

BLEW & ASSOCIATES, P.A.

# STORM WATER MANAGEMENT REPORT

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PANORAMA STORAGE  
LARGE SCALE DEVELOPMENT

*Project Number: 13-316*

FEBRUARY 2016

PREPARED BY

JORGE DU QUESNE, JR. PE  
BLEW & ASSOCIATES, P.A.  
C.O.A. 1534

524 WEST SYCAMORE STREET, SUITE 4  
FAYETTEVILLE, ARKANSAS 72703

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## ***PROJECT DESCRIPTION***

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The Subject Site is composed of one parcel consisting of approximately 6.63 acres. The Post Construction Site shall consist of a new Storage Complex with development requirements as dictated by Benton County. The Subject Site is located on the Northeast Corner of Panorama Road and Highway 94 as shown on the Vicinity Map. The Subject Property is to be developed by:

P&P Holding, LLC  
1353C Henri De Tonti Blvd  
Tontitown, AR 72762  
(479) 366-8746

### **FEMA FLOOD INSURANCE RATE MAP**

The Federal Emergency Management Agency manages the National Flood Insurance Program (NFIP) which consists of three components: Flood Insurance, Floodplain Management, and Flood Hazard Mapping. The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. According to the Federal Emergency Management Agency, Flood Insurance Map for Benton County, Arkansas, Panel Number 05007C0290K, Revision Date June 5th, 2012, this parcel of land falls within Zone "X". Zone "X" is defined as "Areas determined to be outside the 0.2% annual chance floodplain".

### **NRCS SOIL SURVEY INFORMATION**

The Natural Resources Conservation Service (NRCS) has mapped the soils of Benton County. As a part of this process they identify the soil type and relative location / area of the soil. The soils of this site are denoted as: Nixa very gravelly silt loam, 3 to 8 percent slopes (NfC, Hydrologic Soil Group D); Nixa very gravelly silt loam, 8 to 12 percent slopes (NfD, Hydrologic Soil Group D); and Noark very gravelly silt loam, 20 to 40 percent slopes (NfC, Hydrologic Soil Group C). A mapping of these soils can be found in Exhibit 3 of Appendix A.

### **COMPUTER SOFTWARE**

The Storm Water Routing Calculations were determined through the use of *Autodesk's Hydraflow Hydrographs Extension Ver. 9.25* software.

### **DRAINAGE BASIN:**

Based on topographic survey information, the site is at the top of a drainage basin that releases into Beaver Lake. The storm water, from available survey information, does not leave this site.

### **AREA DRAINAGE PROBLEMS**

No Drainage Problems known at this time.

### **STORM EVENTS**

The storm water system shall be analyzed for the 2, 10, 25, 50 and 100 year storm frequencies.

### ***PRE-DEVELOPED PEAK FLOWS***

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The Overall Subject Site Currently Consists of approximately 6.63 Acres of Undeveloped Land with a general slope towards the South.

#### ***SCS CURVE NUMBERS***

The SCS Curve Numbers were selected from USDA's TR-55 Manual's Table 2-2 Runoff Curve Numbers. A Curve Number of 82 is being used for all wood-grass combination.

#### ***TIME OF CONCENTRATION***

The Time of Concentration was calculated using the Sheet Flow and Shallow Concentrated Methods as dictated in USDA's TR-55 Manual. See Appendix B for the Pre Developed Time of Concentrations.

#### ***STORM DISTRIBUTION***

The Storm Distribution used for the site was a Type III Rainfall Distribution. The distribution was selected based on Figure B-2, Appendix B of USDA's TR-55 Manual.

#### ***PRE-DEVELOPED PEAK FLOWS***

The Pre-Developed Peak Flows are calculated using the SCS Method (Unit Hydrograph), which takes into account the Weighted Curve Number (CN), the Time of Concentration (tc), the Storm Distribution, and the Drainage Area for the Basin (A). The Pre-Developed Peak Runoff (cfs) is listed in the table below:

Area (Undeveloped)	Storm Event				
	2- year	10- year	25- year	50- year	100- year
Pre	19.91 cfs	34.56 cfs	41.97 cfs	49.39 cfs	54.94 cfs

*See Appendix B for Peak Runoff calculations.*

### ***POST-DEVELOPED PEAK FLOWS***

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The Post Construction Site Shall Consist of a New Storage Complex. The Storm Water will flow through an Existing Detention Basin.

#### ***SCS CURVE NUMBERS***

The SCS Curve Numbers were selected from USDA's TR-55 Manual's Table 2-2 Runoff Curve Numbers. A Curve Number of 82 is being used for all wood-grass combination; 98 for roofs; 91 for Gravel; and 80 for Open Space in Good Condition.

#### ***TIME OF CONCENTRATION***

The Time of Concentration was calculated using the Sheet Flow and Shallow Concentrated Methods as dictated in USDA's TR-55 Manual. See Appendix B for the Pre Developed Time of Concentrations.

#### ***STORM DISTRIBUTION***

The Storm Distribution used for the site was a Type III Rainfall Distribution. The distribution was selected based on Figure B-2, Appendix B of USDA's TR-55 Manual.

#### ***POST-DEVELOPED PEAK FLOWS***

The Post-Developed Peak Flows are calculated using the SCS Method (Unit Hydrograph), which takes into account the Weighted Curve Number (CN), the Time of Concentration (tc), the Storm Distribution, and the Drainage Area for the Basin (A). The Post-Developed Peak Runoff (cfs) is listed in the table below:

Area (Developed)	Storm Event				
	2- year	10- year	25- year	50- year	100- year
Post	13.52 cfs	22.69 cfs	27.29 cfs	31.88 cfs	35.31 cfs

*See Appendix B for Peak Runoff calculations.*

***POST VS. PRE:***

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The following table compares the Post Peak Runoffs to the Pre Peak Runoffs. The intent is to show the overall change in flows:

*Project Site + Direct Offsite*

State of Project Site	Storm Event				
	2- year	10- year	25- year	50- year	100- year
Total Post	13.52 cfs	22.69 cfs	27.29 cfs	31.88 cfs	35.31 cfs
Total Pre	19.91 cfs	34.56 cfs	41.97 cfs	49.39 cfs	54.94 cfs
<i>Net</i>	<i>-6.39 cfs</i>	<i>-11.87 cfs</i>	<i>-14.68 cfs</i>	<i>-17.51 cfs</i>	<i>-19.63 cfs</i>

***CONCLUSION:***

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I, Jorge Du Quesne, Jr, Registered Professional Engineer No. 12006 in the State of Arkansas, hereby certify that the Storm Water Management System is designed based on Accepted Engineering Practices and limited by weather data provided by the city and/or precipitation maps. This development, if constructed per the construction documents and plans prepared by Jorge Du Quesne, is deemed not to increase existing risk to downstream life or property.

Respectfully,



Jorge Du Quesne, Jr. P.E.

