Appendix A: Service Letter from Village of Byesville

VILLAGE OF BYESVILLE

Office of the Village Administrator

January 13, 2017

Re: The Guernsey Power Station

To Whom It May Concern:

The Village of Byesville is pleased to extend water and sanitary sewer service to the Guernsey Power Station (GPS).

We have an 8" HDPE C900 water line that is within 3,000' feet of the proposed GPS location. This line was installed in 2011. Due to the current proximity extending the line to meet the needs of the GPS would require minimal design and planning.

Our Ultra Filtration water treatment facility currently produces an average of 1.6 million gallons per day (MGD) of potable water. We currently utilize three "wells" that are capable of pumping 3.7 MGD of raw water to the facility. The facility is currently rated to provide 2.5 MGD; however planned upgrades in 2017 will increase filtration capacity to 3.5 MGD. We have also drilled two additional test holes for a proposed 4th "well" source.

Extending sanitary sewer service to the GPS will require the extension of approximately 9,500' feet of line. We are currently analyzing options for the most efficient and cost effective design.

Our Waste Water Treatment facility was placed online in 2011 and treats an average of 250,000 gallons per day (GPD) of residential and industrial waste. Current rated capacity for the facility is 1.0 MGD. In 2017 we will move forward with Phase II of a collection system reline project that will help to reduce and eliminate current inflow and infiltration issues. The completion of this project will further reduce current flow and increase capacity.

221 E. Main Ave
PO Box 8
Byesville, OH 43723

PHONE 740-685-0800 ext 1001
FAX 740-685-8633
EMAIL bdudley@byesvilleoh.gov

The Village of Byesville will continue to work cooperatively with the GPS to provide the necessary infrastructure.

Sincerely,

Brennan D. Dudley
Village Administrator

Appendix B: Stormwater Analysis

Preliminary Stormwater Management Analysis

Guernsey Power Station

Valley Township
Guernsey County, Ohio

Prepared for:

Guernsey Power Station, LLC
6229 White Alder Court
Avon, IN 46123

by

Tetra Tech, Inc.
6715 Tippecanoe Road
Canfield, OH 44406

February 2017

GUERNSEY POWER STATION
VALLEY TOWNSHIP, GUERNSEY COUNTY, OHIO

PRELIMINARY STORMWATER MANAGEMENT ANALYSIS

Table of Contents

i. COVER

ii. TABLE OF CONTENTS

I. POST CONSTRUCTION STORMWATER MANAGEMENT NARRATIVE

- 1.0 Project Overview
- 2.0 Existing Conditions
- 3.0 Stormwater Best Management Practices
- 4.0 Summary

Attachments

Attachment A Site Location Map

Attachment B Custom Soil Resource Report

Attachment C Hydrologic Calculations

GUERNSEY POWER STATION
VALLEY TOWNSHIP, GUERNSEY COUNTY, OHIO

PRELIMINARY STORMWATER MANAGEMENT ANALYSIS

1.0 PROJECT OVERVIEW

Tetra Tech, Inc. (Tetra Tech) has prepared this preliminary stormwater management analysis on behalf of Guernsey Power Station LLC to review potential impacts and conceptual mitigation measures associated with the proposed Guernsey Power Station (the Facility). The Facility is a proposed 1,650-megawatt natural gas fired energy generation facility that will be located in Valley Township, Guernsey County, Ohio approximately 1 mile north of Derwent and approximately 0.75 mile east of the intersection of OH-821 (Marietta Road) and Seneca Lane (Facility Site). A Site Location Map is provided in Attachment A.

2.0 EXISTING CONDITIONS

The Site exists as open land primarily consisting of agricultural field traversed by electric and natural gas utility corridors with a few residential dwellings to the north along Seneca Lane and Puritan Street. Access to the Site is via Puritan Street from the north. The Site is bounded by Seneca Lane to the north, Interstate 77 to the east, Wills Creek to the south, and a railroad track to the west.

The existing surface condition at the Site is primarily meadow in good condition with few trees and small residential parcels. Site topography reflects approximate elevations ranging from 800' to 832', with decreasing elevations sloping to the south, east, and west. Contour ranges from approximately 1 to 30 percent. Runoff currently drains to wetland areas that ultimately discharge into Wills Creek. Existing site soil is predominantly Mentor and Glenford silt loam; hydraulic soil group (HSG) B and C, respectively. A Custom Soil Resource Report is provided in Attachment B.

3.0 STORMWATER BEST MANAGEMENT PRACTICES

This *Preliminary Stormwater Management Analysis* provides concepts that may be incorporated into design of a Storm Water Pollution Prevention Plan (SWPPP) for implementation during and upon completion of construction activities. A separate approach in regards to the handling of stormwater runoff will be required for each construction stage. During earth disturbance activities, an Erosion and Sediment Pollution Control (E&S) Plan will implement best management practices (BMPs) to reduce and/or prevent soil loss and the likelihood of pollution to surface waters caused by erosion and sedimentation. Upon completion of earth disturbance activities, a Post Construction Stormwater Management Plan (PCSM) will implement BMPs to mitigate increases in runoff flow rate and volume attributable to development, and to promote water quality once the site has become stabilized.

As required by the Ohio Environmental Protection Agency (Ohio EPA) General Permit, a SWPPP will be prepared for the Facility that will remain onsite during each stage of construction. The SWPPP will provide in-depth detail regarding pre- vs. post-development Site characteristics, Site design, E&S plans and details, PCSM plans and details, and supporting calculations. The SWPPP will be prepared in accordance guidance defined within the latest edition of the Ohio Department of Natural Resources (ODNR) *Rainwater and Land Development Manual*; and in accordance with codes and ordinances of Guernsey County and/or other associated agencies having jurisdiction. A Notice of Intent (NOI) for General Permit authorization for discharges associated with construction activities will be submitted for approval by the Ohio EPA. Additionally, the Facility SWPPP will be submitted as directed by Guernsey County for review and approval.

Construction Stage

During construction, the Contractor will comply with requirements defined within the approved SWPPP and requirements of the Ohio EPA General Permit. The SWPPP will propose E&S BMPs to minimize pollution to surface waters caused by erosion and sedimentation. E&S BMPs will be structural and nonstructural practices that may include, but may not be limited to: a rock construction entrance, compost filter sock barriers, inlet protection, pumped water filter bags, sediment basin, erosion control blanket, and/or temporary/permanent vegetative stabilization.

E&S BMPs will be designed and maintained in accordance with guidance defined by the *Ohio Rainwater and Land Development Manual*. The SWPPP will include a sequence of construction that minimizes the amount of earth disturbance to that which is necessary to complete objectives of the Facility. A rock construction entrance will be installed to prevent the tracking of mud onto public roadways. Compost filter sock barriers will be installed down slope of disturbed areas to prevent offsite conveyance of sediment caused by sheet flow. Inlet protection will prevent sediment from entering proposed storm sewers that discharge into downstream receiving waters. A sediment basin may be installed to allow settling time for runoff collected from disturbed areas prior to offsite discharge. The sediment basin will be converted into a permanent stormwater detention basin once the Site has achieved stabilization upon completion of construction, and the basin outlet structure will be designed for dual purpose use; it will be modified as necessary during Facility construction phasing. All E&S control BMPs will be maintained during construction by removing accumulated sediment and will be repaired/replaced when necessary. Upon completion of construction, all previously disturbed areas not otherwise stabilized with pavement or aggregate will be stabilized using permanent vegetation.

Post Construction Stage

Upon completion of construction, the permittee will comply with requirements defined within the approved SWPPP and requirements of the Ohio EPA General Permit. The SWPPP will propose PCSM BMPs that mitigate flow rate increases attributable to Site development and promote water quality; the primary structural PCSM BMPs will be a detention basin.

A hydrologic model has been prepared based on the preliminary Site layout plan to develop PCSM BMP concepts that may be suitable for the Facility; Hydrologic Calculations are provided in

Attachment C. The hydrologic model provides a pre- vs. post-development comparison of anticipated runoff flow rates. The flow rate comparison is used to approximate volume of stormwater detention and to determine configuration of an outlet structure for a detention basin that will reduce post-development flow rates to rates that are less than or equal to those of the pre-development Site condition. Conceptual sizing and location of a detention basin has been determined and identified on HYD-02; the basin has also been implemented within the hydrologic model. The model demonstrates that the detention basin can achieve its intended purpose of flow rate reduction. Performance characteristics are summarized Tables 1 through 3.

Table 1

Pre- vs Post-Development Peak Discharge			
Storm Event	**Pre-Dev**	**Post-Dev**	**Difference**
year	cfs	cfs	cfs
2	6.42	2.33	-4.09
10	25.45	12.93	-12.52
25	41.70	32.16	-9.54
50	56.29	50.19	-6.10
100	73.41	61.99	-11.42

cfs, cubic feet per second

Table 2

Pre- vs Post-Development Peak Discharge			
Storm Event	**Pre-Dev**	**Post-Dev**	**Difference**
year	cfs	cfs	cfs
2	2.97	2.72	-0.27
10	12.98	8.55	-4.43
25	21.98	13.16	-8.82
50	30.13	17.23	-12.90
100	39.74	21.95	-17.79

Table 3

Pre- vs Post-Development Peak Discharge			
Storm Event	**Pre-Dev**	**Post-Dev**	**Difference**
year	cfs	cfs	cfs
2	2.46	2.00	-0.46
10	8.28	6.73	-1.55
25	13.03	10.59	-2.44
50	17.26	14.03	-3.23
100	22.17	18.03	-4.14

In addition to flow rate reduction, the detention basin also includes capacity for water quality volume (WQv). WQv is a post-construction stormwater control requirement of the Ohio EPA

General Permit and is a volume of water collected via stormwater runoff that must be retained on Site and treated through the use of methods such as infiltration, evaporation, vegetative uptake, or a combination thereof. WQv is calculated using an equation defined in the *Ohio Rainwater and Land Development Manual*. For the purpose of this analysis, WQv has been determined as summarized in Table 4; standard runoff coefficients are identified in Table 5.

Table 4

WQv = [C x P x A / 12] x 1.20	
C = Runoff Coefficient	0.8
P = precipitation (in)	0.75
A = BMP drainage area (ac)	27.27
WQv (ac-ft)	**1.64**

Table 5

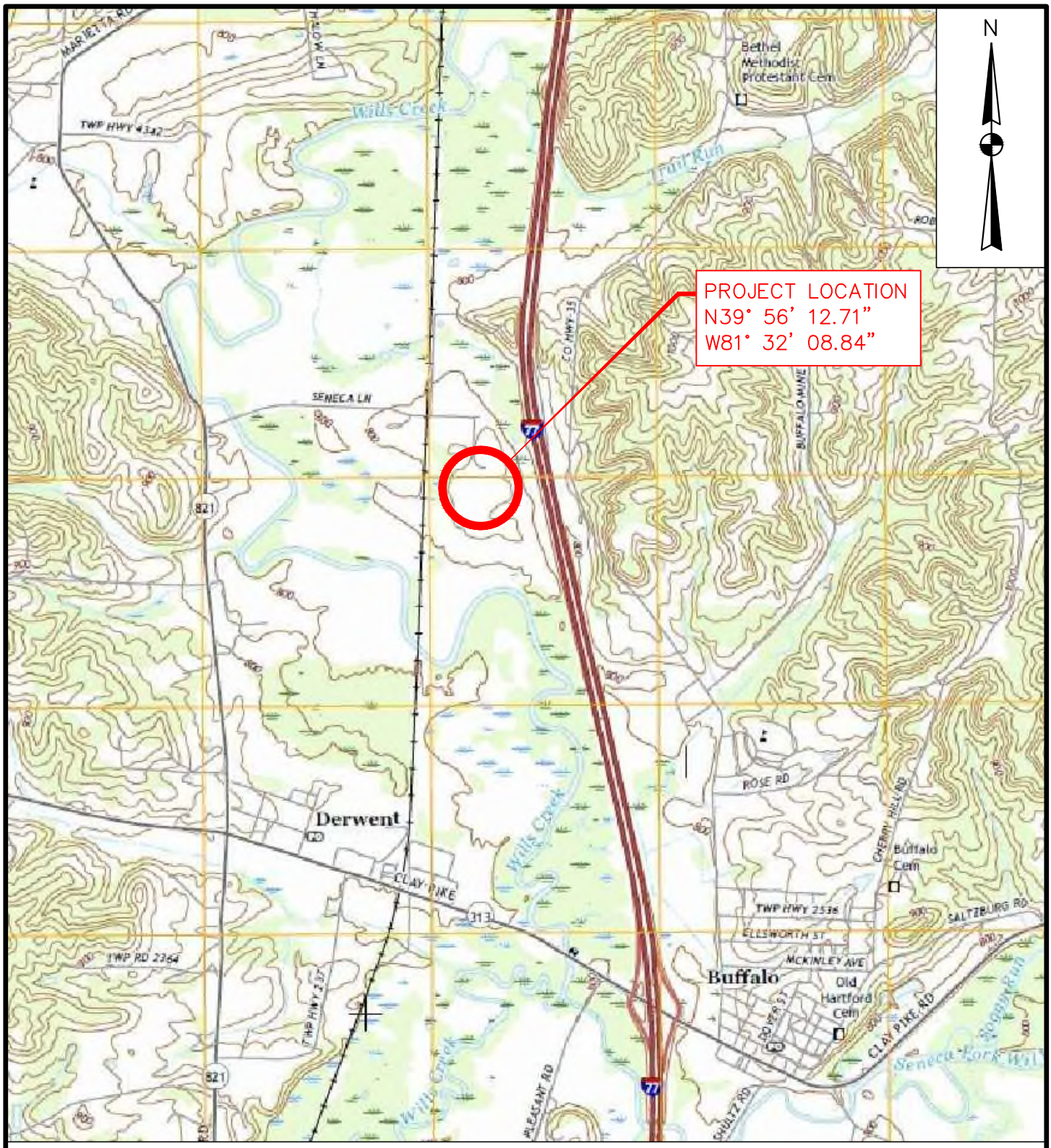
Runoff Coefficient per Land Use	
Industrial / Commercial	0.8
High Density Residential	0.5
Medium Density Residential	0.4
Low Density Residential	0.3
Open Space	0.2

Additional PCSM BMPs can be implemented in conjunction with the detention basin as necessary based on completion of the Facility's final design. For the purpose of this analysis, the single detention basin is sufficient to achieve the required stormwater management objectives; flow could be directed to multiple basis, as design warrants.

4.0 SUMMARY

The purpose of this *Preliminary Stormwater Management Analysis* is to develop conceptual ideas relating to post construction stormwater management planning for proposed construction of the Facility and confirm that an adequate design can be established. The material contained herein is subject to change based on final design. Upon completion of the final design, a SWPPP will be prepared and submitted for review and approval as directed by Guernsey County; and an NOI will be submitted to Ohio EPA for issuance of a General Permit. The SWPPP will specify E&S BMPs and PCSM BMPs that will be implemented during various stages of construction to preserve and promote water quality. This analysis demonstrates that BMPs of sufficient size and capacity can be implemented in locations that can achieve the required stormwater management objectives.

Site Location Map



BYESVILLE QUADRANGLE, OHIO
7.5-MINUTE SERIES, 2016

0 2000 4000
SCALE IN FEET

TETRA TECH
WWW.TETRATECH.COM

6715 TIPPECANOE ROAD – SUITE C201
CANFIELD, OH 44406
T: (330) 286-3683 | F: (330) 286-3573

GUERNSEY POWER STATIOIN
VALLEY TOWNSHIP, GUERNSEY COUNTY

SITE LOCATION MAP

DATE:	01/09/2017
PROJECT NO.:	212IC-CF-00122
DRAWN BY:	BC
CHECKED BY:	CM
SCALE:	AS NOTED
SHEET:	1 OF 1

COPYRIGHT TETRA TECH INC.

Custom Soil Resource Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Guernsey County, Ohio

Guernsey Power Station

January 9, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface..... 2
Soil Map..... 5
Soil Map.....6
Legend.....7
Map Unit Legend..... 8
Map Unit Descriptions..... 8
Guernsey County, Ohio.....10
GnA—Glenford silt loam, 0 to 3 percent slopes..... 10
McA—McGary silt loam, 0 to 3 percent slopes.....11
MeB—Mentor silt loam, 2 to 8 percent slopes.....12
MeC—Mentor silt loam, 8 to 15 percent slopes..... 13
Zs—Zipp silty clay loam, ponded..... 14
Soil Information for All Uses.....16
Soil Properties and Qualities..... 16
Soil Qualities and Features.....16
Hydrologic Soil Group..... 16
References.....21

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:3,890 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Guernsey County, Ohio
Survey Area Data: Version 14, Sep 19, 2016

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

Date(s) aerial images were photographed: Oct 7, 2011—May 11, 2012

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

Guernsey County, Ohio (OH059)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
GnA	Glenford silt loam, 0 to 3 percent slopes	22.0	37.3%
McA	McGary silt loam, 0 to 3 percent slopes	4.6	7.8%
MeB	Mentor silt loam, 2 to 8 percent slopes	18.3	31.0%
MeC	Mentor silt loam, 8 to 15 percent slopes	13.2	22.3%
Zs	Zipp silty clay loam, ponded	0.9	1.5%
Totals for Area of Interest		**59.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Guernsey County, Ohio

GnA—Glenford silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2s5h3
Elevation: 580 to 1,140 feet
Mean annual precipitation: 39 to 43 inches
Mean annual air temperature: 50 to 53 degrees F
Frost-free period: 130 to 193 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Glenford and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenford

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Silty lacustrine deposits

Typical profile

Ap - 0 to 10 inches: silt loam
Bt1 - 10 to 18 inches: silt loam
Bt2 - 18 to 34 inches: silt loam
BC - 34 to 50 inches: silty clay loam
C - 50 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 0.28 in/hr)
Depth to water table: About 15 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Very high (about 12.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Fitchville

Percent of map unit: 10 percent

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Hydric soil rating: No

Sebring

Percent of map unit: 5 percent
Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave, linear
Hydric soil rating: Yes

McA—McGary silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: l0q9
Elevation: 350 to 600 feet
Mean annual precipitation: 35 to 46 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 150 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Mcgary and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcgary

Setting

Landform: Terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Lacustrine deposits

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 36 inches: silty clay
H3 - 36 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.01 to 0.06 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Available water storage in profile: High (about 9.5 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Other vegetative classification: Unnamed (G124XYC-2OH)
Hydric soil rating: No

Minor Components

Poorly drained soils
Percent of map unit: 10 percent
Landform: Closed depressions
Hydric soil rating: Yes

Moderately well drained soils
Percent of map unit:

MeB—Mentor silt loam, 2 to 8 percent slopes

Map Unit Setting
National map unit symbol: l0qc
Elevation: 580 to 1,200 feet
Mean annual precipitation: 34 to 45 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 153 to 195 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Mentor and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mentor

Setting
Landform: Terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Lacustrine deposits

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 52 inches: silt loam
H3 - 52 to 80 inches: silt loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Fitchville

Percent of map unit: 5 percent
Landform: Terraces, lake plains
Down-slope shape: Concave
Across-slope shape: Linear

Moderately well drained soils

Percent of map unit:

MeC—Mentor silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: l0qd
Elevation: 580 to 1,200 feet
Mean annual precipitation: 34 to 40 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 153 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Mentor and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mentor

Setting

Landform: Terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Lacustrine deposits

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 48 inches: silt loam
H3 - 48 to 80 inches: silt loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Severely eroded areas

Percent of map unit: 10 percent

Moderately well drained soils

Percent of map unit:

Zs—Zipp silty clay loam, ponded

Map Unit Setting

National map unit symbol: l0rr
Elevation: 380 to 520 feet
Mean annual precipitation: 37 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Zipp and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zipp

Setting

Landform: Flood plains
Parent material: Lacustrine deposits

Typical profile

H1 - 0 to 8 inches: silty clay loam
H2 - 8 to 48 inches: silty clay
H3 - 48 to 80 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Sarahsville

Percent of map unit: 10 percent
Landform: Flood plains, terraces
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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

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

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

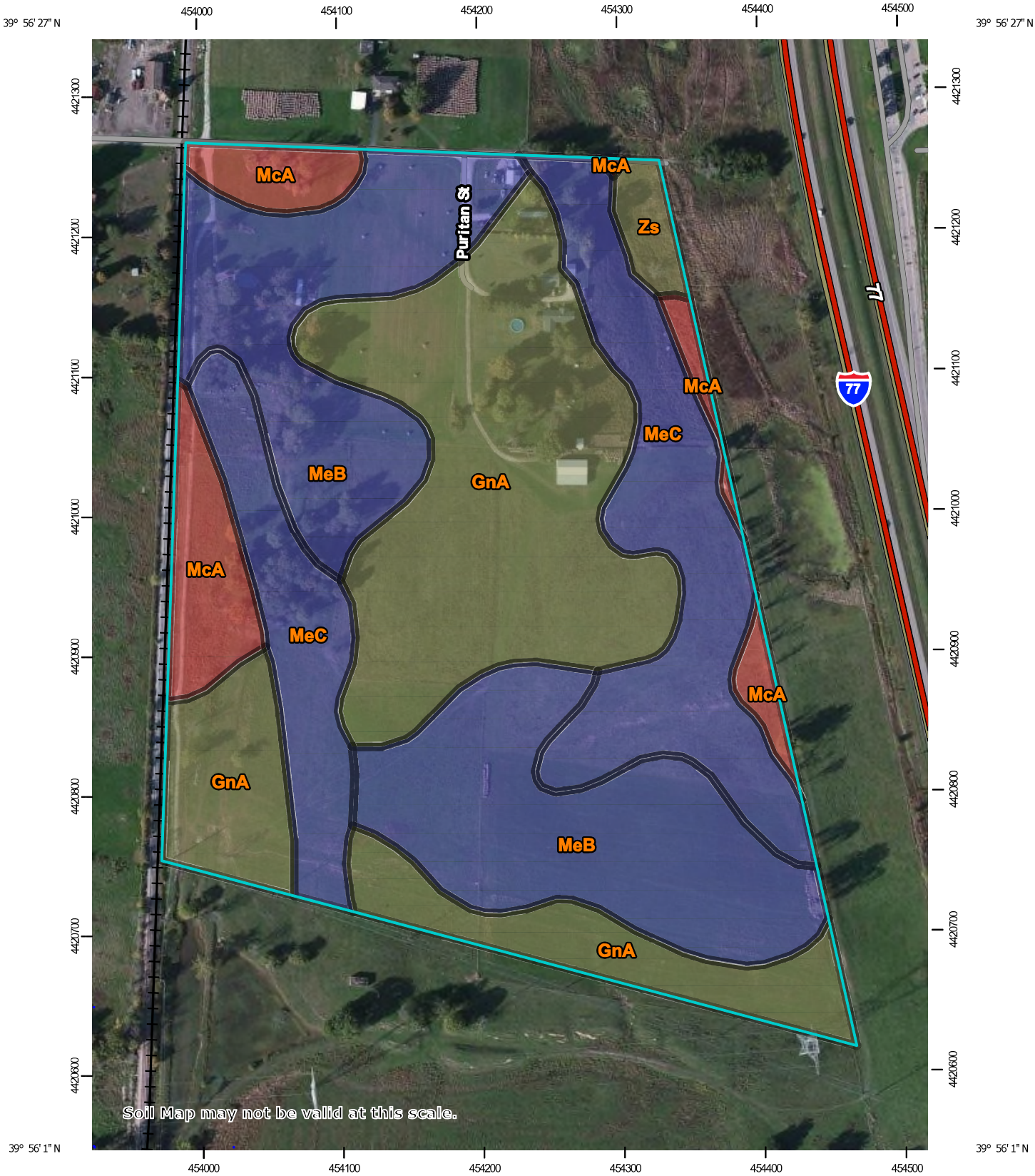
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

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

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

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:3,890 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Guernsey County, Ohio
Survey Area Data: Version 14, Sep 19, 2016

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

Date(s) aerial images were photographed: Oct 7, 2011—May 11, 2012

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.

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Guernsey County, Ohio (OH059)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GnA	Glenford silt loam, 0 to 3 percent slopes	C/D	22.0	37.3%
McA	McGary silt loam, 0 to 3 percent slopes	D	4.6	7.8%
MeB	Mentor silt loam, 2 to 8 percent slopes	B	18.3	31.0%
MeC	Mentor silt loam, 8 to 15 percent slopes	B	13.2	22.3%
Zs	Zipp silty clay loam, ponded	C/D	0.9	1.5%
Totals for Area of Interest			**59.1**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Tetra Tech, Inc.

Attachment C

Hydrologic Calculations

NOAA Atlas 14, Volume 2, Version 3
Location name: Byesville, Ohio, USA*
Latitude: 39.9368°, Longitude: -81.5358°
Elevation: 830.35 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.331 (0.298–0.368)	0.396 (0.356–0.440)	0.479 (0.429–0.531)	0.543 (0.486–0.600)	0.624 (0.557–0.689)	0.686 (0.610–0.757)	0.746 (0.661–0.822)	0.807 (0.713–0.890)	0.890 (0.780–0.979)	0.950 (0.829–1.05)
10-min	0.515 (0.463–0.572)	0.619 (0.555–0.687)	0.744 (0.667–0.826)	0.838 (0.750–0.927)	0.954 (0.851–1.05)	1.04 (0.924–1.15)	1.12 (0.995–1.24)	1.21 (1.07–1.33)	1.31 (1.15–1.44)	1.38 (1.21–1.52)
15-min	0.631 (0.568–0.701)	0.756 (0.679–0.840)	0.914 (0.819–1.01)	1.03 (0.923–1.14)	1.18 (1.05–1.30)	1.29 (1.14–1.42)	1.40 (1.24–1.54)	1.50 (1.32–1.65)	1.63 (1.43–1.80)	1.73 (1.51–1.90)
30-min	0.835 (0.751–0.928)	1.01 (0.909–1.12)	1.25 (1.12–1.39)	1.43 (1.28–1.58)	1.67 (1.49–1.84)	1.84 (1.64–2.03)	2.01 (1.79–2.22)	2.19 (1.93–2.41)	2.42 (2.12–2.66)	2.59 (2.26–2.85)
60-min	1.02 (0.917–1.13)	1.24 (1.12–1.38)	1.57 (1.41–1.74)	1.82 (1.63–2.02)	2.16 (1.93–2.39)	2.42 (2.16–2.68)	2.69 (2.39–2.97)	2.97 (2.62–3.27)	3.34 (2.93–3.68)	3.64 (3.18–4.01)
2-hr	1.19 (1.07–1.32)	1.45 (1.30–1.61)	1.84 (1.66–2.05)	2.16 (1.94–2.40)	2.61 (2.33–2.89)	2.97 (2.65–3.29)	3.36 (2.98–3.71)	3.77 (3.32–4.15)	4.35 (3.81–4.78)	4.82 (4.20–5.28)
3-hr	1.26 (1.13–1.41)	1.53 (1.38–1.71)	1.96 (1.75–2.18)	2.29 (2.05–2.55)	2.77 (2.47–3.08)	3.17 (2.81–3.51)	3.59 (3.17–3.97)	4.04 (3.55–4.46)	4.69 (4.08–5.15)	5.22 (4.51–5.73)
6-hr	1.50 (1.34–1.68)	1.81 (1.62–2.03)	2.29 (2.05–2.56)	2.68 (2.39–2.99)	3.24 (2.88–3.61)	3.72 (3.29–4.13)	4.23 (3.72–4.68)	4.78 (4.18–5.28)	5.58 (4.82–6.14)	6.24 (5.36–6.85)
12-hr	1.77 (1.60–1.99)	2.12 (1.92–2.39)	2.65 (2.39–2.97)	3.09 (2.78–3.46)	3.75 (3.35–4.18)	4.29 (3.82–4.78)	4.89 (4.32–5.42)	5.54 (4.86–6.12)	6.48 (5.64–7.14)	7.28 (6.28–8.00)
24-hr	2.08 (1.90–2.28)	2.49 (2.28–2.74)	3.08 (2.82–3.39)	3.57 (3.26–3.92)	4.29 (3.89–4.70)	4.88 (4.41–5.34)	5.53 (4.96–6.03)	6.22 (5.54–6.79)	7.22 (6.35–7.87)	8.04 (7.01–8.78)
2-day	2.43 (2.23–2.68)	2.90 (2.66–3.20)	3.56 (3.26–3.92)	4.10 (3.74–4.52)	4.87 (4.43–5.36)	5.50 (4.98–6.06)	6.17 (5.55–6.80)	6.89 (6.15–7.59)	7.92 (6.97–8.73)	8.75 (7.63–9.67)
3-day	2.60 (2.39–2.85)	3.09 (2.85–3.39)	3.77 (3.47–4.14)	4.33 (3.97–4.74)	5.11 (4.67–5.59)	5.75 (5.23–6.29)	6.42 (5.81–7.03)	7.13 (6.41–7.81)	8.13 (7.23–8.92)	8.95 (7.87–9.84)
4-day	2.76 (2.56–3.01)	3.29 (3.05–3.58)	3.99 (3.69–4.35)	4.56 (4.21–4.97)	5.36 (4.92–5.83)	6.00 (5.49–6.53)	6.67 (6.07–7.26)	7.37 (6.67–8.03)	8.35 (7.48–9.12)	9.14 (8.12–10.0)
7-day	3.32 (3.09–3.59)	3.94 (3.67–4.27)	4.75 (4.42–5.15)	5.41 (5.02–5.85)	6.32 (5.84–6.83)	7.05 (6.49–7.62)	7.81 (7.16–8.45)	8.60 (7.84–9.30)	9.69 (8.75–10.5)	10.5 (9.44–11.5)
10-day	3.85 (3.59–4.15)	4.56 (4.26–4.91)	5.44 (5.07–5.86)	6.15 (5.72–6.62)	7.11 (6.60–7.65)	7.87 (7.28–8.47)	8.64 (7.96–9.31)	9.42 (8.64–10.2)	10.5 (9.55–11.3)	11.3 (10.2–12.3)
20-day	5.36 (5.03–5.74)	6.34 (5.94–6.78)	7.45 (6.98–7.97)	8.32 (7.78–8.89)	9.46 (8.83–10.1)	10.3 (9.62–11.0)	11.2 (10.4–12.0)	12.0 (11.1–12.9)	13.1 (12.1–14.1)	13.9 (12.8–15.0)
30-day	6.73 (6.30–7.17)	7.92 (7.42–8.43)	9.21 (8.62–9.82)	10.2 (9.55–10.9)	11.5 (10.7–12.2)	12.5 (11.6–13.3)	13.4 (12.5–14.3)	14.4 (13.3–15.3)	15.5 (14.3–16.6)	16.4 (15.1–17.6)
45-day	8.61 (8.11–9.16)	10.1 (9.51–10.7)	11.6 (10.9–12.3)	12.7 (12.0–13.5)	14.2 (13.3–15.1)	15.2 (14.3–16.2)	16.2 (15.2–17.3)	17.2 (16.1–18.4)	18.4 (17.1–19.7)	19.3 (17.9–20.7)
60-day	10.4 (9.80–11.0)	12.1 (11.5–12.8)	13.8 (13.1–14.6)	15.0 (14.2–15.9)	16.6 (15.7–17.5)	17.7 (16.7–18.7)	18.8 (17.7–19.8)	19.7 (18.5–20.9)	20.9 (19.6–22.2)	21.7 (20.3–23.1)

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

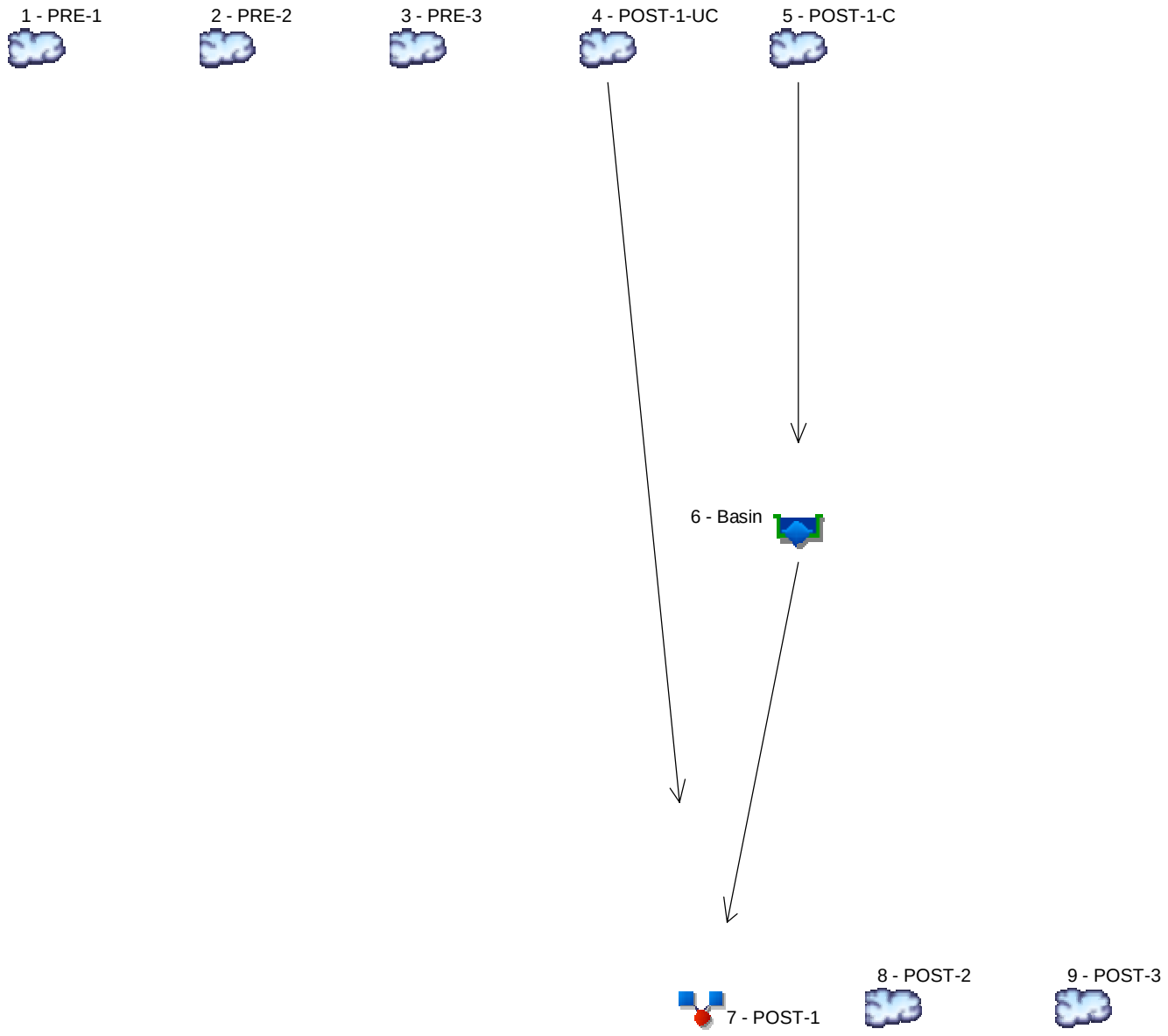
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper 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.

