Introduction

The purpose of this Macro Storm Memorandum (memo) is to evaluate the existing Douglas Station Commercial Park (Development) Regional Stormwater Detention Facility (basin) in regards to its original design parameters and function. If deficits are found to exist in regards to its original design then remedies shall be employed to bring the basin into compliance with its original intent. This memo is being written in conjunction with the development of Lot 10 (6.33 acres) the last undeveloped lot in the Douglas Station Commercial Park Development (25+/- acres). Lot 10 is being developed as a multi-family residential development. The basin is located on Tract A. An aerial image of the basin along with an aerial image of the surrounding area may be found in Exhibit A. The Douglas Station Commercial Park Final Plat Exhibit recorded August 19, 2002 may be found in Exhibit B.

Existing Detention Basin Analysis

The existing basin is located on a 1.174 acre parcel designated Tract A. The original storm study for the Development was not available. However a preliminary storm study for the Development was completed in 2021 and excerpts from that study are available in Exhibit C. The study details some of the original design parameters such as 24.5 acres of the development were to be routed through the basin. Offsite runoff consisting of 27 acres were also routed through the basin as bypass. The peak runoff control design criteria consisted of reducing the post development 25-year peak discharge rate to pre-development levels or less. Lower recurrence interval peak discharge rates for the 50 and 100-year events were to be conveyed via the emergency spillway.

The current basin does not meet the original design intent nor current City Standards. The basin appears to have been silted in during previous construction activities based on the density of ground cover in the basin. The basin has a large area of brush and tree overgrowth in the north portion of the basin. See Exhibit D for an image of the existing vegetative overgrowth in the basin. The vegetative overgrowth and the previous siltation have reduced the basin storage volume significantly. In addition the existing 100-year clogged condition does not meet the required 20-foot setback to the north from property lines/structures. A building runs along the north property line of Tract A and is being encroached by the 100-year clogged water surface elevation.

As discussed peak runoff control was to be provided for 24.5 acres of onsite area and 27 acres of offsite area totaling approximately 51.5 acres. The drainage map was not available from the most recent study which excerpts have been included in this memo, see Exhibit C. Utilizing the City's existing contours we constructed an overall drainage map which depicts the overall area tributary to the basin. Our findings show that mainly a mix of neighborhood commercial and multi-family residential will be tributary to the basin at ultimate buildout. The tributary area consists of approximately 64.64 acres which

is significantly greater than the previously reported tributary area. The basin Overall Drainage Map may be found in Exhibit E.

Table 1 below details the hydrologic properties for the Development and offsite sub-areas along with peak discharge rates for the 2, 10, 25 and 100-year storms.

Table 1 Existing Conditions Sub-Area Data and Peak Discharge Rates

Sub-area	Area (ac.)	CN	Tc (min.)	Q2 (cfs)	Q10 (cfs)	Q25 (cfs)	Q100 (cfs)
Undeveloped Douglas Station	25	74	15.0	41.31	89.86	113.76	157.36
Offsite Developed	39.64	89	23.0	98.97	168.33	200.16	256.40
Combined Pre-Development	64.64			136.53	250.35	304.20	400.52

The Undeveloped Douglas Station Sub-area corresponds to the original undeveloped area for the Development. The Offsite Developed Sub-area is based on the ultimate buildout of the offsite tributary area to the basin per the Overall Drainage Map found in Exhibit E. The Combined Pre-Development hydrograph will provide a set of reference points to determine the proposed detention basin efficacy. Exhibit F contains a full Hydraflow Report with Existing and Proposed hydrographs for each sub-area along with detention basin data and routing hydrographs.

The existing basin deficiencies shall be addressed in the Proposed Detention Basin Modifications section. The objective is to address current basin deficiencies while meeting the original peak runoff control strategy of pre verse post 25-year levels for the Development.

Proposed Detention Basin Modifications

The objective is to modify the existing basin as required to meet original peak runoff control for the Development while bypassing all offsite ultimate buildout flows. The existing 48" outlet pipe shall remain and the rest of the basin shall be regraded to meet the original 25-year pre vs post development runoff control strategy. The basin will be designed to reduce the 25-year post-development peak discharge rate from the Development to pre-development levels while bypassing all offsite tributary flows. The spillway shall be designed to pass the 100-year clogged condition. The spillway shall be located along the west property line for direct conveyance to the existing natural stream to the west. The existing vegetative overgrowth in the basin shall be grubbed, cleared and disposed of prior to commencement of mass grading activities. The proposed Detention Basin Plan may be found in Exhibit G.

The existing single stage earthen detention basin is being redesigned. Following are a list of design parameters for the modified detention system.

Designation: Douglas Station Regional Detention Basin
Type: Earthen Basin
Side Slopes: 3:1 Max. (TRM Stabilized)
Bottom Slope: 0.83% Min., Turf Lined (Water Quality Positive)
Basin Bottom Elevation: 972.42 @ Influent Pipe
Basin Top Berm Elevation: 980.15
Basin Volume: 114,636 cf @ 980.00
Control Element: Ex. 48" CMP, FL In=972.42, FL Out=970.64, L=158.74', S=1.12%
Emergency Spillway: Earthen Broad Crested Weir, Crest Elevation=978.00, Crest Length=85.00'
Consecutive 100-YR Q=376.17 cfs Principal/Emergency Spillway HGL=979.43, Freeboard=0.72'
See Emergency Overflow Analysis at the end of Exhibit H.

Table 2 Proposed Conditions Detention Basin Data

Event	Peak Q In (cfs)	Tp In (min.)	Peak Q Out (cfs)	Tp Out (min)	Peak W.S.E.	Max. Storage Vol. (cf)
Regional Detention Basin						
2-Year	150.63	727	112.86	736	977.90	71,595
10-Year	252.22	727	250.18	728	978.68	86,933
25-Year	297.14	727	295.66	728	978.83	89,893
100-Year	376.17	727	374.44	727	979.07	94,622

As shown in the table above all proposed peak flowrates have been attenuated.

The modified basin shall be designed to attenuate the entire 25 acres from the Development in addition to bypassing another 39.64 acres of offsite tributary flow. The current police headquarters to the south of Lot 10 is to be transitioned into a Joint Operations Center (LSJOC) for both City police and fire. The LSJOC is currently under design and a storm report for the project has been included for reference in Exhibit I. The LSJOC will employ a new detention basin. The LSJOC attenuated runoff will be routed through enclosed storm sewer on Lot 10 for ultimate conveyance to the Development Regional Basin. Model parameters for both the proposed and routed hydrographs for LSJOC where inputted into our Hydraflow Model. Regulatory design criteria such as 24-hour rainfall amounts were utilized in the model. The Routed LSJOC hydrograph was combined with the Douglas Station Buildout hydrograph for a more accurate depiction of

basin inflows. The Combined Post-Development hydrograph was then routed through the proposed Regional Detention Basin to determine proposed peak discharge rates.

Table 3 below details the hydrologic properties for the Development and offsite sub-areas along with peak discharge rates for the 2, 10, 25 and 100-year storms.

Table 3 Proposed Conditions Sub-Area Data and Peak Discharge Rates

Sub-area	Area (ac.)	CN	Tc (min.)	Q2 (cfs)	Q10 (cfs)	Q25 (cfs)	Q100 (cfs)
Douglas Station Buildout	52.25	88	23.0	126.02	217.42	259.38	333.75
LSJOC	12.39	92	11.0*	48.12	78.19	91.87	116.01
Routed LSJOC	12.39			24.62	34.91	37.94	43.05
Combined Post-Development	64.64			150.63	252.22	297.14	376.17
Routed Combined Post	64.64			112.86	250.12	295.66	374.44

*Tc calibrated to approximate original report flows
Combined Post-Development = Douglas Station Buildout + Routed LSJOC

The Douglas Station Buildout hydrograph incorporates the entire Development plus the remaining offsite area not accounted for in the LSJOC hydrograph. The Routed Combined Post hydrograph accounts for the entire tributary flow leaving the basin. These peak discharge rates will be compared to the Existing Conditions Combined Pre-Development peak discharge rates identified in Table 1 to determine peak runoff control compliance as originally intended.

Table 4 Point of Interest Discharge Comparison

POI	Condition	Q2 (cfs)	Q10 (cfs)	Q25 (cfs)	Q100 (cfs)
Basin Outlet	Proposed	112.86	250.12	295.66	374.44
	Existing	136.53	250.35	304.20	400.52
	Difference	-23.67	-0.23	-8.54	-26.08

Proposed peak discharge rates for all regulatory design storms will be reduced below existing at the basin discharge as detailed in Table 4 above with the modification of the existing detention basin. The original 25-year pre vs post development peak runoff control design criteria will be met as originally designed.

Findings

The existing basin has been compromised by siltation and vegetative overgrowth. The existing basin shall be regraded to meet the original target release rate of the 25-year pre-development peak discharge rate with the ability to convey the 100-year peak discharge rate over the principal/emergency spillway. The broad crested earthen turf lined spillway shall be constructed along the west property line of Tract A for direct conveyance to the natural stream and minimal disturbance of adjacent land. The 100-year clogged condition will meet the 20-foot regulatory setback to both the north and west. The emergency spillway shall be 2.15 feet deep and have a freeboard in the 100-year clogged condition of 0.72 feet.

Conclusion

Based on the findings of this memo the existing regional detention basin shall be regraded to meet the original regulatory peak runoff control requirements. We are not familiar with the City's original freeboard requirements in relation to flow through the principal/emergency spillway. We are proposing a 0.72' freeboard for the clogged 100-year event over the spillway. Based on the amount of additional (12.5+/- acres) bypass runoff contributing to the basin from offsite and the existing 48 inch diameter control pipe we believe the stated freeboard is acceptable. The revitalized basin will attenuate all regulatory design storms while conveying the clogged 100-year storm over the emergency spillway. The proposed peak discharge rates will be below existing therefore no negative downstream effects are anticipated. The proposed project meets the City's original design criteria for peak runoff control therefore it is the opinion of this Professional Engineer that the project should be accepted as detailed in the study.

Matthew J Schlicht, PE-2006019708

EXHIBIT A

AERIAL IMAGE OF BASIN
&
AERIAL IMAGE OF SURROUNDING AREA

50 SE 30th Street Lee's Summit, MO 64082
P: (816) 623-9888 F: (816) 623-9849 www.engineeringsolutionskc.com

REGIONAL
DETENTION
BASIN

Main St

NW Sloan


Victoria Park Lot 9 (LSMO)
LOT 10
NW Main St
NW Victoria Dr
NE Victoria Dr
NE Douglas St
NE Grand Ave
NE Magnolia St
NE Buttonwood Ave
NE Beacon Ave
NE Floriewood Ave
NE Dreamweaver Ave
NW Sloan
NE Tudor Rd
NE Tudor Rd
NE Tudor Rd
NW Commerce Dr
NE Douglas St
Outerview Rd
1580 ft
470

EXHIBIT B

DOUGLAS STATION FINAL PLAT EXHIBIT

50 SE 30th Street Lee's Summit, MO 64082
P: (816) 623-9888 F: (816) 623-9849 www.engineeringsolutionskc.com

2002I0070765

Filed for Record this 19
day of August, 2002
at 1 O'Clock 19 Minutes PM.
Recorded in Book 772 At Page 58
Director of Records

By _____ Deputy

Recorder's Fee $ 90-

DOUGLAS STATION COMMERCIAL PARK
LOTS 1 THROUGH 10 & TRACT "A"

A SUBDIVISION OF LAND IN
THE NORTHEAST 1/4 OF SECTION 31, TOWNSHIP 48, RANGE 31
IN LEE'S SUMMIT, JACKSON COUNTY, MISSOURI

THIS IS TO CERTIFY THAT THE WITHIN PLAT OF "DOUGLAS STATION COMMERCIAL PARK – LOTS 1 THOUGH 10 & TRACT A" WAS SUBMITTED TO AND DULY APPROVED BY THE MAYOR AND CITY COUNCIL OF THE CITY OF LEE'S SUMMIT, MISSOURI, THIS 25th DAY OF July, 20 02 BY ORDINANCE NO. 5361

KAREN R. MESSERLI, MAYOR — DATE 8/13/02

MARCIA L. ROSENQUIST, PLANNING COMMISSION SEC. — DATE 8-13-02

ROBERT G. MCKAY, AICP, DIRECTOR OF PLANNING & DEVELOPMENT — DATE 8-7-02

DENISE R. CHISUM, CITY CLERK — DATE 8/13/02

DENA E. MEZGER, P.E., CITY ENGINEER — DATE 8/8/02

JACKSON COUNTY ASSESSOR — DATE 8-19-02

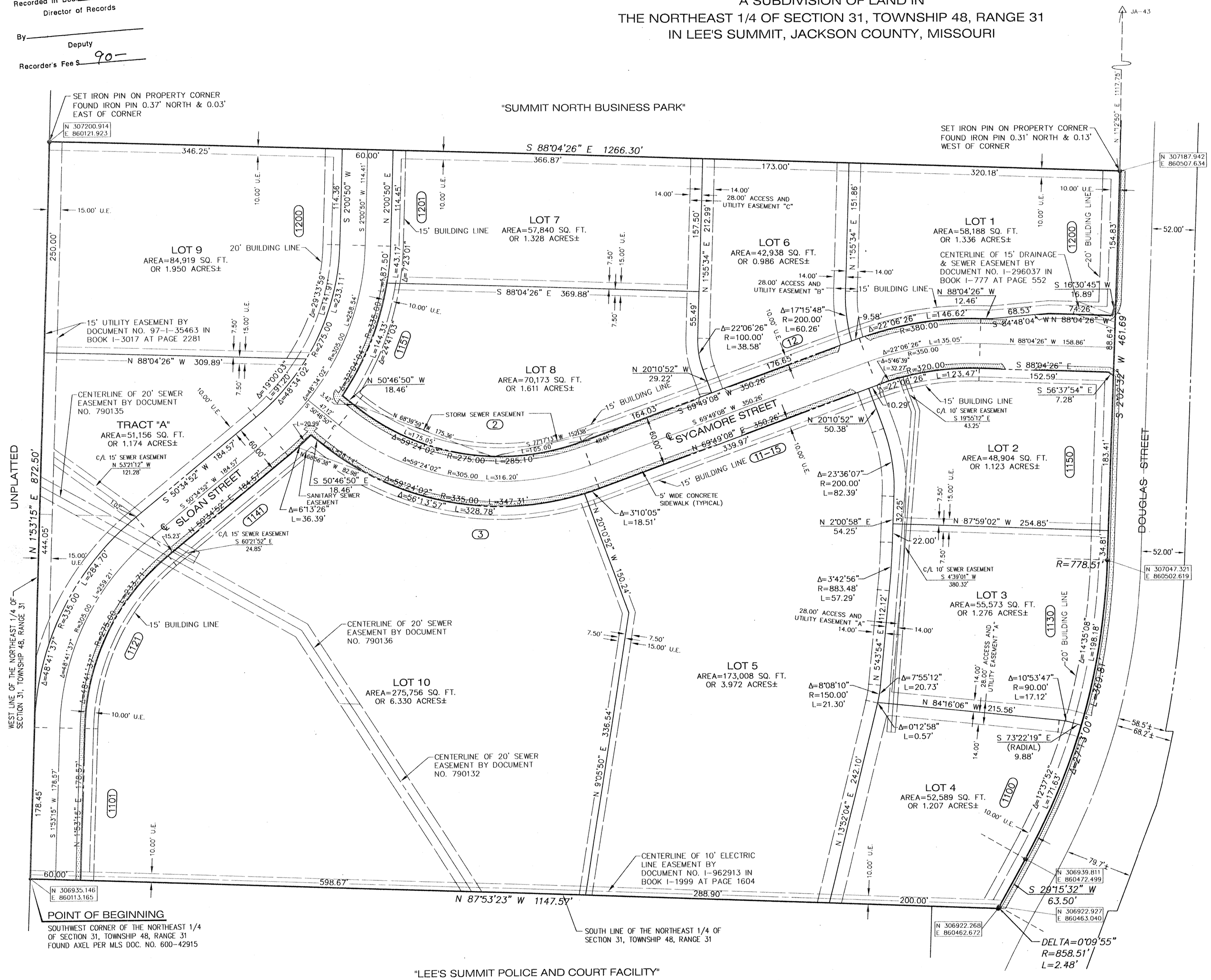


TABLE OF MINIMUM BUILDING FLOOR ELEVATIONS	
LOT NO.	MINIMUM FINISHED FLOOR ELEVATION
1	1005.9
2	1007.5
3	1012.1
4	1015.1
5	993.6
6	998.9
7	983.5
8	980.5
9	979.9
10	975.6

NOTE: THE ABOVE ELEVATIONS WERE PROVIDED TO THIS COMPANY BY DAVIDSON DESIGN GROUP AND REFER TO USGS DATUM.

THE BEARING SYSTEM SHOWN HEREON IS BASED ON THE MISSOURI STATE PLANE SYSTEM – WEST ZONE

SCALE 1 INCH = 60 FEET

60 30 0 60 120 180

SCALE IN FEET

RETURN TO:
Chicago Title Insurance Company
106 W. 11th Street Ste 1800
Kansas City, Missouri 64105
Attn: Pat Jenning

● DENOTES IRON PIN SET ON PROPERTY CORNER UNLESS OTHERWISE NOTED
(####) DENOTES SUGGESTED STREET ADDRESS

SHEET 2 OF 2

"LEE'S SUMMIT POLICE AND COURT FACILITY"

THE COORDINATES SHOWN HEREON ARE IN METERS AND REFER TO THE MISSOURI STATE PLANE COORDINATE SYSTEM OF 1983 BASED ON KANSAS CITY METRO CONTROL POINT JA-43 USING A GRID FACTOR OF 0.9998979.

APPLICANT/DEVELOPER

DOUGLAS STATION, LLC
1725 NE RICE ROAD
LEE'S SUMMIT, MISSOURI 64086

SURVEYOR'S CERTIFICATION: I HEREBY CERTIFY THAT THE PLAT OF "DOUGLAS STATION COMMERCIAL PARK" IS BASED ON AN ACTUAL SURVEY MADE BY ME OR UNDER MY DIRECT SUPERVISION AND THAT SURVEY MEETS OR EXCEEDS THE CURRENT MINIMUM STANDARDS FOR PROPERTY BOUNDARY SURVEYS, AS ESTABLISHED BY THE MISSOURI BOARD FOR ARCHITECTS, PROFESSIONAL ENGINEERS, AND LAND SURVEYORS.

8/1/02

ANDERSON
SURVEY COMPANY
203 N. W. EXECUTIVE WAY
LEE'S SUMMIT, MISSOURI 64063
(816) 246-5050

39590FNL.DWG 31-48-31 02-02-39590-1

08/01/02 04:41:24 PM

EXHIBIT C

PRELIMINARY AS-BUILT MICRO STORM WATER DRAINAGE STUDY EXCERPTS QUIST ENGINEERING INC. JULY 15, 2021

50 SE 30th Street Lee's Summit, MO 64082
P: (816) 623-9888 F: (816) 623-9849 www.engineeringsolutionskc.com

PRELIMINARY AS BUILT
MICRO STORM WATER DRAINAGE STUDY

For:
DOUGLAS STATION COMMERCIAL PARK
LOTS 1 THRU 10 & TRACT "A"
Lee's Summit, Jackson County, Missouri

Water Sheds:
Little Cedar Creek Water shed

July 15, 2021

PREPARED BY:

Quist Engineering Inc.
821 NE Columbus St.
Lee's Summit, MO 64063
Phone: (816) 550-5675

STATE OF MISSOURI
ROBERT A. WALQUIST
NUMBER E-2001018825
7/15/21
REGISTERED PROFESSIONAL ENGINEER

Robert Walquist, PE

TABLE OF CONTENTS

3. GENERAL INFORMATION AND SITE CONDITIONS.

This study is to evaluate the existing regional basin for the "Douglas Station Commercial Park" Subdivision in Lee's Summit, Jackson County, Missouri. The total site area = 25.03 acres

The site is currently fully developed commercial land less lot 10. The site drains northwest into the existing regional basin. The existing regional basin is located on Tract A and is owned by "Douglas Station LLC" believed to be the original developer or owners association. All flow to the existing basin is from underground conveyance system that enters the basin from the north east corner of the basin from a 54" pipe.

The original design of the basin shows 24.5 acres of the development flowing into the basin. We feel that existing contours and conveyance systems does route 24.5ac to the existing basin. The original design shows an additional 27ac off site area flows thru the site into the basin from the south across lot 10. We found that this is accurate. The off site area flowing onto lot 10 is the out fall from a detention basin from a commercial development to the south of lot 10.

The current condition of the basin is poor with lots of trees and vegetation. The contours of the basin do not match the original design. (See the Storm Drainage Plan)

4. OVERVIEW OF THE PROPOSED DESIGN

The storm drainage study was preformed to evaluate the original design and as built performance of the existing regional basin. The original design was to restrict the runoff from the developed site to the pre development conditions for the 25 yr storm event

Current APWA standards. The following max runoff rate; the 2yr less than or equal to 0.5 cfs/acre, the 10yr less than or equal to 2.0 cfs/acre, and the 100yr less than or equal to 3.0 cfs/acre.

5. METHODOLOGY & EVALUATION OF EXISTING DETENTION DESIGN

Currently there is 24.5 acres of onsite developed area flowing to the existing basin along with 27aces of offsite area. Total flow to basin is 24.5 onsite area and 27ac off site area. (See The Drainage area map.)

The current basin outfall structure is a 48" cmp pipe with no structure of restrictive plate.

All calculation for the detention basin was done using the Software Hydra flow. This program utilized the SCS Method to model the different storm events. The following "CN" values where used:

On Site	CN
Pre Development	74
Post Development	88

General Modeling Information

Hyd #	Description
1	Pre development runoff from the site (Area 24ac CN= 74)
2	Total on site area draining into Exiting Basin (Area 24ac CN= 88)
3	Total off site area draining into Existing Basin (Area =27ac CN=78)
4	Total combined runoff of hyd #2 and #23that will flow into Existing Basin
5	Total flow out of the Existing Basin

Required Pre-Development Flow Rates
The following are the runoff rate for the different storm events for the pre development 25 ac site:

Storm Event	Runoff (cfs) (HYD #1)
2yr	9.68
10yr	46.72
25yr	79.85
50yr	103.52
100yr	130.54

The following are the required Current APWA maximum runoff rate for the different storm events for the post development 25 ac site:

Storm Event	max rates	Runoff (cfs)
2yr	0.5 x 25	12.5
10yr	2.0 x 25	50
100yr	3.0 x 25	75

Per & Post-Development Flow Rates for the Development
The following is the summery of the modal (See Hydrologic Modal for additional calculations)

As Designed

Storm Event	Total On Site running into Basin (cfs) (HYD # 2)	Total Off Site running into Basin (cfs) (HYD # 3)	Total combined runoff into Basin (cfs) (HYD #4)	Total runoff form the Basin cfs) (HYD #5)	Total site Runoff (cfs) (HYD #5 - #3)	Max Elevation
2yr	30.45	13.11	41.07	31.50	18.39 > 9.68	974.80
10yr	79.87	49.70	122.39	97.89	48.19 > 46.72	977.80
25yr	117.21	81.52	187.07	136.19	54.67< 79.85	979.76
50yr	103.83	103.83	231.51	155.07	52.85 < 103.52	981.26
100yr	170.41	129.07	281.32	-	- > 130.54	over weir

As Built

Storm Event	Total On Site running into Basin (cfs) (HYD # 2)	Total Off Site running into Basin (cfs) (HYD # 3)	Total combined runoff into Basin (cfs) (HYD #4)	Total runoff form the Basin cfs) (HYD #5)	Total site Runoff (cfs) (HYD #5 - #3)	Max Elevation
2yr	30.45	13.11	41.07	38.69	25.58 > 9.68	975.23
10yr	79.87	49.70	122.39	105.75	56.05 > 46.72	978.08
25yr	117.21	81.52	187.07	---	---> 79.85	over weir
50yr	103.83	103.83	231.51	---	---> 103.52	over weir
100yr	170.41	129.07	281.32	---	---> 130.54	over weir

7. Conclusion & Recommendations

We feel that the Existing basin is in disrepair and needs to be cleaned out of all vegetation and regarded to original design. It is worthy to note that the outfall pipe from the existing basin is within 500 feet of a designated 100yr flood plan. We feel that after the recommended maintenance of the original basin it will operate as desiged.

8. Exhibits:

- **SITE LOCATION MAP**
- **USGS MAP**
- **AERIAL VIEW**
- **FIRMET MAP**
- **CITY OUFALL MAP**
- **STORM DRAINAGE MAP**
- **HYDROLOGIC MODEL**

EXHIBIT D

IMAGE EXISTING BASIN VEGETATIVE OVERGROWTH

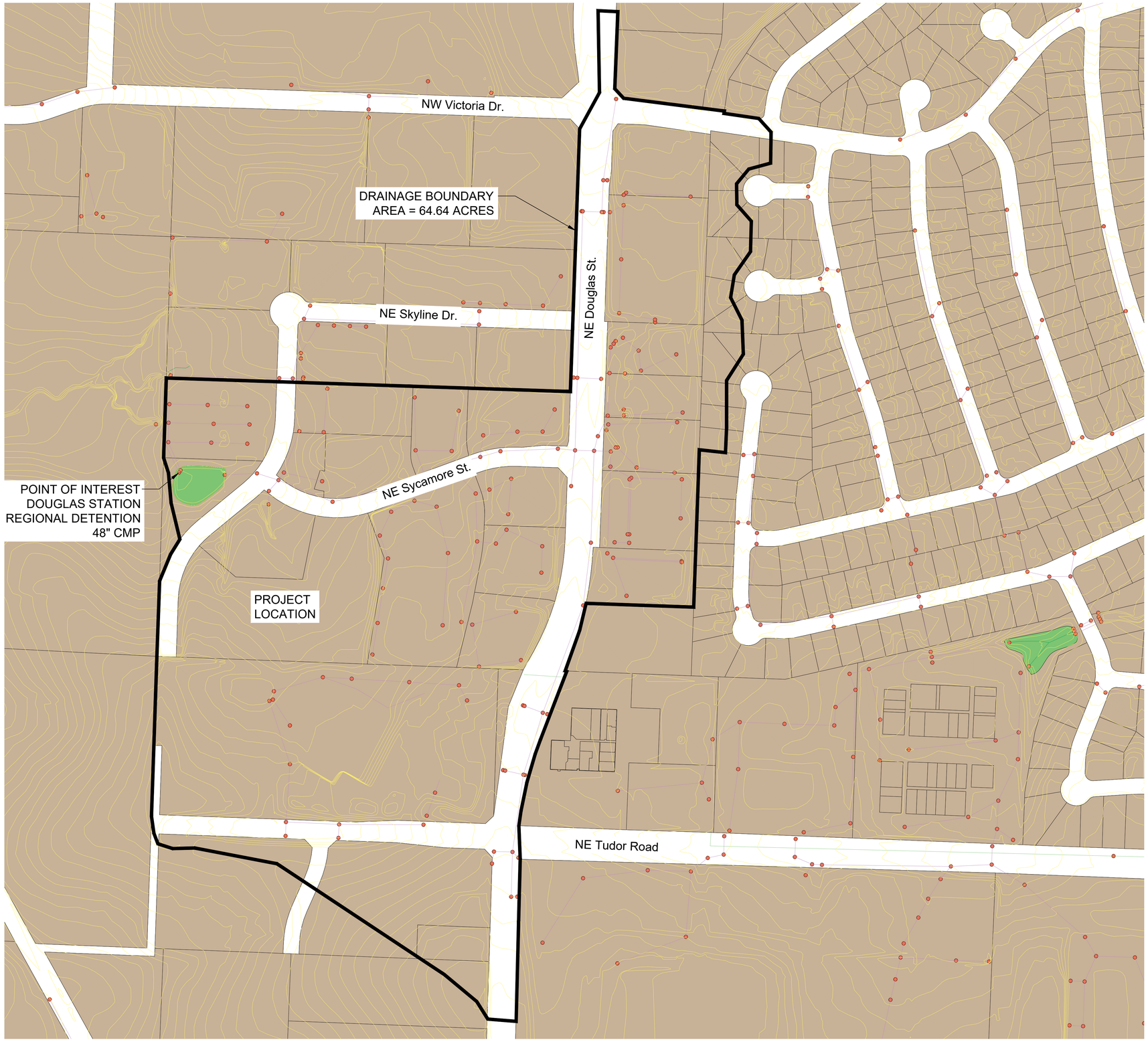
50 SE 30th Street Lee's Summit, MO 64082
P: (816) 623-9888 F: (816) 623-9849 www.engineeringsolutionskc.com


1200 NW Sloan
Exit Street View
© 2025 Google

EXHIBIT E

OVERALL DRAINAGE MAP

50 SE 30th Street Lee's Summit, MO 64082
P: (816) 623-9888 F: (816) 623-9849 www.engineeringsolutionskc.com



North

0 75' 150' 300'

WATERSHED MAP

SCALE: 1" = 150'

ENGINEERING SOLUTIONS
ENGINEERING & SURVEYING
50 SE 30TH STREET
LEE'S SUMMIT, MO 64082
P:(816) 623-0888 F:(816)623-0889

Professional Registration
Missouri
Engineering 2005032186-D
Surveying 2005008319-D
Kansas
Engineering E-1695
Surveying LS-218
Oklahoma
Engineering 6254
Nebraska
Engineering CA2821

Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri

Project: DOUGLAS STATION LSMO
Issue Date: August 11, 2023

WATERSHED MAP

Construction Plans for:
Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri

STATE OF MISSOURI
MATTHEW J. SCHLICHT
NUMBER PE-2006019708
PROFESSIONAL ENGINEER

Matthew J. Schlicht
MO PE 2006019708
KS PE 19071
OK PE 25226
NE PE E-14335

REVISIONS

1 REV. 3/7/2024
2 REV. 4/18/2024
3 REV. 4/26/2024
4 REV. 1/27/2025

EXHIBIT

EXHIBIT F

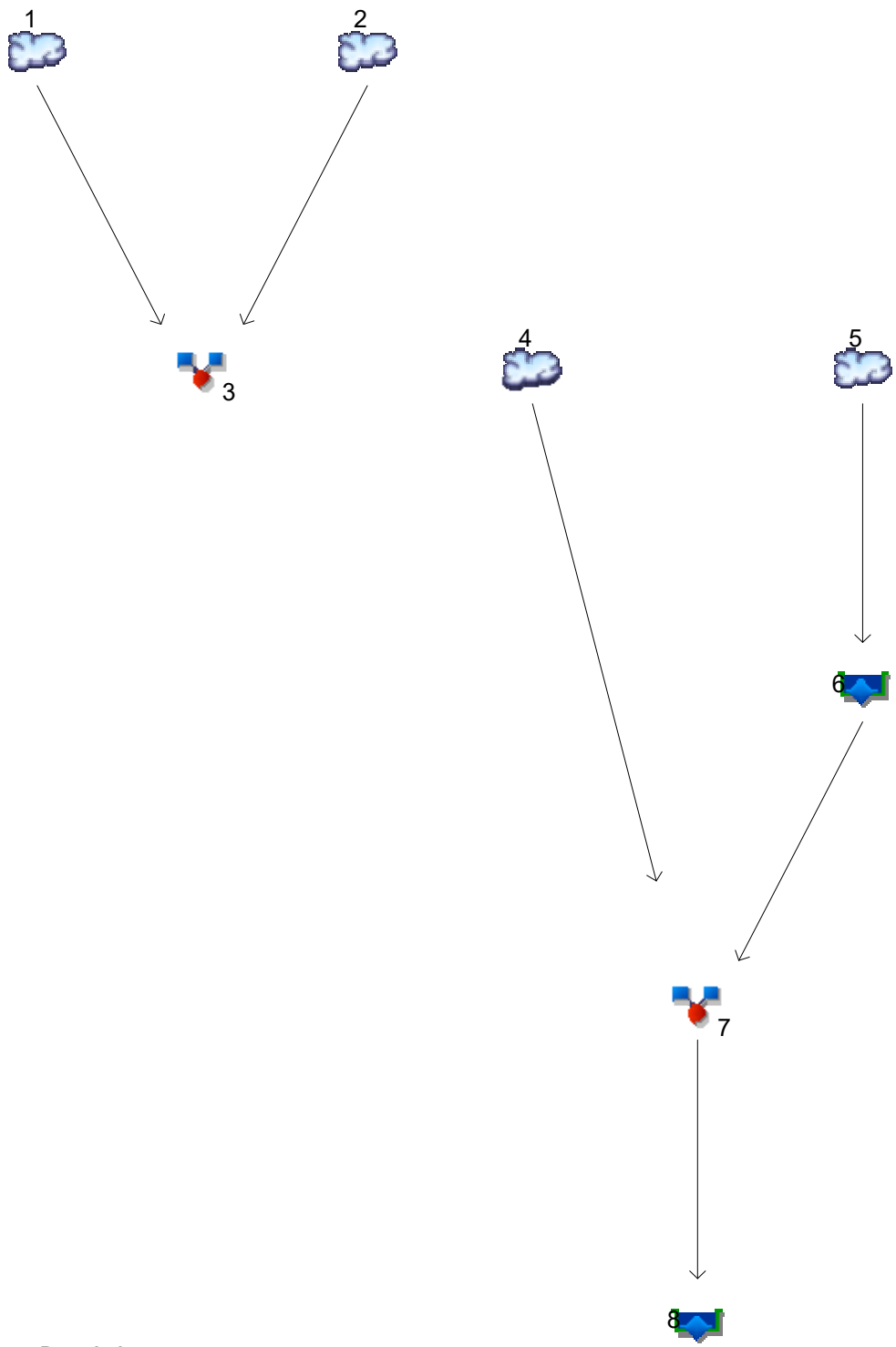
HYDRAFLOW REPORT

50 SE 30th Street Lee's Summit, MO 64082
P: (816) 623-9888 F: (816) 623-9849 www.engineeringsolutionskc.com

Hydraflow Table of Contents

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Friday, 03 / 14 / 2025

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Undeveloped Douglas Station
2	SCS Runoff	Offsite to Basin
3	Combine	Combined Pre-Development
4	SCS Runoff	Douglas Station Buildout
5	SCS Runoff	LSJOC
6	Reservoir	Routed LSJOC
7	Combine	Combined Post-Development
8	Reservoir	Routed Combined Post

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	41.31	-------	-------	89.86	113.76	-------	157.36	Undeveloped Douglas Station
2	SCS Runoff	------	-------	98.97	-------	-------	168.33	200.16	-------	256.40	Offsite to Basin
3	Combine	1, 2	-------	136.53	-------	-------	250.35	304.20	-------	400.52	Combined Pre-Development
4	SCS Runoff	------	-------	126.02	-------	-------	217.42	259.38	-------	333.75	Douglas Station Buildout
5	SCS Runoff	------	-------	48.12	-------	-------	78.19	91.87	-------	116.01	LSJOC
6	Reservoir	5	-------	24.62	-------	-------	34.91	37.94	-------	43.05	Routed LSJOC
7	Combine	4, 6	-------	150.63	-------	-------	252.22	297.14	-------	376.17	Combined Post-Development
8	Reservoir	7	-------	112.86	-------	-------	250.18	295.66	-------	374.44	Routed Combined Post

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

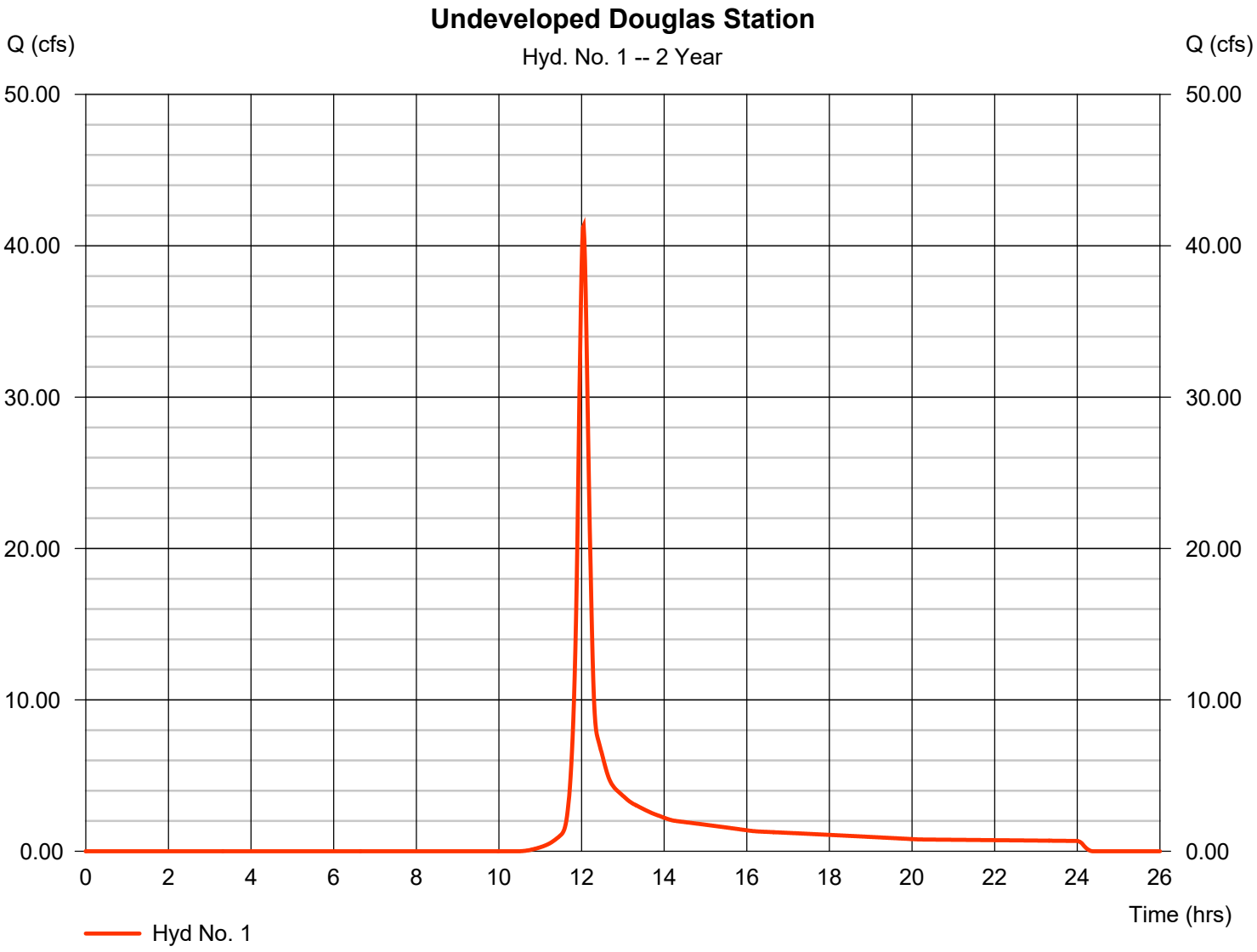
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	41.31	1	723	113,776	------	------	------	Undeveloped Douglas Station
2	SCS Runoff	98.97	1	727	338,789	------	------	------	Offsite to Basin
3	Combine	136.53	1	725	452,565	1, 2	------	------	Combined Pre-Development
4	SCS Runoff	126.02	1	727	429,882	------	------	------	Douglas Station Buildout
5	SCS Runoff	48.12	1	720	121,583	------	------	------	LSJOC
6	Reservoir	24.62	1	728	103,382	5	999.62	48,172	Routed LSJOC
7	Combine	150.63	1	727	533,264	4, 6	------	------	Combined Post-Development
8	Reservoir	112.86	1	736	533,259	7	977.90	71,595	Routed Combined Post

Hydrograph Report

Hyd. No. 1

Undeveloped Douglas Station

Hydrograph type	=	SCS Runoff	Peak discharge	=	41.31 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.05 hrs
Time interval	=	1 min	Hyd. volume	=	113,776 cuft
Drainage area	=	25.000 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.00 min
Total precip.	=	3.52 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

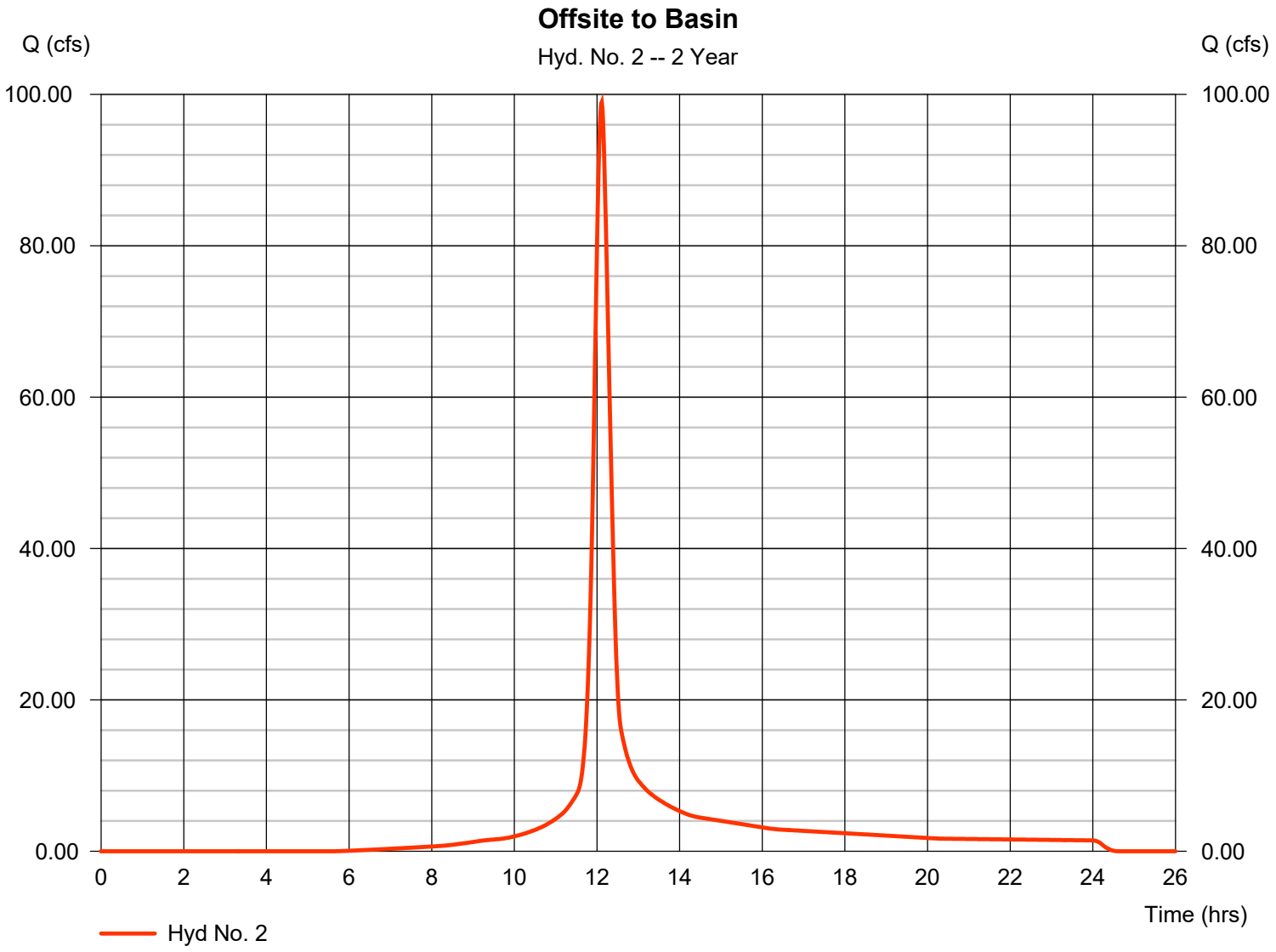


Hydrograph Report

Hyd. No. 2

Offsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	98.97 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.12 hrs
Time interval	=	1 min	Hyd. volume	=	338,789 cuft
Drainage area	=	39.640 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	23.00 min
Total precip.	=	3.52 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

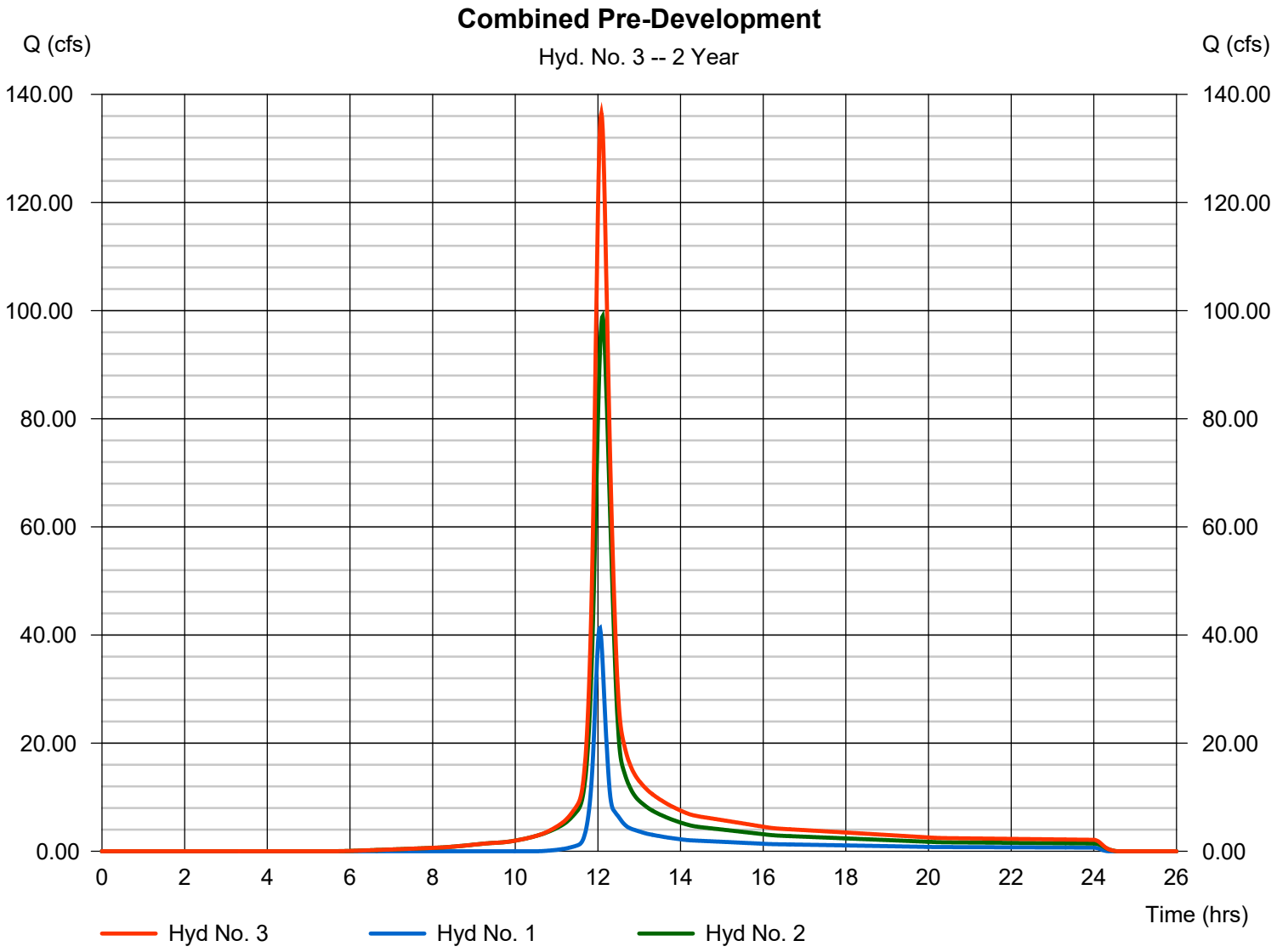


Hydrograph Report

Hyd. No. 3

Combined Pre-Development

Hydrograph type	=	Combine	Peak discharge	=	136.53 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.08 hrs
Time interval	=	1 min	Hyd. volume	=	452,565 cuft
Inflow hyds.	=	1, 2	Contrib. drain. area	=	64.640 ac

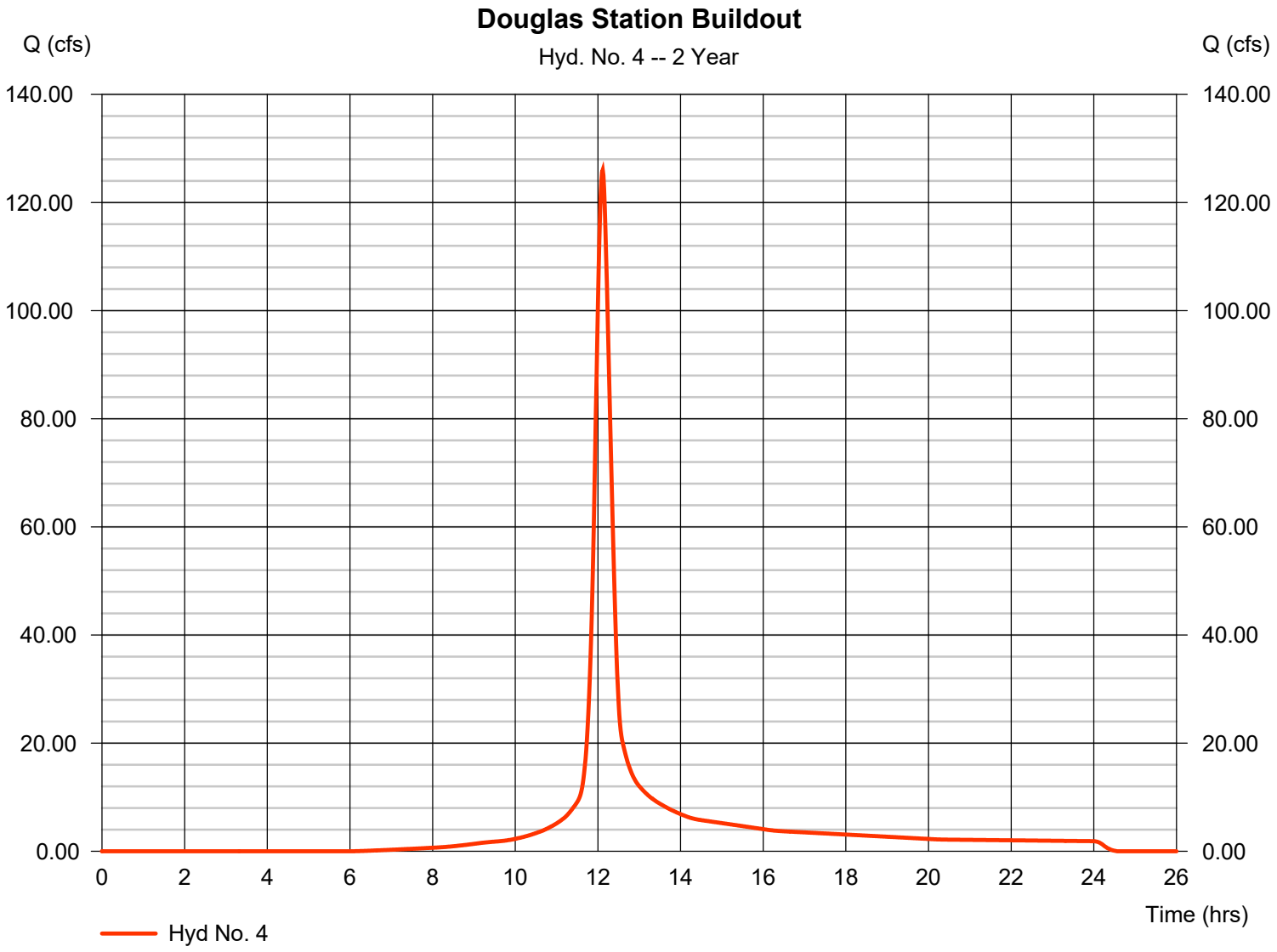


Hydrograph Report

Hyd. No. 4

Douglas Station Buildout

Hydrograph type	=	SCS Runoff	Peak discharge	=	126.02 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.12 hrs
Time interval	=	1 min	Hyd. volume	=	429,882 cuft
Drainage area	=	52.250 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	23.00 min
Total precip.	=	3.52 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

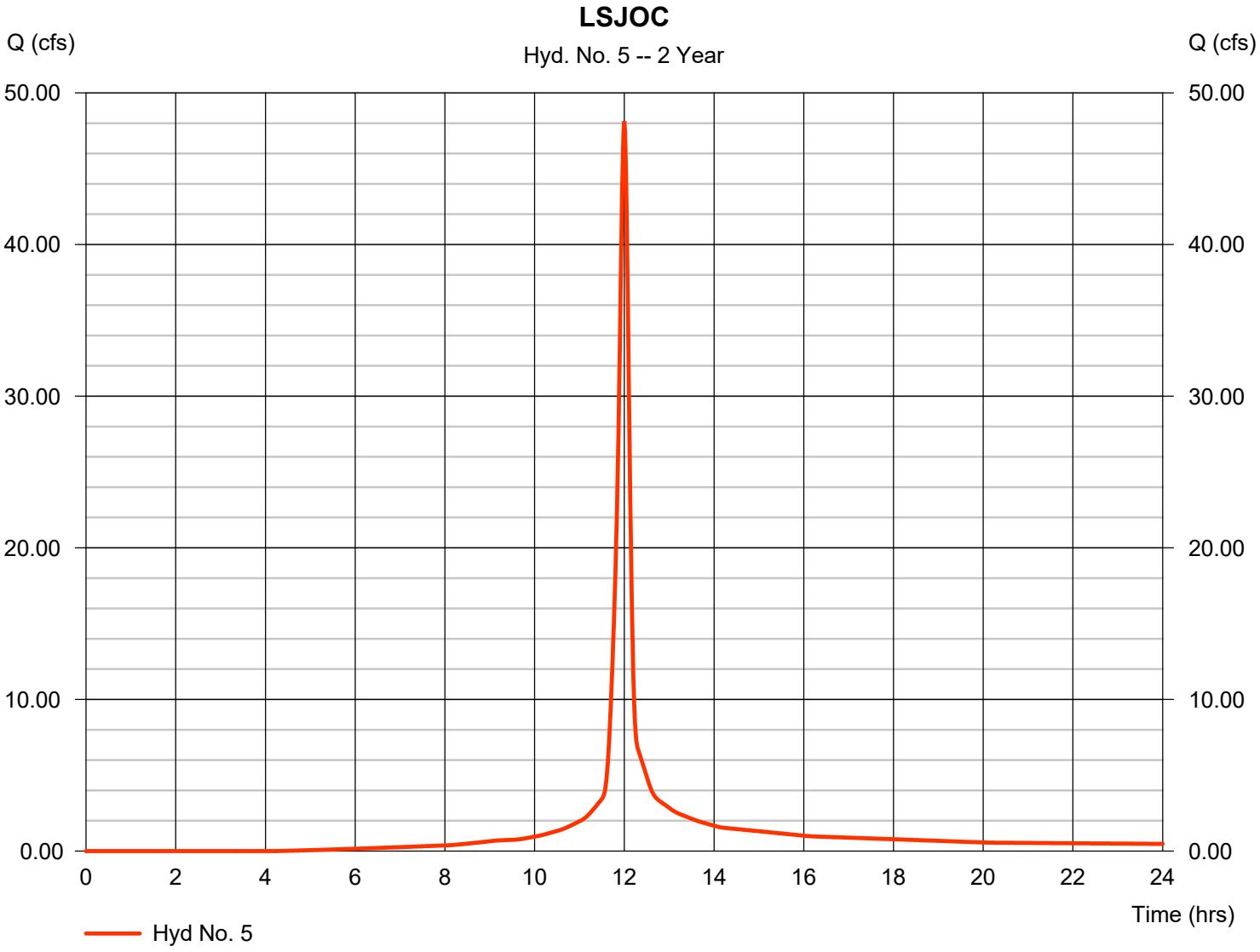


Hydrograph Report

Hyd. No. 5

LSJOC

Hydrograph type	=	SCS Runoff	Peak discharge	=	48.12 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.00 hrs
Time interval	=	1 min	Hyd. volume	=	121,583 cuft
Drainage area	=	12.390 ac	Curve number	=	92
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.00 min
Total precip.	=	3.52 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



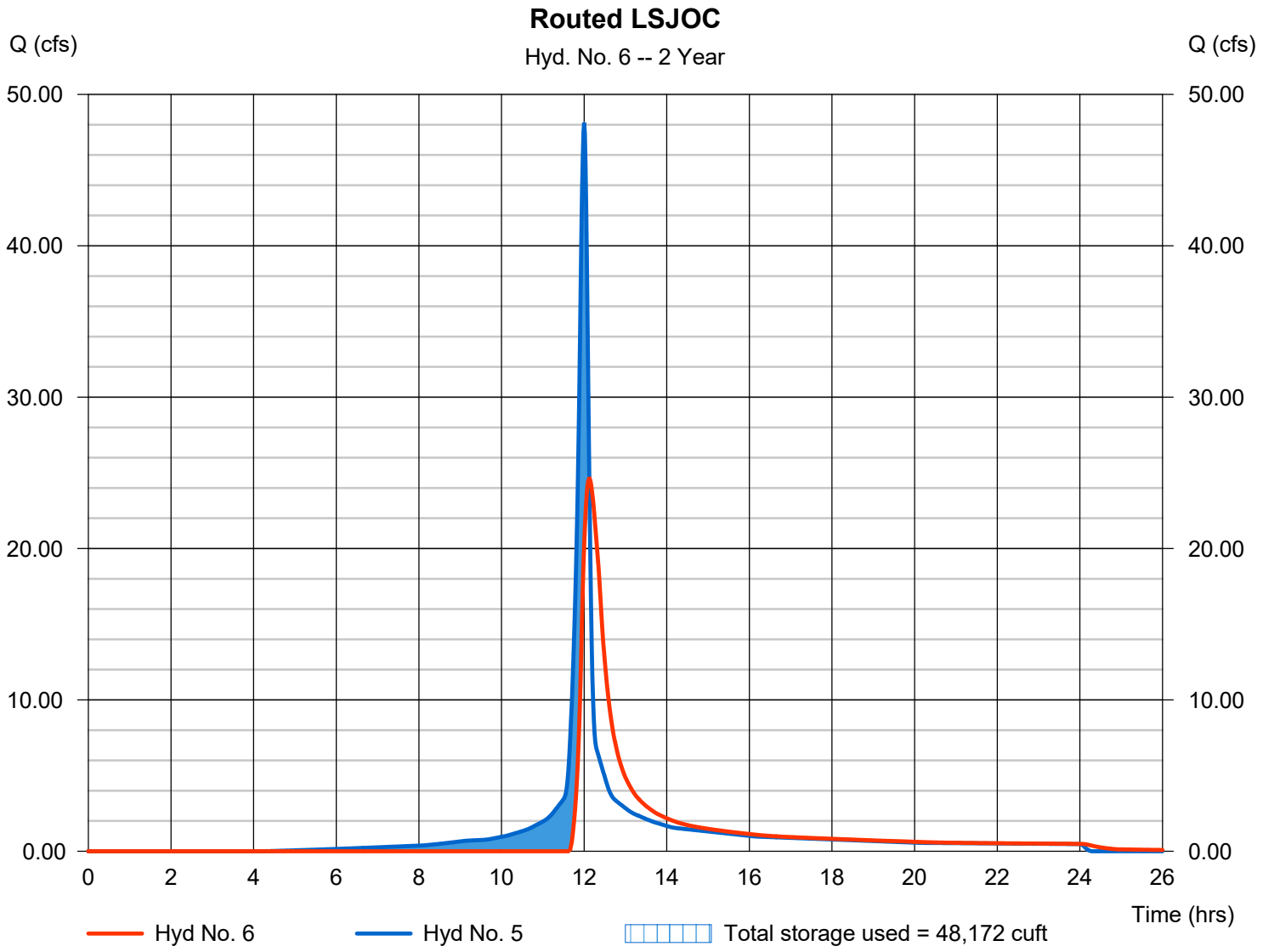
Hydrograph Report

Hyd. No. 6

Routed LSJOC

Hydrograph type	=	Reservoir	Peak discharge	=	24.62 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.13 hrs
Time interval	=	1 min	Hyd. volume	=	103,382 cuft
Inflow hyd. No.	=	5 - LSJOC	Max. Elevation	=	999.62 ft
Reservoir name	=	LSJOC Pond	Max. Storage	=	48,172 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - LSJOC Pond

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 994.78 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	994.78	00	0	0
0.22	995.00	31	3	3
1.22	996.00	5,670	2,851	2,854
2.22	997.00	8,866	7,268	10,122
3.22	998.00	14,193	11,530	21,651
4.22	999.00	16,691	15,442	37,094
5.22	1000.00	19,190	17,941	55,034
6.22	1001.00	21,688	20,439	75,473
7.22	1002.00	24,186	22,937	98,410
8.22	1003.00	26,685	25,435	123,846
9.22	1004.00	29,183	27,934	151,779

Culvert / Orifice Structures

		[A]	[B]	[C]	[PrfRsr]
Rise (in)	=	30.00	3.00	16.00	0.00
Span (in)	=	30.00	3.00	42.00	0.00
No. Barrels	=	1	1	1	0
Invert El. (ft)	=	994.78	1001.00	997.75	0.00
Length (ft)	=	59.30	0.00	0.00	0.00
Slope (%)	=	0.84	0.00	0.00	n/a
N-Value	=	.012	.013	.013	n/a
Orifice Coeff.	=	0.60	0.60	0.60	0.60
Multi-Stage	=	n/a	Yes	Yes	No

Weir Structures

		[A]	[B]	[C]	[D]
Crest Len (ft)	=	1.00	0.00	0.00	0.00
Crest El. (ft)	=	1001.00	0.00	0.00	0.00
Weir Coeff.	=	3.33	3.33	3.33	3.33
Weir Type	=	Rect	---	---	---
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

