BLEW & ASSOCIATES, P.A.

STORM WATER MANAGEMENT REPORT

AUTOMATIC DOOR LARGE SCALE DEVELOPMENT

Blew Job Number: 15-937

This Large Scale Development has been reviewed for general compliance with the City of Tontitown Zoning and Planning Ordinances. Oversight of any regulations does not relieve the Owner of their responsibility to comply with all regulations.

Terry W. Carpenter, P.E.
Tontitown City Engineer, October 26, 2015

OCTOBER 2015

PREPARED BY

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

524 WEST SYCAMORE STREET, SUITE 4
FAYETTEVILLE, ARKANSAS 72703

Table of Contents

PROJECT DESCRIPTION

The subject site is composed of one undeveloped commercial lot in Tontitown Plaza Subdivision totaling 1.047 acres. The Post Construction Site shall consist of a new Office / Warehouse Building, Parking and Other Development requirements as dictated by the City of Tontitown. The Subject Site is located on Naples Street as shown on the Vicinity Map. The Subject Property is to be developed by:

Automatic Door Sales & Service
820 Pratt Rd, Suite 822
Little Rock, AR 72206
(501) 475-2911

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 Washington County, Arkansas, Panel Number 05143C0045F, Revision Date May 16th, 2008, 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 Washington 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: Captina silt loam, 1 to 3 percent slopes (CaB, 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 approximately 0.5 miles from the top of a drainage basin that releases into an unnamed tributary. The site has a general slop to the east. Storm water from the site releases into an unnamed tributary that runs northeast into Brush Creek. From Brush Creek (Based on the USGS Quad Maps provided by The National Map, Appendix A, Exhibit2) the storm water flows into Osage Creek, thence into the Illinois River

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

The overall subject site currently consists of on an undeveloped commercial lot in Tontitown Plaza Subdivision with approximately 1.047 Acres of land with a general slope towards the East. The majority of the site is part of Pre Area East. However, a small portion of the site slopes to the west and is part of the Pre Area West Drainage Area.

RUNOFF COEFFICIENTS

The Runoff Coefficients were selected from the City of Tontitown's Drainage Criteria Manual's Table 2.1 Runoff Coefficient Values. A runoff coefficient of 0.45 is being used for the Grass Areas.

TIME OF CONCENTRATION

The time of concentration was calculated based on the TR-55 Methods of Sheet Flow and Shallow Concentrated Flow per Chapter 3 of NRCS Technical Release 55. See Appendix B for the Pre Developed Time of Concentrations.

IDF CURVES

The Intensity Duration Frequency Curve was developed based on the numbers from the City of Tontitown's Drainage Criteria Manual's Table 2-2 "Rainfall Intensity Chart". This curve is used to determine the rainfall intensity for a given duration.

PRE-DEVELOPED PEAK FLOWS

The Pre-Developed Peak Flows are calculated using Rational Method (Q = CIA), which takes into account the Weighted Runoff Coefficients (C), the IDF Curves in conjunction with the Time of Concentration (I), 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 Area West	0.53 cfs	0.70 cfs	0.81 cfs	0.90 cfs	0.98 cfs
Pre Area East	1.54 cfs	2.08 cfs	2.42 cfs	2.68 cfs	2.94 cfs

See Appendix B for Peak Runoff calculations.

POST-DEVELOPED PEAK FLOWS

The Post Construction Site Shall Consist of a New Office / Warehouse Structure and Parking. A portion of the lot near the southwest corner of the property will be released undetained. The remainder of the site will be detained in the detention pond.

RUNOFF COEFFICIENTS

The Runoff Coefficients were selected from the City of Tontitown's Drainage Criteria Manual's Table 2.1 Runoff Coefficient Values. A runoff coefficient of 0.90 is being used for Impervious Areas, and 0.45 is being used for Grass Areas.

TIME OF CONCENTRATION

The time of concentration was calculated based on the TR-55 Methods of Sheet Flow and Shallow Concentrated Flow per Chapter 3 of NRCS Technical Release 55. See Appendix B for the Post Developed Time of Concentrations.

IDF CURVES

The Intensity Duration Frequency Curve was developed based on the numbers from the City of Tontitown's Drainage Criteria Manual's Table 2-2 "Rainfall Intensity Chart". This curve is used to determine the rainfall intensity for a given duration.

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The Post-Developed Peak Flows are calculated using Rational Method (Q = CIA), which takes into account the Weighted Runoff Coefficients (C), the IDF Curves in conjunction with the Time of Concentration (I), 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 Area West	0.13 cfs	0.17 cfs	0.19 cfs	0.21 cfs	0.23 cfs
Post Area East	1.89 cfs	2.25 cfs	2.59 cfs	2.88 cfs	3.12 cfs

See Appendix B for Peak Runoff calculations.

STORM WATER MANAGEMENT SYSTEM:

The Storm Water Management System has been designed to control the flows from the different storm frequencies. The Storm Water System has been designed for a fully developed state of the project. Part of the area that flows west will be release undetained. The remainder of the site will be directed into the detention pond. The water from the detention pond will be released into an existing natural storm system to the west.

STORM CONVEYANCE SYSTEM

The precipitation from the storm events travels overland to the Municipal / Natural Storm System or Detention Ponds as noted in the Post Area Drainage Map.

STORM WATER DETENTION SYSTEM

The Storm Water Detention System consists of a Dry Detention Pond and outfall structure. The Dry Detention Pond is designed to control all the storm water generated by the site. Design of the ponds are based on the Modified Puls Routing Method and calculated using Autodesk's Hydrograph. The pond releases the water into the natural storm water system at a peak rate that is determined to be less than or equal to that released by the site prior to development.

The Detention Pond will obtain a volume of 0.162 acre-ft at a depth of 2.32 feet. The pond will have a controlled release through the use of an 12" pipe with an invert elevation of 1295.68. The pipe will be 20 feet long at a slope of 0.5%. From the pond, the water will travel into the natural storm water system.

RESTRICTED PEAK FLOWS

As a result of the Proposed Storm Water System, the peak detained storm water flows that leave the site are as follows:

Restricted Post Developed Peak Runoff				
Storm Event	Water Elev.	Vol. Required	Vol. Provided	Restricted Flows
2-year	1296.54	0.027 ac-ft	0.162 ac-ft	1.34 cfs
10-year	1296.79	0.038 ac-ft	0.162 ac-ft	2.00 cfs
25-year	1296.89	0.042 ac-ft	0.162 ac-ft	2.39 cfs
50-year	1296.96	0.046 ac-ft	0.162 ac-ft	2.67 cfs
100-year	1297.02	0.049 ac-ft	0.162 ac-ft	2.85 cfs

POST VS. PRE:

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

State of Project Site Detained (East)	Storm Event				
	2- year	10- year	25- year	50- year	100- year
Total Post	1.34 cfs	2.00 cfs	2.39 cfs	2.67 cfs	2.85 cfs
Total Pre	1.54 cfs	2.08 cfs	2.41 cfs	2.68 cfs	2.94 cfs
Net	*-0.20 cfs*	*-0.08 cfs*	*-0.02 cfs*	*-0.01 cfs*	*-0.09 cfs*

State of Project Site Undetained (West)	Storm Event				
	2- year	10- year	25- year	50- year	100- year
Total Post	0.13 cfs	0.17 cfs	0.19 cfs	0.21 cfs	0.23 cfs
Total Pre	0.53 cfs	0.70 cfs	0.81 cfs	0.90 cfs	0.98 cfs
Net	*-0.40 cfs*	*-0.53 cfs*	*-0.62 cfs*	*-0.69 cfs*	*-0.75 cfs*

CONCLUSION:

I, Jorge Du Quesne, Jr, Registered Professional Engineer No. 12006 in the State of Arkansas, herby 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.

I, Jorge Du Quesne, Jr, Registered Professional Engineer No. 12006 in the State of Arkansas, hereby certify that the drainage studies, reports, calculations, designs, and specifications contained in this report have been prepared in accordance with the requirements of the City of Tontitown. Further, I hereby acknowledge that the review of the drainage studies, reports, calculations, designs, and specifications by the City of Tontitown or its representatives cannot and does not relieve me from any professional responsibility or liability.

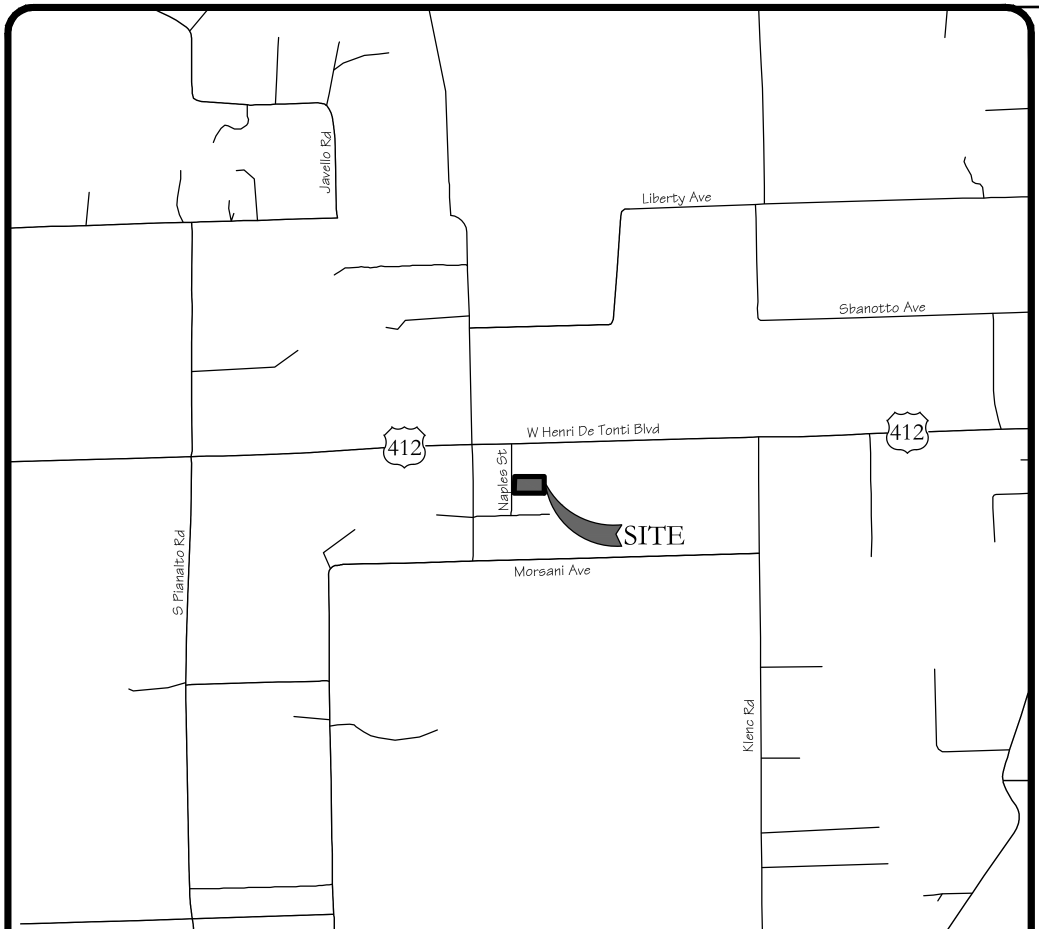
Respectfully,

Jorge Du Quesne, Jr. P.E.

APPENDIX A

EXHIBIT 1

Vicinity Map



VICINITY MAP

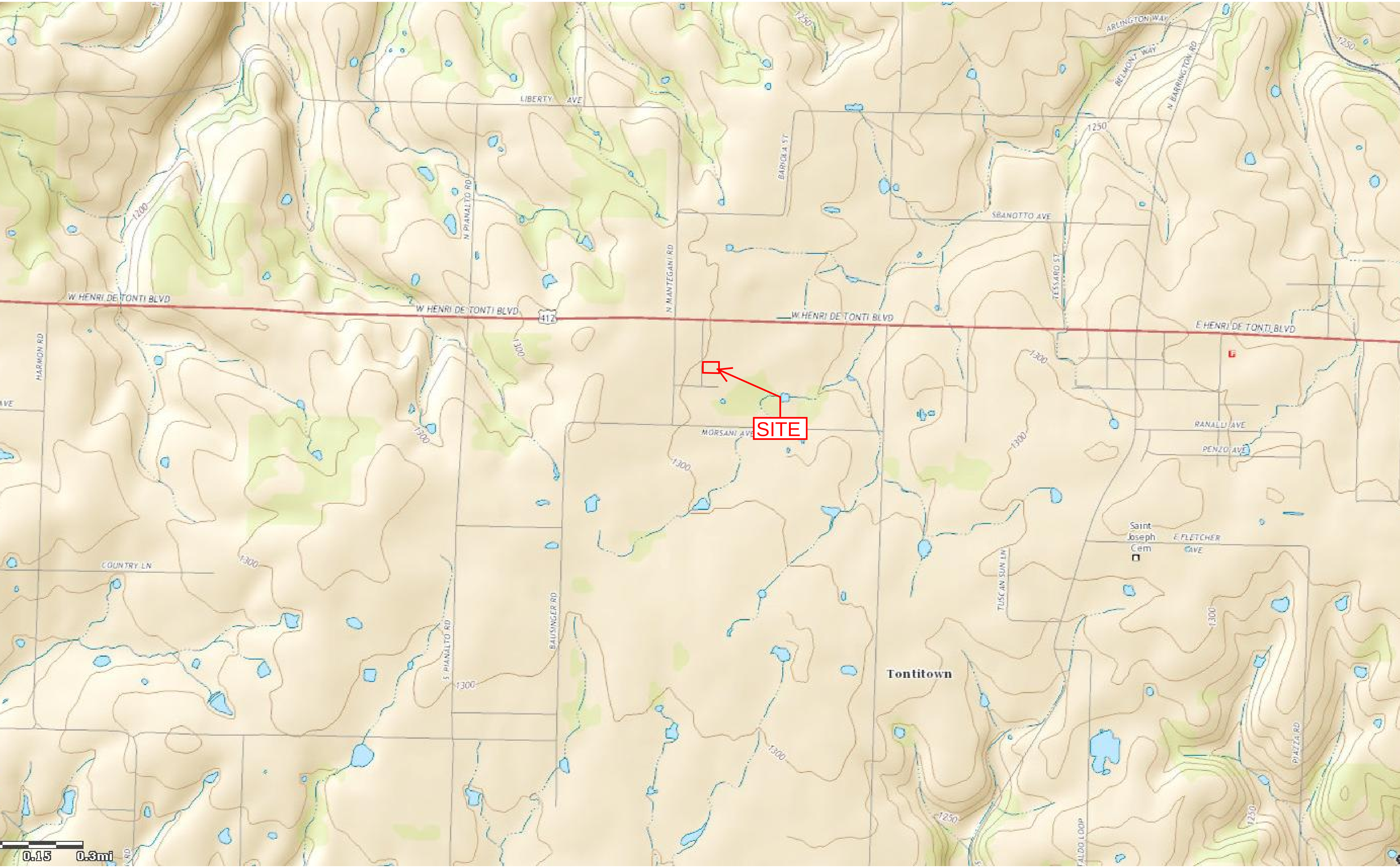
N.T.S.

