

AS-BUILT REPORT

Firestone Complete Auto Care

**3501 SW Market Street
Lee's Summit, MO 64082**

Jackson County

Gresham Smith Project # 40831.45

October 21, 2021

**Prepared for:
GBT Realty Corporation
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Prepared by:



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GENERAL INFORMATION

The proposed Firestone Auto Care store is located on approximately 1.237 acres at 3501 SW Market Street in Lee's Summit, Jackson County, Missouri. The site was constructed and the pond was found to be inadequate to meet the City of Lee's Summit's Detention and WQ requirements. Therefore, Detention Basin Redesign Plans (As-built Fix) were drafted and approved by the City of Lee's Summit on 07/08/2021. See the Approved Detention Basin Redesign Plans in Appendix A for the corrections inadequacies and the corrections needed. Also, see Appendix A for the As-built Survey Plan and Notes. The following report outlines that the stormwater treatment facilities have been constructed in substantial compliance with the approved Detention Basin Redesign Plans dated 07/08/2021.

Allowable Release Rate vs. As-built Release Rate:

The As-built Release flow rates have been reduced to less than the pre-development flow rates. See table below.

Point of Interest Summary - As Built Fix (cfs)			
	2 YR	10YR	100YR
POI #1 Pre-Development	2.3	4.2	7.7
POI #1 Post-Development	2.2	3.7	6.4
POI #2 Pre-Development	5.2	11	22.7
POI #2 Post-Development	3.6	7.5	21.9

Furthermore, the proposed design for the Detention Basin Redesign Plans (As-built Fix) has been compared to the as-built conditions in the Detention Pond Analysis below. The as-built condition outperforms the original approved design.

Detention Pond Analysis								
Recurrence Interval	Design Runoff (As-Built Fix)	As-Built Fix Runoff	Design Maximum Water Surface Elevation (As-Built Fix)	As-Built Fix Maximum Water Surface Elevation	Design Top of Berm (As-Built Fix)	As-Built Fix Top of Berm	Design Freeboard (As-Built Fix)	As-Built Fix Freeboard
2 Year	0.03	0.03	1012.61	1012.60	1016.00	1016.00	3.39	3.40
10 Year	0.13	0.18	1013.74	1013.60	1016.00	1016.00	2.26	2.40
100 Year	5.85	7.14	1014.52	1014.35	1016.00	1016.00	1.48	1.65
100 Year - Clogged	12.10	12.10	1014.96	1014.80	1016.00	1016.00	1.04	1.20

Outlet Structure			
Design Outlet	Design Invert (As-built Fix)	As-Built Fix Outlet	As-built Fix
Top of Riser	1014.29	Top of Riser	1014.08
12"x5" Window	1013.57	12"x5" Window	1013.38
1" Orifice	1009.54	0.75" Orifice	0.75
12" Outlet	1009.50	12" Outlet	1009.26
50' Spillway	1014.75	105' Spillway	1014.60

See Appendix B for the Drainage Calculations.

Proposed Pond Storage vs. As-built Pond Storage:

The as-built pond storage volume exceeds the design pond storage volume.

POND CONTOUR AREAS - DESIGN (AS BUILT FIX)			POND CONTOUR AREAS - AS BUILT FIX		
DESIGN ELEVATION	DESIGN CAD AREA (SF.)	DESIGN CAD VOLUME (CF.) AVG. END METHOD	ASBUILT ELEVATION	ASBUILT CAD AREA (SF.)	ASBUILT CAD VOLUME (CF.) AVG. END METHOD
1009.54	0	0	1009.26	0	0
1010.00	909	209	1010.00	640	237
1011.00	2085	1,706	1011.00	2340	1,727
1012.00	2776	4,137	1012.00	2987	4,390
1013.00	3504	7,277	1013.00	3635	7,701
1014.00	4409	11,234	1014.00	4375	11,706
1015.00	5525	16,201	1015.00	5525	16,656
1016.00	6079	22,003	1016.00	6316	22,577

Proposed WQ vs. As-built WQ:

The as-built WQ volume and drawdown time are within reasonable range of the proposed values. The as-built WQ volume provided exceeds the required WQ volume of 3,394.15 CuFt. The as-built WQ volume drawdown time is 40 hrs. See Appendix C for the WQ calculations.

Conclusions:

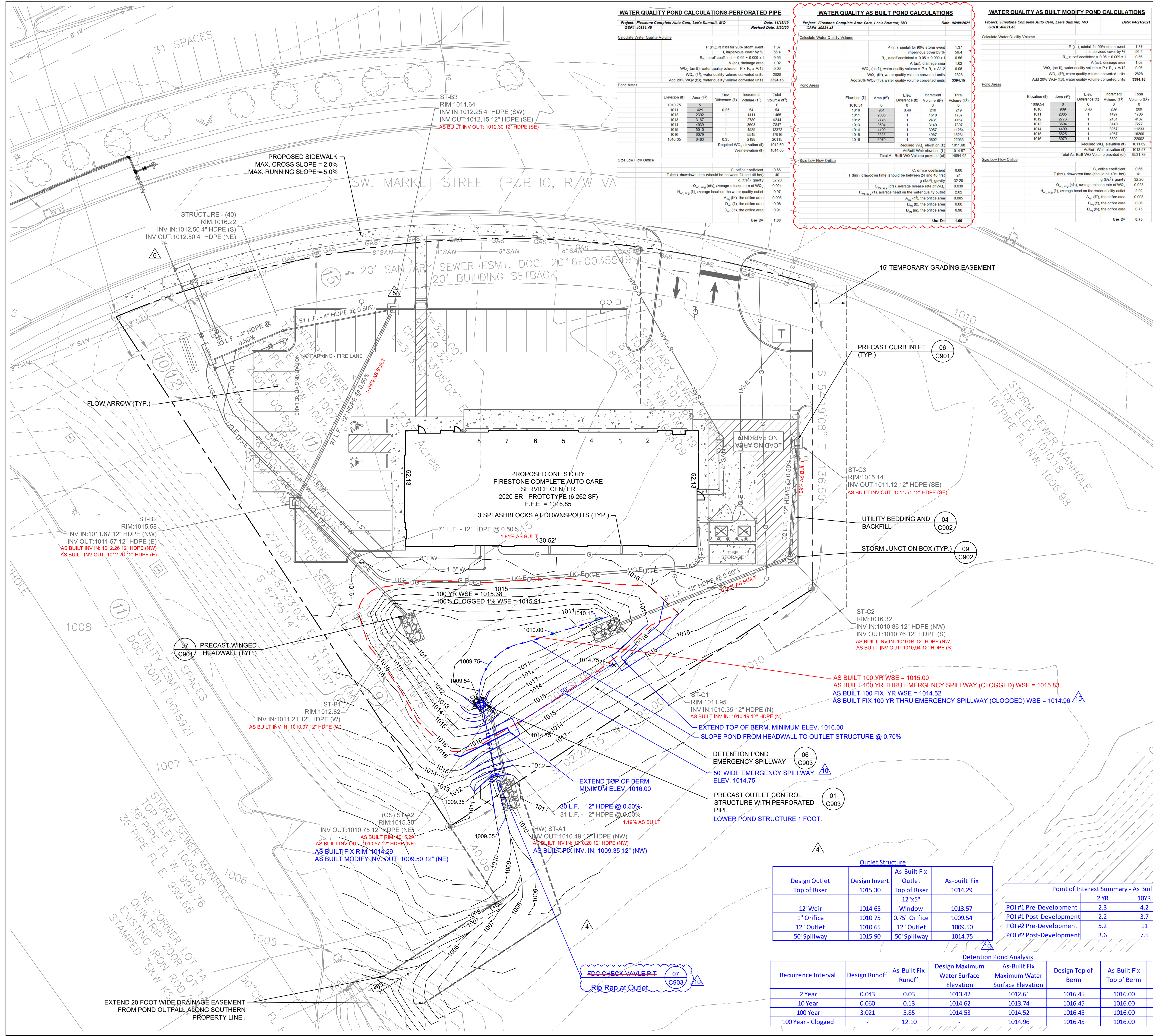
The as-built condition of the site meet the intent of the design and the City of Lee's Summit's Detention and WQ requirements. Additional pictures are provided in Appendix D.

APPENDIX A

Approved Detention Basin Redesign Plans

As-Built Survey Plan and Notes

I:\WA-FS-04\na_rft0514083145\07CAGm100RecordDwgs\Pond AsBuilt Check\4083145-C300_AsBuilt\06.23.2021 - AsBuilt Fix.dwg - Elhan Kluding - 7/7/2021 3:29:20 PM



WATER QUALITY POND CALCULATIONS-PERFORATED PIPE

Project: Firestone Complete Auto Care, Lee's Summit, MO Date: 11/18/19
GSP# 40831.45 Revised Date: 2/20/20

Calculate Water Quality Volume

P (in.), rainfall for 90% storm event	1.37
I, impervious cover by %	56.4
R ₁ , runoff coefficient = 0.05 + 0.009 x I	0.56
A (ac), drainage area	1.02
WQ ₁ (ac-ft), water quality volume = P x R ₁ x A x 12	0.08
WQ ₂ (ft ³), water quality volume converted units	2028
Add 20% WQ ₂ (ft ³), water quality volume converted units	3394.15

Elevation (ft)	Area (ft ²)	Elev. Difference (ft)	Increment Volume (ft ³)	Total Volume (ft ³)
1010.75	5	0	0	0
1011	429	0.25	54	54
1012	2392	1	1411	1465
1013	3167	1	2780	4244
1014	4039	1	3603	7847
1015	5010	1	4525	12372
1016	6079	1	5445	17816
1016.35	6483	0.35	2198	20015
Required WQ ₂ elevation (ft)				1012.69
Actual WQ ₂ elevation (ft)				1014.57
Use D=				1.00

Size Low Flow Office

	C, orifice coefficient	0.66
T (hrs), drawdown time (should be between 24 and 48 hrs)		40
	g (ft/s ²), gravity	32.2
	Q _{avg} (cfs), average release rate of WQ ₂	0.02
	H _{avg} (ft), average head on the water quality outlet	0.97
	A _{or} (ft ²), the orifice area	0.005
	D _{or} (ft), the orifice area	0.08
	D _{or} (in), the orifice area	0.91
	Use D=	1.00

WATER QUALITY AS BUILT POND CALCULATIONS

Project: Firestone Complete Auto Care, Lee's Summit, MO Date: 04/29/2021
GSP# 40831.45

Calculate Water Quality Volume

P (in.), rainfall for 90% storm event	1.37
I, impervious cover by %	56.4
R ₁ , runoff coefficient = 0.05 + 0.009 x I	0.56
A (ac), drainage area	1.02
WQ ₁ (ac-ft), water quality volume = P x R ₁ x A x 12	0.08
WQ ₂ (ft ³), water quality volume converted units	2028
Add 20% WQ ₂ (ft ³), water quality volume converted units	3394.15

Elevation (ft)	Area (ft ²)	Elev. Difference (ft)	Increment Volume (ft ³)	Total Volume (ft ³)
1010.54	0	0	0	0
1010	867	0.46	219	219
1011	2085	1	1516	1737
1012	2776	1	2431	4167
1013	3504	1	3140	7707
1014	4409	1	3957	11664
1015	5525	1	4967	16631
1016	6079	1	5802	22433
Required WQ ₂ elevation (ft)				1011.69
Actual WQ ₂ elevation (ft)				1014.57
Total As Built WQ Volume provided (cfs)				14094.92

Size Low Flow Office

			C, orifice coefficient
T (hrs), drawdown time (should be between 24 and 48 hrs)			
			g (ft/s ²), gravity
			Q _{avg} (cfs), average release rate of WQ ₂
			H _{avg} (ft), average head on the water quality outlet
			A _{or} (ft ²), the orifice area
			D _{or} (ft), the orifice area
			D _{or} (in), the orifice area
			Use D=

WATER QUALITY AS BUILT MODIFY POND CALCULATIONS

Project: Firestone Complete Auto Care, Lee's Summit, MO Date: 04/29/2021
GSP# 40831.45

Calculate Water Quality Volume

P (in.), rainfall for 90% storm event	1.37
I, impervious cover by %	56.4
R ₁ , runoff coefficient = 0.05 + 0.009 x I	0.56
A (ac), drainage area	1.02
WQ ₁ (ac-ft), water quality volume = P x R ₁ x A x 12	0.08
WQ ₂ (ft ³), water quality volume converted units	2028
Add 20% WQ ₂ (ft ³), water quality volume converted units	3394.15

Elevation (ft)	Area (ft ²)	Elev. Difference (ft)	Increment Volume (ft ³)	Total Volume (ft ³)
1009.54	0	0	0	0
1010	909	0.46	209	209
1011	2085	1	1497	1706
1012	2776	1	2431	4137
1013	3504	1	3140	7777
1014	4409	1	3957	11733
1015	5525	1	4967	16700
1016	6079	1	5802	22502
Required WQ ₂ elevation (ft)				1011.69
Actual WQ ₂ elevation (ft)				1013.57
Total As Built WQ Volume provided (cfs)				9531.78

Size Low Flow Office

	C, orifice coefficient	0.66
T (hrs), drawdown time (should be 40+ hrs)		41
	g (ft/s ²), gravity	32.2
Q _{avg} (cfs), average release rate of WQ ₂		0.02
H _{wq, avg} (ft), average head on the water quality outlet		2.02
	A _{or} (ft ²), the orifice area	0.003
	D _{or} (ft), the orifice area	0.06
	D _{or} (in), the orifice area	0.75
	Use D=	0.75

LEGEND

- PROPERTY LINE
- BUILDING LINE
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- MAJOR CONTOUR
- MINOR CONTOUR
- STORM PIPE
- HEADWALL
- STORM MANHOLE
- AREA INLET
- CURB INLET
- STORM CLEANOUT
- SPOT ELEVATION
- FLUSH ELEVATION
- MATCH EXISTING FINISH GRADE ELEVATION
- CURB TOP/BOTTOM ELEVATIONS
- FLOW ARROW

STORM STRUCTURE ABBREVIATIONS

(SCI)	SINGLE CURB INLET	DETAIL 06, SHEET C901
(JB)	JUNCTION BOX	DETAIL 09, SHEET C902
(HW)	HEADWALL	DETAIL 07, SHEET C901
(OS)	OUTLET STRUCTURE	DETAIL 08, SHEET C901

NOTES:

- FOR SITE PREPARATION AND GEOTECHNICAL RECOMMENDATIONS, REFER TO INTERTEK PSI GEOTECHNICAL REPORT 03381947, DATED 7/24/2019.
- ITEMS IN RED AND CLOUDED IN RED INDICATE AS BUILT CONDITIONS.
- ITEMS IN BLUE AND CLOUDED IN BLUE INDICATE AS BUILT FIX, ONCE FIX IS COMPLETED, PROVIDE TOPO SURVEY OF THE ENTIRE SITE INCLUDING PARKING, BUILDING FFE, AREA INLET TOP OF CASTING, POND, POND STRUCTURE INVERTS AND DIMENSIONS.

POND CONTOUR AREAS - DESIGN		
DESIGN ELEVATION	GN CAD AREA	DESIGN CAD VOLUME (CF.) AVG. END METHOD
1010.75	5	0
1011.00	429	54
1012.00	2392	1,465
1013.00	3167	4,244
1014.00	4039	7,847
1015.00	5010	12,372
1016.00	6079	17,916
1016.35	6483	20,115

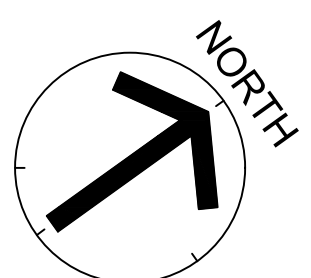
POND CONTOUR AREAS - AS BUILT FIX		
ASBUILT ELEVATION	ASBUILT modify CAD AREA (SF.)	ASBUILT CAD VOLUME (CF.) AVG. END METHOD
1009.54	0	0
1010.00	909	209
1011.00	2085	1,706
1012.00	2776	4,137
1013.00	3504	7,777
1014.00	4409	11,234
1015.00	5525	16,201
1016.00	6079	22,003

RELEASE FOR CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI
07/08/2021

Outlet Structure			
Design Outlet	Design Invert	As-Built Fix Outlet	As-built Fix
Top of Riser	1015.30	Top of Riser	1014.29
12" Weir	1014.65	Window	1013.57
1" Orifice	1010.75	0.75" Orifice	1009.54
12" Outlet	1010.65	12" Outlet	1009.50
50' Spillway	1015.90	50' Spillway	1014.75

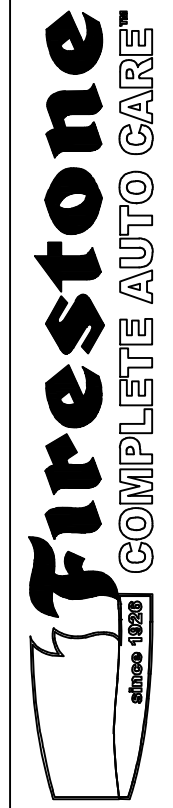
Point of Interest Summary - As Built Fix (cfs)			
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POI #1 Pre-Development	2.3	4.2	7.7
POI #1 Post-Development	2.2	3.7	6.4
POI #2 Pre-Development	5.2	11	22.7
POI #2 Post-Development	3.6	7.5	19.4

Detention Pond Analysis							
Recurrence Interval	Design Runoff	As-Built Fix Runoff	Design Maximum Water Surface Elevation	As-Built Fix Maximum Water Surface Elevation	Design Top of Berm	As-Built Fix Top of Berm	Design Freeboard
2 Year	0.043	0.03	1013.42	1012.61	1016.45	1016.00	3.03
10 Year	0.060	0.13	1014.62	1013.74	1016.45	1016.00	1.83
100 Year	3.021	5.85	1014.53	1014.52	1016.45	1016.00	1.92
100 Year - Clogged	-	12.10	-	1014.96	1016.45	1016.00	-

