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# Vanguard Farms Apartments

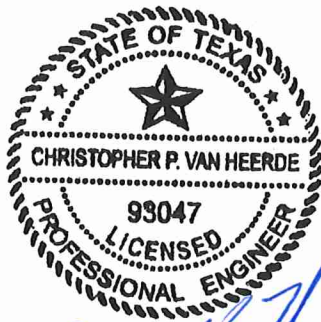
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Job No. 323.001

## Stormwater Management Report

New Braunfels, Texas  
July 2020



*Chris Van Heerde, PE*  
*7/29/2020*

**Prepared by:**



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## 1.0 General Information

HMT Engineering and Surveying has been retained by IMPACT to provide professional engineering services for the future planned development of Vanguard Farms Apartments, in the City of New Braunfels, Texas (Reference Attachment A). Proposed construction includes installation of utilities, including water and sewer mains and services; installation of drainage infrastructure, including channels, storm drains, and inlets; construction of fourteen multi-family residential buildings and a clubhouse; and construction of residential amenities including a pool and outdoor recreation areas. The site is currently undeveloped. The property is not within the 100-year floodplain, according to FEMA Flood Insurance Rate Map (FIRM) Number 48091C0455F date September 2, 2009 (Reference Attachment B). This report addresses the hydrology and hydraulics of the proposed multi-family site, as well as hydraulics and hydrology related to the adjacent Nissan Way Extension, which has been previously submitted (reference City of New Braunfels Permit CP2019-0080, as well as Attachment N for the Nissan Way Drainage Report).

The City of New Braunfels Drainage and Erosion Control Design Manual revised September 2000 (hereafter referred to as the DECDM) was used during the design of this project. The DECDM was updated in February 2018 by authorization of the City Engineer and approval of City Council; however, the drainage criteria used in this design are prior to this revision, as this project is part of a master drainage document/plat approved prior to implementation of the revised criteria (the previously approved Heather Glen master plan). Please see Attachment L for a Memo of Drainage Compliance with the approved master drainage plan.

Because the proposed improvements will consist of more than 1 acre of disturbed land, this project will require a Type 3 Drainage Report.

## 2.0 Hydrology Methodology SCS Method

The peak storm water runoff calculations were determined using the SCS Method as described in the City of New Braunfels Drainage and Erosion Control Manual. The time of concentration was calculated using sheet flow, shallow concentrated flow, and channel flow. The length of overland sheet flow conditions is limited to a maximum of 100 feet. The time of travel for sheet flow conditions is calculated using Manning's kinematic solution (Overtop and Meadows 1976). After 100 feet, the average velocity of the flow is determined using Figure 3-1 of the USDA Technical Release 55 Urban Hydrology for Small Watersheds. The time of travel for concentrated flow conditions is calculated using the equation below:

Sheet Flow

$$\text{Eq 5-4a } T_t = \frac{(n \cdot L)}{288.6 \cdot (S^{0.4})} * 60$$

For shallow concentrated flow, using the average velocity as described above, the time of travel is calculated using this equation:

Shallow Concentrated Flow

$$\text{Eq 5-4b } T_t = \frac{L}{(60)(S^{0.5})}$$

For channelized flow, an estimated peak flow is used to calculate the velocity within the channel cross section for this segment. The time is then calculated using this velocity and the length of flow as shown in Eq 4-8 below.

Channel Flow

$$\text{Eq 5-4c } T_t = \frac{L}{60 * V}$$

Manning's "n" values were taken from the DECDM Tables 5-4 and 9-1 (see Attachment E).

Peak flows for the existing conditions were determined using the Hydraflow Hydrographs program; peak flows for proposed conditions were determined using the Hydraflow Storm and Sanitary Analysis program to aid in routing through the proposed storm drain network.

The Curve Numbers used for calculations were taken from Tables 5-5A and 5-7 from the City of New Braunfels Drainage Manual (see Attachment D). Existing zoning was used for the corresponding drainage areas. The drainage area consists entirely of Type D soils, as seen in the USDA Soil Map (see Attachment C). A Type II storm distribution was used in all calculations.

### 3.0 Existing Conditions Hydrology

The existing drainage area is defined as 59.26 acres that flow generally to the south, and currently consists of undeveloped open field and scrub, with a small portion of existing asphalt roadway. This drainage area ultimately discharges into an existing channel, designed as part of the Heather Glen Subdivision Master Plan. Because improvements related to the Nissan Way Extension have already been submitted to the City (reference City of New Braunfels Permit CP2019-0080), the hydraulic improvements related to that permit (paved street, inlets, and channels) are considered "existing" for the purposes of this report.

The existing conditions consists of two drainage areas, which are further subdivided:

- Drainage Area EX A consists of 49.49 acres that flow generally to the south and west, discharging into an existing channel in the Heather Glen subdivision. It is further subdivided into two areas:
  - Drainage Area EX A1 consists of 44.64 acres of undeveloped pasture/scrub land upstream of the proposed development, which flow generally to the south before being intercepted by the proposed Channel A1 and redirected into an existing channel in the Heather Glen subdivision;
  - Drainage Area EX A2 consists of 4.85 acres of proposed roadway pavement and undeveloped pasture/scrub land, which flow to the proposed Inlet A2 and Channel A2, which discharge into an existing channel in the Heather Glen subdivision.
- Drainage Area EX B consists of 9.77 acres of undeveloped pasture/scrub land that flows generally to the southwest before entering an existing culvert underneath the existing Nissan Way.



Table 1 - Existing Conditions Hydrology Calculations - City of New Braunfels								
Point of Concentration	Drainage Area	Area	T <sub>c</sub>	CN	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
Ex A1a	Ex A1a	43.27	74.13	80.34	34.66	88.02	120.18	160.94
Ex A1b	Ex A1b	1.10	28.83	93.25	2.70	5.26	6.73	8.56
Ex A1c	Ex A1b+A1c	1.37	28.83	90.64	3.11	6.33	8.18	10.48
Ex A1	Ex A1	44.64	74.13	80.33	35.76	90.81	123.98	166.03
Ex A2b	Ex A2b	0.43	38.14	92.98	0.87	1.70	2.18	2.77
Ex A2b	Ex A2a+A2b	4.07	53.01	84.95	5.08	11.60	15.41	20.19
Ex A2	Ex A2	4.85	53.01	84.16	5.85	13.59	18.14	23.84
Ex B	Ex B	9.77	88.48	81.39	7.06	17.53	23.80	31.72

See Attachments F & G for Existing Conditions Drainage Map and Existing Conditions Hydrology Calculations, respectively.

## 4.0 Proposed Conditions Hydrology

The proposed development consists of installation of utilities, including water and sewer mains and services; installation of drainage infrastructure, including channels, storm drains, and inlets; construction of fourteen multi-family residential buildings and a clubhouse; and construction of residential amenities including a pool and outdoor recreation areas.

The proposed conditions addressed in this report contains two drainage areas, A & B. Drainage Area A is largely unchanged from the Nissan Way Extension Drainage Report, with three exceptions.

- Drainage Area A1b, originally shown as 1.10 acres in the Nissan Way Extension Drainage Report, is now 1.93 acres;
- Drainage Area A2a, originally 3.63 acres, is now 2.33 acres;
- Drainage Area A2b, originally 0.43 acres, is now 0.41 acres.

These changes have been analyzed in Hydraflow Hydrographs, and updated street/inlet calculations for these areas are included in this report (see Attachment I). All other drainage areas shown in the Nissan Way Extension Drainage Report are unchanged.

The bulk of this report will focus on Drainage Area B, which is further subdivided into four sub-drainage areas:

- Drainage Area B1 consists of 0.48 acres that flows generally to the east, discharging into the proposed Channel B.
- Drainage Area B2 consists of 2.27 acres that flows generally to the southeast, collecting into a series of area inlets and flowing through a proposed underground storm system before ultimately discharging into Channel B.
- Drainage Area B3 consists of 4.98 acres that flows generally to the south, collecting into a series of area inlets and flowing through a proposed underground storm system before ultimately discharging into the existing culverts underneath Nissan Way.

- Drainage Area B4 consists of 2.23 acres that flows generally to the south and west, collecting into a series of area inlets and flowing through a proposed underground storm system before ultimately discharging into the existing culverts underneath Nissan Way.

Point of Concentration	Drainage Area	Area	$T_c$	CN	$Q_2$ (cfs)	$Q_{10}$ (cfs)	$Q_{25}$ (cfs)	$Q_{100}$ (cfs)
A1a	A1a	43.27	74.13	80.34	34.66	88.02	120.18	160.94
A1b	A1b	1.93	36.79	93.15	5.06	9.48	12.01	15.20
A1c	A1b+A1c	2.20	36.79	91.53	4.49	9.01	11.60	14.83
A1	A1a+A1b+A1c	45.47	74.13	80.89	37.27	93.31	126.97	169.55
A2b	A2b	0.41	14.34	96.78	1.43	2.71	3.45	4.36
A2a	A2a+A2b	2.72	14.34	95.24	9.59	18.13	23.03	29.17
A2	A2a+A2b+A2c	3.52	52.43	91.85	5.65	11.30	14.54	18.58
B1a	B1a	0.27	17.88	93.00	0.82	1.60	2.05	2.61
B1b	B1b	0.21	10.00	93.00	0.77	1.50	1.92	2.44
B2a	B2a	0.33	10.00	93.00	1.21	2.36	3.02	3.84
B2b	B2b	0.36	10.00	93.00	1.31	2.55	3.25	4.14
B2c	B2c	0.28	11.31	93.00	0.98	1.90	2.42	3.08
B2d	B2d	0.35	10.00	93.00	1.28	2.50	3.20	4.06
B2e	B2e	0.32	17.85	93.00	2.00	3.90	4.99	6.35
B2f	B2f	0.63	20.77	93.00	1.82	3.54	4.54	5.77
B3a	B3a	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3b	B3b	0.32	25.58	93.00	0.83	1.62	2.07	2.64
B3c	B3c	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3d	B3d	0.32	25.58	93.00	0.81	1.58	2.03	2.59
B3e	B3e	1.33	47.04	93.00	2.36	4.63	5.93	7.56
B3f	B3f	0.44	14.10	93.00	1.47	2.87	3.67	4.66
B3g	B3g	1.55	12.01	93.00	5.41	10.52	13.45	17.10
B3h	B3h	0.38	10.00	93.00	1.38	2.68	3.43	4.36
B4a	B4a	1.72	10.73	93.00	6.18	12.02	15.37	19.55
B4b	B4b	0.28	63.42	93.00	0.41	0.80	1.03	1.31
B4c	B4c	0.23	52.52	93.00	0.38	0.75	0.96	1.22
B	B	9.96	63.42	93.00	16.15	31.54	40.34	51.35

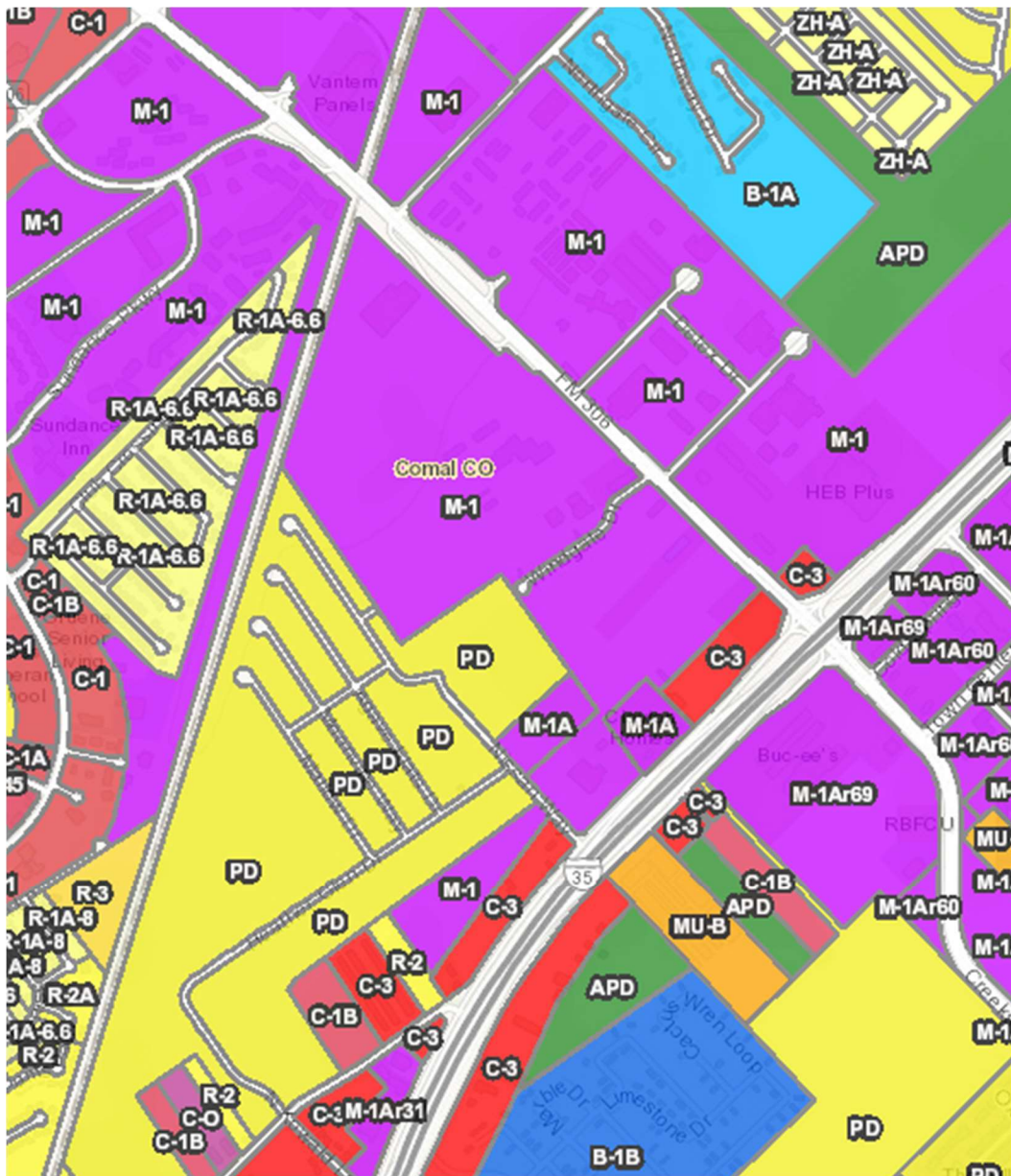
Point of Concentration	Drainage Area	$Q_2$ (cfs)	$Q_{10}$ (cfs)	$Q_{25}$ (cfs)	$Q_{100}$ (cfs)
Ex B	Ex B	7.06	17.53	23.80	31.72
B	B	16.15	31.54	40.34	51.35
Proposed is Less Than or Equal to Existing		NO	NO	NO	NO

\*The Heather Glen project has a detention basin sized to accommodate the developed conditions flows from the proposed apartment site and Nissan Way Extension.

## 5.0 Ultimate Conditions Hydrology

The ultimate conditions are fundamentally similar to the proposed conditions, with the exception that Drainage Area A1a/Ult A1a is zoned M-1 Industrial, and areas A1b, A1c, and A2c are part of the commercial/multifamily zoning. The Ultimate Conditions will include this area being fully built-out.

Because the exact development of portions of this watershed are not known at this time, Table 5-7 (Fully Developed Runoff Coefficients) was used to generate runoff coefficient for these areas when appropriate, based on the existing zoning map, seen below.



*Taken from the City of New Braunfels Planning Map, December 18, 2019*

See Attachment N for hydrology/hydraulic calculations for Drainage Area Ult A. Because the Ultimate Conditions in Drainage Area B are identical to the Proposed Conditions, no further analysis was deemed necessary for this area.

Point of Concentration	Drainage Area	Area	T <sub>c</sub>	CN	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
A1a	Ult A1a	43.27	74.13	90.15	52.18	107.94	139.97	179.94
A1b	Ult A1b	1.93	36.79	95.10	4.34	8.24	10.47	13.27
A1c	Ult A1b+A1c	2.20	36.79	94.84	4.92	9.36	11.91	15.10
A1	Ult A1a+A1b+A1c	45.47	74.13	90.38	55.21	113.79	147.43	189.40
A2b	Ult A2b	0.41	14.34	96.78	1.43	2.71	3.45	4.36
A2a	Ult A2a+A2b	2.72	14.34	95.24	9.59	18.13	23.03	29.17
A2	Ult A2a+A2b+A2c	3.52	52.43	94.73	6.12	11.69	14.88	18.88
B1a	Ult B1a	0.27	17.88	93.00	0.82	1.60	2.05	2.61
B1b	Ult B1b	0.21	10.00	93.00	0.77	1.50	1.92	2.44
B2a	Ult B2a	0.33	10.00	93.00	1.21	2.36	3.02	3.84
B2b	Ult B2b	0.36	10.00	93.00	1.31	2.55	3.25	4.14
B2c	Ult B2c	0.28	11.31	93.00	0.98	1.90	2.42	3.08
B2d	Ult B2d	0.35	10.00	93.00	1.28	2.50	3.20	4.06
B2e	Ult B2e	0.32	17.85	93.00	2.00	3.90	4.99	6.35
B2f	Ult B2f	0.63	20.77	93.00	1.82	3.54	4.54	5.77
B3a	Ult B3a	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3b	Ult B3b	0.32	25.58	93.00	0.83	1.62	2.07	2.64
B3c	Ult B3c	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3d	Ult B3d	0.32	25.58	93.00	0.81	1.58	2.03	2.59
B3e	Ult B3e	1.33	47.04	93.00	2.36	4.63	5.93	7.56
B3f	Ult B3f	0.44	14.10	93.00	1.47	2.87	3.67	4.66
B3g	Ult B3g	1.55	12.01	93.00	5.41	10.52	13.45	17.10
B3h	Ult B3h	0.38	10.00	93.00	1.38	2.68	3.43	4.36
B4a	Ult B4a	1.72	10.73	93.00	6.18	12.02	15.37	19.55
B4b	Ult B4b	0.28	63.42	93.00	0.41	0.80	1.03	1.31
B4c	Ult B4c	0.23	52.52	93.00	0.38	0.75	0.96	1.22
B	Ult B	9.96	63.42	93.00	16.15	31.54	40.34	51.35

Point of Concentration	Drainage Area	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
Ex B	Ex B	7.06	17.53	23.80	31.72
B	Ult B	16.15	31.54	40.34	51.35
Proposed is Less Than or Equal to Existing		NO	NO	NO	NO

\*The Heather Glen project has a detention basin sized to accommodate the developed conditions flows from the proposed apartment site and Nissan Way Extension.

## **6.0 Hydraulics**

As previously discussed, Drainage Area A1b has increased from 1.10 acres as originally shown, to 1.93. Because this drainage area consists of two sections of roadway draining to a common low point (Inlet A1b), we have subdivided the drainage area into two sections for the purpose of street capacity calculations. See Attachment I for a Street Capacity Exhibit, along with updated calculations showing the inlets proposed as part of .

In Drainage Area B, to convey flows in the proposed conditions, a storm network consisting of one open channel (Channel B) and a storm network of area inlets and underground pipes is proposed. Because the routing of this storm network is complex in nature, the Storm and Sanitary Analysis computer program was used for analysis. Detailed output documents for the 100-, 25-, 10-, and 2-year storm events are included in Attachments J-M.

Because this development is part of the Heather Glen subdivision master plan, it is our understanding that all downstream facilities, including existing channels and culverts, have been sized correctly to handle the flows generated by this development.

## **7.0 Detention**

Because this development is part of the Heather Glen subdivision master plan, it is our understanding that the downstream detention basin has been sized correctly to accommodate runoff from this development.

## **8.0 Water Quality**

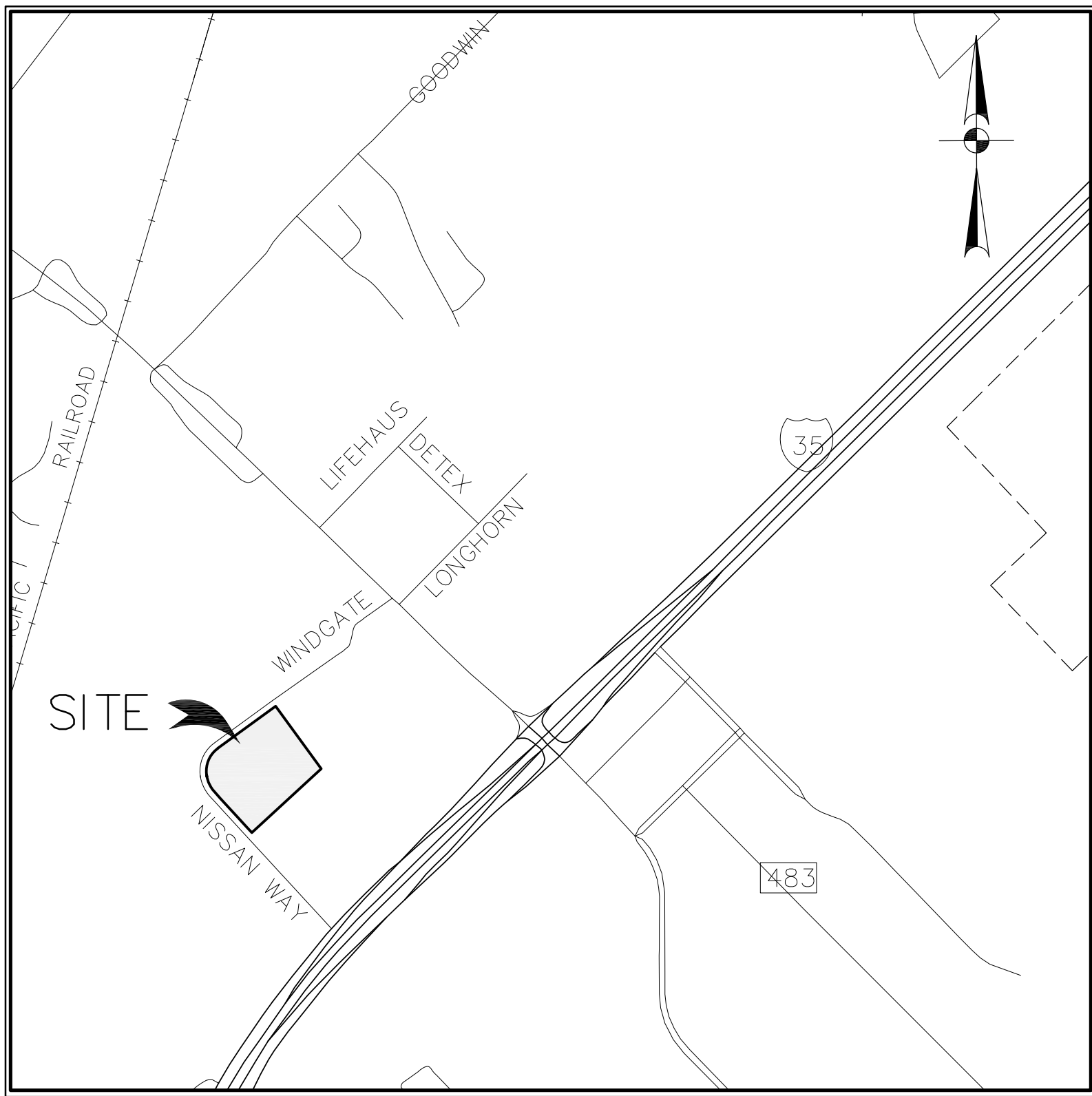
This development was constructed in accordance with the City of New Braunfels DECDM revised September 2000. As such, no water quality is required for this development. The DECDM was updated in February 2018 by authorization of the City Engineer and approval of City Council; however, the drainage criteria used in this design are prior to this revision, as this project is part of a master drainage document/plat approved prior to implementation of the revised criteria (the previously approved Heather Glen master plan). Please see Attachment M for a Memo of Drainage Compliance with the approved master drainage plan.

## **9.0 Conclusion**

The proposed improvements for the Vanguard Farms Apartments development was analyzed for the 2, 10, 25, and 100-year storm events. This analysis was performed in accordance with the City of New Braunfels Drainage and Erosion Control Design Manual revised September 2000, as required by the current approved master plan. As shown by this analysis, the proposed flows are greater than existing flows; however, it is our understanding that the downstream infrastructure constructed as part of the Heather Glen subdivision has been correctly designed to reduce flows from this development to be less than or equal to existing conditions.

# Attachment A

## Location Map



# PROJECT LOCATION MAP

SCALE: N.T.S.



# Attachment B

## FEMA FIRM Map

# National Flood Hazard Layer FIRMette



29°43'56.86"N



0 250 500 1,000 1,500 2,000 Feet

1:6,000

29°43'25.62"N

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Profile Baseline
		Hydrographic Feature
		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/29/2019 at 10:16:03 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

98°49'08"W

USGS The National Map: Orthoimagery. Data refreshed April, 2019.

# Attachment C

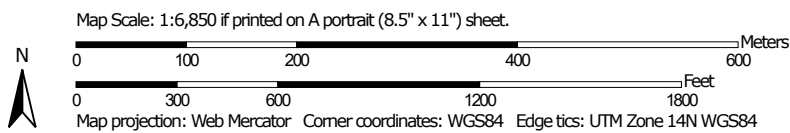
## USDA Soil Map



# Soil Map—Comal and Hays Counties, Texas (EX DA)



Soil Map may not be valid at this scale.



**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

1/30/2020  
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# Soil Map—Comal and Hays Counties, Texas (EX DA)

## 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 1:20,000.

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:

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: Comal and Hays Counties, Texas

Survey Area Data: Version 16, Sep 12, 2019

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

Date(s) aerial images were photographed: Jan 4, 2019—Jan 24, 2019

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

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ByA	Branyon clay, 0 to 1 percent slopes	59.3	100.0%
<b>Totals for Area of Interest</b>		<b>59.3</b>	<b>100.0%</b>

# Attachment D

## Curve Number Charts



**Table 5-5A**  
**General SCS Runoff Curve Numbers**

Cover Type*	CN (AMC III)	
	C	D

Drainage and Erosion Control Design Manual

90

Open space – lawns, parks, golf courses	Poor condition (grass cover <50%)	86	89
	Fair condition (grass cover 50-75%)	79	84
	Good condition (grass cover >75%)	74	80
Impervious	Paved	98	98
	Gravel	89	91
	Dirt	87	89
Urban	Commercial and business	94	95
	Industrial	91	93
Residential	1/8 acre lot size	90	92
	1/4 acre lot size	83	87
	1/2 acre lot size	80	85
	1 acre lot size	79	84
	2 acre lot size	77	82
Pasture, grassland, or range-continuous Forage	Poor	86	89
	Fair	79	84
	Good	74	80
Meadow-continuous generally mowed for hay		71	78
Brush-brush, weed, grass mix	Poor	77	83
	Fair	70	77
	Good	65	73
Woods-grass combination (orchard, tree Farm)	Poor	82	86
	Fair	76	82
	Good	72	79
Woods	Poor	77	83
	Fair	73	79
	Good	70	77
Farmstead		82	86

Zone	"C"	CN (AMCII)	
		C	D
R-1/R-1A Single family	0.53	83	87
R-2/R-2A Single and two family	0.59	90	92
R-3/R-3L Multi family high density	0.67	92	94
R-3/R-3H Multi family low density	0.55	90	92
B-1/B-1A Convent & mobile homes	0.53	83	87
TH/TH-A Townhouse	0.67	92	92
ZH/ZH-A Zero lot line homes	0.55	87	90
C-1/C1A Neighborhood business	0.67	92	93
C-2/C-1B General Business	0.68	93	94
C-3 Commercial	0.80	94	95
C-4/C-4A Resort commercial / PUD*			
M-1/M1A Light industry	0.72	87	90
M-2/M-2A Heavy industry	0.78	94	95

\*must use composite values based on % impervious.

# Attachment E

## Manning's "n" Value Charts

**Table 9-1**  
**Roughness Coefficients of New or Altered Channels**

Type of Channel	Manning's "n"	
Grass lined		
Bermuda	0.04	
St. Augustine	0.045	
Soils		Velocity (fps)
Cobbles	0.035	5.5
Coarse gravel	0.025	6
Graded silts to gravel	0.030	5.5
Graded loam to cobbles	0.030	5
Fine gravel	0.020	5
Shale & hardpan	0.025	6
Alluvial silts, colloidal	0.025	3.75
Stiff clay, very colloidal	0.025	3.75
Firm loam	0.020	2.5
Alluvial silts, non-colloidal	0.020	2
Silt loam, non-colloidal	0.020	2
Sandy loam, non-colloidal	0.020	1.75
Fine sand, colloidal	0.020	1.5
Concrete		
Rough finish	0.02	
Smooth finish	0.015	
Exposed rubble	0.025	
Gabion	0.035	
Rock-cut	0.025	

**Table 5-4**  
**Manning's "n" for Overland Flow and Shallow Concentrated Flow**

<u>Condition</u>	<u>"n"</u>
Concrete (rough or smoothed finish)	0.016
Asphalt	0.02
0-50% vegetated ground cover, remaining bare soil or rock outcrops, minimum brush or tree cover	0.1
50-90% vegetated ground cover, remaining bare soil or rock outcrops, minimum – medium brush or tree cover	0.2
100% vegetated ground cover, medium – dense grasses (lawns, grassy fields, etc) medium brush or tree cover	0.3
100% vegetated ground cover with areas of heavy vegetation (parks, greenbelts, riparian areas, etc) dense undergrowth with medium to heavy tree growth	0.619

# Attachment F

## Existing Conditions Drainage Area Map



Drawing Name: W:\\_Projects\223 - U.F., LLC\001 - Heather Glen Apartments\03a SITE PROJECT SET\323.001\_DWG.dwg User: jghm Jul 29, 2020 - 10:50am

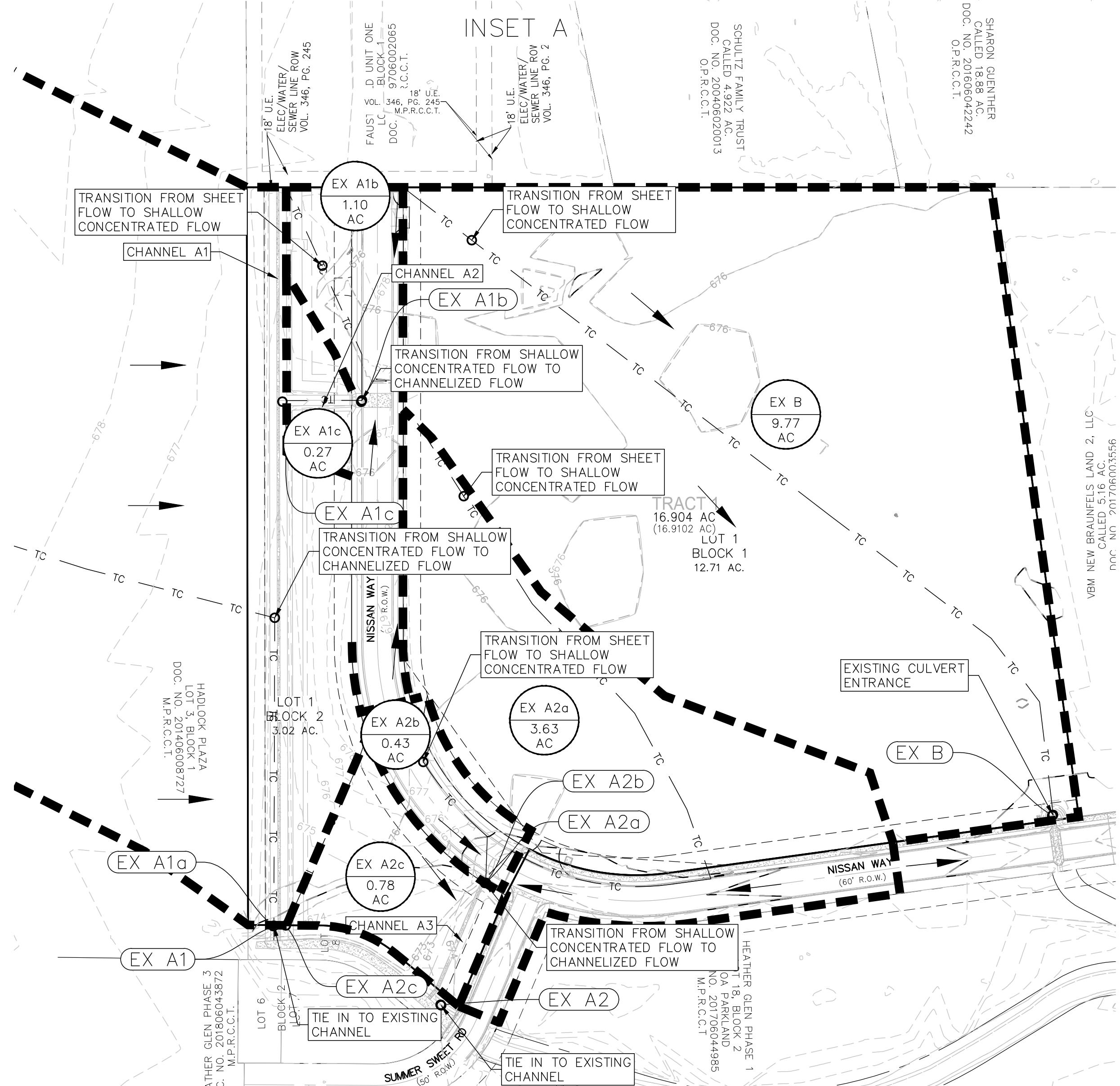
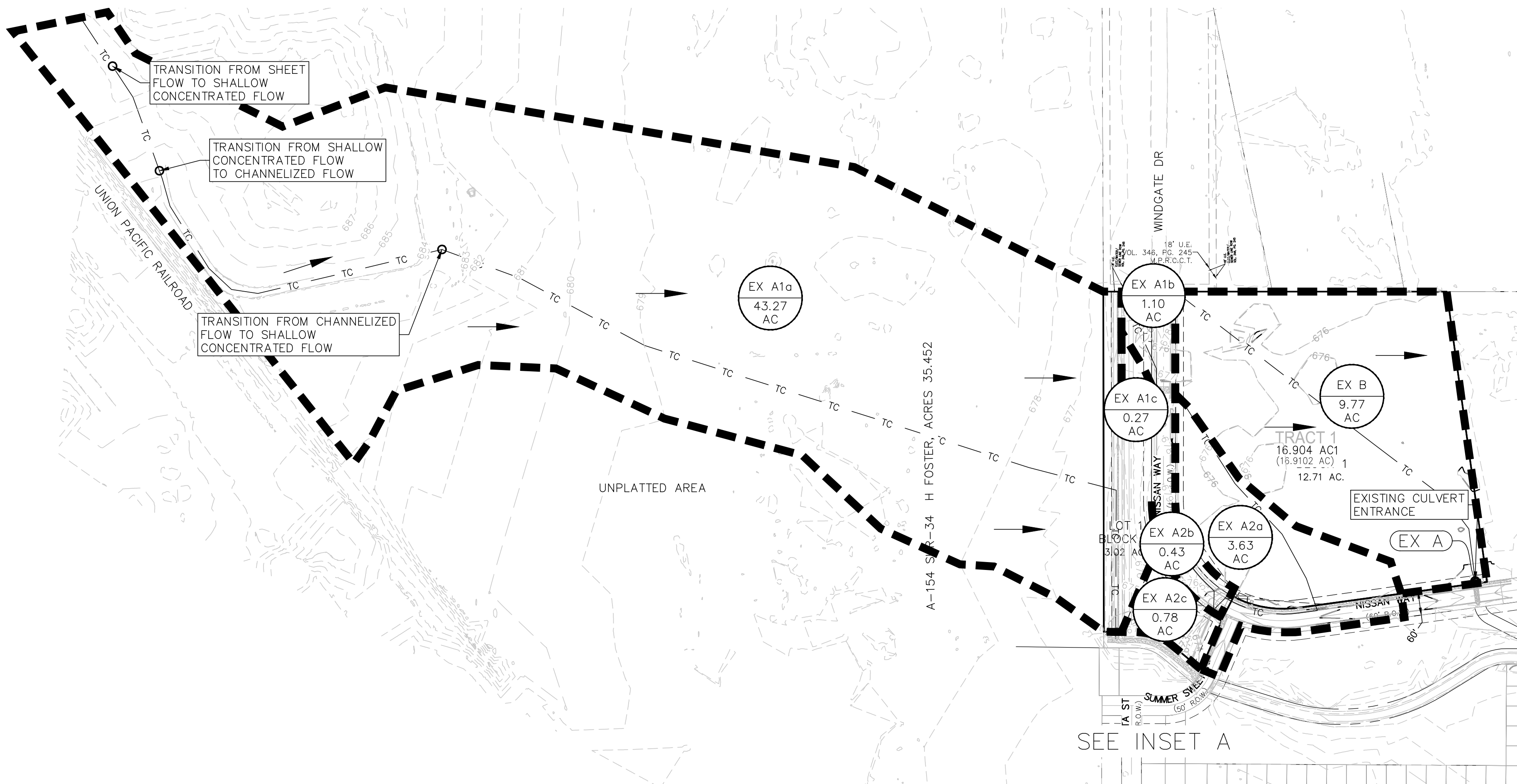
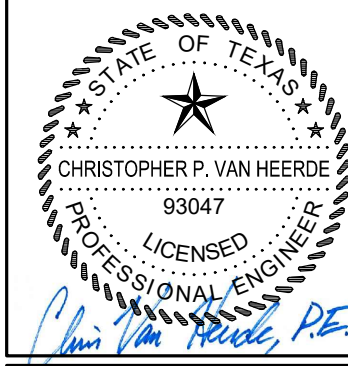


Table 1 - Existing Conditions Hydrology Calculations - City of New Braunfels								
Point of Concentration	Drainage Area	Area	T <sub>c</sub>	CN	Q <sub>2</sub> (dfs)	Q <sub>10</sub> (dfs)	Q <sub>25</sub> (dfs)	Q <sub>100</sub> (dfs)
Ex A1a	Ex A1a	43.27	74.13	80.34	34.66	88.02	120.18	160.94
Ex A1b	Ex A1b	1.10	28.83	93.25	2.70	5.26	6.73	8.56
Ex A1c	Ex A1b+A1c	1.37	28.83	90.64	3.11	6.33	8.18	10.48
Ex A1	Ex A1	44.64	74.13	80.33	35.76	90.81	123.98	166.03
Ex A2b	Ex A2b	0.43	38.14	92.98	0.87	1.70	2.18	2.77
Ex A2b	Ex A2a+A2b	4.07	53.01	84.95	5.08	11.60	15.41	20.19
Ex A2	Ex A2	4.85	53.01	84.16	5.85	13.59	18.14	23.84
Ex B	Ex B	9.77	88.48	81.39	7.06	17.53	23.80	31.72

- LEGEND**
- 700 — EXISTING CONTOURS
  - 700 — PROPOSED CONTOURS
  - B.L. BUILDING SETBACK LINE
  - U.E. UTILITY EASEMENT
  - D.E. DRAINAGE EASEMENT
  - — DRAINAGE AREA
  - TC — TIME OF CONCENTRATION
  - A-1 POINT OF CONCENTRATION
  - DRAINAGE FLOW DIRECTION
  - DA ACRES DRAINAGE AREA LABEL

290 S. CASTELL AVE., STE. 100  
NEW BRAUNFELS, TX 78130  
TBPE FIRM F-10961  
TBPLS FIRM 1053600



07/29/2020

**EXISTING DRAINAGE  
AREA MAP**  
VANGUARD FARMS APARTMENTS

NO.	REVISION DESCRIPTION	REVISION DATE
1	REVISION NOTES	

DATE: **JULY 2020**  
DRAWN BY: **LB**  
DESIGNED BY: **JMM**  
REVIEWED BY: **CYH**  
HMT PROJECT NO.: **323.001**

**SHEET  
C3.0**



# Attachment G

## Existing Conditions Hydrology Calculations

Watershed	Ex A1a
Point of Concentration	Ex A1a
Area	43.27 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.01	S2=	0	S3=	0
T1=	39.35	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	2139	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.005	S2=	0	S3=	0
T1=	31.25	T2=	0.00	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	1270	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	3.53	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	74.13	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	42.45	D	80
Asphalt	0.82	D	98
Concrete	0.00	D	98
Commercial C1	0.00	D	93
Total	43.27		80.34

# Hydrograph Report

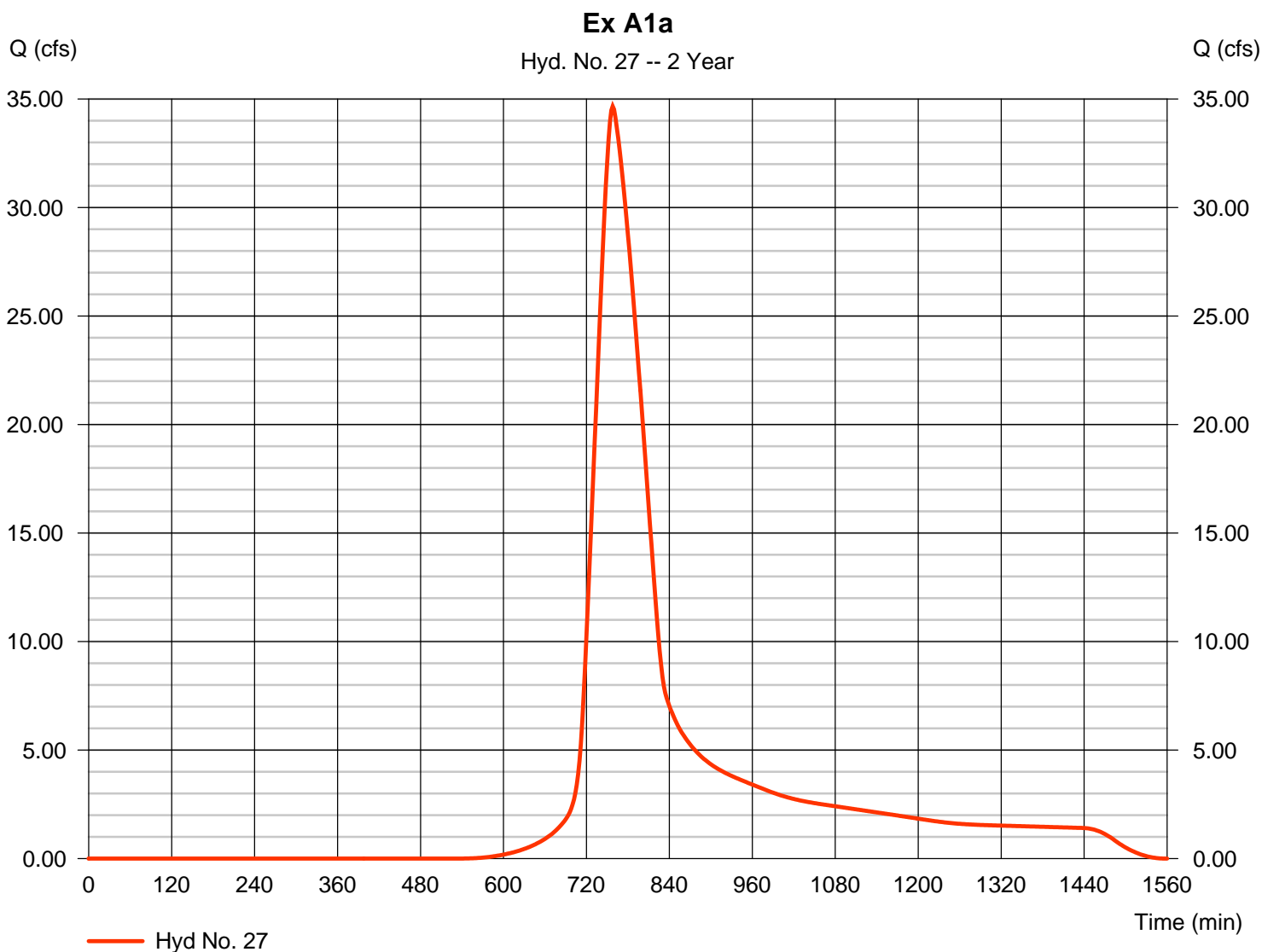
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Monday, 07 / 27 / 2020

## Hyd. No. 27

Ex A1a

Hydrograph type	= SCS Runoff	Peak discharge	= 34.66 cfs
Storm frequency	= 2 yrs	Time to peak	= 758 min
Time interval	= 2 min	Hyd. volume	= 264,399 cuft
Drainage area	= 43.270 ac	Curve number	= 80.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.13 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

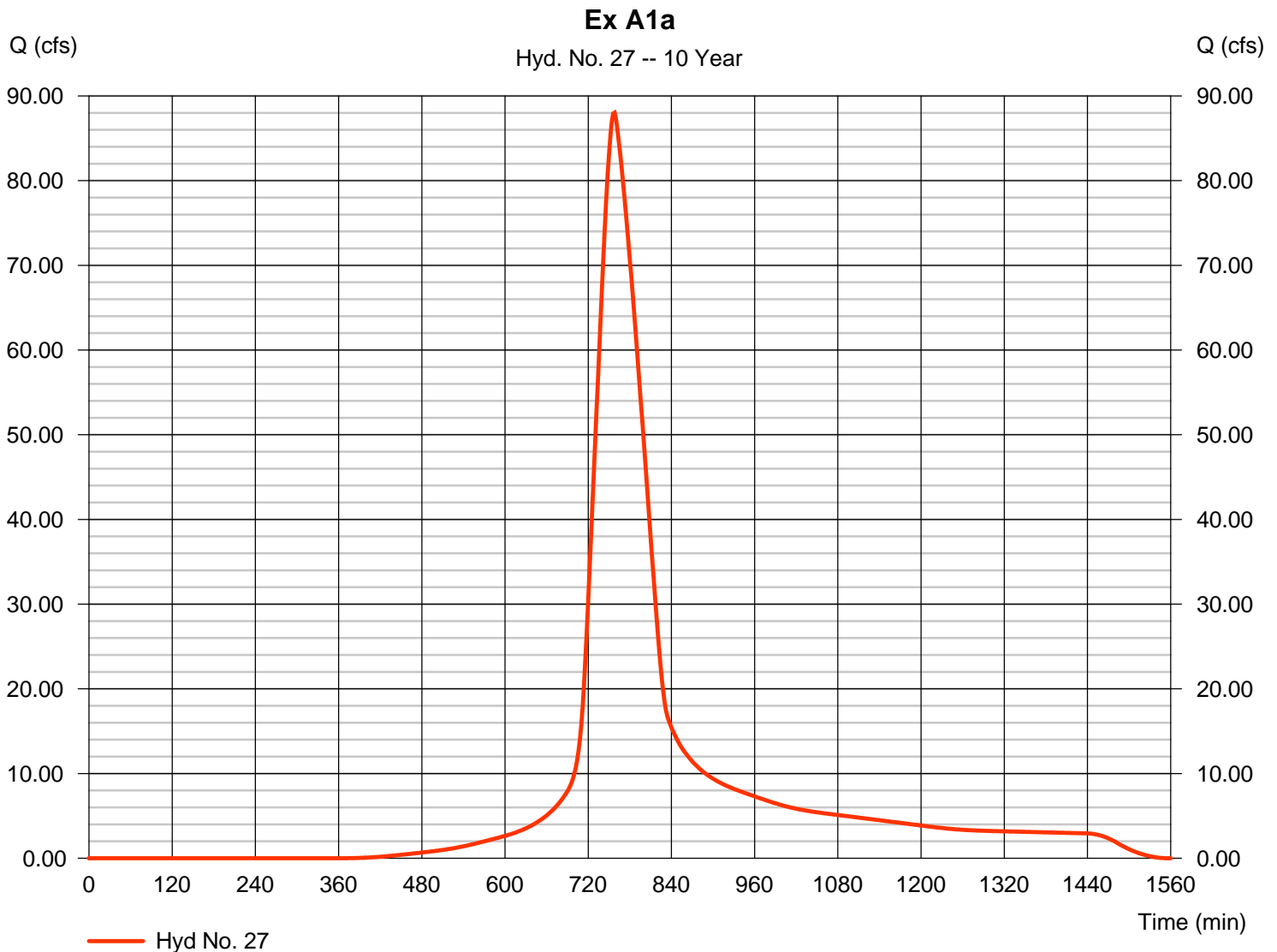
Monday, 07 / 27 / 2020

## Hyd. No. 27

Ex A1a

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 43.270 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 88.02 cfs  
 Time to peak = 758 min  
 Hyd. volume = 659,612 cuft  
 Curve number = 80.3  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.13 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

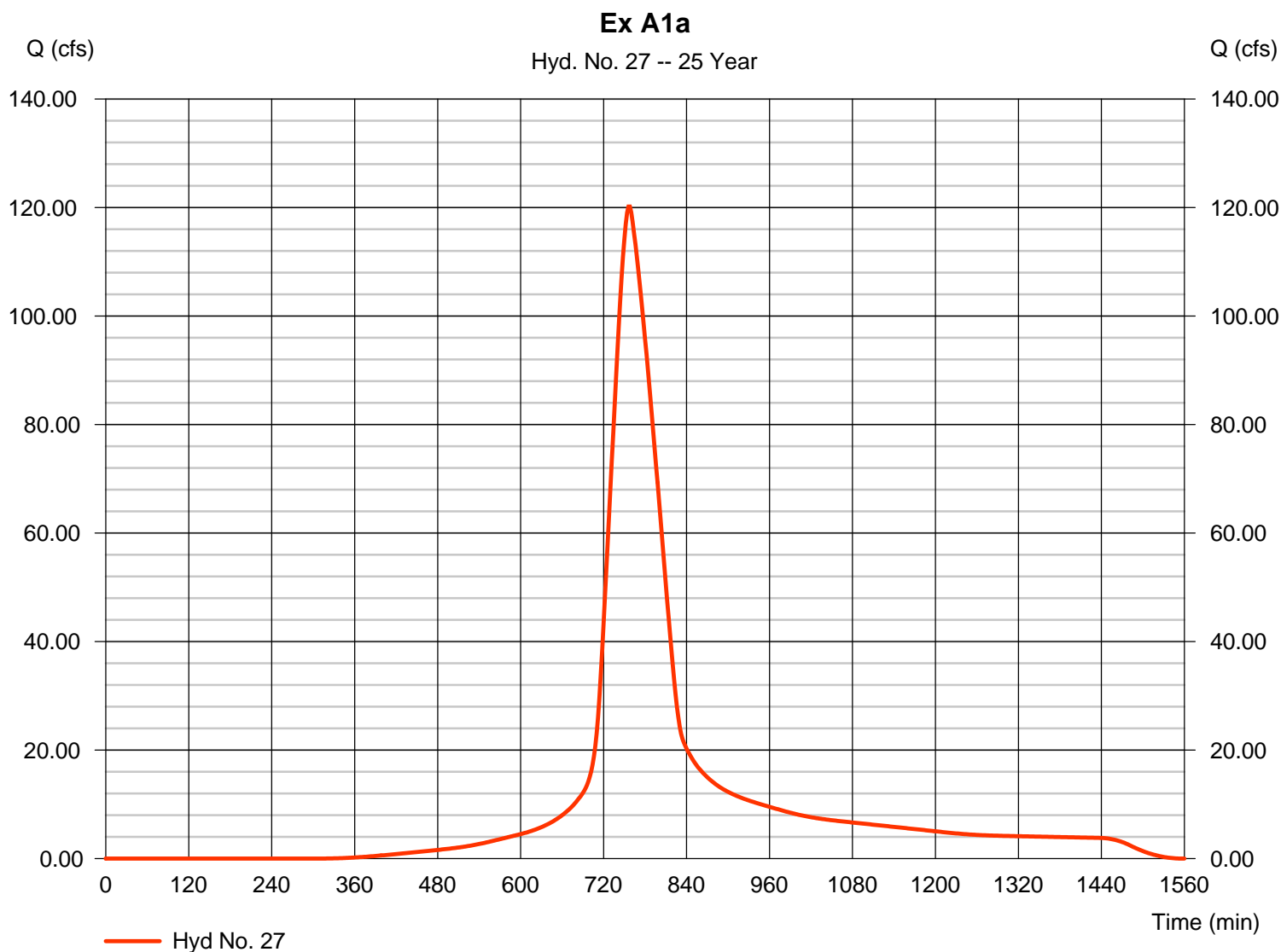
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

## Hyd. No. 27

Ex A1a

Hydrograph type	= SCS Runoff	Peak discharge	= 120.18 cfs
Storm frequency	= 25 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 904,485 cuft
Drainage area	= 43.270 ac	Curve number	= 80.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.13 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

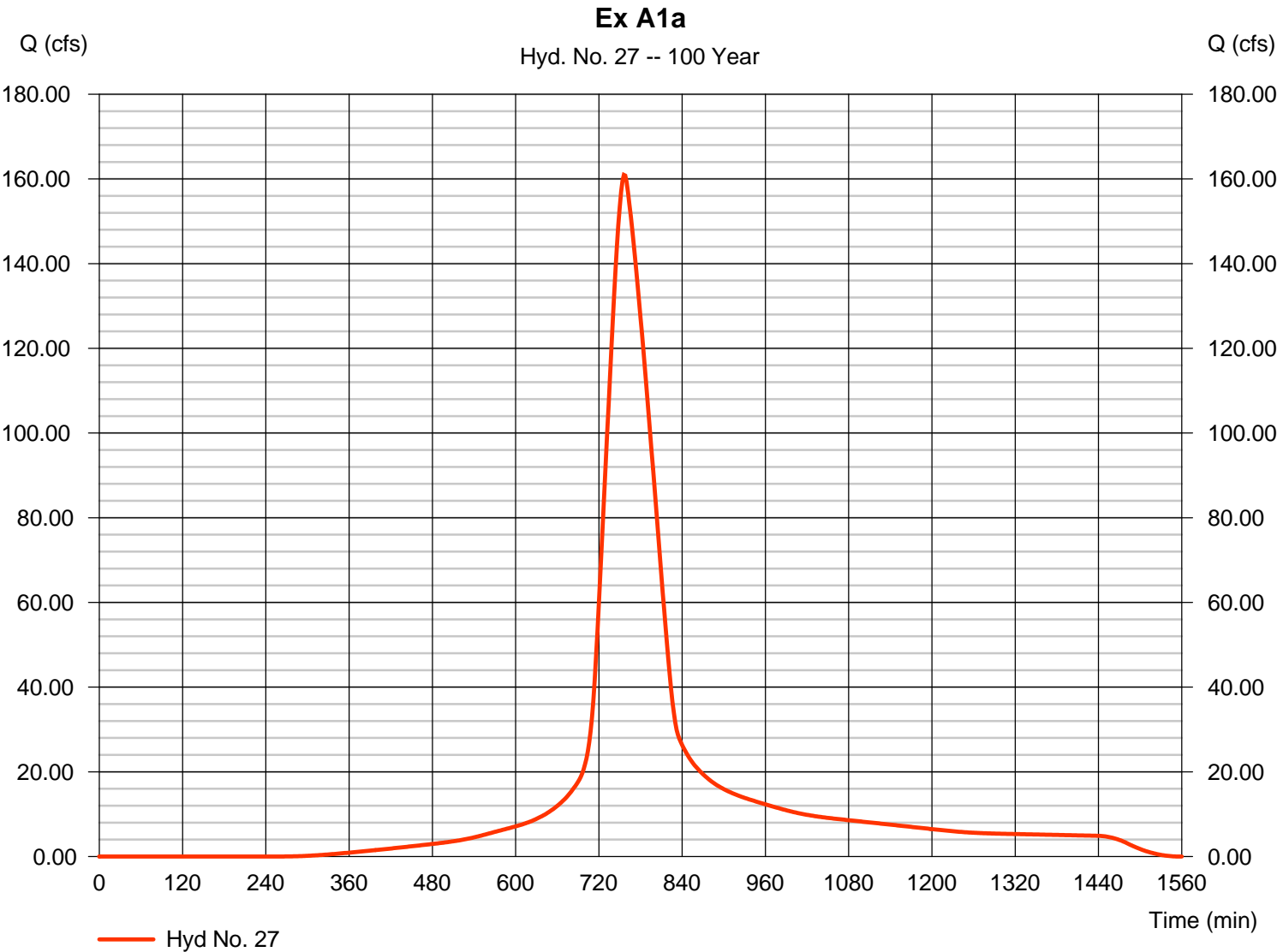


# Hydrograph Report

## Hyd. No. 27

Ex A1a

Hydrograph type	= SCS Runoff	Peak discharge	= 160.94 cfs
Storm frequency	= 100 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 1,219,805 cuft
Drainage area	= 43.270 ac	Curve number	= 80.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.13 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	Ex A1b
Point of Concentration	Ex A1b
Area	1.10 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.026	S2=	0	S3=	0
T1=	26.85	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	113	L2=	53	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.0046	S2=	0.0046	S3=	0
T1=	1.72	T2=	0.26	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	28.83	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.29	D	80
Asphalt	0.81	D	98
Concrete	0.00	D	98
Commercial C1	0.00	D	93
Total	1.10		93.25



# Hydrograph Report

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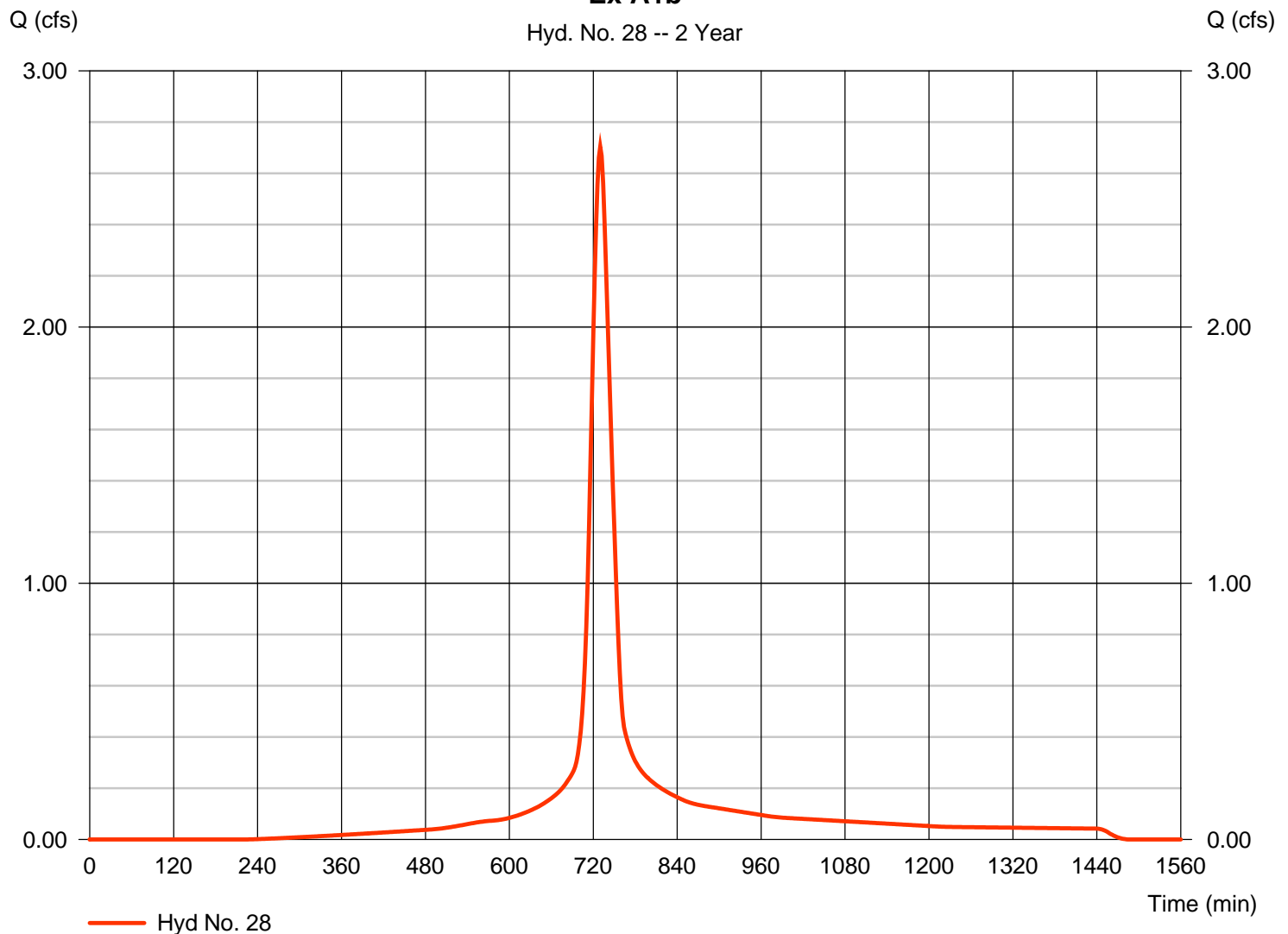
## Hyd. No. 28

Ex A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 2.704 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 11,117 cuft
Drainage area	= 1.100 ac	Curve number	= 93.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.83 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Ex A1b

Hyd. No. 28 -- 2 Year



# Hydrograph Report

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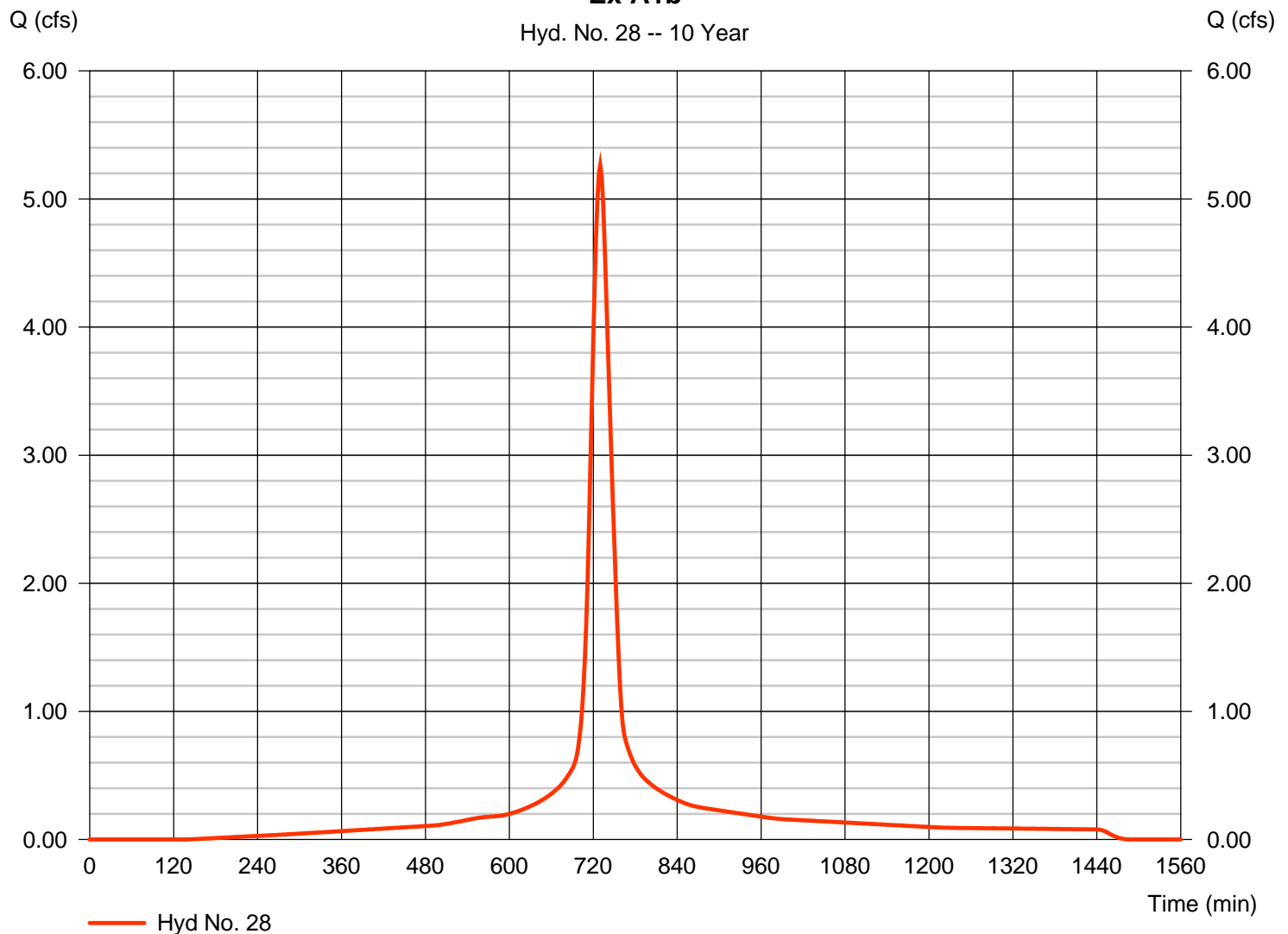
Monday, 07 / 27 / 2020

## Hyd. No. 28

Ex A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 5.263 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 22,410 cuft
Drainage area	= 1.100 ac	Curve number	= 93.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.83 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Ex A1b



# Hydrograph Report

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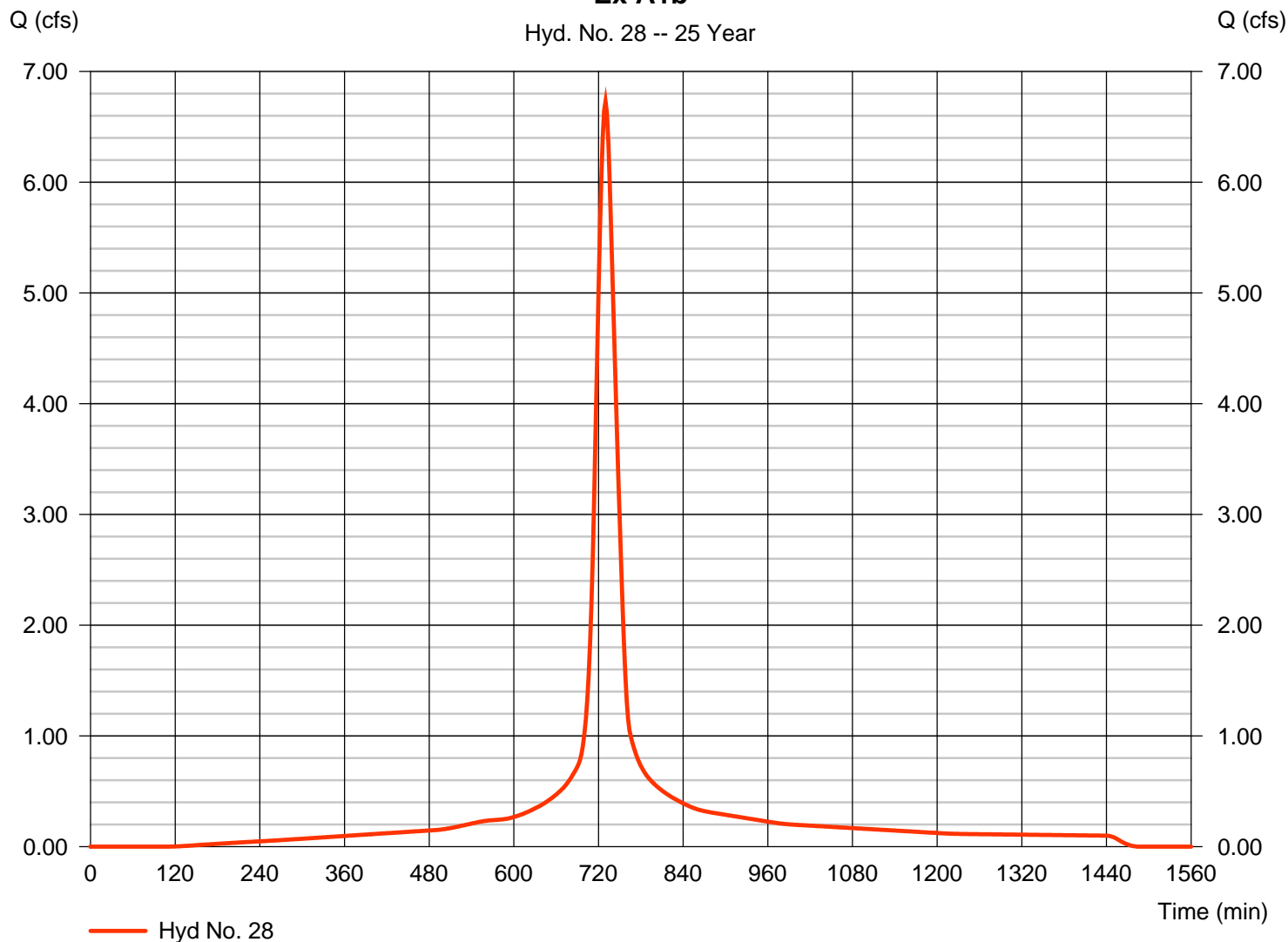
## Hyd. No. 28

Ex A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 6.729 cfs
Storm frequency	= 25 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 29,021 cuft
Drainage area	= 1.100 ac	Curve number	= 93.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.83 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Ex A1b

Hyd. No. 28 -- 25 Year

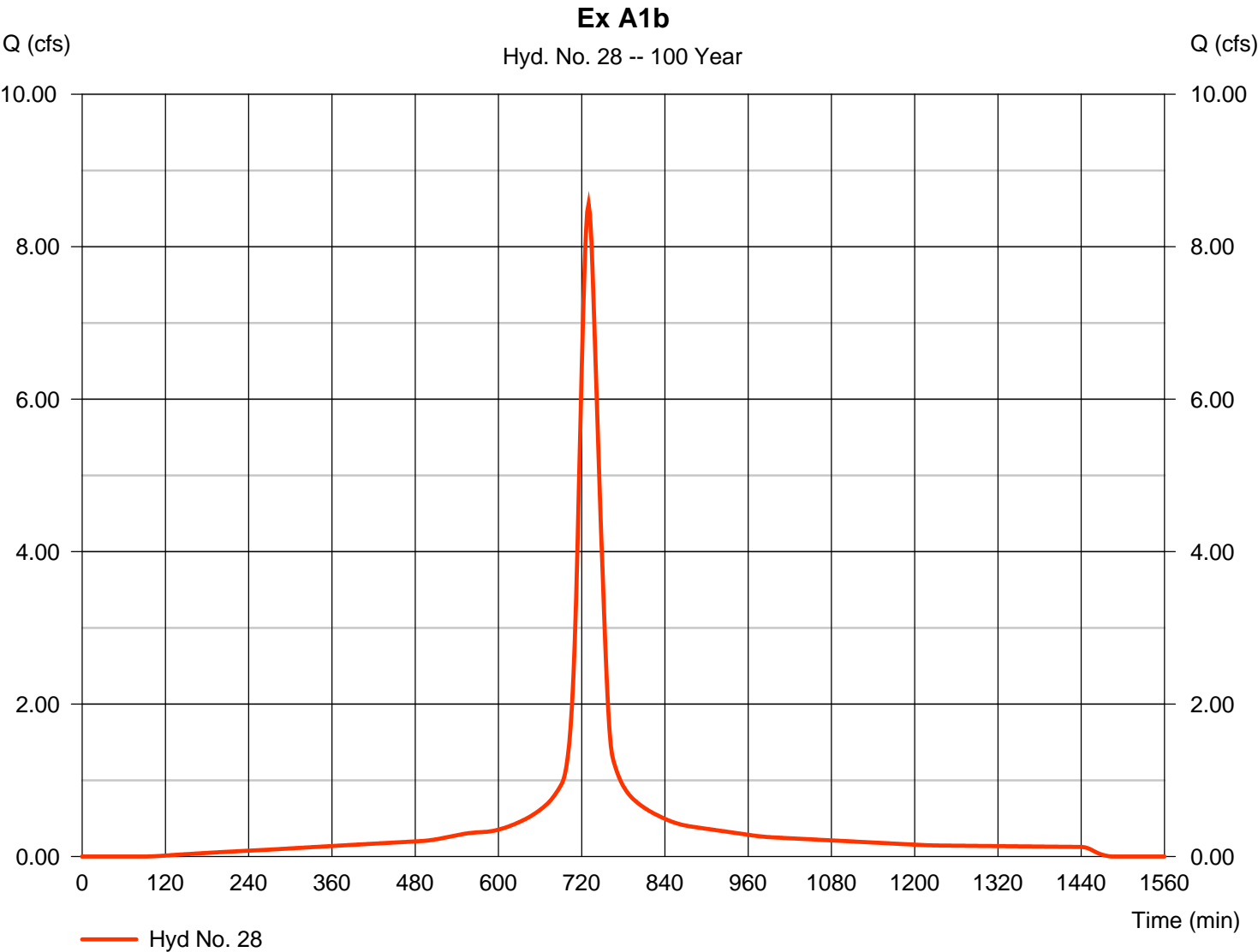


# Hydrograph Report

## Hyd. No. 28

Ex A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 8.560 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 37,360 cuft
Drainage area	= 1.100 ac	Curve number	= 93.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.83 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	Ex A1b+A1c
Point of Concentration	Ex A1c
Area	1.37 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.026	S2=	0	S3=	0
T1=	26.85	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	113	L2=	53	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.0046	S2=	0.0046	S3=	0
T1=	1.72	T2=	0.26	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	28.83	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.56	D	80
Asphalt	0.81	D	98
Concrete	0.00	D	98
Commercial C1	0.00	D	93
Total	1.37		90.64

# Hydrograph Report

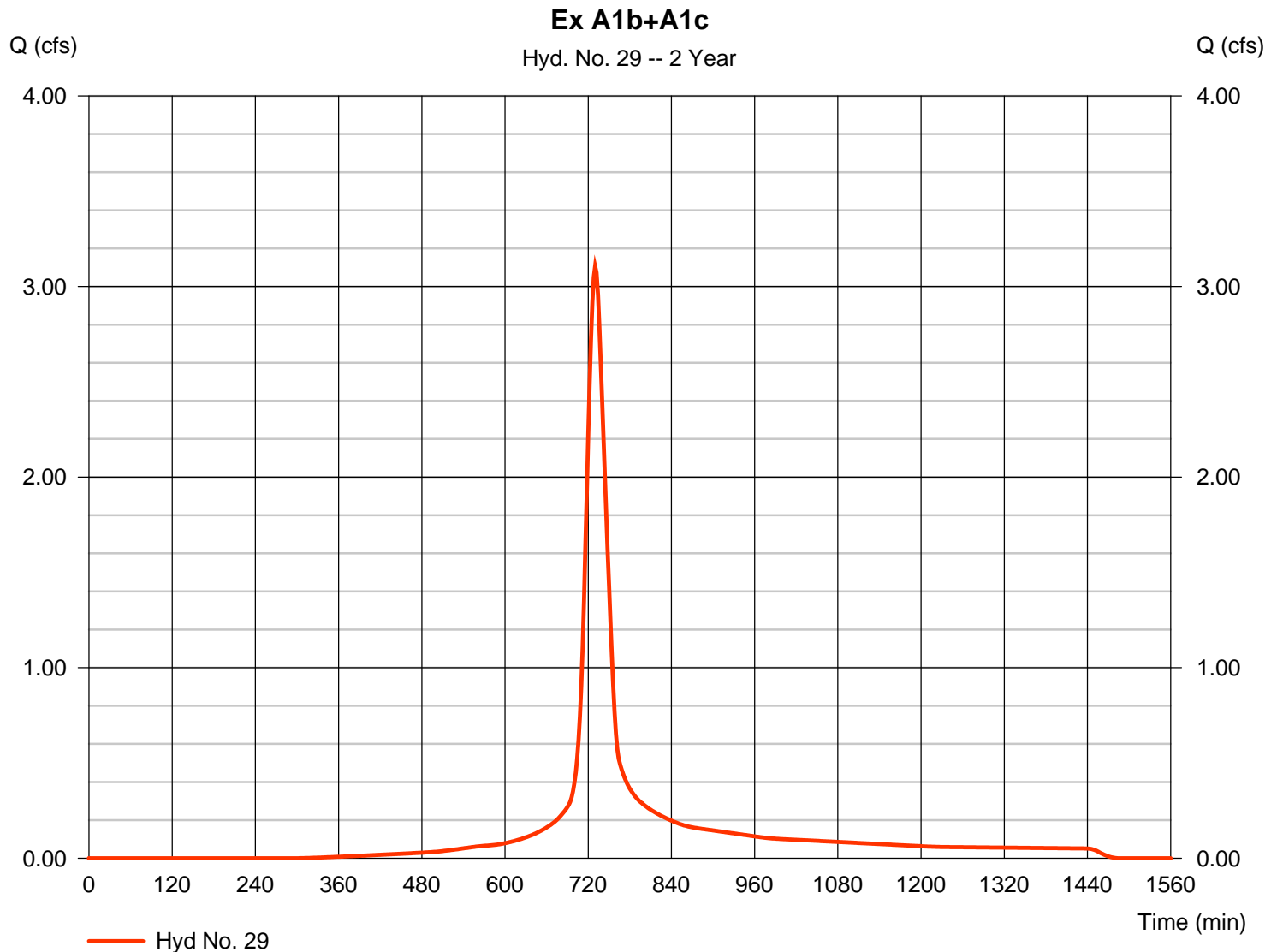
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## Hyd. No. 29

Ex A1b+A1c

Hydrograph type	= SCS Runoff	Peak discharge	= 3.106 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 12,544 cuft
Drainage area	= 1.370 ac	Curve number	= 90.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.83 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

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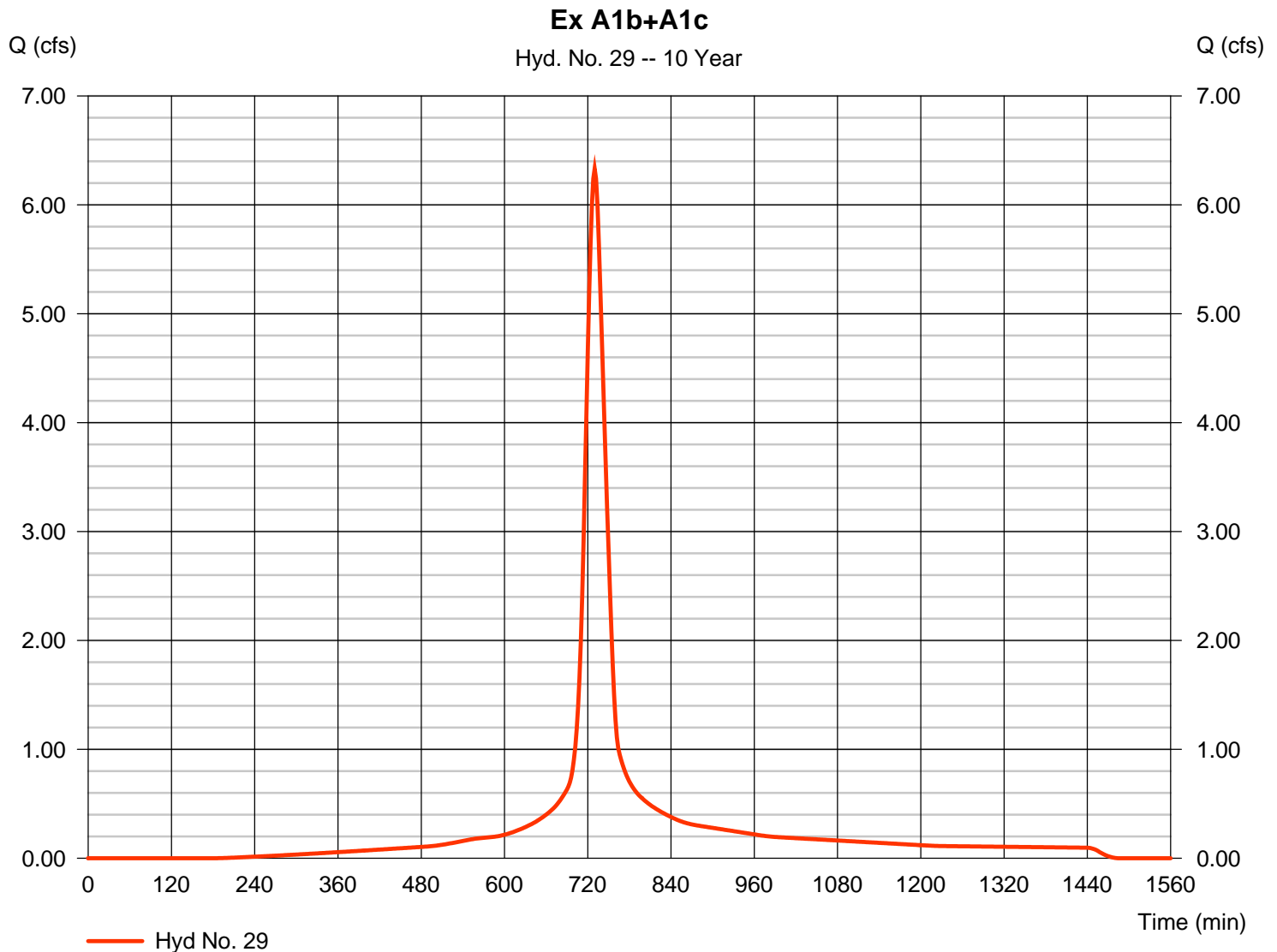
Monday, 07 / 27 / 2020

## Hyd. No. 29

Ex A1b+A1c

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 1.370 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 6.330 cfs  
 Time to peak = 730 min  
 Hyd. volume = 26,377 cuft  
 Curve number = 90.6  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 28.83 min  
 Distribution = Type II  
 Shape factor = 484





# Hydrograph Report

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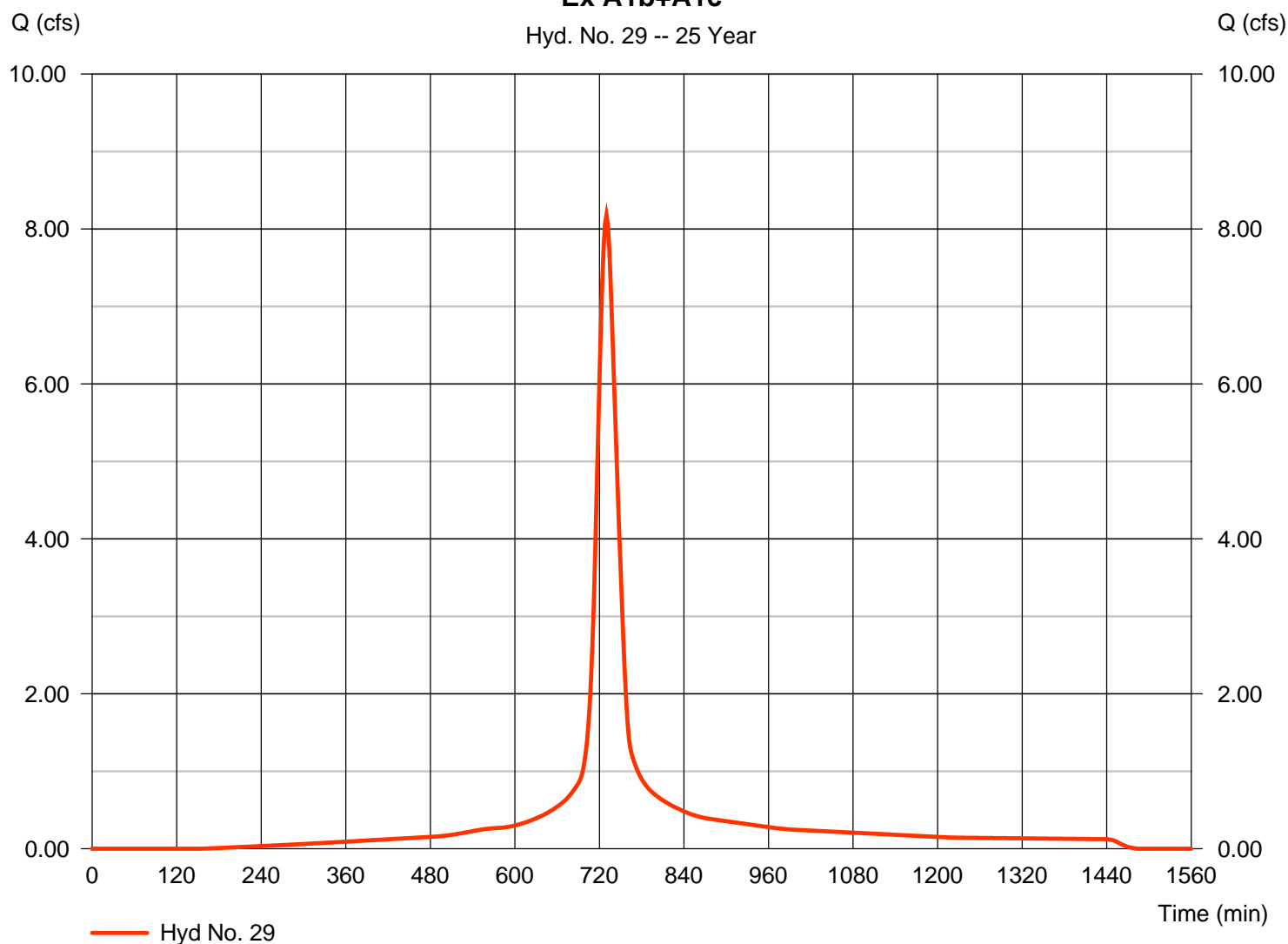
## Hyd. No. 29

Ex A1b+A1c

Hydrograph type	= SCS Runoff	Peak discharge	= 8.178 cfs
Storm frequency	= 25 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 34,543 cuft
Drainage area	= 1.370 ac	Curve number	= 90.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.83 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Ex A1b+A1c

Hyd. No. 29 -- 25 Year

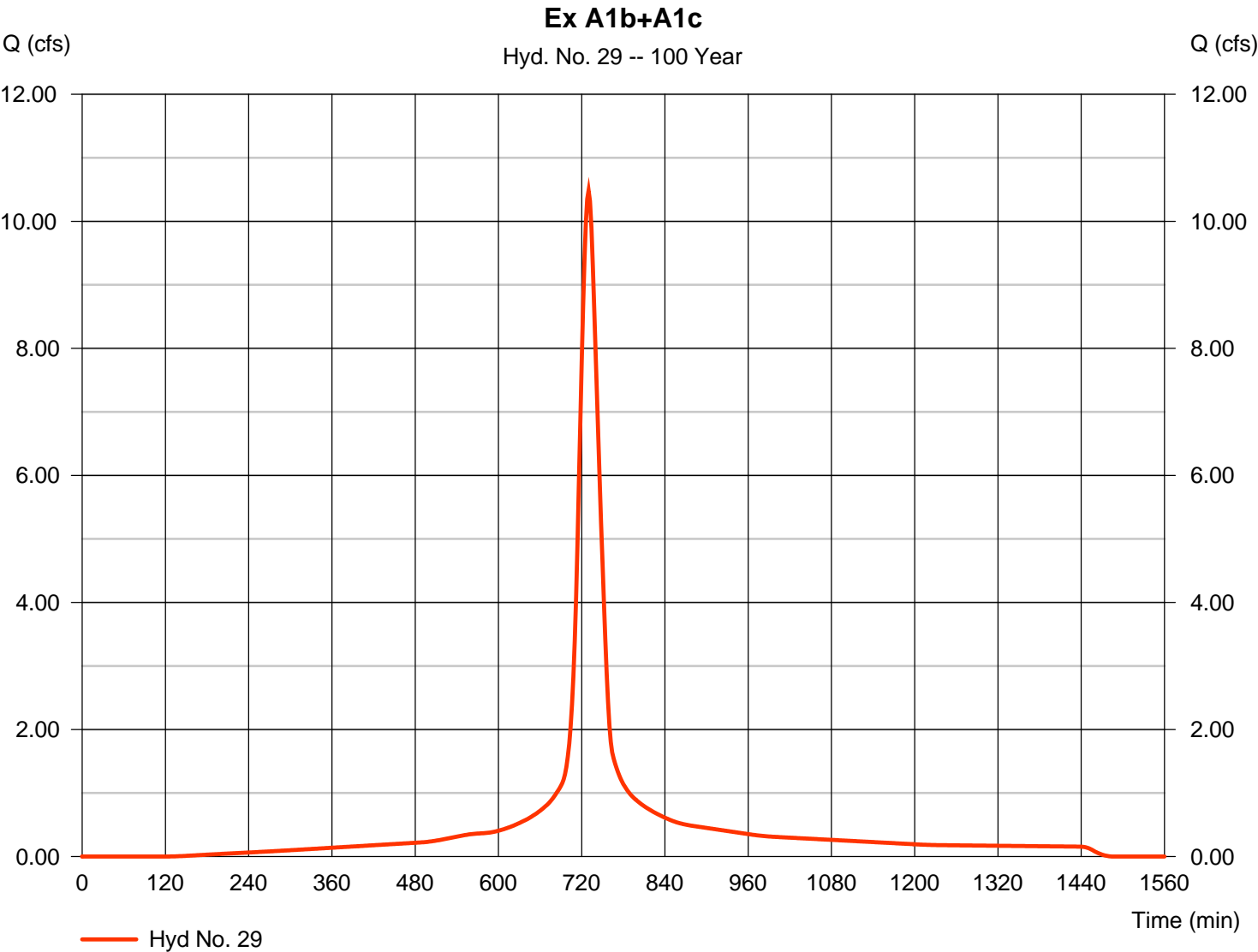


# Hydrograph Report

## Hyd. No. 29

Ex A1b+A1c

Hydrograph type	= SCS Runoff	Peak discharge	= 10.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 44,871 cuft
Drainage area	= 1.370 ac	Curve number	= 90.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.83 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	Ex A1
Point of Concentration	Ex A1
Area	44.64 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.01	S2=	0	S3=	0
T1=	39.35	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	2139	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.005	S2=	0	S3=	0
T1=	31.25	T2=	0.00	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	1270	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	3.53	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	74.13	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	43.83	D	80
Asphalt	0.81	D	98
Concrete	0.00	D	98
Commercial C1	0.00	D	93
<b>Total</b>	<b>44.64</b>		<b>80.33</b>

# Hydrograph Report

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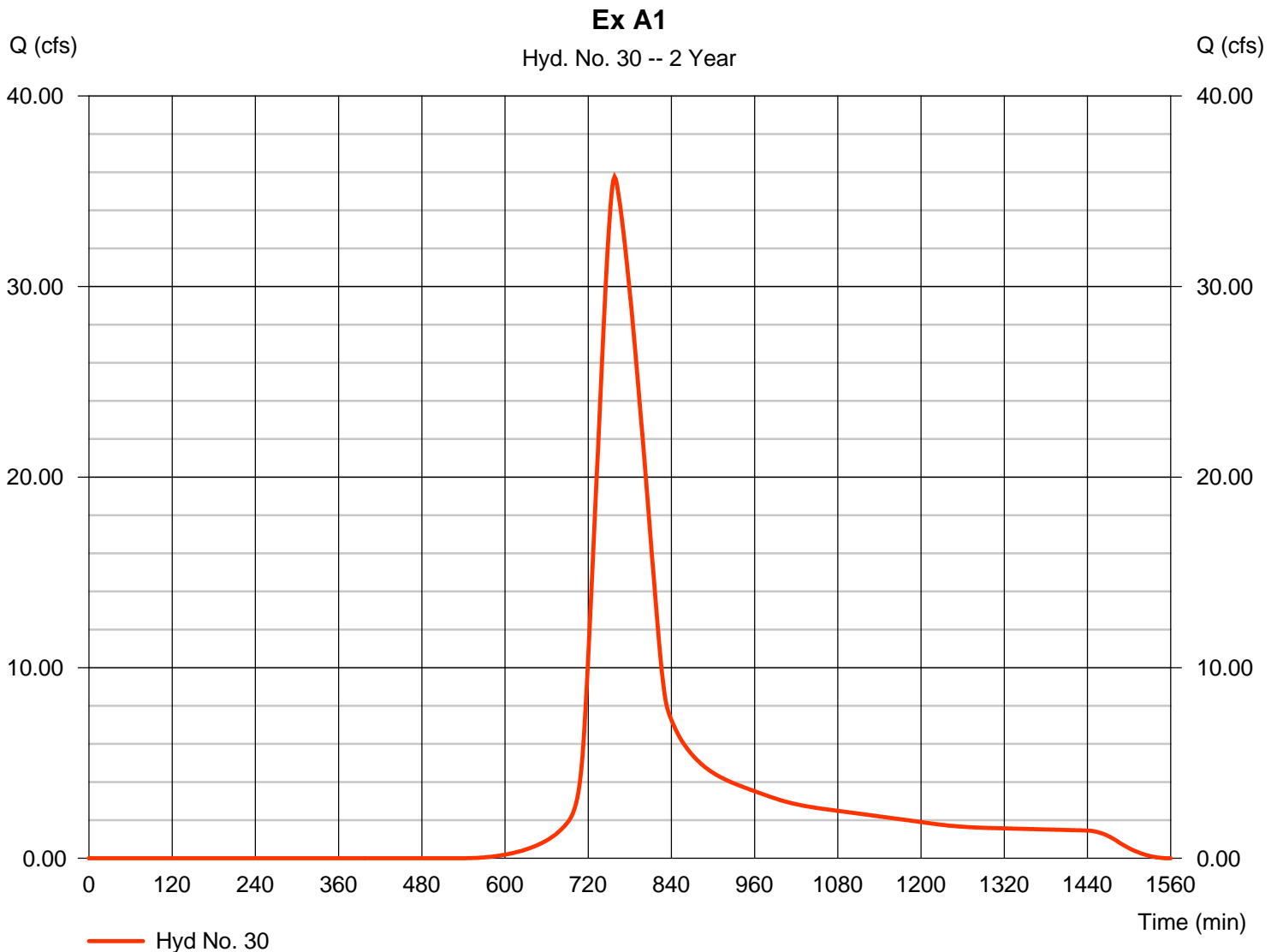
Monday, 07 / 27 / 2020

## Hyd. No. 30

Ex A1

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 44.640 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.52 in  
 Storm duration = 24 hrs

Peak discharge = 35.76 cfs  
 Time to peak = 758 min  
 Hyd. volume = 272,771 cuft  
 Curve number = 80.3  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.13 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

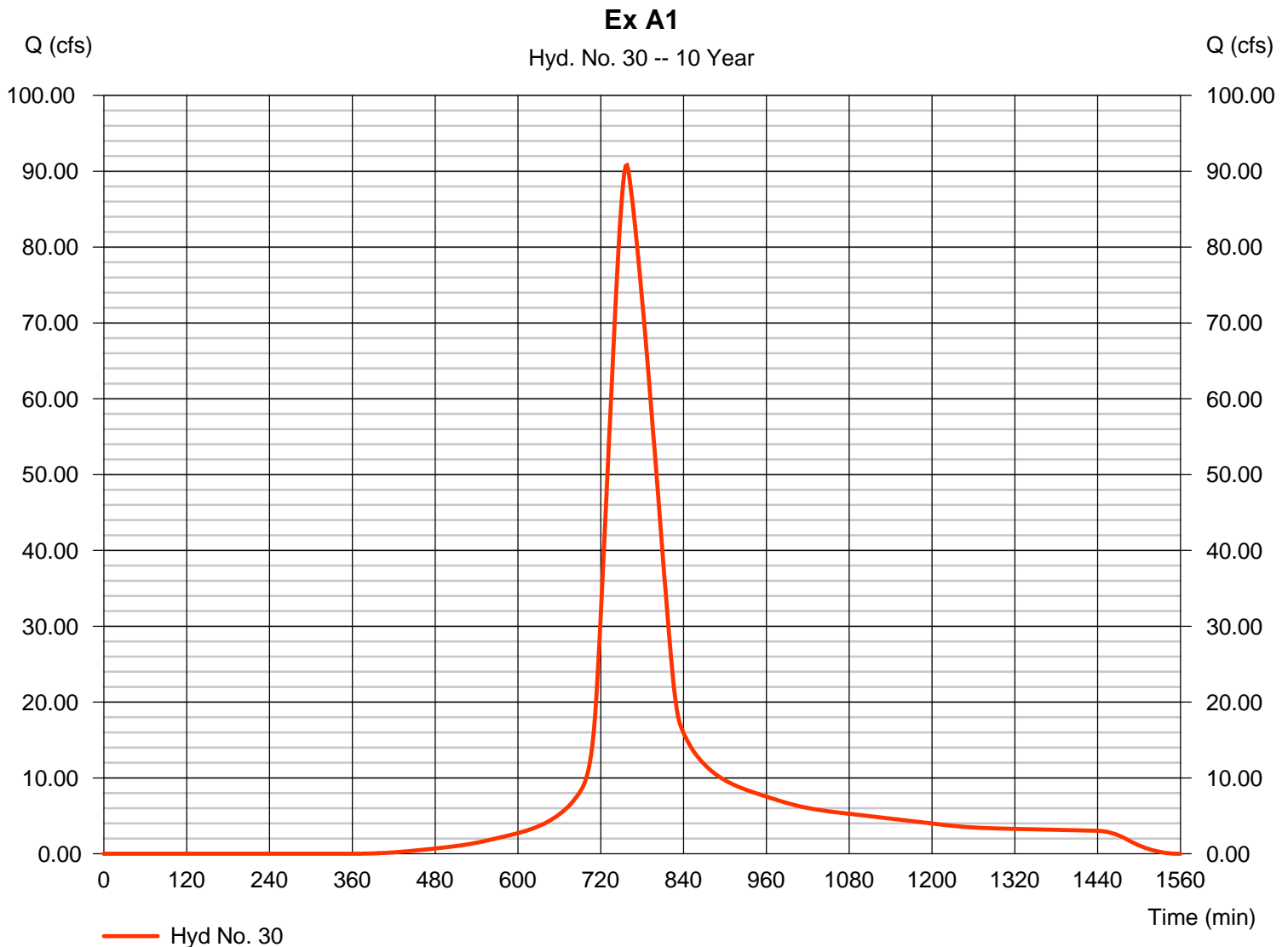
Monday, 07 / 27 / 2020

## Hyd. No. 30

Ex A1

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 44.640 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 90.81 cfs  
 Time to peak = 758 min  
 Hyd. volume = 680,496 cuft  
 Curve number = 80.3  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.13 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

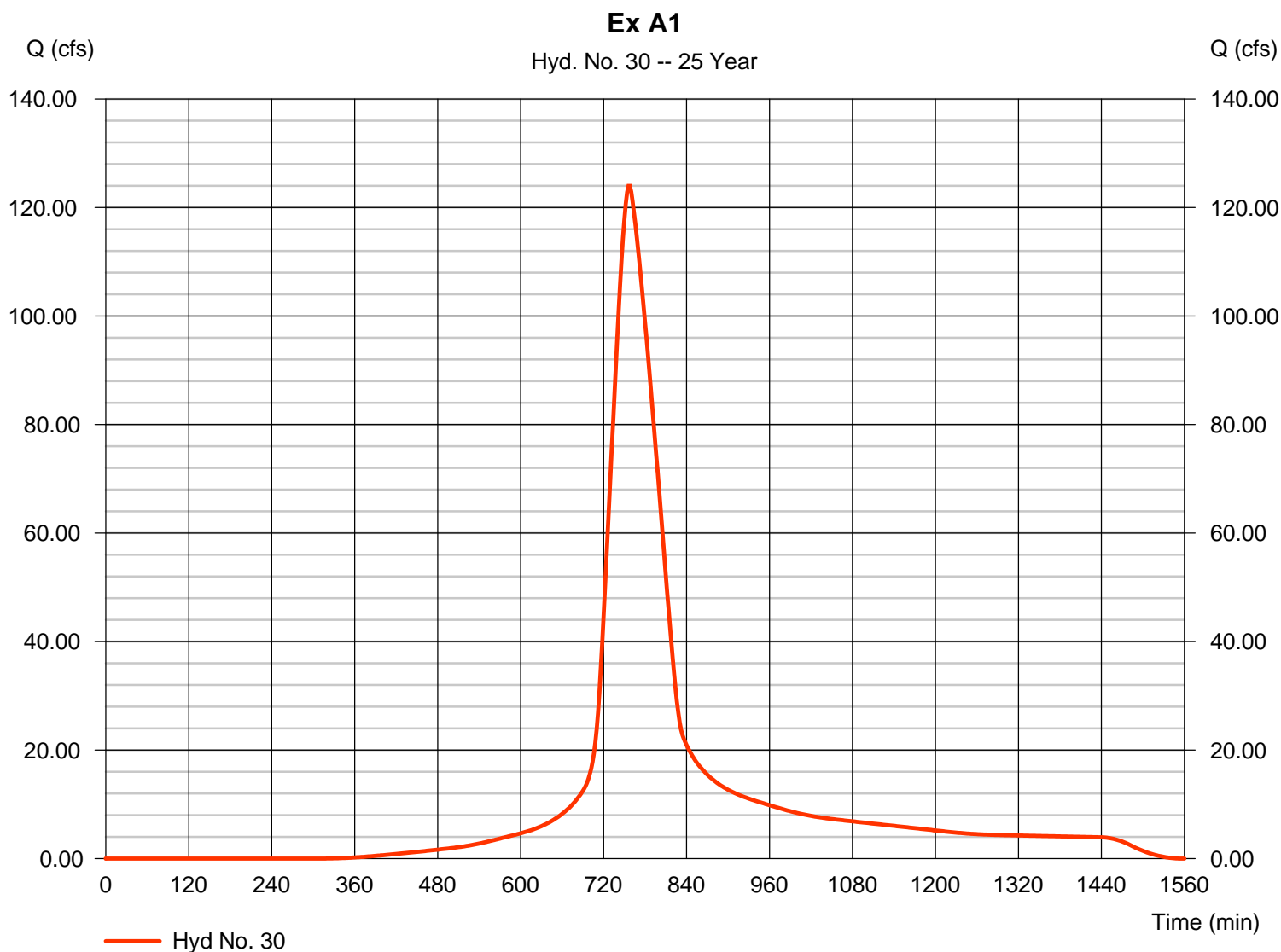
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

## Hyd. No. 30

Ex A1

Hydrograph type	= SCS Runoff	Peak discharge	= 123.98 cfs
Storm frequency	= 25 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 933,122 cuft
Drainage area	= 44.640 ac	Curve number	= 80.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.13 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

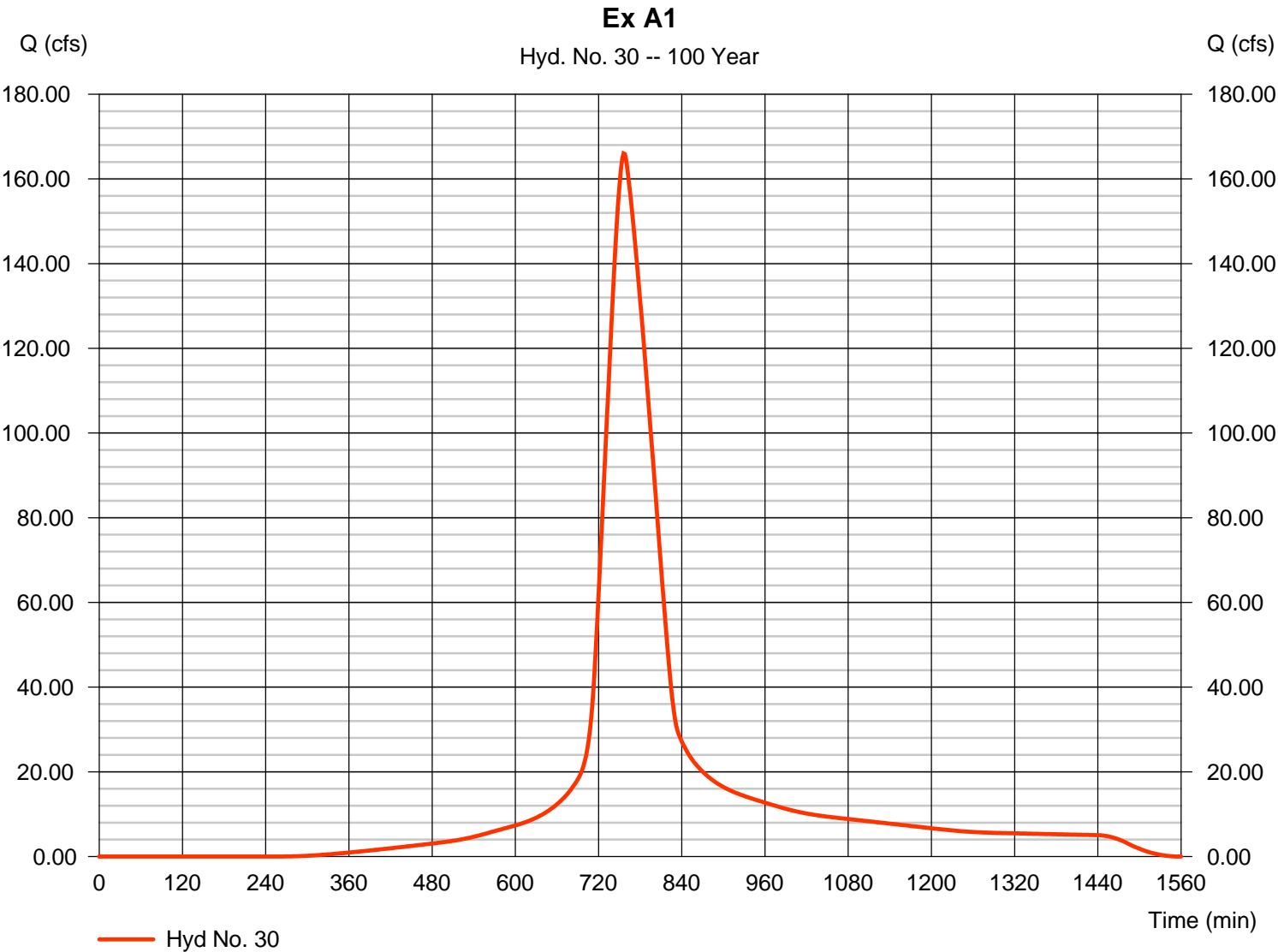


# Hydrograph Report

## Hyd. No. 30

Ex A1

Hydrograph type	= SCS Runoff	Peak discharge	= 166.03 cfs
Storm frequency	= 100 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 1,258,424 cuft
Drainage area	= 44.640 ac	Curve number	= 80.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.13 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





Watershed	Ex A2b
Point of Concentration	Ex A2b
Area	0.43 acres

Sheet Flow					
L1=	78	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.006	S2=	0	S3=	0
T1=	37.65	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	170	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.0133	S2=	0	S3=	0
T1=	0.49	T2=	0.00	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	38.14	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.12	D	80
Asphalt	0.31	D	98
Concrete	0.00	D	98
Commercial C1	0.00	D	93
Total	0.43		92.98

# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

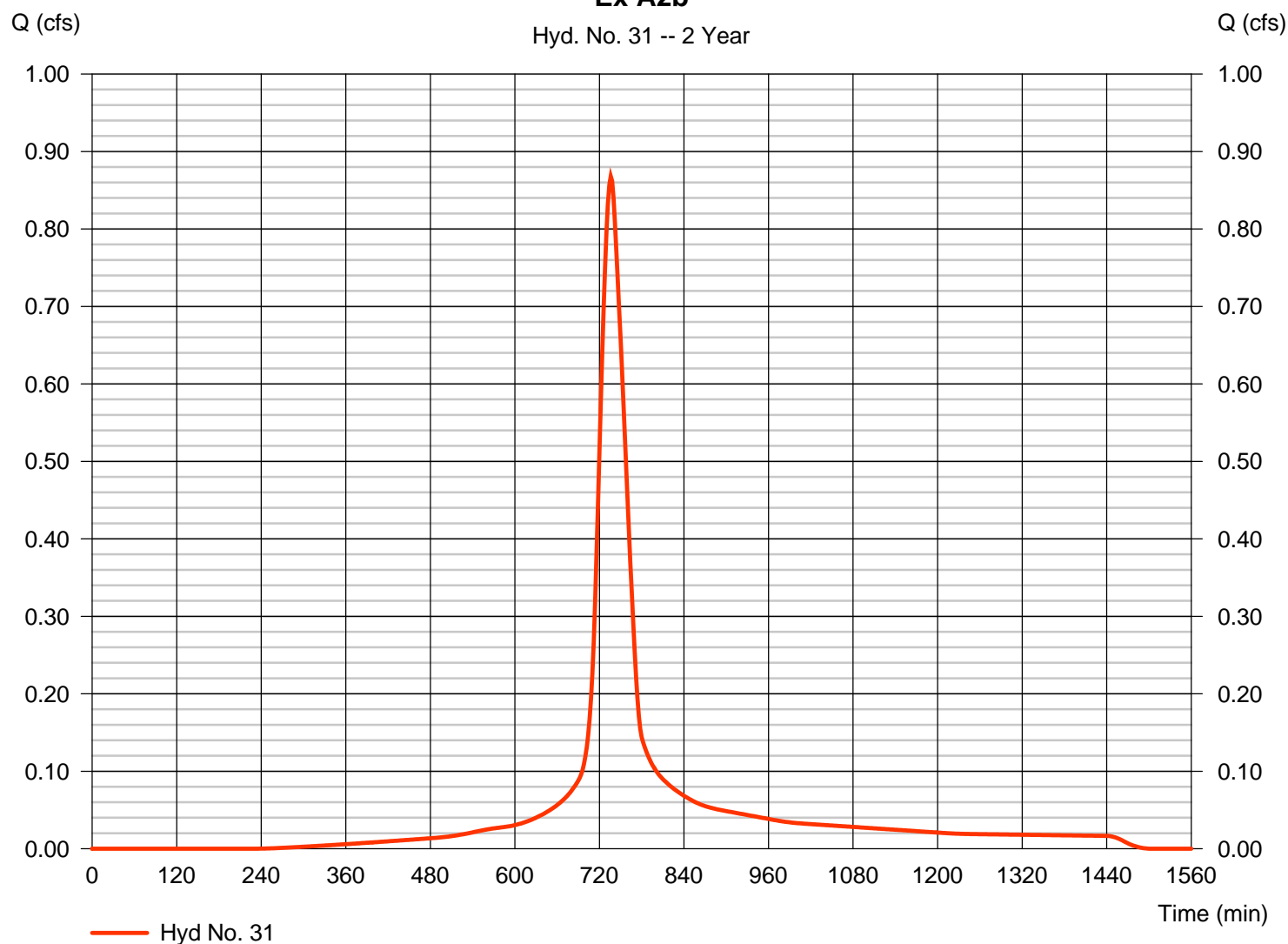
## Hyd. No. 31

Ex A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 0.868 cfs
Storm frequency	= 2 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 4,299 cuft
Drainage area	= 0.430 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 38.14 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Ex A2b

Hyd. No. 31 -- 2 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

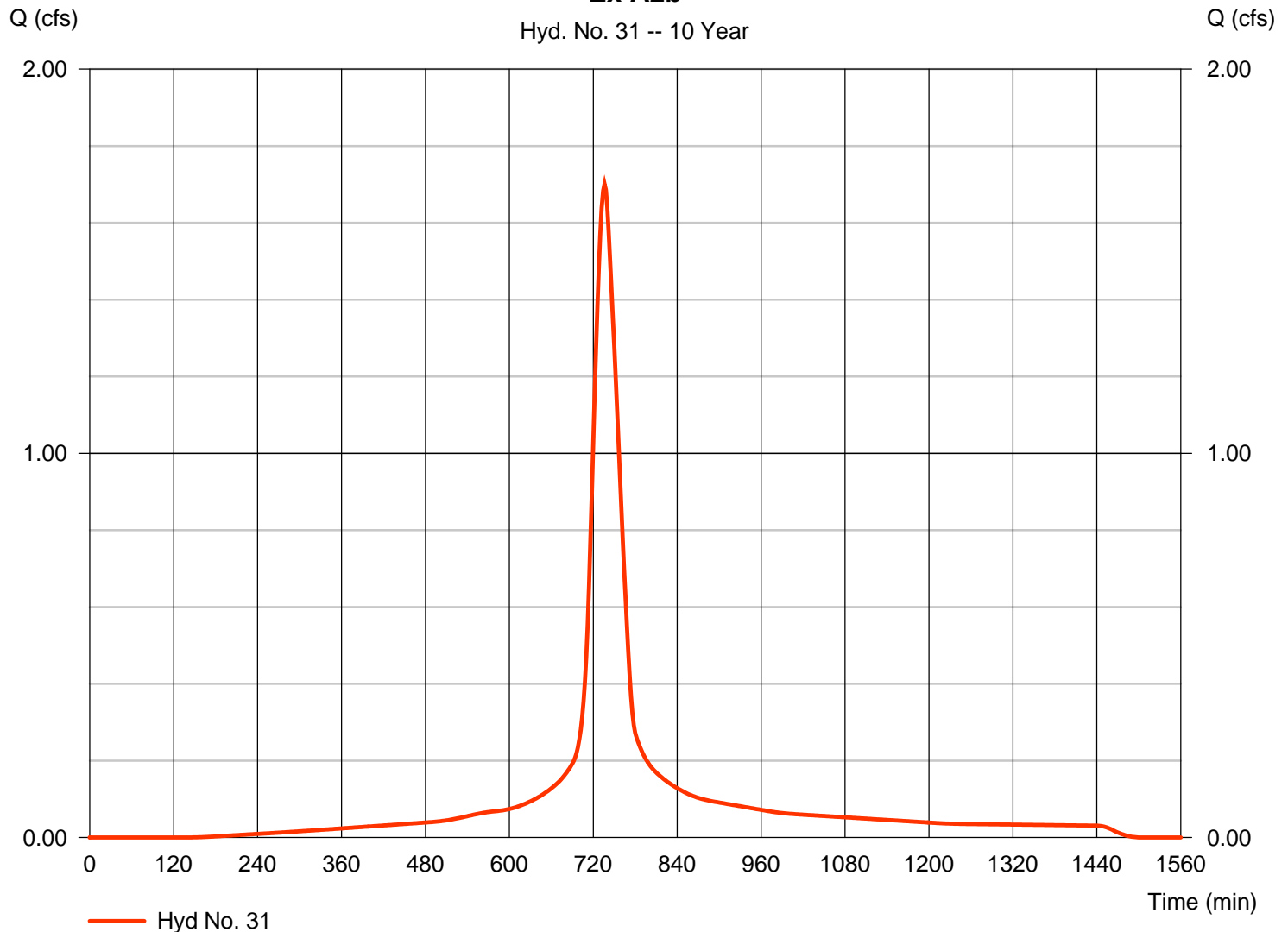
Monday, 07 / 27 / 2020

## Hyd. No. 31

Ex A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 1.701 cfs
Storm frequency	= 10 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 8,706 cuft
Drainage area	= 0.430 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 38.14 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Ex A2b



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

## Hyd. No. 31

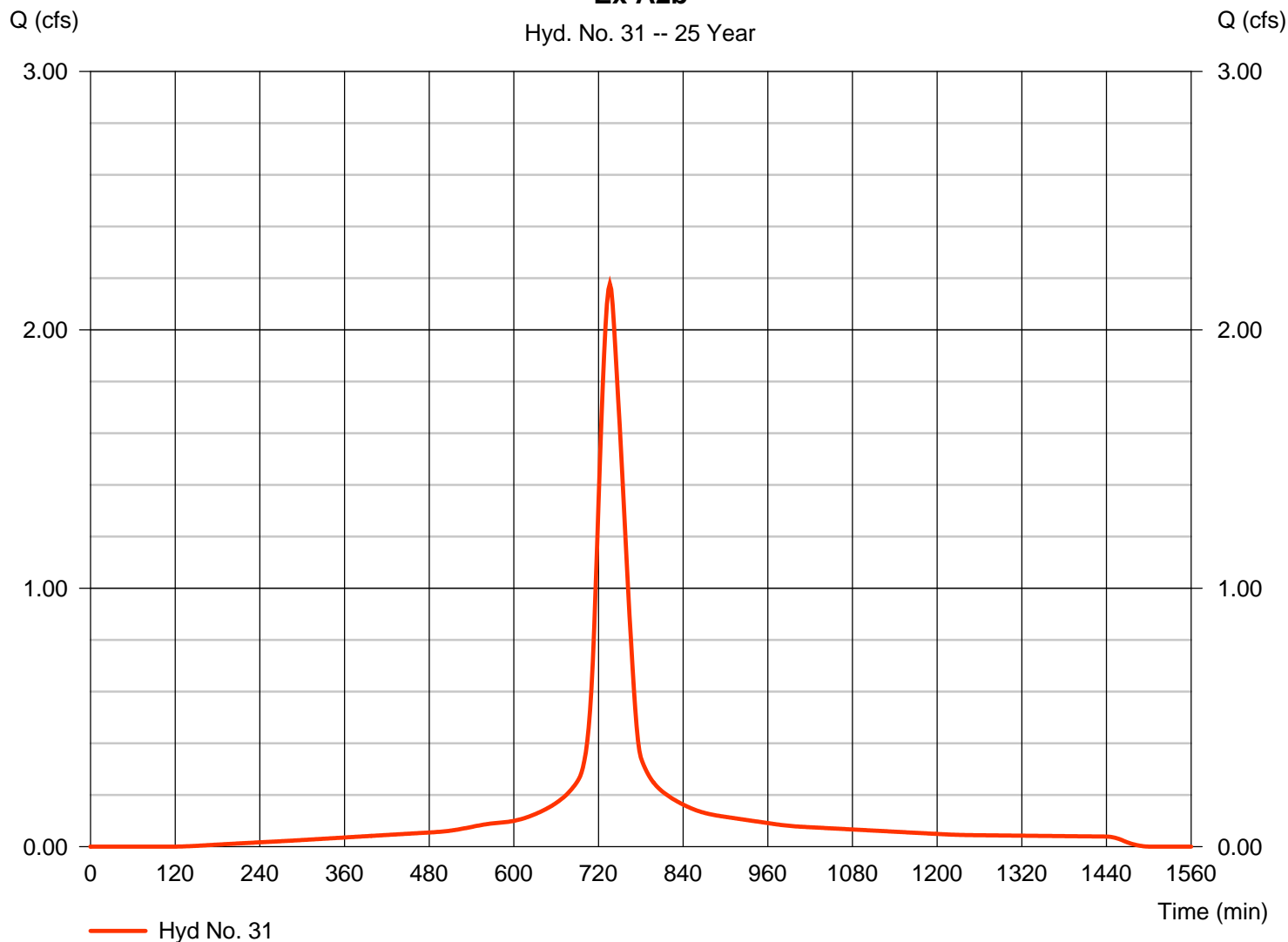
Ex A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 0.430 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 2.178 cfs  
 Time to peak = 736 min  
 Hyd. volume = 11,289 cuft  
 Curve number = 93  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 38.14 min  
 Distribution = Type II  
 Shape factor = 484

### Ex A2b

Hyd. No. 31 -- 25 Year

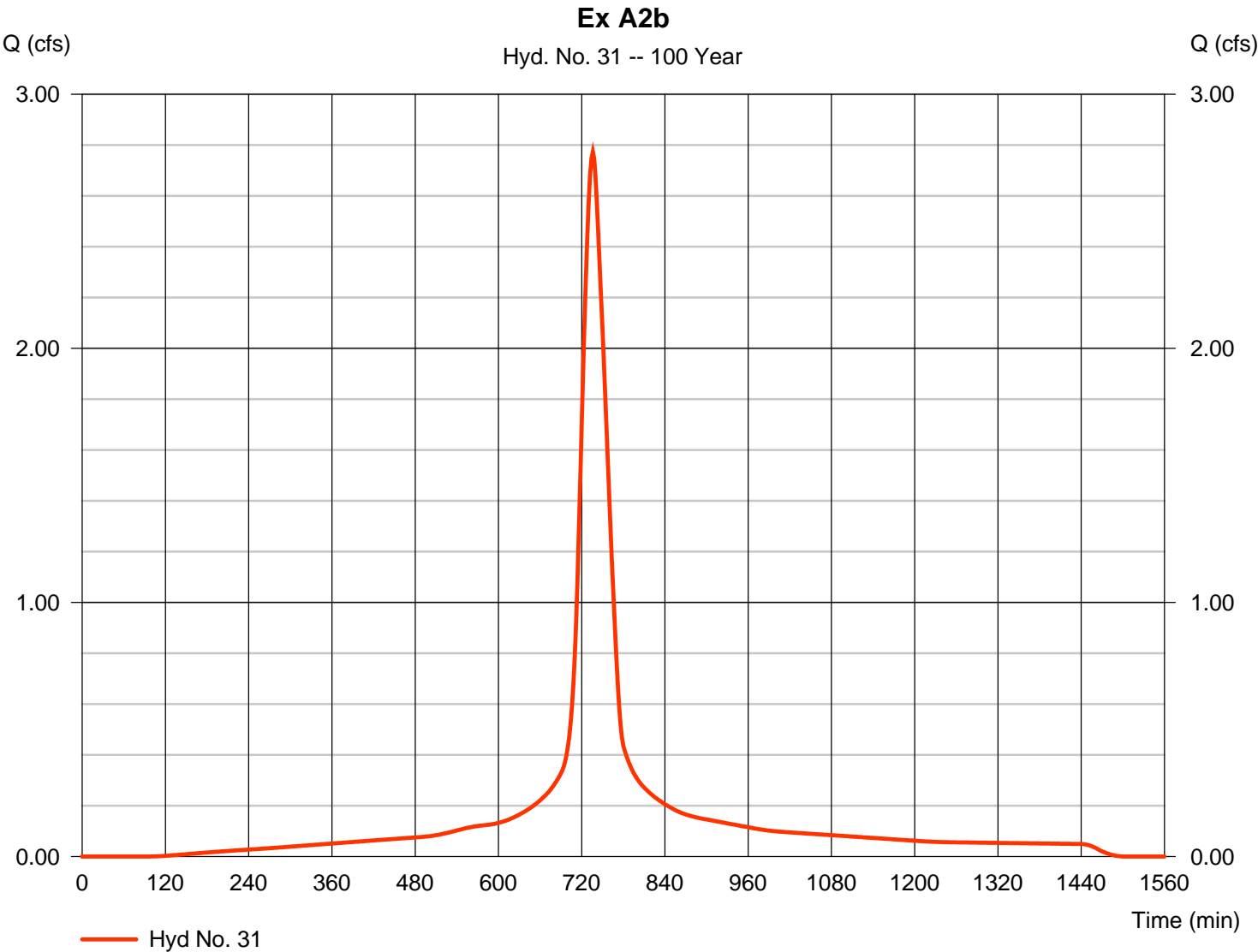


# Hydrograph Report

## Hyd. No. 31

Ex A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 2.773 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 14,547 cuft
Drainage area	= 0.430 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 38.14 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	Ex A2a+A2b
Point of Concentration	Ex A2b
Area	4.07 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.01	S2=	0	S3=	0
T1=	39.35	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	633	L2=	176	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.0025	S2=	0.0102	S3=	0
T1=	13.08	T2=	0.58	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	53.01	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	2.95	D	80
Asphalt	1.12	D	98
Concrete	0.00	D	98
Commercial C1	0.00	D	93
Total	4.07		84.95

# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

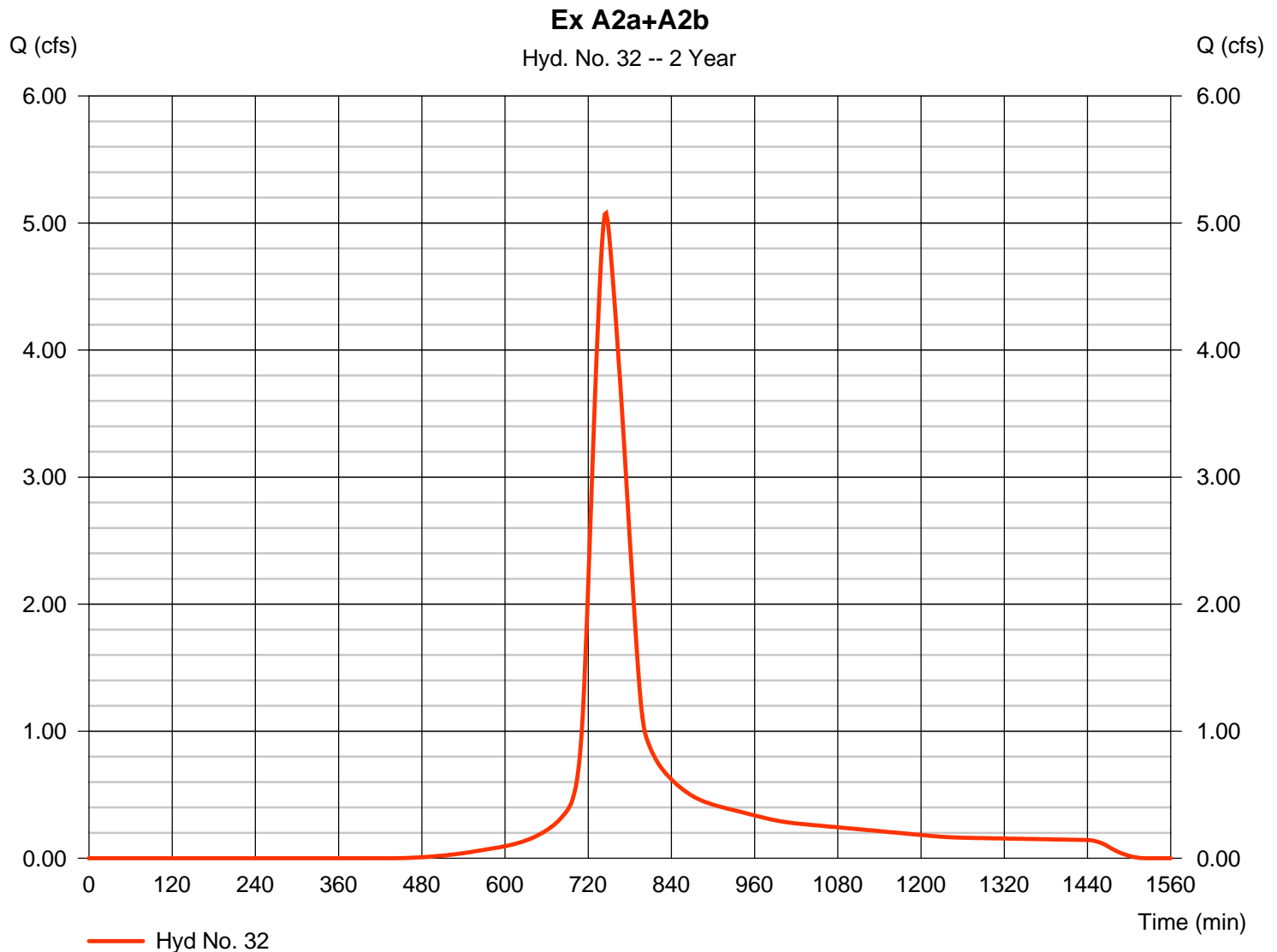
Monday, 07 / 27 / 2020

## Hyd. No. 32

Ex A2a+A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 4.070 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.52 in  
 Storm duration = 24 hrs

Peak discharge = 5.078 cfs  
 Time to peak = 746 min  
 Hyd. volume = 30,282 cuft  
 Curve number = 85  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 53.01 min  
 Distribution = Type II  
 Shape factor = 484





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

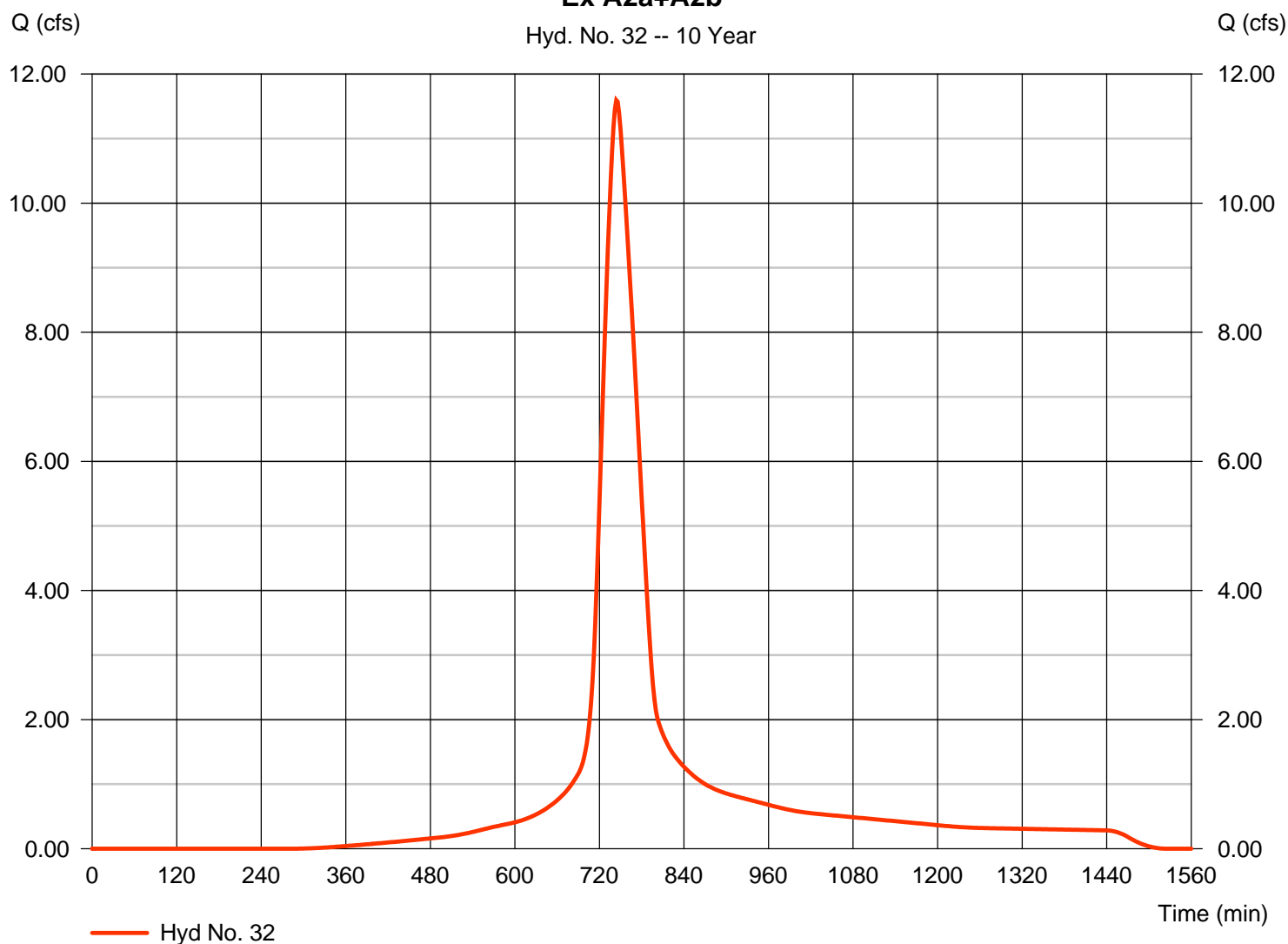
## Hyd. No. 32

Ex A2a+A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 11.60 cfs
Storm frequency	= 10 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 69,698 cuft
Drainage area	= 4.070 ac	Curve number	= 85
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 53.01 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Ex A2a+A2b

Hyd. No. 32 -- 10 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

## Hyd. No. 32

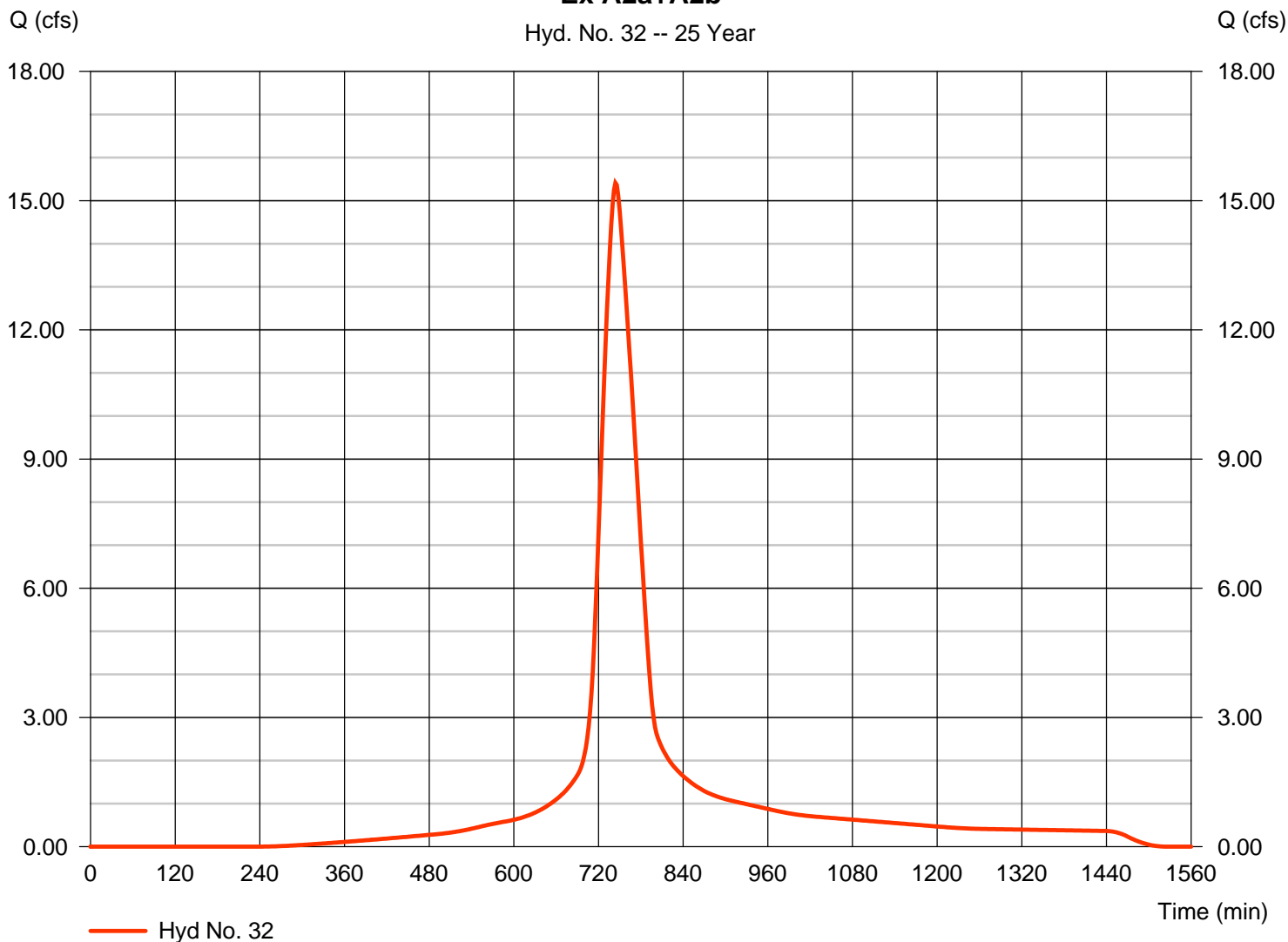
Ex A2a+A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 4.070 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 15.41 cfs  
 Time to peak = 744 min  
 Hyd. volume = 93,518 cuft  
 Curve number = 85  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 53.01 min  
 Distribution = Type II  
 Shape factor = 484

### Ex A2a+A2b

Hyd. No. 32 -- 25 Year

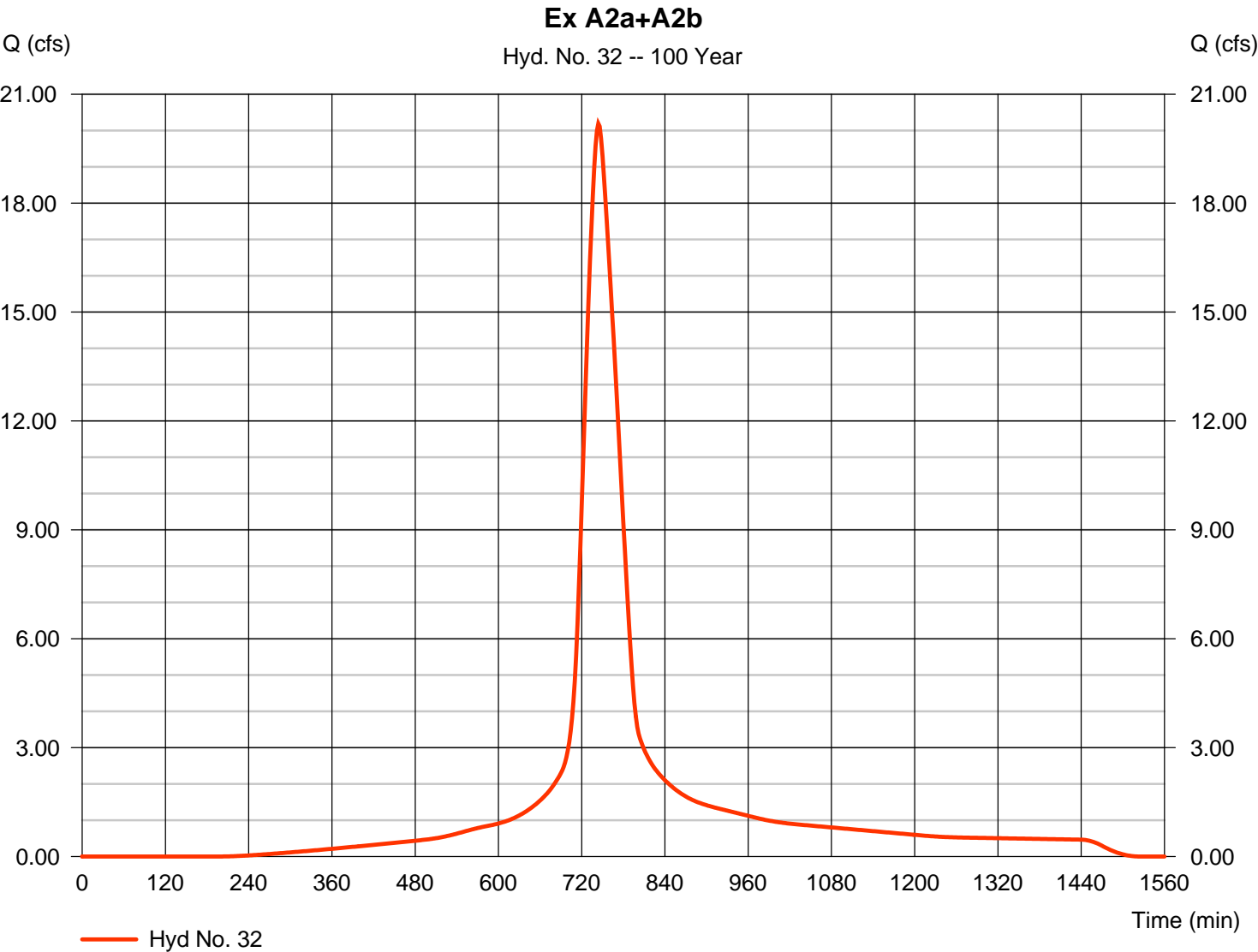


# Hydrograph Report

## Hyd. No. 32

Ex A2a+A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 20.19 cfs
Storm frequency	= 100 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 123,899 cuft
Drainage area	= 4.070 ac	Curve number	= 85
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 53.01 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	Ex A2
Point of Concentration	Ex A2
Area	4.85 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.01	S2=	0	S3=	0
T1=	39.35	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	633	L2=	176	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.0025	S2=	0.0102	S3=	0
T1=	13.08	T2=	0.58	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	53.01	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	3.73	D	80
Asphalt	1.12	D	98
Concrete	0.00	D	98
Commercial C1	0.00	D	93
Total	4.85		84.16

# Hydrograph Report

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Monday, 07 / 27 / 2020

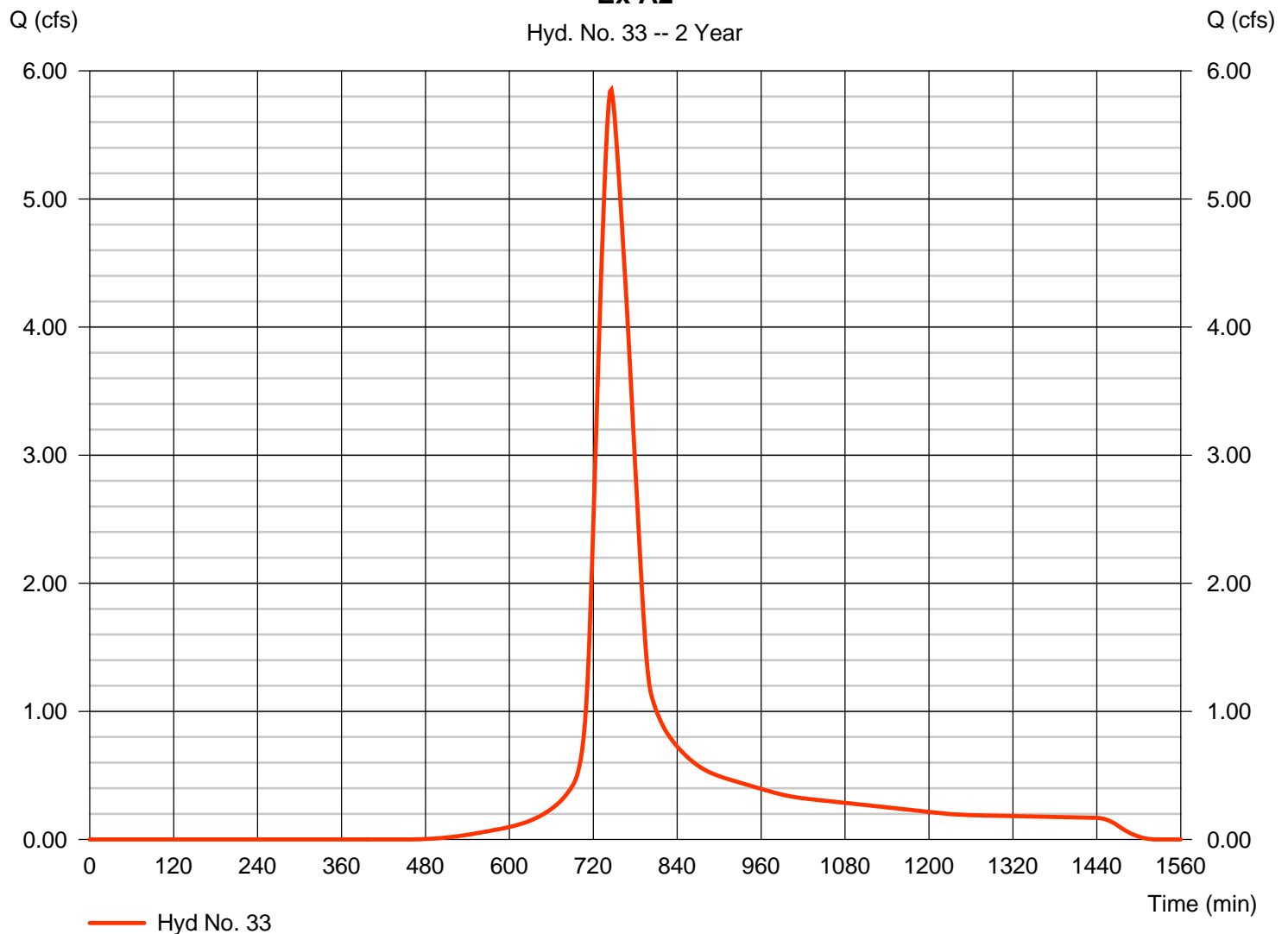
## Hyd. No. 33

Ex A2

Hydrograph type	= SCS Runoff	Peak discharge	= 5.854 cfs
Storm frequency	= 2 yrs	Time to peak	= 746 min
Time interval	= 2 min	Hyd. volume	= 34,945 cuft
Drainage area	= 4.850 ac	Curve number	= 84.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 53.01 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Ex A2

Hyd. No. 33 -- 2 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

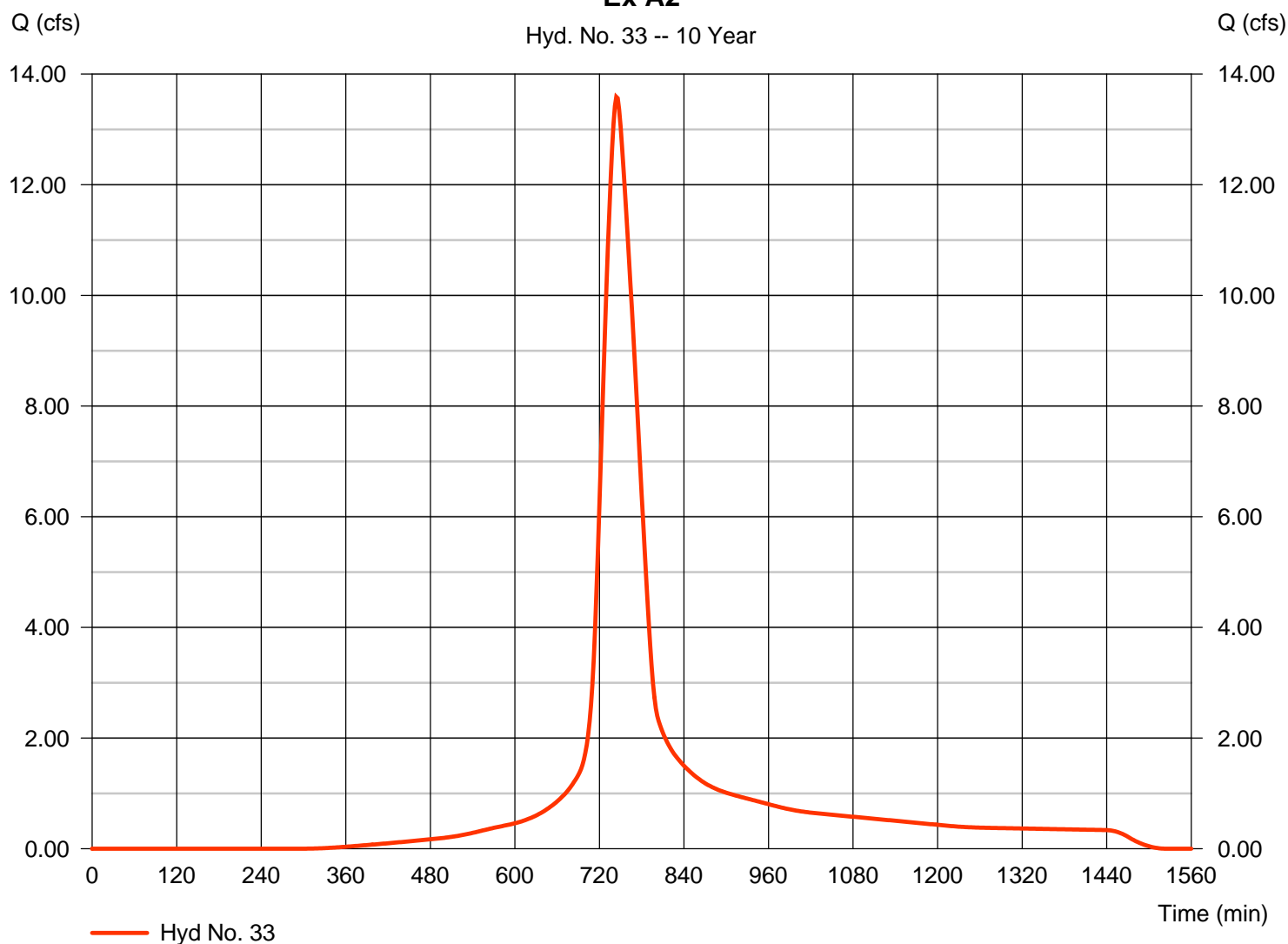
## Hyd. No. 33

Ex A2

Hydrograph type	= SCS Runoff	Peak discharge	= 13.59 cfs
Storm frequency	= 10 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 81,509 cuft
Drainage area	= 4.850 ac	Curve number	= 84.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 53.01 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Ex A2

Hyd. No. 33 -- 10 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

## Hyd. No. 33

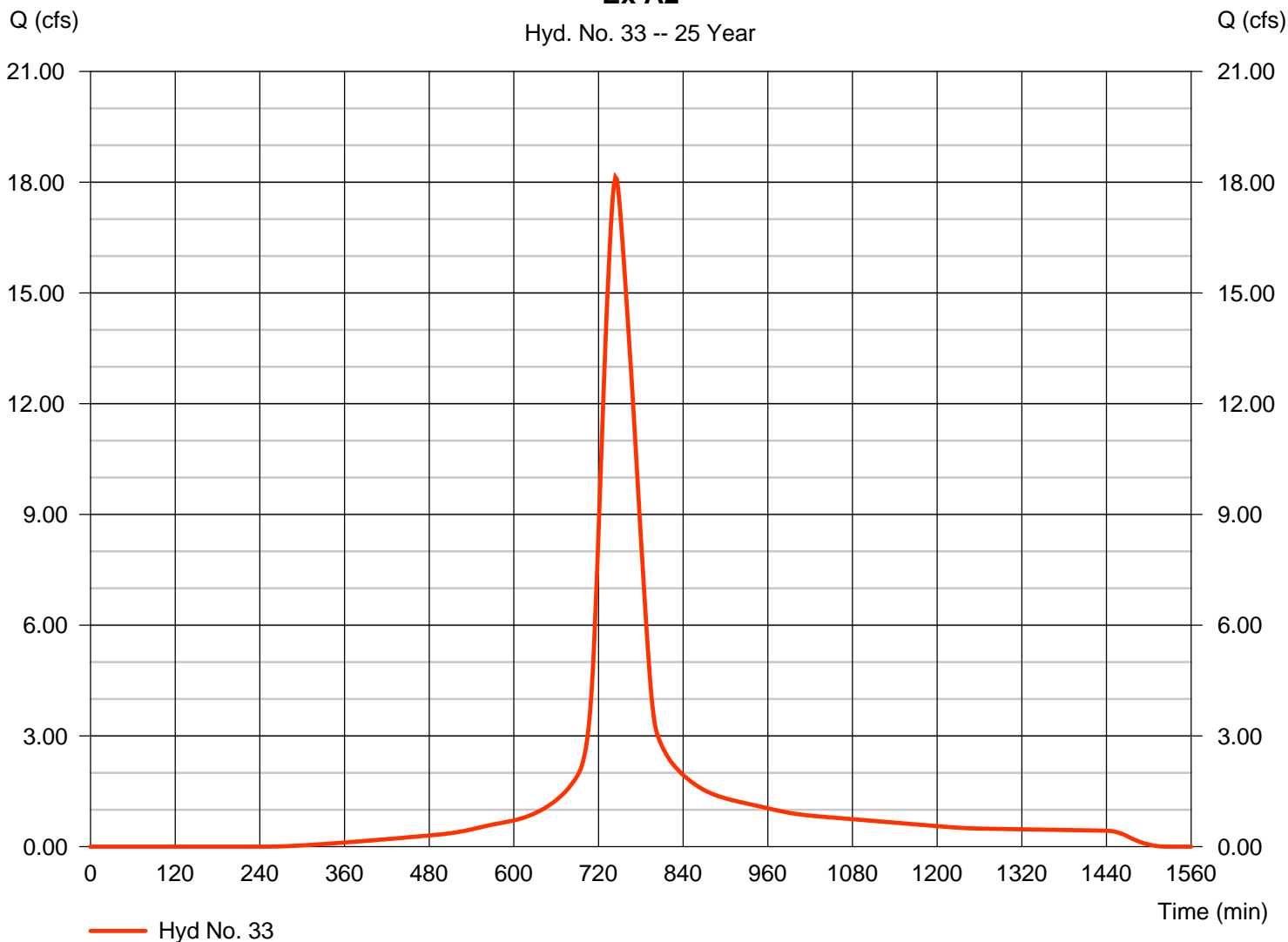
Ex A2

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 4.850 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 18.14 cfs  
 Time to peak = 744 min  
 Hyd. volume = 109,760 cuft  
 Curve number = 84.2  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 53.01 min  
 Distribution = Type II  
 Shape factor = 484

### Ex A2

Hyd. No. 33 -- 25 Year



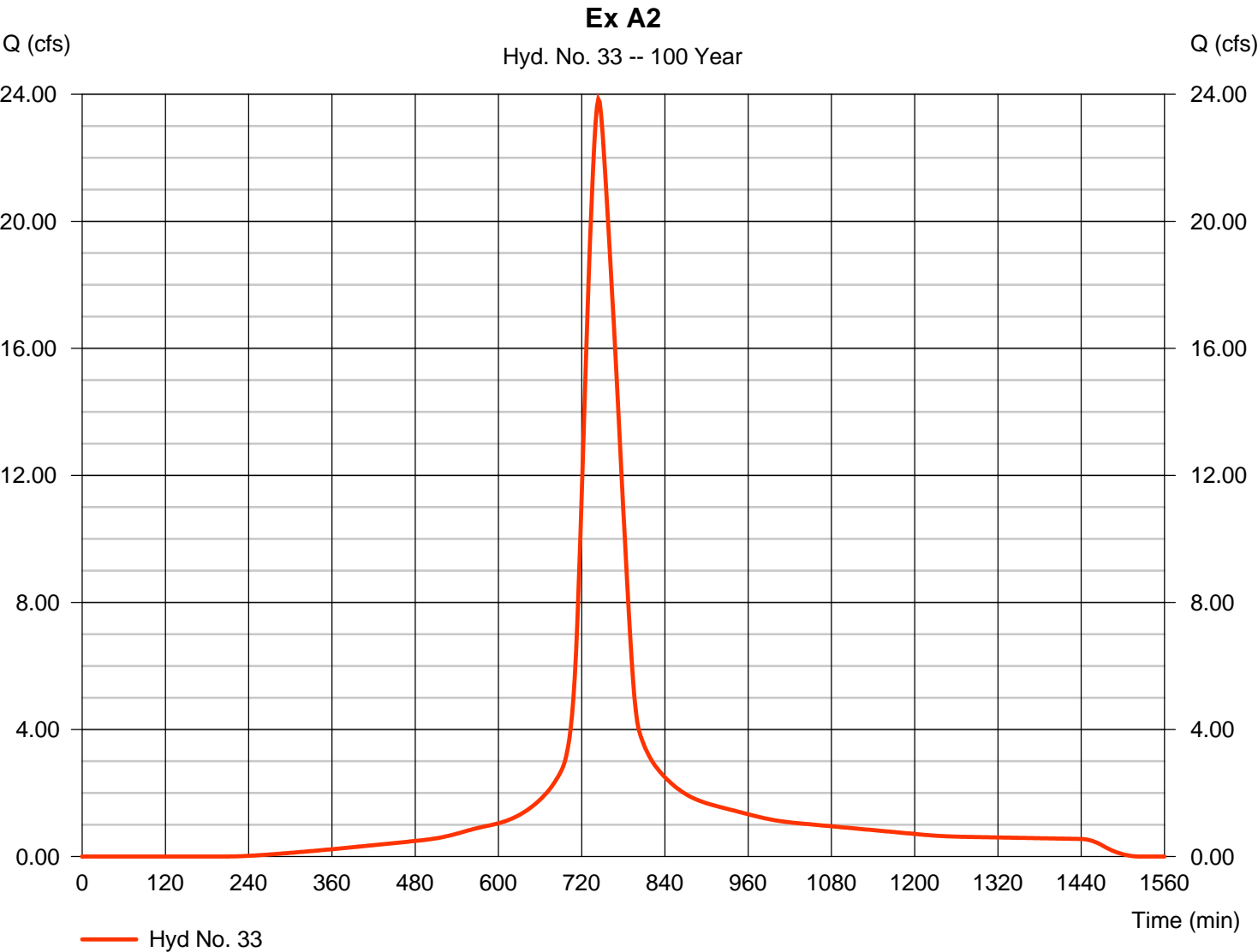


# Hydrograph Report

## Hyd. No. 33

Ex A2

Hydrograph type	= SCS Runoff	Peak discharge	= 23.84 cfs
Storm frequency	= 100 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 145,846 cuft
Drainage area	= 4.850 ac	Curve number	= 84.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 53.01 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	Ex B
Point of Concentration	Ex B
Area	9.77 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.002	S2=	0	S3=	0
T1=	74.91	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	983	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.0056	S2=	0	S3=	0
T1=	13.57	T2=	0.00	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	88.48	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	9.77	D	80
Asphalt	0.82	D	98
Concrete	0.00	D	98
Commercial C1	0.00	D	93
Total	10.59		81.39

# Hydrograph Report

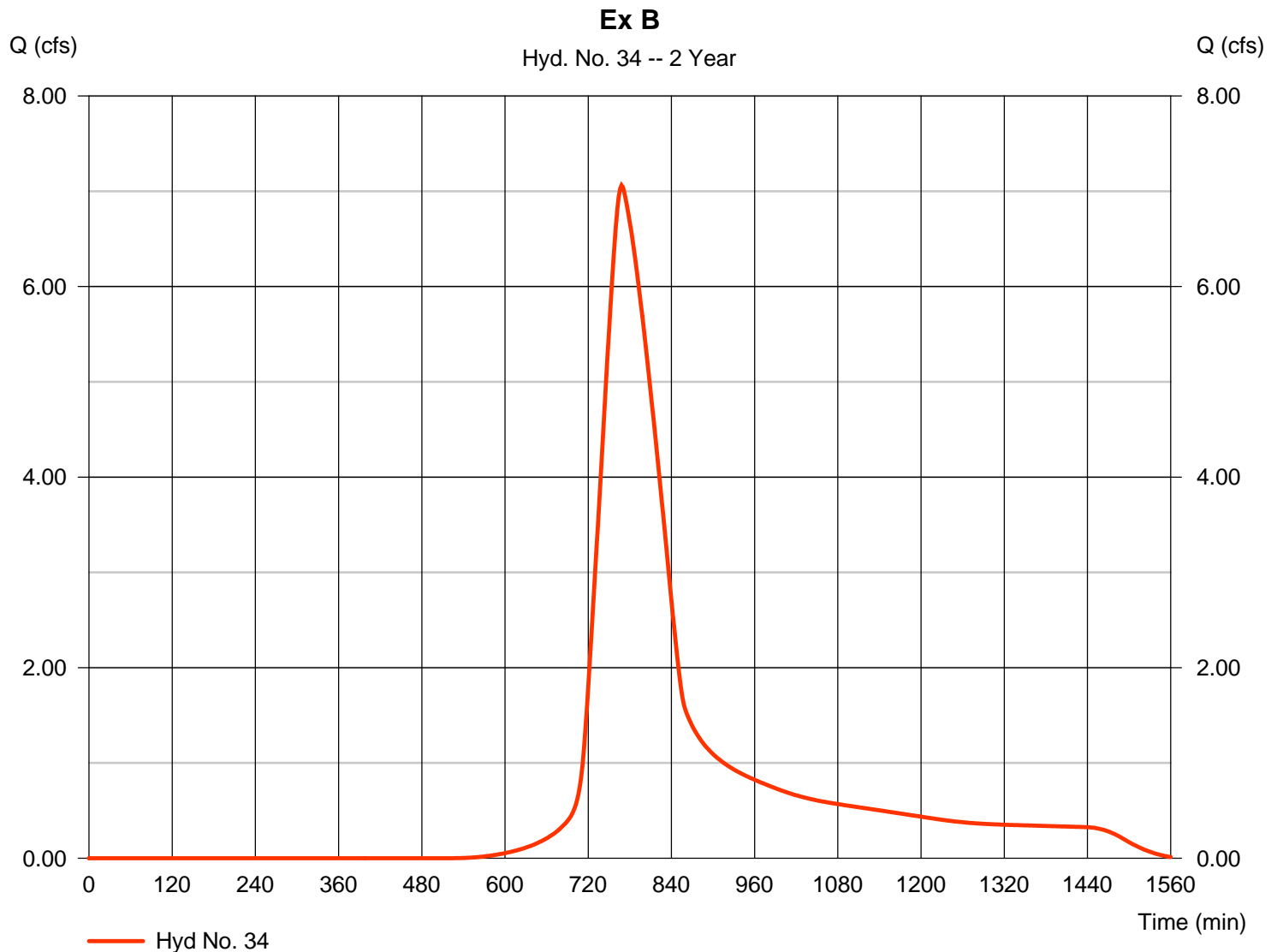
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Monday, 07 / 27 / 2020

## Hyd. No. 34

Ex B

Hydrograph type	= SCS Runoff	Peak discharge	= 7.062 cfs
Storm frequency	= 2 yrs	Time to peak	= 768 min
Time interval	= 2 min	Hyd. volume	= 62,216 cuft
Drainage area	= 9.770 ac	Curve number	= 81.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 88.48 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

## Hyd. No. 34

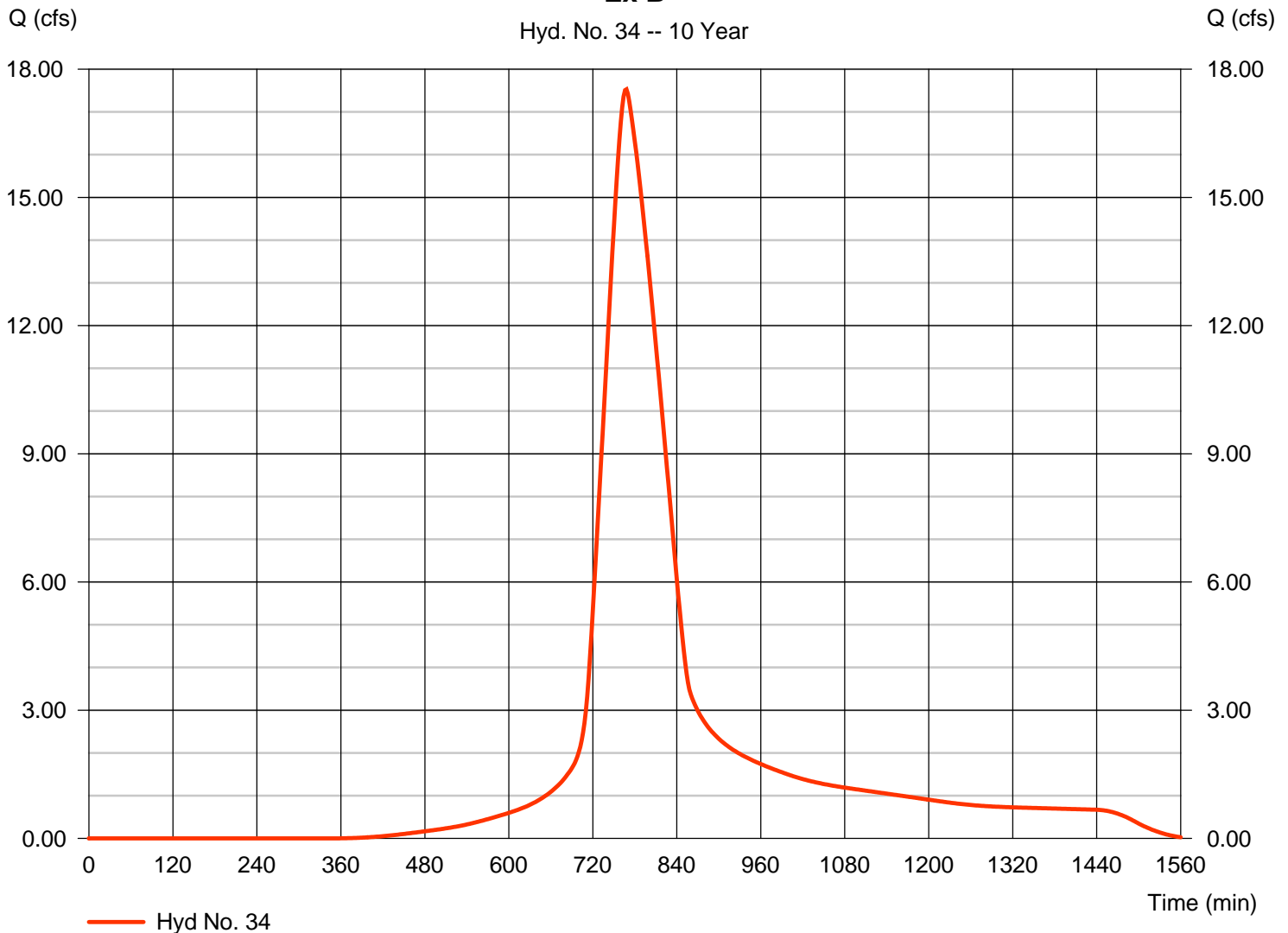
Ex B

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 9.770 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 17.53 cfs  
 Time to peak = 768 min  
 Hyd. volume = 152,236 cuft  
 Curve number = 81.4  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 88.48 min  
 Distribution = Type II  
 Shape factor = 484

### Ex B

Hyd. No. 34 -- 10 Year

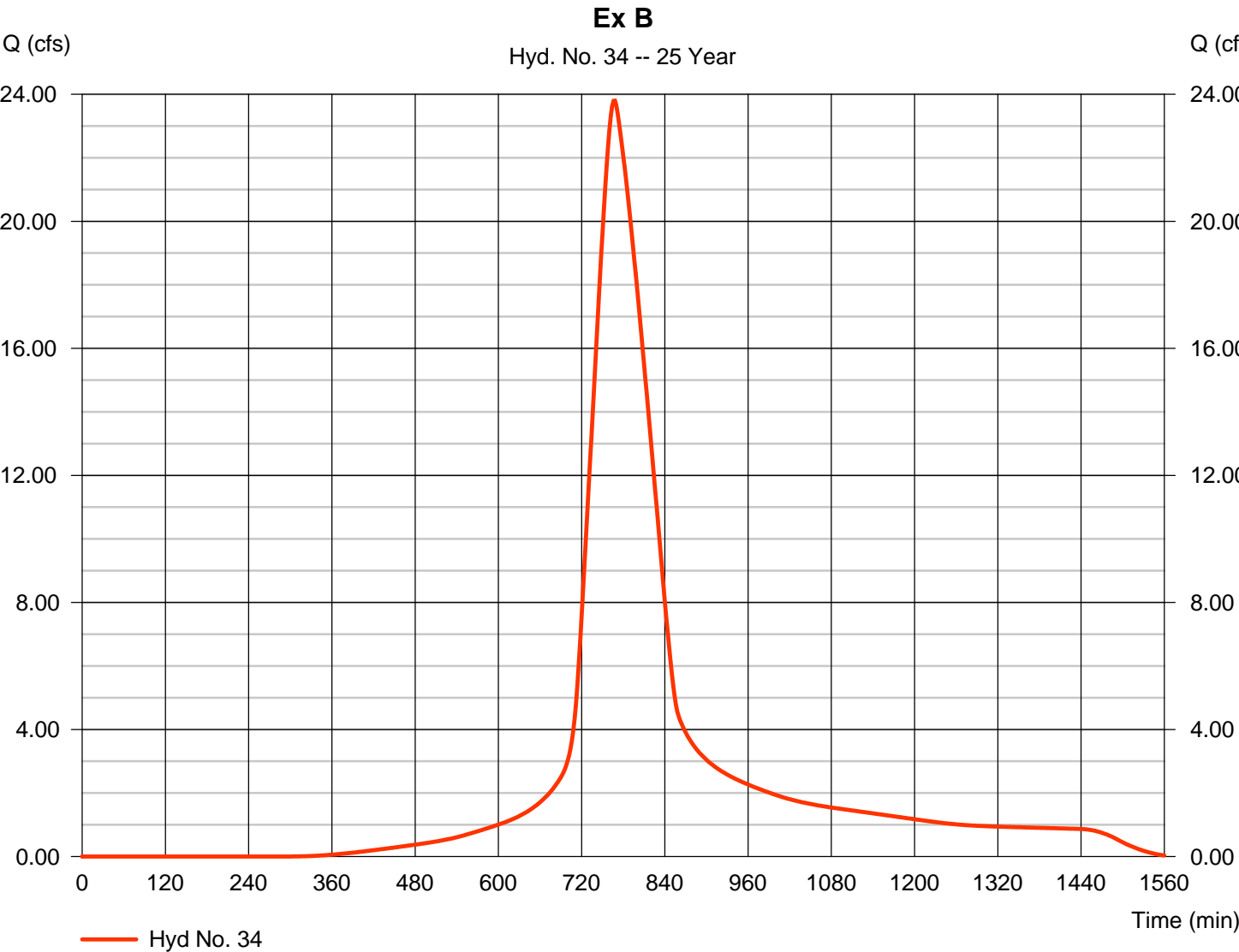


# Hydrograph Report

## Hyd. No. 34

Ex B

Hydrograph type	= SCS Runoff	Peak discharge	= 23.80 cfs
Storm frequency	= 25 yrs	Time to peak	= 768 min
Time interval	= 2 min	Hyd. volume	= 207,666 cuft
Drainage area	= 9.770 ac	Curve number	= 81.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 88.48 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

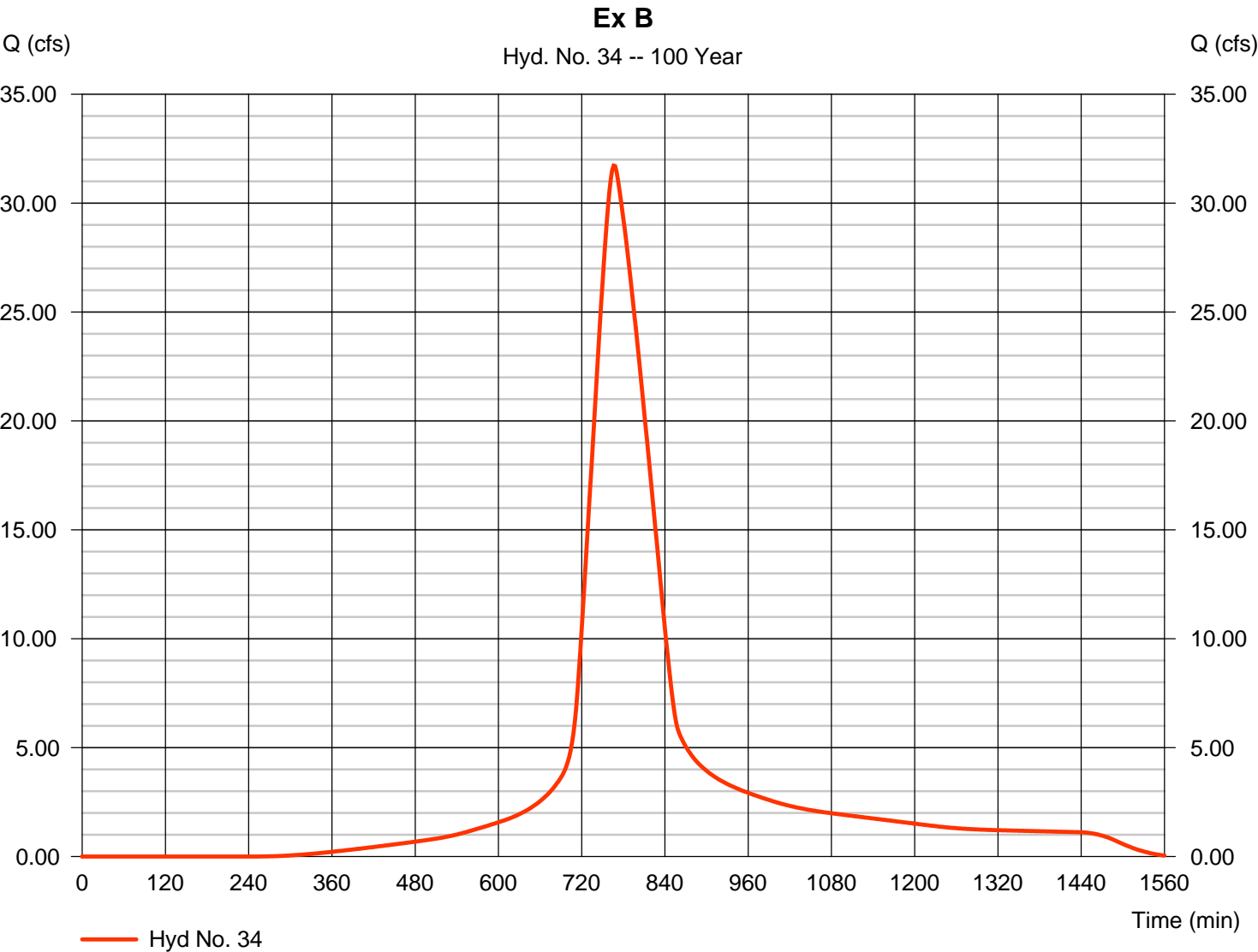


# Hydrograph Report

## Hyd. No. 34

Ex B

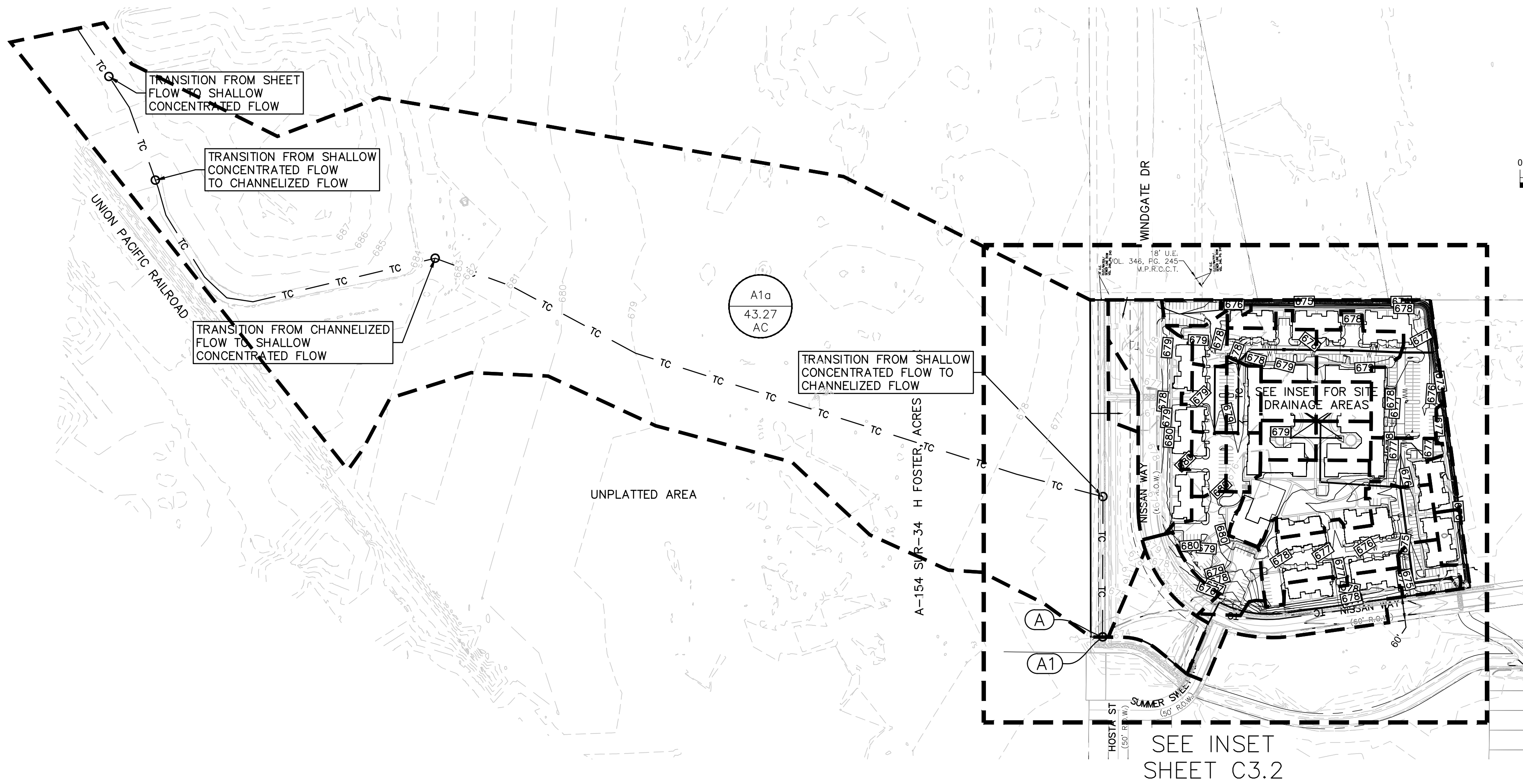
Hydrograph type	= SCS Runoff	Peak discharge	= 31.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 766 min
Time interval	= 2 min	Hyd. volume	= 278,868 cuft
Drainage area	= 9.770 ac	Curve number	= 81.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 88.48 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Attachment H

## Proposed Conditions Drainage Area Map

Drawing Name: W:\\_Projects\223 - ULF, LLC\001 - Heather (Gen Apartments)\C3A\SITE PROJECT SET\323.001\_DRAIN.dwg User: jghm Jul 29, 2020 - 10:51 am



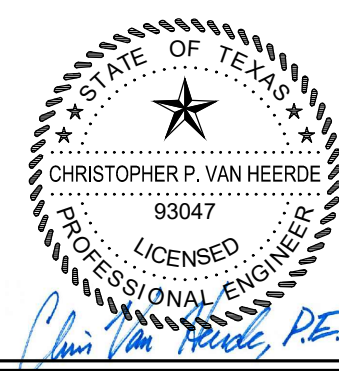
**LEGEND**

- 700 — EXISTING CONTOURS
- 700 — PROPOSED CONTOURS
- B.L. — BUILDING SETBACK LINE
- U.E. — UTILITY EASEMENT
- D.E. — DRAINAGE EASEMENT
- — DRAINAGE AREA
- TC — TC — TIME OF CONCENTRATION
- A-1 — POINT OF CONCENTRATION
- DA — DRAINAGE AREA LABEL

Table 2 - Proposed Conditions Hydrology Calculations - City of New Braunfels								
Point of Concentration	Drainage Area	Area	T <sub>c</sub>	Q <sub>N</sub>	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
A1a	A1a	43.27	74.13	80.34	34.66	88.02	120.18	160.94
A1b	A1b	1.93	36.79	93.15	5.06	9.48	12.01	15.20
A1c	A1b+A1c	2.20	36.79	91.53	4.49	9.01	11.60	14.83
A1	A1a+A1b+A1c	45.47	74.13	80.89	37.27	93.31	126.97	169.55
A2b	A2b	0.41	14.34	96.78	1.43	2.71	3.45	4.36
A2a	A2a+A2b	2.72	14.34	95.24	9.59	18.13	23.03	29.17
A2	A2a+A2b+A2c	3.52	52.43	91.85	5.65	11.30	14.54	18.58
B1a	B1a	0.27	17.88	93.00	0.82	1.60	2.05	2.61
B1b	B1b	0.21	10.00	93.00	0.77	1.50	1.92	2.44
B2a	B2a	0.33	10.00	93.00	1.21	2.36	3.02	3.84
B2b	B2b	0.36	10.00	93.00	1.31	2.55	3.25	4.14
B2c	B2c	0.28	11.31	93.00	0.98	1.90	2.42	3.08
B2d	B2d	0.35	10.00	93.00	1.28	2.50	3.20	4.06
B2e	B2e	0.32	17.85	93.00	2.00	3.90	4.99	6.35
B2f	B2f	0.63	20.77	93.00	1.82	3.54	4.54	5.77
B3a	B3a	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3b	B3b	0.32	25.58	93.00	0.83	1.62	2.07	2.64
B3c	B3c	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3d	B3d	0.32	25.58	93.00	0.81	1.58	2.03	2.59
B3e	B3e	1.33	47.04	93.00	2.36	4.63	5.93	7.56
B3f	B3f	0.44	14.10	93.00	1.47	2.87	3.67	4.66
B3g	B3g	1.55	12.01	93.00	5.41	10.52	13.45	17.10
B3h	B3h	0.38	10.00	93.00	1.38	2.68	3.43	4.36
B4a	B4a	1.72	10.73	93.00	6.18	12.02	15.37	19.55
B4b	B4b	0.28	63.42	93.00	0.41	0.80	1.03	1.31
B4c	B4c	0.23	52.52	93.00	0.38	0.75	0.96	1.22
B	B	9.96	63.42	93.00	16.15	31.54	40.34	51.35

Table 4 - Existing to Proposed Comparison					
Point of Concentration	Drainage Area	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
Ex B	Ex B	7.06	17.53	23.80	31.72
B	B	16.15	31.54	40.34	51.35
Proposed is Less Than or Equal to Existing		NO	NO	NO	NO

290 S. CASTELL AVE., STE. 100  
NEW BRAUNFELS, TX 78130  
TBPE FIRM F-10961  
TBPLS FIRM 1053600



07/29/2020

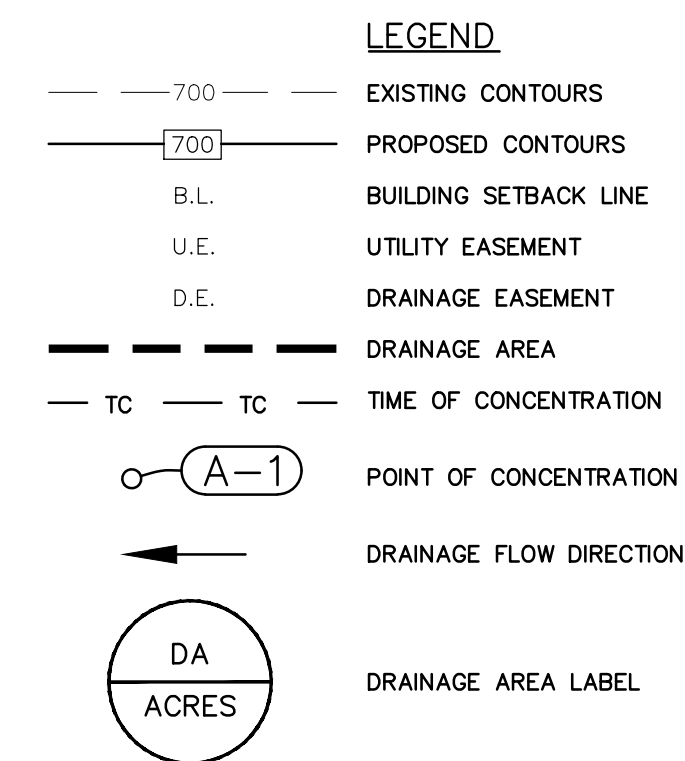
**PROPOSED DRAINAGE  
AREA MAP**  
VANGUARD FARMS APARTMENTS

NO.	REVISION	DESCRIPTION	REVISION DATE	
			DATE	
1				
2				
3				
4				
5				

DATE: **JULY 2020**  
DRAWN BY: **LB**  
DESIGNED BY: **JMM**  
REVIEWED BY: **CVH**  
HMT PROJECT NO.:  
**323.001**

**SHEET**  
**C3.1**



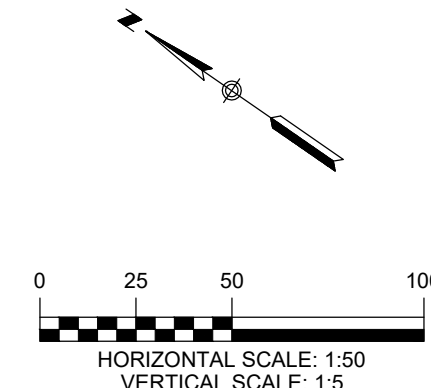
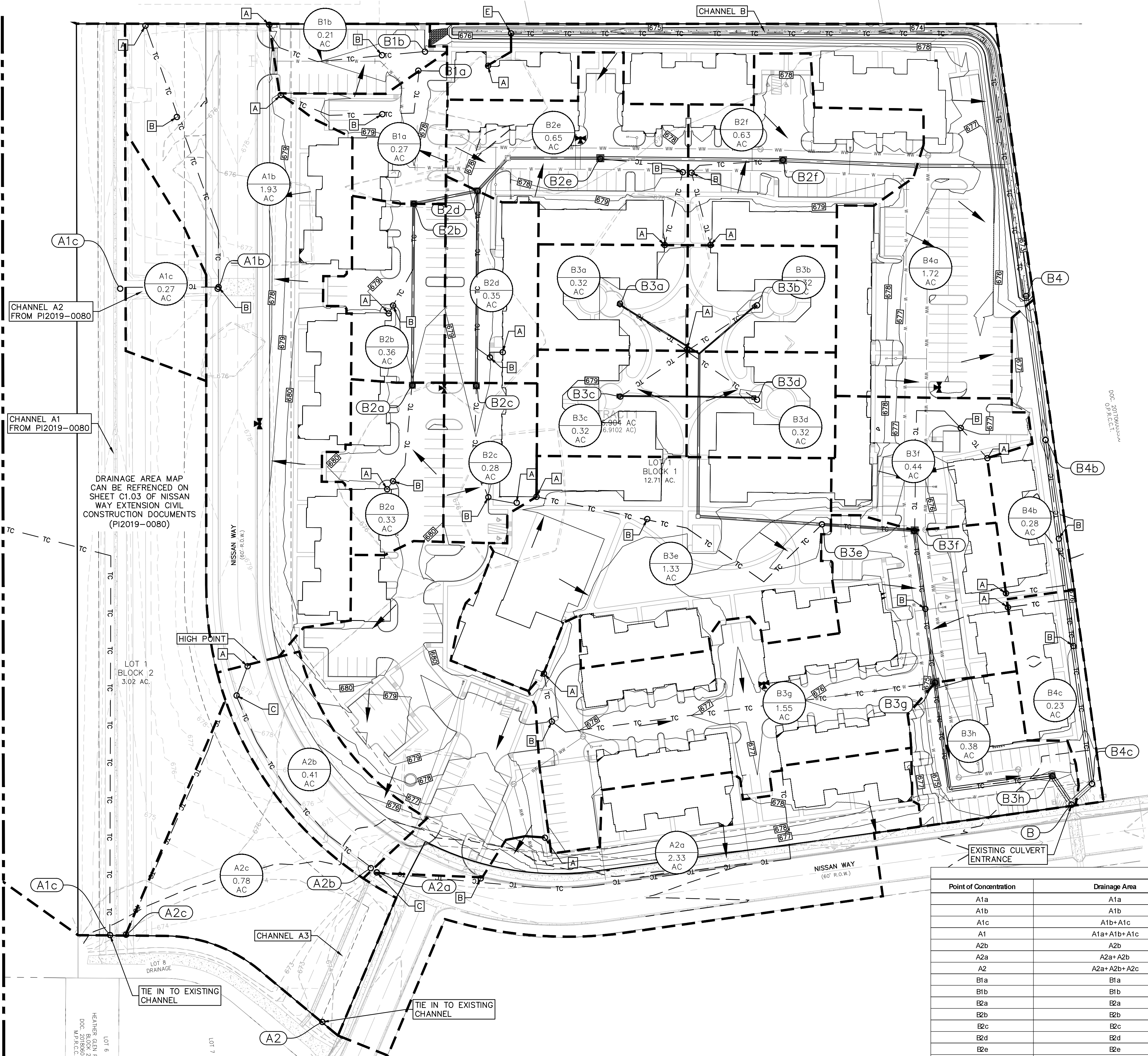


Point of Concentration	Drainage Area	Area	T <sub>c</sub>	CN	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
A1a	A1a	43.27	74.13	80.34	34.66	88.02	120.18	160.94
A1b	A1b	1.93	36.79	93.15	5.06	9.48	12.01	15.20
A1c	A1b+ A1c	2.20	36.79	91.53	4.49	9.01	11.60	14.83
A1	A1a+ A1b+ A1c	45.47	74.13	80.89	37.27	93.31	126.97	169.55
A2b	A2b	0.41	14.34	96.78	1.43	2.71	3.45	4.36
A2a	A2a+ A2b	2.72	14.34	95.24	9.59	18.13	23.03	29.17
A2	A2a+ A2b+ A2c	3.52	52.43	91.85	5.65	11.30	14.54	18.58
B1a	B1a	0.27	17.88	93.00	0.82	1.60	2.05	2.61
B1b	B1b	0.21	10.00	93.00	0.77	1.50	1.92	2.44
B2a	B2a	0.33	10.00	93.00	1.21	2.36	3.02	3.84
B2b	B2b	0.36	10.00	93.00	1.31	2.55	3.25	4.14
B2c	B2c	0.28	11.31	93.00	0.98	1.90	2.42	3.08
B2d	B2d	0.35	10.00	93.00	1.28	2.50	3.20	4.06
B2e	B2e	0.32	17.85	93.00	2.00	3.90	4.99	6.35
B2f	B2f	0.63	20.77	93.00	1.82	3.54	4.54	5.77
B3a	B3a	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3b	B3b	0.32	25.58	93.00	0.83	1.62	2.07	2.64
B3c	B3c	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3d	B3d	0.32	25.58	93.00	0.81	1.58	2.03	2.59
B3e	B3e	1.33	47.04	93.00	2.36	4.63	5.93	7.56
B3f	B3f	0.44	14.10	93.00	1.47	2.87	3.67	4.66
B3g	B3g	1.55	12.01	93.00	5.41	10.52	13.45	17.10
B3h	B3h	0.38	10.00	93.00	1.38	2.68	3.43	4.36
B4a	B4a	1.72	10.73	93.00	6.18	12.02	15.37	19.55
B4b	B4b	0.28	63.42	93.00	0.41	0.80	1.03	1.31
B4c	B4c	0.23	52.52	93.00	0.38	0.75	0.96	1.22
B	B	9.96	63.42	93.00	16.15	31.54	40.34	51.35

Point of Concentration	Drainage Area	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
Ex B	Ex B	7.06	17.53	23.80	31.72
B	B	16.15	31.54	40.34	51.35
Proposed is Less Than or Equal to Existing		NO	NO	NO	NO



SEE SHEET C1.03 OF NISSAN WAY EXTENSION (PI2019-0080) FOR ULTIMATE DRAINAGE AREA MAP



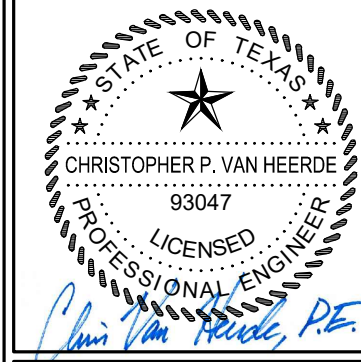
- LEGEND**
- 700 — EXISTING CONTOURS
  - 700 — PROPOSED CONTOURS
  - B.L. BUILDING SETBACK LINE
  - U.E. UTILITY EASEMENT
  - D.E. DRAINAGE EASEMENT
  - — DRAINAGE AREA
  - TC — TC — TIME OF CONCENTRATION
  - A-1 POINT OF CONCENTRATION
  - DRAINAGE FLOW DIRECTION
  - DA ACRES DRAINAGE AREA LABEL
  - A — = BEGIN SHEET FLOW
  - B — = TRANSITION FROM SHEET FLOW TO SHALLOW CONCENTRATED FLOW
  - C — = TRANSITION FROM SHALLOW CONCENTRATED FLOW TO CHANNEL FLOW
  - D — = TRANSITION FROM UNPAVED TO PAVED SHALLOW CONCENTRATED FLOW
  - E — = TRANSITION FROM SHEET FLOW TO CHANNEL FLOW

Table 4 - Existing to Proposed Comparison					
Point of Concentration	Drainage Area	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
Ex B	Ex B	7.06	17.53	23.80	31.72
B	B	16.15	31.54	40.34	51.35
Proposed: Is Less Than or Equal to Existing		NO	NO	NO	NO

Table 2 - Proposed Conditions Hydrology Calculations - City of New Braunfels

Point of Concentration	Drainage Area	Area	T <sub>c</sub>	CN	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
A1a	A1a	43.27	74.13	80.34	34.66	88.02	120.18	160.94
A1b	A1b	1.93	36.79	93.15	5.06	9.48	12.01	15.20
A1c	A1b+A1c	2.20	36.79	91.53	4.49	9.01	11.60	14.83
A1	A1a+A1b+A1c	45.47	74.13	80.89	37.27	93.31	126.97	169.55
A2b	A2b	0.41	14.34	96.78	1.43	2.71	3.45	4.36
A2a	A2a+A2b	2.72	14.34	95.24	9.59	18.13	23.03	29.17
A2	A2a+A2b+A2c	3.52	52.43	91.85	5.65	11.30	14.54	18.58
B1a	B1a	0.27	17.88	93.00	0.82	1.60	2.05	2.61
B1b	B1b	0.21	10.00	93.00	0.77	1.50	1.92	2.44
B2a	B2a	0.33	10.00	93.00	1.21	2.36	3.02	3.84
B2b	B2b	0.36	10.00	93.00	1.31	2.55	3.25	4.14
B2c	B2c	0.28	11.31	93.00	0.98	1.90	2.42	3.08
B2d	B2d	0.35	10.00	93.00	1.28	2.50	3.20	4.06
B2e	B2e	0.32	17.85	93.00	2.00	3.90	4.99	6.35
B2f	B2f	0.63	20.77	93.00	1.82	3.54	4.54	5.77
B3a	B3a	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3b	B3b	0.32	25.58	93.00	0.83	1.62	2.07	2.64
B3c	B3c	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3d	B3d	0.32	25.58	93.00	0.81	1.58	2.03	2.59
B3e	B3e	1.33	47.04	93.00	2.36	4.63	5.93	7.56
B3f	B3f	0.44	14.10	93.00	1.47	2.87	3.67	4.66
B3g	B3g	1.55	12.01	93.00	5.41	10.52	13.45	17.10
B3h	B3h	0.38	10.00	93.00	1.38	2.68	3.43	4.36
B4a	B4a	1.72	10.73	93.00	6.18	12.02	15.37	19.55
B4b	B4b	0.28	63.42	93.00	0.41	0.80	1.03	1.31
B4c	B4c	0.23	52.52	93.00	0.38	0.75	0.96	1.22
B	B	9.96	63.42	93.00	16.15	31.54	40.34	51.35

290 S. CASTELL AVE., STE. 100  
NEW BRAUNFELS, TX 78130  
TBPLS FIRM F-10961  
TBPLS FIRM 1053600



07/29/2020

**PROPOSED DRAINAGE  
AREA MAP INSET**  
VANGUARD FARMS APARTMENTS

REVISION DESCRIPTION		REVISION DATE
NO.		