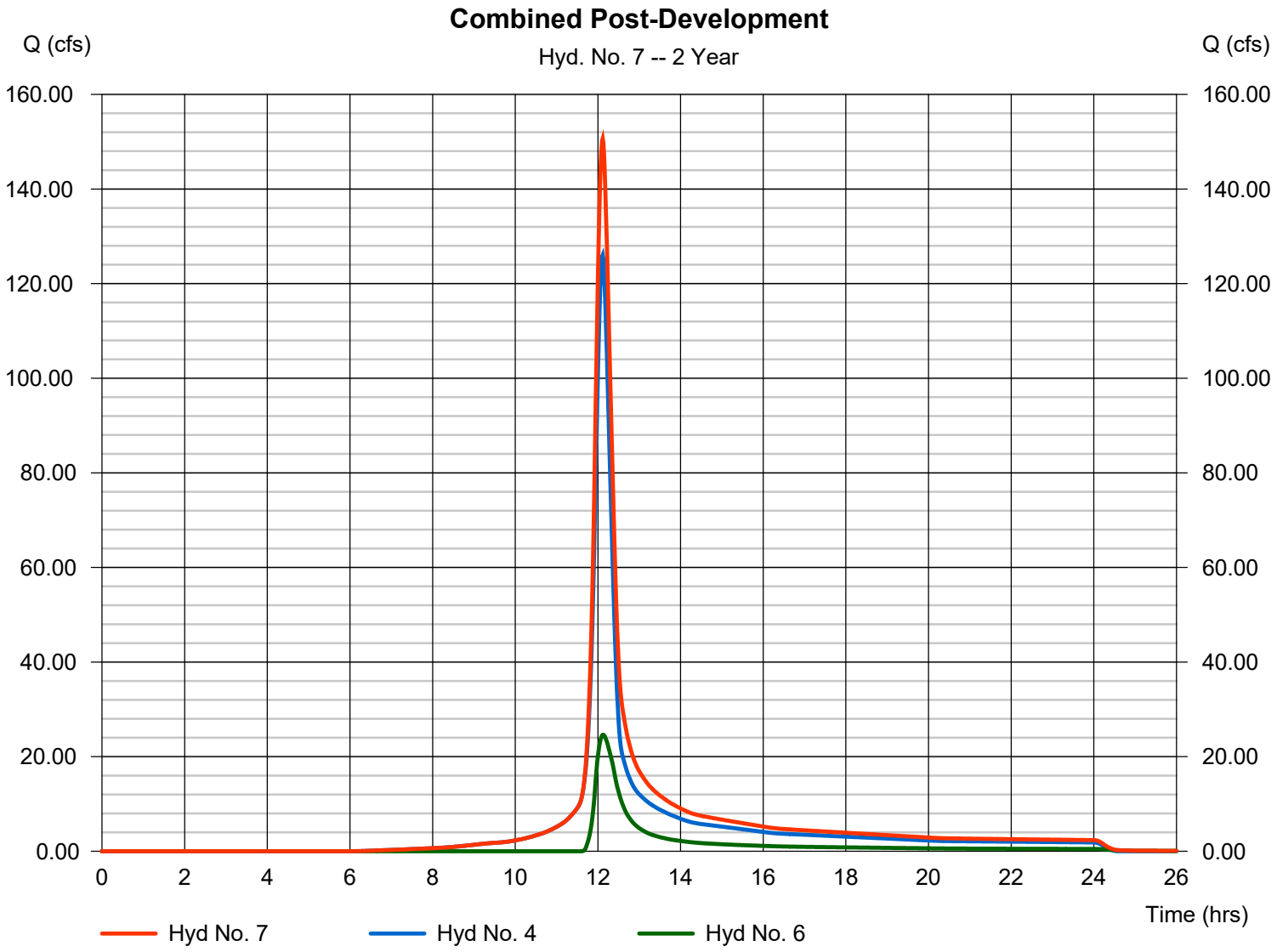
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	994.78	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.22	3	995.00	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
1.22	2,854	996.00	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
2.22	10,122	997.00	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
3.22	21,651	998.00	1.55 ic	0.00	1.49 ic	---	0.00	---	---	---	---	---	1.490
4.22	37,094	999.00	16.66 oc	0.00	16.65 ic	---	0.00	---	---	---	---	---	16.65
5.22	55,034	1000.00	28.27 oc	0.00	28.27 ic	---	0.00	---	---	---	---	---	28.27
6.22	75,473	1001.00	36.05 oc	0.00	36.05 ic	---	0.00	---	---	---	---	---	36.05
7.22	98,410	1002.00	41.61 ic	0.22 ic	38.06 ic	---	3.33	---	---	---	---	---	41.61
8.22	123,846	1003.00	47.83 ic	0.32 ic	38.09 ic	---	9.42	---	---	---	---	---	47.83
9.22	151,779	1004.00	54.31 ic	0.39 ic	36.84 ic	---	17.08 s	---	---	---	---	---	54.31

Hydrograph Report

Hyd. No. 7

Combined Post-Development

Hydrograph type	=	Combine	Peak discharge	=	150.63 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.12 hrs
Time interval	=	1 min	Hyd. volume	=	533,264 cuft
Inflow hyds.	=	4, 6	Contrib. drain. area	=	52.250 ac



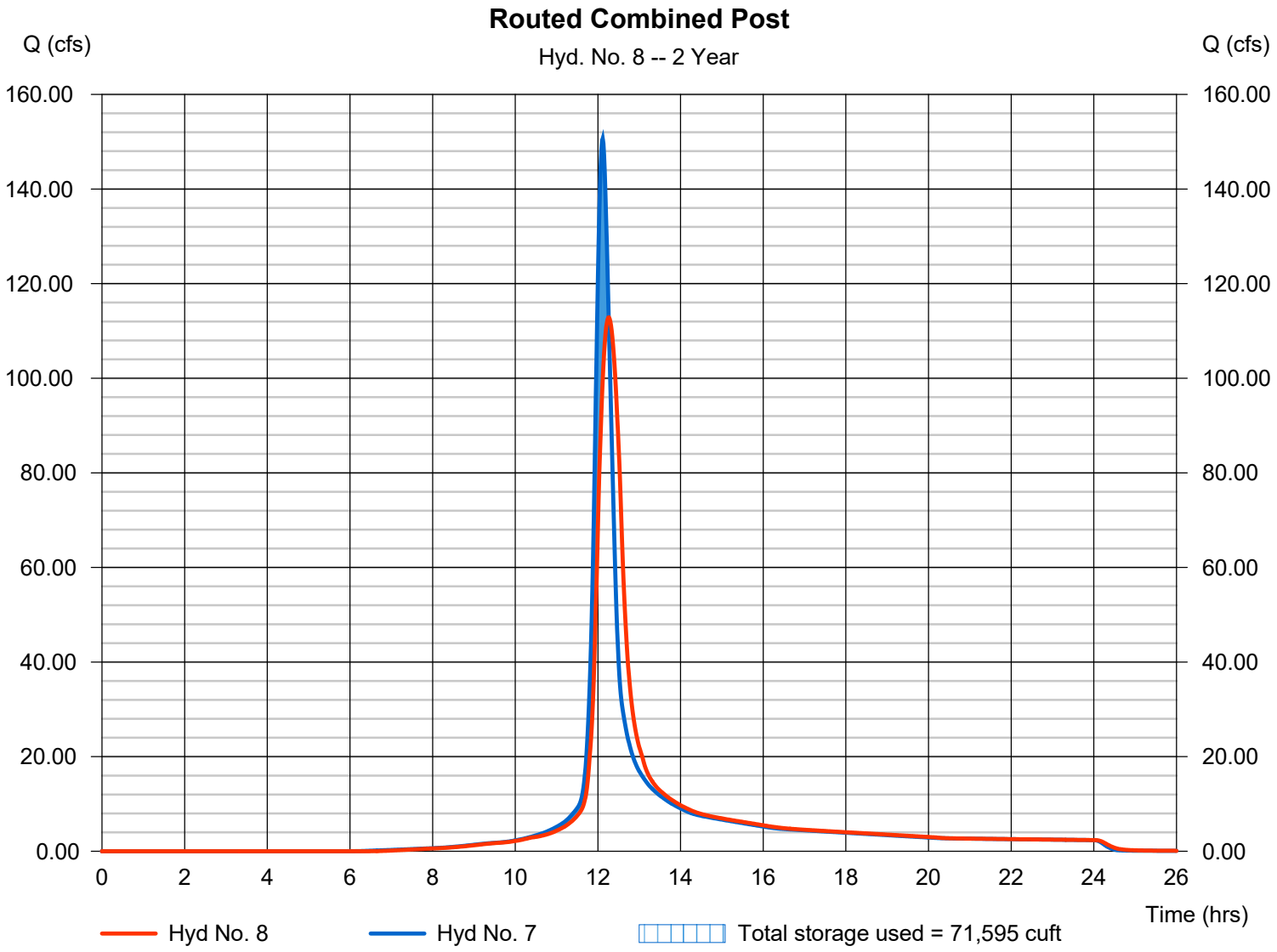
Hydrograph Report

Hyd. No. 8

Routed Combined Post

Hydrograph type	=	Reservoir	Peak discharge	=	112.86 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.27 hrs
Time interval	=	1 min	Hyd. volume	=	533,259 cuft
Inflow hyd. No.	=	7 - Combined Post-Development	Max. Elevation	=	977.90 ft
Reservoir name	=	Douglas Station Basin	Max. Storage	=	71,595 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Douglas Station Basin

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 972.42 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	972.42	00	0	0
0.58	973.00	4,865	1,411	1,411
1.58	974.00	12,806	8,836	10,246
2.58	975.00	14,246	13,526	23,772
3.58	976.00	15,744	14,995	38,767
4.58	977.00	17,304	16,524	55,291
5.58	978.00	18,924	18,114	73,405
6.58	979.00	20,601	19,763	93,168
7.58	980.00	22,335	21,468	114,636

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 48.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 972.42	0.00	0.00	0.00
Length (ft)	= 158.74	0.00	0.00	0.00
Slope (%)	= 1.12	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 85.00	0.00	0.00	0.00
Crest El. (ft)	= 978.00	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (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).

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	972.42	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.58	1,411	973.00	2.93 ic	---	---	---	0.00	---	---	---	---	---	2.928
1.58	10,246	974.00	19.79 ic	---	---	---	0.00	---	---	---	---	---	19.79
2.58	23,772	975.00	46.91 ic	---	---	---	0.00	---	---	---	---	---	46.91
3.58	38,767	976.00	76.43 ic	---	---	---	0.00	---	---	---	---	---	76.43
4.58	55,291	977.00	97.18 ic	---	---	---	0.00	---	---	---	---	---	97.18
5.58	73,405	978.00	114.47 ic	---	---	---	0.00	---	---	---	---	---	114.47
6.58	93,168	979.00	129.47 ic	---	---	---	221.00	---	---	---	---	---	350.47
7.58	114,636	980.00	142.91 ic	---	---	---	625.08	---	---	---	---	---	767.99

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

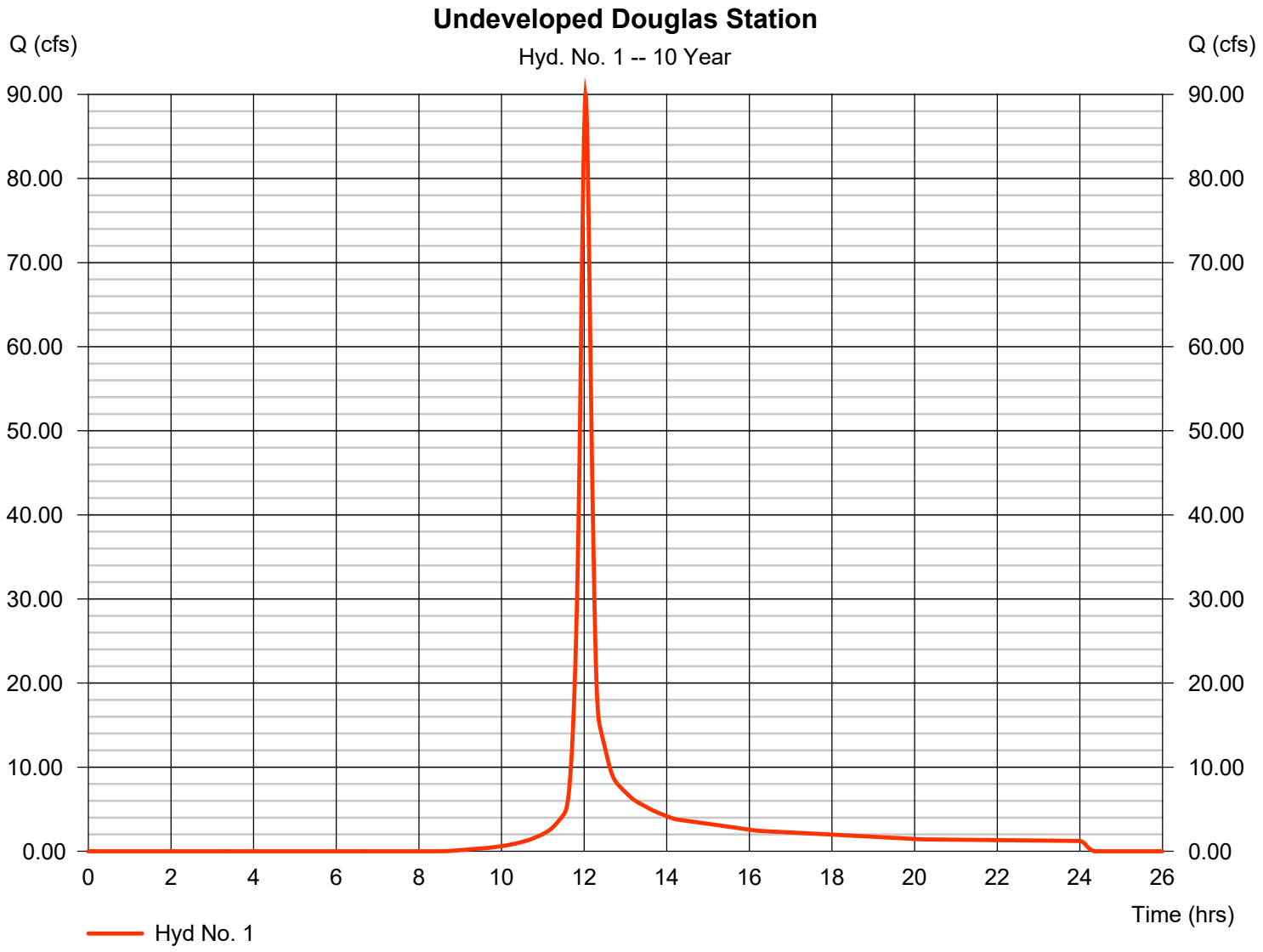
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	89.86	1	722	241,647	------	------	------	Undeveloped Douglas Station
2	SCS Runoff	168.33	1	727	588,558	------	------	------	Offsite to Basin
3	Combine	250.35	1	724	830,205	1, 2	------	------	Combined Pre-Development
4	SCS Runoff	217.42	1	727	755,928	------	------	------	Douglas Station Buildout
5	SCS Runoff	78.19	1	720	203,770	------	------	------	LSJOC
6	Reservoir	34.91	1	728	185,569	5	1000.83	72,003	Routed LSJOC
7	Combine	252.22	1	727	941,496	4, 6	------	------	Combined Post-Development
8	Reservoir	250.18	1	728	941,491	7	978.68	86,933	Routed Combined Post

Hydrograph Report

Hyd. No. 1

Undeveloped Douglas Station

Hydrograph type	=	SCS Runoff	Peak discharge	=	89.86 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.03 hrs
Time interval	=	1 min	Hyd. volume	=	241,647 cuft
Drainage area	=	25.000 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.00 min
Total precip.	=	5.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

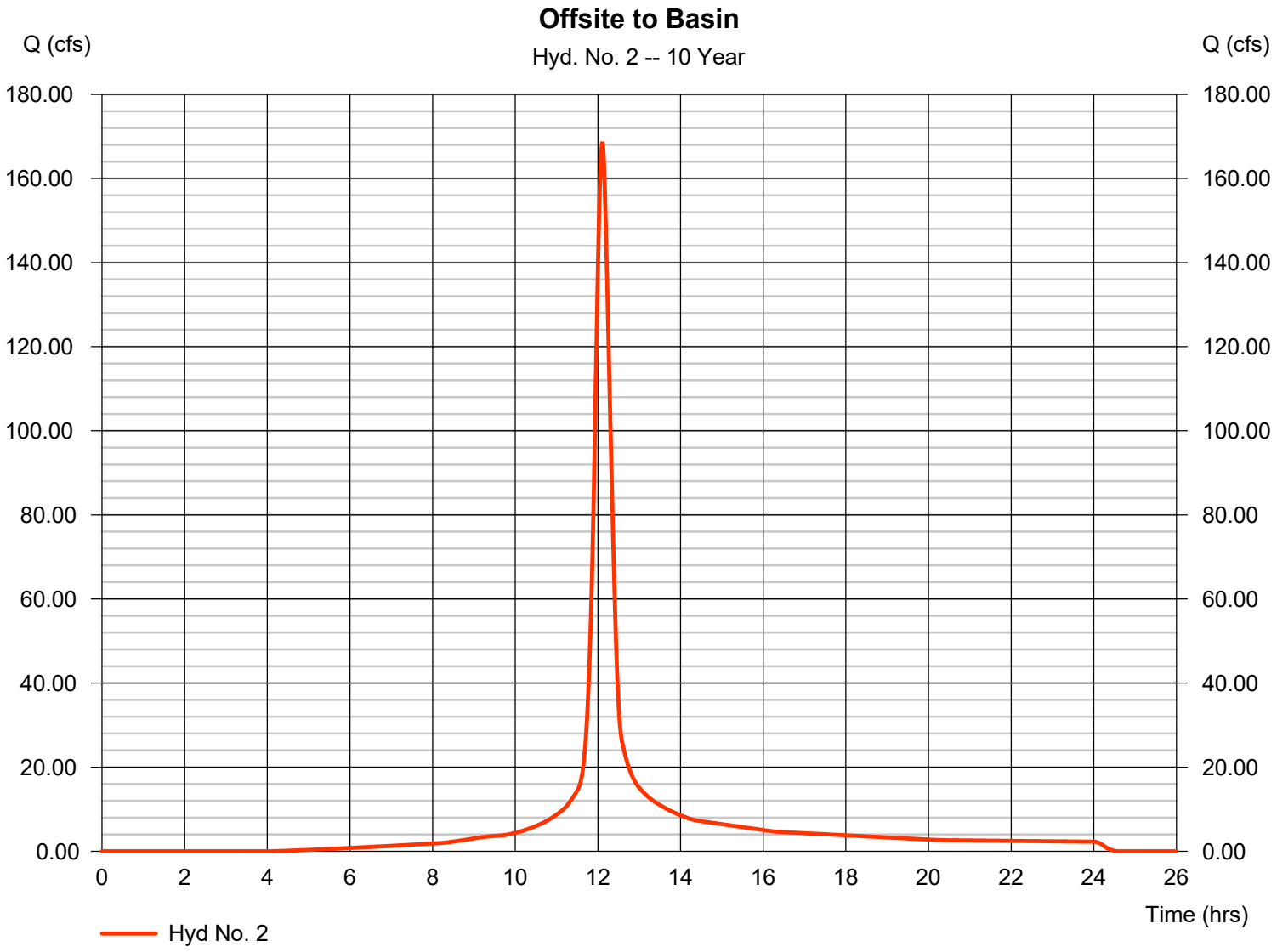


Hydrograph Report

Hyd. No. 2

Offsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	168.33 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.12 hrs
Time interval	=	1 min	Hyd. volume	=	588,558 cuft
Drainage area	=	39.640 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	23.00 min
Total precip.	=	5.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

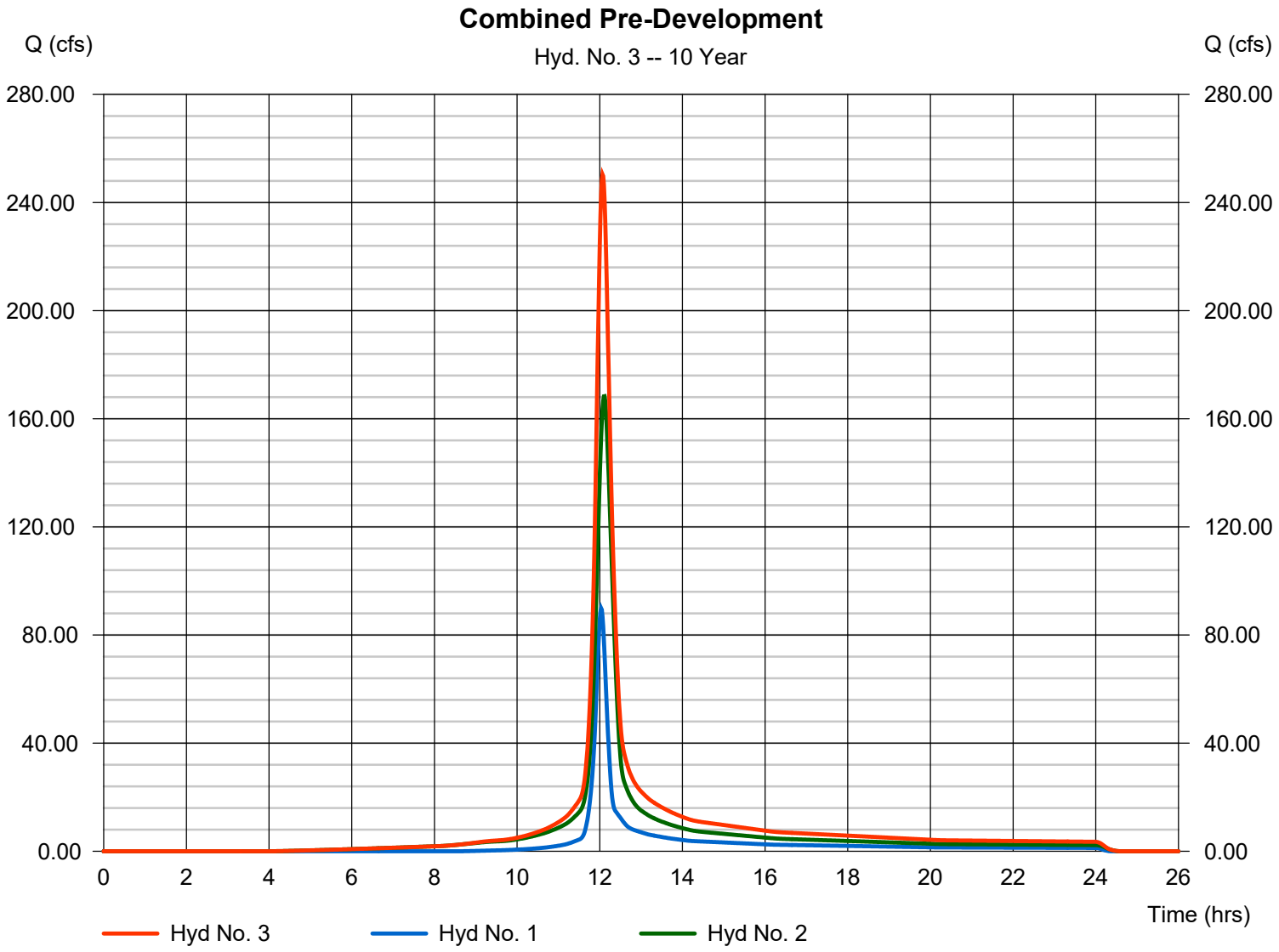


Hydrograph Report

Hyd. No. 3

Combined Pre-Development

Hydrograph type	=	Combine	Peak discharge	=	250.35 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.07 hrs
Time interval	=	1 min	Hyd. volume	=	830,205 cuft
Inflow hyds.	=	1, 2	Contrib. drain. area	=	64.640 ac

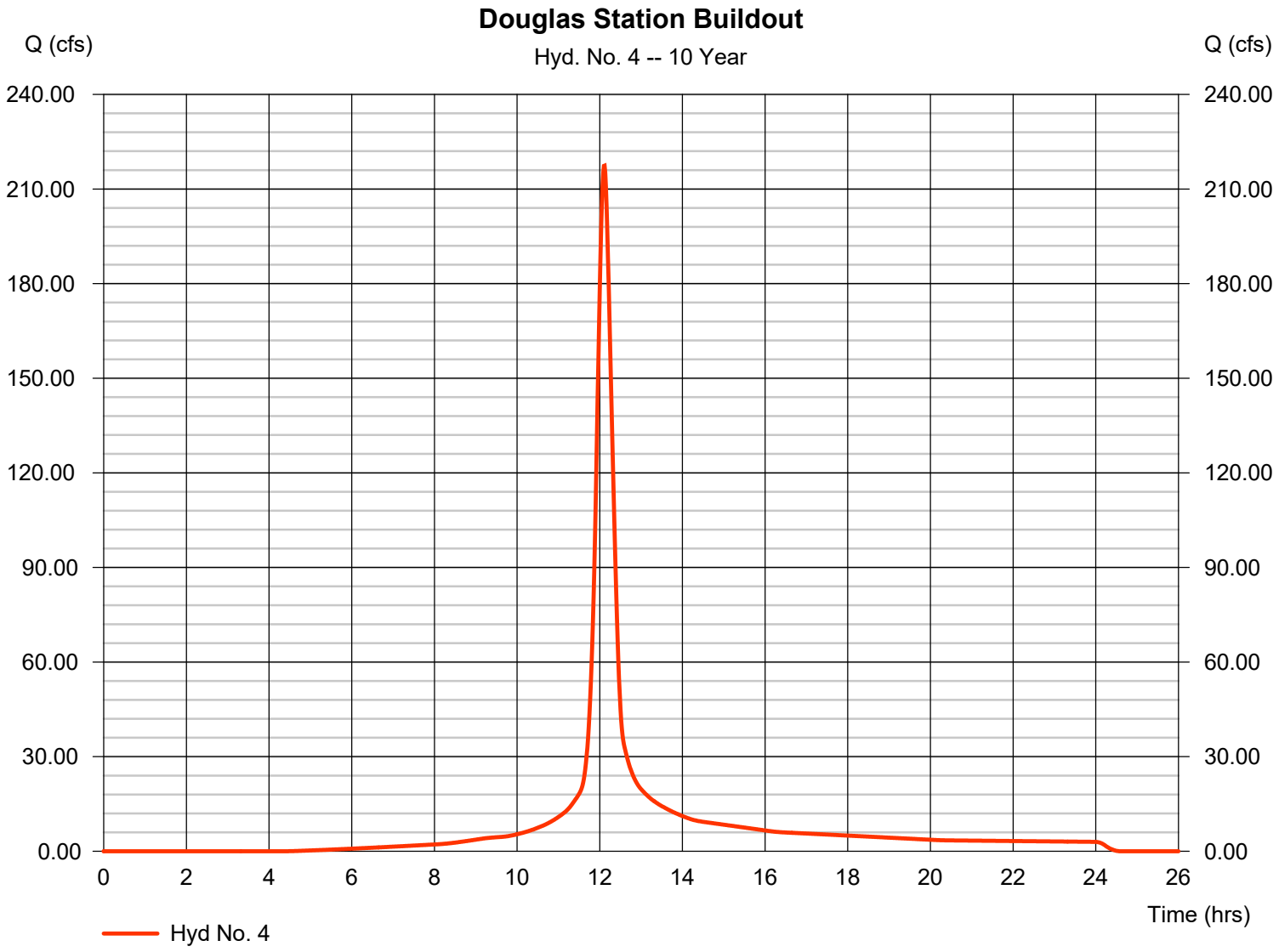


Hydrograph Report

Hyd. No. 4

Douglas Station Buildout

Hydrograph type	=	SCS Runoff	Peak discharge	=	217.42 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.12 hrs
Time interval	=	1 min	Hyd. volume	=	755,928 cuft
Drainage area	=	52.250 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	23.00 min
Total precip.	=	5.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

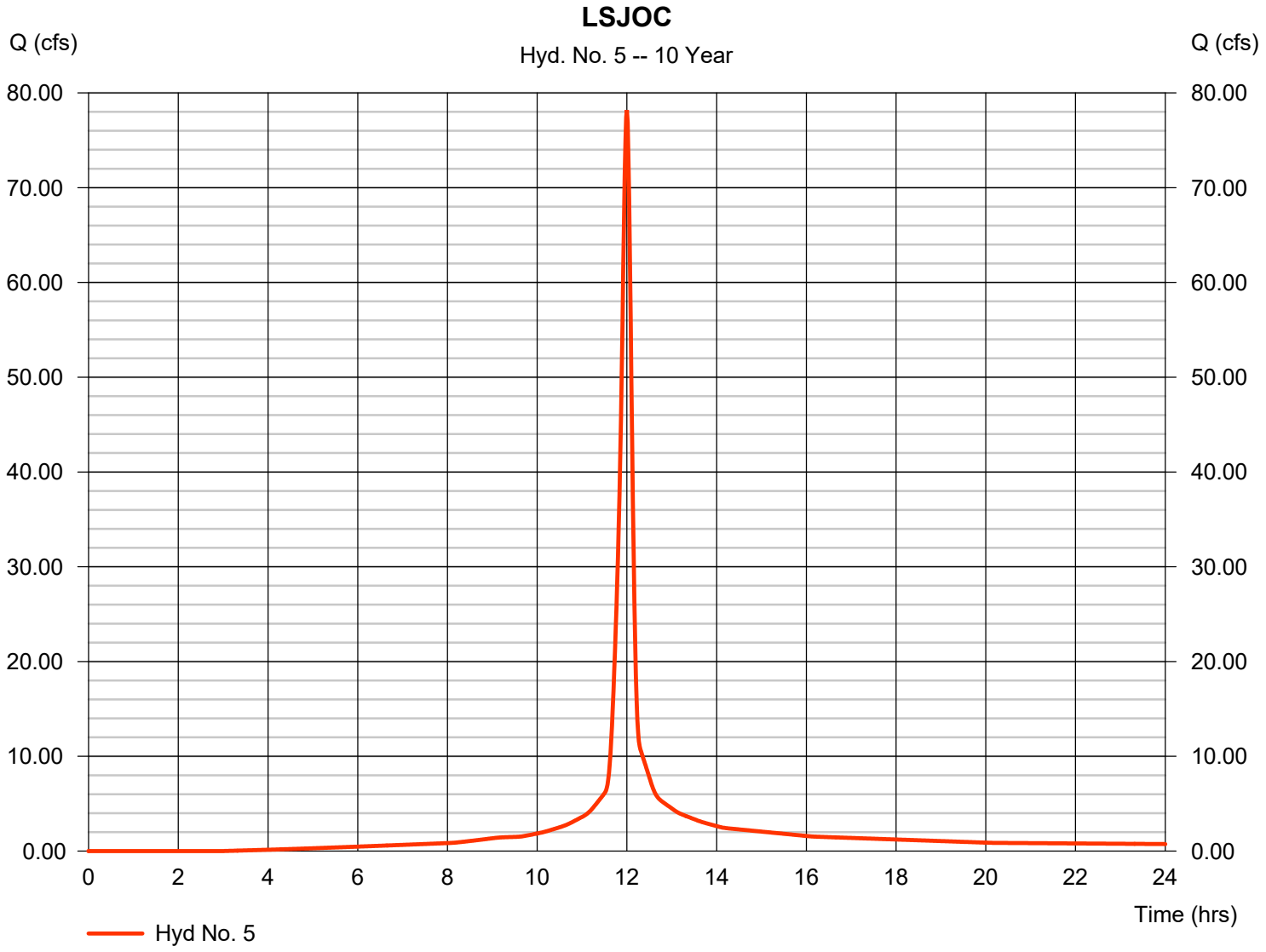


Hydrograph Report

Hyd. No. 5

LSJOC

Hydrograph type	=	SCS Runoff	Peak discharge	=	78.19 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.00 hrs
Time interval	=	1 min	Hyd. volume	=	203,770 cuft
Drainage area	=	12.390 ac	Curve number	=	92
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.00 min
Total precip.	=	5.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



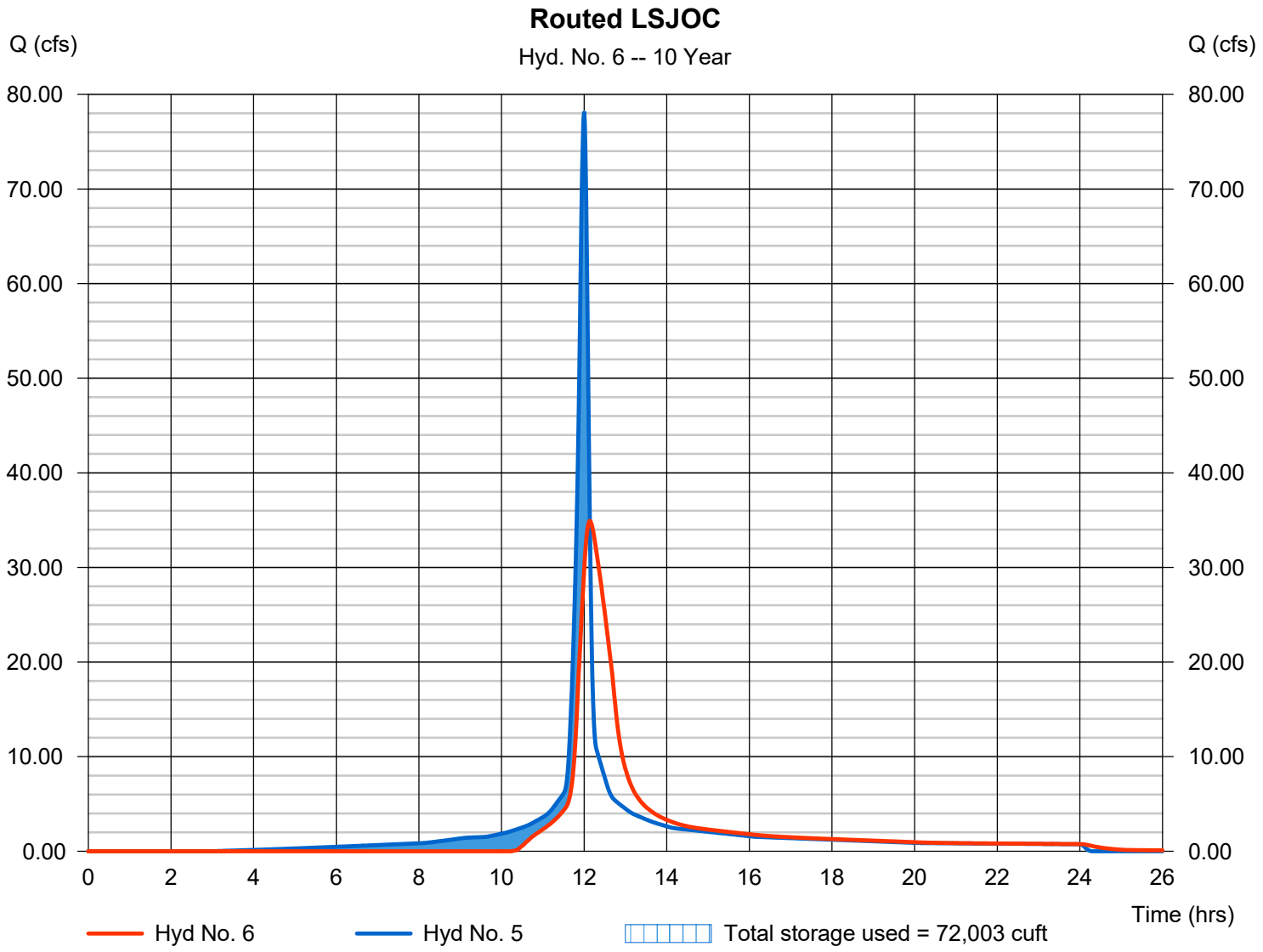
Hydrograph Report

Hyd. No. 6

Routed LSJOC

Hydrograph type	=	Reservoir	Peak discharge	=	34.91 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.13 hrs
Time interval	=	1 min	Hyd. volume	=	185,569 cuft
Inflow hyd. No.	=	5 - LSJOC	Max. Elevation	=	1000.83 ft
Reservoir name	=	LSJOC Pond	Max. Storage	=	72,003 cuft

Storage Indication method used.