Back to Top

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3



Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	6.462	-------	-------	25.45	41.70	56.29	73.41	PRE-1
2	SCS Runoff	------	-------	2.972	-------	-------	12.98	21.98	30.13	39.74	PRE-2
3	SCS Runoff	------	-------	2.462	-------	-------	8.282	13.03	17.26	22.17	PRE-3
4	SCS Runoff	------	-------	2.329	-------	-------	12.93	22.65	31.49	41.95	POST-1-UC
5	SCS Runoff	------	-------	84.17	-------	-------	126.02	153.64	176.16	200.88	POST-1-C
6	Reservoir	5	-------	0.446	-------	-------	4.586	12.96	18.93	20.19	Basin
7	Combine	4, 6	-------	2.329	-------	-------	12.93	32.16	50.19	61.99	POST-1
8	SCS Runoff	------	-------	2.718	-------	-------	8.551	13.16	17.23	21.95	POST-2
9	SCS Runoff	------	-------	2.001	-------	-------	6.733	10.59	14.03	18.03	POST-3

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	6.462	2	728	34,601	------	------	------	PRE-1
2	SCS Runoff	2.972	2	730	19,732	------	------	------	PRE-2
3	SCS Runoff	2.462	2	728	11,480	------	------	------	PRE-3
4	SCS Runoff	2.329	2	726	14,937	------	------	------	POST-1-UC
5	SCS Runoff	84.17	2	716	181,298	------	------	------	POST-1-C
6	Reservoir	0.446	2	1442	5,908	5	817.05	179,060	Basin
7	Combine	2.329	2	726	20,846	4, 6	------	------	POST-1
8	SCS Runoff	2.718	2	720	8,118	------	------	------	POST-2
9	SCS Runoff	2.001	2	728	9,333	------	------	------	POST-3

Hydrograph Report

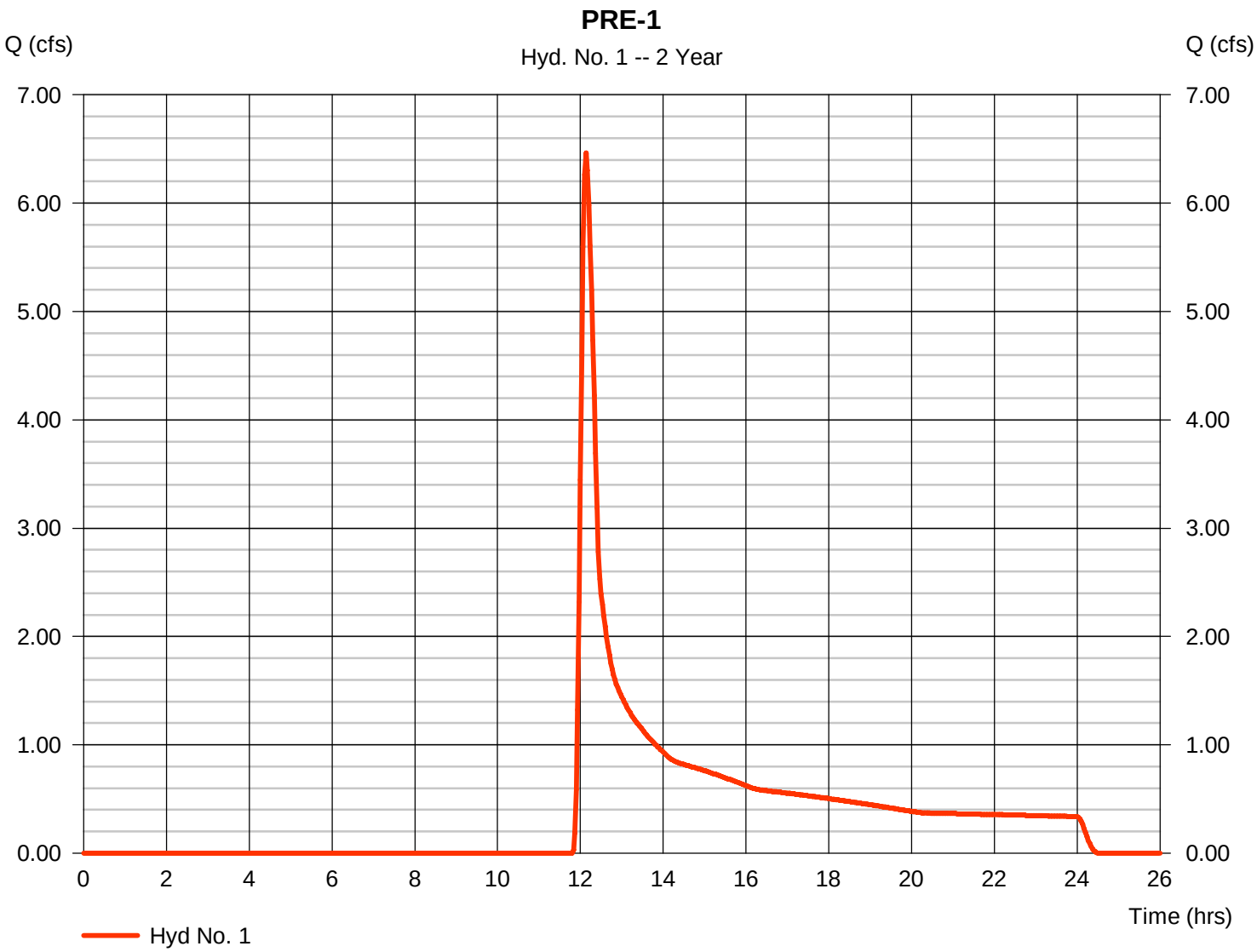
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 1

PRE-1

Hydrograph type	= SCS Runoff	Peak discharge	= 6.462 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 34,601 cuft
Drainage area	= 32.450 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.90 min
Total precip.	= 2.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.190 x 98) + (0.130 x 89) + (16.050 x 58) + (14.050 x 71) + (2.030 x 78)] / 32.450



TR55 Tc Worksheet

Hyd. No. 1

PRE-1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.49		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 13.76**	**+**	**0.00**	**+**	**0.00**	**=**	**13.76**
Shallow Concentrated Flow							
Flow length (ft)	= 869.00		0.00		0.00		
Watercourse slope (%)	= 3.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.79		0.00		0.00		
Travel Time (min)	**= 5.18**	**+**	**0.00**	**+**	**0.00**	**=**	**5.18**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 18.90 min

Hydrograph Report

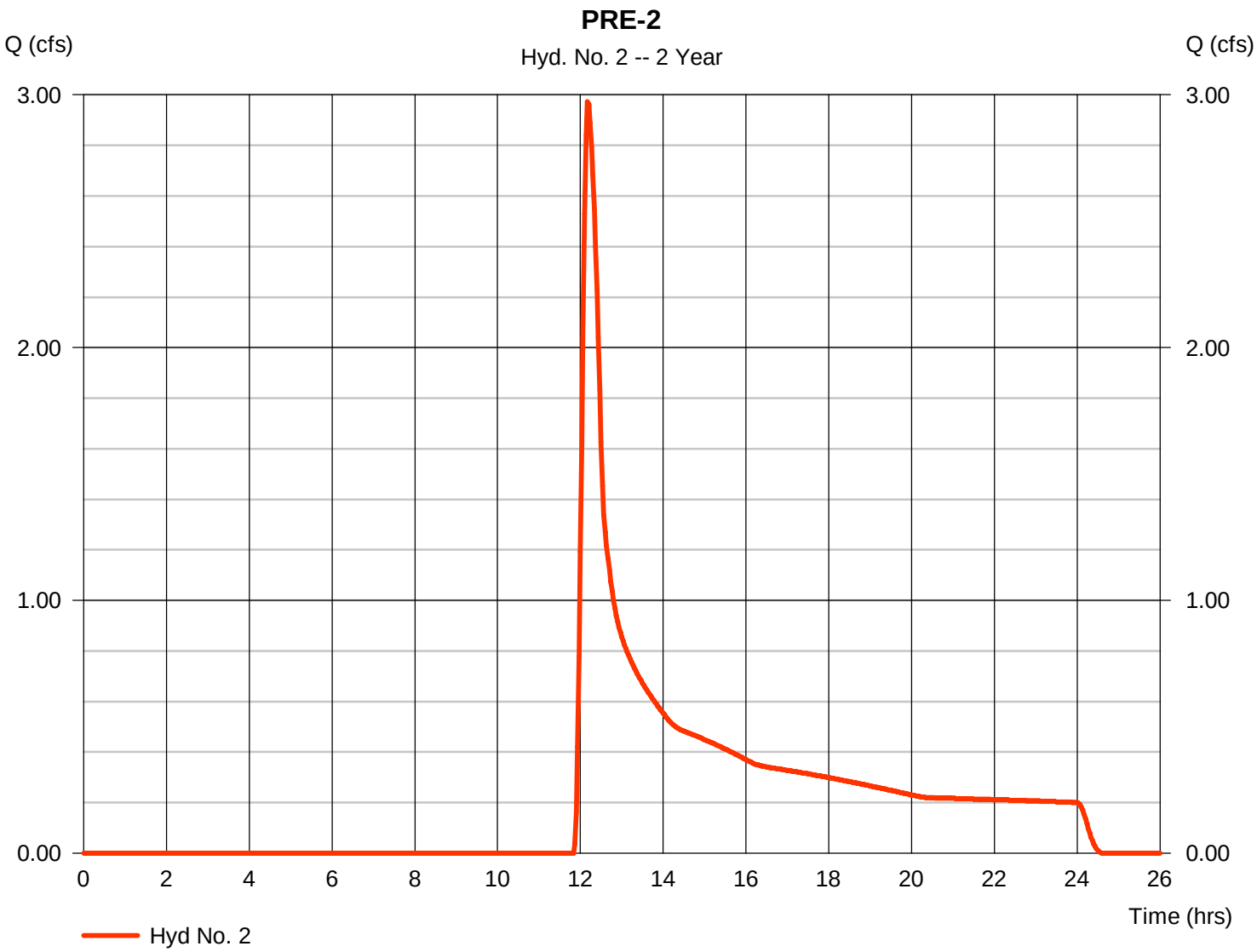
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 2

PRE-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.972 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	19,732 cuft
Drainage area	=	20.060 ac	Curve number	=	64*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.40 min
Total precip.	=	2.49 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(12.790 x 58) + (4.820 x 71) + (2.450 x 78)] / 20.060



TR55 Tc Worksheet

Hyd. No. 2

PRE-2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.49		0.00		0.00		
Land slope (%)	= 3.50		0.00		0.00		
Travel Time (min)	**= 12.93**	**+**	**0.00**	**+**	**0.00**	**=**	**12.93**
Shallow Concentrated Flow							
Flow length (ft)	= 825.00		400.00		0.00		
Watercourse slope (%)	= 3.50		2.00		0.00		
Surface description	= Unpaved		Unpaved		Paved		
Average velocity (ft/s)	=3.02		2.28		0.00		
Travel Time (min)	**= 4.56**	**+**	**2.92**	**+**	**0.00**	**=**	**7.48**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 20.40 min

Hydrograph Report

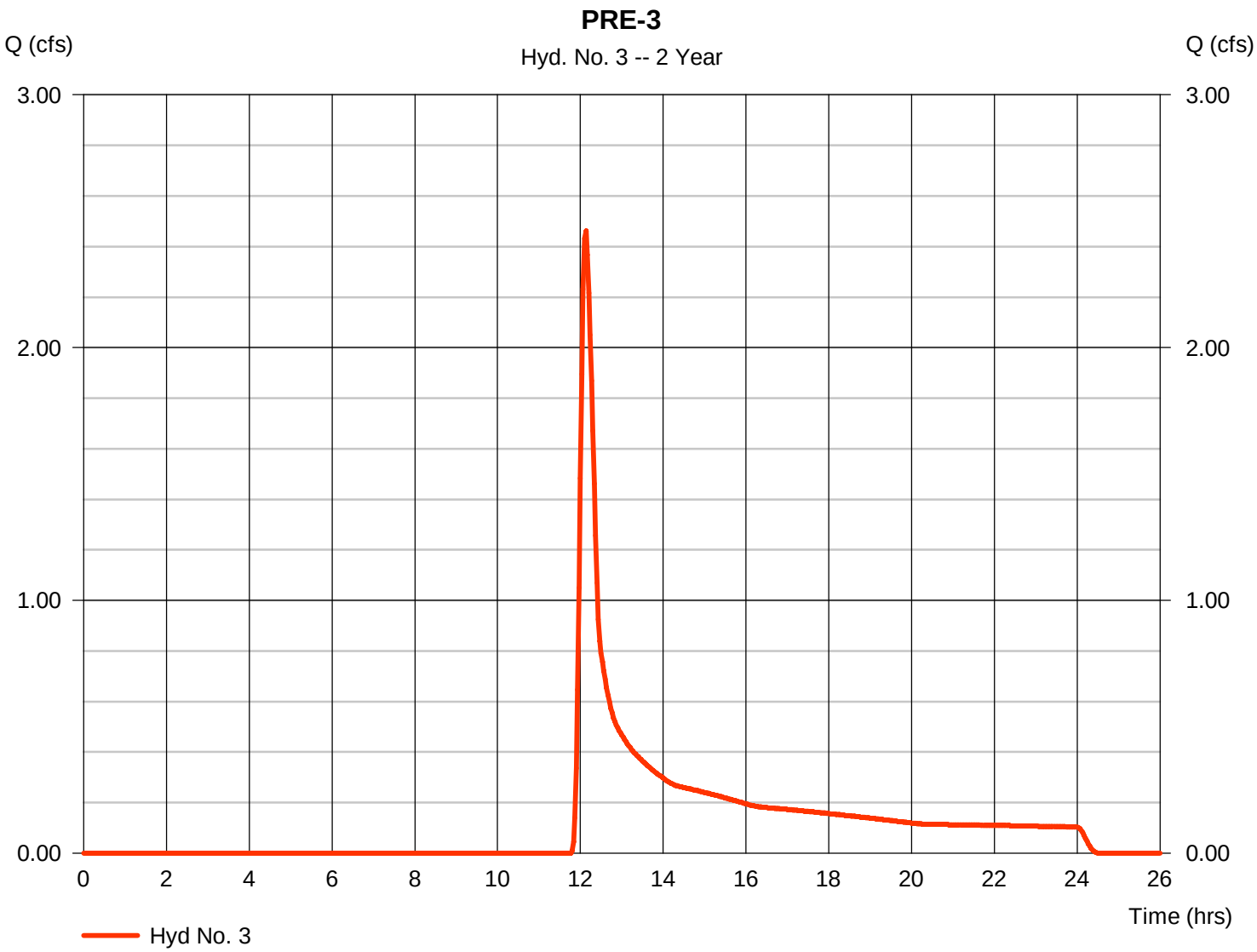
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 3

PRE-3

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.462 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	11,480 cuft
Drainage area	=	8.980 ac	Curve number	=	67*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.90 min
Total precip.	=	2.49 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.270 x 98) + (0.330 x 89) + (4.600 x 58) + (2.720 x 71) + (1.060 x 78)] / 8.980



TR55 Tc Worksheet

Hyd. No. 3

PRE-3

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.49		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 13.76**	**+**	**0.00**	**+**	**0.00**	**=**	**13.76**
Shallow Concentrated Flow							
Flow length (ft)	= 792.00		0.00		0.00		
Watercourse slope (%)	= 2.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.55		0.00		0.00		
Travel Time (min)	**= 5.17**	**+**	**0.00**	**+**	**0.00**	**=**	**5.17**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 18.90 min

Hydrograph Report

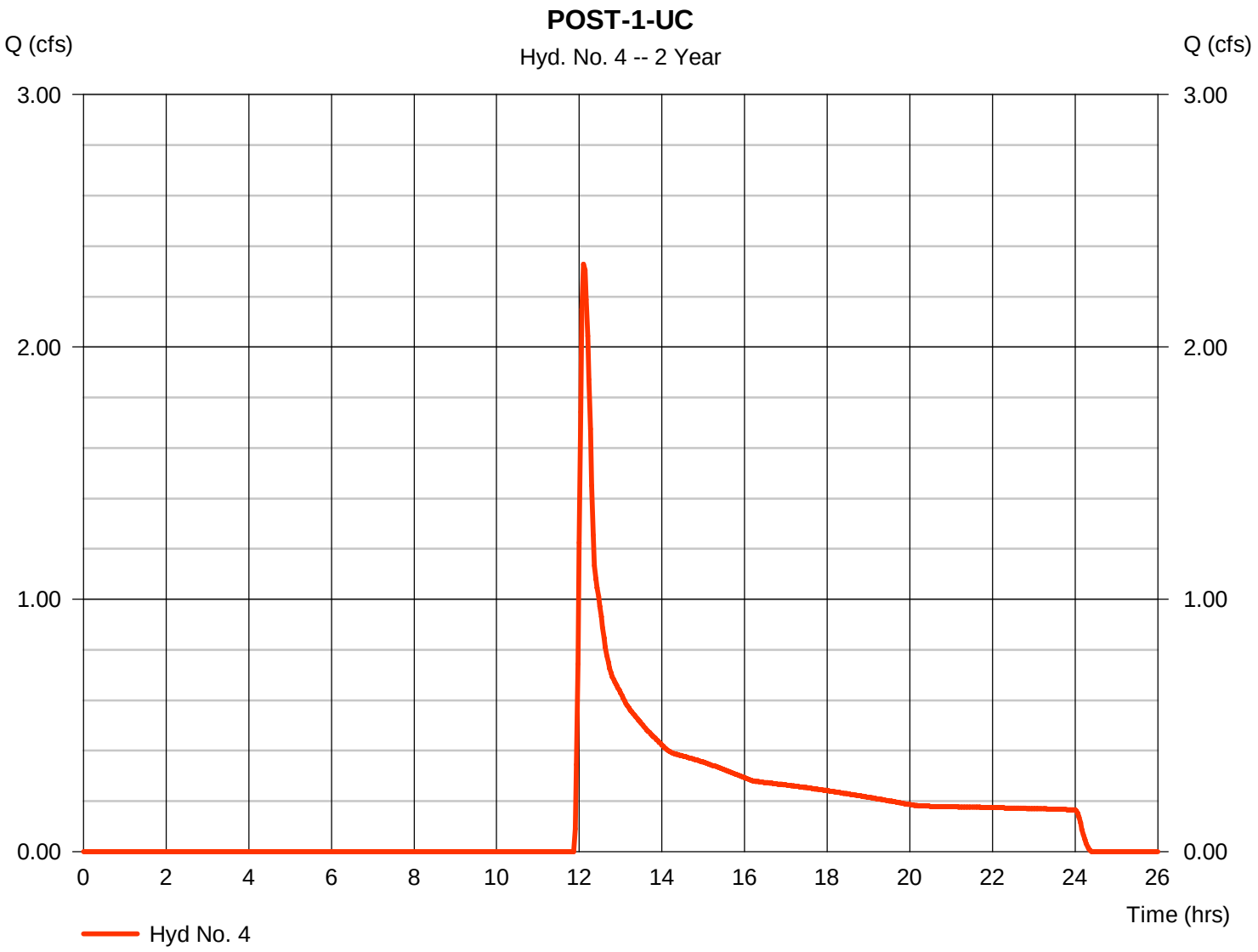
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 4

POST-1-UC

Hydrograph type	= SCS Runoff	Peak discharge	= 2.329 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 14,937 cuft
Drainage area	= 19.570 ac	Curve number	= 62*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.60 min
Total precip.	= 2.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(14.350 x 58) + (3.190 x 71) + (2.030 x 78)] / 19.570



TR55 Tc Worksheet

Hyd. No. 4

POST-1-UC

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.49		0.00		0.00		
Land slope (%)	= 3.75		0.00		0.00		
Travel Time (min)	**= 12.58**	**+**	**0.00**	**+**	**0.00**	**=**	**12.58**
Shallow Concentrated Flow							
Flow length (ft)	= 382.00		0.00		0.00		
Watercourse slope (%)	= 3.75		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.12		0.00		0.00		
Travel Time (min)	**= 2.04**	**+**	**0.00**	**+**	**0.00**	**=**	**2.04**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 14.60 min

Hydrograph Report

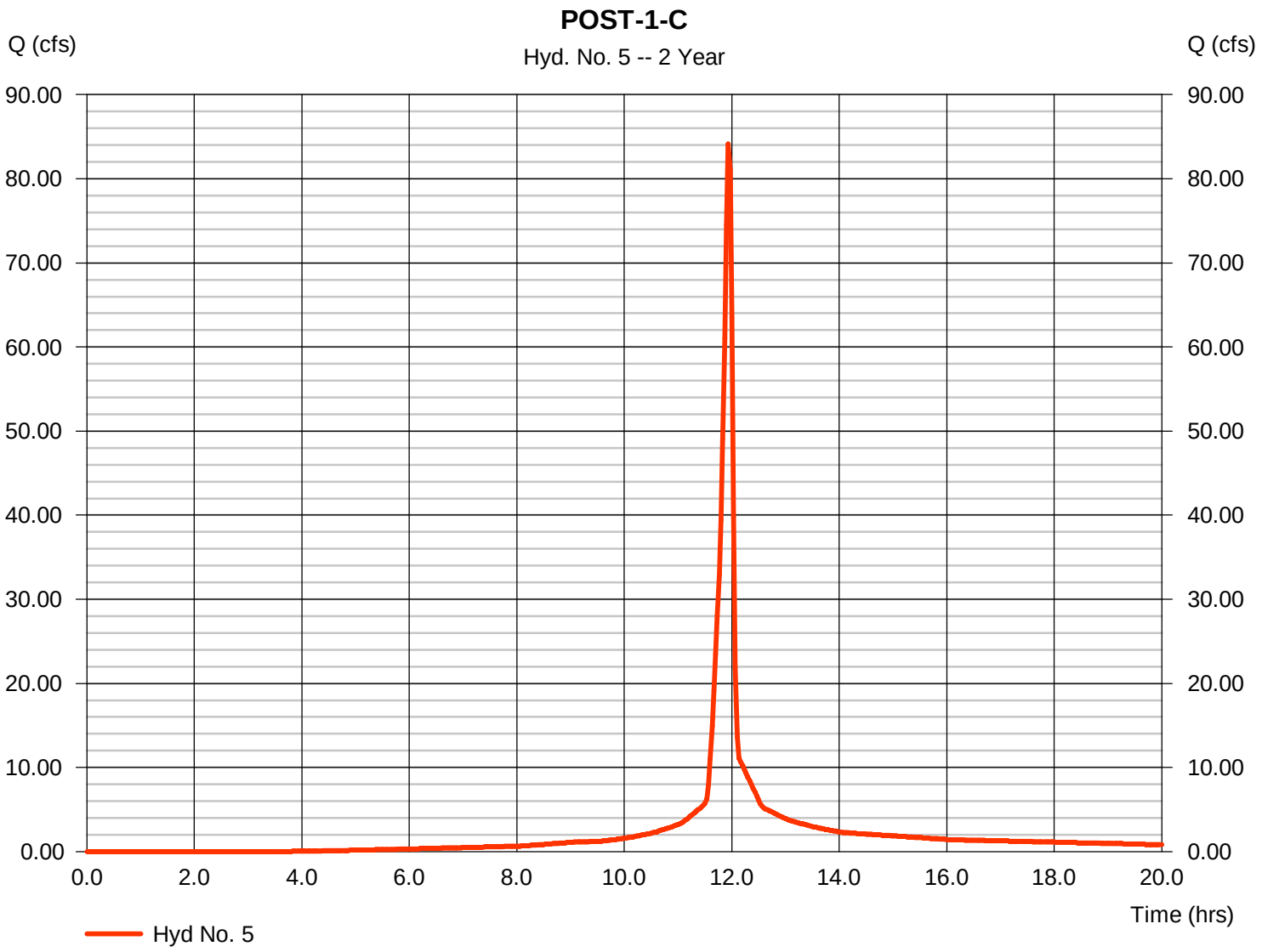
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 5

POST-1-C

Hydrograph type	=	SCS Runoff	Peak discharge	=	84.17 cfs
Storm frequency	=	2 yrs	Time to peak	=	11.93 hrs
Time interval	=	2 min	Hyd. volume	=	181,298 cuft
Drainage area	=	27.270 ac	Curve number	=	95*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.49 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(27.270 x 95)] / 27.270



Hydrograph Report

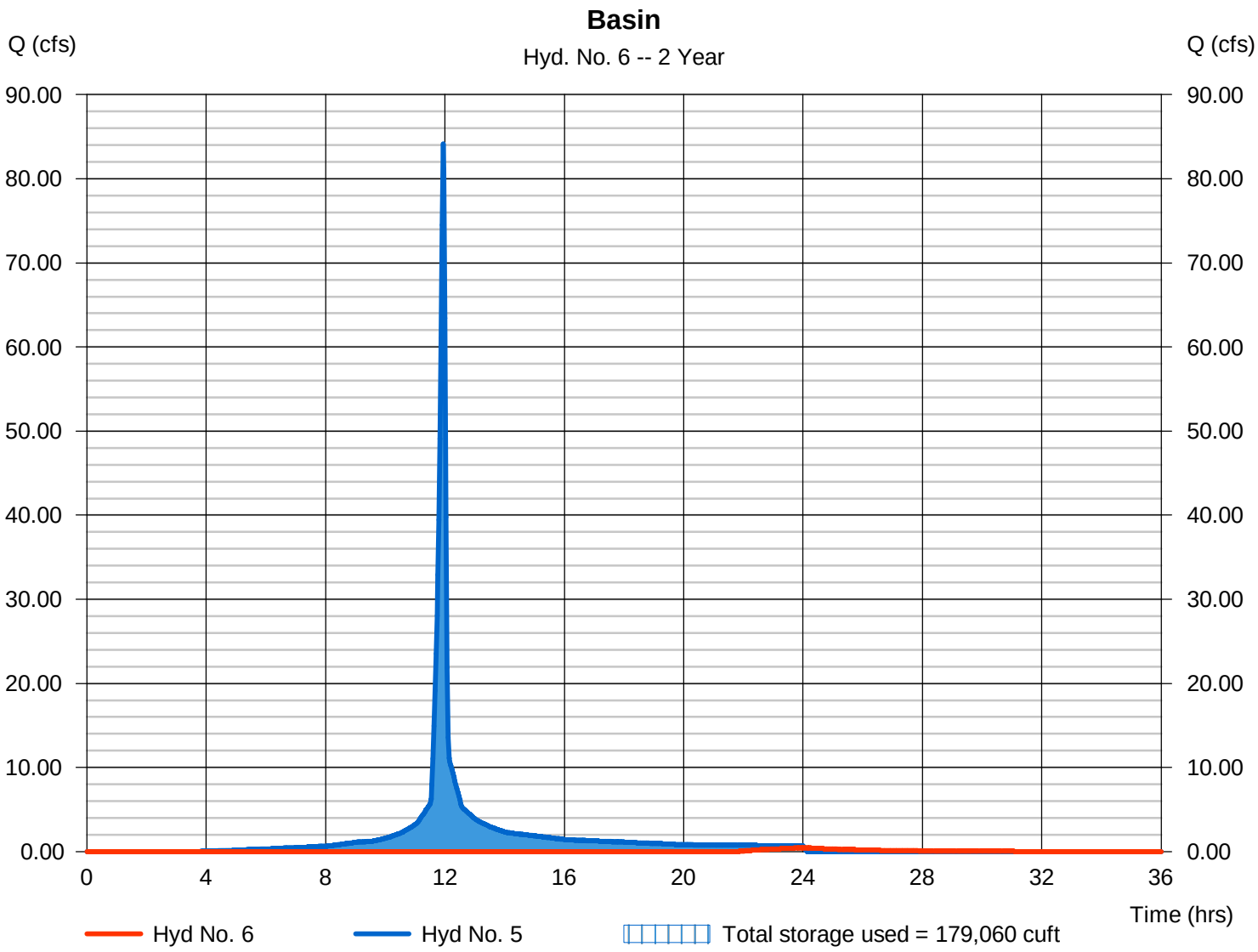
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 6

Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.446 cfs
Storm frequency	= 2 yrs	Time to peak	= 24.03 hrs
Time interval	= 2 min	Hyd. volume	= 5,908 cuft
Inflow hyd. No.	= 5 - POST-1-C	Max. Elevation	= 817.05 ft
Reservoir name	= Basin	Max. Storage	= 179,060 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Pond No. 1 - Basin

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 814.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	814.00	50,386	0	0
1.00	815.00	55,756	53,043	53,043
2.00	816.00	61,182	58,442	111,485
3.00	817.00	66,663	63,897	175,382
4.00	818.00	72,198	69,405	244,787
5.00	819.00	77,787	74,968	319,755
6.00	820.00	83,431	80,584	400,339

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 812.00	0.00	0.00	0.00
Length (ft)	= 200.00	0.00	0.00	0.00
Slope (%)	= 5.00	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	No	No	No

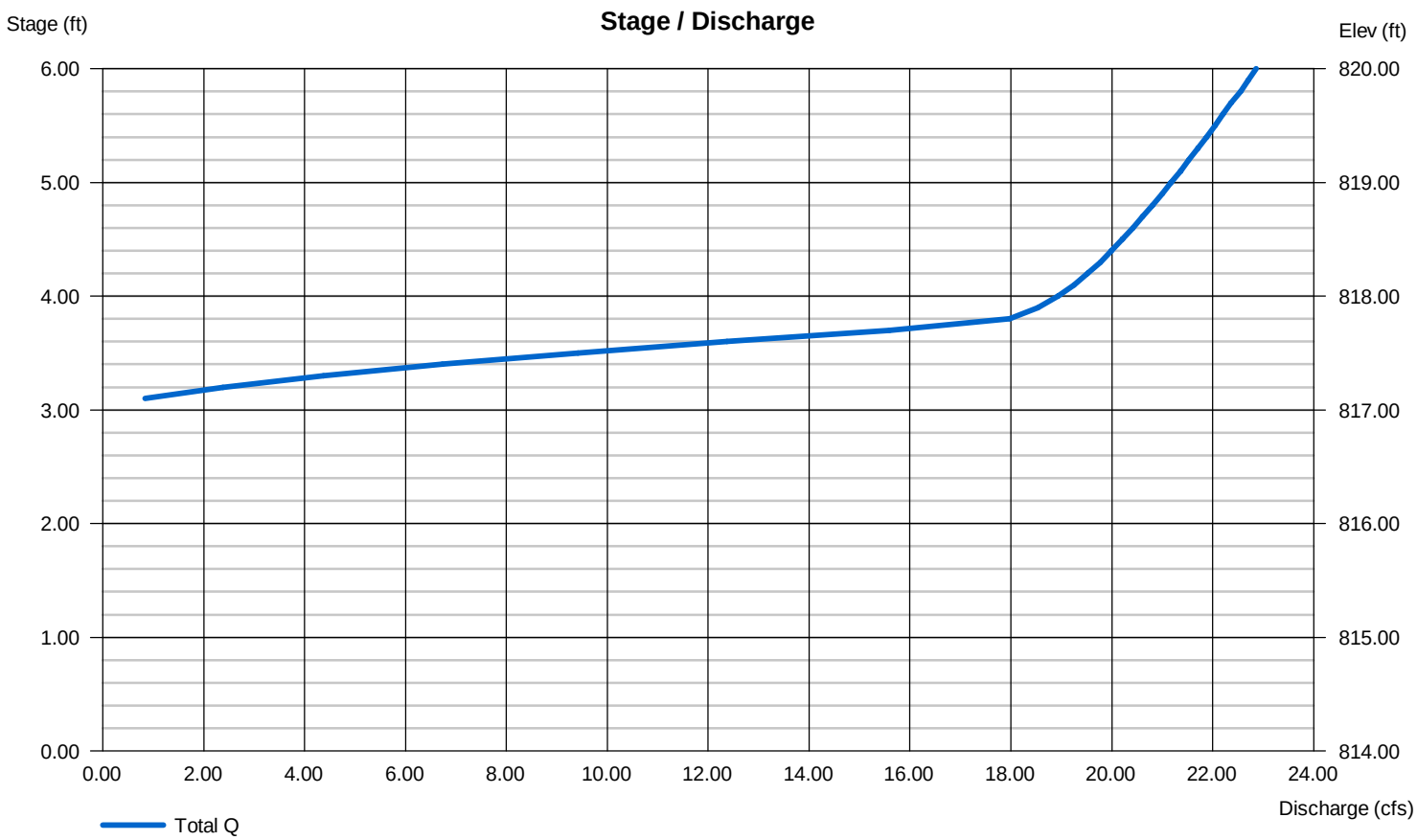
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.00	0.00	0.00
Crest El. (ft)	= 817.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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



