

DRAINAGE DESIGN SUMMARY

FOR

DCI Lee's Summit

Lee's Summit, Jackson County, Missouri

July 25, 2019

Revised August 23, 2019



Prepared for:
Dialysis Clinic, Inc.
1633 Church Street, Suite 500
Nashville, TN 37203
(615) 327-3061

Prepared by:
Catalyst Design Group
5016 Centennial Boulevard, Suite 200
Nashville, TN 37209
(615)866-2410





DCI Lee's Summit
Lee's Summit, Jackson County, Missouri

Table of Contents

General Information	3
Methodology	3
Existing Conditions Analysis	3
Proposed Conditions Analysis	4
Detention and Water Quality Analysis	4
Storm Drainage Design	5
Conclusions and Recommendations	5
Attachments	5
Attachment 1: Site Drainage Area Maps.....	6
Attachment 2: Hydraflow Hydrographs Routing Calculations	7
Attachment 3: Hydraflow Storm Sewers Calculations.....	8
Attachment 4: Water Quality Calculations	9
Attachment 5: Supporting Documents	10



DCI Lee's Summit
Lee's Summit, Jackson County, Missouri

Drainage Design Summary

General Information

The proposed project consists of constructing a 10,220 sf +/- dialysis clinic with associated parking and site improvements. The existing site is located at 2023 NW Shamrock Avenue in Lee's Summit on Parcel ID 62-240-99-04-00-0-00-000. The property is bordered by NW Shamrock Avenue to the North and NW Pryor Road to the East. The project site is located within the southeast corner of Section 2, Township 47N, Range 32W in the Little Blue River watershed of Kansas City.

Methodology

The following methods were used in this drainage design study to model existing and proposed conditions for stormwater runoff:

- Hydraflow Hydrographs 2018 software
 - SCS/NRCS Curve Number Method
 - 24-Hour SCS Type II Rainfall Distribution
 - SCS TR-55 Method for Time of Concentration

Existing Conditions Analysis

Currently, the ±2.225-acre site is undeveloped with pasture-like land cover. The site is generally drains via sheet flow and shallow concentrated flow from the North to the Southeast corner of the property. Stormwater runoff exiting the site discharges into the existing public stormwater system in NW Pryor Road which eventually discharges into the Little Blue River.

In analyzing the existing conditions, the site was split into two drainage areas. The majority of the site is included in the North Drainage Area with the site outfall point in the Southeast corner of the property. Runoff from the North Drainage Area discharges into the public storm system in NW Pryor Road. The southern edge of the site is included in the South Drainage Area also with the site outfall point in the Southeast corner of the property. Runoff from the South Drainage Area discharges towards the neighboring property to the South and enters the public storm system further south along NW Pryor Road. Since both drainage areas discharge to the same final outfall, the public storm system in NW Pryor Road, the peak flows for the North and South Drainage Areas were combined in the analysis of the pre vs. post peak flows.

The North Drainage Area is 1.94 acres with a curve number of 84 and a time of concentration of 10.0 minutes. The South Drainage Area is 0.29 acres with a curve number of 84 and a time of concentration of 9.7 minutes.

The project site does not lie within a special flood hazard area per the federal emergency management agency, (FIRM) map no. 29095C0416G dated January 20, 2017.

The majority of the existing soil within the project site is Greenton-Urban land complex. A sliver of the existing soil near the Northwest corner of the property is Sharpsburg-Urban land complex. Both soil types are classified as Type D soil. The NRCS Soils Map can be found in Attachment 5.

A pre-developed drainage area map is included in Attachment 1 for a detailed view of the pre-developed site. Routing calculations produced by Hydraflow Hydrographs 2018 software are included in Attachment 2.



The pre-development flows to the site outfall point is as follows:

Pre-Development Peak Flows	
<i>Storm Event</i>	<i>Existing Site Peak Flows (cfs)</i>
2-year	6.303
10-year	11.37
100-year	18.21

Proposed Conditions Analysis

The proposed project consists of constructing a 10,220 sf +/- dialysis clinic with associated parking and site improvements. The proposed dialysis clinic is to be located centrally on the site. Proposed stormwater runoff is to be directed via sheet flow, shallow concentrated flow, and channel flow to an extended dry detention pond that is to be located at the south end of the site. A small portion of the south and eastern edge of the site will bypass the proposed extended dry detention pond and discharge to the public storm system along NW Pryor Road as in the existing conditions. A post-developed drainage area map is included in Attachment 1 for a detailed view of the post-developed site.

Detention and Water Quality Analysis

Per Section 5600 of the Kansas City Metropolitan Chapter APWA Standard Specification & Design Criteria manual, the maximum post-developed peak discharge rates from any development shall not exceed those as follows:

- 50% storm peak rate less than or equal to 0.5 cfs per site acre
- 10% storm peak rate less than or equal to 2.0 cfs per site acre
- 1% storm peak rate less than or equal to 3.0 cfs per site acre

Also, for comprehensive control a 40-hour extended detention of runoff from the local 90% mean annual event (1.37"/24-hour rainfall) must be achieved for the water quality volume.

The required water quality treatment volume was calculated to be 5,015 cf (0.115 ac-ft). See Attachment 4 for the water quality treatment volume calculations.

The proposed BMP practice chosen for this site is the extended dry detention basin. Calculations were generated following Chapter 8.10 of the Manual of Best Management Practices for Stormwater Quality. The proposed extended dry detention pond has a volume of 19,672 cf. The water quality treatment volume to be discharged over 40 hours is met at the elevation 963.5 in the proposed pond. The proposed outlet structure in the pond is to consist of a perforated riser with 6 holes with 4" vertical spacing up to the treatment volume elevation. Stormwater runoff exceeding the water quality treatment volume will discharge through an 8" orifice at an elevation of 963.8 and then a 24" pipe to the existing storm system in NW Pryor Road. The grated casting of the outlet structure is set just above the 100 year storm elevation at 966.20 to serve as an emergency overflow weir. The pond is also designed with an emergency spillway located on the East edge of the pond. The spillway is sized to pass the 1% storm from the contributing drainage area as well as the adjacent Fire department development's 1% storm with 1' of freeboard to the top of the dam assuming zero available storage in the ponds and zero flow through the primary outlet. See Attachment 2 for detention routing calculations.

The overall post-development peak flows to the outfall are as follows:

Post-Development Peak Flows	
<i>Storm Event</i>	<i>Proposed Site Peak Flows (cfs)</i>
2-year	1.308
10-year	3.679
100-year	5.937



Storm Drainage Design

All stormwater pipes and structures have been designed to convey the 10-year storm event. Tailwater elevations were considered to be between the crown and critical depth of the pipes.

Pipe and structures calculations were compiled using Hydraflow Storm Sewers 2018 software and are included as Attachment 3. An Inlet Drainage Area Map detailing the areas discharging to each proposed inlet is included in Attachment 1.

Conclusions and Recommendations

The stormwater management system for the proposed development has been designed per Section 5600 of the Kansas City Metropolitan Chapter APWA Standard Specifications Design Criteria and the Manual of Best Management Practices for Stormwater Quality. Due to the increase in impervious area for the proposed development, water quality and detention requirements are to be met by the use of a proposed extended dry detention basin located on the South portion of the project site. The water quality treatment volume calculated to be 5,015 cf is to be released over 40 hours through a perforated riser. The detention requirements specify maximum release rates based on the lesser of either pre-developed peak flow rates or a predetermined flow rate per site acreage. The post-developed peak flow rates calculated for the 10-year and 100-year storm events are less than their respective allowable peak flow rates. The post-developed peak flow rate for the 2-year storm event exceeds the allowable peak flow rate by 0.2 cfs. This minor exceedance is considered to have negligible impact on the downstream infrastructure. The extended dry detention pond also has more than 2 feet of freeboard for all storm events in order to provide exceptional flood protection during extreme storm events.

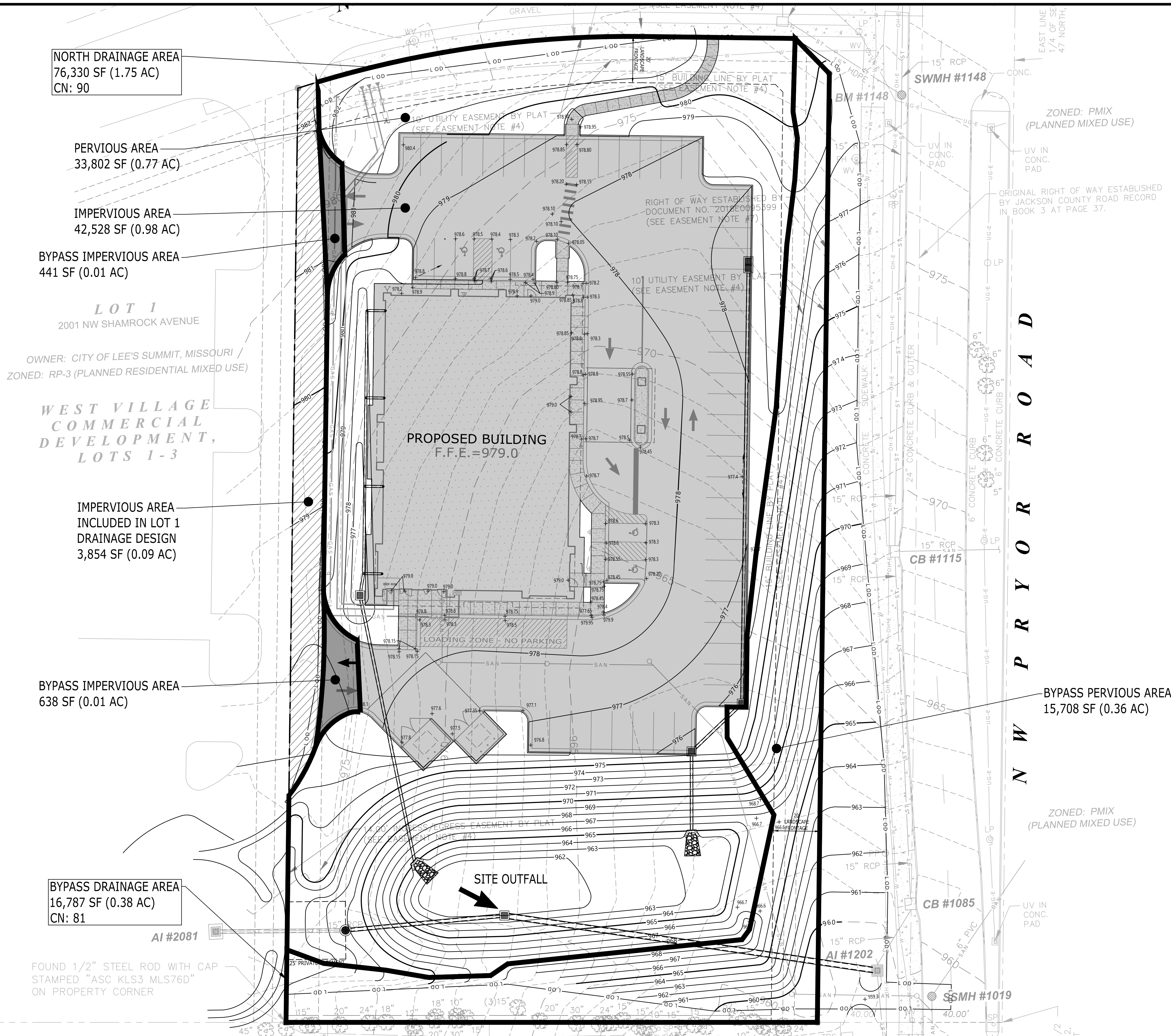
Pre- and Post- Peak Flows Comparison				
<i>Storm Event</i>	<i>Pre-dev. Peak Flow (cfs)</i>	<i>Allowable Post-Dev. Peak Flow (cfs)</i>	<i>Post-Dev. Peak Flows (cfs)</i>	<i>Difference (+/-)</i>
2-year	6.303	(0.5 cfs/2.225 ac) 1.1125	1.308	+0.1955
10-year	11.37	(2.0 cfs/2.225 ac) 4.450	3.679	-0.771
100-year	18.21	(3.0 cfs/2.225 ac) 6.675	5.937	-0.738

Attachments:

- Attachment 1 Site Drainage Area Maps
- Attachment 2 *Hydraflow Hydrographs* Routing Calculations
- Attachment 3 *Hydraflow Storm Sewers* Calculations
- Attachment 4 Water Quality Calculations
- Attachment 5 Supporting Documents

Attachment 1
Site Drainage Area Maps

P:\2018\20180111\Engineering\dwg\20180111_2019-08-21_Post Drainage Area Map.dwg-POST Aug 23, 2019 cwalker



NORTH DRAINAGE AREA
76,330 SF (1.75 AC)
CN: 90

PERVIOUS AREA
33,802 SF (0.77 AC)

IMPERVIOUS AREA
42,528 SF (0.98 AC)

BYPASS IMPERVIOUS AREA
441 SF (0.01 AC)

LOT 1
2001 NW SHAMROCK AVENUE
OWNER: CITY OF LEE'S SUMMIT, MISSOURI /
ZONED: RP-3 (PLANNED RESIDENTIAL MIXED USE)

**WEST VILLAGE
COMMERCIAL
DEVELOPMENT,
LOTS 1 - 3**

IMPERVIOUS AREA
INCLUDED IN LOT 1
DRAINAGE DESIGN
3,854 SF (0.09 AC)

BYPASS IMPERVIOUS AREA
638 SF (0.01 AC)

BYPASS DRAINAGE AREA
16,787 SF (0.38 AC)
CN: 81

FOUND 1/2" STEEL ROD WITH CAP
STAMPED "ASC KLS3 MLS76D"
ON PROPERTY CORNER

NOTE: TIME OF CONCENTRATION CONSIDERED TO BE 5 MIN.

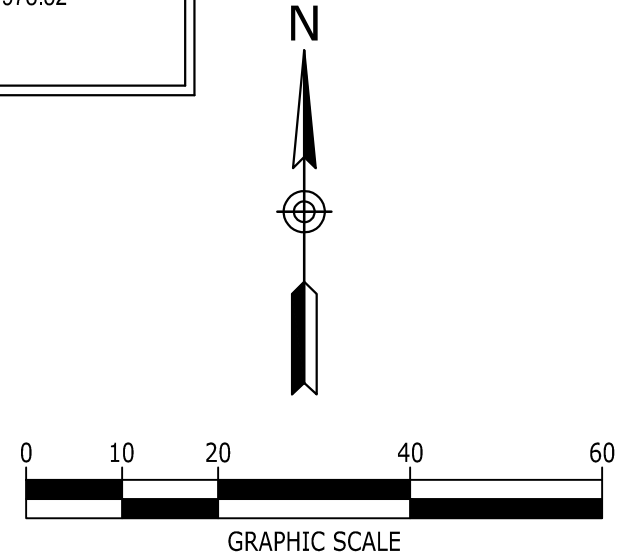
STORM WATER LEGEND
CB #1170
TOP ELEVATION = 980.66
F/L NORTH 15" RCP = 975.46
F/L SOUTHEAST 15" HDPE = 974.81
CB #1206
TOP ELEVATION = 981.70
F/L SOUTH 15" RCP = 976.20
F/L EAST = 976.70
(UNKNOWN PIPE SIZE & TYPE)
TCB = 980.76
CB #1173
TOP ELEVATION = 980.74
F/L SOUTH 15" RCP = 976.04
CB #1115
TOP ELEVATION = 968.97
F/L NORTH 15" RCP = 964.47
F/L SOUTH 15" RCP = 963.62
F/L EAST 15" RCP = 963.97
TCB = 968.01
AI #1202
TOP ELEVATION = 959.95
F/L NORTHEAST 15" RCP = 952.24
F/L SOUTH 24" RCP = 948.65
TCB = 958.57
CB #1085
TOP ELEVATION = 961.05
F/L NORTH 15" RCP = 954.50
F/L SOUTHWEST 15" RCP = 954.30
TCB = 960.10
AI #2081
TOP ELEVATION = 973.94
F/L EAST 15" RCP = 967.09
SWMH #1148
TOP ELEVATION = 978.52
F/L NORTH 15" RCP = 972.38
F/L SOUTH 15" RCP = 972.28
F/L NORTHWEST 15" HDPE = 974.04

SEWER LEGEND
SSMH #1019
TOP ELEVATION = 959.22
F/L NORTHEAST 6" PVC = 947.82
F/L SOUTH 6" PVC = 947.67

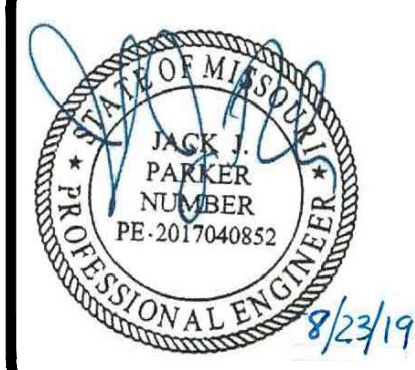
BENCHMARK LEGEND
BM #1148
TOP ELEVATION RIM OF SWMH = 978.52
DATUM = NAVD88



Know what's below.
Call before you dig.