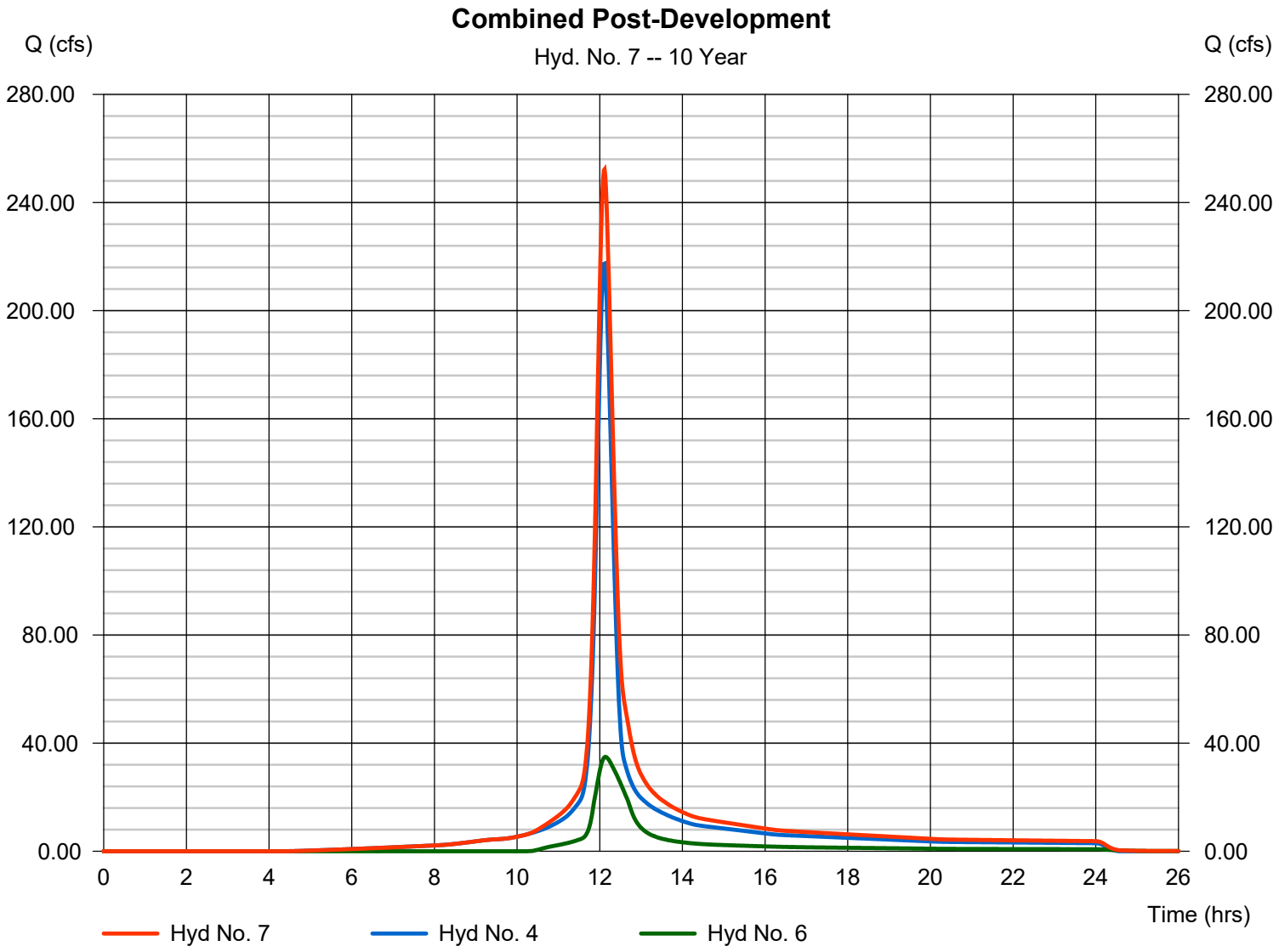


Hydrograph Report

Hyd. No. 7

Combined Post-Development

Hydrograph type	=	Combine	Peak discharge	=	252.22 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.12 hrs
Time interval	=	1 min	Hyd. volume	=	941,496 cuft
Inflow hyds.	=	4, 6	Contrib. drain. area	=	52.250 ac



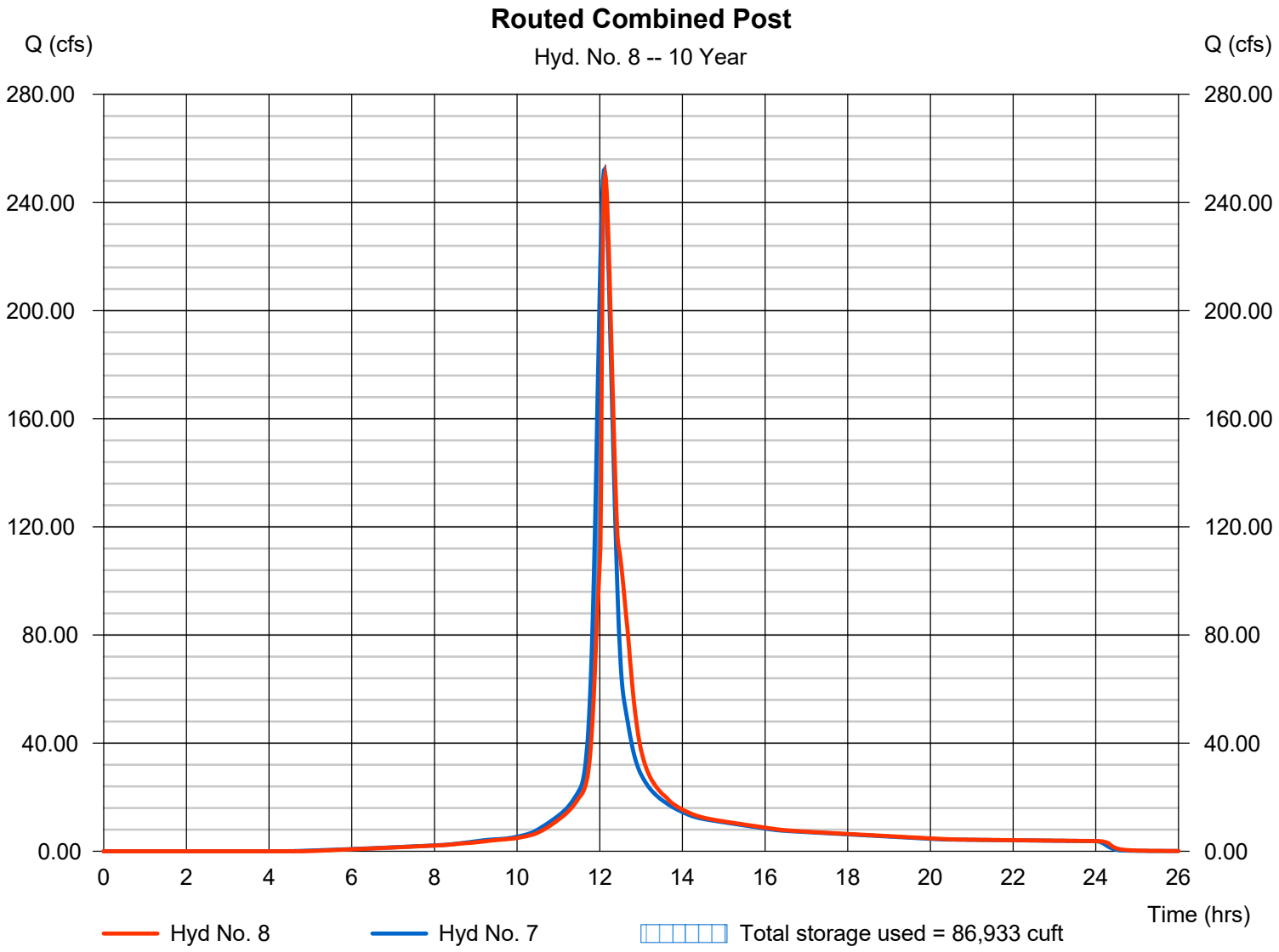
Hydrograph Report

Hyd. No. 8

Routed Combined Post

Hydrograph type	=	Reservoir	Peak discharge	=	250.18 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.13 hrs
Time interval	=	1 min	Hyd. volume	=	941,491 cuft
Inflow hyd. No.	=	7 - Combined Post-Development	Max. Elevation	=	978.68 ft
Reservoir name	=	Douglas Station Basin	Max. Storage	=	86,933 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

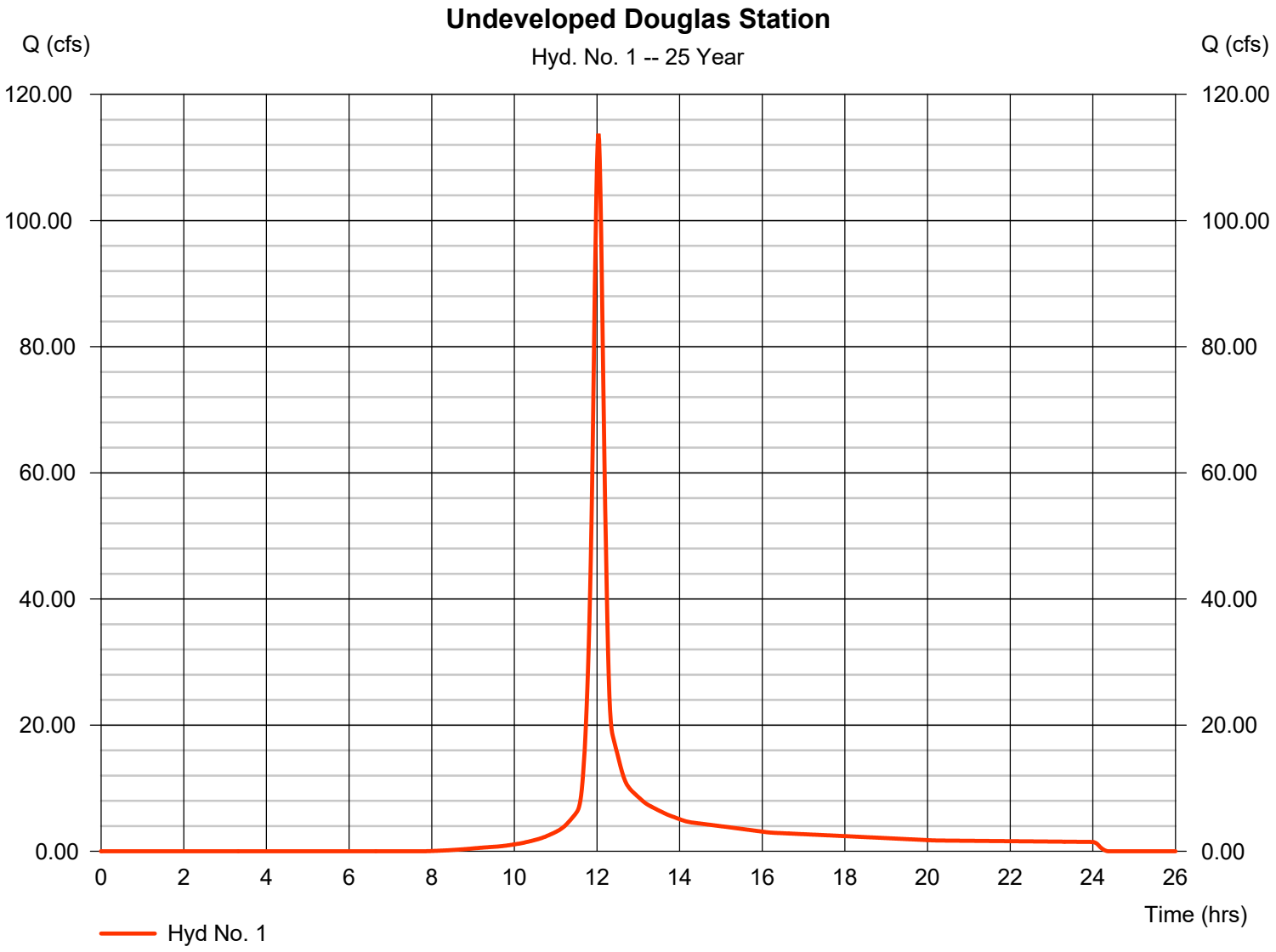
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	113.76	1	722	305,895	------	------	------	Undeveloped Douglas Station
2	SCS Runoff	200.16	1	726	705,735	------	------	------	Offsite to Basin
3	Combine	304.20	1	724	1,011,630	1, 2	------	------	Combined Pre-Development
4	SCS Runoff	259.38	1	726	909,415	------	------	------	Douglas Station Buildout
5	SCS Runoff	91.87	1	720	241,981	------	------	------	LSJOC
6	Reservoir	37.94	1	729	223,779	5	1001.35	83,389	Routed LSJOC
7	Combine	297.14	1	727	1,133,197	4, 6	------	------	Combined Post-Development
8	Reservoir	295.66	1	728	1,133,190	7	978.83	89,893	Routed Combined Post

Hydrograph Report

Hyd. No. 1

Undeveloped Douglas Station

Hydrograph type	=	SCS Runoff	Peak discharge	=	113.76 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.03 hrs
Time interval	=	1 min	Hyd. volume	=	305,895 cuft
Drainage area	=	25.000 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.00 min
Total precip.	=	6.22 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

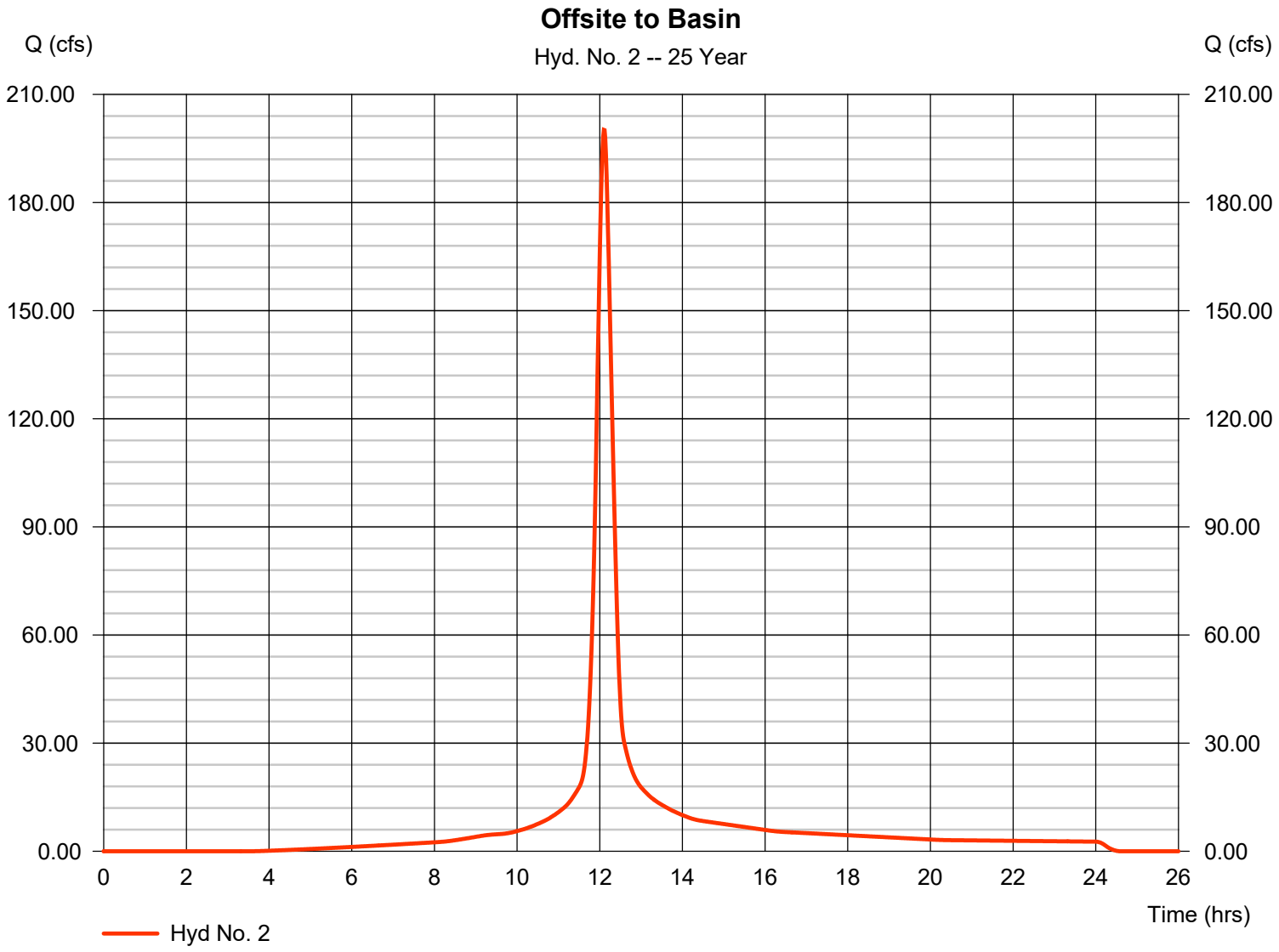


Hydrograph Report

Hyd. No. 2

Offsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	200.16 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	1 min	Hyd. volume	=	705,735 cuft
Drainage area	=	39.640 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	23.00 min
Total precip.	=	6.22 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

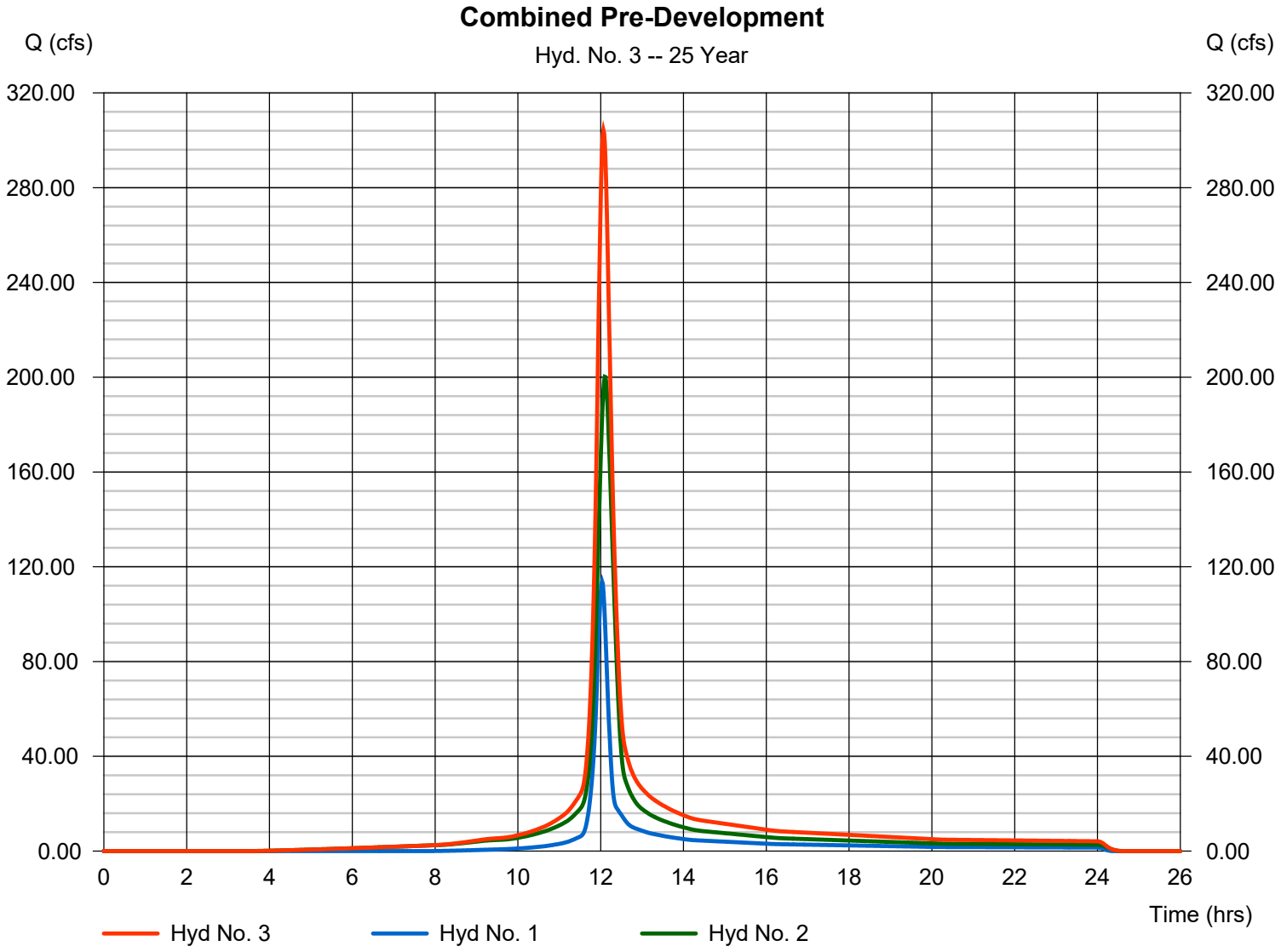


Hydrograph Report

Hyd. No. 3

Combined Pre-Development

Hydrograph type	= Combine	Peak discharge	= 304.20 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 1 min	Hyd. volume	= 1,011,630 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 64.640 ac

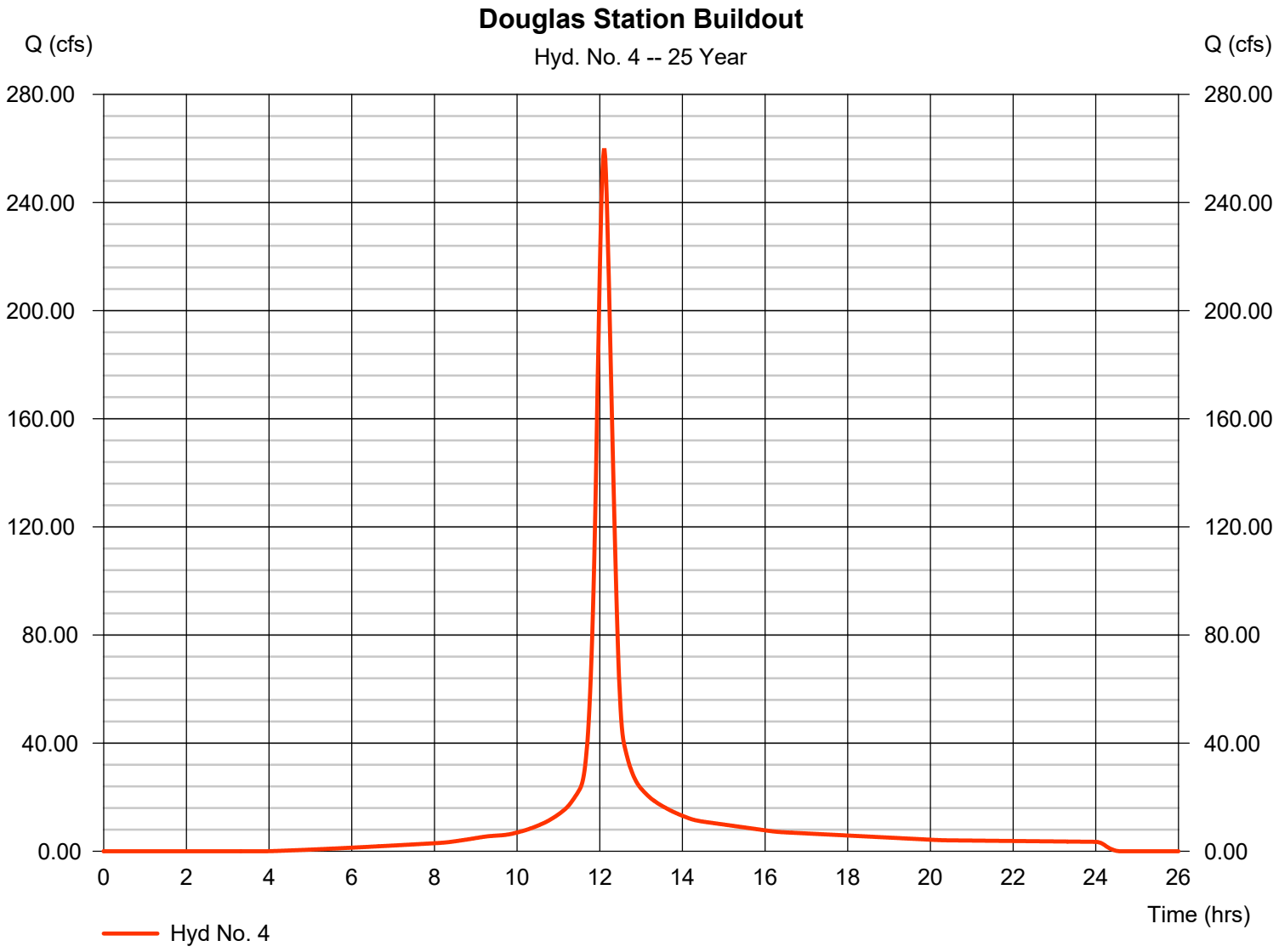


Hydrograph Report

Hyd. No. 4

Douglas Station Buildout

Hydrograph type	=	SCS Runoff	Peak discharge	=	259.38 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.10 hrs
Time interval	=	1 min	Hyd. volume	=	909,415 cuft
Drainage area	=	52.250 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	23.00 min
Total precip.	=	6.22 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

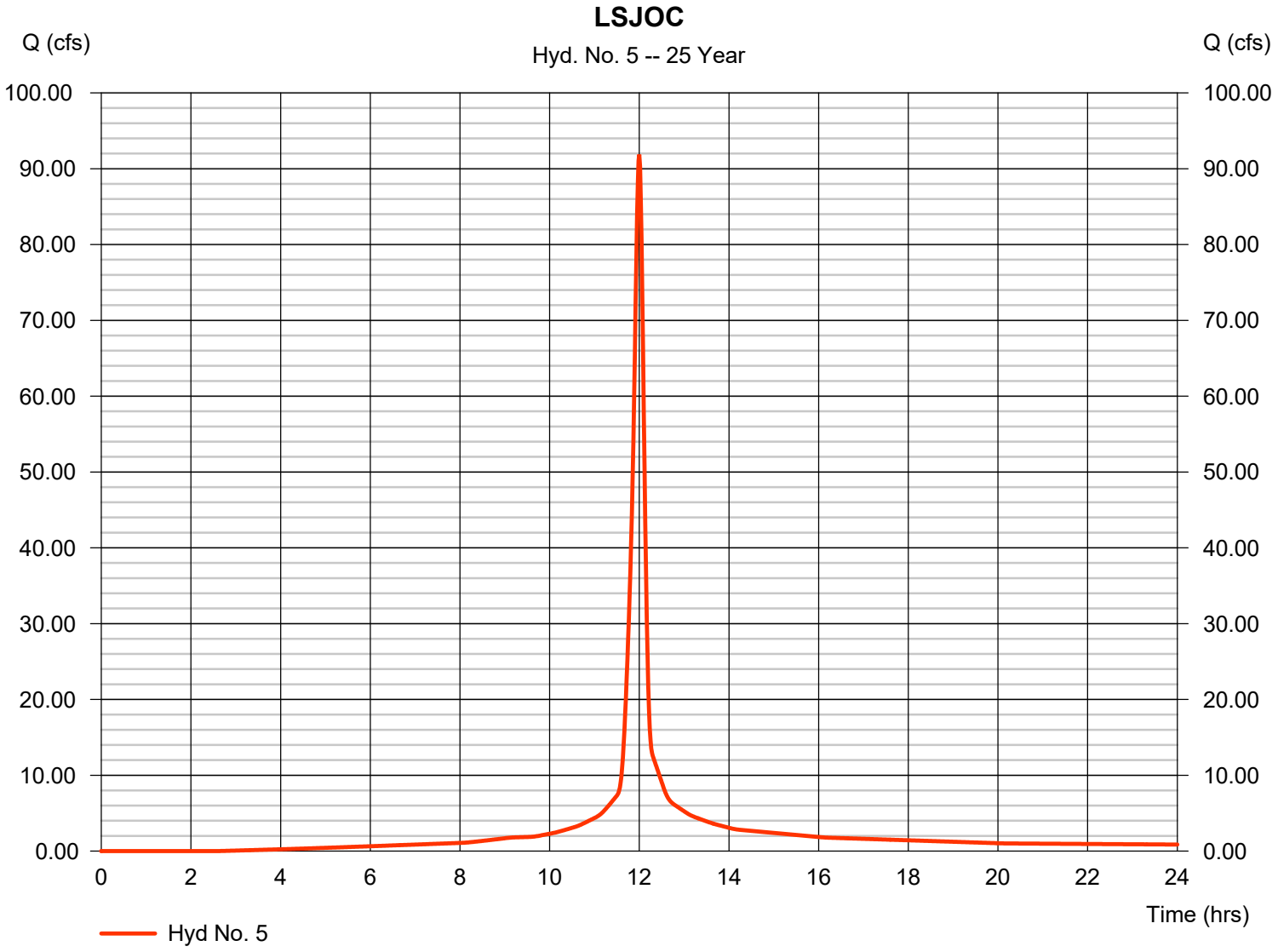


Hydrograph Report

Hyd. No. 5

LSJOC

Hydrograph type	=	SCS Runoff	Peak discharge	=	91.87 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.00 hrs
Time interval	=	1 min	Hyd. volume	=	241,981 cuft
Drainage area	=	12.390 ac	Curve number	=	92
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.00 min
Total precip.	=	6.22 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



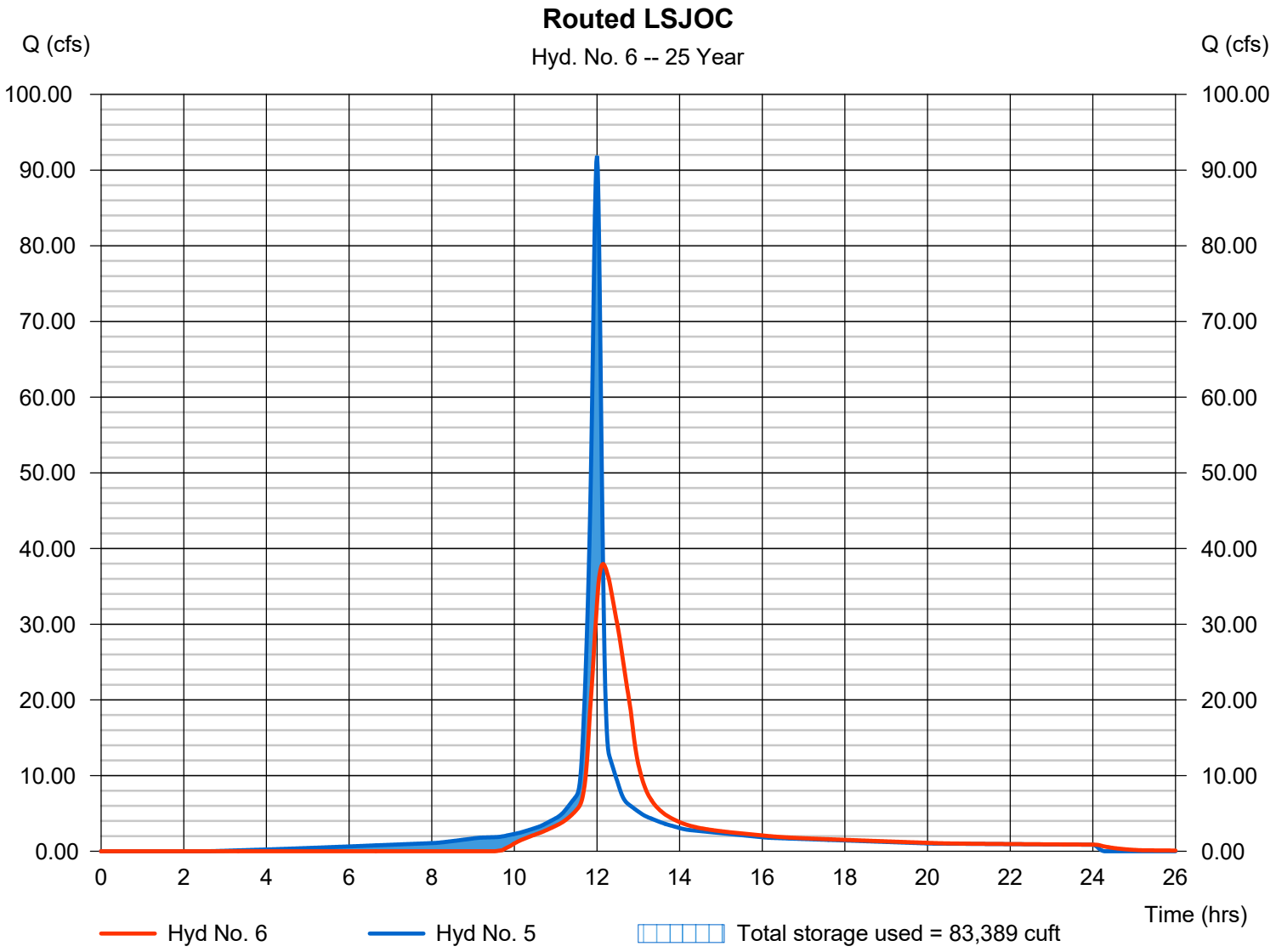
Hydrograph Report

Hyd. No. 6

Routed LSJOC

Hydrograph type	=	Reservoir	Peak discharge	=	37.94 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.15 hrs
Time interval	=	1 min	Hyd. volume	=	223,779 cuft
Inflow hyd. No.	=	5 - LSJOC	Max. Elevation	=	1001.35 ft
Reservoir name	=	LSJOC Pond	Max. Storage	=	83,389 cuft

Storage Indication method used.