DATE: JULY 2020  
DRAWN BY: LB  
DESIGNED BY: JMM  
REVIEWED BY: CVH  
HMT PROJECT NO.: 323.001

**SHEET  
C3.2**



# Attachment I

Proposed Conditions

Hydrology/Hydraulic Calculations –  
Drainage Area A

Watershed	A1a
Point of Concentration	A1a
Area	43.27 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.01	S2=	0	S3=	0
T1=	39.35	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	2139	L2=	0	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.005	S2=	0.0046	S3=	0
T1=	31.25	T2=	0.00	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	1270	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	3.53	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	74.13	minutes
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	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	42.45	D	80
Impervious, Paved	0.82	D	98
Concrete	0.00	D	89
Commercial C1	0.00	D	93
<b>Total</b>	<b>43.27</b>		<b>80.34</b>

# Hydrograph Report

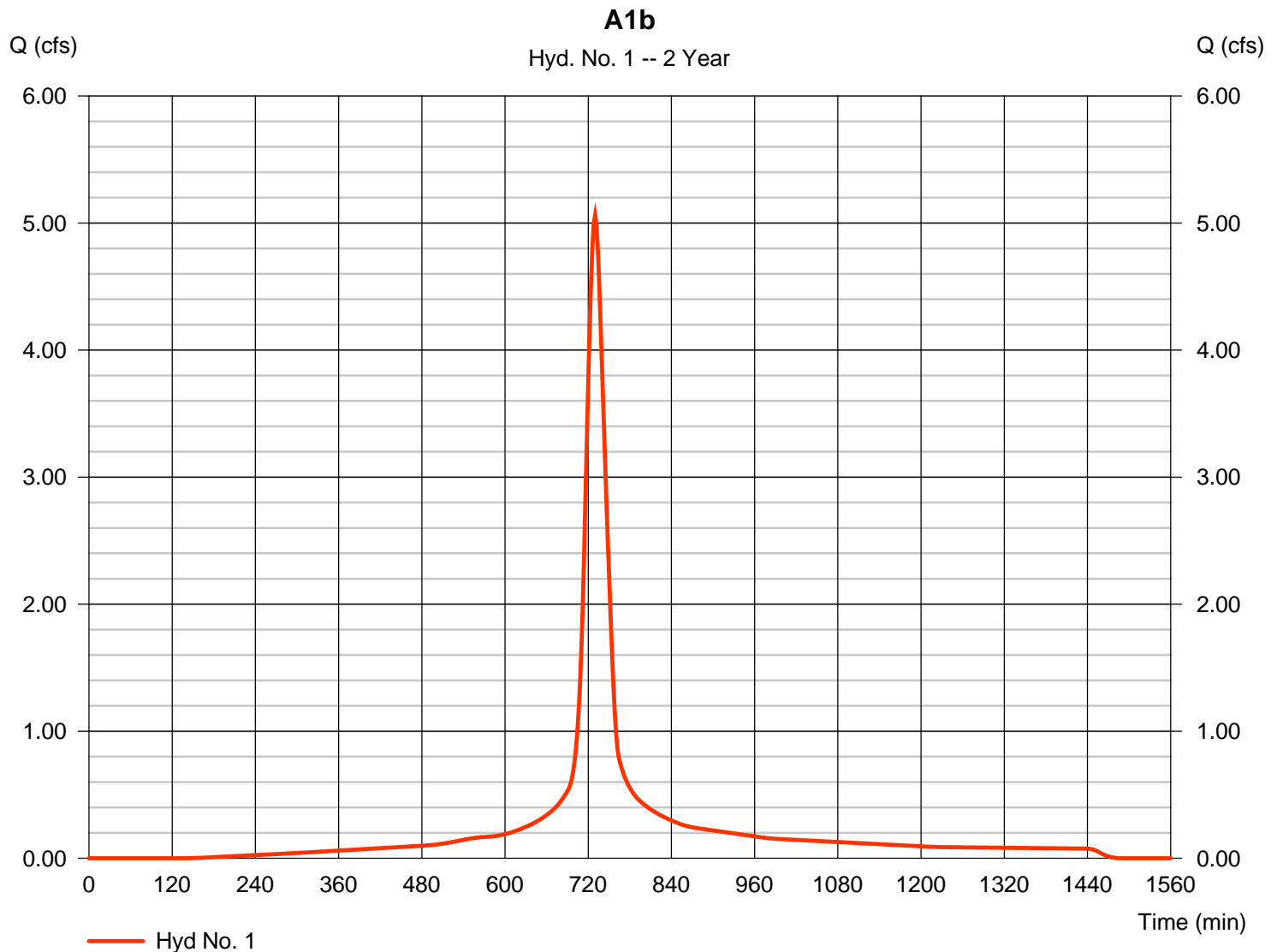
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 1

A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 5.059 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 21,473 cuft
Drainage area	= 1.930 ac	Curve number	= 96
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.70 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

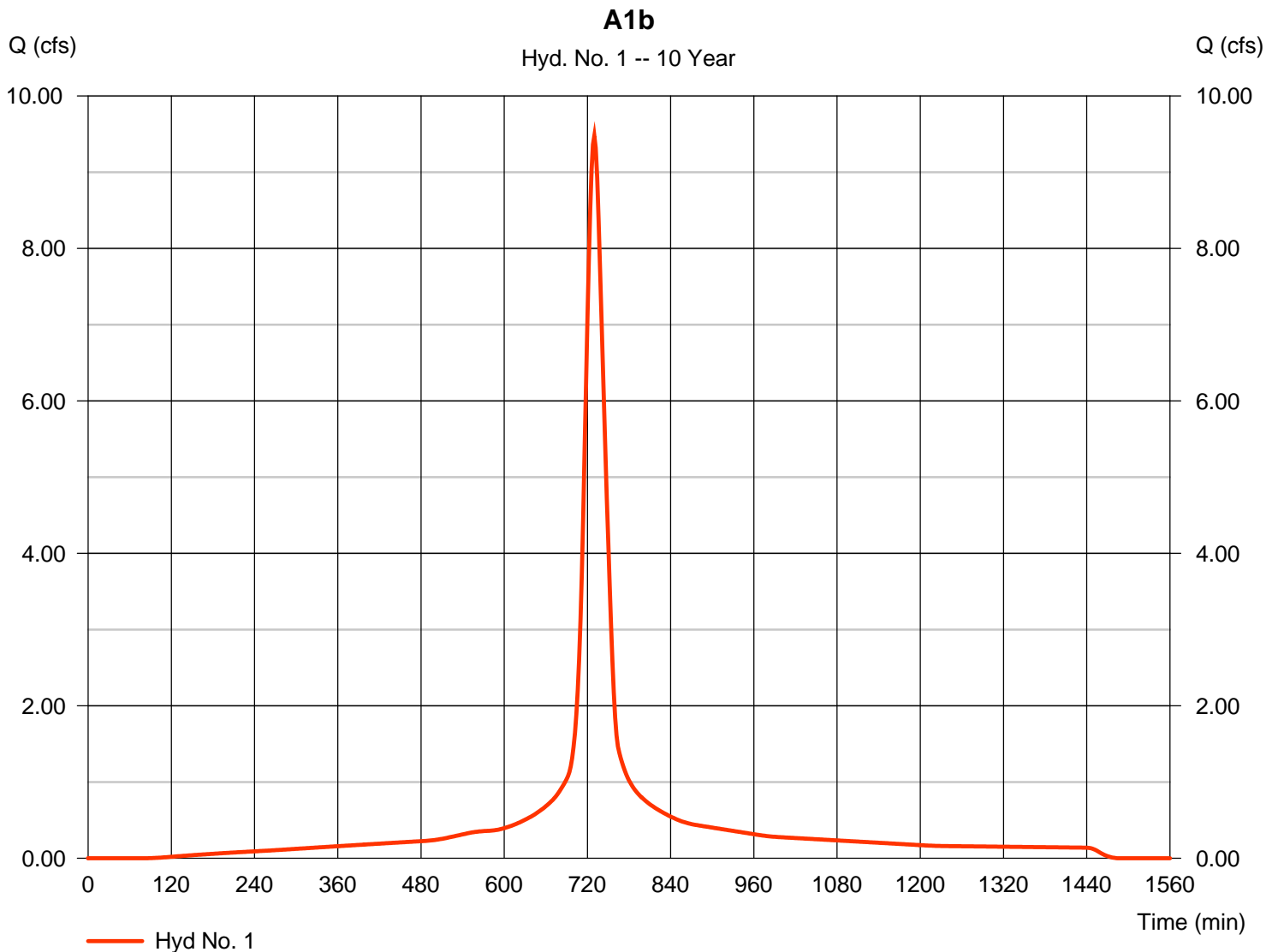
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 1

A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 9.475 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 41,515 cuft
Drainage area	= 1.930 ac	Curve number	= 96
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.70 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

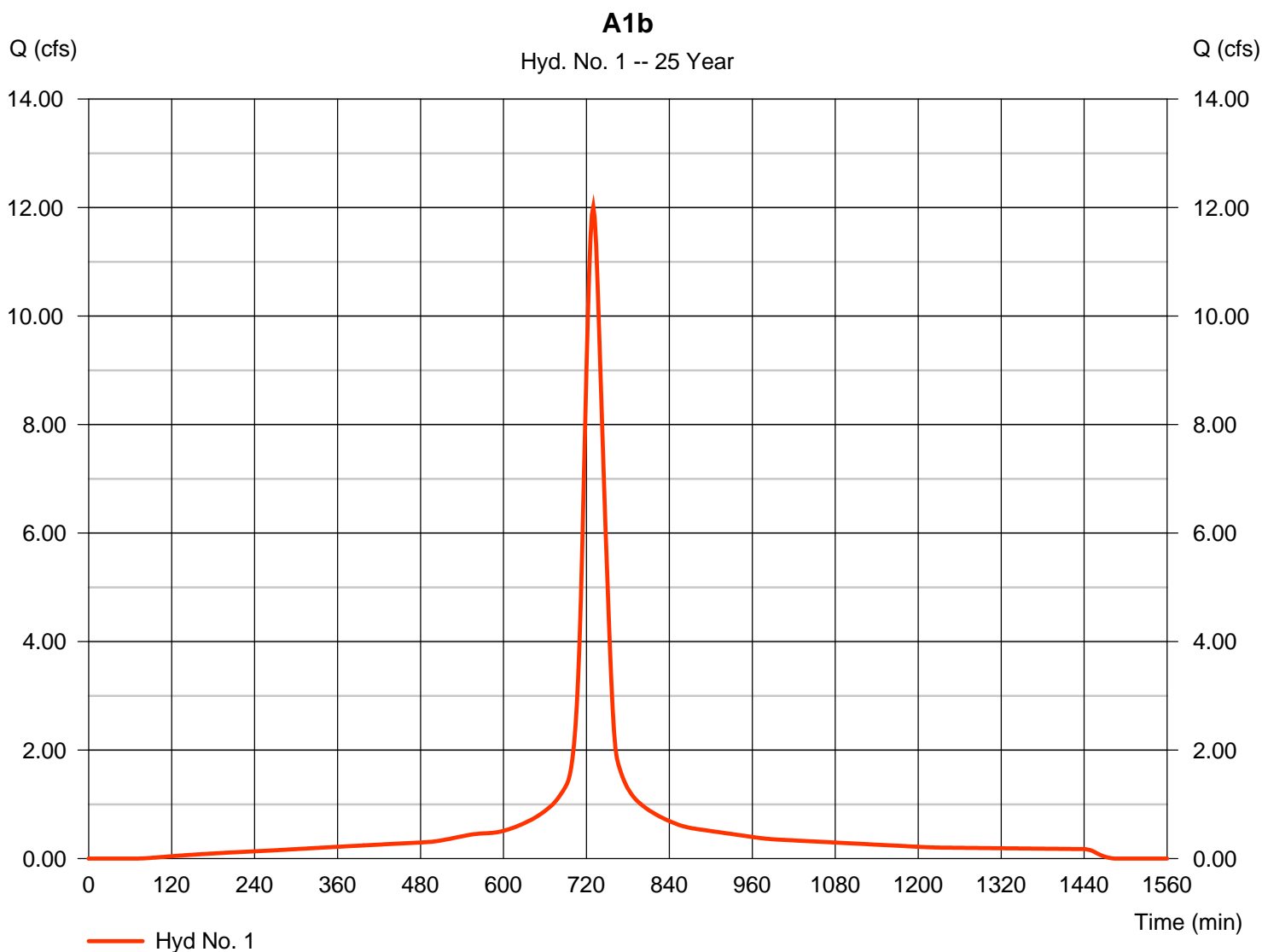
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 1

A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 12.01 cfs
Storm frequency	= 25 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 53,179 cuft
Drainage area	= 1.930 ac	Curve number	= 96
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.70 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

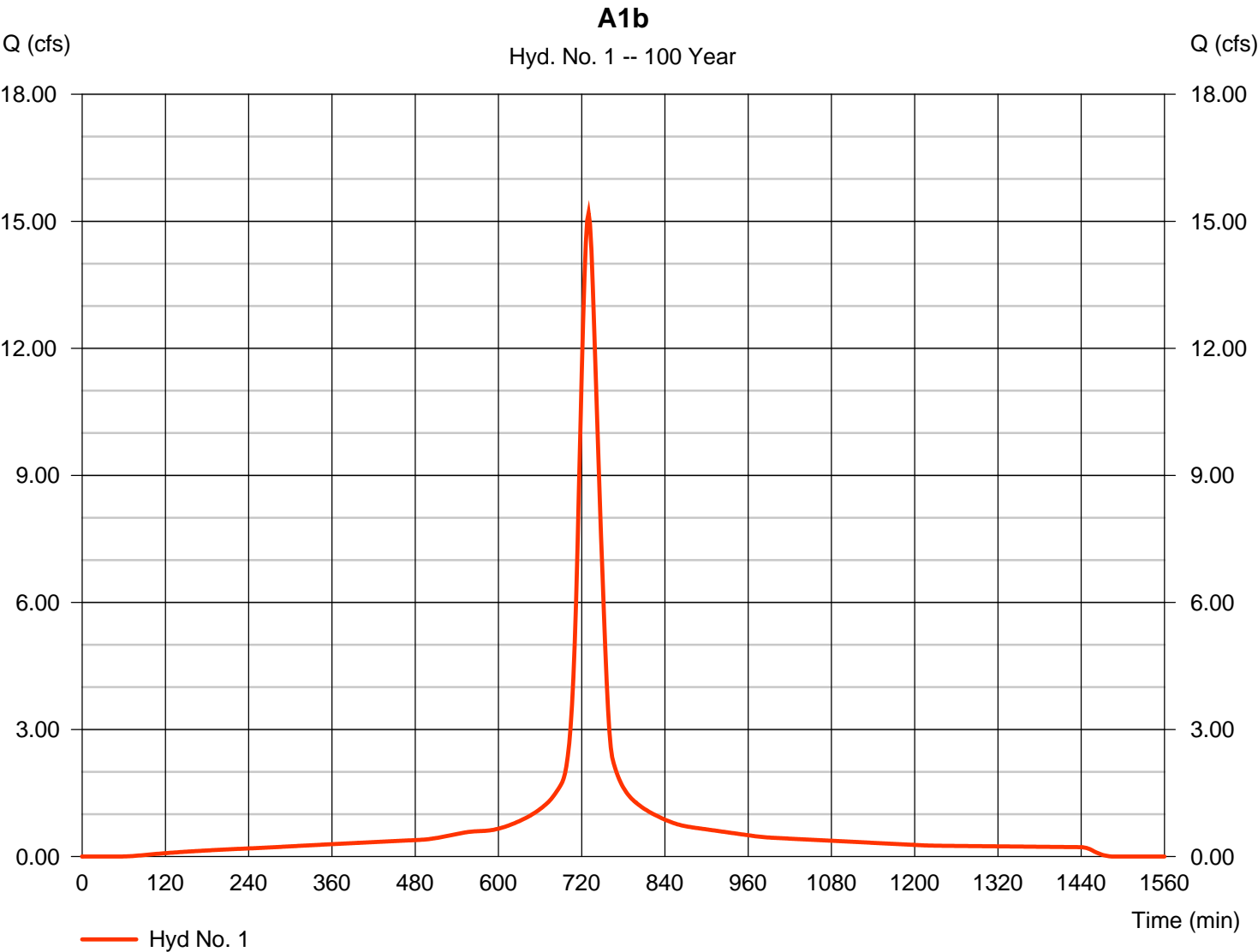


# Hydrograph Report

## Hyd. No. 1

A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 15.20 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 67,863 cuft
Drainage area	= 1.930 ac	Curve number	= 96
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.70 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





Watershed	A1b
Point of Concentration	A1b
Area	1.93 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.026	S2=	0	S3=	0
T1=	26.85	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	113	L2=	53	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.0046	S2=	0.0046	S3=	0
T1=	8.33	T2=	0.26	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	35.44	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.29	D	80
Impervious, Paved	0.81	D	98
Concrete	0.00	D	89
Commercial C1	0.83	D	93
<b>Total</b>	<b>1.93</b>		<b>93.15</b>

# Hydrograph Report

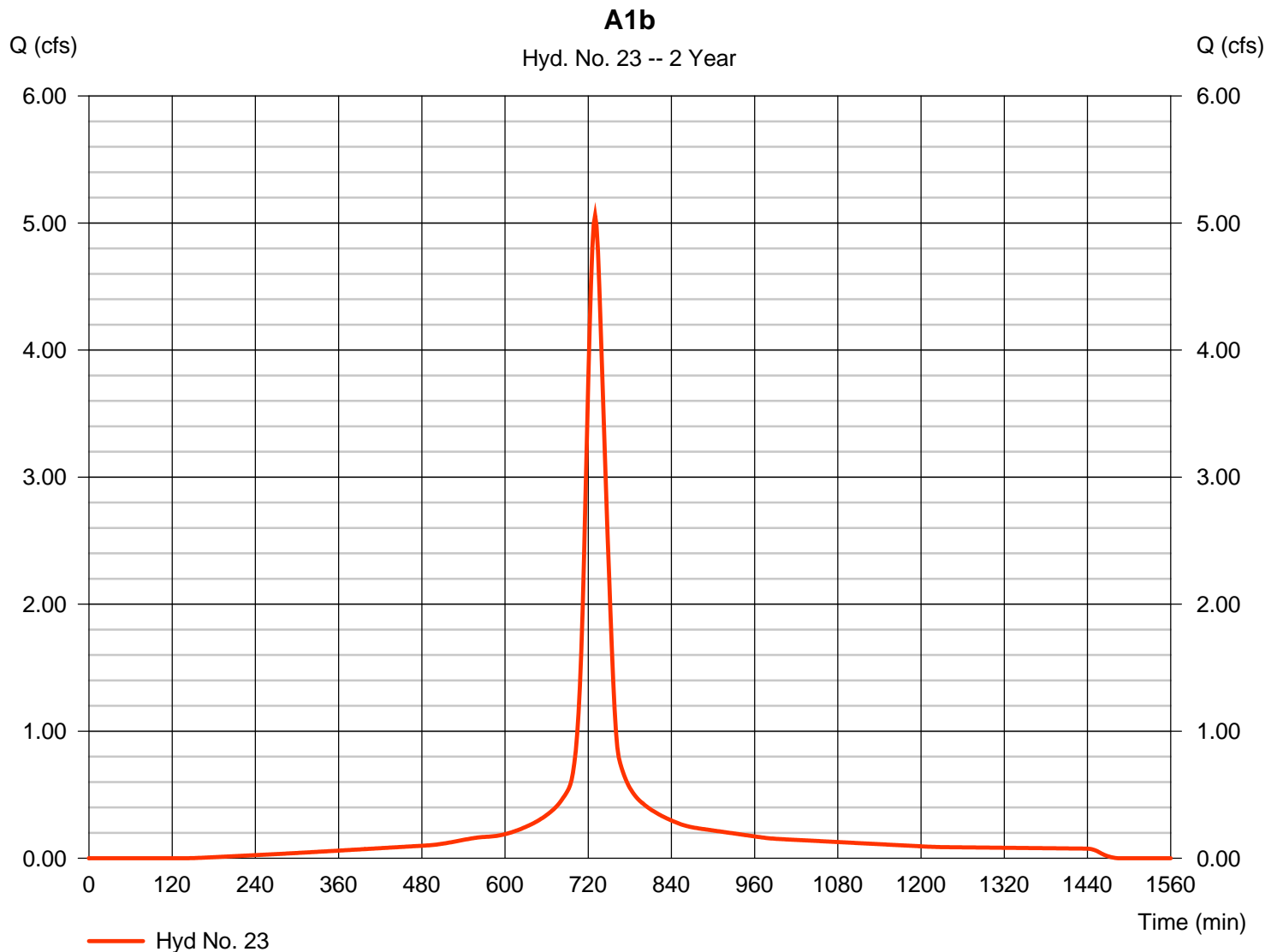
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

## Hyd. No. 23

A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 5.059 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 21,473 cuft
Drainage area	= 1.930 ac	Curve number	= 96
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.70 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

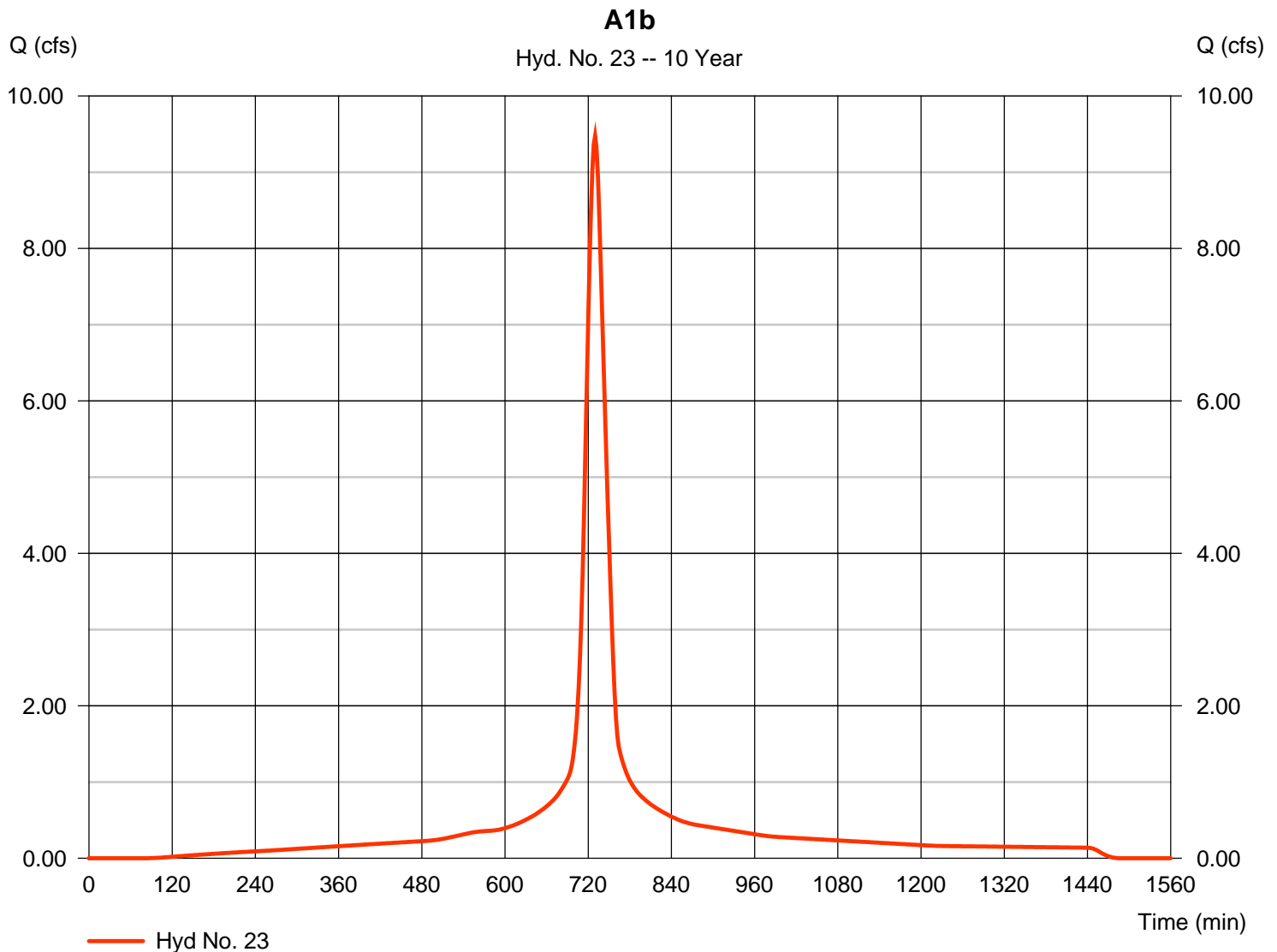
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

## Hyd. No. 23

A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 9.475 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 41,515 cuft
Drainage area	= 1.930 ac	Curve number	= 96
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.70 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

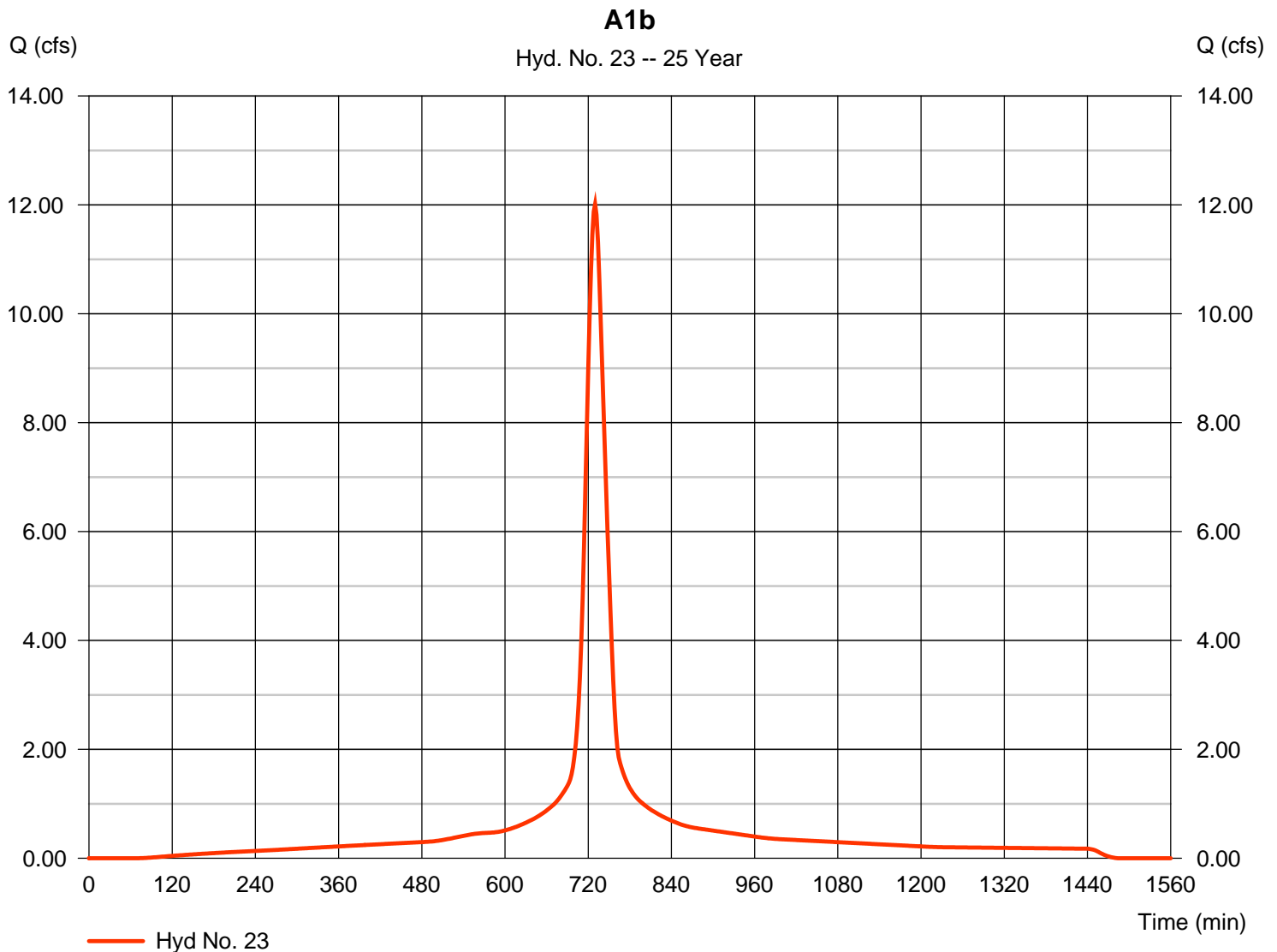
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

## Hyd. No. 23

A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 12.01 cfs
Storm frequency	= 25 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 53,179 cuft
Drainage area	= 1.930 ac	Curve number	= 96
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.70 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

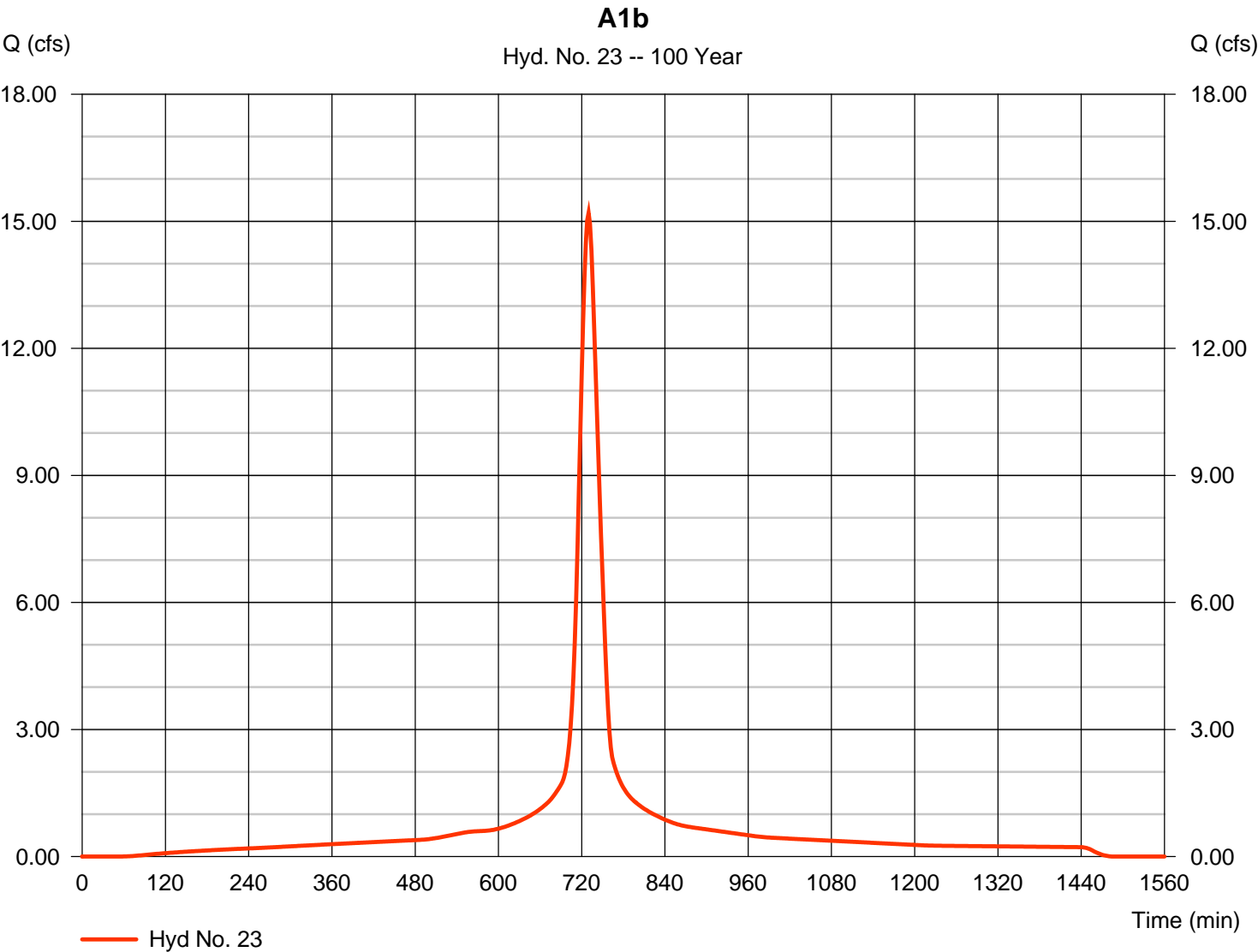


# Hydrograph Report

## Hyd. No. 23

A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 15.20 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 67,863 cuft
Drainage area	= 1.930 ac	Curve number	= 96
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.70 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	A1b+A1c
Point of Concentration	A1c
Area	2.20 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.023	S2=	0	S3=	0
T1=	28.20	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	113	L2=	53	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.0046	S2=	0.0046	S3=	0
T1=	8.33	T2=	0.26	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	36.79	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.56	D	80
Impervious, Paved	0.81	D	98
Concrete	0.00	D	89
Commercial C1	0.83	D	93
<b>Total</b>	<b>2.20</b>		<b>91.53</b>

# Hydrograph Report

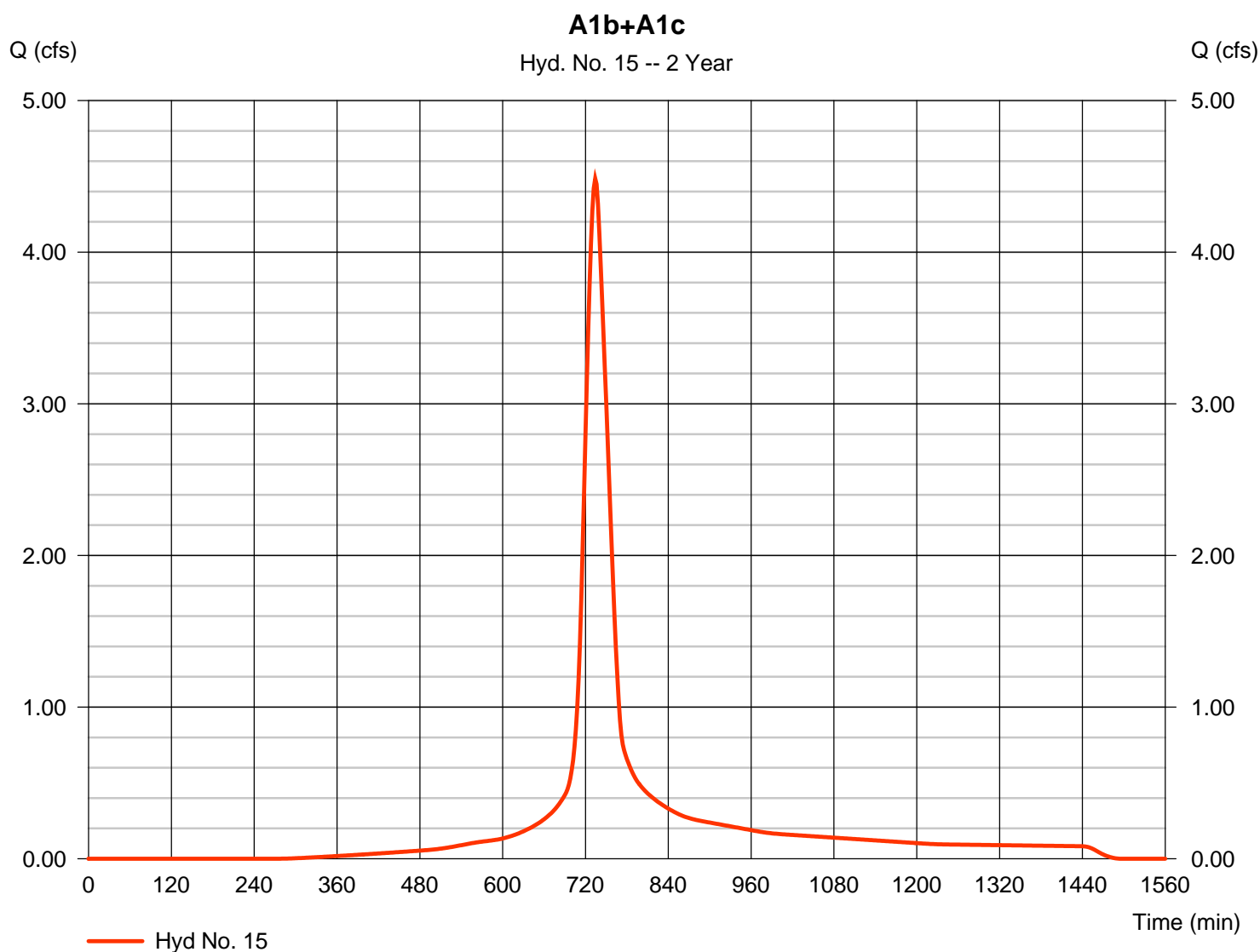
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 15

A1b+A1c

Hydrograph type	= SCS Runoff	Peak discharge	= 4.485 cfs
Storm frequency	= 2 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 20,588 cuft
Drainage area	= 2.200 ac	Curve number	= 91.5
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 36.80 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

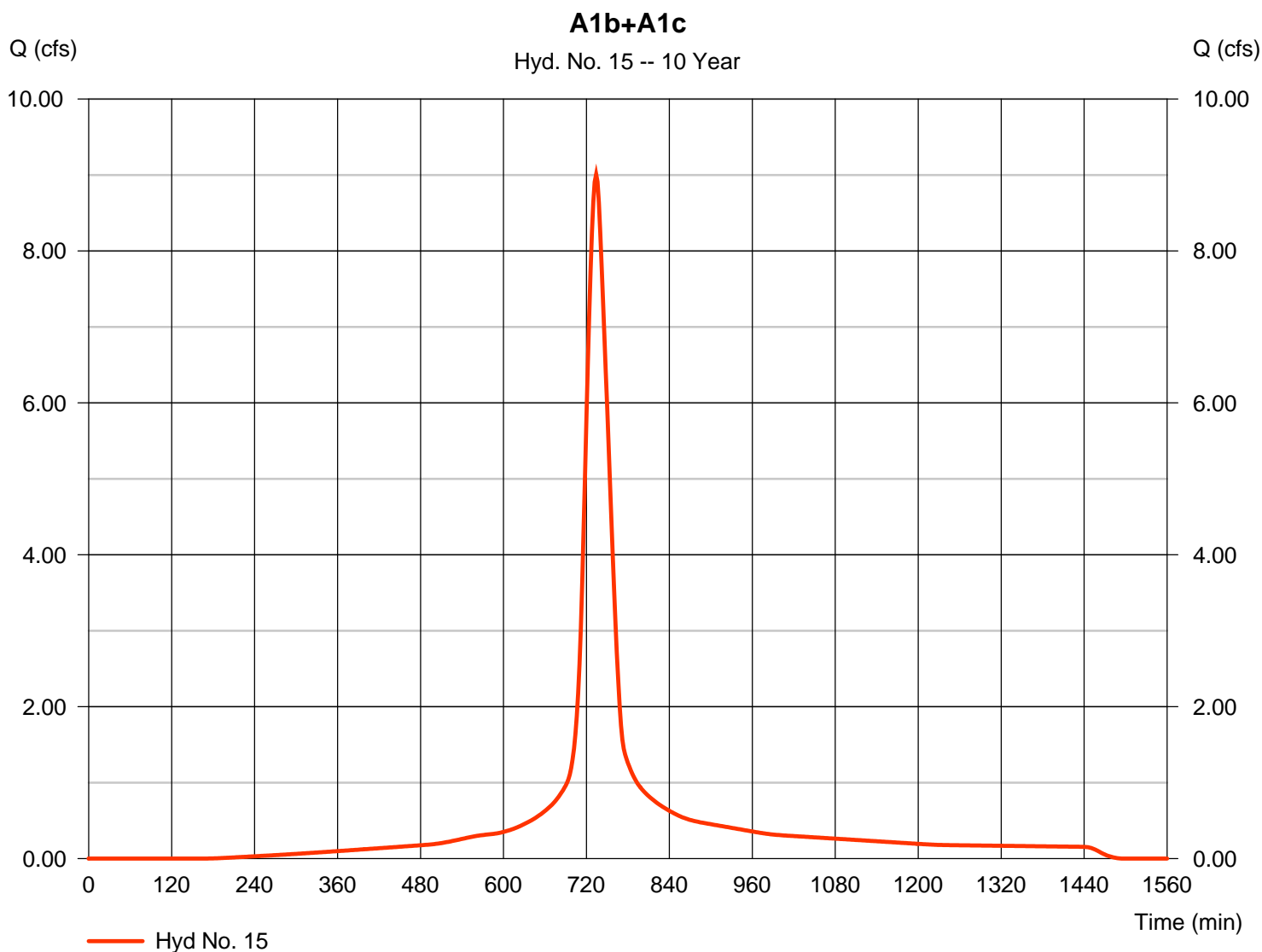
Tuesday, 07 / 28 / 2020

## Hyd. No. 15

A1b+A1c

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 2.200 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 9.009 cfs  
 Time to peak = 734 min  
 Hyd. volume = 42,682 cuft  
 Curve number = 91.5  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 36.80 min  
 Distribution = Type II  
 Shape factor = 484





# Hydrograph Report

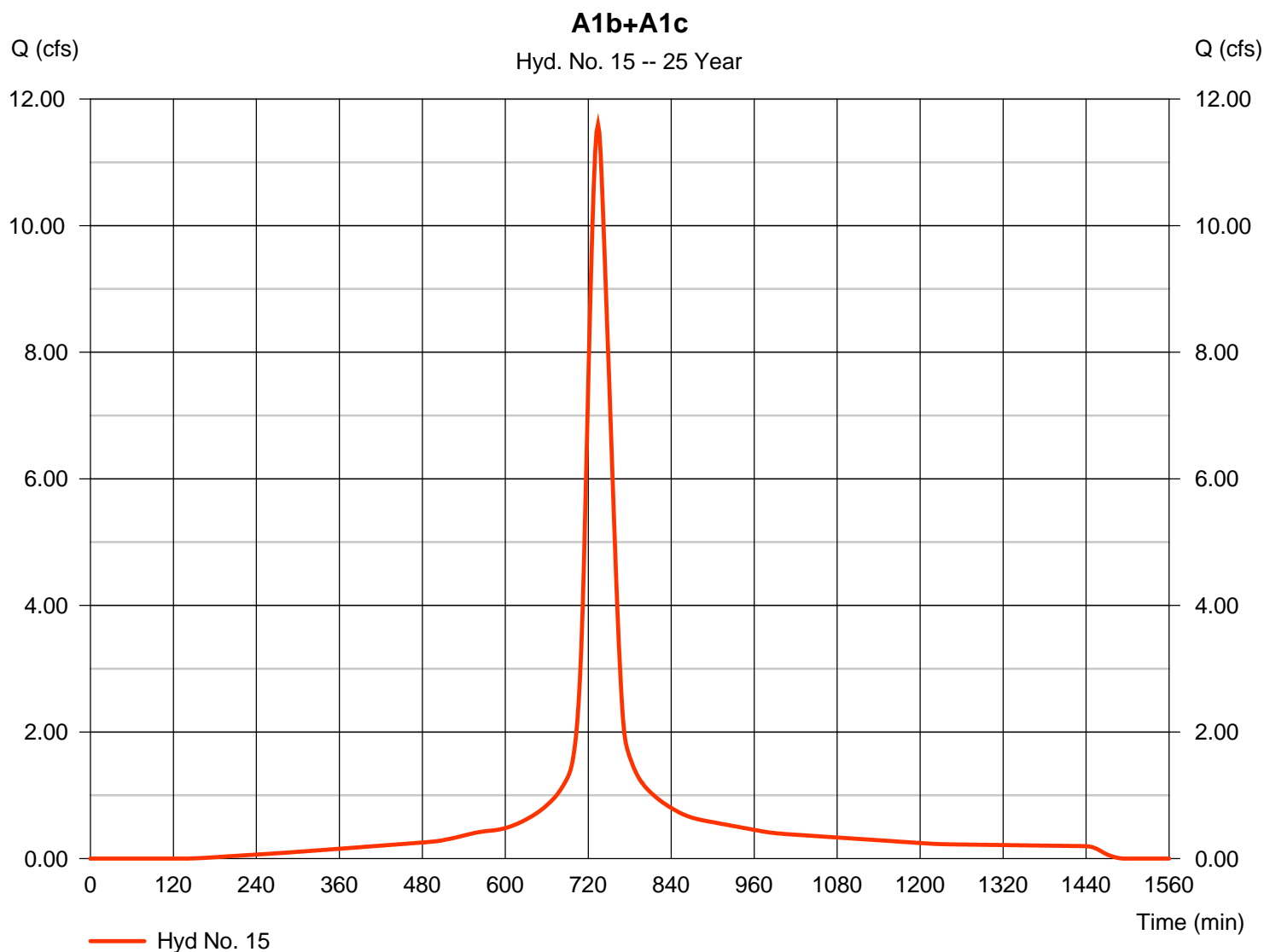
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 15

A1b+A1c

Hydrograph type	= SCS Runoff	Peak discharge	= 11.60 cfs
Storm frequency	= 25 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 55,686 cuft
Drainage area	= 2.200 ac	Curve number	= 91.5
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 36.80 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

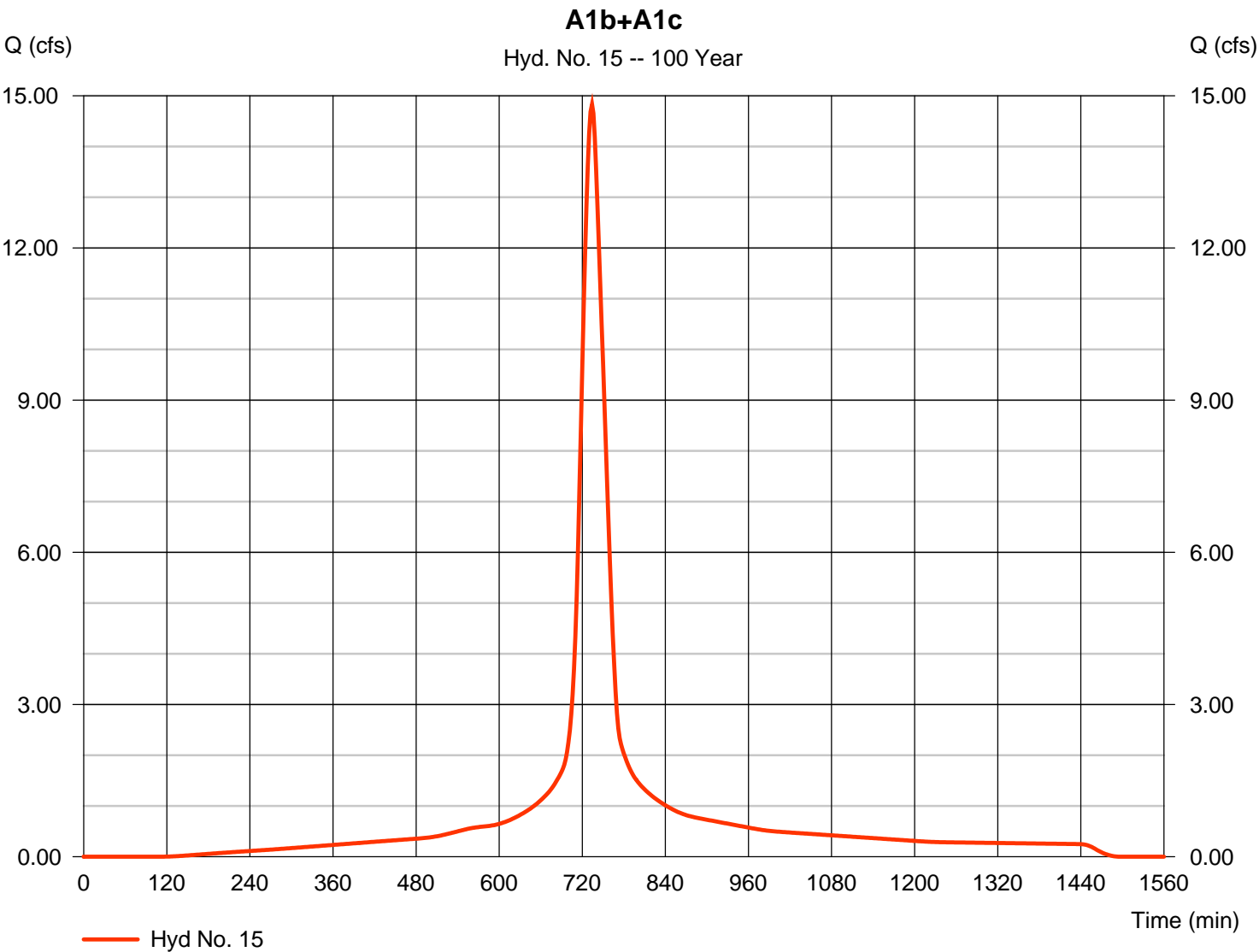


# Hydrograph Report

## Hyd. No. 15

A1b+A1c

Hydrograph type	= SCS Runoff	Peak discharge	= 14.83 cfs
Storm frequency	= 100 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 72,118 cuft
Drainage area	= 2.200 ac	Curve number	= 91.5
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 36.80 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	A1a+A1b+A1c
Point of Concentration	A1
Area	45.47 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.01	S2=	0	S3=	0
T1=	39.35	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	2139	L2=	0	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.005	S2=	0.0046	S3=	0
T1=	31.25	T2=	0.00	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	1270	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	3.53	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	74.13	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	42.74	D	80
Impervious, Paved	1.63	D	98
Concrete	0.00	D	89
Commercial C1	0.83	D	93
<b>Total</b>	<b>45.20</b>		<b>80.89</b>

# Hydrograph Report

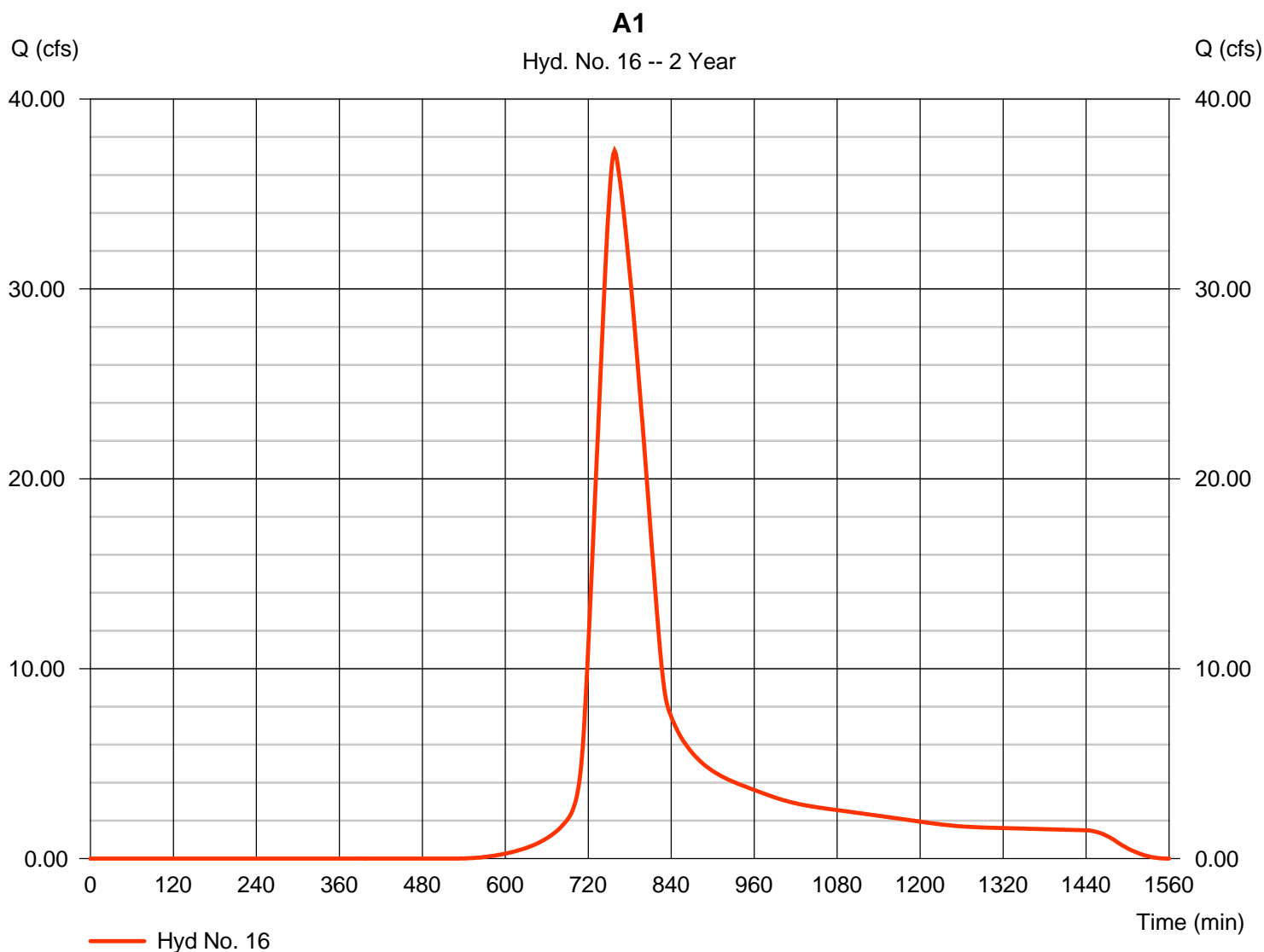
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 16

A1

Hydrograph type	= SCS Runoff	Peak discharge	= 37.27 cfs
Storm frequency	= 2 yrs	Time to peak	= 758 min
Time interval	= 2 min	Hyd. volume	= 283,391 cuft
Drainage area	= 45.200 ac	Curve number	= 80.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

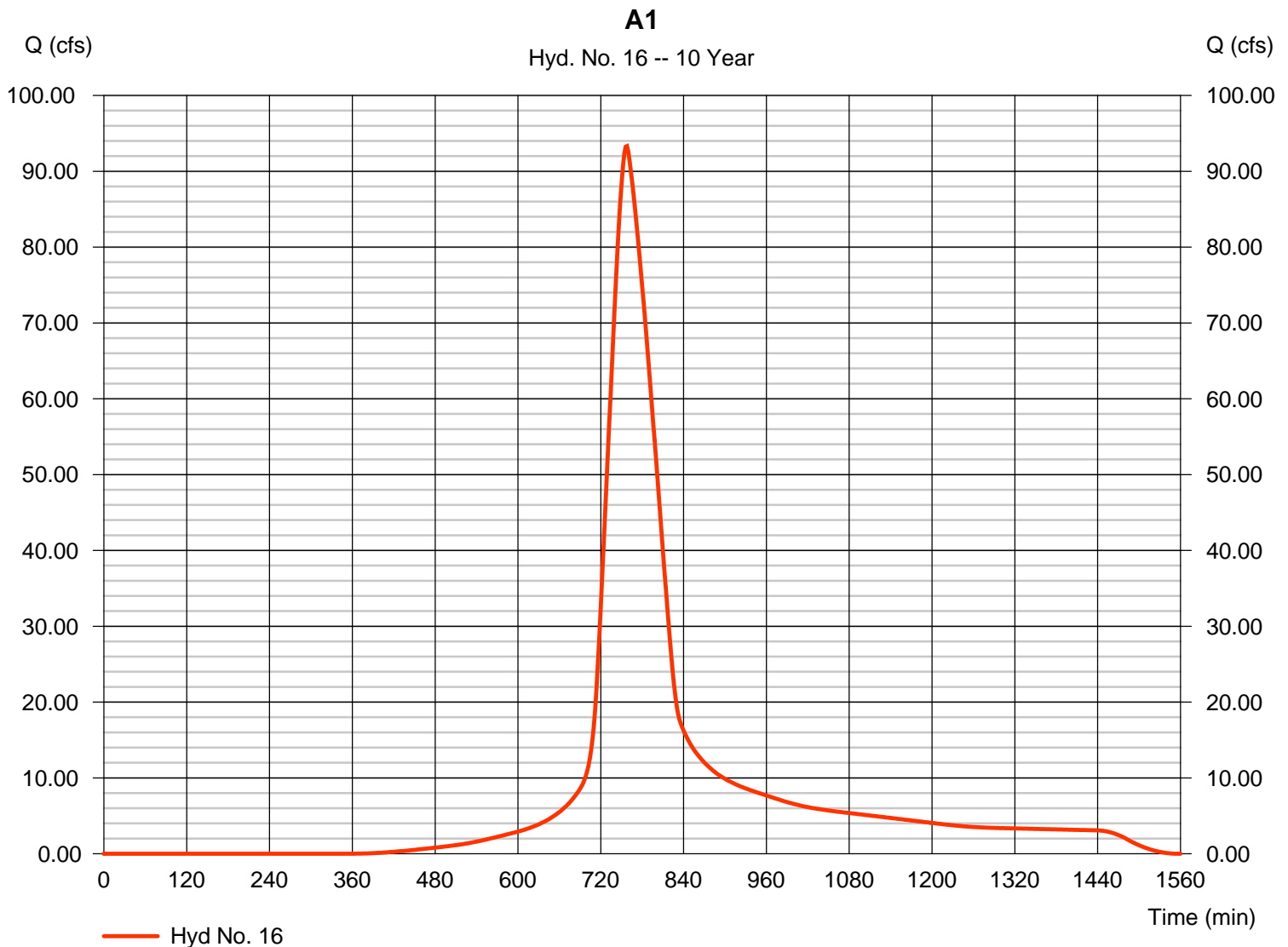
Tuesday, 07 / 28 / 2020

## Hyd. No. 16

A1

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 45.200 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 93.31 cfs  
 Time to peak = 758 min  
 Hyd. volume = 699,529 cuft  
 Curve number = 80.9  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.10 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

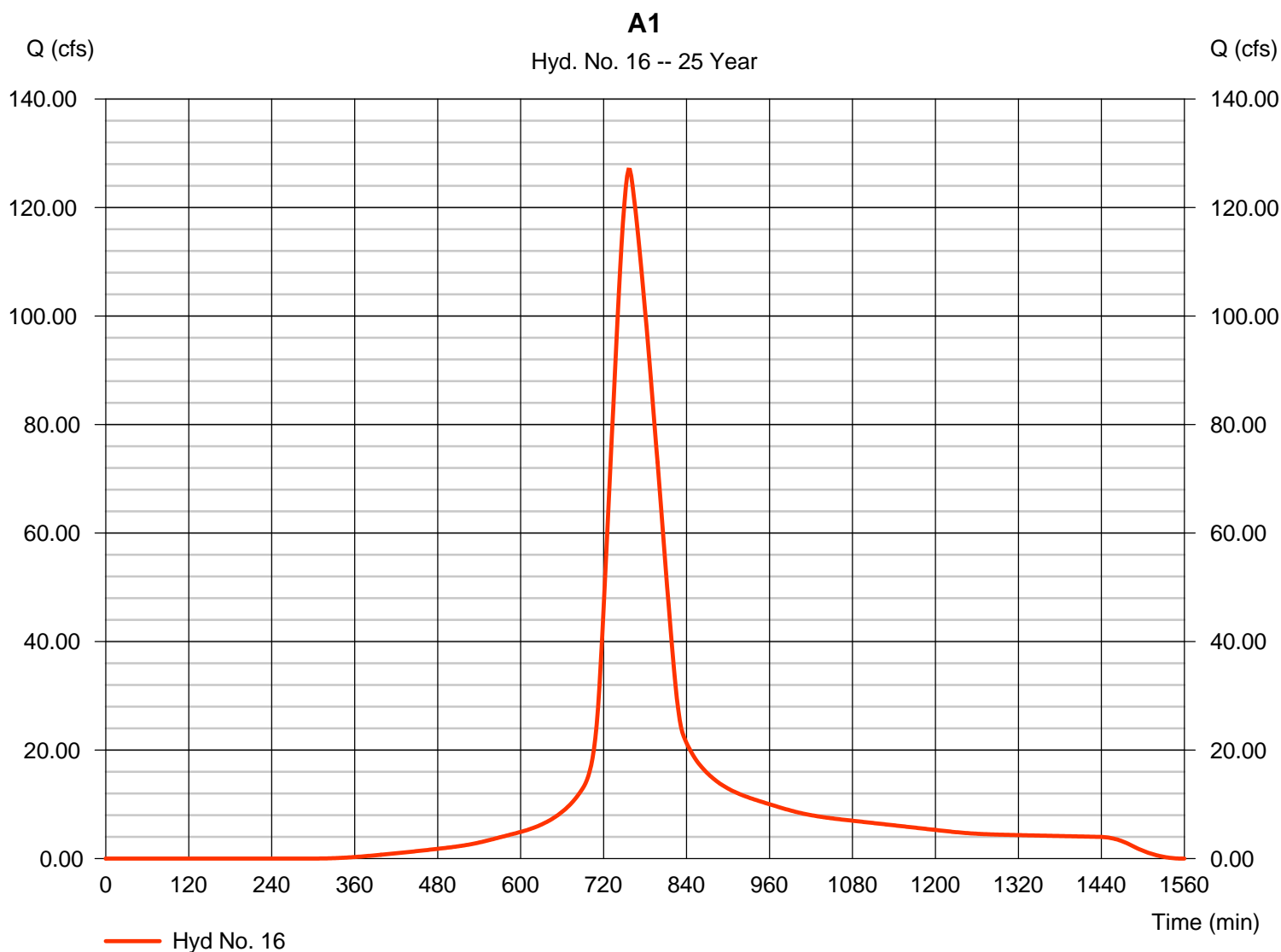
Tuesday, 07 / 28 / 2020

## Hyd. No. 16

A1

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 45.200 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 126.97 cfs  
 Time to peak = 756 min  
 Hyd. volume = 956,484 cuft  
 Curve number = 80.9  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.10 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

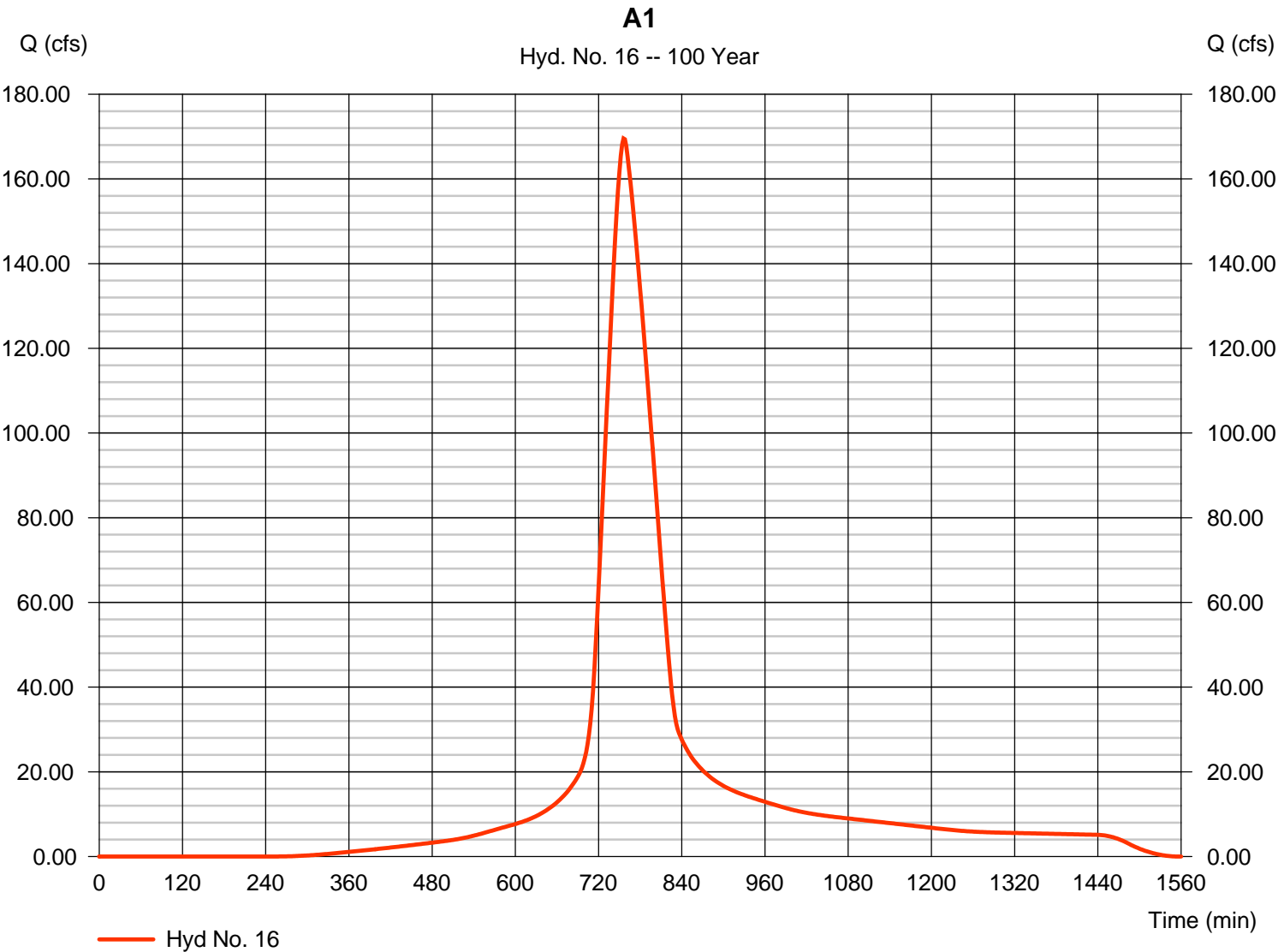
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 16

A1

Hydrograph type	= SCS Runoff	Peak discharge	= 169.55 cfs
Storm frequency	= 100 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 1,286,918 cuft
Drainage area	= 45.200 ac	Curve number	= 80.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	A2b
Point of Concentration	A2b
Area	0.41 acres

Sheet Flow					
L1=	79	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.0752	S2=	0	S3=	0
T1=	13.87	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	100	L2=	0	L3=	0
n1=	0.02	n2=	0.02	n3=	0.3
S1=	0.005	S2=	0.0046	S3=	0
T1=	0.47	T2=	0.00	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	14.34	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.00	D	80
Impervious, Paved	0.31	D	98
Concrete	0.00	D	89
Commercial C1	0.10	D	93
Total	0.41		96.78



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

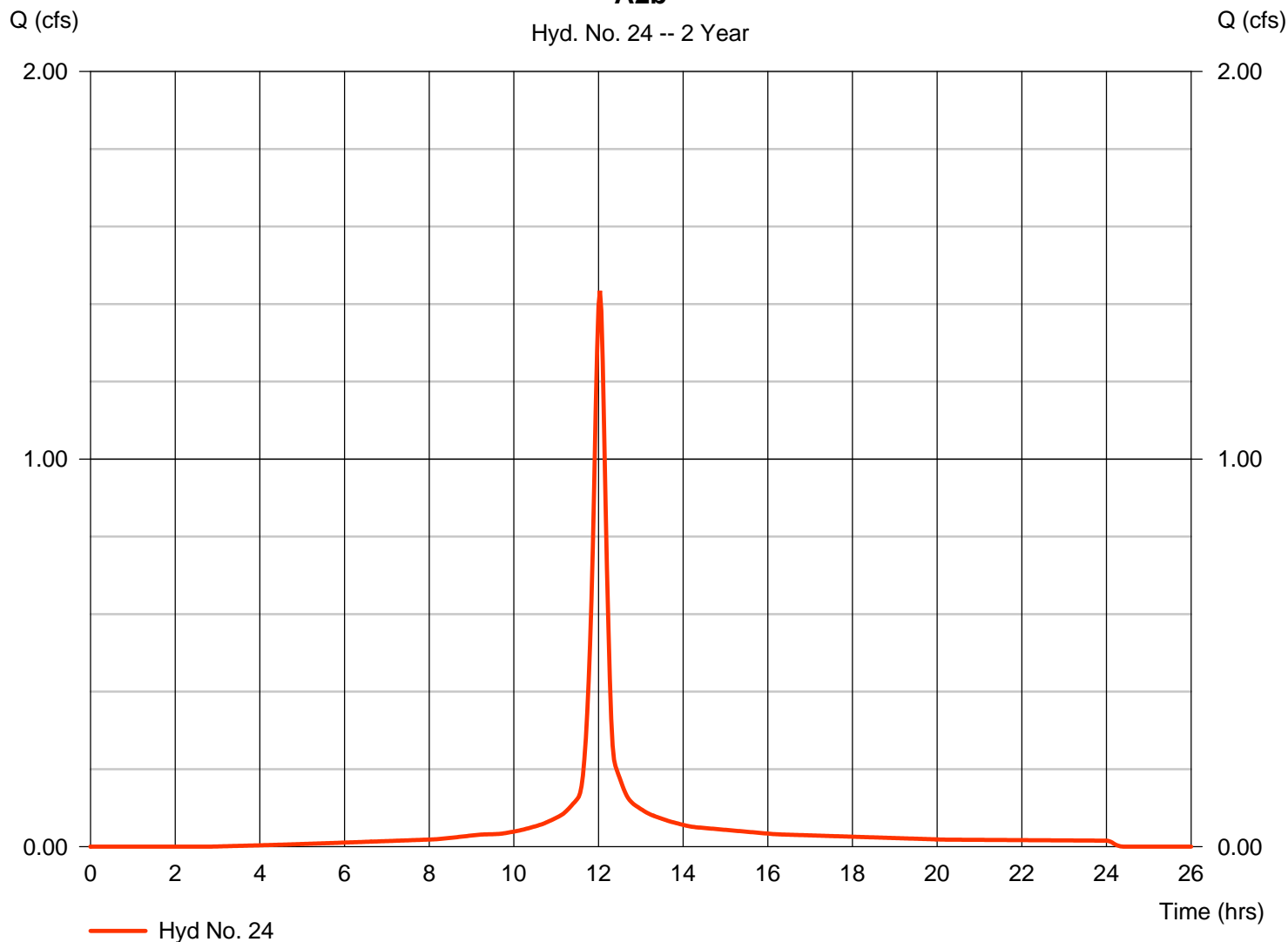
Monday, 07 / 27 / 2020

## Hyd. No. 24

A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 1.434 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 4,293 cuft
Drainage area	= 0.410 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.30 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### A2b



# Hydrograph Report

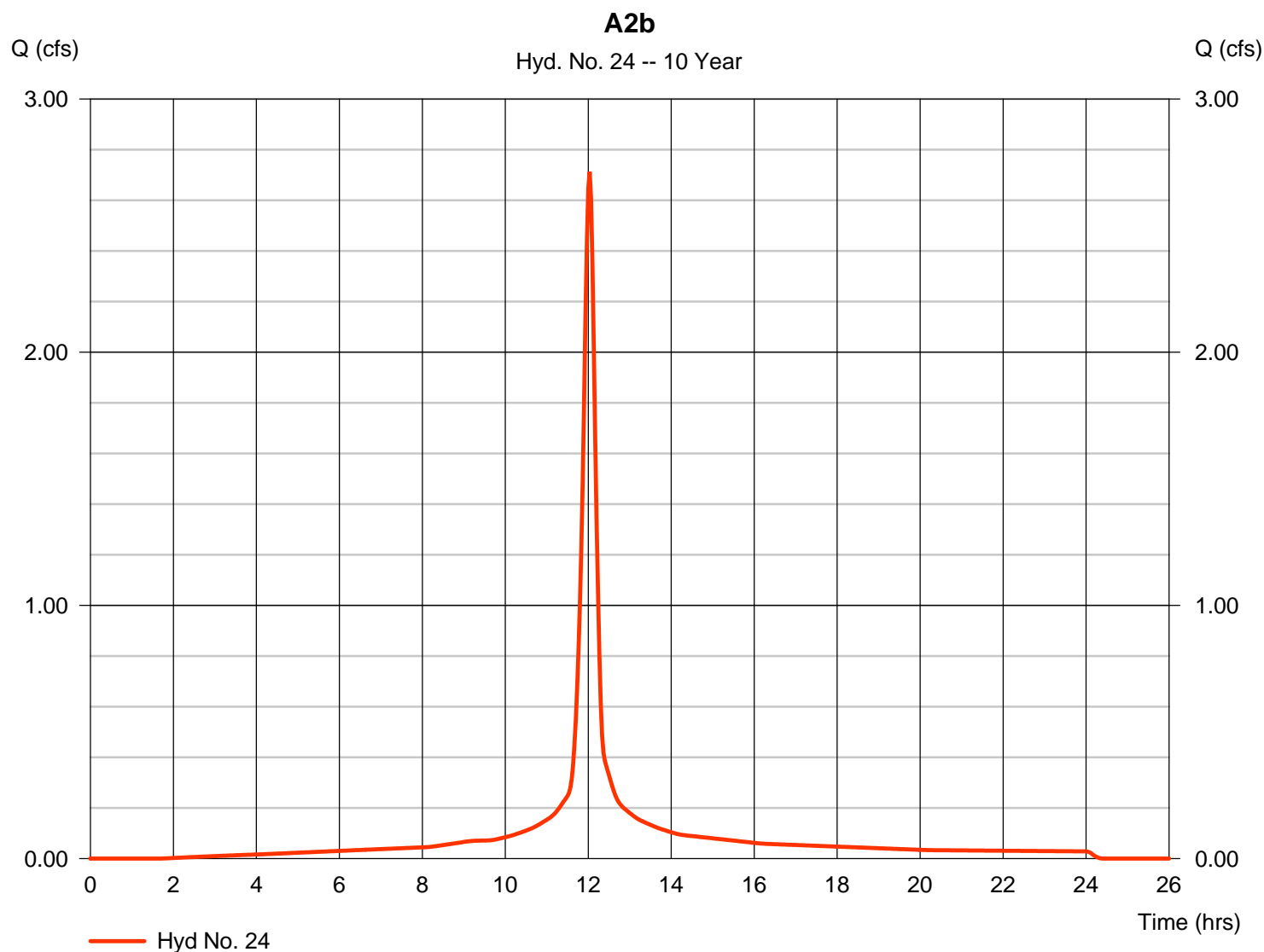
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

## Hyd. No. 24

A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 2.712 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 8,429 cuft
Drainage area	= 0.410 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.30 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

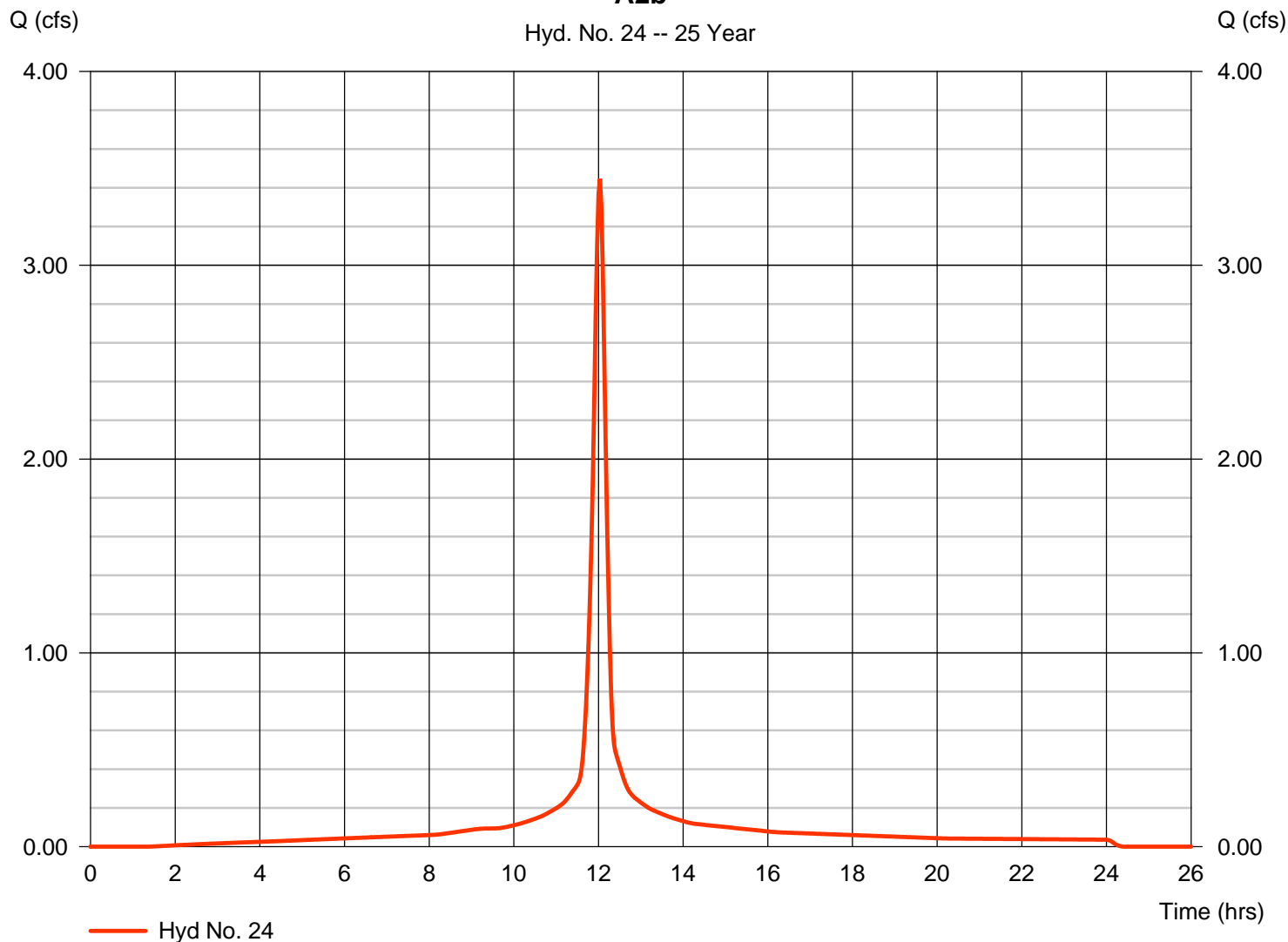
Monday, 07 / 27 / 2020

## Hyd. No. 24

A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 3.446 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 10,841 cuft
Drainage area	= 0.410 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.30 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### A2b



# Hydrograph Report

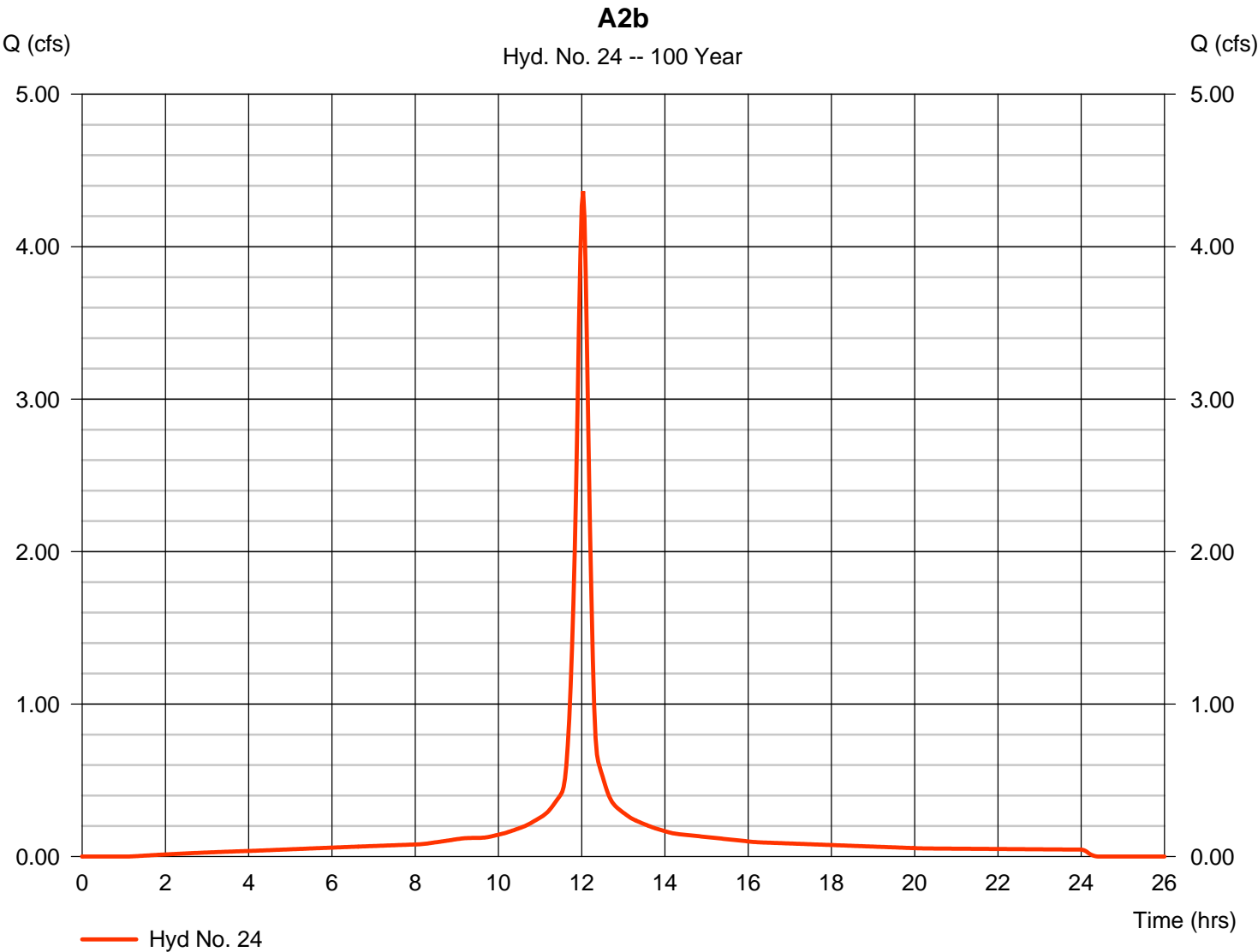
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

## Hyd. No. 24

A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 4.364 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 13,879 cuft
Drainage area	= 0.410 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.30 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	A2a+A2b
Point of Concentration	A2a
Area	2.72 acres

Sheet Flow					
L1=	79	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.0752	S2=	0	S3=	0
T1=	13.87	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	100	L2=	0	L3=	0
n1=	0.02	n2=	0.02	n3=	0.3
S1=	0.005	S2=	0.0046	S3=	0
T1=	0.47	T2=	0.00	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	14.34	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.00	D	80
Impervious, Paved	1.22	D	98
Concrete	0.00	D	89
Commercial C1	1.50	D	93
<b>Total</b>	<b>2.72</b>		<b>95.24</b>

# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

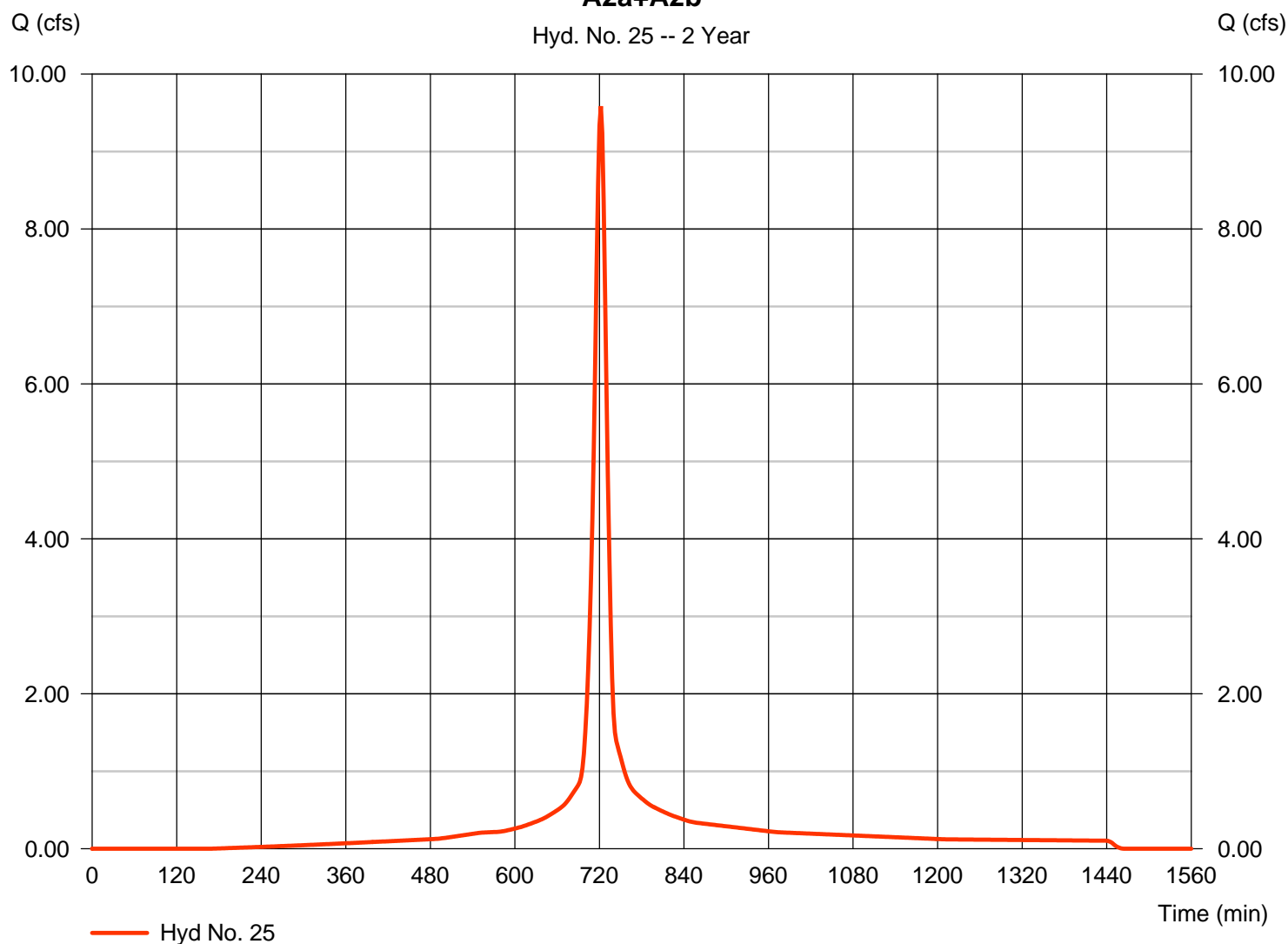
## Hyd. No. 25

A2a+A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 9.585 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 28,692 cuft
Drainage area	= 2.740 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.34 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### A2a+A2b

Hyd. No. 25 -- 2 Year



# Hydrograph Report

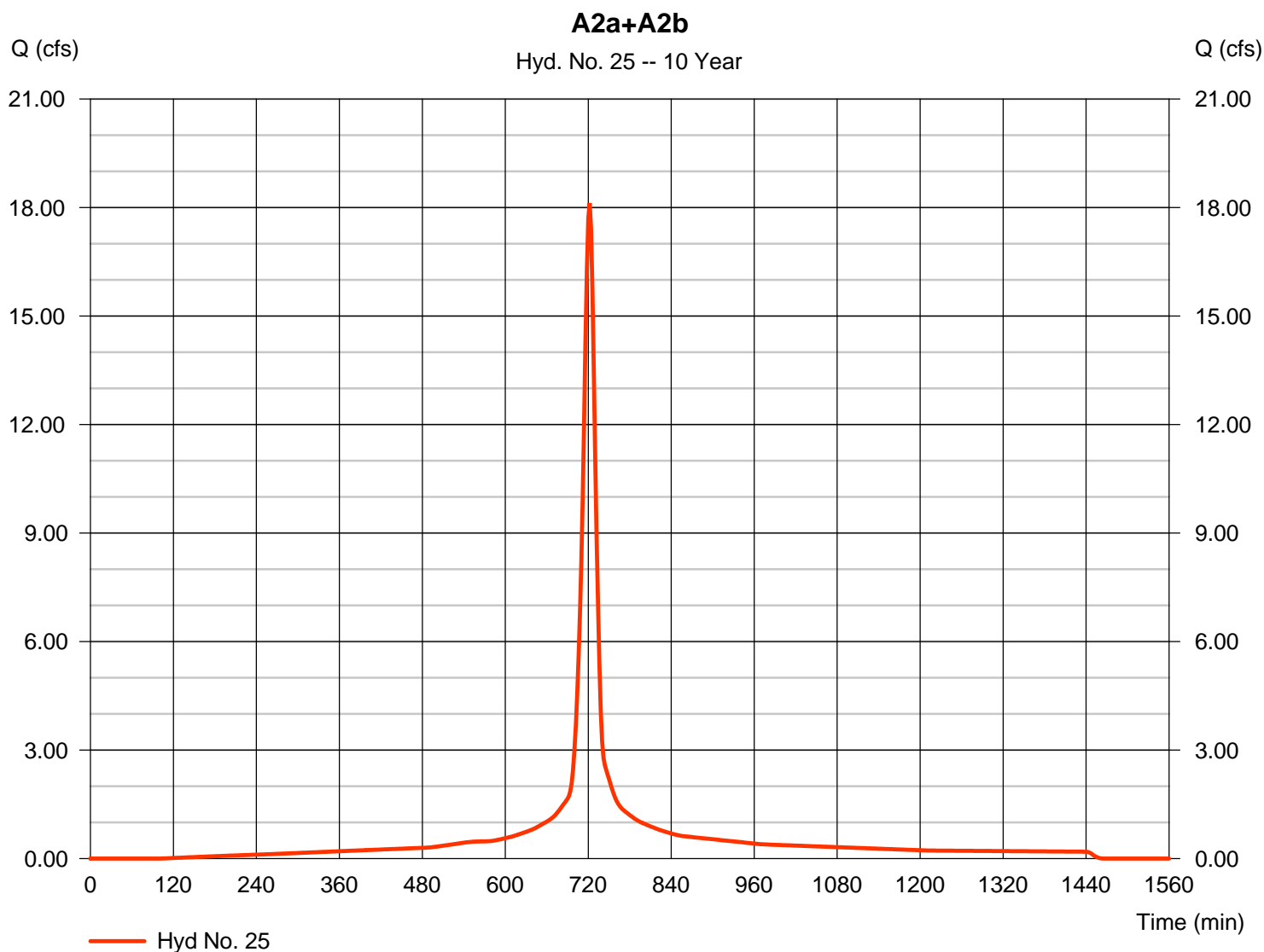
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 07 / 27 / 2020

## Hyd. No. 25

A2a+A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 18.13 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 56,333 cuft
Drainage area	= 2.740 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.34 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

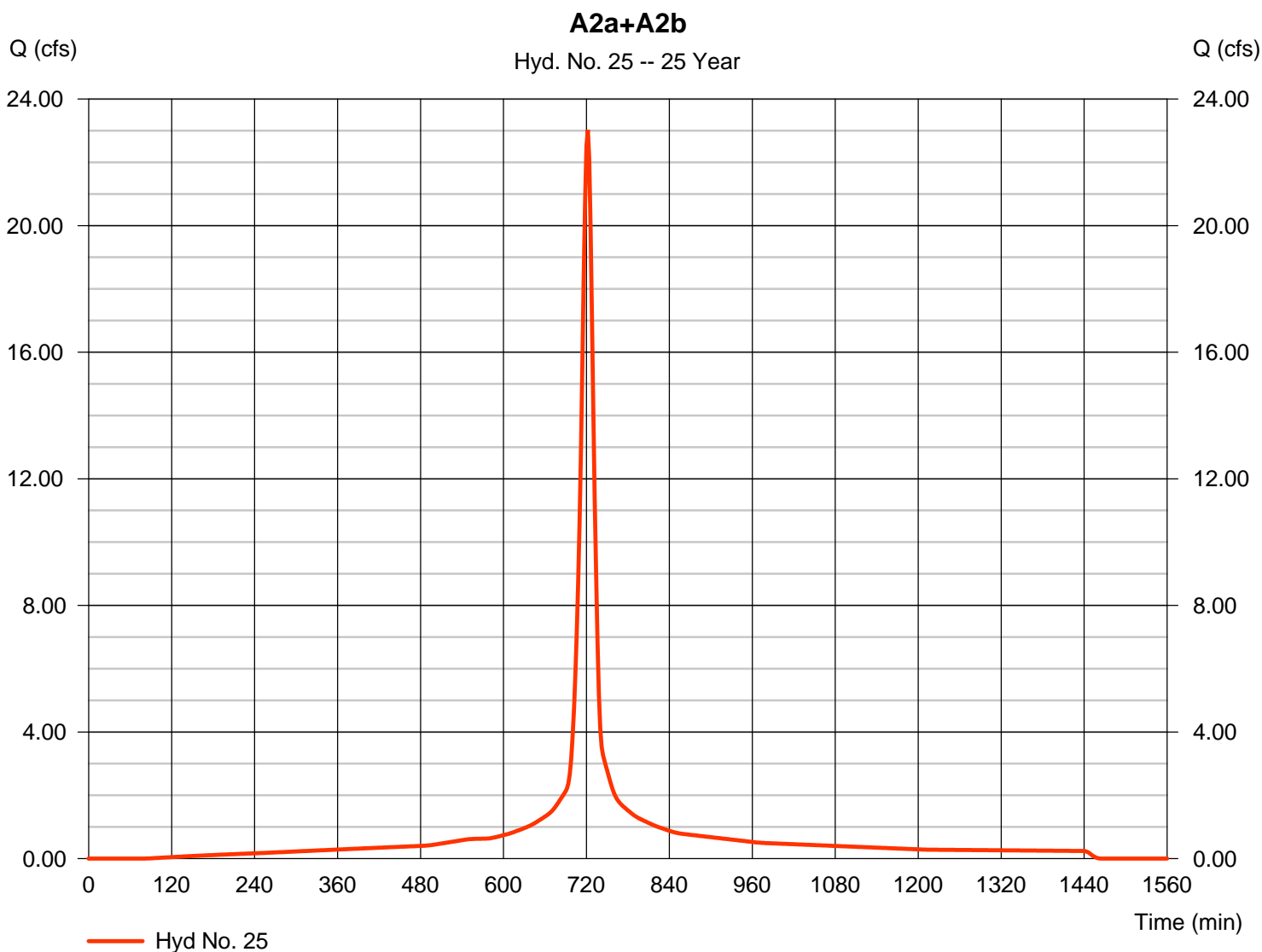
Monday, 07 / 27 / 2020

## Hyd. No. 25

A2a+A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 2.740 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 23.03 cfs  
 Time to peak = 722 min  
 Hyd. volume = 72,451 cuft  
 Curve number = 95  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 14.34 min  
 Distribution = Type II  
 Shape factor = 484



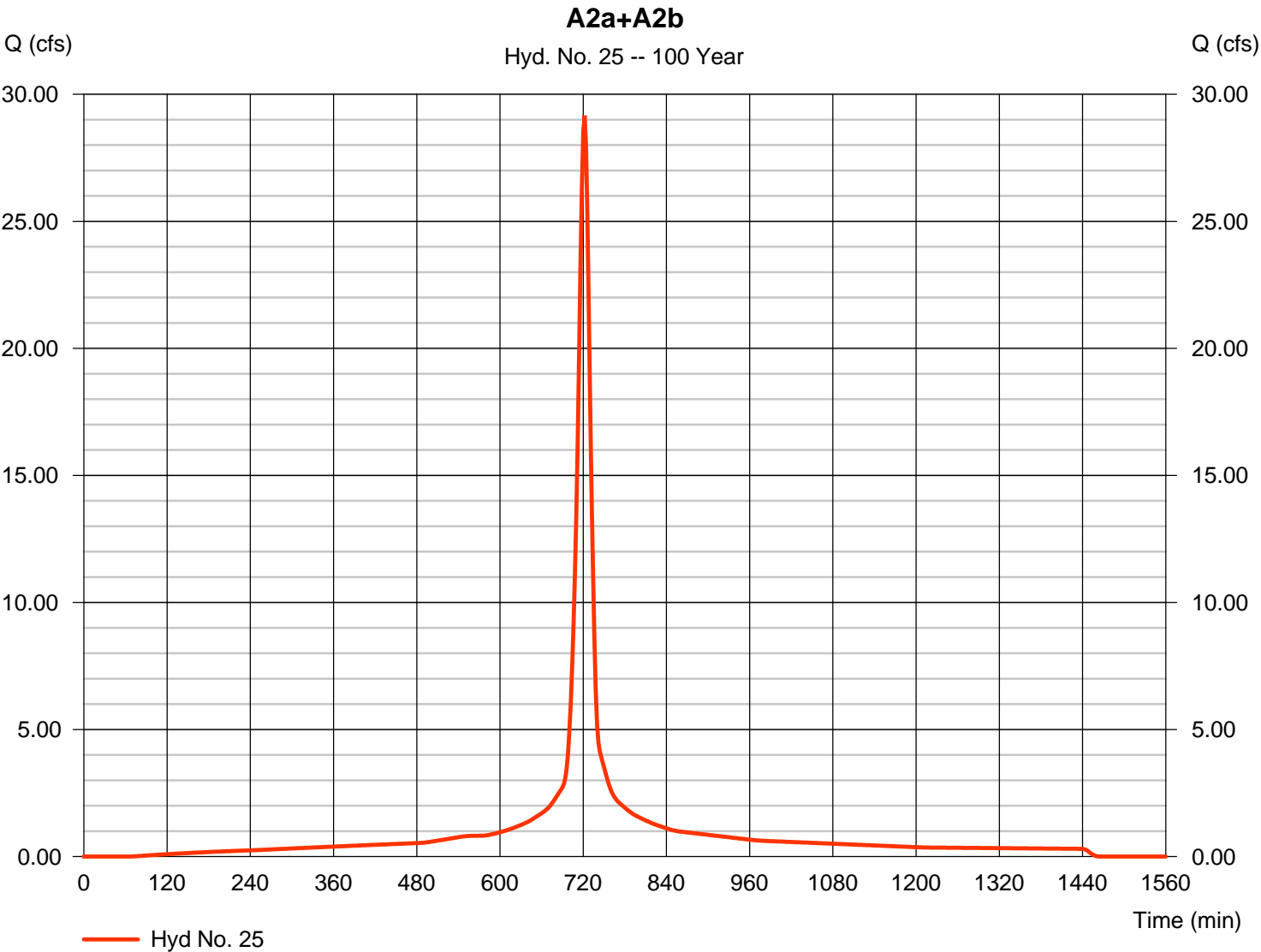


# Hydrograph Report

## Hyd. No. 25

A2a+A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 29.17 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 92,753 cuft
Drainage area	= 2.740 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.34 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	A2a+A2b+A2c
Point of Concentration	A2
Area	3.52 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.01	S2=	0	S3=	0
T1=	39.35	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	633	L2=	176	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.0025	S2=	0.0102	S3=	0
T1=	13.08	T2=	0.58	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	52.43	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.78	D	80
Impervious, Paved	1.22	D	98
Concrete	0.00	D	89
Commercial C1	1.50	D	93
<b>Total</b>	<b>3.50</b>		<b>91.85</b>

# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

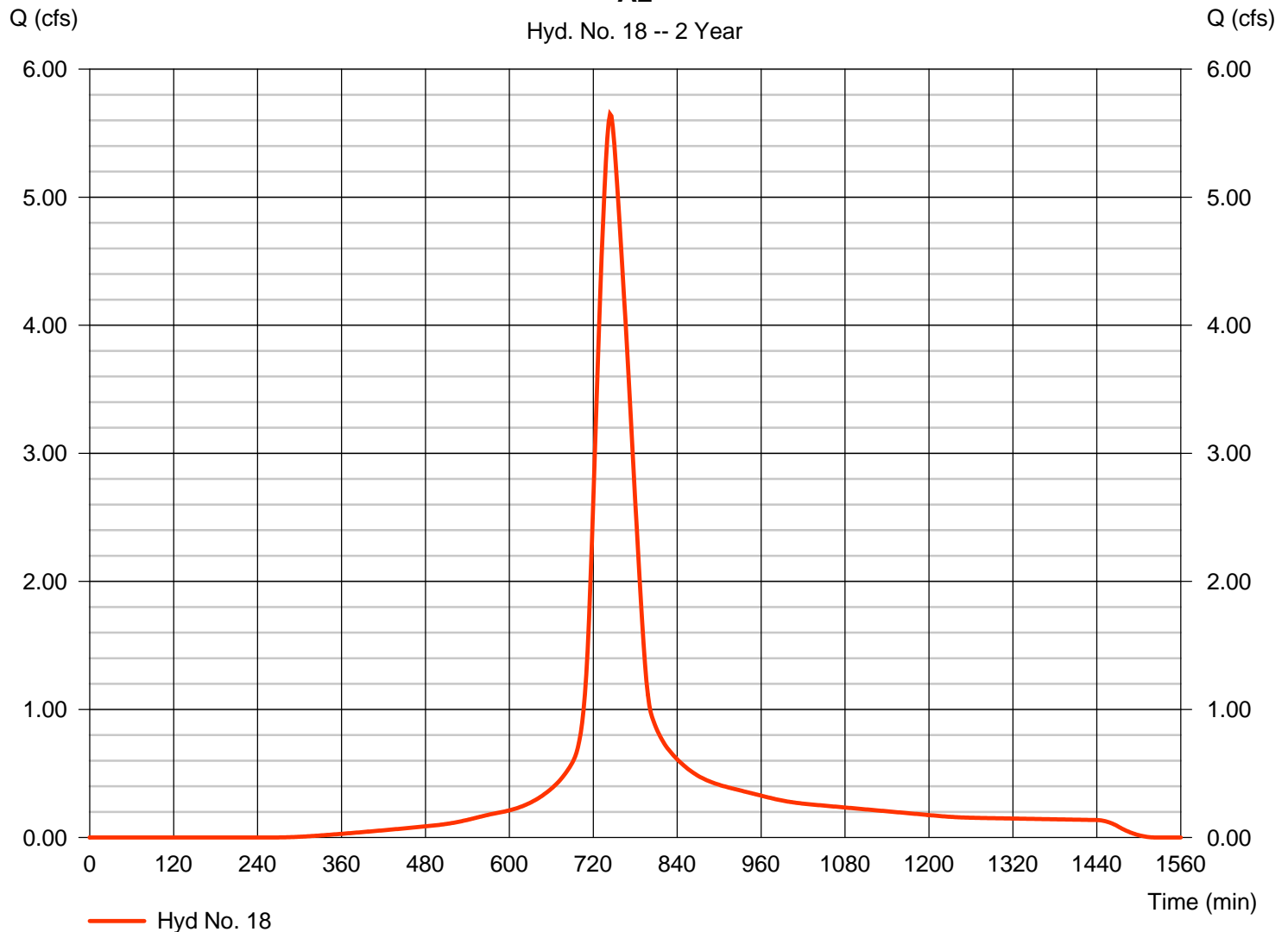
Tuesday, 07 / 28 / 2020

## Hyd. No. 18

A2

Hydrograph type	= SCS Runoff	Peak discharge	= 5.649 cfs
Storm frequency	= 2 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 34,076 cuft
Drainage area	= 3.520 ac	Curve number	= 91.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 52.43 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### A2



# Hydrograph Report

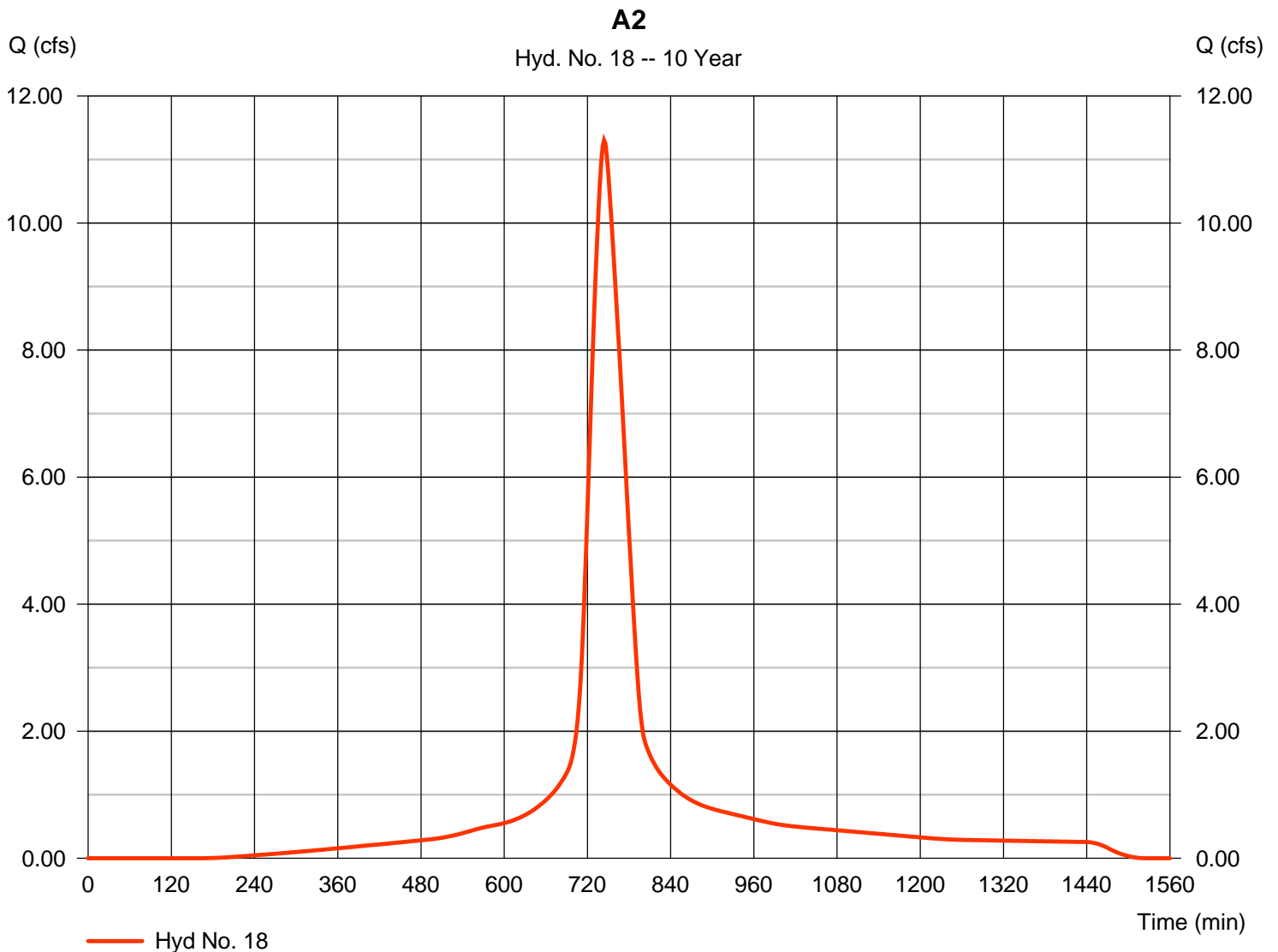
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 18

A2

Hydrograph type	= SCS Runoff	Peak discharge	= 11.30 cfs
Storm frequency	= 10 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 70,203 cuft
Drainage area	= 3.520 ac	Curve number	= 91.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 52.43 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

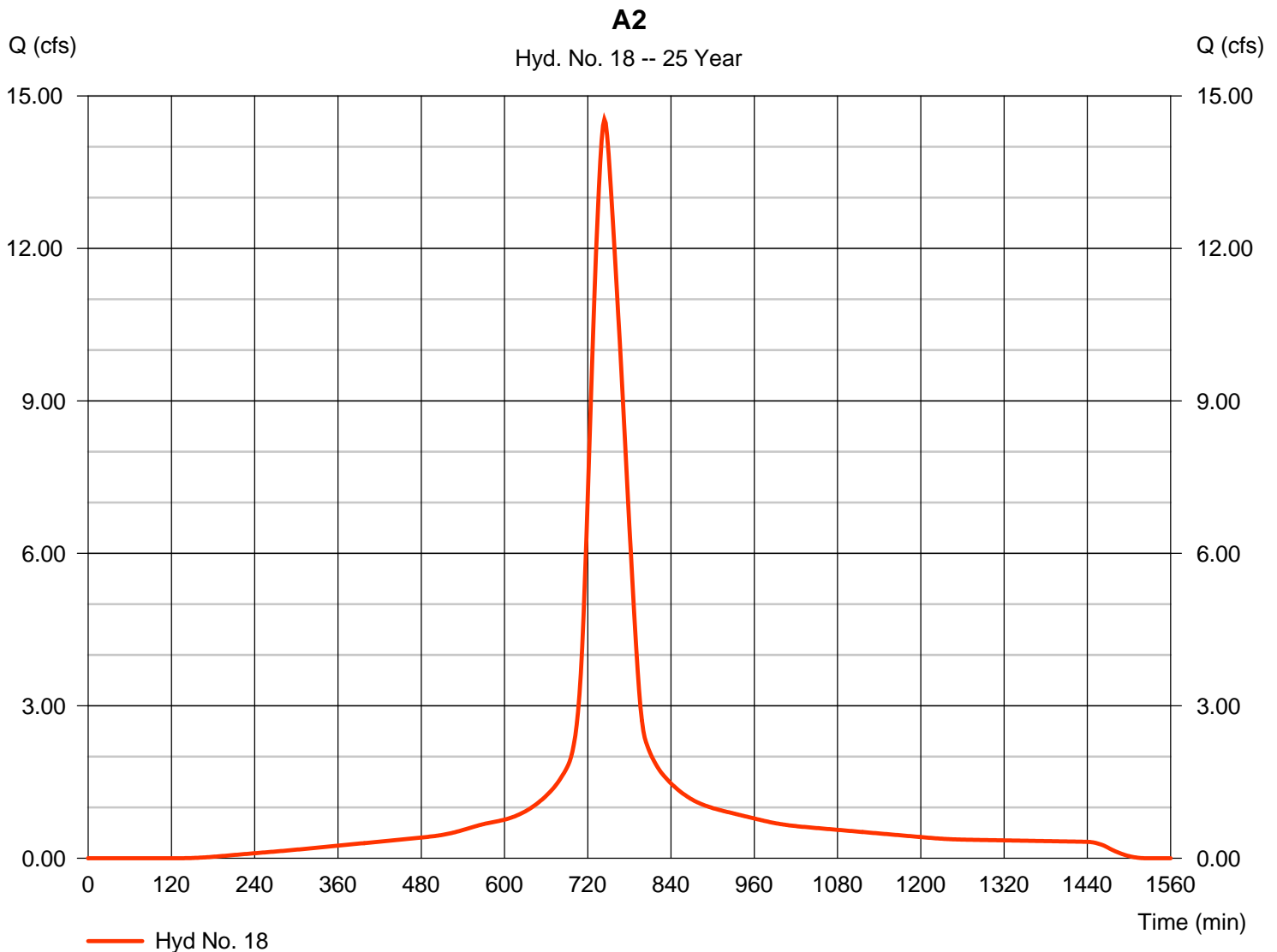
Tuesday, 07 / 28 / 2020

## Hyd. No. 18

A2

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 3.520 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 14.54 cfs  
 Time to peak = 744 min  
 Hyd. volume = 91,441 cuft  
 Curve number = 91.9  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 52.43 min  
 Distribution = Type II  
 Shape factor = 484

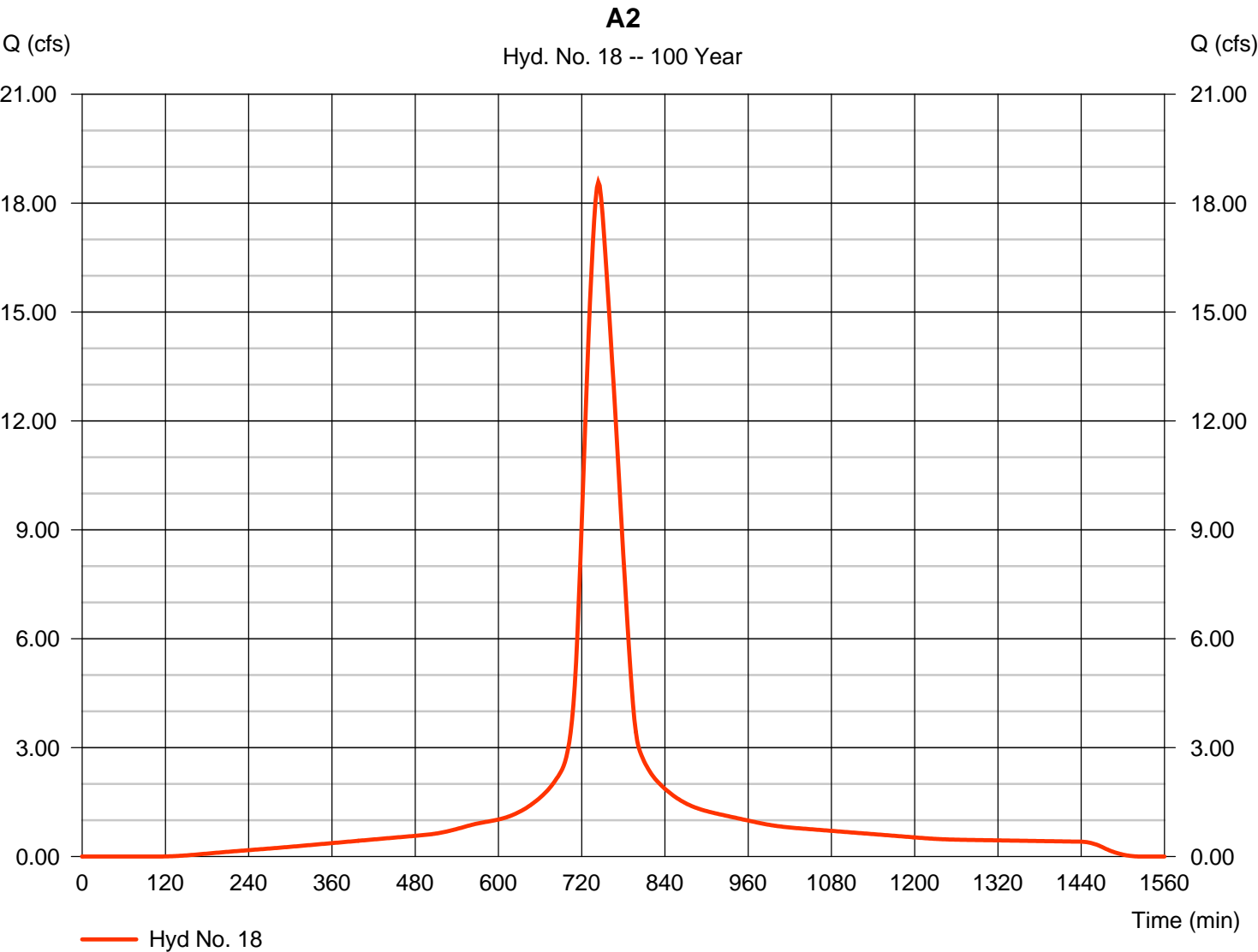


# Hydrograph Report

## Hyd. No. 18

A2

Hydrograph type	= SCS Runoff	Peak discharge	= 18.58 cfs
Storm frequency	= 100 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 118,263 cuft
Drainage area	= 3.520 ac	Curve number	= 91.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 52.43 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Attachment J

Proposed Conditions

Hydrologic/Hydraulic Calculations –  
Drainage Area B (100 year)

## Vanguard Farms Apartments

File Name ..... 323.001\_STRM.SPF

### Project Options

Flow Units ..... CFS  
 Elevation Type ..... Elevation  
 Hydrology Method ..... SCS TR-20  
 Time of Concentration (TOC) Method ..... User-Defined  
 Link Routing Method ..... Kinematic Wave  
 Enable Overflow Ponding at Nodes ..... YES  
 Skip Steady State Analysis Time Periods ..... NO

### Analysis Options

Start Analysis On ..... Jul 15, 2020 00:00:00  
 End Analysis On ..... Jul 16, 2020 00:00:00  
 Start Reporting On ..... Jul 15, 2020 00:00:00  
 Antecedent Dry Days ..... 0 days  
 Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss  
 Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss  
 Reporting Time Step ..... 0 00:02:00 days hh:mm:ss  
 Routing Time Step ..... 5 seconds

### Number of Elements

	Qty
Rain Gages .....	0
Subbasins.....	19
Nodes.....	37
<i>Junctions</i> .....	18
<i>Outfalls</i> .....	2
<i>Flow Diversions</i> .....	0
<i>Inlets</i> .....	17
<i>Storage Nodes</i> .....	0
Links.....	41
<i>Channels</i> .....	18
<i>Pipes</i> .....	23
<i>Pumps</i> .....	0
<i>Orifices</i> .....	0
<i>Weirs</i> .....	0
<i>Outlets</i> .....	0
Pollutants .....	0
Land Uses .....	0



## Subbasin Summary

SN	Subbasin ID	Area	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	B1a	0.27	93.00	10.17	9.32	2.49	2.61	0 00:17:52
2	B1b	0.21	93.00	10.17	9.32	1.95	2.44	0 00:10:00
3	B2a	0.33	93.00	10.17	9.32	3.09	3.84	0 00:10:00
4	B2b	0.36	93.00	10.17	9.32	3.33	4.14	0 00:10:00
5	B2c	0.28	93.00	10.17	9.32	2.59	3.08	0 00:11:18
6	B2d	0.35	93.00	10.17	9.32	3.30	4.06	0 00:10:00
7	B2e	0.65	93.00	10.17	9.32	6.06	6.35	0 00:17:51
8	B2f	0.63	93.00	10.17	9.32	5.88	5.77	0 00:20:46
9	B3a	0.32	93.00	10.17	9.32	2.96	2.41	0 00:30:09
10	B3b	0.32	93.00	10.17	9.32	2.98	2.64	0 00:25:34
11	B3c	0.32	93.00	10.17	9.32	2.99	2.41	0 00:30:09
12	B3d	0.32	93.00	10.17	9.32	2.95	2.59	0 00:25:34
13	B3e	1.33	93.00	10.17	9.32	12.36	7.56	0 00:47:02
14	B3f	0.44	93.00	10.17	9.32	4.09	4.66	0 00:14:06
15	B3g	1.55	93.00	10.17	9.32	14.42	17.10	0 00:12:00
16	B3h	0.38	93.00	10.17	9.32	3.55	4.36	0 00:10:00
17	B4a	1.72	93.00	10.17	9.32	16.03	19.55	0 00:10:43
18	B4b	0.28	93.00	10.17	9.32	2.61	1.31	0 01:03:25
19	B4c	0.23	93.00	10.17	9.32	2.17	1.22	0 00:52:31

## Node Summary

SN Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1 B1-4	Junction	672.61	675.45	672.61	675.45	0.00	48.37	675.45	0.00	0.00	0 12:05	0.43	9.00
2 B2-2	Junction	673.36	677.74	673.36	677.74	0.00	27.47	677.74	0.00	0.00	0 12:08	0.10	7.00
3 B2-5	Junction	674.47	677.61	674.47	677.61	0.00	14.06	677.61	0.00	0.00	0 12:06	0.07	7.00
4 B3-3	Junction	671.02	674.58	671.02	674.58	0.00	26.74	672.62	0.00	1.97	0 00:00	0.00	0.00
5 B3-7	Junction	673.67	679.16	673.67	679.16	0.00	9.95	674.72	0.00	4.45	0 00:00	0.00	0.00
6 B3-8	Junction	674.52	679.79	674.52	679.79	0.00	9.95	675.47	0.00	4.32	0 00:00	0.00	0.00
7 B3-9	Junction	674.89	679.79	674.89	679.79	0.00	5.01	675.65	0.00	4.14	0 00:00	0.00	0.00
8 DRIVE B1a	Junction	678.19	6.00	0.00	0.00	0.00	2.90	678.38	0.00	0.05	0 00:00	0.00	0.00
9 DRIVE B1b	Junction	679.17	6.00	0.00	0.00	0.00	2.44	679.32	0.00	0.09	0 00:00	0.00	0.00
10 DRIVE B2a	Junction	679.85	6.00	0.00	0.00	0.00	3.84	680.06	0.00	0.03	0 00:00	0.00	0.00
11 DRIVE B2b	Junction	675.31	6.00	0.00	0.00	0.00	4.38	679.26	0.00	0.02	0 00:00	0.00	0.00
12 DRIVE B2c	Junction	0.00	6.00	0.00	6.00	0.00	3.07	680.04	0.00	0.05	0 00:00	0.00	0.00
13 DRIVE B2d	Junction	678.76	6.00	0.00	0.00	0.00	4.19	678.97	0.00	0.03	0 00:00	0.00	0.00
14 DRIVE B3f	Junction	0.00	6.00	0.00	6.00	0.00	4.64	676.41	0.00	0.02	0 00:00	0.00	0.00
15 DRIVE B3g-1	Junction	0.00	6.00	0.00	6.00	0.00	17.09	678.82	0.00	0.00	0 12:02	1.92	22.00
16 DRIVE B3h	Junction	674.83	6.00	0.00	0.00	0.00	4.70	675.06	0.00	0.02	0 00:00	0.00	0.00
17 OUTFALL B2	Junction	673.11	679.16	673.11	679.16	0.00	48.38	675.00	0.00	4.16	0 00:00	0.00	0.00
18 SDWK BOX B DUMMY	Junction	675.58	677.34	0.00	0.00	0.00	24.34	676.78	0.00	0.56	0 00:00	0.00	0.00
19 Out-1B1-1	Outfall	670.57					51.35	672.06					
20 Out-1B3-1	Outfall	670.57					29.61	671.98					

## Link Summary

SN Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/Total Depth Ratio	Total Time Surcharged
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1 B1-1	Pipe	B1-2	Out-1B1-1	27.44	670.68	670.57	0.4000	24.000	0.0130	51.35	57.77	0.89	7.10	1.38	0.74	0.00
2 B1-2	Pipe	B1-3	B1-2	325.38	671.98	670.78	0.3700	24.000	0.0130	51.12	42.38	1.21	7.43	1.86	0.93	0.00
3 B1-3	Pipe	B1-4	B1-3	135.92	672.61	672.08	0.4000	24.000	0.0130	50.94	43.95	1.16	7.36	1.85	0.93	0.00
4 B2-1	Pipe	B2-2	OUTFALL B2	81.97	673.36	673.16	0.2400	24.000	0.0130	27.14	23.90	1.14	5.19	1.85	0.93	0.00
5 B2-2	Pipe	B2-3	B2-2	126.09	673.76	673.46	0.2400	24.000	0.0130	27.47	23.90	1.15	5.22	1.86	0.93	0.00
6 B2-3	Pipe	B2-4	B2-3	171.36	674.20	673.86	0.2000	24.000	0.0130	20.18	21.82	0.92	4.34	1.55	0.78	0.00
7 B2-4	Pipe	B2-5	B2-4	86.66	674.47	674.30	0.2000	24.000	0.0130	14.45	12.88	1.12	4.03	1.88	0.94	0.00
8 B2-5	Pipe	B2-6	B2-5	41.89	674.65	674.57	0.2000	24.000	0.0130	14.06	12.88	1.09	3.96	1.90	0.95	0.00
9 B2-6	Pipe	B2-7	B2-6	61.04	674.87	674.75	0.2000	24.000	0.0130	7.53	10.12	0.74	3.53	1.29	0.64	0.00
10 B2-7	Pipe	B2-8	B2-7	170.14	675.31	674.97	0.2000	24.000	0.0150	3.54	11.16	0.32	2.48	0.71	0.36	0.00
11 B2c-1	Pipe	B2c-1	B2-6	182.72	675.12	674.75	0.2000	24.000	0.0130	2.89	12.88	0.22	2.59	0.56	0.28	0.00
12 B3-1	Pipe	B3-2	Out-1B3-1	33.76	670.66	670.57	0.2700	24.000	0.0130	29.61	36.26	0.82	5.24	1.41	0.71	0.00
13 B3-2	Pipe	B3-3	B3-2	96.98	671.02	670.76	0.2700	24.000	0.0130	26.73	36.26	0.74	5.09	1.31	0.66	0.00
14 B3-3	Pipe	B3-4	B3-3	101.12	671.52	671.12	0.4000	24.000	0.0130	26.74	30.86	0.87	5.96	1.49	0.75	0.00
15 B3-4	Pipe	B3-5	B3-4	143.96	672.20	671.62	0.4000	24.000	0.0130	19.21	30.86	0.62	5.47	1.17	0.59	0.00
16 B3-5	Pipe	B3-6	B3-5	87.13	672.88	672.30	0.6700	24.000	0.0110	16.50	21.90	0.75	7.67	1.29	0.65	0.00
17 B3-6	Pipe	B3-7	B3-6	116.41	673.67	672.88	0.6700	24.000	0.0110	9.95	21.90	0.45	6.81	0.94	0.47	0.00
18 B3-7	Pipe	B3-8	B3-7	112.25	674.52	673.77	0.6700	24.000	0.0110	9.95	21.88	0.45	6.81	0.94	0.47	0.00
19 B3-8	Pipe	B3-9	B3-8	40.25	674.89	674.62	0.6700	24.000	0.0120	5.00	20.06	0.25	5.30	0.68	0.34	0.00
20 B3-9	Pipe	INLET B3a	B3-9	87.75	675.58	674.99	0.6700	12.000	0.0110	2.41	3.45	0.70	4.75	0.61	0.62	0.00
21 B3b-1	Pipe	INLET B3b	B3-9	68.38	675.45	674.99	0.6700	12.000	0.0110	2.64	3.45	0.77	4.85	0.65	0.65	0.00
22 B3c-1	Pipe	INLET B3c	B3-8	75.08	675.12	674.62	0.6700	12.000	0.0110	2.41	3.45	0.70	4.76	0.61	0.62	0.00
23 B3d-1	Pipe	INLET B3d	B3-8	51.50	674.97	674.62	0.6700	12.000	0.0110	2.58	3.45	0.75	4.82	0.65	0.65	0.00
24 CHANNEL B 1	Channel	SDWK BOX B DUMMY	OUTFALL B2	621.36	675.58	673.11	0.4000	15.000	0.0400	23.91	26.12	0.92	2.26	1.18	0.95	0.00
25 CHANNEL B 2	Channel	OUTFALL B2	B1-4	123.46	673.11	672.61	0.4000	15.720	0.0240	48.37	82.56	0.59	5.91	1.00	0.76	0.00
26 CHANNEL B DUMMY	Channel	SDWK BOX B	SDWK BOX B DUMMY	1.00	677.34	675.58	176.4000	15.000	0.0400	5.15	550.73	0.01	9.42	0.09	0.07	0.00
27 DRIVE B1a	Channel	DRIVE B1a	SDWK BOX B	172.00	678.19	677.34	0.5000	2.880	0.0130	2.89	5.64	0.51	1.67	0.19	0.78	0.00
28 DRIVE B1a DUMMY	Channel	B2-7	DRIVE B1a	1.00	678.20	678.19	0.5000	2.880	0.0320	0.35	2.30	0.15	0.50	0.12	0.49	0.00
29 DRIVE B1b	Channel	DRIVE B1b	SDWK BOX B	165.84	679.17	677.34	1.1000	2.880	0.0130	2.42	8.41	0.29	2.15	0.15	0.63	0.00
30 DRIVE B2a	Channel	DRIVE B2a	B2-8	163.00	679.85	679.04	0.5000	2.880	0.0130	3.80	5.64	0.67	1.79	0.21	0.86	0.00
31 DRIVE B2b	Channel	DRIVE B2b	B2-7	169.00	679.04	678.20	0.5000	2.880	0.0130	4.35	5.66	0.77	1.86	0.22	0.91	0.00
32 DRIVE B2b DUMMY	Channel	B2-8	DRIVE B2b	1.00	679.04	675.31	373.5300	2.880	0.0320	0.26	62.88	0.00	5.53	0.03	0.13	0.00
33 DRIVE B2c	Channel	DRIVE B2c	B2c-1	218.00	679.85	678.76	0.5000	2.880	0.0130	3.06	5.66	0.54	1.72	0.19	0.79	0.00
34 DRIVE B2d	Channel	DRIVE B2d	B2-6	182.72	678.76	677.85	0.4900	2.880	0.0130	4.16	5.63	0.74	1.83	0.21	0.89	0.00
35 DRIVE B2d DUMMY	Channel	B2c-1	DRIVE B2d	1.00	678.76	678.76	0.5000	2.880	0.0130	0.16	5.68	0.03	0.80	0.06	0.26	0.00
36 DRIVE B2e	Channel	B2-6	B2-4	125.00	677.85	677.22	0.5000	2.880	0.0130	0.31	5.68	0.05	1.00	0.08	0.34	0.00
37 DRIVE B3f	Channel	DRIVE B3f	B3-5	124.52	676.19	675.57	0.5000	2.880	0.0130	4.64	5.66	0.82	1.88	0.22	0.93	0.00
38 DRIVE B3g-1	Channel	DRIVE B3g-1	B3-4	400.00	678.58	674.84	0.9400	2.880	0.0130	7.75	7.75	1.00	2.85	0.24	1.00	20.00
39 DRIVE B3g-2	Channel	B3-5	B3-4	145.00	675.57	674.84	0.5000	2.880	0.0130	0.19	5.68	0.03	0.92	0.07	0.28	0.00
40 DRIVE B3h	Channel	DRIVE B3h	B3-2	185.00	674.83	673.91	0.5000	2.880	0.0130	4.66	5.66	0.82	1.89	0.22	0.93	0.00
41 DRIVE B3h DUMMY	Channel	B3-4	DRIVE B3h	1.00	674.84	674.83	0.6000	2.880	0.0130	0.35	6.18	0.06	1.05	0.08	0.34	0.00



## Inlet Summary

SN	Element ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation	Max (Rim) Elevation	Initial Water Elevation	Ponded Area	Peak Flow	Peak Flow Intercepted	Peak Flow Bypassing Inlet	Inlet Efficiency during Peak Flow	Allowable Spread	Max Gutter Spread during Peak Flow	Max Gutter Water Elev. during Peak Flow
						(ft)	(ft)	(ft)	(ft <sup>2</sup> )	(cfs)	(cfs)	(cfs)	(%)	(ft)	(ft)	(ft)
1	B1-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.68	674.37	670.68	0.00	1.22	N/A	N/A	N/A	7.00	7.10	674.76
2	B1-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	671.98	675.90	671.98	0.00	1.31	N/A	N/A	N/A	7.00	7.49	676.30
3	B2-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	673.76	677.31	673.76	0.00	5.74	N/A	N/A	N/A	7.00	17.35	678.14
4	B2-4	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.20	677.22	674.20	0.00	6.61	N/A	N/A	N/A	7.00	18.47	678.07
5	B2-6	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.65	677.85	674.65	N/A	4.16	3.84	0.32	92.42	7.00	13.73	678.19
6	B2-7	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.87	678.20	674.87	N/A	4.35	4.00	0.35	92.02	7.00	13.97	678.54
7	B2-8	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.31	679.04	675.31	N/A	3.80	3.54	0.26	93.17	7.00	13.26	679.37
8	B2c-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.12	678.76	675.12	N/A	3.06	2.90	0.16	94.86	7.00	12.17	679.07
9	B3-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.66	673.91	670.66	0.00	4.66	N/A	N/A	N/A	7.00	15.60	674.70
10	B3-4	FHWA HEC-22 GENERIC	N/A	On Grade	1	671.52	674.84	671.52	N/A	7.94	7.58	0.35	95.55	7.00	17.65	675.25
11	B3-5	FHWA HEC-22 GENERIC	N/A	On Grade	1	672.20	675.57	672.20	N/A	4.64	4.45	0.19	95.82	7.00	14.34	675.92
12	B3-6	FHWA HEC-22 GENERIC	N/A	On Sag	1	672.88	676.10	672.88	0.00	7.55	N/A	N/A	N/A	7.00	17.64	676.95
13	INLET B3a	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	679.17	675.58	0.00	2.41	N/A	N/A	N/A	7.00	10.37	679.63
14	INLET B3b	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.45	678.68	675.45	0.00	2.63	N/A	N/A	N/A	7.00	10.99	679.15
15	INLET B3c	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.12	679.17	675.12	0.00	2.41	N/A	N/A	N/A	7.00	10.37	679.63
16	INLET B3d	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.97	678.67	674.97	0.00	2.58	N/A	N/A	N/A	7.00	10.85	679.14
17	SDWK BOX B	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	677.34	0.00	0.00	5.14	N/A	N/A	N/A	7.00	21.90	678.26

Subbasin Hydrology

Subbasin : B1a

Input Data

Area (ac) ..... 0.27  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

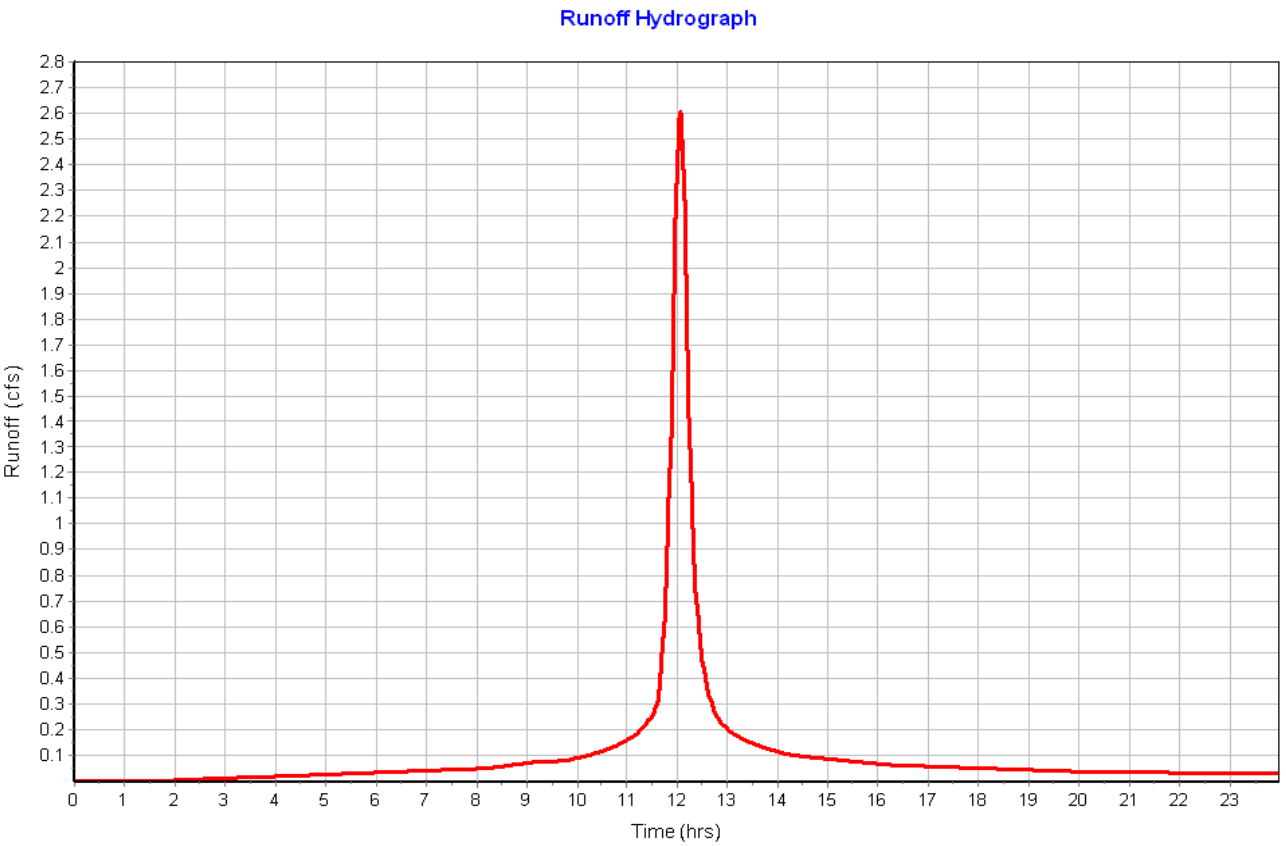
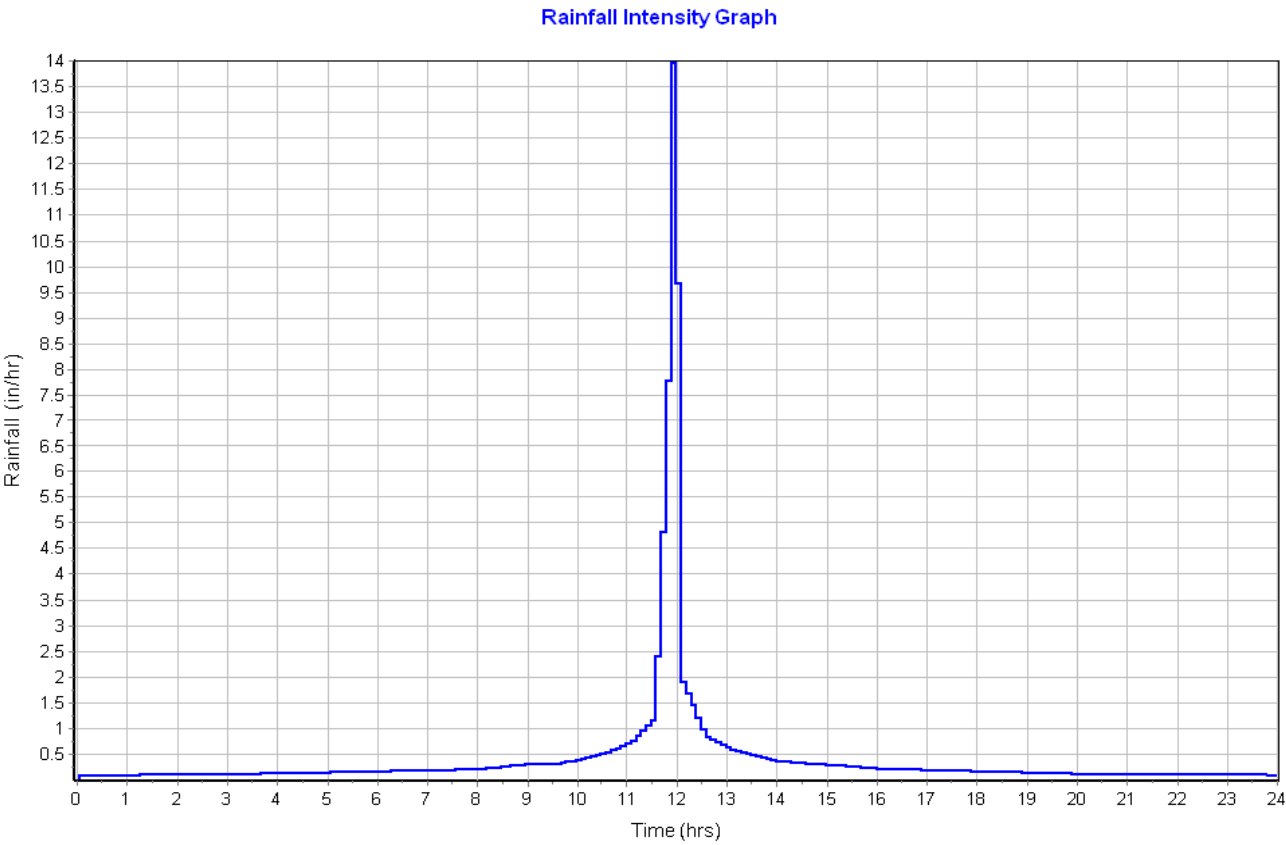
Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.27	-	93.00
Composite Area & Weighted CN	0.27		93.00

Subbasin Runoff Results

Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 2.61  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:17:53

Subbasin : B1a



Subbasin : B1b

Input Data

Area (ac) ..... 0.21  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.21	-	93.00
Composite Area & Weighted CN	0.21		93.00

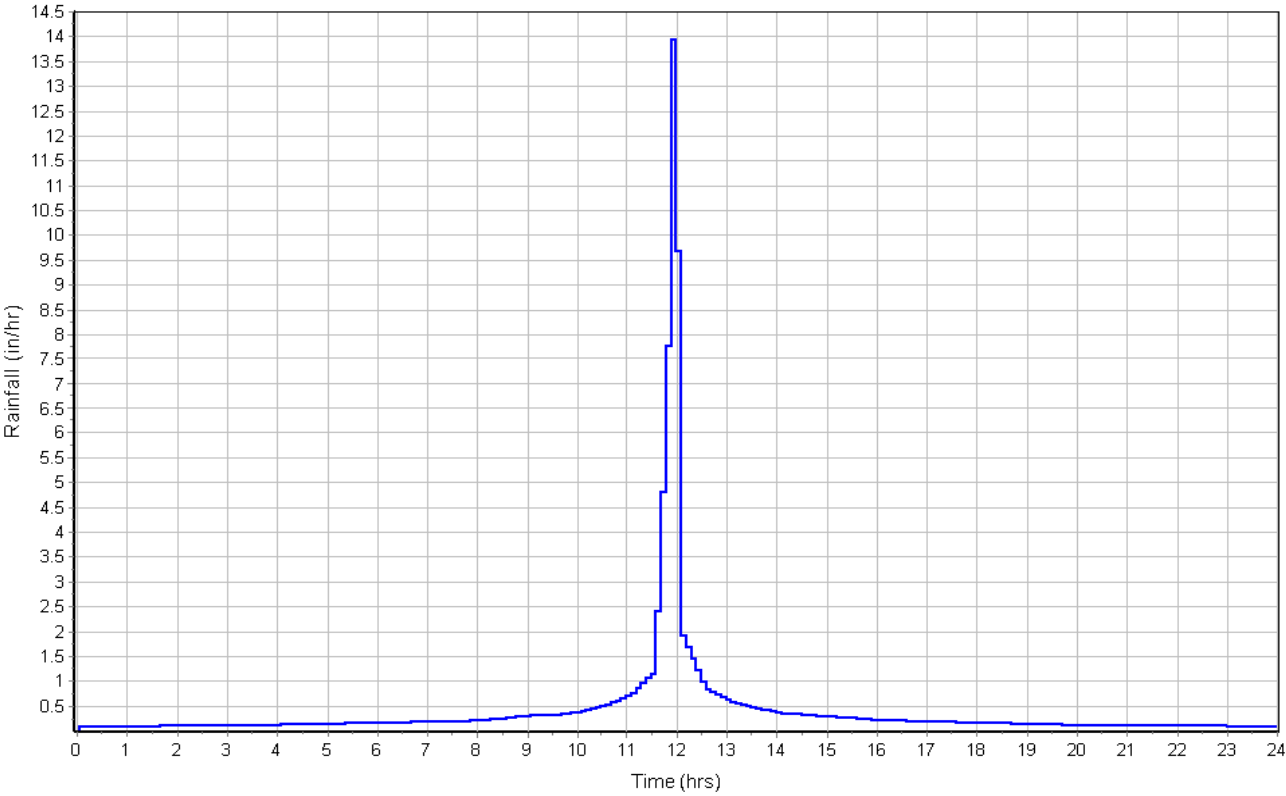
Subbasin Runoff Results

Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 2.44  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

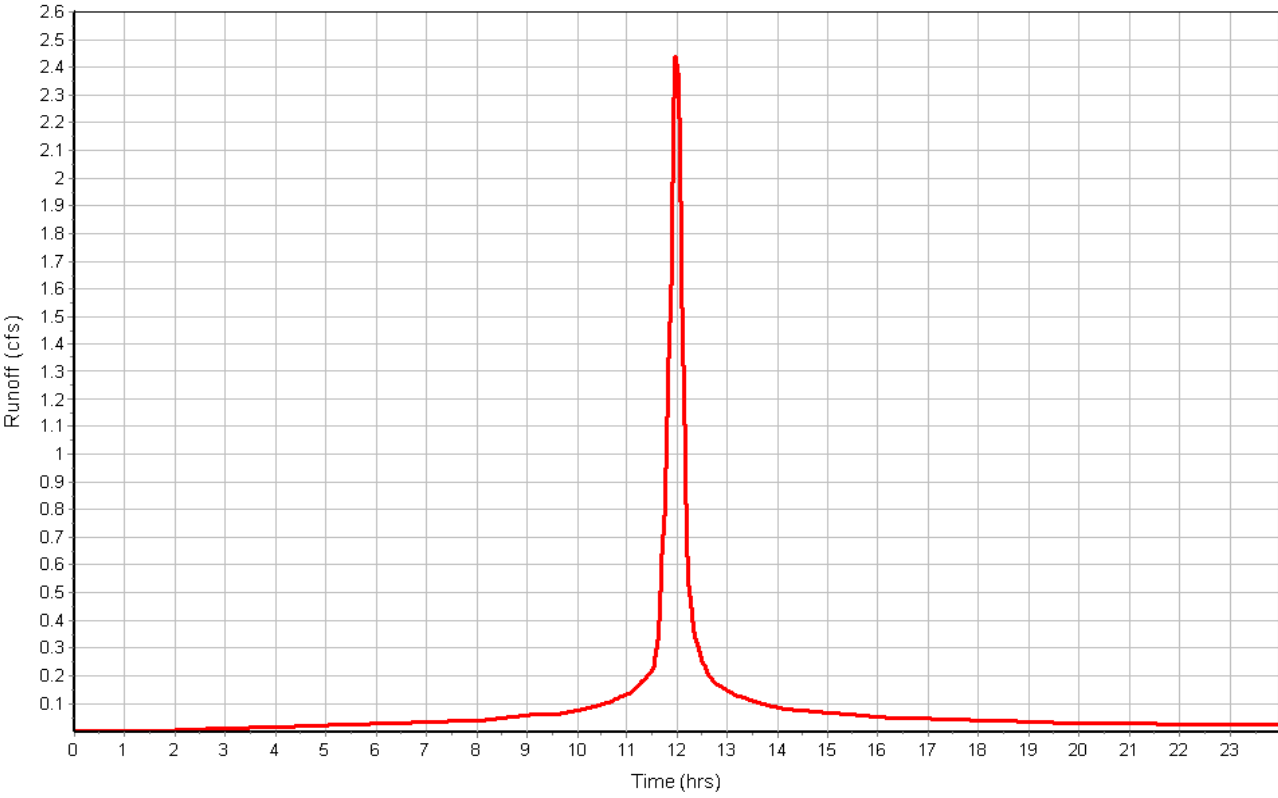


Subbasin : B1b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2a

Input Data

Area (ac) ..... 0.33  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

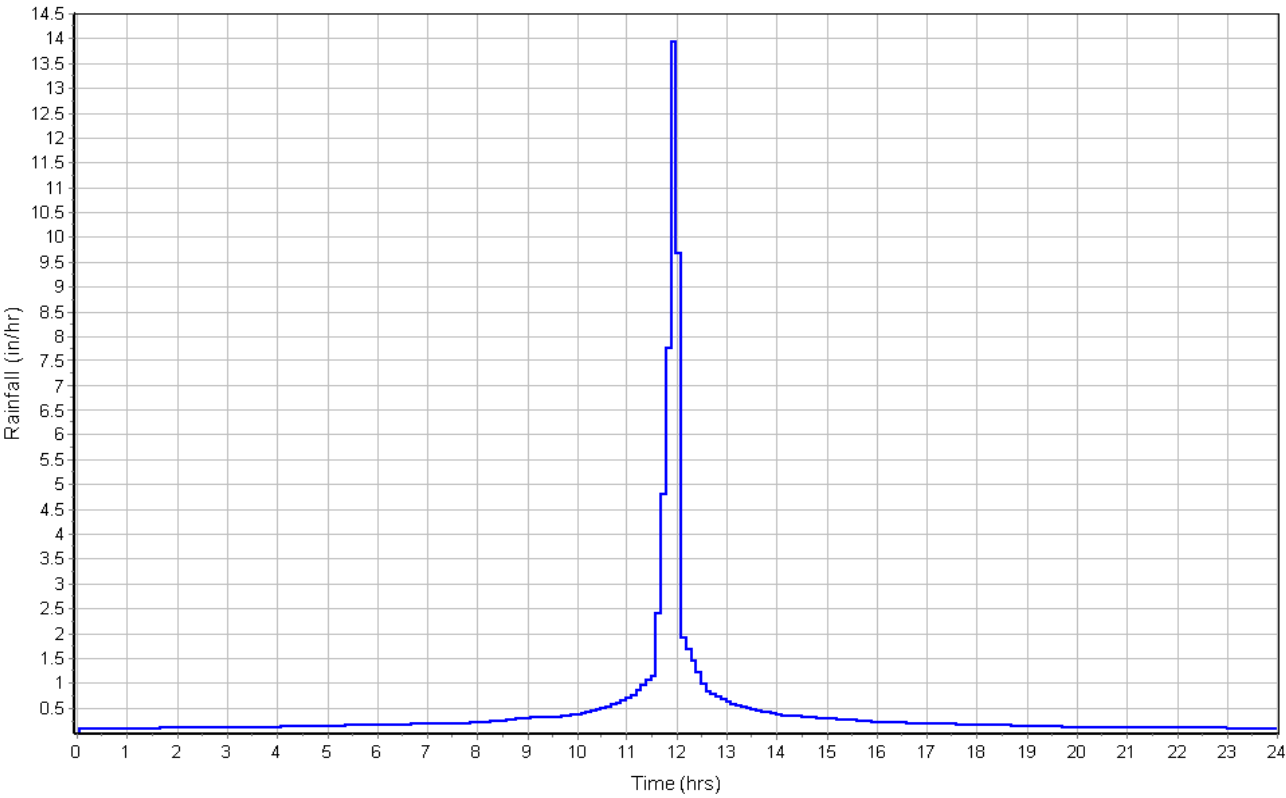
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.33	-	93.00
Composite Area & Weighted CN	0.33		93.00

Subbasin Runoff Results

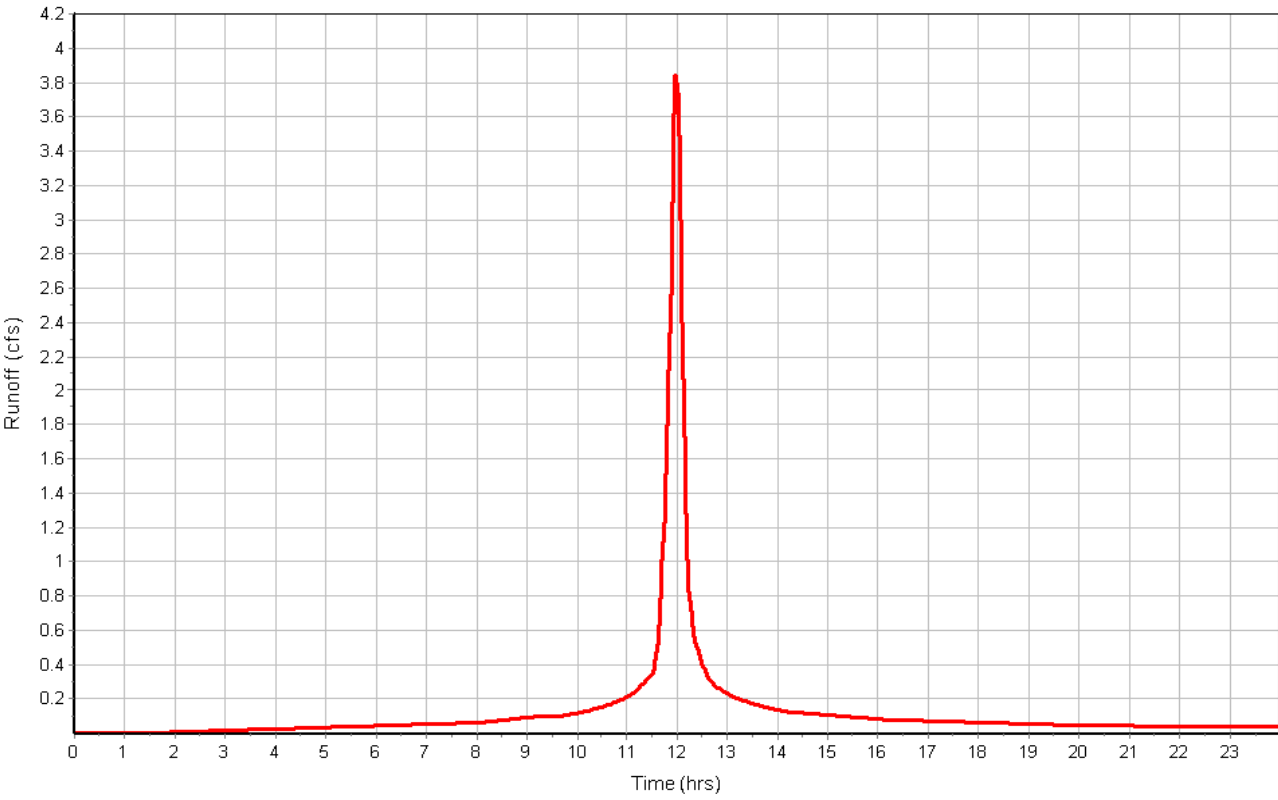
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 3.84  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B2a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2b

Input Data

Area (ac) ..... 0.36  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

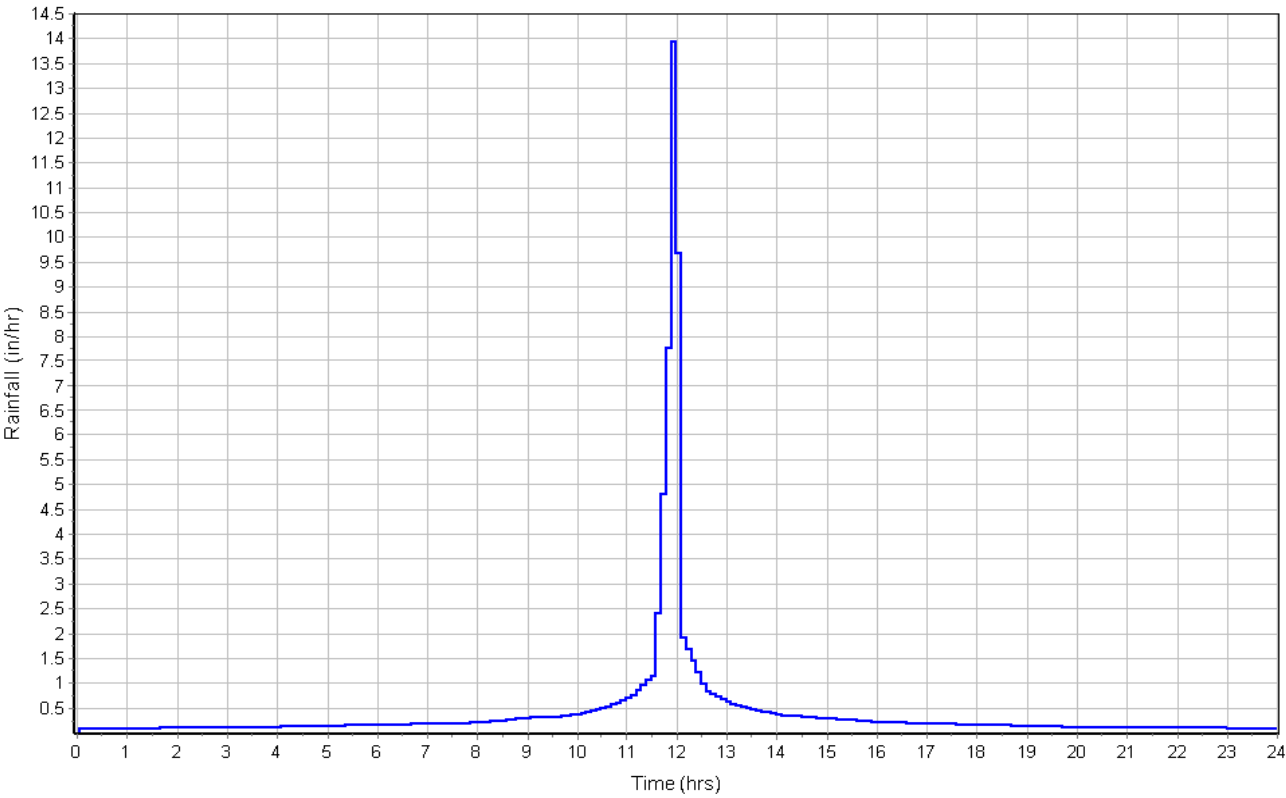
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.36	-	93.00
Composite Area & Weighted CN	0.36		93.00

Subbasin Runoff Results

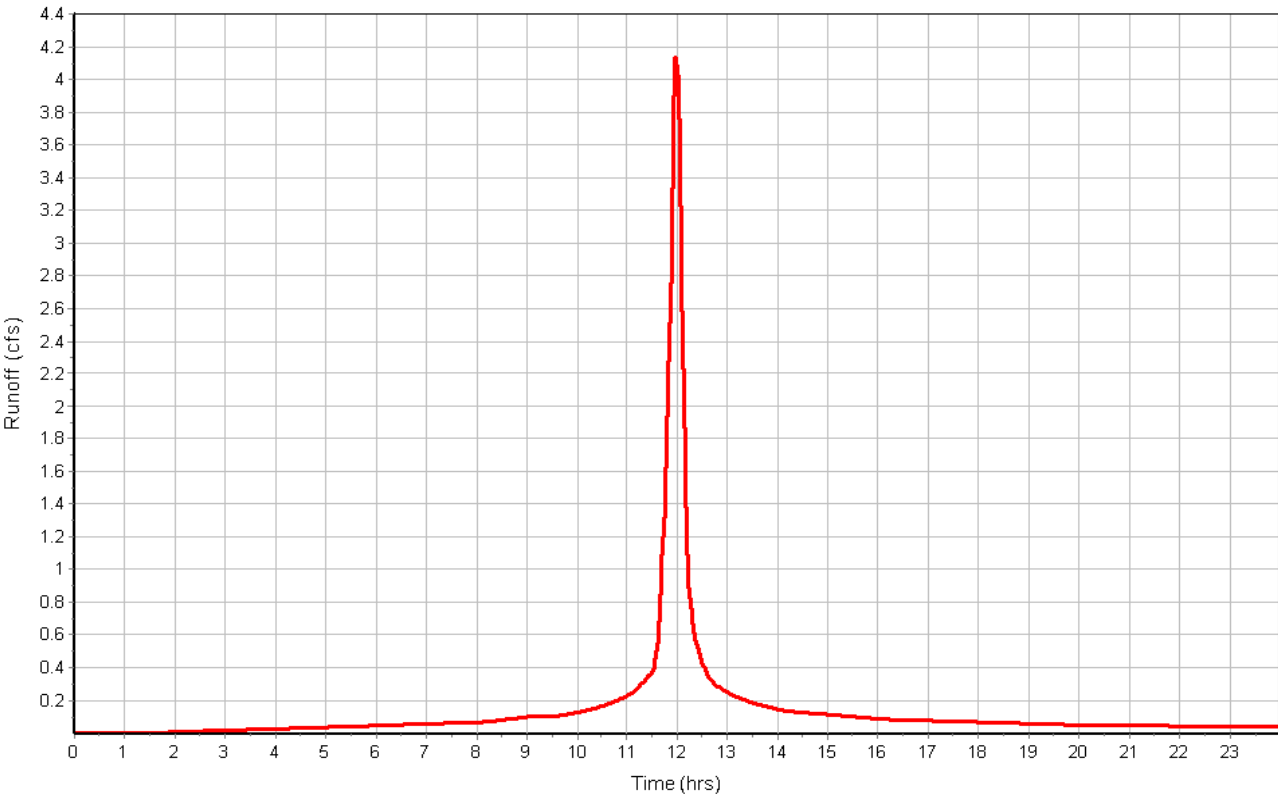
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 4.14  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B2b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2c

Input Data

Area (ac) ..... 0.28  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

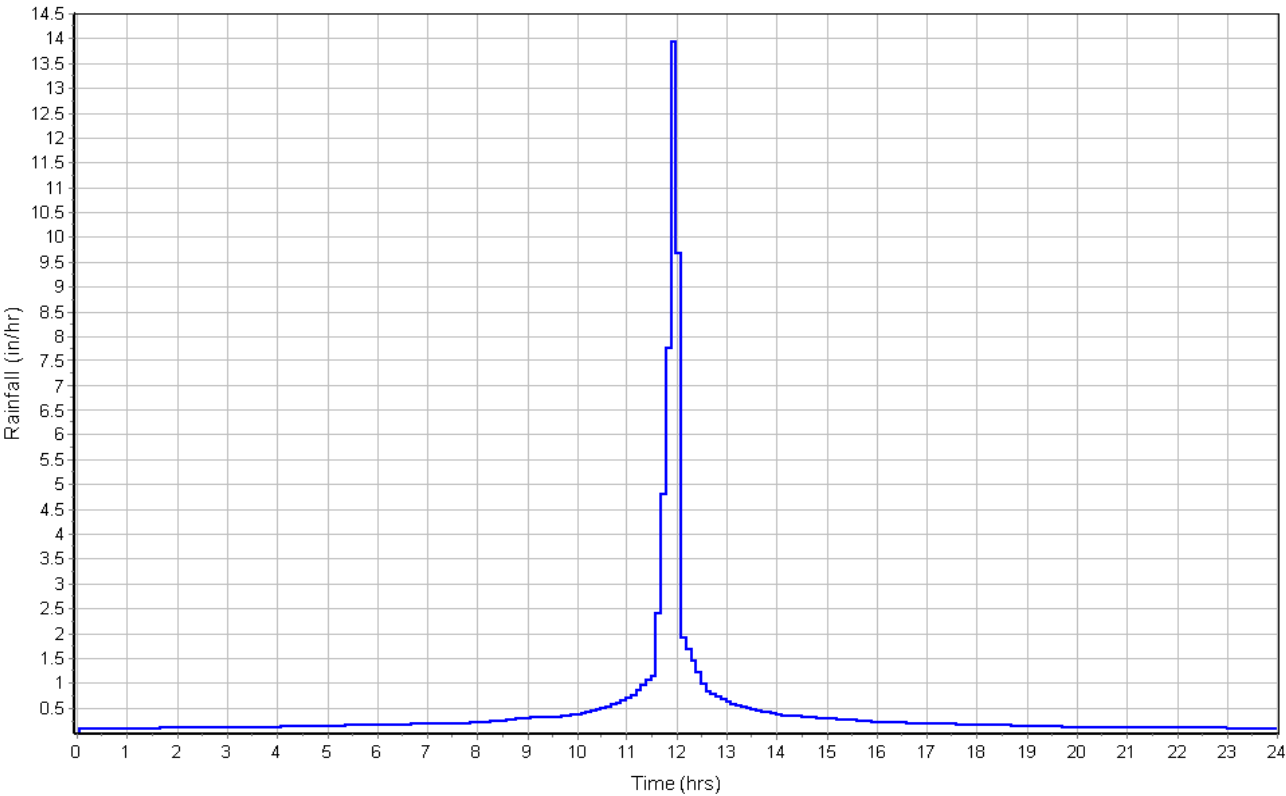
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.28	-	93.00
Composite Area & Weighted CN	0.28		93.00

Subbasin Runoff Results

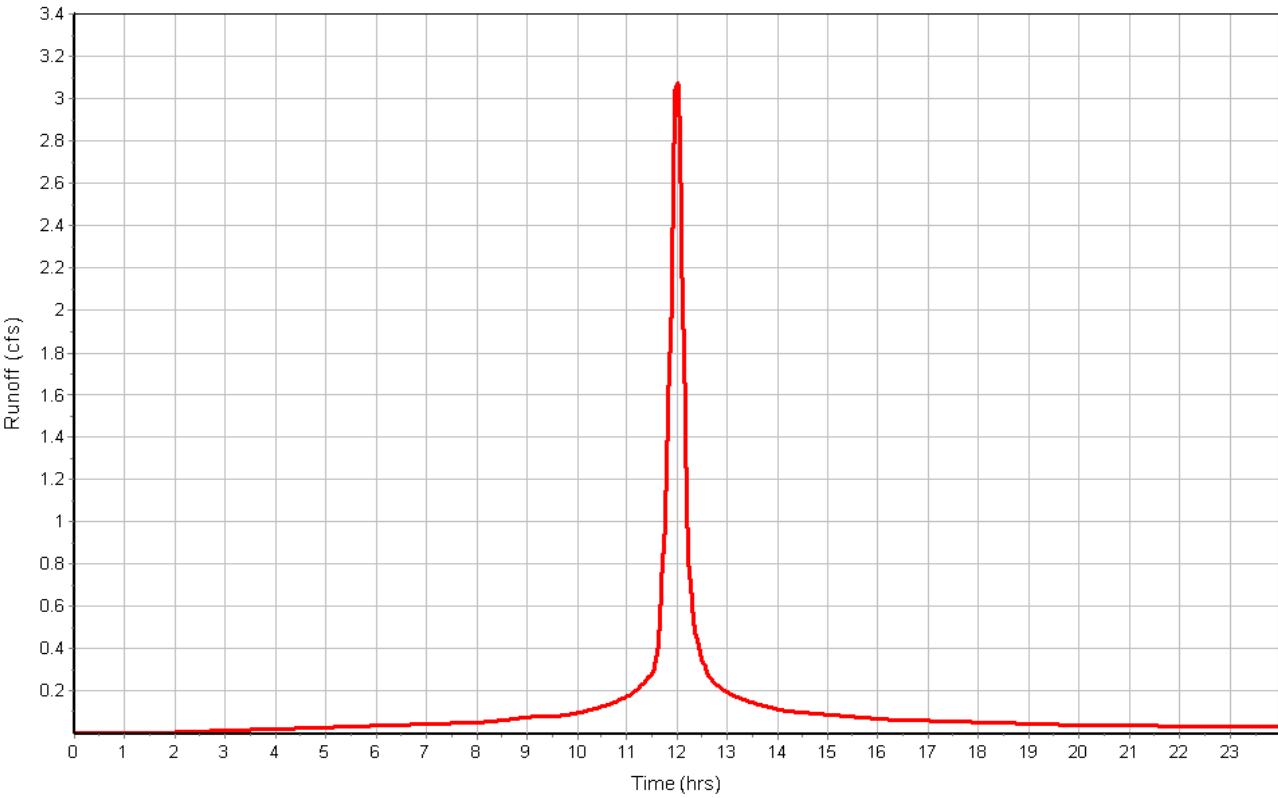
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 3.08  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:11:19

Subbasin : B2c

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2d

Input Data

Area (ac) ..... 0.35  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.35	-	93.00
Composite Area & Weighted CN	0.35		93.00

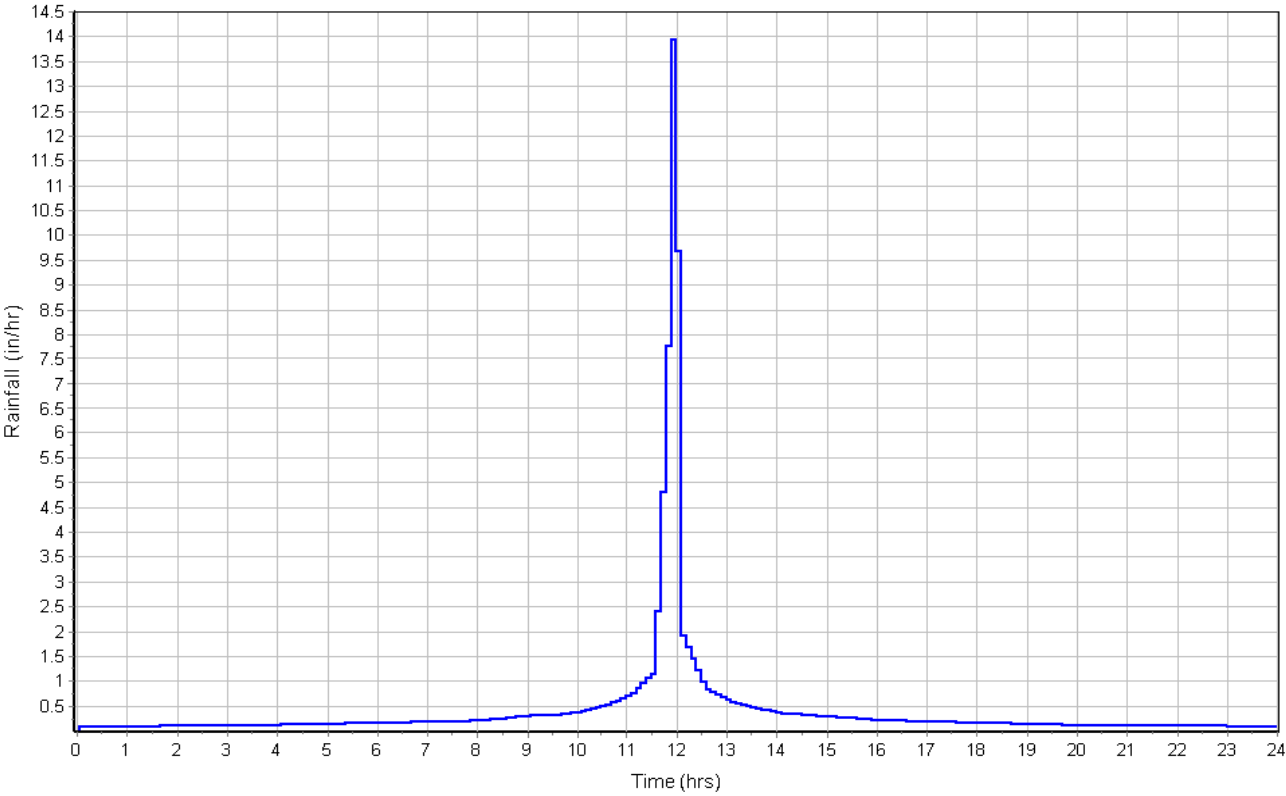
Subbasin Runoff Results

Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 4.06  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

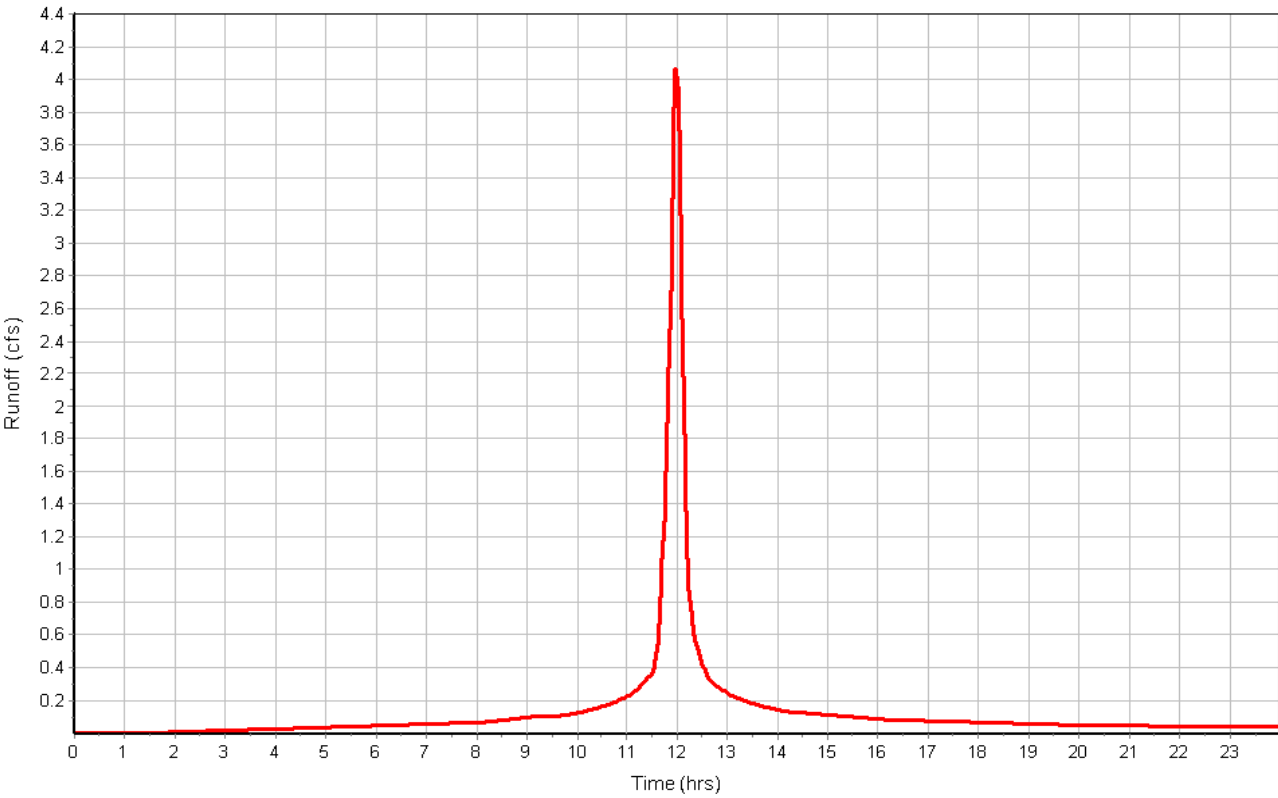


Subbasin : B2d

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2e

Input Data

Area (ac) ..... 0.65  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

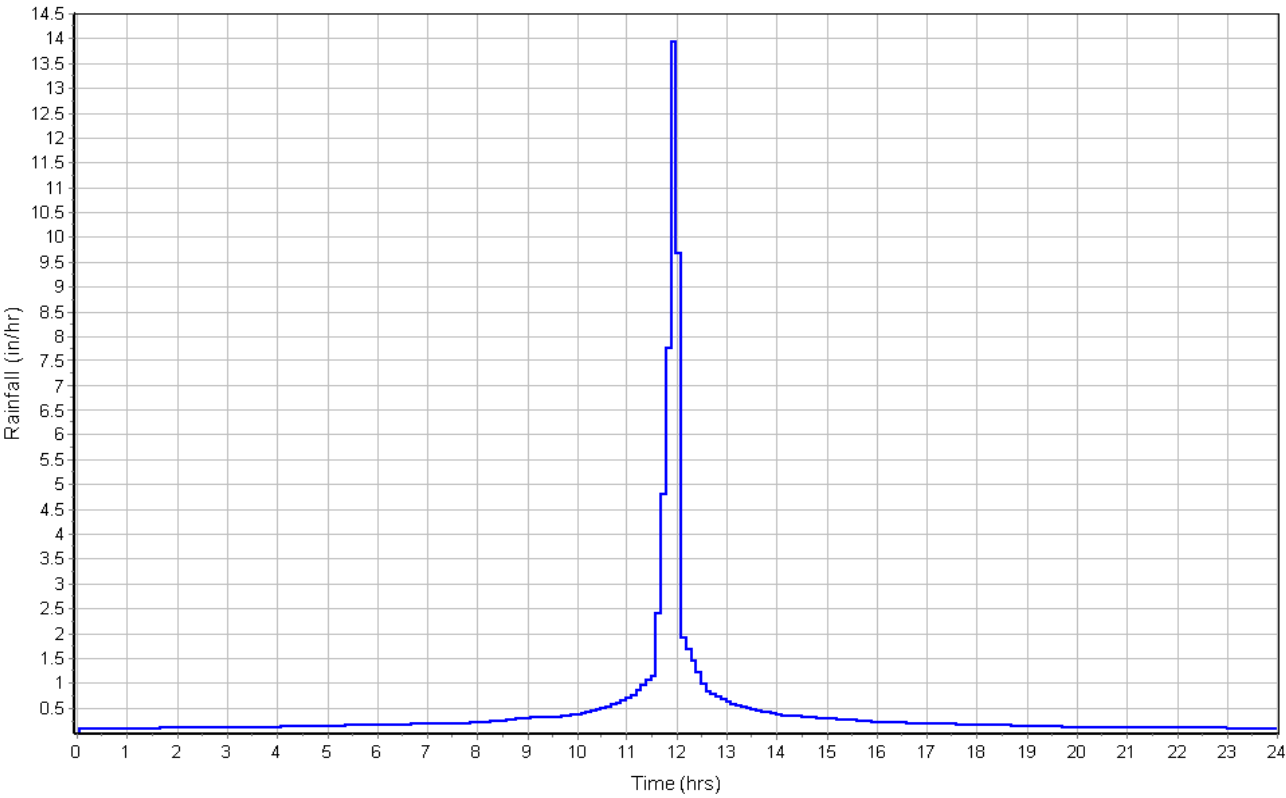
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.65	-	93.00
Composite Area & Weighted CN	0.65		93.00

Subbasin Runoff Results

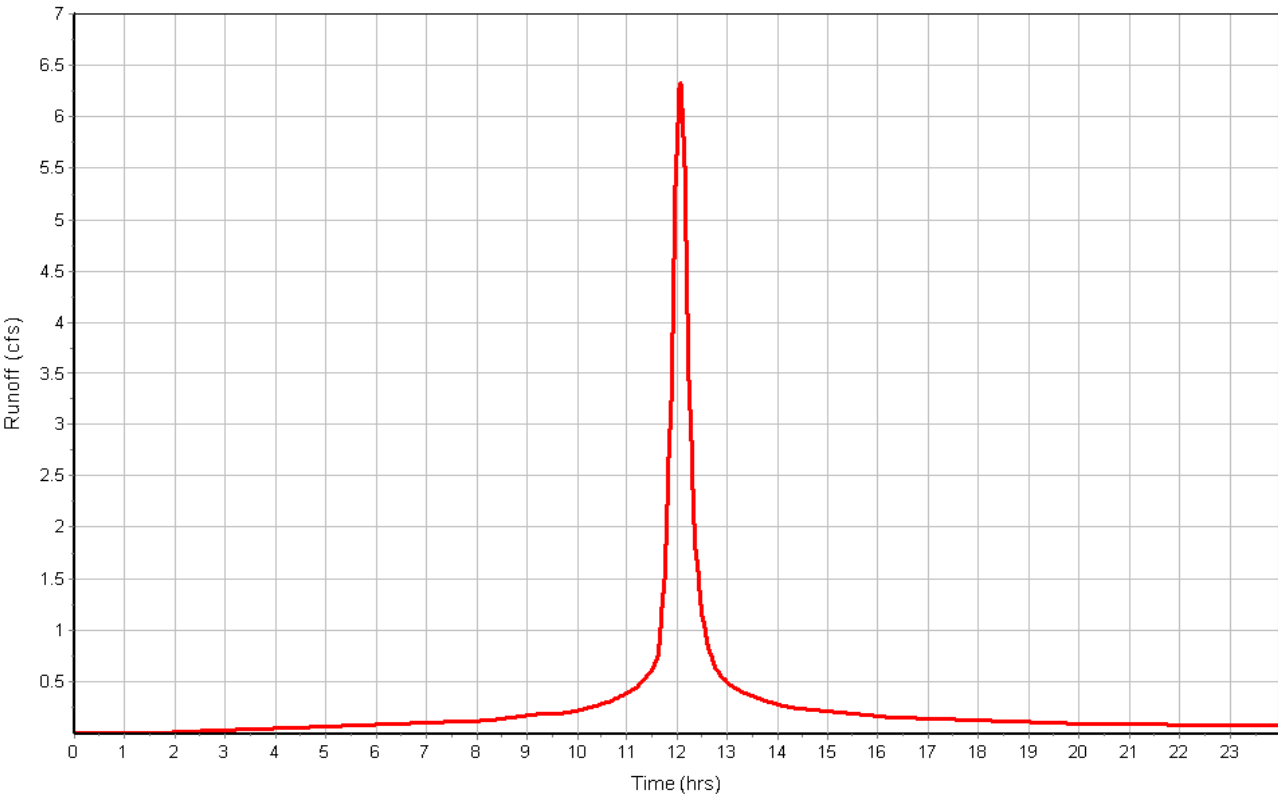
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 6.35  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:17:51

Subbasin : B2e

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2f

Input Data

Area (ac) ..... 0.63  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

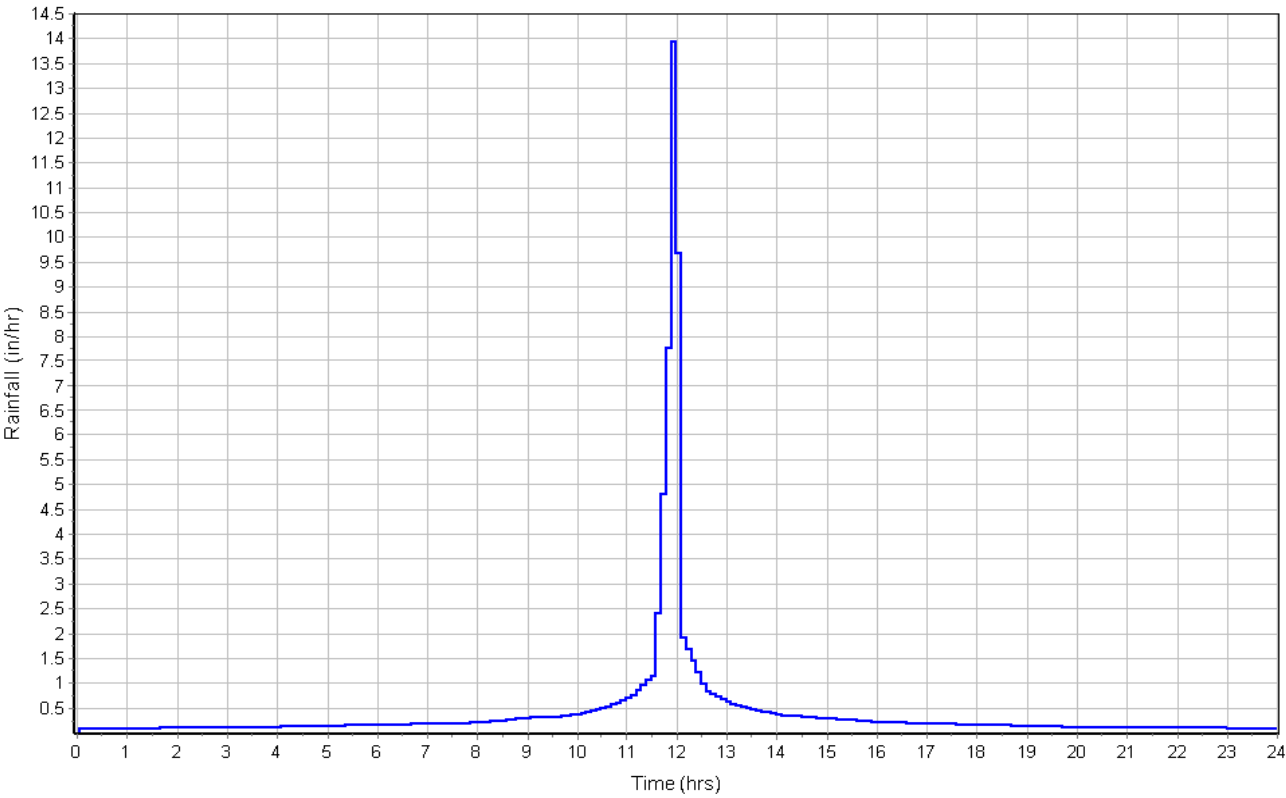
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.63	-	93.00
Composite Area & Weighted CN	0.63		93.00

Subbasin Runoff Results

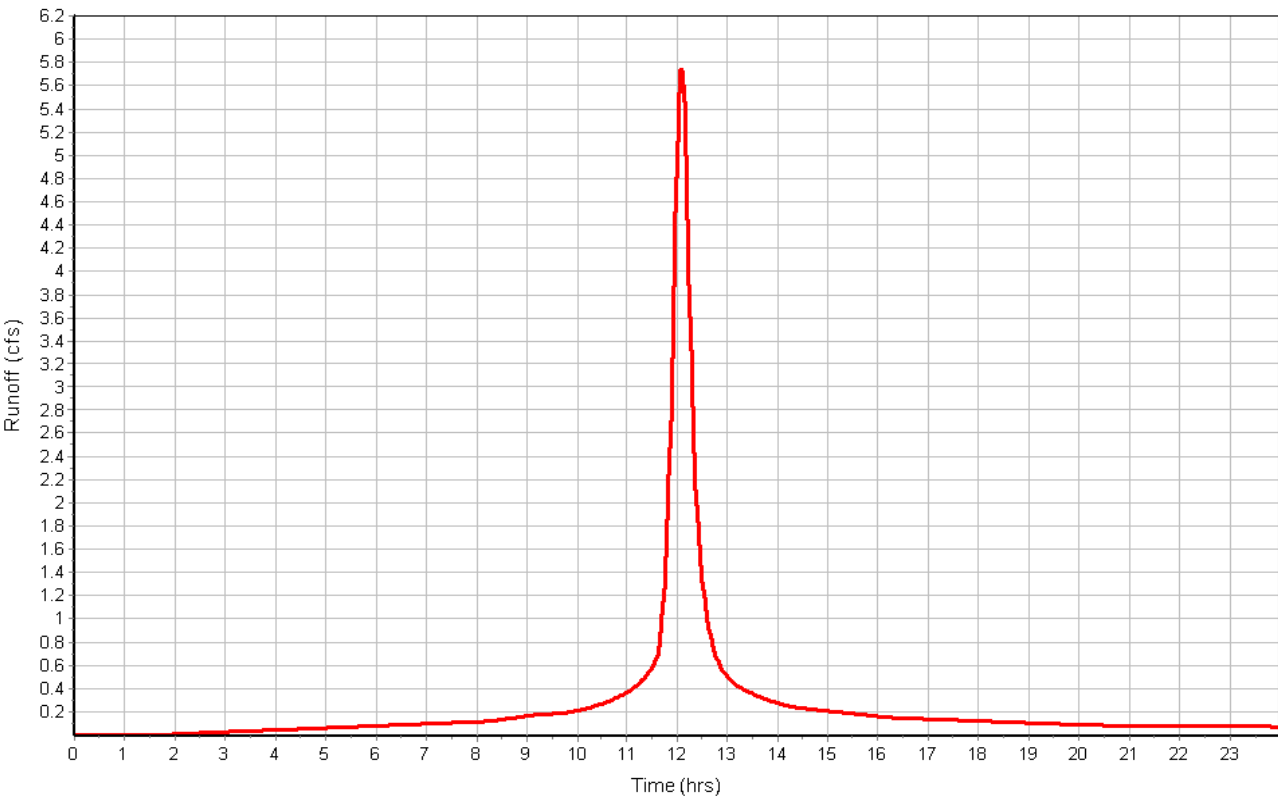
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 5.77  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:20:46

Subbasin : B2f

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3a

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

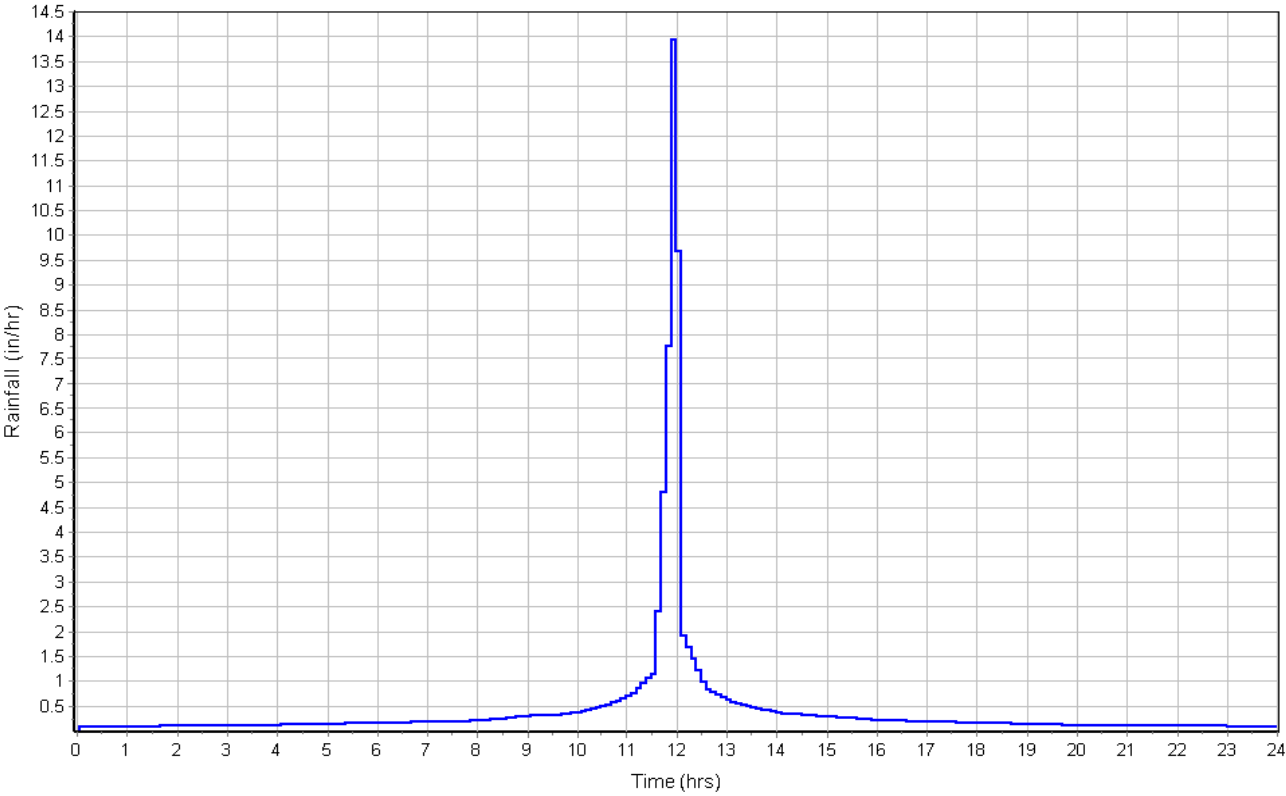
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

Subbasin Runoff Results

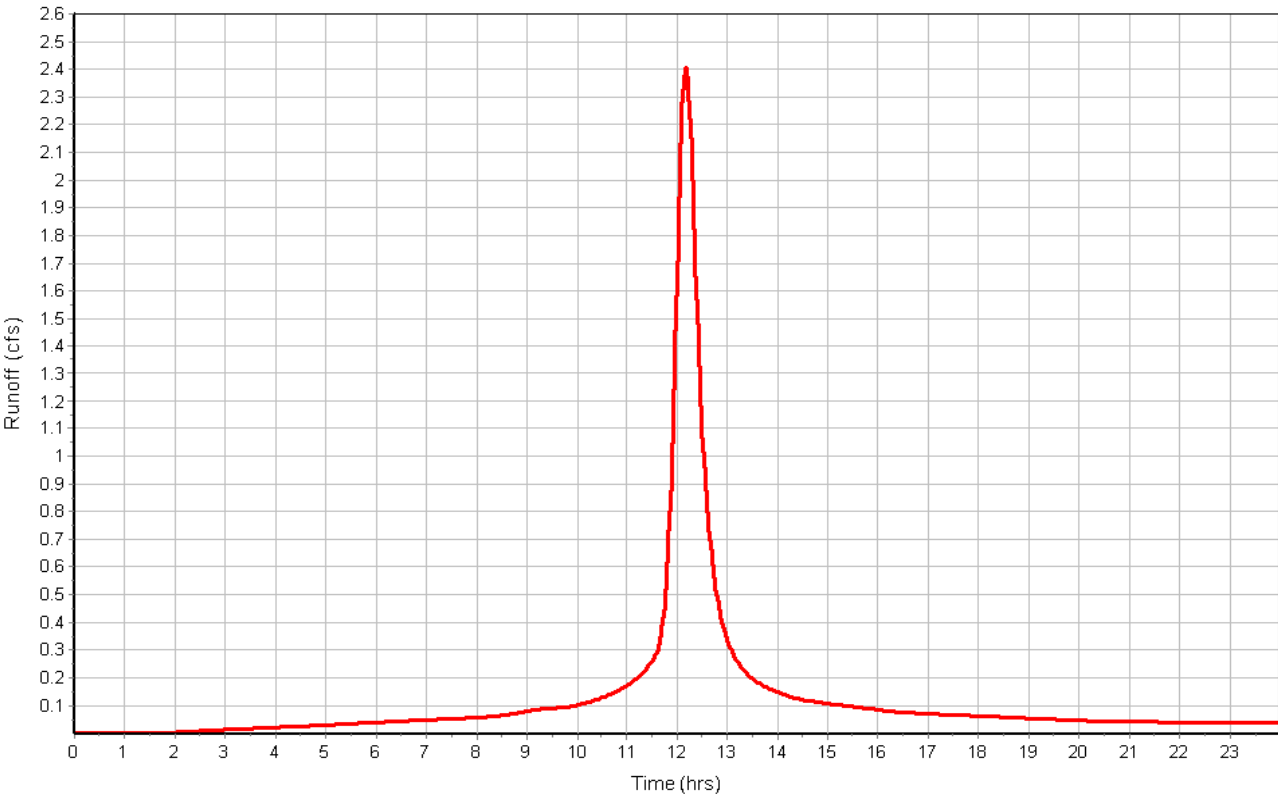
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 2.41  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:30:09

Subbasin : B3a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3b

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

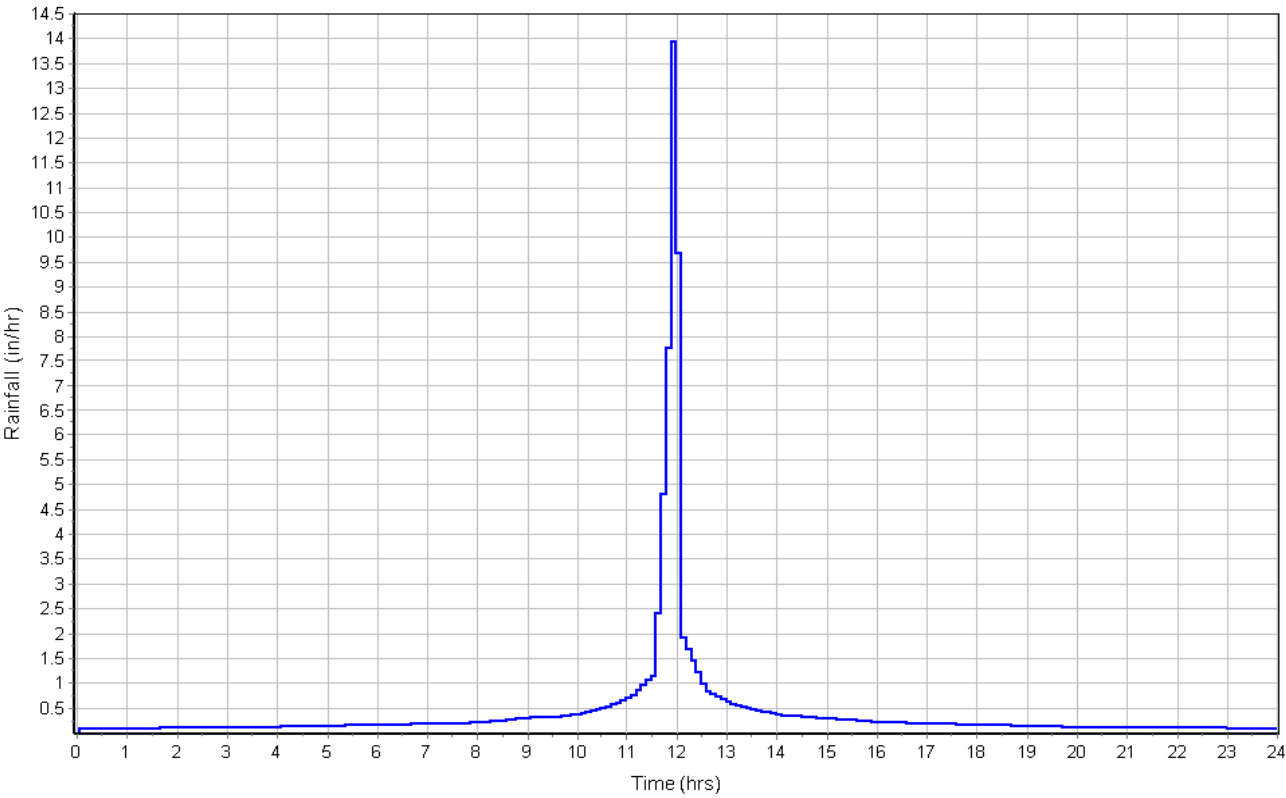
Subbasin Runoff Results

Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 2.64  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:25:35

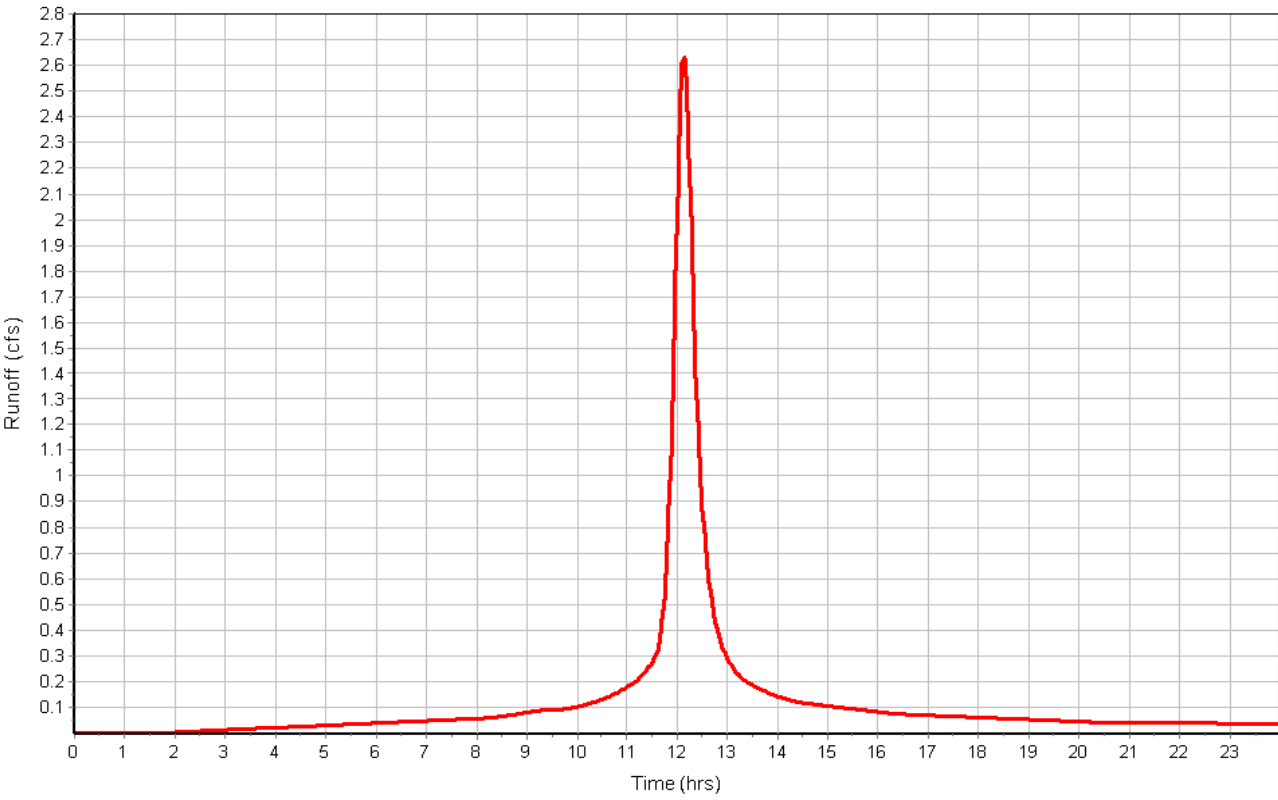


Subbasin : B3b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3c

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

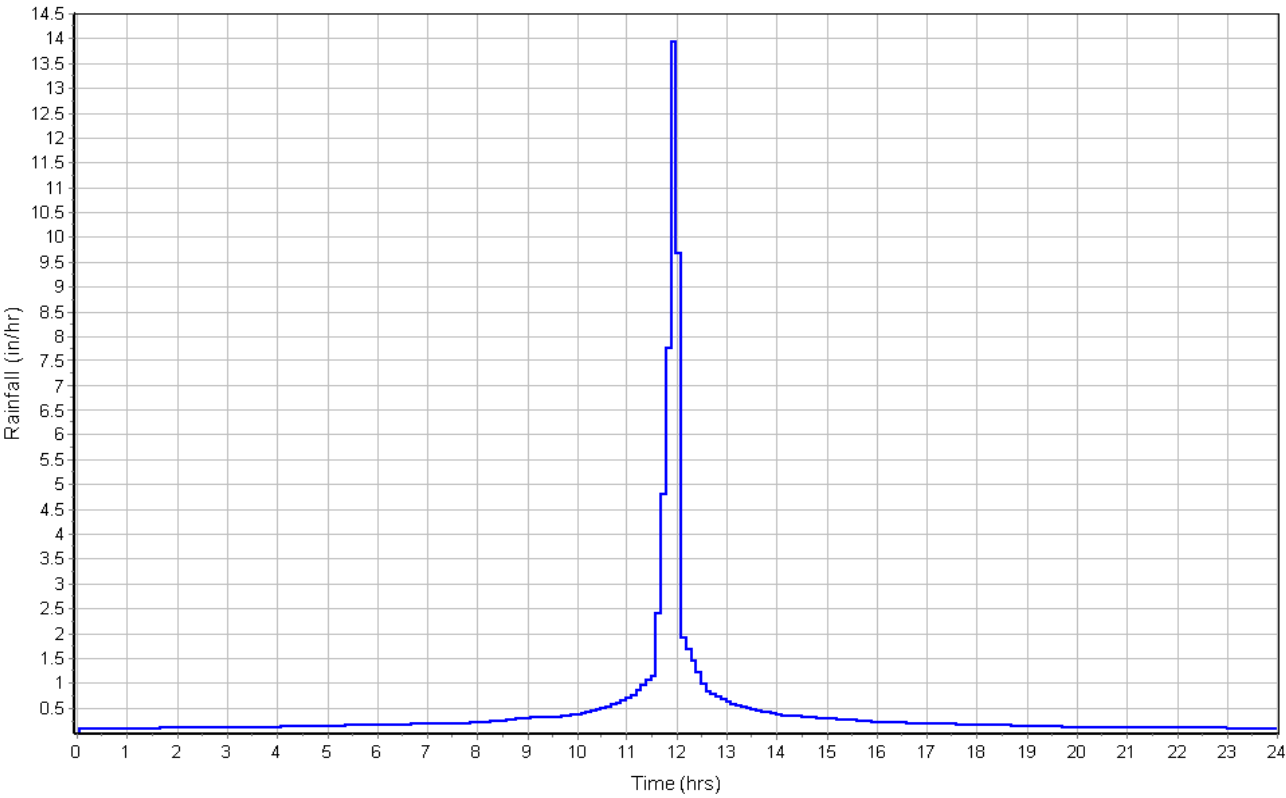
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

Subbasin Runoff Results

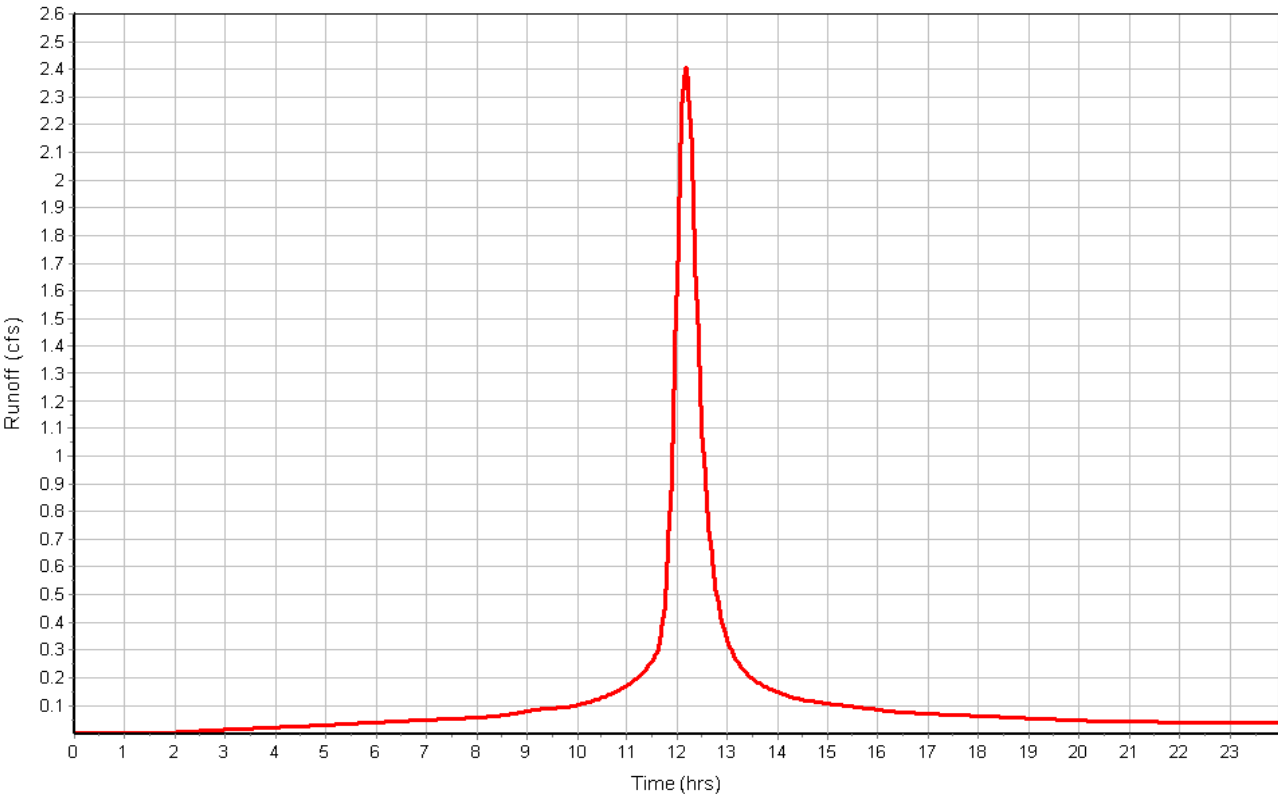
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 2.41  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:30:09

