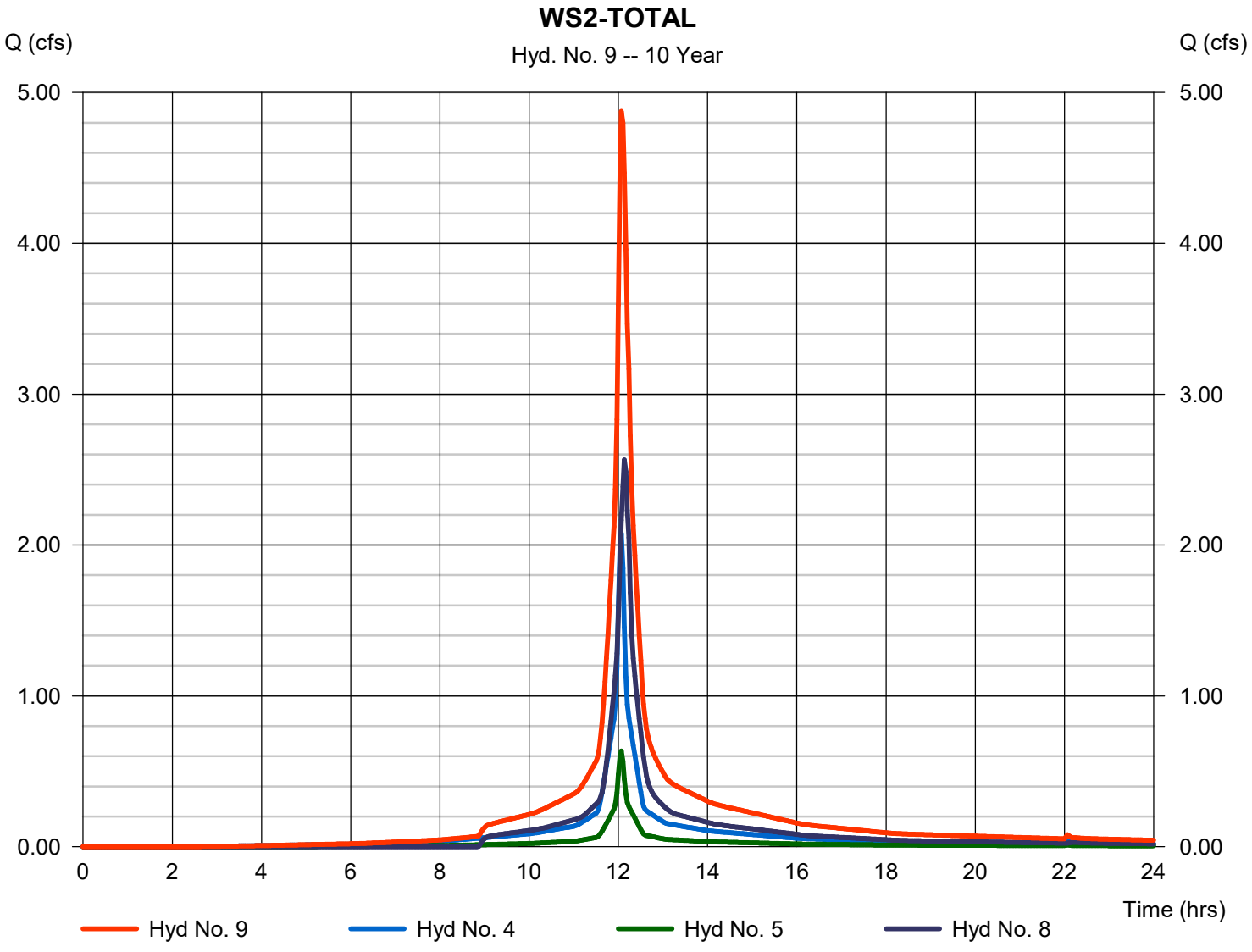


Hydrograph Report

Hyd. No. 9

WS2-TOTAL

Hydrograph type	= Combine	Peak discharge	= 4.875 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 17,643 cuft
Inflow hyds.	= 4, 5, 8	Contrib. drain. area	= 0.549 ac

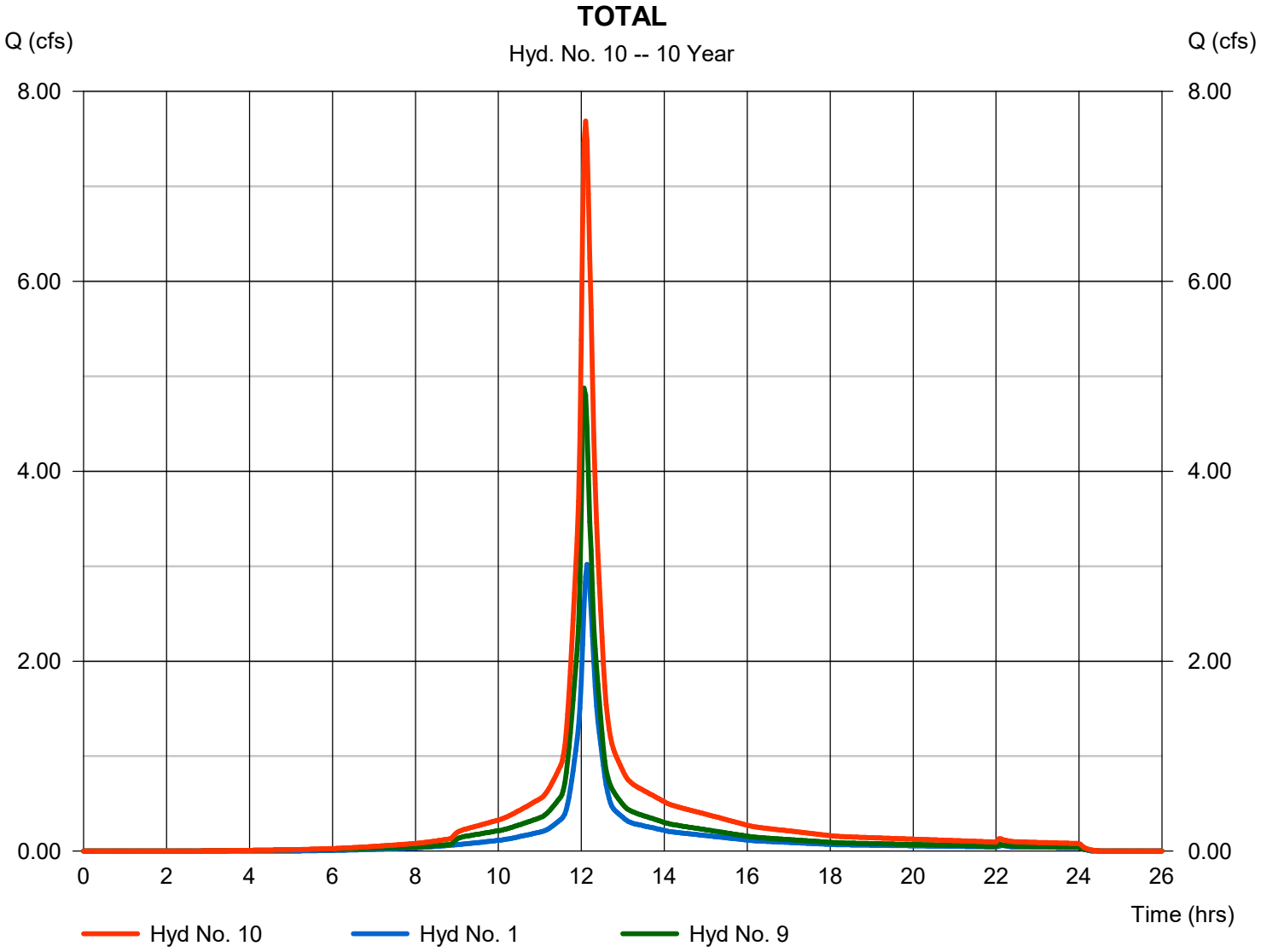


Hydrograph Report

Hyd. No. 10

TOTAL

Hydrograph type	= Combine	Peak discharge	= 7.687 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 29,438 cuft
Inflow hyds.	= 1, 9	Contrib. drain. area	= 0.778 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

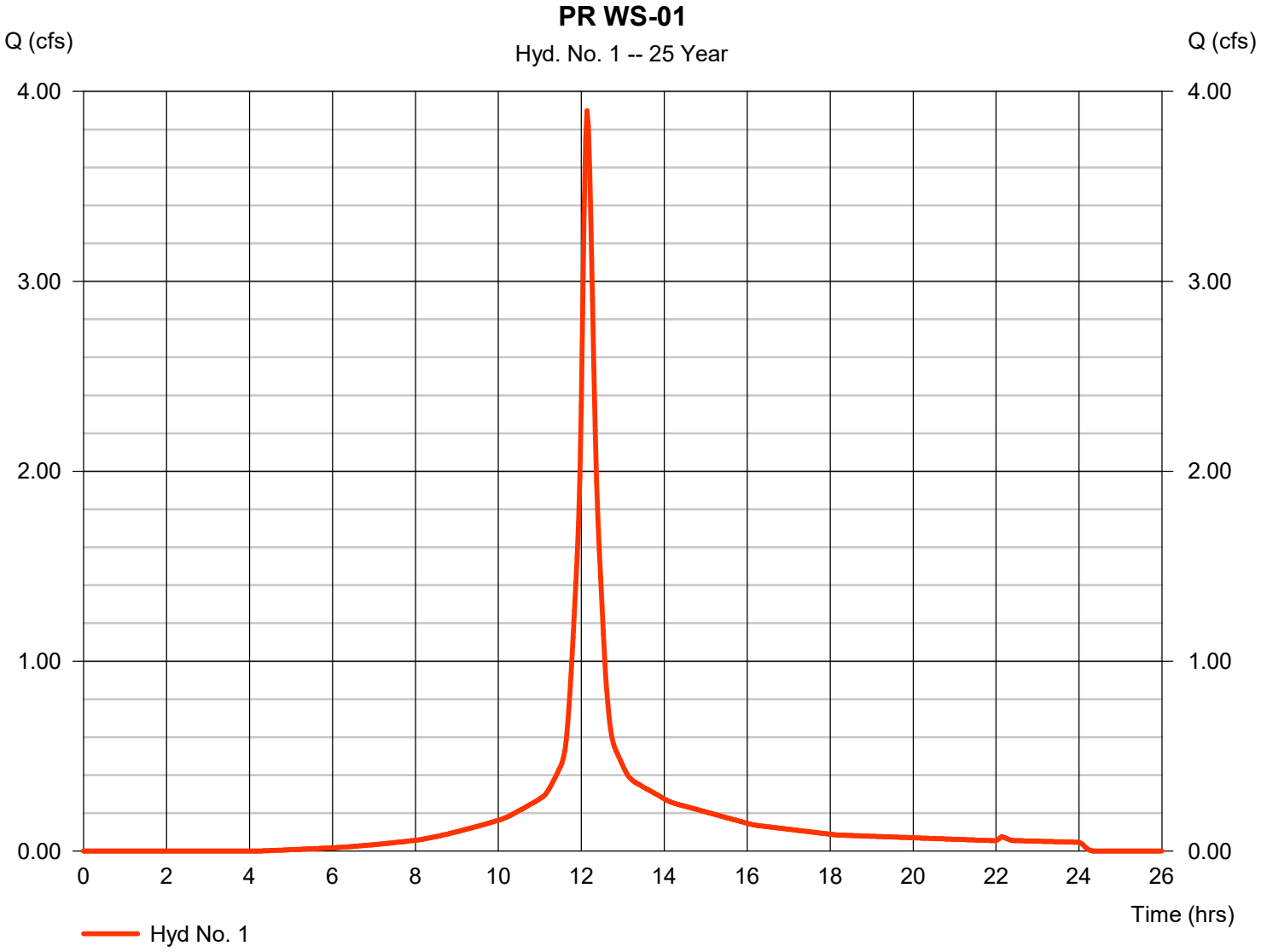
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3.899	2	728	15,423	------	------	------	PR WS-01
2	SCS Runoff	3.081	2	724	10,171	------	------	------	PR WS-02A
3	SCS Runoff	0.814	2	724	2,590	------	------	------	PR WS-02B
4	SCS Runoff	2.597	2	724	8,573	------	------	------	PR WS-02C
5	SCS Runoff	0.810	2	724	2,556	------	------	------	PR WS-02D
6	Combine	3.896	2	724	12,761	2, 3,	------	------	TO-INFILTRATION
7	Reservoir	3.084	2	728	12,064	6	695.29	1,253	NORTHERN CHAMBERS
8	Reservoir	3.015	2	730	11,607	7	695.40	384	SOUTHERN CHAMBERS
9	Combine	5.970	2	724	22,736	4, 5, 8	------	------	WS2-TOTAL
10	Combine	9.639	2	726	38,159	1, 9	------	------	TOTAL

Hydrograph Report

Hyd. No. 1

PR WS-01

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.899 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	15,423 cuft
Drainage area	=	0.778 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.40 min
Total precip.	=	6.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

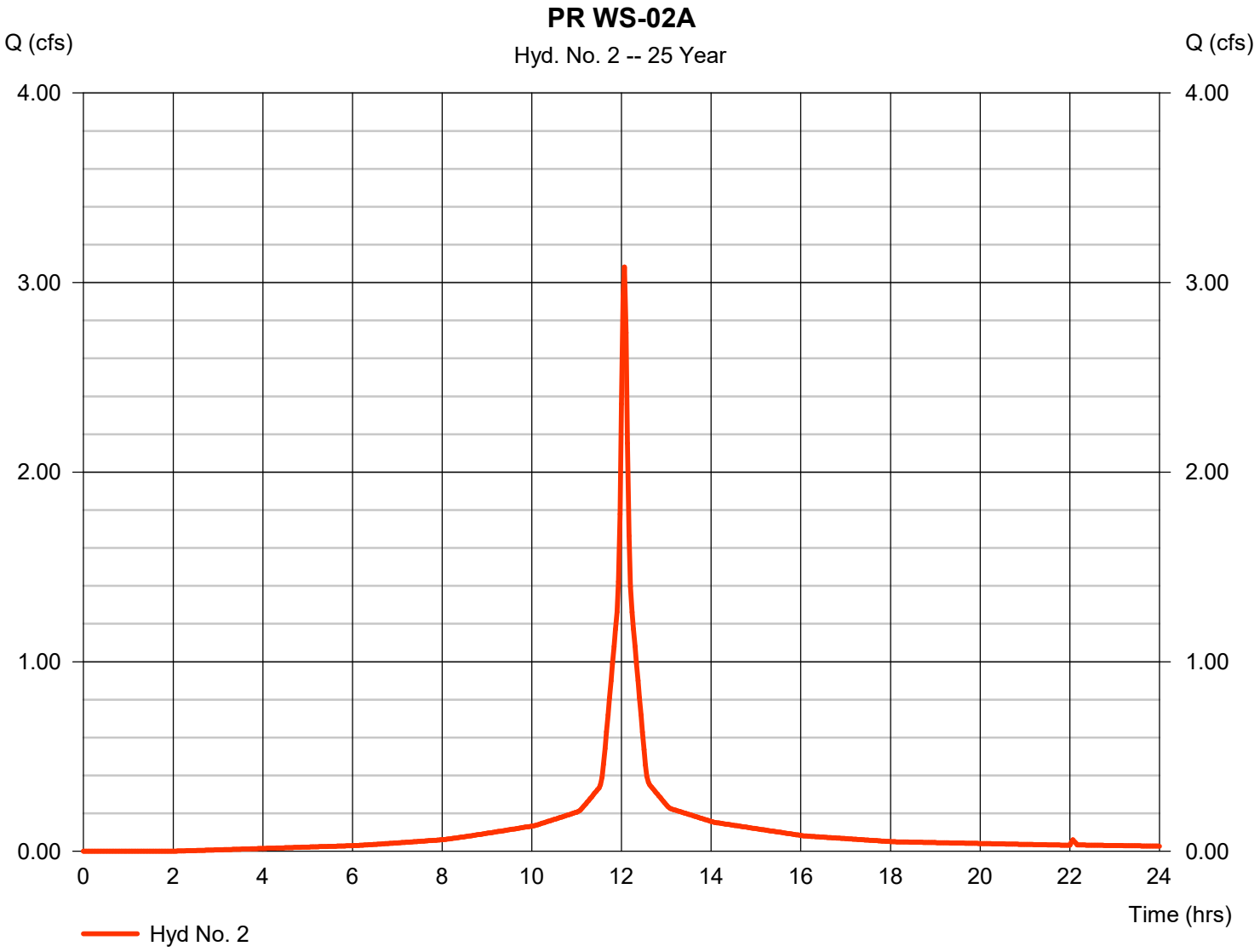


Hydrograph Report

Hyd. No. 2

PR WS-02A

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.081 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	10,171 cuft
Drainage area	=	0.490 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