# APPENDIX A

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# EXHIBIT 1

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Vicinity Map



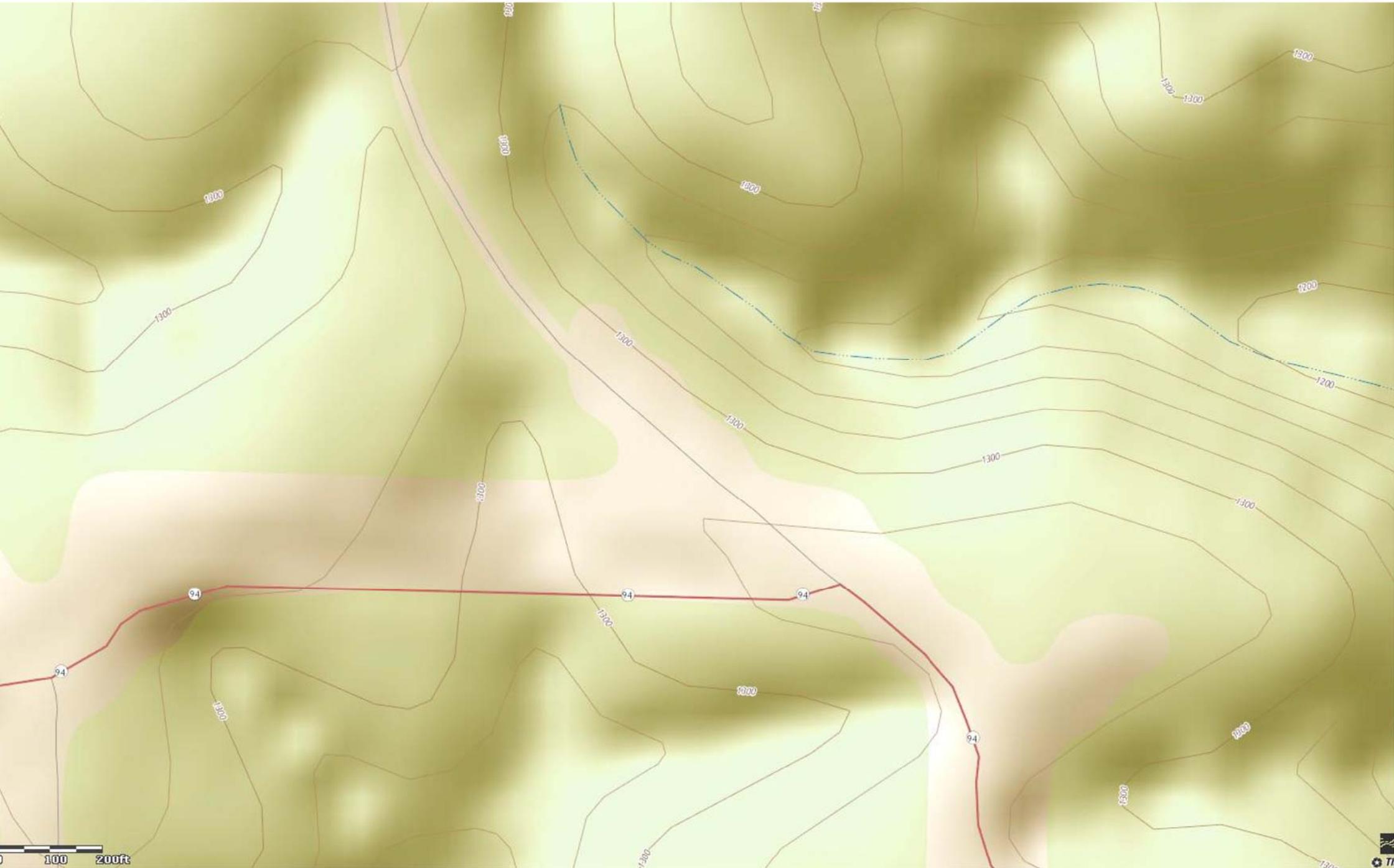
# EXHIBIT 2

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Quad Maps and Aerial Photograph

# The National Map

NOTES: Data available from U.S. Geological Survey, National Geospatial Program.



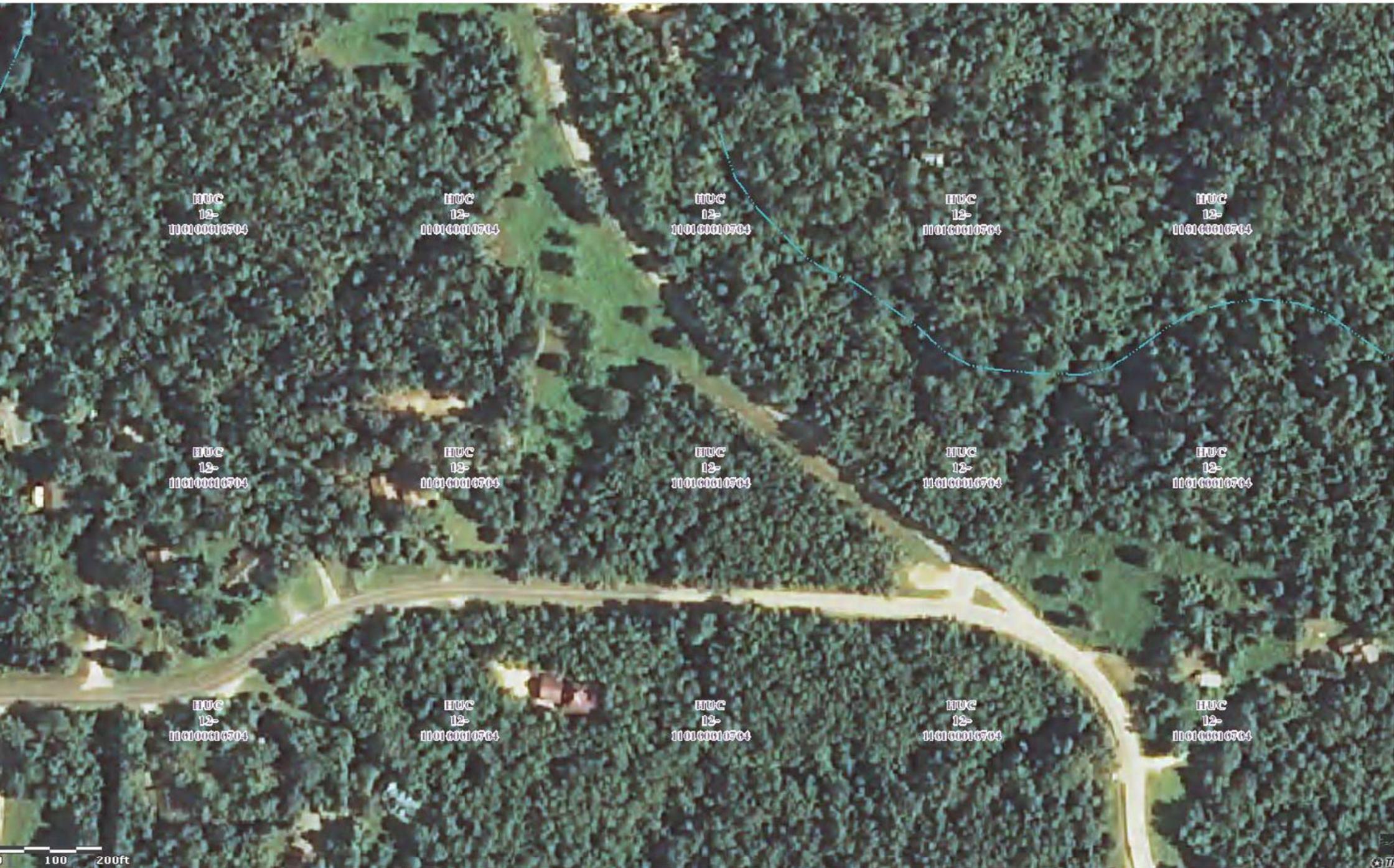
# The National Map

NOTES: Data available from U.S. Geological Survey, National Geospatial Program.



# The National Map

NOTES: Data available from U.S. Geological Survey, National Geospatial Program.



# EXHIBIT 3

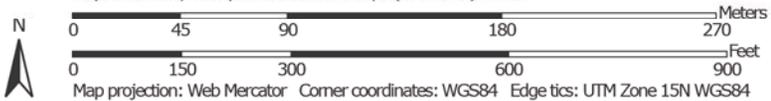
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USDA / NRCS Soil Survey

Hydrologic Soil Group—Benton County, Arkansas



Map Scale: 1:3,150 if printed on A landscape (11" x 8.5") sheet.