Subbasin : B3c

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3d

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

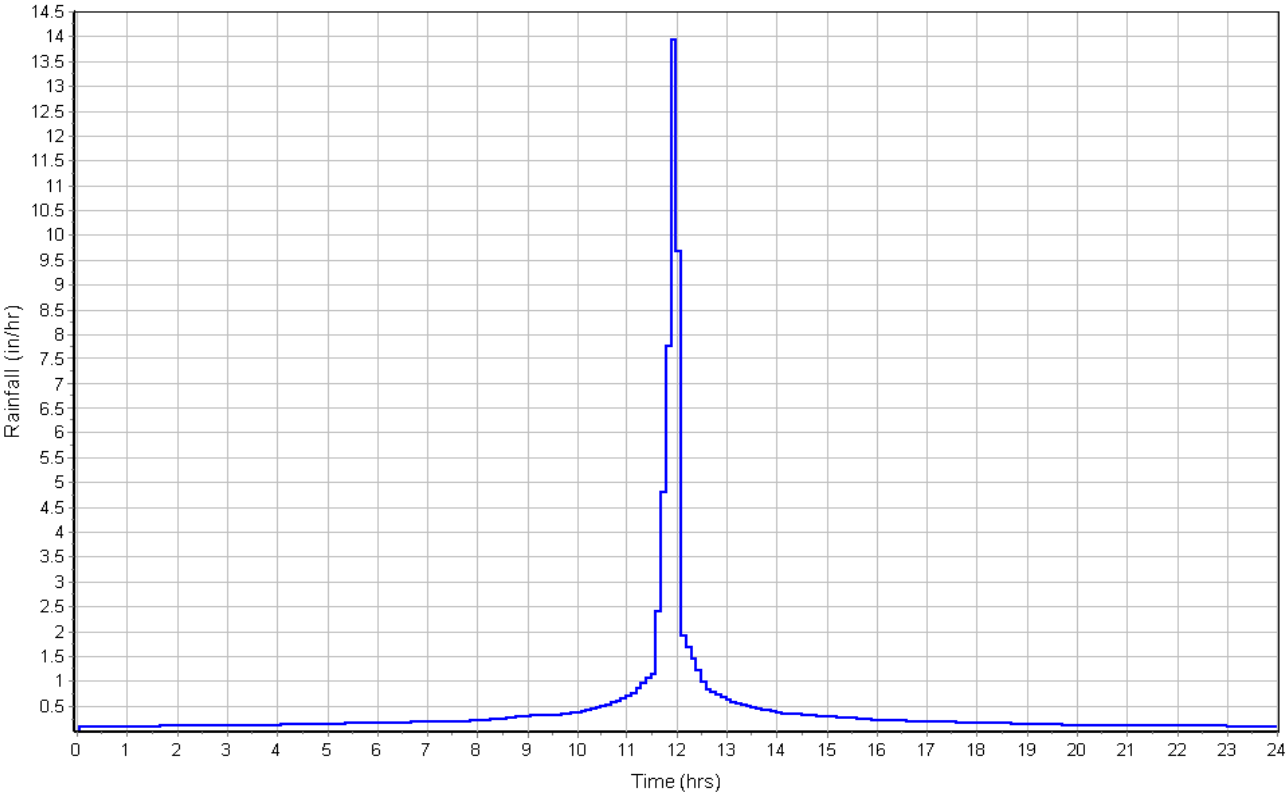
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

Subbasin Runoff Results

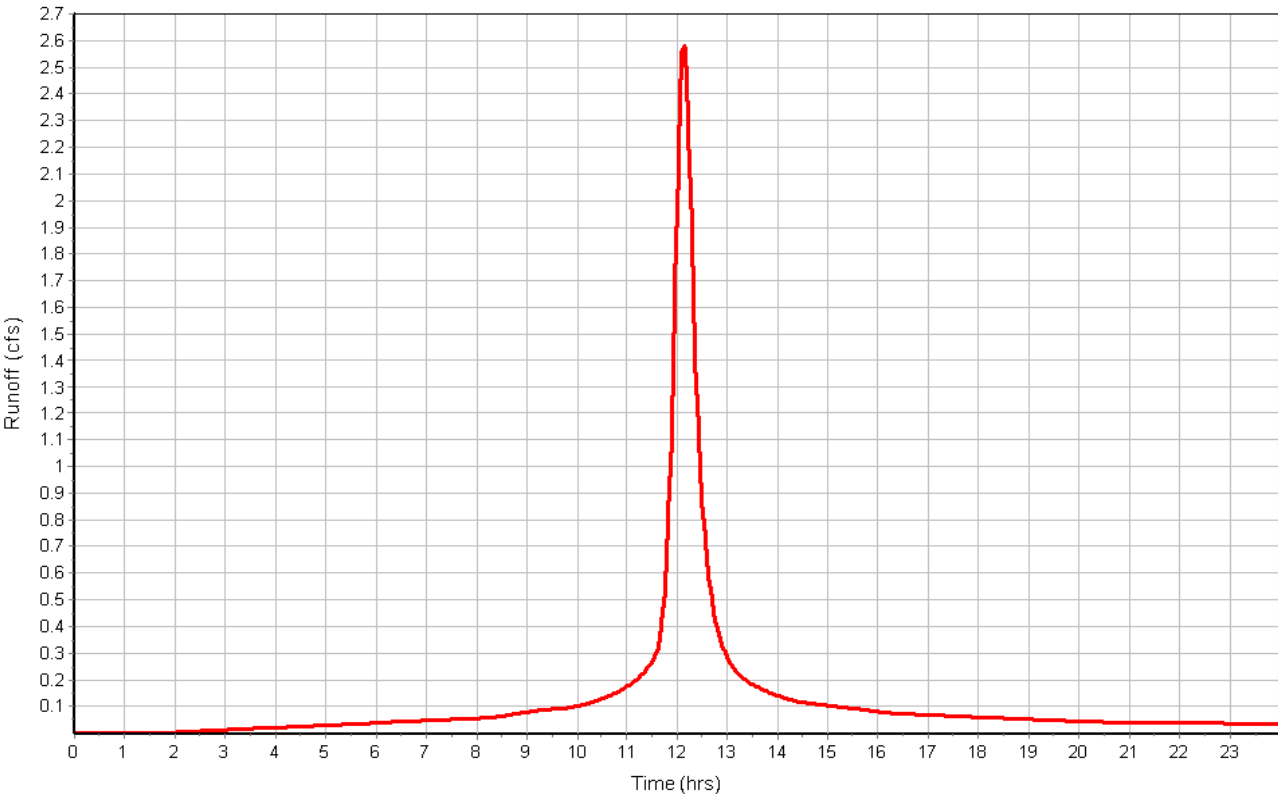
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 2.59  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:25:35

Subbasin : B3d

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3e

Input Data

Area (ac) ..... 1.33  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

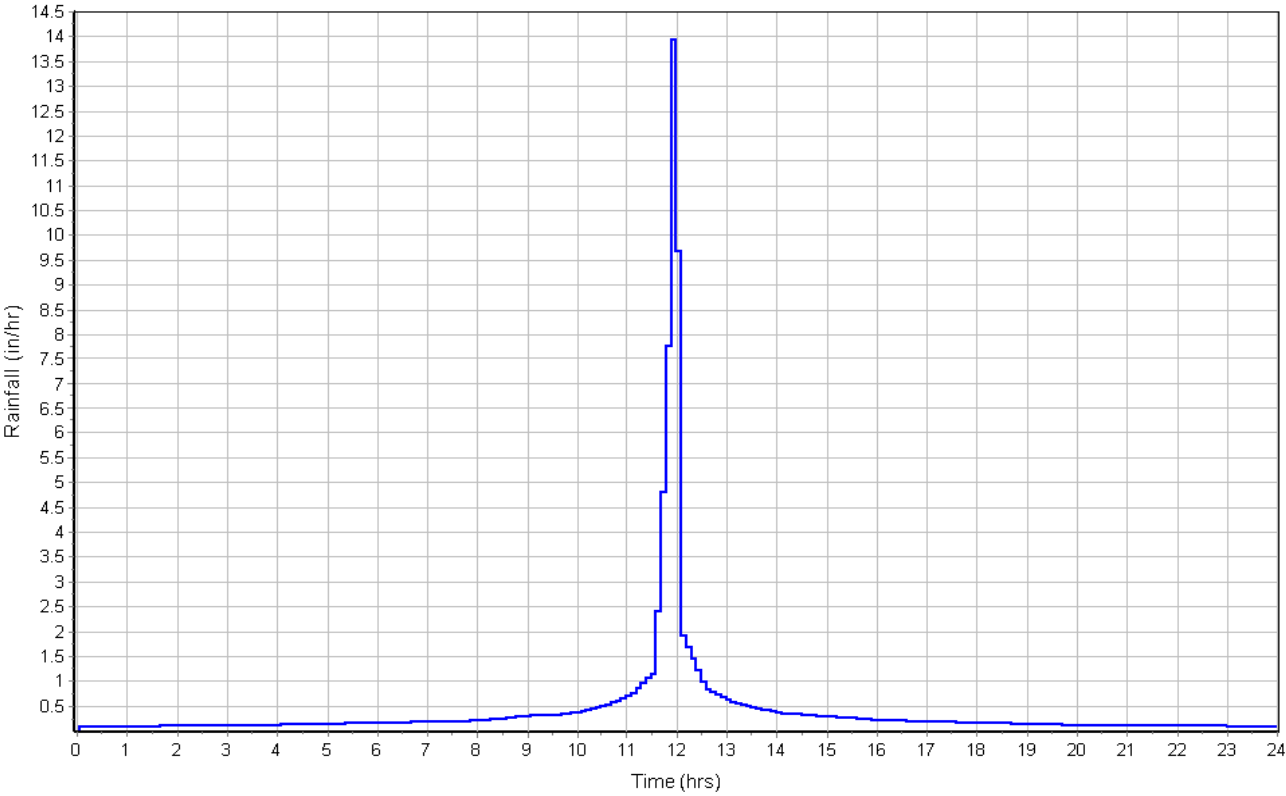
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	1.33	-	93.00
Composite Area & Weighted CN	1.33		93.00

Subbasin Runoff Results

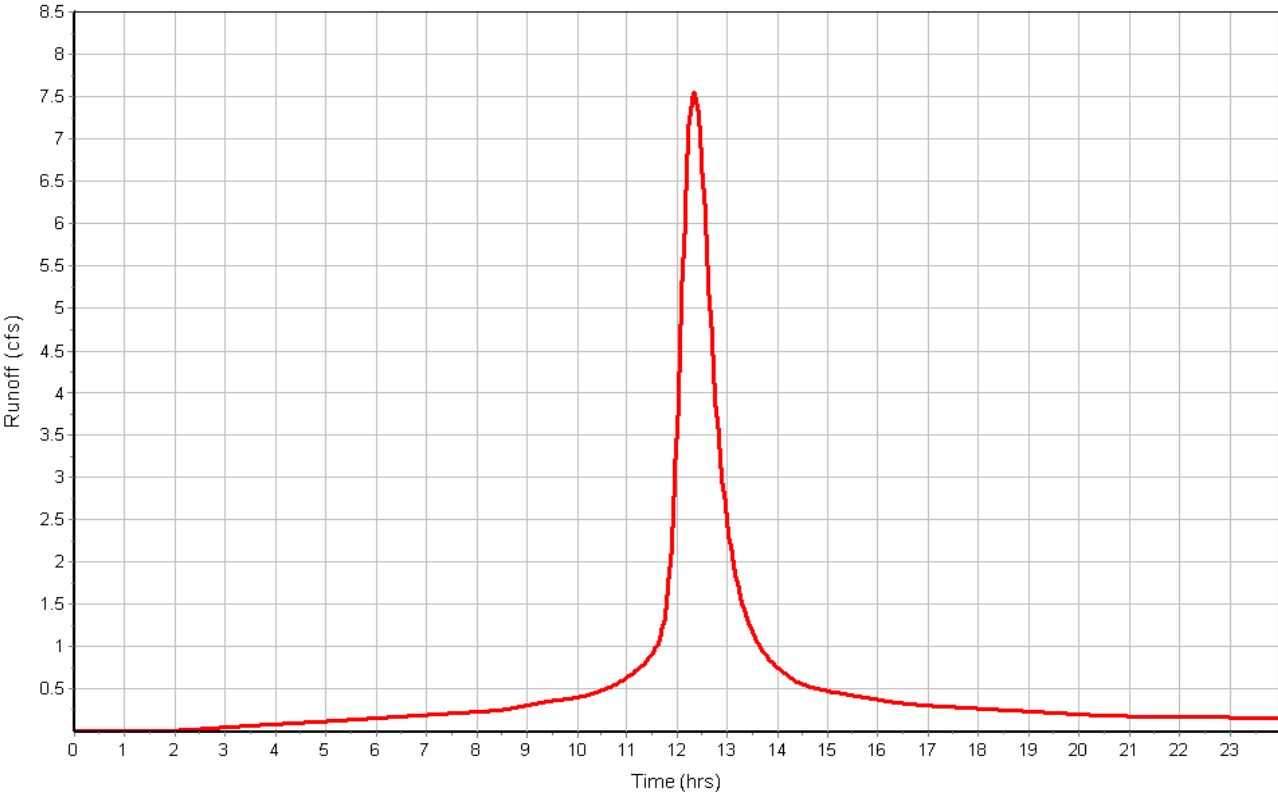
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 7.56  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:47:02

Subbasin : B3e

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3f

Input Data

Area (ac) ..... 0.44  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.44	-	93.00
Composite Area & Weighted CN	0.44		93.00

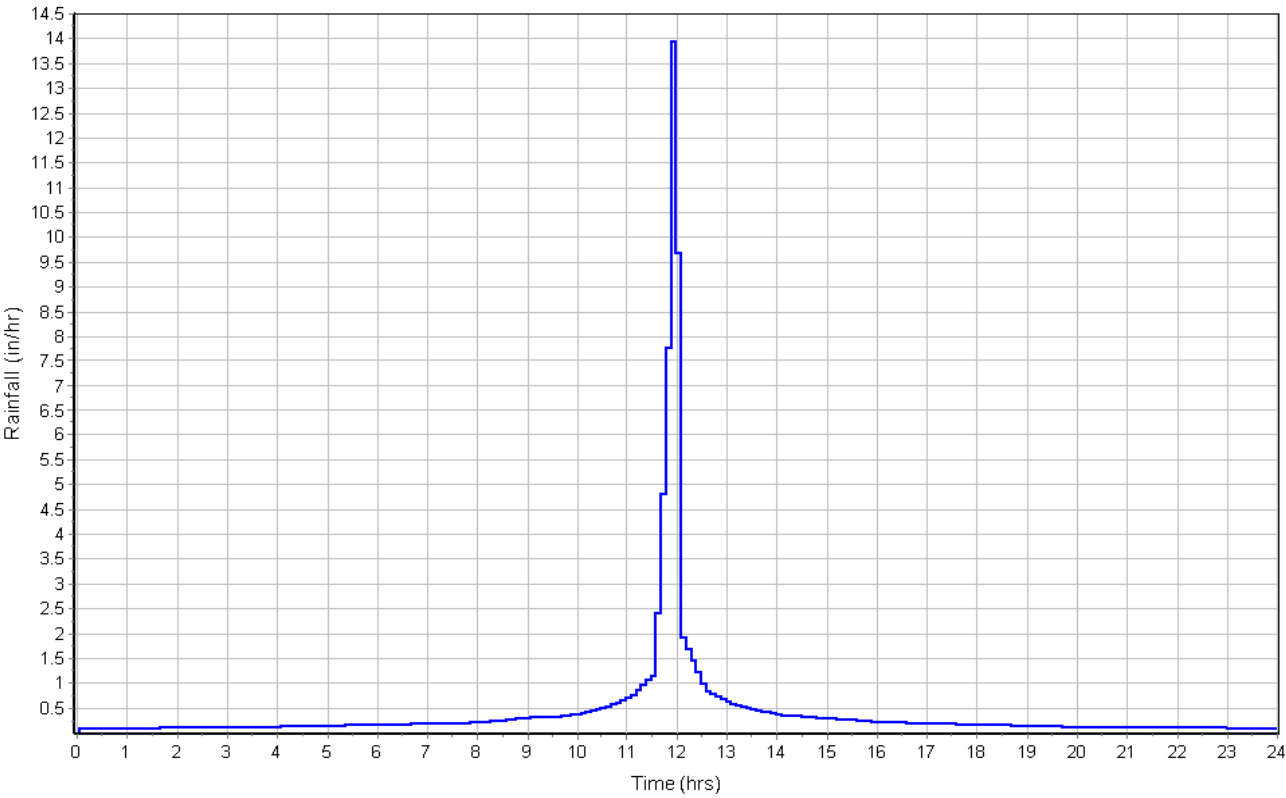
Subbasin Runoff Results

Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 4.66  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:14:06

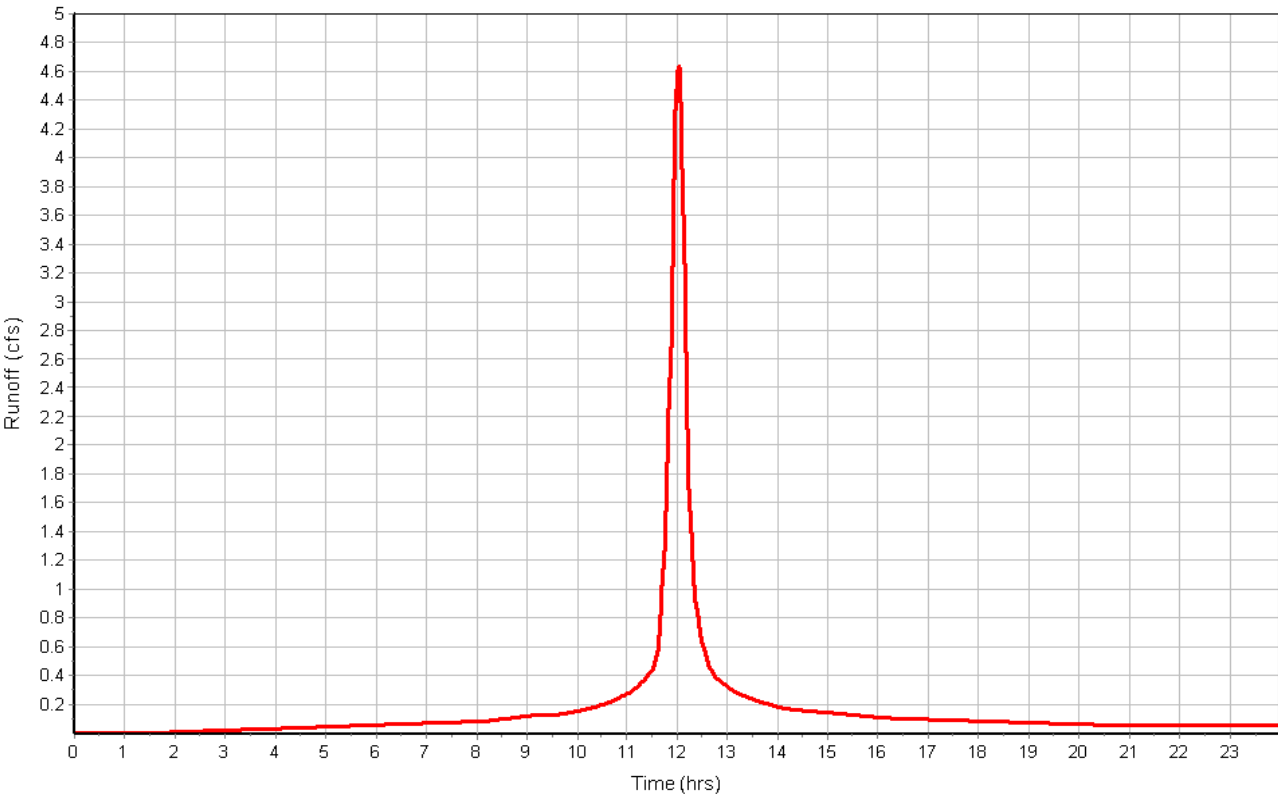


Subbasin : B3f

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3g

Input Data

Area (ac) ..... 1.55  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

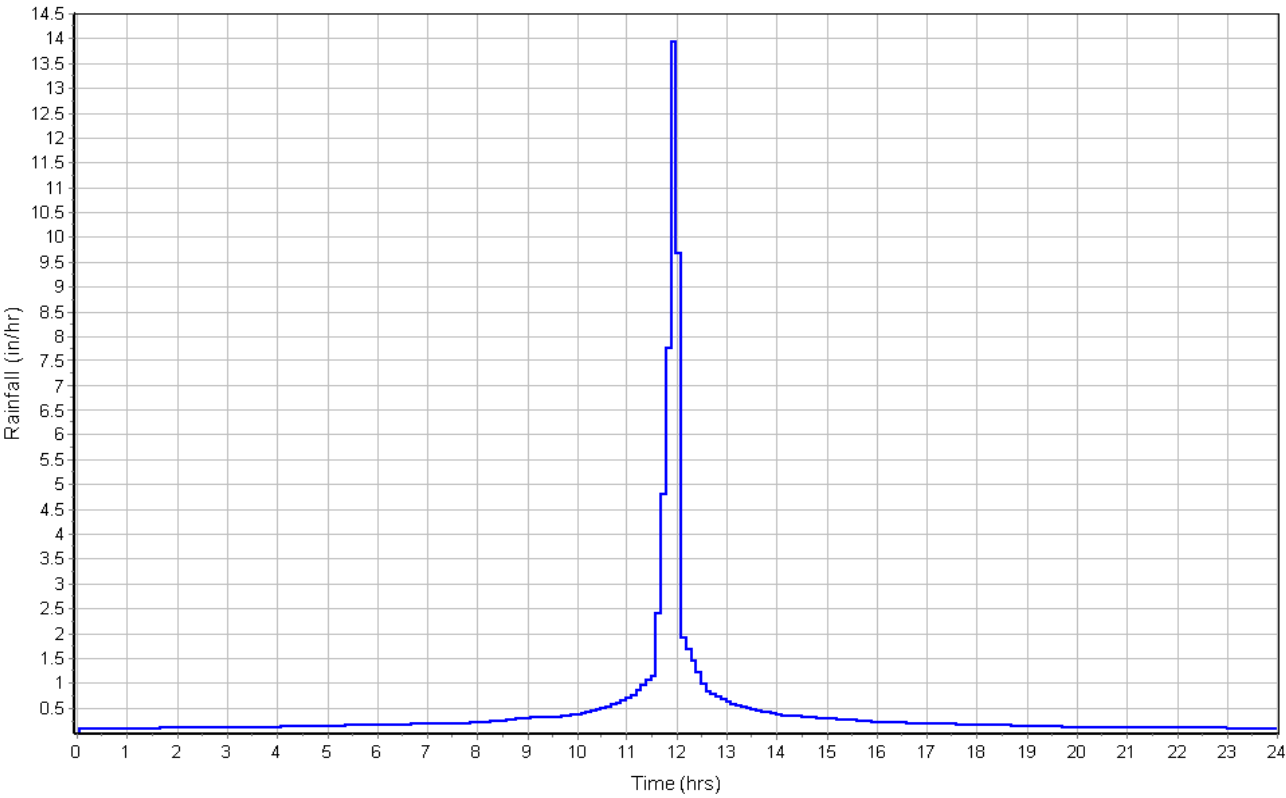
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	1.55	-	93.00
Composite Area & Weighted CN	1.55		93.00

Subbasin Runoff Results

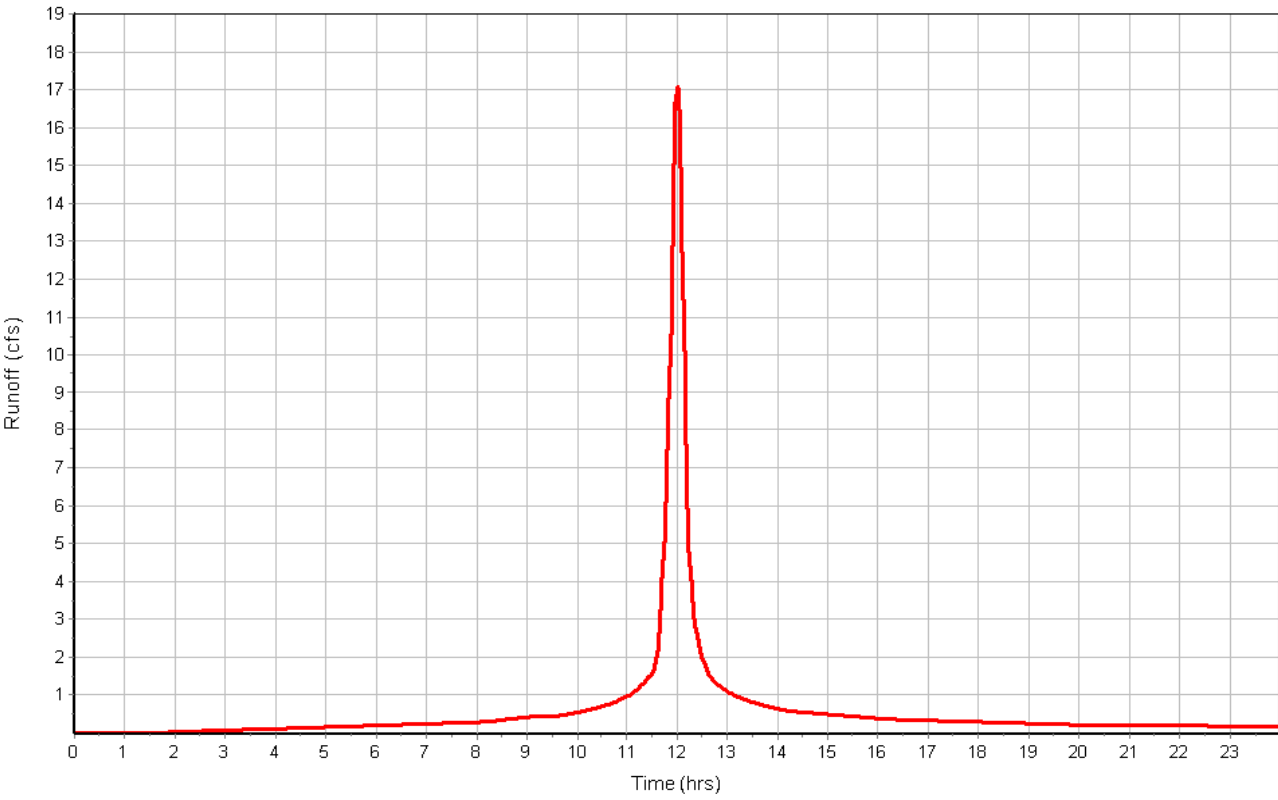
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 17.10  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:12:01

Subbasin : B3g

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3h

Input Data

Area (ac) ..... 0.38  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

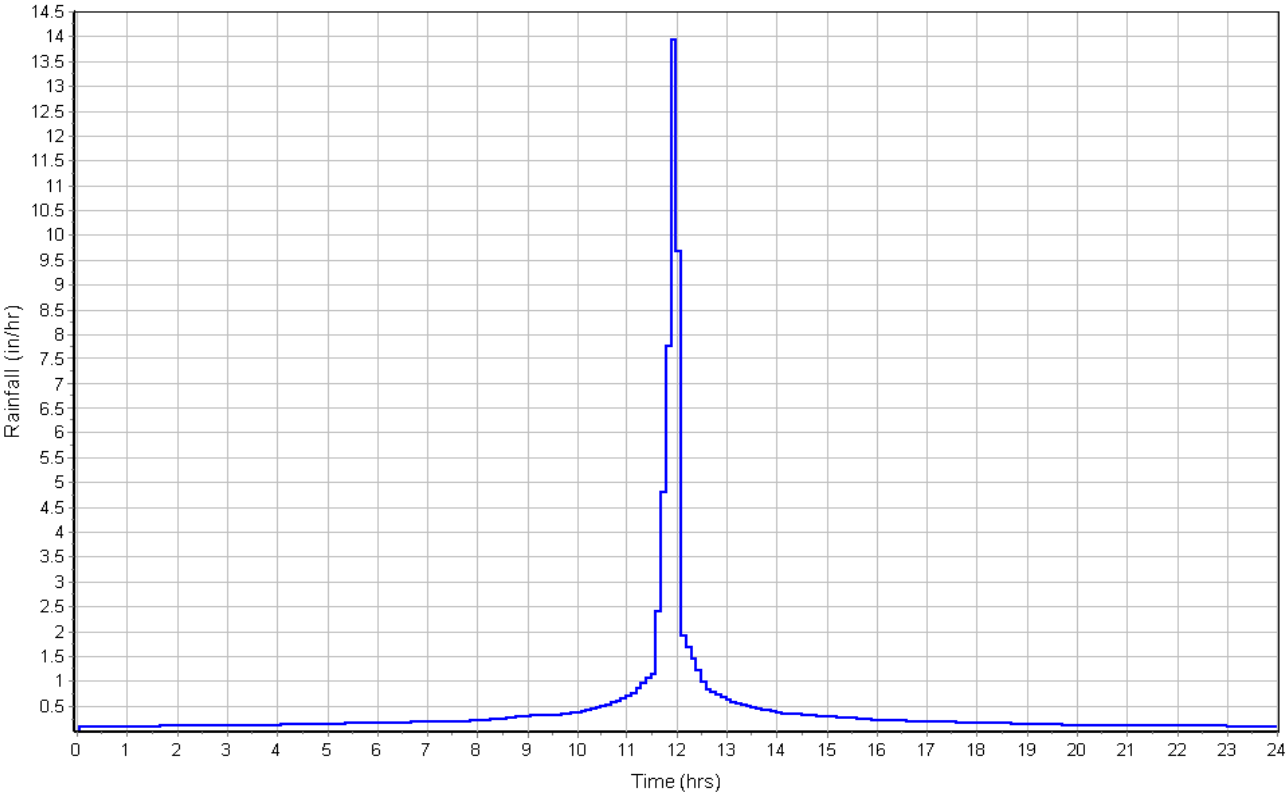
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.38	-	93.00
Composite Area & Weighted CN	0.38		93.00

Subbasin Runoff Results

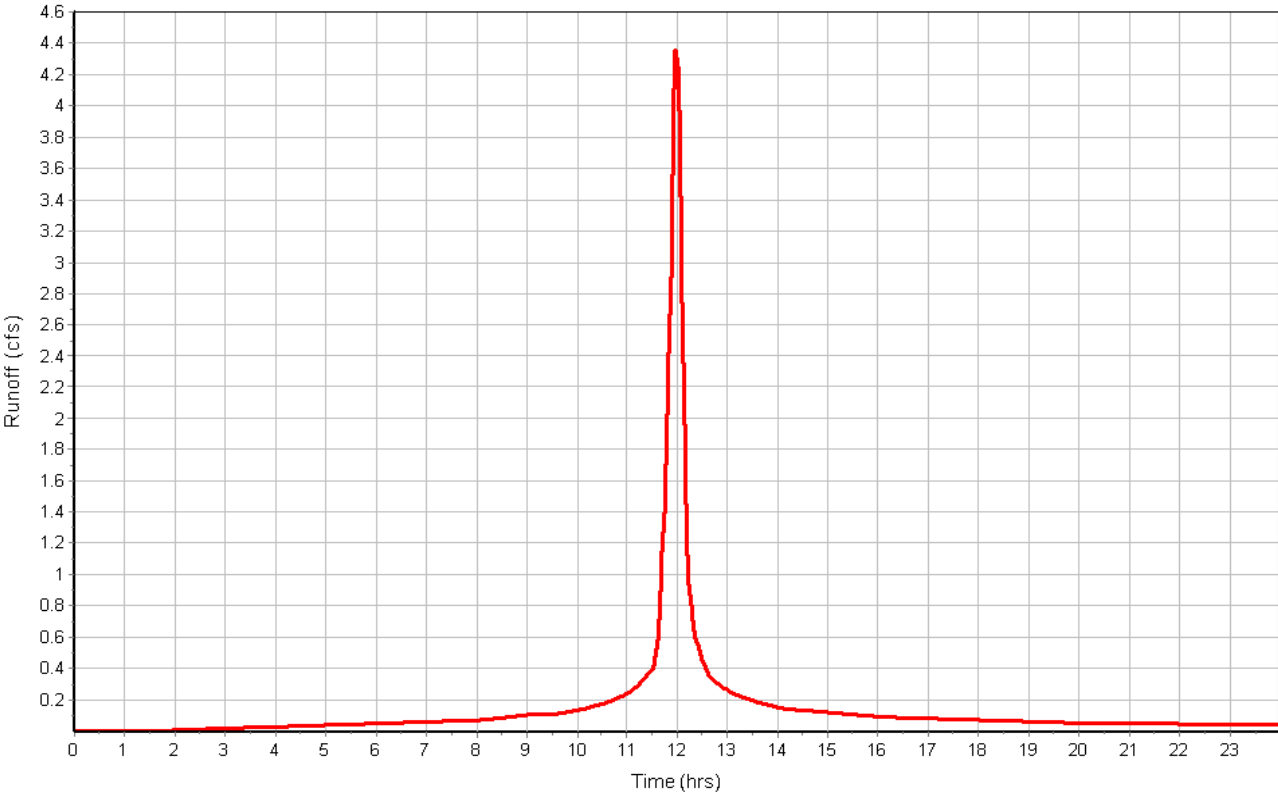
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 4.36  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B3h

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B4a

Input Data

Area (ac) ..... 1.72  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

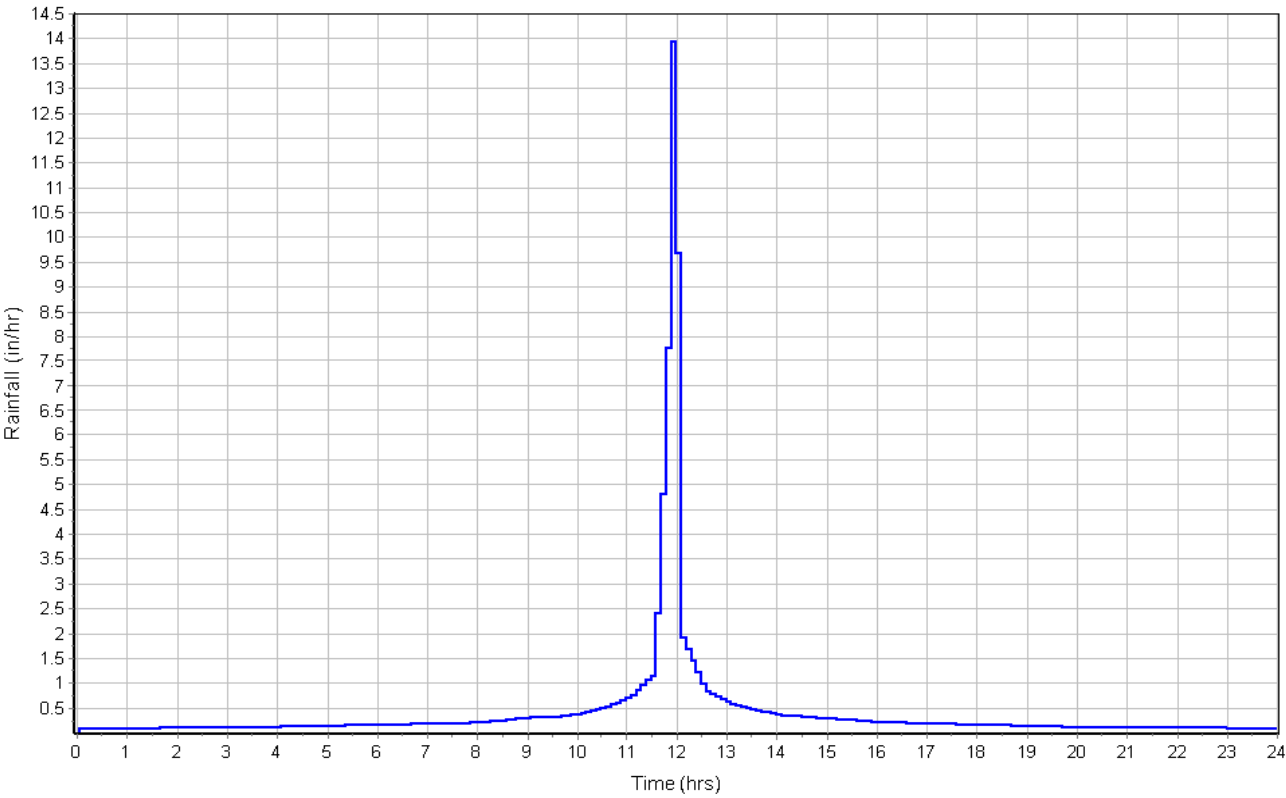
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	1.72	-	93.00
Composite Area & Weighted CN	1.72		93.00

Subbasin Runoff Results

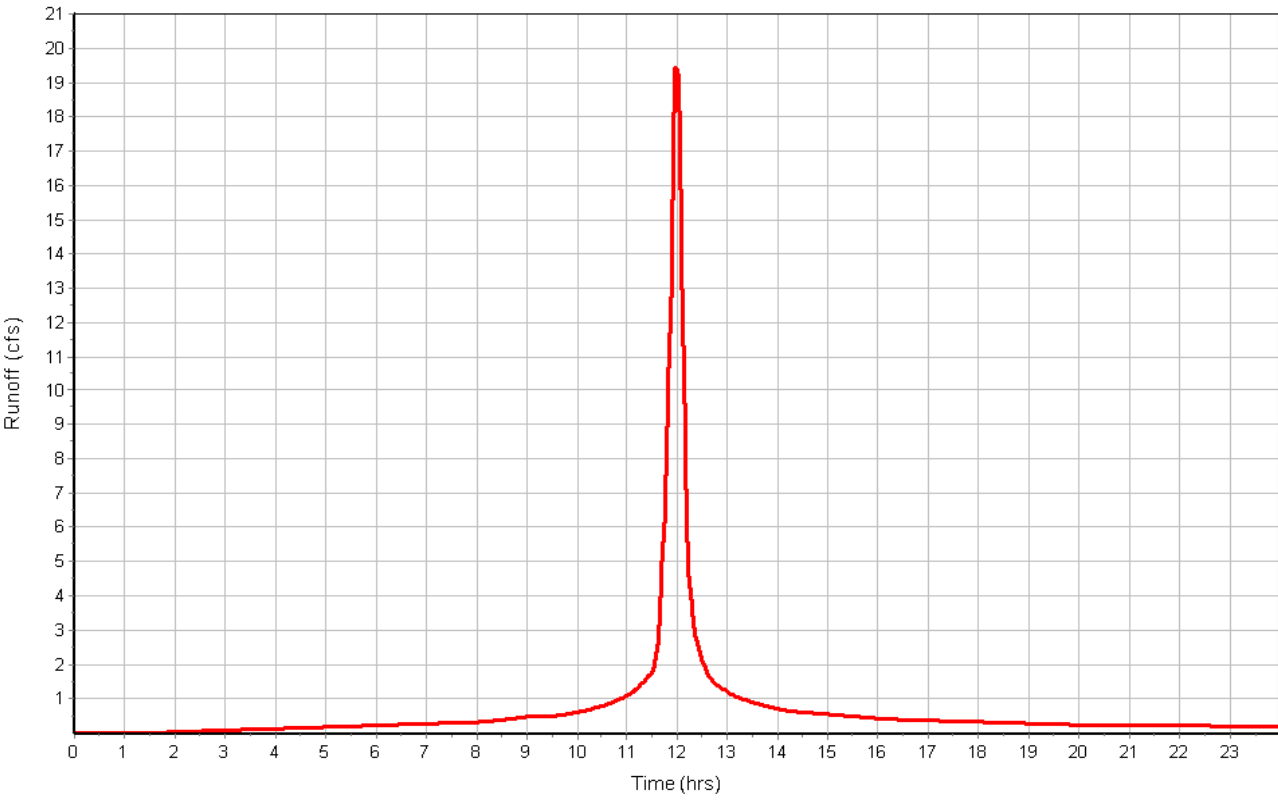
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 19.55  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:44

Subbasin : B4a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B4b

Input Data

Area (ac) ..... 0.28  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.28	-	93.00
Composite Area & Weighted CN	0.28		93.00

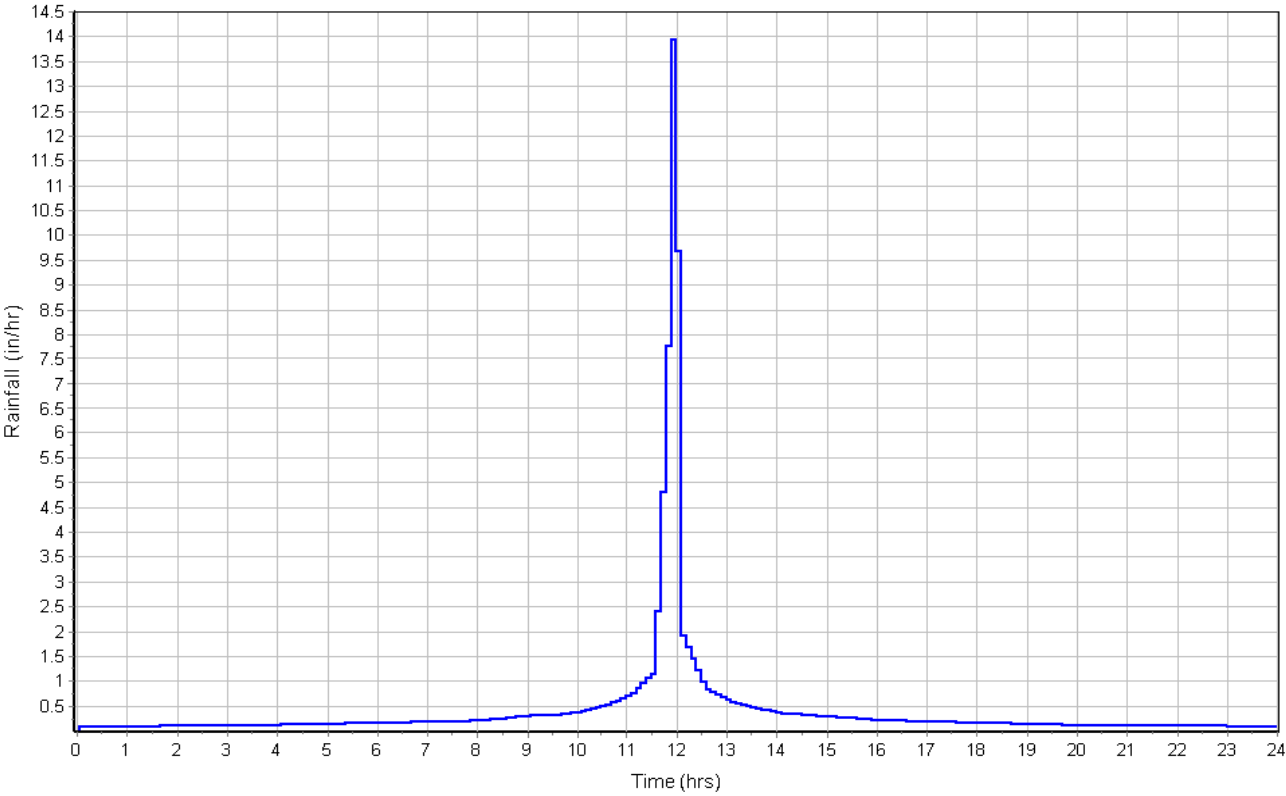
Subbasin Runoff Results

Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 1.31  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 01:03:25

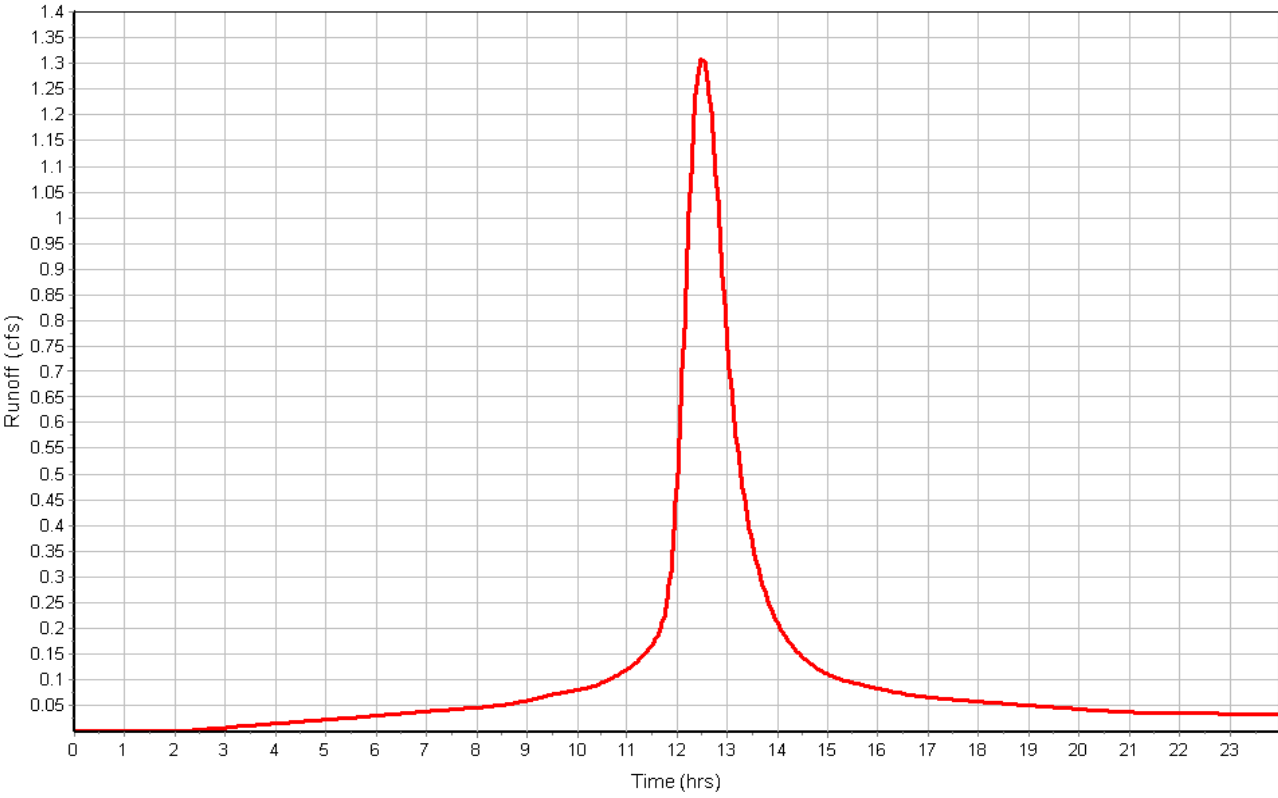


Subbasin : B4b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B4c

Input Data

Area (ac) ..... 0.23  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

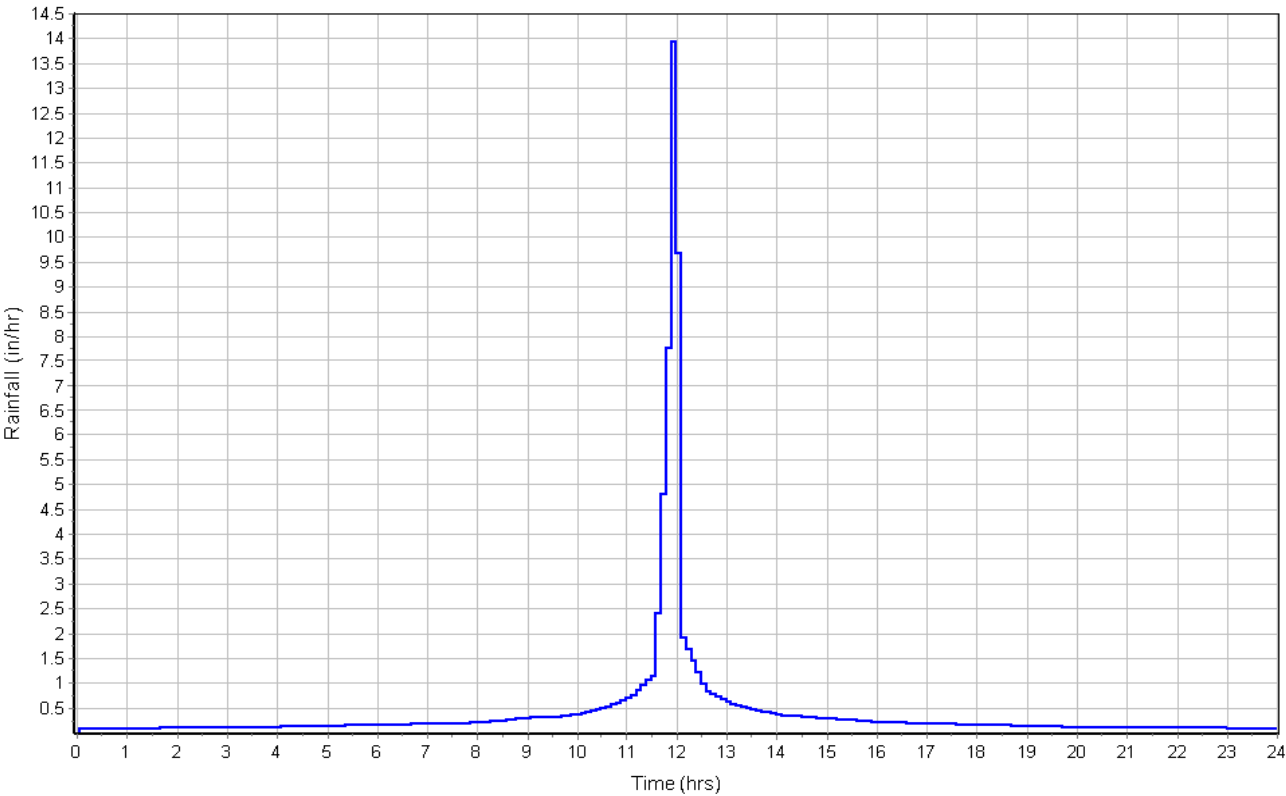
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.23	-	93.00
Composite Area & Weighted CN	0.23		93.00

Subbasin Runoff Results

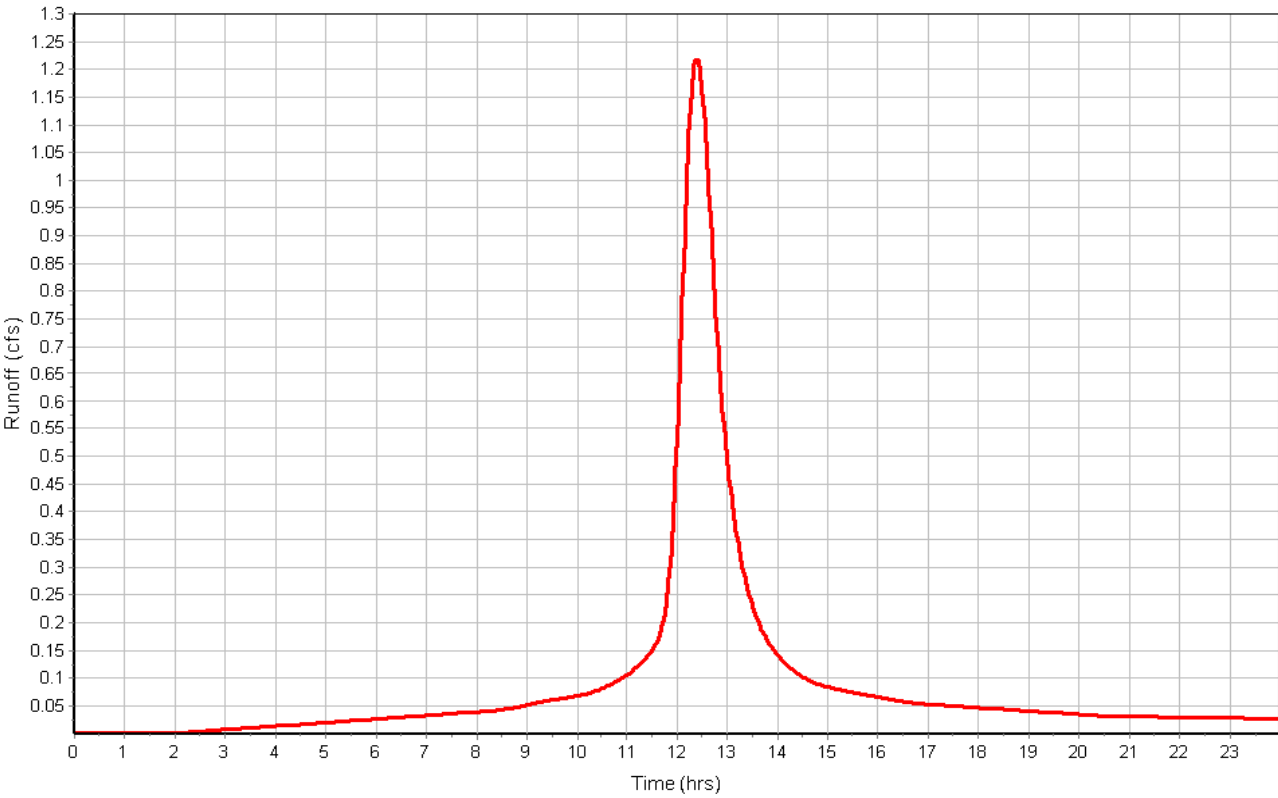
Total Rainfall (in) ..... 10.17  
Total Runoff (in) ..... 9.32  
Peak Runoff (cfs) ..... 1.22  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:52:31

Subbasin : B4c

Rainfall Intensity Graph



Runoff Hydrograph



## Junction Input

SN Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1 B1-4	672.61	675.45	2.83	672.61	0.00	675.45	0.00	0.00	0.00
2 B2-2	673.36	677.74	4.38	673.36	0.00	677.74	0.00	0.00	0.00
3 B2-5	674.47	677.61	3.14	674.47	0.00	677.61	0.00	0.00	0.00
4 B3-3	671.02	674.58	3.56	671.02	0.00	674.58	0.00	0.00	0.00
5 B3-7	673.67	679.16	5.50	673.67	0.00	679.16	0.00	0.00	0.00
6 B3-8	674.52	679.79	5.27	674.52	0.00	679.79	0.00	0.00	0.00
7 B3-9	674.89	679.79	4.90	674.89	0.00	679.79	0.00	0.00	0.00
8 DRIVE B1a	678.19	6.00	-672.19	0.00	-678.19	0.00	-6.00	0.00	0.00
9 DRIVE B1b	679.17	6.00	-673.17	0.00	-679.17	0.00	-6.00	0.00	0.00
10 DRIVE B2a	679.85	6.00	-673.85	0.00	-679.85	0.00	-6.00	0.00	0.00
11 DRIVE B2b	675.31	6.00	-669.31	0.00	-675.31	0.00	-6.00	0.00	0.00
12 DRIVE B2c	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
13 DRIVE B2d	678.76	6.00	-672.76	0.00	-678.76	0.00	-6.00	0.00	0.00
14 DRIVE B3f	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
15 DRIVE B3g-1	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
16 DRIVE B3h	674.83	6.00	-668.83	0.00	-674.83	0.00	-6.00	0.00	0.00
17 OUTFALL B2	673.11	679.16	6.05	673.11	0.00	679.16	0.00	0.00	0.00
18 SDWK BOX B DUMMY	675.58	677.34	1.76	0.00	-675.58	0.00	-677.34	0.00	0.00

## Junction Results

SN Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1 B1-4	48.37	0.00	675.45	2.84	0.00	0.00	672.78	0.17	0 12:01	0 12:05	0.43	9.00
2 B2-2	27.47	0.00	677.74	4.38	0.00	0.00	673.63	0.27	0 12:01	0 12:08	0.10	7.00
3 B2-5	14.06	0.00	677.61	3.14	0.00	0.00	674.72	0.25	0 11:59	0 12:06	0.07	7.00
4 B3-3	26.74	0.00	672.62	1.60	0.00	1.97	671.31	0.29	0 12:11	0 00:00	0.00	0.00
5 B3-7	9.95	0.00	674.72	1.05	0.00	4.45	673.93	0.26	0 12:10	0 00:00	0.00	0.00
6 B3-8	9.95	0.00	675.47	0.95	0.00	4.32	674.74	0.22	0 12:10	0 00:00	0.00	0.00
7 B3-9	5.01	0.00	675.65	0.76	0.00	4.14	675.09	0.20	0 12:10	0 00:00	0.00	0.00
8 DRIVE B1a	2.90	2.60	678.38	0.19	0.00	0.05	678.23	0.04	0 12:04	0 00:00	0.00	0.00
9 DRIVE B1b	2.44	2.44	679.32	0.15	0.00	0.09	679.20	0.03	0 12:00	0 00:00	0.00	0.00
10 DRIVE B2a	3.84	3.84	680.06	0.21	0.00	0.03	679.90	0.05	0 12:00	0 00:00	0.00	0.00
11 DRIVE B2b	4.38	4.13	679.26	3.95	0.00	0.02	679.09	3.78	0 12:00	0 00:00	0.00	0.00
12 DRIVE B2c	3.07	3.07	680.04	680.04	0.00	0.05	679.89	679.89	0 12:02	0 00:00	0.00	0.00
13 DRIVE B2d	4.19	4.06	678.97	0.21	0.00	0.03	678.80	0.04	0 12:00	0 00:00	0.00	0.00
14 DRIVE B3f	4.64	4.64	676.41	676.41	0.00	0.02	676.24	676.24	0 12:04	0 00:00	0.00	0.00
15 DRIVE B3g-1	17.09	17.09	678.82	678.82	0.00	0.00	678.65	678.65	0 11:50	0 12:02	1.92	22.00
16 DRIVE B3h	4.70	4.35	675.06	0.23	0.00	0.02	674.88	0.05	0 12:00	0 00:00	0.00	0.00
17 OUTFALL B2	48.38	0.00	675.00	1.89	0.00	4.16	673.32	0.21	0 12:09	0 00:00	0.00	0.00
18 SDWK BOX B DUMMY	24.34	19.44	676.78	1.20	0.00	0.56	675.72	0.14	0 12:01	0 00:00	0.00	0.00

## Channel Input

SN Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Shape Slope	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)	(ft)	(ft)					(cfs)	
1 CHANNEL B 1	621.36	675.58	0.00	673.11	0.00	2.47	0.4000 Trapezoidal	1.250	13.500	0.0400	0.0000	0.0000	0.0000	0.00	No
2 CHANNEL B 2	123.46	673.11	0.00	672.61	0.00	0.50	0.4000 User-Defined	1.310	13.500	0.0240	0.0000	0.0000	0.0000	0.00	No
3 CHANNEL B DUMMY	1.00	677.34	1.76	675.58	0.00	1.76	176.4000 Trapezoidal	1.250	13.500	0.0400	0.0000	0.0000	0.0000	0.00	No
4 DRIVE B1a	172.00	678.19	0.00	677.34	1.76	0.85	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
5 DRIVE B1a DUMMY	1.00	678.20	3.32	678.19	0.00	0.01	0.5000 Triangular	0.240	24.000	0.0320	0.0000	0.0000	0.0000	0.00	No
6 DRIVE B1b	165.84	679.17	0.00	677.34	1.76	1.83	1.1000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
7 DRIVE B2a	163.00	679.85	0.00	679.04	3.73	0.81	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
8 DRIVE B2b	169.00	679.04	3.74	678.20	3.32	0.84	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
9 DRIVE B2b DUMMY	1.00	679.04	3.73	675.31	0.00	3.74	373.5300 Triangular	0.240	24.000	0.0320	0.0000	0.0000	0.0000	0.00	No
10 DRIVE B2c	218.00	679.85	679.85	678.76	3.65	1.09	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
11 DRIVE B2d	182.72	678.76	0.00	677.85	3.20	0.90	0.4900 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
12 DRIVE B2d DUMMY	1.00	678.76	3.65	678.76	0.00	0.01	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
13 DRIVE B2e	125.00	677.85	3.20	677.22	3.02	0.63	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
14 DRIVE B3f	124.52	676.19	676.19	675.57	3.37	0.62	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
15 DRIVE B3g-1	400.00	678.58	678.58	674.84	3.31	3.74	0.9400 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
16 DRIVE B3g-2	145.00	675.57	3.37	674.84	3.31	0.73	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
17 DRIVE B3h	185.00	674.83	0.00	673.91	3.25	0.93	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
18 DRIVE B3h DUMMY	1.00	674.84	3.31	674.83	0.00	0.01	0.6000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No

## Channel Results

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 CHANNEL B 1	23.91	0 12:05	26.12	0.92	2.26	4.58	1.18	0.95	0.00		
2 CHANNEL B 2	48.37	0 12:05	82.56	0.59	5.91	0.35	1.00	0.76	0.00		
3 CHANNEL B DUMMY	5.15	0 12:04	550.73	0.01	9.42	0.00	0.09	0.07	0.00		
4 DRIVE B1a	2.89	0 12:06	5.64	0.51	1.67	1.72	0.19	0.78	0.00		
5 DRIVE B1a DUMMY	0.35	0 12:01	2.30	0.15	0.50	0.03	0.12	0.49	0.00		
6 DRIVE B1b	2.42	0 12:01	8.41	0.29	2.15	1.29	0.15	0.63	0.00		
7 DRIVE B2a	3.80	0 12:01	5.64	0.67	1.79	1.52	0.21	0.86	0.00		
8 DRIVE B2b	4.35	0 12:01	5.66	0.77	1.86	1.51	0.22	0.91	0.00		
9 DRIVE B2b DUMMY	0.26	0 12:01	62.88	0.00	5.53	0.00	0.03	0.13	0.00		
10 DRIVE B2c	3.06	0 12:02	5.66	0.54	1.72	2.11	0.19	0.79	0.00		
11 DRIVE B2d	4.16	0 12:02	5.63	0.74	1.83	1.66	0.21	0.89	0.00		
12 DRIVE B2d DUMMY	0.16	0 12:02	5.68	0.03	0.80	0.02	0.06	0.26	0.00		
13 DRIVE B2e	0.31	0 12:03	5.68	0.05	1.00	2.08	0.08	0.34	0.00		
14 DRIVE B3f	4.64	0 12:04	5.66	0.82	1.88	1.10	0.22	0.93	0.00		
15 DRIVE B3g-1	7.75	0 11:52	7.75	1.00	2.85	2.34	0.24	1.00	20.00		
16 DRIVE B3g-2	0.19	0 12:06	5.68	0.03	0.92	2.63	0.07	0.28	0.00		
17 DRIVE B3h	4.66	0 12:01	5.66	0.82	1.89	1.63	0.22	0.93	0.00		
18 DRIVE B3h DUMMY	0.35	0 12:06	6.18	0.06	1.05	0.02	0.08	0.34	0.00		

## Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	B1-1	27.44	670.68	0.00	670.57	0.00	0.11	0.4000	Rectangular	24.000	60.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
2	B1-2	325.38	671.98	0.00	670.78	0.10	1.20	0.3700	Rectangular	24.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
3	B1-3	135.92	672.61	0.00	672.08	0.10	0.54	0.4000	Rectangular	24.000	48.000	0.0130	0.2000	0.5000	0.0000	0.00	No	1
4	B2-1	81.97	673.36	0.00	673.16	0.05	0.20	0.2400	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
5	B2-2	126.09	673.76	0.00	673.46	0.10	0.30	0.2400	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
6	B2-3	171.36	674.20	0.00	673.86	0.10	0.34	0.2000	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
7	B2-4	86.66	674.47	0.00	674.30	0.10	0.17	0.2000	Rectangular	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
8	B2-5	41.89	674.65	0.00	674.57	0.10	0.08	0.2000	Rectangular	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
9	B2-6	61.04	674.87	0.00	674.75	0.10	0.12	0.2000	CIRCULAR	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
10	B2-7	170.14	675.31	0.00	674.97	0.10	0.34	0.2000	Rectangular	24.000	24.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
11	B2c-1	182.72	675.12	0.00	674.75	0.10	0.37	0.2000	Rectangular	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
12	B3-1	33.76	670.66	0.00	670.57	0.00	0.09	0.2700	Rectangular	24.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
13	B3-2	96.98	671.02	0.00	670.76	0.10	0.26	0.2700	Rectangular	24.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
14	B3-3	101.12	671.52	0.00	671.12	0.10	0.40	0.4000	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
15	B3-4	143.96	672.20	0.00	671.62	0.10	0.58	0.4000	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
16	B3-5	87.13	672.88	0.00	672.30	0.10	0.58	0.6700	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
17	B3-6	116.41	673.67	0.00	672.88	0.00	0.78	0.6700	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
18	B3-7	112.25	674.52	0.00	673.77	0.10	0.75	0.6700	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
19	B3-8	40.25	674.89	0.00	674.62	0.10	0.27	0.6700	CIRCULAR	24.000	24.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
20	B3-9	87.75	675.58	0.00	674.99	0.10	0.59	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
21	B3b-1	68.38	675.45	0.00	674.99	0.10	0.46	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
22	B3c-1	75.08	675.12	0.00	674.62	0.10	0.50	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
23	B3d-1	51.50	674.97	0.00	674.62	0.10	0.35	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1



## Pipe Results

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 B1-1	51.35	0 12:11	57.77	0.89	7.10	0.06	1.38	0.74	0.00		Calculated
2 B1-2	51.12	0 12:02	42.38	1.21	7.43	0.73	1.86	0.93	0.00		> CAPACITY
3 B1-3	50.94	0 12:09	43.95	1.16	7.36	0.31	1.85	0.93	0.00		> CAPACITY
4 B2-1	27.14	0 12:09	23.90	1.14	5.19	0.26	1.85	0.93	0.00		> CAPACITY
5 B2-2	27.47	0 12:08	23.90	1.15	5.22	0.40	1.86	0.93	0.00		> CAPACITY
6 B2-3	20.18	0 12:06	21.82	0.92	4.34	0.66	1.55	0.78	0.00		Calculated
7 B2-4	14.45	0 12:06	12.88	1.12	4.03	0.36	1.88	0.94	0.00		> CAPACITY
8 B2-5	14.06	0 12:06	12.88	1.09	3.96	0.18	1.90	0.95	0.00		> CAPACITY
9 B2-6	7.53	0 12:02	10.12	0.74	3.53	0.29	1.29	0.64	0.00		Calculated
10 B2-7	3.54	0 12:02	11.16	0.32	2.48	1.14	0.71	0.36	0.00		Calculated
11 B2c-1	2.89	0 12:03	12.88	0.22	2.59	1.18	0.56	0.28	0.00		Calculated
12 B3-1	29.61	0 12:09	36.26	0.82	5.24	0.11	1.41	0.71	0.00		Calculated
13 B3-2	26.73	0 12:11	36.26	0.74	5.09	0.32	1.31	0.66	0.00		Calculated
14 B3-3	26.74	0 12:11	30.86	0.87	5.96	0.28	1.49	0.75	0.00		Calculated
15 B3-4	19.21	0 12:11	30.86	0.62	5.47	0.44	1.17	0.59	0.00		Calculated
16 B3-5	16.50	0 12:14	21.90	0.75	7.67	0.19	1.29	0.65	0.00		Calculated
17 B3-6	9.95	0 12:11	21.90	0.45	6.81	0.28	0.94	0.47	0.00		Calculated
18 B3-7	9.95	0 12:10	21.88	0.45	6.81	0.27	0.94	0.47	0.00		Calculated
19 B3-8	5.00	0 12:10	20.06	0.25	5.30	0.13	0.68	0.34	0.00		Calculated
20 B3-9	2.41	0 12:12	3.45	0.70	4.75	0.31	0.61	0.62	0.00		Calculated
21 B3b-1	2.64	0 12:10	3.45	0.77	4.85	0.23	0.65	0.65	0.00		Calculated
22 B3c-1	2.41	0 12:12	3.45	0.70	4.76	0.26	0.61	0.62	0.00		Calculated
23 B3d-1	2.58	0 12:10	3.45	0.75	4.82	0.18	0.65	0.65	0.00		Calculated

## Inlet Input

SN Element ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Max (Rim) Elevation (ft)	Inlet Depth (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Ponded Area (ft²)	Grate Clogging Factor (%)
1 B1-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.68	674.37	3.69	670.68	0.00	0.00	0.00
2 B1-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	671.98	675.90	3.92	671.98	0.00	0.00	0.00
3 B2-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	673.76	677.31	3.55	673.76	0.00	0.00	0.00
4 B2-4	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.20	677.22	3.02	674.20	0.00	0.00	0.00
5 B2-6	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.65	677.85	3.20	674.65	0.00	N/A	0.00
6 B2-7	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.87	678.20	3.32	674.87	0.00	N/A	0.00
7 B2-8	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.31	679.04	3.73	675.31	0.00	N/A	0.00
8 B2c-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.12	678.76	3.65	675.12	0.00	N/A	0.00
9 B3-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.66	673.91	3.25	670.66	0.00	0.00	0.00
10 B3-4	FHWA HEC-22 GENERIC	N/A	On Grade	1	671.52	674.84	3.31	671.52	0.00	N/A	0.00
11 B3-5	FHWA HEC-22 GENERIC	N/A	On Grade	1	672.20	675.57	3.37	672.20	0.00	N/A	0.00
12 B3-6	FHWA HEC-22 GENERIC	N/A	On Sag	1	672.88	676.10	3.22	672.88	0.00	0.00	0.00
13 INLET B3a	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	679.17	3.59	675.58	0.00	0.00	0.00
14 INLET B3b	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.45	678.68	3.23	675.45	0.00	0.00	0.00
15 INLET B3c	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.12	679.17	4.05	675.12	0.00	0.00	0.00
16 INLET B3d	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.97	678.67	3.71	674.97	0.00	0.00	0.00
17 SDWK BOX B	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	677.34	1.76	0.00	0.00	0.00	0.00

## Roadway & Gutter Input

SN Element ID	Roadway Longitudinal Slope (ft/ft)	Roadway Cross Slope (ft/ft)	Roadway Manning's Roughness	Gutter Cross Slope (ft/ft)	Gutter Width (ft)	Gutter Depression (in)	Allowable Spread (ft)
1 B1-2	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
2 B1-3	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
3 B2-3	N/A	0.0200	0.0160	0.0620	1.50	0.1640	7.00
4 B2-4	N/A	0.0200	0.0160	0.0620	1.50	0.1640	7.00
5 B2-6	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
6 B2-7	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
7 B2-8	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
8 B2c-1	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
9 B3-2	N/A	0.0200	0.0160	0.0620	1.50	0.1640	7.00
10 B3-4	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
11 B3-5	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
12 B3-6	N/A	0.0200	0.0160	0.0620	2.00	0.1640	7.00
13 INLET B3a	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
14 INLET B3b	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
15 INLET B3c	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
16 INLET B3d	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
17 SDWK BOX B	N/A	0.0200	0.0130	0.0620	1.50	0.1640	7.00

**Inlet Results**

SN Element ID	Peak Flow	Peak Lateral Inflow	Peak Flow Intercepted by Inlet	Peak Flow Bypassing Inlet	Inlet Efficiency during Peak Flow (%)	Max Gutter Spread during Peak Flow (ft)	Max Gutter Water Elev. during Peak Flow (ft)	Max Gutter Water Depth during Peak Flow (ft)	Time of Max Depth Occurrence	Total Flooded Volume	Total Time Flooded
	(cfs)	(cfs)	(cfs)	(cfs)					(days hh:mm)	(ac-in)	(min)
1 B1-2	1.22	1.22	N/A	N/A	N/A	7.10	674.76	0.39	0 12:02	0.00	0.00
2 B1-3	1.31	1.31	N/A	N/A	N/A	7.49	676.30	0.40	0 12:00	0.00	0.00
3 B2-3	5.74	5.74	N/A	N/A	N/A	17.35	678.14	0.83	0 12:01	0.00	0.00
4 B2-4	6.61	6.33	N/A	N/A	N/A	18.47	678.07	0.85	0 12:06	0.00	0.00
5 B2-6	4.16	0.00	3.84	0.32	92.42	13.73	678.19	0.34	0 11:59	0.11	7.00
6 B2-7	4.35	0.00	4.00	0.35	92.02	13.97	678.54	0.34	0 12:02	0.00	0.00
7 B2-8	3.80	0.00	3.54	0.26	93.17	13.26	679.37	0.33	0 12:01	0.00	0.00
8 B2c-1	3.06	0.00	2.90	0.16	94.86	12.17	679.07	0.31	0 12:02	0.00	0.00
9 B3-2	4.66	0.00	N/A	N/A	N/A	15.60	674.70	0.79	0 12:09	0.00	0.00
10 B3-4	7.94	0.00	7.58	0.35	95.55	17.65	675.25	0.42	0 12:11	0.00	0.00
11 B3-5	4.64	0.00	4.45	0.19	95.82	14.34	675.92	0.35	0 12:14	0.00	0.00
12 B3-6	7.55	7.55	N/A	N/A	N/A	17.64	676.95	0.85	0 12:14	0.00	0.00
13 INLET B3a	2.41	2.41	N/A	N/A	N/A	10.37	679.63	0.46	0 12:12	0.00	0.00
14 INLET B3b	2.63	2.63	N/A	N/A	N/A	10.99	679.15	0.47	0 12:10	0.00	0.00
15 INLET B3c	2.41	2.41	N/A	N/A	N/A	10.37	679.63	0.46	0 12:12	0.00	0.00
16 INLET B3d	2.58	2.58	N/A	N/A	N/A	10.85	679.14	0.47	0 12:10	0.00	0.00
17 SDWK BOX B	5.14	0.00	N/A	N/A	N/A	21.90	678.26	0.92	0 00:00	0.00	0.00

# Attachment K

Proposed Conditions

Hydrologic/Hydraulic Calculations –  
Drainage Area B (25 year)

## Vanguard Farms Apartments

File Name ..... 323.001\_STRM.SPF

### Project Options

Flow Units ..... CFS  
 Elevation Type ..... Elevation  
 Hydrology Method ..... SCS TR-20  
 Time of Concentration (TOC) Method ..... User-Defined  
 Link Routing Method ..... Kinematic Wave  
 Enable Overflow Ponding at Nodes ..... YES  
 Skip Steady State Analysis Time Periods ..... NO

### Analysis Options

Start Analysis On ..... Jul 15, 2020 00:00:00  
 End Analysis On ..... Jul 16, 2020 00:00:00  
 Start Reporting On ..... Jul 15, 2020 00:00:00  
 Antecedent Dry Days ..... 0 days  
 Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss  
 Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss  
 Reporting Time Step ..... 0 00:02:00 days hh:mm:ss  
 Routing Time Step ..... 5 seconds

### Number of Elements

	Qty
Rain Gages .....	0
Subbasins.....	19
Nodes.....	37
<i>Junctions</i> .....	18
<i>Outfalls</i> .....	2
<i>Flow Diversions</i> .....	0
<i>Inlets</i> .....	17
<i>Storage Nodes</i> .....	0
Links.....	41
<i>Channels</i> .....	18
<i>Pipes</i> .....	23
<i>Pumps</i> .....	0
<i>Orifices</i> .....	0
<i>Weirs</i> .....	0
<i>Outlets</i> .....	0
Pollutants .....	0
Land Uses .....	0

## Vanguard Farms Apartments

SN	Subbasin ID	Area	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	B1a	0.27	93.00	8.07	7.23	1.93	2.05	0 00:17:52
2	B1b	0.21	93.00	8.07	7.23	1.51	1.92	0 00:10:00
3	B2a	0.33	93.00	8.07	7.23	2.40	3.02	0 00:10:00
4	B2b	0.36	93.00	8.07	7.23	2.59	3.25	0 00:10:00
5	B2c	0.28	93.00	8.07	7.23	2.01	2.42	0 00:11:18
6	B2d	0.35	93.00	8.07	7.23	2.56	3.20	0 00:10:00
7	B2e	0.65	93.00	8.07	7.23	4.70	4.99	0 00:17:51
8	B2f	0.63	93.00	8.07	7.23	4.56	4.54	0 00:20:46
9	B3a	0.32	93.00	8.07	7.23	2.30	1.90	0 00:30:09
10	B3b	0.32	93.00	8.07	7.23	2.31	2.07	0 00:25:34
11	B3c	0.32	93.00	8.07	7.23	2.32	1.90	0 00:30:09
12	B3d	0.32	93.00	8.07	7.23	2.29	2.03	0 00:25:34
13	B3e	1.33	93.00	8.07	7.23	9.59	5.93	0 00:47:02
14	B3f	0.44	93.00	8.07	7.23	3.17	3.67	0 00:14:06
15	B3g	1.55	93.00	8.07	7.23	11.19	13.45	0 00:12:00
16	B3h	0.38	93.00	8.07	7.23	2.75	3.43	0 00:10:00
17	B4a	1.72	93.00	8.07	7.23	12.44	15.37	0 00:10:43
18	B4b	0.28	93.00	8.07	7.23	2.02	1.03	0 01:03:25
19	B4c	0.23	93.00	8.07	7.23	1.68	0.96	0 00:52:31

## Vanguard Farms Apartments

SN Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(ft)	(ft)	(ft)	(ft)	(ft <sup>2</sup> )	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1 B1-4	Junction	672.61	675.45	672.61	675.45	0.00	39.36	674.13	0.00	1.32	0 00:00	0.00	0.00
2 B2-2	Junction	673.36	677.74	673.36	677.74	0.00	20.80	674.96	0.00	2.78	0 00:00	0.00	0.00
3 B2-5	Junction	674.47	677.61	674.47	677.61	0.00	11.32	676.11	0.00	1.50	0 00:00	0.00	0.00
4 B3-3	Junction	671.02	674.58	671.02	674.58	0.00	22.58	672.44	0.00	2.14	0 00:00	0.00	0.00
5 B3-7	Junction	673.67	679.16	673.67	679.16	0.00	7.83	674.60	0.00	4.57	0 00:00	0.00	0.00
6 B3-8	Junction	674.52	679.79	674.52	679.79	0.00	7.83	675.35	0.00	4.44	0 00:00	0.00	0.00
7 B3-9	Junction	674.89	679.79	674.89	679.79	0.00	3.94	675.55	0.00	4.24	0 00:00	0.00	0.00
8 DRIVE B1a	Junction	678.19	6.00	0.00	0.00	0.00	2.21	678.36	0.00	0.07	0 00:00	0.00	0.00
9 DRIVE B1b	Junction	679.17	6.00	0.00	0.00	0.00	1.91	679.31	0.00	0.10	0 00:00	0.00	0.00
10 DRIVE B2a	Junction	679.85	6.00	0.00	0.00	0.00	3.02	680.04	0.00	0.05	0 00:00	0.00	0.00
11 DRIVE B2b	Junction	675.31	6.00	0.00	0.00	0.00	3.39	679.24	0.00	0.04	0 00:00	0.00	0.00
12 DRIVE B2c	Junction	0.00	6.00	0.00	6.00	0.00	2.42	680.02	0.00	0.07	0 00:00	0.00	0.00
13 DRIVE B2d	Junction	678.76	6.00	0.00	0.00	0.00	3.26	678.95	0.00	0.04	0 00:00	0.00	0.00
14 DRIVE B3f	Junction	0.00	6.00	0.00	6.00	0.00	3.65	676.39	0.00	0.04	0 00:00	0.00	0.00
15 DRIVE B3g-1	Junction	0.00	6.00	0.00	6.00	0.00	13.44	678.82	0.00	0.00	0 12:02	0.98	17.00
16 DRIVE B3h	Junction	674.83	6.00	0.00	0.00	0.00	3.76	675.04	0.00	0.03	0 00:00	0.00	0.00
17 OUTFALL B2	Junction	673.11	679.16	673.11	679.16	0.00	39.38	674.66	0.00	4.50	0 00:00	0.00	0.00
18 SDWK BOX B DUMMY	Junction	675.58	677.34	0.00	0.00	0.00	19.05	676.64	0.00	0.70	0 00:00	0.00	0.00
19 Out-1B1-1	Outfall	670.57					40.34	671.83					
20 Out-1B3-1	Outfall	670.57					24.91	671.82					



## Vanguard Farms Apartments

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	B1-1	Pipe	B1-2	Out-1B1-1	27.44	670.68	670.57	0.4000	24.000	0.0130	40.34	57.77	0.70	6.42	1.26	0.63	0.00
2	B1-2	Pipe	B1-3	B1-2	325.38	671.98	670.78	0.3700	24.000	0.0130	39.79	42.38	0.94	6.38	1.56	0.78	0.00
3	B1-3	Pipe	B1-4	B1-3	135.92	672.61	672.08	0.4000	24.000	0.0130	39.34	43.95	0.90	6.52	1.51	0.75	0.00
4	B2-1	Pipe	B2-2	OUTFALL B2	81.97	673.36	673.16	0.2400	24.000	0.0130	20.76	23.90	0.87	4.63	1.49	0.75	0.00
5	B2-2	Pipe	B2-3	B2-2	126.09	673.76	673.46	0.2400	24.000	0.0130	20.80	23.90	0.87	4.64	1.49	0.75	0.00
6	B2-3	Pipe	B2-4	B2-3	171.36	674.20	673.86	0.2000	24.000	0.0130	16.42	21.82	0.75	4.09	1.34	0.67	0.00
7	B2-4	Pipe	B2-5	B2-4	86.66	674.47	674.30	0.2000	24.000	0.0130	11.32	12.88	0.88	3.67	1.54	0.77	0.00
8	B2-5	Pipe	B2-6	B2-5	41.89	674.65	674.57	0.2000	24.000	0.0130	11.32	12.88	0.88	3.67	1.54	0.77	0.00
9	B2-6	Pipe	B2-7	B2-6	61.04	674.87	674.75	0.2000	24.000	0.0130	6.00	10.12	0.59	3.36	1.11	0.55	0.00
10	B2-7	Pipe	B2-8	B2-7	170.14	675.31	674.97	0.2000	24.000	0.0150	2.84	11.16	0.25	2.33	0.61	0.31	0.00
11	B2c-1	Pipe	B2c-1	B2-6	182.72	675.12	674.75	0.2000	24.000	0.0130	2.31	12.88	0.18	2.42	0.48	0.24	0.00
12	B3-1	Pipe	B3-2	Out-1B3-1	33.76	670.66	670.57	0.2700	24.000	0.0130	24.91	36.26	0.69	4.99	1.25	0.62	0.00
13	B3-2	Pipe	B3-3	B3-2	96.98	671.02	670.76	0.2700	24.000	0.0130	22.58	36.26	0.62	4.85	1.16	0.58	0.00
14	B3-3	Pipe	B3-4	B3-3	101.12	671.52	671.12	0.4000	24.000	0.0130	22.58	30.86	0.73	5.71	1.32	0.66	0.00
15	B3-4	Pipe	B3-5	B3-4	143.96	672.20	671.62	0.4000	24.000	0.0130	15.11	30.86	0.49	5.11	0.98	0.49	0.00
16	B3-5	Pipe	B3-6	B3-5	87.13	672.88	672.30	0.6700	24.000	0.0110	12.95	21.90	0.59	7.26	1.11	0.55	0.00
17	B3-6	Pipe	B3-7	B3-6	116.41	673.67	672.88	0.6700	24.000	0.0110	7.82	21.90	0.36	6.39	0.82	0.41	0.00
18	B3-7	Pipe	B3-8	B3-7	112.25	674.52	673.77	0.6700	24.000	0.0110	7.83	21.88	0.36	6.39	0.82	0.41	0.00
19	B3-8	Pipe	B3-9	B3-8	40.25	674.89	674.62	0.6700	24.000	0.0120	3.93	20.06	0.20	4.96	0.60	0.30	0.00
20	B3-9	Pipe	INLET B3a	B3-9	87.75	675.58	674.99	0.6700	12.000	0.0110	1.89	3.45	0.55	4.49	0.53	0.53	0.00
21	B3b-1	Pipe	INLET B3b	B3-9	68.38	675.45	674.99	0.6700	12.000	0.0110	2.07	3.45	0.60	4.60	0.56	0.56	0.00
22	B3c-1	Pipe	INLET B3c	B3-8	75.08	675.12	674.62	0.6700	12.000	0.0110	1.89	3.45	0.55	4.49	0.53	0.53	0.00
23	B3d-1	Pipe	INLET B3d	B3-8	51.50	674.97	674.62	0.6700	12.000	0.0110	2.03	3.45	0.59	4.57	0.55	0.55	0.00
24	CHANNEL B 1	Channel	SDWK BOX B DUMMY	OUTFALL B2	621.36	675.58	673.11	0.4000	15.000	0.0400	18.62	26.12	0.71	2.11	1.04	0.83	0.00
25	CHANNEL B 2	Channel	OUTFALL B2	B1-4	123.46	673.11	672.61	0.4000	15.720	0.0240	39.36	82.56	0.48	5.40	0.89	0.68	0.00
26	CHANNEL B DUMMY	Channel	SDWK BOX B	SDWK BOX B DUMMY	1.00	677.34	675.58	176.4000	15.000	0.0400	3.96	550.73	0.01	8.53	0.07	0.06	0.00
27	DRIVE B1a	Channel	DRIVE B1a	SDWK BOX B	172.00	678.19	677.34	0.5000	2.880	0.0130	2.20	5.64	0.39	1.57	0.17	0.70	0.00
28	DRIVE B1a DUMMY	Channel	B2-7	DRIVE B1a	1.00	678.20	678.19	0.5000	2.880	0.0320	0.20	2.30	0.09	0.43	0.10	0.40	0.00
29	DRIVE B1b	Channel	DRIVE B1b	SDWK BOX B	165.84	679.17	677.34	1.1000	2.880	0.0130	1.90	8.41	0.23	2.03	0.14	0.57	0.00
30	DRIVE B2a	Channel	DRIVE B2a	B2-8	163.00	679.85	679.04	0.5000	2.880	0.0130	2.99	5.64	0.53	1.69	0.19	0.79	0.00
31	DRIVE B2b	Channel	DRIVE B2b	B2-7	169.00	679.04	678.20	0.5000	2.880	0.0130	3.36	5.66	0.59	1.74	0.20	0.82	0.00
32	DRIVE B2b DUMMY	Channel	B2-8	DRIVE B2b	1.00	679.04	675.31	373.5300	2.880	0.0320	0.15	62.88	0.00	4.81	0.02	0.10	0.00
33	DRIVE B2c	Channel	DRIVE B2c	B2c-1	218.00	679.85	678.76	0.5000	2.880	0.0130	2.40	5.66	0.42	1.62	0.17	0.72	0.00
34	DRIVE B2d	Channel	DRIVE B2d	B2-6	182.72	678.76	677.85	0.4900	2.880	0.0130	3.23	5.63	0.57	1.73	0.19	0.81	0.00
35	DRIVE B2d DUMMY	Channel	B2c-1	DRIVE B2d	1.00	678.76	678.76	0.5000	2.880	0.0130	0.09	5.68	0.02	0.69	0.05	0.21	0.00
36	DRIVE B2e	Channel	B2-6	B2-4	125.00	677.85	677.22	0.5000	2.880	0.0130	0.18	5.68	0.03	0.90	0.06	0.27	0.00
37	DRIVE B3f	Channel	DRIVE B3f	B3-5	124.52	676.19	675.57	0.5000	2.880	0.0130	3.65	5.66	0.64	1.77	0.20	0.85	0.00
38	DRIVE B3g-1	Channel	DRIVE B3g-1	B3-4	400.00	678.58	674.84	0.9400	2.880	0.0130	7.75	7.75	1.00	2.86	0.24	1.00	15.00
39	DRIVE B3g-2	Channel	B3-5	B3-4	145.00	675.57	674.84	0.5000	2.880	0.0130	0.10	5.68	0.02	0.82	0.05	0.22	0.00
40	DRIVE B3h	Channel	DRIVE B3h	B3-2	185.00	674.83	673.91	0.5000	2.880	0.0130	3.73	5.66	0.66	1.79	0.20	0.85	0.00
41	DRIVE B3h DUMMY	Channel	B3-4	DRIVE B3h	1.00	674.84	674.83	0.6000	2.880	0.0130	0.34	6.18	0.06	1.04	0.08	0.34	0.00



## Vanguard Farms Apartments

SN Element ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation	Max (Rim) Elevation	Initial Water Elevation	Ponded Area	Peak Flow	Peak Flow Intercepted	Peak Flow Bypassing	Inlet Efficiency during Peak Flow	Allowable Spread	Max Gutter Spread during Peak Flow	Max Gutter Water Elev. during Peak Flow
					(ft)	(ft)	(ft)	(ft <sup>2</sup> )	(cfs)	(cfs)	(cfs)	(%)	(ft)	(ft)	(ft)
1 B1-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.68	674.37	670.68	0.00	0.96	N/A	N/A	N/A	7.00	5.90	674.72
2 B1-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	671.98	675.90	671.98	0.00	1.02	N/A	N/A	N/A	7.00	6.28	676.28
3 B2-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	673.76	677.31	673.76	0.00	4.51	N/A	N/A	N/A	7.00	15.69	678.11
4 B2-4	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.20	677.22	674.20	0.00	5.14	N/A	N/A	N/A	7.00	16.56	678.03
5 B2-6	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.65	677.85	674.65	N/A	3.23	3.05	0.18	94.43	7.00	12.44	678.17
6 B2-7	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.87	678.20	674.87	N/A	3.36	3.16	0.20	94.15	7.00	12.63	678.51
7 B2-8	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.31	679.04	675.31	N/A	2.99	2.84	0.15	95.03	7.00	12.07	679.34
8 B2c-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.12	678.76	675.12	N/A	2.40	2.31	0.09	96.36	7.00	11.05	679.05
9 B3-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.66	673.91	670.66	0.00	3.73	N/A	N/A	N/A	7.00	14.07	674.67
10 B3-4	FHWA HEC-22 GENERIC	N/A	On Grade	1	671.52	674.84	671.52	N/A	7.85	7.50	0.34	95.61	7.00	17.57	675.25
11 B3-5	FHWA HEC-22 GENERIC	N/A	On Grade	1	672.20	675.57	672.20	N/A	3.65	3.55	0.11	97.08	7.00	13.05	675.89
12 B3-6	FHWA HEC-22 GENERIC	N/A	On Sag	1	672.88	676.10	672.88	0.00	5.92	N/A	N/A	N/A	7.00	14.99	676.90
13 INLET B3a	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	679.17	675.58	0.00	1.89	N/A	N/A	N/A	7.00	8.62	679.60
14 INLET B3b	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.45	678.68	675.45	0.00	2.07	N/A	N/A	N/A	7.00	9.45	679.12
15 INLET B3c	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.12	679.17	675.12	0.00	1.89	N/A	N/A	N/A	7.00	8.62	679.60
16 INLET B3d	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.97	678.67	674.97	0.00	2.03	N/A	N/A	N/A	7.00	9.34	679.11
17 SDWK BOX B	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	677.34	0.00	0.00	3.96	N/A	N/A	N/A	7.00	18.41	678.19

Vanguard Farms Apartments

Subbasin : B1a

Input Data

Area (ac) ..... 0.27  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

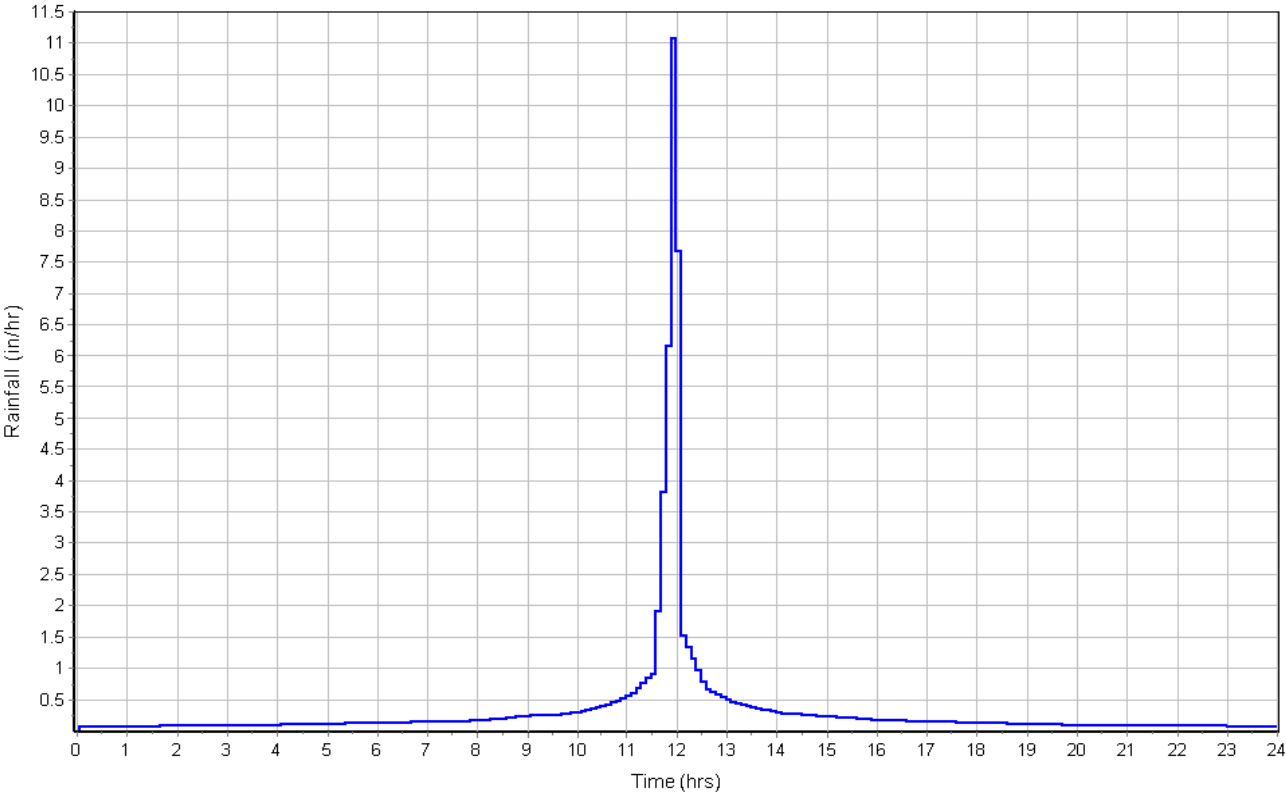
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.27	-	93.00
Composite Area & Weighted CN	0.27		93.00

Subbasin Runoff Results

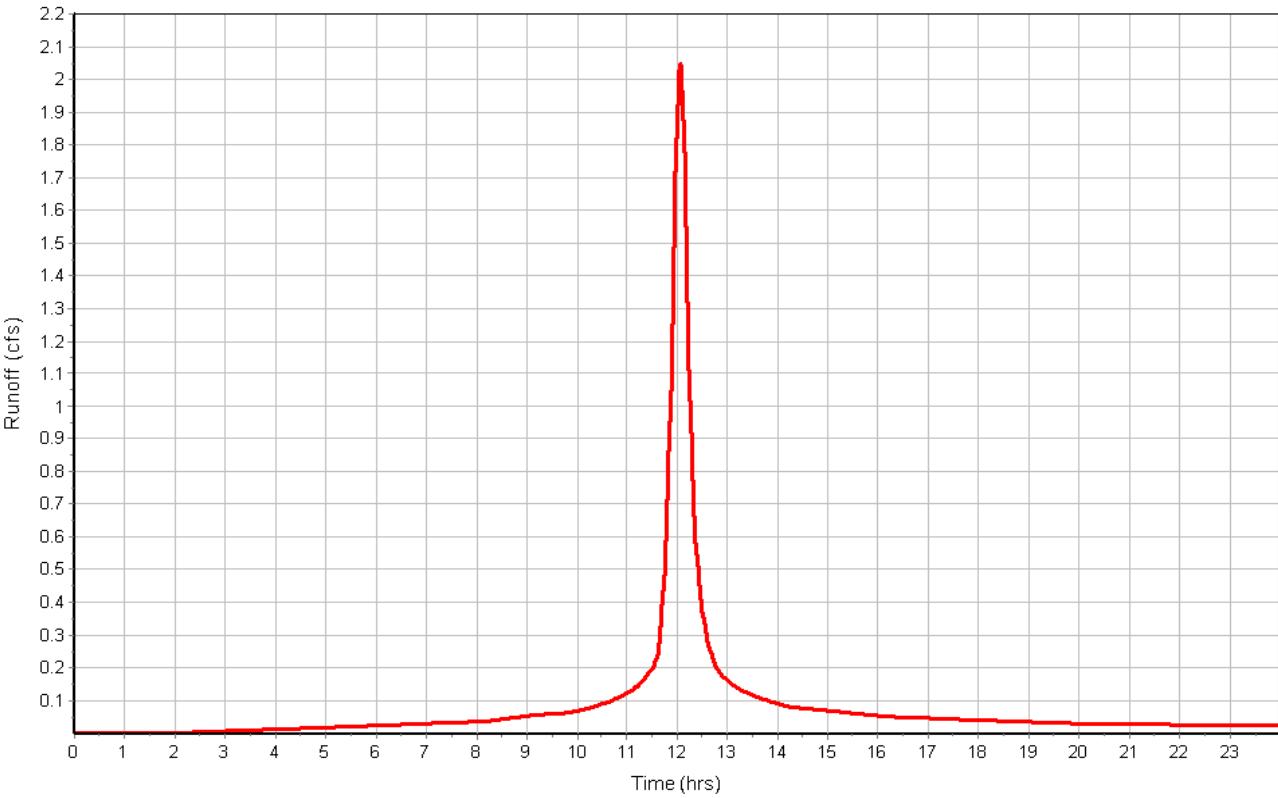
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 2.05  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:17:53

Subbasin : B1a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B1b

Input Data

Area (ac) ..... 0.21  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

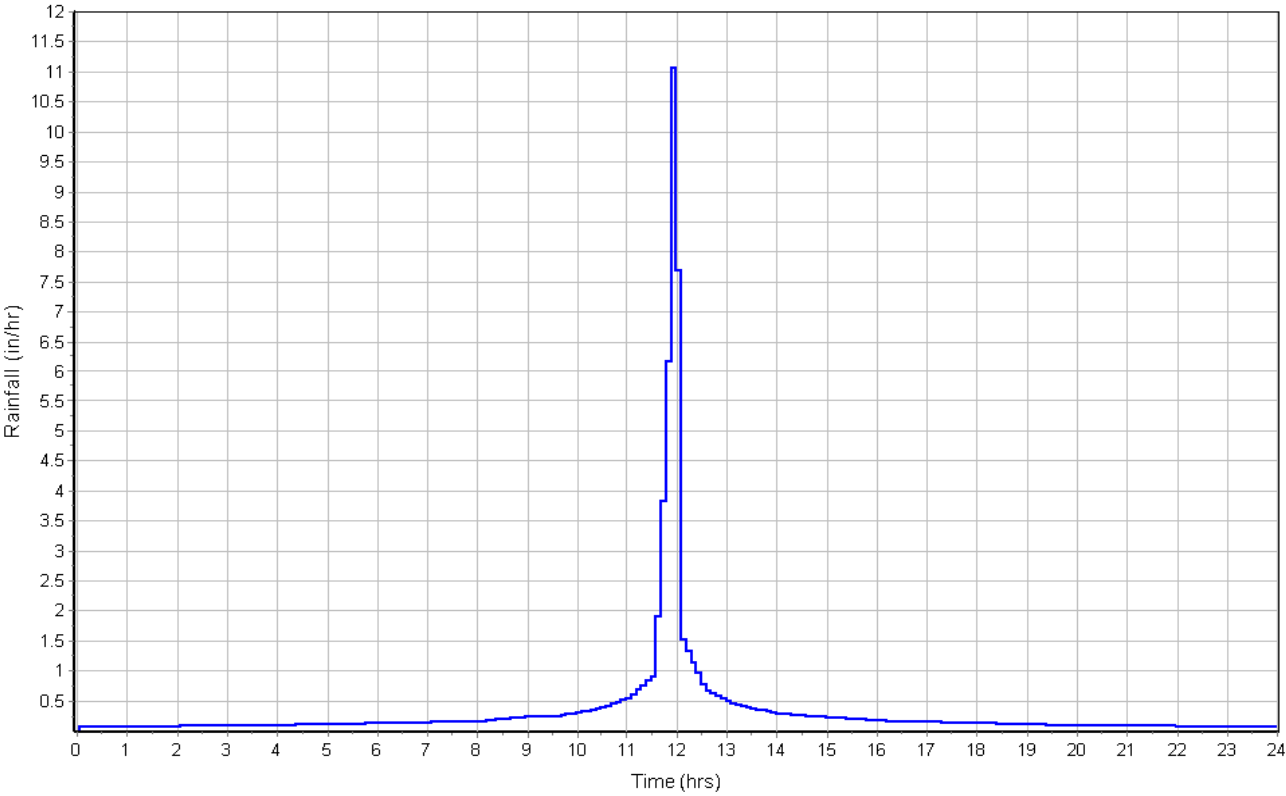
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.21	-	93.00
Composite Area & Weighted CN	0.21		93.00

Subbasin Runoff Results

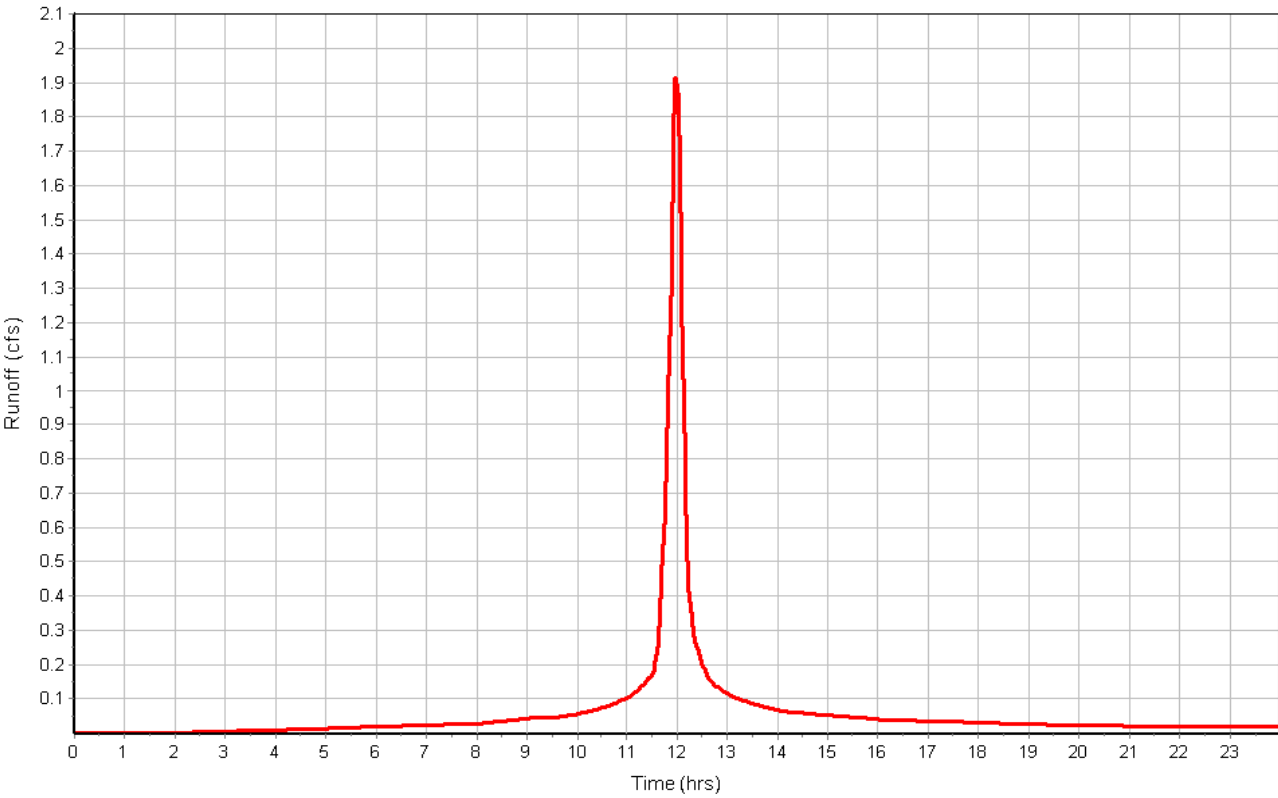
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 1.92  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B1b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2a

Input Data

Area (ac) ..... 0.33  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.33	-	93.00
Composite Area & Weighted CN	0.33		93.00

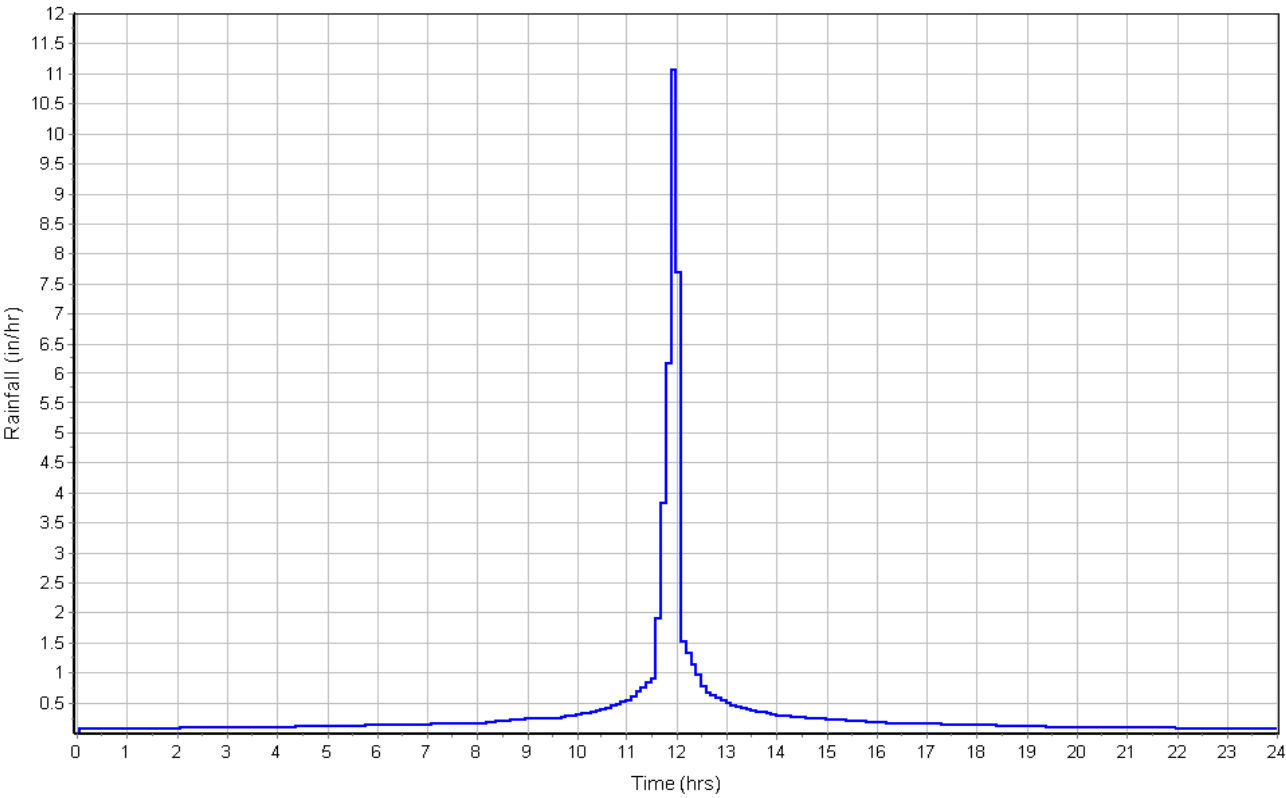
Subbasin Runoff Results

Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 3.02  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

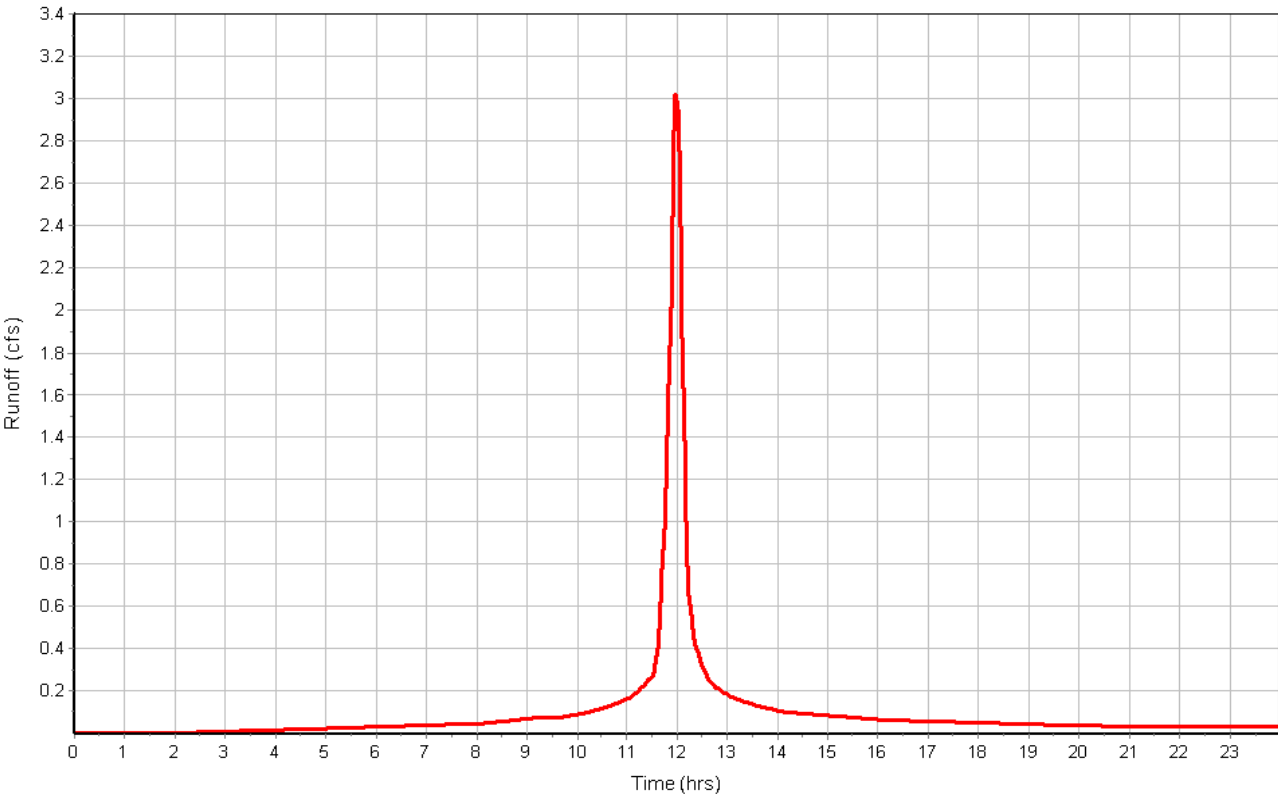


Subbasin : B2a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2b

Input Data

Area (ac) ..... 0.36  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

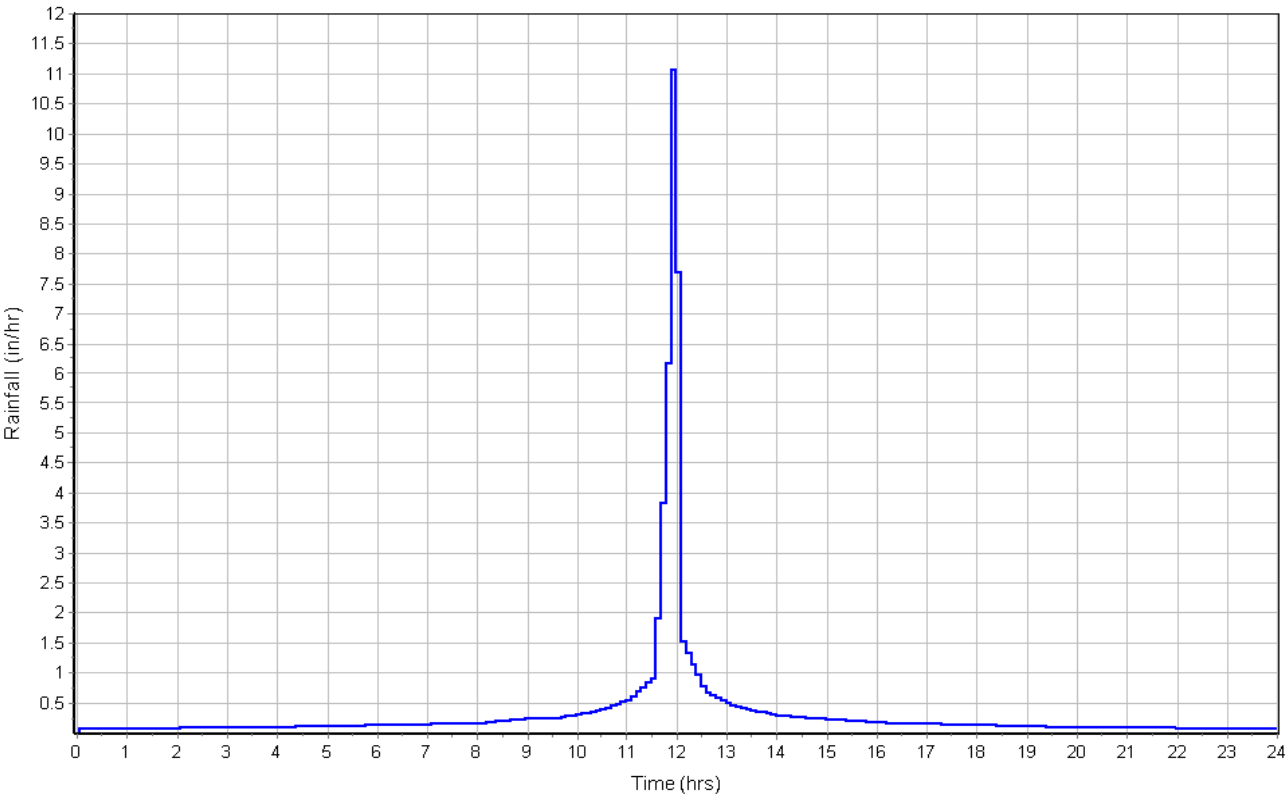
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.36	-	93.00
Composite Area & Weighted CN	0.36		93.00

Subbasin Runoff Results

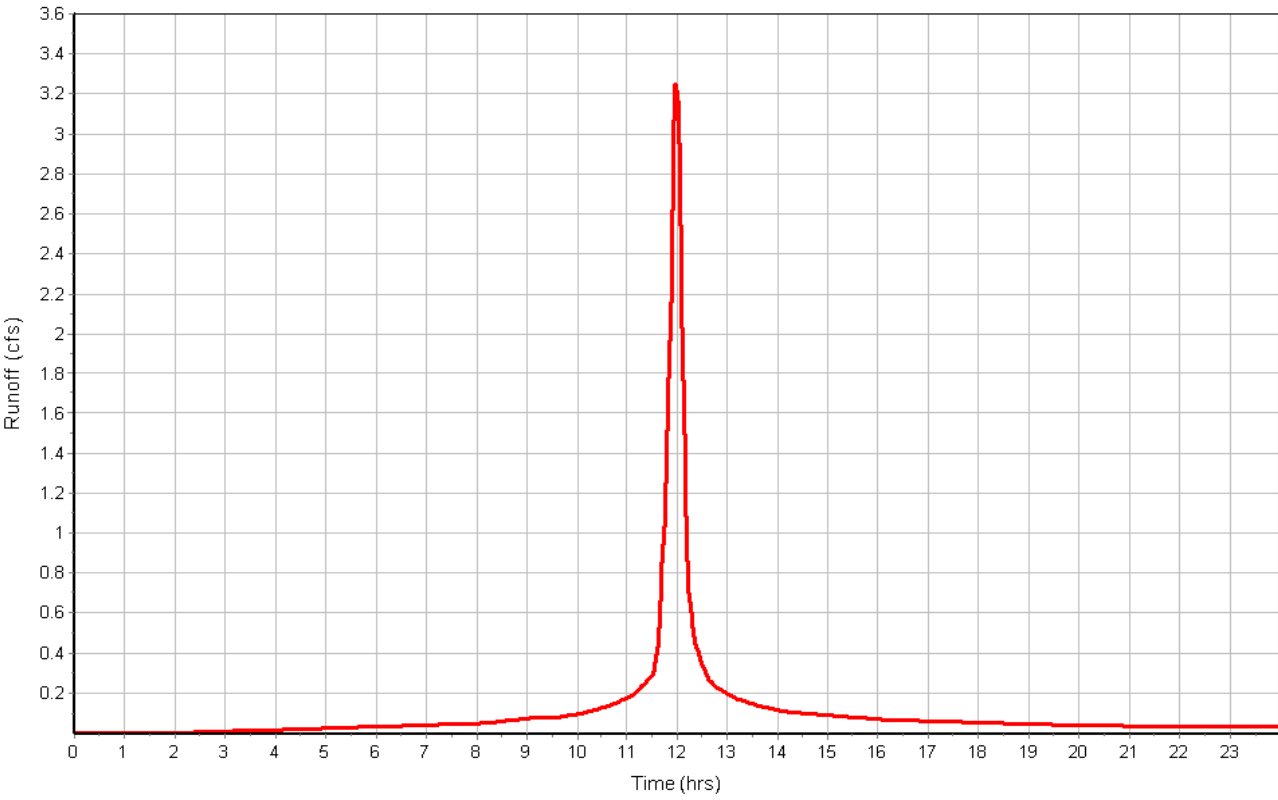
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 3.25  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B2b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2c

Input Data

Area (ac) ..... 0.28  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

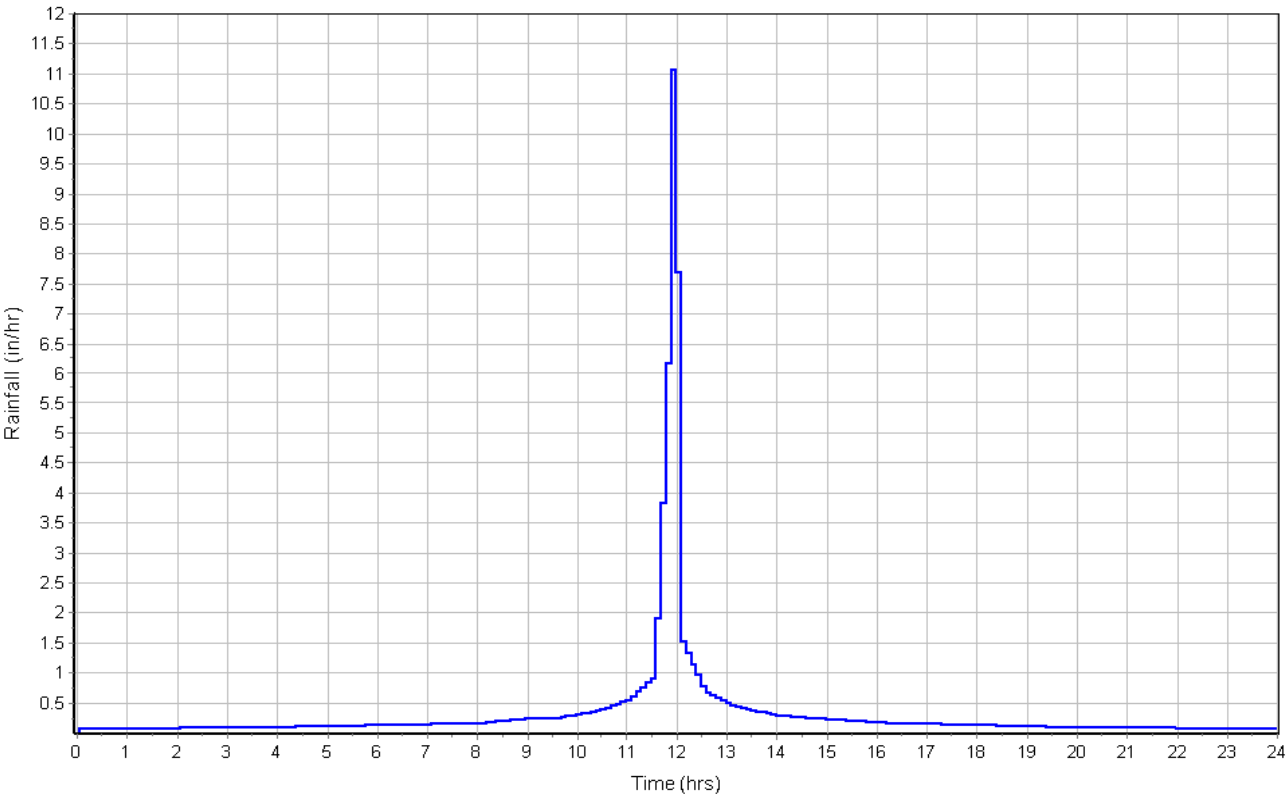
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.28	-	93.00
Composite Area & Weighted CN	0.28		93.00

Subbasin Runoff Results

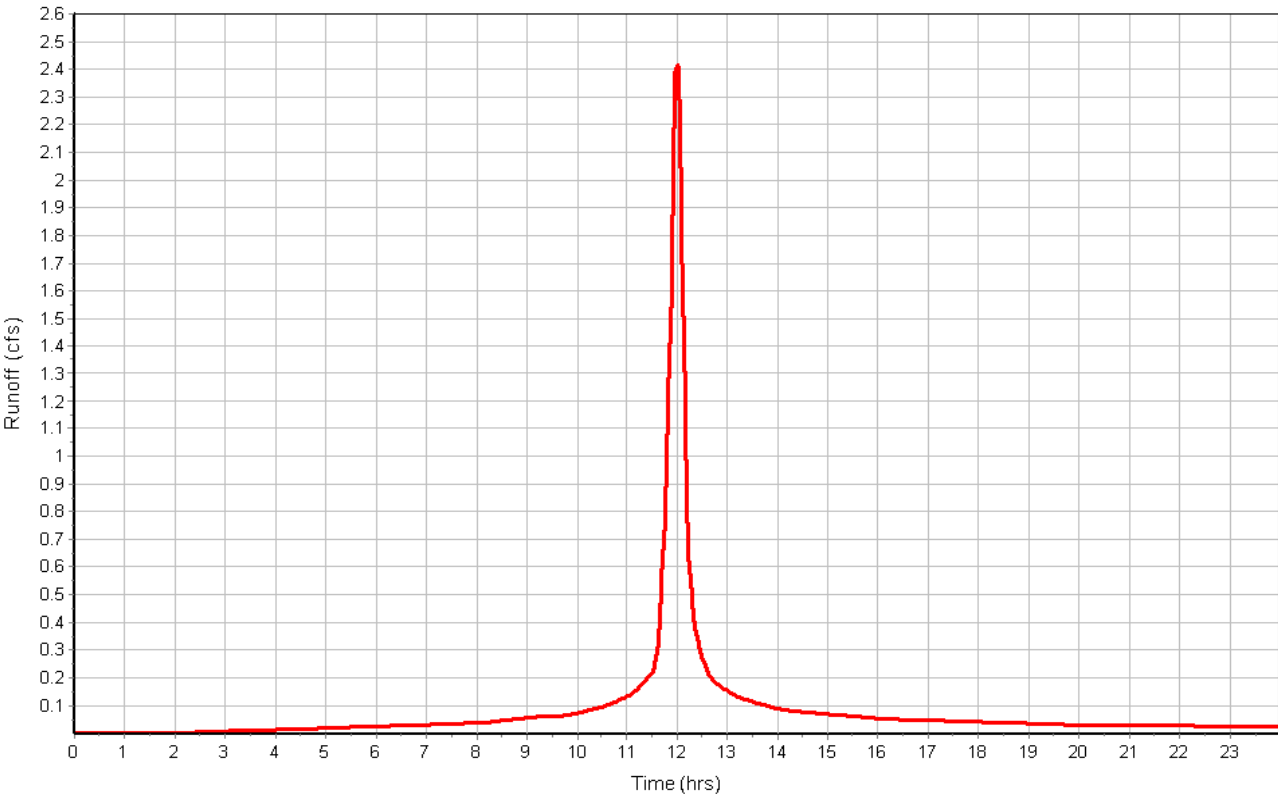
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 2.42  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:11:19

Subbasin : B2c

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2d

Input Data

Area (ac) ..... 0.35  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

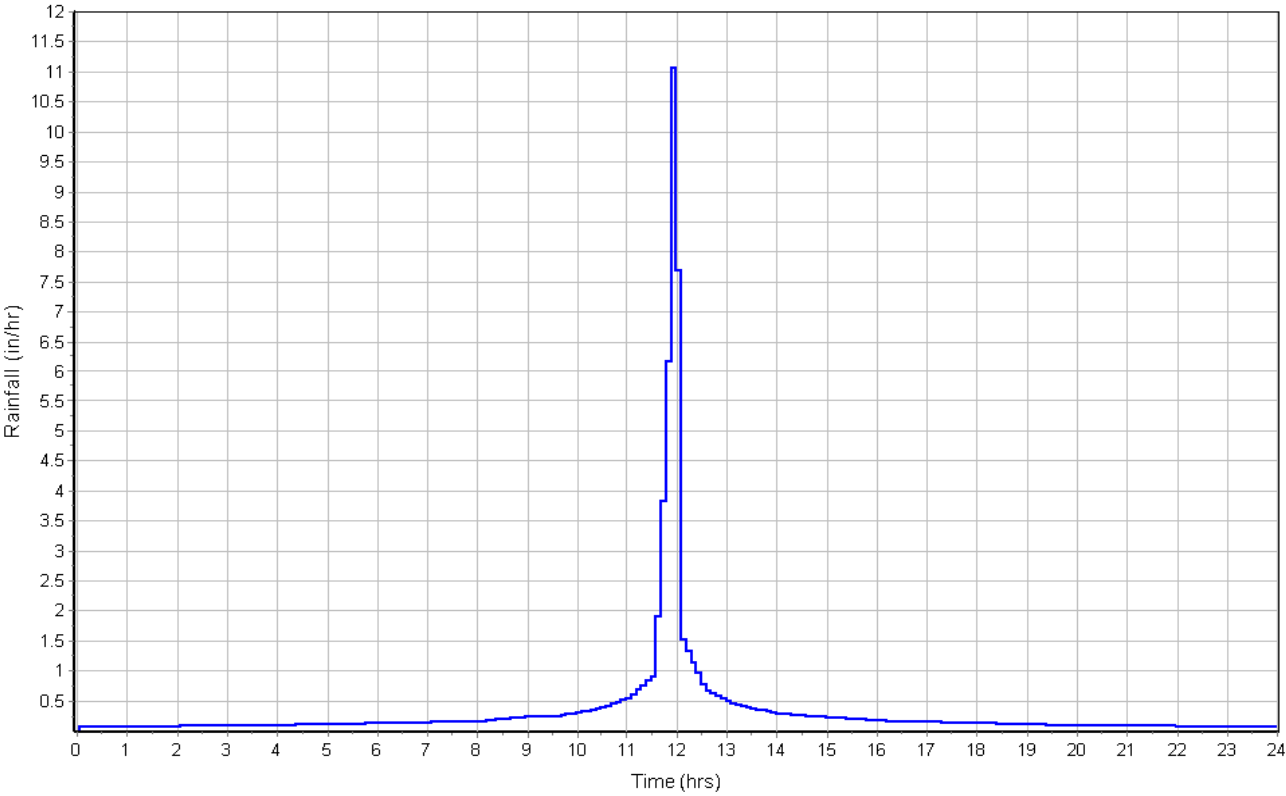
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.35	-	93.00
Composite Area & Weighted CN	0.35		93.00

Subbasin Runoff Results

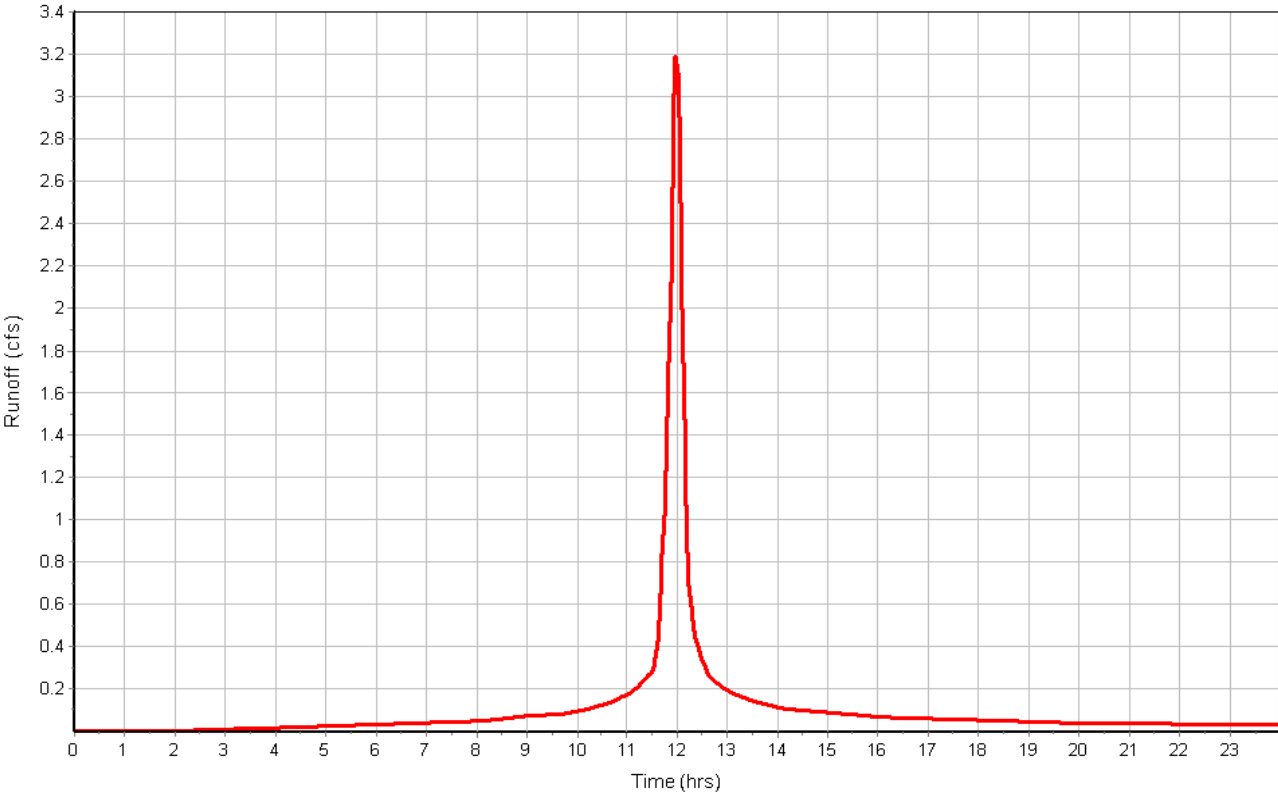
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 3.20  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B2d

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2e

Input Data

Area (ac) ..... 0.65  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.65	-	93.00
Composite Area & Weighted CN	0.65		93.00

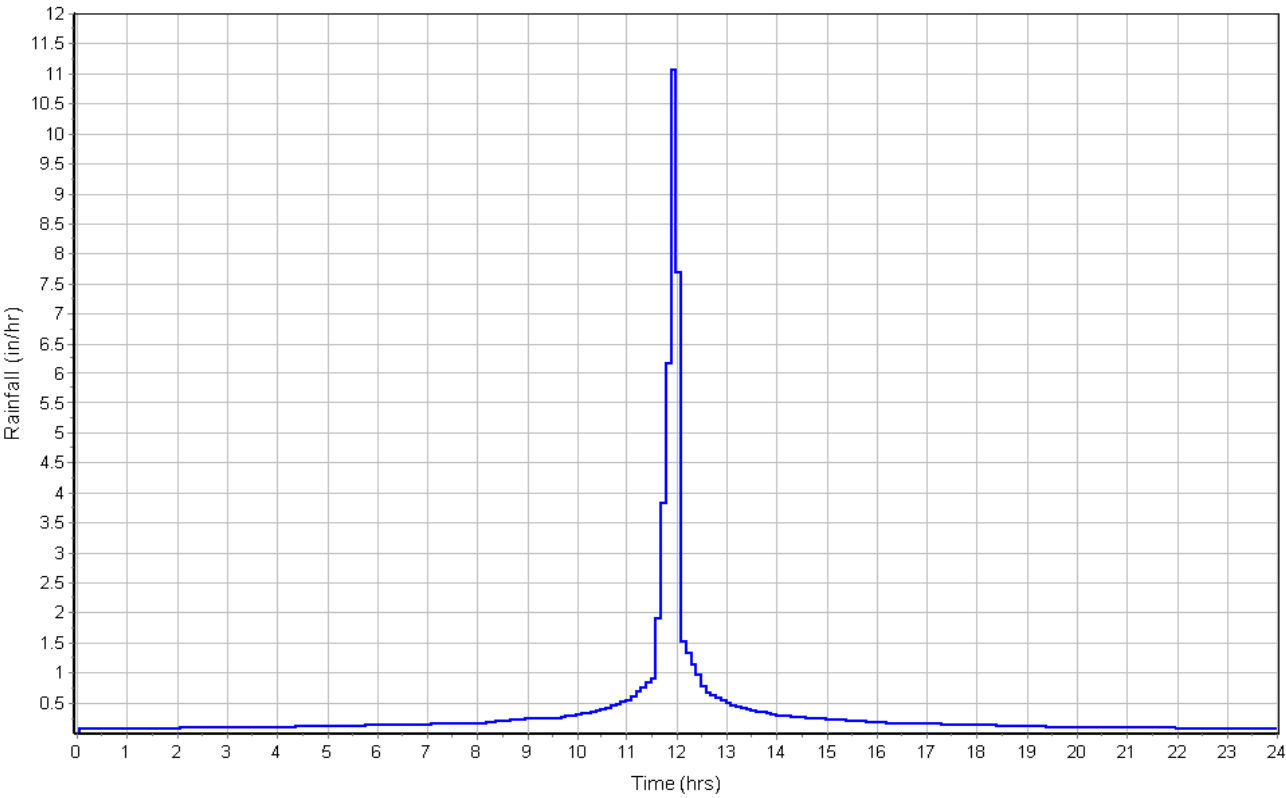
Subbasin Runoff Results

Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 4.99  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:17:51

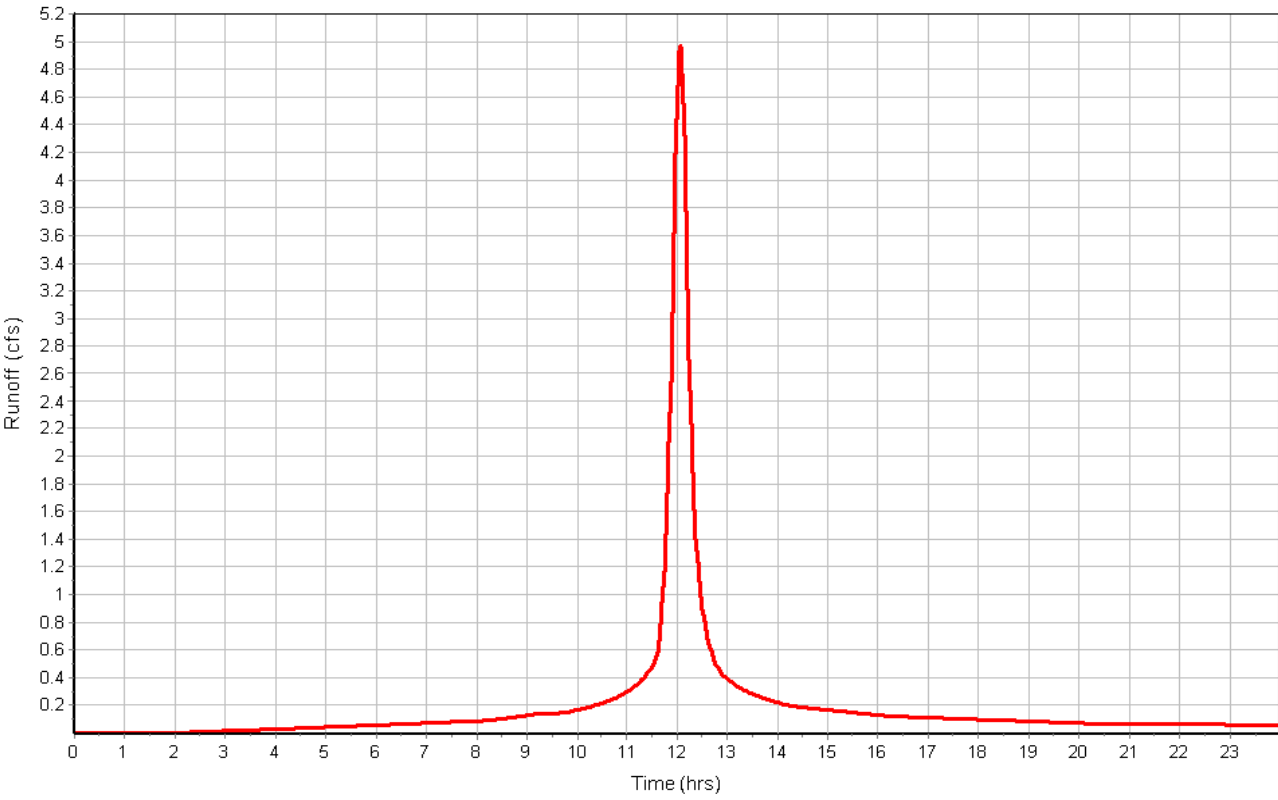


Subbasin : B2e

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2f

Input Data

Area (ac) ..... 0.63  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

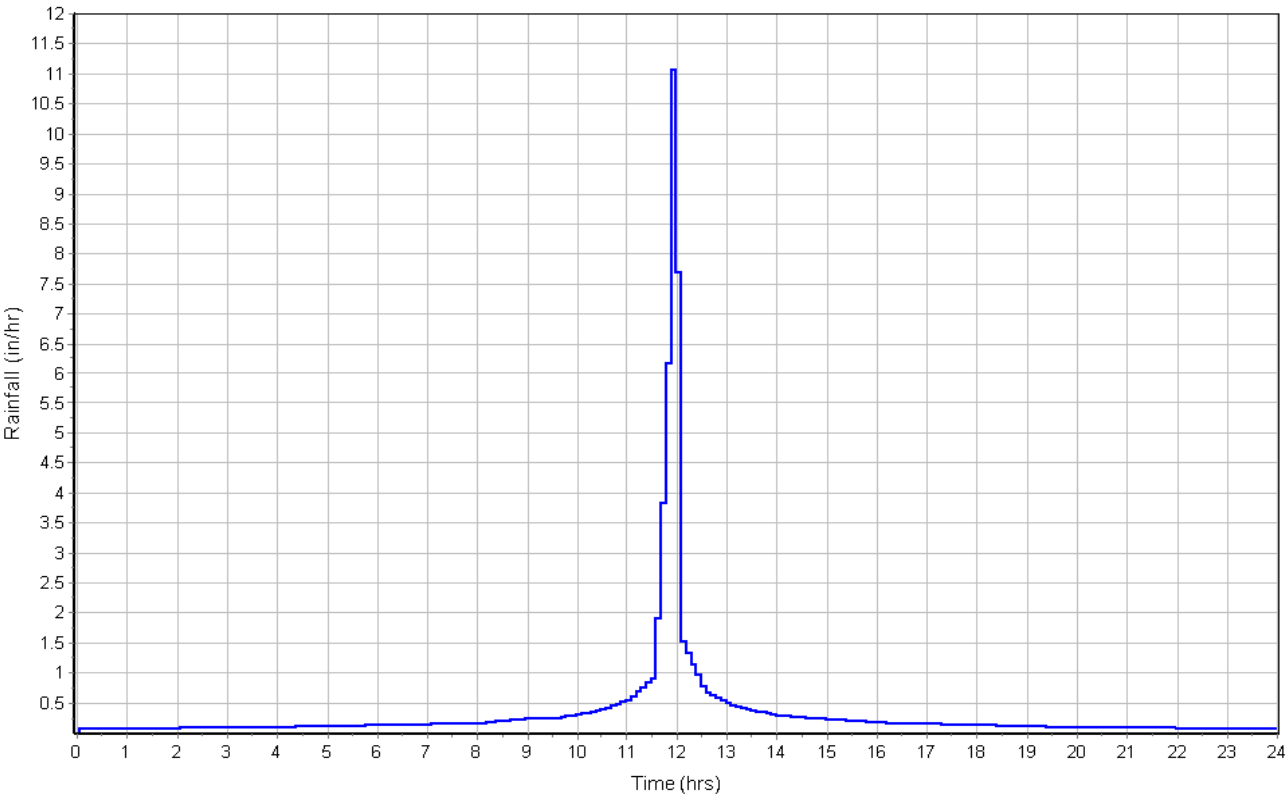
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.63	-	93.00
Composite Area & Weighted CN	0.63		93.00

Subbasin Runoff Results

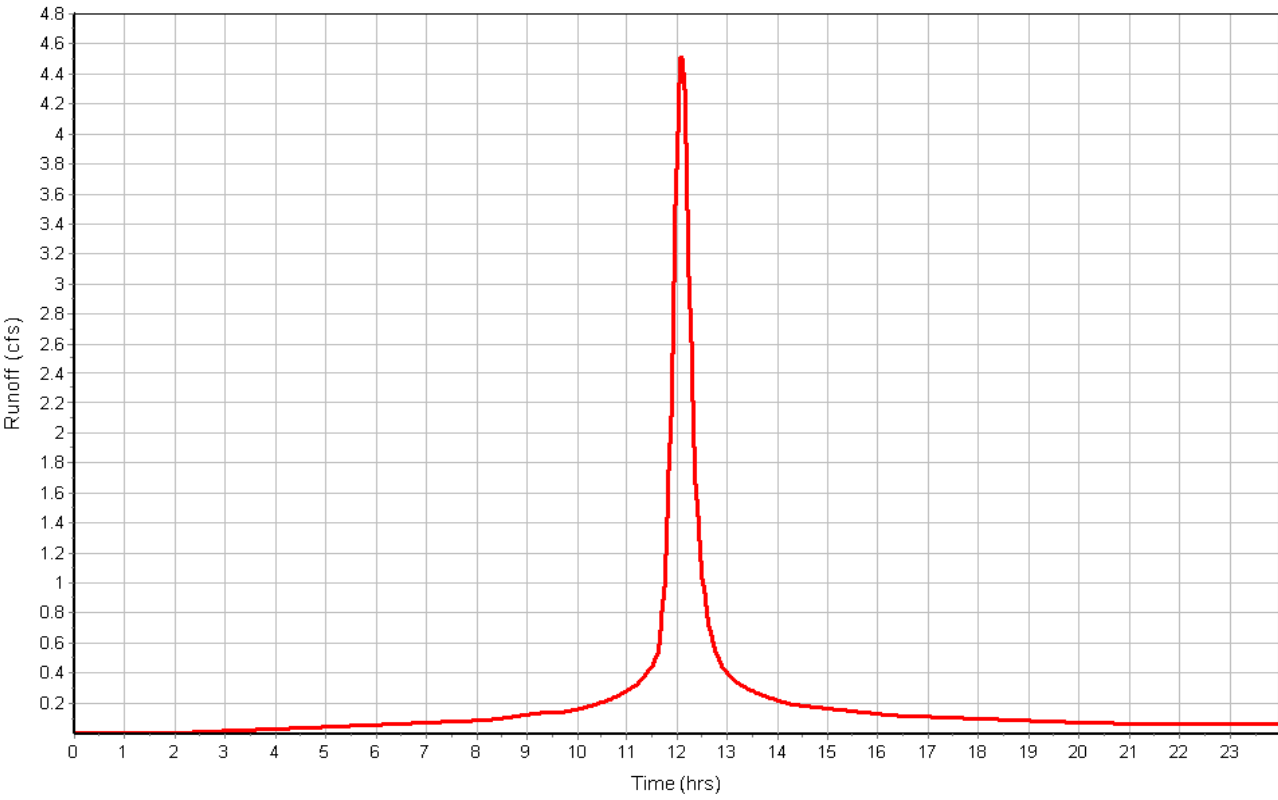
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 4.54  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:20:46

Subbasin : B2f

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3a

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

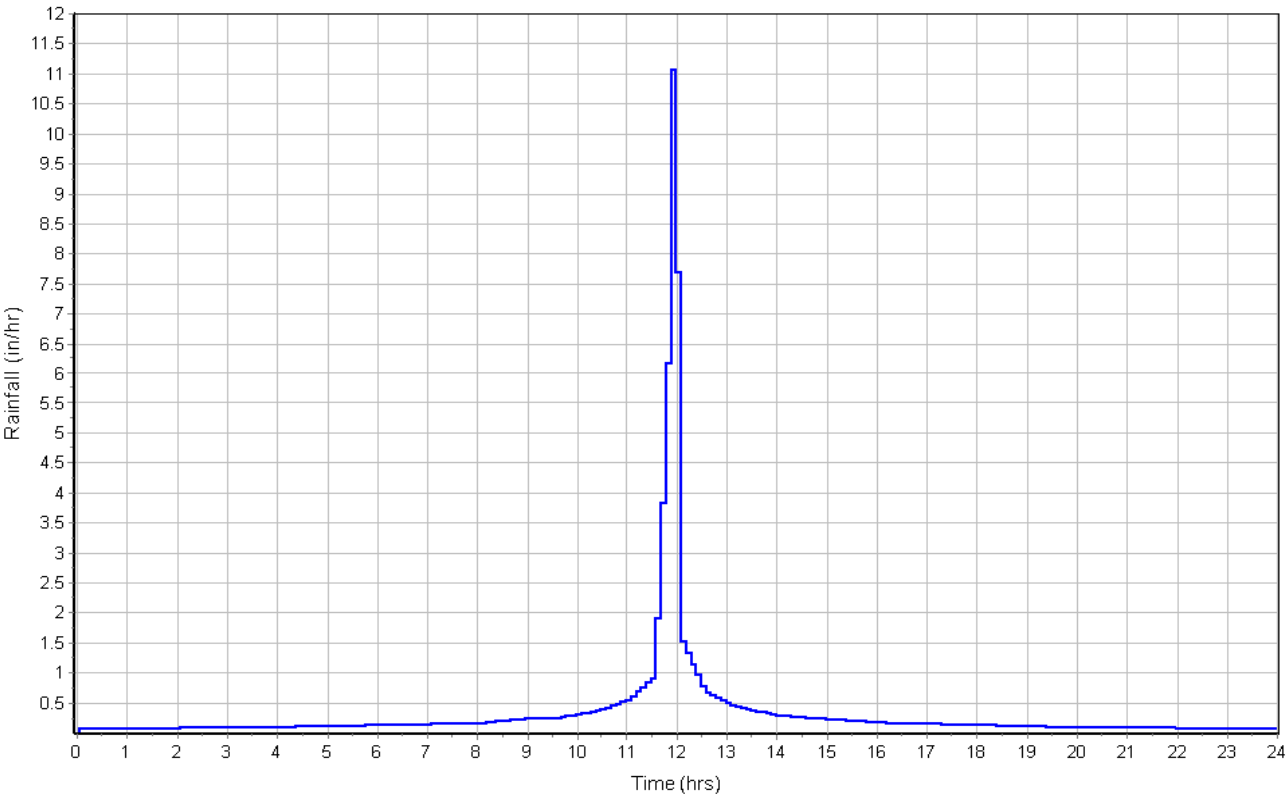
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

Subbasin Runoff Results

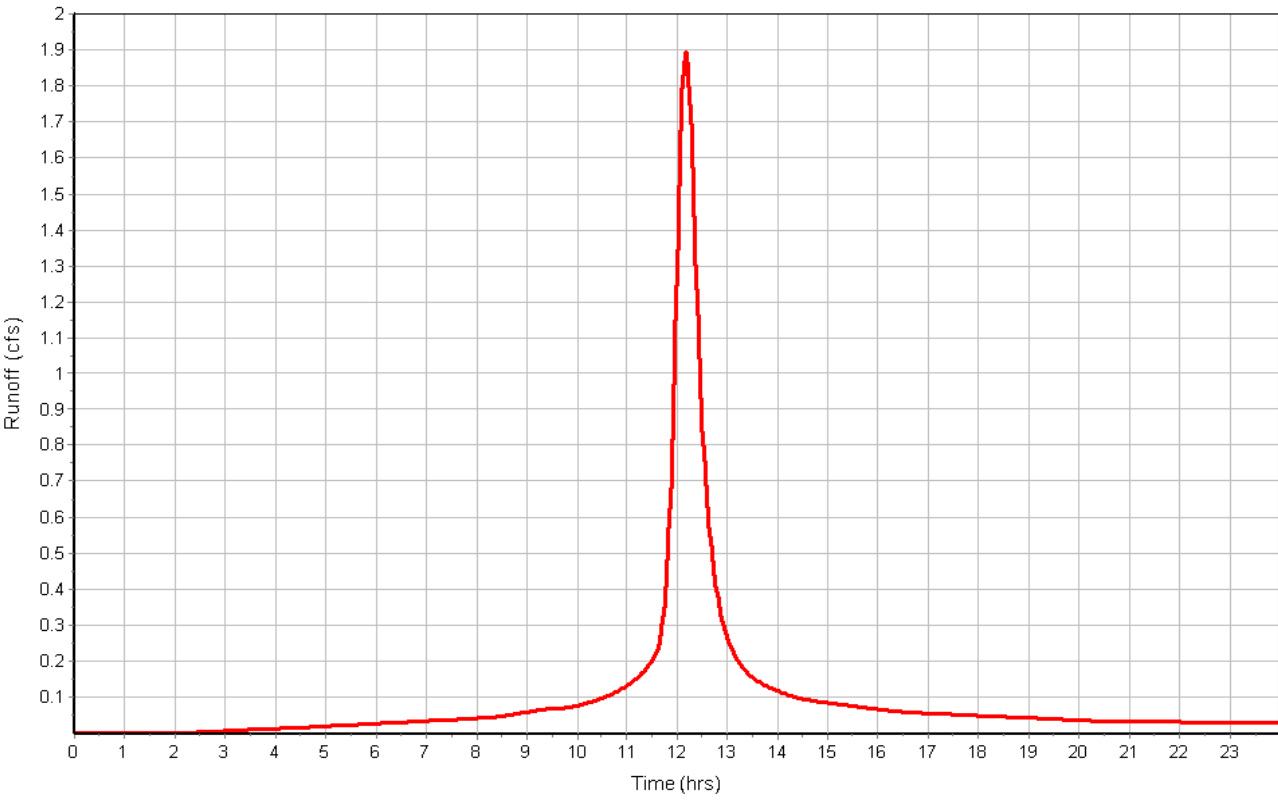
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 1.90  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:30:09

Subbasin : B3a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3b

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

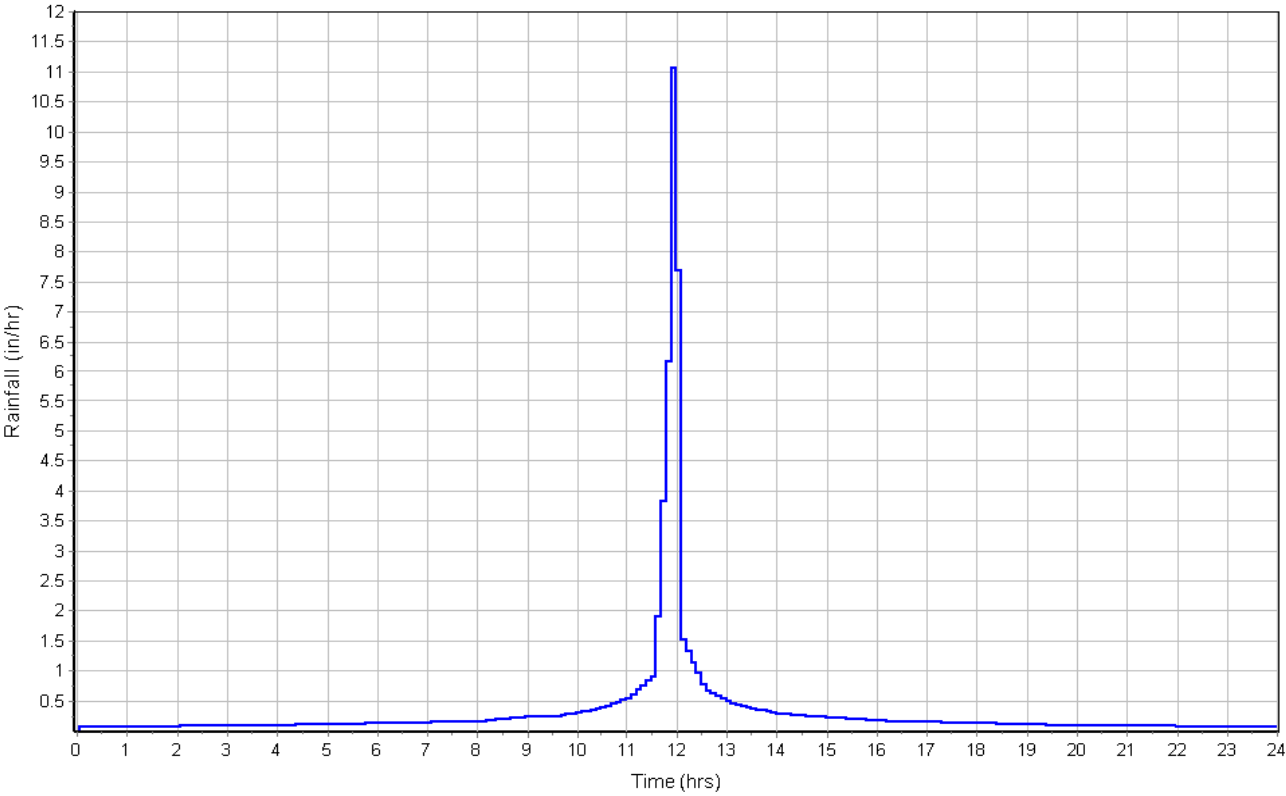
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

Subbasin Runoff Results

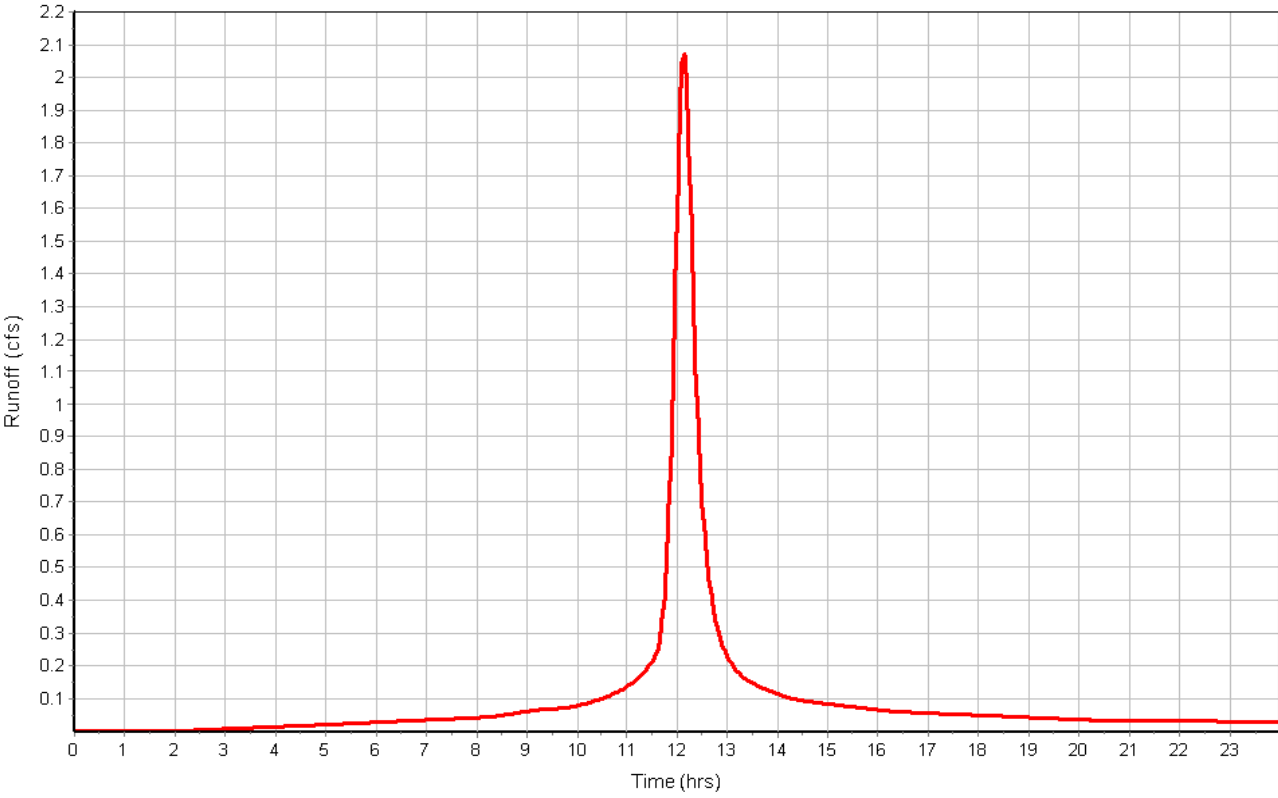
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 2.07  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:25:35

Subbasin : B3b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3c

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

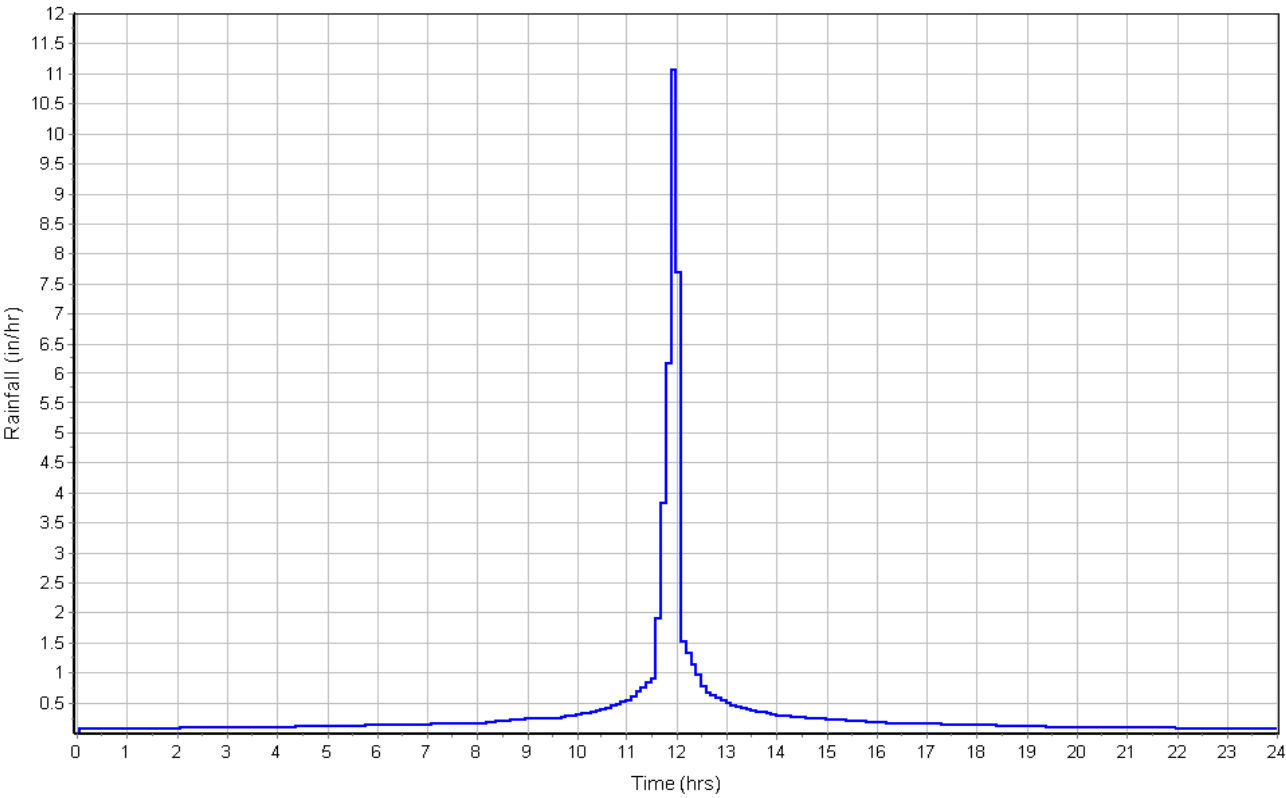
Subbasin Runoff Results

Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 1.90  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:30:09

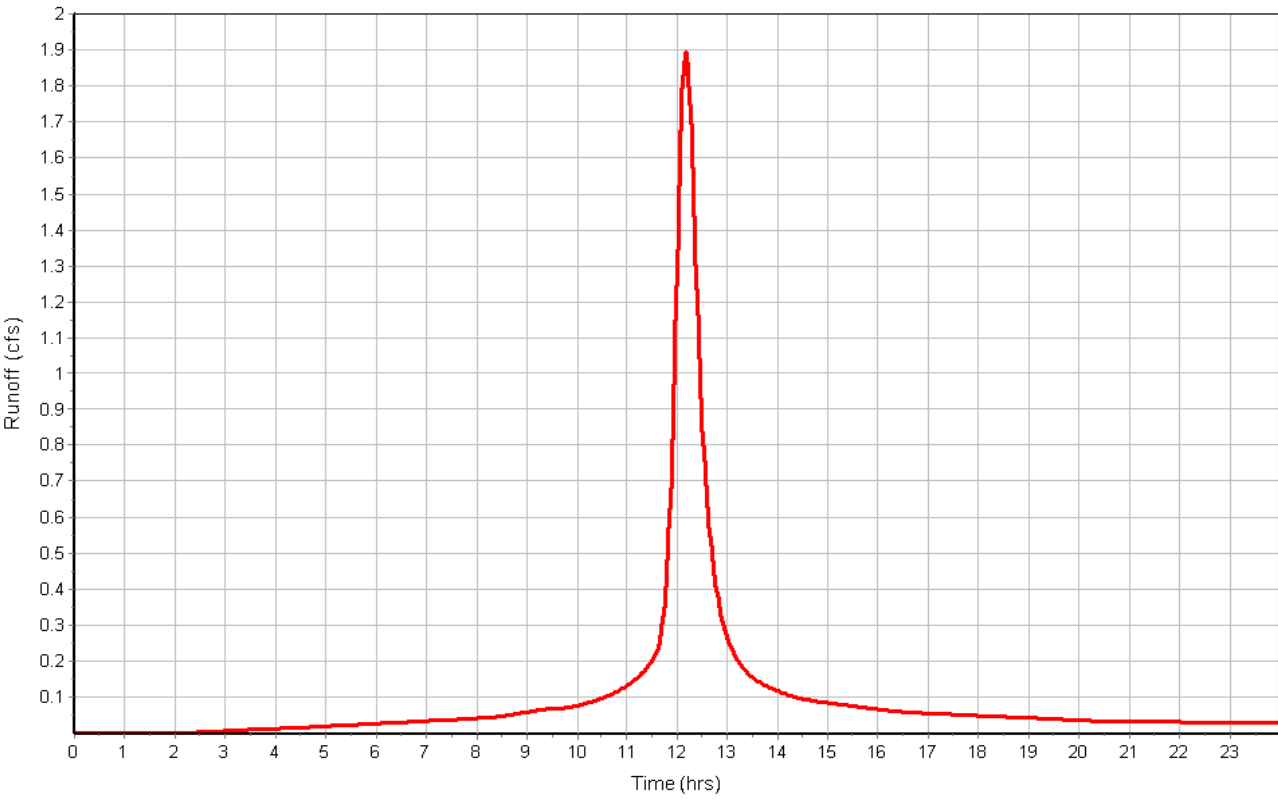


Subbasin : B3c

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3d

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

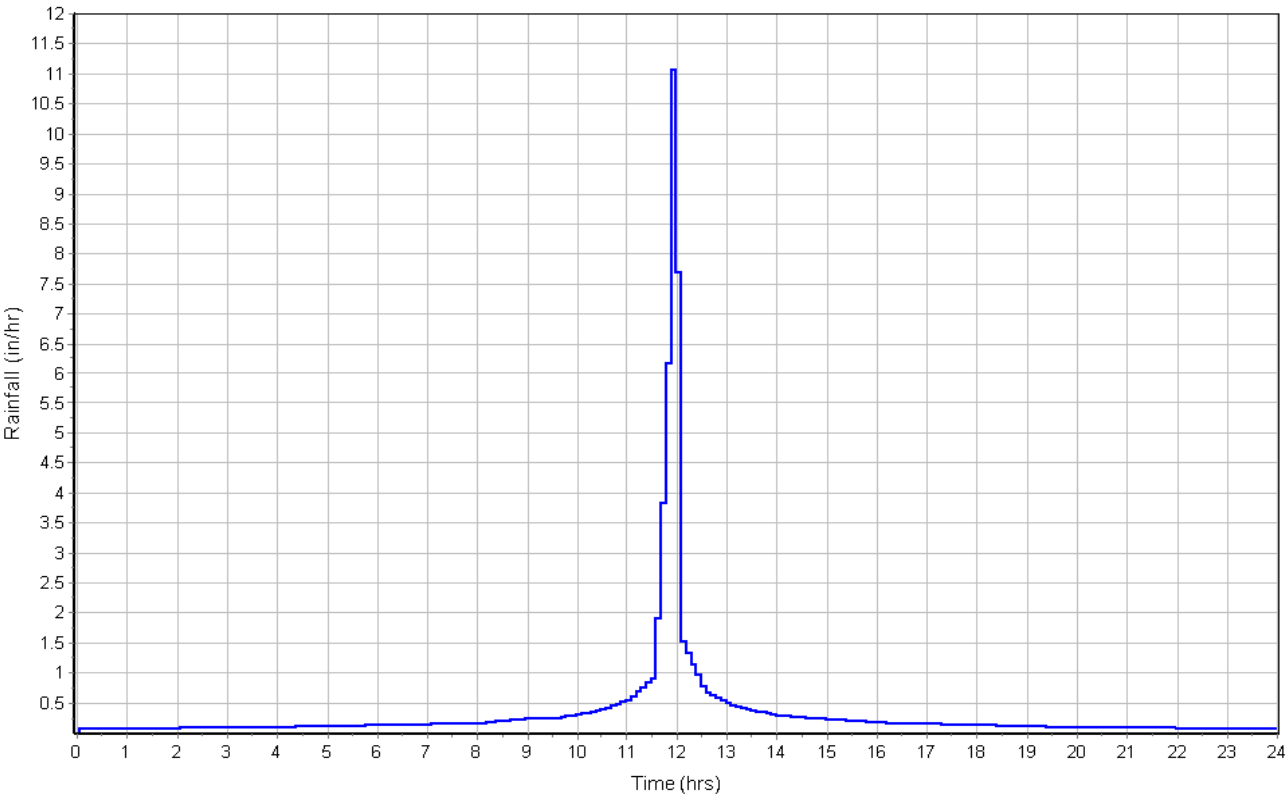
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

Subbasin Runoff Results

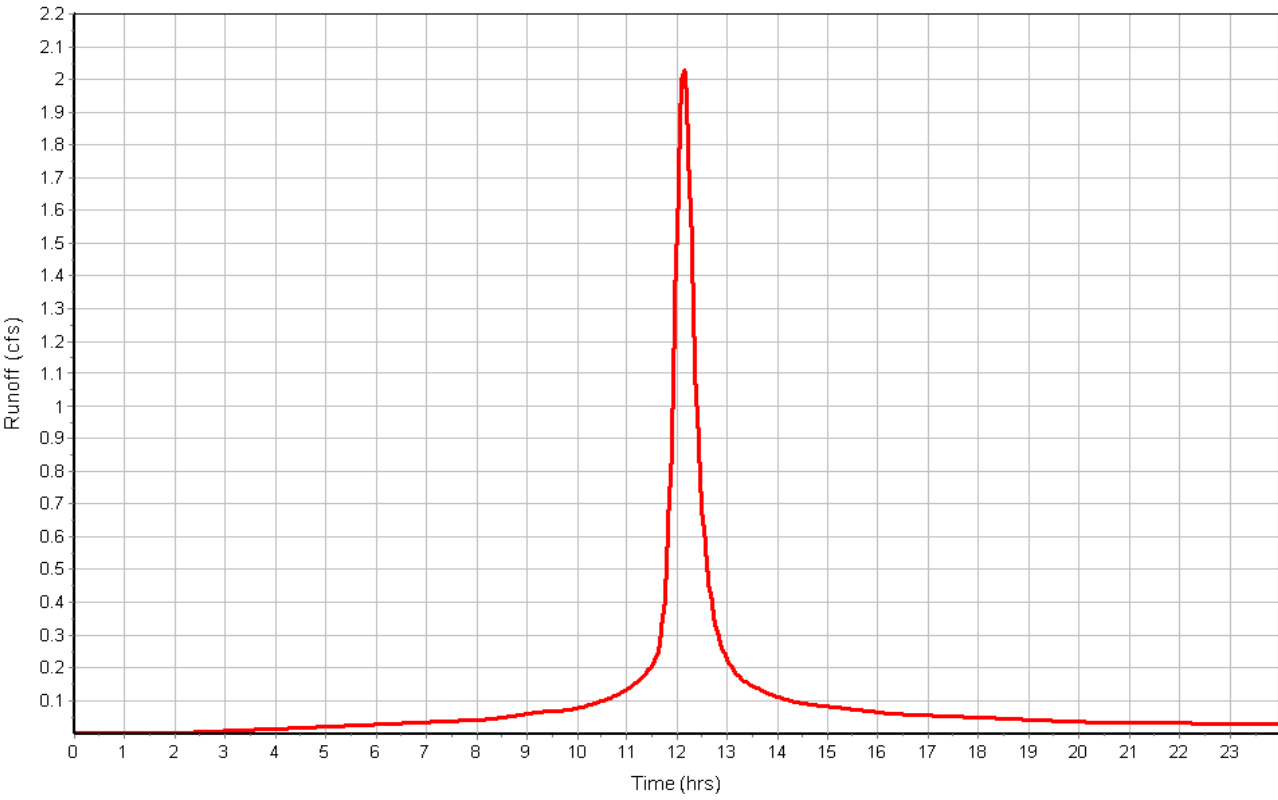
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 2.03  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:25:35

Subbasin : B3d

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3e

Input Data

Area (ac) ..... 1.33  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

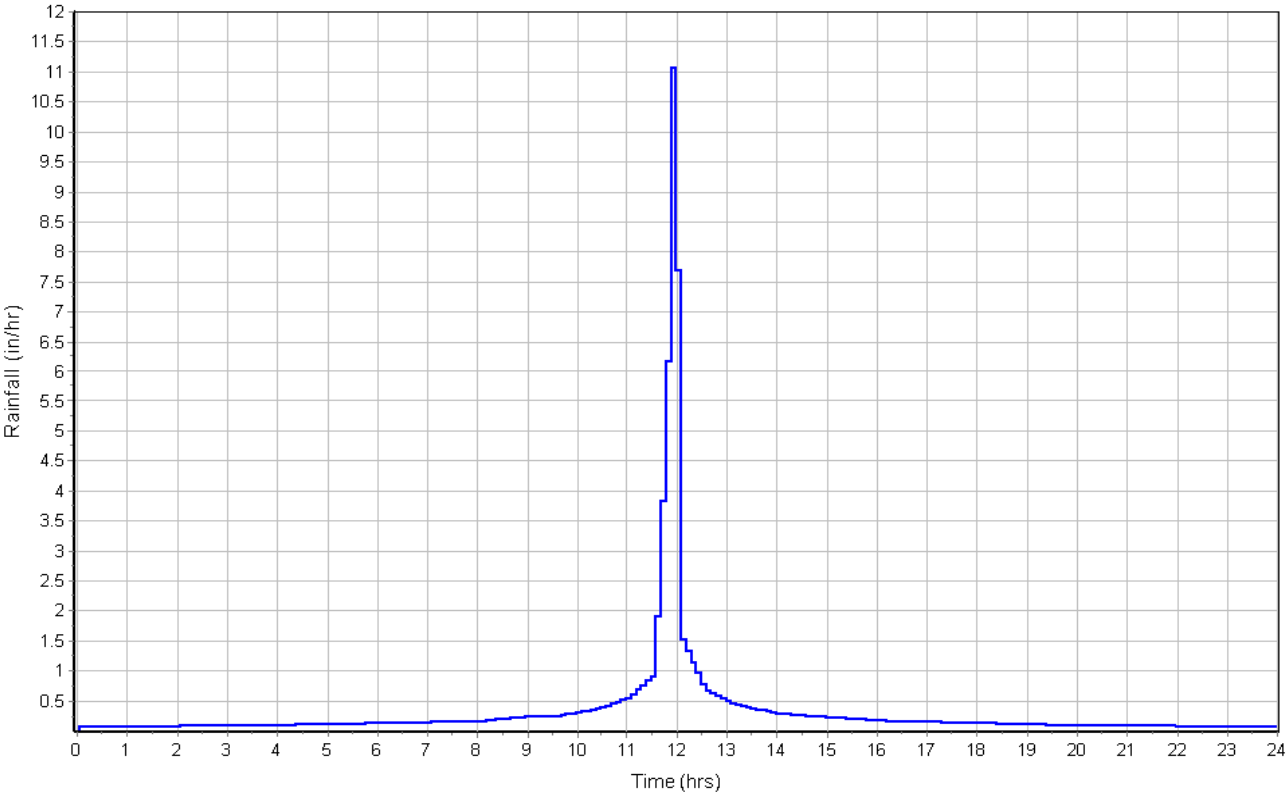
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	1.33	-	93.00
Composite Area & Weighted CN	1.33		93.00

Subbasin Runoff Results

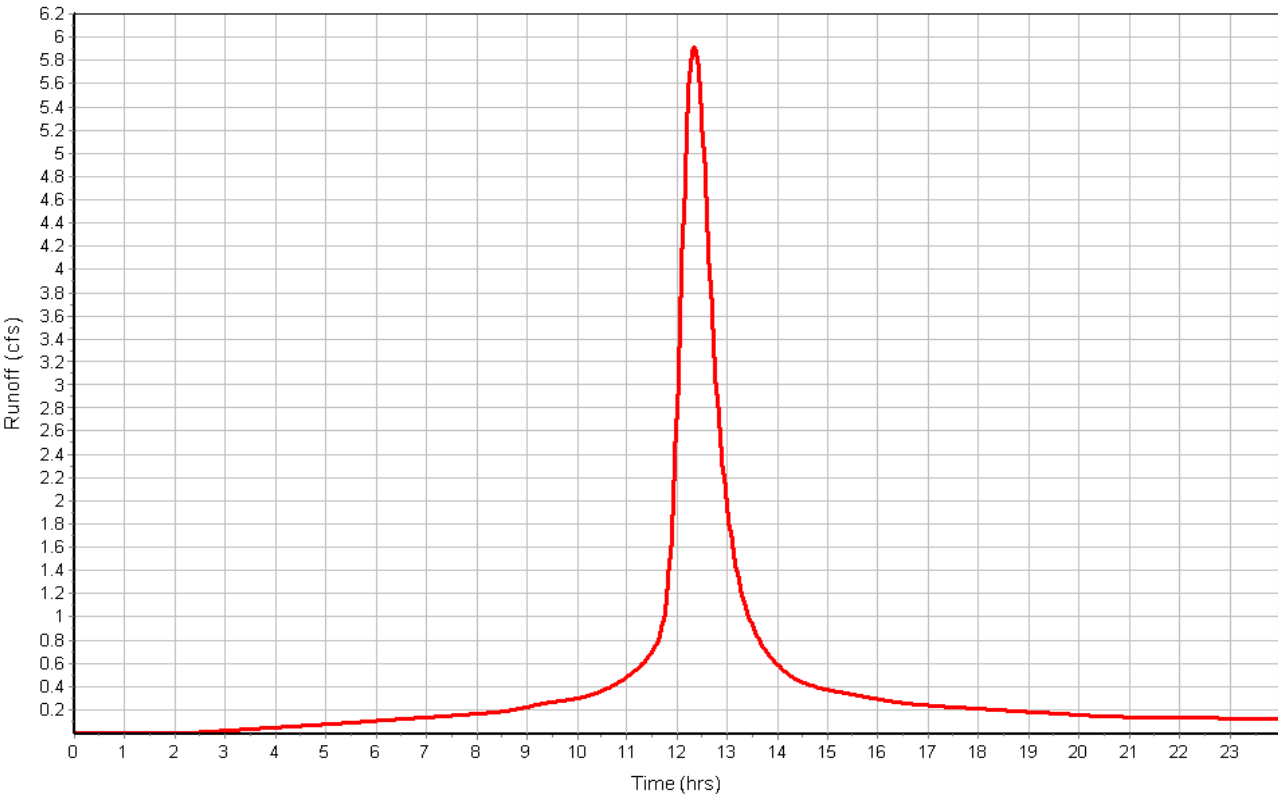
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 5.93  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:47:02

Subbasin : B3e

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3f

Input Data

Area (ac) ..... 0.44  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

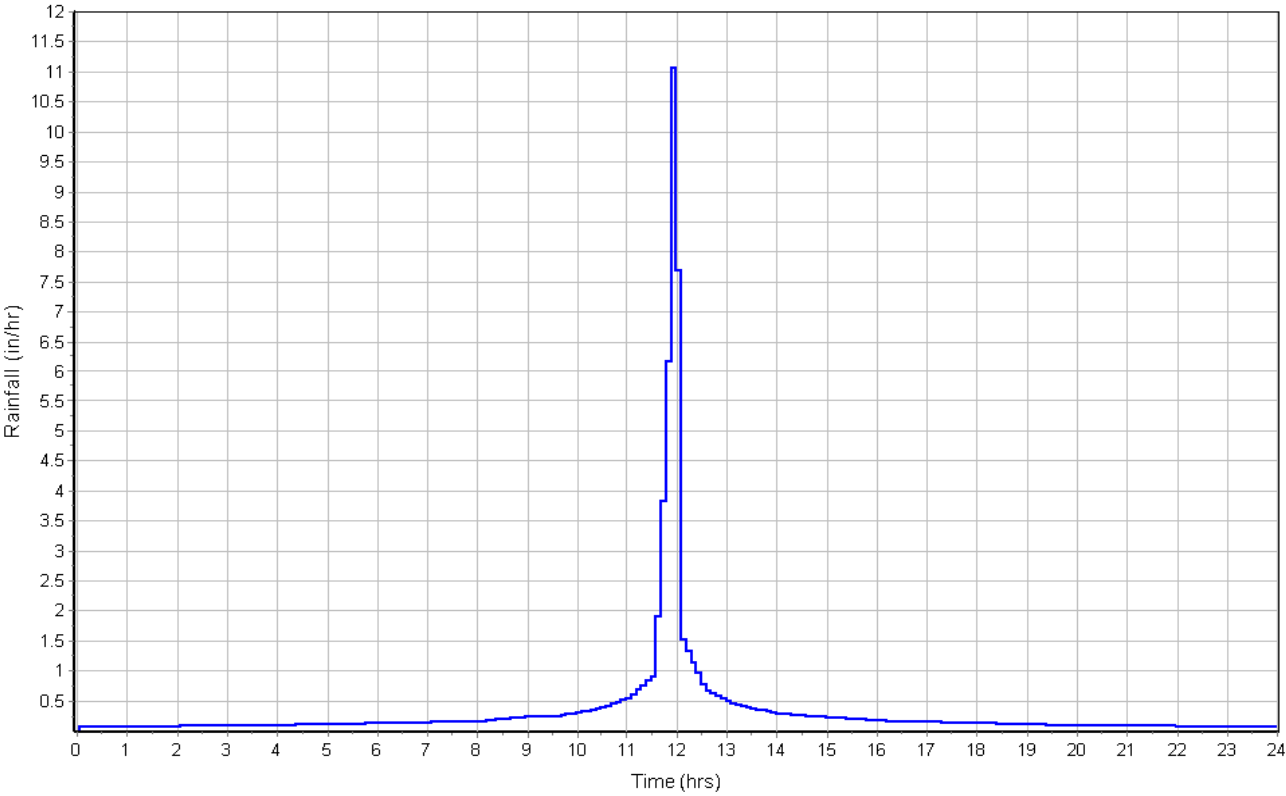
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.44	-	93.00
Composite Area & Weighted CN	0.44		93.00

Subbasin Runoff Results

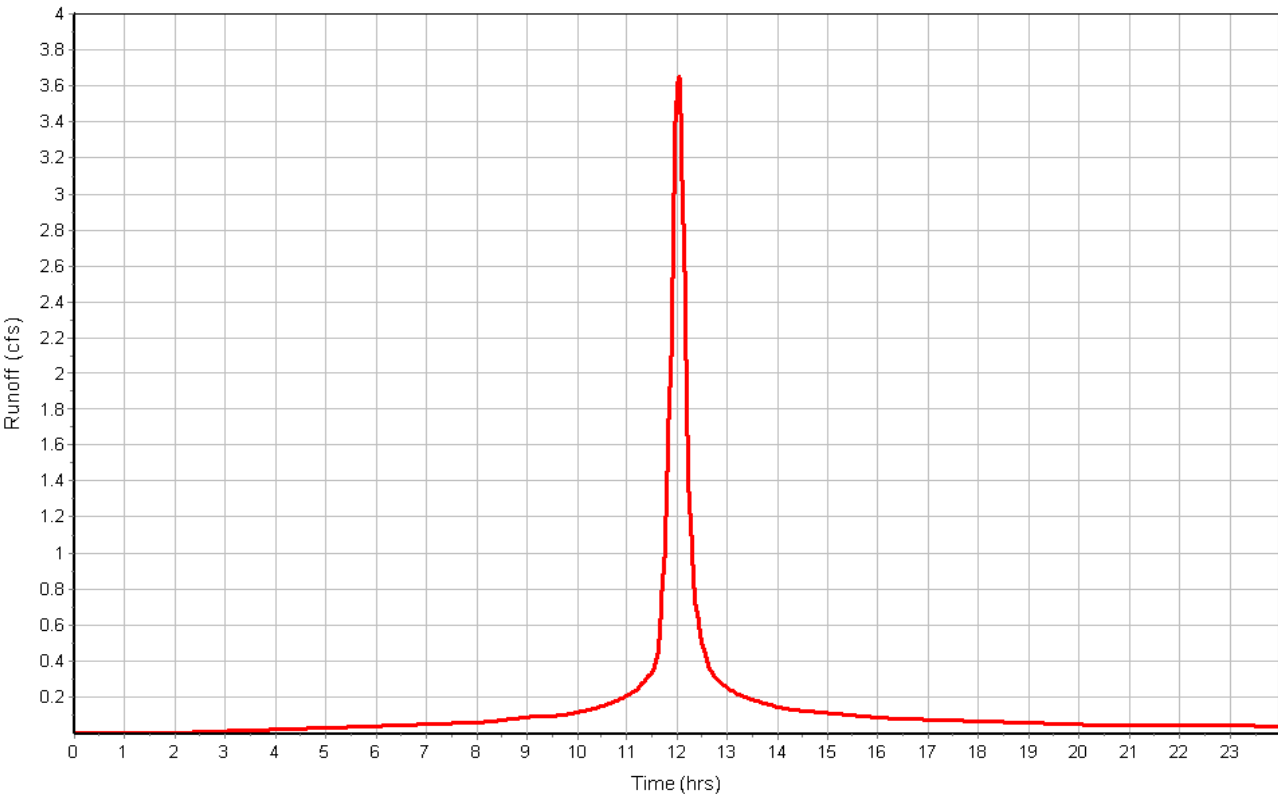
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 3.67  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:14:06

Subbasin : B3f

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3g

Input Data

Area (ac) ..... 1.55  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	1.55	-	93.00
Composite Area & Weighted CN	1.55		93.00

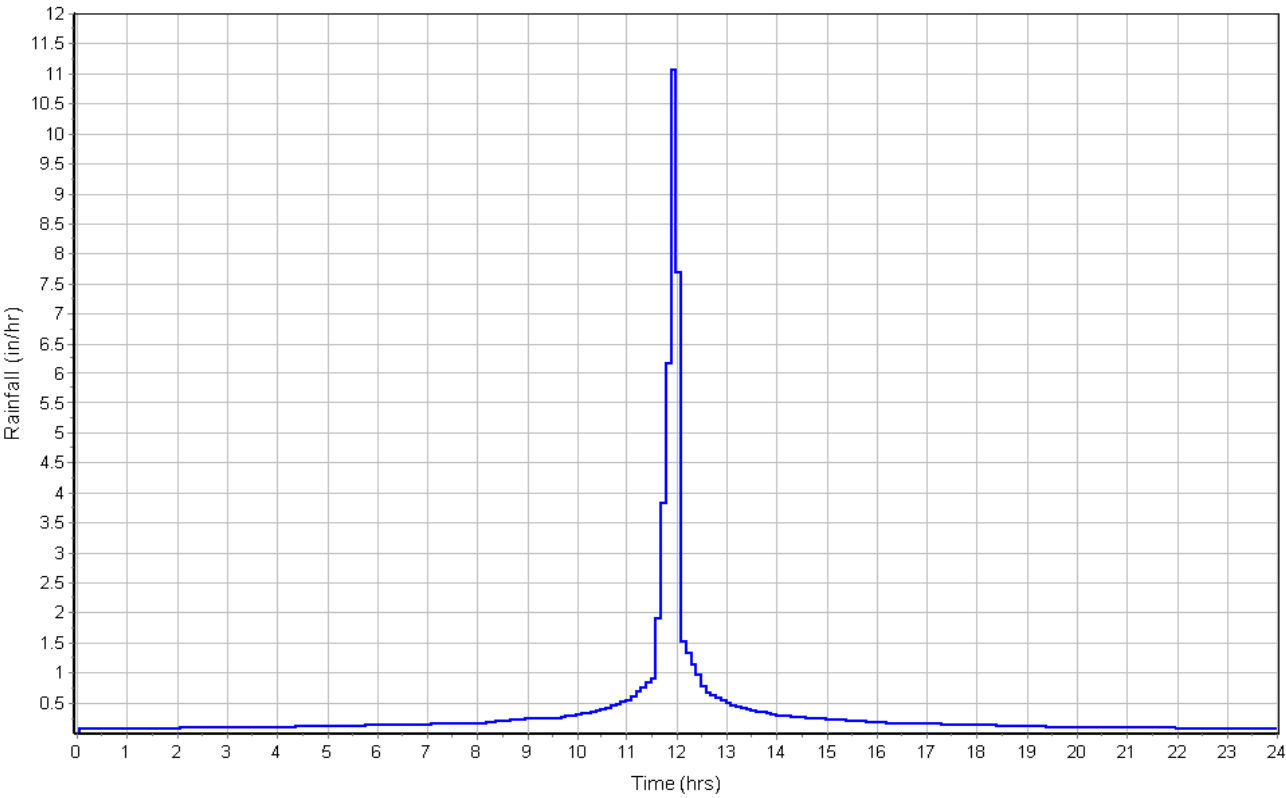
Subbasin Runoff Results

Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 13.45  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:12:01

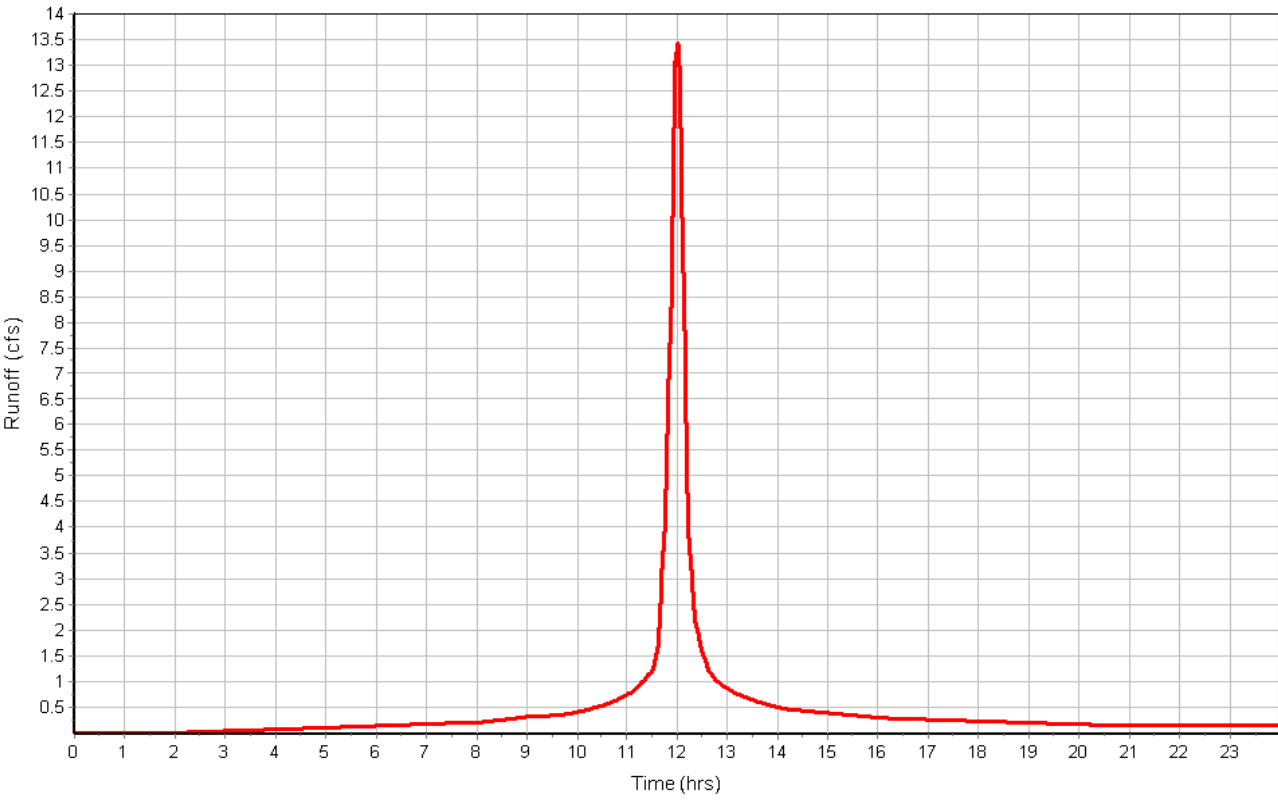


Subbasin : B3g

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3h

Input Data

Area (ac) ..... 0.38  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

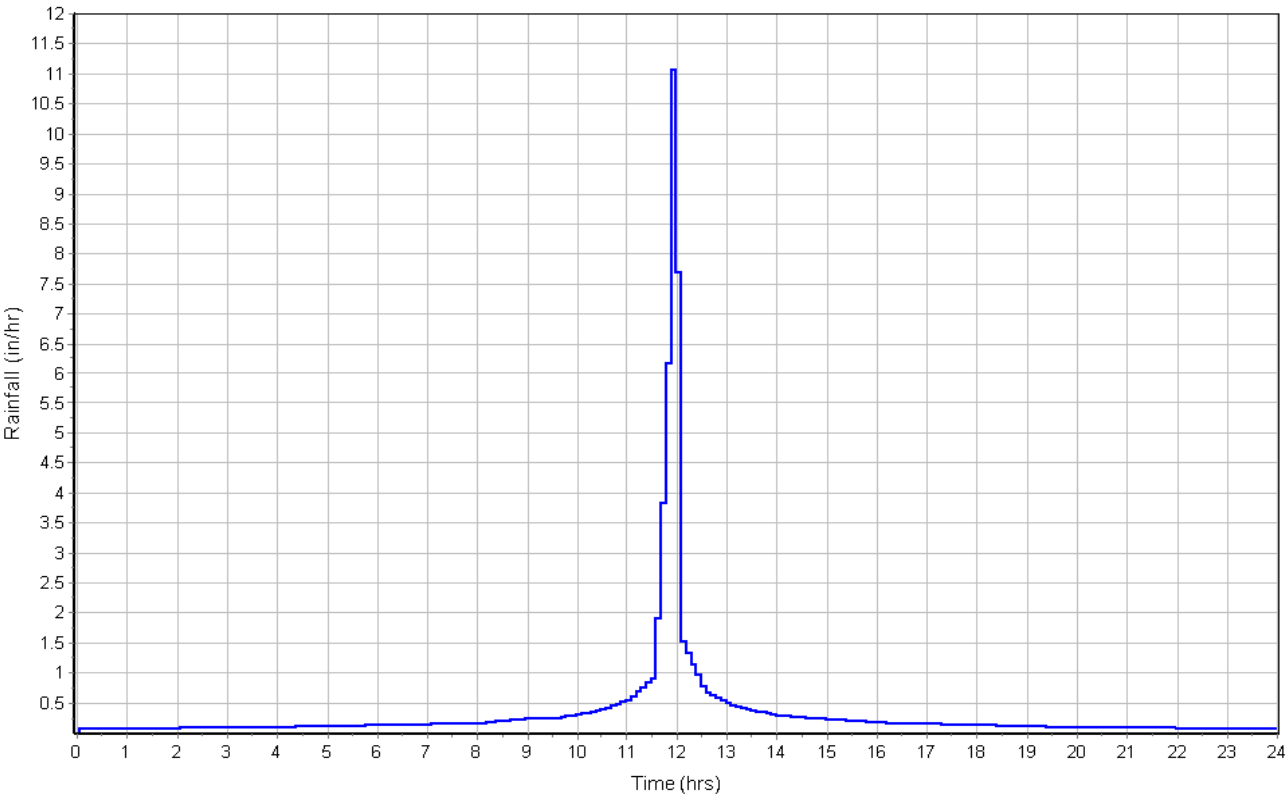
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.38	-	93.00
Composite Area & Weighted CN	0.38		93.00

Subbasin Runoff Results

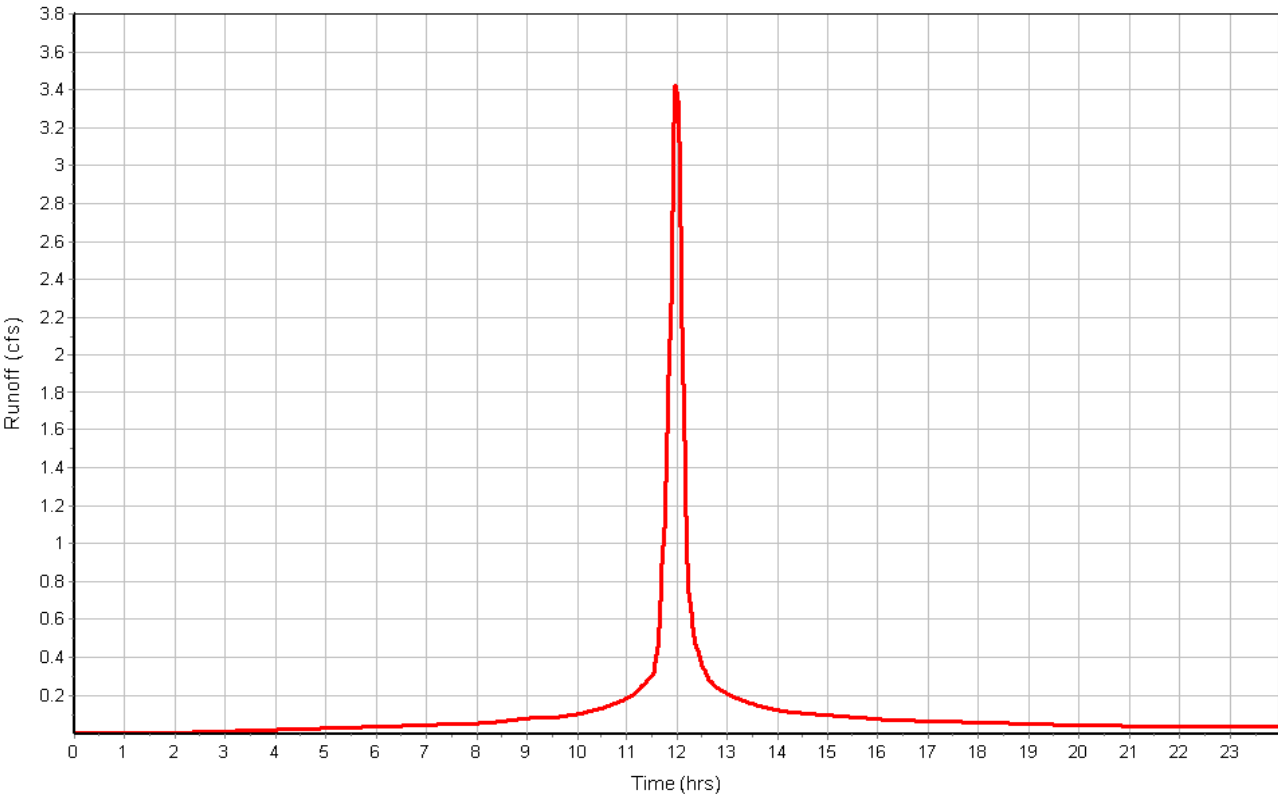
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 3.43  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B3h

