Stormwater Management Report

Existing Manufacturing/Warehouse Building
Proposed Trailer Expansion Area

40 Wisconsin Avenue
Norwich, Connecticut

New Park Avenue
Franklin, Connecticut

Prepared for:

The Grossman Companies

Prepared By:

F. A. Hesketh & Associates, Inc
East Granby, CT

April 27, 2021

TABLE OF CONTENTS

1. Introduction

This stormwater management report has been prepared to demonstrate that the stormwater management practices for the proposed re-development project adequately manage stormwater runoff, incorporate measures to protect adjacent landowners from adverse stormwater impacts and that the practices meet the Hydrologic Sizing Criteria for Stormwater Treatment Practices for capturing and treating the minimum deep-recommended water quality volume set forth in the 2004 Connecticut Stormwater Quality Manual.

The proposed development will employ a storm-drain system which will convey runoff to an underground stormwater detention facility. The detention system will outlet through a wall penetration into rip-rap plunge pool and level spreader before discharging to an upland area adjacent to down-gradient wetlands.

Proposed storm-drainage systems have been designed to convey all runoff from the proposed trailer storage area to the detention system for the 25-year storm event. Hydraflow Storm Sewers software was utilized in the design of the storm-drain systems.

The pre- and post-developed conditions peak rates of discharge were analyzed using Hydraflow Hydrographs software. The post-developed peak rates of runoff were compared to the pre-developed peak rates of runoff at the same design points. The analysis demonstrates no increase in peak flow due to the proposed development and no adverse impact to down gradient or adjacent properties.

2. Project Description

The project is proposed on a parcel of land totaling approximately 25.8 acres, 11.3 acres of which are located in the Town of Franklin and 14.5 acres in Norwich. The town line roughly bisects the site in a general east-west direction. The majority of the existing site improvements are located in Norwich, including existing access drives, perimeter drive, paved parking and loading areas, and the building structure itself. Only a small portion of the rear access drive crosses the boundary between Norwich and Franklin (in the area adjacent to the east corner of the building). Other than parking area restriping, no other improvements are proposed in Norwich. Improvement related to construction of the trailer storage area are in Franklin.

The improvements consist of the construction of a new, 182-space tractor trailer storage area and associated grading and drainage improvements. With the exception of interconnection of the trailer parking access aisles with the existing perimeter access drive in the rear of the building, the vast majority of the construction activities are proposed in the Town of Franklin. The minor work associated with the access drive will not alter current drainage patterns for the

existing site improvements. Current drainage patterns associated with the existing access drives, perimeter drive, paved parking and loading areas, and the building structure itself will not be altered. There are, therefore, no changes to drainage patterns associates with these existing improvements. As such, analysis presented in this report is focused on the proposed improvements.

The overall stormwater management design related to the new improvements incorporates an underground stormwater management system comprised of parabolic gallies and a concrete outlet structure. The underground system will include a total of 260 Stormtech SC-740 chambers with a total underground storage capacity of 19,474 cubic feet. Conventional storm-drainage systems comprised of catch basins, manholes and culverts will convey runoff into the underground system. The underground system is sized to be large enough to capture and treat the minimum CT DEEP-recommended Water Quality Volume, as well as detain a sufficient volume of runoff to mitigate peak rates due to the proposed increase in impervious area.

Design of the underground system and associated conveyance piping included a hydrologic analysis using Hydraflow Hydrographs and Hydraflow Storm Sewer software.

3. Hydrologic Analysis

In accordance with town and state requirements and sound engineering practice, the proposal will incorporate measures for attenuation of peak stormwater flows associated with the re-development. These management practices include incorporation of an underground stormwater detention facility and outlet structure.

The underground detention facility has been engineered to provide sufficient storage volume to attenuate any increase in peak flow rates due to development. In accordance with town regulations, the system has been designed to attenuate peak discharge for storms events of 2, 5, 10, 25, 50 and 100-year return periods. For these return periods, post-developed condition off-site peak discharge rates will be slightly lower than pre-developed off-site peak discharge rates.

METHODOLOGIES

Hydrologic analysis was conducted for both the existing condition and the proposed developed condition of the site to determine peak flow of runoff under both conditions. The Rational Method was used to determine peak flows for pre- and post-redeveloped conditions utilizing Hydraflow Hydrographs 2007 computer software for the runoff analysis. An ascending limb factor of 1.0 and a receding limb factor of 1.667 was used in generating the unit hydrogrqaphs.

Times of concentration (Tc) were determined by utilizing the TR-55 methodology Tc Worksheets provided in the program. Input data included flow path lengths and slopes for overland sheet flow, shallow concentrated flow, and channel flow, as appropriate, and Manning roughness coefficients for each surface type along the flow path. Areas of watersheds were demined by polyline delineations in the AutoCAD program. Runoff coefficients (C) were arrived at by determining the percentage of impervious, wooded, and landscaped areas within each watershed for each surface characteristic and computing a weighted average for each watershed.

Surficial soil mapping indicates that the site soils are comprised of Canton and Charlton, Charlton-Chatfield, Sutton, and Hollis-Chatfield complexes. These soils range from Hydrologic Group B to B/D. The CT DOT drainage manual has a range of Rational Method coefficients to use for selected hydrologic groups and slope ranges. (See attached Table 6-3) Based on the DOT table and inspection of the soil map and topography, the following Rational Coefficients were used in the analysis:

- For wooded areas, a C value of 0.15 was used;
- For landscaped areas, a C value of 0.20 was used; and
- For impervious areas (i.e., pavement and rooftops) a C value of 0.90 was used.

Soil web survey maps and site soil types are included in Attachment A. CT DOT Drainage Manual Table 6-3 is included in Attachment B.

In accordance with CT DOT protocol, rainfall intensity data for the project area was taken from NOAA Atlas 14 data off the NOAA website. This rainfall intensity data was used in the model. A copy of the NOAA rainfall data and the Rainfall Intensity Curve is presented in Attachment C.

The program requires inputting stage-storage relationships of detention facilities. An excel spreadsheet was used to provide stage-storage relationships of the underground detention facility based upon data provided from the manufacturer. The spreadsheet calculates stage-storage values at 6-inch depth intervals for the total number of chambers input into the spreadsheet. This data is input into the program to provide the stage-storage curve used in the model. Data on the geometry of the outlet structure, including outlet piping, orifice and weir size and flow line elevations are also input into the program. The program calculates the stage-discharge relationships from the input data. Because the area is characterized by rock outcrops, it is assumed that little to no infiltration will occur in the soils below the chambers. As such, no infiltration was modeled.

Analysis was performed for the 2-, 5-, 10-, 25-, 50- and 100-year return period storm events, using the IDF curves generated with the current NOAA Atlas 14

data for the project site. Input and output data, as well as the stage-storage calculation spreadsheet for the underground storage units are presented in Attachment D.

The Hydraflow program is based on industry standards and is accepted by the Connecticut Department of Transportation for runoff analysis. Results of analysis are summarized herein.

EXISTING CONDITIONS

The existing conditions analysis included modeling four watersheds, WS-EX-1, WS-EX-2, WS-EX-3, and WS-EX 4. WS EX-1 conveys runoff from the majority of the developed and undeveloped portion of the site, including most of the developed portion of the site in Norwich. It discharges to the contiguous wetland located at the southern border of the parcel. For modeling purposes, WS-EX-1 was modeled to Design Point 1. WS-EX-2 conveys runoff from the western half of the paved parking and loading area located south of the building. This runoff flows overland and eventually into the same receiving contiguous wetland as WS-EX-1. For modeling purposes, WS-EX-2 was modeled to Design Point 2. WS-EX-3 conveys runoff from the eastern third of the developed portion of the parcel located in Norwich to the storm-drain system located north and east of the building in Wisconsin Ave. For modeling purposes, WS-EX-3 was modeled to Design Point 3. WS-EX-4 conveys runoff from the eastern half of the paved parking and loading area located south of the building to a different storm-drain system located in Wisconsin Ave. For modeling purposes, WS-EX-4 was modeled to Design Point 4. The delineations of the existing-conditions watersheds and corresponding Design Points are shown on Figure DA-1A and Figure DA-1B.

These watersheds were analyzed to determine the peak rates of discharge under the existing site conditions. The results of analysis are summarized for each of the storm event return periods on Table 1. Detailed summary reports of analysis generated by the HydraFlow software for the existing site condition are included in Attachment D.

PROPOSED CONDITIONS

The proposed-conditions analysis included modeling four watersheds, WS-PR-1, WS-PR-2, WS-PR-3, and WS-PR-4. Watershed, WS-EX-1, is the only watershed area that will have an altered flow and is the focus of the hydrologic study. Under proposed site conditions, this watershed was divided into two subwatersheds, PR-1-UND AND PR-1-DET. The other watersheds are the same as those modeled in the existing condition analysis as there is no change in the existing condition flow patterns for these watersheds. The delineations of the proposed-conditions watersheds are shown on Figure DA-2A and Figure DA-2B.

Development within Watershed EX-1 will result in re-grading and increase in impervious area. Following development, runoff from this watershed will continue to flow in a southerly direction, towards the Design Point 1. Stormwater detention facilities will, however, be incorporated into the design to ensure that following development, the peak rate of runoff from the development area will be at or below the pre-developed peak rate of discharge of the pre-developed site. For modeling the proposed condition, WS-EX-1 was broken into two watersheds, WS-PR-1-DET, and WS-PR-UND. WS-PR-1-UND is the portion of the watershed that flows unimpeded to Design Point 1. WS-PR-1-DET is the portion of the watershed that will be directed to and detained by the underground detention system.

The runoff from the proposed trailer storage area, as well as peripheral upgradient areas (WS-PR-1-DET) will be collected in conventional storm-drain systems and discharged to the underground storage facility. Water will accumulate in the system and discharge through a concrete outlet structure. This structure is designed to buffer peak discharge rates associated with increases in impervious areas, throttle back the peak, and discharge the runoff more slowly over time in order to better simulate the pre-developed hydrologic characteristics of the site. The underground storage facility will also serve as a polishing basin to treat runoff through mechanisms of settling, infiltration and filtration, before releasing the runoff.

The program models the runoff into the underground storage facility and routes the runoff through the facility, using the stage-storage data input in the program and stage-discharge relationship calculated by inputting the outlet geometry, which includes a 24-inch outfall pipe, a 9-inch orifice and 3-foot-wide overflow weir. The program calculates the peak outflow from the structure, storage capacity and internal water elevations. The program then combines the total outflow from the detention facility with the un-detained runoff from within the same watershed to calculate the peak post-developed flow rates to Design Point 1. Several iterations were required to select the correct number and configuration of the galleys as well as the outlet geometry of the outlet structure to provide sufficient storage without overtaxing the underground system and to ensure the post-developed peak runoff would not exceed the pre-developed peak runoff peak rates were mitigated.

The results of the detailed hydrologic and hydraulic analysis are summarized on Table 1. Detailed summary reports of analysis generated by the HydraFlow software for the proposed developed site conditions are included in Attachment D.

TABLE 1

COMPARISON OF EXISTING & PROPOSED CONDITIONS OF PEAK STORM RUNOFF FROM THE DEVELOPMENT AREA		
	PEAK RUNOFF	
	EXISTING CONDITIONS C.F.S.	PROPOSED CONDITIONS C.F.S.
PEAK FLOW 2-YEAR STORM	13.50	13.37
PEAK FLOW 5-YEAR STORM	17.04	16.67
PEAK FLOW 10-YEAR STORM	20.04	19.44
PEAK FLOW 25-YEAR STORM	24.11	23.19
PEAK FLOW 50-YEAR STORM	27.27	26.11
PEAK FLOW 100-YEAR STORM	30.47	29.09

The attached calculations (Attachment D) demonstrate that the proposed development does not result in a net increase of peak rate of runoff over existing conditions peak rate of runoff for the modeled watershed area.

4. Pipe to Pipe Analysis

The configuration of the proposed storm-drain systems is depicted on Sheet GR-1 in the drawing set. For the proposed storm-drainage system, a detailed, pipe-to-pipe analysis was conducted using the Hydraflow Storm Sewers 2008 for Windows software. This software uses the Rational Method and Manning's Formula to compute peak flow to each basin, and to calculate the capacity of individual culverts.

Input data includes the geometry and configuration of the storm-drainage system, catchment area of each inlet, runoff coefficients, and times to inlet. Catchment areas were calculated based on proposed topography utilizing polyline delineations in AutoCAD. The catchment areas are depicted graphically on Figure DA-3. Weighted runoff coefficients for each catchment area were calculated based on percentages of impervious and pervious areas within each catchment area, as determined by polyline delineations in AutoCAD (i.e. areas of pavement, rooftops, and landscaped areas). A coefficient of 0.90 was used for all rooftops and impervious areas. A coefficient of 0.20 was used for landscaped areas.

Rainfall intensity data was taken from the NOAA Atlas 14 data for the subject site. A copy of the NOAA Atlas 14 data & Rainfall Intensity Curve is presented in Attachment C. Because of the relatively small catchment areas which are predominately paved, the time to inlet to each basin is assumed to be five minutes.

The pipe-to-pipe analysis was conducted for a 25-year storm event. Results of analysis are attached and include summaries of system design based on CT DOT output formats. Program input and output data reports are presented in Attachment E. The analysis indicates that all storm-drain culverts are designed to adequately convey the 25-year storm event.

5. Hydrologic Sizing Criteria for Stormwater Treatment Practices

This section presents information to demonstrate the proposed stormwater treatment practices for Water Quality Volume and follows the recommendations of the 2004 Connecticut Stormwater Quality Manual (SWQM) as presented in Chapter 7, Hydrologic Sizing Criteria for Stormwater Treatment Practices for pollutant reduction.

Water Quality Volume (WQV)

The pollutant reduction objectives for the proposed project will be met through treatment of more than the minimum required water quality volume (WQV). This will be achieved through the use of the underground detention system that will receive stormwater runoff from the majority of the developed portions of the site. The underground system is designed to capture and treat more than the DEEP-recommended minimum WQV. By capturing and treating the minimum water quality volume, the 80% TSS removal goal will be met. Summaries of calculations demonstrating achievement of the WQV recommendations are shown below.

Water Quality Volume (WQV) calculations were made for the proposed stormwater management basin, using the formula presented in Section 7.4.1 of the SWQM.

WATER QUALITY VOLUME (WQV)

WQV (AC-FT) = 1(R)(A)/12
R = (RUNOFF COEF)=.05+.009(I)
I = PERCENT IMPREVIOUS COVERAGE
A = AREA(AC)

Runoff:

Area = 5.39 Acres
Imp. Area = 4.81 Acres

I= 100%
R= 0.05 + 0.009(100) = 0.8532

Recommended WQV= 1 (0.8532) (4.81) / 12 = 0.38321 Ac-ft = 16,693 C.F.

Provided WQV in SC 740 systems = 260 units x 74.9 C.F./unit = 17,716 C.F.
@ elev. 315.0 **(WQV IS PROVIDED)**

Total WQV Provided = 17,716 C.F.

17,716 C.F. > 16,693 C.F. **(WQV IS PROVIDED)**

WATERSHED AREA MAPS

WATERSHED BOUNDARY (TYP.)

150' SHEET FLOW
n=0.4 S=11.33%

958' SHALLOW CONC. FLOW
UNPAVED, S=4.9%

Tc FLOW PATH (TYP.)

DESIGN POINT 1

DESIGN POINT 2

WS-EX-1

WS-EX-2

EXISTING MANUFACTURING/WAREHOUSE BUILDING

EXISTING BUILDING
221,742± S.F. (TOTAL FOOTPRINT)
198,475± WAREHOUSE
#40

WATERSHED AREAS (ACRES)			
WATERSHED	LANDSCAPE (C=0.20)	WOODS (C=0.15)	IMPERVIOUS (C=.90)
WS-EX-1	46,865 S.F. (1.08 Ac.)	462,692 S.F. (10.62 Ac.)	177,880 S.F. (4.08 Ac.)
WS-EX-2	35901 S.F. (0.82 Ac.)	8,677 S.F. (0.16 Ac.)	77,704 S.F. (1.78 Ac.)
WS-EX-3	39,674 S.F. (0.91 Ac.)	35,992 S.F. (0.83 Ac.)	121,353 S.F. (2.79 Ac.)
WS-EX-4	40,661 S.F. (0.93 Ac.)	55,833 S.F. (1.28 Ac.)	26,296 S.F. (0.60 Ac.)

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

OWNER: Norwich 40 TGCI LLC
859 WILLARD STREET, SUITE 501
QUINCY, MA 02169
(617) 657-5799

APPLICANT: THE GROSSMAN COMPANIES
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Revisions:

No.	Date	Description

EXISTING DRAINAGE AREAS – WEST HALF
PREPARED FOR
WISCONSIN AVENUE
WISCONSIN AVENUE
NORWICH, CONNECTICUT

Date: 04-23-2021 | Drawn by: ERW | Job no: 21126
Scale: 1" = 40' | Checked by: GAH | Sheet no: 1 OF 1

DA-1A

DESIGN POINT 2

WS-EX-1

EXISTING MANUFACTURING/WAREHOUSE BUILDING

WS-EX-2

WS-EX-2

EXISTING MANUFACTURING/WAREHOUSE BUILDING

WS-EX-3

WS-EX-4

163' SHALLOW CONC. FLOW
PAVED, S=9.82%

139' SHALLOW CONC. FLOW
PAVED, S=2.88%

Tc FLOW PATH
(TYP.)

150' SHEET FLOW
n=0.011 , S=2.67%

178' SHEET FLOW
n=0.15 , S=18%

86' SHEET FLOW
n=0.15 , S=25.6%

WATERSHED BOUNDARY
(TYP.)

DESIGN POINT 4

DESIGN POINT 4

DESIGN POINT 3

DESIGN POINT 3

WATERSHED AREAS (ACRES)

WATERSHED	LANDSCAPE (C=0.20)	WOODS (C=0.15)	IMPERVIOUS (C=.90)
WS-EX-1	46,865 S.F. (1.08 Ac.)	462,692 S.F. (10.62 Ac.)	177,880 S.F. (4.08 Ac.)
WS-EX-2	35901 S.F. (0.82 Ac.)	8,677 S.F. (0.16 Ac.)	77,704 S.F. (1.78 Ac.)
WS-EX-3	39,674 S.F. (0.91 Ac.)	35,992 S.F. (0.83 Ac.)	121,353 S.F. (2.79 Ac.)
WS-EX-4	40,661 S.F. (0.93 Ac.)	55,833 S.F. (1.28 Ac.)	26,296 S.F. (0.60 Ac.)

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Scale: 1" = 40'

DA-1B

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WATERSHED BOUNDARY (TYP.)

761' SHALLOW CONC. FLOW UNPAVED, S=6.83%

150' SHEET FLOW n=0.4 S=8.0%

WS-PR-1-UND

WS-PR-1-DET

Tc FLOW PATH (TYP.)

DESIGN POINT 1

DESIGN POINT 2

WS-P-UND-2

WS-PR-1-UND

EXISTING MANUFACTURING/WAREHOUSE BUILDING

EXISTING BUILDING
221,742± S.F. (TOTAL FOOTPRINT)
198,475± WAREHOUSE
#40

1 STORY - WAREHOUSE

TOTAL LOT AREA= 25.709± ACRES (1,120,020.19± s.f.)

(AREA IN FRANKLIN= 5.342± AC.)

N/F UNKNOWN OWNER

N/F POPPINS HILL LLC

N/F NALAS ENGINEERING SERVICES INC.

ZONE X (AREAS OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN)

ZONE A

30' WIDE PERMANENT RIGHT OF WAY & EASEMENT IN FAVOR OF THE ALGONQUIN GAS TRANSMISSION CO. BK: 258 PG: 392

WATERSHED AREAS (ACRES)			
WATERSHED	LANDSCAPE (C=0.20)	WOODS (C=0.15)	IMPERVIOUS (C=.90)
WS-P-DET	25,219 S.F. (0.58 Ac.)	–	209,613 S.F. (4.81 Ac.)
WS-P-UND-1	11,827 S.F. (0.27 Ac.)	252,882 S.F. (5.81 Ac.)	187,781 S.F. (4.31 Ac.)
WS-P-UND-2	35901 S.F. (0.82 Ac.)	8,677 S.F. (0.16 Ac.)	77,704 S.F. (1.78 Ac.)
WS-P-UND-3	39,674 S.F. (0.91 Ac.)	35,992 S.F. (0.83 Ac.)	121,353 S.F. (2.79 Ac.)
WS-P-UND-4	40,661 S.F. (0.93 Ac.)	55,833 S.F. (1.28 Ac.)	26,296 S.F. (0.60 Ac.)

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PROPOSED DRAINAGE AREAS – WEST HALF
PREPARED FOR
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WISCONSIN AVENUE
NORWICH, CONNECTICUT

Date: 04-23-2021 | Drawn by: ERW | Job no: 21126
Scale: 1" = 40' | Checked by: GAH | Sheet no: 1 OF 1

DA-2A

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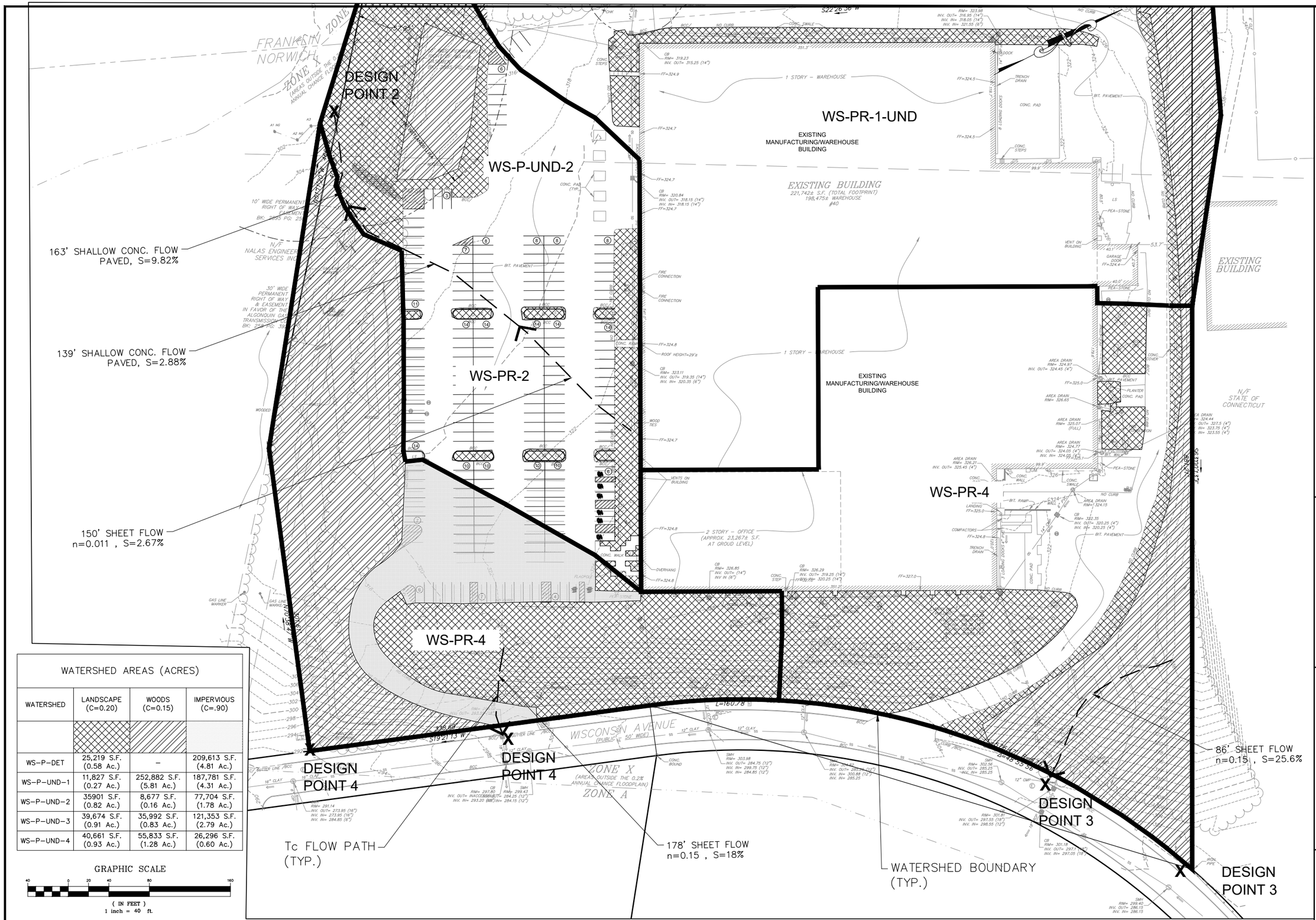

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DA-2B

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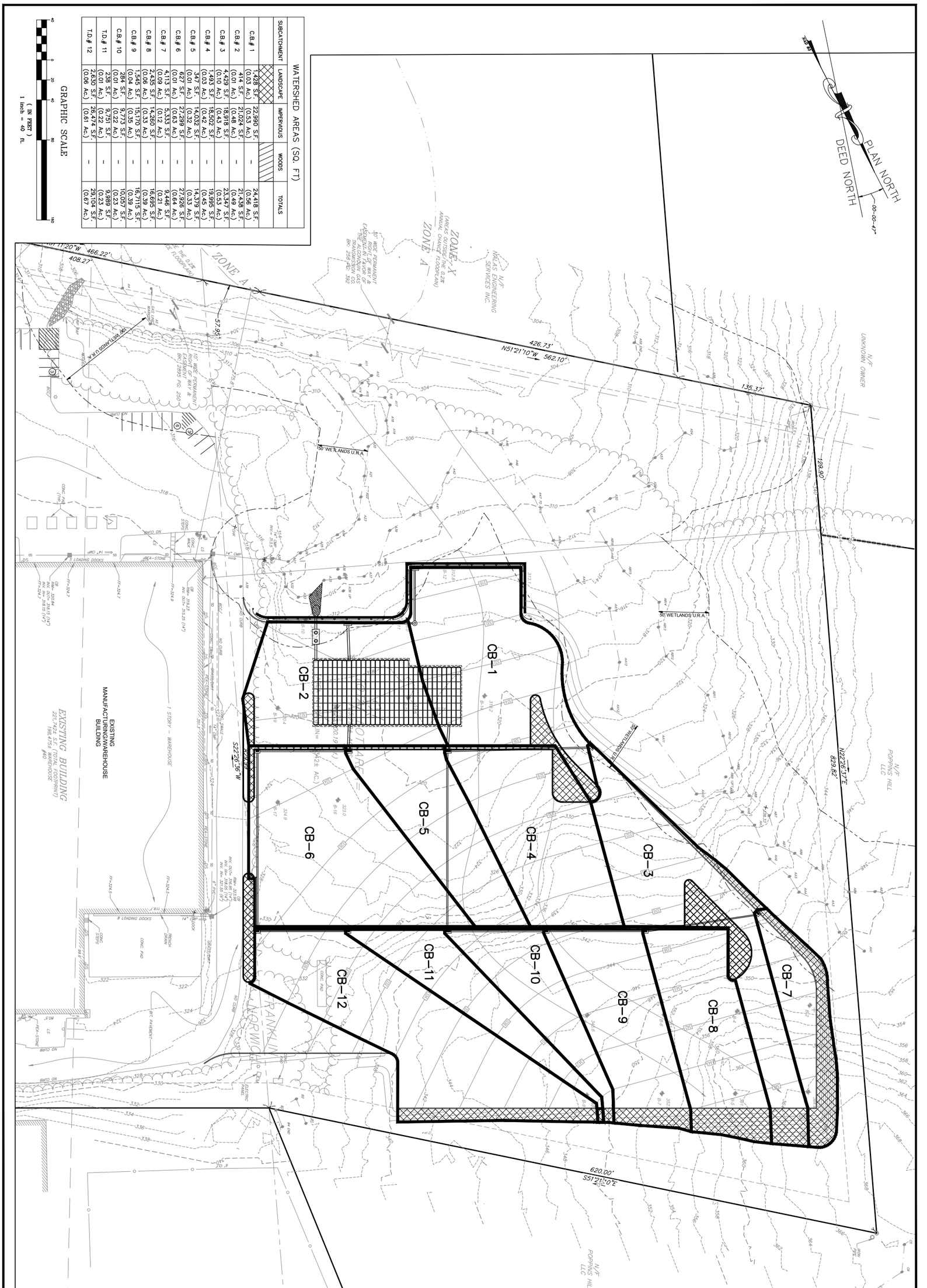

WATERSHED AREAS (SQ. FT)

SUBCATCHMENT	LANDSCAPE	IMPERVIOUS	WOODS	TOTALS
C.B.# 1	1,428 S.F. (0.03 Ac.)	22,990 S.F. (0.53 Ac.)	–	24,418 S.F. (0.56 Ac.)
C.B.# 2	414 S.F. (0.01 Ac.)	21,024 S.F. (0.48 Ac.)	–	21,438 S.F. (0.49 Ac.)
C.B.# 3	4,429 S.F. (0.10 Ac.)	18,918 S.F. (0.43 Ac.)	–	23,347 S.F. (0.53 Ac.)
C.B.# 4	1,493 S.F. (0.03 Ac.)	16,502 S.F. (0.38 Ac.)	–	18,995 S.F. (0.44 Ac.)
C.B.# 5	347 S.F. (0.01 Ac.)	14,032 S.F. (0.32 Ac.)	–	14,379 S.F. (0.33 Ac.)
C.B.# 6	627 S.F. (0.01 Ac.)	27,299 S.F. (0.63 Ac.)	–	27,926 S.F. (0.64 Ac.)
C.B.# 7	4,113 S.F. (0.09 Ac.)	5,333 S.F. (0.12 Ac.)	–	9,446 S.F. (0.21 Ac.)
C.B.# 8	2,435 S.F. (0.06 Ac.)	14,260 S.F. (0.33 Ac.)	–	16,695 S.F. (0.39 Ac.)
C.B.# 9	1,545 S.F. (0.04 Ac.)	15,170 S.F. (0.35 Ac.)	–	16,7115 S.F. (0.39 Ac.)
C.B.# 10	284 S.F. (0.01 Ac.)	9,773 S.F. (0.22 Ac.)	–	10,057 S.F. (0.23 Ac.)
T.D.# 11	238 S.F. (0.01 Ac.)	9,751 S.F. (0.22 Ac.)	–	9,989 S.F. (0.23 Ac.)
T.D.# 12	2,630 S.F. (0.06 Ac.)	26,474 S.F. (0.61 Ac.)	–	29,104 S.F. (0.67 Ac.)

DA-3

PROPOSED CB DRAINAGE AREAS
PREPARED FOR
WISCONSIN AVENUE
WISCONSIN AVENUE
NORWICH, CONNECTICUT

Date: *04-23-2021* | Drawn by: *ERN* | Job no: *21126*
Scale: *1" = 40'* | Checked by: *GAH* | Sheet no: *1 OF 1*

Revisions:

No.	Date	Description

APPLICANT: THE GROSSMAN COMPANIES
ONE ADAMS PLACE
859 WILLARD STREET, SUITE 501
QUINCY, MA 02169
(617) 657-5799

OWNER: Norwich 40 TGCI LLC
859 WILLARD STREET, SUITE 501
QUINCY, MA 02169
(617) 657-5799

F. A. Hesketh & Associates, Inc.
3 Creamery Brook, East Granby, CT 06026
Phone (860) 653-8000 Fax (860) 844-8600
Civil & Traffic Engineers • Surveyors • Planners • Landscape Architects
www.fahesketh.com • mail@fahesketh.com

Q:\2020\20154-Wisconsin Ave Norwich\2021-04-23\WS DA-1 2021-04-23.dwg, DA-3-west half, Apr. 29, 2021 - 11:23:43 AM

ATTACHMENT A

Soil Types Map

Soil Map—State of Connecticut

Map Scale: 1:5,130 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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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: Mar 20, 2019—Mar 27, 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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	1.5	3.4%
52C	Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony	5.0	10.9%
62C	Canton and Charlton fine sandy loams, 3 to 15 percent slopes, extremely stony	0.4	0.9%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	17.0	37.4%
73E	Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky	1.5	3.2%
75C	Hollis-Chatfield-Rock outcrop complex, 3 to 15 percent slopes	0.1	0.2%
75E	Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes	3.0	6.5%
306	Udorthents-Urban land complex	17.1	37.5%
Totals for Area of Interest		**45.5**	**100.0%**

ATTACHMENT B

CT DOT Drainage Manual – Table 6-3

The final element to be factored into the determination of runoff coefficients is the land slope. As the slope of the drainage basin increases, the selected C value should also increase. This is caused by the fact that as the slope of the drainage area increases, the velocity of overland and channel flow will increase allowing less opportunity for water to infiltrate the ground surface. Thus, more of the rainfall will become runoff from the drainage area.

In summary, it should be reiterated that in assigning a value to the runoff coefficient for use in the rational method, the engineer must rely heavily on experience and judgement.

Table 6-3 Recommended Coefficient Of Runoff For Pervious Surfaces By Selected Hydrologic Soil Groupings And Slope Ranges

slopes:
exist: 4.9%
prop: 6.83%
avg: 5.87%

Slope	A	B	C	D
Flat (0 - 1%)	0.04-0.09	0.07-0.12	0.11-0.16	0.15-0.20
Average (2 - 6%)	0.09-0.14	0.12-0.17	0.16-0.21	0.20-0.25
Steep (Over 6%)	0.13-0.18	0.18-0.24	0.23-0.31	0.28-0.38

Source: Storm Drainage Design Manual, Erie and Niagara Counties Regional Planning Board.

Table 6-4 Recommended Coefficient Of Runoff Values For Various Selected Land Uses

Description of Area		Runoff Coefficients
Business: Downtown areas		0.70-0.95
Neighborhood areas		0.50-0.70
Residential:	Single-family areas	0.30-0.50
	Multi units, detached	0.40-0.60
	Multi units, attached	0.60-0.75
	Suburban	0.25-0.40
Residential (0.5 ha (1.2 ac) lots or more)		0.30-0.45
Apartment dwelling areas		0.50-0.70
Industrial:	Light areas	0.50-0.80
	Heavy areas	0.60-0.90
Parks, cemeteries		0.10-0.25
Playgrounds		0.20-0.40
Railroad yard areas		0.20-0.40
Unimproved areas		0.10-0.30

ATTACHMENT C

NOAA Rainfall Data

NOAA Atlas 14, Volume 10, Version 3
Location name: Norwich, Connecticut, USA*
Latitude: 41.5788°, Longitude: -72.1147°
Elevation: 320.98 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/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.02** (3.08-5.18)	**4.80** (3.68-6.19)	**6.08** (4.64-7.86)	**7.14** (5.42-9.26)	**8.60** (6.35-11.5)	**9.71** (7.03-13.2)	**10.8** (7.64-15.2)	**12.1** (8.14-17.2)	**13.9** (9.01-20.3)	**15.4** (9.74-22.8)
10-min	**2.85** (2.18-3.67)	**3.40** (2.61-4.39)	**4.31** (3.29-5.57)	**5.06** (3.85-6.56)	**6.09** (4.49-8.17)	**6.87** (4.97-9.36)	**7.69** (5.41-10.8)	**8.59** (5.76-12.2)	**9.86** (6.38-14.4)	**10.9** (6.90-16.2)
15-min	**2.24** (1.72-2.88)	**2.67** (2.04-3.44)	**3.38** (2.58-4.36)	**3.97** (3.02-5.15)	**4.78** (3.52-6.40)	**5.39** (3.90-7.34)	**6.03** (4.24-8.44)	**6.74** (4.52-9.58)	**7.74** (5.01-11.3)	**8.55** (5.41-12.7)
30-min	**1.55** (1.19-2.00)	**1.85** (1.42-2.38)	**2.34** (1.79-3.03)	**2.75** (2.09-3.57)	**3.31** (2.44-4.44)	**3.74** (2.70-5.09)	**4.18** (2.94-5.85)	**4.67** (3.13-6.64)	**5.36** (3.47-7.83)	**5.93** (3.75-8.79)
60-min	**0.991** (0.760-1.28)	**1.18** (0.907-1.53)	**1.50** (1.14-1.94)	**1.76** (1.34-2.28)	**2.12** (1.56-2.84)	**2.39** (1.73-3.25)	**2.67** (1.88-3.74)	**2.98** (2.00-4.24)	**3.43** (2.22-5.00)	**3.79** (2.40-5.62)
2-hr	**0.646** (0.498-0.826)	**0.768** (0.592-0.984)	**0.968** (0.744-1.24)	**1.13** (0.866-1.46)	**1.36** (1.01-1.82)	**1.53** (1.12-2.08)	**1.72** (1.22-2.40)	**1.93** (1.30-2.72)	**2.23** (1.45-3.24)	**2.49** (1.58-3.66)
3-hr	**0.500** (0.387-0.637)	**0.593** (0.458-0.757)	**0.746** (0.575-0.954)	**0.873** (0.669-1.12)	**1.05** (0.781-1.39)	**1.18** (0.862-1.59)	**1.32** (0.940-1.84)	**1.48** (0.998-2.08)	**1.72** (1.12-2.49)	**1.93** (1.23-2.83)
6-hr	**0.321** (0.249-0.406)	**0.380** (0.295-0.482)	**0.477** (0.369-0.606)	**0.557** (0.429-0.711)	**0.668** (0.500-0.883)	**0.750** (0.552-1.01)	**0.839** (0.602-1.16)	**0.943** (0.638-1.32)	**1.10** (0.717-1.58)	**1.23** (0.785-1.79)
12-hr	**0.200** (0.156-0.251)	**0.237** (0.185-0.298)	**0.297** (0.231-0.375)	**0.348** (0.269-0.440)	**0.417** (0.313-0.547)	**0.468** (0.346-0.625)	**0.523** (0.376-0.720)	**0.588** (0.399-0.815)	**0.683** (0.447-0.972)	**0.762** (0.488-1.10)
24-hr	**0.119** (0.093-0.148)	**0.142** (0.111-0.177)	**0.179** (0.140-0.225)	**0.210** (0.164-0.265)	**0.253** (0.191-0.330)	**0.285** (0.212-0.378)	**0.320** (0.231-0.437)	**0.360** (0.245-0.495)	**0.419** (0.275-0.592)	**0.468** (0.301-0.672)
2-day	**0.067** (0.053-0.083)	**0.080** (0.063-0.100)	**0.103** (0.081-0.128)	**0.122** (0.095-0.152)	**0.147** (0.112-0.191)	**0.166** (0.124-0.219)	**0.187** (0.136-0.255)	**0.212** (0.145-0.289)	**0.248** (0.164-0.349)	**0.280** (0.180-0.398)
3-day	**0.048** (0.038-0.059)	**0.058** (0.046-0.072)	**0.074** (0.059-0.092)	**0.088** (0.069-0.109)	**0.107** (0.081-0.138)	**0.120** (0.090-0.158)	**0.135** (0.099-0.184)	**0.153** (0.105-0.209)	**0.180** (0.119-0.252)	**0.204** (0.131-0.288)
4-day	**0.039** (0.031-0.048)	**0.047** (0.037-0.057)	**0.060** (0.047-0.074)	**0.070** (0.055-0.087)	**0.085** (0.065-0.109)	**0.096** (0.072-0.126)	**0.108** (0.079-0.146)	**0.122** (0.084-0.165)	**0.143** (0.095-0.200)	**0.162** (0.105-0.229)
7-day	**0.026** (0.021-0.032)	**0.031** (0.025-0.038)	**0.039** (0.031-0.049)	**0.046** (0.036-0.057)	**0.056** (0.043-0.071)	**0.062** (0.047-0.081)	**0.070** (0.051-0.094)	**0.079** (0.054-0.106)	**0.092** (0.061-0.128)	**0.104** (0.067-0.145)
10-day	**0.021** (0.017-0.026)	**0.025** (0.020-0.031)	**0.031** (0.025-0.038)	**0.036** (0.028-0.044)	**0.043** (0.033-0.055)	**0.048** (0.036-0.062)	**0.053** (0.039-0.071)	**0.060** (0.041-0.080)	**0.069** (0.046-0.096)	**0.077** (0.050-0.108)
20-day	**0.015** (0.012-0.018)	**0.017** (0.014-0.021)	**0.020** (0.016-0.025)	**0.023** (0.018-0.028)	**0.027** (0.021-0.033)	**0.029** (0.022-0.038)	**0.032** (0.024-0.042)	**0.035** (0.025-0.047)	**0.040** (0.026-0.054)	**0.043** (0.028-0.060)
30-day	**0.013** (0.010-0.015)	**0.014** (0.011-0.017)	**0.016** (0.013-0.020)	**0.018** (0.014-0.022)	**0.021** (0.016-0.026)	**0.022** (0.017-0.028)	**0.024** (0.018-0.031)	**0.026** (0.018-0.035)	**0.029** (0.019-0.039)	**0.031** (0.020-0.042)
45-day	**0.011** (0.008-0.013)	**0.011** (0.009-0.014)	**0.013** (0.010-0.016)	**0.014** (0.011-0.017)	**0.016** (0.012-0.020)	**0.017** (0.013-0.022)	**0.019** (0.014-0.024)	**0.020** (0.014-0.026)	**0.021** (0.014-0.029)	**0.022** (0.015-0.031)
60-day	**0.009** (0.007-0.011)	**0.010** (0.008-0.012)	**0.011** (0.009-0.013)	**0.012** (0.010-0.015)	**0.013** (0.010-0.017)	**0.015** (0.011-0.018)	**0.016** (0.011-0.020)	**0.016** (0.011-0.022)	**0.017** (0.012-0.023)	**0.018** (0.012-0.025)

[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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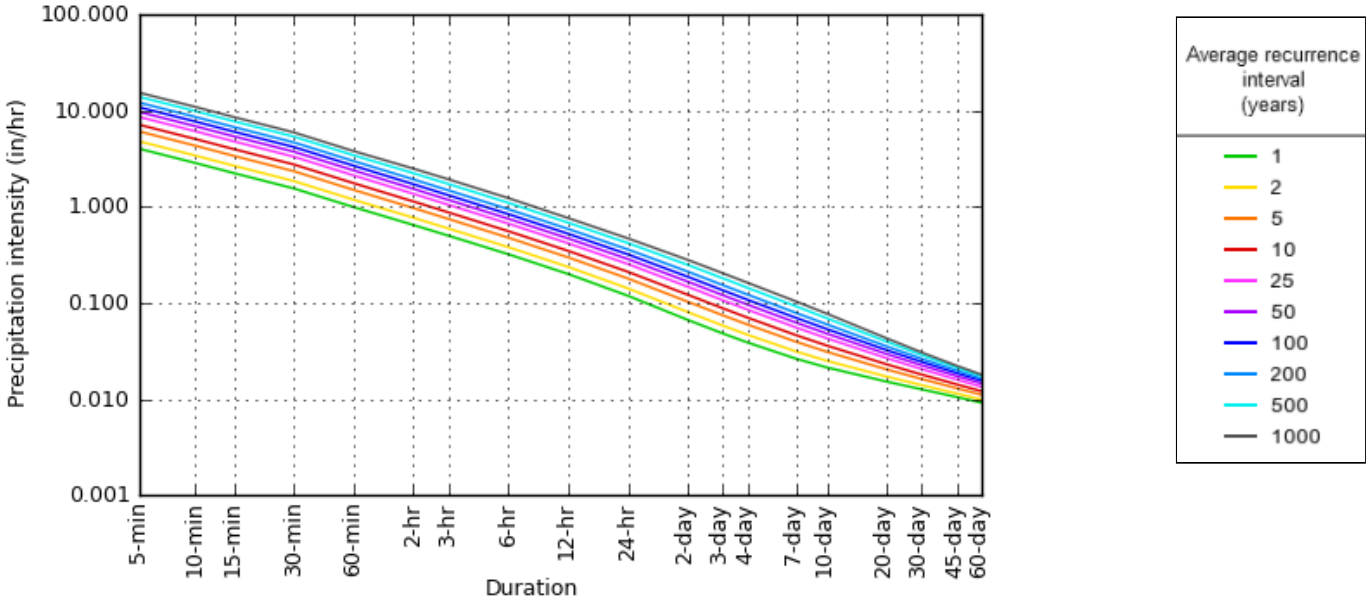
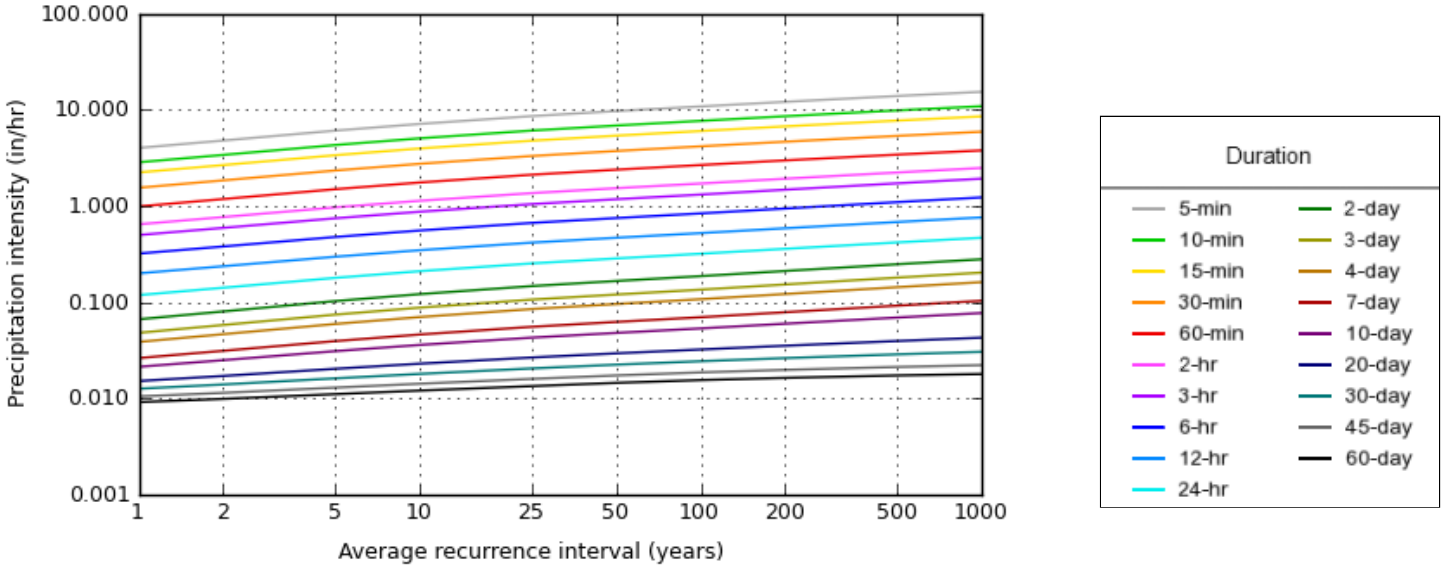
PF graphical