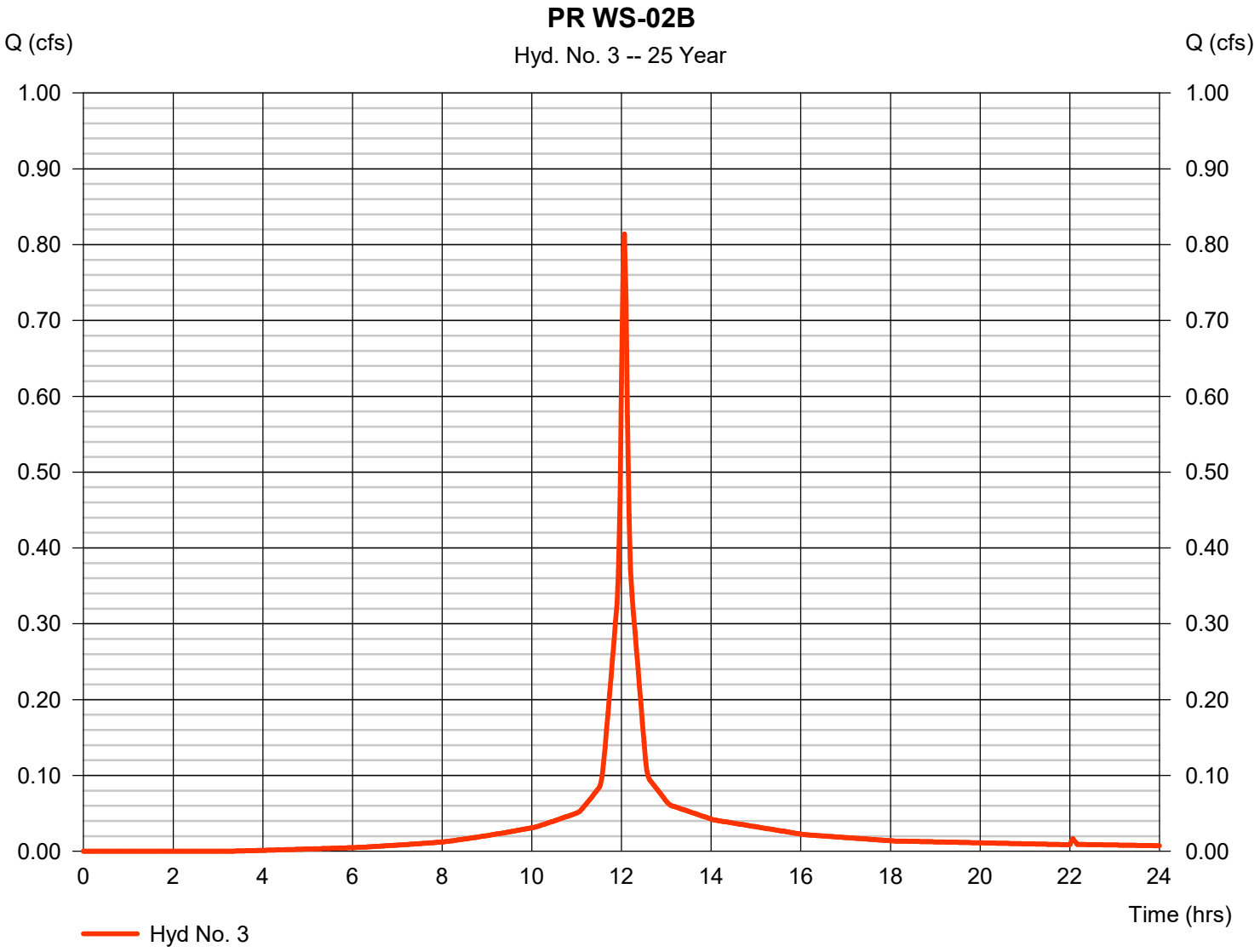


Hydrograph Report

Hyd. No. 3

PR WS-02B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.814 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	2,590 cuft
Drainage area	=	0.135 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

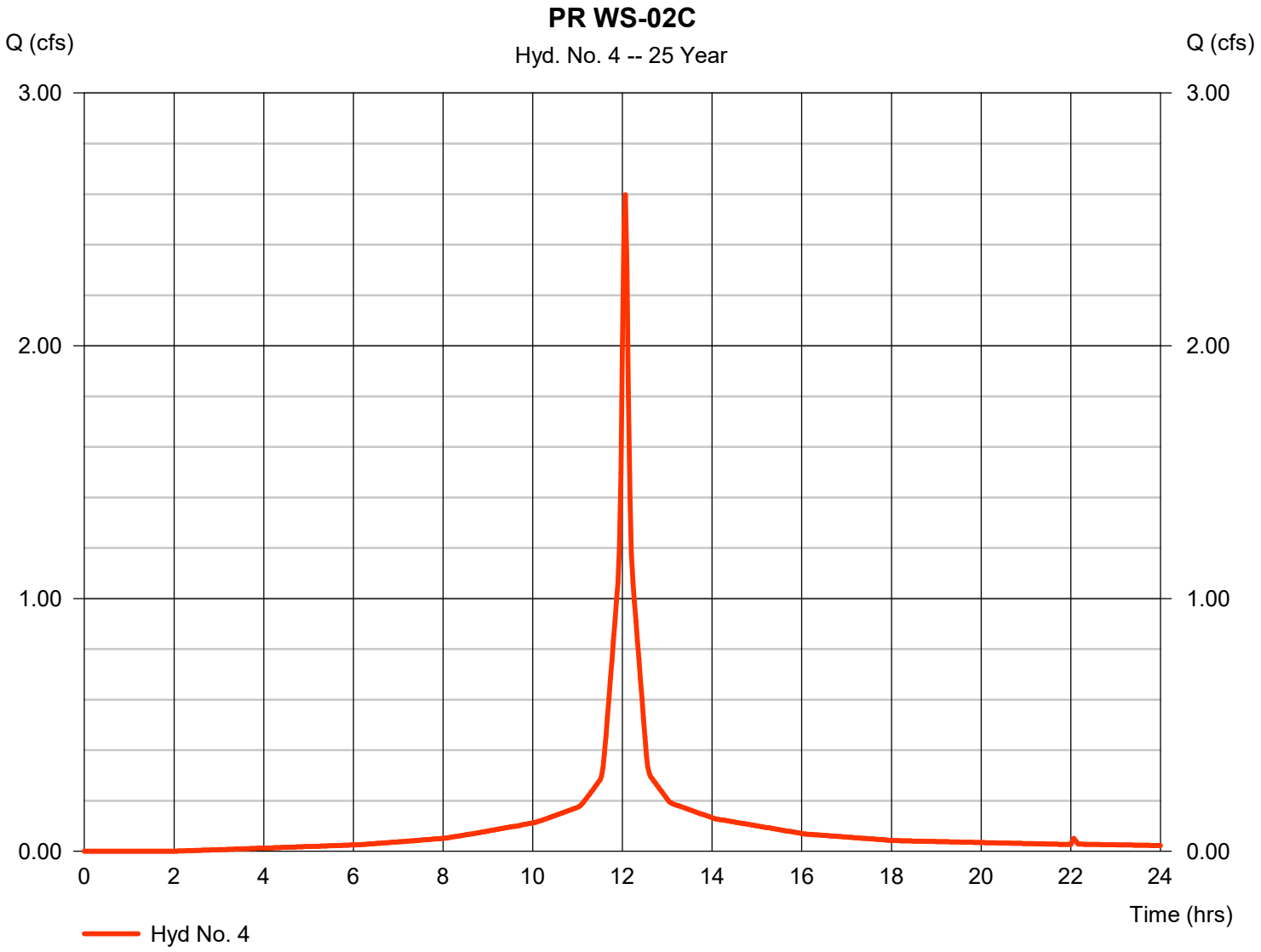


Hydrograph Report

Hyd. No. 4

PR WS-02C

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.597 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	8,573 cuft
Drainage area	=	0.413 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

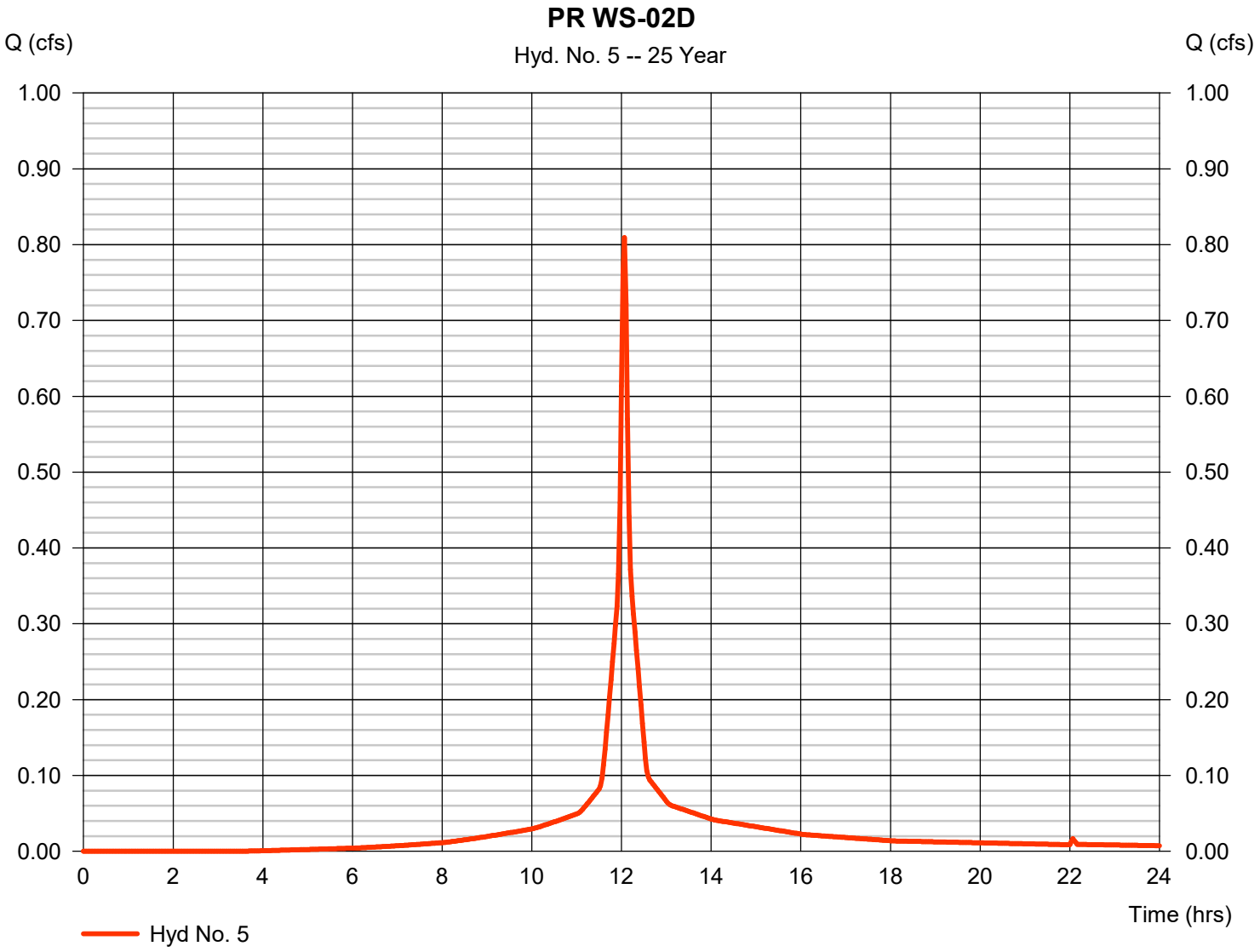


Hydrograph Report

Hyd. No. 5

PR WS-02D

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.810 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	2,556 cuft
Drainage area	=	0.136 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

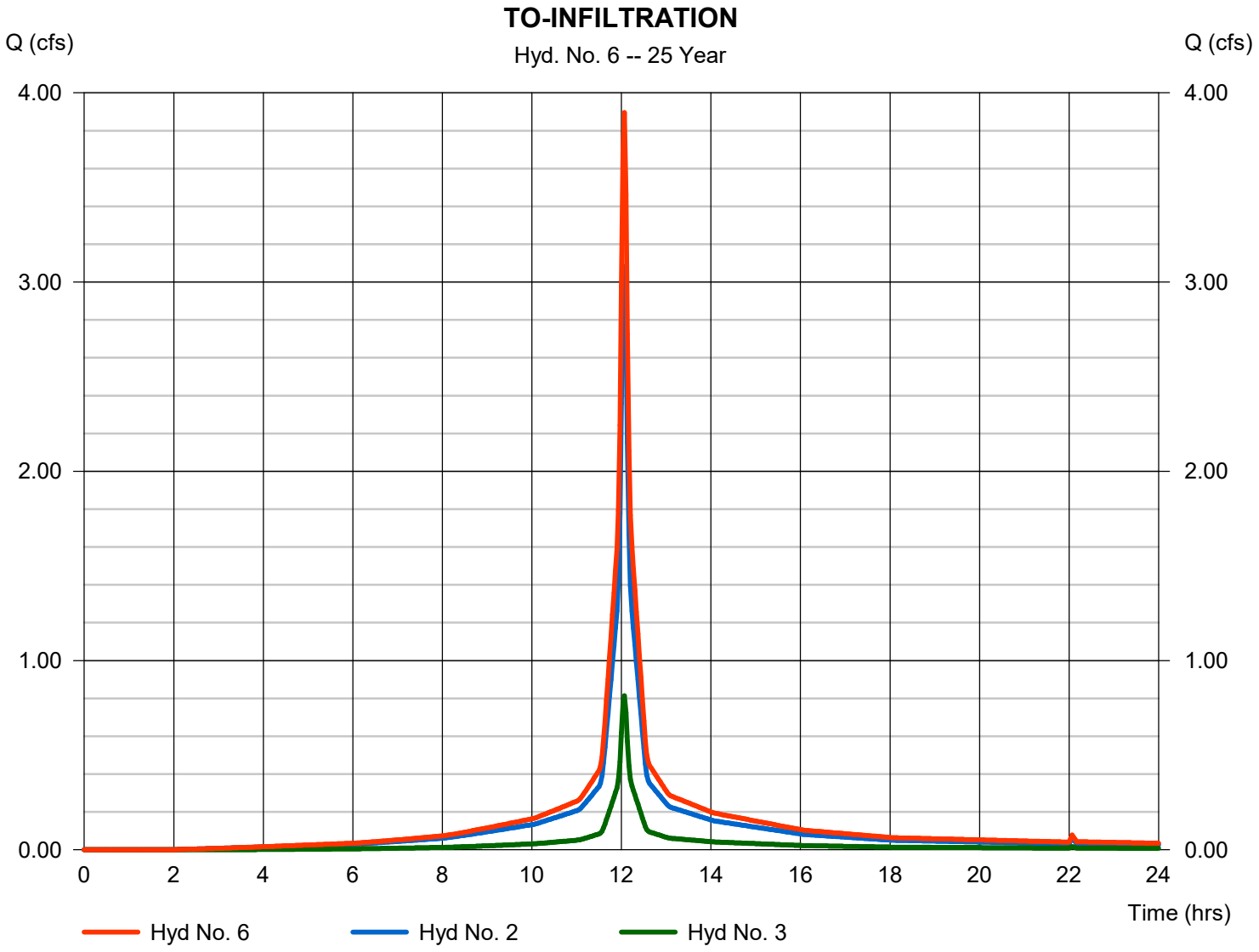


Hydrograph Report

Hyd. No. 6

TO-INFILTRATION

Hydrograph type	=	Combine	Peak discharge	=	3.896 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	12,761 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	0.625 ac



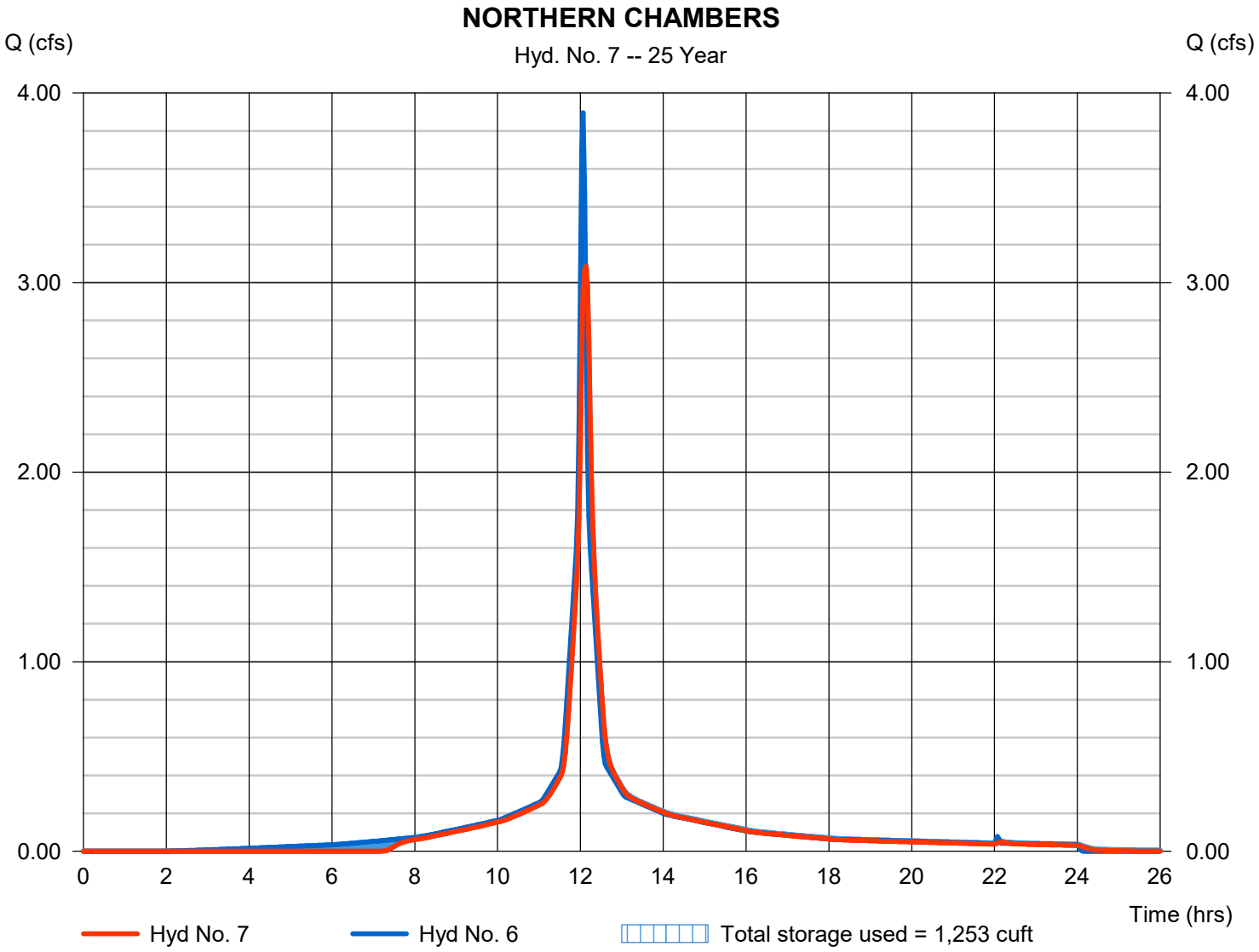
Hydrograph Report

Hyd. No. 7

NORTHERN CHAMBERS

Hydrograph type	=	Reservoir	Peak discharge	=	3.084 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	12,064 cuft
Inflow hyd. No.	=	6 - TO-INFILTRATION	Max. Elevation	=	695.29 ft
Reservoir name	=	CHAMBERS	Max. Storage	=	1,253 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