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B4a

Input Data

Area (ac) ..... 1.72  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

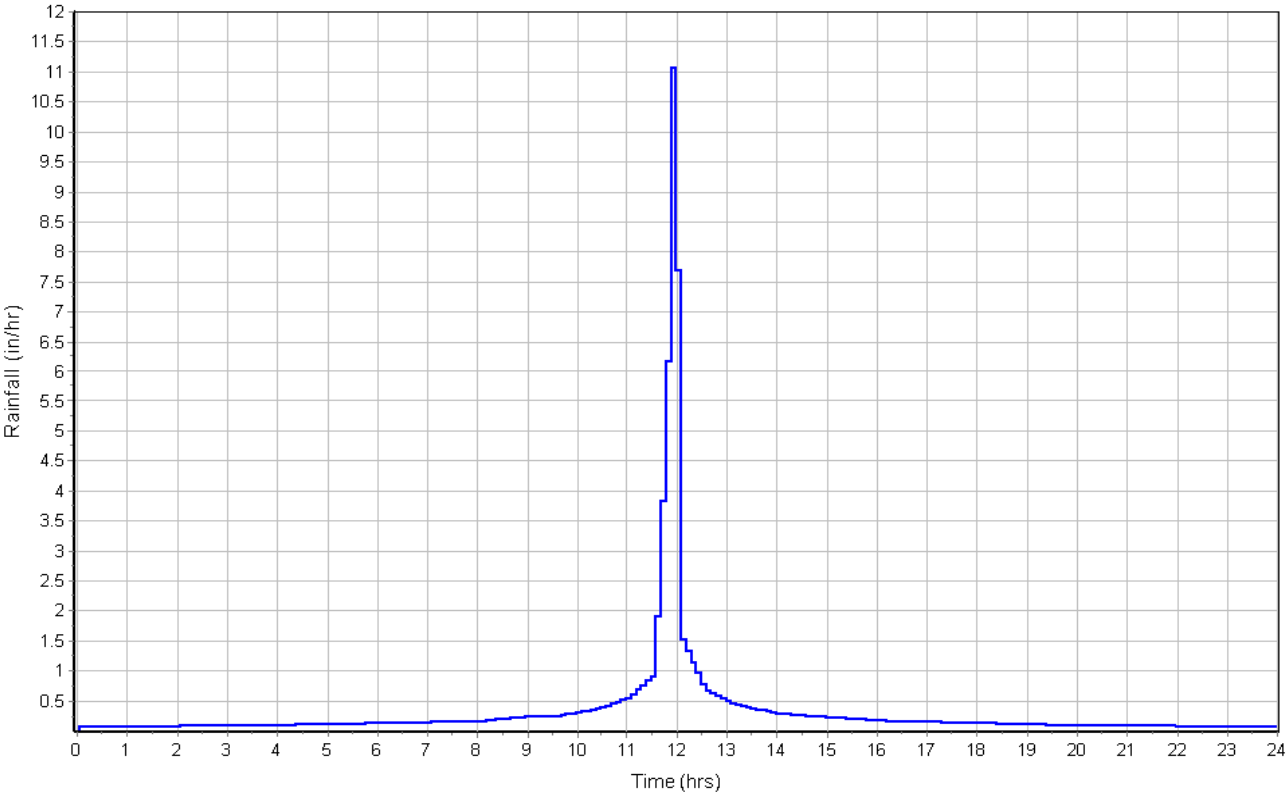
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	1.72	-	93.00
Composite Area & Weighted CN	1.72		93.00

Subbasin Runoff Results

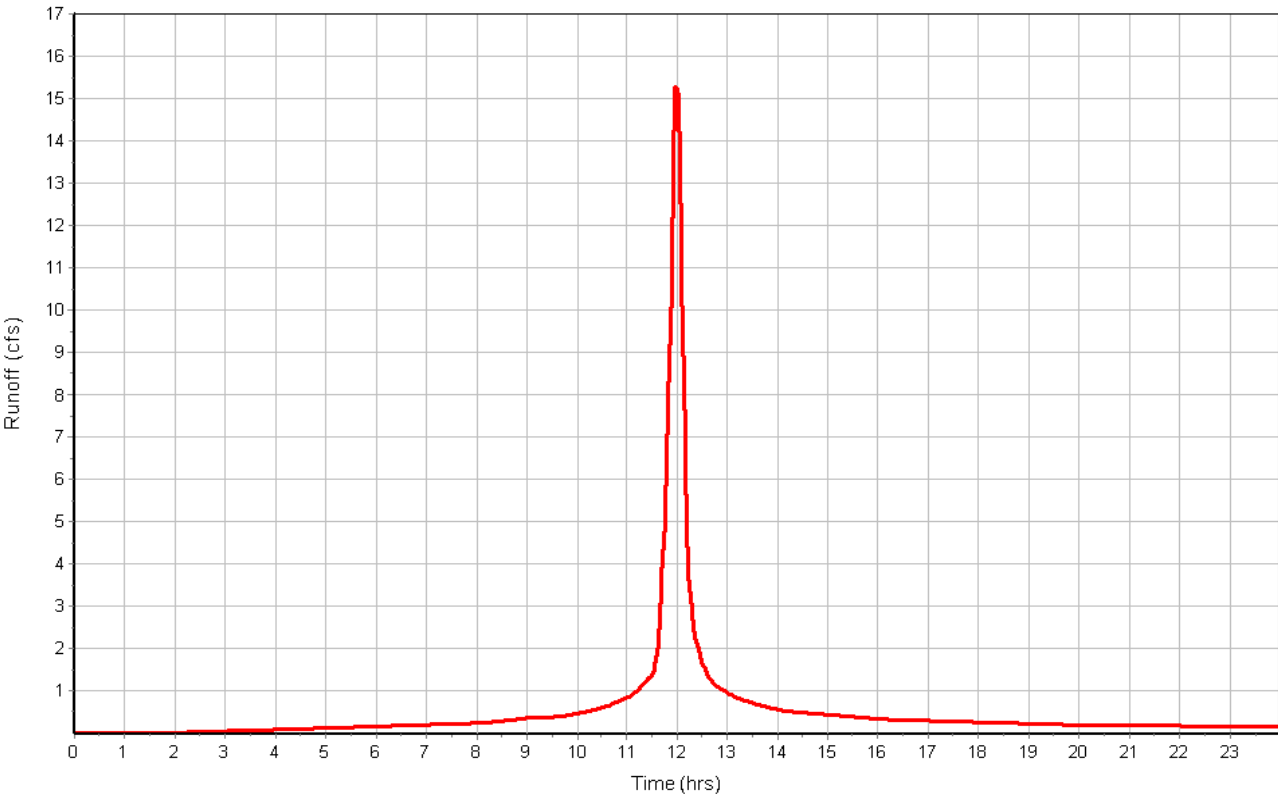
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 15.37  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:44

Subbasin : B4a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B4b

Input Data

Area (ac) ..... 0.28  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

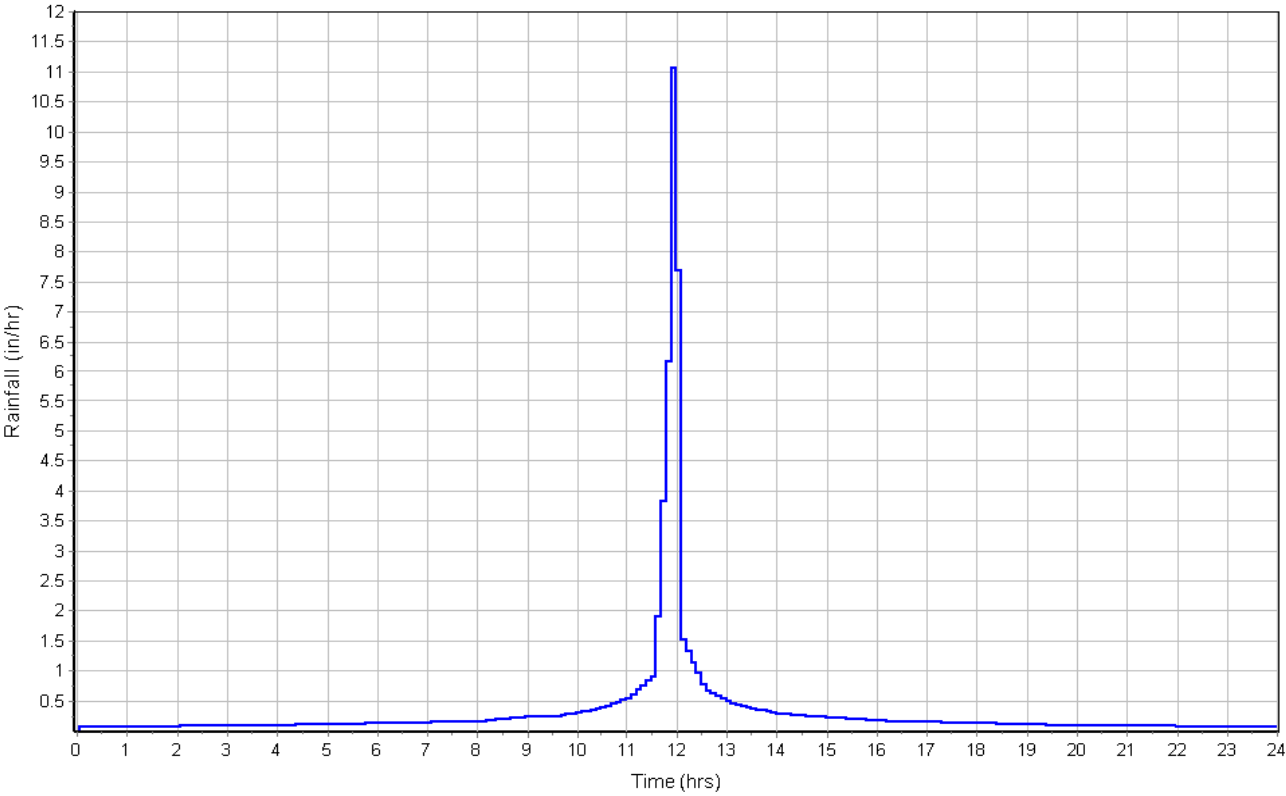
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.28	-	93.00
Composite Area & Weighted CN	0.28		93.00

Subbasin Runoff Results

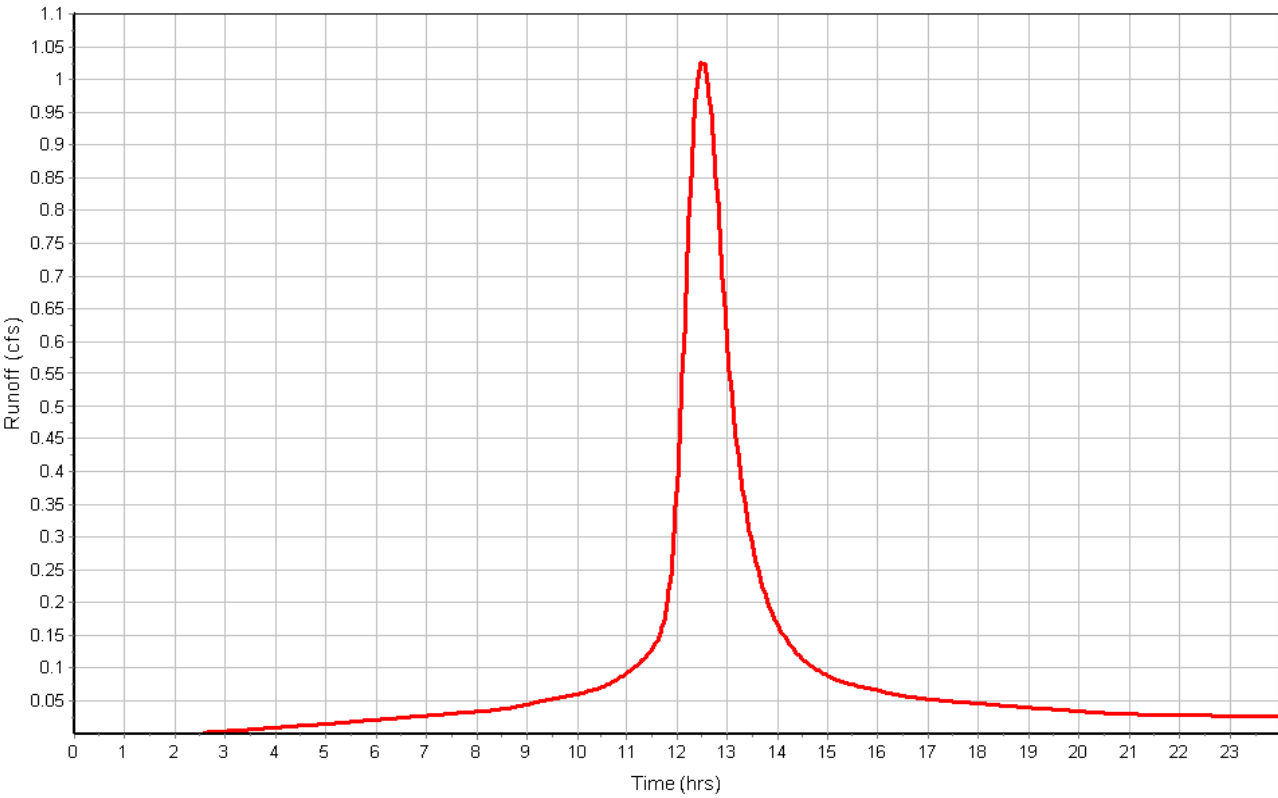
Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 1.03  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 01:03:25

Subbasin : B4b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B4c

Input Data

Area (ac) ..... 0.23  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.23	-	93.00
Composite Area & Weighted CN	0.23		93.00

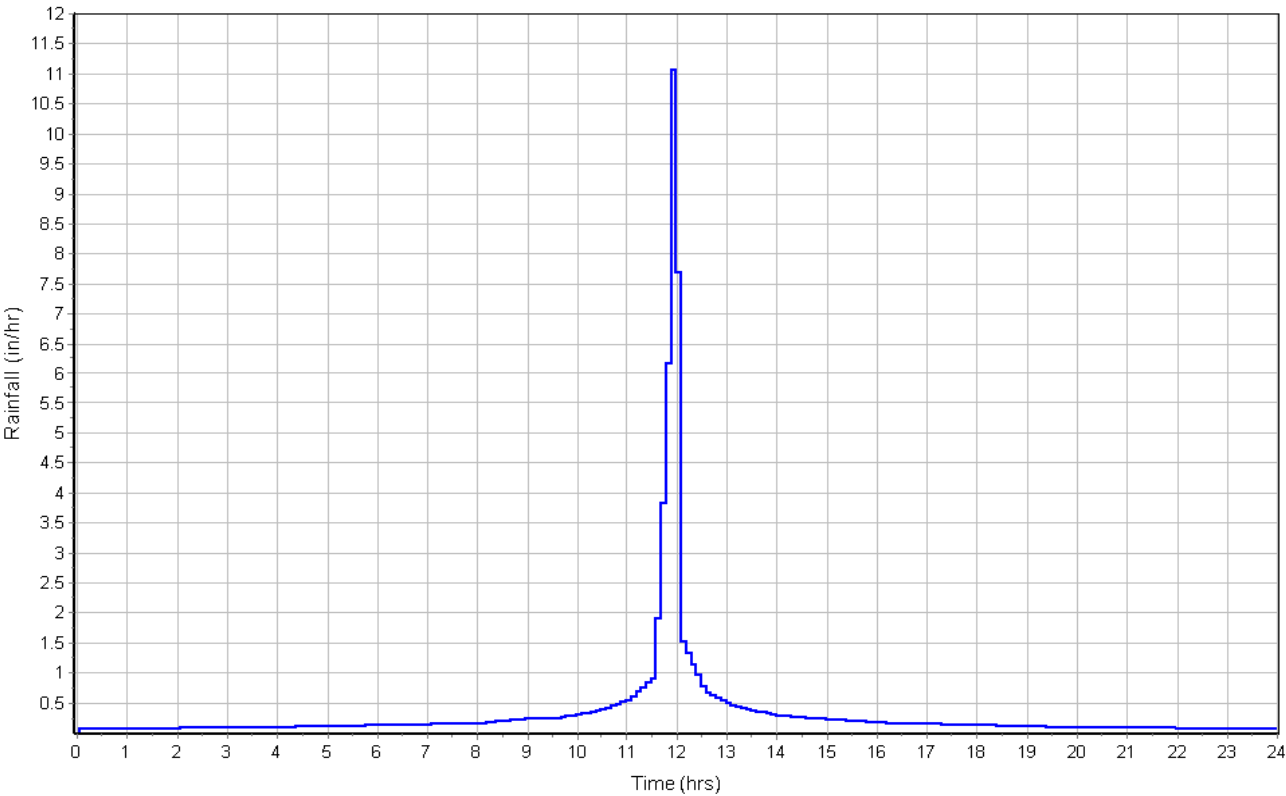
Subbasin Runoff Results

Total Rainfall (in) ..... 8.07  
Total Runoff (in) ..... 7.23  
Peak Runoff (cfs) ..... 0.96  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:52:31

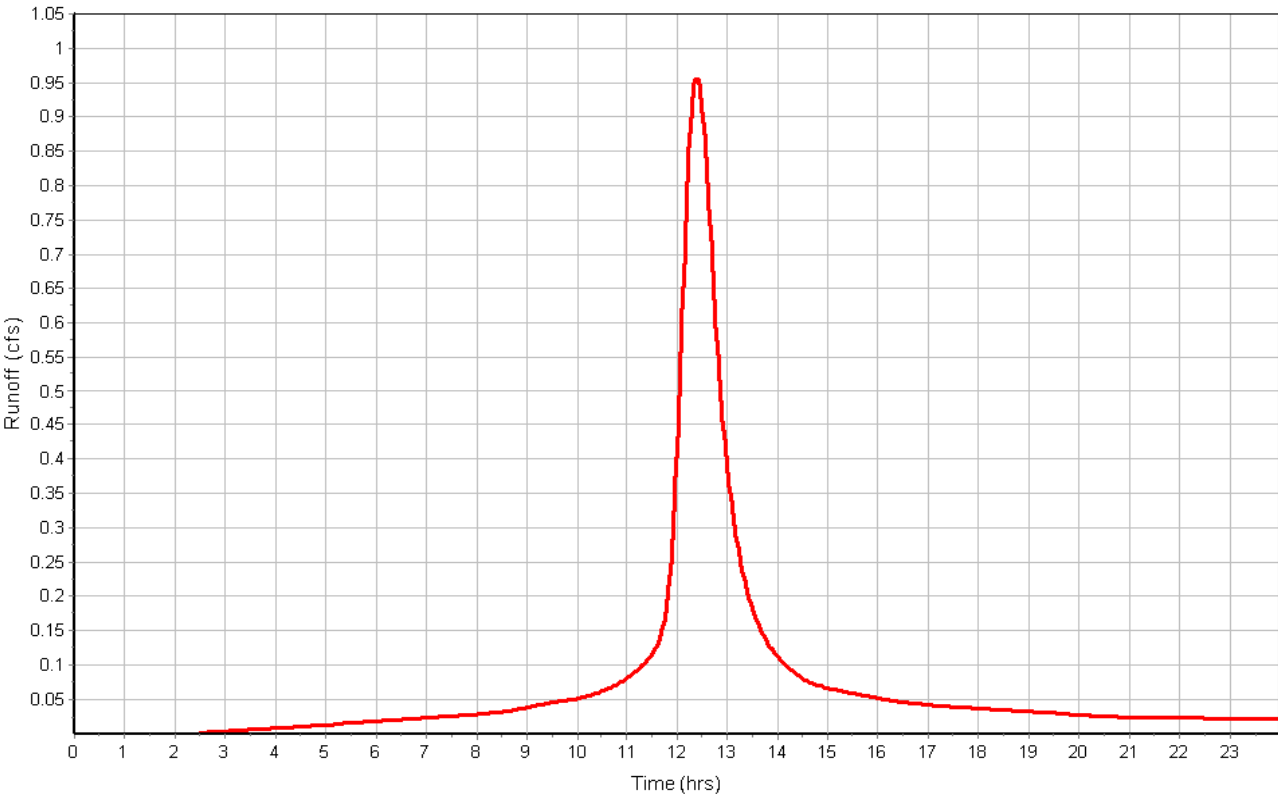


Subbasin : B4c

Rainfall Intensity Graph



Runoff Hydrograph



## Vanguard Farms Apartments

SN Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1 B1-4	672.61	675.45	2.83	672.61	0.00	675.45	0.00	0.00	0.00
2 B2-2	673.36	677.74	4.38	673.36	0.00	677.74	0.00	0.00	0.00
3 B2-5	674.47	677.61	3.14	674.47	0.00	677.61	0.00	0.00	0.00
4 B3-3	671.02	674.58	3.56	671.02	0.00	674.58	0.00	0.00	0.00
5 B3-7	673.67	679.16	5.50	673.67	0.00	679.16	0.00	0.00	0.00
6 B3-8	674.52	679.79	5.27	674.52	0.00	679.79	0.00	0.00	0.00
7 B3-9	674.89	679.79	4.90	674.89	0.00	679.79	0.00	0.00	0.00
8 DRIVE B1a	678.19	6.00	-672.19	0.00	-678.19	0.00	-6.00	0.00	0.00
9 DRIVE B1b	679.17	6.00	-673.17	0.00	-679.17	0.00	-6.00	0.00	0.00
10 DRIVE B2a	679.85	6.00	-673.85	0.00	-679.85	0.00	-6.00	0.00	0.00
11 DRIVE B2b	675.31	6.00	-669.31	0.00	-675.31	0.00	-6.00	0.00	0.00
12 DRIVE B2c	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
13 DRIVE B2d	678.76	6.00	-672.76	0.00	-678.76	0.00	-6.00	0.00	0.00
14 DRIVE B3f	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
15 DRIVE B3g-1	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
16 DRIVE B3h	674.83	6.00	-668.83	0.00	-674.83	0.00	-6.00	0.00	0.00
17 OUTFALL B2	673.11	679.16	6.05	673.11	0.00	679.16	0.00	0.00	0.00
18 SDWK BOX B DUMMY	675.58	677.34	1.76	0.00	-675.58	0.00	-677.34	0.00	0.00

## Vanguard Farms Apartments

SN Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1 B1-4	39.36	0.00	674.13	1.52	0.00	1.32	672.75	0.14	0 12:05	0 00:00	0.00	0.00
2 B2-2	20.80	0.00	674.96	1.60	0.00	2.78	673.59	0.23	0 12:04	0 00:00	0.00	0.00
3 B2-5	11.32	0.00	676.11	1.64	0.00	1.50	674.69	0.22	0 12:02	0 00:00	0.00	0.00
4 B3-3	22.58	0.00	672.44	1.42	0.00	2.14	671.28	0.26	0 12:11	0 00:00	0.00	0.00
5 B3-7	7.83	0.00	674.60	0.93	0.00	4.57	673.91	0.24	0 12:10	0 00:00	0.00	0.00
6 B3-8	7.83	0.00	675.35	0.83	0.00	4.44	674.73	0.21	0 12:10	0 00:00	0.00	0.00
7 B3-9	3.94	0.00	675.55	0.66	0.00	4.24	675.08	0.19	0 12:10	0 00:00	0.00	0.00
8 DRIVE B1a	2.21	2.05	678.36	0.17	0.00	0.07	678.23	0.04	0 12:04	0 00:00	0.00	0.00
9 DRIVE B1b	1.91	1.91	679.31	0.14	0.00	0.10	679.20	0.03	0 12:00	0 00:00	0.00	0.00
10 DRIVE B2a	3.02	3.02	680.04	0.19	0.00	0.05	679.89	0.04	0 12:00	0 00:00	0.00	0.00
11 DRIVE B2b	3.39	3.25	679.24	3.93	0.00	0.04	679.08	3.77	0 12:00	0 00:00	0.00	0.00
12 DRIVE B2c	2.42	2.42	680.02	680.02	0.00	0.07	679.89	679.89	0 12:02	0 00:00	0.00	0.00
13 DRIVE B2d	3.26	3.19	678.95	0.19	0.00	0.04	678.80	0.04	0 12:00	0 00:00	0.00	0.00
14 DRIVE B3f	3.65	3.65	676.39	676.39	0.00	0.04	676.24	676.24	0 12:04	0 00:00	0.00	0.00
15 DRIVE B3g-1	13.44	13.44	678.82	678.82	0.00	0.00	678.64	678.64	0 11:53	0 12:02	0.98	17.00
16 DRIVE B3h	3.76	3.42	675.04	0.21	0.00	0.03	674.87	0.04	0 12:00	0 00:00	0.00	0.00
17 OUTFALL B2	39.38	0.00	674.66	1.55	0.00	4.50	673.29	0.18	0 12:05	0 00:00	0.00	0.00
18 SDWK BOX B DUMMY	19.05	15.28	676.64	1.06	0.00	0.70	675.70	0.12	0 12:02	0 00:00	0.00	0.00

## Vanguard Farms Apartments

SN Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Shape Slope	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)	(ft)	(ft)					(cfs)	
1 CHANNEL B 1	621.36	675.58	0.00	673.11	0.00	2.47	0.4000 Trapezoidal	1.250	13.500	0.0400	0.0000	0.0000	0.0000	0.00	No
2 CHANNEL B 2	123.46	673.11	0.00	672.61	0.00	0.50	0.4000 User-Defined	1.310	13.500	0.0240	0.0000	0.0000	0.0000	0.00	No
3 CHANNEL B DUMMY	1.00	677.34	1.76	675.58	0.00	1.76	176.4000 Trapezoidal	1.250	13.500	0.0400	0.0000	0.0000	0.0000	0.00	No
4 DRIVE B1a	172.00	678.19	0.00	677.34	1.76	0.85	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
5 DRIVE B1a DUMMY	1.00	678.20	3.32	678.19	0.00	0.01	0.5000 Triangular	0.240	24.000	0.0320	0.0000	0.0000	0.0000	0.00	No
6 DRIVE B1b	165.84	679.17	0.00	677.34	1.76	1.83	1.1000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
7 DRIVE B2a	163.00	679.85	0.00	679.04	3.73	0.81	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
8 DRIVE B2b	169.00	679.04	3.74	678.20	3.32	0.84	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
9 DRIVE B2b DUMMY	1.00	679.04	3.73	675.31	0.00	3.74	373.5300 Triangular	0.240	24.000	0.0320	0.0000	0.0000	0.0000	0.00	No
10 DRIVE B2c	218.00	679.85	679.85	678.76	3.65	1.09	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
11 DRIVE B2d	182.72	678.76	0.00	677.85	3.20	0.90	0.4900 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
12 DRIVE B2d DUMMY	1.00	678.76	3.65	678.76	0.00	0.01	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
13 DRIVE B2e	125.00	677.85	3.20	677.22	3.02	0.63	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
14 DRIVE B3f	124.52	676.19	676.19	675.57	3.37	0.62	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
15 DRIVE B3g-1	400.00	678.58	678.58	674.84	3.31	3.74	0.9400 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
16 DRIVE B3g-2	145.00	675.57	3.37	674.84	3.31	0.73	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
17 DRIVE B3h	185.00	674.83	0.00	673.91	3.25	0.93	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
18 DRIVE B3h DUMMY	1.00	674.84	3.31	674.83	0.00	0.01	0.6000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No

## Vanguard Farms Apartments

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 CHANNEL B 1	18.62	0 12:05	26.12	0.71	2.11	4.91	1.04	0.83	0.00		
2 CHANNEL B 2	39.36	0 12:05	82.56	0.48	5.40	0.38	0.89	0.68	0.00		
3 CHANNEL B DUMMY	3.96	0 12:04	550.73	0.01	8.53	0.00	0.07	0.06	0.00		
4 DRIVE B1a	2.20	0 12:06	5.64	0.39	1.57	1.83	0.17	0.70	0.00		
5 DRIVE B1a DUMMY	0.20	0 12:01	2.30	0.09	0.43	0.04	0.10	0.40	0.00		
6 DRIVE B1b	1.90	0 12:01	8.41	0.23	2.03	1.36	0.14	0.57	0.00		
7 DRIVE B2a	2.99	0 12:01	5.64	0.53	1.69	1.61	0.19	0.79	0.00		
8 DRIVE B2b	3.36	0 12:01	5.66	0.59	1.74	1.62	0.20	0.82	0.00		
9 DRIVE B2b DUMMY	0.15	0 12:01	62.88	0.00	4.81	0.00	0.02	0.10	0.00		
10 DRIVE B2c	2.40	0 12:02	5.66	0.42	1.62	2.24	0.17	0.72	0.00		
11 DRIVE B2d	3.23	0 12:02	5.63	0.57	1.73	1.76	0.19	0.81	0.00		
12 DRIVE B2d DUMMY	0.09	0 12:03	5.68	0.02	0.69	0.02	0.05	0.21	0.00		
13 DRIVE B2e	0.18	0 12:03	5.68	0.03	0.90	2.31	0.06	0.27	0.00		
14 DRIVE B3f	3.65	0 12:04	5.66	0.64	1.77	1.17	0.20	0.85	0.00		
15 DRIVE B3g-1	7.75	0 11:54	7.75	1.00	2.86	2.33	0.24	1.00	15.00		
16 DRIVE B3g-2	0.10	0 12:06	5.68	0.02	0.82	2.95	0.05	0.22	0.00		
17 DRIVE B3h	3.73	0 12:02	5.66	0.66	1.79	1.72	0.20	0.85	0.00		
18 DRIVE B3h DUMMY	0.34	0 12:06	6.18	0.06	1.04	0.02	0.08	0.34	0.00		

## Vanguard Farms Apartments

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	B1-1	27.44	670.68	0.00	670.57	0.00	0.11	0.4000	Rectangular	24.000	60.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
2	B1-2	325.38	671.98	0.00	670.78	0.10	1.20	0.3700	Rectangular	24.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
3	B1-3	135.92	672.61	0.00	672.08	0.10	0.54	0.4000	Rectangular	24.000	48.000	0.0130	0.2000	0.5000	0.0000	0.00	No	1
4	B2-1	81.97	673.36	0.00	673.16	0.05	0.20	0.2400	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
5	B2-2	126.09	673.76	0.00	673.46	0.10	0.30	0.2400	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
6	B2-3	171.36	674.20	0.00	673.86	0.10	0.34	0.2000	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
7	B2-4	86.66	674.47	0.00	674.30	0.10	0.17	0.2000	Rectangular	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
8	B2-5	41.89	674.65	0.00	674.57	0.10	0.08	0.2000	Rectangular	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
9	B2-6	61.04	674.87	0.00	674.75	0.10	0.12	0.2000	CIRCULAR	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
10	B2-7	170.14	675.31	0.00	674.97	0.10	0.34	0.2000	Rectangular	24.000	24.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
11	B2c-1	182.72	675.12	0.00	674.75	0.10	0.37	0.2000	Rectangular	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
12	B3-1	33.76	670.66	0.00	670.57	0.00	0.09	0.2700	Rectangular	24.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
13	B3-2	96.98	671.02	0.00	670.76	0.10	0.26	0.2700	Rectangular	24.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
14	B3-3	101.12	671.52	0.00	671.12	0.10	0.40	0.4000	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
15	B3-4	143.96	672.20	0.00	671.62	0.10	0.58	0.4000	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
16	B3-5	87.13	672.88	0.00	672.30	0.10	0.58	0.6700	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
17	B3-6	116.41	673.67	0.00	672.88	0.00	0.78	0.6700	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
18	B3-7	112.25	674.52	0.00	673.77	0.10	0.75	0.6700	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
19	B3-8	40.25	674.89	0.00	674.62	0.10	0.27	0.6700	CIRCULAR	24.000	24.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
20	B3-9	87.75	675.58	0.00	674.99	0.10	0.59	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
21	B3b-1	68.38	675.45	0.00	674.99	0.10	0.46	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
22	B3c-1	75.08	675.12	0.00	674.62	0.10	0.50	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
23	B3d-1	51.50	674.97	0.00	674.62	0.10	0.35	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1

## Vanguard Farms Apartments

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 B1-1	40.34	0 12:06	57.77	0.70	6.42	0.07	1.26	0.63	0.00		Calculated
2 B1-2	39.79	0 12:06	42.38	0.94	6.38	0.85	1.56	0.78	0.00		Calculated
3 B1-3	39.34	0 12:05	43.95	0.90	6.52	0.35	1.51	0.75	0.00		Calculated
4 B2-1	20.76	0 12:05	23.90	0.87	4.63	0.30	1.49	0.75	0.00		Calculated
5 B2-2	20.80	0 12:04	23.90	0.87	4.64	0.45	1.49	0.75	0.00		Calculated
6 B2-3	16.42	0 12:04	21.82	0.75	4.09	0.70	1.34	0.67	0.00		Calculated
7 B2-4	11.32	0 12:03	12.88	0.88	3.67	0.39	1.54	0.77	0.00		Calculated
8 B2-5	11.32	0 12:02	12.88	0.88	3.67	0.19	1.54	0.77	0.00		Calculated
9 B2-6	6.00	0 12:02	10.12	0.59	3.36	0.30	1.11	0.55	0.00		Calculated
10 B2-7	2.84	0 12:02	11.16	0.25	2.33	1.22	0.61	0.31	0.00		Calculated
11 B2c-1	2.31	0 12:03	12.88	0.18	2.42	1.26	0.48	0.24	0.00		Calculated
12 B3-1	24.91	0 12:09	36.26	0.69	4.99	0.11	1.25	0.62	0.00		Calculated
13 B3-2	22.58	0 12:11	36.26	0.62	4.85	0.33	1.16	0.58	0.00		Calculated
14 B3-3	22.58	0 12:11	30.86	0.73	5.71	0.30	1.32	0.66	0.00		Calculated
15 B3-4	15.11	0 12:11	30.86	0.49	5.11	0.47	0.98	0.49	0.00		Calculated
16 B3-5	12.95	0 12:14	21.90	0.59	7.26	0.20	1.11	0.55	0.00		Calculated
17 B3-6	7.82	0 12:10	21.90	0.36	6.39	0.30	0.82	0.41	0.00		Calculated
18 B3-7	7.83	0 12:10	21.88	0.36	6.39	0.29	0.82	0.41	0.00		Calculated
19 B3-8	3.93	0 12:10	20.06	0.20	4.96	0.14	0.60	0.30	0.00		Calculated
20 B3-9	1.89	0 12:12	3.45	0.55	4.49	0.33	0.53	0.53	0.00		Calculated
21 B3b-1	2.07	0 12:10	3.45	0.60	4.60	0.25	0.56	0.56	0.00		Calculated
22 B3c-1	1.89	0 12:12	3.45	0.55	4.49	0.28	0.53	0.53	0.00		Calculated
23 B3d-1	2.03	0 12:10	3.45	0.59	4.57	0.19	0.55	0.55	0.00		Calculated

## Vanguard Farms Apartments

SN Element ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Max (Rim) Elevation (ft)	Inlet Depth (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Ponded Area (ft²)	Grate Clogging Factor (%)
1 B1-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.68	674.37	3.69	670.68	0.00	0.00	0.00
2 B1-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	671.98	675.90	3.92	671.98	0.00	0.00	0.00
3 B2-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	673.76	677.31	3.55	673.76	0.00	0.00	0.00
4 B2-4	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.20	677.22	3.02	674.20	0.00	0.00	0.00
5 B2-6	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.65	677.85	3.20	674.65	0.00	N/A	0.00
6 B2-7	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.87	678.20	3.32	674.87	0.00	N/A	0.00
7 B2-8	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.31	679.04	3.73	675.31	0.00	N/A	0.00
8 B2c-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.12	678.76	3.65	675.12	0.00	N/A	0.00
9 B3-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.66	673.91	3.25	670.66	0.00	0.00	0.00
10 B3-4	FHWA HEC-22 GENERIC	N/A	On Grade	1	671.52	674.84	3.31	671.52	0.00	N/A	0.00
11 B3-5	FHWA HEC-22 GENERIC	N/A	On Grade	1	672.20	675.57	3.37	672.20	0.00	N/A	0.00
12 B3-6	FHWA HEC-22 GENERIC	N/A	On Sag	1	672.88	676.10	3.22	672.88	0.00	0.00	0.00
13 INLET B3a	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	679.17	3.59	675.58	0.00	0.00	0.00
14 INLET B3b	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.45	678.68	3.23	675.45	0.00	0.00	0.00
15 INLET B3c	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.12	679.17	4.05	675.12	0.00	0.00	0.00
16 INLET B3d	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.97	678.67	3.71	674.97	0.00	0.00	0.00
17 SDWK BOX B	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	677.34	1.76	0.00	0.00	0.00	0.00



## Vanguard Farms Apartments

SN Element ID	Roadway Longitudinal Slope (ft/ft)	Roadway Cross Slope (ft/ft)	Roadway Manning's Roughness	Gutter Cross Slope (ft/ft)	Gutter Width (ft)	Gutter Depression (in)	Allowable Spread (ft)
1 B1-2	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
2 B1-3	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
3 B2-3	N/A	0.0200	0.0160	0.0620	1.50	0.1640	7.00
4 B2-4	N/A	0.0200	0.0160	0.0620	1.50	0.1640	7.00
5 B2-6	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
6 B2-7	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
7 B2-8	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
8 B2c-1	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
9 B3-2	N/A	0.0200	0.0160	0.0620	1.50	0.1640	7.00
10 B3-4	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
11 B3-5	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
12 B3-6	N/A	0.0200	0.0160	0.0620	2.00	0.1640	7.00
13 INLET B3a	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
14 INLET B3b	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
15 INLET B3c	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
16 INLET B3d	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
17 SDWK BOX B	N/A	0.0200	0.0130	0.0620	1.50	0.1640	7.00

**Vanguard Farms Apartments**

SN Element ID	Peak Flow	Peak Lateral Inflow	Peak Flow Intercepted	Peak Flow Bypassing Inlet	Inlet Efficiency during Peak	Max Gutter Spread during Peak	Max Gutter Water Elev. during Peak	Max Gutter Water Depth during Peak	Time of Max Depth Occurrence	Total Flooded Volume	Total Time Flooded
	(cfs)	(cfs)	(cfs)	(cfs)	Flow (%)	Flow (ft)	Flow (ft)	Flow (ft)	(days hh:mm)	(ac-in)	(min)
1 B1-2	0.96	0.96	N/A	N/A	N/A	5.90	674.72	0.36	0 12:06	0.00	0.00
2 B1-3	1.02	1.02	N/A	N/A	N/A	6.28	676.28	0.38	0 12:05	0.00	0.00
3 B2-3	4.51	4.51	N/A	N/A	N/A	15.69	678.11	0.80	0 12:04	0.00	0.00
4 B2-4	5.14	4.97	N/A	N/A	N/A	16.56	678.03	0.81	0 12:03	0.00	0.00
5 B2-6	3.23	0.00	3.05	0.18	94.43	12.44	678.17	0.31	0 12:02	0.00	0.00
6 B2-7	3.36	0.00	3.16	0.20	94.15	12.63	678.51	0.32	0 12:02	0.00	0.00
7 B2-8	2.99	0.00	2.84	0.15	95.03	12.07	679.34	0.30	0 12:01	0.00	0.00
8 B2c-1	2.40	0.00	2.31	0.09	96.36	11.05	679.05	0.28	0 12:02	0.00	0.00
9 B3-2	3.73	0.00	N/A	N/A	N/A	14.07	674.67	0.76	0 12:11	0.00	0.00
10 B3-4	7.85	0.00	7.50	0.34	95.61	17.57	675.25	0.41	0 12:11	0.00	0.00
11 B3-5	3.65	0.00	3.55	0.11	97.08	13.05	675.89	0.32	0 12:14	0.00	0.00
12 B3-6	5.92	5.92	N/A	N/A	N/A	14.99	676.90	0.80	0 12:13	0.00	0.00
13 INLET B3a	1.89	1.89	N/A	N/A	N/A	8.62	679.60	0.42	0 12:12	0.00	0.00
14 INLET B3b	2.07	2.07	N/A	N/A	N/A	9.45	679.12	0.44	0 12:09	0.00	0.00
15 INLET B3c	1.89	1.89	N/A	N/A	N/A	8.62	679.60	0.42	0 12:12	0.00	0.00
16 INLET B3d	2.03	2.03	N/A	N/A	N/A	9.34	679.11	0.44	0 12:09	0.00	0.00
17 SDWK BOX B	3.96	0.00	N/A	N/A	N/A	18.41	678.19	0.85	0 00:00	0.00	0.00

# Attachment L

Proposed Conditions

Hydrologic/Hydraulic Calculations –  
Drainage Area B (10 year)

## Vanguard Farms Apartments

File Name ..... 323.001\_STRM.SPF

### Project Options

Flow Units ..... CFS  
 Elevation Type ..... Elevation  
 Hydrology Method ..... SCS TR-20  
 Time of Concentration (TOC) Method ..... User-Defined  
 Link Routing Method ..... Kinematic Wave  
 Enable Overflow Ponding at Nodes ..... YES  
 Skip Steady State Analysis Time Periods ..... NO

### Analysis Options

Start Analysis On ..... Jul 15, 2020 00:00:00  
 End Analysis On ..... Jul 16, 2020 00:00:00  
 Start Reporting On ..... Jul 15, 2020 00:00:00  
 Antecedent Dry Days ..... 0 days  
 Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss  
 Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss  
 Reporting Time Step ..... 0 00:02:00 days hh:mm:ss  
 Routing Time Step ..... 5 seconds

### Number of Elements

	Qty
Rain Gages .....	0
Subbasins.....	19
Nodes.....	37
<i>Junctions</i> .....	18
<i>Outfalls</i> .....	2
<i>Flow Diversions</i> .....	0
<i>Inlets</i> .....	17
<i>Storage Nodes</i> .....	0
Links.....	41
<i>Channels</i> .....	18
<i>Pipes</i> .....	23
<i>Pumps</i> .....	0
<i>Orifices</i> .....	0
<i>Weirs</i> .....	0
<i>Outlets</i> .....	0
Pollutants .....	0
Land Uses .....	0

## Vanguard Farms Apartments

SN	Subbasin ID	Area	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	B1a	0.27	93.00	6.40	5.58	1.49	1.60	0 00:17:52
2	B1b	0.21	93.00	6.40	5.58	1.17	1.50	0 00:10:00
3	B2a	0.33	93.00	6.40	5.58	1.85	2.36	0 00:10:00
4	B2b	0.36	93.00	6.40	5.58	2.00	2.55	0 00:10:00
5	B2c	0.28	93.00	6.40	5.58	1.55	1.90	0 00:11:18
6	B2d	0.35	93.00	6.40	5.58	1.97	2.50	0 00:10:00
7	B2e	0.65	93.00	6.40	5.58	3.62	3.90	0 00:17:51
8	B2f	0.63	93.00	6.40	5.58	3.52	3.54	0 00:20:46
9	B3a	0.32	93.00	6.40	5.58	1.77	1.48	0 00:30:09
10	B3b	0.32	93.00	6.40	5.58	1.78	1.62	0 00:25:34
11	B3c	0.32	93.00	6.40	5.58	1.79	1.48	0 00:30:09
12	B3d	0.32	93.00	6.40	5.58	1.77	1.58	0 00:25:34
13	B3e	1.33	93.00	6.40	5.58	7.40	4.63	0 00:47:02
14	B3f	0.44	93.00	6.40	5.58	2.45	2.87	0 00:14:06
15	B3g	1.55	93.00	6.40	5.58	8.63	10.52	0 00:12:00
16	B3h	0.38	93.00	6.40	5.58	2.12	2.68	0 00:10:00
17	B4a	1.72	93.00	6.40	5.58	9.59	12.02	0 00:10:43
18	B4b	0.28	93.00	6.40	5.58	1.56	0.80	0 01:03:25
19	B4c	0.23	93.00	6.40	5.58	1.30	0.75	0 00:52:31

## Vanguard Farms Apartments

SN Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1 B1-4	Junction	672.61	675.45	672.61	675.45	0.00	30.74	673.88	0.00	1.57	0 00:00	0.00	0.00
2 B2-2	Junction	673.36	677.74	673.36	677.74	0.00	16.27	674.71	0.00	3.03	0 00:00	0.00	0.00
3 B2-5	Junction	674.47	677.61	674.47	677.61	0.00	8.95	675.85	0.00	1.76	0 00:00	0.00	0.00
4 B3-3	Junction	671.02	674.58	671.02	674.58	0.00	19.14	672.29	0.00	2.29	0 00:00	0.00	0.00
5 B3-7	Junction	673.67	679.16	673.67	679.16	0.00	6.10	674.49	0.00	4.67	0 00:00	0.00	0.00
6 B3-8	Junction	674.52	679.79	674.52	679.79	0.00	6.10	675.24	0.00	4.55	0 00:00	0.00	0.00
7 B3-9	Junction	674.89	679.79	674.89	679.79	0.00	3.07	675.47	0.00	4.32	0 00:00	0.00	0.00
8 DRIVE B1a	Junction	678.19	6.00	0.00	0.00	0.00	1.68	678.34	0.00	0.09	0 00:00	0.00	0.00
9 DRIVE B1b	Junction	679.17	6.00	0.00	0.00	0.00	1.50	679.30	0.00	0.11	0 00:00	0.00	0.00
10 DRIVE B2a	Junction	679.85	6.00	0.00	0.00	0.00	2.36	680.02	0.00	0.07	0 00:00	0.00	0.00
11 DRIVE B2b	Junction	675.31	6.00	0.00	0.00	0.00	2.62	679.22	0.00	0.06	0 00:00	0.00	0.00
12 DRIVE B2c	Junction	0.00	6.00	0.00	6.00	0.00	1.89	680.01	0.00	0.08	0 00:00	0.00	0.00
13 DRIVE B2d	Junction	678.76	6.00	0.00	0.00	0.00	2.53	678.93	0.00	0.06	0 00:00	0.00	0.00
14 DRIVE B3f	Junction	0.00	6.00	0.00	6.00	0.00	2.86	676.38	0.00	0.05	0 00:00	0.00	0.00
15 DRIVE B3g-1	Junction	0.00	6.00	0.00	6.00	0.00	10.52	678.82	0.00	0.00	0 12:02	0.36	12.00
16 DRIVE B3h	Junction	674.83	6.00	0.00	0.00	0.00	3.01	675.02	0.00	0.05	0 00:00	0.00	0.00
17 OUTFALL B2	Junction	673.11	679.16	673.11	679.16	0.00	30.75	674.41	0.00	4.75	0 00:00	0.00	0.00
18 SDWK BOX B DUMMY	Junction	675.58	677.34	0.00	0.00	0.00	14.85	676.50	0.00	0.84	0 00:00	0.00	0.00
19 Out-1B1-1	Outfall	670.57					31.54	671.63					
20 Out-1B3-1	Outfall	670.57					21.17	671.68					

## Vanguard Farms Apartments

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	B1-1	Pipe	B1-2	Out-1B1-1	27.44	670.68	670.57	0.4000	24.000	0.0130	31.54	57.77	0.55	5.94	1.06	0.53	0.00
2	B1-2	Pipe	B1-3	B1-2	325.38	671.98	670.78	0.3700	24.000	0.0130	31.09	42.38	0.73	5.95	1.31	0.65	0.00
3	B1-3	Pipe	B1-4	B1-3	135.92	672.61	672.08	0.4000	24.000	0.0130	30.74	43.95	0.70	6.08	1.27	0.63	0.00
4	B2-1	Pipe	B2-2	OUTFALL B2	81.97	673.36	673.16	0.2400	24.000	0.0130	16.26	23.90	0.68	4.34	1.25	0.62	0.00
5	B2-2	Pipe	B2-3	B2-2	126.09	673.76	673.46	0.2400	24.000	0.0130	16.27	23.90	0.68	4.34	1.24	0.62	0.00
6	B2-3	Pipe	B2-4	B2-3	171.36	674.20	673.86	0.2000	24.000	0.0130	12.87	21.82	0.59	3.82	1.12	0.56	0.00
7	B2-4	Pipe	B2-5	B2-4	86.66	674.47	674.30	0.2000	24.000	0.0130	8.95	12.88	0.69	3.49	1.28	0.64	0.00
8	B2-5	Pipe	B2-6	B2-5	41.89	674.65	674.57	0.2000	24.000	0.0130	8.95	12.88	0.69	3.48	1.28	0.64	0.00
9	B2-6	Pipe	B2-7	B2-6	61.04	674.87	674.75	0.2000	24.000	0.0130	4.74	10.12	0.47	3.17	0.96	0.48	0.00
10	B2-7	Pipe	B2-8	B2-7	170.14	675.31	674.97	0.2000	24.000	0.0150	2.26	11.16	0.20	2.18	0.52	0.26	0.00
11	B2c-1	Pipe	B2c-1	B2-6	182.72	675.12	674.75	0.2000	24.000	0.0130	1.83	12.88	0.14	2.25	0.41	0.20	0.00
12	B3-1	Pipe	B3-2	Out-1B3-1	33.76	670.66	670.57	0.2700	24.000	0.0130	21.17	36.26	0.58	4.75	1.11	0.56	0.00
13	B3-2	Pipe	B3-3	B3-2	96.98	671.02	670.76	0.2700	24.000	0.0130	19.13	36.26	0.53	4.61	1.04	0.52	0.00
14	B3-3	Pipe	B3-4	B3-3	101.12	671.52	671.12	0.4000	24.000	0.0130	19.14	30.86	0.62	5.46	1.16	0.58	0.00
15	B3-4	Pipe	B3-5	B3-4	143.96	672.20	671.62	0.4000	24.000	0.0130	11.84	30.86	0.38	4.76	0.83	0.41	0.00
16	B3-5	Pipe	B3-6	B3-5	87.13	672.88	672.30	0.6700	24.000	0.0110	10.10	21.90	0.46	6.83	0.95	0.48	0.00
17	B3-6	Pipe	B3-7	B3-6	116.41	673.67	672.88	0.6700	24.000	0.0110	6.10	21.90	0.28	5.97	0.72	0.36	0.00
18	B3-7	Pipe	B3-8	B3-7	112.25	674.52	673.77	0.6700	24.000	0.0110	6.10	21.88	0.28	5.97	0.72	0.36	0.00
19	B3-8	Pipe	B3-9	B3-8	40.25	674.89	674.62	0.6700	24.000	0.0120	3.07	20.06	0.15	4.62	0.53	0.26	0.00
20	B3-9	Pipe	INLET B3a	B3-9	87.75	675.58	674.99	0.6700	12.000	0.0110	1.48	3.45	0.43	4.22	0.46	0.46	0.00
21	B3b-1	Pipe	INLET B3b	B3-9	68.38	675.45	674.99	0.6700	12.000	0.0110	1.61	3.45	0.47	4.32	0.48	0.48	0.00
22	B3c-1	Pipe	INLET B3c	B3-8	75.08	675.12	674.62	0.6700	12.000	0.0110	1.48	3.45	0.43	4.22	0.46	0.46	0.00
23	B3d-1	Pipe	INLET B3d	B3-8	51.50	674.97	674.62	0.6700	12.000	0.0110	1.58	3.45	0.46	4.30	0.48	0.48	0.00
24	CHANNEL B 1	Channel	SDWK BOX B DUMMY	OUTFALL B2	621.36	675.58	673.11	0.4000	15.000	0.0400	14.49	26.12	0.55	1.98	0.91	0.73	0.00
25	CHANNEL B 2	Channel	OUTFALL B2	B1-4	123.46	673.11	672.61	0.4000	15.720	0.0240	30.74	82.56	0.37	5.01	0.79	0.60	0.00
26	CHANNEL B DUMMY	Channel	SDWK BOX B	SDWK BOX B DUMMY	1.00	677.34	675.58	176.4000	15.000	0.0400	3.06	550.73	0.01	7.72	0.06	0.05	0.00
27	DRIVE B1a	Channel	DRIVE B1a	SDWK BOX B	172.00	678.19	677.34	0.5000	2.880	0.0130	1.68	5.64	0.30	1.47	0.15	0.63	0.00
28	DRIVE B1a DUMMY	Channel	B2-7	DRIVE B1a	1.00	678.20	678.19	0.5000	2.880	0.0320	0.11	2.30	0.05	0.37	0.08	0.32	0.00
29	DRIVE B1b	Channel	DRIVE B1b	SDWK BOX B	165.84	679.17	677.34	1.1000	2.880	0.0130	1.48	8.41	0.18	1.91	0.12	0.52	0.00
30	DRIVE B2a	Channel	DRIVE B2a	B2-8	163.00	679.85	679.04	0.5000	2.880	0.0130	2.34	5.64	0.41	1.59	0.17	0.72	0.00
31	DRIVE B2b	Channel	DRIVE B2b	B2-7	169.00	679.04	678.20	0.5000	2.880	0.0130	2.60	5.66	0.46	1.64	0.18	0.75	0.00
32	DRIVE B2b DUMMY	Channel	B2-8	DRIVE B2b	1.00	679.04	675.31	373.5300	2.880	0.0320	0.08	62.88	0.00	4.15	0.02	0.08	0.00
33	DRIVE B2c	Channel	DRIVE B2c	B2c-1	218.00	679.85	678.76	0.5000	2.880	0.0130	1.88	5.66	0.33	1.53	0.16	0.66	0.00
34	DRIVE B2d	Channel	DRIVE B2d	B2-6	182.72	678.76	677.85	0.4900	2.880	0.0130	2.51	5.63	0.45	1.62	0.18	0.74	0.00
35	DRIVE B2d DUMMY	Channel	B2c-1	DRIVE B2d	1.00	678.76	678.76	0.5000	2.880	0.0130	0.05	5.68	0.01	0.59	0.04	0.16	0.00
36	DRIVE B2e	Channel	B2-6	B2-4	125.00	677.85	677.22	0.5000	2.880	0.0130	0.09	5.68	0.02	0.88	0.05	0.21	0.00
37	DRIVE B3f	Channel	DRIVE B3f	B3-5	124.52	676.19	675.57	0.5000	2.880	0.0130	2.85	5.66	0.50	1.67	0.19	0.77	0.00
38	DRIVE B3g-1	Channel	DRIVE B3g-1	B3-4	400.00	678.58	674.84	0.9400	2.880	0.0130	7.75	7.75	1.00	2.85	0.24	1.00	11.00
39	DRIVE B3g-2	Channel	B3-5	B3-4	145.00	675.57	674.84	0.5000	2.880	0.0130	0.05	5.68	0.01	0.81	0.04	0.17	0.00
40	DRIVE B3h	Channel	DRIVE B3h	B3-2	185.00	674.83	673.91	0.5000	2.880	0.0130	2.99	5.66	0.53	1.69	0.19	0.79	0.00
41	DRIVE B3h DUMMY	Channel	B3-4	DRIVE B3h	1.00	674.84	674.83	0.6000	2.880	0.0130	0.34	6.18	0.05	1.04	0.08	0.34	0.00





## Vanguard Farms Apartments

SN Element ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation	Max (Rim) Elevation	Initial Water Elevation	Ponded Area	Peak Flow	Peak Flow Intercepted	Peak Flow Bypassing	Inlet Efficiency during Peak Flow	Allowable Spread	Max Gutter Spread during Peak Flow	Max Gutter Water Elev. during Peak Flow
					(ft)	(ft)	(ft)	(ft <sup>2</sup> )	(cfs)	(cfs)	(cfs)	(%)	(ft)	(ft)	(ft)
1 B1-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.68	674.37	670.68	0.00	0.75	N/A	N/A	N/A	7.00	4.61	674.65
2 B1-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	671.98	675.90	671.98	0.00	0.80	N/A	N/A	N/A	7.00	4.93	676.20
3 B2-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	673.76	677.31	673.76	0.00	3.53	N/A	N/A	N/A	7.00	14.24	678.08
4 B2-4	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.20	677.22	674.20	0.00	3.99	N/A	N/A	N/A	7.00	14.94	678.00
5 B2-6	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.65	677.85	674.65	N/A	2.51	2.42	0.10	96.13	7.00	11.27	678.14
6 B2-7	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.87	678.20	674.87	N/A	2.60	2.49	0.11	95.91	7.00	11.41	678.49
7 B2-8	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.31	679.04	675.31	N/A	2.34	2.26	0.08	96.49	7.00	10.93	679.32
8 B2c-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.12	678.76	675.12	N/A	1.88	1.83	0.05	97.57	7.00	10.00	679.02
9 B3-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.66	673.91	670.66	0.00	2.99	N/A	N/A	N/A	7.00	12.79	674.64
10 B3-4	FHWA HEC-22 GENERIC	N/A	On Grade	1	671.52	674.84	671.52	N/A	7.80	7.46	0.34	95.65	7.00	17.53	675.25
11 B3-5	FHWA HEC-22 GENERIC	N/A	On Grade	1	672.20	675.57	672.20	N/A	2.85	2.80	0.05	98.08	7.00	11.84	675.87
12 B3-6	FHWA HEC-22 GENERIC	N/A	On Sag	1	672.88	676.10	672.88	0.00	4.63	N/A	N/A	N/A	7.00	12.71	676.86
13 INLET B3a	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	679.17	675.58	0.00	1.48	N/A	N/A	N/A	7.00	6.14	679.55
14 INLET B3b	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.45	678.68	675.45	0.00	1.61	N/A	N/A	N/A	7.00	6.96	679.07
15 INLET B3c	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.12	679.17	675.12	0.00	1.48	N/A	N/A	N/A	7.00	6.14	679.55
16 INLET B3d	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.97	678.67	674.97	0.00	1.58	N/A	N/A	N/A	7.00	6.77	679.06
17 SDWK BOX B	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	677.34	0.00	0.00	3.05	N/A	N/A	N/A	7.00	15.47	678.13

Vanguard Farms Apartments

Subbasin : B1a

Input Data

Area (ac) ..... 0.27  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

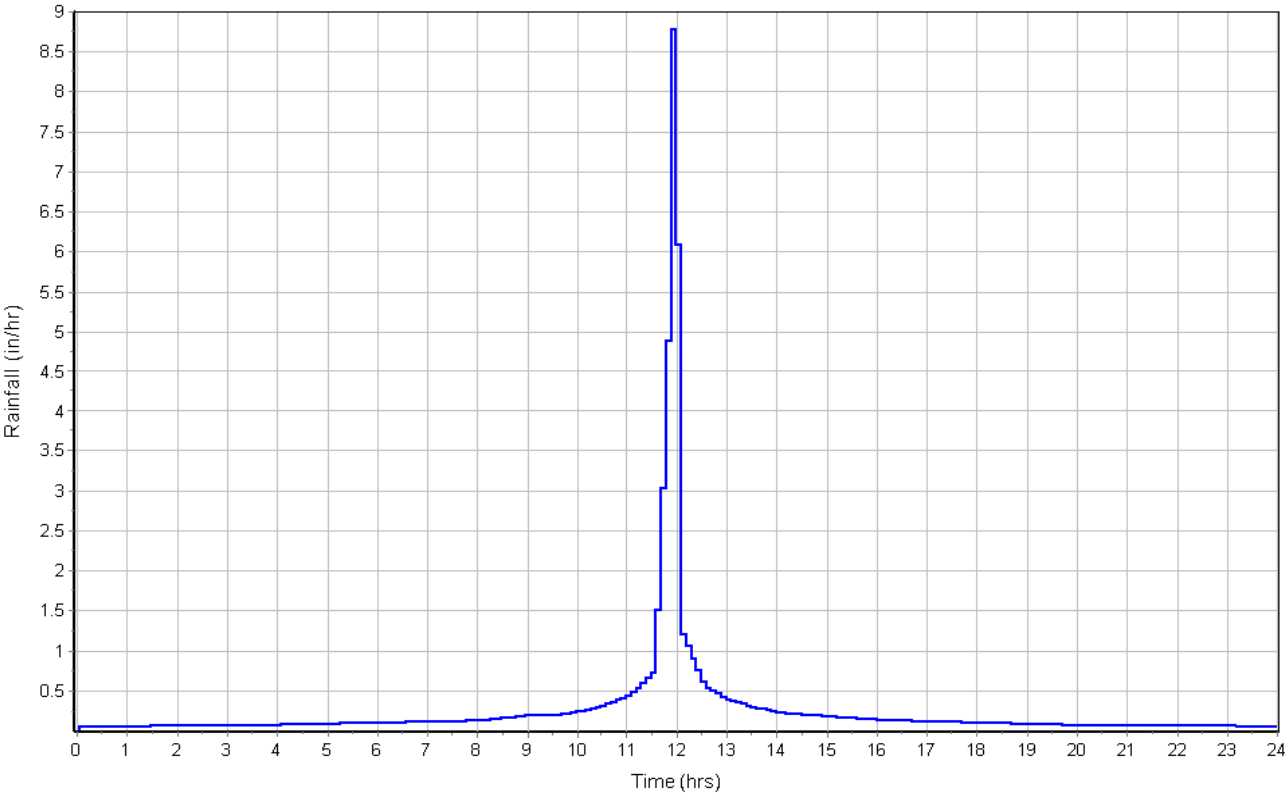
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.27	-	93.00
Composite Area & Weighted CN	0.27		93.00

Subbasin Runoff Results

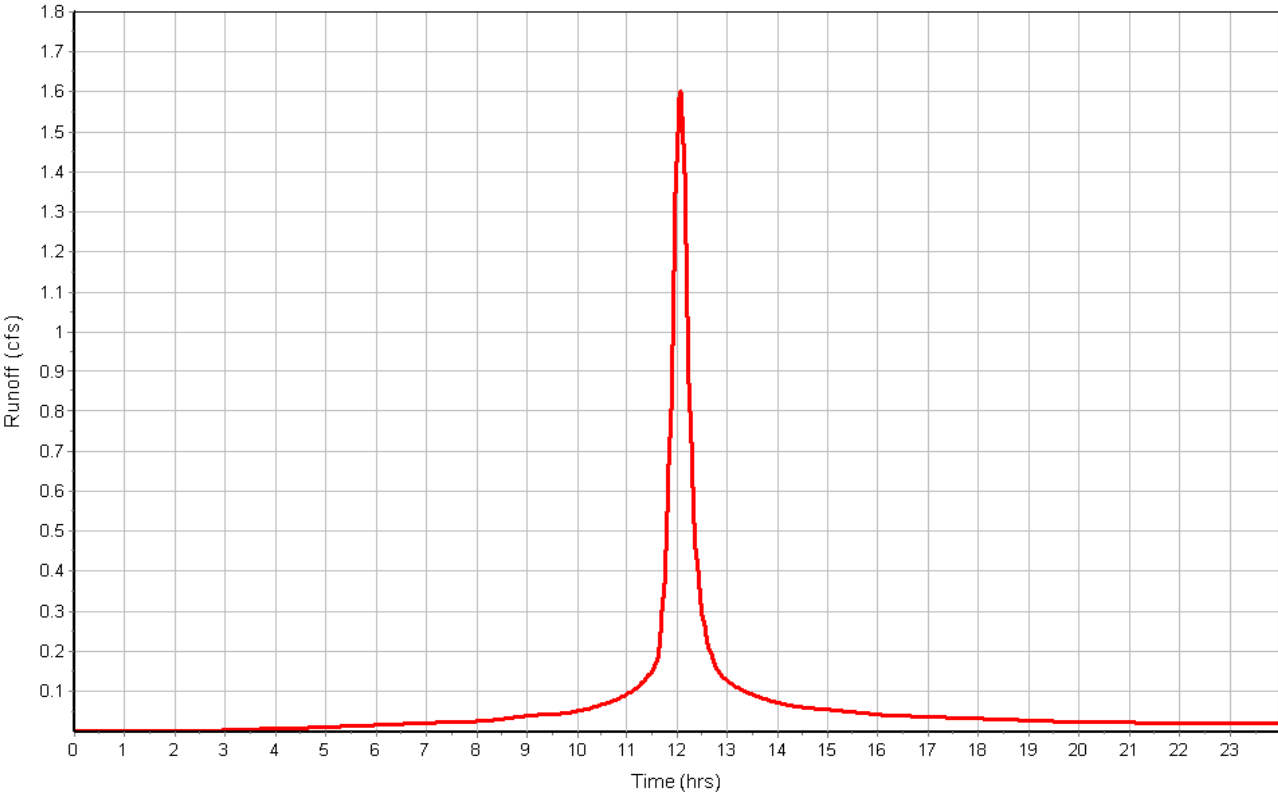
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 1.60  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:17:53

Subbasin : B1a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B1b

Input Data

Area (ac) ..... 0.21  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

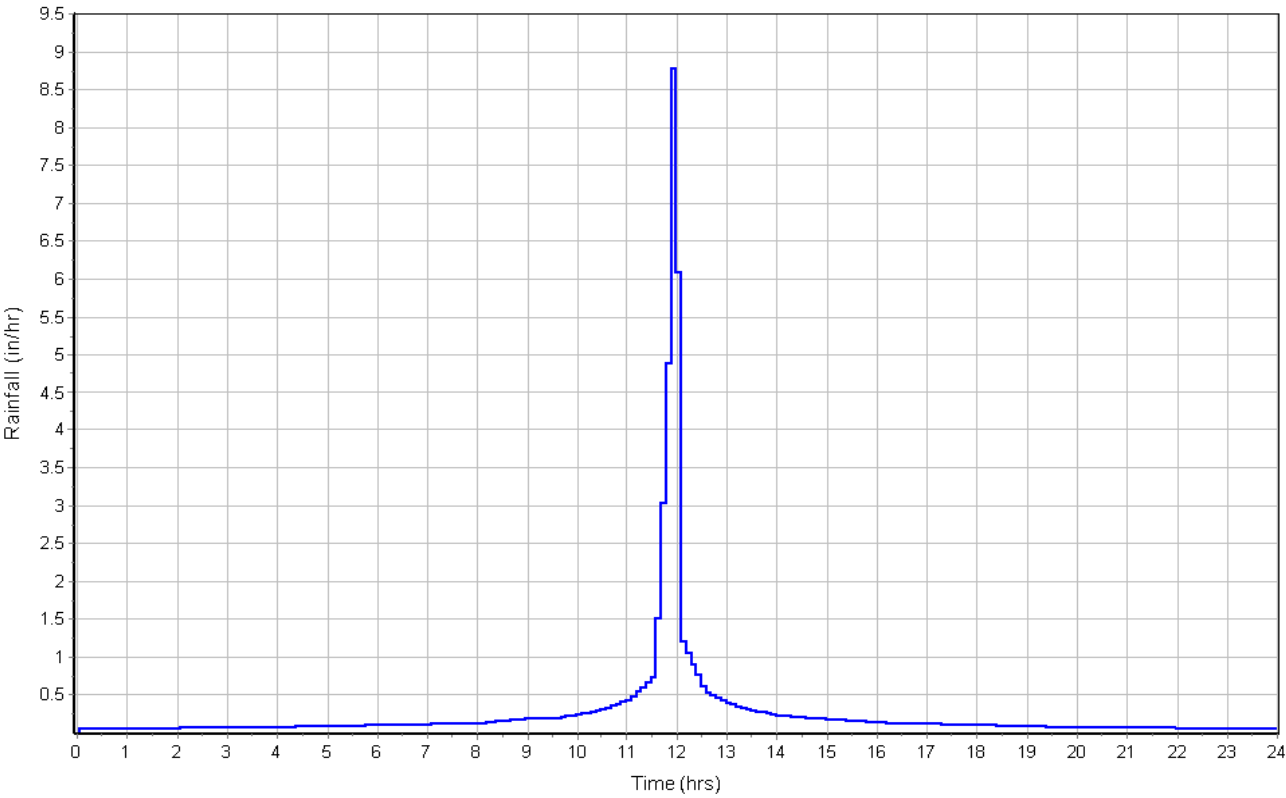
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.21	-	93.00
Composite Area & Weighted CN	0.21		93.00

Subbasin Runoff Results

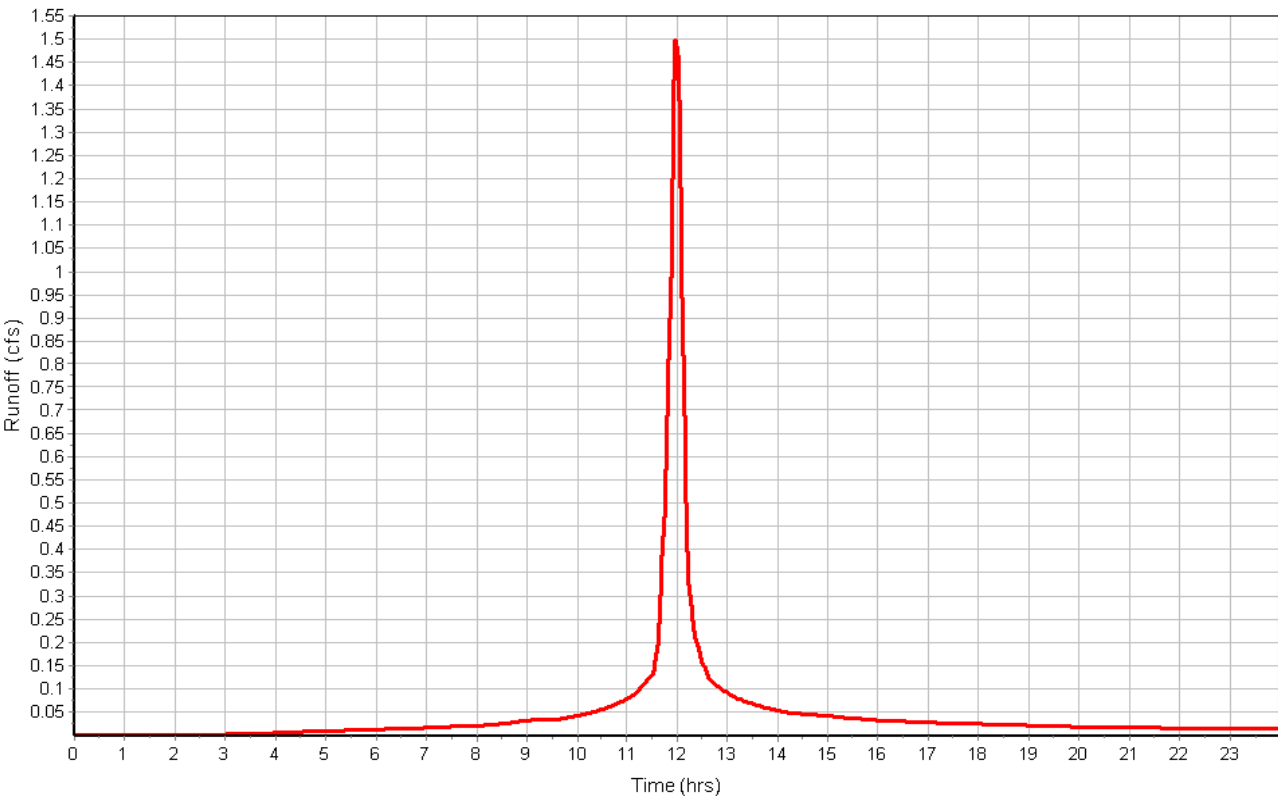
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 1.50  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B1b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2a

Input Data

Area (ac) ..... 0.33  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

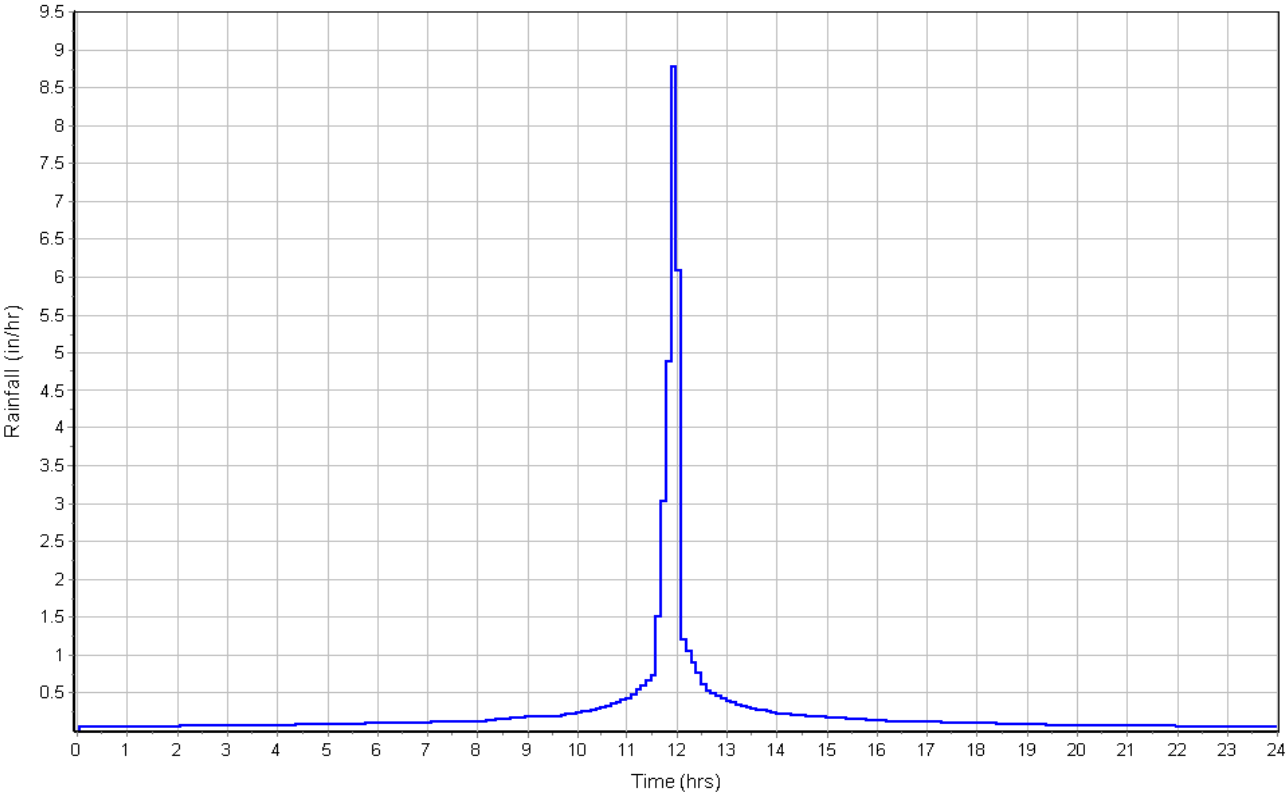
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.33	-	93.00
Composite Area & Weighted CN	0.33		93.00

Subbasin Runoff Results

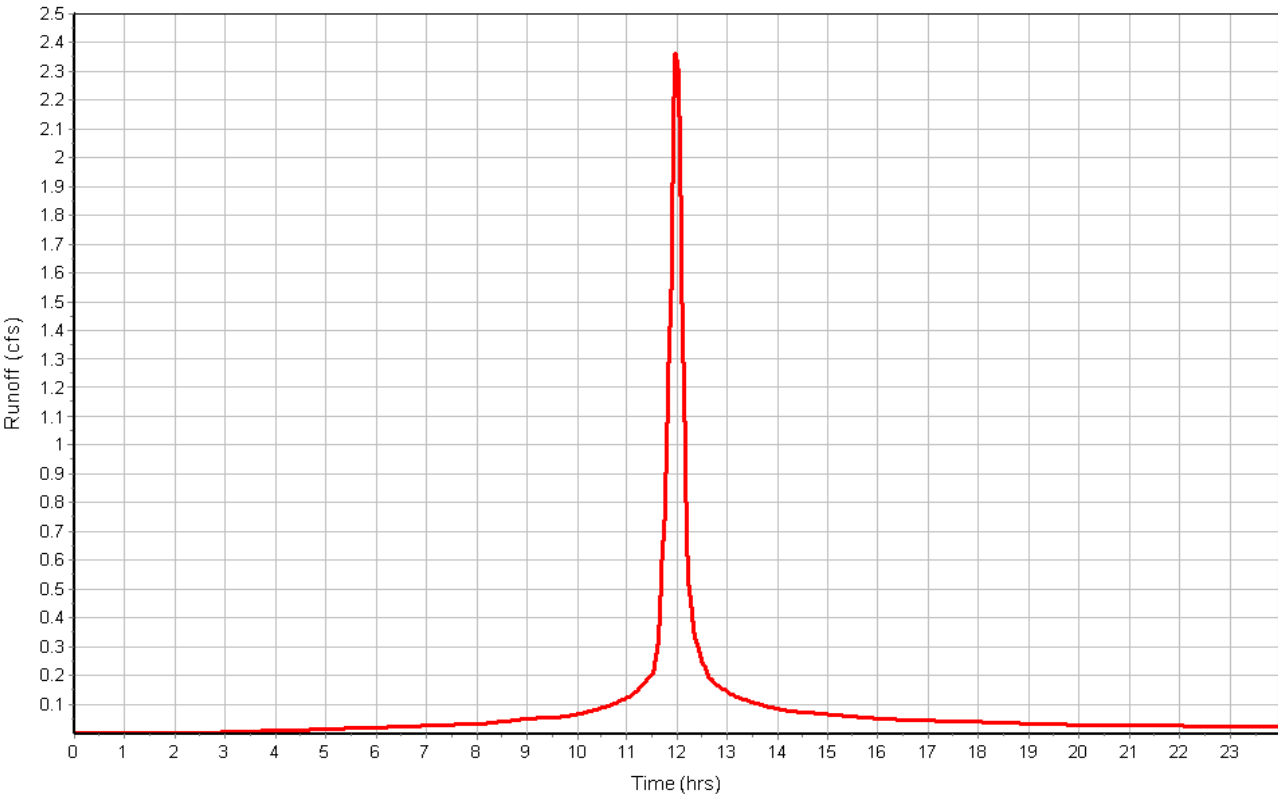
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 2.36  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B2a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2b

Input Data

Area (ac) ..... 0.36  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.36	-	93.00
Composite Area & Weighted CN	0.36		93.00

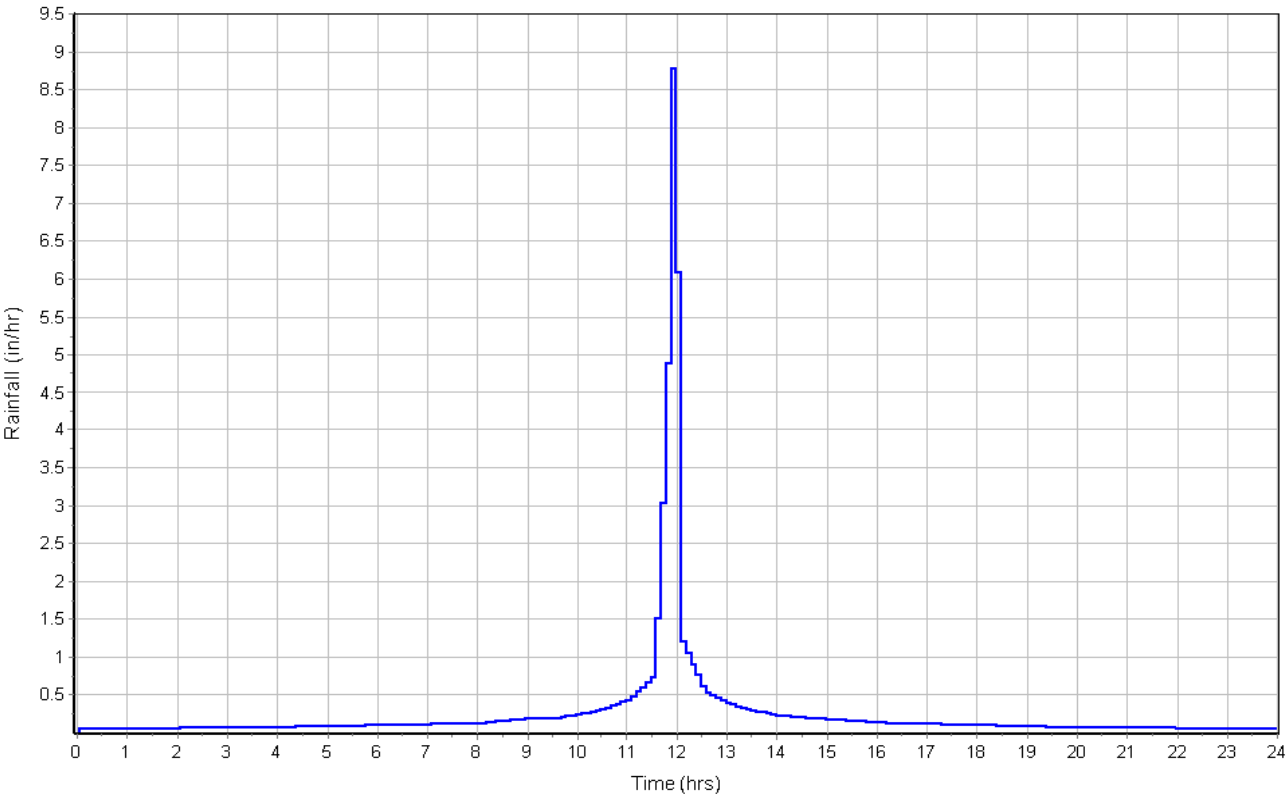
Subbasin Runoff Results

Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 2.55  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

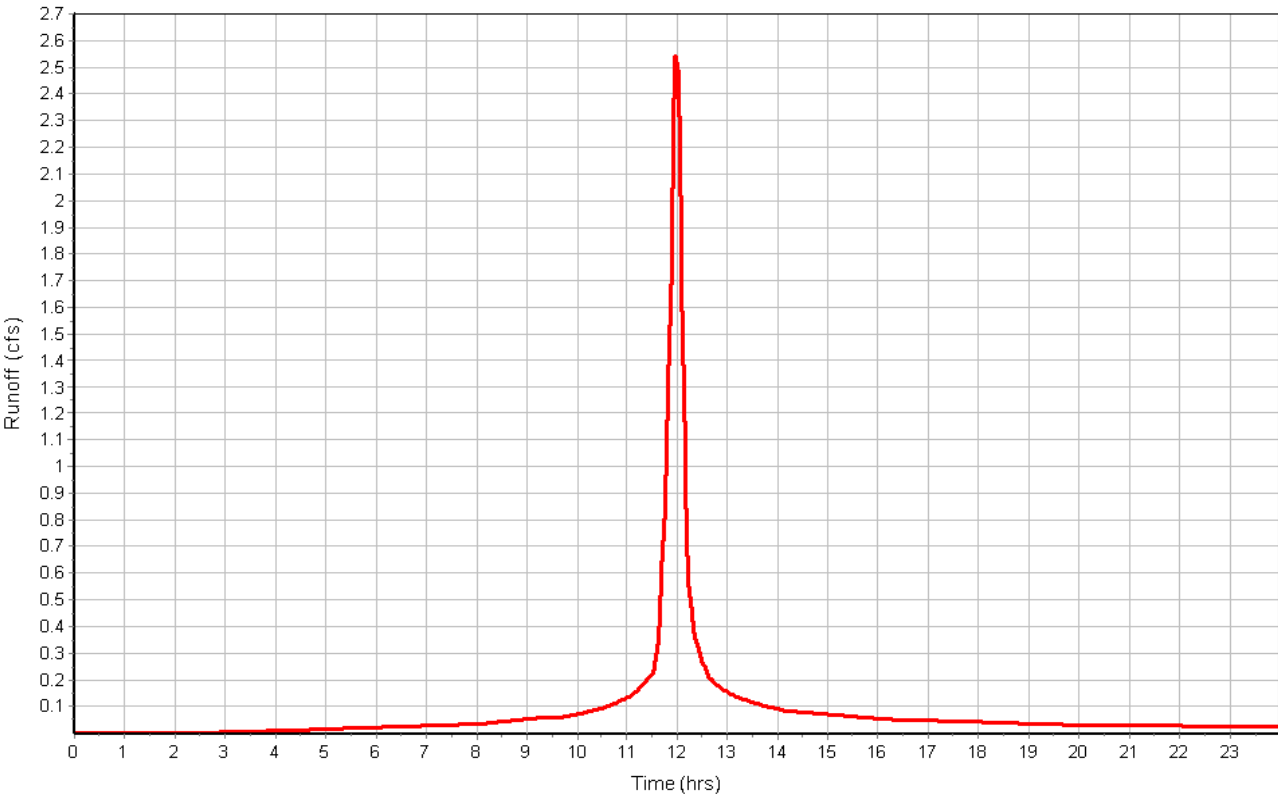


Subbasin : B2b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2c

Input Data

Area (ac) ..... 0.28  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

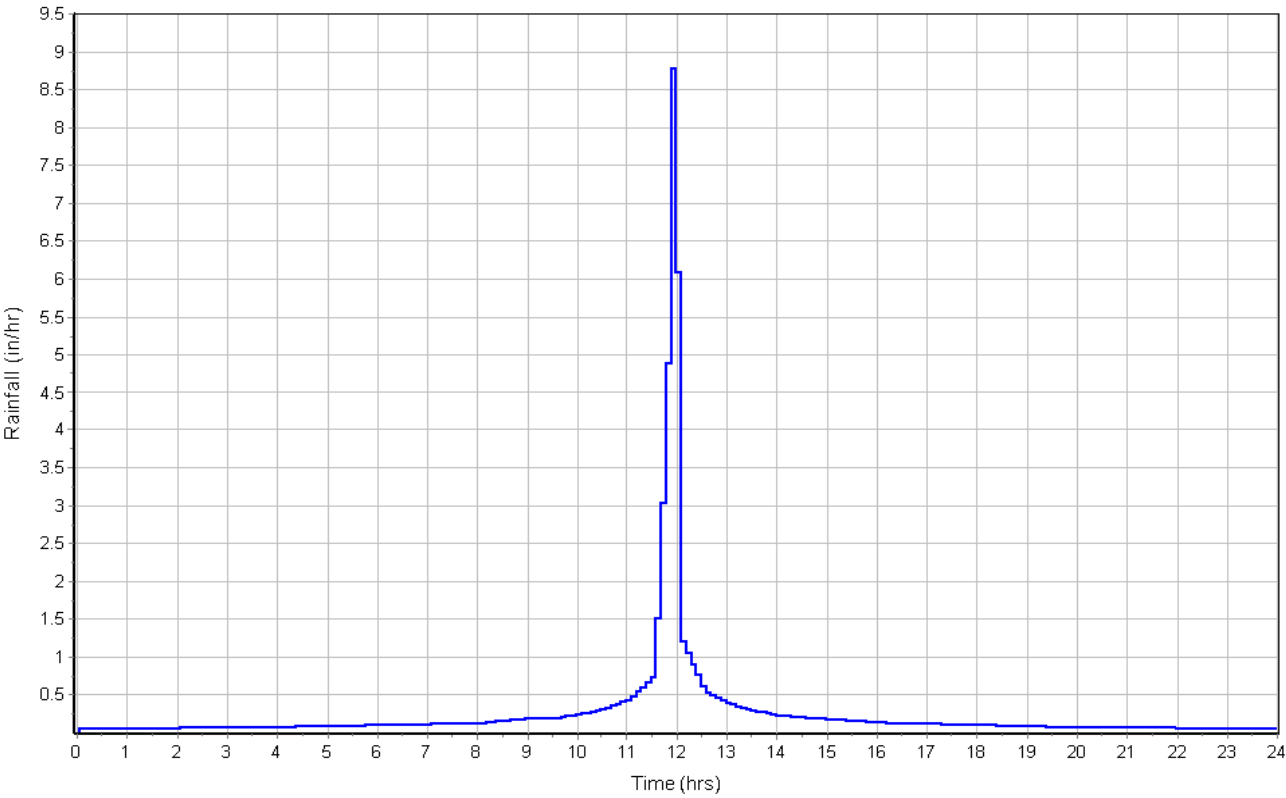
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.28	-	93.00
Composite Area & Weighted CN	0.28		93.00

Subbasin Runoff Results

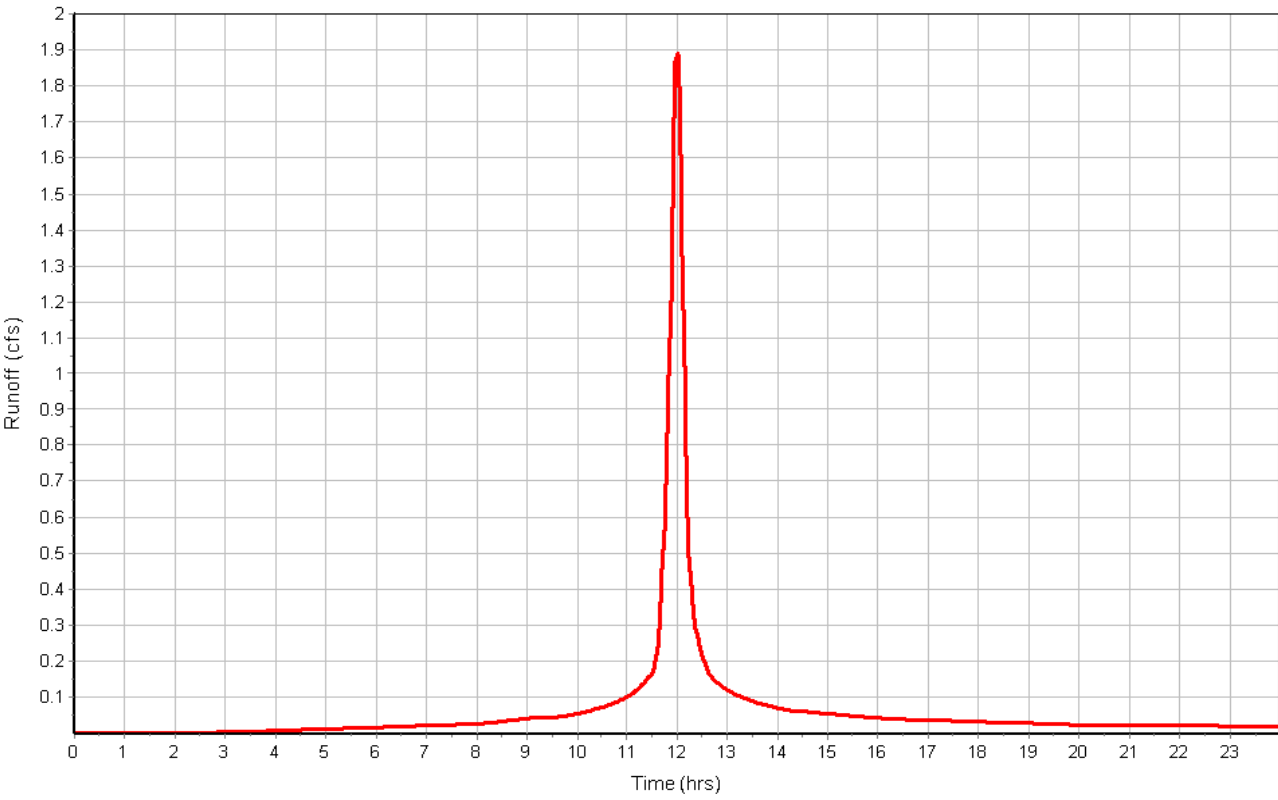
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 1.90  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:11:19

Subbasin : B2c

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2d

Input Data

Area (ac) ..... 0.35  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

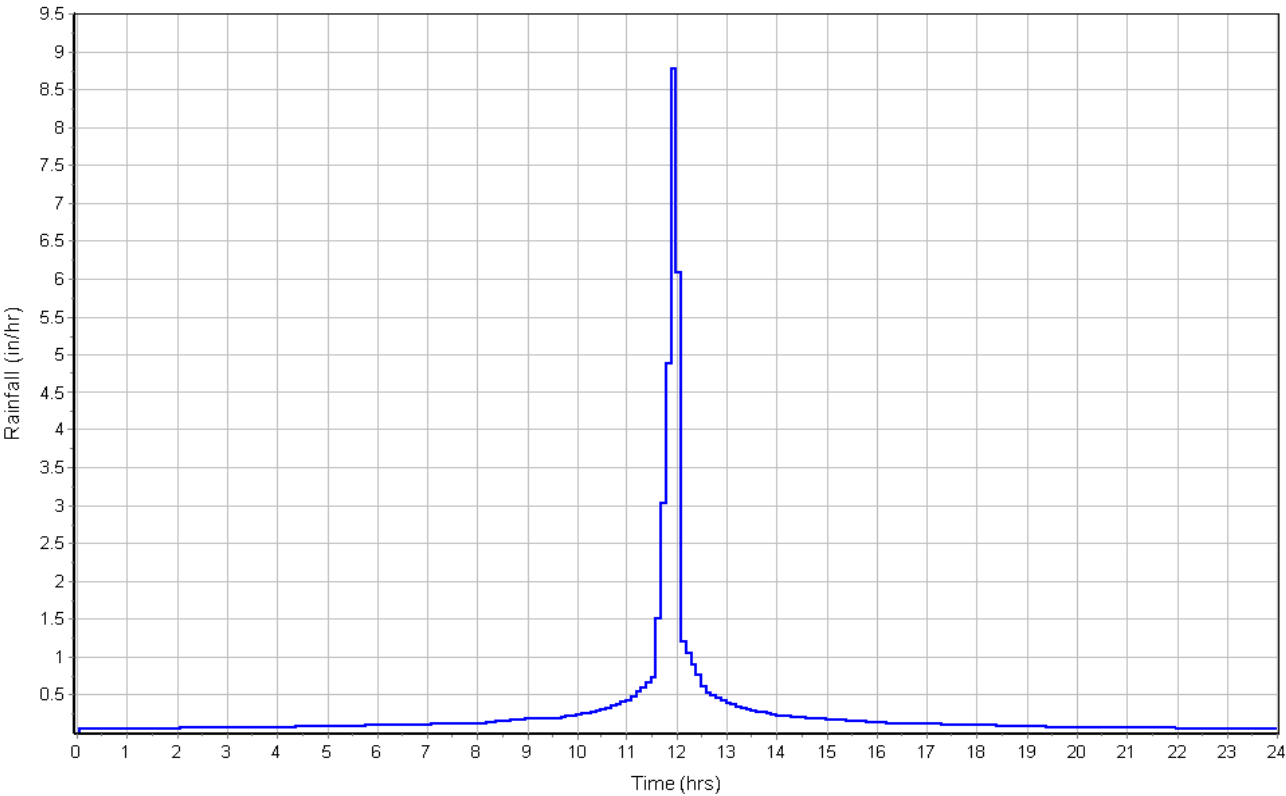
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.35	-	93.00
Composite Area & Weighted CN	0.35		93.00

Subbasin Runoff Results

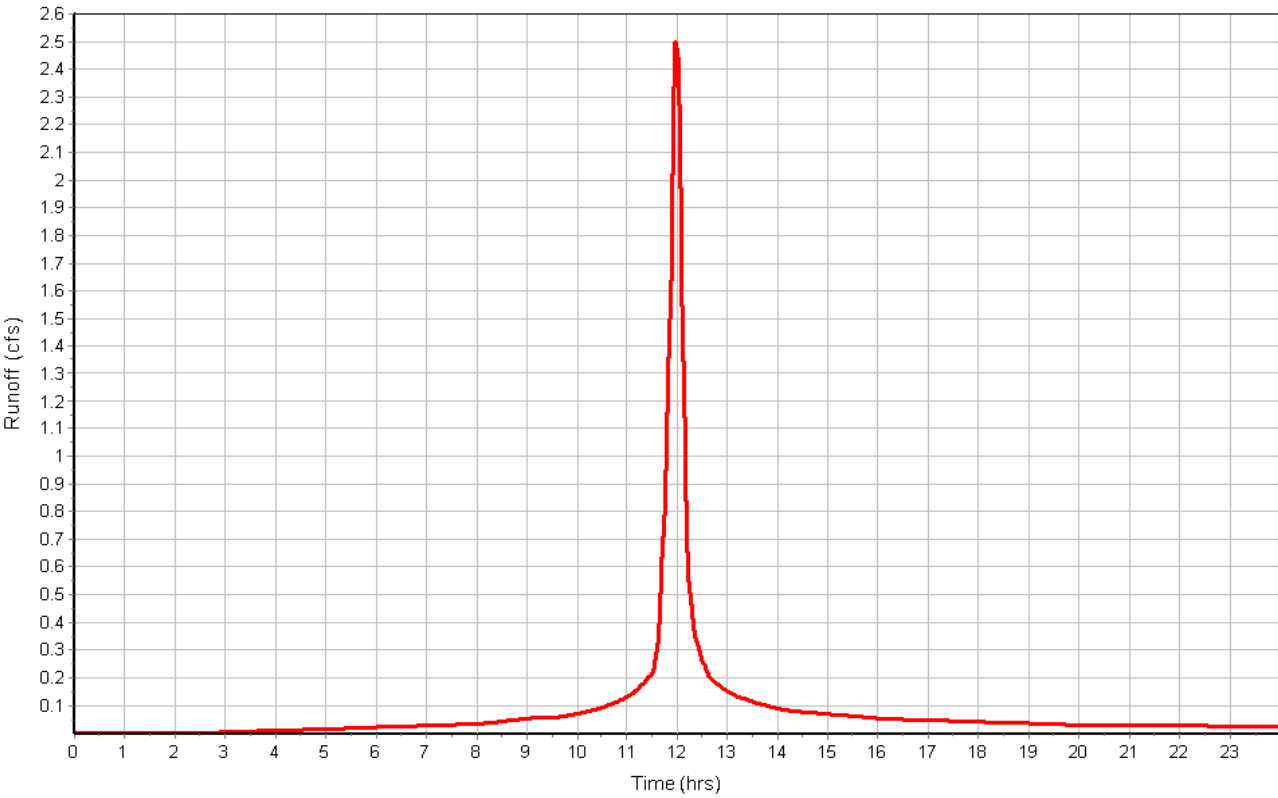
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 2.50  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B2d

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2e

Input Data

Area (ac) ..... 0.65  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

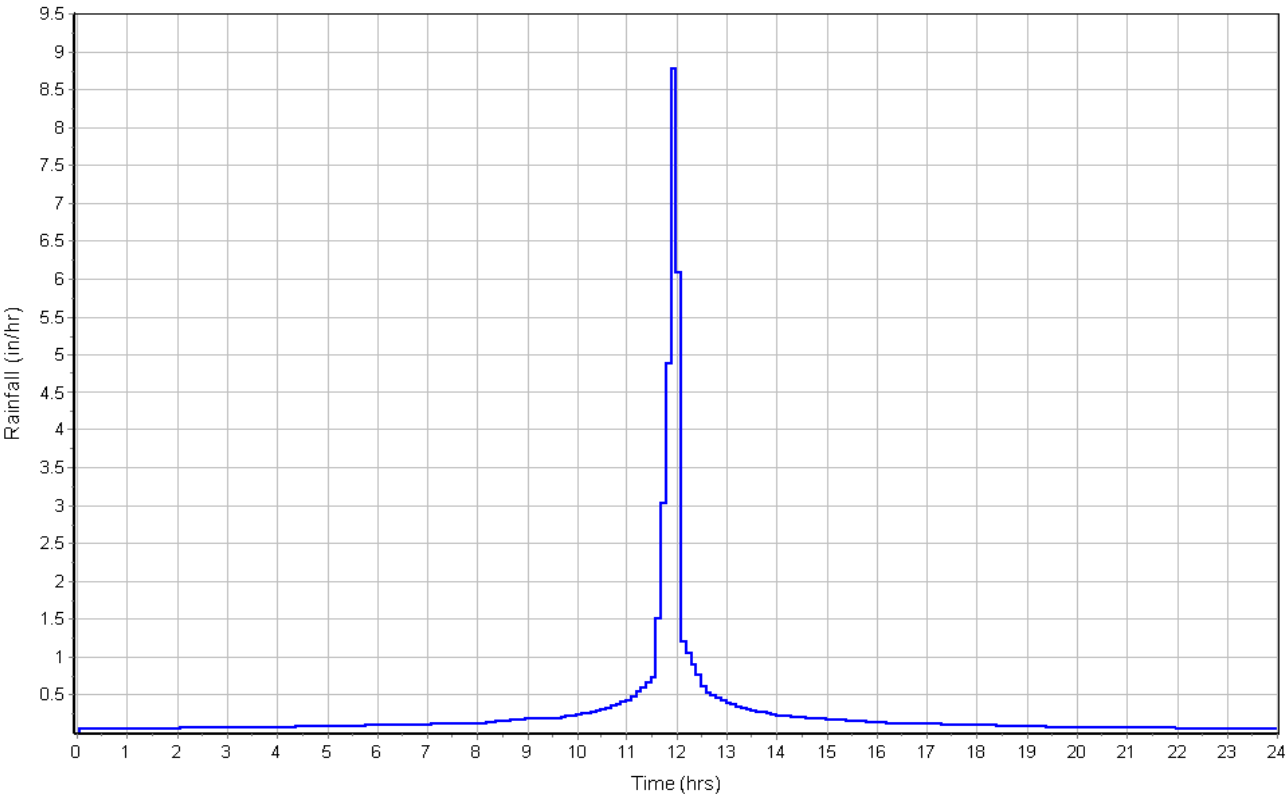
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.65	-	93.00
Composite Area & Weighted CN	0.65		93.00

Subbasin Runoff Results

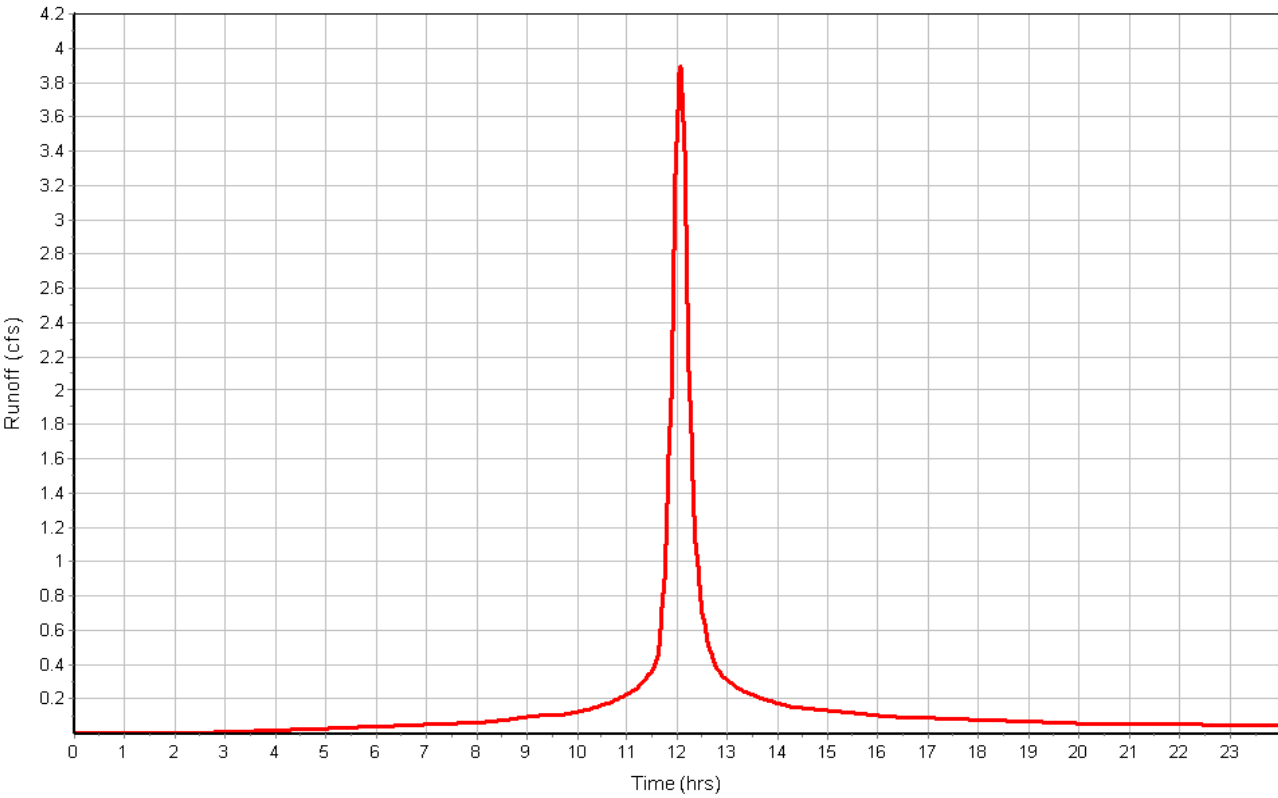
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 3.90  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:17:51

Subbasin : B2e

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2f

Input Data

Area (ac) ..... 0.63  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.63	-	93.00
Composite Area & Weighted CN	0.63		93.00

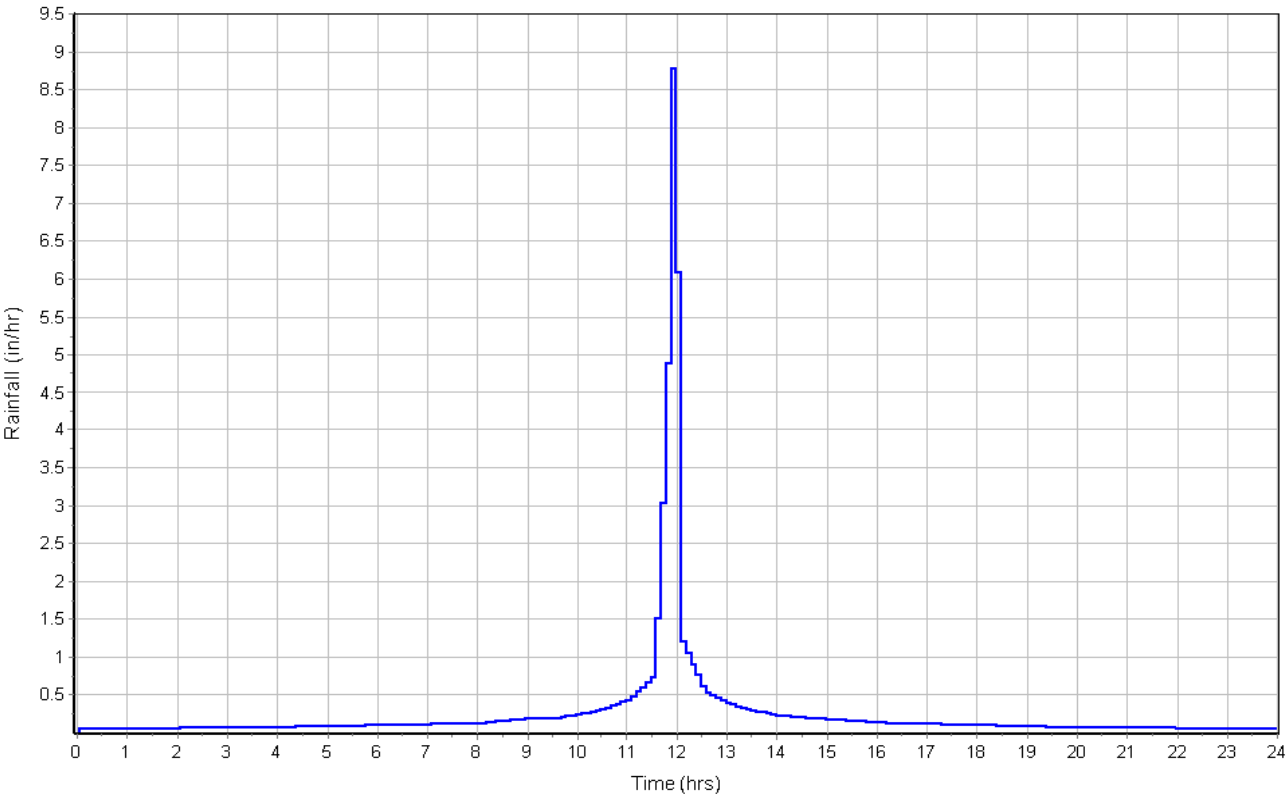
Subbasin Runoff Results

Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 3.54  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:20:46

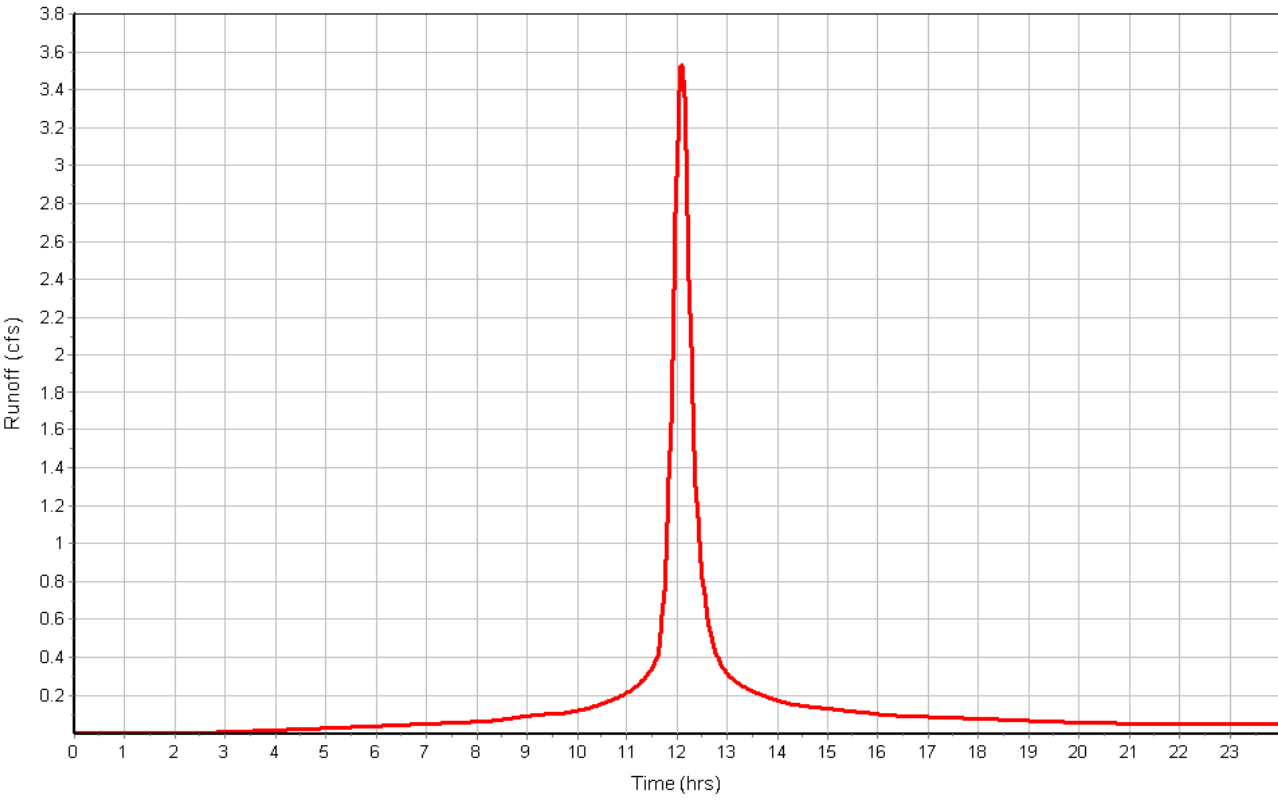


Subbasin : B2f

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3a

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

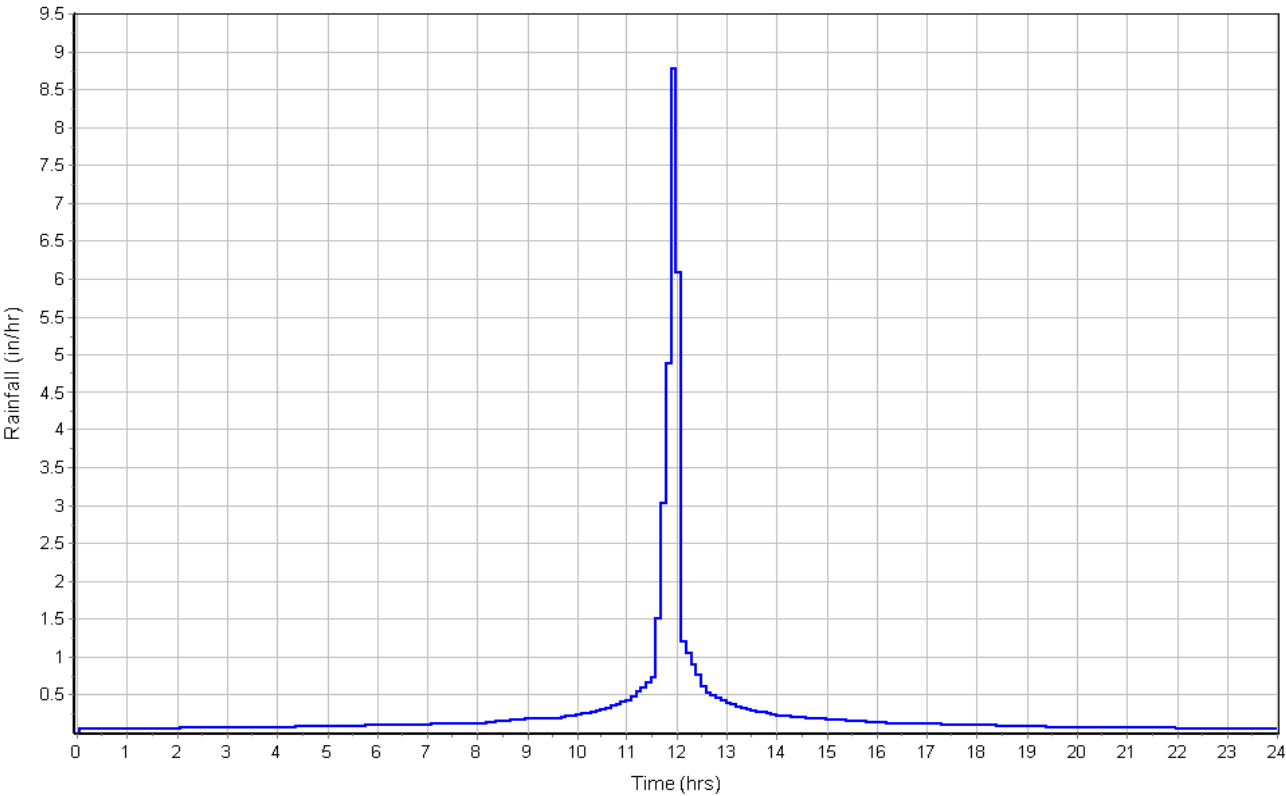
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

Subbasin Runoff Results

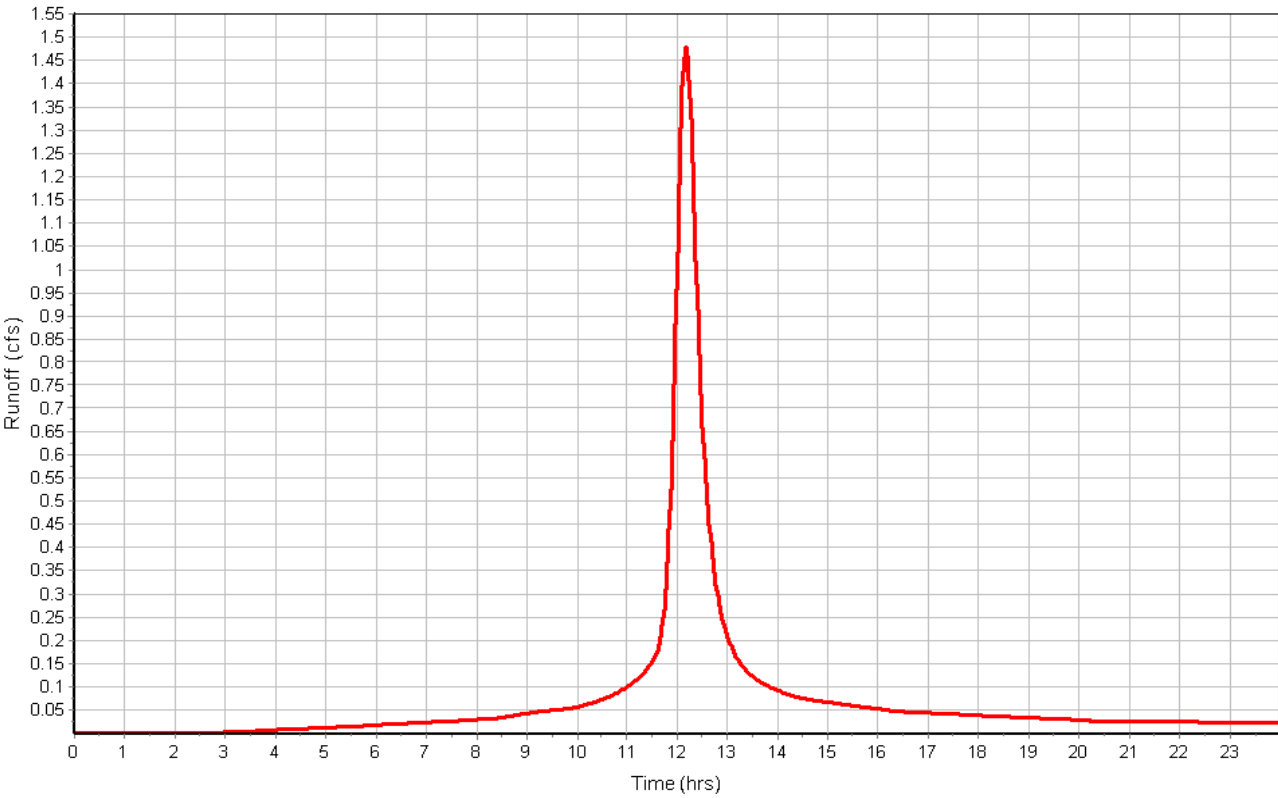
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 1.48  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:30:09

Subbasin : B3a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3b

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

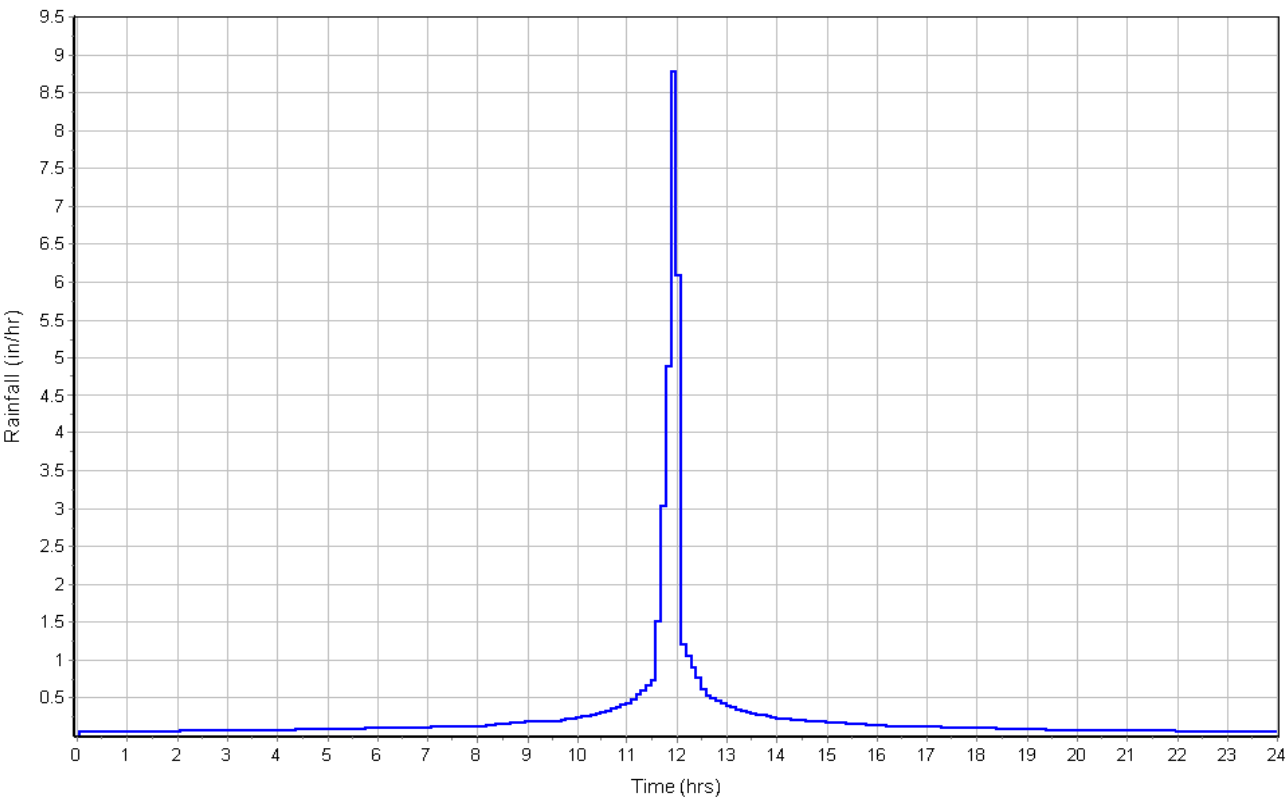
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

Subbasin Runoff Results

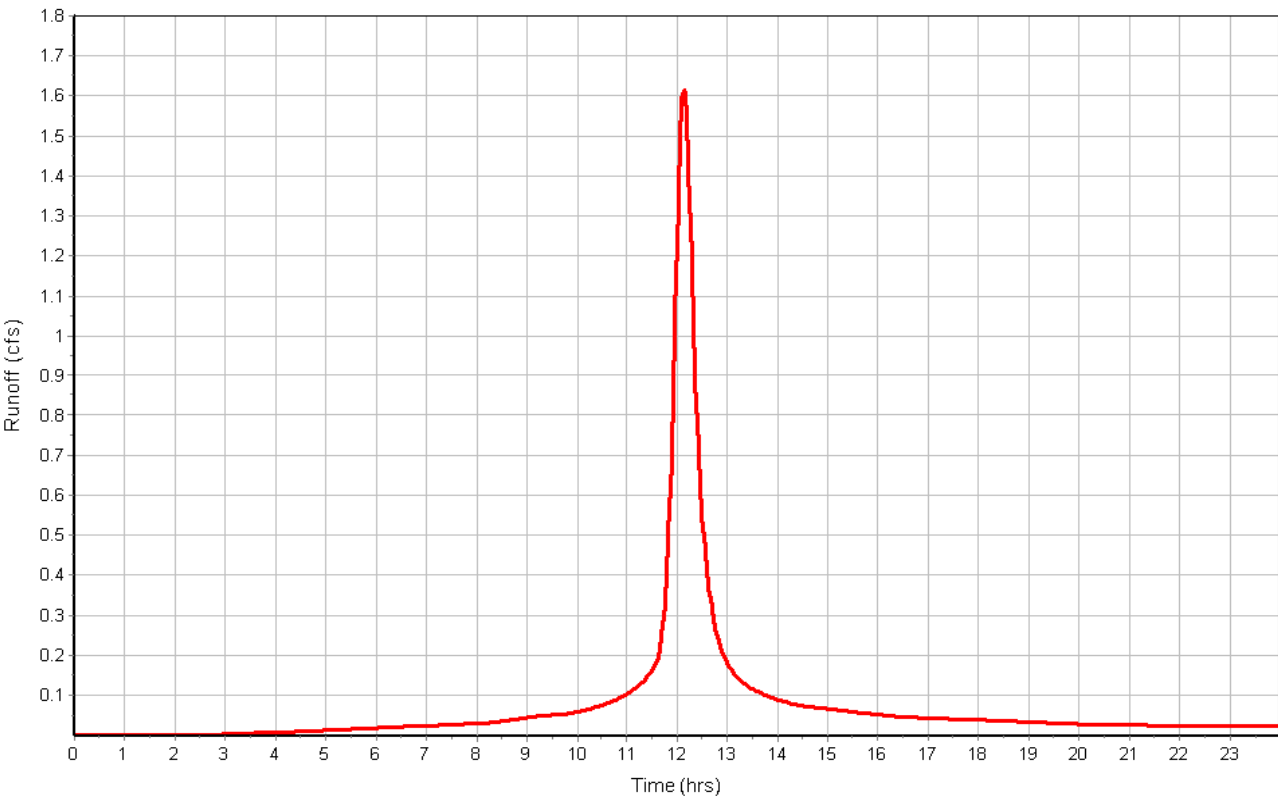
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 1.62  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:25:35

Subbasin : B3b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3c

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

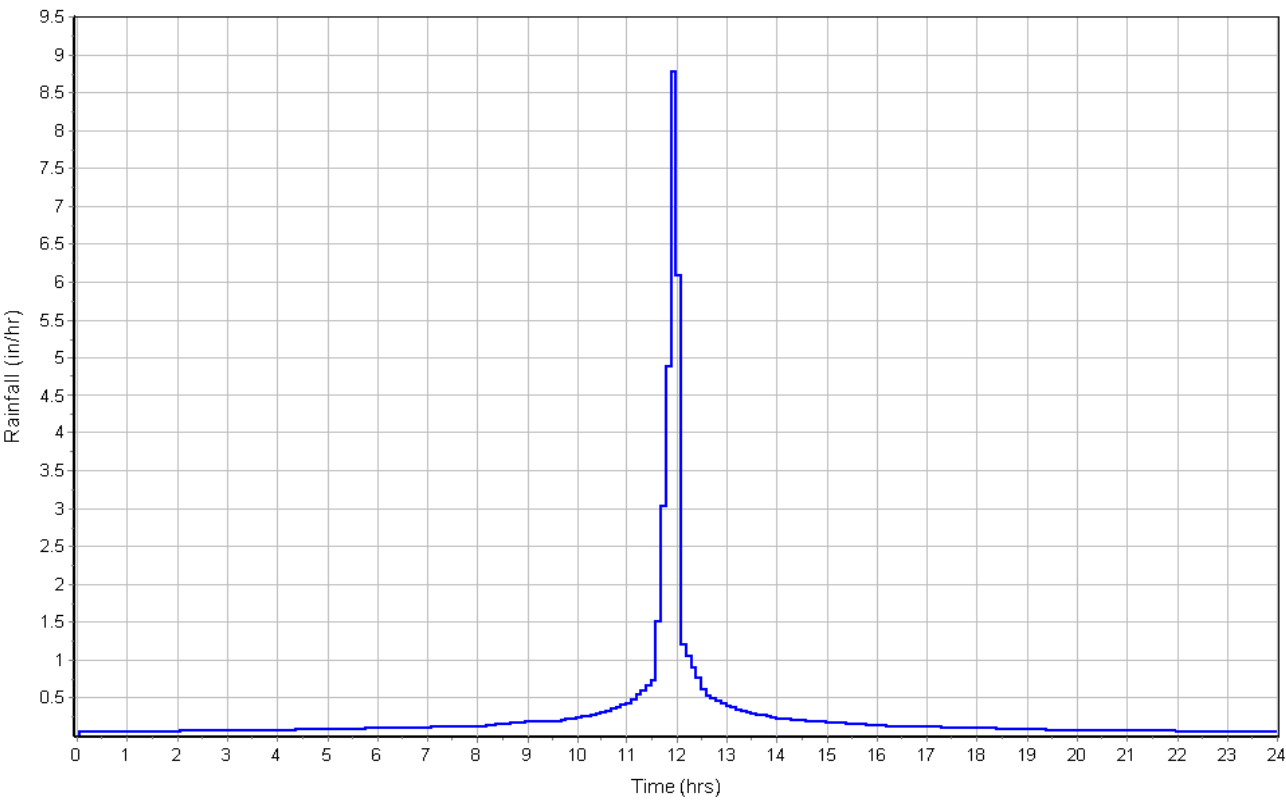
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

Subbasin Runoff Results

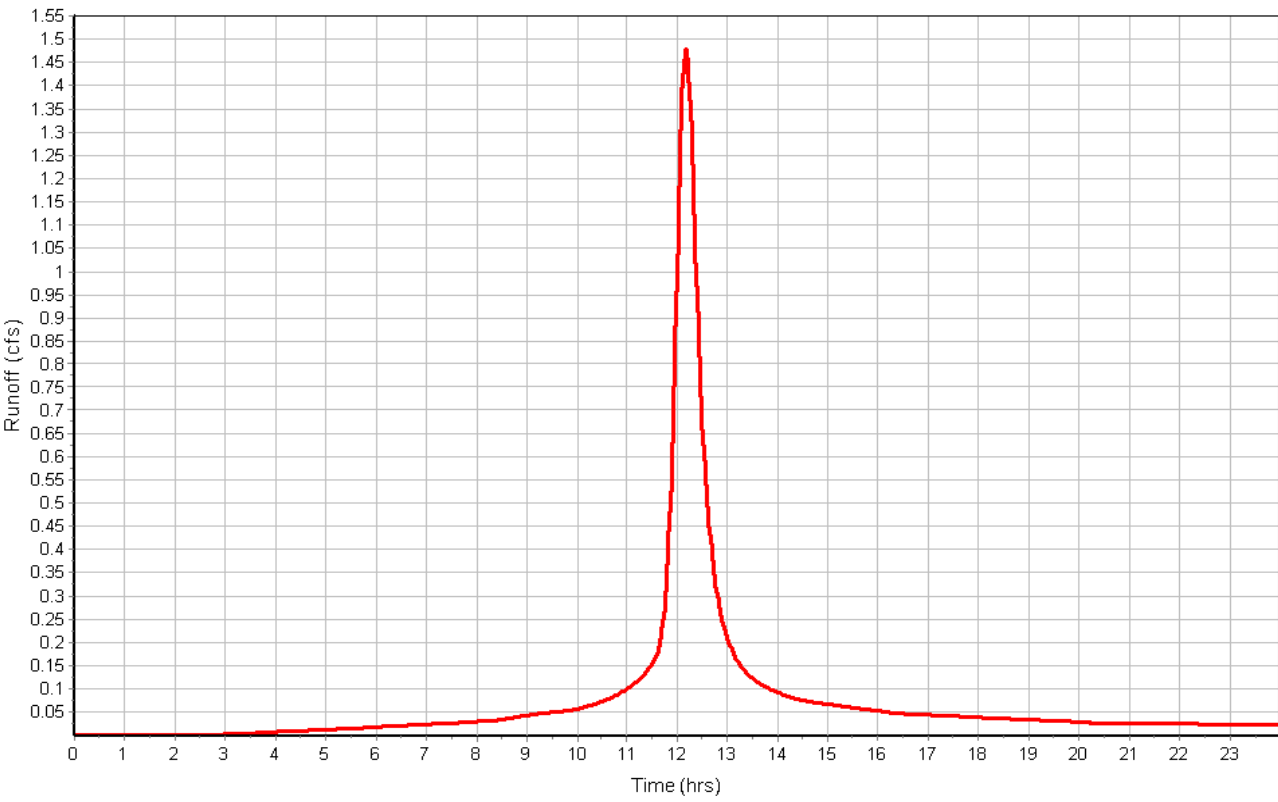
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 1.48  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:30:09

Subbasin : B3c

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3d

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

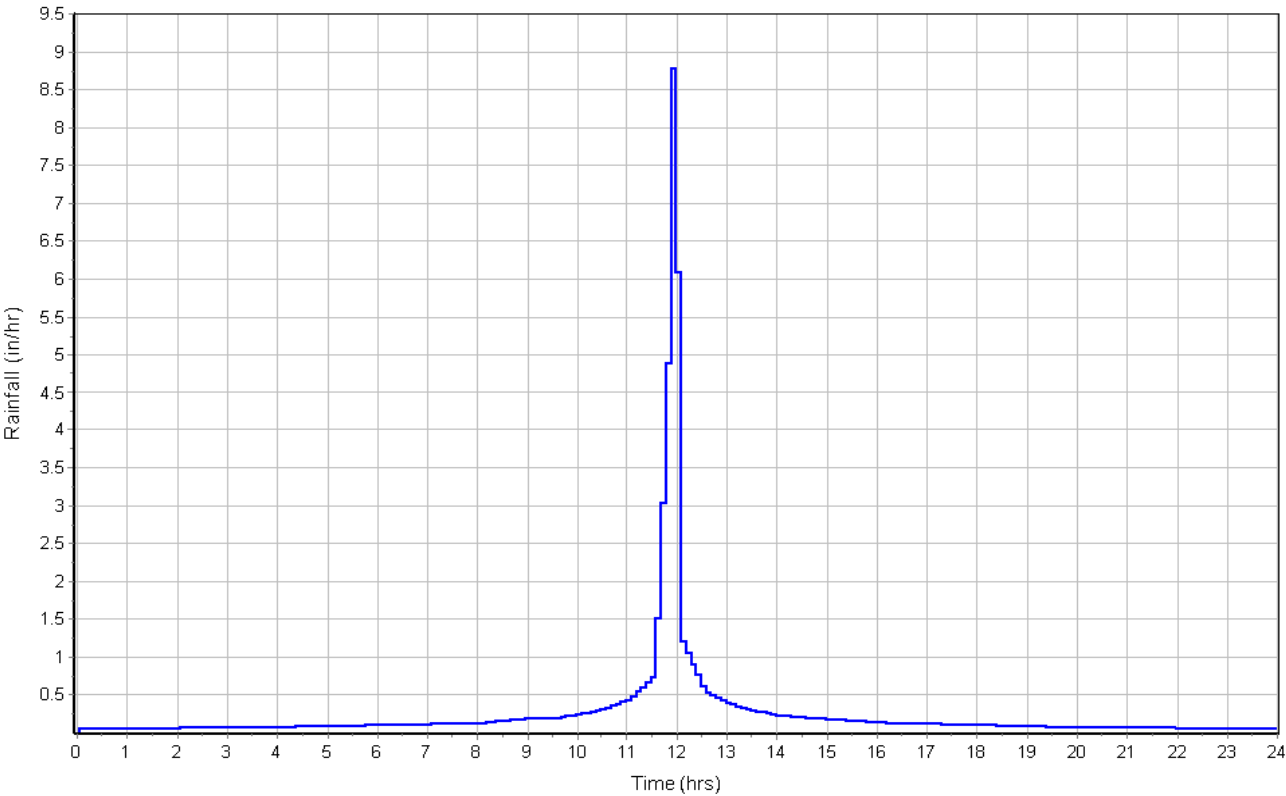
Subbasin Runoff Results

Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 1.58  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:25:35

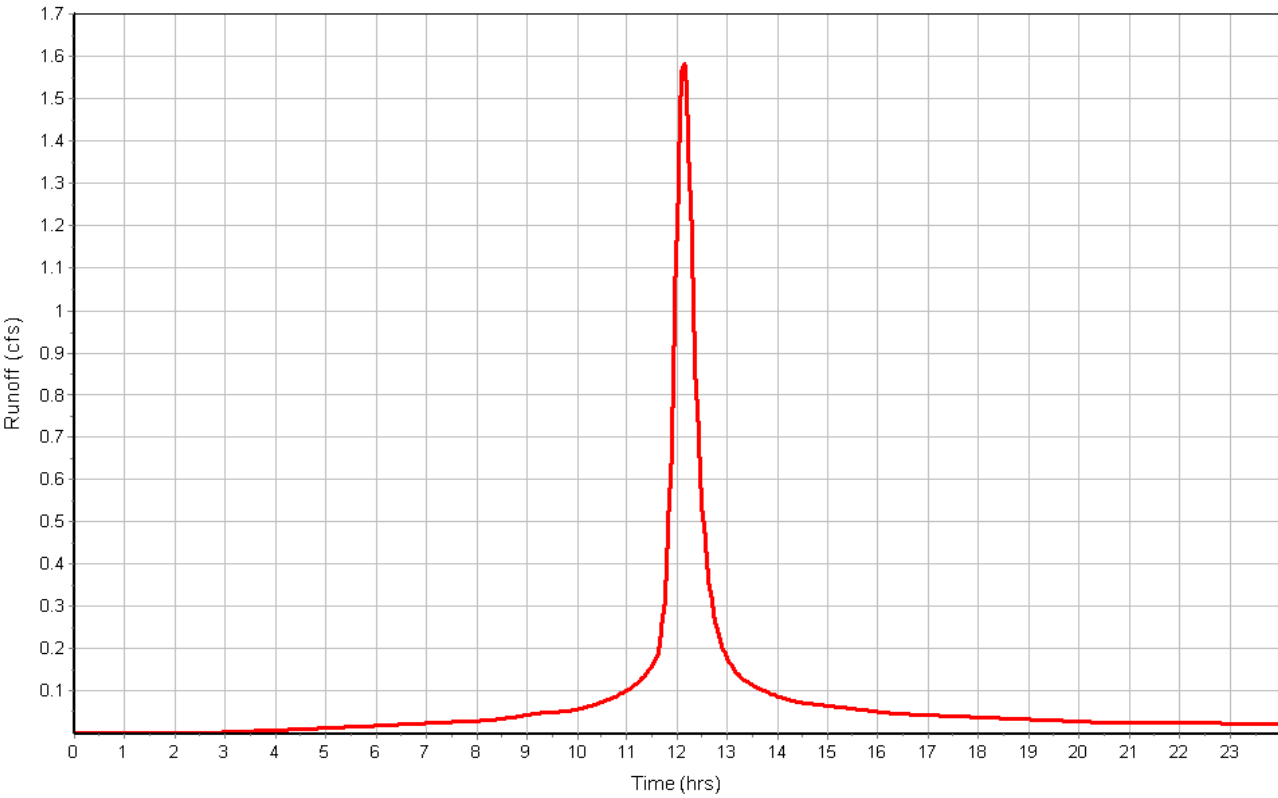


Subbasin : B3d

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3e

Input Data

Area (ac) ..... 1.33  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

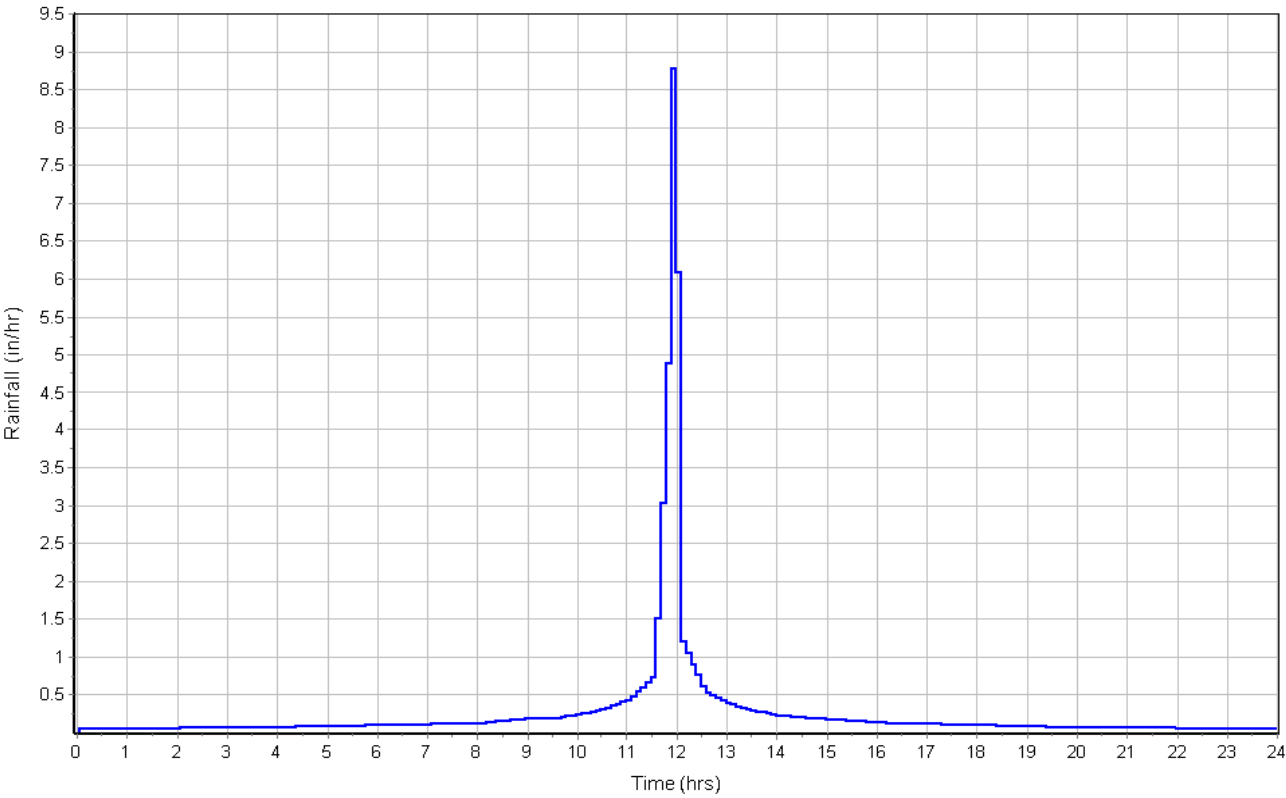
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	1.33	-	93.00
Composite Area & Weighted CN	1.33		93.00

Subbasin Runoff Results

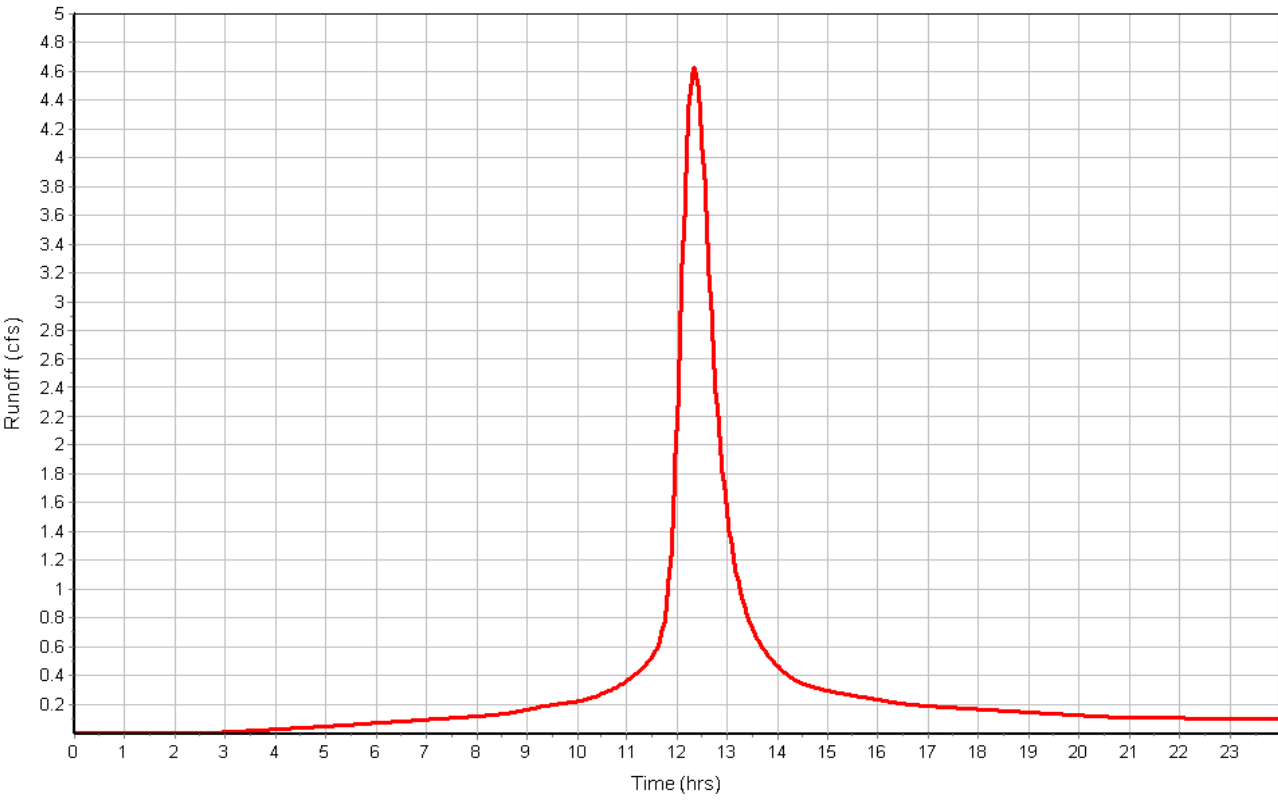
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 4.63  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:47:02

Subbasin : B3e

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3f

Input Data

Area (ac) ..... 0.44  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

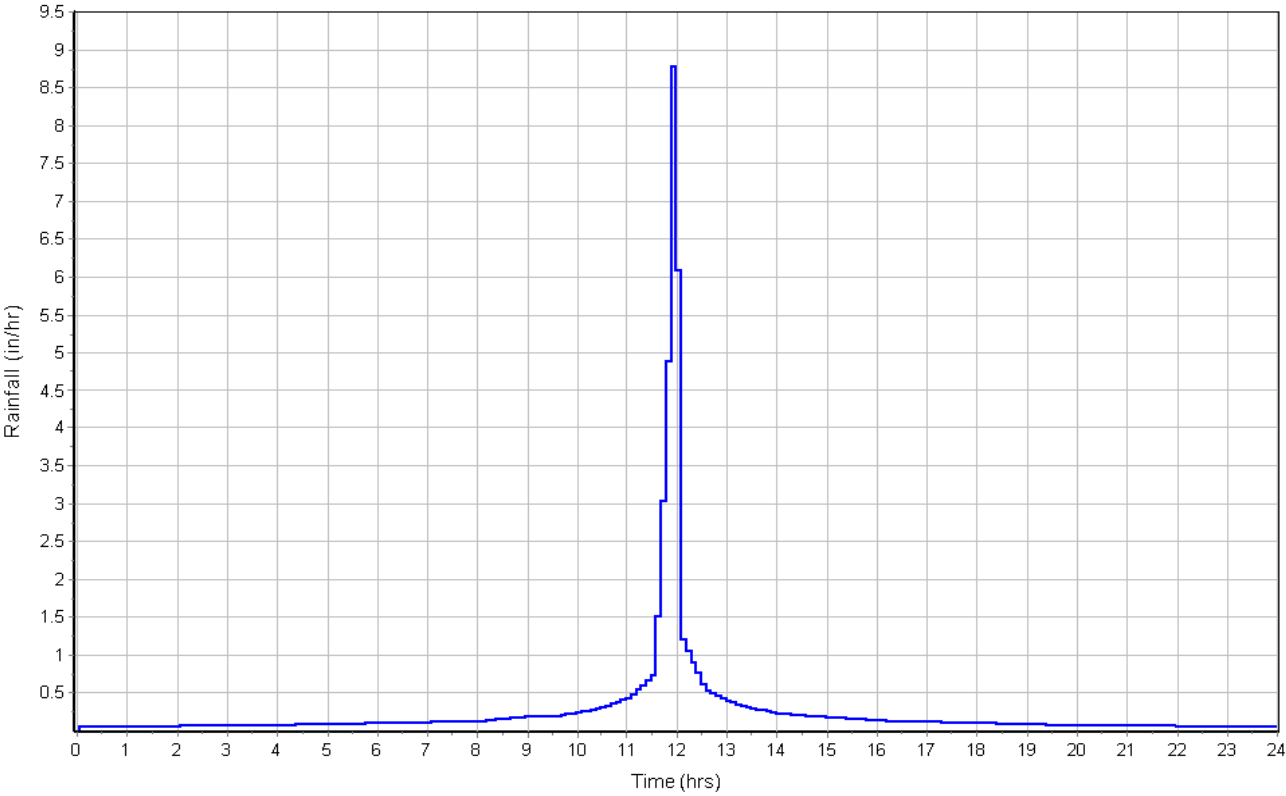
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.44	-	93.00
Composite Area & Weighted CN	0.44		93.00

Subbasin Runoff Results

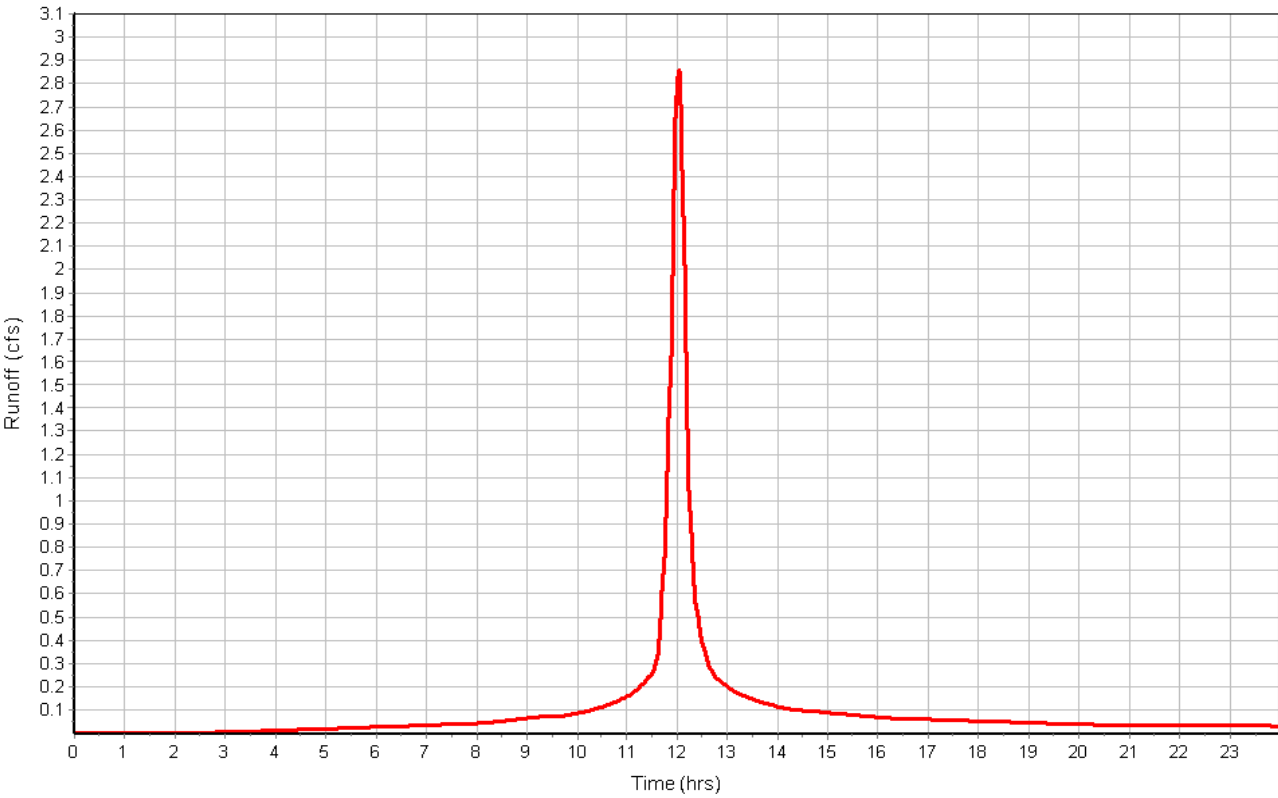
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 2.87  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:14:06

Subbasin : B3f

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3g

Input Data

Area (ac) ..... 1.55  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

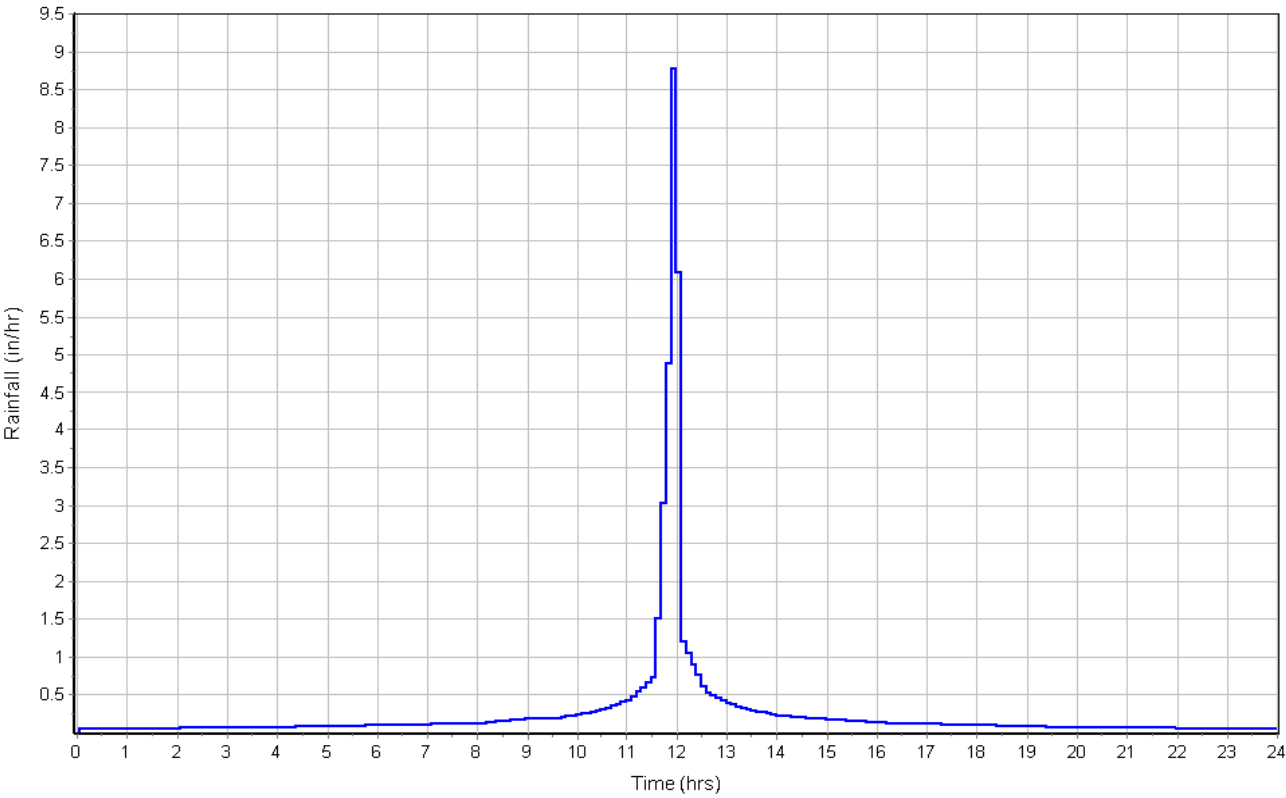
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	1.55	-	93.00
Composite Area & Weighted CN	1.55		93.00

Subbasin Runoff Results

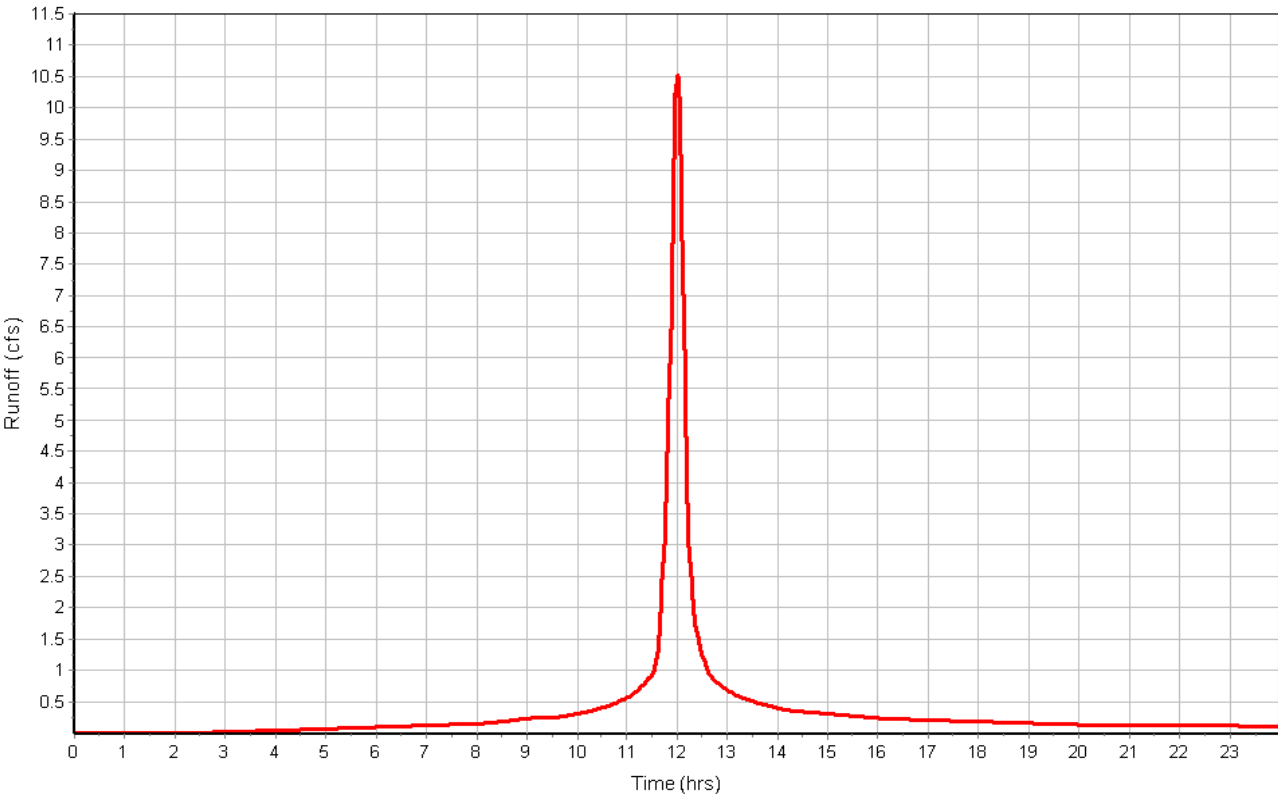
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 10.52  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:12:01

Subbasin : B3g

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3h

Input Data

Area (ac) ..... 0.38  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.38	-	93.00
Composite Area & Weighted CN	0.38		93.00

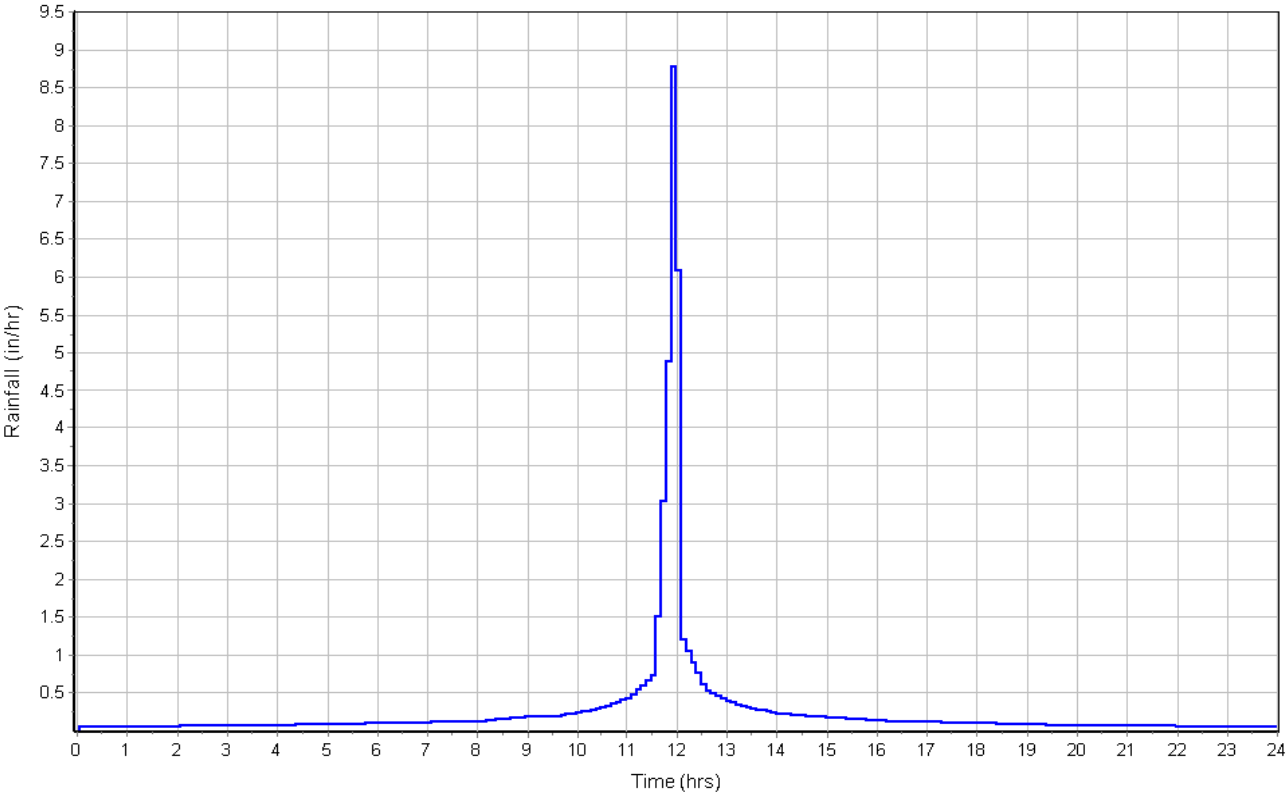
Subbasin Runoff Results

Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 2.68  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

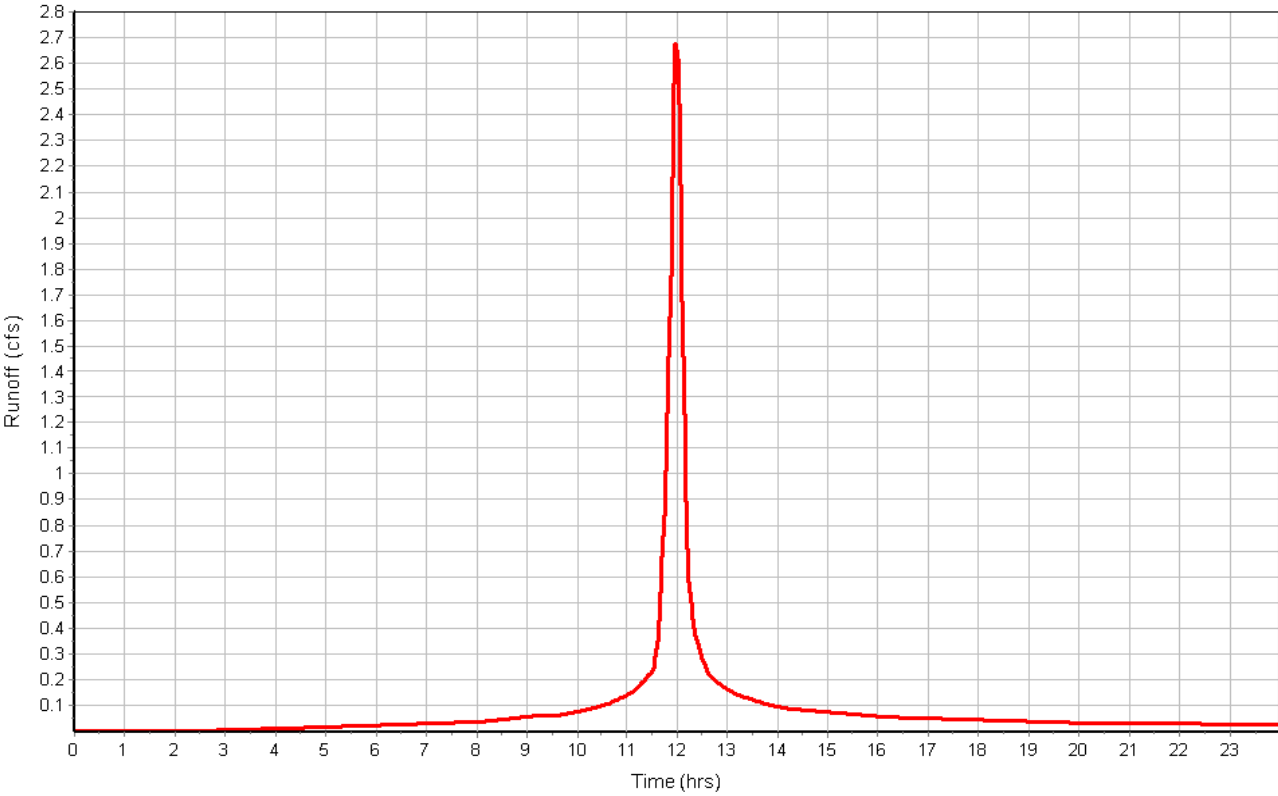


Subbasin : B3h

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B4a

Input Data

Area (ac) ..... 1.72  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

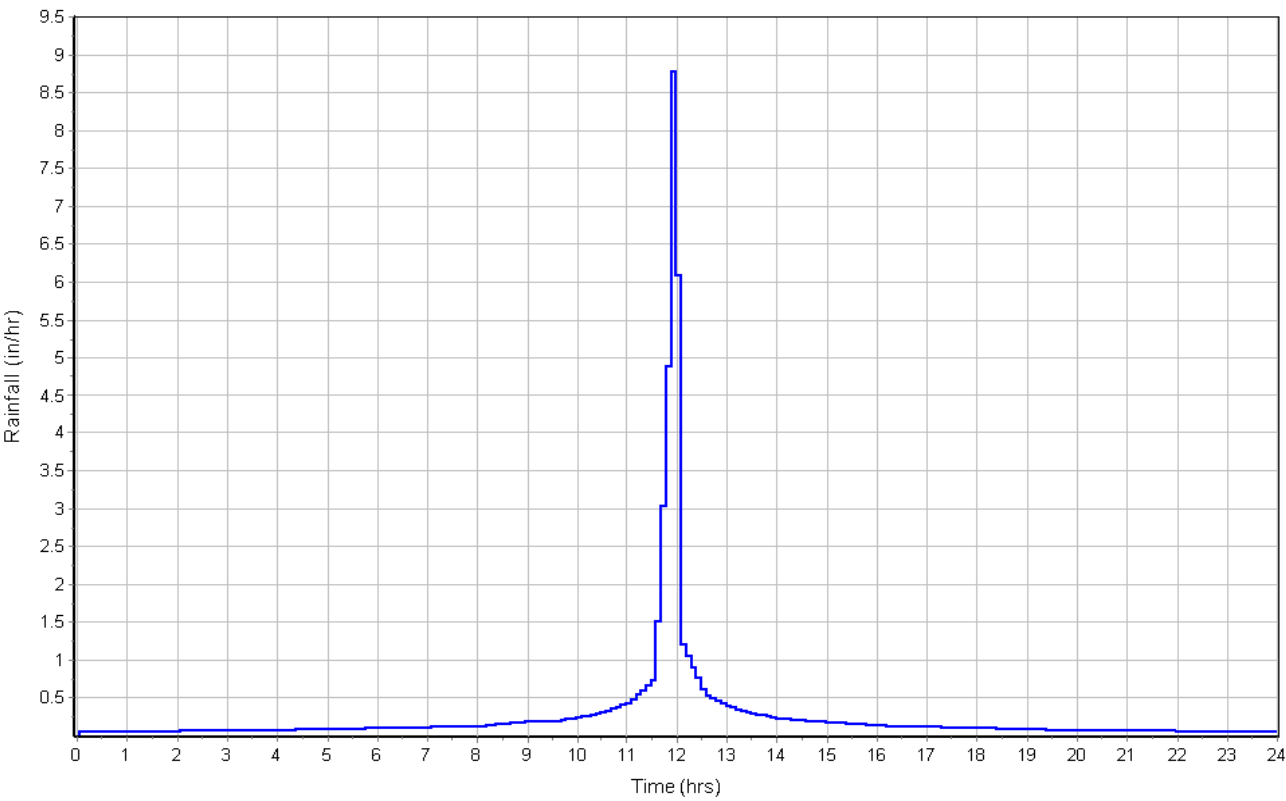
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	1.72	-	93.00
Composite Area & Weighted CN	1.72		93.00

Subbasin Runoff Results

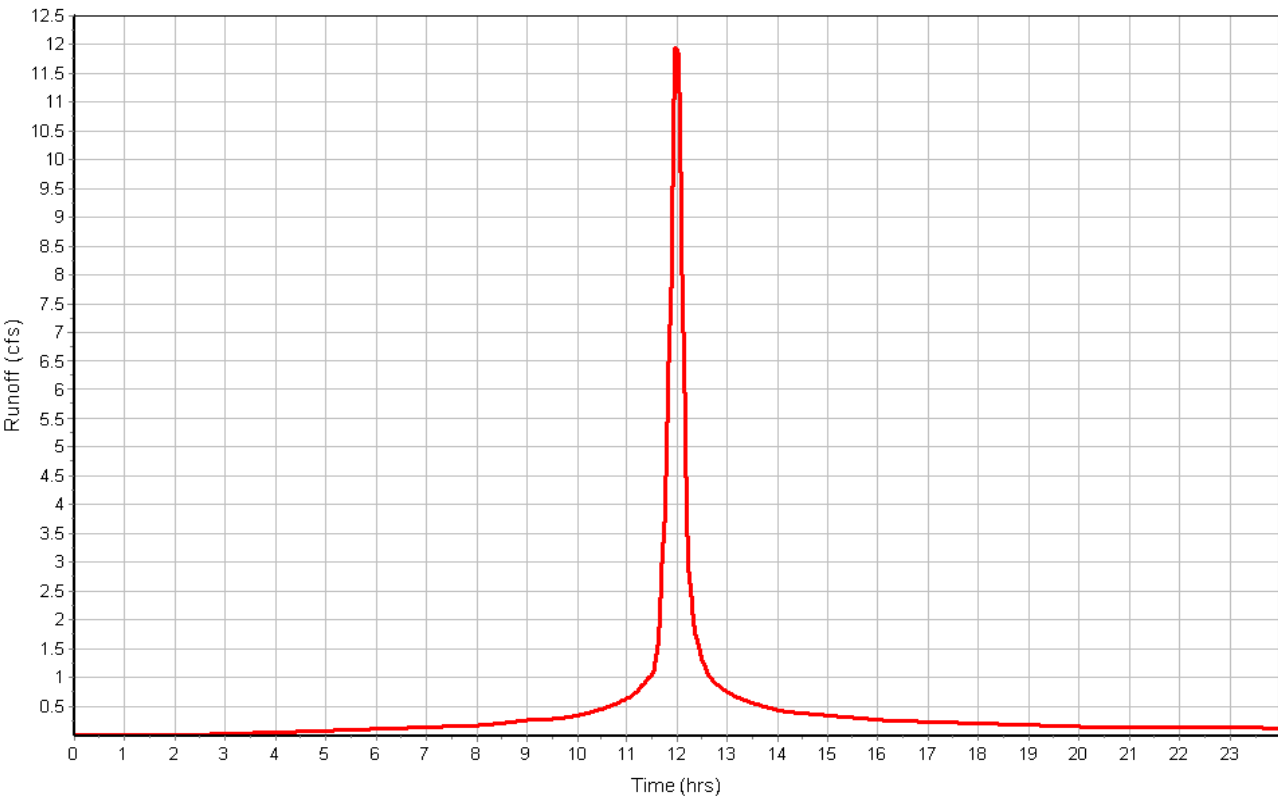
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 12.02  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:44

Subbasin : B4a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B4b

Input Data

Area (ac) ..... 0.28  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

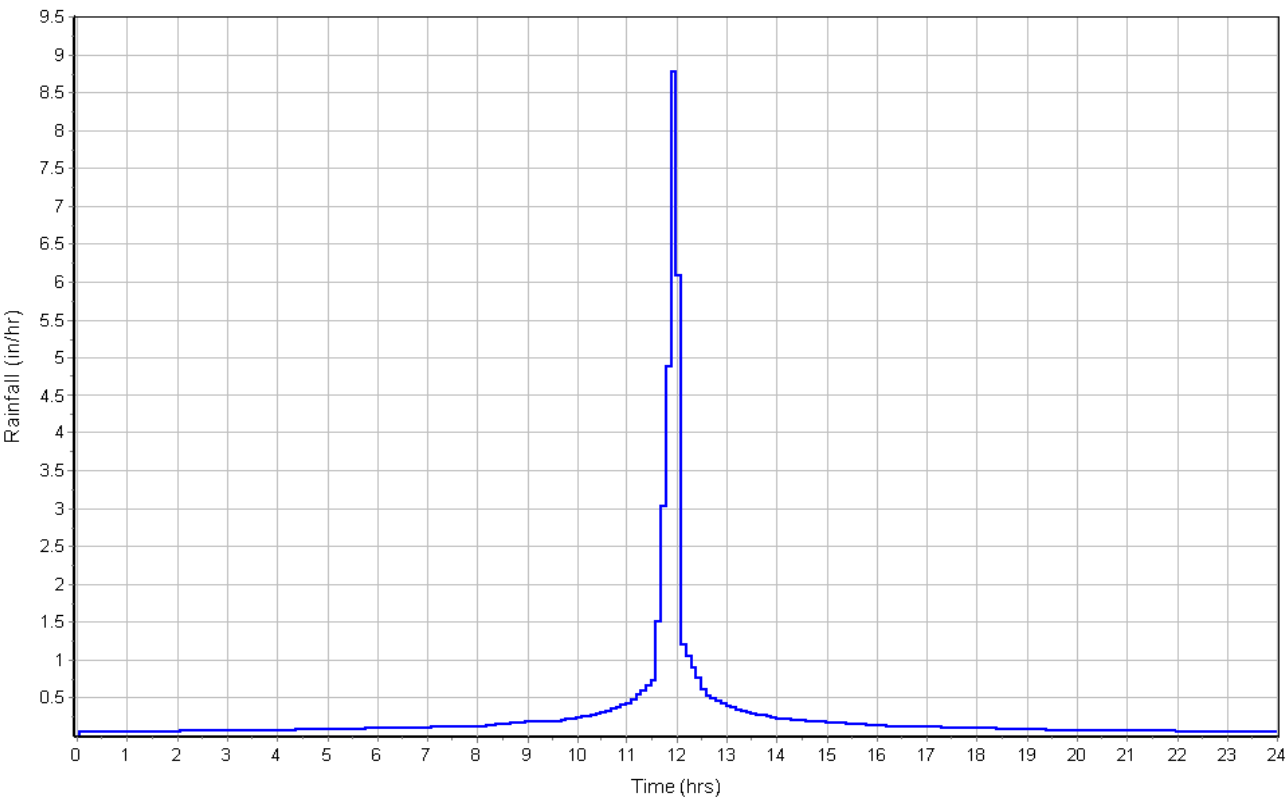
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.28	-	93.00
Composite Area & Weighted CN	0.28		93.00

Subbasin Runoff Results

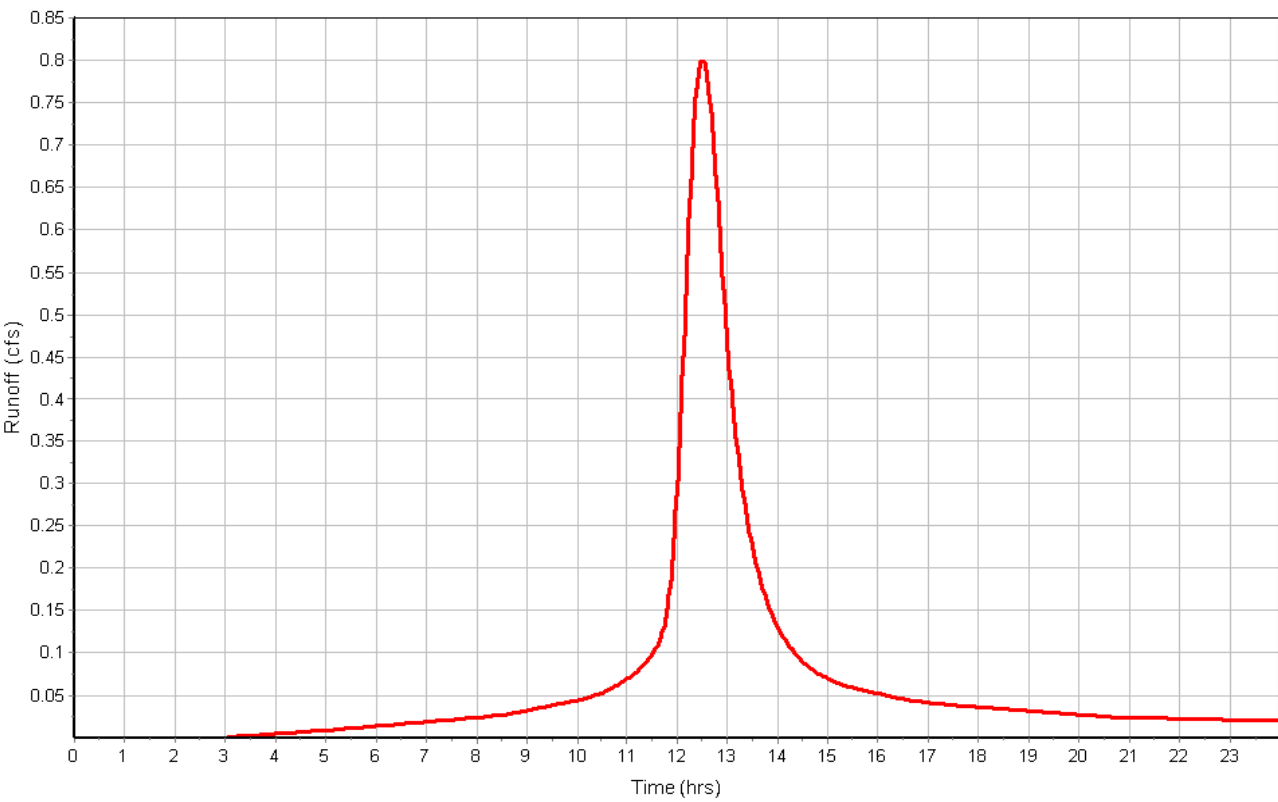
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 0.80  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 01:03:25

Subbasin : B4b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B4c

Input Data

Area (ac) ..... 0.23  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

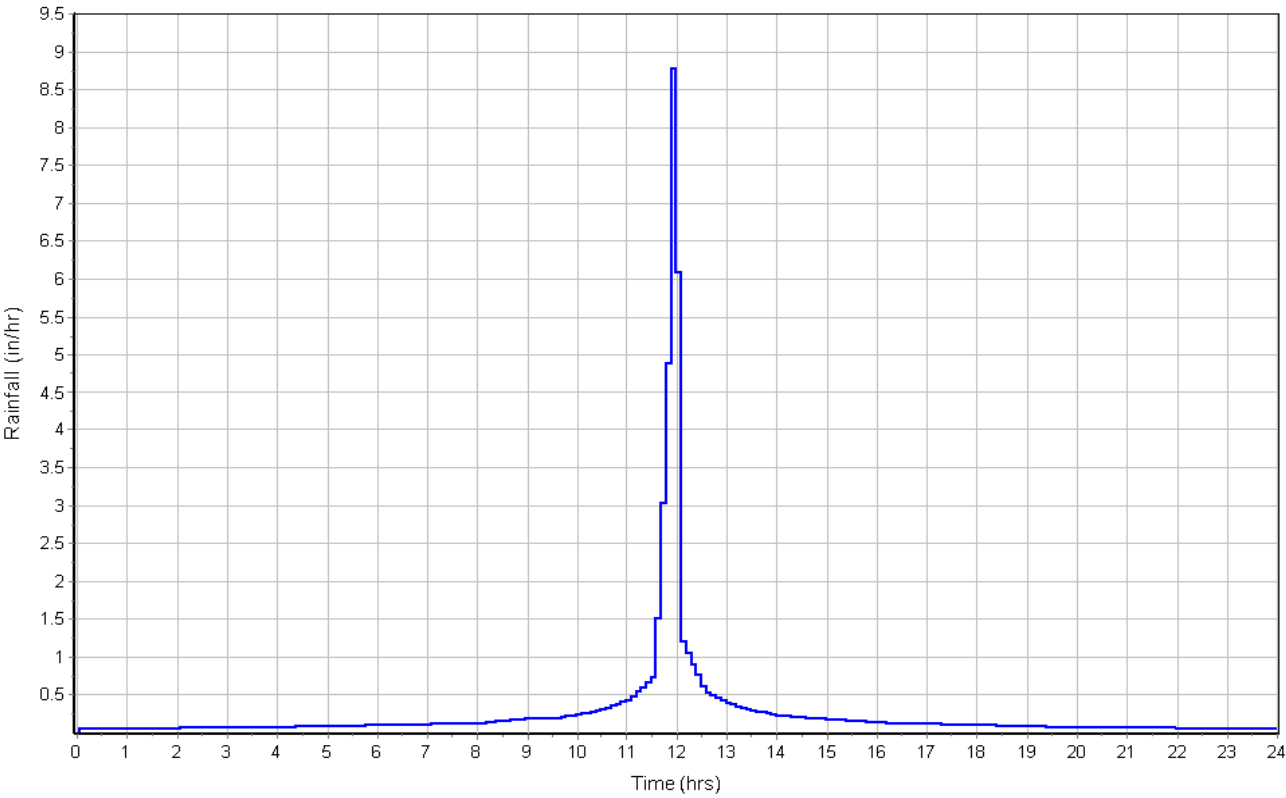
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.23	-	93.00
Composite Area & Weighted CN	0.23		93.00

Subbasin Runoff Results

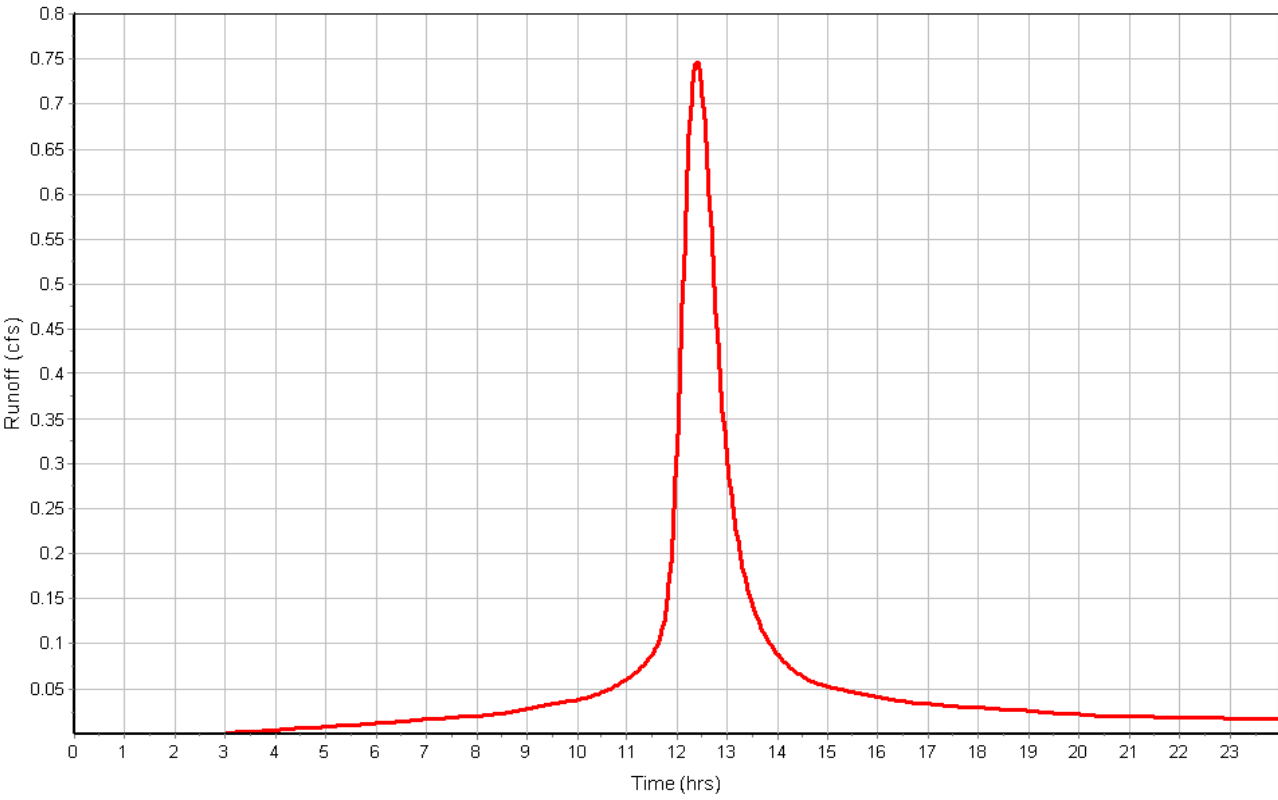
Total Rainfall (in) ..... 6.40  
Total Runoff (in) ..... 5.58  
Peak Runoff (cfs) ..... 0.75  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:52:31

Subbasin : B4c

Rainfall Intensity Graph



Runoff Hydrograph



## Vanguard Farms Apartments

SN Element ID	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft²)	(in)
1 B1-4	672.61	675.45	2.83	672.61	0.00	675.45	0.00	0.00	0.00
2 B2-2	673.36	677.74	4.38	673.36	0.00	677.74	0.00	0.00	0.00
3 B2-5	674.47	677.61	3.14	674.47	0.00	677.61	0.00	0.00	0.00
4 B3-3	671.02	674.58	3.56	671.02	0.00	674.58	0.00	0.00	0.00
5 B3-7	673.67	679.16	5.50	673.67	0.00	679.16	0.00	0.00	0.00
6 B3-8	674.52	679.79	5.27	674.52	0.00	679.79	0.00	0.00	0.00
7 B3-9	674.89	679.79	4.90	674.89	0.00	679.79	0.00	0.00	0.00
8 DRIVE B1a	678.19	6.00	-672.19	0.00	-678.19	0.00	-6.00	0.00	0.00
9 DRIVE B1b	679.17	6.00	-673.17	0.00	-679.17	0.00	-6.00	0.00	0.00
10 DRIVE B2a	679.85	6.00	-673.85	0.00	-679.85	0.00	-6.00	0.00	0.00
11 DRIVE B2b	675.31	6.00	-669.31	0.00	-675.31	0.00	-6.00	0.00	0.00
12 DRIVE B2c	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
13 DRIVE B2d	678.76	6.00	-672.76	0.00	-678.76	0.00	-6.00	0.00	0.00
14 DRIVE B3f	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
15 DRIVE B3g-1	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
16 DRIVE B3h	674.83	6.00	-668.83	0.00	-674.83	0.00	-6.00	0.00	0.00
17 OUTFALL B2	673.11	679.16	6.05	673.11	0.00	679.16	0.00	0.00	0.00
18 SDWK BOX B DUMMY	675.58	677.34	1.76	0.00	-675.58	0.00	-677.34	0.00	0.00



## Vanguard Farms Apartments

SN Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1 B1-4	30.74	0.00	673.88	1.27	0.00	1.57	672.74	0.13	0 12:05	0 00:00	0.00	0.00
2 B2-2	16.27	0.00	674.71	1.35	0.00	3.03	673.57	0.21	0 12:05	0 00:00	0.00	0.00
3 B2-5	8.95	0.00	675.85	1.38	0.00	1.76	674.67	0.20	0 12:03	0 00:00	0.00	0.00
4 B3-3	19.14	0.00	672.29	1.27	0.00	2.29	671.25	0.23	0 12:09	0 00:00	0.00	0.00
5 B3-7	6.10	0.00	674.49	0.82	0.00	4.67	673.89	0.22	0 12:10	0 00:00	0.00	0.00
6 B3-8	6.10	0.00	675.24	0.72	0.00	4.55	674.71	0.19	0 12:10	0 00:00	0.00	0.00
7 B3-9	3.07	0.00	675.47	0.58	0.00	4.32	675.07	0.18	0 12:10	0 00:00	0.00	0.00
8 DRIVE B1a	1.68	1.60	678.34	0.15	0.00	0.09	678.23	0.04	0 12:05	0 00:00	0.00	0.00
9 DRIVE B1b	1.50	1.50	679.30	0.13	0.00	0.11	679.20	0.03	0 12:00	0 00:00	0.00	0.00
10 DRIVE B2a	2.36	2.36	680.02	0.17	0.00	0.07	679.89	0.04	0 12:00	0 00:00	0.00	0.00
11 DRIVE B2b	2.62	2.54	679.22	3.91	0.00	0.06	679.08	3.77	0 12:00	0 00:00	0.00	0.00
12 DRIVE B2c	1.89	1.89	680.01	680.01	0.00	0.08	679.88	679.88	0 12:02	0 00:00	0.00	0.00
13 DRIVE B2d	2.53	2.50	678.93	0.17	0.00	0.06	678.79	0.03	0 12:00	0 00:00	0.00	0.00
14 DRIVE B3f	2.86	2.86	676.38	676.38	0.00	0.05	676.23	676.23	0 12:04	0 00:00	0.00	0.00
15 DRIVE B3g-1	10.52	10.52	678.82	678.82	0.00	0.00	678.64	678.64	0 11:55	0 12:02	0.36	12.00
16 DRIVE B3h	3.01	2.68	675.02	0.19	0.00	0.05	674.87	0.04	0 12:00	0 00:00	0.00	0.00
17 OUTFALL B2	30.75	0.00	674.41	1.30	0.00	4.75	673.27	0.16	0 12:05	0 00:00	0.00	0.00
18 SDWK BOX B DUMMY	14.85	11.94	676.50	0.92	0.00	0.84	675.68	0.10	0 12:02	0 00:00	0.00	0.00

## Vanguard Farms Apartments

SN Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Shape Slope	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)	(ft)	(ft)					(cfs)	
1 CHANNEL B 1	621.36	675.58	0.00	673.11	0.00	2.47	0.4000 Trapezoidal	1.250	13.500	0.0400	0.0000	0.0000	0.0000	0.00	No
2 CHANNEL B 2	123.46	673.11	0.00	672.61	0.00	0.50	0.4000 User-Defined	1.310	13.500	0.0240	0.0000	0.0000	0.0000	0.00	No
3 CHANNEL B DUMMY	1.00	677.34	1.76	675.58	0.00	1.76	176.4000 Trapezoidal	1.250	13.500	0.0400	0.0000	0.0000	0.0000	0.00	No
4 DRIVE B1a	172.00	678.19	0.00	677.34	1.76	0.85	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
5 DRIVE B1a DUMMY	1.00	678.20	3.32	678.19	0.00	0.01	0.5000 Triangular	0.240	24.000	0.0320	0.0000	0.0000	0.0000	0.00	No
6 DRIVE B1b	165.84	679.17	0.00	677.34	1.76	1.83	1.1000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
7 DRIVE B2a	163.00	679.85	0.00	679.04	3.73	0.81	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
8 DRIVE B2b	169.00	679.04	3.74	678.20	3.32	0.84	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
9 DRIVE B2b DUMMY	1.00	679.04	3.73	675.31	0.00	3.74	373.5300 Triangular	0.240	24.000	0.0320	0.0000	0.0000	0.0000	0.00	No
10 DRIVE B2c	218.00	679.85	679.85	678.76	3.65	1.09	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
11 DRIVE B2d	182.72	678.76	0.00	677.85	3.20	0.90	0.4900 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
12 DRIVE B2d DUMMY	1.00	678.76	3.65	678.76	0.00	0.01	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
13 DRIVE B2e	125.00	677.85	3.20	677.22	3.02	0.63	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
14 DRIVE B3f	124.52	676.19	676.19	675.57	3.37	0.62	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
15 DRIVE B3g-1	400.00	678.58	678.58	674.84	3.31	3.74	0.9400 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
16 DRIVE B3g-2	145.00	675.57	3.37	674.84	3.31	0.73	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
17 DRIVE B3h	185.00	674.83	0.00	673.91	3.25	0.93	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No
18 DRIVE B3h DUMMY	1.00	674.84	3.31	674.83	0.00	0.01	0.6000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00	No

## Vanguard Farms Apartments

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 CHANNEL B 1	14.49	0 12:05	26.12	0.55	1.98	5.23	0.91	0.73	0.00		
2 CHANNEL B 2	30.74	0 12:05	82.56	0.37	5.01	0.41	0.79	0.60	0.00		
3 CHANNEL B DUMMY	3.06	0 12:04	550.73	0.01	7.72	0.00	0.06	0.05	0.00		
4 DRIVE B1a	1.68	0 12:06	5.64	0.30	1.47	1.95	0.15	0.63	0.00		
5 DRIVE B1a DUMMY	0.11	0 12:02	2.30	0.05	0.37	0.05	0.08	0.32	0.00		
6 DRIVE B1b	1.48	0 12:01	8.41	0.18	1.91	1.45	0.12	0.52	0.00		
7 DRIVE B2a	2.34	0 12:02	5.64	0.41	1.59	1.71	0.17	0.72	0.00		
8 DRIVE B2b	2.60	0 12:02	5.66	0.46	1.64	1.72	0.18	0.75	0.00		
9 DRIVE B2b DUMMY	0.08	0 12:02	62.88	0.00	4.15	0.00	0.02	0.08	0.00		
10 DRIVE B2c	1.88	0 12:03	5.66	0.33	1.53	2.37	0.16	0.66	0.00		
11 DRIVE B2d	2.51	0 12:02	5.63	0.45	1.62	1.88	0.18	0.74	0.00		
12 DRIVE B2d DUMMY	0.05	0 12:03	5.68	0.01	0.59	0.03	0.04	0.16	0.00		
13 DRIVE B2e	0.09	0 12:04	5.68	0.02	0.88	2.37	0.05	0.21	0.00		
14 DRIVE B3f	2.85	0 12:04	5.66	0.50	1.67	1.24	0.19	0.77	0.00		
15 DRIVE B3g-1	7.75	0 11:57	7.75	1.00	2.85	2.34	0.24	1.00	11.00		
16 DRIVE B3g-2	0.05	0 12:07	5.68	0.01	0.81	2.98	0.04	0.17	0.00		
17 DRIVE B3h	2.99	0 12:02	5.66	0.53	1.69	1.82	0.19	0.79	0.00		
18 DRIVE B3h DUMMY	0.34	0 12:07	6.18	0.05	1.04	0.02	0.08	0.34	0.00		

## Vanguard Farms Apartments

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	B1-1	27.44	670.68	0.00	670.57	0.00	0.11	0.4000	Rectangular	24.000	60.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
2	B1-2	325.38	671.98	0.00	670.78	0.10	1.20	0.3700	Rectangular	24.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
3	B1-3	135.92	672.61	0.00	672.08	0.10	0.54	0.4000	Rectangular	24.000	48.000	0.0130	0.2000	0.5000	0.0000	0.00	No	1
4	B2-1	81.97	673.36	0.00	673.16	0.05	0.20	0.2400	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
5	B2-2	126.09	673.76	0.00	673.46	0.10	0.30	0.2400	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
6	B2-3	171.36	674.20	0.00	673.86	0.10	0.34	0.2000	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
7	B2-4	86.66	674.47	0.00	674.30	0.10	0.17	0.2000	Rectangular	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
8	B2-5	41.89	674.65	0.00	674.57	0.10	0.08	0.2000	Rectangular	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
9	B2-6	61.04	674.87	0.00	674.75	0.10	0.12	0.2000	CIRCULAR	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
10	B2-7	170.14	675.31	0.00	674.97	0.10	0.34	0.2000	Rectangular	24.000	24.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
11	B2c-1	182.72	675.12	0.00	674.75	0.10	0.37	0.2000	Rectangular	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
12	B3-1	33.76	670.66	0.00	670.57	0.00	0.09	0.2700	Rectangular	24.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
13	B3-2	96.98	671.02	0.00	670.76	0.10	0.26	0.2700	Rectangular	24.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
14	B3-3	101.12	671.52	0.00	671.12	0.10	0.40	0.4000	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
15	B3-4	143.96	672.20	0.00	671.62	0.10	0.58	0.4000	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
16	B3-5	87.13	672.88	0.00	672.30	0.10	0.58	0.6700	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
17	B3-6	116.41	673.67	0.00	672.88	0.00	0.78	0.6700	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
18	B3-7	112.25	674.52	0.00	673.77	0.10	0.75	0.6700	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
19	B3-8	40.25	674.89	0.00	674.62	0.10	0.27	0.6700	CIRCULAR	24.000	24.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
20	B3-9	87.75	675.58	0.00	674.99	0.10	0.59	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
21	B3b-1	68.38	675.45	0.00	674.99	0.10	0.46	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
22	B3c-1	75.08	675.12	0.00	674.62	0.10	0.50	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
23	B3d-1	51.50	674.97	0.00	674.62	0.10	0.35	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1

## Vanguard Farms Apartments

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 B1-1	31.54	0 12:06	57.77	0.55	5.94	0.08	1.06	0.53	0.00		Calculated
2 B1-2	31.09	0 12:06	42.38	0.73	5.95	0.91	1.31	0.65	0.00		Calculated
3 B1-3	30.74	0 12:05	43.95	0.70	6.08	0.37	1.27	0.63	0.00		Calculated
4 B2-1	16.26	0 12:05	23.90	0.68	4.34	0.31	1.25	0.62	0.00		Calculated
5 B2-2	16.27	0 12:05	23.90	0.68	4.34	0.48	1.24	0.62	0.00		Calculated
6 B2-3	12.87	0 12:04	21.82	0.59	3.82	0.75	1.12	0.56	0.00		Calculated
7 B2-4	8.95	0 12:03	12.88	0.69	3.49	0.41	1.28	0.64	0.00		Calculated
8 B2-5	8.95	0 12:03	12.88	0.69	3.48	0.20	1.28	0.64	0.00		Calculated
9 B2-6	4.74	0 12:02	10.12	0.47	3.17	0.32	0.96	0.48	0.00		Calculated
10 B2-7	2.26	0 12:02	11.16	0.20	2.18	1.30	0.52	0.26	0.00		Calculated
11 B2c-1	1.83	0 12:04	12.88	0.14	2.25	1.35	0.41	0.20	0.00		Calculated
12 B3-1	21.17	0 12:09	36.26	0.58	4.75	0.12	1.11	0.56	0.00		Calculated
13 B3-2	19.13	0 12:09	36.26	0.53	4.61	0.35	1.04	0.52	0.00		Calculated
14 B3-3	19.14	0 12:09	30.86	0.62	5.46	0.31	1.16	0.58	0.00		Calculated
15 B3-4	11.84	0 12:11	30.86	0.38	4.76	0.50	0.83	0.41	0.00		Calculated
16 B3-5	10.10	0 12:14	21.90	0.46	6.83	0.21	0.95	0.48	0.00		Calculated
17 B3-6	6.10	0 12:11	21.90	0.28	5.97	0.32	0.72	0.36	0.00		Calculated
18 B3-7	6.10	0 12:10	21.88	0.28	5.97	0.31	0.72	0.36	0.00		Calculated
19 B3-8	3.07	0 12:10	20.06	0.15	4.62	0.15	0.53	0.26	0.00		Calculated
20 B3-9	1.48	0 12:12	3.45	0.43	4.22	0.35	0.46	0.46	0.00		Calculated
21 B3b-1	1.61	0 12:10	3.45	0.47	4.32	0.26	0.48	0.48	0.00		Calculated
22 B3c-1	1.48	0 12:12	3.45	0.43	4.22	0.30	0.46	0.46	0.00		Calculated
23 B3d-1	1.58	0 12:10	3.45	0.46	4.30	0.20	0.48	0.48	0.00		Calculated

## Vanguard Farms Apartments

SN Element ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Max (Rim) Elevation (ft)	Inlet Depth (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Ponded Area (ft²)	Grate Clogging Factor (%)
1 B1-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.68	674.37	3.69	670.68	0.00	0.00	0.00
2 B1-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	671.98	675.90	3.92	671.98	0.00	0.00	0.00
3 B2-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	673.76	677.31	3.55	673.76	0.00	0.00	0.00
4 B2-4	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.20	677.22	3.02	674.20	0.00	0.00	0.00
5 B2-6	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.65	677.85	3.20	674.65	0.00	N/A	0.00
6 B2-7	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.87	678.20	3.32	674.87	0.00	N/A	0.00
7 B2-8	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.31	679.04	3.73	675.31	0.00	N/A	0.00
8 B2c-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.12	678.76	3.65	675.12	0.00	N/A	0.00
9 B3-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.66	673.91	3.25	670.66	0.00	0.00	0.00
10 B3-4	FHWA HEC-22 GENERIC	N/A	On Grade	1	671.52	674.84	3.31	671.52	0.00	N/A	0.00
11 B3-5	FHWA HEC-22 GENERIC	N/A	On Grade	1	672.20	675.57	3.37	672.20	0.00	N/A	0.00
12 B3-6	FHWA HEC-22 GENERIC	N/A	On Sag	1	672.88	676.10	3.22	672.88	0.00	0.00	0.00
13 INLET B3a	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	679.17	3.59	675.58	0.00	0.00	0.00
14 INLET B3b	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.45	678.68	3.23	675.45	0.00	0.00	0.00
15 INLET B3c	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.12	679.17	4.05	675.12	0.00	0.00	0.00
16 INLET B3d	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.97	678.67	3.71	674.97	0.00	0.00	0.00
17 SDWK BOX B	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	677.34	1.76	0.00	0.00	0.00	0.00