EXHIBIT 2

Quad Maps and Aerial Photograph

The National Map

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

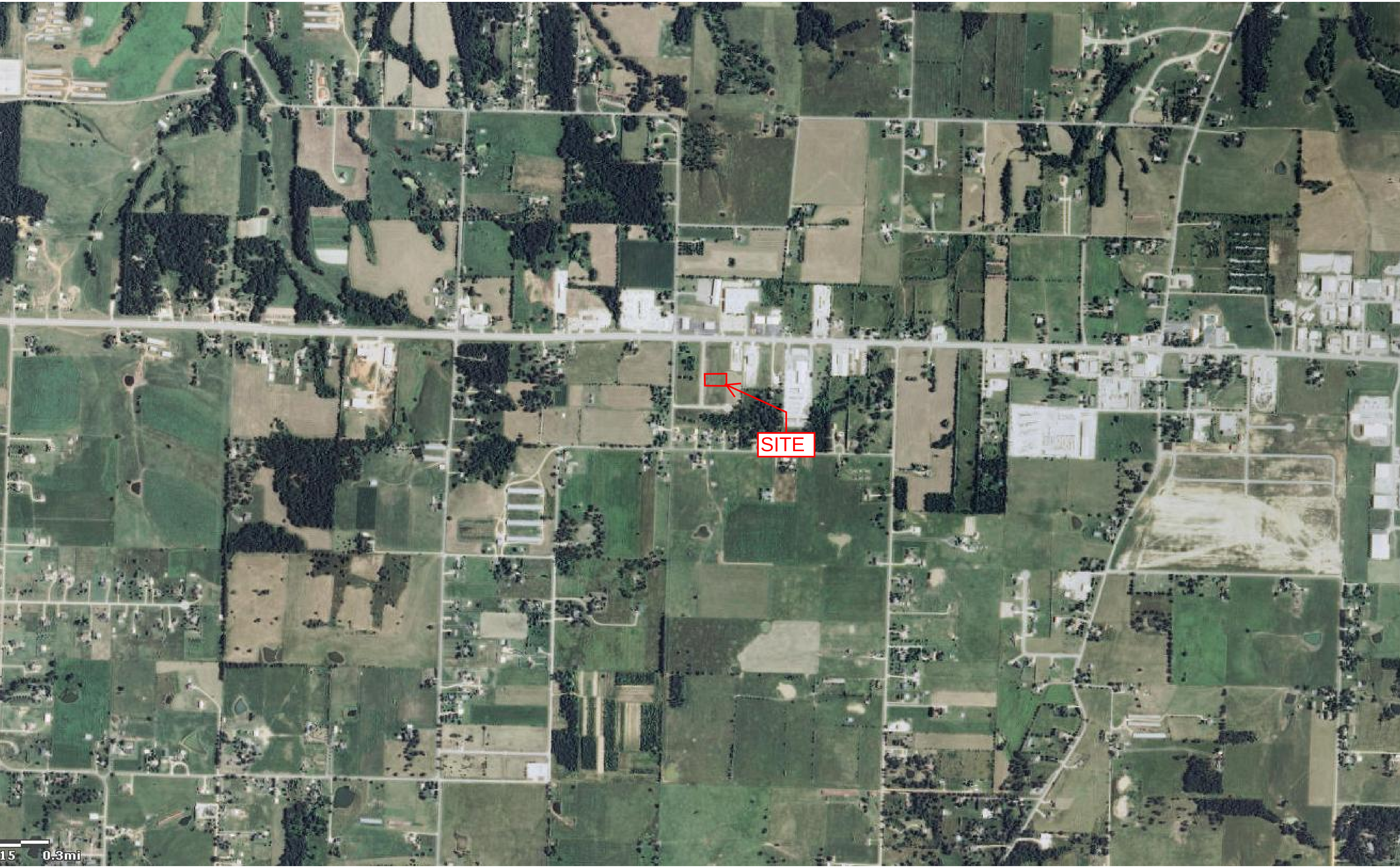


Open in The National Map Viewer

10/5/15 5:42 PM

The National Map

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



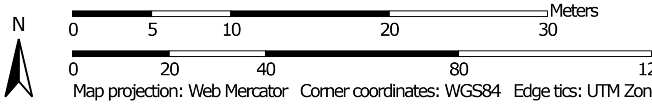
Open in The National Map Viewer

10/5/15 5:43 PM

EXHIBIT 3

USDA / NRCS Soil Survey

Map Scale: 1:478 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N 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 1:20,000.

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: Washington County, Arkansas
Survey Area Data: Version 11, Sep 22, 2014

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 — Washington County, Arkansas (AR143)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
CaB	Captina silt loam, 1 to 3 percent slopes	C/D	1.0	99.8%
Jo	Johnsburg silt loam, 0 to 2 percent slopes	D	0.0	0.2%
Totals for Area of Interest			**1.0**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

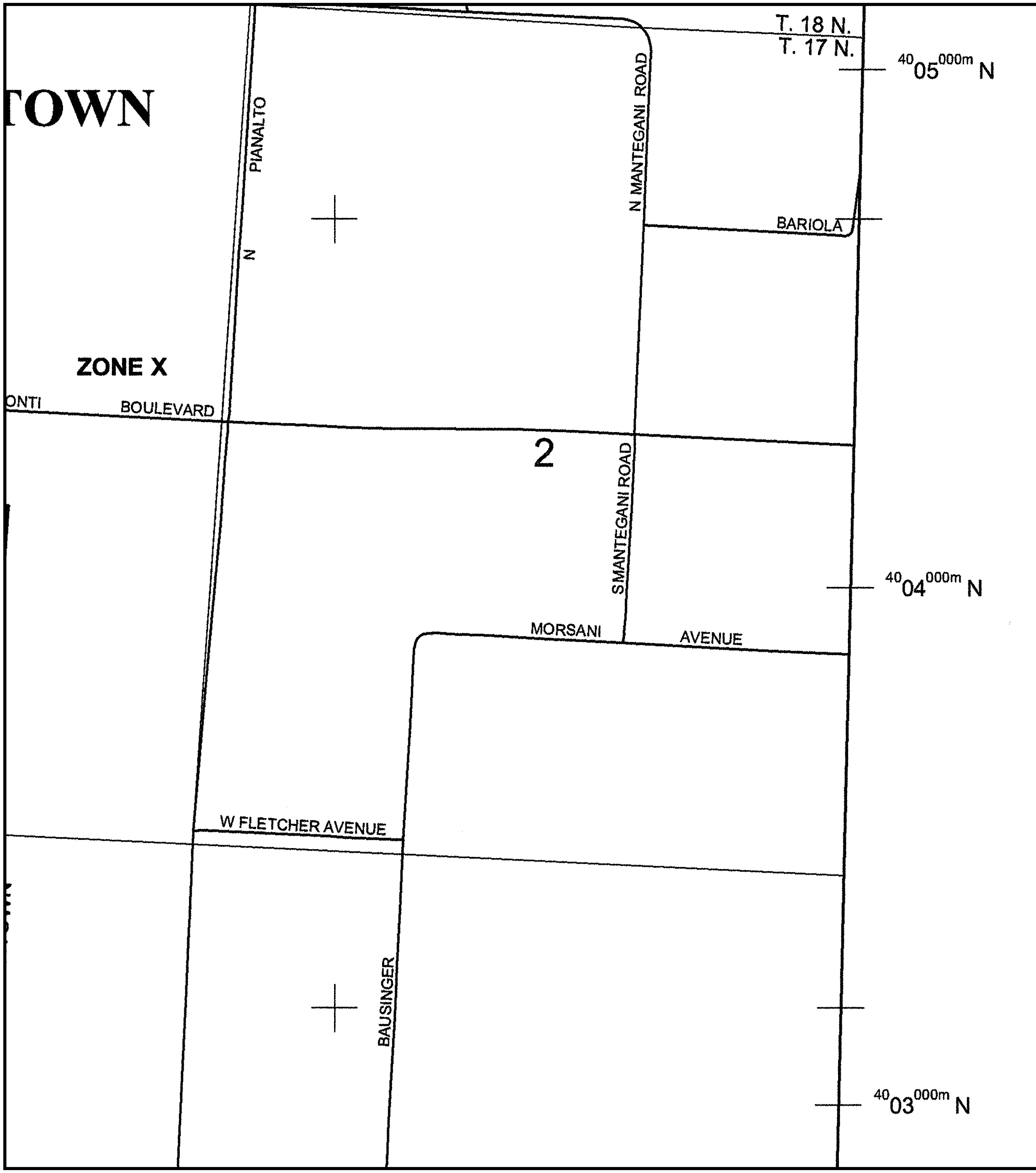
Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

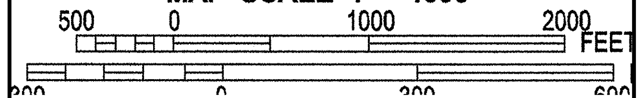
Tie-break Rule: Higher

EXHIBIT 4

FEMA Firmette



MAP SCALE 1" = 1000'



PANEL 0045F

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

WASHINGTON COUNTY, ARKANSAS

AND INCORPORATED AREAS

PANEL 45 OF 575

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
WASHINGTON COUNTY	050212	0045	F
TONTITOWN, TOWN OF	050293	0045	F

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.

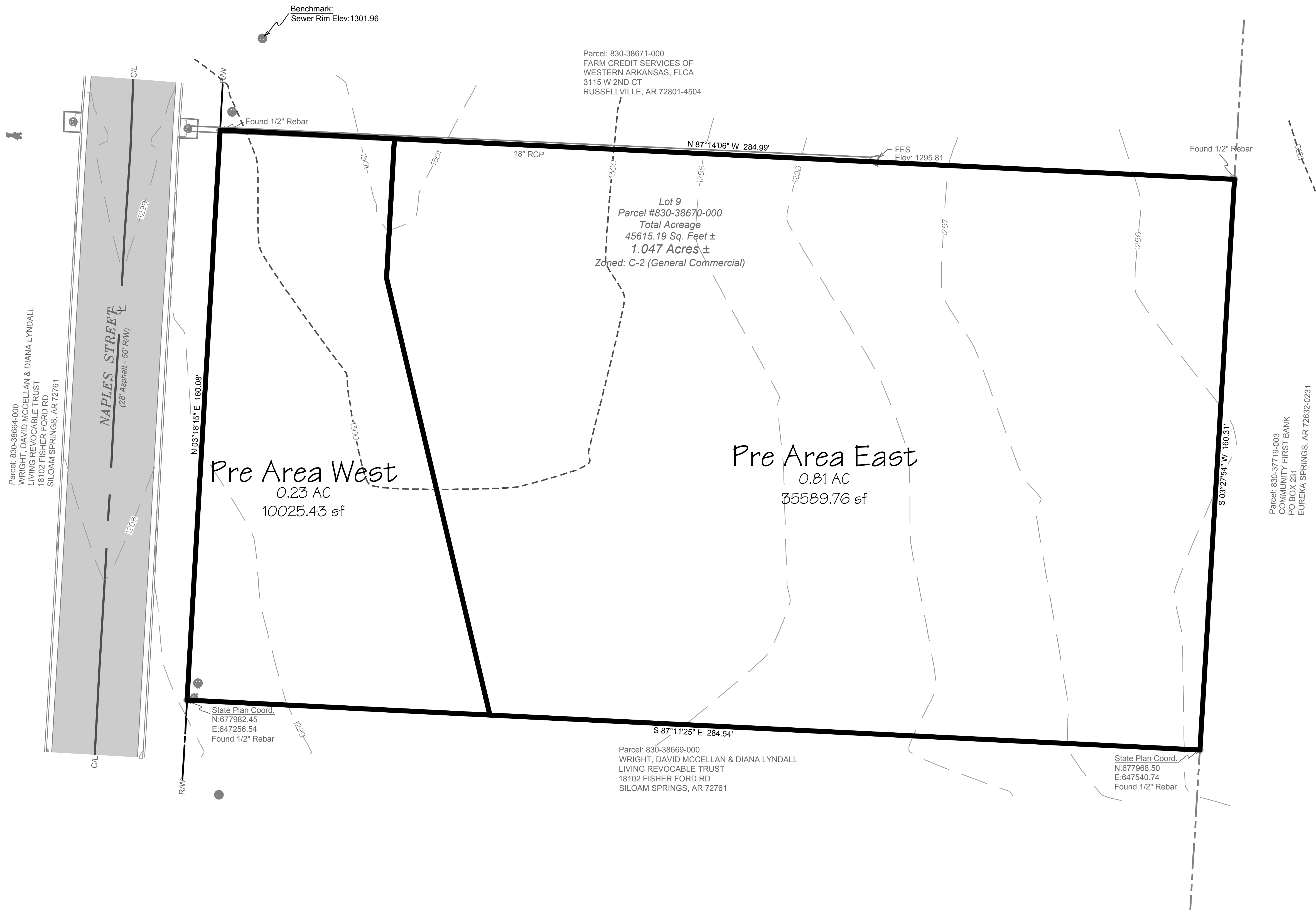
MAP NUMBER
05143C0045F

MAP REVISED
MAY 16, 2008

Federal Emergency Management Agency

EXHIBIT 5

Drainage Areas



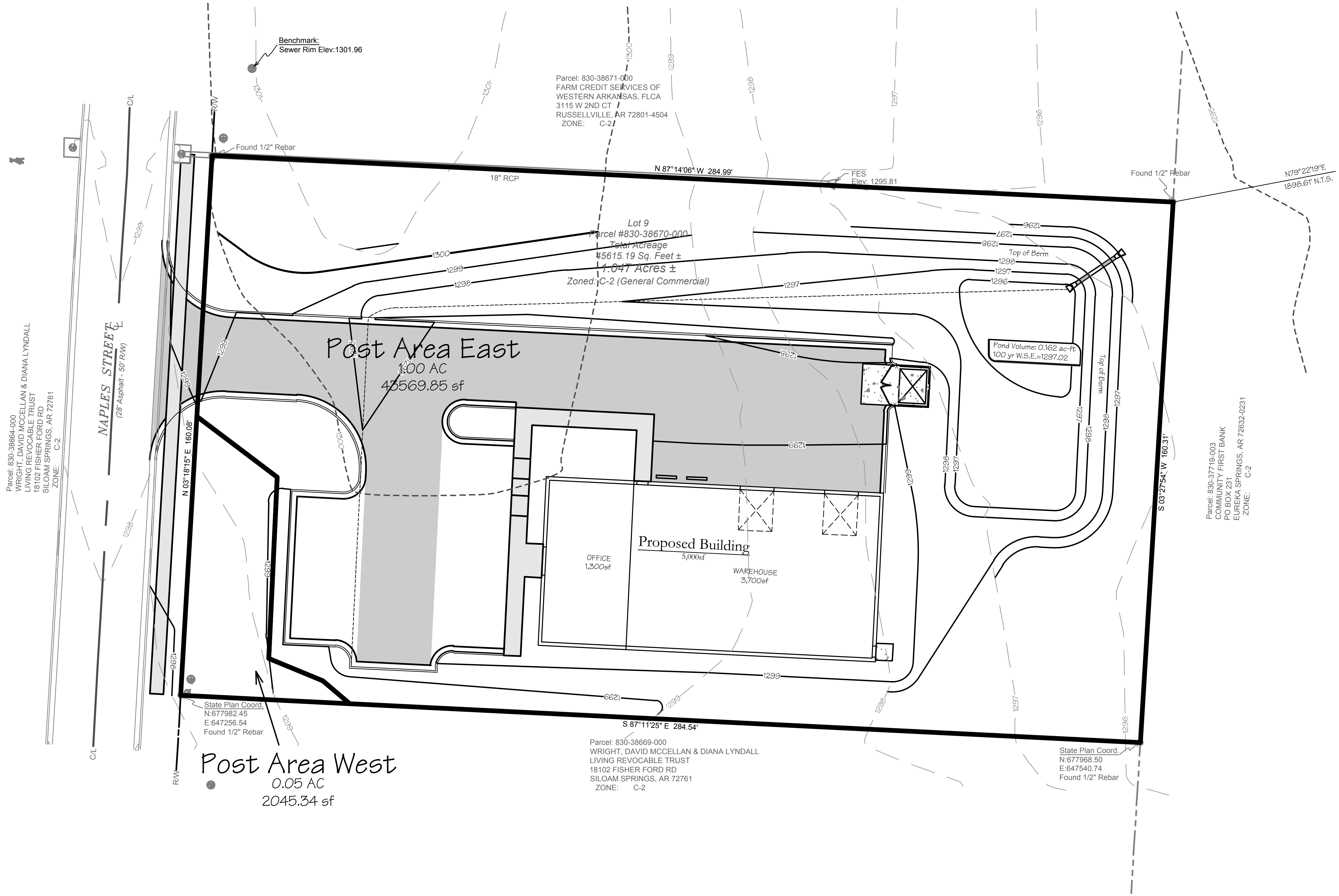
Pre-Development Drainage Areas

Date: 10/05/2015

1 inch = 30 ft

Project Number: 15-937

BLEW & ASSOCIATES, PA
CIVIL ENGINEERS & LAND SURVEYORS
Certificate of Authorization № 1534
524 W. Sycamore Street, Suite 4 • Fayetteville, Arkansas 72703 • 479.443.4506 Office • 479.582-1883 Fax



Post-Development Drainage Areas

1 inch = 30 ft

Date: 10/06/2015

Project Number: 15-937

BLEW & ASSOCIATES, PA
CIVIL ENGINEERS & LAND SURVEYORS
Certificate of Authorization № 1534
524 W. Sycamore Street, Suite 4 • Fayetteville, Arkansas 72703 • 479.443.4506 Office • 479.582-1883 Fax