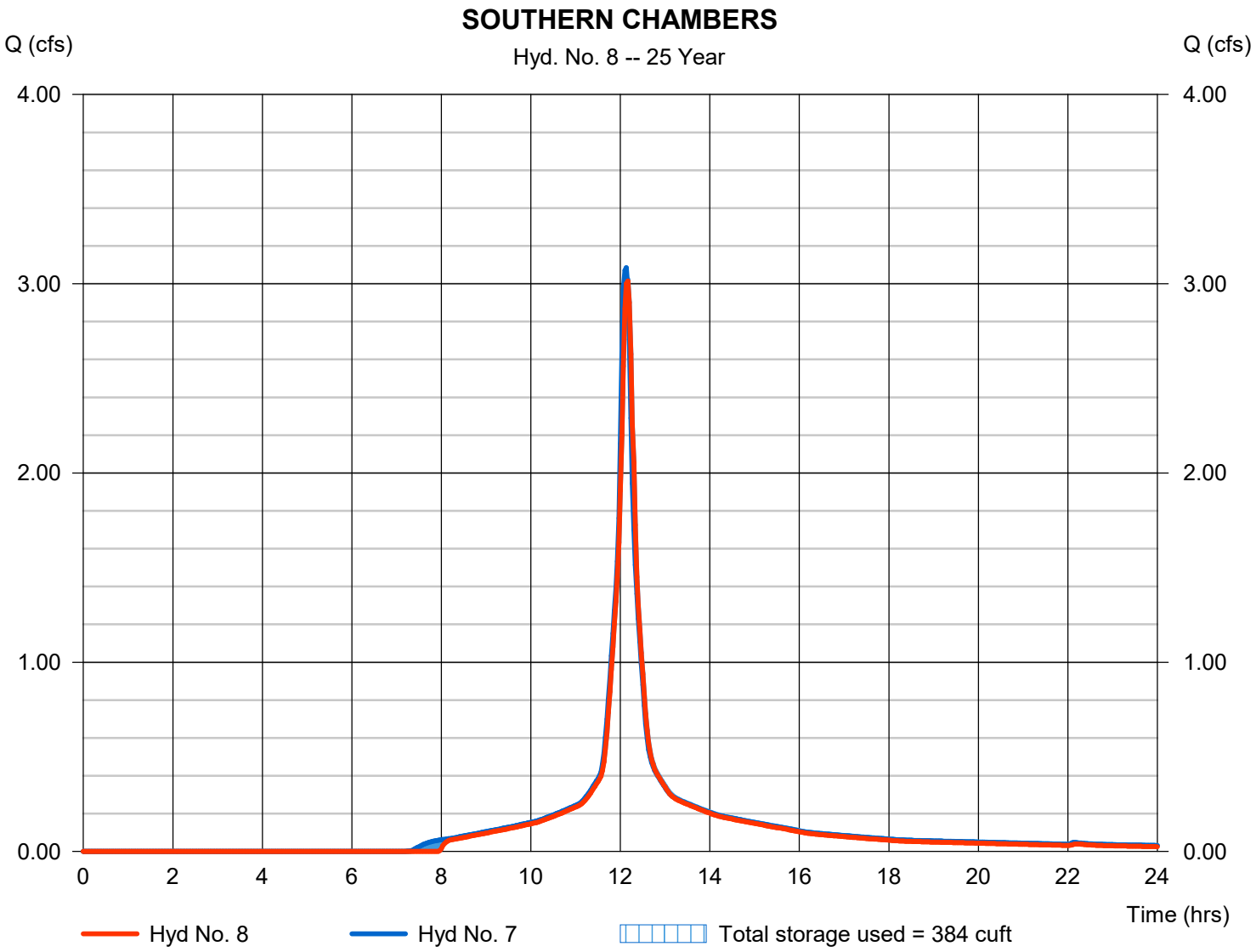
Hydrograph Report

Hyd. No. 8

SOUTHERN CHAMBERS

Hydrograph type	=	Reservoir	Peak discharge	=	3.015 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	11,607 cuft
Inflow hyd. No.	=	7 - NORTHERN CHAMBERS	Max. Elevation	=	695.40 ft
Reservoir name	=	Chambers-2	Max. Storage	=	384 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

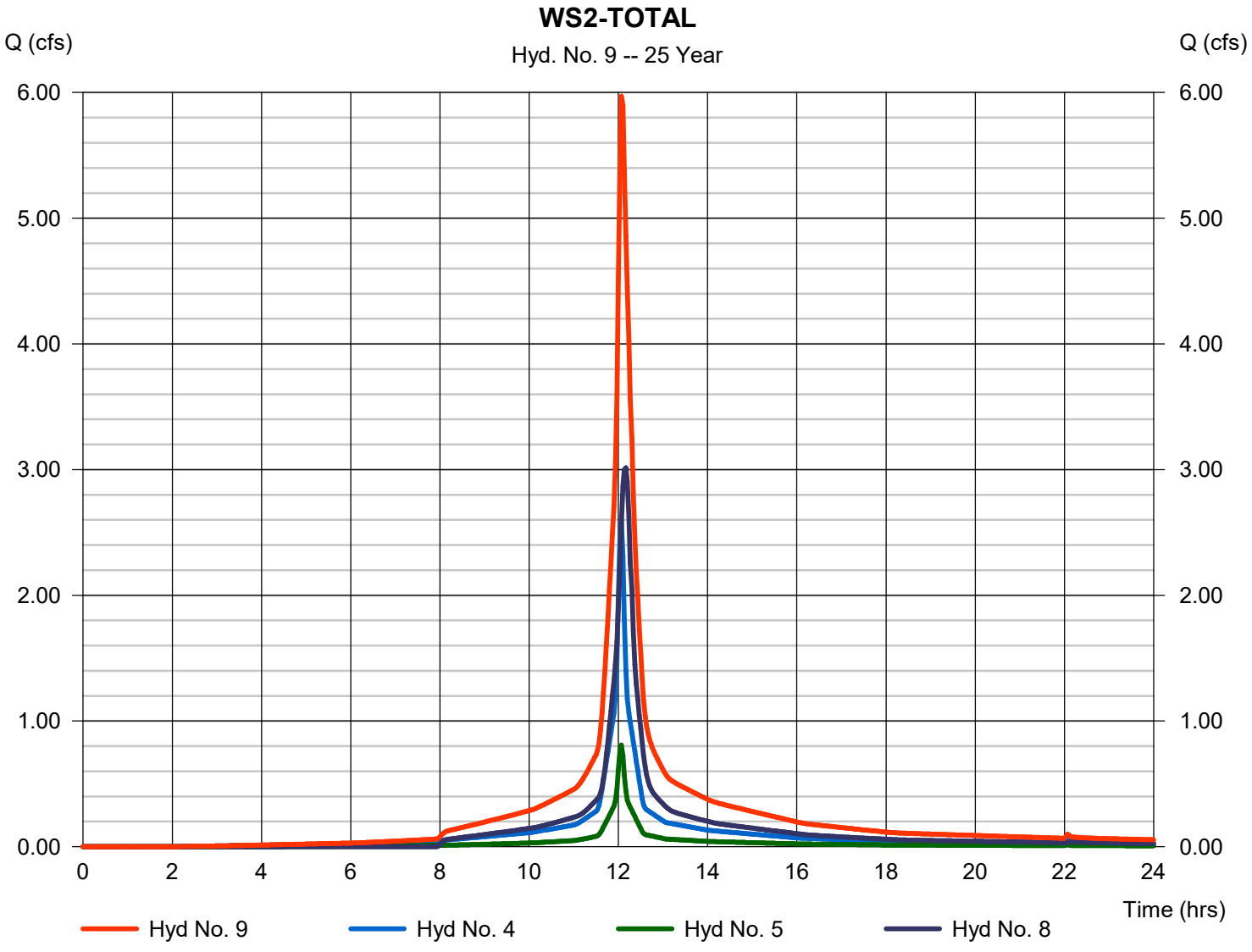


Hydrograph Report

Hyd. No. 9

WS2-TOTAL

Hydrograph type	= Combine	Peak discharge	= 5.970 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 22,736 cuft
Inflow hyds.	= 4, 5, 8	Contrib. drain. area	= 0.549 ac

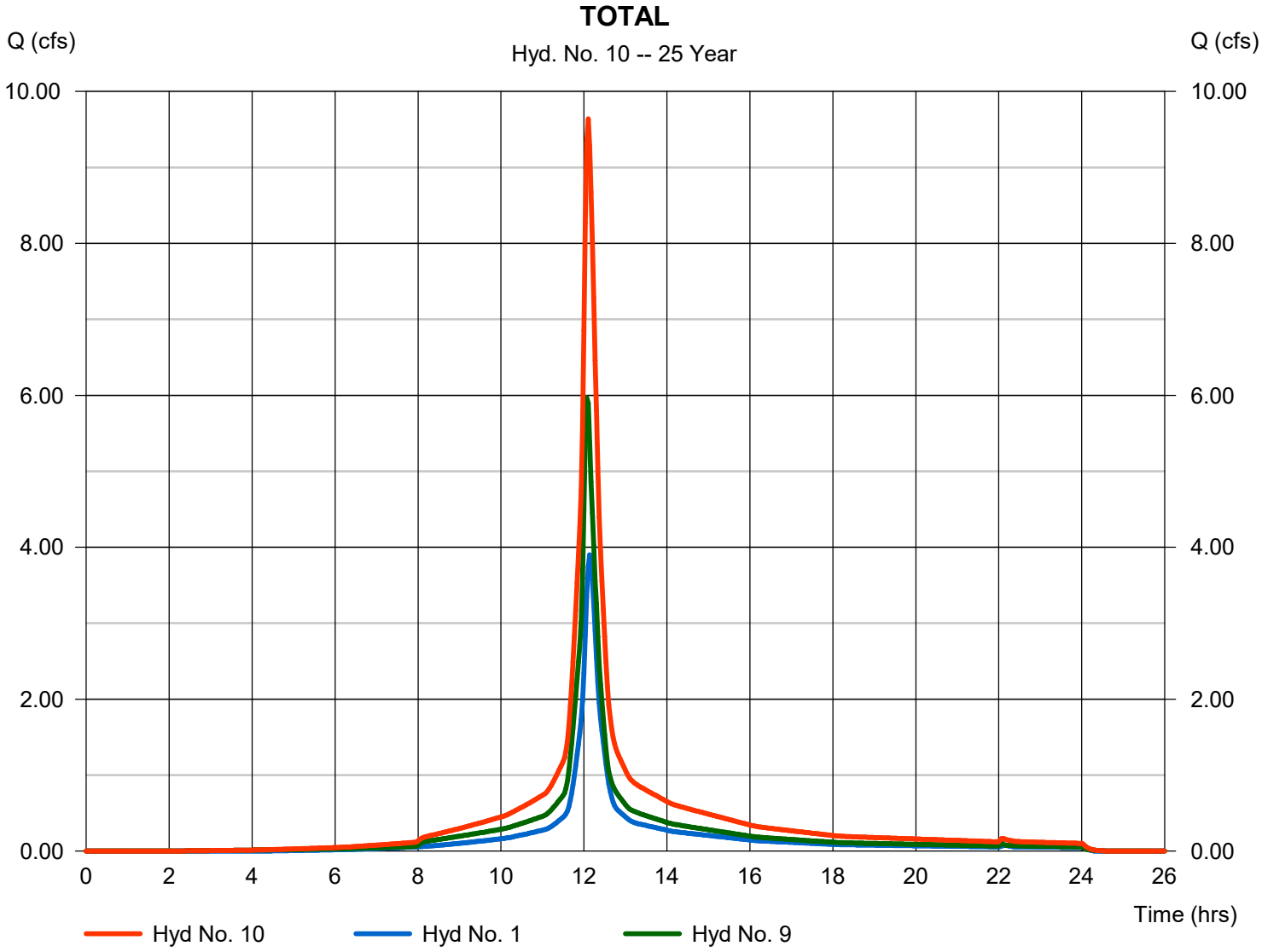


Hydrograph Report

Hyd. No. 10

TOTAL

Hydrograph type	= Combine	Peak discharge	= 9.639 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 38,159 cuft
Inflow hyds.	= 1, 9	Contrib. drain. area	= 0.778 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

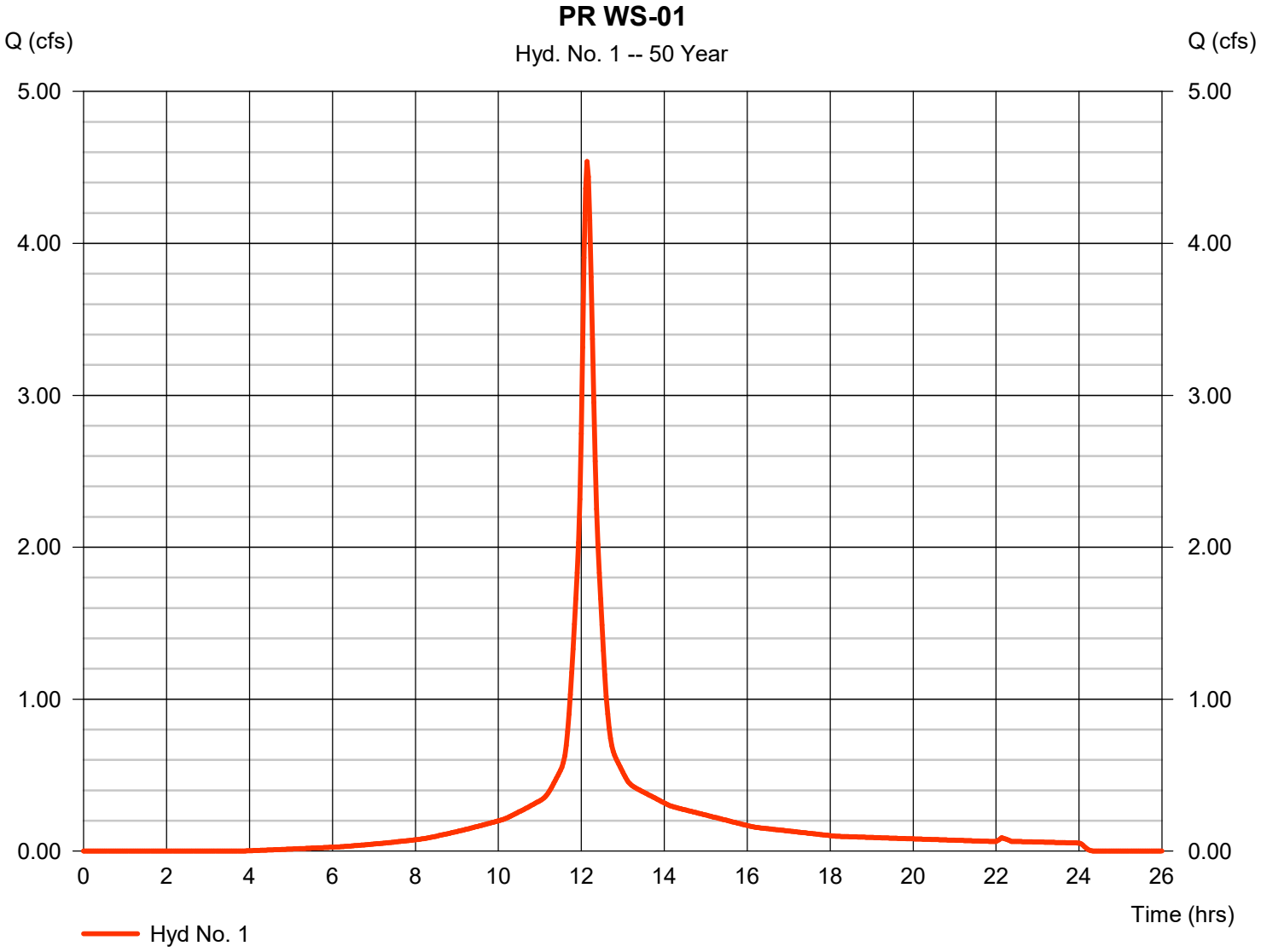
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.540	2	728	18,104	------	------	------	PR WS-01
2	SCS Runoff	3.531	2	724	11,745	------	------	------	PR WS-02A
3	SCS Runoff	0.940	2	724	3,018	------	------	------	PR WS-02B
4	SCS Runoff	2.976	2	724	9,899	------	------	------	PR WS-02C
5	SCS Runoff	0.937	2	724	2,986	------	------	------	PR WS-02D
6	Combine	4.471	2	724	14,763	2, 3,	------	------	TO-INFILTRATION
7	Reservoir	3.967	2	726	14,061	6	695.46	1,349	NORTHERN CHAMBERS
8	Reservoir	3.649	2	728	13,590	7	695.95	470	SOUTHERN CHAMBERS
9	Combine	6.879	2	726	26,475	4, 5, 8	------	------	WS2-TOTAL
10	Combine	11.24	2	726	44,579	1, 9	------	------	TOTAL