PDS-based intensity-duration-frequency (IDF) curves
Latitude: 41.5788°, Longitude: -72.1147°





NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Fri Apr 23 18:31:16 2021

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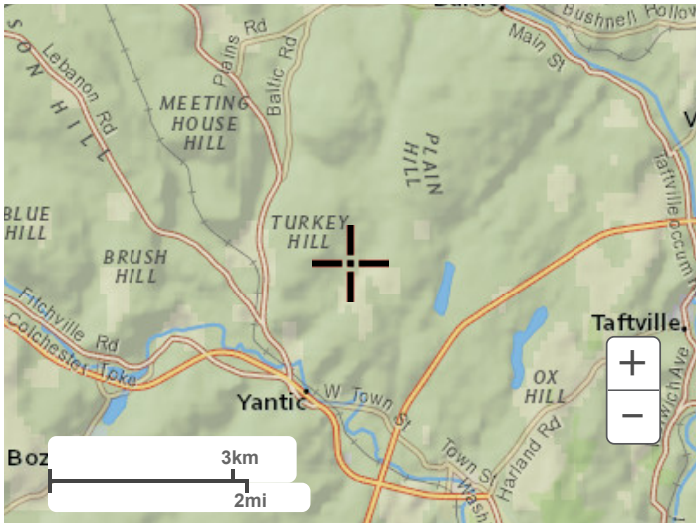
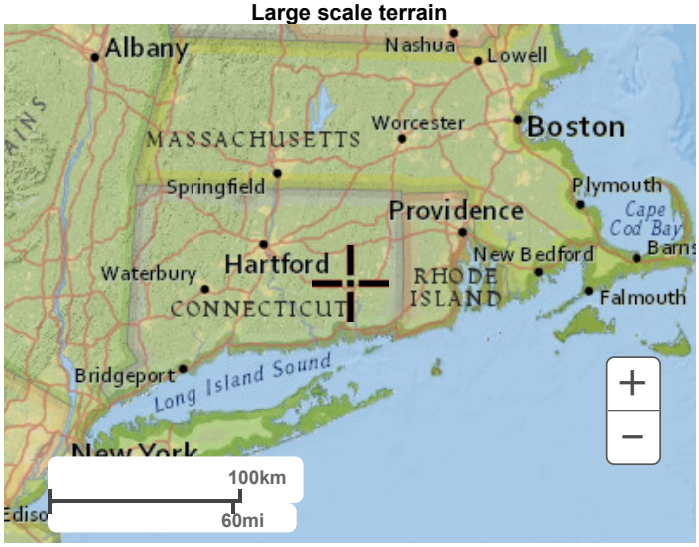
Maps & aerials

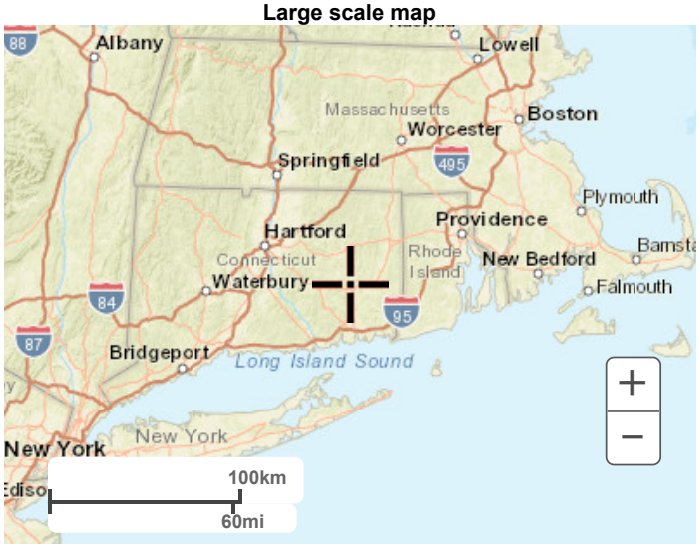
Small scale terrain



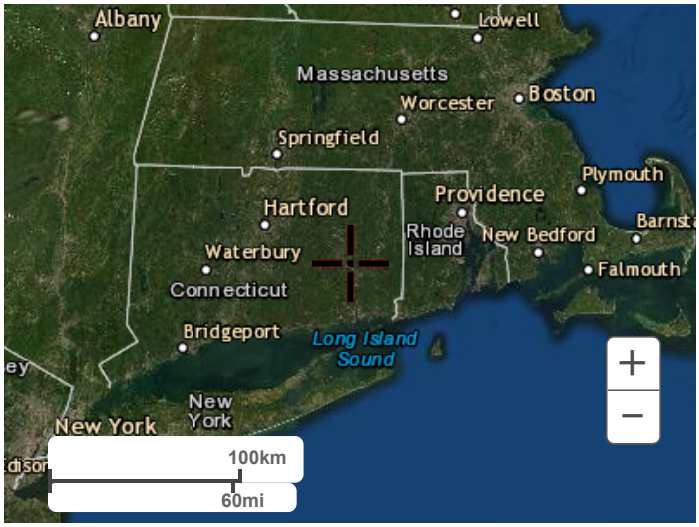
Large scale terrain



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

ATTACHMENT D

Hydrologic Analysis

Hydraflow Analysis Summary Report

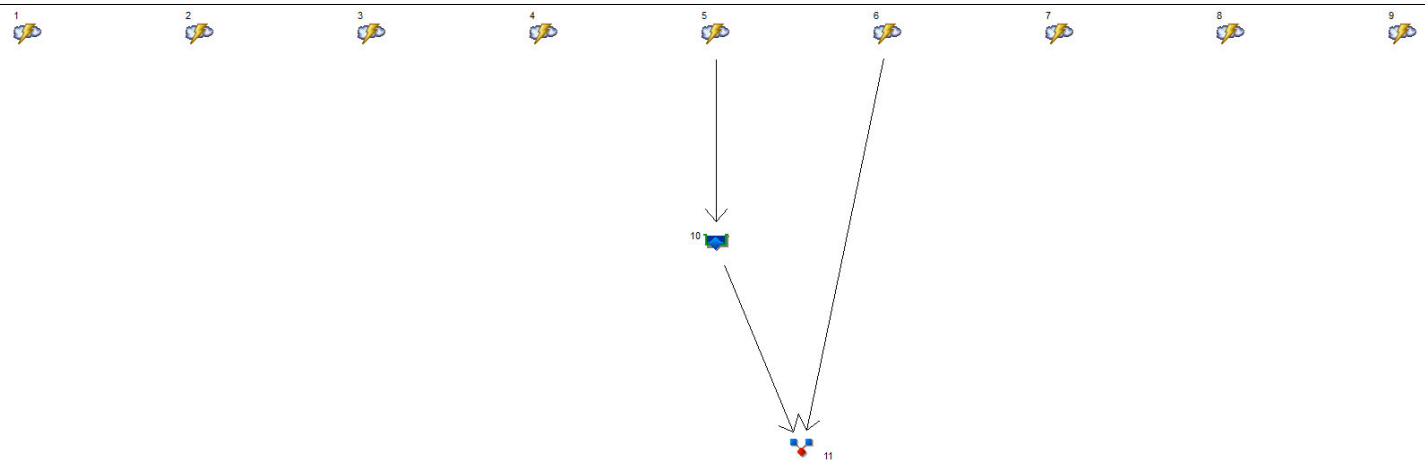
Hydraflow Table of Contents

Hydraflow-2021-04-28.gpw

Hydraflow Hydrographs by Intelisolve v9.1

Wednesday, Apr 28, 2021

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	Rational	WS-EX-1 to Design Point 1
2	Rational	WS-EX-2 to Design Point 2
3	Rational	WS-EX-3 to Design Point 3
4	Rational	WS-EX-4 to Design Point 4
5	Rational	WS-PR-1-DET
6	Rational	WS-PR-1-UND to Design Point 1
7	Rational	WS-PR-2 to Design Point 2
8	Rational	WS-PR-3 to Design Point 3
9	Rational	WS-PR-4 to Design Point 4
10	Reservoir	Outflow - UG Chambers
11	Combine	Total Proposed to Design Point 1

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.1

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	Rational	-------	-------	13.50	-------	17.04	20.04	24.11	27.27	30.47	WS-EX-1 to Design Point 1
2	Rational	-------	-------	10.33	-------	13.13	15.40	18.50	20.90	23.11	WS-EX-2 to Design Point 2
3	Rational	-------	-------	16.17	-------	20.55	24.11	28.96	32.72	36.18	WS-EX-3 to Design Point 3
4	Rational	-------	-------	4.121	-------	5.212	6.125	7.361	8.327	9.255	WS-EX-4 to Design Point 4
5	Rational	-------	-------	19.64	-------	24.84	29.19	35.08	39.69	44.11	WS-PR-1-DET
6	Rational	-------	-------	11.33	-------	14.31	16.83	20.25	22.90	25.58	WS-PR-1-UND to Design Point 1
7	Rational	-------	-------	10.33	-------	13.13	15.40	18.50	20.90	23.11	WS-PR-2 to Design Point 2
8	Rational	-------	-------	16.17	-------	20.55	24.11	28.96	32.72	36.18	WS-PR-3 to Design Point 3
9	Rational	-------	-------	4.121	-------	5.212	6.125	7.361	8.327	9.255	WS-PR-4 to Design Point 4
10	Reservoir	5	-------	2.121	-------	2.448	2.700	3.045	3.354	4.144	Outflow - UG Chambers
11	Combine	6, 10	-------	13.37	-------	16.67	19.44	23.19	26.11	29.09	Total Proposed to Design Point 1

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.1

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	Rational	13.50	1	19	20,524	----	------	------	WS-EX-1 to Design Point 1
2	Rational	10.33	1	3	2,479	----	------	------	WS-EX-2 to Design Point 2
3	Rational	16.17	1	3	3,880	----	------	------	WS-EX-3 to Design Point 3
4	Rational	4.121	1	6	1,978	----	------	------	WS-EX-4 to Design Point 4
5	Rational	19.64	1	6	9,429	----	------	------	WS-PR-1-DET
6	Rational	11.33	1	20	18,136	----	------	------	WS-PR-1-UND to Design Point 1
7	Rational	10.33	1	3	2,479	----	------	------	WS-PR-2 to Design Point 2
8	Rational	16.17	1	3	3,880	----	------	------	WS-PR-3 to Design Point 3
9	Rational	4.121	1	6	1,978	----	------	------	WS-PR-4 to Design Point 4
10	Reservoir	2.121	1	15	9,410	5	313.37	8,219	Outflow - UG Chambers
11	Combine	13.37	1	20	27,431	6, 10	------	------	Total Proposed to Design Point 1

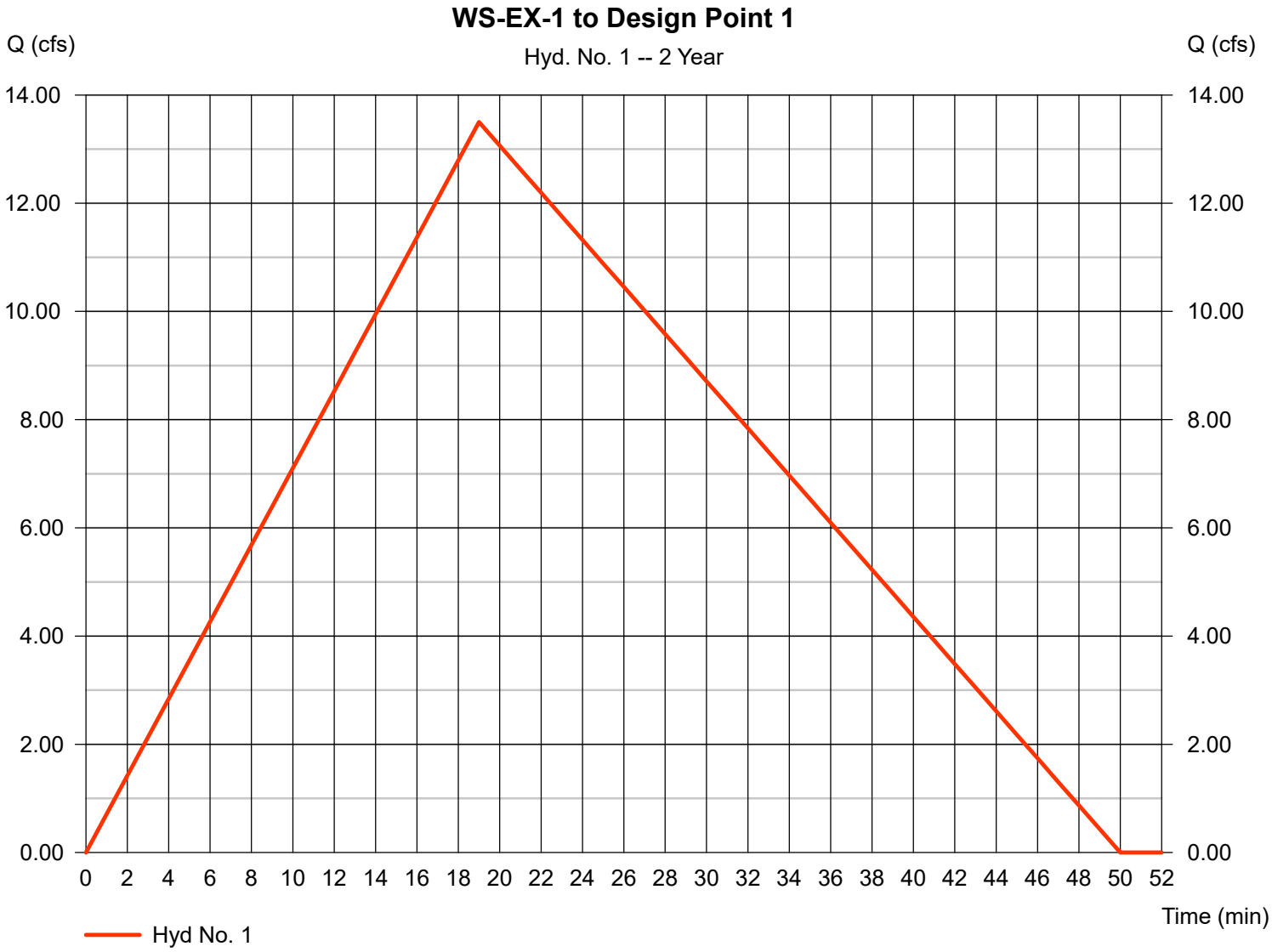
Hydrograph Report

Hyd. No. 1

WS-EX-1 to Design Point 1

Hydrograph type	=	Rational	Peak discharge	=	13.50 cfs
Storm frequency	=	2 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	20,524 cuft
Drainage area	=	15.780 ac	Runoff coeff.	=	0.35*
Intensity	=	2.445 in/hr	Tc by TR55	=	19.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(1.080 x 0.20) + (10.620 x 0.15) + (4.080 x 0.90)] / 15.780



TR55 Tc Worksheet

Hyd. No. 1

WS-EX-1 to Design Point 1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.39		0.00		0.00		
Land slope (%)	= 11.33		0.00		0.00		
Travel Time (min)	**= 14.42**	**+**	**0.00**	**+**	**0.00**	**=**	**14.42**
Shallow Concentrated Flow							
Flow length (ft)	= 958.00		0.00		0.00		
Watercourse slope (%)	= 4.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 3.57		0.00		0.00		
Travel Time (min)	**= 4.47**	**+**	**0.00**	**+**	**0.00**	**=**	**4.47**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 19.00 min

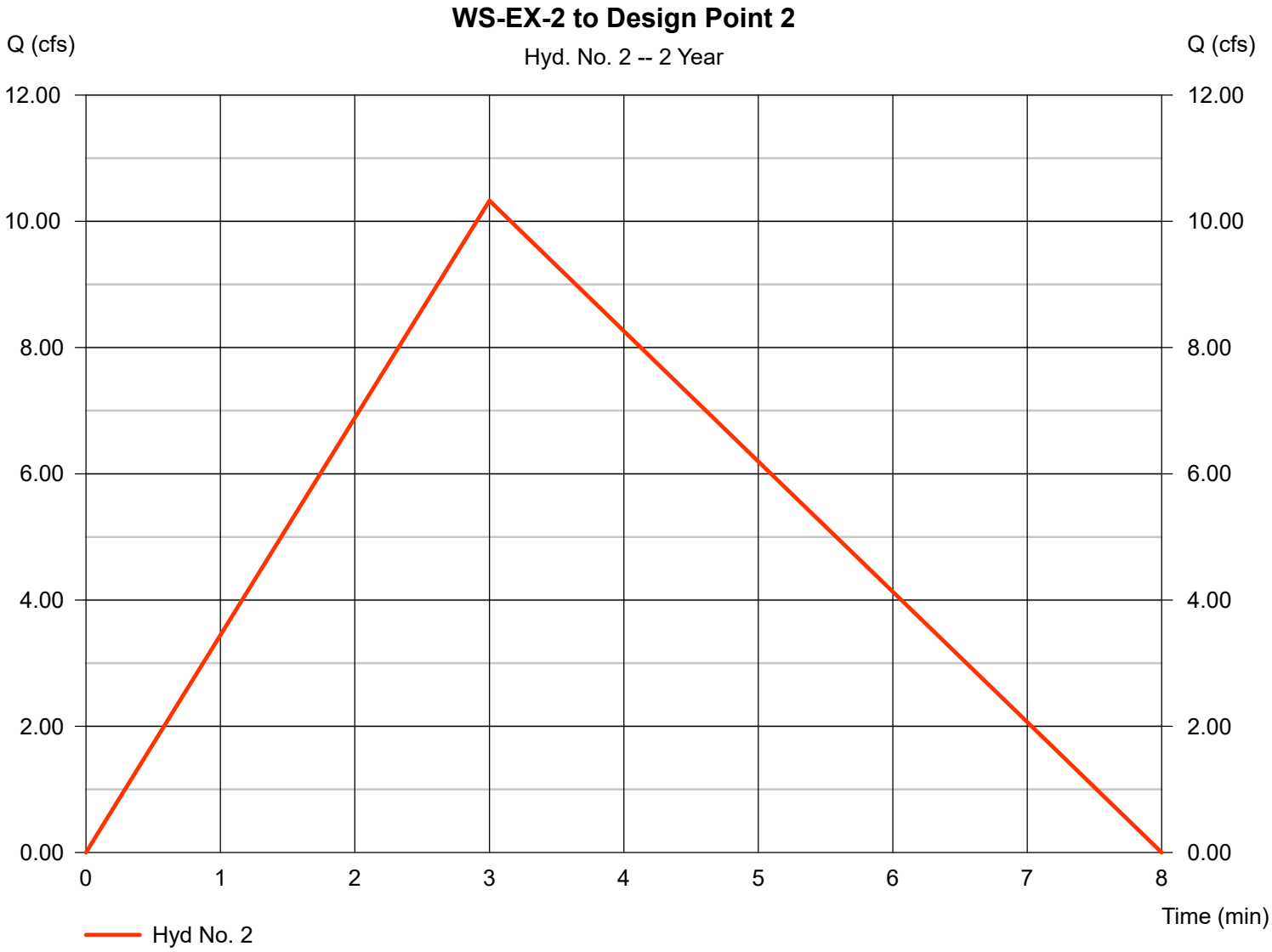
Hydrograph Report

Hyd. No. 2

WS-EX-2 to Design Point 2

Hydrograph type	=	Rational	Peak discharge	=	10.33 cfs
Storm frequency	=	2 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	2,479 cuft
Drainage area	=	2.760 ac	Runoff coeff.	=	0.65*
Intensity	=	5.756 in/hr	Tc by TR55	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.820 x 0.20) + (0.160 x 0.15) + (1.780 x 0.90)] / 2.760



TR55 Tc Worksheet

Hyd. No. 2

WS-EX-2 to Design Point 2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.39		0.00		0.00		
Land slope (%)	= 2.67		0.00		0.00		
Travel Time (min)	**= 1.45**	**+**	**0.00**	**+**	**0.00**	**=**	**1.45**
Shallow Concentrated Flow							
Flow length (ft)	= 139.00		163.00		0.00		
Watercourse slope (%)	= 2.88		9.82		0.00		
Surface description	= Paved		Unpaved		Paved		
Average velocity (ft/s)	= 3.45		5.06		0.00		
Travel Time (min)	**= 0.67**	**+**	**0.54**	**+**	**0.00**	**=**	**1.21**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 3.00 min

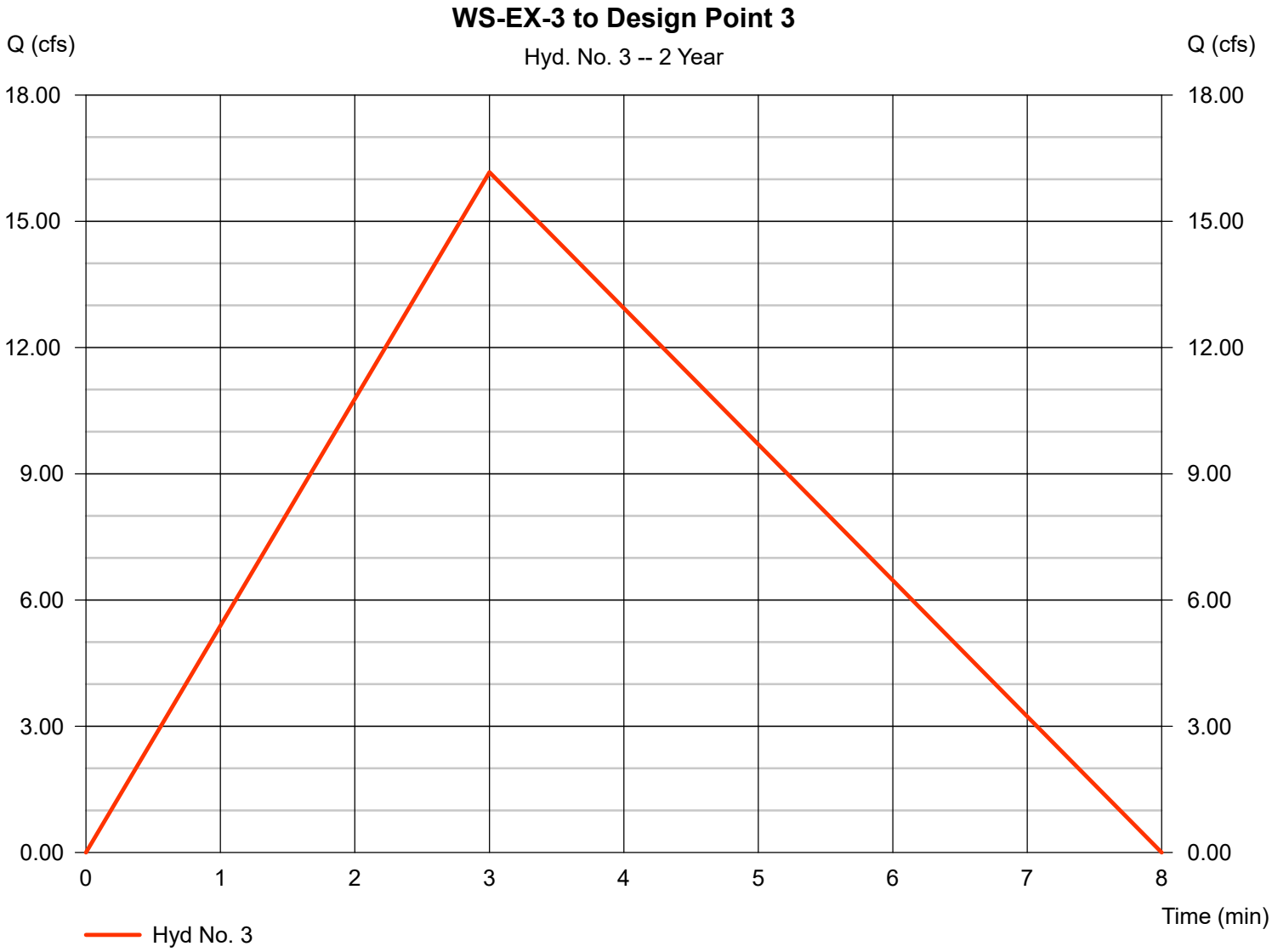
Hydrograph Report

Hyd. No. 3

WS-EX-3 to Design Point 3

Hydrograph type	=	Rational	Peak discharge	=	16.17 cfs
Storm frequency	=	2 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	3,880 cuft
Drainage area	=	4.530 ac	Runoff coeff.	=	0.62*
Intensity	=	5.756 in/hr	Tc by TR55	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.910 x 0.20) + (0.830 x 0.15) + (2.790 x 0.90)] / 4.530



TR55 Tc Worksheet

Hyd. No. 3

WS-EX-3 to Design Point 3

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 86.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.39		0.00		0.00		
Land slope (%)	= 25.60		0.00		0.00		
Travel Time (min)	**= 3.04**	**+**	**0.00**	**+**	**0.00**	**=**	**3.04**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 3.00 min

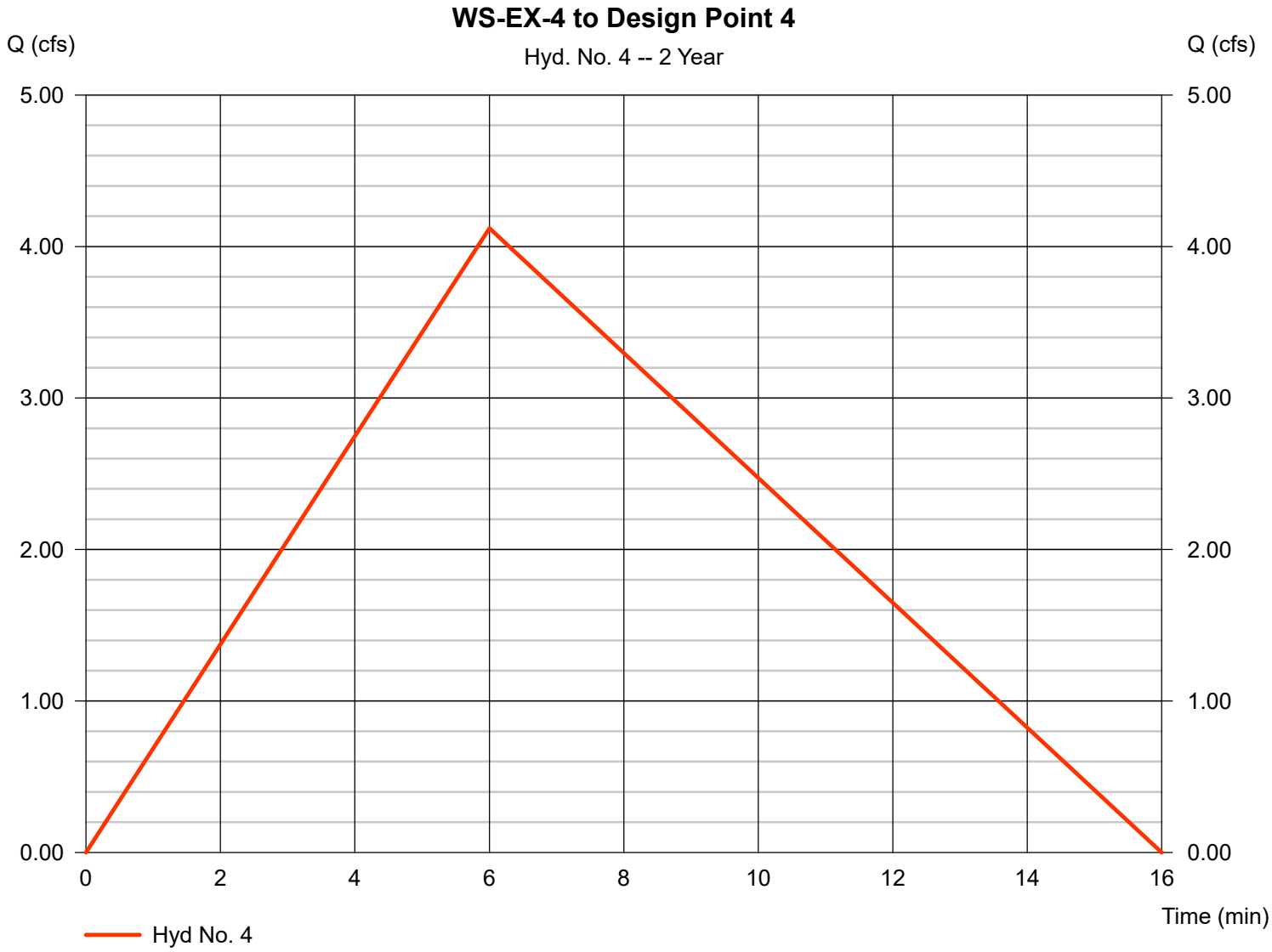
Hydrograph Report

Hyd. No. 4

WS-EX-4 to Design Point 4

Hydrograph type	=	Rational	Peak discharge	=	4.121 cfs
Storm frequency	=	2 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	1,978 cuft
Drainage area	=	2.810 ac	Runoff coeff.	=	0.33*
Intensity	=	4.444 in/hr	Tc by TR55	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.930 x 0.20) + (1.280 x 0.15) + (0.600 x 0.90)] / 2.810



TR55 Tc Worksheet

Hyd. No. 4

WS-EX-4 to Design Point 4

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 178.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.39		0.00		0.00		
Land slope (%)	= 18.00		0.00		0.00		
Travel Time (min)	**= 6.27**	**+**	**0.00**	**+**	**0.00**	**=**	**6.27**
Shallow Concentrated Flow							
Flow length (ft)	= 0.00		0.00		0.00		
Watercourse slope (%)	= 0.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	= 0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 6.00 min

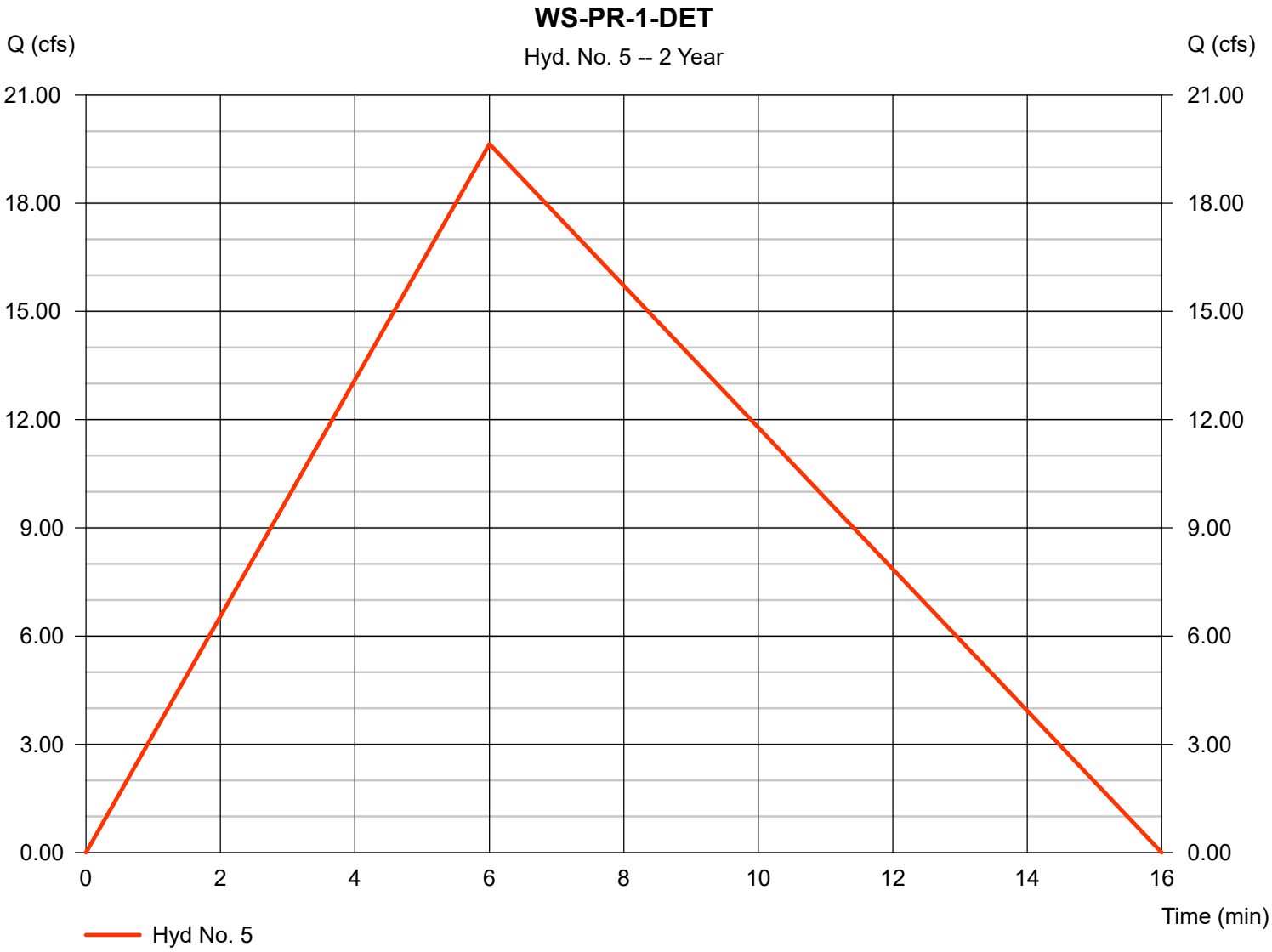
Hydrograph Report

Hyd. No. 5

WS-PR-1-DET

Hydrograph type	=	Rational	Peak discharge	=	19.64 cfs
Storm frequency	=	2 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	9,429 cuft
Drainage area	=	5.390 ac	Runoff coeff.	=	0.82*
Intensity	=	4.444 in/hr	Tc by User	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.580 x 0.20) + (4.810 x 0.90)] / 5.390



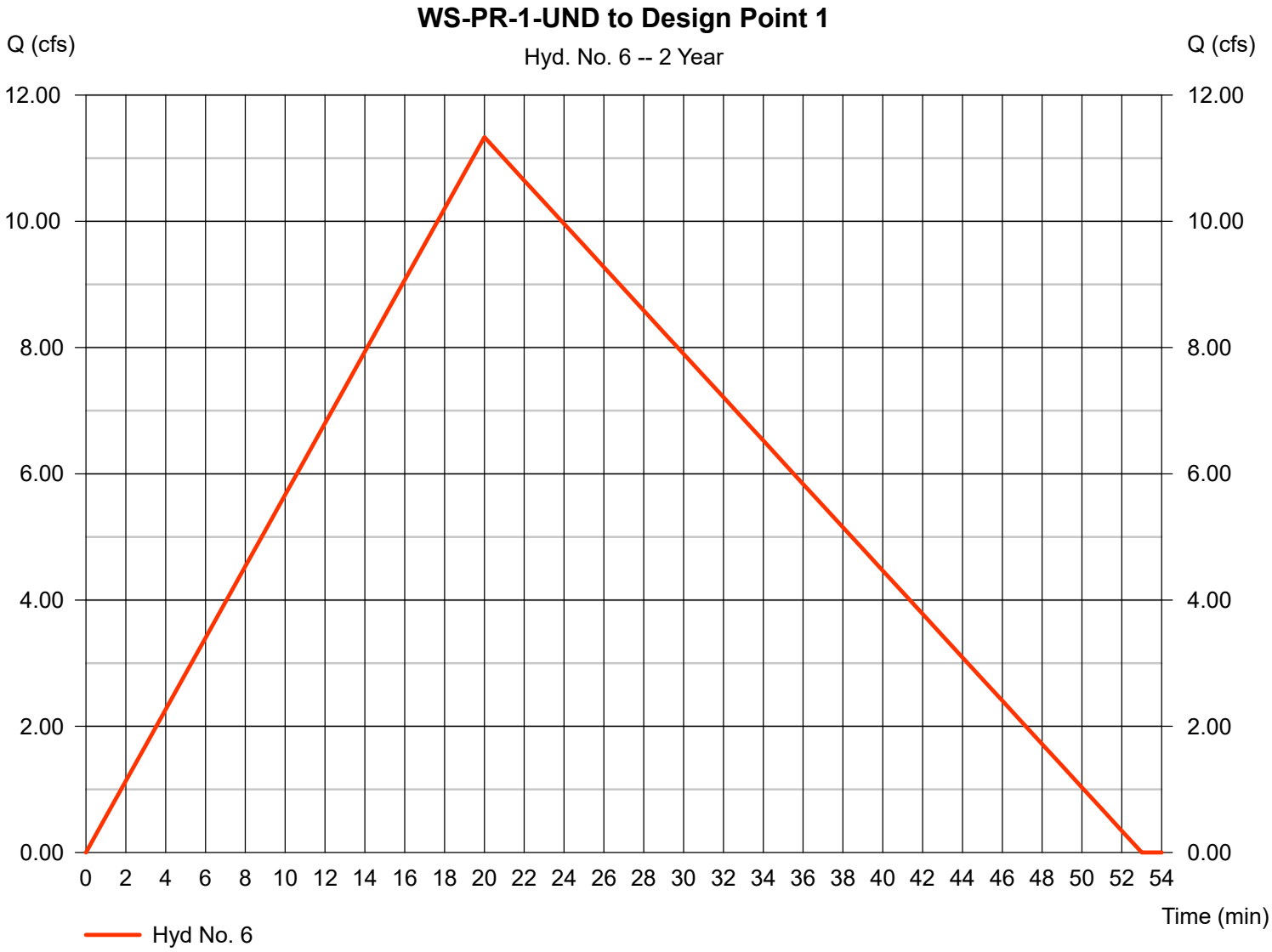
Hydrograph Report

Hyd. No. 6

WS-PR-1-UND to Design Point 1

Hydrograph type	=	Rational	Peak discharge	=	11.33 cfs
Storm frequency	=	2 yrs	Time to peak	=	20 min
Time interval	=	1 min	Hyd. volume	=	18,136 cuft
Drainage area	=	10.390 ac	Runoff coeff.	=	0.46*
Intensity	=	2.371 in/hr	Tc by TR55	=	20.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.270 x 0.20) + (5.810 x 0.15) + (4.310 x 0.90)] / 10.390



TR55 Tc Worksheet

Hyd. No. 6

WS-PR-1-UND to Design Point 1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.39		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 16.57**	**+**	**0.00**	**+**	**0.00**	**=**	**16.57**
Shallow Concentrated Flow							
Flow length (ft)	= 761.00		0.00		0.00		
Watercourse slope (%)	= 6.83		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 4.22		0.00		0.00		
Travel Time (min)	**= 3.01**	**+**	**0.00**	**+**	**0.00**	**=**	**3.01**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 20.00 min

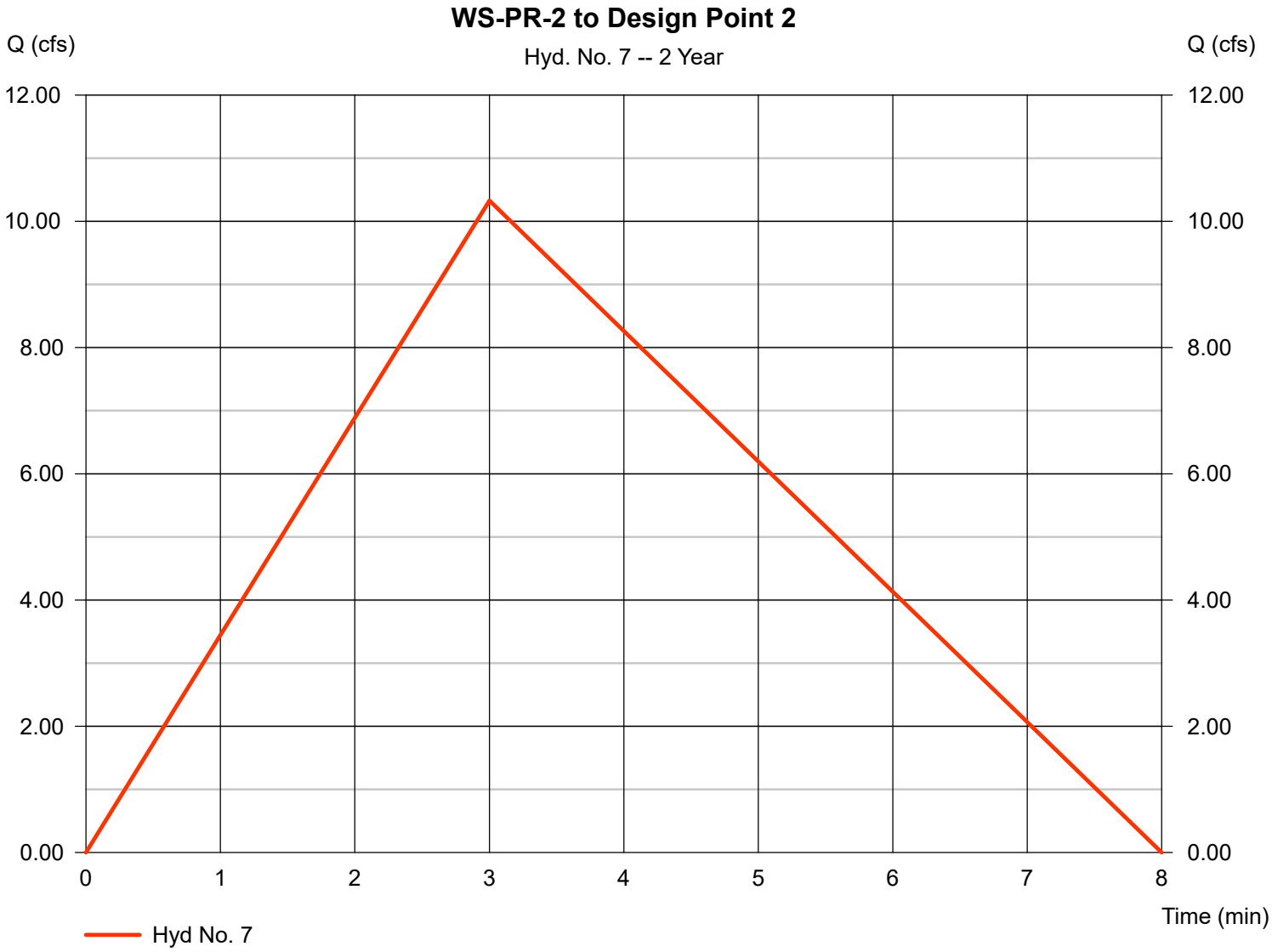
Hydrograph Report

Hyd. No. 7

WS-PR-2 to Design Point 2

Hydrograph type	=	Rational	Peak discharge	=	10.33 cfs
Storm frequency	=	2 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	2,479 cuft
Drainage area	=	2.760 ac	Runoff coeff.	=	0.65*
Intensity	=	5.756 in/hr	Tc by User	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.820 x 0.20) + (0.160 x 0.15) + (1.780 x 0.90)] / 2.760