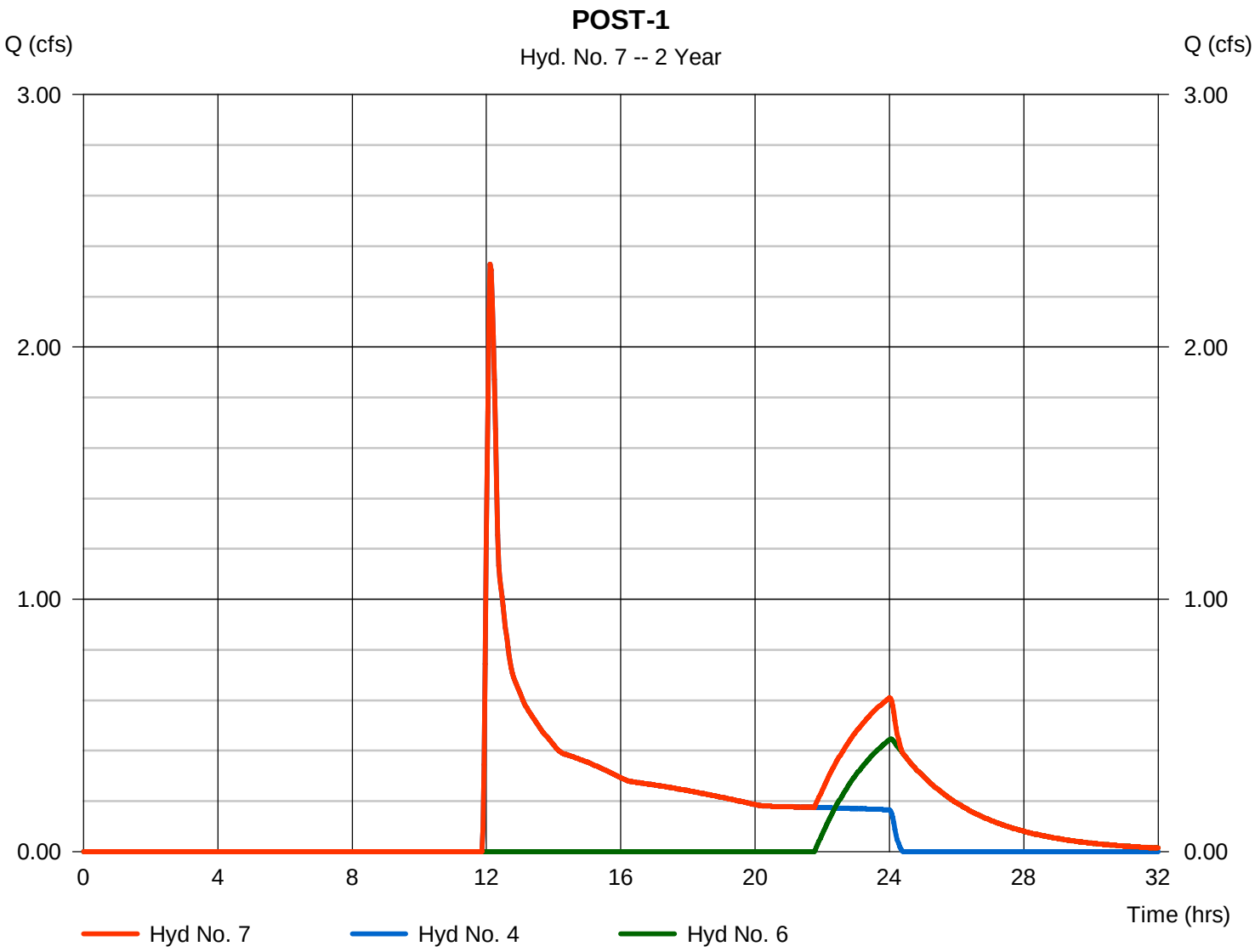
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 7

POST-1

Hydrograph type	= Combine	Peak discharge	= 2.329 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 20,846 cuft
Inflow hyds.	= 4, 6	Contrib. drain. area	= 19.570 ac



Hydrograph Report

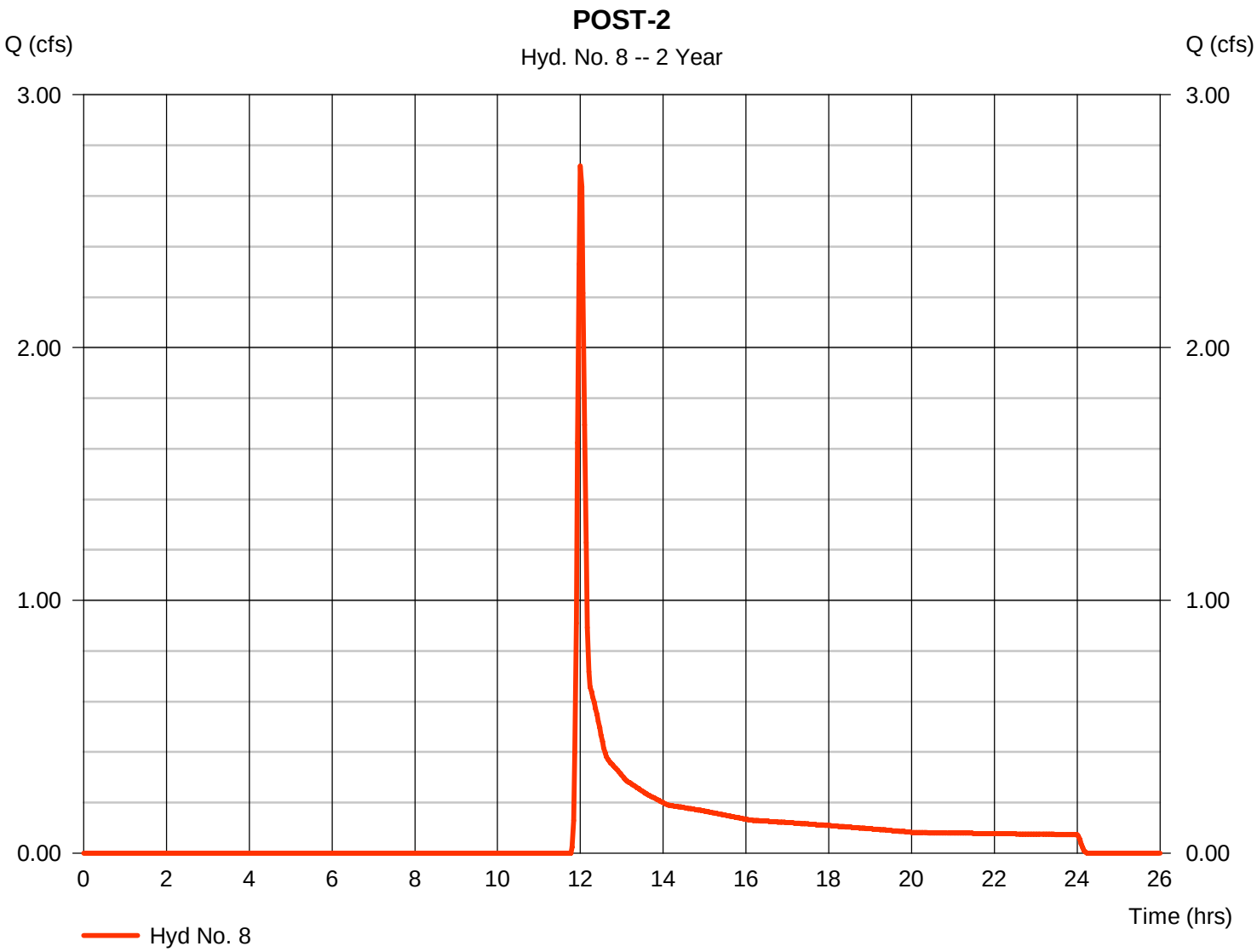
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 8

POST-2

Hydrograph type	= SCS Runoff	Peak discharge	= 2.718 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 8,118 cuft
Drainage area	= 6.350 ac	Curve number	= 67*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.40 min
Total precip.	= 2.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.600 x 58) + (3.000 x 71) + (0.750 x 78)] / 6.350



TR55 Tc Worksheet

Hyd. No. 8

POST-2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.49		0.00		0.00		
Land slope (%)	= 14.00		0.00		0.00		
Travel Time (min)	**= 7.43**	**+**	**0.00**	**+**	**0.00**	**=**	**7.43**
Shallow Concentrated Flow							
Flow length (ft)	= 200.00		0.00		0.00		
Watercourse slope (%)	= 5.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.61		0.00		0.00		
Travel Time (min)	**= 0.92**	**+**	**0.00**	**+**	**0.00**	**=**	**0.92**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 8.40 min

Hydrograph Report

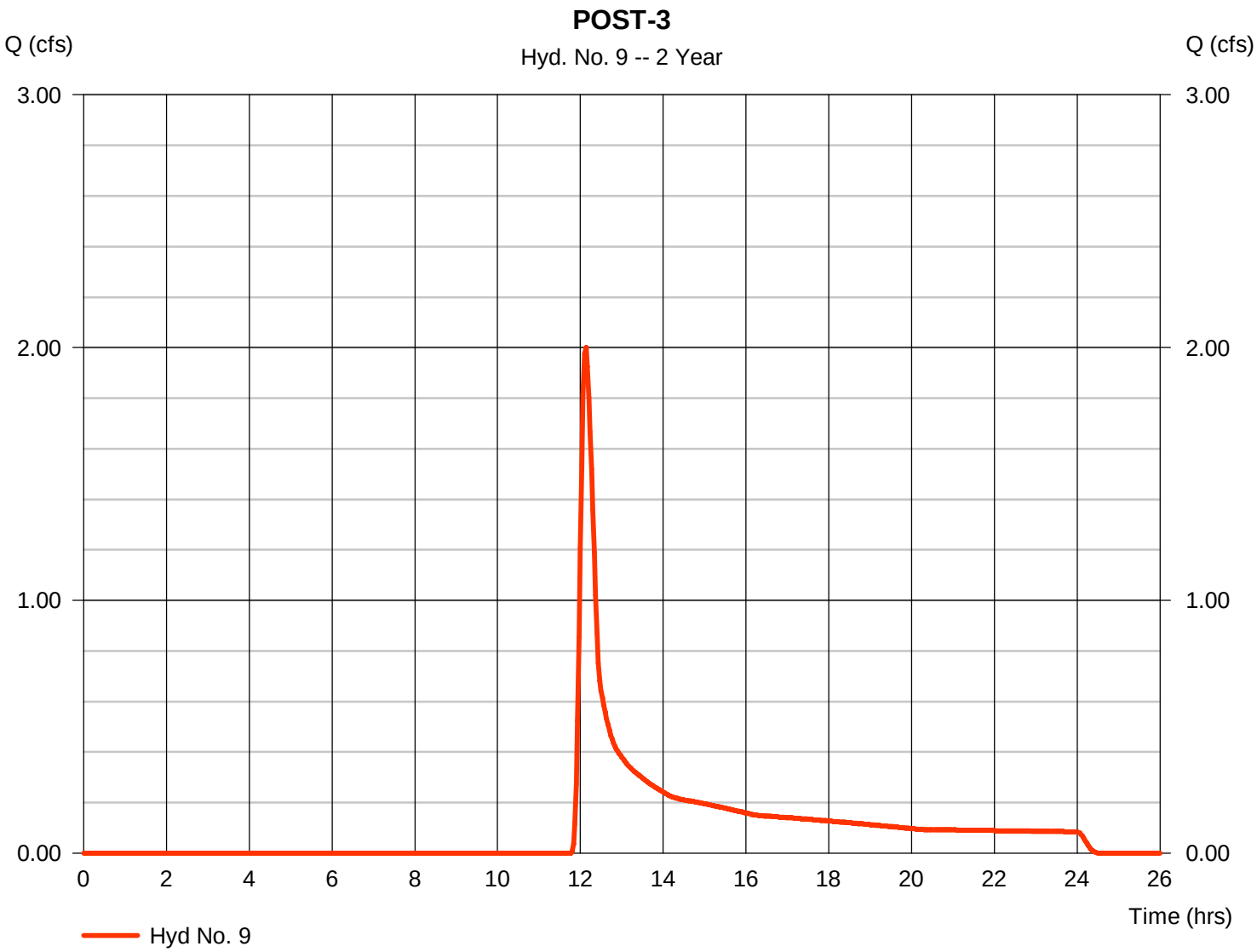
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 9

POST-3

Hydrograph type	= SCS Runoff	Peak discharge	= 2.001 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 9,333 cuft
Drainage area	= 7.300 ac	Curve number	= 67*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.30 min
Total precip.	= 2.49 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.450 x 98) + (3.980 x 58) + (1.810 x 71) + (1.060 x 78)] / 7.300



TR55 Tc Worksheet

Hyd. No. 9

POST-3

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.49		0.00		0.00		
Land slope (%)	= 2.50		0.00		0.00		
Travel Time (min)	**= 14.80**	**+**	**0.00**	**+**	**0.00**	**=**	**14.80**
Shallow Concentrated Flow							
Flow length (ft)	= 535.00		0.00		0.00		
Watercourse slope (%)	= 2.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.55		0.00		0.00		
Travel Time (min)	**= 3.50**	**+**	**0.00**	**+**	**0.00**	**=**	**3.50**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 18.30 min

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	25.45	2	726	92,931	------	------	------	PRE-1
2	SCS Runoff	12.98	2	728	54,901	------	------	------	PRE-2
3	SCS Runoff	8.282	2	726	29,002	------	------	------	PRE-3
4	SCS Runoff	12.93	2	724	44,912	------	------	------	POST-1-UC
5	SCS Runoff	126.02	2	716	279,136	------	------	------	POST-1-C
6	Reservoir	4.586	2	804	103,746	5	817.31	196,822	Basin
7	Combine	12.93	2	724	148,658	4, 6	------	------	POST-1
8	SCS Runoff	8.551	2	720	20,508	------	------	------	POST-2
9	SCS Runoff	6.733	2	726	23,576	------	------	------	POST-3

Hydrograph Report

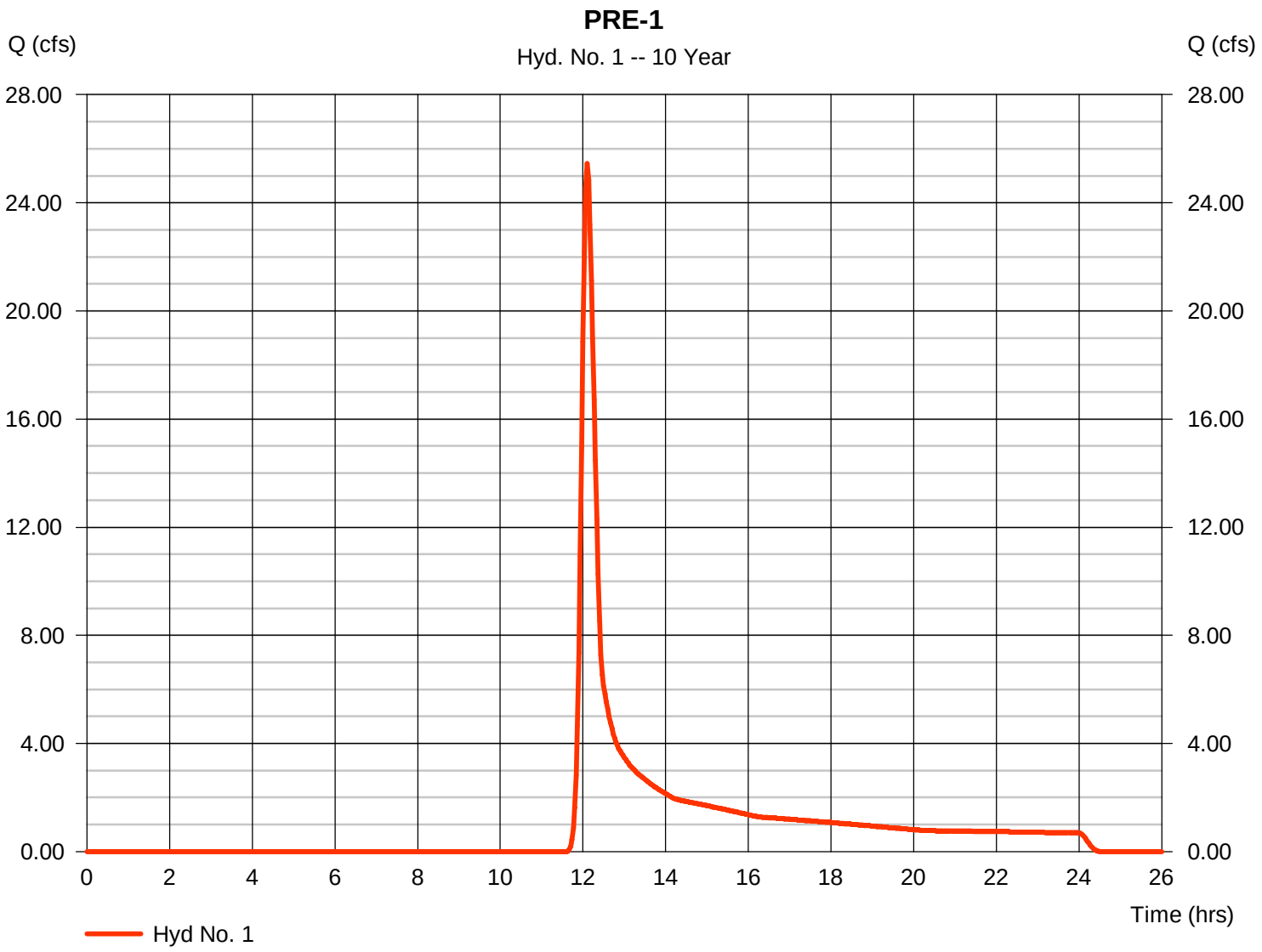
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 1

PRE-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	25.45 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	92,931 cuft
Drainage area	=	32.450 ac	Curve number	=	65*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.90 min
Total precip.	=	3.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.190 x 98) + (0.130 x 89) + (16.050 x 58) + (14.050 x 71) + (2.030 x 78)] / 32.450



Hydrograph Report

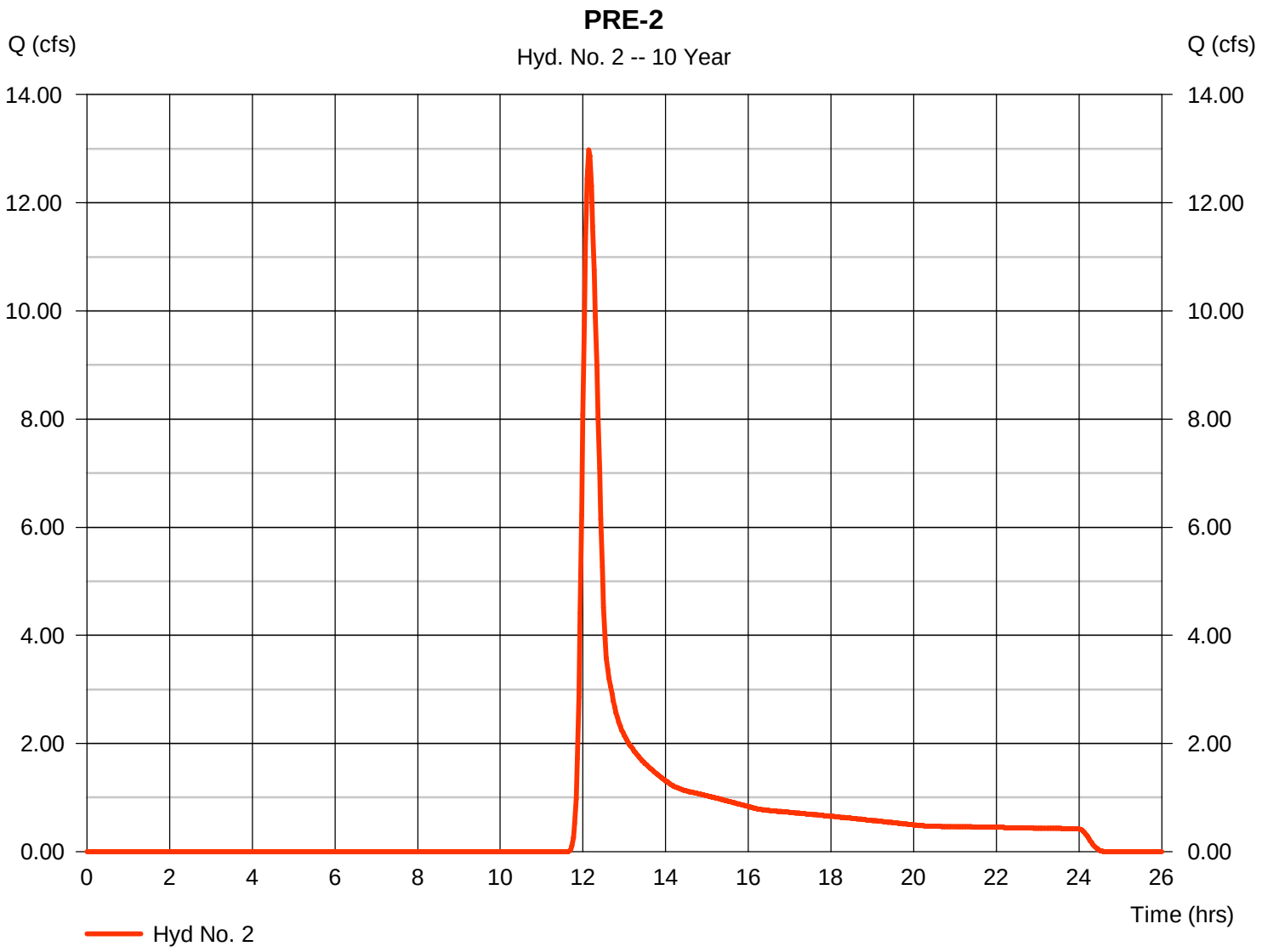
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 2

PRE-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.98 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	54,901 cuft
Drainage area	=	20.060 ac	Curve number	=	64*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.40 min
Total precip.	=	3.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(12.790 x 58) + (4.820 x 71) + (2.450 x 78)] / 20.060



Hydrograph Report

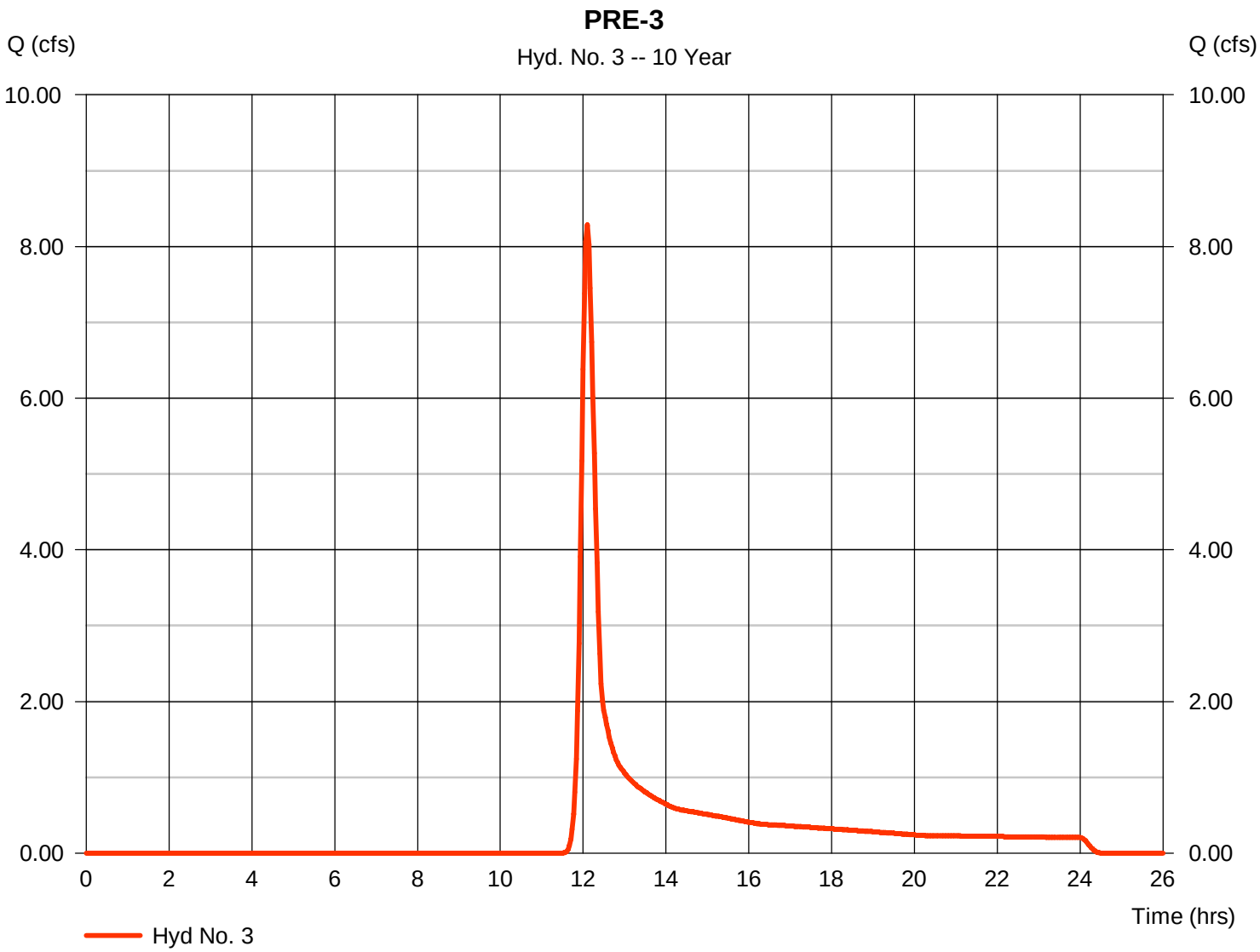
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 3

PRE-3

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.282 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	29,002 cuft
Drainage area	=	8.980 ac	Curve number	=	67*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.90 min
Total precip.	=	3.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.270 x 98) + (0.330 x 89) + (4.600 x 58) + (2.720 x 71) + (1.060 x 78)] / 8.980



Hydrograph Report

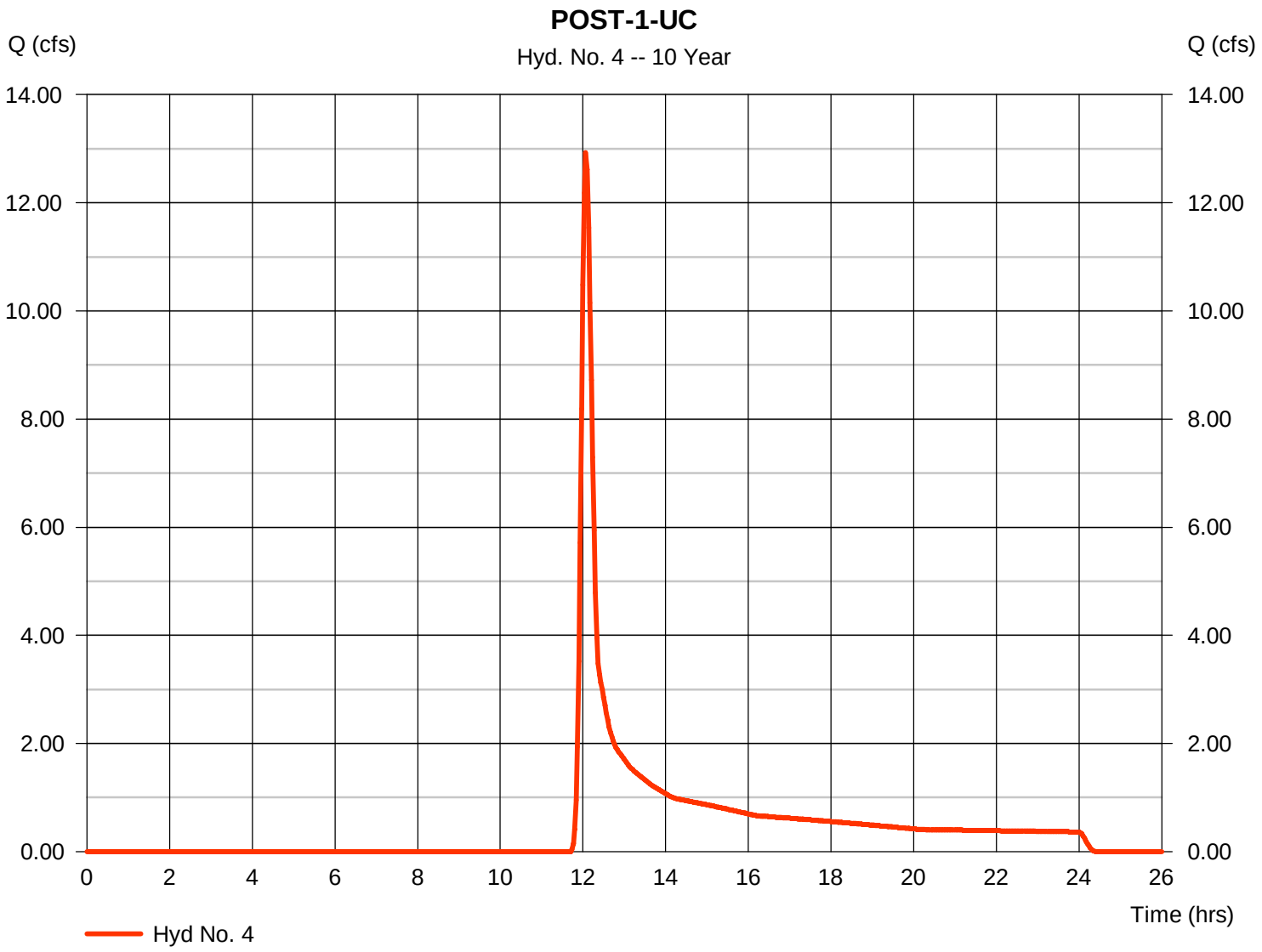
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 4

POST-1-UC

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.93 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	44,912 cuft
Drainage area	=	19.570 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	14.60 min
Total precip.	=	3.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(14.350 x 58) + (3.190 x 71) + (2.030 x 78)] / 19.570



Hydrograph Report

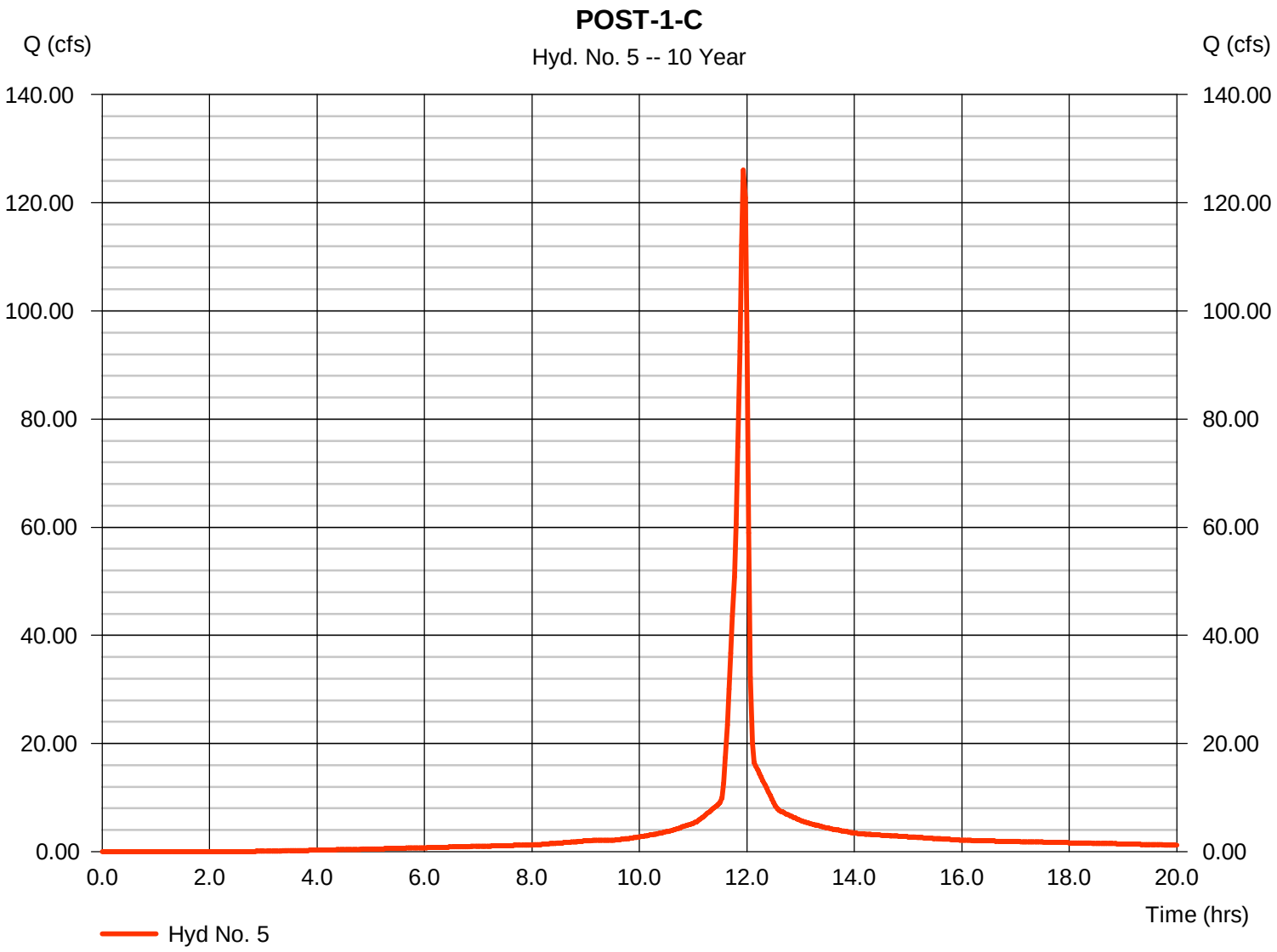
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 5