### 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 1:20,000.

**Warning:** Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
 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: Benton County, Arkansas  
 Survey Area Data: Version 13, Sep 28, 2015

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

Date(s) aerial images were photographed: Sep 19, 2010—Oct 30, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Benton County, Arkansas (AR007)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
NfC	Nixa very gravelly silt loam, 3 to 8 percent slopes	D	14.0	73.7%
NfD	Nixa very gravelly silt loam, 8 to 12 percent slopes	D	0.4	1.9%
NoF	Noark very gravelly silt loam, 20 to 40 percent slopes	C	4.6	24.4%
<b>Totals for Area of Interest</b>			<b>19.0</b>	<b>100.0%</b>

### Description

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

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

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

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

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

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

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

## Rating Options

*Aggregation Method:* Dominant Condition

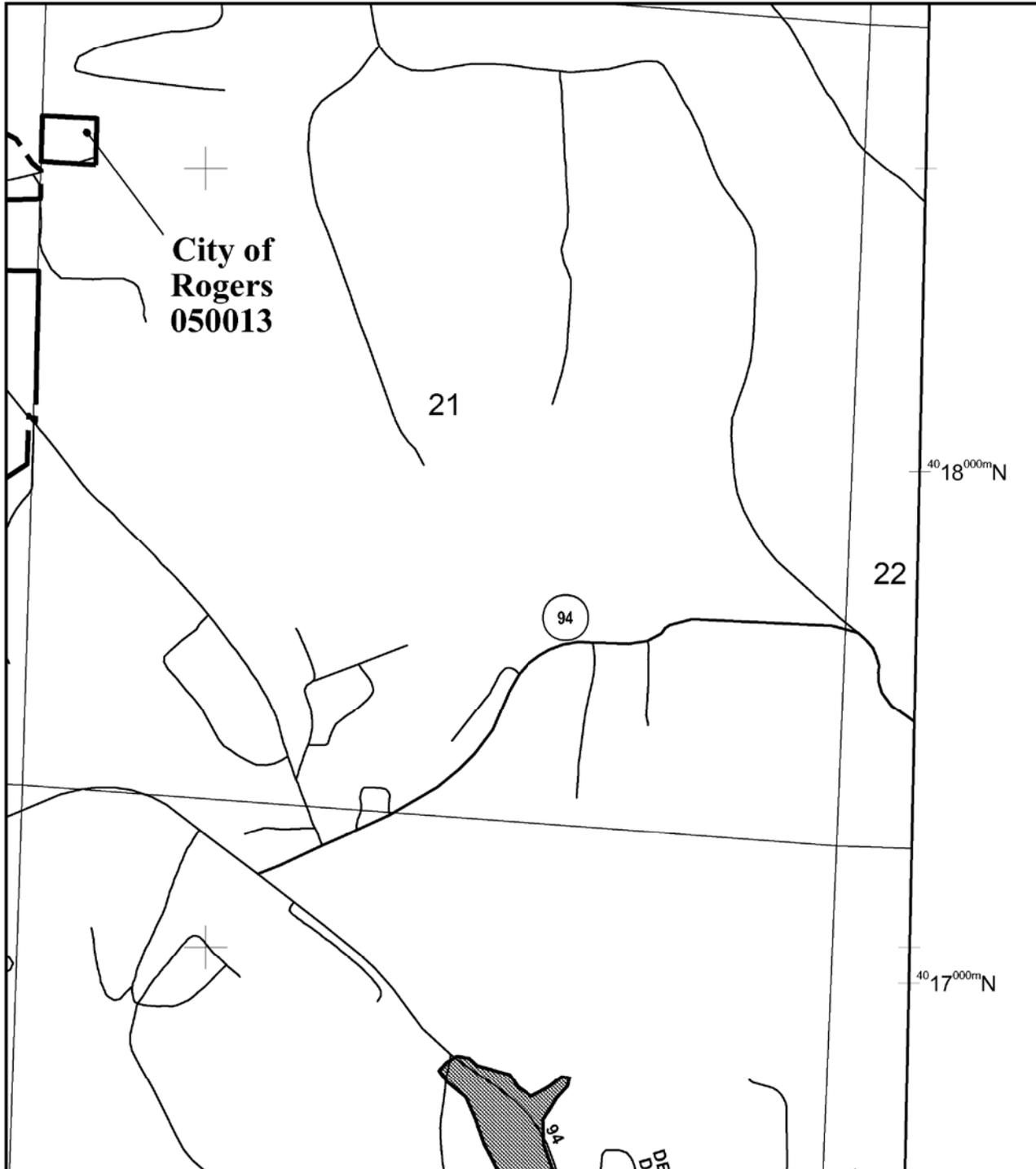
*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

# EXHIBIT 4

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FEMA Firmette



City of  
Rogers  
050013

21

22

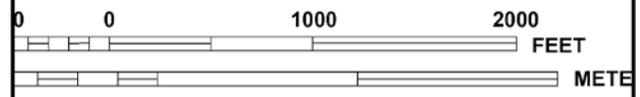
94

40° 18' 00" N

40° 17' 00" N



MAP SCALE 1" = 1000'



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0290K

**FIRM**  
FLOOD INSURANCE RATE MAP

BENTON COUNTY,  
ARKANSAS  
AND INCORPORATED AREAS

**PANEL 290 OF 560**  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BENTON COUNTY	050419	0290	K
LOWELL, CITY OF	050342	0200	K
ROGERS, CITY OF	050013	0290	K

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



**MAP NUMBER**  
05007C0290K

**MAP REVISED**  
JUNE 5, 2012

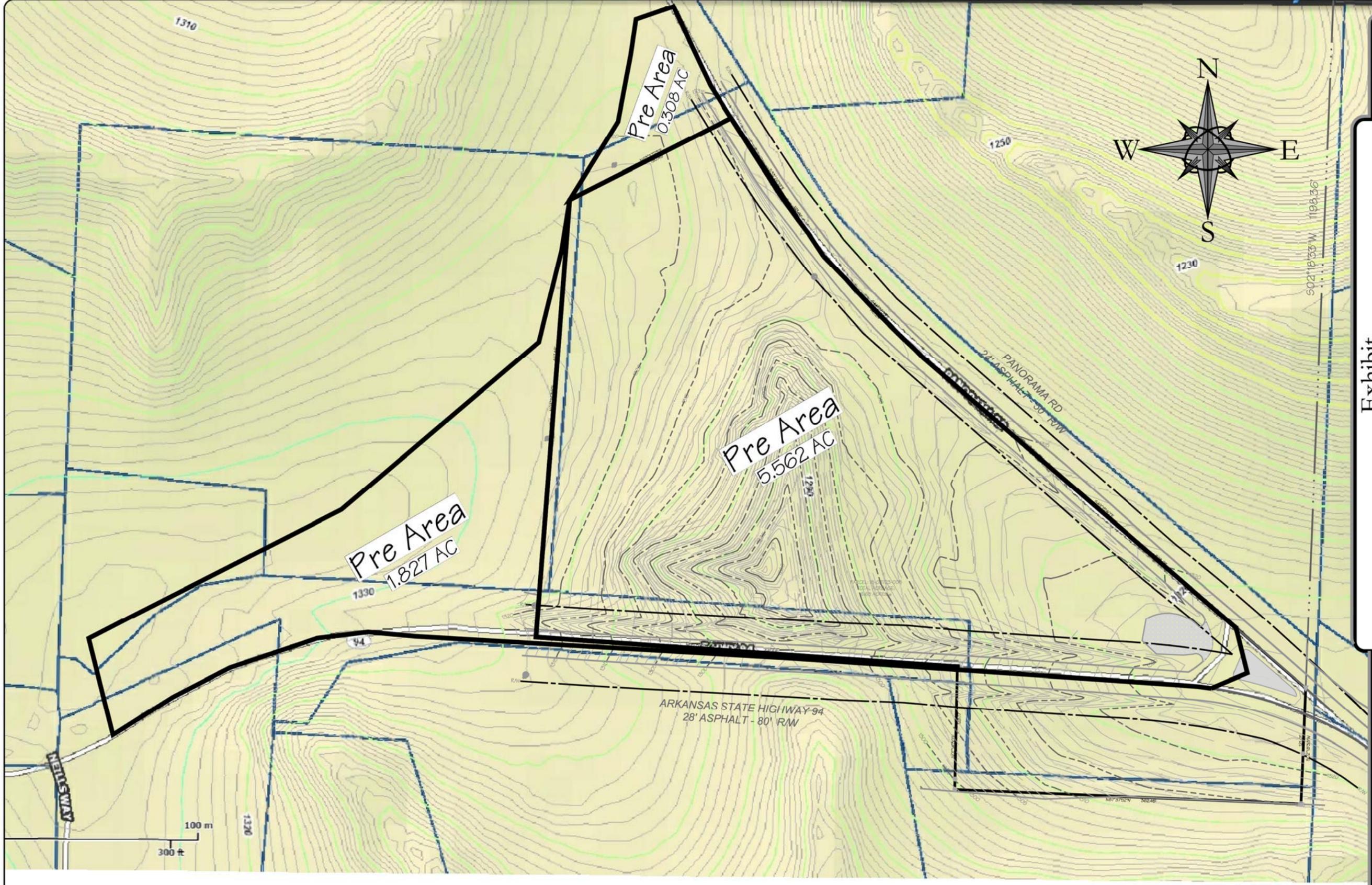
Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)