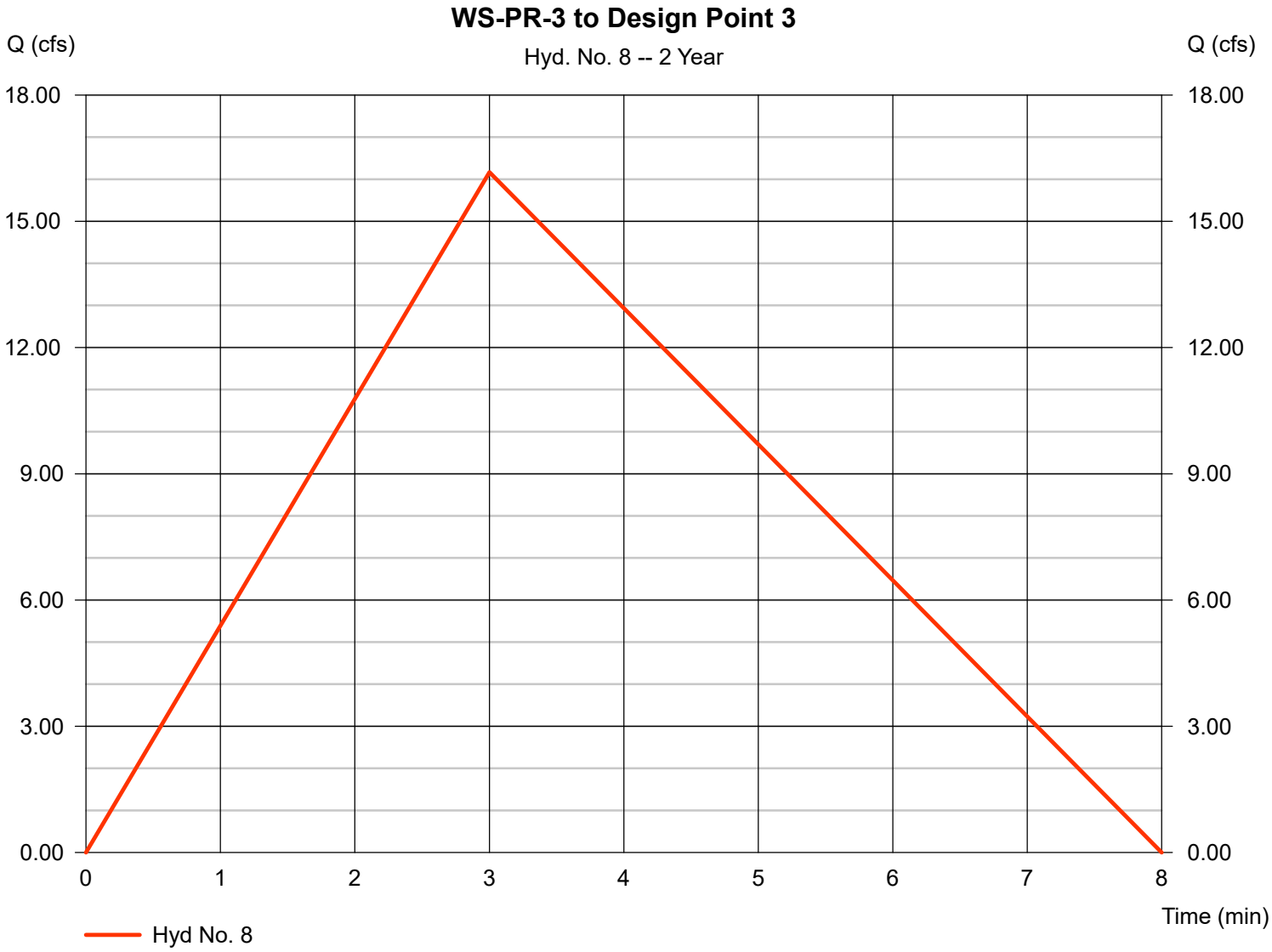
Hydrograph Report

Hyd. No. 8

WS-PR-3 to Design Point 3

Hydrograph type	=	Rational	Peak discharge	=	16.17 cfs
Storm frequency	=	2 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	3,880 cuft
Drainage area	=	4.530 ac	Runoff coeff.	=	0.62*
Intensity	=	5.756 in/hr	Tc by TR55	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.910 x 0.20) + (0.830 x 0.15) + (2.790 x 0.90)] / 4.530



TR55 Tc Worksheet

Hyd. No. 8

WS-PR-3 to Design Point 3

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 86.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.39	0.00	0.00	
Land slope (%)	= 25.60	0.00	0.00	
Travel Time (min)	**= 3.04**	**+ 0.00**	**+ 0.00**	**= 3.04**
Shallow Concentrated Flow				
Flow length (ft)	= 0.00	0.00	0.00	
Watercourse slope (%)	= 0.00	0.00	0.00	
Surface description	= Paved	Paved	Paved	
Average velocity (ft/s)	= 0.00	0.00	0.00	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	= 0.00	0.00	0.00	
Flow length (ft)	= 0.0	0.0	0.0	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**

Total Travel Time, Tc ..... 3.00 min

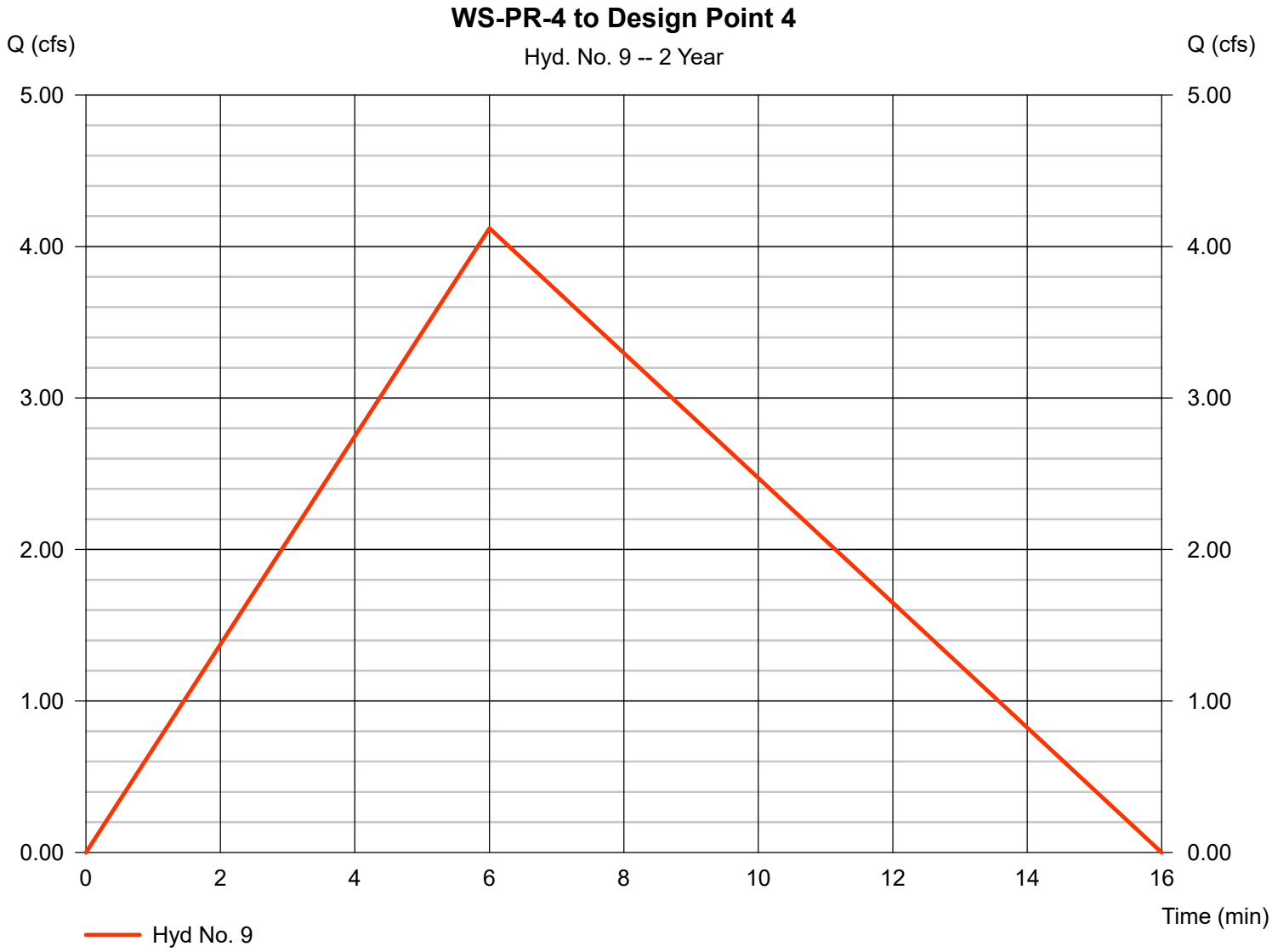
Hydrograph Report

Hyd. No. 9

WS-PR-4 to Design Point 4

Hydrograph type	=	Rational	Peak discharge	=	4.121 cfs
Storm frequency	=	2 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	1,978 cuft
Drainage area	=	2.810 ac	Runoff coeff.	=	0.33*
Intensity	=	4.444 in/hr	Tc by TR55	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.930 x 0.20) + (1.280 x 0.15) + (0.600 x 0.90)] / 2.810



TR55 Tc Worksheet

Hyd. No. 9

WS-PR-4 to Design Point 4

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	178.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.39		0.00		0.00		
Land slope (%)	=	18.00		0.00		0.00		
Travel Time (min)	**=**	**6.27**	**+**	**0.00**	**+**	**0.00**	**=**	**6.27**
Shallow Concentrated Flow								
Flow length (ft)	=	0.00		0.00		0.00		
Watercourse slope (%)	=	0.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	0.00		0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=	0.00		0.00		0.00		
Flow length (ft)	=	0.0		0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 6.00 min

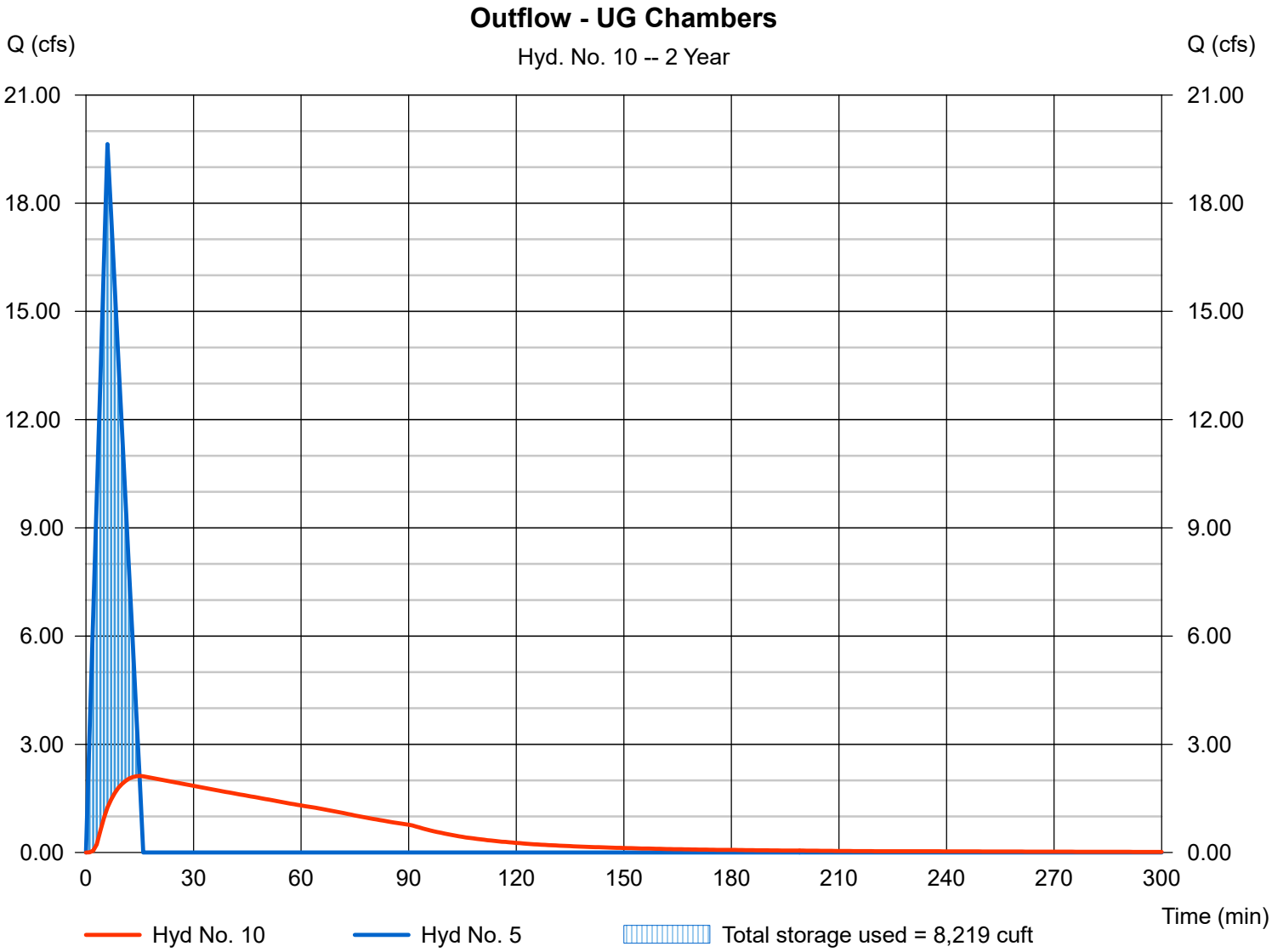
Hydrograph Report

Hyd. No. 10

Outflow - UG Chambers

Hydrograph type	=	Reservoir	Peak discharge	=	2.121 cfs
Storm frequency	=	2 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	9,410 cuft
Inflow hyd. No.	=	5 - WS-PR-1-DET	Max. Elevation	=	313.37 ft
Reservoir name	=	UG Chambers	Max. Storage	=	8,219 cuft

Storage Indication method used.



Pond No. 1 - UG Chambers

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	312.00	n/a	0	0
0.50	312.50	n/a	1,758	1,758
1.00	313.00	n/a	3,783	5,541
1.50	313.50	n/a	3,619	9,160
2.00	314.00	n/a	3,369	12,529
2.50	314.50	n/a	2,983	15,512
3.00	315.00	n/a	2,204	17,716
3.50	315.50	n/a	1,758	19,474
4.00	316.00	n/a	10	19,484
4.50	316.50	n/a	10	19,494
5.00	317.00	n/a	10	19,504
5.50	317.50	n/a	10	19,514

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	9.00	0.00	0.00
Span (in)	= 24.00	9.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 310.00	312.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.00	0.00	0.00	0.00
Crest El. (ft)	= 315.25	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) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

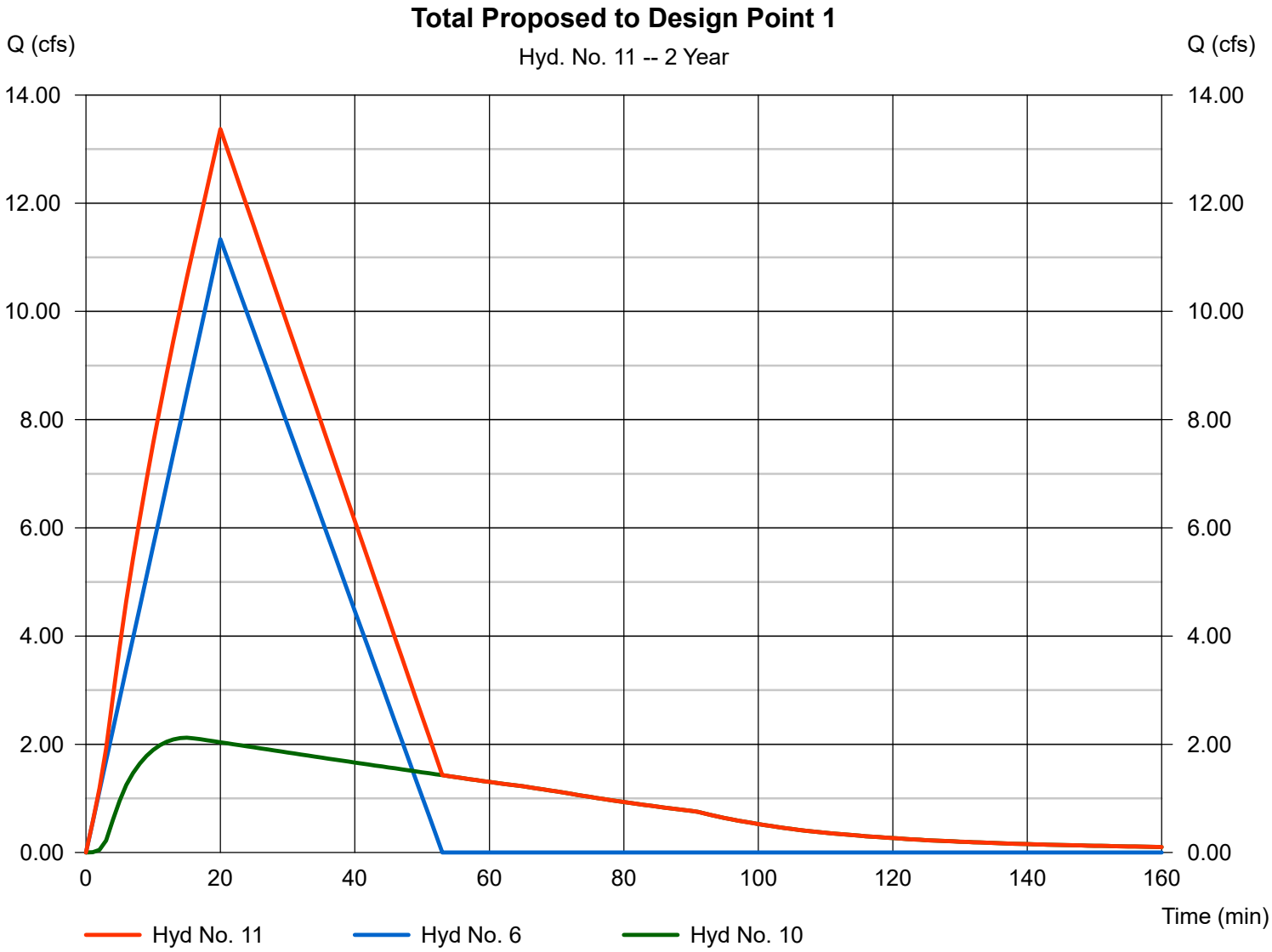
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	312.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.00
0.50	1,758	312.50	12.25 oc	0.76 ic	---	---	0.00	---	---	---	---	---	0.76
1.00	5,541	313.00	12.25 oc	1.68 ic	---	---	0.00	---	---	---	---	---	1.68
1.50	9,160	313.50	12.25 oc	2.26 ic	---	---	0.00	---	---	---	---	---	2.26
2.00	12,529	314.00	12.25 oc	2.71 ic	---	---	0.00	---	---	---	---	---	2.71
2.50	15,512	314.50	12.25 oc	3.10 ic	---	---	0.00	---	---	---	---	---	3.10
3.00	17,716	315.00	12.25 oc	3.45 ic	---	---	0.00	---	---	---	---	---	3.45
3.50	19,474	315.50	12.25 oc	3.76 ic	---	---	1.25	---	---	---	---	---	5.01
4.00	19,484	316.00	12.25 oc	4.05 ic	---	---	6.49	---	---	---	---	---	10.54
4.50	19,494	316.50	12.25 oc	4.32 ic	---	---	13.96	---	---	---	---	---	18.28
5.00	19,504	317.00	12.25 oc	4.57 ic	---	---	23.13	---	---	---	---	---	27.70
5.50	19,514	317.50	12.25 oc	4.82 ic	---	---	33.72	---	---	---	---	---	38.53

Hydrograph Report

Hyd. No. 11

Total Proposed to Design Point 1

Hydrograph type	= Combine	Peak discharge	= 13.37 cfs
Storm frequency	= 2 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 27,431 cuft
Inflow hyds.	= 6, 10	Contrib. drain. area	= 10.390 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.1

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	Rational	17.04	1	19	25,911	----	------	------	WS-EX-1 to Design Point 1
2	Rational	13.13	1	3	3,151	----	------	------	WS-EX-2 to Design Point 2
3	Rational	20.55	1	3	4,934	----	------	------	WS-EX-3 to Design Point 3
4	Rational	5.212	1	6	2,502	----	------	------	WS-EX-4 to Design Point 4
5	Rational	24.84	1	6	11,926	----	------	------	WS-PR-1-DET
6	Rational	14.31	1	20	22,900	----	------	------	WS-PR-1-UND to Design Point 1
7	Rational	13.13	1	3	3,151	----	------	------	WS-PR-2 to Design Point 2
8	Rational	20.55	1	3	4,934	----	------	------	WS-PR-3 to Design Point 3
9	Rational	5.212	1	6	2,502	----	------	------	WS-PR-4 to Design Point 4
10	Reservoir	2.448	1	15	11,908	5	313.70	10,510	Outflow - UG Chambers
11	Combine	16.67	1	20	34,662	6, 10	------	------	Total Proposed to Design Point 1

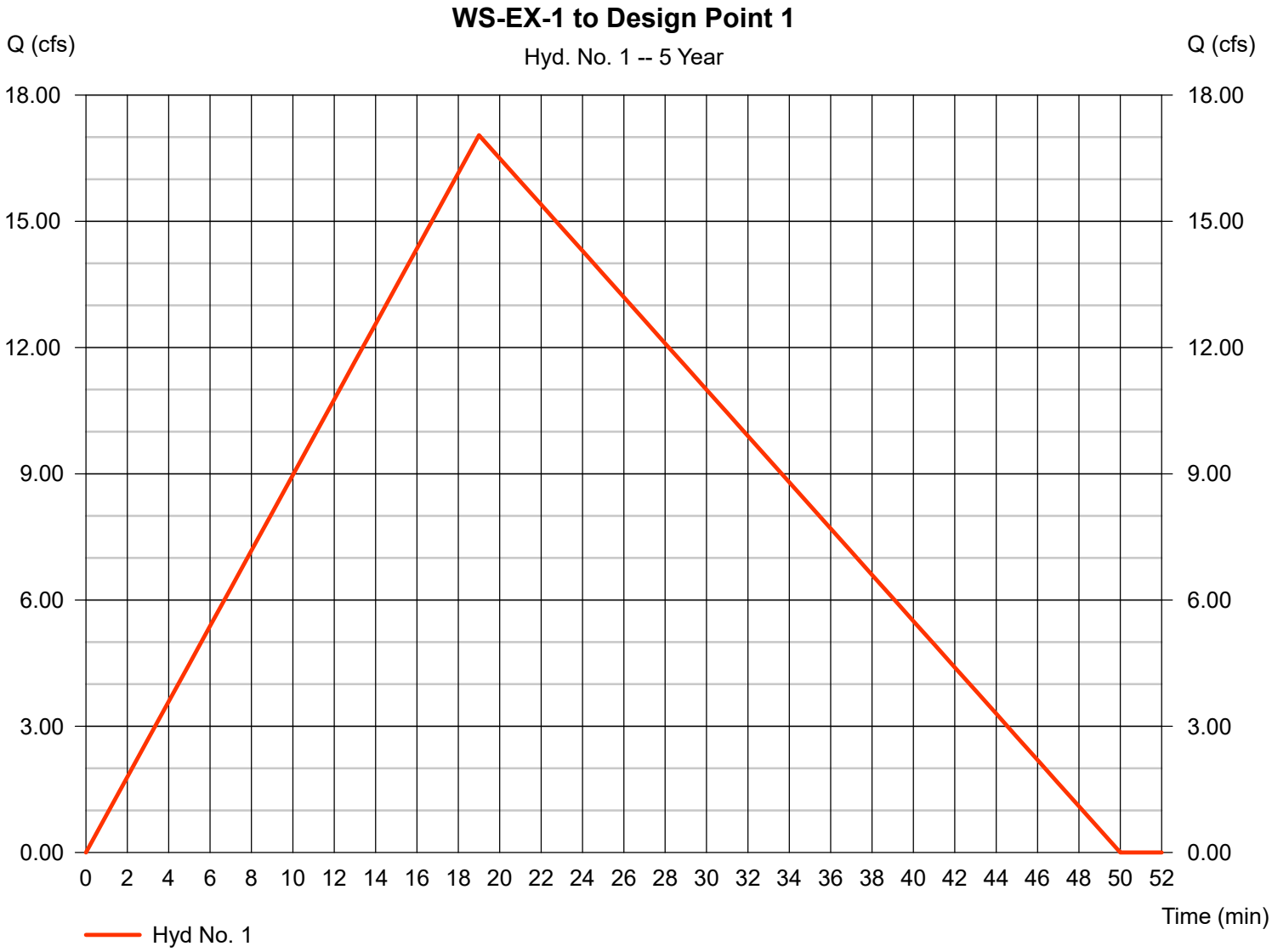
Hydrograph Report

Hyd. No. 1

WS-EX-1 to Design Point 1

Hydrograph type	=	Rational	Peak discharge	=	17.04 cfs
Storm frequency	=	5 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	25,911 cuft
Drainage area	=	15.780 ac	Runoff coeff.	=	0.35*
Intensity	=	3.086 in/hr	Tc by TR55	=	19.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(1.080 x 0.20) + (10.620 x 0.15) + (4.080 x 0.90)] / 15.780



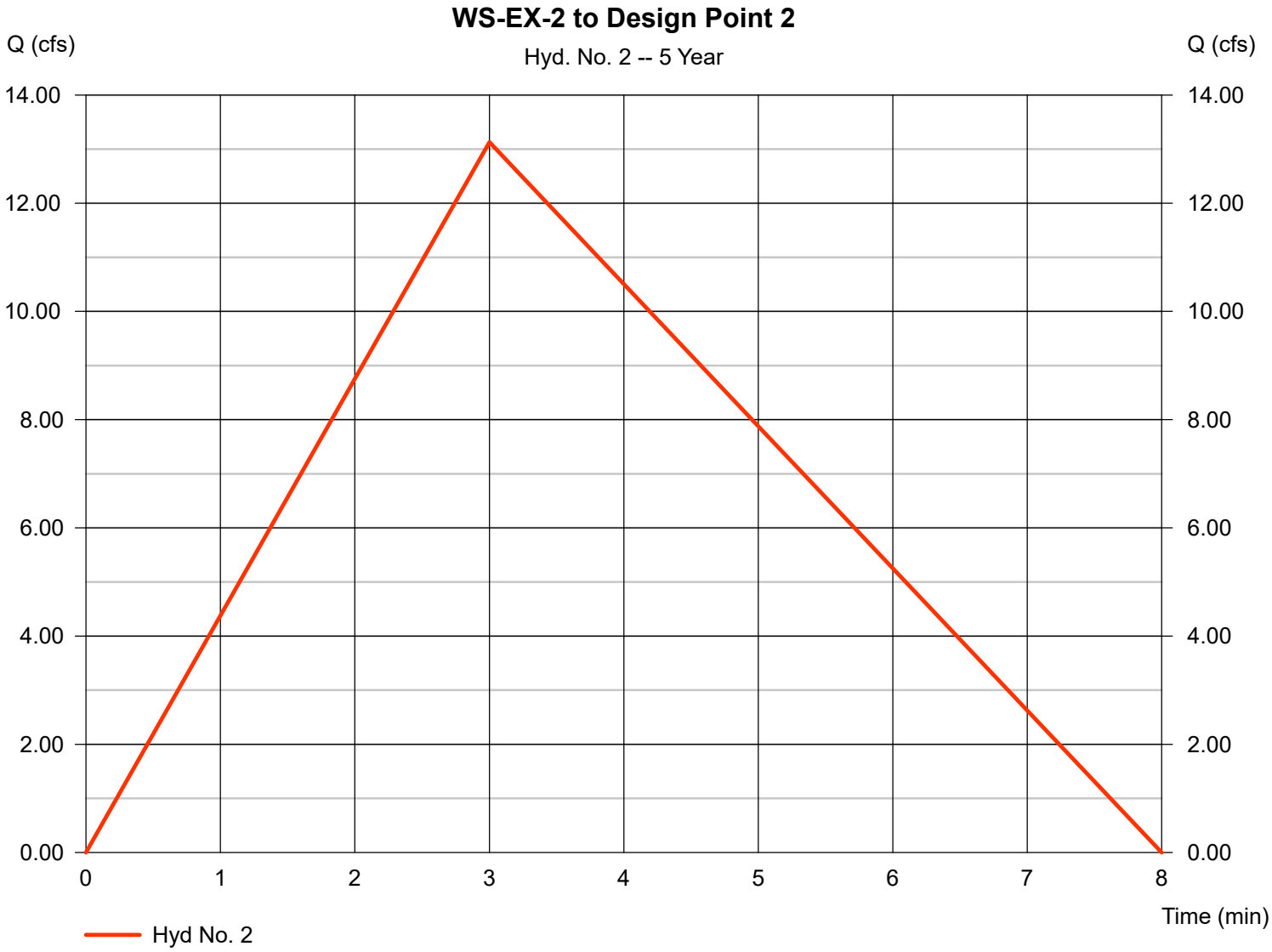
Hydrograph Report

Hyd. No. 2

WS-EX-2 to Design Point 2

Hydrograph type	=	Rational	Peak discharge	=	13.13 cfs
Storm frequency	=	5 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	3,151 cuft
Drainage area	=	2.760 ac	Runoff coeff.	=	0.65*
Intensity	=	7.318 in/hr	Tc by TR55	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.820 x 0.20) + (0.160 x 0.15) + (1.780 x 0.90)] / 2.760



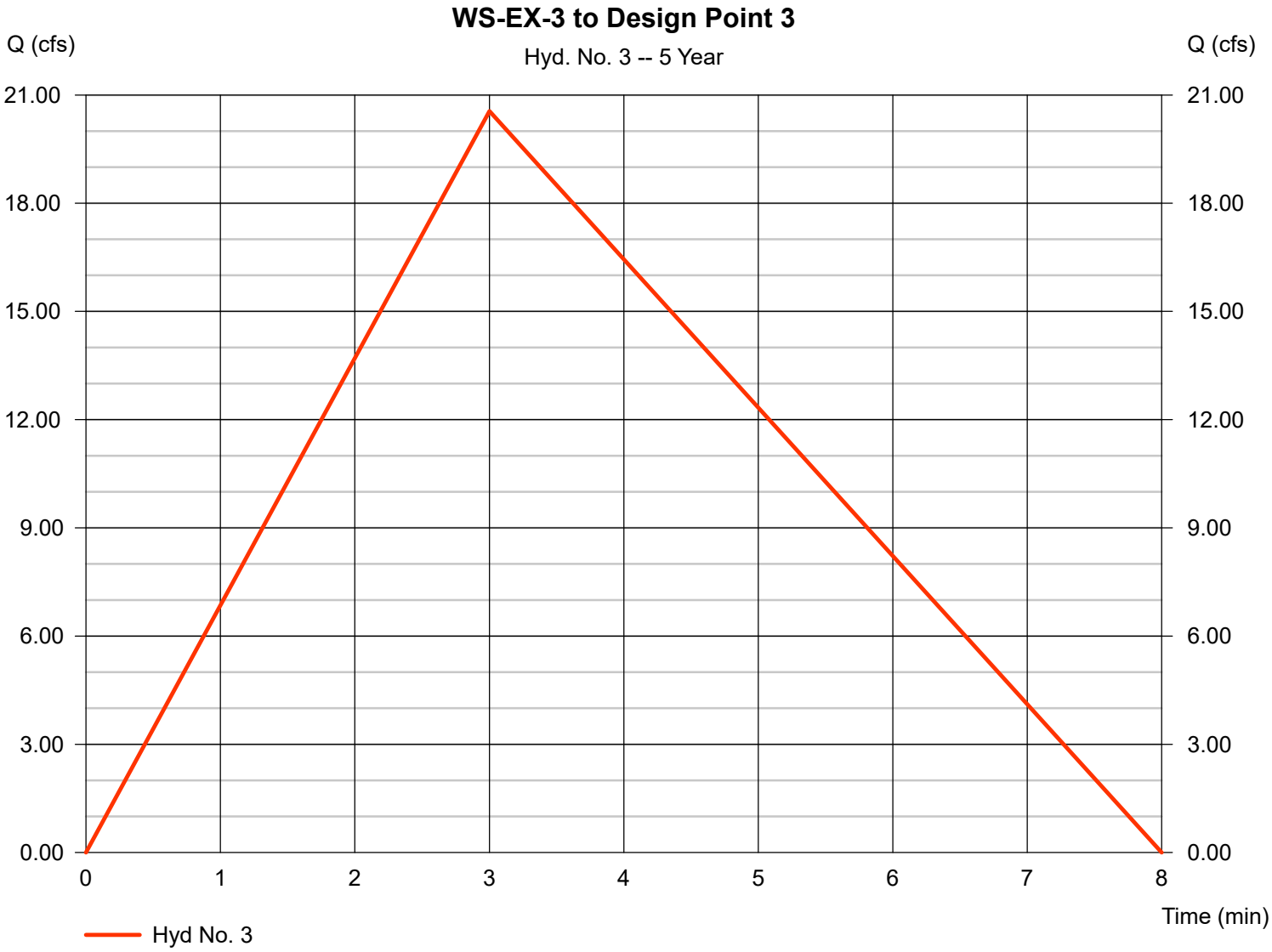
Hydrograph Report

Hyd. No. 3

WS-EX-3 to Design Point 3

Hydrograph type	=	Rational	Peak discharge	=	20.55 cfs
Storm frequency	=	5 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	4,934 cuft
Drainage area	=	4.530 ac	Runoff coeff.	=	0.62*
Intensity	=	7.318 in/hr	Tc by TR55	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.910 x 0.20) + (0.830 x 0.15) + (2.790 x 0.90)] / 4.530



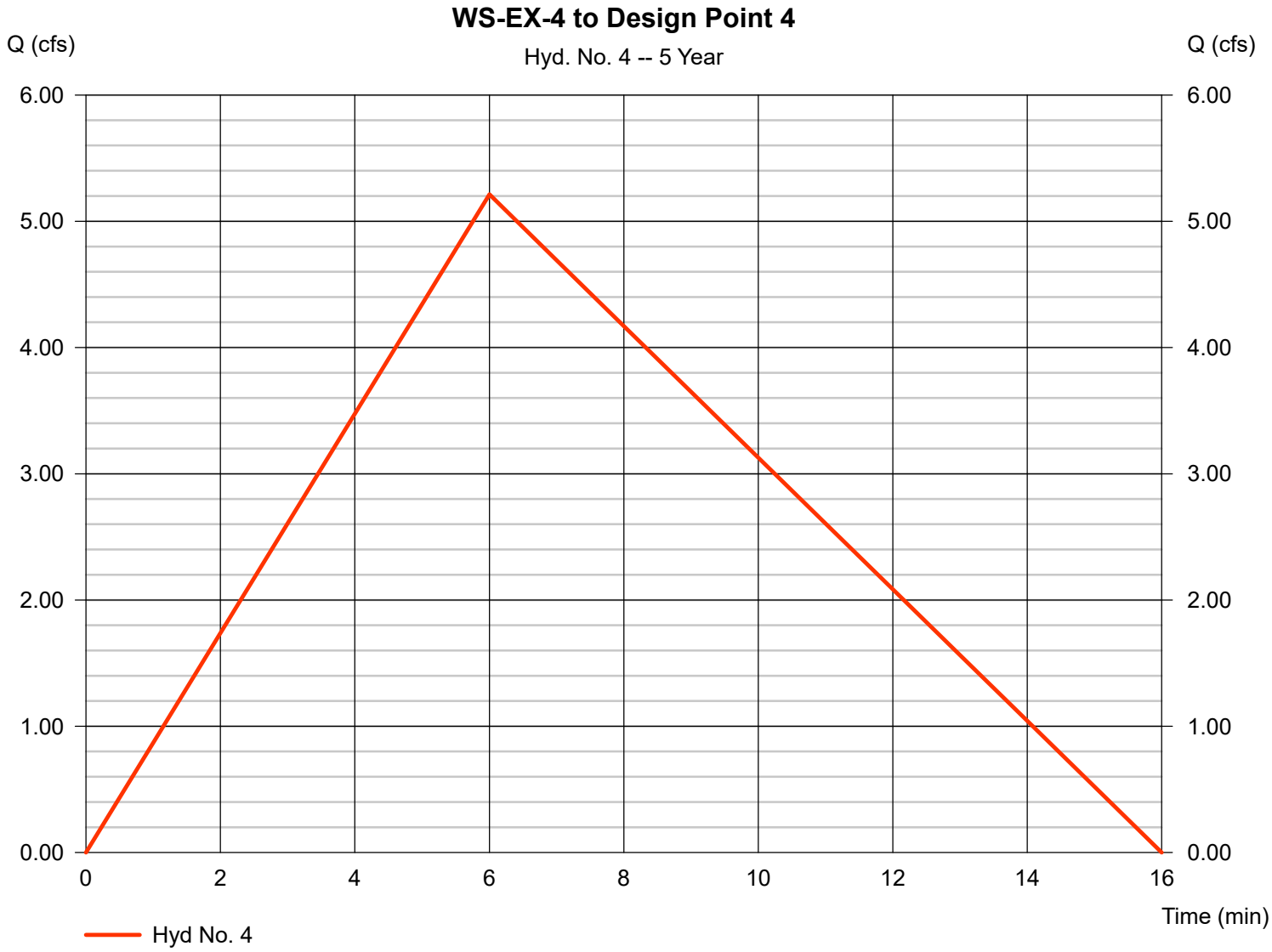
Hydrograph Report

Hyd. No. 4

WS-EX-4 to Design Point 4

Hydrograph type	=	Rational	Peak discharge	=	5.212 cfs
Storm frequency	=	5 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	2,502 cuft
Drainage area	=	2.810 ac	Runoff coeff.	=	0.33*
Intensity	=	5.621 in/hr	Tc by TR55	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.930 x 0.20) + (1.280 x 0.15) + (0.600 x 0.90)] / 2.810



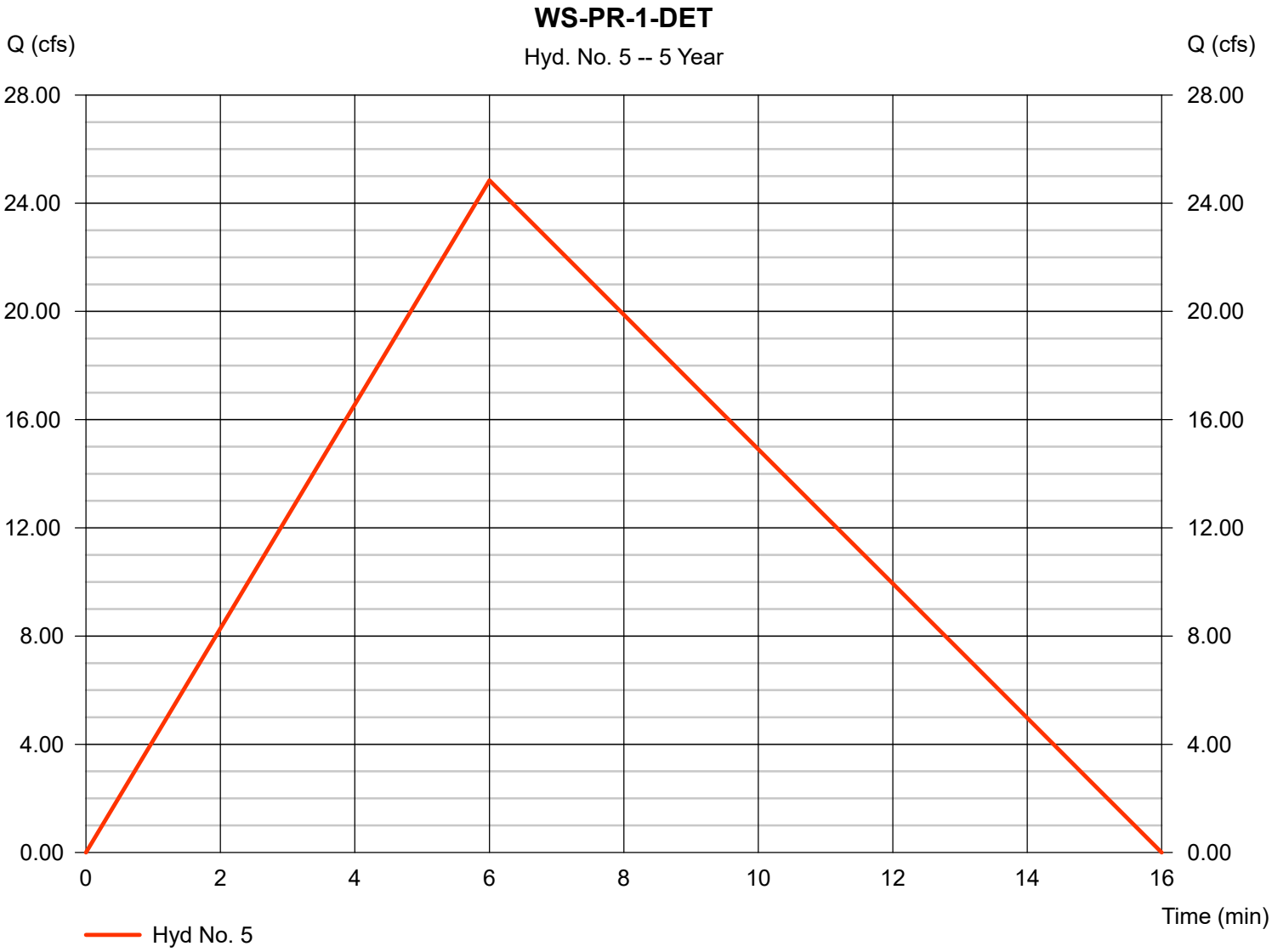
Hydrograph Report

Hyd. No. 5

WS-PR-1-DET

Hydrograph type	=	Rational	Peak discharge	=	24.84 cfs
Storm frequency	=	5 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	11,926 cuft
Drainage area	=	5.390 ac	Runoff coeff.	=	0.82*
Intensity	=	5.621 in/hr	Tc by User	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.580 x 0.20) + (4.810 x 0.90)] / 5.390



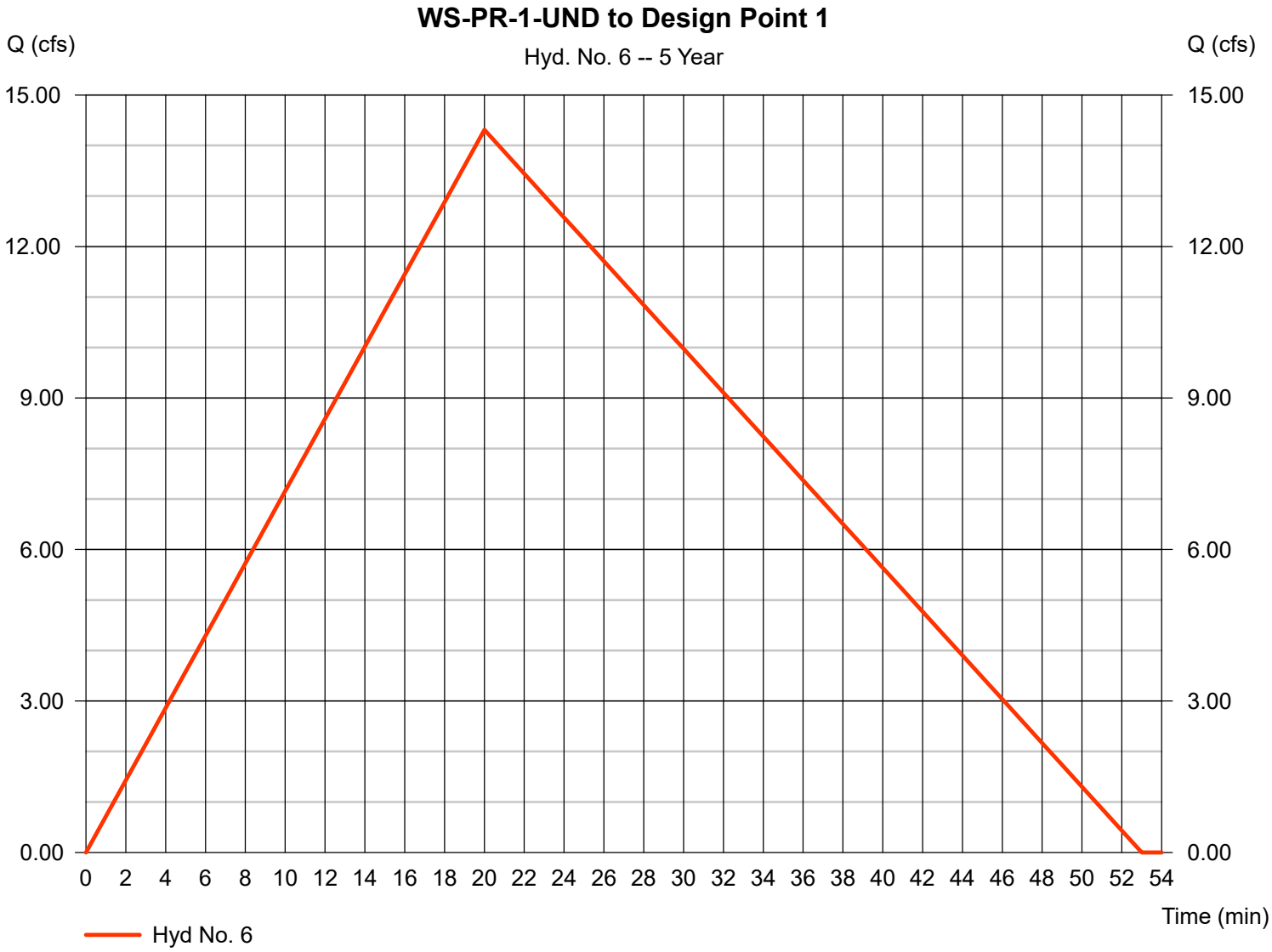
Hydrograph Report

Hyd. No. 6

WS-PR-1-UND to Design Point 1

Hydrograph type	=	Rational	Peak discharge	=	14.31 cfs
Storm frequency	=	5 yrs	Time to peak	=	20 min
Time interval	=	1 min	Hyd. volume	=	22,900 cuft
Drainage area	=	10.390 ac	Runoff coeff.	=	0.46*
Intensity	=	2.994 in/hr	Tc by TR55	=	20.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.270 x 0.20) + (5.810 x 0.15) + (4.310 x 0.90)] / 10.390