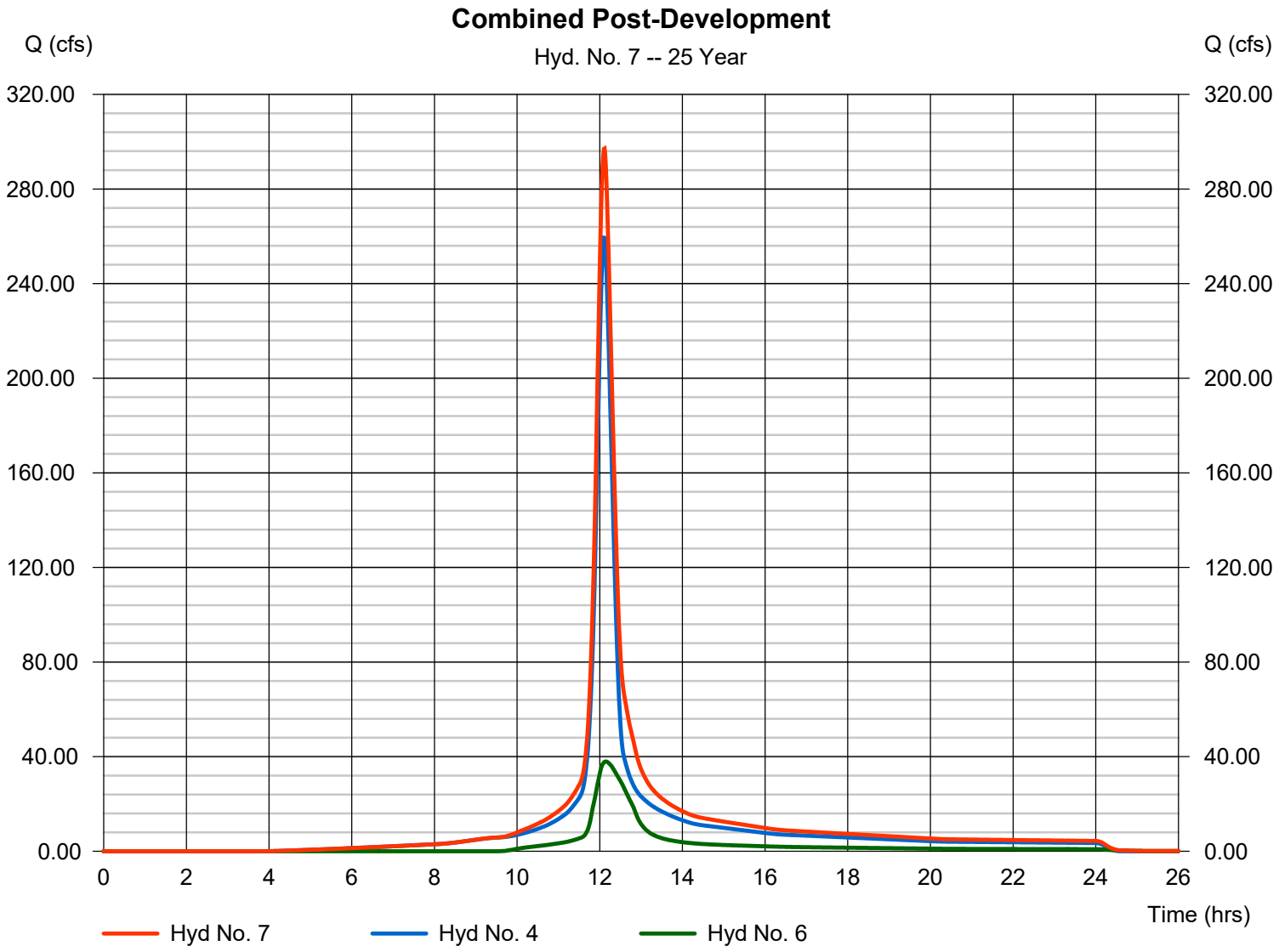


Hydrograph Report

Hyd. No. 7

Combined Post-Development

Hydrograph type	=	Combine	Peak discharge	=	297.14 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.12 hrs
Time interval	=	1 min	Hyd. volume	=	1,133,197 cuft
Inflow hyds.	=	4, 6	Contrib. drain. area	=	52.250 ac



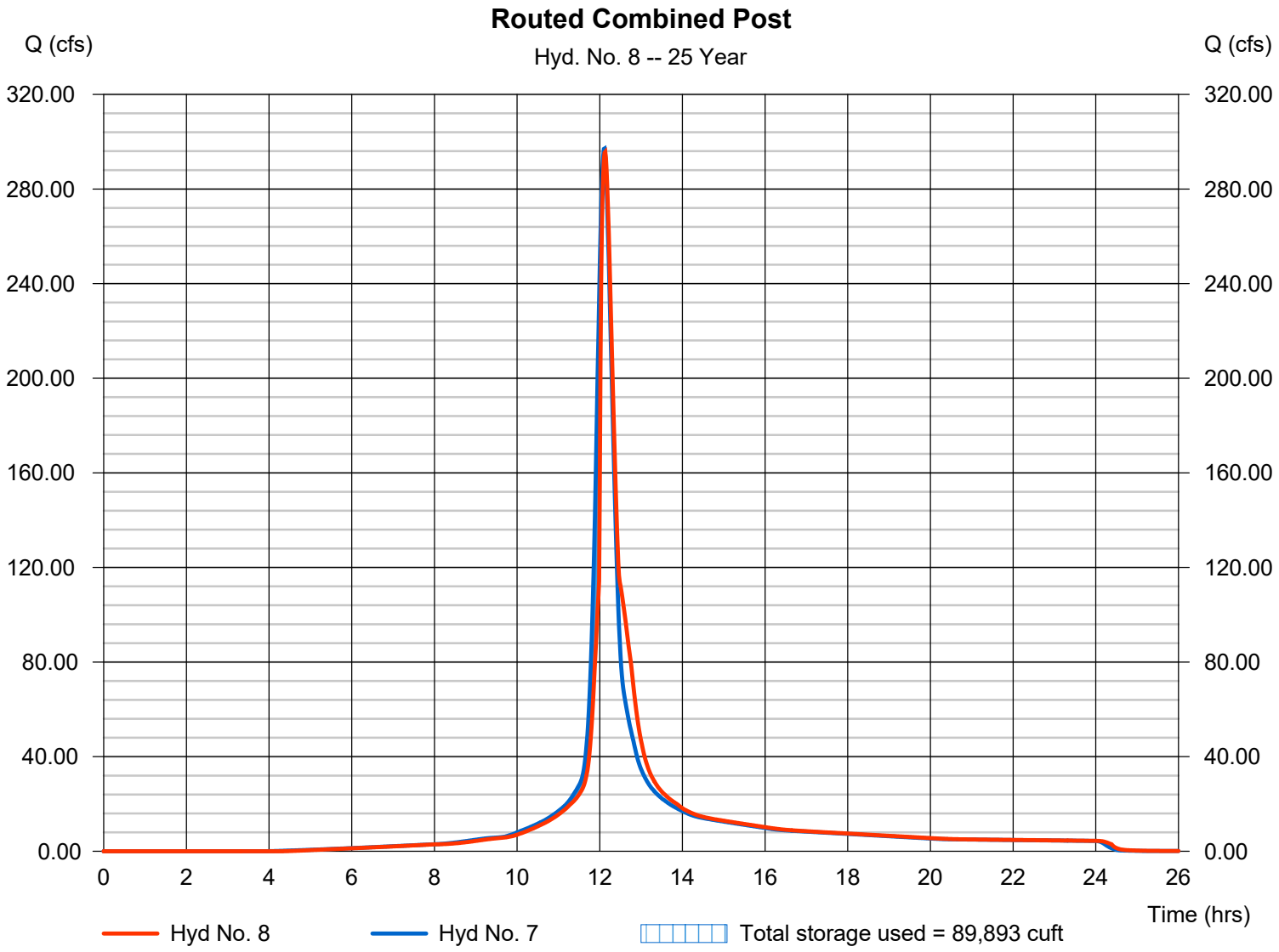
Hydrograph Report

Hyd. No. 8

Routed Combined Post

Hydrograph type	=	Reservoir	Peak discharge	=	295.66 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.13 hrs
Time interval	=	1 min	Hyd. volume	=	1,133,190 cuft
Inflow hyd. No.	=	7 - Combined Post-Development	Max. Elevation	=	978.83 ft
Reservoir name	=	Douglas Station Basin	Max. Storage	=	89,893 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

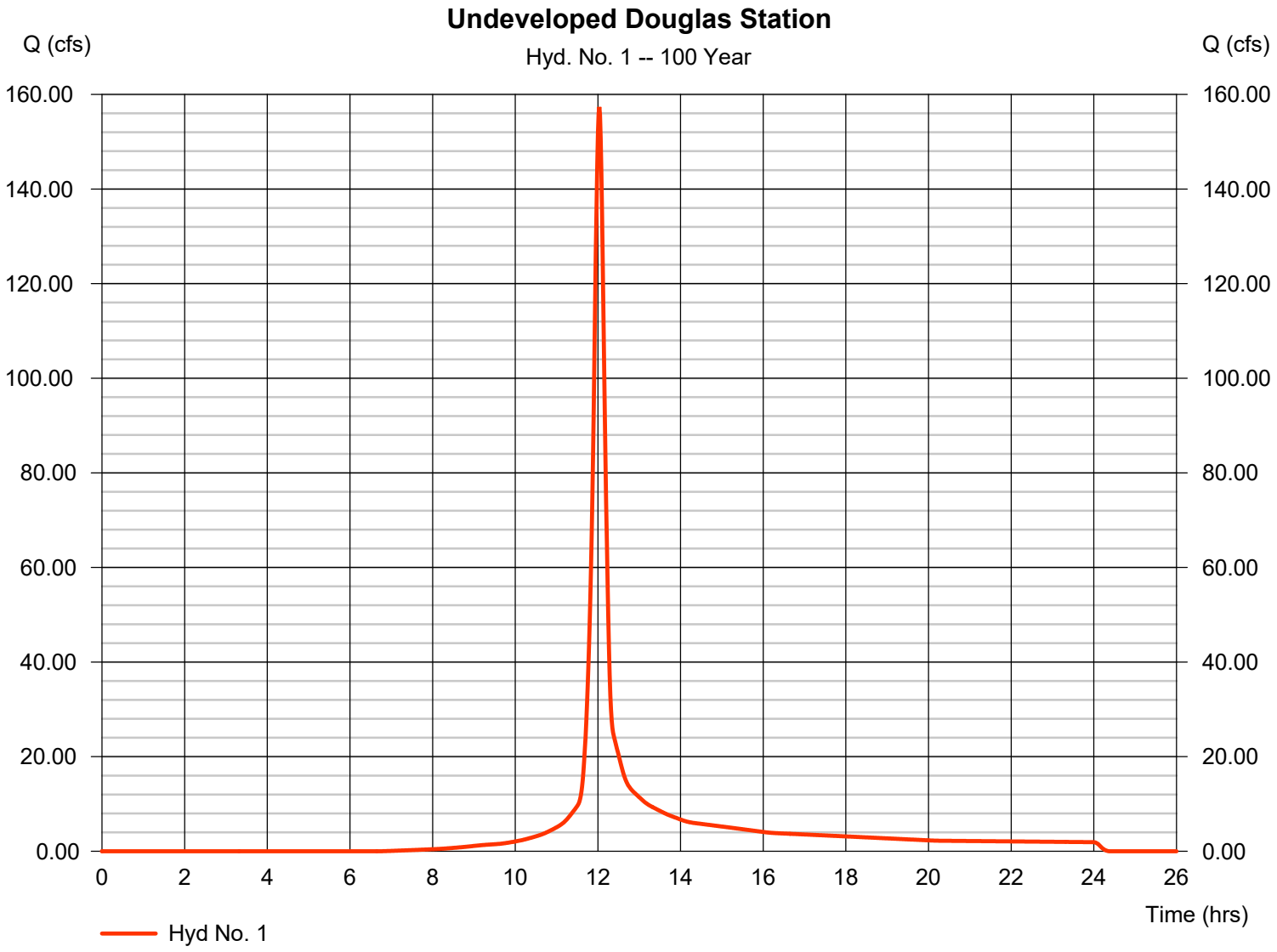
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	157.36	1	722	425,157	------	------	------	Undeveloped Douglas Station
2	SCS Runoff	256.40	1	726	915,840	------	------	------	Offsite to Basin
3	Combine	400.52	1	724	1,340,997	1, 2	------	------	Combined Pre-Development
4	SCS Runoff	333.75	1	726	1,185,071	------	------	------	Douglas Station Buildout
5	SCS Runoff	116.01	1	720	310,210	------	------	------	LSJOC
6	Reservoir	43.05	1	729	292,008	5	1002.24	104,520	Routed LSJOC
7	Combine	376.17	1	727	1,477,082	4, 6	------	------	Combined Post-Development
8	Reservoir	374.44	1	727	1,477,076	7	979.07	94,622	Routed Combined Post

Hydrograph Report

Hyd. No. 1

Undeveloped Douglas Station

Hydrograph type	=	SCS Runoff	Peak discharge	=	157.36 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.03 hrs
Time interval	=	1 min	Hyd. volume	=	425,157 cuft
Drainage area	=	25.000 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.00 min
Total precip.	=	7.73 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

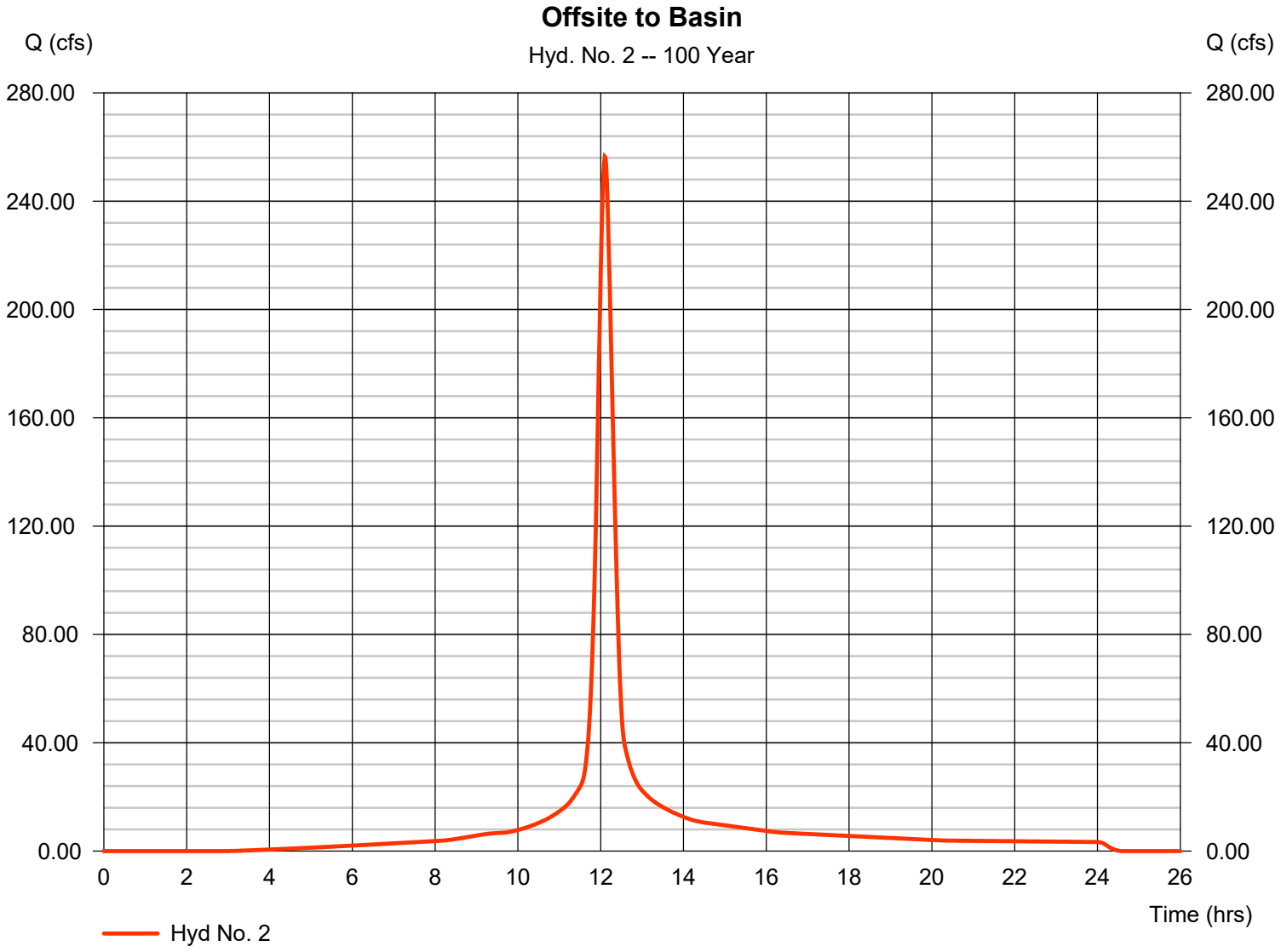


Hydrograph Report

Hyd. No. 2

Offsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	256.40 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	1 min	Hyd. volume	=	915,840 cuft
Drainage area	=	39.640 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	23.00 min
Total precip.	=	7.73 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

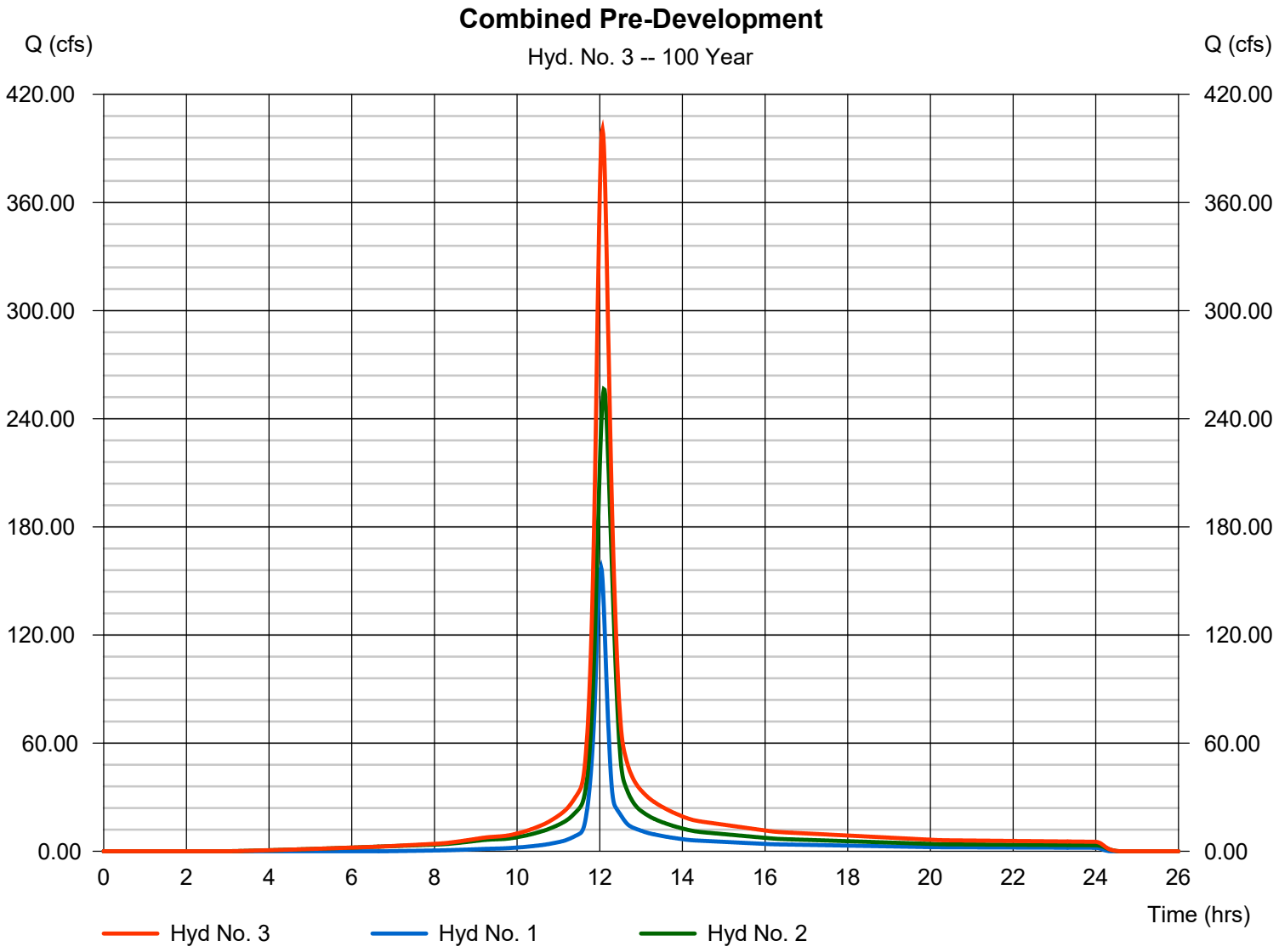


Hydrograph Report

Hyd. No. 3

Combined Pre-Development

Hydrograph type	=	Combine	Peak discharge	=	400.52 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.07 hrs
Time interval	=	1 min	Hyd. volume	=	1,340,997 cuft
Inflow hyds.	=	1, 2	Contrib. drain. area	=	64.640 ac

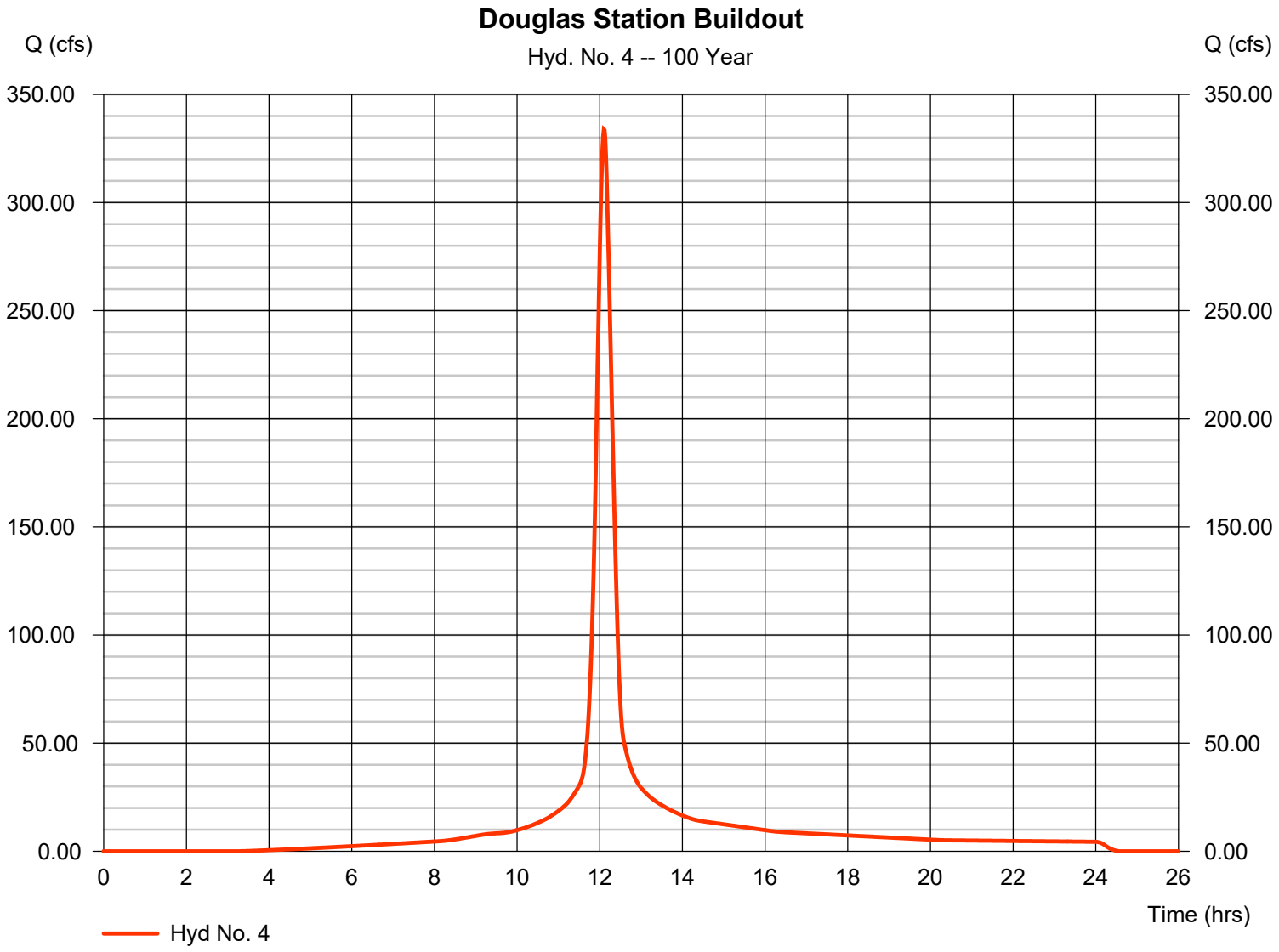


Hydrograph Report

Hyd. No. 4

Douglas Station Buildout

Hydrograph type	=	SCS Runoff	Peak discharge	=	333.75 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	1 min	Hyd. volume	=	1,185,071 cuft
Drainage area	=	52.250 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	23.00 min
Total precip.	=	7.73 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