Hydrograph Report

Hyd. No. 1

PR WS-01

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.540 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	18,104 cuft
Drainage area	=	0.778 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.40 min
Total precip.	=	7.76 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

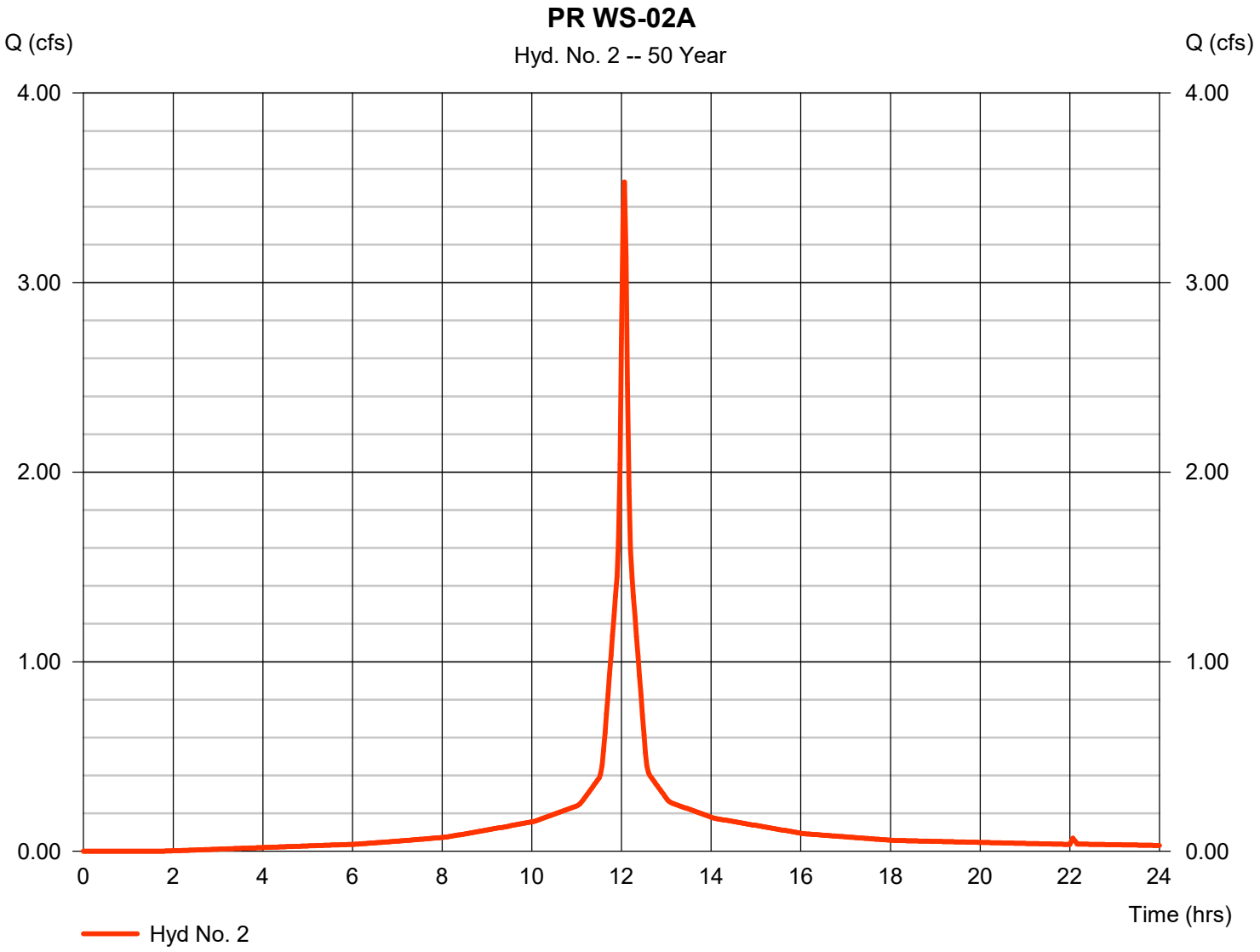


Hydrograph Report

Hyd. No. 2

PR WS-02A

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.531 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	11,745 cuft
Drainage area	=	0.490 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.76 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

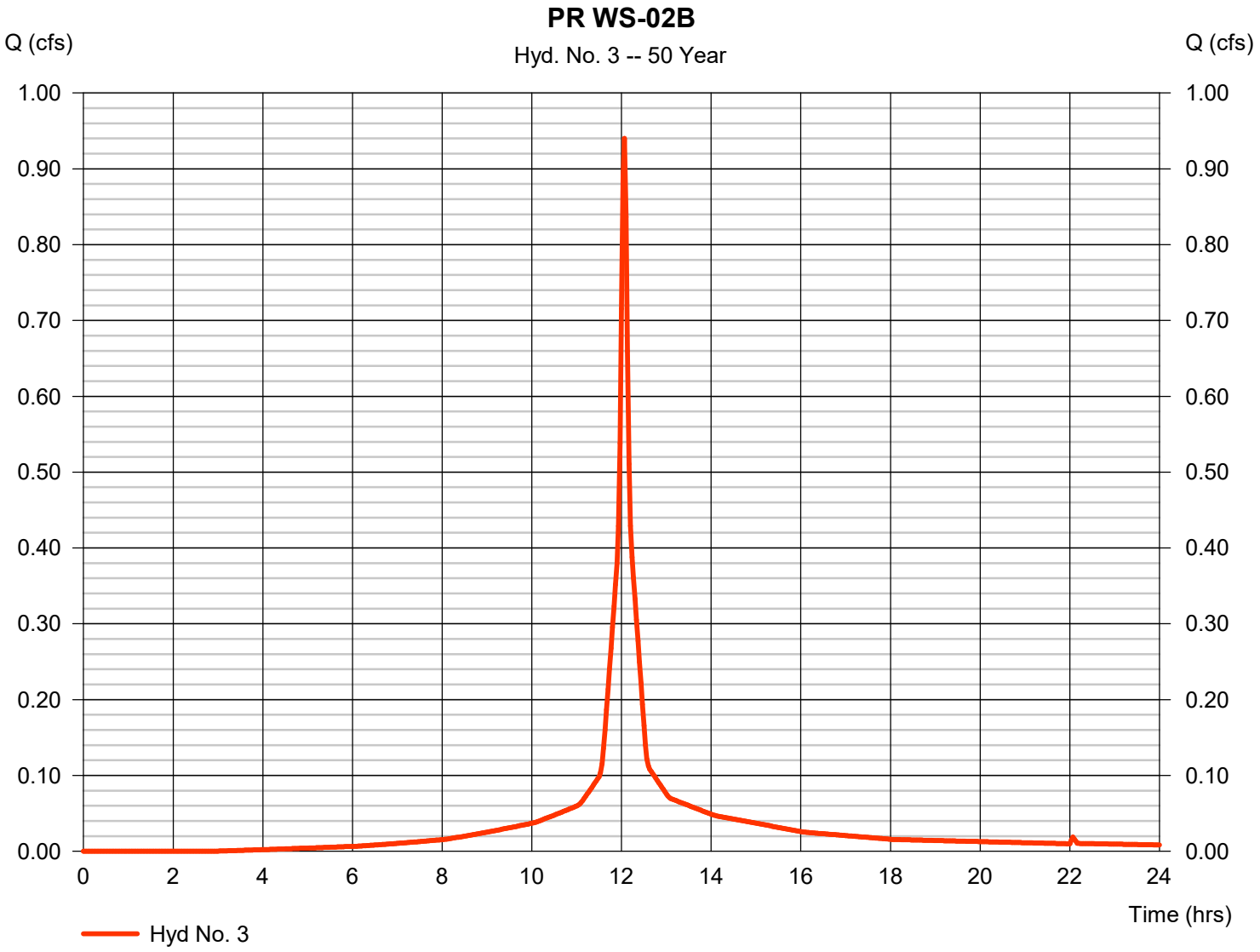


Hydrograph Report

Hyd. No. 3

PR WS-02B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.940 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	3,018 cuft
Drainage area	=	0.135 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.76 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

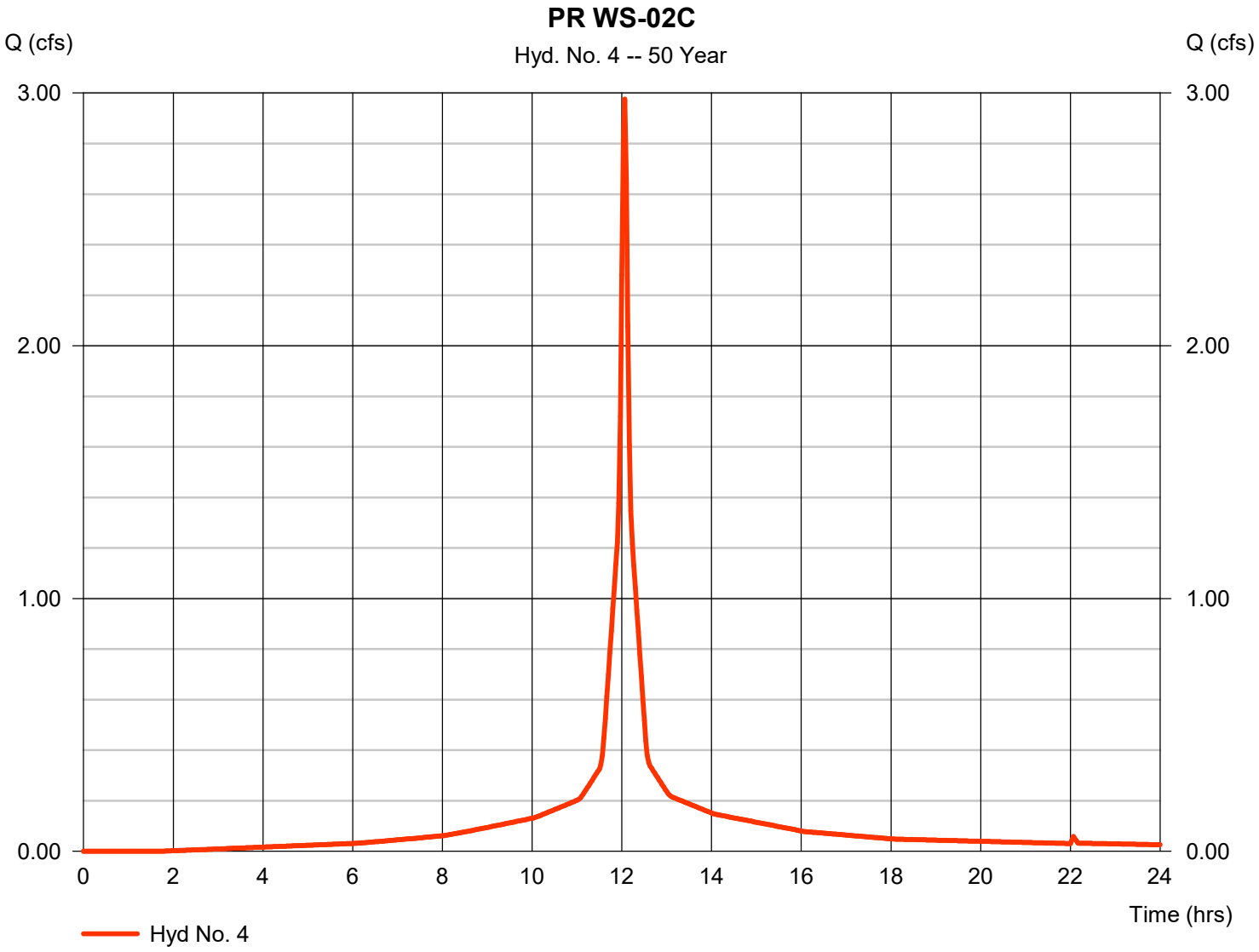


Hydrograph Report

Hyd. No. 4

PR WS-02C

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.976 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	9,899 cuft
Drainage area	=	0.413 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.76 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

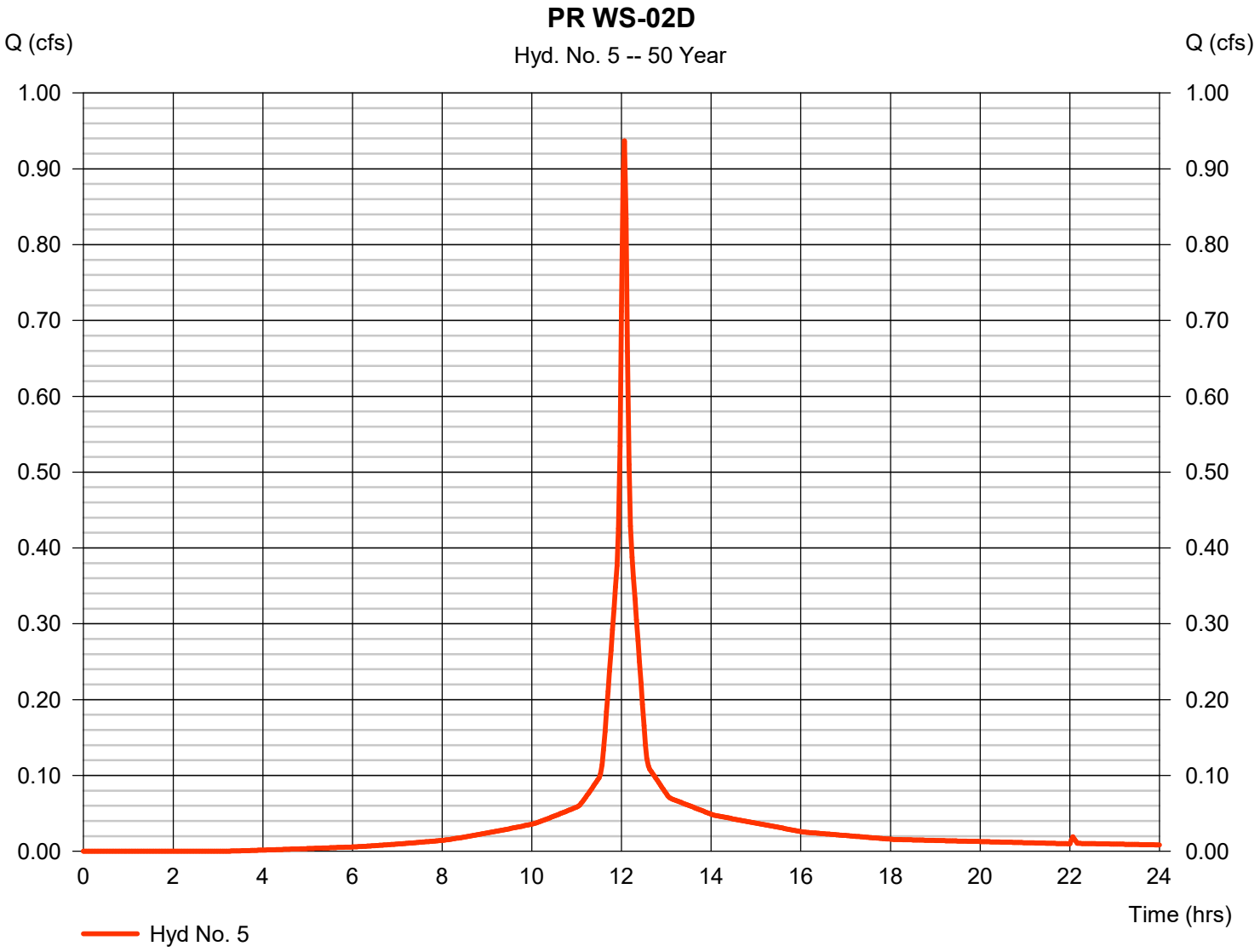


Hydrograph Report

Hyd. No. 5

PR WS-02D

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.937 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	2,986 cuft
Drainage area	=	0.136 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.76 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