## Vanguard Farms Apartments

SN Element ID	Roadway Longitudinal Slope (ft/ft)	Roadway Cross Slope (ft/ft)	Roadway Manning's Roughness	Gutter Cross Slope (ft/ft)	Gutter Width (ft)	Gutter Depression (in)	Allowable Spread (ft)
1 B1-2	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
2 B1-3	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
3 B2-3	N/A	0.0200	0.0160	0.0620	1.50	0.1640	7.00
4 B2-4	N/A	0.0200	0.0160	0.0620	1.50	0.1640	7.00
5 B2-6	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
6 B2-7	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
7 B2-8	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
8 B2c-1	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
9 B3-2	N/A	0.0200	0.0160	0.0620	1.50	0.1640	7.00
10 B3-4	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
11 B3-5	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
12 B3-6	N/A	0.0200	0.0160	0.0620	2.00	0.1640	7.00
13 INLET B3a	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
14 INLET B3b	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
15 INLET B3c	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
16 INLET B3d	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
17 SDWK BOX B	N/A	0.0200	0.0130	0.0620	1.50	0.1640	7.00

## Vanguard Farms Apartments

SN Element ID	Peak Flow	Peak Lateral Inflow	Peak Flow Intercepted	Peak Flow Bypassing Inlet	Inlet Efficiency during Peak	Max Gutter Spread during Peak	Max Gutter Water Elev. during Peak	Max Gutter Water Depth during Peak	Time of Max Depth Occurrence	Total Flooded Volume	Total Time Flooded
	(cfs)	(cfs)	(cfs)	(cfs)	Flow (%)	Flow (ft)	Flow (ft)	Flow (ft)	(days hh:mm)	(ac-in)	(min)
1 B1-2	0.75	0.75	N/A	N/A	N/A	4.61	674.65	0.28	0 12:06	0.00	0.00
2 B1-3	0.80	0.80	N/A	N/A	N/A	4.93	676.20	0.30	0 12:05	0.00	0.00
3 B2-3	3.53	3.53	N/A	N/A	N/A	14.24	678.08	0.76	0 12:04	0.00	0.00
4 B2-4	3.99	3.89	N/A	N/A	N/A	14.94	678.00	0.78	0 12:03	0.00	0.00
5 B2-6	2.51	0.00	2.42	0.10	96.13	11.27	678.14	0.29	0 12:02	0.00	0.00
6 B2-7	2.60	0.00	2.49	0.11	95.91	11.41	678.49	0.29	0 12:02	0.00	0.00
7 B2-8	2.34	0.00	2.26	0.08	96.49	10.93	679.32	0.28	0 12:02	0.00	0.00
8 B2c-1	1.88	0.00	1.83	0.05	97.57	10.00	679.02	0.26	0 12:03	0.00	0.00
9 B3-2	2.99	0.00	N/A	N/A	N/A	12.79	674.64	0.73	0 12:09	0.00	0.00
10 B3-4	7.80	0.00	7.46	0.34	95.65	17.53	675.25	0.41	0 12:09	0.00	0.00
11 B3-5	2.85	0.00	2.80	0.05	98.08	11.84	675.87	0.30	0 12:14	0.00	0.00
12 B3-6	4.63	4.63	N/A	N/A	N/A	12.71	676.86	0.76	0 12:14	0.00	0.00
13 INLET B3a	1.48	1.48	N/A	N/A	N/A	6.14	679.55	0.37	0 12:12	0.00	0.00
14 INLET B3b	1.61	1.61	N/A	N/A	N/A	6.96	679.07	0.39	0 12:10	0.00	0.00
15 INLET B3c	1.48	1.48	N/A	N/A	N/A	6.14	679.55	0.37	0 12:12	0.00	0.00
16 INLET B3d	1.58	1.58	N/A	N/A	N/A	6.77	679.06	0.39	0 12:10	0.00	0.00
17 SDWK BOX B	3.05	0.00	N/A	N/A	N/A	15.47	678.13	0.79	0 00:00	0.00	0.00



# Attachment M

Proposed Conditions

Hydrologic/Hydraulic Calculations –  
Drainage Area B (2 year)

## Vanguard Farms Apartments

File Name ..... 323.001\_STRM.SPF

### Project Options

Flow Units ..... CFS  
 Elevation Type ..... Elevation  
 Hydrology Method ..... SCS TR-20  
 Time of Concentration (TOC) Method ..... User-Defined  
 Link Routing Method ..... Kinematic Wave  
 Enable Overflow Ponding at Nodes ..... YES  
 Skip Steady State Analysis Time Periods ..... NO

### Analysis Options

Start Analysis On ..... Jul 15, 2020 00:00:00  
 End Analysis On ..... Jul 16, 2020 00:00:00  
 Start Reporting On ..... Jul 15, 2020 00:00:00  
 Antecedent Dry Days ..... 0 days  
 Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss  
 Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss  
 Reporting Time Step ..... 0 00:02:00 days hh:mm:ss  
 Routing Time Step ..... 5 seconds

### Number of Elements

	Qty
Rain Gages .....	0
Subbasins.....	19
Nodes.....	37
<i>Junctions</i> .....	18
<i>Outfalls</i> .....	2
<i>Flow Diversions</i> .....	0
<i>Inlets</i> .....	17
<i>Storage Nodes</i> .....	0
Links.....	41
<i>Channels</i> .....	18
<i>Pipes</i> .....	23
<i>Pumps</i> .....	0
<i>Orifices</i> .....	0
<i>Weirs</i> .....	0
<i>Outlets</i> .....	0
Pollutants .....	0
Land Uses .....	0

## Vanguard Farms Apartments

SN	Subbasin ID	Area	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	B1a	0.27	93.00	3.52	2.75	0.73	0.82	0 00:17:52
2	B1b	0.21	93.00	3.52	2.75	0.58	0.77	0 00:10:00
3	B2a	0.33	93.00	3.52	2.75	0.91	1.21	0 00:10:00
4	B2b	0.36	93.00	3.52	2.75	0.99	1.31	0 00:10:00
5	B2c	0.28	93.00	3.52	2.75	0.76	0.98	0 00:11:18
6	B2d	0.35	93.00	3.52	2.75	0.97	1.28	0 00:10:00
7	B2e	0.65	93.00	3.52	2.75	1.79	2.00	0 00:17:51
8	B2f	0.63	93.00	3.52	2.75	1.74	1.82	0 00:20:46
9	B3a	0.32	93.00	3.52	2.75	0.88	0.76	0 00:30:09
10	B3b	0.32	93.00	3.52	2.75	0.88	0.83	0 00:25:34
11	B3c	0.32	93.00	3.52	2.75	0.88	0.76	0 00:30:09
12	B3d	0.32	93.00	3.52	2.75	0.87	0.81	0 00:25:34
13	B3e	1.33	93.00	3.52	2.75	3.65	2.36	0 00:47:02
14	B3f	0.44	93.00	3.52	2.75	1.21	1.47	0 00:14:06
15	B3g	1.55	93.00	3.52	2.75	4.26	5.41	0 00:12:00
16	B3h	0.38	93.00	3.52	2.75	1.05	1.38	0 00:10:00
17	B4a	1.72	93.00	3.52	2.75	4.74	6.18	0 00:10:43
18	B4b	0.28	93.00	3.52	2.75	0.77	0.41	0 01:03:25
19	B4c	0.23	93.00	3.52	2.75	0.64	0.38	0 00:52:31

## Vanguard Farms Apartments

SN Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1 B1-4	Junction	672.61	675.45	672.61	675.45	0.00	15.73	673.41	0.00	2.04	0 00:00	0.00	0.00
2 B2-2	Junction	673.36	677.74	673.36	677.74	0.00	8.40	674.24	0.00	3.50	0 00:00	0.00	0.00
3 B2-5	Junction	674.47	677.61	674.47	677.61	0.00	4.66	675.36	0.00	2.26	0 00:00	0.00	0.00
4 B3-3	Junction	671.02	674.58	671.02	674.58	0.00	10.63	671.89	0.00	2.69	0 00:00	0.00	0.00
5 B3-7	Junction	673.67	679.16	673.67	679.16	0.00	3.12	674.28	0.00	4.88	0 00:00	0.00	0.00
6 B3-8	Junction	674.52	679.79	674.52	679.79	0.00	3.12	675.03	0.00	4.76	0 00:00	0.00	0.00
7 B3-9	Junction	674.89	679.79	674.89	679.79	0.00	1.57	675.32	0.00	4.47	0 00:00	0.00	0.00
8 DRIVE B1a	Junction	678.19	6.00	0.00	0.00	0.00	0.83	678.31	0.00	0.12	0 00:00	0.00	0.00
9 DRIVE B1b	Junction	679.17	6.00	0.00	0.00	0.00	0.77	679.27	0.00	0.14	0 00:00	0.00	0.00
10 DRIVE B2a	Junction	679.85	6.00	0.00	0.00	0.00	1.21	679.98	0.00	0.11	0 00:00	0.00	0.00
11 DRIVE B2b	Junction	675.31	6.00	0.00	0.00	0.00	1.31	679.18	0.00	0.10	0 00:00	0.00	0.00
12 DRIVE B2c	Junction	0.00	6.00	0.00	6.00	0.00	0.97	679.97	0.00	0.12	0 00:00	0.00	0.00
13 DRIVE B2d	Junction	678.76	6.00	0.00	0.00	0.00	1.28	678.89	0.00	0.10	0 00:00	0.00	0.00
14 DRIVE B3f	Junction	0.00	6.00	0.00	6.00	0.00	1.47	676.33	0.00	0.10	0 00:00	0.00	0.00
15 DRIVE B3g-1	Junction	0.00	6.00	0.00	6.00	0.00	5.40	678.79	0.00	0.03	0 00:00	0.00	0.00
16 DRIVE B3h	Junction	674.83	6.00	0.00	0.00	0.00	1.47	674.98	0.00	0.10	0 00:00	0.00	0.00
17 OUTFALL B2	Junction	673.11	679.16	673.11	679.16	0.00	15.73	673.94	0.00	5.22	0 00:00	0.00	0.00
18 SDWK BOX B DUMMY	Junction	675.58	677.34	0.00	0.00	0.00	7.60	676.22	0.00	1.12	0 00:00	0.00	0.00
19 Out-1B1-1	Outfall	670.57					16.15	671.25					
20 Out-1B3-1	Outfall	670.57					11.91	671.32					

## Vanguard Farms Apartments

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	B1-1	Pipe	B1-2	Out-1B1-1	27.44	670.68	670.57	0.4000	24.000	0.0130	16.15	57.77	0.28	4.76	0.68	0.34	0.00
2	B1-2	Pipe	B1-3	B1-2	325.38	671.98	670.78	0.3700	24.000	0.0130	15.91	42.38	0.38	4.85	0.82	0.41	0.00
3	B1-3	Pipe	B1-4	B1-3	135.92	672.61	672.08	0.4000	24.000	0.0130	15.72	43.95	0.36	4.95	0.79	0.40	0.00
4	B2-1	Pipe	B2-2	OUTFALL B2	81.97	673.36	673.16	0.2400	24.000	0.0130	8.40	23.90	0.35	3.59	0.78	0.39	0.00
5	B2-2	Pipe	B2-3	B2-2	126.09	673.76	673.46	0.2400	24.000	0.0130	8.40	23.90	0.35	3.59	0.78	0.39	0.00
6	B2-3	Pipe	B2-4	B2-3	171.36	674.20	673.86	0.2000	24.000	0.0130	6.63	21.82	0.30	3.14	0.70	0.35	0.00
7	B2-4	Pipe	B2-5	B2-4	86.66	674.47	674.30	0.2000	24.000	0.0130	4.66	12.88	0.36	2.96	0.79	0.39	0.00
8	B2-5	Pipe	B2-6	B2-5	41.89	674.65	674.57	0.2000	24.000	0.0130	4.66	12.88	0.36	2.96	0.79	0.39	0.00
9	B2-6	Pipe	B2-7	B2-6	61.04	674.87	674.75	0.2000	24.000	0.0130	2.47	10.12	0.24	2.66	0.67	0.34	0.00
10	B2-7	Pipe	B2-8	B2-7	170.14	675.31	674.97	0.2000	24.000	0.0150	1.19	11.16	0.11	1.77	0.33	0.17	0.00
11	B2c-1	Pipe	B2c-1	B2-6	182.72	675.12	674.75	0.2000	24.000	0.0130	0.96	12.88	0.07	1.81	0.26	0.13	0.00
12	B3-1	Pipe	B3-2	Out-1B3-1	33.76	670.66	670.57	0.2700	24.000	0.0130	11.91	36.26	0.33	3.97	0.75	0.38	0.00
13	B3-2	Pipe	B3-3	B3-2	96.98	671.02	670.76	0.2700	24.000	0.0130	10.63	36.26	0.29	3.82	0.69	0.35	0.00
14	B3-3	Pipe	B3-4	B3-3	101.12	671.52	671.12	0.4000	24.000	0.0130	10.63	30.86	0.34	4.61	0.77	0.38	0.00
15	B3-4	Pipe	B3-5	B3-4	143.96	672.20	671.62	0.4000	24.000	0.0130	6.05	30.86	0.20	3.85	0.52	0.26	0.00
16	B3-5	Pipe	B3-6	B3-5	87.13	672.88	672.30	0.6700	24.000	0.0110	5.17	21.90	0.24	5.71	0.66	0.33	0.00
17	B3-6	Pipe	B3-7	B3-6	116.41	673.67	672.88	0.6700	24.000	0.0110	3.12	21.90	0.14	4.94	0.51	0.25	0.00
18	B3-7	Pipe	B3-8	B3-7	112.25	674.52	673.77	0.6700	24.000	0.0110	3.12	21.88	0.14	4.94	0.51	0.26	0.00
19	B3-8	Pipe	B3-9	B3-8	40.25	674.89	674.62	0.6700	24.000	0.0120	1.57	20.06	0.08	3.80	0.38	0.19	0.00
20	B3-9	Pipe	INLET B3a	B3-9	87.75	675.58	674.99	0.6700	12.000	0.0110	0.76	3.45	0.22	3.52	0.32	0.32	0.00
21	B3b-1	Pipe	INLET B3b	B3-9	68.38	675.45	674.99	0.6700	12.000	0.0110	0.83	3.45	0.24	3.61	0.33	0.33	0.00
22	B3c-1	Pipe	INLET B3c	B3-8	75.08	675.12	674.62	0.6700	12.000	0.0110	0.76	3.45	0.22	3.52	0.32	0.32	0.00
23	B3d-1	Pipe	INLET B3d	B3-8	51.50	674.97	674.62	0.6700	12.000	0.0110	0.81	3.45	0.24	3.59	0.33	0.33	0.00
24	CHANNEL B 1	Channel	SDWK BOX B DUMMY	OUTFALL B2	621.36	675.58	673.11	0.4000	15.000	0.0400	7.34	26.12	0.28	1.65	0.62	0.50	0.00
25	CHANNEL B 2	Channel	OUTFALL B2	B1-4	123.46	673.11	672.61	0.4000	15.720	0.0240	15.73	82.56	0.19	4.07	0.55	0.42	0.00
26	CHANNEL B DUMMY	Channel	SDWK BOX B	SDWK BOX B DUMMY	1.00	677.34	675.58	176.4000	15.000	0.0400	1.53	550.73	0.00	5.90	0.04	0.03	0.00
27	DRIVE B1a	Channel	DRIVE B1a	SDWK BOX B	172.00	678.19	677.34	0.5000	2.880	0.0130	0.83	5.64	0.15	1.23	0.12	0.49	0.00
28	DRIVE B1a DUMMY	Channel	B2-7	DRIVE B1a	1.00	678.20	678.19	0.5000	2.880	0.0320	0.02	2.30	0.01	0.23	0.04	0.16	0.00
29	DRIVE B1b	Channel	DRIVE B1b	SDWK BOX B	165.84	679.17	677.34	1.1000	2.880	0.0130	0.76	8.41	0.09	1.62	0.10	0.41	0.00
30	DRIVE B2a	Channel	DRIVE B2a	B2-8	163.00	679.85	679.04	0.5000	2.880	0.0130	1.20	5.64	0.21	1.36	0.13	0.56	0.00
31	DRIVE B2b	Channel	DRIVE B2b	B2-7	169.00	679.04	678.20	0.5000	2.880	0.0130	1.31	5.66	0.23	1.39	0.14	0.58	0.00
32	DRIVE B2b DUMMY	Channel	B2-8	DRIVE B2b	1.00	679.04	675.31	373.5300	2.880	0.0320	0.01	62.88	0.00	0.00	0.01	0.04	0.00
33	DRIVE B2c	Channel	DRIVE B2c	B2c-1	218.00	679.85	678.76	0.5000	2.880	0.0130	0.96	5.66	0.17	1.31	0.12	0.51	0.00
34	DRIVE B2d	Channel	DRIVE B2d	B2-6	182.72	678.76	677.85	0.4900	2.880	0.0130	1.27	5.63	0.23	1.38	0.14	0.57	0.00
35	DRIVE B2d DUMMY	Channel	B2c-1	DRIVE B2d	1.00	678.76	678.76	0.5000	2.880	0.0130	0.01	5.68	0.00	0.34	0.02	0.07	0.00
36	DRIVE B2e	Channel	B2-6	B2-4	125.00	677.85	677.22	0.5000	2.880	0.0130	0.01	5.68	0.00	0.94	0.02	0.10	0.00
37	DRIVE B3f	Channel	DRIVE B3f	B3-5	124.52	676.19	675.57	0.5000	2.880	0.0130	1.47	5.66	0.26	1.42	0.14	0.60	0.00
38	DRIVE B3g-1	Channel	DRIVE B3g-1	B3-4	400.00	678.58	674.84	0.9400	2.880	0.0130	5.35	7.75	0.69	2.53	0.21	0.87	0.00
39	DRIVE B3g-2	Channel	B3-5	B3-4	145.00	675.57	674.84	0.5000	2.880	0.0130	0.01	5.68	0.00	0.59	0.02	0.07	0.00
40	DRIVE B3h	Channel	DRIVE B3h	B3-2	185.00	674.83	673.91	0.5000	2.880	0.0130	1.47	5.66	0.26	1.44	0.14	0.60	0.00
41	DRIVE B3h DUMMY	Channel	B3-4	DRIVE B3h	1.00	674.84	674.83	0.6000	2.880	0.0130	0.13	6.18	0.02	0.82	0.06	0.24	0.00



## Vanguard Farms Apartments

SN Element ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation	Max (Rim) Elevation	Initial Water Elevation	Ponded Area	Peak Flow	Peak Flow Intercepted	Peak Flow Bypassing	Inlet Efficiency during Peak Flow	Allowable Spread	Max Gutter Spread during Peak Flow	Max Gutter Water Elev. during Peak Flow
					(ft)	(ft)	(ft)	(ft <sup>2</sup> )	(cfs)	(cfs)	(cfs)	(%)	(ft)	(ft)	(ft)
1 B1-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.68	674.37	670.68	0.00	0.38	N/A	N/A	N/A	7.00	2.34	674.51
2 B1-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	671.98	675.90	671.98	0.00	0.41	N/A	N/A	N/A	7.00	2.51	676.05
3 B2-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	673.76	677.31	673.76	0.00	1.81	N/A	N/A	N/A	7.00	10.28	678.00
4 B2-4	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.20	677.22	674.20	0.00	2.01	N/A	N/A	N/A	7.00	11.72	677.94
5 B2-6	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.65	677.85	674.65	N/A	1.27	1.26	0.02	98.81	7.00	8.51	678.09
6 B2-7	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.87	678.20	674.87	N/A	1.31	1.29	0.02	98.76	7.00	8.60	678.43
7 B2-8	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.31	679.04	675.31	N/A	1.20	1.19	0.01	98.96	7.00	8.30	679.27
8 B2c-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.12	678.76	675.12	N/A	0.96	0.96	0.01	99.47	7.00	7.57	678.98
9 B3-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.66	673.91	670.66	0.00	1.47	N/A	N/A	N/A	7.00	7.10	674.53
10 B3-4	FHWA HEC-22 GENERIC	N/A	On Grade	1	671.52	674.84	671.52	N/A	5.35	5.22	0.13	97.50	7.00	15.15	675.20
11 B3-5	FHWA HEC-22 GENERIC	N/A	On Grade	1	672.20	675.57	672.20	N/A	1.47	1.46	0.01	99.59	7.00	9.05	675.81
12 B3-6	FHWA HEC-22 GENERIC	N/A	On Sag	1	672.88	676.10	672.88	0.00	2.36	N/A	N/A	N/A	7.00	8.09	676.76
13 INLET B3a	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	679.17	675.58	0.00	0.76	N/A	N/A	N/A	7.00	2.49	679.41
14 INLET B3b	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.45	678.68	675.45	0.00	0.83	N/A	N/A	N/A	7.00	2.72	678.94
15 INLET B3c	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.12	679.17	675.12	0.00	0.76	N/A	N/A	N/A	7.00	2.49	679.41
16 INLET B3d	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.97	678.67	674.97	0.00	0.81	N/A	N/A	N/A	7.00	2.67	678.93
17 SDWK BOX B	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	677.34	0.00	0.00	1.53	N/A	N/A	N/A	7.00	9.63	678.01

Vanguard Farms Apartments

Subbasin : B1a

Input Data

Area (ac) ..... 0.27  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.27	-	93.00
Composite Area & Weighted CN	0.27		93.00

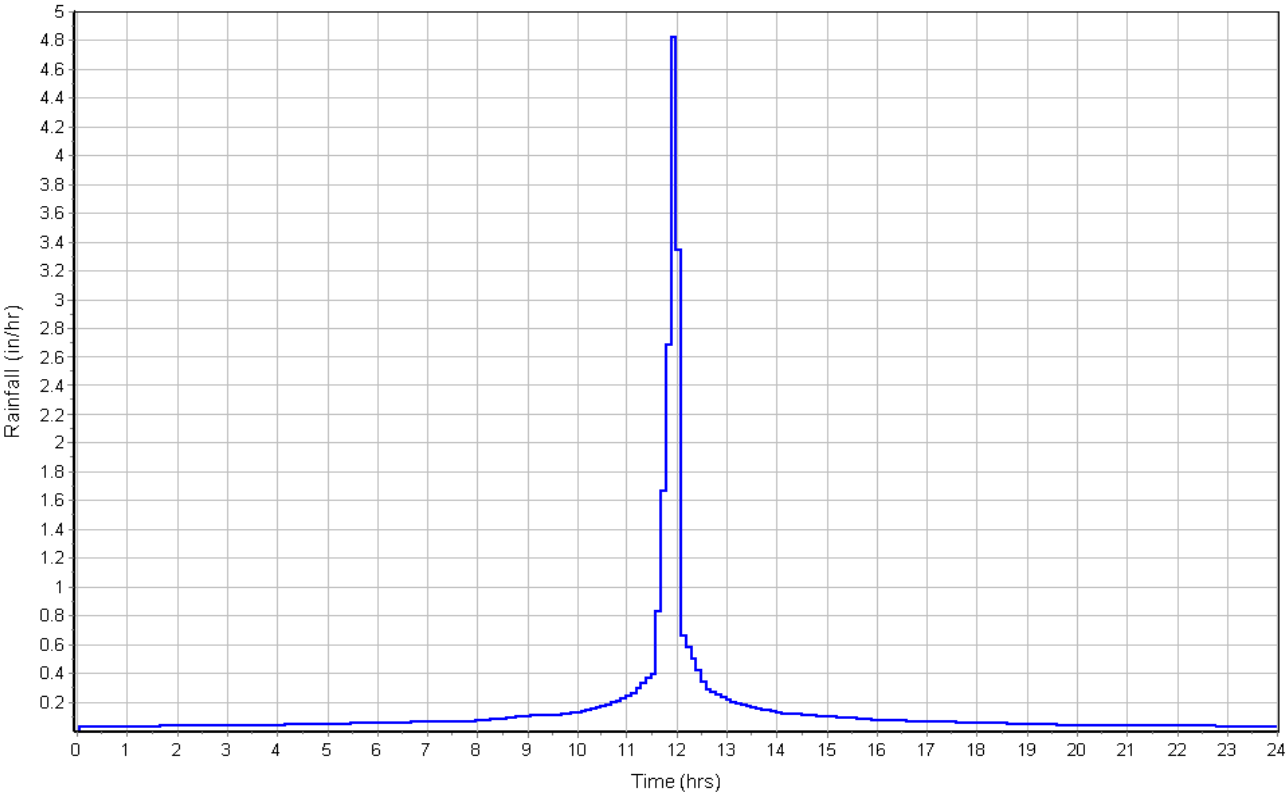
Subbasin Runoff Results

Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 0.82  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:17:53

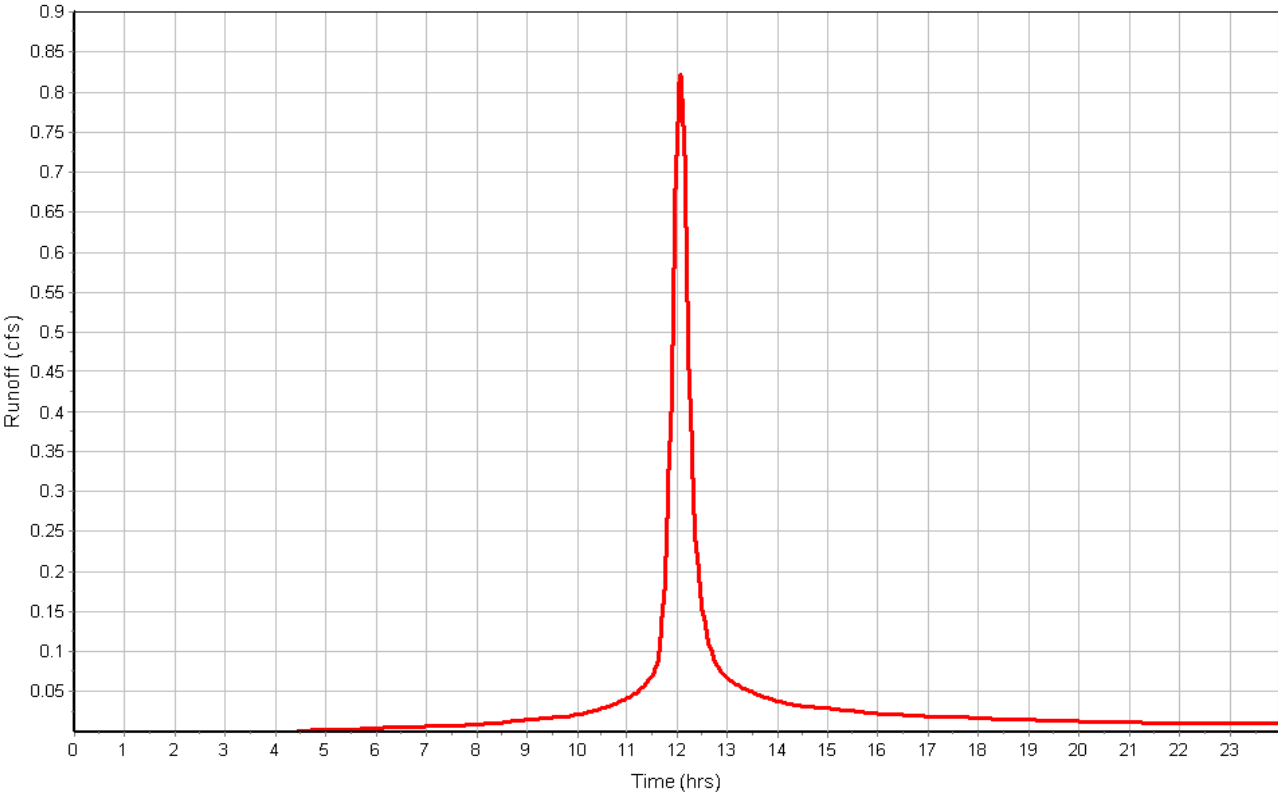


Subbasin : B1a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B1b

Input Data

Area (ac) ..... 0.21  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

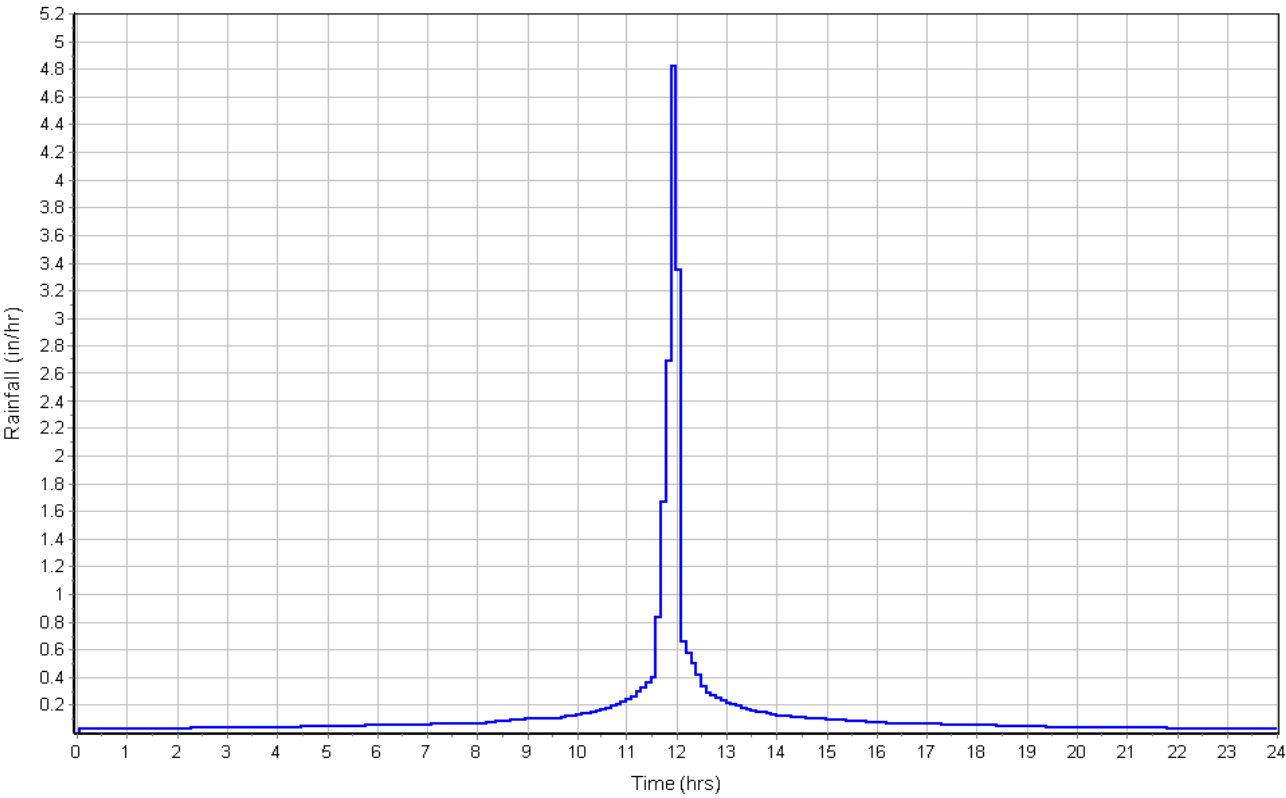
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.21	-	93.00
Composite Area & Weighted CN	0.21		93.00

Subbasin Runoff Results

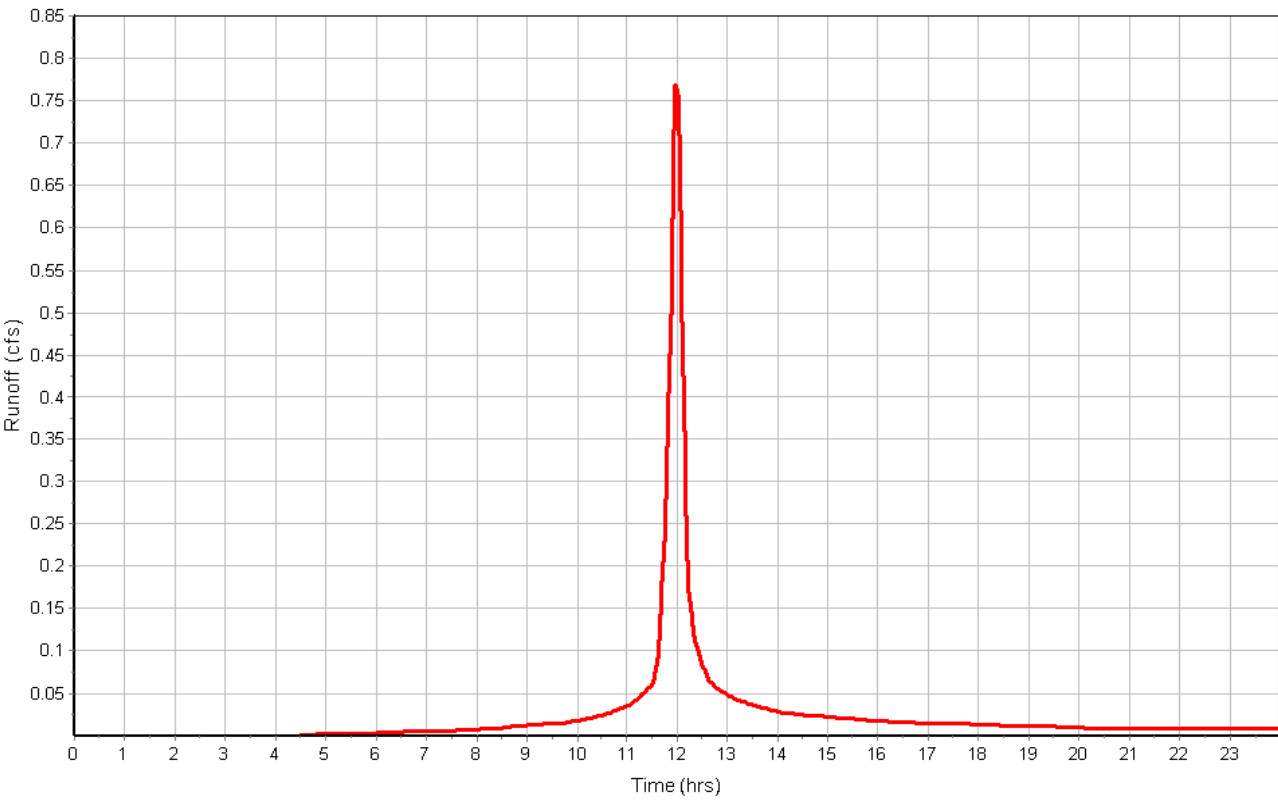
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 0.77  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B1b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2a

Input Data

Area (ac) ..... 0.33  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

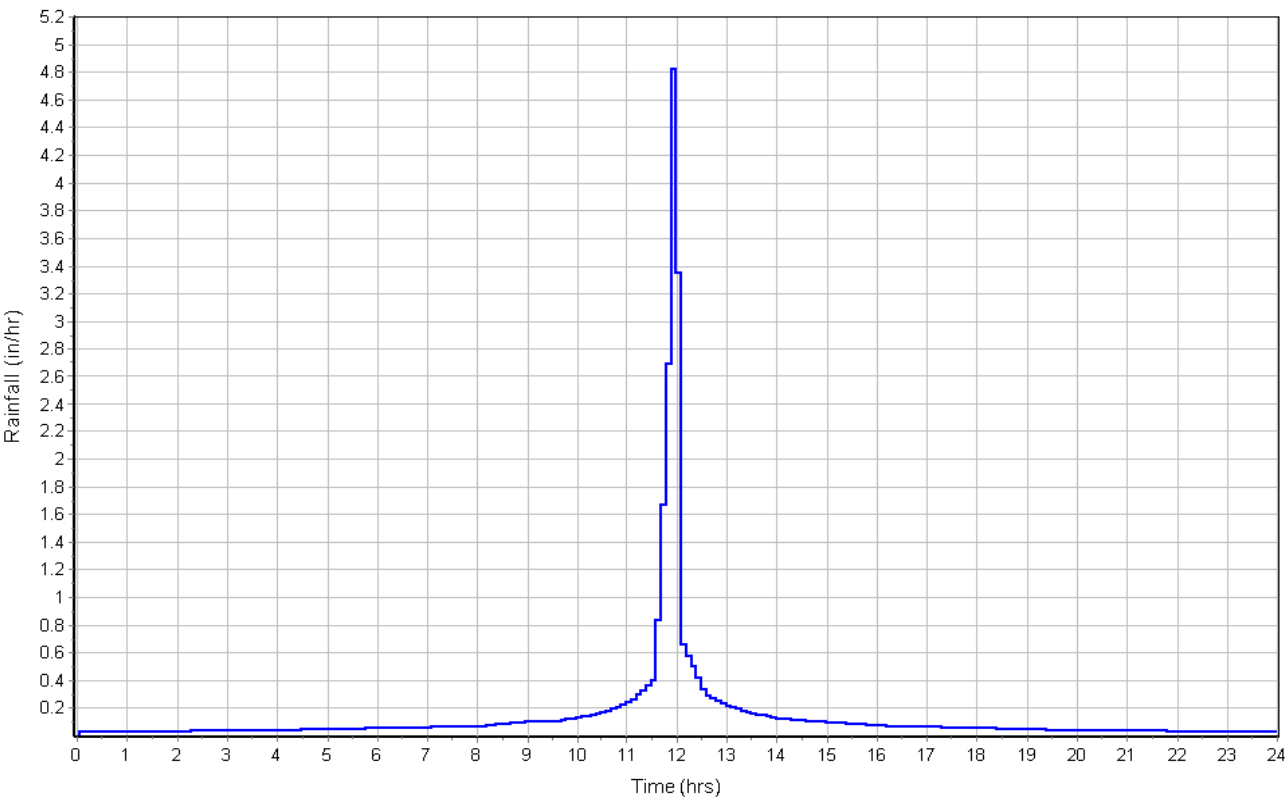
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.33	-	93.00
Composite Area & Weighted CN	0.33		93.00

Subbasin Runoff Results

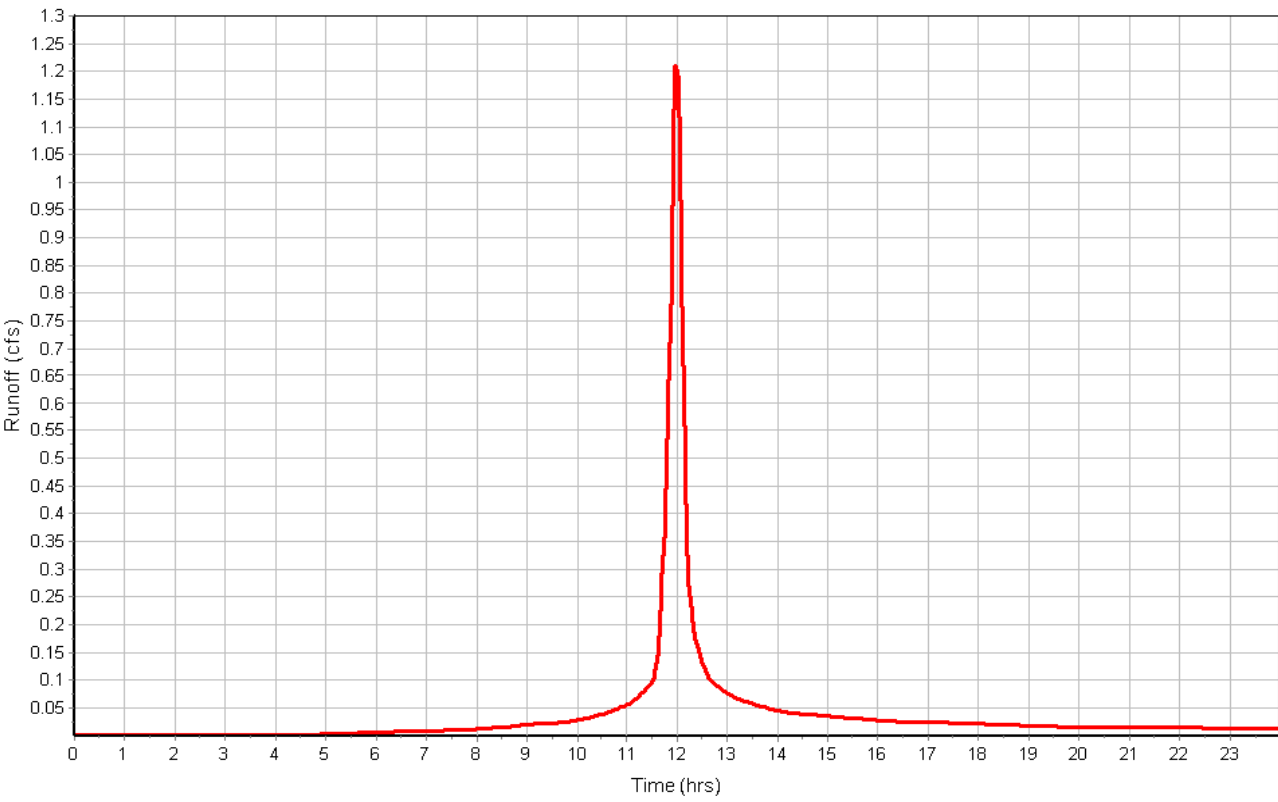
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 1.21  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B2a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2b

Input Data

Area (ac) ..... 0.36  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

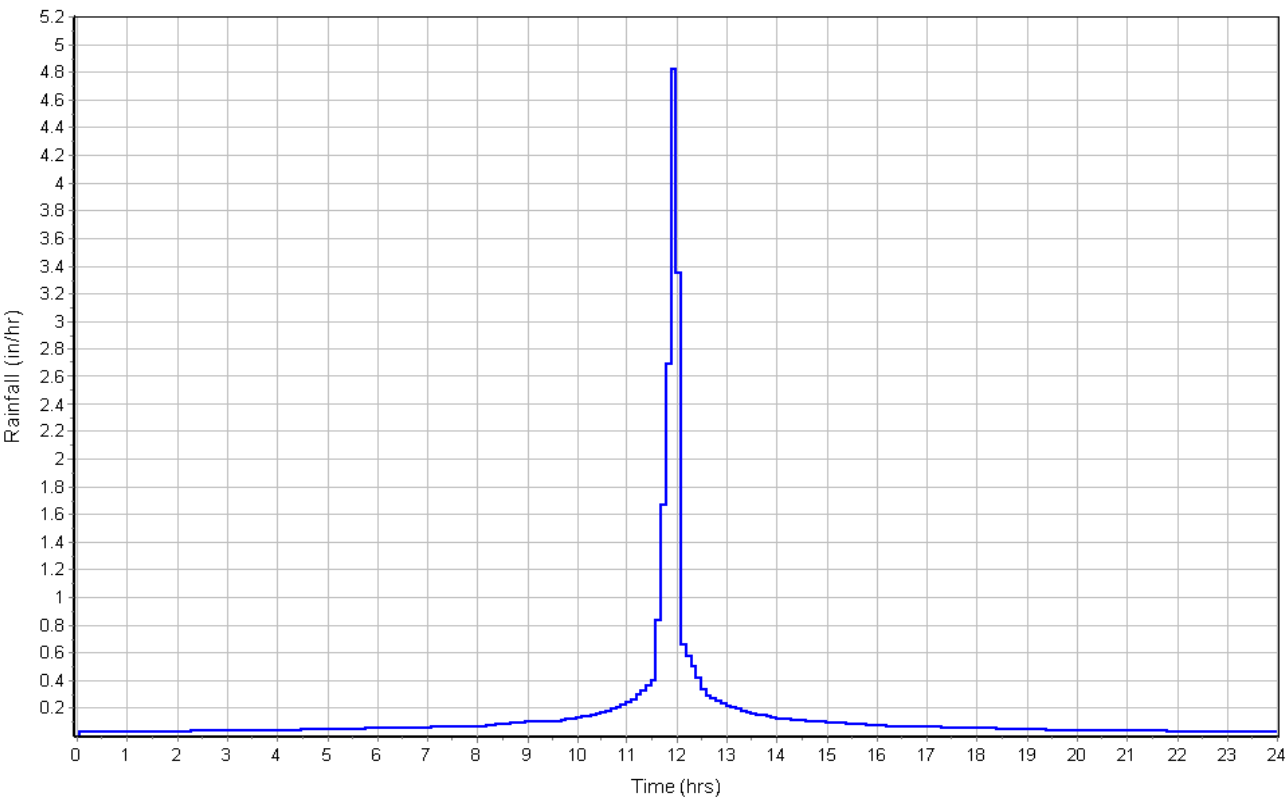
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.36	-	93.00
Composite Area & Weighted CN	0.36		93.00

Subbasin Runoff Results

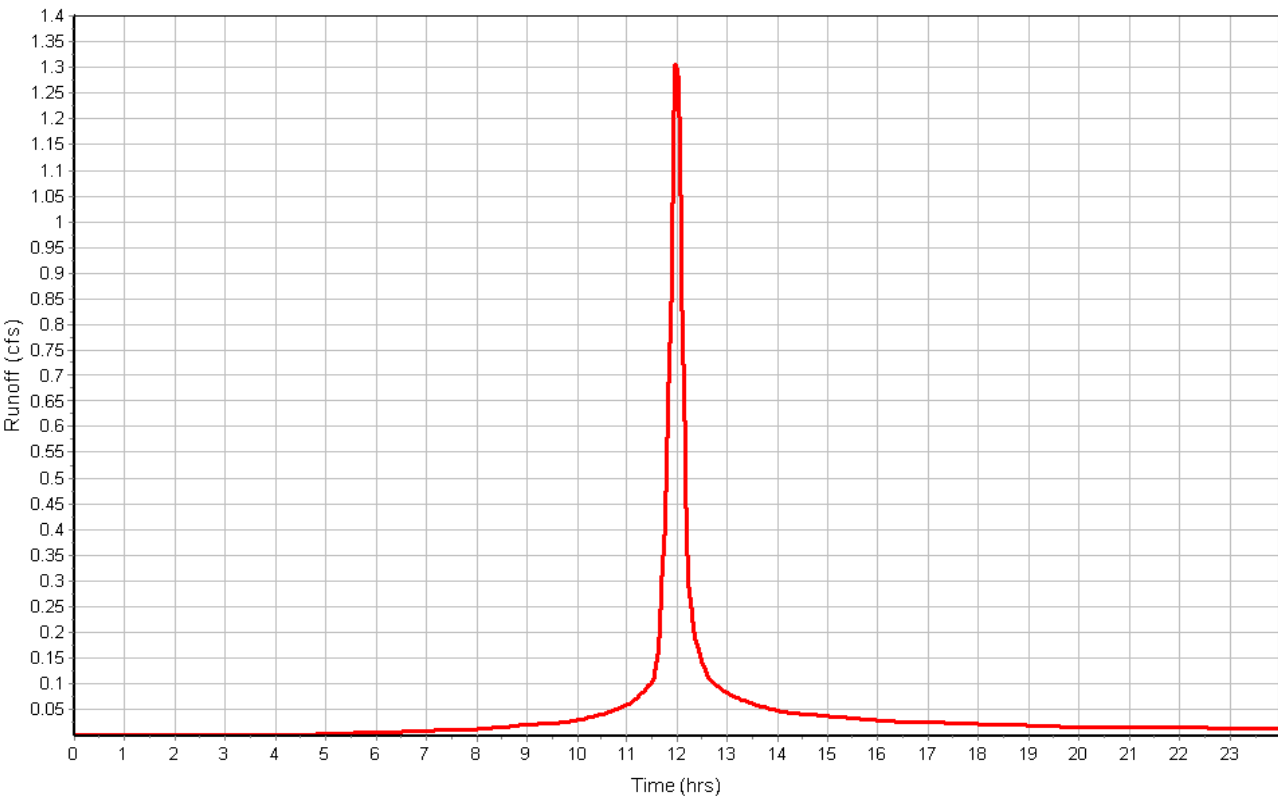
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 1.31  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B2b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2c

Input Data

Area (ac) ..... 0.28  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.28	-	93.00
Composite Area & Weighted CN	0.28		93.00

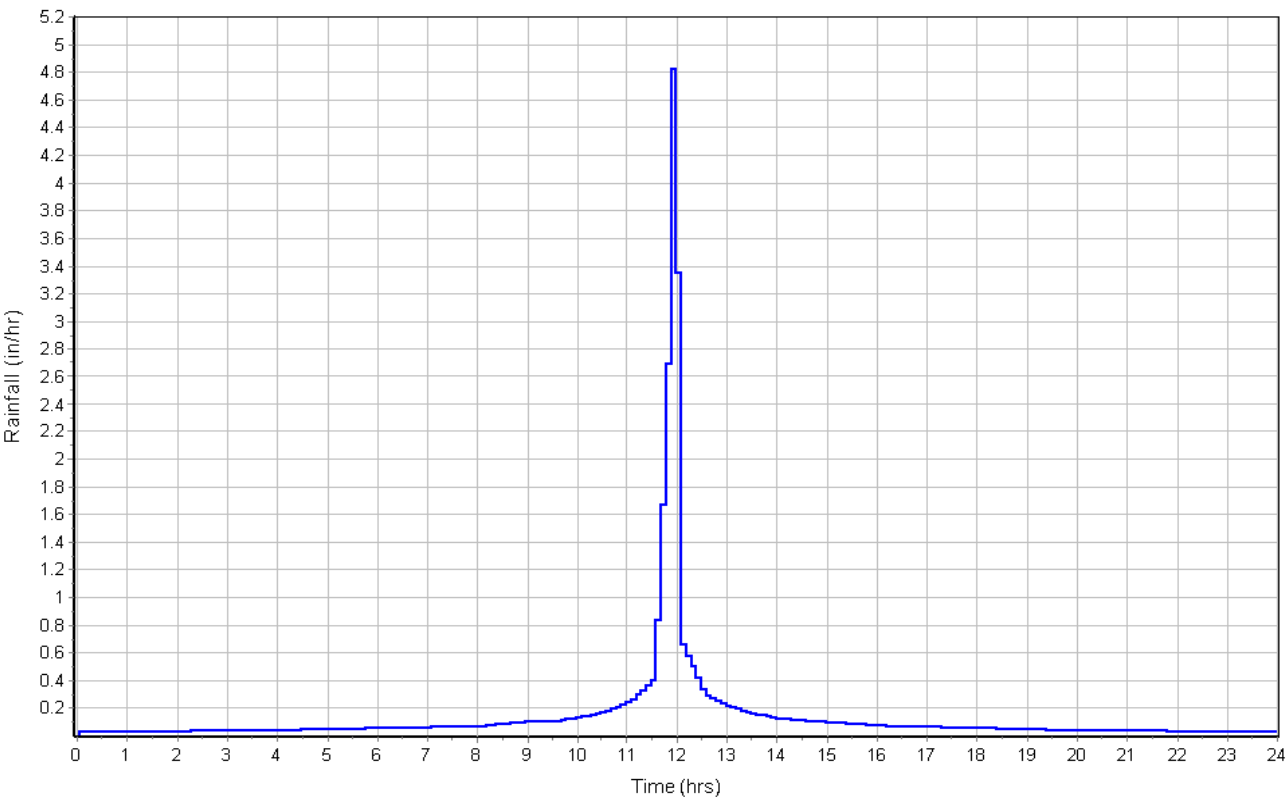
Subbasin Runoff Results

Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 0.98  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:11:19

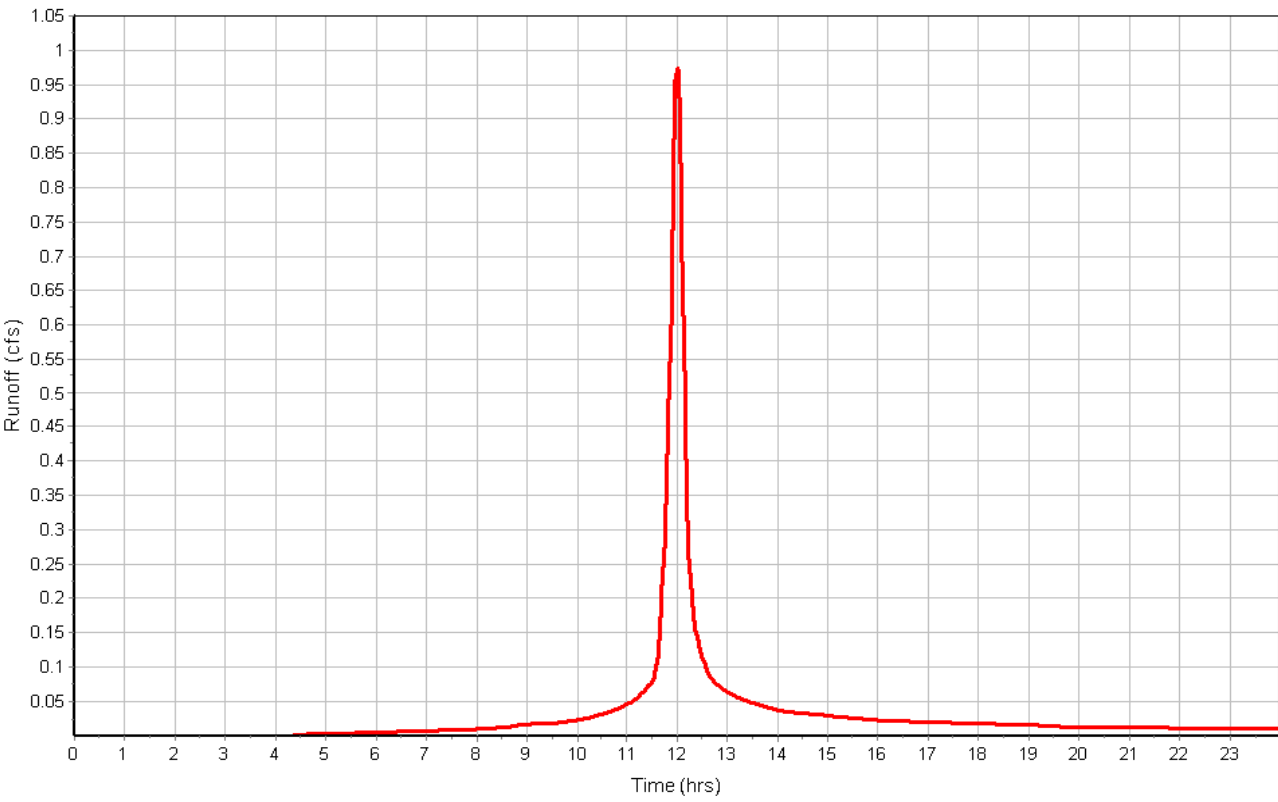


Subbasin : B2c

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2d

Input Data

Area (ac) ..... 0.35  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

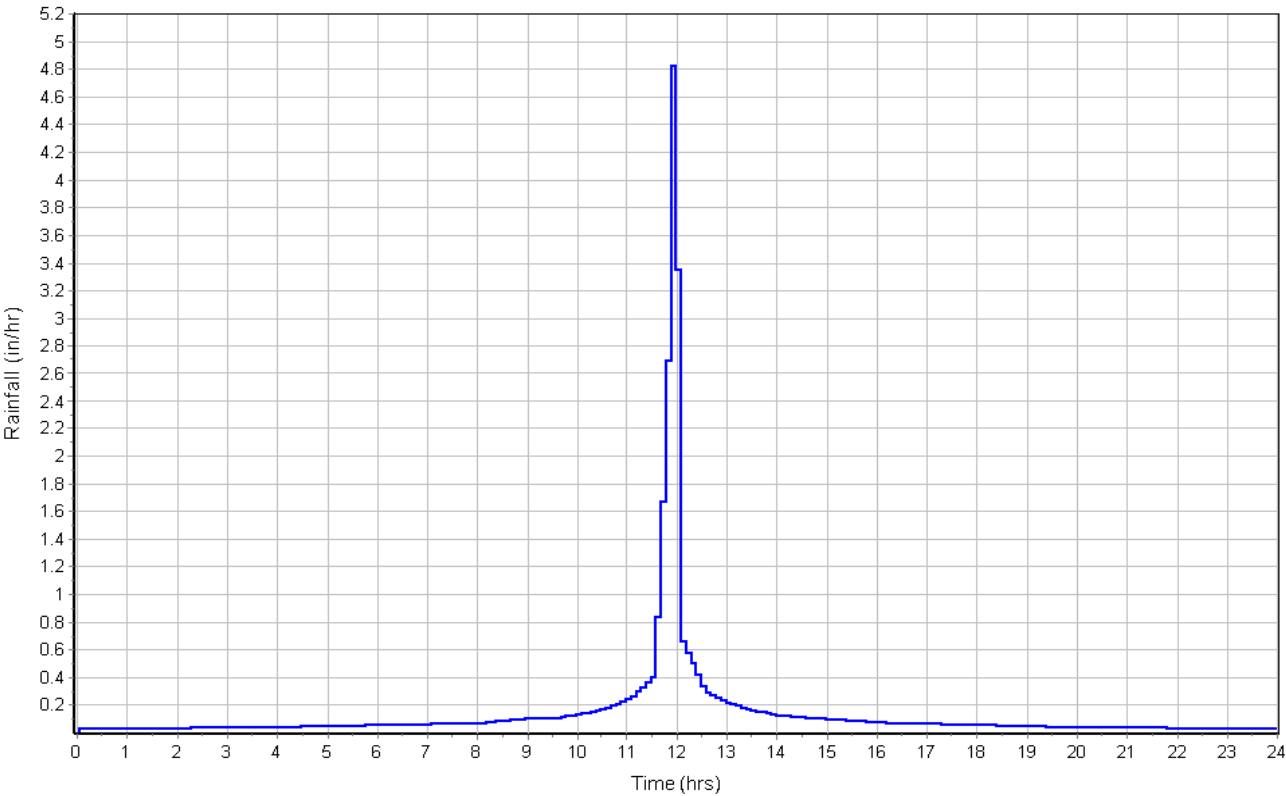
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.35	-	93.00
Composite Area & Weighted CN	0.35		93.00

Subbasin Runoff Results

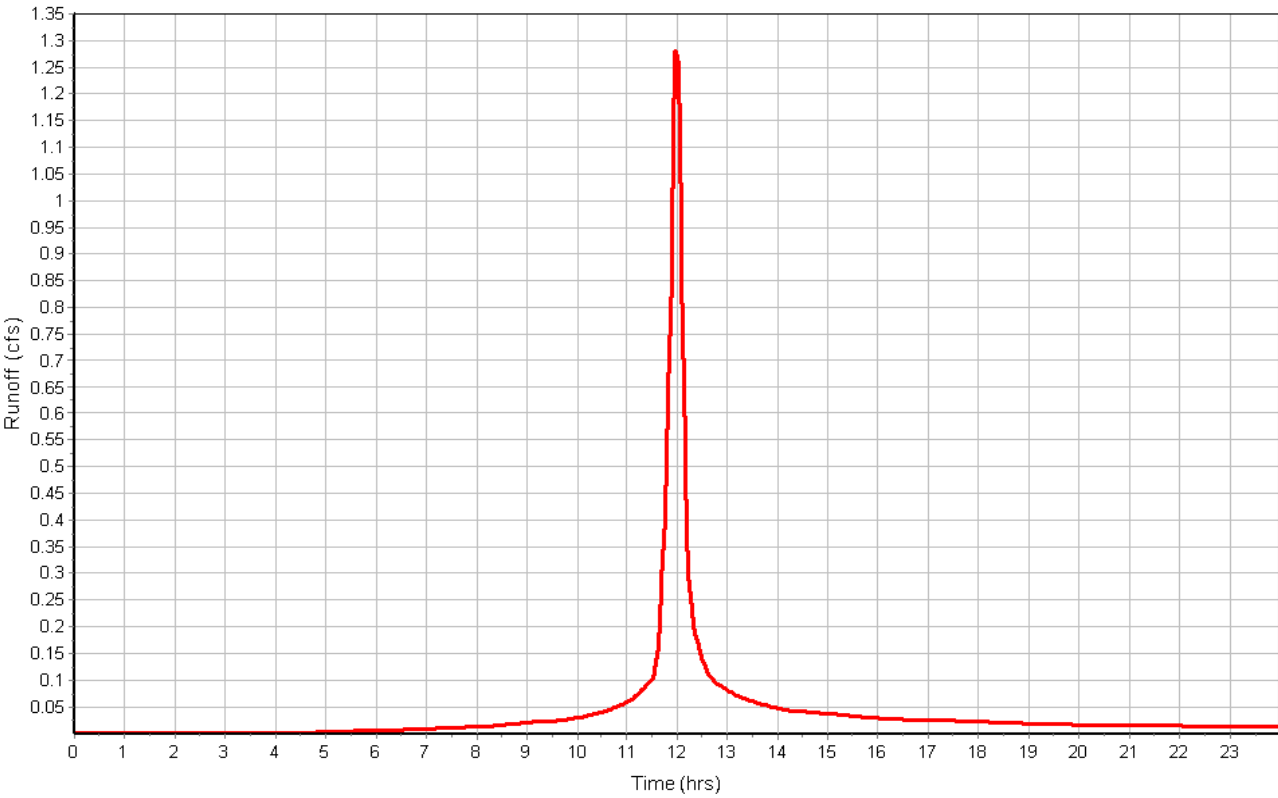
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 1.28  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B2d

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2e

Input Data

Area (ac) ..... 0.65  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

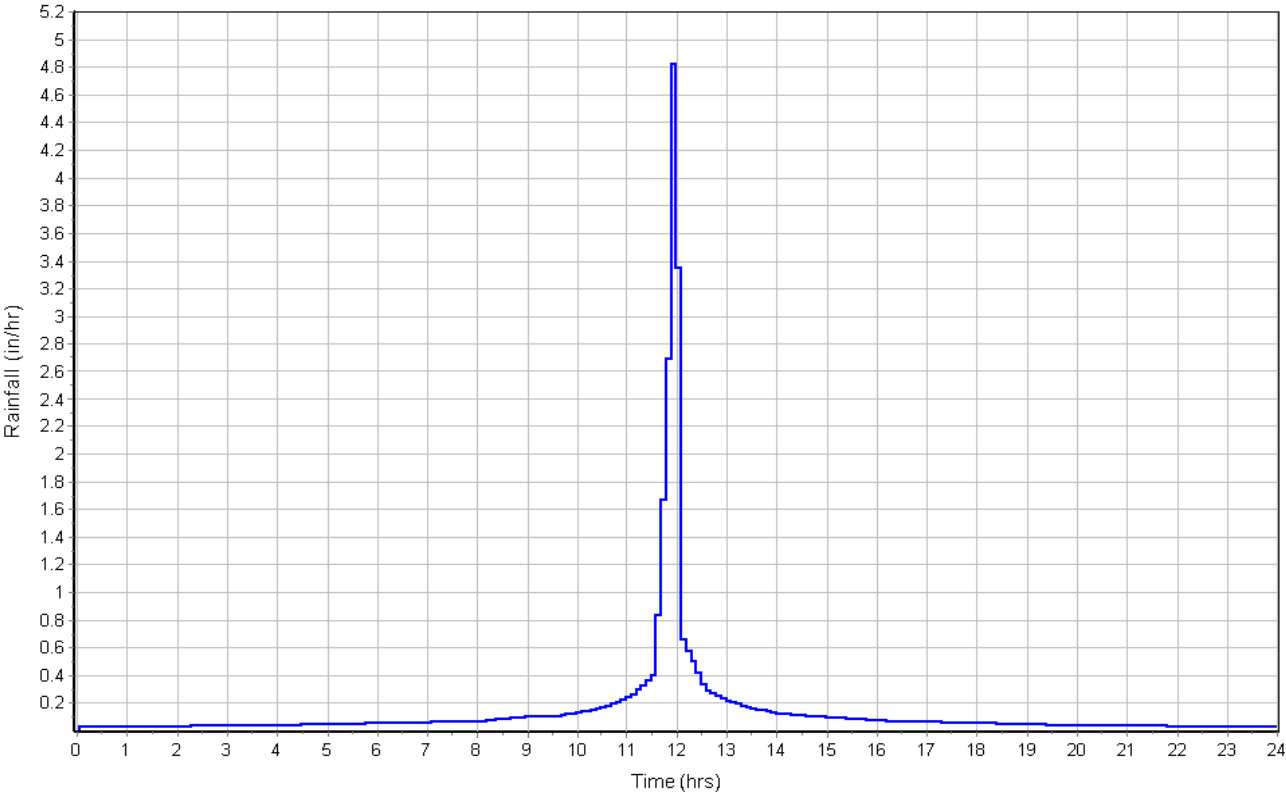
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.65	-	93.00
Composite Area & Weighted CN	0.65		93.00

Subbasin Runoff Results

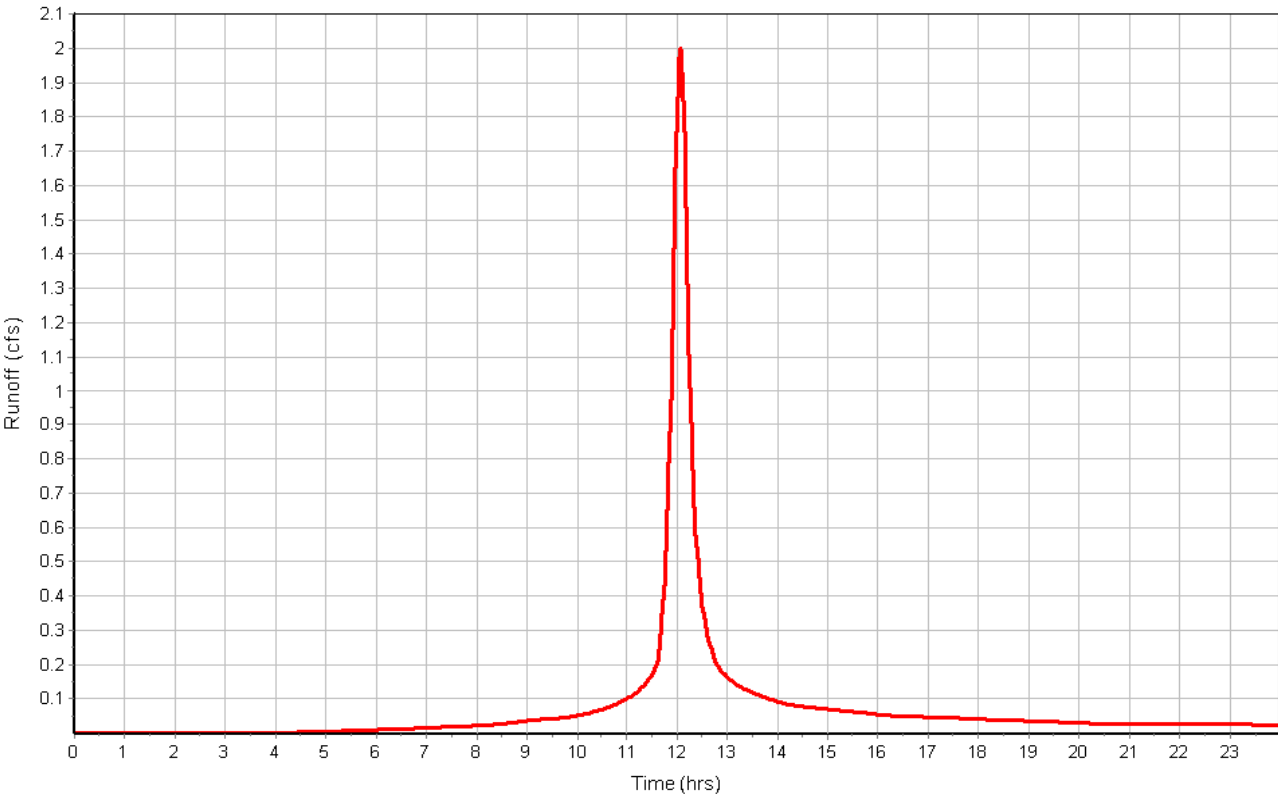
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 2.00  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:17:51

Subbasin : B2e

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B2f

Input Data

Area (ac) ..... 0.63  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

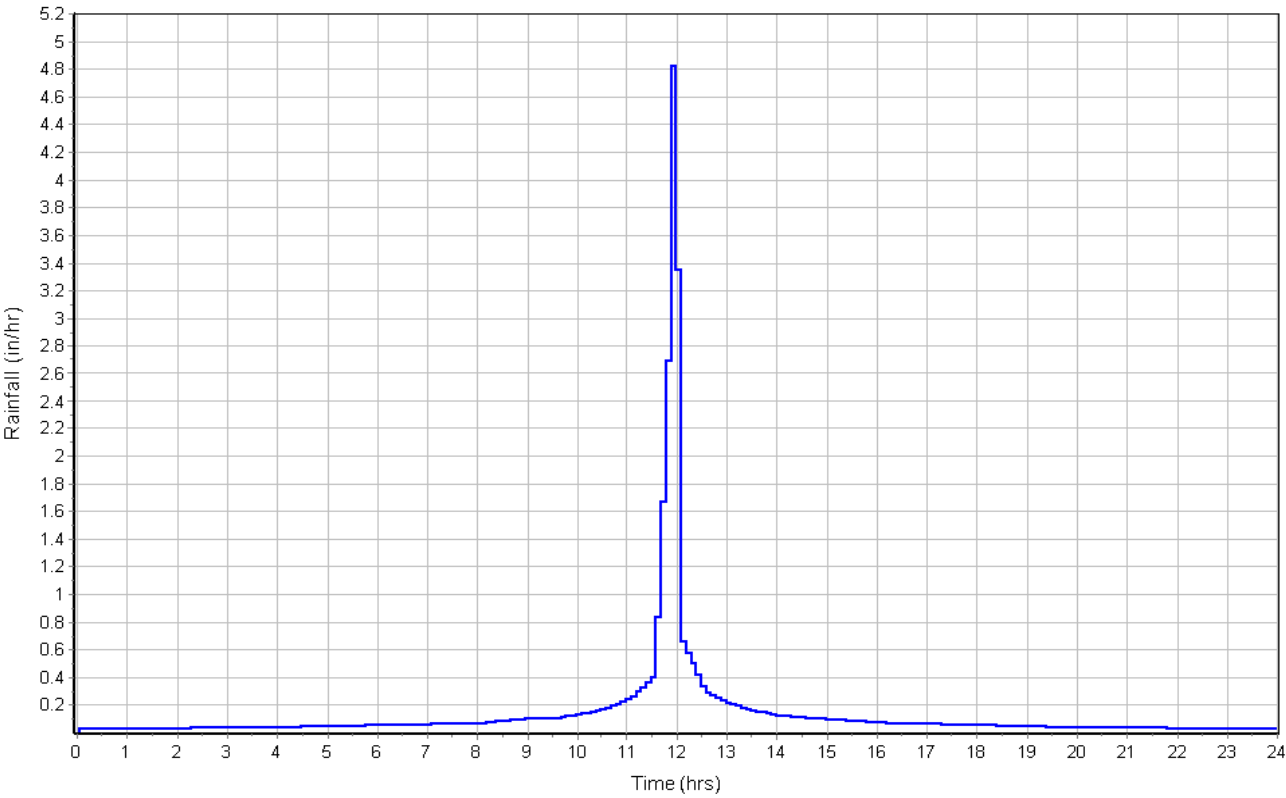
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.63	-	93.00
Composite Area & Weighted CN	0.63		93.00

Subbasin Runoff Results

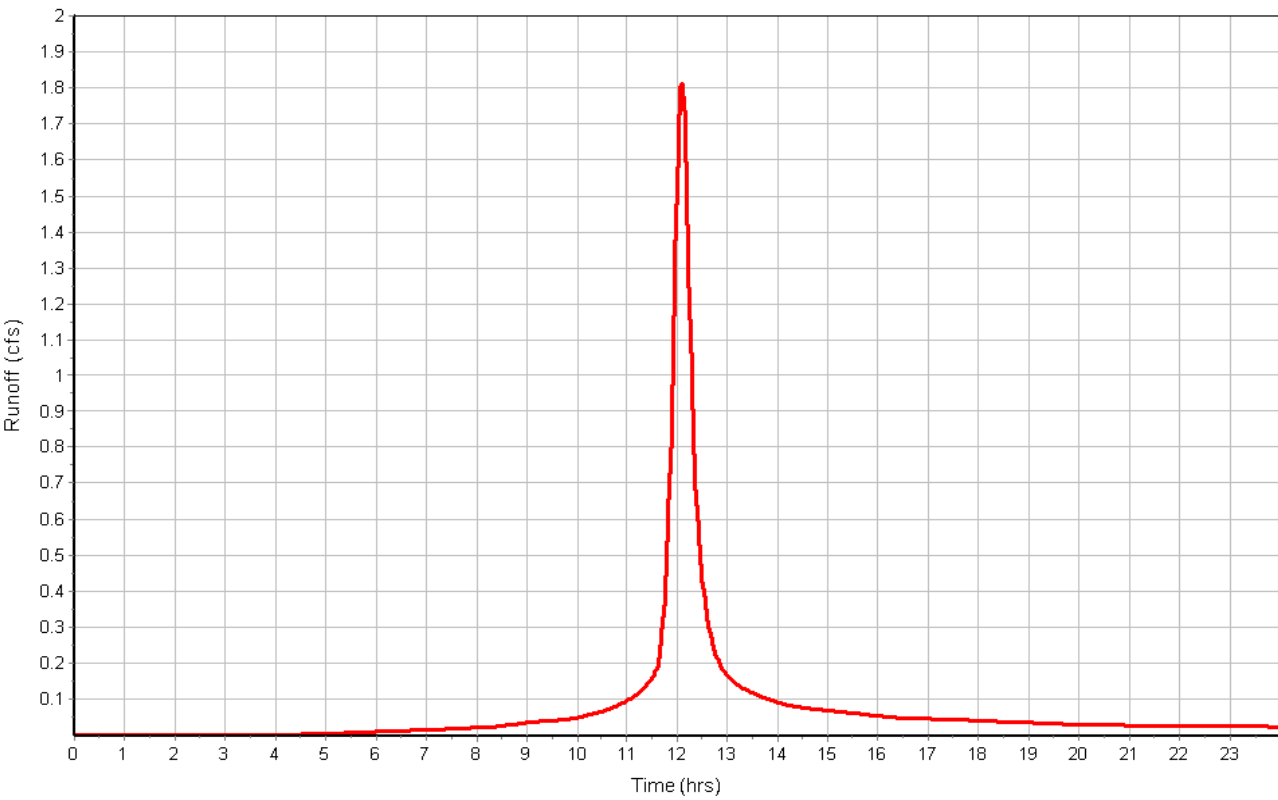
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 1.82  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:20:46

Subbasin : B2f

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3a

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

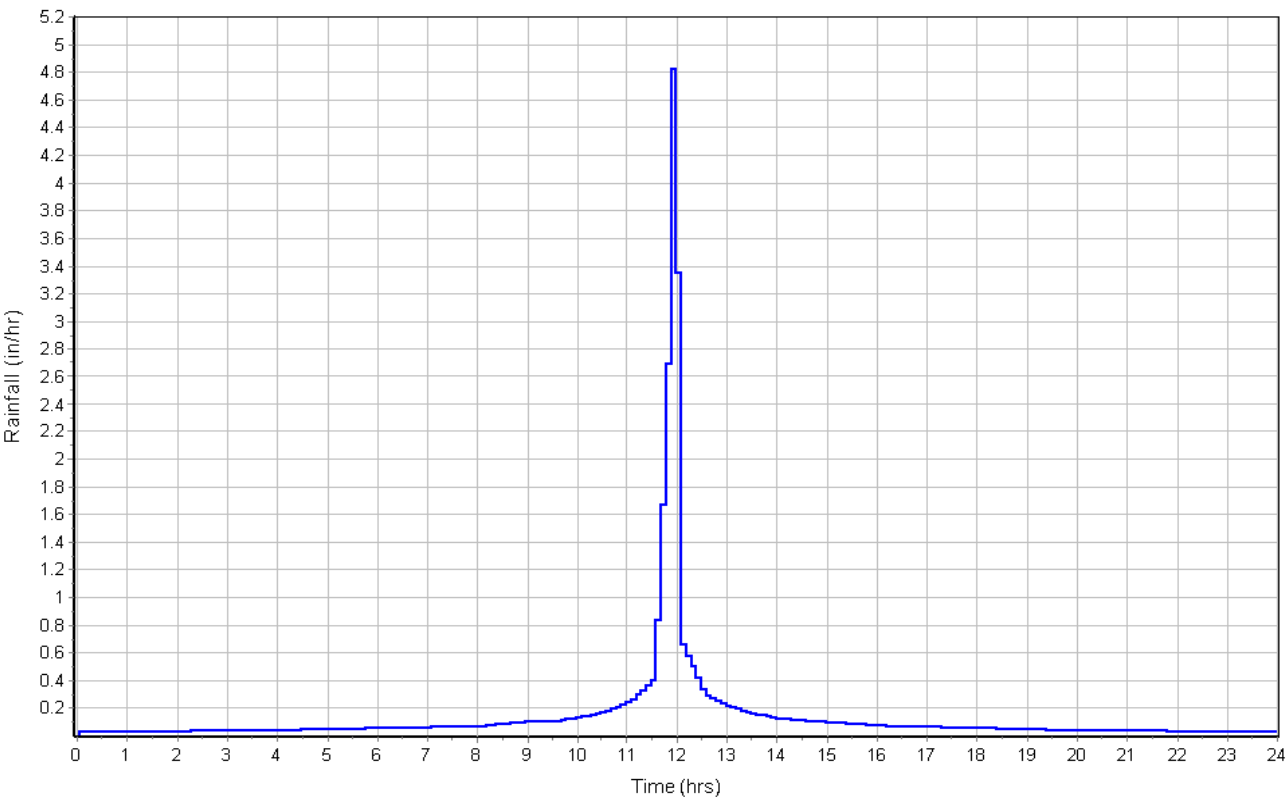
Subbasin Runoff Results

Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 0.76  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:30:09

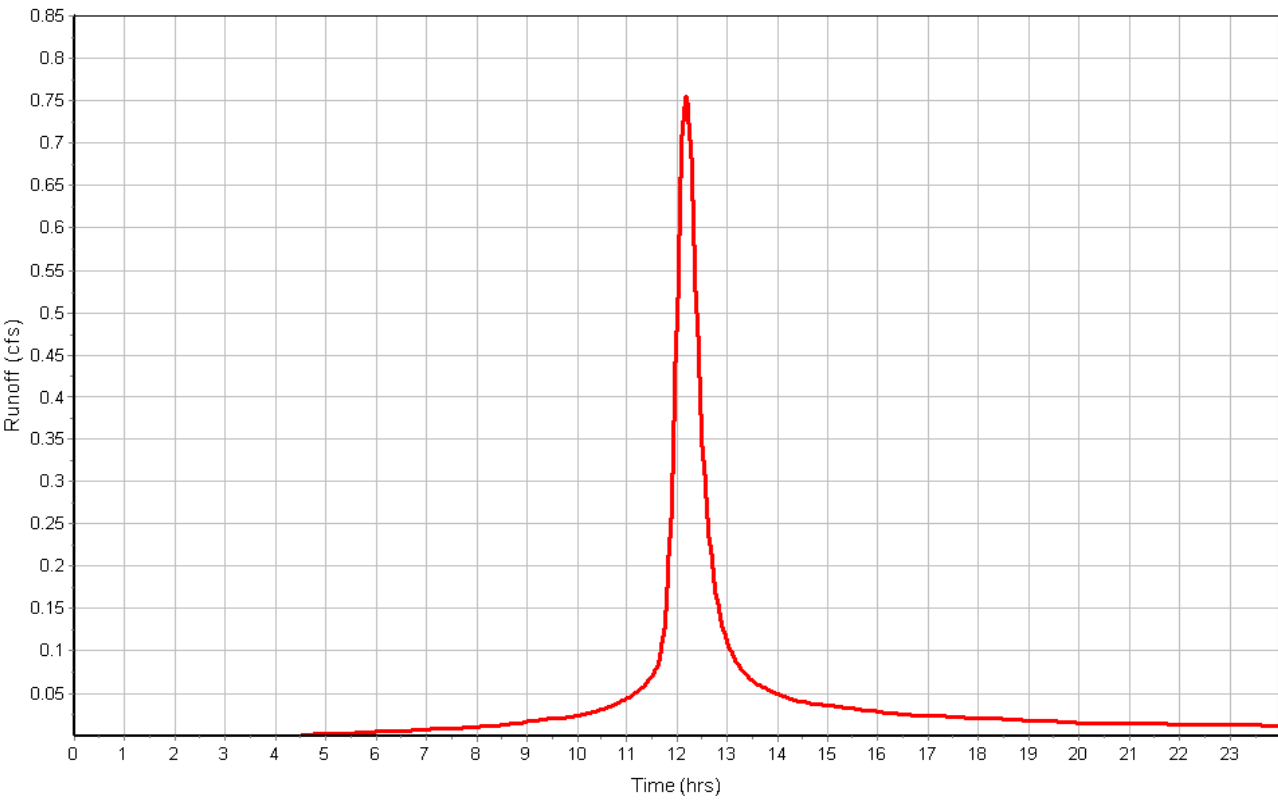


Subbasin : B3a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3b

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

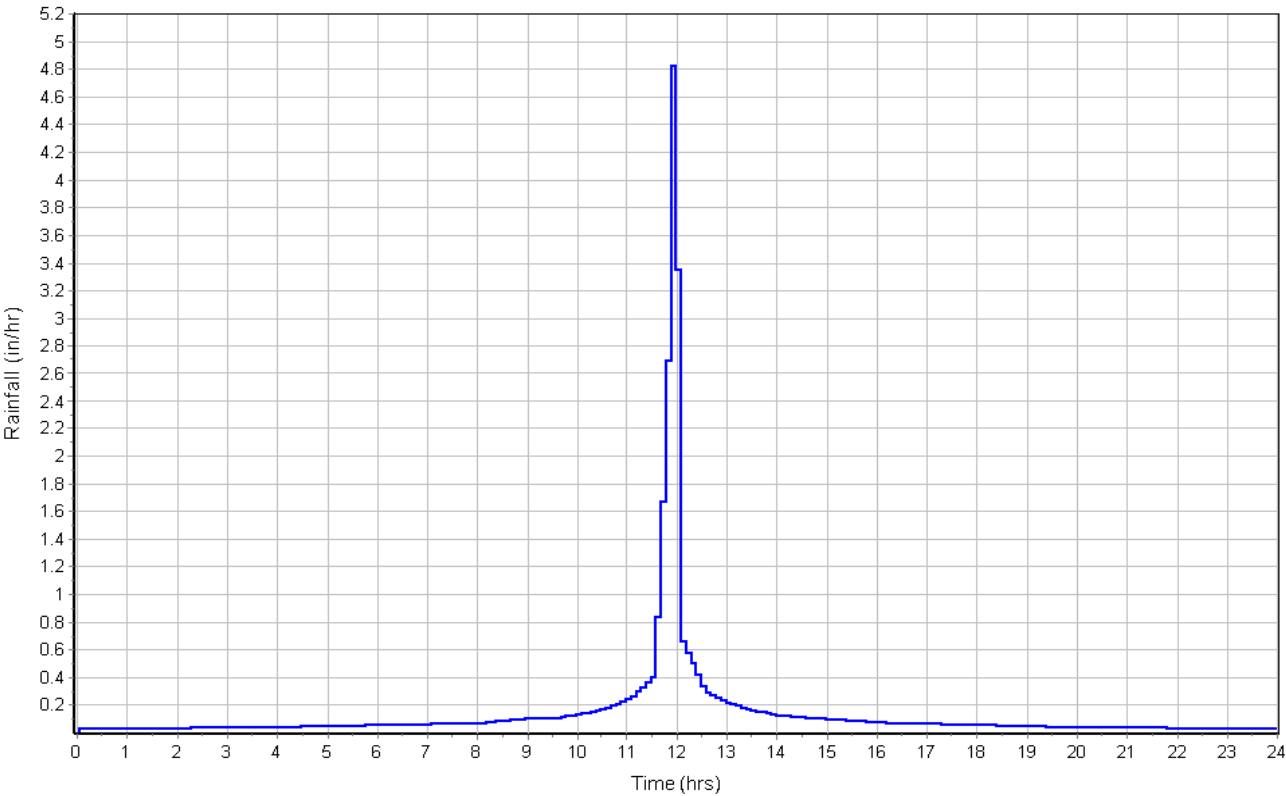
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

Subbasin Runoff Results

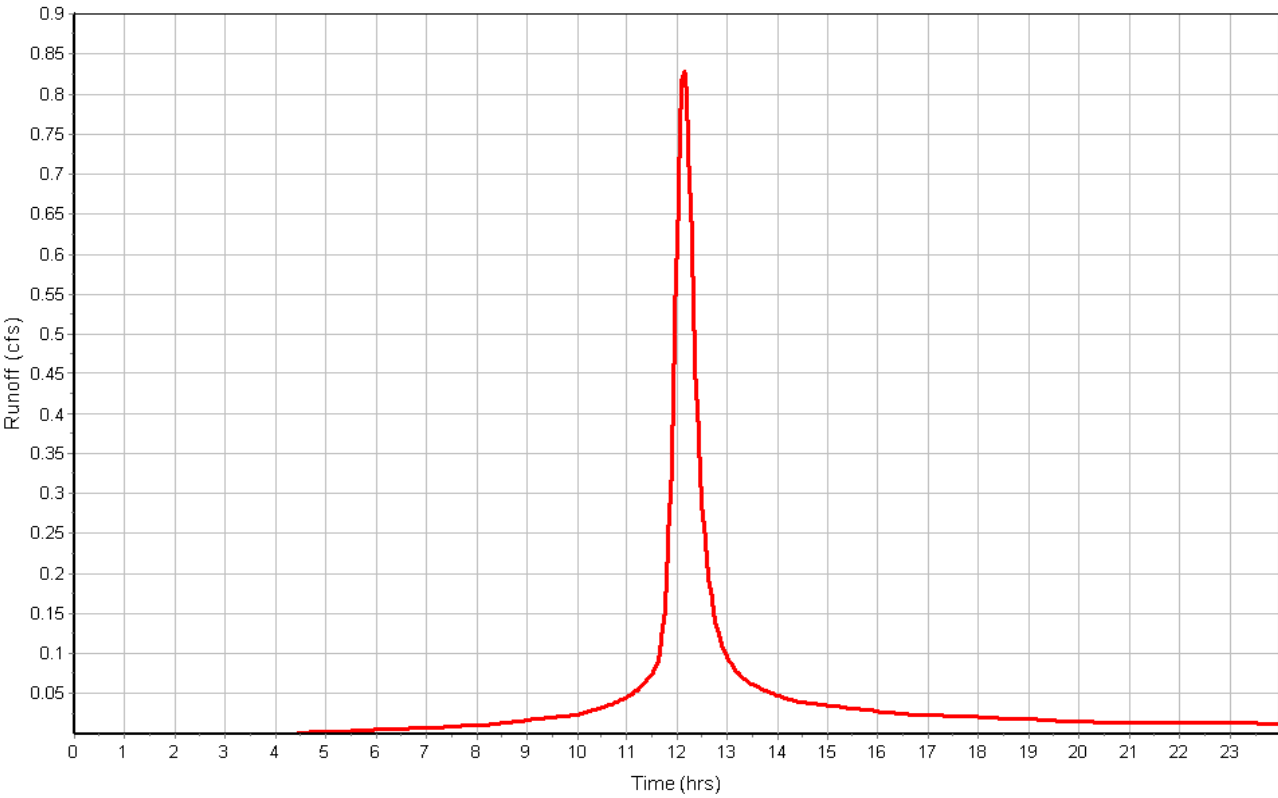
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 0.83  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:25:35

Subbasin : B3b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3c

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

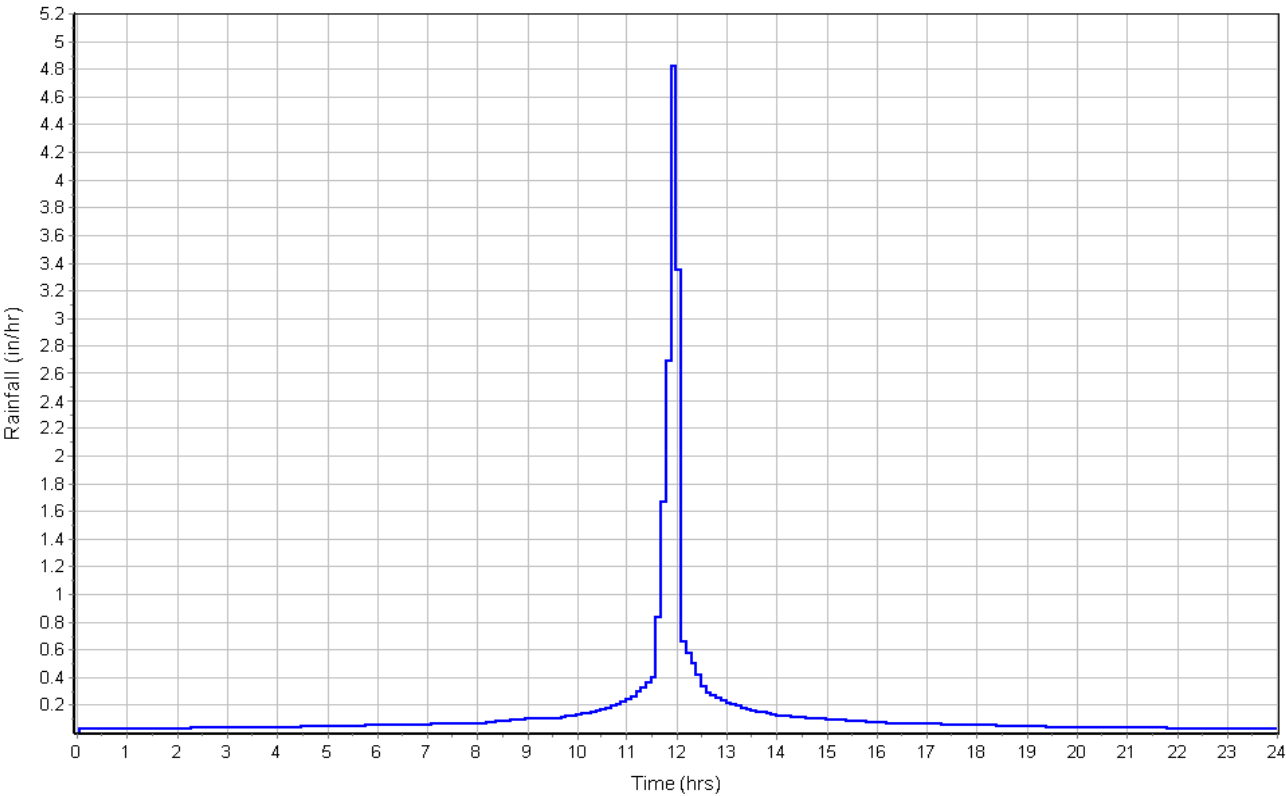
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

Subbasin Runoff Results

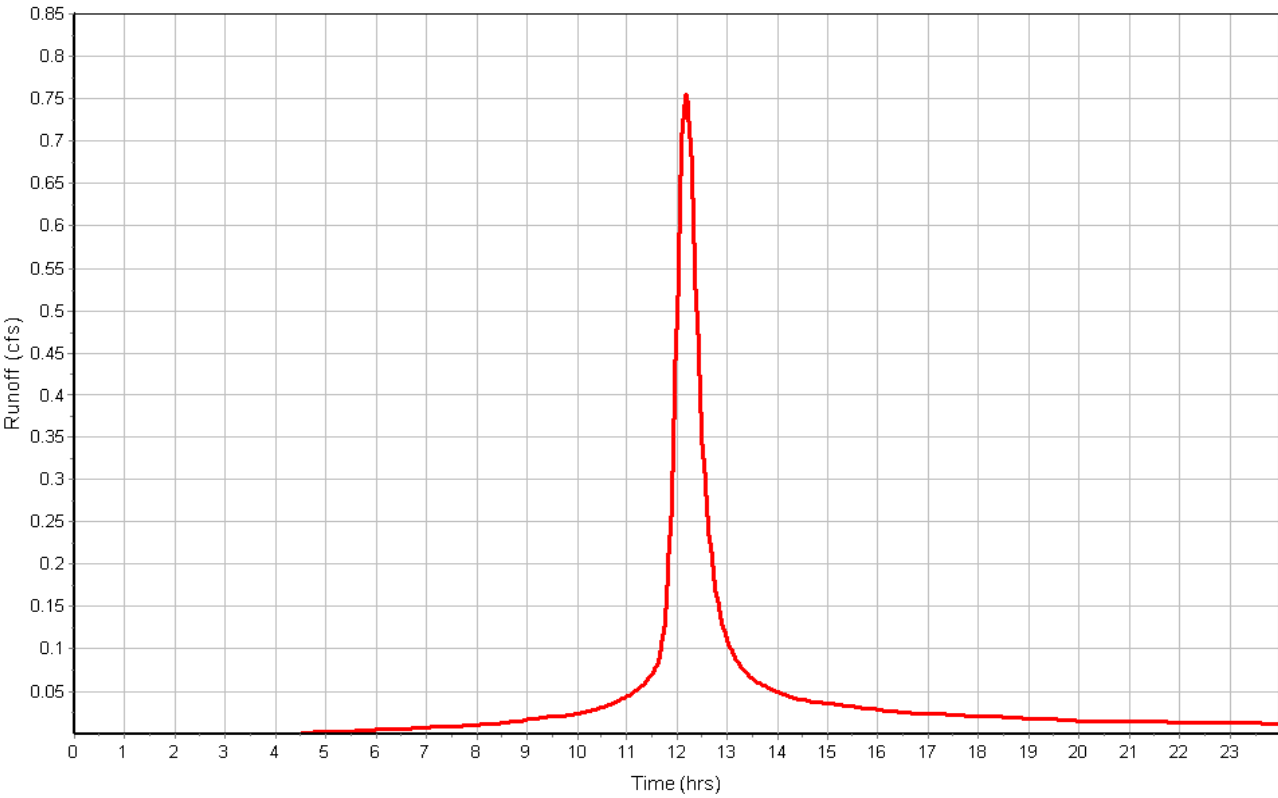
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 0.76  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:30:09

Subbasin : B3c

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3d

Input Data

Area (ac) ..... 0.32  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

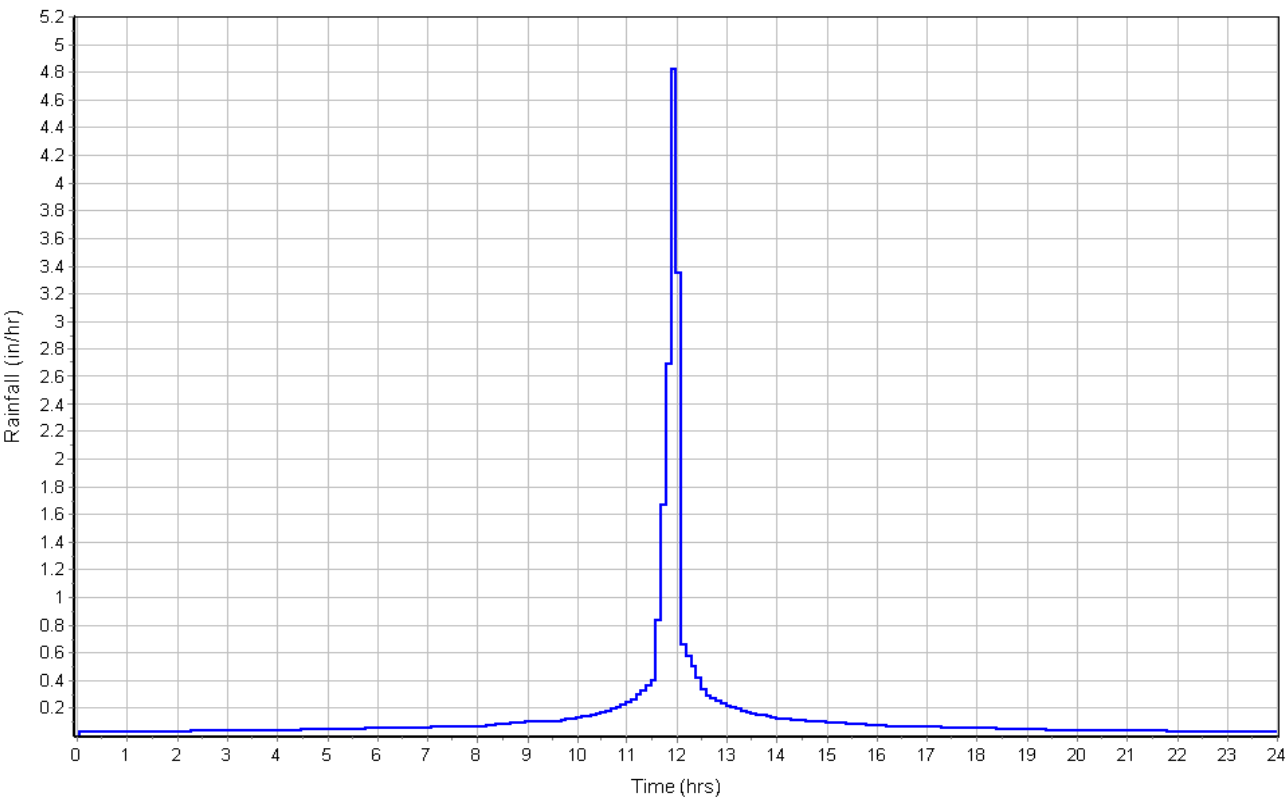
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.32	-	93.00
Composite Area & Weighted CN	0.32		93.00

Subbasin Runoff Results

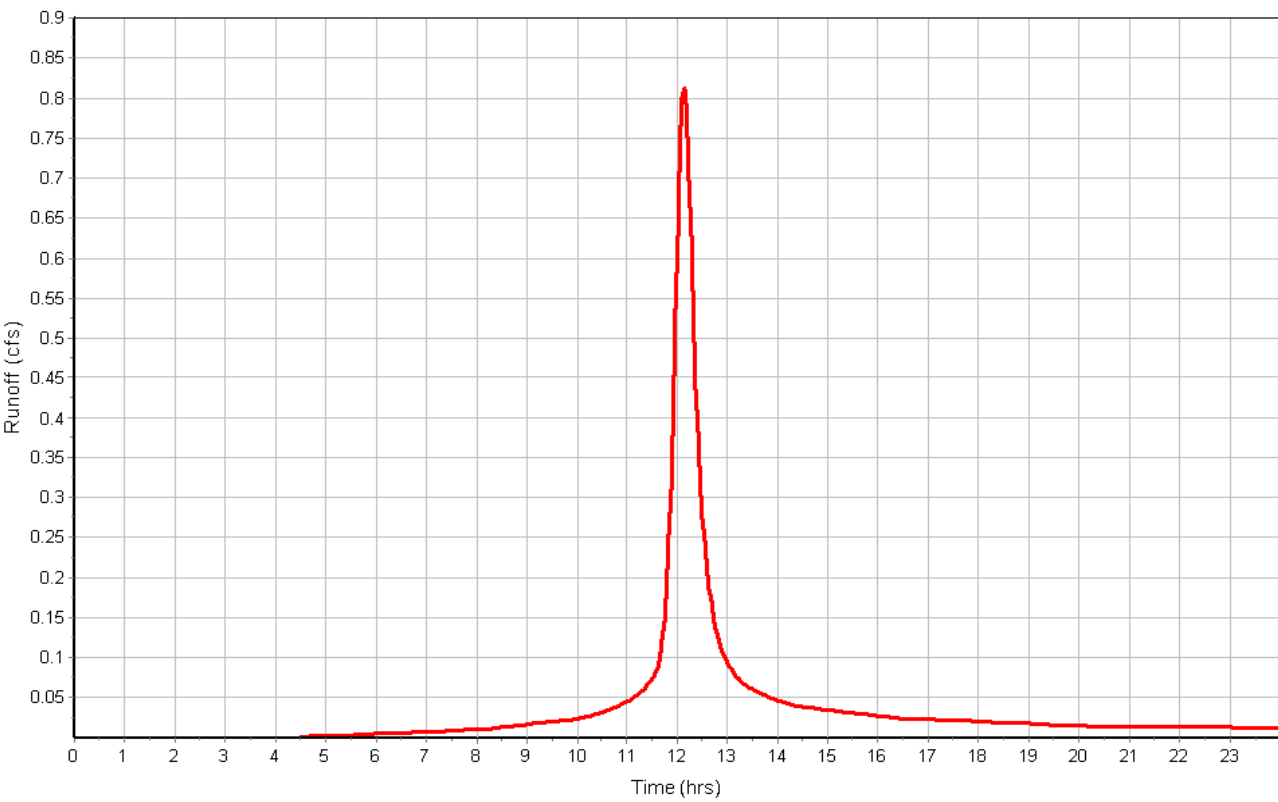
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 0.81  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:25:35

Subbasin : B3d

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3e

Input Data

Area (ac) ..... 1.33  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	1.33	-	93.00
Composite Area & Weighted CN	1.33		93.00

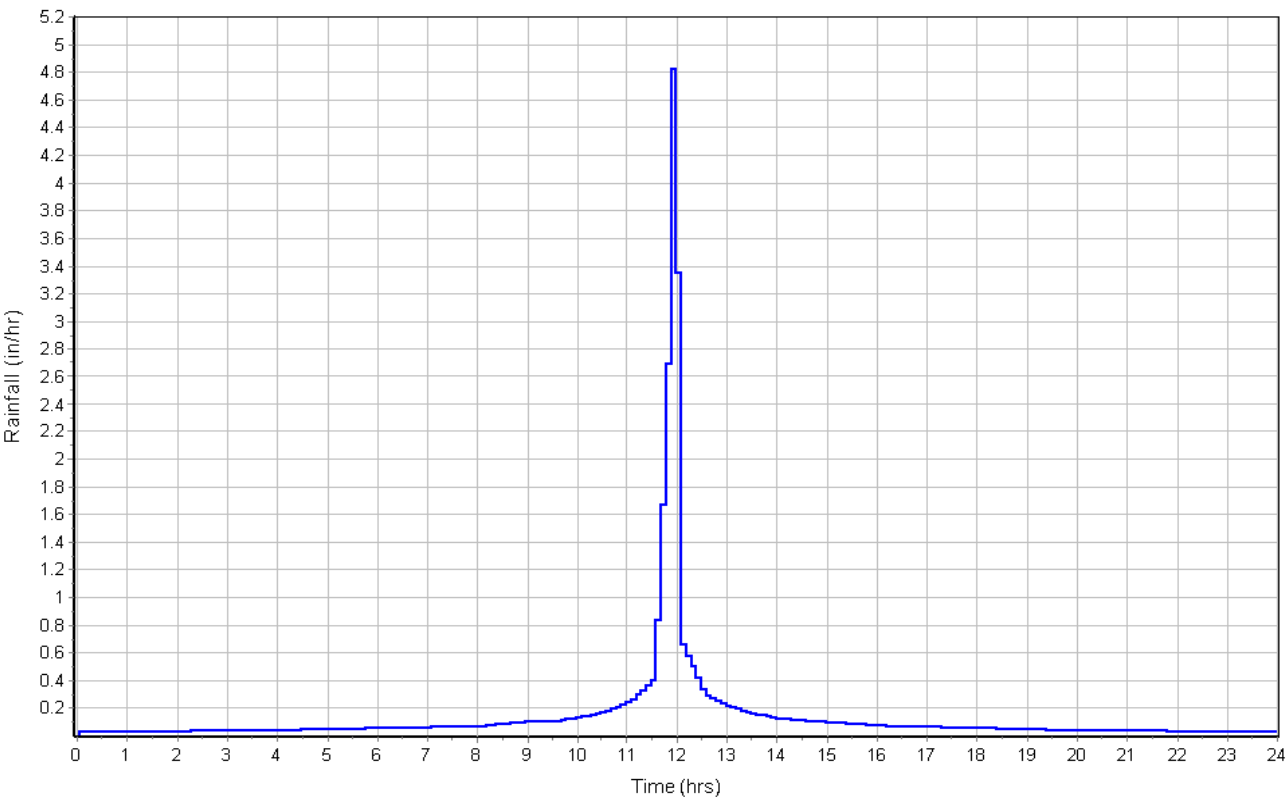
Subbasin Runoff Results

Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 2.36  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:47:02

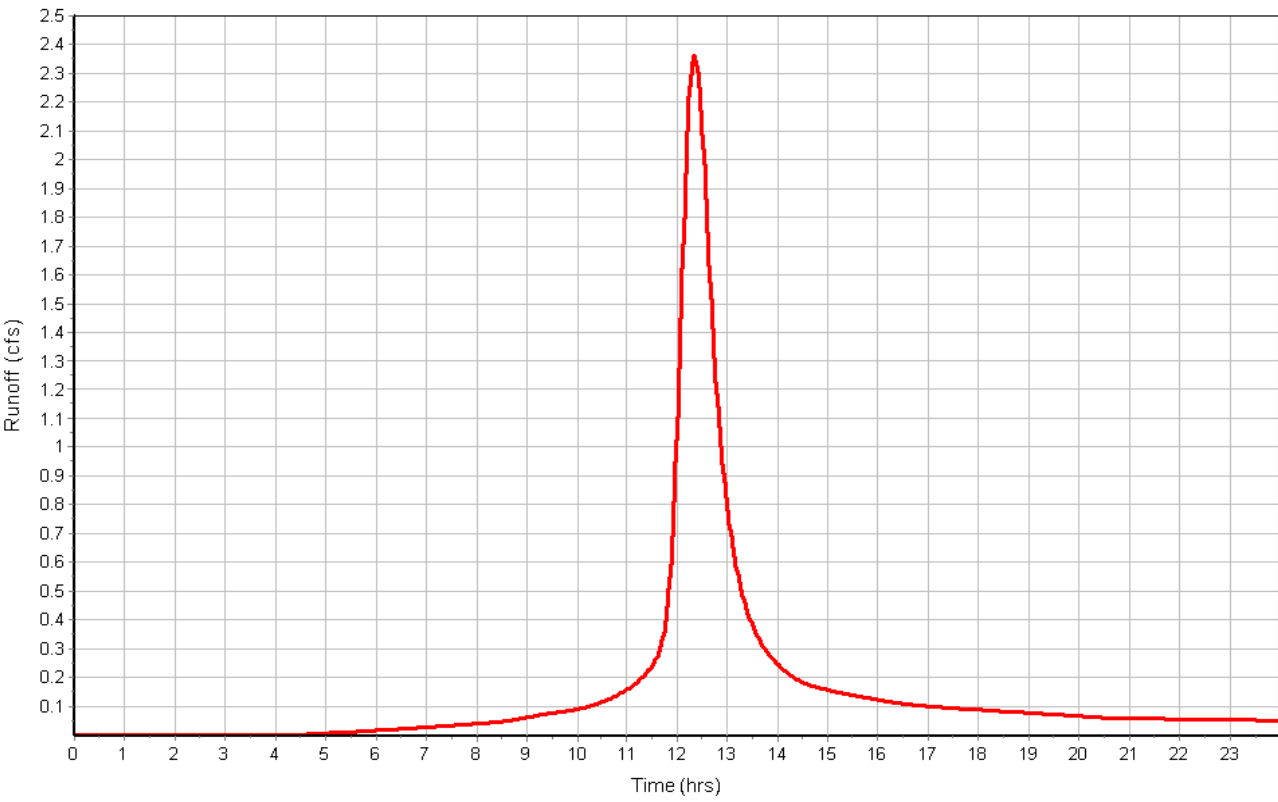


Subbasin : B3e

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3f

Input Data

Area (ac) ..... 0.44  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

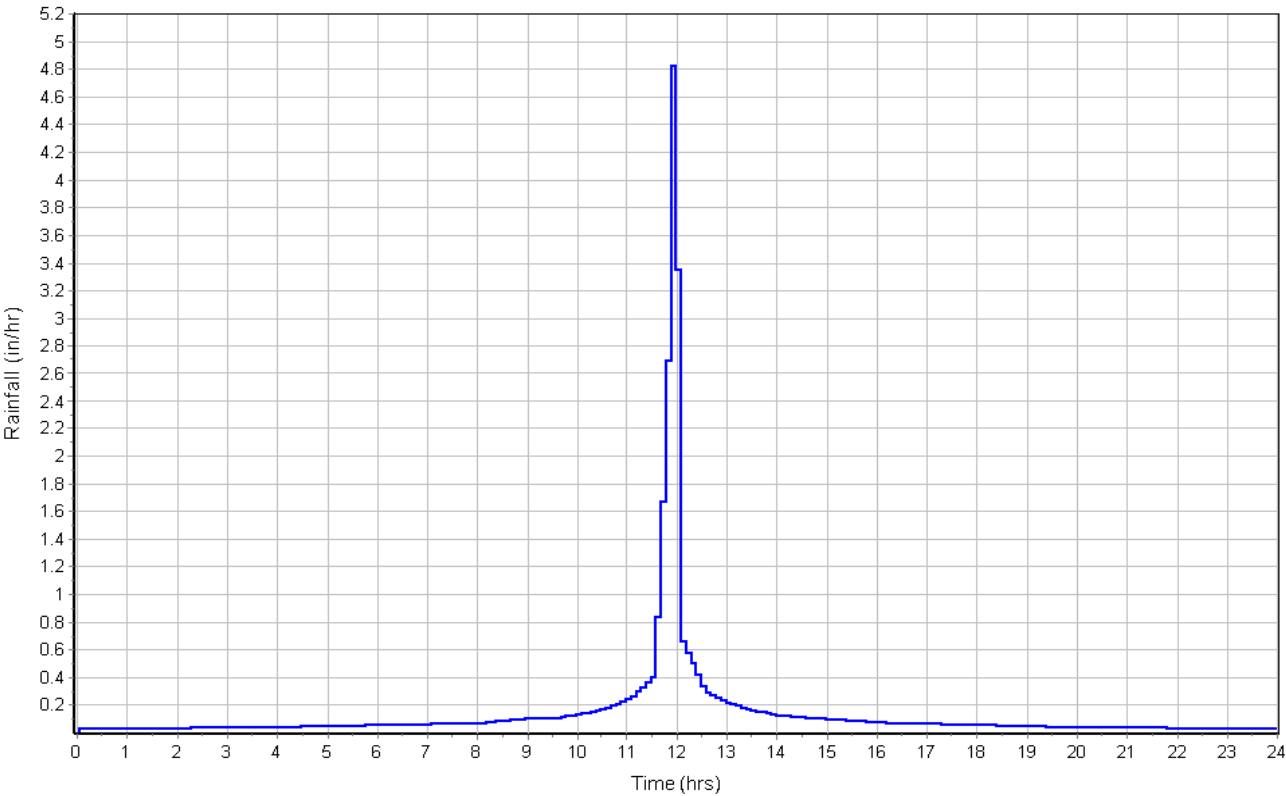
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.44	-	93.00
Composite Area & Weighted CN	0.44		93.00

Subbasin Runoff Results

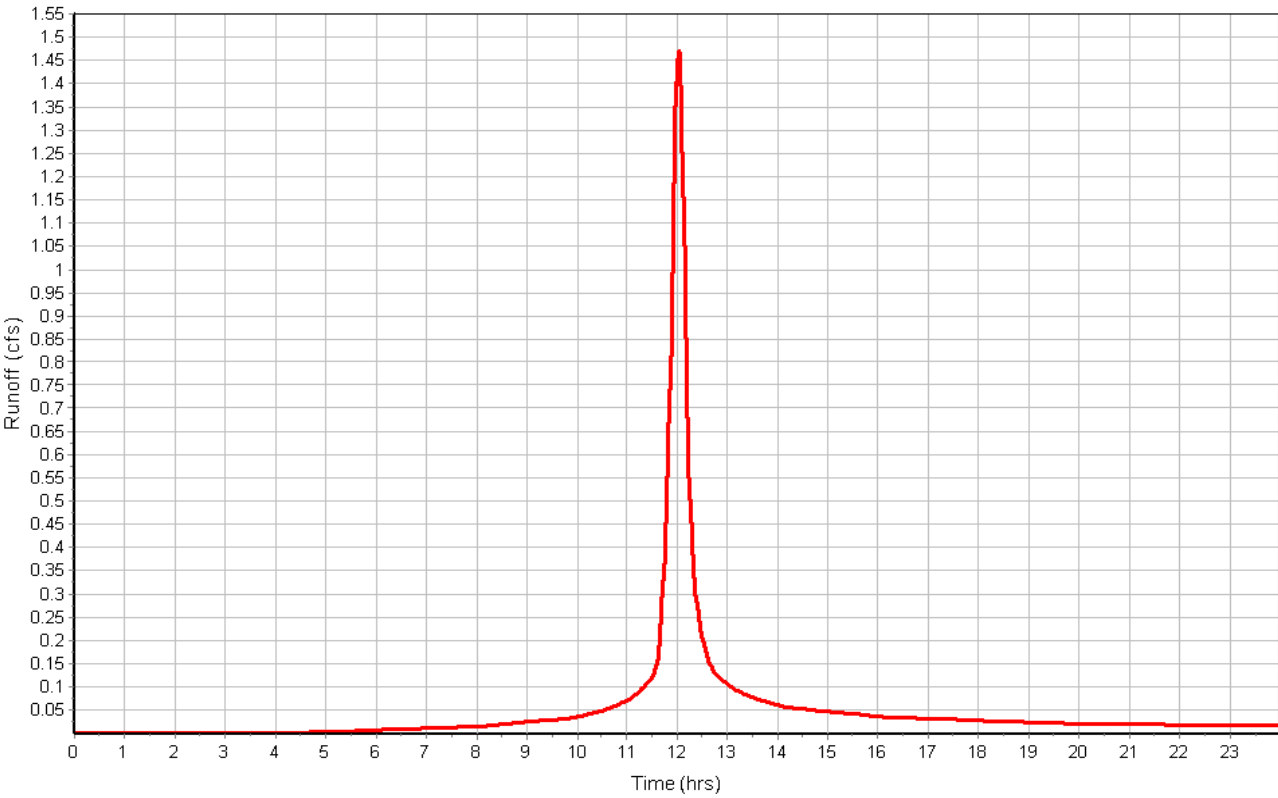
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 1.47  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:14:06

Subbasin : B3f

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3g

Input Data

Area (ac) ..... 1.55  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

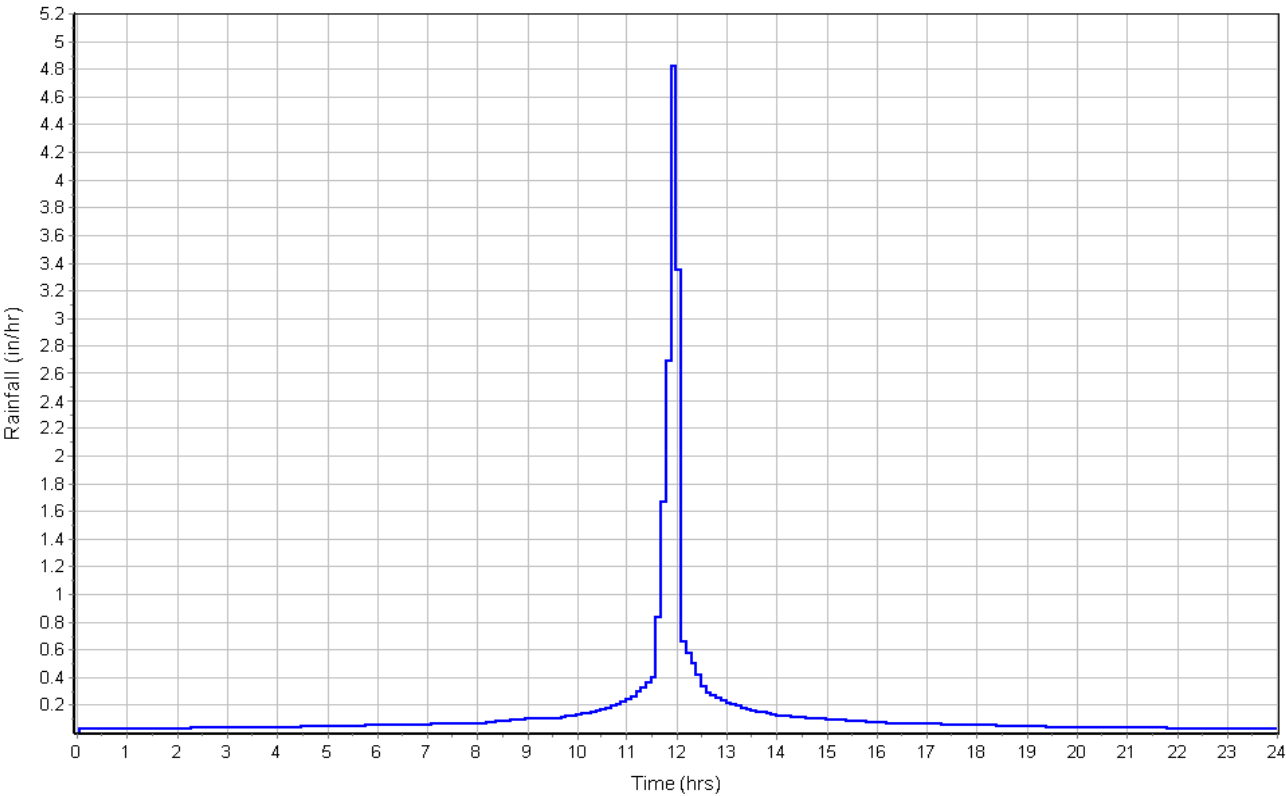
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	1.55	-	93.00
Composite Area & Weighted CN	1.55		93.00

Subbasin Runoff Results

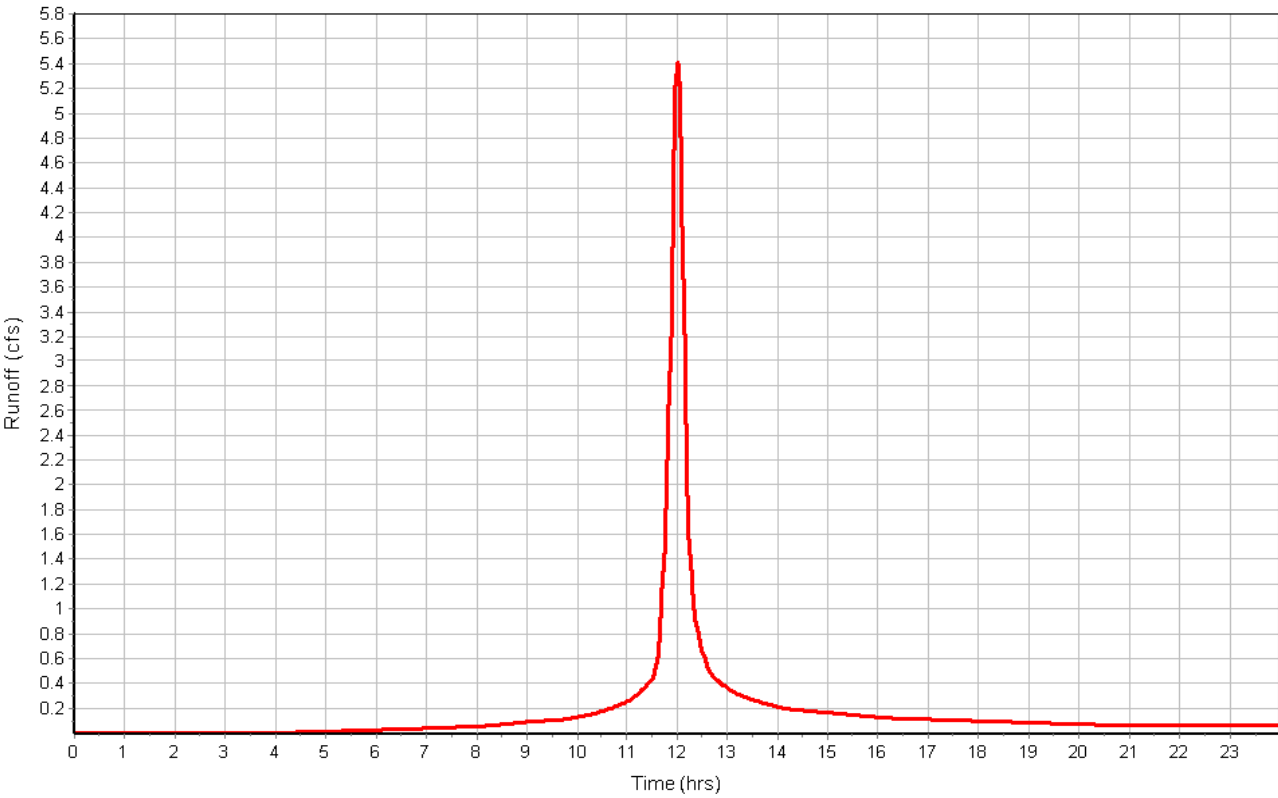
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 5.41  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:12:01

Subbasin : B3g

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B3h

Input Data

Area (ac) ..... 0.38  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

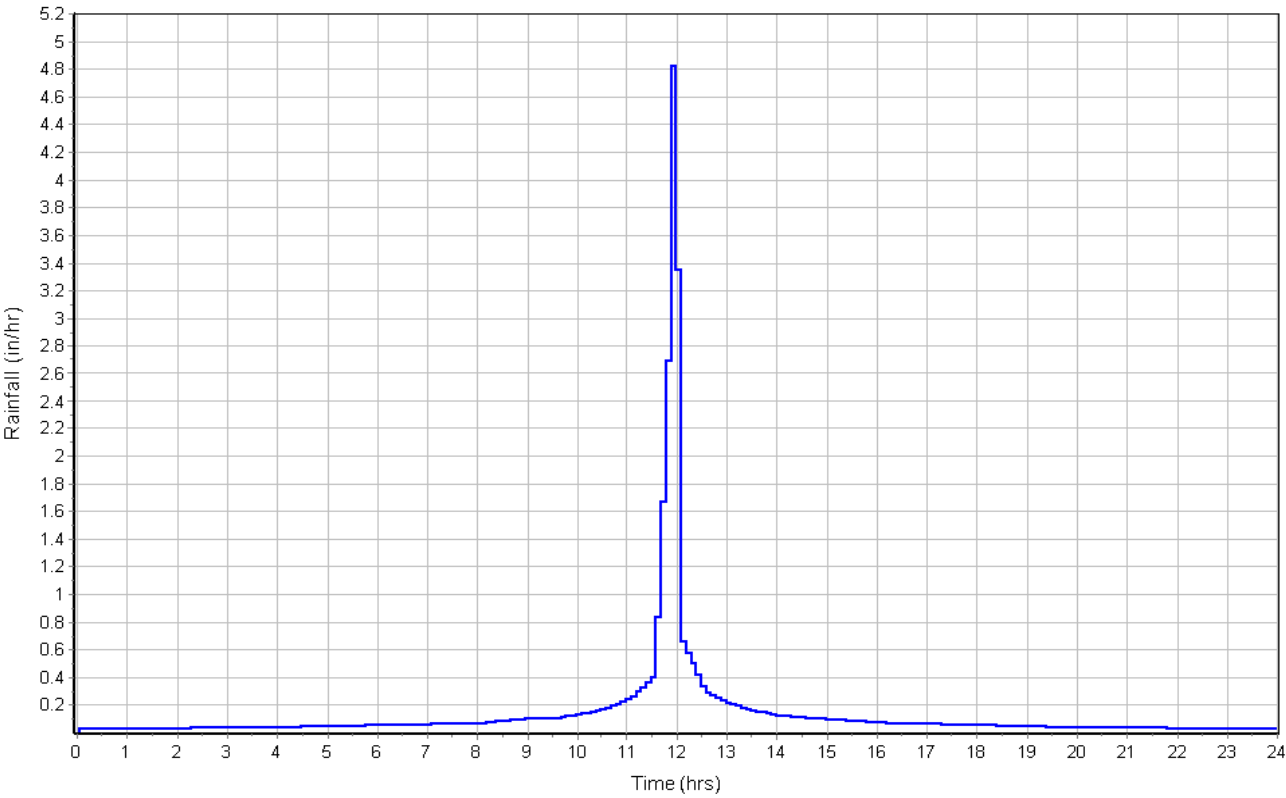
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.38	-	93.00
Composite Area & Weighted CN	0.38		93.00

Subbasin Runoff Results

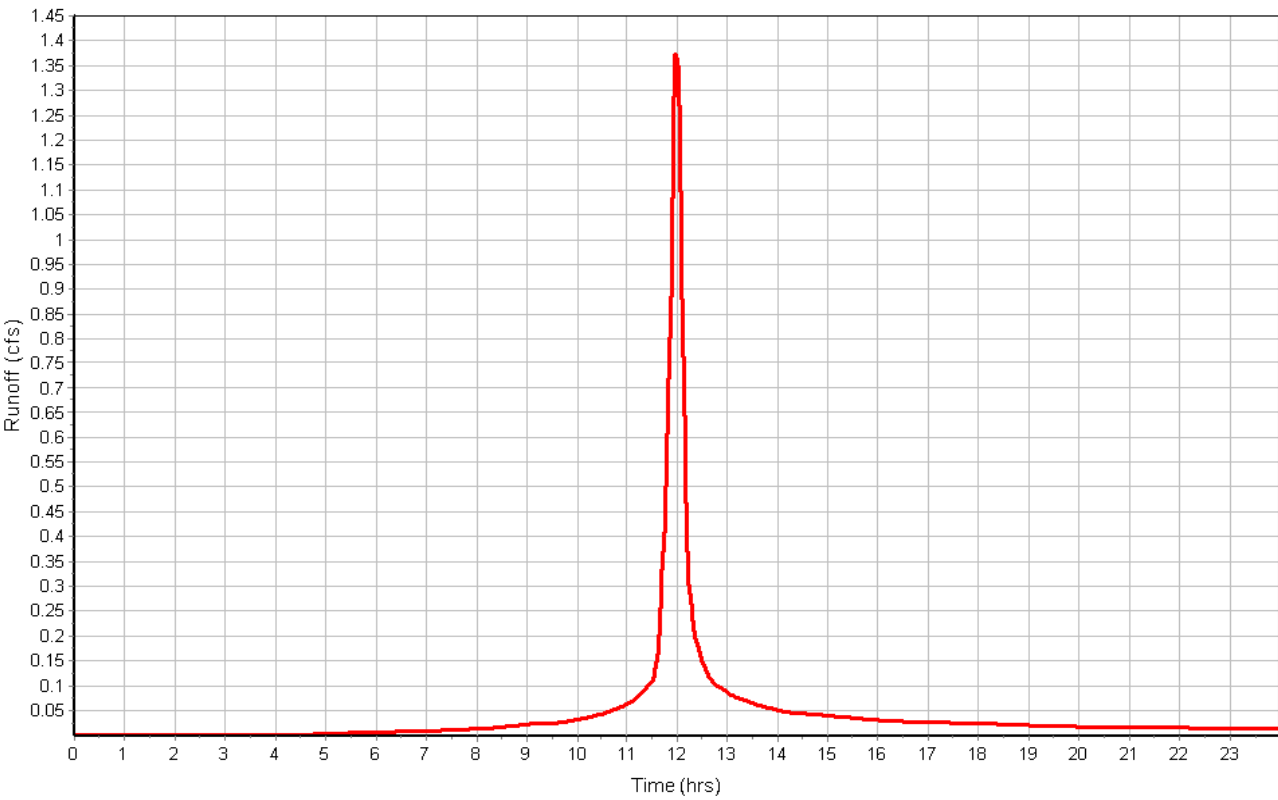
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 1.38  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:00

Subbasin : B3h

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B4a

Input Data

Area (ac) ..... 1.72  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	1.72	-	93.00
Composite Area & Weighted CN	1.72		93.00

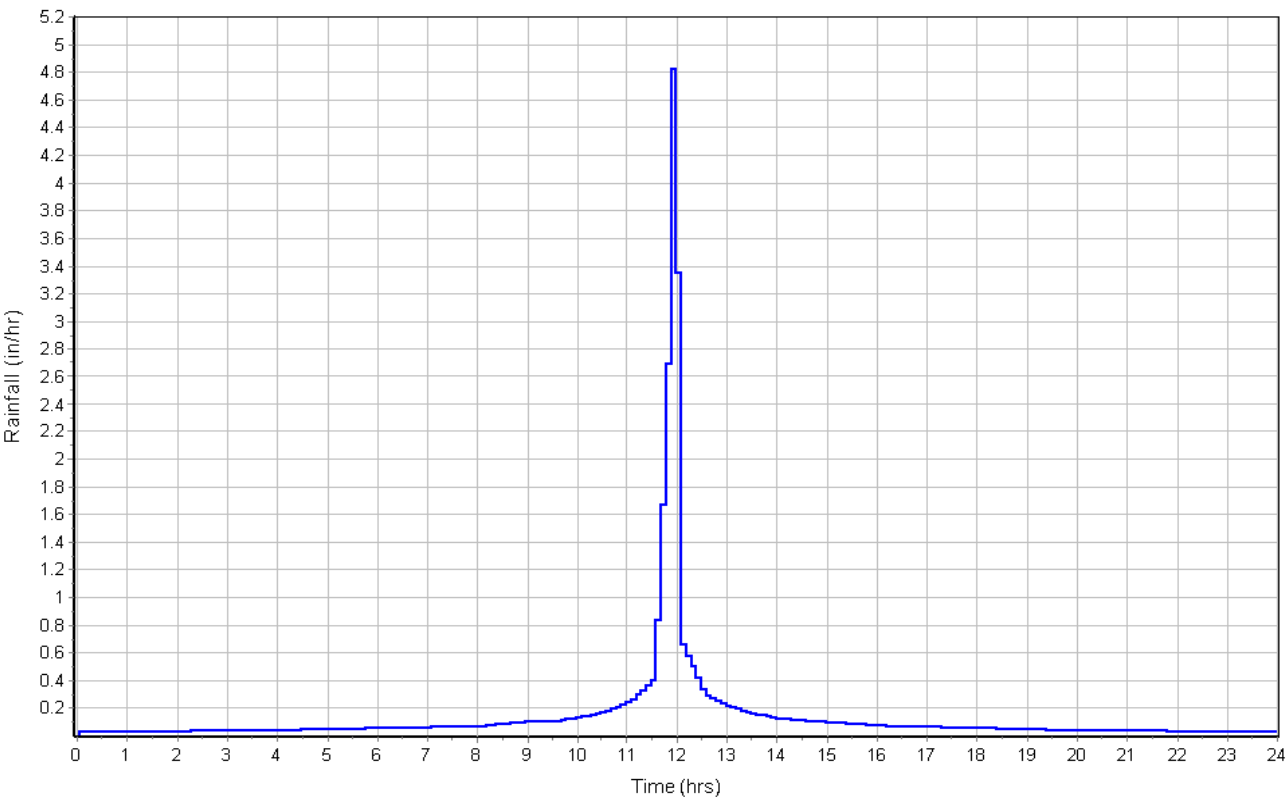
Subbasin Runoff Results

Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 6.18  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:10:44

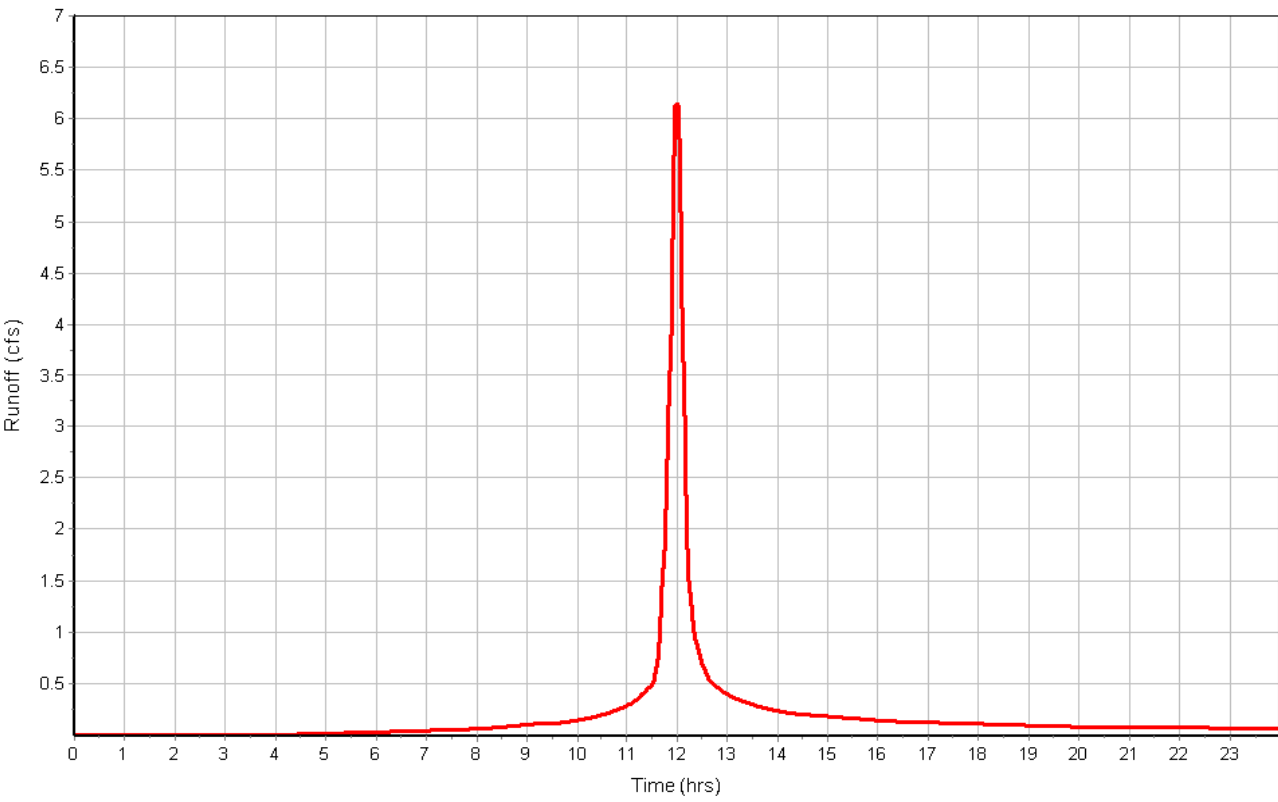


Subbasin : B4a

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B4b

Input Data

Area (ac) ..... 0.28  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

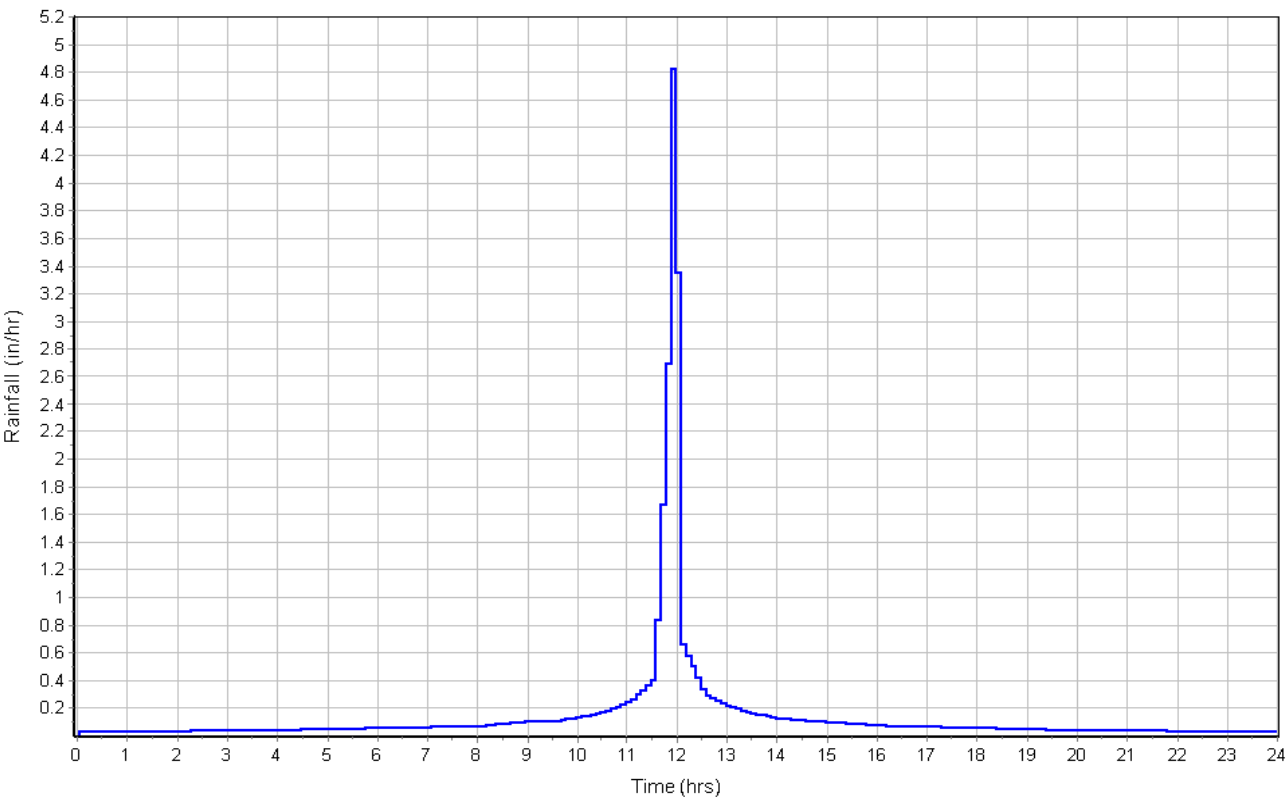
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.28	-	93.00
Composite Area & Weighted CN	0.28		93.00

Subbasin Runoff Results

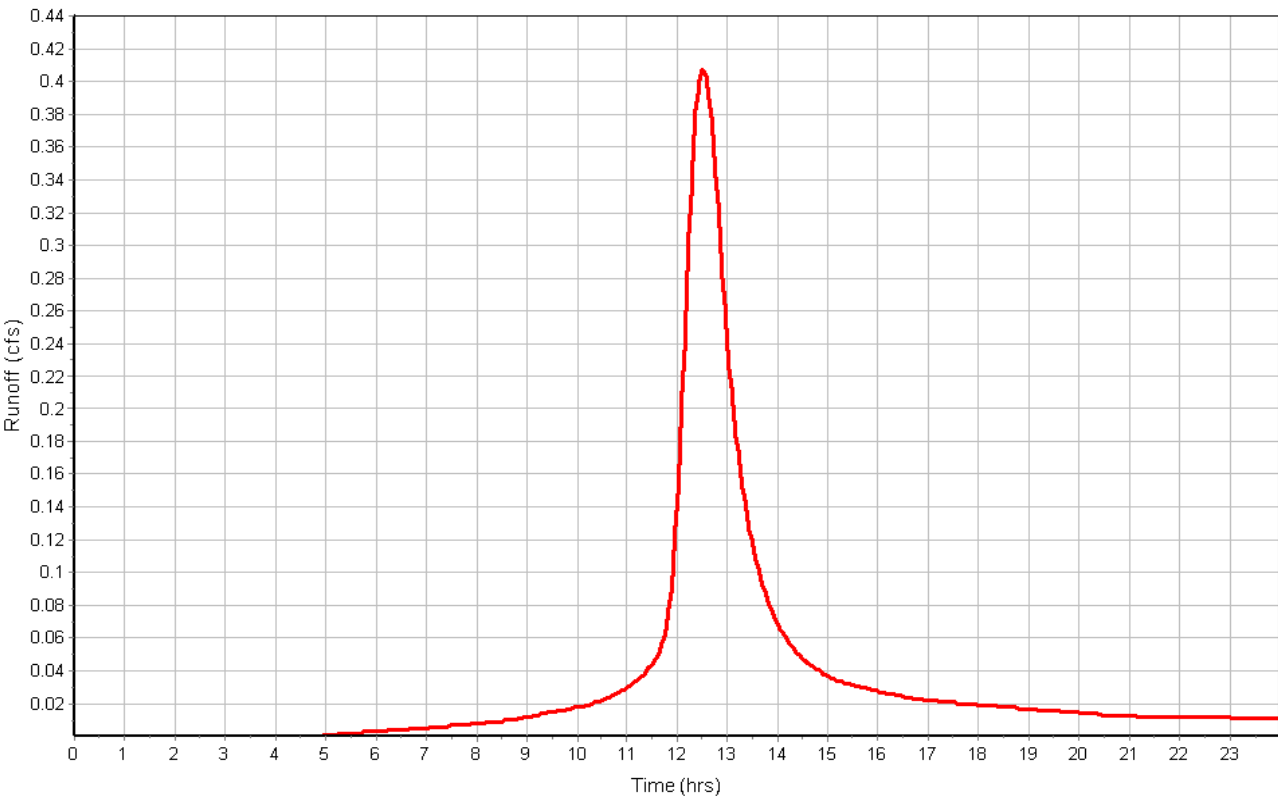
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 0.41  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 01:03:25

Subbasin : B4b

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : B4c

Input Data

Area (ac) ..... 0.23  
Weighted Curve Number ..... 93.00  
Rain Gage ID ..... \*

Composite Curve Number

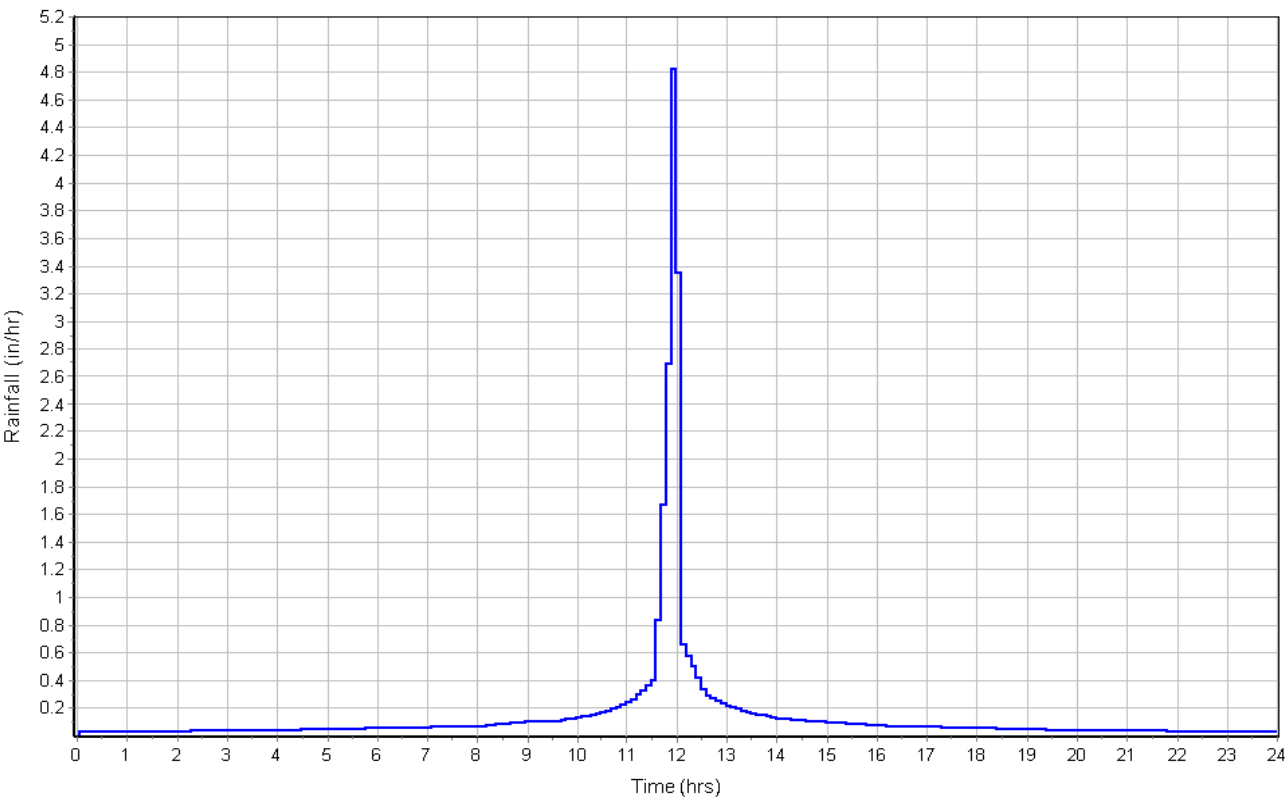
Soil/Surface Description	Area (acres)	Soil Group	Curve Number
-	0.23	-	93.00
Composite Area & Weighted CN	0.23		93.00

Subbasin Runoff Results

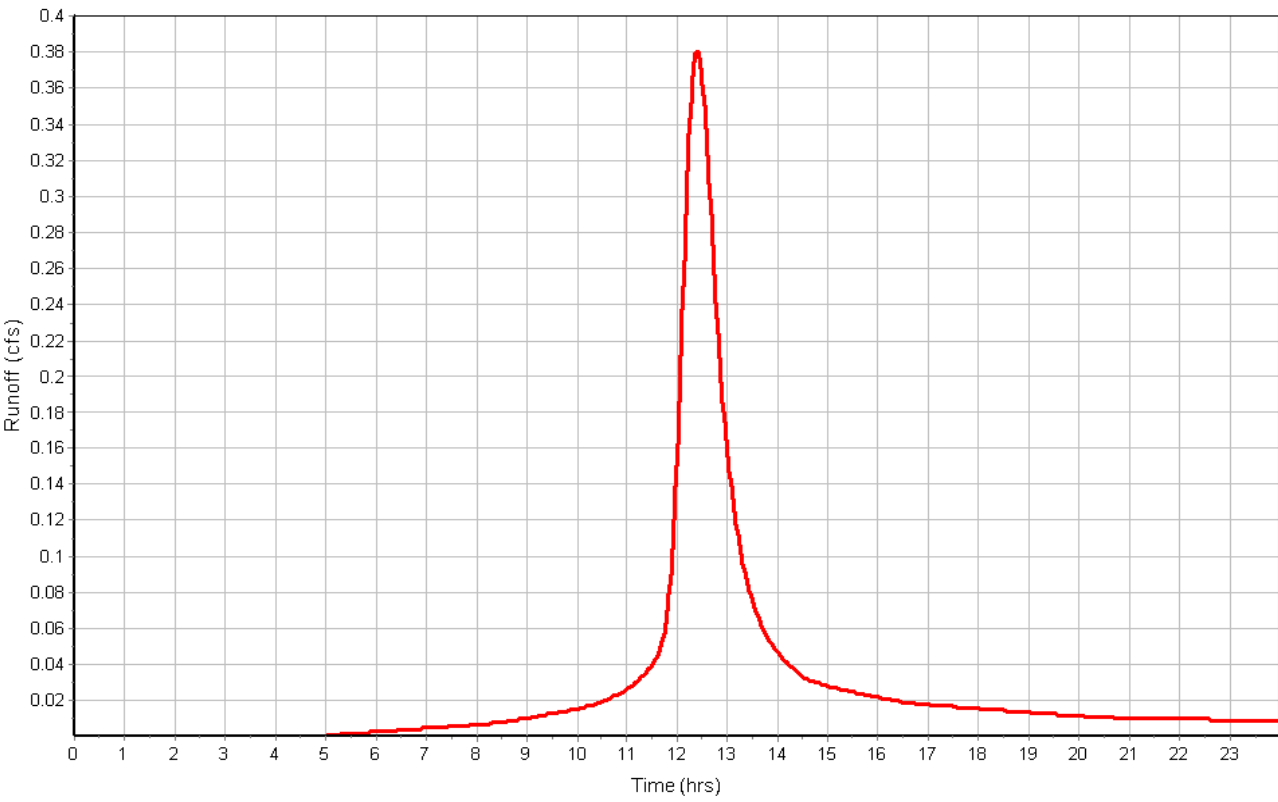
Total Rainfall (in) ..... 3.52  
Total Runoff (in) ..... 2.75  
Peak Runoff (cfs) ..... 0.38  
Weighted Curve Number ..... 93.00  
Time of Concentration (days hh:mm:ss) ..... 0 00:52:31

Subbasin : B4c

Rainfall Intensity Graph



Runoff Hydrograph



## Vanguard Farms Apartments

SN Element ID	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft²)	(in)
1 B1-4	672.61	675.45	2.83	672.61	0.00	675.45	0.00	0.00	0.00
2 B2-2	673.36	677.74	4.38	673.36	0.00	677.74	0.00	0.00	0.00
3 B2-5	674.47	677.61	3.14	674.47	0.00	677.61	0.00	0.00	0.00
4 B3-3	671.02	674.58	3.56	671.02	0.00	674.58	0.00	0.00	0.00
5 B3-7	673.67	679.16	5.50	673.67	0.00	679.16	0.00	0.00	0.00
6 B3-8	674.52	679.79	5.27	674.52	0.00	679.79	0.00	0.00	0.00
7 B3-9	674.89	679.79	4.90	674.89	0.00	679.79	0.00	0.00	0.00
8 DRIVE B1a	678.19	6.00	-672.19	0.00	-678.19	0.00	-6.00	0.00	0.00
9 DRIVE B1b	679.17	6.00	-673.17	0.00	-679.17	0.00	-6.00	0.00	0.00
10 DRIVE B2a	679.85	6.00	-673.85	0.00	-679.85	0.00	-6.00	0.00	0.00
11 DRIVE B2b	675.31	6.00	-669.31	0.00	-675.31	0.00	-6.00	0.00	0.00
12 DRIVE B2c	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
13 DRIVE B2d	678.76	6.00	-672.76	0.00	-678.76	0.00	-6.00	0.00	0.00
14 DRIVE B3f	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
15 DRIVE B3g-1	0.00	6.00	6.00	0.00	0.00	6.00	0.00	0.00	0.00
16 DRIVE B3h	674.83	6.00	-668.83	0.00	-674.83	0.00	-6.00	0.00	0.00
17 OUTFALL B2	673.11	679.16	6.05	673.11	0.00	679.16	0.00	0.00	0.00
18 SDWK BOX B DUMMY	675.58	677.34	1.76	0.00	-675.58	0.00	-677.34	0.00	0.00

## Vanguard Farms Apartments

SN Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1 B1-4	15.73	0.00	673.41	0.80	0.00	2.04	672.70	0.09	0 12:06	0 00:00	0.00	0.00
2 B2-2	8.40	0.00	674.24	0.88	0.00	3.50	673.53	0.17	0 12:06	0 00:00	0.00	0.00
3 B2-5	4.66	0.00	675.36	0.89	0.00	2.26	674.63	0.16	0 12:03	0 00:00	0.00	0.00
4 B3-3	10.63	0.00	671.89	0.87	0.00	2.69	671.20	0.18	0 12:07	0 00:00	0.00	0.00
5 B3-7	3.12	0.00	674.28	0.61	0.00	4.88	673.85	0.18	0 12:11	0 00:00	0.00	0.00
6 B3-8	3.12	0.00	675.03	0.51	0.00	4.76	674.68	0.16	0 12:10	0 00:00	0.00	0.00
7 B3-9	1.57	0.00	675.32	0.43	0.00	4.47	675.04	0.15	0 12:10	0 00:00	0.00	0.00
8 DRIVE B1a	0.83	0.82	678.31	0.12	0.00	0.12	678.22	0.03	0 12:06	0 00:00	0.00	0.00
9 DRIVE B1b	0.77	0.77	679.27	0.10	0.00	0.14	679.19	0.02	0 12:00	0 00:00	0.00	0.00
10 DRIVE B2a	1.21	1.21	679.98	0.13	0.00	0.11	679.88	0.03	0 12:00	0 00:00	0.00	0.00
11 DRIVE B2b	1.31	1.30	679.18	3.87	0.00	0.10	679.07	3.76	0 12:00	0 00:00	0.00	0.00
12 DRIVE B2c	0.97	0.97	679.97	679.97	0.00	0.12	679.87	679.87	0 12:02	0 00:00	0.00	0.00
13 DRIVE B2d	1.28	1.28	678.89	0.13	0.00	0.10	678.78	0.02	0 12:00	0 00:00	0.00	0.00
14 DRIVE B3f	1.47	1.47	676.33	676.33	0.00	0.10	676.22	676.22	0 12:04	0 00:00	0.00	0.00
15 DRIVE B3g-1	5.40	5.40	678.79	678.79	0.00	0.03	678.62	678.62	0 12:02	0 00:00	0.00	0.00
16 DRIVE B3h	1.47	1.37	674.98	0.15	0.00	0.10	674.86	0.03	0 12:02	0 00:00	0.00	0.00
17 OUTFALL B2	15.73	0.00	673.94	0.83	0.00	5.22	673.23	0.12	0 12:06	0 00:00	0.00	0.00
18 SDWK BOX B DUMMY	7.60	6.14	676.22	0.64	0.00	1.12	675.64	0.06	0 12:02	0 00:00	0.00	0.00

## Vanguard Farms Apartments

SN Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Shape Slope	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flap Flow Gate
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)	(ft)	(ft)					(cfs)
1 CHANNEL B 1	621.36	675.58	0.00	673.11	0.00	2.47	0.4000 Trapezoidal	1.250	13.500	0.0400	0.0000	0.0000	0.0000	0.00 No
2 CHANNEL B 2	123.46	673.11	0.00	672.61	0.00	0.50	0.4000 User-Defined	1.310	13.500	0.0240	0.0000	0.0000	0.0000	0.00 No
3 CHANNEL B DUMMY	1.00	677.34	1.76	675.58	0.00	1.76	176.4000 Trapezoidal	1.250	13.500	0.0400	0.0000	0.0000	0.0000	0.00 No
4 DRIVE B1a	172.00	678.19	0.00	677.34	1.76	0.85	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No
5 DRIVE B1a DUMMY	1.00	678.20	3.32	678.19	0.00	0.01	0.5000 Triangular	0.240	24.000	0.0320	0.0000	0.0000	0.0000	0.00 No
6 DRIVE B1b	165.84	679.17	0.00	677.34	1.76	1.83	1.1000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No
7 DRIVE B2a	163.00	679.85	0.00	679.04	3.73	0.81	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No
8 DRIVE B2b	169.00	679.04	3.74	678.20	3.32	0.84	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No
9 DRIVE B2b DUMMY	1.00	679.04	3.73	675.31	0.00	3.74	373.5300 Triangular	0.240	24.000	0.0320	0.0000	0.0000	0.0000	0.00 No
10 DRIVE B2c	218.00	679.85	679.85	678.76	3.65	1.09	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No
11 DRIVE B2d	182.72	678.76	0.00	677.85	3.20	0.90	0.4900 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No
12 DRIVE B2d DUMMY	1.00	678.76	3.65	678.76	0.00	0.01	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No
13 DRIVE B2e	125.00	677.85	3.20	677.22	3.02	0.63	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No
14 DRIVE B3f	124.52	676.19	676.19	675.57	3.37	0.62	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No
15 DRIVE B3g-1	400.00	678.58	678.58	674.84	3.31	3.74	0.9400 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No
16 DRIVE B3g-2	145.00	675.57	3.37	674.84	3.31	0.73	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No
17 DRIVE B3h	185.00	674.83	0.00	673.91	3.25	0.93	0.5000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No
18 DRIVE B3h DUMMY	1.00	674.84	3.31	674.83	0.00	0.01	0.6000 Triangular	0.240	24.000	0.0130	0.0000	0.0000	0.0000	0.00 No



## Vanguard Farms Apartments

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 CHANNEL B 1	7.34	0 12:06	26.12	0.28	1.65	6.28	0.62	0.50	0.00		
2 CHANNEL B 2	15.73	0 12:06	82.56	0.19	4.07	0.51	0.55	0.42	0.00		
3 CHANNEL B DUMMY	1.53	0 12:04	550.73	0.00	5.90	0.00	0.04	0.03	0.00		
4 DRIVE B1a	0.83	0 12:07	5.64	0.15	1.23	2.33	0.12	0.49	0.00		
5 DRIVE B1a DUMMY	0.02	0 12:02	2.30	0.01	0.23	0.07	0.04	0.16	0.00		
6 DRIVE B1b	0.76	0 12:02	8.41	0.09	1.62	1.71	0.10	0.41	0.00		
7 DRIVE B2a	1.20	0 12:02	5.64	0.21	1.36	2.00	0.13	0.56	0.00		
8 DRIVE B2b	1.31	0 12:02	5.66	0.23	1.39	2.03	0.14	0.58	0.00		
9 DRIVE B2b DUMMY	0.01	0 12:02	62.88	0.00	0.00		0.01	0.04	0.00		
10 DRIVE B2c	0.96	0 12:04	5.66	0.17	1.31	2.77	0.12	0.51	0.00		
11 DRIVE B2d	1.27	0 12:02	5.63	0.23	1.38	2.21	0.14	0.57	0.00		
12 DRIVE B2d DUMMY	0.01	0 12:04	5.68	0.00	0.34	0.05	0.02	0.07	0.00		
13 DRIVE B2e	0.01	0 12:06	5.68	0.00	0.94	2.22	0.02	0.10	0.00		
14 DRIVE B3f	1.47	0 12:04	5.66	0.26	1.42	1.46	0.14	0.60	0.00		
15 DRIVE B3g-1	5.35	0 12:04	7.75	0.69	2.53	2.64	0.21	0.87	0.00		
16 DRIVE B3g-2	0.01	0 12:09	5.68	0.00	0.59	4.10	0.02	0.07	0.00		
17 DRIVE B3h	1.47	0 12:03	5.66	0.26	1.44	2.14	0.14	0.60	0.00		
18 DRIVE B3h DUMMY	0.13	0 12:04	6.18	0.02	0.82	0.02	0.06	0.24	0.00		

## Vanguard Farms Apartments

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	B1-1	27.44	670.68	0.00	670.57	0.00	0.11	0.4000	Rectangular	24.000	60.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
2	B1-2	325.38	671.98	0.00	670.78	0.10	1.20	0.3700	Rectangular	24.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
3	B1-3	135.92	672.61	0.00	672.08	0.10	0.54	0.4000	Rectangular	24.000	48.000	0.0130	0.2000	0.5000	0.0000	0.00	No	1
4	B2-1	81.97	673.36	0.00	673.16	0.05	0.20	0.2400	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
5	B2-2	126.09	673.76	0.00	673.46	0.10	0.30	0.2400	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
6	B2-3	171.36	674.20	0.00	673.86	0.10	0.34	0.2000	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
7	B2-4	86.66	674.47	0.00	674.30	0.10	0.17	0.2000	Rectangular	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
8	B2-5	41.89	674.65	0.00	674.57	0.10	0.08	0.2000	Rectangular	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
9	B2-6	61.04	674.87	0.00	674.75	0.10	0.12	0.2000	CIRCULAR	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
10	B2-7	170.14	675.31	0.00	674.97	0.10	0.34	0.2000	Rectangular	24.000	24.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1
11	B2c-1	182.72	675.12	0.00	674.75	0.10	0.37	0.2000	Rectangular	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
12	B3-1	33.76	670.66	0.00	670.57	0.00	0.09	0.2700	Rectangular	24.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
13	B3-2	96.98	671.02	0.00	670.76	0.10	0.26	0.2700	Rectangular	24.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
14	B3-3	101.12	671.52	0.00	671.12	0.10	0.40	0.4000	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
15	B3-4	143.96	672.20	0.00	671.62	0.10	0.58	0.4000	Rectangular	24.000	36.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
16	B3-5	87.13	672.88	0.00	672.30	0.10	0.58	0.6700	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
17	B3-6	116.41	673.67	0.00	672.88	0.00	0.78	0.6700	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
18	B3-7	112.25	674.52	0.00	673.77	0.10	0.75	0.6700	CIRCULAR	24.000	24.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
19	B3-8	40.25	674.89	0.00	674.62	0.10	0.27	0.6700	CIRCULAR	24.000	24.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
20	B3-9	87.75	675.58	0.00	674.99	0.10	0.59	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
21	B3b-1	68.38	675.45	0.00	674.99	0.10	0.46	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
22	B3c-1	75.08	675.12	0.00	674.62	0.10	0.50	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1
23	B3d-1	51.50	674.97	0.00	674.62	0.10	0.35	0.6700	CIRCULAR	12.000	12.000	0.0110	0.5000	0.5000	0.0000	0.00	No	1

## Vanguard Farms Apartments

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 B1-1	16.15	0 12:07	57.77	0.28	4.76	0.10	0.68	0.34	0.00		Calculated
2 B1-2	15.91	0 12:07	42.38	0.38	4.85	1.12	0.82	0.41	0.00		Calculated
3 B1-3	15.72	0 12:07	43.95	0.36	4.95	0.46	0.79	0.40	0.00		Calculated
4 B2-1	8.40	0 12:06	23.90	0.35	3.59	0.38	0.78	0.39	0.00		Calculated
5 B2-2	8.40	0 12:06	23.90	0.35	3.59	0.59	0.78	0.39	0.00		Calculated
6 B2-3	6.63	0 12:04	21.82	0.30	3.14	0.91	0.70	0.35	0.00		Calculated
7 B2-4	4.66	0 12:03	12.88	0.36	2.96	0.49	0.79	0.39	0.00		Calculated
8 B2-5	4.66	0 12:03	12.88	0.36	2.96	0.24	0.79	0.39	0.00		Calculated
9 B2-6	2.47	0 12:03	10.12	0.24	2.66	0.38	0.67	0.34	0.00		Calculated
10 B2-7	1.19	0 12:03	11.16	0.11	1.77	1.60	0.33	0.17	0.00		Calculated
11 B2c-1	0.96	0 12:05	12.88	0.07	1.81	1.68	0.26	0.13	0.00		Calculated
12 B3-1	11.91	0 12:07	36.26	0.33	3.97	0.14	0.75	0.38	0.00		Calculated
13 B3-2	10.63	0 12:07	36.26	0.29	3.82	0.42	0.69	0.35	0.00		Calculated
14 B3-3	10.63	0 12:07	30.86	0.34	4.61	0.37	0.77	0.38	0.00		Calculated
15 B3-4	6.05	0 12:11	30.86	0.20	3.85	0.62	0.52	0.26	0.00		Calculated
16 B3-5	5.17	0 12:14	21.90	0.24	5.71	0.25	0.66	0.33	0.00		Calculated
17 B3-6	3.12	0 12:11	21.90	0.14	4.94	0.39	0.51	0.25	0.00		Calculated
18 B3-7	3.12	0 12:11	21.88	0.14	4.94	0.38	0.51	0.26	0.00		Calculated
19 B3-8	1.57	0 12:10	20.06	0.08	3.80	0.18	0.38	0.19	0.00		Calculated
20 B3-9	0.76	0 12:12	3.45	0.22	3.52	0.42	0.32	0.32	0.00		Calculated
21 B3b-1	0.83	0 12:10	3.45	0.24	3.61	0.32	0.33	0.33	0.00		Calculated
22 B3c-1	0.76	0 12:12	3.45	0.22	3.52	0.36	0.32	0.32	0.00		Calculated
23 B3d-1	0.81	0 12:10	3.45	0.24	3.59	0.24	0.33	0.33	0.00		Calculated

## Vanguard Farms Apartments

SN Element ID	Inlet Manufacturer	Manufacturer Part Number	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Max (Rim) Elevation (ft)	Inlet Depth (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Ponded Area (ft²)	Grate Clogging Factor (%)
1 B1-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.68	674.37	3.69	670.68	0.00	0.00	0.00
2 B1-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	671.98	675.90	3.92	671.98	0.00	0.00	0.00
3 B2-3	FHWA HEC-22 GENERIC	N/A	On Sag	1	673.76	677.31	3.55	673.76	0.00	0.00	0.00
4 B2-4	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.20	677.22	3.02	674.20	0.00	0.00	0.00
5 B2-6	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.65	677.85	3.20	674.65	0.00	N/A	0.00
6 B2-7	FHWA HEC-22 GENERIC	N/A	On Grade	1	674.87	678.20	3.32	674.87	0.00	N/A	0.00
7 B2-8	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.31	679.04	3.73	675.31	0.00	N/A	0.00
8 B2c-1	FHWA HEC-22 GENERIC	N/A	On Grade	1	675.12	678.76	3.65	675.12	0.00	N/A	0.00
9 B3-2	FHWA HEC-22 GENERIC	N/A	On Sag	1	670.66	673.91	3.25	670.66	0.00	0.00	0.00
10 B3-4	FHWA HEC-22 GENERIC	N/A	On Grade	1	671.52	674.84	3.31	671.52	0.00	N/A	0.00
11 B3-5	FHWA HEC-22 GENERIC	N/A	On Grade	1	672.20	675.57	3.37	672.20	0.00	N/A	0.00
12 B3-6	FHWA HEC-22 GENERIC	N/A	On Sag	1	672.88	676.10	3.22	672.88	0.00	0.00	0.00
13 INLET B3a	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	679.17	3.59	675.58	0.00	0.00	0.00
14 INLET B3b	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.45	678.68	3.23	675.45	0.00	0.00	0.00
15 INLET B3c	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.12	679.17	4.05	675.12	0.00	0.00	0.00
16 INLET B3d	FHWA HEC-22 GENERIC	N/A	On Sag	1	674.97	678.67	3.71	674.97	0.00	0.00	0.00
17 SDWK BOX B	FHWA HEC-22 GENERIC	N/A	On Sag	1	675.58	677.34	1.76	0.00	0.00	0.00	0.00

## Vanguard Farms Apartments

SN Element ID	Roadway Longitudinal Slope (ft/ft)	Roadway Cross Slope (ft/ft)	Roadway Manning's Roughness	Gutter Cross Slope (ft/ft)	Gutter Width (ft)	Gutter Depression (in)	Allowable Spread (ft)
1 B1-2	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
2 B1-3	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
3 B2-3	N/A	0.0200	0.0160	0.0620	1.50	0.1640	7.00
4 B2-4	N/A	0.0200	0.0160	0.0620	1.50	0.1640	7.00
5 B2-6	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
6 B2-7	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
7 B2-8	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
8 B2c-1	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
9 B3-2	N/A	0.0200	0.0160	0.0620	1.50	0.1640	7.00
10 B3-4	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
11 B3-5	0.0050	0.0200	0.0160	0.0620	1.50	0.1640	7.00
12 B3-6	N/A	0.0200	0.0160	0.0620	2.00	0.1640	7.00
13 INLET B3a	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
14 INLET B3b	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
15 INLET B3c	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
16 INLET B3d	N/A	0.0200	0.0160	0.0620	2.00	0.0656	7.00
17 SDWK BOX B	N/A	0.0200	0.0130	0.0620	1.50	0.1640	7.00

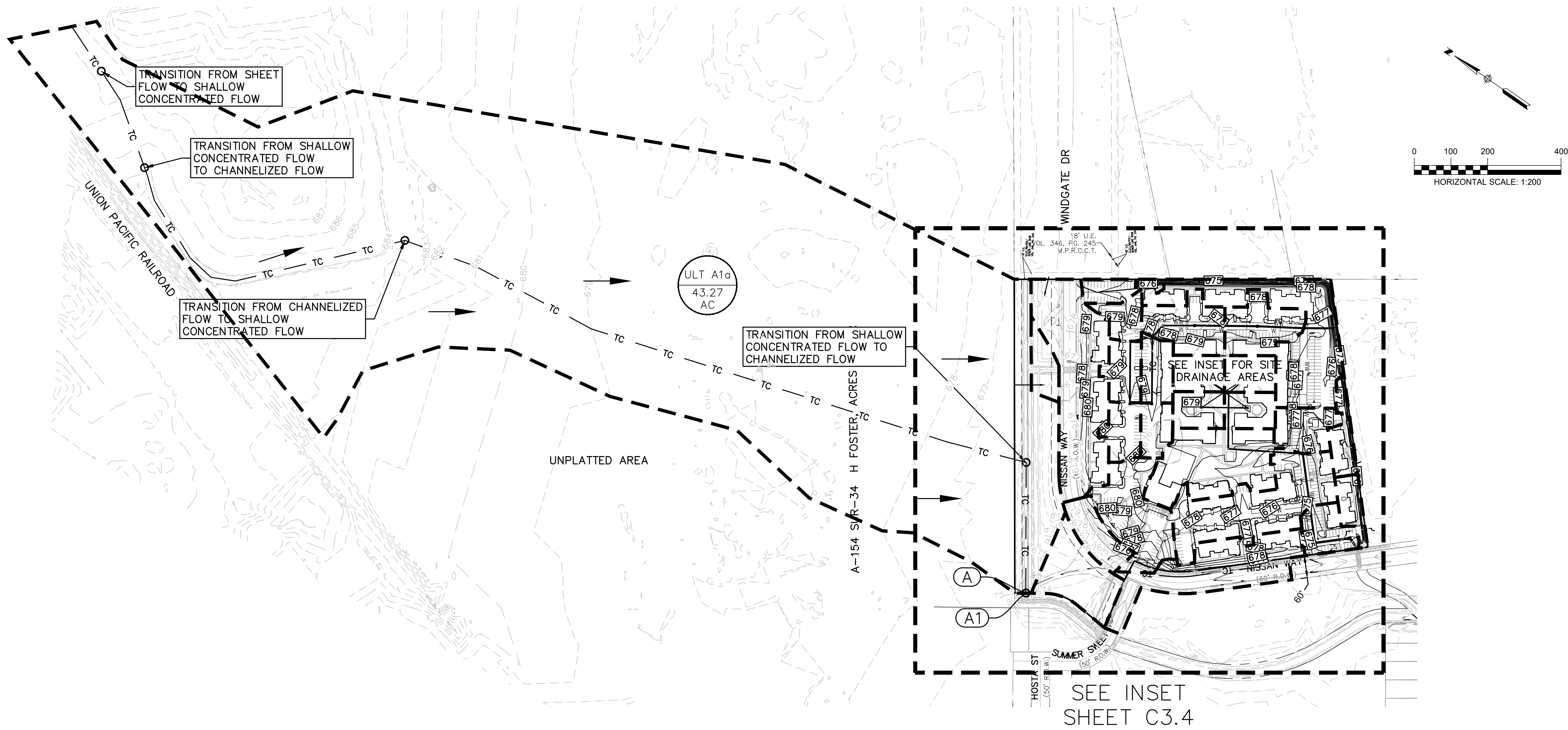
**Vanguard Farms Apartments**

SN Element ID	Peak Flow	Peak Lateral Inflow	Peak Flow Intercepted	Peak Flow Bypassing Inlet	Inlet Efficiency during Peak	Max Gutter Spread during Peak	Max Gutter Water Elev. during Peak	Max Gutter Water Depth during Peak	Time of Max Depth Occurrence	Total Flooded Volume	Total Time Flooded
	(cfs)	(cfs)	(cfs)	(cfs)	Flow (%)	Flow (ft)	Flow (ft)	Flow (ft)	(days hh:mm)	(ac-in)	(min)
1 B1-2	0.38	0.38	N/A	N/A	N/A	2.34	674.51	0.14	0 12:07	0.00	0.00
2 B1-3	0.41	0.41	N/A	N/A	N/A	2.51	676.05	0.15	0 12:07	0.00	0.00
3 B2-3	1.81	1.81	N/A	N/A	N/A	10.28	678.00	0.69	0 12:04	0.00	0.00
4 B2-4	2.01	2.00	N/A	N/A	N/A	11.72	677.94	0.71	0 12:03	0.00	0.00
5 B2-6	1.27	0.00	1.26	0.02	98.81	8.51	678.09	0.23	0 12:03	0.00	0.00
6 B2-7	1.31	0.00	1.29	0.02	98.76	8.60	678.43	0.23	0 12:02	0.00	0.00
7 B2-8	1.20	0.00	1.19	0.01	98.96	8.30	679.27	0.23	0 12:02	0.00	0.00
8 B2c-1	0.96	0.00	0.96	0.01	99.47	7.57	678.98	0.21	0 12:04	0.00	0.00
9 B3-2	1.47	0.00	N/A	N/A	N/A	7.10	674.53	0.62	0 12:07	0.00	0.00
10 B3-4	5.35	0.00	5.22	0.13	97.50	15.15	675.20	0.37	0 12:06	0.00	0.00
11 B3-5	1.47	0.00	1.46	0.01	99.59	9.05	675.81	0.24	0 12:14	0.00	0.00
12 B3-6	2.36	2.36	N/A	N/A	N/A	8.09	676.76	0.66	0 12:14	0.00	0.00
13 INLET B3a	0.76	0.76	N/A	N/A	N/A	2.49	679.41	0.24	0 12:12	0.00	0.00
14 INLET B3b	0.83	0.83	N/A	N/A	N/A	2.72	678.94	0.26	0 12:10	0.00	0.00
15 INLET B3c	0.76	0.76	N/A	N/A	N/A	2.49	679.41	0.24	0 12:12	0.00	0.00
16 INLET B3d	0.81	0.81	N/A	N/A	N/A	2.67	678.93	0.26	0 12:10	0.00	0.00
17 SDWK BOX B	1.53	0.00	N/A	N/A	N/A	9.63	678.01	0.67	0 00:00	0.00	0.00

# Attachment N

## Ultimate Conditions Drainage Area Map

Drawing Name: W:\\_Projects\223 - ULF, LLC\001 - Heather (Gen Apartments)\Cadd\Site Project SET\323.001\_DWG.dwg User: jghm Jul 29, 2020 - 10:58am



**LEGEND**

- EXISTING CONTOURS
- PROPOSED CONTOURS
- B.L. BUILDING SETBACK LINE
- U.E. UTILITY EASEMENT
- D.E. DRAINAGE EASEMENT
- DRAINAGE AREA
- TC TIME OF CONCENTRATION
- POINT OF CONCENTRATION
- DRAINAGE FLOW DIRECTION
- DRAINAGE AREA LABEL

Table 3 - Ultimate Conditions Hydrology Calculations - City of New Braunfels								
Point of Concentration	Drainage Area	Area	T <sub>c</sub>	CN	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
A1a	Ult A1a	43.27	74.13	90.15	52.18	107.94	139.97	179.94
A1b	Ult A1b	1.93	36.79	95.10	4.34	8.24	10.47	13.27
A1c	Ult A1b+ A1c	2.20	36.79	94.84	4.92	9.36	11.91	15.10
A1	Ult A1a+ A1b+ A1c	45.47	74.13	90.38	55.21	113.79	147.43	189.40
A2b	Ult A2b	0.41	14.34	96.78	1.43	2.71	3.45	4.36
A2a	Ult A2a+ A2b	2.72	14.34	95.24	9.59	18.13	23.03	29.17
A2	Ult A2a+ A2b+ A2c	3.52	52.43	94.73	6.12	11.69	14.88	18.88
B1a	Ult B1a	0.27	17.88	93.00	0.82	1.60	2.05	2.61
B1b	Ult B1b	0.21	10.00	93.00	0.77	1.50	1.92	2.44
B2a	Ult B2a	0.33	10.00	93.00	1.21	2.36	3.02	3.84
B2b	Ult B2b	0.36	10.00	93.00	1.31	2.55	3.25	4.14
B2c	Ult B2c	0.28	11.31	93.00	0.98	1.90	2.42	3.08
B2d	Ult B2d	0.35	10.00	93.00	1.28	2.50	3.20	4.06
B2e	Ult B2e	0.32	17.85	93.00	2.00	3.90	4.99	6.35
B2f	Ult B2f	0.63	20.77	93.00	1.82	3.54	4.54	5.77
B3a	Ult B3a	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3b	Ult B3b	0.32	25.58	93.00	0.83	1.62	2.07	2.64
B3c	Ult B3c	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3d	Ult B3d	0.32	25.58	93.00	0.81	1.58	2.03	2.59
B3e	Ult B3e	1.33	47.04	93.00	2.36	4.63	5.93	7.56
B3f	Ult B3f	0.44	14.10	93.00	1.47	2.87	3.67	4.66
B3g	Ult B3g	1.55	12.01	93.00	5.41	10.52	13.45	17.10
B3h	Ult B3h	0.38	10.00	93.00	1.38	2.68	3.43	4.36
B4a	Ult B4a	1.72	10.73	93.00	6.18	12.02	15.37	19.55
B4b	Ult B4b	0.28	63.42	93.00	0.41	0.80	1.03	1.31
B4c	Ult B4c	0.23	52.52	93.00	0.38	0.75	0.96	1.22
B	Ult B	9.96	63.42	93.00	16.15	31.54	40.34	51.35

Table 5 - Existing to Ultimate Comparison					
Point of Concentration	Drainage Area	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
Ex B	Ex B	7.06	17.53	23.80	31.72
B	Ult B	16.15	31.54	40.34	51.35
Proposed is Less Than or Equal to Existing		NO	NO	NO	NO

290 S. CASTELL AVE., STE. 100  
NEW BRAUNFELS, TX 78130  
TBPE FIRM F-10961  
TBPLS FIRM 1053600

**HMT**  
ENGINEERING & SURVEYING

CHRISTOPHER P. VAN HERDE  
93047  
LICENSED PROFESSIONAL ENGINEER  
*Chris Van Heerde, P.E.*

07/29/2020

ULTIMATE DRAINAGE  
AREA MAP  
VANGUARD FARMS APARTMENTS

NO.	REVISION DESCRIPTION	REVISION DATE

DATE: **JULY 2020**  
DRAWN BY: **LB**  
DESIGNED BY: **JMM**  
REVIEWED BY: **CWH**  
HMT PROJECT NO.: **323.001**

**SHEET**  
**C3.3**



Drawing Name: M:\Projects\223 - ULF, LLC\001 - Heather (On Apartments)\CADD\PROJECT SET\223.001\_DWG.dwg User: jghm Jul 29, 2020 - 11:09am

SEE SHEET C1.03 OF NISSAN WAY EXTENSION (PI2019-0080) FOR ULTIMATE DRAINAGE AREA MAP

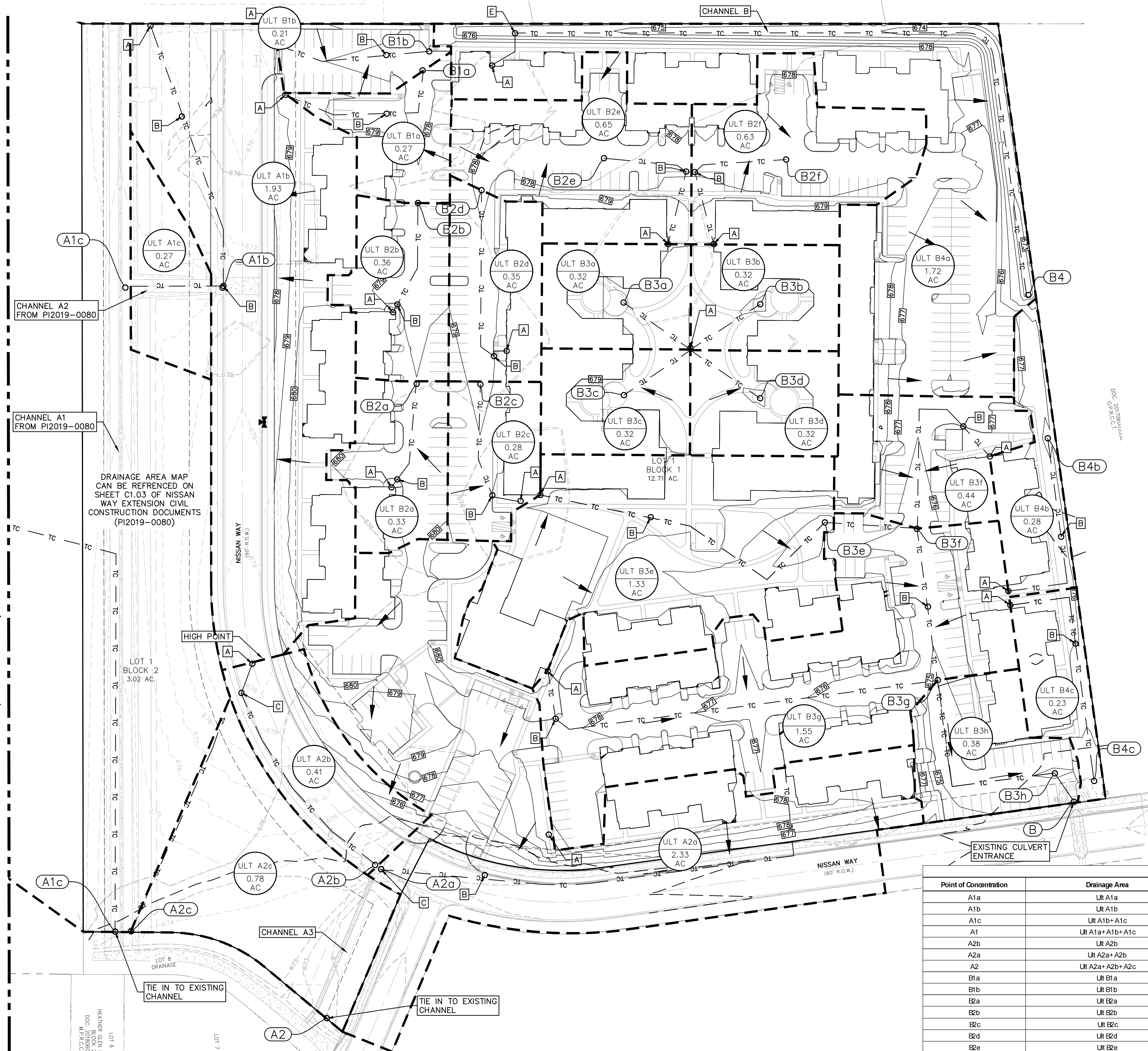


Table 3 - Ultimate Conditions Hydrology Calculations - City of New Braunfels

Point of Concentration	Drainage Area	Area	T <sub>c</sub>	CN	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
A1a	Ult A1a	43.27	74.13	90.15	52.18	107.94	139.97	179.94
A1b	Ult A1b	1.93	36.79	95.10	4.34	8.24	10.47	13.27
A1c	Ult A1c	2.20	36.79	94.84	4.92	9.36	11.91	15.10
A1	Ult A1a+A1b+A1c	45.47	74.13	90.38	55.21	113.79	147.43	189.40
A2b	Ult A2b	0.41	14.34	96.78	1.43	2.71	3.45	4.36
A2a	Ult A2a+A2b	2.72	14.34	95.24	9.59	18.13	23.03	29.17
A2	Ult A2a+A2b+A2c	3.52	52.43	94.73	6.12	11.69	14.88	18.88
B1a	Ult B1a	0.27	17.88	93.00	0.82	1.60	2.05	2.61
B1b	Ult B1b	0.21	10.00	93.00	0.77	1.50	1.92	2.44
B2a	Ult B2a	0.33	10.00	93.00	1.21	2.36	3.02	3.84
B2b	Ult B2b	0.36	10.00	93.00	1.31	2.55	3.25	4.14
B2c	Ult B2c	0.28	11.31	93.00	0.98	1.90	2.42	3.08
B2d	Ult B2d	0.35	10.00	93.00	1.28	2.50	3.20	4.06
B2e	Ult B2e	0.32	17.85	93.00	2.00	3.90	4.99	6.35
B2f	Ult B2f	0.63	20.77	93.00	1.82	3.54	4.54	5.77
B3a	Ult B3a	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3b	Ult B3b	0.32	25.58	93.00	0.83	1.62	2.07	2.64
B3c	Ult B3c	0.32	30.15	93.00	0.76	1.48	1.90	2.41
B3d	Ult B3d	0.32	25.58	93.00	0.81	1.58	2.03	2.59
B3e	Ult B3e	1.33	47.04	93.00	2.36	4.63	5.93	7.56
B3f	Ult B3f	0.44	14.10	93.00	1.47	2.87	3.67	4.66
B3g	Ult B3g	1.55	12.01	93.00	5.41	10.52	13.45	17.10
B3h	Ult B3h	0.38	10.00	93.00	1.38	2.68	3.43	4.36
B4a	Ult B4a	1.72	10.73	93.00	6.18	12.02	15.37	19.55
B4b	Ult B4b	0.28	63.42	93.00	0.41	0.80	1.03	1.31
B4c	Ult B4c	0.23	52.52	93.00	0.38	0.75	0.96	1.22
B	Ult B	9.96	63.42	93.00	16.15	31.54	40.34	51.35

Table 5 - Existing to Ultimate Comparison

Point of Concentration	Drainage Area	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
Ex B	Ult B	7.06	17.53	23.80	31.72
B	Ult B	16.15	31.54	40.34	51.35
Proposed is Less Than or Equal to Existing		NO	NO	NO	NO

LEGEND

- EXISTING CONTOURS
- PROPOSED CONTOURS
- B.L. BUILDING SETBACK LINE
- U.E. UTILITY EASEMENT
- D.E. DRAINAGE EASEMENT
- DRAINAGE AREA
- TC TIME OF CONCENTRATION
- POINT OF CONCENTRATION
- DRAINAGE FLOW DIRECTION
- DRAINAGE AREA LABEL
- BEGIN SHEET FLOW
- TRANSITION FROM SHEET FLOW TO SHALLOW CONCENTRATED FLOW
- TRANSITION FROM SHALLOW CONCENTRATED FLOW TO CHANNEL FLOW
- TRANSITION FROM UNPAVED TO PAVED SHALLOW CONCENTRATED FLOW
- TRANSITION FROM SHEET FLOW TO CHANNEL FLOW

290 S. CASTELL AVE., STE. 100  
NEW BRAUNFELS, TX 78130  
TBPE FIRM F-10961  
TBPLS FIRM 1053600



07/29/2020

ULTIMATE DRAINAGE  
AREA MAP INSET  
VANGUARD FARMS APARTMENTS

NO.	REVISION DESCRIPTION	REVISION DATE

DATE: JULY 2020

DRAWN BY: LB

DESIGNED BY: JMM

REVIEWED BY: CVH

HMT PROJECT NO.:

323.001

SHEET  
C3.4



# Attachment 0

Ultimate Conditions

Hydrology/Hydraulic Calculations –  
Drainage Area A

Watershed	Ult A1a
Point of Concentration	A1a
Area	43.27 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.01	S2=	0	S3=	0
T1=	39.35	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	2139	L2=	0	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.005	S2=	0.0046	S3=	0
T1=	31.25	T2=	0.00	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	1270	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	3.53	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	74.13	minutes
-----	-------	---------

	Area	Soil Group	CN
Industrial M1	42.45	D	90
Impervious, Paved	0.82	D	98
Concrete	0.00	D	89
Commercial C1	0.00	D	93
<b>Total</b>	<b>43.27</b>		<b>90.15</b>

# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

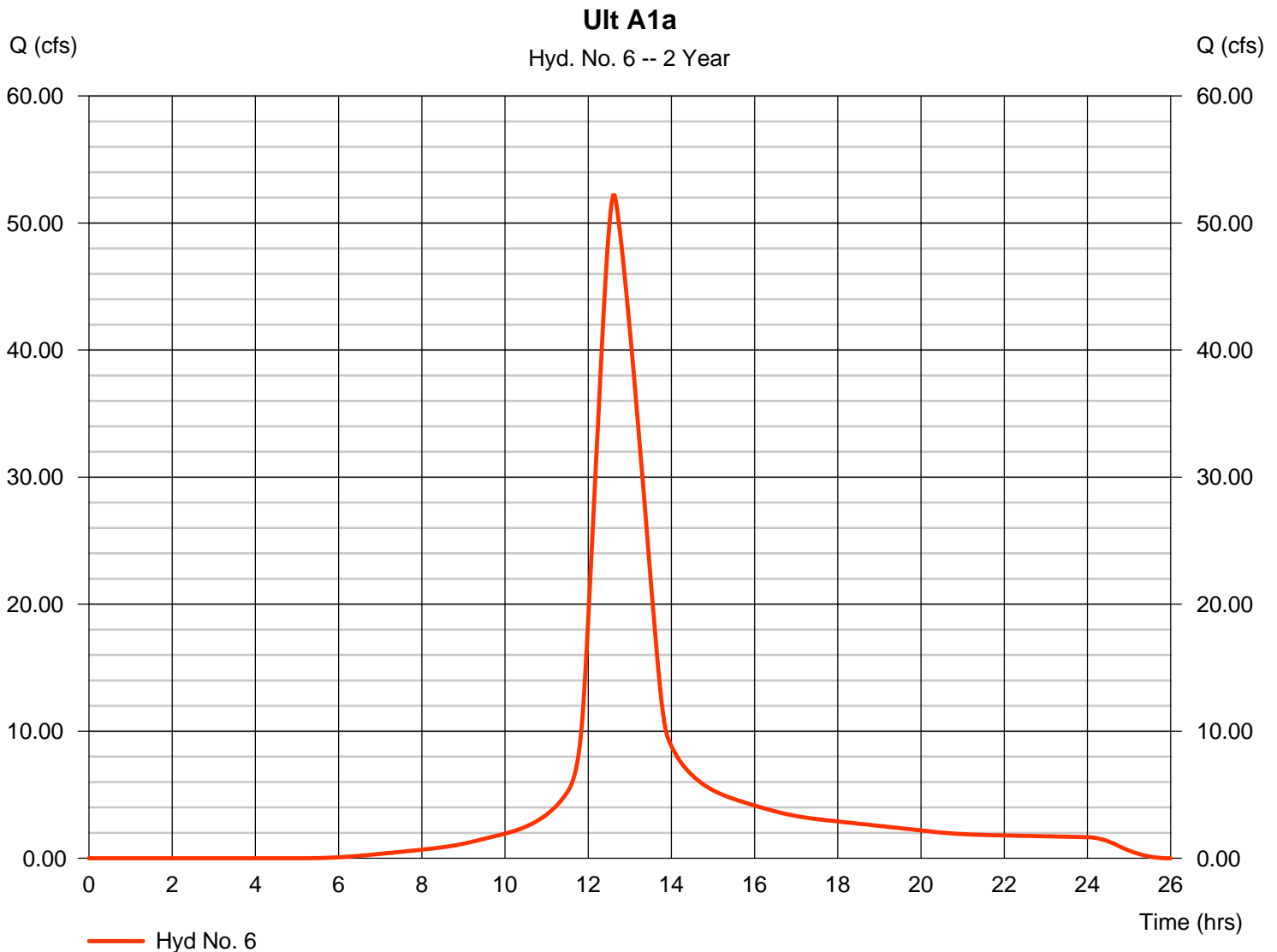
Tuesday, 07 / 28 / 2020

## Hyd. No. 6

Ult A1a

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 43.270 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.52 in  
 Storm duration = 24 hrs

Peak discharge = 52.18 cfs  
 Time to peak = 12.63 hrs  
 Hyd. volume = 392,564 cuft  
 Curve number = 90.2  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.10 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

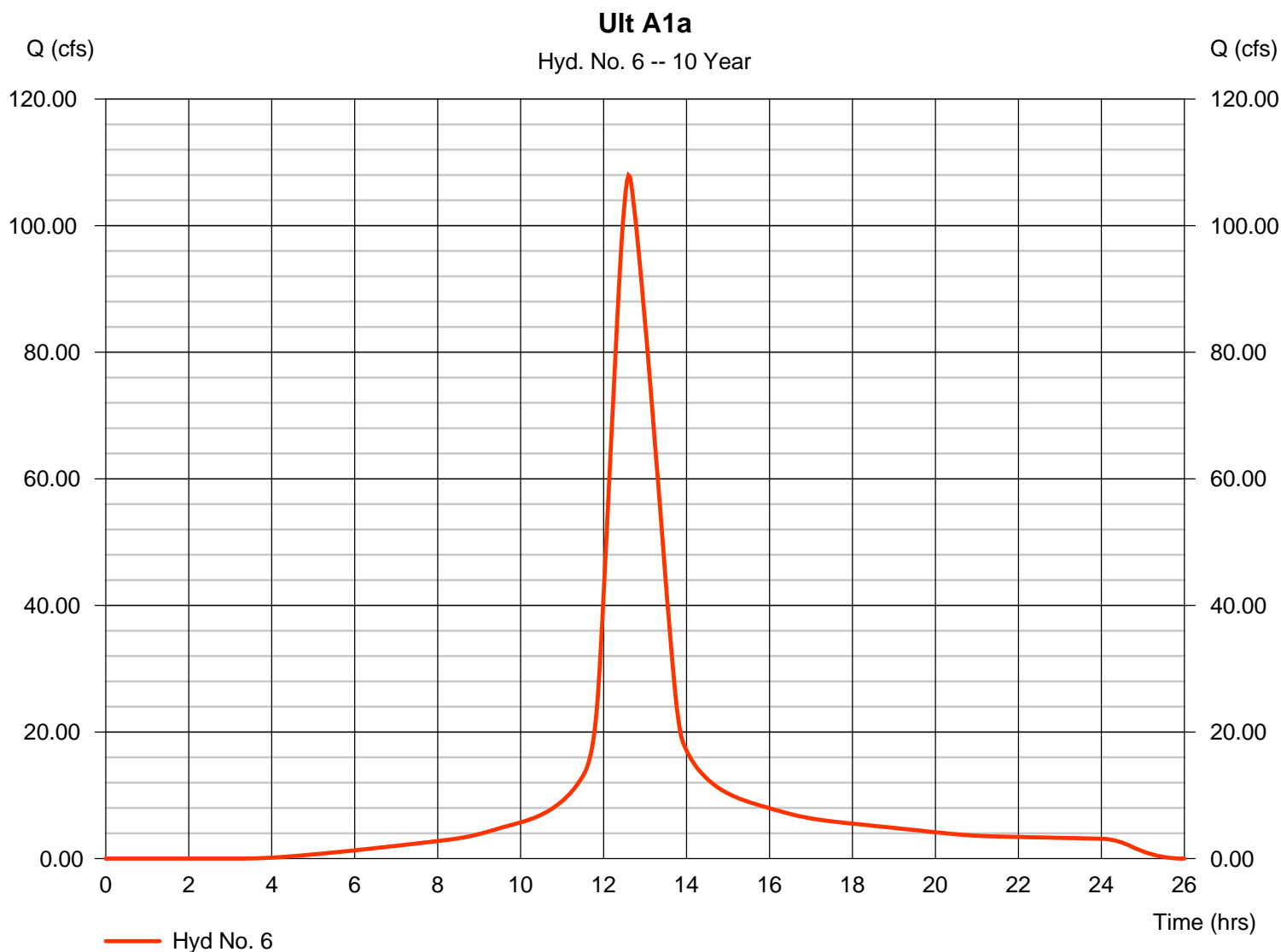
Tuesday, 07 / 28 / 2020

## Hyd. No. 6

Ult A1a

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 43.270 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 107.94 cfs  
 Time to peak = 12.60 hrs  
 Hyd. volume = 830,665 cuft  
 Curve number = 90.2  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.10 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

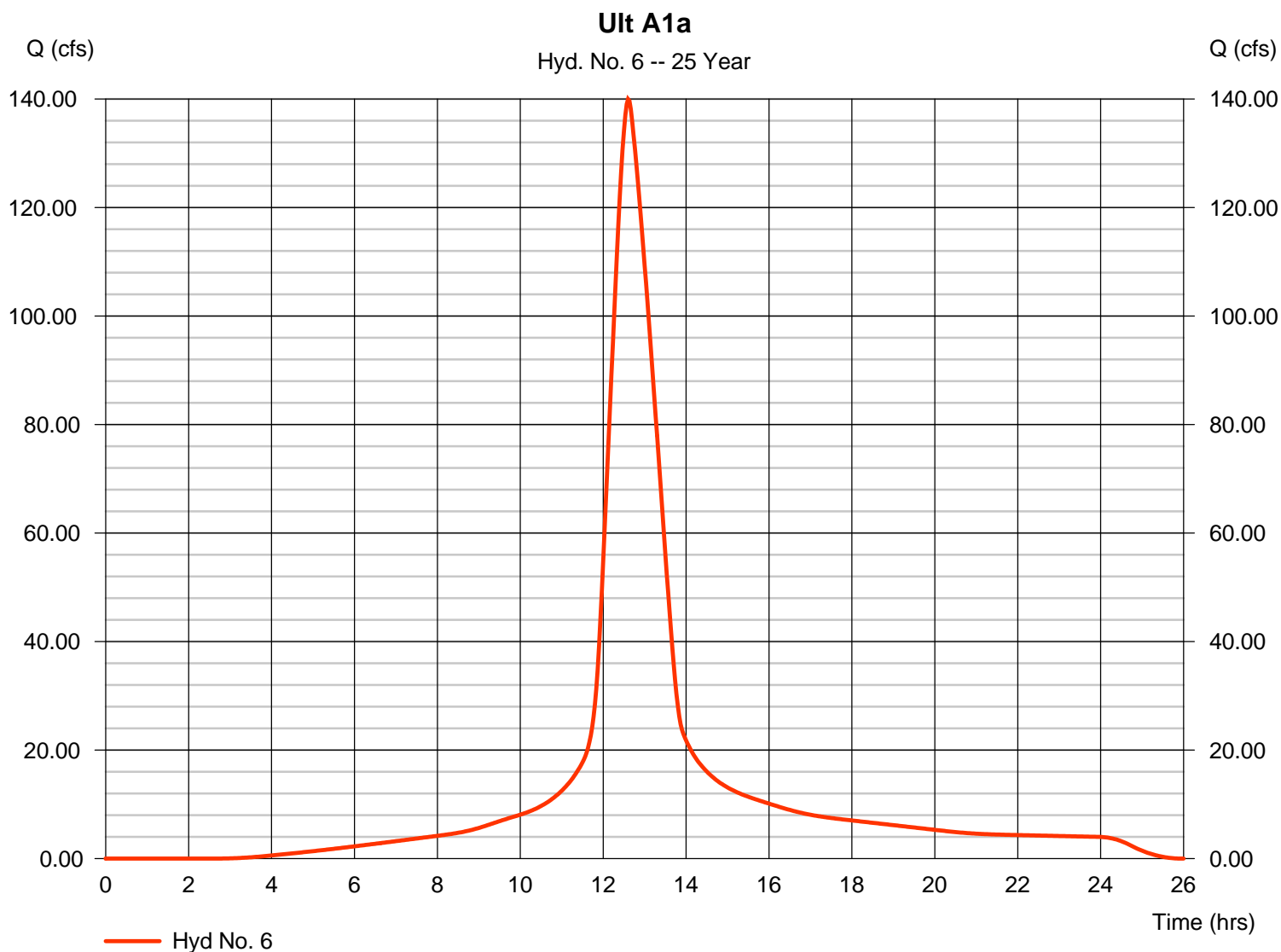
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 6

Ult A1a

Hydrograph type	= SCS Runoff	Peak discharge	= 139.97 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 1,089,670 cuft
Drainage area	= 43.270 ac	Curve number	= 90.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