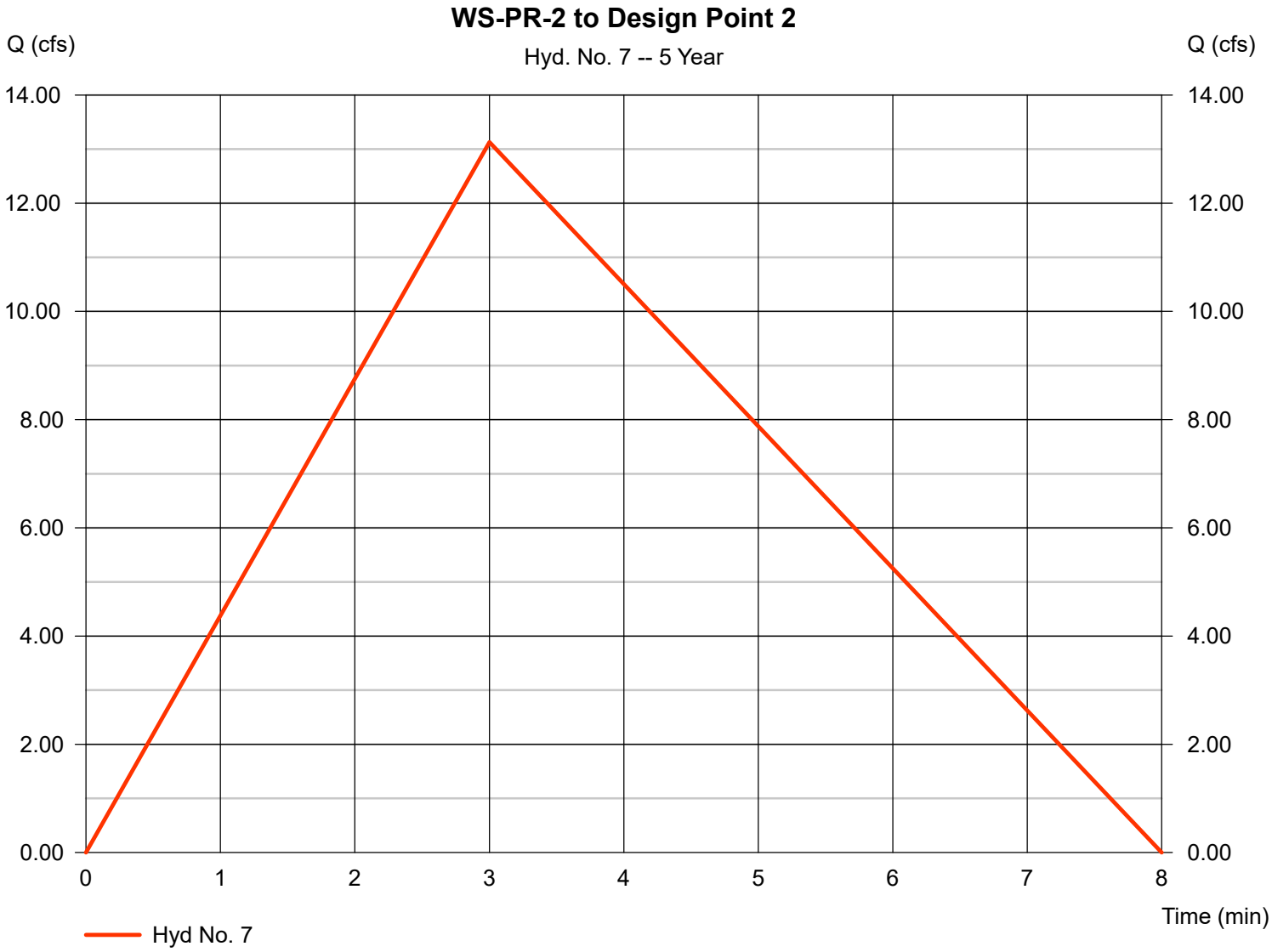
Hydrograph Report

Hyd. No. 7

WS-PR-2 to Design Point 2

Hydrograph type	=	Rational	Peak discharge	=	13.13 cfs
Storm frequency	=	5 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	3,151 cuft
Drainage area	=	2.760 ac	Runoff coeff.	=	0.65*
Intensity	=	7.318 in/hr	Tc by User	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.820 x 0.20) + (0.160 x 0.15) + (1.780 x 0.90)] / 2.760



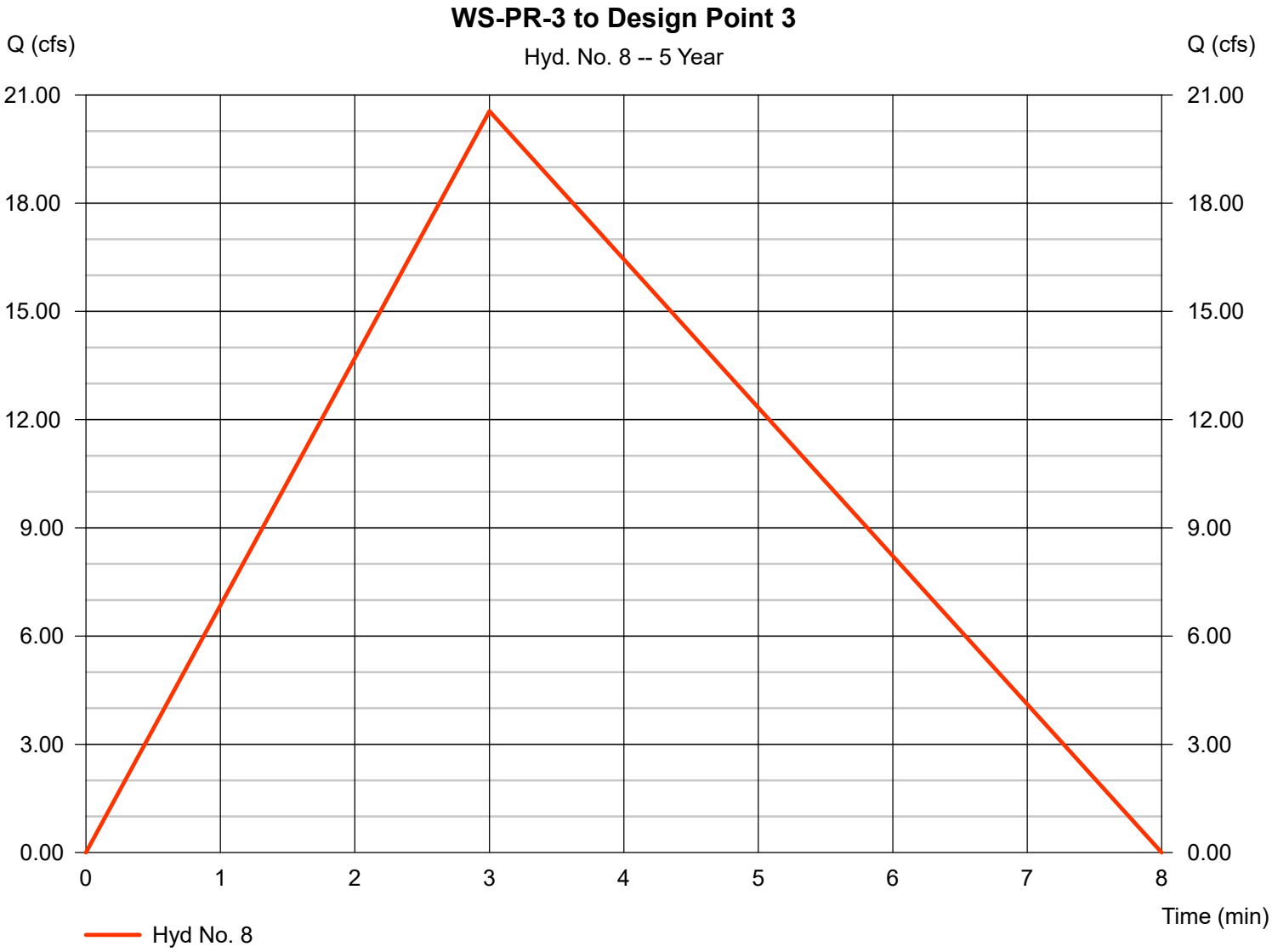
Hydrograph Report

Hyd. No. 8

WS-PR-3 to Design Point 3

Hydrograph type	=	Rational	Peak discharge	=	20.55 cfs
Storm frequency	=	5 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	4,934 cuft
Drainage area	=	4.530 ac	Runoff coeff.	=	0.62*
Intensity	=	7.318 in/hr	Tc by TR55	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.910 x 0.20) + (0.830 x 0.15) + (2.790 x 0.90)] / 4.530



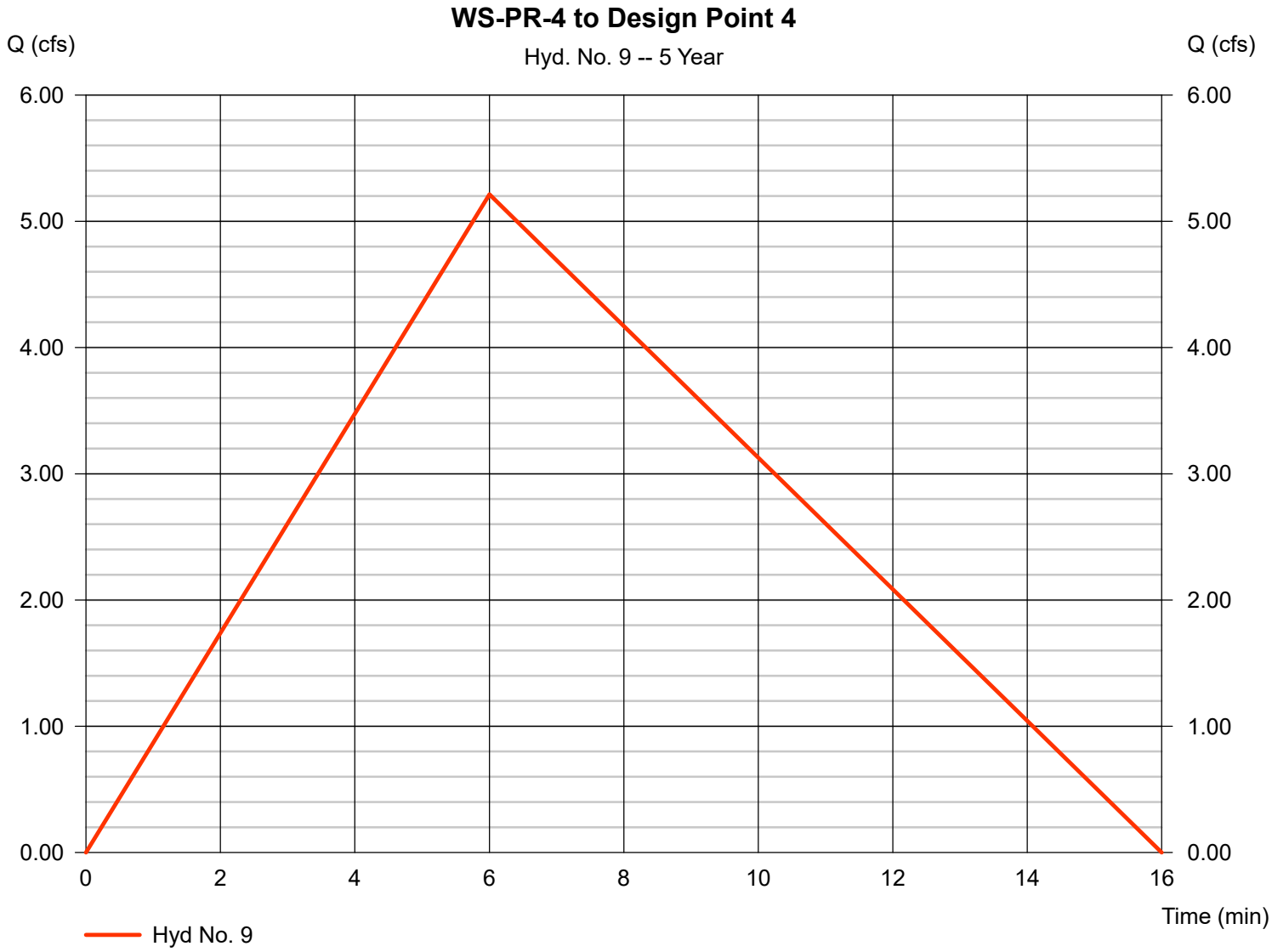
Hydrograph Report

Hyd. No. 9

WS-PR-4 to Design Point 4

Hydrograph type	=	Rational	Peak discharge	=	5.212 cfs
Storm frequency	=	5 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	2,502 cuft
Drainage area	=	2.810 ac	Runoff coeff.	=	0.33*
Intensity	=	5.621 in/hr	Tc by TR55	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.930 x 0.20) + (1.280 x 0.15) + (0.600 x 0.90)] / 2.810



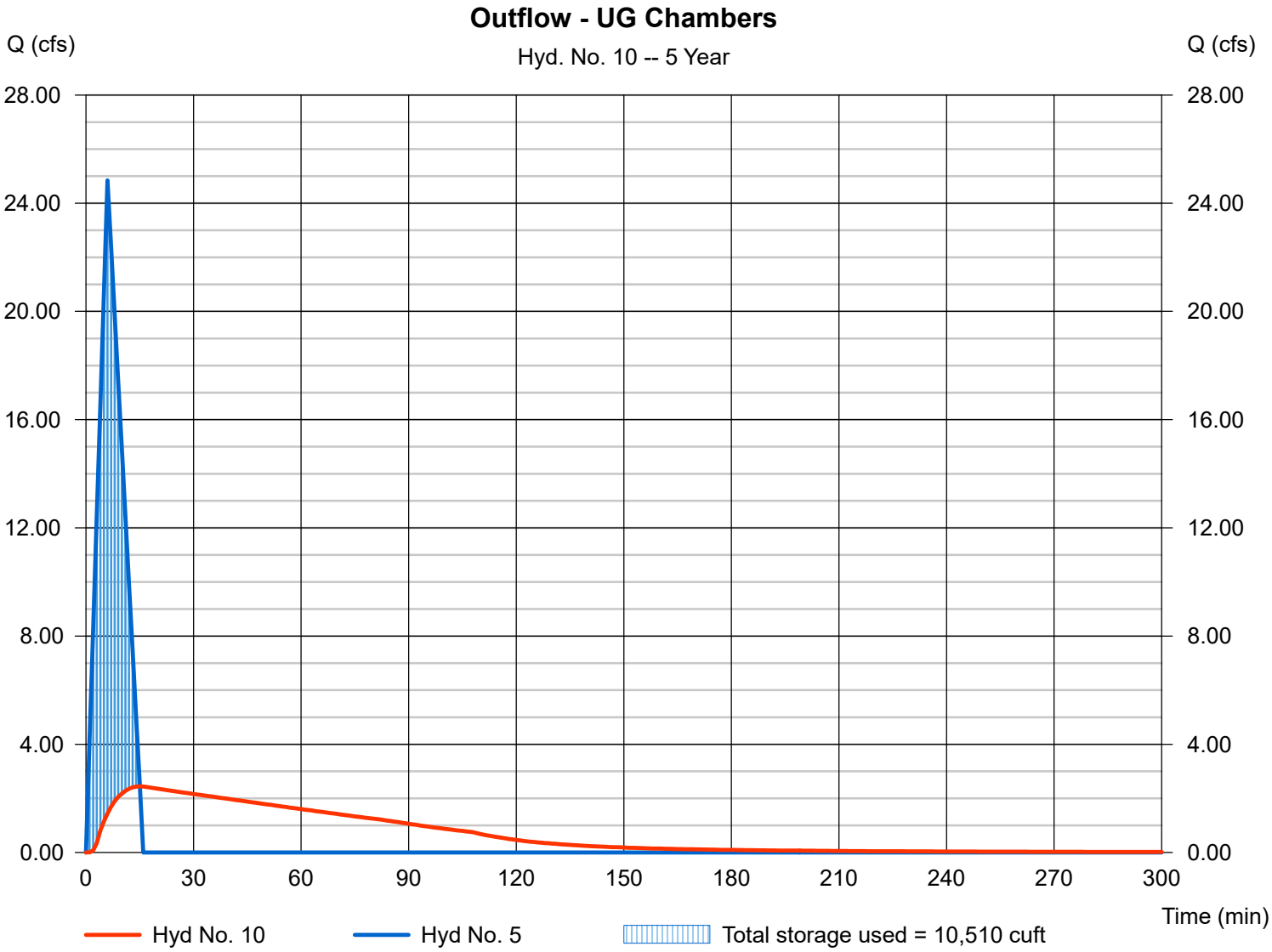
Hydrograph Report

Hyd. No. 10

Outflow - UG Chambers

Hydrograph type	=	Reservoir	Peak discharge	=	2.448 cfs
Storm frequency	=	5 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	11,908 cuft
Inflow hyd. No.	=	5 - WS-PR-1-DET	Max. Elevation	=	313.70 ft
Reservoir name	=	UG Chambers	Max. Storage	=	10,510 cuft

Storage Indication method used.

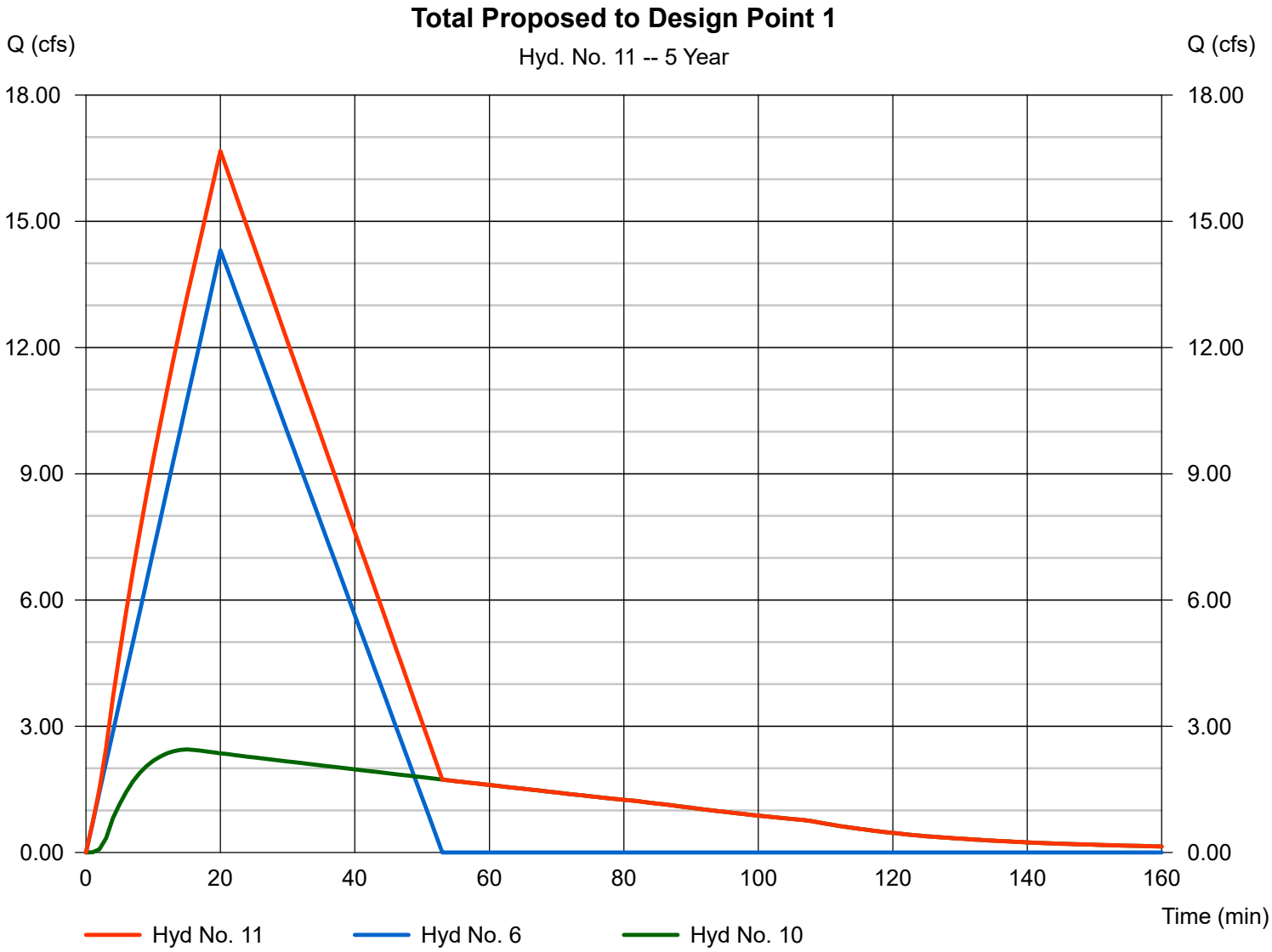


Hydrograph Report

Hyd. No. 11

Total Proposed to Design Point 1

Hydrograph type	= Combine	Peak discharge	= 16.67 cfs
Storm frequency	= 5 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 34,662 cuft
Inflow hyds.	= 6, 10	Contrib. drain. area	= 10.390 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.1

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	Rational	20.04	1	19	30,470	----	------	------	WS-EX-1 to Design Point 1
2	Rational	15.40	1	3	3,696	----	------	------	WS-EX-2 to Design Point 2
3	Rational	24.11	1	3	5,787	----	------	------	WS-EX-3 to Design Point 3
4	Rational	6.125	1	6	2,940	----	------	------	WS-EX-4 to Design Point 4
5	Rational	29.19	1	6	14,014	----	------	------	WS-PR-1-DET
6	Rational	16.83	1	20	26,927	----	------	------	WS-PR-1-UND to Design Point 1
7	Rational	15.40	1	3	3,696	----	------	------	WS-PR-2 to Design Point 2
8	Rational	24.11	1	3	5,787	----	------	------	WS-PR-3 to Design Point 3
9	Rational	6.125	1	6	2,940	----	------	------	WS-PR-4 to Design Point 4
10	Reservoir	2.700	1	15	13,995	5	313.99	12,439	Outflow - UG Chambers
11	Combine	19.44	1	20	40,750	6, 10	------	------	Total Proposed to Design Point 1

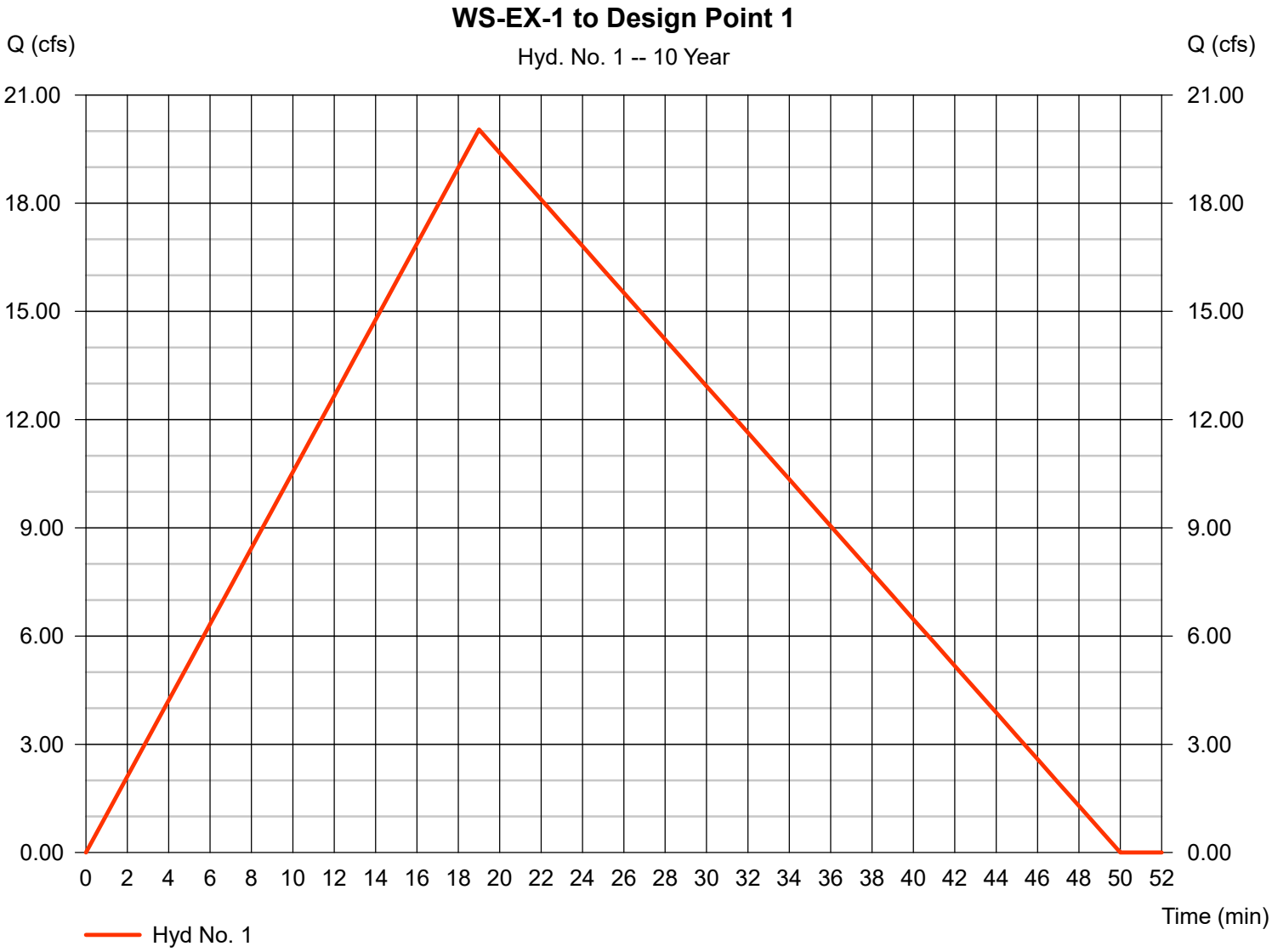
Hydrograph Report

Hyd. No. 1

WS-EX-1 to Design Point 1

Hydrograph type	=	Rational	Peak discharge	=	20.04 cfs
Storm frequency	=	10 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	30,470 cuft
Drainage area	=	15.780 ac	Runoff coeff.	=	0.35*
Intensity	=	3.629 in/hr	Tc by TR55	=	19.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(1.080 x 0.20) + (10.620 x 0.15) + (4.080 x 0.90)] / 15.780



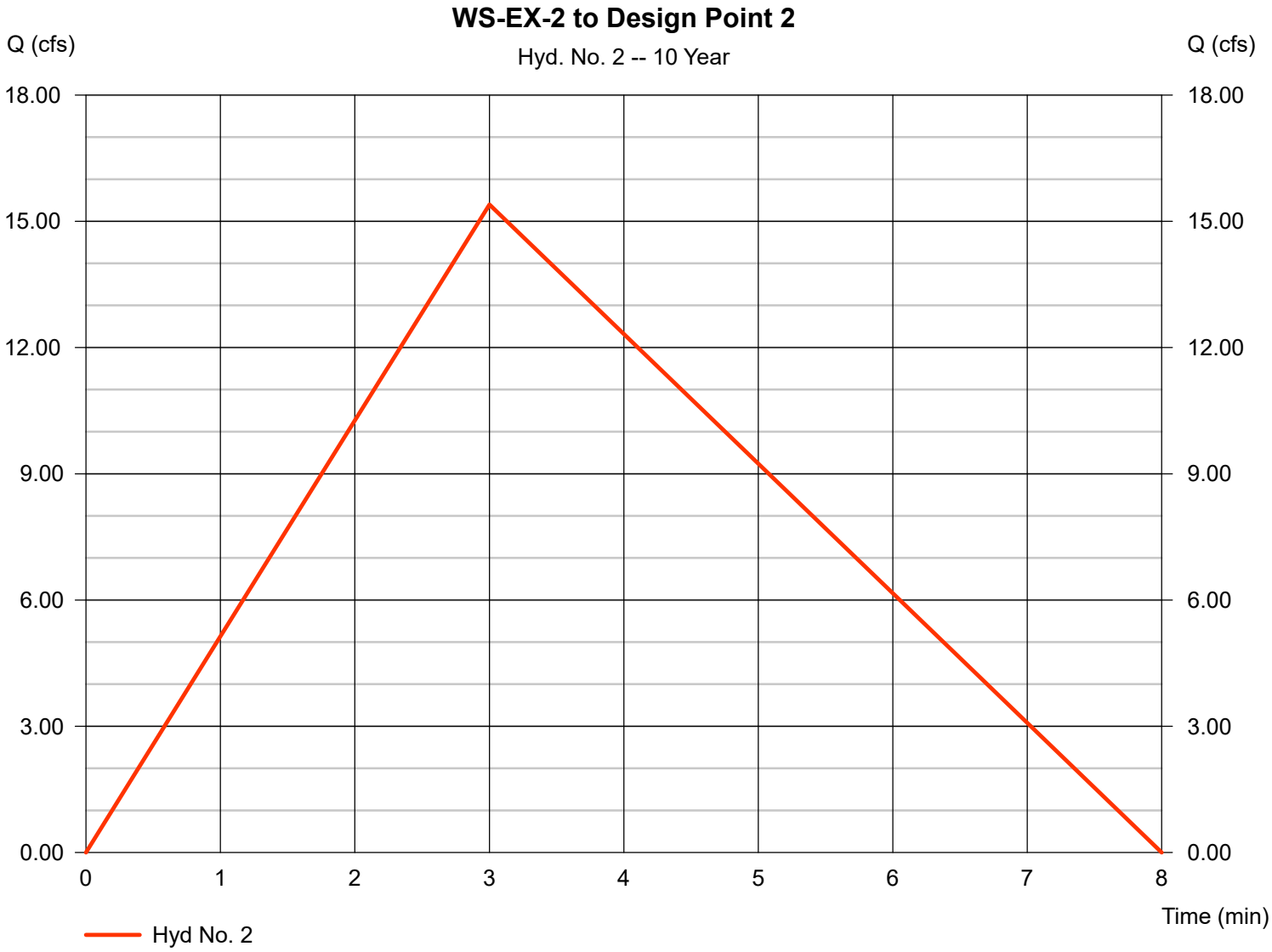
Hydrograph Report

Hyd. No. 2

WS-EX-2 to Design Point 2

Hydrograph type	=	Rational	Peak discharge	=	15.40 cfs
Storm frequency	=	10 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	3,696 cuft
Drainage area	=	2.760 ac	Runoff coeff.	=	0.65*
Intensity	=	8.584 in/hr	Tc by TR55	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.820 x 0.20) + (0.160 x 0.15) + (1.780 x 0.90)] / 2.760



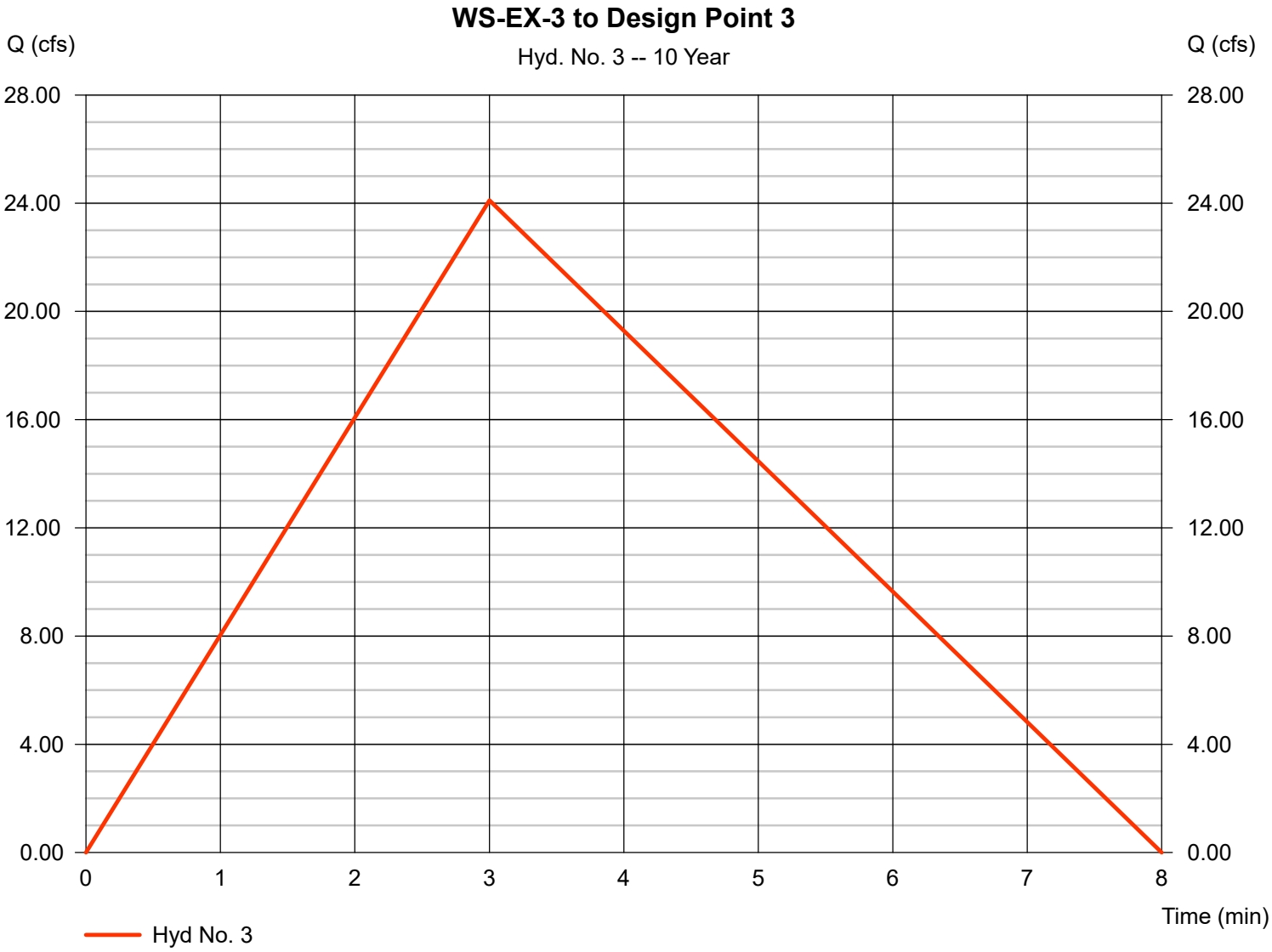
Hydrograph Report

Hyd. No. 3

WS-EX-3 to Design Point 3

Hydrograph type	= Rational	Peak discharge	= 24.11 cfs
Storm frequency	= 10 yrs	Time to peak	= 3 min
Time interval	= 1 min	Hyd. volume	= 5,787 cuft
Drainage area	= 4.530 ac	Runoff coeff.	= 0.62*
Intensity	= 8.584 in/hr	Tc by TR55	= 3.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.910 x 0.20) + (0.830 x 0.15) + (2.790 x 0.90)] / 4.530



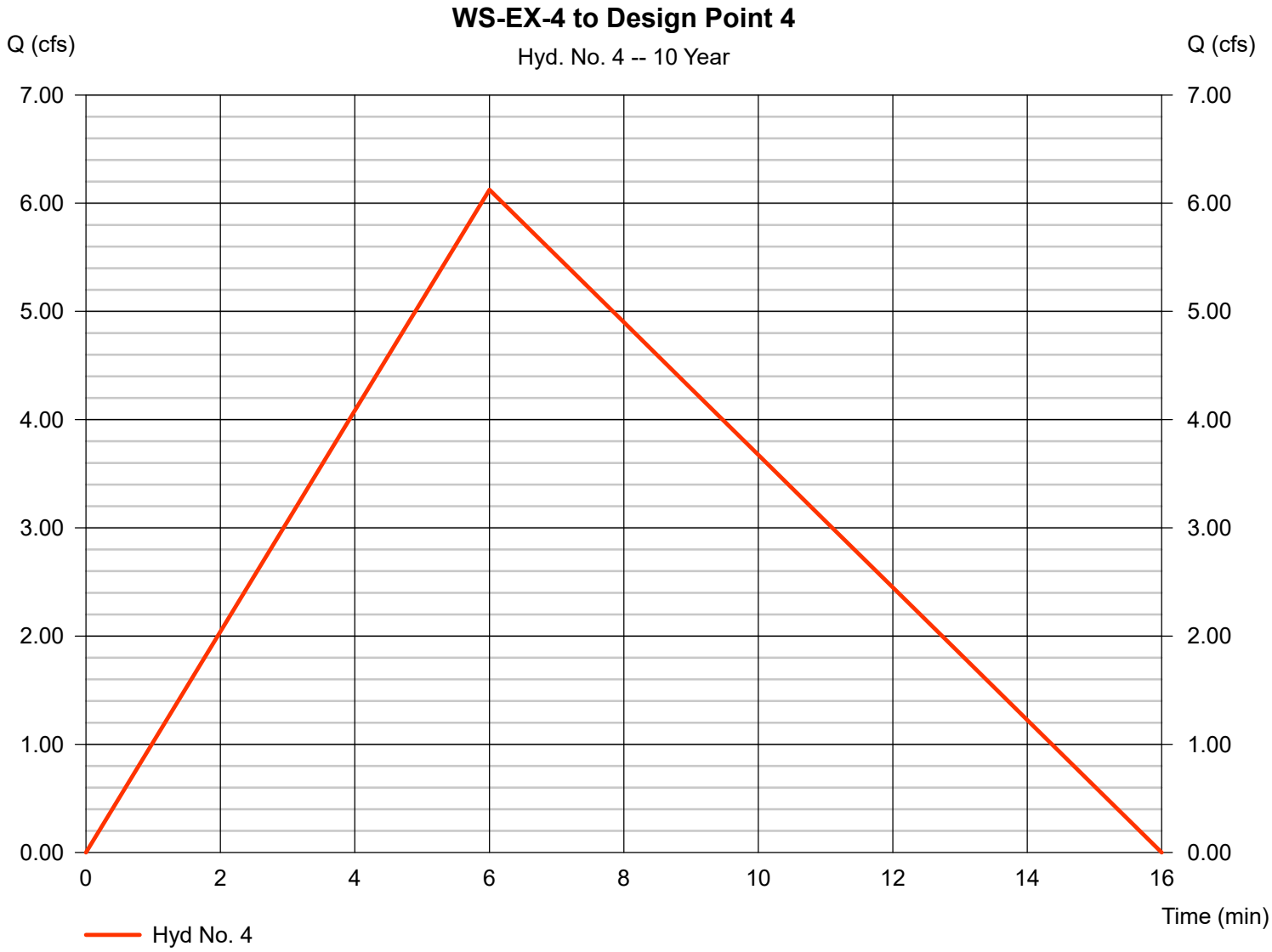
Hydrograph Report

Hyd. No. 4

WS-EX-4 to Design Point 4

Hydrograph type	= Rational	Peak discharge	= 6.125 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 2,940 cuft
Drainage area	= 2.810 ac	Runoff coeff.	= 0.33*
Intensity	= 6.605 in/hr	Tc by TR55	= 6.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.930 x 0.20) + (1.280 x 0.15) + (0.600 x 0.90)] / 2.810



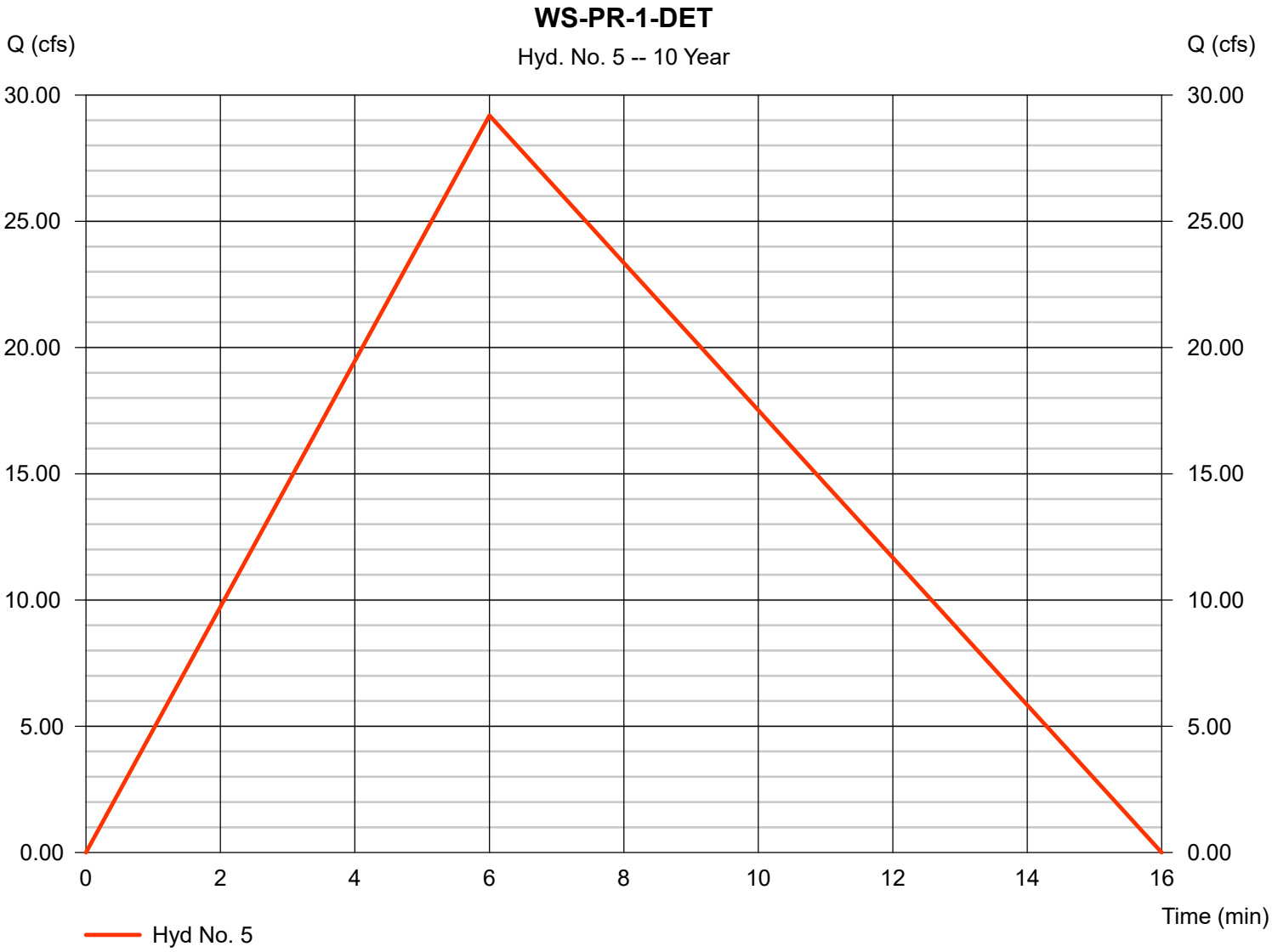
Hydrograph Report

Hyd. No. 5

WS-PR-1-DET

Hydrograph type	= Rational	Peak discharge	= 29.19 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 14,014 cuft
Drainage area	= 5.390 ac	Runoff coeff.	= 0.82*
Intensity	= 6.605 in/hr	Tc by User	= 6.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.580 x 0.20) + (4.810 x 0.90)] / 5.390



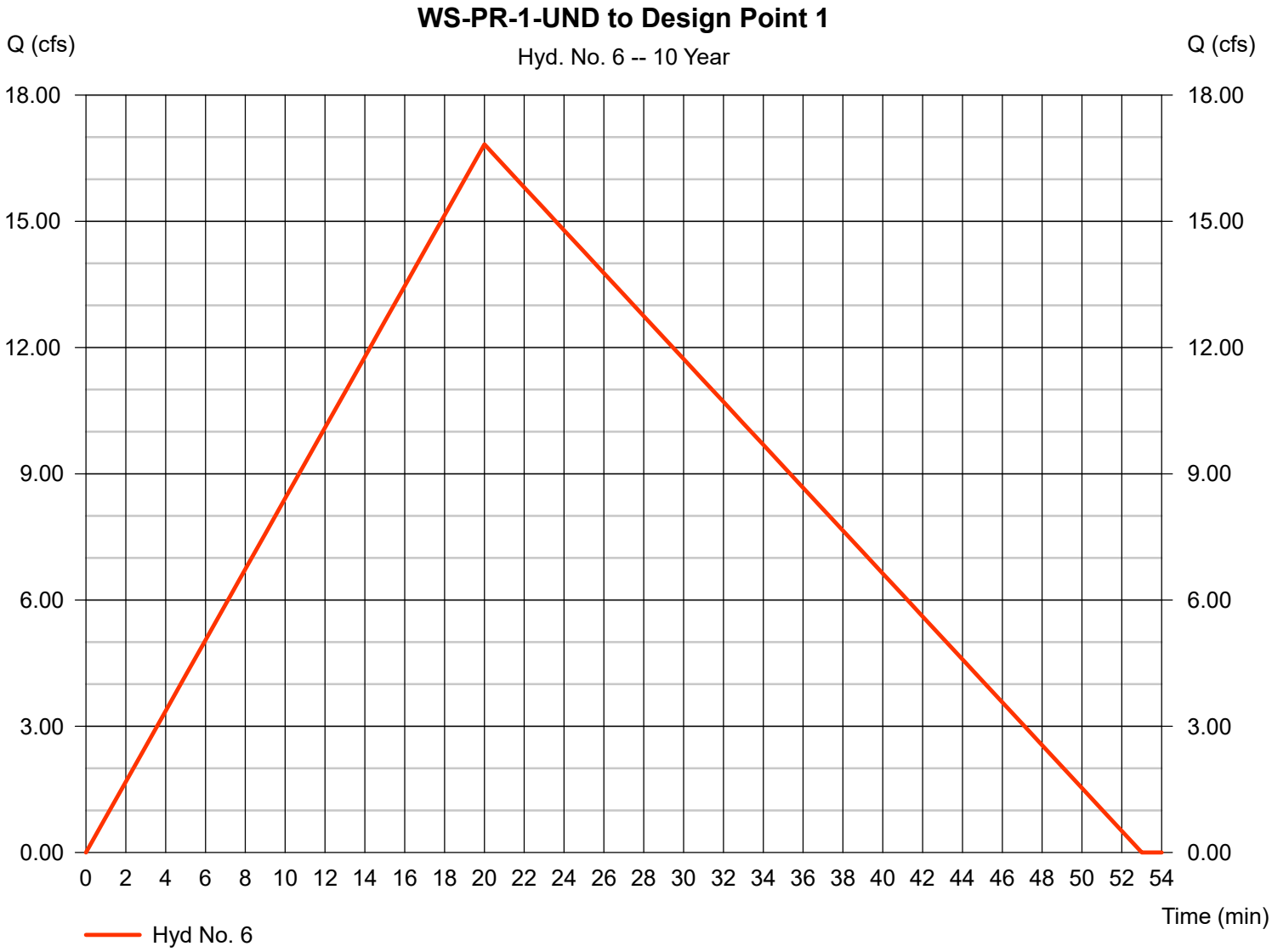
Hydrograph Report

Hyd. No. 6

WS-PR-1-UND to Design Point 1

Hydrograph type	= Rational	Peak discharge	= 16.83 cfs
Storm frequency	= 10 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 26,927 cuft
Drainage area	= 10.390 ac	Runoff coeff.	= 0.46*
Intensity	= 3.521 in/hr	Tc by TR55	= 20.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.270 x 0.20) + (5.810 x 0.15) + (4.310 x 0.90)] / 10.390