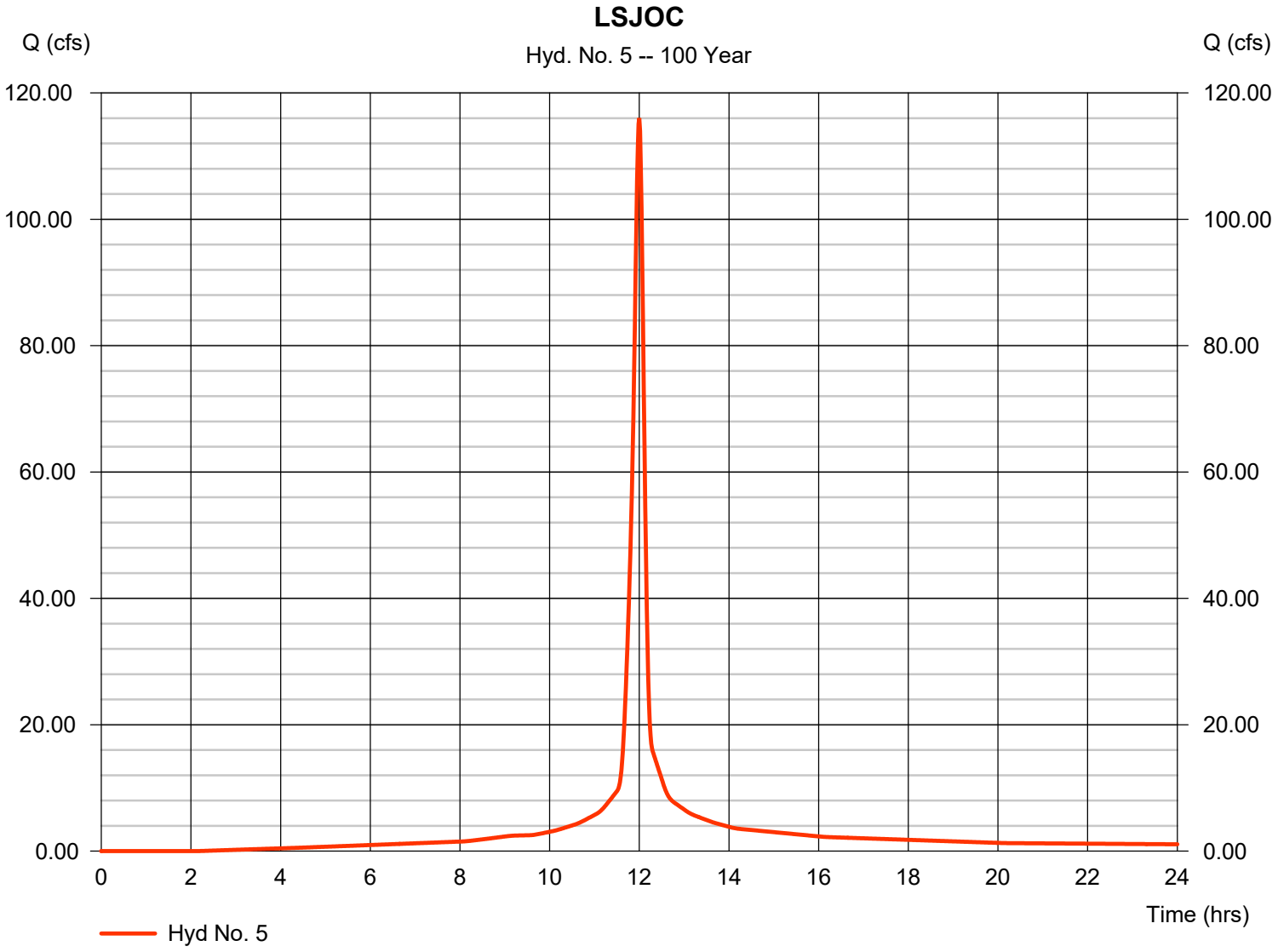


Hydrograph Report

Hyd. No. 5

LSJOC

Hydrograph type	=	SCS Runoff	Peak discharge	=	116.01 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.00 hrs
Time interval	=	1 min	Hyd. volume	=	310,210 cuft
Drainage area	=	12.390 ac	Curve number	=	92
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.00 min
Total precip.	=	7.73 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



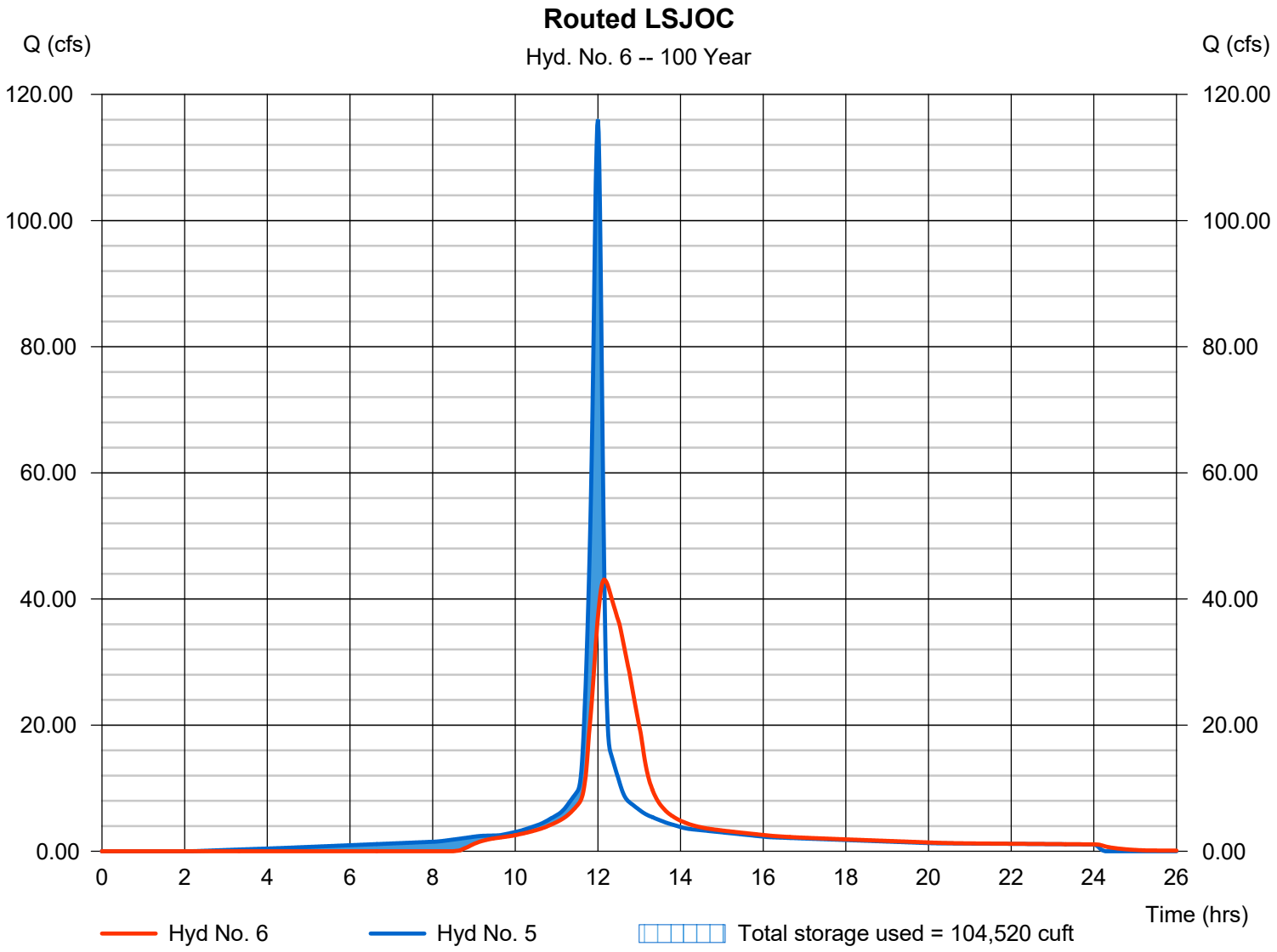
Hydrograph Report

Hyd. No. 6

Routed LSJOC

Hydrograph type	=	Reservoir	Peak discharge	=	43.05 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.15 hrs
Time interval	=	1 min	Hyd. volume	=	292,008 cuft
Inflow hyd. No.	=	5 - LSJOC	Max. Elevation	=	1002.24 ft
Reservoir name	=	LSJOC Pond	Max. Storage	=	104,520 cuft

Storage Indication method used.

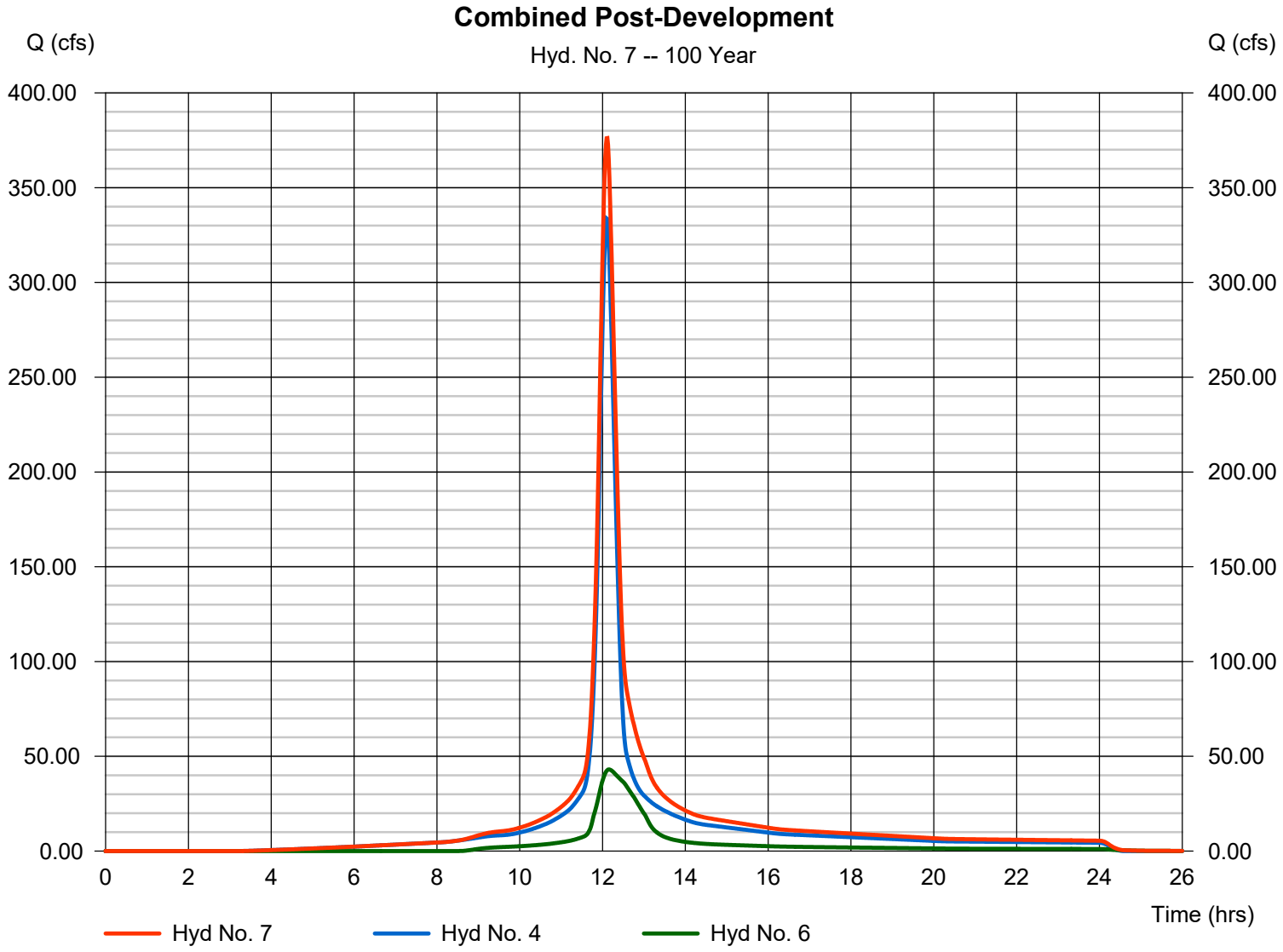


Hydrograph Report

Hyd. No. 7

Combined Post-Development

Hydrograph type	=	Combine	Peak discharge	=	376.17 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.12 hrs
Time interval	=	1 min	Hyd. volume	=	1,477,082 cuft
Inflow hyds.	=	4, 6	Contrib. drain. area	=	52.250 ac



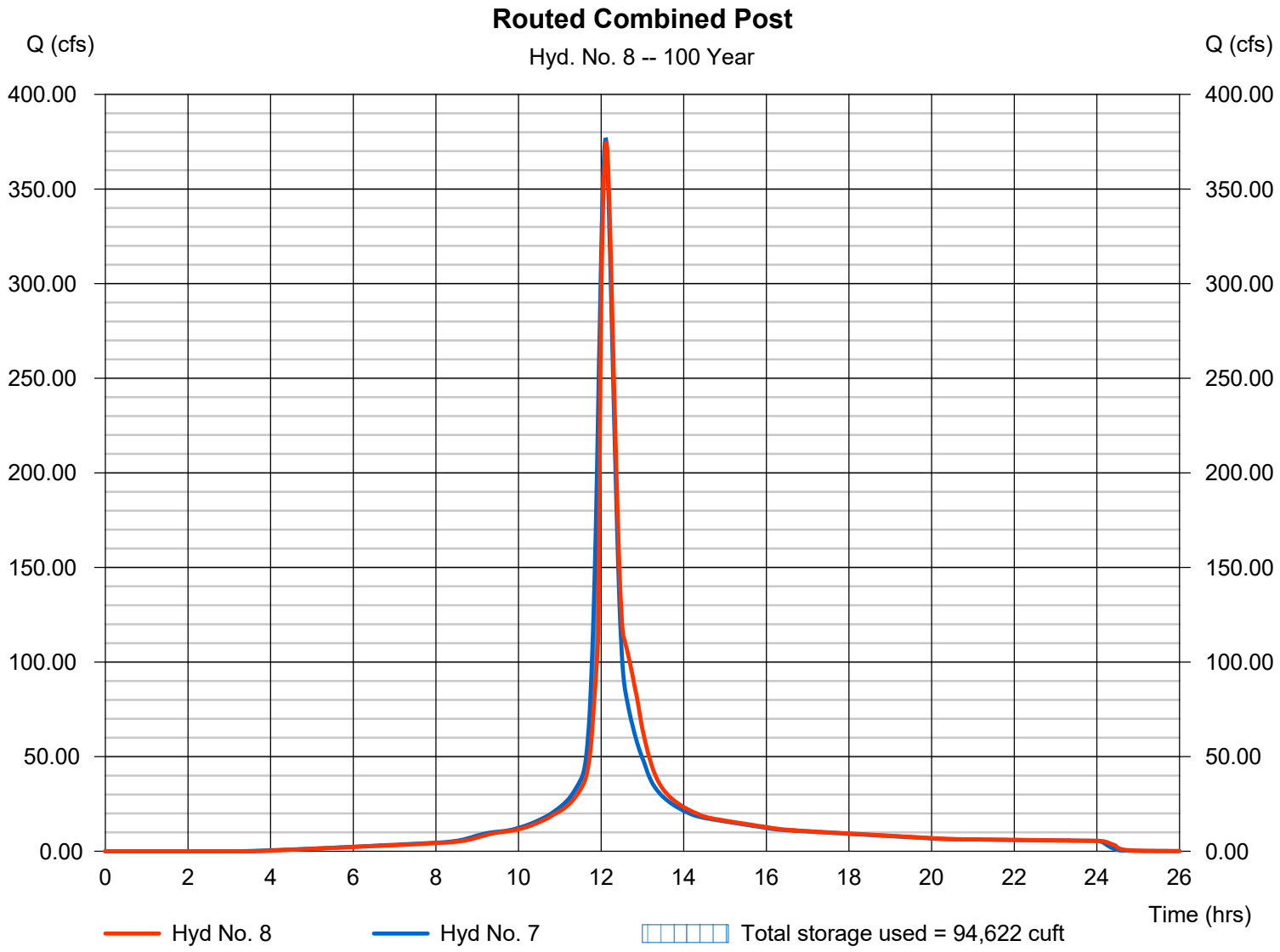
Hydrograph Report

Hyd. No. 8

Routed Combined Post

Hydrograph type	=	Reservoir	Peak discharge	=	374.44 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.12 hrs
Time interval	=	1 min	Hyd. volume	=	1,477,076 cuft
Inflow hyd. No.	=	7 - Combined Post-Development	Max. Elevation	=	979.07 ft
Reservoir name	=	Douglas Station Basin	Max. Storage	=	94,622 cuft

Storage Indication method used.



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	79.5706	15.0000	0.8977	--------
3	0.0000	0.0000	0.0000	--------
5	100.0945	17.1000	0.8850	--------
10	90.6951	15.4000	0.8336	--------
25	112.5419	15.8000	0.8190	--------
50	135.5891	16.1000	0.8156	--------
100	160.7297	16.8000	0.8186	--------

File name: APWA 2011 K.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.41	4.42	3.76	3.27	2.90	2.61	2.37	2.18	2.02	1.88	1.76	1.65
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.47	5.40	4.65	4.09	3.66	3.31	3.03	2.79	2.59	2.42	2.27	2.14
10	7.34	6.12	5.27	4.64	4.16	3.77	3.46	3.19	2.97	2.78	2.62	2.47
25	9.37	7.86	6.80	6.01	5.40	4.91	4.51	4.18	3.89	3.65	3.44	3.25
50	11.27	9.48	8.22	7.28	6.55	5.96	5.48	5.08	4.74	4.44	4.19	3.96
100	12.90	10.89	9.47	8.40	7.57	6.90	6.35	5.89	5.50	5.16	4.86	4.60

Tc = time in minutes. Values may exceed 60.

Precip. file name: C:\AP\STORM WATER 240321\TR55\LSMO TP40.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	1.37	3.52	0.00	4.63	5.37	6.22	6.93	7.73
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	2.49	3.10	0.00	4.01	4.64	5.52	6.21	6.90
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

EXHIBIT G

PROPOSED DETENTION BASIN PLAN

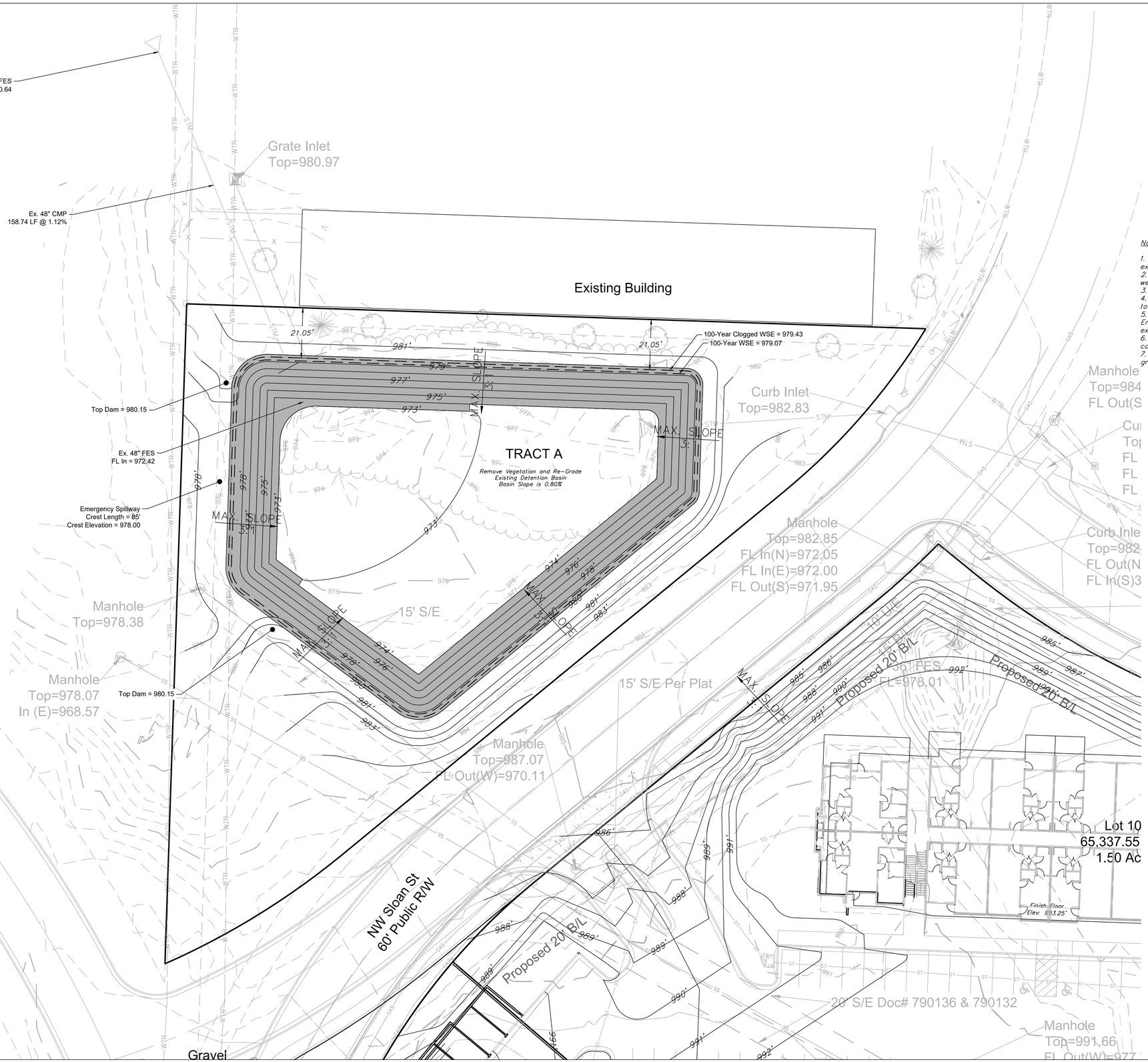
50 SE 30th Street Lee's Summit, MO 64082
P: (816) 623-9888 F: (816) 623-9849 www.engineeringsolutionskc.com

OFF-SITE DETENTION BASIN

SCALE: 1" = 20'

North

0 10' 20' 40'



(TRM) Turf Reinforcement Mat
3:1 Slopes = 10,062 SF

NOTES:

1. *DETENTION BASIN RE-GRADING AND REHAB IS REQUIRED PRIOR TO ALL OTHER ACTIVITIES ON THE SITE, EXCEPT FOR EROSION AND SEDIMENT CONTROL ACTIVITIES.*
2. *AS-BUILT RECORD DRAWING OF THE DETENTION BASIN IS REQUIRED PRIOR TO ISSUANCE OF A CERTIFICATE OF OCCUPANCY*

Notes

1. Contractor is responsible for verifying all existing utility locations prior to excavation
2. There are no known natural or artificial water storage detention areas, or wetlands in the area designated for construction
3. No part of the project lies within the 100 year flood plain
4. All erosion and sediment control measures need to be implemented prior to construction
5. Additional erosion control may be required by the CIty Engineer, Design Engineer or Owner at any time problematic areas are noted in the field or existing measures are found to be ineffective
6. Soil Stabilization of disturbed areas shall be completed within 14 days of construction inactivity
7. Contractor responsible for all density testing of roadway subgrade and granular base.

ENGINEERING SOLUTIONS
ENGINEERING & SURVEYING
50 SE 30TH STREET
LEE'S SUMMIT, MO 64082
P:(816) 623-9888 F:(816)623-9849

Professional Registration
Missouri
Engineering 2005002186-D
Surveying 2005000319-D
Kansas
Engineering E-1695
Surveying LS-218
Oklahoma
Engineering 6254
Nebraska
Engineering CA2821

Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri

Project: DOUGLAS STATION LSMO
Issue Date: August 11, 2023

OFF-SITE DETENTION BASIN
Construction Plans for:
Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri

STATE OF MISSOURI
MATTHEW J. SCHLICHT
NUMBER PE-2006019708
PROFESSIONAL ENGINEER

Matthew J. Schlicht
MO PE 2006019708
KS PE 19071
OK PE 25226
NE PE E-14335

REVISIONS

1. REV. 3/7/2024
2. REV. 4/18/2024
3. REV. 4/26/2024
4. REV. 1/27/2025

C.203

EXHIBIT H

EMERGENCY OVERFLOW ANAYLSIS

50 SE 30th Street Lee's Summit, MO 64082
P: (816) 623-9888 F: (816) 623-9849 www.engineeringsolutionskc.com

Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Mar 14 2025

Detention Earthen Spillway

Rectangular Weir

Crest	= Broad
Bottom Length (ft)	= 85.00
Total Depth (ft)	= 2.15

Calculations

Weir Coeff. Cw	= 2.60
Compute by:	Known Q
Known Q (cfs)	= 376.17

Highlighted

Depth (ft)	= 1.43
Q (cfs)	= 376.17
Area (sqft)	= 121.20
Velocity (ft/s)	= 3.10
Top Width (ft)	= 85.00

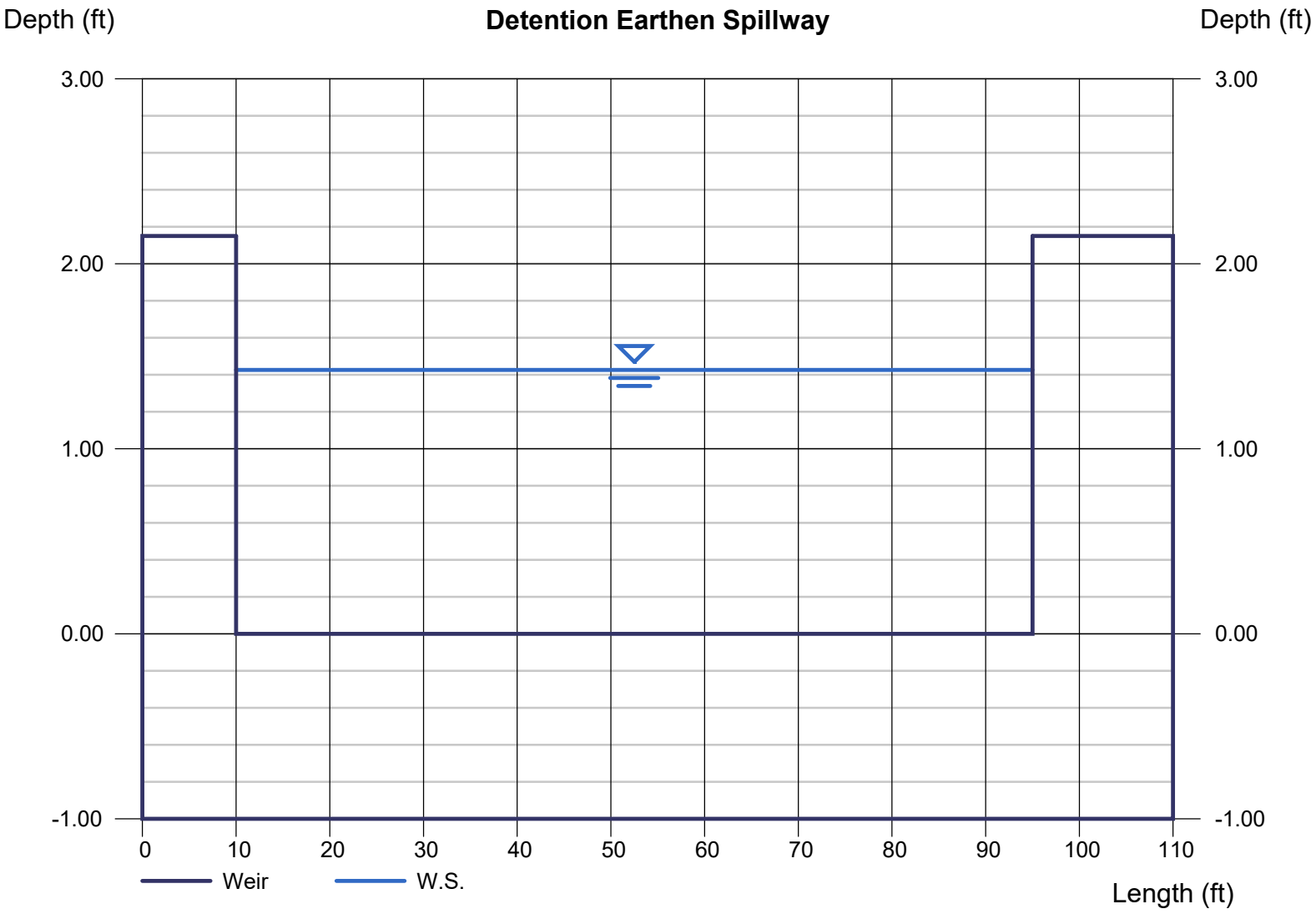


EXHIBIT I

FINAL STORMWATER REPORT
FOR
LEE"S SUMMIT JOINT OPERATIONS CAMPUS
BHC
12-20-2024

50 SE 30th Street Lee's Summit, MO 64082
P: (816) 623-9888 F: (816) 623-9849 www.engineeringsolutionskc.com

FINAL STORMWATER REPORT
FOR
Lee's Summit Joint Operations Campus

Project Location:

10 NE Tudor Road, Lee's Summit, MO 64086

BHC Project # 041470.00.01

10/16/2024
Rev. 12/20/2024

Michael T. Makris
Missouri PE 2021035286
12/20/2024

CIVIL ENGINEERING / SURVEYING / UTILITIES

Table of Contents

Table of Appendices

1.0 Introduction

This Final Stormwater Management Study is prepared for the expansion of the existing Lee's Summit Joint Operations Campus located at 10 NE Tudor Road, Lee's Summit, Missouri. The purpose of this study is to evaluate the existing on-site detention pond and the impacts of the expanded development on the existing detention pond and surrounding area. The project will result in the construction of a new Fire Administration building and associated Parking.

Governing design criteria is based on the APWA 5600 comprehensive control and the capacity of the downstream system to convey discharge during the systems design events.

Figure 1: Project Location Aerial

1. 1 Methodology

The unit hydrograph modeling for this report was conducted using TR-55 methodologies within HydroCAD.

Runoff for this report was determined using a SCS Type II 24-Hour rainfall event.

The design storms used for this report were the 2-year (50%), 10-year (10%), and 100-year (1%) events. Rainfall depths for these events were determined from NOAA Atlas 14. The table below contains these rainfall depths.

Table I: Report Design Storms

Report Design Storms	
Storm Event	**Rainfall Depth (in)**
2-Year	3.70
10-Year	5.66
100-Year	9.23

The following documents were used as the design criteria for this report:

- Kansas City Metropolitan Chapter of APWA Standards, Specification and Design Criteria, Section 5600 (2011)

Controlling Design Requirement

APWA 5600 requires that rainfall events are held to the following to the following release rates. 0.5 cfs for the 2-year, 2.0 cfs for the 10-yr, and 3.0 cfs for the 100-yr for any newly developed area. For this site the area considered new development would the eastern third of the site where the Fire Administration be located. BHC and the City of Lee's Summit have been unable to find the existing drainage study for the project and have not quantified release rates. BHC has reached out to the engineer of record (Bartlett and West), but at the submission of this report has not yet received that information.

Additionally, BHC reviewed the receiving system to evaluate potential flooding issues down stream of the site. In this case the down stream system is the proposed storm sewer installed as part of the development of the Douglas Station Multifamily site to the north. This site is not yet developed, therefore BHC has relied on the final development plans prepared by the developer and their engineer, dated March 8, 2024. From that review BHC has determined that the developer has considered release rates from our proposed pond that pass through to the Douglas Station Commercial Park Regional Pond. **From conversations between BHC and City Staff (Gene Williams and Grant White), BHC has determined that the assumed Joint Operations Center pond release rates contained within the Douglas Station Multifamily Final Development Plans should be considered the controlling design requirement.**

2.0 Existing Conditions

2.1 Project Site

The existing project site is currently occupied by the existing Lee's Summit Municipal Court Facility basin on the site grading, the project site has 11.41 acres tributary to the detention pond, and additional 0.78 acres of off-site runoff from the right-of-way of Tudor. Total tributary area is 12.19 acres.

2.2 Hydrology

A majority of the project site drains towards the existing detention pond. This drainage area is summarized below in Table II.

Table II: Existing Drainage Areas

		AREA		PERVIOUS		IMPERVIOUS		CN-Value	C-VALUE
	Total	631,858 SF	(14.51 ac)	294518.55 SF	(6.76 ac)	337,339 SF	(7.74 ac)	90	0.62
To Pond	Onsite	497,121 SF	(11.41 ac)	237177.93 SF	(5.44 ac)	259,943 SF	(5.97 ac)	89	0.61
	Offsite	33,883 SF	(0.78 ac)	12318.70 SF	(0.28 ac)	21,564 SF	(0.50 ac)	91	0.68
Not to Pond	Onsite	26,149 SF	(0.60 ac)	21777.89 SF	(0.50 ac)	4,371 SF	(0.10 ac)	83	0.40
	Offsite	74,704 SF	(1.71 ac)	23244.02 SF	(0.53 ac)	51,460 SF	(1.18 ac)	92	0.71

The drainage area was analyzed in HydroCAD, using TR-55 methodologies to calculate the peak runoff from the existing site in the 2-, 10-, and 100-year storm events to the existing detention pond. These calculations are found in Appendix A1. Table III below summarizes these quantities.