POST-1-C

Hydrograph type	= SCS Runoff	Peak discharge	= 126.02 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 279,136 cuft
Drainage area	= 27.270 ac	Curve number	= 95*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.57 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(27.270 x 95)] / 27.270



Hydrograph Report

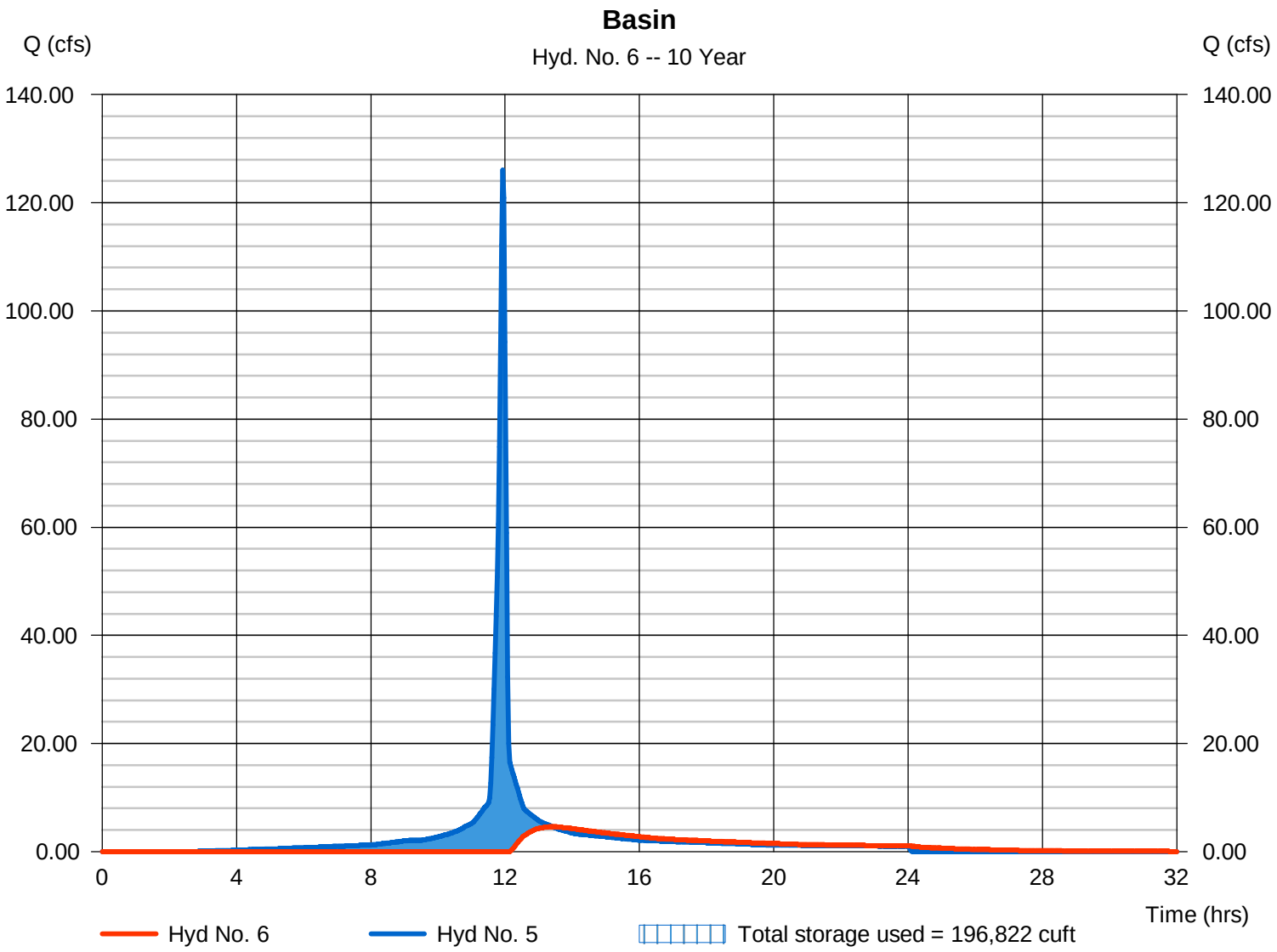
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 6

Basin

Hydrograph type	= Reservoir	Peak discharge	= 4.586 cfs
Storm frequency	= 10 yrs	Time to peak	= 13.40 hrs
Time interval	= 2 min	Hyd. volume	= 103,746 cuft
Inflow hyd. No.	= 5 - POST-1-C	Max. Elevation	= 817.31 ft
Reservoir name	= Basin	Max. Storage	= 196,822 cuft

Storage Indication method used.



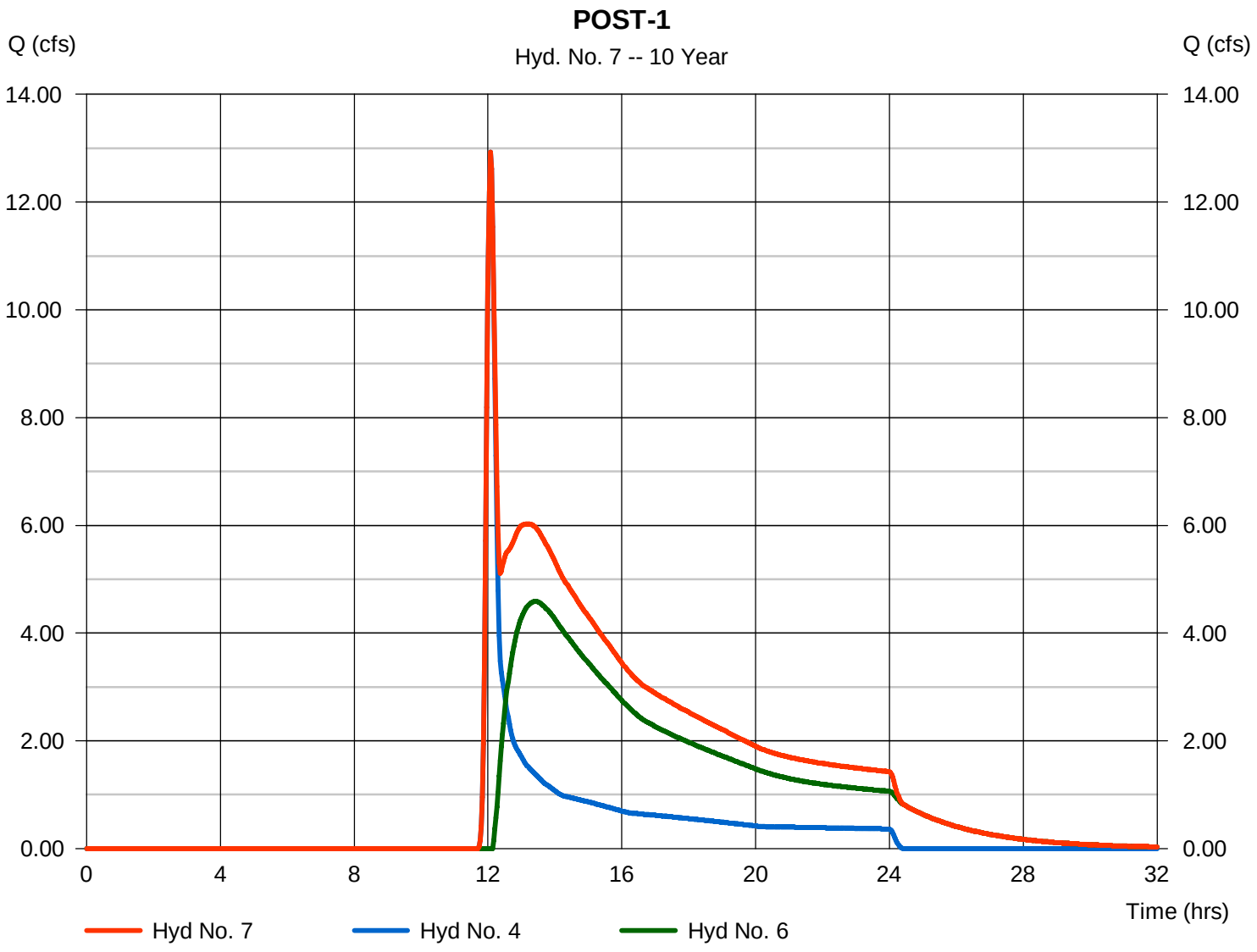
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 7

POST-1

Hydrograph type	=	Combine	Peak discharge	=	12.93 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	148,658 cuft
Inflow hyds.	=	4, 6	Contrib. drain. area	=	19.570 ac



Hydrograph Report

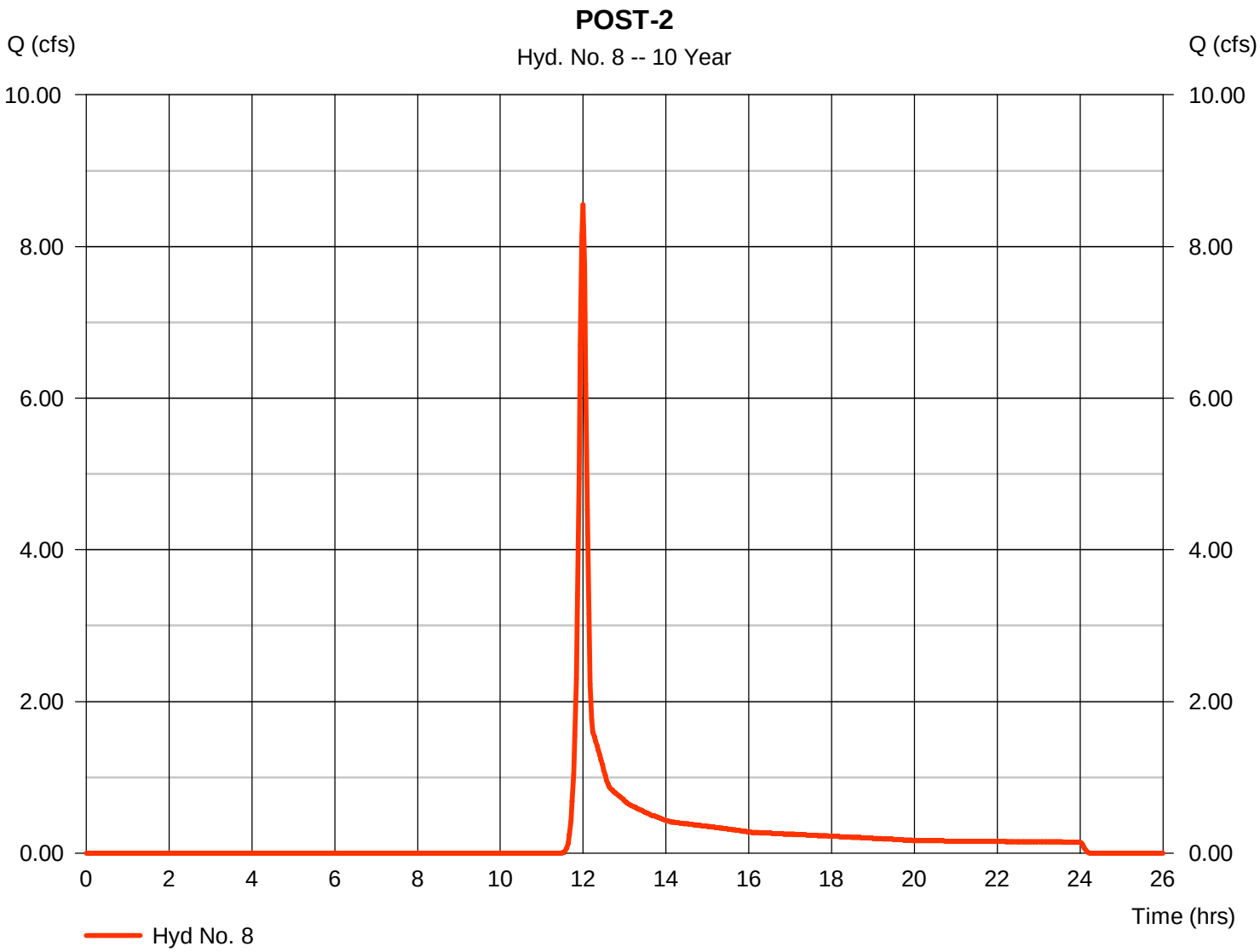
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 8

POST-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.551 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.00 hrs
Time interval	=	2 min	Hyd. volume	=	20,508 cuft
Drainage area	=	6.350 ac	Curve number	=	67*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	3.57 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.600 x 58) + (3.000 x 71) + (0.750 x 78)] / 6.350



Hydrograph Report

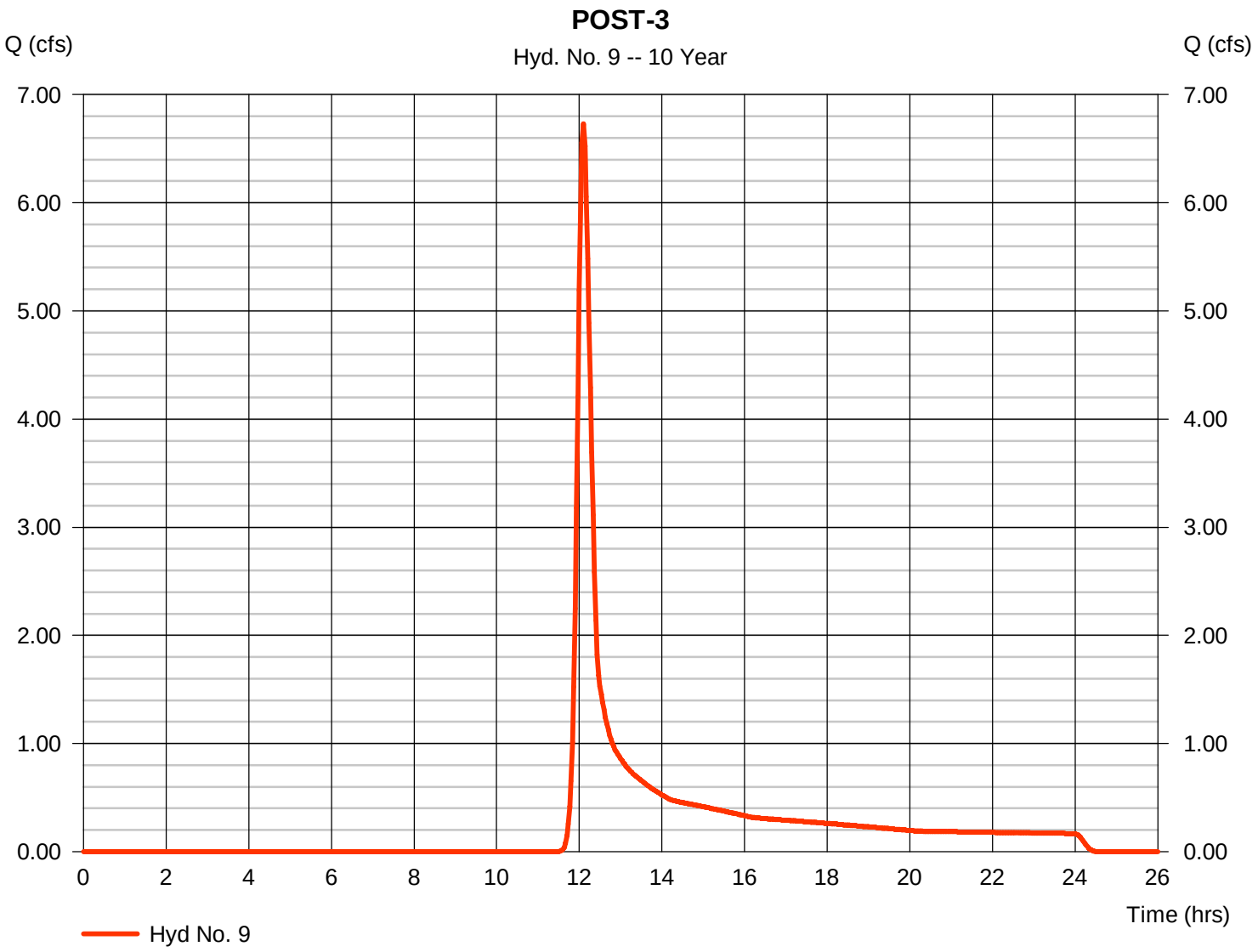
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 9

POST-3

Hydrograph type	= SCS Runoff	Peak discharge	= 6.733 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 23,576 cuft
Drainage area	= 7.300 ac	Curve number	= 67*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.30 min
Total precip.	= 3.57 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.450 x 98) + (3.980 x 58) + (1.810 x 71) + (1.060 x 78)] / 7.300



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	41.70	2	726	141,443	------	------	------	PRE-1
2	SCS Runoff	21.98	2	728	84,466	------	------	------	PRE-2
3	SCS Runoff	13.03	2	726	43,260	------	------	------	PRE-3
4	SCS Runoff	22.65	2	724	70,739	------	------	------	POST-1-UC
5	SCS Runoff	153.64	2	716	344,970	------	------	------	POST-1-C
6	Reservoir	12.96	2	746	169,580	5	817.62	218,274	Basin
7	Combine	32.16	2	726	240,319	4, 6	------	------	POST-1
8	SCS Runoff	13.16	2	720	30,591	------	------	------	POST-2
9	SCS Runoff	10.59	2	726	35,167	------	------	------	POST-3

Hydrograph Report

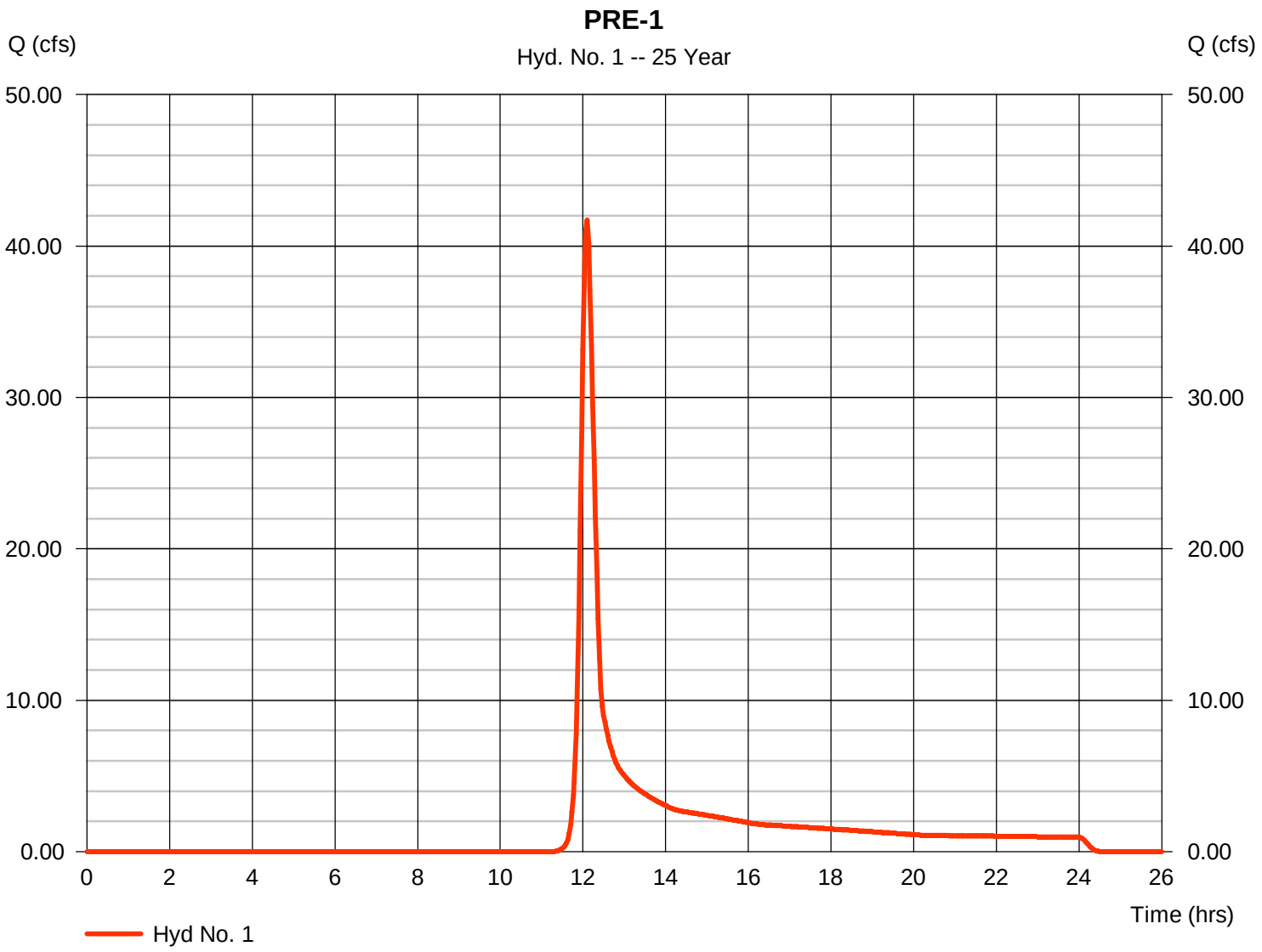
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 1

PRE-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	41.70 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	141,443 cuft
Drainage area	=	32.450 ac	Curve number	=	65*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.90 min
Total precip.	=	4.29 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.190 x 98) + (0.130 x 89) + (16.050 x 58) + (14.050 x 71) + (2.030 x 78)] / 32.450



Hydrograph Report

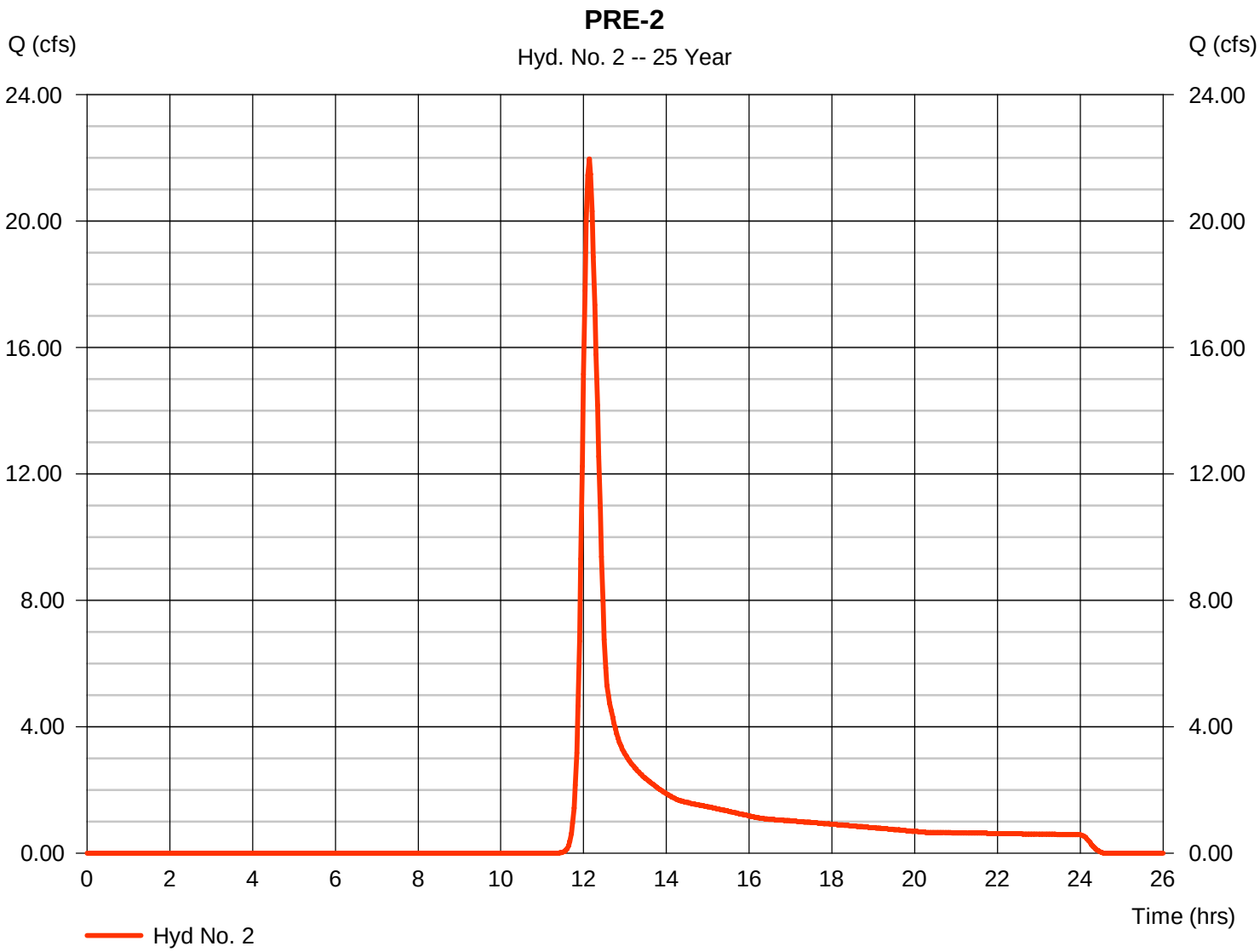
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 2

PRE-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	21.98 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	84,466 cuft
Drainage area	=	20.060 ac	Curve number	=	64*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.40 min
Total precip.	=	4.29 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(12.790 x 58) + (4.820 x 71) + (2.450 x 78)] / 20.060



Hydrograph Report

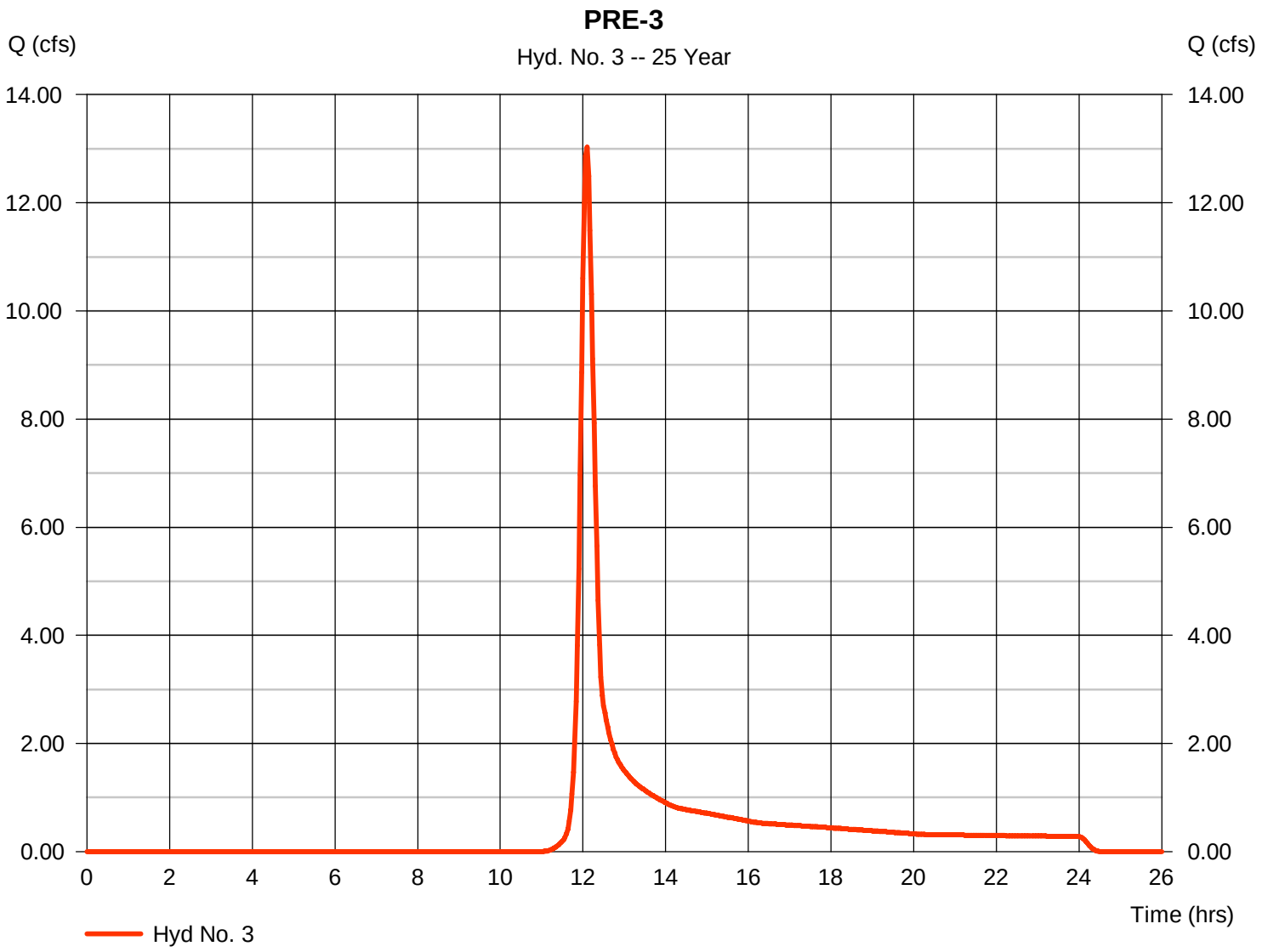
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 3

PRE-3

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.03 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	43,260 cuft
Drainage area	=	8.980 ac	Curve number	=	67*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.90 min
Total precip.	=	4.29 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.270 x 98) + (0.330 x 89) + (4.600 x 58) + (2.720 x 71) + (1.060 x 78)] / 8.980



Hydrograph Report

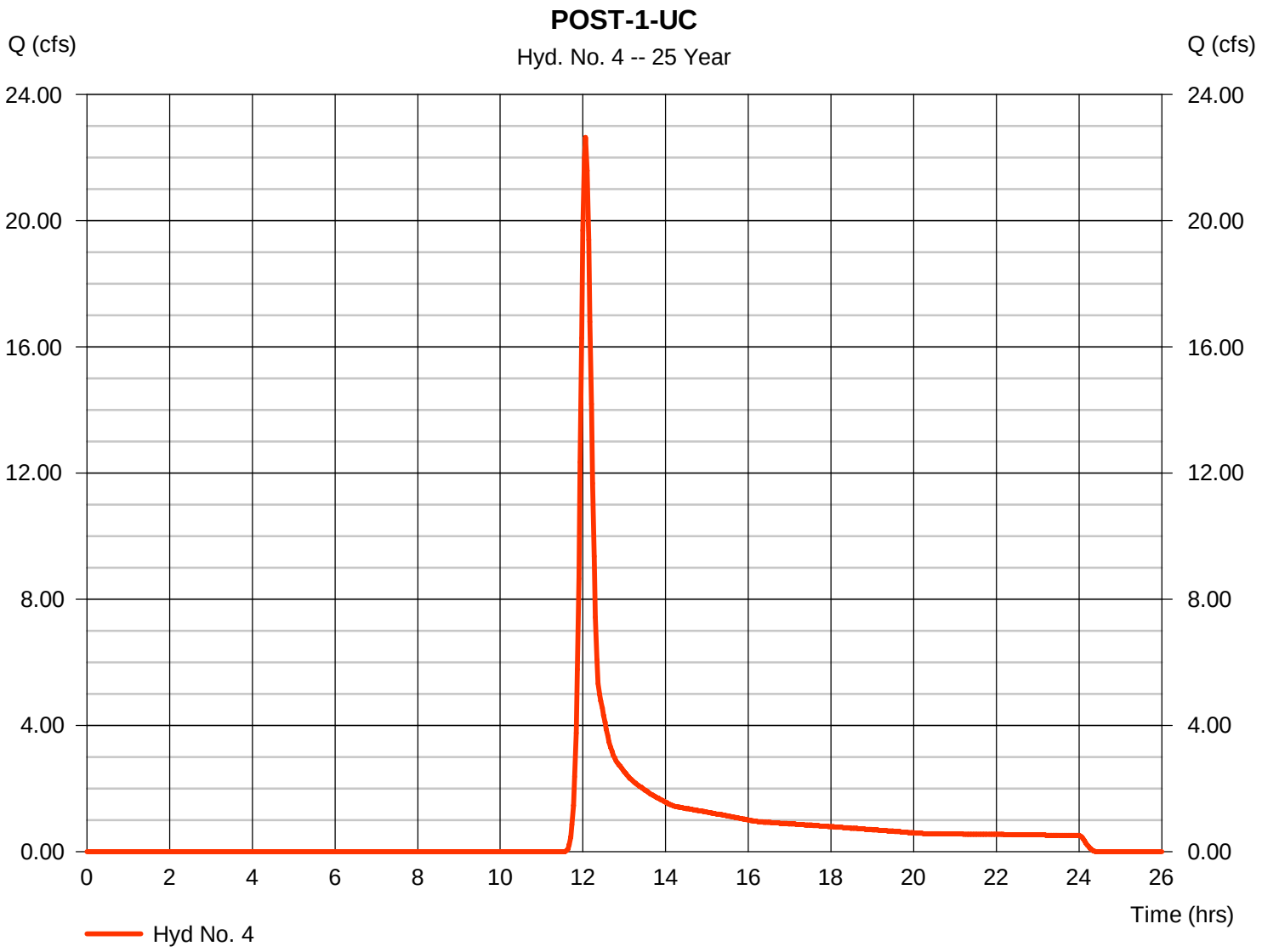
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 4