DIALYSIS CLINIC, INC.
1633 CHURCH STREET, STE 500
NASHVILLE, TN 37203
615.327.3061



CONSTRUCTION DRAWINGS
DCI - LEE'S SUMMIT
2001 NW SHAMROCK AVENUE
LEE'S SUMMIT, MISSOURI, 64081
JACKSON COUNTY

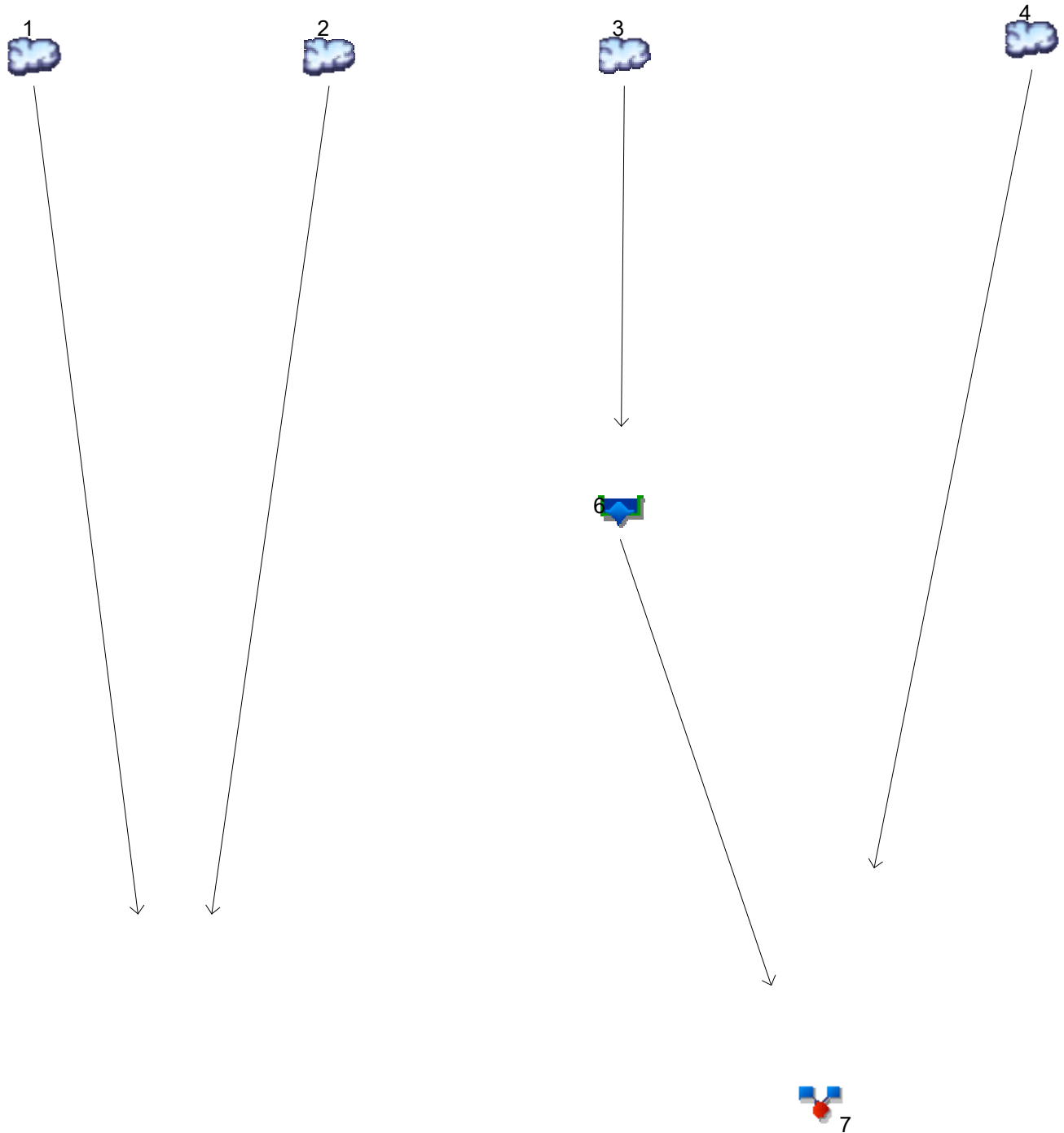
NO.	DATE	DESCRIPTION

DRAWING TITLE
**POST DEVELOPED
DRAINAGE AREA
MAP**
PROJECT NUMBER
20180111
DRAWING NUMBER
POST

Attachment 2
Hydraflow Hydrographs Routing Calculations

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020



Legend



Hyd.	Origin	Description
1	SCS Runoff	EXISTING NORTH
2	SCS Runoff	EXISTING SOUTH
3	SCS Runoff	PROPOSED NORTH
4	SCS Runoff	PROPOSED BYPASS
5	Combine	EXISTING SITE
6	Reservoir	PROPOSED TO DET
7	Combine	PROPOSED SITE

Hydraflow Table of Contents

N:\820111\Engineering\Hydraflow\20180111_2019-08-22 ROUTING CALCULATIONS.gpw

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Thursday, 08 / 22 / 2019

Watershed Model Schematic.....	1
Hydrograph Return Period Recap.....	2
2 - Year	
Summary Report.....	3
Hydrograph Reports.....	4
Hydrograph No. 1, SCS Runoff, EXISTING NORTH.....	4
TR-55 Tc Worksheet.....	5
Hydrograph No. 2, SCS Runoff, EXISTING SOUTH.....	6
TR-55 Tc Worksheet.....	7
Hydrograph No. 3, SCS Runoff, PROPOSED NORTH.....	8
Hydrograph No. 4, SCS Runoff, PROPOSED BYPASS.....	9
Hydrograph No. 5, Combine, EXISTING SITE.....	10
Hydrograph No. 6, Reservoir, PROPOSED TO DET.....	11
Pond Report - Detention Pond.....	12
Hydrograph No. 7, Combine, PROPOSED SITE.....	14
10 - Year	
Summary Report.....	15
Hydrograph Reports.....	16
Hydrograph No. 1, SCS Runoff, EXISTING NORTH.....	16
Hydrograph No. 2, SCS Runoff, EXISTING SOUTH.....	17
Hydrograph No. 3, SCS Runoff, PROPOSED NORTH.....	18
Hydrograph No. 4, SCS Runoff, PROPOSED BYPASS.....	19
Hydrograph No. 5, Combine, EXISTING SITE.....	20
Hydrograph No. 6, Reservoir, PROPOSED TO DET.....	21
Hydrograph No. 7, Combine, PROPOSED SITE.....	22
100 - Year	
Summary Report.....	23
Hydrograph Reports.....	24
Hydrograph No. 1, SCS Runoff, EXISTING NORTH.....	24
Hydrograph No. 2, SCS Runoff, EXISTING SOUTH.....	25
Hydrograph No. 3, SCS Runoff, PROPOSED NORTH.....	26
Hydrograph No. 4, SCS Runoff, PROPOSED BYPASS.....	27
Hydrograph No. 5, Combine, EXISTING SITE.....	28
Hydrograph No. 6, Reservoir, PROPOSED TO DET.....	29
Hydrograph No. 7, Combine, PROPOSED SITE.....	30
IDF Report.....	31

Hydrograph Report

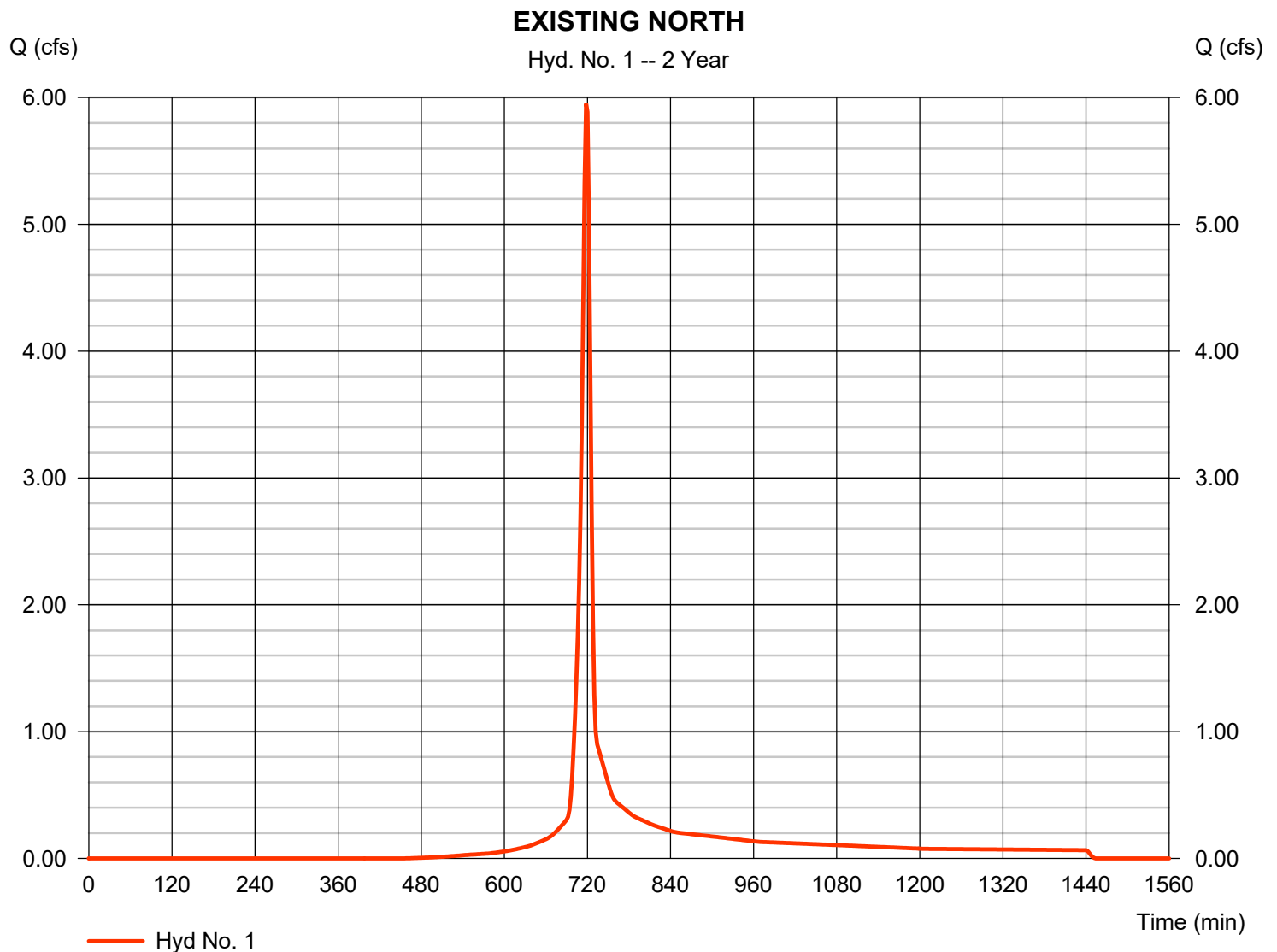
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Thursday, 08 / 22 / 2019

Hyd. No. 1

EXISTING NORTH

Hydrograph type	= SCS Runoff	Peak discharge	= 5.952 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 13,637 cuft
Drainage area	= 1.940 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.00 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(1.940 \times 84)] / 1.940$ 

TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Hyd. No. 1

EXISTING NORTH

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>			
Sheet Flow							
Manning's n-value	= 0.150	0.011	0.011				
Flow length (ft)	= 100.0	0.0	0.0				
Two-year 24-hr precip. (in)	= 3.50	0.00	0.00				
Land slope (%)	= 5.70	0.00	0.00				
Travel Time (min)	= 6.16	+	0.00	+	0.00	=	6.16
Shallow Concentrated Flow							
Flow length (ft)	= 367.00	0.00	0.00				
Watercourse slope (%)	= 4.06	0.00	0.00				
Surface description	= Unpaved	Paved	Paved				
Average velocity (ft/s)	=3.25	0.00	0.00				
Travel Time (min)	= 1.88	+	0.00	+	0.00	=	1.88
Channel Flow							
X sectional flow area (sqft)	= 0.00	0.00	0.00				
Wetted perimeter (ft)	= 0.00	0.00	0.00				
Channel slope (%)	= 0.00	0.00	0.00				
Manning's n-value	= 0.015	0.015	0.015				
Velocity (ft/s)	=0.00	0.00	0.00				
Flow length (ft)	((0})0.0	0.0	0.0				
Travel Time (min)	= 0.00	+	0.00	+	0.00	=	0.00
Total Travel Time, Tc				8.00 min			

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

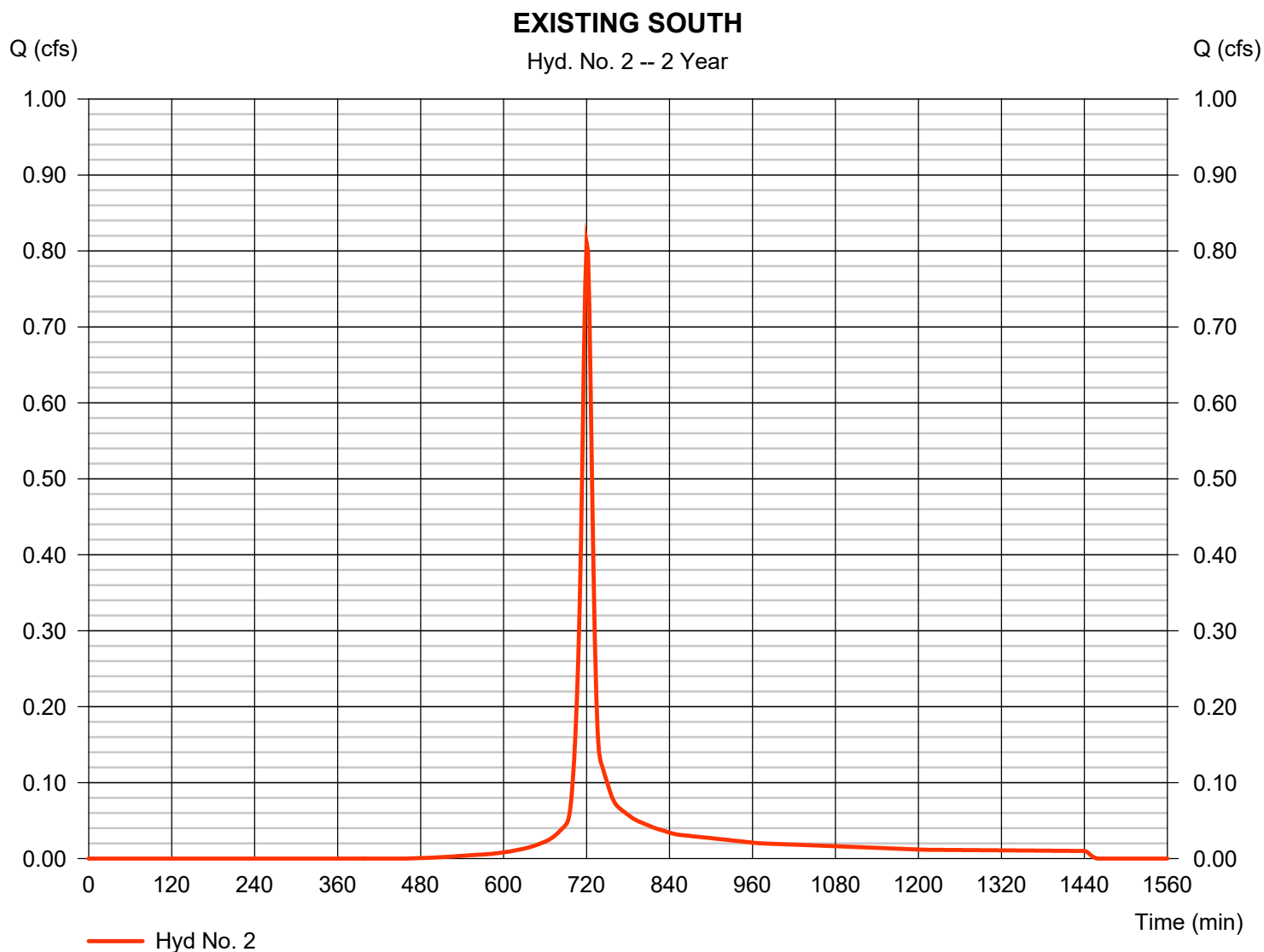
Thursday, 08 / 22 / 2019

Hyd. No. 2

EXISTING SOUTH

Hydrograph type	= SCS Runoff	Peak discharge	= 0.811 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 2,102 cuft
Drainage area	= 0.290 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.10 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.290 \times 84)] / 0.290$



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Hyd. No. 2

EXISTING SOUTH

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>			
Sheet Flow							
Manning's n-value	= 0.150	0.011	0.011				
Flow length (ft)	= 100.0	0.0	0.0				
Two-year 24-hr precip. (in)	= 3.50	0.00	0.00				
Land slope (%)	= 2.00	0.00	0.00				
Travel Time (min)	= 9.37	+	0.00	+	0.00	=	9.37
Shallow Concentrated Flow							
Flow length (ft)	= 206.00	0.00	0.00				
Watercourse slope (%)	= 7.52	0.00	0.00				
Surface description	= Unpaved	Paved	Paved				
Average velocity (ft/s)	=4.42	0.00	0.00				
Travel Time (min)	= 0.78	+	0.00	+	0.00	=	0.78
Channel Flow							
X sectional flow area (sqft)	= 0.00	0.00	0.00				
Wetted perimeter (ft)	= 0.00	0.00	0.00				
Channel slope (%)	= 0.00	0.00	0.00				
Manning's n-value	= 0.015	0.015	0.015				
Velocity (ft/s)	=0.00	0.00	0.00				
Flow length (ft)	(0)0.0	0.0	0.0				
Travel Time (min)	= 0.00	+	0.00	+	0.00	=	0.00
Total Travel Time, Tc				10.10 min			

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

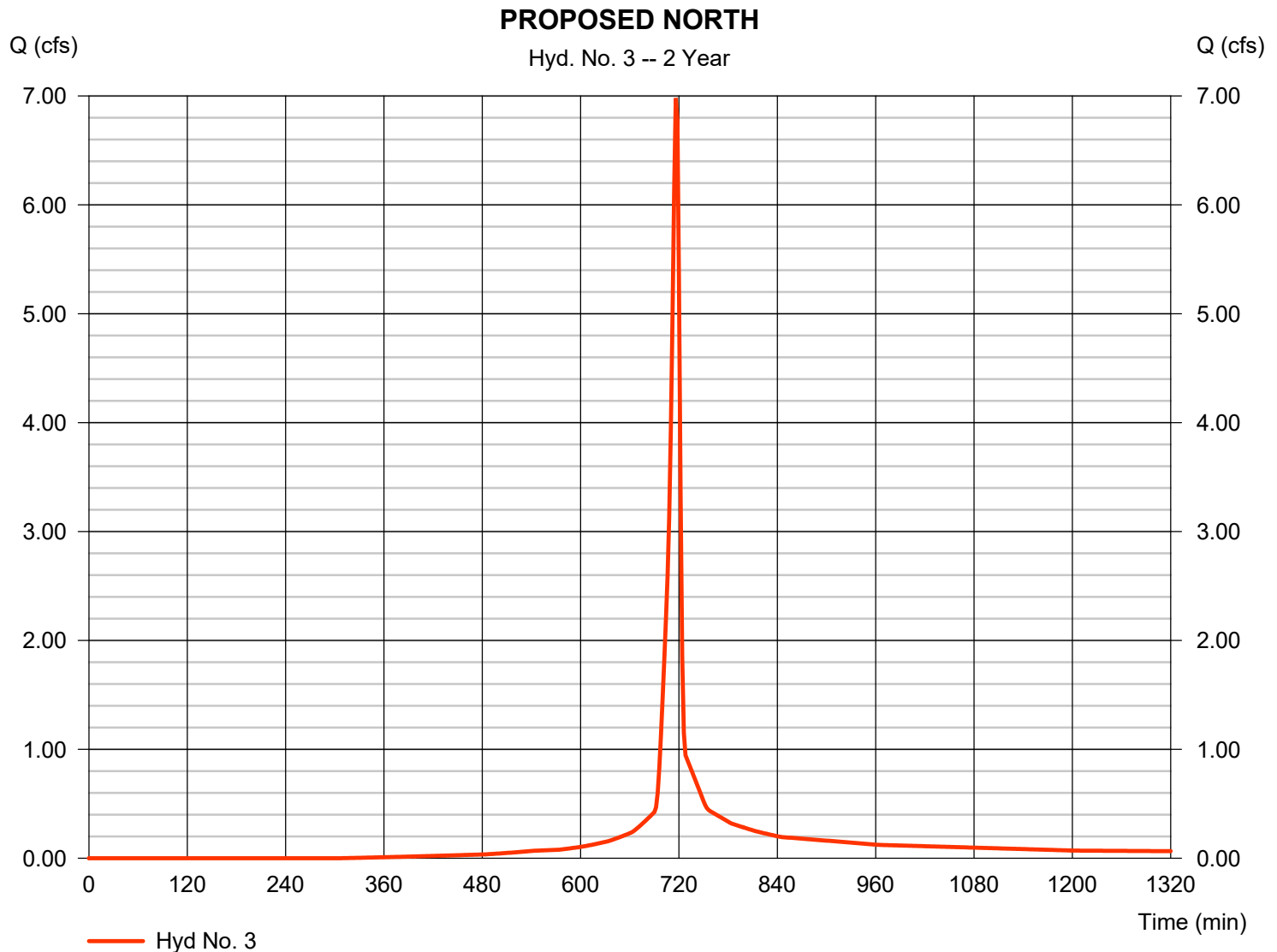
Thursday, 08 / 22 / 2019

Hyd. No. 3

PROPOSED NORTH

Hydrograph type	= SCS Runoff	Peak discharge	= 6.980 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 14,579 cuft
Drainage area	= 1.750 ac	Curve number	= 90*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.770 \times 80) + (0.980 \times 98)] / 1.750$