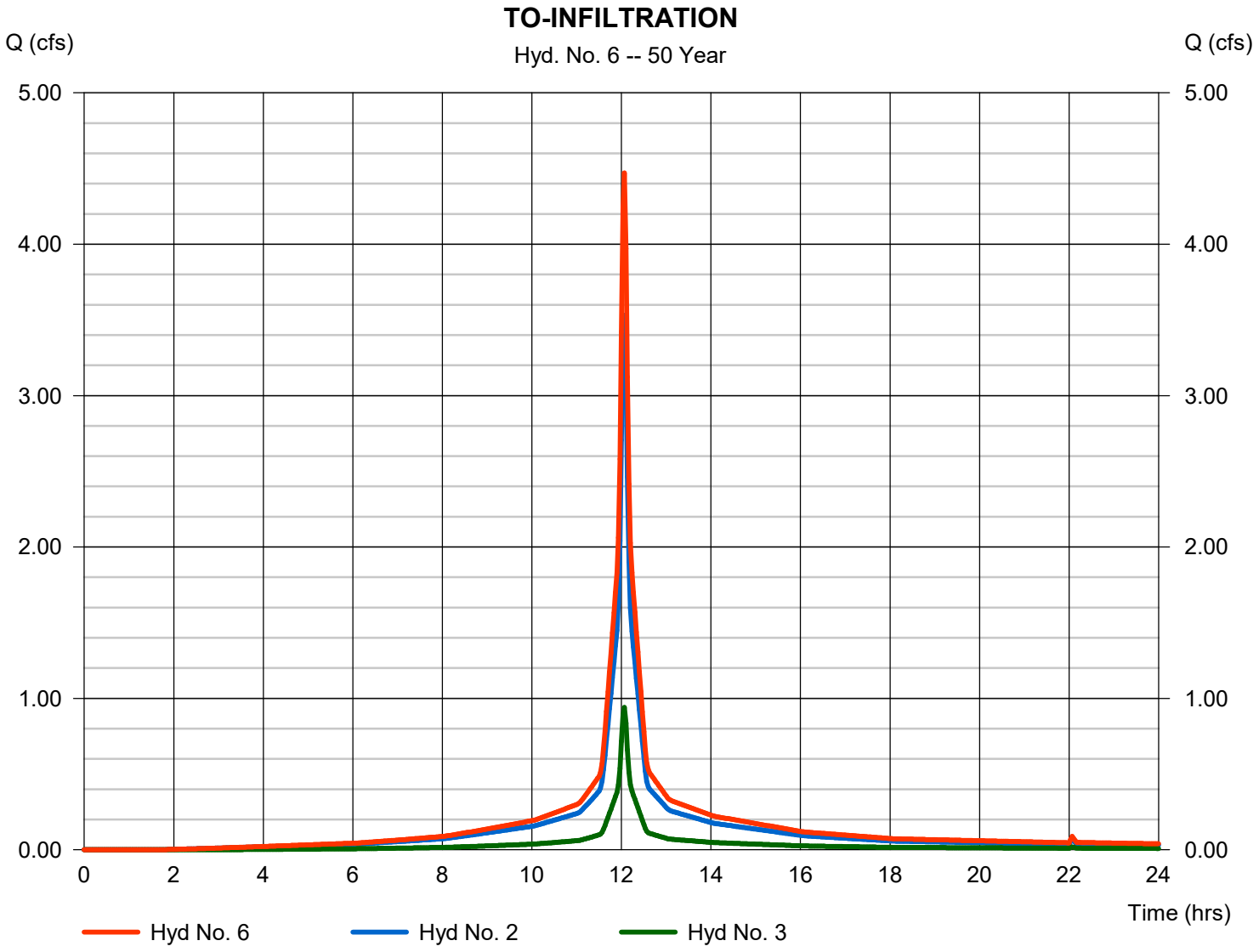


Hydrograph Report

Hyd. No. 6

TO-INFILTRATION

Hydrograph type	=	Combine	Peak discharge	=	4.471 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	14,763 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	0.625 ac



Hydrograph Report

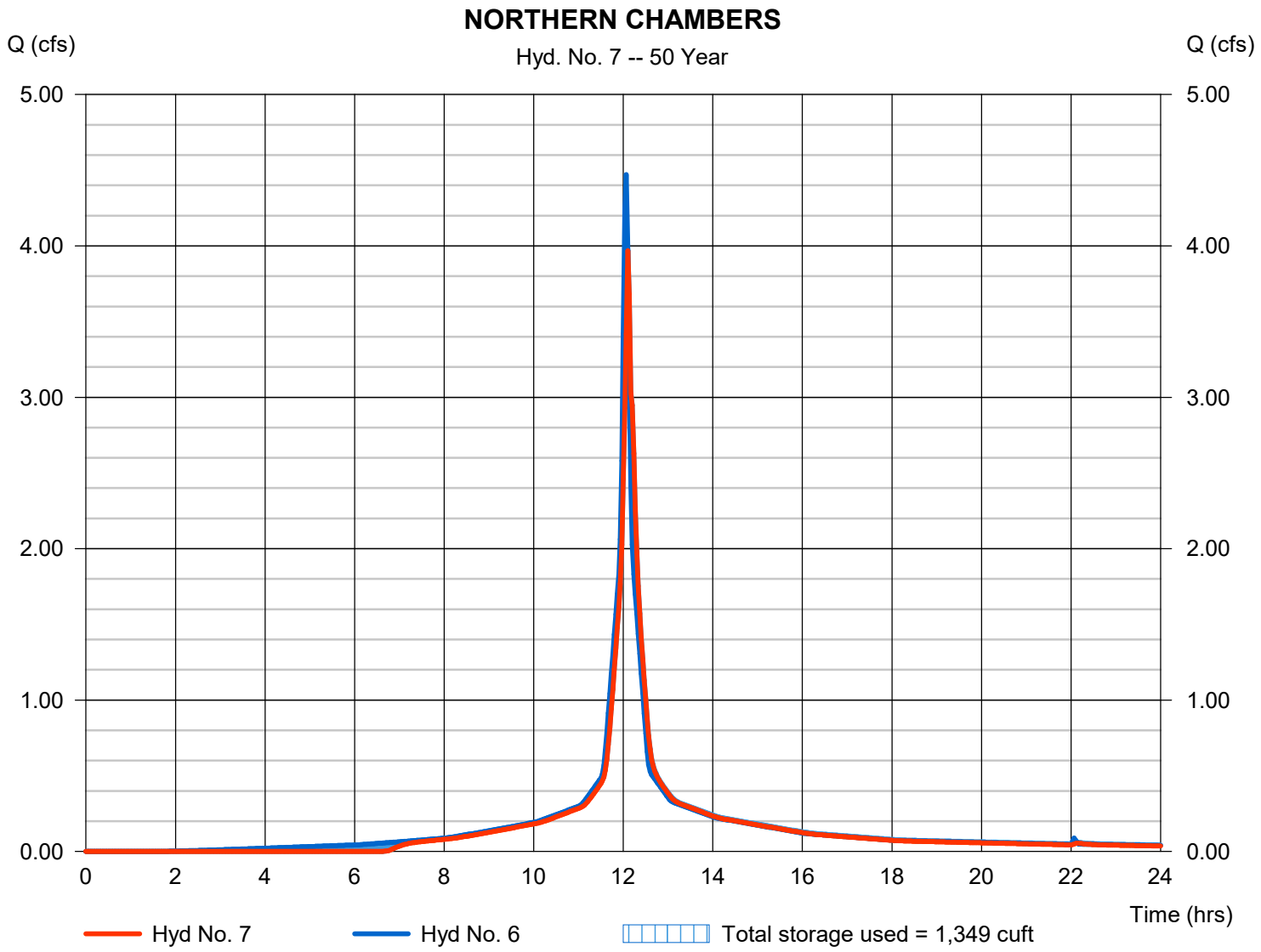
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Tuesday, 01 / 25 / 2022

Hyd. No. 7

NORTHERN CHAMBERS

Hydrograph type	=	Reservoir	Peak discharge	=	3.967 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	14,061 cuft
Inflow hyd. No.	=	6 - TO-INFILTRATION	Max. Elevation	=	695.46 ft
Reservoir name	=	CHAMBERS	Max. Storage	=	1,349 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



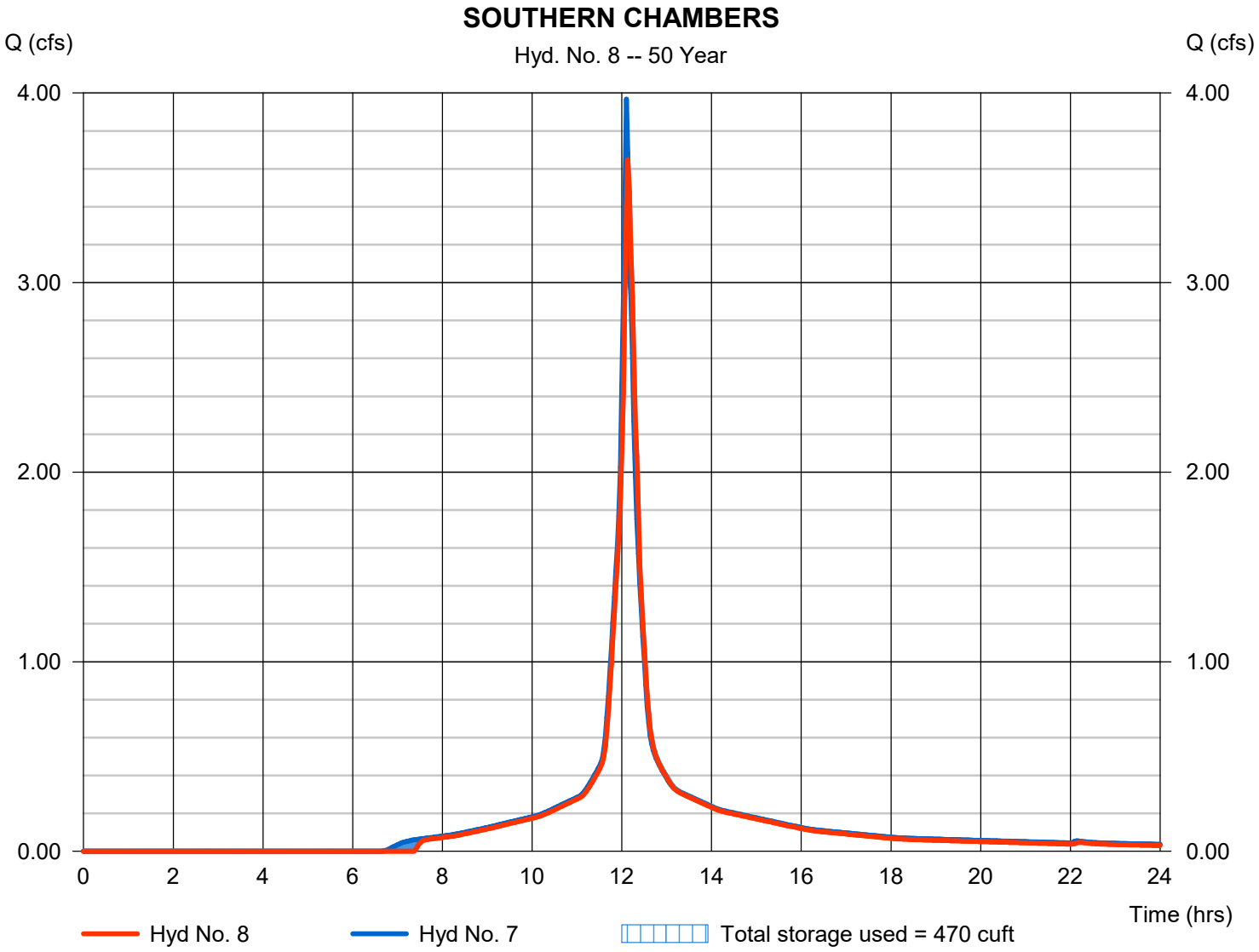
Hydrograph Report

Hyd. No. 8

SOUTHERN CHAMBERS

Hydrograph type	=	Reservoir	Peak discharge	=	3.649 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	13,590 cuft
Inflow hyd. No.	=	7 - NORTHERN CHAMBERS	Max. Elevation	=	695.95 ft
Reservoir name	=	Chambers-2	Max. Storage	=	470 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

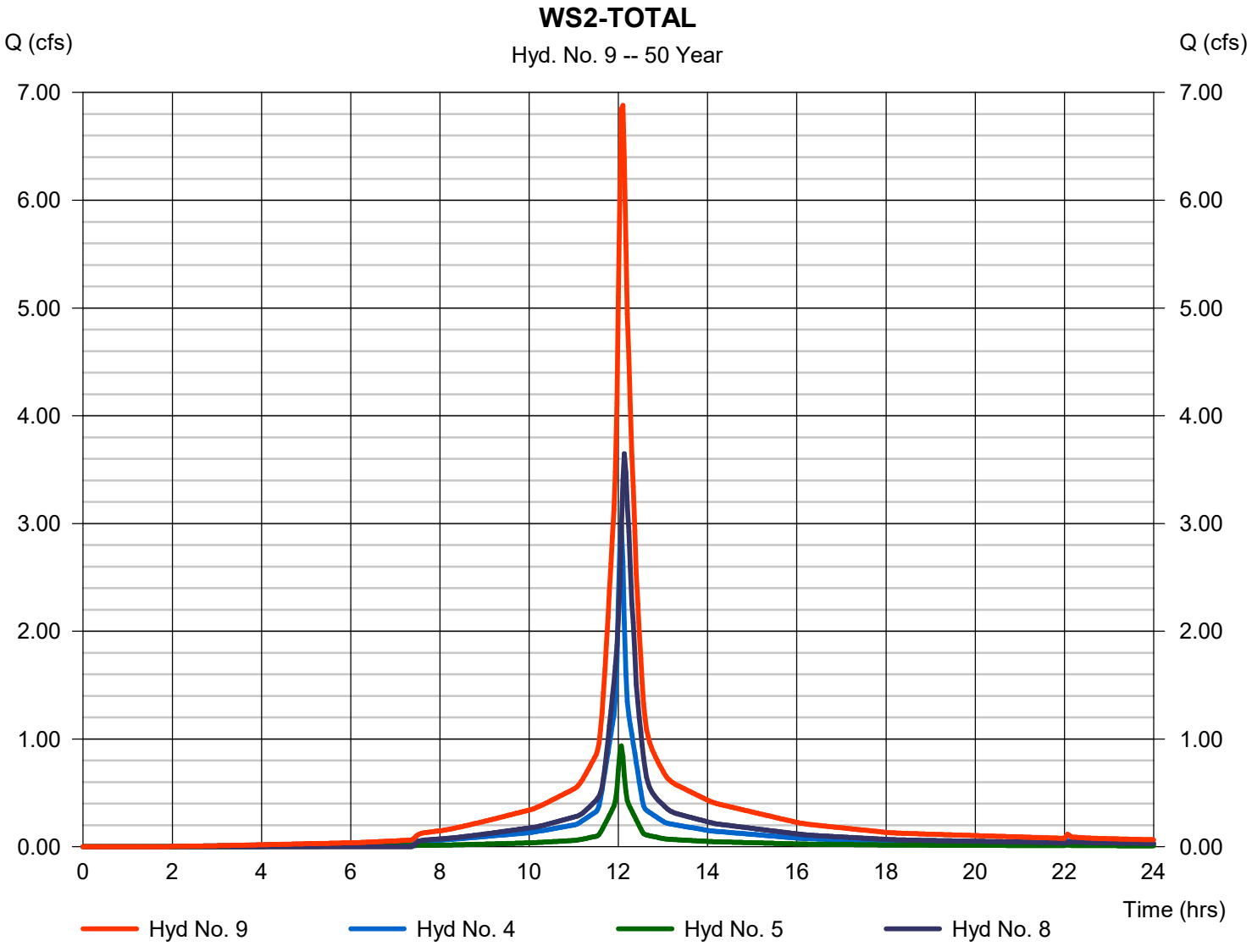


Hydrograph Report

Hyd. No. 9

WS2-TOTAL

Hydrograph type	= Combine	Peak discharge	= 6.879 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 26,475 cuft
Inflow hyds.	= 4, 5, 8	Contrib. drain. area	= 0.549 ac