POST-1-UC

Hydrograph type	=	SCS Runoff	Peak discharge	=	22.65 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	70,739 cuft
Drainage area	=	19.570 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	14.60 min
Total precip.	=	4.29 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(14.350 x 58) + (3.190 x 71) + (2.030 x 78)] / 19.570



Hydrograph Report

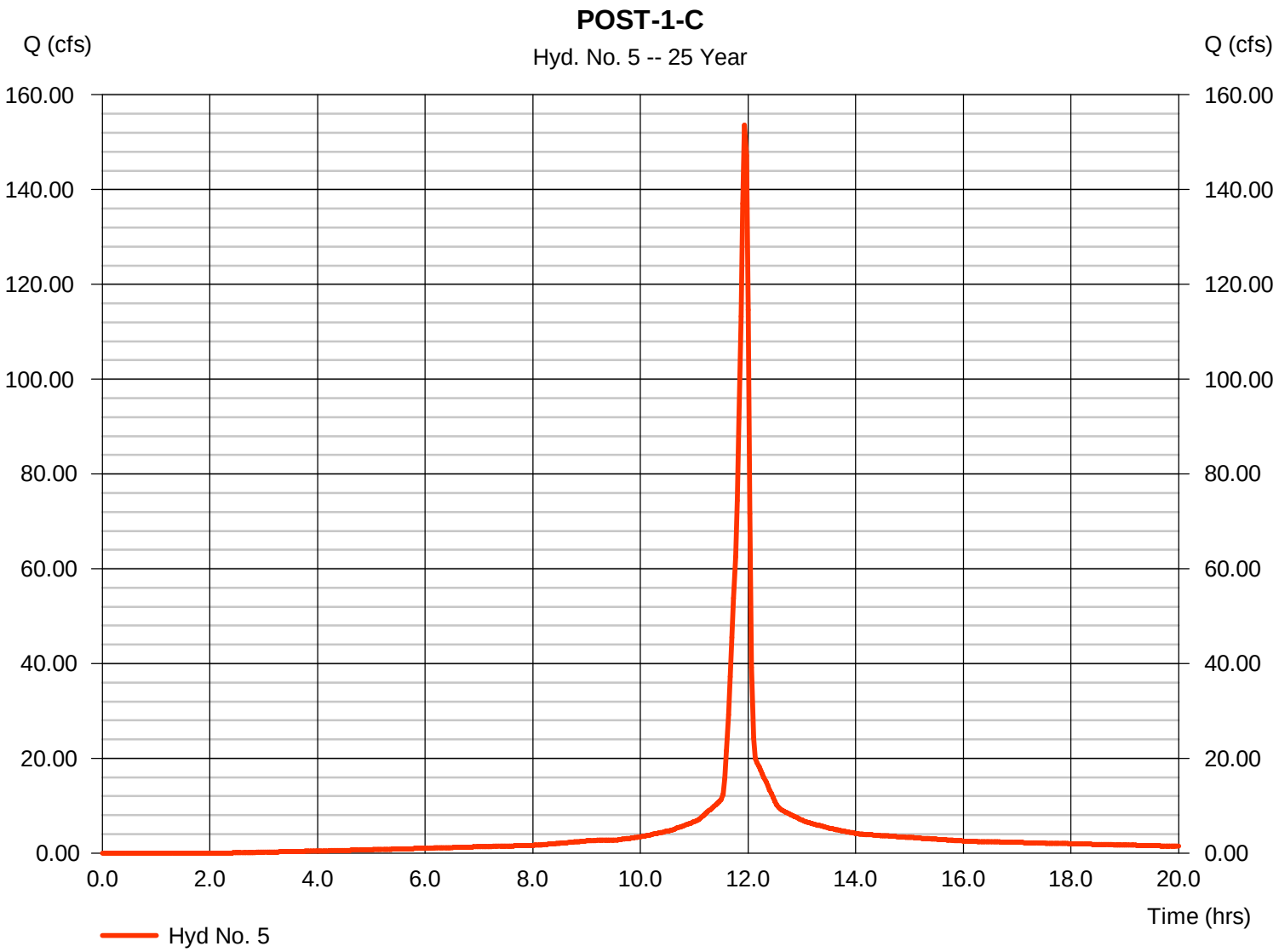
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 5

POST-1-C

Hydrograph type	= SCS Runoff	Peak discharge	= 153.64 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 344,970 cuft
Drainage area	= 27.270 ac	Curve number	= 95*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(27.270 x 95)] / 27.270



Hydrograph Report

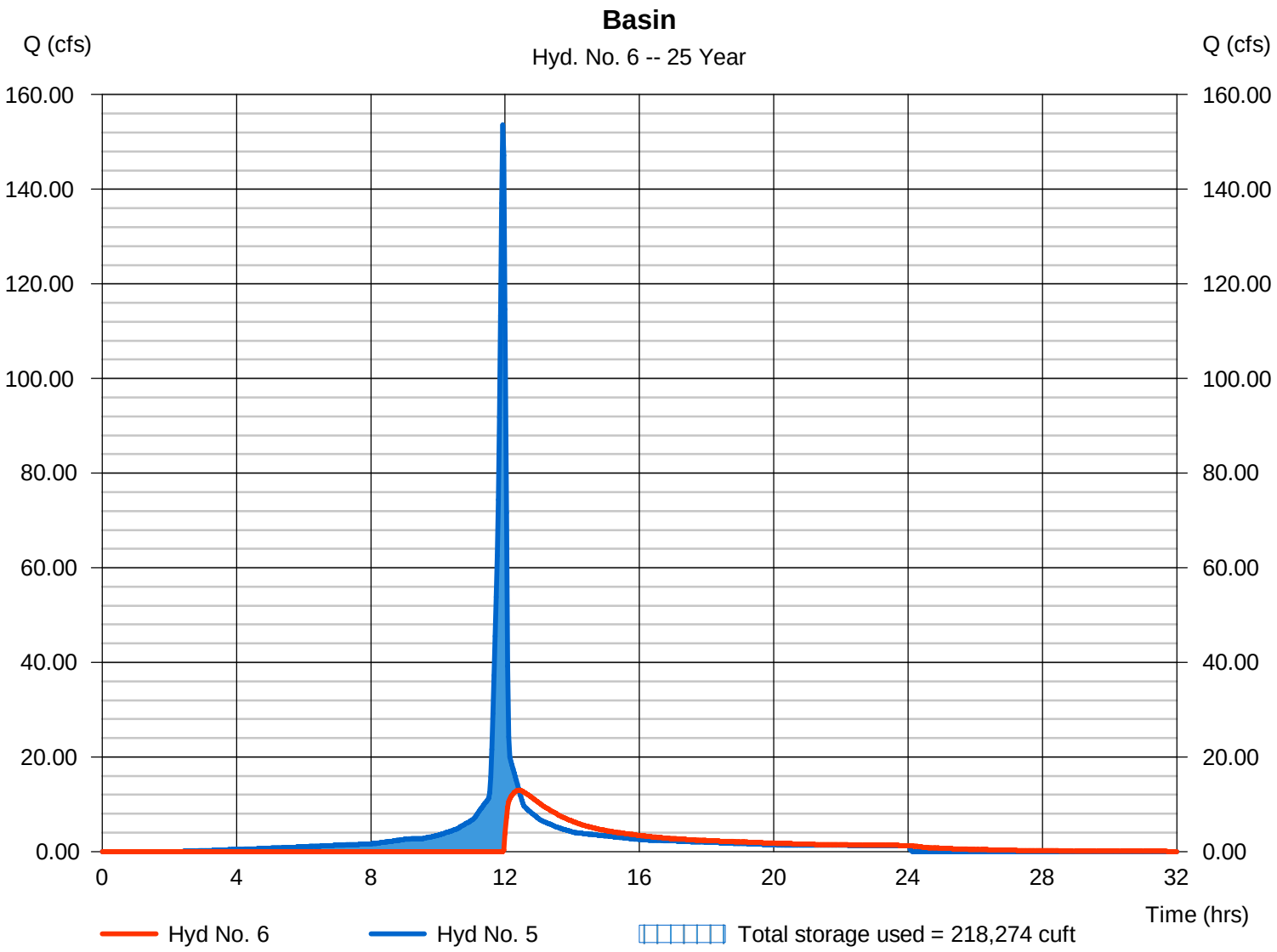
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 6

Basin

Hydrograph type	=	Reservoir	Peak discharge	=	12.96 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.43 hrs
Time interval	=	2 min	Hyd. volume	=	169,580 cuft
Inflow hyd. No.	=	5 - POST-1-C	Max. Elevation	=	817.62 ft
Reservoir name	=	Basin	Max. Storage	=	218,274 cuft

Storage Indication method used.



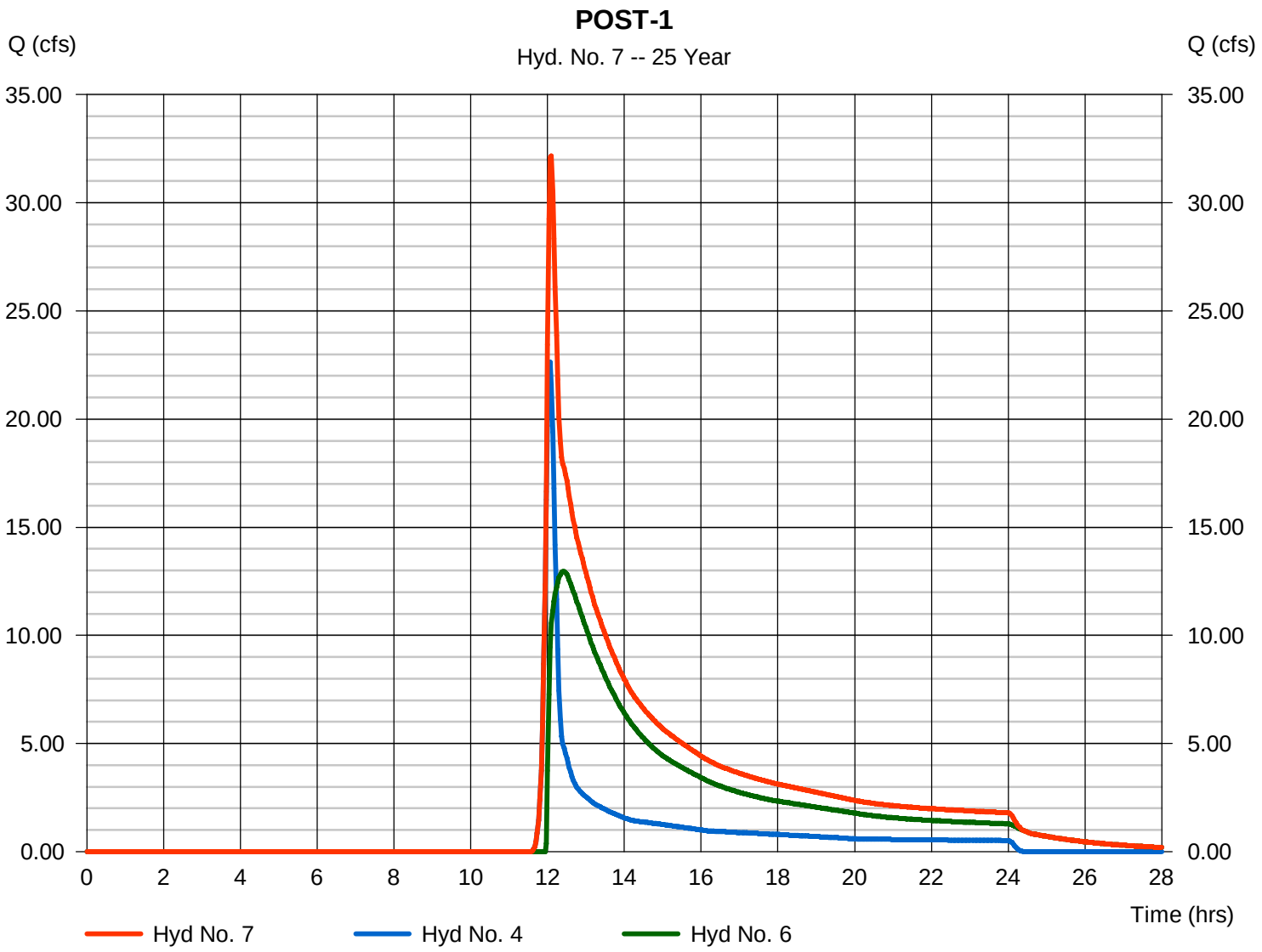
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 7

POST-1

Hydrograph type	=	Combine	Peak discharge	=	32.16 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	240,319 cuft
Inflow hyds.	=	4, 6	Contrib. drain. area	=	19.570 ac



Hydrograph Report

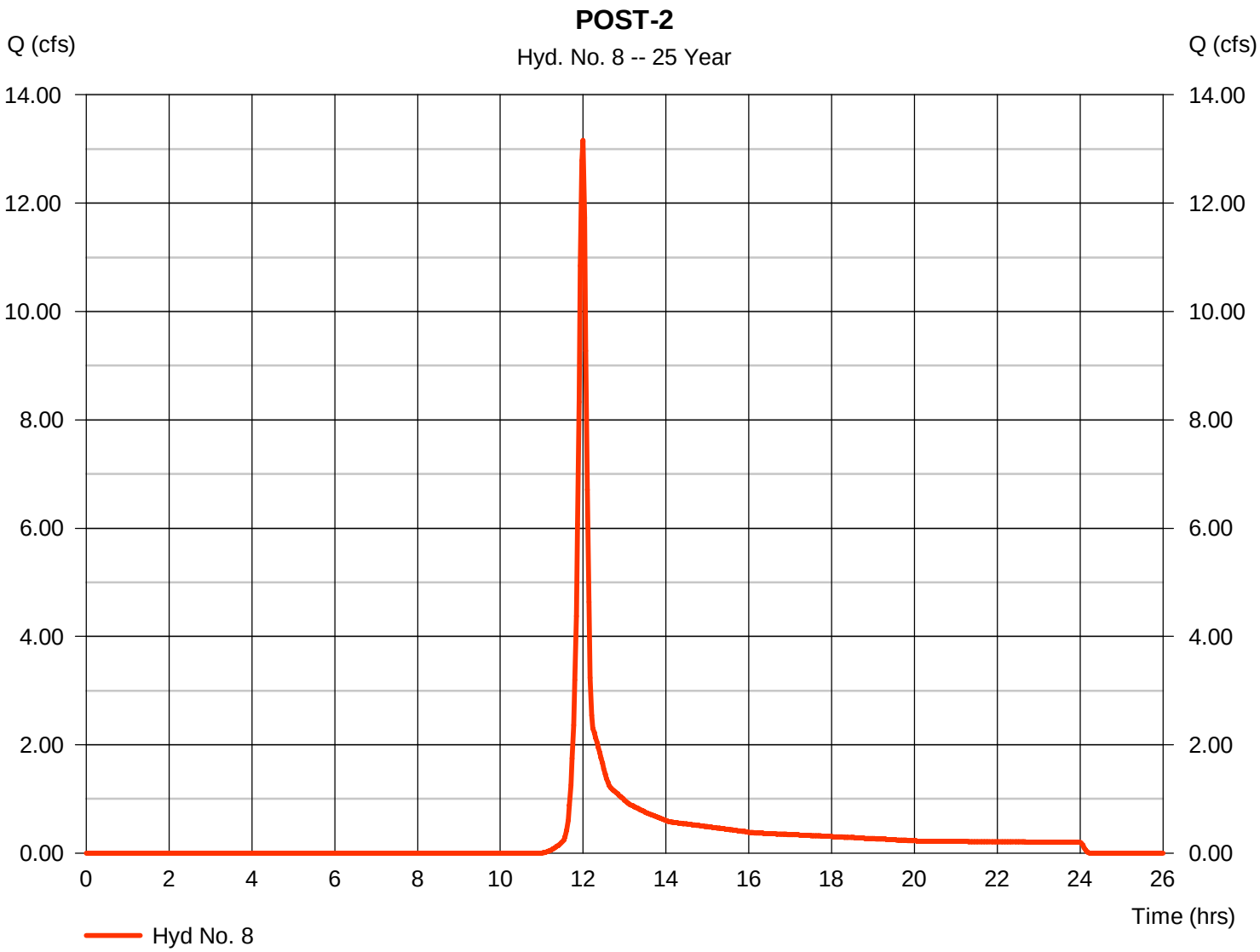
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 8

POST-2

Hydrograph type	= SCS Runoff	Peak discharge	= 13.16 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 30,591 cuft
Drainage area	= 6.350 ac	Curve number	= 67*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.40 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.600 x 58) + (3.000 x 71) + (0.750 x 78)] / 6.350



Hydrograph Report

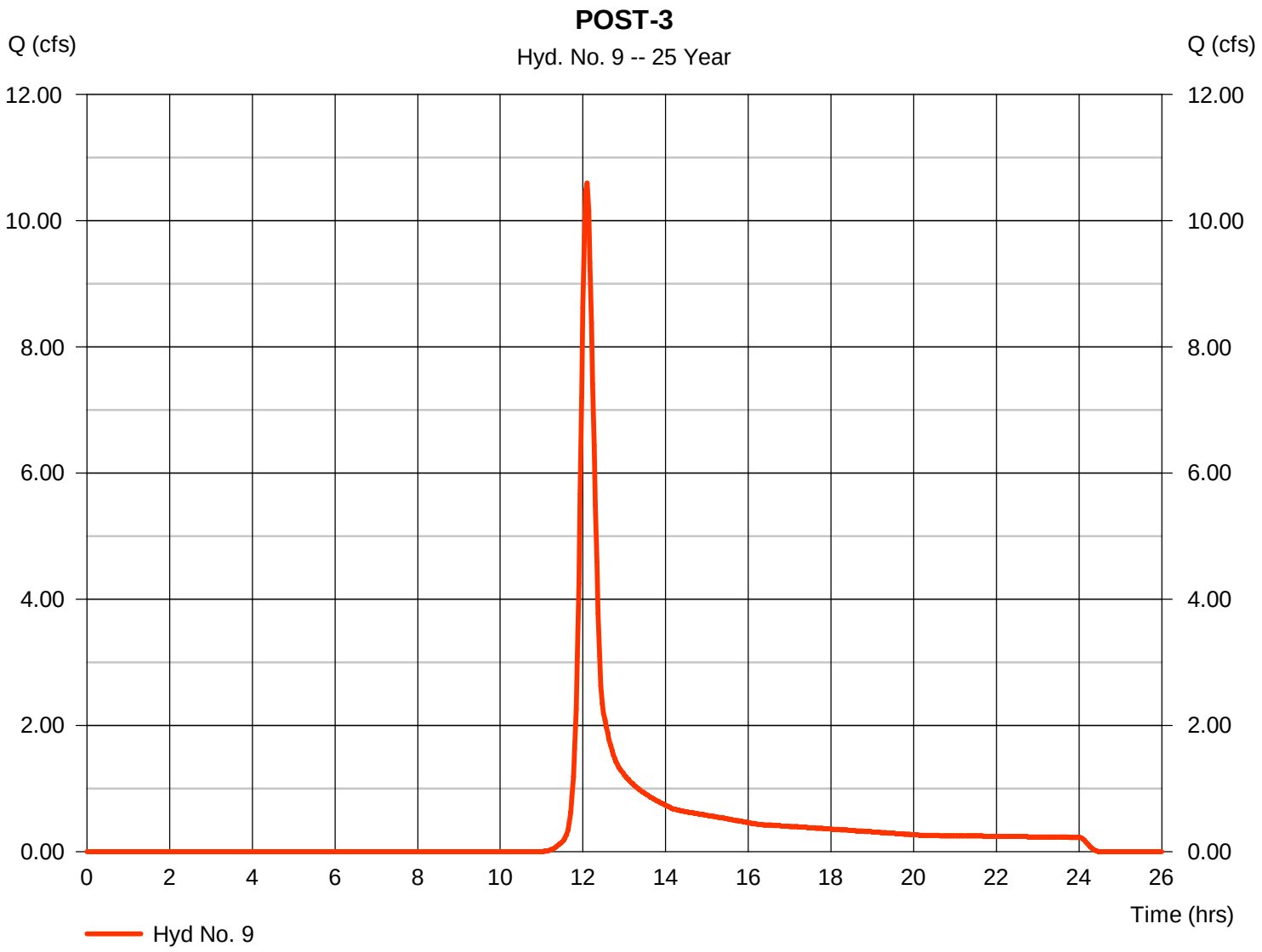
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 9

POST-3

Hydrograph type	= SCS Runoff	Peak discharge	= 10.59 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 35,167 cuft
Drainage area	= 7.300 ac	Curve number	= 67*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.30 min
Total precip.	= 4.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.450 x 98) + (3.980 x 58) + (1.810 x 71) + (1.060 x 78)] / 7.300



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	56.29	2	726	185,432	------	------	------	PRE-1
2	SCS Runoff	30.13	2	728	111,414	------	------	------	PRE-2
3	SCS Runoff	17.26	2	726	56,066	------	------	------	PRE-3
4	SCS Runoff	31.49	2	724	94,537	------	------	------	POST-1-UC
5	SCS Runoff	176.16	2	716	399,117	------	------	------	POST-1-C
6	Reservoir	18.93	2	736	223,727	5	818.00	244,699	Basin
7	Combine	50.19	2	724	318,264	4, 6	------	------	POST-1
8	SCS Runoff	17.23	2	720	39,646	------	------	------	POST-2
9	SCS Runoff	14.03	2	726	45,577	------	------	------	POST-3

Hydrograph Report

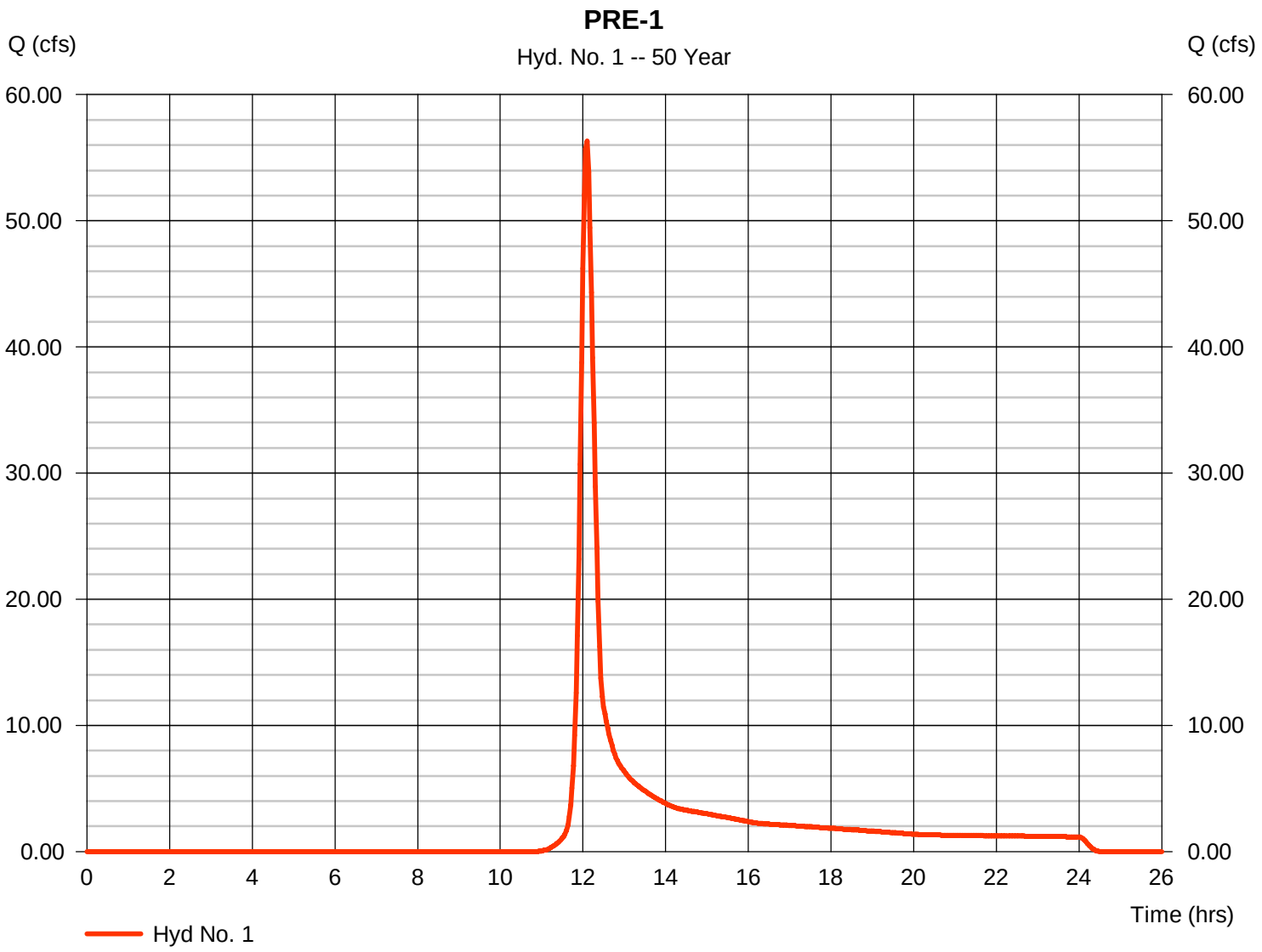
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 1

PRE-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	56.29 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	185,432 cuft
Drainage area	=	32.450 ac	Curve number	=	65*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.90 min
Total precip.	=	4.88 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.190 x 98) + (0.130 x 89) + (16.050 x 58) + (14.050 x 71) + (2.030 x 78)] / 32.450



Hydrograph Report

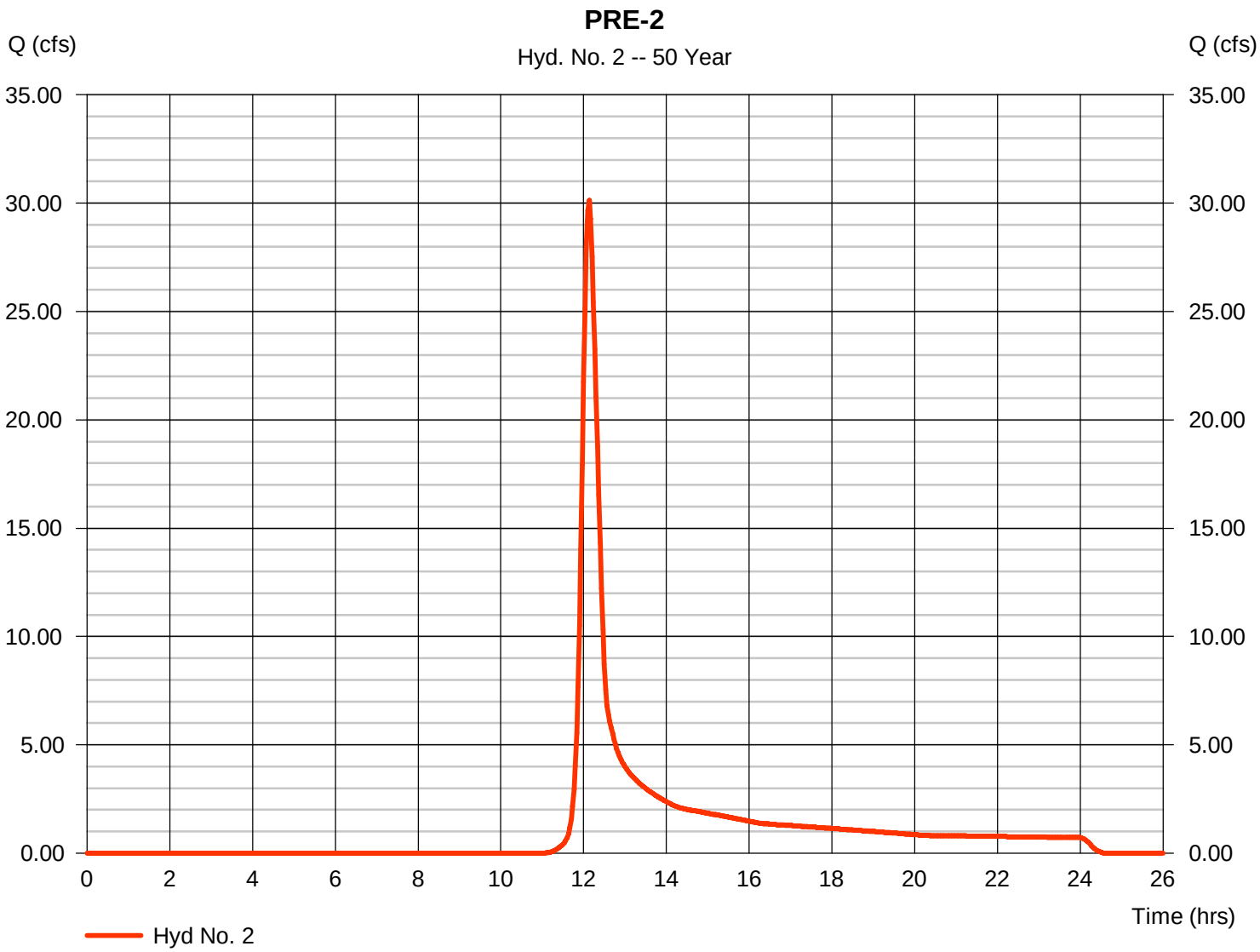
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 2

PRE-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	30.13 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	111,414 cuft
Drainage area	=	20.060 ac	Curve number	=	64*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.40 min
Total precip.	=	4.88 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(12.790 x 58) + (4.820 x 71) + (2.450 x 78)] / 20.060



Hydrograph Report

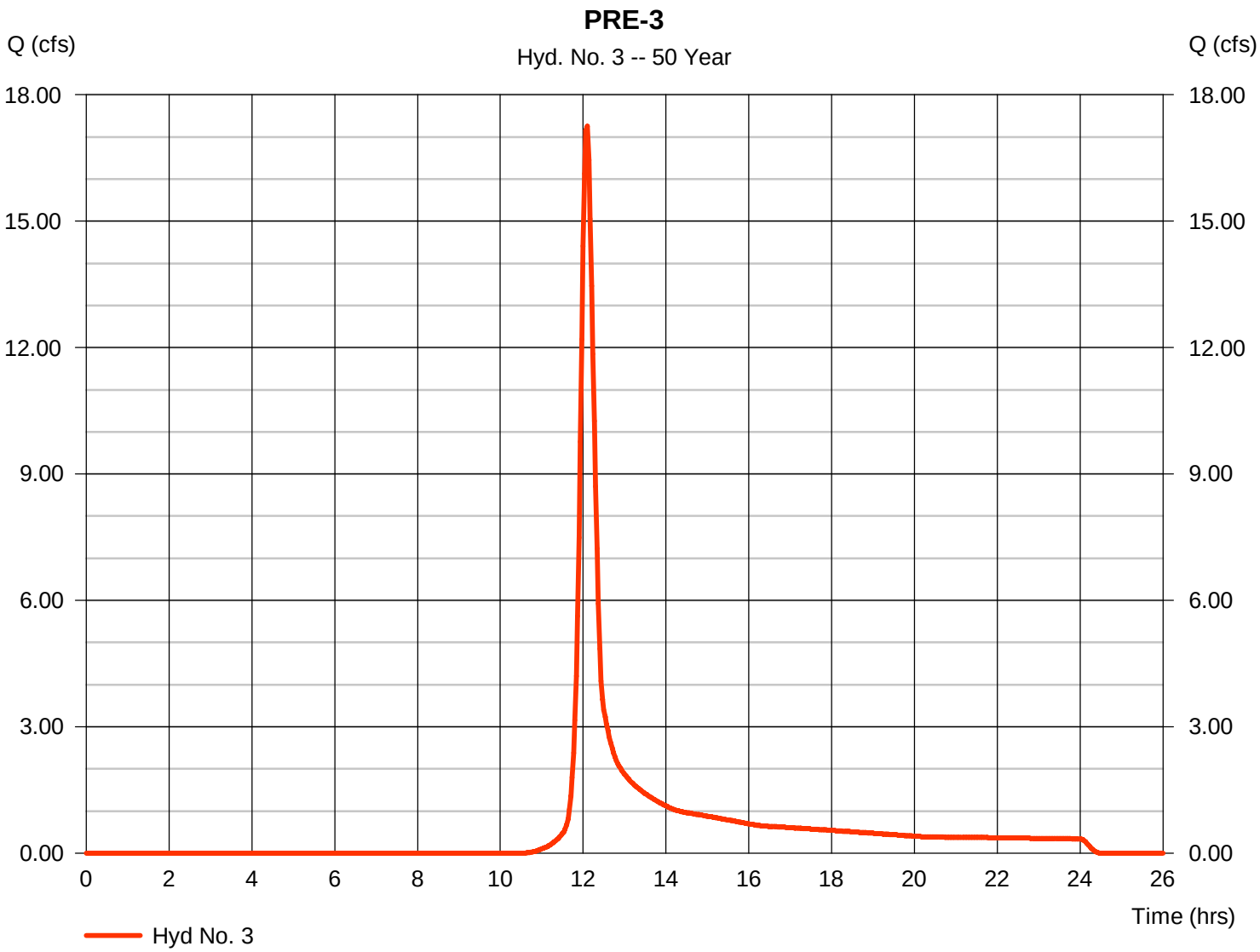
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 3

PRE-3

Hydrograph type	= SCS Runoff	Peak discharge	= 17.26 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 56,066 cuft
Drainage area	= 8.980 ac	Curve number	= 67*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.90 min
Total precip.	= 4.88 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.270 x 98) + (0.330 x 89) + (4.600 x 58) + (2.720 x 71) + (1.060 x 78)] / 8.980