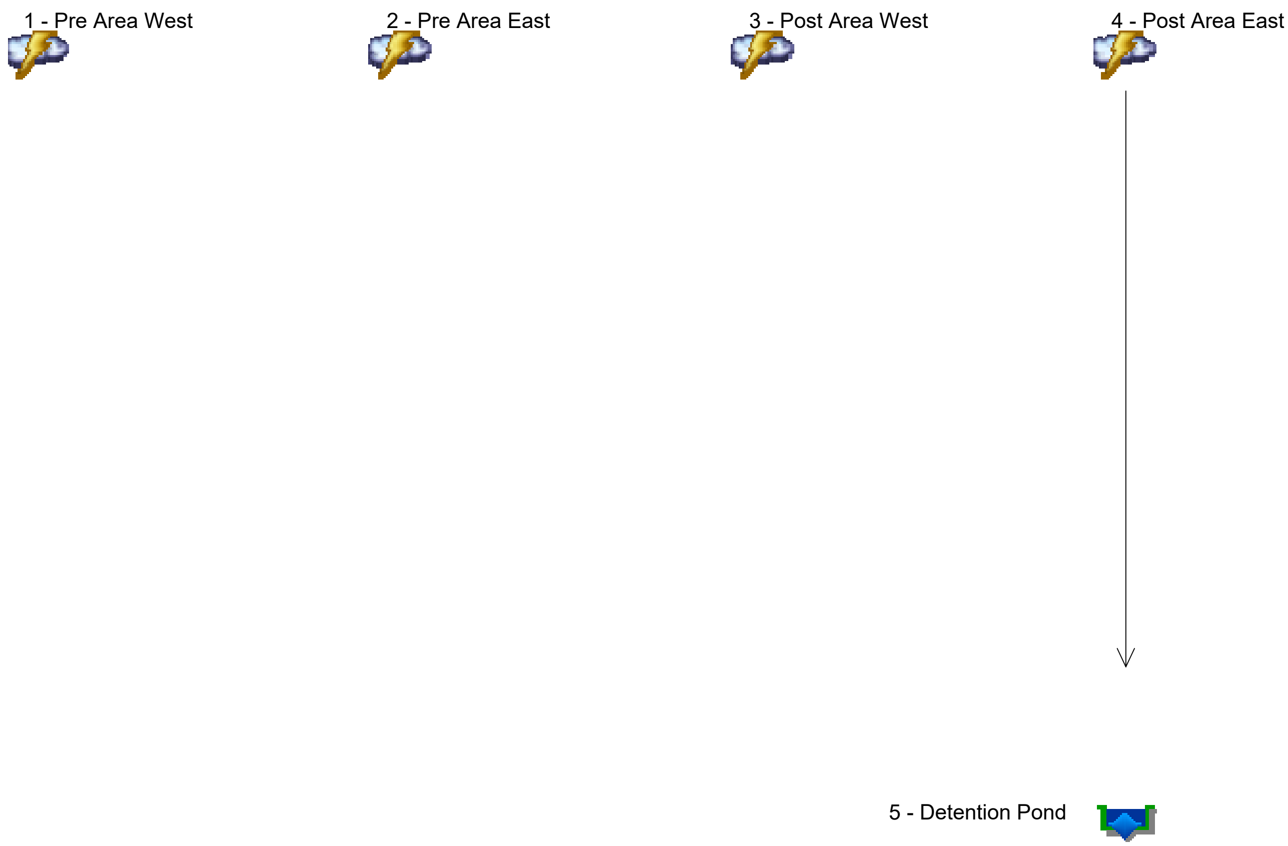
APPENDIX B

Routing Calculations

Hydraflow Table of Contents

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Project: Drainage.gpw	Monday, 10 / 5 / 2015

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Rational	------	-------	0.525	-------	-------	0.702	0.811	0.897	0.979	Pre Area West
2	Rational	------	-------	1.539	-------	-------	2.085	2.424	2.683	2.930	Pre Area East
3	Rational	------	-------	0.125	-------	-------	0.165	0.190	0.210	0.230	Post Area West
4	Mod. Rational	------	-------	1.889	-------	-------	2.248	2.587	2.884	3.121	Post Area East
5	Reservoir	4	-------	1.339	-------	-------	1.995	2.387	2.668	2.847	Detention Pond

Proj. file: Drainage 002.gpw

Tuesday, 10 / 20 / 2015

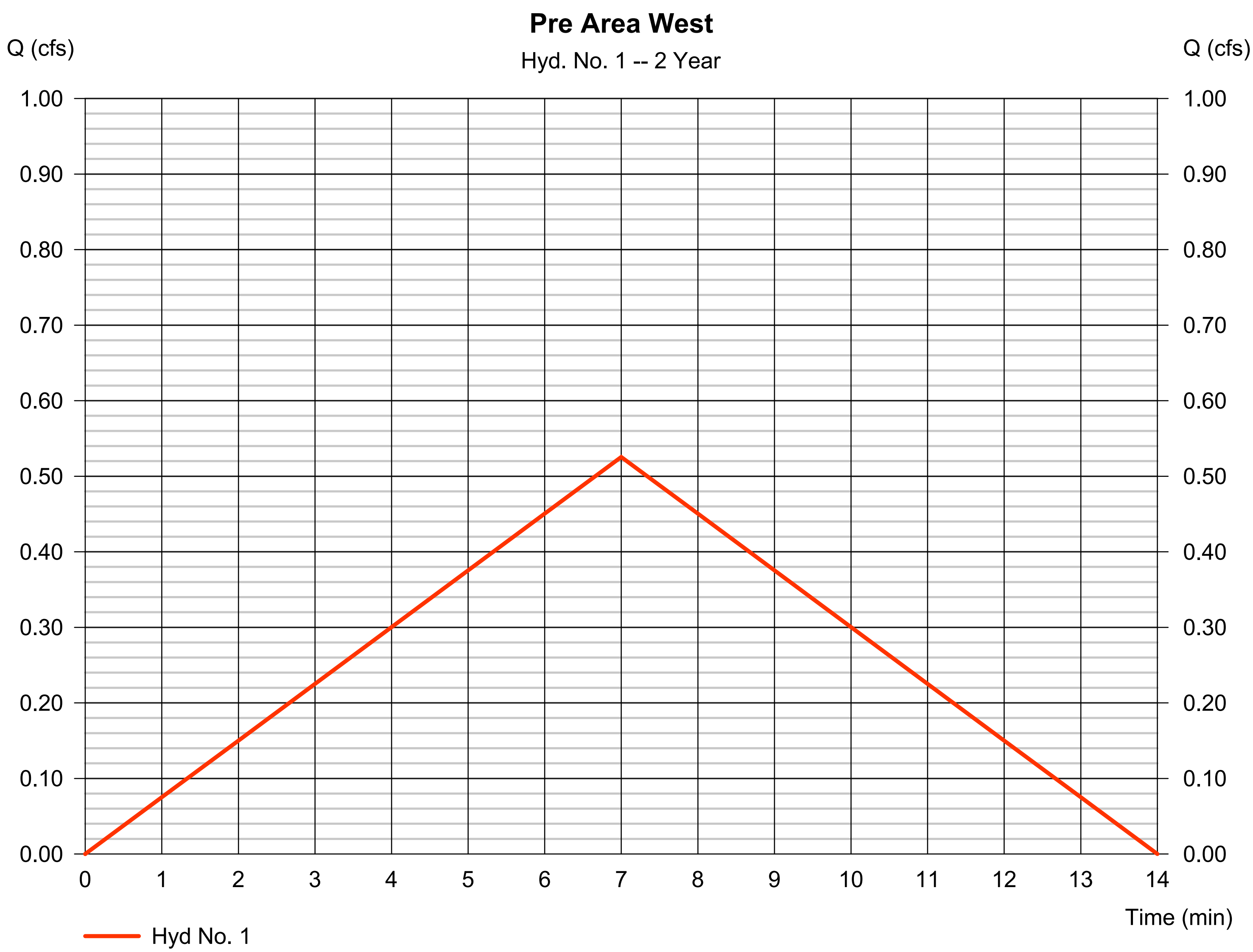
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Tuesday, 10 / 20 / 2015

Hyd. No. 1

Pre Area West

Hydrograph type	= Rational	Peak discharge	= 0.525 cfs
Storm frequency	= 2 yrs	Time to peak	= 7 min
Time interval	= 1 min	Hyd. volume	= 0.005 acft
Drainage area	= 0.230 ac	Runoff coeff.	= 0.45
Intensity	= 5.077 in/hr	Tc by TR55	= 7.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1



TR55 Tc Worksheet

Hyd. No. 1

Pre Area West

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	81.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	4.08		0.00		0.00		
Land slope (%)	=	1.90		0.00		0.00		
Travel Time (min)	**=**	**7.48**	**+**	**0.00**	**+**	**0.00**	**=**	**7.48**
Shallow Concentrated Flow								
Flow length (ft)	=	0.00		0.00		0.00		
Watercourse slope (%)	=	0.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=0.00			0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow								
X sectional flow area (sqft)	=	0.00		0.00		0.00		
Wetted perimeter (ft)	=	0.00		0.00		0.00		
Channel slope (%)	=	0.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=0.00							
				0.00				
						0.00		
Flow length (ft)	({0})0.0			0.0		0.0		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc .... 7.00 min

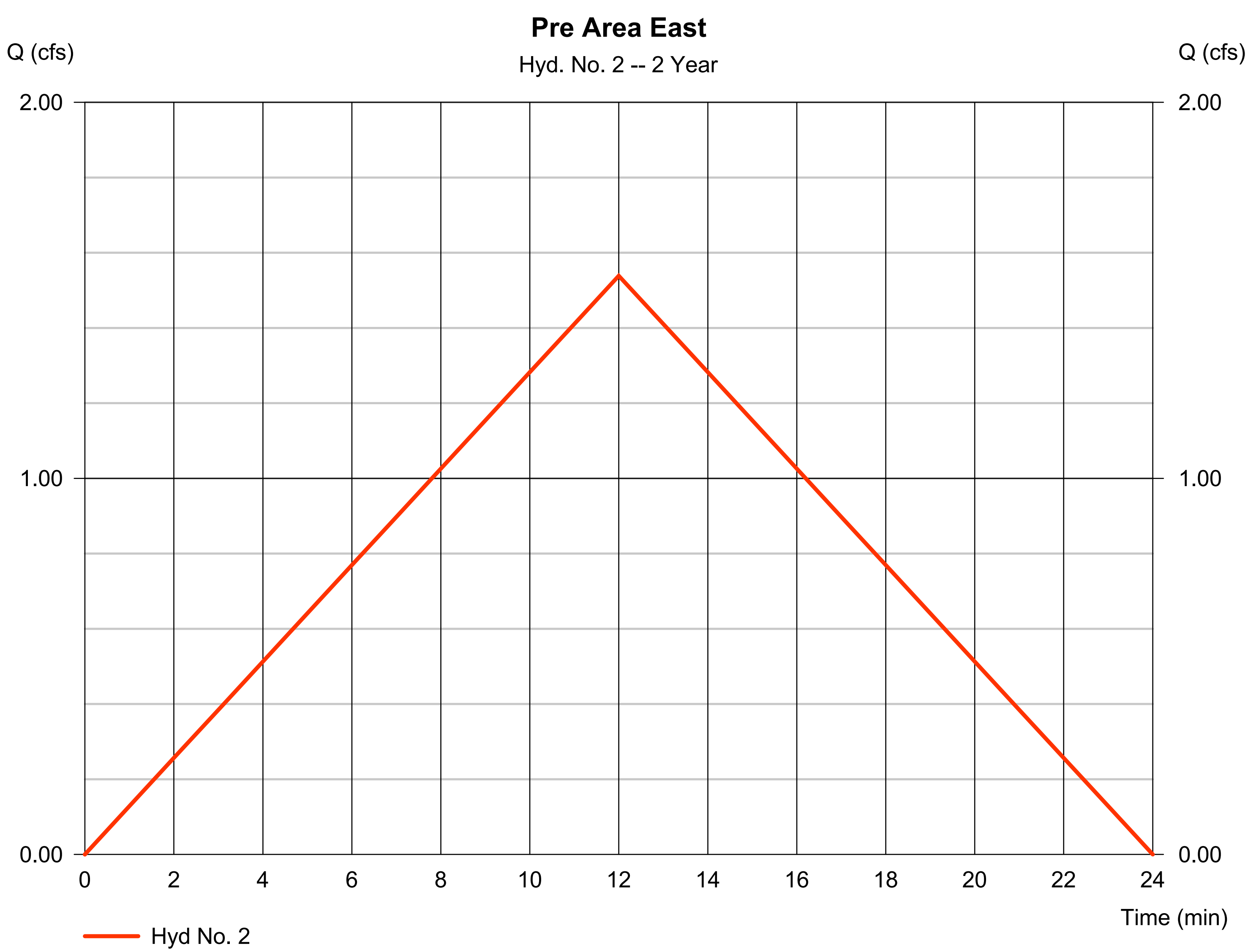
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 2

Pre Area East

Hydrograph type	= Rational	Peak discharge	= 1.539 cfs
Storm frequency	= 2 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 0.025 acft
Drainage area	= 0.810 ac	Runoff coeff.	= 0.45
Intensity	= 4.221 in/hr	Tc by TR55	= 12.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1



TR55 Tc Worksheet

Hyd. No. 2

Pre Area East

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		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 (%)	=	1.25		0.00		0.00		
Travel Time (min)	**=**	**10.47**	**+**	**0.00**	**+**	**0.00**	**=**	**10.47**
Shallow Concentrated Flow								
Flow length (ft)	=	168.00		0.00		0.00		
Watercourse slope (%)	=	2.70		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.65			0.00		0.00		
Travel Time (min)	**=**	**1.06**	**+**	**0.00**	**+**	**0.00**	**=**	**1.06**
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 .... 12.00 min

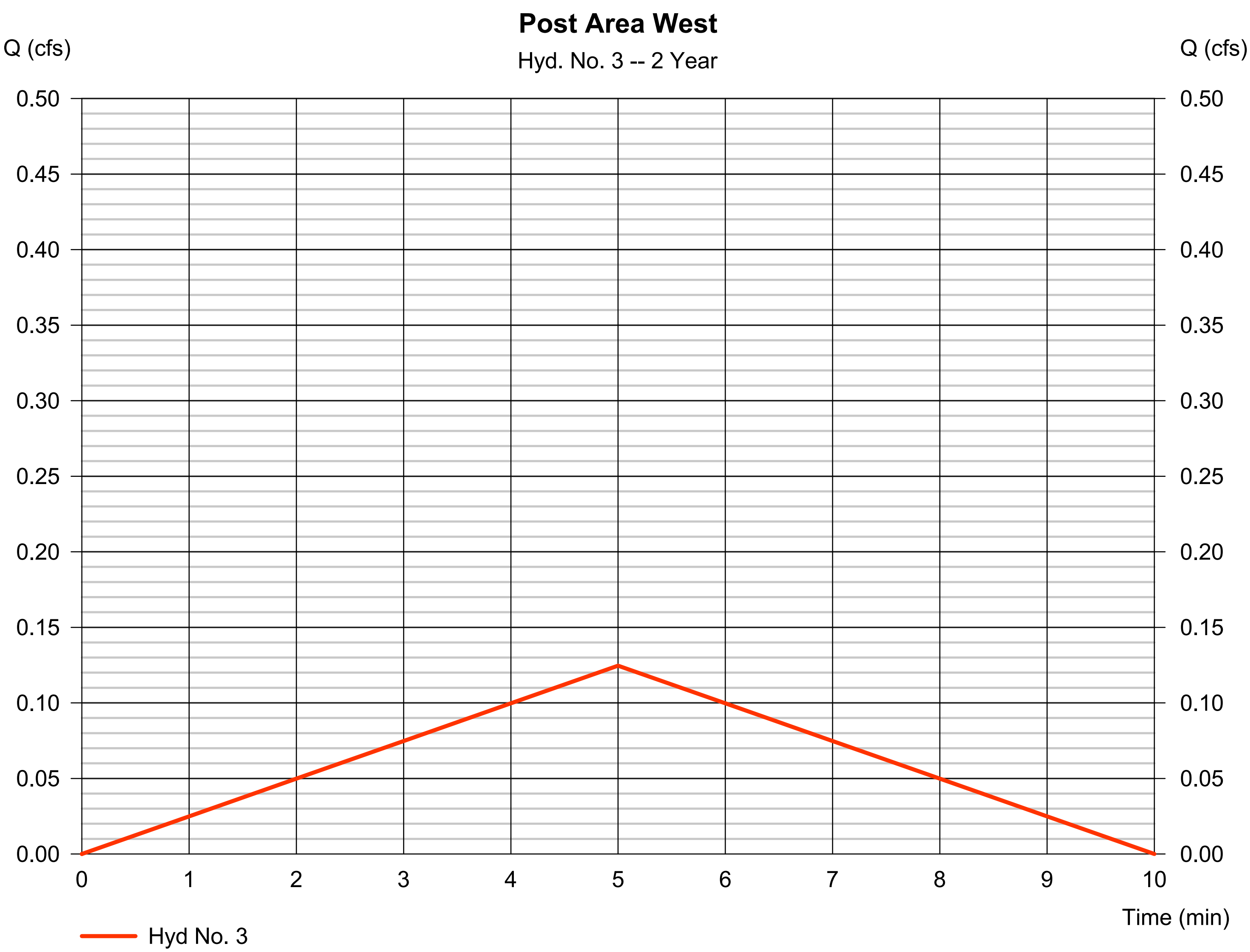
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 | Tuesday, 10 / 20 / 2015

Hyd. No. 3

Post Area West

Hydrograph type	= Rational	Peak discharge	= 0.125 cfs
Storm frequency	= 2 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 0.001 acft
Drainage area	= 0.050 ac	Runoff coeff.	= 0.45
Intensity	= 5.539 in/hr	Tc by User	= 5.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