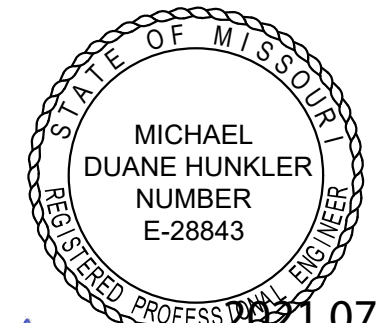


GreshamSmith.com

222 Second Avenue South
Suite 1400
Nashville, TN 37201
615.770.8100



3561 SW MARKET STREET
LEE'S SUMMIT, MISSOURI 64082



Michael D. Hunkler
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Revision

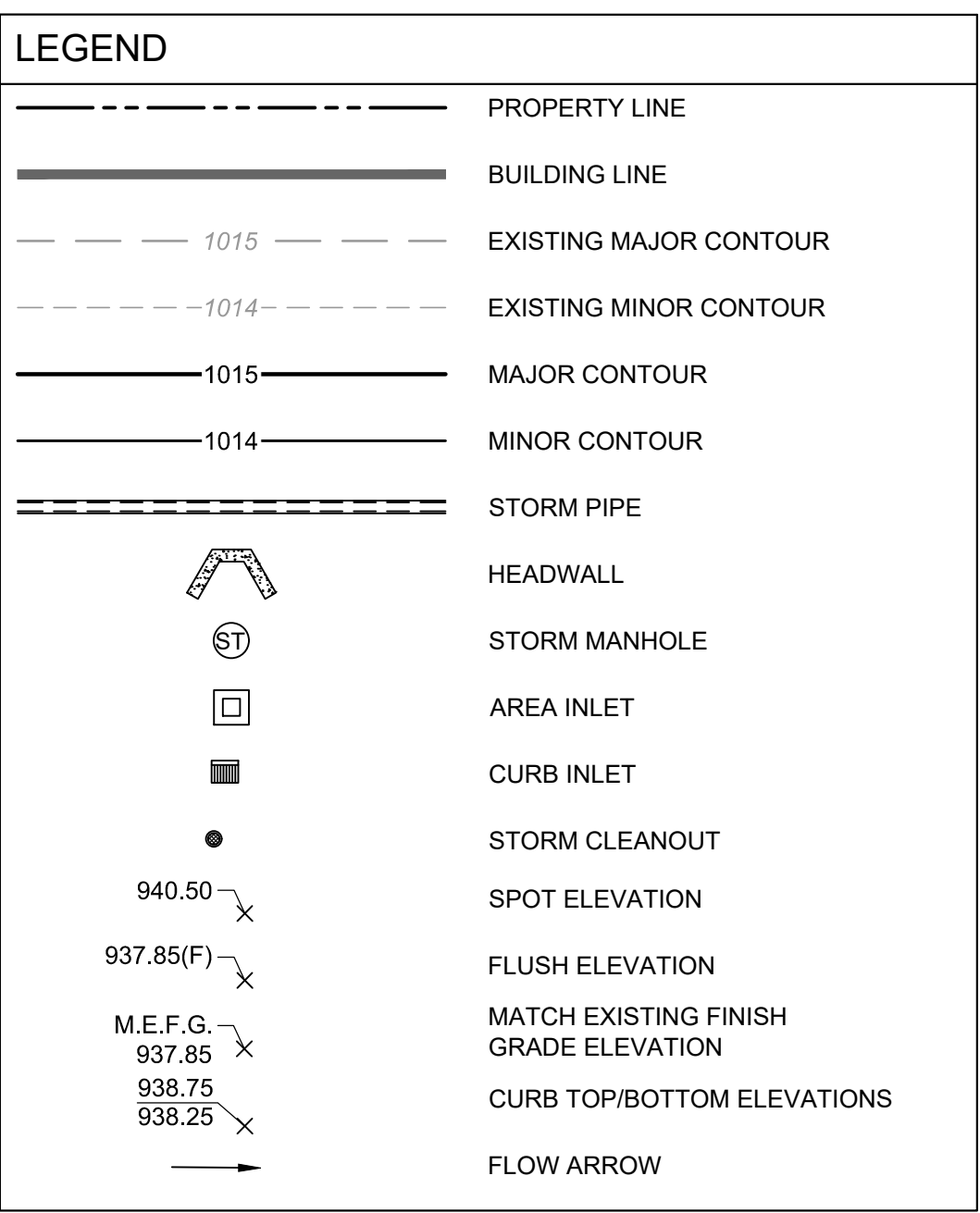
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2	02.21.2020	CITY COMMENTS
3	03.27.2020	CITY COMMENTS
4	04.28.2020	CITY COMMENTS
5	05.15.2020	CITY COMMENTS
6	06.01.2020	CITY COMMENTS
7	04.12.2021	AS BUILT
8	04.15.2021	AS BUILT
9	04.22.2021	AS BUILT FIX
10	06.29.2021	AS BUILT FIX
11	07.07.2021	AS BUILT FIX

GRADING AND DRAINAGE PLAN

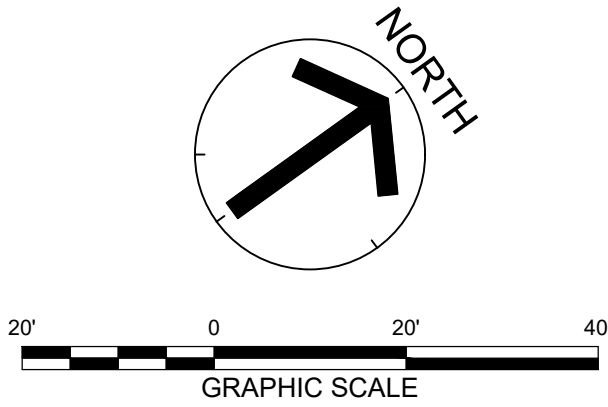
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40831.45
JANUARY 8, 2020

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<u>STORM STRUCTURE ABBREVIATIONS</u>		
(SCI)	SINGLE CURB INLET	DETAIL 06, SHEET C901
(JB)	JUNCTION BOX	DETAIL 09, SHEET C902
(HW)	HEADWALL	DETAIL 07, SHEET C901
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NOTES:


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2. **ITEMS IN RED AND CLOUDED IN RED INDICATE AS BUILT CONDITIONS.**
3. **ITEMS IN BLUE AND CLOUDED IN BLUE INDICATE AS BUILT FIX. ONCE FIX IS COMPLETED, PROVIDE TOPO SURVEY OF THE ENTIRE SITE INCLUDING PARKING, BUILDING FFE, AREA INLET TOP OF CASTING, POND, POND STRUCTURE INVERTS AND DIMENSIONS.**



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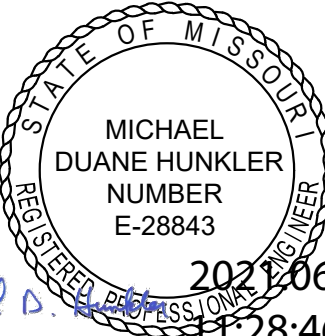
222 Second Avenue South
Suite 1400
Nashville, TN 37201

615.770.8100



3561 SW MARKET STREET
LEE'S SUMMIT, MISSOURI 64082

THIS DRAWING IS THE PROPERTY OF BRIDGESTONE RETAIL OPERATIONS, LLC AND IS LOANED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO THE INTERESTS OF BRIDGESTONE RETAIL OPERATIONS, LLC. THE ACCEPTANCE OF THIS DRAWING WILL BE CONSTRUED AS AN ACCEPTANCE OF THE FOREGOING CONDITION AND AS ADMISSION TO THE EXCLUSIVE OWNERSHIP IN AND TO THE DRAWING BY BRIDGESTONE RETAIL OPERATIONS, LLC.



2021.06.29

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Revision

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STORM PLAN AND PROFILE

C301

40831.45
JANUARY 8, 2020

1

Items Corresponding to Schedule B

- 8 -Terms, provisions and easement contained in the Grading Consent and Temporary Construction Easement Agreement, recorded April 6, 1998 as Document No. 98-1-23424 in Book 1-3171 at Page 1069, by and between QuikTrip Corporation, an Oklahoma corporation and E.L. Robinson, Jr. and Letha M. Robinson, Trustees for Trust dated September 22, 1988, for the benefit of the lands in question.
- 9 -TEMPORARY EASEMENT IS NO LONGER IN AFFECT.
- 10 -Terms, provisions and easements contained in the Storm Sewer Easement Agreement, recorded April 8, 1998 as Document No. 98-1-23425 in Book 1-3171 at Page 1076, by and between QuikTrip Corporation, an Oklahoma corporation and E.L. Robinson, Jr. and Letha M. Robinson, Trustees for Trust dated September 22, 1988, benefiting the lands in question.
- 11 -PLOTTED AND SHOWN.
- 12 -Rights of way, easements granted and appurtenances pertaining to the State of Missouri, acting by and through the Missouri highway and Transportation Commission, described by instrument recorded May 10, 1999 as Document No. 1999 1 0036039.
- 13 -PLOTTED AND SHOWN.
- 14 -An easement granted to the City of Lee's Summit, a municipal corporation, described by instrument recorded March 23, 2001 as Document No. 2001 1 0018921.
- 15 -Terms, provisions, easements and boundaries imposed, including but not limited to the limitations of direct access, of the Quitclaim Deed granted to the City of Lee's Summit, a municipal corporation, recorded October 31 2008 as Document No. 2008E0114649.
- 16 -PLOTTED AND SHOWN.
- 17 -Amended, 111119;
- 18 -Terms and provisions of the Declaration of Restrictions recorded June 26, 2014 as Document No. 2014E0051570, and the First Amendment to Declaration of Restrictions, but omitting any covenants or restrictions, if any, including but not limited to those based upon race, color, religion, sex, sexual orientation, familial status, marital status, disability, handicap, national origin, ancestry, source of income, gender, gender identity, gender expression, medical condition or genetic information, as set forth in applicable state or federal laws, except to the extent that said covenant or restriction is permitted by applicable law.
- 19 -AFFECTS SUBJECT PROPERTY, BLANKET IN NATURE, NOT PLOTTABLE
- 20 -The effect of the Sorvino's Affidavit recorded March 23, 2016 as Document No. 2016E0025038.
- 21 -DOES NOT AFFECT SUBJECT PROPERTY.
- 22 -An easement for sanitary sewers granted to Lee's Summit, described by instrument recorded April 25, 2016 as Document No. 2016E0035549.
- 23 -PLOTTED AND SHOWN.
- 24 -The surviving easements and conditions of the instrument captioned Temporary Construction Easement granted to the QuikTrip Corporation, an Oklahoma corporation, described by instrument recorded May 11, 2017 as Document No. 2017E0042035.
- 25 -DOES NOT AFFECT SUBJECT PROPERTY.
- 26 -Added, 111119;
- 27 -An easement granted to The City of Lee's Summit, Missouri, described by instrument recorded May 23, 1975 as Document No. 1-211265 in Book 1-596 at Page 173.
- 28 -DOES NOT AFFECT SUBJECT PROPERTY.
- 29 -Added, 111119;
- 30 -An easement granted to the City of Lee's Summit, Missouri, described by instrument recorded April 25, 2016 as Document No. 2016E0035549.
- 31 -SAME AS ITEM NO. 15, PLOTTED AND SHOWN AS NO. 15.
- 32 -Added, 111119;
- 33 -Terms and provisions of the Declaration of Use Restrictions, recorded December 9, 2016 as Document No. 2016E0116521, but omitting any covenants or restrictions, if any, including but not limited to those based upon race, color, religion, sex, sexual orientation, familial status, marital status, disability, handicap, national origin, ancestry, source of income, gender, gender identity, gender expression, medical condition or genetic information, as set forth in applicable state or federal laws, except to the extent that said covenant or restriction is permitted by applicable law.
- 34 -AFFECTS SUBJECT PROPERTY, BLANKET IN NATURE, NOT PLOTTABLE

Miscellaneous Notes

- A The bearings shown hereon are based upon the Missouri State Plane Coordinate System, station no JA-137, N. 974542.6936 E. 2824145.0197, ELEV. 993.438 (NAVD 88), located about 7 miles South of the intersection of Hwy. 150 and Hwy. 291.
- B This survey does not reflect any easements, rights-of-way or other instruments of record except those shown on the current mentioned Title Commitment.
- C Underground utilities are shown per One call ticket 193242567, dated 11-20-2019.
- D At the date this survey was done in the field, earth moving, asphalt paving, concrete work and construction was not complete.
- E There is no evidence of subject site being used as a solid waste dump or sanitary land fill.
- F There is no evidence of subject site being used as a burial ground or cemetery.
- G This survey meets the accuracy requirements for "Urban" property as defined by the Missouri Minimum Standards. Closure 1 in 615041.
- H The site has vehicular and pedestrian access to a public ROW

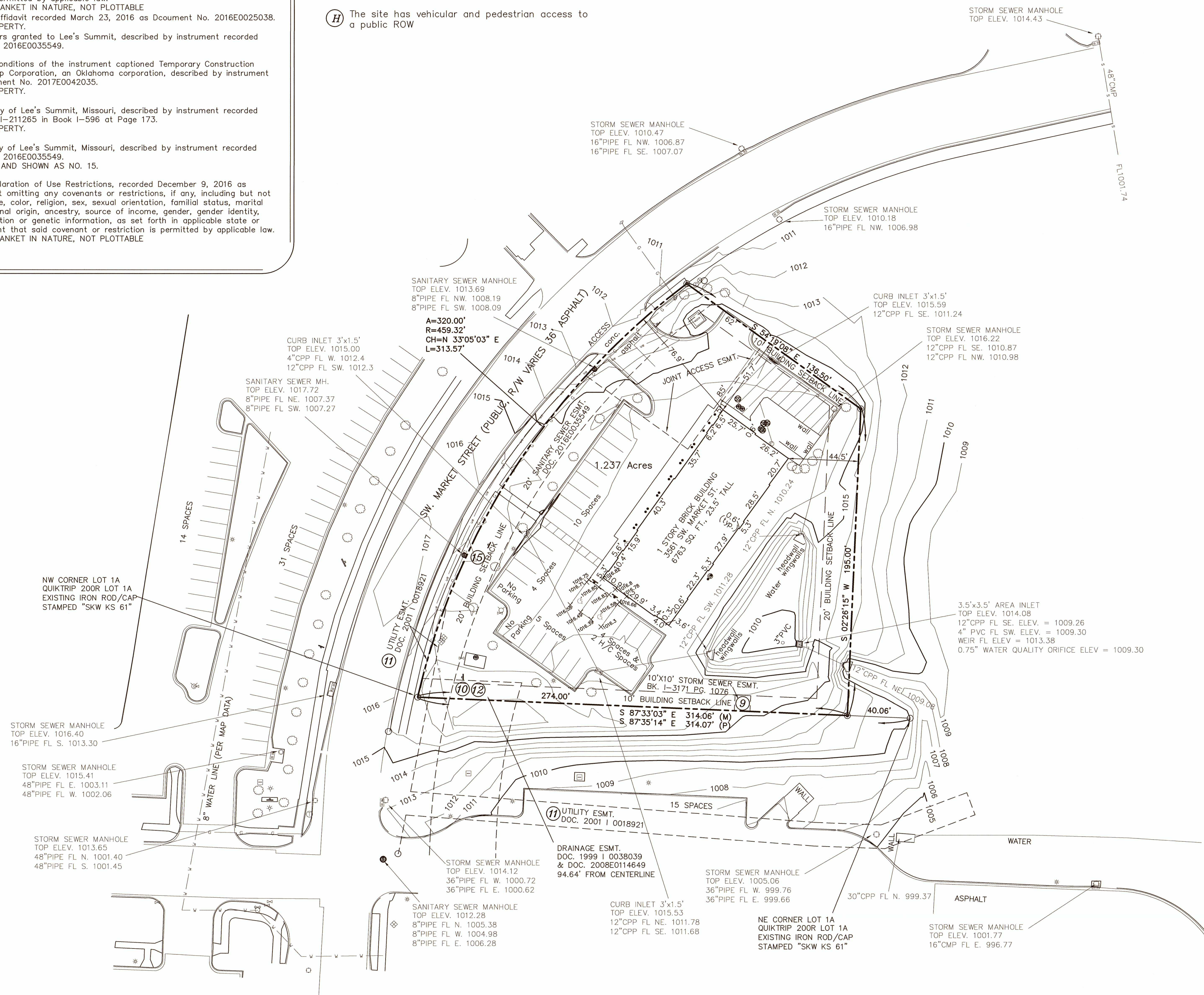
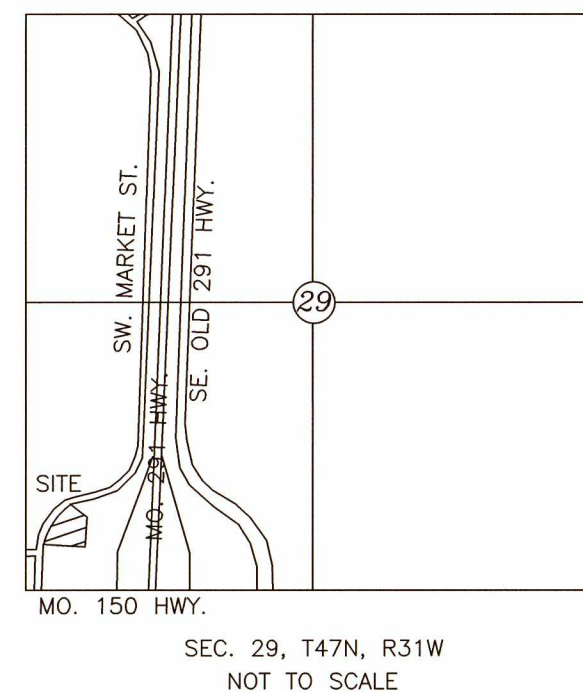
Possible Encroachments

NONE

Flood Note

This property is in no Special Flood Hazard Zone according to Flood Insurance Rate Map, Community Number 200590 0002 A, effective date October 25, 1977.

Vicinity Map



Commitment Legal Description

FIDELITY NATIONAL TITLE COMMITMENT NO. 191439 REVISION 111119, DATED NOVEMBER 1, 2019 AT 12:00 P.M. A portion of land lying and situated in the Southwest Quarter of Section 29, Township 47 North, Range 31 West of Fifth Principal Meridian, in Lee's Summit, Jackson County, Missouri, being part of a parcel of land described in Book 1-1847 at Page 2006, said parcel lying Southeastly of Market Street, Westerly of the West Right-of-Way line of Missouri Highway 291, North of QUIKTRIP 200R, a subdivision of land and Northerly of QUIKTRIP 200R LOT 1A, a subdivision of land.