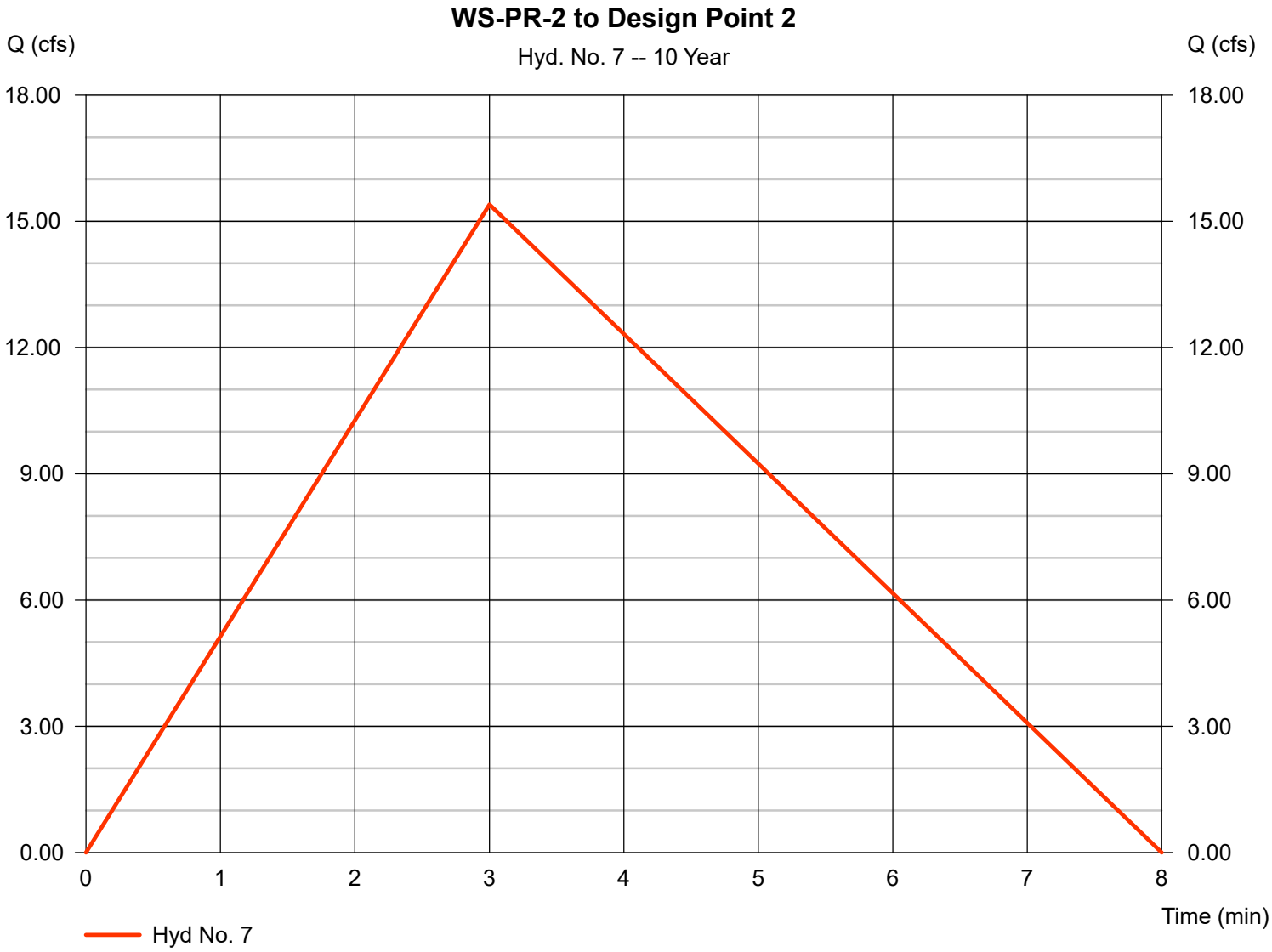
Hydrograph Report

Hyd. No. 7

WS-PR-2 to Design Point 2

Hydrograph type	=	Rational	Peak discharge	=	15.40 cfs
Storm frequency	=	10 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	3,696 cuft
Drainage area	=	2.760 ac	Runoff coeff.	=	0.65*
Intensity	=	8.584 in/hr	Tc by User	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.820 x 0.20) + (0.160 x 0.15) + (1.780 x 0.90)] / 2.760



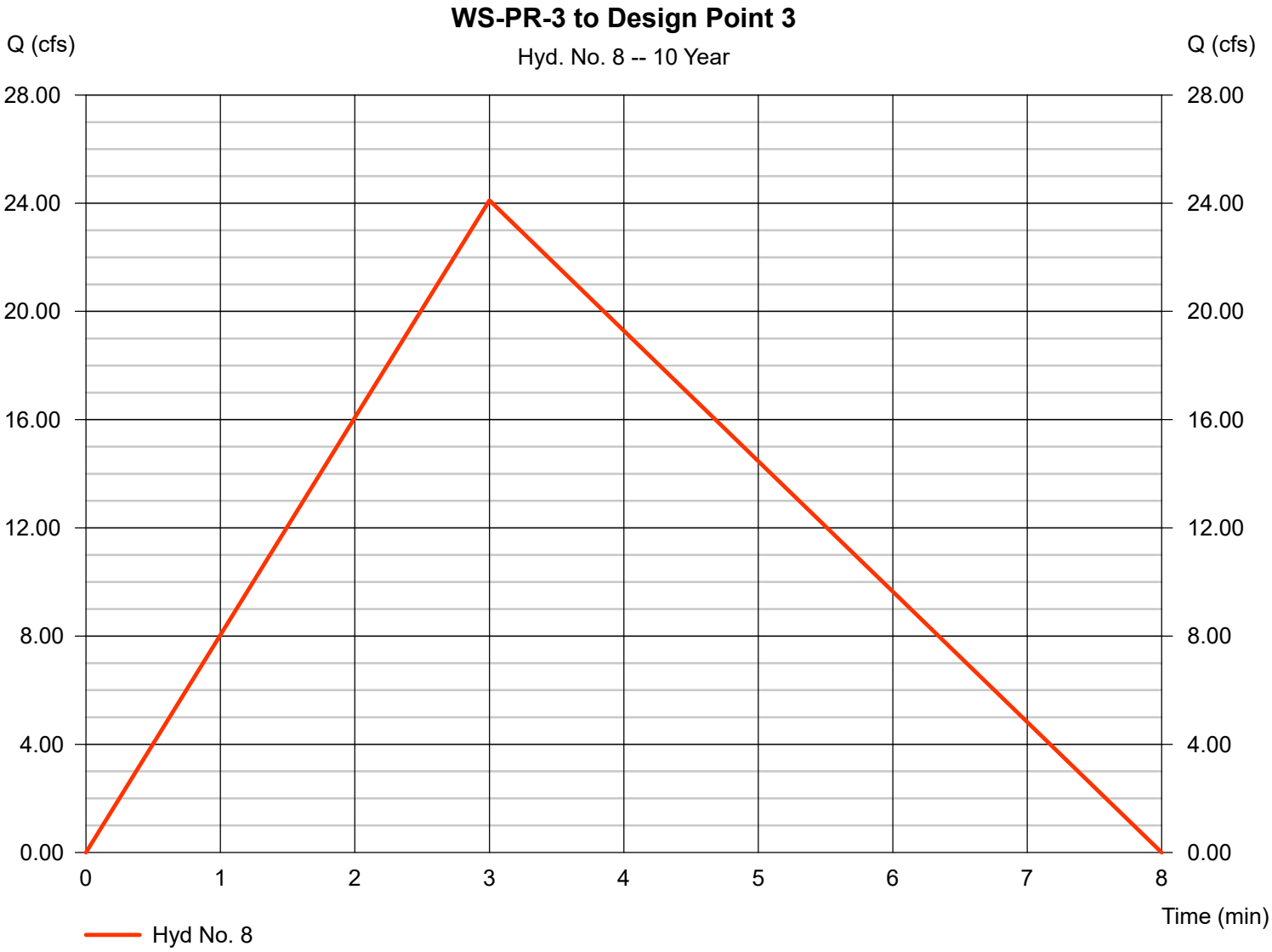
Hydrograph Report

Hyd. No. 8

WS-PR-3 to Design Point 3

Hydrograph type	= Rational	Peak discharge	= 24.11 cfs
Storm frequency	= 10 yrs	Time to peak	= 3 min
Time interval	= 1 min	Hyd. volume	= 5,787 cuft
Drainage area	= 4.530 ac	Runoff coeff.	= 0.62*
Intensity	= 8.584 in/hr	Tc by TR55	= 3.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.910 x 0.20) + (0.830 x 0.15) + (2.790 x 0.90)] / 4.530



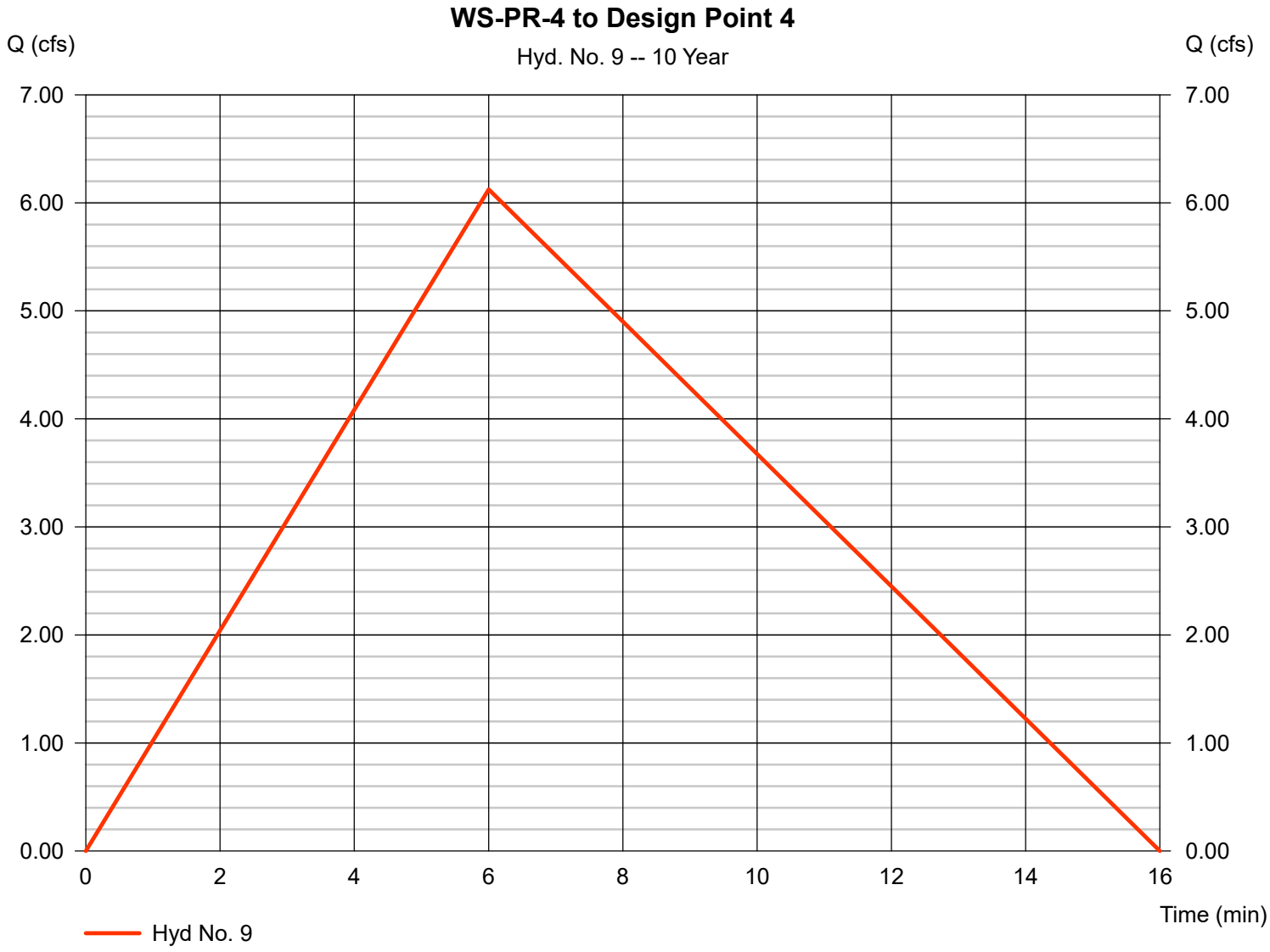
Hydrograph Report

Hyd. No. 9

WS-PR-4 to Design Point 4

Hydrograph type	= Rational	Peak discharge	= 6.125 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 2,940 cuft
Drainage area	= 2.810 ac	Runoff coeff.	= 0.33*
Intensity	= 6.605 in/hr	Tc by TR55	= 6.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.930 x 0.20) + (1.280 x 0.15) + (0.600 x 0.90)] / 2.810



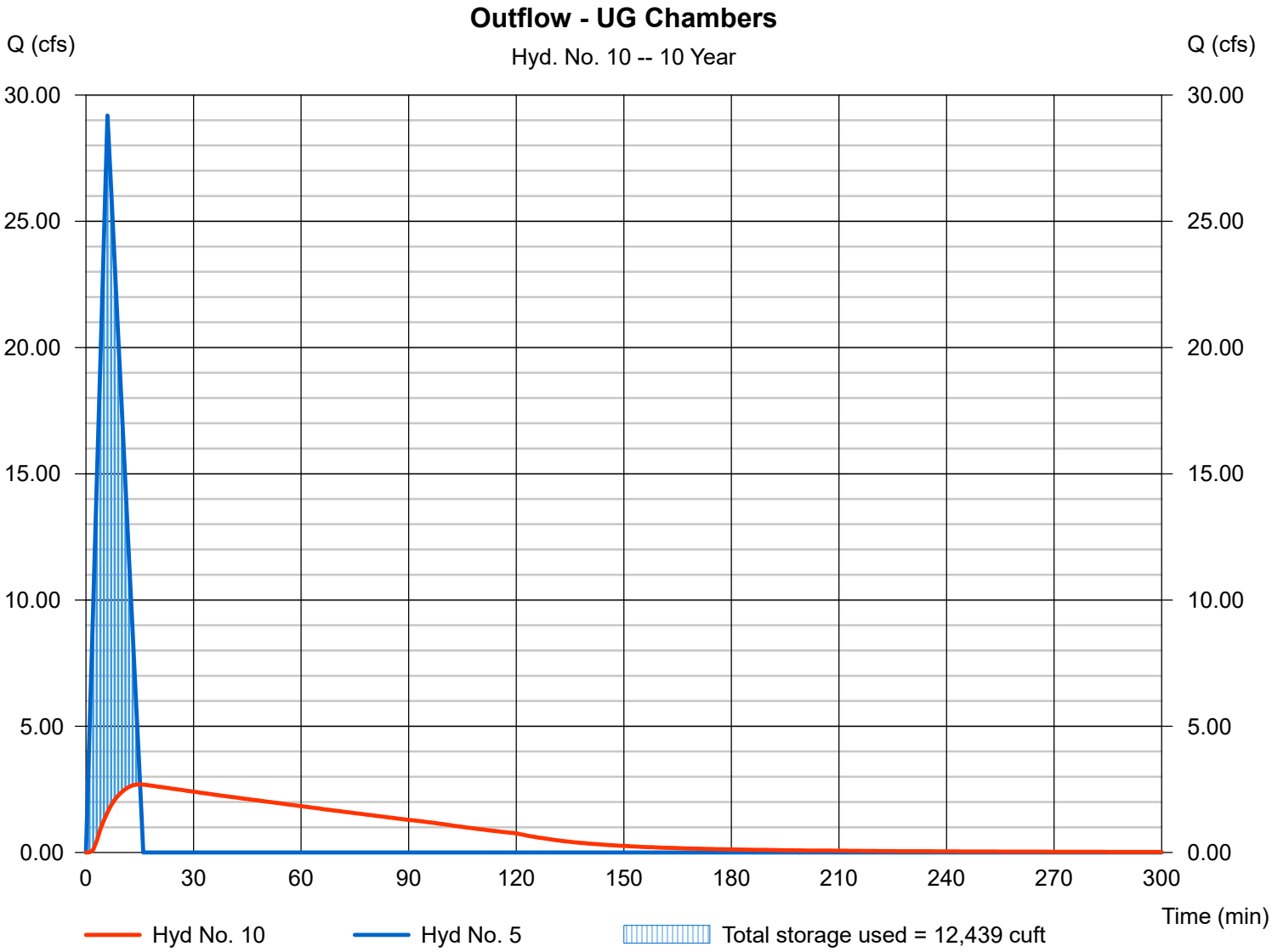
Hydrograph Report

Hyd. No. 10

Outflow - UG Chambers

Hydrograph type	=	Reservoir	Peak discharge	=	2.700 cfs
Storm frequency	=	10 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	13,995 cuft
Inflow hyd. No.	=	5 - WS-PR-1-DET	Max. Elevation	=	313.99 ft
Reservoir name	=	UG Chambers	Max. Storage	=	12,439 cuft

Storage Indication method used.

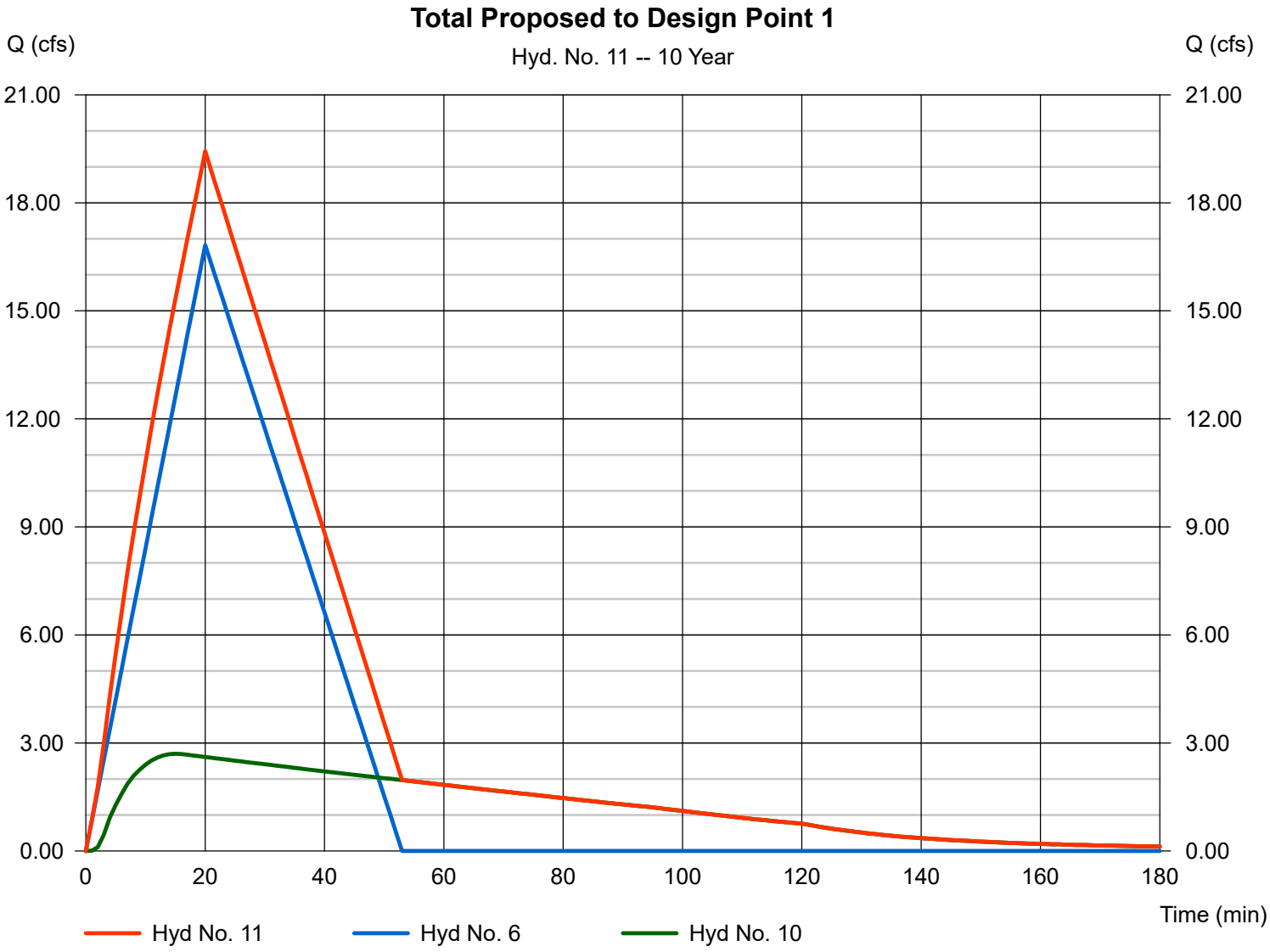


Hydrograph Report

Hyd. No. 11

Total Proposed to Design Point 1

Hydrograph type	= Combine	Peak discharge	= 19.44 cfs
Storm frequency	= 10 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 40,750 cuft
Inflow hyds.	= 6, 10	Contrib. drain. area	= 10.390 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.1

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	Rational	24.11	1	19	36,657	----	------	------	WS-EX-1 to Design Point 1
2	Rational	18.50	1	3	4,440	----	------	------	WS-EX-2 to Design Point 2
3	Rational	28.96	1	3	6,952	----	------	------	WS-EX-3 to Design Point 3
4	Rational	7.361	1	6	3,534	----	------	------	WS-EX-4 to Design Point 4
5	Rational	35.08	1	6	16,843	----	------	------	WS-PR-1-DET
6	Rational	20.25	1	20	32,397	----	------	------	WS-PR-1-UND to Design Point 1
7	Rational	18.50	1	3	4,440	----	------	------	WS-PR-2 to Design Point 2
8	Rational	28.96	1	3	6,952	----	------	------	WS-PR-3 to Design Point 3
9	Rational	7.361	1	6	3,534	----	------	------	WS-PR-4 to Design Point 4
10	Reservoir	3.045	1	15	16,823	5	314.43	15,061	Outflow - UG Chambers
11	Combine	23.19	1	20	49,014	6, 10	------	------	Total Proposed to Design Point 1

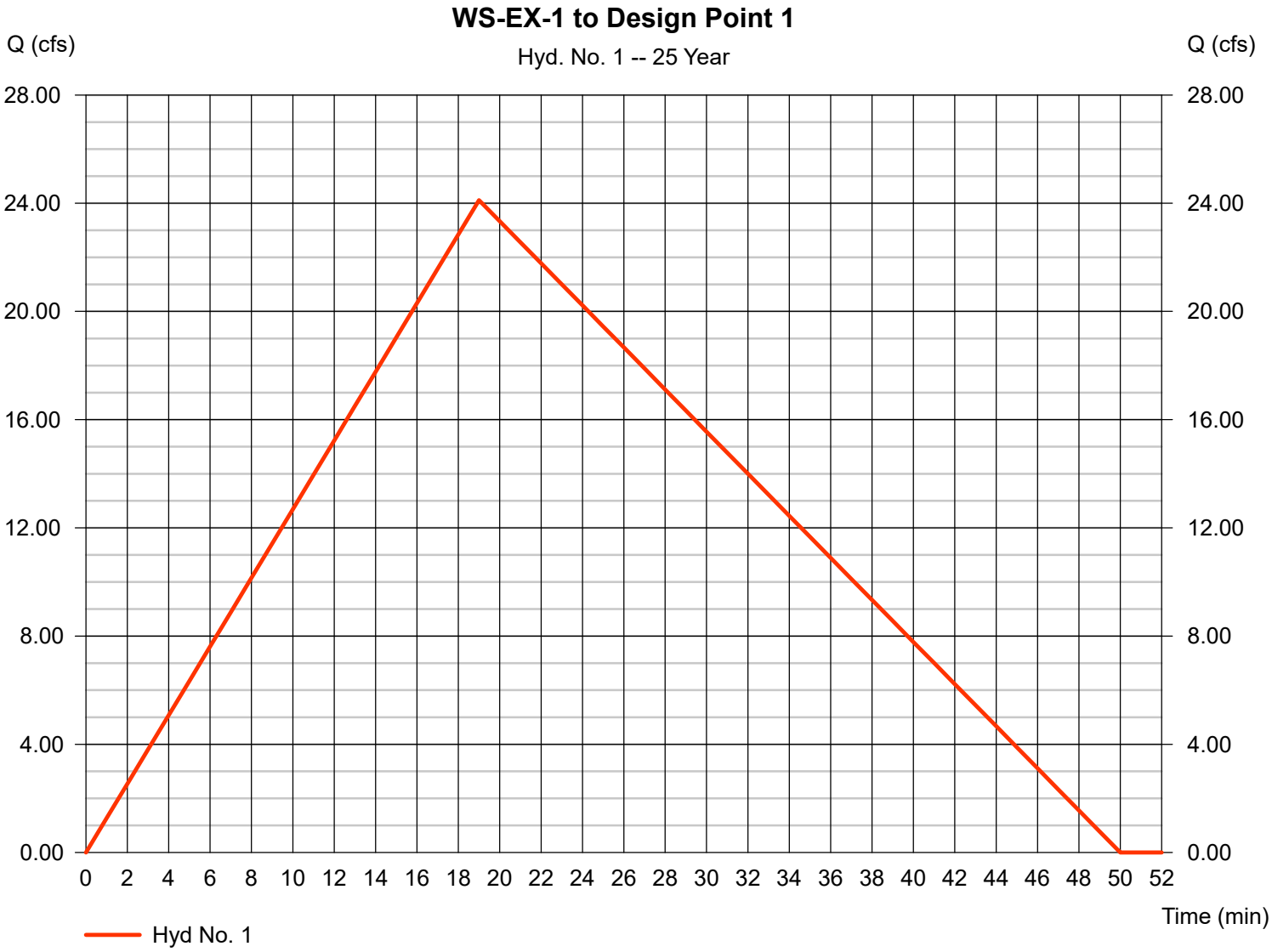
Hydrograph Report

Hyd. No. 1

WS-EX-1 to Design Point 1

Hydrograph type	= Rational	Peak discharge	= 24.11 cfs
Storm frequency	= 25 yrs	Time to peak	= 19 min
Time interval	= 1 min	Hyd. volume	= 36,657 cuft
Drainage area	= 15.780 ac	Runoff coeff.	= 0.35*
Intensity	= 4.366 in/hr	Tc by TR55	= 19.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(1.080 x 0.20) + (10.620 x 0.15) + (4.080 x 0.90)] / 15.780



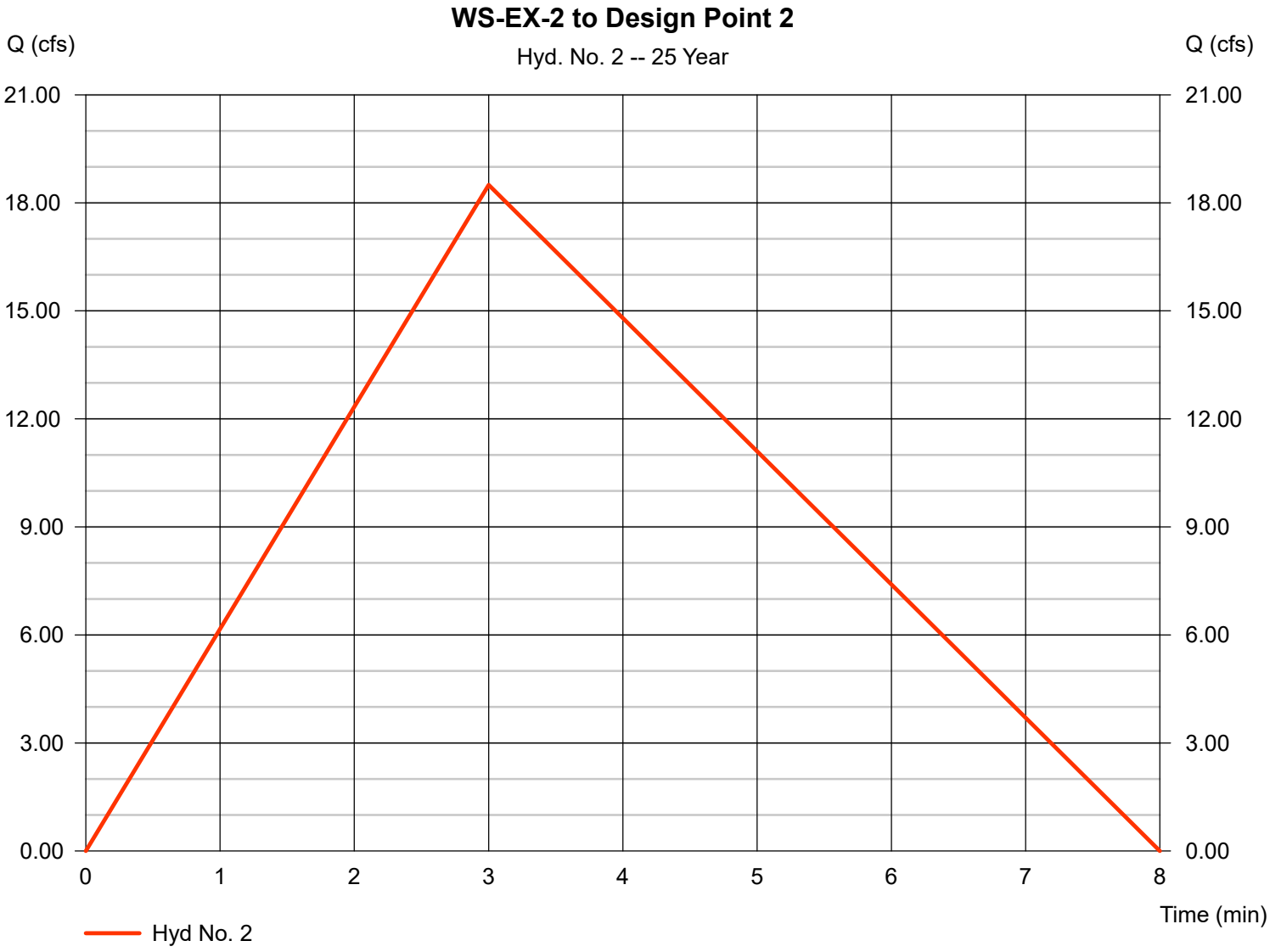
Hydrograph Report

Hyd. No. 2

WS-EX-2 to Design Point 2

Hydrograph type	= Rational	Peak discharge	= 18.50 cfs
Storm frequency	= 25 yrs	Time to peak	= 3 min
Time interval	= 1 min	Hyd. volume	= 4,440 cuft
Drainage area	= 2.760 ac	Runoff coeff.	= 0.65*
Intensity	= 10.312 in/hr	Tc by TR55	= 3.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.820 x 0.20) + (0.160 x 0.15) + (1.780 x 0.90)] / 2.760



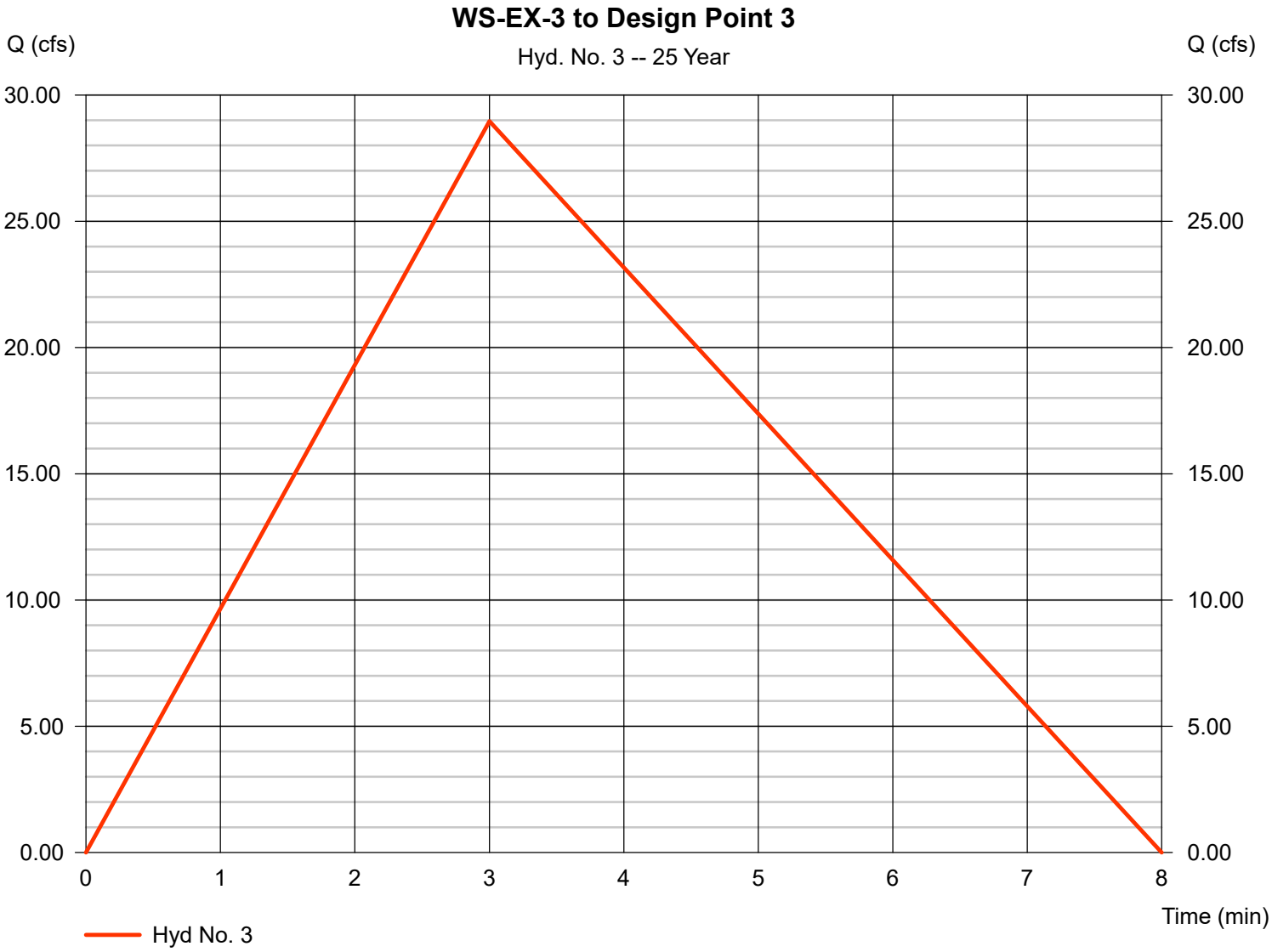
Hydrograph Report

Hyd. No. 3

WS-EX-3 to Design Point 3

Hydrograph type	= Rational	Peak discharge	= 28.96 cfs
Storm frequency	= 25 yrs	Time to peak	= 3 min
Time interval	= 1 min	Hyd. volume	= 6,952 cuft
Drainage area	= 4.530 ac	Runoff coeff.	= 0.62*
Intensity	= 10.312 in/hr	Tc by TR55	= 3.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.910 x 0.20) + (0.830 x 0.15) + (2.790 x 0.90)] / 4.530



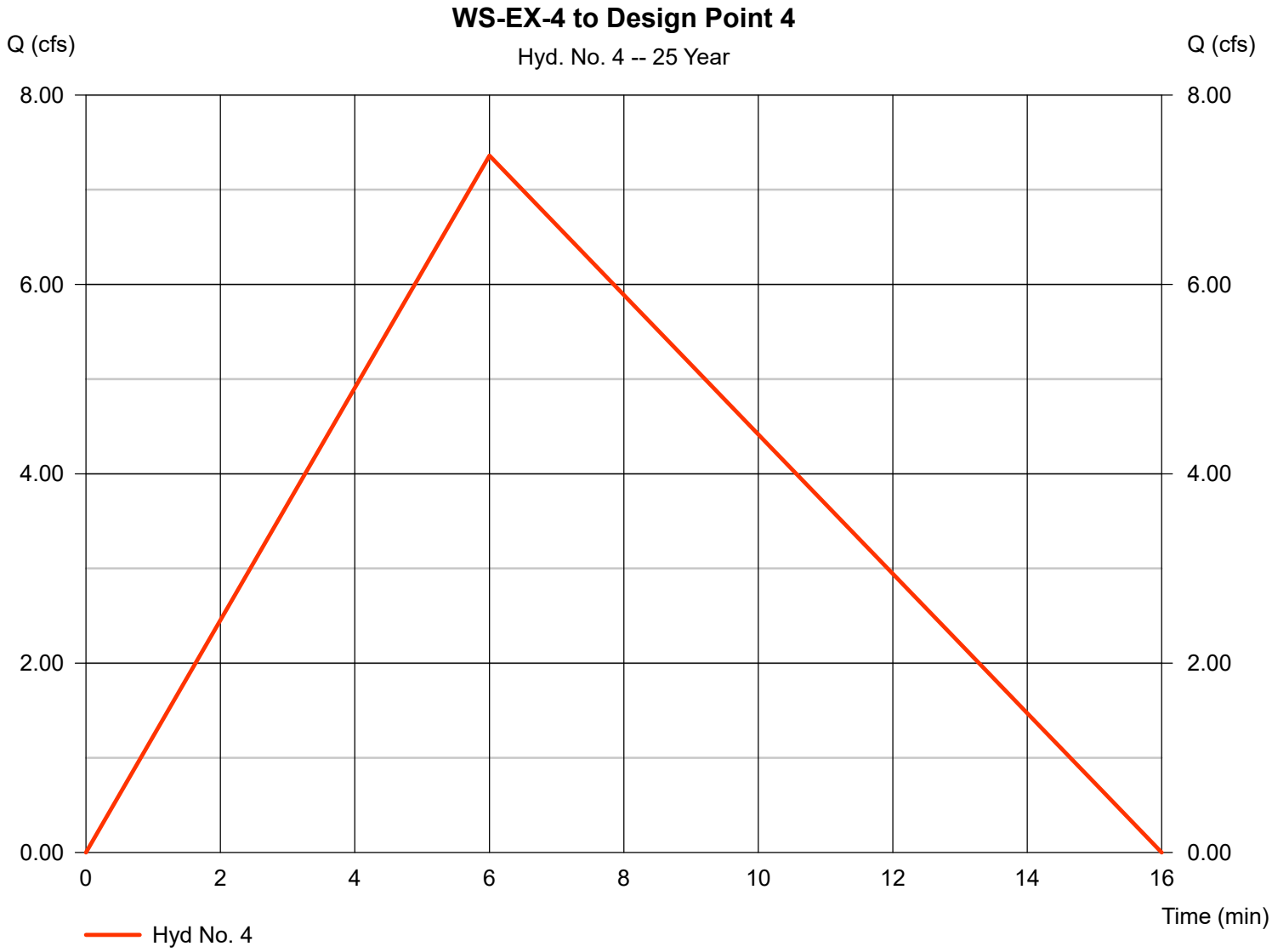
Hydrograph Report

Hyd. No. 4

WS-EX-4 to Design Point 4

Hydrograph type	=	Rational	Peak discharge	=	7.361 cfs
Storm frequency	=	25 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	3,534 cuft
Drainage area	=	2.810 ac	Runoff coeff.	=	0.33*
Intensity	=	7.938 in/hr	Tc by TR55	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.930 x 0.20) + (1.280 x 0.15) + (0.600 x 0.90)] / 2.810



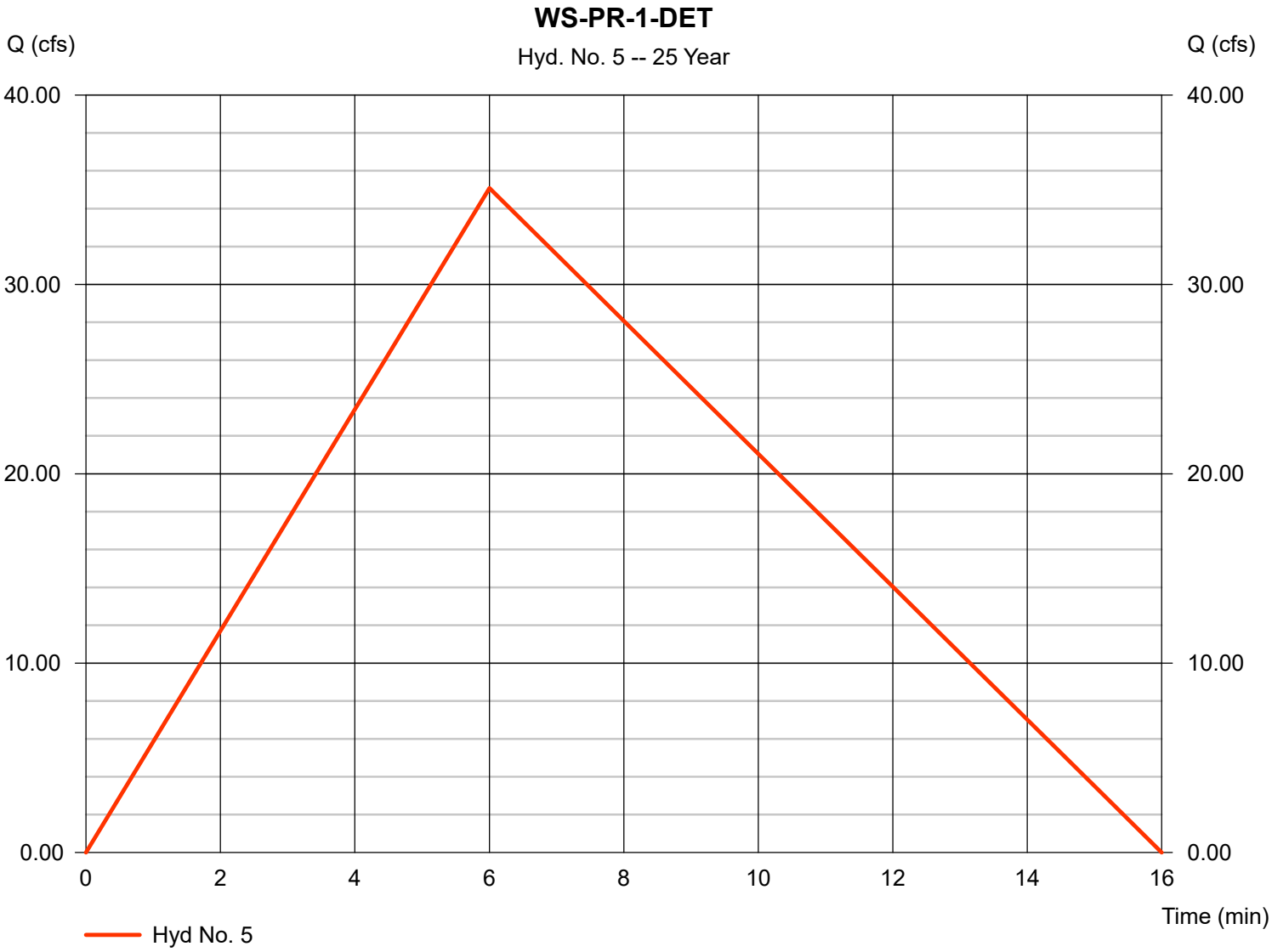
Hydrograph Report

Hyd. No. 5

WS-PR-1-DET

Hydrograph type	=	Rational	Peak discharge	=	35.08 cfs
Storm frequency	=	25 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	16,843 cuft
Drainage area	=	5.390 ac	Runoff coeff.	=	0.82*
Intensity	=	7.938 in/hr	Tc by User	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.580 x 0.20) + (4.810 x 0.90)] / 5.390