Table III: Existing Site Generated Runoff

Existing Site Generated Runoff (cfs)		
2-Year	**10-Year**	**100-Year**
47.16	78.42	134.50

2.3 Existing Detention

The existing detention pond was evaluated in the all runoff events. The storm events are attenuated through the pond by two existing 30” CMP culvert pipes. During the 2013 modifications to the site a 2-ft plate with multiple orifices was added to detention pond, an image of this control structure is below. The Stormwater Management Study from 2013 modification has not been found at the time this report was submitted, therefore, BHC evaluated the flow through the pond based on the conditions that presently exist. This results in the following pond peak release rates:

Existing Detention Pond				
Storm Event	**Primary Spillway Peak Release (cfs)**	**Overflow Spillway Peak Release (cfs)**	**Combined Peak Release (CFS)**	**Stage Storage Elevation**
2-year	29.89	0	29.89	1002.57
10-year	53.31	1.89	55.21	1003.29
100-year	73.08	42.83	115.91	1003.97

Due to the activation of the overflow spillway in the 10-year event, BHC believes that the existing pond is undersized, based on the established Design Methodology Section 1.1 of this report. Therefore, additional volume is needed with the proposed modification to address the current undersized pond.

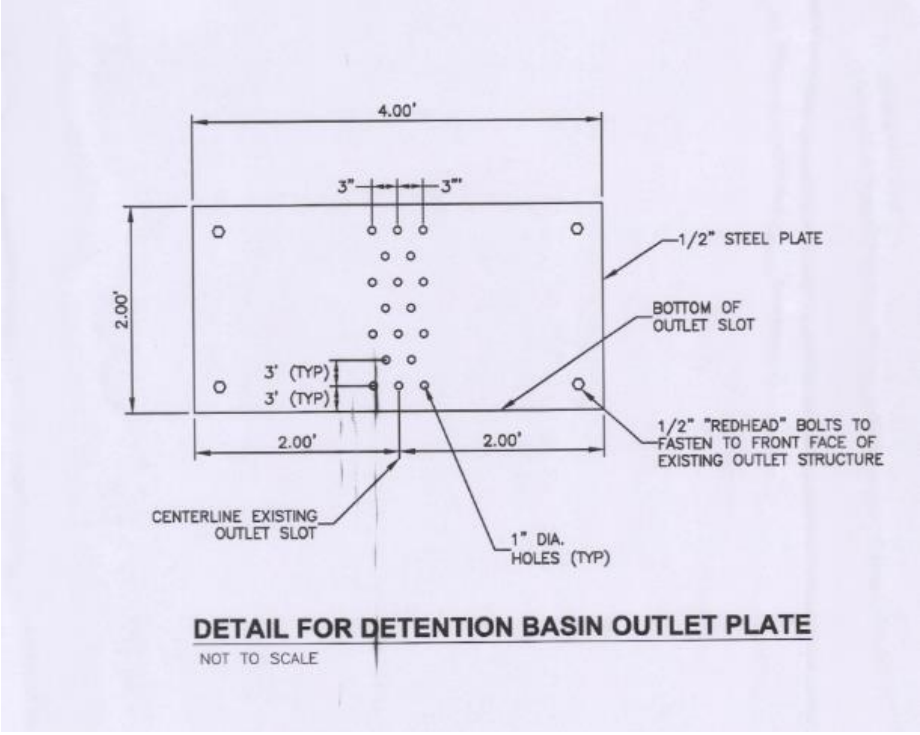


Image: 2013 Pond Modifications

3.0 Proposed Condition

3.1 Project Site

The project will result in the construction of a Fire Administration building, associated parking and site grading changes. This will result in an increase of the tributary area to the detention pond from 12.19 acres to 12.39 (11.59 acres from project site and 0.8 acres from Tudor right-of-way).

3.2 Hydrology

A majority of the project site drains towards the existing detention pond. This drainage area is summarized below in Table IV.

Table IV: Proposed Drainage Areas

		AREA		PERVIOUS		IMPERVIOUS		CN-Value	C-VALUE
	Total	632,704 SF	(14.52 ac)	226,996 SF	(5.21 ac)	405,708 SF	(9.31 ac)	92	0.68
To Pond	Onsite	504,869 SF	(11.59 ac)	175,873 SF	(4.04 ac)	328,996 SF	(7.55 ac)	92	0.69
	Offsite	34,740 SF	(0.80 ac)	13,154 SF	(0.30 ac)	21,586 SF	(0.50 ac)	91	0.67
Not to Pond	Onsite	19,248 SF	(0.44 ac)	15,814 SF	(0.36 ac)	3,434 SF	(0.08 ac)	83	0.41
	Offsite	73,848 SF	(1.70 ac)	22,155 SF	(0.51 ac)	51,692 SF	(1.19 ac)	93	0.72

The drainage area was analyzed in HydroCAD, using TR-55 methodologies to calculate the peak runoff from the existing site in the 2-, 10-, and 100-year storm events. These calculations are found in Appendix A1. Table V below summarizes these quantities.

Table V: Proposed Site Generated Runoff

Proposed Site Generated Runoff (cfs)		
2-Year	**10-Year**	**100-Year**
50.58	82.12	138.64

The proposed development of the site results in an increase in peak runoff rates in all analyzed storm events. To manage runoff to pre-development levels the existing detention pond will need to be expanded.

3.3 Controlling Release Rate

Downstream Analysis

The City of Lee's Summit provided the Final Development Plans submitted by for the multi-family development located north of the project site. BHC has reviewed the plans and sheet C202 indicates that a release rate from the pond located on the Joint Operations Center property considered a release rate of 36 cfs in the 10-year storm, and 54 CFS in the 100-year storm.

Additionally, the current overflow spillway discharges to the proposed Douglas Station Multi-Family Project. The current spillway location creates a potential of flooding of downstream Multi-Family site. Therefore, this proposed design includes raising the top of the north berm elevation of the detention pond to 1005.50. This allows for the construction of spillway to west towards Commerce Drive and minimizes downstream flooding during an emergency overflow event.

3.3 Proposed Detention

Detention will be provided by modification of the existing dry detention pond. Presently, the outlet of the pond includes two 30" CMP outlet pipes, the proposed solutions considers replacing the existing CMP structures an outlet control structure with a weir wall. The weir wall will have a 3" opening for the water quality storm (extended dry detention released over 40 hours). The 10-year events will be controlled by 42" wide by 16" tall opening. Additionally, the 100-yr event will include another 12" wide by 8" tall opening to provide additional release during the 100-yr event. The depth an area of the pond has been increased to allow for (1) additional detention and (2) a direct connection to the proposed inlet 1-6 located on the development to the north.

Information regarding the downstream system has been provided in Appendix A2.

This controls the release rate to the flows assumed for the project.

Proposed Detention Pond		
Storm Event	**Peak Release (cfs)**	**Stage Storage Elevation**
Water Quality	0.40	997.75
*2-year	25.75	999.60
10-year	35.71	1000.88
100-year	54.00	1002.77
Bottom of Emergency Spillway	--	1003.77
**Top of Emergency Spillway	--	1004.70
Top of Berm	--	1005.50

*The 2-year event was not defined in the downstream system.
**Spillway sizing is provided in Appendix A3.

Emergency Overflow Spillway

As previously discussed, the current emergency overflow spillway discharges onto property proposed for multifamily construction. This creates potential for downstream flooding during an event that activates the emergency spillway. To prevent this the proposed design raises the top of berm height to 1005.50 and relocates the spillway to the discharge on Commerce Drive. To provide the flow required for the 100-year event the spillway will need to be constructed of concrete and include a retaining wall to stabilize the berm along the northside of the site. This location of the spillway is conceptually located plans. Full detailing of the concrete spillway pad and any retaining walls will be provided with the final development plans.

The current spillway design provides 0.8-ft of freeboard between the top of spillway flow elevation and the top of berm. This is 0.2-ft less than the 1-ft required by APWA 5600, however, following discussions with the city it has been determined that the 0.2-ft is acceptable.

4.0 Downstream Analysis

As previously discussed BHC reviewed downstream infrastructure as part of this analysis. The site discharges to a currently undeveloped site that has an active Final Development Plan in review by the City of Lee's Summit. The proposed development includes installation of an enclosed storm sewer system through the property replacing the existing channel. The proposed detention meets the allowed release rates to that system from the on-site pond. However, the site does not have surface flow capacity for the emergency overflow event required by APWA 5600. Therefore, the proposed design relocates the existing emergency spillway to discharge to Commerce Drive. As part of the Stormwater Management Study. Downstream conditions were considered.

Additionally, BHC recommends a direct connection to the Douglas Station Muli-Family system to in lieu of an overland flow.

4.0 Water Quality

Per the Lee Summit design and construction manual “volumetric and/or extended detention control of the 90% mean annual event storm event shall be provided for broad protection of the receiving system, including channel erosion protection and flood peak reductions over a range of return periods.”

This is achieved as described above with the use of the restricted 3” orifice to manage runoff from the 1.37 inch event.

6.0 Permitting

6.1 United State Army Corps of Engineers (USACE)

The National Wetland Inventory and USGS Mapping does not Identify and jurisdictional waters within the site area. There are no known USACE regulated levees with 500-feet of the site.

6.2 Federal Emergency Management Agency (FEMA)

The site is located within the Zone X, and outside of the 1% and 0.2% annual chance flood hazard, as shown on FEMA FIRM Map 29095C0417G, effective 1/20/2017. The FEMA Firmette for the project site can be found in Appendix A4

6.3 Missouri Department of Natural Resources (MoDNR)

The area to be disturbed by the project site exceeds 1-arce; a Notice of Intent (NOI) is required to be submitted to MoDNR and a Stormwater Pollution Prevention Plan (SWPPP) will be prepared for the project.

6.0 Conclusion

Multiple stormwater control criteria were considered for the development of the proposed project. It was also determined that the existing pond is undersized as the emergency spillway is activated in the 10-year event. Therefore, the existing undersize of this pond needs addressed as part of the proposed improvements.

It was determined that limiting release rate criteria is the capacity of the proposed Douglas Station Multifamily storm sewer system. The design rates of the Joint Operations Center to the receiving storm sewer system were considered the controlling design criteria.

The existing emergency spillway discharging to the Douglas Station project is proposed to be relocated to discharge to Commerce Drive.

Additionally, the stormwater design meets the Lee's Summit Design and Construction manual requirements for water quality control through the use of an Extended Dry Detention system.

Appendix A – Reference Documents

A1 – HyrdoCAD Output Summary

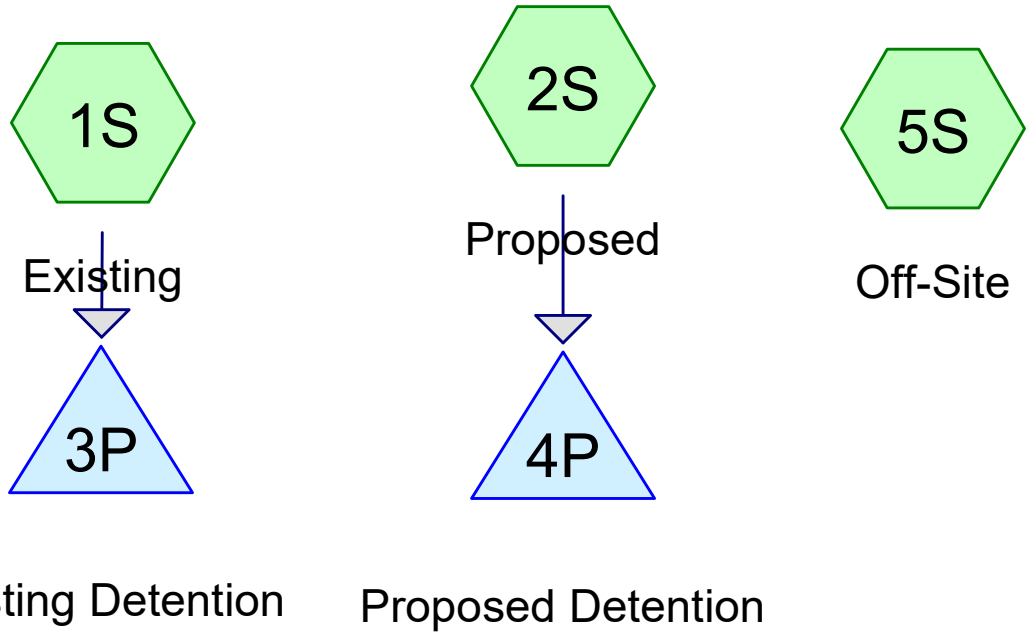
A2 – Douglass Station Commercial Park Reference Documents

A3 – Spillway Design

A4 – FEMA Firmette

A5 – Drainage Maps

APPENDIX A1



Subcat Reach Pond Link

Routing Diagram for LS Joint Ops

Prepared by {enter your company name here}, Printed 12/20/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
12.190	90	(1S)
12.390	92	(2S)
0.500	91	(5S)
25.080	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
25.080	Other	1S, 2S, 5S
25.080		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	25.080	25.080		1S, 2S, 5S
0.000	**0.000**	**0.000**	**0.000**	**25.080**	**25.080**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	3P	999.50	999.00	40.0	0.0125	0.025	30.0	0.0	0.0
2	4P	994.78	994.28	59.3	0.0084	0.012	30.0	0.0	0.0

Time span=5.00-60.00 hrs, dt=0.05 hrs, 1101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Runoff Area=12.190 ac 0.00% Impervious Runoff Depth>2.64"
Tc=10.0 min CN=90 Runoff=47.16 cfs 2.677 af

Subcatchment 2S: Proposed Runoff Area=12.390 ac 0.00% Impervious Runoff Depth>2.83"
Tc=10.0 min CN=92 Runoff=50.58 cfs 2.918 af

Subcatchment 5S: Off-Site Runoff Area=0.500 ac 0.00% Impervious Runoff Depth>2.73"
Tc=5.0 min CN=91 Runoff=2.33 cfs 0.114 af

Pond 3P: Existing Detention Peak Elev=1,002.57' Storage=33,368 cf Inflow=47.16 cfs 2.677 af
Primary=29.89 cfs 2.670 af Secondary=0.00 cfs 0.000 af Outflow=29.89 cfs 2.670 af

Pond 4P: Proposed Detention Peak Elev=999.60' Storage=47,512 cf Inflow=50.58 cfs 2.918 af
Outflow=24.58 cfs 2.918 af

Total Runoff Area = 25.080 ac Runoff Volume = 5.709 af Average Runoff Depth = 2.73"
100.00% Pervious = 25.080 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Existing

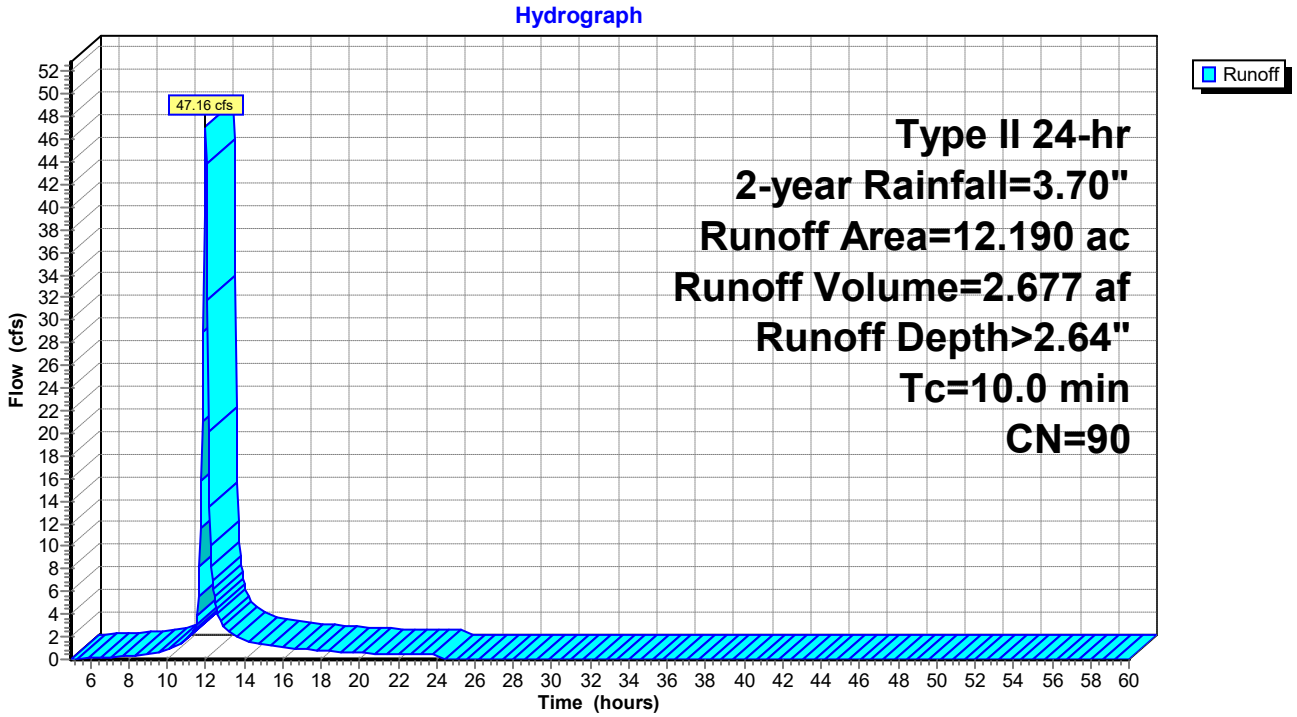
Runoff = 47.16 cfs @ 12.01 hrs, Volume= 2.677 af, Depth> 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-year Rainfall=3.70"

	Area (ac)	CN	Description
*	12.190	90	
	12.190		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 1S: Existing



Summary for Subcatchment 2S: Proposed

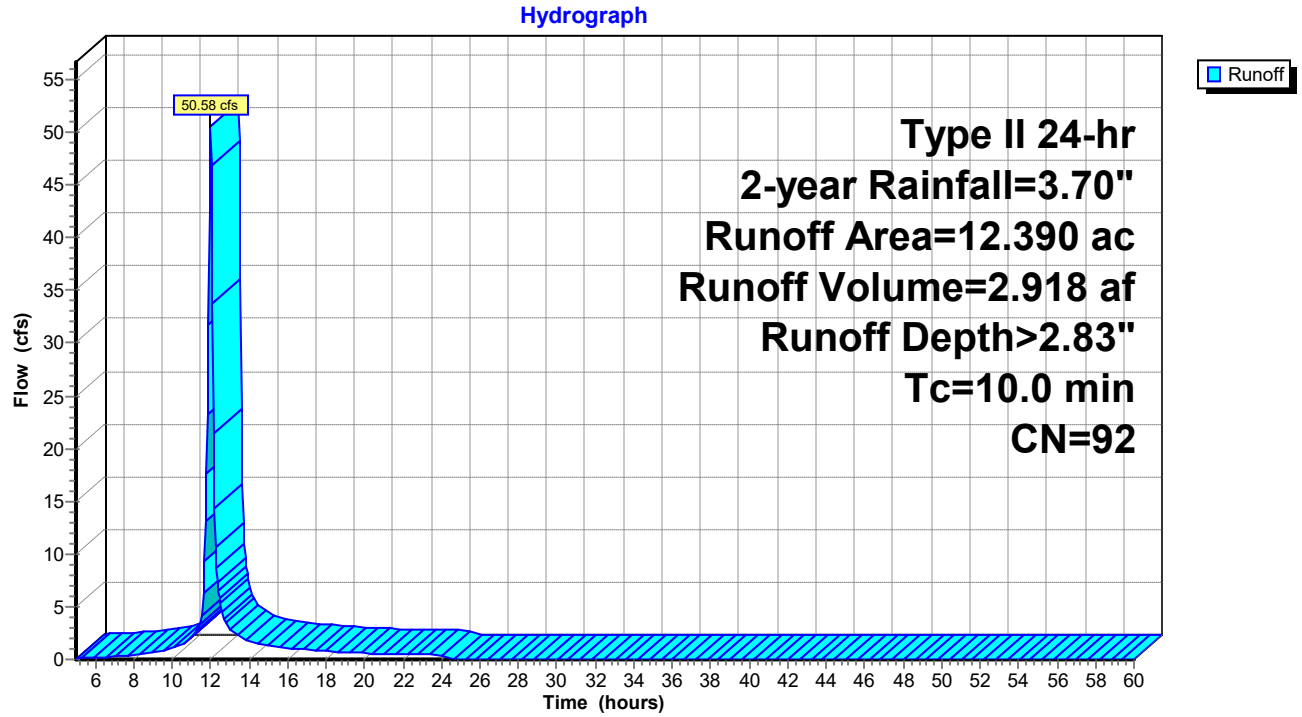
Runoff = 50.58 cfs @ 12.01 hrs, Volume= 2.918 af, Depth> 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-year Rainfall=3.70"

	Area (ac)	CN	Description
*	12.390	92	
	12.390		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2S: Proposed



Summary for Subcatchment 5S: Off-Site

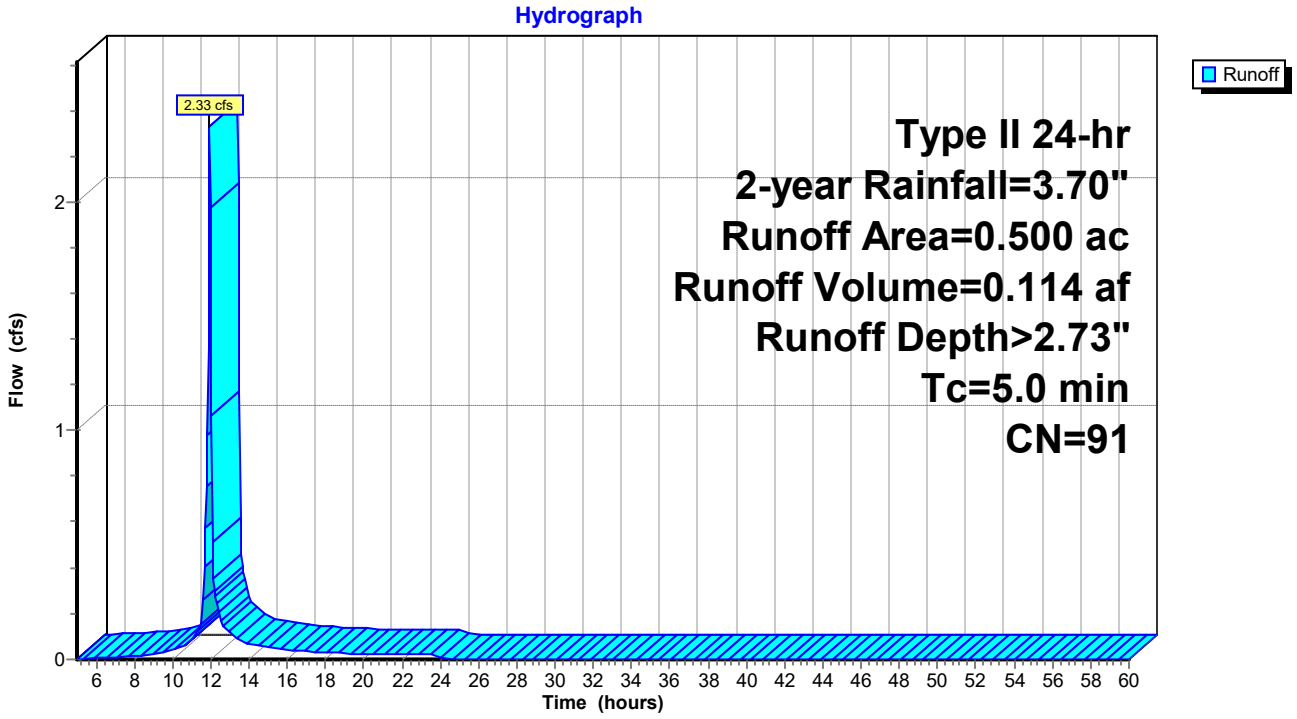
Runoff = 2.33 cfs @ 11.95 hrs, Volume= 0.114 af, Depth> 2.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-year Rainfall=3.70"

	Area (ac)	CN	Description
*	0.500	91	
	0.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 5S: Off-Site



Summary for Pond 3P: Existing Detention

Inflow Area = 12.190 ac, 0.00% Impervious, Inflow Depth > 2.64" for 2-year event
Inflow = 47.16 cfs @ 12.01 hrs, Volume= 2.677 af
Outflow = 29.89 cfs @ 12.11 hrs, Volume= 2.670 af, Atten= 37%, Lag= 6.0 min
Primary = 29.89 cfs @ 12.11 hrs, Volume= 2.670 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 1,002.57' @ 12.11 hrs Surf.Area= 18,484 sf Storage= 33,368 cf

Plug-Flow detention time= 87.9 min calculated for 2.668 af (100% of inflow)
Center-of-Mass det. time= 86.7 min (888.6 - 802.0)

Volume	Invert	Avail.Storage	Storage Description
#1	999.00'	88,385 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

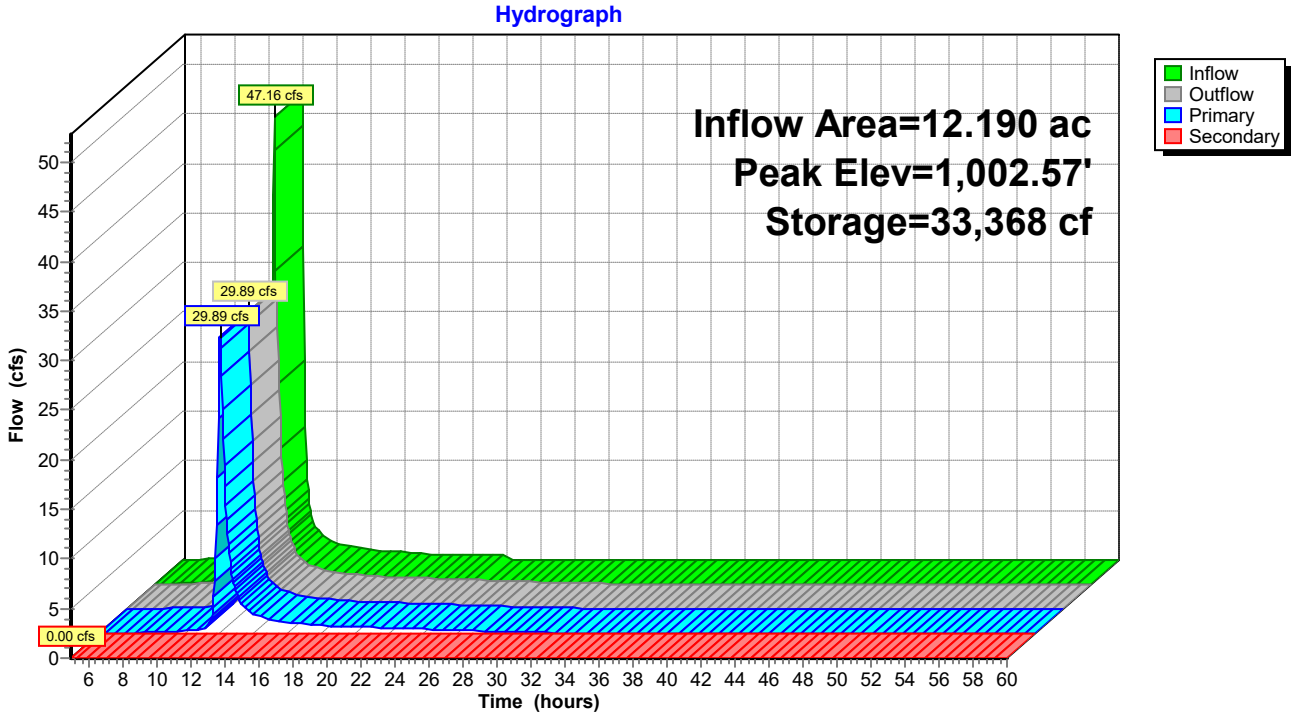
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
999.00	10	0	0
1,000.00	2,580	1,295	1,295
1,001.00	12,035	7,308	8,603
1,002.00	17,125	14,580	23,183
1,003.00	19,500	18,313	41,495
1,004.00	22,140	20,820	62,315
1,005.00	30,000	26,070	88,385

Device	Routing	Invert	Outlet Devices
#1	Primary	999.50'	**30.0" Round CMP_Round 30" X 2.00** L= 40.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 999.50' / 999.00' S= 0.0125 '/' Cc= 0.900 n= 0.025, Flow Area= 4.91 sf
#2	Device 1	999.25'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#3	Device 1	999.50'	**1.0" Vert. Orifice/Grate X 2.00** C= 0.600
#4	Device 1	999.75'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#5	Device 1	1,000.00'	**1.0" Vert. Orifice/Grate X 2.00** C= 0.600
#6	Device 1	1,000.25'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#7	Device 1	1,000.50'	**1.0" Vert. Orifice/Grate X 2.00** C= 0.600
#8	Device 1	1,000.75'	**3.0" Vert. Orifice/Grate X 3.00** C= 0.600
#9	Secondary	1,003.20'	**24.0' long x 22.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#10	Device 1	1,001.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Primary OutFlow Max=29.57 cfs @ 12.11 hrs HW=1,002.56' (Free Discharge)
└─**1=CMP_Round 30"** (Passes 29.57 cfs of 52.84 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 8.42 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.09 cfs @ 8.37 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 0.13 cfs @ 8.01 fps)
  ├─**5=Orifice/Grate** (Orifice Controls 0.08 cfs @ 7.64 fps)
  ├─**6=Orifice/Grate** (Orifice Controls 0.12 cfs @ 7.25 fps)
  ├─**7=Orifice/Grate** (Orifice Controls 0.07 cfs @ 6.84 fps)
  ├─**8=Orifice/Grate** (Orifice Controls 0.92 cfs @ 6.25 fps)
  └─**10=Sharp-Crested Rectangular Weir** (Weir Controls 28.01 cfs @ 4.87 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=999.00' (Free Discharge)
└─**9=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Existing Detention



Summary for Pond 4P: Proposed Detention

Inflow Area = 12.390 ac, 0.00% Impervious, Inflow Depth > 2.83" for 2-year event
Inflow = 50.58 cfs @ 12.01 hrs, Volume= 2.918 af
Outflow = 24.58 cfs @ 12.14 hrs, Volume= 2.918 af, Atten= 51%, Lag= 7.9 min
Primary = 24.58 cfs @ 12.14 hrs, Volume= 2.918 af

Routing by Stor-Ind method, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 999.60' @ 12.14 hrs Surf.Area= 18,184 sf Storage= 47,512 cf

Plug-Flow detention time= 203.1 min calculated for 2.918 af (100% of inflow)
Center-of-Mass det. time= 203.0 min (996.6 - 793.6)