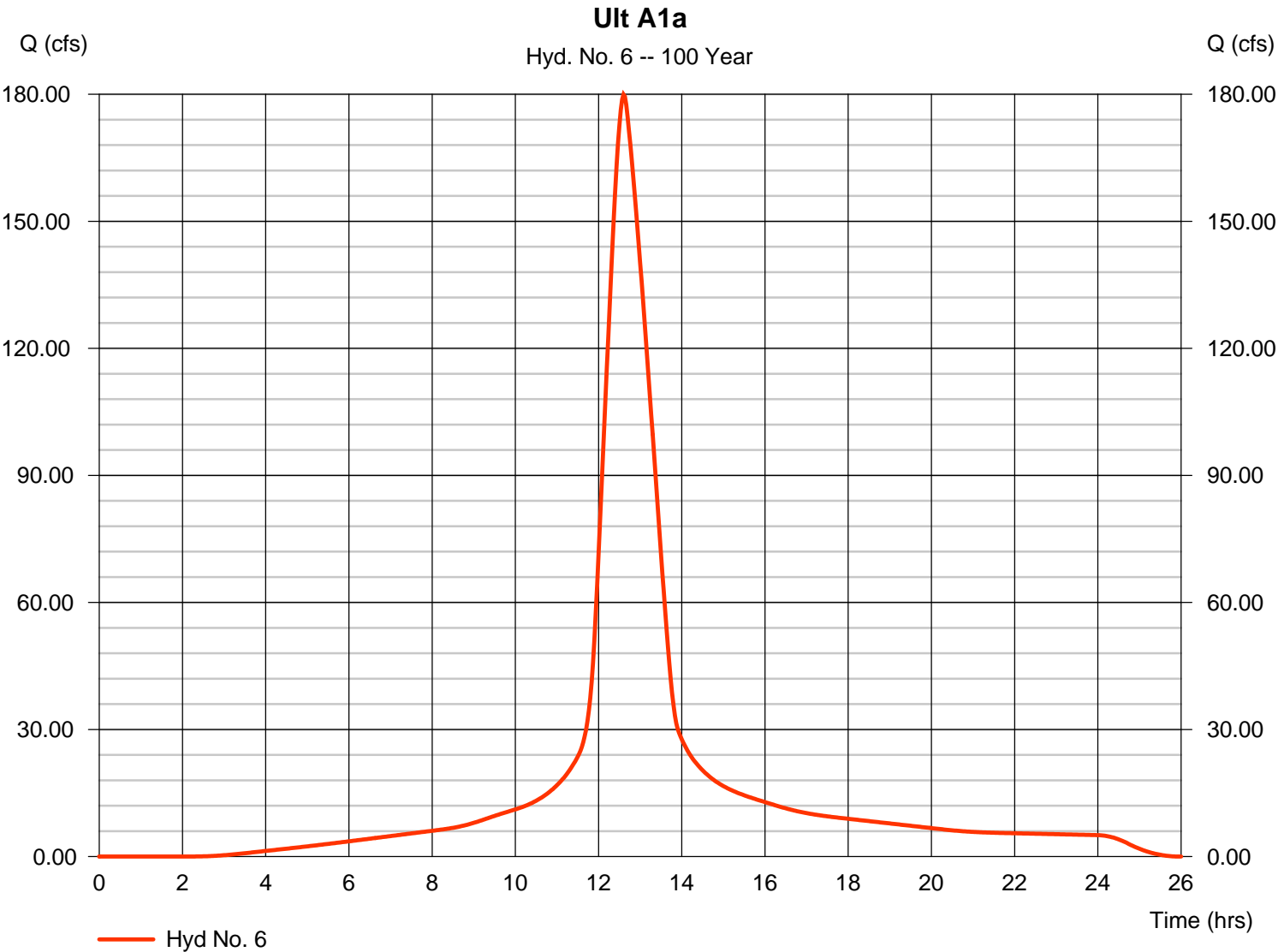


# Hydrograph Report

## Hyd. No. 6

Ult A1a

Hydrograph type	= SCS Runoff	Peak discharge	= 179.94 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 1,417,423 cuft
Drainage area	= 43.270 ac	Curve number	= 90.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	Ult A1b
Point of Concentration	A1b
Area	1.93 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.023	S2=	0	S3=	0
T1=	28.20	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	113	L2=	53	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.0046	S2=	0.0046	S3=	0
T1=	8.33	T2=	0.26	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	36.79	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.00	D	80
Impervious, Paved	0.81	D	98
Concrete	0.00	D	89
Commercial C1	1.12	D	93
<b>Total</b>	<b>1.93</b>		<b>95.10</b>



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

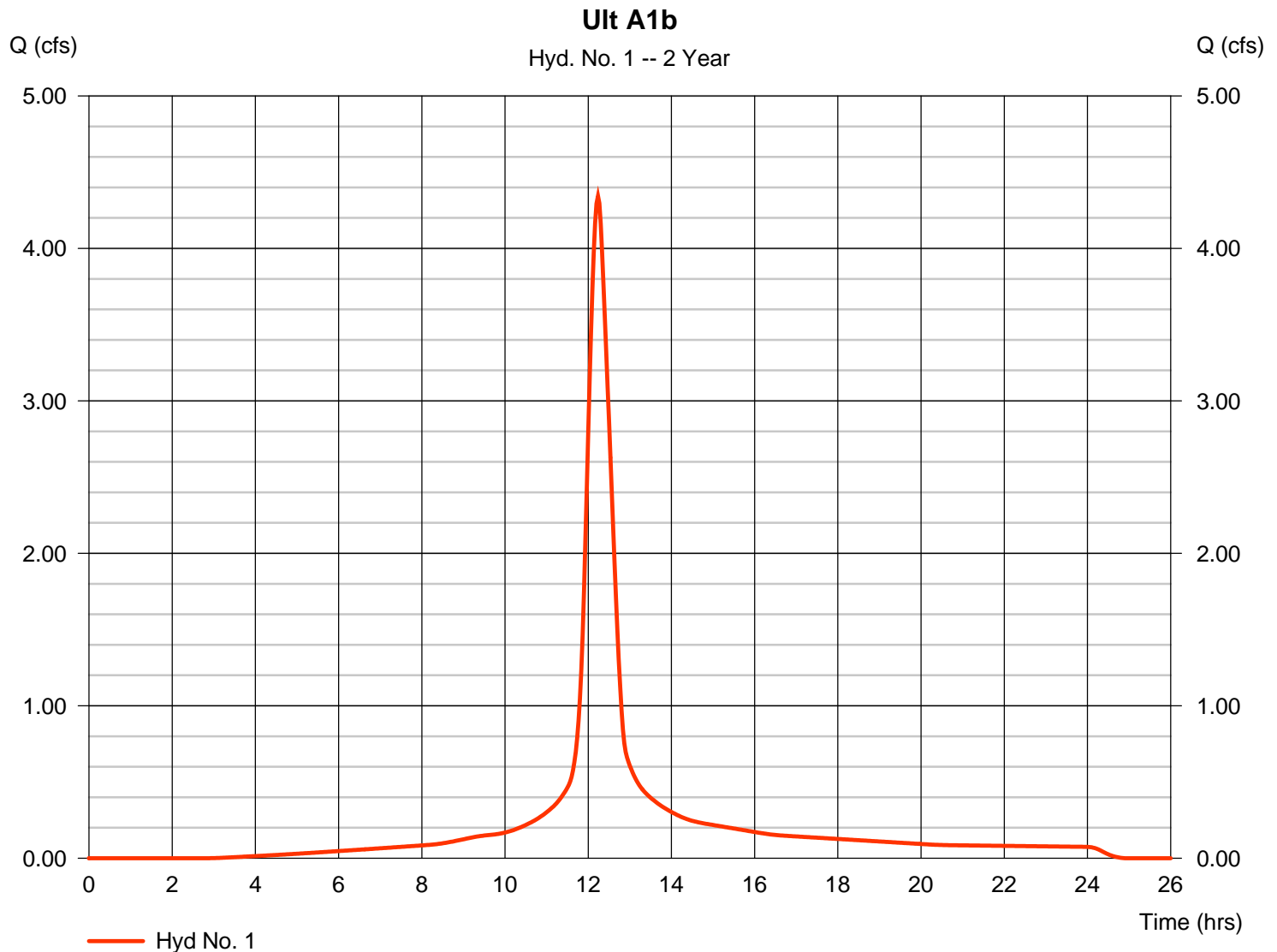
Tuesday, 07 / 28 / 2020

## Hyd. No. 1

Ult A1b

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 1.930 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.52 in  
 Storm duration = 24 hrs

Peak discharge = 4.343 cfs  
 Time to peak = 12.23 hrs  
 Hyd. volume = 20,566 cuft  
 Curve number = 95.1  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 36.79 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

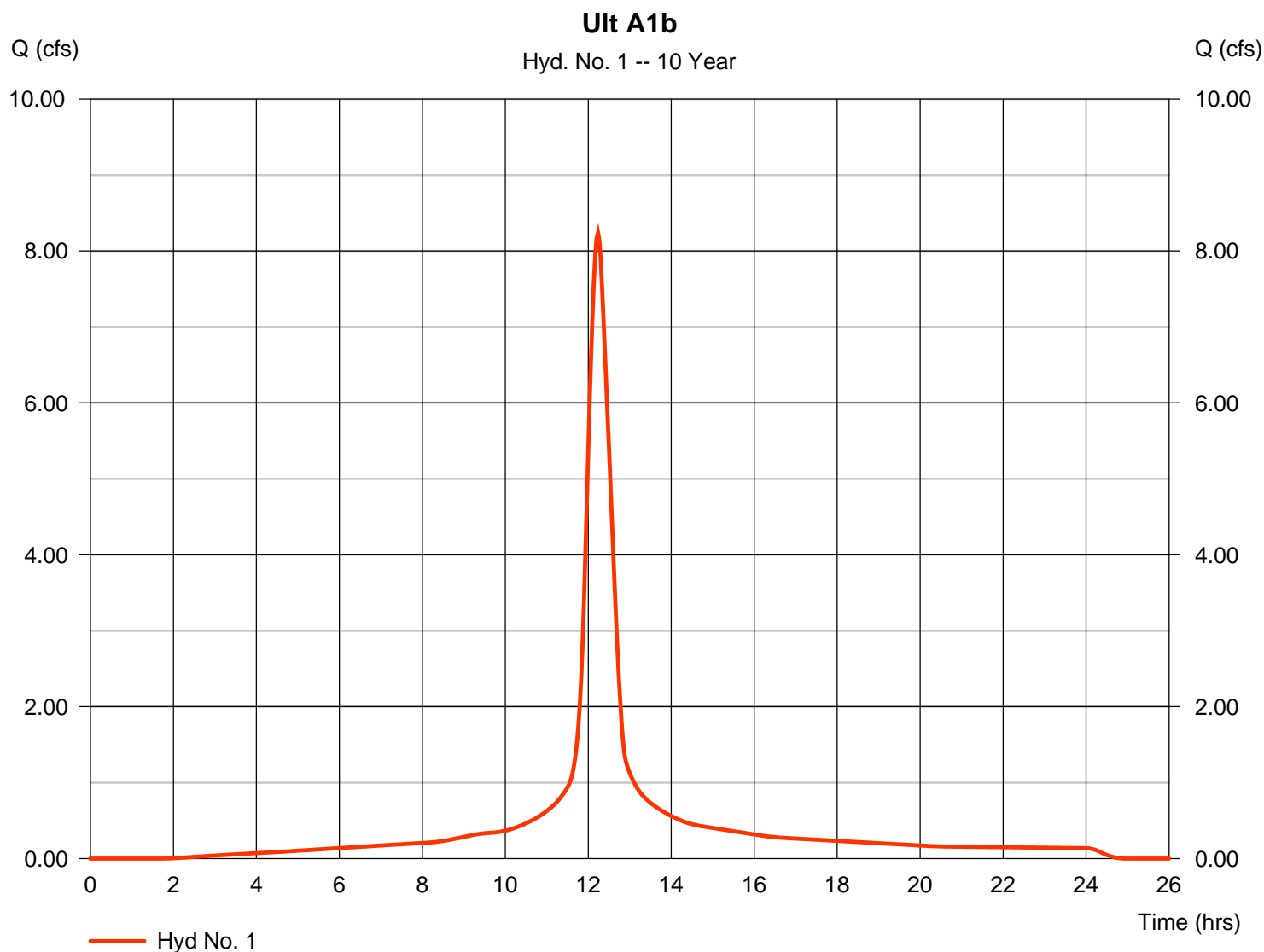
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 1

Ult A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 8.237 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 40,316 cuft
Drainage area	= 1.930 ac	Curve number	= 95.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 36.79 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

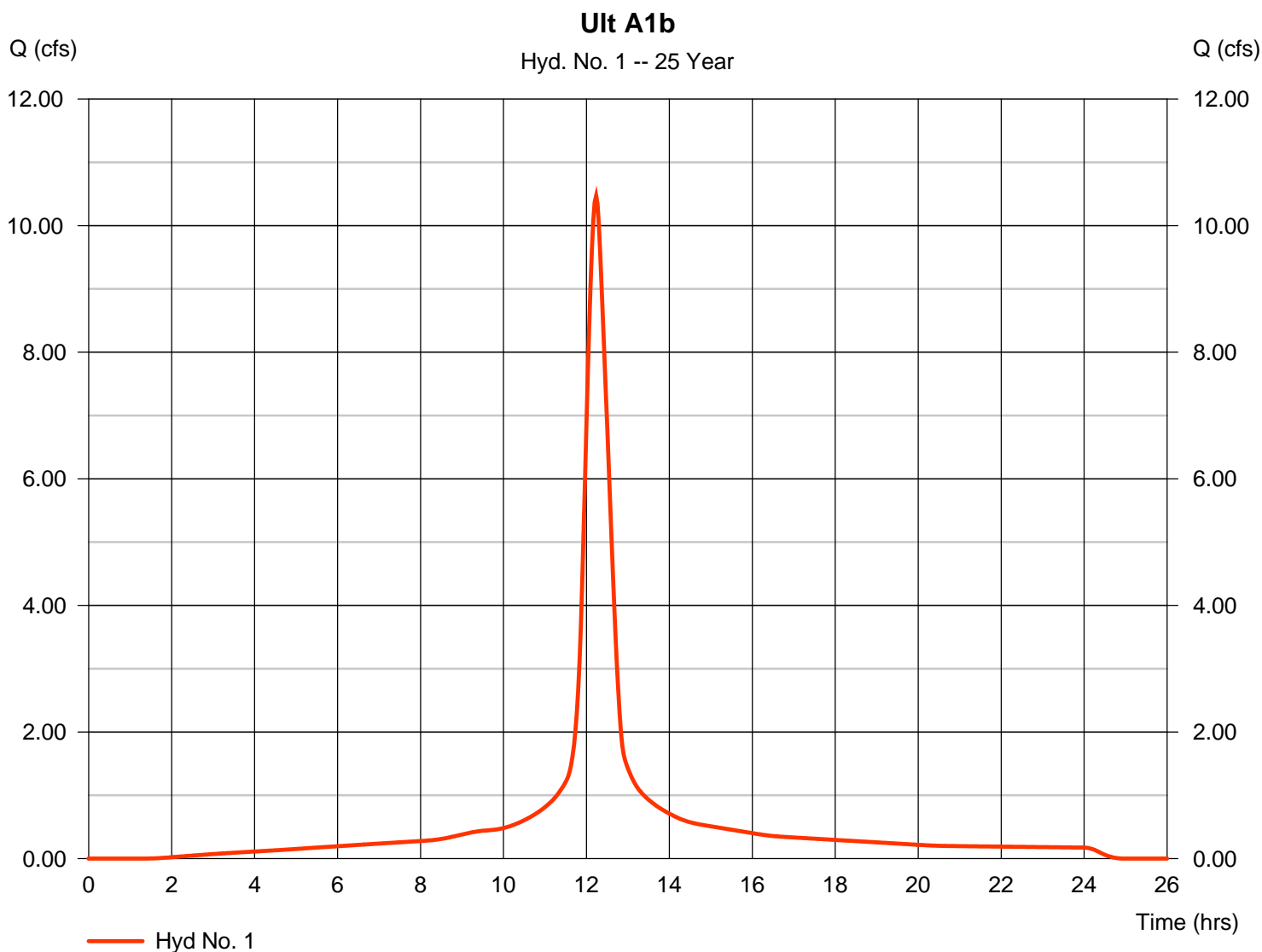
Tuesday, 07 / 28 / 2020

## Hyd. No. 1

Ult A1b

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 1.930 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 10.47 cfs  
 Time to peak = 12.23 hrs  
 Hyd. volume = 51,829 cuft  
 Curve number = 95.1  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 36.79 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

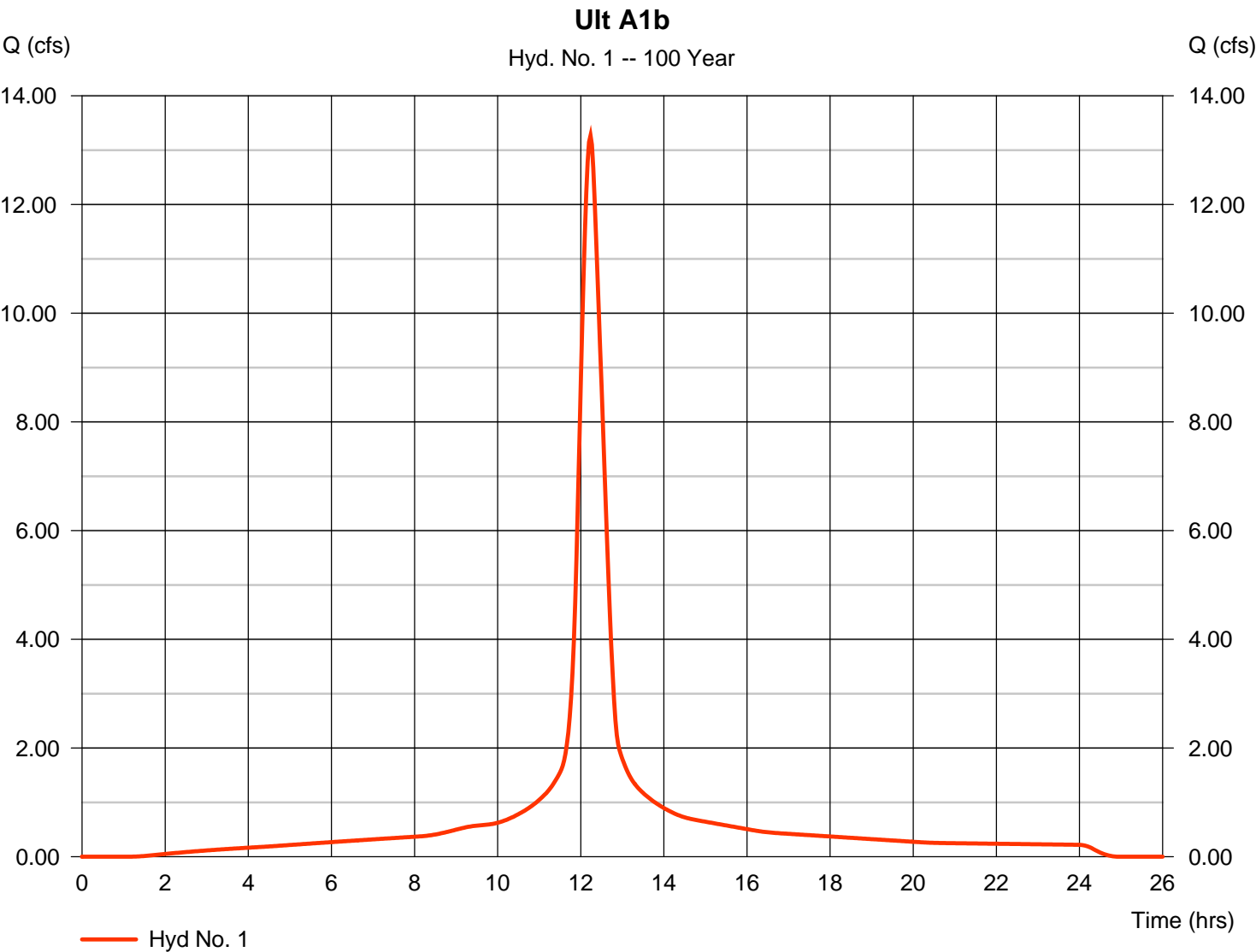
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 1

Ult A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 13.27 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 66,332 cuft
Drainage area	= 1.930 ac	Curve number	= 95.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 36.79 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



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## Worksheet for Sidewalk Box A2 2yr

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### Project Description

Solve For                      Spread

### Input Data

Discharge		4.34	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.02	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		15.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	11.24	ft
Depth	0.22	ft
Gutter Depression	0.00	ft
Total Depression	0.42	ft

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## Worksheet for Sidewalk Box A2 10yr

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### Project Description

Solve For                      Spread

### Input Data

Discharge		8.24	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.02	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		15.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	17.24	ft
Depth	0.34	ft
Gutter Depression	0.00	ft
Total Depression	0.42	ft

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## Worksheet for Sidewalk Box A2 25yr

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### Project Description

Solve For                      Spread

### Input Data

Discharge		10.47	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.02	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		15.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	20.22	ft
Depth	0.40	ft
Gutter Depression	0.00	ft
Total Depression	0.42	ft

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## Worksheet for Sidewalk Box A2 100yr

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### Project Description

Solve For                      Spread

### Input Data

Discharge		13.27	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.02	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		15.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	23.68	ft
Depth	0.47	ft
Gutter Depression	0.00	ft
Total Depression	0.42	ft



Watershed	Ult A1b+A1c
Point of Concentration	A1c
Area	2.20 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.023	S2=	0	S3=	0
T1=	28.20	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	113	L2=	53	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.0046	S2=	0.0046	S3=	0
T1=	8.33	T2=	0.26	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	36.79	minutes
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	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.00	D	80
Impervious, Paved	0.81	D	98
Concrete	0.00	D	89
Commercial C1	1.39	D	93
<b>Total</b>	<b>2.20</b>		<b>94.84</b>

## Worksheet for Channel A2 2yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.01840	ft/ft
Discharge	4.92	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.62
0+02	0.12
0+06	0.03
0+08	0.00
0+09	0.03
0+14	0.12
0+15	0.62

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.62)	(0+02, 0.12)	0.030
(0+02, 0.12)	(0+06, 0.03)	0.030
(0+06, 0.03)	(0+08, 0.00)	0.016
(0+08, 0.00)	(0+09, 0.03)	0.016
(0+09, 0.03)	(0+14, 0.12)	0.030
(0+14, 0.12)	(0+15, 0.62)	0.030

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.24	ft
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## Worksheet for Channel A2 2yr

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### Results

Elevation Range	0.00 to 0.62 ft	
Flow Area	2.17	ft <sup>2</sup>
Wetted Perimeter	12.75	ft
Hydraulic Radius	0.17	ft
Top Width	12.70	ft
Normal Depth	0.24	ft
Critical Depth	0.23	ft
Critical Slope	0.01987	ft/ft
Velocity	2.27	ft/s
Velocity Head	0.08	ft
Specific Energy	0.32	ft
Froude Number	0.97	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.24	ft
Critical Depth	0.23	ft
Channel Slope	0.01840	ft/ft
Critical Slope	0.01987	ft/ft

## Worksheet for Channel A2 10yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.01840	ft/ft
Discharge	9.36	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.62
0+02	0.12
0+06	0.03
0+08	0.00
0+09	0.03
0+14	0.12
0+15	0.62

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.62)	(0+02, 0.12)	0.030
(0+02, 0.12)	(0+06, 0.03)	0.030
(0+06, 0.03)	(0+08, 0.00)	0.016
(0+08, 0.00)	(0+09, 0.03)	0.016
(0+09, 0.03)	(0+14, 0.12)	0.030
(0+14, 0.12)	(0+15, 0.62)	0.030

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.32	ft
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## Worksheet for Channel A2 10yr

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### Results

Elevation Range	0.00 to 0.62 ft	
Flow Area	3.25	ft <sup>2</sup>
Wetted Perimeter	13.27	ft
Hydraulic Radius	0.25	ft
Top Width	13.21	ft
Normal Depth	0.32	ft
Critical Depth	0.32	ft
Critical Slope	0.01758	ft/ft
Velocity	2.88	ft/s
Velocity Head	0.13	ft
Specific Energy	0.45	ft
Froude Number	1.02	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.32	ft
Critical Depth	0.32	ft
Channel Slope	0.01840	ft/ft
Critical Slope	0.01758	ft/ft

## Worksheet for Channel A2 25yr

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope    0.01840    ft/ft  
Discharge    11.91    ft<sup>3</sup>/s  
Section Definitions

Station (ft)	Elevation (ft)
0+00	0.62
0+02	0.12
0+06	0.03
0+08	0.00
0+09	0.03
0+14	0.12
0+15	0.62

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.62)	(0+02, 0.12)	0.030
(0+02, 0.12)	(0+06, 0.03)	0.030
(0+06, 0.03)	(0+08, 0.00)	0.016
(0+08, 0.00)	(0+09, 0.03)	0.016
(0+09, 0.03)	(0+14, 0.12)	0.030
(0+14, 0.12)	(0+15, 0.62)	0.030

### Options

Current Roughness weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth    0.36    ft

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## Worksheet for Channel A2 25yr

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### Results

Elevation Range	0.00 to 0.62 ft	
Flow Area	3.79	ft <sup>2</sup>
Wetted Perimeter	13.53	ft
Hydraulic Radius	0.28	ft
Top Width	13.45	ft
Normal Depth	0.36	ft
Critical Depth	0.37	ft
Critical Slope	0.01682	ft/ft
Velocity	3.14	ft/s
Velocity Head	0.15	ft
Specific Energy	0.51	ft
Froude Number	1.04	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.36	ft
Critical Depth	0.37	ft
Channel Slope	0.01840	ft/ft
Critical Slope	0.01682	ft/ft

## Worksheet for Channel A2 100yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.01840	ft/ft
Discharge	15.10	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.62
0+02	0.12
0+06	0.03
0+08	0.00
0+09	0.03
0+14	0.12
0+15	0.62

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.62)	(0+02, 0.12)	0.030
(0+02, 0.12)	(0+06, 0.03)	0.030
(0+06, 0.03)	(0+08, 0.00)	0.016
(0+08, 0.00)	(0+09, 0.03)	0.016
(0+09, 0.03)	(0+14, 0.12)	0.030
(0+14, 0.12)	(0+15, 0.62)	0.030

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.41	ft
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## Worksheet for Channel A2 100yr

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### Results

Elevation Range	0.00 to 0.62 ft	
Flow Area	4.42	ft <sup>2</sup>
Wetted Perimeter	13.82	ft
Hydraulic Radius	0.32	ft
Top Width	13.72	ft
Normal Depth	0.41	ft
Critical Depth	0.42	ft
Critical Slope	0.01613	ft/ft
Velocity	3.42	ft/s
Velocity Head	0.18	ft
Specific Energy	0.59	ft
Froude Number	1.06	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.41	ft
Critical Depth	0.42	ft
Channel Slope	0.01840	ft/ft
Critical Slope	0.01613	ft/ft

Watershed	Ult A1a+A1b+A1c
Point of Concentration	A1
Area	45.47 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.01	S2=	0	S3=	0
T1=	39.35	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	2139	L2=	0	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.005	S2=	0.0046	S3=	0
T1=	31.25	T2=	0.00	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	1270	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	3.53	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	74.13	minutes
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	Area	Soil Group	CN
Industrial M1	42.45	D	90
Impervious, Paved	1.63	D	98
Concrete	0.00	D	89
Commercial C1	1.39	D	93
<b>Total</b>	<b>45.47</b>		<b>90.38</b>

# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

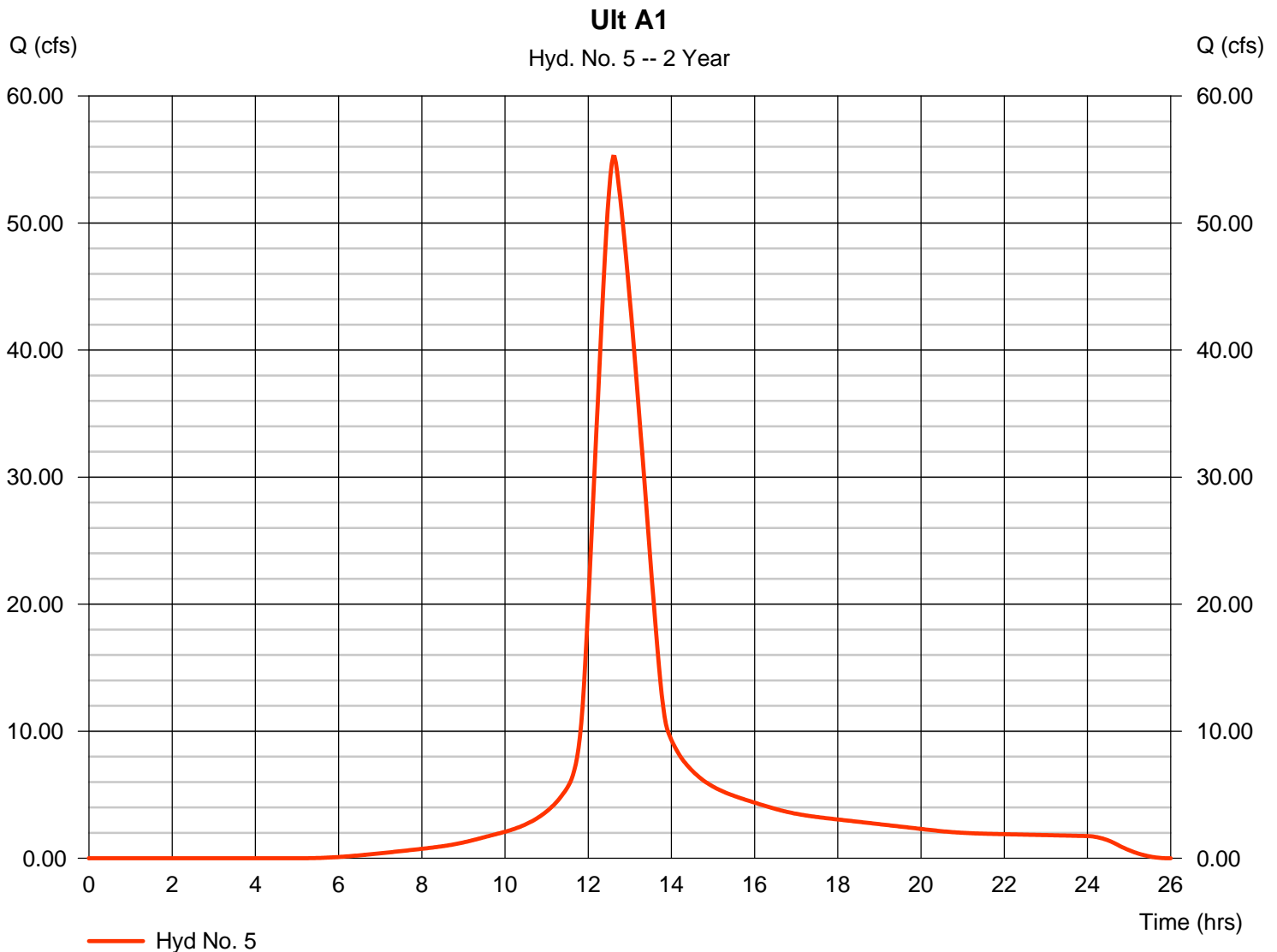
Tuesday, 07 / 28 / 2020

## Hyd. No. 5

Ult A1

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 45.470 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.52 in  
 Storm duration = 24 hrs

Peak discharge = 55.21 cfs  
 Time to peak = 12.60 hrs  
 Hyd. volume = 415,607 cuft  
 Curve number = 90.4  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.10 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

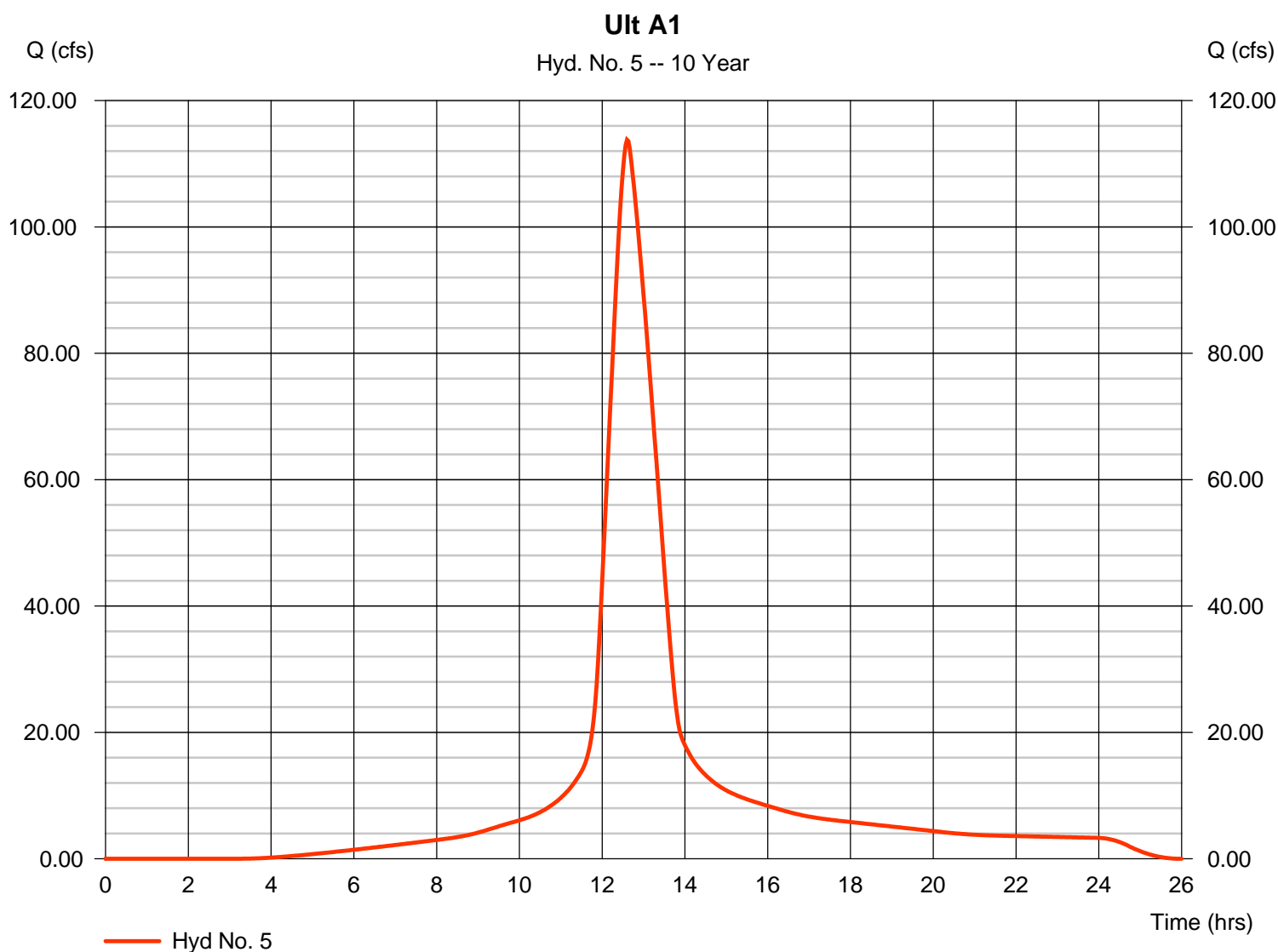
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 5

Ult A1

Hydrograph type	= SCS Runoff	Peak discharge	= 113.79 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 876,651 cuft
Drainage area	= 45.470 ac	Curve number	= 90.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

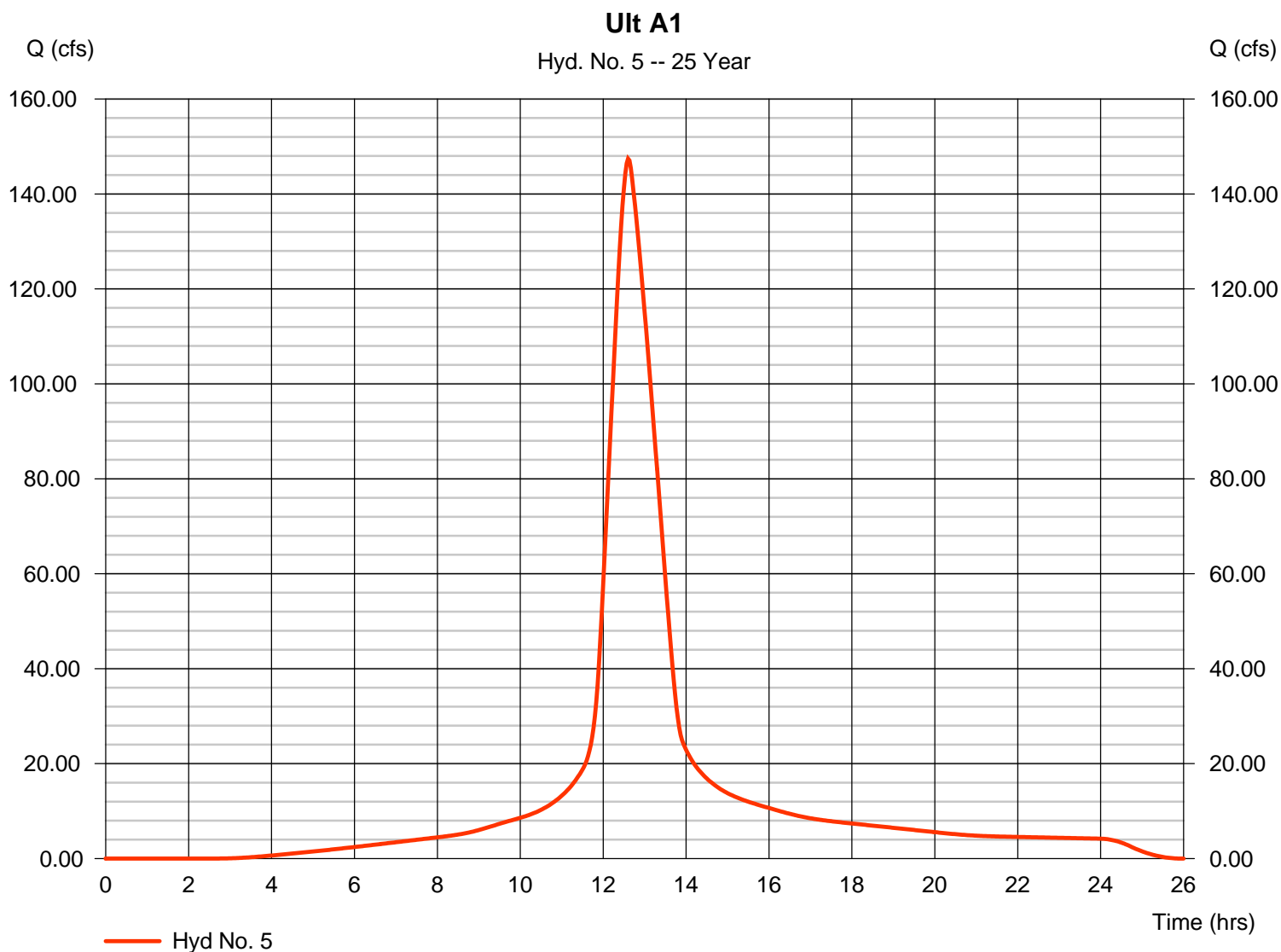
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Tuesday, 07 / 28 / 2020

## Hyd. No. 5

Ult A1

Hydrograph type	= SCS Runoff	Peak discharge	= 147.43 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 1,149,025 cuft
Drainage area	= 45.470 ac	Curve number	= 90.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

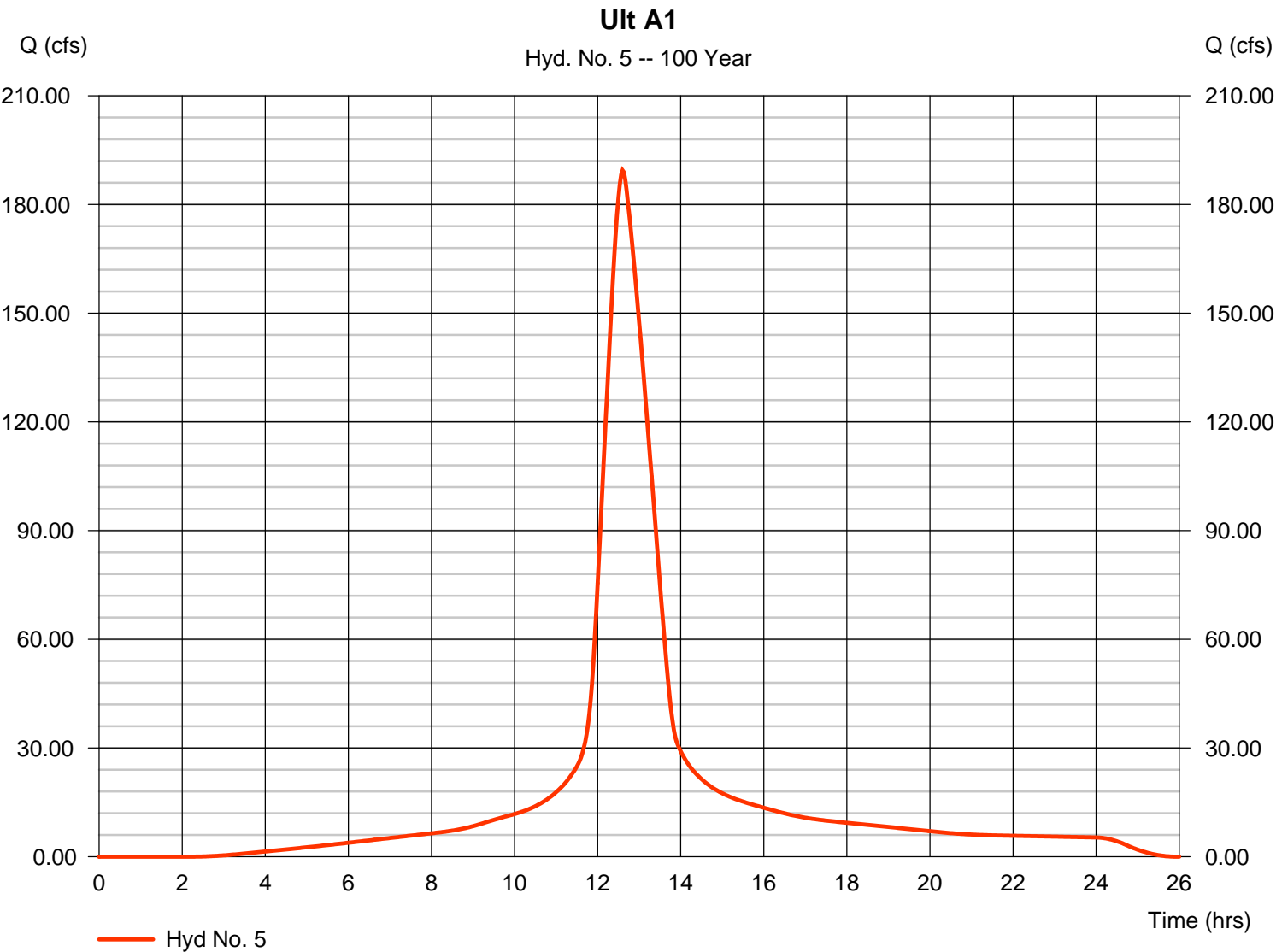
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Tuesday, 07 / 28 / 2020

## Hyd. No. 5

Ult A1

Hydrograph type	= SCS Runoff	Peak discharge	= 189.40 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 1,493,614 cuft
Drainage area	= 45.470 ac	Curve number	= 90.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	Ult A2b
Point of Concentration	A2b
Area	0.41 acres

Sheet Flow					
L1=	79	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.0752	S2=	0	S3=	0
T1=	13.87	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	100	L2=	0	L3=	0
n1=	0.02	n2=	0.02	n3=	0.3
S1=	0.005	S2=	0.0046	S3=	0
T1=	0.47	T2=	0.00	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	14.34	minutes
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	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.00	D	80
Impervious, Paved	0.31	D	98
Concrete	0.00	D	89
Commercial C1	0.10	D	93
<b>Total</b>	<b>0.41</b>		<b>96.78</b>

# Hydrograph Report

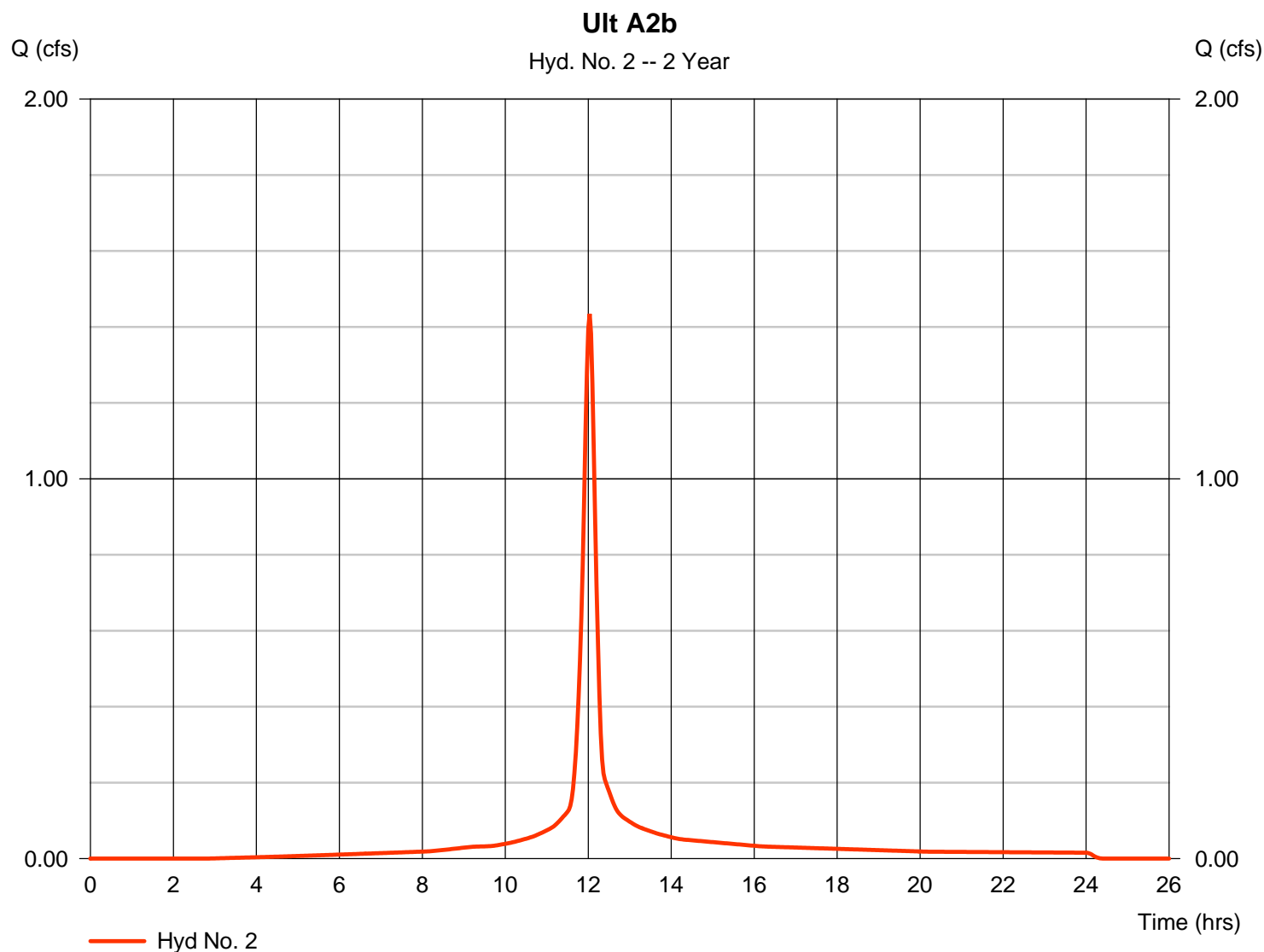
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Tuesday, 07 / 28 / 2020

## Hyd. No. 2

Ult A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 1.434 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 4,293 cuft
Drainage area	= 0.410 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.30 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

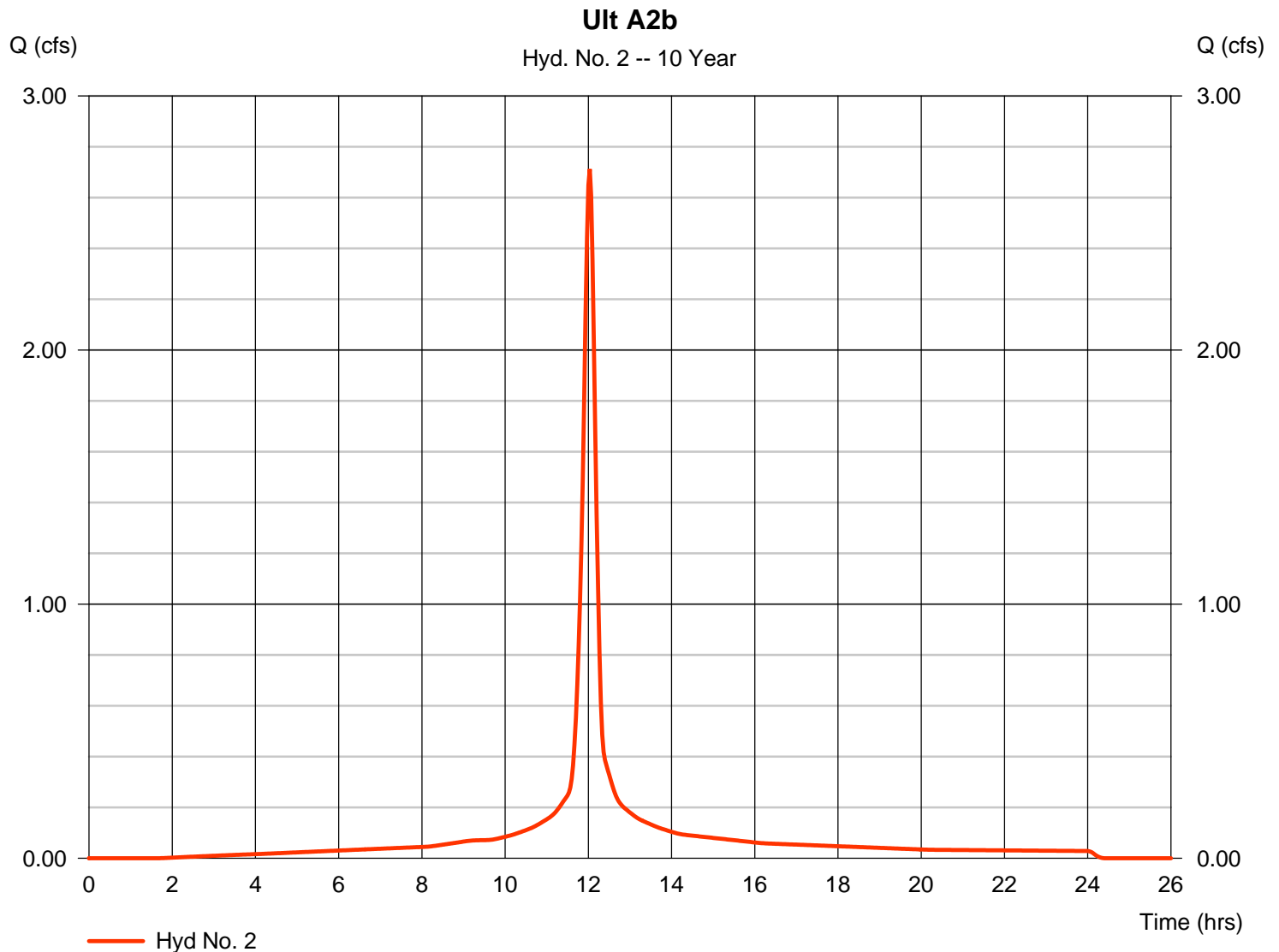
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 2

Ult A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 2.712 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 8,429 cuft
Drainage area	= 0.410 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.30 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

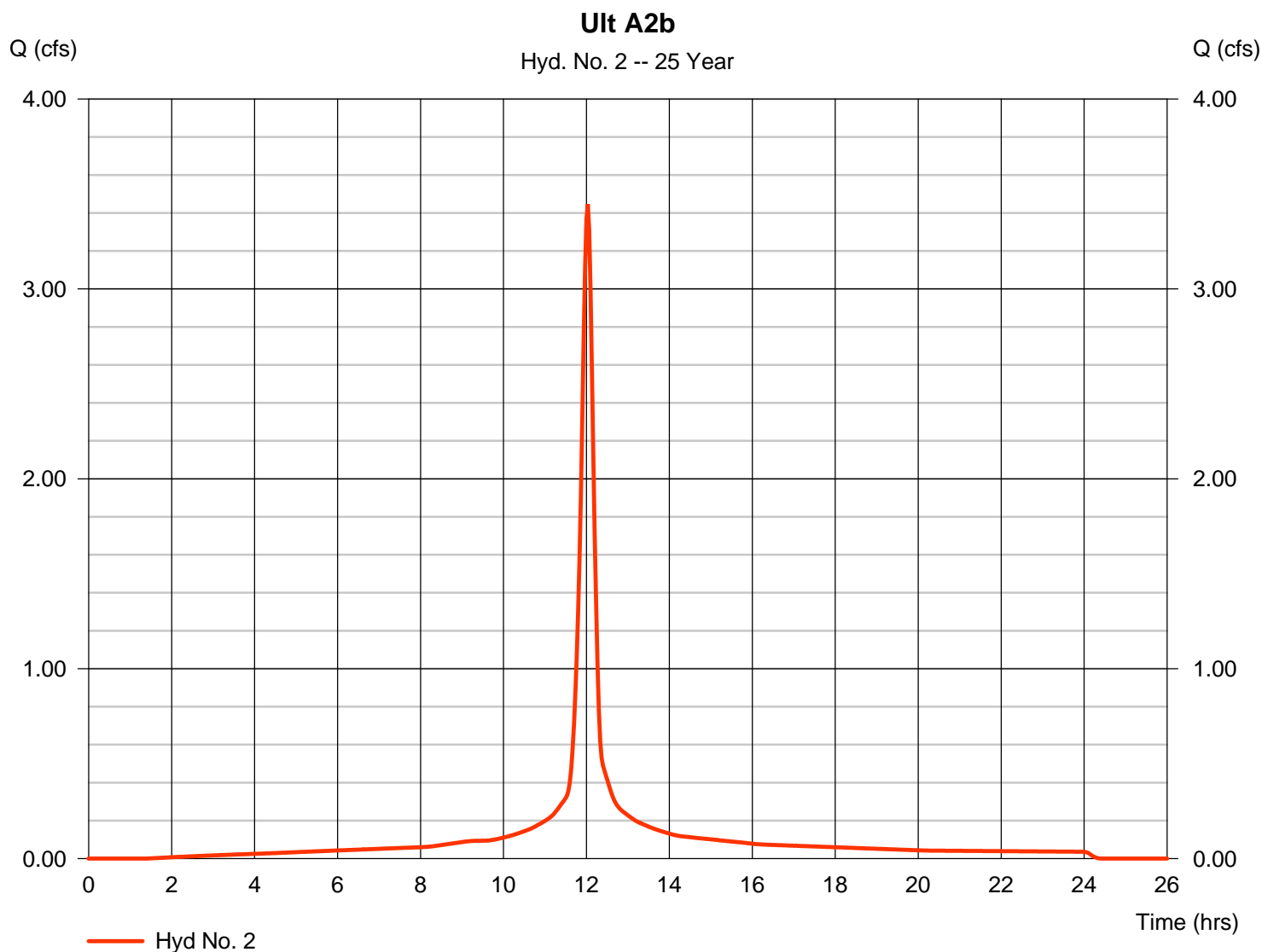
Tuesday, 07 / 28 / 2020

## Hyd. No. 2

Ult A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 0.410 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 3.446 cfs  
 Time to peak = 12.03 hrs  
 Hyd. volume = 10,841 cuft  
 Curve number = 95  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 14.30 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

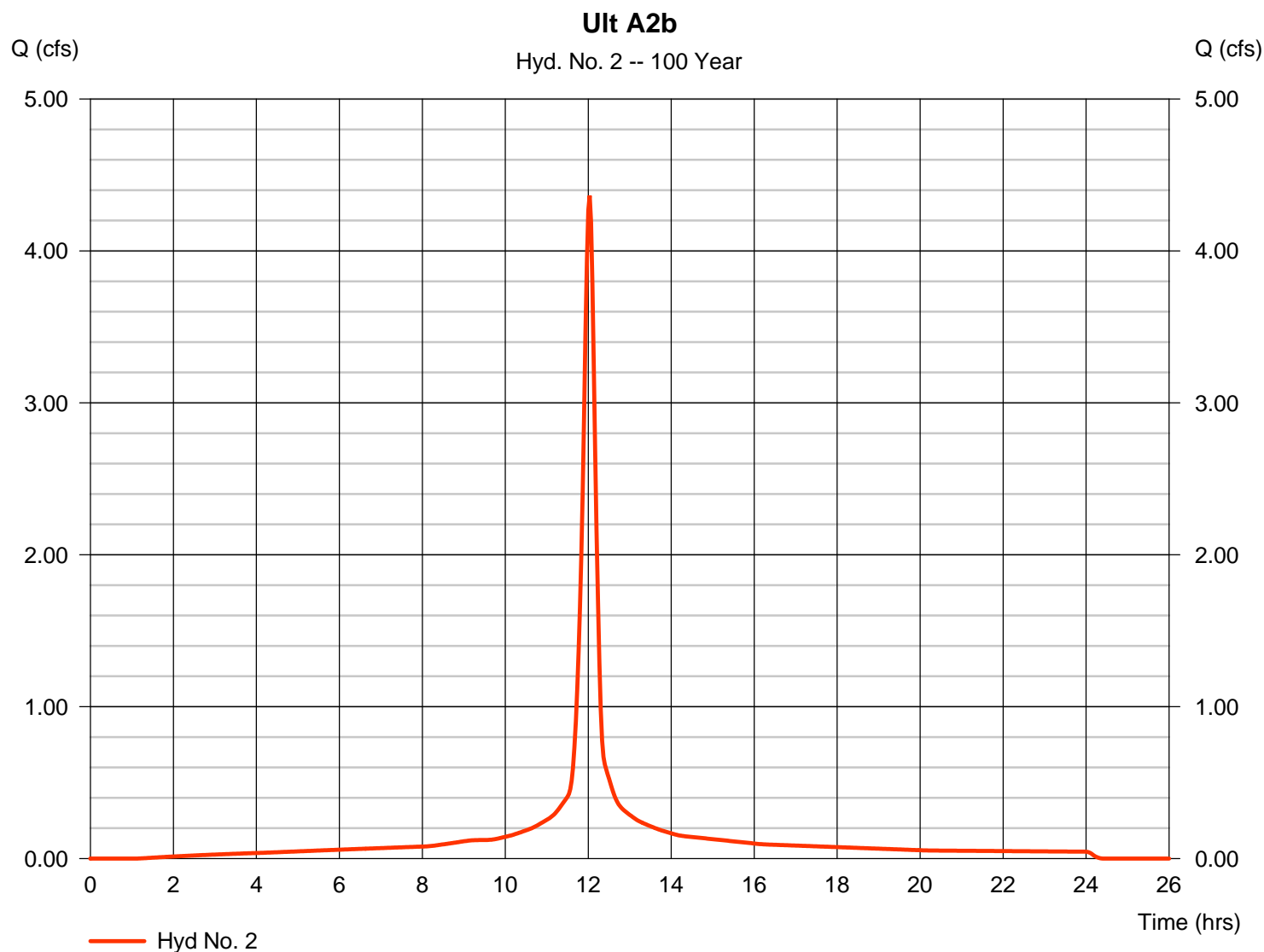
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 2

Ult A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 4.364 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 13,879 cuft
Drainage area	= 0.410 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.30 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Watershed	Ult A2a+A2b
Point of Concentration	A2a
Area	2.72 acres

Sheet Flow					
L1=	79	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.0752	S2=	0	S3=	0
T1=	13.87	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	100	L2=	0	L3=	0
n1=	0.02	n2=	0.02	n3=	0.3
S1=	0.005	S2=	0.0046	S3=	0
T1=	0.47	T2=	0.00	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	14.34	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.00	D	80
Impervious, Paved	1.22	D	98
Concrete	0.00	D	89
Commercial C1	1.50	D	93
<b>Total</b>	<b>2.72</b>		<b>95.24</b>

# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

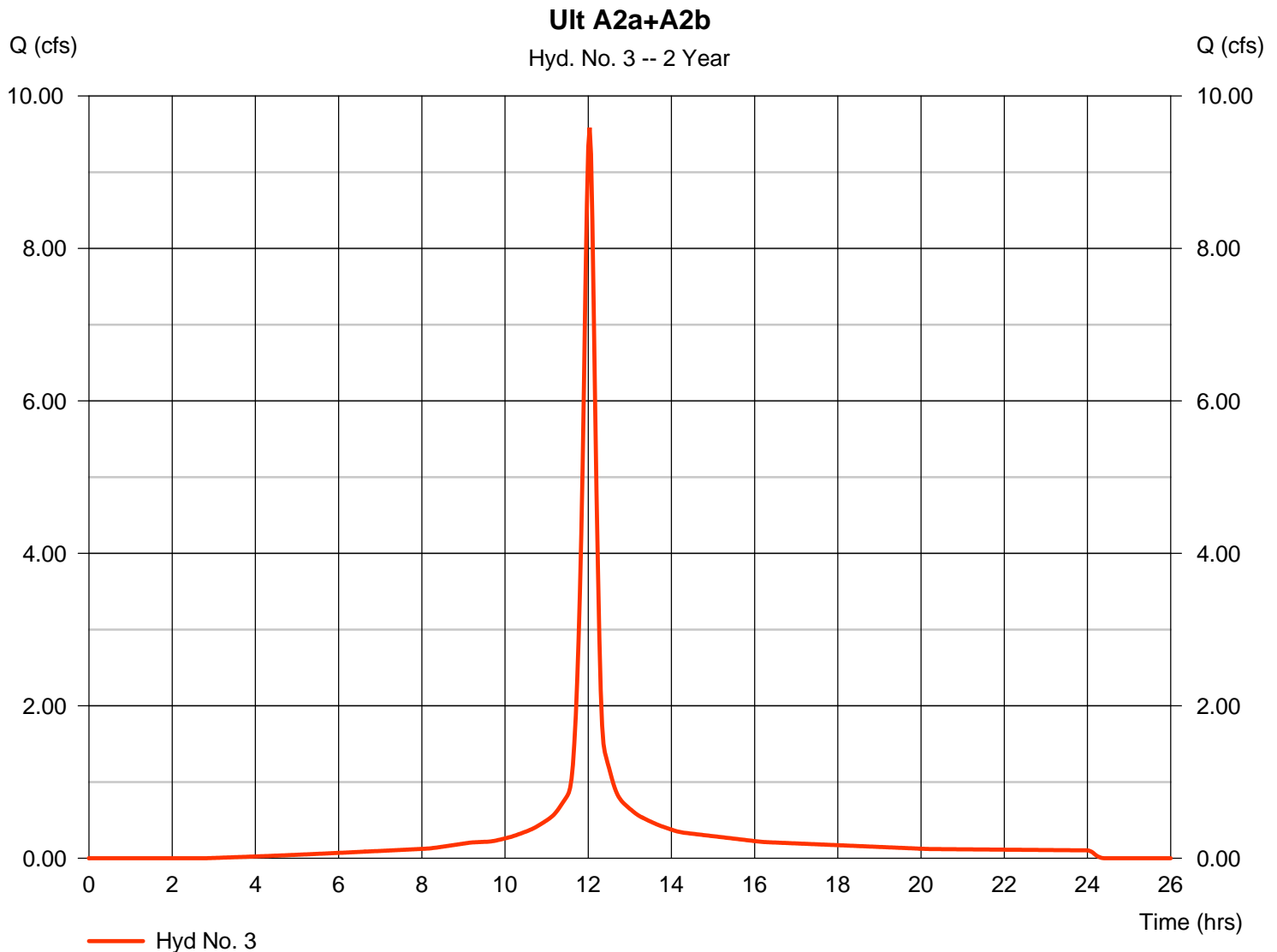
Tuesday, 07 / 28 / 2020

## Hyd. No. 3

Ult A2a+A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 2.740 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.52 in  
 Storm duration = 24 hrs

Peak discharge = 9.585 cfs  
 Time to peak = 12.03 hrs  
 Hyd. volume = 28,692 cuft  
 Curve number = 95  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 14.30 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

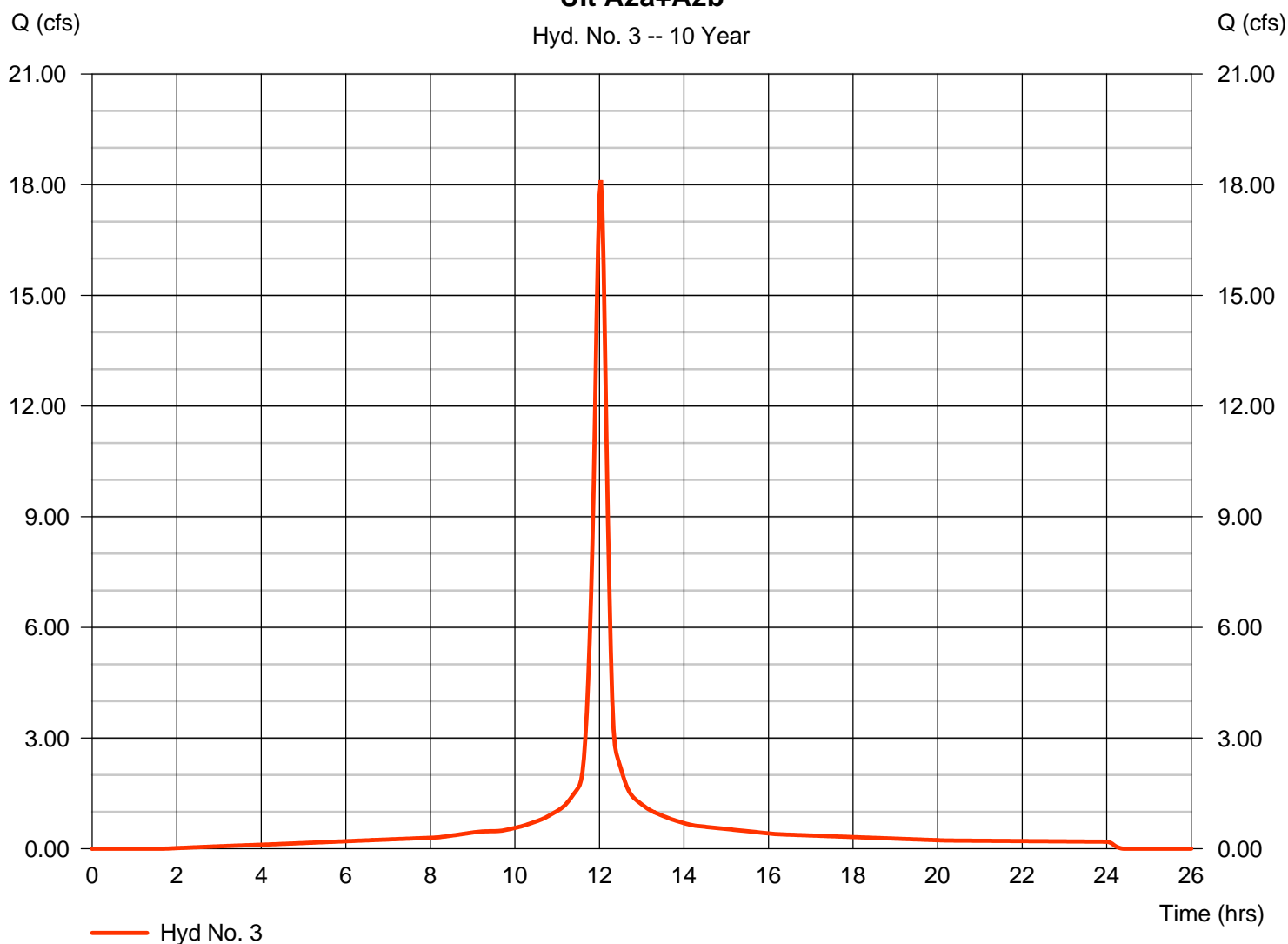
## Hyd. No. 3

Ult A2a+A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 18.13 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 56,333 cuft
Drainage area	= 2.740 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.30 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### Ult A2a+A2b

Hyd. No. 3 -- 10 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

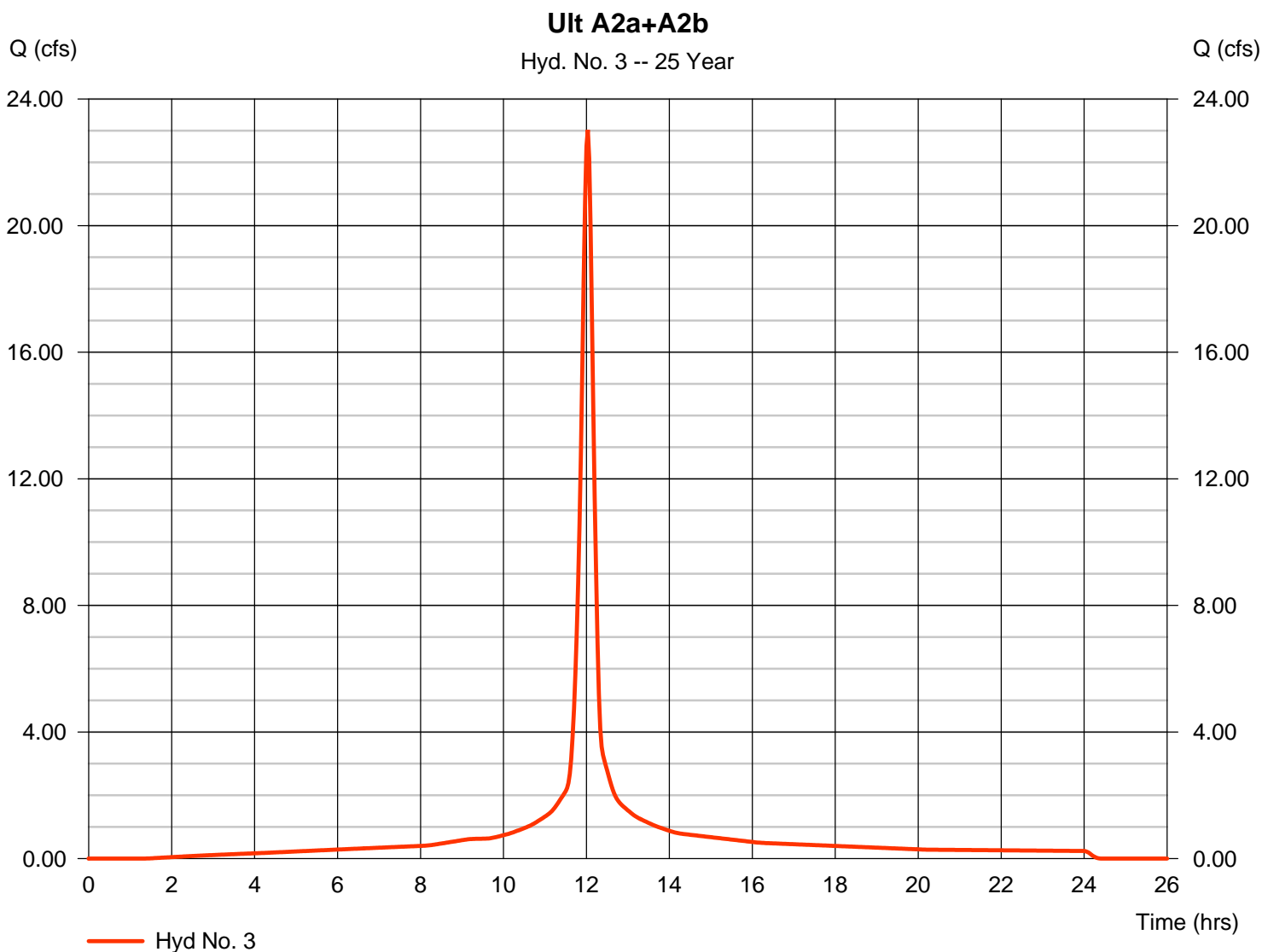
Tuesday, 07 / 28 / 2020

## Hyd. No. 3

Ult A2a+A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 2.740 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 23.03 cfs  
 Time to peak = 12.03 hrs  
 Hyd. volume = 72,451 cuft  
 Curve number = 95  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 14.30 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

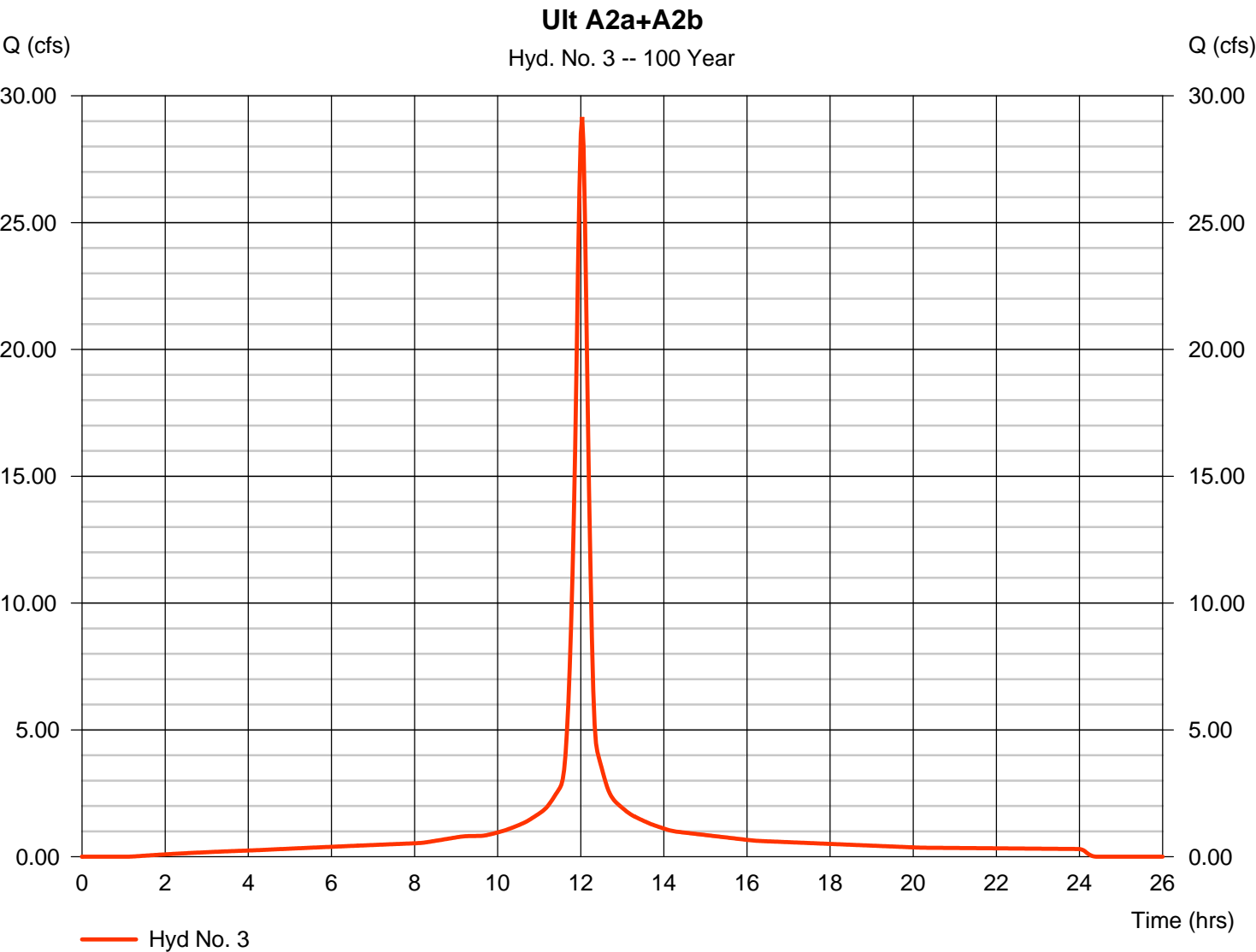
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 3

Ult A2a+A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 29.17 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 92,753 cuft
Drainage area	= 2.740 ac	Curve number	= 95
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.30 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





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## Worksheet for Sidewalk Box A3 2yr

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### Project Description

Solve For                      Spread

### Input Data

Discharge		9.59	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.02	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		30.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	12.67	ft
Depth	0.25	ft
Gutter Depression	0.00	ft
Total Depression	0.42	ft

---

## Worksheet for Sidewalk Box A3 10yr

---

### Project Description

Solve For                      Spread

### Input Data

Discharge		18.13	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.02	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		30.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	19.37	ft
Depth	0.39	ft
Gutter Depression	0.00	ft
Total Depression	0.42	ft

---

## Worksheet for Sidewalk Box A3 25yr

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### Project Description

Solve For                      Spread

### Input Data

Discharge		23.03	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.02	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		30.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	22.72	ft
Depth	0.45	ft
Gutter Depression	0.00	ft
Total Depression	0.42	ft

---

## Worksheet for Sidewalk Box A3 100yr

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### Project Description

Solve For                      Spread

### Input Data

Discharge		29.17	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.02	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		30.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	26.59	ft
Depth	0.53	ft
Gutter Depression	0.00	ft
Total Depression	0.42	ft

Watershed	Ult A2a+A2b+A2c
Point of Concentration	A2
Area	3.52 acres

Sheet Flow					
L1=	100	L2=	0	L3=	0
n1=	0.3	n2=	0.3	n3=	0.3
S1=	0.01	S2=	0	S3=	0
T1=	39.35	T2=	0.00	T3=	0.00

$$T = \frac{60 * L * n}{288.6 * S^{0.4}}$$

Shallow Concentrated Flow					
L1=	633	L2=	176	L3=	0
n1=	0.3	n2=	0.02	n3=	0.3
S1=	0.0025	S2=	0.0102	S3=	0
T1=	13.08	T2=	0.58	T3=	0.00

$$T = \frac{L * n}{60 * S^{0.5}}$$

Channelized Flow					
L1=	0	L2=	0	L3=	0
V1=	6	V2=	6	V3=	6
T1=	0.00	T2=	0.00	T3=	0.00

$$T = \frac{L}{V}$$

Tt=	52.43	minutes
-----	-------	---------

	Area	Soil Group	CN
Pasture/Range (Flat, 0-2%)	0.00	D	80
Impervious, Paved	1.22	D	98
Concrete	0.00	D	89
Commercial C1	2.30	D	93
<b>Total</b>	<b>3.52</b>		<b>94.73</b>

# Hydrograph Report

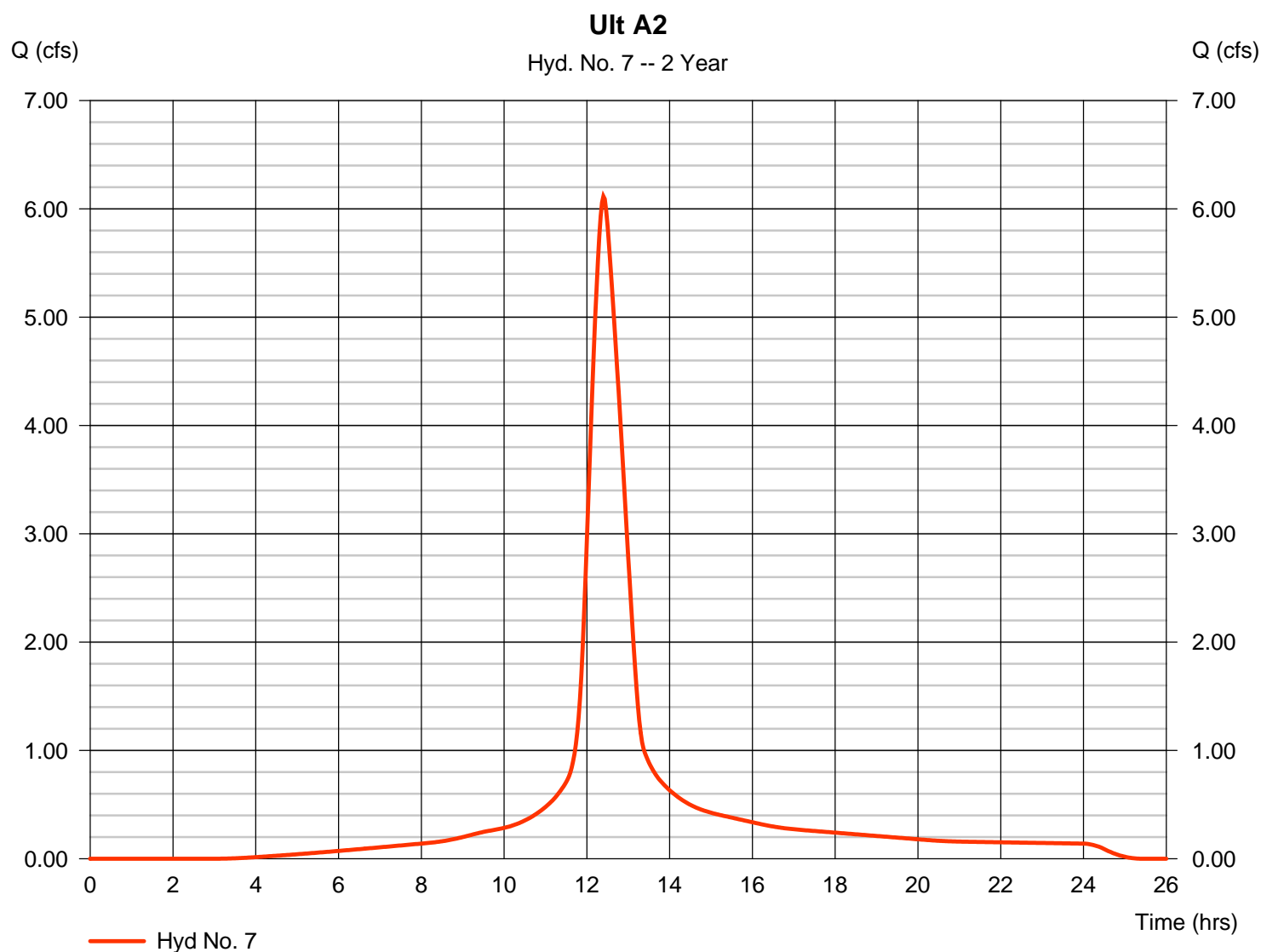
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Tuesday, 07 / 28 / 2020

## Hyd. No. 7

Ult A2

Hydrograph type	= SCS Runoff	Peak discharge	= 6.116 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 37,697 cuft
Drainage area	= 3.520 ac	Curve number	= 94.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 52.40 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

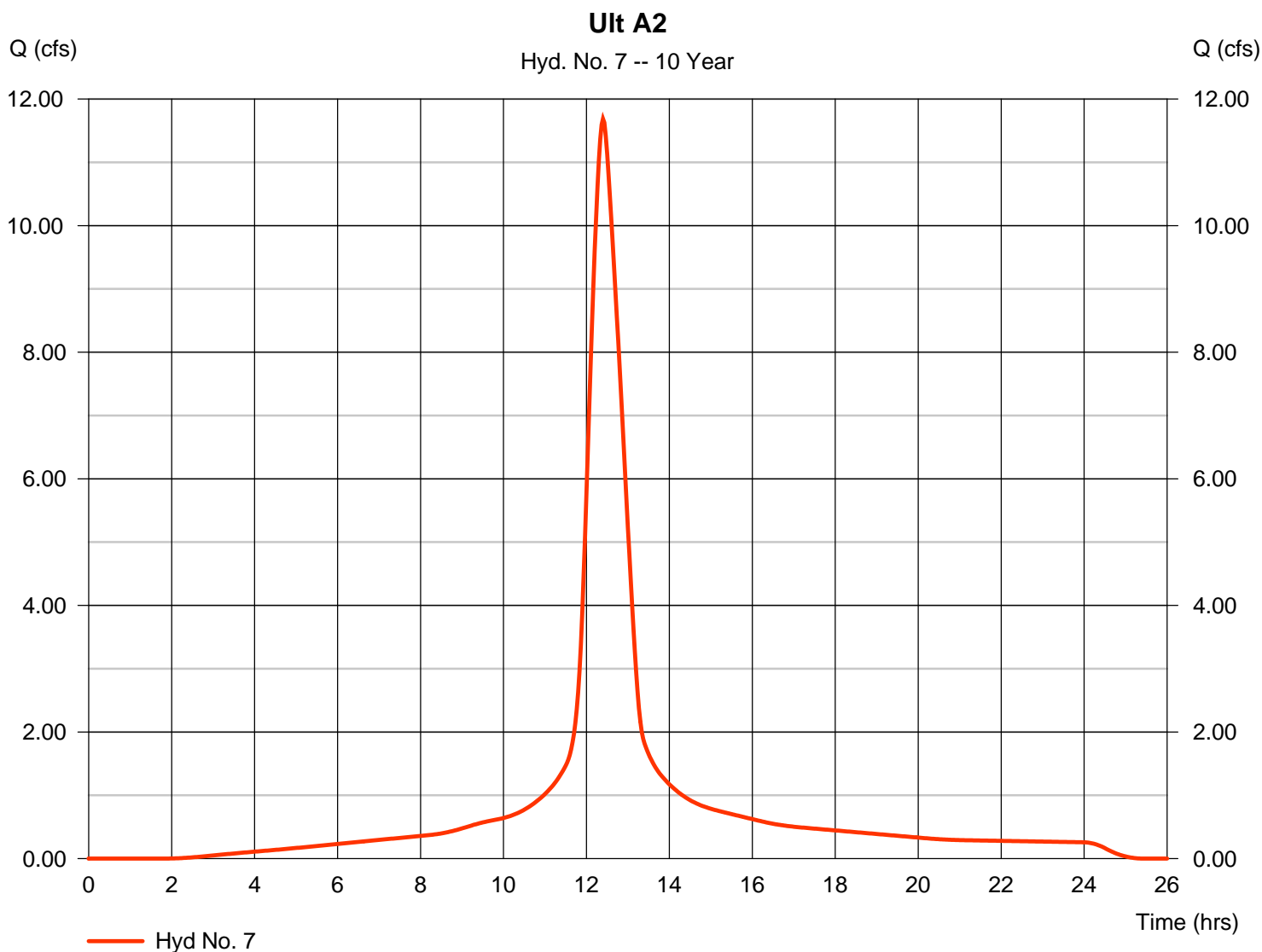
Tuesday, 07 / 28 / 2020

## Hyd. No. 7

Ult A2

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 3.520 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 11.69 cfs  
 Time to peak = 12.40 hrs  
 Hyd. volume = 74,356 cuft  
 Curve number = 94.7  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 52.40 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

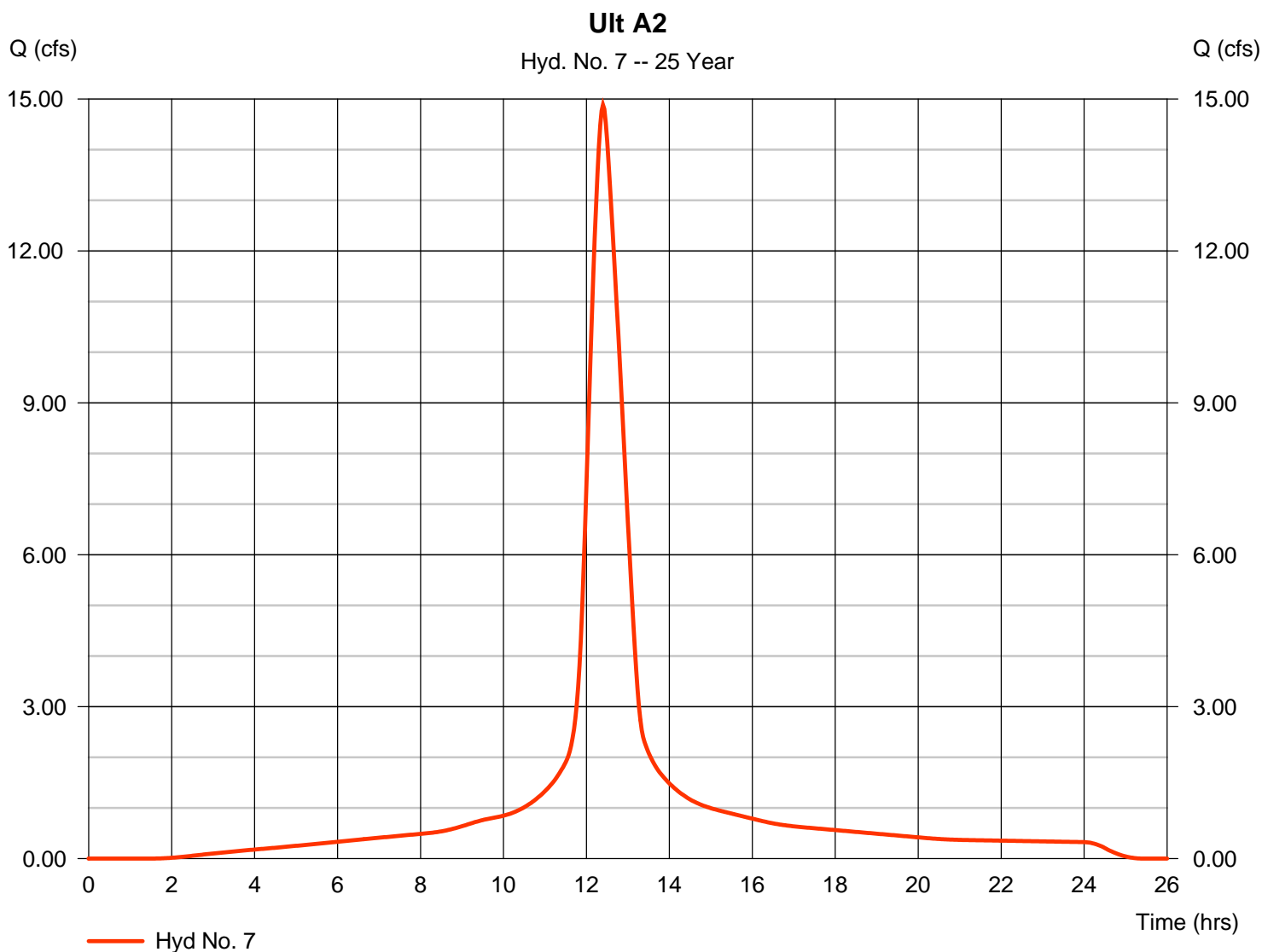
Tuesday, 07 / 28 / 2020

## Hyd. No. 7

Ult A2

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 3.520 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 14.88 cfs  
 Time to peak = 12.40 hrs  
 Hyd. volume = 95,746 cuft  
 Curve number = 94.7  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 52.40 min  
 Distribution = Type II  
 Shape factor = 484



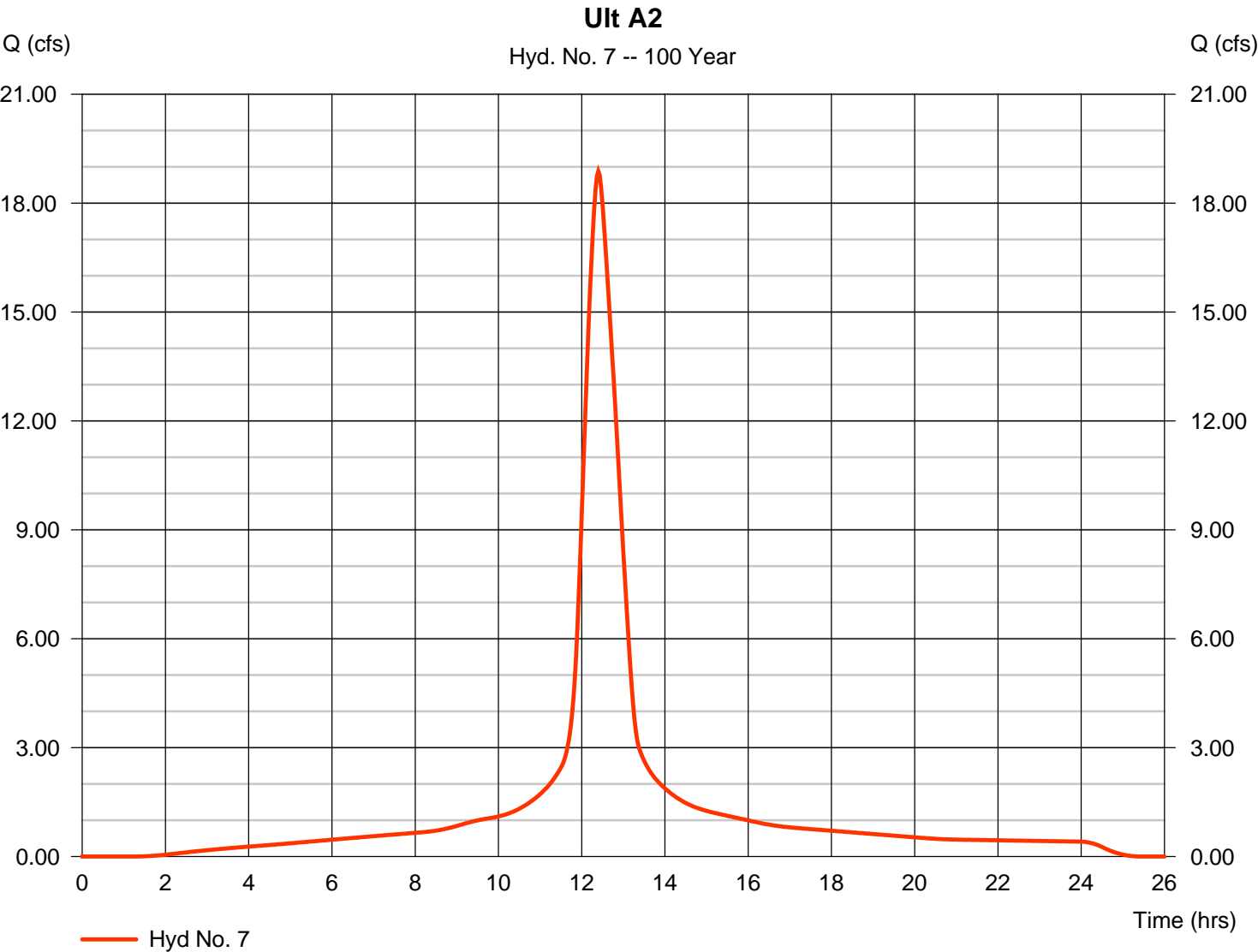


# Hydrograph Report

## Hyd. No. 7

Ult A2

Hydrograph type	= SCS Runoff	Peak discharge	= 18.88 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 122,695 cuft
Drainage area	= 3.520 ac	Curve number	= 94.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 52.40 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



## Worksheet for Channel A3 2yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.016	
Channel Slope	0.03700	ft/ft
Bottom Width	3.00	ft
Discharge	6.12	ft <sup>3</sup> /s

### Results

Normal Depth	0.29	ft
Flow Area	0.88	ft <sup>2</sup>
Wetted Perimeter	3.58	ft
Hydraulic Radius	0.24	ft
Top Width	3.00	ft
Critical Depth	0.51	ft
Critical Slope	0.00690	ft/ft
Velocity	6.98	ft/s
Velocity Head	0.76	ft
Specific Energy	1.05	ft
Froude Number	2.28	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.29	ft
Critical Depth	0.51	ft
Channel Slope	0.03700	ft/ft
Critical Slope	0.00690	ft/ft

## Worksheet for Channel A3 10yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.016	
Channel Slope	0.03700	ft/ft
Bottom Width	3.00	ft
Discharge	11.69	ft <sup>3</sup> /s

### Results

Normal Depth	0.44	ft
Flow Area	1.33	ft <sup>2</sup>
Wetted Perimeter	3.89	ft
Hydraulic Radius	0.34	ft
Top Width	3.00	ft
Critical Depth	0.78	ft
Critical Slope	0.00708	ft/ft
Velocity	8.76	ft/s
Velocity Head	1.19	ft
Specific Energy	1.64	ft
Froude Number	2.32	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.44	ft
Critical Depth	0.78	ft
Channel Slope	0.03700	ft/ft
Critical Slope	0.00708	ft/ft

## Worksheet for Channel A3 25yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.016	
Channel Slope	0.03700	ft/ft
Bottom Width	3.00	ft
Discharge	14.88	ft <sup>3</sup> /s

### Results

Normal Depth	0.52	ft
Flow Area	1.57	ft <sup>2</sup>
Wetted Perimeter	4.04	ft
Hydraulic Radius	0.39	ft
Top Width	3.00	ft
Critical Depth	0.91	ft
Critical Slope	0.00725	ft/ft
Velocity	9.50	ft/s
Velocity Head	1.40	ft
Specific Energy	1.92	ft
Froude Number	2.32	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.52	ft
Critical Depth	0.91	ft
Channel Slope	0.03700	ft/ft
Critical Slope	0.00725	ft/ft

## Worksheet for Channel A3 100yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.016	
Channel Slope	0.03700	ft/ft
Bottom Width	3.00	ft
Discharge	18.88	ft <sup>3</sup> /s

### Results

Normal Depth	0.61	ft
Flow Area	1.84	ft <sup>2</sup>
Wetted Perimeter	4.23	ft
Hydraulic Radius	0.44	ft
Top Width	3.00	ft
Critical Depth	1.07	ft
Critical Slope	0.00748	ft/ft
Velocity	10.26	ft/s
Velocity Head	1.64	ft
Specific Energy	2.25	ft
Froude Number	2.31	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.61	ft
Critical Depth	1.07	ft
Channel Slope	0.03700	ft/ft
Critical Slope	0.00748	ft/ft

## Worksheet for Channel A1 2yr

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope    0.00420    ft/ft  
Discharge    55.21    ft<sup>3</sup>/s  
Section Definitions

Station (ft)	Elevation (ft)
0+00	2.20
0+06	0.20
0+15	0.03
0+16	0.00
0+18	0.03
0+26	0.20
0+32	2.20

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2.20)	(0+06, 0.20)	0.030
(0+06, 0.20)	(0+15, 0.03)	0.030
(0+15, 0.03)	(0+16, 0.00)	0.016
(0+16, 0.00)	(0+18, 0.03)	0.016
(0+18, 0.03)	(0+26, 0.20)	0.030
(0+26, 0.20)	(0+32, 2.20)	0.030

### Options

Current Roughness weighted Method                      Pavlovskii's Method  
Open Channel Weighting Method                      Pavlovskii's Method  
Closed Channel Weighting Method                      Pavlovskii's Method

### Results

Normal Depth    0.98    ft

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## Worksheet for Channel A1 2yr

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### Results

Elevation Range	0.00 to 2.20 ft	
Flow Area	19.42	ft <sup>2</sup>
Wetted Perimeter	24.94	ft
Hydraulic Radius	0.78	ft
Top Width	24.68	ft
Normal Depth	0.98	ft
Critical Depth	0.71	ft
Critical Slope	0.01466	ft/ft
Velocity	2.84	ft/s
Velocity Head	0.13	ft
Specific Energy	1.11	ft
Froude Number	0.57	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.98	ft
Critical Depth	0.71	ft
Channel Slope	0.00420	ft/ft
Critical Slope	0.01466	ft/ft

## Worksheet for Channel A1 10yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.00420	ft/ft
Discharge	113.79	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	2.20
0+06	0.20
0+15	0.03
0+16	0.00
0+18	0.03
0+26	0.20
0+32	2.20

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2.20)	(0+06, 0.20)	0.030
(0+06, 0.20)	(0+15, 0.03)	0.030
(0+15, 0.03)	(0+16, 0.00)	0.016
(0+16, 0.00)	(0+18, 0.03)	0.016
(0+18, 0.03)	(0+26, 0.20)	0.030
(0+26, 0.20)	(0+32, 2.20)	0.030

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	1.44	ft
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## Worksheet for Channel A1 10yr

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### Results

Elevation Range	0.00 to 2.20 ft	
Flow Area	31.43	ft <sup>2</sup>
Wetted Perimeter	27.85	ft
Hydraulic Radius	1.13	ft
Top Width	27.44	ft
Normal Depth	1.44	ft
Critical Depth	1.07	ft
Critical Slope	0.01293	ft/ft
Velocity	3.62	ft/s
Velocity Head	0.20	ft
Specific Energy	1.64	ft
Froude Number	0.60	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.44	ft
Critical Depth	1.07	ft
Channel Slope	0.00420	ft/ft
Critical Slope	0.01293	ft/ft

## Project Description

## Input Data

0+00	2.20
0+06	0.20
0+15	0.03
0+16	0.00
0+18	0.03
0+26	0.20
0+32	2.20

(0+00, 2.20)	(0+06, 0.20)	0.030
(0+06, 0.20)	(0+15, 0.03)	0.030
(0+15, 0.03)	(0+16, 0.00)	0.016
(0+16, 0.00)	(0+18, 0.03)	0.016
(0+18, 0.03)	(0+26, 0.20)	0.030
(0+26, 0.20)	(0+32, 2.20)	0.030

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Normal Depth	1.66	ft
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## Worksheet for Channel A1 25yr

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### Results

Elevation Range	0.00 to 2.20 ft	
Flow Area	37.46	ft <sup>2</sup>
Wetted Perimeter	29.21	ft
Hydraulic Radius	1.28	ft
Top Width	28.73	ft
Normal Depth	1.66	ft
Critical Depth	1.24	ft
Critical Slope	0.01239	ft/ft
Velocity	3.94	ft/s
Velocity Head	0.24	ft
Specific Energy	1.90	ft
Froude Number	0.61	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.66	ft
Critical Depth	1.24	ft
Channel Slope	0.00420	ft/ft
Critical Slope	0.01239	ft/ft

## Project Description

## Input Data

0+00	2.20
0+06	0.20
0+15	0.03
0+16	0.00
0+18	0.03
0+26	0.20
0+32	2.20

(0+00, 2.20)	(0+06, 0.20)	0.030
(0+06, 0.20)	(0+15, 0.03)	0.030
(0+15, 0.03)	(0+16, 0.00)	0.016
(0+16, 0.00)	(0+18, 0.03)	0.016
(0+18, 0.03)	(0+26, 0.20)	0.030
(0+26, 0.20)	(0+32, 2.20)	0.030

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Normal Depth	1.89	ft
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## Worksheet for Channel A1 100yr

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### Results

Elevation Range	0.00 to 2.20 ft	
Flow Area	44.46	ft <sup>2</sup>
Wetted Perimeter	30.71	ft
Hydraulic Radius	1.45	ft
Top Width	30.16	ft
Normal Depth	1.89	ft
Critical Depth	1.43	ft
Critical Slope	0.01190	ft/ft
Velocity	4.26	ft/s
Velocity Head	0.28	ft
Specific Energy	2.18	ft
Froude Number	0.62	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.89	ft
Critical Depth	1.43	ft
Channel Slope	0.00420	ft/ft
Critical Slope	0.01190	ft/ft

# Attachment P

## Drainage Compliance Memo



290 S. Castell Avenue, Ste 100  
New Braunfels, TX 78130  
TBPE-FIRM F-10961  
TBPLS FIRM 10153600

July 27, 2020

Corey Rayburn, PE  
City of New Braunfels  
550 Landa Street  
New Braunfels TX 78130

RE: Vanguard Farms – Heather Glen Master Plan Compliance

Dear Mr. Rayburn,

Vanguard Farms is a multi-family development at the corner of Nissan Way and Summer Sweet Rd in New Braunfels, Texas. The site is part of the Post Road Development, now known as the Heather Glen Development and Zoned PD per Ordinance No. 2016-56.

I acknowledge and verify that the drainage plan for the proposed Vanguard Farms multi-family site to be in compliance with the Heather Glen Detention Facilities performed by Yalgo, LLC dated March 22, 2017. I believe that the calculations and comparisons for the existing and proposed drainage conditions found in the Heather Glen Detention Facilities are in compliance with the New Braunfels Drainage and Erosion Control Manual (DECDM) and remain valid for this site. This site shall also be considered grandfathered under the 2000 DCM and shall not be required to provide water quality.

I hope everything is in order, and if you have any questions or comments, please contact me at (210) 625-8555.

Thank you,

A handwritten signature in blue ink that reads 'Chris Van Heerde, PE'. The signature is fluid and cursive, with the initials 'PE' written in a slightly different style.

Chris Van Heerde, PE  
Managing Partner  
HMT Engineering & Surveying



7/27/20

# Attachment Q

## Nissan Way Extension Drainage Report



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# Nissan Way Extension

A distinguished project by:

**IMPACT Developers**

**Job No. 323.001**

## Stormwater Management Report

New Braunfels, Texas

July 2020



*Chris Van Heerde, PE*  
7/7/2020



**Prepared by:**

290 S. Castell Avenue, Ste. 100  
New Braunfels, TX 78130  
(830) 625-8555  
TBPE-FIRM F-10961  
TBPLS FIRM 10153600

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## 1.0 General Information

HMT Engineering and Surveying has been retained by IMPACT to provide professional engineering services for the future planned development of Nissan Way, in the City of New Braunfels, Texas (Reference Attachment A). Proposed construction includes installation of utilities, including water and sewer mains; installation of drainage infrastructure, including channels and inlets; and installation of a paved roadway. The site is currently undeveloped. The property is not within the 100-year floodplain, according to FEMA Flood Insurance Rate Map (FIRM) Number 48091C0455F date September 2, 2009 (Reference Attachment B). This report addresses the hydrology and hydraulics of the proposed Nissan Way Extension only.

The City of New Braunfels Drainage and Erosion Control Design Manual revised September 2000 (hereafter referred to as the DECDM) was used during the design of this project. The DECDM was updated in February 2018 by authorization of the City Engineer and approval of City Council; however, the drainage criteria used in this design are prior to this revision, as this project is part of a master drainage document/plat approved prior to implementation of the revised criteria (the previously approved Heather Glen master plan). Please see Attachment L for a Memo of Drainage Compliance with the approved master drainage plan.

Because the proposed improvements will consist of more than 1 acre of disturbed land, this project will require a Type 3 Drainage Report.

## 2.0 Hydrology Methodology Rational Method

The peak storm water runoff calculations were determined using the SCS Method as described in the City of New Braunfels Drainage and Erosion Control Manual. The time of concentration was calculated using sheet flow, shallow concentrated flow, and channel flow. The length of overland sheet flow conditions is limited to a maximum of 100 feet. The time of travel for sheet flow conditions is calculated using Manning's kinematic solution (Overtop and Meadows 1976). After 100 feet, the average velocity of the flow is determined using Figure 3-1 of the USDA Technical Release 55 Urban Hydrology for Small Watersheds. The time of travel for concentrated flow conditions is calculated using the equation below:

Sheet Flow

$$\text{Eq 5-4a } T_t = \frac{(n*L)}{288.6*(S^{0.4})} * 60$$

For shallow concentrated flow, using the average velocity as described above, the time of travel is calculated using this equation:

Shallow Concentrated Flow

$$\text{Eq 5-4b } T_t = \frac{L}{(60)(S^{0.5})}$$

For channelized flow, an estimated peak flow is used to calculate the velocity within the channel cross section for this segment. The time is then calculated using this velocity and the length of flow as shown in Eq 4-8 below.

#### Channel Flow

$$\text{Eq 5-4c } T_t = \frac{L}{60 * V}$$

The runoff coefficient was determined based on the impervious cover within each sub-watershed and the zoning for that parcel of land. Rainfall intensities were calculated using the time of concentration and constants from Table 3-2 of the DECDM for each storm event respectively (reference Attachment E for Hydrology Calculations).

The Peak Stormwater runoff calculations were determined using Hydraflow Hydrographs program. This model was built to determine the peak flows for existing and proposed conditions for the proposed development.

The Curve Numbers used for calculations were taken from Tables 5-5A and 5-7 from the City of New Braunfels Drainage Manual. Existing zoning was used for the corresponding drainage areas. The drainage area consists entirely of Type D soils, as seen in the USDA Soil Map (see Attachment C). A Type II storm distribution was used in the Hydraflow Hydrograph calculations.

### 3.0 Existing Conditions Hydrology

The existing drainage area is defined as 59.26 acres that flow generally to the south, and currently consists of undeveloped open field and scrub, with a small portion of existing asphalt roadway. This drainage area ultimately discharges into an existing channel, designed as part of the Heather Glen Subdivision Master Plan. Please refer to Attachments F and G for the Existing Conditions Drainage Area Map and Existing Conditions Hydrology Calculations, respectively.

### 4.0 Proposed Conditions Hydrology

The proposed development consists of a stretch of paved roadway, two inlets, and three channels. Please refer to Attachments H and I for the Proposed Conditions Drainage Area Map and Proposed Conditions Hydrology Calculations, respectively.

The proposed conditions consists of two drainage areas, which are further subdivided:

- Drainage Area A consists of 49.49 acres that flow generally to the south and west, discharging into an existing channel in the Heather Glen subdivision. It is further subdivided into two areas:
  - Drainage Area A1 consists of 44.64 acres of undeveloped pasture/scrub land upstream of the proposed development, which flow generally to the south before being intercepted by the proposed Channel A1 and redirected into an existing channel in the Heather Glen subdivision;
  - Drainage Area A2 consists of 4.85 acres of proposed roadway pavement and undeveloped pasture/scrub land, which flow to the proposed Inlet A2 and Channel A2, which discharge into an existing channel in the Heather Glen subdivision.

- Drainage Area B consists of 9.77 acres of undeveloped pasture/scrub land that flows generally to the southwest before entering an existing culvert underneath the existing Nissan Way.

<b>Table 4 - Existing to Proposed Comparison</b>					
Point of Concentration	Drainage Area	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
EX A	EX A	10.83	17.37	23.41	35.67
A	A+B	14.41	22.69	30.44	46.11
Proposed is Less Than or Equal to Existing		NO	NO	NO	NO

\*The Heather Glen project has a detention basin sized to accommodate the developed conditions flows from the proposed apartment site and Nissan Way Extension.

## 5.0 Ultimate Conditions Hydrology

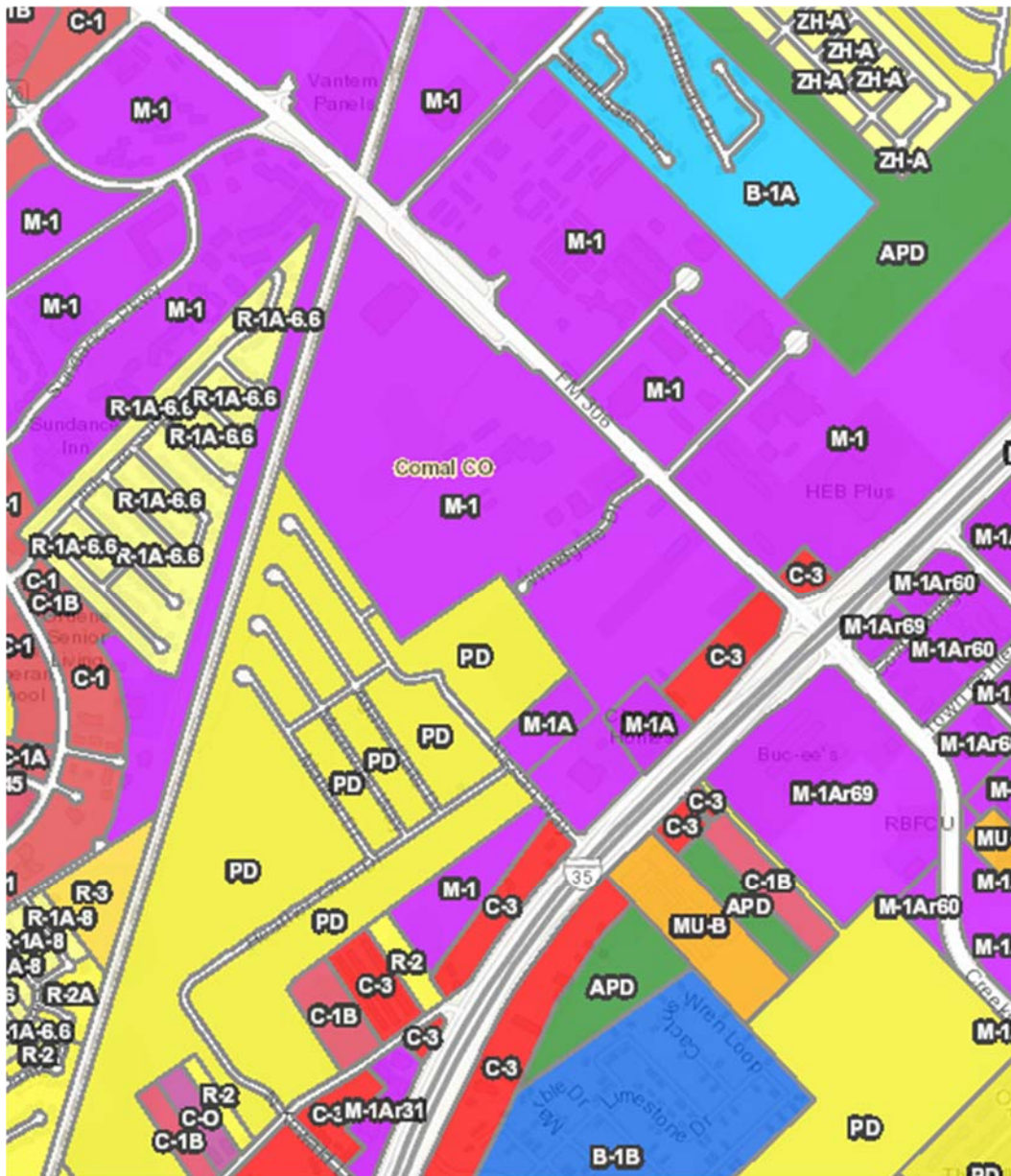
The ultimate development of this drainage area will include the construction of additional multi-family residential property on both sides of the proposed Nissan Way Extension. Please see Attachments J and K for the Ultimate Conditions Drainage Area Map and Ultimate Conditions Hydrology Calculations, respectively. The ultimate conditions are subdivided identically to the proposed conditions.

<b>Table 5 - Existing to Ultimate Comparison</b>					
Point of Concentration	Drainage Area	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
EX A	EX A	10.83	17.37	23.41	35.67
Ult A	Ult A+B	87.91	130.84	172.79	256.79
Proposed is Less Than or Equal to Existing		NO	NO	NO	NO

\*The Heather Glen project has a detention basin sized to accommodate the developed conditions flows from the proposed apartment site and Nissan Way Extension.

Because the exact development of portions of this watershed are not known at this time, Table 5-7 (Fully Developed Runoff Coefficients) was used to generate runoff coefficient for these areas when appropriate, based on the existing zoning map, seen below.





*Taken from the City of New Braunfels Planning Map, December 18, 2019*

## 6.0 Hydraulics

To convey flows in the proposed and ultimate conditions, three channels are proposed in the area, along with two sidewalk boxes to convey flows from the proposed Nissan Way extension into the proposed channels. In order to ensure adequate capacity, the channels were sized using flows derived from the ultimate conditions of the site and upstream areas. Please see Attachment K for hydraulic calculations.

Because this development is part of the Heather Glen subdivision master plan, it is our understanding that all downstream facilities, including existing channels and culverts, have been sized correctly to handle the flows generated by this development.

## **7.0 Detention**

Because this development is part of the Heather Glen subdivision master plan, it is our understanding that the downstream detention basin has been sized correctly to accommodate runoff from this development.

## **8.0 Water Quality**

This development was constructed in accordance with the City of New Braunfels DECDM revised September 2000. As such, no water quality is required for this development. The DECDM was updated in February 2018 by authorization of the City Engineer and approval of City Council; however, the drainage criteria used in this design are prior to this revision, as this project is part of a master drainage document/plat approved prior to implementation of the revised criteria (the previously approved Heather Glen master plan). Please see Attachment M for a Memo of Drainage Compliance with the approved master drainage plan.

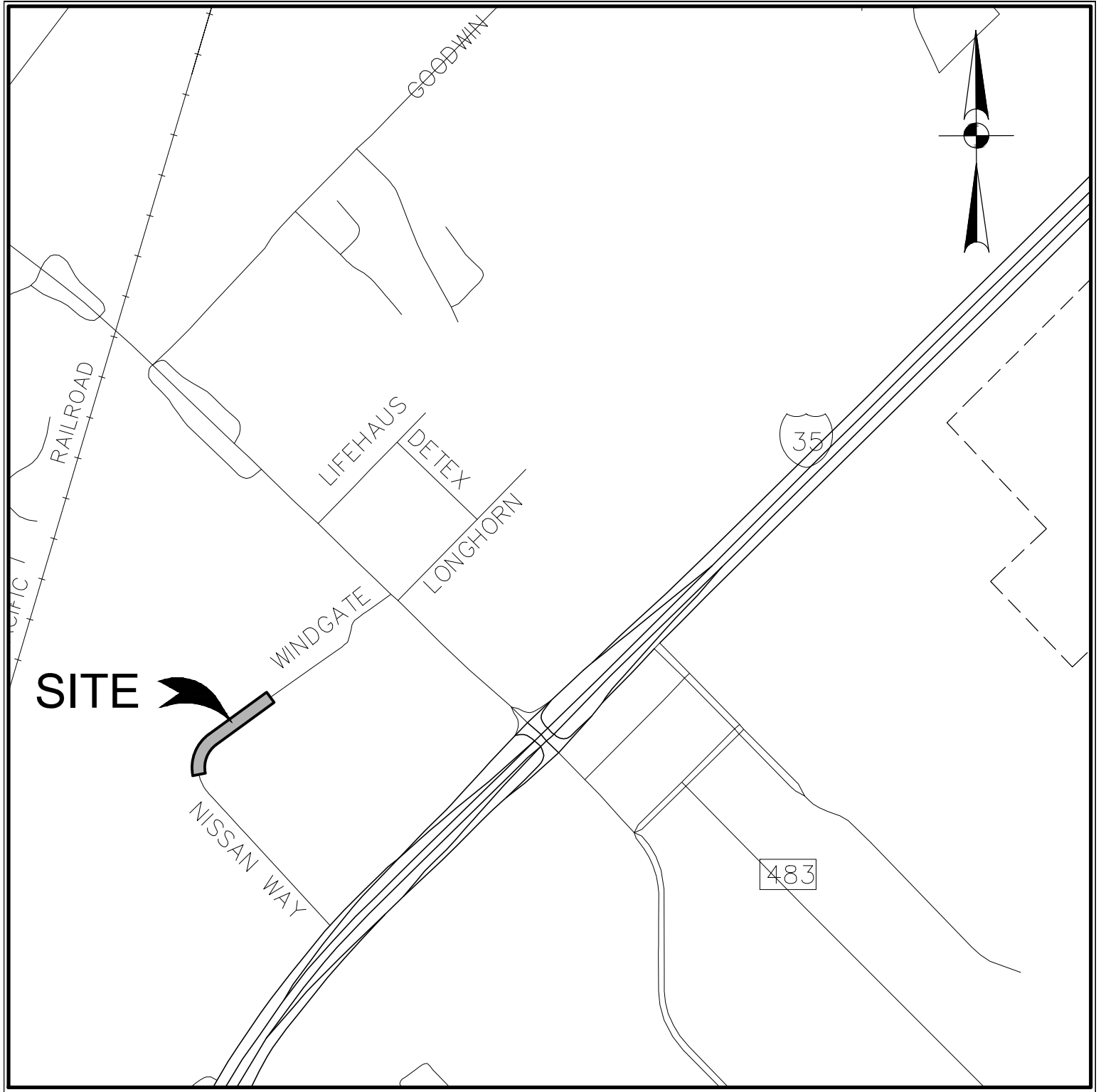
## **9.0 Conclusion**

The proposed improvements for the Nissan Way Extension was analyzed for the 2, 10, 25, and 100-year storm events. This analysis was performed in accordance with the City of New Braunfels Drainage and Erosion Control Design Manual revised September 2000, as required by the current approved master plan. As shown by this analysis, the proposed and ultimate conditions flows are greater than existing flows; however, it is our understanding that the downstream infrastructure constructed as part of the Heather Glen subdivision has been correctly designed to reduce flows from this development to be less than or equal to existing conditions.

# Attachment A

## Location Map





# PROJECT LOCATION MAP

SCALE: N.T.S.

# Attachment B

## FEMA FIRM Map

# National Flood Hazard Layer FIRMette



29°43'56.86"N



USGS The National Map: Orthoimagery. Data refreshed April, 2019. 1:6,000 29°43'25.62"N

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/29/2019 at 10:16:03 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

# Attachment C

## USDA Soil Map



Soil Map—Comal and Hays Counties, Texas  
(EX DA)



Natural Resources  
Conservation Service

Web Soil Survey  
National Cooperative Soil Survey

1/30/2020  
Page 1 of 3

# Soil Map—Comal and Hays Counties, Texas (EX DA)

## 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 1:20,000.

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:

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: Comal and Hays Counties, Texas

Survey Area Data: Version 16, Sep 12, 2019

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

Date(s) aerial images were photographed: Jan 4, 2019—Jan 24, 2019

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

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ByA	Branyon clay, 0 to 1 percent slopes	59.3	100.0%
<b>Totals for Area of Interest</b>		<b>59.3</b>	<b>100.0%</b>

# Attachment D

## Curve Number Charts



**Table 5-5A**  
**General SCS Runoff Curve Numbers**

Cover Type*	CN (AMC III)	
	C	D

Drainage and Erosion Control Design Manual

90

Open space – lawns, parks, golf courses	Poor condition (grass cover <50%)	86	89
	Fair condition (grass cover 50-75%)	79	84
	Good condition (grass cover >75%)	74	80
Impervious	Paved	98	98
	Gravel	89	91
	Dirt	87	89
Urban	Commercial and business	94	95
	Industrial	91	93
Residential	1/8 acre lot size	90	92
	1/4 acre lot size	83	87
	1/2 acre lot size	80	85
	1 acre lot size	79	84
	2 acre lot size	77	82
Pasture, grassland, or range-continuous Forage	Poor	86	89
	Fair	79	84
	Good	74	80
Meadow-continuous generally mowed for hay		71	78
Brush-brush, weed, grass mix	Poor	77	83
	Fair	70	77
	Good	65	73
Woods-grass combination (orchard, tree Farm)	Poor	82	86
	Fair	76	82
	Good	72	79
Woods	Poor	77	83
	Fair	73	79
	Good	70	77
Farmstead		82	86

Zone	"C"	CN (AMCII)	
		C	D
R-1/R-1A Single family	0.53	83	87
R-2/R-2A Single and two family	0.59	90	92
R-3/R-3L Multi family high density	0.67	92	94
R-3/R-3H Multi family low density	0.55	90	92
B-1/B-1A Convent & mobile homes	0.53	83	87
TH/TH-A Townhouse	0.67	92	92
ZH/ZH-A Zero lot line homes	0.55	87	90
C-1/C1A Neighborhood business	0.67	92	93
C-2/C-1B General Business	0.68	93	94
C-3 Commercial	0.80	94	95
C-4/C-4A Resort commercial / PUD*			
M-1/M1A Light industry	0.72	87	90
M-2/M-2A Heavy industry	0.78	94	95

\*must use composite values based on % impervious.

# Attachment E

## Manning's "n" Value Charts

**Table 5-4**  
**Manning's "n" for Overland Flow and Shallow Concentrated Flow**

<u>Condition</u>	<u>"n"</u>
Concrete (rough or smoothed finish)	0.016
Asphalt	0.02
0-50% vegetated ground cover, remaining bare soil or rock outcrops, minimum brush or tree cover	0.1
50-90% vegetated ground cover, remaining bare soil or rock outcrops, minimum – medium brush or tree cover	0.2
100% vegetated ground cover, medium – dense grasses (lawns, grassy fields, etc) medium brush or tree cover	0.3
100% vegetated ground cover with areas of heavy vegetation (parks, greenbelts, riparian areas, etc) dense undergrowth with medium to heavy tree growth	0.619

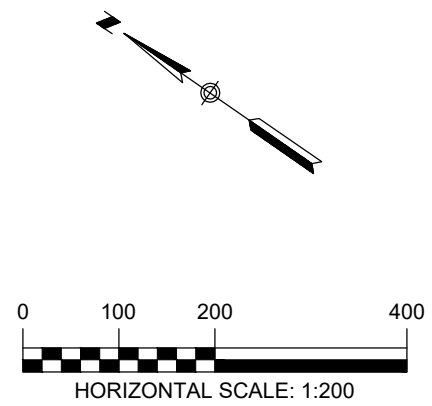
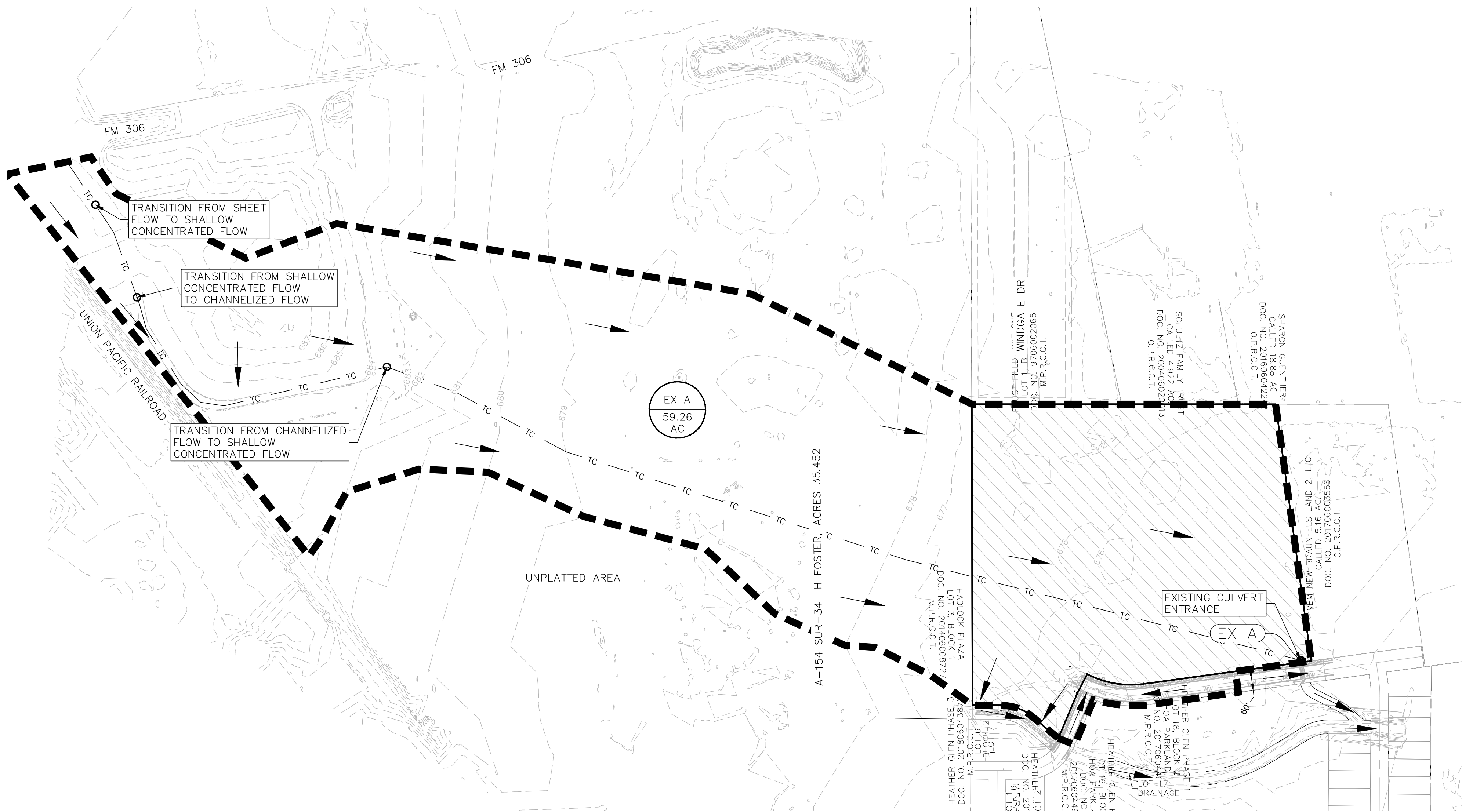
**Table 9-1**  
**Roughness Coefficients of New or Altered Channels**

Type of Channel	Manning's "n"	
Grass lined		
Bermuda	0.04	
St. Augustine	0.045	
Soils		Velocity (fps)
Cobbles	0.035	5.5
Coarse gravel	0.025	6
Graded silts to gravel	0.030	5.5
Graded loam to cobbles	0.030	5
Fine gravel	0.020	5
Shale & hardpan	0.025	6
Alluvial silts, colloidal	0.025	3.75
Stiff clay, very colloidal	0.025	3.75
Firm loam	0.020	2.5
Alluvial silts, non-colloidal	0.020	2
Silt loam, non-colloidal	0.020	2
Sandy loam, non-colloidal	0.020	1.75
Fine sand, colloidal	0.020	1.5
Concrete		
Rough finish	0.02	
Smooth finish	0.015	
Exposed rubble	0.025	
Gabion	0.035	
Rock-cut	0.025	

# Attachment F

## Existing Conditions Drainage Area Map

Drawing Name: \\A:\Projects\323 - ULF, LLC\001 - Heather Glen Apartments\CDa\STREET PROJECT SET\323.001\_DRNG.dwg User: jphnm Mar 02, 2020 - 9:39am



- LEGEND**
- 700 — EXISTING CONTOURS
  - 700 — PROPOSED CONTOURS
  - B.L. BUILDING SETBACK LINE
  - U.E. UTILITY EASEMENT
  - D.E. DRAINAGE EASEMENT
  - — DRAINAGE AREA
  - TC — TC — TIME OF CONCENTRATION
  - A-1 ○ POINT OF CONCENTRATION
  - — DRAINAGE FLOW DIRECTION
  - DA ACRES DRAINAGE AREA LABEL

Table 1 - Existing Conditions Hydrology Calculations - City of New Braunfels									
Point of Concentration	Description	Drainage Area	Area	T <sub>c</sub>	CN	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
EX A	Drainage Area A1 Comparison	EX A	59.26	86.69	80.00	41.18	105.53	144.43	193.72

290 S. CASTELL AVE., STE. 100  
NEW BRAUNFELS, TX 78130  
TBPE FIRM F-10961  
TBPLS FIRM 1053600

**HMT**  
ENGINEERING & SURVEYING

03/01/2020

EXISTING DRAINAGE  
AREA MAP  
NISSAN WAY EXTENSION

NO.	REVISION DESCRIPTION	REVISION DATE

DATE: **MARCH 2020**

DRAWN BY: **JMM**

DESIGNED BY: **JMM**

REVIEWED BY: **SWH/CVH**

HMT PROJECT NO.:  
**323.001**

**SHEET**  
**C1.01**

# Attachment G

## Existing Conditions Hydrology Calculations



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

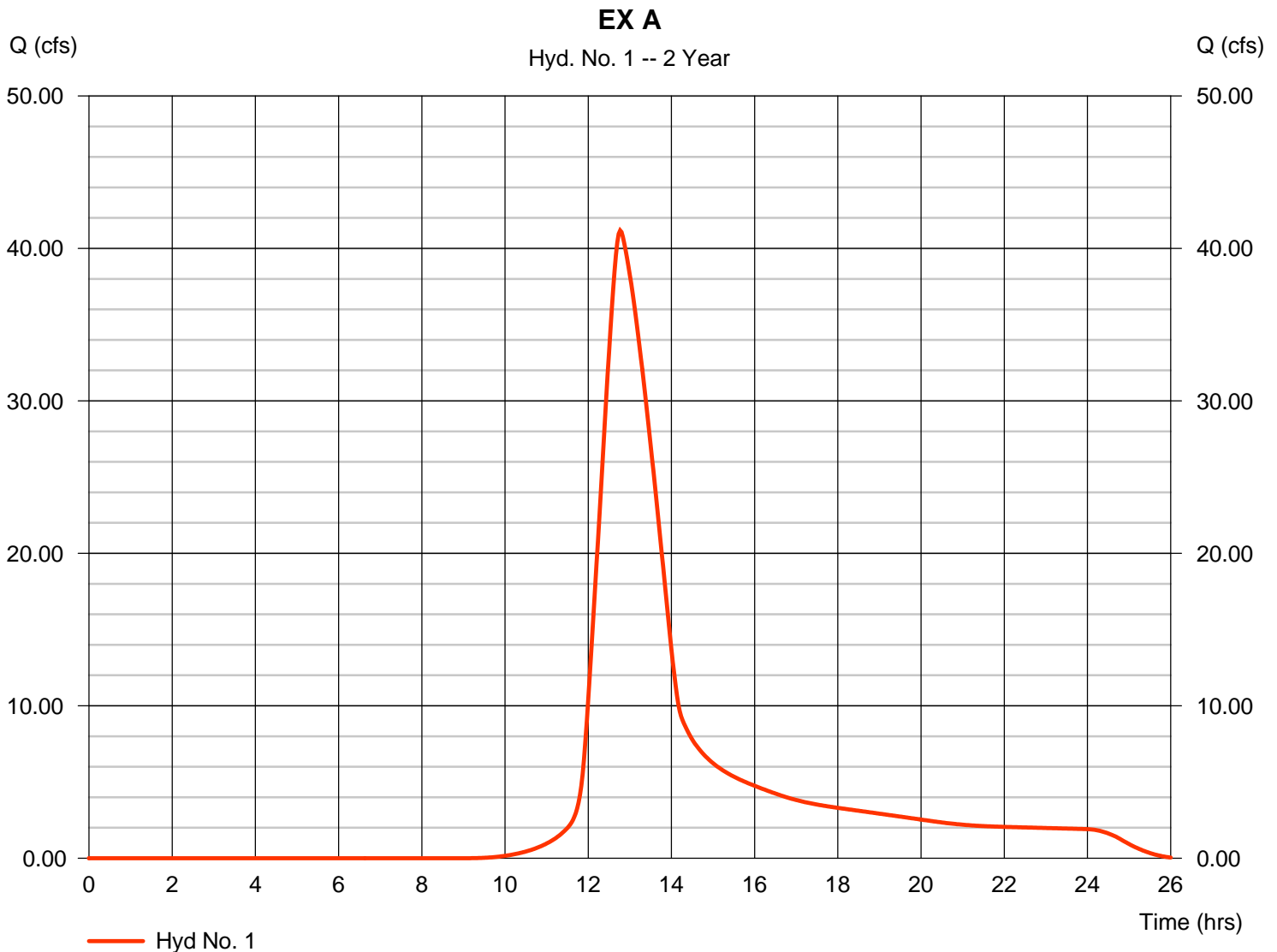
Monday, 03 / 2 / 2020

## Hyd. No. 1

EX A

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 59.260 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.52 in  
 Storm duration = 24 hrs

Peak discharge = 41.18 cfs  
 Time to peak = 12.77 hrs  
 Hyd. volume = 353,712 cuft  
 Curve number = 80  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 86.70 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

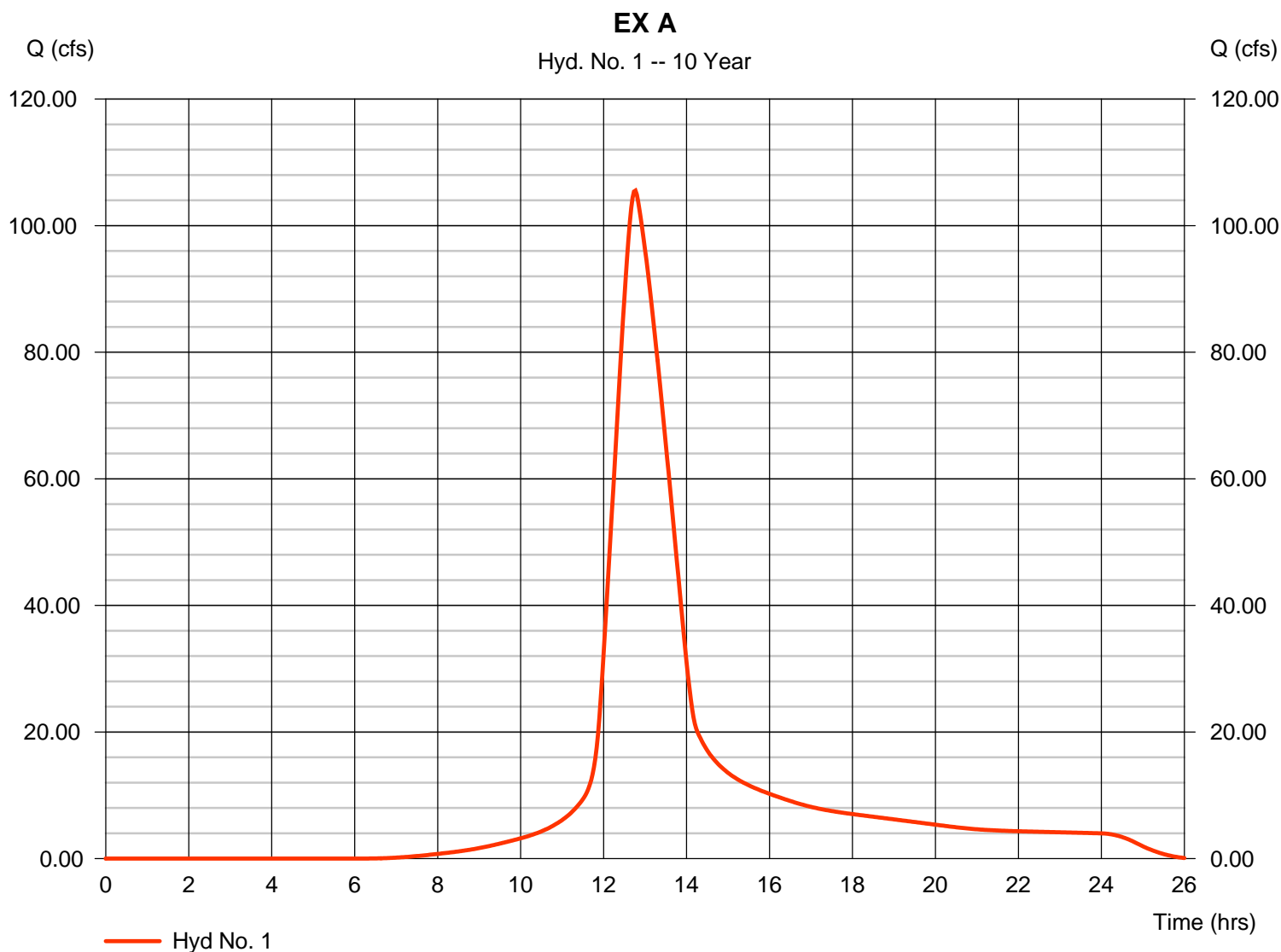
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 1

EX A

Hydrograph type	= SCS Runoff	Peak discharge	= 105.53 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.77 hrs
Time interval	= 2 min	Hyd. volume	= 887,156 cuft
Drainage area	= 59.260 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 86.70 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

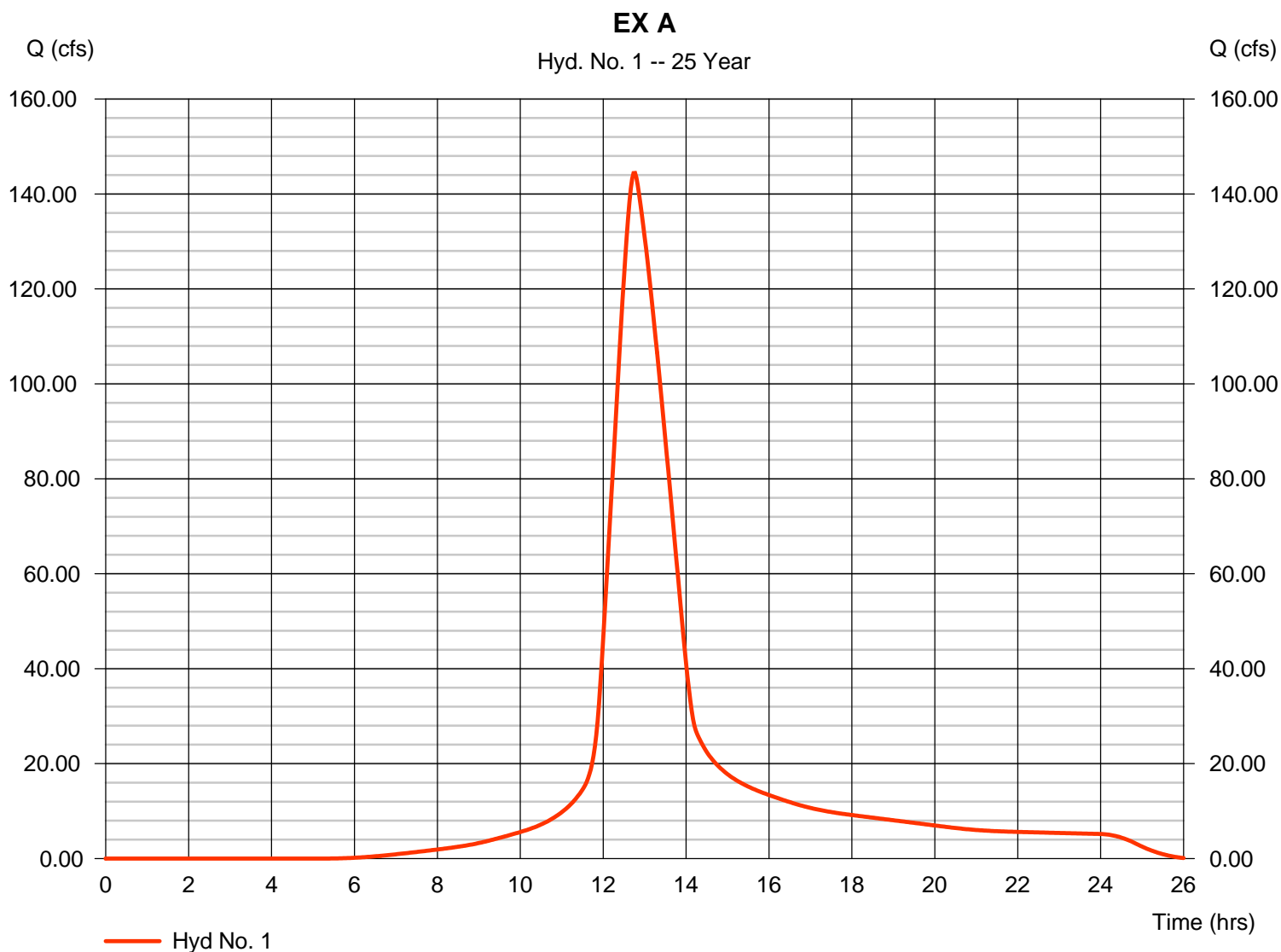
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 1

EX A

Hydrograph type	= SCS Runoff	Peak discharge	= 144.43 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.77 hrs
Time interval	= 2 min	Hyd. volume	= 1,218,252 cuft
Drainage area	= 59.260 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 86.70 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

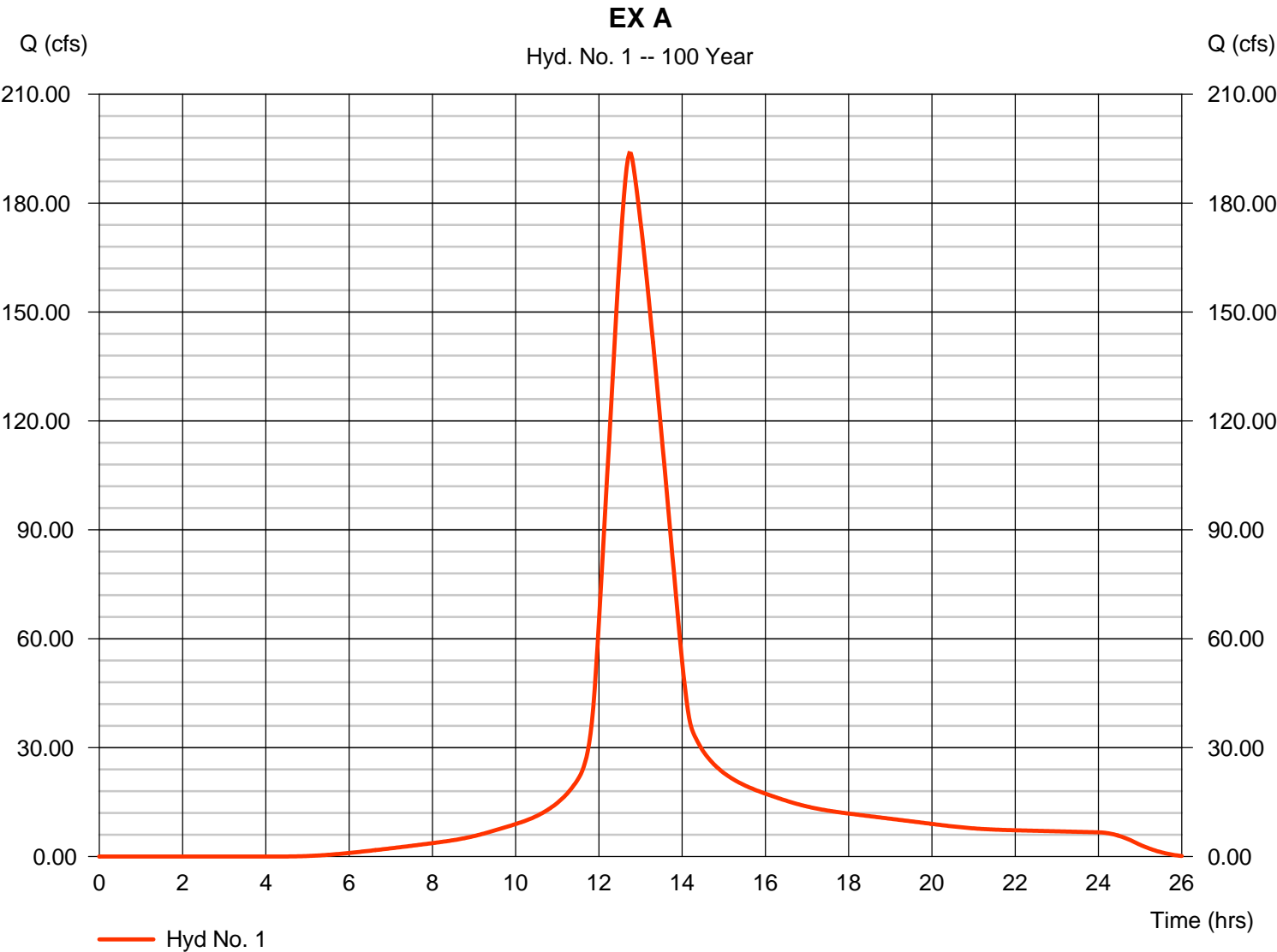


# Hydrograph Report

## Hyd. No. 1

EX A

Hydrograph type	= SCS Runoff	Peak discharge	= 193.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.73 hrs
Time interval	= 2 min	Hyd. volume	= 1,644,892 cuft
Drainage area	= 59.260 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 86.70 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

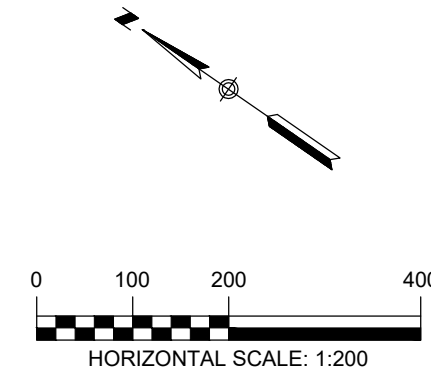
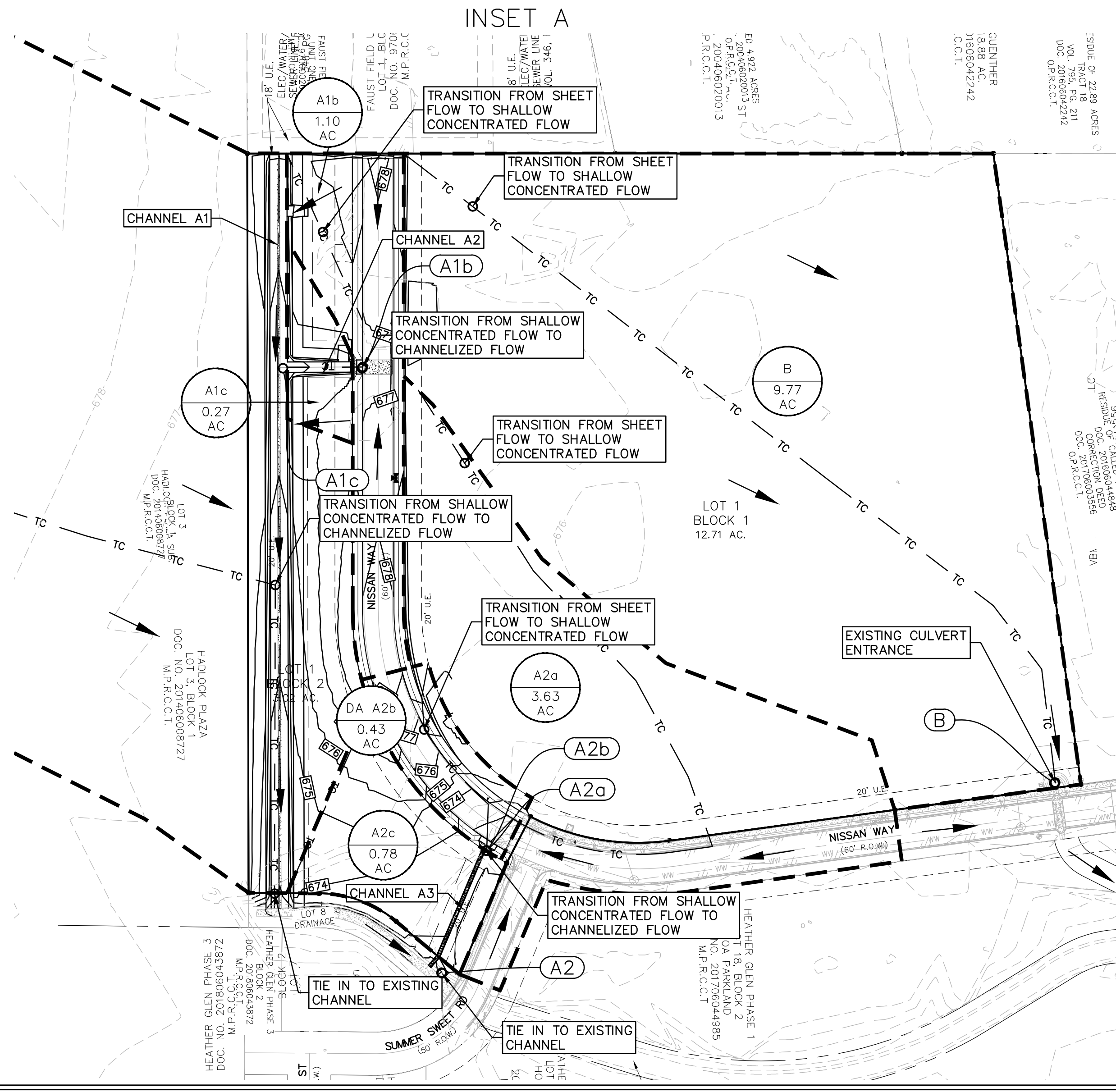
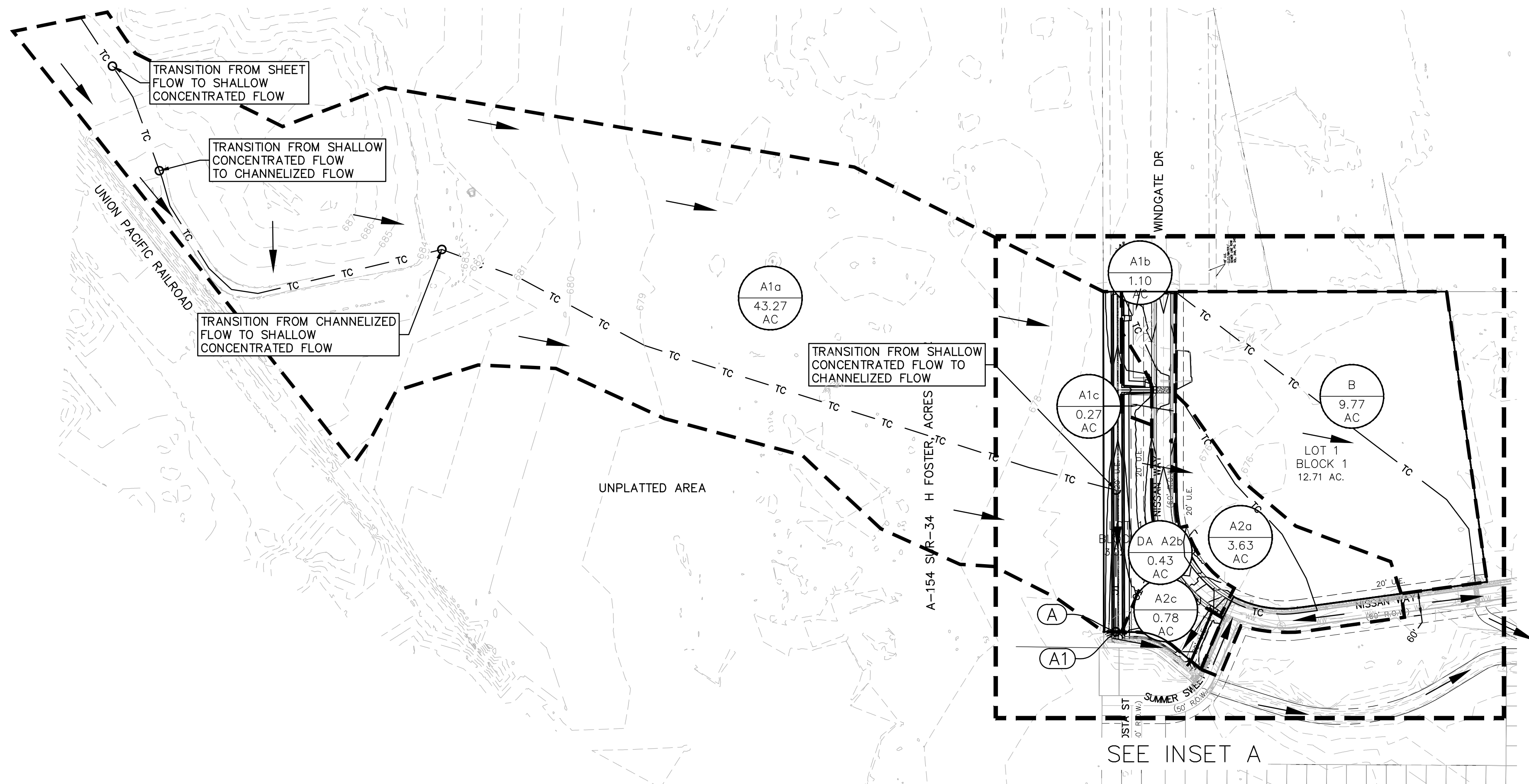


# Attachment H

## Proposed Conditions Drainage Area Map



Drawing Name: W:\\_Projects\223 - U.F. LLC\001 - Heather Glen Apartments\00a\STREET PROJECT SET\323.001\_DRNG.dwg User: jphmm Mar 02, 2020 - 9:39am



- LEGEND**
- EXISTING CONTOURS
  - PROPOSED CONTOURS
  - B.L. BUILDING SETBACK LINE
  - U.E. UTILITY EASEMENT
  - D.E. DRAINAGE EASEMENT
  - DRAINAGE AREA
  - TC TIME OF CONCENTRATION
  - POINT OF CONCENTRATION
  - DRAINAGE FLOW DIRECTION
  - DA ACRES DRAINAGE AREA LABEL

Table 2 - Proposed Conditions Hydrology Calculations - City of New Braunfels									
Point of Concentration	Description	Drainage Area	Area	T <sub>c</sub>	CN	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
A1a	Channel Sizing Calculations	A1a	43.27	74.13	80.34	34.66	88.02	120.18	160.94
A1b	Inlet Sizing Calculations	A1b	1.10	28.83	93.25	2.70	5.26	6.73	8.56
A1c	Channel Sizing Calculations	A1b+A1c	1.37	28.83	90.64	3.11	6.33	8.18	10.48
A1	Channel Sizing Calculations	A1	44.64	74.13	80.33	35.76	90.81	123.98	166.03
A2b	Street Capacity Calculations	A2b	0.43	38.15	92.98	0.87	1.70	2.18	2.77
A2b	Inlet Sizing Calculations	A2a+A2b	4.07	53.01	84.95	5.08	11.60	15.41	20.19
A2	Channel Sizing Calculations	A2	4.85	53.01	84.16	5.85	13.59	18.14	23.84
B	Drainage Area EX A Comparison	B	9.77	88.48	80.00	6.60	16.93	23.18	31.09
A+B	Drainage Area EX A Comparison	A+B	59.26	74.13	80.59	48.16	121.44	165.53	221.35

Table 3 - Existing to Proposed Comparison					
Point of Concentration	Drainage Area	Q <sub>2</sub> (cfs)	Q <sub>10</sub> (cfs)	Q <sub>25</sub> (cfs)	Q <sub>100</sub> (cfs)
EX A	EX A	41.18	105.53	144.43	193.72
A+B	A+B	48.16	121.44	165.53	221.35
Proposed is Less Than or Equal to Existing		NO	NO	NO	NO

290 S. CASTELL AVE., STE. 100  
NEW BRAUNFELS, TX 78130  
TBPE FIRM F-10961  
TBPLS FIRM 1053600



03/01/2020

**PROPOSED DRAINAGE  
AREA MAP**  
NISSAN WAY EXTENSION

NO.	REVISION	DESCRIPTION	DATE

DATE: MARCH 2020  
DRAWN BY: JMM  
DESIGNED BY: JMM  
REVIEWED BY: SWH/CVH  
HMT PROJECT NO.: 323.001

**SHEET  
C1.02**

# Attachment I

## Proposed Conditions Hydrology Calculations

# Hydrograph Report

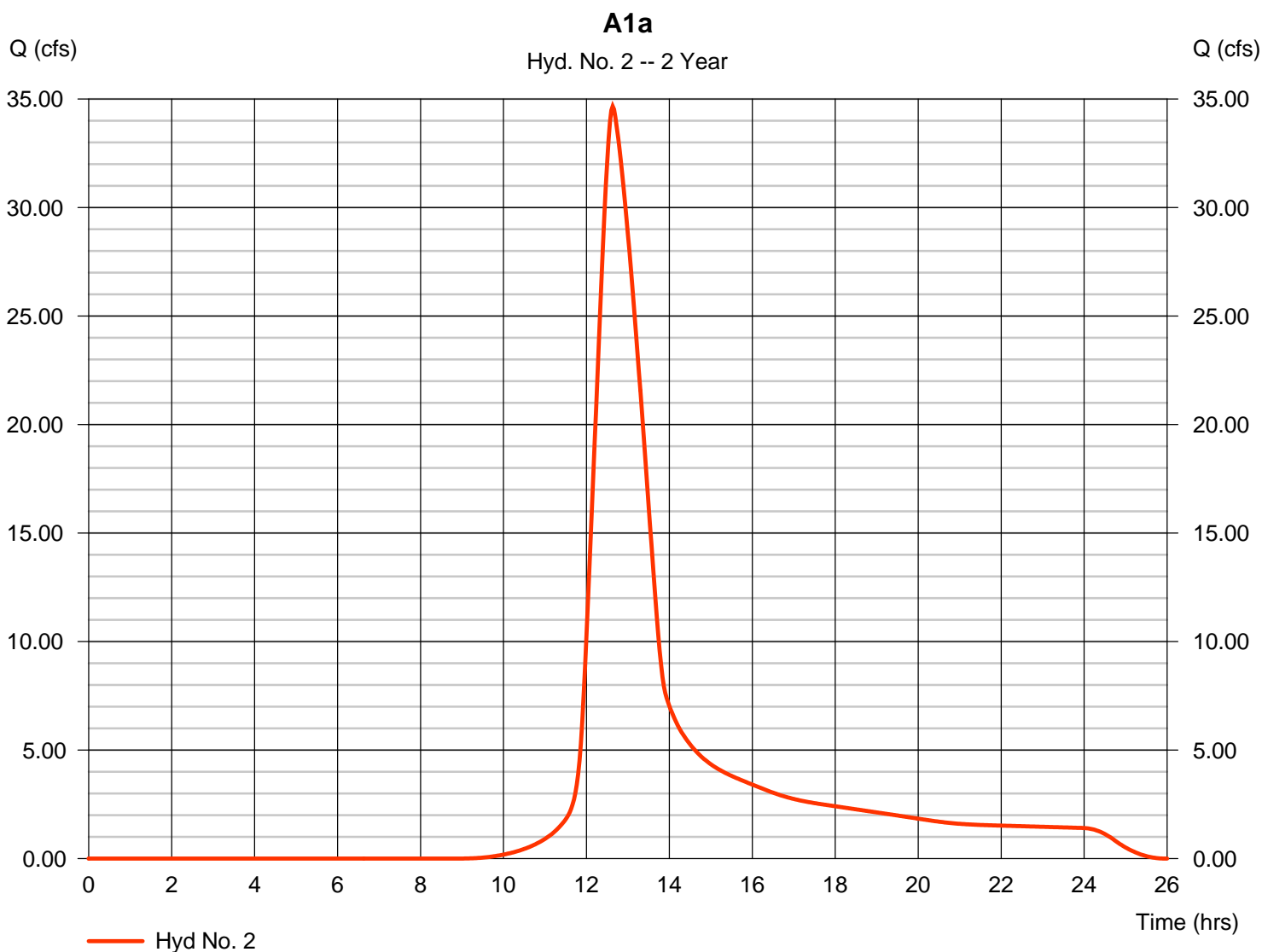
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 2

A1a

Hydrograph type	= SCS Runoff	Peak discharge	= 34.66 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.63 hrs
Time interval	= 2 min	Hyd. volume	= 264,399 cuft
Drainage area	= 43.270 ac	Curve number	= 80.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

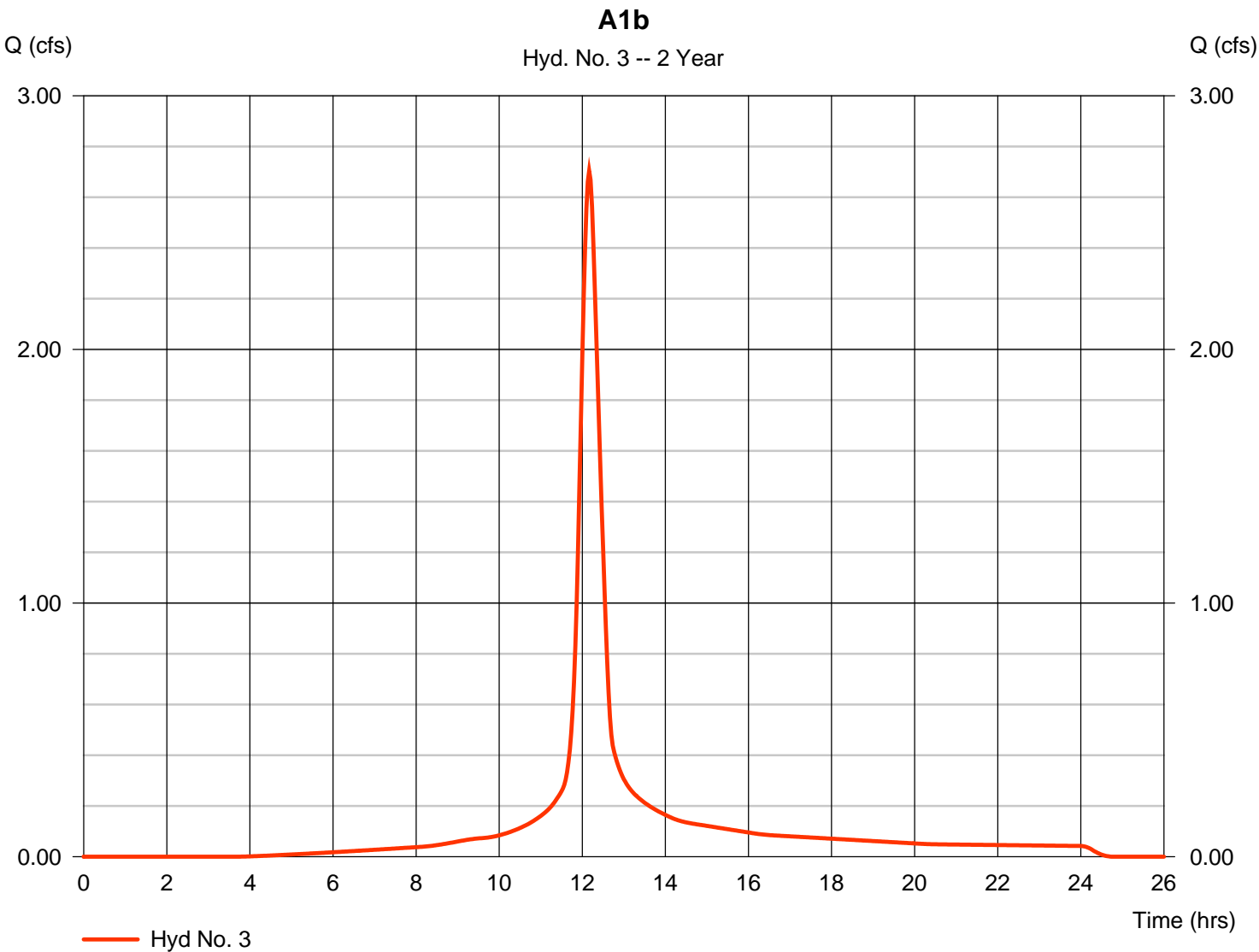
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 3

A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 2.704 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 11,117 cuft
Drainage area	= 1.100 ac	Curve number	= 93.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.80 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

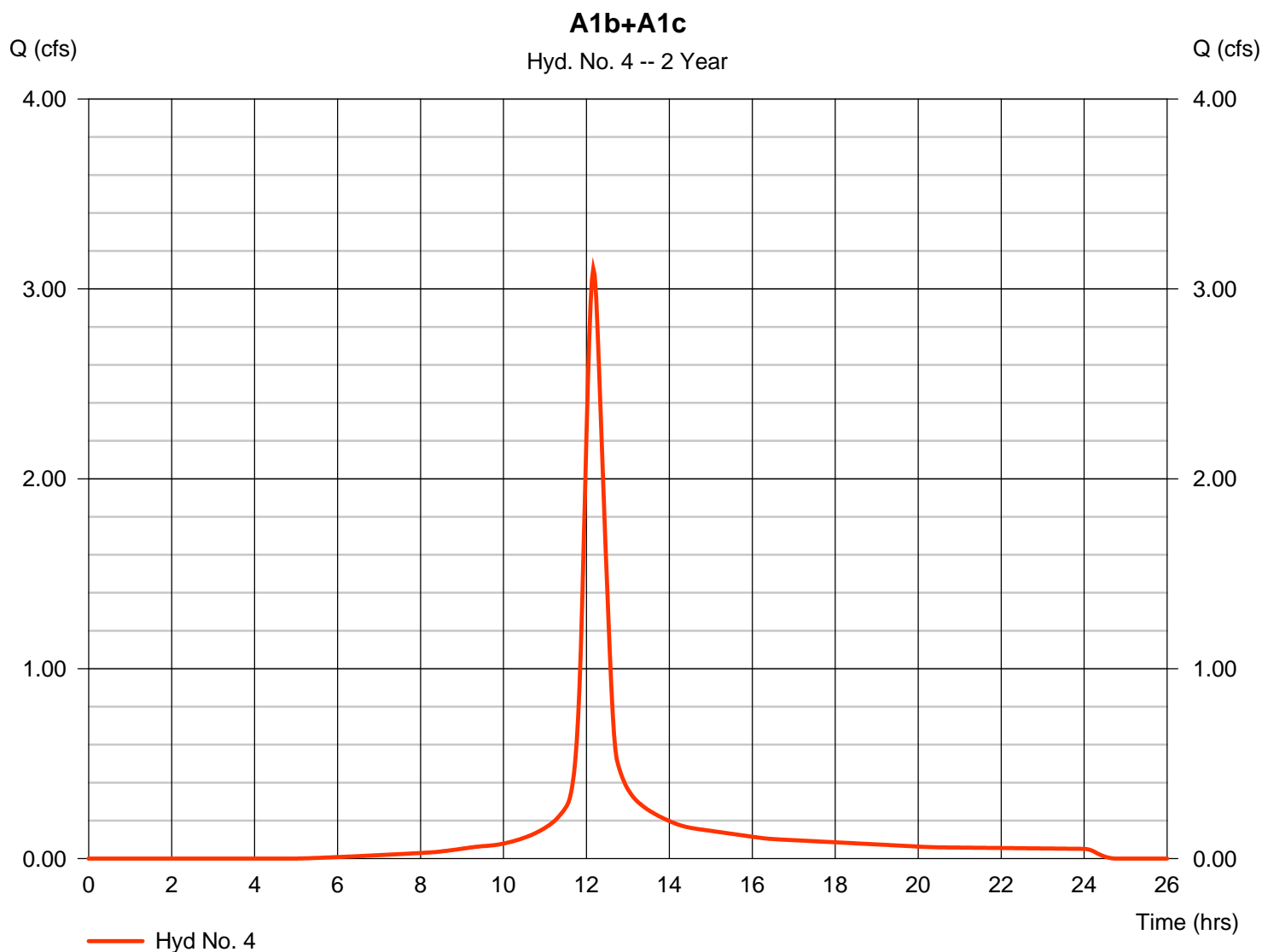
Monday, 03 / 2 / 2020

## Hyd. No. 4

A1b+A1c

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 1.370 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.52 in  
 Storm duration = 24 hrs

Peak discharge = 3.106 cfs  
 Time to peak = 12.17 hrs  
 Hyd. volume = 12,544 cuft  
 Curve number = 90.6  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 28.80 min  
 Distribution = Type II  
 Shape factor = 484

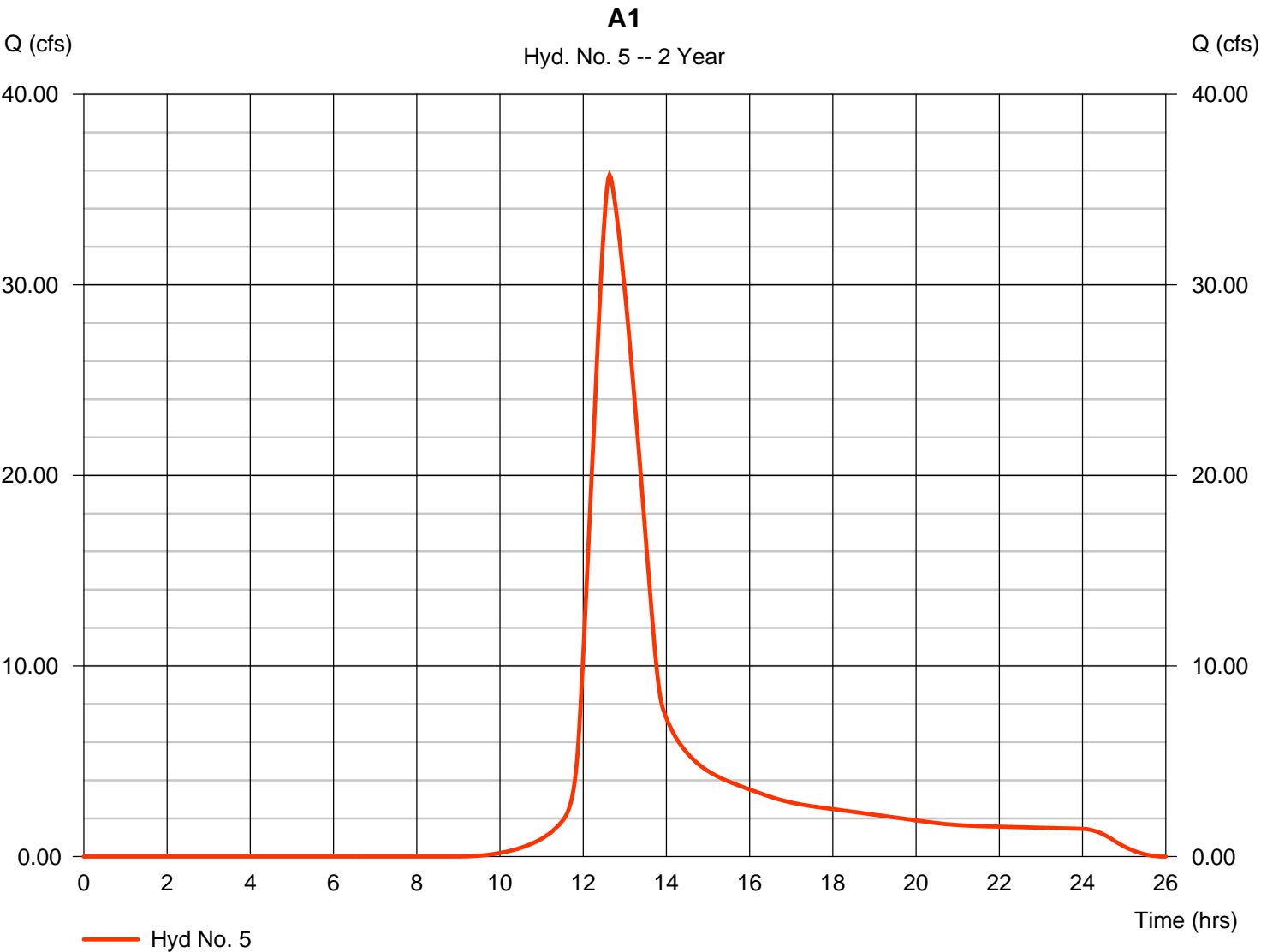


# Hydrograph Report

## Hyd. No. 5

A1

Hydrograph type	= SCS Runoff	Peak discharge	= 35.76 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.63 hrs
Time interval	= 2 min	Hyd. volume	= 272,771 cuft
Drainage area	= 44.640 ac	Curve number	= 80.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

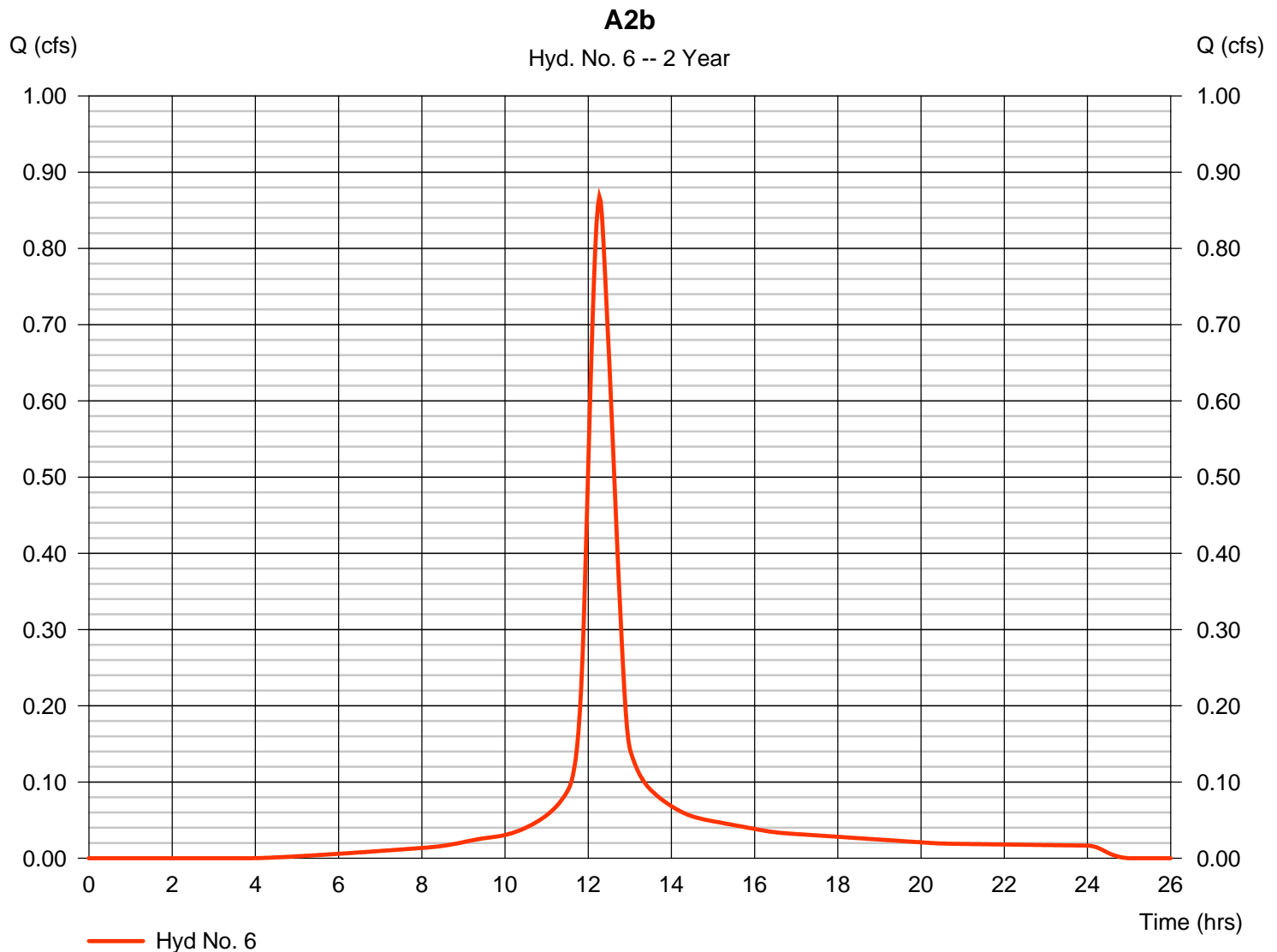
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 6

A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 0.868 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 4,299 cuft
Drainage area	= 0.430 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 38.20 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

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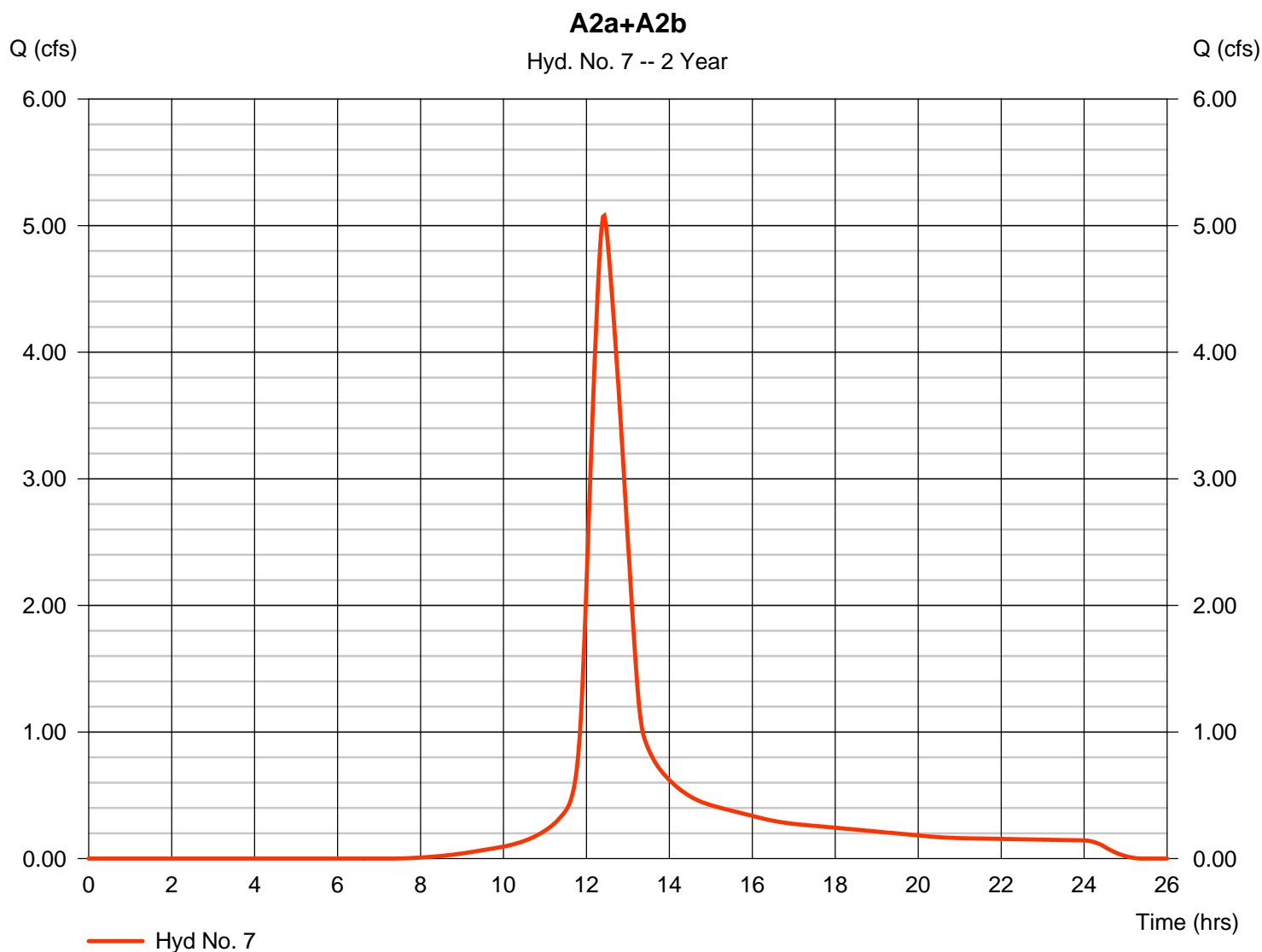
Monday, 03 / 2 / 2020

## Hyd. No. 7

A2a+A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 4.070 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.52 in  
 Storm duration = 24 hrs

Peak discharge = 5.078 cfs  
 Time to peak = 12.43 hrs  
 Hyd. volume = 30,282 cuft  
 Curve number = 85  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 53.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

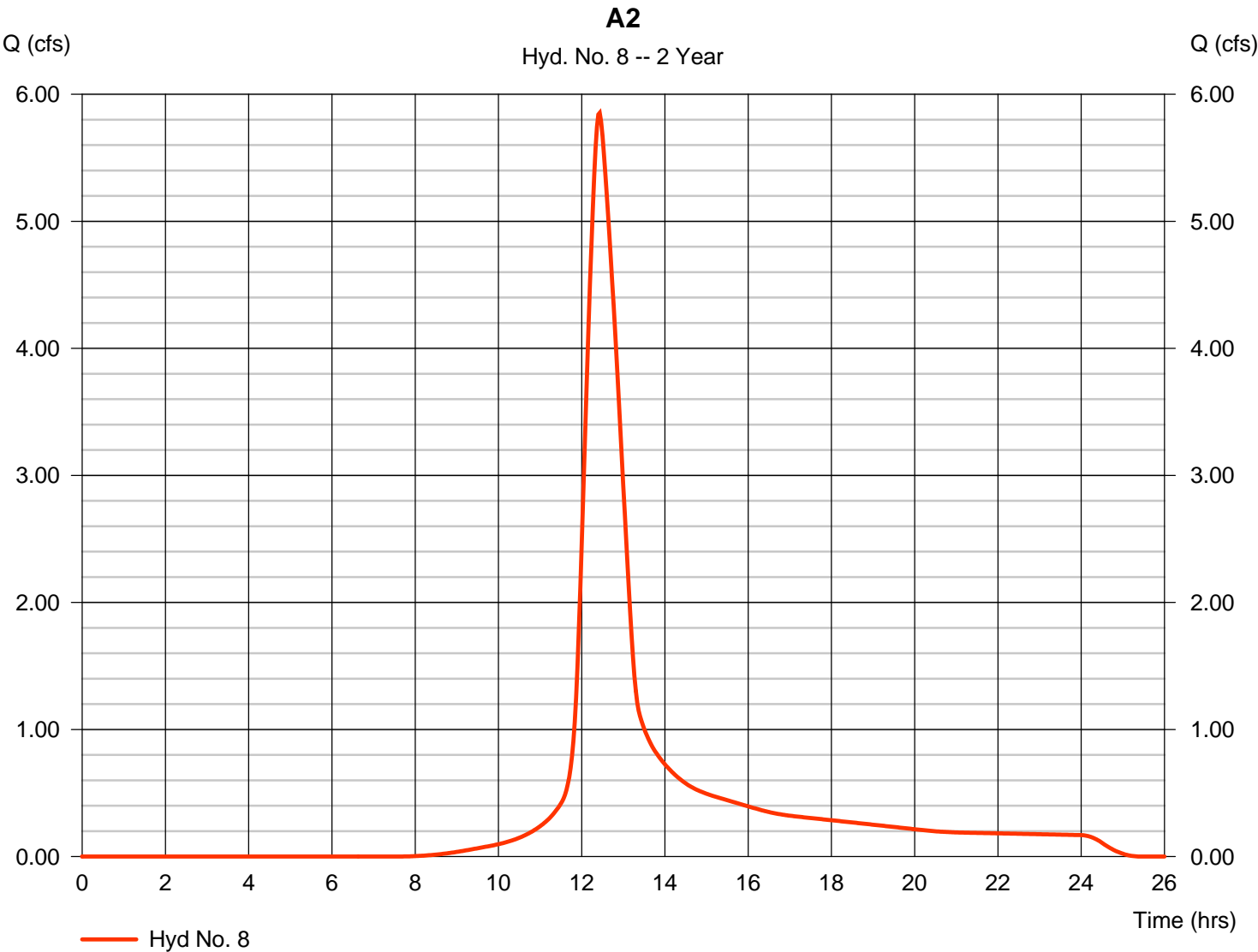
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 8

A2

Hydrograph type	= SCS Runoff	Peak discharge	= 5.854 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.43 hrs
Time interval	= 2 min	Hyd. volume	= 34,945 cuft
Drainage area	= 4.850 ac	Curve number	= 84.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 53.00 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

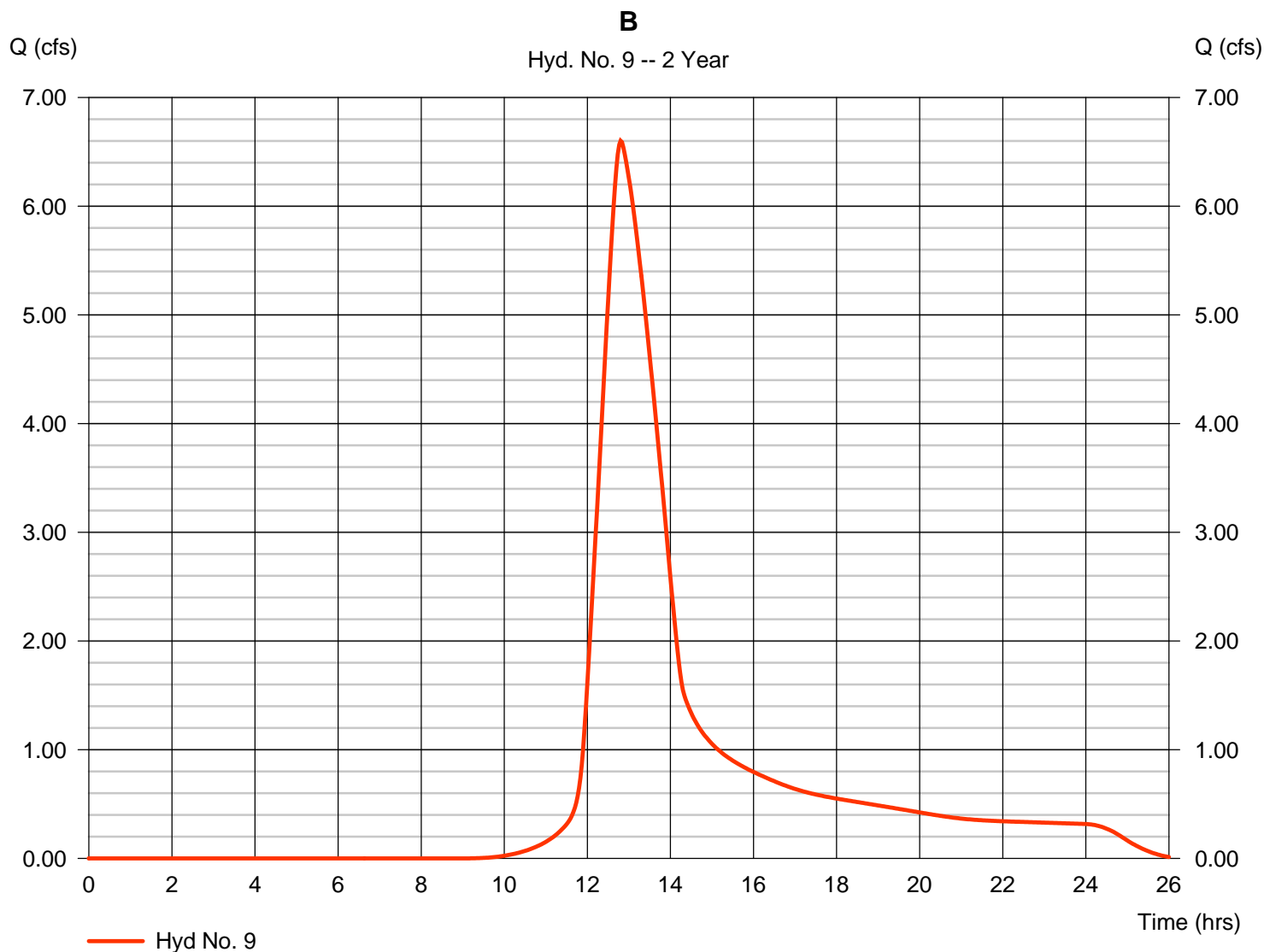
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Monday, 03 / 2 / 2020

## Hyd. No. 9

B

Hydrograph type	= SCS Runoff	Peak discharge	= 6.602 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.80 hrs
Time interval	= 2 min	Hyd. volume	= 58,597 cuft
Drainage area	= 9.770 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 88.50 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

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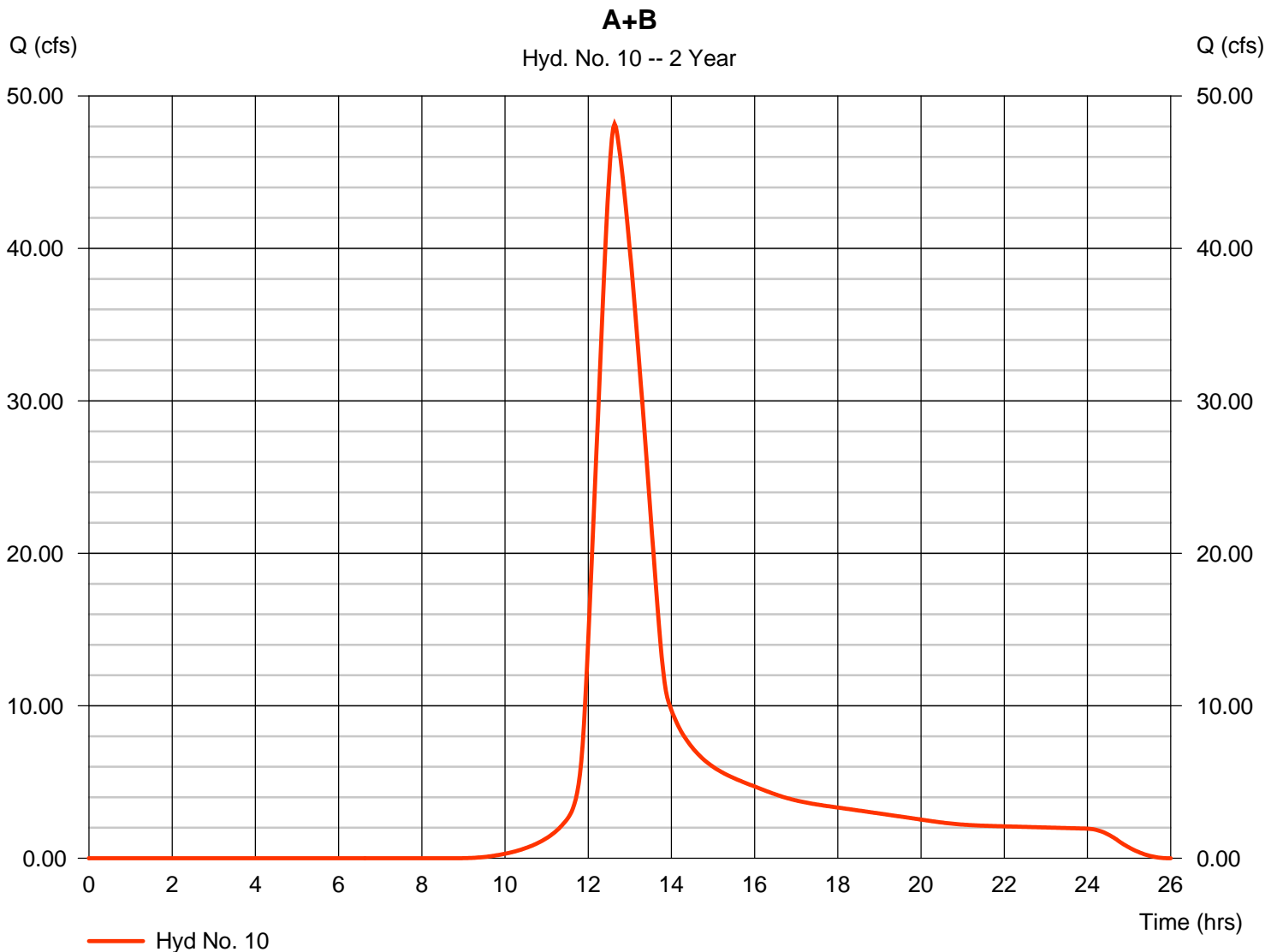
Monday, 03 / 2 / 2020

## Hyd. No. 10

A+B

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 59.260 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.52 in  
 Storm duration = 24 hrs

Peak discharge = 48.16 cfs  
 Time to peak = 12.63 hrs  
 Hyd. volume = 366,806 cuft  
 Curve number = 80.6  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.10 min  
 Distribution = Type II  
 Shape factor = 484





# Hydrograph Report

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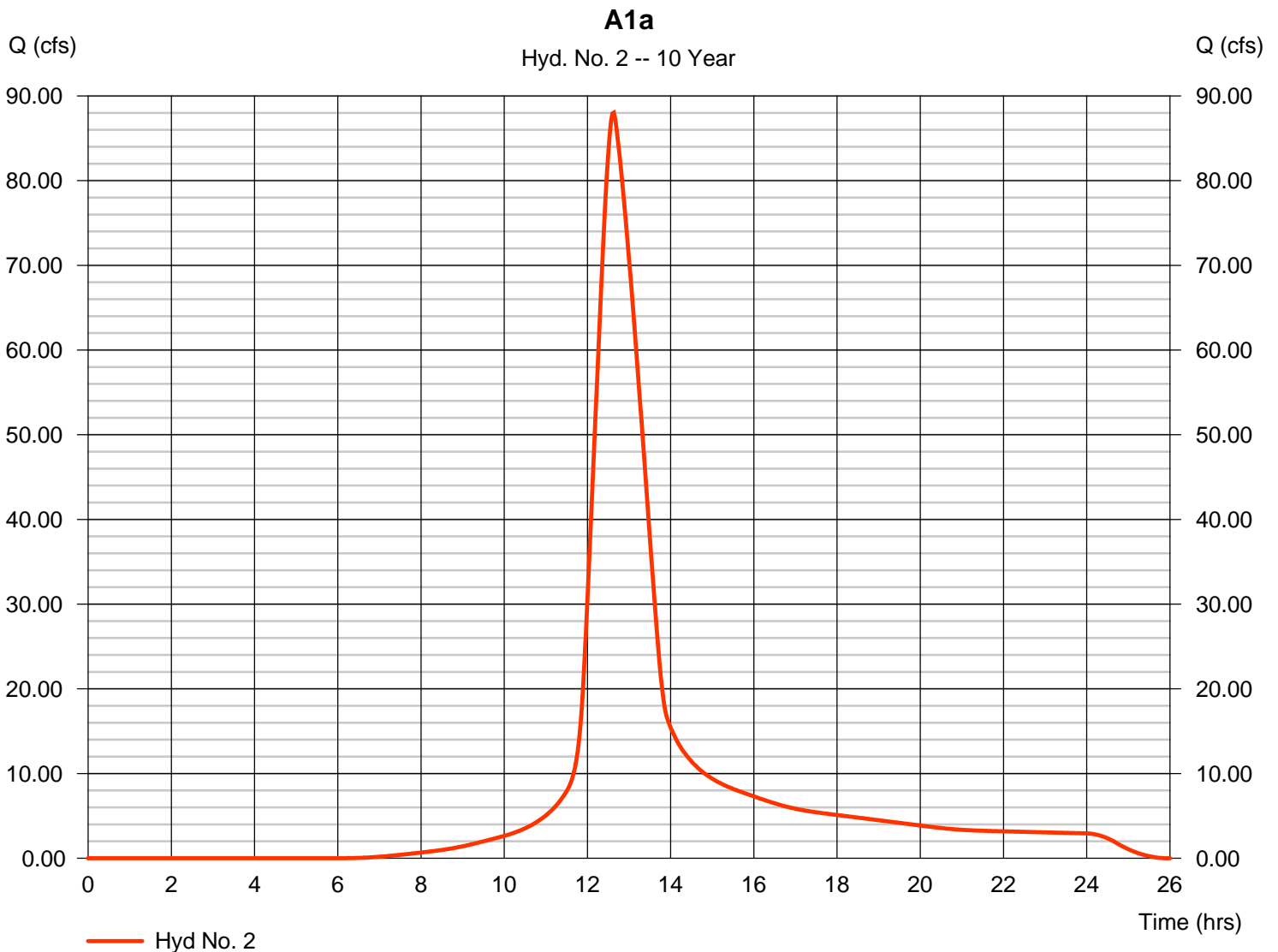
Monday, 03 / 2 / 2020

## Hyd. No. 2

A1a

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 43.270 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 88.02 cfs  
 Time to peak = 12.63 hrs  
 Hyd. volume = 659,612 cuft  
 Curve number = 80.3  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.10 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

