

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
Revised June 4, 2021**

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Drainage Area Maps

Attachment A - Soil Types Map

Attachment B - CT DOT Drainage Manual – Table 6-3

Attachment C - NOAA Rainfall Data

Attachment D - Hydrologic Analysis - Hydraflow Analysis Summary Report

Attachment E - Pipe-to-Pipe Analysis

Attachment F - Water Quality Calculations

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 associated 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 gullies and a concrete outlet structure. The underground system will include a total of 279 Stormtech SC-740 chambers with a total underground storage capacity of 19,011 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 hydrographs.

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-1-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, an 8.75-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	PROPOSED CONDITIONS
	C.F.S.	C.F.S.
PEAK FLOW 2-YEAR STORM	13.55	13.49
PEAK FLOW 5-YEAR STORM	17.10	16.81
PEAK FLOW 10-YEAR STORM	20.11	19.60
PEAK FLOW 25-YEAR STORM	24.20	23.39
PEAK FLOW 50-YEAR STORM	27.37	26.37
PEAK FLOW 100-YEAR STORM	30.57	29.41

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 DEEP minimum-recommended 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. In addition, the system incorporated "Isolator Rows" designed to capture and treat the minimum water quality flow (WQF) for the contributory areas that discharge to the isolator rows. By capturing and treating the WQV and WQF, the 80% TSS removal goal will be met. Summaries of calculations demonstrating achievement of the WQV and WQF 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)

$$\text{WQV (AC-FT)} = 1(R)(A)/12$$

$$R = (\text{RUNOFF COEF}) = .05 + .009(I)$$

$$I = \text{PERCENT IMPREVIOUS COVERAGE}$$

$$A = \text{AREA(AC)}$$

Runoff:

Area = 5.15 Acres

Imp. Area = 4.65 Acres

I = 100%

R = $0.05 + 0.009(100) = 0.8626$

Recommended WQV = $1(0.8626)(5.15)/12 = 0.37021 \text{ Ac-ft} = 16,126 \text{ C.F.}$

Provided WQV in SC 740 systems = $279 \text{ units} \times 74.9 \text{ C.F./unit} = 20,897 \text{ C.F. @}$
elev. 315.5 (**WQV IS PROVIDED**)

Total WQV Provided = 20,897 C.F.

20,897 C.F. > 16,126 C.F. (WQV IS PROVIDED)

Water Quality Flow

In addition to sizing the underground stormwater management system to capture and treat the minimum-recommended water quality volume, the system will be designed to treat the minimum water quality flow (WQF). The Stormtech system will incorporate the use of "Isolator Rows" designed to treat the water quality flow for the receiving catchment areas. Per the Stormtech Design Manual, each chamber of the Isolator Row will treat 0.15 CFS of flow.

There are three series of Isolator Rows Proposed, Isolator Row NW, Isolator Row NE, and Isolator Road S. Isolator Row NW will receive runoff from the northwest portion of the trailer parking area (CBs 3, 4, 7, 8, 9, and 10). Isolator Row NE will receive runoff from the northeast portion of the trailer parking area (CBs 5, 6, 11 and 12). Isolator Row S will receive runoff from the south portion of the trailer parking area (CBs 1 and 2).

WQF calculations were conducted following the procedure presented in Section of the SWQM (Chapter 7, Section 7.4.2). Calculations are presented in Attachment F.

Isolator Row NE: WQF = 1.63 CFS

Number of chambers required = $1.63 \text{ CFS} / 0.15 \text{ CFS/Chamber} = 10.9 \text{ Chambers}$
Number of chambers provided = 18 Chambers

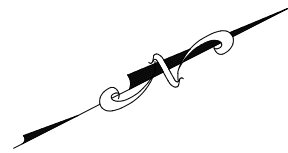
Isolator Row NW: WQF = 1.75 CFS

Number of chambers required = $1.75 \text{ CFS} / 0.15 \text{ CFS/Chamber} = 11.7 \text{ Chambers}$
Number of chambers provided = 18 Chambers

Isolator Row S: WQF = 1.01 CFS

Number of chambers required = $1.01 \text{ CFS} / 0.15 \text{ CFS/Chamber} = 6.7 \text{ Chambers}$
Number of chambers provided = 9 Chambers

WATERSHED AREA MAPS



WATERSHED BOUNDARY
(TYP.)

N/F
UNKNOWN OWNER

150' SHEET FLOW
n=0.4 S=11.33%

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

DESIGN
POINT 1

Tc FLOW PATH
(TYP.)

DESIGN
POINT 2

WS-EX-1

WS-EX-1

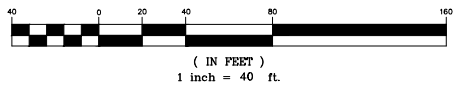
EXISTING
MANUFACTURING/WAREHOUSE
BUILDING

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

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	35,901 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



EXISTING DRAINAGE AREAS - WEST HALF
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

DA-1A

Revisions:
No. Date Description

No.	Date	Description
1.	06-04-2021	IWMC Comments

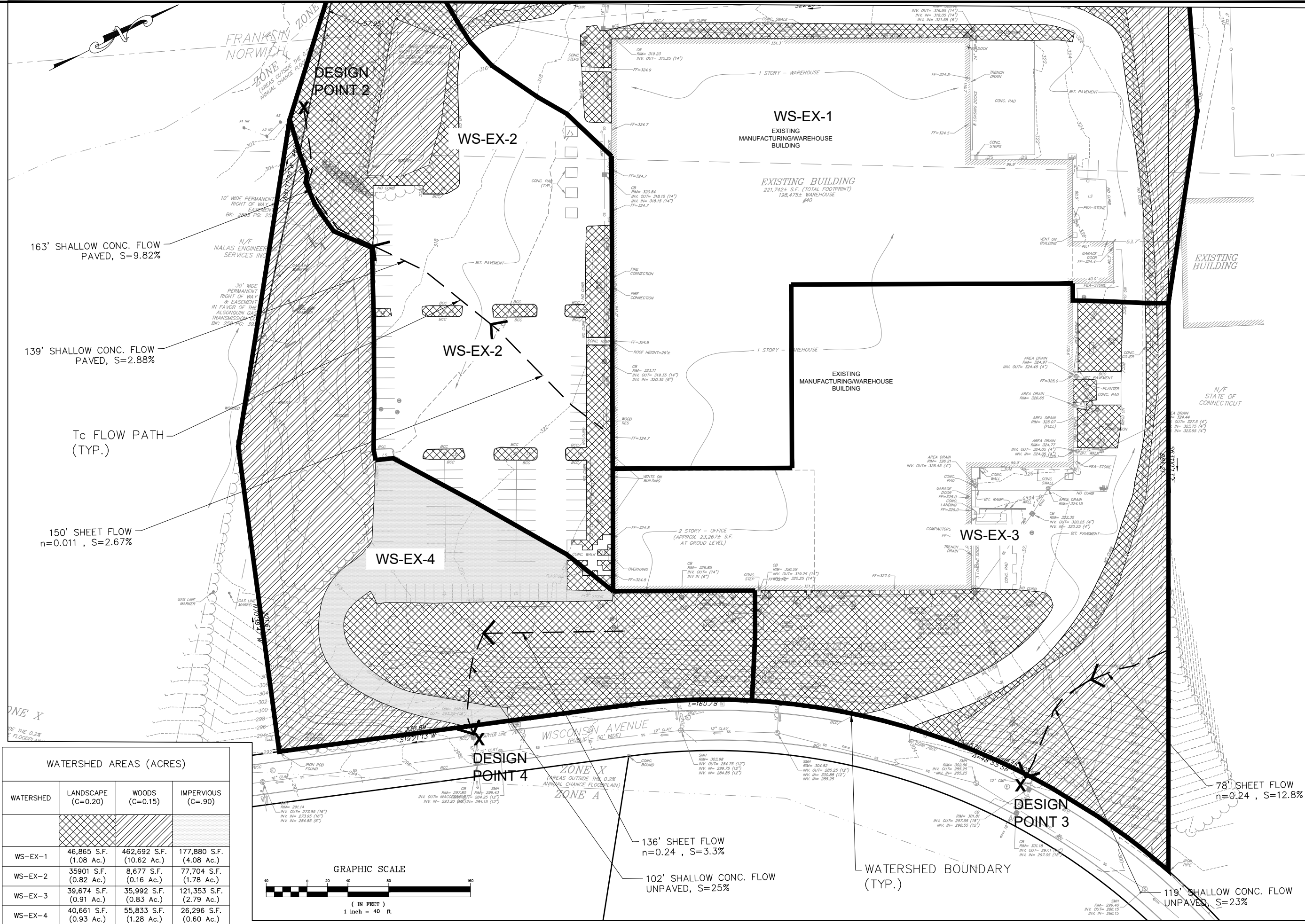
APPLICANT: THE GROSSMAN COMPANIES
ONE ADAMS PLACE
859 WILLARD STREET, SUITE 501
QUINCY, MA 02169
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OWNER: NORWICH 40 TGI LLC
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163' SHALLOW CONC. FLOW
PAVED, S=9.82%

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

Tc FLOW PATH
(TYP.)

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

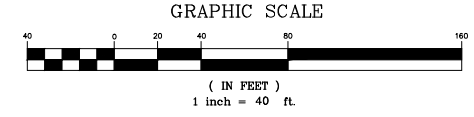
78' SHEET FLOW
n=0.24, S=12.8%

136' SHEET FLOW
n=0.24, S=3.3%

102' SHALLOW CONC. FLOW
UNPAVED, S=25%

119' SHALLOW CONC. FLOW
UNPAVED, S=23%

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	35,901 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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 www.fahsketh.com · Landscape Architects
 Civil & Traffic Engineers · Surveyors · Planners

FAH

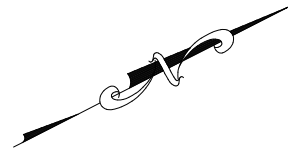
EXISTING DRAINAGE AREAS - EAST HALF
 PREPARED FOR
WISCONSIN AVENUE
 WISCONSIN AVENUE
 NORWICH, CONNECTICUT

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 Scale: 1" = 40' Checked by: GAH Sheet no: 1 OF 1

DA-1B

Revisions:
 No. Date Description
 1. 06-04-2021 I/MC Comments

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WATERSHED BOUNDARY
(TYP.)

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

150' SHEET FLOW
n=0.4 S=8.0%

Tc FLOW PATH
(TYP.)

WS-PR-1-UND

WS-PR-1-DET

DESIGN
POINT 1

DESIGN
POINT 2

WS-PR-2

WS-PR-1-UND

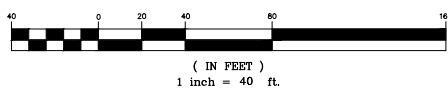
EXISTING
MANUFACTURING/WAREHOUSE
BUILDING

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

WATERSHED AREAS (ACRES)

WATERSHED	LANDSCAPE (C=0.20)	WOODS (C=0.15)	IMPERVIOUS (C=.90)
WS-PR-1-DET	20,748 S.F. (0.48 Ac.)	-	199,707 S.F. (4.58 Ac.)
WS-PR-1-UND	16,179 S.F. (0.37 Ac.)	252,018 S.F. (5.79 Ac.)	199,707 S.F. (4.57 Ac.)
WS-PR-2	35,901 S.F. (0.82 Ac.)	8,677 S.F. (0.20 Ac.)	77,704 S.F. (1.78 Ac.)
WS-PR-3	39,674 S.F. (0.91 Ac.)	35,992 S.F. (0.83 Ac.)	121,353 S.F. (2.79 Ac.)
WS-PR-4	40,661 S.F. (0.93 Ac.)	55,833 S.F. (1.28 Ac.)	26,293 S.F. (0.60 Ac.)

GRAPHIC SCALE



N/F
NALAS ENGINEERING
SERVICES INC.
ZONE A
(AREAS OUTSIDE THE 0.2%
ANNUAL CHANCE FLOODPLAIN)

30' WIDE PERMANENT
RIGHT OF WAY &
EASEMENT IN FAVOR OF
THE ALCOHOLIC GAS
TRANSMISSION CO.
BIC 258-AC-392

30' WIDE PERMANENT
RIGHT OF WAY &
EASEMENT IN FAVOR OF
THE ALCOHOLIC GAS
TRANSMISSION CO.
BIC 258-AC-392

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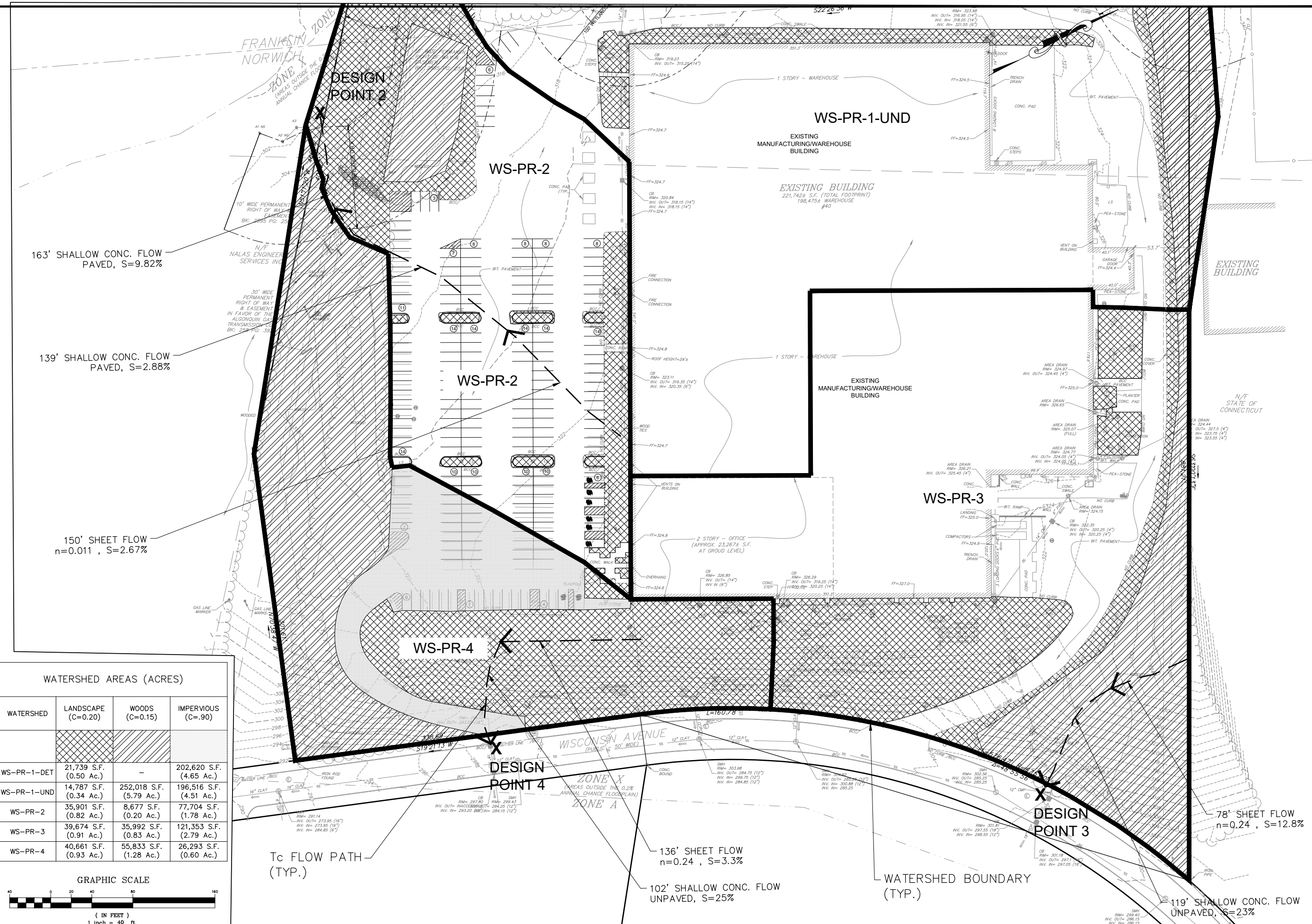
Revisions:

No.	Date	Description
1.	06-04-2021	IWMC Comments

PROPOSED DRAINAGE AREAS - WEST HALF
WISCONSIN AVENUE
WISCONSIN AVENUE
NORWICH, CONNECTICUT

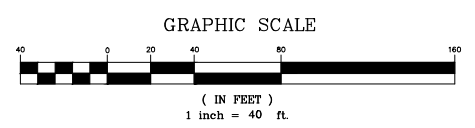
DA-2A

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



WATERSHED AREAS (ACRES)

WATERSHED	LANDSCAPE (C=0.20)	WOODS (C=0.15)	IMPERVIOUS (C=.90)
WS-PR-1-DET	21,739 S.F. (0.50 Ac.)	-	202,620 S.F. (4.65 Ac.)
WS-PR-1-UND	14,787 S.F. (0.34 Ac.)	252,018 S.F. (5.79 Ac.)	196,516 S.F. (4.51 Ac.)
WS-PR-2	35,901 S.F. (0.82 Ac.)	8,677 S.F. (0.20 Ac.)	77,704 S.F. (1.78 Ac.)
WS-PR-3	39,674 S.F. (0.91 Ac.)	35,992 S.F. (0.83 Ac.)	121,353 S.F. (2.79 Ac.)
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 859 WILLARD STREET, SUITE 501
 QUINCY, MA 02169
 (617) 657-5799

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

Revisions:
 No. Date Description
 1. 06-04-2021 I/M/C Comments

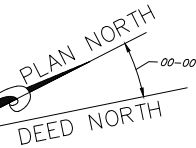
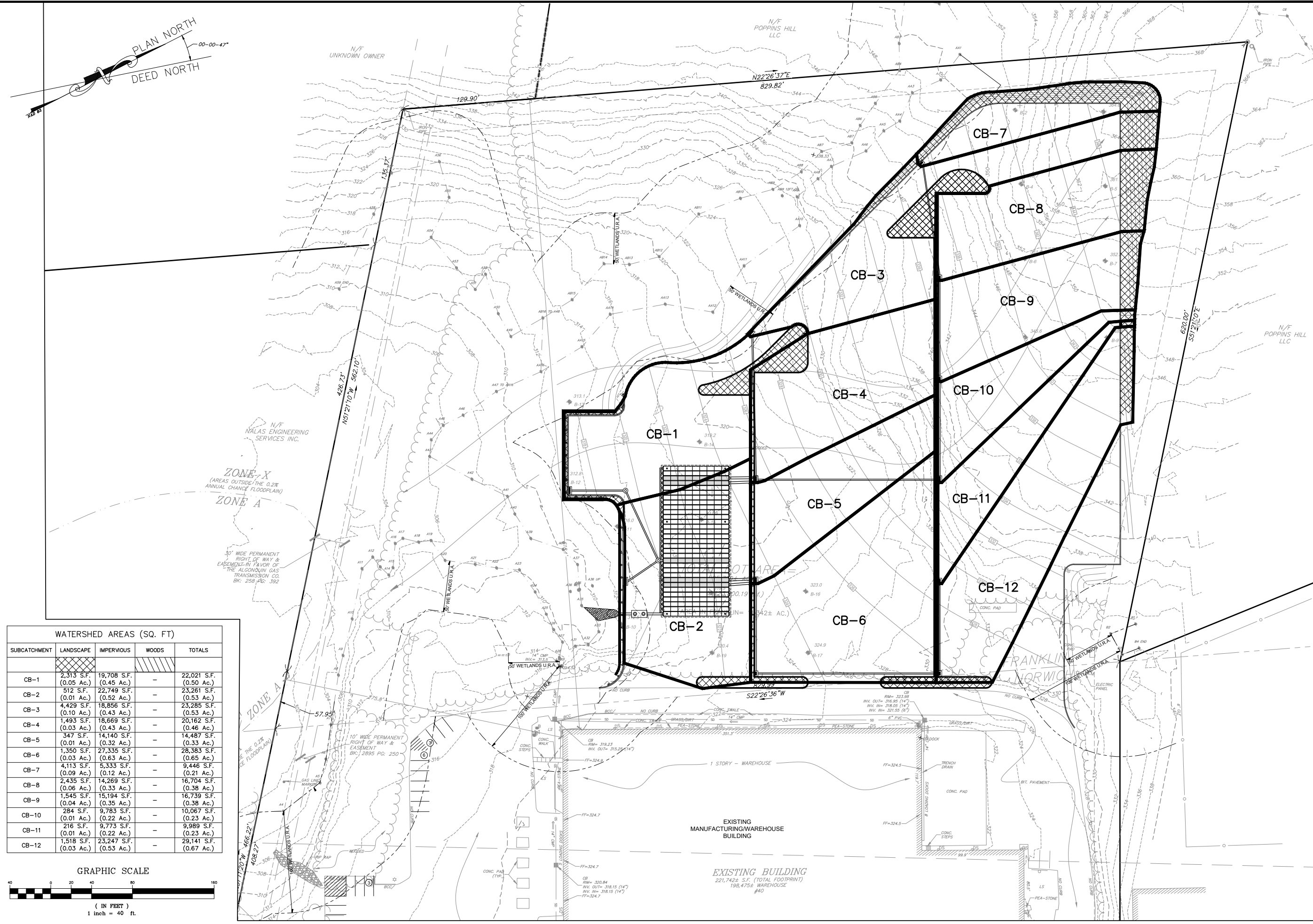
PROPOSED DRAINAGE AREAS - EAST HALF
 WISCONSIN AVENUE
 WISCONSIN AVENUE
 NORWICH, CONNECTICUT

DA-2B

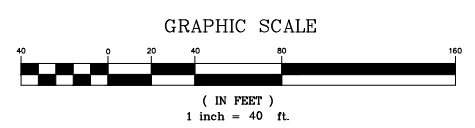
Date: 04-23-2021 Drawn by: ERN Job no: 21126
 Scale: 1" = 40' Checked by: GAH Sheet no: 1 OF 1

F. A. Hesketh & Associates, Inc.
 3 Creamery Brook, East Granby, CT 06026
 Phone (860) 653-8000 Fax (860) 844-8600
 www.fahsketh.com • m.fahsketh.com
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Q:\2020\20154-Wisconsin Ave Norwich\2021-06-04 I/M/C Revisions\WS DA-1 2021-06-04.dwg, D:\z-28-east_half, Jun. 07, 2021 - 11:05:20 AM



WATERSHED AREAS (SQ. FT)				
SUBCATCHMENT	LANDSCAPE	IMPERVIOUS	WOODS	TOTALS
CB-1	2,313 S.F. (0.05 Ac.)	19,708 S.F. (0.45 Ac.)	-	22,021 S.F. (0.50 Ac.)
CB-2	512 S.F. (0.01 Ac.)	22,749 S.F. (0.52 Ac.)	-	23,261 S.F. (0.53 Ac.)
CB-3	4,429 S.F. (0.10 Ac.)	18,856 S.F. (0.43 Ac.)	-	23,285 S.F. (0.53 Ac.)
CB-4	1,493 S.F. (0.03 Ac.)	18,669 S.F. (0.43 Ac.)	-	20,162 S.F. (0.46 Ac.)
CB-5	347 S.F. (0.01 Ac.)	14,140 S.F. (0.32 Ac.)	-	14,487 S.F. (0.33 Ac.)
CB-6	1,350 S.F. (0.03 Ac.)	27,335 S.F. (0.63 Ac.)	-	28,383 S.F. (0.65 Ac.)
CB-7	4,113 S.F. (0.09 Ac.)	5,333 S.F. (0.12 Ac.)	-	9,446 S.F. (0.21 Ac.)
CB-8	2,435 S.F. (0.06 Ac.)	14,269 S.F. (0.33 Ac.)	-	16,704 S.F. (0.38 Ac.)
CB-9	1,545 S.F. (0.04 Ac.)	15,194 S.F. (0.35 Ac.)	-	16,739 S.F. (0.38 Ac.)
CB-10	284 S.F. (0.01 Ac.)	9,783 S.F. (0.22 Ac.)	-	10,067 S.F. (0.23 Ac.)
CB-11	216 S.F. (0.01 Ac.)	9,773 S.F. (0.22 Ac.)	-	9,989 S.F. (0.23 Ac.)
CB-12	1,518 S.F. (0.03 Ac.)	23,247 S.F. (0.53 Ac.)	-	29,141 S.F. (0.67 Ac.)



Revisions:
 No. Date Description
 1. 06-04-2021 I/MWC Comments

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

APPLICANT: THE GROSSMAN COMPANIES
 OWNER: Norwich 40 TGI LLC
 859 WILLARD STREET, SUITE 501
 QUINCY, MA 02169
 (617) 657-5799

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

DA-3

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ATTACHMENT A

Soil Types Map

Soil Map—State of Connecticut

72° 7' 22" W 7399000 7400000 7401000 7402000 7403000 7404000 7405000 7406000 7407000 7408000 7409000 72° 6' 34" W 41° 34' 58" N 4607400 4607300 4607200 4607100 4607000 4606900 4606800 41° 34' 34" N



Soil Map may not be valid at this scale.

N

Map Scale: 1:5,130 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

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

<u>Slope</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
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

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

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

<u>Description of Area</u>	<u>Runoff Coefficients</u>
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 & aeriels](#)

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)

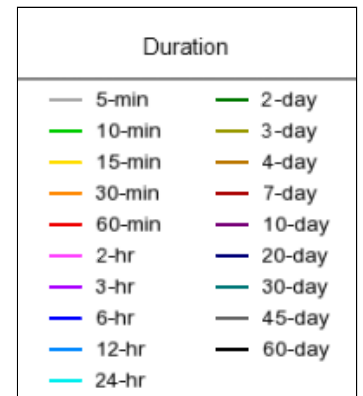
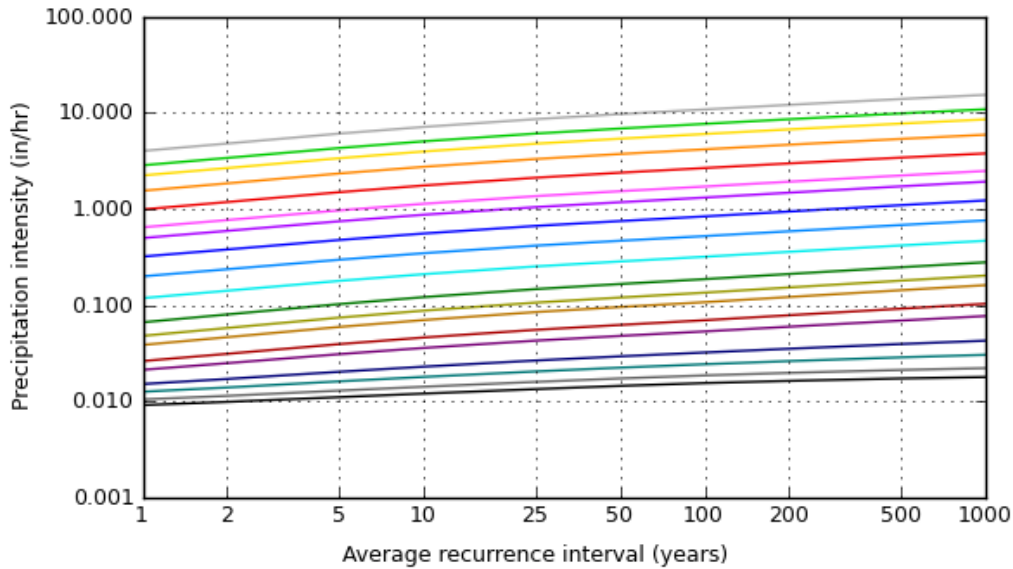
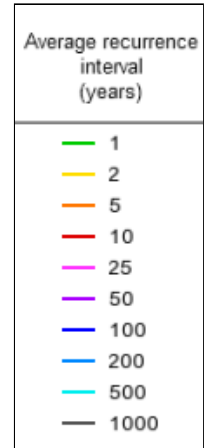
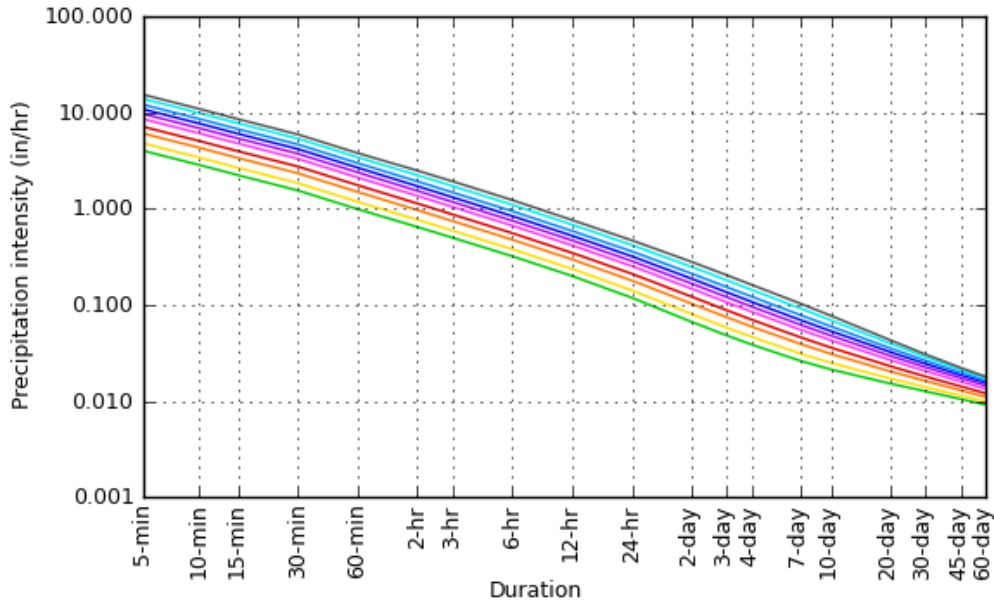
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average 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

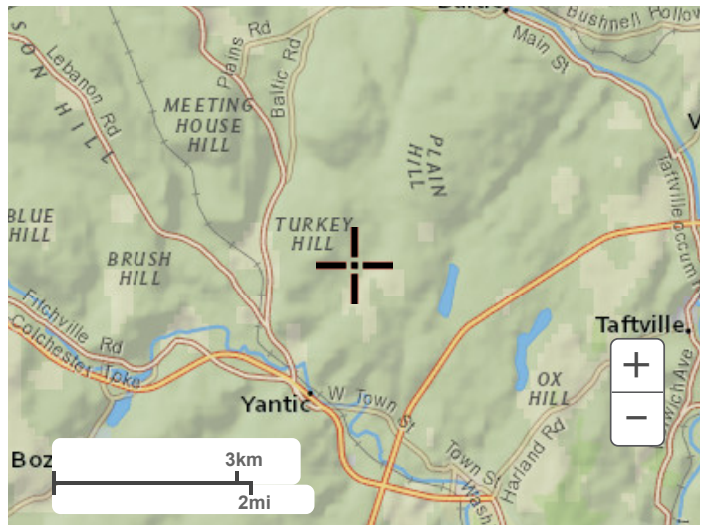
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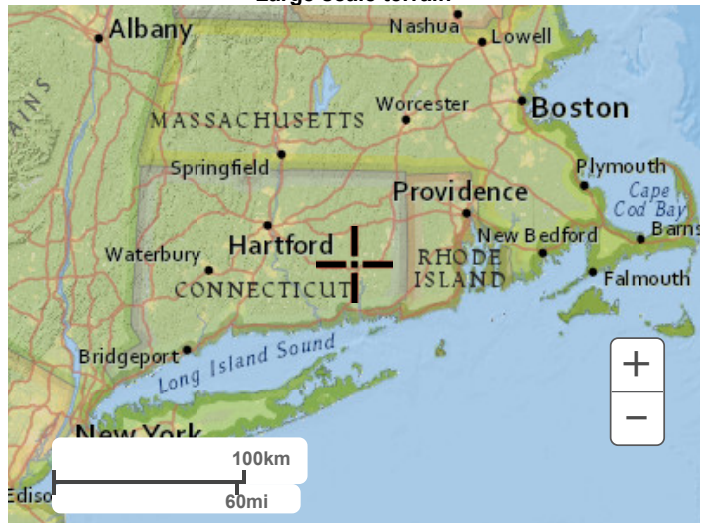
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Maps & aerials

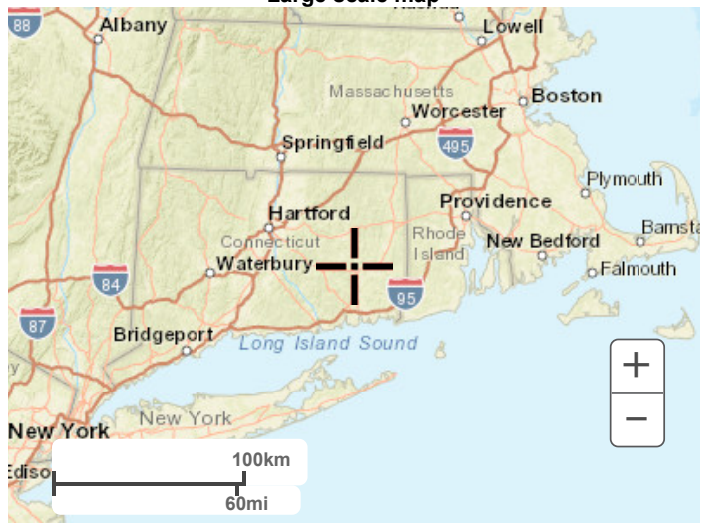
Small scale terrain



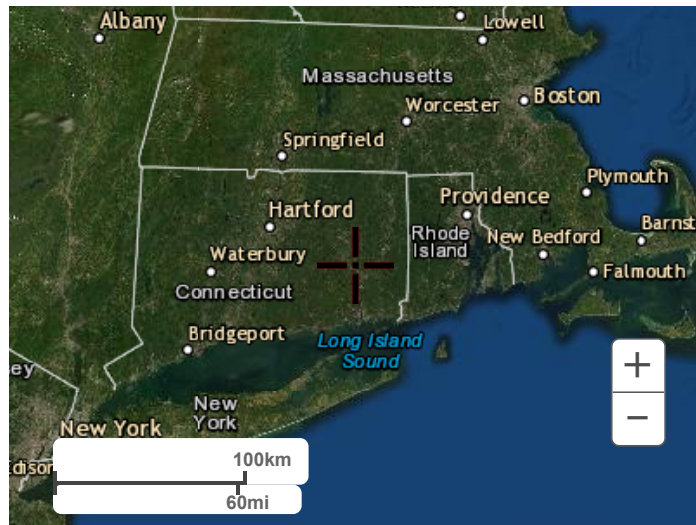
Large scale terrain



Large scale map



Large scale aerial



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

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ATTACHMENT D

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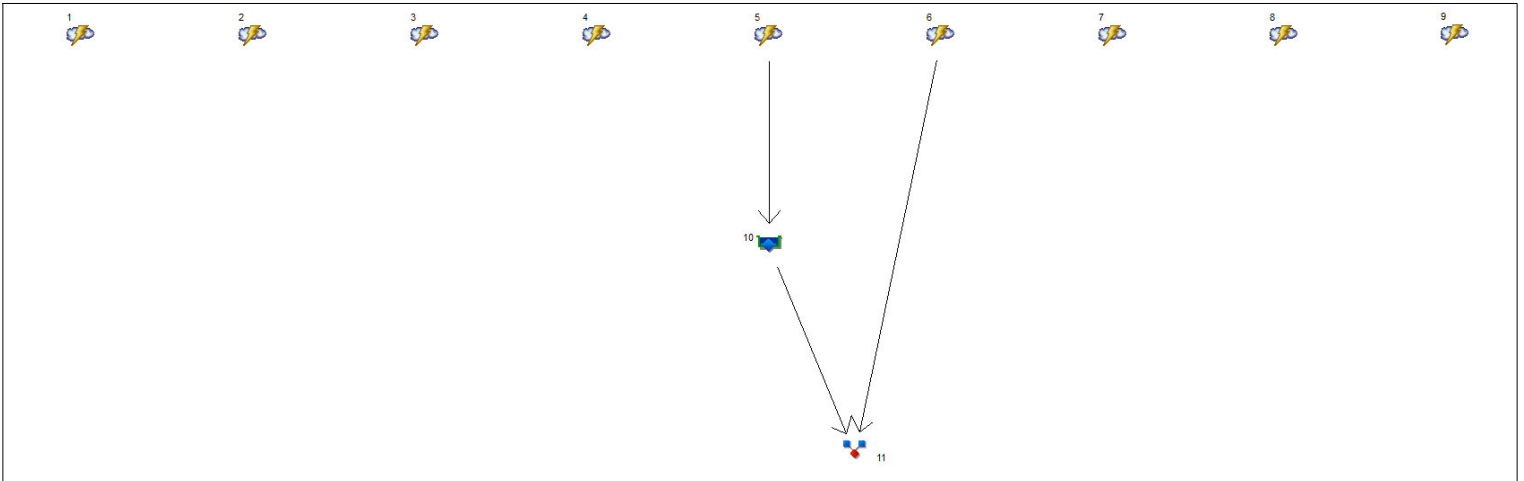
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Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.1



Legend

<u>Hyd.</u>	<u>Origin</u>	<u>Description</u>
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	-----	-----	13.55	-----	17.10	20.11	24.20	27.37	30.57	WS-EX-1 to Design Point 1
2	Rational	-----	-----	8.603	-----	10.89	12.80	15.38	17.39	19.31	WS-EX-2 to Design Point 2
3	Rational	-----	-----	13.47	-----	17.06	20.03	24.07	27.23	30.22	WS-EX-3 to Design Point 3
4	Rational	-----	-----	2.626	-----	3.314	3.897	4.687	5.303	5.920	WS-EX-4 to Design Point 4
5	Rational	-----	-----	16.36	-----	20.67	24.30	29.21	33.05	36.80	WS-PR-1-DET
6	Rational	-----	-----	11.48	-----	14.49	17.04	20.50	23.18	25.90	WS-PR-1-UND to Design Point 1
7	Rational	-----	-----	8.603	-----	10.89	12.80	15.38	17.39	19.31	WS-PR-2 to Design Point 2
8	Rational	-----	-----	13.47	-----	17.06	20.03	24.07	27.23	30.22	WS-PR-3 to Design Point 3
9	Rational	-----	-----	2.598	-----	3.279	3.856	4.638	5.248	5.859	WS-PR-4 to Design Point 4
10	Reservoir	5	-----	2.013	-----	2.320	2.560	2.888	3.184	3.510	Outflow - UG Chambers
11	Combine	6, 10	-----	13.49	-----	16.81	19.60	23.39	26.37	29.41	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	13.55	1	19	20,476	----	-----	-----	WS-EX-1 to Design Point 1
2	Rational	8.603	1	5	3,442	----	-----	-----	WS-EX-2 to Design Point 2
3	Rational	13.47	1	5	5,388	----	-----	-----	WS-EX-3 to Design Point 3
4	Rational	2.626	1	15	3,093	----	-----	-----	WS-EX-4 to Design Point 4
5	Rational	16.36	1	8	10,474	----	-----	-----	WS-PR-1-DET
6	Rational	11.48	1	20	17,981	----	-----	-----	WS-PR-1-UND to Design Point 1
7	Rational	8.603	1	5	3,442	----	-----	-----	WS-PR-2 to Design Point 2
8	Rational	13.47	1	5	5,388	----	-----	-----	WS-PR-3 to Design Point 3
9	Rational	2.598	1	15	3,119	----	-----	-----	WS-PR-4 to Design Point 4
10	Reservoir	2.013	1	19	10,290	5	313.37	8,800	Outflow - UG Chambers
11	Combine	13.49	1	20	27,849	6, 10	-----	-----	Total Proposed to Design Point 1
Hydraflow-2021-06-04.gpw					Return Period: 2 Year			Tuesday, Jun 8, 2021	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