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Thursday, 08 / 22 / 2019

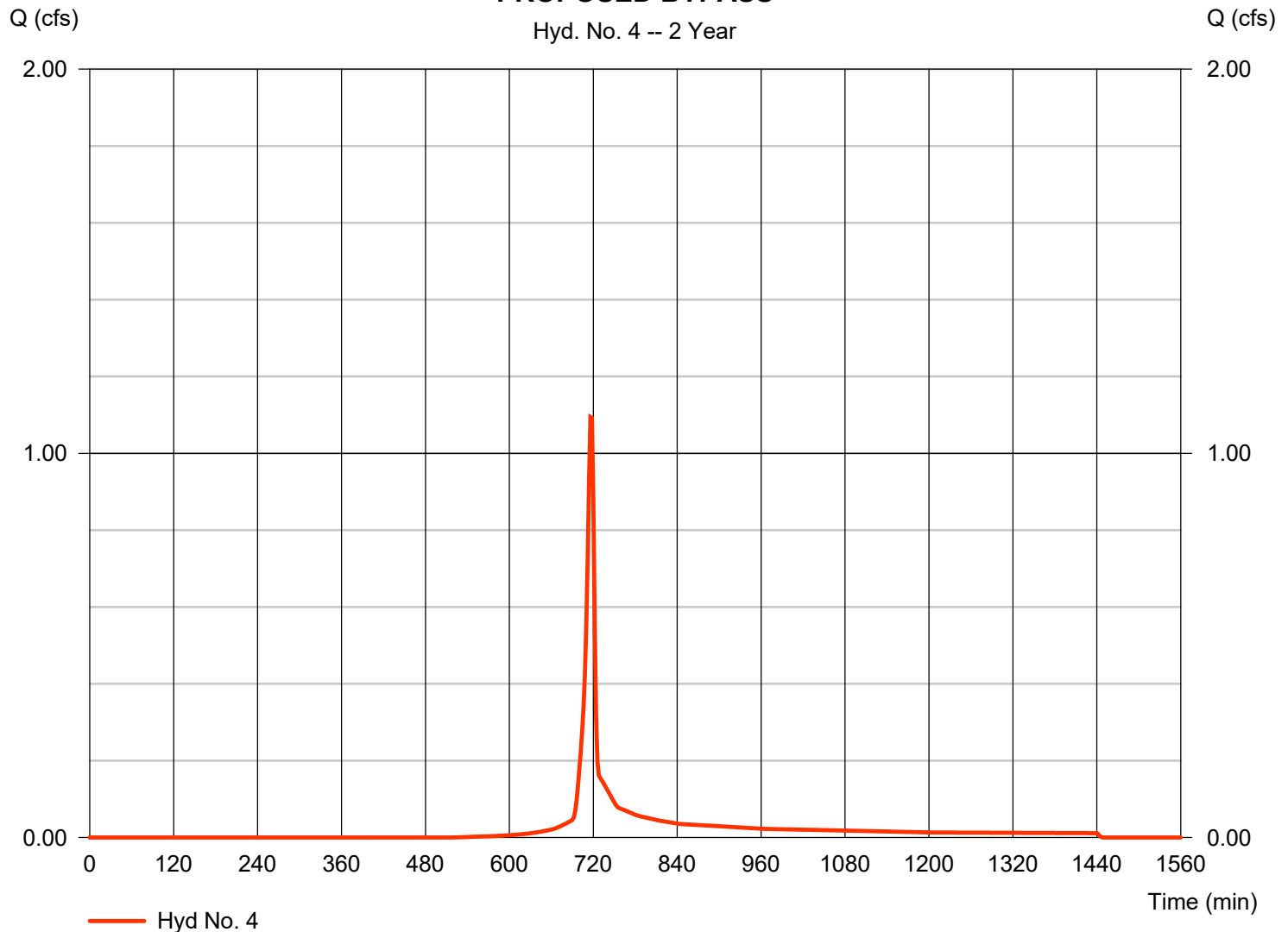
Hyd. No. 4

PROPOSED BYPASS

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.094 cfs
Storm frequency	=	2 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	2,209 cuft
Drainage area	=	0.380 ac	Curve number	=	81*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = $[(0.360 \times 80) + (0.020 \times 98)] / 0.380$

PROPOSED BYPASS



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

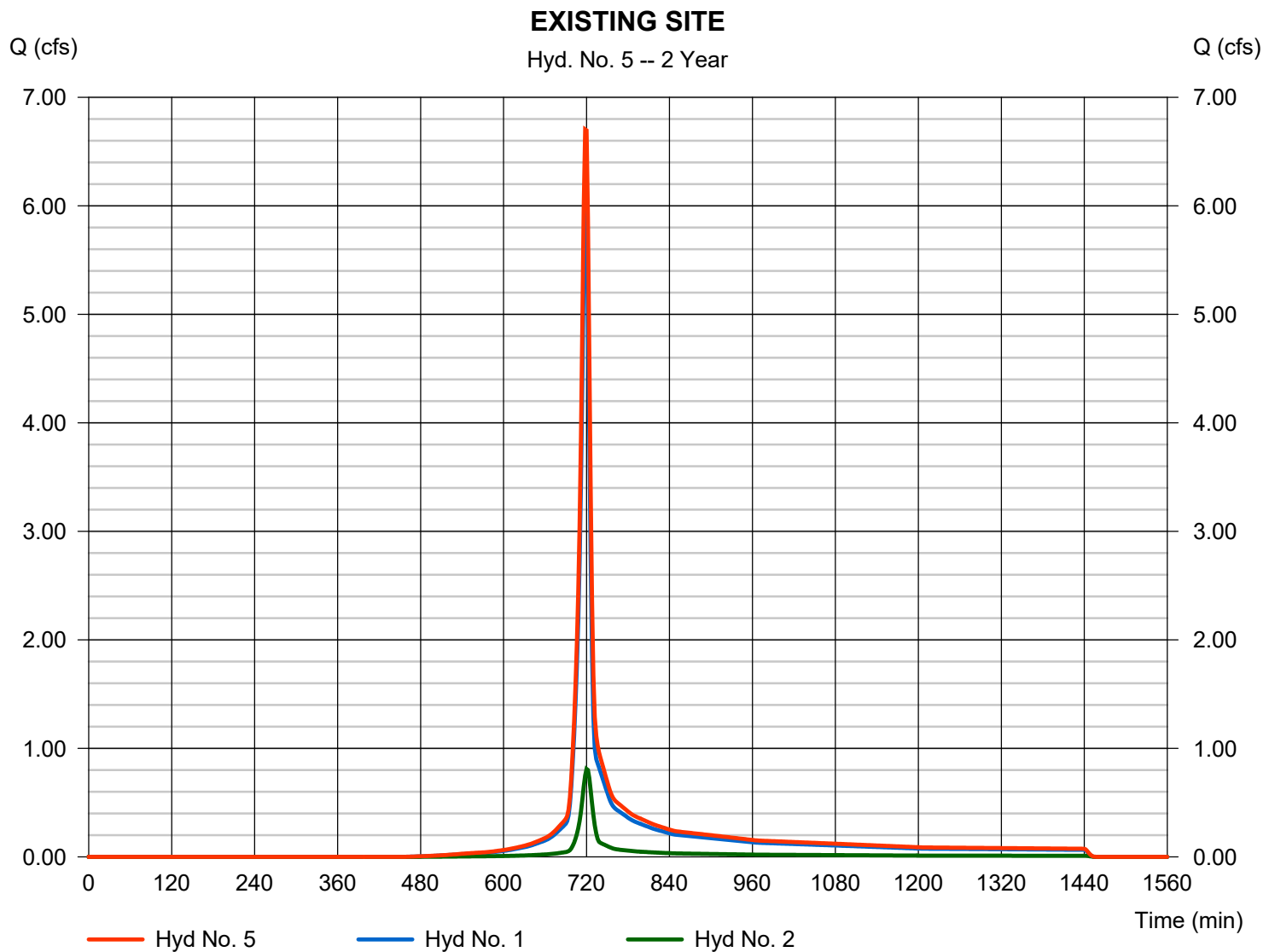
Thursday, 08 / 22 / 2019

Hyd. No. 5

EXISTING SITE

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

Peak discharge = 6.704 cfs
Time to peak = 718 min
Hyd. volume = 15,739 cuft
Contrib. drain. area = 2.230 ac



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

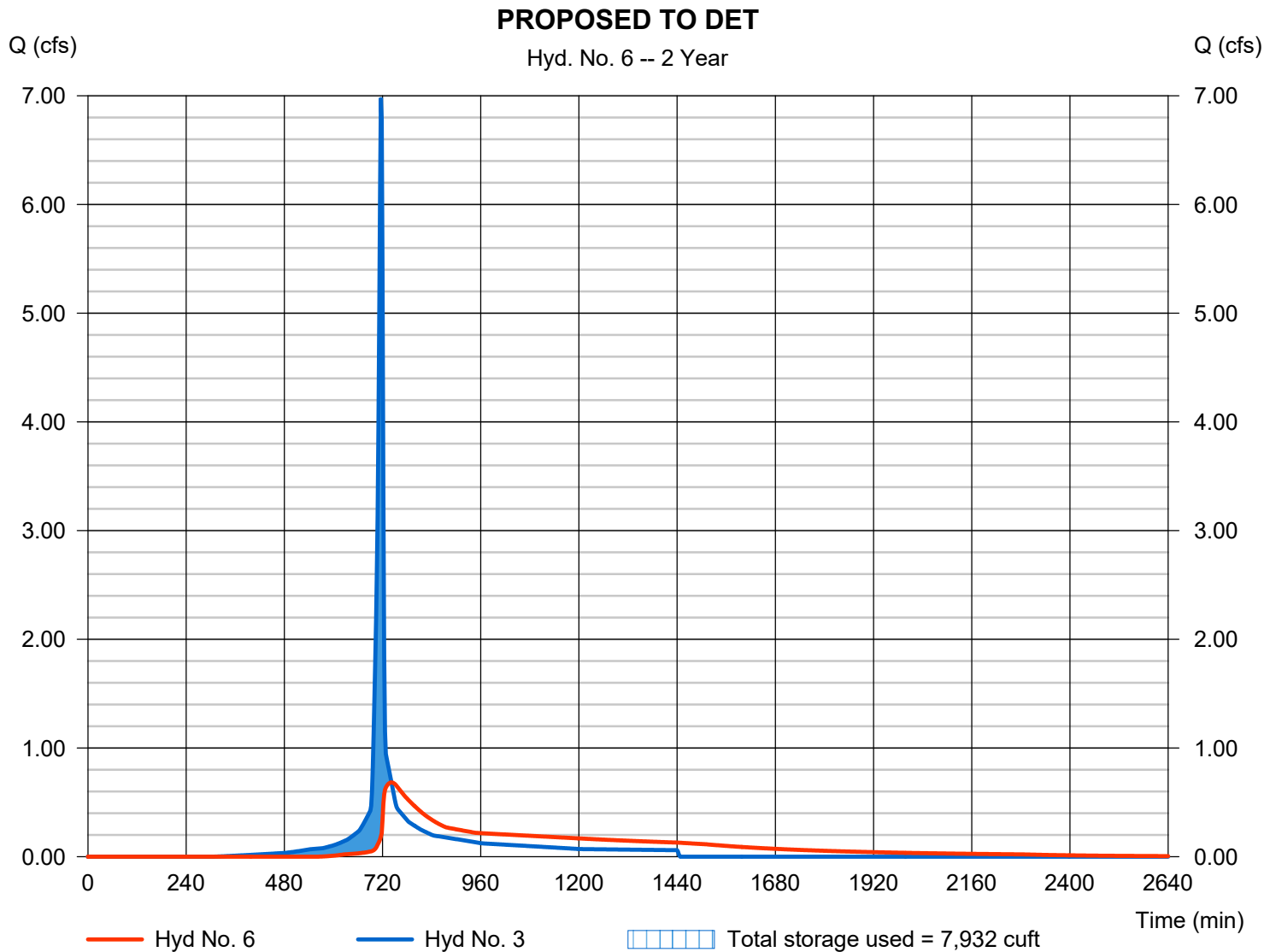
Thursday, 08 / 22 / 2019

Hyd. No. 6

PROPOSED TO DET

Hydrograph type	= Reservoir	Peak discharge	= 0.683 cfs
Storm frequency	= 2 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 14,127 cuft
Inflow hyd. No.	= 3 - PROPOSED NORTH	Max. Elevation	= 964.17 ft
Reservoir name	= Detention Pond	Max. Storage	= 7,932 cuft

Storage Indication method used.



Pond Report

12

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Thursday, 08 / 22 / 2019

Pond No. 1 - Detention Pond

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 961.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	961.00	10	0	0
1.00	962.00	1,575	793	793
2.00	963.00	3,200	2,388	3,180
3.00	964.00	4,610	3,905	7,085
4.00	965.00	5,590	5,100	12,185
5.00	966.00	6,670	6,130	18,315
5.20	966.20	6,895	1,357	19,672

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	8.00	Inactive	1.00
Span (in)	= 24.00	8.00	0.00	1.00
No. Barrels	= 1	1	0	6
Invert El. (ft)	= 958.00	963.80	0.00	961.52
Length (ft)	= 162.00	1.00	0.00	1.65
Slope (%)	= 1.05	0.50	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	Yes

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	Inactive	Inactive	Inactive
Crest El. (ft)	= 966.20	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	961.00	0.00	0.00	---	0.00	0.00	---	---	---	---	---	0.000
0.10	79	961.10	21.39 ic	0.00	---	0.00	0.00	---	---	---	---	---	0.000
0.20	159	961.20	21.39 ic	0.00	---	0.00	0.00	---	---	---	---	---	0.000
0.30	238	961.30	21.39 ic	0.00	---	0.00	0.00	---	---	---	---	---	0.000
0.40	317	961.40	21.39 ic	0.00	---	0.00	0.00	---	---	---	---	---	0.000
0.50	396	961.50	21.39 ic	0.00	---	0.00	0.00	---	---	---	---	---	0.000
0.60	476	961.60	21.39 ic	0.00	---	0.00	0.00	---	---	---	---	---	0.001
0.70	555	961.70	21.39 ic	0.00	---	0.00	0.00	---	---	---	---	---	0.005
0.80	634	961.80	21.39 ic	0.00	---	0.01	0.00	---	---	---	---	---	0.009
0.90	713	961.90	21.39 ic	0.00	---	0.01	0.00	---	---	---	---	---	0.015
1.00	793	962.00	21.39 ic	0.00	---	0.02	0.00	---	---	---	---	---	0.021
1.10	1,031	962.10	21.39 ic	0.00	---	0.03	0.00	---	---	---	---	---	0.028
1.20	1,270	962.20	21.39 ic	0.00	---	0.04	0.00	---	---	---	---	---	0.036
1.30	1,509	962.30	21.39 ic	0.00	---	0.04	0.00	---	---	---	---	---	0.044
1.40	1,748	962.40	21.39 ic	0.00	---	0.05	0.00	---	---	---	---	---	0.053
1.50	1,986	962.50	21.39 ic	0.00	---	0.06	0.00	---	---	---	---	---	0.062
1.60	2,225	962.60	21.39 ic	0.00	---	0.07	0.00	---	---	---	---	---	0.071
1.70	2,464	962.70	21.39 ic	0.00	---	0.08	0.00	---	---	---	---	---	0.082
1.80	2,703	962.80	21.39 ic	0.00	---	0.09	0.00	---	---	---	---	---	0.092
1.90	2,941	962.90	21.39 ic	0.00	---	0.10	0.00	---	---	---	---	---	0.103
2.00	3,180	963.00	21.39 ic	0.00	---	0.11	0.00	---	---	---	---	---	0.115
2.10	3,571	963.10	21.39 ic	0.00	---	0.13	0.00	---	---	---	---	---	0.126
2.20	3,961	963.20	21.39 ic	0.00	---	0.14	0.00	---	---	---	---	---	0.139
2.30	4,352	963.30	21.39 ic	0.00	---	0.15	0.00	---	---	---	---	---	0.151
2.40	4,742	963.40	21.39 ic	0.00	---	0.16	0.00	---	---	---	---	---	0.164
2.50	5,133	963.50	21.39 ic	0.00	---	0.18	0.00	---	---	---	---	---	0.177
2.60	5,523	963.60	21.39 ic	0.00	---	0.19	0.00	---	---	---	---	---	0.191
2.70	5,914	963.70	21.39 ic	0.00	---	0.20	0.00	---	---	---	---	---	0.205
2.80	6,304	963.80	21.39 ic	0.00	---	0.22	0.00	---	---	---	---	---	0.219
2.90	6,695	963.90	21.39 ic	0.04 ic	---	0.23	0.00	---	---	---	---	---	0.270
3.00	7,085	964.00	21.39 ic	0.13 ic	---	0.25	0.00	---	---	---	---	---	0.384
3.10	7,595	964.10	21.39 ic	0.29 ic	---	0.26	0.00	---	---	---	---	---	0.550
3.20	8,105	964.20	21.39 ic	0.47 ic	---	0.28	0.00	---	---	---	---	---	0.751
3.30	8,615	964.30	21.39 ic	0.68 ic	---	0.30	0.00	---	---	---	---	---	0.975
3.40	9,125	964.40	21.39 ic	0.88 ic	---	0.31	0.00	---	---	---	---	---	1.187
3.50	9,635	964.50	21.39 ic	1.02 ic	---	0.33	0.00	---	---	---	---	---	1.345

Continues on next page...