Hydrograph Report

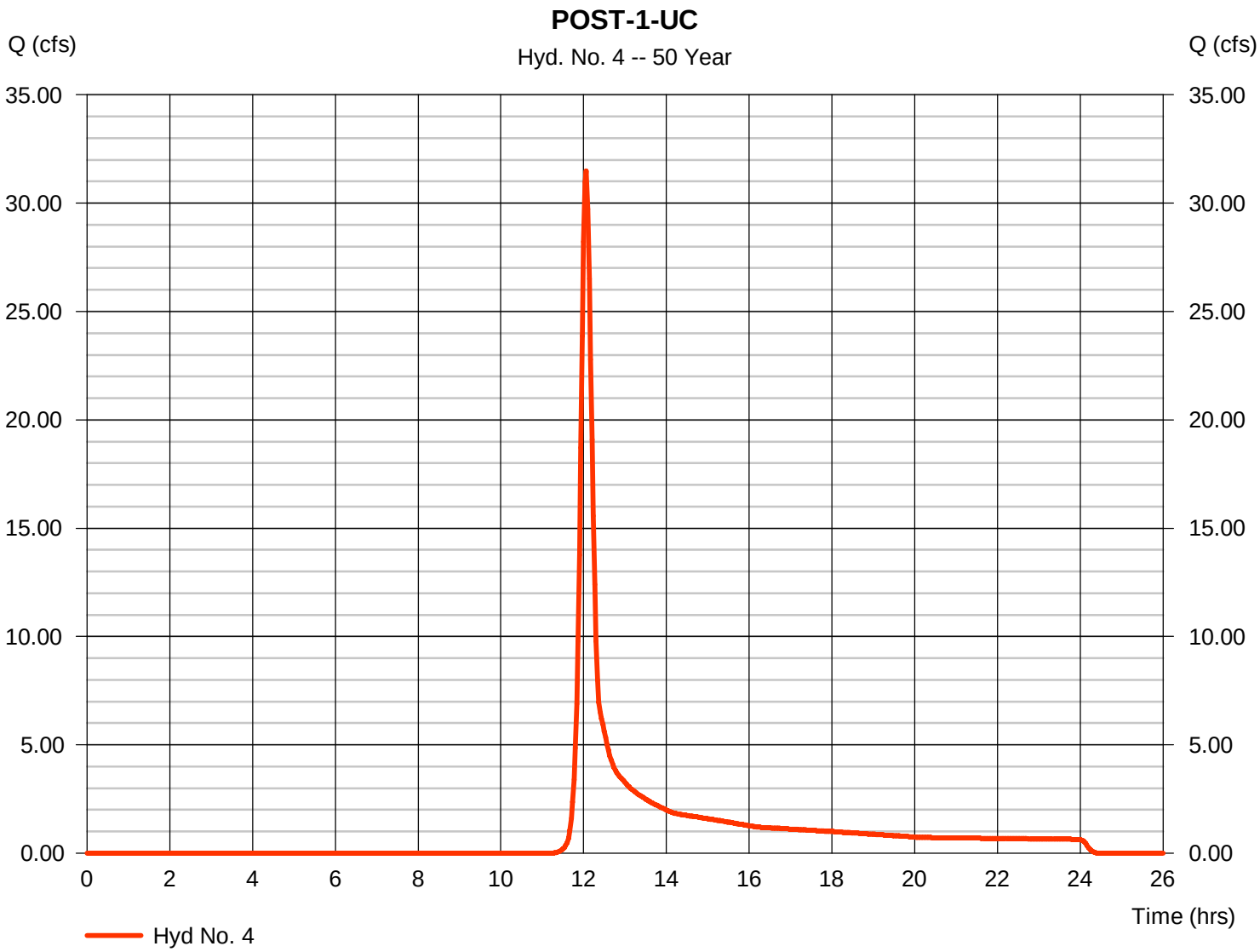
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 4

POST-1-UC

Hydrograph type	=	SCS Runoff	Peak discharge	=	31.49 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	94,537 cuft
Drainage area	=	19.570 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	14.60 min
Total precip.	=	4.88 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(14.350 x 58) + (3.190 x 71) + (2.030 x 78)] / 19.570



Hydrograph Report

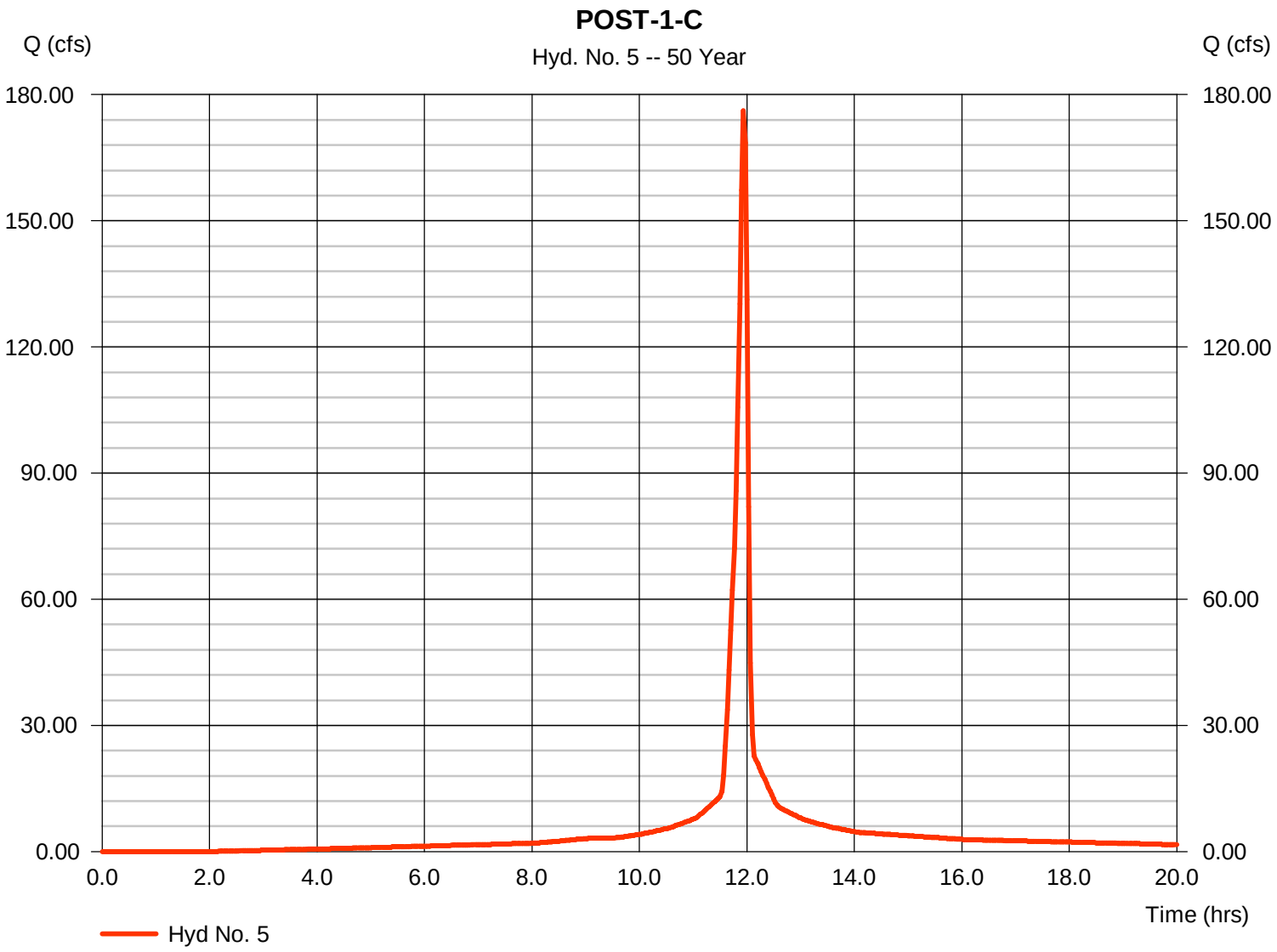
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 5

POST-1-C

Hydrograph type	= SCS Runoff	Peak discharge	= 176.16 cfs
Storm frequency	= 50 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 399,117 cuft
Drainage area	= 27.270 ac	Curve number	= 95*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.88 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(27.270 x 95)] / 27.270



Hydrograph Report

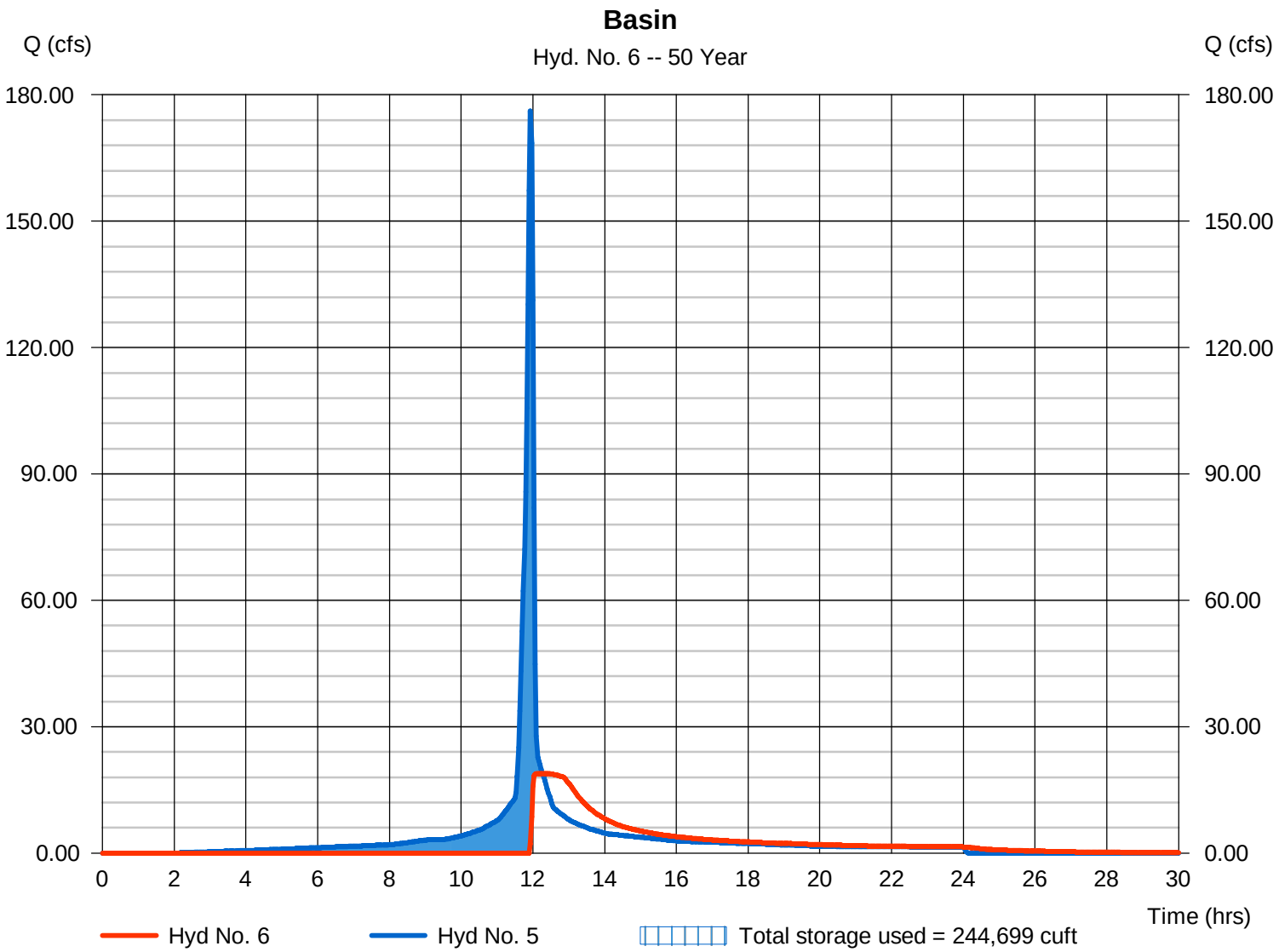
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 6

Basin

Hydrograph type	= Reservoir	Peak discharge	= 18.93 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 223,727 cuft
Inflow hyd. No.	= 5 - POST-1-C	Max. Elevation	= 818.00 ft
Reservoir name	= Basin	Max. Storage	= 244,699 cuft

Storage Indication method used.



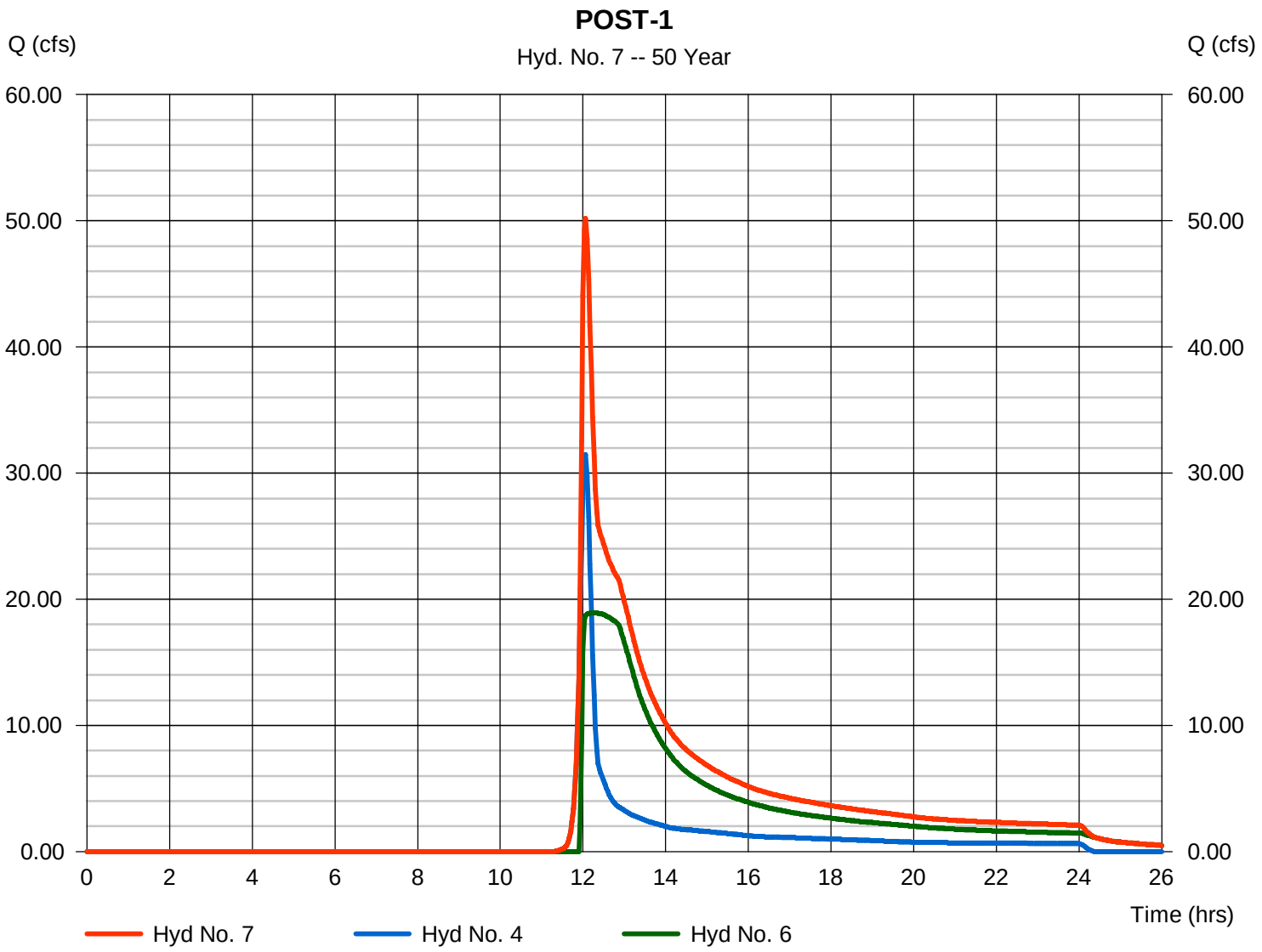
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 7

POST-1

Hydrograph type	=	Combine	Peak discharge	=	50.19 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	318,264 cuft
Inflow hyds.	=	4, 6	Contrib. drain. area	=	19.570 ac



Hydrograph Report

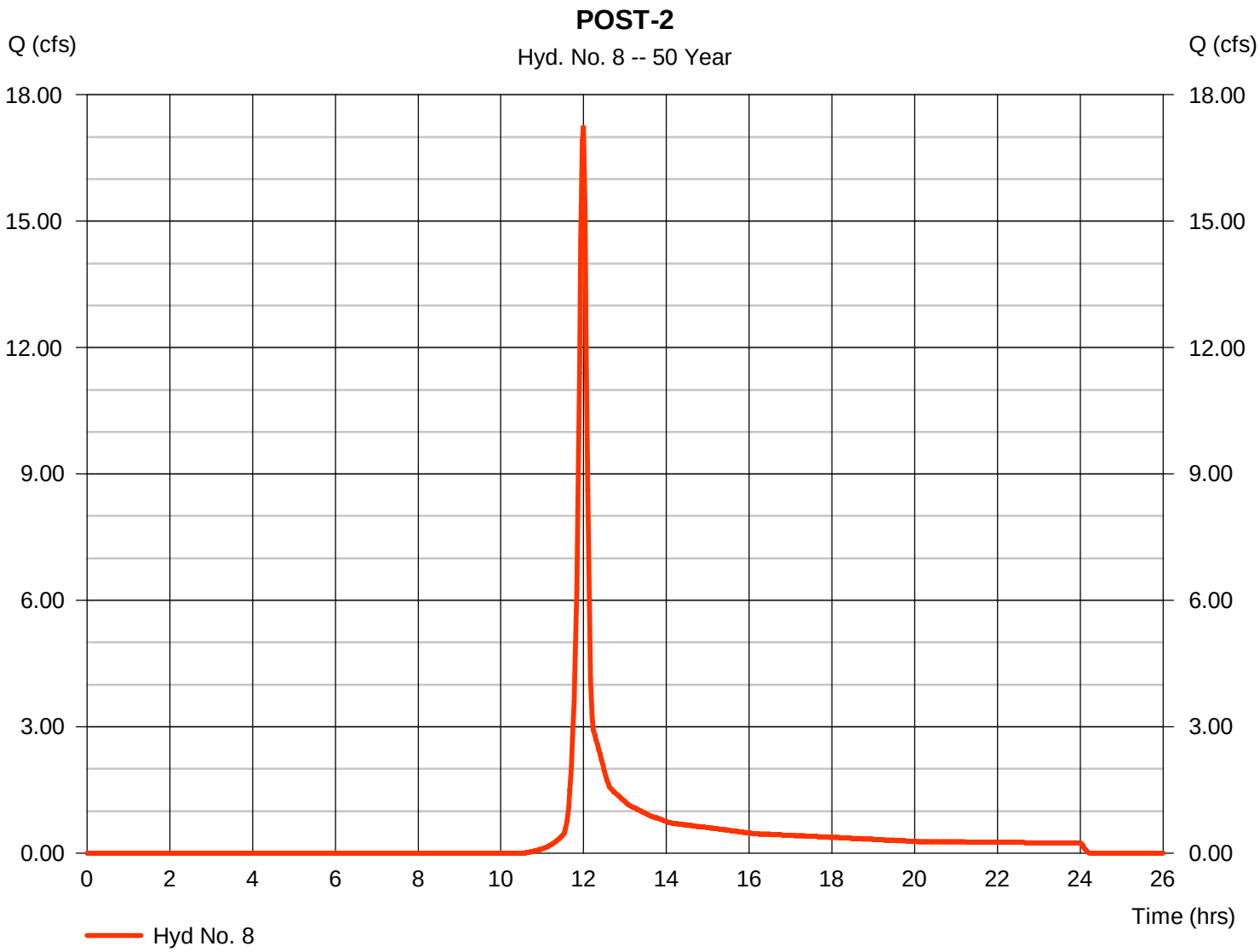
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 8

POST-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.23 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.00 hrs
Time interval	=	2 min	Hyd. volume	=	39,646 cuft
Drainage area	=	6.350 ac	Curve number	=	67*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	8.40 min
Total precip.	=	4.88 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.600 x 58) + (3.000 x 71) + (0.750 x 78)] / 6.350



Hydrograph Report

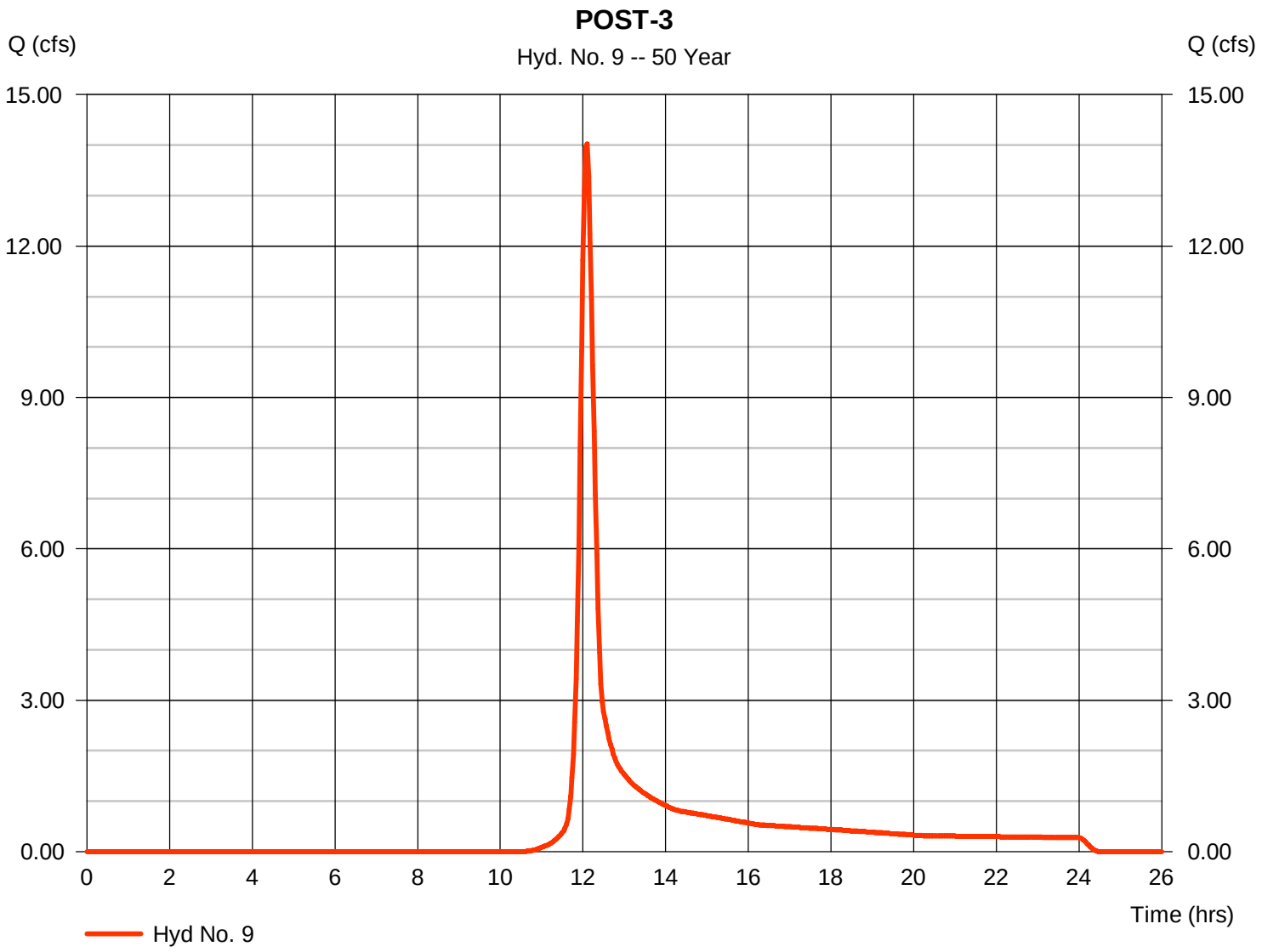
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 9

POST-3

Hydrograph type	= SCS Runoff	Peak discharge	= 14.03 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 45,577 cuft
Drainage area	= 7.300 ac	Curve number	= 67*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.30 min
Total precip.	= 4.88 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.450 x 98) + (3.980 x 58) + (1.810 x 71) + (1.060 x 78)] / 7.300



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	73.41	2	726	237,437	------	------	------	PRE-1
2	SCS Runoff	39.74	2	728	143,389	------	------	------	PRE-2
3	SCS Runoff	22.17	2	726	71,101	------	------	------	PRE-3
4	SCS Runoff	41.95	2	724	122,989	------	------	------	POST-1-UC
5	SCS Runoff	200.88	2	716	458,909	------	------	------	POST-1-C
6	Reservoir	20.19	2	738	283,519	5	818.49	281,672	Basin
7	Combine	61.99	2	724	406,508	4, 6	------	------	POST-1
8	SCS Runoff	21.95	2	720	50,277	------	------	------	POST-2
9	SCS Runoff	18.03	2	726	57,799	------	------	------	POST-3

Hydrograph Report

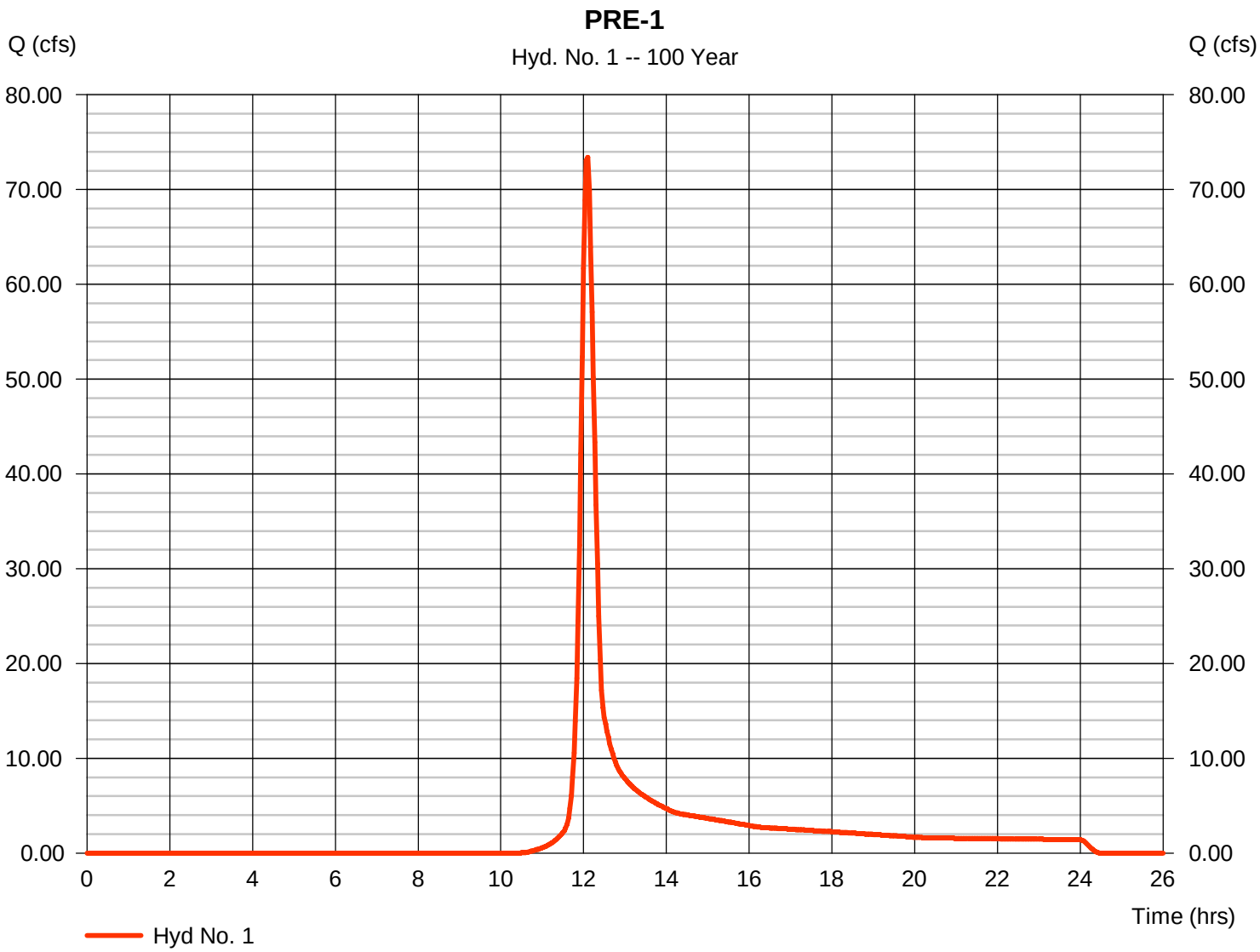
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 1

PRE-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	73.41 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	237,437 cuft
Drainage area	=	32.450 ac	Curve number	=	65*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.90 min
Total precip.	=	5.53 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.190 x 98) + (0.130 x 89) + (16.050 x 58) + (14.050 x 71) + (2.030 x 78)] / 32.450



Hydrograph Report

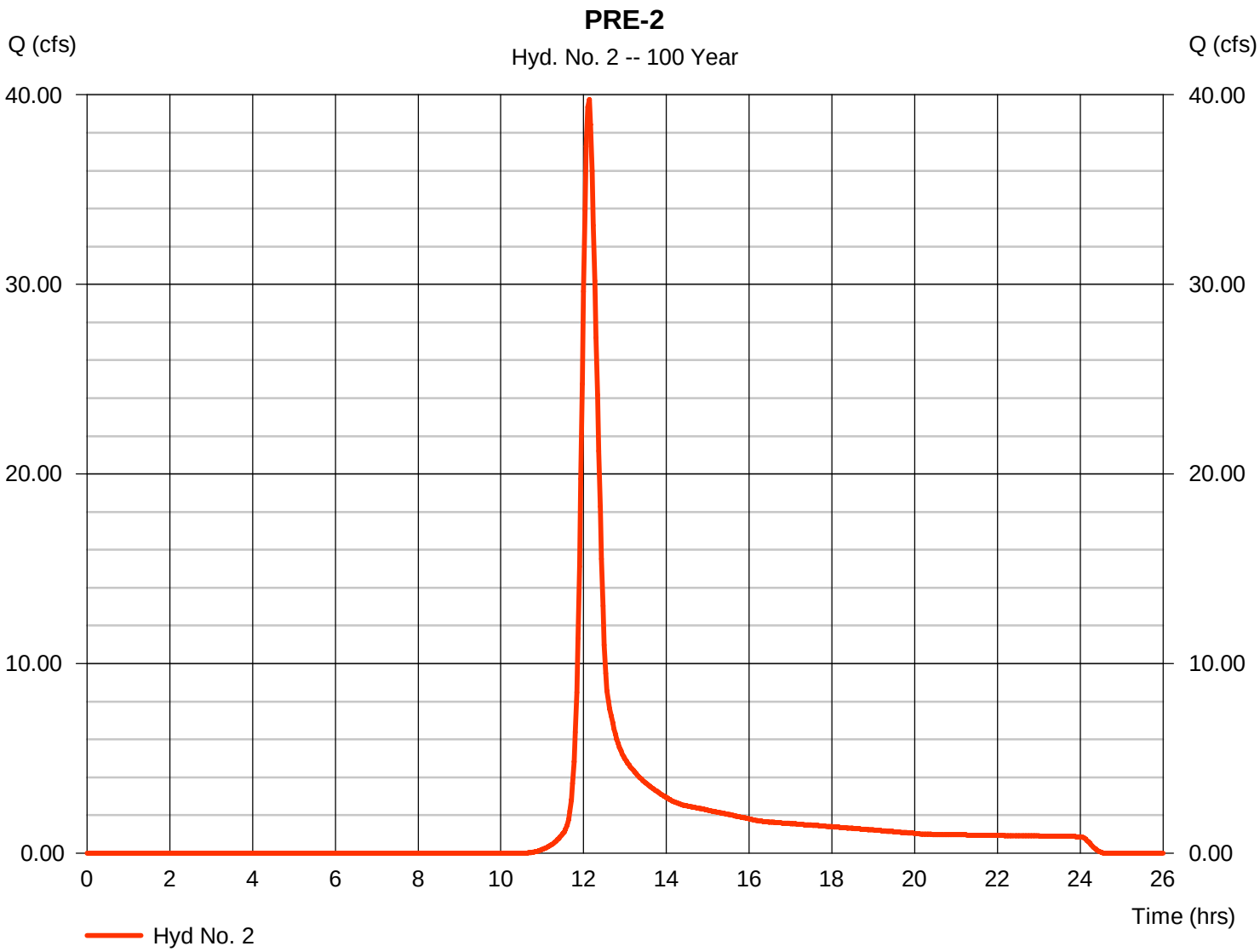
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 2

PRE-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	39.74 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	143,389 cuft
Drainage area	=	20.060 ac	Curve number	=	64*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.40 min
Total precip.	=	5.53 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(12.790 x 58) + (4.820 x 71) + (2.450 x 78)] / 20.060