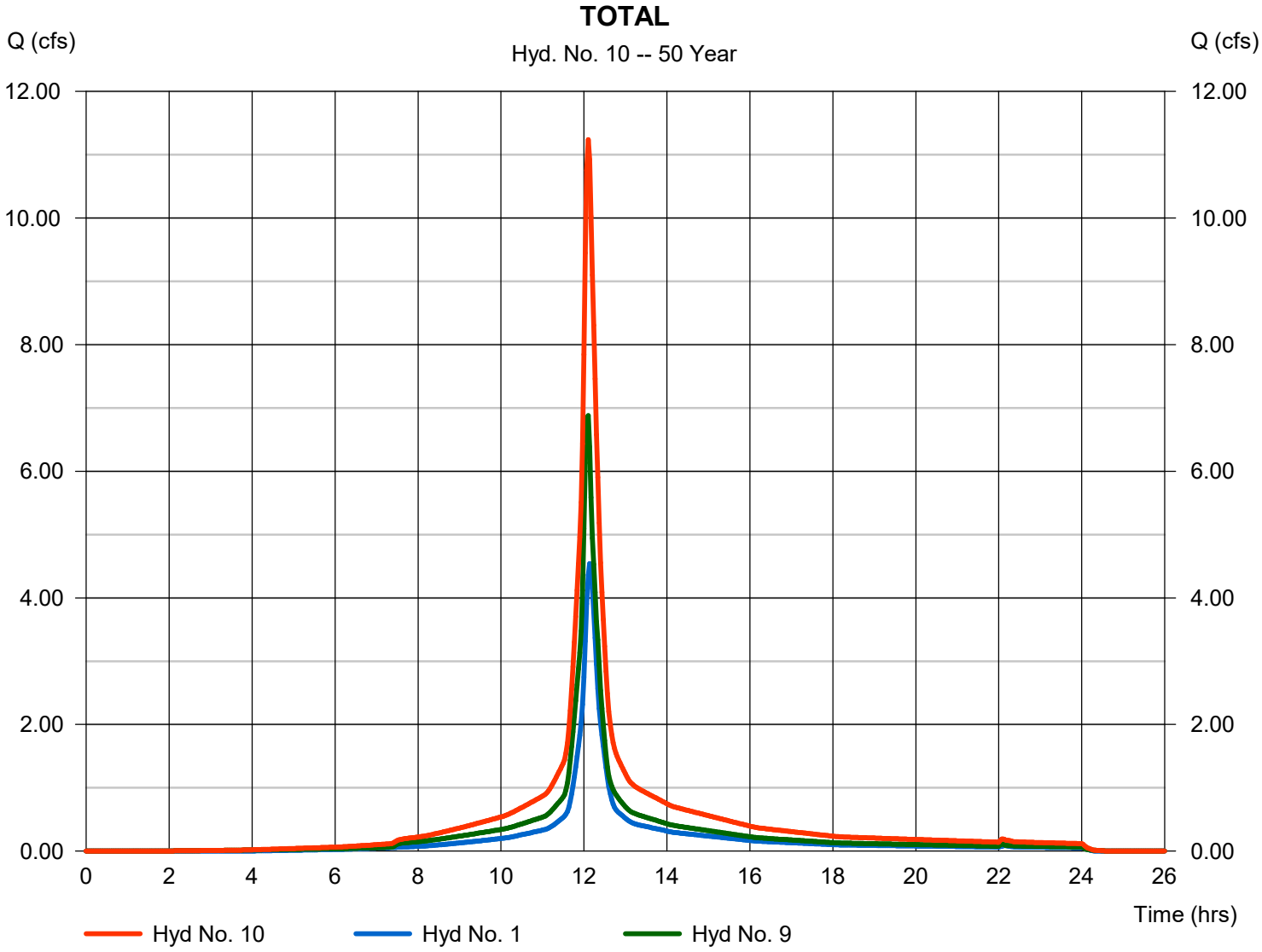


Hydrograph Report

Hyd. No. 10

TOTAL

Hydrograph type	= Combine	Peak discharge	= 11.24 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 44,579 cuft
Inflow hyds.	= 1, 9	Contrib. drain. area	= 0.778 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

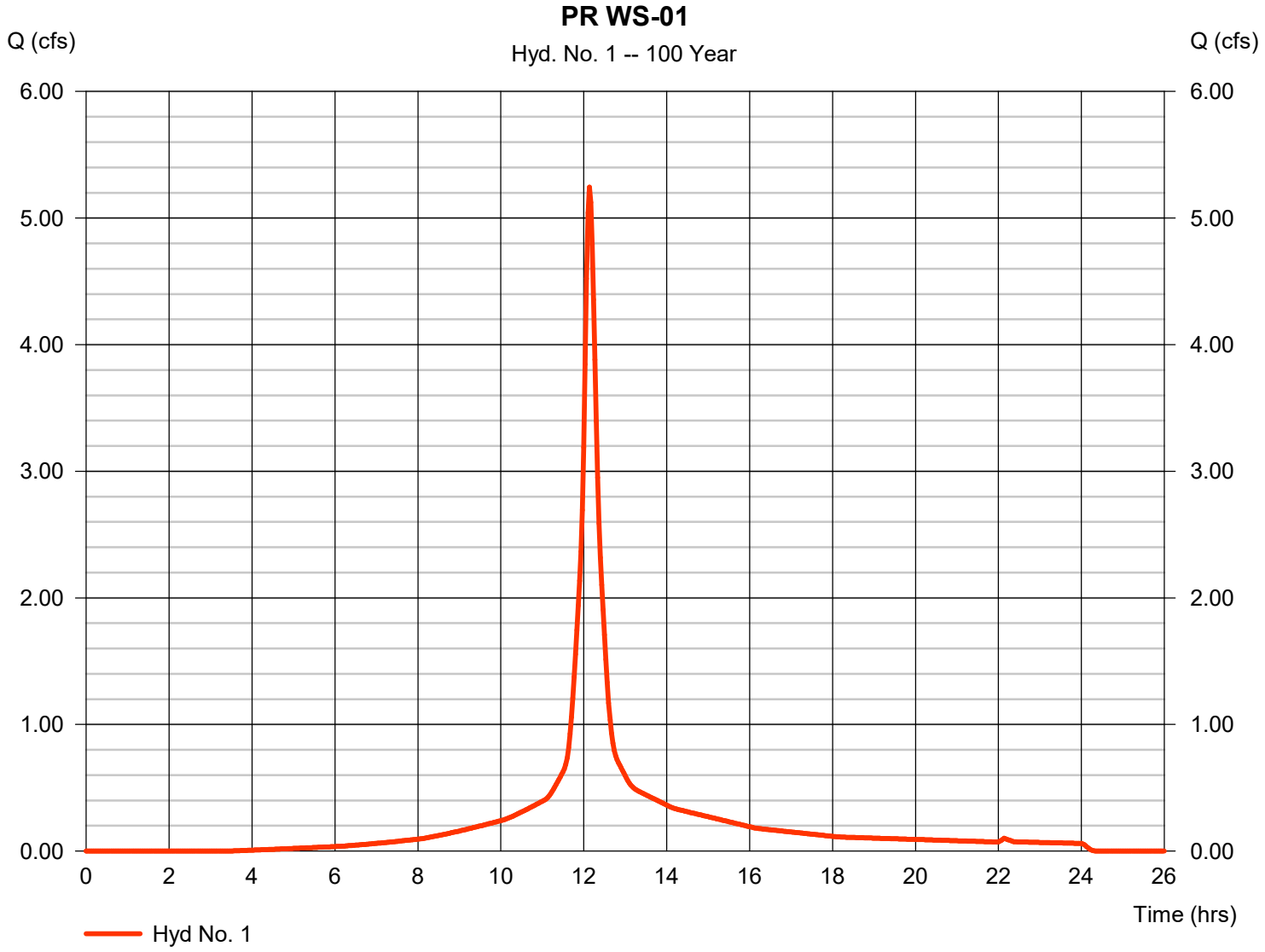
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	5.245	2	728	21,086	------	------	------	PR WS-01
2	SCS Runoff	4.026	2	724	13,487	------	------	------	PR WS-02A
3	SCS Runoff	1.079	2	724	3,493	------	------	------	PR WS-02B
4	SCS Runoff	3.393	2	724	11,367	------	------	------	PR WS-02C
5	SCS Runoff	1.077	2	724	3,463	------	------	------	PR WS-02D
6	Combine	5.105	2	724	16,980	2, 3,	------	------	TO-INFILTRATION
7	Reservoir	4.653	2	726	16,273	6	695.62	1,437	NORTHERN CHAMBERS
8	Reservoir	4.275	2	728	15,789	7	696.59	564	SOUTHERN CHAMBERS
9	Combine	8.015	2	726	30,620	4, 5, 8	------	------	WS2-TOTAL
10	Combine	13.06	2	726	51,706	1, 9	------	------	TOTAL

Hydrograph Report

Hyd. No. 1

PR WS-01

Hydrograph type	= SCS Runoff	Peak discharge	= 5.245 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 21,086 cuft
Drainage area	= 0.778 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.40 min
Total precip.	= 8.81 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

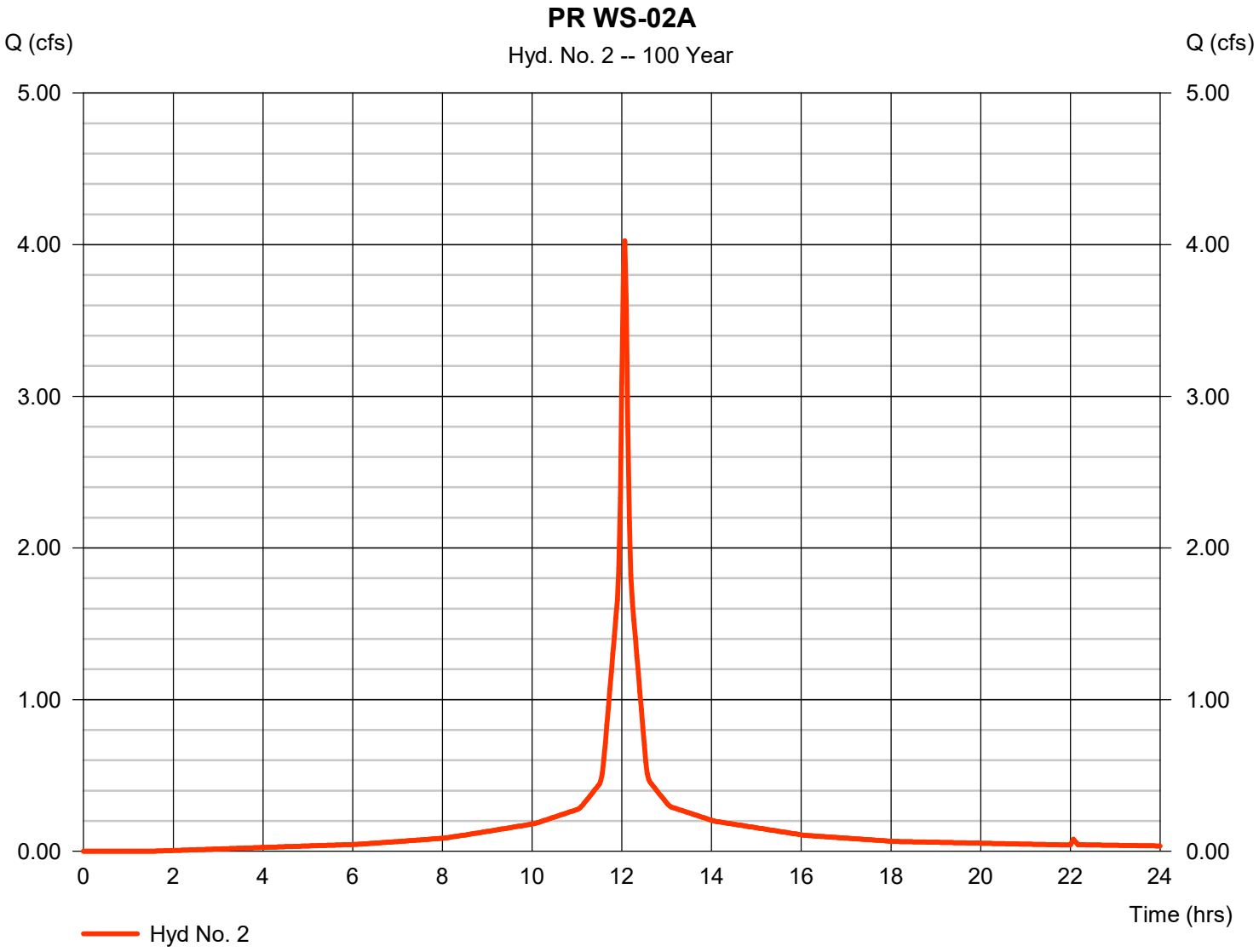


Hydrograph Report

Hyd. No. 2

PR WS-02A

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.026 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	13,487 cuft
Drainage area	=	0.490 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

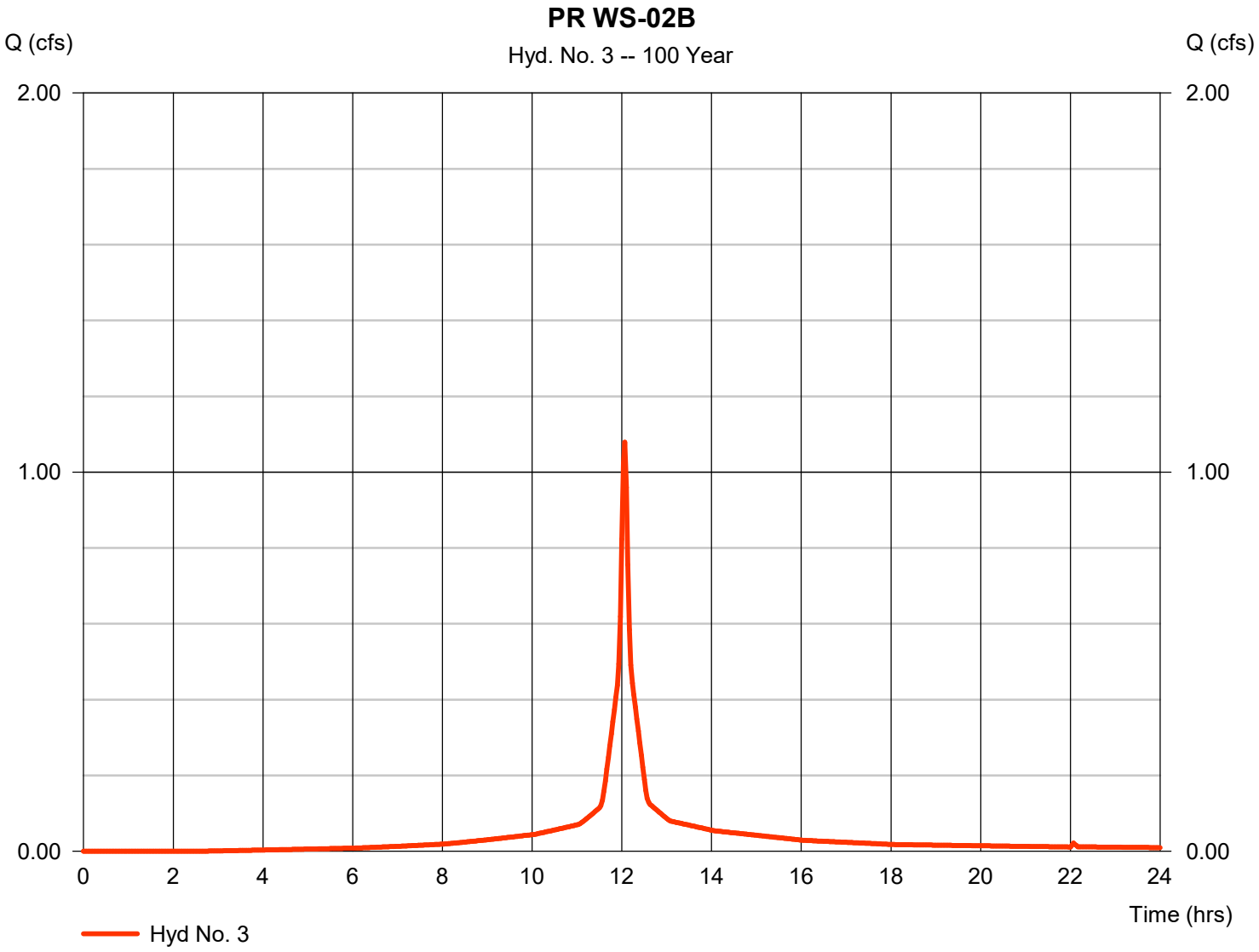


Hydrograph Report

Hyd. No. 3

PR WS-02B

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.079 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	3,493 cuft
Drainage area	=	0.135 ac	Curve number	=	90
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