Detention Pond

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
3.60	10,145	964.60	21.39 ic	1.15 ic	---	0.34	0.00	---	---	---	---	---	1.492
3.70	10,655	964.70	21.39 ic	1.26 ic	---	0.36	0.00	---	---	---	---	---	1.626
3.80	11,165	964.80	21.39 ic	1.37 ic	---	0.38	0.00	---	---	---	---	---	1.750
3.90	11,675	964.90	21.39 ic	1.47 ic	---	0.40	0.00	---	---	---	---	---	1.867
4.00	12,185	965.00	21.39 ic	1.56 ic	---	0.41	0.00	---	---	---	---	---	1.978
4.10	12,798	965.10	21.39 ic	1.65 ic	---	0.43	0.00	---	---	---	---	---	2.083
4.20	13,411	965.20	21.39 ic	1.74 ic	---	0.45	0.00	---	---	---	---	---	2.185
4.30	14,024	965.30	21.39 ic	1.82 ic	---	0.47	0.00	---	---	---	---	---	2.283
4.40	14,637	965.40	21.39 ic	1.89 ic	---	0.49	0.00	---	---	---	---	---	2.378
4.50	15,250	965.50	21.39 ic	1.96 ic	---	0.51	0.00	---	---	---	---	---	2.470
4.60	15,863	965.60	21.39 ic	2.04 ic	---	0.52	0.00	---	---	---	---	---	2.560
4.70	16,476	965.70	21.39 ic	2.10 ic	---	0.54	0.00	---	---	---	---	---	2.647
4.80	17,089	965.80	21.39 ic	2.17 ic	---	0.56	0.00	---	---	---	---	---	2.733
4.90	17,702	965.90	21.39 ic	2.23 ic	---	0.58	0.00	---	---	---	---	---	2.817
5.00	18,315	966.00	21.39 ic	2.30 ic	---	0.60	0.00	---	---	---	---	---	2.900
5.02	18,451	966.02	21.39 ic	2.31 ic	---	0.61	0.00	---	---	---	---	---	2.916
5.04	18,586	966.04	21.39 ic	2.32 ic	---	0.61	0.00	---	---	---	---	---	2.932
5.06	18,722	966.06	21.39 ic	2.33 ic	---	0.62	0.00	---	---	---	---	---	2.948
5.08	18,858	966.08	21.39 ic	2.34 ic	---	0.62	0.00	---	---	---	---	---	2.965
5.10	18,993	966.10	21.39 ic	2.36 ic	---	0.62	0.00	---	---	---	---	---	2.981
5.12	19,129	966.12	21.39 ic	2.37 ic	---	0.63	0.00	---	---	---	---	---	2.997
5.14	19,265	966.14	21.39 ic	2.38 ic	---	0.63	0.00	---	---	---	---	---	3.013
5.16	19,400	966.16	21.39 ic	2.39 ic	---	0.64	0.00	---	---	---	---	---	3.029
5.18	19,536	966.18	21.39 ic	2.40 ic	---	0.64	0.00	---	---	---	---	---	3.045
5.20	19,672	966.20	21.39 ic	2.42 ic	---	0.64	0.00	---	---	---	---	---	3.060

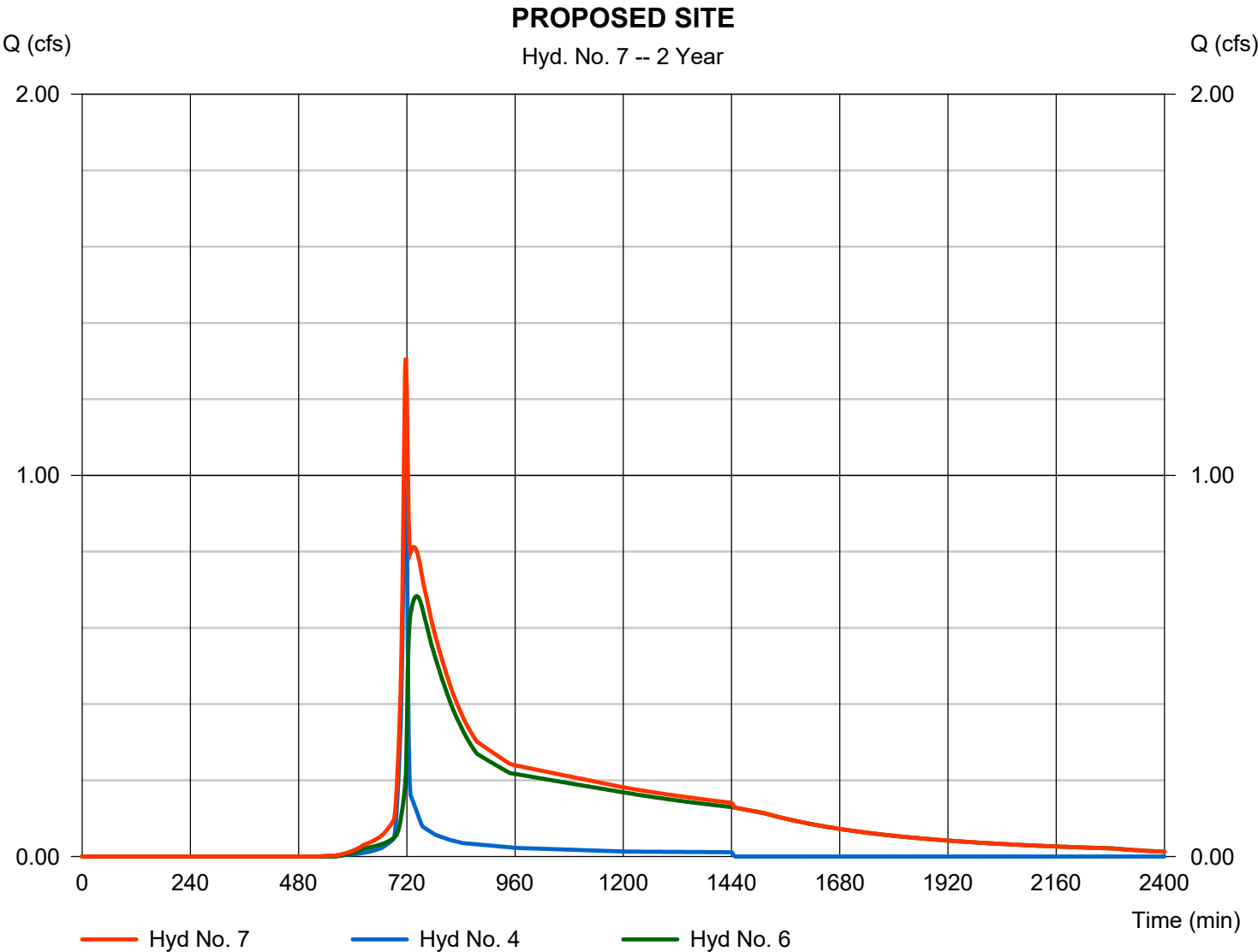
...End

Hydrograph Report

Hyd. No. 7

PROPOSED SITE

Hydrograph type	= Combine	Peak discharge	= 1.308 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 16,337 cuft
Inflow hyds.	= 4, 6	Contrib. drain. area	= 0.380 ac



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

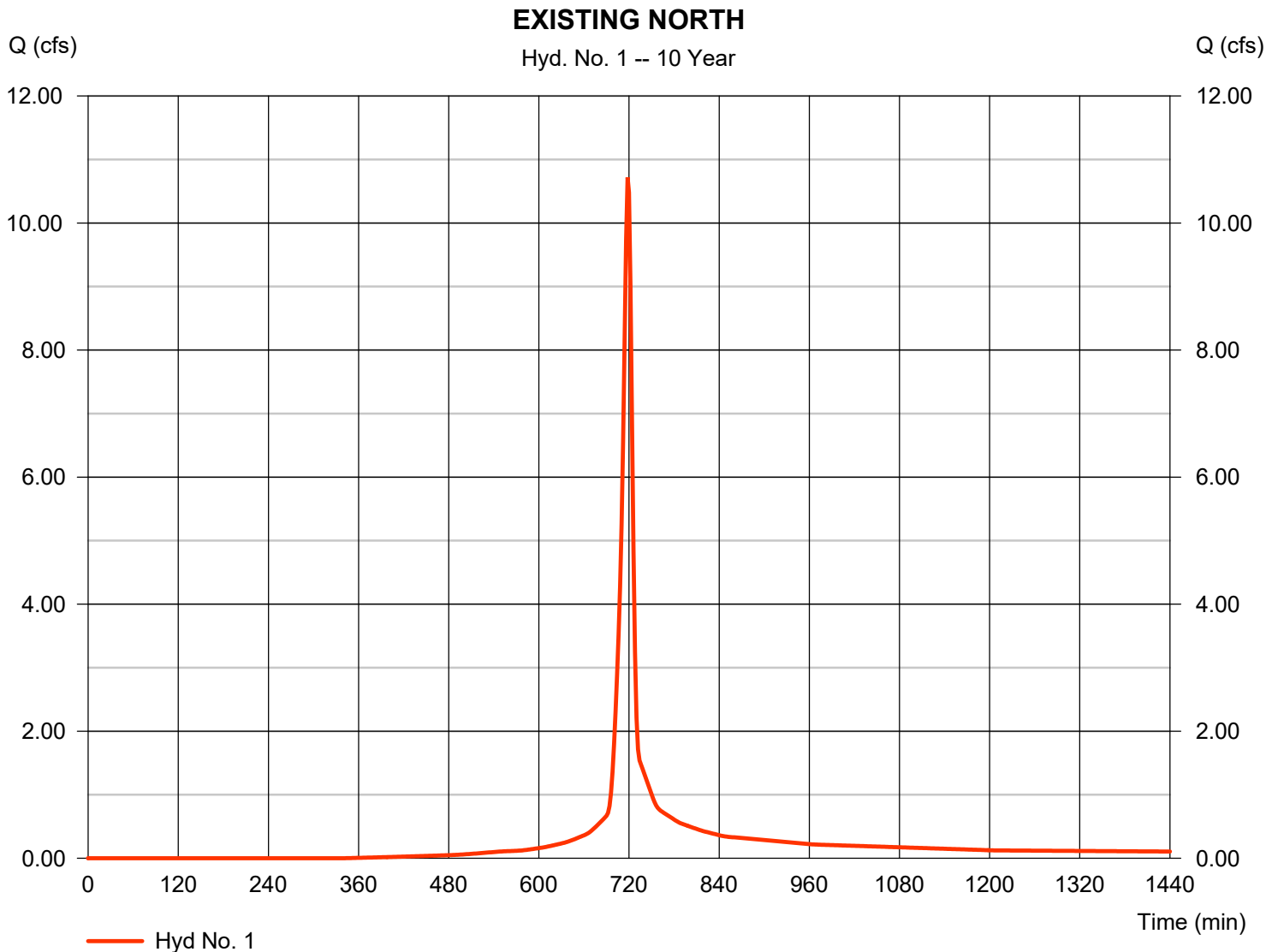
Thursday, 08 / 22 / 2019

Hyd. No. 1

EXISTING NORTH

Hydrograph type	= SCS Runoff	Peak discharge	= 10.72 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 24,971 cuft
Drainage area	= 1.940 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.00 min
Total precip.	= 5.30 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(1.940 \times 84)] / 1.940$



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

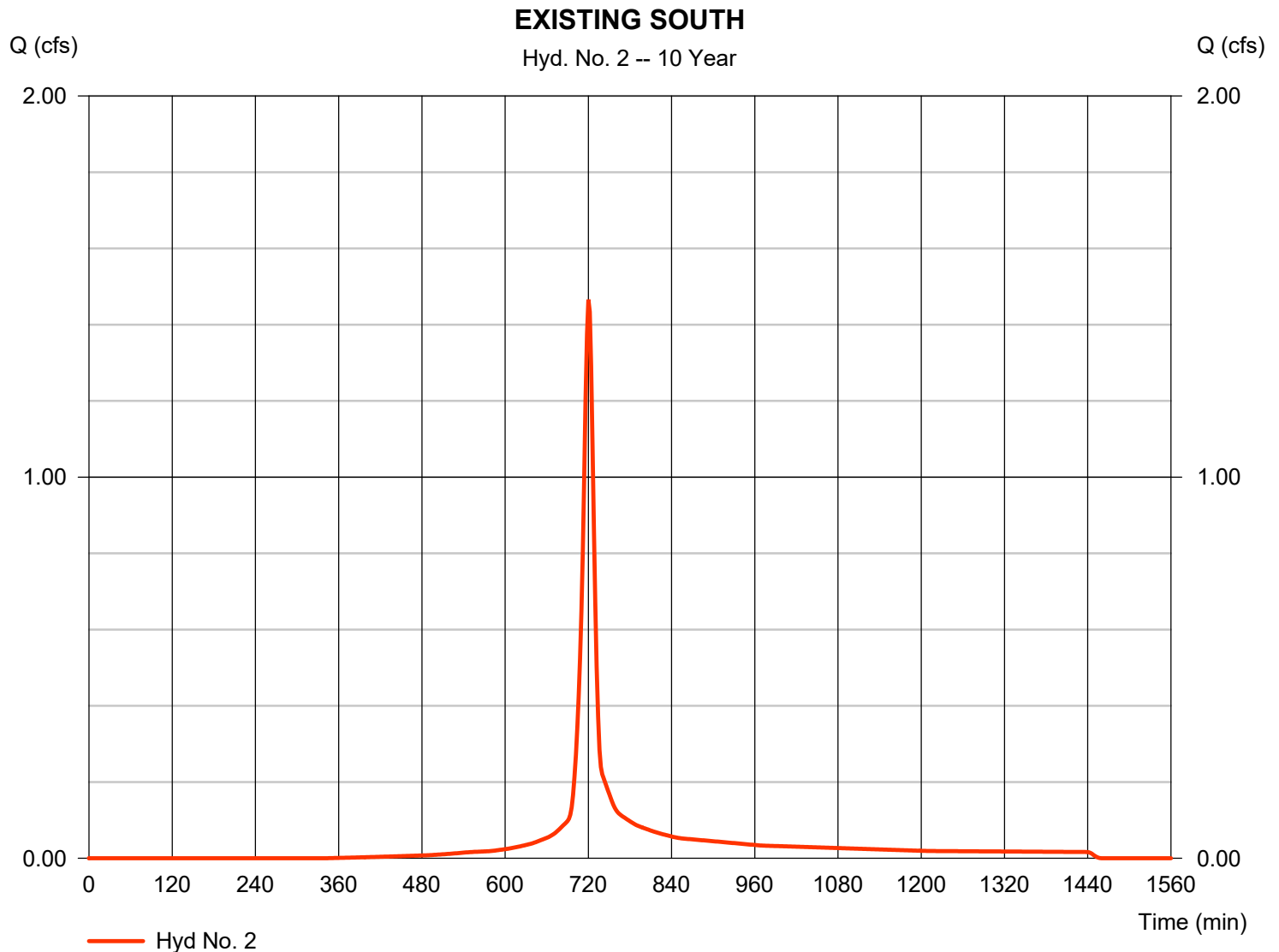
Thursday, 08 / 22 / 2019

Hyd. No. 2

EXISTING SOUTH

Hydrograph type	= SCS Runoff	Peak discharge	= 1.466 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 3,849 cuft
Drainage area	= 0.290 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.10 min
Total precip.	= 5.30 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.290 \times 84)] / 0.290$



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

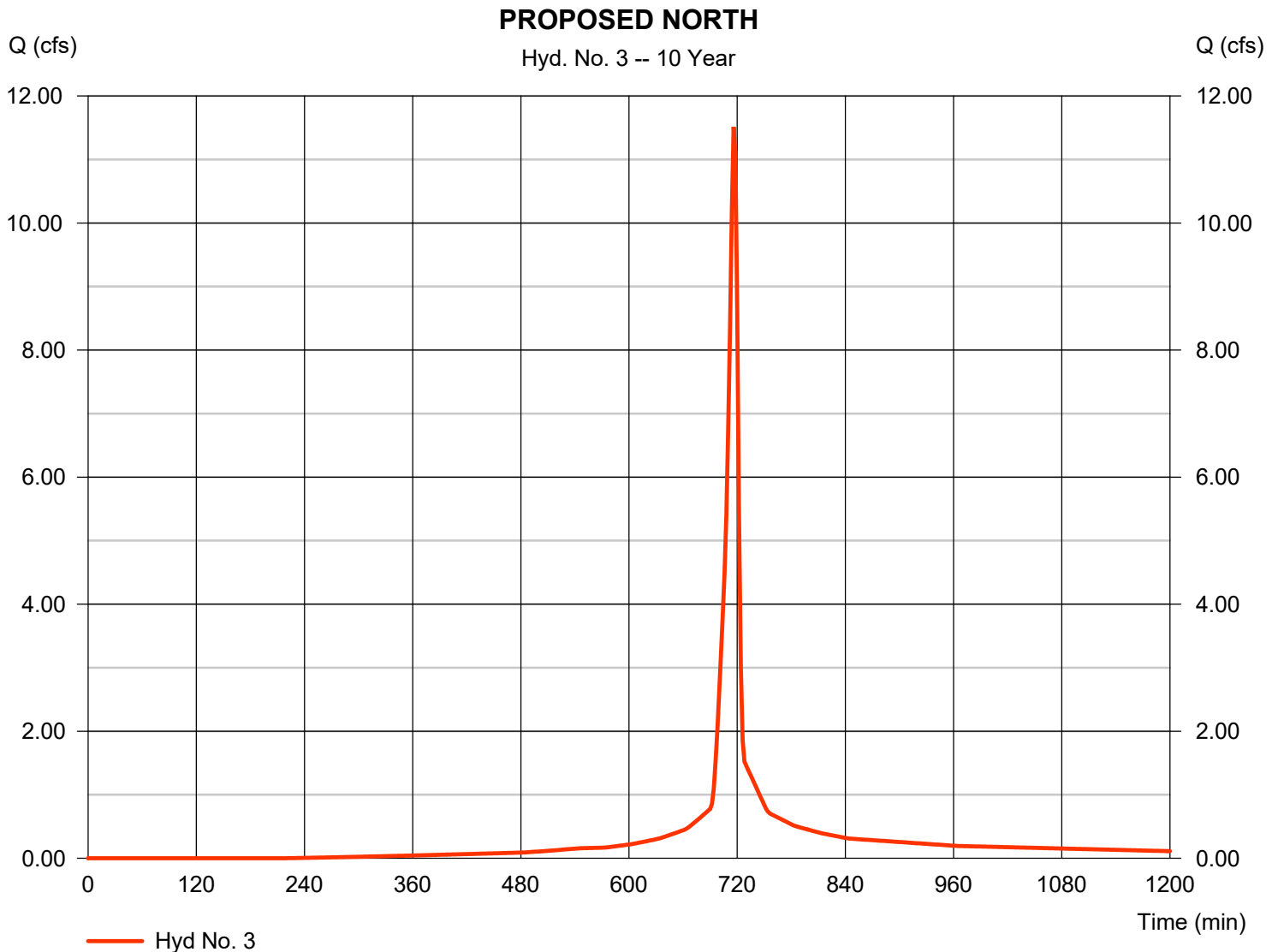
Thursday, 08 / 22 / 2019

Hyd. No. 3

PROPOSED NORTH

Hydrograph type	= SCS Runoff	Peak discharge	= 11.51 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 24,811 cuft
Drainage area	= 1.750 ac	Curve number	= 90*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.30 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.770 \times 80) + (0.980 \times 98)] / 1.750$



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

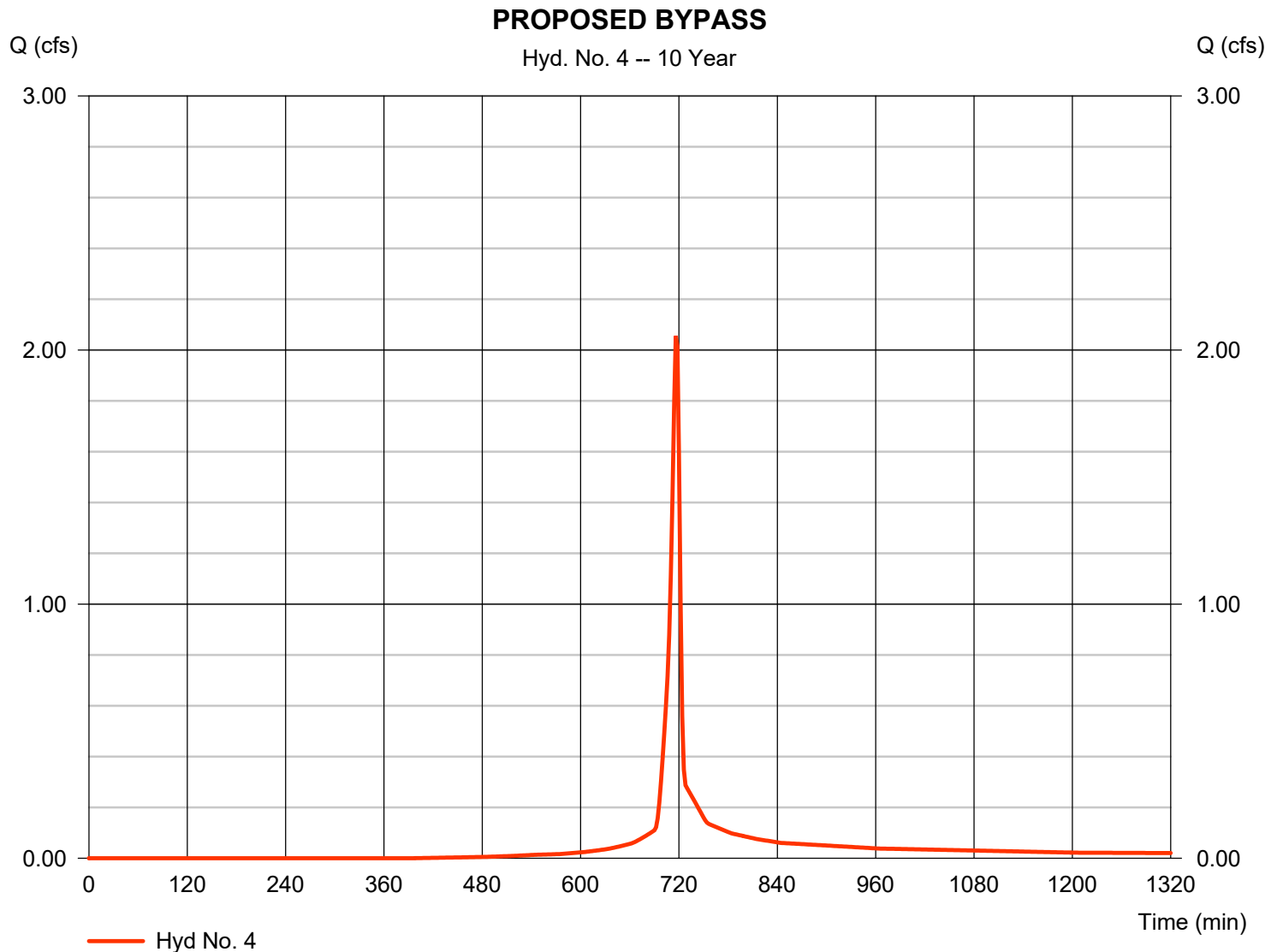
Thursday, 08 / 22 / 2019

Hyd. No. 4

PROPOSED BYPASS

Hydrograph type	= SCS Runoff	Peak discharge	= 2.056 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 4,205 cuft
Drainage area	= 0.380 ac	Curve number	= 81*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.30 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.360 \times 80) + (0.020 \times 98)] / 0.380$