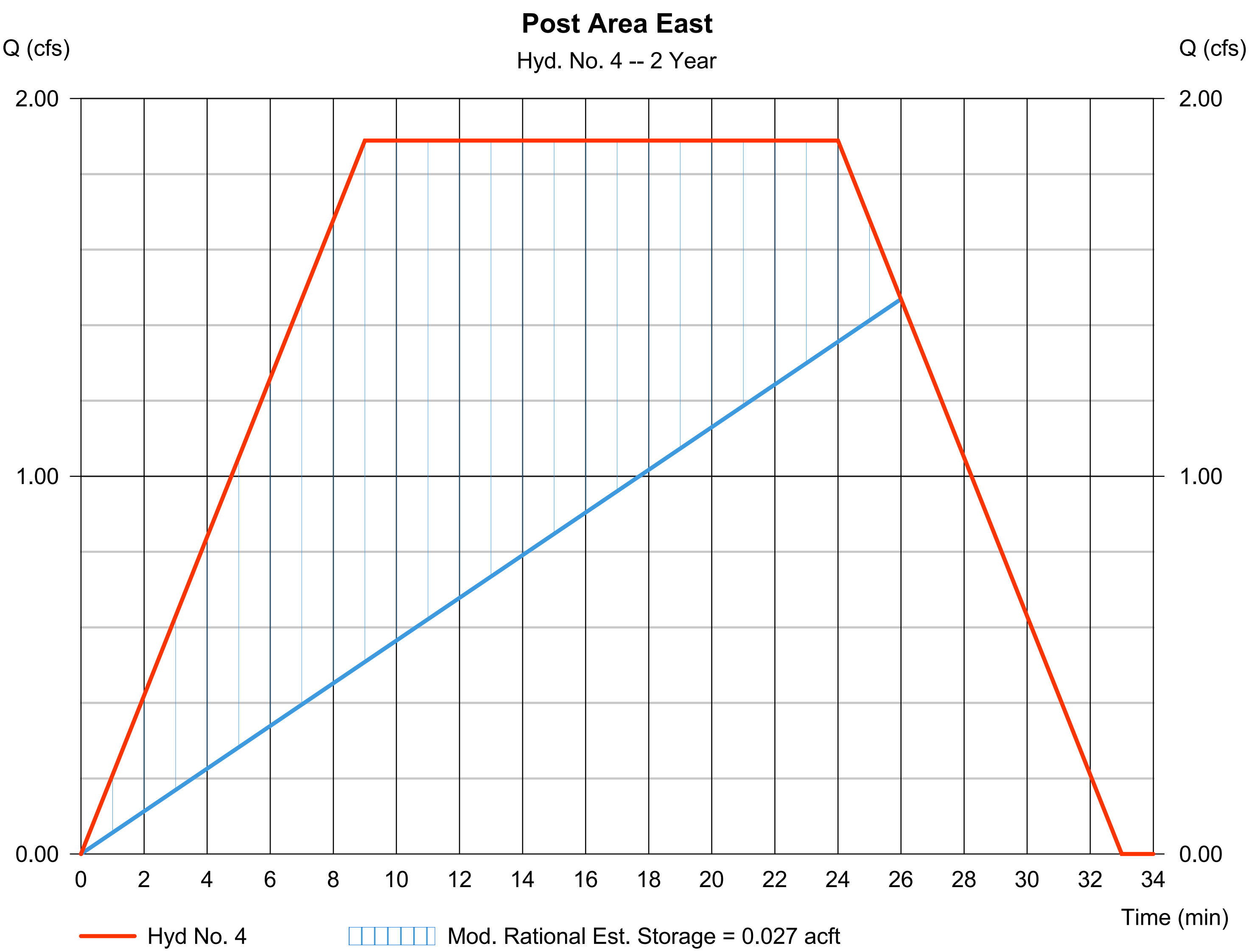
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 4

Post Area East

Hydrograph type	= Mod. Rational	Peak discharge	= 1.889 cfs
Storm frequency	= 2 yrs	Time to peak	= 9 min
Time interval	= 1 min	Hyd. volume	= 0.063 acft
Drainage area	= 1.000 ac	Runoff coeff.	= 0.62*
Intensity	= 3.046 in/hr	Tc by TR55	= 9.00 min
IDF Curve	= AR - Tontitown.IDF	Storm duration	= 2.7 x Tc
Target Q	=1.540 cfs	Est. Req'd Storage	=0.027 acft

* Composite (Area/C) = [(0.380 x 0.90) + (0.620 x 0.45)] / 1.000



TR55 Tc Worksheet

Hyd. No. 4

Post Area East

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		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 (%)	=	2.25		0.00		0.00		
Travel Time (min)	**=**	**8.28**	**+**	**0.00**	**+**	**0.00**	**=**	**8.28**
Shallow Concentrated Flow								
Flow length (ft)	=	142.00		0.00		0.00		
Watercourse slope (%)	=	1.75		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.13			0.00		0.00		
Travel Time (min)	**=**	**1.11**	**+**	**0.00**	**+**	**0.00**	**=**	**1.11**
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 .... 9.00 min

Hydrograph Report

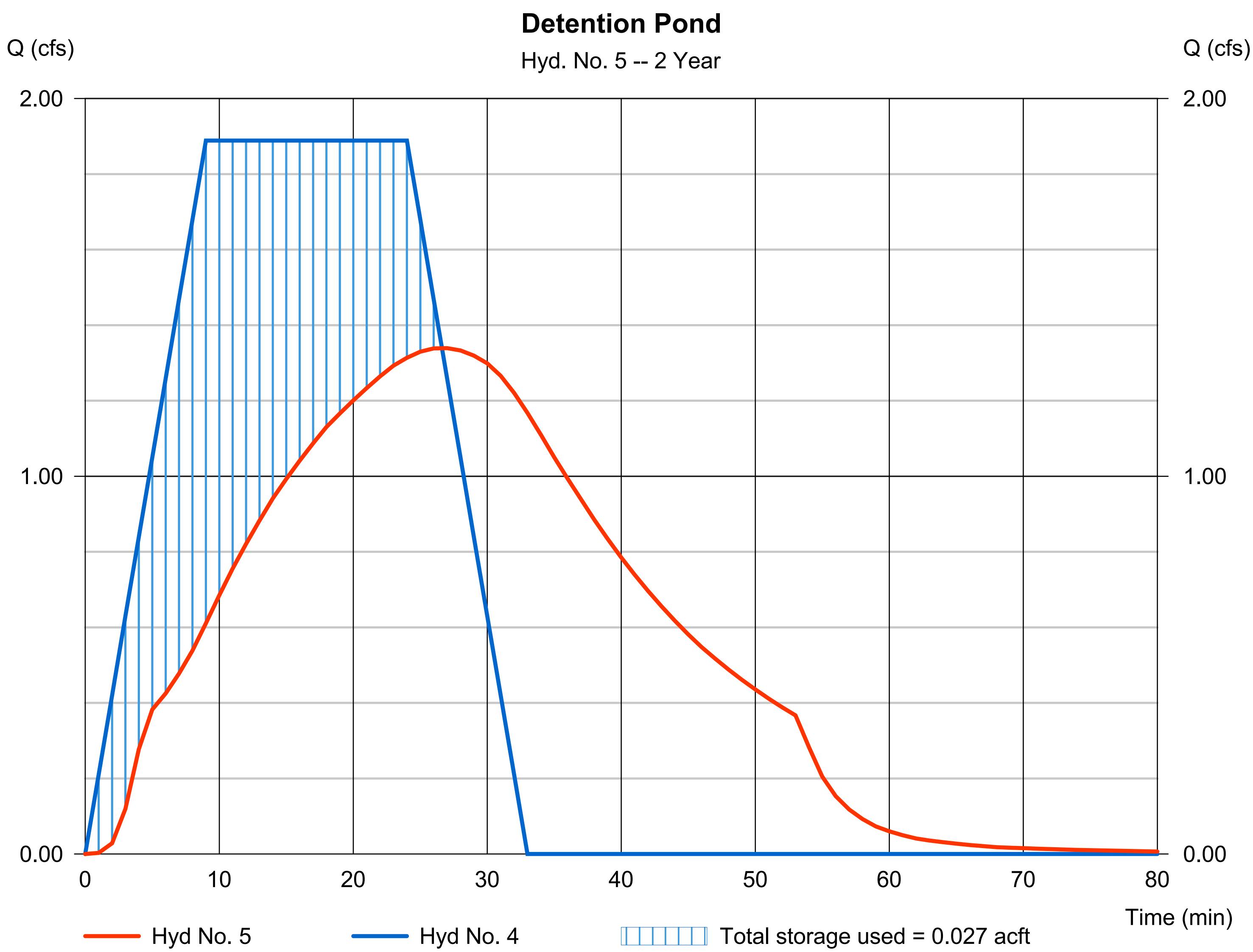
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 | Tuesday, 10 / 20 / 2015

Hyd. No. 5

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 1.339 cfs
Storm frequency	= 2 yrs	Time to peak	= 27 min
Time interval	= 1 min	Hyd. volume	= 0.062 acft
Inflow hyd. No.	= 4 - Post Area East	Max. Elevation	= 1296.54 ft
Reservoir name	= <New Pond>	Max. Storage	= 0.027 acft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Pond No. 1 - <New Pond>

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1295.68 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	1295.68	00	0.000	0.000
0.32	1296.00	921	0.002	0.002
1.32	1297.00	3,278	0.045	0.048
2.32	1298.00	6,907	0.114	0.162

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1295.68	0.00	0.00	0.00
Length (ft)	= 22.00	0.00	0.00	0.00
Slope (%)	= 0.50	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

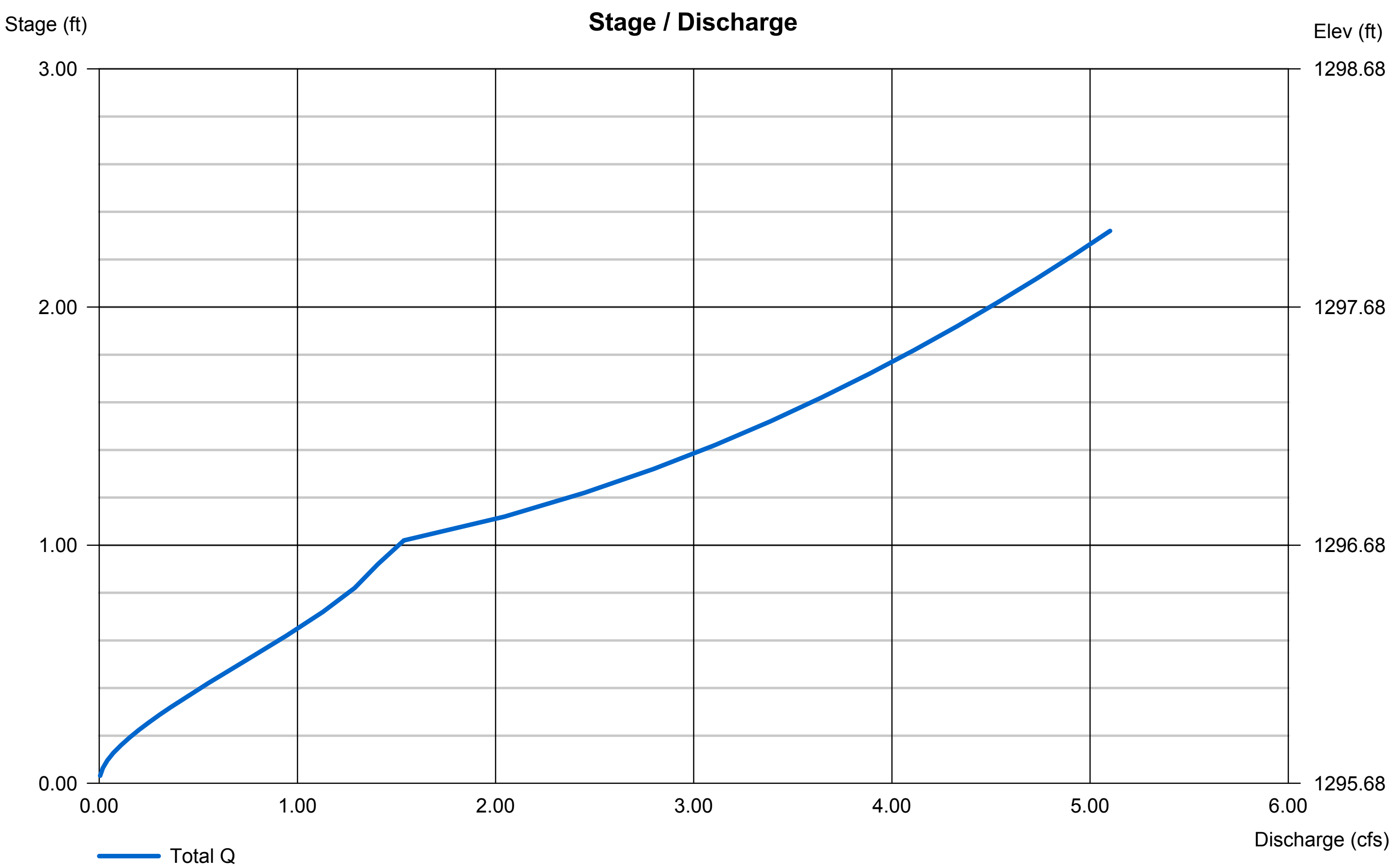
Weir Structures

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

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

TW Elev. (ft) = 0.00

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

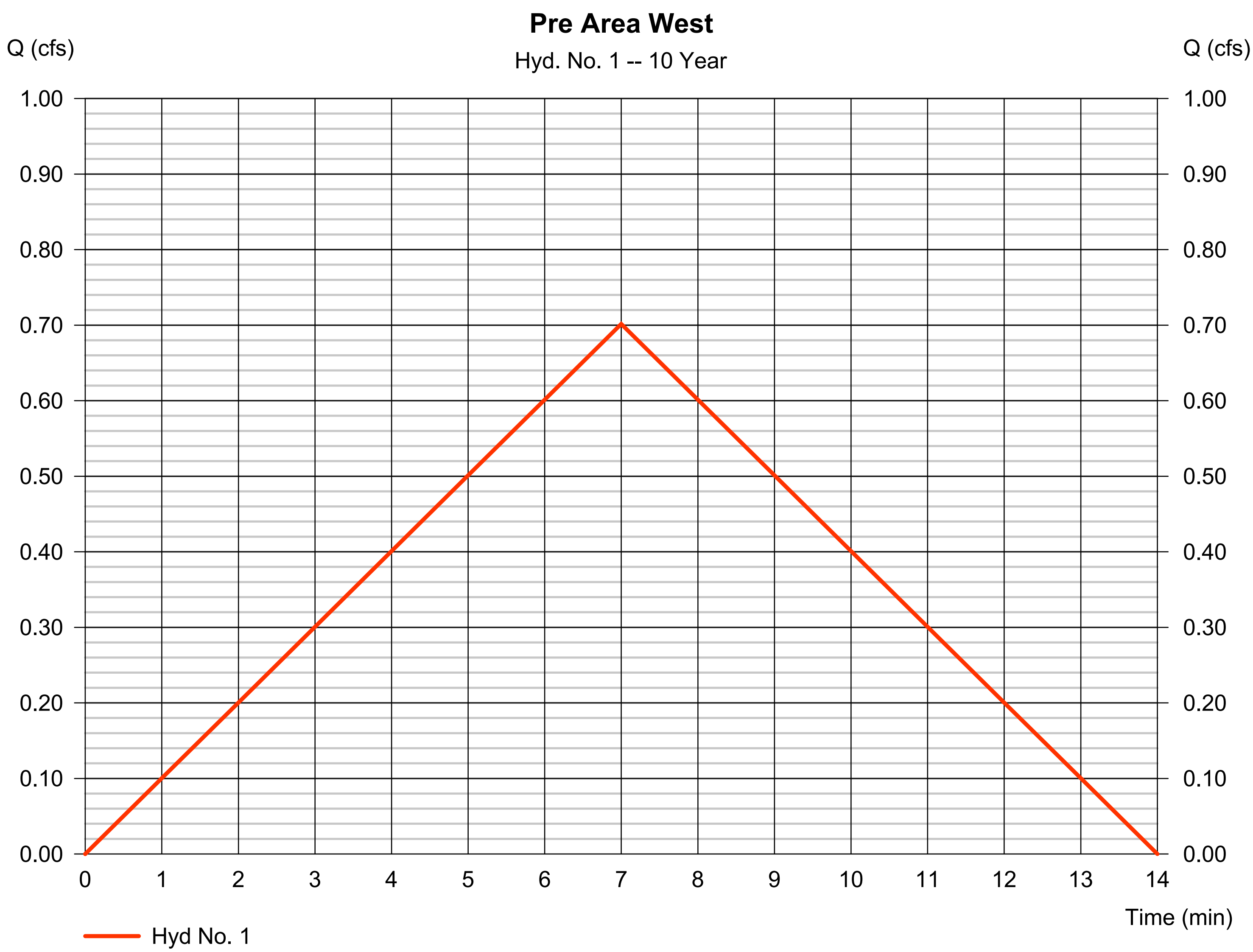


Hydrograph Report

Hyd. No. 1

Pre Area West

Hydrograph type	= Rational	Peak discharge	= 0.702 cfs
Storm frequency	= 10 yrs	Time to peak	= 7 min
Time interval	= 1 min	Hyd. volume	= 0.007 acft
Drainage area	= 0.230 ac	Runoff coeff.	= 0.45
Intensity	= 6.778 in/hr	Tc by TR55	= 7.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1