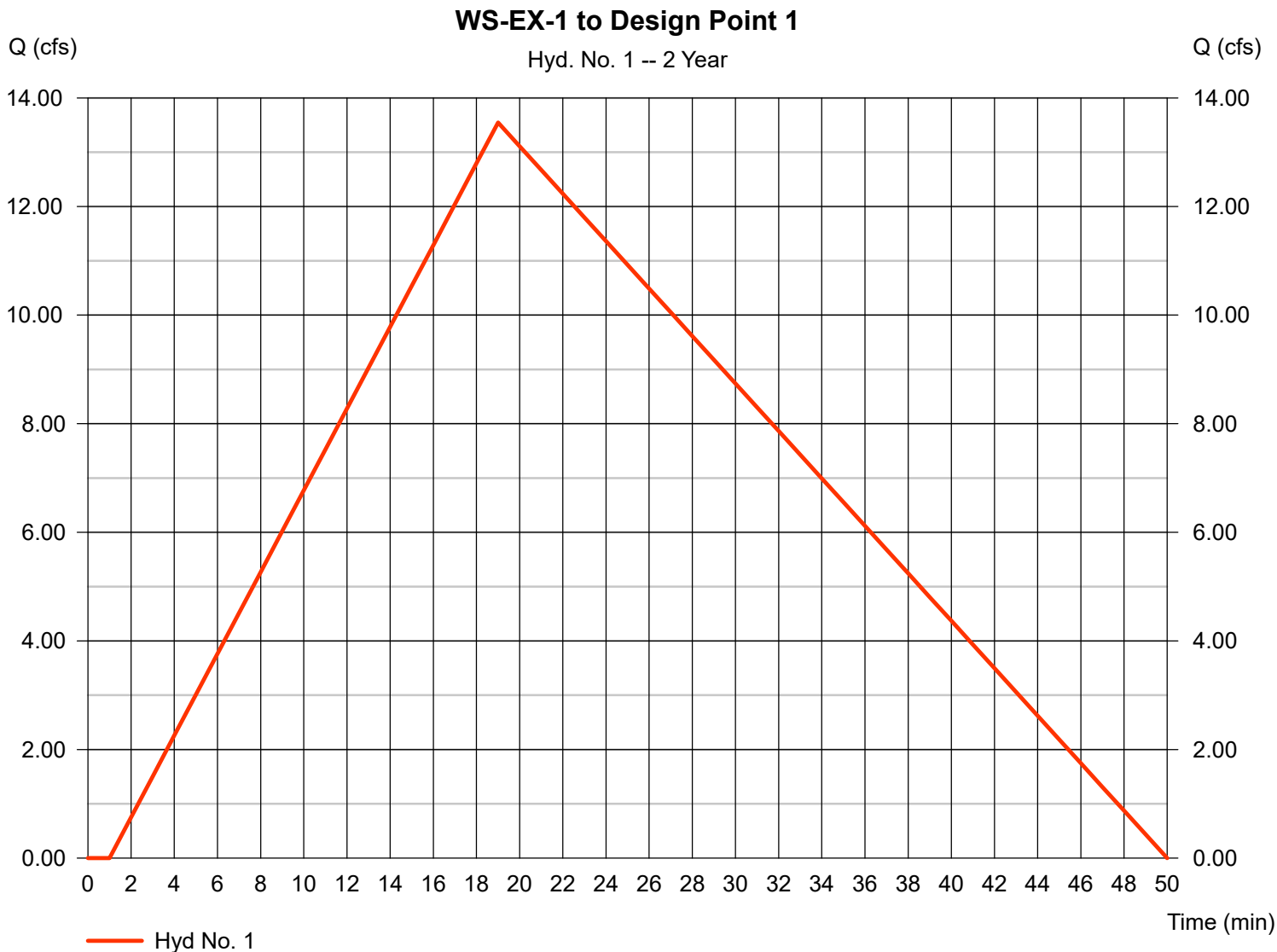
Hyd. No. 1

WS-EX-1 to Design Point 1

Hydrograph type = Rational
 Storm frequency = 2 yrs
 Time interval = 1 min
 Drainage area = 15.780 ac
 Intensity = 2.453 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 13.55 cfs
 Time to peak = 19 min
 Hyd. volume = 20,476 cuft
 Runoff coeff. = 0.35*
 Tc by TR55 = 18.89 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 1

WS-EX-1 to Design Point 1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
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				18.89 min

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

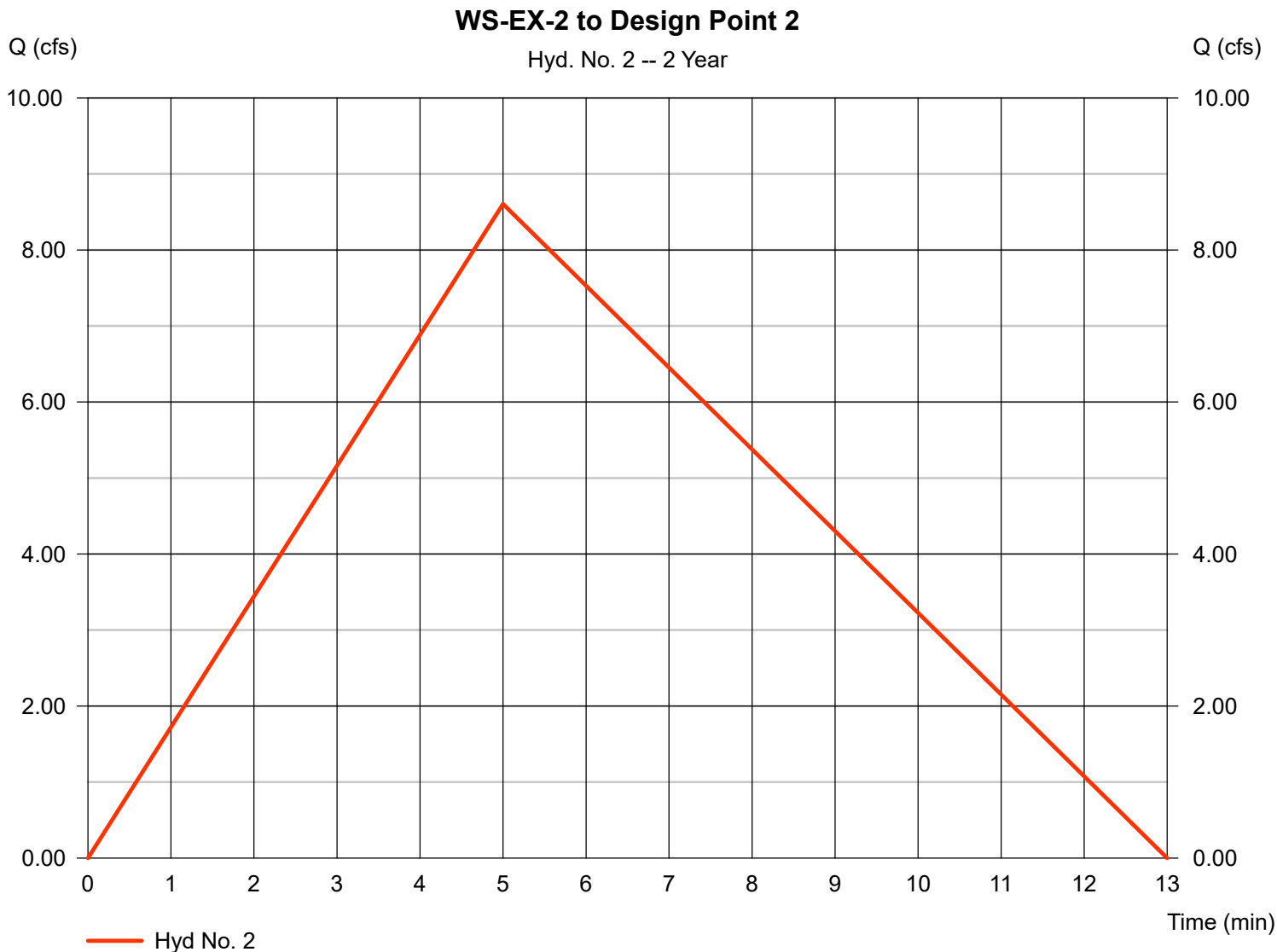
Hyd. No. 2

WS-EX-2 to Design Point 2

Hydrograph type = Rational
 Storm frequency = 2 yrs
 Time interval = 1 min
 Drainage area = 2.760 ac
 Intensity = 4.796 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 8.603 cfs
 Time to peak = 5 min
 Hyd. volume = 3,442 cuft
 Runoff coeff. = 0.65*
 Tc by User = 5.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

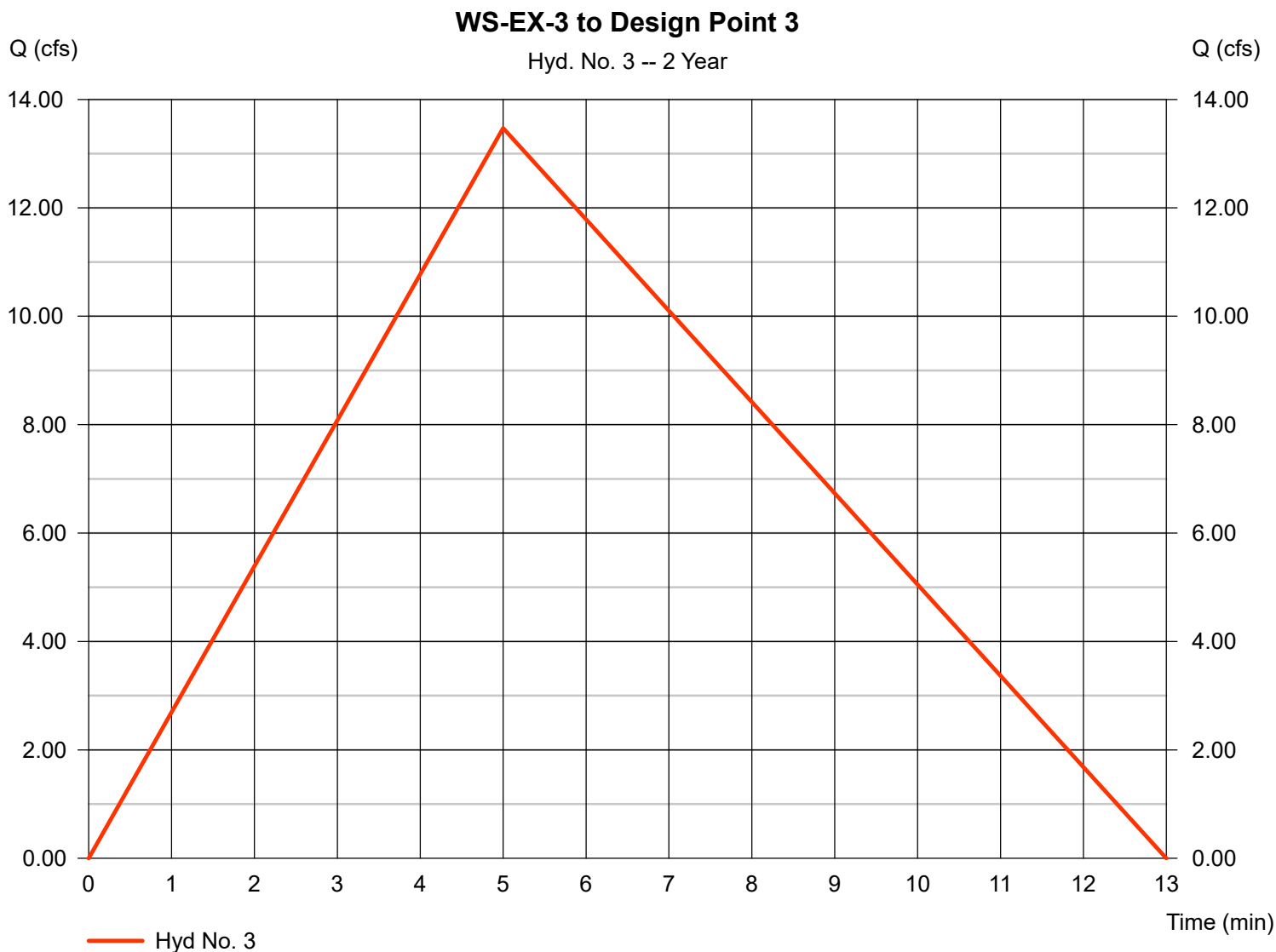
Hyd. No. 3

WS-EX-3 to Design Point 3

Hydrograph type = Rational
 Storm frequency = 2 yrs
 Time interval = 1 min
 Drainage area = 4.530 ac
 Intensity = 4.796 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 13.47 cfs
 Time to peak = 5 min
 Hyd. volume = 5,388 cuft
 Runoff coeff. = 0.62*
 Tc by TR55 = 5.00 min
 Asc/Rec limb fact = 1/1.667

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



TR55 Tc Worksheet

Hyd. No. 3

WS-EX-3 to Design Point 3

<u>Description</u>	<u>A</u>		<u>B</u>		<u>C</u>		<u>Totals</u>	
Sheet Flow								
Manning's n-value	= 0.240		0.011		0.011			
Flow length (ft)	= 78.0		0.0		0.0			
Two-year 24-hr precip. (in)	= 3.39		0.00		0.00			
Land slope (%)	= 12.80		0.00		0.00			
Travel Time (min)	= 5.41	+	0.00	+	0.00	=	5.41	
Shallow Concentrated Flow								
Flow length (ft)	= 119.00		0.00		0.00			
Watercourse slope (%)	= 323.00		0.00		0.00			
Surface description	= Unpaved		Paved		Paved			
Average velocity (ft/s)	= 29.00		0.00		0.00			
Travel Time (min)	= 0.07	+	0.00	+	0.00	=	0.07	
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							=	5.00 min

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

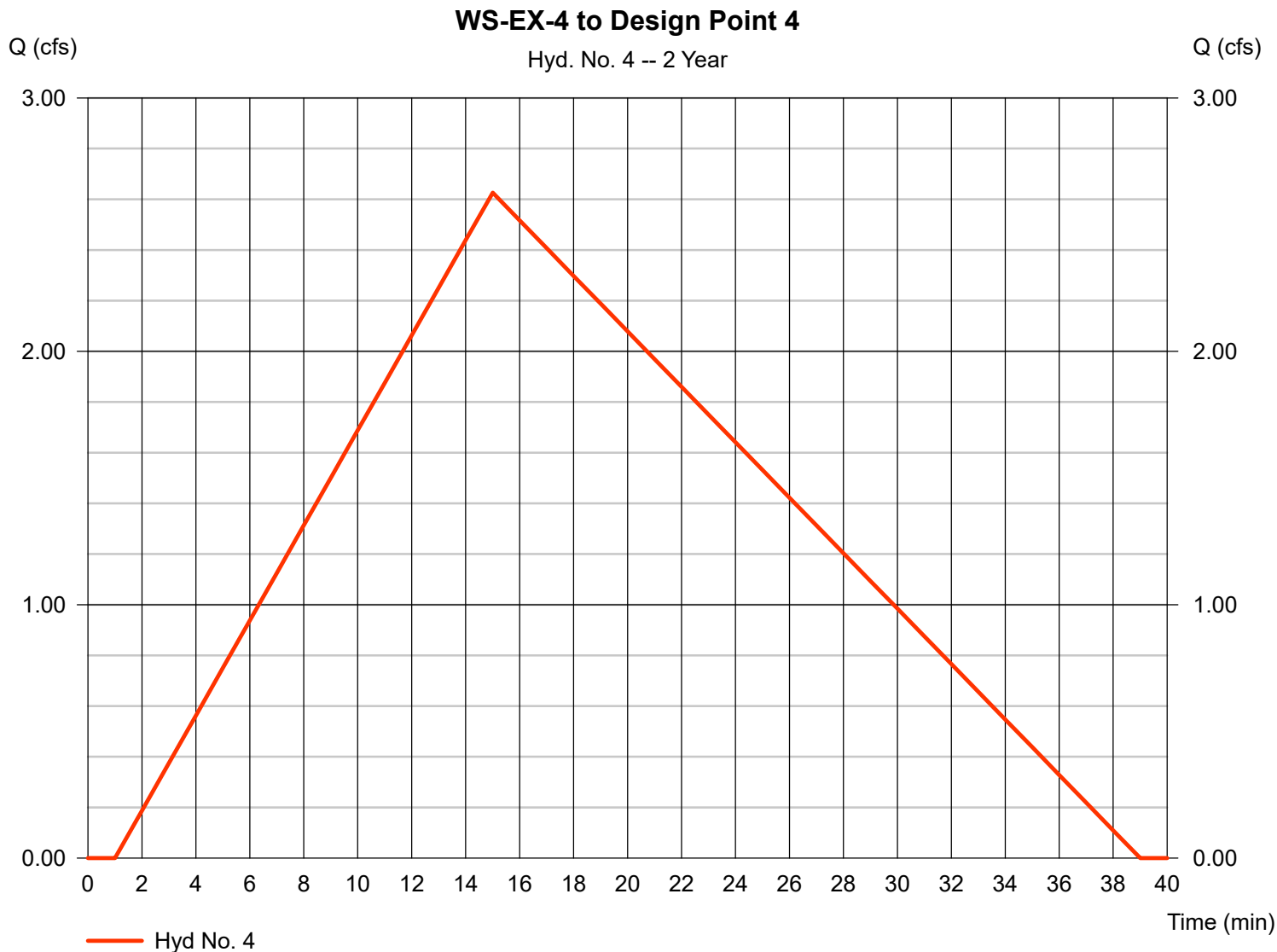
Hyd. No. 4

WS-EX-4 to Design Point 4

Hydrograph type = Rational
 Storm frequency = 2 yrs
 Time interval = 1 min
 Drainage area = 2.810 ac
 Intensity = 2.832 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 2.626 cfs
 Time to peak = 15 min
 Hyd. volume = 3,093 cuft
 Runoff coeff. = 0.33*
 Tc by TR55 = 14.72 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 4

WS-EX-4 to Design Point 4

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 136.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.39	0.00	0.00	
Land slope (%)	= 3.30	0.00	0.00	
Travel Time (min)	= 14.51	+ 0.00	+ 0.00	= 14.51
Shallow Concentrated Flow				
Flow length (ft)	= 102.00	0.00	0.00	
Watercourse slope (%)	= 25.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 8.07	0.00	0.00	
Travel Time (min)	= 0.21	+ 0.00	+ 0.00	= 0.21
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				14.72 min

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

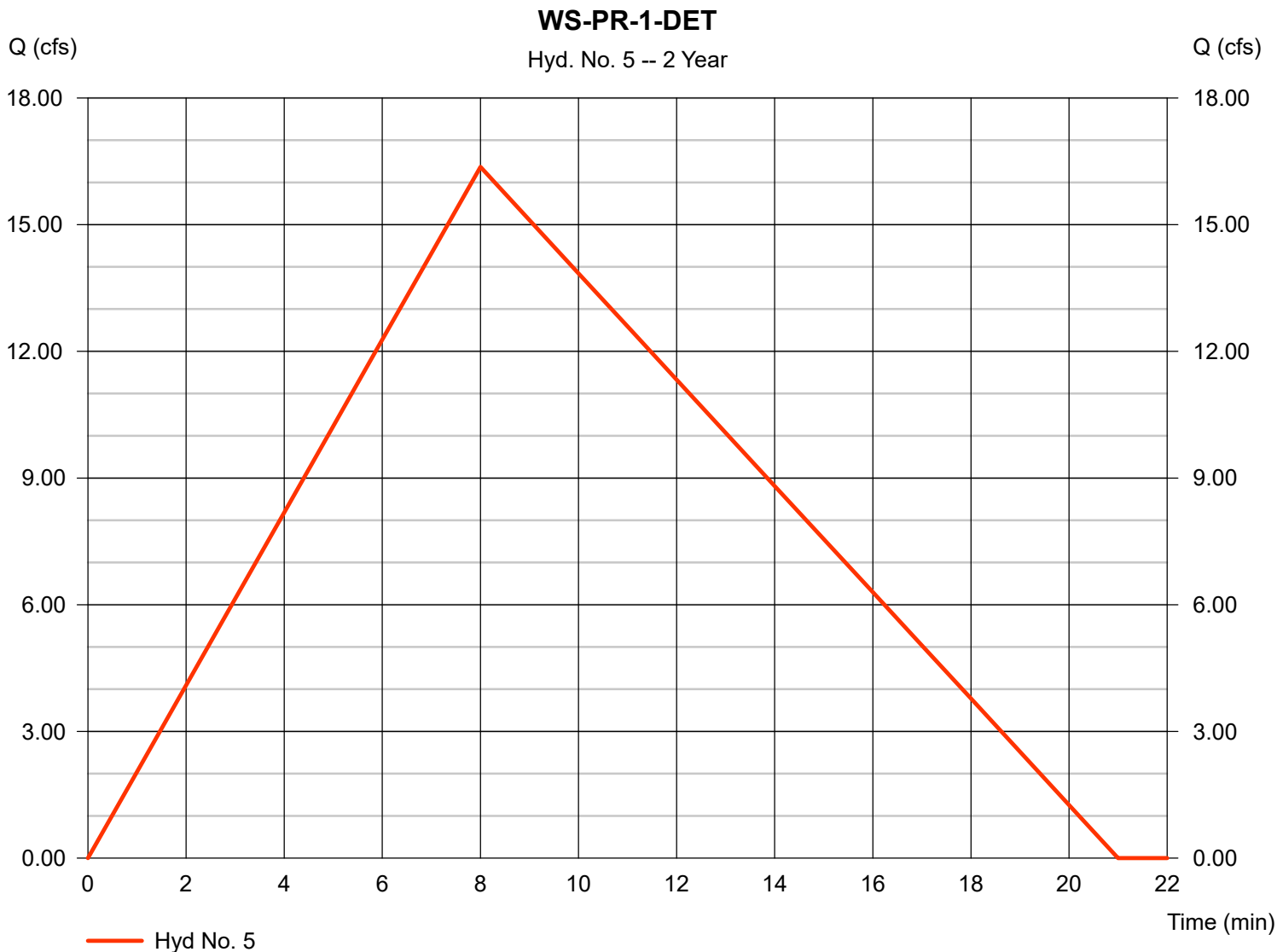
Hyd. No. 5

WS-PR-1-DET

Hydrograph type = Rational
 Storm frequency = 2 yrs
 Time interval = 1 min
 Drainage area = 5.060 ac
 Intensity = 3.896 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 16.36 cfs
 Time to peak = 8 min
 Hyd. volume = 10,474 cuft
 Runoff coeff. = 0.83*
 Tc by User = 8.00 min
 Asc/Rec limb fact = 1/1.667

* Composite (Area/C) = [(0.480 x 0.20) + (4.580 x 0.90)] / 5.060



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

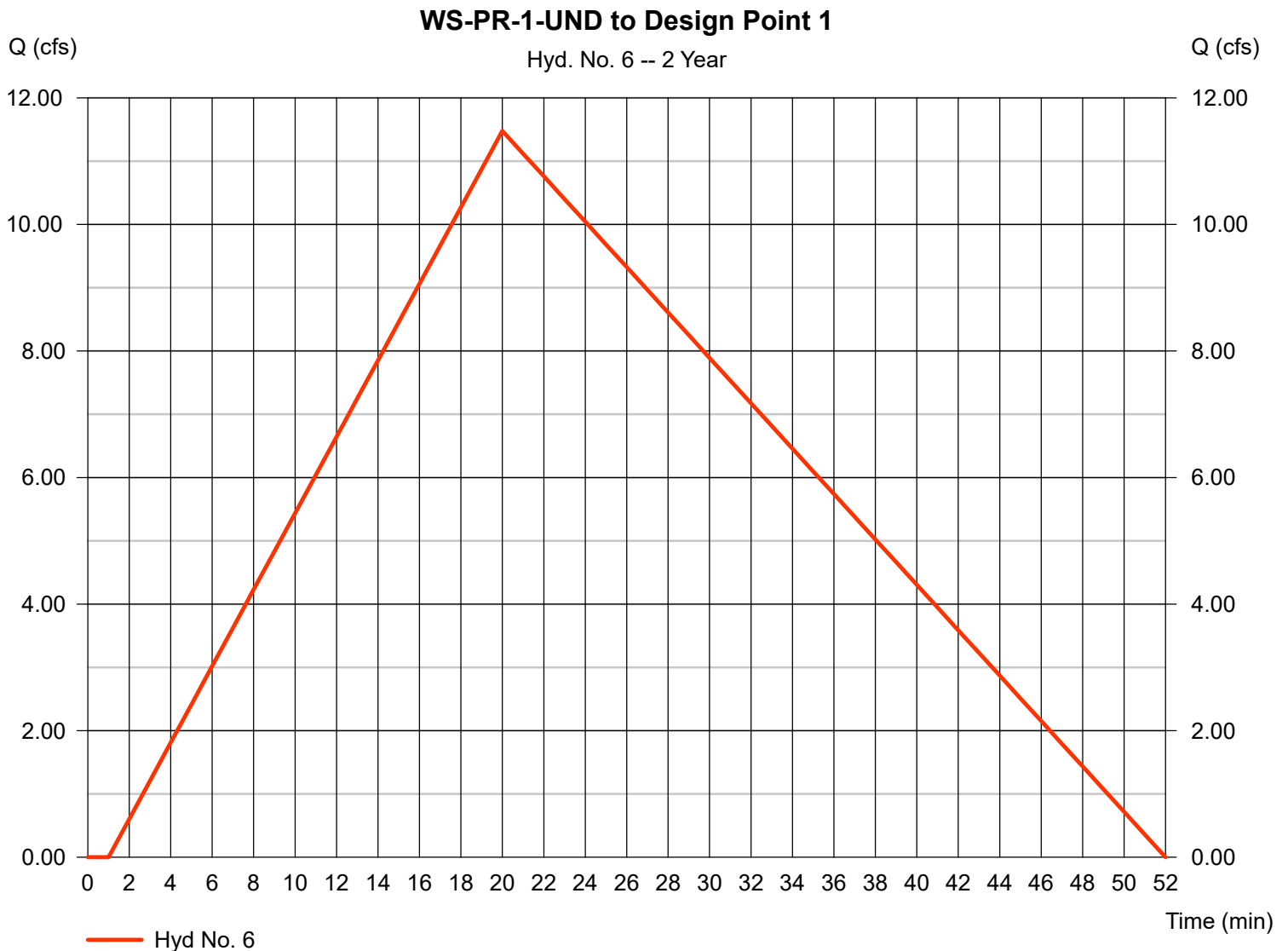
Hyd. No. 6

WS-PR-1-UND to Design Point 1

Hydrograph type = Rational
 Storm frequency = 2 yrs
 Time interval = 1 min
 Drainage area = 10.390 ac
 Intensity = 2.401 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 11.48 cfs
 Time to peak = 20 min
 Hyd. volume = 17,981 cuft
 Runoff coeff. = 0.46*
 Tc by TR55 = 19.58 min
 Asc/Rec limb fact = 1/1.667

* Composite (Area/C) = [(0.370 x 0.20) + (5.790 x 0.15) + (4.570 x 0.90)] / 10.390



TR55 Tc Worksheet

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 6

WS-PR-1-UND to Design Point 1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
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				19.58 min

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

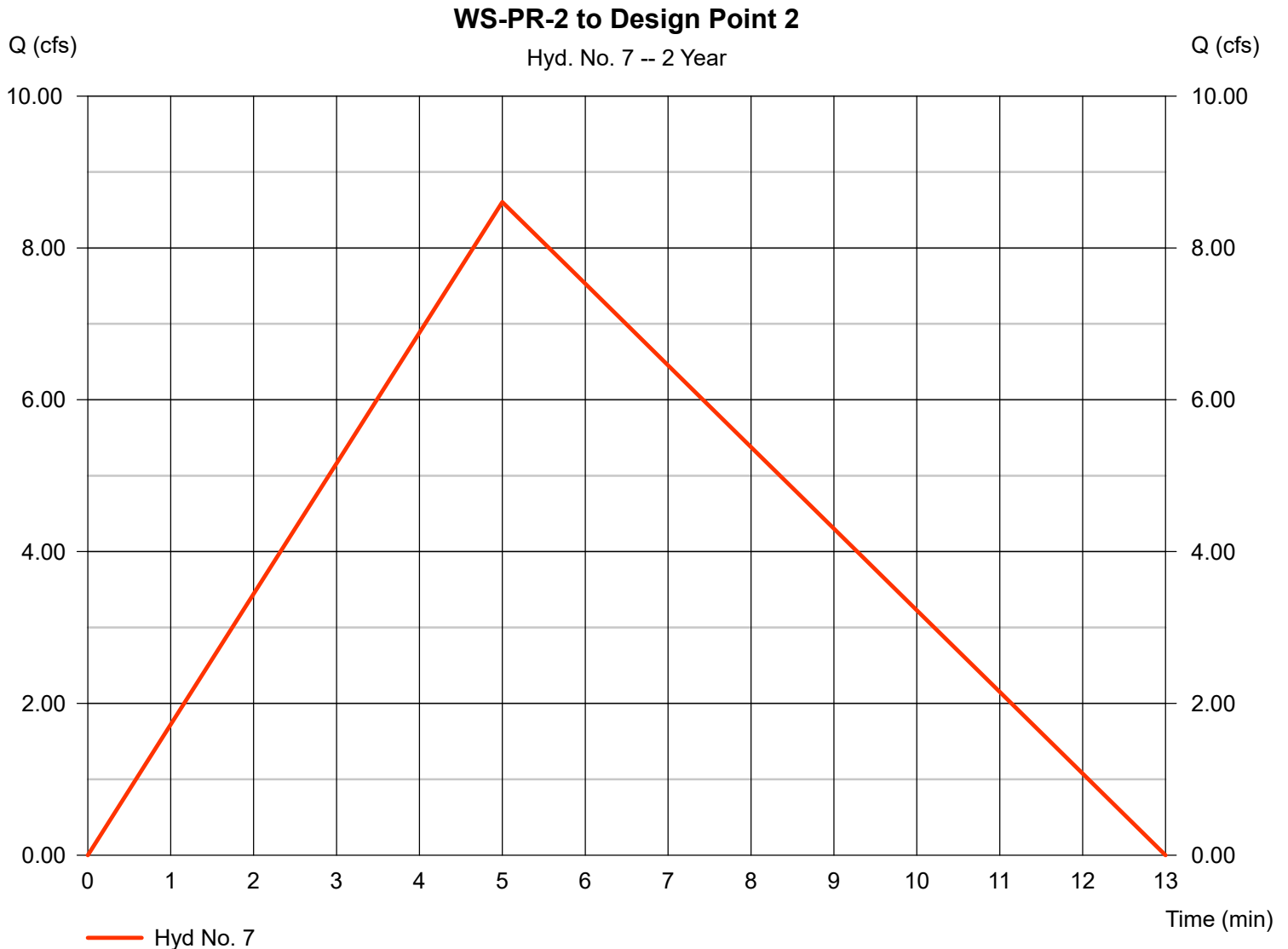
Hyd. No. 7

WS-PR-2 to Design Point 2

Hydrograph type = Rational
 Storm frequency = 2 yrs
 Time interval = 1 min
 Drainage area = 2.760 ac
 Intensity = 4.796 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 8.603 cfs
 Time to peak = 5 min
 Hyd. volume = 3,442 cuft
 Runoff coeff. = 0.65*
 Tc by User = 5.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

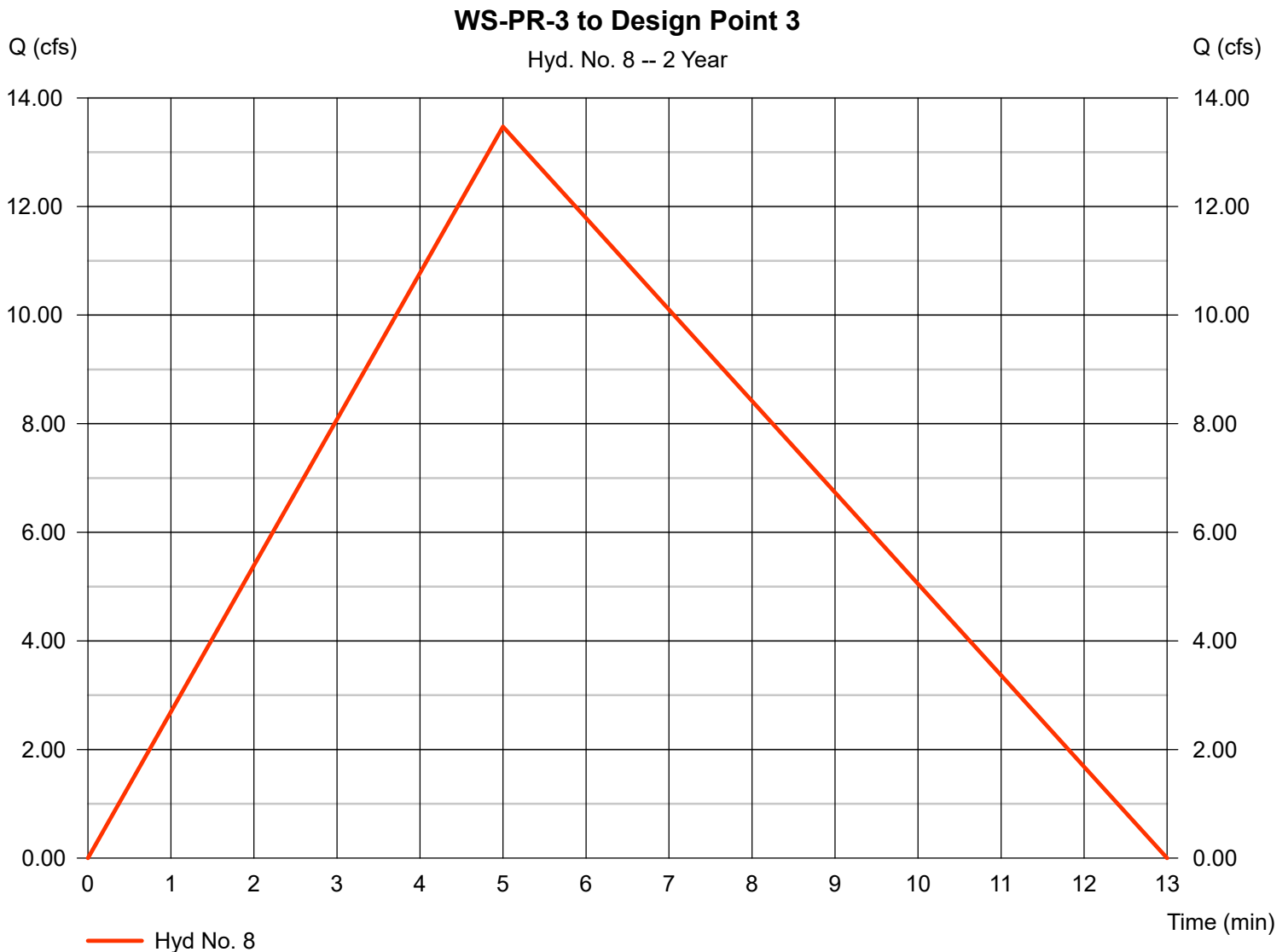
Hyd. No. 8

WS-PR-3 to Design Point 3

Hydrograph type = Rational
 Storm frequency = 2 yrs
 Time interval = 1 min
 Drainage area = 4.530 ac
 Intensity = 4.796 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 13.47 cfs
 Time to peak = 5 min
 Hyd. volume = 5,388 cuft
 Runoff coeff. = 0.62*
 Tc by TR55 = 5.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 8

WS-PR-3 to Design Point 3

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 78.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.39	0.00	0.00	
Land slope (%)	= 12.80	0.00	0.00	
Travel Time (min)	= 5.41	+	0.00	+
				0.00
				= 5.41
Shallow Concentrated Flow				
Flow length (ft)	= 119.00	0.00	0.00	
Watercourse slope (%)	= 323.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 29.00	0.00	0.00	
Travel Time (min)	= 0.07	+	0.00	+
				0.00
				= 0.07
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				5.00 min

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

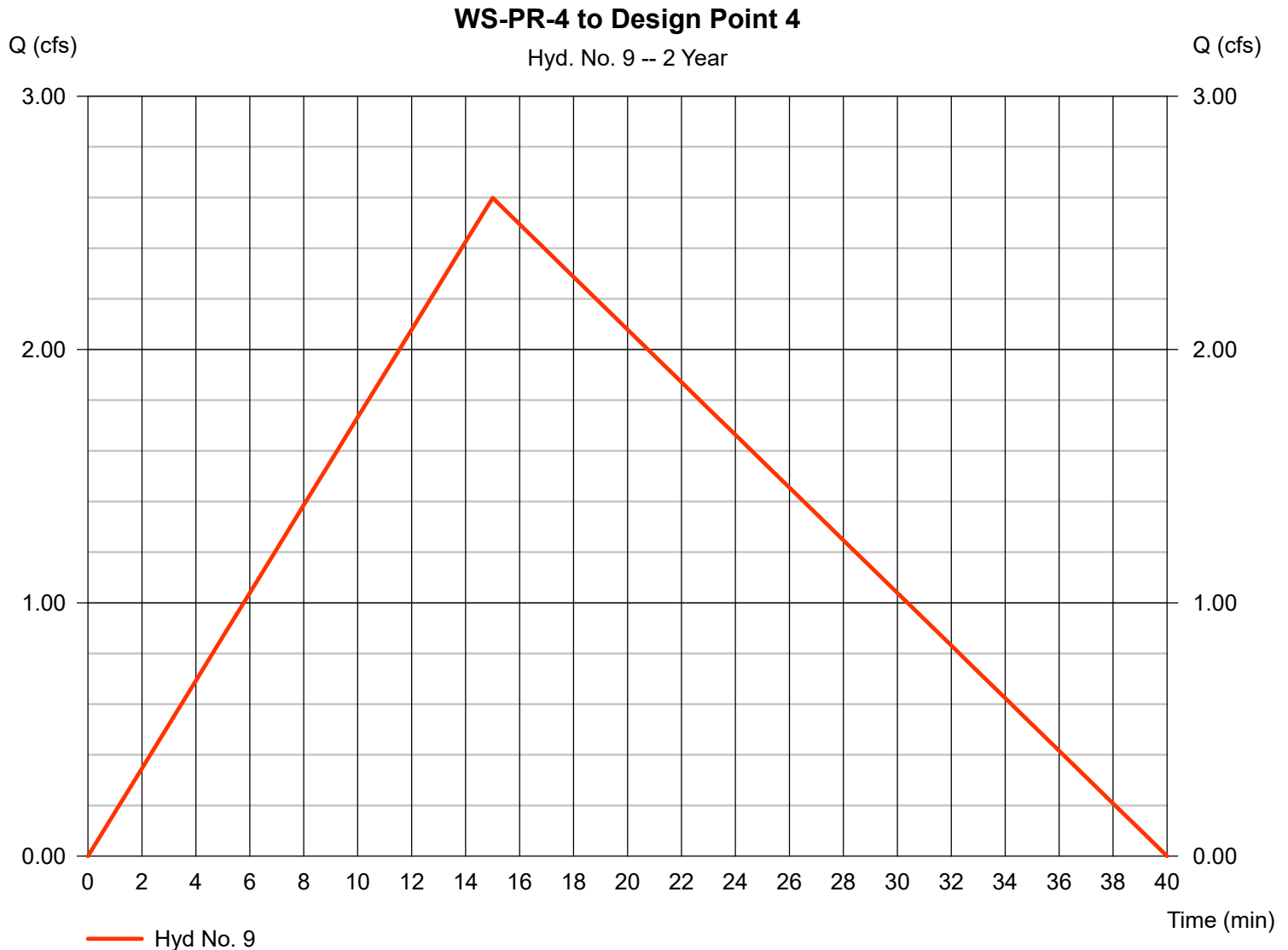
Hyd. No. 9

WS-PR-4 to Design Point 4

Hydrograph type = Rational
 Storm frequency = 2 yrs
 Time interval = 1 min
 Drainage area = 2.810 ac
 Intensity = 2.802 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 2.598 cfs
 Time to peak = 15 min
 Hyd. volume = 3,119 cuft
 Runoff coeff. = 0.33*
 Tc by TR55 = 15.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Hyd. No. 9

WS-PR-4 to Design Point 4

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 136.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.39	0.00	0.00	
Land slope (%)	= 3.30	0.00	0.00	
Travel Time (min)	= 14.51	+ 0.00	+ 0.00	= 14.51
Shallow Concentrated Flow				
Flow length (ft)	= 102.00	0.00	0.00	
Watercourse slope (%)	= 25.00	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	= 8.07	0.00	0.00	
Travel Time (min)	= 0.21	+ 0.00	+ 0.00	= 0.21
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				15.00 min

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

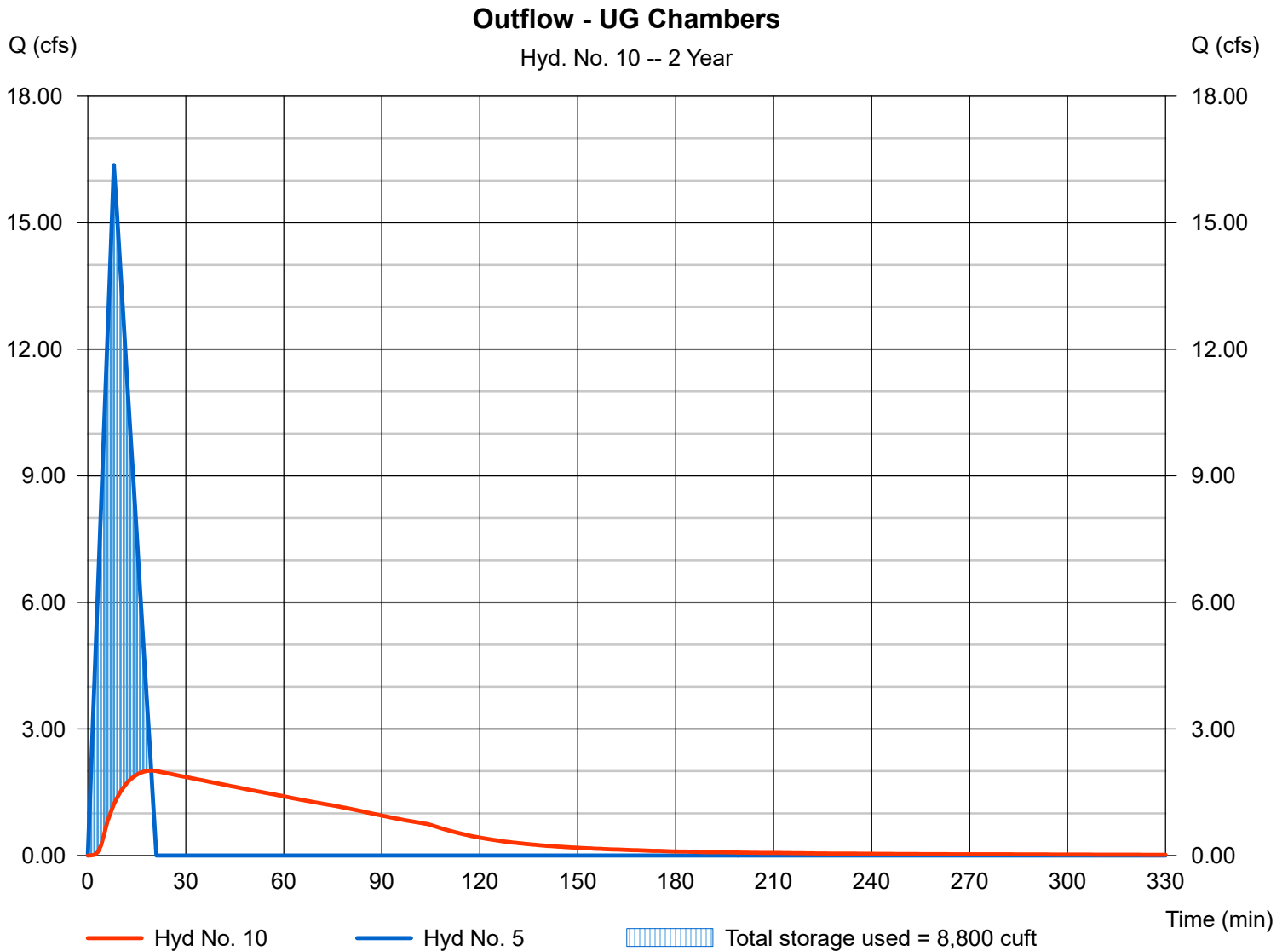
Tuesday, Jun 8, 2021

Hyd. No. 10

Outflow - UG Chambers

Hydrograph type	= Reservoir	Peak discharge	= 2.013 cfs
Storm frequency	= 2 yrs	Time to peak	= 19 min
Time interval	= 1 min	Hyd. volume	= 10,290 cuft
Inflow hyd. No.	= 5 - WS-PR-1-DET	Max. Elevation	= 313.37 ft
Reservoir name	= UG Chambers	Max. Storage	= 8,800 cuft

Storage Indication method used.