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

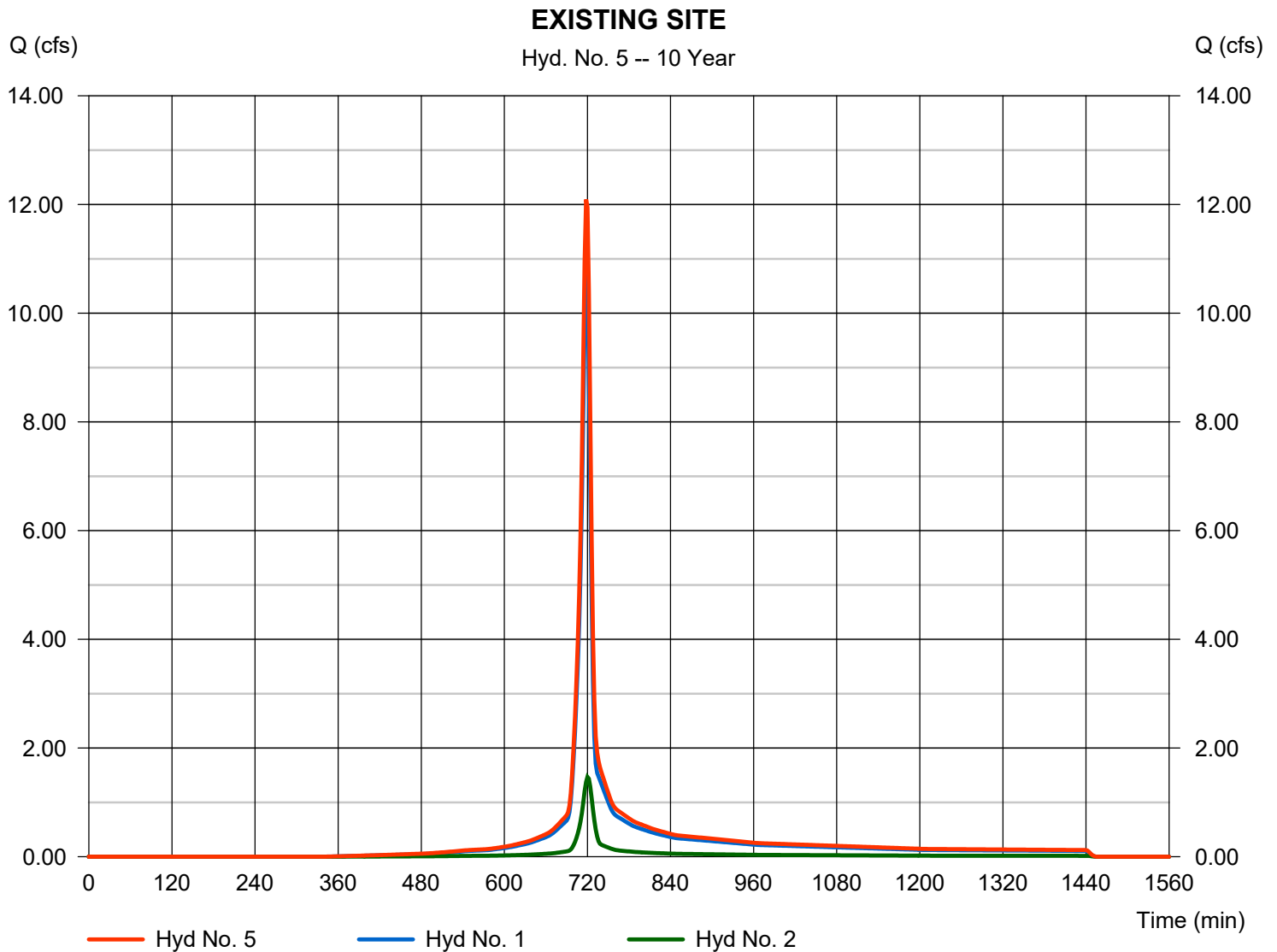
Thursday, 08 / 22 / 2019

Hyd. No. 5

EXISTING SITE

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

Peak discharge = 12.09 cfs
Time to peak = 718 min
Hyd. volume = 28,821 cuft
Contrib. drain. area = 2.230 ac



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

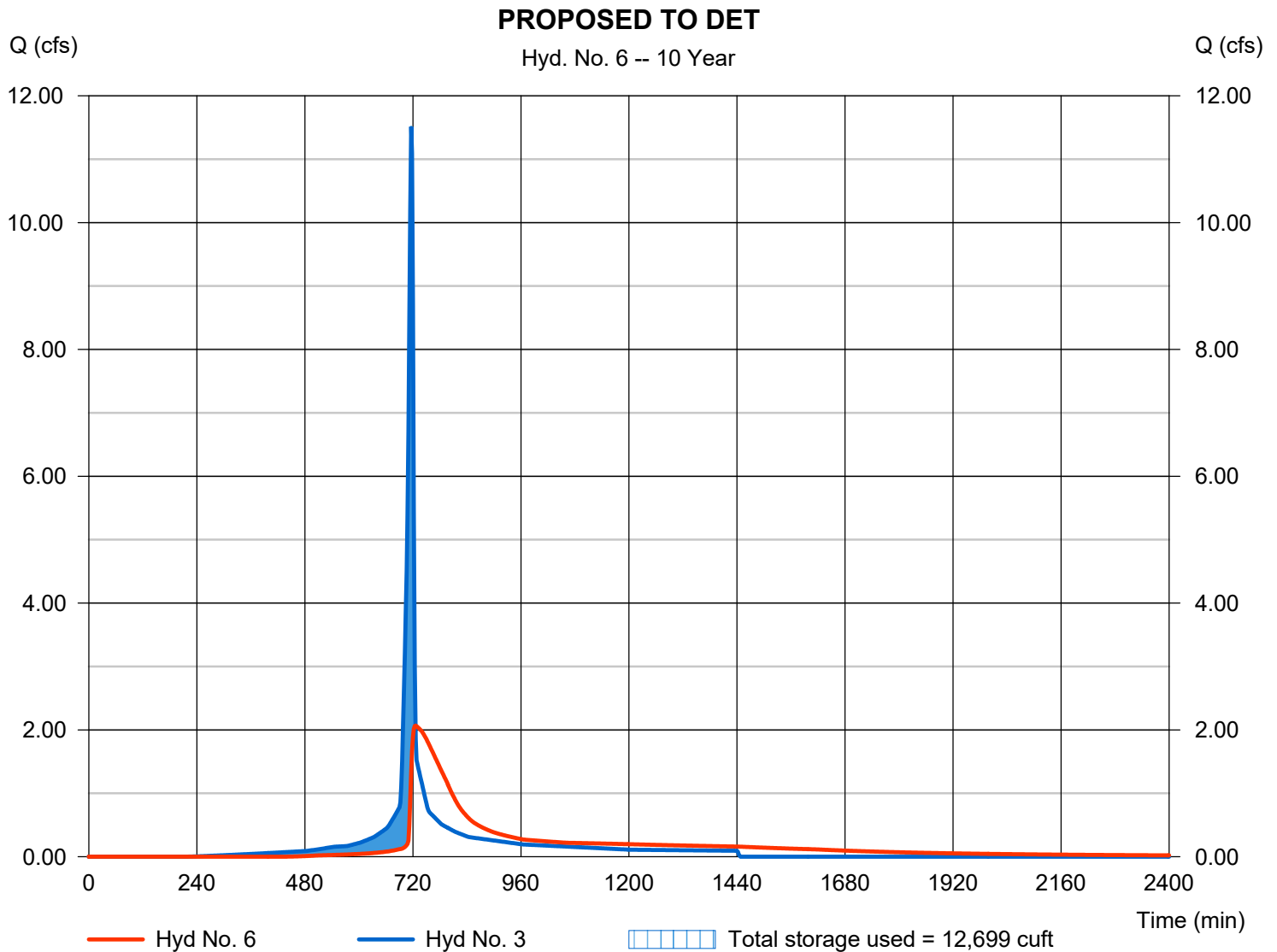
Thursday, 08 / 22 / 2019

Hyd. No. 6

PROPOSED TO DET

Hydrograph type	= Reservoir	Peak discharge	= 2.066 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 24,360 cuft
Inflow hyd. No.	= 3 - PROPOSED NORTH	Max. Elevation	= 965.09 ft
Reservoir name	= Detention Pond	Max. Storage	= 12,699 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

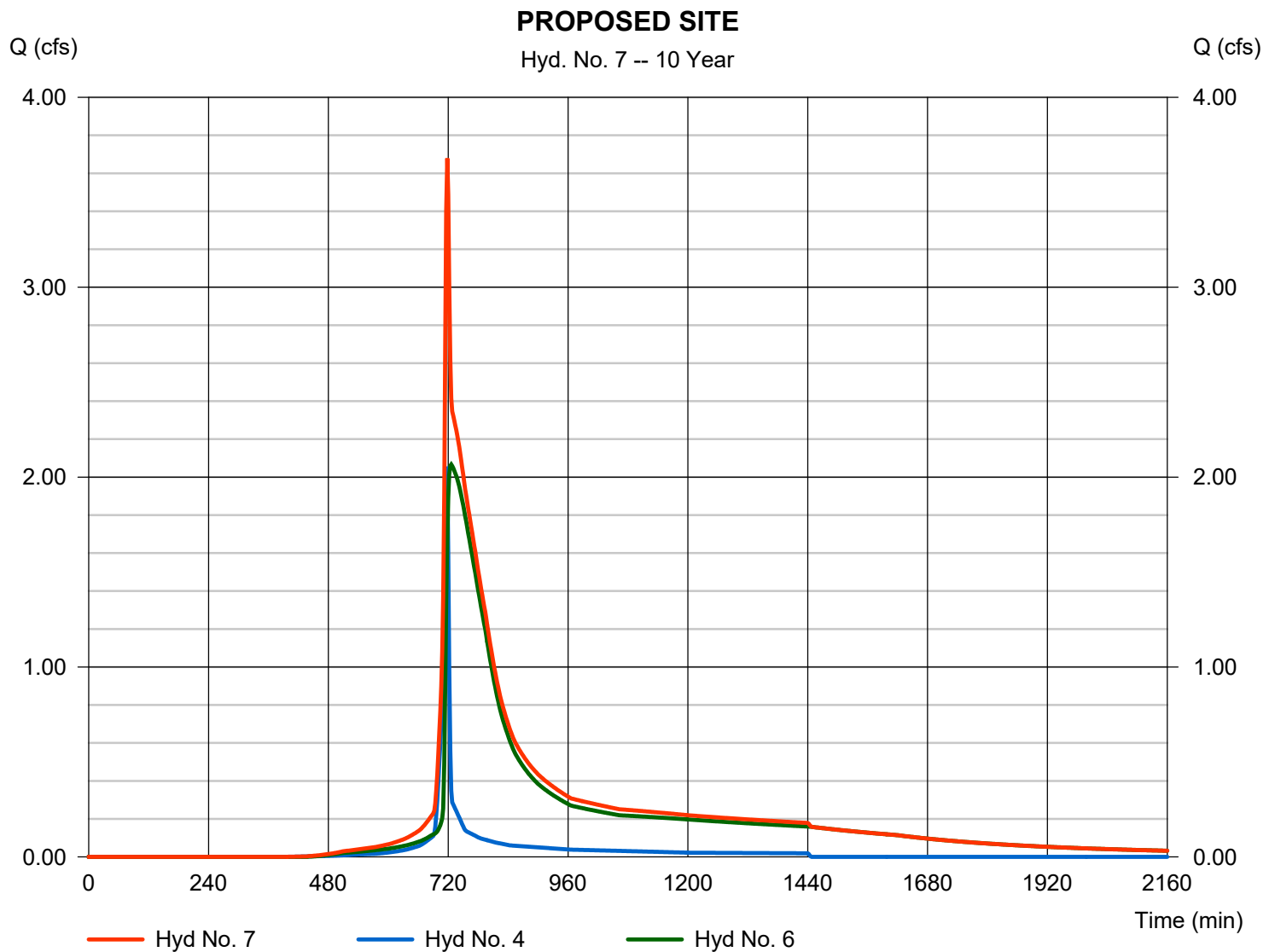
Thursday, 08 / 22 / 2019

Hyd. No. 7

PROPOSED SITE

Hydrograph type = Combine
 Storm frequency = 10 yrs
 Time interval = 2 min
 Inflow hyds. = 4, 6

Peak discharge = 3.679 cfs
 Time to peak = 718 min
 Hyd. volume = 28,565 cuft
 Contrib. drain. area = 0.380 ac



Hydrograph Report

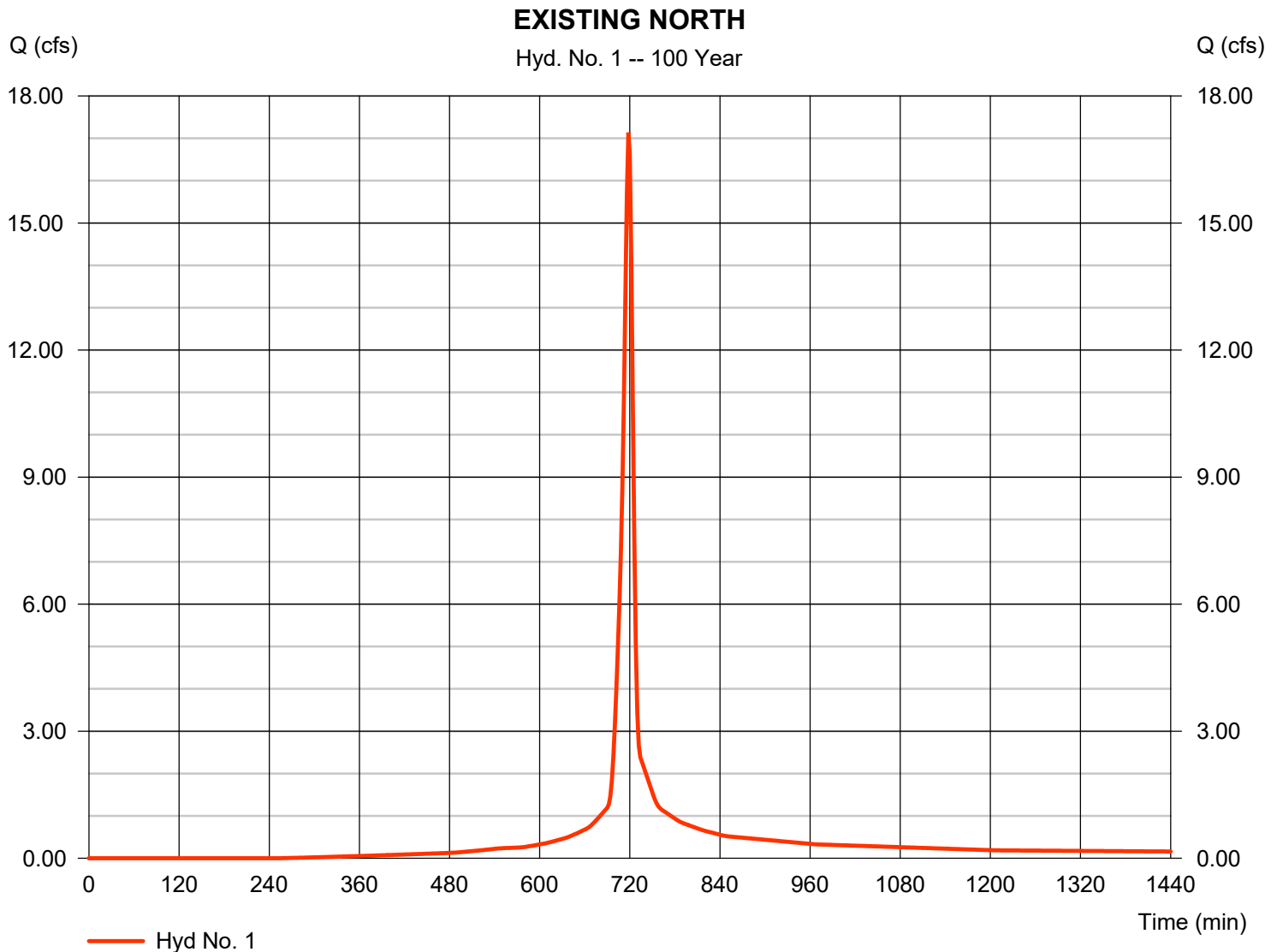
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Thursday, 08 / 22 / 2019

Hyd. No. 1

EXISTING NORTH

Hydrograph type	= SCS Runoff	Peak discharge	= 17.14 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 40,898 cuft
Drainage area	= 1.940 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.00 min
Total precip.	= 7.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(1.940 \times 84)] / 1.940$ 