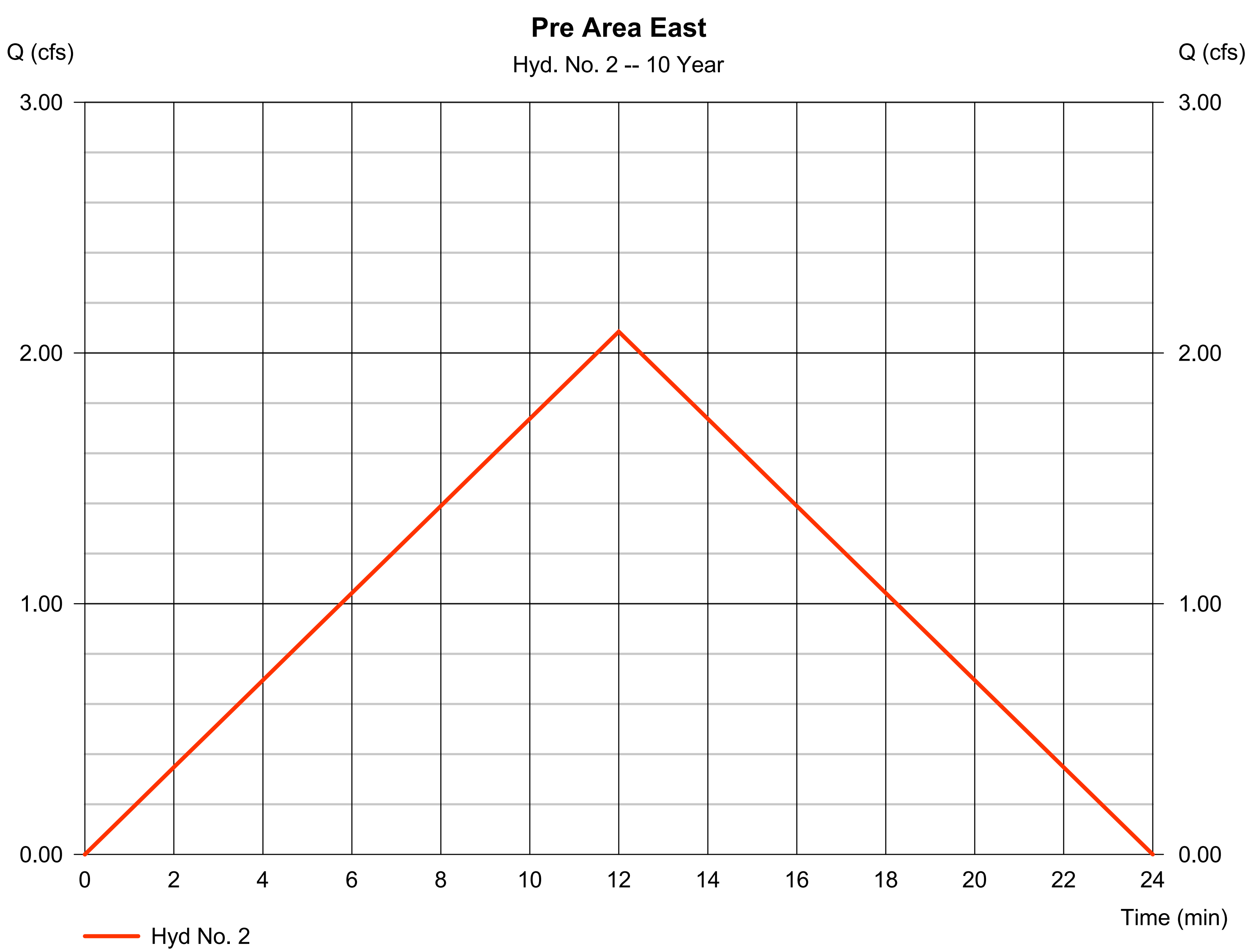


Hydrograph Report

Hyd. No. 2

Pre Area East

Hydrograph type	= Rational	Peak discharge	= 2.085 cfs
Storm frequency	= 10 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 0.034 acft
Drainage area	= 0.810 ac	Runoff coeff.	= 0.45
Intensity	= 5.720 in/hr	Tc by TR55	= 12.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1



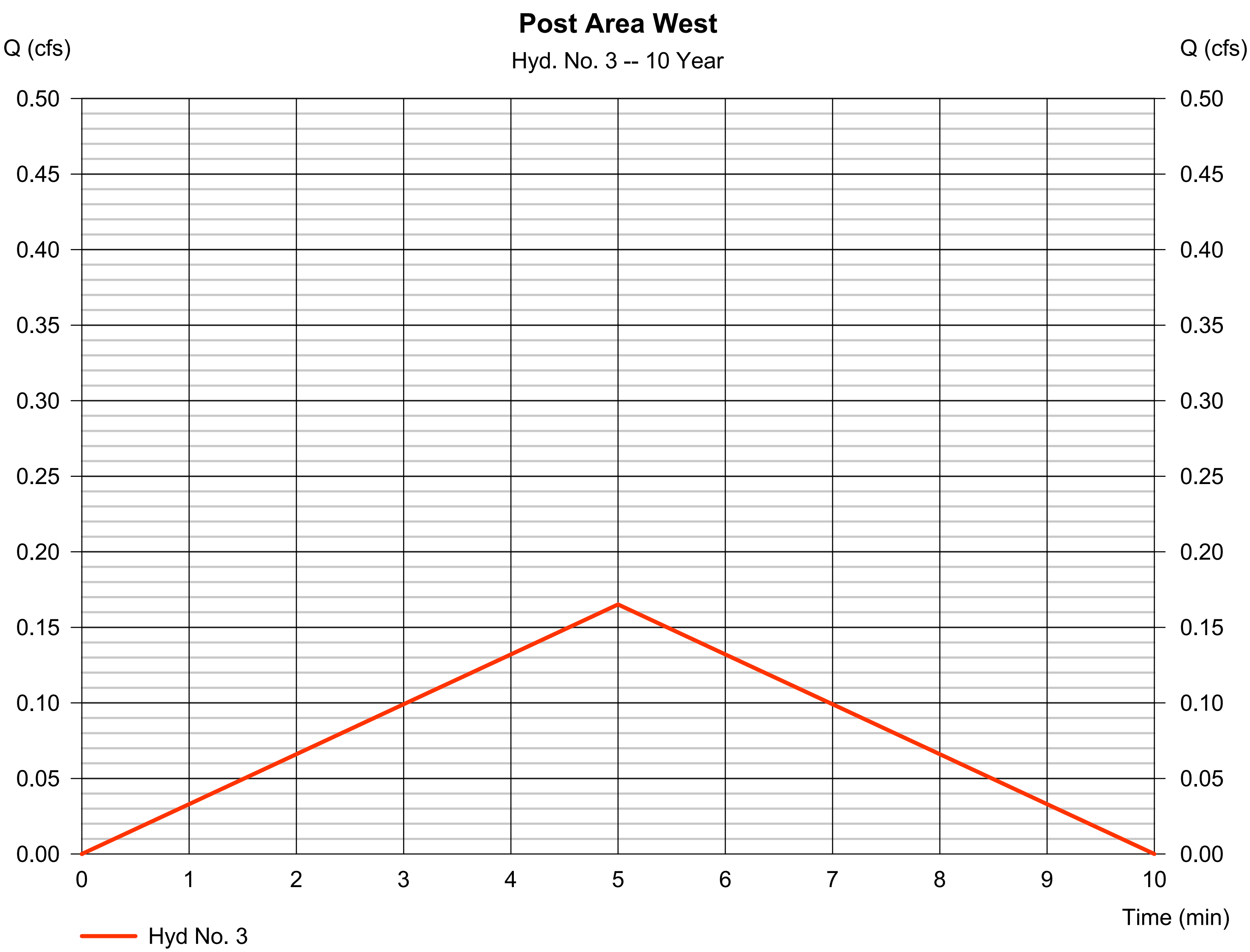
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 3

Post Area West

Hydrograph type	= Rational	Peak discharge	= 0.165 cfs
Storm frequency	= 10 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 0.001 acft
Drainage area	= 0.050 ac	Runoff coeff.	= 0.45
Intensity	= 7.338 in/hr	Tc by User	= 5.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

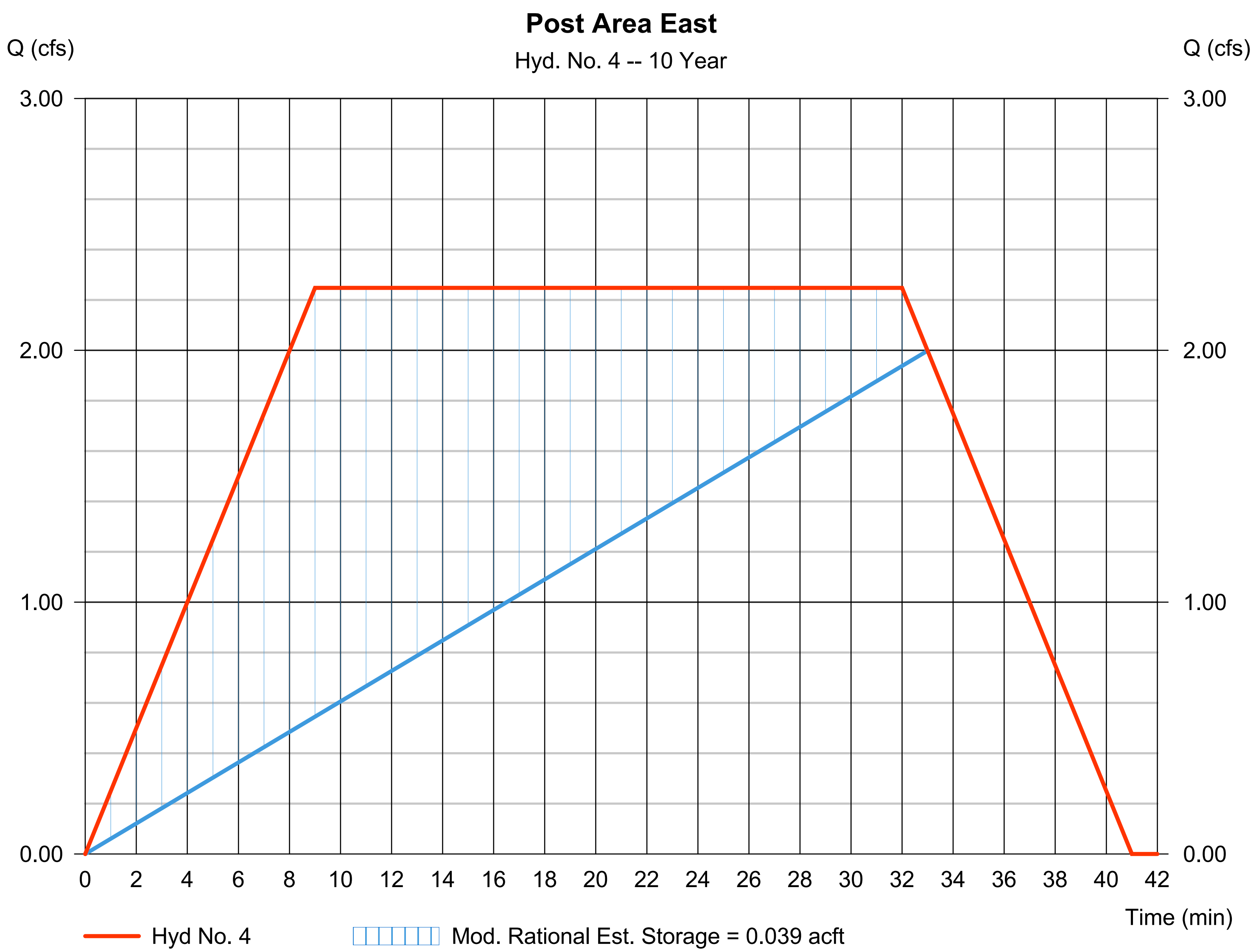
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 4

Post Area East

Hydrograph type	= Mod. Rational	Peak discharge	= 2.248 cfs
Storm frequency	= 10 yrs	Time to peak	= 9 min
Time interval	= 1 min	Hyd. volume	= 0.099 acft
Drainage area	= 1.000 ac	Runoff coeff.	= 0.62*
Intensity	= 3.626 in/hr	Tc by TR55	= 9.00 min
IDF Curve	= AR - Tontitown.IDF	Storm duration	= 3.6 x Tc
Target Q	=2.090 cfs	Est. Req'd Storage	=0.039 acft

* Composite (Area/C) = [(0.380 x 0.90) + (0.620 x 0.45)] / 1.000



Hydrograph Report

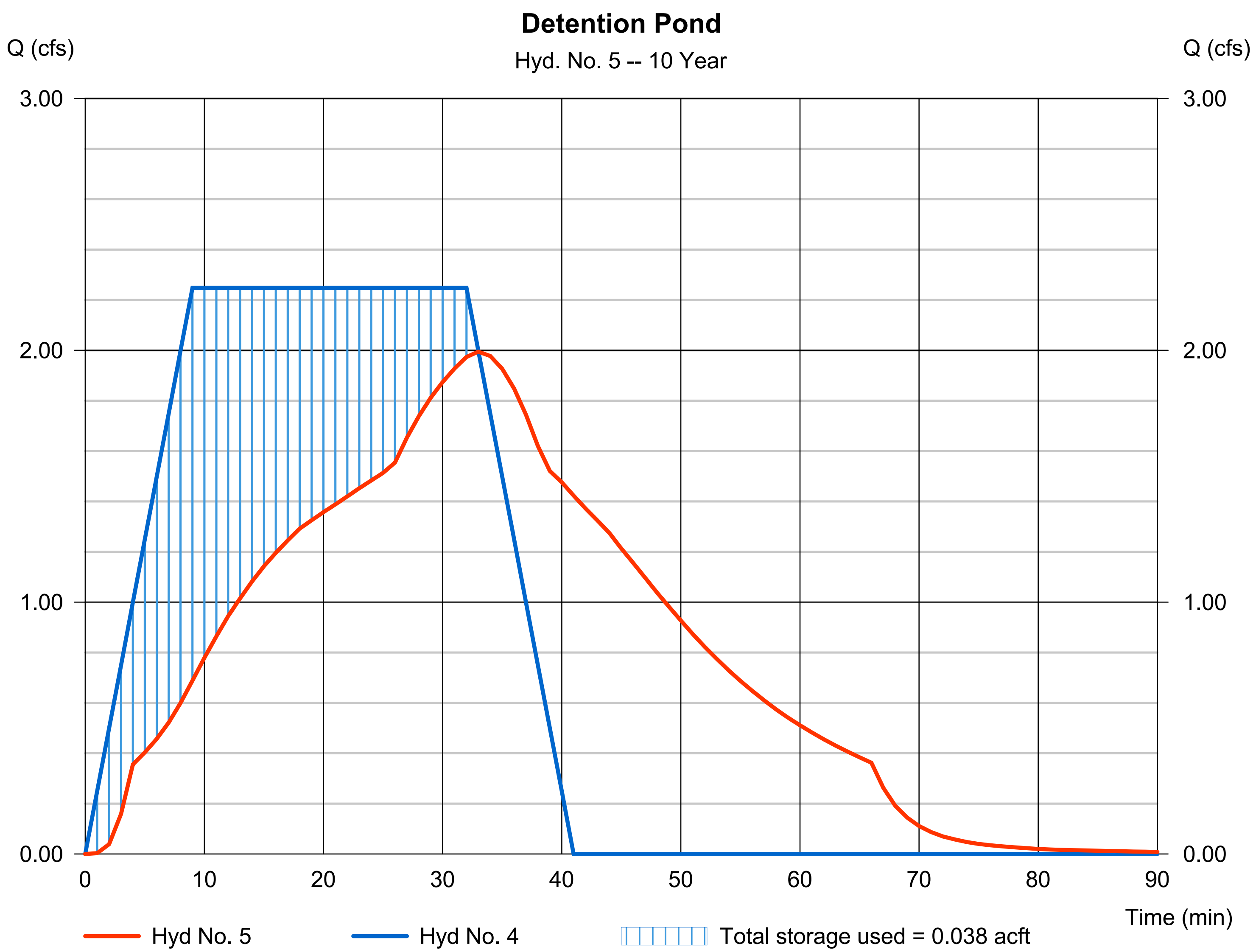
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 5

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 1.995 cfs
Storm frequency	= 10 yrs	Time to peak	= 33 min
Time interval	= 1 min	Hyd. volume	= 0.099 acft
Inflow hyd. No.	= 4 - Post Area East	Max. Elevation	= 1296.79 ft
Reservoir name	= <New Pond>	Max. Storage	= 0.038 acft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 1