Hydrograph Report

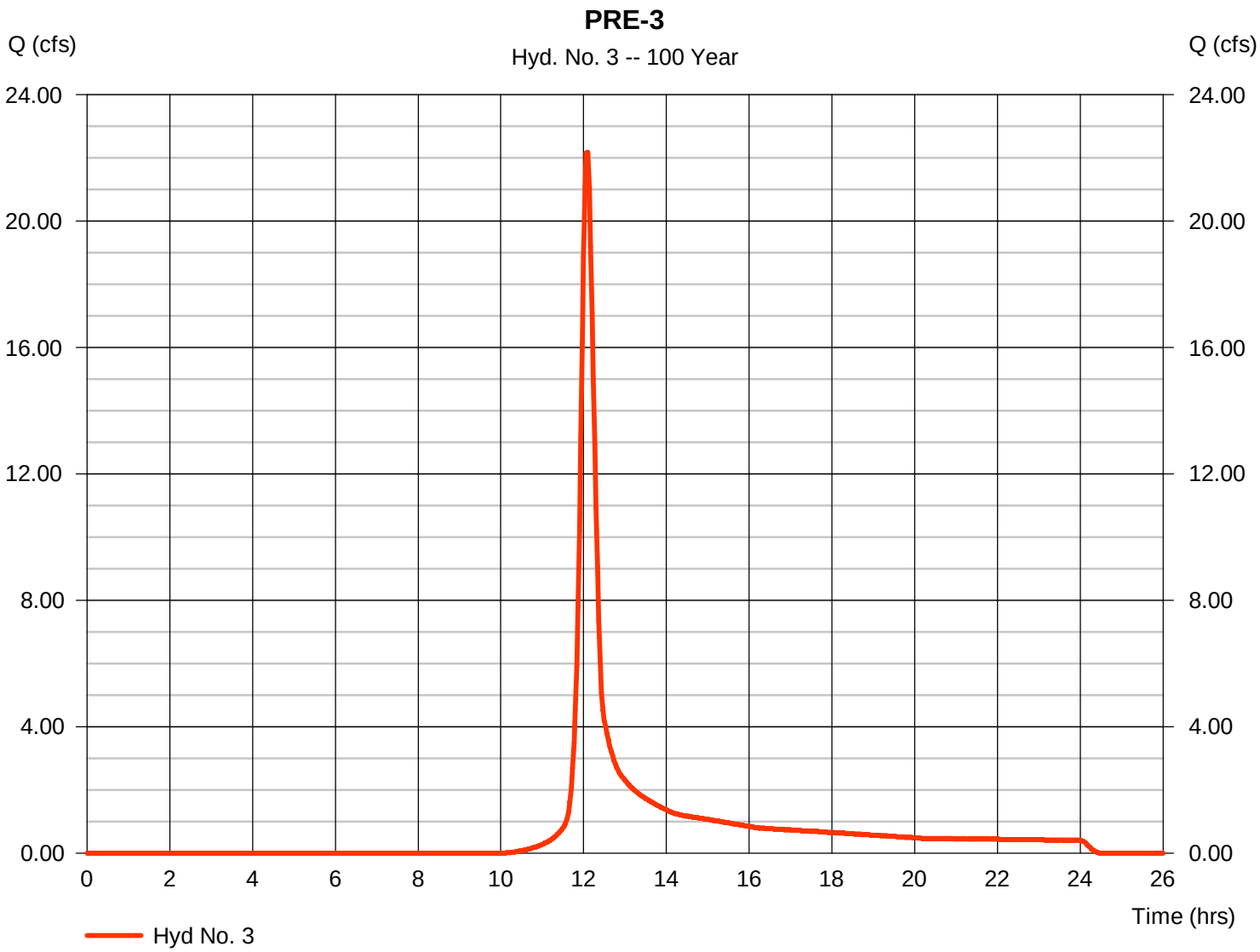
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 3

PRE-3

Hydrograph type	=	SCS Runoff	Peak discharge	=	22.17 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	71,101 cuft
Drainage area	=	8.980 ac	Curve number	=	67*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.90 min
Total precip.	=	5.53 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.270 x 98) + (0.330 x 89) + (4.600 x 58) + (2.720 x 71) + (1.060 x 78)] / 8.980



Hydrograph Report

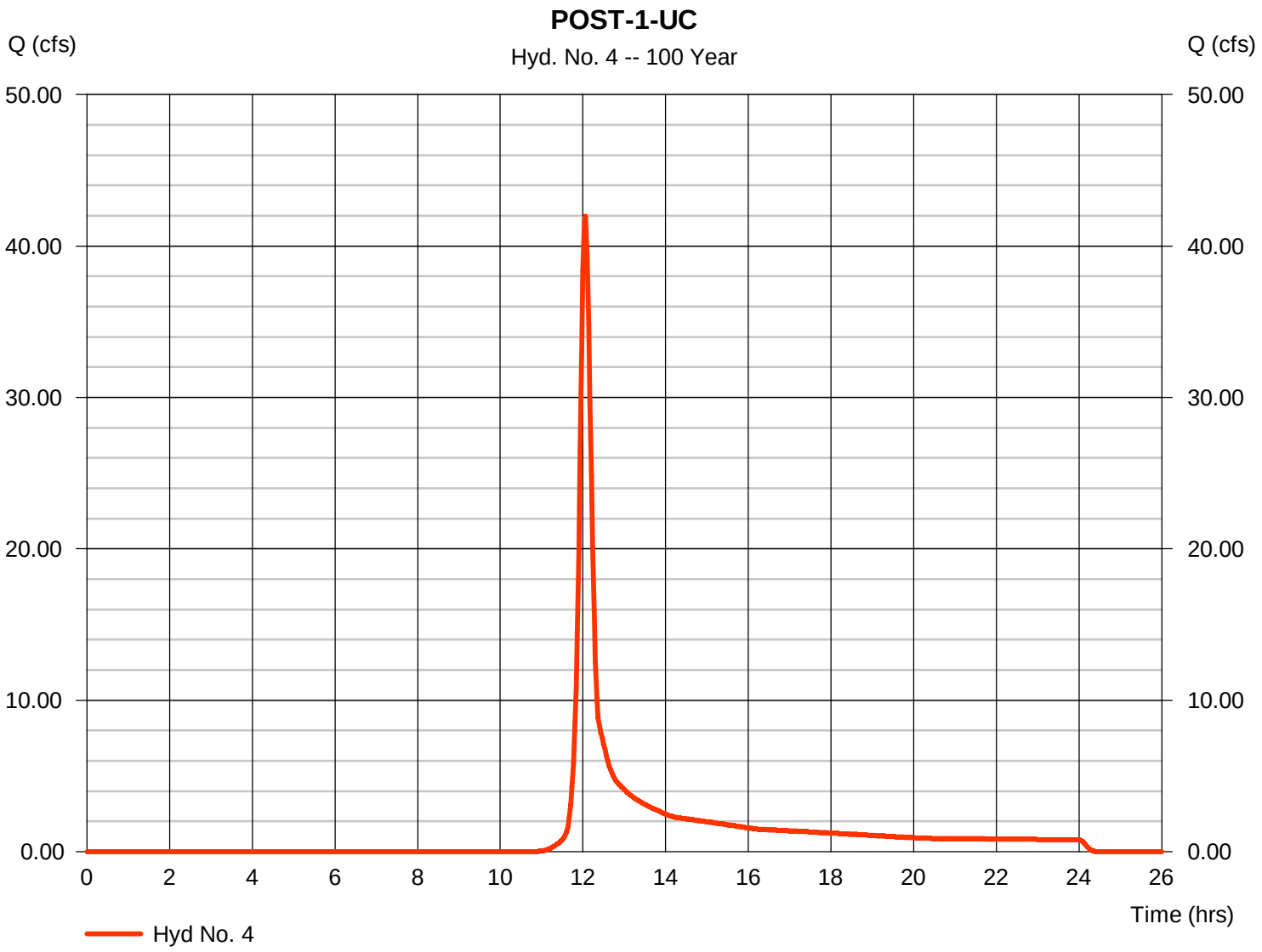
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 4

POST-1-UC

Hydrograph type	=	SCS Runoff	Peak discharge	=	41.95 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	122,989 cuft
Drainage area	=	19.570 ac	Curve number	=	62*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	14.60 min
Total precip.	=	5.53 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(14.350 x 58) + (3.190 x 71) + (2.030 x 78)] / 19.570



Hydrograph Report

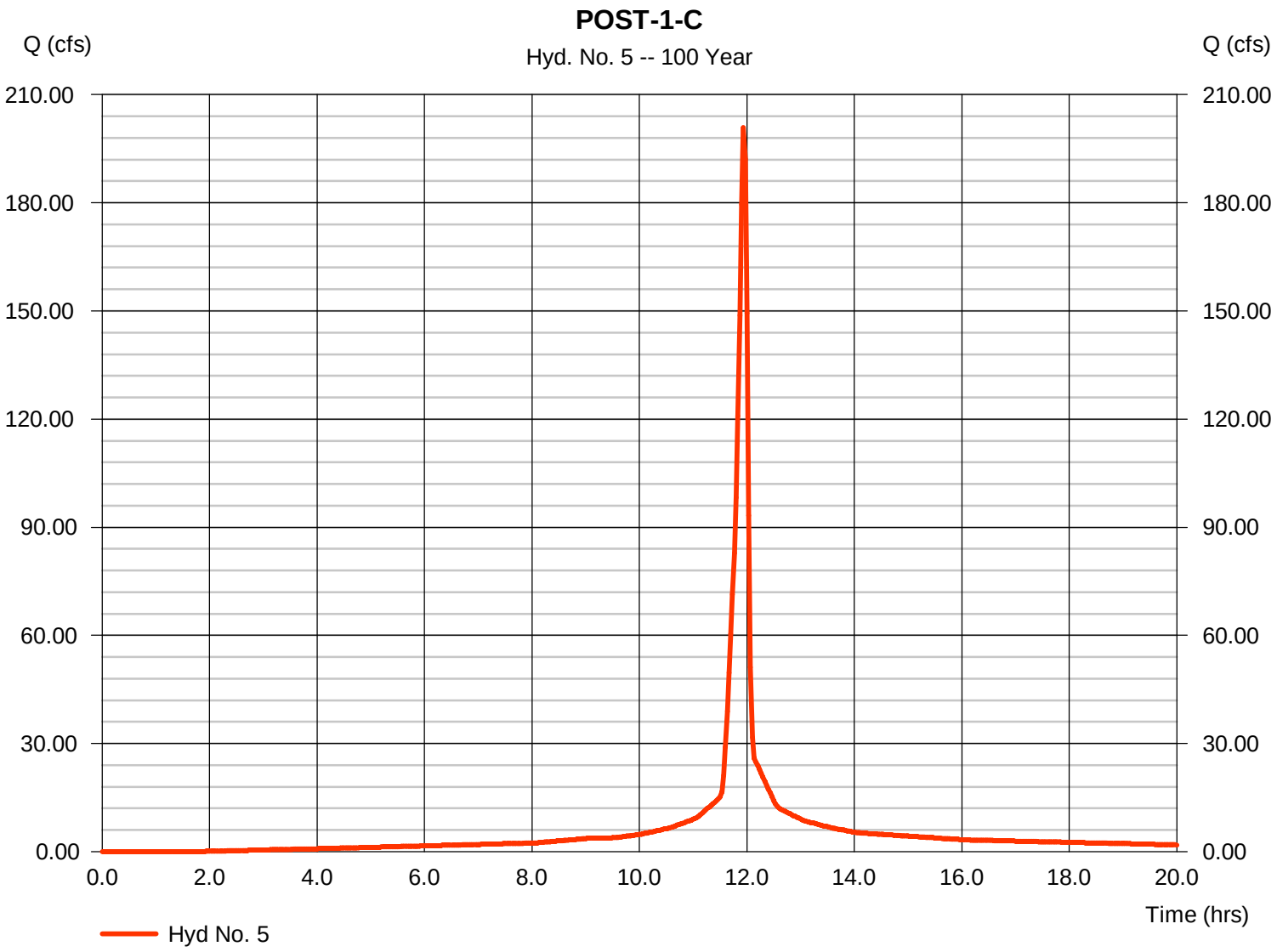
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 5

POST-1-C

Hydrograph type	= SCS Runoff	Peak discharge	= 200.88 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 458,909 cuft
Drainage area	= 27.270 ac	Curve number	= 95*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(27.270 x 95)] / 27.270



Hydrograph Report

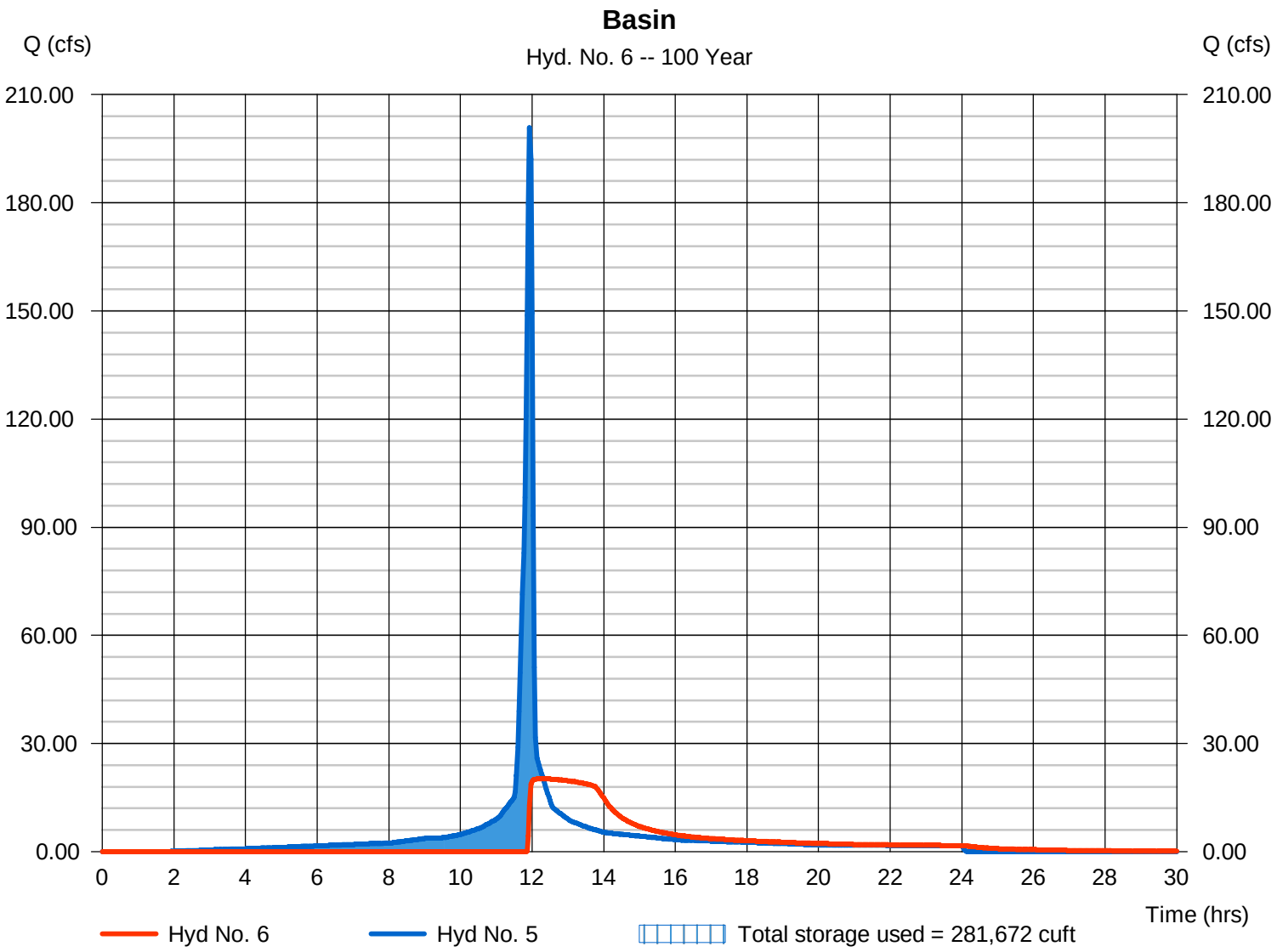
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 6

Basin

Hydrograph type	= Reservoir	Peak discharge	= 20.19 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 283,519 cuft
Inflow hyd. No.	= 5 - POST-1-C	Max. Elevation	= 818.49 ft
Reservoir name	= Basin	Max. Storage	= 281,672 cuft

Storage Indication method used.



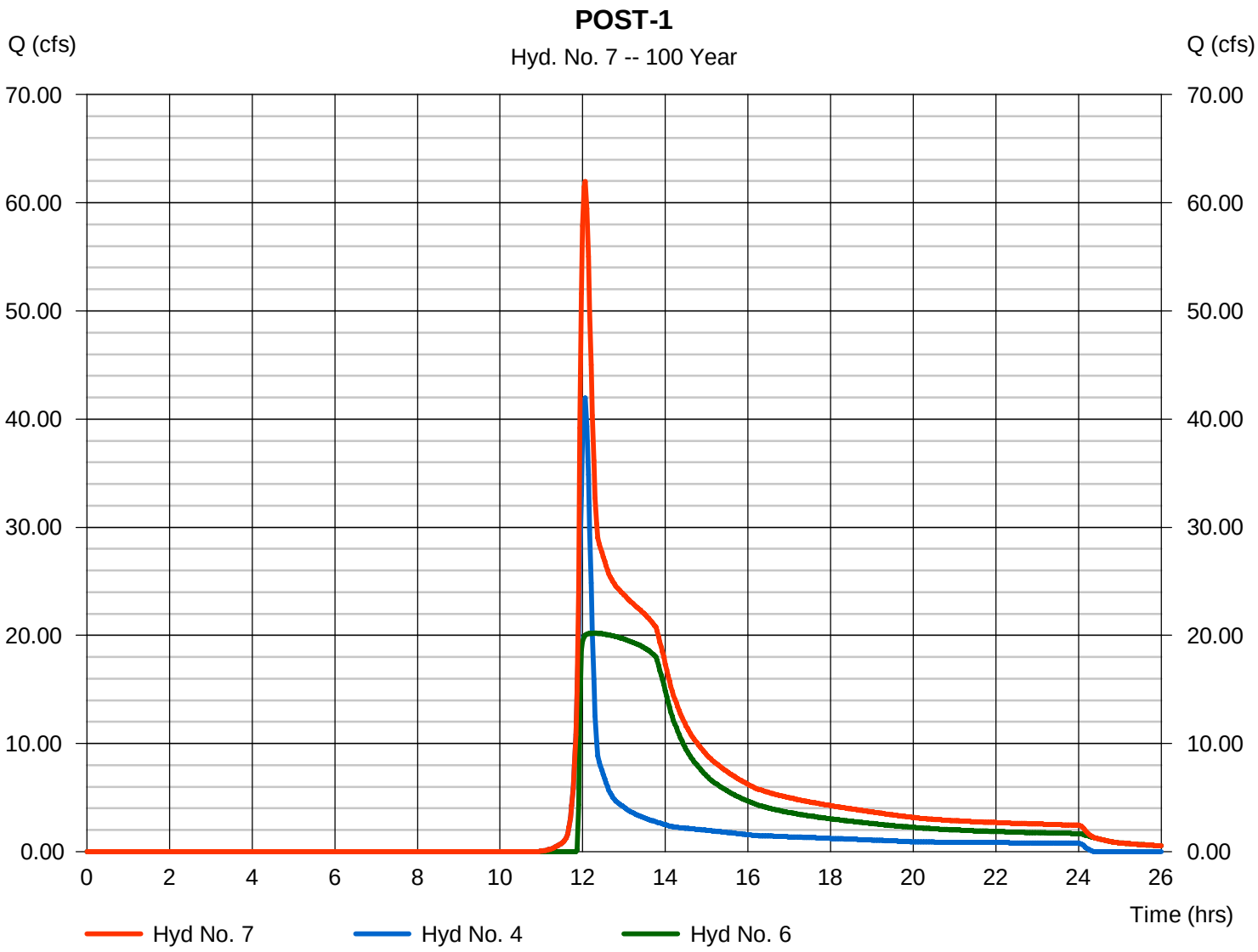
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 7

POST-1

Hydrograph type	= Combine	Peak discharge	= 61.99 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 406,508 cuft
Inflow hyds.	= 4, 6	Contrib. drain. area	= 19.570 ac



Hydrograph Report

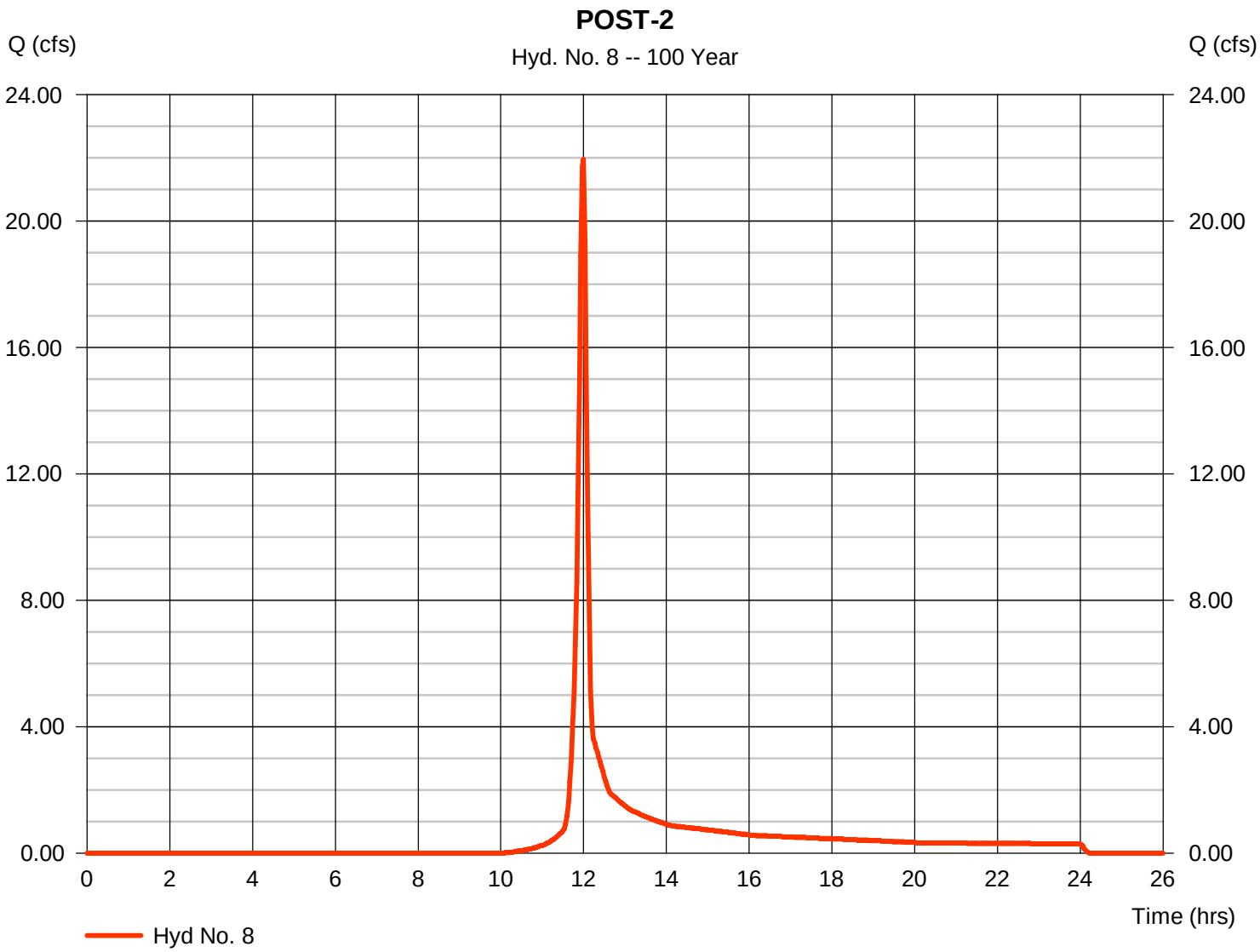
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 8

POST-2

Hydrograph type	= SCS Runoff	Peak discharge	= 21.95 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 50,277 cuft
Drainage area	= 6.350 ac	Curve number	= 67*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.40 min
Total precip.	= 5.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.600 x 58) + (3.000 x 71) + (0.750 x 78)] / 6.350



Hydrograph Report

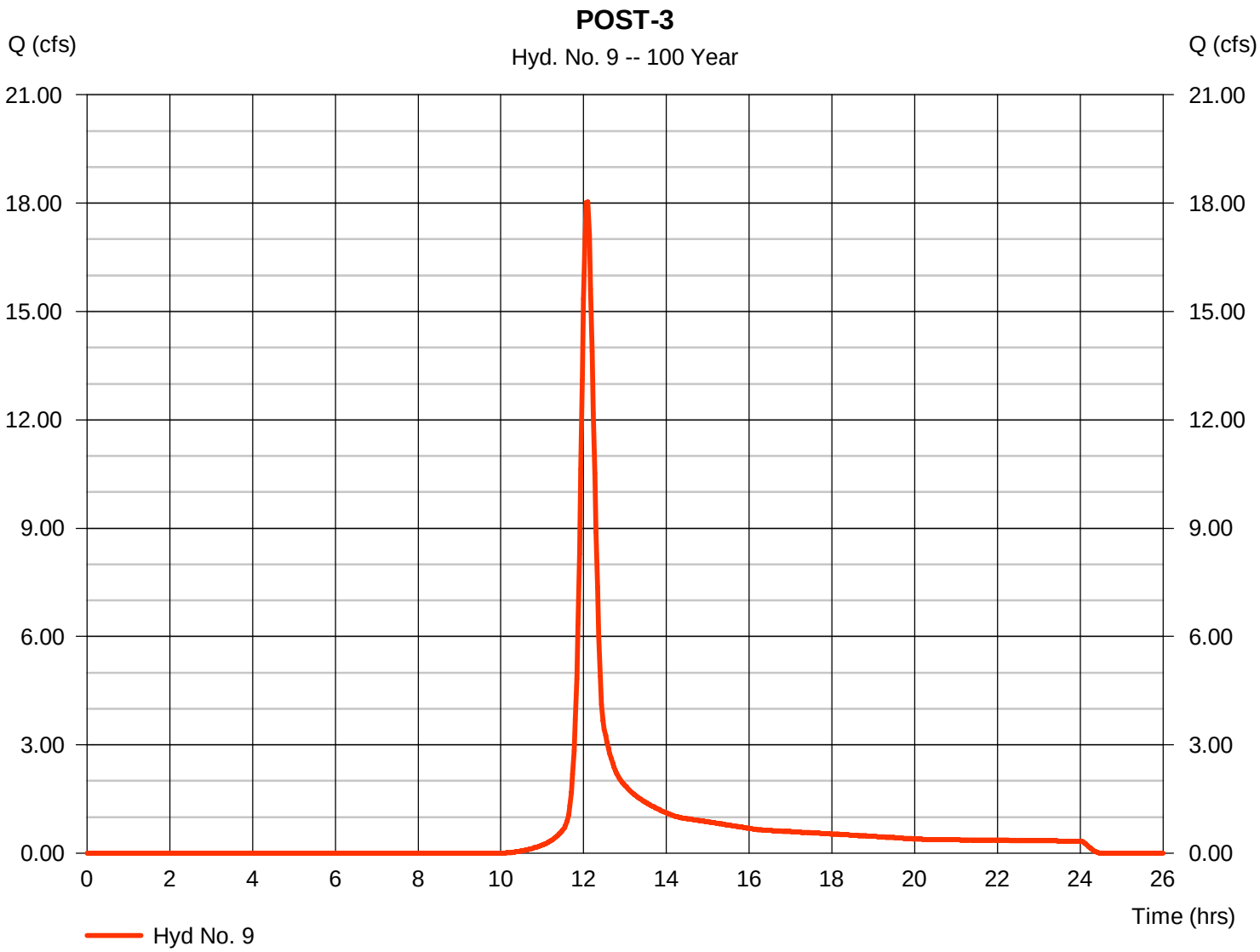
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Friday, 02 / 3 / 2017

Hyd. No. 9

POST-3

Hydrograph type	= SCS Runoff	Peak discharge	= 18.03 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 57,799 cuft
Drainage area	= 7.300 ac	Curve number	= 67*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.30 min
Total precip.	= 5.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.450 x 98) + (3.980 x 58) + (1.810 x 71) + (1.060 x 78)] / 7.300



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	0.0000	0.0000	0.0000	--------
3	0.0000	0.0000	0.0000	--------
5	0.0000	0.0000	0.0000	--------
10	0.0000	0.0000	0.0000	--------
25	0.0000	0.0000	0.0000	--------
50	0.0000	0.0000	0.0000	--------
100	0.0000	0.0000	0.0000	--------

File name: GuernseyCo.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tc = time in minutes. Values may exceed 60.

file name: X:\Project Files_Boston\212IC-CF-00122 - Guernsey Energy Station\PCSM Analysis\calcs\GuernseyCo.pc

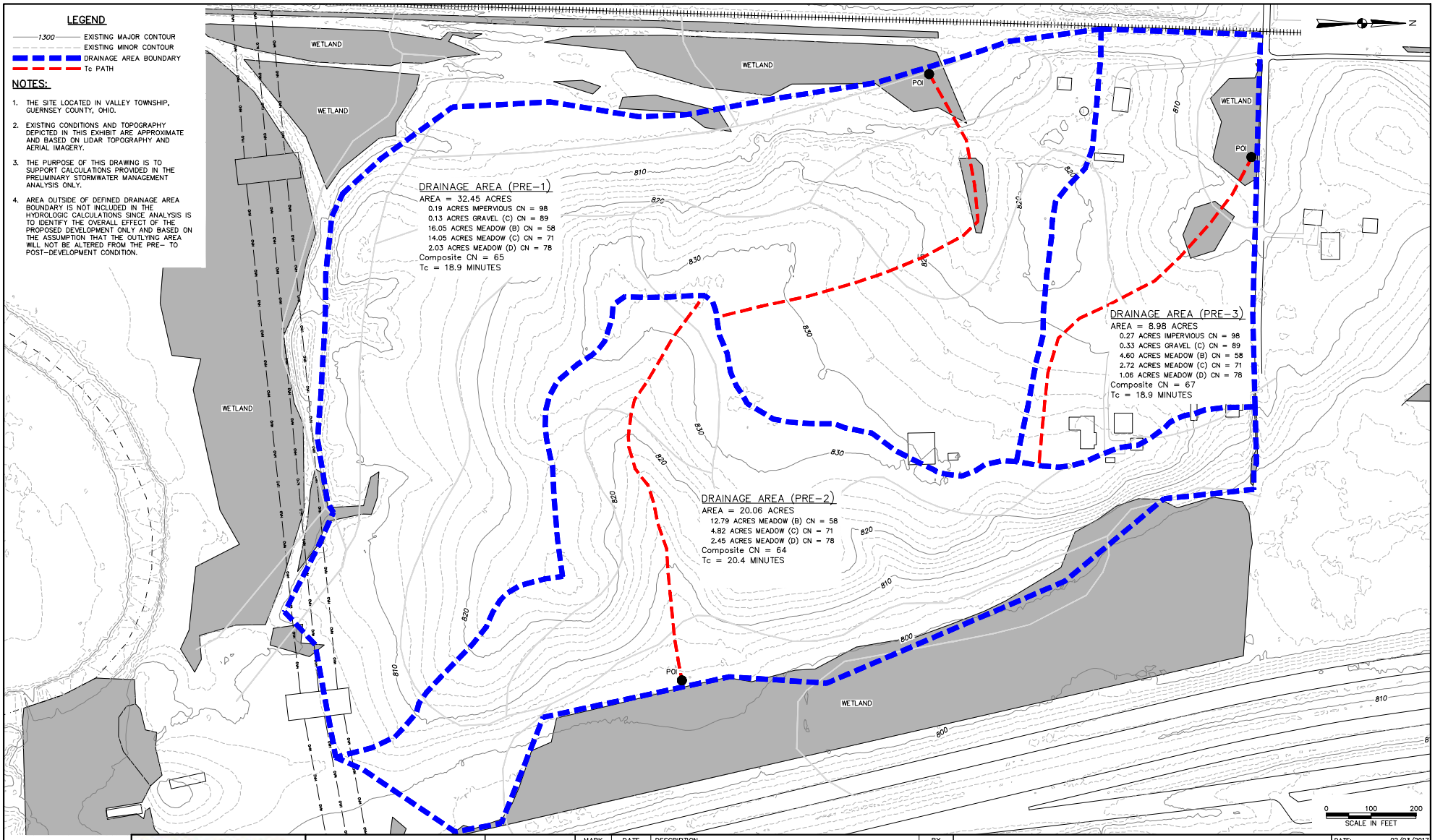
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	2.49	0.00	0.00	3.57	4.29	4.88	5.53
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

LEGEND

- 1300 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE AREA BOUNDARY
- Tc PATH

NOTES:

1. THE SITE LOCATED IN VALLEY TOWNSHIP, GUERNSEY COUNTY, OHIO.
2. EXISTING CONDITIONS AND TOPOGRAPHY DEPICTED IN THIS EXHIBIT ARE APPROXIMATE AND BASED ON LIDAR TOPOGRAPHY AND AERIAL IMAGERY.
3. THE PURPOSE OF THIS DRAWING IS TO SUPPORT CALCULATIONS PROVIDED IN THE PRELIMINARY STORMWATER MANAGEMENT ANALYSIS ONLY.
4. AREA OUTSIDE OF DEFINED DRAINAGE AREA BOUNDARY IS NOT INCLUDED IN THE HYDROLOGIC CALCULATIONS SINCE ANALYSIS IS TO IDENTIFY THE OVERALL EFFECT OF THE PROPOSED DEVELOPMENT ONLY AND BASED ON THE ASSUMPTION THAT THE OUTLYING AREA WILL NOT BE ALTERED FROM THE PRE- TO POST-DEVELOPMENT CONDITION.