AS-SURVEYED DESCRIPTION:
Written by William A. Booe, RLS 2002010970, October 23, 2019
A tract of land located in a portion of the Southwest Quarter of Section 29, Township 47 North, Range 31 West of the 5th Principal Meridian, Lee's Summit, Jackson County, Missouri, and being more particularly described as follows:
BEGINNING at the Northwest corner of Lot 1A, Minor Plat of Quiktrip 200R Lot 1A;
Thence along a curve to the right and the Southeastly right of way of Market Street, having a radius of 459.32 feet, a length of 320.00 feet and a chord bearing and distance of N 33°05'03" E, 313.57 feet;
Thence S 54°19'08" E a distance of 136.50 feet;
Thence S 02°26'15" W a distance of 195.00 feet to the North line of said Lot 1A;
Thence N 87°33'03" W along said North line a distance of 274.00 feet to the point of beginning, containing 1.237 acres.

The property surveyed is the same property as that is described in the title commitment.

Legend of Symbols & Abbreviations

○	Existing Iron Rod	(M)	Measured Dimension
●	Origin Unknown (unless noted)	(D)	Deed Dimension
△	Set 1/2"x24" Iron Rod/Cap (unless otherwise noted)	(P)	Plat Dimension
△	Section Corner	R/W	Right of Way
△	Origin Unknown (unless noted)	□	Storm Drain Manhole
△	Boundary Line	○	Water Meter
△	Setback Line	○	Guy Wire
△	Fence	○	Gas Meter
△	Overhead Electric Line	○	Gas Valve
△	Underground Electric Line	○	Telephone Riser Box
△	Water Line	○	Gas Line Marker
△	Gas Line	○	Sanitary Sewer Manhole
△	Underground Telephone	○	Sign
△	Sanitary Sewer Line	○	Light Pole
△	Bollard	○	Power Pole
△	Curb Inlet or Area Inlet	○	Water Valve
△	Fire Hydrant	○	Electric Meter
△	Handicap Parking	○	Tree
△	Electric Cabinet	○	Fire Protection Valve
△	Yard Light	○	

ALTA/NSPS As-built Land Title Survey

To:

GBT Realty
Franklin Land Associates, LLC

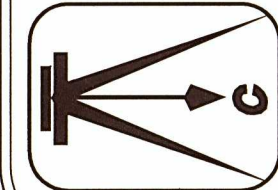
This is to certify that this map or plat and the survey on which it is based were made in accordance with the 2021 Minimum Standard Detail Requirements for ALTA/NSPS Land Title Surveys, jointly established and adopted by ALTA and NSPS, and includes Items 1, 2, 3, 4, 5, 6(b), 7(a), 7(b)(1), 7(c), 8, 9, 10, 11(a), 13, 14, 16 and 17 of Table A thereof. The field work was completed on April 13, 2021.

William A. Booe

William A. Booe, RLS 2002010970



CORNERSTONE
Regional Surveying, LLC



Serving Kansas, Missouri & Oklahoma
1921 North Penn, Independence, KS 67301 Ph: 620-331-6767

DRAWN BY: DLB

CHECKED BY: WAB

DATE: 10-21-2021

PREPARED FOR:

GBT Realty

ALTA/NSPS AS-BUILT LAND TITLE SURVEY
of a portion of SECTION 29, TOWNSHIP 47 NORTH,
RANGE 31 WEST of the 5th PRINCIPAL MERIDIAN,
JACKSON COUNTY, MISSOURI

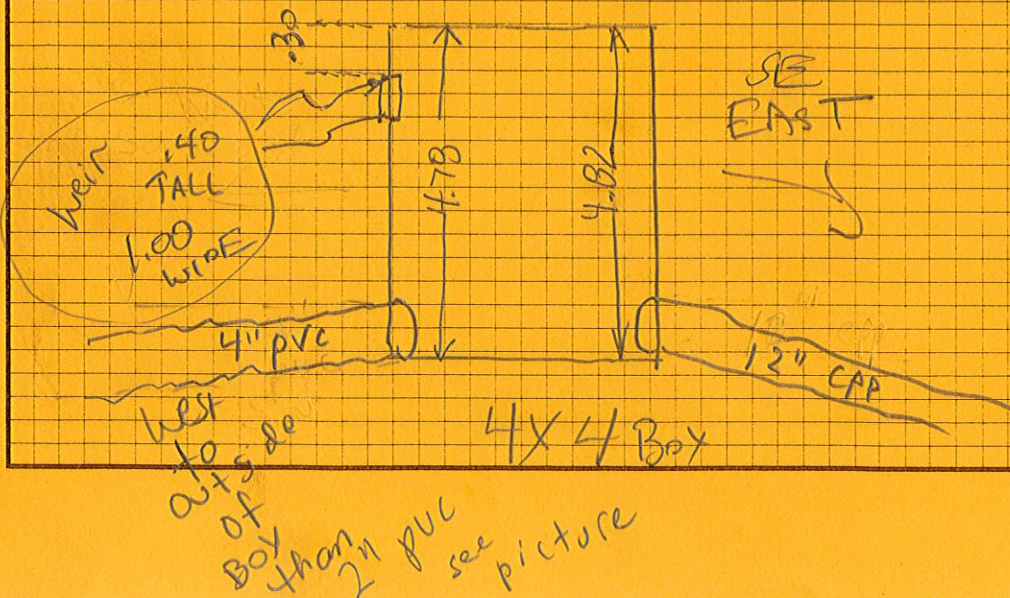


JOB NAME GBT JOB # 2103132 PAGE 1 OF 1
PARTY CHIEF _____ RODMAN TM DATE 8.11.21
INSTRUMENT MAN CB WEATHER Humid

$\Delta = 48^\circ - 120^\circ 9'$
 $R.O. = 47'$

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END 3112

down to grate to top of
weir

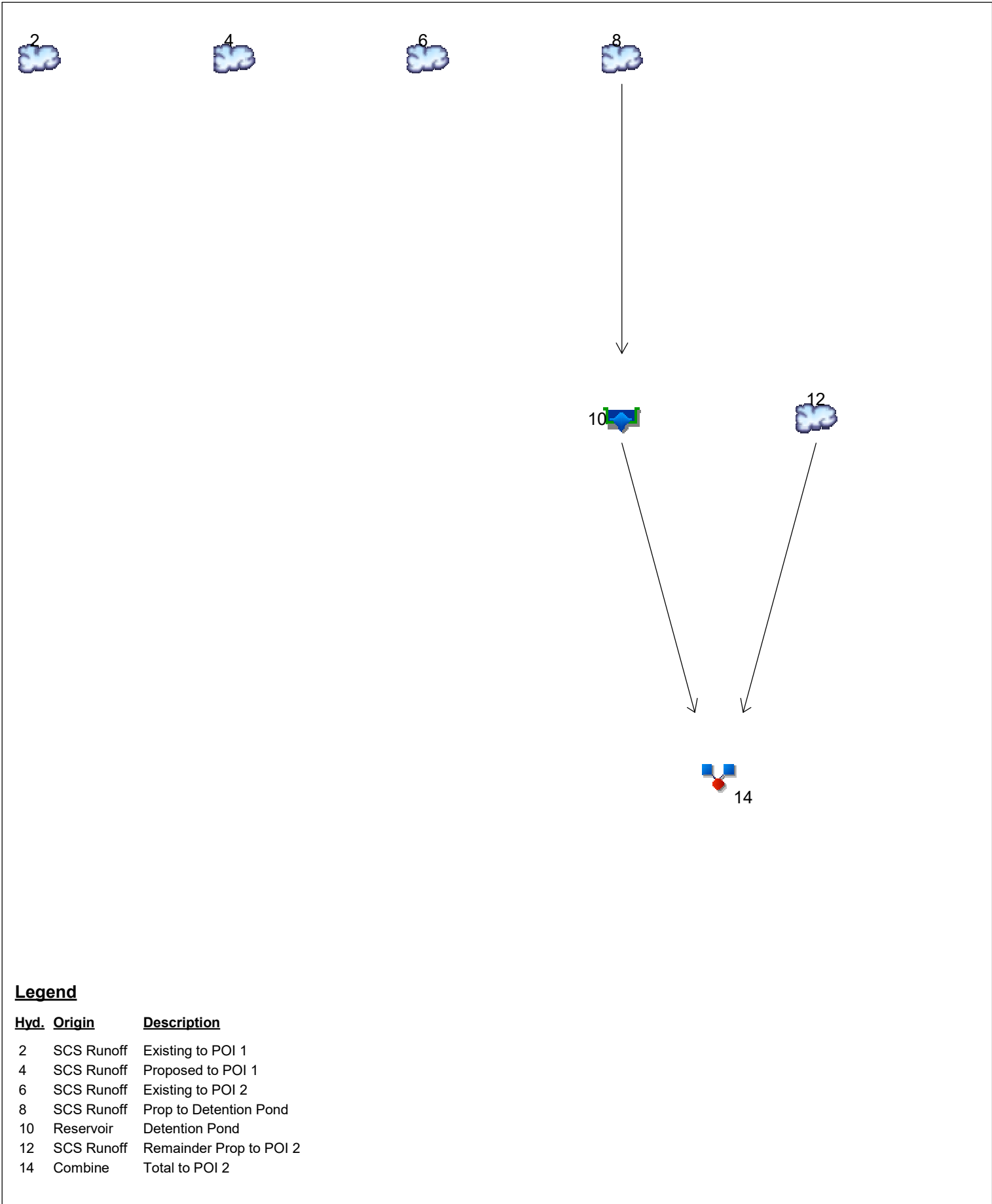


APPENDIX B

Onsite Drainage Calculations

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021



Legend

Hyd.	Origin	Description
2	SCS Runoff	Existing to POI 1
4	SCS Runoff	Proposed to POI 1
6	SCS Runoff	Existing to POI 2
8	SCS Runoff	Prop to Detention Pond
10	Reservoir	Detention Pond
12	SCS Runoff	Remainder Prop to POI 2
14	Combine	Total to POI 2

Hydraflow Table of Contents

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Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

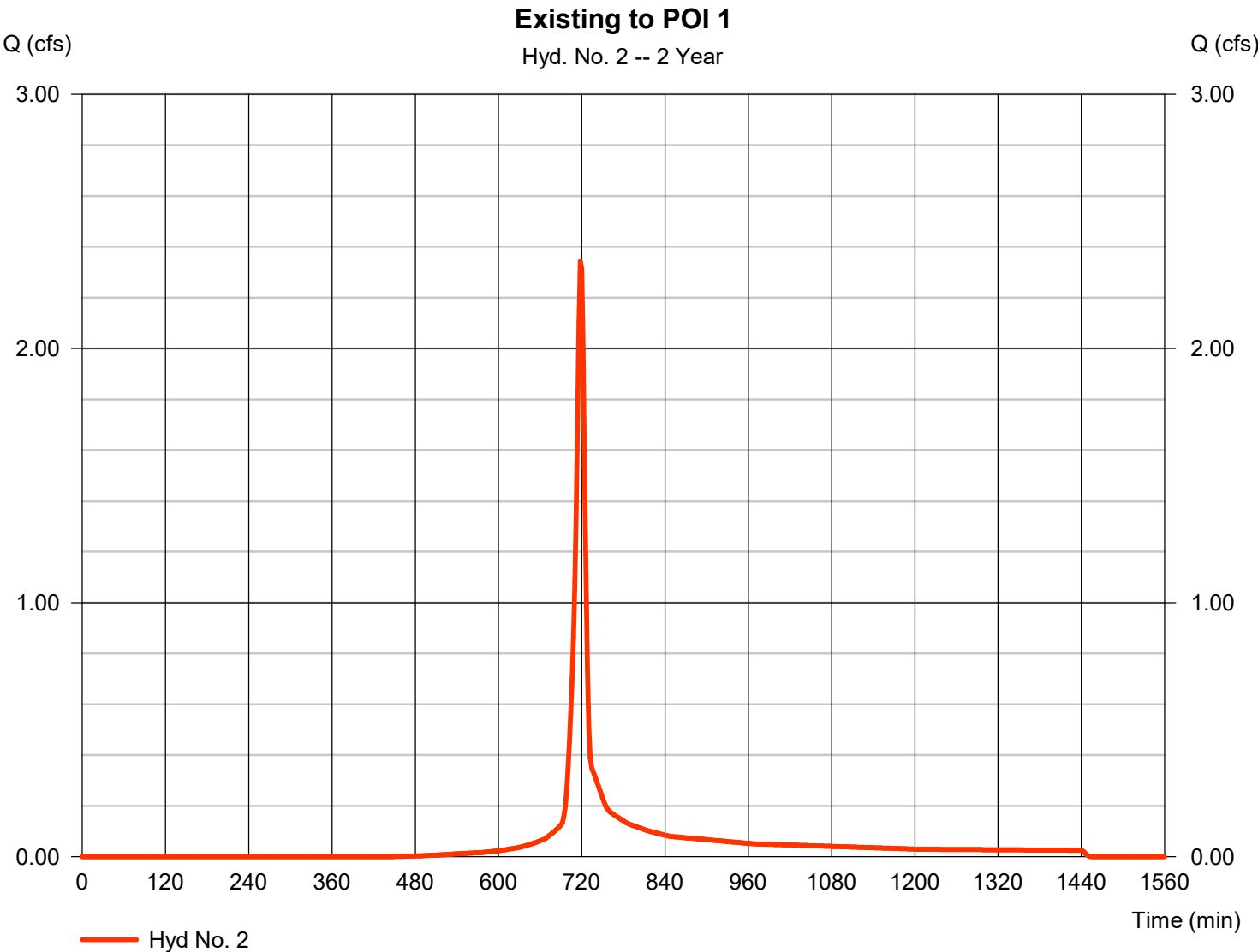
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
2	SCS Runoff	2.343	2	718	5,375	-----	-----	-----	Existing to POI 1
4	SCS Runoff	2.248	2	716	4,711	-----	-----	-----	Proposed to POI 1
6	SCS Runoff	5.230	2	720	12,002	-----	-----	-----	Existing to POI 2
8	SCS Runoff	4.086	2	716	8,447	-----	-----	-----	Prop to Detention Pond
10	Reservoir	0.027	2	1072	3,988	8	1012.60	5,975	Detention Pond
12	SCS Runoff	3.543	2	720	8,130	-----	-----	-----	Remainder Prop to POI 2
14	Combine	3.567	2	720	12,118	10, 12,	-----	-----	Total to POI 2

Hydrograph Report

Hyd. No. 2

Existing to POI 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.343 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	5,375 cuft
Drainage area	=	0.708 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	9.60 min
Total precip.	=	3.68 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No. 2

Existing to POI 1

<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)	= 3.68	0.00	0.00				
Land slope (%)	= 2.24	0.00	0.00				
Travel Time (min)	= 8.73	+	0.00	+	0.00	=	8.73
Shallow Concentrated Flow							
Flow length (ft)	= 100.00	0.00	0.00				
Watercourse slope (%)	= 1.50	0.00	0.00				
Surface description	= Unpaved	Paved	Paved				
Average velocity (ft/s)	=1.98	0.00	0.00				
Travel Time (min)	= 0.84	+	0.00	+	0.00	=	0.84
Channel Flow							
X sectional flow area (sqft)	= 0.00	0.00	0.00				
Wetted perimeter (ft)	= 0.00	0.00	0.00				
Channel slope (%)	= 0.00	0.00	0.00				
Manning's n-value	= 0.015	0.015	0.015				
Velocity (ft/s)	=0.00	0.00	0.00				
Flow length (ft)	((0})0.0	0.0	0.0				
Travel Time (min)	= 0.00	+	0.00	+	0.00	=	0.00
Total Travel Time, Tc				9.60 min			

Hydrograph Report

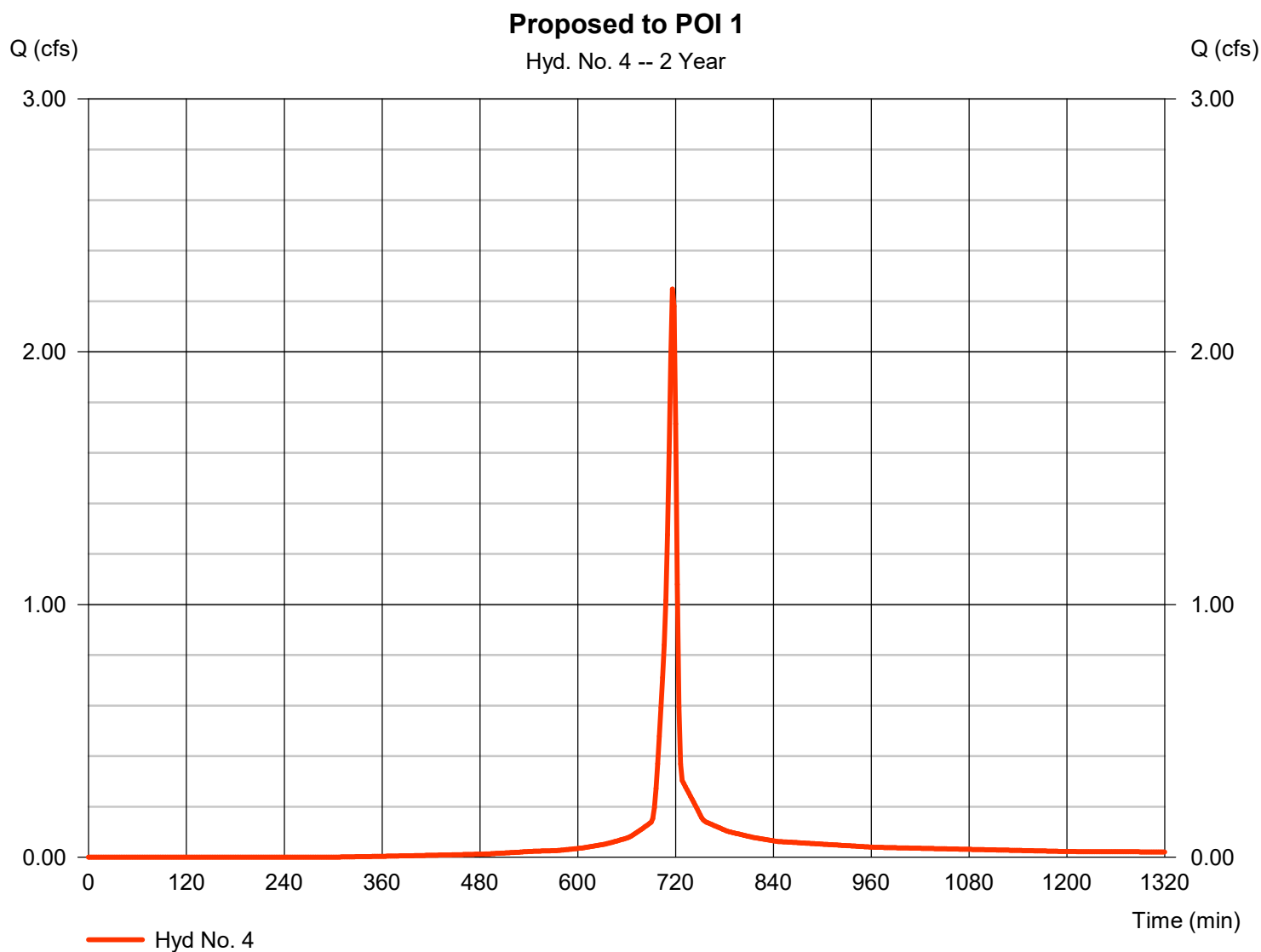
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Friday, 08 / 27 / 2021