Pre Area West

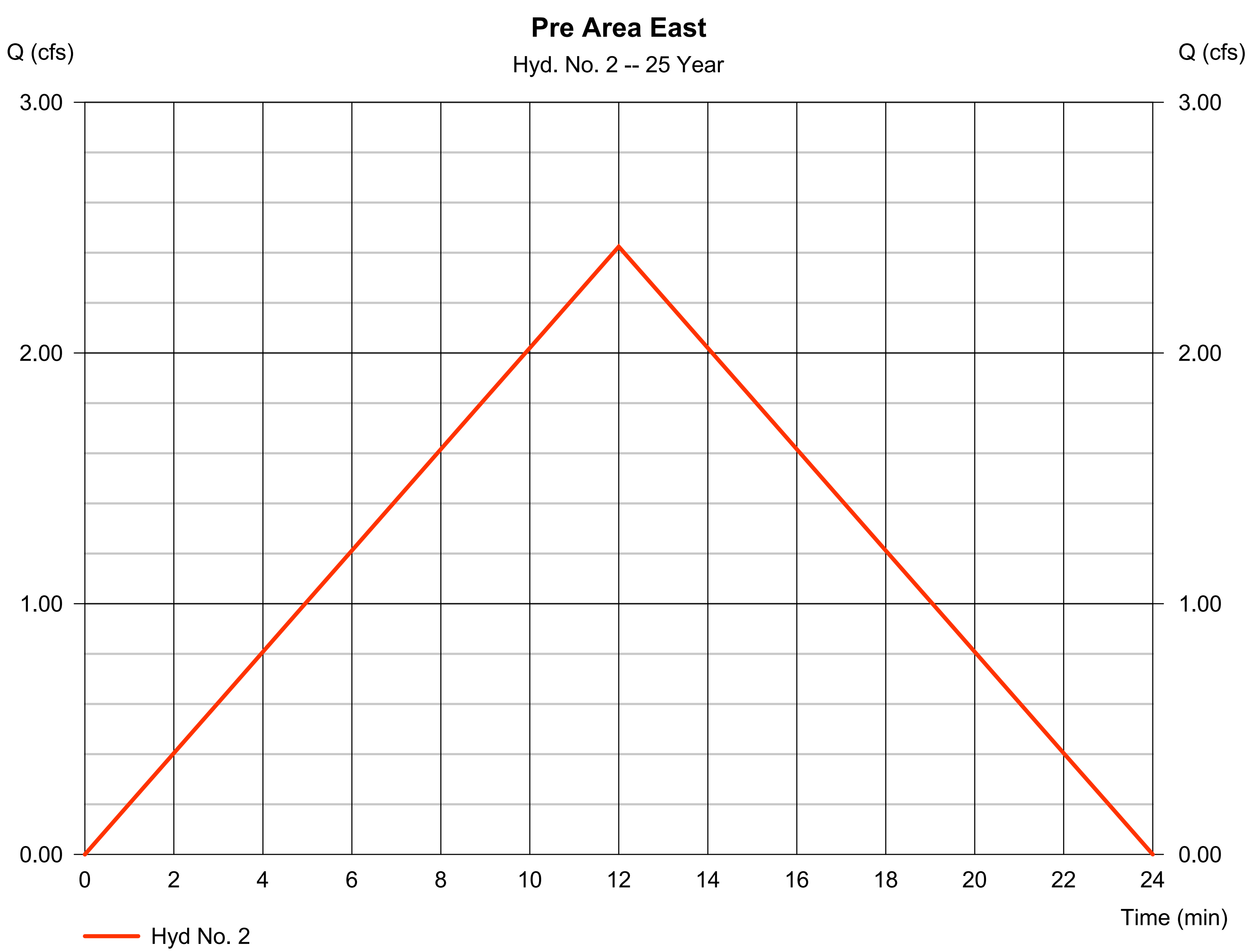
Hydrograph type	= Rational	Peak discharge	= 0.811 cfs
Storm frequency	= 25 yrs	Time to peak	= 7 min
Time interval	= 1 min	Hyd. volume	= 0.008 acft
Drainage area	= 0.230 ac	Runoff coeff.	= 0.45
Intensity	= 7.836 in/hr	Tc by TR55	= 7.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Report

Hyd. No. 2

Pre Area East

Hydrograph type	= Rational	Peak discharge	= 2.424 cfs
Storm frequency	= 25 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 0.040 acft
Drainage area	= 0.810 ac	Runoff coeff.	= 0.45
Intensity	= 6.651 in/hr	Tc by TR55	= 12.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1



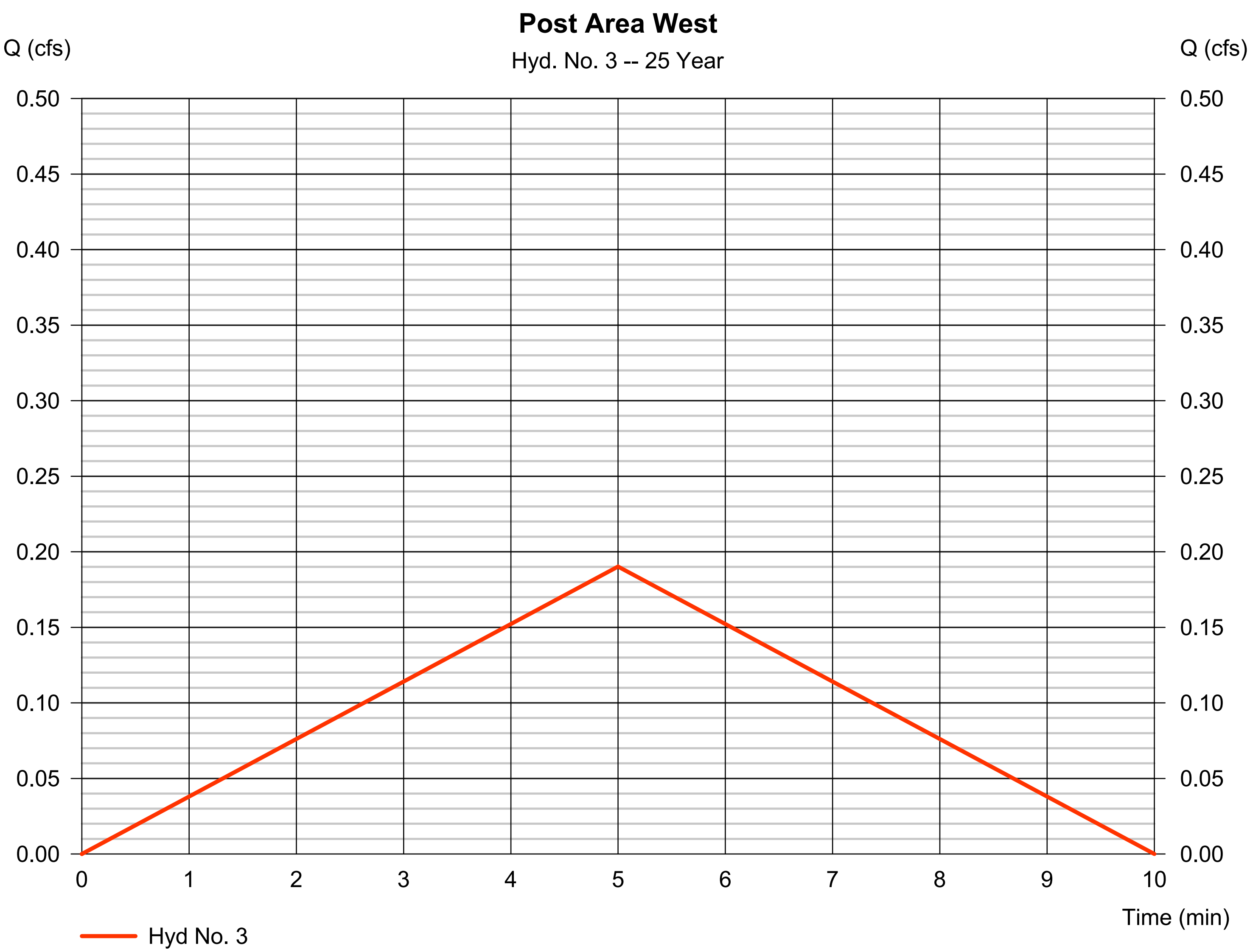
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 3

Post Area West

Hydrograph type	= Rational	Peak discharge	= 0.190 cfs
Storm frequency	= 25 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 0.001 acft
Drainage area	= 0.050 ac	Runoff coeff.	= 0.45
Intensity	= 8.455 in/hr	Tc by User	= 5.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

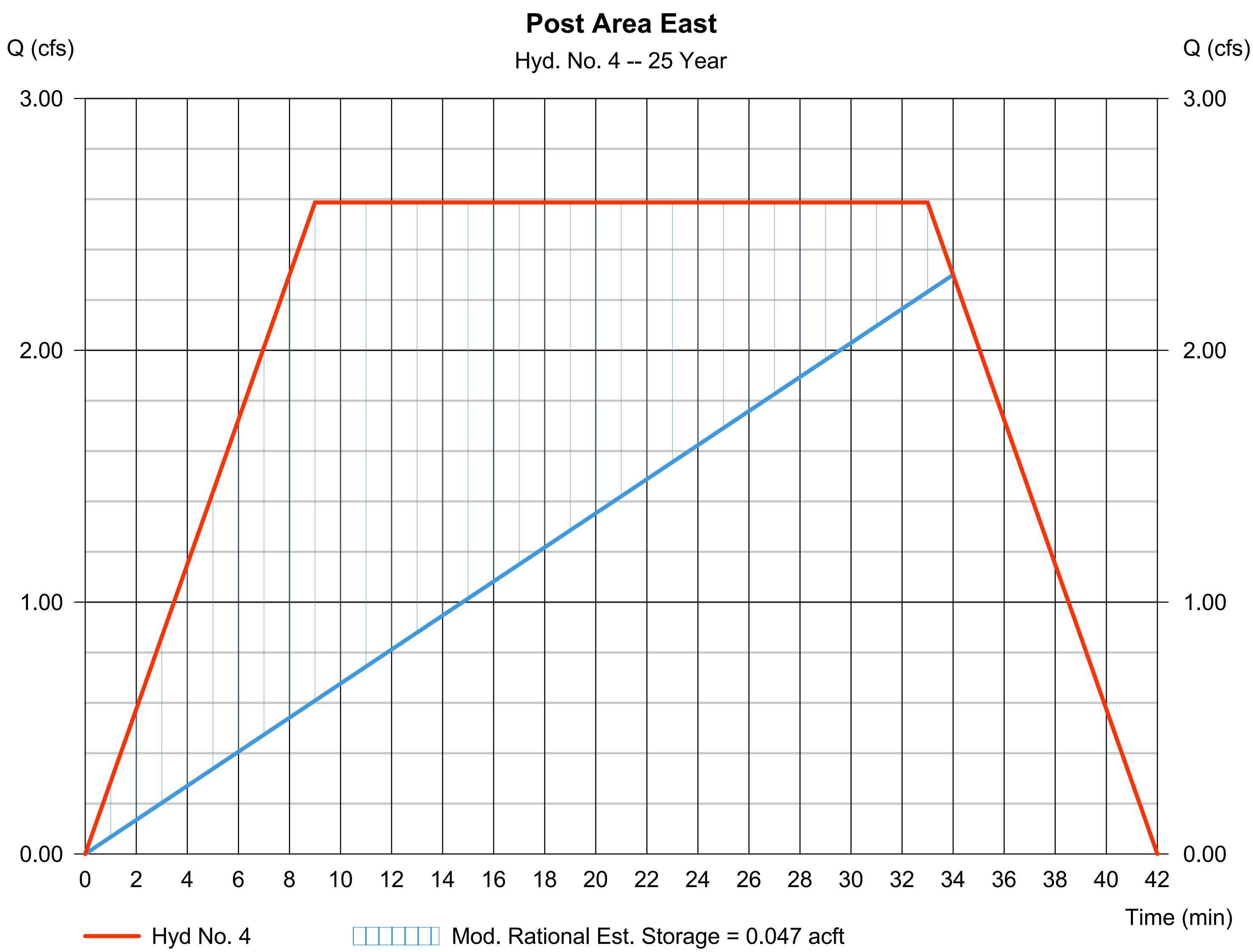
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 4

Post Area East

Hydrograph type	= Mod. Rational	Peak discharge	= 2.587 cfs
Storm frequency	= 25 yrs	Time to peak	= 9 min
Time interval	= 1 min	Hyd. volume	= 0.118 acft
Drainage area	= 1.000 ac	Runoff coeff.	= 0.62*
Intensity	= 4.173 in/hr	Tc by TR55	= 9.00 min
IDF Curve	= AR - Tontitown.IDF	Storm duration	= 3.7 x Tc
Target Q	=2.420 cfs	Est. Req'd Storage	=0.047 acft

* Composite (Area/C) = [(0.380 x 0.90) + (0.620 x 0.45)] / 1.000



Hydrograph Report

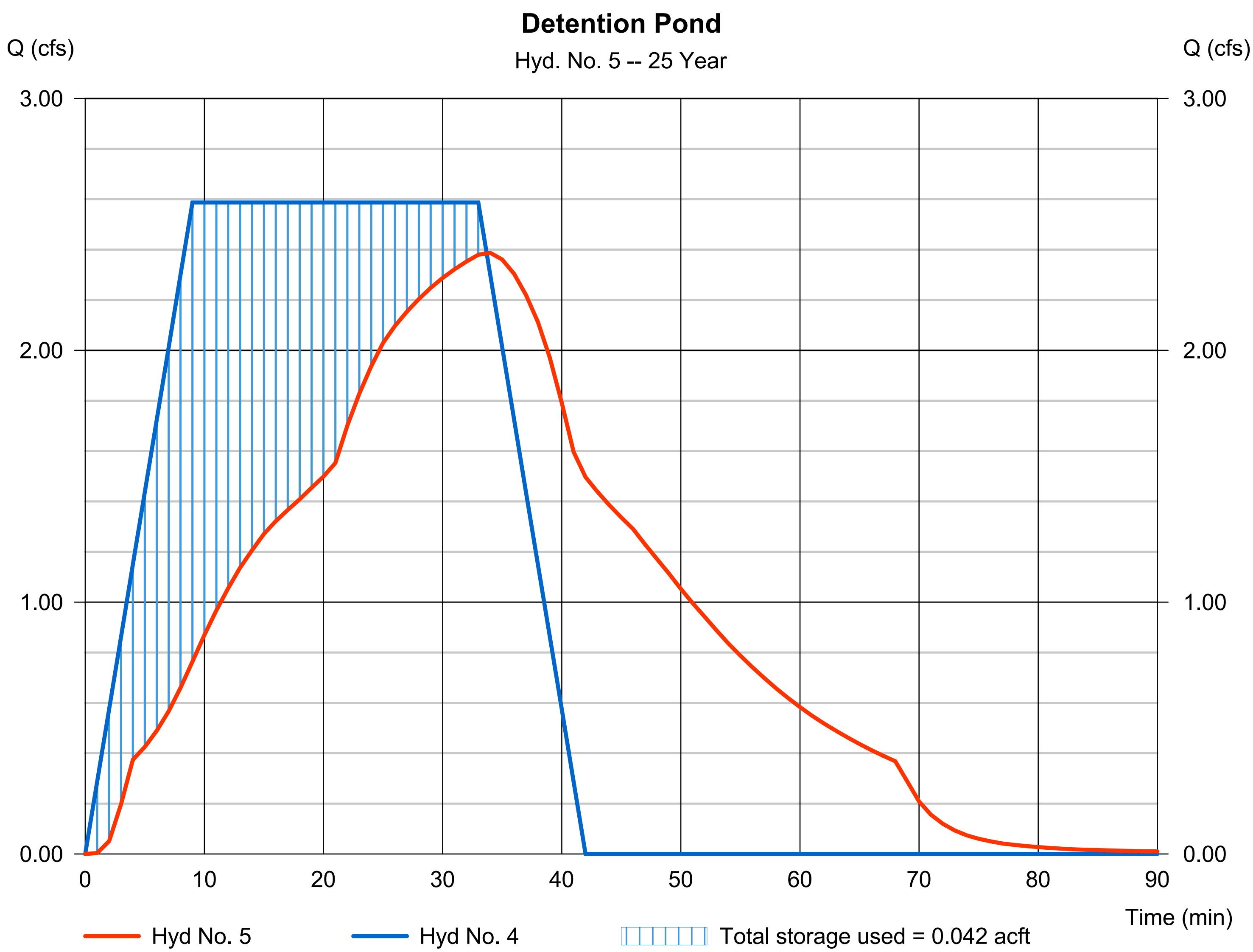
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 5

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 2.387 cfs
Storm frequency	= 25 yrs	Time to peak	= 34 min
Time interval	= 1 min	Hyd. volume	= 0.118 acft
Inflow hyd. No.	= 4 - Post Area East	Max. Elevation	= 1296.89 ft
Reservoir name	= <New Pond>	Max. Storage	= 0.042 acft

Storage Indication method used.