Pond Report

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	1,886	1,886
1.00	313.00	n/a	4,059	5,945
1.50	313.50	n/a	3,884	9,829
2.00	314.00	n/a	3,616	13,445
2.50	314.50	n/a	3,200	16,645
3.00	315.00	n/a	2,366	19,011
3.50	315.50	n/a	1,886	20,897
4.00	316.00	n/a	10	20,907
4.50	316.50	n/a	10	20,917
5.00	317.00	n/a	10	20,927
5.50	317.50	n/a	10	20,937

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	8.75	0.00	0.00
Span (in)	= 24.00	8.75	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 310.00	312.00	313.00	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)	= 315.50	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	1,886	312.50	12.25 oc	0.74 ic	---	---	0.00	---	---	---	---	---	0.74
1.00	5,945	313.00	12.25 oc	1.60 ic	---	---	0.00	---	---	---	---	---	1.60
1.50	9,829	313.50	12.25 oc	2.14 ic	---	---	0.00	---	---	---	---	---	2.14
2.00	13,445	314.00	12.25 oc	2.57 ic	---	---	0.00	---	---	---	---	---	2.57
2.50	16,645	314.50	12.25 oc	2.94 ic	---	---	0.00	---	---	---	---	---	2.94
3.00	19,011	315.00	12.25 oc	3.26 ic	---	---	0.00	---	---	---	---	---	3.26
3.50	20,897	315.50	12.25 oc	3.56 ic	---	---	0.00	---	---	---	---	---	3.56
4.00	20,907	316.00	12.25 oc	3.83 ic	---	---	3.53	---	---	---	---	---	7.37
4.50	20,917	316.50	12.25 oc	4.09 ic	---	---	9.99	---	---	---	---	---	14.08
5.00	20,927	317.00	12.25 oc	4.33 ic	---	---	18.35	---	---	---	---	---	22.68
5.50	20,937	317.50	12.25 oc	4.56 ic	---	---	28.26	---	---	---	---	---	32.81

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 11

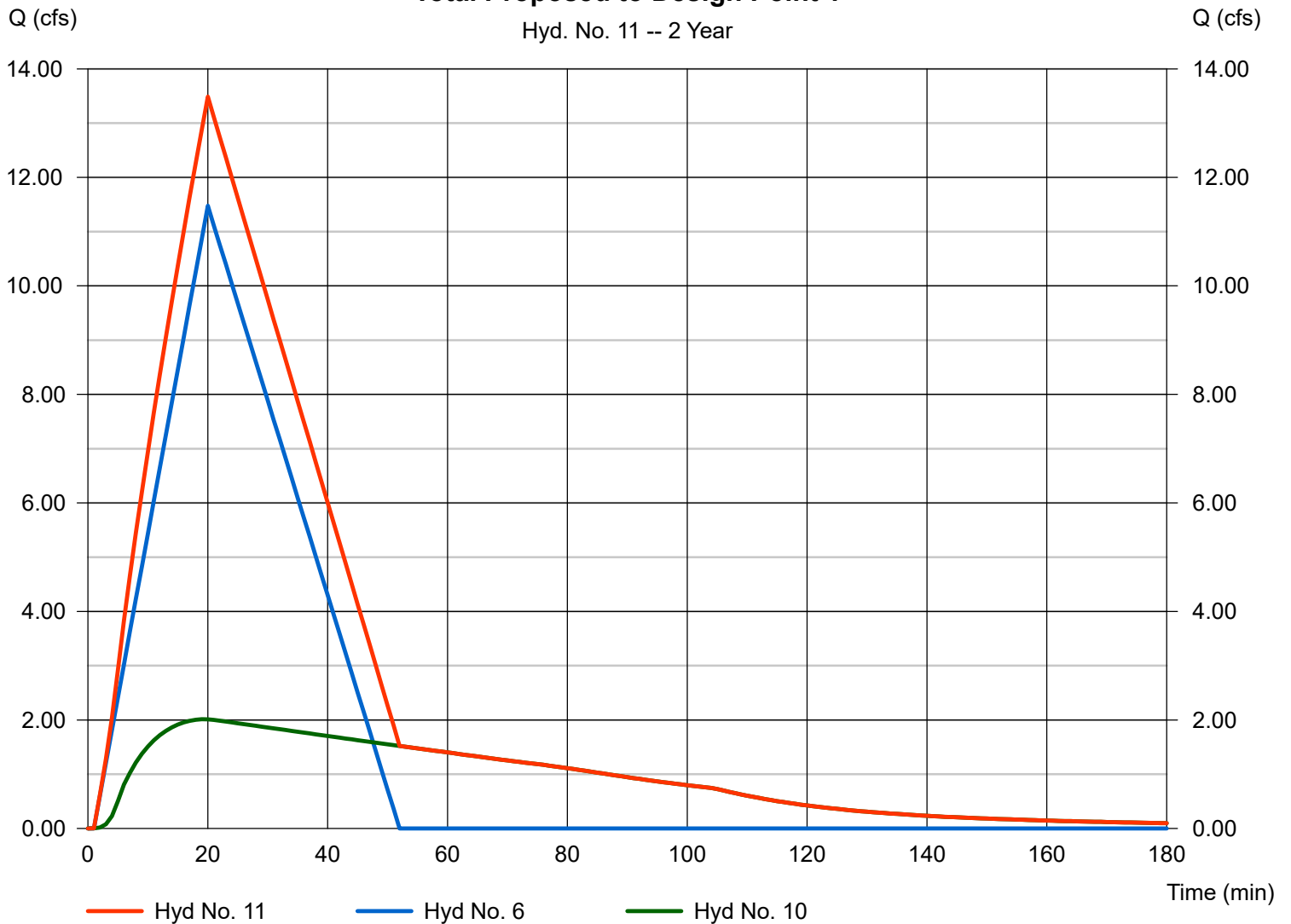
Total Proposed to Design Point 1

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 1 min
Inflow hyds. = 6, 10

Peak discharge = 13.49 cfs
Time to peak = 20 min
Hyd. volume = 27,849 cuft
Contrib. drain. area = 10.390 ac

Total Proposed to Design Point 1

Hyd. No. 11 -- 2 Year



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	17.10	1	19	25,850	----	-----	-----	WS-EX-1 to Design Point 1
2	Rational	10.89	1	5	4,358	----	-----	-----	WS-EX-2 to Design Point 2
3	Rational	17.06	1	5	6,823	----	-----	-----	WS-EX-3 to Design Point 3
4	Rational	3.314	1	15	3,903	----	-----	-----	WS-EX-4 to Design Point 4
5	Rational	20.67	1	8	13,230	----	-----	-----	WS-PR-1-DET
6	Rational	14.49	1	20	22,703	----	-----	-----	WS-PR-1-UND to Design Point 1
7	Rational	10.89	1	5	4,358	----	-----	-----	WS-PR-2 to Design Point 2
8	Rational	17.06	1	5	6,823	----	-----	-----	WS-PR-3 to Design Point 3
9	Rational	3.279	1	15	3,935	----	-----	-----	WS-PR-4 to Design Point 4
10	Reservoir	2.320	1	20	13,003	5	313.70	11,253	Outflow - UG Chambers
11	Combine	16.81	1	20	35,173	6, 10	-----	-----	Total Proposed to Design Point 1
Hydraflow-2021-06-04.gpw					Return Period: 5 Year			Tuesday, Jun 8, 2021	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

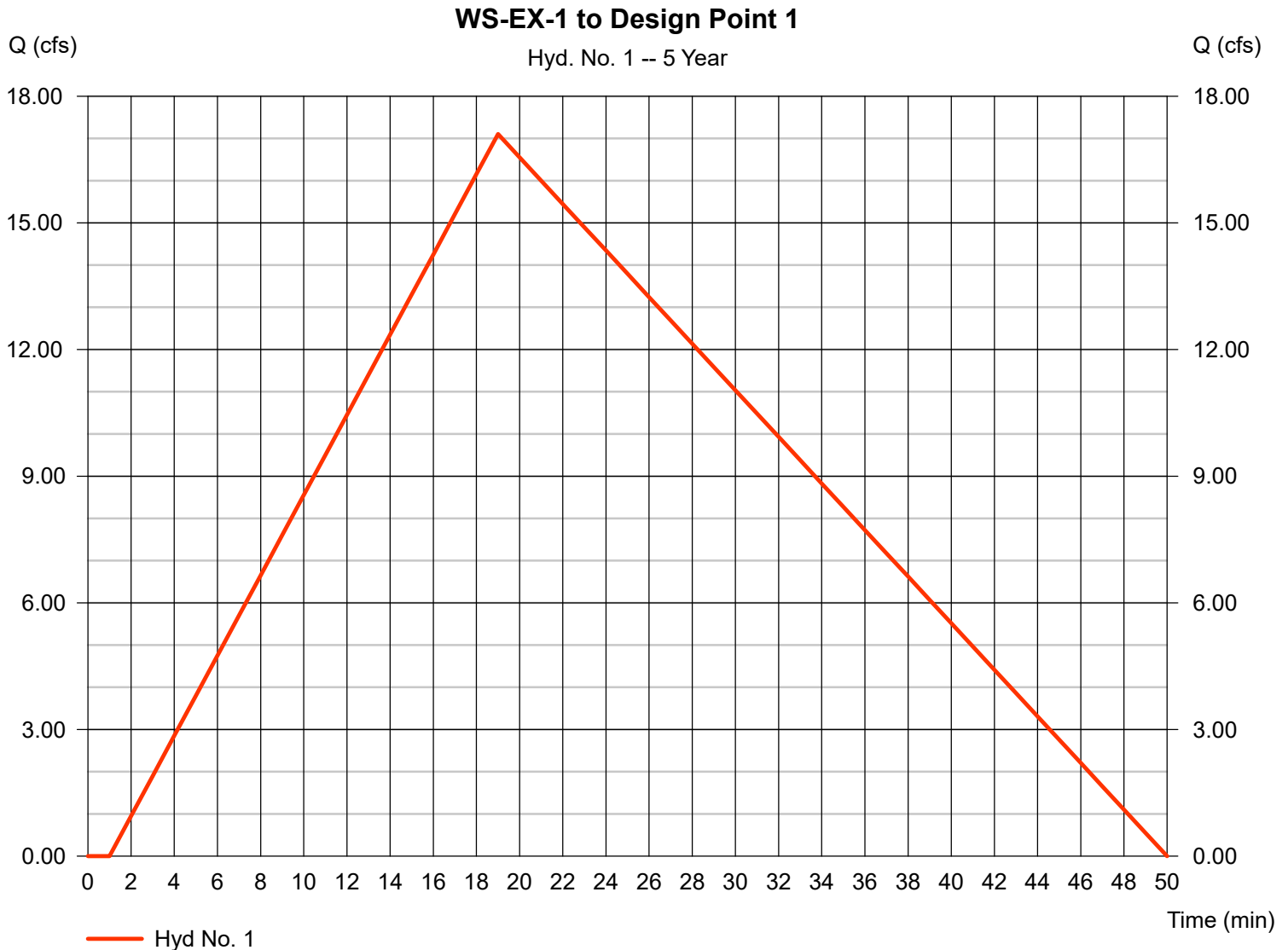
Hyd. No. 1

WS-EX-1 to Design Point 1

Hydrograph type = Rational
 Storm frequency = 5 yrs
 Time interval = 1 min
 Drainage area = 15.780 ac
 Intensity = 3.097 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 17.10 cfs
 Time to peak = 19 min
 Hyd. volume = 25,850 cuft
 Runoff coeff. = 0.35*
 Tc by TR55 = 18.89 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 2

WS-EX-2 to Design Point 2

Hydrograph type = Rational
 Storm frequency = 5 yrs
 Time interval = 1 min
 Drainage area = 2.760 ac
 Intensity = 6.073 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 10.89 cfs
 Time to peak = 5 min
 Hyd. volume = 4,358 cuft
 Runoff coeff. = 0.65*
 Tc by User = 5.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 3

WS-EX-3 to Design Point 3

Hydrograph type = Rational
 Storm frequency = 5 yrs
 Time interval = 1 min
 Drainage area = 4.530 ac
 Intensity = 6.073 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 17.06 cfs
 Time to peak = 5 min
 Hyd. volume = 6,823 cuft
 Runoff coeff. = 0.62*
 Tc by TR55 = 5.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

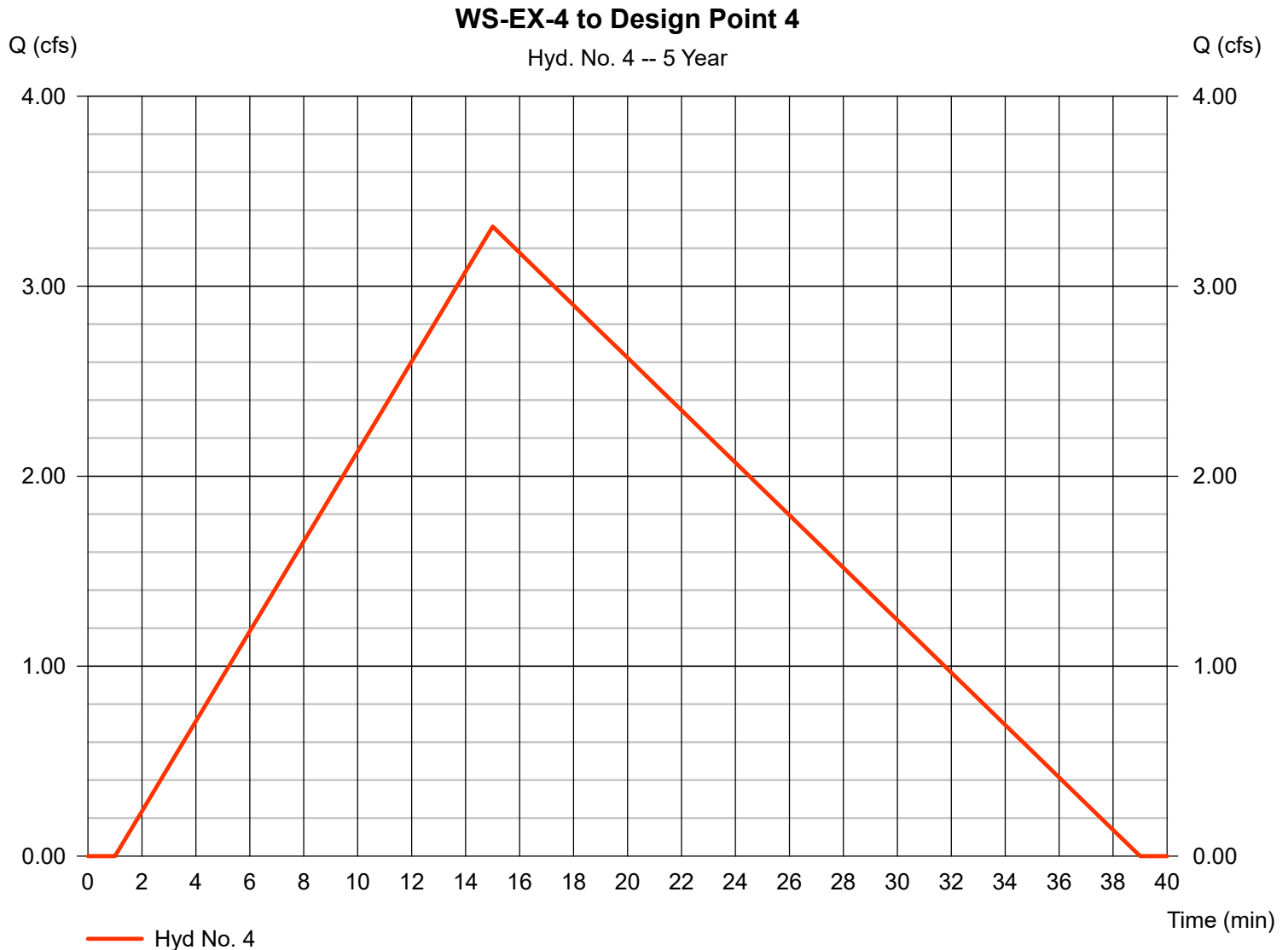
Hyd. No. 4

WS-EX-4 to Design Point 4

Hydrograph type = Rational
 Storm frequency = 5 yrs
 Time interval = 1 min
 Drainage area = 2.810 ac
 Intensity = 3.573 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 3.314 cfs
 Time to peak = 15 min
 Hyd. volume = 3,903 cuft
 Runoff coeff. = 0.33*
 Tc by TR55 = 14.72 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

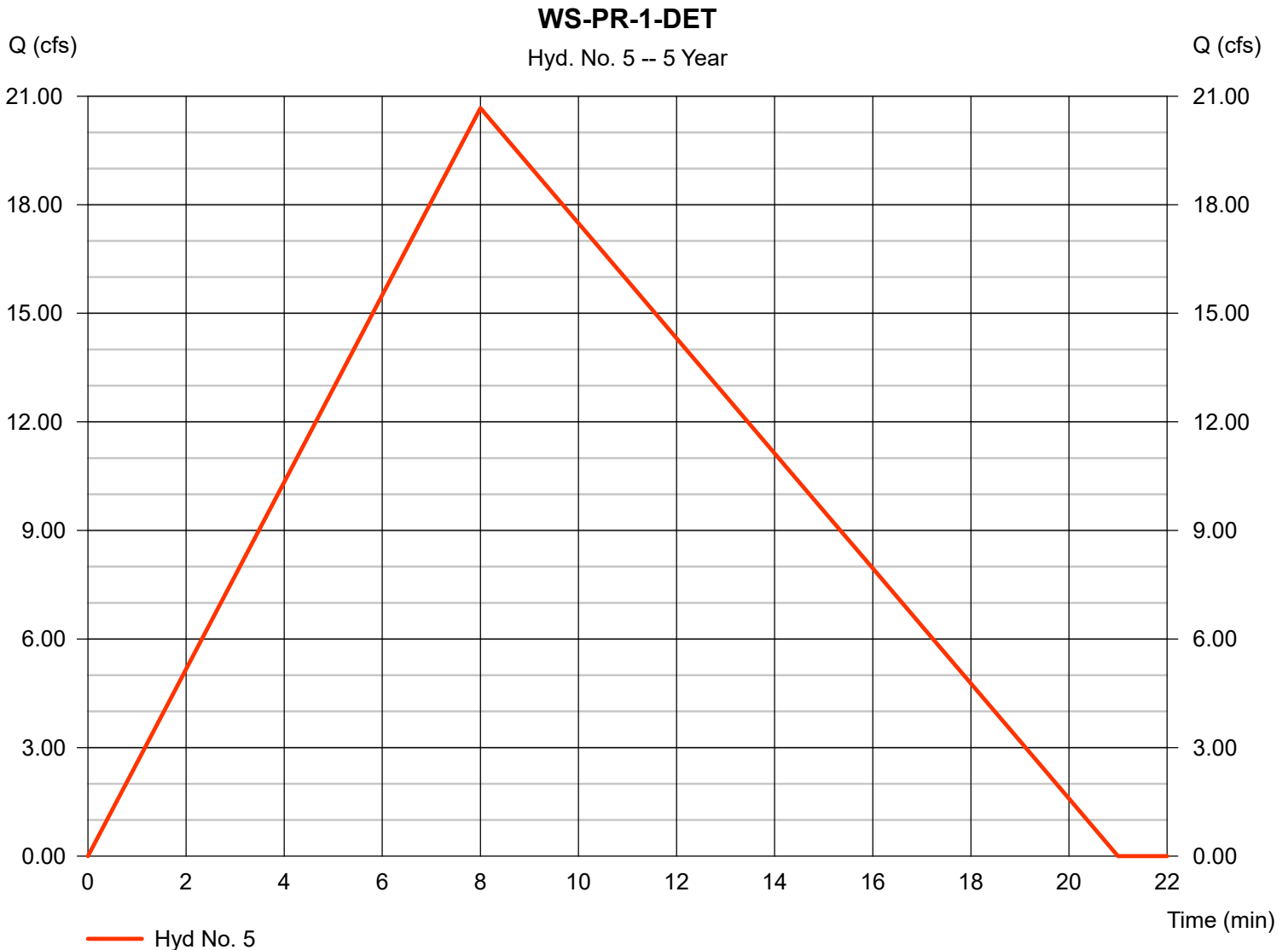
Hyd. No. 5

WS-PR-1-DET

Hydrograph type = Rational
 Storm frequency = 5 yrs
 Time interval = 1 min
 Drainage area = 5.060 ac
 Intensity = 4.922 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 20.67 cfs
 Time to peak = 8 min
 Hyd. volume = 13,230 cuft
 Runoff coeff. = 0.83*
 Tc by User = 8.00 min
 Asc/Rec limb fact = 1/1.667

* Composite (Area/C) = [(0.480 x 0.20) + (4.580 x 0.90)] / 5.060



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

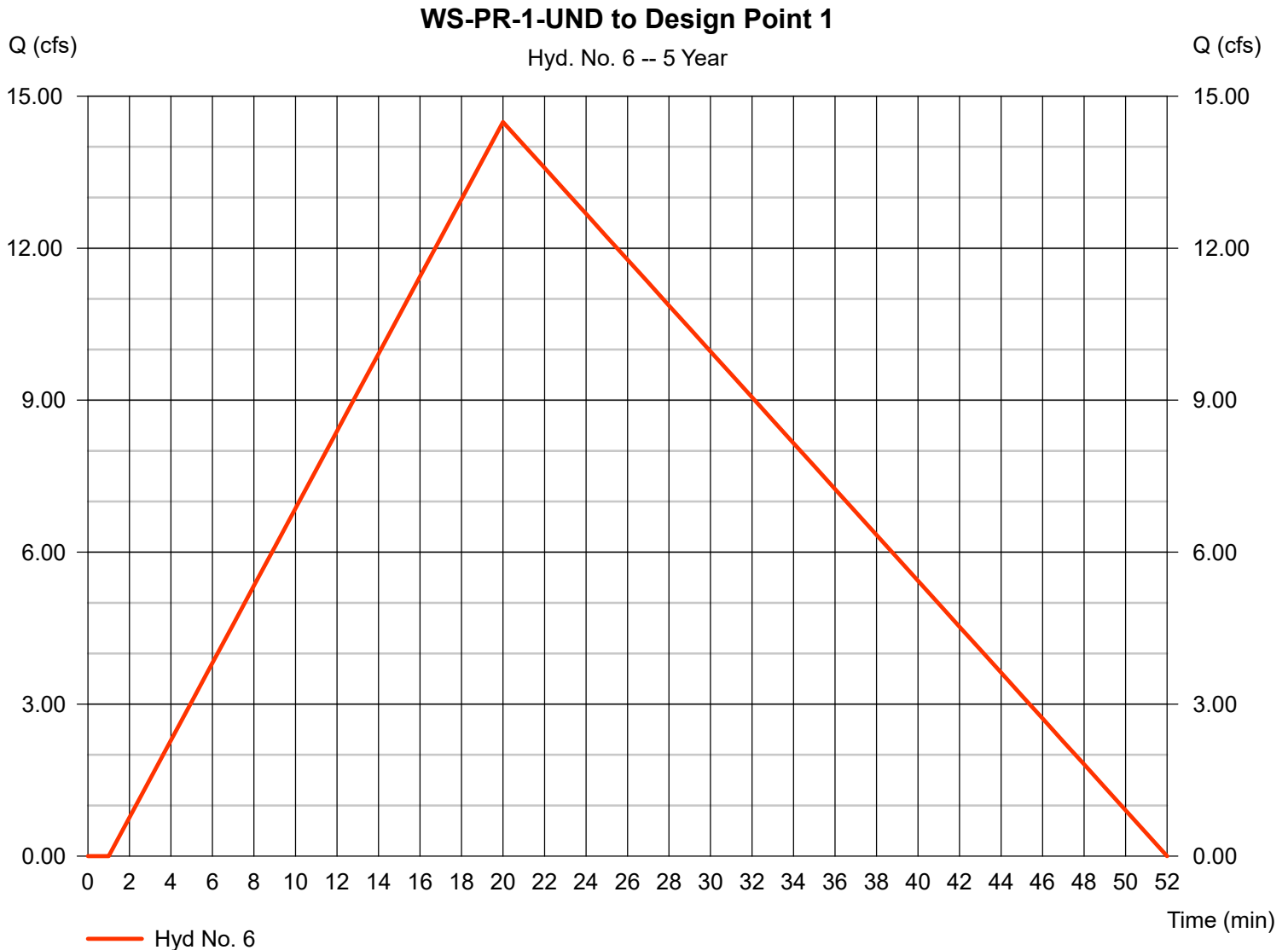
Hyd. No. 6

WS-PR-1-UND to Design Point 1

Hydrograph type = Rational
 Storm frequency = 5 yrs
 Time interval = 1 min
 Drainage area = 10.390 ac
 Intensity = 3.032 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 14.49 cfs
 Time to peak = 20 min
 Hyd. volume = 22,703 cuft
 Runoff coeff. = 0.46*
 Tc by TR55 = 19.58 min
 Asc/Rec limb fact = 1/1.667

* Composite (Area/C) = [(0.370 x 0.20) + (5.790 x 0.15) + (4.570 x 0.90)] / 10.390



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

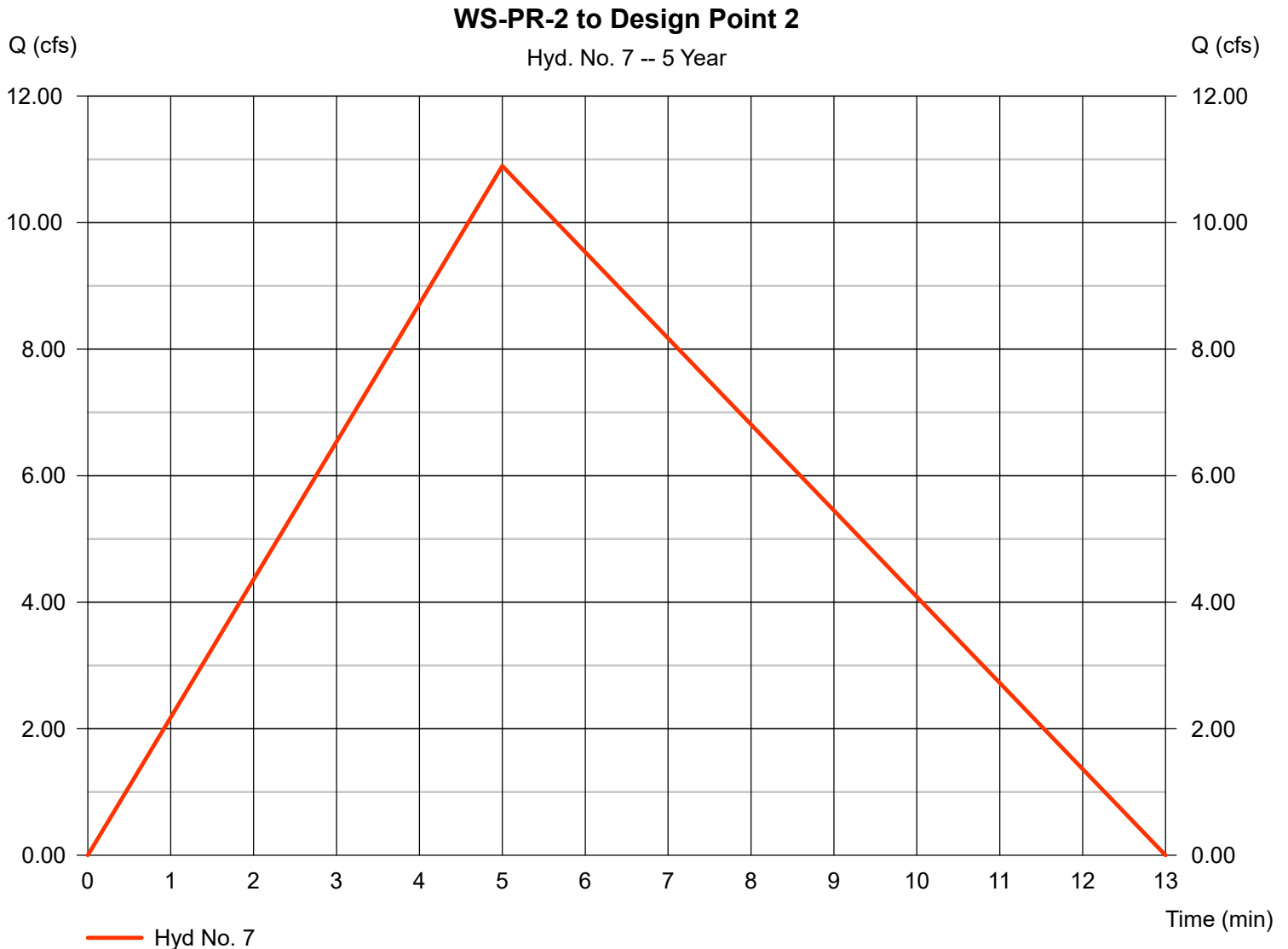
Hyd. No. 7

WS-PR-2 to Design Point 2

Hydrograph type = Rational
 Storm frequency = 5 yrs
 Time interval = 1 min
 Drainage area = 2.760 ac
 Intensity = 6.073 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 10.89 cfs
 Time to peak = 5 min
 Hyd. volume = 4,358 cuft
 Runoff coeff. = 0.65*
 Tc by User = 5.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 8

WS-PR-3 to Design Point 3

Hydrograph type = Rational
 Storm frequency = 5 yrs
 Time interval = 1 min
 Drainage area = 4.530 ac
 Intensity = 6.073 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 17.06 cfs
 Time to peak = 5 min
 Hyd. volume = 6,823 cuft
 Runoff coeff. = 0.62*
 Tc by TR55 = 5.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 9

WS-PR-4 to Design Point 4

Hydrograph type = Rational
 Storm frequency = 5 yrs
 Time interval = 1 min
 Drainage area = 2.810 ac
 Intensity = 3.536 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 3.279 cfs
 Time to peak = 15 min
 Hyd. volume = 3,935 cuft
 Runoff coeff. = 0.33*
 Tc by TR55 = 15.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 10

Outflow - UG Chambers

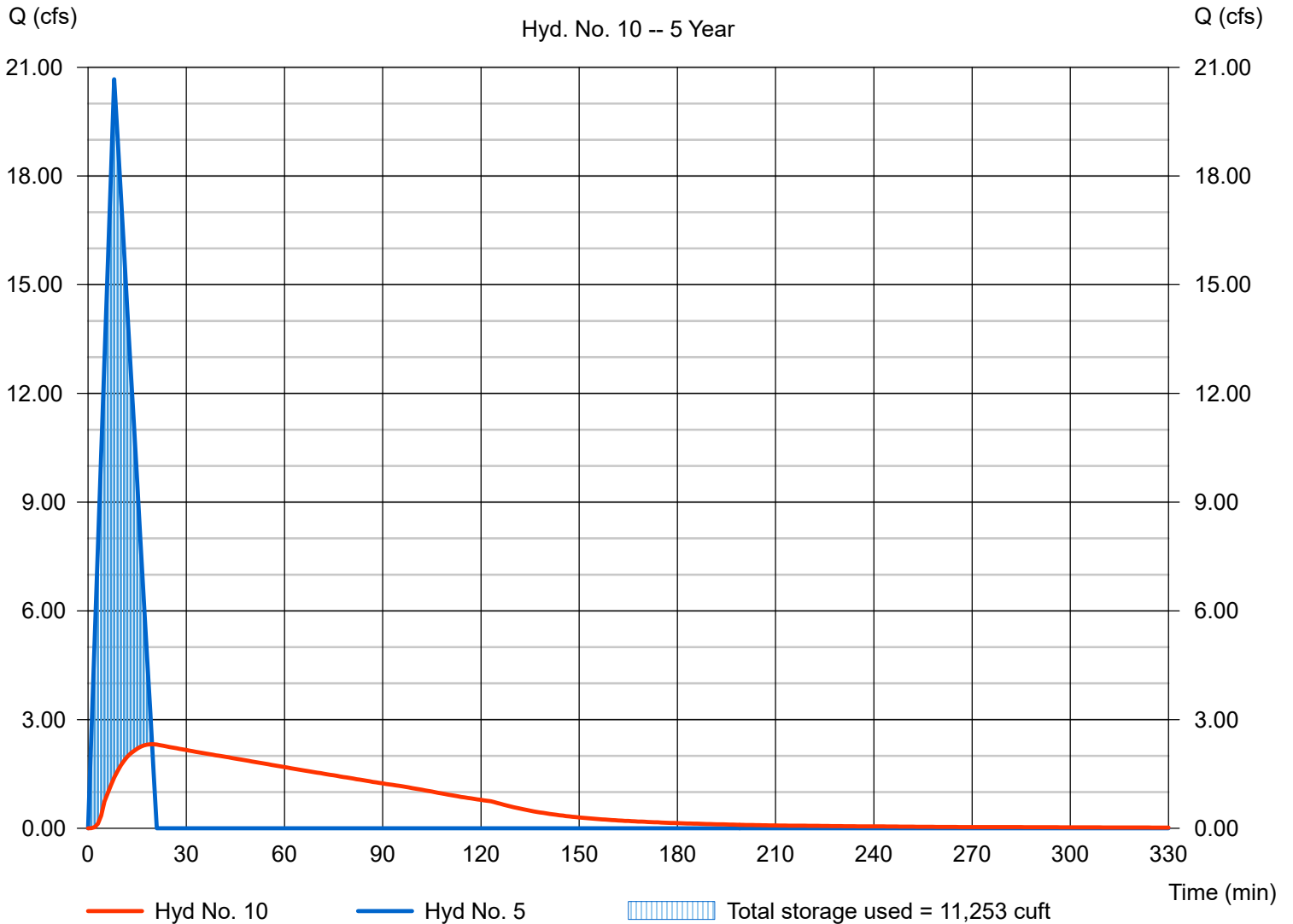
Hydrograph type = Reservoir
Storm frequency = 5 yrs
Time interval = 1 min
Inflow hyd. No. = 5 - WS-PR-1-DET
Reservoir name = UG Chambers

Peak discharge = 2.320 cfs
Time to peak = 20 min
Hyd. volume = 13,003 cuft
Max. Elevation = 313.70 ft
Max. Storage = 11,253 cuft

Storage Indication method used.