# EXHIBIT 5

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Drainage Areas



Exhibit

**BLEW & ASSOCIATES, PA**  
CIVIL ENGINEERS & LAND SURVEYORS

Project Number: XX-XXXX

Certificate of Authorization № 1534

Date: 02/11/2016

524 W. Sycamore Street, Suite 4 • Fayetteville, Arkansas 72703 • 479.443.4506 Office • 479.582-1883 Fax



Exhibit

**BLEW & ASSOCIATES, PA**  
 CIVIL ENGINEERS & LAND SURVEYORS

Project Number: XX-XXXX

Certificate of Authorization № 1534

Date: 02/11/2016

524 W. Sycamore Street, Suite 4 • Fayetteville, Arkansas 72703 • 479.443.4506 Office • 479.582-1883 Fax

# APPENDIX B

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## Routing Calculations

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# Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5



**Legend**

<u>Hyd.</u>	<u>Origin</u>	<u>Description</u>
1	SCS Runoff	Pre Area
2	SCS Runoff	Post Area

# Hydrograph Return Period Recap

Hydranow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

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	-----	-----	19.91	-----	-----	34.56	41.97	49.39	54.94	Pre Area
2	SCS Runoff	-----	-----	13.52	-----	-----	22.69	27.29	31.88	35.31	Post Area

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

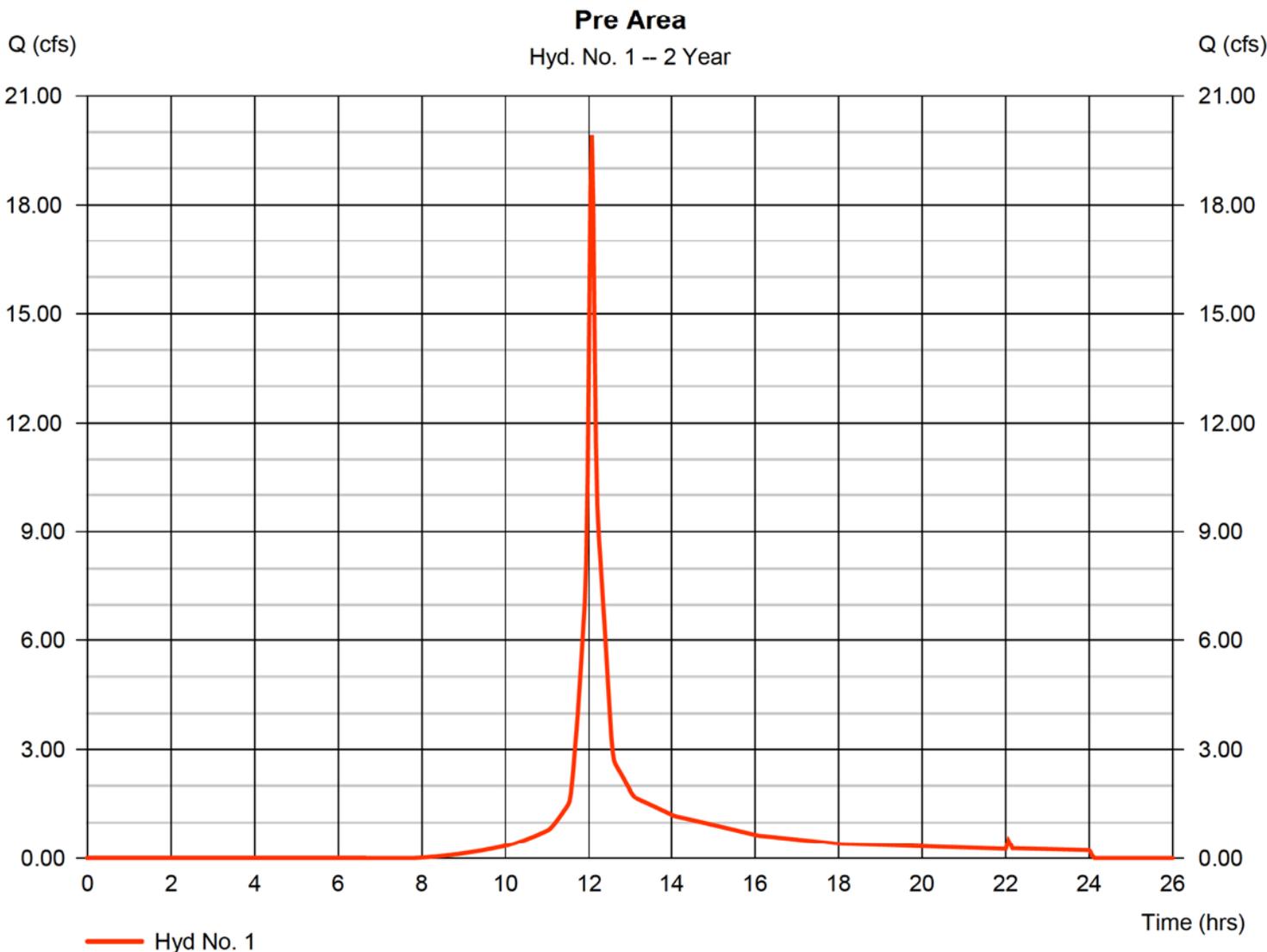
Thursday, 02 / 11 / 2016

## Hyd. No. 1

### Pre Area

Hydrograph type	= SCS Runoff	Peak discharge	= 19.91 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1.366 acft
Drainage area	= 7.700 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.10 min
Total precip.	= 4.08 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.830 x 82) + (5.560 x 82) + (0.310 x 82)] / 7.700



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

## Hyd. No. 1

Pre Area

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.400	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 4.08	0.00	0.00	
Land slope (%)	= 1.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 25.09</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 25.09</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 270.00	145.00	75.00	
Watercourse slope (%)	= 4.00	10.00	33.00	
Surface description	= Unpaved	Unpaved	Unpaved	
Average velocity (ft/s)	=3.23	5.10	9.27	
<b>Travel Time (min)</b>	<b>= 1.39</b>	<b>+ 0.47</b>	<b>+ 0.13</b>	<b>= 2.00</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>27.10 min</b>