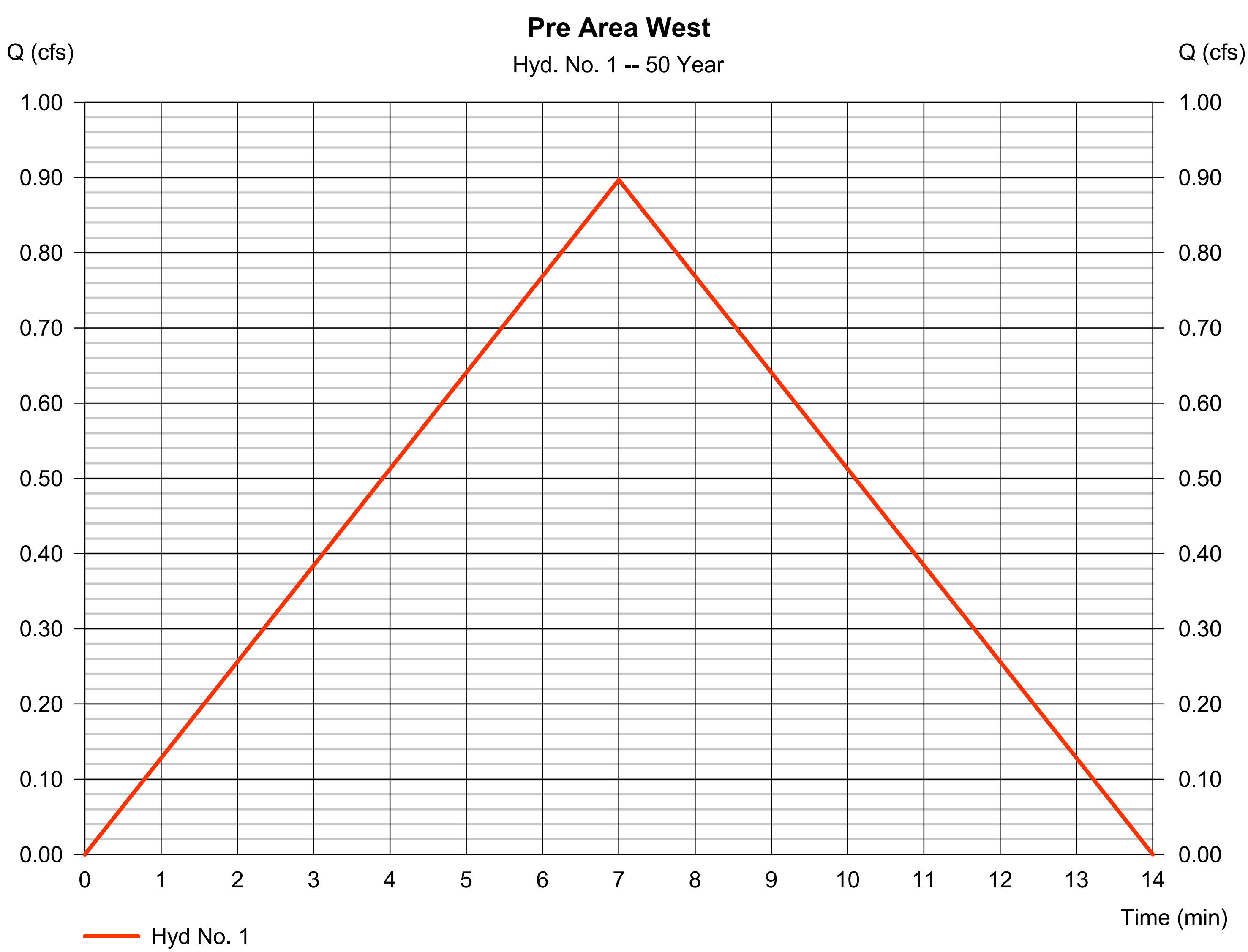
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 1

Pre Area West

Hydrograph type	= Rational	Peak discharge	= 0.897 cfs
Storm frequency	= 50 yrs	Time to peak	= 7 min
Time interval	= 1 min	Hyd. volume	= 0.009 acft
Drainage area	= 0.230 ac	Runoff coeff.	= 0.45
Intensity	= 8.665 in/hr	Tc by TR55	= 7.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1



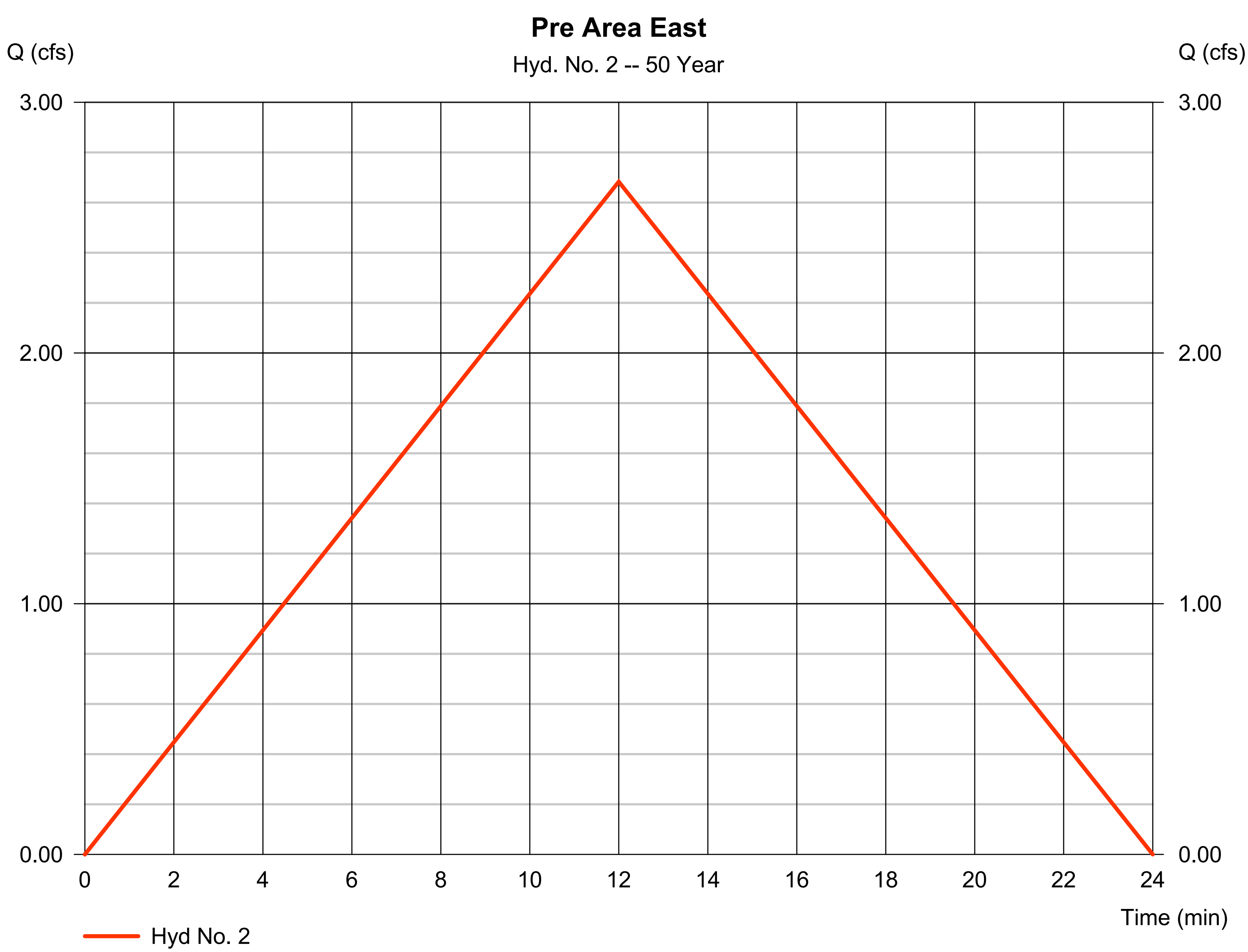
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 2

Pre Area East

Hydrograph type	= Rational	Peak discharge	= 2.683 cfs
Storm frequency	= 50 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 0.044 acft
Drainage area	= 0.810 ac	Runoff coeff.	= 0.45
Intensity	= 7.362 in/hr	Tc by TR55	= 12.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1



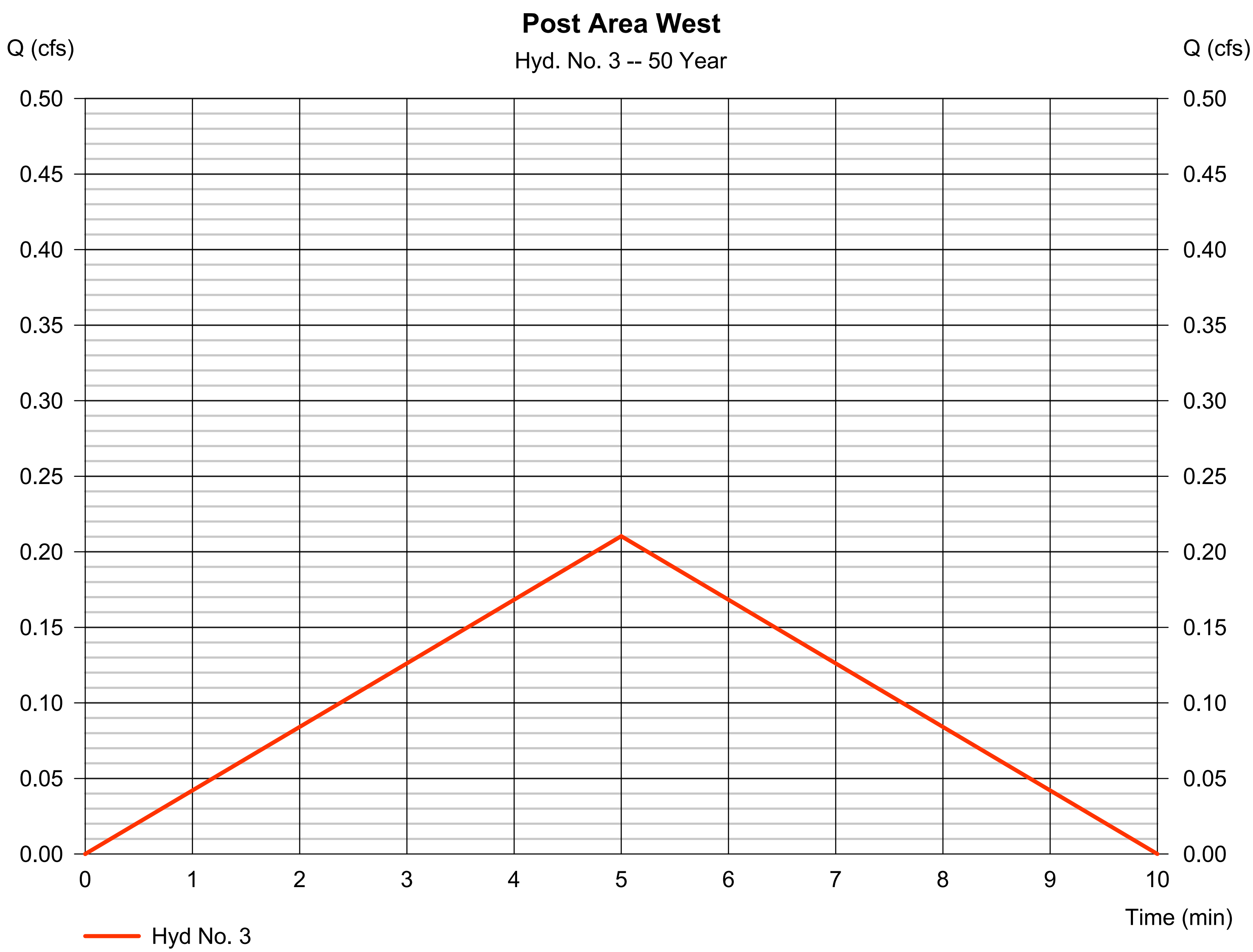
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 3

Post Area West

Hydrograph type	= Rational	Peak discharge	= 0.210 cfs
Storm frequency	= 50 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 0.001 acft
Drainage area	= 0.050 ac	Runoff coeff.	= 0.45
Intensity	= 9.347 in/hr	Tc by User	= 5.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

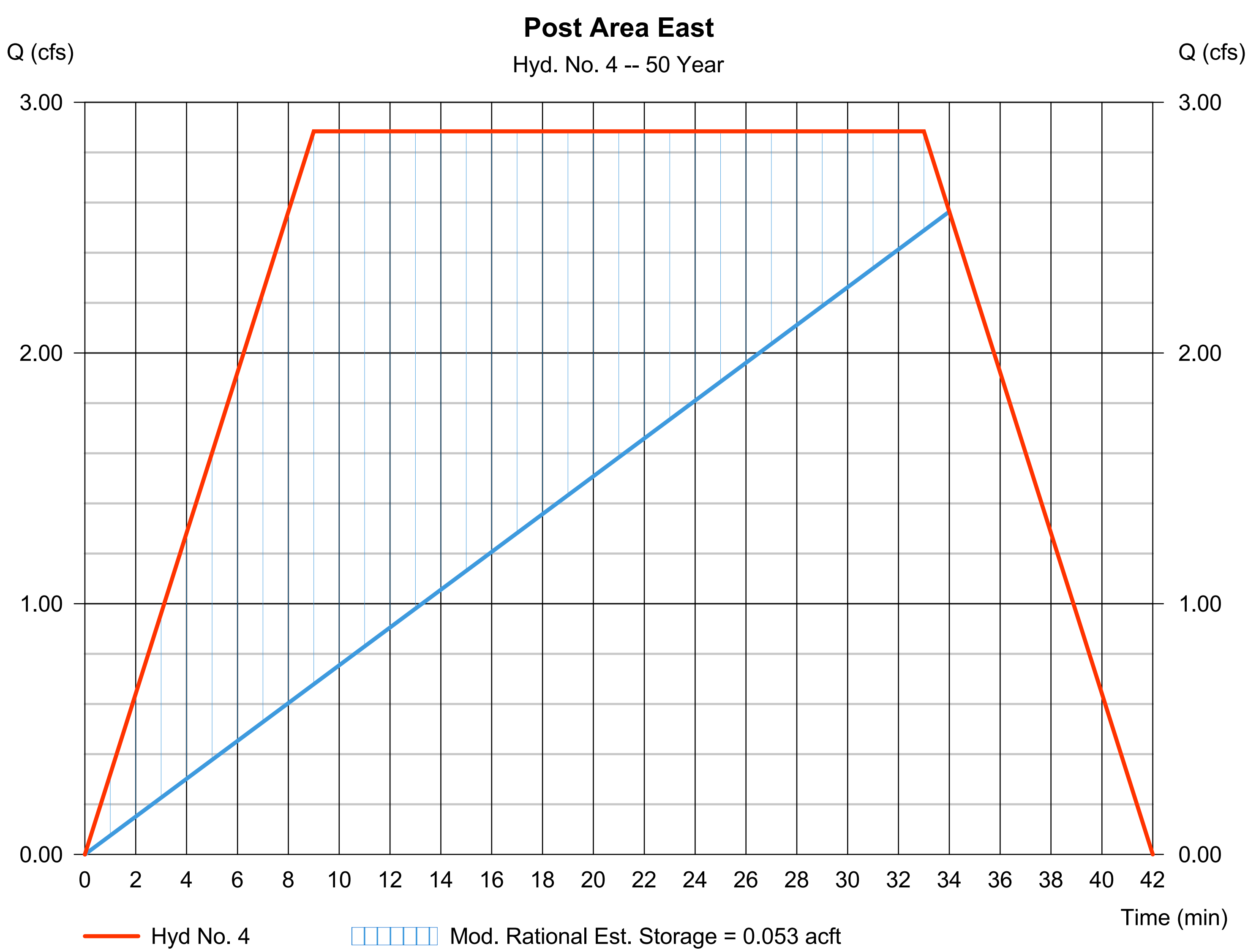
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Tuesday, 10 / 20 / 2015

Hyd. No. 4

Post Area East

Hydrograph type	= Mod. Rational	Peak discharge	= 2.884 cfs
Storm frequency	= 50 yrs	Time to peak	= 9 min
Time interval	= 1 min	Hyd. volume	= 0.131 acft
Drainage area	= 1.000 ac	Runoff coeff.	= 0.62*
Intensity	= 4.652 in/hr	Tc by TR55	= 9.00 min
IDF Curve	= AR - Tontitown.IDF	Storm duration	= 3.7 x Tc
Target Q	=2.680 cfs	Est. Req'd Storage	=0.053 acft