Outflow - UG Chambers

Hyd. No. 10 -- 5 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 11

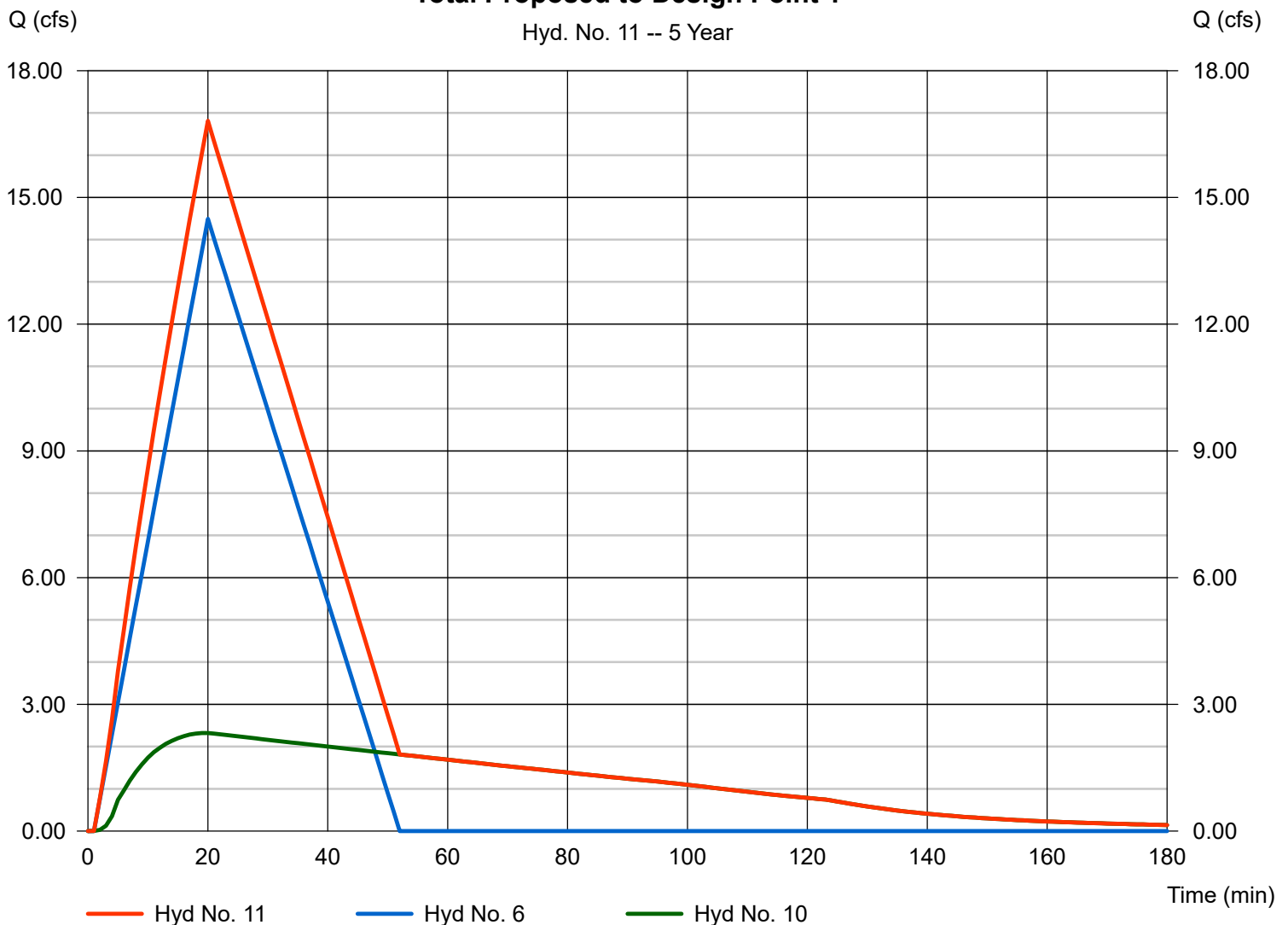
Total Proposed to Design Point 1

Hydrograph type = Combine
 Storm frequency = 5 yrs
 Time interval = 1 min
 Inflow hyds. = 6, 10

Peak discharge = 16.81 cfs
 Time to peak = 20 min
 Hyd. volume = 35,173 cuft
 Contrib. drain. area = 10.390 ac

Total Proposed to Design Point 1

Hyd. No. 11 -- 5 Year



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	20.11	1	19	30,397	----	-----	-----	WS-EX-1 to Design Point 1
2	Rational	12.80	1	5	5,119	----	-----	-----	WS-EX-2 to Design Point 2
3	Rational	20.03	1	5	8,015	----	-----	-----	WS-EX-3 to Design Point 3
4	Rational	3.897	1	15	4,591	----	-----	-----	WS-EX-4 to Design Point 4
5	Rational	24.30	1	8	15,554	----	-----	-----	WS-PR-1-DET
6	Rational	17.04	1	20	26,696	----	-----	-----	WS-PR-1-UND to Design Point 1
7	Rational	12.80	1	5	5,119	----	-----	-----	WS-PR-2 to Design Point 2
8	Rational	20.03	1	5	8,015	----	-----	-----	WS-PR-3 to Design Point 3
9	Rational	3.856	1	15	4,628	----	-----	-----	WS-PR-4 to Design Point 4
10	Reservoir	2.560	1	20	15,290	5	313.99	13,347	Outflow - UG Chambers
11	Combine	19.60	1	20	41,359	6, 10	-----	-----	Total Proposed to Design Point 1
Hydraflow-2021-06-04.gpw					Return Period: 10 Year			Tuesday, Jun 8, 2021	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 1

WS-EX-1 to Design Point 1

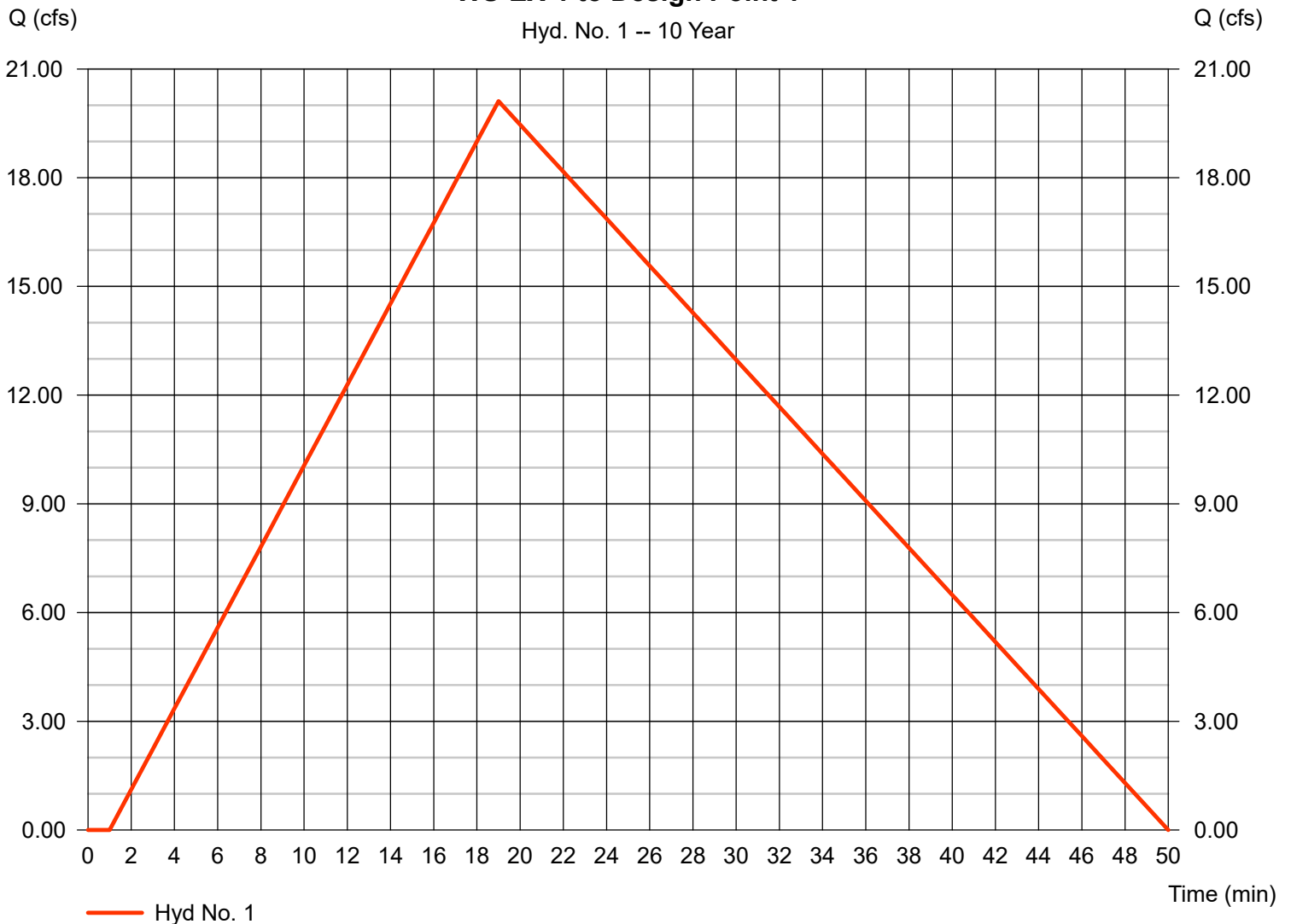
Hydrograph type = Rational
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 15.780 ac
 Intensity = 3.641 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 20.11 cfs
 Time to peak = 19 min
 Hyd. volume = 30,397 cuft
 Runoff coeff. = 0.35*
 Tc by TR55 = 18.89 min
 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

WS-EX-1 to Design Point 1

Hyd. No. 1 -- 10 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

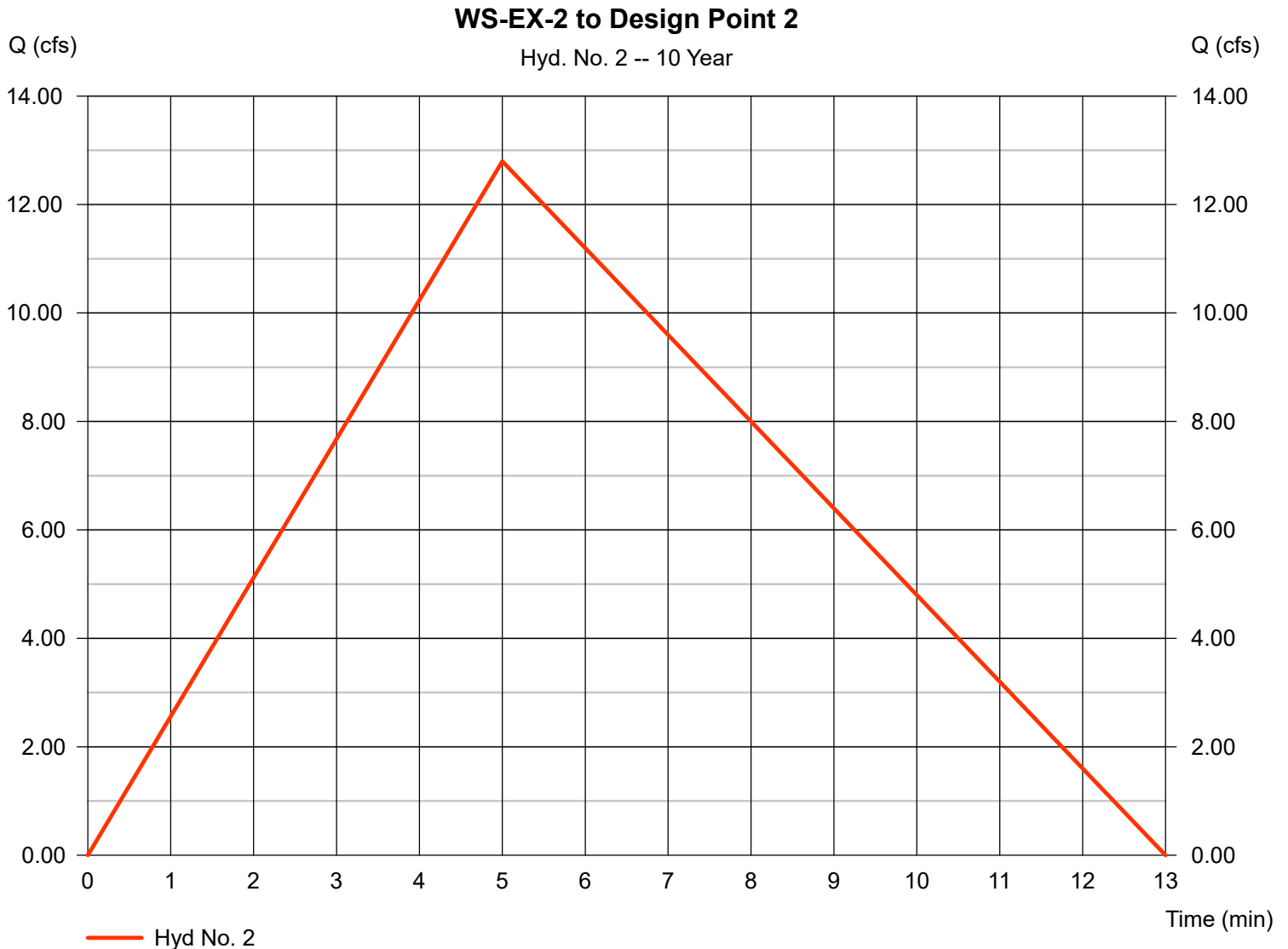
Hyd. No. 2

WS-EX-2 to Design Point 2

Hydrograph type = Rational
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 2.760 ac
 Intensity = 7.133 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 12.80 cfs
 Time to peak = 5 min
 Hyd. volume = 5,119 cuft
 Runoff coeff. = 0.65*
 Tc by User = 5.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 3

WS-EX-3 to Design Point 3

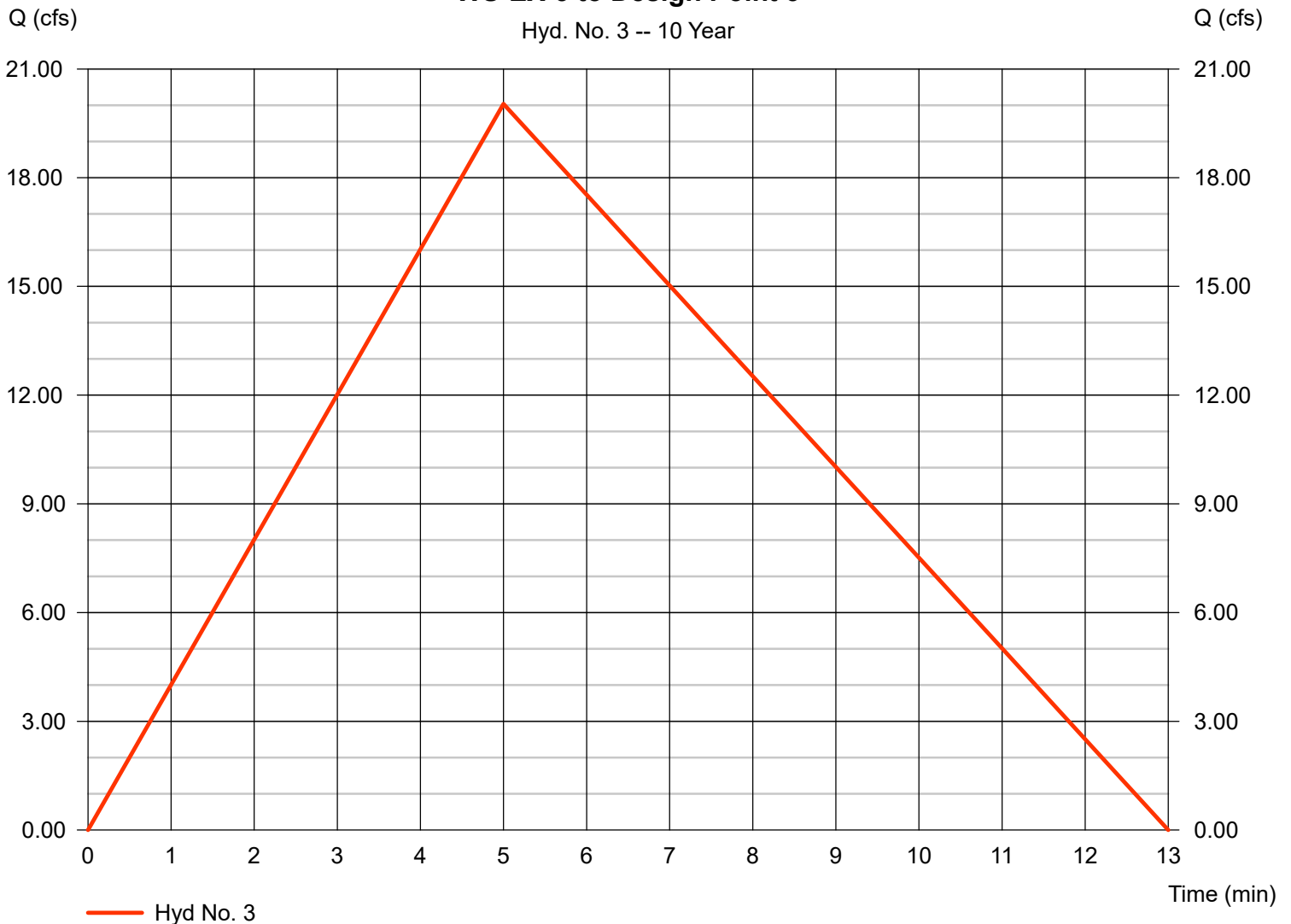
Hydrograph type = Rational
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 4.530 ac
 Intensity = 7.133 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 20.03 cfs
 Time to peak = 5 min
 Hyd. volume = 8,015 cuft
 Runoff coeff. = 0.62*
 Tc by TR55 = 5.00 min
 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

WS-EX-3 to Design Point 3

Hyd. No. 3 -- 10 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

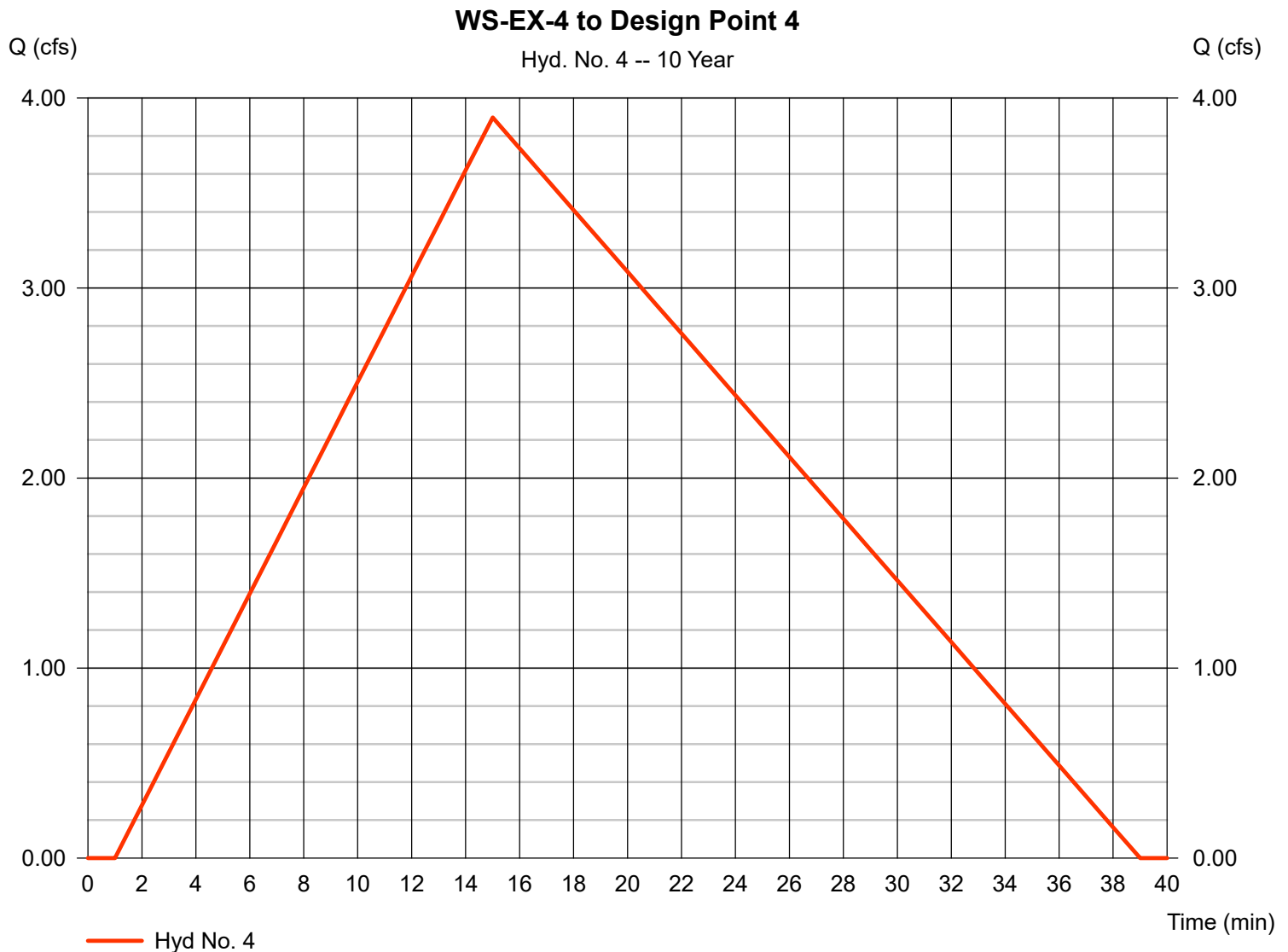
Hyd. No. 4

WS-EX-4 to Design Point 4

Hydrograph type = Rational
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 2.810 ac
 Intensity = 4.203 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 3.897 cfs
 Time to peak = 15 min
 Hyd. volume = 4,591 cuft
 Runoff coeff. = 0.33*
 Tc by TR55 = 14.72 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

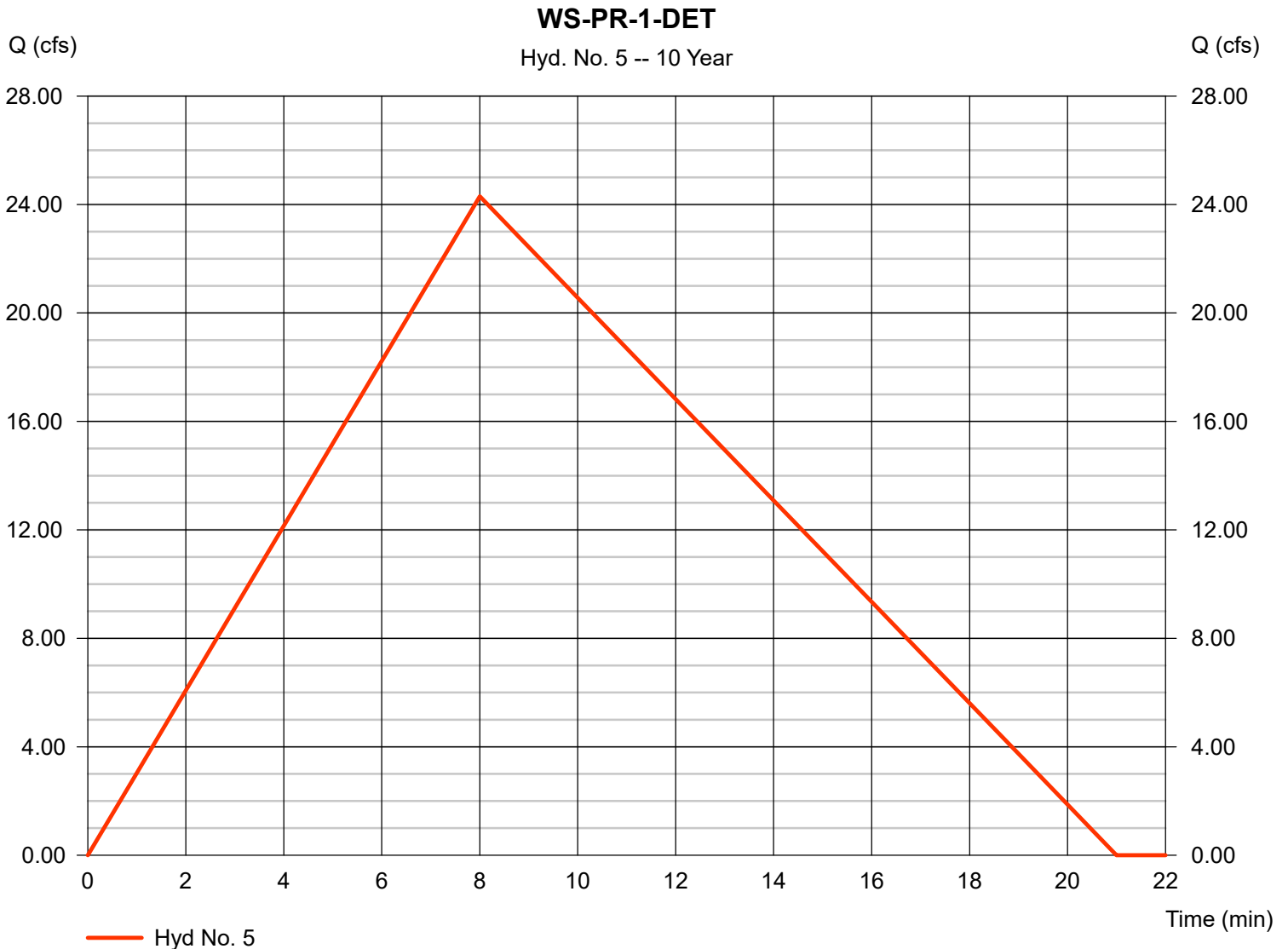
Hyd. No. 5

WS-PR-1-DET

Hydrograph type = Rational
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 5.060 ac
 Intensity = 5.786 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 24.30 cfs
 Time to peak = 8 min
 Hyd. volume = 15,554 cuft
 Runoff coeff. = 0.83*
 Tc by User = 8.00 min
 Asc/Rec limb fact = 1/1.667

* Composite (Area/C) = [(0.480 x 0.20) + (4.580 x 0.90)] / 5.060



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 6

WS-PR-1-UND to Design Point 1

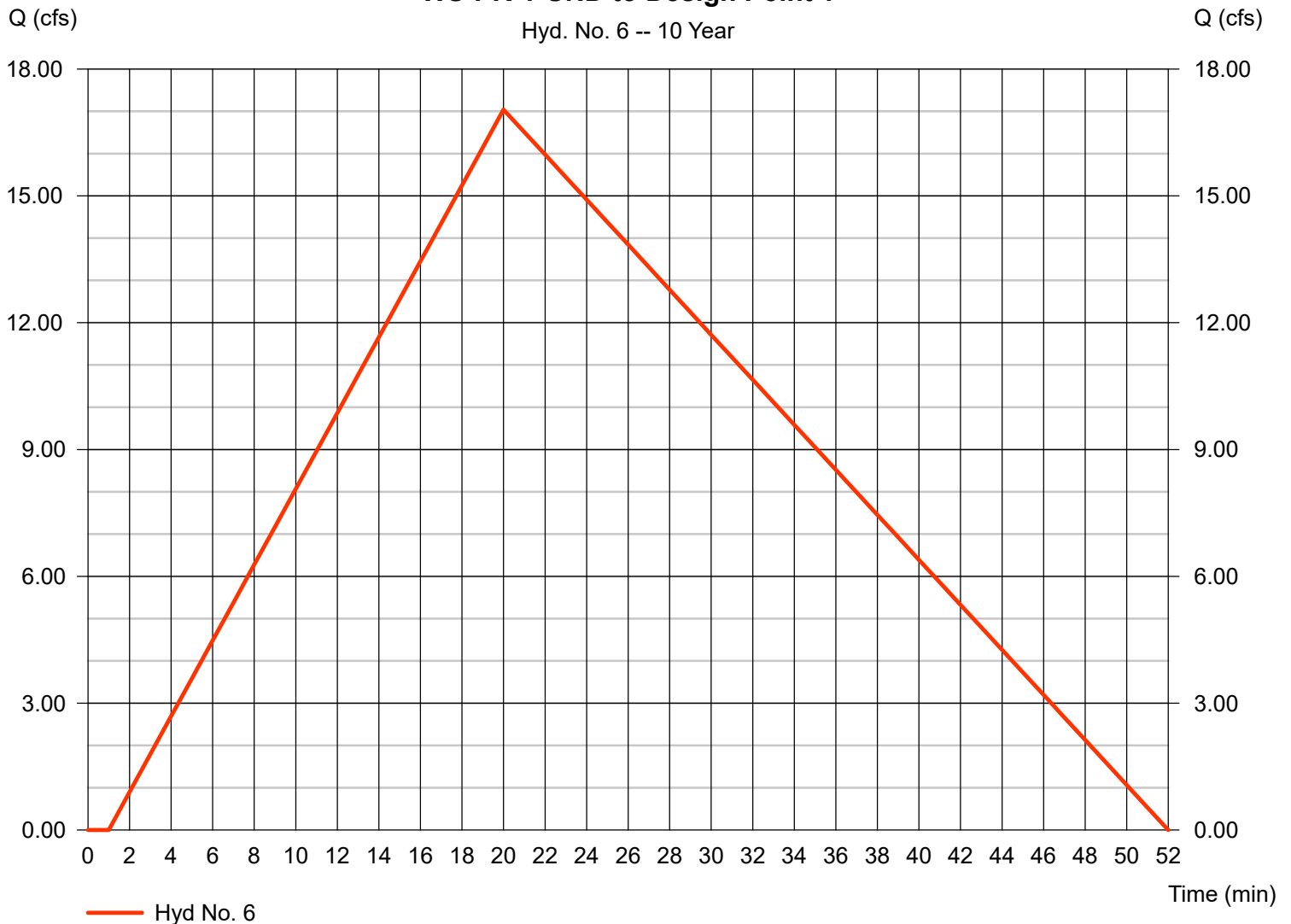
Hydrograph type = Rational
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 10.390 ac
 Intensity = 3.565 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 17.04 cfs
 Time to peak = 20 min
 Hyd. volume = 26,696 cuft
 Runoff coeff. = 0.46*
 Tc by TR55 = 19.58 min
 Asc/Rec limb fact = 1/1.667

* Composite (Area/C) = [(0.370 x 0.20) + (5.790 x 0.15) + (4.570 x 0.90)] / 10.390

WS-PR-1-UND to Design Point 1

Hyd. No. 6 -- 10 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

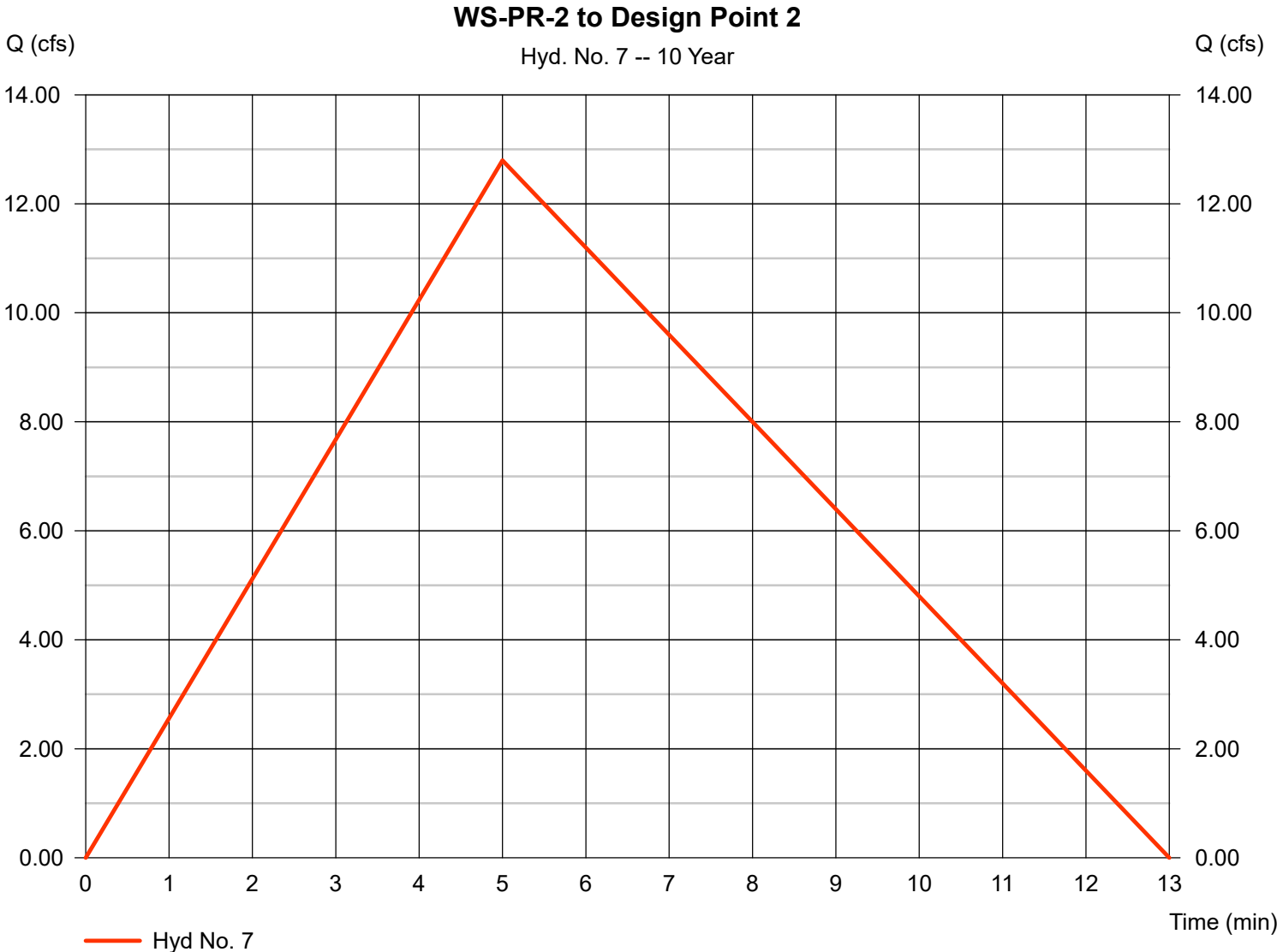
Hyd. No. 7

WS-PR-2 to Design Point 2

Hydrograph type = Rational
Storm frequency = 10 yrs
Time interval = 1 min
Drainage area = 2.760 ac
Intensity = 7.133 in/hr
IDF Curve = Norwich.IDF

Peak discharge = 12.80 cfs
Time to peak = 5 min
Hyd. volume = 5,119 cuft
Runoff coeff. = 0.65*
Tc by User = 5.00 min
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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 8

WS-PR-3 to Design Point 3

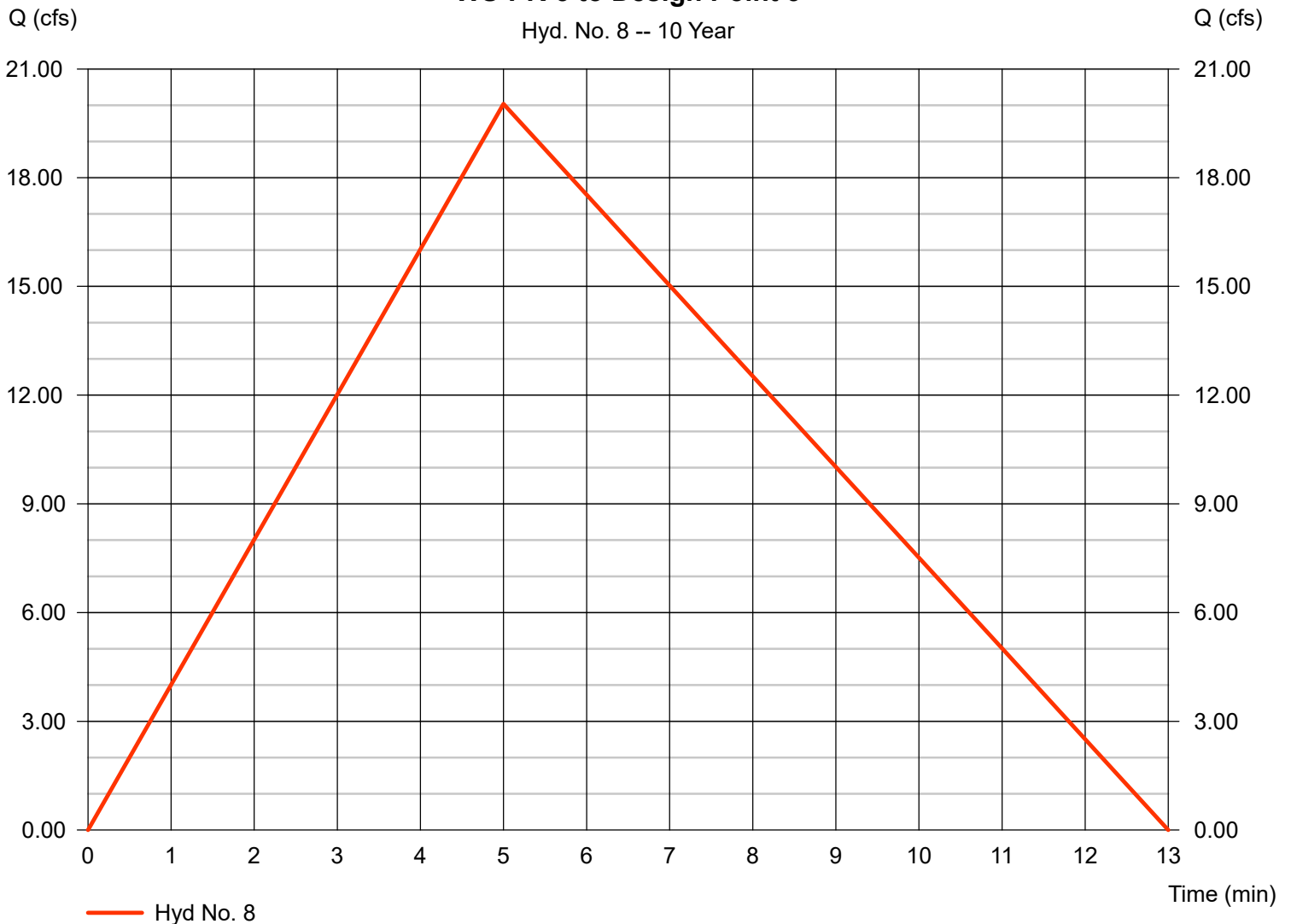
Hydrograph type = Rational
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 4.530 ac
 Intensity = 7.133 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 20.03 cfs
 Time to peak = 5 min
 Hyd. volume = 8,015 cuft
 Runoff coeff. = 0.62*
 Tc by TR55 = 5.00 min
 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

WS-PR-3 to Design Point 3

Hyd. No. 8 -- 10 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

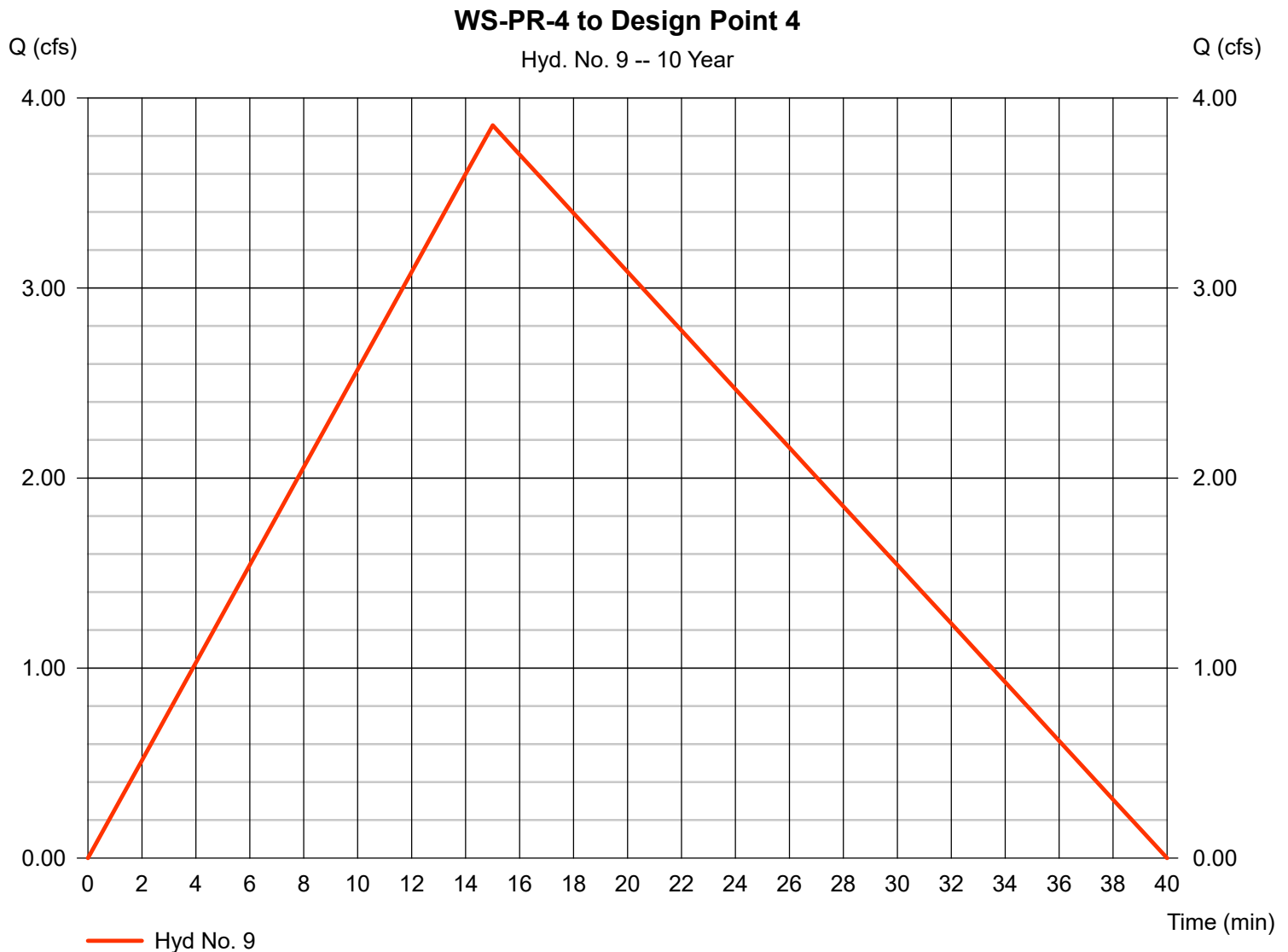
Hyd. No. 9

WS-PR-4 to Design Point 4

Hydrograph type = Rational
Storm frequency = 10 yrs
Time interval = 1 min
Drainage area = 2.810 ac
Intensity = 4.159 in/hr
IDF Curve = Norwich.IDF

Peak discharge = 3.856 cfs
Time to peak = 15 min
Hyd. volume = 4,628 cuft
Runoff coeff. = 0.33*
Tc by TR55 = 15.00 min
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

Hydraflow Hydrographs by Intelisolve v9.1

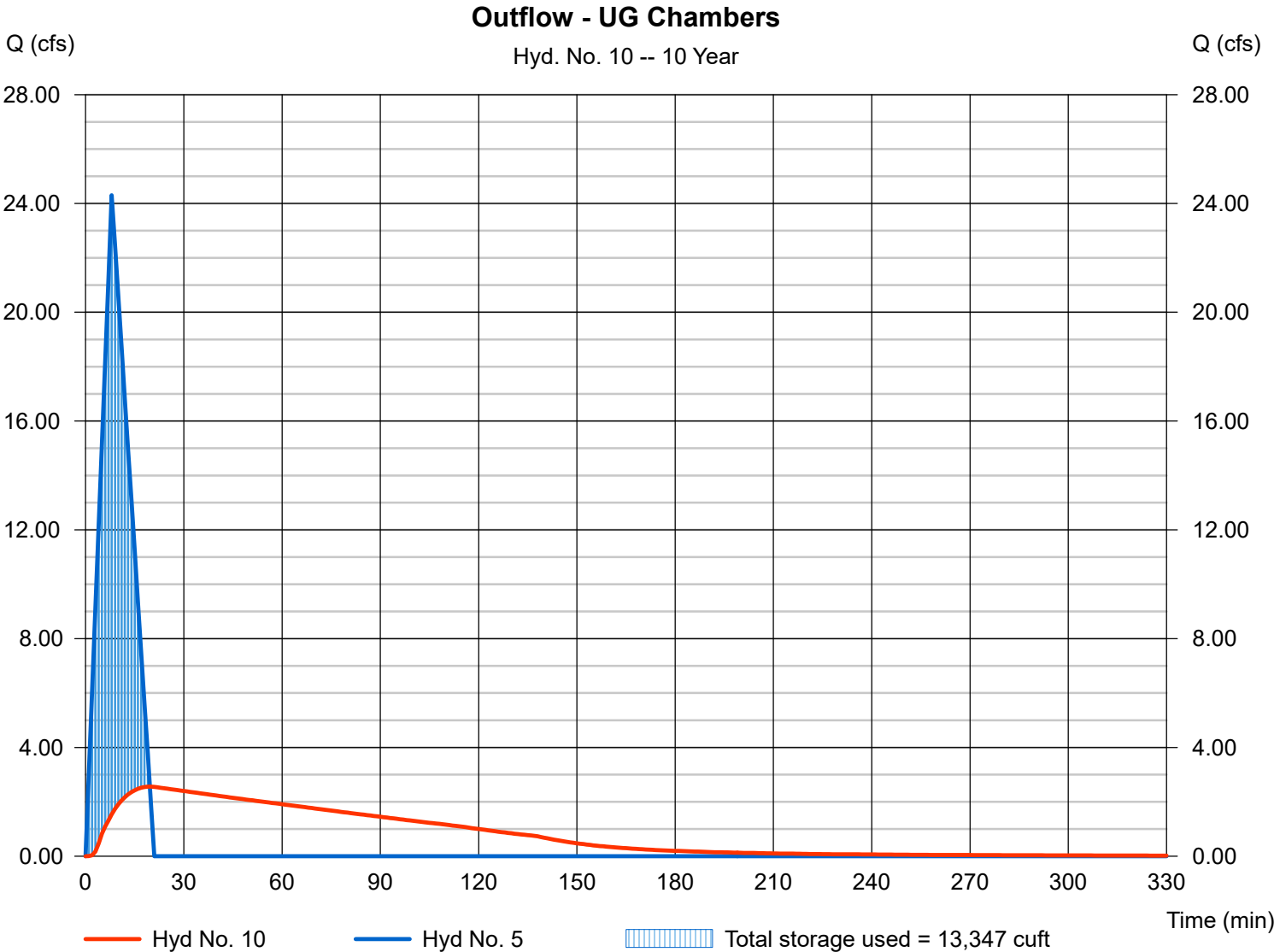
Tuesday, Jun 8, 2021

Hyd. No. 10

Outflow - UG Chambers

Hydrograph type	= Reservoir	Peak discharge	= 2.560 cfs
Storm frequency	= 10 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 15,290 cuft
Inflow hyd. No.	= 5 - WS-PR-1-DET	Max. Elevation	= 313.99 ft
Reservoir name	= UG Chambers	Max. Storage	= 13,347 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