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

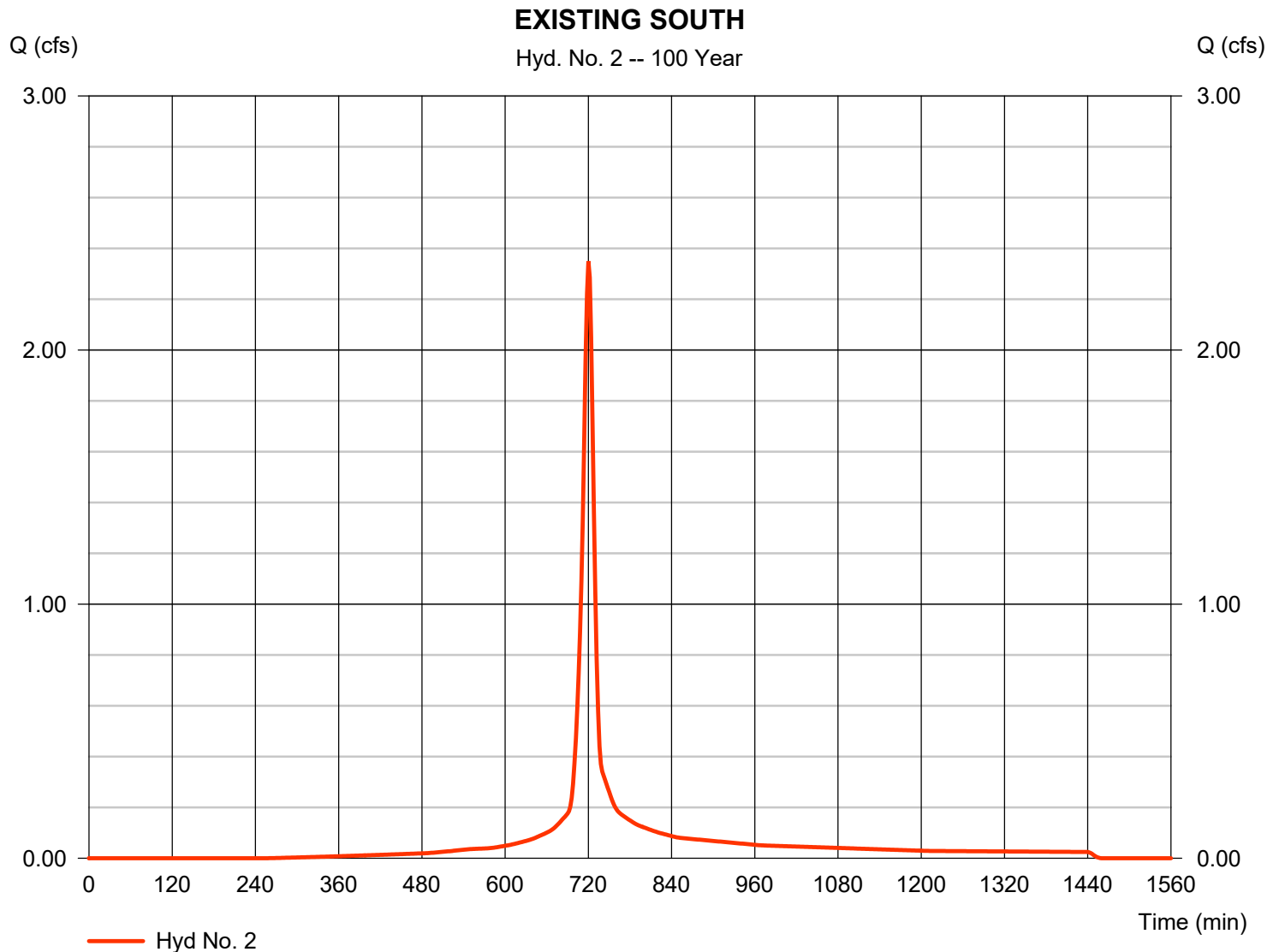
Thursday, 08 / 22 / 2019

Hyd. No. 2

EXISTING SOUTH

Hydrograph type	= SCS Runoff	Peak discharge	= 2.350 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 6,305 cuft
Drainage area	= 0.290 ac	Curve number	= 84*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 10.10 min
Total precip.	= 7.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.290 \times 84)] / 0.290$



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

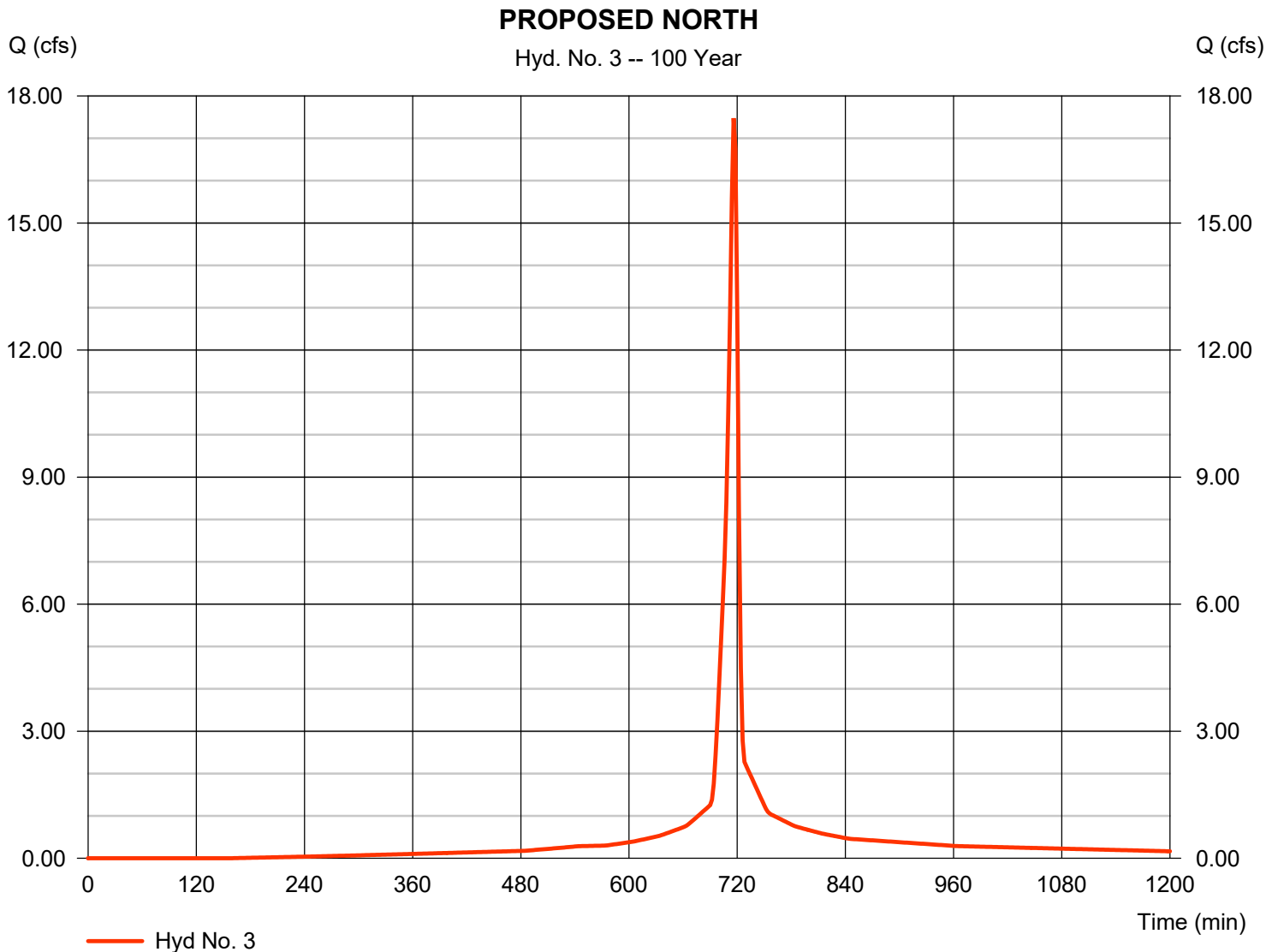
Thursday, 08 / 22 / 2019

Hyd. No. 3

PROPOSED NORTH

Hydrograph type	= SCS Runoff	Peak discharge	= 17.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 38,772 cuft
Drainage area	= 1.750 ac	Curve number	= 90*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.770 \times 80) + (0.980 \times 98)] / 1.750$



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

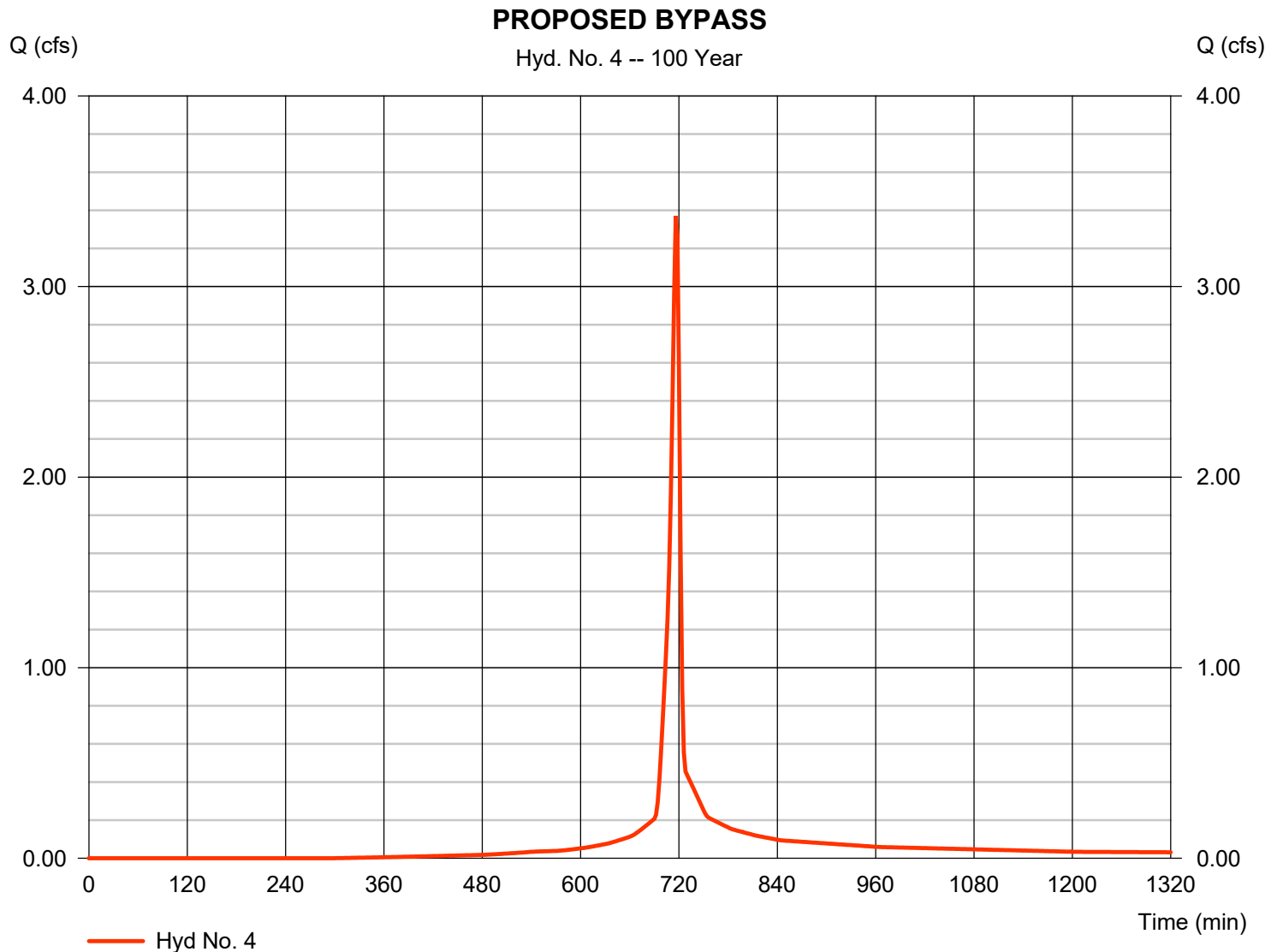
Thursday, 08 / 22 / 2019

Hyd. No. 4

PROPOSED BYPASS

Hydrograph type	= SCS Runoff	Peak discharge	= 3.371 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 7,060 cuft
Drainage area	= 0.380 ac	Curve number	= 81*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.360 \times 80) + (0.020 \times 98)] / 0.380$



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

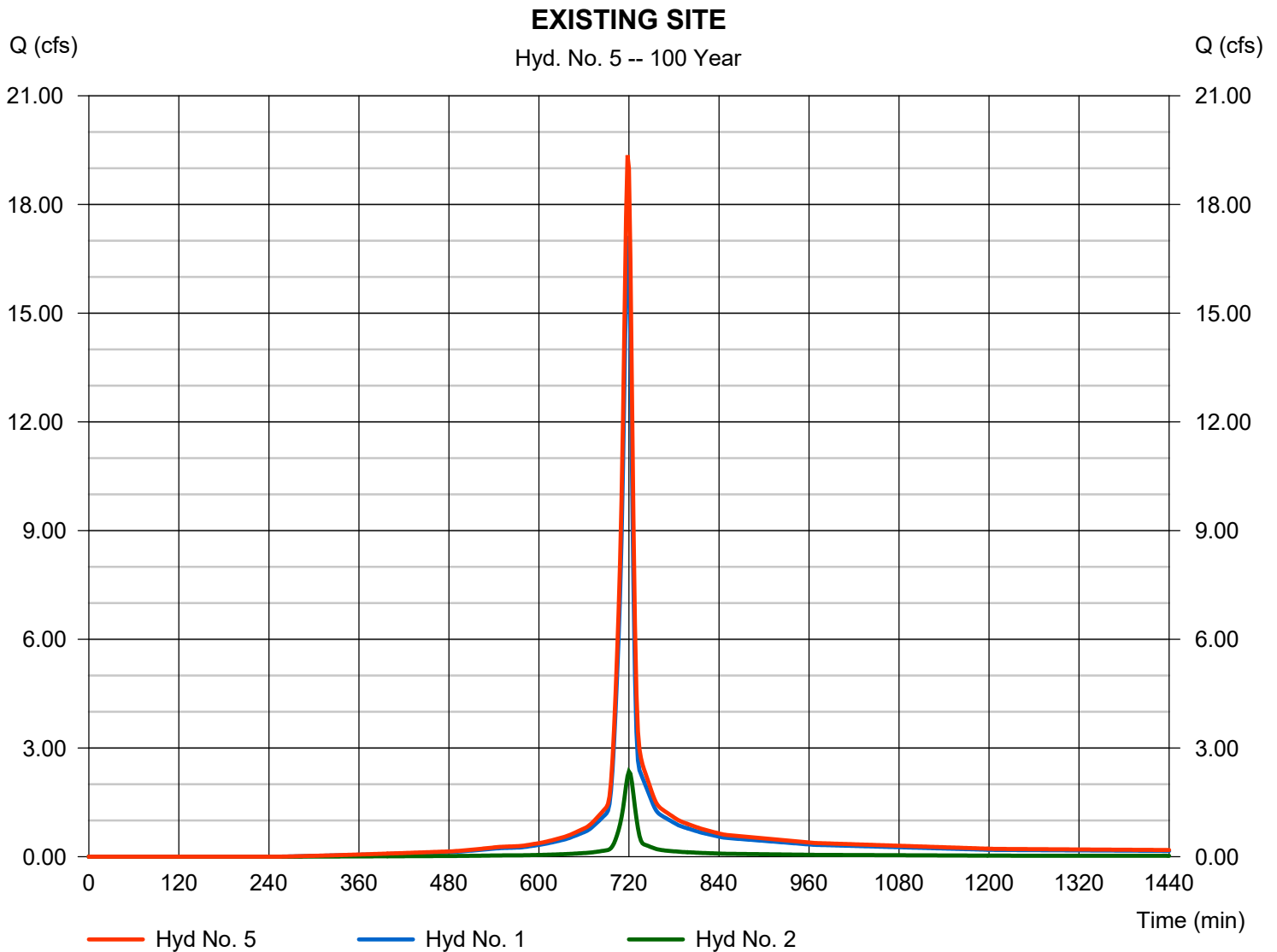
Thursday, 08 / 22 / 2019

Hyd. No. 5

EXISTING SITE

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 1, 2

Peak discharge = 19.36 cfs
Time to peak = 718 min
Hyd. volume = 47,203 cuft
Contrib. drain. area = 2.230 ac



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

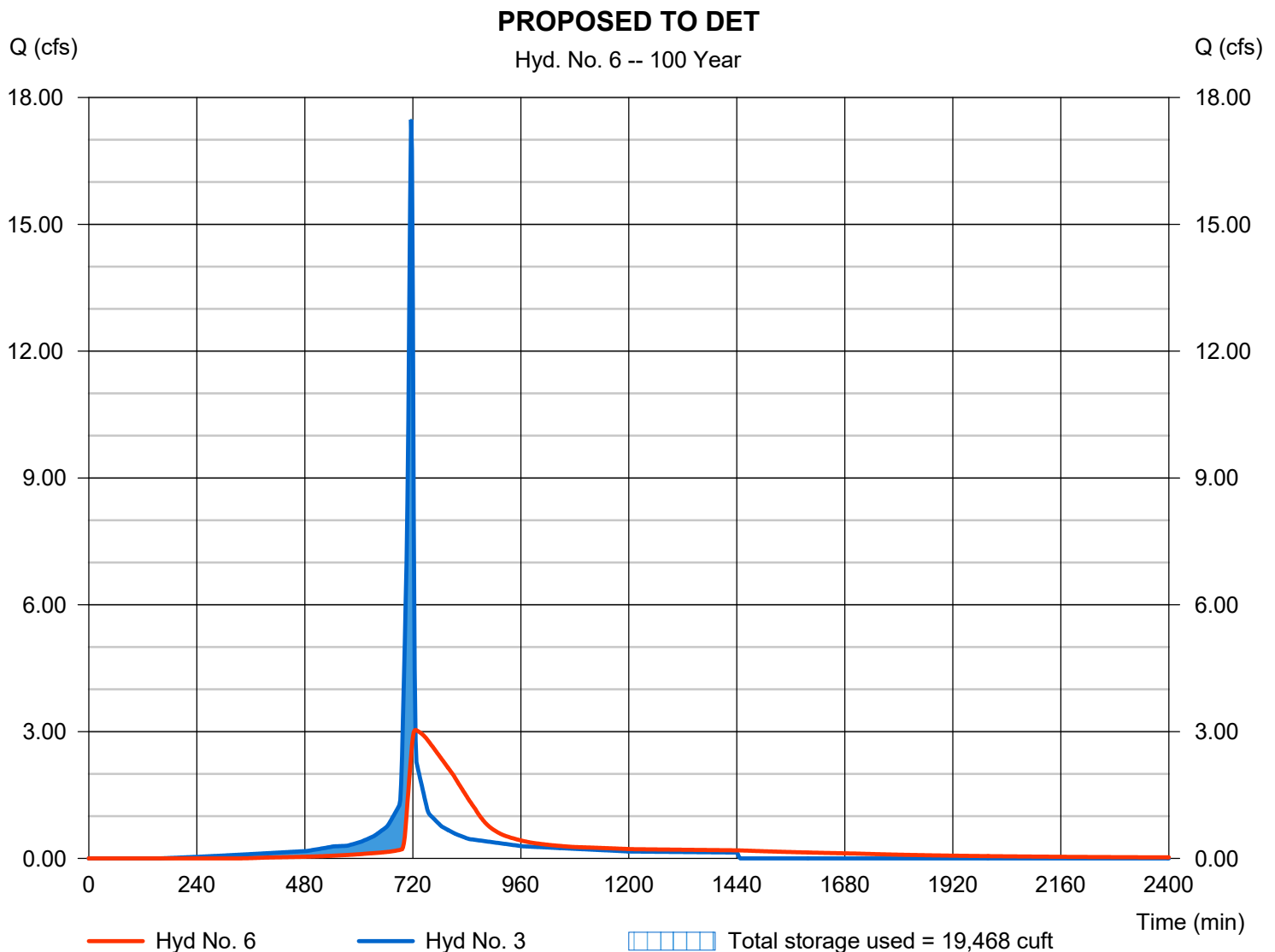
Thursday, 08 / 22 / 2019

Hyd. No. 6

PROPOSED TO DET

Hydrograph type	= Reservoir	Peak discharge	= 3.037 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 38,321 cuft
Inflow hyd. No.	= 3 - PROPOSED NORTH	Max. Elevation	= 966.17 ft
Reservoir name	= Detention Pond	Max. Storage	= 19,468 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