Hyd. No. 4

Proposed to POI 1

Hydrograph type	= SCS Runoff	Peak discharge	= 2.248 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 4,711 cuft
Drainage area	= 0.529 ac	Curve number	= 90
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

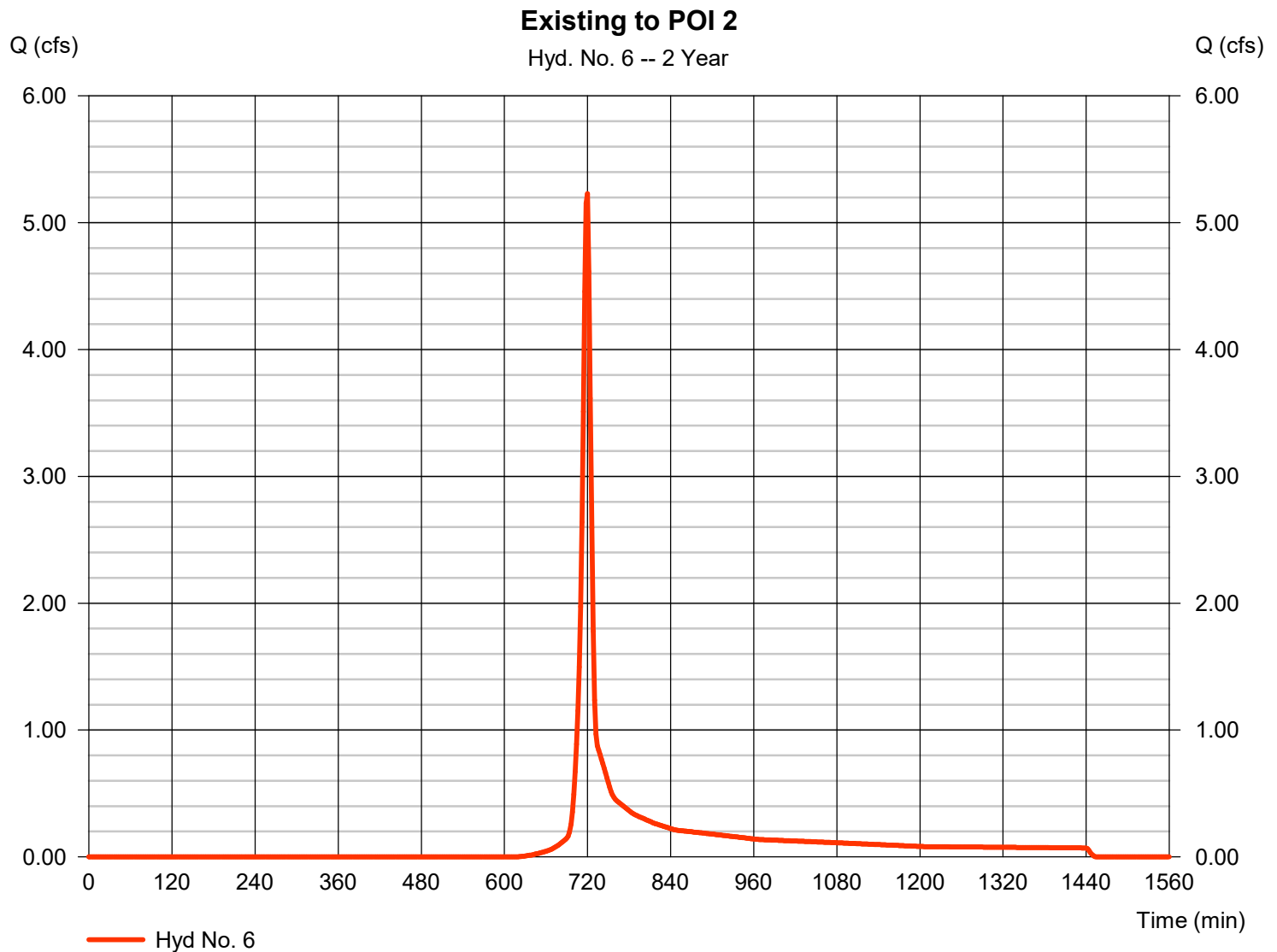
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Friday, 08 / 27 / 2021

Hyd. No. 6

Existing to POI 2

Hydrograph type	= SCS Runoff	Peak discharge	= 5.230 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 12,002 cuft
Drainage area	= 2.421 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.80 min
Total precip.	= 3.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

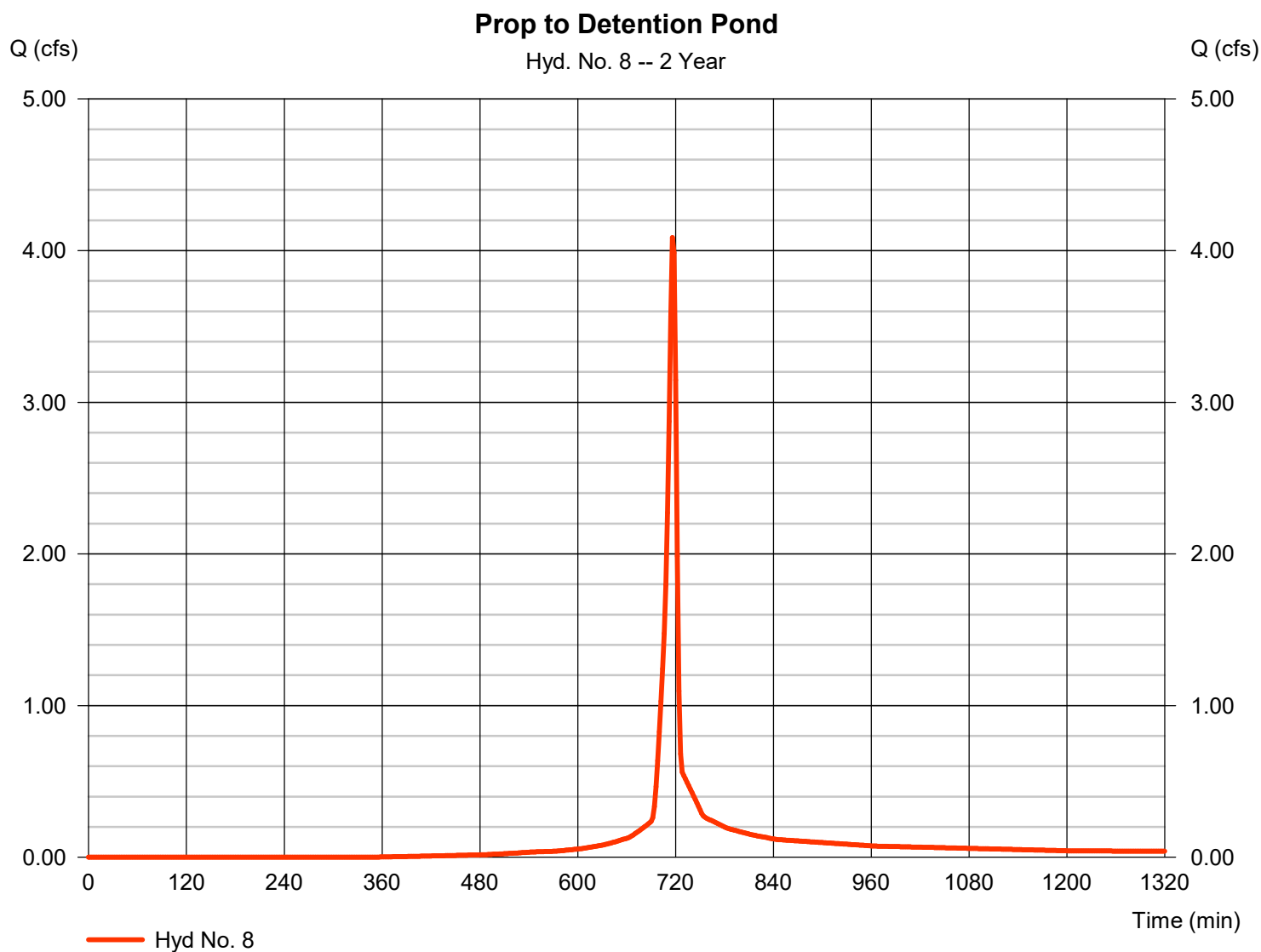
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Friday, 08 / 27 / 2021

Hyd. No. 8

Prop to Detention Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 4.086 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 8,447 cuft
Drainage area	= 1.020 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

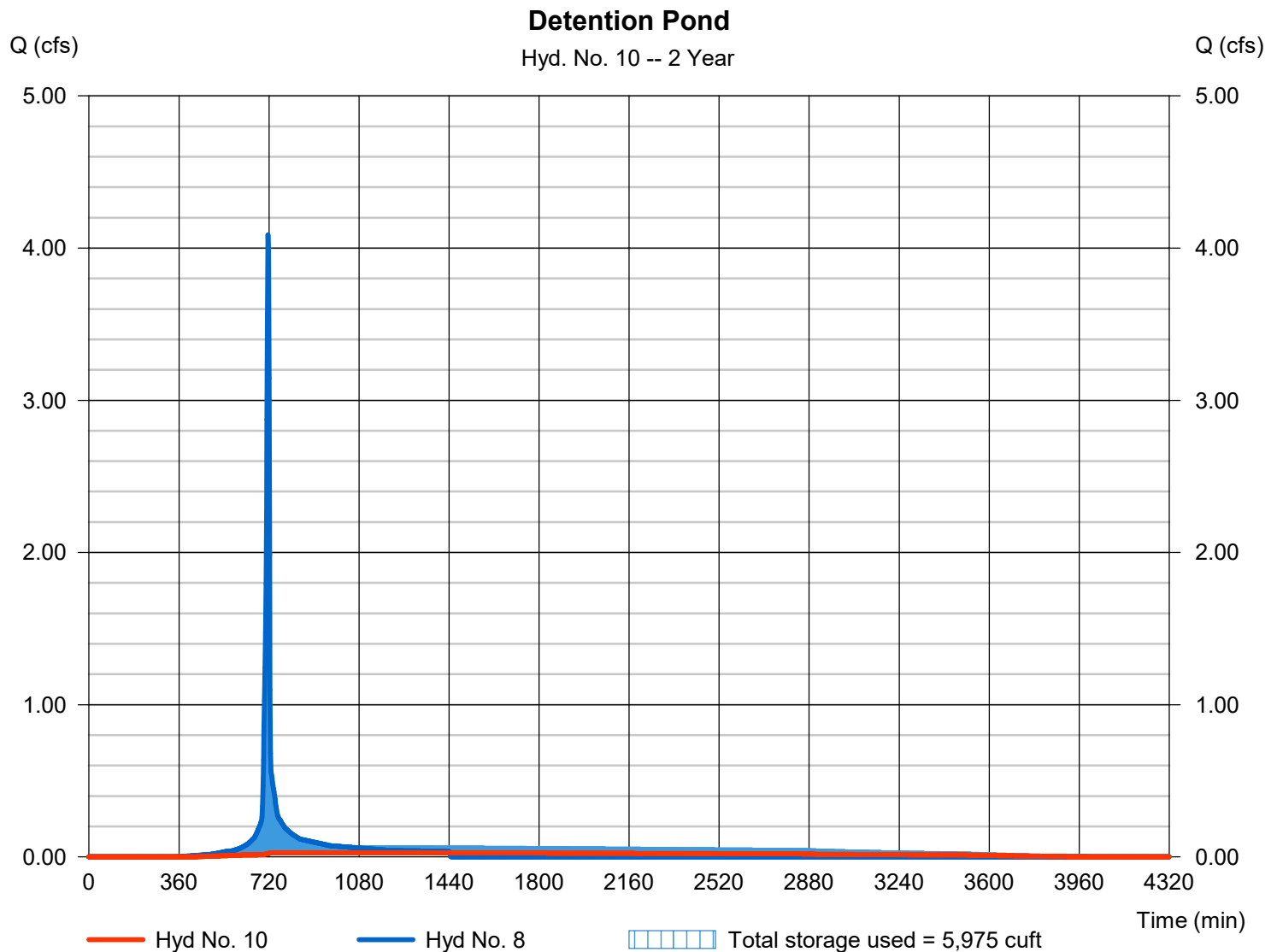
Friday, 08 / 27 / 2021

Hyd. No. 10

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.027 cfs
Storm frequency	= 2 yrs	Time to peak	= 1072 min
Time interval	= 2 min	Hyd. volume	= 3,988 cuft
Inflow hyd. No.	= 8 - Prop to Detention Pond	Max. Elevation	= 1012.60 ft
Reservoir name	= Detention Pond	Max. Storage	= 5,975 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond No. 1 - Detention Pond

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 1009.26 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1009.26	00	0	0
0.74	1010.00	640	237	237
1.46	1011.00	2,340	1,073	1,310
2.46	1012.00	2,987	2,664	3,973
3.46	1013.00	3,635	3,311	7,284
4.46	1014.00	4,375	4,005	11,289
5.46	1015.00	5,525	4,950	16,239
6.46	1016.00	6,316	5,921	22,160

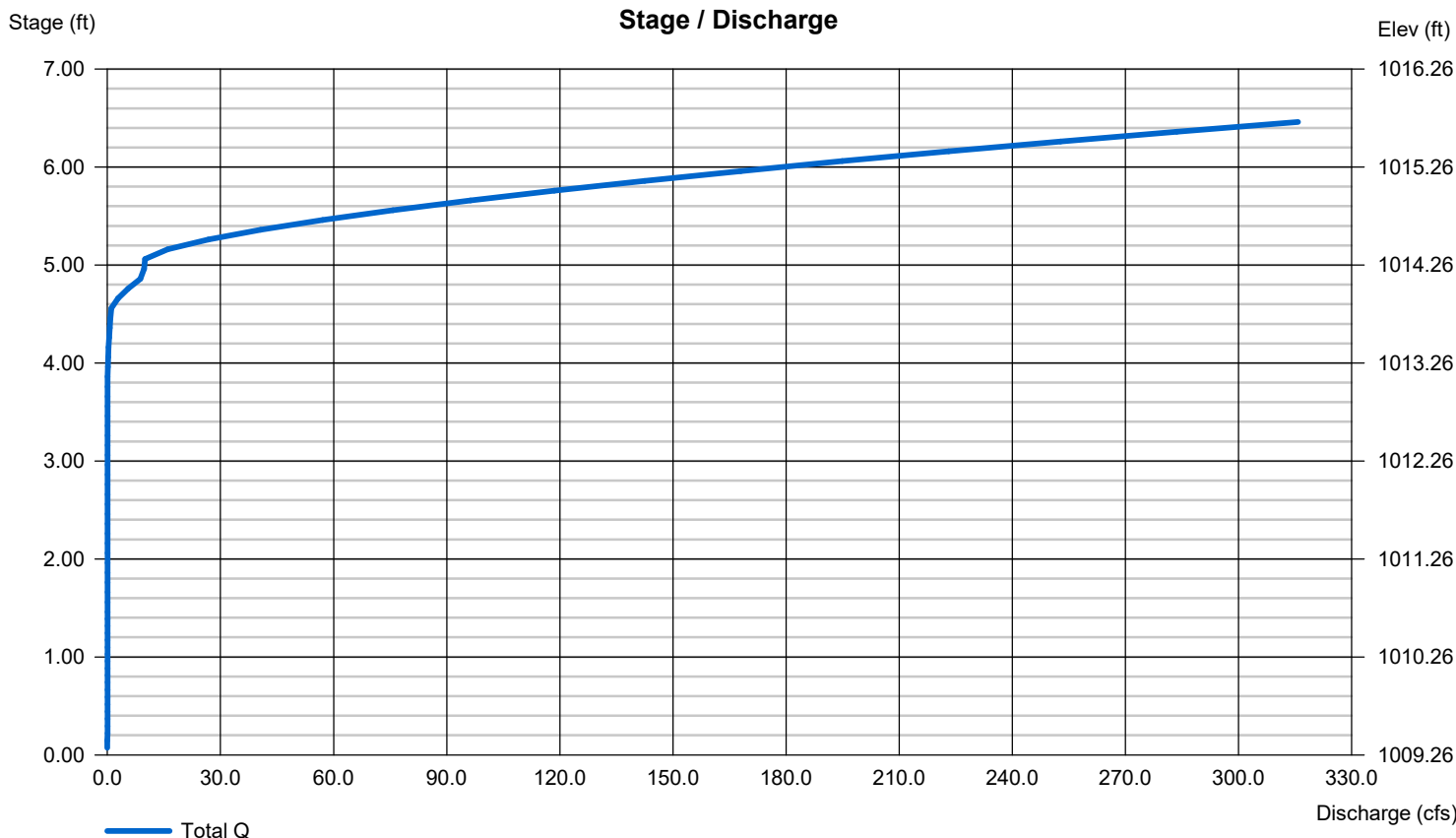
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.75	12.00	0.00
Span (in)	= 12.00	0.75	5.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 1009.26	1009.30	1013.38	0.00
Length (ft)	= 30.00	0.50	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	55.00	0.00	Inactive
Crest El. (ft)	= 1014.08	1014.60	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Ciplti	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.420 (by Contour)			
TW Elev. (ft)	= 0.00			