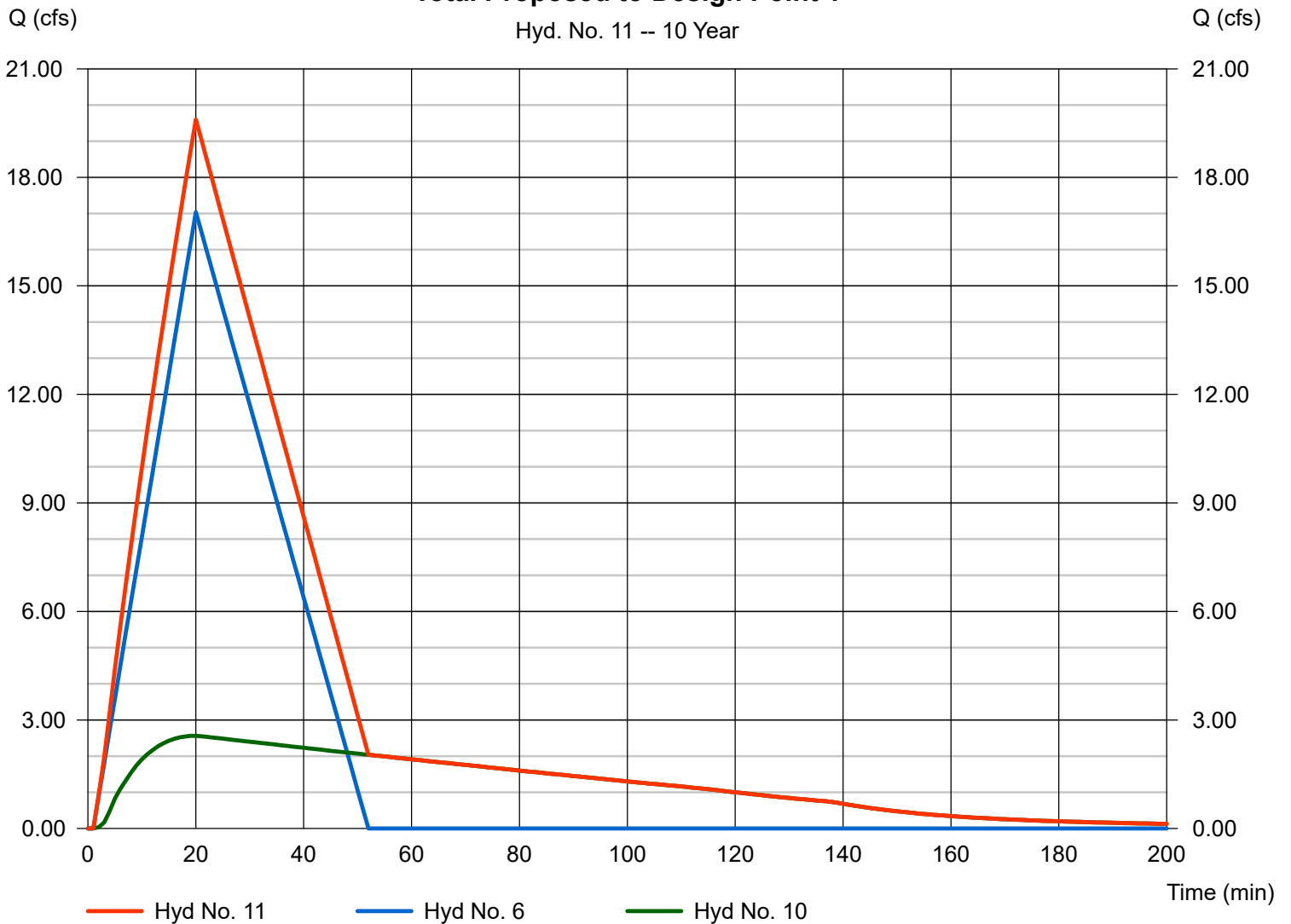
Hyd. No. 11

Total Proposed to Design Point 1

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 1 min
Inflow hyds. = 6, 10

Peak discharge = 19.60 cfs
Time to peak = 20 min
Hyd. volume = 41,359 cuft
Contrib. drain. area = 10.390 ac

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	24.20	1	19	36,570	----	-----	-----	WS-EX-1 to Design Point 1
2	Rational	15.38	1	5	6,152	----	-----	-----	WS-EX-2 to Design Point 2
3	Rational	24.07	1	5	9,631	----	-----	-----	WS-EX-3 to Design Point 3
4	Rational	4.687	1	15	5,522	----	-----	-----	WS-EX-4 to Design Point 4
5	Rational	29.21	1	8	18,698	----	-----	-----	WS-PR-1-DET
6	Rational	20.50	1	20	32,118	----	-----	-----	WS-PR-1-UND to Design Point 1
7	Rational	15.38	1	5	6,152	----	-----	-----	WS-PR-2 to Design Point 2
8	Rational	24.07	1	5	9,631	----	-----	-----	WS-PR-3 to Design Point 3
9	Rational	4.638	1	15	5,567	----	-----	-----	WS-PR-4 to Design Point 4
10	Reservoir	2.888	1	20	18,384	5	314.43	16,189	Outflow - UG Chambers
11	Combine	23.39	1	20	49,748	6, 10	-----	-----	Total Proposed to Design Point 1
Hydraflow-2021-06-04.gpw					Return Period: 25 Year			Tuesday, Jun 8, 2021	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 1

WS-EX-1 to Design Point 1

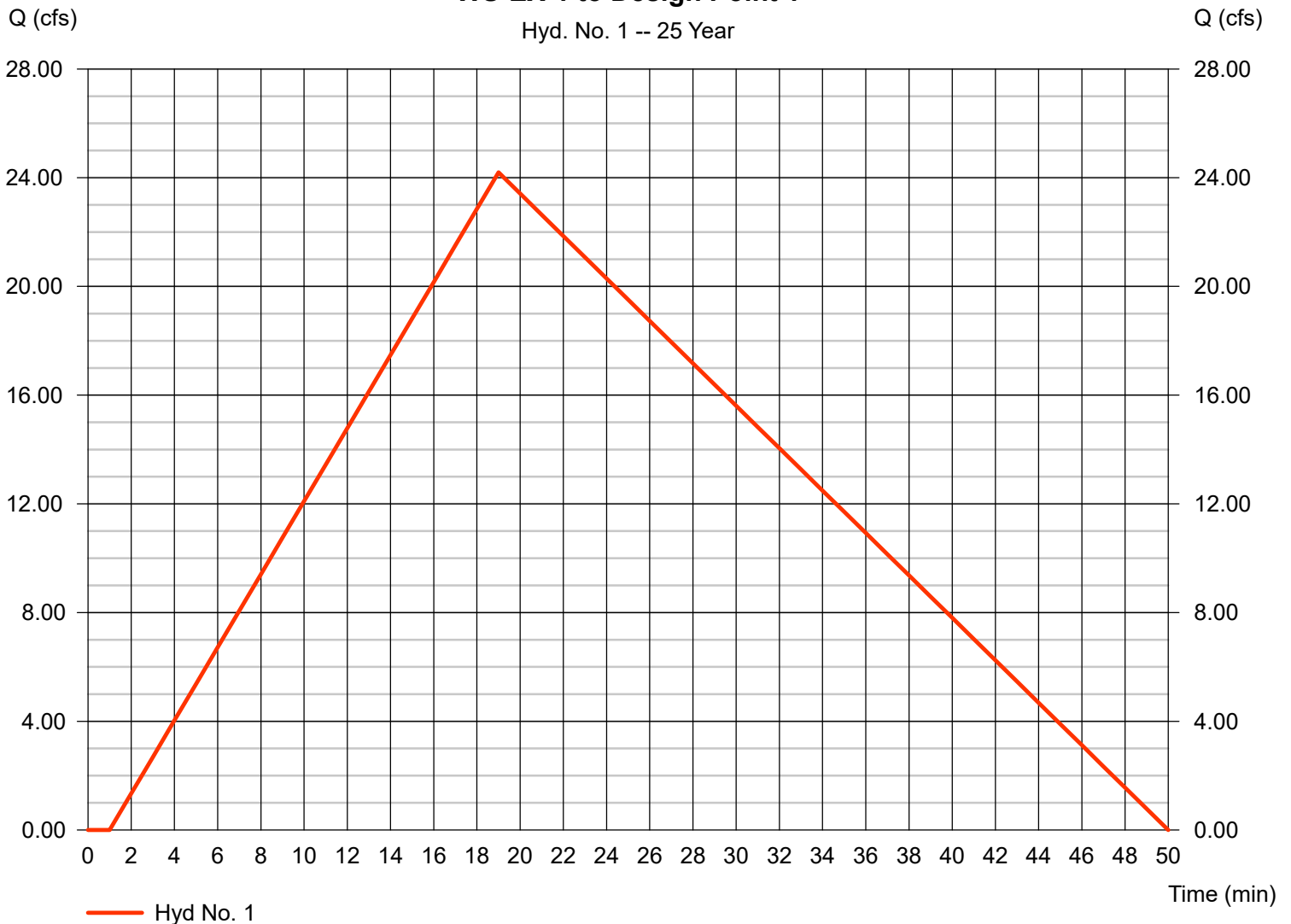
Hydrograph type = Rational
 Storm frequency = 25 yrs
 Time interval = 1 min
 Drainage area = 15.780 ac
 Intensity = 4.381 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 24.20 cfs
 Time to peak = 19 min
 Hyd. volume = 36,570 cuft
 Runoff coeff. = 0.35*
 Tc by TR55 = 18.89 min
 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

WS-EX-1 to Design Point 1

Hyd. No. 1 -- 25 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 2

WS-EX-2 to Design Point 2

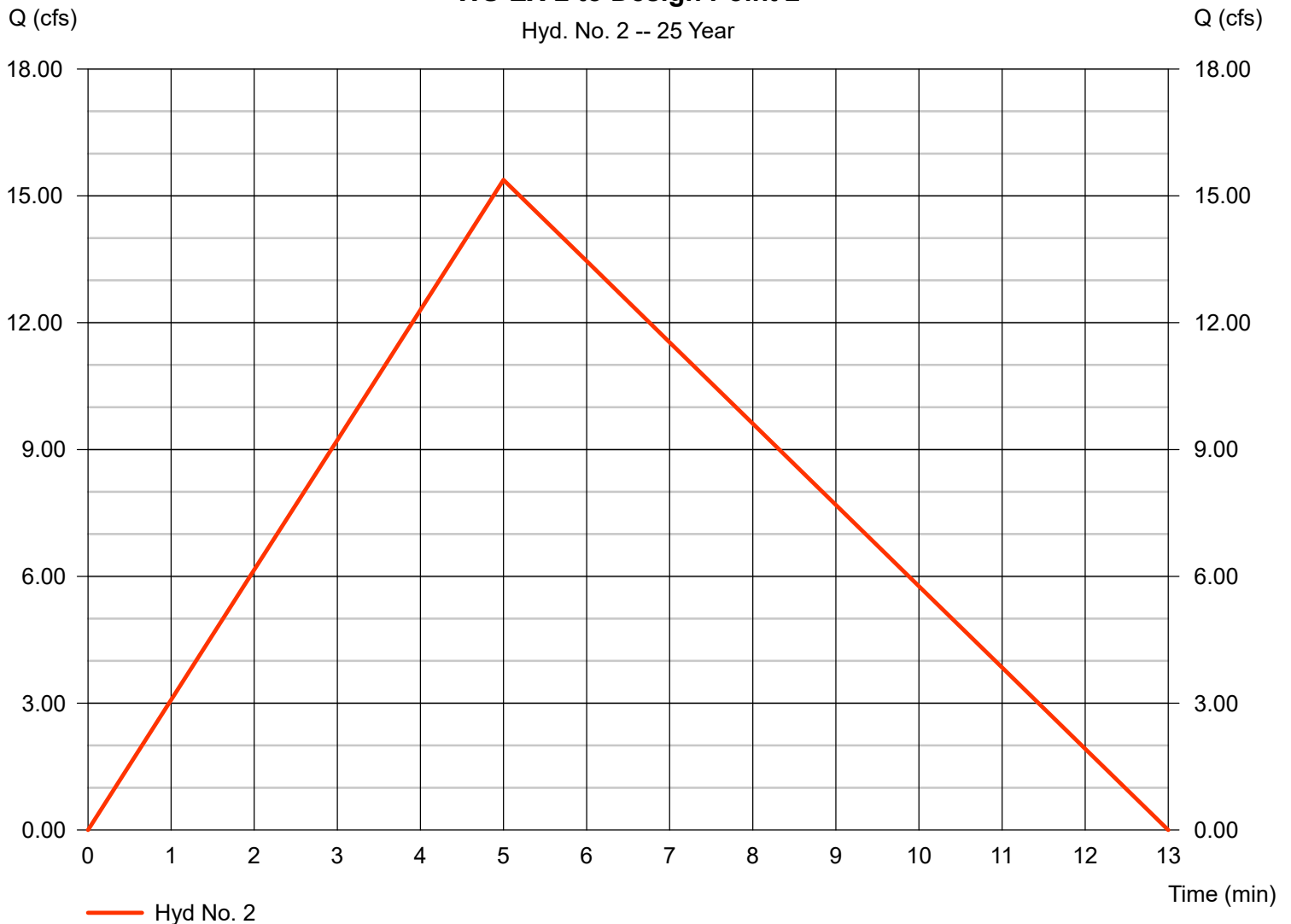
Hydrograph type = Rational
 Storm frequency = 25 yrs
 Time interval = 1 min
 Drainage area = 2.760 ac
 Intensity = 8.572 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 15.38 cfs
 Time to peak = 5 min
 Hyd. volume = 6,152 cuft
 Runoff coeff. = 0.65*
 Tc by User = 5.00 min
 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

WS-EX-2 to Design Point 2

Hyd. No. 2 -- 25 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 3

WS-EX-3 to Design Point 3

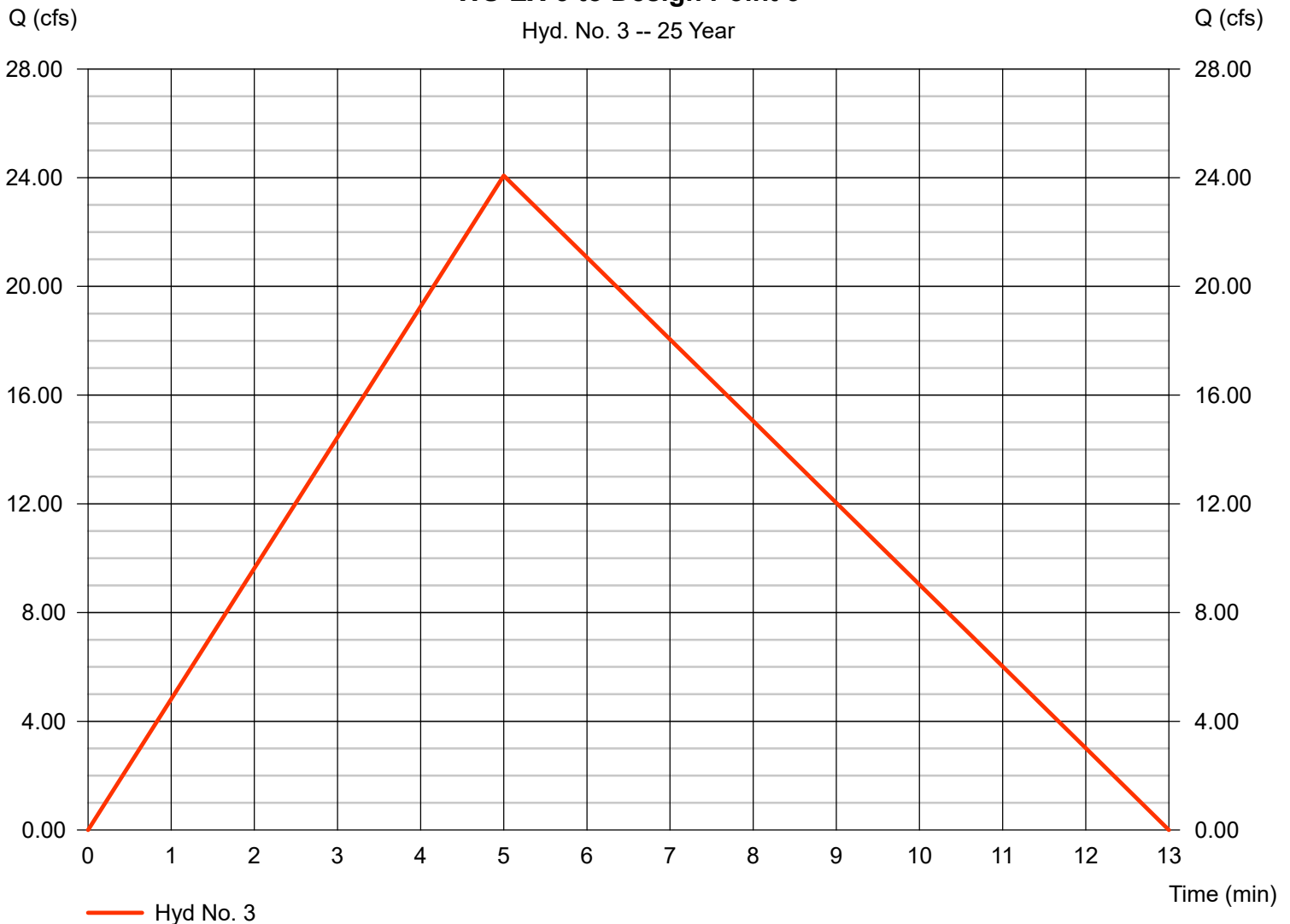
Hydrograph type = Rational
 Storm frequency = 25 yrs
 Time interval = 1 min
 Drainage area = 4.530 ac
 Intensity = 8.572 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 24.07 cfs
 Time to peak = 5 min
 Hyd. volume = 9,631 cuft
 Runoff coeff. = 0.62*
 Tc by TR55 = 5.00 min
 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

WS-EX-3 to Design Point 3

Hyd. No. 3 -- 25 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

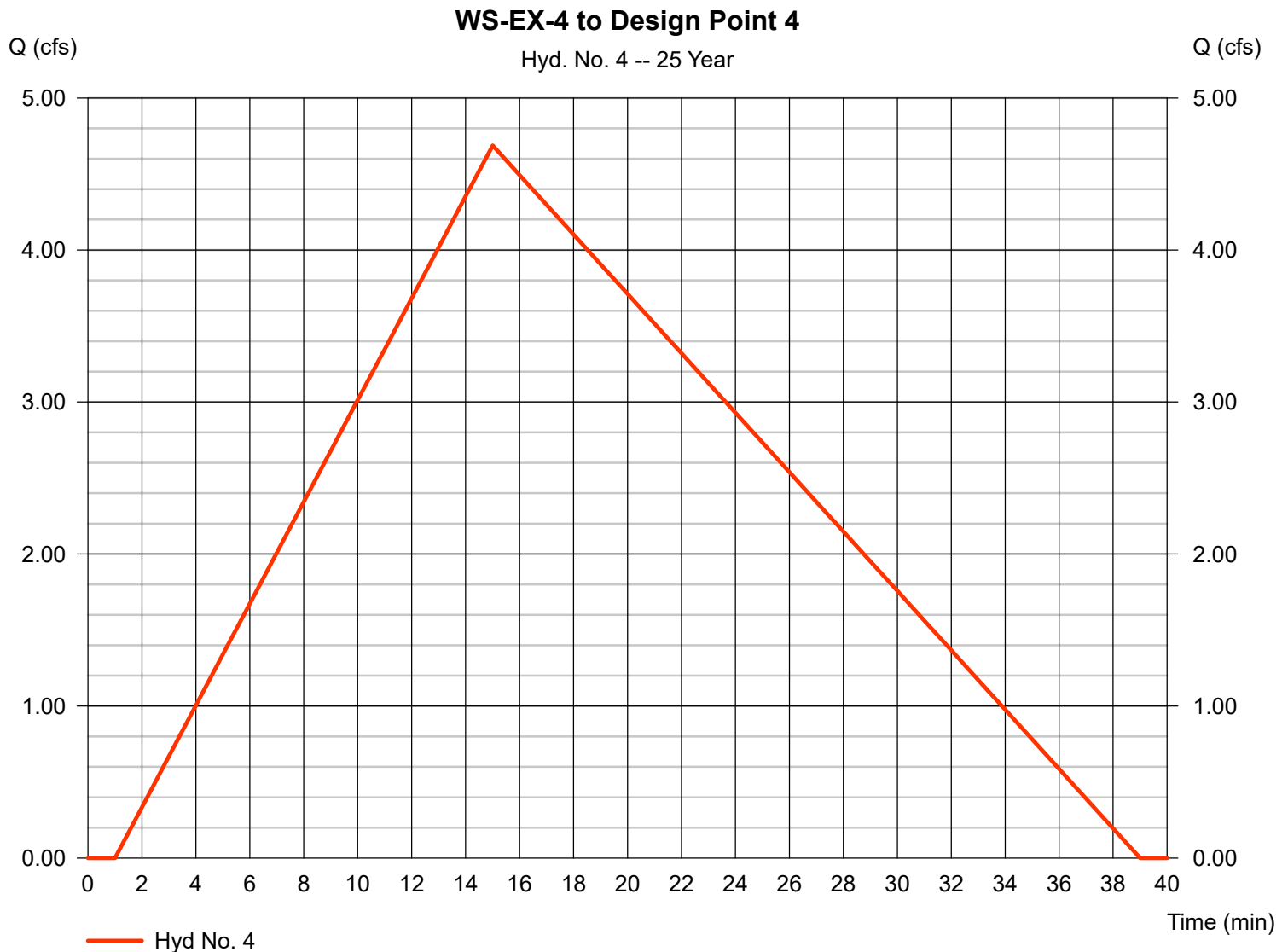
Hyd. No. 4

WS-EX-4 to Design Point 4

Hydrograph type = Rational
 Storm frequency = 25 yrs
 Time interval = 1 min
 Drainage area = 2.810 ac
 Intensity = 5.055 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 4.687 cfs
 Time to peak = 15 min
 Hyd. volume = 5,522 cuft
 Runoff coeff. = 0.33*
 Tc by TR55 = 14.72 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

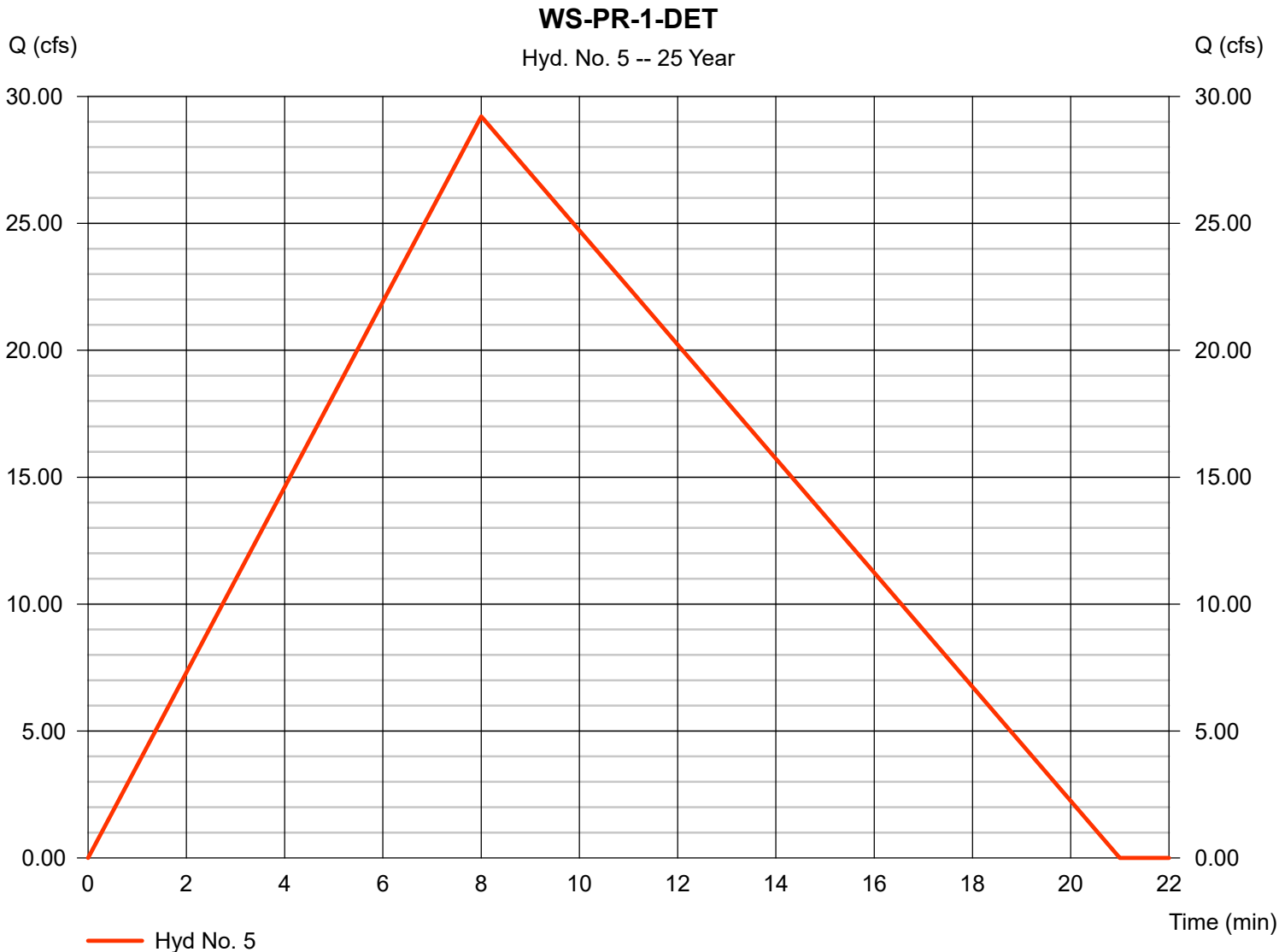
Hyd. No. 5

WS-PR-1-DET

Hydrograph type = Rational
Storm frequency = 25 yrs
Time interval = 1 min
Drainage area = 5.060 ac
Intensity = 6.955 in/hr
IDF Curve = Norwich.IDF

Peak discharge = 29.21 cfs
Time to peak = 8 min
Hyd. volume = 18,698 cuft
Runoff coeff. = 0.83*
Tc by User = 8.00 min
Asc/Rec limb fact = 1/1.667

* Composite (Area/C) = [(0.480 x 0.20) + (4.580 x 0.90)] / 5.060



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 6

WS-PR-1-UND to Design Point 1

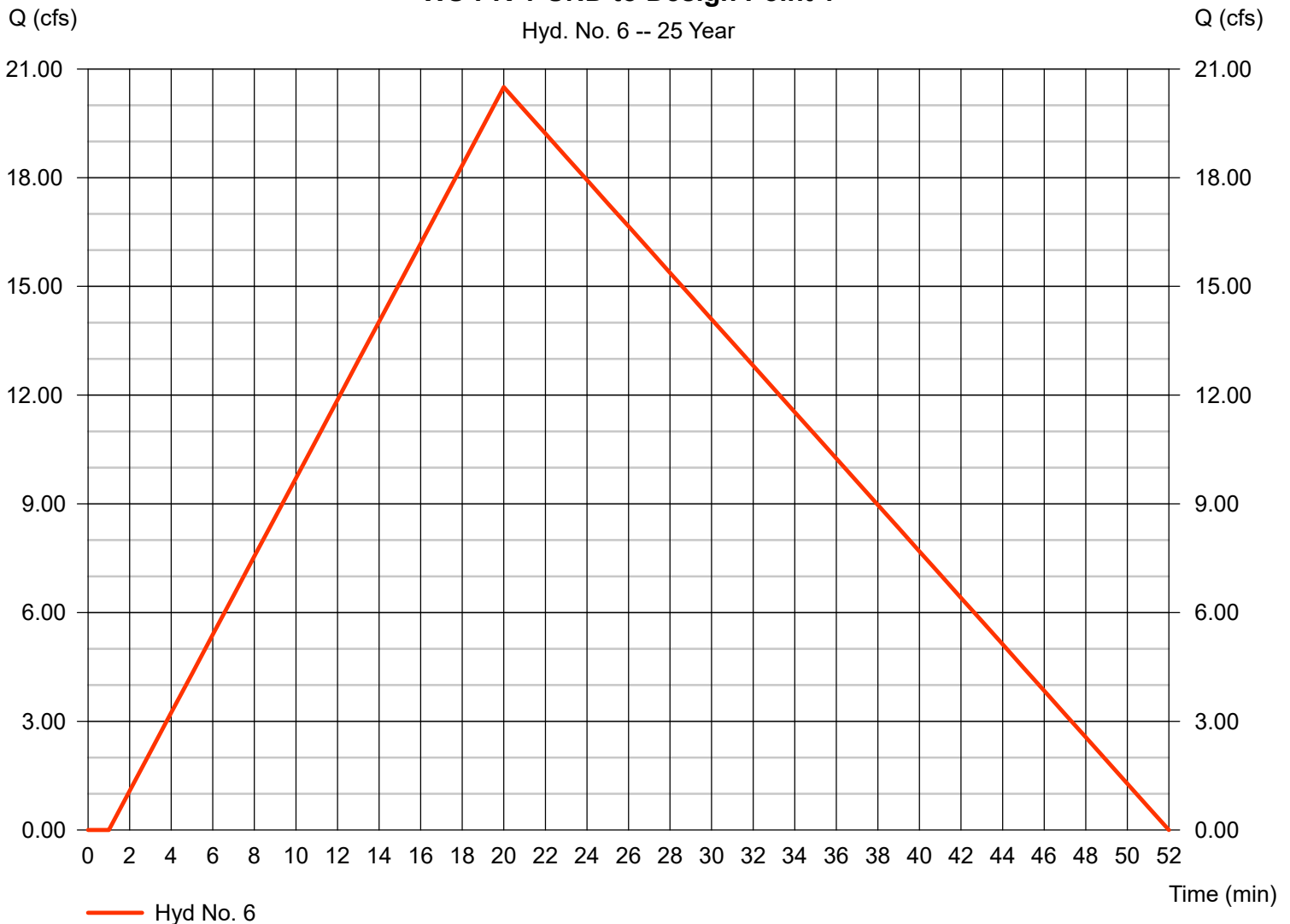
Hydrograph type = Rational
 Storm frequency = 25 yrs
 Time interval = 1 min
 Drainage area = 10.390 ac
 Intensity = 4.289 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 20.50 cfs
 Time to peak = 20 min
 Hyd. volume = 32,118 cuft
 Runoff coeff. = 0.46*
 Tc by TR55 = 19.58 min
 Asc/Rec limb fact = 1/1.667

* Composite (Area/C) = [(0.370 x 0.20) + (5.790 x 0.15) + (4.570 x 0.90)] / 10.390

WS-PR-1-UND to Design Point 1

Hyd. No. 6 -- 25 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 7

WS-PR-2 to Design Point 2

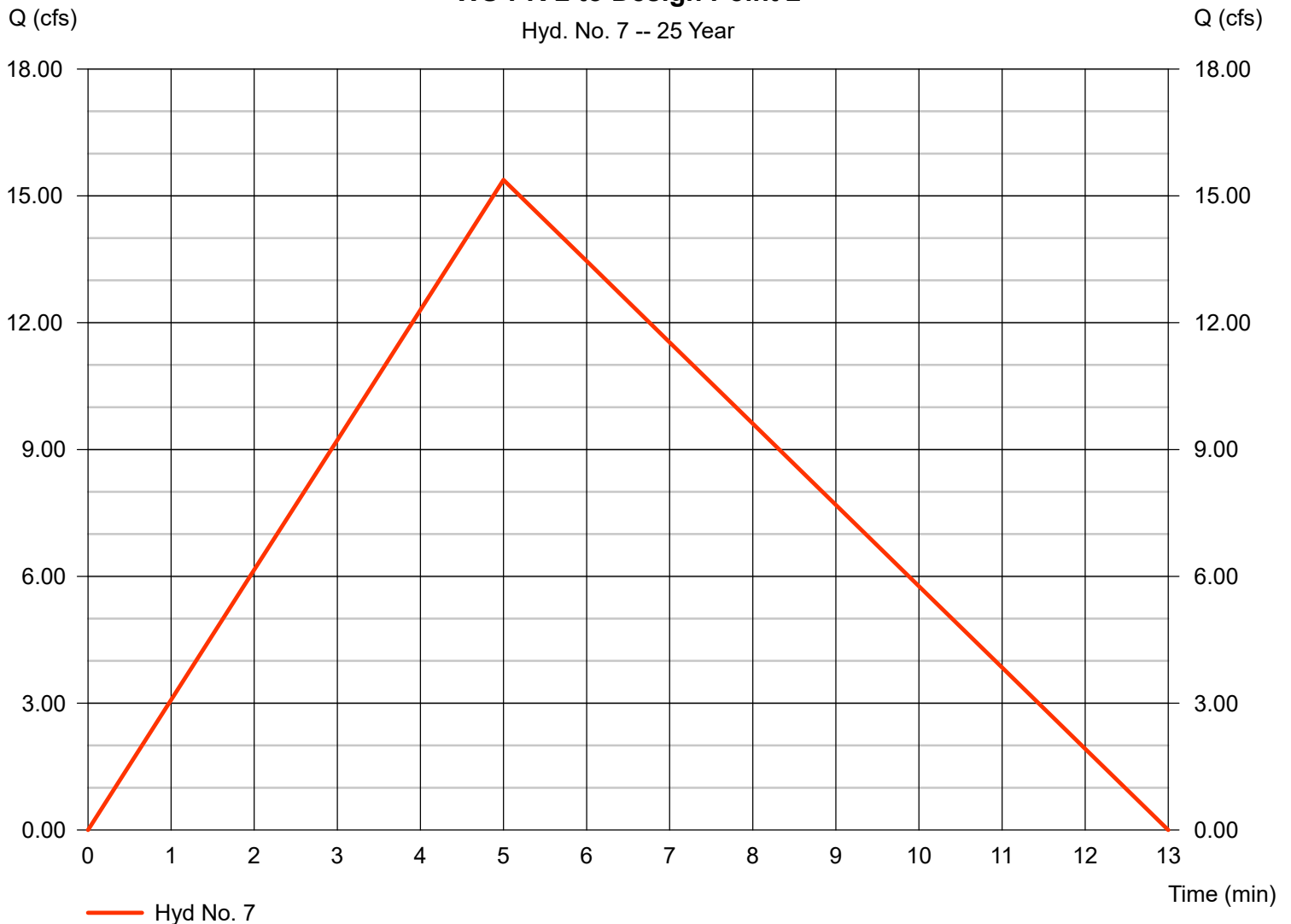
Hydrograph type = Rational
 Storm frequency = 25 yrs
 Time interval = 1 min
 Drainage area = 2.760 ac
 Intensity = 8.572 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 15.38 cfs
 Time to peak = 5 min
 Hyd. volume = 6,152 cuft
 Runoff coeff. = 0.65*
 Tc by User = 5.00 min
 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

WS-PR-2 to Design Point 2

Hyd. No. 7 -- 25 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 8

WS-PR-3 to Design Point 3

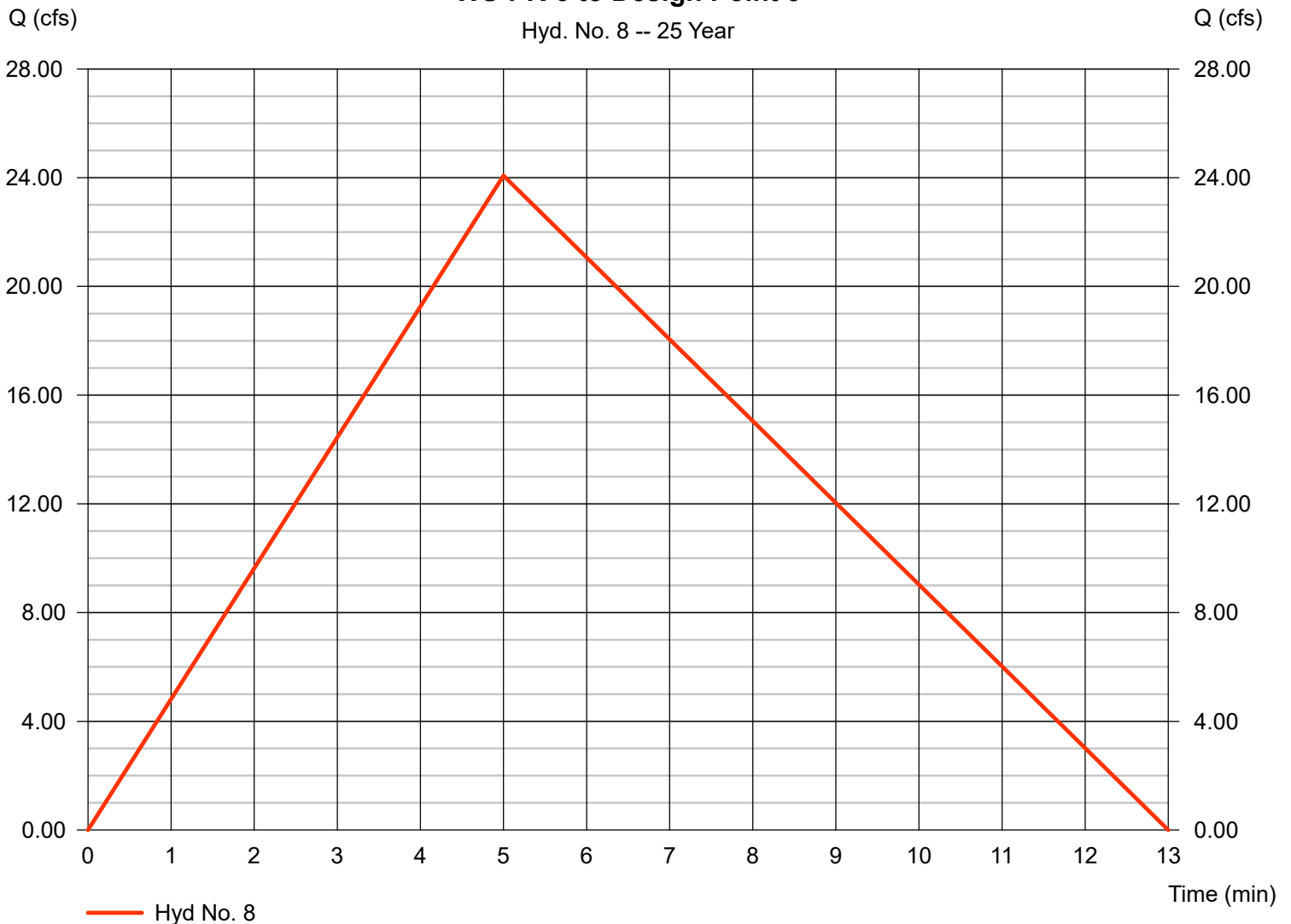
Hydrograph type = Rational
 Storm frequency = 25 yrs
 Time interval = 1 min
 Drainage area = 4.530 ac
 Intensity = 8.572 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 24.07 cfs
 Time to peak = 5 min
 Hyd. volume = 9,631 cuft
 Runoff coeff. = 0.62*
 Tc by TR55 = 5.00 min
 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

WS-PR-3 to Design Point 3

Hyd. No. 8 -- 25 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 9

WS-PR-4 to Design Point 4

Hydrograph type = Rational
 Storm frequency = 25 yrs
 Time interval = 1 min
 Drainage area = 2.810 ac
 Intensity = 5.002 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 4.638 cfs
 Time to peak = 15 min
 Hyd. volume = 5,567 cuft
 Runoff coeff. = 0.33*
 Tc by TR55 = 15.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 10

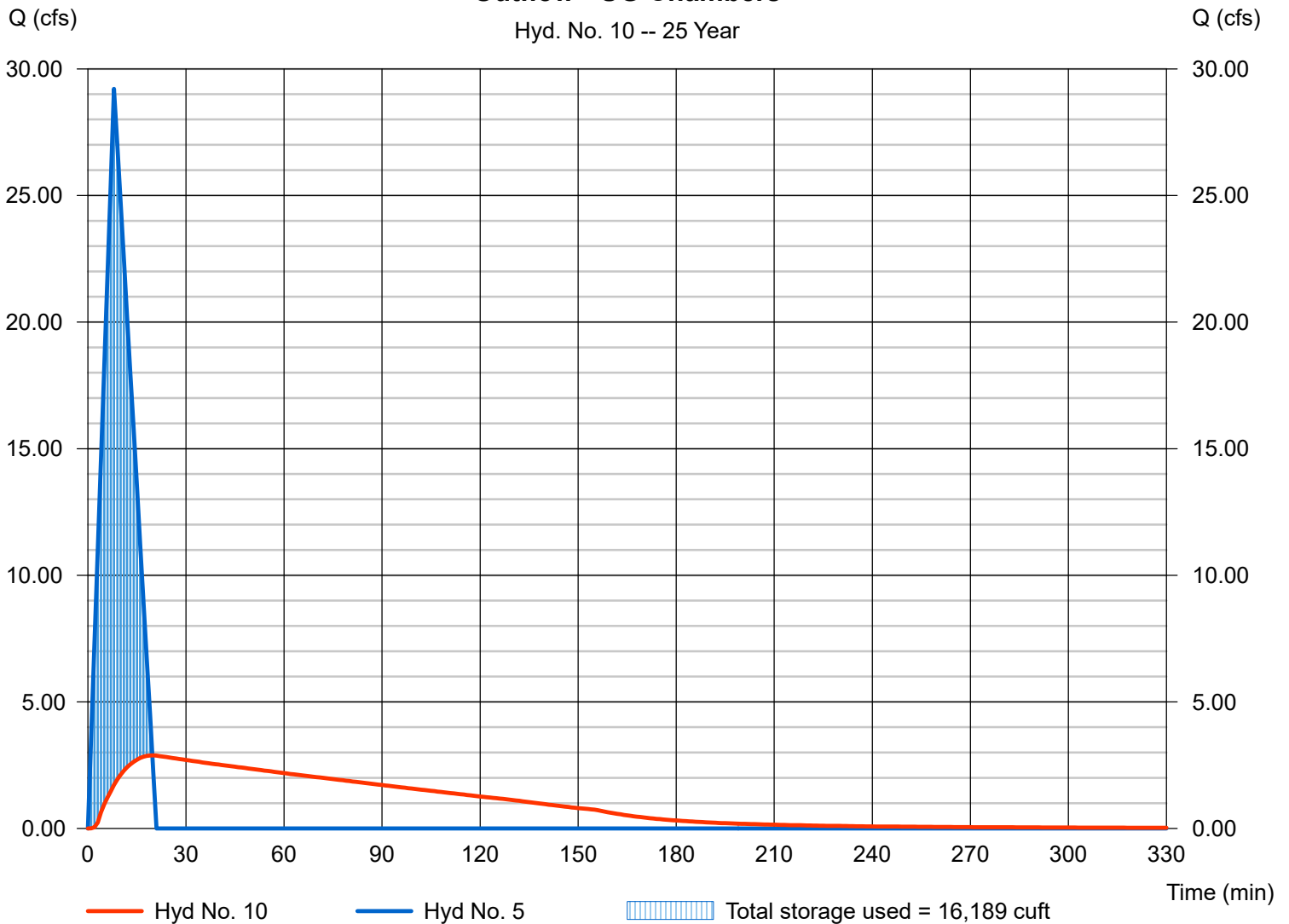
Outflow - UG Chambers

Hydrograph type	= Reservoir	Peak discharge	= 2.888 cfs
Storm frequency	= 25 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 18,384 cuft
Inflow hyd. No.	= 5 - WS-PR-1-DET	Max. Elevation	= 314.43 ft
Reservoir name	= UG Chambers	Max. Storage	= 16,189 cuft

Storage Indication method used.