* Composite (Area/C) = [(0.380 x 0.90) + (0.620 x 0.45)] / 1.000



Hydrograph Report

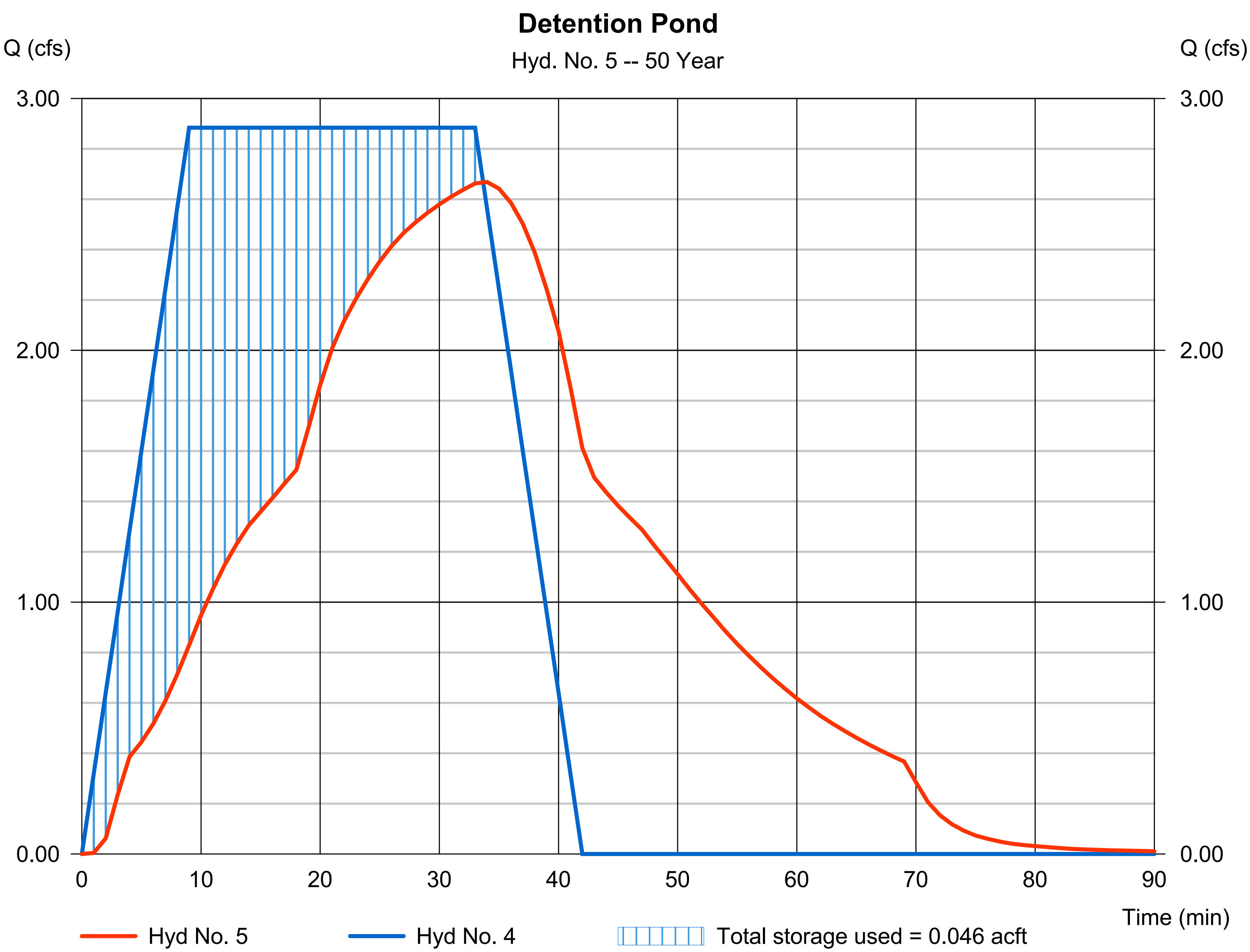
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 — Tuesday, 10 / 20 / 2015

Hyd. No. 5

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 2.668 cfs
Storm frequency	= 50 yrs	Time to peak	= 34 min
Time interval	= 1 min	Hyd. volume	= 0.131 acft
Inflow hyd. No.	= 4 - Post Area East	Max. Elevation	= 1296.96 ft
Reservoir name	= <New Pond>	Max. Storage	= 0.046 acft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 1

Pre Area West

Hydrograph type	= Rational	Peak discharge	= 0.979 cfs
Storm frequency	= 100 yrs	Time to peak	= 7 min
Time interval	= 1 min	Hyd. volume	= 0.009 acft
Drainage area	= 0.230 ac	Runoff coeff.	= 0.45
Intensity	= 9.462 in/hr	Tc by TR55	= 7.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1

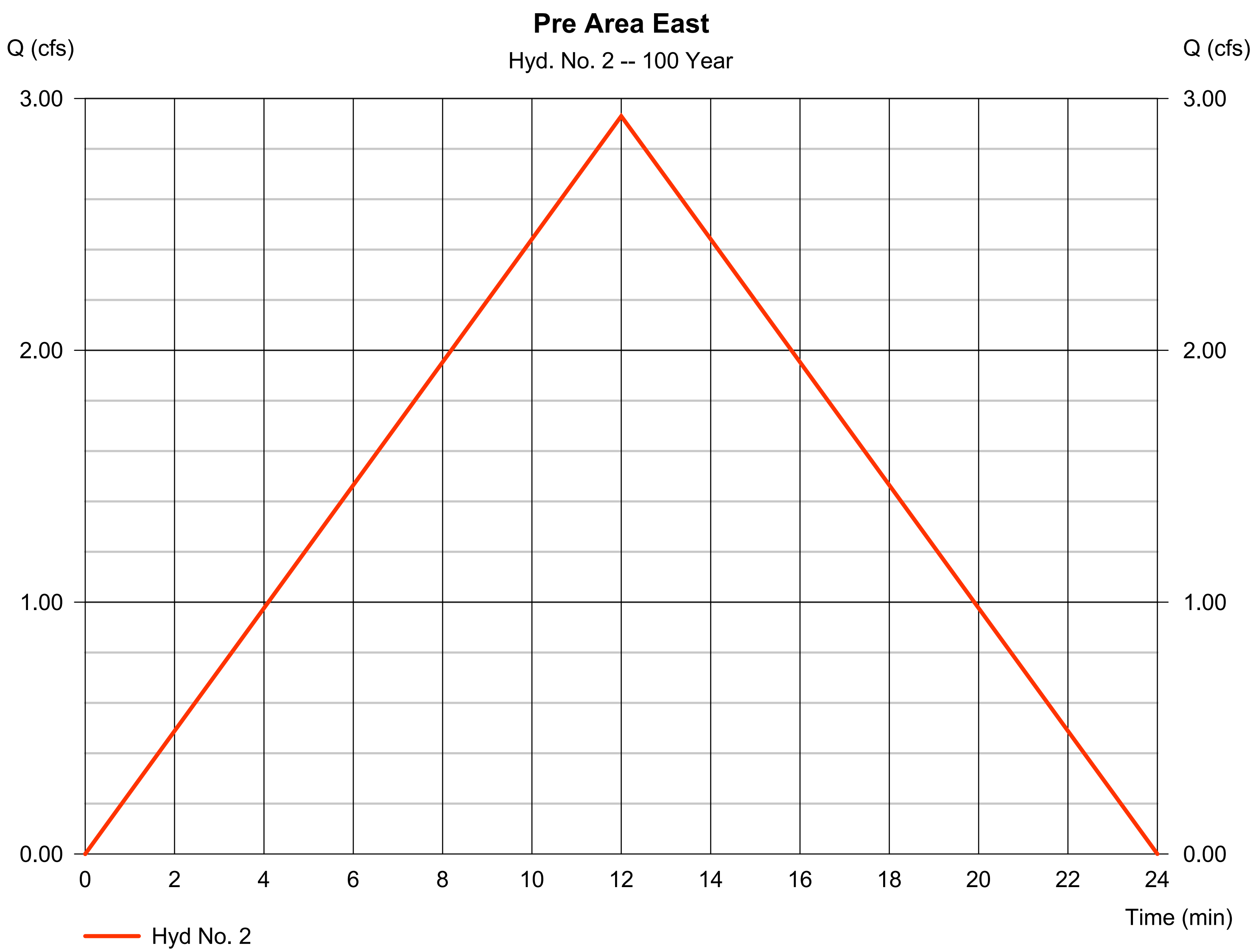
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 2

Pre Area East

Hydrograph type	= Rational	Peak discharge	= 2.930 cfs
Storm frequency	= 100 yrs	Time to peak	= 12 min
Time interval	= 1 min	Hyd. volume	= 0.048 acft
Drainage area	= 0.810 ac	Runoff coeff.	= 0.45
Intensity	= 8.038 in/hr	Tc by TR55	= 12.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1



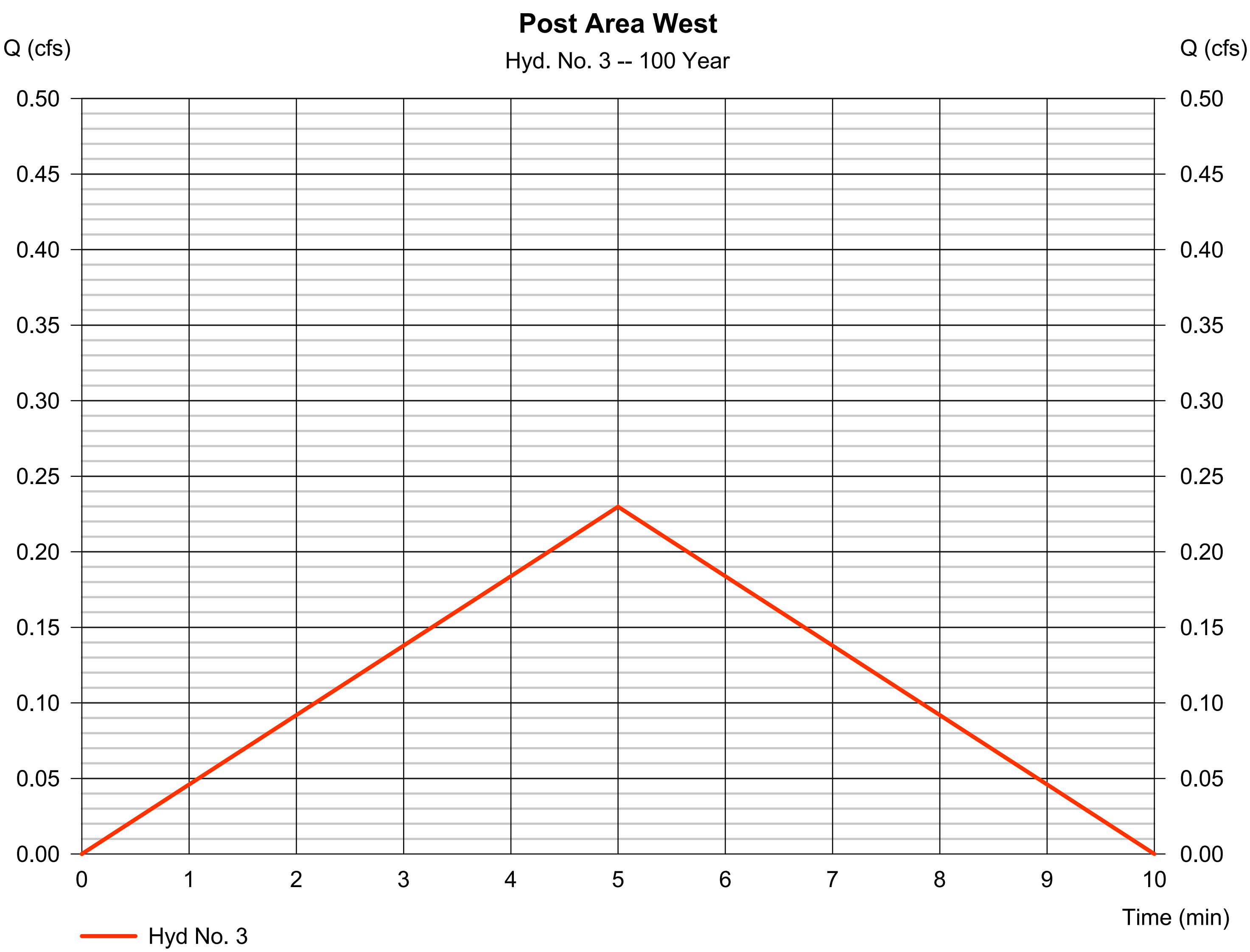
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 | Tuesday, 10 / 20 / 2015

Hyd. No. 3

Post Area West

Hydrograph type	= Rational	Peak discharge	= 0.230 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 0.002 acft
Drainage area	= 0.050 ac	Runoff coeff.	= 0.45
Intensity	= 10.215 in/hr	Tc by User	= 5.00 min
IDF Curve	= AR - Tontitown.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

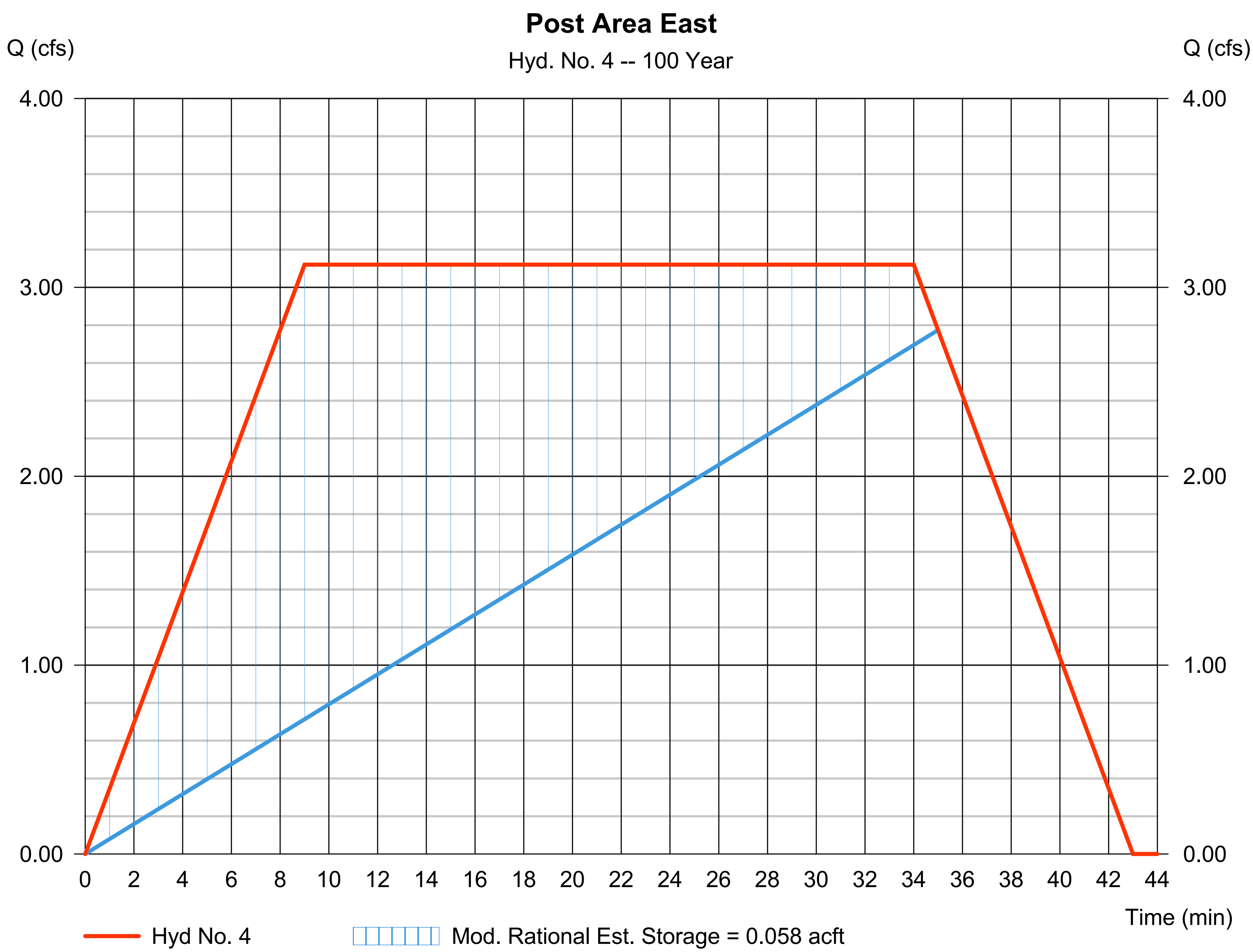
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 4

Post Area East

Hydrograph type	= Mod. Rational	Peak discharge	= 3.121 cfs
Storm frequency	= 100 yrs	Time to peak	= 9 min
Time interval	= 1 min	Hyd. volume	= 0.146 acft
Drainage area	= 1.000 ac	Runoff coeff.	= 0.62*
Intensity	= 5.033 in/hr	Tc by TR55	= 9.00 min
IDF Curve	= AR - Tontitown.IDF	Storm duration	= 3.8 x Tc
Target Q	=2.930 cfs	Est. Req'd Storage	=0.058 acft

* Composite (Area/C) = [(0.380 x 0.90) + (0.620 x 0.45)] / 1.000



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Tuesday, 10 / 20 / 2015

Hyd. No. 5

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 2.847 cfs
Storm frequency	= 100 yrs	Time to peak	= 35 min
Time interval	= 1 min	Hyd. volume	= 0.146 acft
Inflow hyd. No.	= 4 - Post Area East	Max. Elevation	= 1297.02 ft
Reservoir name	= <New Pond>	Max. Storage	= 0.049 acft

Storage Indication method used.