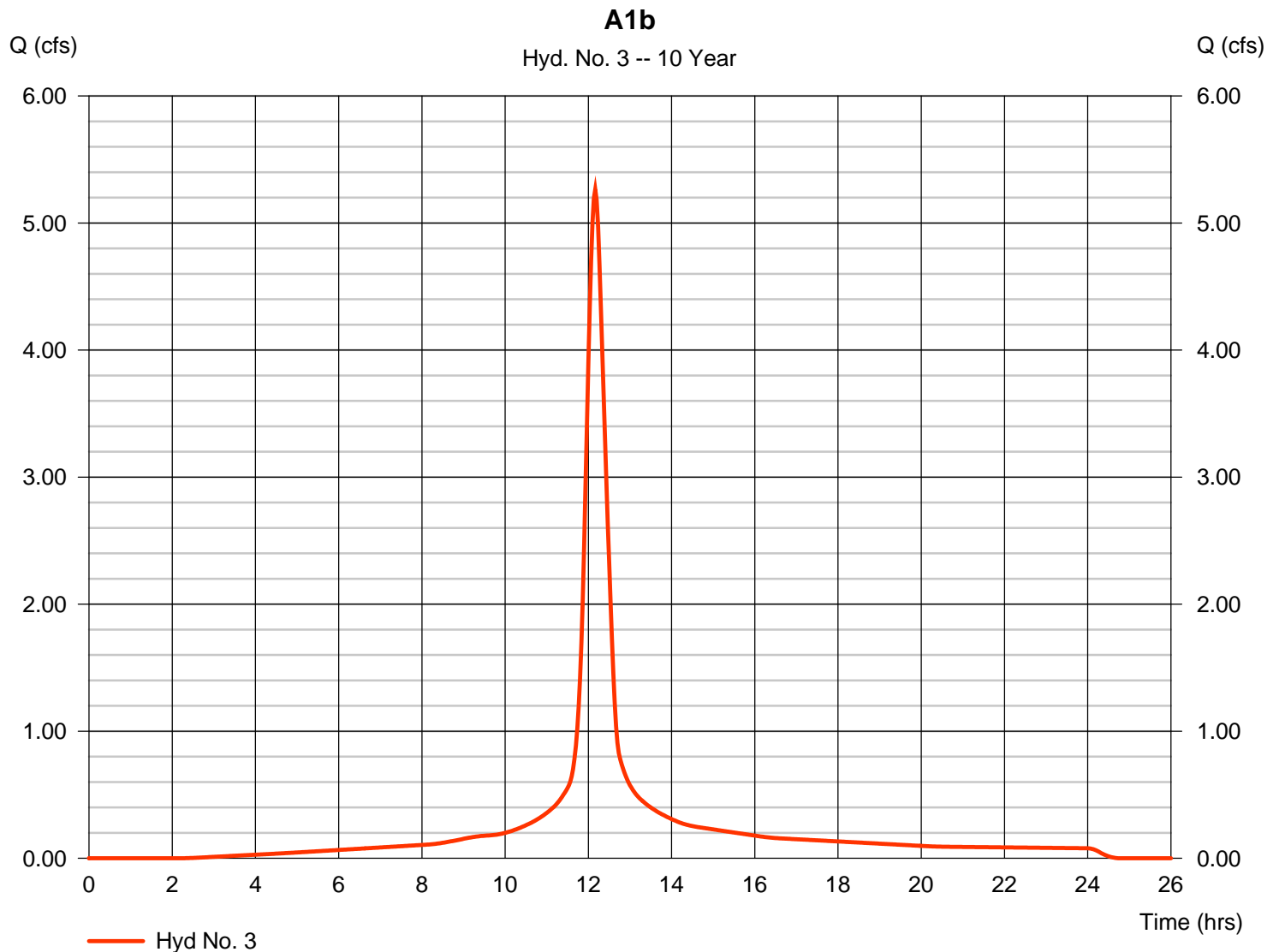
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 3

A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 5.263 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 22,410 cuft
Drainage area	= 1.100 ac	Curve number	= 93.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.80 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

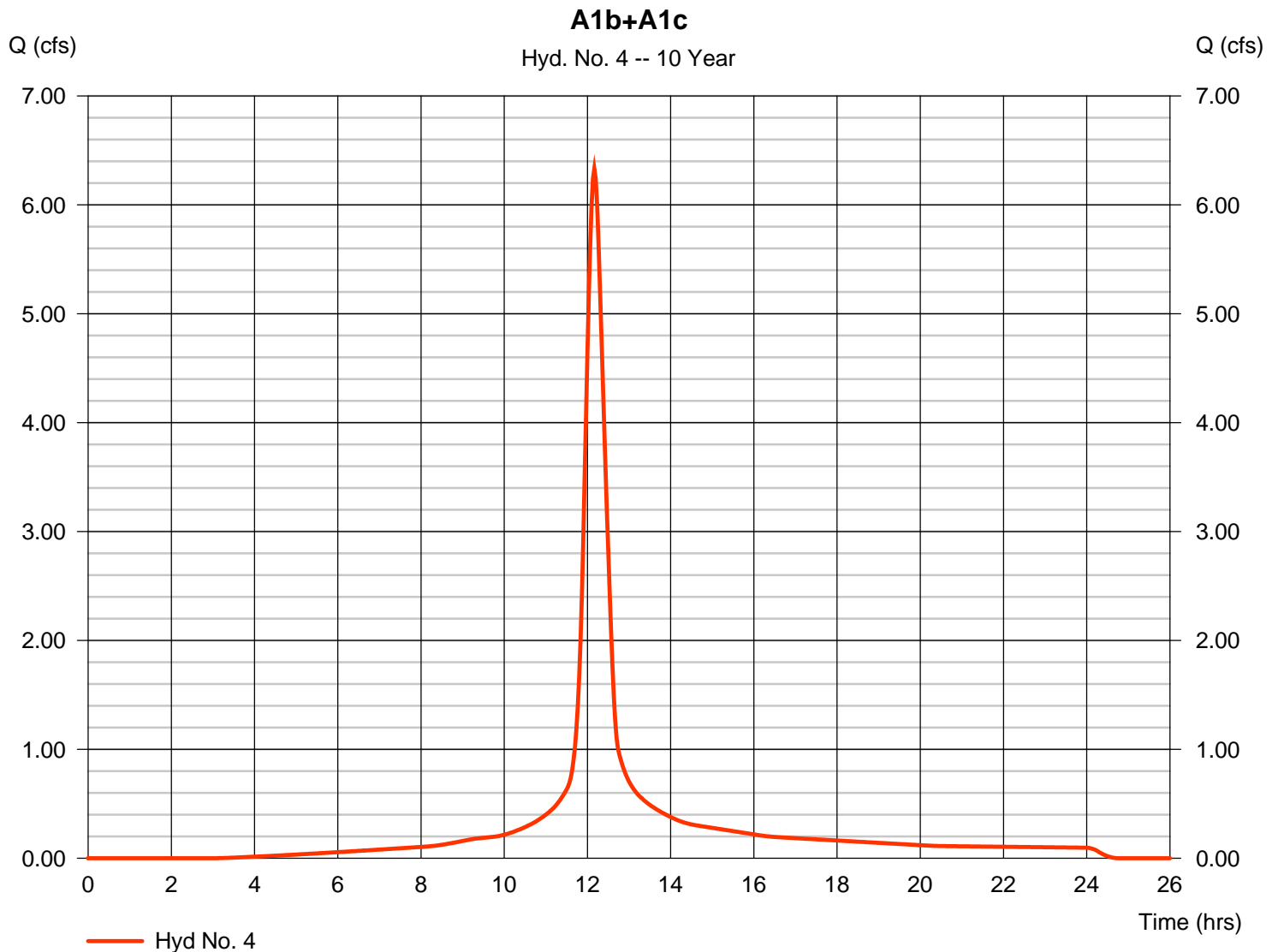
Monday, 03 / 2 / 2020

## Hyd. No. 4

A1b+A1c

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 1.370 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 6.330 cfs  
 Time to peak = 12.17 hrs  
 Hyd. volume = 26,377 cuft  
 Curve number = 90.6  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 28.80 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

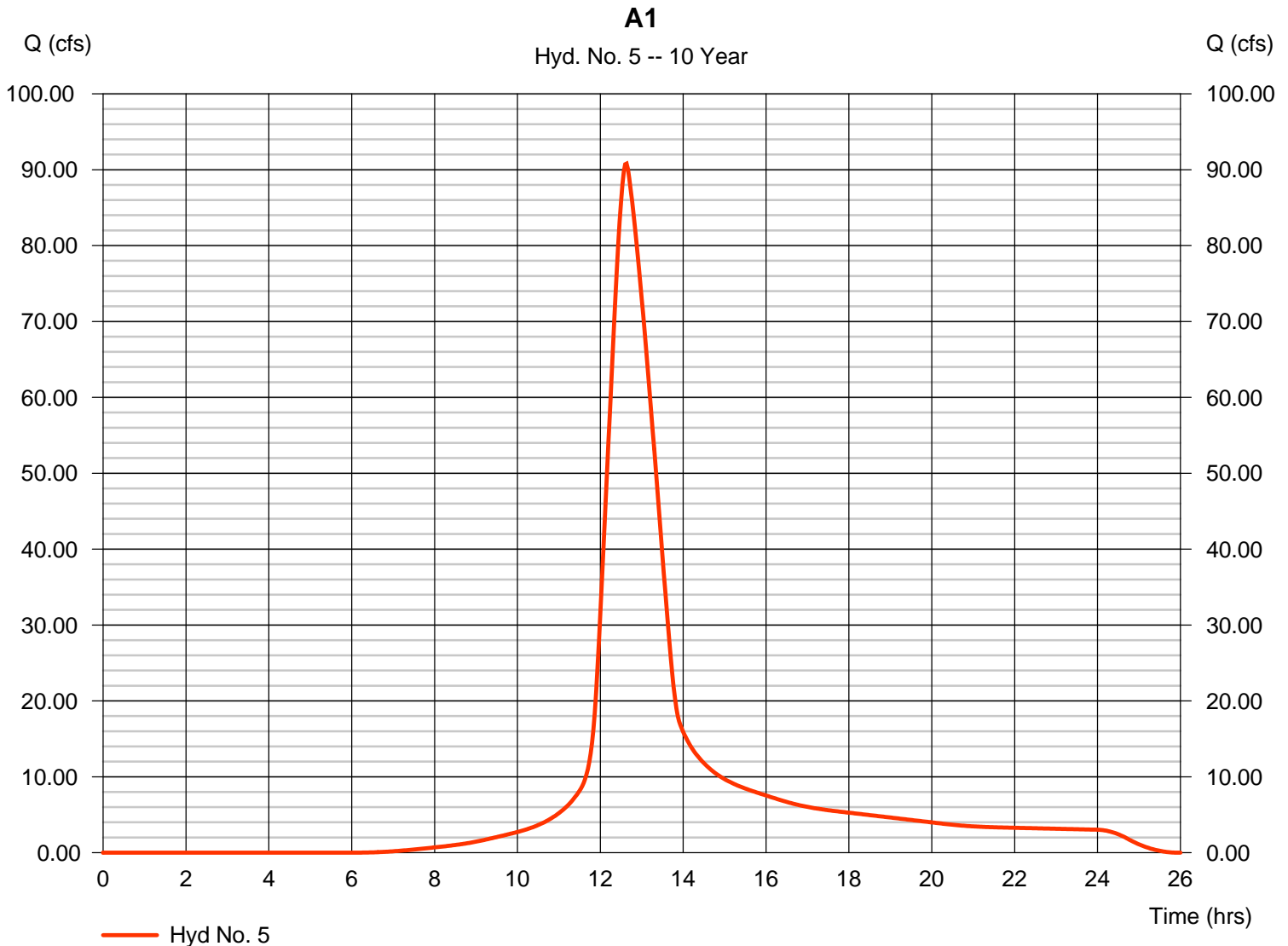
Monday, 03 / 2 / 2020

## Hyd. No. 5

A1

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 44.640 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 90.81 cfs  
 Time to peak = 12.63 hrs  
 Hyd. volume = 680,496 cuft  
 Curve number = 80.3  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.10 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

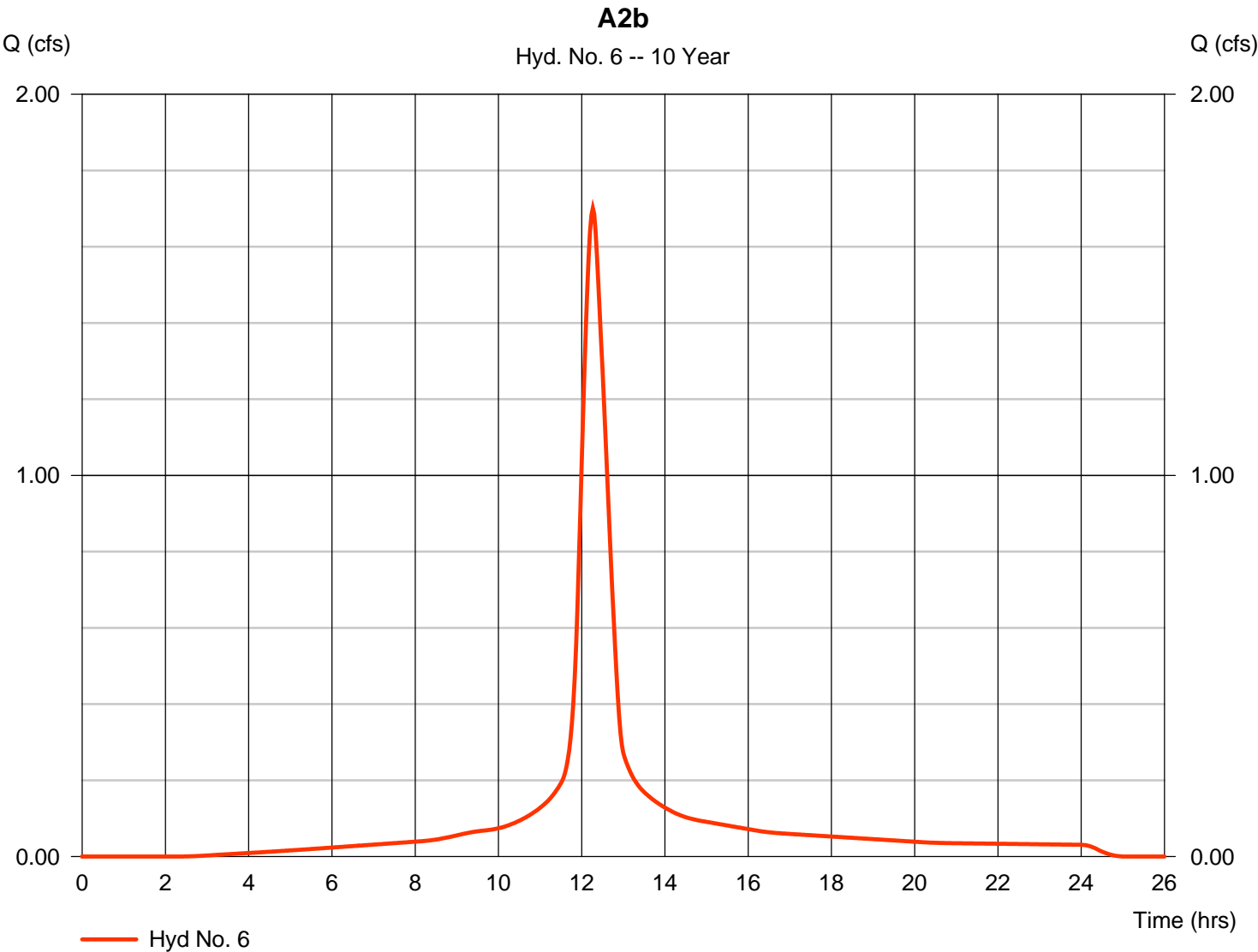
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 6

A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 1.701 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 8,706 cuft
Drainage area	= 0.430 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 38.20 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

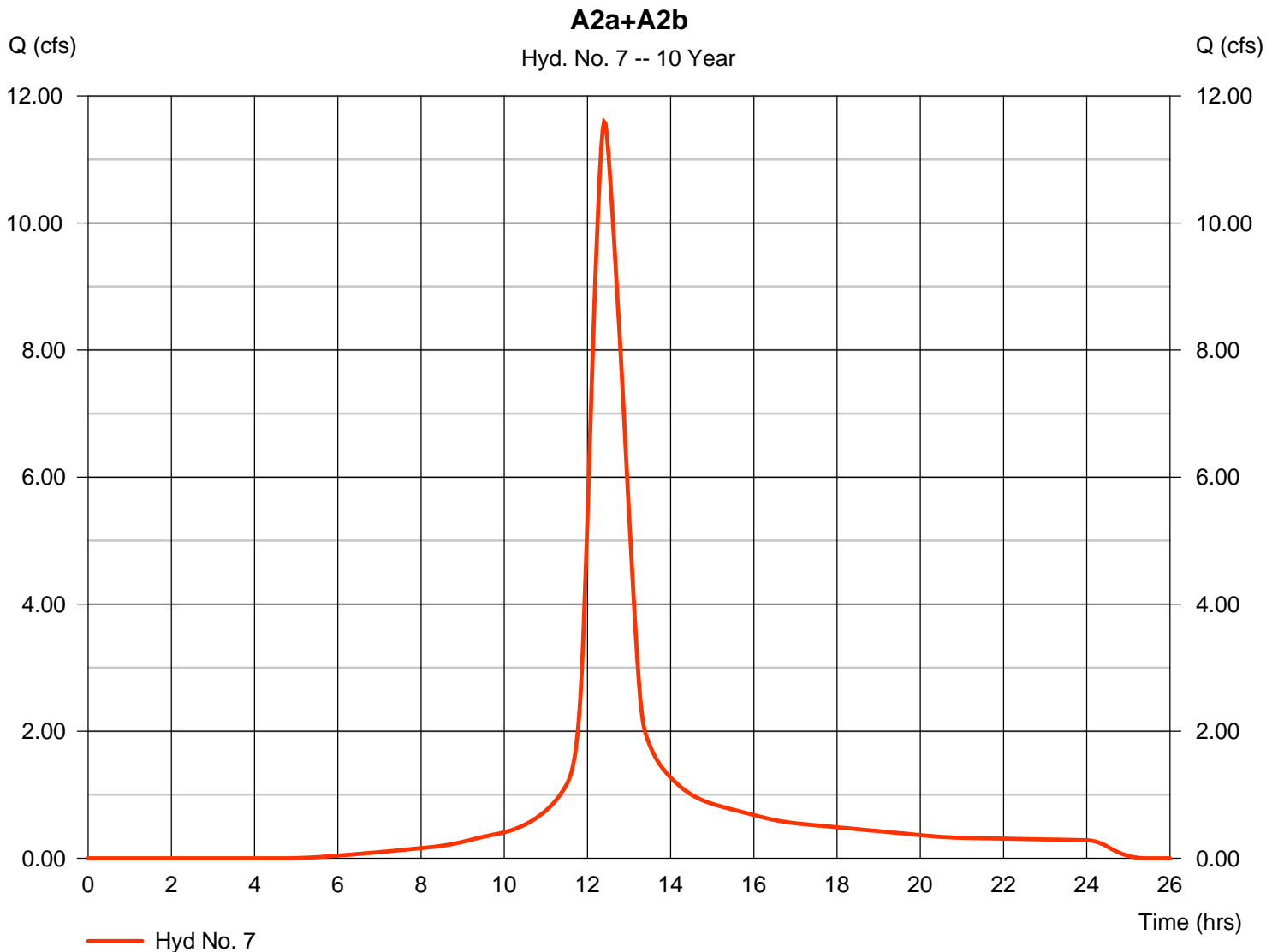
Monday, 03 / 2 / 2020

## Hyd. No. 7

A2a+A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 4.070 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 11.60 cfs  
 Time to peak = 12.40 hrs  
 Hyd. volume = 69,698 cuft  
 Curve number = 85  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 53.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

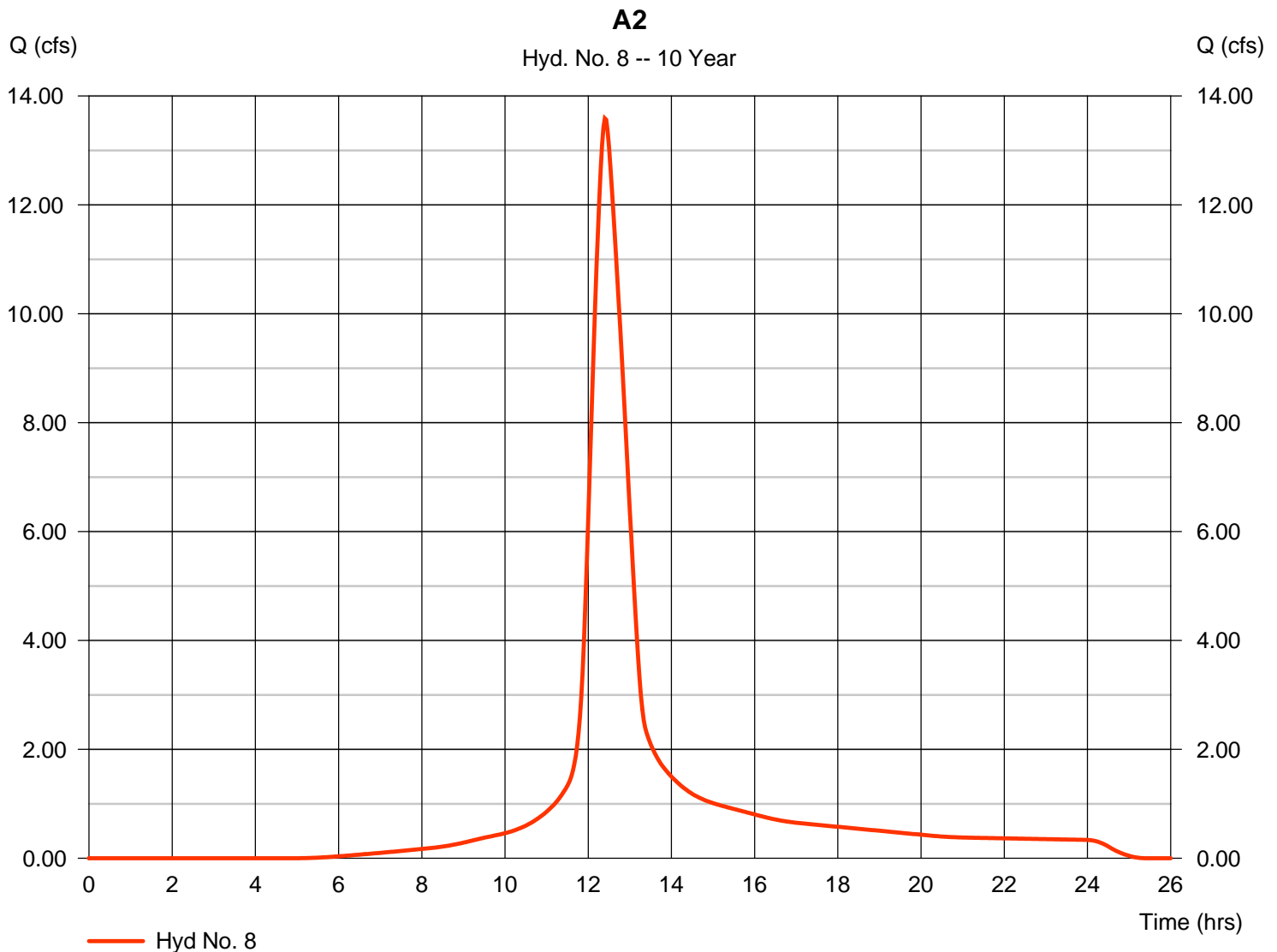
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Monday, 03 / 2 / 2020

## Hyd. No. 8

A2

Hydrograph type	= SCS Runoff	Peak discharge	= 13.59 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 81,509 cuft
Drainage area	= 4.850 ac	Curve number	= 84.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 53.00 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

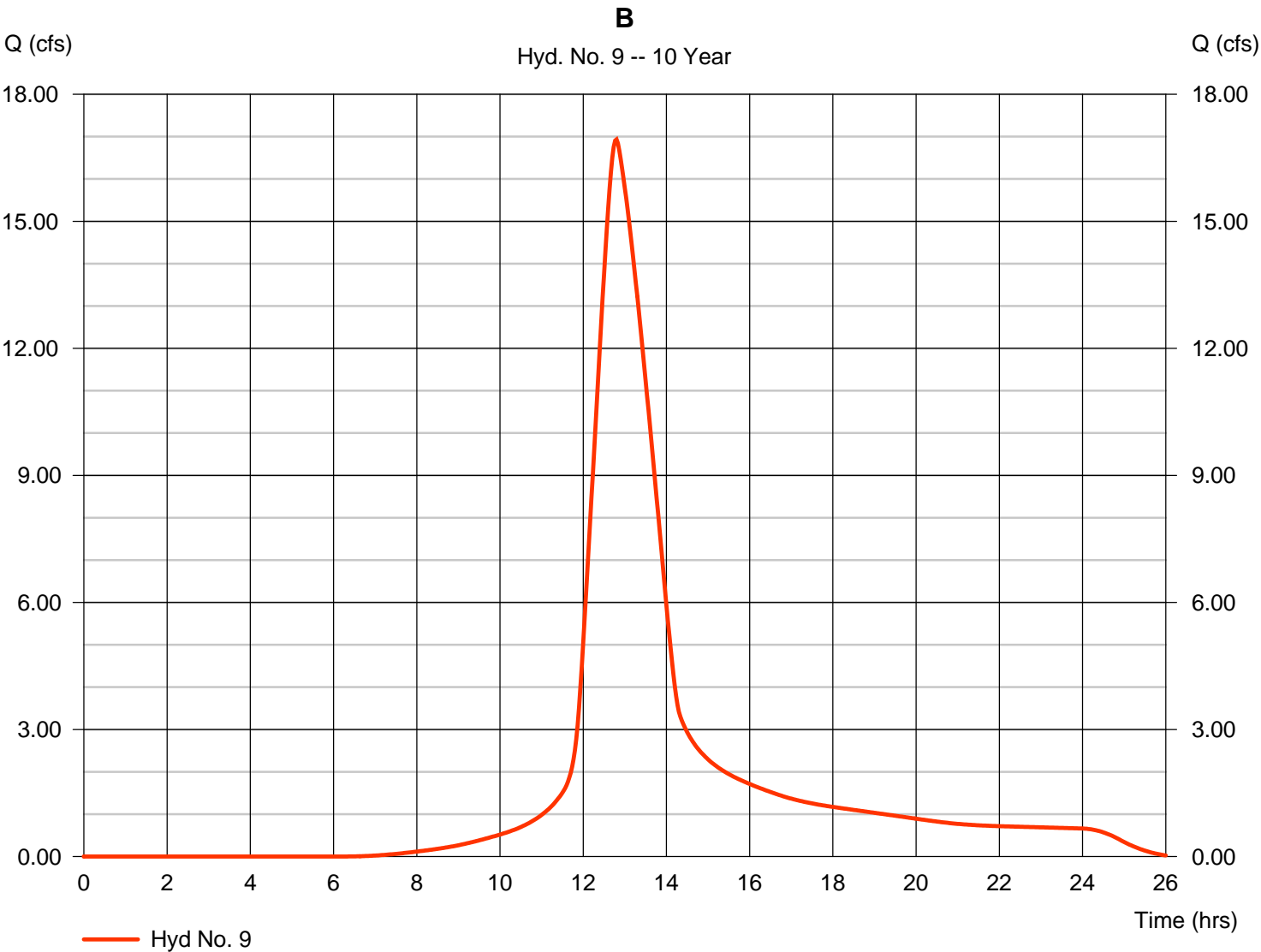
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Monday, 03 / 2 / 2020

## Hyd. No. 9

B

Hydrograph type	= SCS Runoff	Peak discharge	= 16.93 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.80 hrs
Time interval	= 2 min	Hyd. volume	= 146,969 cuft
Drainage area	= 9.770 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 88.50 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

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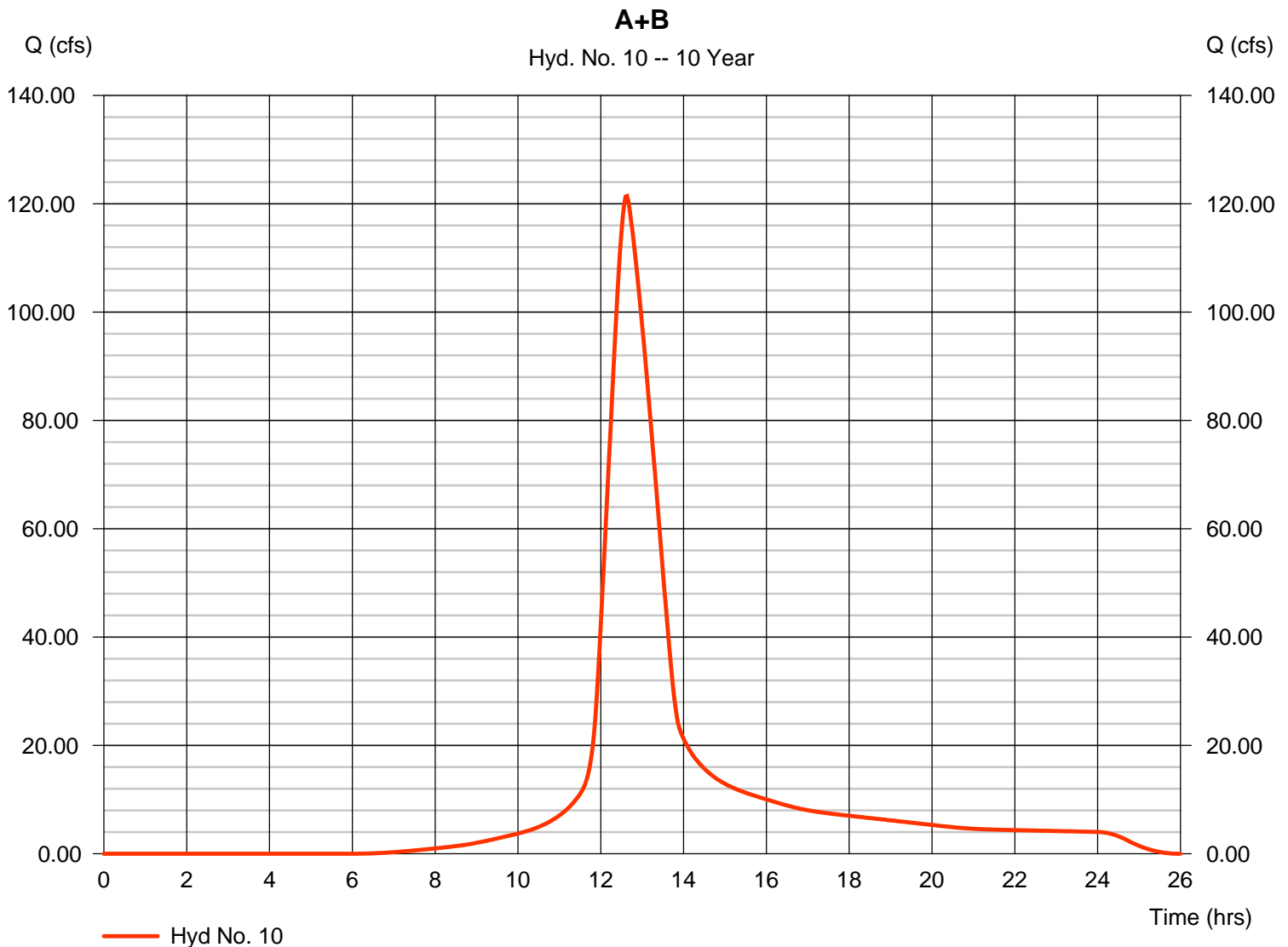
Monday, 03 / 2 / 2020

## Hyd. No. 10

A+B

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 59.260 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 121.44 cfs  
 Time to peak = 12.63 hrs  
 Hyd. volume = 910,238 cuft  
 Curve number = 80.6  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.10 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

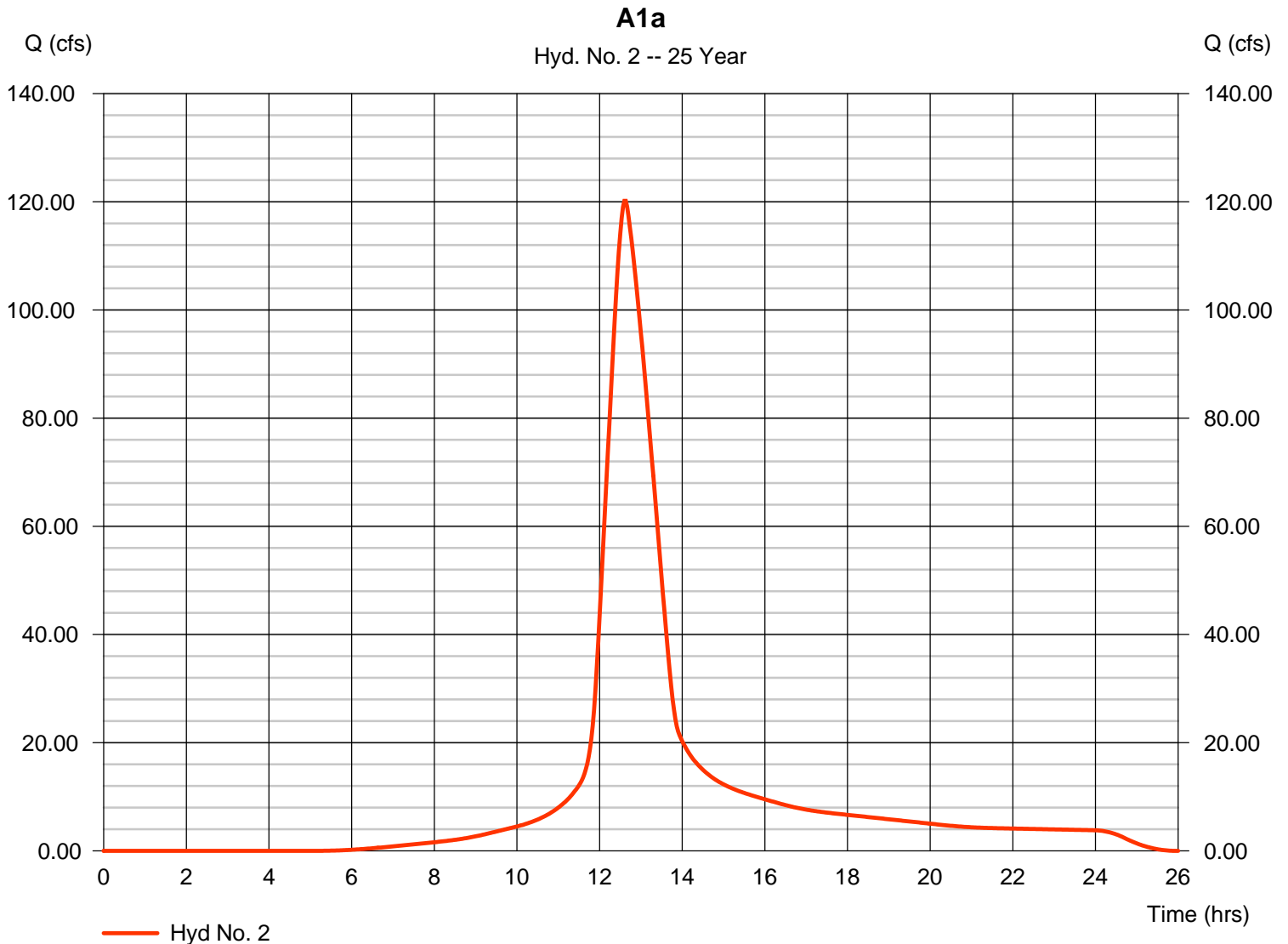
Monday, 03 / 2 / 2020

## Hyd. No. 2

A1a

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 43.270 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 120.18 cfs  
 Time to peak = 12.60 hrs  
 Hyd. volume = 904,485 cuft  
 Curve number = 80.3  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.10 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

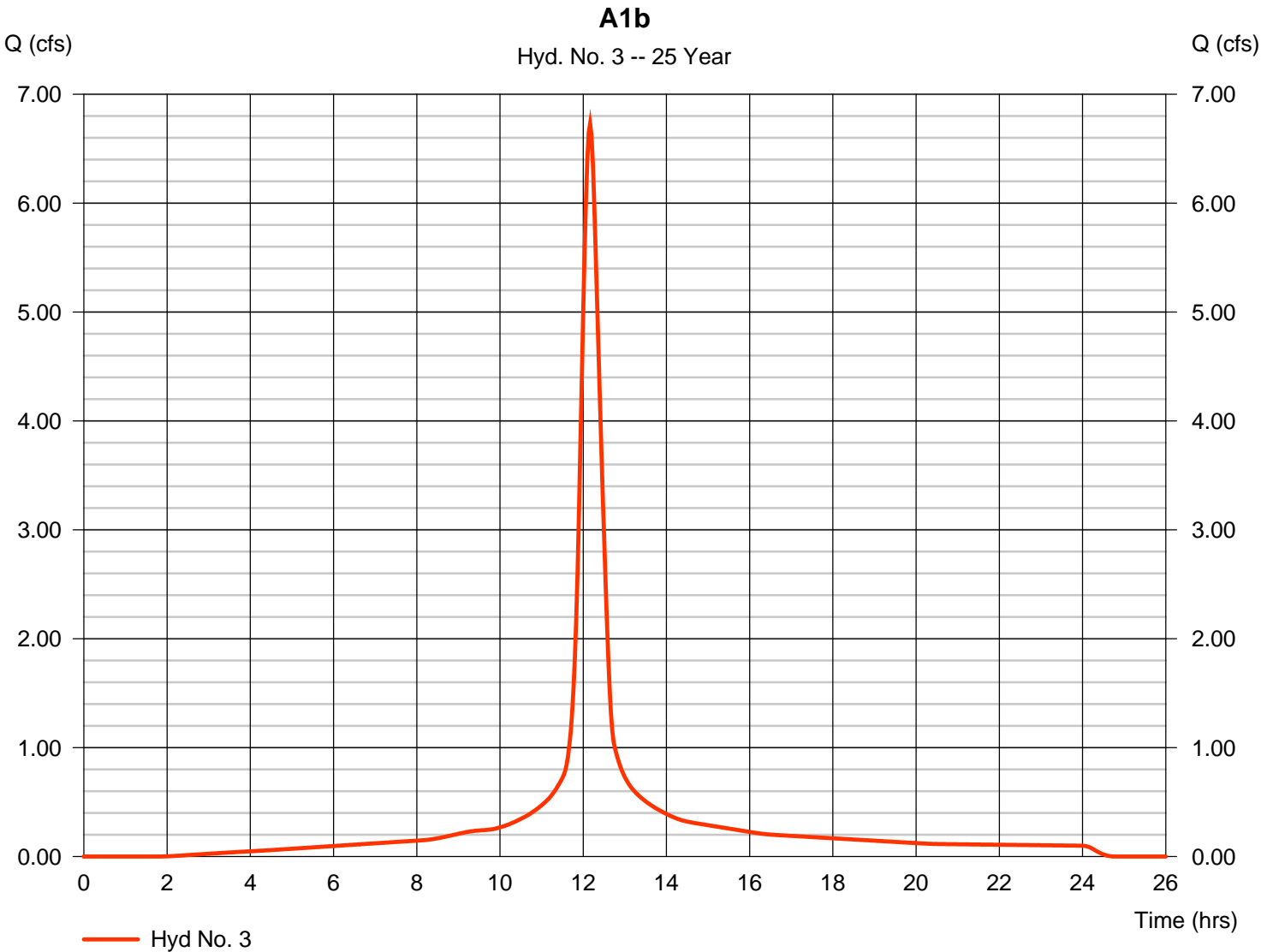
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 3

A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 6.729 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 29,021 cuft
Drainage area	= 1.100 ac	Curve number	= 93.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.80 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

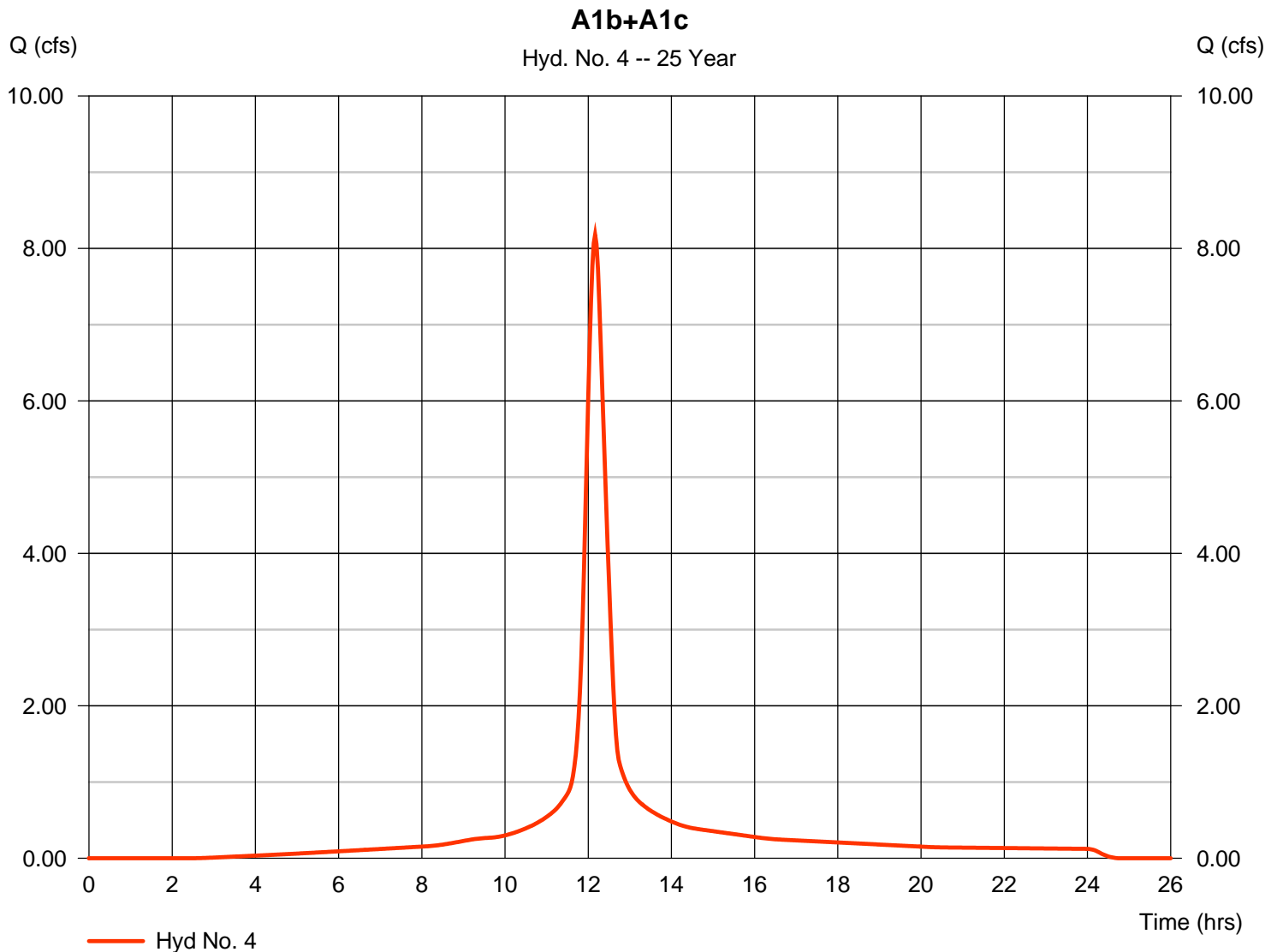
Monday, 03 / 2 / 2020

## Hyd. No. 4

A1b+A1c

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 1.370 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 8.178 cfs  
 Time to peak = 12.17 hrs  
 Hyd. volume = 34,543 cuft  
 Curve number = 90.6  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 28.80 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

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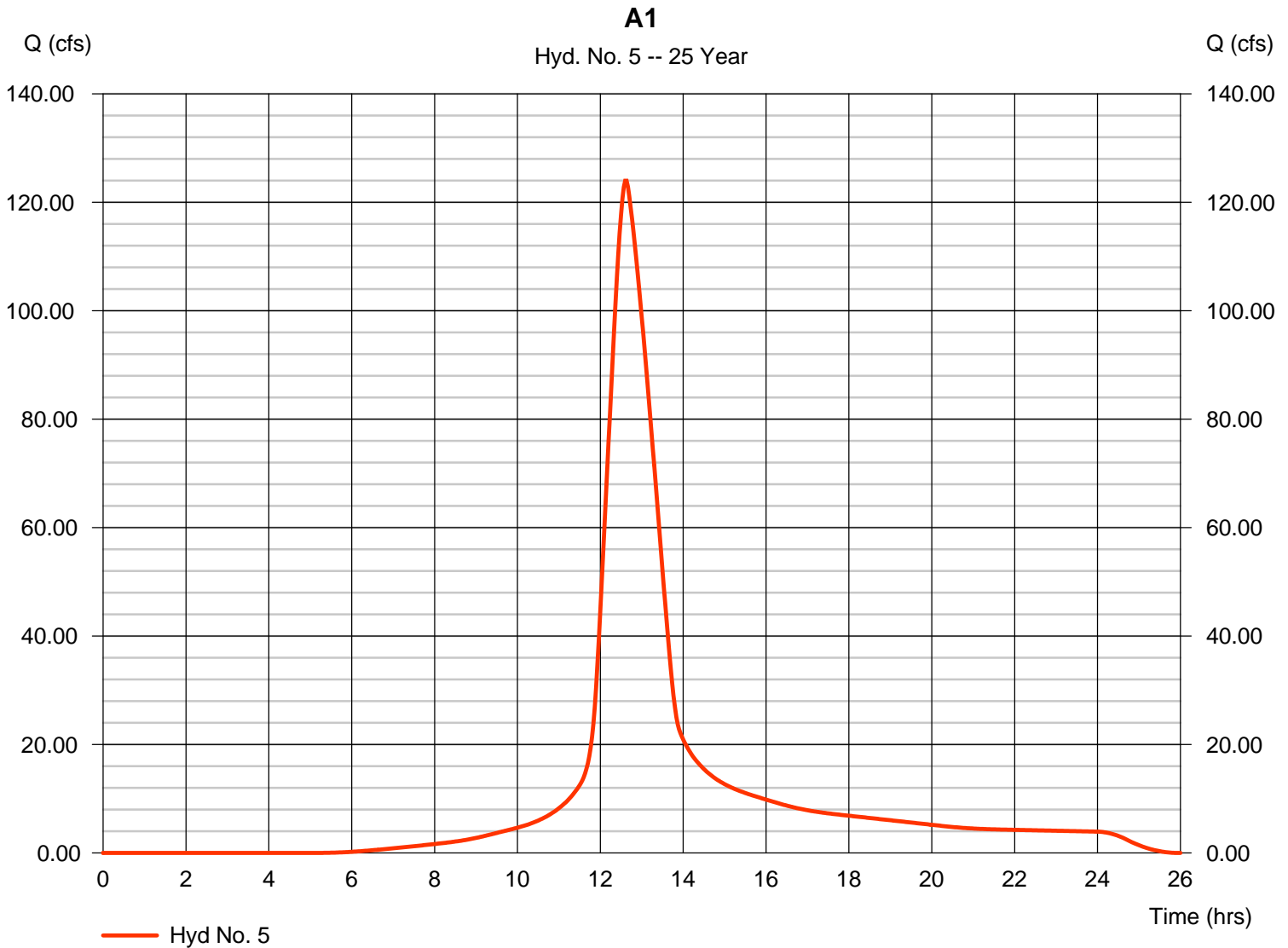
Monday, 03 / 2 / 2020

## Hyd. No. 5

A1

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 44.640 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 123.98 cfs  
 Time to peak = 12.60 hrs  
 Hyd. volume = 933,122 cuft  
 Curve number = 80.3  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 74.10 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

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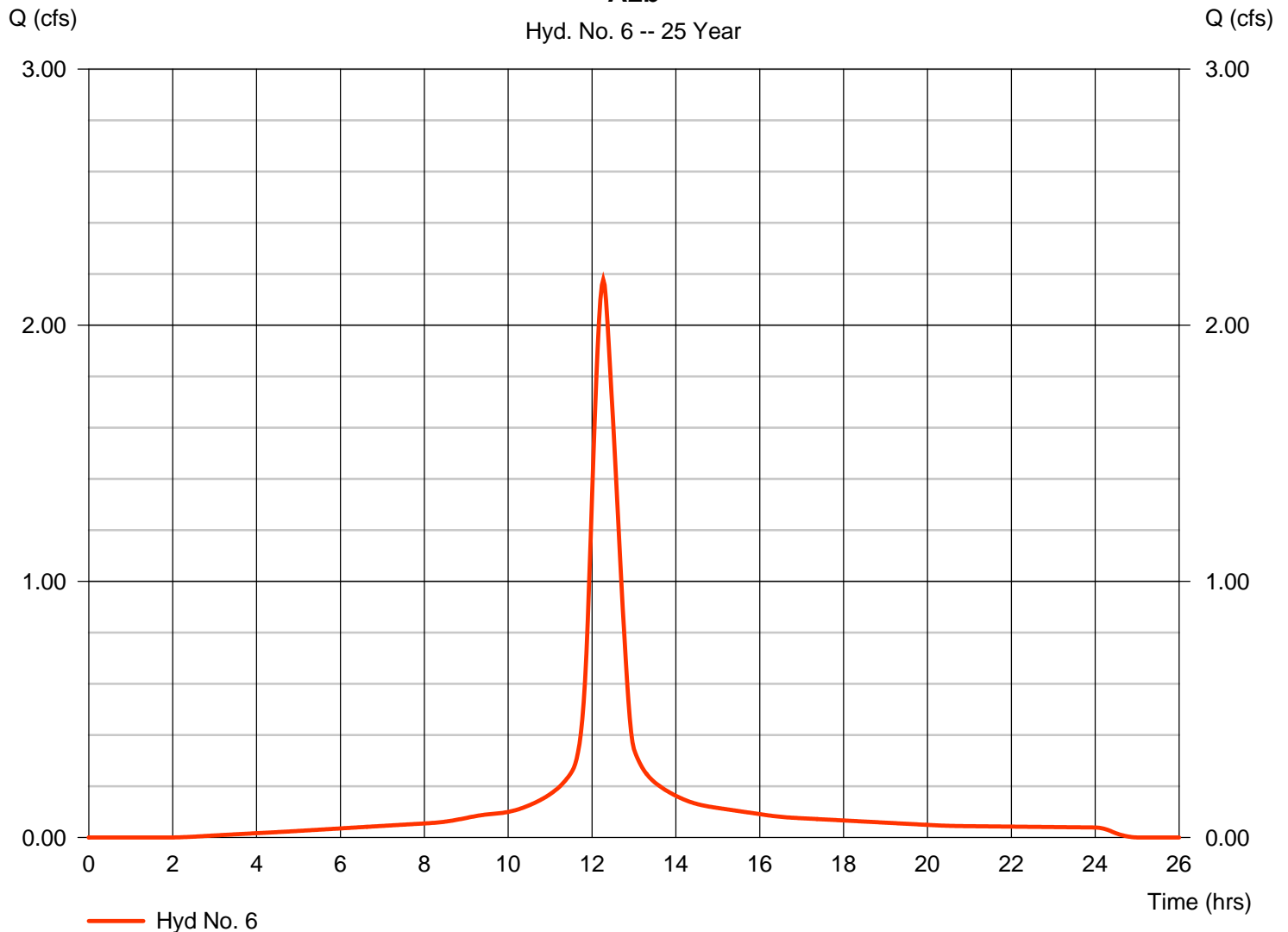
Monday, 03 / 2 / 2020

## Hyd. No. 6

A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 2.178 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 11,289 cuft
Drainage area	= 0.430 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 38.20 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

### A2b



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

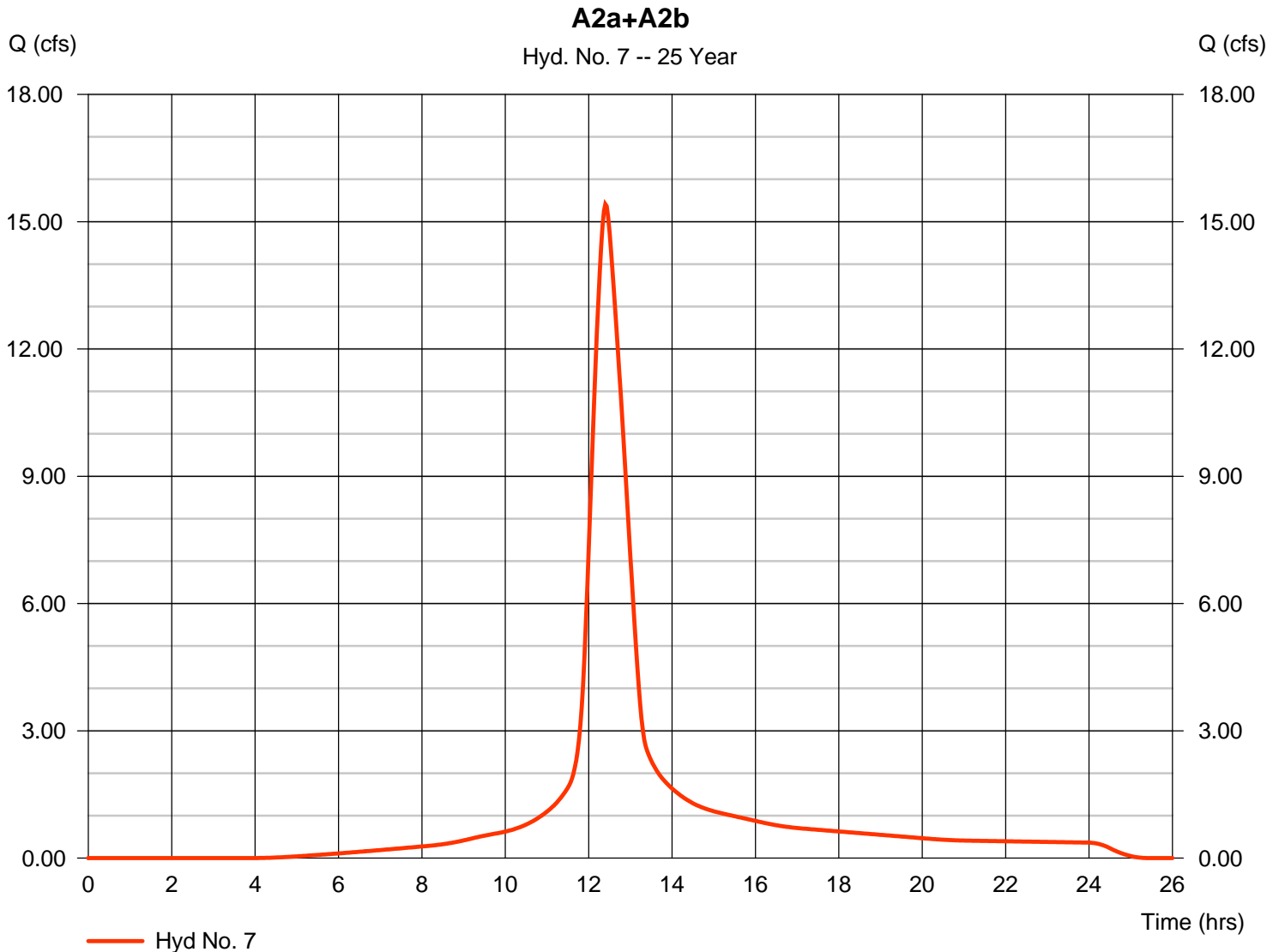
Monday, 03 / 2 / 2020

## Hyd. No. 7

A2a+A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 4.070 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 15.41 cfs  
 Time to peak = 12.40 hrs  
 Hyd. volume = 93,518 cuft  
 Curve number = 85  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 53.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

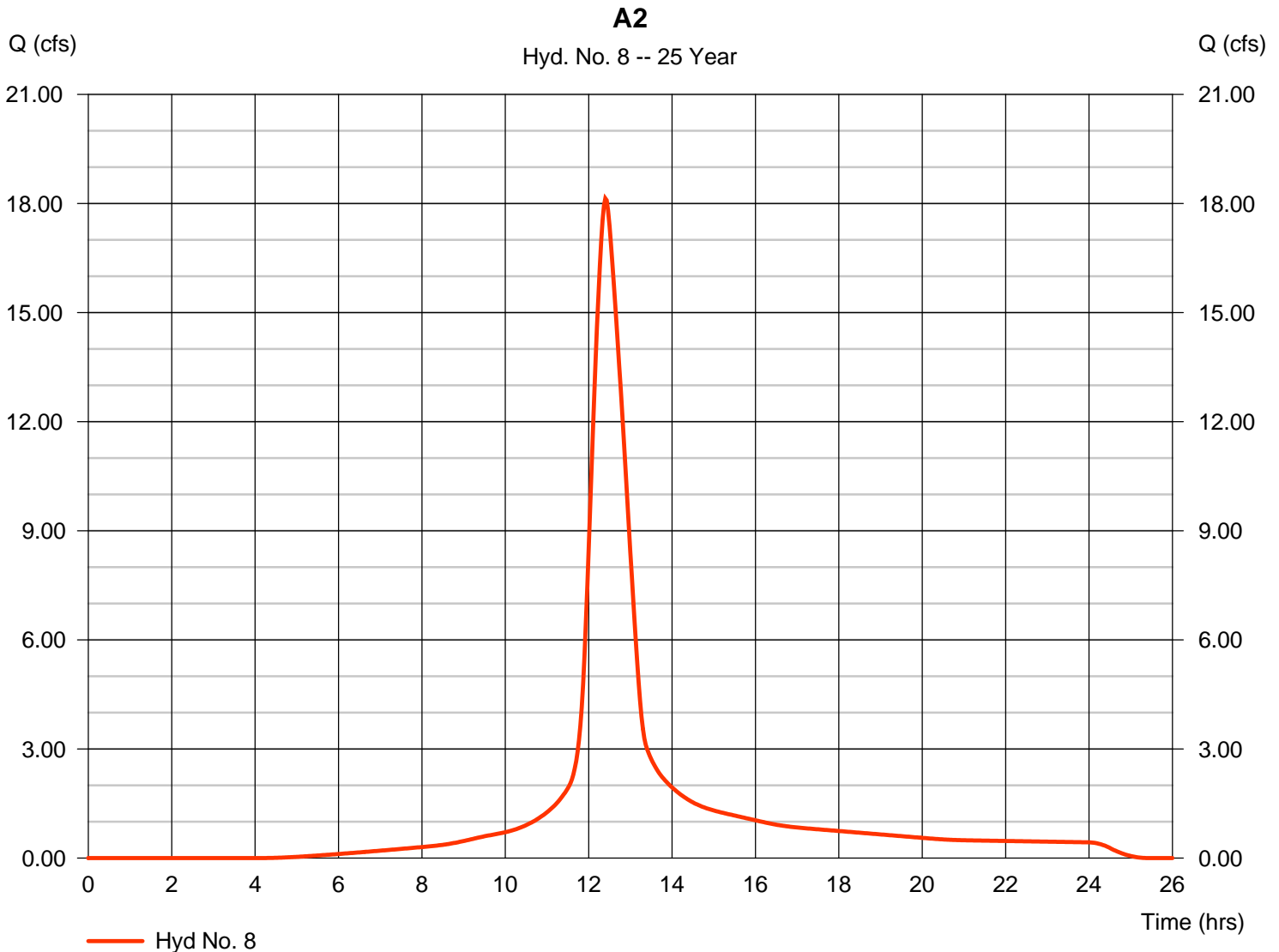
Monday, 03 / 2 / 2020

## Hyd. No. 8

A2

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 4.850 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 18.14 cfs  
 Time to peak = 12.40 hrs  
 Hyd. volume = 109,760 cuft  
 Curve number = 84.2  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 53.00 min  
 Distribution = Type II  
 Shape factor = 484





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

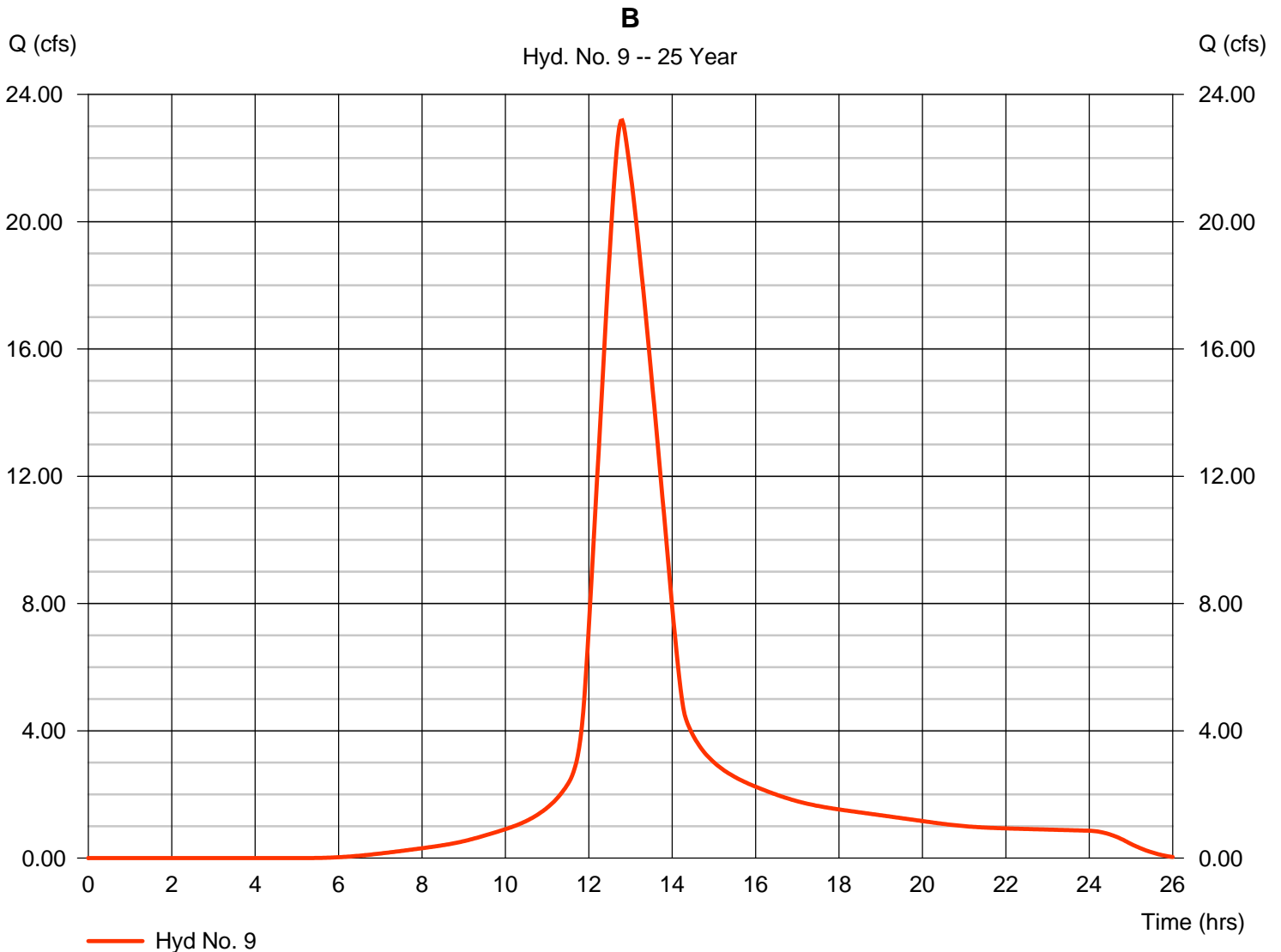
Monday, 03 / 2 / 2020

## Hyd. No. 9

B

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 9.770 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 23.18 cfs  
 Time to peak = 12.80 hrs  
 Hyd. volume = 201,820 cuft  
 Curve number = 80  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 88.50 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

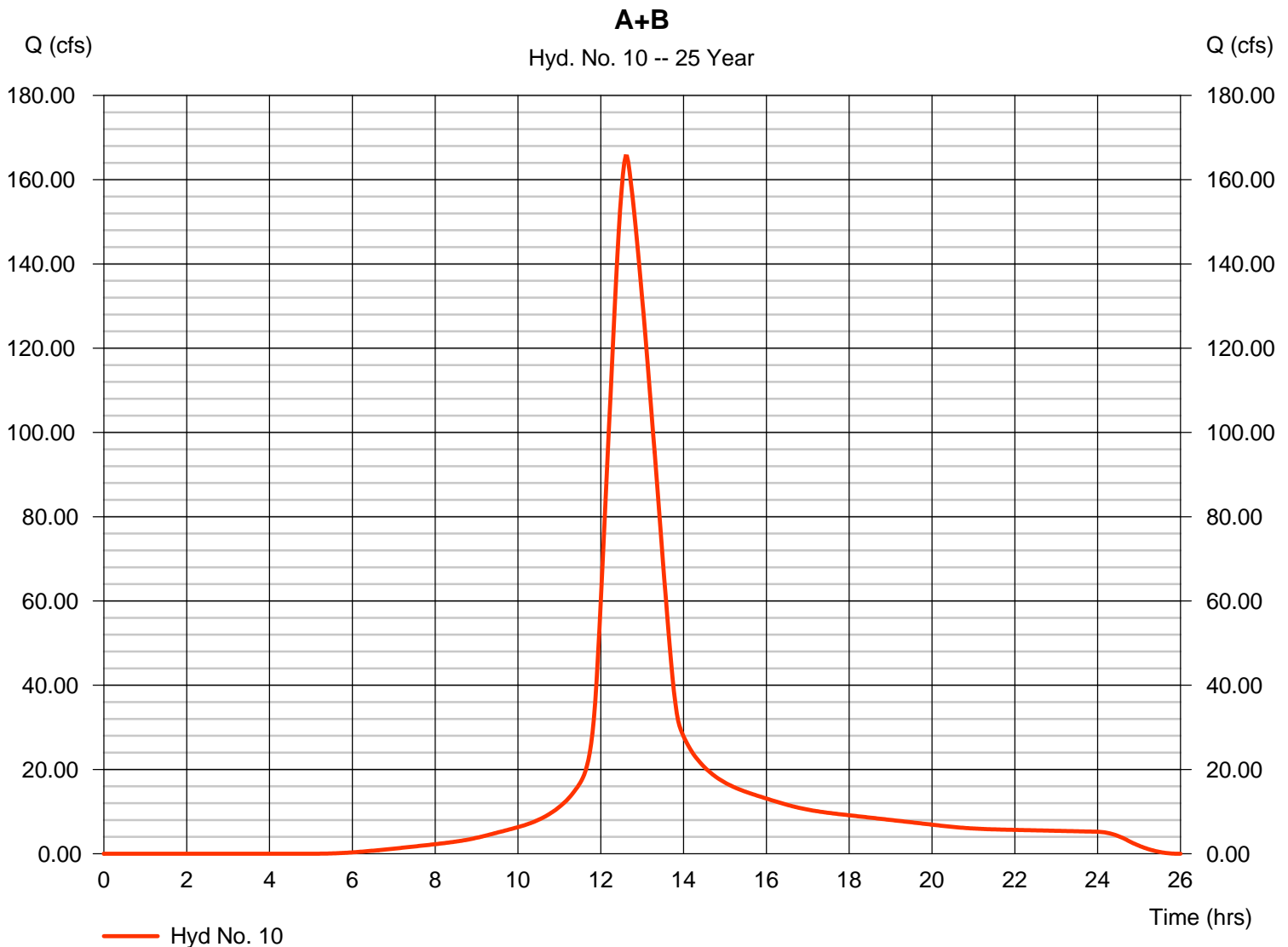
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 10

A+B

Hydrograph type	= SCS Runoff	Peak discharge	= 165.53 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 1,246,367 cuft
Drainage area	= 59.260 ac	Curve number	= 80.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

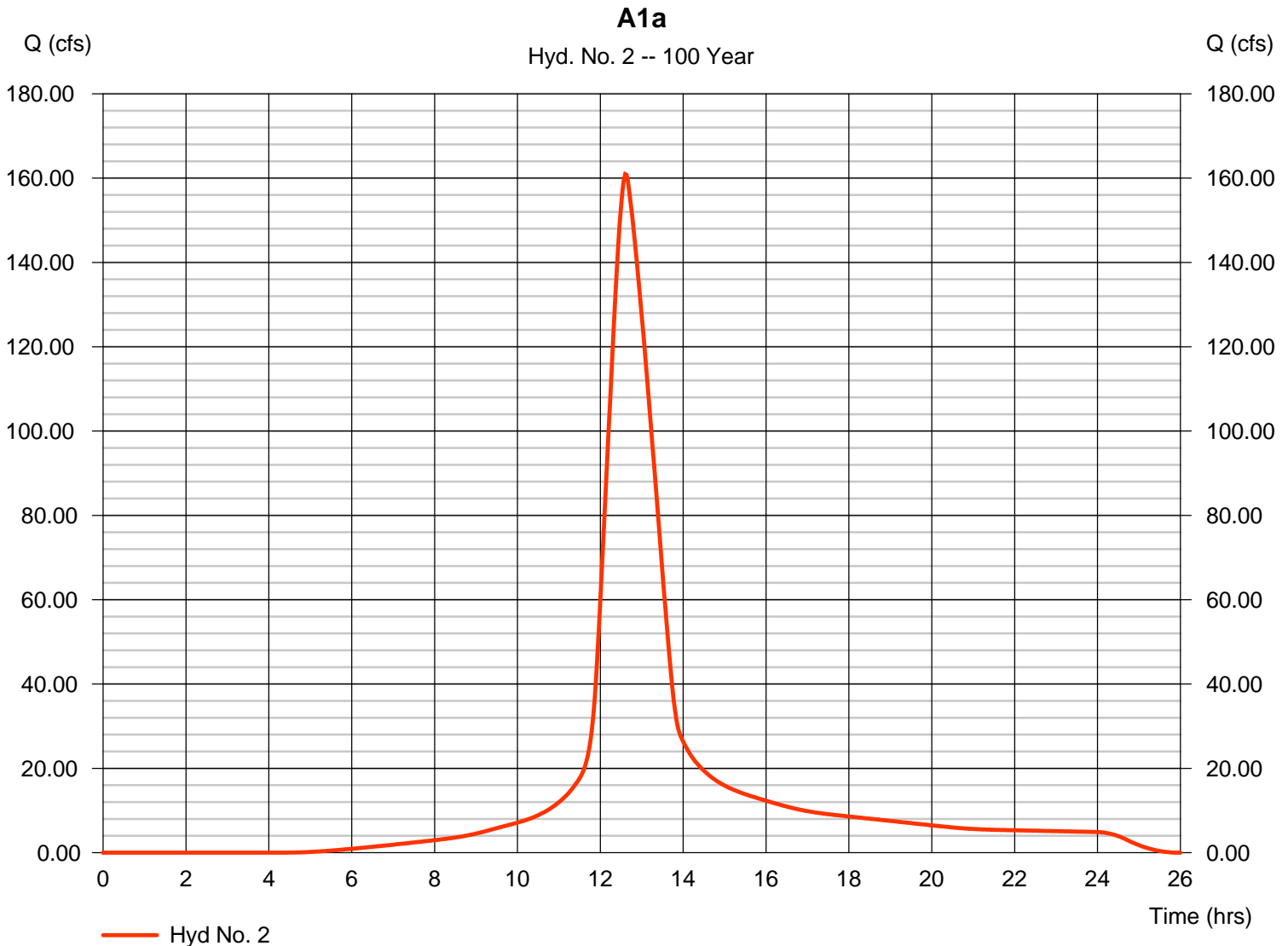
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 2

A1a

Hydrograph type	= SCS Runoff	Peak discharge	= 160.94 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 1,219,805 cuft
Drainage area	= 43.270 ac	Curve number	= 80.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

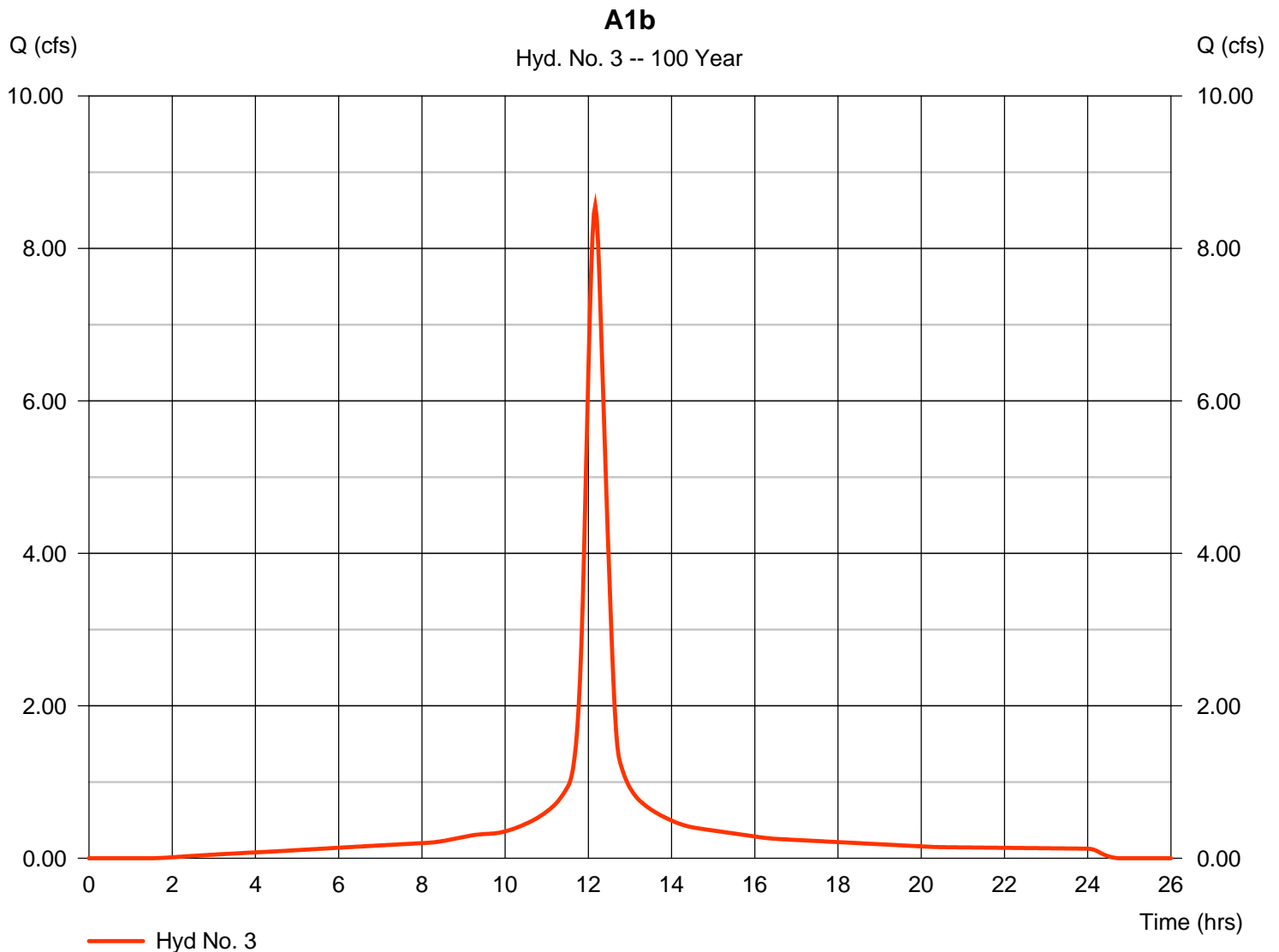
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 3

A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 8.560 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 37,360 cuft
Drainage area	= 1.100 ac	Curve number	= 93.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.80 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

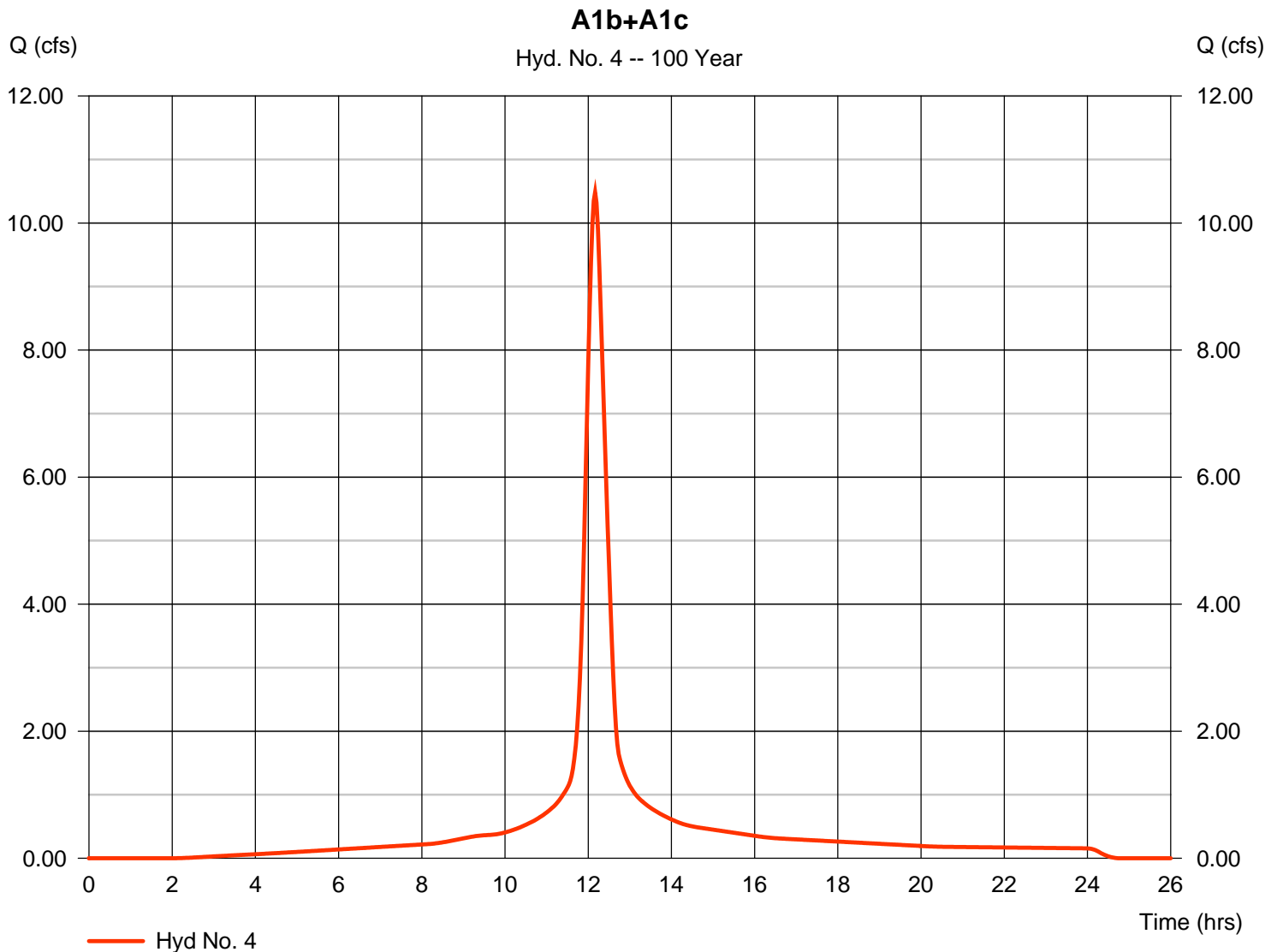
Monday, 03 / 2 / 2020

## Hyd. No. 4

A1b+A1c

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 2 min  
 Drainage area = 1.370 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 10.17 in  
 Storm duration = 24 hrs

Peak discharge = 10.48 cfs  
 Time to peak = 12.17 hrs  
 Hyd. volume = 44,871 cuft  
 Curve number = 90.6  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 28.80 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

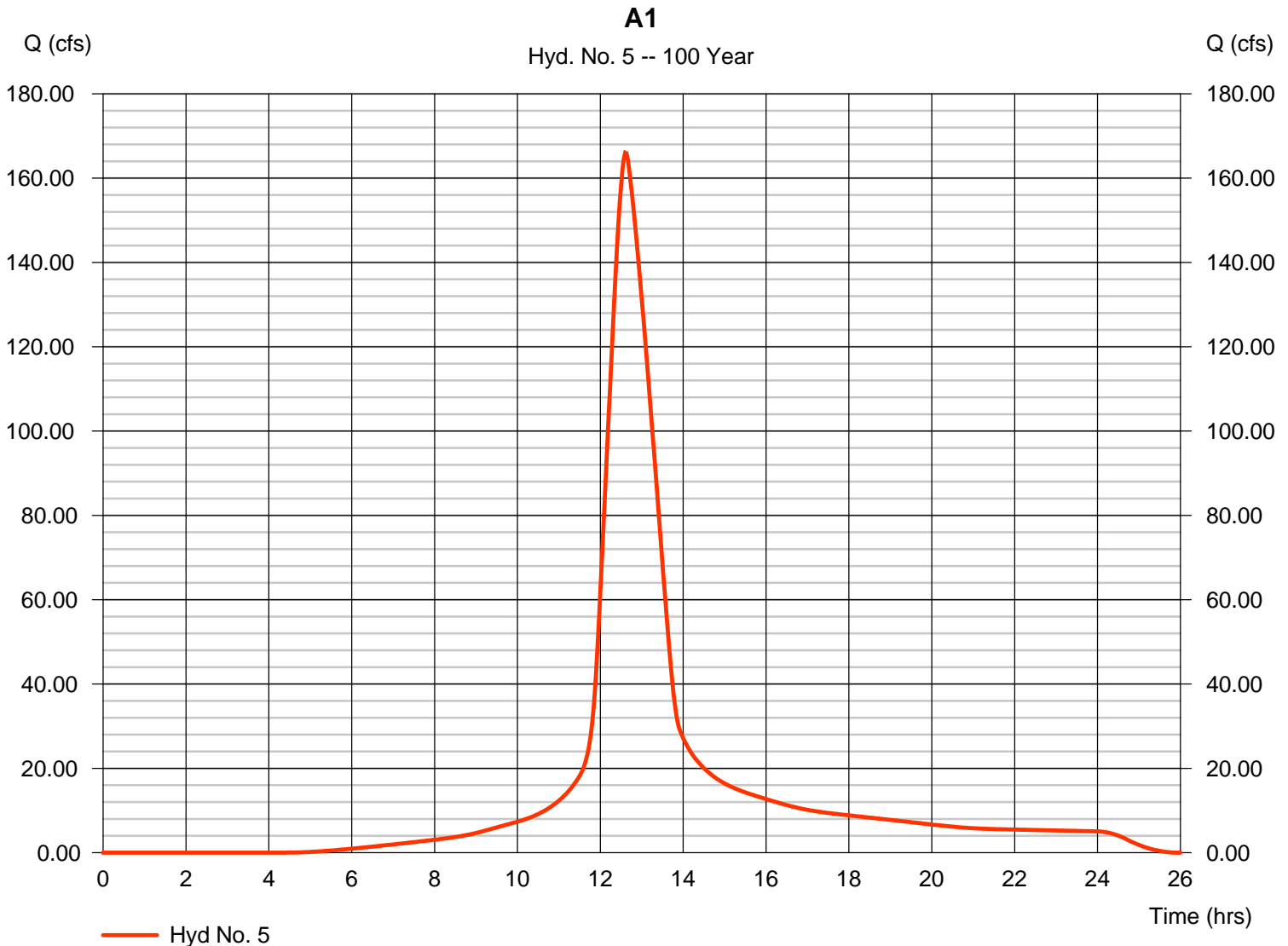
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 5

A1

Hydrograph type	= SCS Runoff	Peak discharge	= 166.03 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 1,258,424 cuft
Drainage area	= 44.640 ac	Curve number	= 80.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

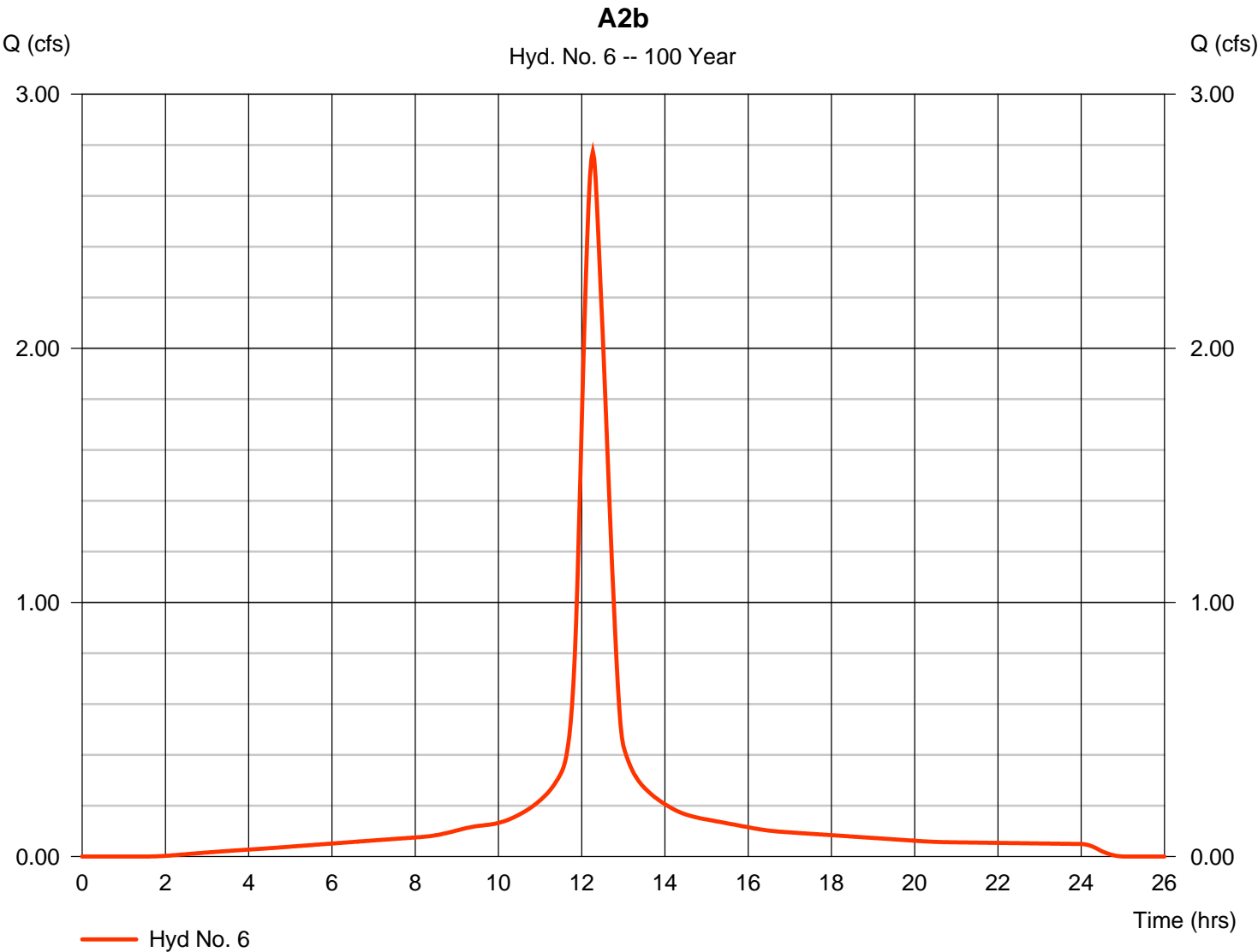
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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## Hyd. No. 6

A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 2.773 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 14,547 cuft
Drainage area	= 0.430 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 38.20 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

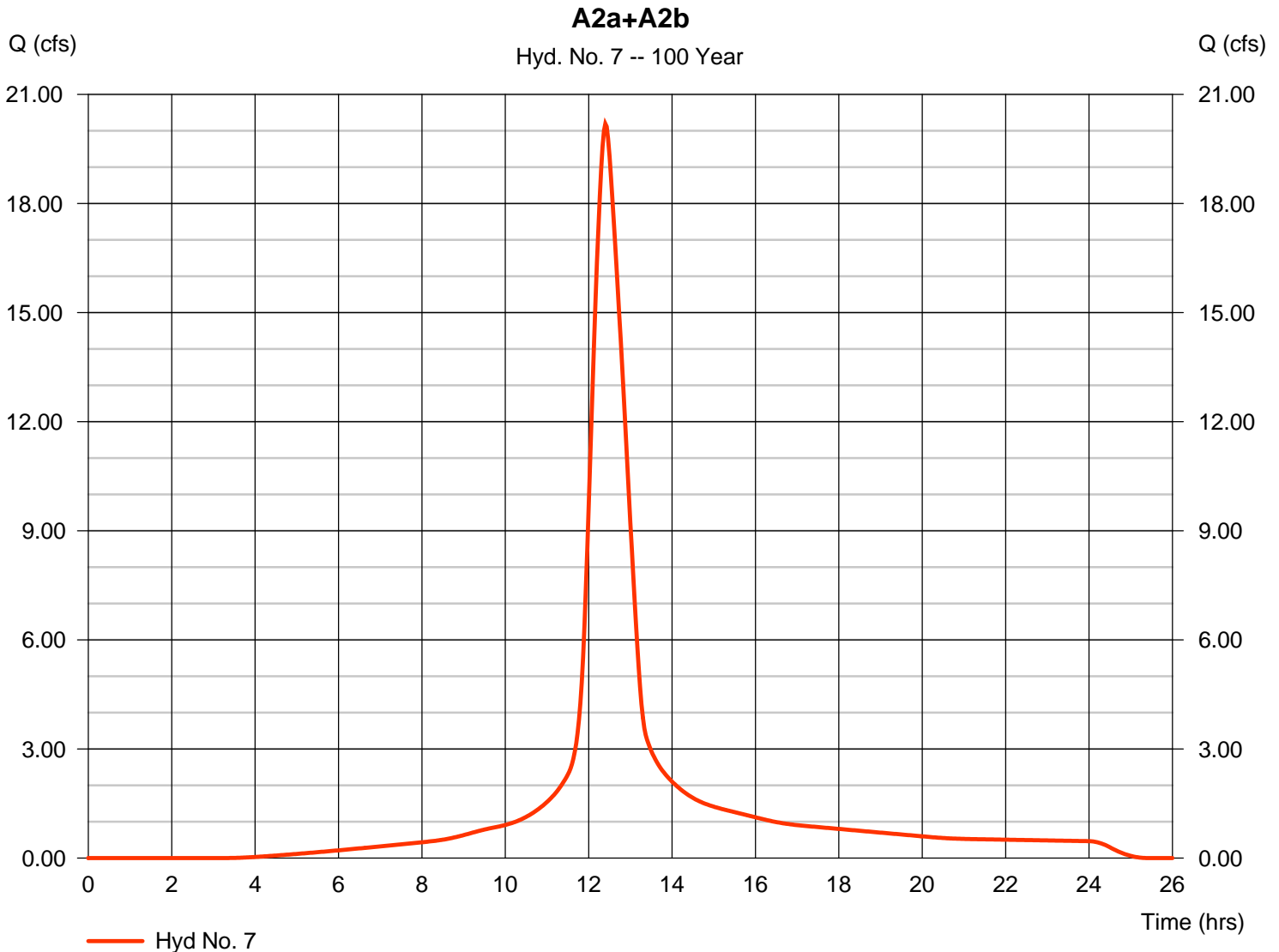
Monday, 03 / 2 / 2020

## Hyd. No. 7

A2a+A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 2 min  
 Drainage area = 4.070 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 10.17 in  
 Storm duration = 24 hrs

Peak discharge = 20.19 cfs  
 Time to peak = 12.40 hrs  
 Hyd. volume = 123,899 cuft  
 Curve number = 85  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 53.00 min  
 Distribution = Type II  
 Shape factor = 484





# Hydrograph Report

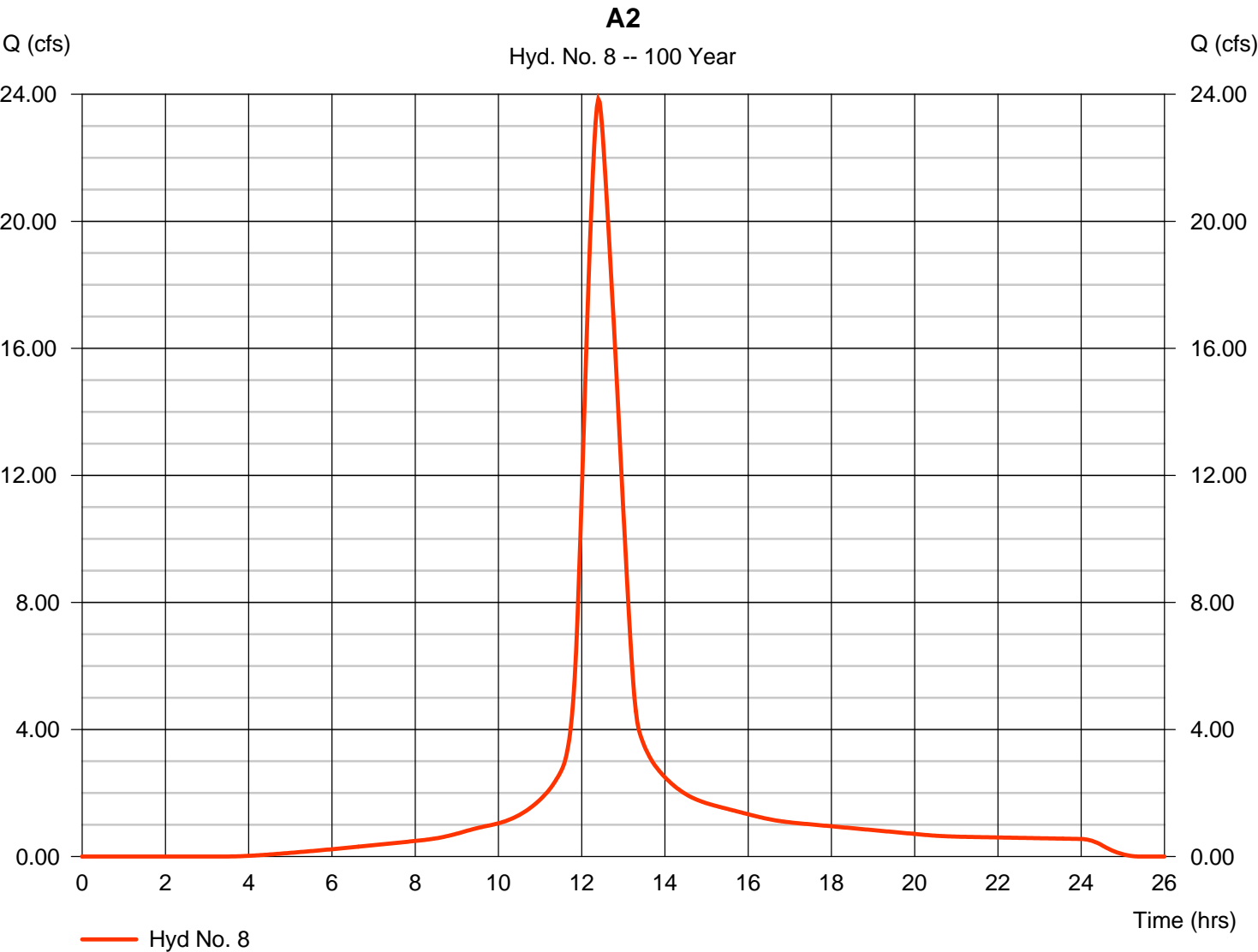
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 8

A2

Hydrograph type	= SCS Runoff	Peak discharge	= 23.84 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 145,846 cuft
Drainage area	= 4.850 ac	Curve number	= 84.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 53.00 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

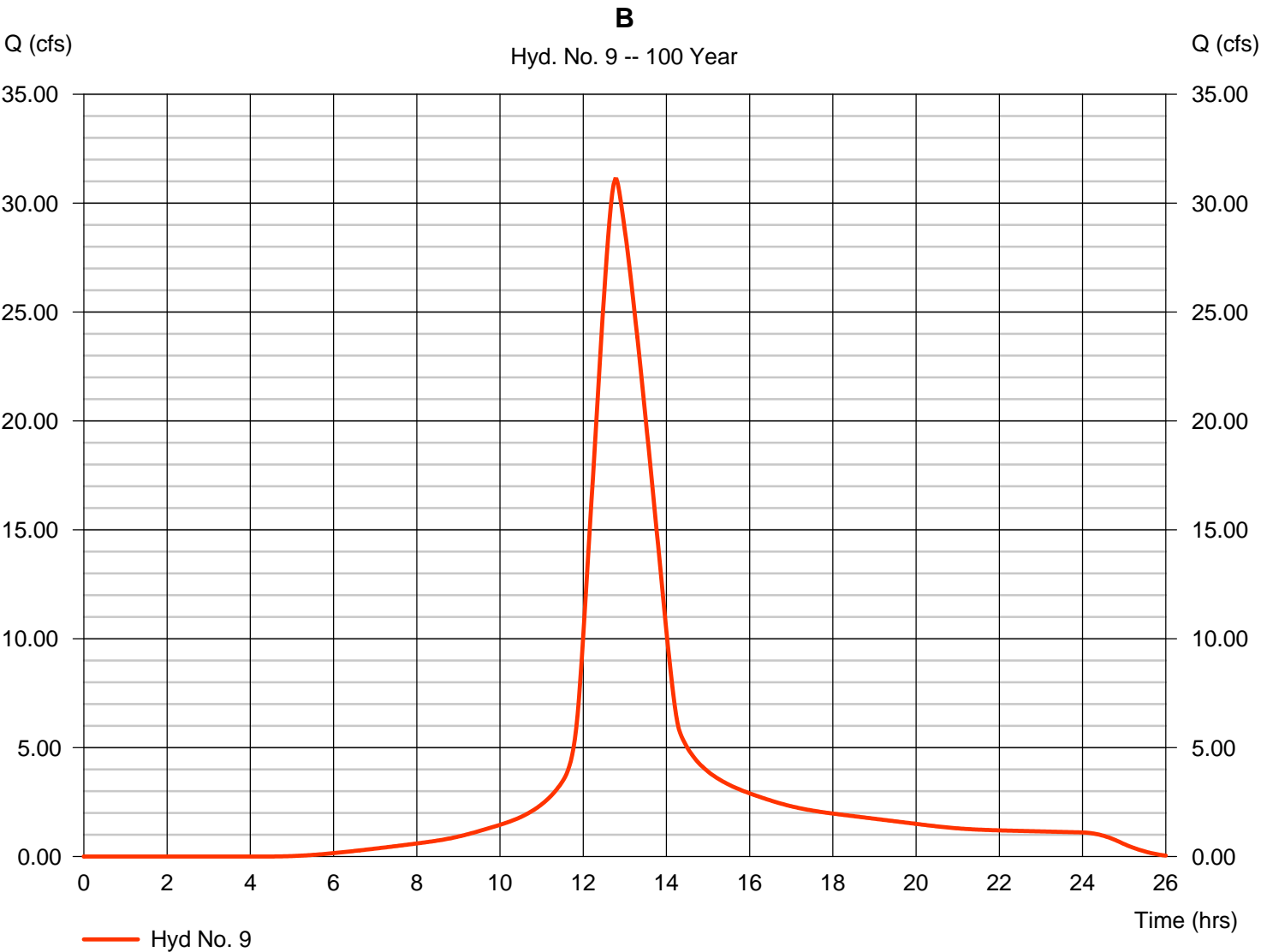
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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## Hyd. No. 9

B

Hydrograph type	= SCS Runoff	Peak discharge	= 31.09 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.77 hrs
Time interval	= 2 min	Hyd. volume	= 272,498 cuft
Drainage area	= 9.770 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 88.50 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

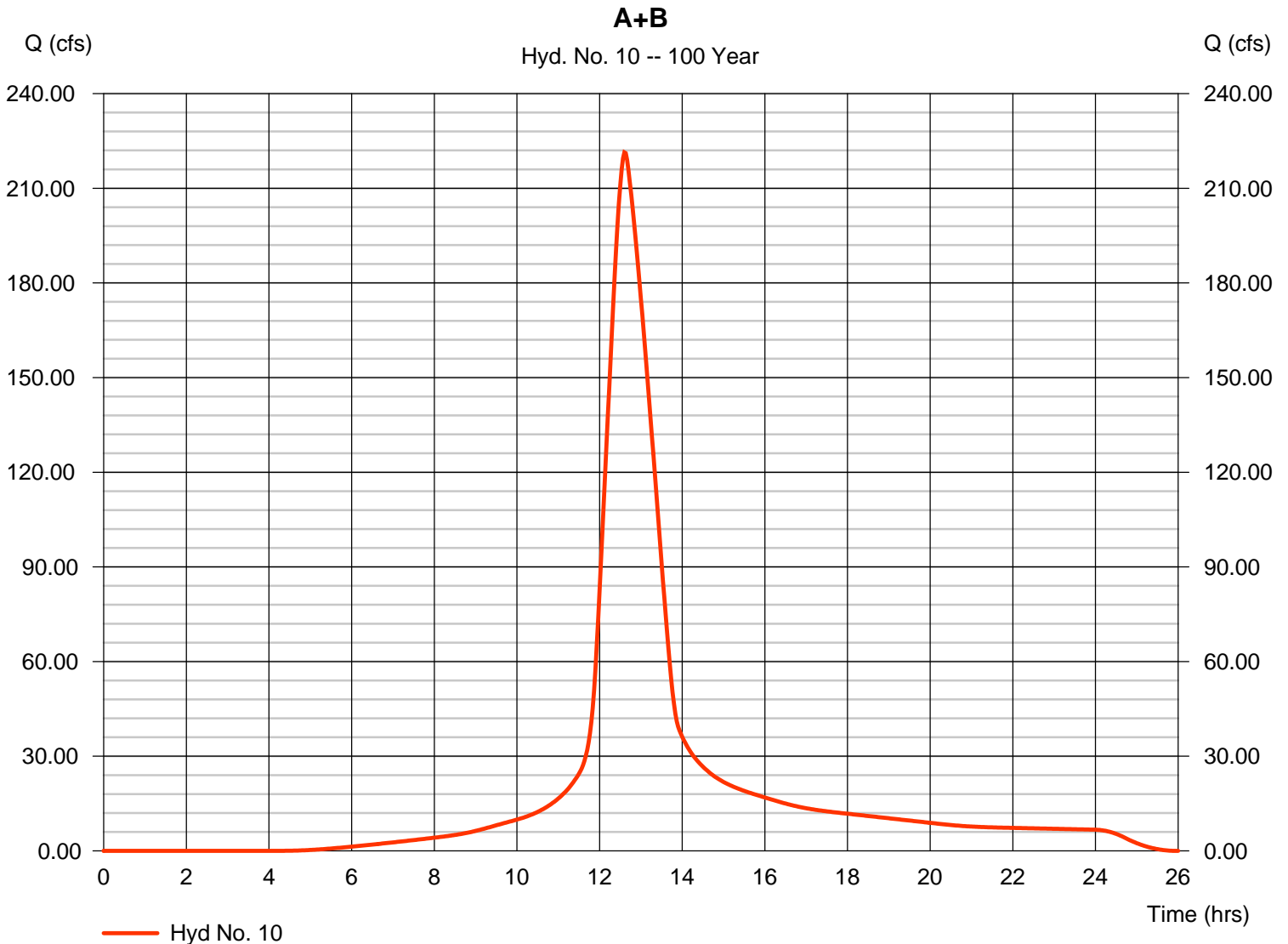
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 10

A+B

Hydrograph type	= SCS Runoff	Peak discharge	= 221.35 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 1,678,904 cuft
Drainage area	= 59.260 ac	Curve number	= 80.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 74.10 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

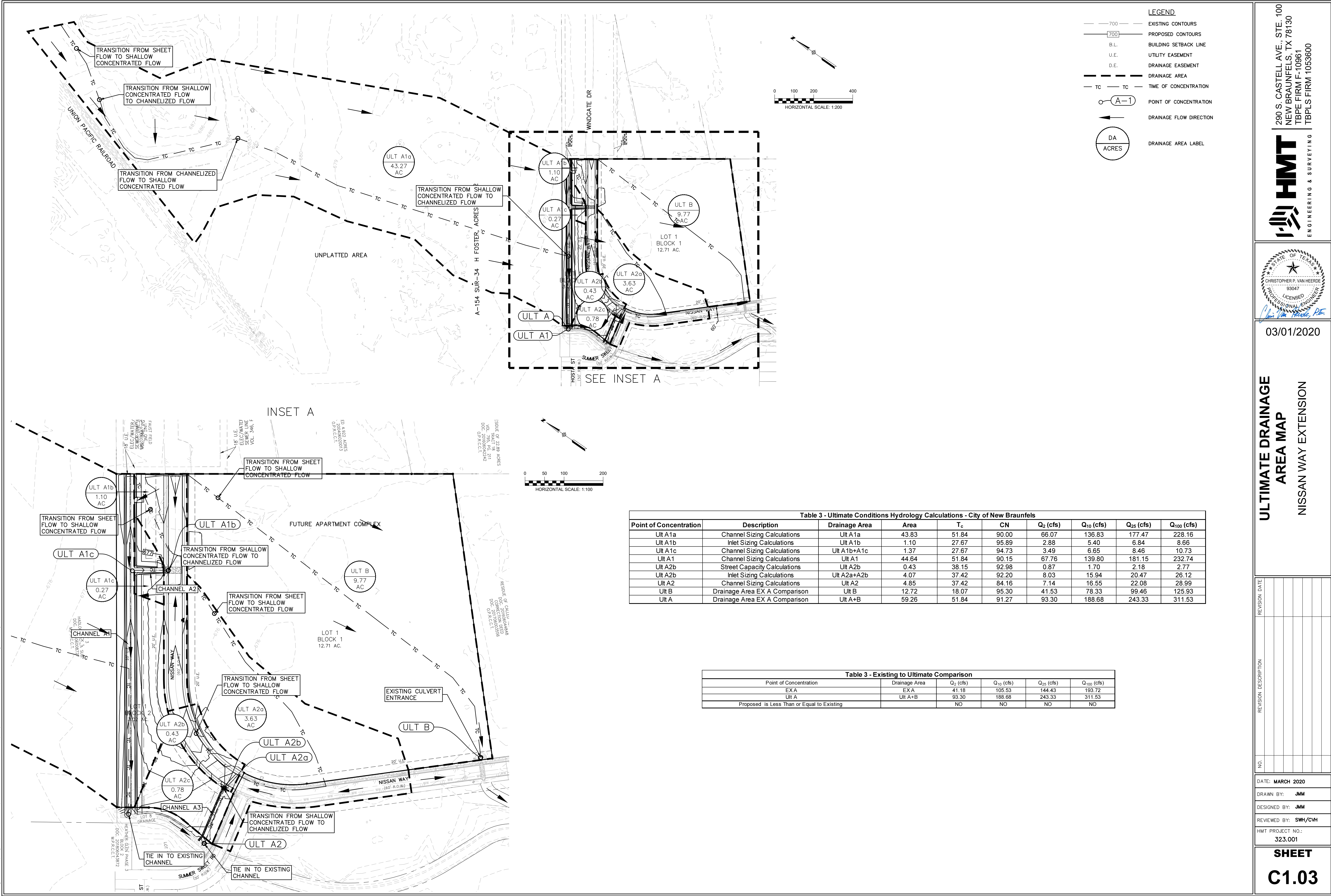


# Attachment J

## Ultimate Conditions Drainage Area Map



Drawing Name: W:\\_Projects\223 - ULF, LLC\001 - Heather (On Apartments)\CDA\STREET PROJECT SET\223.001\_DRNG.dwg User: jphnm Mar 02, 2020 - 9:40am



290 S. CASTELL AVE., STE. 100  
NEW BRAUNFELS, TX 78130  
TBPE FIRM F-10961  
TBPLS FIRM 1053600

**HMT**  
ENGINEERING & SURVEYING

CHRISTOPHER P. VAN HEERDE  
93047  
LICENSED PROFESSIONAL ENGINEER  
*Chris Van Heerde, P.E.*

03/01/2020

**ULTIMATE DRAINAGE  
AREA MAP**  
NISSAN WAY EXTENSION

REVISION	DESCRIPTION	DATE
NO.		

DATE: MARCH 2020  
DRAWN BY: JMM  
DESIGNED BY: JMM  
REVIEWED BY: SWH/CVH  
HMT PROJECT NO.: 223.001

**SHEET  
C1.03**

# Attachment K

## Ultimate Conditions Hydrology Calculations

# Hydrograph Report

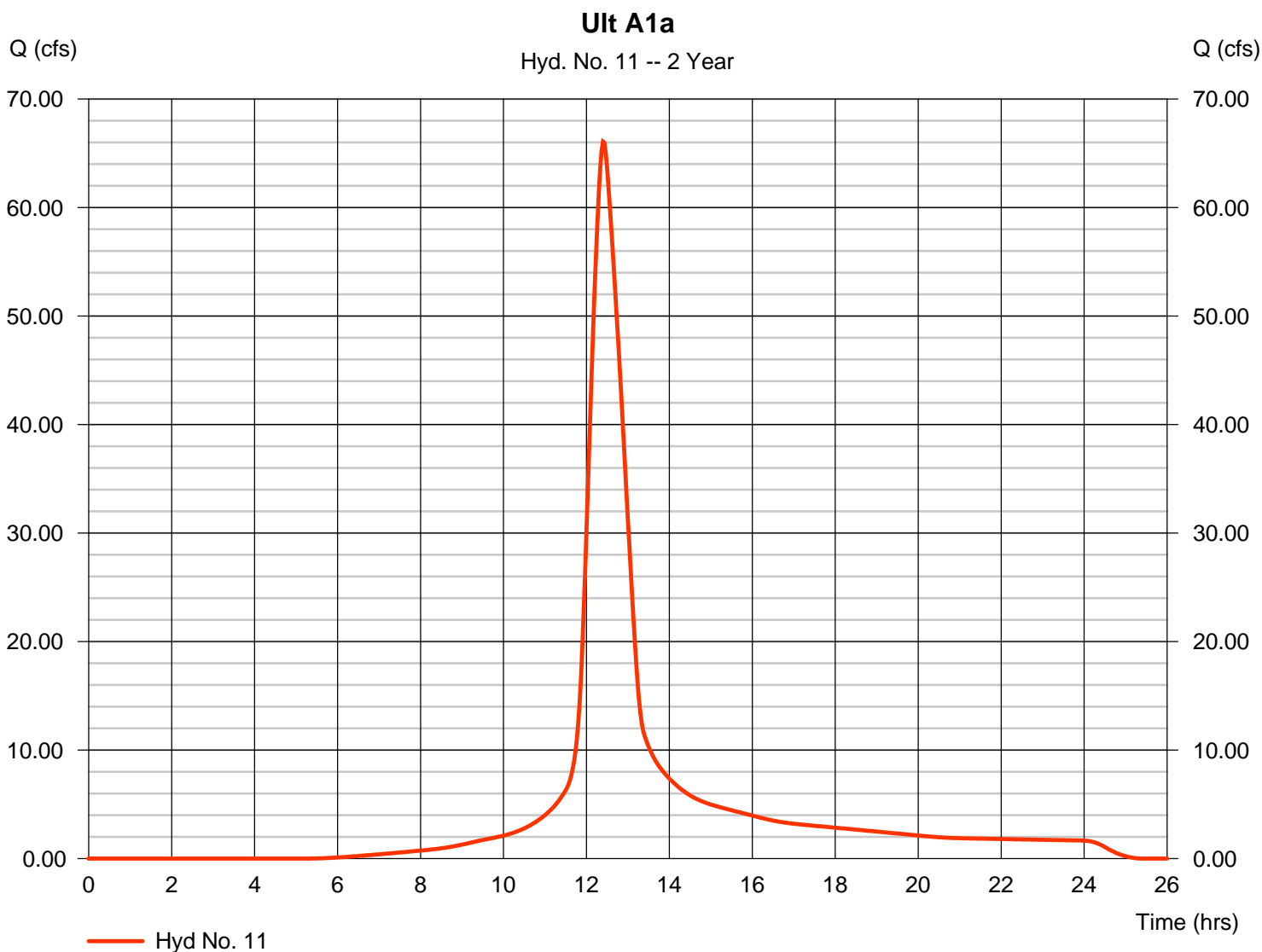
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 11

Ult A1a

Hydrograph type	= SCS Runoff	Peak discharge	= 66.07 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 395,523 cuft
Drainage area	= 43.830 ac	Curve number	= 90
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 51.80 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

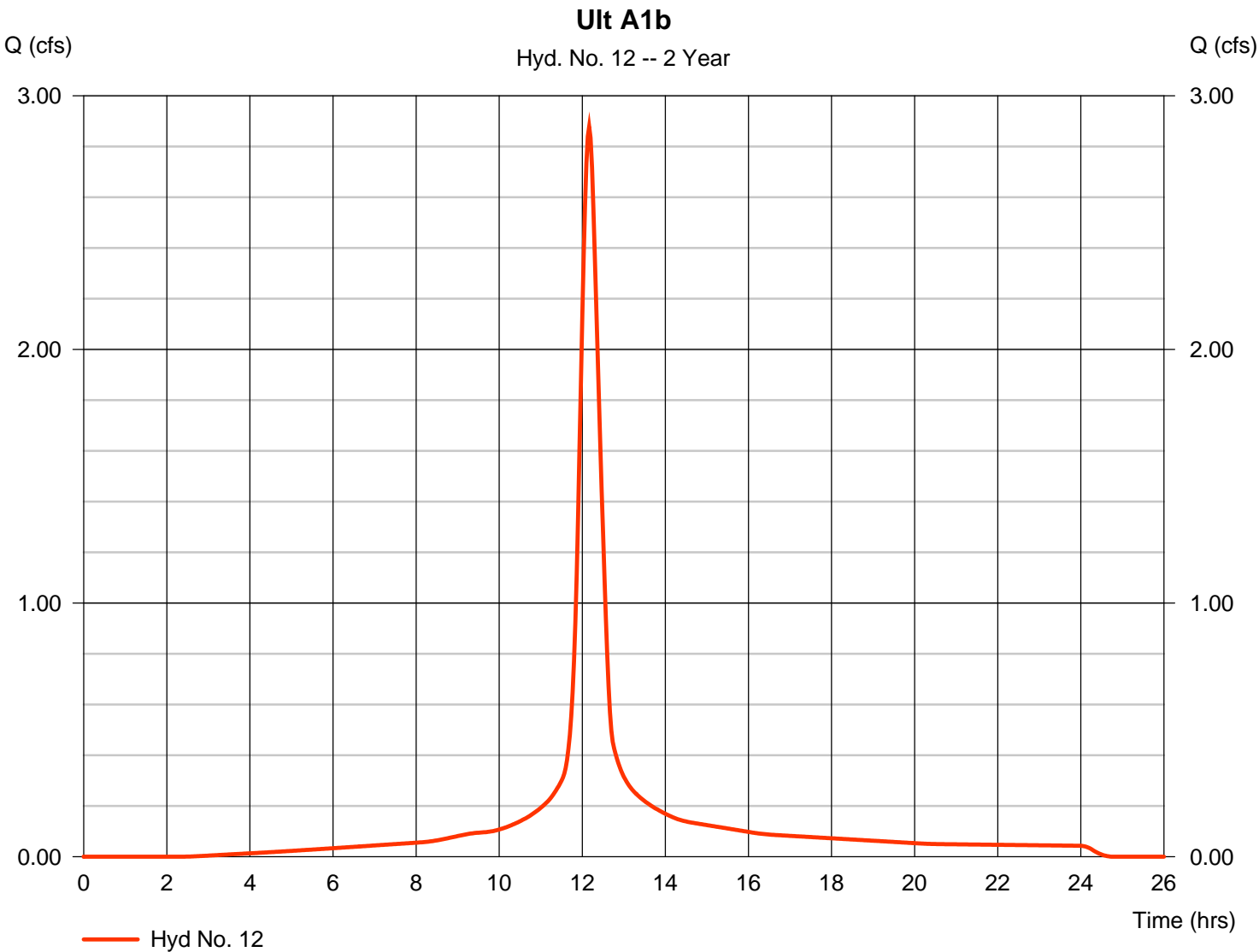
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 12

Ult A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 2.878 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 12,196 cuft
Drainage area	= 1.100 ac	Curve number	= 95.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.70 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





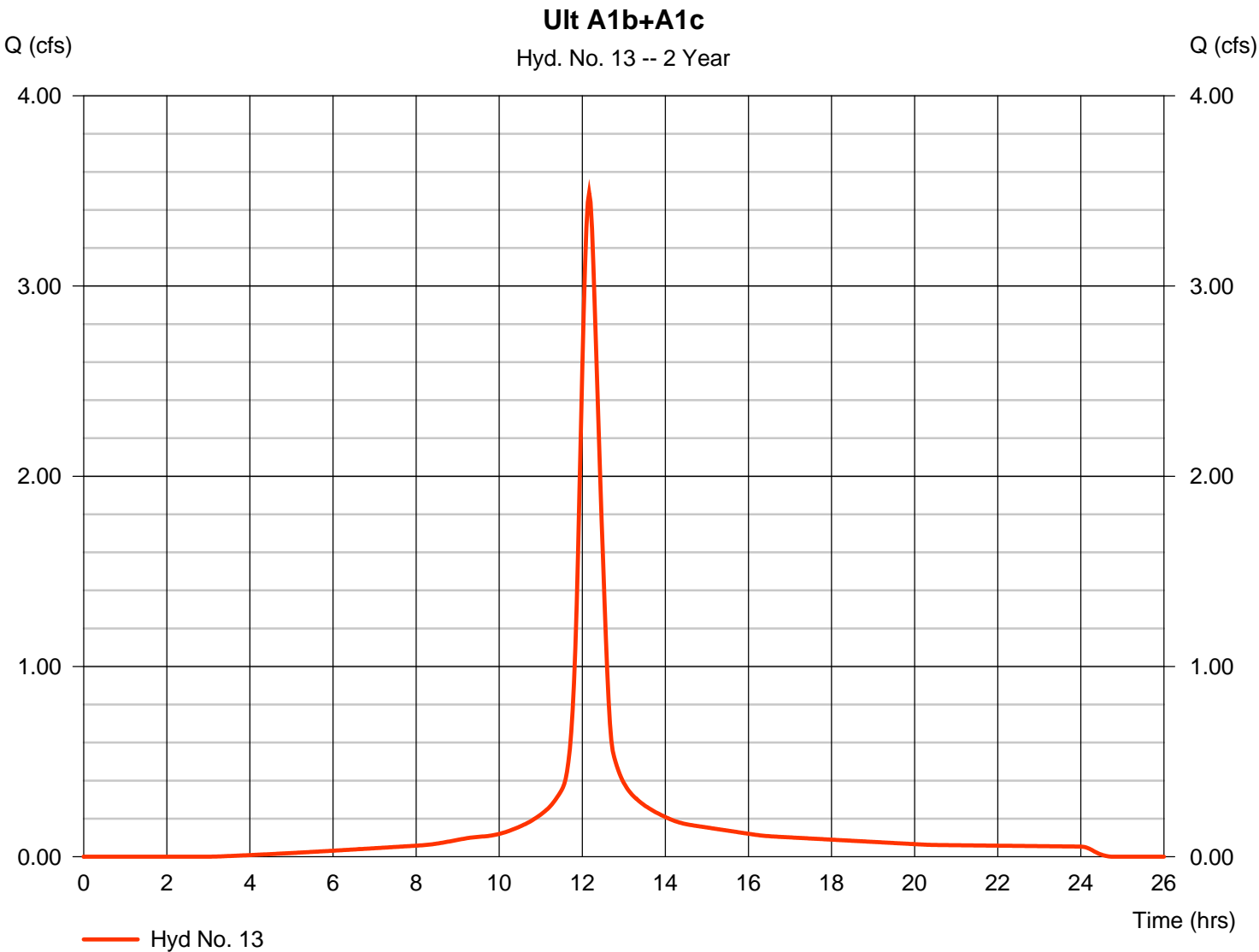
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2
Monday, 03 / 2 / 2020

## Hyd. No. 13

Ult A1b+A1c

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.490 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	14,558 cuft
Drainage area	=	1.370 ac	Curve number	=	94.7
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	27.70 min
Total precip.	=	3.52 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

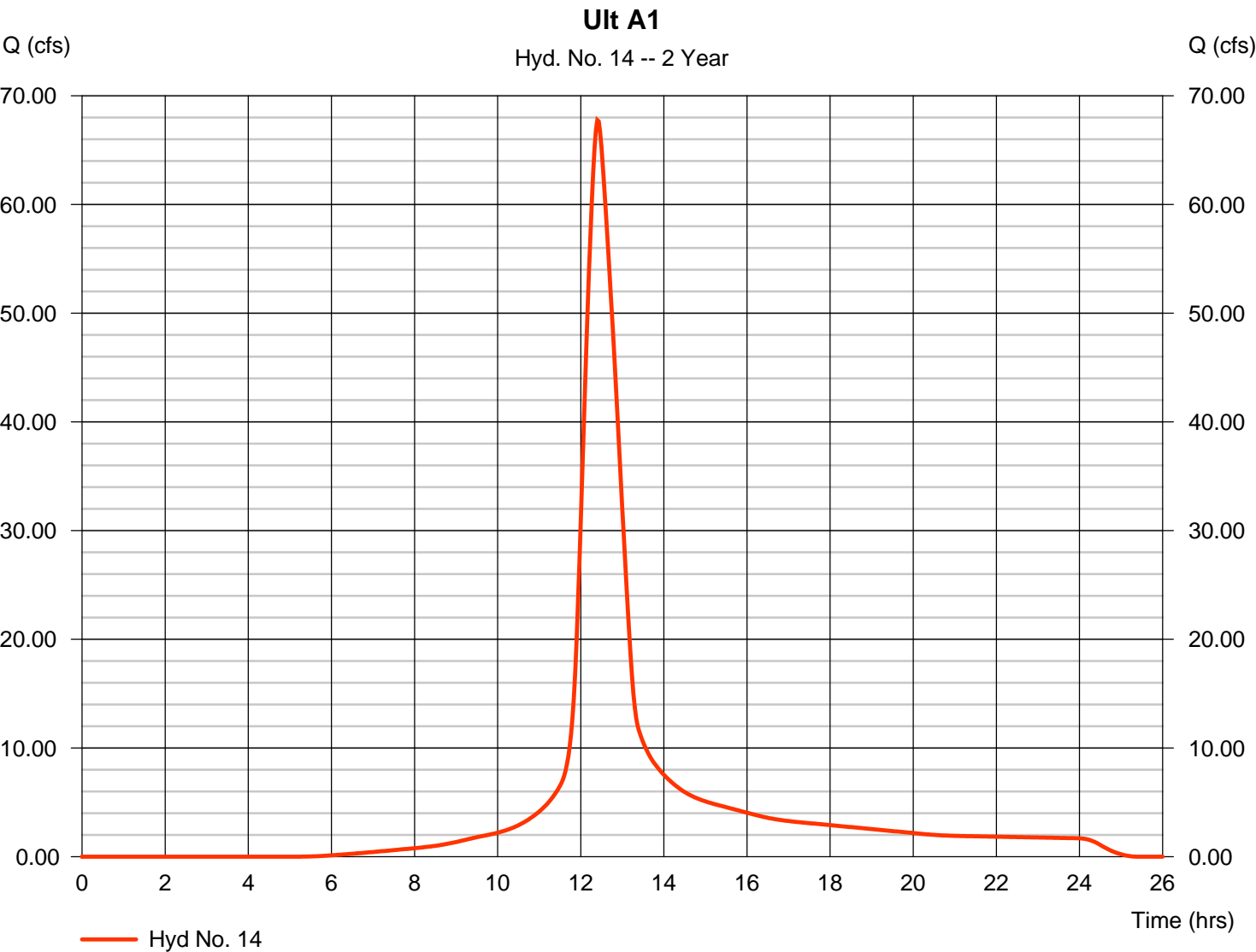


# Hydrograph Report

## Hyd. No. 14

Ult A1

Hydrograph type	= SCS Runoff	Peak discharge	= 67.76 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 405,851 cuft
Drainage area	= 44.640 ac	Curve number	= 90.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 51.80 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

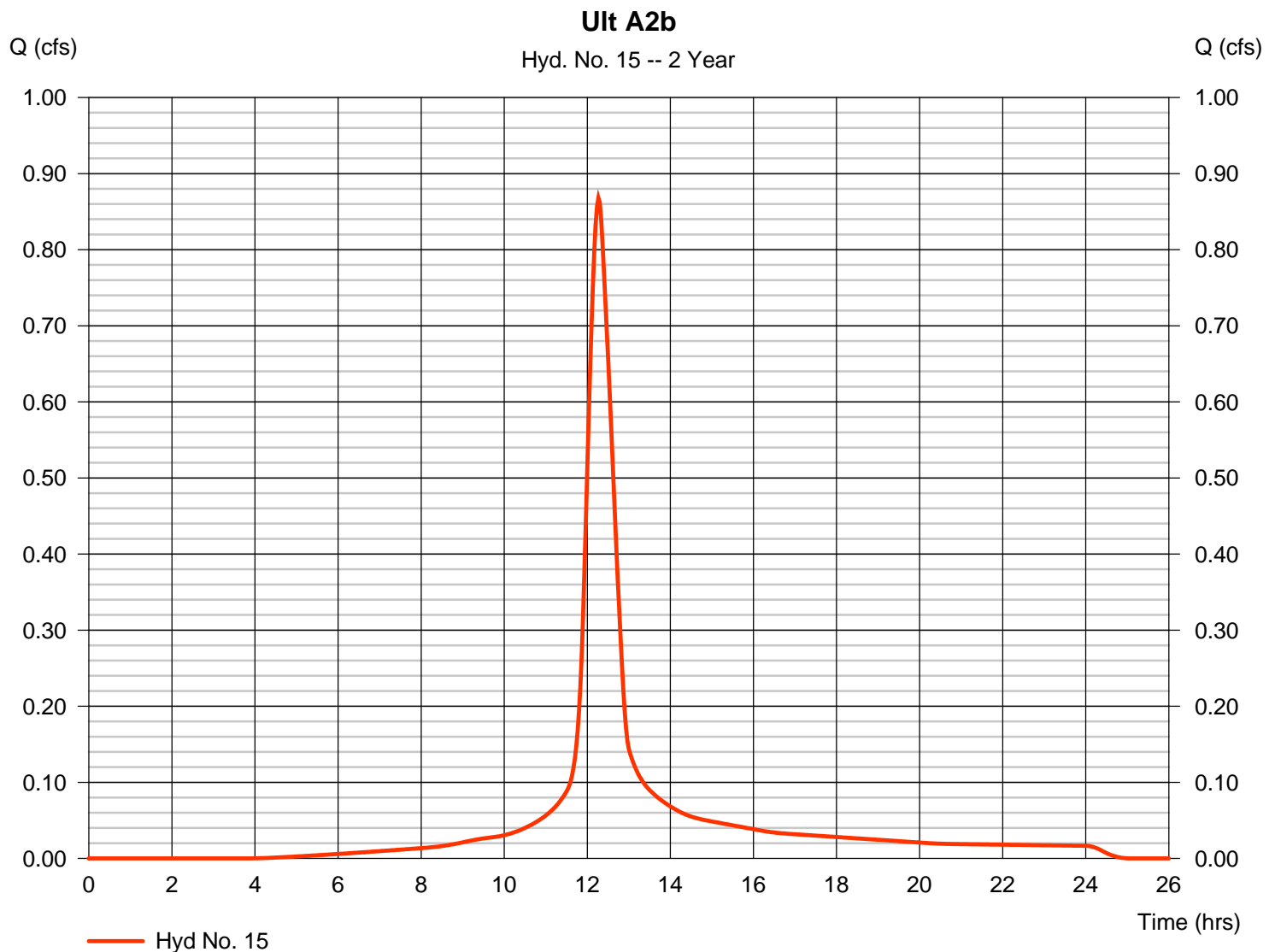
Monday, 03 / 2 / 2020

## Hyd. No. 15

Ult A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 0.430 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.52 in  
 Storm duration = 24 hrs

Peak discharge = 0.868 cfs  
 Time to peak = 12.27 hrs  
 Hyd. volume = 4,299 cuft  
 Curve number = 93  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 38.20 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

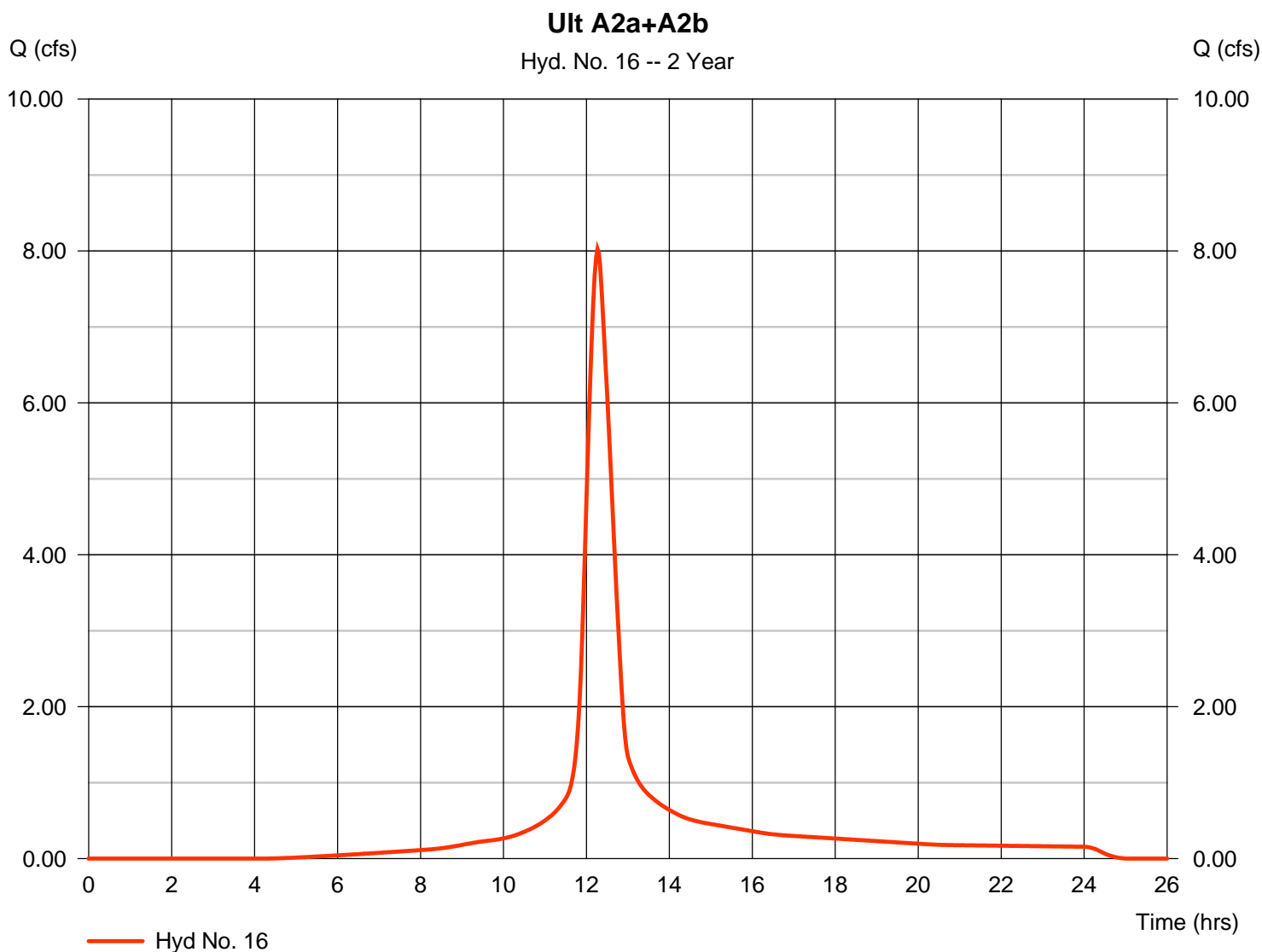
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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## Hyd. No. 16

Ult A2a+A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 8.025 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 39,526 cuft
Drainage area	= 4.070 ac	Curve number	= 92.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 37.40 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

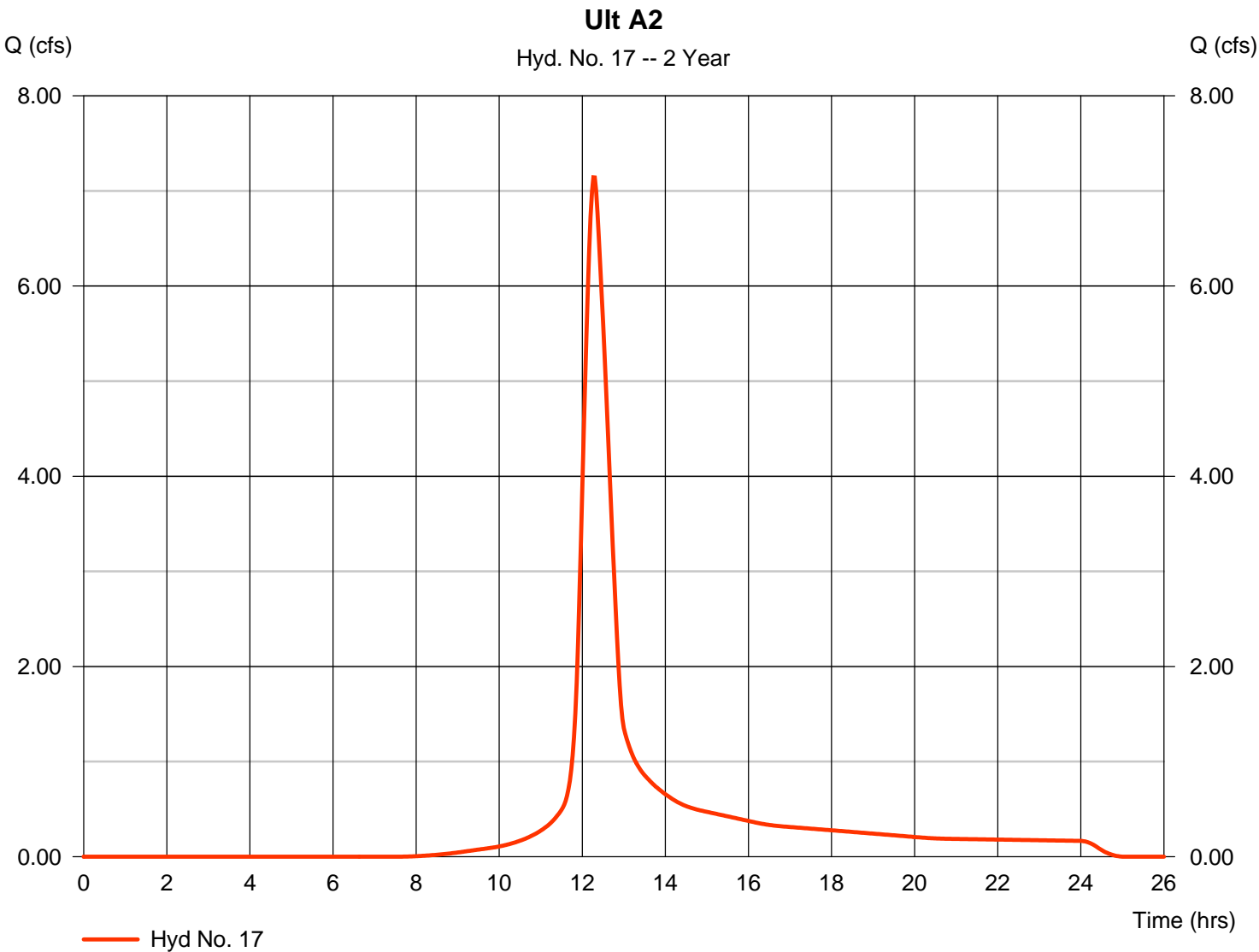
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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## Hyd. No. 17

Ult A2

Hydrograph type	= SCS Runoff	Peak discharge	= 7.141 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 34,674 cuft
Drainage area	= 4.850 ac	Curve number	= 84.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 37.40 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

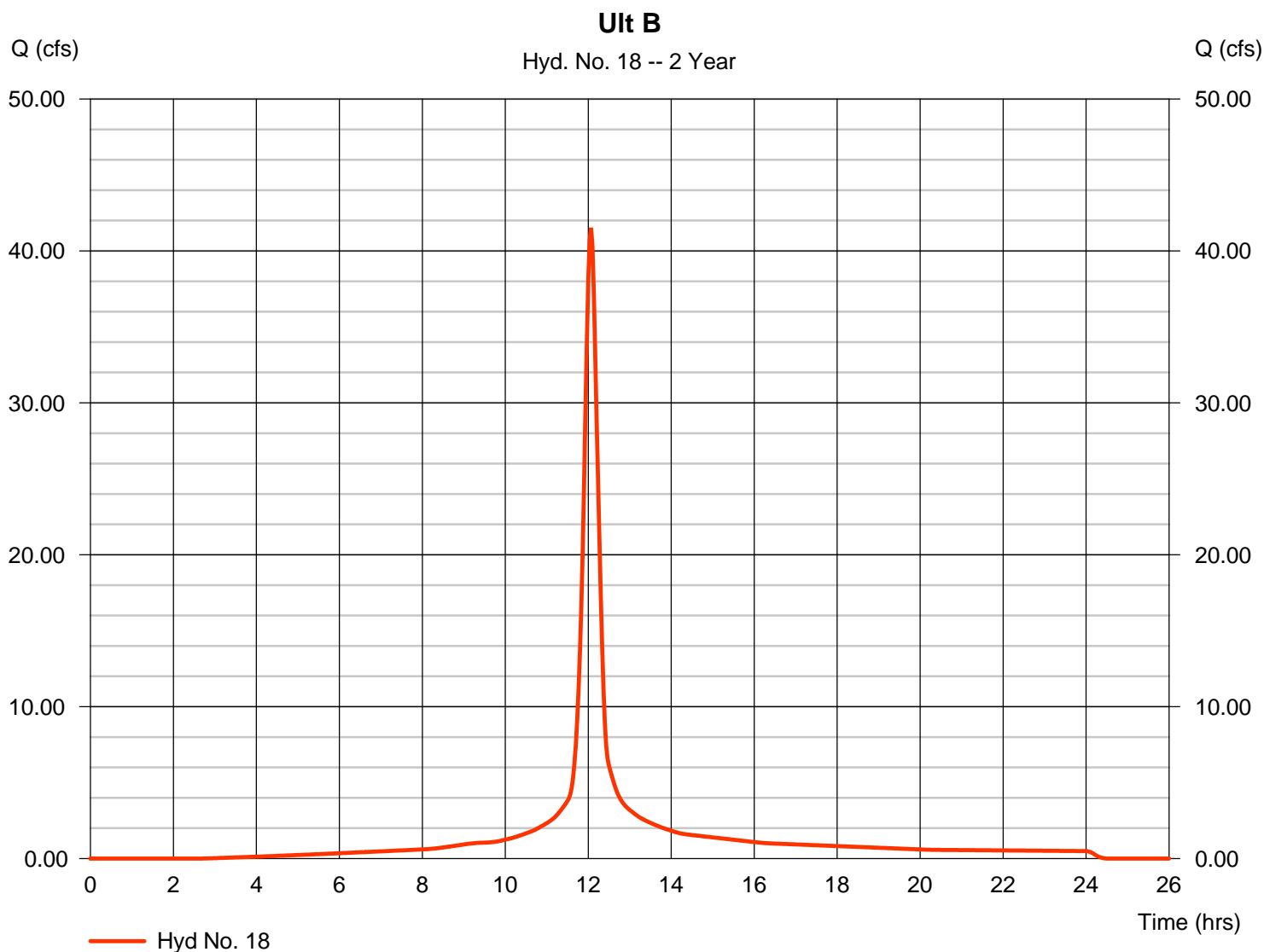
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 18

Ult B

Hydrograph type	= SCS Runoff	Peak discharge	= 41.53 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 138,074 cuft
Drainage area	= 12.720 ac	Curve number	= 95.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 18.10 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

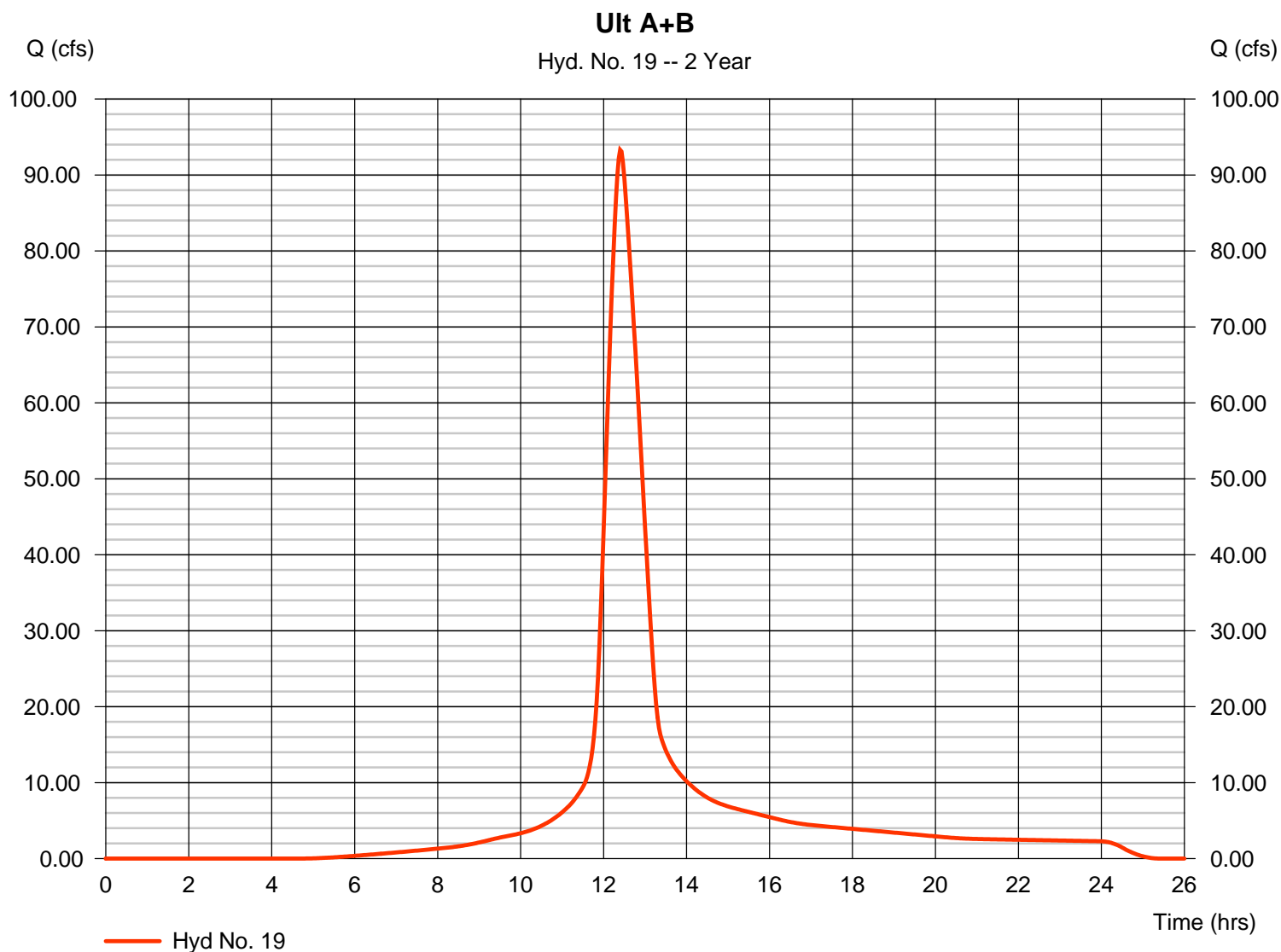
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Monday, 03 / 2 / 2020

## Hyd. No. 19

Ult A+B

Hydrograph type	= SCS Runoff	Peak discharge	= 93.30 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 561,185 cuft
Drainage area	= 59.260 ac	Curve number	= 91.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 51.80 min
Total precip.	= 3.52 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

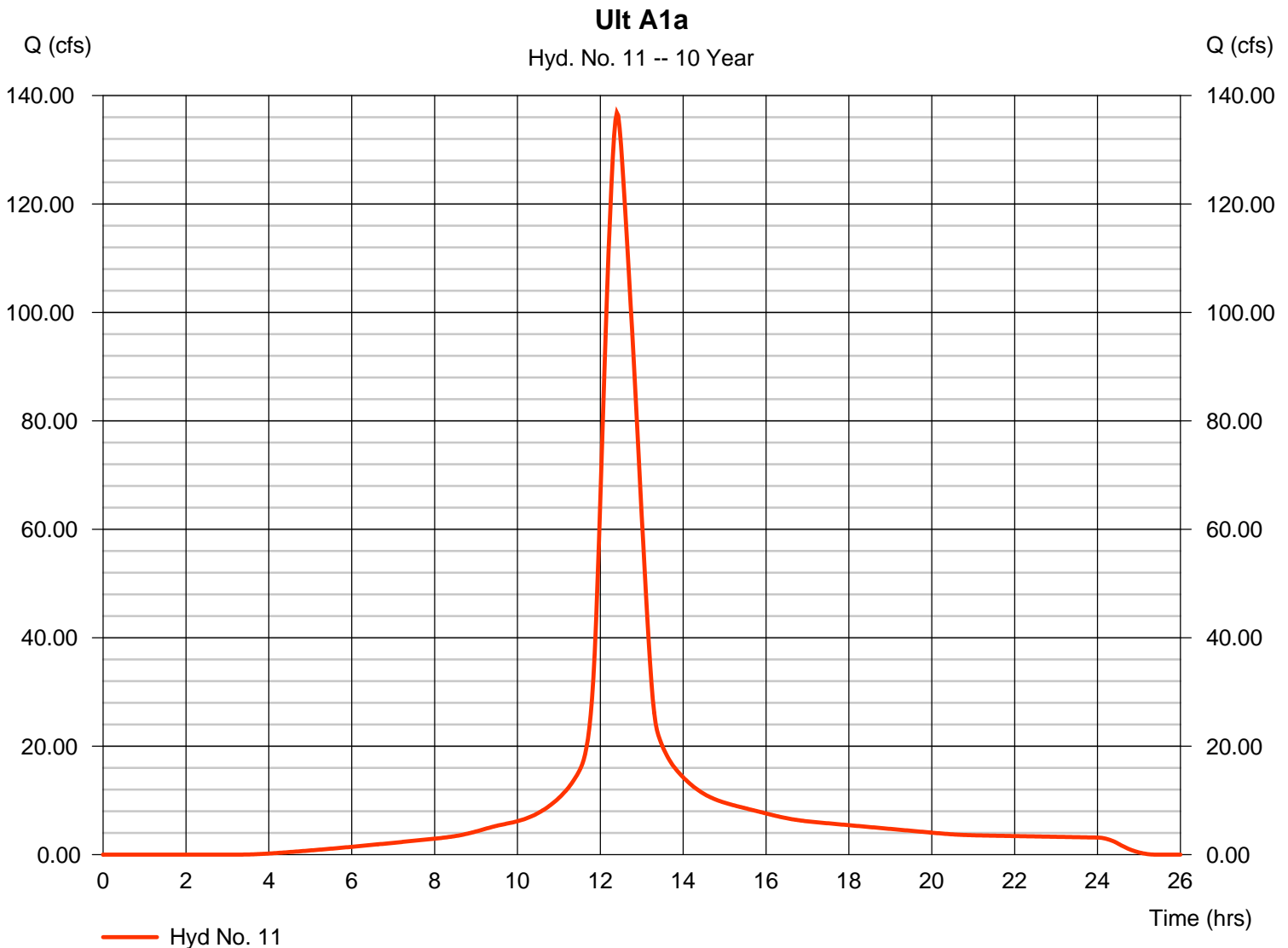
Monday, 03 / 2 / 2020

## Hyd. No. 11

Ult A1a

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 43.830 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 136.83 cfs  
 Time to peak = 12.40 hrs  
 Hyd. volume = 839,578 cuft  
 Curve number = 90  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 51.80 min  
 Distribution = Type II  
 Shape factor = 484





# Hydrograph Report

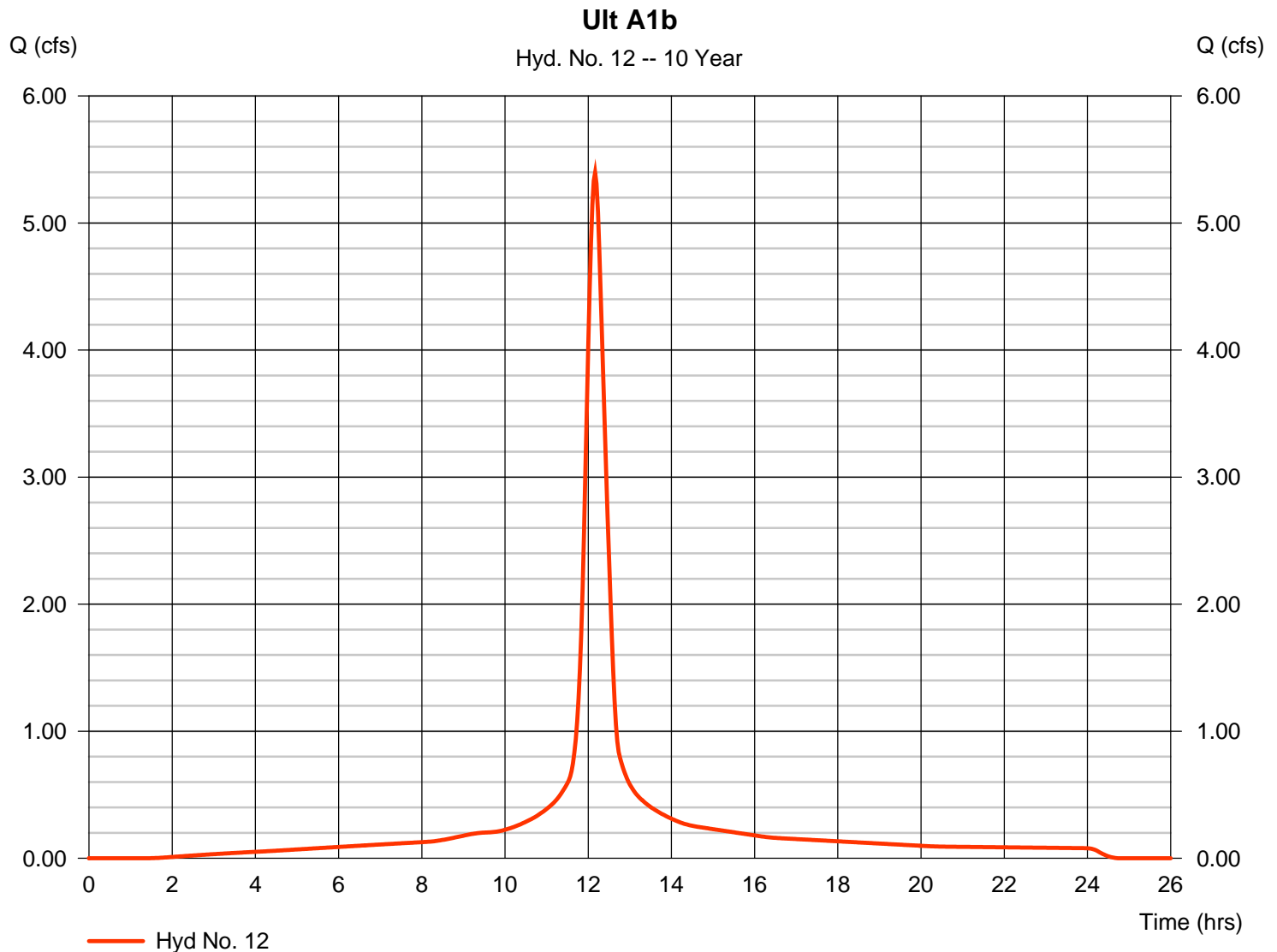
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 12

Ult A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 5.396 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 23,615 cuft
Drainage area	= 1.100 ac	Curve number	= 95.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.70 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

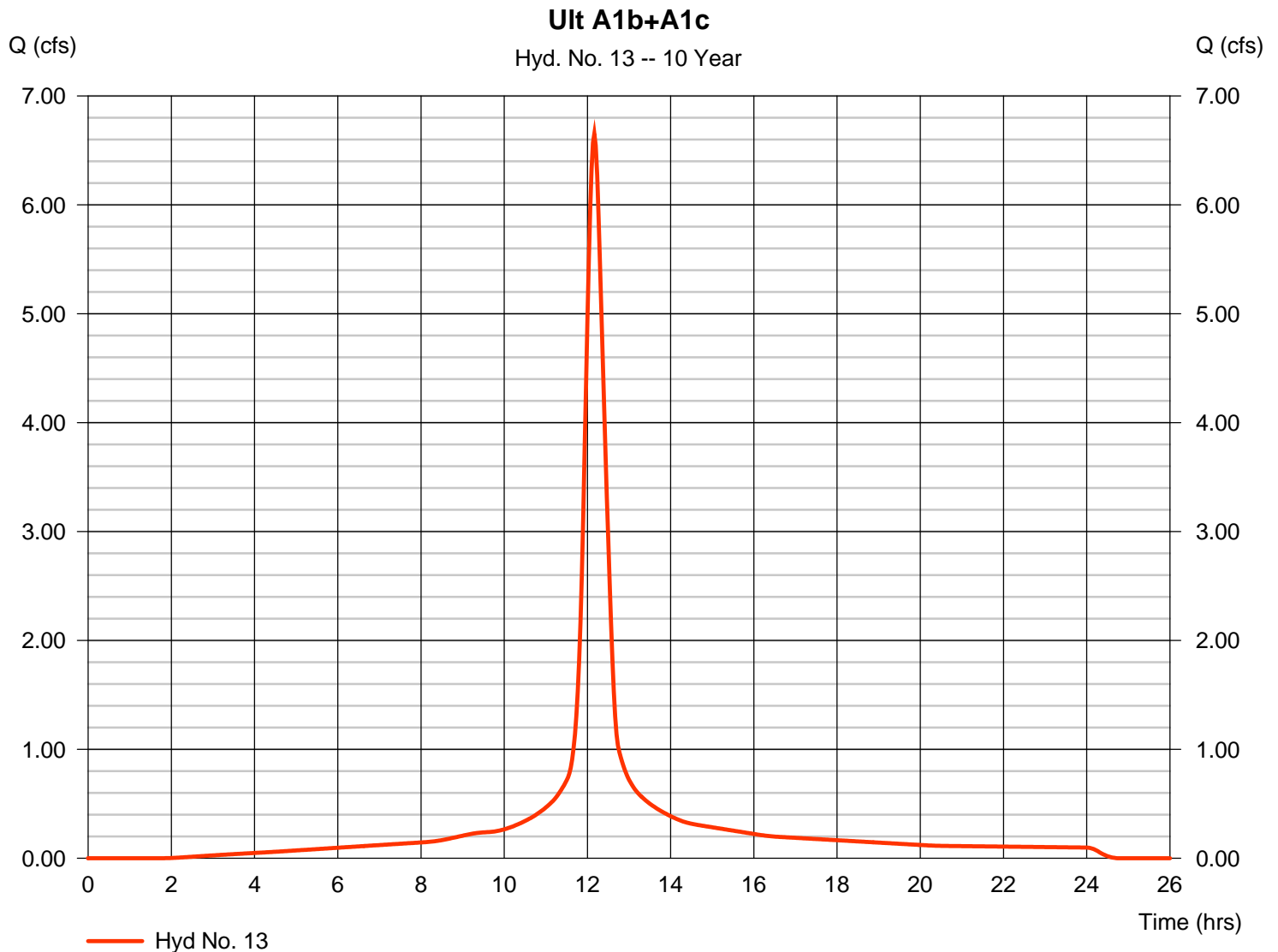
Monday, 03 / 2 / 2020

## Hyd. No. 13

Ult A1b+A1c

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 1.370 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 6.652 cfs  
 Time to peak = 12.17 hrs  
 Hyd. volume = 28,715 cuft  
 Curve number = 94.7  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 27.70 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

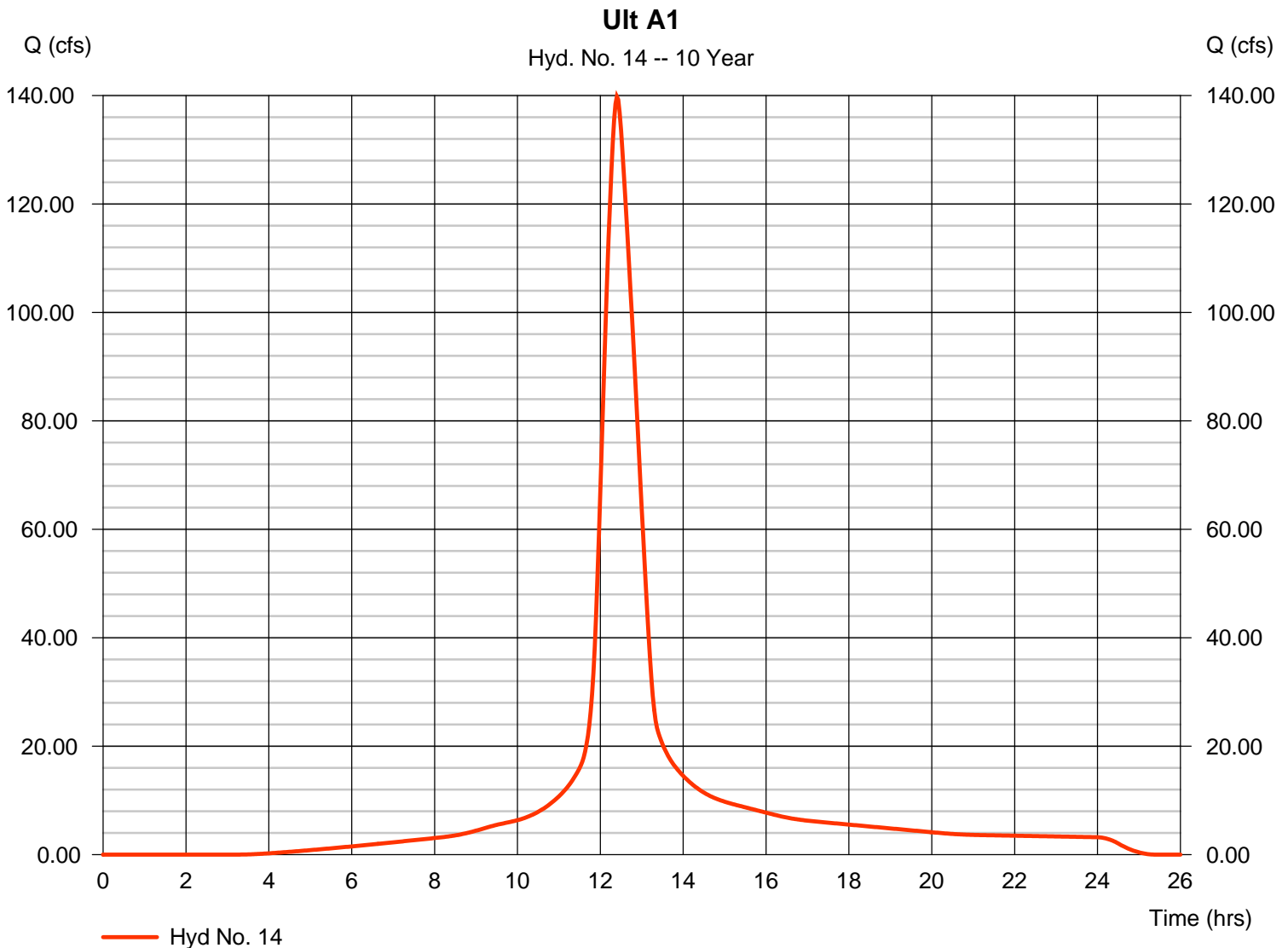
Monday, 03 / 2 / 2020

## Hyd. No. 14

Ult A1

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 44.640 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 139.80 cfs  
 Time to peak = 12.40 hrs  
 Hyd. volume = 858,780 cuft  
 Curve number = 90.2  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 51.80 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

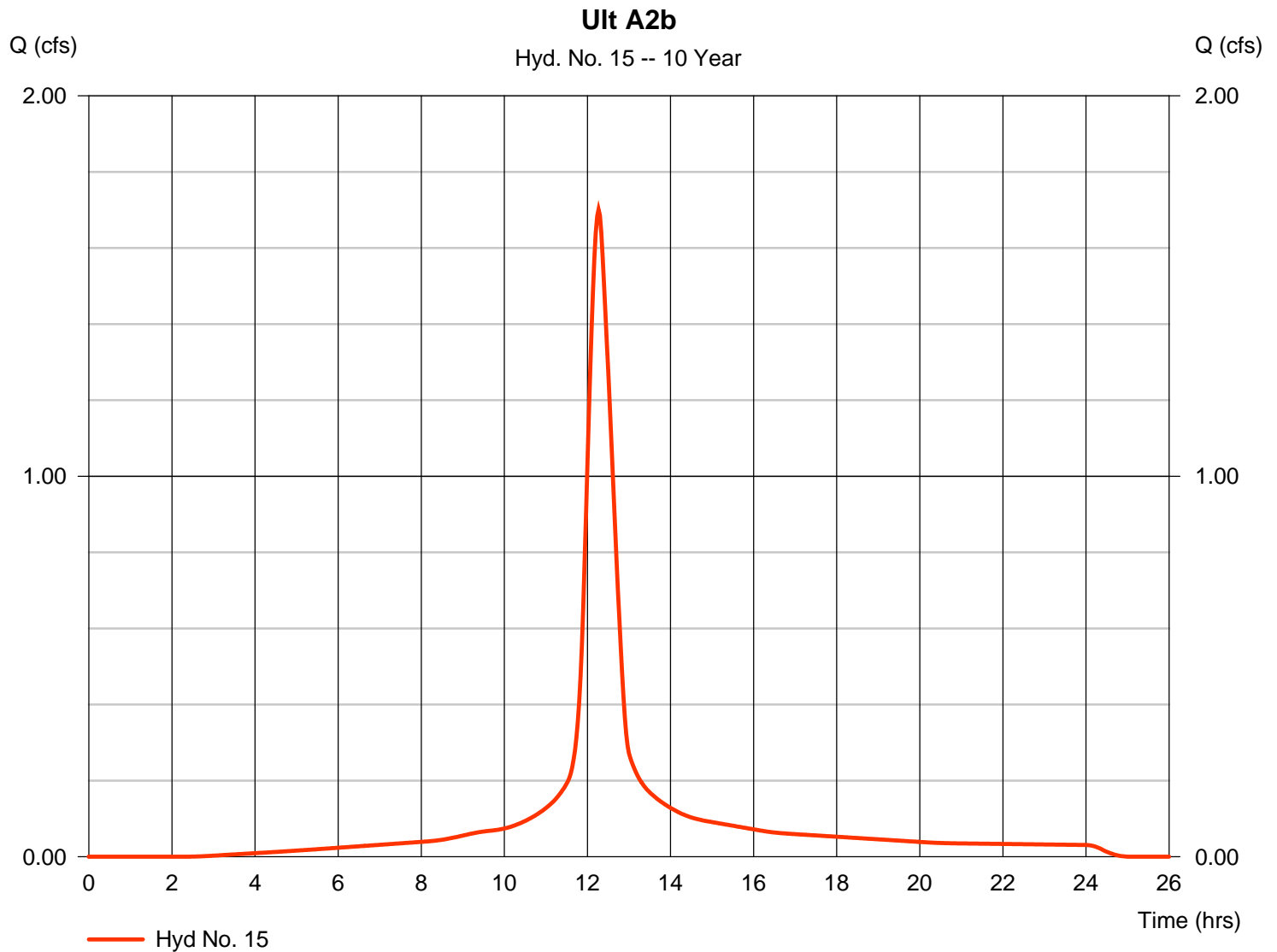
Monday, 03 / 2 / 2020

## Hyd. No. 15

Ult A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 0.430 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 1.701 cfs  
 Time to peak = 12.27 hrs  
 Hyd. volume = 8,706 cuft  
 Curve number = 93  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 38.20 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

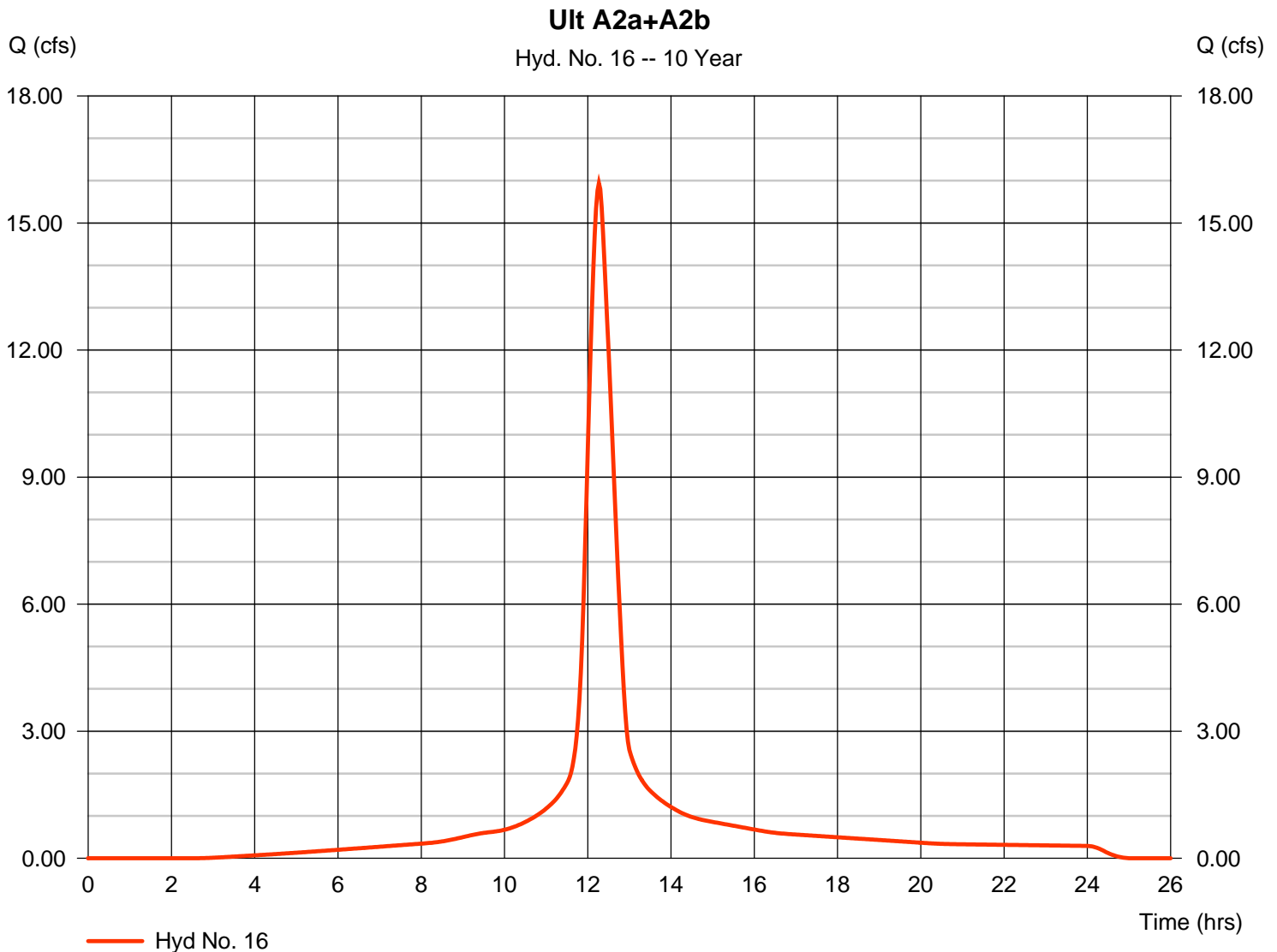
Monday, 03 / 2 / 2020

## Hyd. No. 16

Ult A2a+A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 4.070 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 15.94 cfs  
 Time to peak = 12.27 hrs  
 Hyd. volume = 81,050 cuft  
 Curve number = 92.2  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 37.40 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

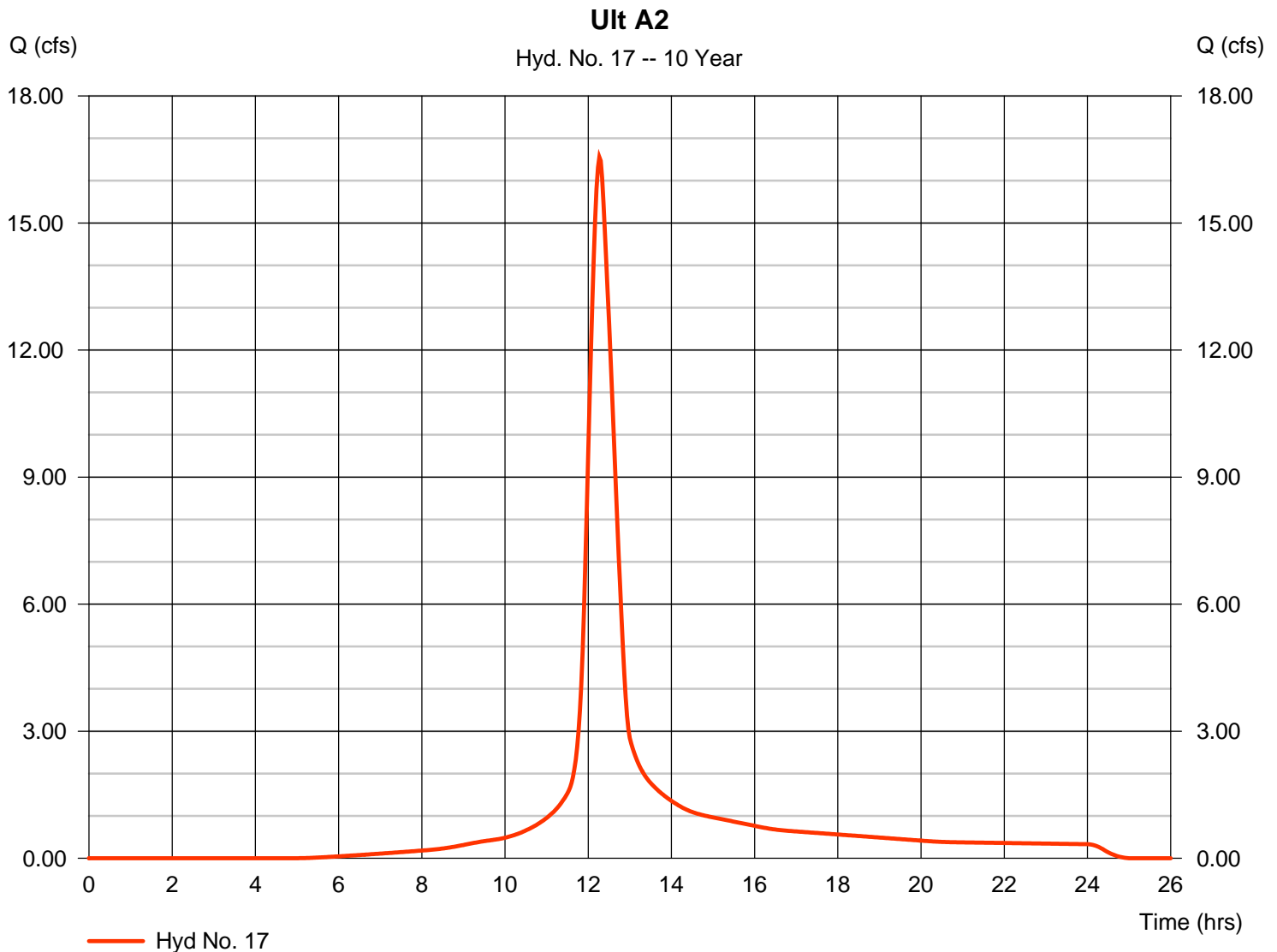
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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## Hyd. No. 17

Ult A2

Hydrograph type	= SCS Runoff	Peak discharge	= 16.55 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 80,877 cuft
Drainage area	= 4.850 ac	Curve number	= 84.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 37.40 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

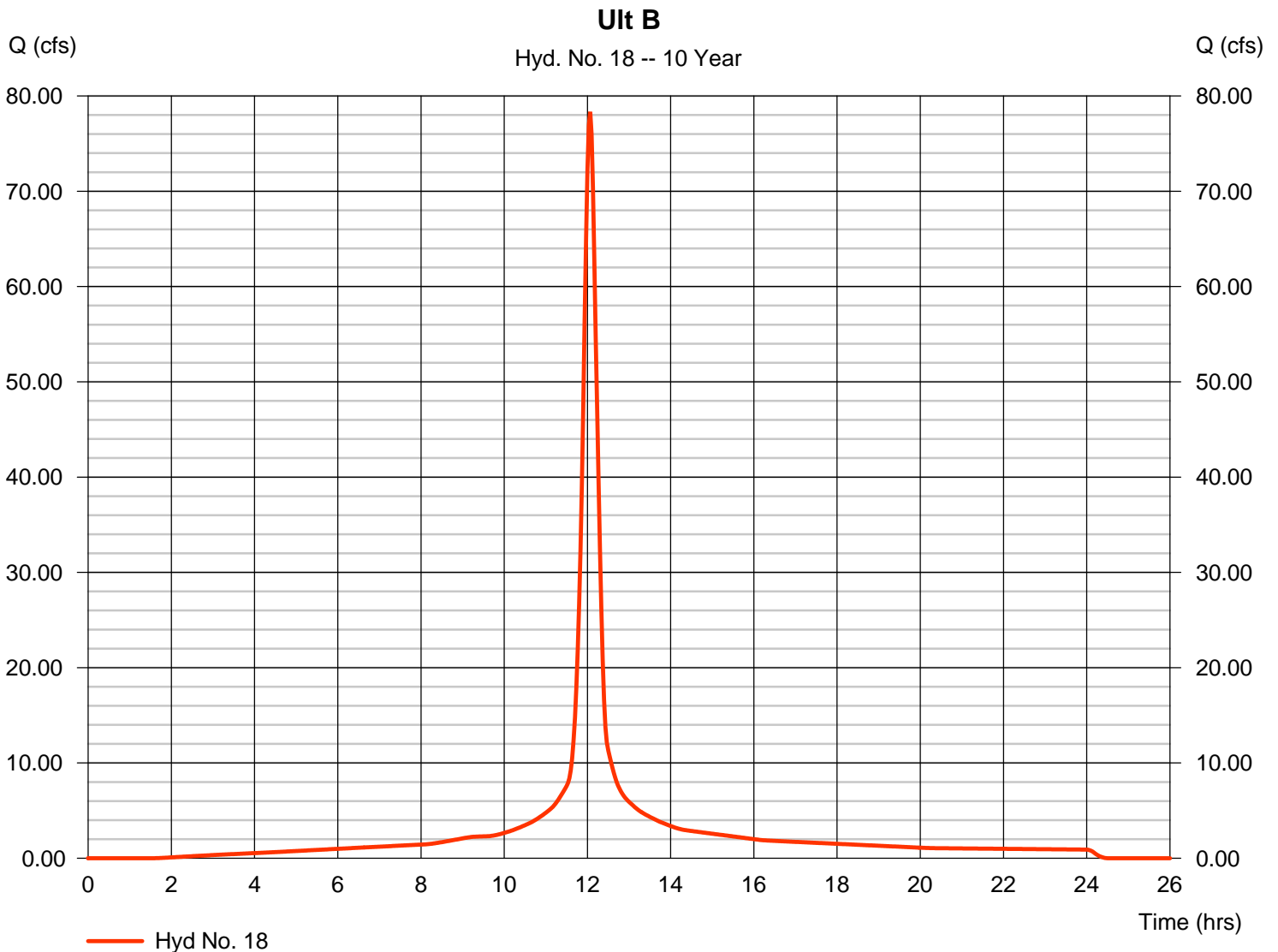
Monday, 03 / 2 / 2020

## Hyd. No. 18

Ult B

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 2 min  
 Drainage area = 12.720 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 6.40 in  
 Storm duration = 24 hrs

Peak discharge = 78.33 cfs  
 Time to peak = 12.07 hrs  
 Hyd. volume = 269,838 cuft  
 Curve number = 95.3  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 18.10 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

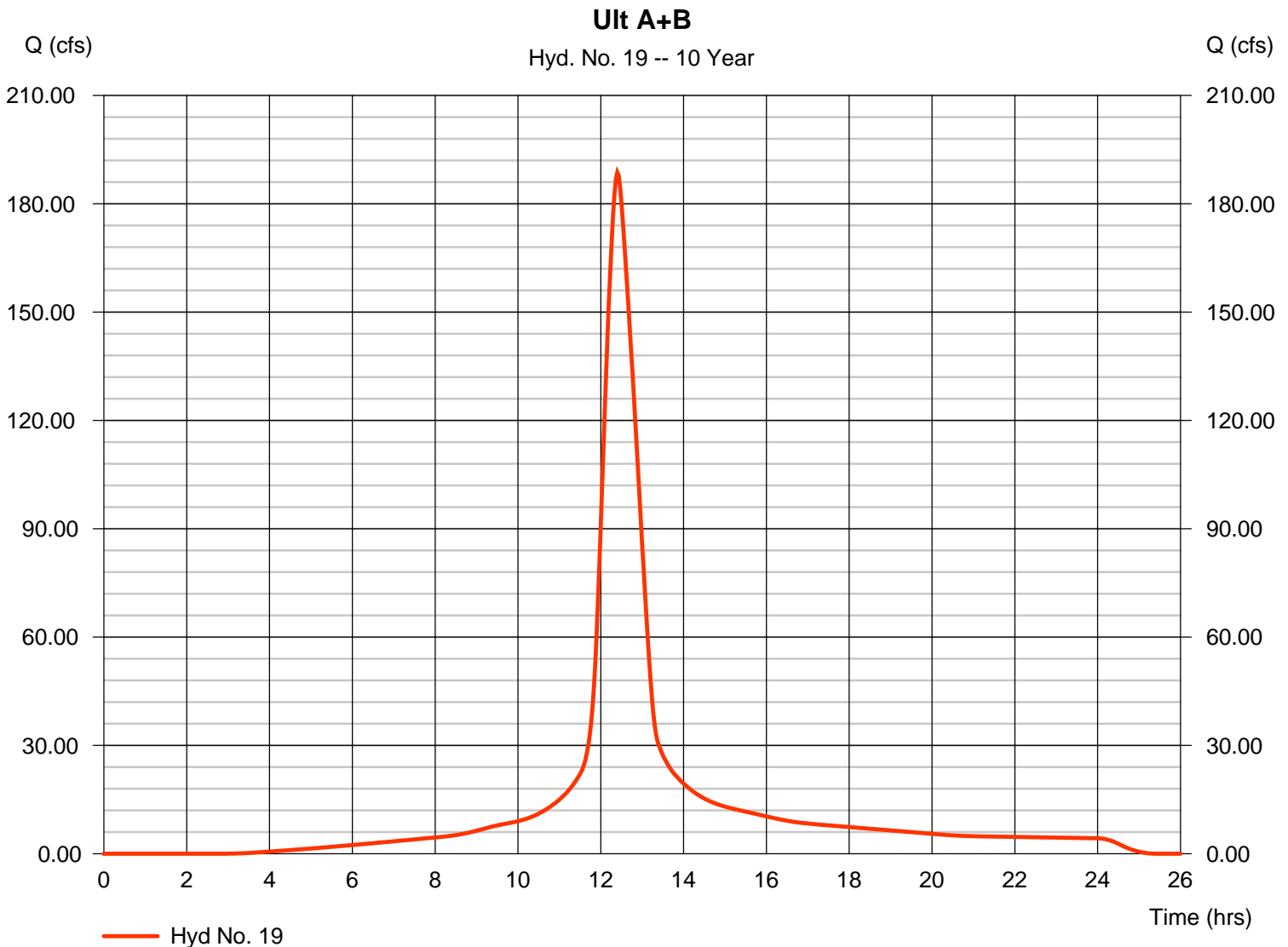
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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## Hyd. No. 19

Ult A+B

Hydrograph type	= SCS Runoff	Peak discharge	= 188.68 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 1,167,068 cuft
Drainage area	= 59.260 ac	Curve number	= 91.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 51.80 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

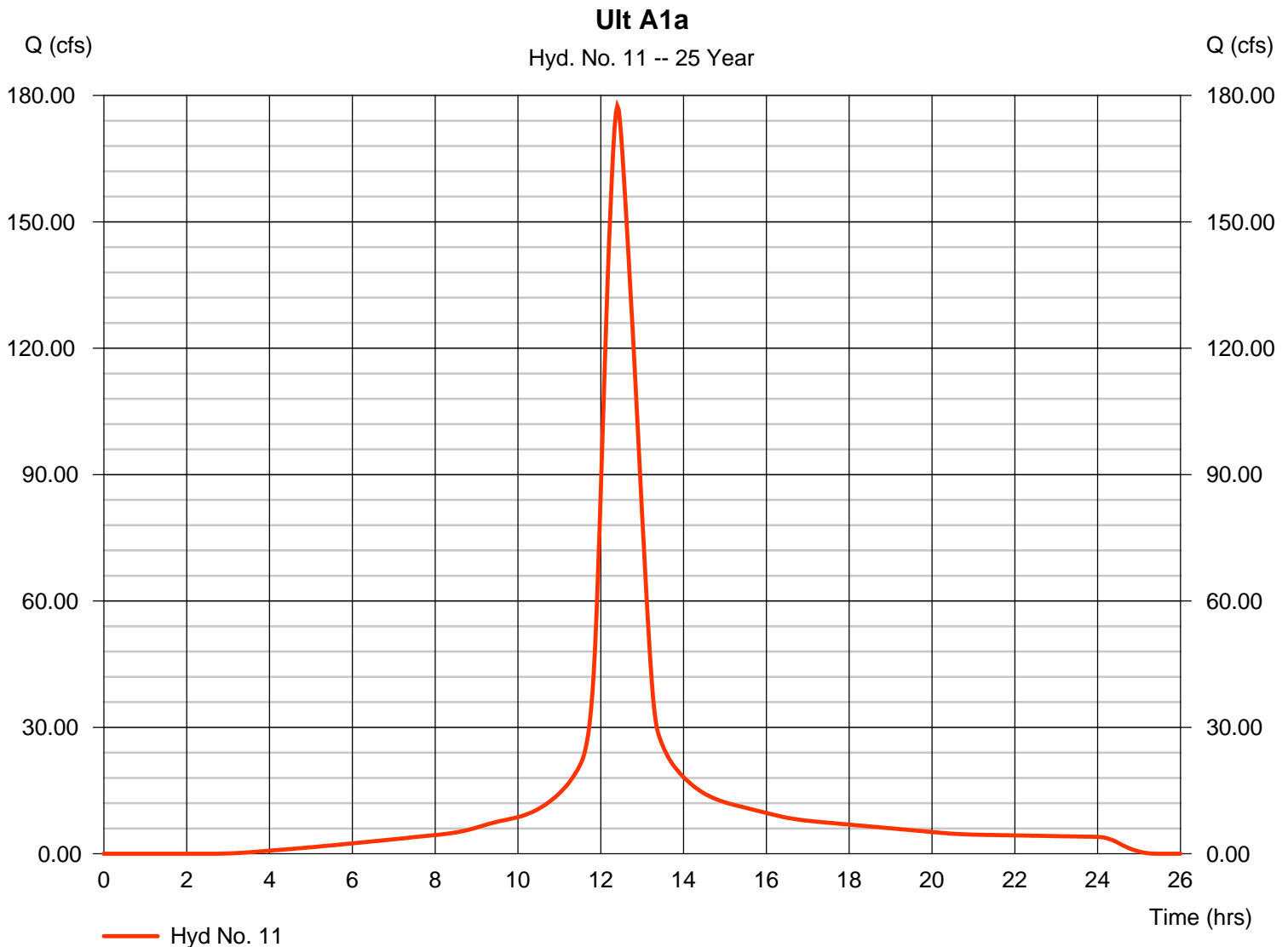
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 11

Ult A1a

Hydrograph type	= SCS Runoff	Peak discharge	= 177.47 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 1,102,293 cuft
Drainage area	= 43.830 ac	Curve number	= 90
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 51.80 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

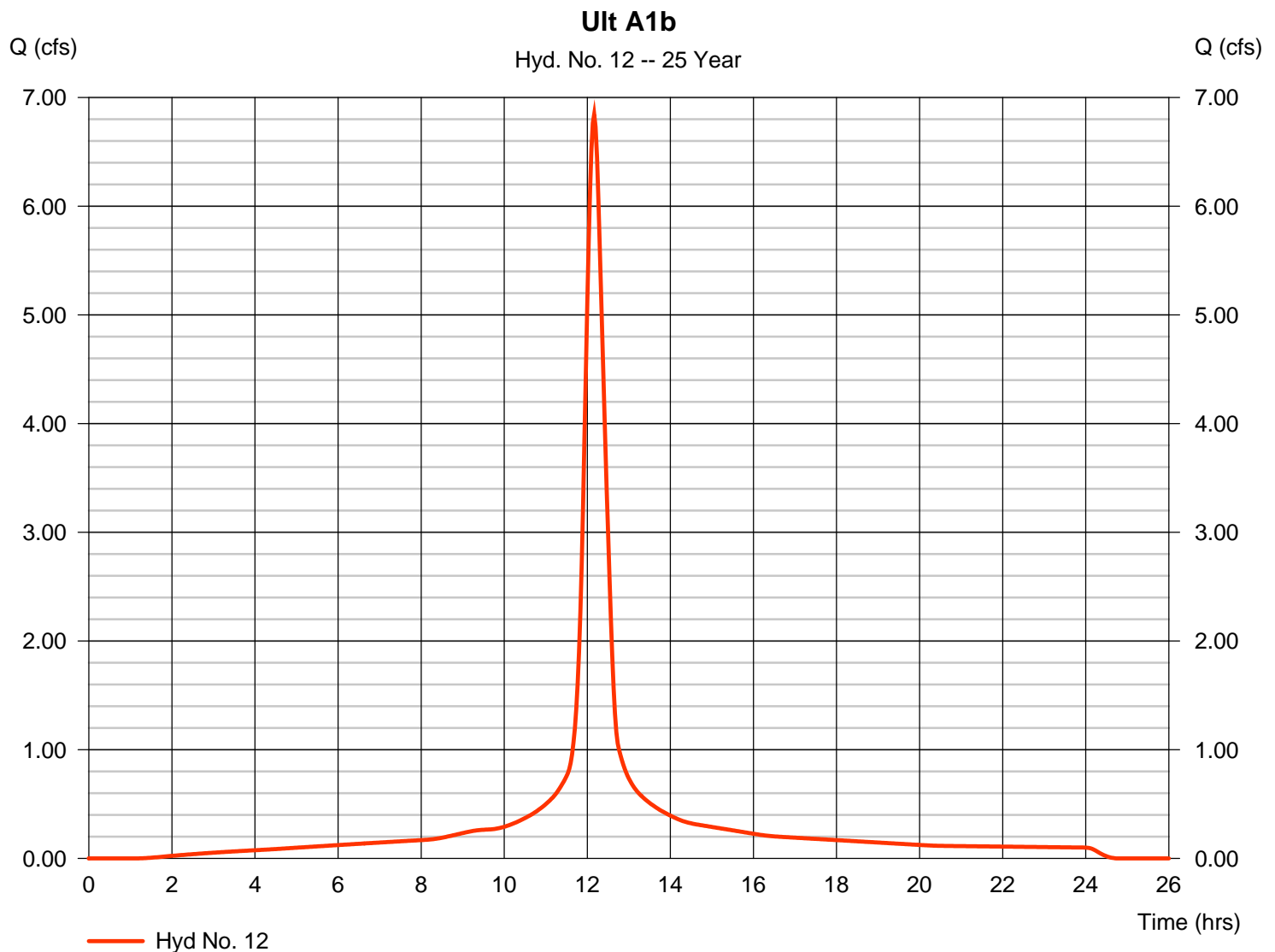
Monday, 03 / 2 / 2020

## Hyd. No. 12

Ult A1b

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 1.100 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 6.844 cfs  
 Time to peak = 12.17 hrs  
 Hyd. volume = 30,262 cuft  
 Curve number = 95.9  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 27.70 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

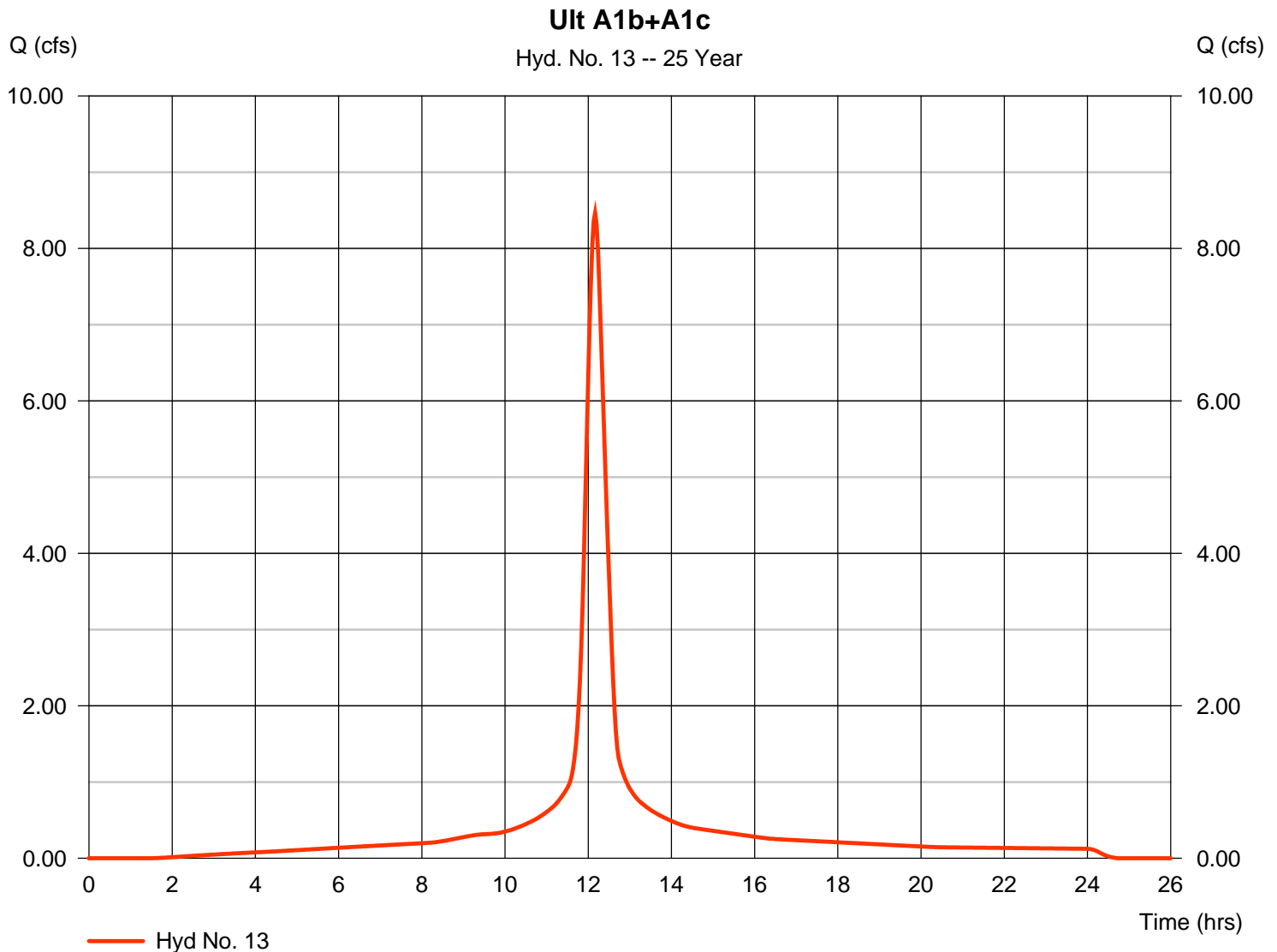
Monday, 03 / 2 / 2020

## Hyd. No. 13

Ult A1b+A1c

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 1.370 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 8.464 cfs  
 Time to peak = 12.17 hrs  
 Hyd. volume = 36,976 cuft  
 Curve number = 94.7  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 27.70 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

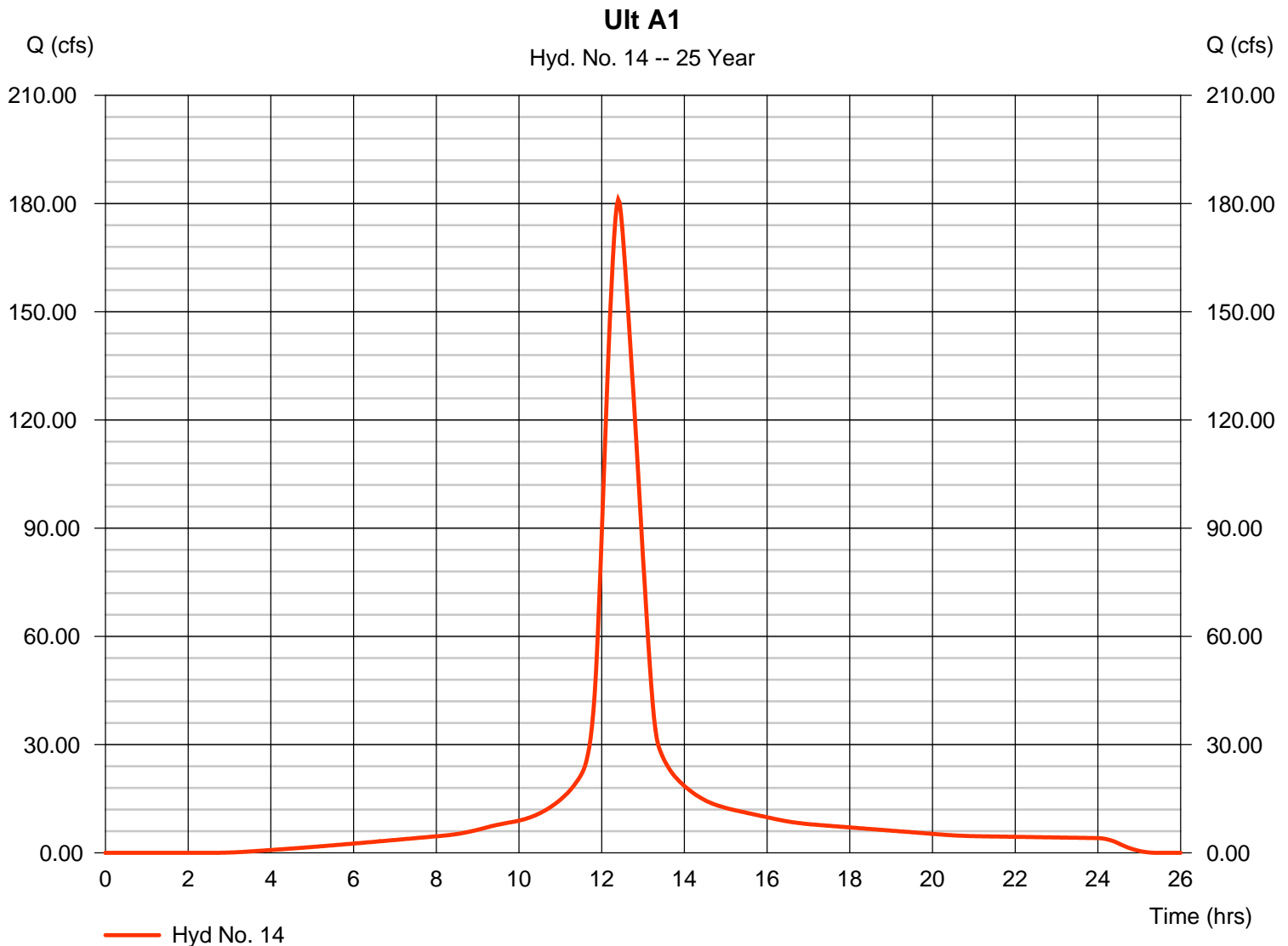
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 14

Ult A1

Hydrograph type	= SCS Runoff	Peak discharge	= 181.15 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 1,126,553 cuft
Drainage area	= 44.640 ac	Curve number	= 90.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 51.80 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

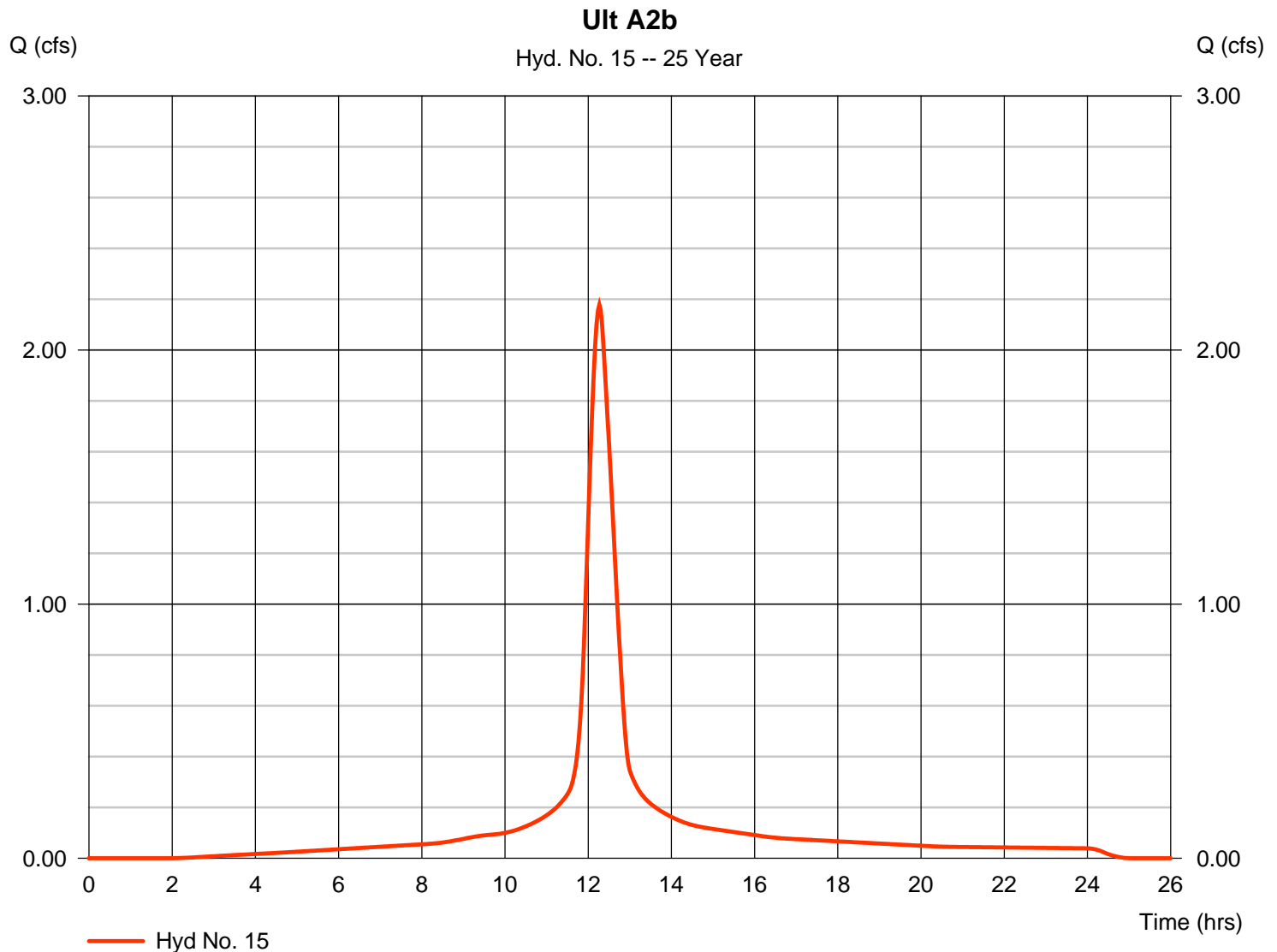
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 15