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



Hydrograph Report

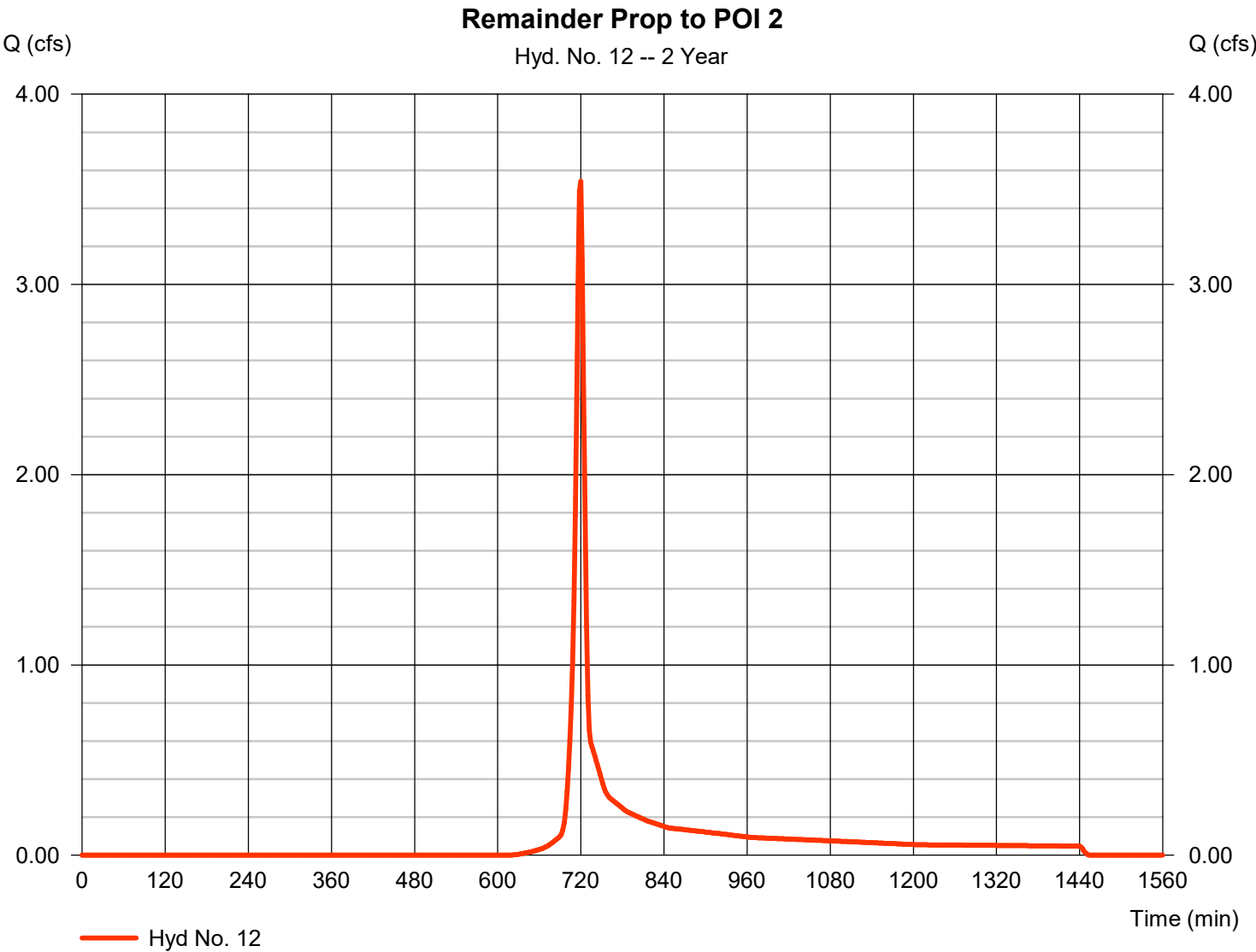
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Friday, 08 / 27 / 2021

Hyd. No. 12

Remainder Prop to POI 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.543 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	8,130 cuft
Drainage area	=	1.640 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	9.80 min
Total precip.	=	3.68 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

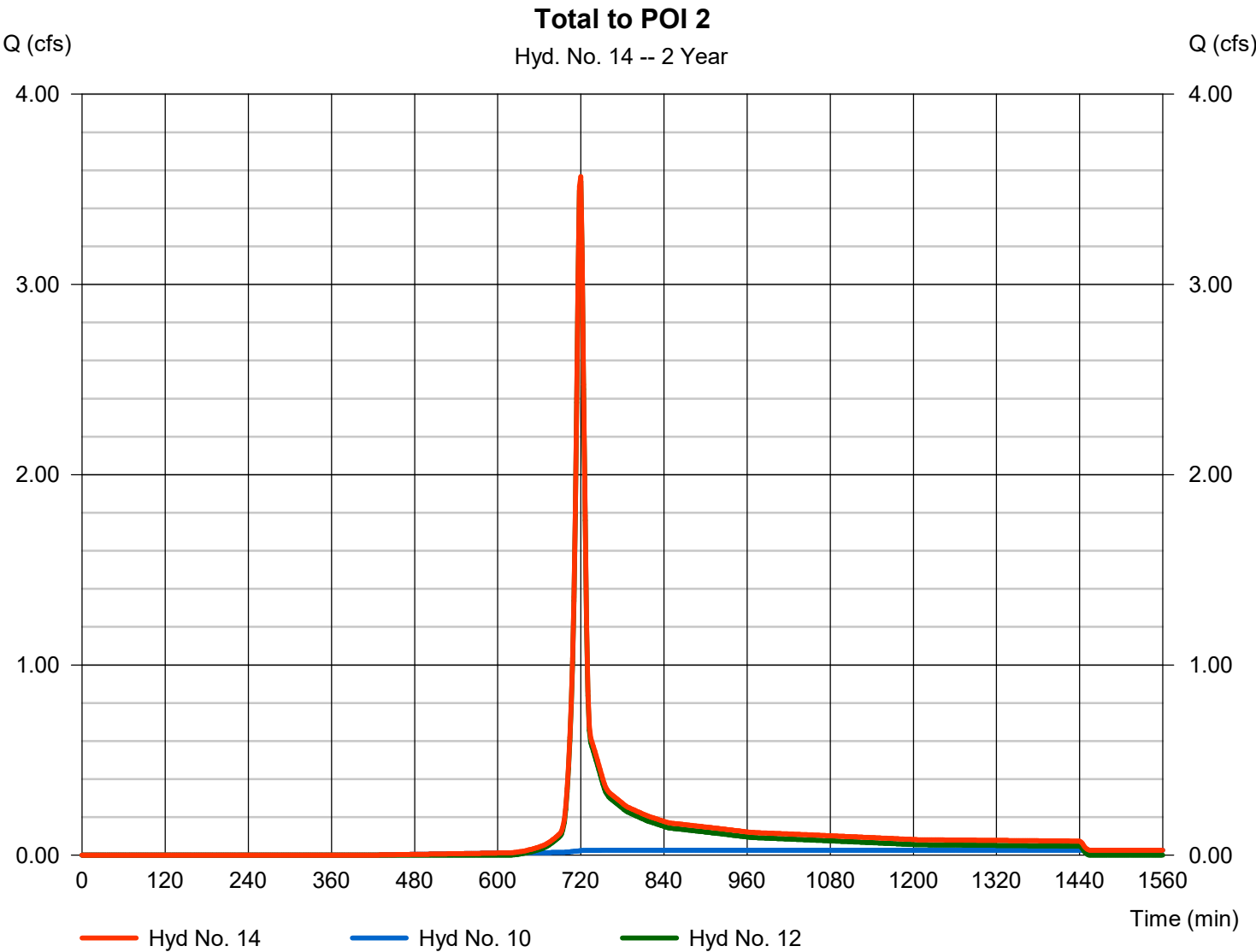
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Friday, 08 / 27 / 2021

Hyd. No. 14

Total to POI 2

Hydrograph type	= Combine	Peak discharge	= 3.567 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 12,118 cuft
Inflow hyds.	= 10, 12	Contrib. drain. area	= 1.640 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
2	SCS Runoff	4.214	2	718	9,851	-----	-----	-----	Existing to POI 1
4	SCS Runoff	3.714	2	716	8,041	-----	-----	-----	Proposed to POI 1
6	SCS Runoff	10.99	2	718	25,132	-----	-----	-----	Existing to POI 2
8	SCS Runoff	6.926	2	716	14,757	-----	-----	-----	Prop to Detention Pond
10	Reservoir	0.181	2	824	8,122	8	1013.60	9,704	Detention Pond
12	SCS Runoff	7.442	2	718	17,025	-----	-----	-----	Remainder Prop to POI 2
14	Combine	7.470	2	718	25,147	10, 12,	-----	-----	Total to POI 2

Hydrograph Report

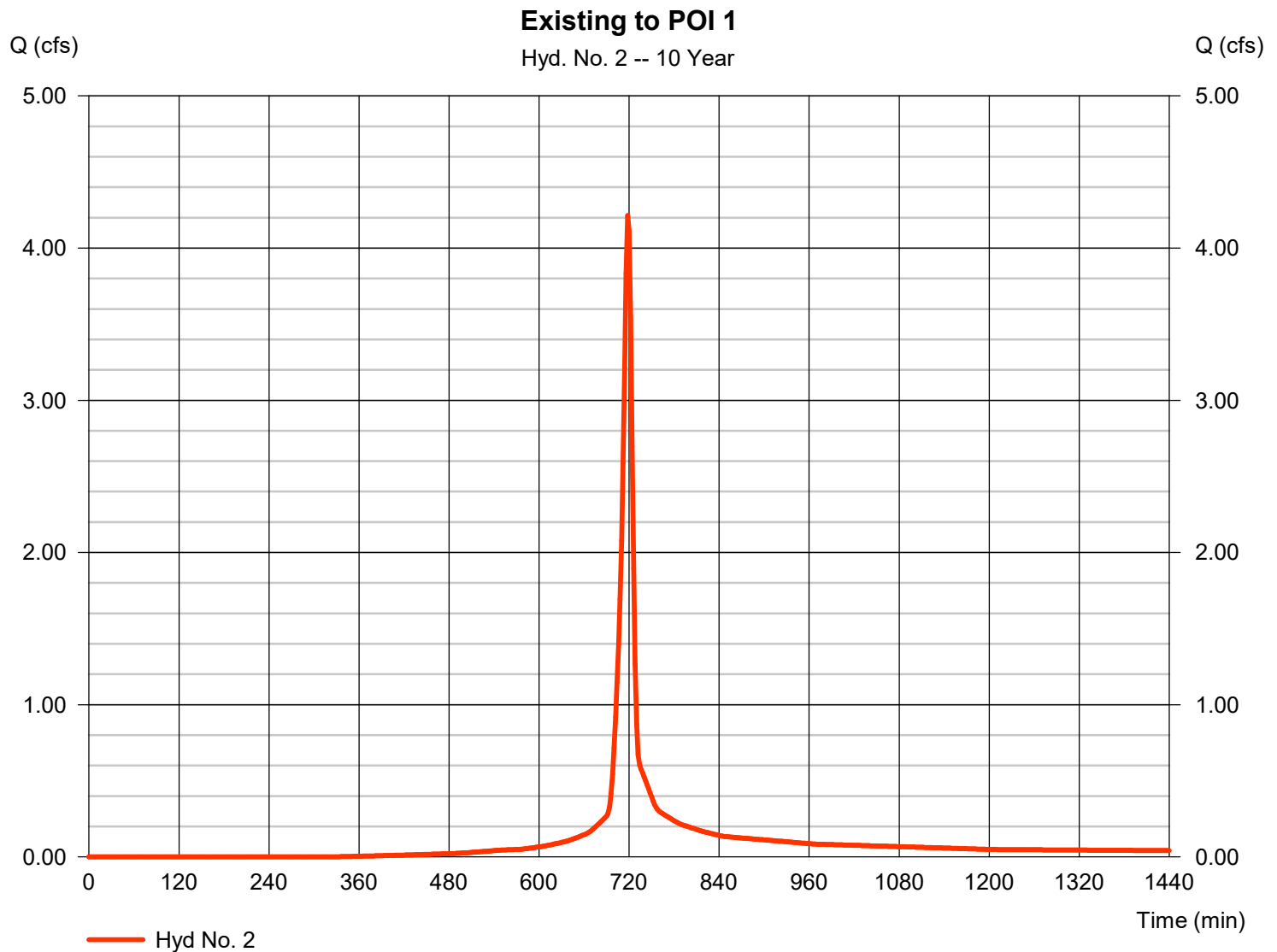
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Hyd. No. 2

Existing to POI 1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.214 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 9,851 cuft
Drainage area	= 0.708 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.60 min
Total precip.	= 5.61 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

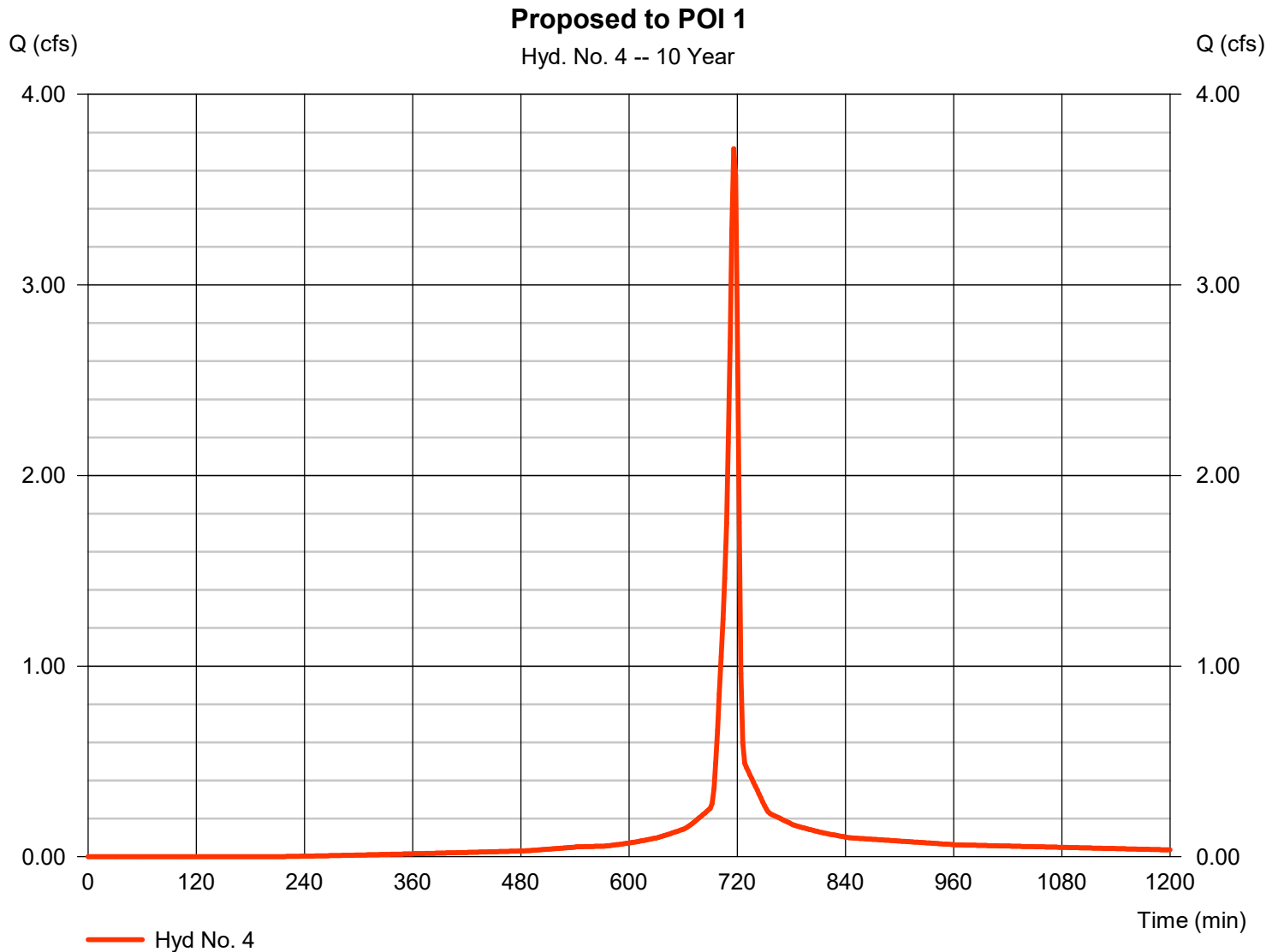
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Friday, 08 / 27 / 2021

Hyd. No. 4

Proposed to POI 1

Hydrograph type	= SCS Runoff	Peak discharge	= 3.714 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 8,041 cuft
Drainage area	= 0.529 ac	Curve number	= 90
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.61 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