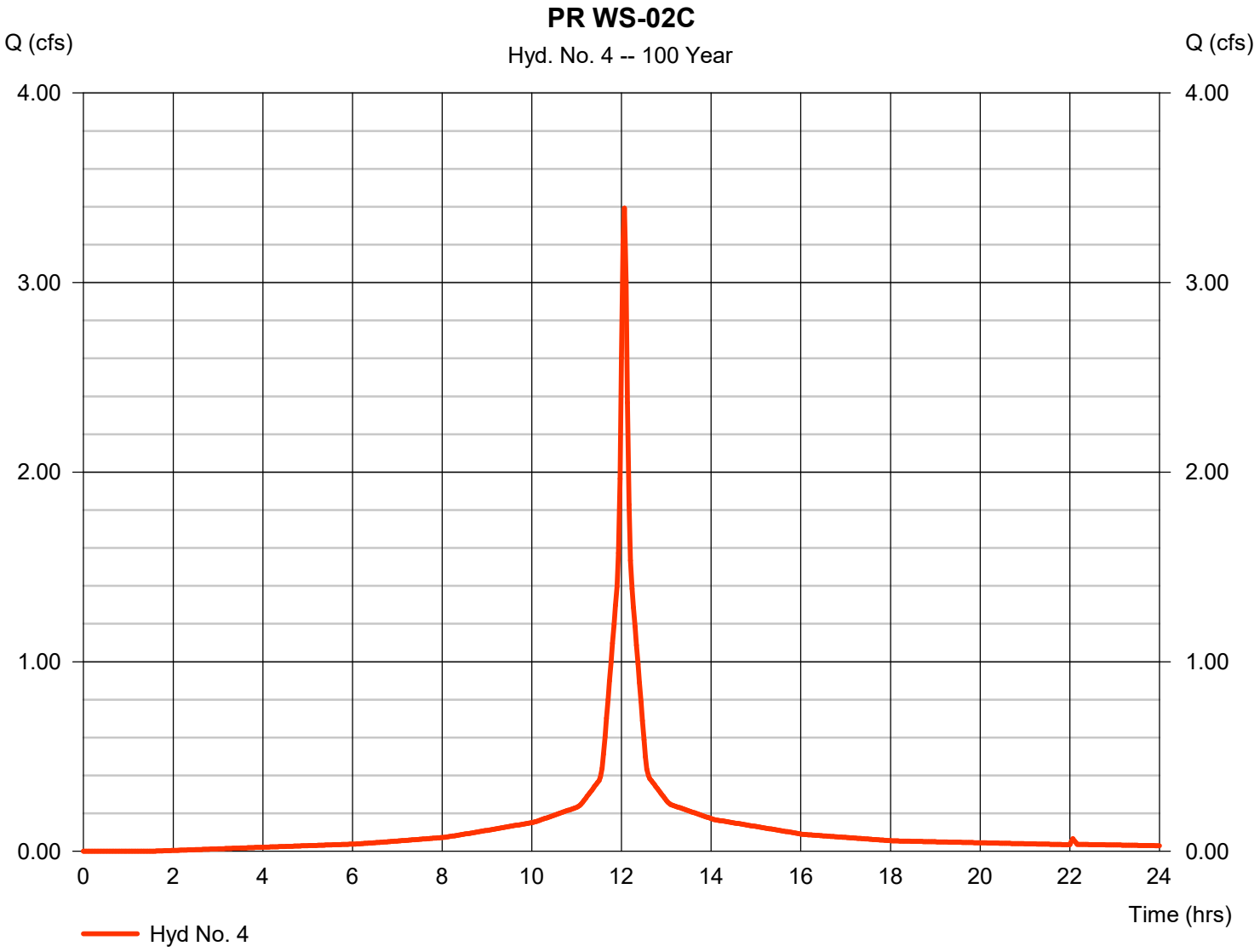


Hydrograph Report

Hyd. No. 4

PR WS-02C

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.393 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	11,367 cuft
Drainage area	=	0.413 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

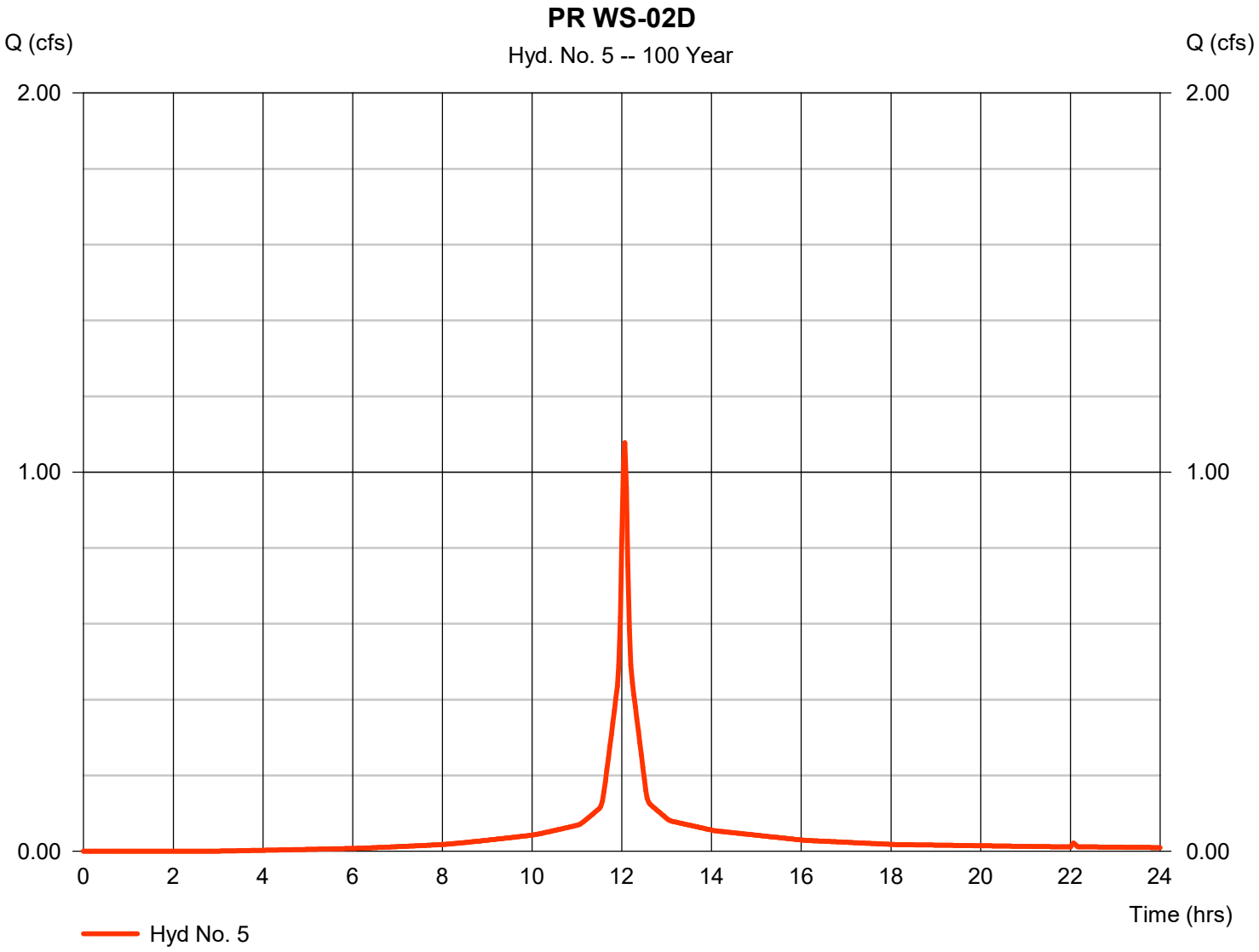


Hydrograph Report

Hyd. No. 5

PR WS-02D

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.077 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	3,463 cuft
Drainage area	=	0.136 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.81 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

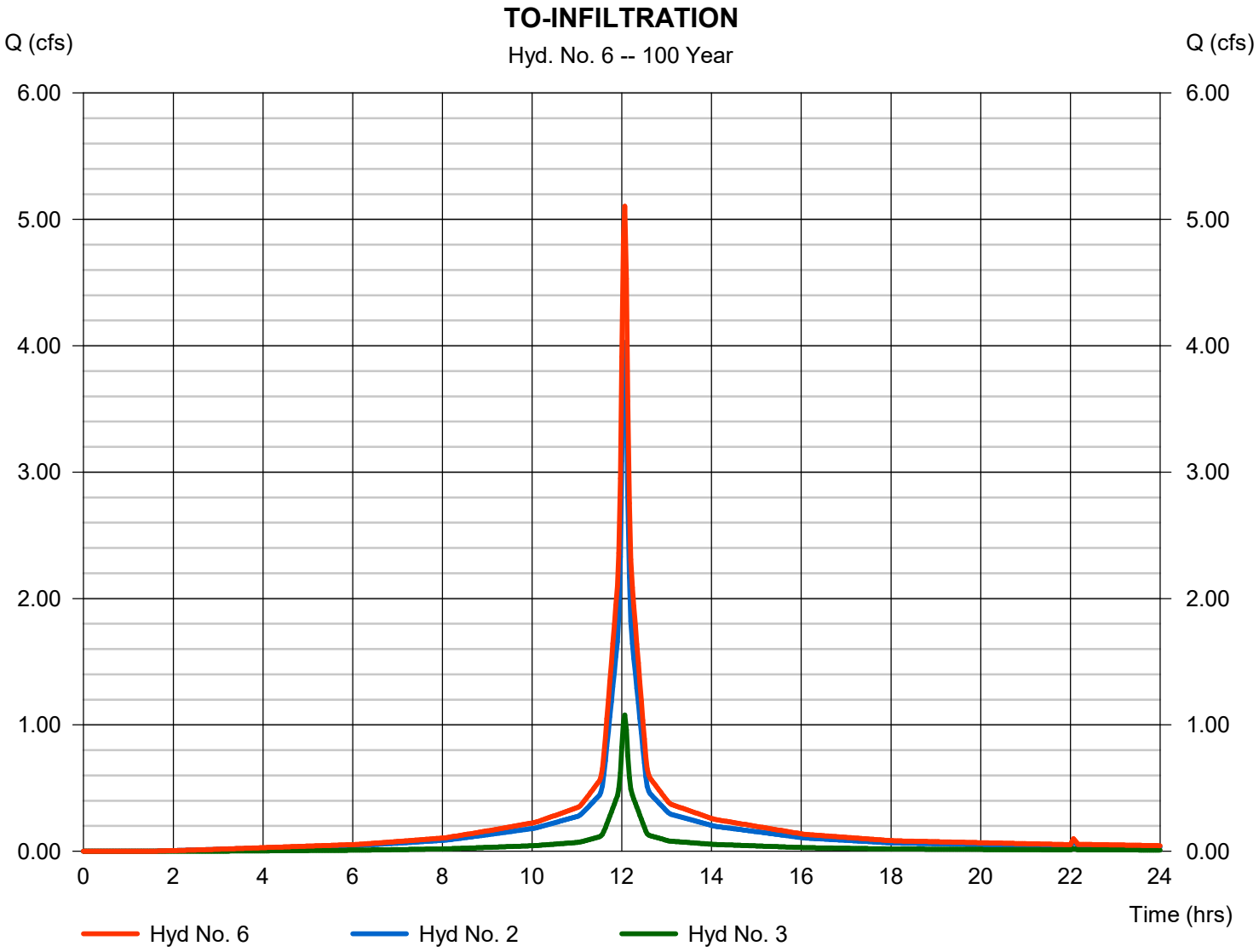


Hydrograph Report

Hyd. No. 6

TO-INFILTRATION

Hydrograph type	= Combine	Peak discharge	= 5.105 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 16,980 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 0.625 ac



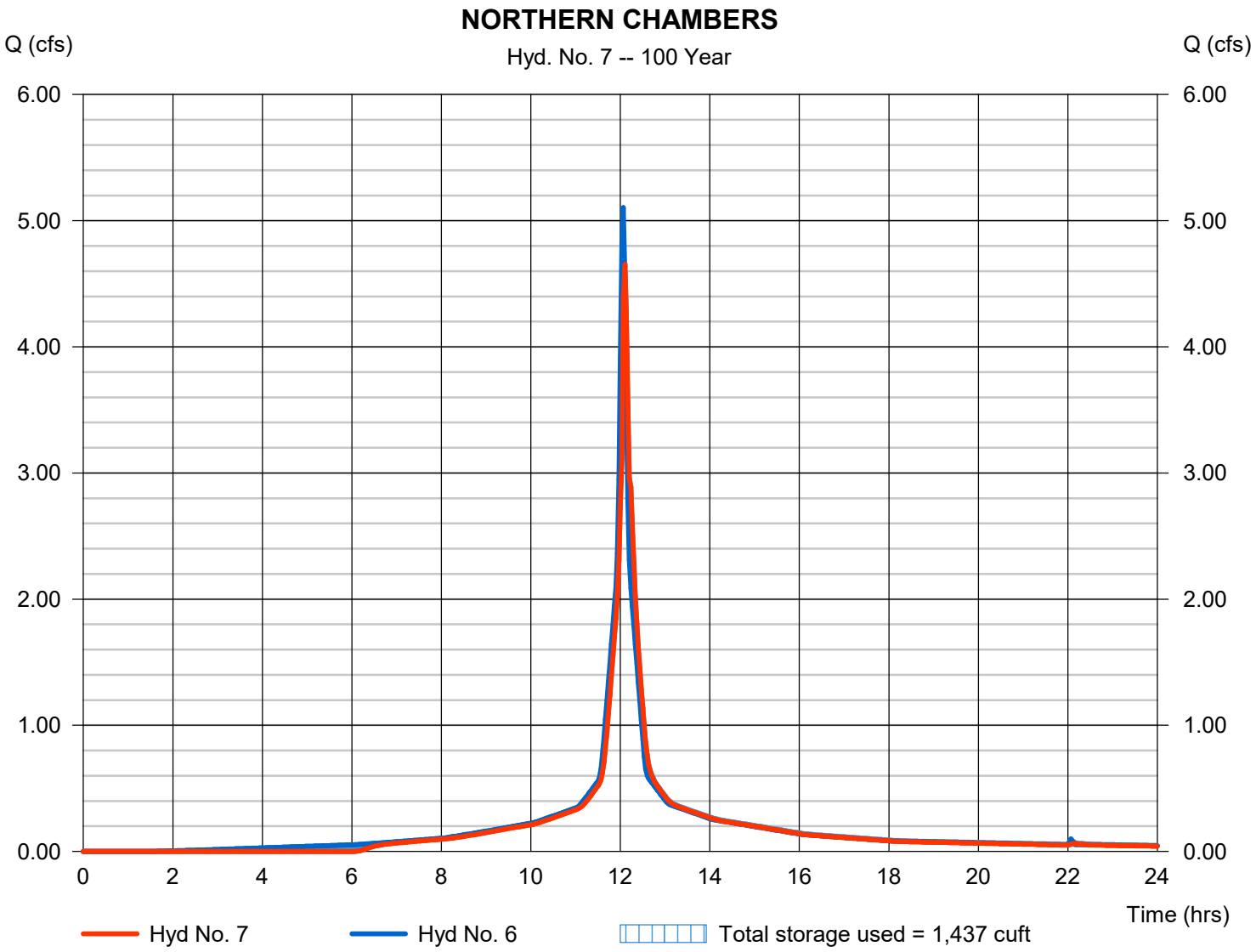
Hydrograph Report

Hyd. No. 7

NORTHERN CHAMBERS

Hydrograph type	=	Reservoir	Peak discharge	=	4.653 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	16,273 cuft
Inflow hyd. No.	=	6 - TO-INFILTRATION	Max. Elevation	=	695.62 ft
Reservoir name	=	CHAMBERS	Max. Storage	=	1,437 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



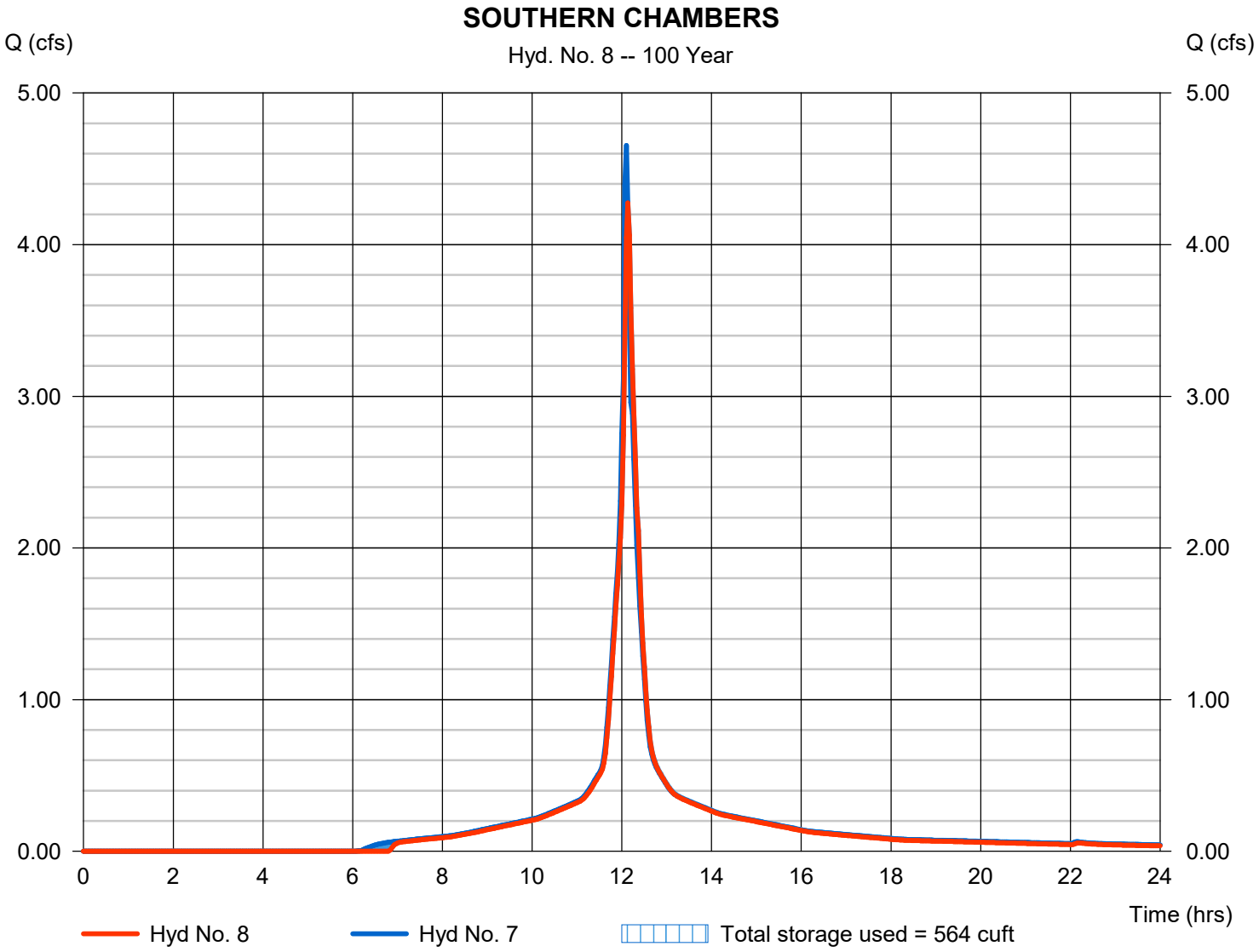
Hydrograph Report

Hyd. No. 8

SOUTHERN CHAMBERS

Hydrograph type	=	Reservoir	Peak discharge	=	4.275 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	15,789 cuft
Inflow hyd. No.	=	7 - NORTHERN CHAMBERS	Max. Elevation	=	696.59 ft
Reservoir name	=	Chambers-2	Max. Storage	=	564 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