Outflow - UG Chambers

Hyd. No. 10 -- 25 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

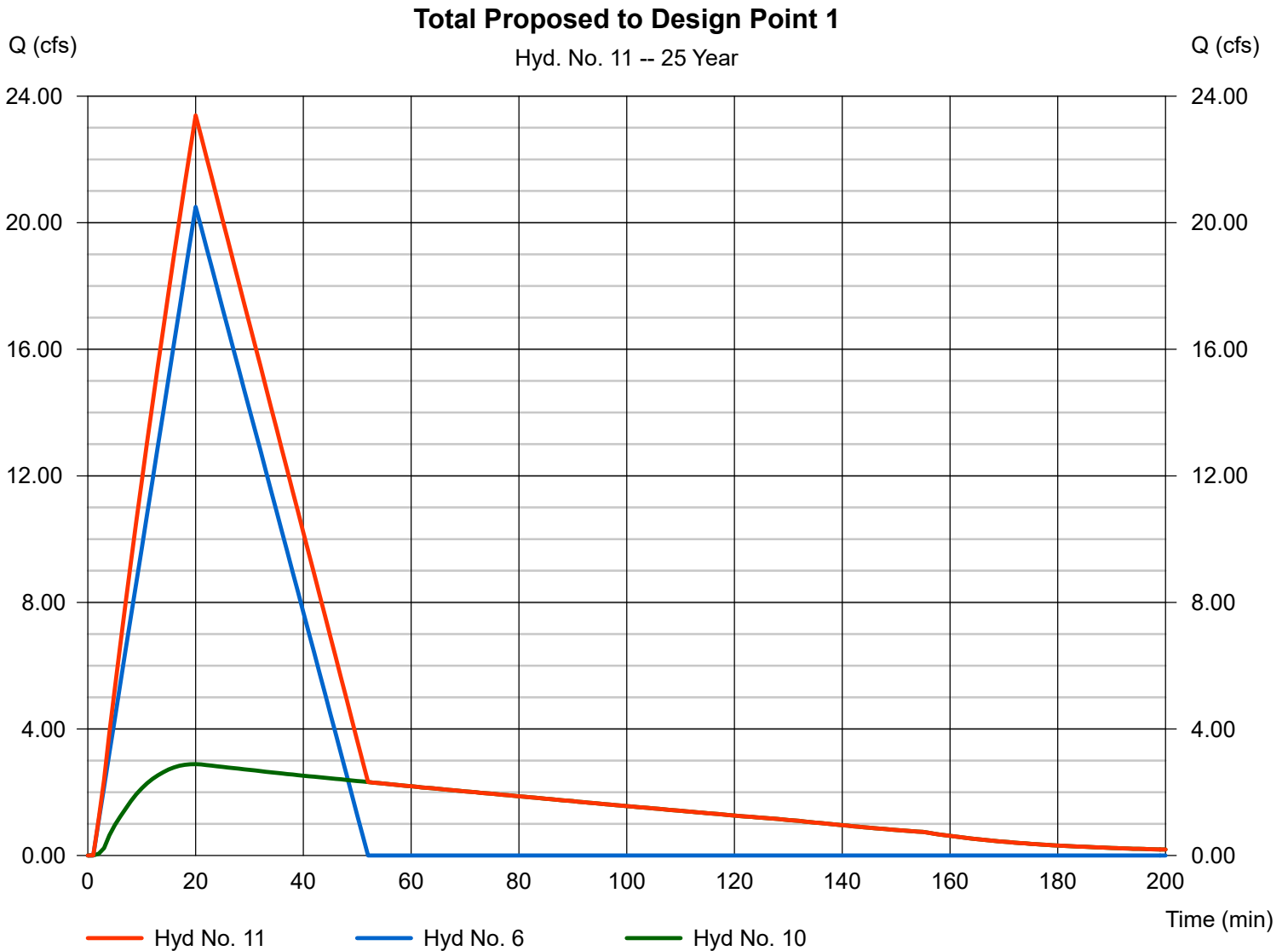
Tuesday, Jun 8, 2021

Hyd. No. 11

Total Proposed to Design Point 1

Hydrograph type = Combine
 Storm frequency = 25 yrs
 Time interval = 1 min
 Inflow hyds. = 6, 10

Peak discharge = 23.39 cfs
 Time to peak = 20 min
 Hyd. volume = 49,748 cuft
 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	27.37	1	19	41,363	----	-----	-----	WS-EX-1 to Design Point 1
2	Rational	17.39	1	5	6,957	----	-----	-----	WS-EX-2 to Design Point 2
3	Rational	27.23	1	5	10,892	----	-----	-----	WS-EX-3 to Design Point 3
4	Rational	5.303	1	15	6,247	----	-----	-----	WS-EX-4 to Design Point 4
5	Rational	33.05	1	8	21,158	----	-----	-----	WS-PR-1-DET
6	Rational	23.18	1	20	36,325	----	-----	-----	WS-PR-1-UND to Design Point 1
7	Rational	17.39	1	5	6,957	----	-----	-----	WS-PR-2 to Design Point 2
8	Rational	27.23	1	5	10,892	----	-----	-----	WS-PR-3 to Design Point 3
9	Rational	5.248	1	15	6,298	----	-----	-----	WS-PR-4 to Design Point 4
10	Reservoir	3.184	1	20	20,805	5	314.88	18,410	Outflow - UG Chambers
11	Combine	26.37	1	20	56,278	6, 10	-----	-----	Total Proposed to Design Point 1
Hydraflow-2021-06-04.gpw					Return Period: 50 Year			Tuesday, Jun 8, 2021	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 1

WS-EX-1 to Design Point 1

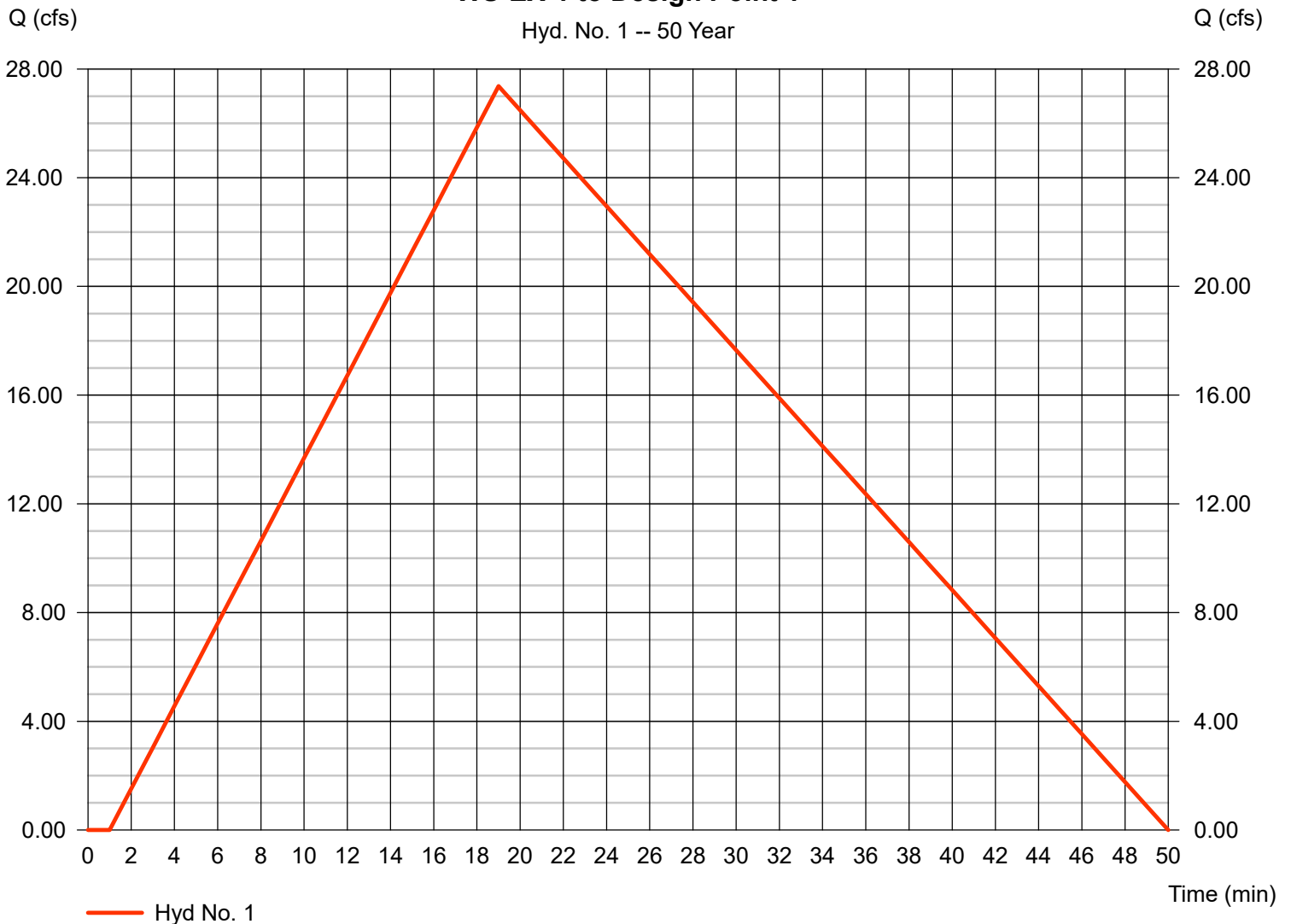
Hydrograph type = Rational
 Storm frequency = 50 yrs
 Time interval = 1 min
 Drainage area = 15.780 ac
 Intensity = 4.955 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 27.37 cfs
 Time to peak = 19 min
 Hyd. volume = 41,363 cuft
 Runoff coeff. = 0.35*
 Tc by TR55 = 18.89 min
 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

WS-EX-1 to Design Point 1

Hyd. No. 1 -- 50 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

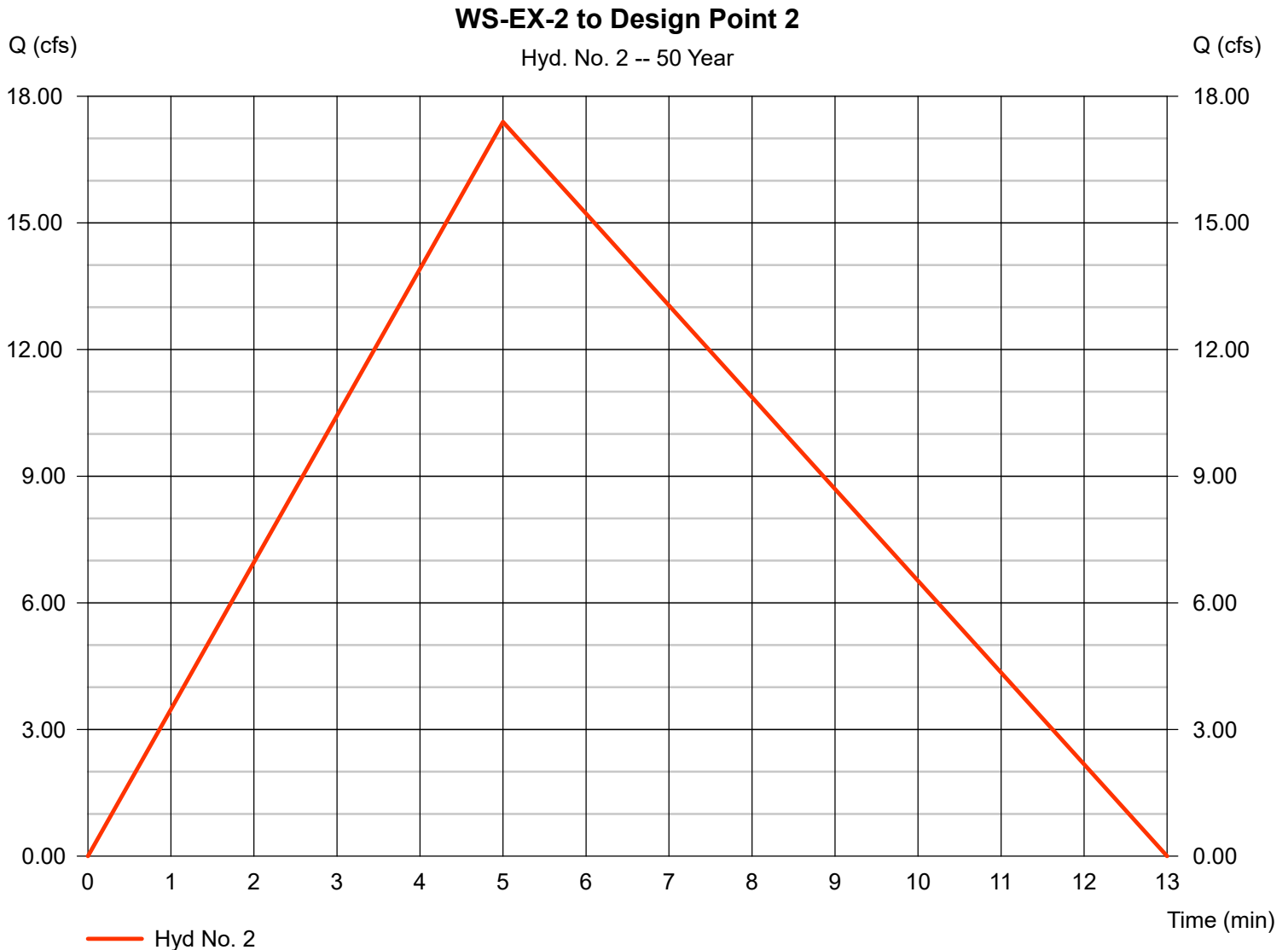
Hyd. No. 2

WS-EX-2 to Design Point 2

Hydrograph type = Rational
 Storm frequency = 50 yrs
 Time interval = 1 min
 Drainage area = 2.760 ac
 Intensity = 9.694 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 17.39 cfs
 Time to peak = 5 min
 Hyd. volume = 6,957 cuft
 Runoff coeff. = 0.65*
 Tc by User = 5.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 3

WS-EX-3 to Design Point 3

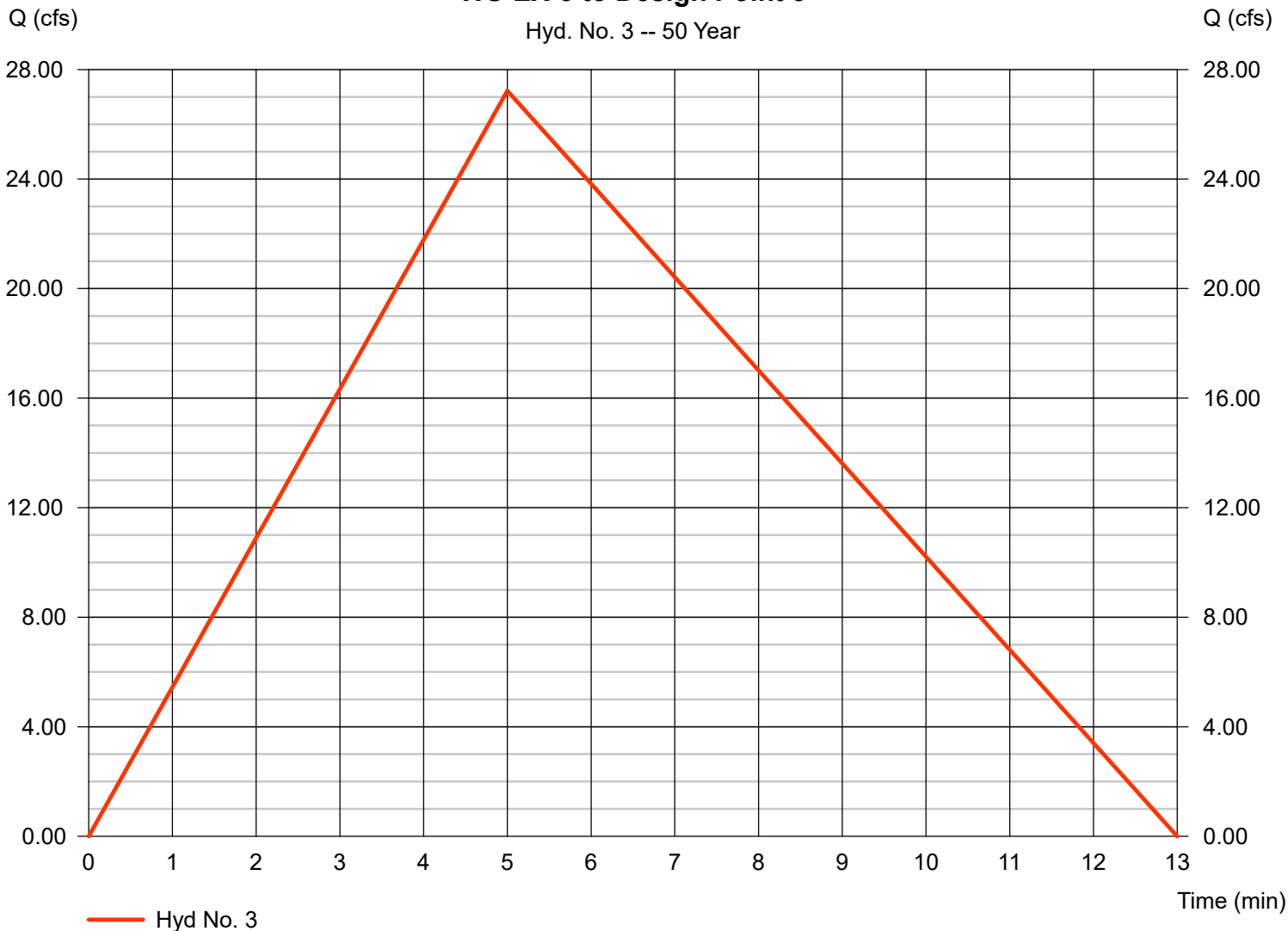
Hydrograph type = Rational
Storm frequency = 50 yrs
Time interval = 1 min
Drainage area = 4.530 ac
Intensity = 9.694 in/hr
IDF Curve = Norwich.IDF

Peak discharge = 27.23 cfs
Time to peak = 5 min
Hyd. volume = 10,892 cuft
Runoff coeff. = 0.62*
Tc by TR55 = 5.00 min
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

WS-EX-3 to Design Point 3

Hyd. No. 3 -- 50 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

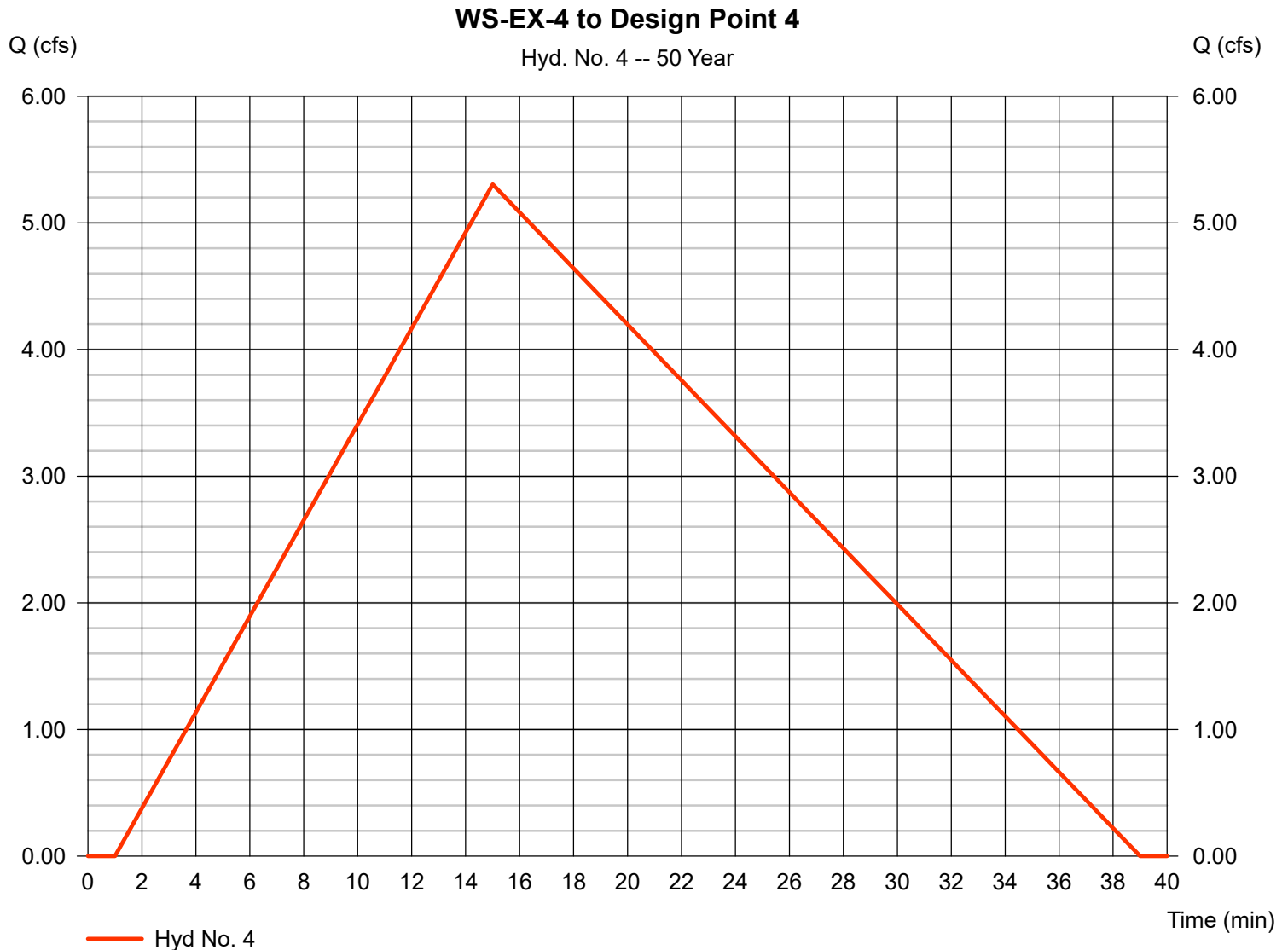
Hyd. No. 4

WS-EX-4 to Design Point 4

Hydrograph type = Rational
 Storm frequency = 50 yrs
 Time interval = 1 min
 Drainage area = 2.810 ac
 Intensity = 5.719 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 5.303 cfs
 Time to peak = 15 min
 Hyd. volume = 6,247 cuft
 Runoff coeff. = 0.33*
 Tc by TR55 = 14.72 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

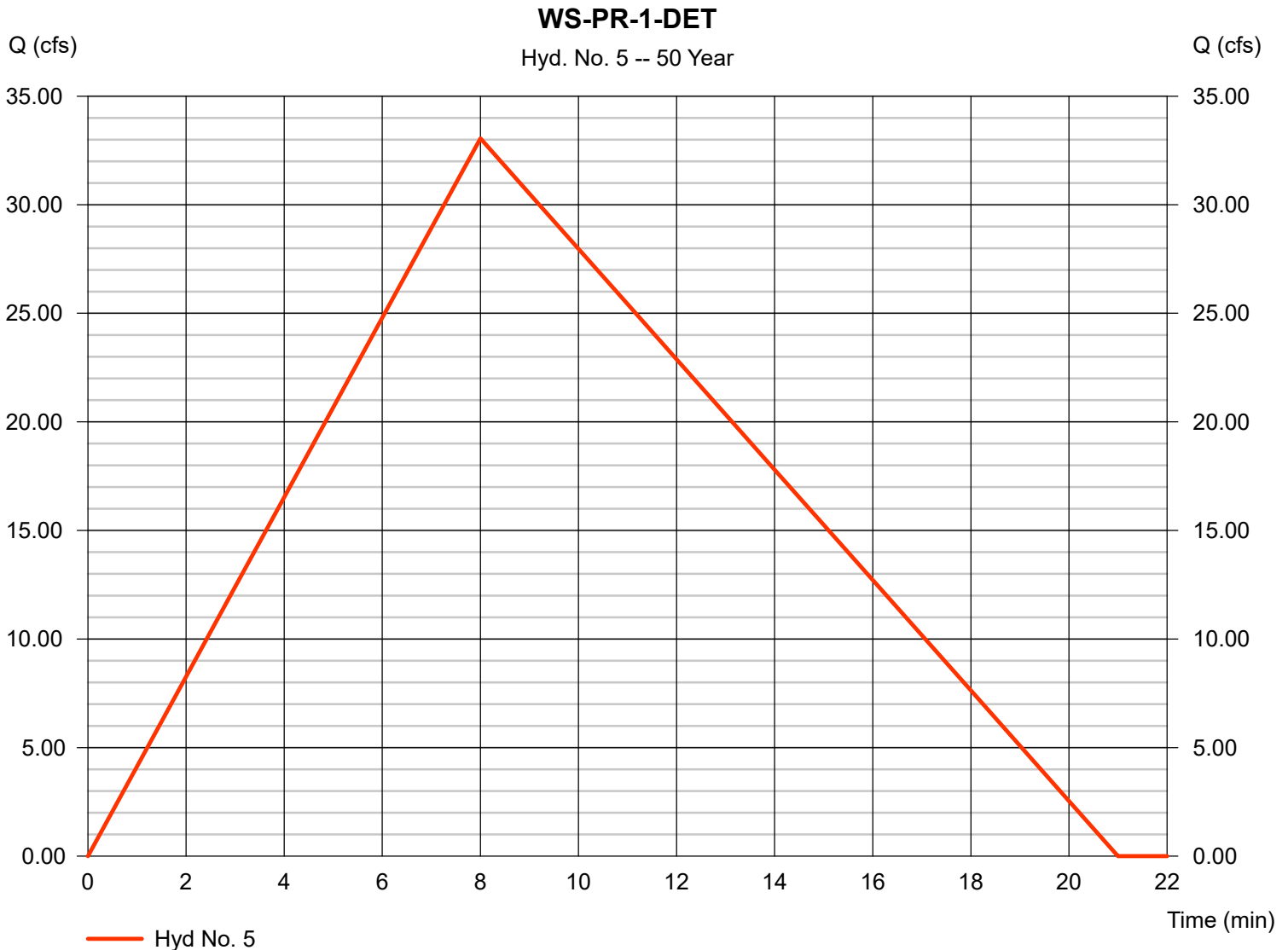
Hyd. No. 5

WS-PR-1-DET

Hydrograph type = Rational
 Storm frequency = 50 yrs
 Time interval = 1 min
 Drainage area = 5.060 ac
 Intensity = 7.871 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 33.05 cfs
 Time to peak = 8 min
 Hyd. volume = 21,158 cuft
 Runoff coeff. = 0.83*
 Tc by User = 8.00 min
 Asc/Rec limb fact = 1/1.667

* Composite (Area/C) = [(0.480 x 0.20) + (4.580 x 0.90)] / 5.060



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 6

WS-PR-1-UND to Design Point 1

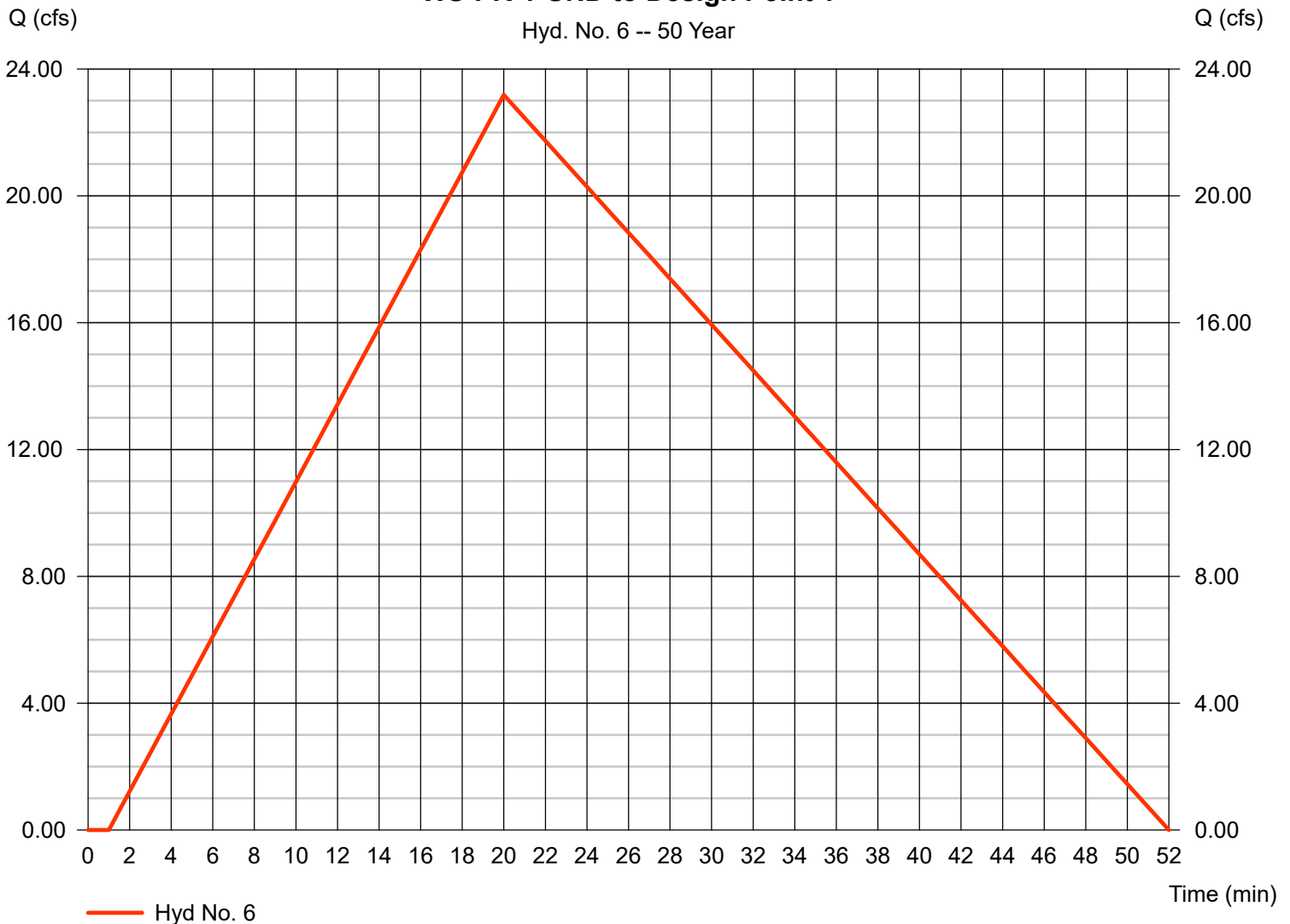
Hydrograph type = Rational
 Storm frequency = 50 yrs
 Time interval = 1 min
 Drainage area = 10.390 ac
 Intensity = 4.851 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 23.18 cfs
 Time to peak = 20 min
 Hyd. volume = 36,325 cuft
 Runoff coeff. = 0.46*
 Tc by TR55 = 19.58 min
 Asc/Rec limb fact = 1/1.667

* Composite (Area/C) = [(0.370 x 0.20) + (5.790 x 0.15) + (4.570 x 0.90)] / 10.390

WS-PR-1-UND to Design Point 1

Hyd. No. 6 -- 50 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

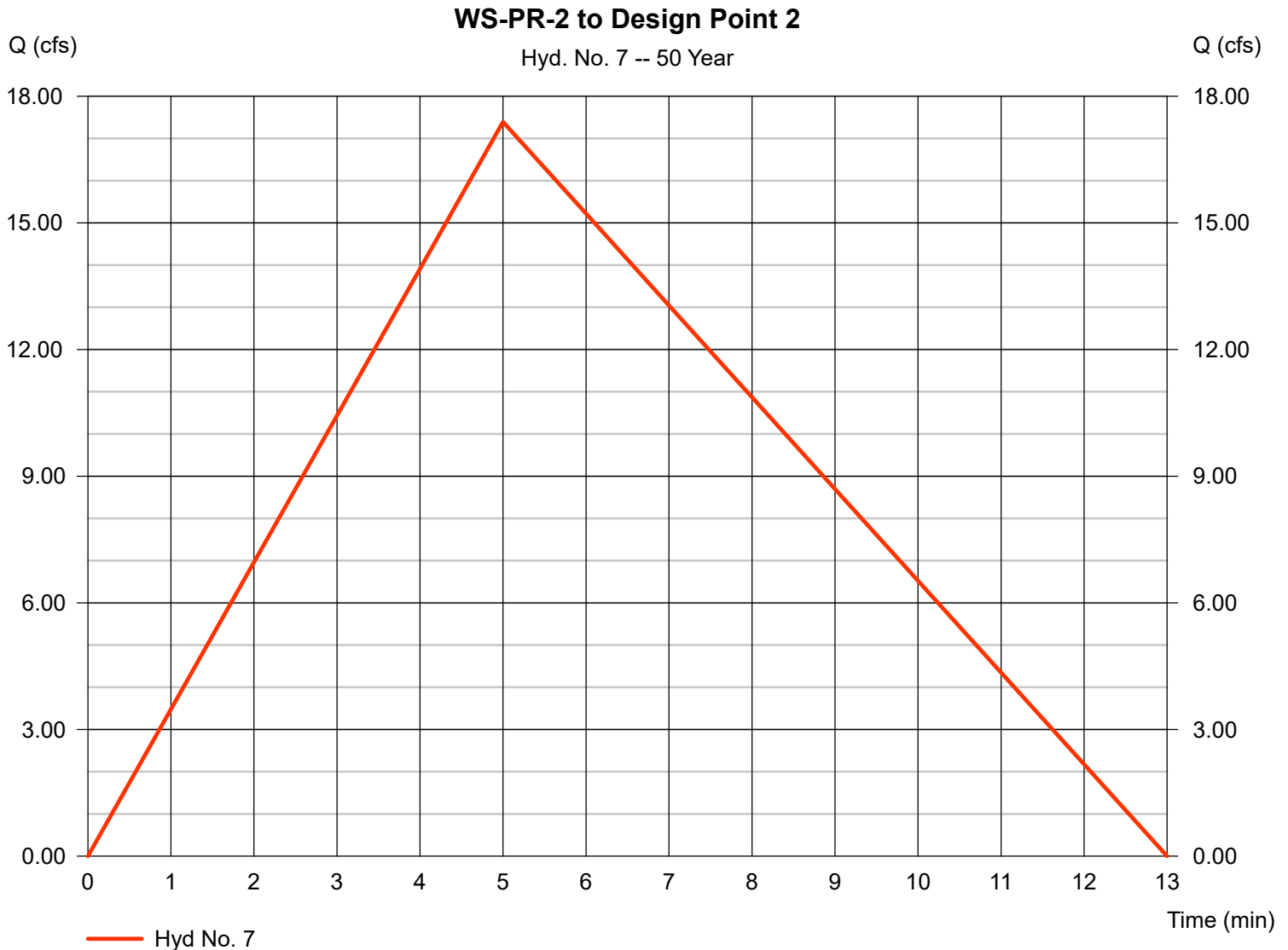
Hyd. No. 7

WS-PR-2 to Design Point 2

Hydrograph type = Rational
 Storm frequency = 50 yrs
 Time interval = 1 min
 Drainage area = 2.760 ac
 Intensity = 9.694 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 17.39 cfs
 Time to peak = 5 min
 Hyd. volume = 6,957 cuft
 Runoff coeff. = 0.65*
 Tc by User = 5.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

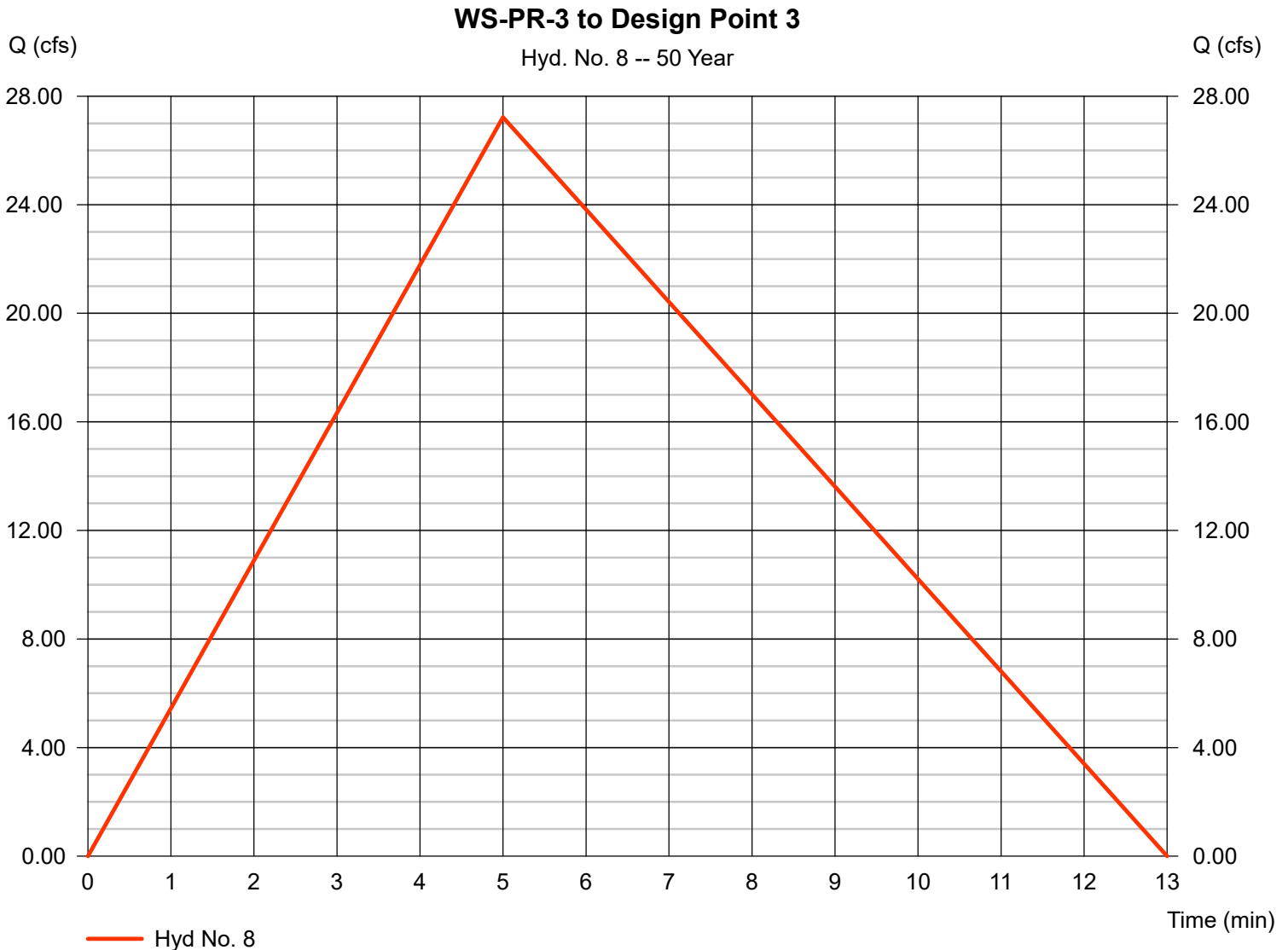
Hyd. No. 8

WS-PR-3 to Design Point 3

Hydrograph type = Rational
 Storm frequency = 50 yrs
 Time interval = 1 min
 Drainage area = 4.530 ac
 Intensity = 9.694 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 27.23 cfs
 Time to peak = 5 min
 Hyd. volume = 10,892 cuft
 Runoff coeff. = 0.62*
 Tc by TR55 = 5.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