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

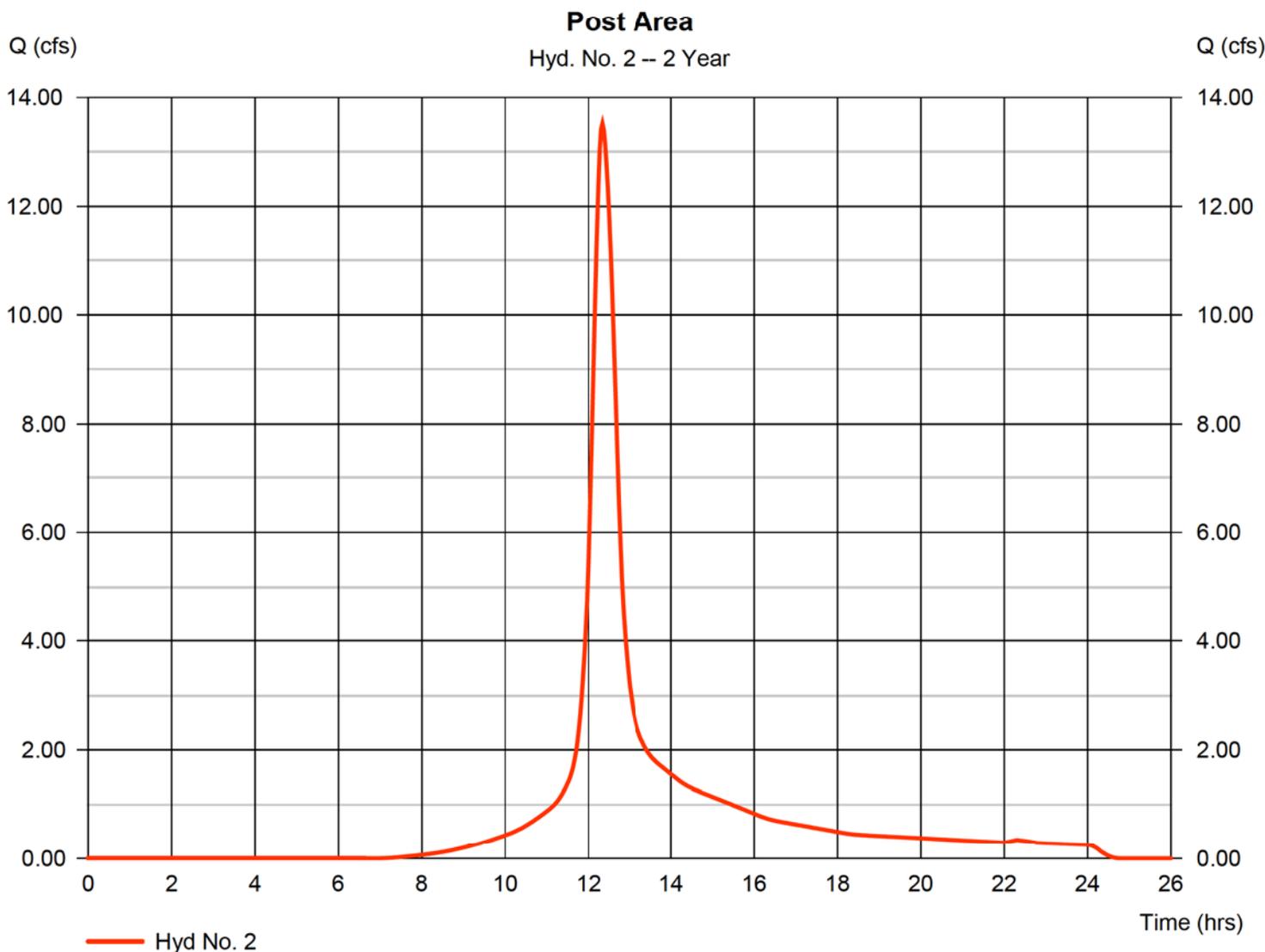
Thursday, 02 / 11 / 2016

## Hyd. No. 2

### Post Area

Hydrograph type	= SCS Runoff	Peak discharge	= 13.52 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.33 hrs
Time interval	= 2 min	Hyd. volume	= 1.623 acft
Drainage area	= 7.700 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.80 min
Total precip.	= 4.08 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.827 x 82) + (0.308 x 82) + (0.970 x 98) + (1.710 x 91) + (2.880 x 80)] / 7.700



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

## Hyd. No. 2

Post Area

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
<b>Sheet Flow</b>				
Manning's n-value	= 0.400	0.011	0.011	
Flow length (ft)	= 100.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 4.08	0.00	0.00	
Land slope (%)	= 1.00	0.00	0.00	
<b>Travel Time (min)</b>	<b>= 25.09</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 25.09</b>
<b>Shallow Concentrated Flow</b>				
Flow length (ft)	= 224.00	27.00	245.00	
Watercourse slope (%)	= 4.00	33.00	1.00	
Surface description	= Unpaved	Unpaved	Unpaved	
Average velocity (ft/s)	=3.23	9.27	1.61	
<b>Travel Time (min)</b>	<b>= 1.16</b>	<b>+ 0.05</b>	<b>+ 2.53</b>	<b>= 3.74</b>
<b>Channel Flow</b>				
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	
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+ 0.00</b>	<b>+ 0.00</b>	<b>= 0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>28.80 min</b>

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

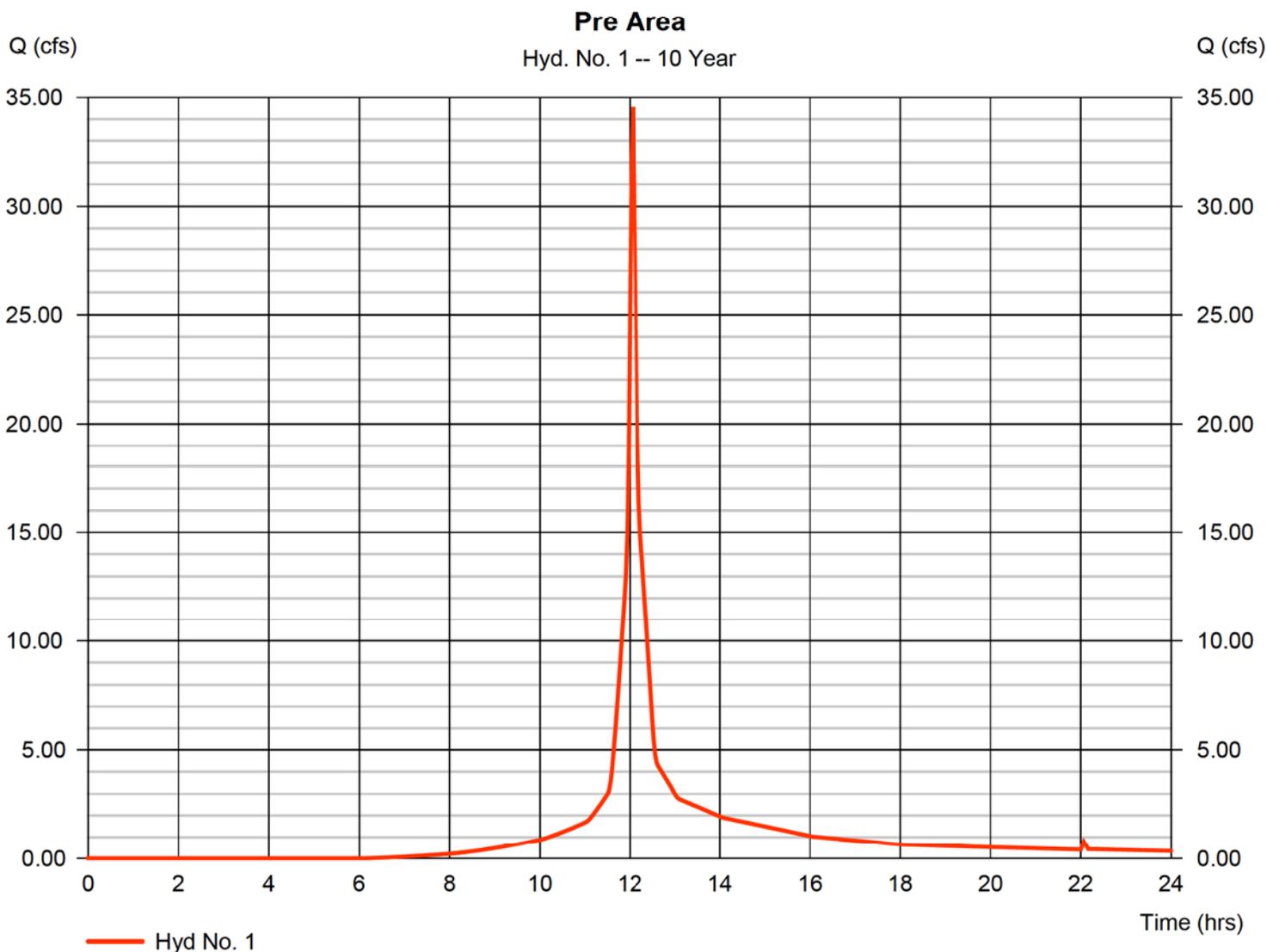
Thursday, 02 / 11 / 2016

## Hyd. No. 1

### Pre Area

Hydrograph type	= SCS Runoff	Peak discharge	= 34.56 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 2.398 acft
Drainage area	= 7.700 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.10 min
Total precip.	= 6.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.830 x 82) + (5.560 x 82) + (0.310 x 82)] / 7.700