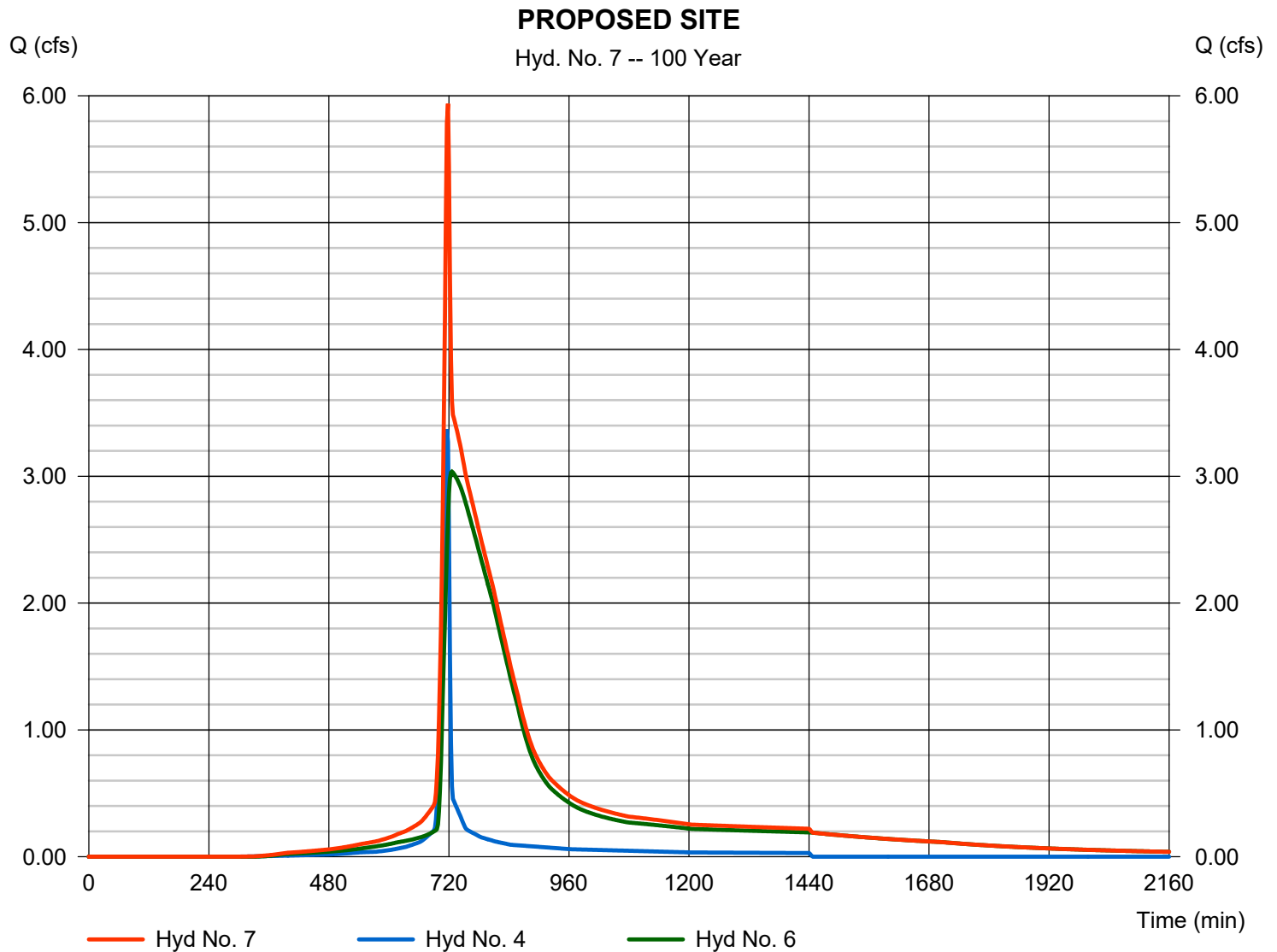
Thursday, 08 / 22 / 2019

Hyd. No. 7

PROPOSED SITE

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 4, 6

Peak discharge = 5.937 cfs
Time to peak = 718 min
Hyd. volume = 45,382 cuft
Contrib. drain. area = 0.380 ac



$$\text{Intensity} = B / (T_c + D)^E$$

Tc = time in minutes. Values may exceed 60.

[illegible]

Channel Report

Emergency Spillway

Trapezoidal

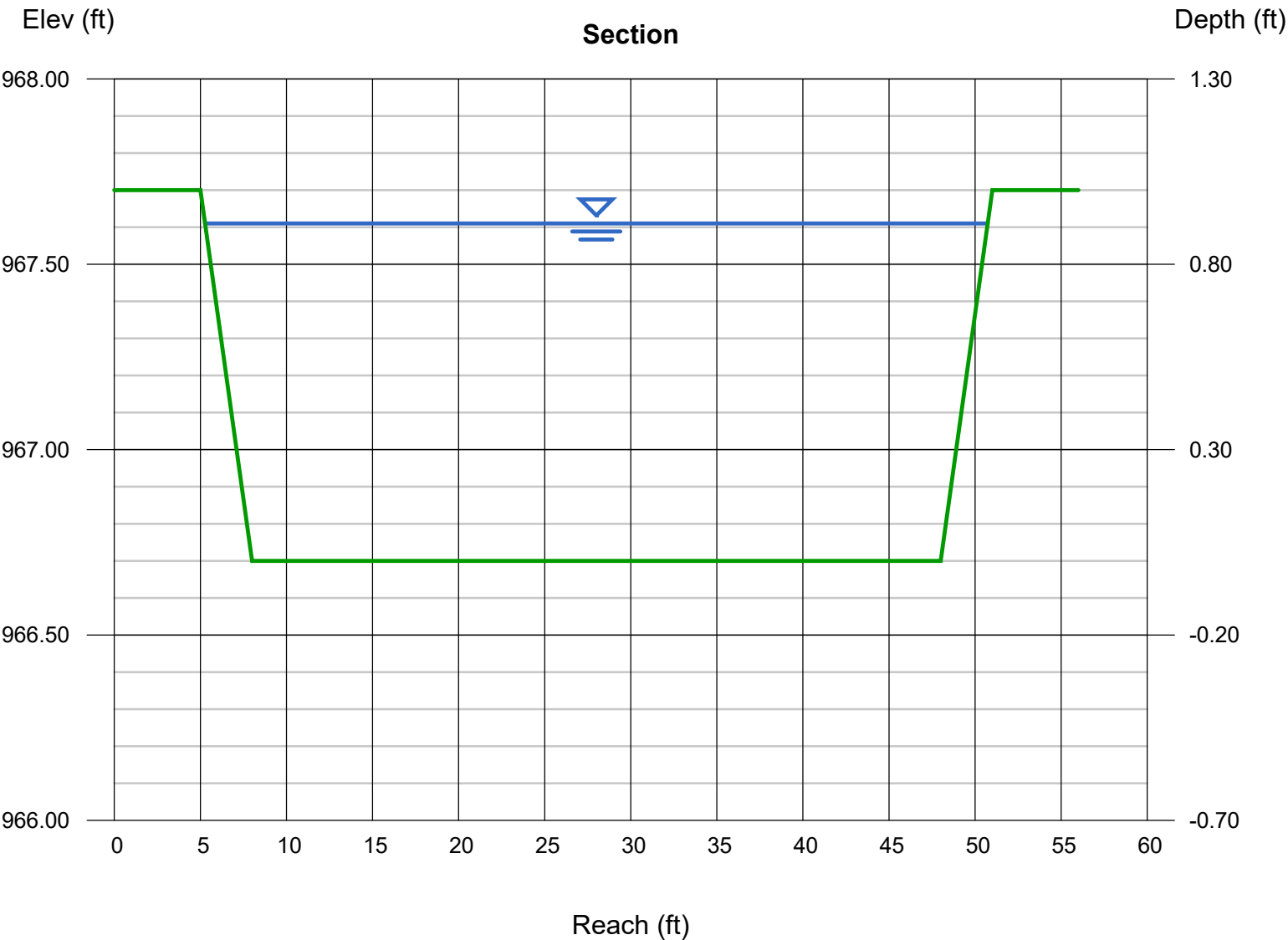
Bottom Width (ft) = 40.00
Side Slopes (z:1) = 3.00, 3.00
Total Depth (ft) = 1.00
Invert Elev (ft) = 966.70
Slope (%) = 1.00
N-Value = 0.150

Calculations

Compute by: Known Q
Known Q (cfs) = 34.51

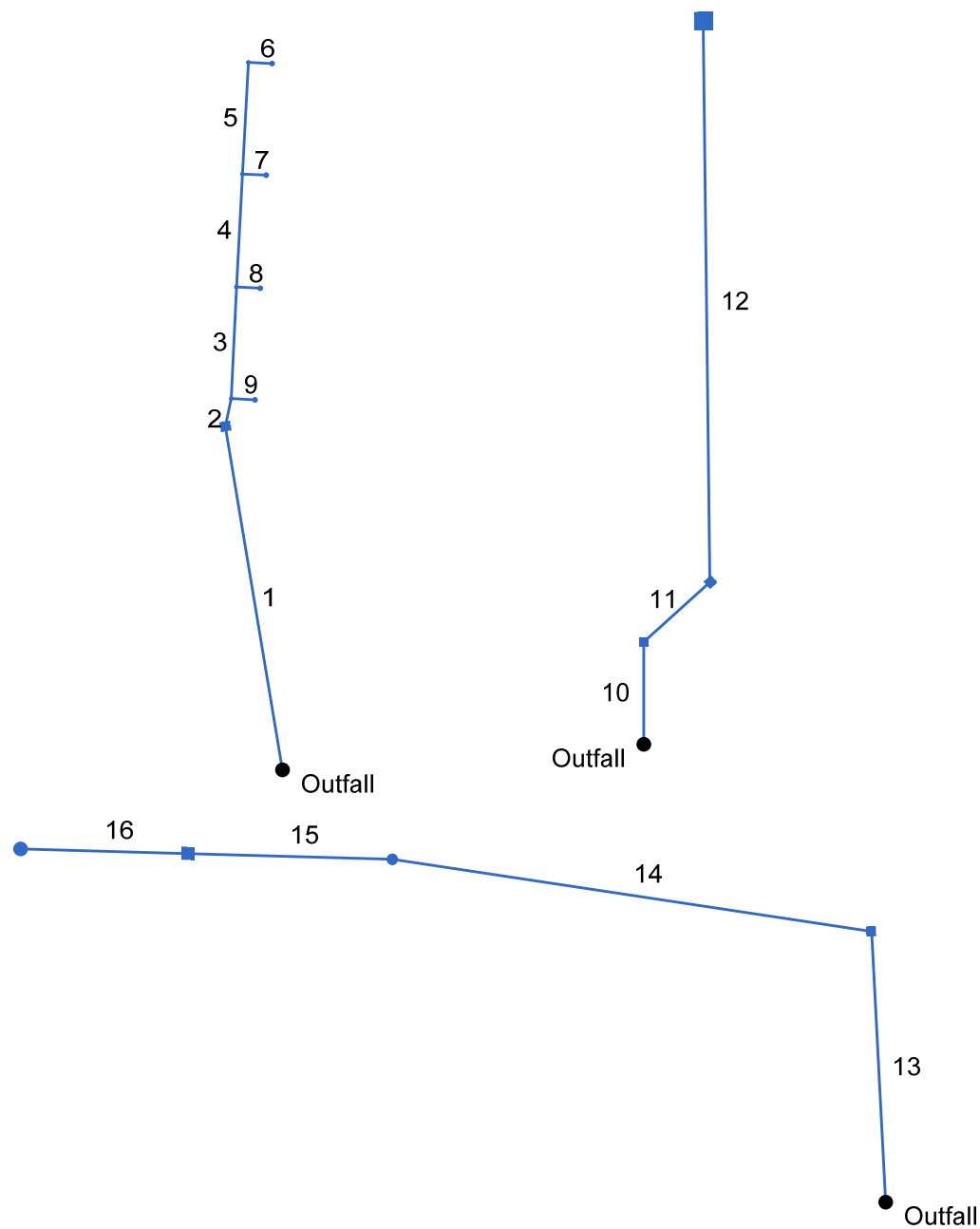
Highlighted

Depth (ft) = 0.91
Q (cfs) = 34.51
Area (sqft) = 38.88
Velocity (ft/s) = 0.89
Wetted Perim (ft) = 45.76
Crit Depth, Yc (ft) = 0.29
Top Width (ft) = 45.46
EGL (ft) = 0.92



Attachment 3
Hydraflow Storm Sewers Calculations

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	B2-B1	2.29	12	Cir	117.73	963.50	972.63	7.755	964.32	973.28	n/a	973.28 j	End	Grate
2	B3-B2	2.12	10	Cir	9.60	972.83	972.93	1.042	973.48	973.58	0.33	973.58	1	Manhole
3	B4-B3	1.66	10	Cir	37.80	972.93	973.30	0.979	973.58	973.88	n/a	973.88 j	2	Manhole
4	B5-B4	1.13	10	Cir	38.29	973.30	973.69	1.019	973.88	974.16	n/a	974.16 j	3	Manhole
5	B6-B5	0.46	10	Cir	37.80	973.69	974.06	0.979	974.16	974.36	n/a	974.36 j	4	Manhole
6	RF4-B6	0.46	10	Cir	8.00	974.06	974.25	2.375	974.36	974.55	n/a	974.55	5	Grate
7	RF3-B5	0.66	10	Cir	8.00	973.69	974.25	7.000	974.16	974.61	n/a	974.61 j	4	Grate
8	RF2-B4	0.53	10	Cir	8.00	973.30	974.25	11.875	973.88	974.57	n/a	974.57 j	3	Grate
9	RF1-B3	0.46	10	Cir	8.00	972.93	974.25	16.500	973.58	974.55	n/a	974.55 j	2	Grate
10	C2-C1	4.74	12	Cir	34.68	963.50	969.00	15.859	964.45	969.90	n/a	969.90 j	End	Curb-Horiz
11	C3-C2	3.54	12	Cir	30.04	969.20	971.30	6.991	969.90	972.10	n/a	972.10	10	Curb-Horiz
12	C4-C3	2.55	12	Cir	190.02	971.50	973.50	1.053	972.12	974.18	n/a	974.18	11	Curb-Horiz
13	Pipe - (4)	6.67	24	Cir	91.74	947.73	948.65	1.003	949.19	949.56	n/a	949.56 j	End	Grate
14	A1-EX AL#1202	5.84	24	Cir	163.20	948.85	958.00	5.607	949.56	958.85	n/a	958.85	13	Grate
15	A2-A1	2.16	15	Cir	69.11	958.20	966.58	12.125	958.85	967.17	n/a	967.17 j	14	Manhole
16	EX AI #2081 - A2	2.16	15	Cir	56.15	966.58	967.00	0.748	967.17	967.59	n/a	967.59	15	Grate
Project File: 20180111_2019-08-23 Storm Sewers.stm									Number of lines: 16			Run Date: 8/22/2019		
NOTES: Return period = 10 Yrs. ; j - Line contains hyd. jump.														

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (I) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	117.73	0.07	0.39	0.35	0.02	0.33	5.0	5.0	7.0	2.29	9.92	3.79	12	7.76	963.50	972.63	964.32	973.28	965.00	976.50	B2-B1
2	1	9.60	0.00	0.32	0.00	0.00	0.30	0.0	5.0	7.0	2.12	2.24	4.65	10	1.04	972.83	972.93	973.48	973.58	976.50	976.80	B3-B2
3	2	37.80	0.00	0.25	0.00	0.00	0.24	0.0	5.0	7.0	1.66	2.17	3.86	10	0.98	972.93	973.30	973.58	973.88	976.80	977.10	B4-B3
4	3	38.29	0.00	0.17	0.00	0.00	0.16	0.0	5.0	7.0	1.13	2.21	3.16	10	1.02	973.30	973.69	973.88	974.16	977.10	977.80	B5-B4
5	4	37.80	0.00	0.07	0.00	0.00	0.07	0.0	5.0	7.0	0.46	2.17	2.05	10	0.98	973.69	974.06	974.16	974.36	977.80	978.00	B6-B5
6	5	8.00	0.07	0.07	0.95	0.07	0.07	5.0	5.0	7.0	0.46	3.37	2.66	10	2.38	974.06	974.25	974.36	974.55	978.00	979.00	RF4-B6
7	4	8.00	0.10	0.10	0.95	0.10	0.10	5.0	5.0	7.0	0.66	5.79	2.52	10	7.00	973.69	974.25	974.16	974.61	977.80	979.00	RF3-B5
8	3	8.00	0.08	0.08	0.95	0.08	0.08	5.0	5.0	7.0	0.53	7.55	2.04	10	11.88	973.30	974.25	973.88	974.57	977.10	979.00	RF2-B4
9	2	8.00	0.07	0.07	0.95	0.07	0.07	5.0	5.0	7.0	0.46	8.90	1.83	10	16.50	972.93	974.25	973.58	974.55	976.80	979.00	RF1-B3
10	End	34.68	0.18	0.94	0.95	0.17	0.68	5.0	5.0	7.0	4.74	14.18	6.25	12	15.86	963.50	969.00	964.45	969.90	965.00	975.80	C2-C1
11	10	30.04	0.15	0.76	0.95	0.14	0.51	5.0	5.0	7.0	3.54	9.42	5.63	12	6.99	969.20	971.30	969.90	972.10	975.80	975.80	C3-C2
12	11	190.02	0.61	0.61	0.60	0.37	0.37	5.0	5.0	7.0	2.55	3.65	4.74	12	1.05	971.50	973.50	972.12	974.18	975.80	977.60	C4-C3
13	End	91.74	0.34	0.34	0.35	0.12	0.12	5.0	5.0	7.0	6.67	22.65	3.74	24	1.00	947.73	948.65	949.19	949.56	950.00	959.95	Pipe - (4)
14	13	163.20	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	5.84	53.56	5.18	24	5.61	948.85	958.00	949.56	958.85	959.95	966.20	A1-EX AL#1202
15	14	69.11	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.16	22.49	3.58	15	12.13	958.20	966.58	958.85	967.17	966.20	971.20	A2-A1
16	15	56.15	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.16	5.58	3.82	15	0.75	966.58	967.00	967.17	967.59	971.20	973.94	EX AI #2081 - A2
Project File: 20180111_2019-08-23 Storm Sewers.stm																Number of lines: 16				Run Date: 8/22/2019		
NOTES:Intensity = 66.71 / (Inlet time + 12.50) ^ 0.79; Return period =Yrs. 10 ; Pipe travel time suppressed. ; c = cir e = ellip b = box																						

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	B2	0.17	0.00	0.17	0.00	Grate	0.0	0.00	2.60	2.30	2.30	Sag	2.00	0.050	0.020	0.013	0.08	1.63	0.08	1.63	0.0	Off
2	B3	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	B4	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
4	B5	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
5	B6	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	RF4	0.46	0.00	0.46	0.00	Grate	0.0	0.00	0.81	1.00	1.00	Sag	2.00	0.050	0.020	0.013	0.16	5.16	0.16	5.16	0.0	Off
7	RF3	0.66	0.00	0.66	0.00	Grate	0.0	0.00	0.81	1.00	1.00	Sag	2.00	0.050	0.020	0.013	0.20	7.02	0.20	7.02	0.0	Off
8	RF2	0.53	0.00	0.53	0.00	Grate	0.0	0.00	0.81	1.00	1.00	Sag	2.00	0.050	0.020	0.013	0.18	5.81	0.18	5.81	0.0	Off
9	RF1	0.46	0.00	0.46	0.00	Grate	0.0	0.00	0.81	1.00	1.00	Sag	2.00	0.050	0.020	0.013	0.16	5.16	0.16	5.16	0.0	Off
10	C2	1.19	0.00	1.19	0.00	Curb	4.0	2.30	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.013	0.26	9.87	0.26	9.87	0.0	Off
11	C3	0.99	0.00	0.99	0.00	Curb	4.0	2.30	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.013	0.23	8.74	0.23	8.74	0.0	Off
12	C4	2.55	0.00	2.55	0.00	Curb	4.0	4.60	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.013	0.32	13.17	0.32	13.17	0.0	Off
13	EX AL#1202	0.83	0.00	0.74	0.09	Grate	0.0	0.00	0.00	2.60	2.60	0.020	2.00	0.050	0.020	0.013	0.15	4.49	0.07	1.32	0.0	Off
14	A1	3.68*	0.00	3.68	0.00	Grate	0.0	0.00	2.30	2.60	2.60	Sag	2.00	0.050	0.020	0.013	0.36	14.81	0.36	14.81	0.0	Off
15	A2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
16	EX AI #2081	2.16*	0.00	2.16	0.00	Grate	0.0	0.00	3.14	2.00	2.00	Sag	2.00	0.050	0.020	0.013	0.29	11.66	0.29	11.66	0.0	Off