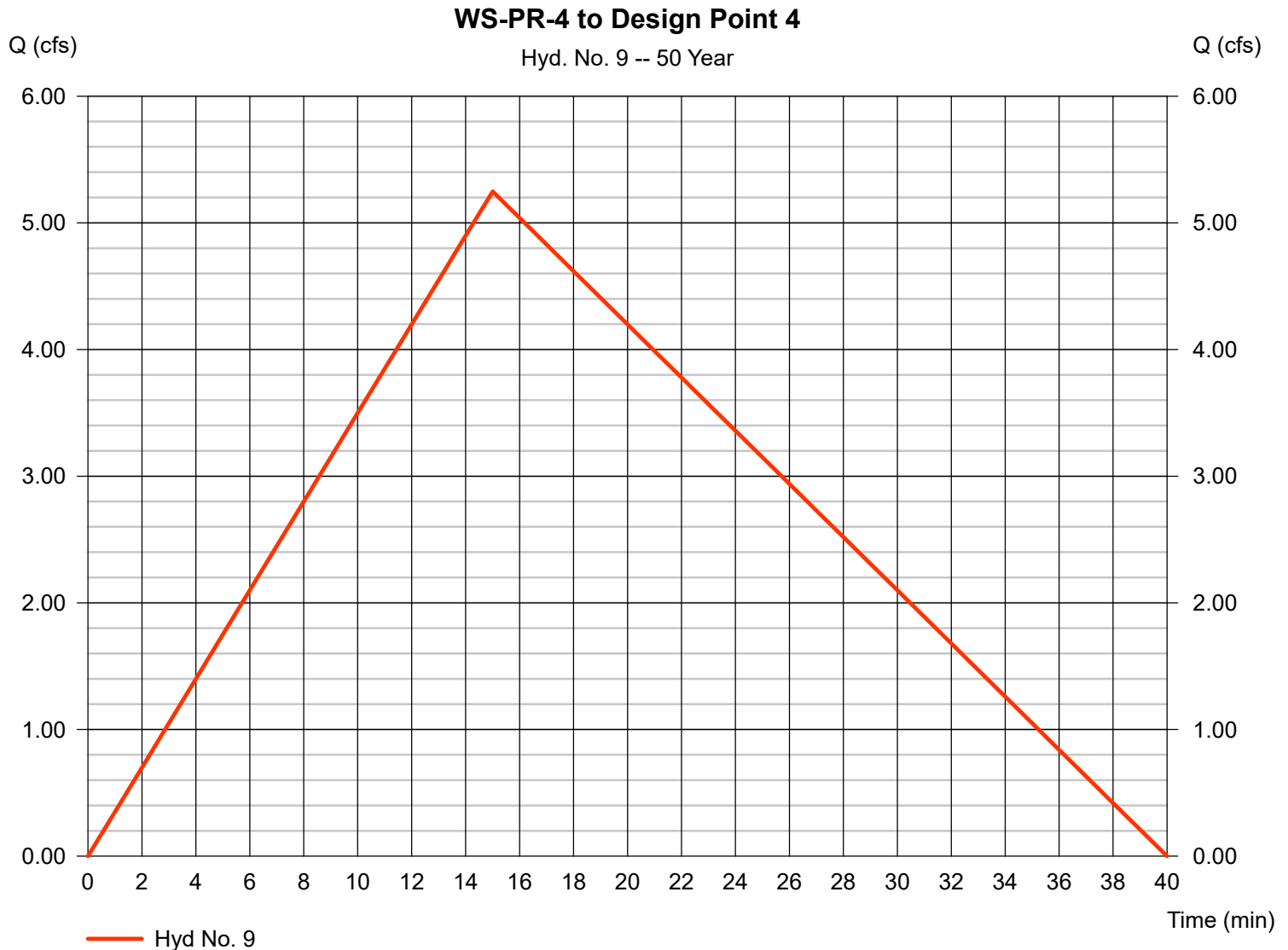
Hyd. No. 9

WS-PR-4 to Design Point 4

Hydrograph type = Rational
 Storm frequency = 50 yrs
 Time interval = 1 min
 Drainage area = 2.810 ac
 Intensity = 5.659 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 5.248 cfs
 Time to peak = 15 min
 Hyd. volume = 6,298 cuft
 Runoff coeff. = 0.33*
 Tc by TR55 = 15.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 10

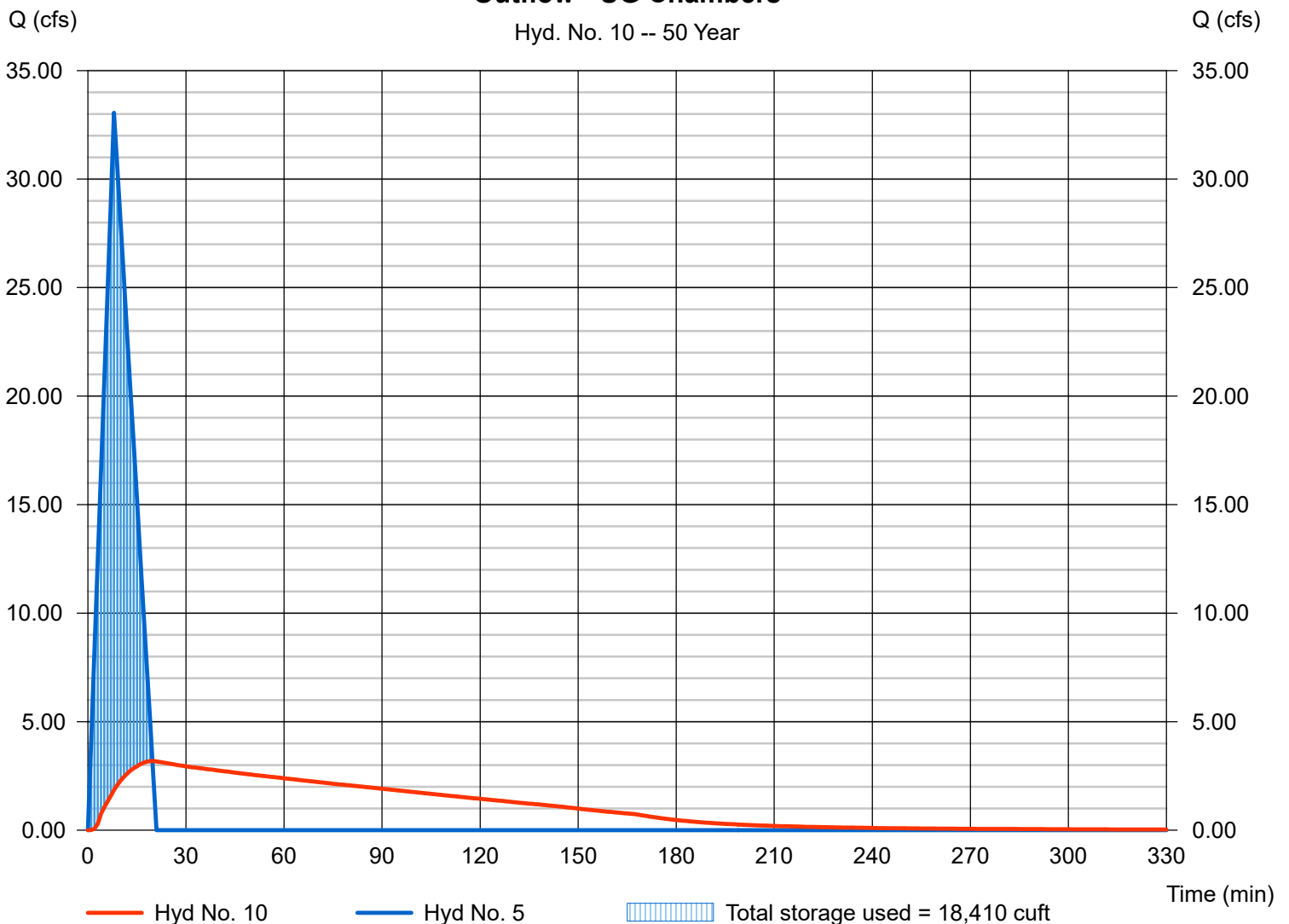
Outflow - UG Chambers

Hydrograph type	= Reservoir	Peak discharge	= 3.184 cfs
Storm frequency	= 50 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 20,805 cuft
Inflow hyd. No.	= 5 - WS-PR-1-DET	Max. Elevation	= 314.88 ft
Reservoir name	= UG Chambers	Max. Storage	= 18,410 cuft

Storage Indication method used.

Outflow - UG Chambers

Hyd. No. 10 -- 50 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

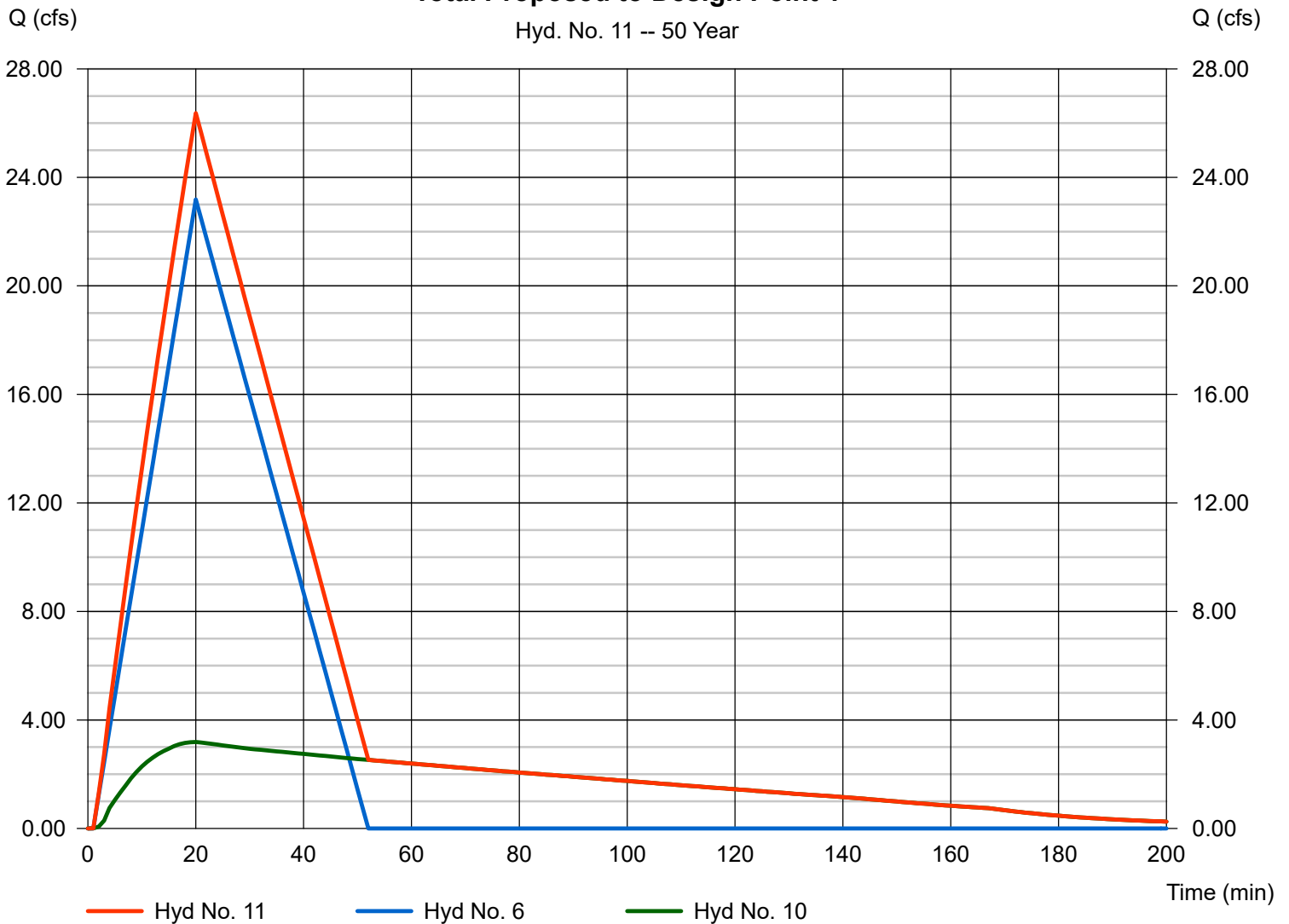
Hyd. No. 11

Total Proposed to Design Point 1

Hydrograph type = Combine
Storm frequency = 50 yrs
Time interval = 1 min
Inflow hyds. = 6, 10

Peak discharge = 26.37 cfs
Time to peak = 20 min
Hyd. volume = 56,278 cuft
Contrib. drain. area = 10.390 ac

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	30.57	1	19	46,204	----	-----	-----	WS-EX-1 to Design Point 1
2	Rational	19.31	1	5	7,723	----	-----	-----	WS-EX-2 to Design Point 2
3	Rational	30.22	1	5	12,091	----	-----	-----	WS-EX-3 to Design Point 3
4	Rational	5.920	1	15	6,974	----	-----	-----	WS-EX-4 to Design Point 4
5	Rational	36.80	1	8	23,557	----	-----	-----	WS-PR-1-DET
6	Rational	25.90	1	20	40,580	----	-----	-----	WS-PR-1-UND to Design Point 1
7	Rational	19.31	1	5	7,723	----	-----	-----	WS-PR-2 to Design Point 2
8	Rational	30.22	1	5	12,091	----	-----	-----	WS-PR-3 to Design Point 3
9	Rational	5.859	1	15	7,032	----	-----	-----	WS-PR-4 to Design Point 4
10	Reservoir	3.510	1	20	23,167	5	315.42	20,568	Outflow - UG Chambers
11	Combine	29.41	1	20	62,794	6, 10	-----	-----	Total Proposed to Design Point 1
Hydraflow-2021-06-04.gpw					Return Period: 100 Year			Tuesday, Jun 8, 2021	

Hydrograph Report

Hyd. No. 1

WS-EX-1 to Design Point 1

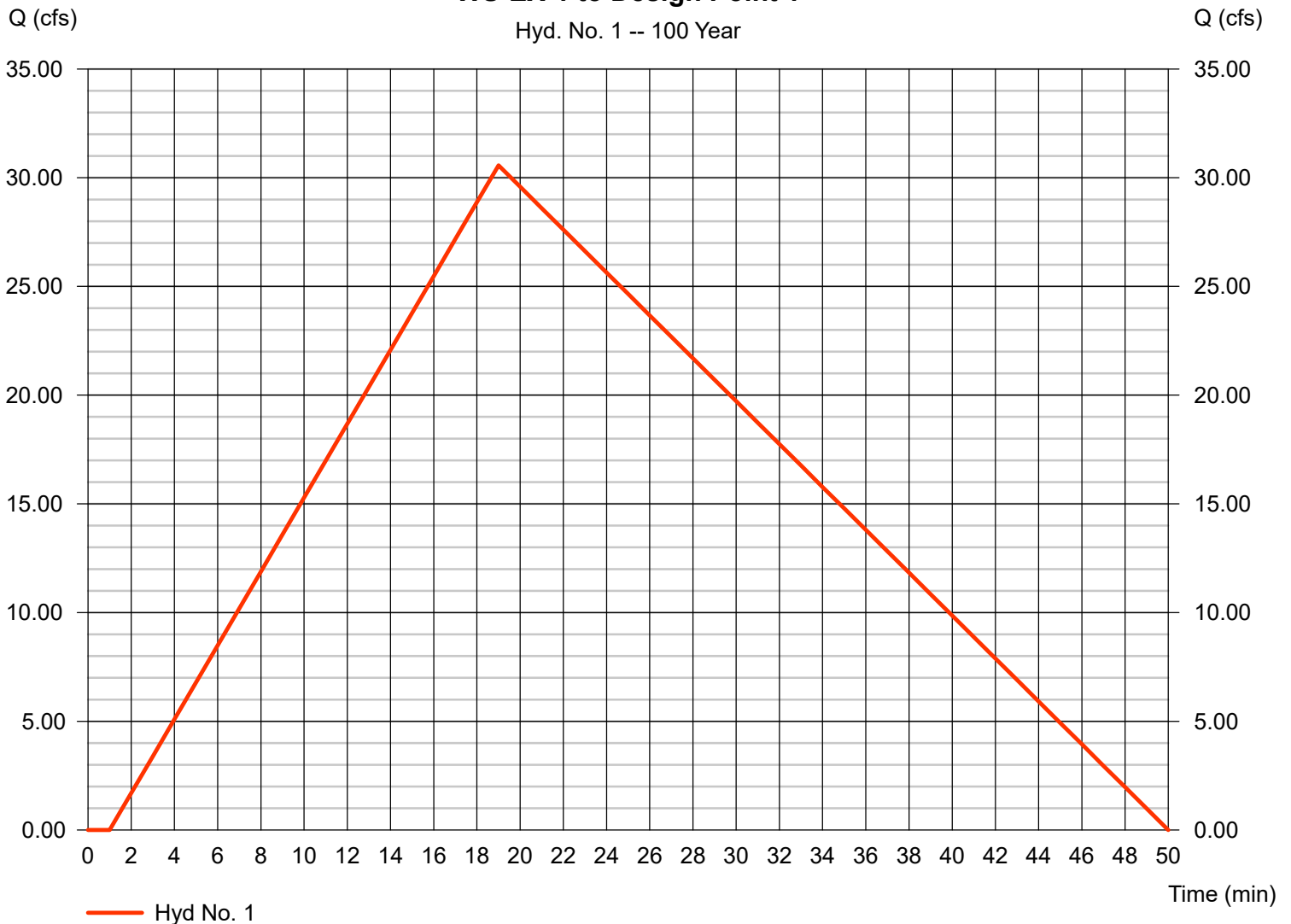
Hydrograph type = Rational
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 15.780 ac
Intensity = 5.535 in/hr
IDF Curve = Norwich.IDF

Peak discharge = 30.57 cfs
Time to peak = 19 min
Hyd. volume = 46,204 cuft
Runoff coeff. = 0.35*
Tc by TR55 = 18.89 min
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

WS-EX-1 to Design Point 1

Hyd. No. 1 -- 100 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 2

WS-EX-2 to Design Point 2

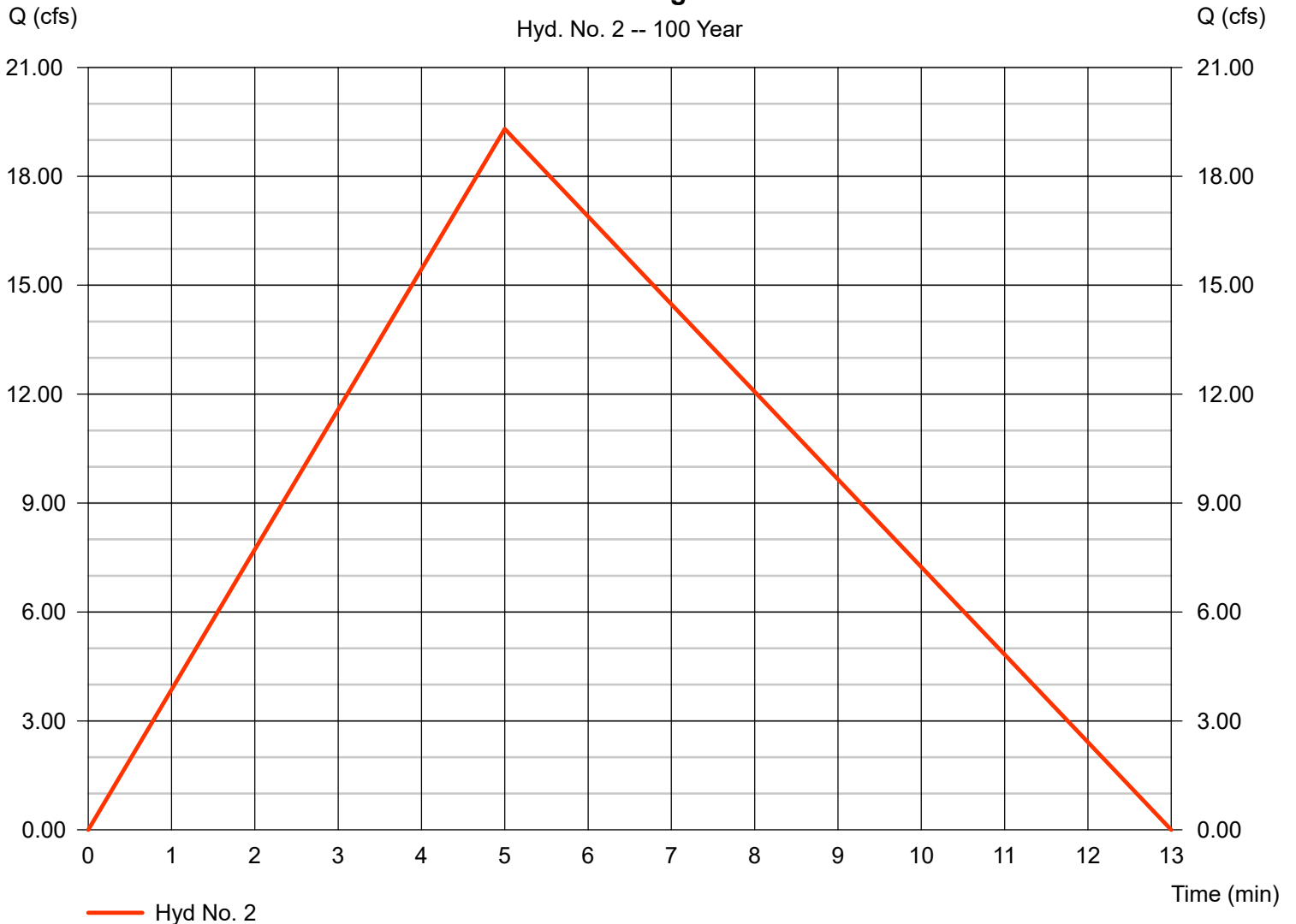
Hydrograph type = Rational
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 2.760 ac
 Intensity = 10.761 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 19.31 cfs
 Time to peak = 5 min
 Hyd. volume = 7,723 cuft
 Runoff coeff. = 0.65*
 Tc by User = 5.00 min
 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

WS-EX-2 to Design Point 2

Hyd. No. 2 -- 100 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 3

WS-EX-3 to Design Point 3

Hydrograph type = Rational
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 4.530 ac
 Intensity = 10.761 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 30.22 cfs
 Time to peak = 5 min
 Hyd. volume = 12,091 cuft
 Runoff coeff. = 0.62*
 Tc by TR55 = 5.00 min
 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

WS-EX-3 to Design Point 3

Hyd. No. 3 -- 100 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 4

WS-EX-4 to Design Point 4

Hydrograph type = Rational
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 2.810 ac
 Intensity = 6.384 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 5.920 cfs
 Time to peak = 15 min
 Hyd. volume = 6,974 cuft
 Runoff coeff. = 0.33*
 Tc by TR55 = 14.72 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

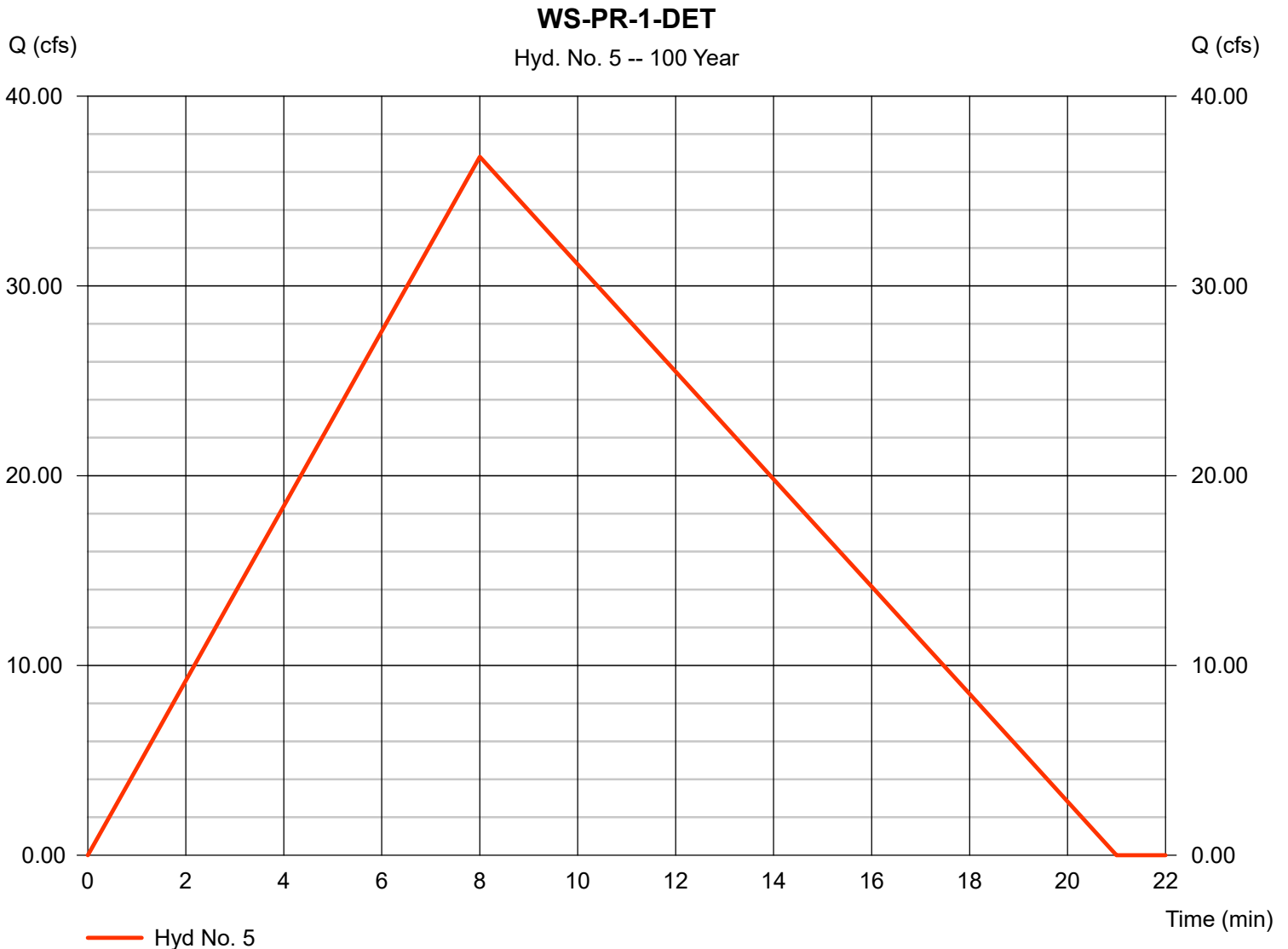
Hyd. No. 5

WS-PR-1-DET

Hydrograph type = Rational
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 5.060 ac
 Intensity = 8.763 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 36.80 cfs
 Time to peak = 8 min
 Hyd. volume = 23,557 cuft
 Runoff coeff. = 0.83*
 Tc by User = 8.00 min
 Asc/Rec limb fact = 1/1.667

* Composite (Area/C) = [(0.480 x 0.20) + (4.580 x 0.90)] / 5.060



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 6

WS-PR-1-UND to Design Point 1

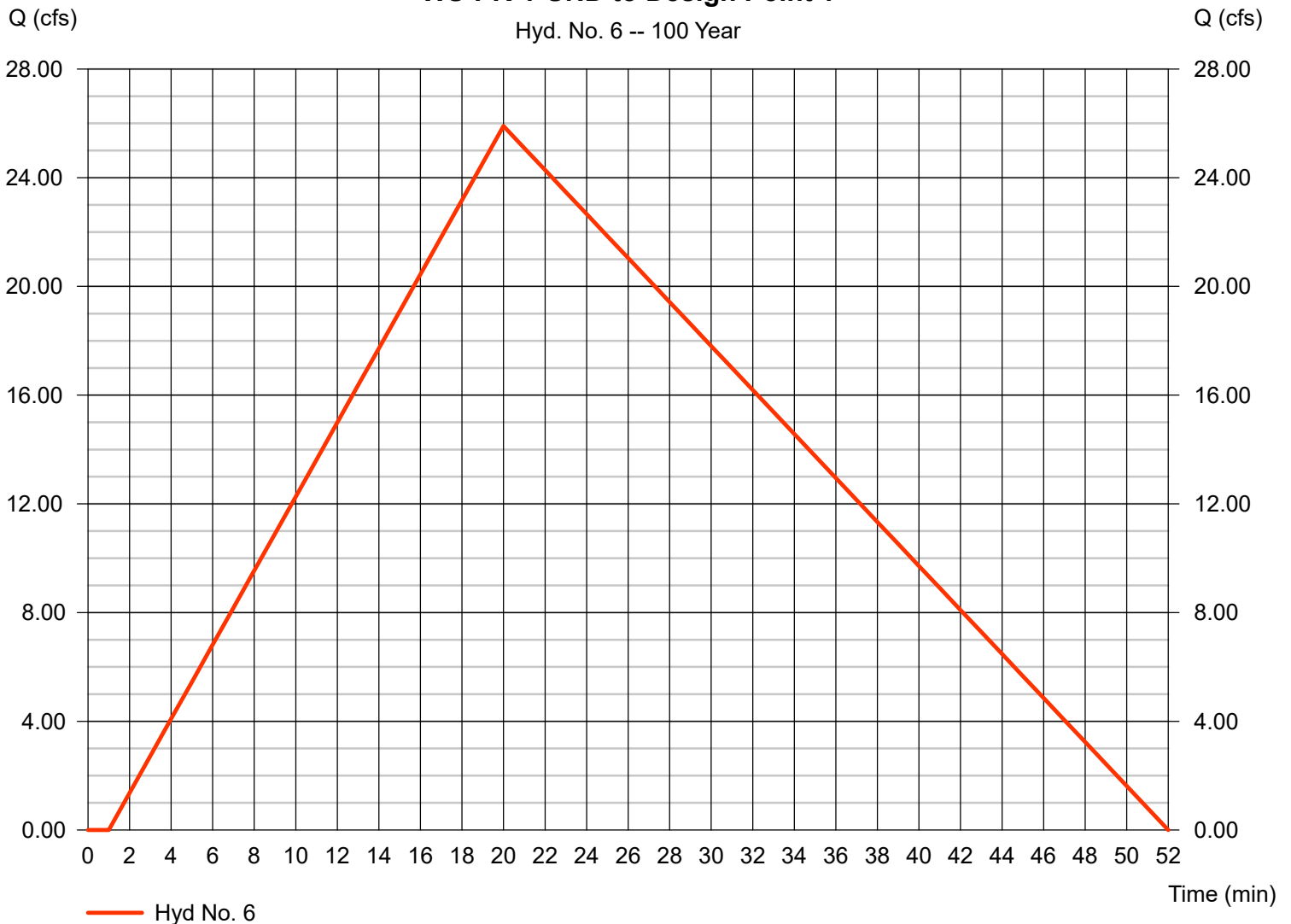
Hydrograph type = Rational
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 10.390 ac
 Intensity = 5.419 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 25.90 cfs
 Time to peak = 20 min
 Hyd. volume = 40,580 cuft
 Runoff coeff. = 0.46*
 Tc by TR55 = 19.58 min
 Asc/Rec limb fact = 1/1.667

* Composite (Area/C) = [(0.370 x 0.20) + (5.790 x 0.15) + (4.570 x 0.90)] / 10.390

WS-PR-1-UND to Design Point 1

Hyd. No. 6 -- 100 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 7

WS-PR-2 to Design Point 2

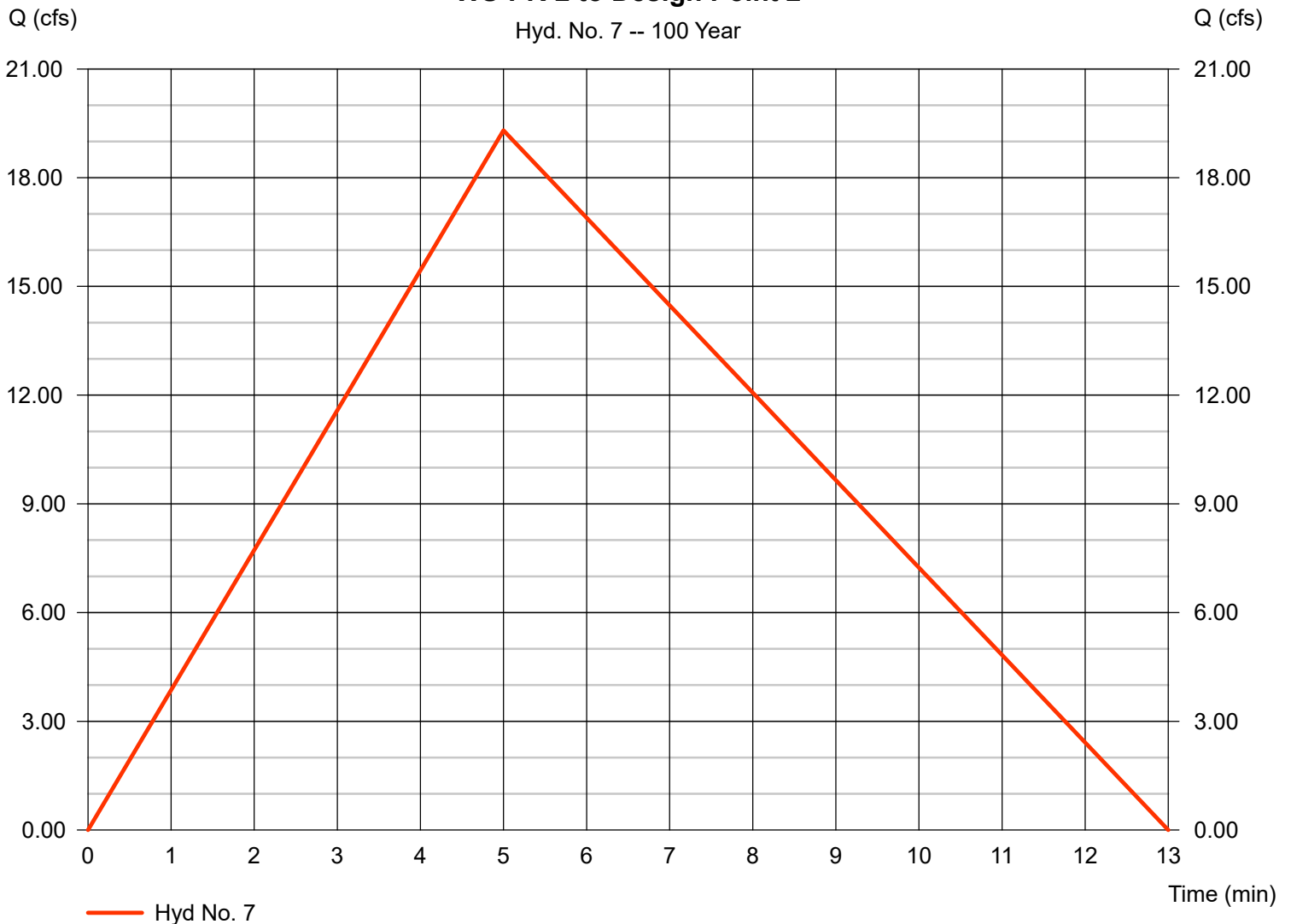
Hydrograph type = Rational
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 2.760 ac
 Intensity = 10.761 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 19.31 cfs
 Time to peak = 5 min
 Hyd. volume = 7,723 cuft
 Runoff coeff. = 0.65*
 Tc by User = 5.00 min
 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

WS-PR-2 to Design Point 2

Hyd. No. 7 -- 100 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 8

WS-PR-3 to Design Point 3

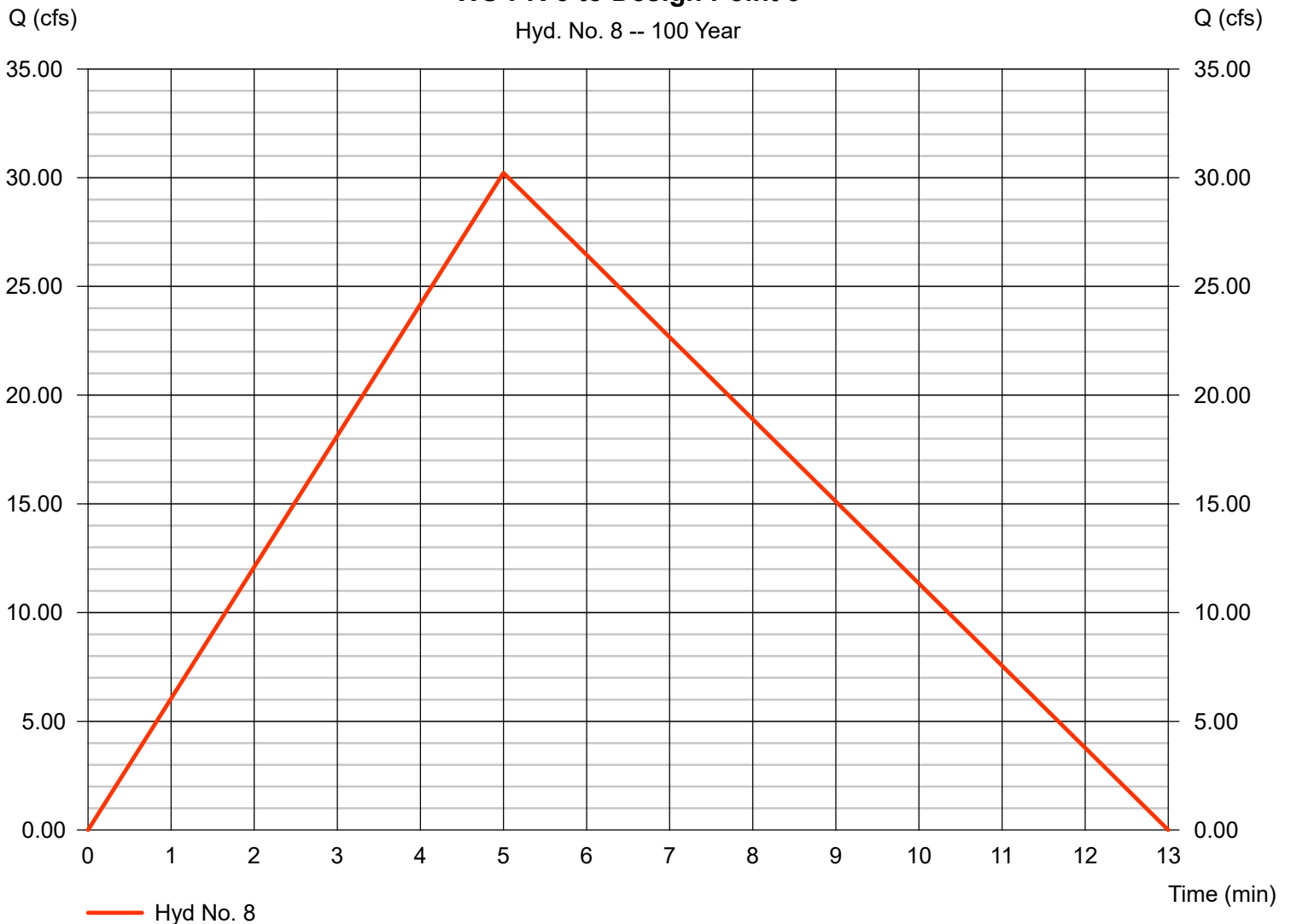
Hydrograph type = Rational
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 4.530 ac
 Intensity = 10.761 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 30.22 cfs
 Time to peak = 5 min
 Hyd. volume = 12,091 cuft
 Runoff coeff. = 0.62*
 Tc by TR55 = 5.00 min
 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