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

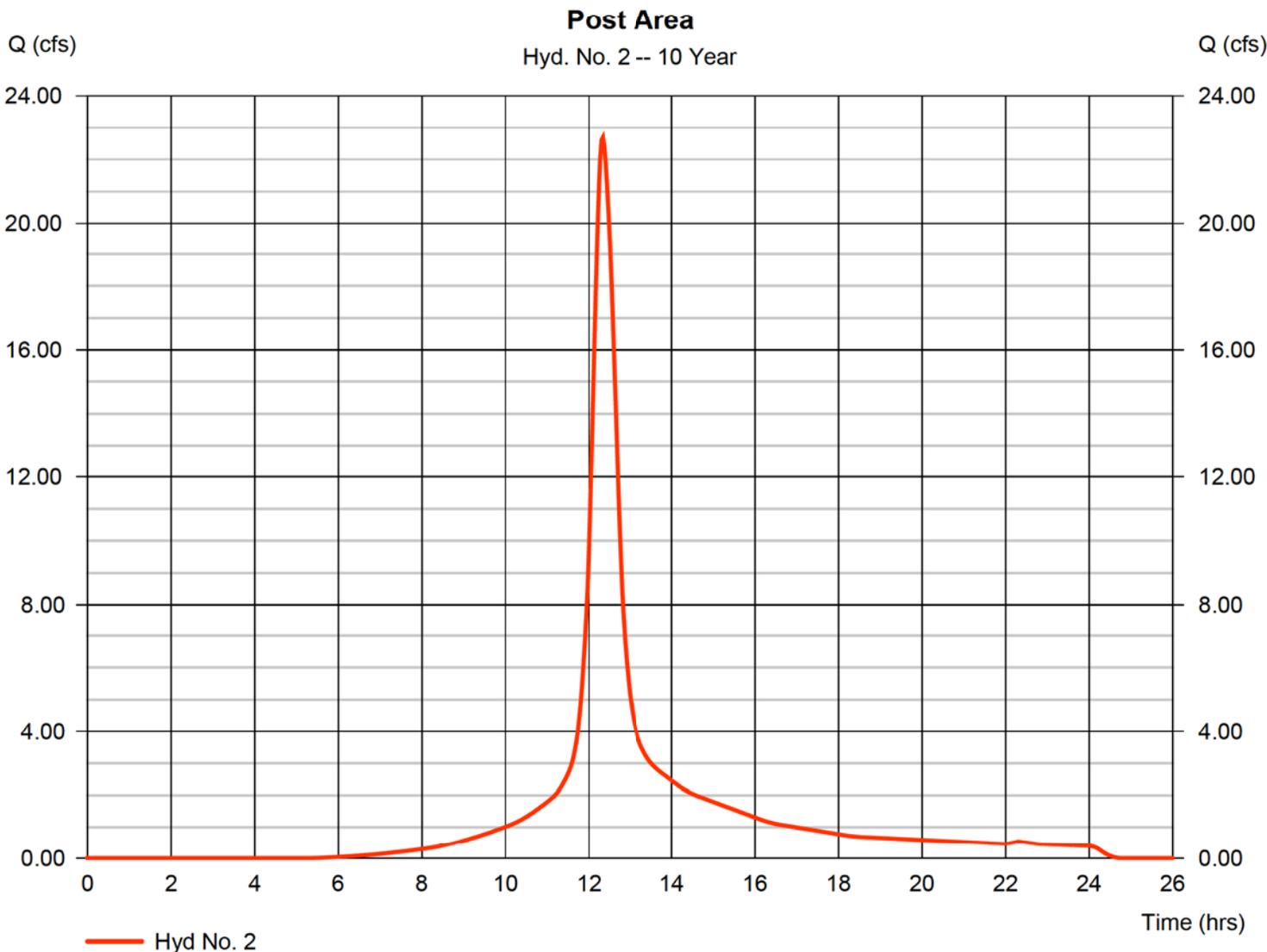
Thursday, 02 / 11 / 2016

## Hyd. No. 2

### Post Area

Hydrograph type	= SCS Runoff	Peak discharge	= 22.69 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.33 hrs
Time interval	= 2 min	Hyd. volume	= 2.761 acft
Drainage area	= 7.700 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.80 min
Total precip.	= 6.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.827 x 82) + (0.308 x 82) + (0.970 x 98) + (1.710 x 91) + (2.880 x 80)] / 7.700



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

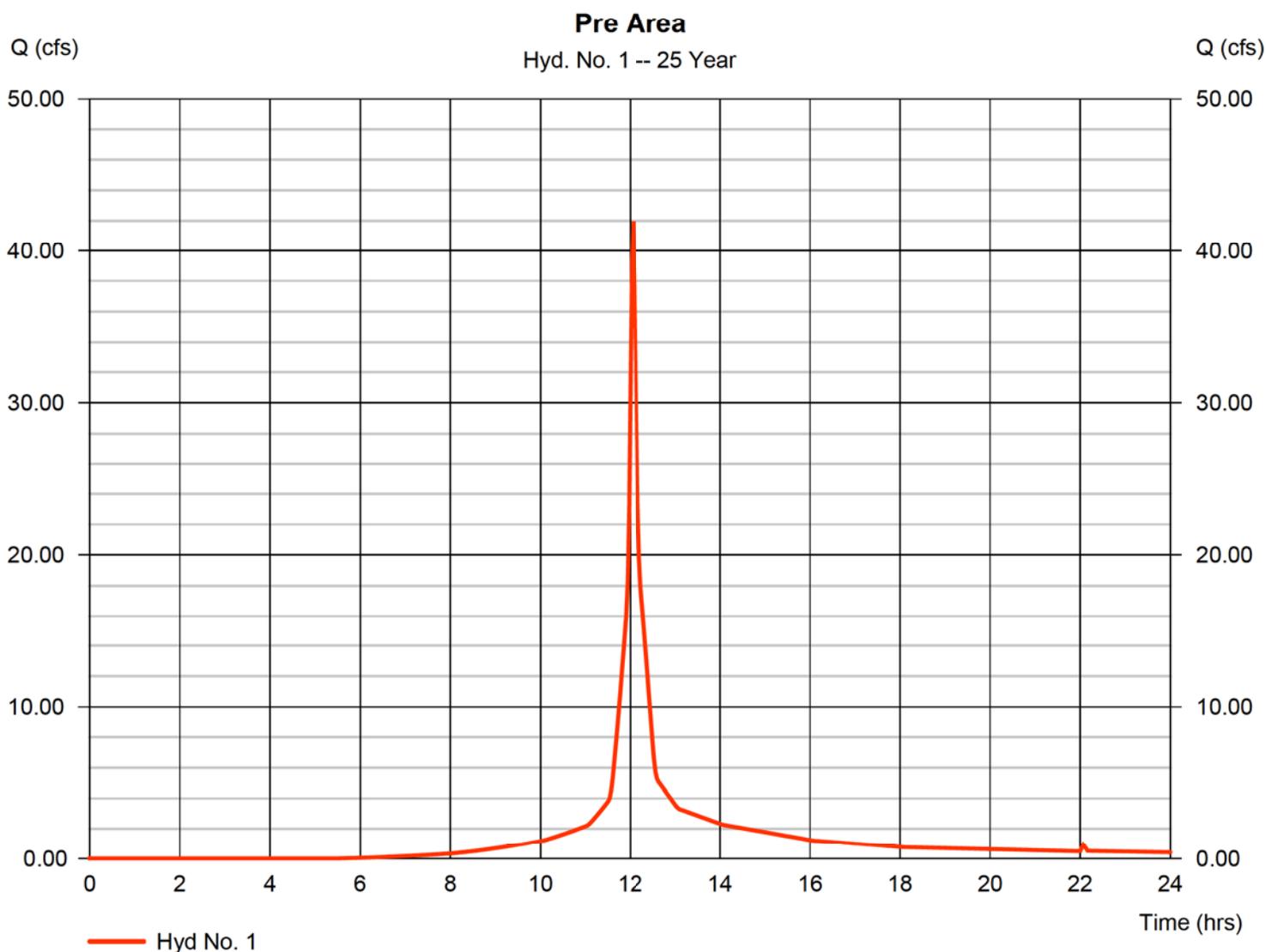
Thursday, 02 / 11 / 2016

## Hyd. No. 1

### Pre Area

Hydrograph type	= SCS Runoff	Peak discharge	= 41.97 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 2.935 acft
Drainage area	= 7.700 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.10 min
Total precip.	= 6.96 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.830 x 82) + (5.560 x 82) + (0.310 x 82)] / 7.700