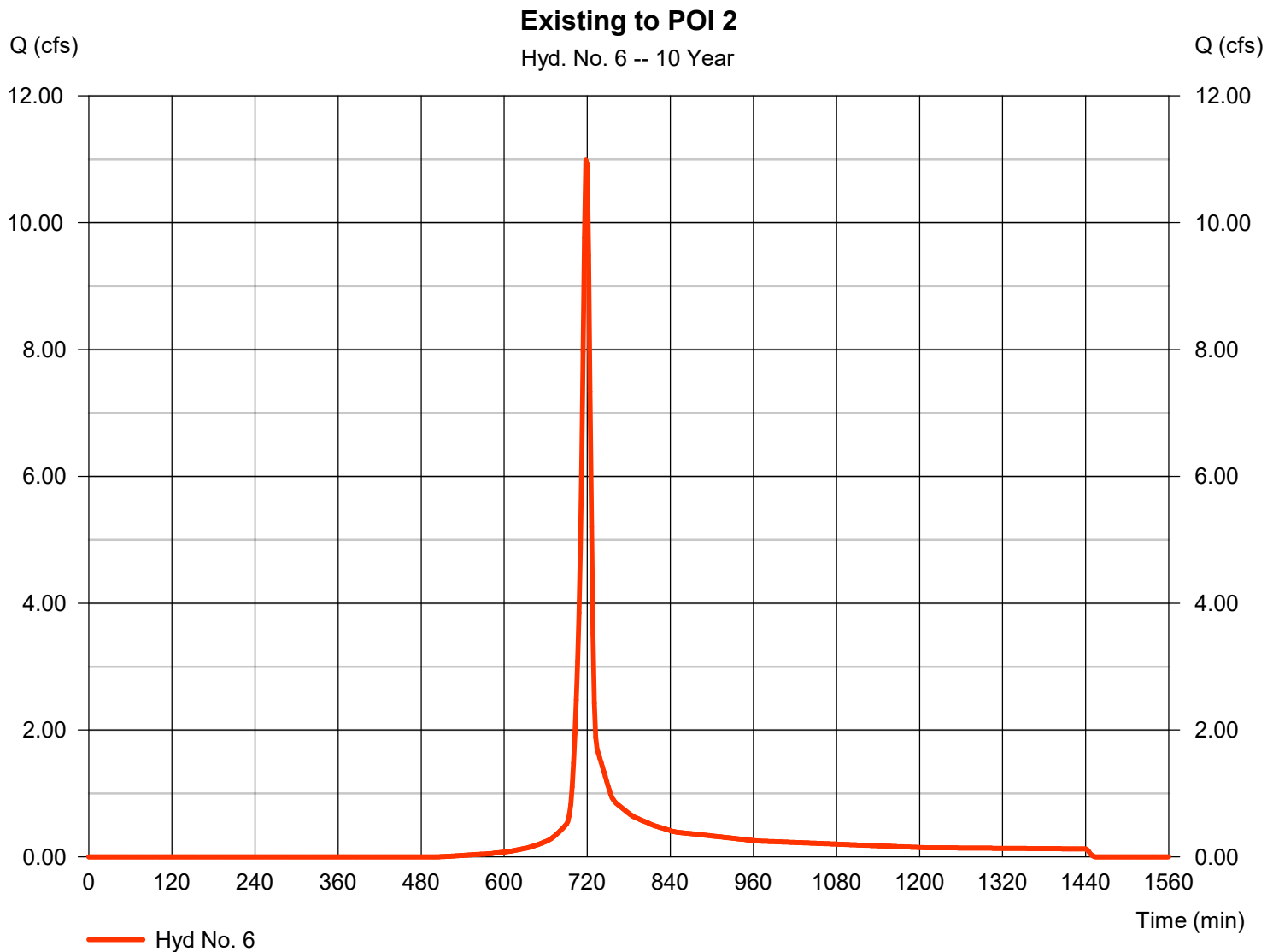
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Friday, 08 / 27 / 2021

Hyd. No. 6

Existing to POI 2

Hydrograph type	= SCS Runoff	Peak discharge	= 10.99 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 25,132 cuft
Drainage area	= 2.421 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.80 min
Total precip.	= 5.61 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

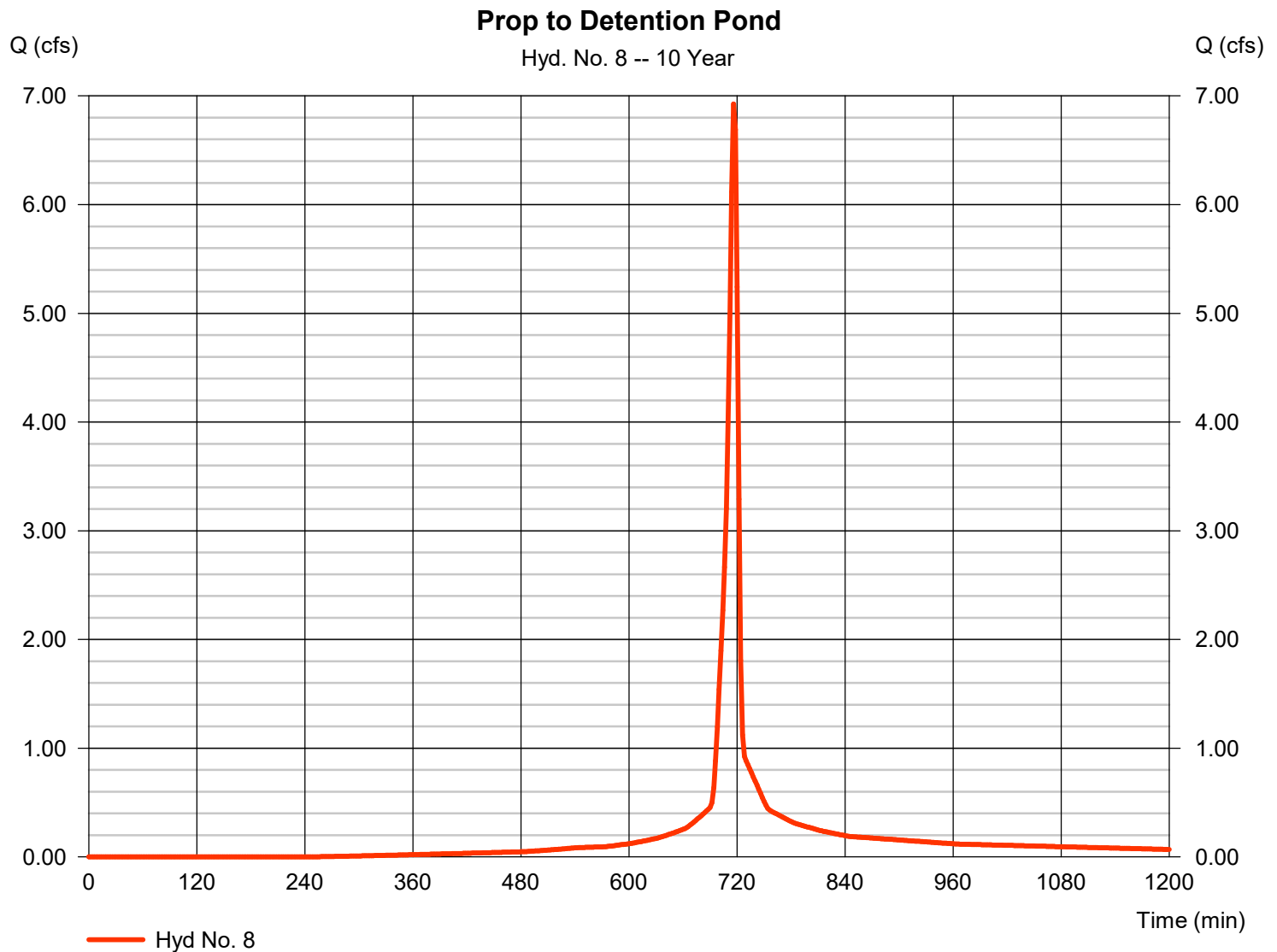
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Friday, 08 / 27 / 2021

Hyd. No. 8

Prop to Detention Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 6.926 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 14,757 cuft
Drainage area	= 1.020 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.61 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

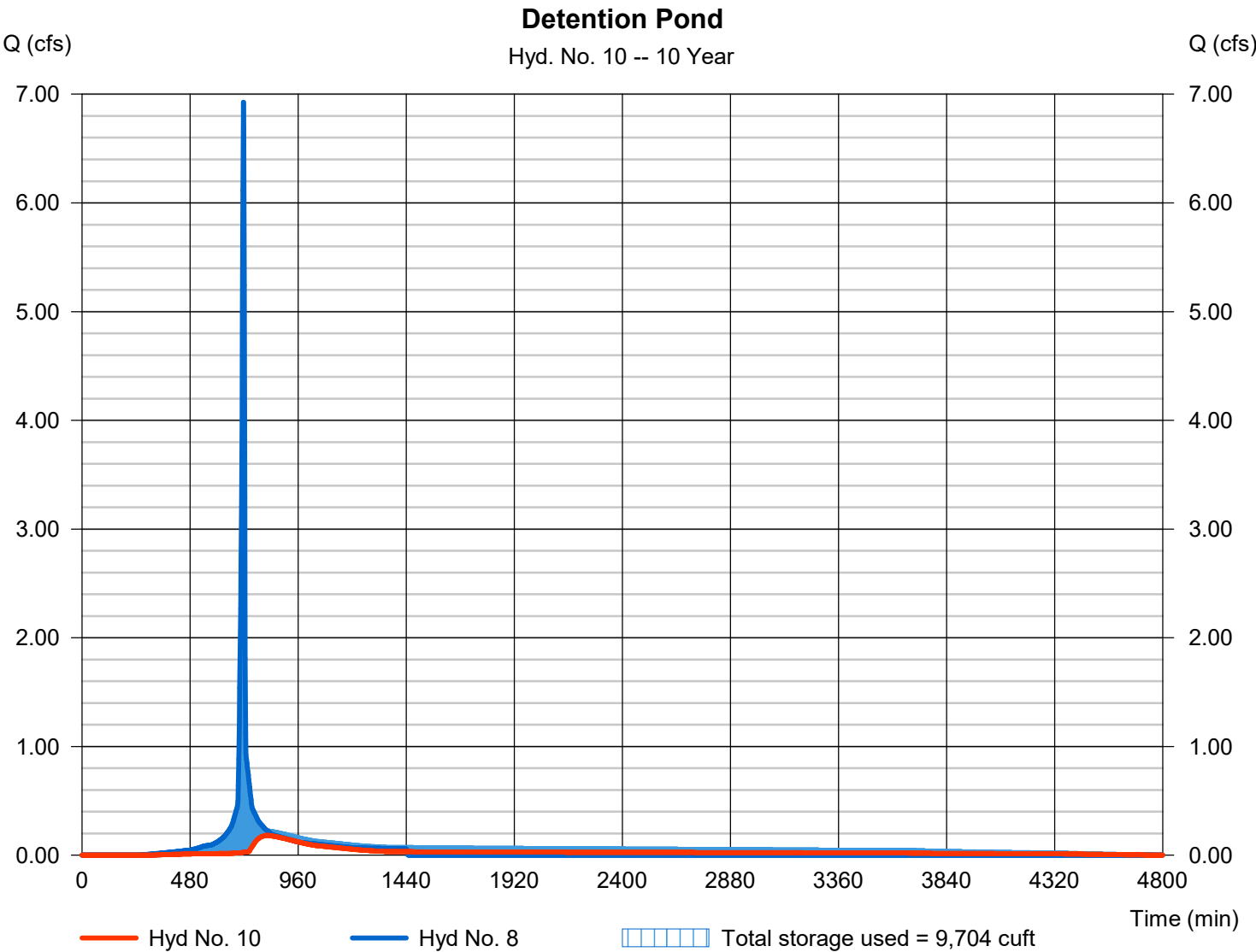
Friday, 08 / 27 / 2021

Hyd. No. 10

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.181 cfs
Storm frequency	= 10 yrs	Time to peak	= 824 min
Time interval	= 2 min	Hyd. volume	= 8,122 cuft
Inflow hyd. No.	= 8 - Prop to Detention Pond	Max. Elevation	= 1013.60 ft
Reservoir name	= Detention Pond	Max. Storage	= 9,704 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

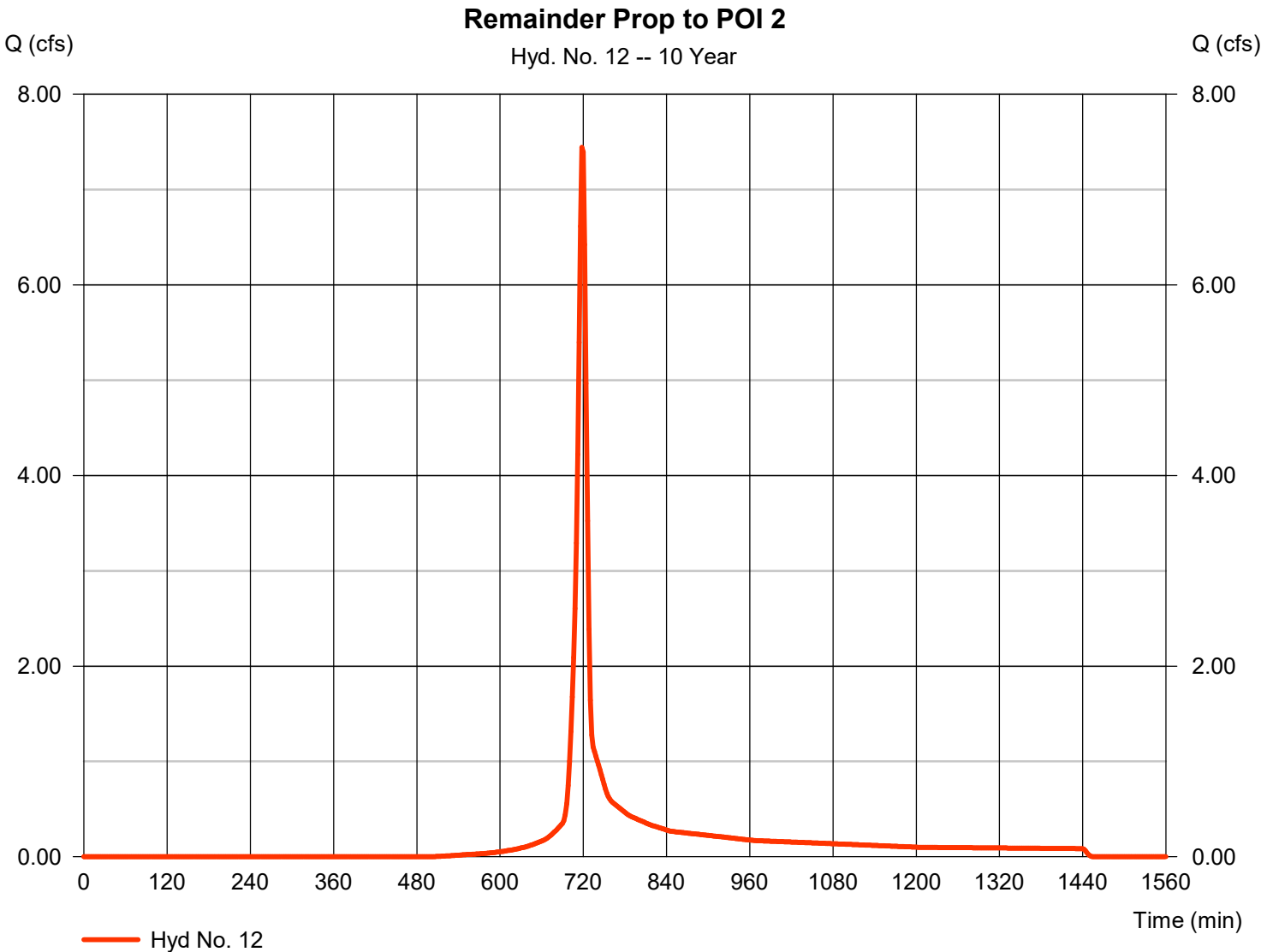
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Friday, 08 / 27 / 2021

Hyd. No. 12

Remainder Prop to POI 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.442 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	17,025 cuft
Drainage area	=	1.640 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	9.80 min
Total precip.	=	5.61 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

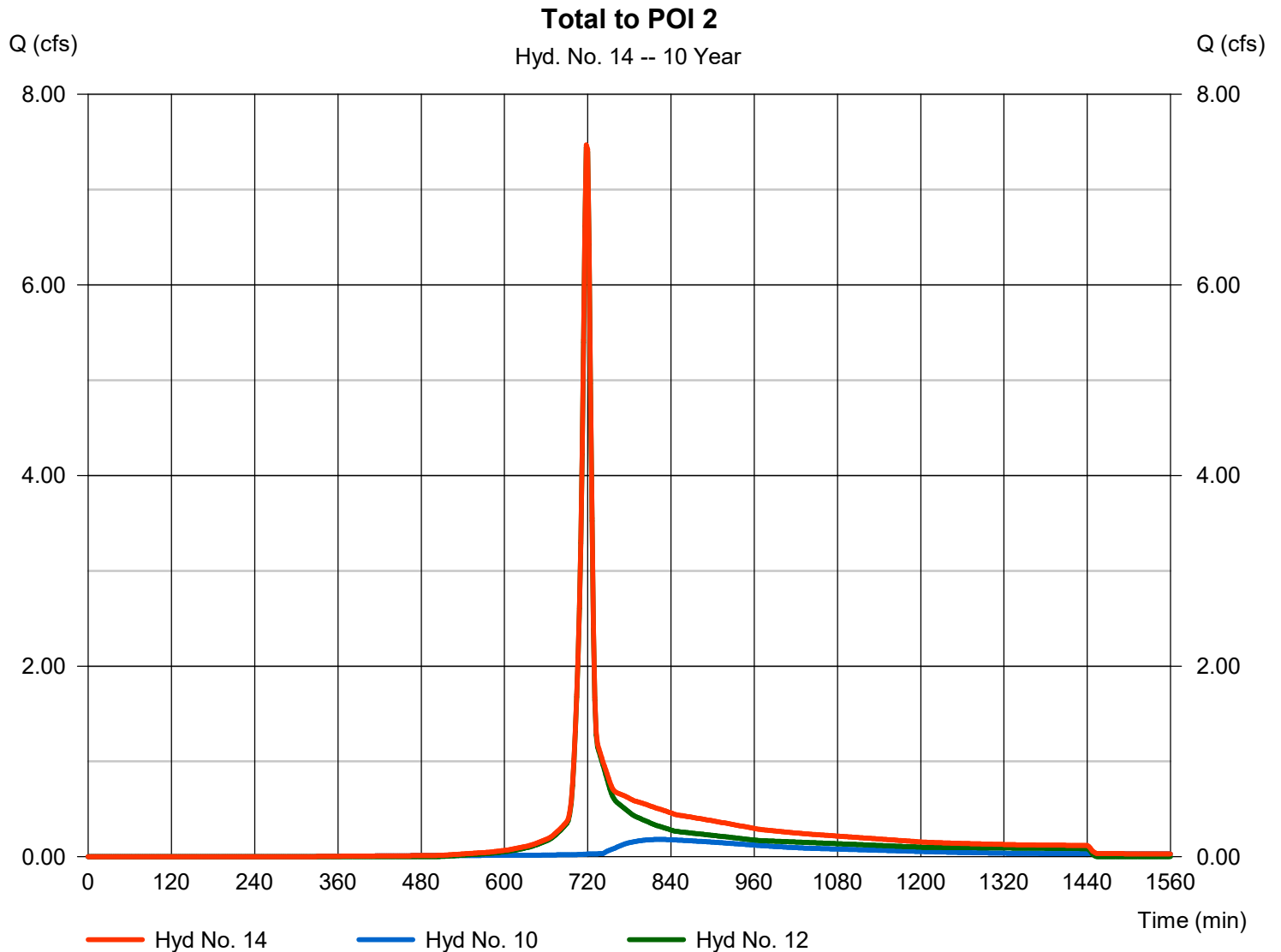
Friday, 08 / 27 / 2021

Hyd. No. 14

Total to POI 2

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 10, 12

Peak discharge = 7.470 cfs
Time to peak = 718 min
Hyd. volume = 25,147 cuft
Contrib. drain. area = 1.640 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
2	SCS Runoff	7.681	2	718	18,565	-----	-----	-----	Existing to POI 1
4	SCS Runoff	6.376	2	716	14,329	-----	-----	-----	Proposed to POI 1
6	SCS Runoff	22.65	2	718	52,590	-----	-----	-----	Existing to POI 2
8	SCS Runoff	12.10	2	716	26,780	-----	-----	-----	Prop to Detention Pond
10	Reservoir	7.141	2	722	19,727	8	1014.35	13,036	Detention Pond
12	SCS Runoff	15.34	2	718	35,625	-----	-----	-----	Remainder Prop to POI 2
14	Combine	21.94	2	720	55,352	10, 12,	-----	-----	Total to POI 2