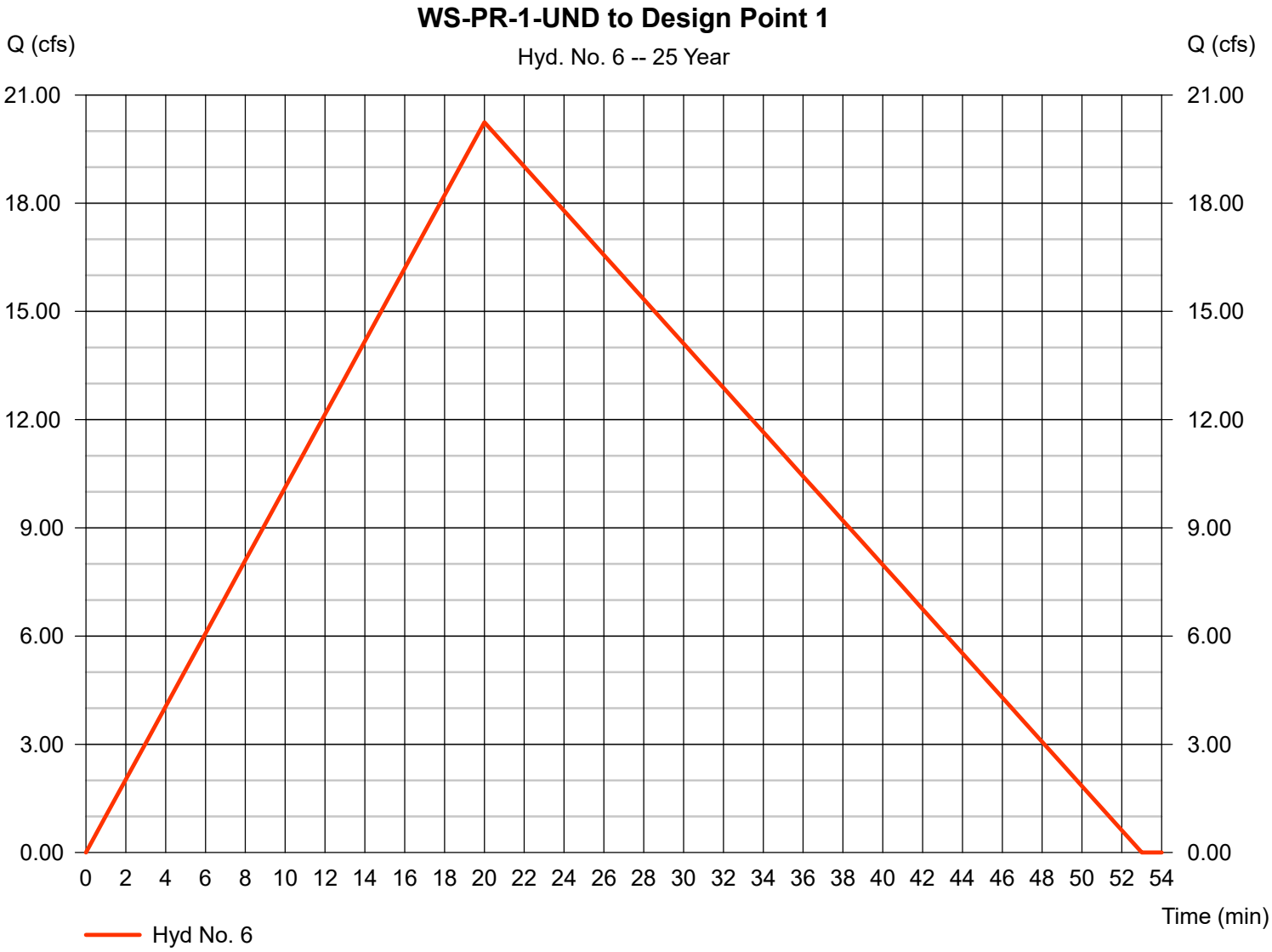
Hydrograph Report

Hyd. No. 6

WS-PR-1-UND to Design Point 1

Hydrograph type	=	Rational	Peak discharge	=	20.25 cfs
Storm frequency	=	25 yrs	Time to peak	=	20 min
Time interval	=	1 min	Hyd. volume	=	32,397 cuft
Drainage area	=	10.390 ac	Runoff coeff.	=	0.46*
Intensity	=	4.236 in/hr	Tc by TR55	=	20.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.270 x 0.20) + (5.810 x 0.15) + (4.310 x 0.90)] / 10.390



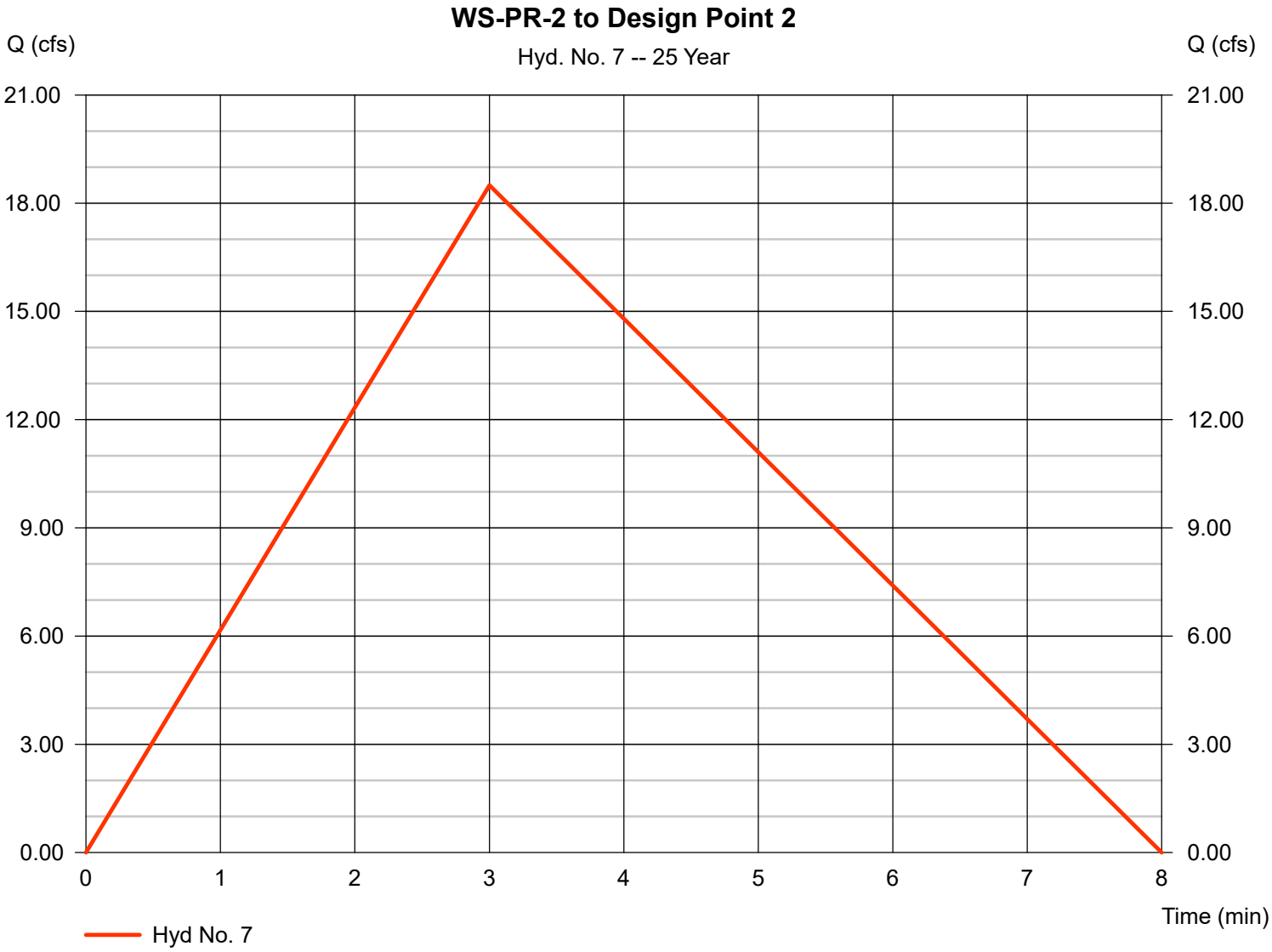
Hydrograph Report

Hyd. No. 7

WS-PR-2 to Design Point 2

Hydrograph type	=	Rational	Peak discharge	=	18.50 cfs
Storm frequency	=	25 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	4,440 cuft
Drainage area	=	2.760 ac	Runoff coeff.	=	0.65*
Intensity	=	10.312 in/hr	Tc by User	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.820 x 0.20) + (0.160 x 0.15) + (1.780 x 0.90)] / 2.760



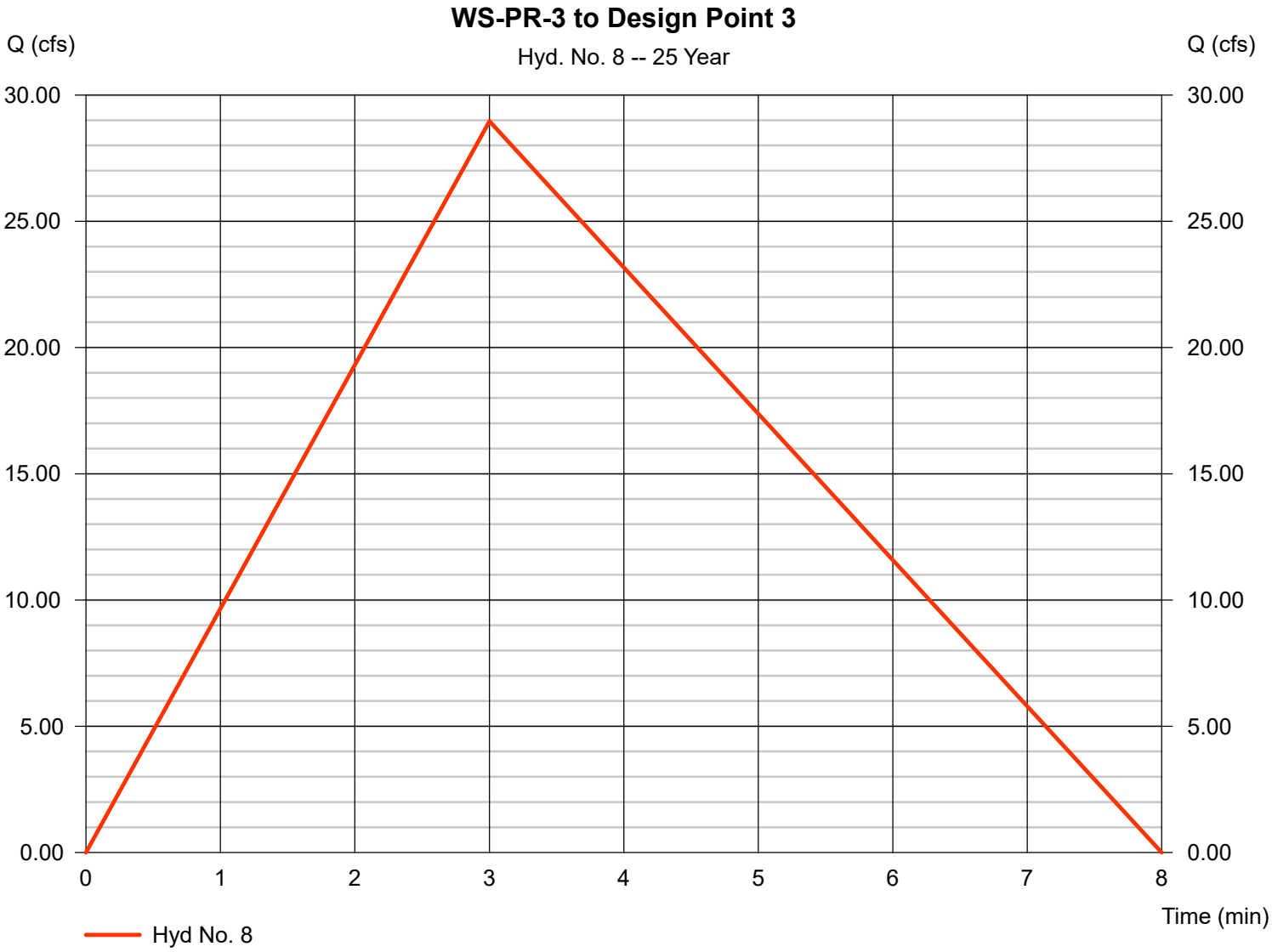
Hydrograph Report

Hyd. No. 8

WS-PR-3 to Design Point 3

Hydrograph type	= Rational	Peak discharge	= 28.96 cfs
Storm frequency	= 25 yrs	Time to peak	= 3 min
Time interval	= 1 min	Hyd. volume	= 6,952 cuft
Drainage area	= 4.530 ac	Runoff coeff.	= 0.62*
Intensity	= 10.312 in/hr	Tc by TR55	= 3.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.910 x 0.20) + (0.830 x 0.15) + (2.790 x 0.90)] / 4.530



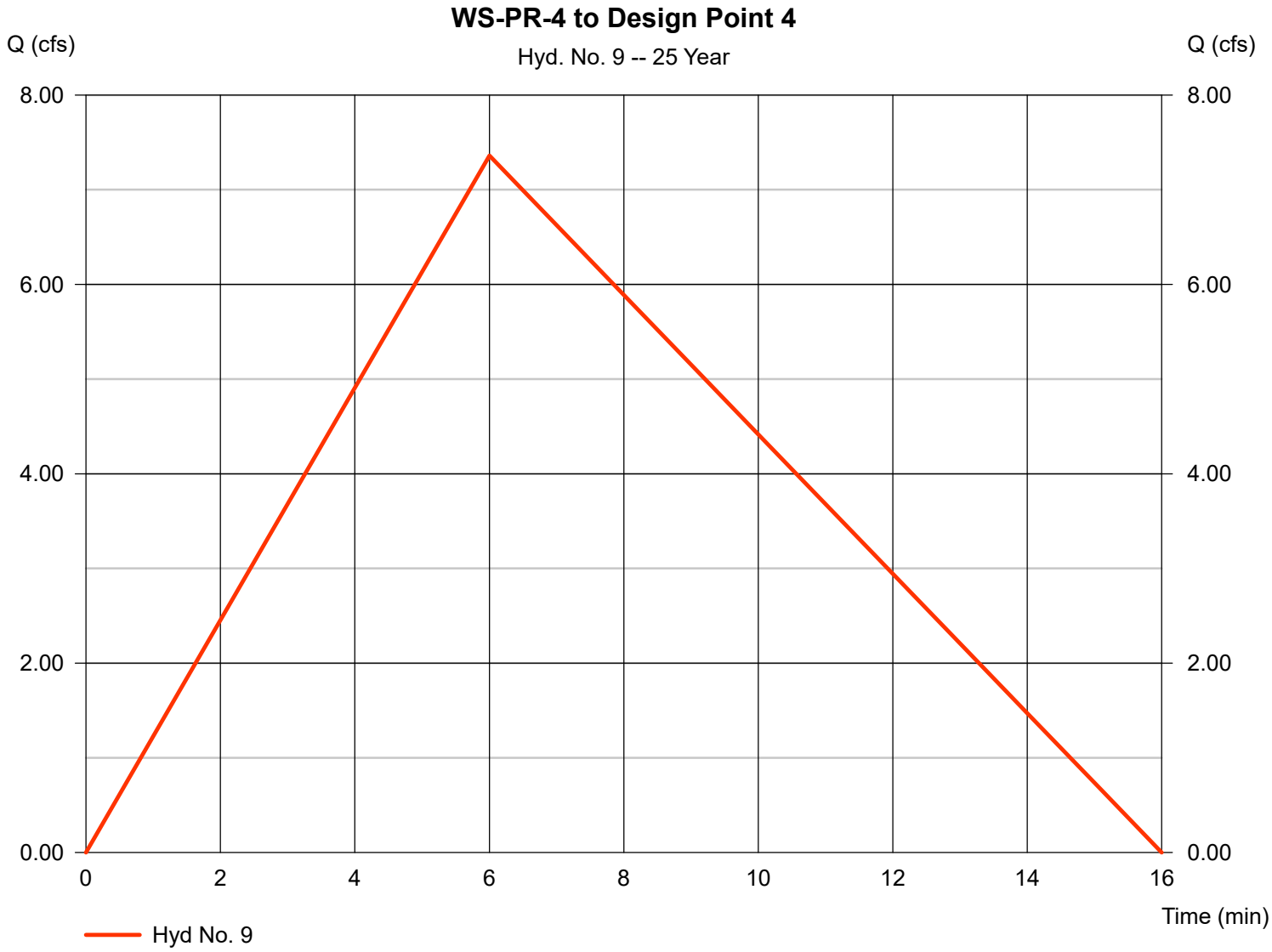
Hydrograph Report

Hyd. No. 9

WS-PR-4 to Design Point 4

Hydrograph type	=	Rational	Peak discharge	=	7.361 cfs
Storm frequency	=	25 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	3,534 cuft
Drainage area	=	2.810 ac	Runoff coeff.	=	0.33*
Intensity	=	7.938 in/hr	Tc by TR55	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.930 x 0.20) + (1.280 x 0.15) + (0.600 x 0.90)] / 2.810



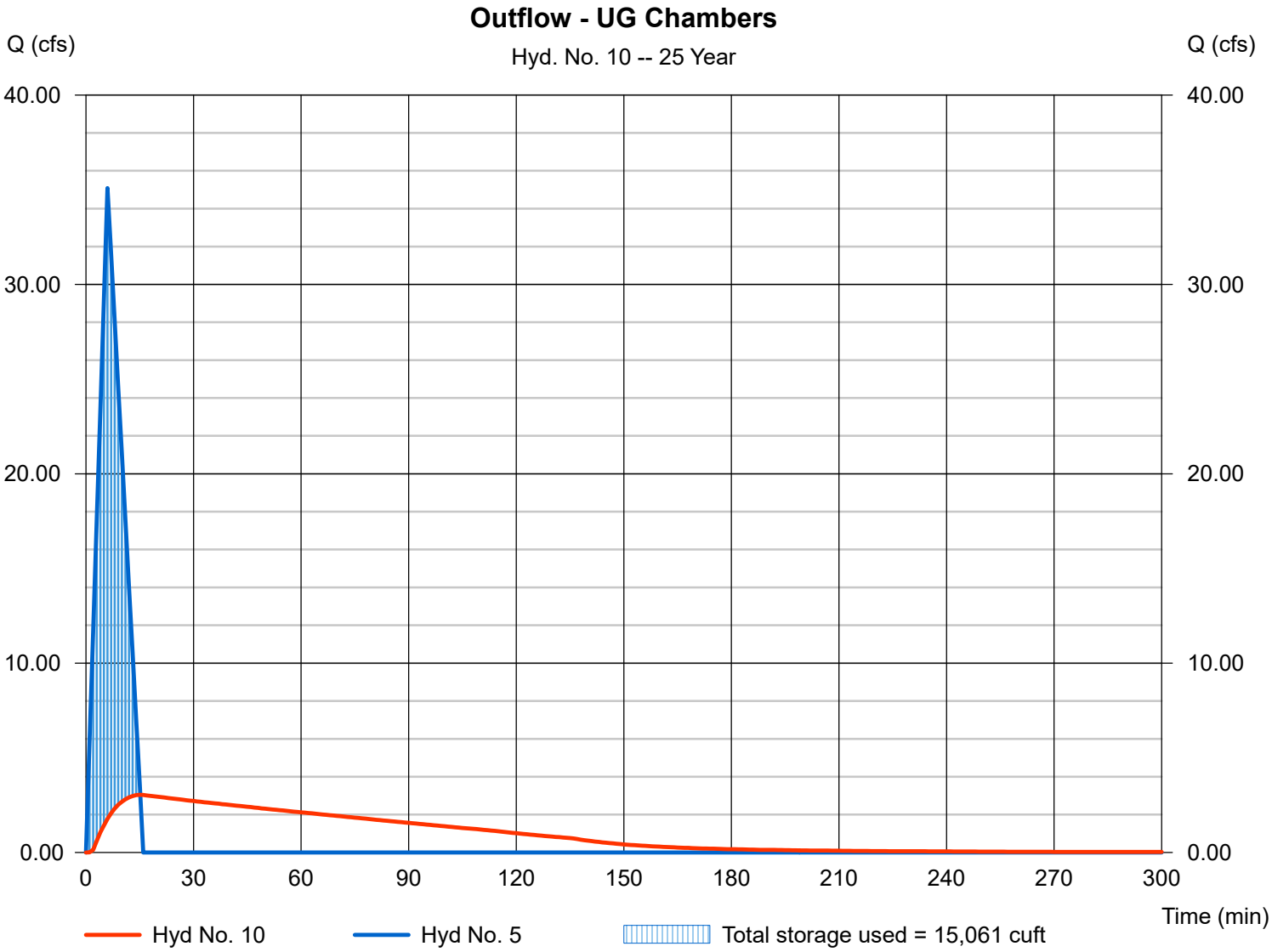
Hydrograph Report

Hyd. No. 10

Outflow - UG Chambers

Hydrograph type	=	Reservoir	Peak discharge	=	3.045 cfs
Storm frequency	=	25 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	16,823 cuft
Inflow hyd. No.	=	5 - WS-PR-1-DET	Max. Elevation	=	314.43 ft
Reservoir name	=	UG Chambers	Max. Storage	=	15,061 cuft

Storage Indication method used.

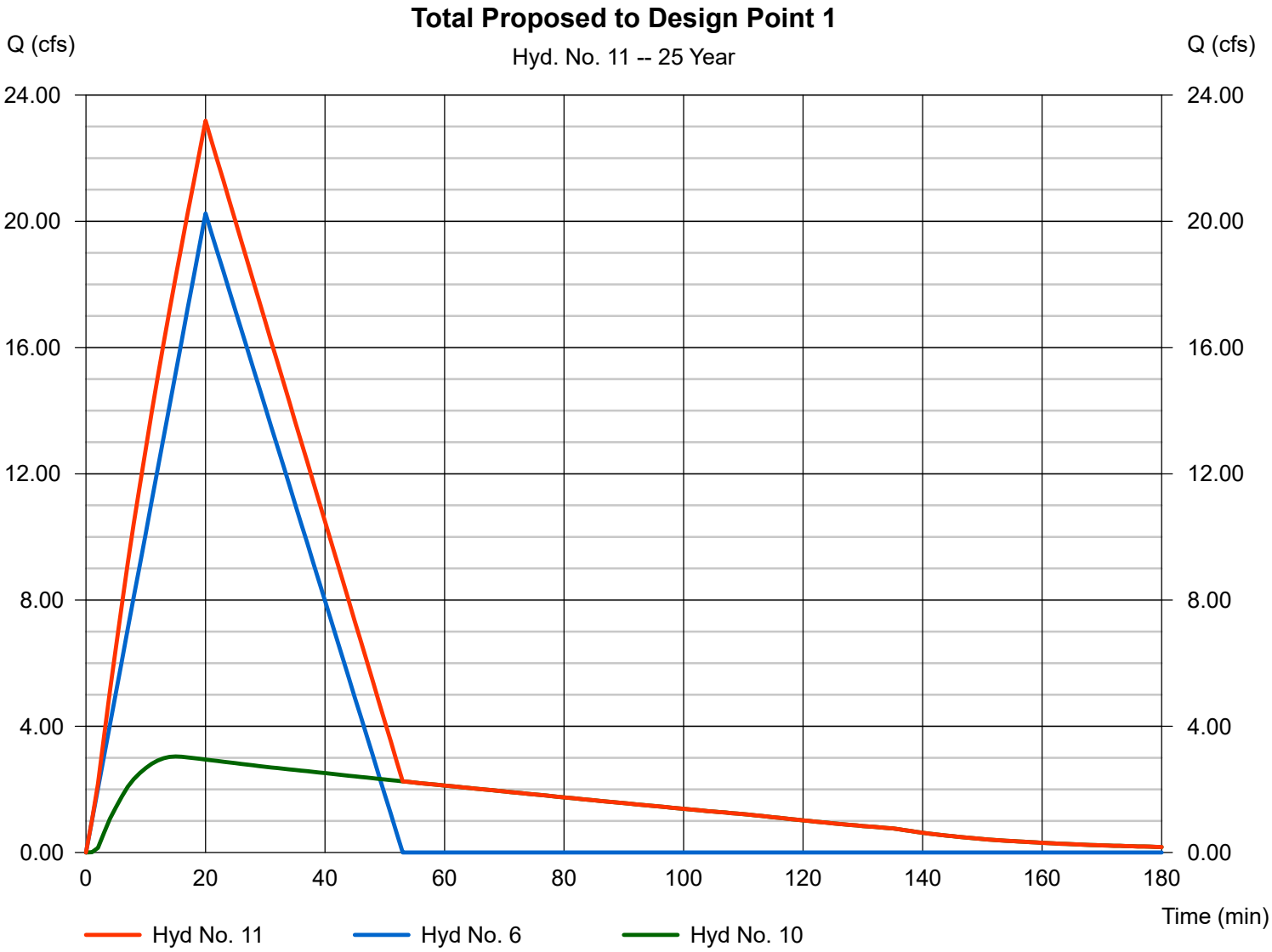


Hydrograph Report

Hyd. No. 11

Total Proposed to Design Point 1

Hydrograph type	= Combine	Peak discharge	= 23.19 cfs
Storm frequency	= 25 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 49,014 cuft
Inflow hyds.	= 6, 10	Contrib. drain. area	= 10.390 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.1

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	Rational	27.27	1	19	41,461	----	------	------	WS-EX-1 to Design Point 1
2	Rational	20.90	1	3	5,016	----	------	------	WS-EX-2 to Design Point 2
3	Rational	32.72	1	3	7,853	----	------	------	WS-EX-3 to Design Point 3
4	Rational	8.327	1	6	3,997	----	------	------	WS-EX-4 to Design Point 4
5	Rational	39.69	1	6	19,053	----	------	------	WS-PR-1-DET
6	Rational	22.90	1	20	36,639	----	------	------	WS-PR-1-UND to Design Point 1
7	Rational	20.90	1	3	5,016	----	------	------	WS-PR-2 to Design Point 2
8	Rational	32.72	1	3	7,853	----	------	------	WS-PR-3 to Design Point 3
9	Rational	8.327	1	6	3,997	----	------	------	WS-PR-4 to Design Point 4
10	Reservoir	3.354	1	15	19,034	5	314.87	17,108	Outflow - UG Chambers
11	Combine	26.11	1	20	55,439	6, 10	------	------	Total Proposed to Design Point 1

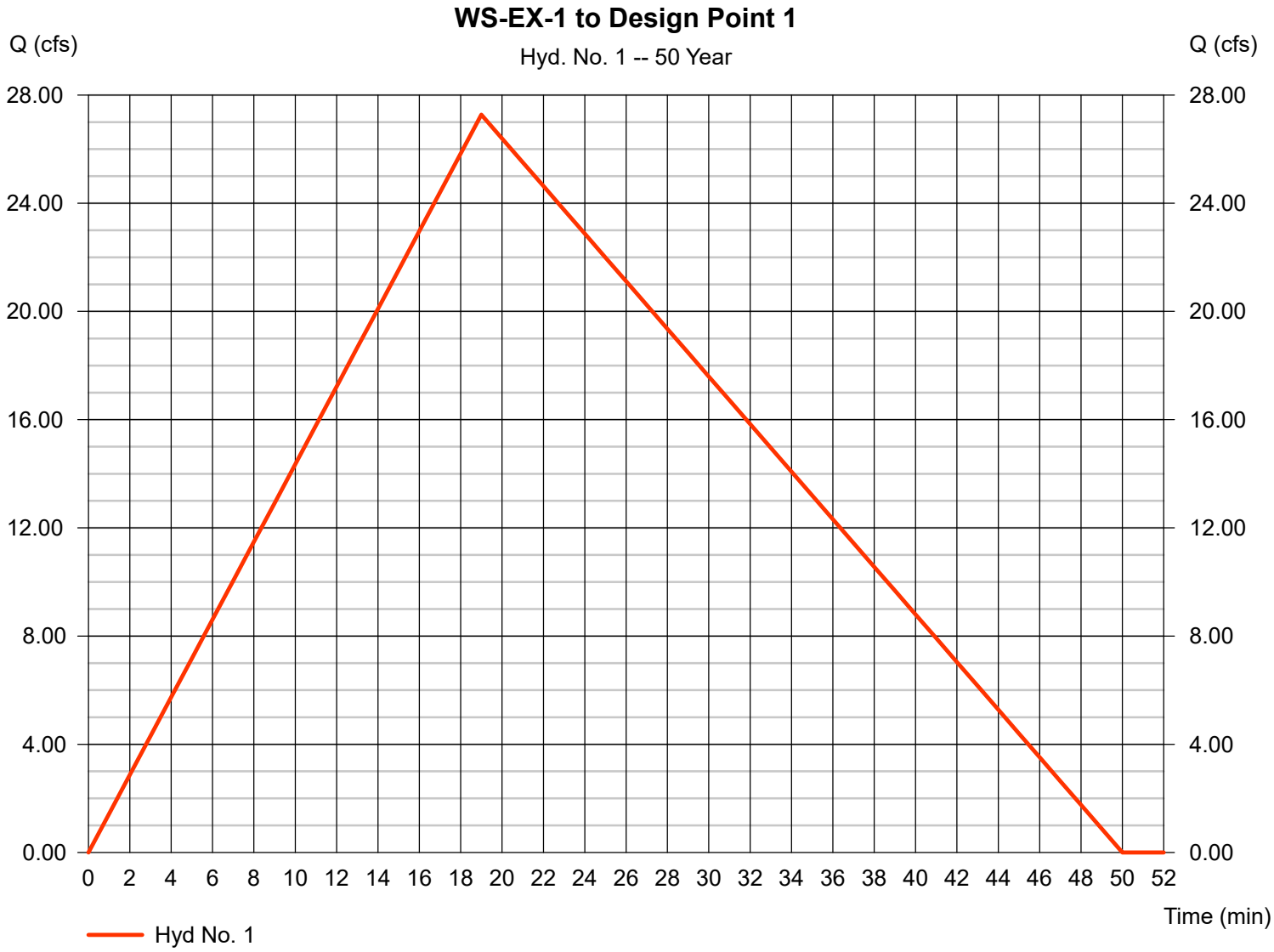
Hydrograph Report

Hyd. No. 1

WS-EX-1 to Design Point 1

Hydrograph type	=	Rational	Peak discharge	=	27.27 cfs
Storm frequency	=	50 yrs	Time to peak	=	19 min
Time interval	=	1 min	Hyd. volume	=	41,461 cuft
Drainage area	=	15.780 ac	Runoff coeff.	=	0.35*
Intensity	=	4.938 in/hr	Tc by TR55	=	19.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(1.080 x 0.20) + (10.620 x 0.15) + (4.080 x 0.90)] / 15.780



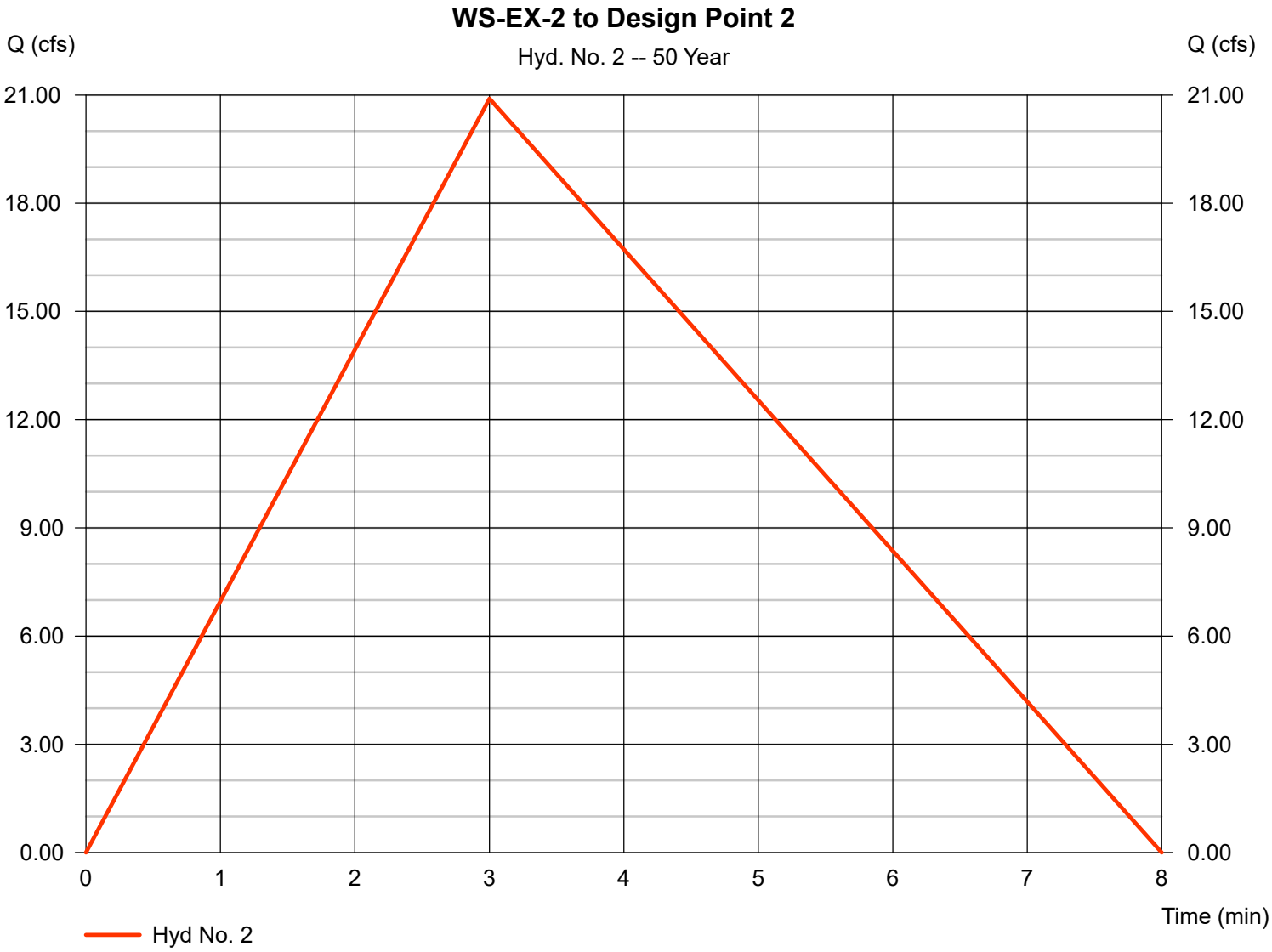
Hydrograph Report

Hyd. No. 2

WS-EX-2 to Design Point 2

Hydrograph type	=	Rational	Peak discharge	=	20.90 cfs
Storm frequency	=	50 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	5,016 cuft
Drainage area	=	2.760 ac	Runoff coeff.	=	0.65*
Intensity	=	11.649 in/hr	Tc by TR55	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.820 x 0.20) + (0.160 x 0.15) + (1.780 x 0.90)] / 2.760



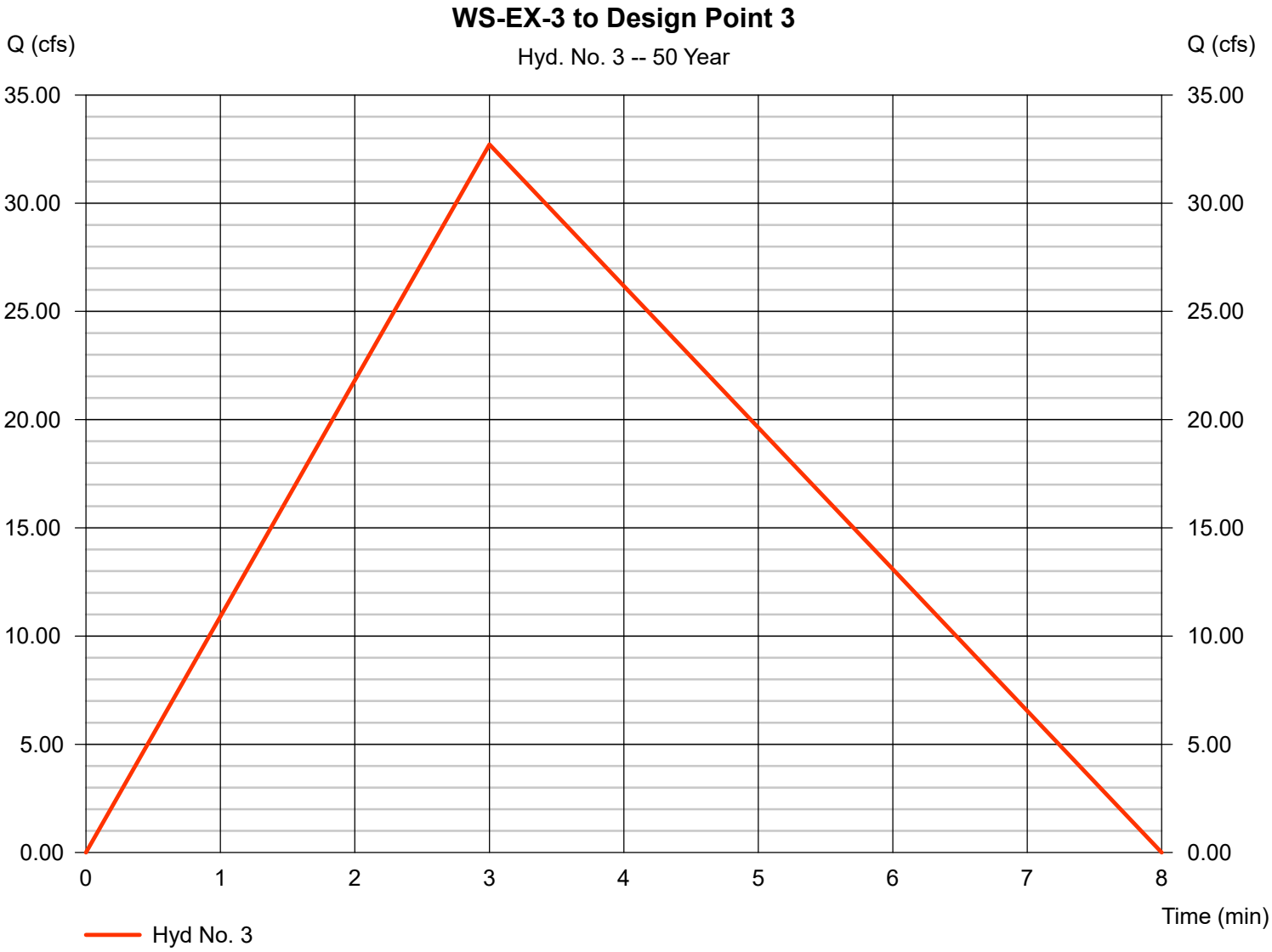
Hydrograph Report

Hyd. No. 3

WS-EX-3 to Design Point 3

Hydrograph type	=	Rational	Peak discharge	=	32.72 cfs
Storm frequency	=	50 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	7,853 cuft
Drainage area	=	4.530 ac	Runoff coeff.	=	0.62*
Intensity	=	11.649 in/hr	Tc by TR55	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.910 x 0.20) + (0.830 x 0.15) + (2.790 x 0.90)] / 4.530



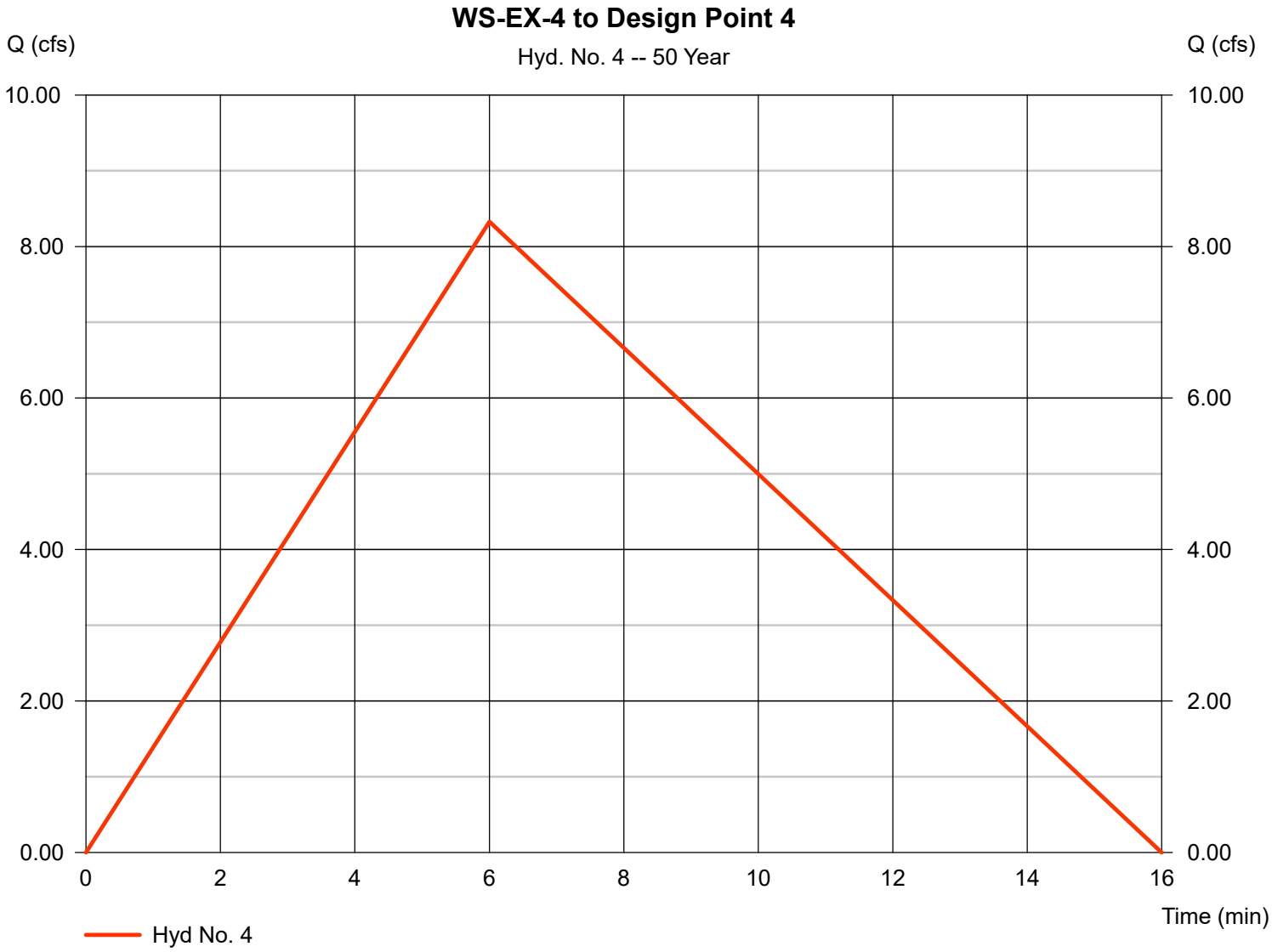
Hydrograph Report

Hyd. No. 4

WS-EX-4 to Design Point 4

Hydrograph type	=	Rational	Peak discharge	=	8.327 cfs
Storm frequency	=	50 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	3,997 cuft
Drainage area	=	2.810 ac	Runoff coeff.	=	0.33*
Intensity	=	8.980 in/hr	Tc by TR55	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.930 x 0.20) + (1.280 x 0.15) + (0.600 x 0.90)] / 2.810