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

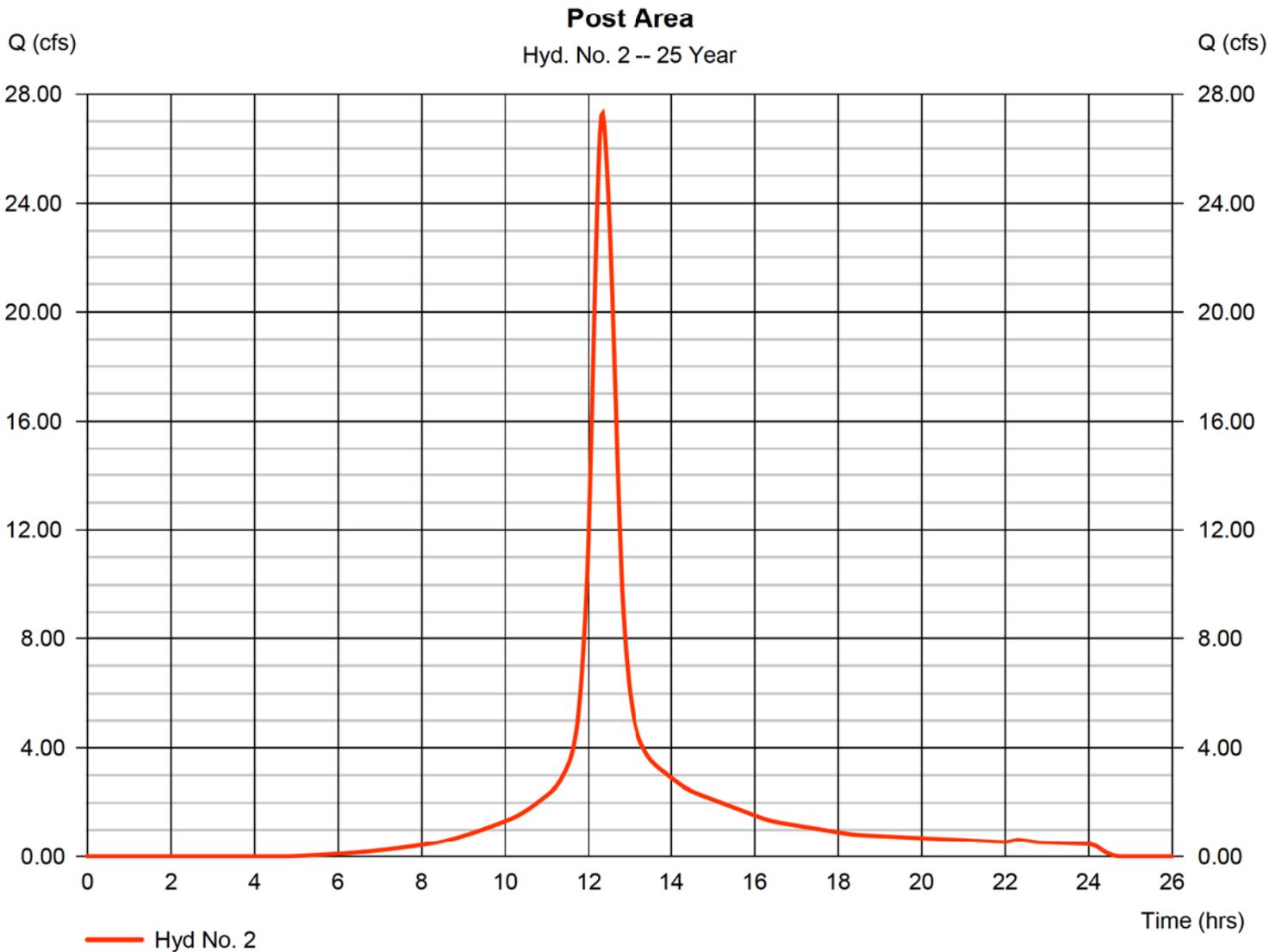
Thursday, 02 / 11 / 2016

## Hyd. No. 2

### Post Area

Hydrograph type	= SCS Runoff	Peak discharge	= 27.29 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.33 hrs
Time interval	= 2 min	Hyd. volume	= 3.346 acft
Drainage area	= 7.700 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.80 min
Total precip.	= 6.96 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.827 x 82) + (0.308 x 82) + (0.970 x 98) + (1.710 x 91) + (2.880 x 80)] / 7.700



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

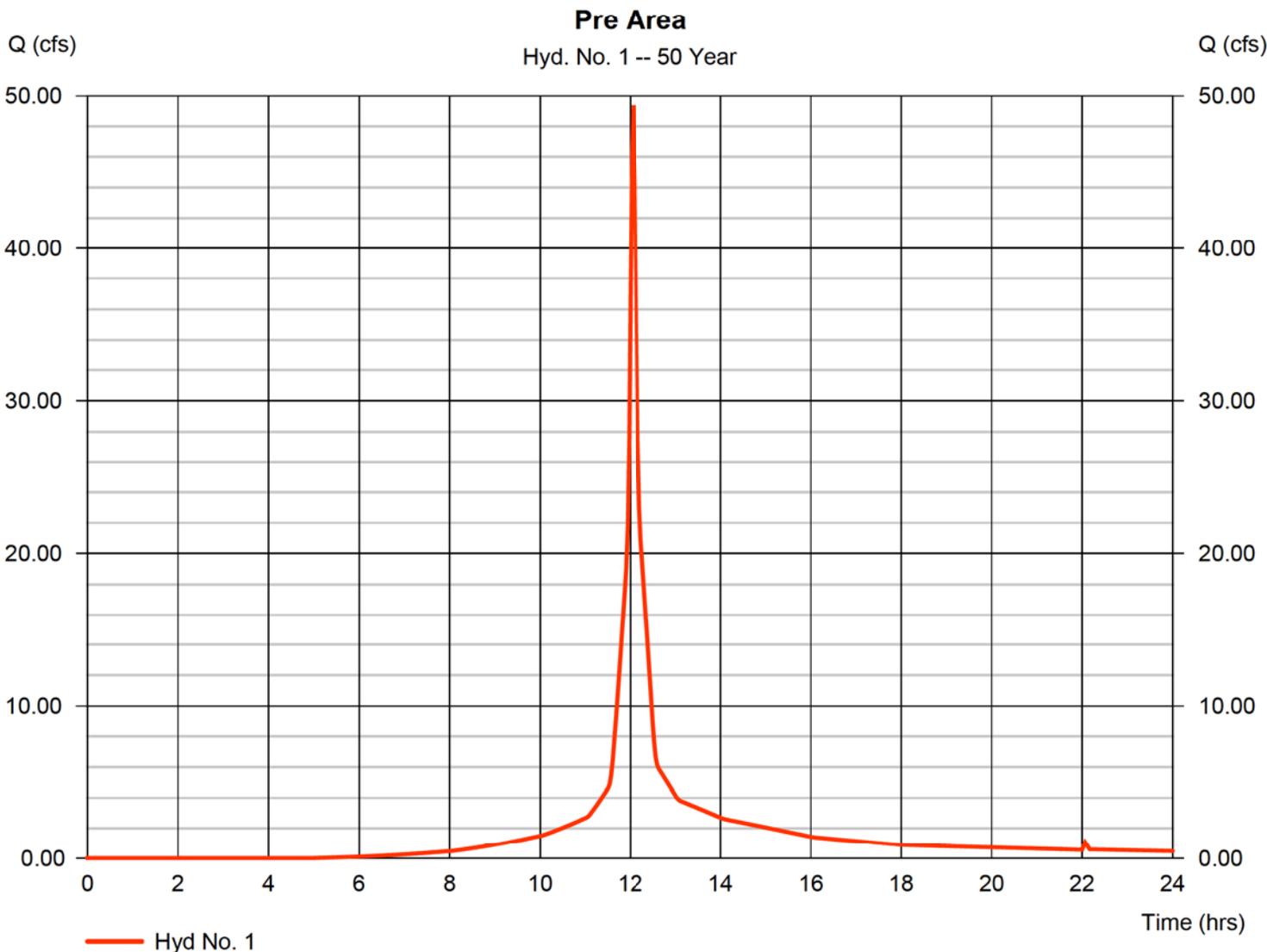
Thursday, 02 / 11 / 2016

## Hyd. No. 1

### Pre Area

Hydrograph type	= SCS Runoff	Peak discharge	= 49.39 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 3.479 acft
Drainage area	= 7.700 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.10 min
Total precip.	= 7.92 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.830 x 82) + (5.560 x 82) + (0.310 x 82)] / 7.700