Hydrograph Report

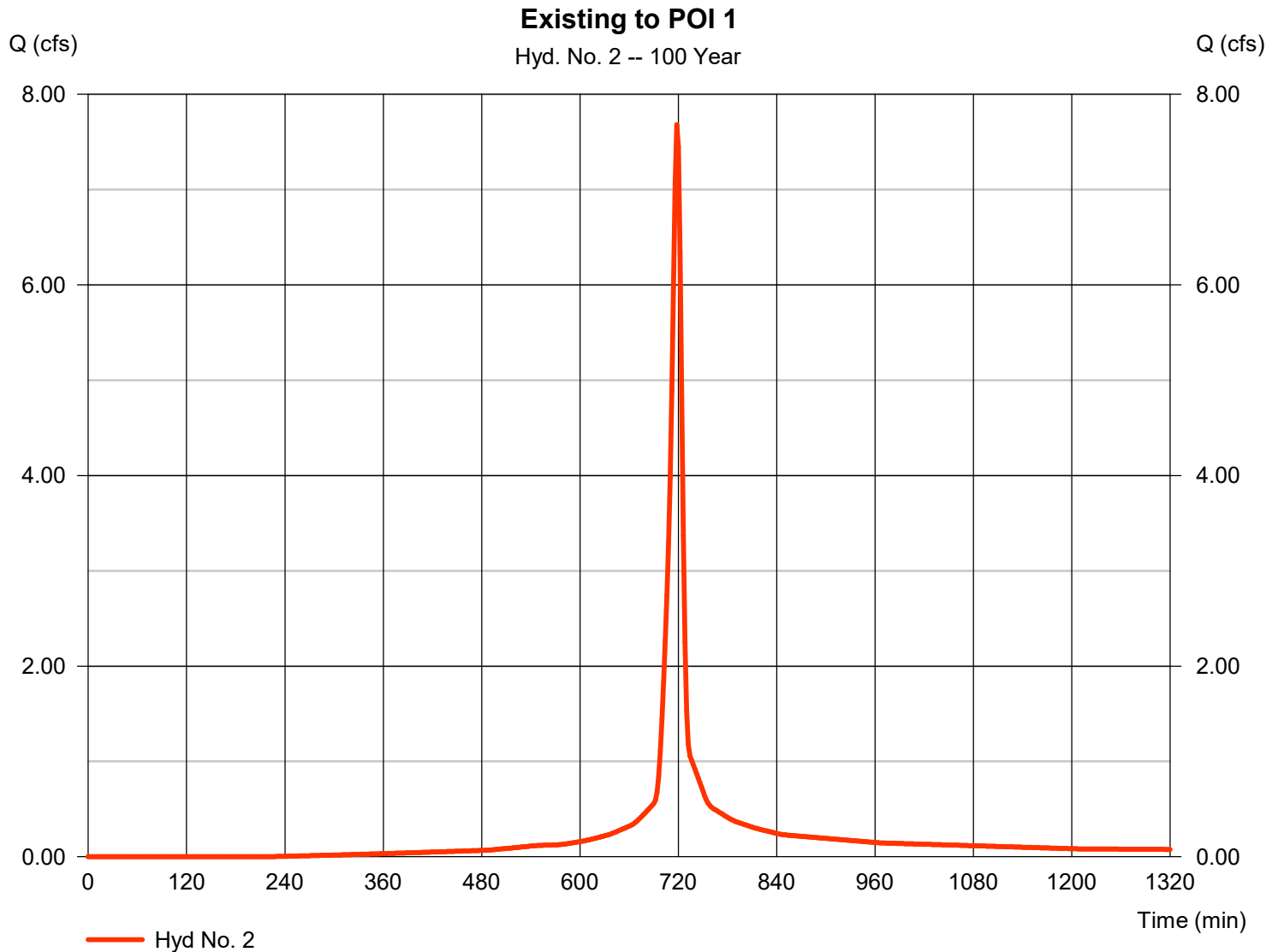
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Friday, 08 / 27 / 2021

Hyd. No. 2

Existing to POI 1

Hydrograph type	= SCS Runoff	Peak discharge	= 7.681 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 18,565 cuft
Drainage area	= 0.708 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.60 min
Total precip.	= 9.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

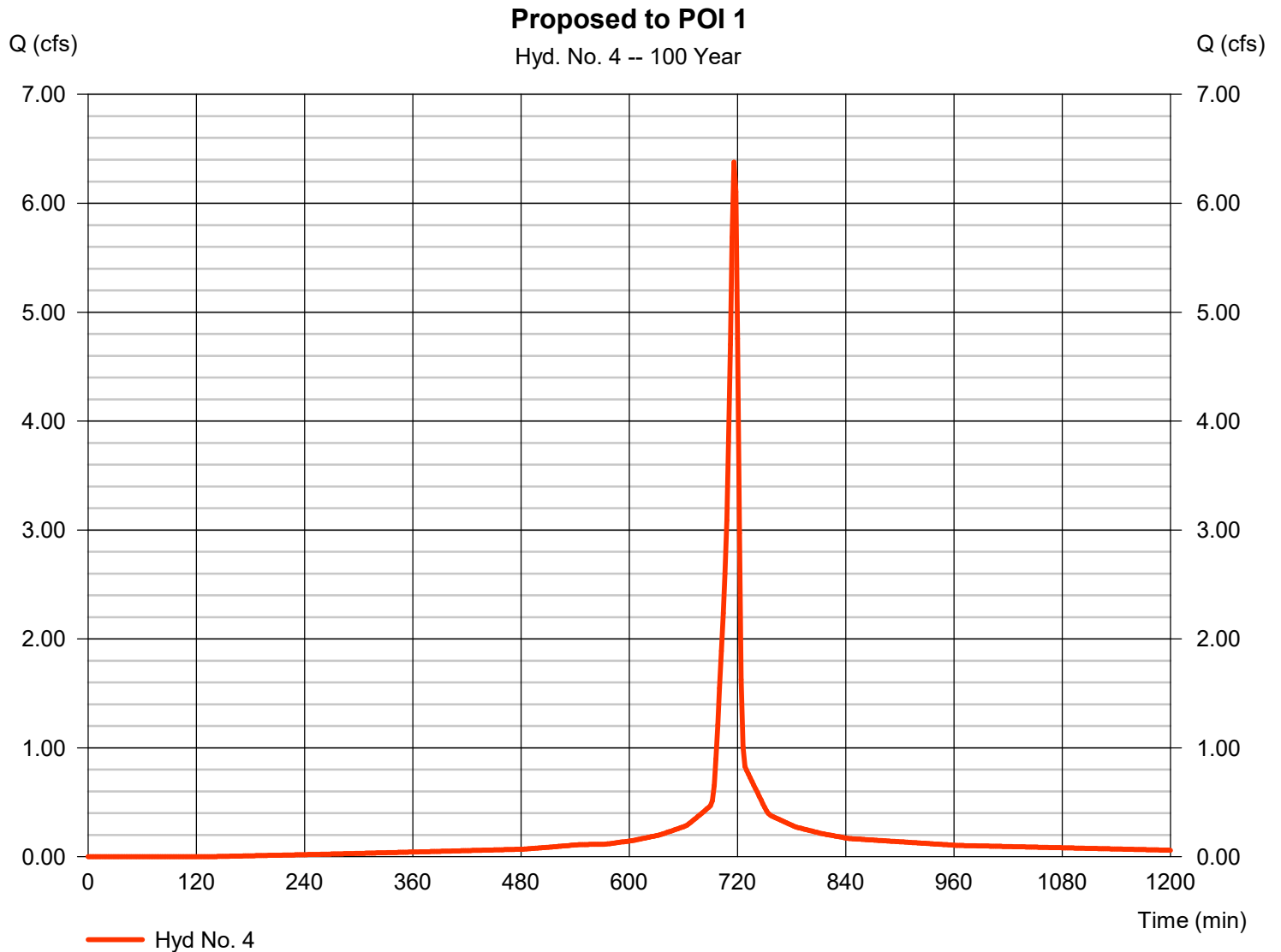
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Friday, 08 / 27 / 2021

Hyd. No. 4

Proposed to POI 1

Hydrograph type	= SCS Runoff	Peak discharge	= 6.376 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 14,329 cuft
Drainage area	= 0.529 ac	Curve number	= 90
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 9.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

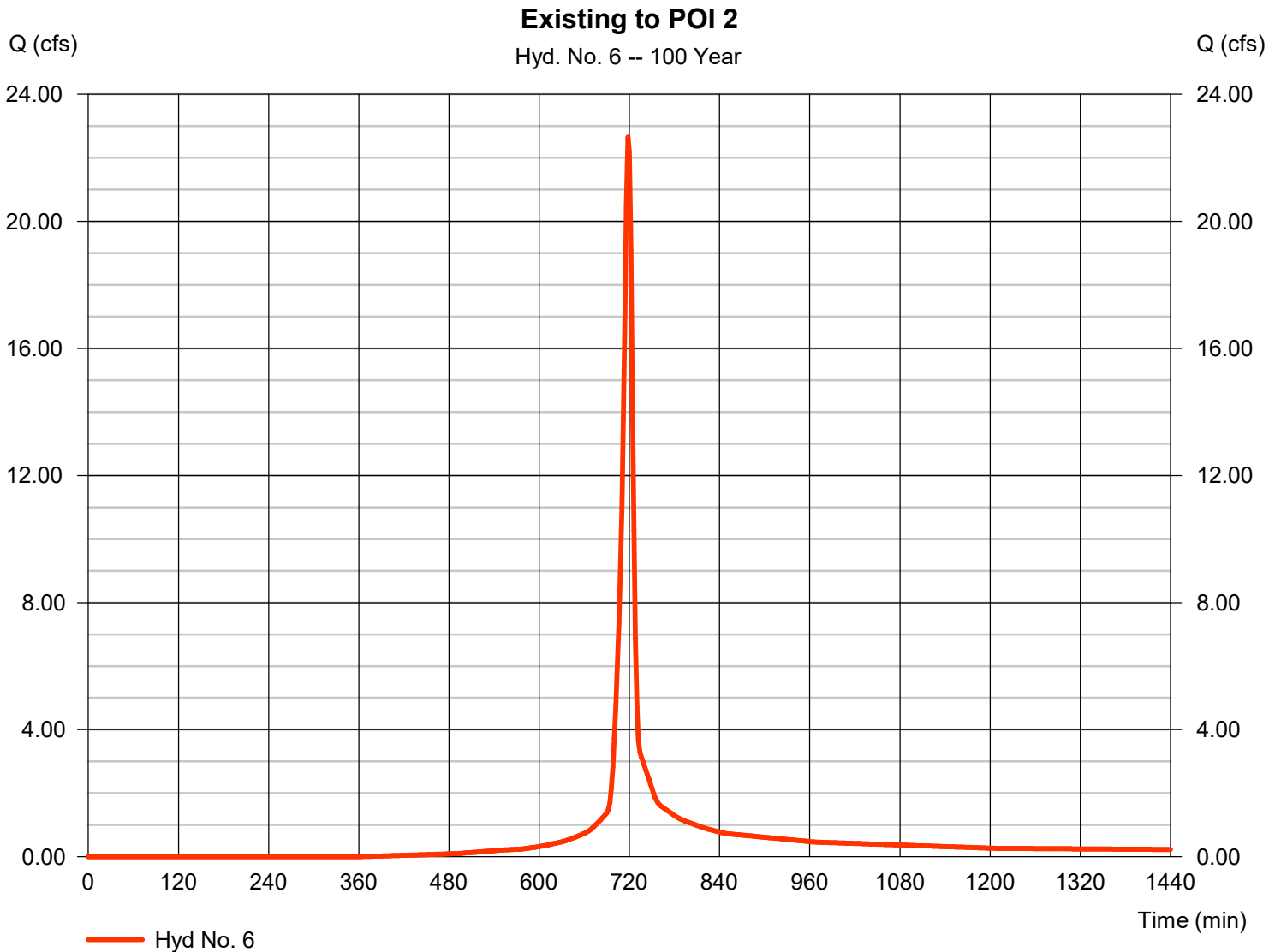
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Friday, 08 / 27 / 2021

Hyd. No. 6

Existing to POI 2

Hydrograph type	= SCS Runoff	Peak discharge	= 22.65 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 52,590 cuft
Drainage area	= 2.421 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.80 min
Total precip.	= 9.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

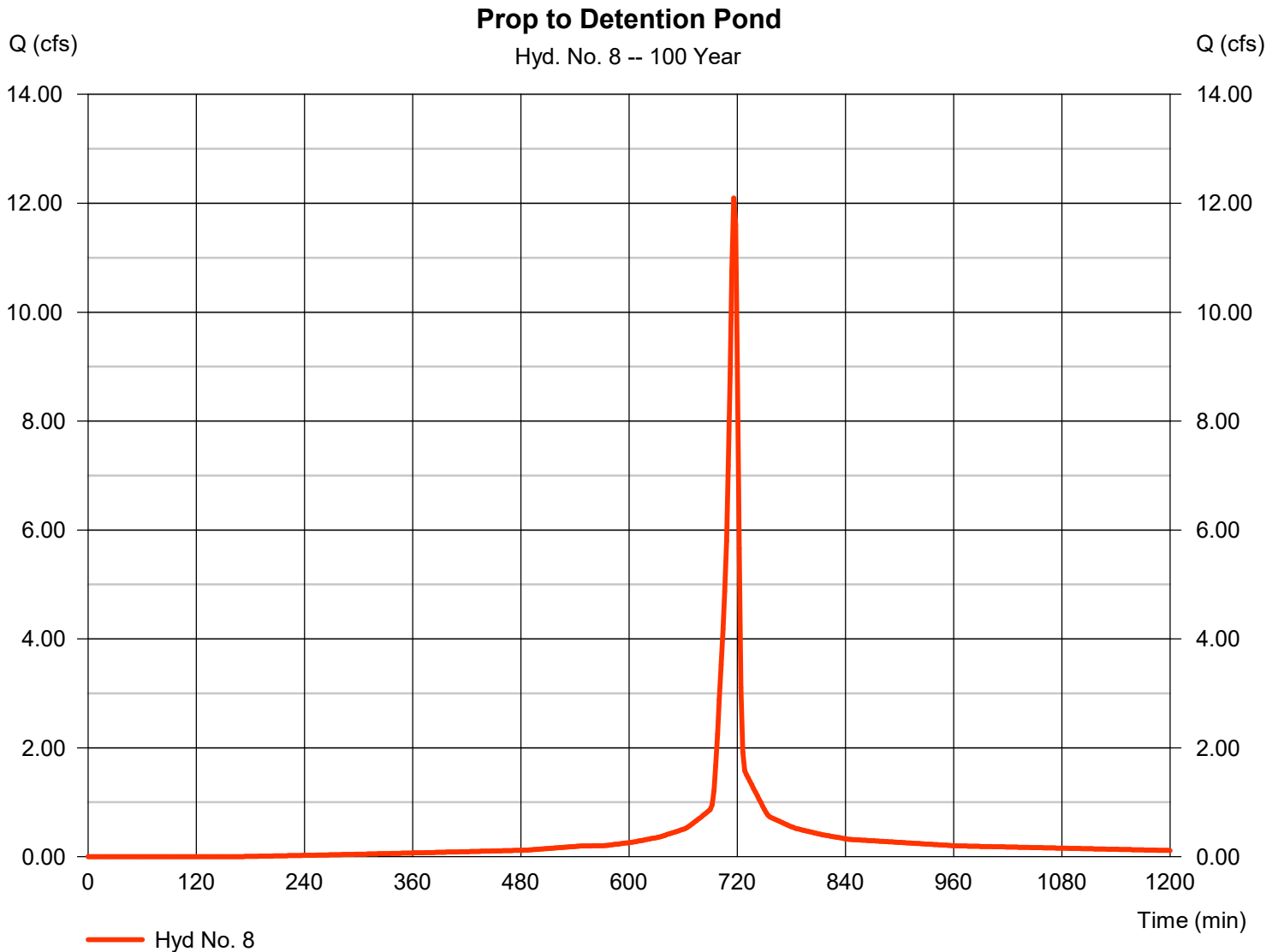
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Friday, 08 / 27 / 2021

Hyd. No. 8

Prop to Detention Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 12.10 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 26,780 cuft
Drainage area	= 1.020 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 9.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