Ult A2b

Hydrograph type	= SCS Runoff	Peak discharge	= 2.178 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 11,289 cuft
Drainage area	= 0.430 ac	Curve number	= 93
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 38.20 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

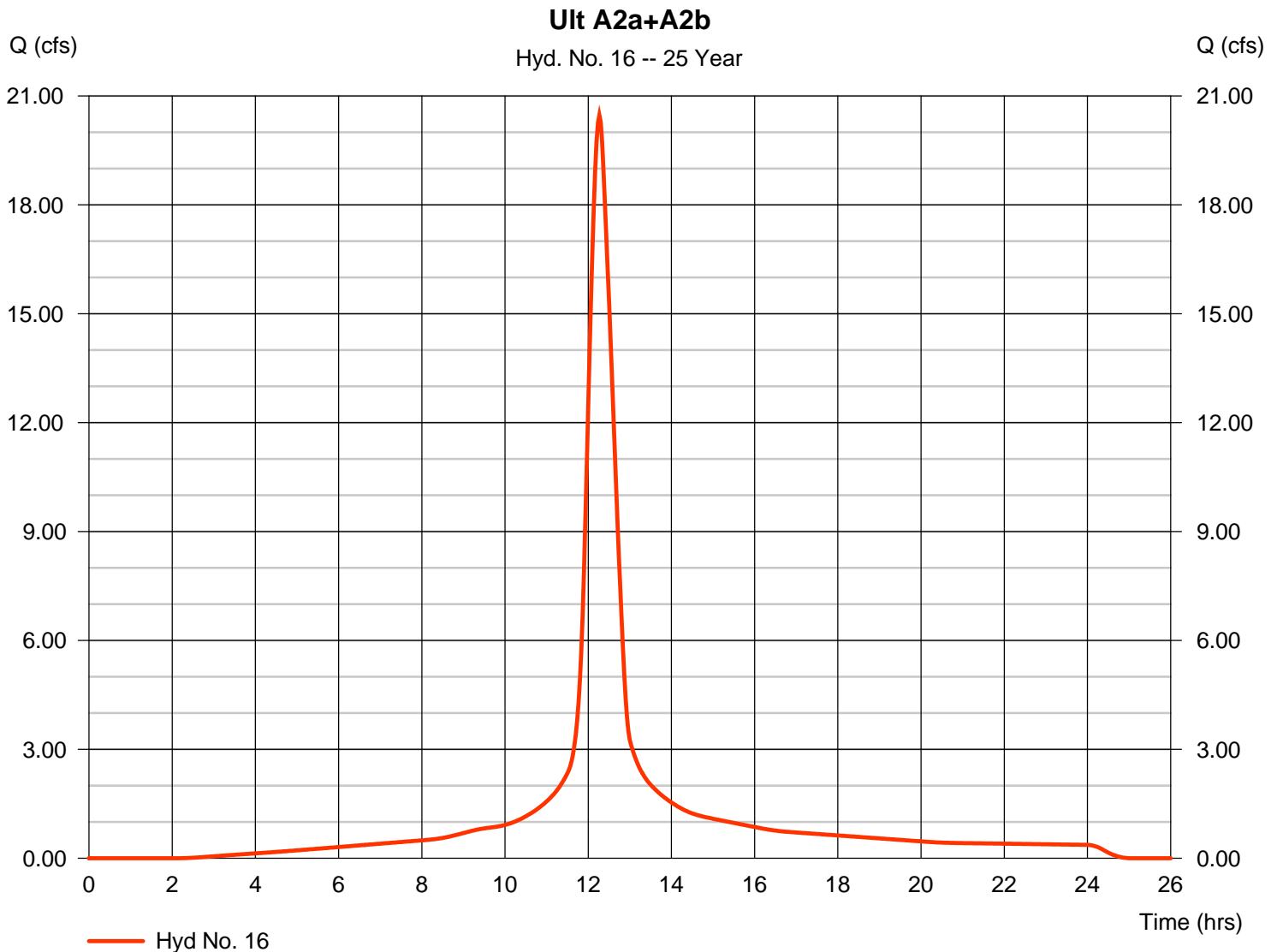
Monday, 03 / 2 / 2020

## Hyd. No. 16

Ult A2a+A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 4.070 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 20.47 cfs  
 Time to peak = 12.27 hrs  
 Hyd. volume = 105,437 cuft  
 Curve number = 92.2  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 37.40 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

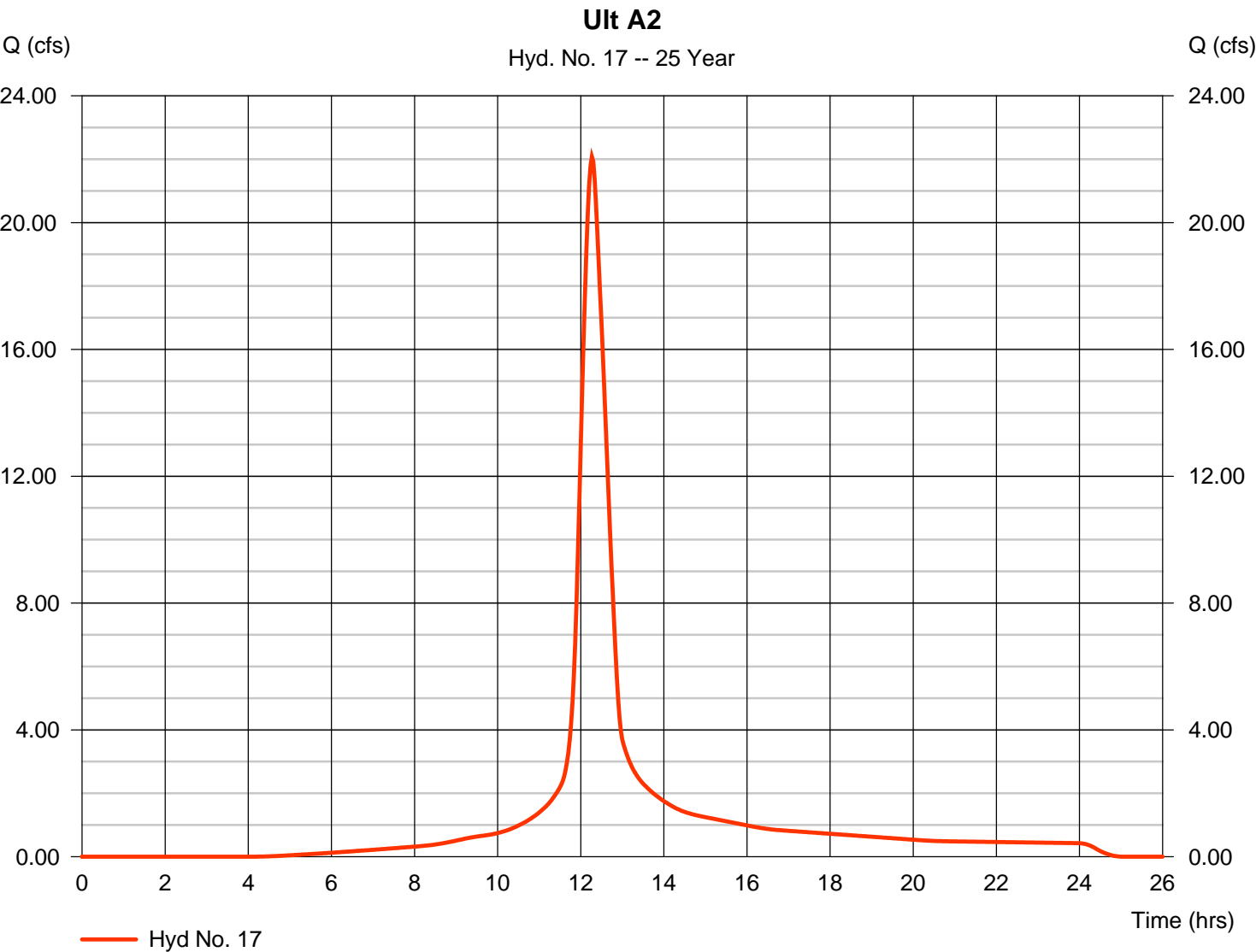
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 17

Ult A2

Hydrograph type	= SCS Runoff	Peak discharge	= 22.08 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 108,910 cuft
Drainage area	= 4.850 ac	Curve number	= 84.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 37.40 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

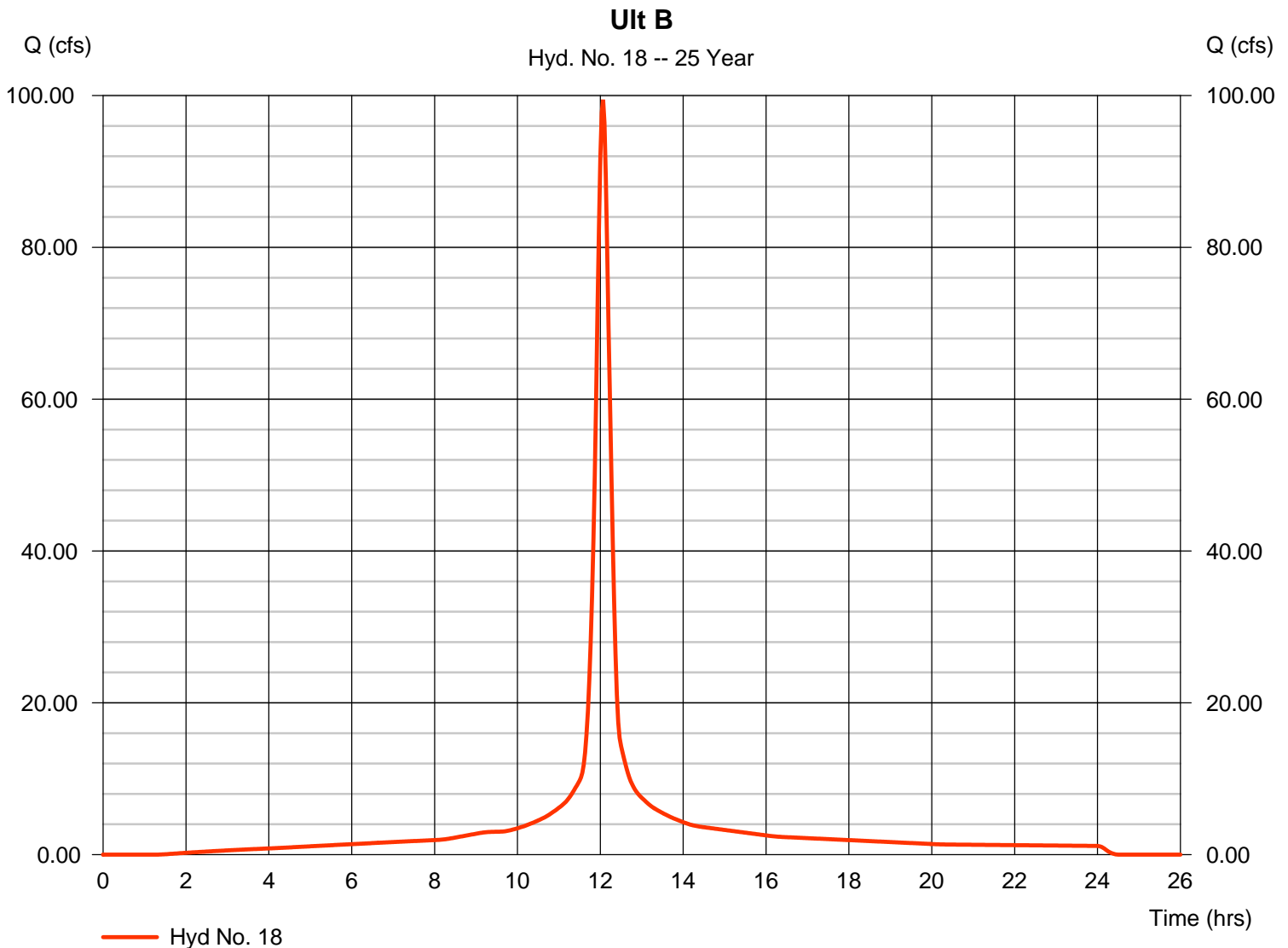
Monday, 03 / 2 / 2020

## Hyd. No. 18

Ult B

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 2 min  
 Drainage area = 12.720 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 8.07 in  
 Storm duration = 24 hrs

Peak discharge = 99.46 cfs  
 Time to peak = 12.07 hrs  
 Hyd. volume = 346,621 cuft  
 Curve number = 95.3  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 18.10 min  
 Distribution = Type II  
 Shape factor = 484





# Hydrograph Report

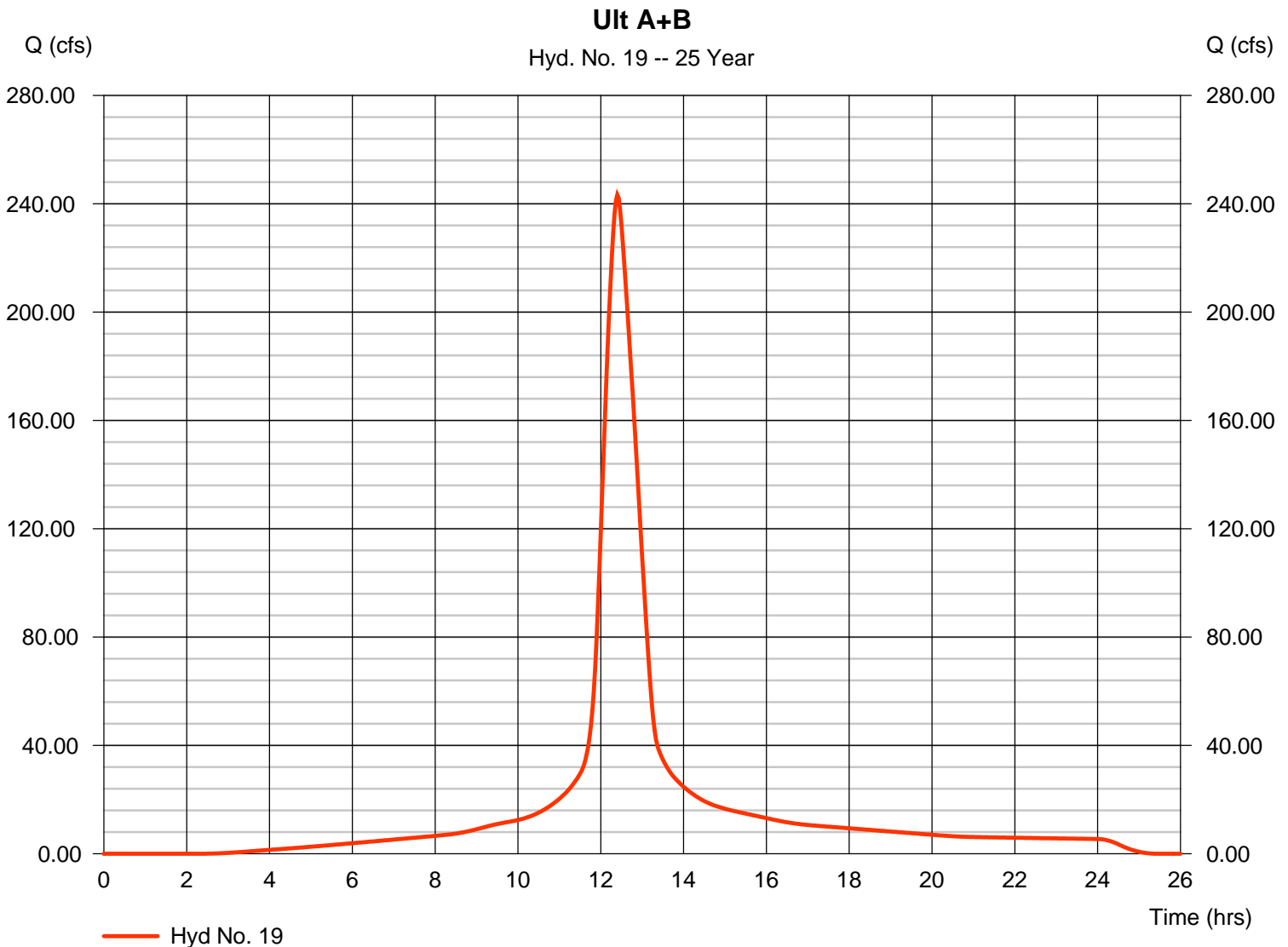
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 19

Ult A+B

Hydrograph type	= SCS Runoff	Peak discharge	= 243.33 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 1,523,918 cuft
Drainage area	= 59.260 ac	Curve number	= 91.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 51.80 min
Total precip.	= 8.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

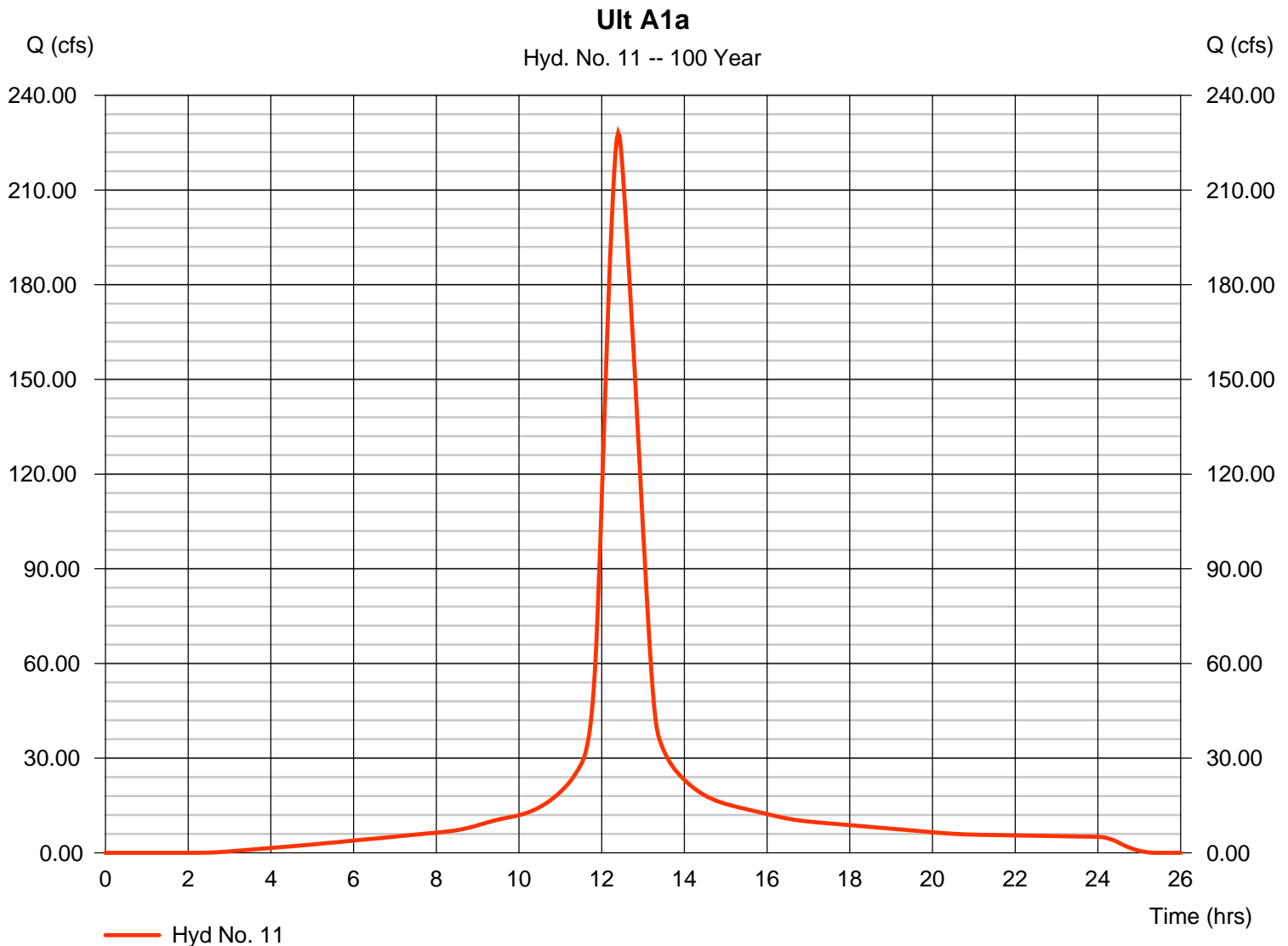
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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## Hyd. No. 11

Ult A1a

Hydrograph type	= SCS Runoff	Peak discharge	= 228.16 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 1,434,823 cuft
Drainage area	= 43.830 ac	Curve number	= 90
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 51.80 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

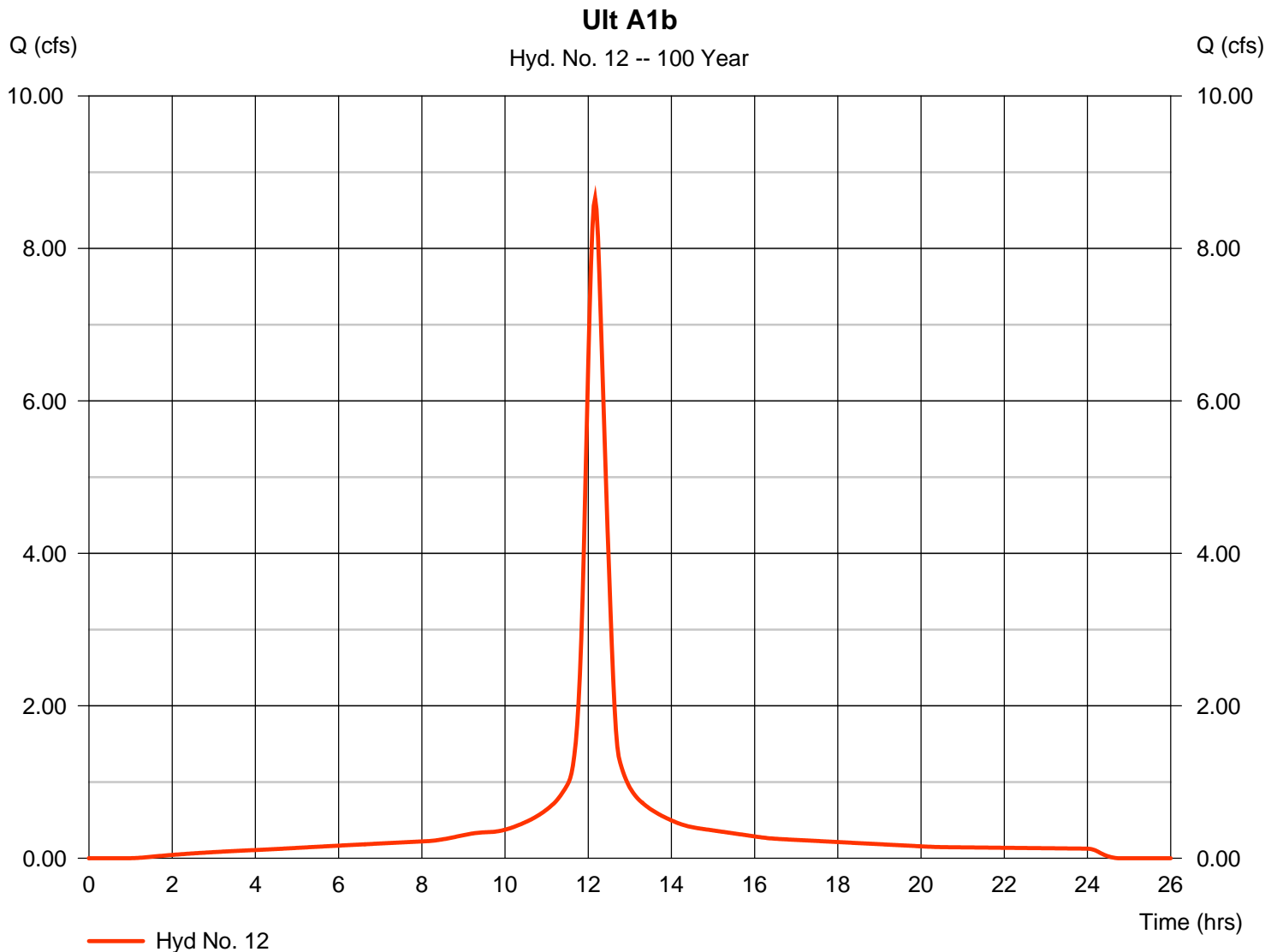
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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## Hyd. No. 12

Ult A1b

Hydrograph type	= SCS Runoff	Peak discharge	= 8.658 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 38,630 cuft
Drainage area	= 1.100 ac	Curve number	= 95.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 27.70 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

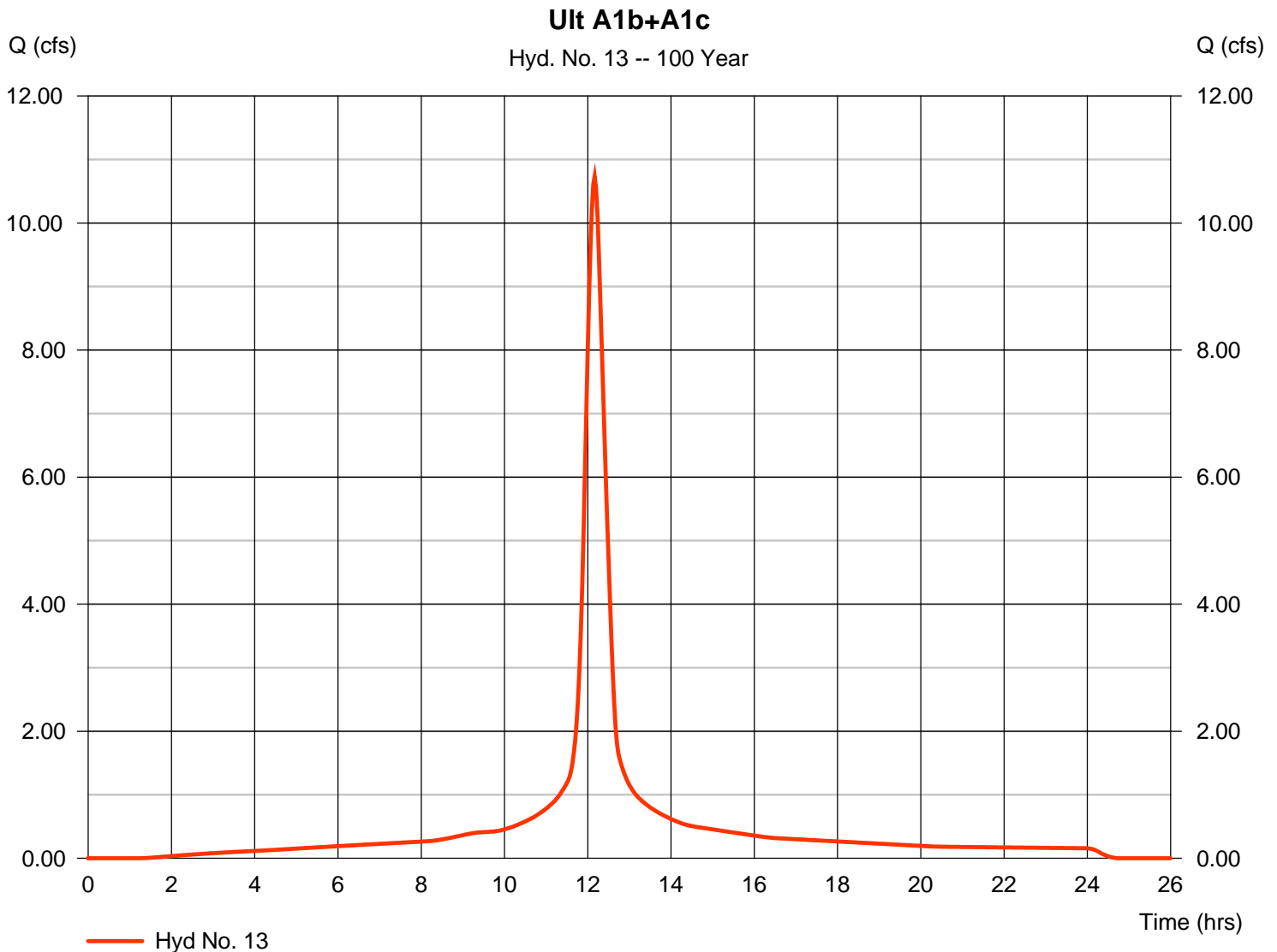
Monday, 03 / 2 / 2020

## Hyd. No. 13

Ult A1b+A1c

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 2 min  
 Drainage area = 1.370 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 10.17 in  
 Storm duration = 24 hrs

Peak discharge = 10.73 cfs  
 Time to peak = 12.17 hrs  
 Hyd. volume = 47,383 cuft  
 Curve number = 94.7  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 27.70 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

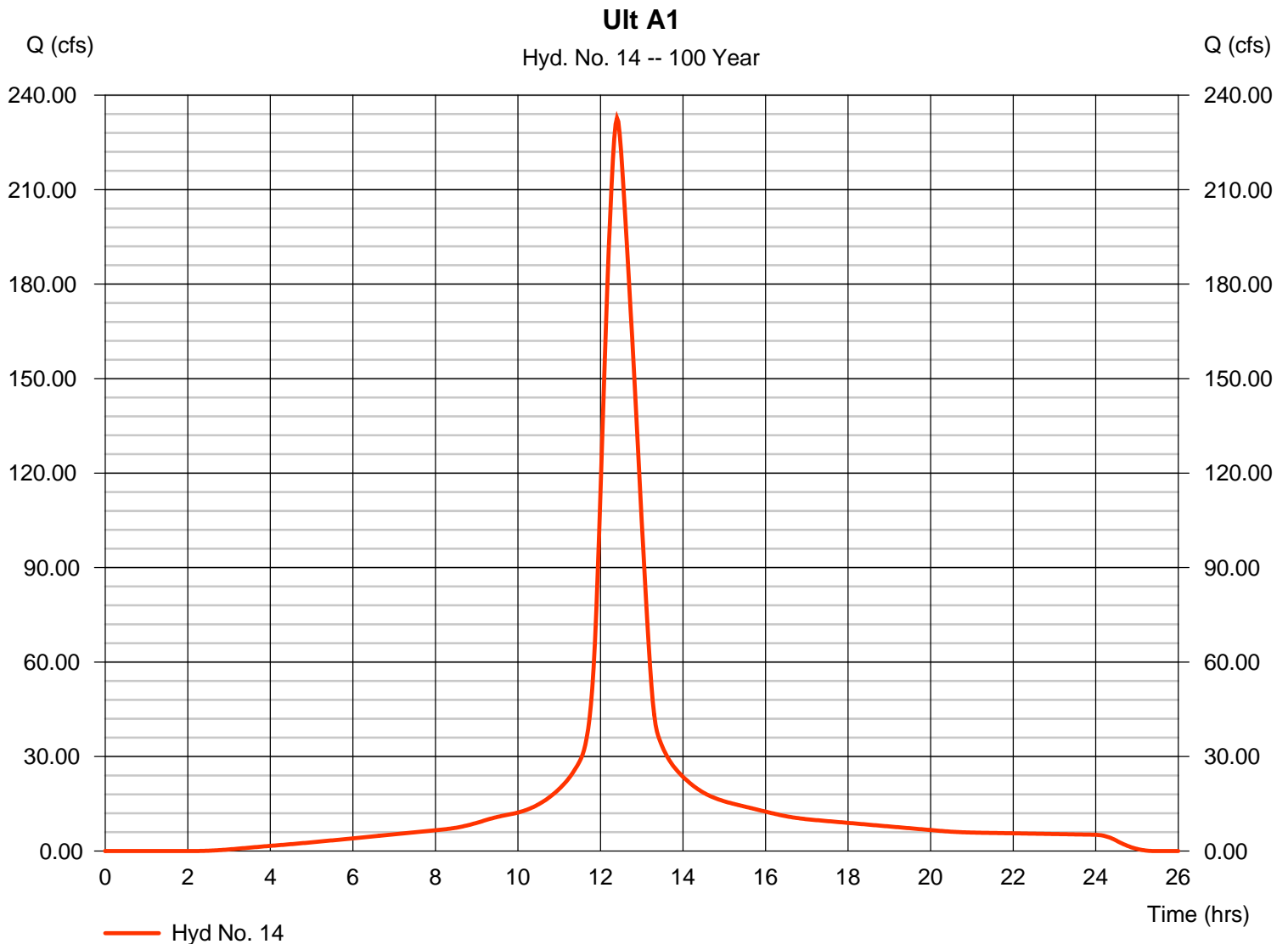
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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## Hyd. No. 14

Ult A1

Hydrograph type	= SCS Runoff	Peak discharge	= 232.74 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 1,465,399 cuft
Drainage area	= 44.640 ac	Curve number	= 90.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 51.80 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

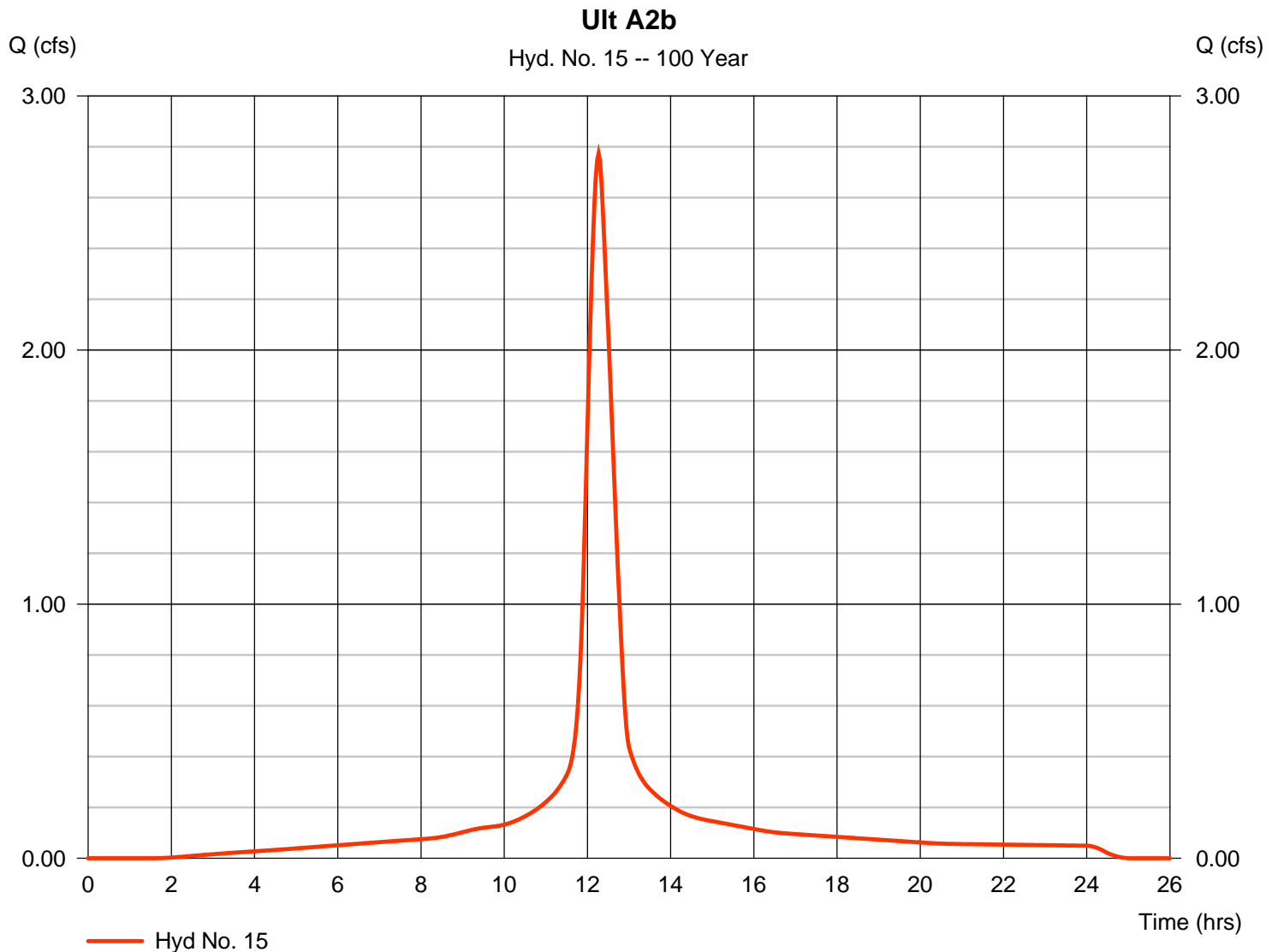
Monday, 03 / 2 / 2020

## Hyd. No. 15

Ult A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 2 min  
 Drainage area = 0.430 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 10.17 in  
 Storm duration = 24 hrs

Peak discharge = 2.773 cfs  
 Time to peak = 12.27 hrs  
 Hyd. volume = 14,547 cuft  
 Curve number = 93  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 38.20 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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## Hyd. No. 16

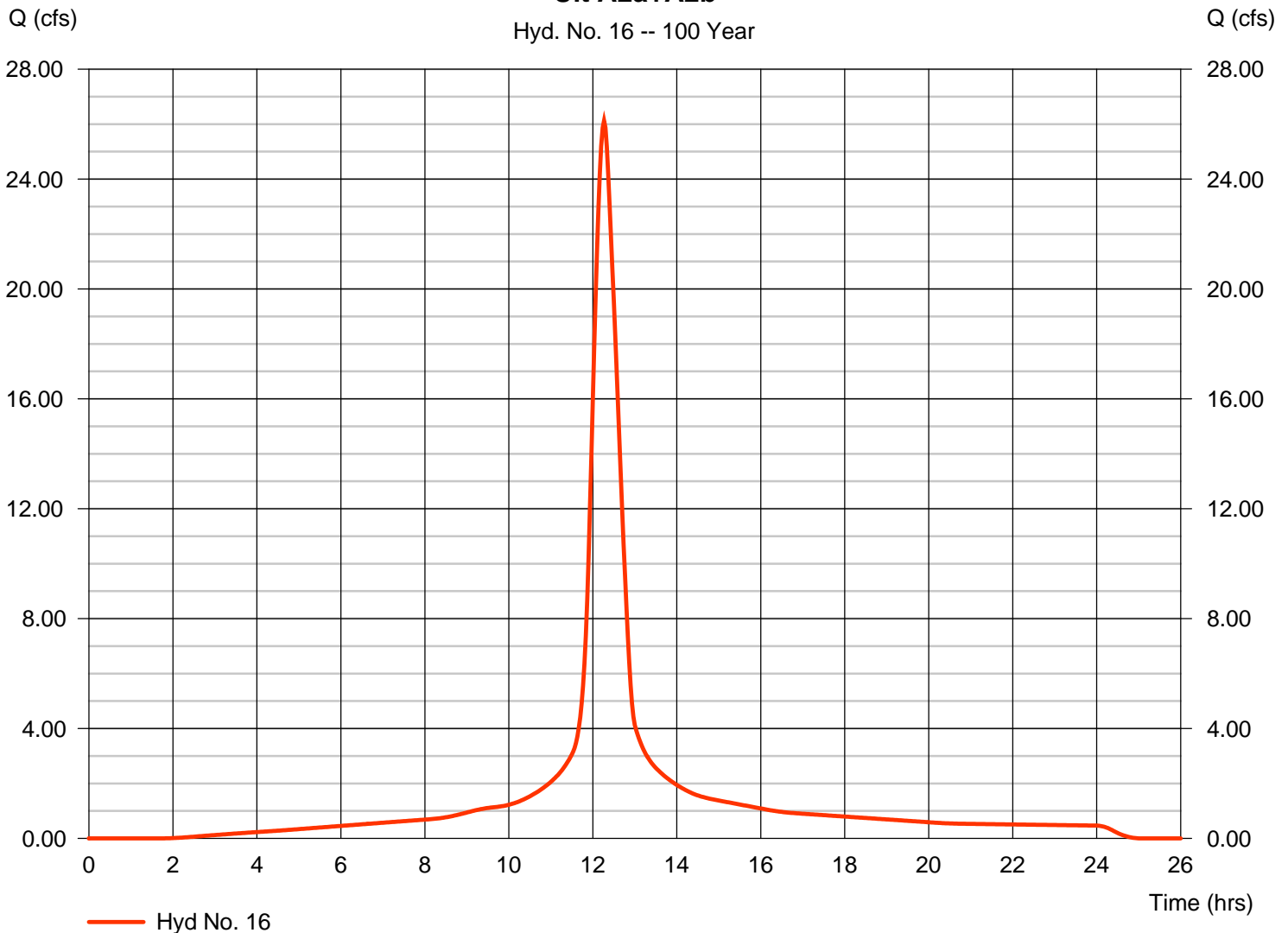
Ult A2a+A2b

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 2 min  
 Drainage area = 4.070 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 10.17 in  
 Storm duration = 24 hrs

Peak discharge = 26.12 cfs  
 Time to peak = 12.27 hrs  
 Hyd. volume = 136,229 cuft  
 Curve number = 92.2  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 37.40 min  
 Distribution = Type II  
 Shape factor = 484

### Ult A2a+A2b

Hyd. No. 16 -- 100 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

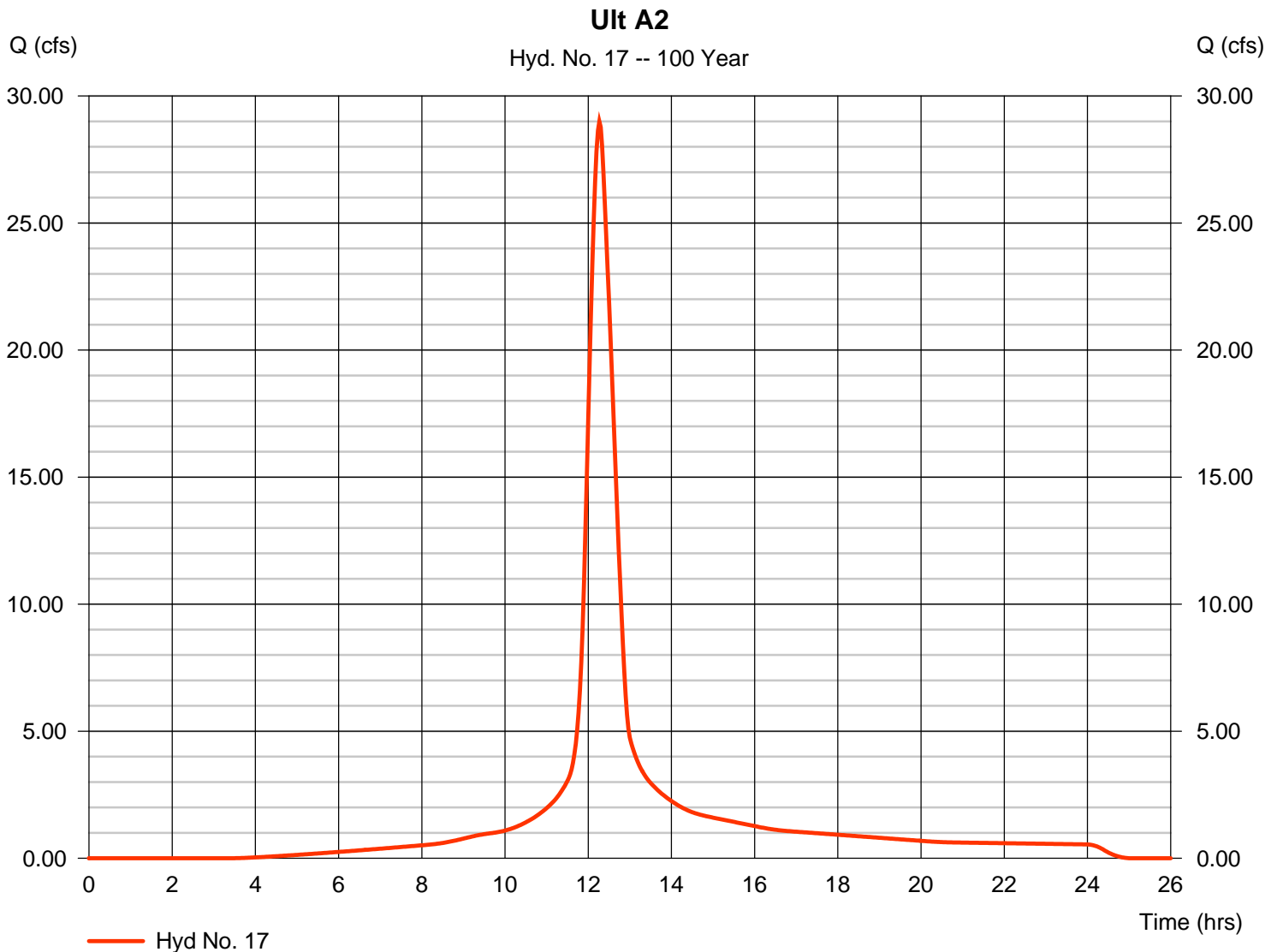
Monday, 03 / 2 / 2020

## Hyd. No. 17

Ult A2

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 2 min  
 Drainage area = 4.850 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 10.17 in  
 Storm duration = 24 hrs

Peak discharge = 28.99 cfs  
 Time to peak = 12.27 hrs  
 Hyd. volume = 144,716 cuft  
 Curve number = 84.2  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 37.40 min  
 Distribution = Type II  
 Shape factor = 484





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

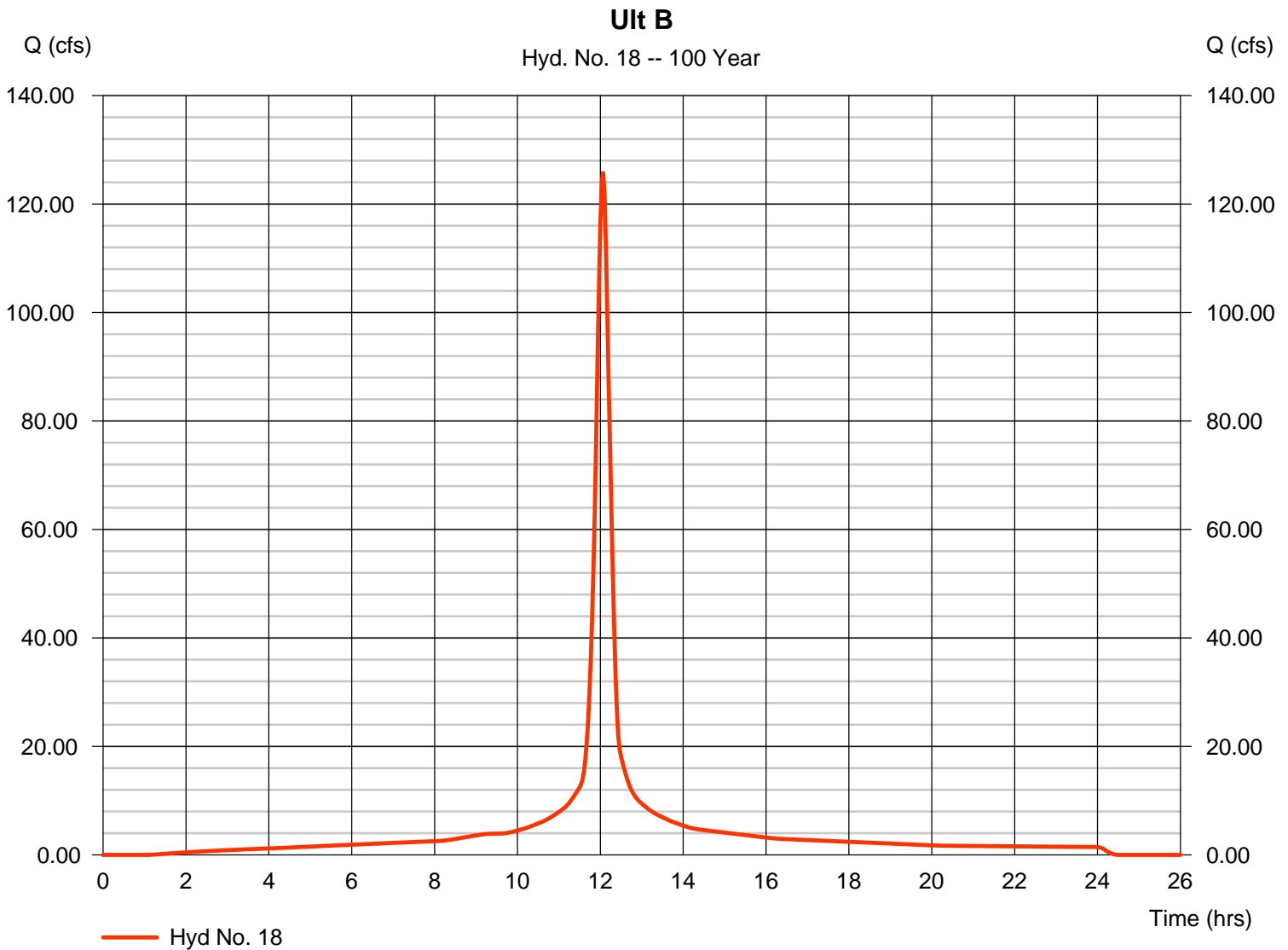
Monday, 03 / 2 / 2020

## Hyd. No. 18

Ult B

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 2 min  
 Drainage area = 12.720 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 10.17 in  
 Storm duration = 24 hrs

Peak discharge = 125.93 cfs  
 Time to peak = 12.07 hrs  
 Hyd. volume = 443,322 cuft  
 Curve number = 95.3  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 18.10 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

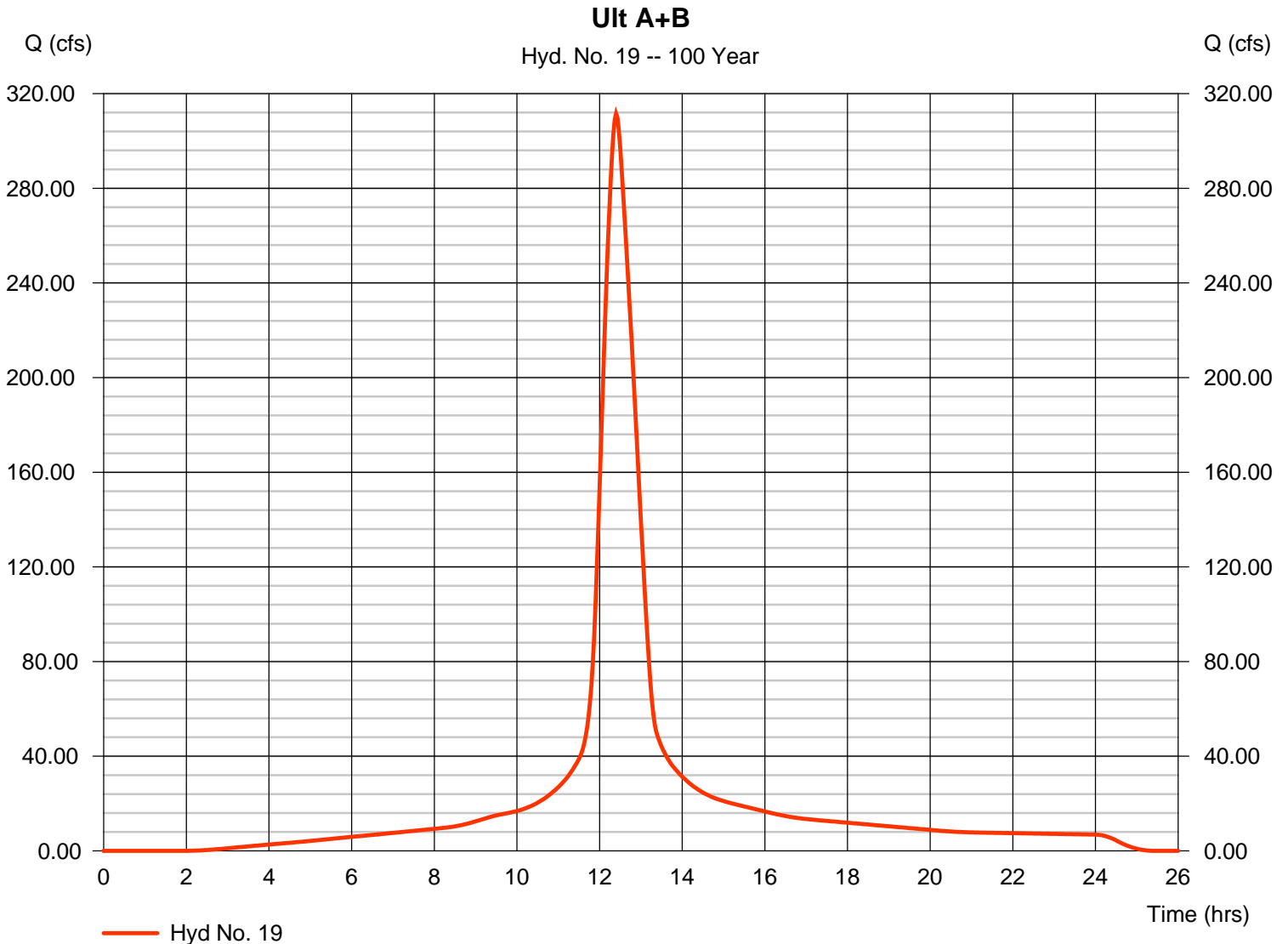
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Monday, 03 / 2 / 2020

## Hyd. No. 19

Ult A+B

Hydrograph type	= SCS Runoff	Peak discharge	= 311.53 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 1,974,905 cuft
Drainage area	= 59.260 ac	Curve number	= 91.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 51.80 min
Total precip.	= 10.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Attachment L

## Street, Inlet, & Channel Capacity Calculations

## Cross Section for Nissan Way 2yr Max Slope

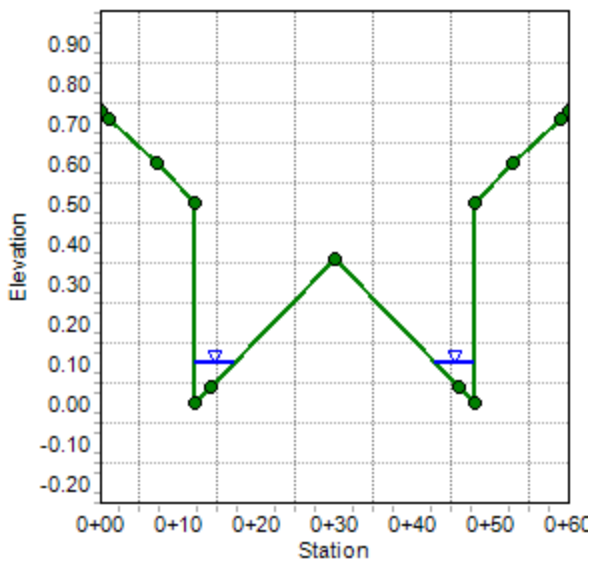
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.02570	ft/ft
Normal Depth	0.10	ft
Discharge	0.87	ft <sup>3</sup> /s

### Cross Section Image



## Worksheet for Nissan Way 2yr Max Slope

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.02570	ft/ft
Discharge	0.87	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.73
0+01	0.71
0+07	0.60
0+12	0.50
0+12	0.00
0+14	0.04
0+30	0.36
0+46	0.04
0+48	0.00
0+48	0.50
0+53	0.60
0+59	0.71
0+60	0.73

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.73)	(0+01, 0.71)	0.300
(0+01, 0.71)	(0+07, 0.60)	0.016
(0+07, 0.60)	(0+12, 0.50)	0.300
(0+12, 0.50)	(0+12, 0.00)	0.016
(0+12, 0.00)	(0+14, 0.04)	0.016
(0+14, 0.04)	(0+30, 0.36)	0.020
(0+30, 0.36)	(0+46, 0.04)	0.020
(0+46, 0.04)	(0+48, 0.00)	0.016

## Worksheet for Nissan Way 2yr Max Slope

### Input Data

Start Station	Ending Station	Roughness Coefficient
(0+48, 0.00)	(0+48, 0.50)	0.016
(0+48, 0.50)	(0+53, 0.60)	0.300
(0+53, 0.60)	(0+59, 0.71)	0.016
(0+59, 0.71)	(0+60, 0.73)	0.300

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.10	ft
Elevation Range	0.00 to 0.73 ft	
Flow Area	0.50	ft <sup>2</sup>
Wetted Perimeter	10.23	ft
Hydraulic Radius	0.05	ft
Top Width	10.03	ft
Normal Depth	0.10	ft
Critical Depth	0.11	ft
Critical Slope	0.01328	ft/ft
Velocity	1.73	ft/s
Velocity Head	0.05	ft
Specific Energy	0.15	ft
Froude Number	1.36	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
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## Worksheet for Nissan Way 2yr Max Slope

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### GVF Output Data

Profile Description

Profile Headloss 0.00 ft

Downstream Velocity Infinity ft/s

Upstream Velocity Infinity ft/s

Normal Depth 0.10 ft

Critical Depth 0.11 ft

Channel Slope 0.02570 ft/ft

Critical Slope 0.01328 ft/ft

## Cross Section for Nissan Way 2yr Min Slope

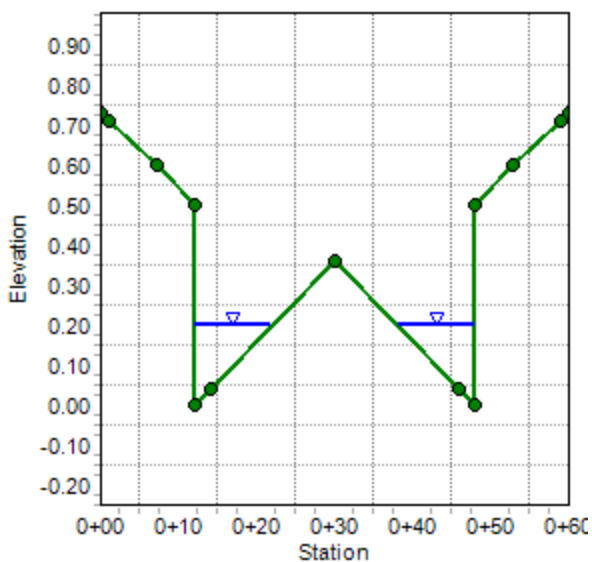
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.00830	ft/ft
Normal Depth	0.20	ft
Discharge	2.88	ft <sup>3</sup> /s

### Cross Section Image





## Worksheet for Nissan Way 2yr Min Slope

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.00830	ft/ft
Discharge	2.88	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.73
0+01	0.71
0+07	0.60
0+12	0.50
0+12	0.00
0+14	0.04
0+30	0.36
0+46	0.04
0+48	0.00
0+48	0.50
0+53	0.60
0+59	0.71
0+60	0.73

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.73)	(0+01, 0.71)	0.300
(0+01, 0.71)	(0+07, 0.60)	0.016
(0+07, 0.60)	(0+12, 0.50)	0.300
(0+12, 0.50)	(0+12, 0.00)	0.016
(0+12, 0.00)	(0+14, 0.04)	0.016
(0+14, 0.04)	(0+30, 0.36)	0.020
(0+30, 0.36)	(0+46, 0.04)	0.020
(0+46, 0.04)	(0+48, 0.00)	0.016

## Worksheet for Nissan Way 2yr Min Slope

### Input Data

Start Station	Ending Station	Roughness Coefficient
(0+48, 0.00)	(0+48, 0.50)	0.016
(0+48, 0.50)	(0+53, 0.60)	0.300
(0+53, 0.60)	(0+59, 0.71)	0.016
(0+59, 0.71)	(0+60, 0.73)	0.300

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.20	ft
Elevation Range	0.00 to 0.73 ft	
Flow Area	1.94	ft <sup>2</sup>
Wetted Perimeter	20.07	ft
Hydraulic Radius	0.10	ft
Top Width	19.68	ft
Normal Depth	0.20	ft
Critical Depth	0.18	ft
Critical Slope	0.01224	ft/ft
Velocity	1.49	ft/s
Velocity Head	0.03	ft
Specific Energy	0.23	ft
Froude Number	0.84	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
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## Worksheet for Nissan Way 2yr Min Slope

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### GVF Output Data

Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.20	ft
Critical Depth	0.18	ft
Channel Slope	0.00830	ft/ft
Critical Slope	0.01224	ft/ft

## Cross Section for Nissan Way 10yr Max Slope

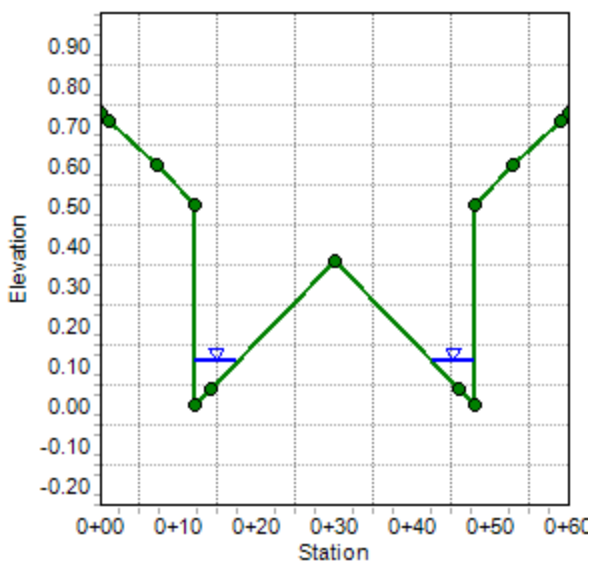
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.02570	ft/ft
Normal Depth	0.11	ft
Discharge	1.07	ft <sup>3</sup> /s

### Cross Section Image



## Worksheet for Nissan Way 10yr Max Slope

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.02570	ft/ft
Discharge	1.07	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.73
0+01	0.71
0+07	0.60
0+12	0.50
0+12	0.00
0+14	0.04
0+30	0.36
0+46	0.04
0+48	0.00
0+48	0.50
0+53	0.60
0+59	0.71
0+60	0.73

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.73)	(0+01, 0.71)	0.300
(0+01, 0.71)	(0+07, 0.60)	0.016
(0+07, 0.60)	(0+12, 0.50)	0.300
(0+12, 0.50)	(0+12, 0.00)	0.016
(0+12, 0.00)	(0+14, 0.04)	0.016
(0+14, 0.04)	(0+30, 0.36)	0.020
(0+30, 0.36)	(0+46, 0.04)	0.020
(0+46, 0.04)	(0+48, 0.00)	0.016

## Worksheet for Nissan Way 10yr Max Slope

### Input Data

Start Station	Ending Station	Roughness Coefficient
(0+48, 0.00)	(0+48, 0.50)	0.016
(0+48, 0.50)	(0+53, 0.60)	0.300
(0+53, 0.60)	(0+59, 0.71)	0.016
(0+59, 0.71)	(0+60, 0.73)	0.300

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.11	ft
Elevation Range	0.00 to 0.73 ft	
Flow Area	0.59	ft <sup>2</sup>
Wetted Perimeter	11.07	ft
Hydraulic Radius	0.05	ft
Top Width	10.85	ft
Normal Depth	0.11	ft
Critical Depth	0.12	ft
Critical Slope	0.01307	ft/ft
Velocity	1.82	ft/s
Velocity Head	0.05	ft
Specific Energy	0.16	ft
Froude Number	1.38	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
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## Worksheet for Nissan Way 10yr Max Slope

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### GVF Output Data

Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.11	ft
Critical Depth	0.12	ft
Channel Slope	0.02570	ft/ft
Critical Slope	0.01307	ft/ft

## Cross Section for Nissan Way 10yr Min Slope

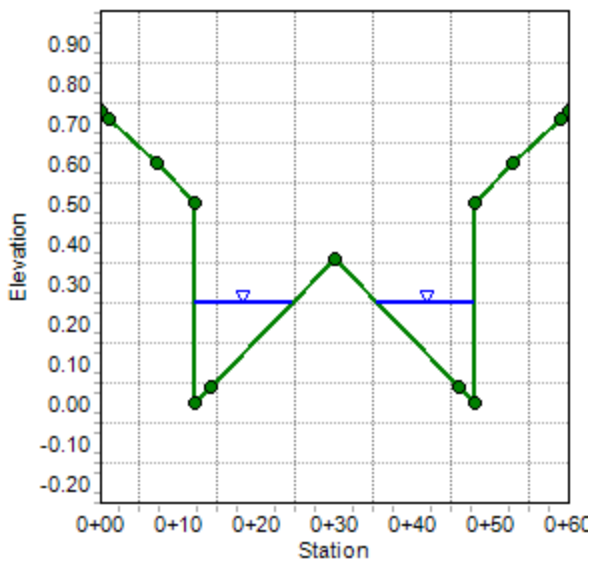
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.00830	ft/ft
Normal Depth	0.25	ft
Discharge	5.40	ft <sup>3</sup> /s

### Cross Section Image





## Worksheet for Nissan Way 10yr Min Slope

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.00830	ft/ft
Discharge	5.40	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.73
0+01	0.71
0+07	0.60
0+12	0.50
0+12	0.00
0+14	0.04
0+30	0.36
0+46	0.04
0+48	0.00
0+48	0.50
0+53	0.60
0+59	0.71
0+60	0.73

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.73)	(0+01, 0.71)	0.300
(0+01, 0.71)	(0+07, 0.60)	0.016
(0+07, 0.60)	(0+12, 0.50)	0.300
(0+12, 0.50)	(0+12, 0.00)	0.016
(0+12, 0.00)	(0+14, 0.04)	0.016
(0+14, 0.04)	(0+30, 0.36)	0.020
(0+30, 0.36)	(0+46, 0.04)	0.020
(0+46, 0.04)	(0+48, 0.00)	0.016

## Worksheet for Nissan Way 10yr Min Slope

### Input Data

Start Station	Ending Station	Roughness Coefficient
(0+48, 0.00)	(0+48, 0.50)	0.016
(0+48, 0.50)	(0+53, 0.60)	0.300
(0+53, 0.60)	(0+59, 0.71)	0.016
(0+59, 0.71)	(0+60, 0.73)	0.300

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.25	ft
Elevation Range	0.00 to 0.73 ft	
Flow Area	3.12	ft <sup>2</sup>
Wetted Perimeter	25.50	ft
Hydraulic Radius	0.12	ft
Top Width	24.99	ft
Normal Depth	0.25	ft
Critical Depth	0.24	ft
Critical Slope	0.01143	ft/ft
Velocity	1.73	ft/s
Velocity Head	0.05	ft
Specific Energy	0.30	ft
Froude Number	0.86	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
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## Worksheet for Nissan Way 10yr Min Slope

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### GVF Output Data

Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.25	ft
Critical Depth	0.24	ft
Channel Slope	0.00830	ft/ft
Critical Slope	0.01143	ft/ft

## Cross Section for Nissan Way 25yr Max Slope

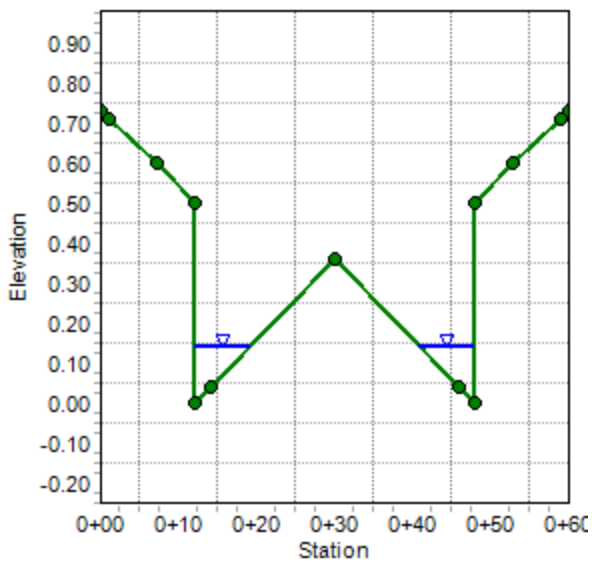
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.02570	ft/ft
Normal Depth	0.14	ft
Discharge	2.18	ft <sup>3</sup> /s

### Cross Section Image



## Worksheet for Nissan Way 25yr Max Slope

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.02570	ft/ft
Discharge	2.18	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.73
0+01	0.71
0+07	0.60
0+12	0.50
0+12	0.00
0+14	0.04
0+30	0.36
0+46	0.04
0+48	0.00
0+48	0.50
0+53	0.60
0+59	0.71
0+60	0.73

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.73)	(0+01, 0.71)	0.300
(0+01, 0.71)	(0+07, 0.60)	0.016
(0+07, 0.60)	(0+12, 0.50)	0.300
(0+12, 0.50)	(0+12, 0.00)	0.016
(0+12, 0.00)	(0+14, 0.04)	0.016
(0+14, 0.04)	(0+30, 0.36)	0.020
(0+30, 0.36)	(0+46, 0.04)	0.020
(0+46, 0.04)	(0+48, 0.00)	0.016

## Worksheet for Nissan Way 25yr Max Slope

### Input Data

Start Station	Ending Station	Roughness Coefficient
(0+48, 0.00)	(0+48, 0.50)	0.016
(0+48, 0.50)	(0+53, 0.60)	0.300
(0+53, 0.60)	(0+59, 0.71)	0.016
(0+59, 0.71)	(0+60, 0.73)	0.300

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.14	ft
Elevation Range	0.00 to 0.73 ft	
Flow Area	1.02	ft <sup>2</sup>
Wetted Perimeter	14.59	ft
Hydraulic Radius	0.07	ft
Top Width	14.30	ft
Normal Depth	0.14	ft
Critical Depth	0.16	ft
Critical Slope	0.01232	ft/ft
Velocity	2.13	ft/s
Velocity Head	0.07	ft
Specific Energy	0.21	ft
Froude Number	1.41	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
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## Worksheet for Nissan Way 25yr Max Slope

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### GVF Output Data

Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.14	ft
Critical Depth	0.16	ft
Channel Slope	0.02570	ft/ft
Critical Slope	0.01232	ft/ft

## Cross Section for Nissan Way 25yr Min Slope

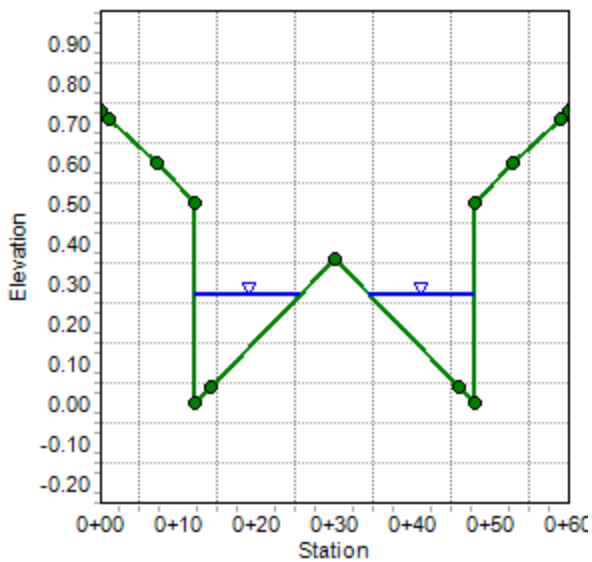
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.00830	ft/ft
Normal Depth	0.27	ft
Discharge	6.84	ft <sup>3</sup> /s

### Cross Section Image





## Worksheet for Nissan Way 25yr Min Slope

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.00830	ft/ft
Discharge	6.84	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.73
0+01	0.71
0+07	0.60
0+12	0.50
0+12	0.00
0+14	0.04
0+30	0.36
0+46	0.04
0+48	0.00
0+48	0.50
0+53	0.60
0+59	0.71
0+60	0.73

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.73)	(0+01, 0.71)	0.300
(0+01, 0.71)	(0+07, 0.60)	0.016
(0+07, 0.60)	(0+12, 0.50)	0.300
(0+12, 0.50)	(0+12, 0.00)	0.016
(0+12, 0.00)	(0+14, 0.04)	0.016
(0+14, 0.04)	(0+30, 0.36)	0.020
(0+30, 0.36)	(0+46, 0.04)	0.020
(0+46, 0.04)	(0+48, 0.00)	0.016

## Worksheet for Nissan Way 25yr Min Slope

### Input Data

Start Station	Ending Station	Roughness Coefficient
(0+48, 0.00)	(0+48, 0.50)	0.016
(0+48, 0.50)	(0+53, 0.60)	0.300
(0+53, 0.60)	(0+59, 0.71)	0.016
(0+59, 0.71)	(0+60, 0.73)	0.300

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.27	ft
Elevation Range	0.00 to 0.73 ft	
Flow Area	3.75	ft <sup>2</sup>
Wetted Perimeter	27.93	ft
Hydraulic Radius	0.13	ft
Top Width	27.38	ft
Normal Depth	0.27	ft
Critical Depth	0.26	ft
Critical Slope	0.01114	ft/ft
Velocity	1.83	ft/s
Velocity Head	0.05	ft
Specific Energy	0.33	ft
Froude Number	0.87	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
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## Worksheet for Nissan Way 25yr Min Slope

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### GVF Output Data

Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.27	ft
Critical Depth	0.26	ft
Channel Slope	0.00830	ft/ft
Critical Slope	0.01114	ft/ft

## Cross Section for Nissan Way 100yr Max Slope

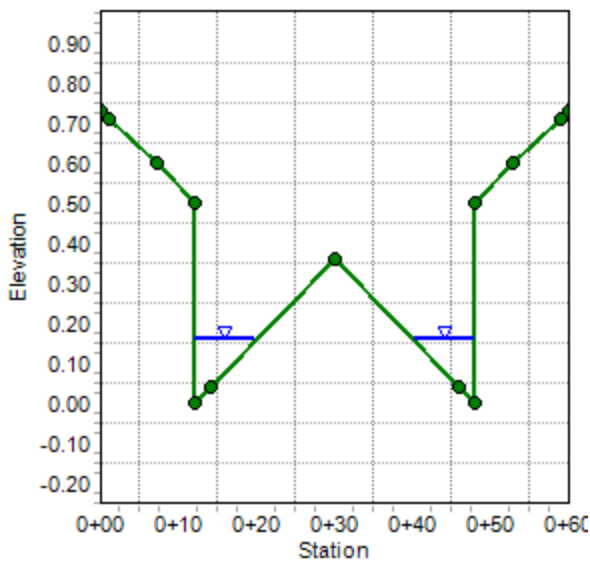
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.02570	ft/ft
Normal Depth	0.16	ft
Discharge	2.77	ft <sup>3</sup> /s

### Cross Section Image



## Worksheet for Nissan Way 100yr Max Slope

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.02570	ft/ft
Discharge	2.77	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.73
0+01	0.71
0+07	0.60
0+12	0.50
0+12	0.00
0+14	0.04
0+30	0.36
0+46	0.04
0+48	0.00
0+48	0.50
0+53	0.60
0+59	0.71
0+60	0.73

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.73)	(0+01, 0.71)	0.300
(0+01, 0.71)	(0+07, 0.60)	0.016
(0+07, 0.60)	(0+12, 0.50)	0.300
(0+12, 0.50)	(0+12, 0.00)	0.016
(0+12, 0.00)	(0+14, 0.04)	0.016
(0+14, 0.04)	(0+30, 0.36)	0.020
(0+30, 0.36)	(0+46, 0.04)	0.020
(0+46, 0.04)	(0+48, 0.00)	0.016

## Worksheet for Nissan Way 100yr Max Slope

### Input Data

Start Station	Ending Station	Roughness Coefficient
(0+48, 0.00)	(0+48, 0.50)	0.016
(0+48, 0.50)	(0+53, 0.60)	0.300
(0+53, 0.60)	(0+59, 0.71)	0.016
(0+59, 0.71)	(0+60, 0.73)	0.300

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.16	ft
Elevation Range	0.00 to 0.73 ft	
Flow Area	1.23	ft <sup>2</sup>
Wetted Perimeter	15.97	ft
Hydraulic Radius	0.08	ft
Top Width	15.65	ft
Normal Depth	0.16	ft
Critical Depth	0.18	ft
Critical Slope	0.01206	ft/ft
Velocity	2.26	ft/s
Velocity Head	0.08	ft
Specific Energy	0.24	ft
Froude Number	1.42	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
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## Worksheet for Nissan Way 100yr Max Slope

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### GVF Output Data

Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.16	ft
Critical Depth	0.18	ft
Channel Slope	0.02570	ft/ft
Critical Slope	0.01206	ft/ft

## Cross Section for Nissan Way 100yr Min Slope

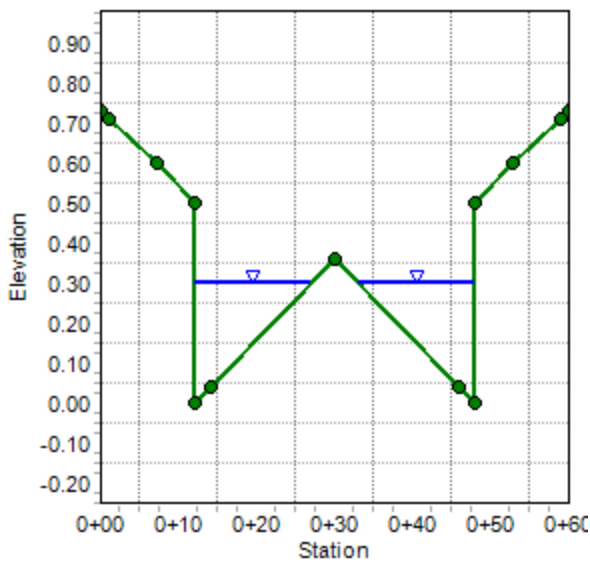
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.00830	ft/ft
Normal Depth	0.30	ft
Discharge	8.66	ft <sup>3</sup> /s

### Cross Section Image





## Worksheet for Nissan Way 100yr Min Slope

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.00830	ft/ft
Discharge	8.66	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.73
0+01	0.71
0+07	0.60
0+12	0.50
0+12	0.00
0+14	0.04
0+30	0.36
0+46	0.04
0+48	0.00
0+48	0.50
0+53	0.60
0+59	0.71
0+60	0.73

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.73)	(0+01, 0.71)	0.300
(0+01, 0.71)	(0+07, 0.60)	0.016
(0+07, 0.60)	(0+12, 0.50)	0.300
(0+12, 0.50)	(0+12, 0.00)	0.016
(0+12, 0.00)	(0+14, 0.04)	0.016
(0+14, 0.04)	(0+30, 0.36)	0.020
(0+30, 0.36)	(0+46, 0.04)	0.020
(0+46, 0.04)	(0+48, 0.00)	0.016

## Worksheet for Nissan Way 100yr Min Slope

### Input Data

Start Station	Ending Station	Roughness Coefficient
(0+48, 0.00)	(0+48, 0.50)	0.016
(0+48, 0.50)	(0+53, 0.60)	0.300
(0+53, 0.60)	(0+59, 0.71)	0.016
(0+59, 0.71)	(0+60, 0.73)	0.300

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.30	ft
Elevation Range	0.00 to 0.73 ft	
Flow Area	4.47	ft <sup>2</sup>
Wetted Perimeter	30.50	ft
Hydraulic Radius	0.15	ft
Top Width	29.89	ft
Normal Depth	0.30	ft
Critical Depth	0.28	ft
Critical Slope	0.01084	ft/ft
Velocity	1.94	ft/s
Velocity Head	0.06	ft
Specific Energy	0.36	ft
Froude Number	0.88	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
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## Worksheet for Nissan Way 100yr Min Slope

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### GVF Output Data

Profile Description

Profile Headloss 0.00 ft

Downstream Velocity Infinity ft/s

Upstream Velocity Infinity ft/s

Normal Depth 0.30 ft

Critical Depth 0.28 ft

Channel Slope 0.00830 ft/ft

Critical Slope 0.01084 ft/ft

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## Worksheet for Inlet A2 2yr

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### Project Description

Solve For                      Spread

### Input Data

Discharge		2.88	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.020	ft/ft
Road Cross Slope		0.015	ft/ft
Curb Opening Length		15.00	ft
Opening Height		1.00	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	11.40	ft
Depth	0.18	ft
Gutter Depression	0.01	ft
Total Depression	0.42	ft

---

## Worksheet for Inlet A2 10yr

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### Project Description

Solve For Spread

### Input Data

Discharge	5.40	ft <sup>3</sup> /s
Gutter Width	1.50	ft
Gutter Cross Slope	0.020	ft/ft
Road Cross Slope	0.015	ft/ft
Curb Opening Length	15.00	ft
Opening Height	1.00	ft
Curb Throat Type	Horizontal	
Local Depression	5.00	in
Local Depression Width	1.50	ft
Throat Incline Angle	90.00	degrees

### Results

Spread	17.34	ft
Depth	0.27	ft
Gutter Depression	0.01	ft
Total Depression	0.42	ft

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## Worksheet for Inlet A2 25yr

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### Project Description

Solve For                      Spread

### Input Data

Discharge		6.84	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.020	ft/ft
Road Cross Slope		0.015	ft/ft
Curb Opening Length		15.00	ft
Opening Height		1.00	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	20.30	ft
Depth	0.31	ft
Gutter Depression	0.01	ft
Total Depression	0.42	ft

---

## Worksheet for Inlet A2 100yr

---

### Project Description

Solve For Spread

### Input Data

Discharge	8.66	ft <sup>3</sup> /s
Gutter Width	1.50	ft
Gutter Cross Slope	0.020	ft/ft
Road Cross Slope	0.015	ft/ft
Curb Opening Length	15.00	ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Local Depression	5.00	in
Local Depression Width	1.50	ft
Throat Incline Angle	90.00	degrees

### Results

Spread	23.76	ft
Depth	0.36	ft
Gutter Depression	0.01	ft
Total Depression	0.42	ft

---

## Worksheet for Inlet A3 2yr

---

### Project Description

Solve For                      Spread

### Input Data

Discharge		8.03	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.020	ft/ft
Road Cross Slope		0.015	ft/ft
Curb Opening Length		30.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	15.00	ft
Depth	0.23	ft
Gutter Depression	0.01	ft
Total Depression	0.42	ft



---

## Worksheet for Inlet A3 10yr

---

### Project Description

Solve For                      Spread

### Input Data

Discharge		15.94	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.020	ft/ft
Road Cross Slope		0.015	ft/ft
Curb Opening Length		30.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	23.70	ft
Depth	0.36	ft
Gutter Depression	0.01	ft
Total Depression	0.42	ft

---

## Worksheet for Inlet A3 25yr

---

### Project Description

Solve For                      Spread

### Input Data

Discharge		20.47	ft³/s
Gutter Width		1.50	ft
Gutter Cross Slope		0.020	ft/ft
Road Cross Slope		0.015	ft/ft
Curb Opening Length		30.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	28.00	ft
Depth	0.43	ft
Gutter Depression	0.01	ft
Total Depression	0.42	ft

---

## Worksheet for Inlet A3 100yr

---

### Project Description

Solve For                      Spread

### Input Data

Discharge		26.12	ft <sup>3</sup> /s
Gutter Width		1.50	ft
Gutter Cross Slope		0.020	ft/ft
Road Cross Slope		0.015	ft/ft
Curb Opening Length		30.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		5.00	in
Local Depression Width		1.50	ft
Throat Incline Angle		90.00	degrees

### Results

Spread	32.94	ft
Depth	0.50	ft
Gutter Depression	0.01	ft
Total Depression	0.42	ft

## Cross Section for Channel A1 2yr

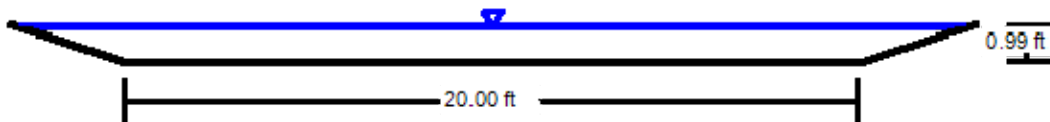
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00422	ft/ft
Normal Depth	0.99	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	20.00	ft
Discharge	66.07	ft <sup>3</sup> /s

### Cross Section Image



V: 1  
H: 1

## Worksheet for Channel A1 2yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00422	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	20.00	ft
Discharge	66.07	ft <sup>3</sup> /s

### Results

Normal Depth	0.99	ft
Flow Area	22.64	ft <sup>2</sup>
Wetted Perimeter	26.24	ft
Hydraulic Radius	0.86	ft
Top Width	25.92	ft
Critical Depth	0.67	ft
Critical Slope	0.01559	ft/ft
Velocity	2.92	ft/s
Velocity Head	0.13	ft
Specific Energy	1.12	ft
Froude Number	0.55	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.99	ft
Critical Depth	0.67	ft
Channel Slope	0.00422	ft/ft

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## Worksheet for Channel A1 2yr

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### GVF Output Data

Critical Slope 0.01559 ft/ft

## Cross Section for Channel A1 10yr

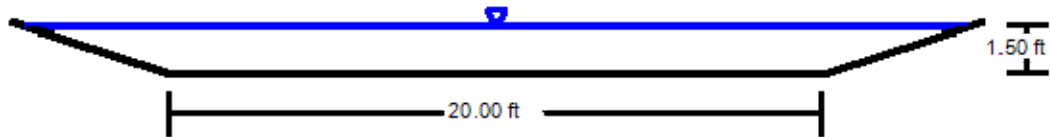
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00422	ft/ft
Normal Depth	1.50	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	20.00	ft
Discharge	136.83	ft <sup>3</sup> /s

### Cross Section Image



V: 1  
H: 1

## Worksheet for Channel A1 10yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00422	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	20.00	ft
Discharge	136.83	ft³/s

### Results

Normal Depth	1.50	ft
Flow Area	36.73	ft²
Wetted Perimeter	29.48	ft
Hydraulic Radius	1.25	ft
Top Width	29.00	ft
Critical Depth	1.07	ft
Critical Slope	0.01362	ft/ft
Velocity	3.72	ft/s
Velocity Head	0.22	ft
Specific Energy	1.72	ft
Froude Number	0.58	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.07	ft
Channel Slope	0.00422	ft/ft



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Worksheet for Channel A1 10yr

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GVF Output Data

Critical Slope 0.01362 ft/ft

## Cross Section for Channel A1 25yr

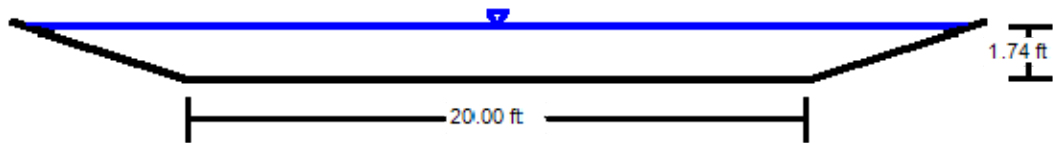
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00422	ft/ft
Normal Depth	1.74	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	20.00	ft
Discharge	177.47	ft <sup>3</sup> /s

### Cross Section Image



V: 1  
H: 1

## Worksheet for Channel A1 25yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00422	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	20.00	ft
Discharge	177.47	ft³/s

### Results

Normal Depth	1.74	ft
Flow Area	43.80	ft²
Wetted Perimeter	30.99	ft
Hydraulic Radius	1.41	ft
Top Width	30.42	ft
Critical Depth	1.26	ft
Critical Slope	0.01300	ft/ft
Velocity	4.05	ft/s
Velocity Head	0.26	ft
Specific Energy	1.99	ft
Froude Number	0.60	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.74	ft
Critical Depth	1.26	ft
Channel Slope	0.00422	ft/ft

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Worksheet for Channel A1 25yr

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GVF Output Data

Critical Slope 0.01300 ft/ft

## Cross Section for Channel A1 100yr

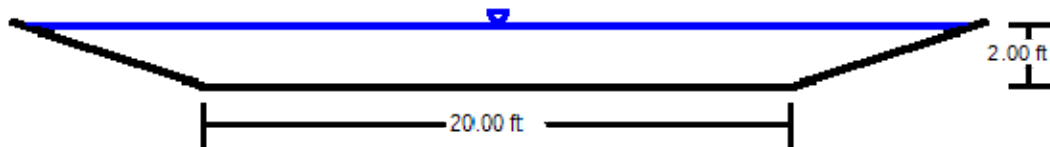
### Project Description

Friction Method	Manning Formula
Solve For	Channel Slope

### Input Data

Roughness Coefficient	0.030
Channel Slope	0.00422 ft/ft
Normal Depth	2.00 ft
Left Side Slope	3.00 ft/ft (H:V)
Right Side Slope	3.00 ft/ft (H:V)
Bottom Width	20.00 ft
Discharge	228.16 ft <sup>3</sup> /s

### Cross Section Image



V: 1  
H: 1

## Worksheet for Channel A1 100yr

### Project Description

Friction Method	Manning Formula
Solve For	Channel Slope

### Input Data

Roughness Coefficient	0.030	
Normal Depth	2.00	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	20.00	ft
Discharge	228.16	ft³/s

### Results

Channel Slope	0.00422	ft/ft
Flow Area	52.00	ft²
Wetted Perimeter	32.65	ft
Hydraulic Radius	1.59	ft
Top Width	32.00	ft
Critical Depth	1.47	ft
Critical Slope	0.01245	ft/ft
Velocity	4.39	ft/s
Velocity Head	0.30	ft
Specific Energy	2.30	ft
Froude Number	0.61	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.00	ft
Critical Depth	1.47	ft
Channel Slope	0.00422	ft/ft

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## Worksheet for Channel A1 100yr

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### GVF Output Data

Critical Slope 0.01245 ft/ft

## Cross Section for Channel A2 2yr

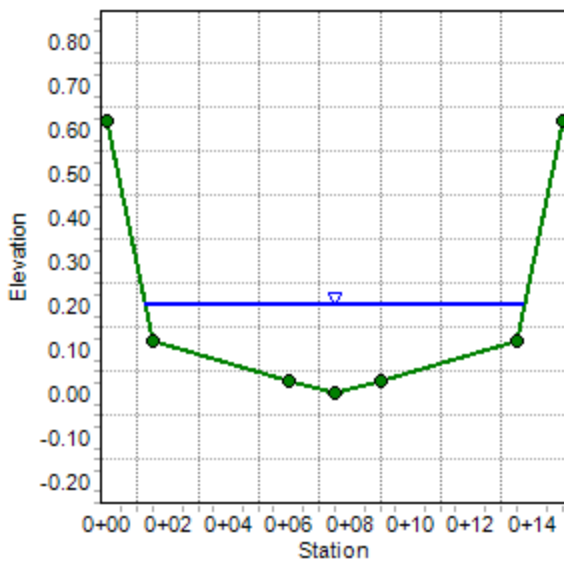
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.01840	ft/ft
Normal Depth	0.20	ft
Discharge	3.49	ft <sup>3</sup> /s

### Cross Section Image





## Worksheet for Channel A2 2yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.01840	ft/ft
Discharge	3.49	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.62
0+02	0.12
0+06	0.03
0+08	0.00
0+09	0.03
0+14	0.12
0+15	0.62

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.62)	(0+02, 0.12)	0.030
(0+02, 0.12)	(0+06, 0.03)	0.030
(0+06, 0.03)	(0+08, 0.00)	0.015
(0+08, 0.00)	(0+09, 0.03)	0.015
(0+09, 0.03)	(0+14, 0.12)	0.030
(0+14, 0.12)	(0+15, 0.62)	0.030

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.20	ft
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## Worksheet for Channel A2 2yr

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### Results

Elevation Range	0.00 to 0.62 ft	
Flow Area	1.75	ft <sup>2</sup>
Wetted Perimeter	12.53	ft
Hydraulic Radius	0.14	ft
Top Width	12.50	ft
Normal Depth	0.20	ft
Critical Depth	0.20	ft
Critical Slope	0.02106	ft/ft
Velocity	2.00	ft/s
Velocity Head	0.06	ft
Specific Energy	0.27	ft
Froude Number	0.94	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.20	ft
Critical Depth	0.20	ft
Channel Slope	0.01840	ft/ft
Critical Slope	0.02106	ft/ft

## Cross Section for Channel A2 10yr

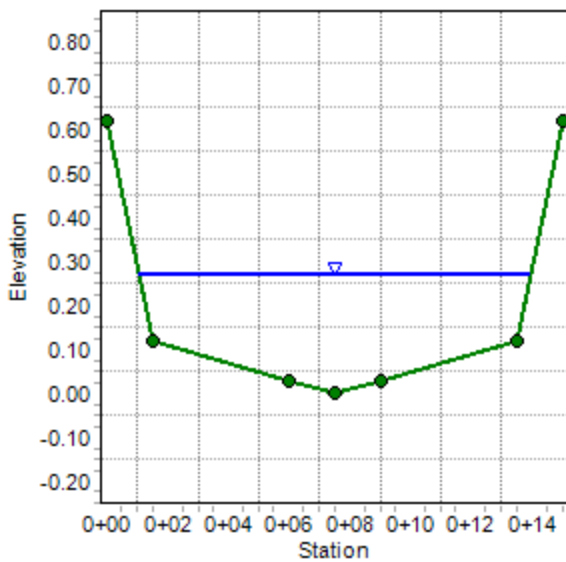
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.01840	ft/ft
Normal Depth	0.27	ft
Discharge	6.65	ft <sup>3</sup> /s

### Cross Section Image



## Worksheet for Channel A2 10yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.01840	ft/ft
Discharge	6.65	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.62
0+02	0.12
0+06	0.03
0+08	0.00
0+09	0.03
0+14	0.12
0+15	0.62

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.62)	(0+02, 0.12)	0.030
(0+02, 0.12)	(0+06, 0.03)	0.030
(0+06, 0.03)	(0+08, 0.00)	0.015
(0+08, 0.00)	(0+09, 0.03)	0.015
(0+09, 0.03)	(0+14, 0.12)	0.030
(0+14, 0.12)	(0+15, 0.62)	0.030

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.27	ft
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## Worksheet for Channel A2 10yr

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### Results

Elevation Range	0.00 to 0.62 ft	
Flow Area	2.61	ft <sup>2</sup>
Wetted Perimeter	12.96	ft
Hydraulic Radius	0.20	ft
Top Width	12.91	ft
Normal Depth	0.27	ft
Critical Depth	0.27	ft
Critical Slope	0.01857	ft/ft
Velocity	2.54	ft/s
Velocity Head	0.10	ft
Specific Energy	0.37	ft
Froude Number	1.00	
Flow Type	Subcritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.27	ft
Critical Depth	0.27	ft
Channel Slope	0.01840	ft/ft
Critical Slope	0.01857	ft/ft

## Cross Section for Channel A2 25yr

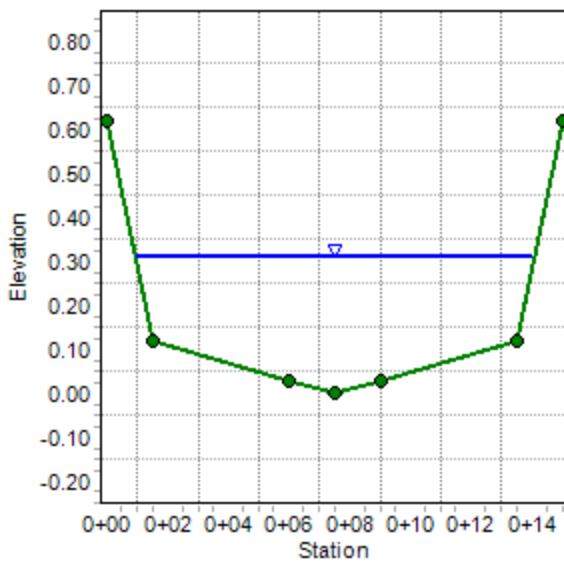
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.01840	ft/ft
Normal Depth	0.31	ft
Discharge	8.46	ft <sup>3</sup> /s

### Cross Section Image



## Worksheet for Channel A2 25yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.01840	ft/ft
Discharge	8.46	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.62
0+02	0.12
0+06	0.03
0+08	0.00
0+09	0.03
0+14	0.12
0+15	0.62

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.62)	(0+02, 0.12)	0.030
(0+02, 0.12)	(0+06, 0.03)	0.030
(0+06, 0.03)	(0+08, 0.00)	0.015
(0+08, 0.00)	(0+09, 0.03)	0.015
(0+09, 0.03)	(0+14, 0.12)	0.030
(0+14, 0.12)	(0+15, 0.62)	0.030

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.31	ft
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## Worksheet for Channel A2 25yr

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### Results

Elevation Range	0.00 to 0.62 ft	
Flow Area	3.04	ft <sup>2</sup>
Wetted Perimeter	13.17	ft
Hydraulic Radius	0.23	ft
Top Width	13.11	ft
Normal Depth	0.31	ft
Critical Depth	0.31	ft
Critical Slope	0.01775	ft/ft
Velocity	2.78	ft/s
Velocity Head	0.12	ft
Specific Energy	0.43	ft
Froude Number	1.02	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.31	ft
Critical Depth	0.31	ft
Channel Slope	0.01840	ft/ft
Critical Slope	0.01775	ft/ft



## Cross Section for Channel A2 100yr

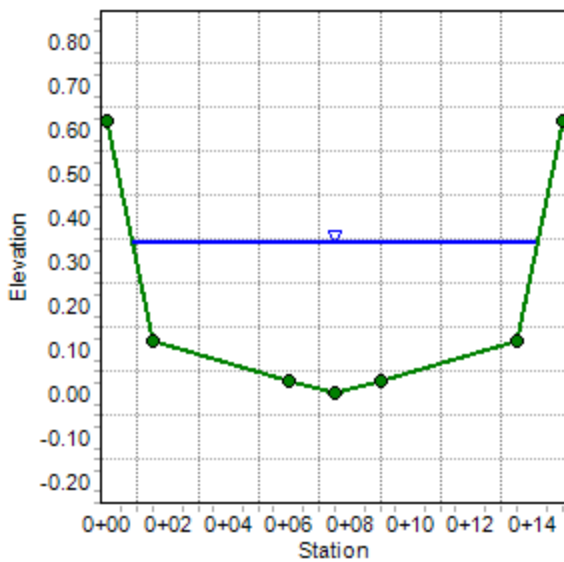
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.01840	ft/ft
Normal Depth	0.34	ft
Discharge	10.73	ft <sup>3</sup> /s

### Cross Section Image



## Worksheet for Channel A2 100yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Channel Slope	0.01840	ft/ft
Discharge	10.73	ft <sup>3</sup> /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.62
0+02	0.12
0+06	0.03
0+08	0.00
0+09	0.03
0+14	0.12
0+15	0.62

### Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.62)	(0+02, 0.12)	0.030
(0+02, 0.12)	(0+06, 0.03)	0.030
(0+06, 0.03)	(0+08, 0.00)	0.015
(0+08, 0.00)	(0+09, 0.03)	0.015
(0+09, 0.03)	(0+14, 0.12)	0.030
(0+14, 0.12)	(0+15, 0.62)	0.030

### Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

### Results

Normal Depth	0.34	ft
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## Worksheet for Channel A2 100yr

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### Results

Elevation Range	0.00 to 0.62 ft	
Flow Area	3.54	ft <sup>2</sup>
Wetted Perimeter	13.41	ft
Hydraulic Radius	0.26	ft
Top Width	13.33	ft
Normal Depth	0.34	ft
Critical Depth	0.35	ft
Critical Slope	0.01699	ft/ft
Velocity	3.03	ft/s
Velocity Head	0.14	ft
Specific Energy	0.49	ft
Froude Number	1.04	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.34	ft
Critical Depth	0.35	ft
Channel Slope	0.01840	ft/ft
Critical Slope	0.01699	ft/ft

Cross Section for Channel A3 2yr

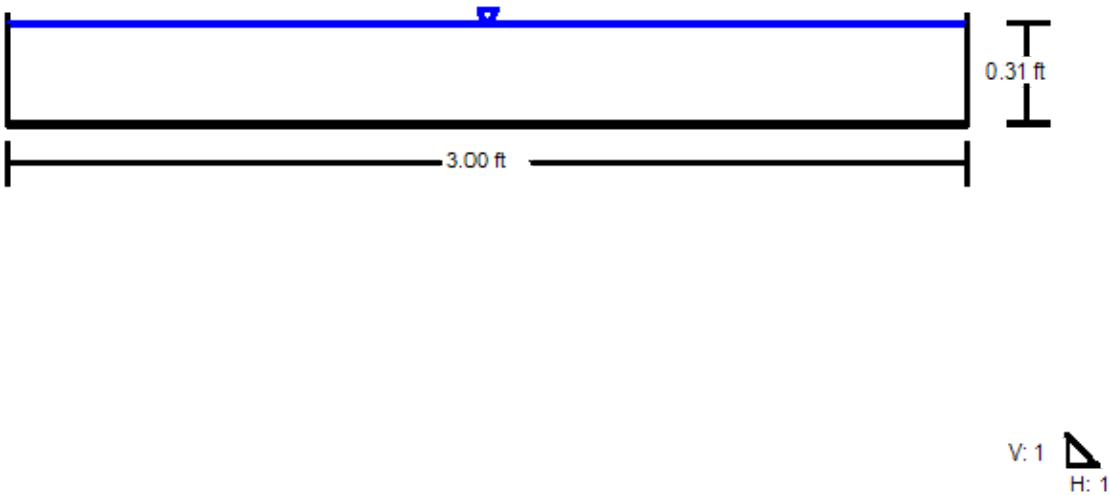
Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.03700	ft/ft
Normal Depth	0.31	ft
Bottom Width	3.00	ft
Discharge	7.13	ft³/s

Cross Section Image



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## Worksheet for Channel A3 2yr

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### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.015	
Channel Slope	0.03700	ft/ft
Bottom Width	3.00	ft
Discharge	7.13	ft <sup>3</sup> /s

### Results

Normal Depth	0.31	ft
Flow Area	0.93	ft <sup>2</sup>
Wetted Perimeter	3.62	ft
Hydraulic Radius	0.26	ft
Top Width	3.00	ft
Critical Depth	0.56	ft
Critical Slope	0.00607	ft/ft
Velocity	7.68	ft/s
Velocity Head	0.92	ft
Specific Energy	1.23	ft
Froude Number	2.44	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.31	ft
Critical Depth	0.56	ft
Channel Slope	0.03700	ft/ft
Critical Slope	0.00607	ft/ft

## Cross Section for Channel A3 10yr

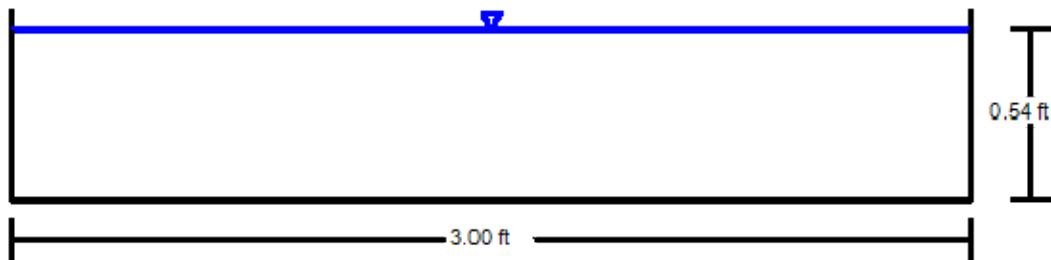
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.015	
Channel Slope	0.03700	ft/ft
Normal Depth	0.54	ft
Bottom Width	3.00	ft
Discharge	16.52	ft <sup>3</sup> /s

### Cross Section Image



V: 1  
H: 1

## Worksheet for Channel A3 10yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.015	
Channel Slope	0.03700	ft/ft
Bottom Width	3.00	ft
Discharge	16.52	ft <sup>3</sup> /s

### Results

Normal Depth	0.54	ft
Flow Area	1.61	ft <sup>2</sup>
Wetted Perimeter	4.07	ft
Hydraulic Radius	0.40	ft
Top Width	3.00	ft
Critical Depth	0.98	ft
Critical Slope	0.00645	ft/ft
Velocity	10.27	ft/s
Velocity Head	1.64	ft
Specific Energy	2.17	ft
Froude Number	2.47	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.54	ft
Critical Depth	0.98	ft
Channel Slope	0.03700	ft/ft
Critical Slope	0.00645	ft/ft

## Cross Section for Channel A3 25yr

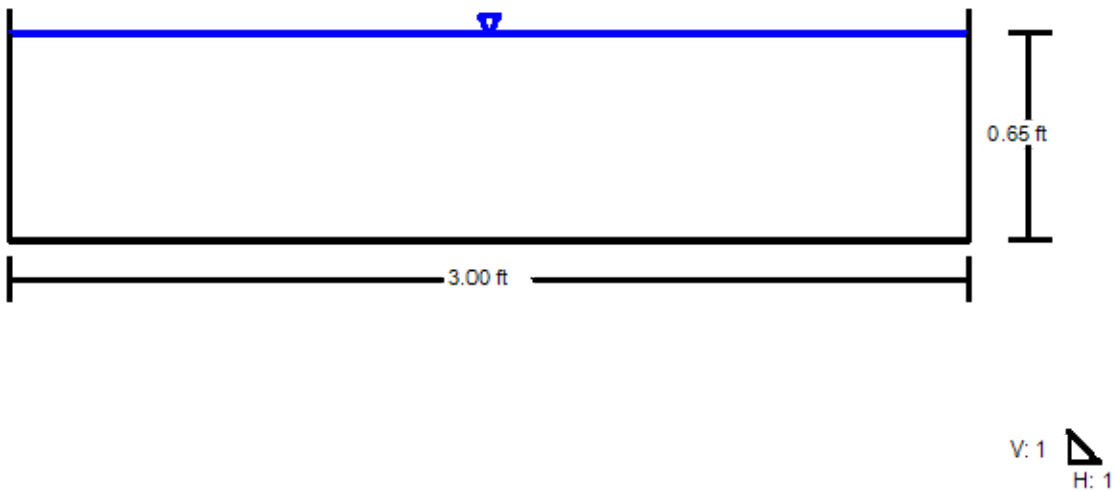
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.015	
Channel Slope	0.03700	ft/ft
Normal Depth	0.65	ft
Bottom Width	3.00	ft
Discharge	22.03	ft <sup>3</sup> /s

### Cross Section Image





## Worksheet for Channel A3 25yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.015	
Channel Slope	0.03700	ft/ft
Bottom Width	3.00	ft
Discharge	22.03	ft <sup>3</sup> /s

### Results

Normal Depth	0.65	ft
Flow Area	1.96	ft <sup>2</sup>
Wetted Perimeter	4.30	ft
Hydraulic Radius	0.45	ft
Top Width	3.00	ft
Critical Depth	1.19	ft
Critical Slope	0.00674	ft/ft
Velocity	11.26	ft/s
Velocity Head	1.97	ft
Specific Energy	2.62	ft
Froude Number	2.46	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.65	ft
Critical Depth	1.19	ft
Channel Slope	0.03700	ft/ft
Critical Slope	0.00674	ft/ft

## Cross Section for Channel A3 100yr

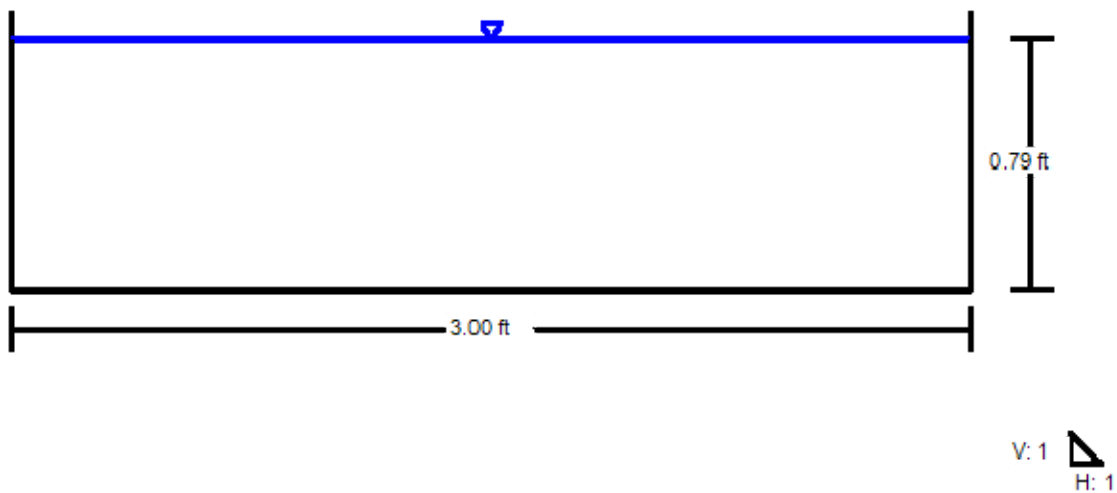
### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.015
Channel Slope	0.03700 ft/ft
Normal Depth	0.79 ft
Bottom Width	3.00 ft
Discharge	28.93 ft <sup>3</sup> /s

### Cross Section Image



## Worksheet for Channel A3 100yr

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.015	
Channel Slope	0.03700	ft/ft
Bottom Width	3.00	ft
Discharge	28.93	ft <sup>3</sup> /s

### Results

Normal Depth	0.79	ft
Flow Area	2.36	ft <sup>2</sup>
Wetted Perimeter	4.57	ft
Hydraulic Radius	0.52	ft
Top Width	3.00	ft
Critical Depth	1.42	ft
Critical Slope	0.00710	ft/ft
Velocity	12.26	ft/s
Velocity Head	2.34	ft
Specific Energy	3.12	ft
Froude Number	2.44	
Flow Type	Supercritical	

### GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

### GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.79	ft
Critical Depth	1.42	ft
Channel Slope	0.03700	ft/ft
Critical Slope	0.00710	ft/ft

# Attachment M

## Drainage Compliance Memo



290 S. Castell Avenue, Ste 100  
New Braunfels, TX 78130  
TBPE-FIRM F-10961  
TBPLS FIRM 10153600

July 7, 2020

Melissa Reynolds, PE  
City of New Braunfels  
550 Landa Street  
New Braunfels TX 78130

RE: Vanguard Farms – Heather Glen Master Plan Compliance

Dear Mrs. Reynolds,

Vanguard Farms is a multi-family development at the corner of Nissan Way and Summer Sweet Rd in New Braunfels, Texas. The site is part of the Post Road Development, now known as the Heather Glen Development and Zoned PD per Ordinance No. 2016-56.

I acknowledge and verify that the drainage plan for the proposed Vanguard Farms multi-family site to be in compliance with the Heather Glen Detention Facilities performed by Yalco, LLC dated March 22, 2017. I believe that the calculations and comparisons for the existing and proposed drainage conditions found in the Heather Glen Detention Facilities are in compliance with the New Braunfels Drainage Criteria Manual (DCM) and remain valid for this site. This site shall also be considered grandfathered under the 2000 DCM and shall not be required to provide water quality.

I hope everything is in order, and if you have any questions or comments, please contact me at (210) 625-8555.

Thank you,

A handwritten signature in blue ink that reads "Chris Van Heerde, PE". The signature is fluid and cursive.

Chris Van Heerde, PE  
Managing Partner  
HMT Engineering & Surveying



7/7/2020

# Attachment N

## Heather Glen Subdivision Drainage Report



# 2<sup>nd</sup> Revised Drainage Analysis

## Heather Glen Detention Facilities

Property Name: **Heather Glen**  
Prepared For: **WBW Development Group LLC, Killeen, Texas**  
Site Location: **West of the intersection of FM 306 and IH35, adjacent to Post Road.**  
Site City and State: **New Braunfels, Texas**  
Report Date: **March 22, 2017**  
Prepared By: **Joseph Theriot, P.E. #120299**  
**Yalgo, LLC, Texas Registered Engineering Firm**  
**F-10264; Killeen, Texas**



The engineering means and methods used in this analysis are proprietary and are considered a trade secret. Release of this report to the public would expose this trade secret, causing competitive harm to Yalgo, LLC. We ask that this report not be released to any third party, besides the governmental oversight team, without our written permission.

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## 1. Summary

The detention facilities for Heather Glen were designed per the September 2000 New Braunfels Drainage and Erosion Control Design Manual. The spillways were designed to safely pass the 2-year, 10-year, 25-year, and 100-year storm hydrographs with the required 1.0 foot minimum freeboard to the top of embankment. The spillways also safely pass the 25-year storm in the event that their respective pond is already at peak capacity from a 100-year storm. The detention facilities were designed to accept water from a fully developed Heather Glen subdivision. There are three discharge locations from the Heather Glen development. The first one is at the boundary of the development where Kowald Lane intersects Post Road. The second discharge location is at the very southern tip of the development, adjacent to Post Road. The final discharge location is adjacent to the Union Pacific Railroad, where the drainage channel crosses to the south side of the tracks. The detention facilities allow for pre-development flows to be matched or lowered at all discharge locations for the 2-year, 10-year, 25-year, and 100-year storm events. Hydrographs created using HEC-HMS for each discharge location are included on the following pages for the pre-development and post-development models of the 2-year, 10-year, 25-year, and 100-year storm events. The peak discharge flow rates for all discharge locations are summarized in Table 1 below.

**Table 1: Pre-development and Post-development discharge rates for the three discharge locations of the Heather Glen development**

Storm Event	Pre-Development at Kowald	Post-Development at Kowald	Pre-Development South Corner	Post-Development South Corner	Pre-Development at RR	Post-Development at RR
2-year	67.2	65.3	18.7	18.7	8.6	1.6
10-year	191.8	178.7	55.0	45.3	30.6	16.8
25-year	259.5	245.7	74.5	60.1	43.1	30.0
100-year	379.4	373.2	109.1	86.6	65.5	57.2

Inputs and outputs, as well as a run log, for the HEC-HMS models are attached to the end of this report.

## **2. Methodology**

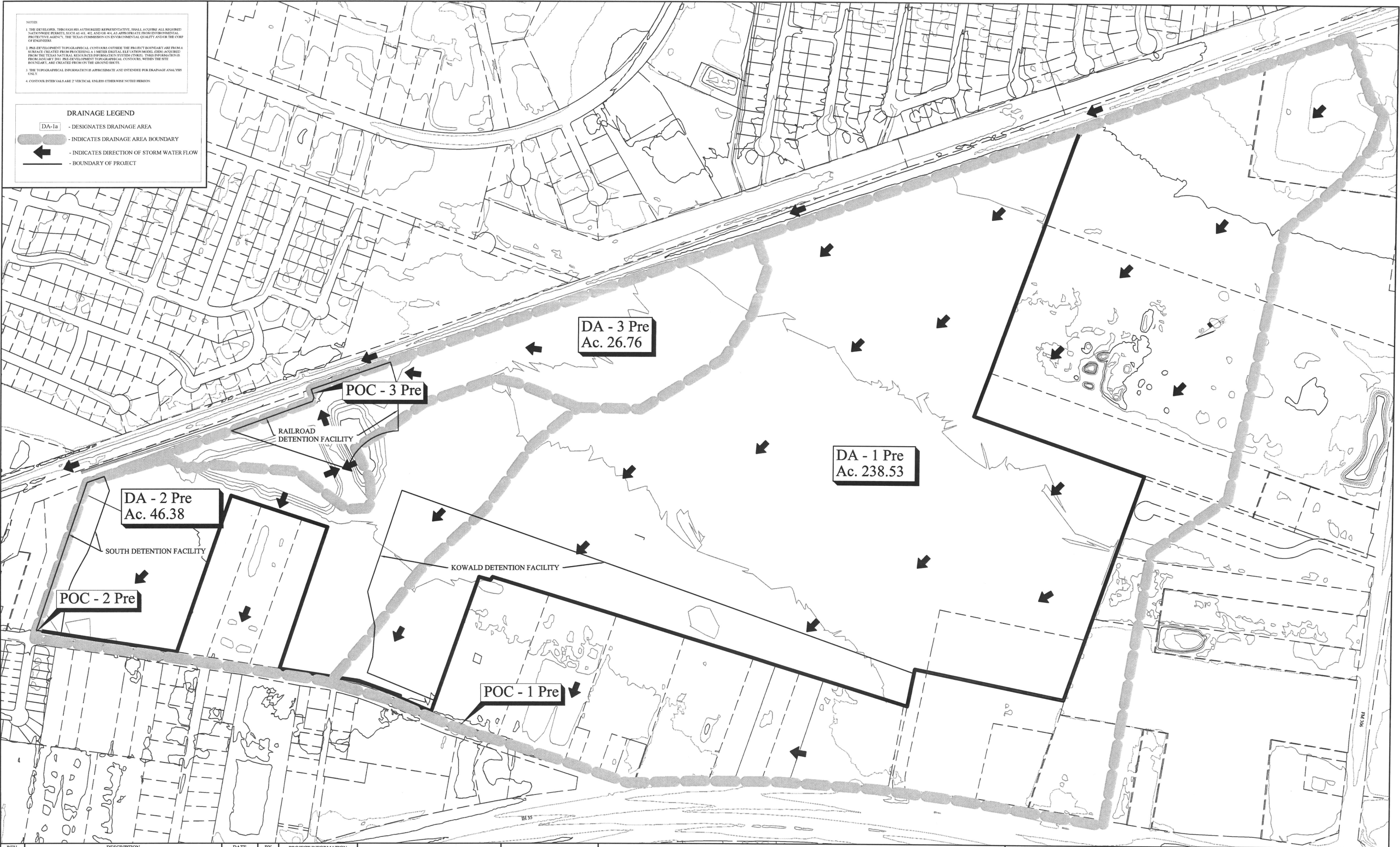
To design the detention facility, a hydrologic model was created in HEC-HMS. Pre-development and post-development drainage basins were delineated based on existing and preliminary design topography, respectively.

### **2.1 Drainage Basins**

The pre-development model consists of three drainage areas (DAs). DA-1 PRE drains to Post Road near Kowald Lane and contains the north half of the project, portions of the tracts between the project and FM 306, and tracts along Post Road. DA-2 PRE contains the majority of the southern portion of the project and drains south to an existing regional detention pond via Post Road. DA-3 PRE contains a small portion of the project along the Union Pacific Railroad and drains to an existing regional detention pond via a large channel.

The post-development model consists of five drainage areas. The drainage areas have very similar shapes, sizes, and drainage patterns as their corresponding pre-development areas. DA-1 PRE and DA-2 PRE were broken into two post drainage areas. DA-1A POST drains to the main detention facility which outfalls to Post Road near Kowald Lane. DA-1B POST bypasses the project. DA-2A POST drains to a detention facility on the southern tip of the project which outfalls to Post Road. DA-2B POST drains to Post Road. DA-3 POST drains to a channel adjacent to the railroad track and then to a third detention facility which outfalls to an existing channel along the railroad track.

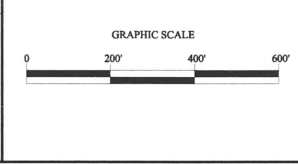
Pre- and post-development drainage basins can be seen on the following pages.



REV.	DESCRIPTION	DATE	BY
1	ORIGINAL RELEASE	5/20/2016	TWF

PROJECT NUMBER: NB01	CLIENT NAME: WBW DEVELOPMENT GROUP, LLC
CHECKED BY: JAT	CLIENT LOCATION: KILLEEN, TX
AUTHORIZED BY: WBW	

PROJECT INFORMATION
TOTAL SIZE: 187.51 ACRES



NGS BRASS MONUMENT  
TEXAS STATE PLANE  
COORDINATE SYSTEM, NAD1983  
(2011) DATUM, TEXAS SOUTH  
CENTRAL ZONE NO. 4204  
N: 13809772.48  
E: 2257880.15  
Z: 668.31'

PRE DEVELOPMENT DRAINAGE  
HEATHER GLEN  
NEW BRAUNFELS, COMAL COUNTY, TEXAS

**Yalco, LLC**  
3000 Illinois Ave., Suite 100  
Killeen, TX 76543  
PH (254) 953-5353  
FX (254) 953-5057  
Texas Registered  
Engineering Firm F-10264  
Texas Registered  
Surveying Firm 10194095



NOTES:  
1. THE DEVELOPER, THROUGH HIS AUTHORIZED REPRESENTATIVE, SHALL ACQUIRE ALL REQUIRED NATIONWIDE PERMITS, SUCH AS 401, 402, AND/OR 404, AS APPROPRIATE FROM ENVIRONMENTAL PROTECTIVE AGENCY, THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY AND/OR THE CORP OF ENGINEERS.  
2. PRE-DEVELOPMENT TOPOGRAPHICAL CONTOURS OUTSIDE THE PROJECT BOUNDARY ARE FROM A SURFACE CREATED FROM PROCESSING A 1 METER DIGITAL ELEVATION MODEL (DEM) ACQUIRED FROM THE TEXAS NATURAL RESOURCES INFORMATION SYSTEM (TNRIS). THIS INFORMATION IS FROM JANUARY 2011 POST-DEVELOPMENT TOPOGRAPHICAL CONTOURS, WITHIN THE SITE BOUNDARY, ARE CREATED FROM THE DESIGN SURFACE.  
3. THE TOPOGRAPHICAL INFORMATION IS APPROXIMATE AND INTENDED FOR DRAINAGE ANALYSIS ONLY.  
4. CONTOUR INTERVALS ARE 2' VERTICAL UNLESS OTHERWISE NOTED HEREON.

DRAINAGE LEGEND

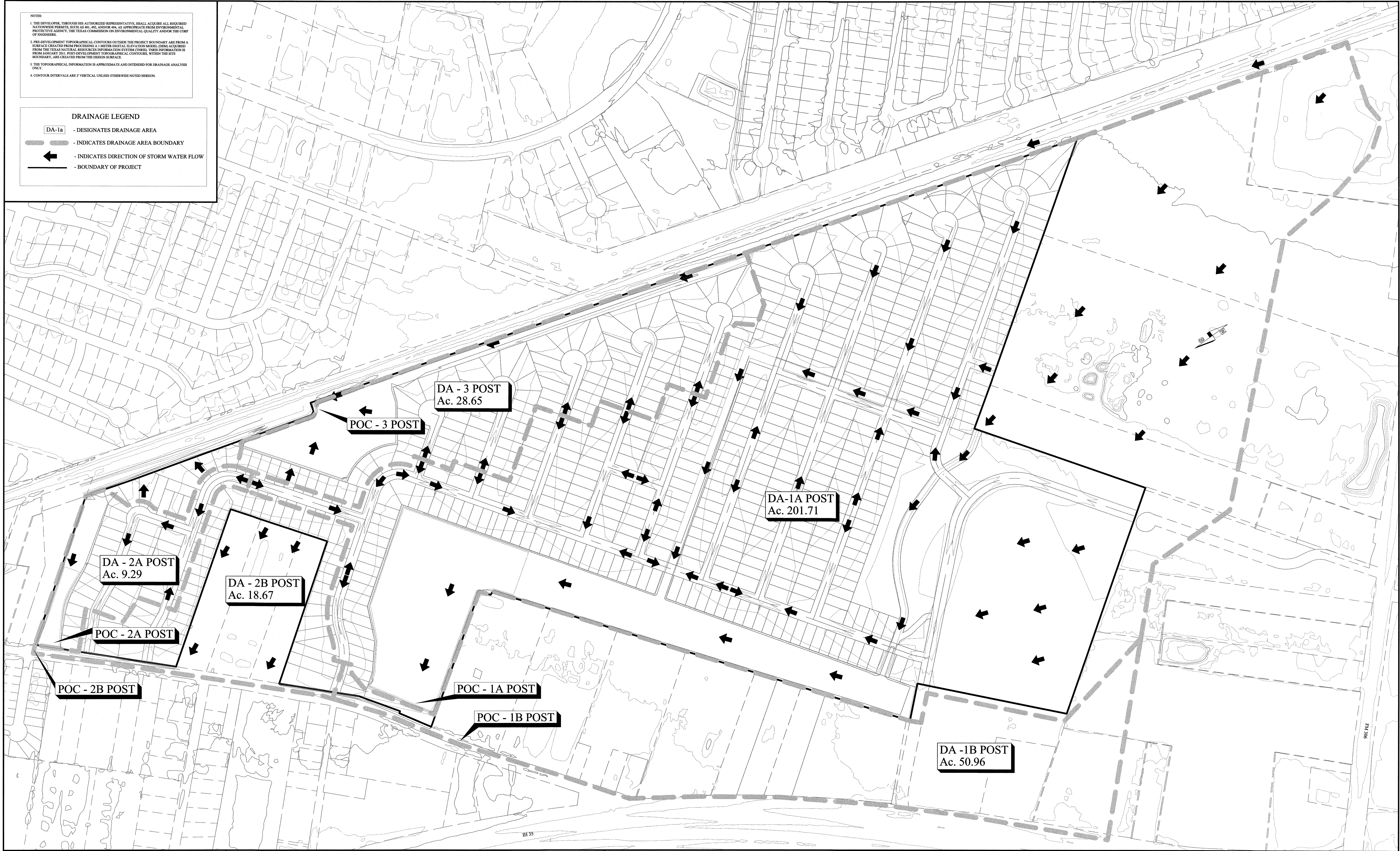
DA-1a

- DESIGNATES DRAINAGE AREA

- INDICATES DRAINAGE AREA BOUNDARY

- INDICATES DIRECTION OF STORM WATER FLOW

- BOUNDARY OF PROJECT



REV.		DESCRIPTION	DATE	BY	PROJECT INFORMATION		<div>NGS BRASS MONUMENT</div> <div>TEXAS STATE PLANE COORDINATE SYSTEM, NAD1983 (2011) DATUM, TEXAS SOUTH CENTRAL ZONE NO. 4204 N: 13809772.48 E: 2257880.15 Z: 668.31'</div>		<div>POST DEVELOPMENT DRAINAGE</div> <div>HEATHER GLEN</div> <div>NEW BRAUNFELS, COMAL COUNTY, TEXAS</div>					<div>Yalgo, LLC</div> <div>3000 Illinois Ave., Suite 100 Killeen, TX 76543 PH (254) 953-5353 FX (254) 953-5057</div> <div>Texas Registered Engineering Firm F-10264</div> <div>Texas Registered Surveying Firm 10194095</div>	SHEET
1		ORIGINAL RELEASE	5/20/2016	TWF	TOTAL SIZE: 187.51 ACRES										
PROJECT NUMBER: HG02		CLIENT NAME: WBW DEVELOPMENT GROUP, LLC			<div>GRAPHIC SCALE</div> <div><div>0</div><div>200'</div><div>400'</div><div>600'</div></div>										
CHECKED BY: JAT		CLIENT LOCATION: KILLEEN, TX													
AUTHORIZED BY: WBW															

## 2.2 Times of Concentration

For pre-development and post-development drainage areas, sheet flow was calculated using the Kerby equation for a maximum of 300 feet in undeveloped areas and 30 feet in developed areas or until topography seemed to form a natural channel. Shallow concentrated flow, calculated using NRCS National Engineering Handbook Chapter 15 methods, was used through the remainder of the drainage area until a channel was reached. Within channels, velocities were assumed to be 6 fps, except in designed channels where actual velocities were calculated (see Section 3. Time of Concentration for values).

## 2.3 Curve Numbers

Composite curve numbers were calculated using NRCS TR-55 methods. Google Earth images dated 12/16/2015 and soil types from USDA-NCRS were overlaid on the drainage areas to calculate the Curve Numbers. On-the-ground visual confirmation and adjustments were performed for a more accurate model (see Section 4. Curve Numbers for values and calculations).

## 2.4 Rainfall Data

Depth-Duration values were taken from the New Braunfels Drainage and Erosion Control Design Manual. Depth-Duration values were input into HEC-HMS and were used to create a 24-hour frequency storm.



### 3. Time of Concentration

Time of concentration and subsequent lag times for the drainage areas are listed in the following tables. Lag times are  $3/5^{\text{th}}$  of the time of concentration.

**Table 2: Pre-Development Times of Concentration & Lag Times**

<b>Drainage Area</b>	<b>Time of Concentration (min)</b>	<b>Lag Time, T<sub>L</sub> (min)</b>
DA-1 PRE	245.48	147.29
DA-2 PRE	135.81	81.49
DA-3A PRE	112.56	67.54

**Table 3: Post-Development Times of Concentration & Lag Times**

<b>Drainage Area</b>	<b>Time of Concentration (min)</b>	<b>Lag Time, T<sub>L</sub> (min)</b>
DA-1A POST	118.77	71.26
DA-1B POST	156.42	93.85
DA-2A POST	18.96	11.38
DA-2B POST	73.46	44.07
DA-3 POST	22.92	13.75

Drainage Areas and Times of Concentration

Drainage Area	Total Area, acres	Acres of Type		Overland Flow (Kerby)						1st Shallow Concentrated Flow (NRCS-Ch. 15)							2nd Shallow Concentrated Flow (NRCS-Ch. 15)							Channalized flow			Time of Conc'n, Tc (min)	Lag Time (min)
		Open Space	Single-Family	Length of Flow (ft)	High Elevation (ft)	Low Elevation (ft)	Slope (ft/ft)	Retardance coefficient, N	Flow Time, Tt (min)	Length of Flow (ft)	High Elevation (ft)	Low Elevation (ft)	Slope (ft/ft)	Flow Type	Velocity Multiplier	Flow Time, Tt (min)	Length of Flow (ft)	High Elevation (ft)	Low Elevation (ft)	Slope (ft/ft)	Flow Type	Velocity Multiplier	Flow Time, Tt (min)	Length of Flow (ft)	Velocity (ft/s)	Flow Time, Tt (min)		
DA-1 PRE	238.53	208.53	30.00	300.00	688.50	685.00	1.17%	0.4	21.95	4396.00	685.00	673.00	0.27%	5	6.962	201.42	836.00	673.00	671.50	0.18%	2	16.135	20.39	618.00	6.00	1.72	245.48	147.29
DA-2 PRE	46.38	42.85	3.53	300.00	674.50	674.10	0.13%	0.4	36.42	1500.00	674.10	671.50	0.17%	5	6.962	86.25	547.00	671.50	689.66	0.34%	2	16.135	9.74	1223.00	6.00	3.40	135.81	81.49
DA-3 PRE	26.76	26.76	0.00	300.00	678.45	676.14	0.77%	0.4	24.19	2194.00	676.14	668.39	0.35%	5	6.962	88.37	NOT USED							NOT USED			112.56	67.54
DA-1A POST	201.71	79.96	121.76	300.00	698.50	685.00	1.17%	0.4	21.95	2492.00	685.00	674.00	0.44%	5	6.962	89.79	NOT USED							1265.00	3.00	7.03	118.77	71.26
DA-1B POST	50.96	34.07	16.89	300.00	676.50	676.00	0.17%	0.4	34.57	1330.00	676.00	675.00	0.08%	5	6.962	116.12	NOT USED							2064.00	6.00	5.73	156.42	93.85
DA-2A POST	9.29	1.97	7.32	30.00	676.72	676.44	0.93%	0.3	6.90	7.00	676.44	676.36	1.14%	2	16.135	0.07	958.00	675.86	671.75	0.43%	1.00	20.328	11.99	NOT USED			18.96	11.38
DA-2B POST	18.67	6.49	12.18	300.00	672.50	671.50	0.33%	0.4	29.41	676.00	671.50	670.50	0.15%	5	6.962	42.08	NOT USED							710.00	6.00	1.97	73.46	44.07
DA-3 POST	28.65	7.29	21.36	20.00	677.28	677.15	0.65%	0.3	6.21	726.00	676.65	672.60	0.56%	1	20.328	7.97	NOT USED							1573.00	3.00	8.74	22.92	13.75

- Shallow Concentrated Flow Types
- 1

Pavement and small upland gullies
- 2

Grassed Waterways
- 3

Nearly bare and untilled (overland flow); and alluvial fans in western mountain regions
- 4

Cultivated stright row crops
- 5

Short-grass pasture
- 6

Minimum tillage cultivation, contour or strip-cropped, and woodlands
- 7

Forest with heavy ground litter and hay meadows

## 4. Curve Numbers

Runoff curve numbers for the drainage areas were obtained using NRCS TR-55 methods. Composite curve numbers were calculated for drainage areas containing multiple ground cover types. The curve numbers used in the HEC-HMS model are as follows:

**Table 4: Curve Numbers**

<b>Drainage Area</b>	<b>Runoff Composite Curve Number</b>
DA-1 PRE	79.5
DA-2 PRE	77.6
DA-3 PRE	71.9
DA-1A POST	86.5
DA-1B POST	83.4
DA-2A POST	87.1
DA-2B POST	85.5
DA-3 POST	84.5

All of the drainage areas' curve numbers are composite numbers due to multiple types of ground cover and soils. The calculations for these curve numbers are shown in the following tables:



**Table 5: DA-1 PRE**

Area ID	Soil Name and Hydrologic Group (Appendix A)	Cover Description	CN			Area (Acres)	Product of CN x Area
			Table 2-2a	Table 2-2b	Table 2-2c		
1	C	Brush-weed grass mixture, mostly brush - fair			70	9.60	672.32
2	D	Brush-weed grass mixture, mostly brush - fair			77	131.36	10114.84
3	C	Woods - fair			73	0	0
4	D	Woods - fair			79	16.92	1336.57
5	C	Good condition (grass cover >75%)	74			0	0
6	D	Good condition (grass cover >75%)	80			3.26	260.97
7	D	Meadow-continuous grass, no grazing, cut for hay			78	38.76	3023.65
8	D	Fair condition (grass cover 50% to 75%)	84			8.62	723.76
9	D	3/4 Acre Residential (Average of 1 Acre and 1/2 Acre)	84.5			0.73	61.55
10	D	1/2 Acre Residential	85			0.56	47.91
11	C	Residential 1/6 acre	87			0	0
12	D	Residential 1/6 acre	90			0	0
13	D	1/8 Acre or Less Residential (Town Houses)	92			2.04	187.64
14	D	Multi-Family	95			0	0
15	D	Commercial and business	95			23.77	2258.29
16	C	Paved; open ditched (including ROW)	92			0	0
17	D	Paved; open ditched (including ROW)	93			2.90	269.56
			Totals			238.53	18957.07
			CN			79.5	

**Table 6: DA-2 PRE**

Area ID	Soil Name and Hydrologic Group (Appendix A)	Cover Description	CN			Area (Acres)	Product of CN x Area
			Table 2-2a	Table 2-2b	Table 2-2c		
1	C	Brush-weed grass mixture, mostly brush - fair			70	3.76	263.54
2	D	Brush-weed grass mixture, mostly brush - fair			77	28.03	2158.46
3	C	Woods - fair			73	2.73	199.29
4	D	Woods - fair			79	8.32	657.64
5	C	Good condition (grass cover >75%)	74			0	0
6	D	Good condition (grass cover >75%)	80			0	0
7	D	Meadow-continuous grass, no grazing, cut for hay			78	0	0
8	D	Fair condition (grass cover 50% to 75%)	84			0	0
9	D	3/4 Acre Residential (Average of 1 Acre and 1/2 Acre)	84.5			0.75	63.72
10	D	1/2 Acre Residential	85			0.52	44.15
11	C	Residential 1/6 acre	87			0	0
12	D	Residential 1/6 acre	90.0			0	0
13	D	1/8 Acre or Less Residential (Town Houses)	92			0	0
14	D	Multi-Family	95			0	0
15	D	Commercial and business	95			1.33	125.95
16	C	Paved; open ditched (including ROW)	92			0.25	23.29
17	D	Paved; open ditched (including ROW)	93			0.67	62.59
			Totals			46.38	3598.64
			CN			77.6	

**Table 7: DA-3 PRE**

Area ID	Soil Name and Hydrologic Group (Appendix A)	Cover Description	CN			Area (Acres)	Product of CN x Area
			Table 2-2a	Table 2-2b	Table 2-2c		
1	C	Brush-weed grass mixture, mostly brush - fair			70	19.38	1356.65
2	D	Brush-weed grass mixture, mostly brush - fair			77	7.31	562.81
3	C	Woods - fair			73	0	0
4	D	Woods - fair			79	0.07	5.39
5	C	Good condition (grass cover >75%)	74			0	0
6	D	Good condition (grass cover >75%)	80			0	0
7	D	Meadow-continuous grass, no grazing, cut for hay			78	0	0
8	D	Fair condition (grass cover 50% to 75%)	84			0	0
9	D	3/4 Acre Residential (Average of 1 Acre and 1/2 Acre)	84.5			0	0
10	D	1/2 Acre Residential	85			0	0
11	C	Residential 1/6 acre	87			0	0
12	D	Residential 1/6 acre	90			0	0
13	D	1/8 Acre or Less Residential (Town Houses)	92			0	0
14	D	Multi-Family	95			0	0
15	D	Commercial and business	95			0	0
16	C	Paved; open ditched (including ROW)	92			0	0
17	D	Paved; open ditched (including ROW)	93			0	0
			<b>Totals</b>			26.76	1924.85
			<b>CN</b>			<b>71.9</b>	

**Table 8: DA-1A POST**

Area ID	Soil Name and Hydrologic Group (Appendix A)	Cover Description	CN			Area (Acres)	Product of CN x Area
			Table 2-2a	Table 2-2b	Table 2-2c		
1	C	Brush-weed grass mixture, mostly brush - fair			70	0	0
2	D	Brush-weed grass mixture, mostly brush - fair			77	4.98	383.66
3	C	Woods - fair			73	0	0
4	D	Woods - fair			79	0	0
5	C	Good condition (grass cover >75%)	74			0.57	41.83
6	D	Good condition (grass cover >75%)	80			33.40	2672.31
7	D	Meadow-continuous grass, no grazing, cut for hay			78	32.39	2526.20
8	D	Fair condition (grass cover 50% to 75%)	84			8.62	723.76
9	D	3/4 Acre Residential (Average of 1 Acre and 1/2 Acre)	84.5			0	0
10	D	1/2 Acre Residential	85			0	0
11	C	Residential 1/6 acre	87			10.16	883.78
12	D	Residential 1/6 acre	90			73.87	6648.68
13	D	1/8 Acre or Less Residential (Town Houses)	92			2.04	187.56
14	D	Multi-Family	95			20.88	1983.92
15	D	Commercial and business	95			11.87	1127.34
16	C	Paved; open ditched (including ROW)	92			0	0
17	D	Paved; open ditched (including ROW)	93			2.94	273.01
			Totals			201.71	17452.06
			CN			86.5	

**Table 9: DA-1B POST**

Area ID	Soil Name and Hydrologic Group (Appendix A)	Cover Description	CN			Area (Acres)	Product of CN x Area
			Table 2-2a	Table 2-2b	Table 2-2c		
1	C	Brush-weed grass mixture, mostly brush - fair			70	0	0
2	D	Brush-weed grass mixture, mostly brush - fair			77	10.17	782.77
3	C	Woods - fair			73	0	0
4	D	Woods - fair			79	16.87	1332.67
5	C	Good condition (grass cover >75%)	74			0	0
6	D	Good condition (grass cover >75%)	80			0.62	49.35
7	D	Meadow-continuous grass, no grazing, cut for hay			78	6.42	500.47
8	D	Fair condition (grass cover 50% to 75%)	84			0	0
9	D	3/4 Acre Residential (Average of 1 Acre and 1/2 Acre)	84.5			0.73	61.55
10	D	1/2 Acre Residential	85			0.56	47.91
11	C	Residential 1/6 acre	87			0	0
12	D	Residential 1/6 acre	90			0.18	16.56
13	D	1/8 Acre or Less Residential (Town Houses)	92			0	0
14	D	Multi-Family	95			0	0
15	D	Commercial and business	95			11.90	1130.95
16	C	Paved; open ditched (including ROW)	92			0	0
17	D	Paved; open ditched (including ROW)	93			3.51	326.35
			Totals			50.96	4248.58
			CN			83.4	

**Table 10: DA-2A POST**

Area ID	Soil Name and Hydrologic Group (Appendix A)	Cover Description	CN			Area (Acres)	Product of CN x Area
			Table 2-2a	Table 2-2b	Table 2-2c		
1	C	Brush-weed grass mixture, mostly brush - fair			70	0	0
2	D	Brush-weed grass mixture, mostly brush - fair			77	0	0
3	C	Woods - fair			73	0	0
4	D	Woods - fair			79	0	0
5	C	Good condition (grass cover >75%)	74			0.94	69.43
6	D	Good condition (grass cover >75%)	80			1.03	82.44
7	D	Meadow-continuous grass, no grazing, cut for hay			78	0	0
8	D	Fair condition (grass cover 50% to 75%)	84			0	0
9	D	3/4 Acre Residential (Average of 1 Acre and 1/2 Acre)	84.5			0	0
10	D	1/2 Acre Residential	85			0	0
11	C	Residential 1/6 acre	87			0.58	50.16
12	D	Residential 1/6 acre	90			6.74	606.94
13	D	1/8 Acre or Less Residential (Town Houses)	92			0	0
14	D	Multi-Family	95			0	0
15	D	Commercial and business	95			0	0
16	C	Paved; open ditched (including ROW)	92			0	0
17	D	Paved; open ditched (including ROW)	93			0	0
			Totals			9.29	808.98
			CN			87.1	

**Table 11:DA-2B POST**

Area ID	Soil Name and Hydrologic Group (Appendix A)	Cover Description	CN			Area (Acres)	Product of CN x Area
			Table 2-2a	Table 2-2b	Table 2-2c		
1	C	Brush-weed grass mixture, mostly brush - fair			70	0	0
2	D	Brush-weed grass mixture, mostly brush - fair			77	6.49	499.57
3	C	Woods - fair			73	0	0
4	D	Woods - fair			79	0	0
5	C	Good condition (grass cover >75%)	74			0	0
6	D	Good condition (grass cover >75%)	80			0	0
7	D	Meadow-continuous grass, no grazing, cut for hay			78	0	0
8	D	Fair condition (grass cover 50% to 75%)	84			0	0
9	D	3/4 Acre Residential (Average of 1 Acre and 1/2 Acre)	84.5			0.76	63.83
10	D	1/2 Acre Residential	85			0.52	44.11
11	C	Residential 1/6 acre	87			1.07	93.14
12	D	Residential 1/6 acre	90			7.41	666.67
13	D	1/8 Acre or Less Residential (Town Houses)	92			0	0
14	D	Multi-Family	95			0	0
15	D	Commercial and business	95			1.33	125.95
16	C	Paved; open ditched (including ROW)	92			0.40	36.66
17	D	Paved; open ditched (including ROW)	93			0.71	65.80
			Totals			18.67	1595.74
			CN			85.5	

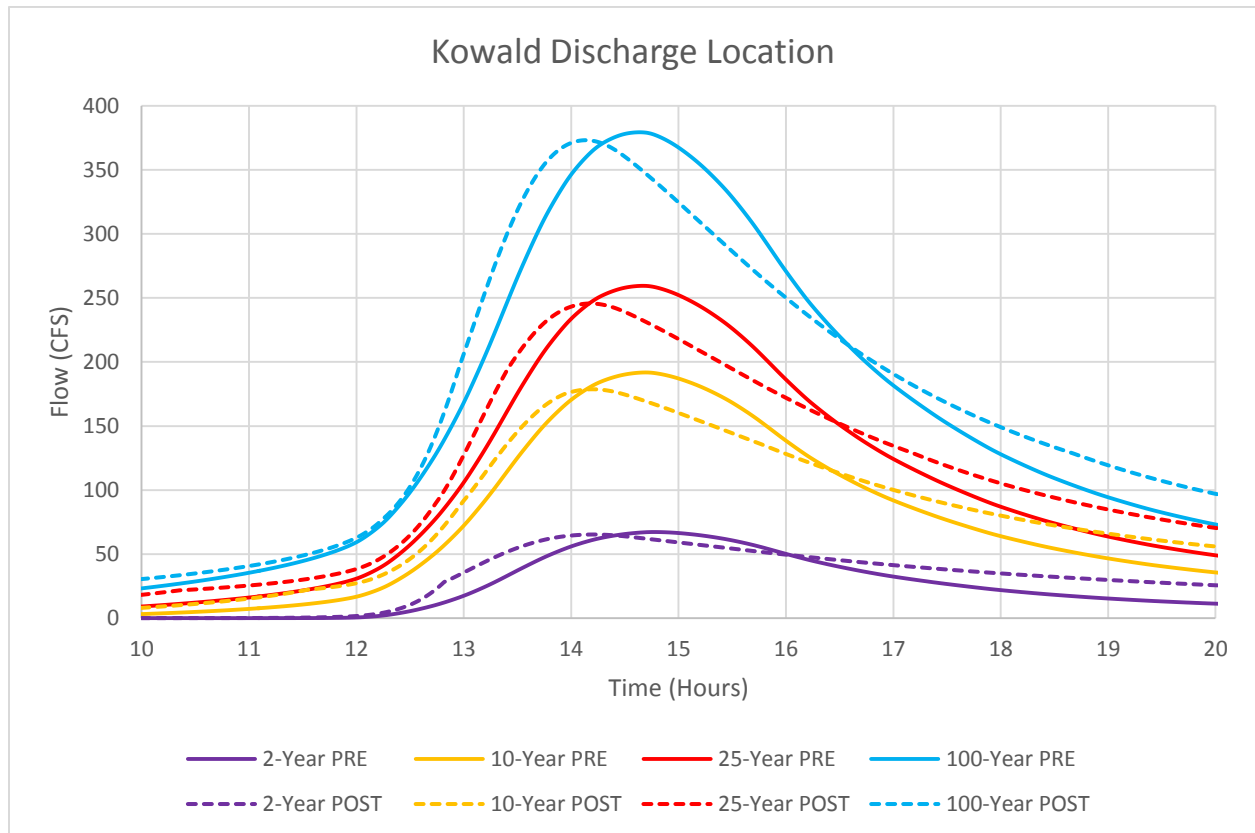
**Table 12: DA-3 POST**

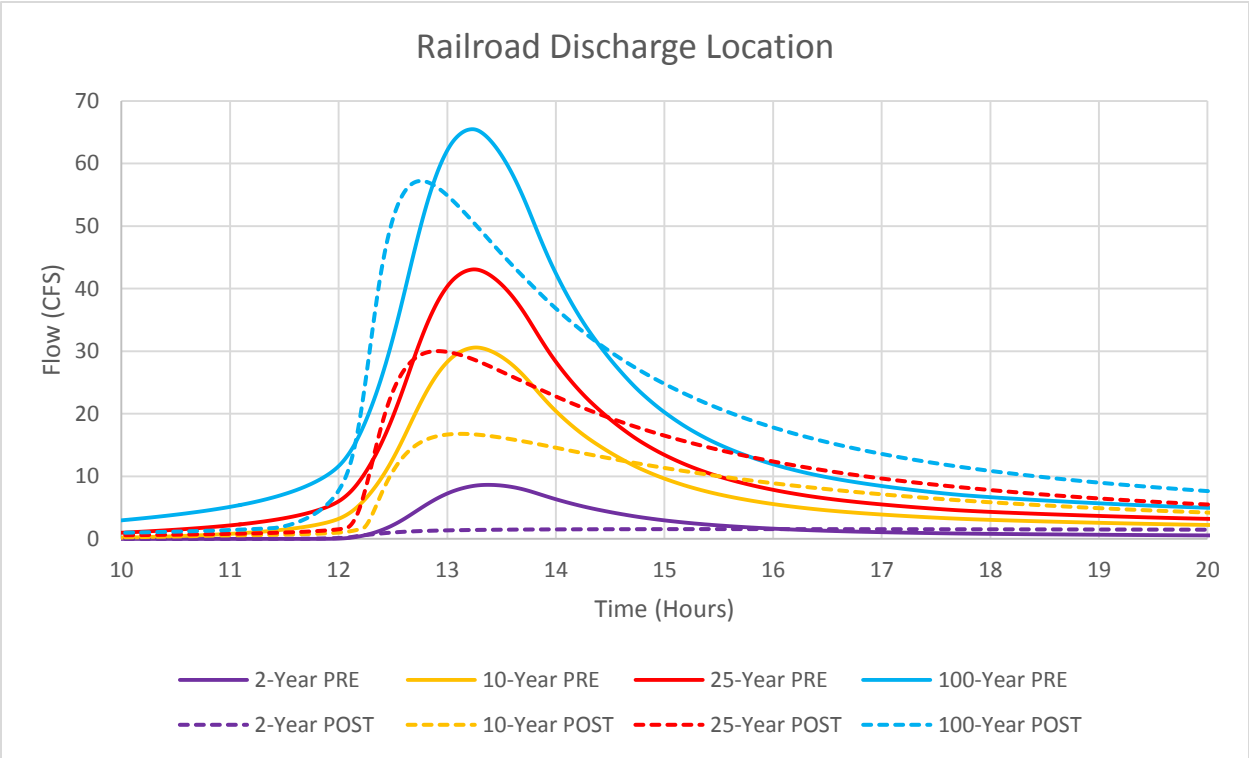
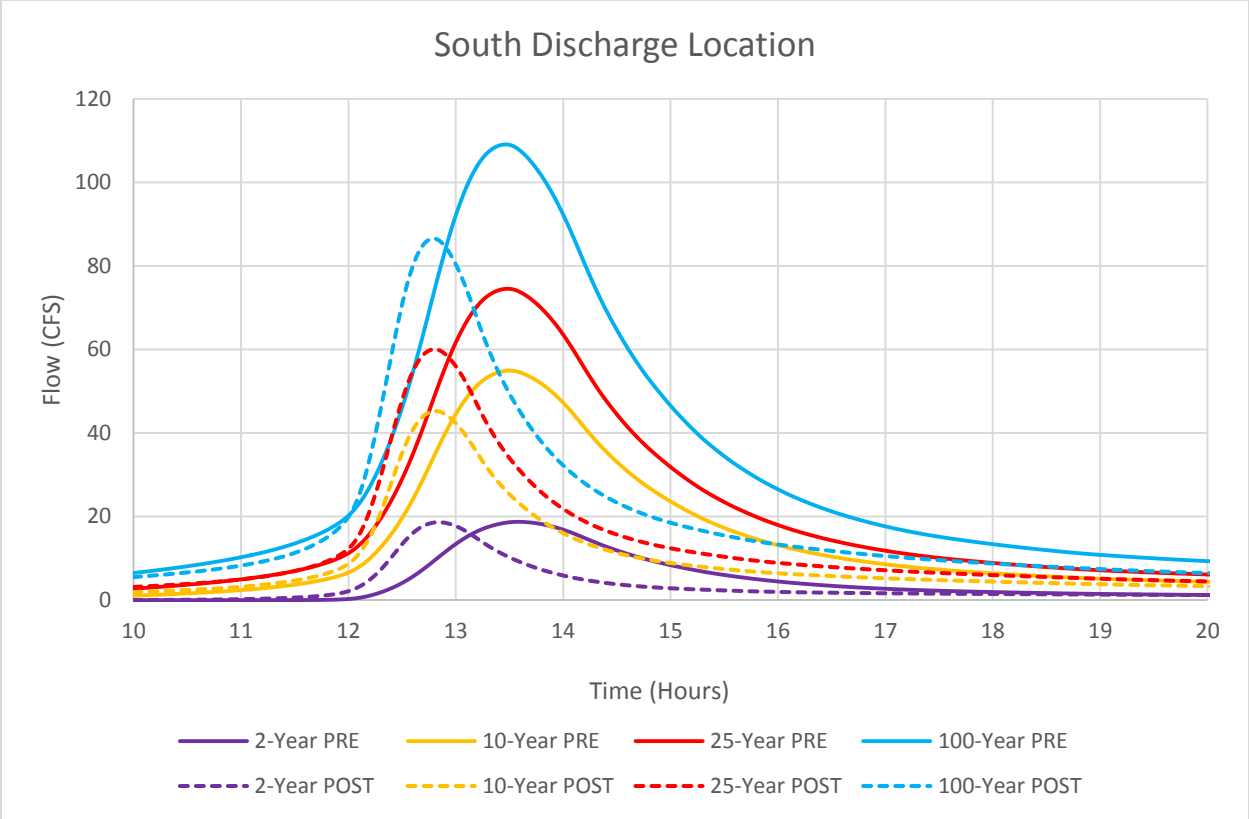
Area ID	Soil Name and Hydrologic Group (Appendix A)	Cover Description	CN			Area (Acres)	Product of CN x Area
			Table 2-2a	Table 2-2b	Table 2-2c		
1	C	Brush-weed grass mixture, mostly brush - fair			70	0	0
2	D	Brush-weed grass mixture, mostly brush - fair			77	0	0
3	C	Woods - fair			73	0	0
4	D	Woods - fair			79	0	0
5	C	Good condition (grass cover >75%)	74			6.69	494.75
6	D	Good condition (grass cover >75%)	80			0.61	48.42
7	D	Meadow-continuous grass, no grazing, cut for hay			78	0	0
8	D	Fair condition (grass cover 50% to 75%)	84			0	0
9	D	3/4 Acre Residential (Average of 1 Acre and 1/2 Acre)	84.5			0	0
10	D	1/2 Acre Residential	85			0	0
11	C	Residential 1/6 acre	87			15.11	1314.38
12	D	Residential 1/6 acre	90			6.26	562.99
13	D	1/8 Acre or Less Residential (Town Houses)	92			0	0
14	D	Multi-Family	95			0	0
15	D	Commercial and business	95			0	0
16	C	Paved; open ditched (including ROW)	92			0	0
17	D	Paved; open ditched (including ROW)	93			0	0
			Totals			28.65	2420.54
			CN			84.5	



## 5. Hydrographs

Below are the hydrographs for all three discharge locations analyzed in this report. While the storm duration in the model is 24 hours, these hydrographs have been narrowed down to the few hours surrounding the peak flowrates for clarity purposes. The Kowald, South, and Railroad detention facilities take approximately 21.75 hours, 16.33 hours, and 14.75 hours, respectively, to empty from a 100-yr storm.





## 6. HEC-HMS Models



Figure 1: Pre-Development Model

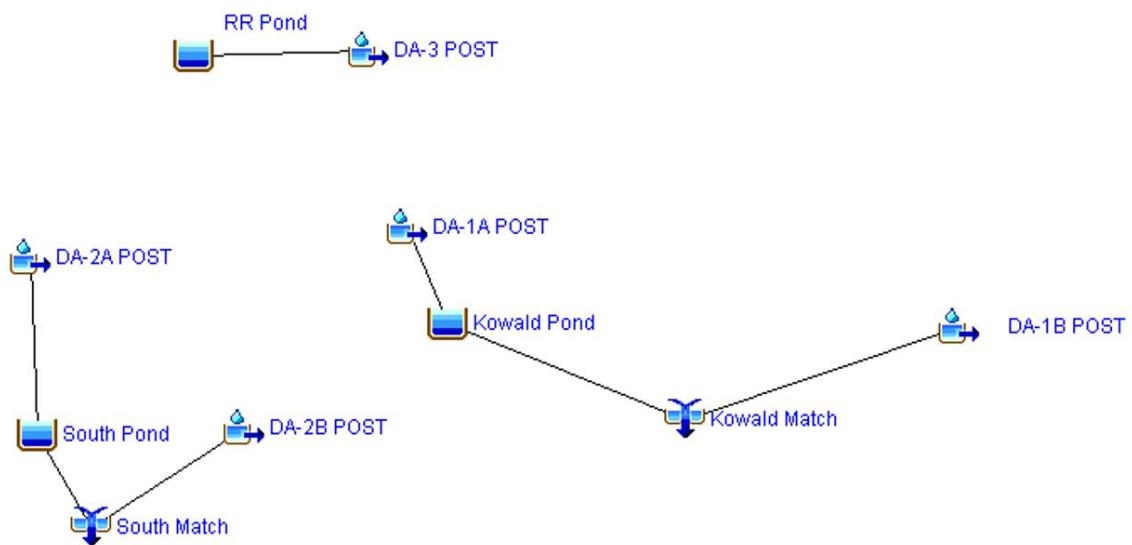


Figure 2: Post Development Model

## 7. HEC-HMS Detention Pond Inputs

Listed below are tables showing the inputs to HEC-HMS:


 Paired Data		Table	Graph
Elevation (FT)		Area (AC)	
	667.0		0.0000
	668.0		9.7431
	669.0		14.8566
	670.0		19.0767
	671.0		19.6413
	672.0		20.1705
	672.6		20.5050

Figure 3: Kowald Detention Pond Elevation-Storage Table


 Paired Data	Table	Graph
Elevation (FT)	Area (AC)	
667.0	0.0000	
668.0	0.5357	
669.0	1.3509	
670.0	1.4994	
671.0	1.6160	
672.0	1.7586	

Figure 4: South Detention Pond Elevation-Storage Table


 Paired Data	Table	Graph
Elevation (FT)	Area (AC)	
668.0	0.0000	
669.0	4.1231	
670.0	4.2699	
671.0	4.4311	
672.0	4.5494	
673.0	4.6900	

Figure 5: RR Detention Pond Elevation-Storage Table

The outfall structures are multi-tiered spillways, their inputs are shown below.

Reservoir	Spillway 1	Options	Reservoir	Spillway 2	Options
<b>Basin Name: POST</b> <b>Element Name: Kowald Pond</b> Method: Broad-Crested Spillway Direction: Main *Elevation (FT): 667 *Length (FT): 5.5 *Coefficient: 3 Gates: 0			<b>Basin Name: POST</b> <b>Element Name: Kowald Pond</b> Method: Broad-Crested Spillway Direction: Main *Elevation (FT): 669.0 *Length (FT): 9.5 *Coefficient: 3 Gates: 0		

Kowald Pond Spillway Inputs

Reservoir	Spillway 1	Options	Reservoir	Spillway 2	Options
<b>Basin Name: POST</b> <b>Element Name: South Pond</b> Method: Broad-Crested Spillway Direction: Main *Elevation (FT): 667 *Length (FT): 0.1 *Coefficient: 3 Gates: 0			<b>Basin Name: POST</b> <b>Element Name: South Pond</b> Method: Broad-Crested Spillway Direction: Main *Elevation (FT): 669 *Length (FT): 1.5 *Coefficient: 3 Gates: 0		

South Pond Spillway Inputs

Reservoir	Spillway 1	Options	Reservoir	Spillway 2	Options
<b>Basin Name: POST</b> <b>Element Name: RR Pond</b> Method: Broad-Crested Spillway Direction: Main *Elevation (FT): 668.5 *Length (FT): 0.5 *Coefficient: 3 Gates: 0			<b>Basin Name: POST</b> <b>Element Name: RR Pond</b> Method: Broad-Crested Spillway Direction: Main *Elevation (FT): 669.6 *Length (FT): 7 *Coefficient: 3 Gates: 0		

Railroad Pond Spillway Inputs

The overall properties of each pond are shown below.

**Table 13: Pond Overall Properties**

<b>Pond Name</b>	<b>Pond Size (Acres)</b>	<b>Pond Dimensions (feet)</b>	<b>Pond Total Capacity (ac. ft.)</b>
Kowald	21.05	2 rectangles roughly 2220' x 210' and 985' x 435'	103.99
South	1.97	Roughly a 770' x 117' rectangle	6.76
Railroad	4.89	Roughly a right triangle with base of 775' and height of 589'	22.06

## 8. HEC-HMS Detention Pond Outputs

Output summary for the Pre-Development 2-year storm:

Global Summary Results for Run "2-Year PRE"

Project: NB00\_v4      Simulation Run: 2-Year PRE

Start of Run: 01May2016, 01:00      Basin Model: PRE  
 End of Run: 02May2016, 01:00      Meteorologic Model: 2-Year  
 Compute Time: 06Jun2016, 12:53:31      Control Specifications: Control 1

Show Elements: All Elements      Volume Units: ☒ IN ☐ AC-FT      Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
DA-1 PRE	0.372702	67.2	01May2016, 15:45	1.23
DA-2 PRE	0.072464	18.7	01May2016, 14:34	1.15
DA-3 PRE	0.041810	8.6	01May2016, 14:22	0.84

Output summary for the Post-Development 2-year storm:

Global Summary Results for Run "2-Year POST"

Project: NB00\_v4      Simulation Run: 2-Year POST

Start of Run: 01May2016, 01:00      Basin Model: POST  
 End of Run: 02May2016, 01:00      Meteorologic Model: 2-Year  
 Compute Time: 06Jun2016, 12:53:29      Control Specifications: Control 1

Show Elements: All Elements      Volume Units: ☒ IN ☐ AC-FT      Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
DA-1A POST	0.315175	143.5	01May2016, 14:19	1.76
Kowald Pond	0.315175	45.3	01May2016, 15:55	1.61
DA-1B POST	0.079622	25.3	01May2016, 14:45	1.52
Kowald Match	0.394797	65.3	01May2016, 15:11	1.59
DA-3 POST	0.044772	53.0	01May2016, 13:16	1.63
RR Pond	0.044772	1.6	01May2016, 16:32	0.60
DA-2B POST	0.029175	17.9	01May2016, 13:49	1.69
DA-2A POST	0.014514	21.2	01May2016, 13:13	1.83
South Pond	0.014514	0.8	01May2016, 15:32	0.91
South Match	0.043689	18.7	01May2016, 13:49	1.43

Output summary for the Pre-Development 10-year storm:

Global Summary Results for Run "10-Year PRE"				
Project: NB00_v4		Simulation Run: 10-Year PRE		
Start of Run: 01May2016, 01:00		Basin Model:	PRE	
End of Run: 02May2016, 01:00		Meteorologic Model:	10-Year	
Compute Time: 06Jun2016, 12:53:17		Control Specifications:	Control 1	
Show Elements:	All Elements	Volume Units:	<input checked="" type="radio"/> IN <input type="radio"/> AC-FT	Sorting: Hydrologic
Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
DA-1 PRE	0.372702	191.8	01May2016, 15:41	3.82
DA-2 PRE	0.072464	55.0	01May2016, 14:29	3.73
DA-3 PRE	0.041810	30.6	01May2016, 14:15	3.18

Output summary for the Post-Development 10-year storm:

Global Summary Results for Run "10-Year POST"				
Project: NB00_v4		Simulation Run: 10-Year POST		
Start of Run: 01May2016, 01:00		Basin Model:	POST	
End of Run: 02May2016, 01:00		Meteorologic Model:	10-Year	
Compute Time: 06Jun2016, 12:53:16		Control Specifications:	Control 1	
Show Elements:	All Elements	Volume Units:	<input checked="" type="radio"/> IN <input type="radio"/> AC-FT	Sorting: Hydrologic
Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
DA-1A POST	0.315175	324.6	01May2016, 14:16	4.69
Kowald Pond	0.315175	128.1	01May2016, 15:40	4.13
DA-1B POST	0.079622	63.1	01May2016, 14:41	4.32
Kowald Match	0.394797	178.7	01May2016, 15:11	4.17
DA-3 POST	0.044772	122.1	01May2016, 13:15	4.55
RR Pond	0.044772	16.8	01May2016, 14:07	3.02
DA-2B POST	0.029175	40.9	01May2016, 13:47	4.62
DA-2A POST	0.014514	45.6	01May2016, 13:13	4.84
South Pond	0.014514	4.6	01May2016, 14:12	3.22
South Match	0.043689	45.3	01May2016, 13:48	4.15



Output summary for the Pre-Development 25-year storm:

Global Summary Results for Run "25-Year PRE"				
Project: NB00_v4		Simulation Run: 25-Year PRE		
Start of Run: 01May2016, 01:00		Basin Model:	PRE	
End of Run: 02May2016, 01:00		Meteorologic Model:	25-Year	
Compute Time: 06Jun2016, 12:53:24		Control Specifications:	Control 1	
Show Elements:	All Elements	Volume Units:	<input checked="" type="radio"/> IN <input type="radio"/> AC-FT	Sorting: Hydrologic
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
DA-1 PRE	0.372702	259.5	01May2016, 15:39	5.33
DA-2 PRE	0.072464	74.5	01May2016, 14:28	5.26
DA-3 PRE	0.041810	43.1	01May2016, 14:14	4.63

Output summary for the Post-Development 25-year storm:

Global Summary Results for Run "25-Year POST"				
Project: NB00_v4		Simulation Run: 25-Year POST		
Start of Run: 01May2016, 01:00		Basin Model:	POST	
End of Run: 02May2016, 01:00		Meteorologic Model:	25-Year	
Compute Time: 06Jun2016, 12:53:23		Control Specifications:	Control 1	
Show Elements:	All Elements	Volume Units:	<input checked="" type="radio"/> IN <input type="radio"/> AC-FT	Sorting: Hydrologic
Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
DA-1A POST	0.315175	416.6	01May2016, 14:15	6.32
Kowald Pond	0.315175	177.8	01May2016, 15:34	5.60
DA-1B POST	0.079622	82.7	01May2016, 14:40	5.91
Kowald Match	0.394797	245.7	01May2016, 15:10	5.66
DA-3 POST	0.044772	156.3	01May2016, 13:15	6.20
RR Pond	0.044772	30.0	01May2016, 13:54	4.57
DA-2B POST	0.029175	52.4	01May2016, 13:47	6.26
DA-2A POST	0.014514	57.5	01May2016, 13:13	6.51
South Pond	0.014514	7.7	01May2016, 13:59	4.74
South Match	0.043689	60.1	01May2016, 13:47	5.75

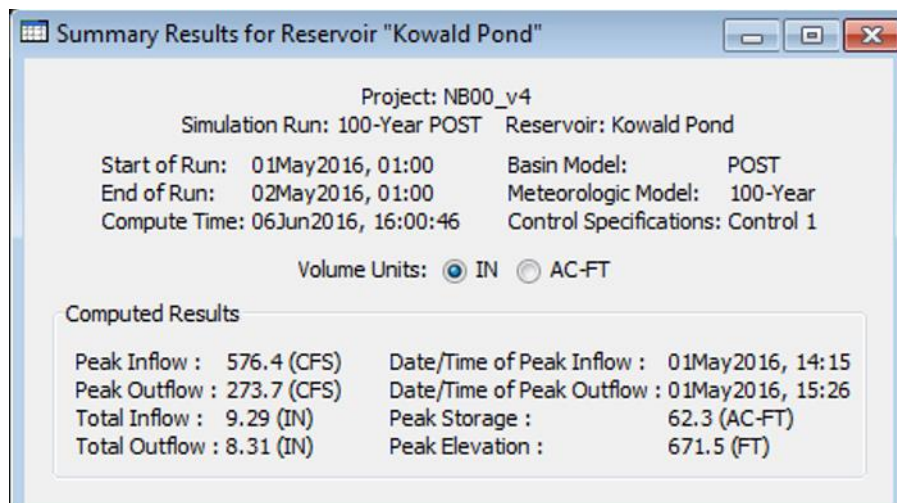
Output summary for the Pre-Development 100-year storm:

Global Summary Results for Run "100-Year PRE"				
Project: NB00_v4		Simulation Run: 100-Year PRE		
Start of Run: 01May2016, 01:00		Basin Model: PRE		
End of Run: 02May2016, 01:00		Meteorologic Model: 100-Year		
Compute Time: 06Jun2016, 12:53:11		Control Specifications: Control 1		
Show Elements:	All Elements	Volume Units:	<input checked="" type="radio"/> IN <input type="radio"/> AC-FT	Sorting: Hydrologic
Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
DA-1 PRE	0.372702	379.4	01May2016, 15:37	8.12
DA-2 PRE	0.072464	109.1	01May2016, 14:27	8.09
DA-3 PRE	0.041810	65.5	01May2016, 14:13	7.37

Output summary for the Post-Development 100-year storm:

Global Summary Results for Run "100-Year POST"				
Project: NB00_v4		Simulation Run: 100-Year POST		
Start of Run: 01May2016, 01:00		Basin Model: POST		
End of Run: 02May2016, 01:00		Meteorologic Model: 100-Year		
Compute Time: 06Jun2016, 12:53:09		Control Specifications: Control 1		
Show Elements:	All Elements	Volume Units:	<input checked="" type="radio"/> IN <input type="radio"/> AC-FT	Sorting: Hydrologic
Hydrologic Element	Drainage Area (MI <sup>2</sup> )	Peak Discharge (CFS)	Time of Peak	Volume (IN)
DA-1A POST	0.315175	576.4	01May2016, 14:15	9.29
Kowald Pond	0.315175	273.7	01May2016, 15:26	8.31
DA-1B POST	0.079622	117.0	01May2016, 14:39	8.82
Kowald Match	0.394797	373.2	01May2016, 15:07	8.41
DA-3 POST	0.044772	215.7	01May2016, 13:15	9.20
RR Pond	0.044772	57.2	01May2016, 13:44	7.43
DA-2B POST	0.029175	72.5	01May2016, 13:47	9.24
DA-2A POST	0.014514	78.3	01May2016, 13:13	9.54
South Pond	0.014514	14.1	01May2016, 13:48	7.55
South Match	0.043689	86.6	01May2016, 13:47	8.68

Output summary for the Kowald Pond, 100-Year:



Summary Results for Reservoir "Kowald Pond"

Project: NB00\_v4  
Simulation Run: 100-Year POST    Reservoir: Kowald Pond

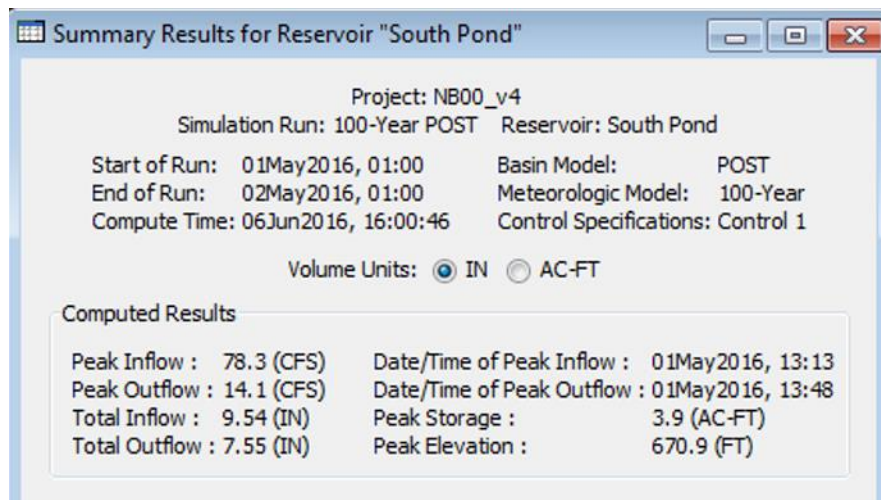
Start of Run: 01May2016, 01:00    Basin Model: POST  
End of Run: 02May2016, 01:00    Meteorologic Model: 100-Year  
Compute Time: 06Jun2016, 16:00:46    Control Specifications: Control 1

Volume Units: ☒ IN    ☐ AC-FT

Computed Results

Peak Inflow : 576.4 (CFS)	Date/Time of Peak Inflow : 01May2016, 14:15
Peak Outflow : 273.7 (CFS)	Date/Time of Peak Outflow : 01May2016, 15:26
Total Inflow : 9.29 (IN)	Peak Storage : 62.3 (AC-FT)
Total Outflow : 8.31 (IN)	Peak Elevation : 671.5 (FT)

Output summary for the South Pond, 100-Year:



Summary Results for Reservoir "South Pond"

Project: NB00\_v4  
Simulation Run: 100-Year POST    Reservoir: South Pond

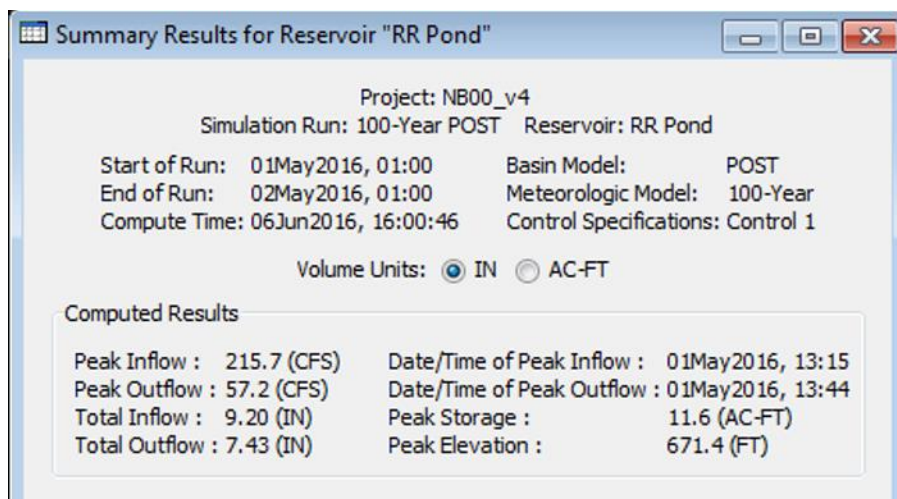
Start of Run: 01May2016, 01:00    Basin Model: POST  
End of Run: 02May2016, 01:00    Meteorologic Model: 100-Year  
Compute Time: 06Jun2016, 16:00:46    Control Specifications: Control 1

Volume Units: ☒ IN    ☐ AC-FT

Computed Results

Peak Inflow : 78.3 (CFS)	Date/Time of Peak Inflow : 01May2016, 13:13
Peak Outflow : 14.1 (CFS)	Date/Time of Peak Outflow : 01May2016, 13:48
Total Inflow : 9.54 (IN)	Peak Storage : 3.9 (AC-FT)
Total Outflow : 7.55 (IN)	Peak Elevation : 670.9 (FT)

Output summary for the Railroad Pond, 100-Year:



Summary Results for Reservoir "RR Pond"

Project: NB00\_v4  
Simulation Run: 100-Year POST    Reservoir: RR Pond

Start of Run: 01May2016, 01:00    Basin Model: POST  
End of Run: 02May2016, 01:00    Meteorologic Model: 100-Year  
Compute Time: 06Jun2016, 16:00:46    Control Specifications: Control 1

Volume Units: ☒ IN    ☐ AC-FT

Computed Results

Peak Inflow : 215.7 (CFS)	Date/Time of Peak Inflow : 01May2016, 13:15
Peak Outflow : 57.2 (CFS)	Date/Time of Peak Outflow : 01May2016, 13:44
Total Inflow : 9.20 (IN)	Peak Storage : 11.6 (AC-FT)
Total Outflow : 7.43 (IN)	Peak Elevation : 671.4 (FT)

The outfall velocity for each pond is shown below.

**Table 14: Pond Outfall Velocities**

<b>Pond</b>	<b>2-Year (fps)</b>	<b>10-Year (fps)</b>	<b>25-Year (fps)</b>	<b>100-Year (fps)</b>
Kowald	4.15	4.43	4.88	5.65
South	4.21	3.11	3.63	4.35
Railroad	3.20	2.90	3.41	4.07

## 9. HEC-HMS Run Log

Run log for the Pre-Development 2-year storm:

NOTE 10184: Began computing simulation run "2-Year PRE" at time 06Jun2016, 12:53:30.

NOTE 20045: Storm area is not set for frequency storm.

Storm will be adjusted to each subbasin area.

NOTE 20364: Found no parameter problems in meteorologic model "2-Year".

WARNING 20043: Control specifications time interval is less than duration of maximum intensity.

Precipitation data will be interpolated.

NOTE 40040: The basin model contains 3 outlets: DA-1 PRE, DA-2 PRE, DA-3 PRE

NOTE 40049: Found no parameter problems in basin model "PRE".

NOTE 10185: Finished computing simulation run "2-Year PRE" at time 06Jun2016, 12:53:31.

Run log for the Post-Development 2-year storm:

NOTE 10184: Began computing simulation run "2-Year POST" at time 06Jun2016, 12:53:26.

NOTE 20045: Storm area is not set for frequency storm.

Storm will be adjusted to each subbasin area.

NOTE 20364: Found no parameter problems in meteorologic model "2-Year".

WARNING 20043: Control specifications time interval is less than duration of maximum intensity.

Precipitation data will be interpolated.

NOTE 40040: The basin model contains 3 outlets: Kowald Match, RR Pond, South Match

NOTE 40049: Found no parameter problems in basin model "POST".

NOTE 40257: Reservoir "Kowald Pond" used a minimum time step of 1 seconds.

NOTE 40257: Reservoir "RR Pond" used a minimum time step of 30 seconds.

NOTE 40257: Reservoir "South Pond" used a minimum time step of 1 seconds.

NOTE 10185: Finished computing simulation run "2-Year POST" at time 06Jun2016, 12:53:29.

Run log for the Pre-Development 10-year storm:

NOTE 10184: Began computing simulation run "10-Year PRE" at time 06Jun2016, 12:53:17.

NOTE 20045: Storm area is not set for frequency storm.

Storm will be adjusted to each subbasin area.

NOTE 20364: Found no parameter problems in meteorologic model "10-Year".

WARNING 20043: Control specifications time interval is less than duration of maximum intensity.

Precipitation data will be interpolated.

NOTE 40040: The basin model contains 3 outlets: DA-1 PRE, DA-2 PRE, DA-3 PRE

NOTE 40049: Found no parameter problems in basin model "PRE".

NOTE 10185: Finished computing simulation run "10-Year PRE" at time 06Jun2016, 12:53:17.

Run log for the Post-Development 10-year storm:

NOTE 10184: Began computing simulation run "10-Year POST" at time 06Jun2016, 12:53:12.

NOTE 20045: Storm area is not set for frequency storm.

Storm will be adjusted to each subbasin area.

NOTE 20364: Found no parameter problems in meteorologic model "10-Year".

WARNING 20043: Control specifications time interval is less than duration of maximum intensity.

Precipitation data will be interpolated.

NOTE 40040: The basin model contains 3 outlets: Kowald Match, RR Pond, South Match

NOTE 40049: Found no parameter problems in basin model "POST".

NOTE 40257: Reservoir "Kowald Pond" used a minimum time step of 1 seconds.

NOTE 40257: Reservoir "RR Pond" used a minimum time step of 20 seconds.

NOTE 40257: Reservoir "South Pond" used a minimum time step of 1 seconds.

NOTE 10185: Finished computing simulation run "10-Year POST" at time 06Jun2016, 12:53:16.

Run log for the Pre-Development 25-year storm:

NOTE 10184: Began computing simulation run "25-Year PRE" at time 06Jun2016, 12:53:24.

NOTE 20045: Storm area is not set for frequency storm.

Storm will be adjusted to each subbasin area.

NOTE 20364: Found no parameter problems in meteorologic model "25-Year".

WARNING 20043: Control specifications time interval is less than duration of maximum intensity.

Precipitation data will be interpolated.

NOTE 40040: The basin model contains 3 outlets: DA-1 PRE, DA-2 PRE, DA-3 PRE

NOTE 40049: Found no parameter problems in basin model "PRE".

NOTE 10185: Finished computing simulation run "25-Year PRE" at time 06Jun2016, 12:53:24.

Run log for the Post-Development 25-year storm:

NOTE 10184: Began computing simulation run "25-Year POST" at time 06Jun2016, 12:53:19.

NOTE 20045: Storm area is not set for frequency storm.

Storm will be adjusted to each subbasin area.

NOTE 20364: Found no parameter problems in meteorologic model "25-Year".

WARNING 20043: Control specifications time interval is less than duration of maximum intensity.

Precipitation data will be interpolated.

NOTE 40040: The basin model contains 3 outlets: Kowald Match, RR Pond, South Match

NOTE 40049: Found no parameter problems in basin model "POST".

NOTE 40257: Reservoir "Kowald Pond" used a minimum time step of 1 seconds.

NOTE 40257: Reservoir "RR Pond" used a minimum time step of 30 seconds.

NOTE 40257: Reservoir "South Pond" used a minimum time step of 1 seconds.

NOTE 10185: Finished computing simulation run "25-Year POST" at time 06Jun2016, 12:53:23.

Run log for the Pre-Development 100-year storm:

NOTE 10184: Began computing simulation run "100-Year PRE" at time 06Jun2016, 12:53:10.

NOTE 20045: Storm area is not set for frequency storm.

Storm will be adjusted to each subbasin area.

NOTE 20364: Found no parameter problems in meteorologic model "100-Year".

WARNING 20043: Control specifications time interval is less than duration of maximum intensity.

Precipitation data will be interpolated.

NOTE 40040: The basin model contains 3 outlets: DA-1 PRE, DA-2 PRE, DA-3 PRE

NOTE 40049: Found no parameter problems in basin model "PRE".

NOTE 10185: Finished computing simulation run "100-Year PRE" at time 06Jun2016, 12:53:11.

Run log for the Post-Development 100-year storm:

NOTE 10184: Began computing simulation run "100-Year POST" at time 06Jun2016, 12:53:04.

NOTE 20045: Storm area is not set for frequency storm.

Storm will be adjusted to each subbasin area.

NOTE 20364: Found no parameter problems in meteorologic model "100-Year".

WARNING 20043: Control specifications time interval is less than duration of maximum intensity.

Precipitation data will be interpolated.

NOTE 40040: The basin model contains 3 outlets: Kowald Match, RR Pond, South Match

NOTE 40049: Found no parameter problems in basin model "POST".

NOTE 40257: Reservoir "Kowald Pond" used a minimum time step of 1 seconds.

NOTE 40257: Reservoir "RR Pond" used a minimum time step of 30 seconds.

NOTE 40257: Reservoir "South Pond" used a minimum time step of 1 seconds.

NOTE 10185: Finished computing simulation run "100-Year POST" at time 06Jun2016, 12:53:09.

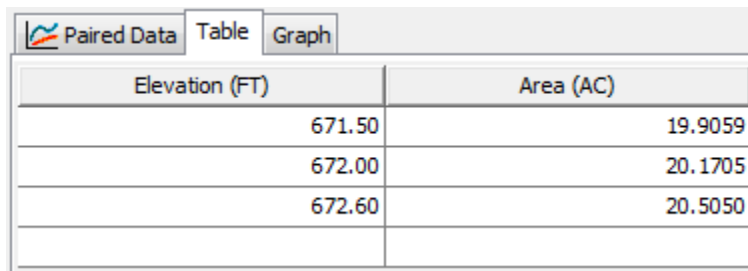


## 10. 25-Year Emergency Spillways

Each pond allows for the 25-year storm to be safely passed in the event that the pond is at peak capacity from a 100-year event. To model this event, the HEC-HMS model was copied and then modified to reflect the ponds being at peak capacity for a 100-yr storm.

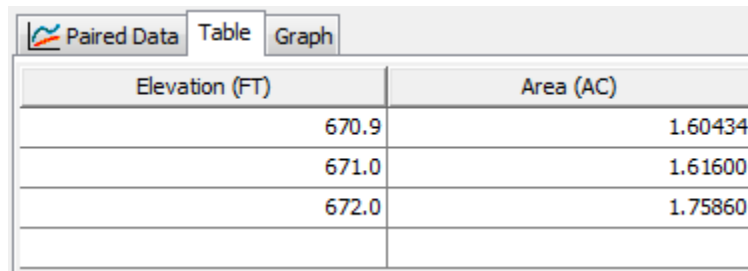
### 10.1 HEC-HMS Detention Pond Inputs

Each Elevation Storage Table was modified to remove the storage being used by the 100-year storm.



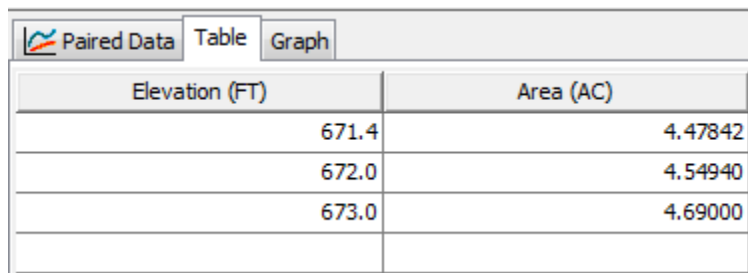
Elevation (FT)	Area (AC)
671.50	19.9059
672.00	20.1705
672.60	20.5050

Figure 6: Kowald Detention Pond Emergency Elevation-Storage Table



Elevation (FT)	Area (AC)
670.9	1.60434
671.0	1.61600
672.0	1.75860

Figure 7: South Detention Pond Emergency Elevation-Storage Table



Elevation (FT)	Area (AC)
671.4	4.47842
672.0	4.54940
673.0	4.69000

Figure 8: RR Detention Pond Emergency Elevation-Storage Table

Each outfall structure was also modified to remove the portion being using by the 100-year storm. The emergency spillway contains a combination of the concrete outfall structure and an earthen berm with rock rip-rap.

Reservoir	Spillway 1	Options
<b>Basin Name: POST</b>		
<b>Element Name: Kowald Pond</b>		
Method:	Broad-Crested Spillway	
Direction:	Main	
*Elevation (FT)	671.5	
*Length (FT)	100	
*Coefficient:	3	
Gates:	0	

**Kowald Pond Emergency Spillway Inputs**

Reservoir	Spillway 1	Options
<b>Basin Name: POST</b>		
<b>Element Name: South Pond</b>		
Method:	Broad-Crested Spillway	
Direction:	Main	
*Elevation (FT)	670.91	
*Length (FT)	50	
*Coefficient:	3	
Gates:	0	

**South Pond Emergency Spillway Inputs**

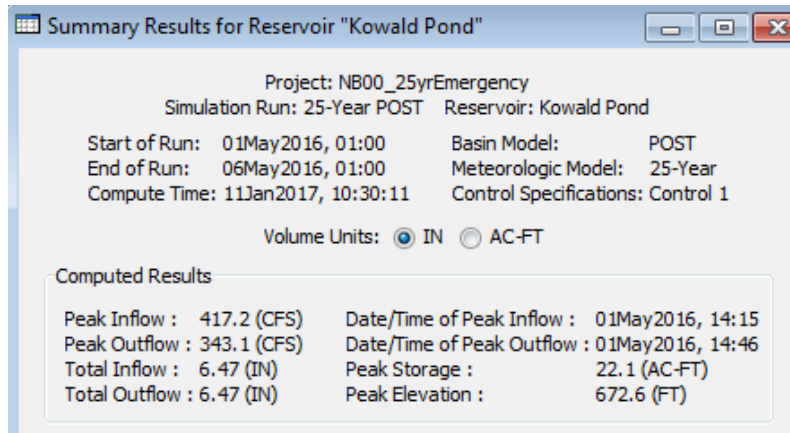
Reservoir	Spillway 1	Options
<b>Basin Name: POST</b>		
<b>Element Name: RR Pond</b>		
Method:	Broad-Crested Spillway	
Direction:	Main	
*Elevation (FT)	671.41	
*Length (FT)	30	
*Coefficient:	3	
Gates:	0	

**RR Pond Emergency Spillway Inputs**

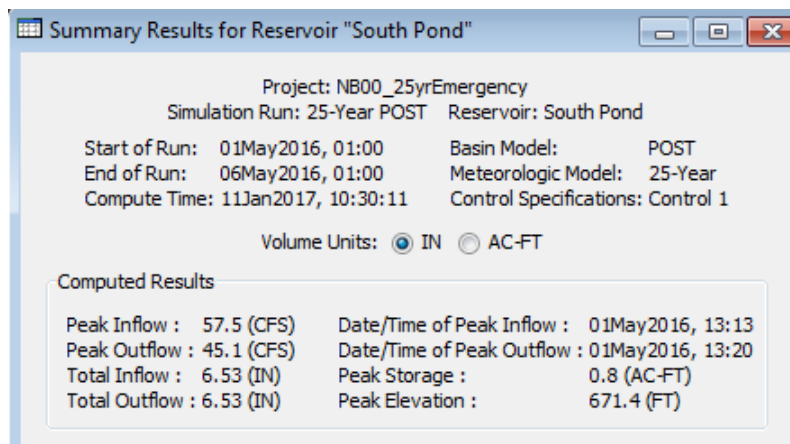
## 10.2 HEC-HMS Detention pond Outputs

The summary outputs below show that the peak water surface elevation does not exceed the top pond elevation for any of the three ponds.

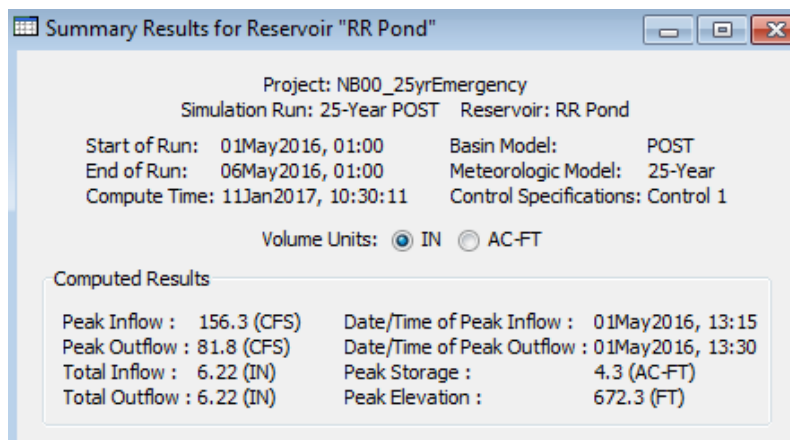
Output summary for the Kowald Pond (Top Elevation=672.6), 25-Year Emergency:



Output summary for the South Pond (Top Elevation=672.0), 25-Year Emergency:



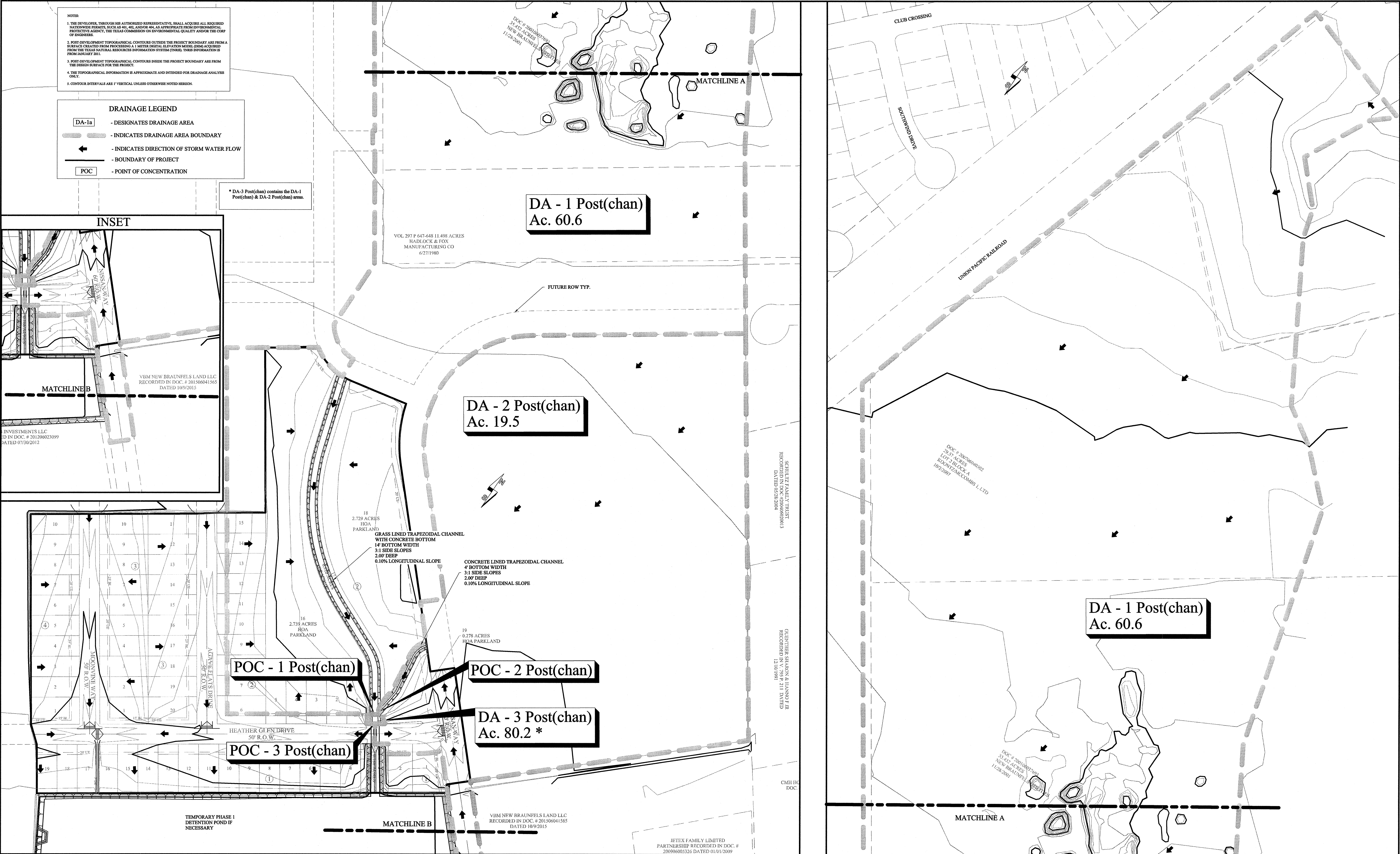
Output summary for the Railroad Pond (Top Elevation=673.0), 25-Year Emergency:



### **3. CHANNEL AND CULVERT FLOW ANALYSIS**

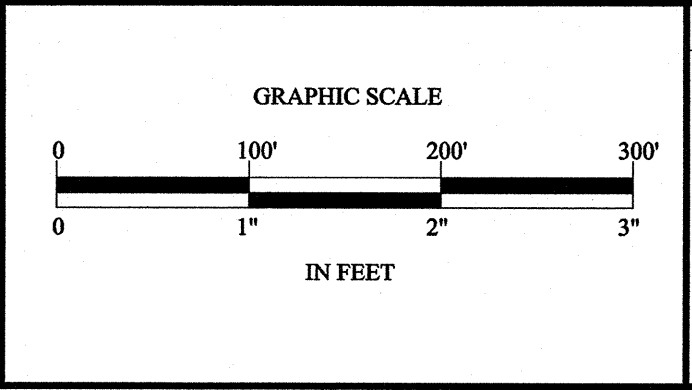
All channels are designed to convey the runoff from the 100yr storm event within the limits of the channel. The channels also provide a minimum velocity of 2 feet per second and maximum 6 feet per second in the 2yr, 10yr, 25yr, and 100yr storm events. Pilot channels are utilized in all grass-lined channels to help maintain acceptable velocities. The culvert conveys the flow from the 25yr storm with headwater 1 foot below the top of embankment and the 100yr storm without any water overtopping the roadway. The Rational Method was used to calculate flow rates for all channels and culverts. The channels and culverts were modeled in HEC-RAS. Tailwater effects from the detention facility were also taken into account.

This section contains the design cross sections for the channel system with their 100-year water surface elevations (WSE). The cross section number will be denoted by its RS number (ex. RS=202). The model uses 3 reaches to define the channels. Reach 1 is the main channel running from the northwest to the southeast through the park, ending at the junction with reach 3. Reach 2 is the section of channel downstream of the junction and includes the culvert. Reach 3 is the channel flowing north to south from Nissan Way to the junction with Reach 1. Bank stations display where changes in manning's values occur across each cross section. The manning's values can be seen across the top of each cross section's profile. The culvert under Heather Glen Drive is also shown in the cross sections and consists of 3-3' high by 6' wide concrete box culverts.



REV.	DESCRIPTION	DATE	BY
2	ADDED POINTS OF CONCENTRATION, REVISED DRAINAGE AREAS.	08/16/2016	TWF
1	ORIGINAL RELEASE	07/18/2016	TWF
PROJECT NUMBER: NB01		CLIENT NAME: WBW DEVELOPMENT GROUP, LLC	
CHECKED BY: JAT		CLIENT LOCATION: KILLEEN, TX	
AUTHORIZED BY: WBW			

PROJECT INFORMATION
TOTAL SIZE: 18.569 ACRES
TOTAL BLOCKS: 4
TOTAL RESIDENTIAL LOTS: 63
TOTAL NON-RESIDENTIAL LOTS: 5



BENCHMARK
NGS BRASS MONUMENT
TEXAS STATE PLANE COORDINATE SYSTEM, NAD1983
2011 DATUM, TEXAS SOUTH CENTRAL ZONE NO. 4204
N: 13809772.48
E: 2257880.15
Z: 668.31'

POST-DRAINAGE FOR CHANNELS  
HEATHER GLEN PHASE 1  
NEW BRAUNFELS, COMAL COUNTY, TEXAS

ENGINEER'S APPROVAL

<b>Yalco, LLC</b> 3000 Illinois Ave., Suite 100 Killeen, TX 76543 PH (254) 953-5353 FX (254) 953-5057 Texas Registered Engineering Firm F-10264 Texas Registered Surveying Firm 10194095
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SHEET	8	OF	39
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Post-Development Drainage Area Runoff Flows for Channels

Drainage Area	Total Area, acres	Time of Conc'n, Tc (min)	2 YR EVENT			5 YR EVENT			10 YR EVENT			25 YR EVENT			50 YR EVENT			100 YR EVENT		
			C	I, in/hr	Q, cfs	C	I, in/hr	Q, cfs	C	I, in/hr	Q, cfs	C	I, in/hr	Q, cfs	C	I, in/hr	Q, cfs	C	I, in/hr	Q, cfs
DA-1 Post(chan)	60.6	122.09	0.35	1.100	23.600	0.35	1.460	31.300	0.35	1.690	36.300	0.35	2.050	44.000	0.35	2.370	50.800	0.35	2.720	58.4
DA-2 Post(chan)	19.5	85.85	0.81	1.440	22.800	0.81	1.880	29.800	0.81	2.180	34.600	0.81	2.620	41.500	0.81	3.020	47.900	0.81	3.460	54.9
DA-3 Post(chan)	80.2	120.56	0.47	1.110	41.500	0.47	1.470	54.900	0.47	1.710	63.900	0.47	2.070	77.400	0.47	2.390	89.300	0.47	2.740	102.4

Notes:  
DA-3 Post(chan) includes the DA-1 Post(chan) & DA-2 Post(chan) areas

**Table 1: Channel Reach Average Results**

Waterway	Channel Depth (ft)	2-yr Depth (ft)	2-yr Critical Depth (ft)	2-yr Velocity (fps)	10-yr Depth (ft)	10-yr Critical Depth (ft)	10-yr Velocity (fps)
Reach 1	2.00	0.79	0.59	2.61	1.04	0.77	3.05
Reach 2	2.00	0.61	0.59	4.31	0.83	0.79	4.77
Reach 3	2.00	1.05	0.81	3.10	1.28	1.02	3.51

Waterway	Channel Depth (ft)	25-yr Depth (ft)	25-yr Critical Depth (ft)	25-yr Velocity (fps)	50-yr Depth (ft)	50-yr Critical Depth (ft)	50-yr Velocity (fps)
Reach 1	2.00	1.17	0.88	3.25	1.36	0.95	3.22
Reach 2	2.00	0.95	0.89	5.05	1.53	0.98	3.57
Reach 3	2.00	1.40	1.12	3.71	1.59	1.19	3.50

Waterway	Channel Depth (ft)	100-yr Depth (ft)	100-yr Critical Depth (ft)	100-yr Velocity (fps)
Reach 1	2.00	1.45	1.05	3.44
Reach 2	2.00	1.55	1.07	4.06
Reach 3	2.00	1.67	1.27	3.73

**Table 2: Culvert 25-year Results**

Culvert Height (ft)	25-Year Depth (ft)	25-Year Critical Depth (ft)	25-Year Velocity (fps)
3	1.13	0.83	4.63