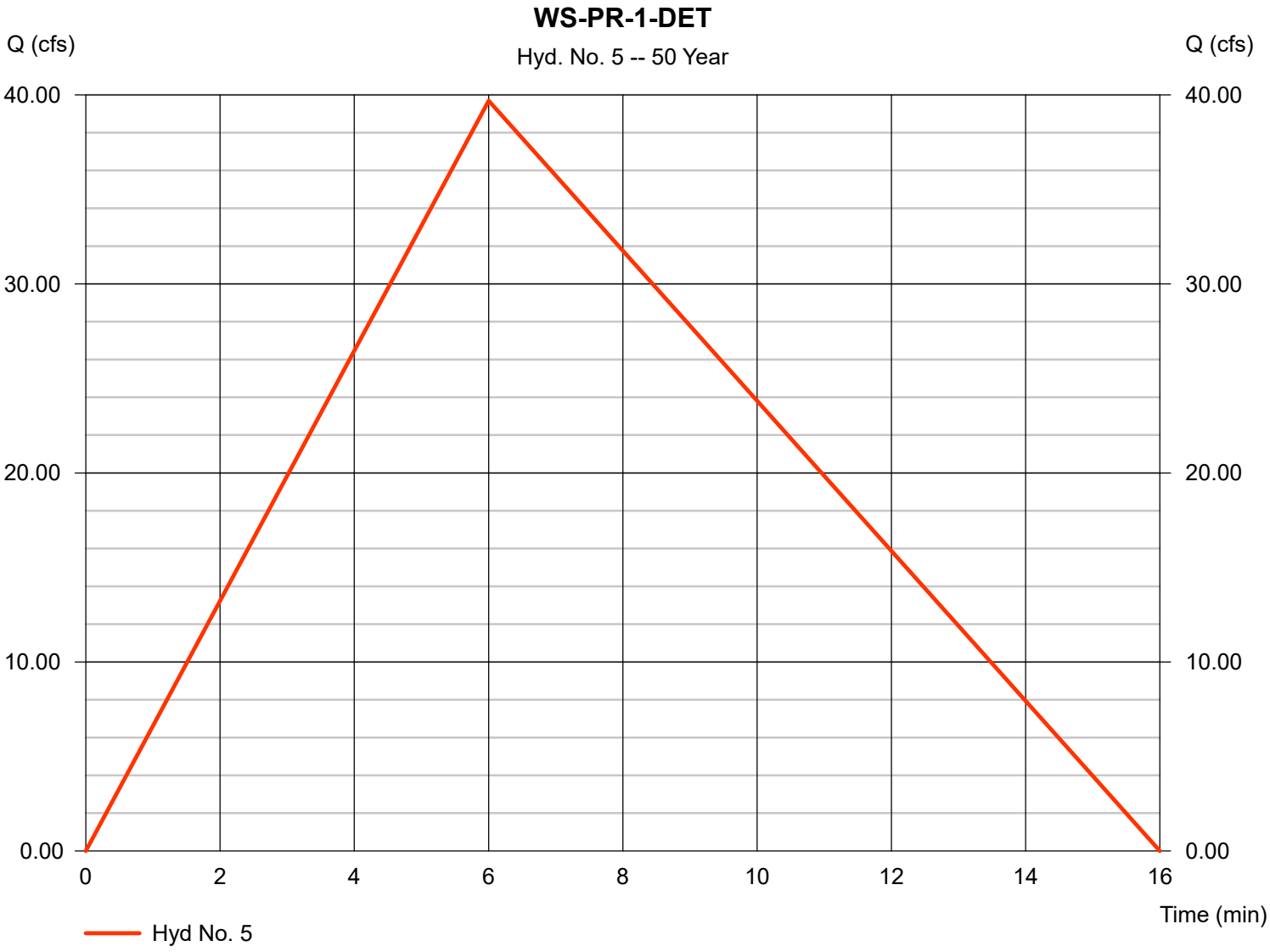
Hydrograph Report

Hyd. No. 5

WS-PR-1-DET

Hydrograph type	=	Rational	Peak discharge	=	39.69 cfs
Storm frequency	=	50 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	19,053 cuft
Drainage area	=	5.390 ac	Runoff coeff.	=	0.82*
Intensity	=	8.980 in/hr	Tc by User	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.580 x 0.20) + (4.810 x 0.90)] / 5.390



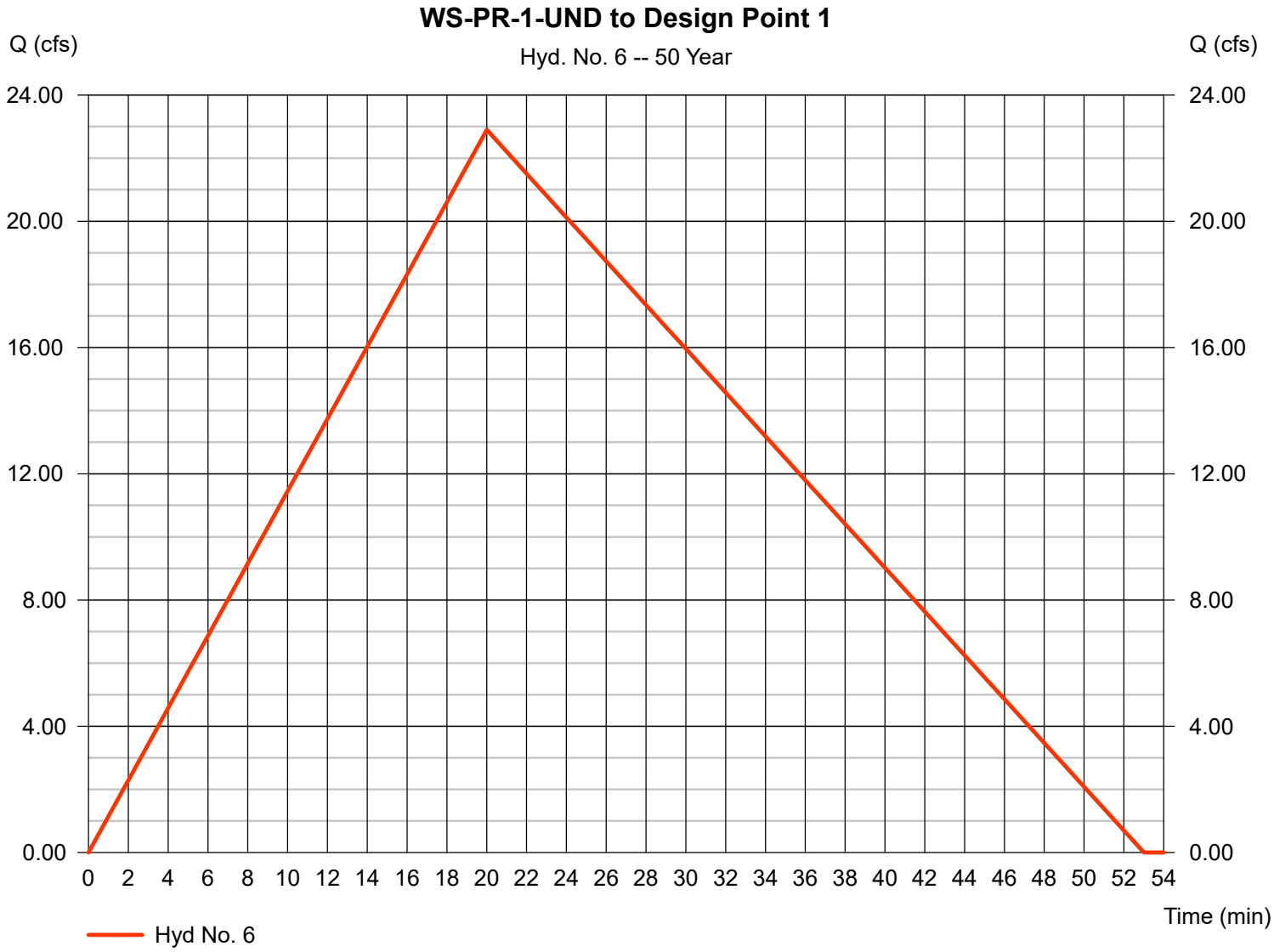
Hydrograph Report

Hyd. No. 6

WS-PR-1-UND to Design Point 1

Hydrograph type	=	Rational	Peak discharge	=	22.90 cfs
Storm frequency	=	50 yrs	Time to peak	=	20 min
Time interval	=	1 min	Hyd. volume	=	36,639 cuft
Drainage area	=	10.390 ac	Runoff coeff.	=	0.46*
Intensity	=	4.791 in/hr	Tc by TR55	=	20.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.270 x 0.20) + (5.810 x 0.15) + (4.310 x 0.90)] / 10.390



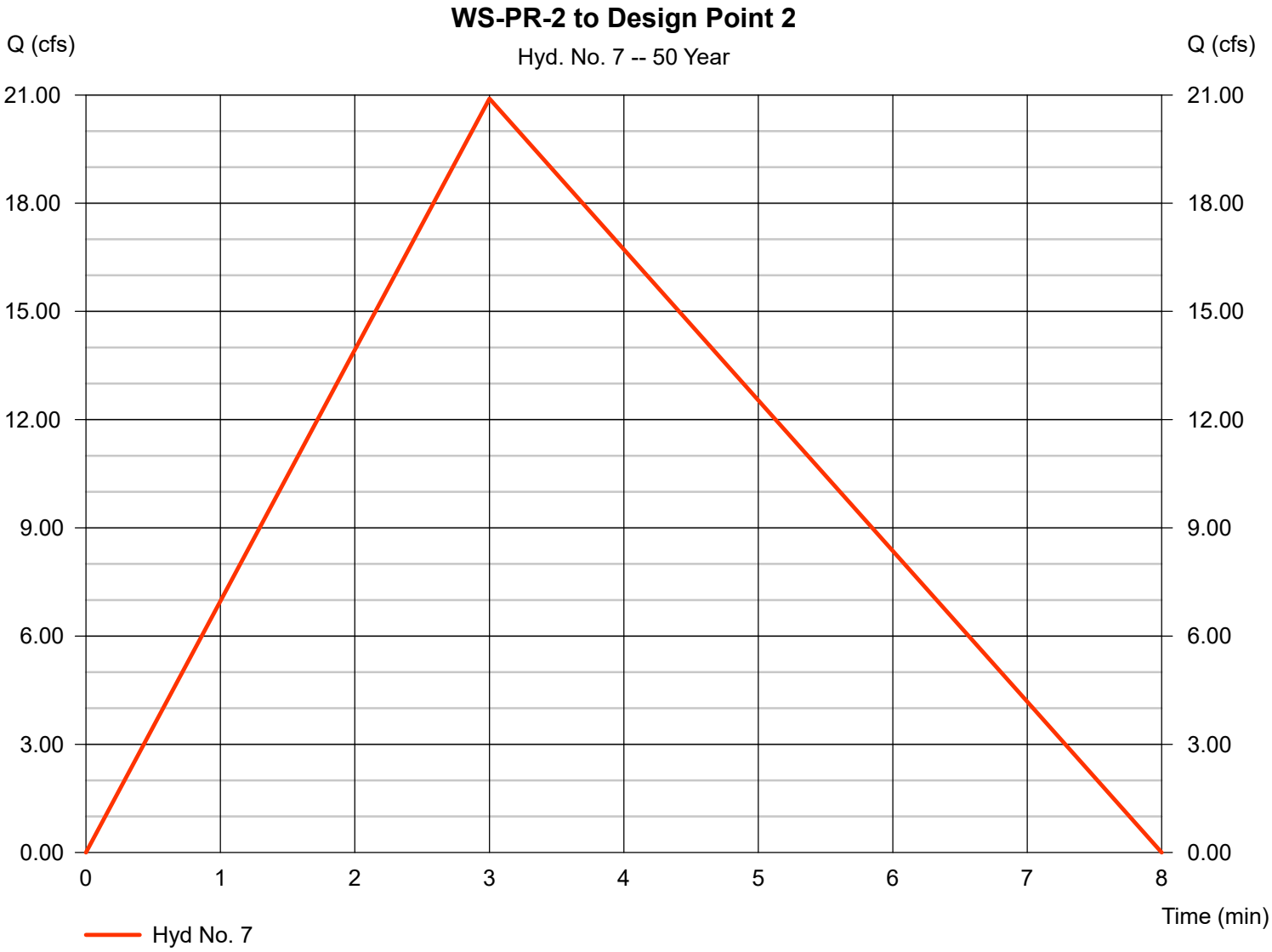
Hydrograph Report

Hyd. No. 7

WS-PR-2 to Design Point 2

Hydrograph type	=	Rational	Peak discharge	=	20.90 cfs
Storm frequency	=	50 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	5,016 cuft
Drainage area	=	2.760 ac	Runoff coeff.	=	0.65*
Intensity	=	11.649 in/hr	Tc by User	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.820 x 0.20) + (0.160 x 0.15) + (1.780 x 0.90)] / 2.760



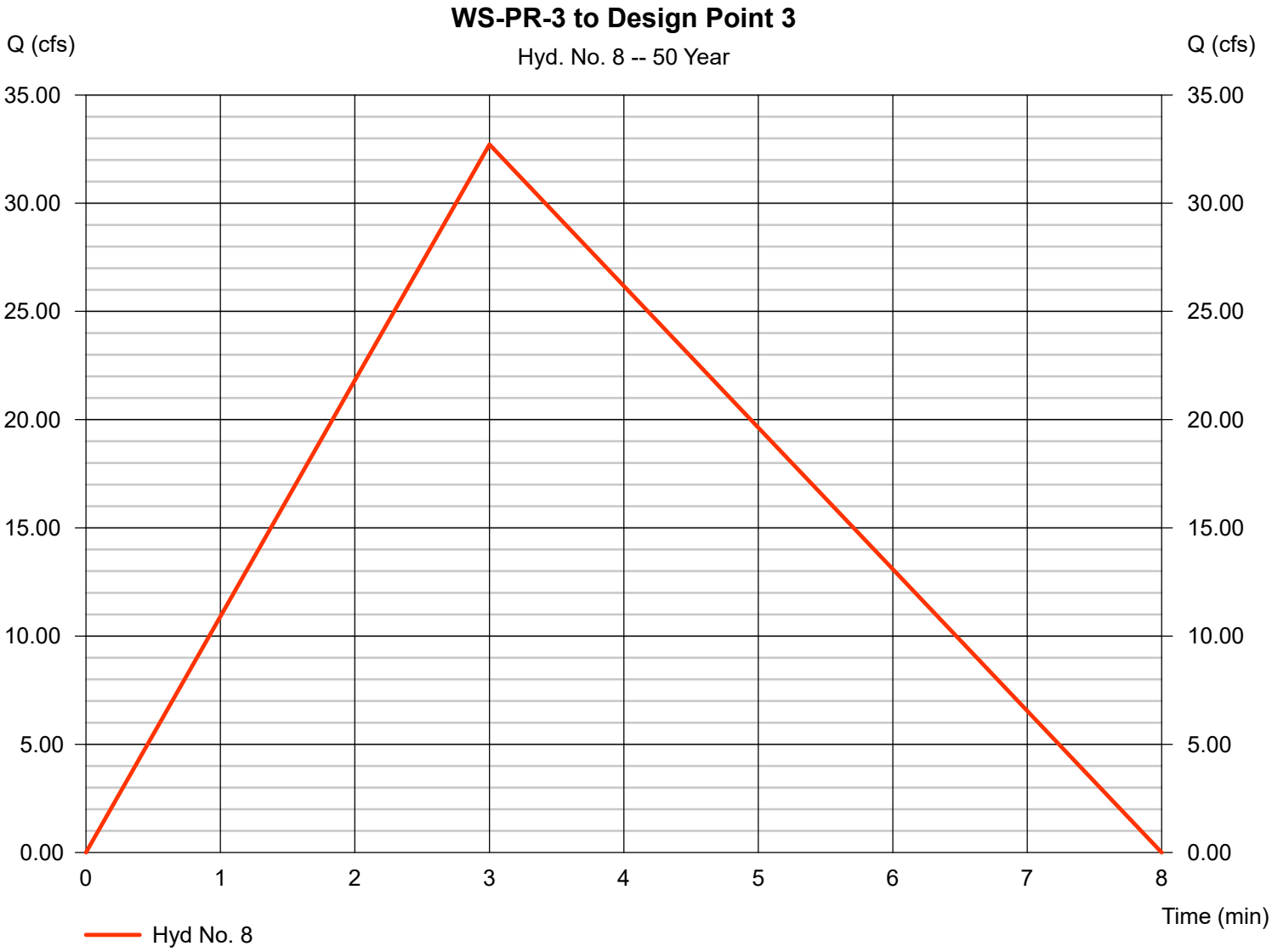
Hydrograph Report

Hyd. No. 8

WS-PR-3 to Design Point 3

Hydrograph type	=	Rational	Peak discharge	=	32.72 cfs
Storm frequency	=	50 yrs	Time to peak	=	3 min
Time interval	=	1 min	Hyd. volume	=	7,853 cuft
Drainage area	=	4.530 ac	Runoff coeff.	=	0.62*
Intensity	=	11.649 in/hr	Tc by TR55	=	3.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.910 x 0.20) + (0.830 x 0.15) + (2.790 x 0.90)] / 4.530



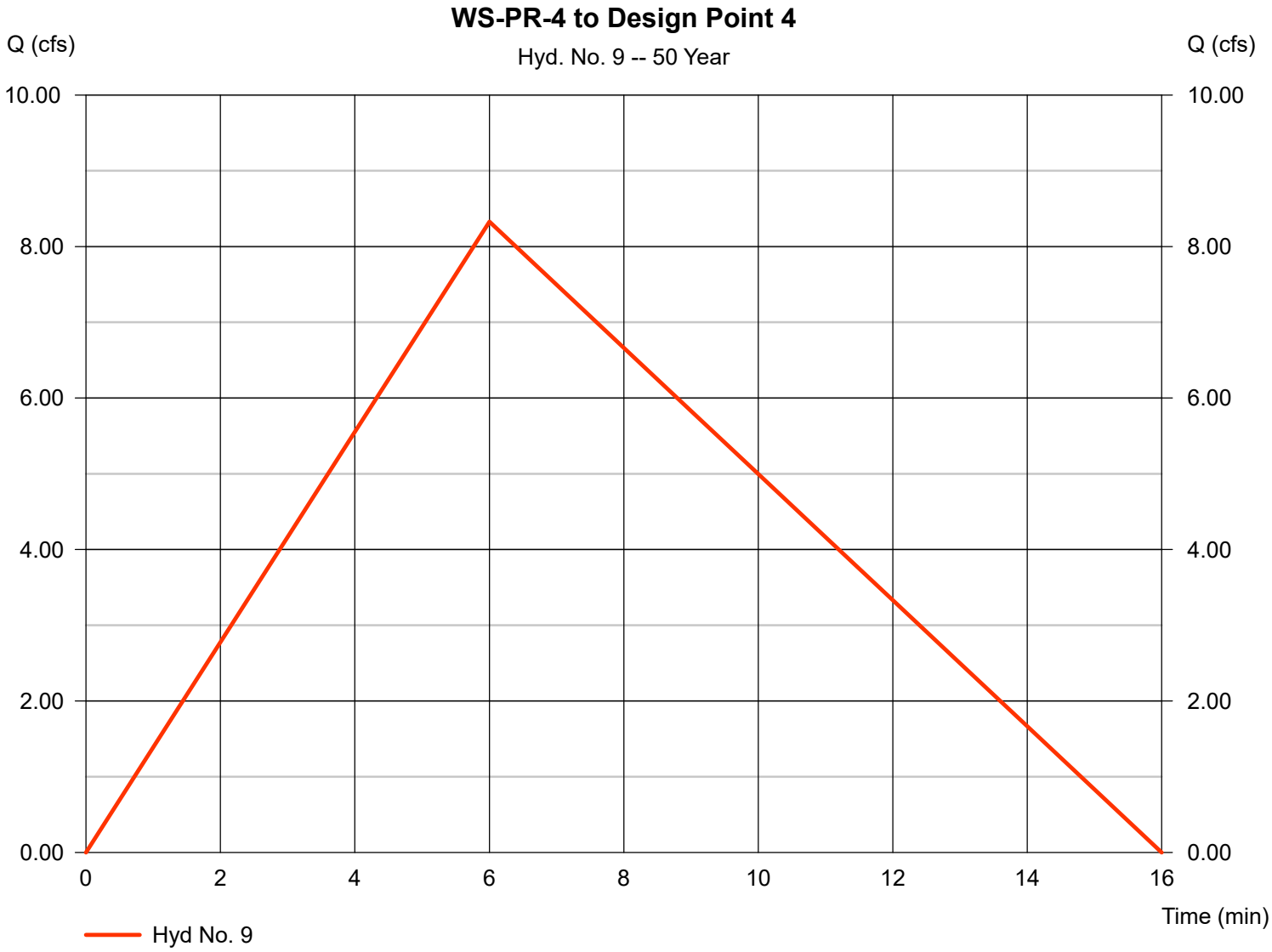
Hydrograph Report

Hyd. No. 9

WS-PR-4 to Design Point 4

Hydrograph type	=	Rational	Peak discharge	=	8.327 cfs
Storm frequency	=	50 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	3,997 cuft
Drainage area	=	2.810 ac	Runoff coeff.	=	0.33*
Intensity	=	8.980 in/hr	Tc by TR55	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.930 x 0.20) + (1.280 x 0.15) + (0.600 x 0.90)] / 2.810



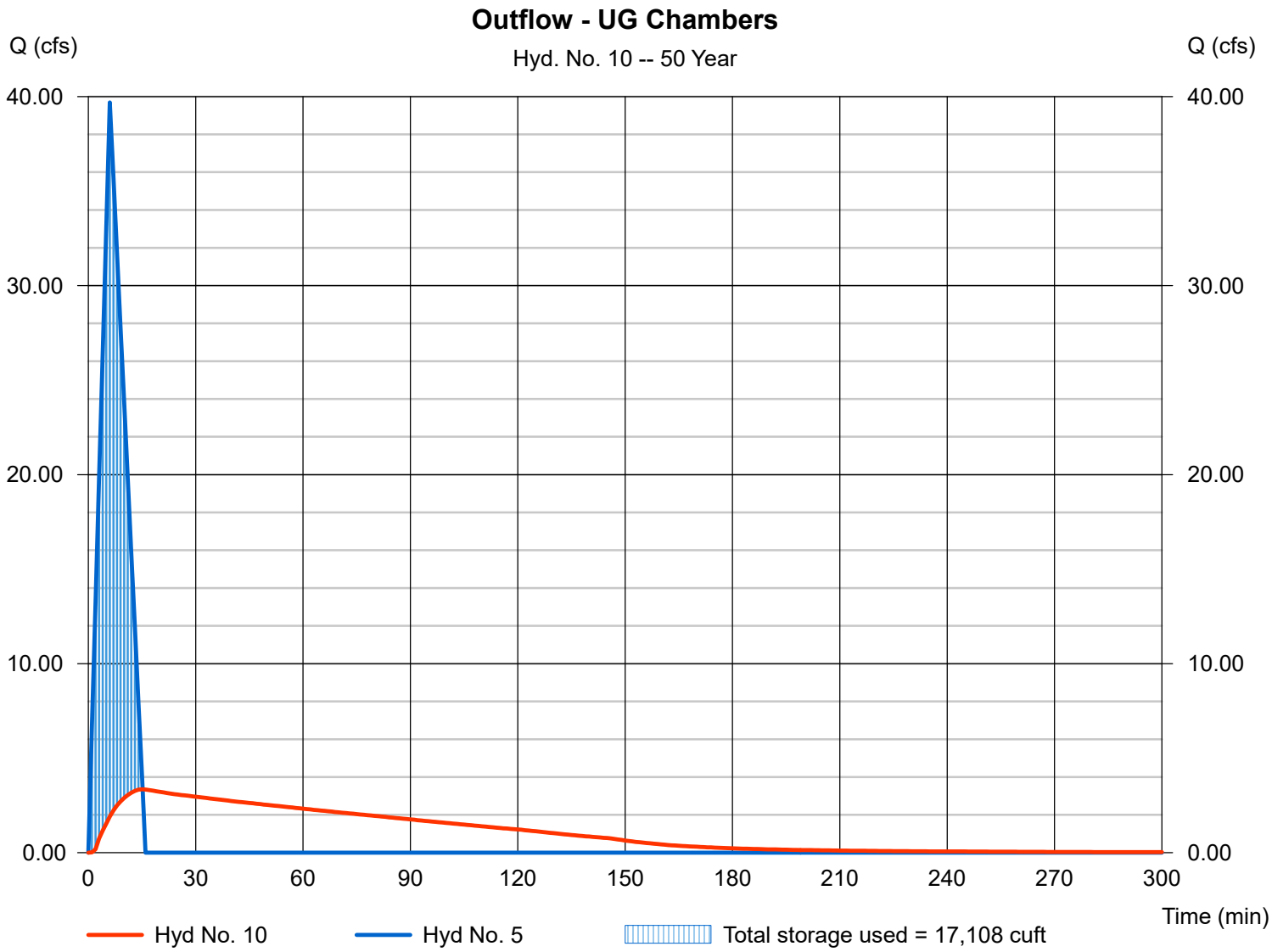
Hydrograph Report

Hyd. No. 10

Outflow - UG Chambers

Hydrograph type	=	Reservoir	Peak discharge	=	3.354 cfs
Storm frequency	=	50 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	19,034 cuft
Inflow hyd. No.	=	5 - WS-PR-1-DET	Max. Elevation	=	314.87 ft
Reservoir name	=	UG Chambers	Max. Storage	=	17,108 cuft

Storage Indication method used.

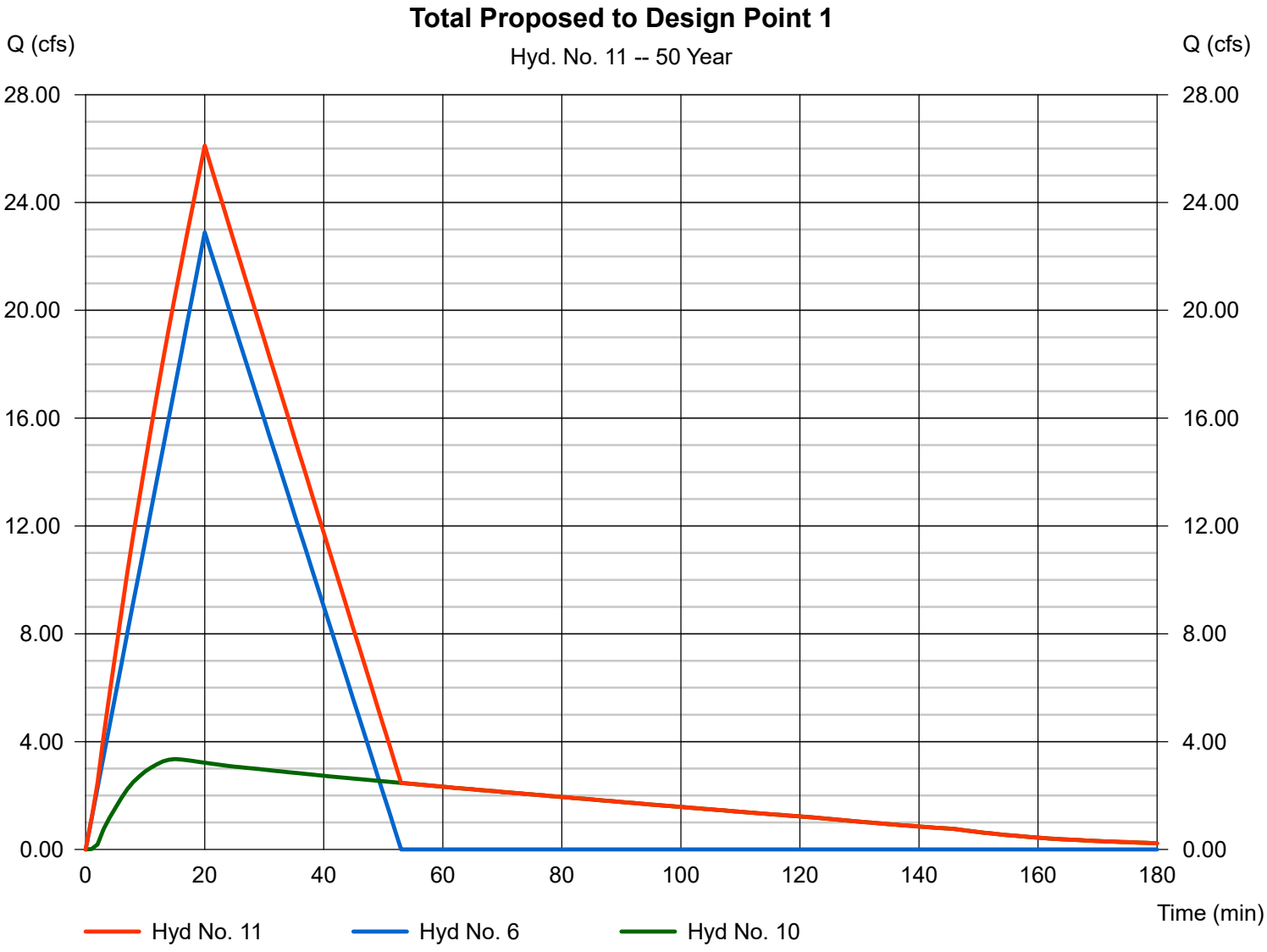


Hydrograph Report

Hyd. No. 11

Total Proposed to Design Point 1

Hydrograph type	= Combine	Peak discharge	= 26.11 cfs
Storm frequency	= 50 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 55,439 cuft
Inflow hyds.	= 6, 10	Contrib. drain. area	= 10.390 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.1

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	Rational	30.47	1	19	46,314	----	------	------	WS-EX-1 to Design Point 1
2	Rational	23.11	1	3	5,548	----	------	------	WS-EX-2 to Design Point 2
3	Rational	36.18	1	3	8,685	----	------	------	WS-EX-3 to Design Point 3
4	Rational	9.255	1	6	4,443	----	------	------	WS-EX-4 to Design Point 4
5	Rational	44.11	1	6	21,177	----	------	------	WS-PR-1-DET
6	Rational	25.58	1	20	40,932	----	------	------	WS-PR-1-UND to Design Point 1
7	Rational	23.11	1	3	5,548	----	------	------	WS-PR-2 to Design Point 2
8	Rational	36.18	1	3	8,685	----	------	------	WS-PR-3 to Design Point 3
9	Rational	9.255	1	6	4,443	----	------	------	WS-PR-4 to Design Point 4
10	Reservoir	4.144	1	15	21,157	5	315.38	19,042	Outflow - UG Chambers
11	Combine	29.09	1	20	61,828	6, 10	------	------	Total Proposed to Design Point 1

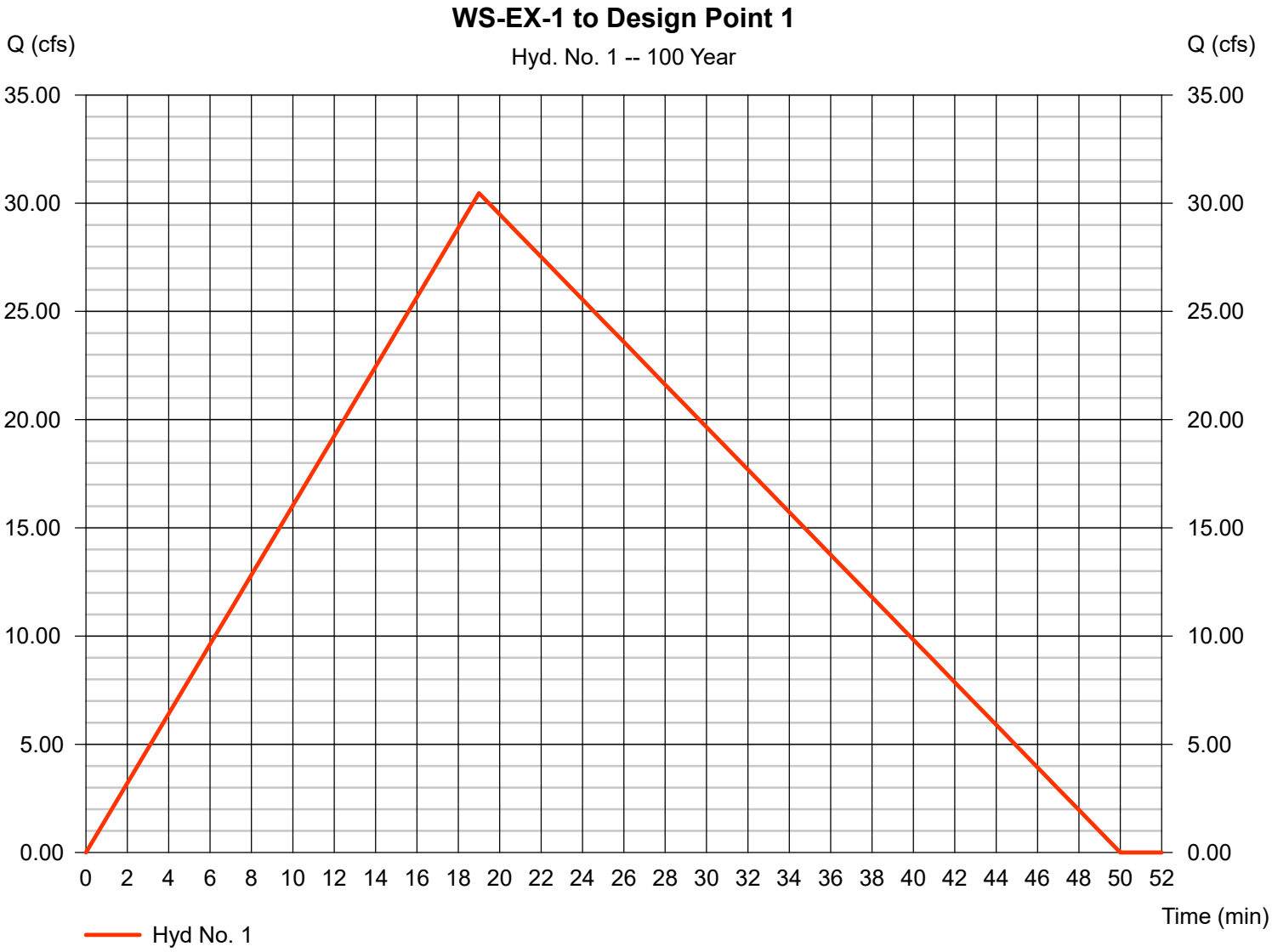
Hydrograph Report

Hyd. No. 1

WS-EX-1 to Design Point 1

Hydrograph type	= Rational	Peak discharge	= 30.47 cfs
Storm frequency	= 100 yrs	Time to peak	= 19 min
Time interval	= 1 min	Hyd. volume	= 46,314 cuft
Drainage area	= 15.780 ac	Runoff coeff.	= 0.35*
Intensity	= 5.516 in/hr	Tc by TR55	= 19.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(1.080 x 0.20) + (10.620 x 0.15) + (4.080 x 0.90)] / 15.780



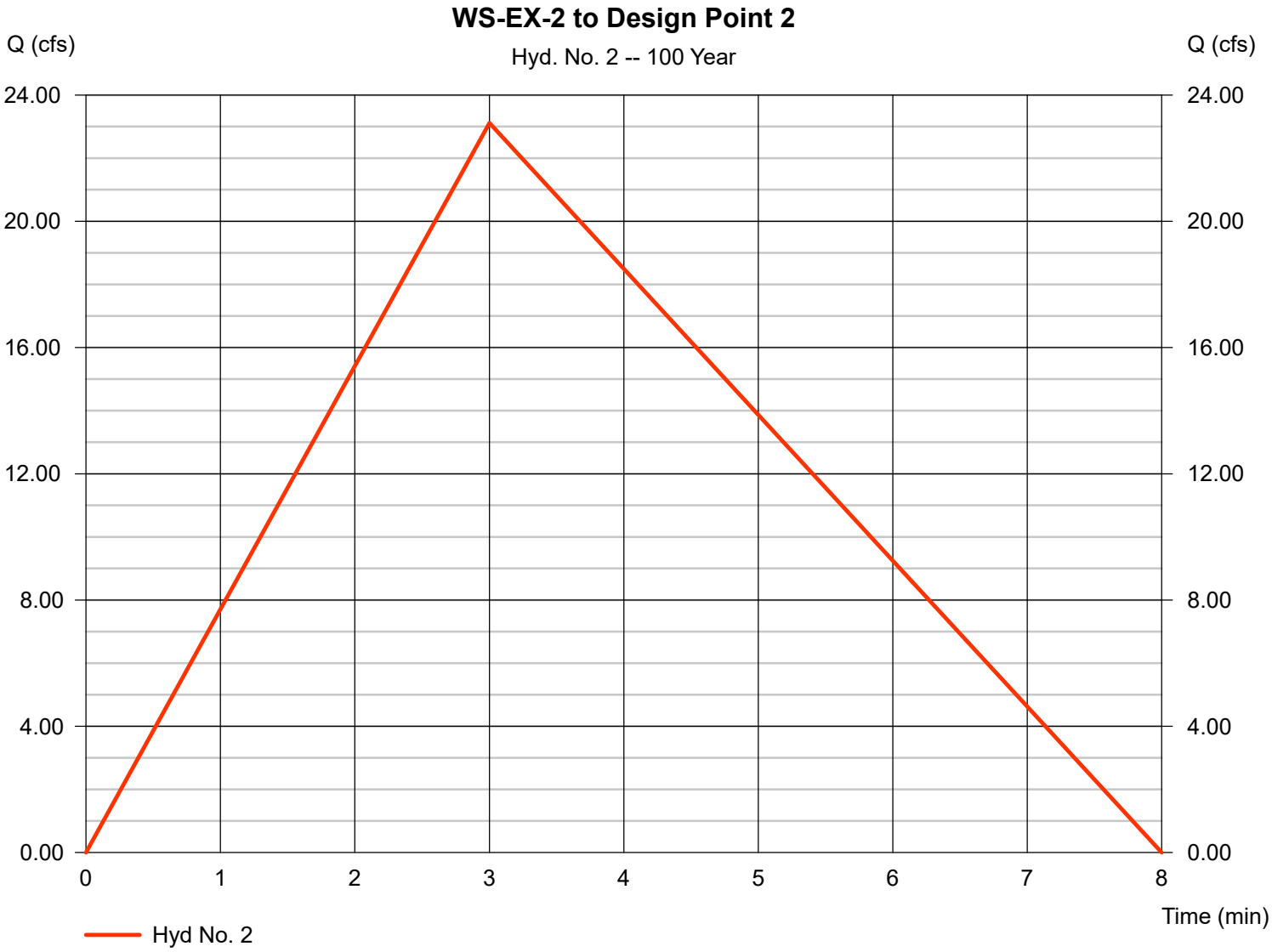
Hydrograph Report

Hyd. No. 2

WS-EX-2 to Design Point 2

Hydrograph type	= Rational	Peak discharge	= 23.11 cfs
Storm frequency	= 100 yrs	Time to peak	= 3 min
Time interval	= 1 min	Hyd. volume	= 5,548 cuft
Drainage area	= 2.760 ac	Runoff coeff.	= 0.65*
Intensity	= 12.883 in/hr	Tc by TR55	= 3.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.820 x 0.20) + (0.160 x 0.15) + (1.780 x 0.90)] / 2.760



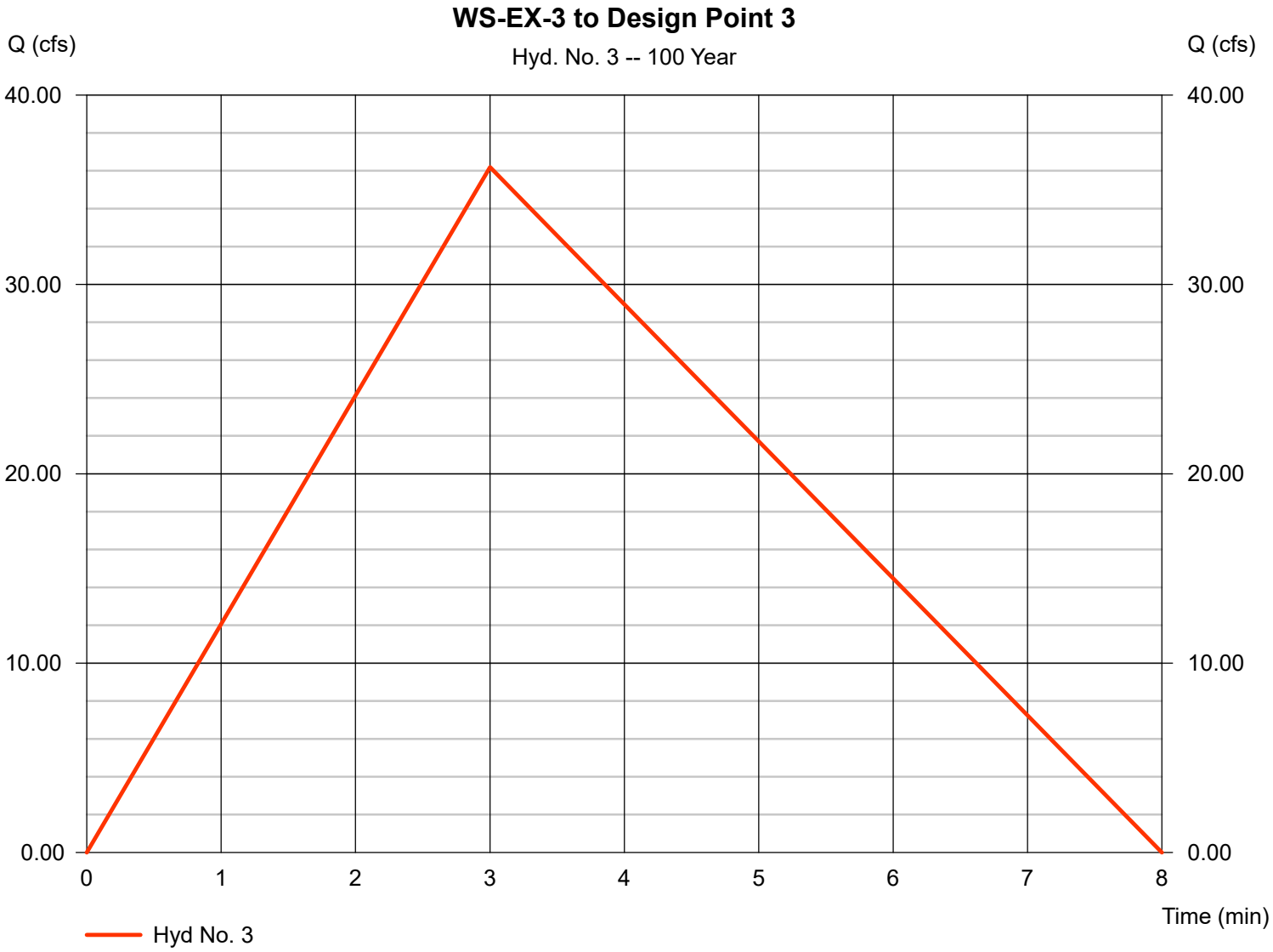
Hydrograph Report

Hyd. No. 3

WS-EX-3 to Design Point 3

Hydrograph type	= Rational	Peak discharge	= 36.18 cfs
Storm frequency	= 100 yrs	Time to peak	= 3 min
Time interval	= 1 min	Hyd. volume	= 8,685 cuft
Drainage area	= 4.530 ac	Runoff coeff.	= 0.62*
Intensity	= 12.883 in/hr	Tc by TR55	= 3.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.910 x 0.20) + (0.830 x 0.15) + (2.790 x 0.90)] / 4.530



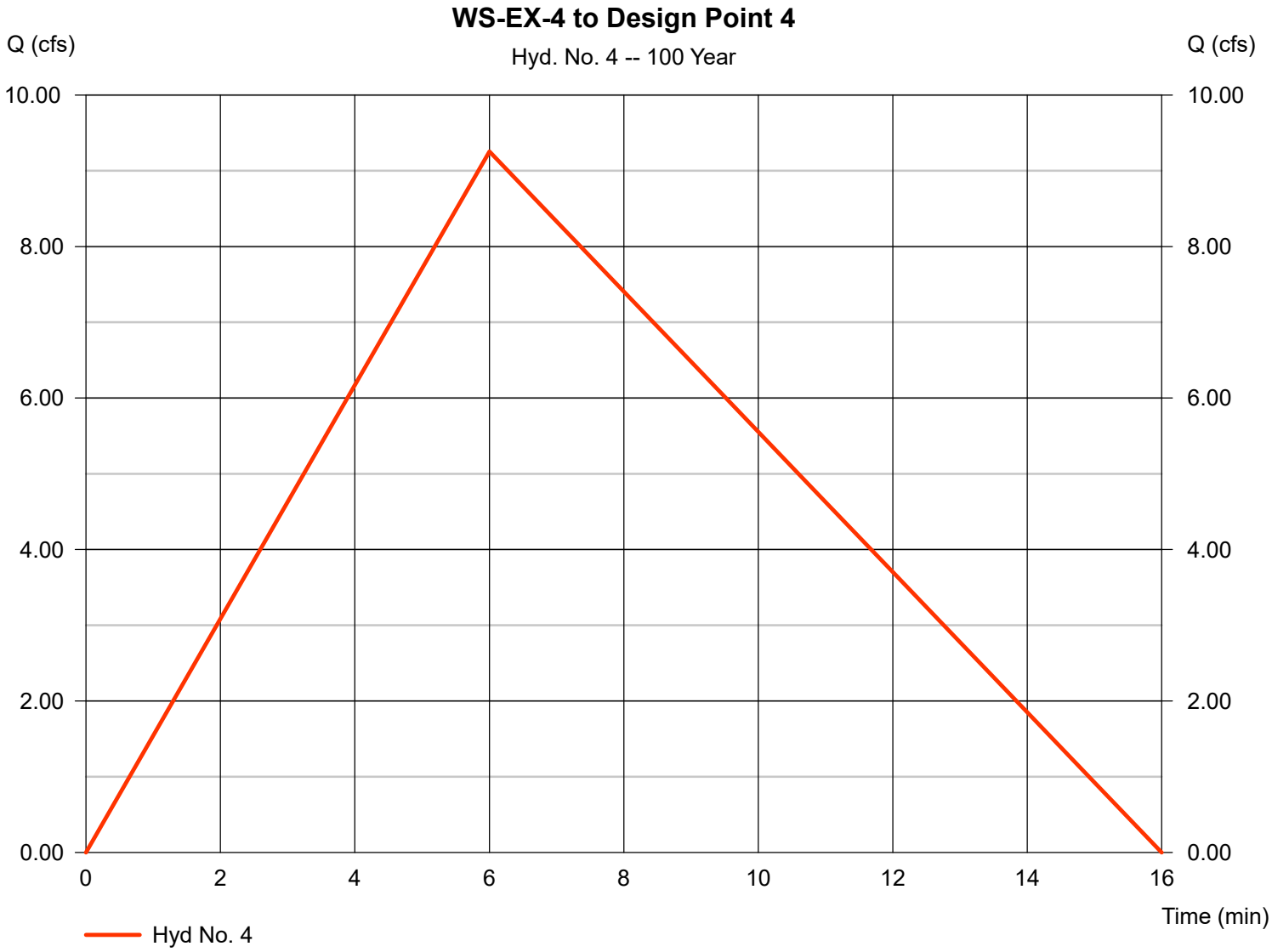
Hydrograph Report

Hyd. No. 4

WS-EX-4 to Design Point 4

Hydrograph type	=	Rational	Peak discharge	=	9.255 cfs
Storm frequency	=	100 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	4,443 cuft
Drainage area	=	2.810 ac	Runoff coeff.	=	0.33*
Intensity	=	9.981 in/hr	Tc by TR55	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.930 x 0.20) + (1.280 x 0.15) + (0.600 x 0.90)] / 2.810