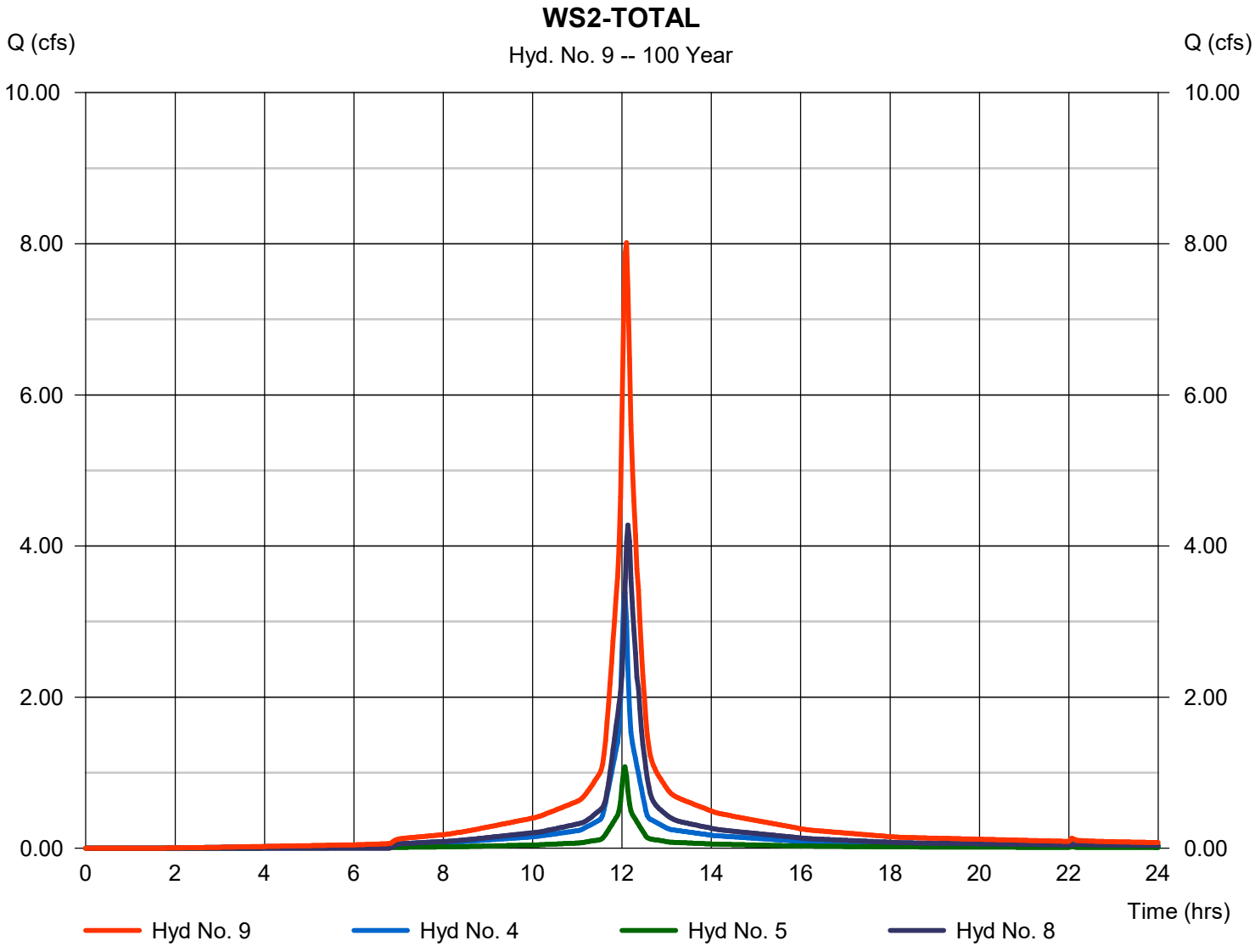


Hydrograph Report

Hyd. No. 9

WS2-TOTAL

Hydrograph type	= Combine	Peak discharge	= 8.015 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 30,620 cuft
Inflow hyds.	= 4, 5, 8	Contrib. drain. area	= 0.549 ac

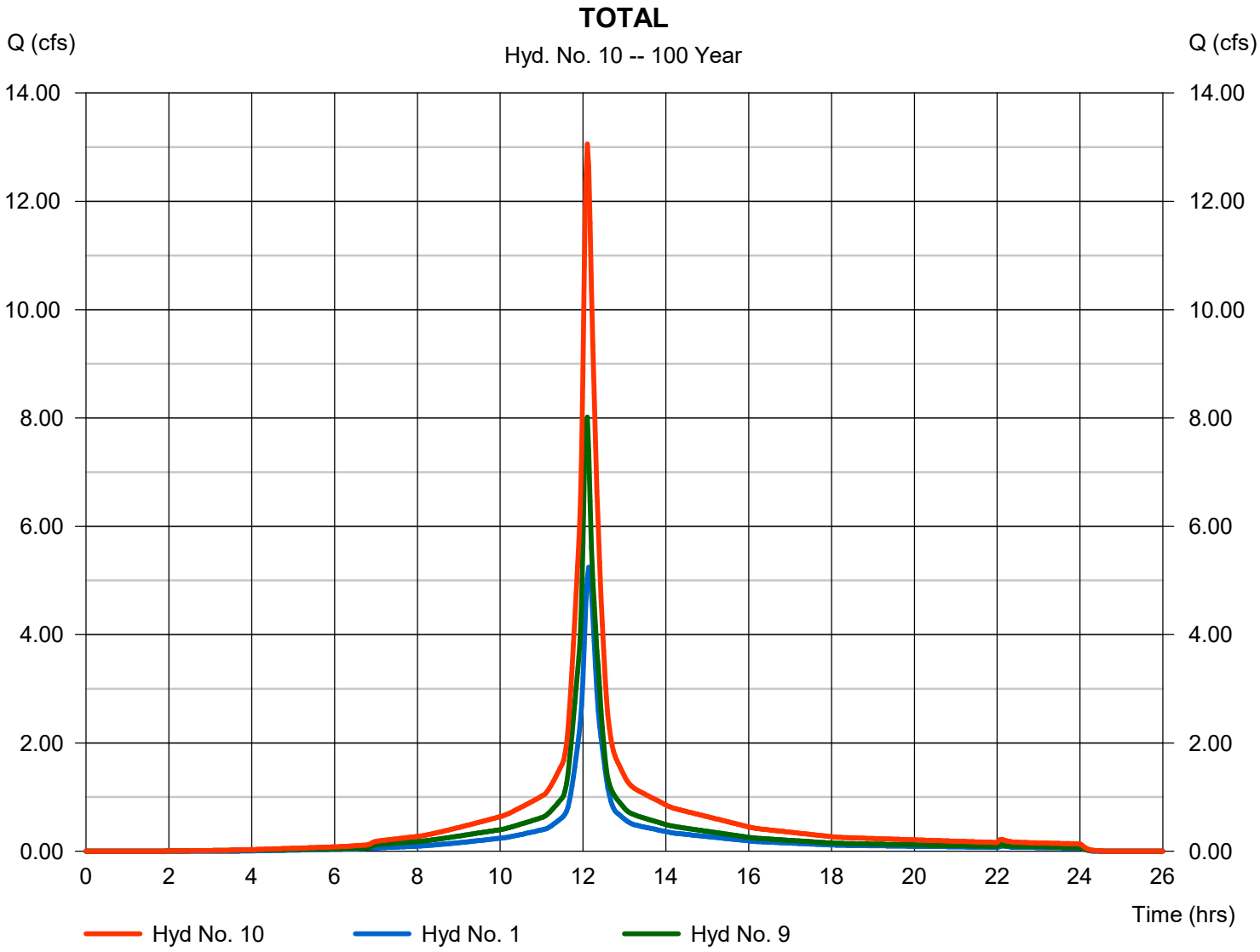


Hydrograph Report

Hyd. No. 10

TOTAL

Hydrograph type	= Combine	Peak discharge	= 13.06 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 51,706 cuft
Inflow hyds.	= 1, 9	Contrib. drain. area	= 0.778 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	23.5148	3.7000	0.7122	--------
3	0.0000	0.0000	0.0000	--------
5	0.0000	0.0000	0.0000	--------
10	34.7354	3.8000	0.7163	--------
25	41.7402	3.8000	0.7182	--------
50	46.4988	3.7000	0.7165	--------
100	50.9151	3.6000	0.7127	--------

File name: washingtonct.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	5.04	3.65	2.92	2.47	2.15	1.92	1.74	1.60	1.48	1.38	1.29	1.22
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	7.32	5.30	4.25	3.59	3.13	2.79	2.53	2.32	2.14	2.00	1.88	1.77
25	8.75	6.34	5.07	4.28	3.74	3.33	3.02	2.76	2.56	2.38	2.24	2.11
50	9.87	7.13	5.70	4.81	4.20	3.74	3.39	3.10	2.87	2.68	2.51	2.37
100	10.99	7.93	6.34	5.35	4.67	4.16	3.77	3.46	3.20	2.98	2.80	2.64

Tc = time in minutes. Values may exceed 60.

Precip. file name: norwalk.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.93	3.44	0.00	0.00	5.51	6.81	7.76	8.81
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

APPENDIX E

WQA-2A

WQA-1

WQA-2B

SOLLEY HALL

BRINSMADE

GUNN DORMITORY

TISCH SCHOOLHOUSE

STATE ROUTE 47

STATE ROUTE 199

SCIENCE BUILDING

BURTON FAMILY WORKING CENTER

BURTON ALUMNI CENTER

BOURNE ADMINISTRATIVE BUILDING

GRAHAM HOUSE

COLLEGE OFFICE

N

0 60' 120'

SCALE: 1" = 60'

THE FREDERICK GUNN SCHOOL
CENTER FOR INNOVATION AND ACTIVE CITIZENSHIP
WASHINGTON, CT

WATER QUALITY AREA FIGURE

DATE:	01/24/2022
SCALE:	1"=60'
FIGURE:	WQA

Tighe&Bond

Jan 25, 2022-12:21pm Plotted By: AClark
Tighe & Bond, Inc. J:\G\G5012\G5012-002 Gunnery Math & Science\Drawings_Figures\AutoCAD\Figures\G5012-02-WQA-FIGURE.dwg

Tighe&Bond
Consulting Engineers
Environmental Specialists

Project Name: **The Frederick Gunn School - Center for Innovation and Active Citizenship**
Project Number: **G5012-002**
Project Location: **Washington, CT**
Description: **Water Quality Flow**
Prepared By: **AVC** Date: **January 24, 2022**

Water Quality Area 1 (WQA-1)
Required Water Quality Volume (WQv)

Total Area in acres (A)	=	0.562
Impervious Area in acres	=	0.100
Pecenct of Impervious Area (I)	=	18
Volumetric Runoff Coefficient (R)		

R = 0.05+0.009(I) = 0.210

WQv = $\frac{(1")(R)(A)}{12}$ = **0.0098 ac*ft** = **429 cf**

Calculated in accordence with the 2004 Connecticut Stormwater Quality Manual Sections 7.4.1 and 7.4.2

Tighe&Bond
Consulting Engineers
Environmental Specialists

Project Name: **The Frederick Gunn School - Center for Innovation and Active Citizenship**
Project Number: **G5012-002**
Project Location: **Washington, CT**
Description: **Water Quality Flow**
Prepared By: **AVC** Date: **January 24, 2022**

Water Quality Area 2A (WQA-2A)
Required Water Quality Volume (WQv)

Total Area in acres (A)	=	0.491
Impervious Area in acres	=	0.070
Pecenct of Impervious Area (I)	=	14
Volumetric Runoff Coefficient (R)		

R = 0.05+0.009(I) = 0.178

WQv = (1")(R)(A) / 12 = **0.0073 ac*ft** = **318 cf**

Required Water Quality Flow (WQf)

WQv (Ac*ft)	=	0.0073
Drainage Area (Ac)	=	0.491

Q= WQv*12 / DA = **0.178 in**

Runoff Depth in inches (Q)	=	**0.178** in
Design Precipitation in inches (P)	=	**1** in

CN=1000/[10+5*P+10Q-10*(Q^2+1.25QP)^1/2] = **85 CN**

From table 4-1 in chapter 4, TR-55

I_a = **0.353 in**
I_a / P = **0.353**

From Exhibit 4-11 in chapter 4, TR-55

q_u = **550 csm/in**

Unit peak discharge in csm/in (q_u)	=	**550**
Area in square miles (A)	=	**0.001**
Runoff Depth in inches (Q)	=	**0.178**

WQF=q_u*A*Q = **0.075 cfs**

Calculated in accordence with the 2004 Connecticut Stormwater Quality Manual Sections 7.4.1 and 7.4.2

Tighe&Bond
Consulting Engineers
Environmental Specialists

Project Name: **The Frederick Gunn School - Center for Innovation and Active Citizenship**
Project Number: **G5012-002**
Project Location: **Washington, CT**
Description: **Water Quality Flow**
Prepared By: **AVC** Date: **January 24, 2022**

Water Quality Area 2B (WQA-2B)
Required Water Quality Volume (WQv)

Total Area in acres (A)	=	0.136
Impervious Area in acres	=	0.045
Pecenct of Impervious Area (I)	=	33
Volumetric Runoff Coefficient (R)		

R = 0.05+0.009(I) = 0.348

WQv = (1")(R)(A) / 12 = **0.0039 ac*ft** = **172 cf**

Required Water Quality Flow (WQf)

WQv (Ac*ft)	=	0.0039
Drainage Area (Ac)	=	0.136

Q= WQv*12 / DA = **0.348 in**

Runoff Depth in inches (Q)	=	**0.348** in
Design Precipitation in inches (P)	=	**1** in

CN=1000/[10+5*P+10Q-10*(Q²+1.25QP)^½] = **91 CN**

From table 4-1 in chapter 4, TR-55

I_a = **0.198 in**
I_a / P = **0.198**

From Exhibit 4-11 in chapter 4, TR-55

q_u = **625 csm/in**

Unit peak discharge in csm/in (q_u)	=	**625**
Area in square miles (A)	=	**0.000**
Runoff Depth in inches (Q)	=	**0.348**

WQF=q_u*A*Q = **0.046 cfs**

Calculated in accordence with the 2004 Connecticut Stormwater Quality Manual Sections 7.4.1 and 7.4.2

Available Models

CDS Model	Treatment Capacity[3] (cfs)	Maximum Sediment Storage Capacity (CF)
1515	1.0	26
w/ 1' added sump	1.0	33
w/ 2' added sump	1.0	40
w/ 3' added sump	1.0	47
2015_4	1.4	50
w/ 1' added sump	1.4	63
w/ 2' added sump	1.4	75
w/ 3' added sump	1.4	88
2015	1.4	79
w/ 1' added sump	1.4	98
w/ 2' added sump	1.4	118
2020	2.2	90
w/ 1' added sump	2.2	110
w/ 2' added sump	2.2	129
2025	3.2	97
w/ 1' added sump	3.2	117
w/ 2' added sump	3.2	136
3020	3.9	134
w/ 1' added sump	3.9	163
w/ 2' added sump	3.9	191
3030	6.1	157
w/ 1' added sump	6.1	185
w/ 2' added sump	6.1	213
4030	7.9	329
w/ 1' added sump	7.9	379
w/ 2' added sump	7.9	429
4040	12.4	381
w/ 1' added sump	12.4	431
w/ 2' added sump	12.4	482

1. Structure diameter represents the typical inside dimension of the concrete structure. Offline systems will require additional concrete diversion components
2. Depth below pipe can vary to accommodate site specific design. Depth below pipe invert represents the depth from the pipe invert to the inside bottom of concrete structure.
3. Treatment Capacity is based on laboratory testing using OK-110 (average d50 particle size of approximately 100 microns) and a 2400 micron screen.

Sediment Depths Indicating Required Servicing*

CDS Model	Standard Sediment Depth (in.)	w/ 1' added Sump Sediment Depth (in.)	w/ 2' added Sump Sediment Depth (in.)
1515	18	27	36
2015_4	18	30	42
2015	18	30	42
2020	18	30	42
2025	18	30	42
3020	18	30	42
3030	18	39	42
4030	27	39	51
4040	27	39	51

* Based on 75% capacity of isolated sump.