Project File: 20180111_2019-08-23 Storm Sewers.stm

Number of lines: 16

Run Date: 8/22/2019

NOTES: Inlet N-Values = 0.016; Intensity = 66.71 / (Inlet time + 12.50) ^ 0.79; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	B2-B1	3.19	12	Cir	117.73	963.50	972.63	7.755	964.38	973.39	n/a	973.39 j	End	Grate
2	B3-B2	2.95	10	Cir	9.60	972.83	972.93	1.042	973.62	973.76	0.45	974.21	1	Manhole
3	B4-B3	2.31	10	Cir	37.80	972.93	973.30	0.979	974.21*	974.63*	0.28	974.91	2	Manhole
4	B5-B4	1.57	10	Cir	38.29	973.30	973.69	1.019	974.91*	975.11*	0.13	975.24	3	Manhole
5	B6-B5	0.65	10	Cir	37.80	973.69	974.06	0.979	975.24*	975.27*	0.02	975.29	4	Manhole
6	RF4-B6	0.65	10	Cir	8.00	974.06	974.25	2.375	975.29*	975.30*	0.02	975.32	5	Grate
7	RF3-B5	0.92	10	Cir	8.00	973.69	974.25	7.000	975.24*	975.25*	0.04	975.30	4	Grate
8	RF2-B4	0.74	10	Cir	8.00	973.30	974.25	11.875	974.91	974.91	0.04	974.95	3	Grate
9	RF1-B3	0.65	10	Cir	8.00	972.93	974.25	16.500	974.21	974.60	n/a	974.60 j	2	Grate
10	C2-C1	6.60	12	Cir	34.68	963.50	969.00	15.859	964.48	969.97	n/a	969.97 j	End	Curb-Horiz
11	C3-C2	4.94	12	Cir	30.04	969.20	971.30	6.991	969.97	972.21	0.79	972.21	10	Curb-Horiz
12	C4-C3	3.56	12	Cir	190.02	971.50	973.50	1.053	972.30	974.30	n/a	974.30	11	Curb-Horiz
13	Pipe - (4)	10.48	24	Cir	91.74	947.73	948.65	1.003	949.31	949.81	n/a	949.81 j	End	Grate
14	A1-EX AL#1202	9.32	24	Cir	163.20	948.85	958.00	5.607	949.81	959.09	n/a	959.09	13	Grate
15	A2-A1	3.38	15	Cir	69.11	958.20	966.58	12.125	959.09	967.32	n/a	967.32 j	14	Manhole
16	EX AI #2081 - A2	3.38	15	Cir	56.15	966.58	967.00	0.748	967.32	967.74	n/a	967.74	15	Grate
Project File: 20180111_2019-08-23 Storm Sewers.stm									Number of lines: 16			Run Date: 8/22/2019		
NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.														

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Dn	Up	Dn	Up	Dn	Up	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	117.73	0.07	0.39	0.35	0.02	0.33	5.0	5.0	9.7	3.19	9.92	4.65	12	7.76	963.50	972.63	964.38	973.39	965.00	976.50	B2-B1
2	1	9.60	0.00	0.32	0.00	0.00	0.30	0.0	5.0	9.7	2.95	2.24	5.47	10	1.04	972.83	972.93	973.62	973.76	976.50	976.80	B3-B2
3	2	37.80	0.00	0.25	0.00	0.00	0.24	0.0	5.0	9.7	2.31	2.17	4.23	10	0.98	972.93	973.30	974.21	974.63	976.80	977.10	B4-B3
4	3	38.29	0.00	0.17	0.00	0.00	0.16	0.0	5.0	9.7	1.57	2.21	2.88	10	1.02	973.30	973.69	974.91	975.11	977.10	977.80	B5-B4
5	4	37.80	0.00	0.07	0.00	0.00	0.07	0.0	5.0	9.7	0.65	2.17	1.19	10	0.98	973.69	974.06	975.24	975.27	977.80	978.00	B6-B5
6	5	8.00	0.07	0.07	0.95	0.07	0.07	5.0	5.0	9.7	0.65	3.37	1.19	10	2.38	974.06	974.25	975.29	975.30	978.00	979.00	RF4-B6
7	4	8.00	0.10	0.10	0.95	0.10	0.10	5.0	5.0	9.7	0.92	5.79	1.69	10	7.00	973.69	974.25	975.24	975.25	977.80	979.00	RF3-B5
8	3	8.00	0.08	0.08	0.95	0.08	0.08	5.0	5.0	9.7	0.74	7.55	1.47	10	11.88	973.30	974.25	974.91	974.91	977.10	979.00	RF2-B4
9	2	8.00	0.07	0.07	0.95	0.07	0.07	5.0	5.0	9.7	0.65	8.90	2.06	10	16.50	972.93	974.25	974.21	974.60	976.80	979.00	RF1-B3
10	End	34.68	0.18	0.94	0.95	0.17	0.68	5.0	5.0	9.7	6.60	14.18	8.46	12	15.86	963.50	969.00	964.48	969.97	965.00	975.80	C2-C1
11	10	30.04	0.15	0.76	0.95	0.14	0.51	5.0	5.0	9.7	4.94	9.42	7.10	12	6.99	969.20	971.30	969.97	972.21	975.80	975.80	C3-C2
12	11	190.02	0.61	0.61	0.60	0.37	0.37	5.0	5.0	9.7	3.56	3.65	5.28	12	1.05	971.50	973.50	972.30	974.30	975.80	977.60	C4-C3
13	End	91.74	0.34	0.34	0.35	0.12	0.12	5.0	5.0	9.7	10.48	22.65	4.75	24	1.00	947.73	948.65	949.31	949.81	950.00	959.95	Pipe - (4)
14	13	163.20	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	9.32	53.56	5.80	24	5.61	948.85	958.00	949.81	959.09	959.95	966.20	A1-EX AL#1202
15	14	69.11	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.38	22.49	4.04	15	12.13	958.20	966.58	959.09	967.32	966.20	971.20	A2-A1
16	15	56.15	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.38	5.58	4.46	15	0.75	966.58	967.00	967.32	967.74	971.20	973.94	EX AI #2081 - A2
Project File: 20180111_2019-08-23 Storm Sewers.stm																Number of lines: 16				Run Date: 8/22/2019		
NOTES:Intensity = 170.80 / (Inlet time + 18.20) ^ 0.91; Return period =Yrs. 100 ; Pipe travel time suppressed. ; c = cir e = ellip b = box																						

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	B2	0.24	0.00	0.24	0.00	Grate	0.0	0.00	2.60	2.30	2.30	Sag	2.00	0.050	0.020	0.013	0.10	2.09	0.10	2.09	0.0	Off
2	B3	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
3	B4	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
4	B5	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
5	B6	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	RF4	0.65	0.00	0.65	0.00	Grate	0.0	0.00	0.81	1.00	1.00	Sag	2.00	0.050	0.020	0.013	0.20	6.88	0.20	6.88	0.0	Off
7	RF3	0.92	0.00	0.92	0.00	Grate	0.0	0.00	0.81	1.00	1.00	Sag	2.00	0.050	0.020	0.013	0.24	9.20	0.24	9.20	0.0	Off
8	RF2	0.74	0.00	0.74	0.00	Grate	0.0	0.00	0.81	1.00	1.00	Sag	2.00	0.050	0.020	0.013	0.21	7.68	0.21	7.68	0.0	Off
9	RF1	0.65	0.00	0.65	0.00	Grate	0.0	0.00	0.81	1.00	1.00	Sag	2.00	0.050	0.020	0.013	0.20	6.88	0.20	6.88	0.0	Off
10	C2	1.66	0.00	1.66	0.00	Curb	4.0	2.30	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.013	0.31	12.32	0.31	12.32	0.0	Off
11	C3	1.38	0.00	1.38	0.00	Curb	4.0	2.30	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.013	0.28	10.91	0.28	10.91	0.0	Off
12	C4	3.56	0.00	3.56	0.00	Curb	4.0	4.60	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.013	0.39	16.43	0.39	16.43	0.0	Off
13	EX AL#1202	1.16	0.00	0.96	0.19	Grate	0.0	0.00	0.00	2.60	2.60	0.020	2.00	0.050	0.020	0.013	0.17	5.33	0.09	1.79	0.0	Off
14	A1	5.94*	0.00	5.94	0.00	Grate	0.0	0.00	2.30	2.60	2.60	Sag	2.00	0.050	0.020	0.013	0.47	20.29	0.47	20.29	0.0	Off
15	A2	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
16	EX AI #2081	3.38*	0.00	3.38	0.00	Grate	0.0	0.00	3.14	2.00	2.00	Sag	2.00	0.050	0.020	0.013	0.38	15.89	0.38	15.89	0.0	Off

Project File: 20180111_2019-08-23 Storm Sewers.stm

Number of lines: 16

Run Date: 8/22/2019

NOTES: Inlet N-Values = 0.016; Intensity = 170.80 / (Inlet time + 18.20) ^ 0.91; Return period = 100 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

Attachment 4
Water Quality Calculations

Date: 7/25/2019
Revised: 8/23/2019

Proposed Conditions

Drainage Area	Pervious Area (ac)	Impervious Area (ac)	Total Area, DA (ac)	Total Area, DA (sf)	Percent Site Impervious, I	Volumetric Runoff Coefficient, Rv = .05+.009I	Required WQ Treatment Volume, WQv=P(Rv) (in)	Required WQ Treatment Volume, WQv=P(Rv)(DA) (cf)
North	0.77	0.98	1.75	76,330	56.0%	0.554	0.759	4,827.75
Bypass	0.36	0.02	0.38	16,756	5.3%	0.098	0.134	186.90
Sum=							5014.64	

Extended Dry Detention Pond

Elevation-Area-Volume Table		
Elevation	Area (sf)	Volume (cf)
961	10	0
962	1,575	793
963	3,200	3,180
963.5	3,905	5,132
964	4,610	7,085
965	5,590	12,185
966	6,670	18,315
966.2	6,895	19,672

*WQv elevation

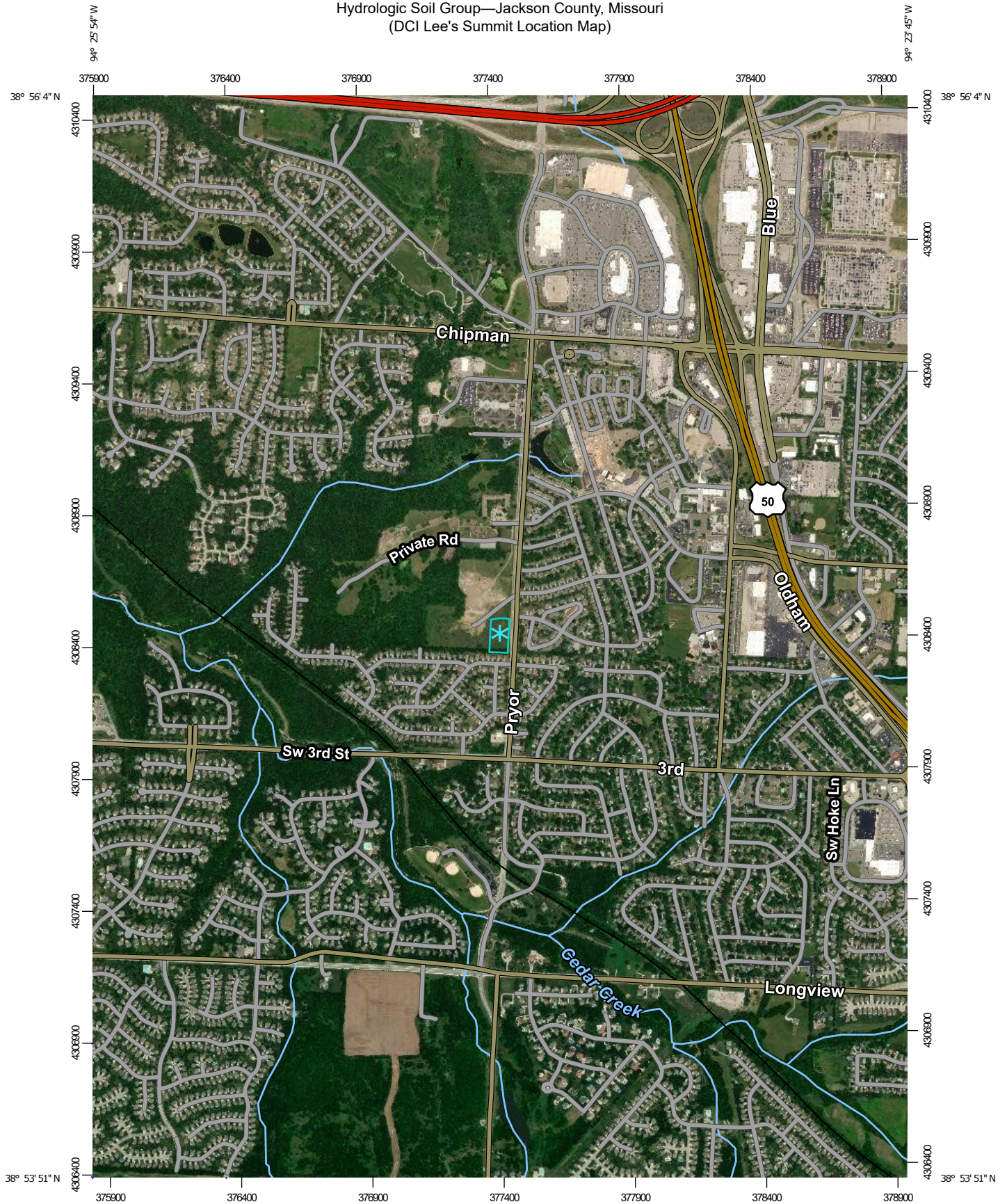
Extended Dry Detention Pond	Return Event (years)	Max Water Surface Elevation (ft)	Freeboard (ft)
	2	964.17	4.53
	10	965.09	3.61
	100	966.17	2.53

Perforated Riser

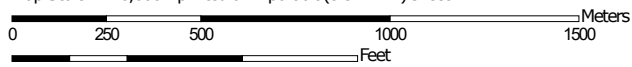
WQv Treatment Depth Above Lowest Orifice, Zwq	2.5 ft
Water Quality Volume	5,132 cf
Water Quality Volume	0.118 ac-ft
Recommended Max Outlet Area per Row, Ao	1.35 sq. in
$A_o = \frac{WQ_v}{(0.013(Z_{wq})^2 + 0.22(Z_{wq}) - 0.10)}$	
Number of columns, nc	1 column
Design circular perforation diameter, Dperf	1 in
Number of rows (4" vertical spacing), nr	6 rows
Perforation 1 Elevation	961.52
Perforation 2 Elevation	961.85
Perforation 3 Elevation	962.18
Perforation 4 Elevation	962.51
Perforation 5 Elevation	962.84
Perforation 6 Elevation	963.17

Attachment 5
Supporting Documents

Hydrologic Soil Group—Jackson County, Missouri (DCI Lee's Summit Location Map)



Map Scale: 1:20,000 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

* - Site Location



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

7/8/2019
Page 1 of 4

Hydrologic Soil Group—Jackson County, Missouri (DCI Lee's Summit)



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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: Jackson County, Missouri
Survey Area Data: Version 19, Sep 13, 2018

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

Date(s) aerial images were photographed: Jun 11, 2017—Sep 22, 2017

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10024	Greenton-Urban land complex, 5 to 9 percent slopes	D	2.2	97.6%
10128	Sharpsburg-Urban land complex, 2 to 5 percent slopes	D	0.1	2.4%
Totals for Area of Interest			2.2	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

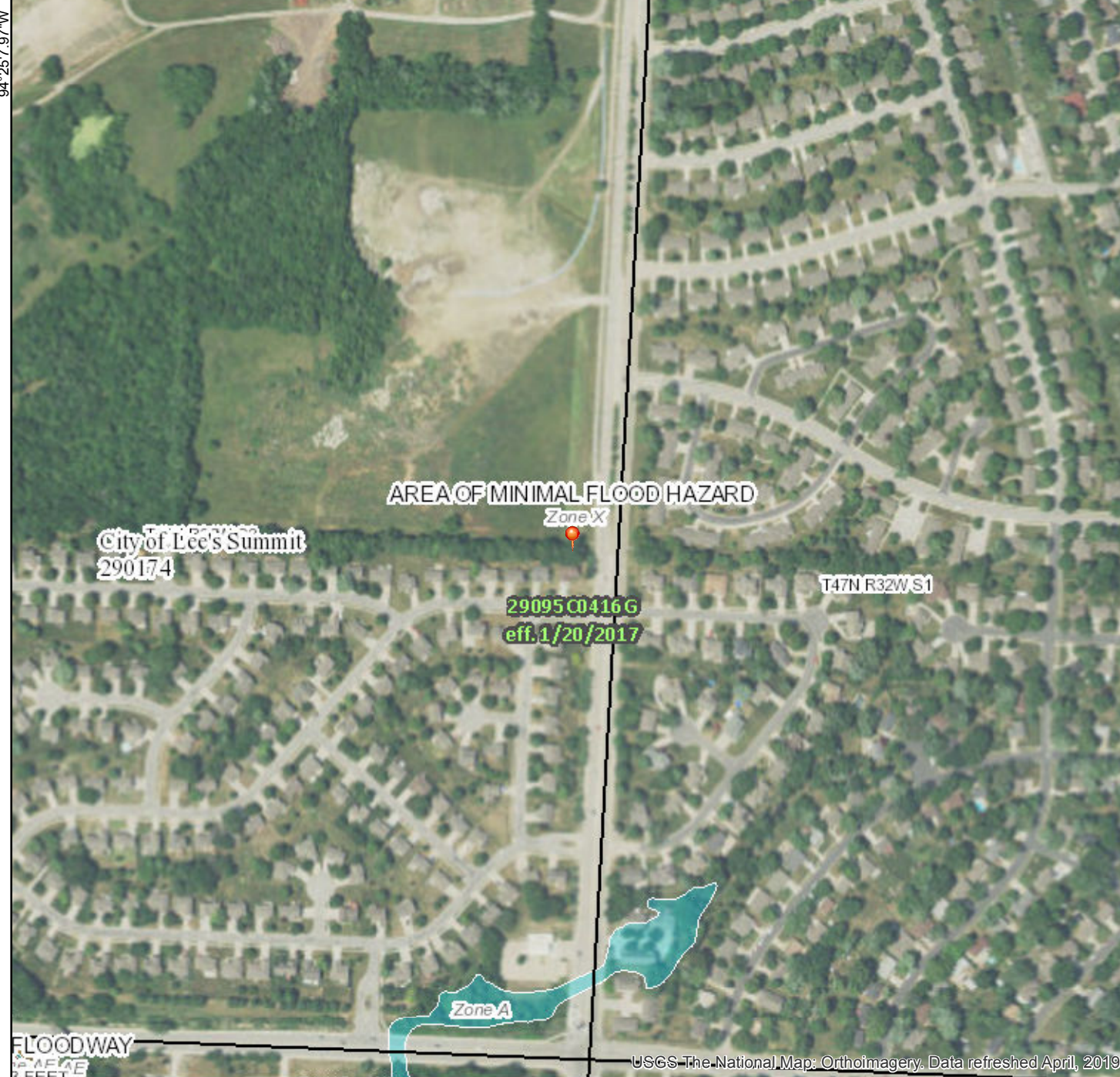
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

National Flood Hazard Layer FIRMette



38°55'10.28"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

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

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 7/9/2019 at 8:48:53 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.