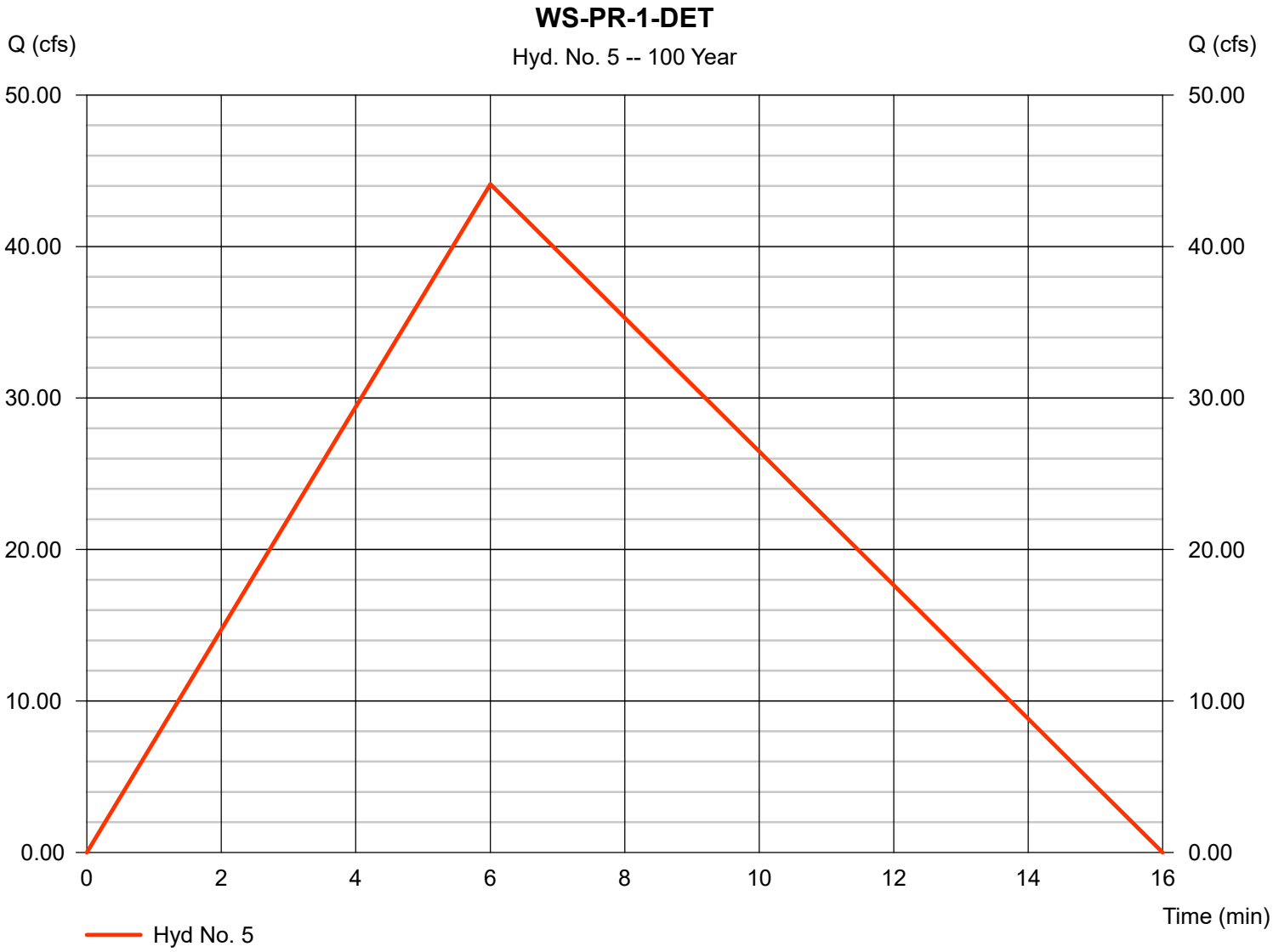
Hydrograph Report

Hyd. No. 5

WS-PR-1-DET

Hydrograph type	=	Rational	Peak discharge	=	44.11 cfs
Storm frequency	=	100 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	21,177 cuft
Drainage area	=	5.390 ac	Runoff coeff.	=	0.82*
Intensity	=	9.981 in/hr	Tc by User	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.580 x 0.20) + (4.810 x 0.90)] / 5.390



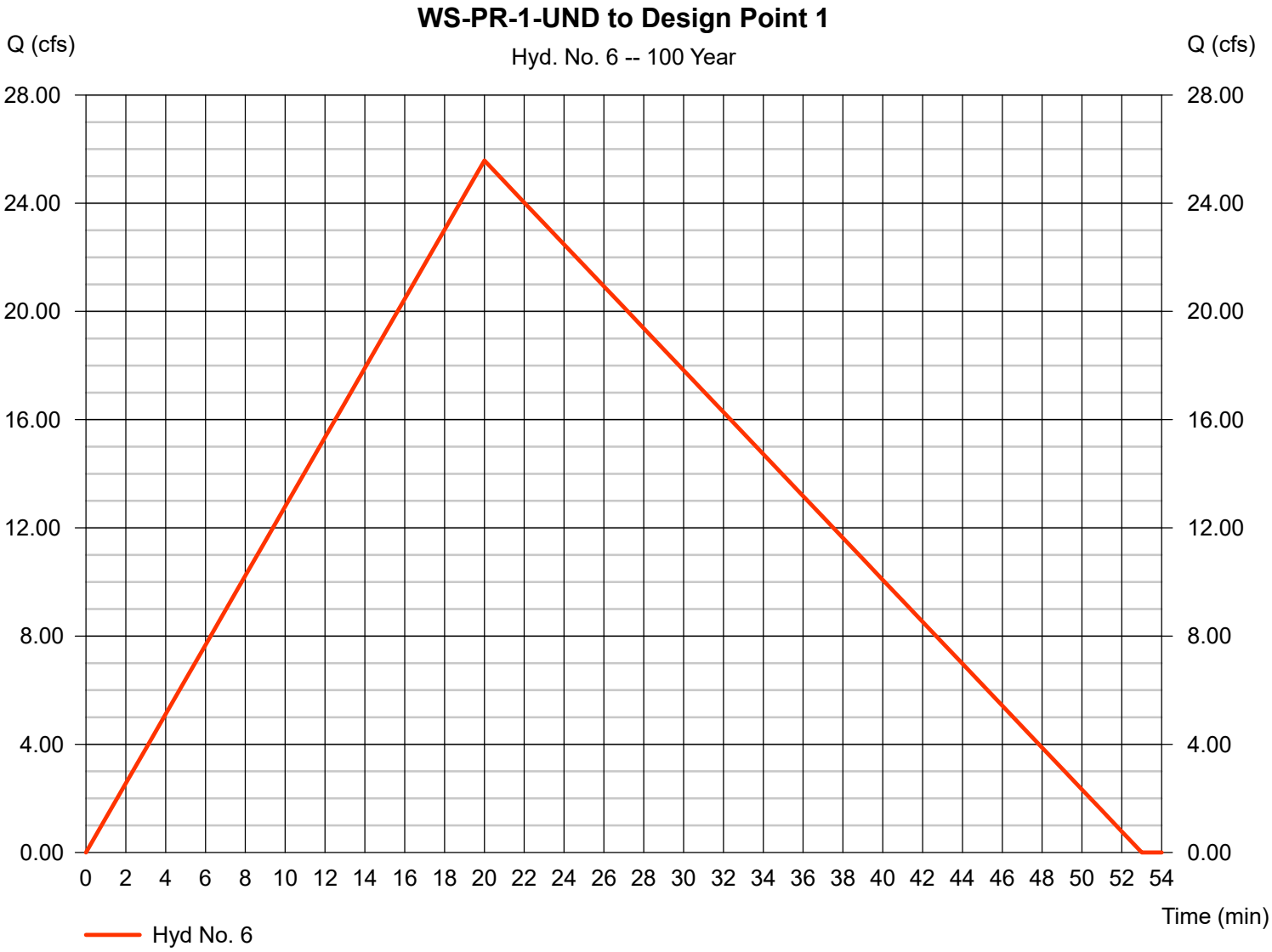
Hydrograph Report

Hyd. No. 6

WS-PR-1-UND to Design Point 1

Hydrograph type	=	Rational	Peak discharge	=	25.58 cfs
Storm frequency	=	100 yrs	Time to peak	=	20 min
Time interval	=	1 min	Hyd. volume	=	40,932 cuft
Drainage area	=	10.390 ac	Runoff coeff.	=	0.46*
Intensity	=	5.352 in/hr	Tc by TR55	=	20.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.270 x 0.20) + (5.810 x 0.15) + (4.310 x 0.90)] / 10.390



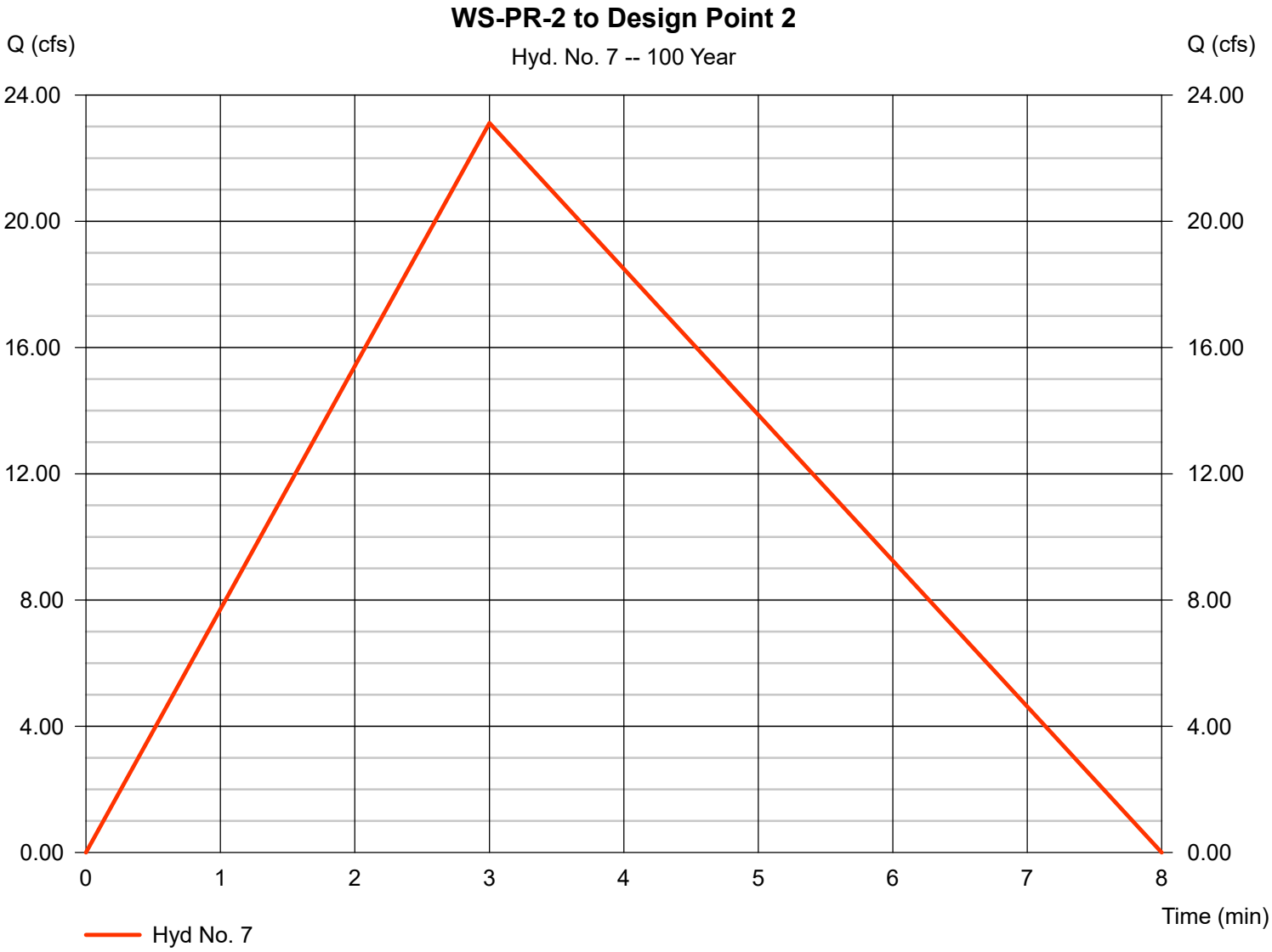
Hydrograph Report

Hyd. No. 7

WS-PR-2 to Design Point 2

Hydrograph type	= Rational	Peak discharge	= 23.11 cfs
Storm frequency	= 100 yrs	Time to peak	= 3 min
Time interval	= 1 min	Hyd. volume	= 5,548 cuft
Drainage area	= 2.760 ac	Runoff coeff.	= 0.65*
Intensity	= 12.883 in/hr	Tc by User	= 3.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.820 x 0.20) + (0.160 x 0.15) + (1.780 x 0.90)] / 2.760



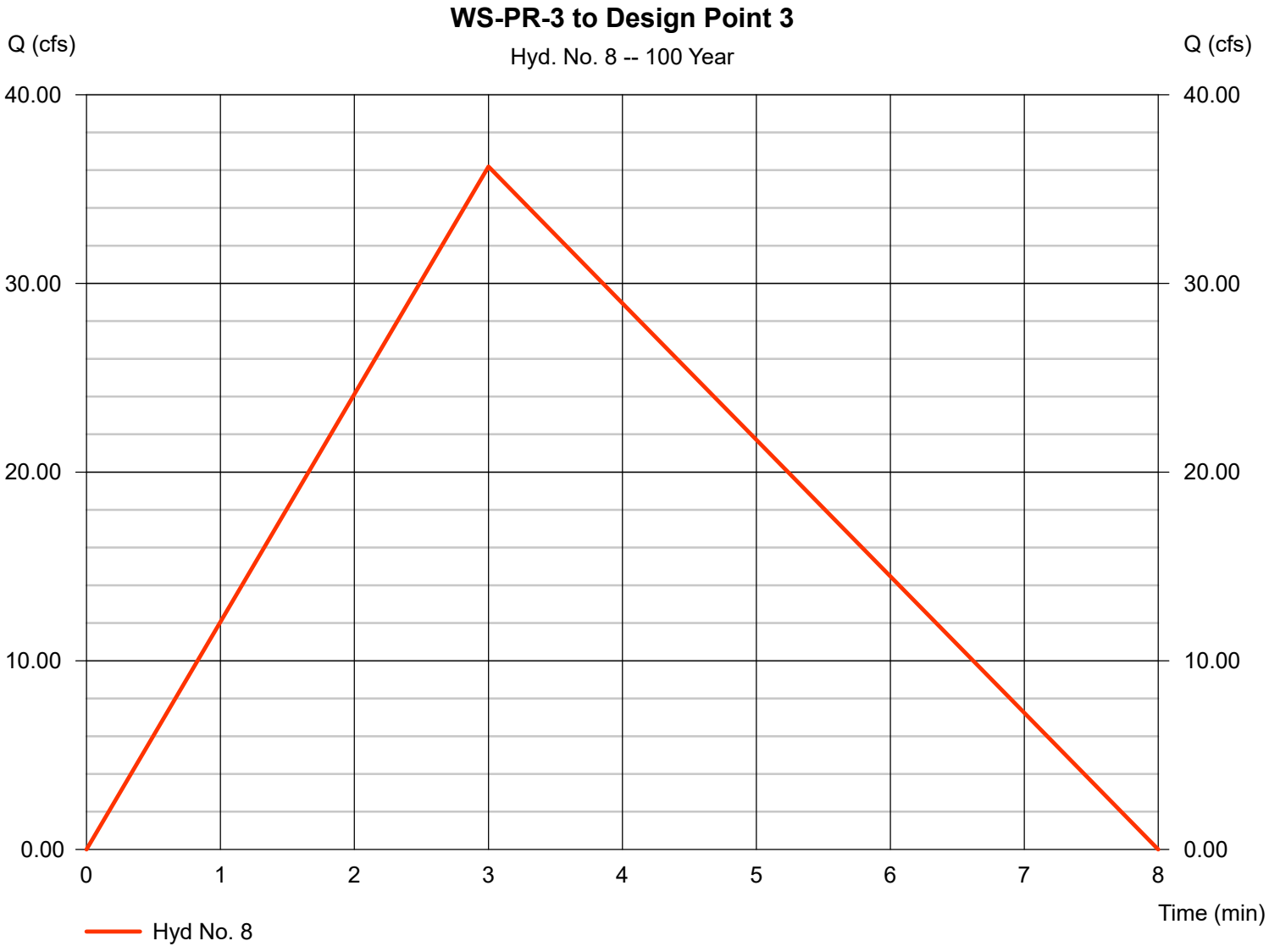
Hydrograph Report

Hyd. No. 8

WS-PR-3 to Design Point 3

Hydrograph type	= Rational	Peak discharge	= 36.18 cfs
Storm frequency	= 100 yrs	Time to peak	= 3 min
Time interval	= 1 min	Hyd. volume	= 8,685 cuft
Drainage area	= 4.530 ac	Runoff coeff.	= 0.62*
Intensity	= 12.883 in/hr	Tc by TR55	= 3.00 min
IDF Curve	= Norwich.IDF	Asc/Rec limb fact	= 1/1.667

* Composite (Area/C) = [(0.910 x 0.20) + (0.830 x 0.15) + (2.790 x 0.90)] / 4.530



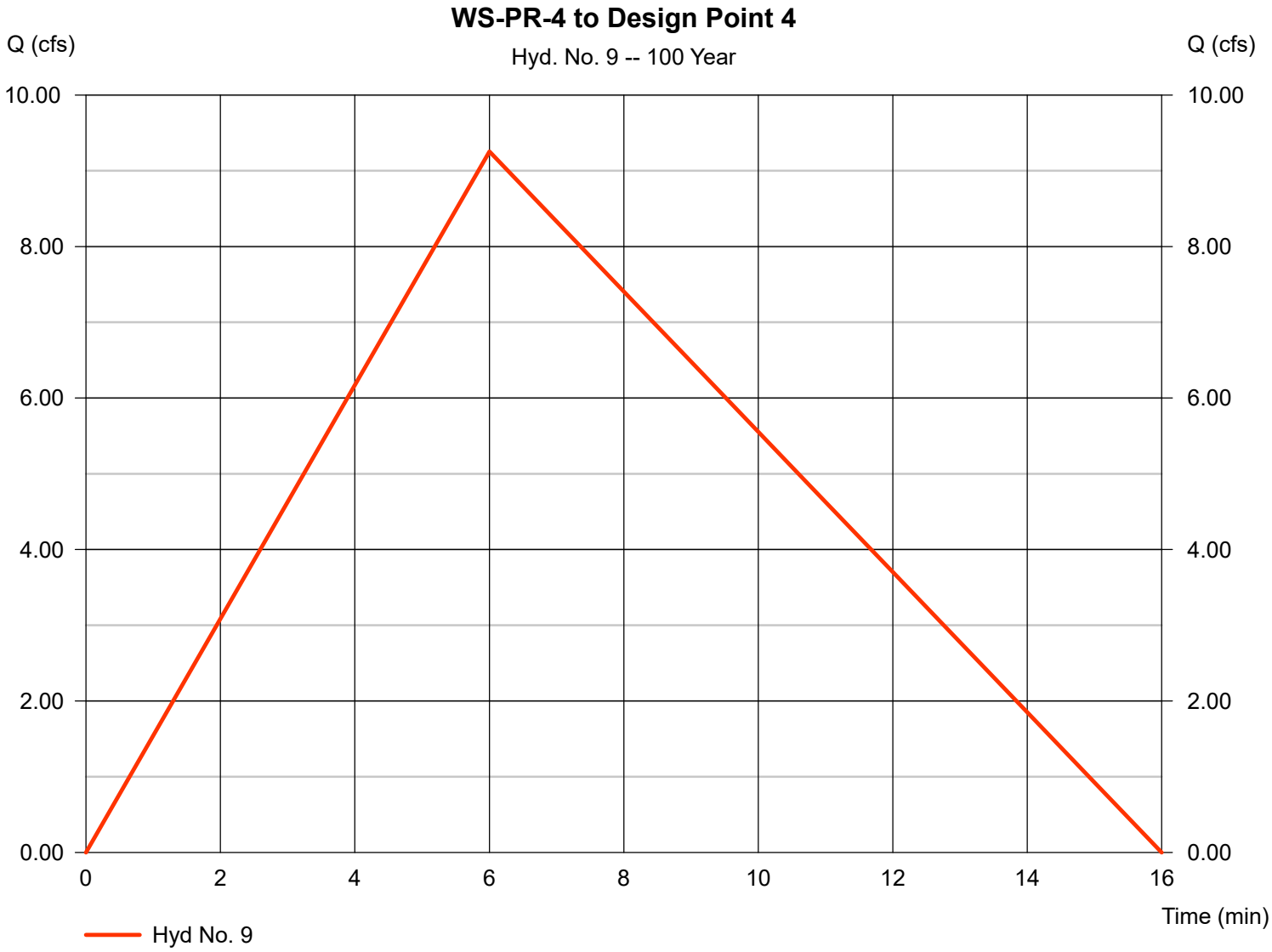
Hydrograph Report

Hyd. No. 9

WS-PR-4 to Design Point 4

Hydrograph type	=	Rational	Peak discharge	=	9.255 cfs
Storm frequency	=	100 yrs	Time to peak	=	6 min
Time interval	=	1 min	Hyd. volume	=	4,443 cuft
Drainage area	=	2.810 ac	Runoff coeff.	=	0.33*
Intensity	=	9.981 in/hr	Tc by TR55	=	6.00 min
IDF Curve	=	Norwich.IDF	Asc/Rec limb fact	=	1/1.667

* Composite (Area/C) = [(0.930 x 0.20) + (1.280 x 0.15) + (0.600 x 0.90)] / 2.810



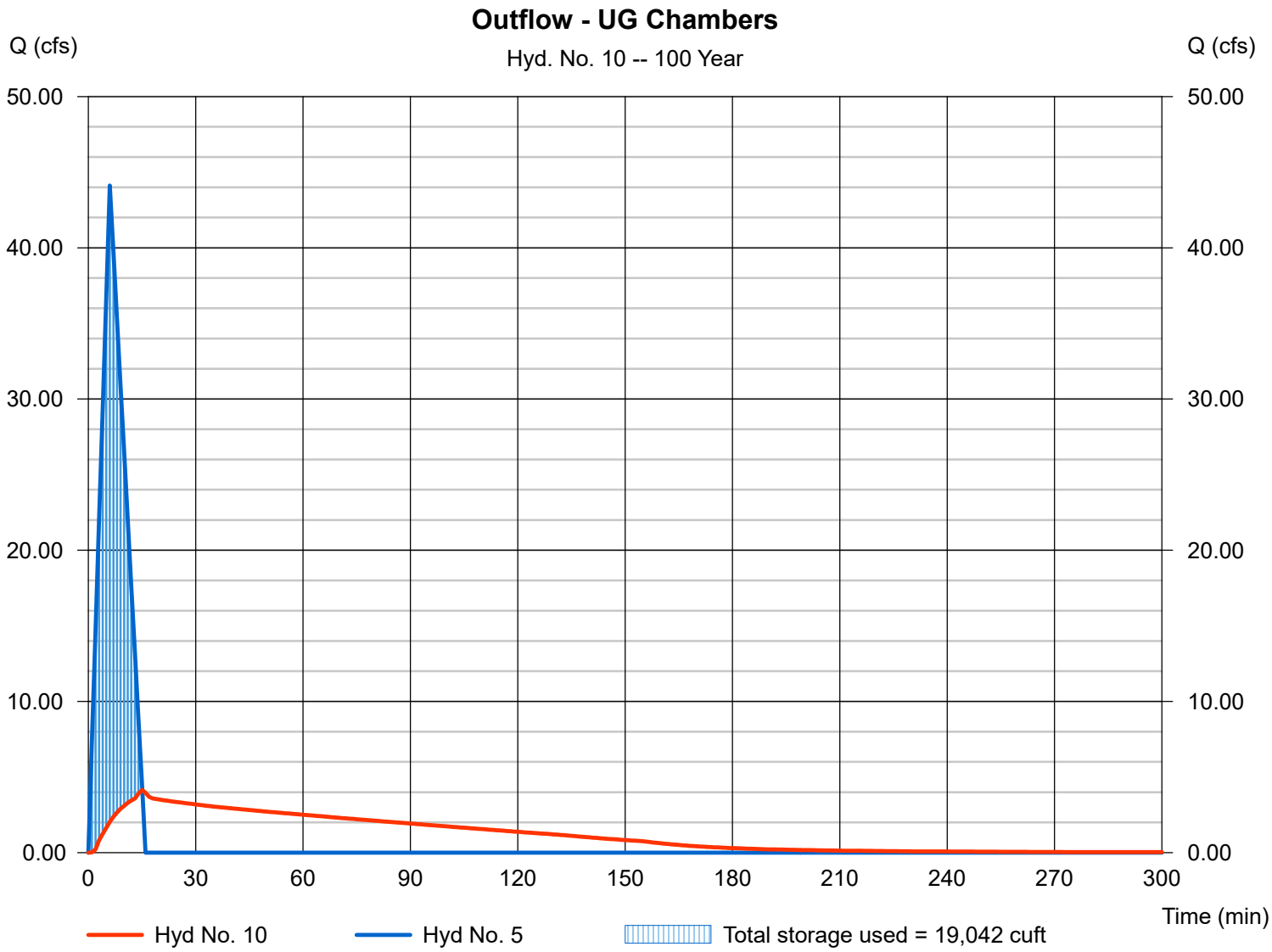
Hydrograph Report

Hyd. No. 10

Outflow - UG Chambers

Hydrograph type	=	Reservoir	Peak discharge	=	4.144 cfs
Storm frequency	=	100 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	21,157 cuft
Inflow hyd. No.	=	5 - WS-PR-1-DET	Max. Elevation	=	315.38 ft
Reservoir name	=	UG Chambers	Max. Storage	=	19,042 cuft

Storage Indication method used.

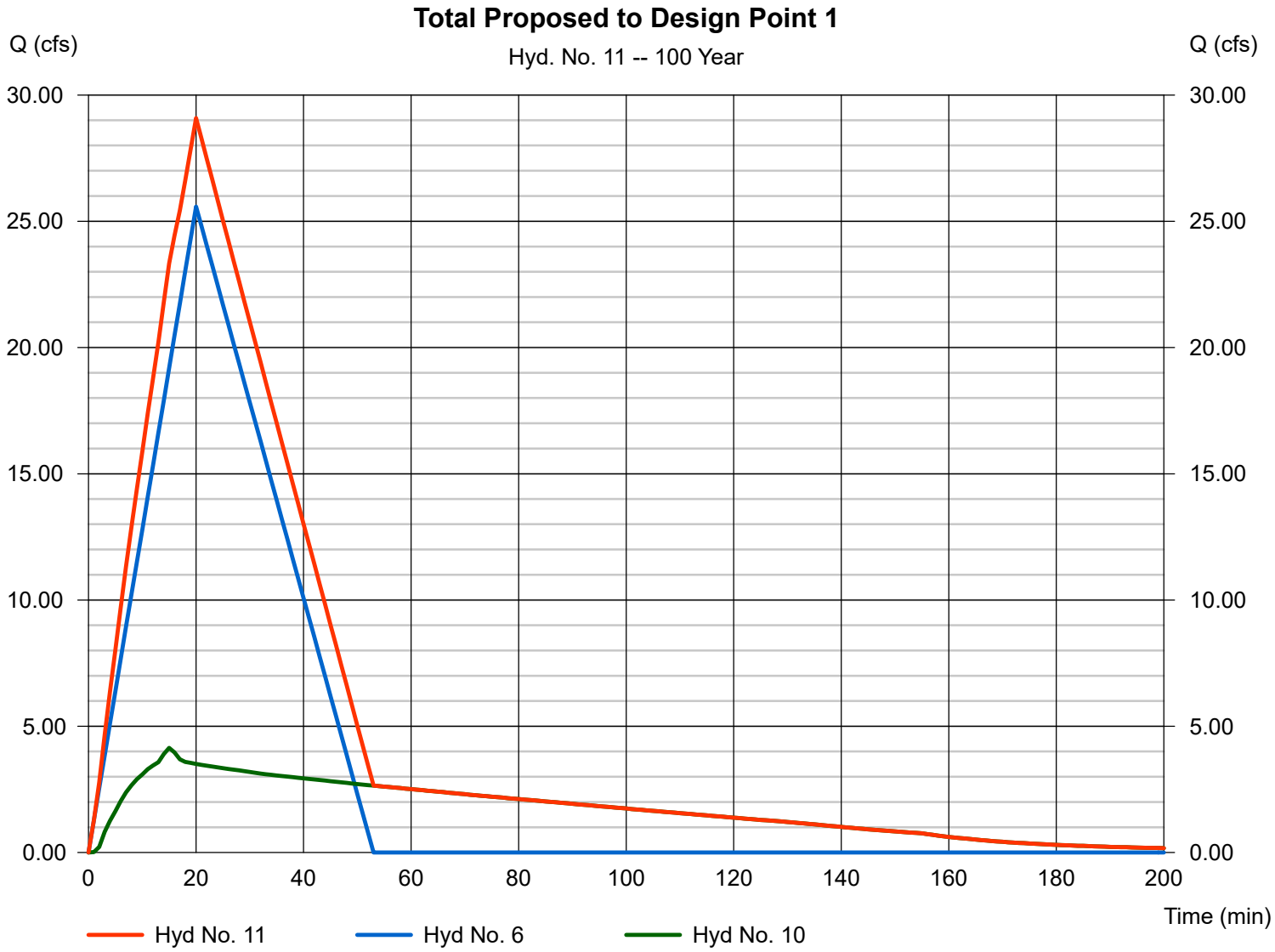


Hydrograph Report

Hyd. No. 11

Total Proposed to Design Point 1

Hydrograph type	= Combine	Peak discharge	= 29.09 cfs
Storm frequency	= 100 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 61,828 cuft
Inflow hyds.	= 6, 10	Contrib. drain. area	= 10.390 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	18.3463	3.7000	0.7025	--------
2	22.3546	3.8000	0.7078	--------
3	0.0000	0.0000	0.0000	--------
5	26.8960	3.5000	0.6954	--------
10	32.1274	3.6000	0.6994	--------
25	38.5092	3.6000	0.6982	--------
50	44.3894	3.7000	0.7033	--------
100	50.4867	3.9000	0.7071	--------

File name: Norwich.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	4.01	2.92	2.34	1.98	1.74	1.55	1.41	1.29	1.20	1.12	1.05	0.99
2	4.80	3.49	2.80	2.37	2.07	1.85	1.68	1.54	1.43	1.33	1.25	1.18
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.07	4.40	3.54	2.99	2.62	2.34	2.12	1.95	1.81	1.69	1.59	1.50
10	7.13	5.18	4.16	3.52	3.08	2.75	2.50	2.29	2.12	1.98	1.86	1.76
25	8.57	6.22	5.00	4.24	3.70	3.31	3.00	2.76	2.56	2.39	2.24	2.12
50	9.69	7.04	5.66	4.79	4.19	3.74	3.39	3.12	2.89	2.70	2.53	2.39
100	10.76	7.85	6.32	5.35	4.68	4.18	3.79	3.48	3.23	3.01	2.83	2.67

Tc = time in minutes. Values may exceed 60.

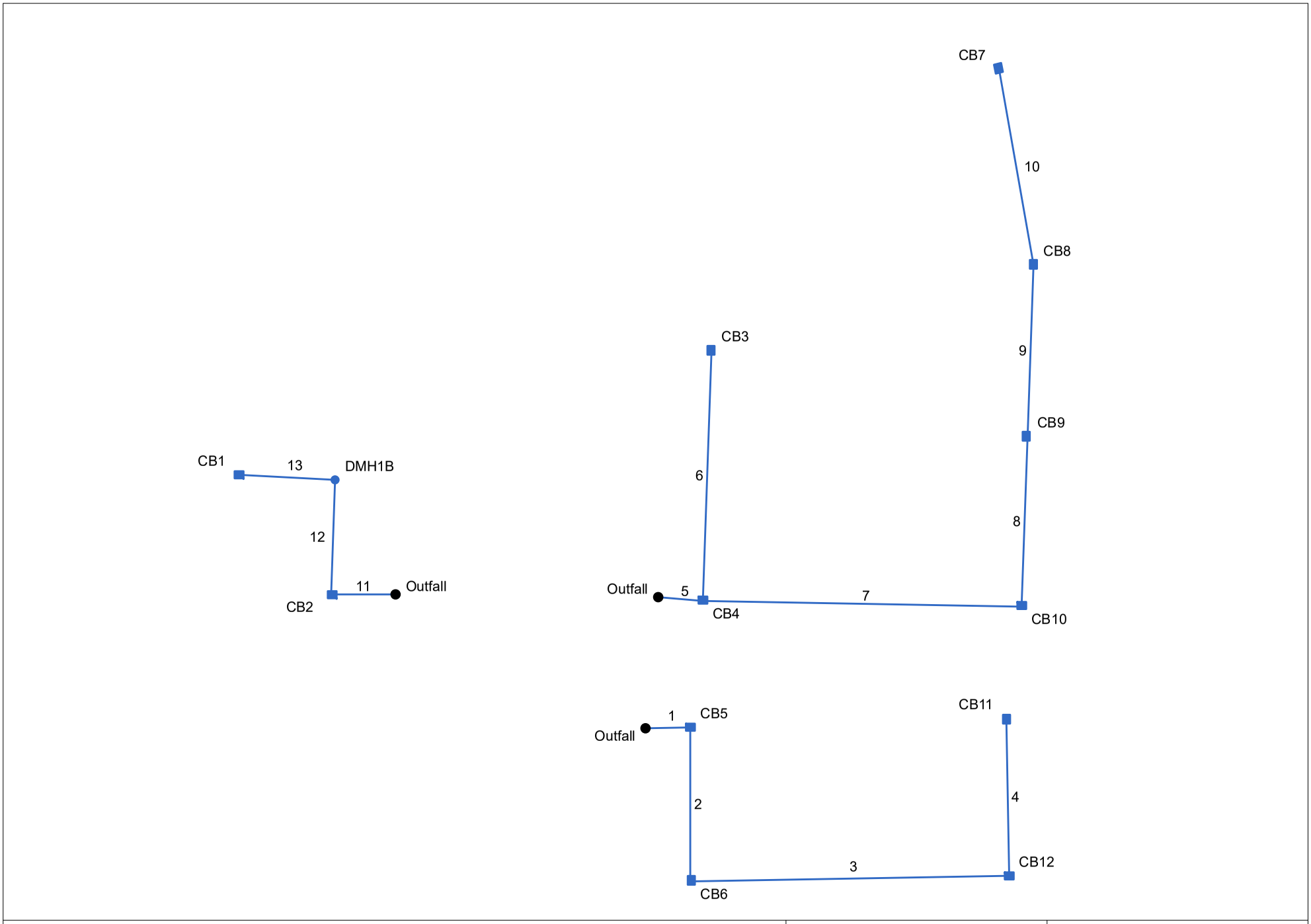
Precip. file name: Norwich.pcp

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	2.84	1.18	0.00	1.50	1.76	2.12	2.39	2.67
SCS 6-Hr	1.90	2.28	0.00	2.86	3.34	4.00	4.49	5.02
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

ATTACHMENT E

Pipe-to-Pipe Analysis

Hydraflow Storm Sewers Plan



Project File: PIPE TO PIPE - 2021-04-23.stm	Number of lines: 13	Date: 04-28-2021

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.	Junction Type
1	OUTFALL2-CB5	12.50	24	Cir	25	312.51	312.64	0.520	313.78	313.90	0.84	314.74	End	Combination
2	CB6-CB5	8.49	18	Cir	86	317.84	318.95	1.291	318.73	320.06	n/a	320.06	1	Combination
3	CB6-CB12	6.68	15	Cir	178	319.20	322.28	1.730	320.17	323.31	n/a	323.31	2	Combination
4	CB12-CB11	1.77	12	Cir	88	322.53	325.76	3.670	323.82	326.33	n/a	326.33 j	3	Combination
5	OUTFALL1-CB4	14.06	24	Cir	25	312.51	312.64	0.520	313.88	313.97	0.93	314.90	End	Combination
6	CB4-CB3	4.09	15	Cir	140	321.77	323.79	1.443	322.39	324.60	0.37	324.60	5	Combination
7	CB4-CB10	8.31	15	Cir	178	321.77	329.32	4.242	322.45	330.45	1.18	330.45	5	Combination
8	CB10-CB9	7.00	15	Cir	95	329.32	331.98	2.800	330.73	333.04	n/a	333.04 j	7	Combination
9	CB9-CB8	4.41	12	Cir	96	332.23	333.60	1.427	333.17	334.48	n/a	334.48 j	8	Combination
10	CB8-CB7	1.62	12	Cir	111	333.60	334.25	0.586	334.89	335.07	0.09	335.15	9	Combination
11	OUTFALL3-CB2	7.70	24	Cir	36	312.51	312.69	0.500	313.88	313.90	0.35	314.25	End	Combination
12	CB2-DMH1B	4.22	15	Cir	64	312.69	313.01	0.500	314.30*	314.57*	0.18	314.76	11	Manhole
13	DMH1B-CB1	4.32	15	Cir	54	313.01	313.28	0.500	314.76*	315.00*	0.19	315.19	12	Combination

Project File: PIPE TO PIPE - 2021-04-23.stm | Number of lines: 13 | Run Date: 04-28-2021

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	25	0.64	1.87	0.90	0.58	1.68	5.0	7.0	7.4	12.50	17.67	5.98	24	0.52	312.51	312.64	313.78	313.90	318.00	323.40	OUTFALL2-CB5
2	1	86	0.33	1.23	0.90	0.30	1.11	5.0	6.5	7.7	8.49	12.92	6.92	18	1.29	317.84	318.95	318.73	320.06	323.40	322.45	CB6-CB5
3	2	178	0.67	0.90	0.90	0.60	0.81	5.0	5.5	8.2	6.68	9.20	6.35	15	1.73	319.20	322.28	320.17	323.31	322.45	325.53	CB6-CB12
4	3	88	0.23	0.23	0.90	0.21	0.21	5.0	5.0	8.6	1.77	7.39	3.07	12	3.67	322.53	325.76	323.82	326.33	325.53	328.76	CB12-CB11
5	End	25	0.45	2.20	0.90	0.41	1.98	5.0	7.7	7.1	14.06	17.67	6.22	24	0.52	312.51	312.64	313.88	313.97	318.00	325.02	OUTFALL1-CB4
6	5	140	0.53	0.53	0.90	0.48	0.48	5.0	5.0	8.6	4.09	8.40	5.83	15	1.44	321.77	323.79	322.39	324.60	325.02	327.04	CB4-CB3
7	5	178	0.23	1.22	0.90	0.21	1.10	5.0	6.7	7.6	8.31	14.41	9.63	15	4.24	321.77	329.32	322.45	330.45	325.02	332.57	CB4-CB10
8	7	95	0.39	0.99	0.90	0.35	0.89	5.0	6.2	7.9	7.00	11.71	6.01	15	2.80	329.32	331.98	330.73	333.04	332.57	335.23	CB10-CB9
9	8	96	0.39	0.60	0.90	0.35	0.54	5.0	5.6	8.2	4.41	4.61	5.89	12	1.43	332.23	333.60	333.17	334.48	335.23	336.60	CB9-CB8
10	9	111	0.21	0.21	0.90	0.19	0.19	5.0	5.0	8.6	1.62	2.95	2.21	12	0.59	333.60	334.25	334.89	335.07	336.60	337.25	CB8-CB7
11	End	36	0.49	1.05	0.90	0.44	0.95	5.0	5.7	8.1	7.70	15.99	3.62	24	0.50	312.51	312.69	313.88	313.90	319.22	318.25	OUTFALL3-CB2
12	11	64	0.00	0.56	0.90	0.00	0.50	5.0	5.3	8.4	4.22	4.57	3.44	15	0.50	312.69	313.01	314.30	314.57	318.25	319.17	CB2-DMH1B
13	12	54	0.56	0.56	0.90	0.50	0.50	5.0	5.0	8.6	4.32	4.57	3.52	15	0.50	313.01	313.28	314.76	315.00	319.17	316.23	DMH1B-CB1

Project File: PIPE TO PIPE - 2021-04-23.stm

Number of lines: 13

Run Date: 04-28-2021

NOTES: Intensity = 38.51 / (Inlet time + 3.60) ^ 0.70; Return period = 25 Yrs. ; c = cir e = ellip b = box

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	CB5	4.94	0.97	3.81	2.09	Comb	3.0	5.83	0.00	5.83	1.63	0.014	2.00	0.030	0.021	0.013	0.27	11.76	0.39	10.59	2.0	2
2	CB6	2.55	2.09	4.64	0.00	Comb	3.0	2.73	3.13	3.14	1.63	Sag	2.00	0.030	0.021	0.000	0.24	10.63	0.39	10.63	2.0	Off
3	CB12	5.17	0.56	5.73	0.00	Comb	3.0	2.73	3.13	3.14	1.63	Sag	2.00	0.030	0.015	0.000	0.31	18.89	0.45	18.89	2.0	Off
4	CB11	1.77	0.78	2.00	0.56	Comb	3.0	2.73	0.00	3.14	1.63	0.036	2.00	0.030	0.044	0.013	0.18	4.77	0.30	2.98	2.0	3
5	CB4	3.47	0.00	2.50	0.97	Comb	3.0	5.83	0.00	5.83	1.63	0.015	2.00	0.030	0.021	0.013	0.22	9.48	0.33	7.97	2.0	1
6	CB3	4.09	0.36	3.76	0.69	Comb	3.0	5.83	0.00	5.83	1.63	0.045	2.00	0.030	0.066	0.013	0.23	4.55	0.37	3.13	2.0	13
7	CB10	1.77	1.67	2.66	0.78	Comb	3.0	5.83	0.00	5.83	1.63	0.028	2.00	0.030	0.032	0.013	0.21	6.56	0.33	4.98	2.0	4
8	CB9	3.01	0.77	2.11	1.67	Comb	3.0	2.73	0.00	3.14	1.63	0.005	2.00	0.030	0.020	0.013	0.27	12.40	0.39	11.27	2.0	7
9	CB8	3.01	0.00	2.24	0.77	Comb	3.0	2.73	0.00	3.14	1.63	0.026	2.00	0.030	0.044	0.013	0.21	5.34	0.33	3.78	2.0	8
10	CB7	1.62	0.00	1.26	0.36	Comb	3.0	2.73	0.00	3.14	1.63	0.015	2.00	0.030	0.033	0.013	0.18	5.48	0.28	3.59	2.0	6
11	CB2	3.78	0.00	3.78	0.00	Comb	3.0	5.83	6.26	5.83	1.63	Sag	2.00	0.030	0.041	0.000	0.08	2.52	0.27	2.52	2.0	Off
12	DMH1B	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
13	CB1	4.32	0.69	5.01	0.00	Comb	3.0	5.83	6.26	5.83	1.63	Sag	2.00	0.030	0.048	0.000	0.13	3.40	0.33	3.40	2.0	Off

Project File: PIPE TO PIPE - 2021-04-23.stm | Number of lines: 13 | Run Date: 04-28-2021

NOTES: Inlet N-Values = 0.013 ; Intensity = 38.51 / (Inlet time + 3.60) ^ 0.70; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

ATTACHMENT F

Water Quality Calculations

40 Wisconsin Avenue
Norwich, Connecticut

U.G. Infiltration System

Stage-Storage Relationship

Number of SC-740 Chambers = 260

Minimum-recommended Water Quality Volume = **16,693 CU FT**

WQV Provided below overflow weir (el. 315.25):
Storage vol.@ el. 315.00 = **17,716 CU FT**

260 Chambers Provided: Total Storage = **19,474 CU FT**

Elevation	U.G. Chamber Storage Volume per LF (CU FT)	Chamber System Length (FT)	Incremental Storage Volume (CU FT)	Cumulative Storage Volume (CU FT)	Storage Vol. per Chamber (CU FT) *
	Stormceptor Units ***				
312.00	0.000	1850	0	0	0
312.50	0.950	1850	1758	1758	6.76
313.00	2.044	1850	3783	5541	21.31
313.50	1.956	1850	3619	9160	35.23
314.00	1.821	1850	3370	12529	48.19
314.50	1.612	1850	2982	15512	59.66
315.00	1.192	1850	2205	17716	68.14
315.50	0.950	1850	1758	19474	74.9
316.00	0.000	1850	10	19484	
316.50	0.000	1850	10	19494	
317.00	0.000	1850	10	19504	

* see cut sheet for volumetric capacity of unit and stone fill