Ohio Utilities Protection Service
Call 811 before you dig

TETRA TECH
www.tetratech.com
6715 TIPPECANOE ROAD – SUITE C201
CANFIELD, OH 44406
T: (330) 286-3683 | F: (330) 286-3573

MARK	DATE	DESCRIPTION	BY

GUERNSEY POWER STATION
VALLEY TOWNSHIP, GUERNSEY COUNTY, OHIO

PRE-DEVELOPMENT HYDROLOGY

DATE:	02/03/2017
PROJECT NO.:	212IC-CF-00122
DRAWN BY:	BC
CHECKED BY:	CM
SCALE:	AS SHOWN
SHEET:	1 OF 2

COPYRIGHT TETRA TECH INC.

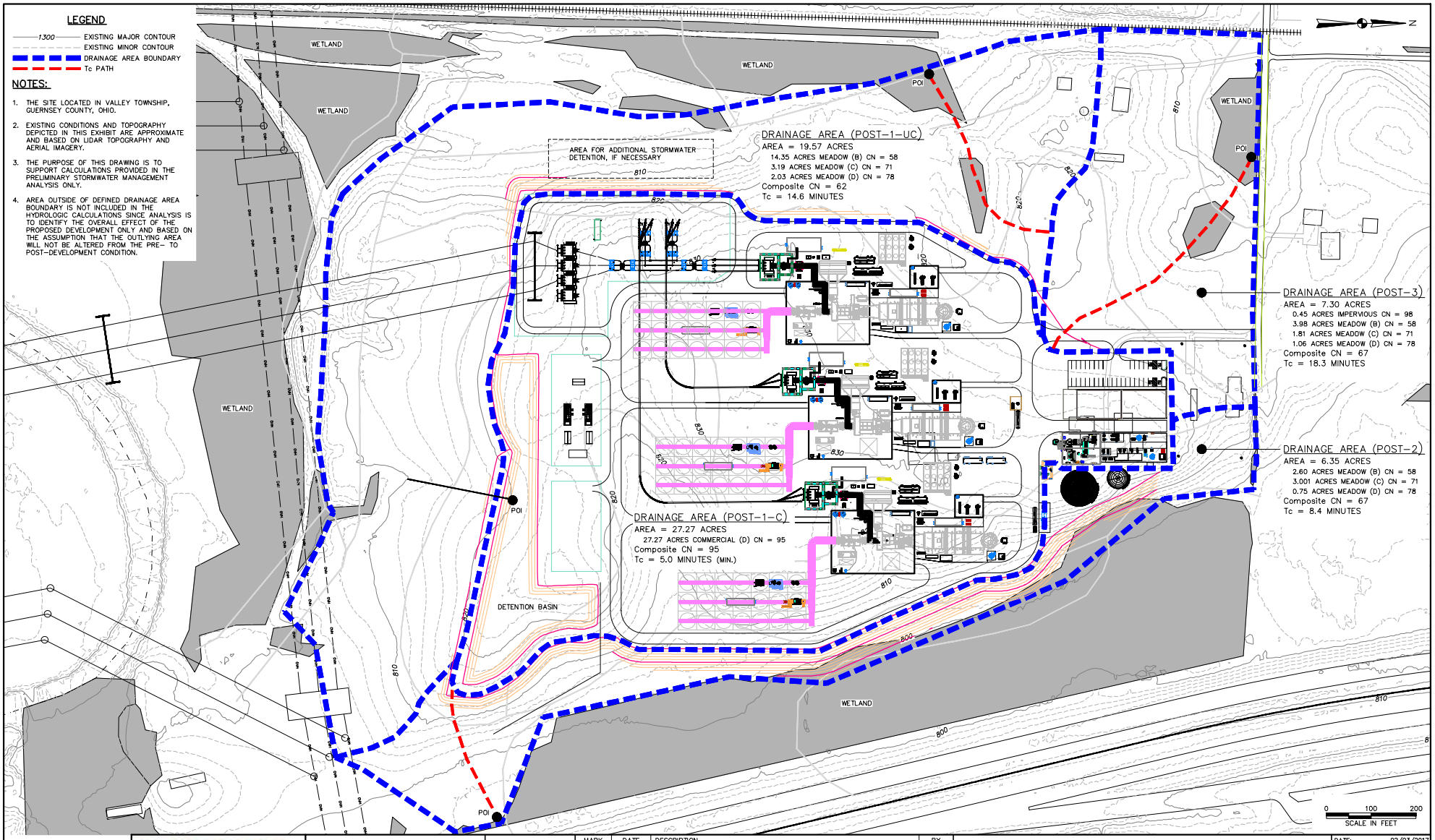
HYD-01

LEGEND

- 1300 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE AREA BOUNDARY
- Tc PATH

NOTES:

1. THE SITE LOCATED IN VALLEY TOWNSHIP, GUERNSEY COUNTY, OHIO.
2. EXISTING CONDITIONS AND TOPOGRAPHY DEPICTED IN THIS EXHIBIT ARE APPROXIMATE AND BASED ON LIDAR TOPOGRAPHY AND AERIAL IMAGERY.
3. THE PURPOSE OF THIS DRAWING IS TO SUPPORT CALCULATIONS PROVIDED IN THE PRELIMINARY STORMWATER MANAGEMENT ANALYSIS ONLY.
4. AREA OUTSIDE OF DEFINED DRAINAGE AREA BOUNDARY IS NOT INCLUDED IN THE HYDROLOGIC CALCULATIONS SINCE ANALYSIS IS TO IDENTIFY THE OVERALL EFFECT OF THE PROPOSED DEVELOPMENT ONLY AND BASED ON THE ASSUMPTION THAT THE OUTLYING AREA WILL NOT BE ALTERED FROM THE PRE- TO POST-DEVELOPMENT CONDITION.



Ohio Utilities Protection Service
Call 811 before you dig

TETRA TECH
www.tetratech.com
6715 TIPPECANOE ROAD – SUITE C201
CANFIELD, OH 44406
T: (330) 286-3683 | F: (330) 286-3573

MARK	DATE	DESCRIPTION	BY

GUERNSEY POWER STATION
VALLEY TOWNSHIP, GUERNSEY COUNTY, OHIO

POST-DEVELOPMENT HYDROLOGY

DATE:	02/03/2017
PROJECT NO.:	212IC-CF-00122
DRAWN BY:	BC
CHECKED BY:	CM
SCALE:	AS SHOWN
SHEET:	2 OF 2

COPYRIGHT TETRA TECH INC.

HYD-02

Appendix C: Public Involvement Process

Notice of Public Informational Meeting for Proposed Major Utility Facility

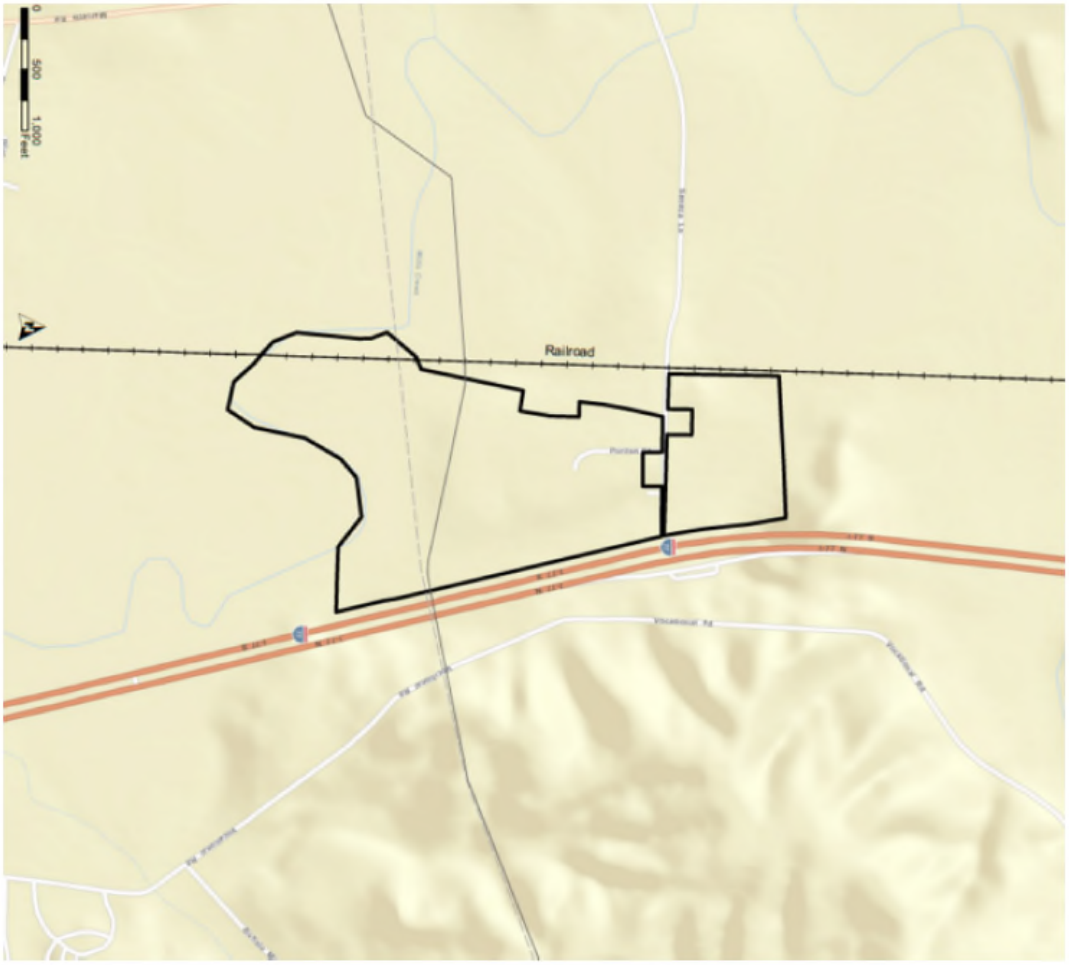
Guernsey Power Station, LLC Schedules January 25, 2017 Public Meeting to Outline Plans for a 1,650 Megawatt Gas Fired Generation Plant To Be Built in Valley Township, Guernsey County, Ohio

Guernsey Power Station, LLC invites residents of Guernsey County, Ohio and other interested members of the public, to attend a public informational meeting regarding company plans to build a 1,650 megawatt gas fired, combined cycle power station.

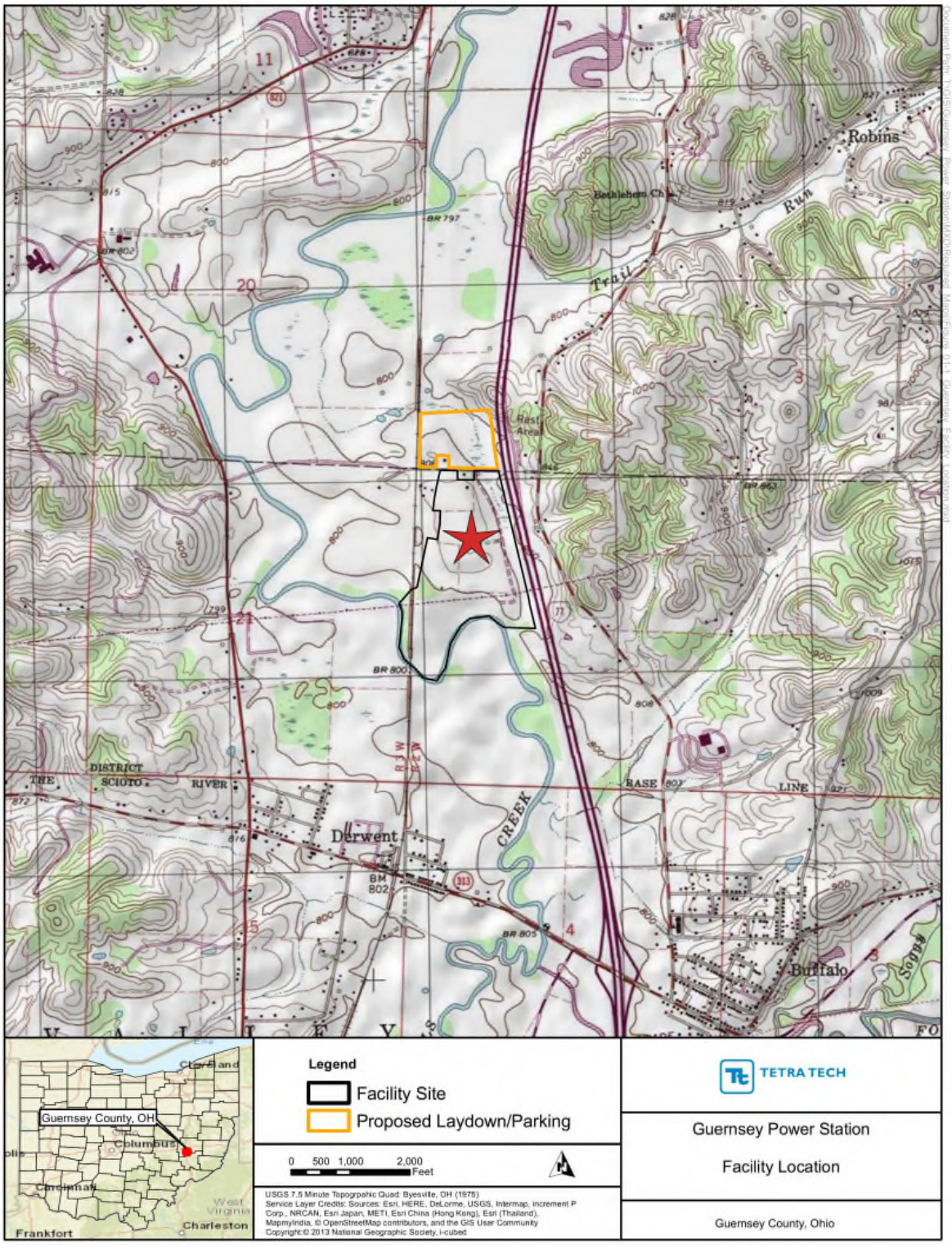
The electric generating facility will be located in Valley Township, Guernsey County located off of Puritan Street. The project area is generally bordered by Seneca Lane, Interstate 77, Clay Pike Road, and a private rail line.

The project will consist of three gas fired, high efficiency combustion turbines, each using a gas and steam turbine with a heat recovery steam generator. It will use high efficiency air cooled technology. The plant will be served by natural gas from one or more pipelines. The generating station will be interconnected to a 745 kV transmission line located on the project property. Water and wastewater services will be supplied by the Village of Byesville. Construction of the project is estimated to begin in first quarter of 2018, with projected commercial operation to begin in third quarter 2020.

The public meeting will take place from **5:30 p.m. to 7:30 p.m., on Wednesday, January 25, 2017** in the cafeteria at the Meadowbrook High School, 58615 Marietta Road, Byesville, OH 43723. The meeting format will be similar to an open house and stations with information about the project presented on boards scattered throughout the room. Maps of the project area will be available to review. Company representatives will be near each station to answer questions. Those who attend the meeting may write written comments that the applicant will summarize and include in its application.



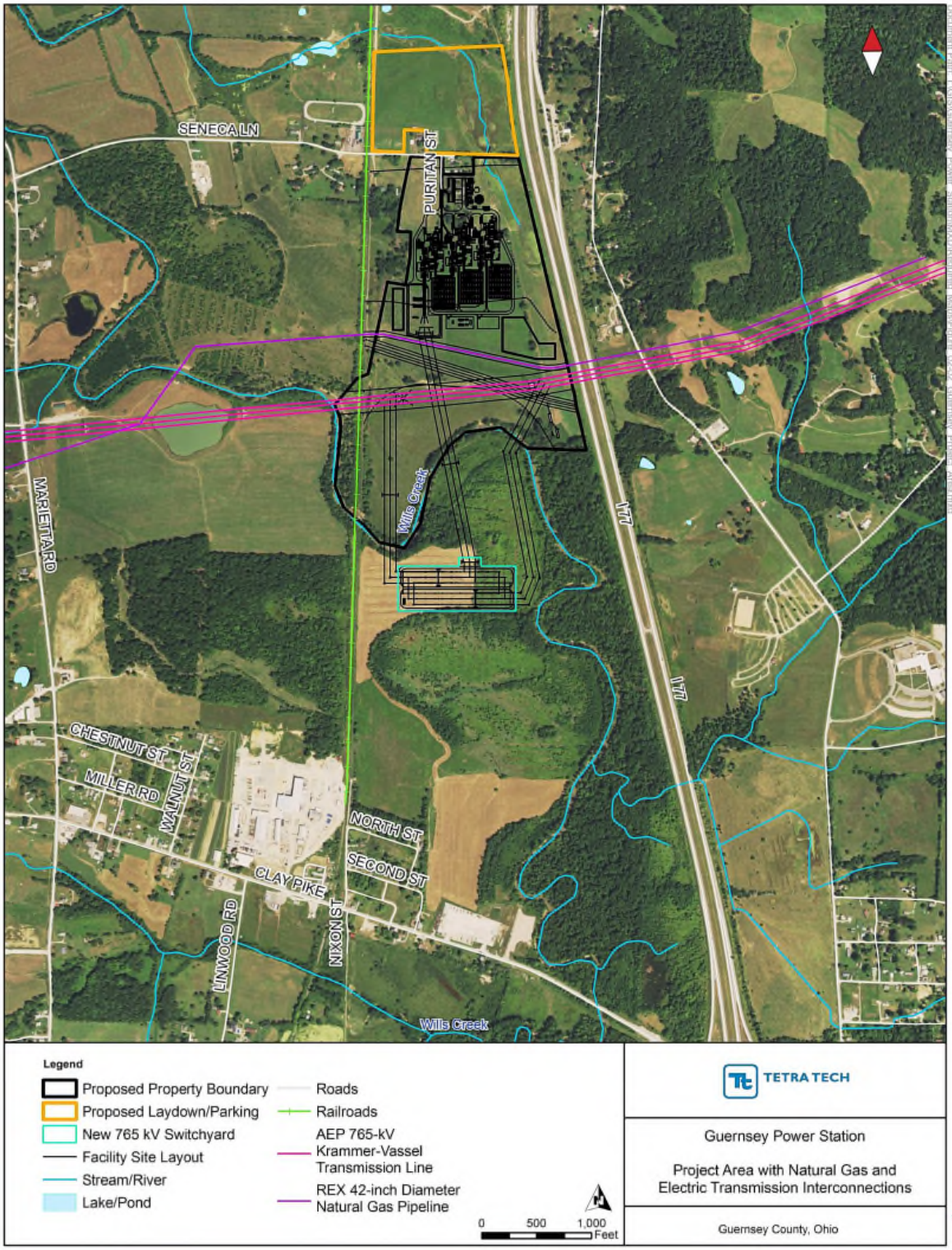
Site Location



Clean, reliable Ohio energy.

Apex Power Group, LLC and Caithness Energy, L.L.C. are privately held independent power producers specializing in the development, operation, and management of renewable energy and natural gas-fueled power projects. Using state-of-the-art combined cycle technology, Guernsey Power Station will generate up to 50% more power with a fraction of the fuel compared to traditional power plants.

Site Details



*conceptual

Clean, reliable Ohio energy.

Apex Power Group, LLC and Caithness Energy, L.L.C. are privately held independent power producers specializing in the development, operation, and management of renewable energy and natural gas-fueled power projects. Using state-of-the-art combined cycle technology, Guernsey Power Station will generate up to 50% more power with a fraction of the fuel compared to traditional power plants.

Plant Details

Project Details

Location	Valley Township, Guernsey County, OH
Capacity	1650 MW (net)
Capacity Region	PJM
Fuel Type	Natural Gas
Technology	Combined cycle, Dry-cooled
Gas Interconnection	Rockies Express pipeline (on-site), possibly others
Electric Interconnection	AEP 765kV line (on-site)

*conceptual

Environmental Stewardship

Efficiency. Guernsey Power Station is a state-of-the-art facility designed to maximize power output with minimal impact on the surrounding environment. The plant will used combined cycle technology consisting of clean-burning natural gas-powered turbines and steam-powered turbines. The combined cycle design captures the excess heat generated by powering the gas turbines and, rather than releasing that heat into the air, uses it to power the steam turbines, allowing the plant to generate up to 50% more electricity from the equivalent amount of fuel at a traditional plant.

Reduced water consumption. The plant will use dry-cooling technology, reducing water usage by as much as 95% compared to traditional water-cooled plants. Water and wastewater services will be provided by the Village of Byesville.

Lower air emissions. Combined cycle technology and dry-cooling technology combine to allow the facility to achieve the lowest possible air emissions, an impact that will be amplified as greater reliance for power is placed on new, clean technology power plants like Guernsey Power Station.

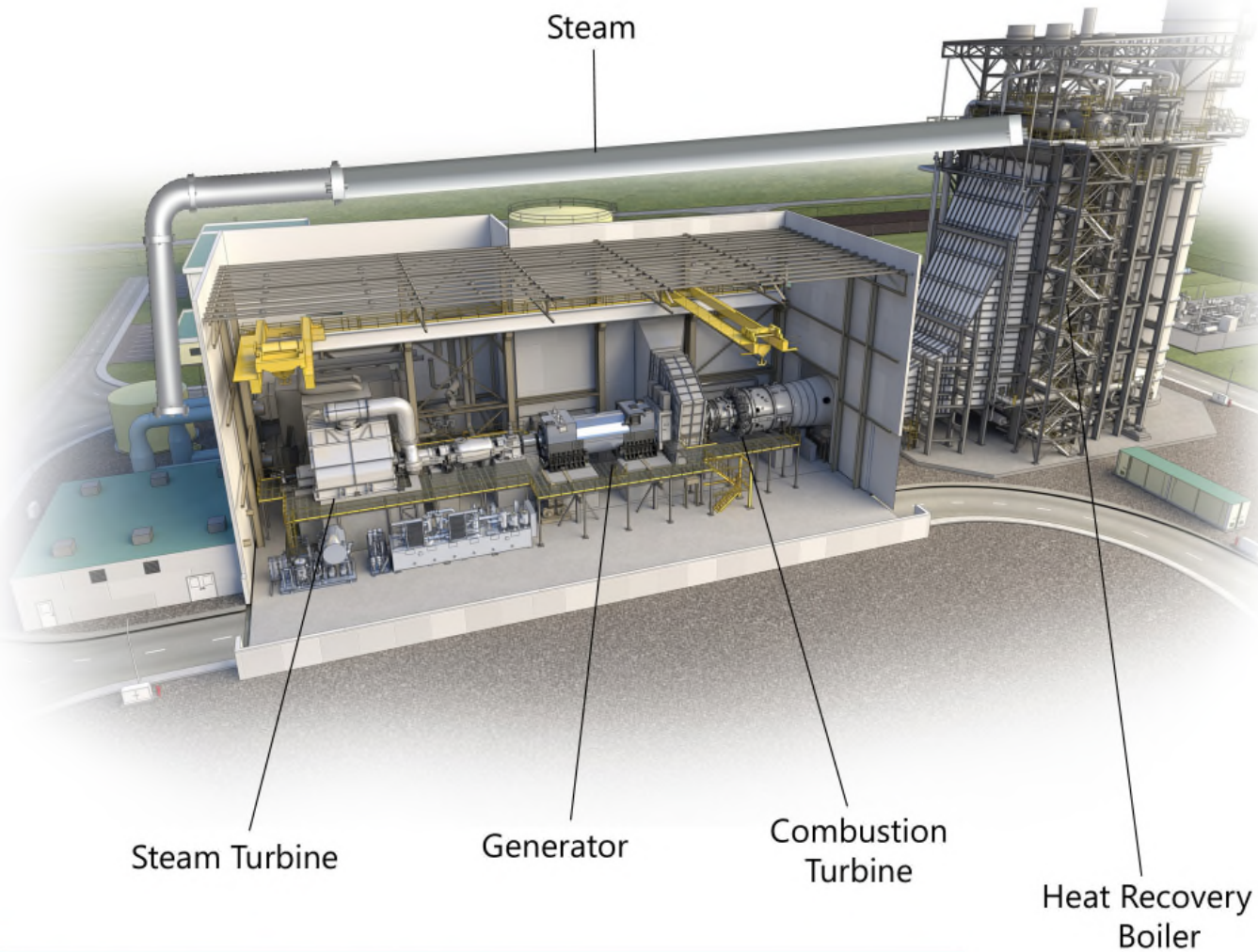
Clean, reliable Ohio energy.

Apex Power Group, LLC and Caithness Energy, L.L.C. are privately held independent power producers specializing in the development, operation, and management of renewable energy and natural gas-fueled power projects. Using state-of-the-art combined cycle technology, Guernsey Power Station will generate up to 50% more power with a fraction of the fuel compared to traditional power plants.

Combined Cycle Technology

Guernsey Power Station

1-on-1 Single-Shaft Combined Cycle Generator



Combined Cycle Technology

Guernsey Power Station will employ 3 Single-Shaft Combustion Turbine Generators

- Combustion Turbine
- Steam Turbine
- Electric Generator
  - Three Heat Recovery Steam Generators with Environmental Control Systems
  - Three Air Cooled Condensers
  - Electrical Step up Transformers and Switching Gear

Image Source: General Electric

Clean, reliable Ohio energy.

Apex Power Group, LLC and Caithness Energy, L.L.C. are privately held independent power producers specializing in the development, operation, and management of renewable energy and natural gas-fueled power projects. Using state-of-the-art combined cycle technology, Guernsey Power Station will generate up to 50% more power with a fraction of the fuel compared to traditional power plants.

Community Benefits

Guernsey Power Station

Guernsey Power Station is an approximately $1.4 billion project. Developers are eager to contribute to the vitality of the surrounding community. Benefits to the community include . . .

Creating jobs

Guernsey Power Station expects to break ground in Q1 of 2018. Construction will last approximately 30 months and will create up to **500 jobs** during periods of peak construction. Once operational, the plant will require an estimated **25 permanent, highly-skilled, full-time positions.**

Boosting local economy

Developers anticipate **partnering with local workers and businesses** to meet plant construction and operation needs such as natural gas supply; readily available construction, maintenance and safety equipment; and ongoing plant operations. The anticipated **annual plant maintenance budget is $20 million**, with at least half that being spent locally.

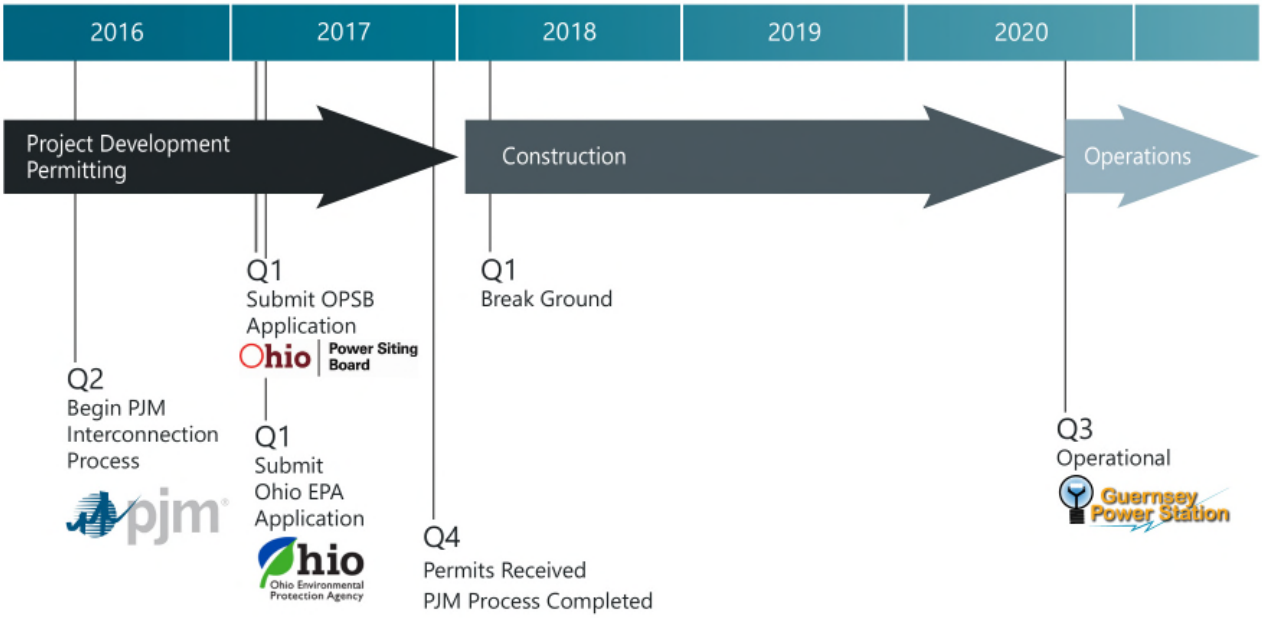
Partnering with local communities

The plant will generate **additional revenue** for the Village of Byesville, which has agreed to provide water and wastewater services for the new plant.

Clean, reliable Ohio energy.

Apex Power Group, LLC and Caithness Energy, L.L.C. are privately held independent power producers specializing in the development, operation, and management of renewable energy and natural gas-fueled power projects. Using state-of-the-art combined cycle technology, Guernsey Power Station will generate up to 50% more power with a fraction of the fuel compared to traditional power plants.

Development Timeline



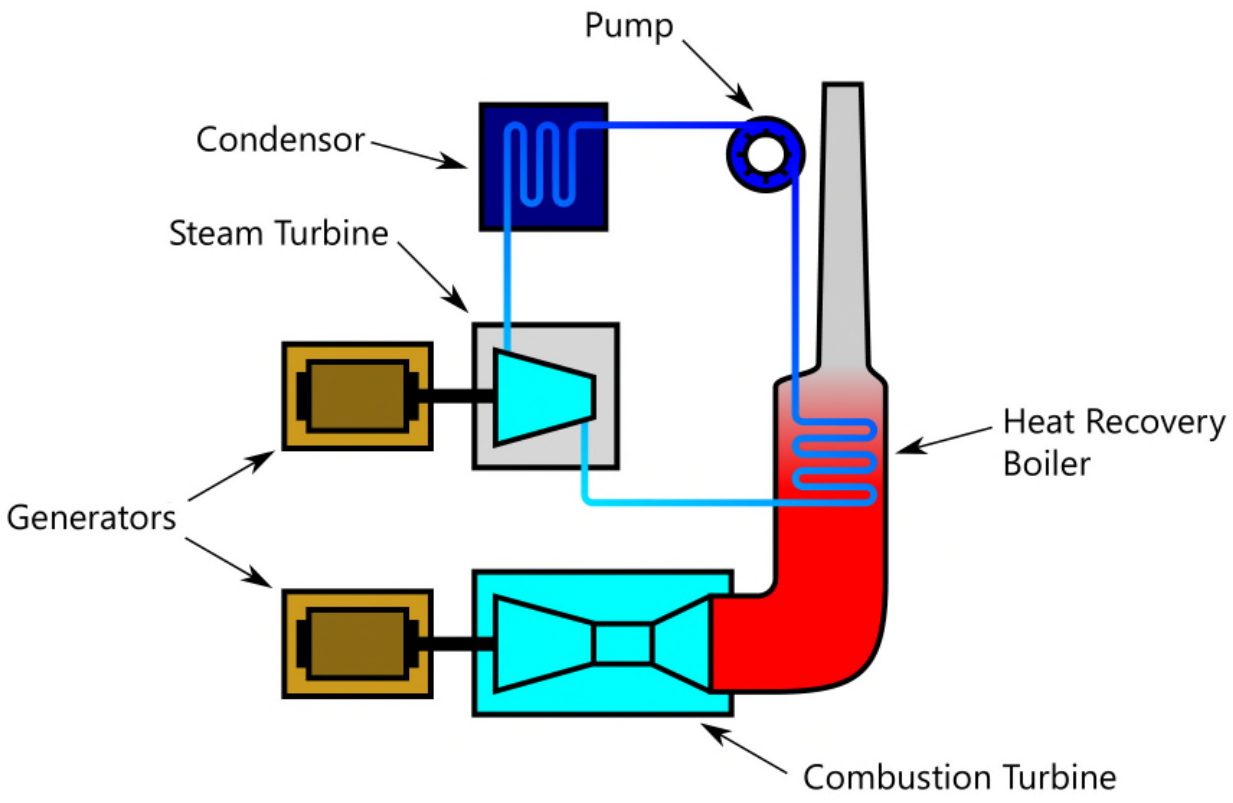
Clean, reliable Ohio energy.

Apex Power Group, LLC and Caithness Energy, L.L.C. are privately held independent power producers specializing in the development, operation, and management of renewable energy and natural gas-fueled power projects. Using state-of-the-art combined cycle technology, Guernsey Power Station will generate up to 50% more power with a fraction of the fuel compared to traditional power plants.

Combined Cycle Technology

Guernsey Power Station

Combined Cycle Generator



Combined Cycle Technology

Guernsey Power Station will employ 3 single-shaft combustion turbine generators

- Combustion Turbine
- Steam Turbine
- Electric Generator
  - Three Heat Recovery Steam Generators with Environmental Control Systems
  - Three Air Cooled Condensers
  - Electrical Step up Transformers and Switching Gear

Clean, reliable Ohio energy.

Apex Power Group, LLC and Caithness Energy, L.L.C. are privately held independent power producers specializing in the development, operation, and management of renewable energy and natural gas-fueled power projects. Using state-of-the-art combined cycle technology, Guernsey Power Station will generate up to 50% more power with a fraction of the fuel compared to traditional power plants.

This foregoing document was electronically filed with the Public Utilities

Commission of Ohio Docketing Information System on

3/16/2017 11:24:40 AM

in

Case No(s). 16-2443-EL-BGN

Summary: Application of Guernsey Power Station, LLC Part 5 - Appendices A-C electronically filed by Teresa Orahood on behalf of Sally W. Bloomfield