WS-PR-3 to Design Point 3

Hyd. No. 8 -- 100 Year



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

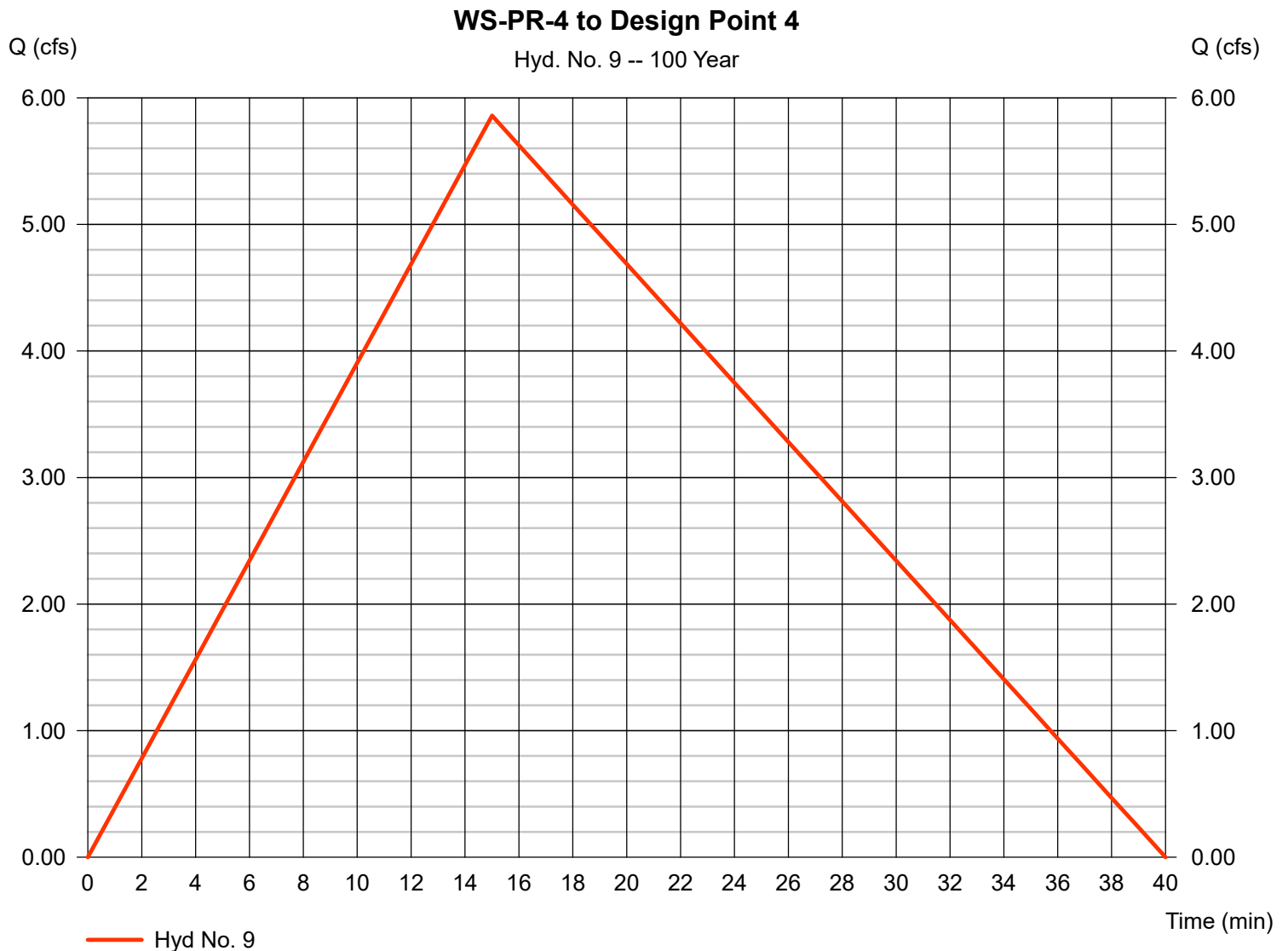
Hyd. No. 9

WS-PR-4 to Design Point 4

Hydrograph type = Rational
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 2.810 ac
 Intensity = 6.318 in/hr
 IDF Curve = Norwich.IDF

Peak discharge = 5.859 cfs
 Time to peak = 15 min
 Hyd. volume = 7,032 cuft
 Runoff coeff. = 0.33*
 Tc by TR55 = 15.00 min
 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

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

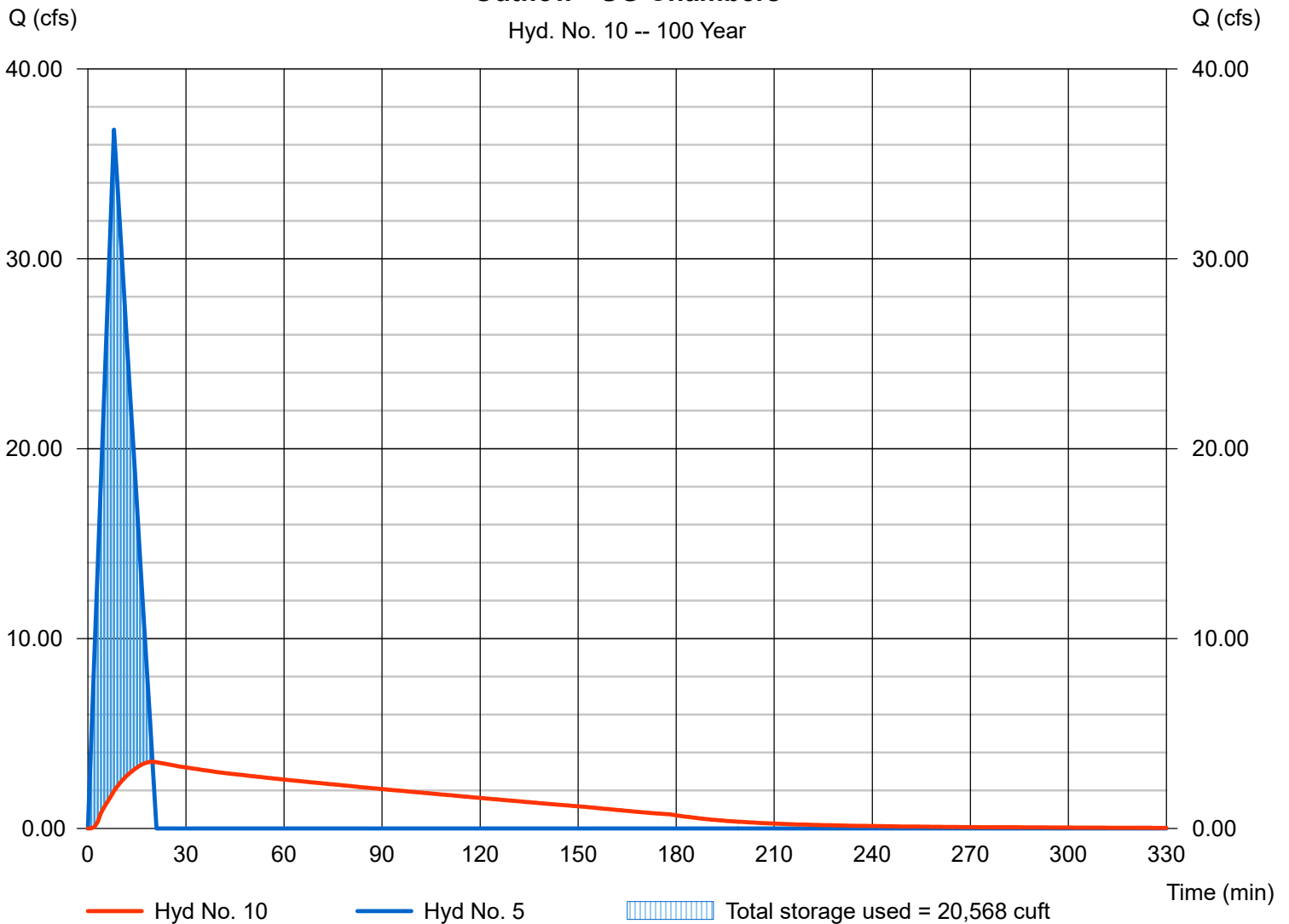
Hyd. No. 10

Outflow - UG Chambers

Hydrograph type	= Reservoir	Peak discharge	= 3.510 cfs
Storm frequency	= 100 yrs	Time to peak	= 20 min
Time interval	= 1 min	Hyd. volume	= 23,167 cuft
Inflow hyd. No.	= 5 - WS-PR-1-DET	Max. Elevation	= 315.42 ft
Reservoir name	= UG Chambers	Max. Storage	= 20,568 cuft

Storage Indication method used.

Outflow - UG Chambers



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Tuesday, Jun 8, 2021

Hyd. No. 11

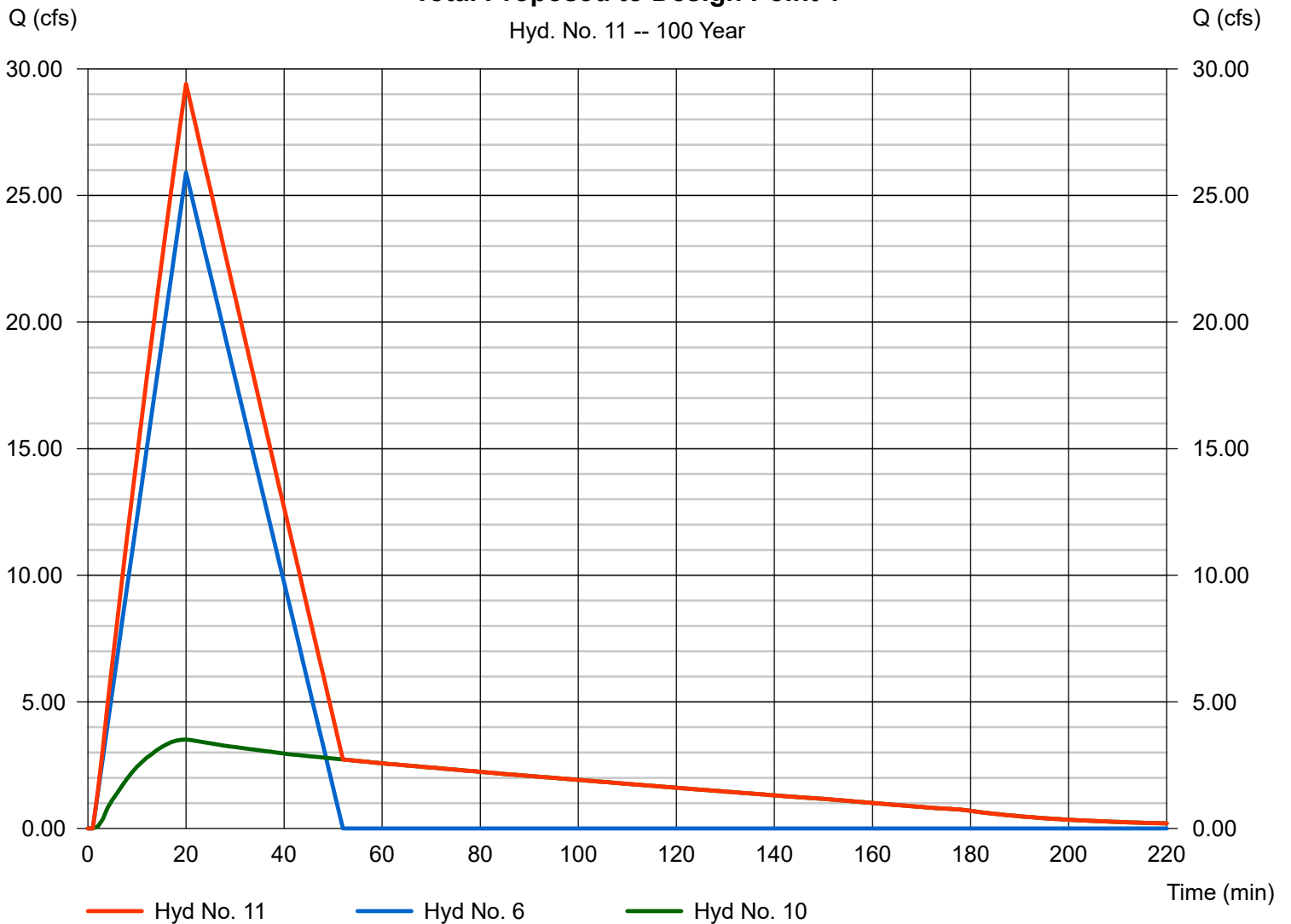
Total Proposed to Design Point 1

Hydrograph type = Combine
 Storm frequency = 100 yrs
 Time interval = 1 min
 Inflow hyds. = 6, 10

Peak discharge = 29.41 cfs
 Time to peak = 20 min
 Hyd. volume = 62,794 cuft
 Contrib. drain. area = 10.390 ac

Total Proposed to Design Point 1

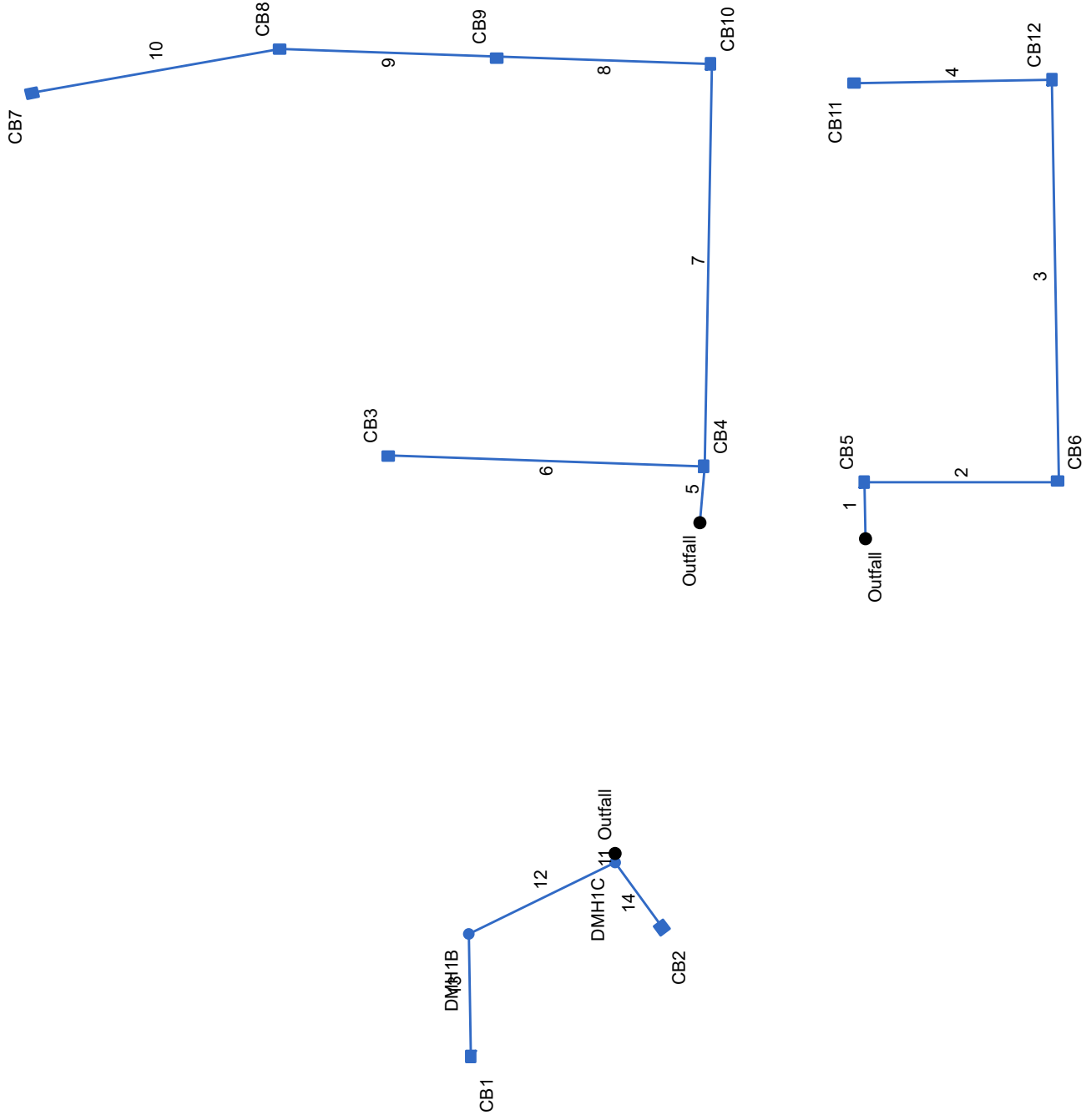
Hyd. No. 11 -- 100 Year



ATTACHMENT E

Pipe-to-Pipe Analysis

Hydraflow Storm Sewers Plan



Storm Sewer Tabulation

Station	Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID	
		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)		
1	End	25	0.33	1.78	0.88	0.29	1.55	5.0	7.0	7.4	11.49	0.00	3.66	24	0.00	312.51	312.51	314.51	314.57	318.00	323.40	OUTFALL2-CB6
2	1	86	0.66	1.45	0.87	0.57	1.26	5.0	6.5	7.7	9.64	12.92	7.23	18	1.29	317.84	318.95	318.81	320.13	323.40	322.45	CB6-CB5
3	2	178	0.56	0.79	0.86	0.48	0.68	5.0	5.5	8.2	5.62	9.20	5.10	15	1.73	319.20	322.28	320.45	323.23	322.45	325.53	CB6-CB12
4	3	88	0.23	0.23	0.87	0.20	0.20	5.0	5.0	8.6	1.72	7.39	3.01	12	3.67	322.53	325.76	323.65	326.32	325.53	328.76	CB12-CB11
5	End	25	0.46	2.21	0.85	0.39	1.76	5.0	7.7	7.1	12.47	0.00	3.97	24	0.00	312.51	312.51	314.51	314.57	318.00	325.02	OUTFALL1-CB4
6	5	140	0.53	0.53	0.77	0.41	0.41	5.0	5.0	8.6	3.50	8.40	5.55	15	1.44	321.77	323.79	322.33	324.54	325.02	327.04	CB4-CB3
7	5	178	0.23	1.22	0.87	0.20	0.96	5.0	6.7	7.6	7.25	14.41	9.10	15	4.24	321.77	329.32	322.40	330.40	325.02	332.57	CB4-CB10
8	7	95	0.39	0.99	0.83	0.32	0.76	5.0	6.2	7.9	5.95	11.71	5.32	15	2.80	329.32	331.98	330.68	332.96	332.57	335.23	CB10-CB9
9	8	96	0.39	0.60	0.79	0.31	0.43	5.0	5.6	8.2	3.55	4.61	4.96	12	1.43	332.23	333.60	333.16	334.40	335.23	336.60	CB9-CB8
10	9	111	0.21	0.21	0.60	0.13	0.13	5.0	5.0	8.6	1.08	2.95	1.71	12	0.59	333.60	334.25	334.80	334.89	336.60	337.25	CB8-CB7
11	End	4	0.00	1.03	0.00	0.00	0.89	0.0	5.7	8.1	7.20	0.00	2.29	24	0.00	312.51	312.51	314.51	314.51	319.22	319.95	OUTFALL3-DMH1
12	11	72	0.00	0.50	0.90	0.00	0.42	5.0	5.3	8.4	3.47	4.95	2.83	15	0.50	313.01	313.37	314.59	314.77	319.95	319.41	DMH1C-DMH1B
13	12	54	0.50	0.50	0.83	0.42	0.42	5.0	5.0	8.6	3.56	4.95	2.90	15	0.50	313.37	313.64	314.88	315.02	319.41	316.48	DMH1B-CB1
14	11	36	0.53	0.53	0.89	0.47	0.47	5.0	5.0	8.6	4.04	7.00	5.36	15	1.00	314.14	314.50	314.82	315.31	319.95	318.25	DMH1C-CB2

Project File: Pipe-to-Pipe-2020-06-04.stm

Number of lines: 14

Run Date: 06-08-2021

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

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-CB6	11.49	24	Cir	25	312.51	312.51	0.000	314.51*	314.57*	0.31	314.88	End	Combination
2	CB6-CB5	9.64	18	Cir	86	317.84	318.95	1.291	318.81	320.13	0.97	320.13	1	Combination
3	CB6-CB12	5.62	15	Cir	178	319.20	322.28	1.730	320.45	323.23	n/a	323.23 j	2	Combination
4	CB12-CB11	1.72	12	Cir	88	322.53	325.76	3.670	323.65	326.32	n/a	326.32 j	3	Combination
5	OUTFALL1-CB4	12.47	24	Cir	25	312.51	312.51	0.000	314.51*	314.57*	0.55	315.12	End	Combination
6	CB4-CB3	3.50	15	Cir	140	321.77	323.79	1.443	322.33	324.54	n/a	324.54	5	Combination
7	CB4-CB10	7.25	15	Cir	178	321.77	329.32	4.242	322.40	330.40	n/a	330.40	5	Combination
8	CB10-CB9	5.95	15	Cir	95	329.32	331.98	2.800	330.68	332.96	n/a	332.96 j	7	Combination
9	CB9-CB8	3.55	12	Cir	96	332.23	333.60	1.427	333.16	334.40	n/a	334.40 j	8	Combination
10	CB8-CB7	1.08	12	Cir	111	333.60	334.25	0.586	334.80	334.89	0.06	334.95	9	Combination
11	OUTFALL3-DMH1C	7.20	24	Cir	4	312.51	312.51	0.000	314.51*	314.51*	0.08	314.59	End	Manhole
12	DMH1C-DMH1B	3.47	15	Cir	72	313.01	313.37	0.500	314.59*	314.77*	0.11	314.88	11	Manhole
13	DMH1B-CB1	3.56	15	Cir	54	313.37	313.64	0.500	314.88*	315.02*	0.13	315.15	12	Combination
14	DMH1C-CB2	4.04	15	Cir	36	314.14	314.50	1.000	314.82	315.31	0.36	315.67	11	Combination

Project File: Pipe-to-Pipe-2020-06-04.stm

Number of lines: 14

Run Date: 06-08-2021

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

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)	Depth (ft)	
1	CB5	2.49	0.93	2.47	0.95	Comb	3.0	5.83	0.00	5.83	1.63	0.014	2.00	0.030	0.021	0.013	0.22	9.52	0.34	8.06	2.0	2
2	CB6	4.92	0.95	5.87	0.00	Comb	3.0	3.14	3.13	1.63	Sag	2.00	0.030	0.021	0.000	0.31	13.97	0.46	13.97	2.0	Off	
3	CB12	4.13	0.50	4.62	0.00	Comb	3.0	3.14	3.13	1.63	Sag	2.00	0.030	0.015	0.000	0.25	14.89	0.39	14.89	2.0	Off	
4	CB11	1.72	0.67	1.89	0.50	Comb	3.0	3.14	0.00	1.63	0.036	2.00	0.030	0.044	0.013	0.18	4.66	0.29	2.83	2.0	3	
5	CB4	3.35	0.00	2.42	0.93	Comb	3.0	5.83	0.00	1.63	0.015	2.00	0.030	0.021	0.013	0.21	9.33	0.33	7.83	2.0	1	
6	CB3	3.50	0.18	3.20	0.48	Comb	3.0	5.83	0.00	1.63	0.045	2.00	0.030	0.066	0.013	0.21	4.29	0.35	2.75	2.0	12	
7	CB10	1.72	1.44	2.48	0.67	Comb	3.0	5.83	0.00	1.63	0.028	2.00	0.030	0.032	0.013	0.20	6.38	0.32	4.73	2.0	4	
8	CB9	2.77	0.61	1.95	1.44	Comb	3.0	3.14	0.00	1.63	0.005	2.00	0.030	0.020	0.013	0.26	11.90	0.38	10.72	2.0	7	
9	CB8	2.64	0.00	2.03	0.61	Comb	3.0	3.14	0.00	1.63	0.026	2.00	0.030	0.044	0.013	0.20	5.11	0.32	3.46	2.0	8	
10	CB7	1.08	0.00	0.90	0.18	Comb	3.0	3.14	0.00	1.63	0.015	2.00	0.030	0.033	0.013	0.15	4.73	0.25	2.43	2.0	6	
11	DMH1C	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off	
12	DMH1B	0.00	0.48	0.00	0.48	MH	0.0	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00	Off	
13	CB1	3.56	0.00	3.56	0.00	Comb	3.0	5.83	6.26	1.63	Sag	2.00	0.030	0.048	0.013	0.06	1.91	0.26	1.98	2.0	Off	
14	CB2	4.04	0.00	4.04	0.00	Comb	3.0	5.83	6.26	1.63	Sag	2.00	0.030	0.041	0.013	0.10	3.01	0.29	3.01	2.0	Off	

Project File: Pipe-to-Pipe-2020-06-04.stm

Number of lines: 14

Run Date: 06-08-2021

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 , CT
Water Quality Volume Size Calculations

June 4, 2021

Minimum-Recommended Water Quality Volume (WQV)

Watershed	Total Area (Ac) A	Impervious Area (Ac)	Impervious (%) I	Runoff (R)	Min. Rec. WQV (ac-ft)	Min. Rec. WQV (Cu.Ft.)
WS-PR-1-DET	5.15	4.65	90.3	0.8626	0.37021	16,126
Isolator Row NW*	2.21	1.88	85.1	0.8156	0.15021	6,543
Isolator Row NE**	1.88	1.77	94.1	0.8973	0.14058	6,124
Isolator Row S***	1.04	0.97	93.3	0.8894	0.07708	3,358

* CB's 3, 4, 7, 8, 9, 10
 ** CB's 1, 2, 5, 6, 11, 12
 *** CB's 1 & 2

$$WQV = \frac{(1)(R)(A)}{12}$$

WQV = water quality volume (ac-ft)

R = volumetric runoff coefficient
 0.05+0.009(I)

I = percent impervious cover

A= Site area (acres)

40 Wisconsin Avenue
Norwich, Connecticut

U.G. Infiltration System

Stage-Storage Relationship

Number of SC-740 Chambers = 279

Minimum-recommended Water Quality Volume = **16,126 CU FT**

WQV Provided below overflow weir (el. 315.25):

Storage vol.@ el. 315.00 = **19,011 CU FT**

279 Chambers Provided: Total Storage = **19,011 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)
	Stormceptor Units ***			
312.00	0.000	1986	0	0
312.50	0.950	1986	1886	1886
313.00	2.044	1986	4059	5945
313.50	1.956	1986	3884	9829
314.00	1.821	1986	3616	13445
314.50	1.612	1986	3200	16645
315.00	1.192	1986	2366	19011
315.50	0.950	1986	1886	20897
316.00	0.000	1986	10	20907
316.50	0.000	1986	10	20917
317.00	0.000	1986	10	20927

Storage Vol. per Chamber (CU FT) *
0
6.76
21.31
35.23
48.19
59.66
68.14
74.9

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

40 Wisconsin Road, Norwich , CT Water Quality Flow Calculations

June 4, 2021

Minimum-Recommended Water Quality Flow (WQF) Isolator Row NE *

Runoff Depth (Q) = WQV * (12) / A

A = Area (Acres) 1.88 Ac
WQV = Water Quality Volume (Ac-Ft) 0.14058 Ac-Ft

Q =	0.90 in
-----	---------

NRCS Curve Number (CN) = 95

Time of Concentration (Tc) = 7 Min,
0.12 Hrs

Calculate initial abstraction (Ia) = 0.2 x S

S = (1000/CN)-10 S = 0.53
Ia = 0.105

Compute Ia/P:

P = 1 inch for WQF Ia/P = 0.105

Obtain qu (Read from Exhibit 4-111, TR-55) qu = 625 csm/in

Compute Water Quality Flow (WQF) = qu x Asm X Q

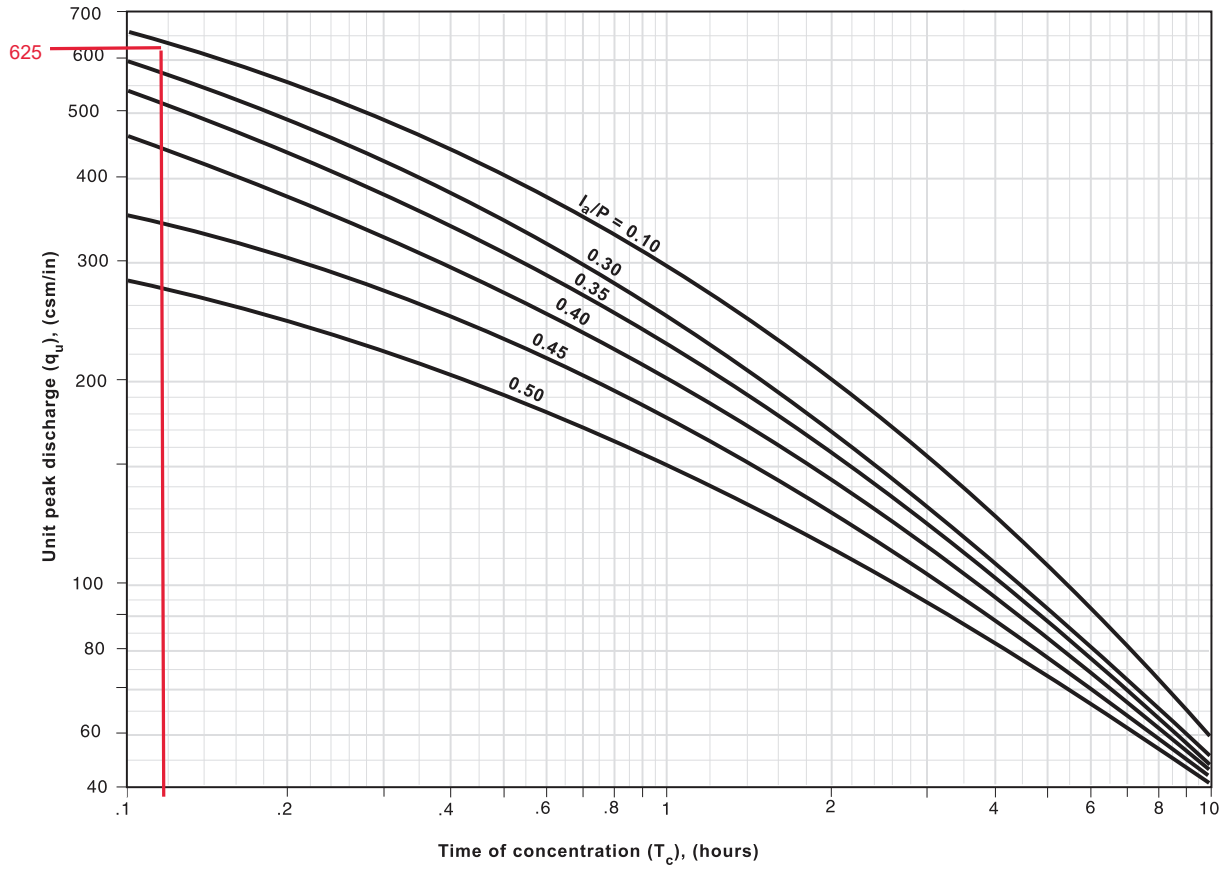
qu = 625 csm/in
Asm = 0.0029375 sq. mi.
Q = 0.90 in

WQF =	1.65 CFS
-------	----------

* CBs 5, 6, 11, and 12

Isolator Row NE

Exhibit 4-III Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



40 Wisconsin Road, Norwich , CT Water Quality Flow Calculations

June 4, 2021

Minimum-Recommended Water Quality Flow (WQF) Isolator Row NW *

Runoff Depth (Q) = WQV * (12) / A

A = Area (Acres) 2.21 Ac
WQV = Water Quality Volume (Ac-Ft) 0.15021 Ac-Ft

Q =	0.82 in
-----	---------

NRCS Curve Number (CN) = 94

Time of Concentration (Tc) = 7 Min,
0.12 Hrs

Calculate initial abstraction (Ia) = 0.2 x S

S = (1000/CN)-10 S = 0.64
Ia = 0.128

Compute Ia/P:

P= 1 inch for WQF Ia/P = 0.128

Obtain qu (Read from Exhibit 4-111, TR-55) qu = 620 csm/in

Compute Water Quality Flow (WQF) = qu x Asm X Q

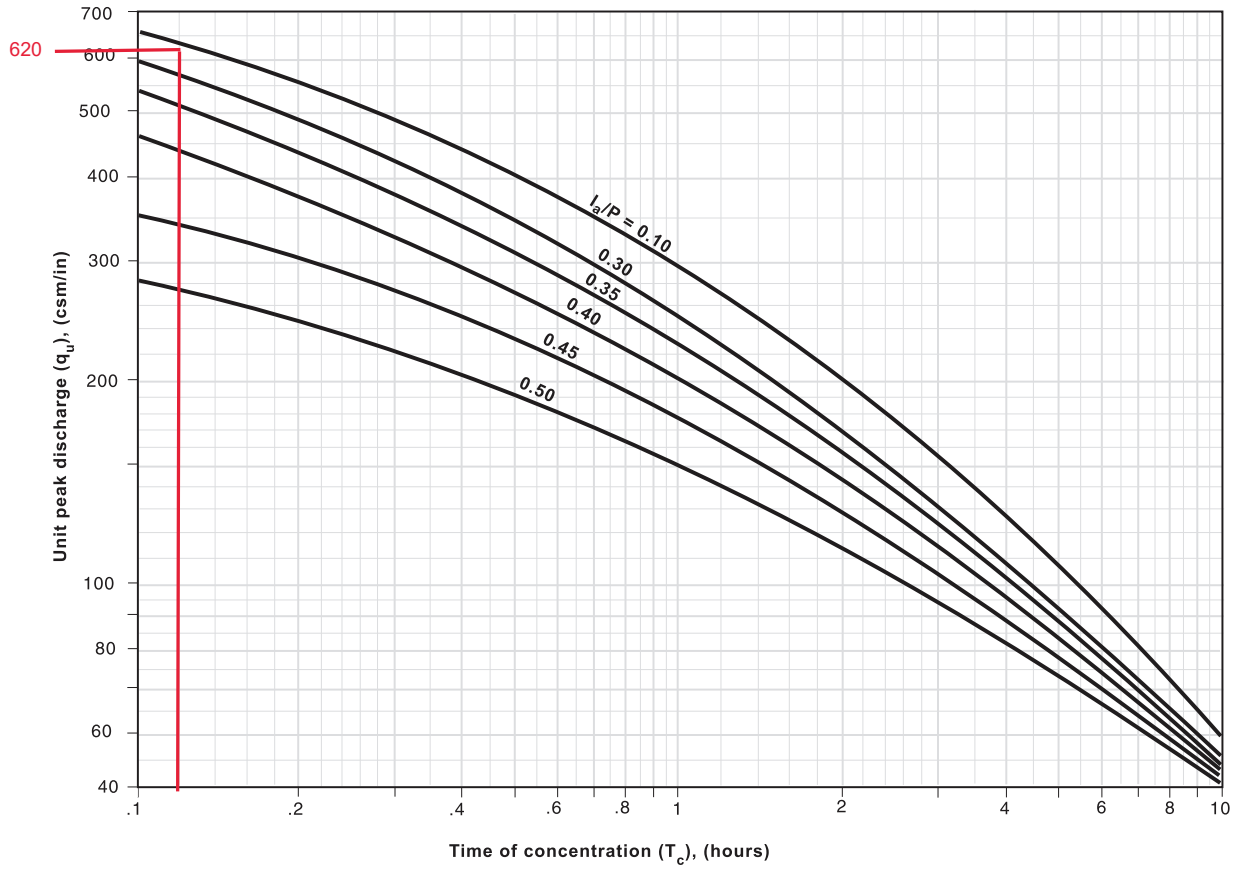
qu = 620 csm/in
Asm = 0.0034531 sq. mi.
Q = 0.82 in

WQF =	1.75 CFS
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* CBs 3, 4, 7, 8, 9, and 10

Isolator Row NW

Exhibit 4-III Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution



40 Wisconsin Road, Norwich , CT Water Quality Flow Calculations

June 4, 2021

Minimum-Recommended Water Quality Flow (WQF) Isolator Row S *

Runoff Depth (Q) = WQV * (12) / A

A = Area (Acres)

1.04 Ac

WQV = Water Quality Volume (Ac-Ft)

0.07708 Ac-Ft

Q =	0.89 in
-----	---------

NRCS Curve Number (CN) =

96

Time of Concentration (Tc) =

7 Min,
0.12 Hrs

Calculate initial abstraction (Ia) = 0.2 x S

S = (1000/CN)-10

S = 0.42

Ia = 0.083

Compute Ia/P:

P= 1 inch for WQF

Ia/P = 0.083

Obtain qu (Read from Exhibit 4-111, TR-55)

qu = 700 csm/in

Compute Water Quality Flow (WQF) = qu x Asm X Q

qu = 700 csm/in

Asm = 0.001625 sq. mi.

Q = 0.89 in

WQF =	1.01 CFS
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* CBs 1 and 2

Isolator Row S

Exhibit 4-III Unit peak discharge (q_u) for NRCS (SCS) type III rainfall distribution

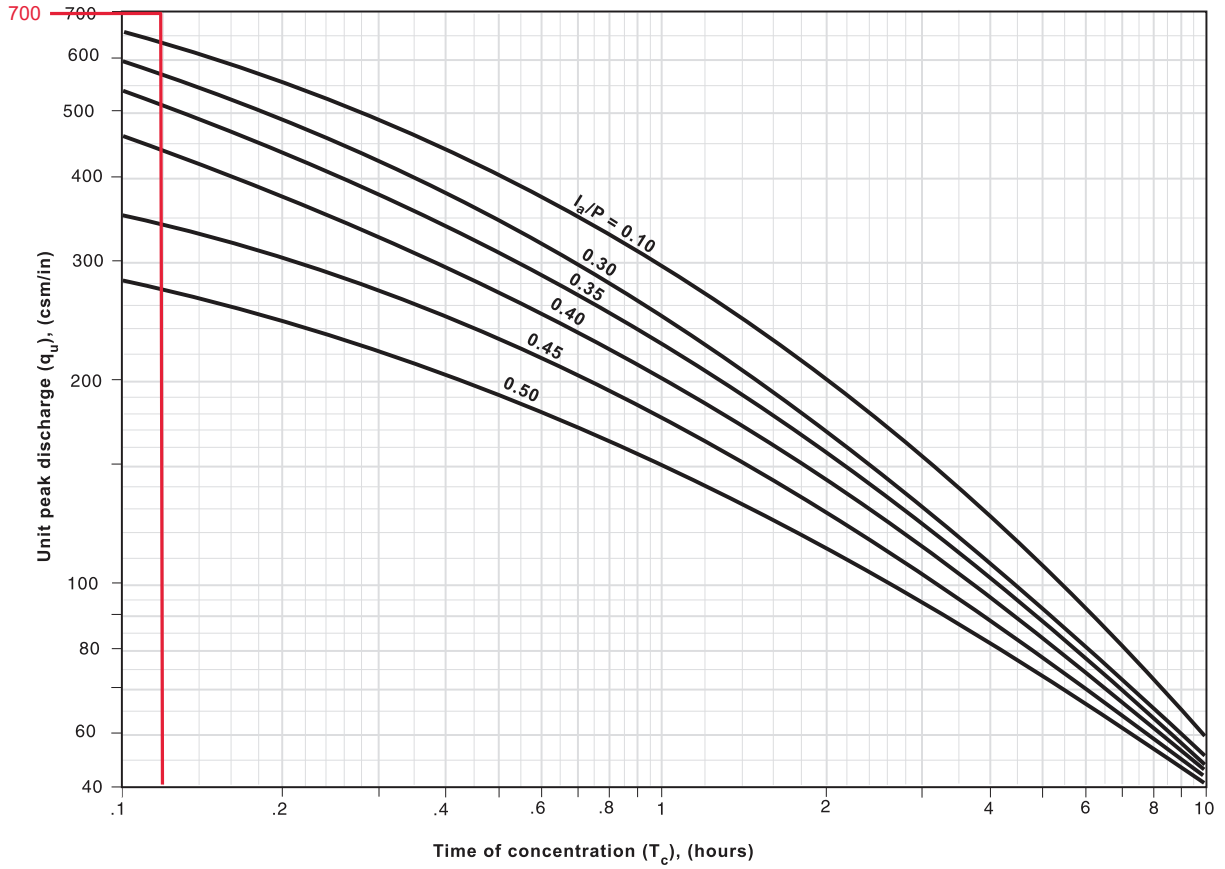


Table 2-2a Runoff curve numbers for urban areas ^{1/}

Cover description	Average percent impervious area ^{2/}	Curve numbers for hydrologic soil group			
		A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) ^{3/} :					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) ^{4/}		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82

Developing urban areas

Newly graded areas
(pervious areas only, no vegetation) ^{5/}

	77	86	91	94
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Idle lands (CN's are determined using cover types
similar to those in table 2-2c).

^{1/} Average runoff condition, and $I_a = 0.2S$.

^{2/} The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

^{3/} CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

^{4/} Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

^{5/} Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands ^{1/}

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment ^{2/}	Hydrologic condition ^{3/}	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
C&T+ CR	Poor	65	73	79	81	
	Good	61	70	77	80	
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
C&T+ CR	Poor	60	71	78	81	
	Good	58	69	77	80	
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

¹ Average runoff condition, and $I_a=0.2S$

² Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

³ Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good $\geq 20\%$), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands ^{1/}

Cover description	Hydrologic condition	Curve numbers for hydrologic soil group			
		A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. ^{2/}	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. ^{3/}	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 ^{4/}	48	65	73
Woods—grass combination (orchard or tree farm). ^{5/}	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. ^{6/}	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 ^{4/}	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

¹ Average runoff condition, and $I_a = 0.2S$.

² **Poor:** <50% ground cover or heavily grazed with no mulch.

Fair: 50 to 75% ground cover and not heavily grazed.

Good: > 75% ground cover and lightly or only occasionally grazed.

³ **Poor:** <50% ground cover.

Fair: 50 to 75% ground cover.

Good: >75% ground cover.

⁴ Actual curve number is less than 30; use CN = 30 for runoff computations.

⁵ CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

⁶ **Poor:** Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.

Fair: Woods are grazed but not burned, and some forest litter covers the soil.

Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

40 Wisconsin Ave
Norwich, CT

WEIGHTED CN VALUES CALCULATIONS

6/4/2021

	Areas in Acres		Total Area (S.F.)	Weighted CN
	Landscape	Imperv.		
CN Values	69	98		
WS-PR-1-DET	0.50	4.65	5.15	95
Isolator Row NE*	0.17	1.71	1.88	95
Isolator Row NW*	0.33	1.88	2.21	94
Isolator Row S*	0.07	0.97	1.04	96