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

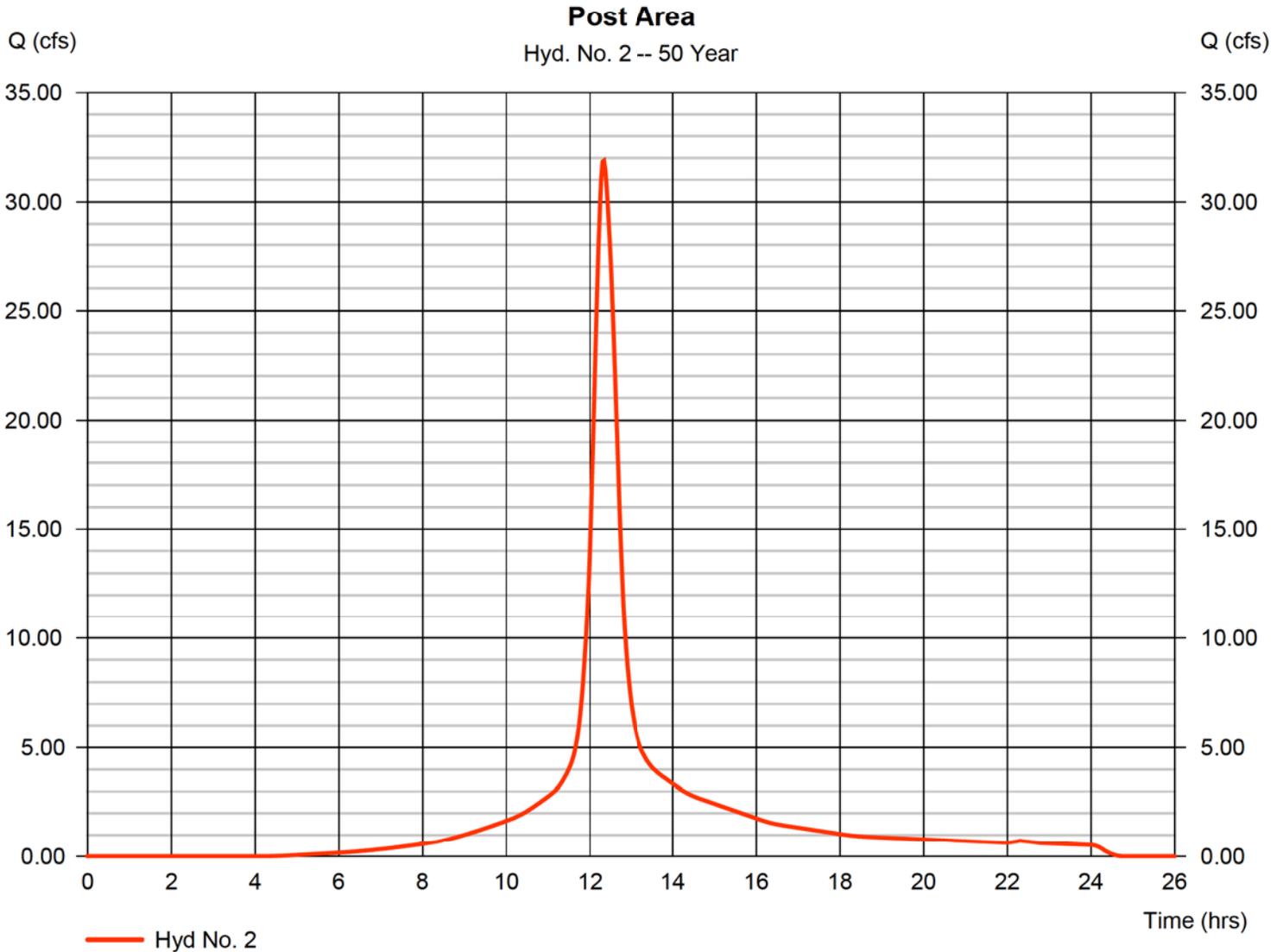
Thursday, 02 / 11 / 2016

## Hyd. No. 2

### Post Area

Hydrograph type	= SCS Runoff	Peak discharge	= 31.88 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.33 hrs
Time interval	= 2 min	Hyd. volume	= 3.937 acft
Drainage area	= 7.700 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.80 min
Total precip.	= 7.92 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.827 x 82) + (0.308 x 82) + (0.970 x 98) + (1.710 x 91) + (2.880 x 80)] / 7.700



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

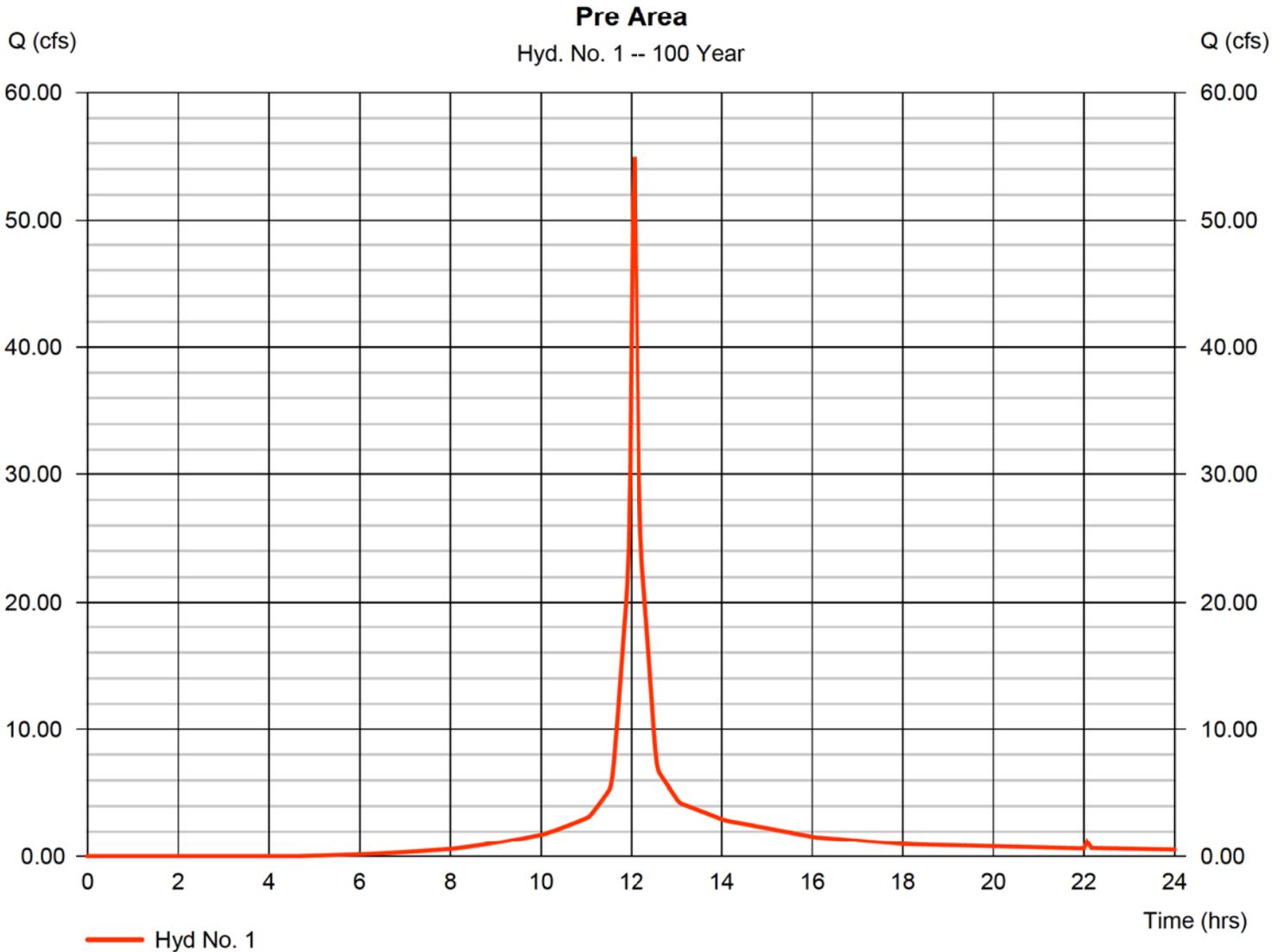
Thursday, 02 / 11 / 2016

## Hyd. No. 1

### Pre Area

Hydrograph type	= SCS Runoff	Peak discharge	= 54.94 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 3.892 acft
Drainage area	= 7.700 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 27.10 min
Total precip.	= 8.64 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.830 x 82) + (5.560 x 82) + (0.310 x 82)] / 7.700



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

Thursday, 02 / 11 / 2016

## Hyd. No. 2

### Post Area

Hydrograph type	= SCS Runoff	Peak discharge	= 35.31 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.33 hrs
Time interval	= 2 min	Hyd. volume	= 4.384 acft
Drainage area	= 7.700 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.80 min
Total precip.	= 8.64 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) = [(1.827 x 82) + (0.308 x 82) + (0.970 x 98) + (1.710 x 91) + (2.880 x 80)] / 7.700