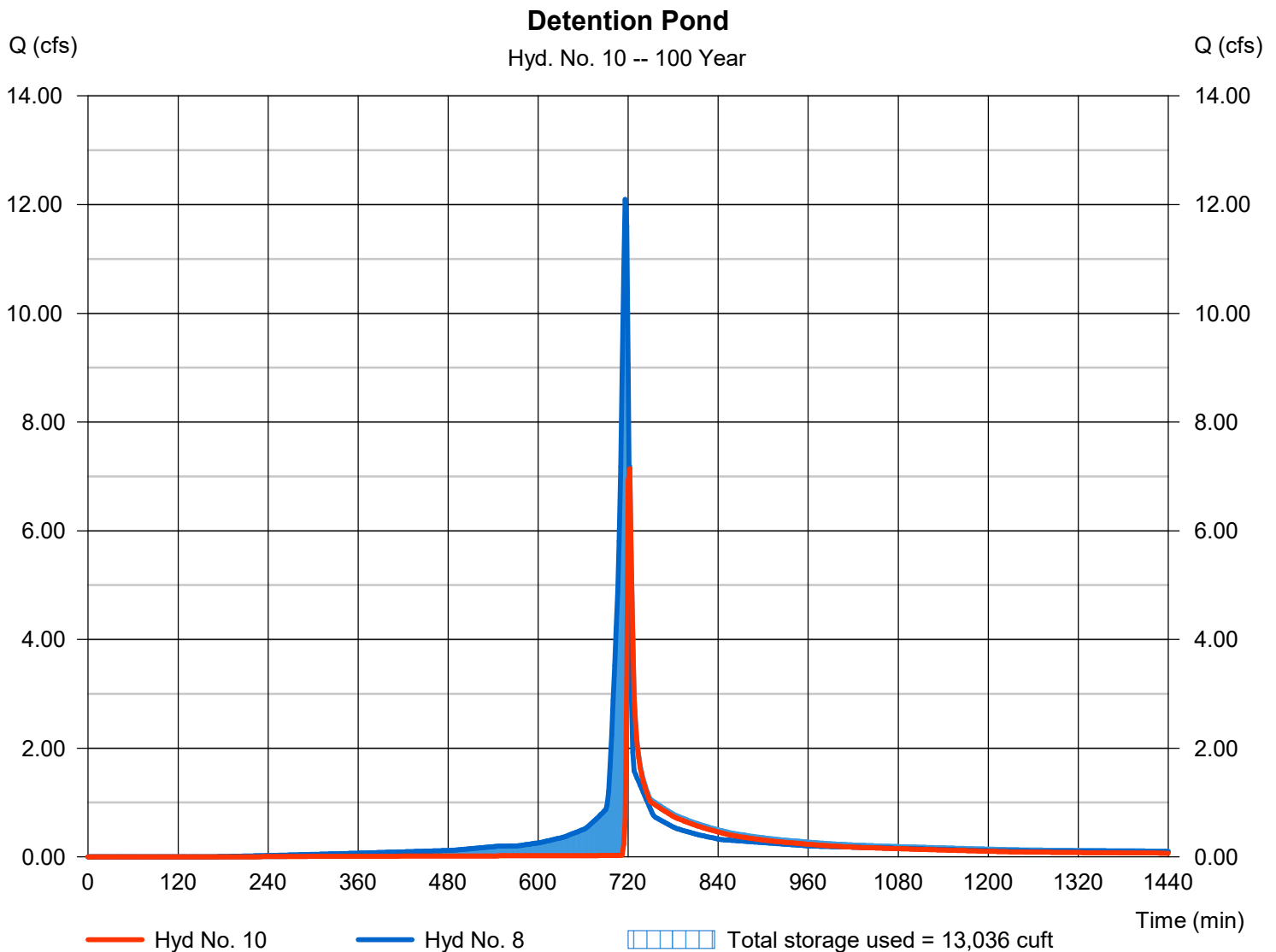
Friday, 08 / 27 / 2021

Hyd. No. 10

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 7.141 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 19,727 cuft
Inflow hyd. No.	= 8 - Prop to Detention Pond	Max. Elevation	= 1014.35 ft
Reservoir name	= Detention Pond	Max. Storage	= 13,036 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

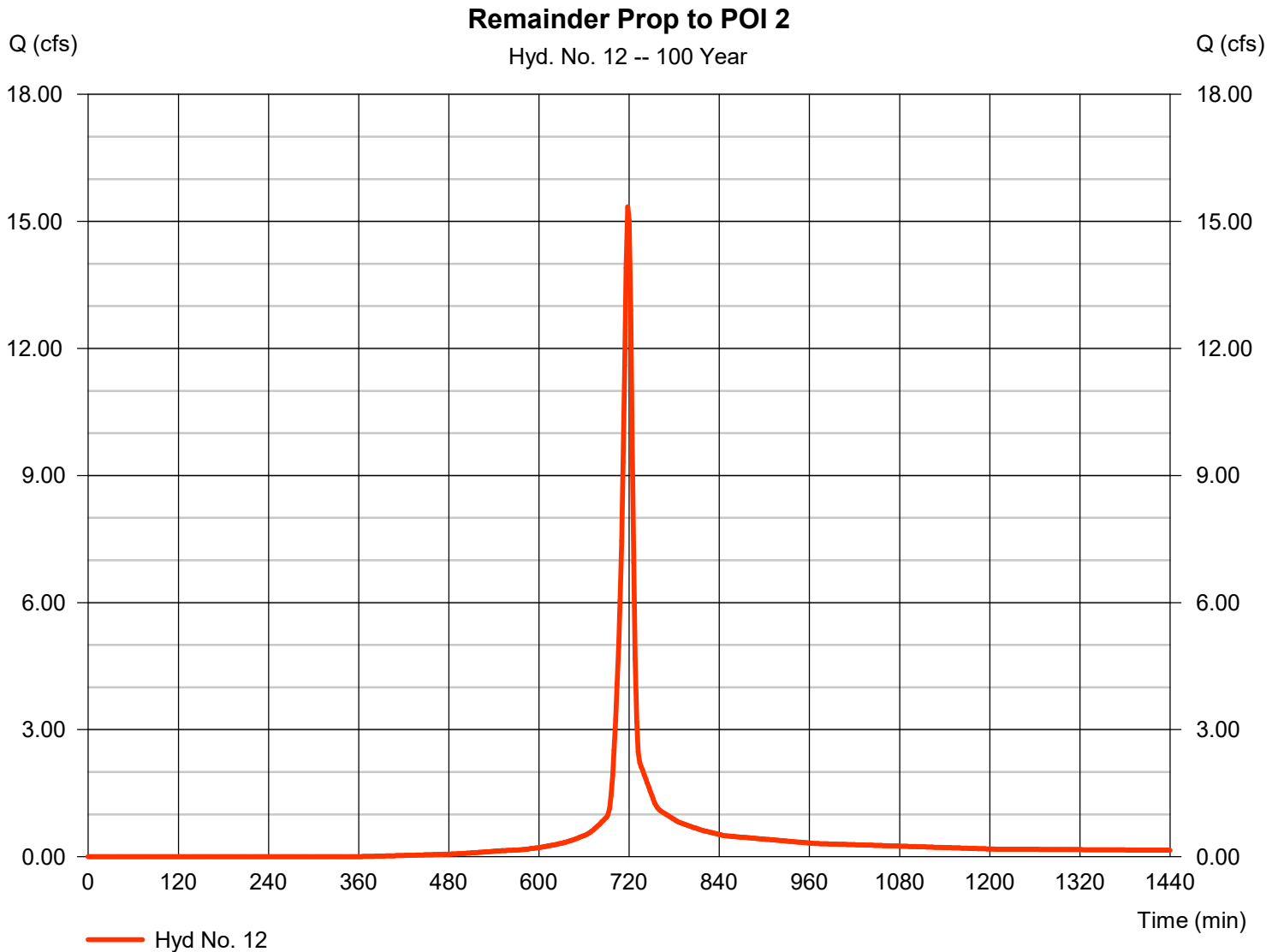
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Friday, 08 / 27 / 2021

Hyd. No. 12

Remainder Prop to POI 2

Hydrograph type	= SCS Runoff	Peak discharge	= 15.34 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 35,625 cuft
Drainage area	= 1.640 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.80 min
Total precip.	= 9.17 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

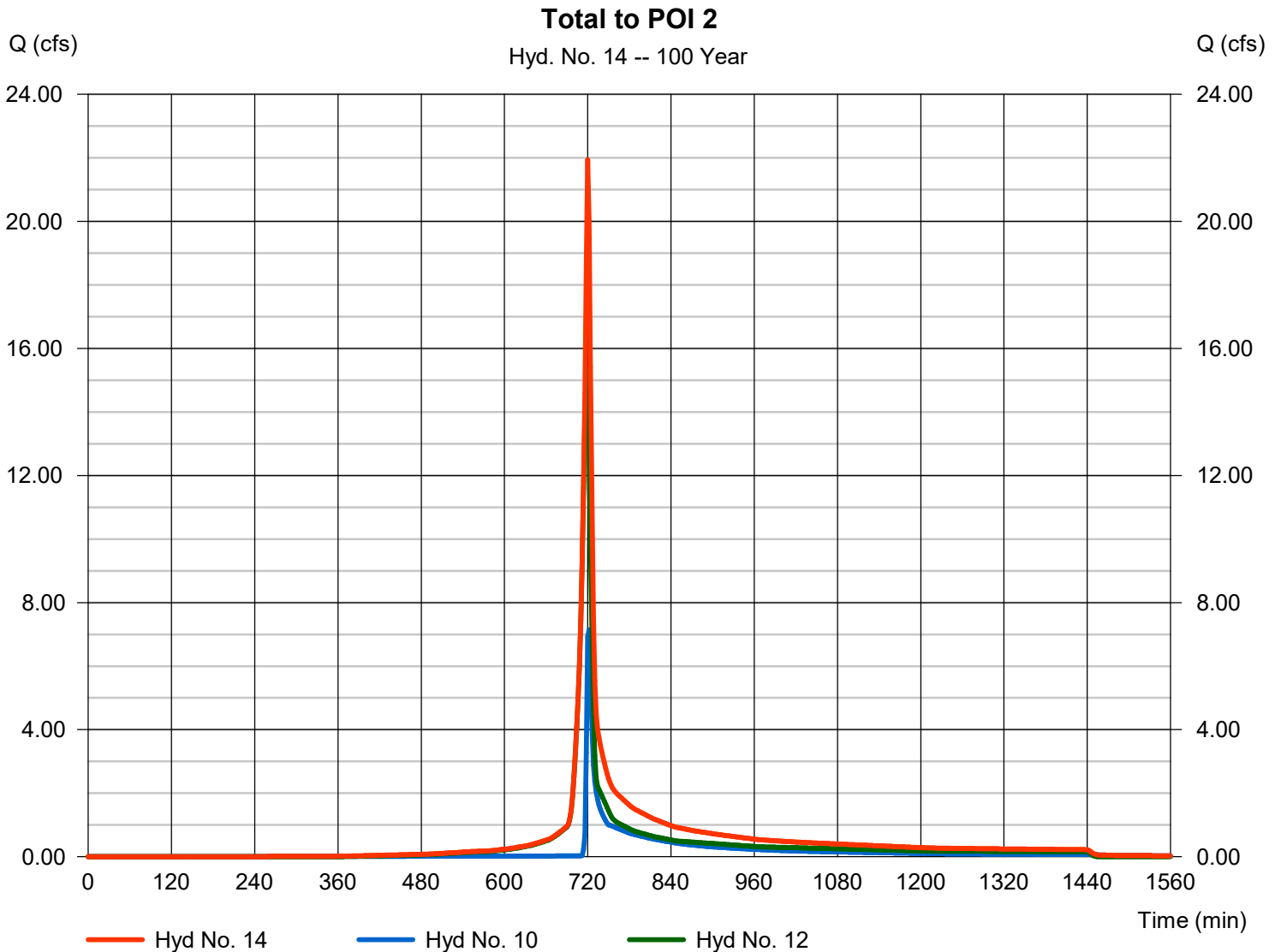
Friday, 08 / 27 / 2021

Hyd. No. 14

Total to POI 2

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 10, 12

Peak discharge = 21.94 cfs
Time to peak = 720 min
Hyd. volume = 55,352 cuft
Contrib. drain. area = 1.640 ac



Weir Report

Emergency Spillway(100yr)

Trapezoidal Weir

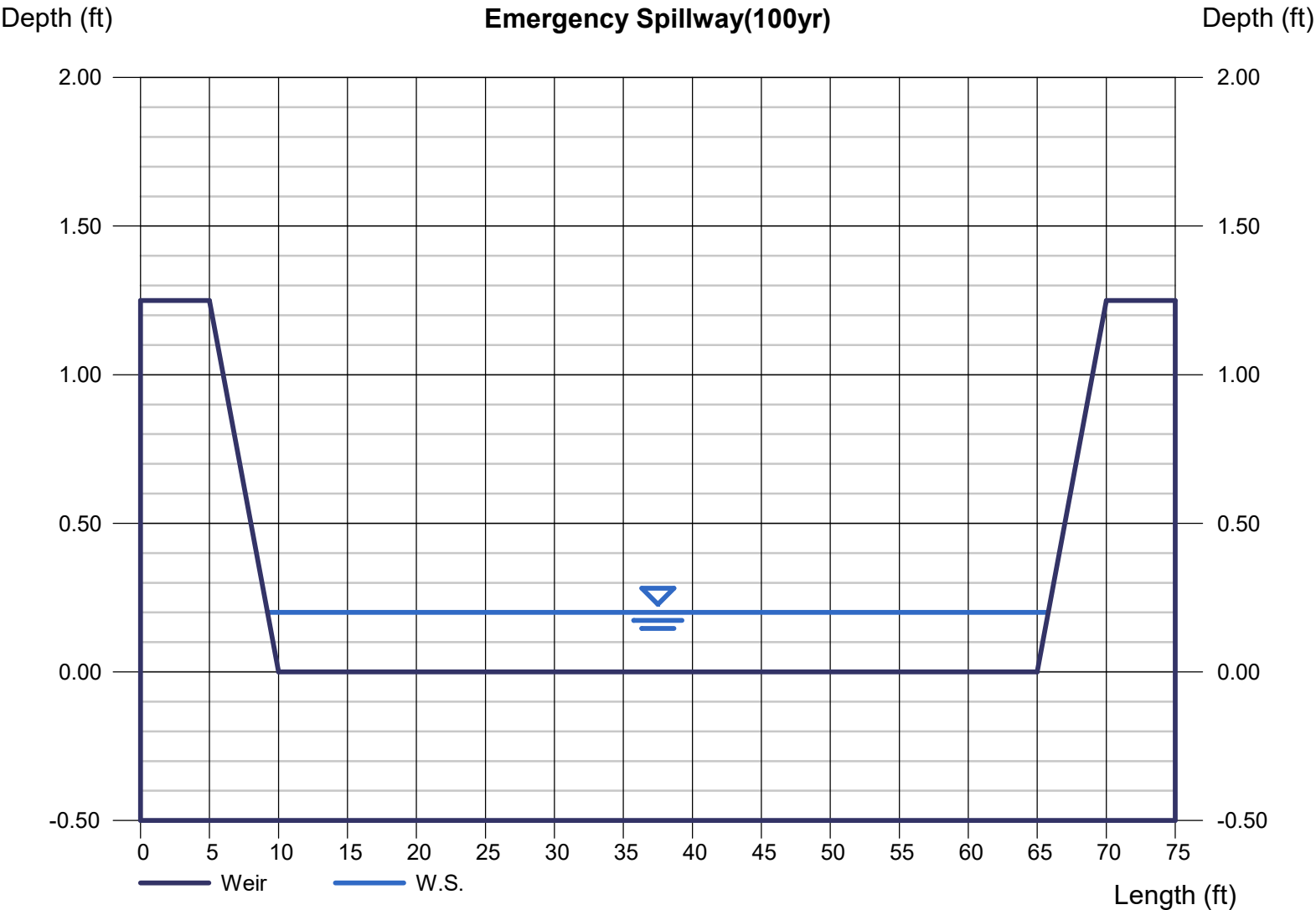
Crest = Sharp
Bottom Length (ft) = 55.00
Total Depth (ft) = 1.25
Side Slope (z:1) = 4.00

Highlighted

Depth (ft) = 0.20
Q (cfs) = 12.10
Area (sqft) = 11.16
Velocity (ft/s) = 1.08
Top Width (ft) = 56.60

Calculations

Weir Coeff. Cw = 2.60
Compute by: Known Q
Known Q (cfs) = 12.10



APPENDIX C

Water Quality Calculations

WATER QUALITY AS BUILT POND CALCULATIONS

Project: Firestone Complete Auto Care, Lee's Summit, MO

Date: 10/21/2021

GSP# 40831.45

Calculate Water Quality Volume

P (in.), rainfall for 90% storm event	1.37
I, impervious cover by %	56.4
R_v , runoff coefficient = $0.05 + 0.009 \times I$	0.56
A (ac), drainage area	1.02
WQ_v (ac-ft), water quality volume = $P \times R_v \times A/12$	0.06
WQ_v (ft ³), water quality volume converted units	2828
Add 20% WQ_v (ft ³), water quality volume converted units	3394.15

Pond Areas

Elevation (ft)	Area (ft ²)	Elev. Difference (ft)	Increment Volume (ft ³)	Total Volume (ft ³)
1009.26	0	0	0	0
1010	640	0.74	237	237
1011	2340	1	1490	1727
1012	2987	1	2664	4390
1013	3635	1	3311	7701
1014	4375	1	4005	11706
1015	5525	1	4950	16656
1016	6316	1	5921	22577
Required WQ_v elevation (ft)				1011.63
AsBuilt WQ_v elevation (ft)				1013.38
Total As Built WQ Volume provided (cf)				9223.20

Size Low Flow Orifice

C, orifice coefficient	0.66
T (hrs), drawdown time (should be 40+- hrs)	40
g (ft/s ²), gravity	32.20
$Q_{wq, avg}$ (cfs), average release rate of WQ_v	0.024
$H_{wq, avg}$ (ft), average head on the water quality outlet	2.06
A_{wq} (ft ²), the orifice area	0.003
D_{wq} (ft), the orifice area	0.06
D_{wq} (in), the orifice area	0.75
Use D=	0.75

APPENDIX D

Site Pictures





PRETECH
Precast Concrete Technology