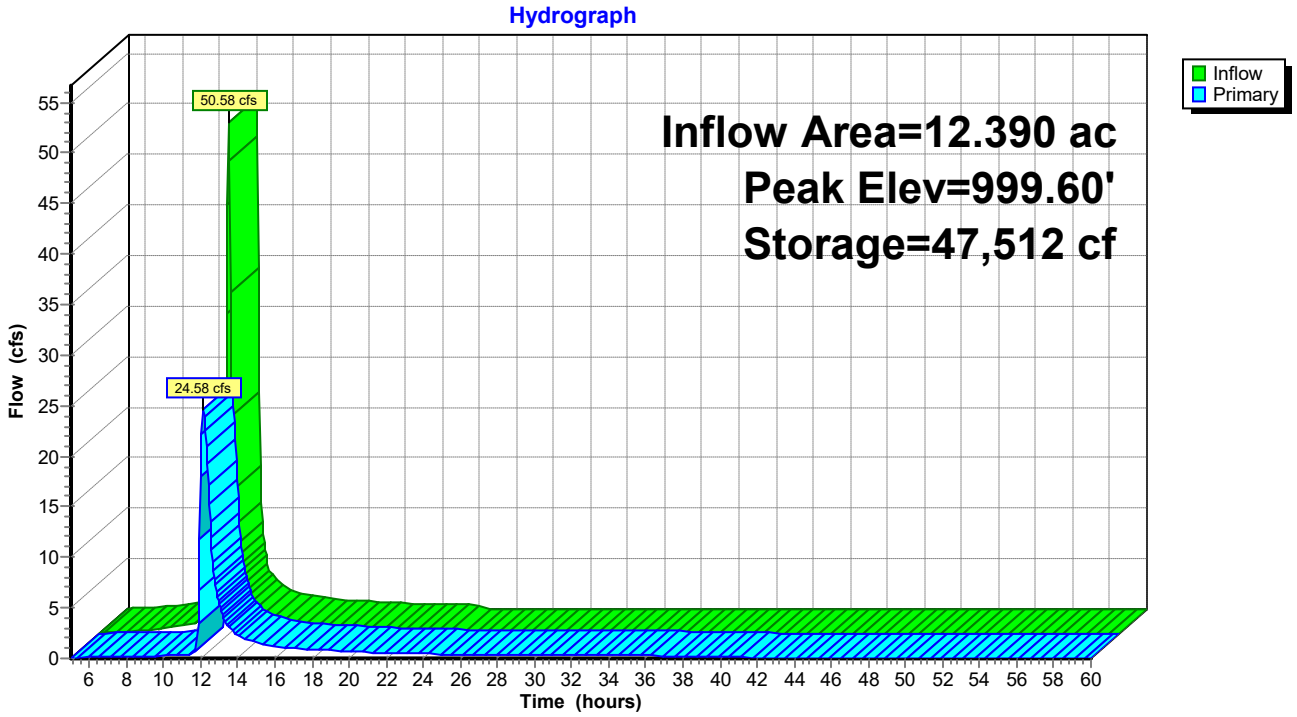
Volume	Invert	Avail.Storage	Storage Description
#1	995.00'	151,776 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.00	31	0	0
996.00	5,670	2,851	2,851
997.00	8,866	7,268	10,119
998.00	14,193	11,530	21,648
1,004.00	29,183	130,128	151,776

Device	Routing	Invert	Outlet Devices
#1	Primary	994.78'	**30.0" Round Culvert** L= 59.3' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 994.78' / 994.28' S= 0.0084 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Device 1	994.83'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	997.75'	**42.0" W x 16.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	1,001.00'	**1.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.7' Crest Height

Primary OutFlow Max=24.51 cfs @ 12.14 hrs HW=999.59' (Free Discharge)
└**1=Culvert** (Passes 24.51 cfs of 44.60 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.51 cfs @ 10.37 fps)
  ├**3=Orifice/Grate** (Orifice Controls 24.00 cfs @ 5.14 fps)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: Proposed Detention



Time span=5.00-60.00 hrs, dt=0.05 hrs, 1101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Runoff Area=12.190 ac 0.00% Impervious Runoff Depth>4.50"
Tc=10.0 min CN=90 Runoff=78.42 cfs 4.575 af

Subcatchment 2S: Proposed Runoff Area=12.390 ac 0.00% Impervious Runoff Depth>4.71"
Tc=10.0 min CN=92 Runoff=82.12 cfs 4.862 af

Subcatchment 5S: Off-Site Runoff Area=0.500 ac 0.00% Impervious Runoff Depth>4.61"
Tc=5.0 min CN=91 Runoff=3.81 cfs 0.192 af

Pond 3P: Existing Detention Peak Elev=1,003.29' Storage=47,320 cf Inflow=78.42 cfs 4.575 af
Primary=53.31 cfs 4.559 af Secondary=1.89 cfs 0.009 af Outflow=55.21 cfs 4.568 af

Pond 4P: Proposed Detention Peak Elev=1,000.88' Storage=72,825 cf Inflow=82.12 cfs 4.862 af
Outflow=35.71 cfs 4.862 af

Total Runoff Area = 25.080 ac Runoff Volume = 9.629 af Average Runoff Depth = 4.61"
100.00% Pervious = 25.080 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Existing

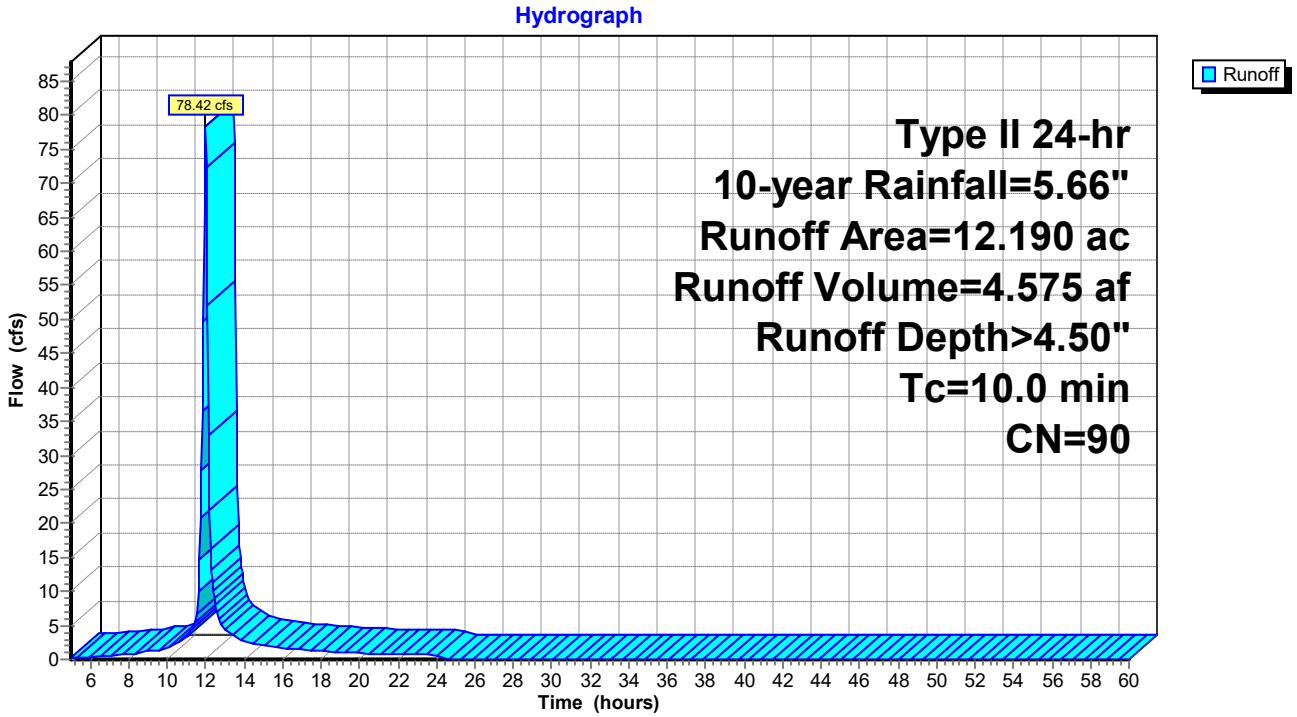
Runoff = 78.42 cfs @ 12.01 hrs, Volume= 4.575 af, Depth> 4.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-year Rainfall=5.66"

	Area (ac)	CN	Description
*	12.190	90	
	12.190		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 1S: Existing



Summary for Subcatchment 2S: Proposed

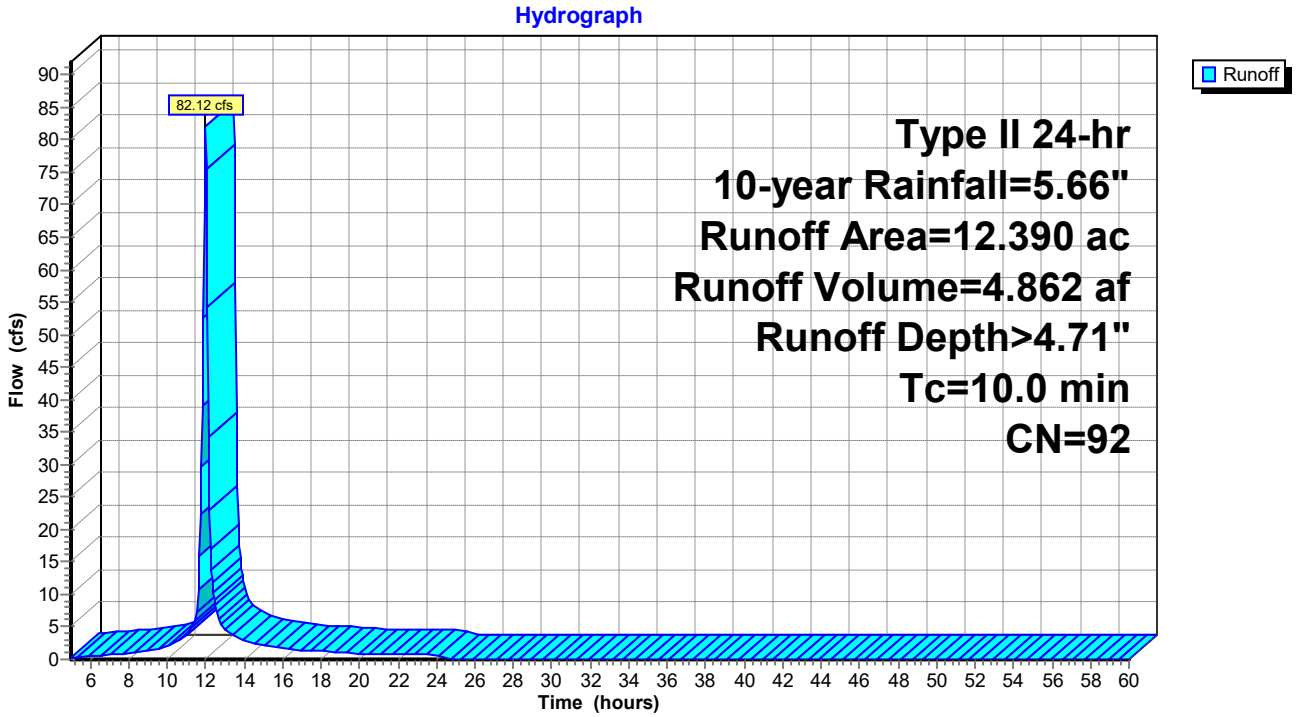
Runoff = 82.12 cfs @ 12.01 hrs, Volume= 4.862 af, Depth> 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-year Rainfall=5.66"

	Area (ac)	CN	Description
*	12.390	92	
	12.390		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2S: Proposed



Summary for Subcatchment 5S: Off-Site

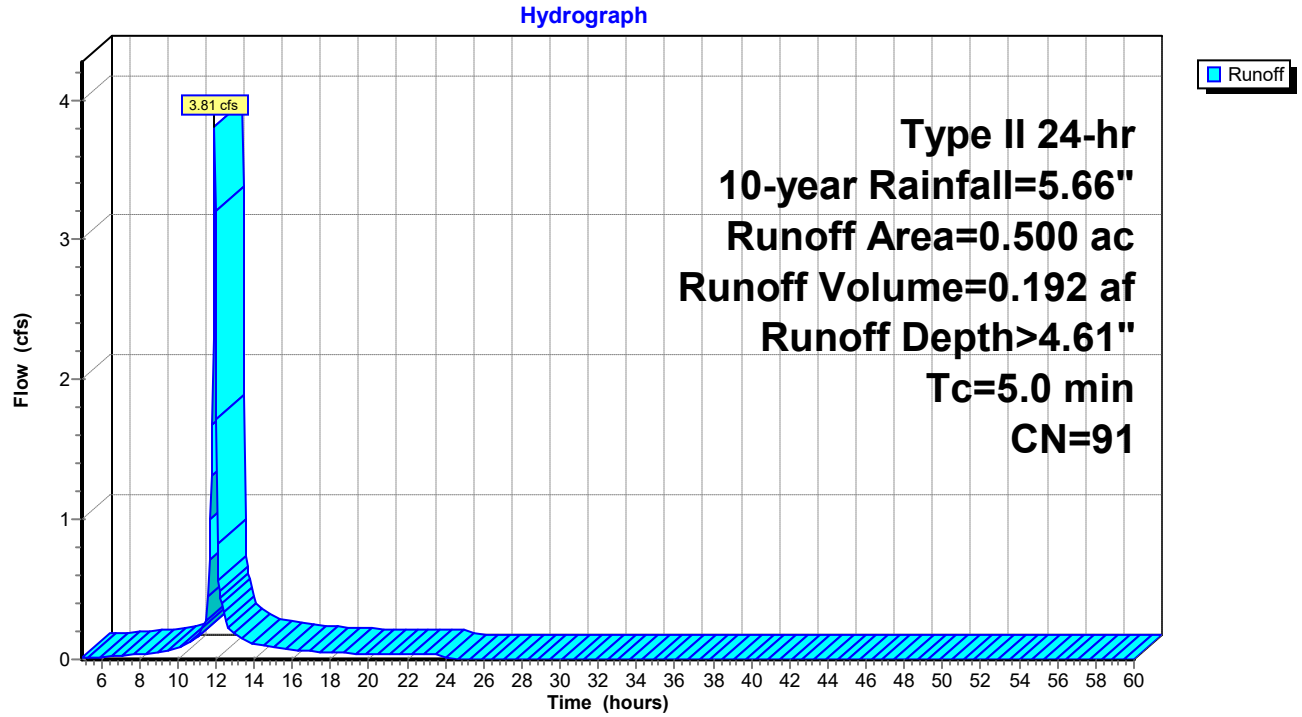
Runoff = 3.81 cfs @ 11.95 hrs, Volume= 0.192 af, Depth> 4.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-year Rainfall=5.66"

	Area (ac)	CN	Description
*	0.500	91	
	0.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 5S: Off-Site



Summary for Pond 3P: Existing Detention

Inflow Area = 12.190 ac, 0.00% Impervious, Inflow Depth > 4.50" for 10-year event
Inflow = 78.42 cfs @ 12.01 hrs, Volume= 4.575 af
Outflow = 55.21 cfs @ 12.10 hrs, Volume= 4.568 af, Atten= 30%, Lag= 5.4 min
Primary = 53.31 cfs @ 12.10 hrs, Volume= 4.559 af
Secondary = 1.89 cfs @ 12.10 hrs, Volume= 0.009 af

Routing by Stor-Ind method, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 1,003.29' @ 12.10 hrs Surf.Area= 20,273 sf Storage= 47,320 cf

Plug-Flow detention time= 66.2 min calculated for 4.567 af (100% of inflow)
Center-of-Mass det. time= 64.4 min (852.7 - 788.3)

Volume	Invert	Avail.Storage	Storage Description
#1	999.00'	88,385 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

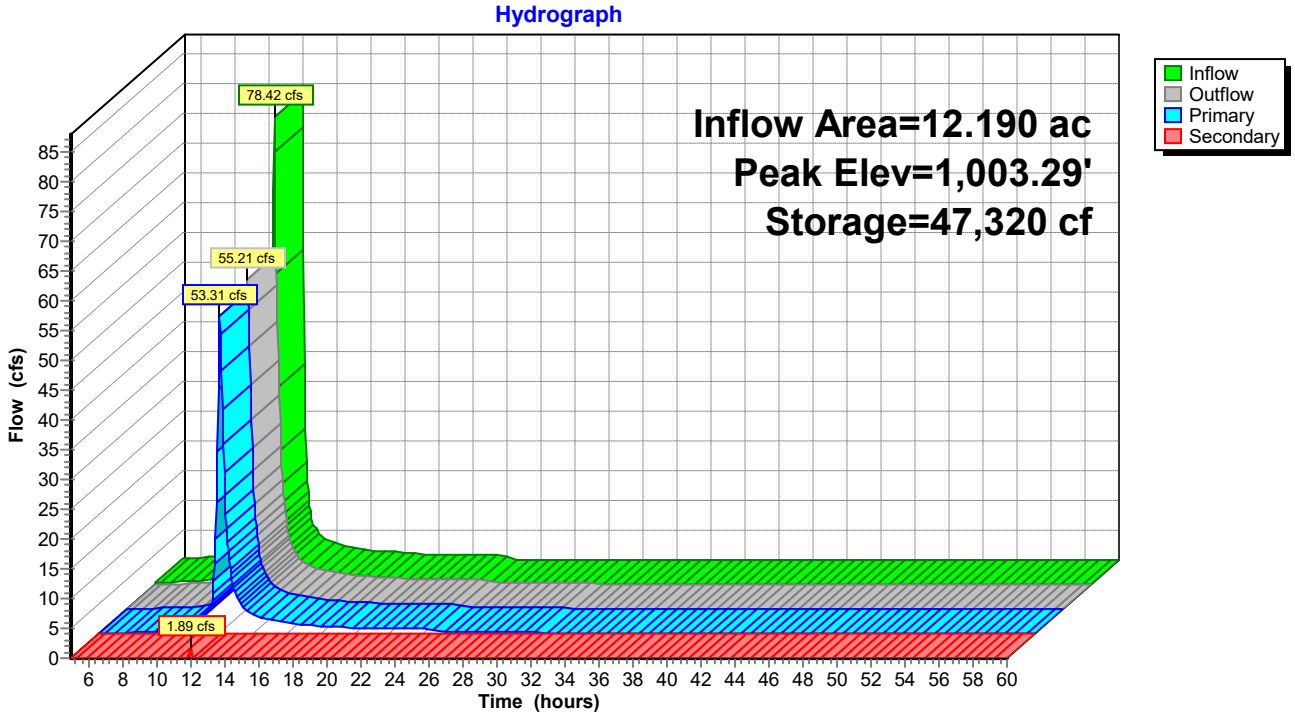
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
999.00	10	0	0
1,000.00	2,580	1,295	1,295
1,001.00	12,035	7,308	8,603
1,002.00	17,125	14,580	23,183
1,003.00	19,500	18,313	41,495
1,004.00	22,140	20,820	62,315
1,005.00	30,000	26,070	88,385

Device	Routing	Invert	Outlet Devices
#1	Primary	999.50'	**30.0" Round CMP_Round 30" X 2.00** L= 40.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 999.50' / 999.00' S= 0.0125 '/' Cc= 0.900 n= 0.025, Flow Area= 4.91 sf
#2	Device 1	999.25'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#3	Device 1	999.50'	**1.0" Vert. Orifice/Grate X 2.00** C= 0.600
#4	Device 1	999.75'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#5	Device 1	1,000.00'	**1.0" Vert. Orifice/Grate X 2.00** C= 0.600
#6	Device 1	1,000.25'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#7	Device 1	1,000.50'	**1.0" Vert. Orifice/Grate X 2.00** C= 0.600
#8	Device 1	1,000.75'	**3.0" Vert. Orifice/Grate X 3.00** C= 0.600
#9	Secondary	1,003.20'	**24.0' long x 22.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#10	Device 1	1,001.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Primary OutFlow Max=53.25 cfs @ 12.10 hrs HW=1,003.29' (Free Discharge)
└─**1=CMP_Round 30"** (Passes 53.25 cfs of 62.25 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.15 cfs @ 9.38 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.10 cfs @ 9.32 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 0.15 cfs @ 9.01 fps)
  ├─**5=Orifice/Grate** (Orifice Controls 0.09 cfs @ 8.68 fps)
  ├─**6=Orifice/Grate** (Orifice Controls 0.14 cfs @ 8.34 fps)
  ├─**7=Orifice/Grate** (Orifice Controls 0.09 cfs @ 7.98 fps)
  ├─**8=Orifice/Grate** (Orifice Controls 1.10 cfs @ 7.48 fps)
  └─**10=Sharp-Crested Rectangular Weir** (Weir Controls 51.43 cfs @ 6.34 fps)

Secondary OutFlow Max=1.79 cfs @ 12.10 hrs HW=1,003.29' (Free Discharge)
└─**9=Broad-Crested Rectangular Weir** (Weir Controls 1.79 cfs @ 0.81 fps)

Pond 3P: Existing Detention



Summary for Pond 4P: Proposed Detention

Inflow Area = 12.390 ac, 0.00% Impervious, Inflow Depth > 4.71" for 10-year event
Inflow = 82.12 cfs @ 12.01 hrs, Volume= 4.862 af
Outflow = 35.71 cfs @ 12.15 hrs, Volume= 4.862 af, Atten= 57%, Lag= 8.7 min
Primary = 35.71 cfs @ 12.15 hrs, Volume= 4.862 af

Routing by Stor-Ind method, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 1,000.88' @ 12.15 hrs Surf.Area= 21,381 sf Storage= 72,825 cf

Plug-Flow detention time= 141.6 min calculated for 4.857 af (100% of inflow)
Center-of-Mass det. time= 142.3 min (924.5 - 782.2)

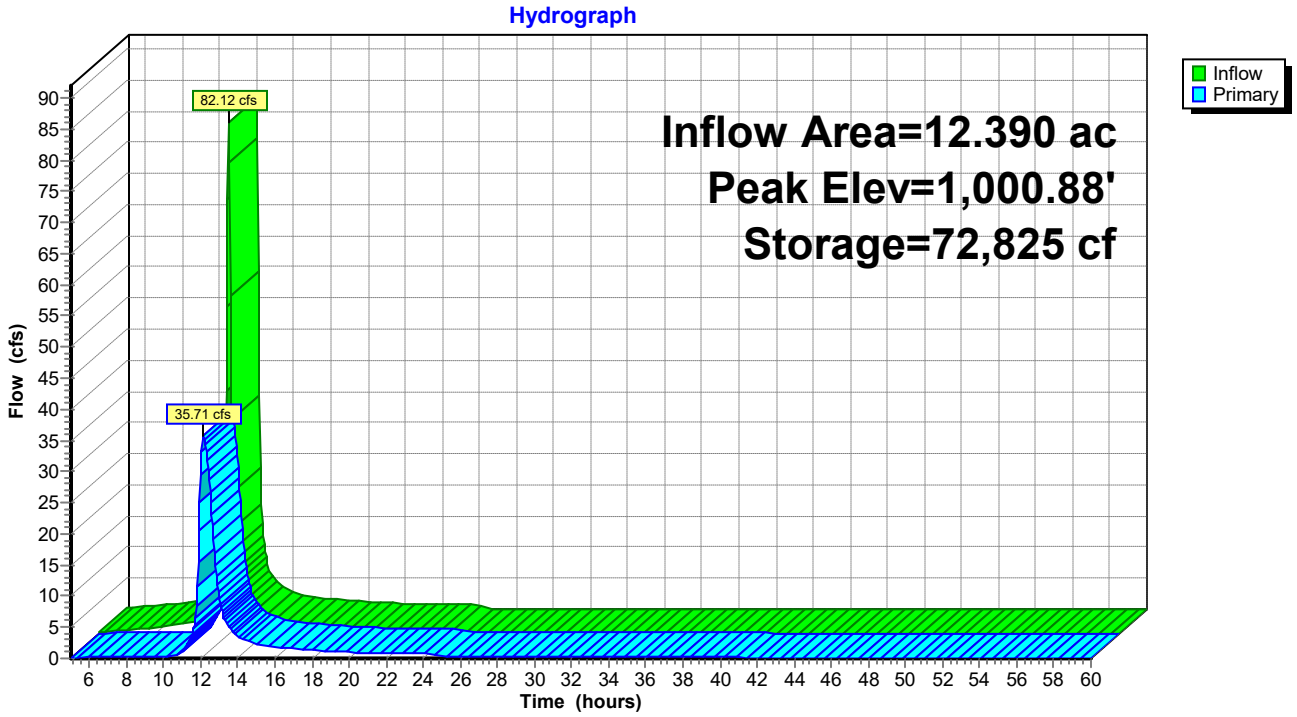
Volume	Invert	Avail.Storage	Storage Description
#1	995.00'	151,776 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.00	31	0	0
996.00	5,670	2,851	2,851
997.00	8,866	7,268	10,119
998.00	14,193	11,530	21,648
1,004.00	29,183	130,128	151,776

Device	Routing	Invert	Outlet Devices
#1	Primary	994.78'	**30.0" Round Culvert** L= 59.3' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 994.78' / 994.28' S= 0.0084 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Device 1	994.83'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	997.75'	**42.0" W x 16.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	1,001.00'	**1.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.7' Crest Height

Primary OutFlow Max=35.68 cfs @ 12.15 hrs HW=1,000.87' (Free Discharge)
└**1=Culvert** (Passes 35.68 cfs of 52.01 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.57 cfs @ 11.71 fps)
  ├**3=Orifice/Grate** (Orifice Controls 35.11 cfs @ 7.52 fps)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: Proposed Detention



Time span=5.00-60.00 hrs, dt=0.05 hrs, 1101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Runoff Area=12.190 ac 0.00% Impervious Runoff Depth>7.94"
Tc=10.0 min CN=90 Runoff=134.50 cfs 8.068 af

Subcatchment 2S: Proposed Runoff Area=12.390 ac 0.00% Impervious Runoff Depth>8.15"
Tc=10.0 min CN=92 Runoff=138.64 cfs 8.411 af

Subcatchment 5S: Off-Site Runoff Area=0.500 ac 0.00% Impervious Runoff Depth>8.04"
Tc=5.0 min CN=91 Runoff=6.47 cfs 0.335 af

Pond 3P: Existing Detention Peak Elev=1,003.97' Storage=61,626 cf Inflow=134.50 cfs 8.068 af
Primary=73.08 cfs 7.468 af Secondary=42.83 cfs 0.592 af Outflow=115.91 cfs 8.060 af

Pond 4P: Proposed Detention Peak Elev=1,002.77' Storage=117,746 cf Inflow=138.64 cfs 8.411 af
Outflow=54.00 cfs 8.411 af

Total Runoff Area = 25.080 ac Runoff Volume = 16.814 af Average Runoff Depth = 8.04"
100.00% Pervious = 25.080 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Existing

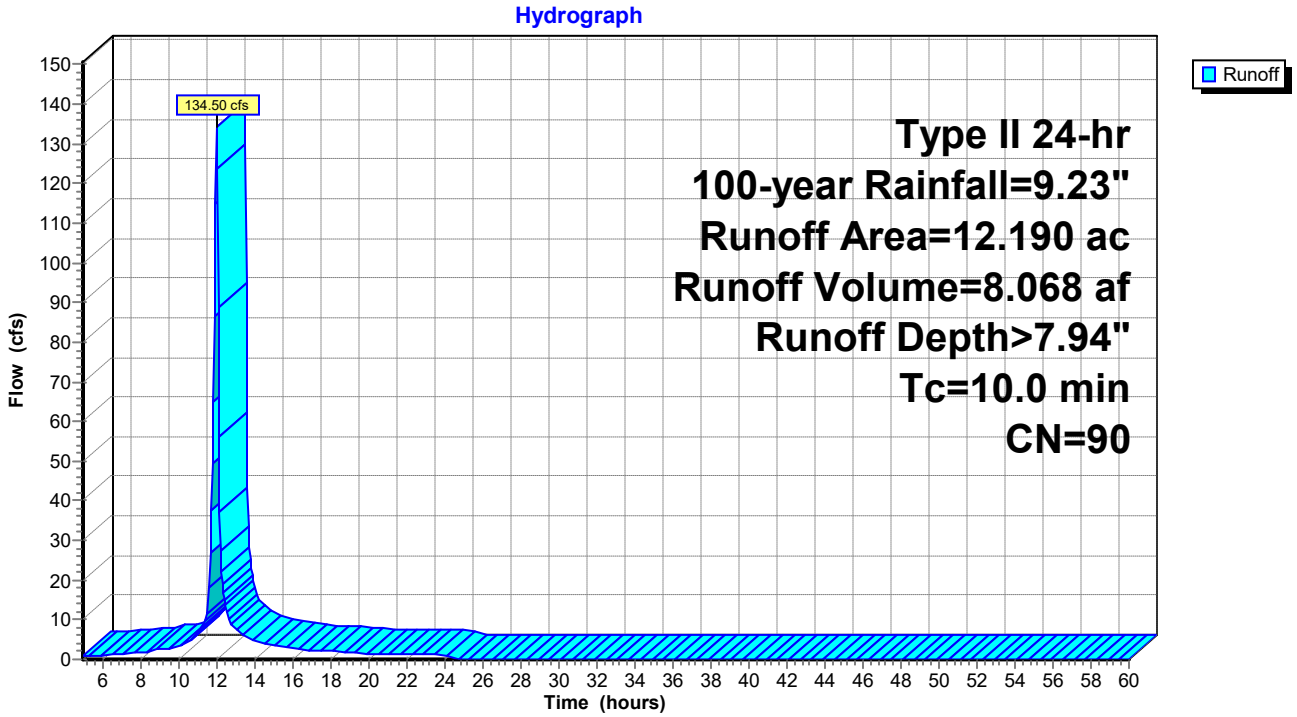
Runoff = 134.50 cfs @ 12.01 hrs, Volume= 8.068 af, Depth> 7.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-year Rainfall=9.23"

	Area (ac)	CN	Description
*	12.190	90	
	12.190		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 1S: Existing



Summary for Subcatchment 2S: Proposed

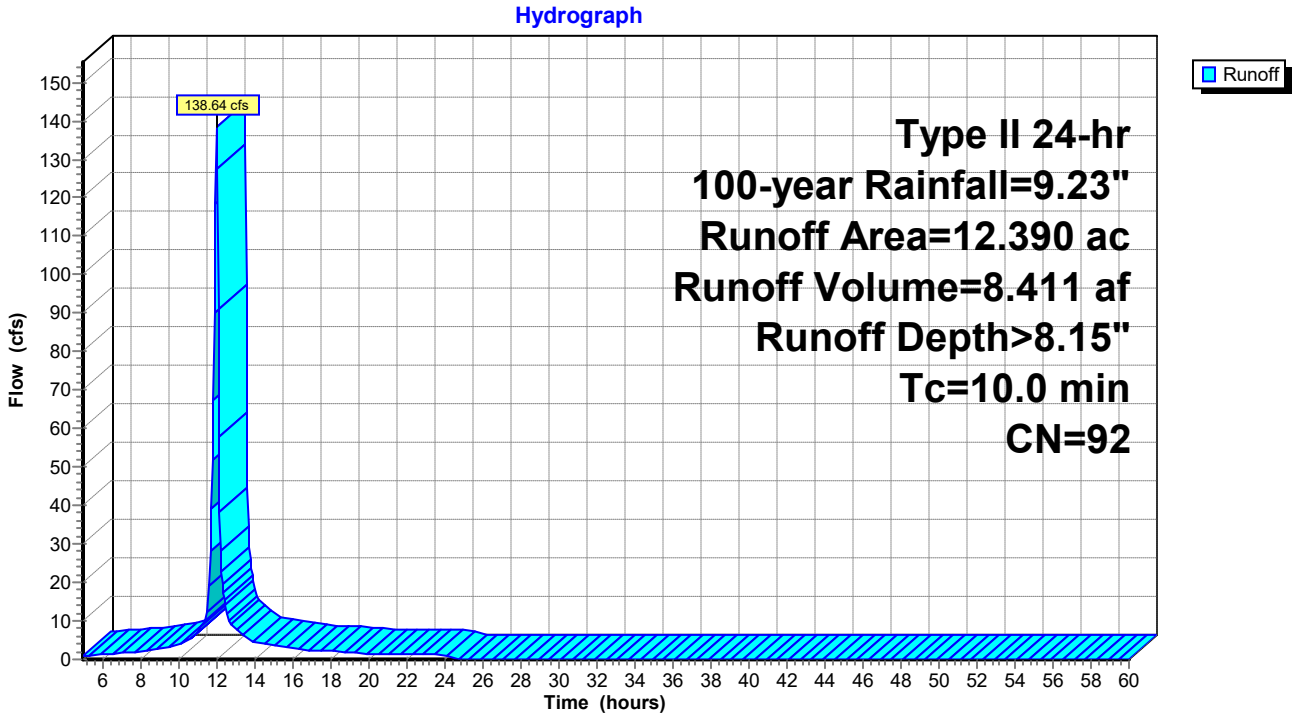
Runoff = 138.64 cfs @ 12.01 hrs, Volume= 8.411 af, Depth> 8.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-year Rainfall=9.23"

	Area (ac)	CN	Description
*	12.390	92	
	12.390		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2S: Proposed



Summary for Subcatchment 5S: Off-Site

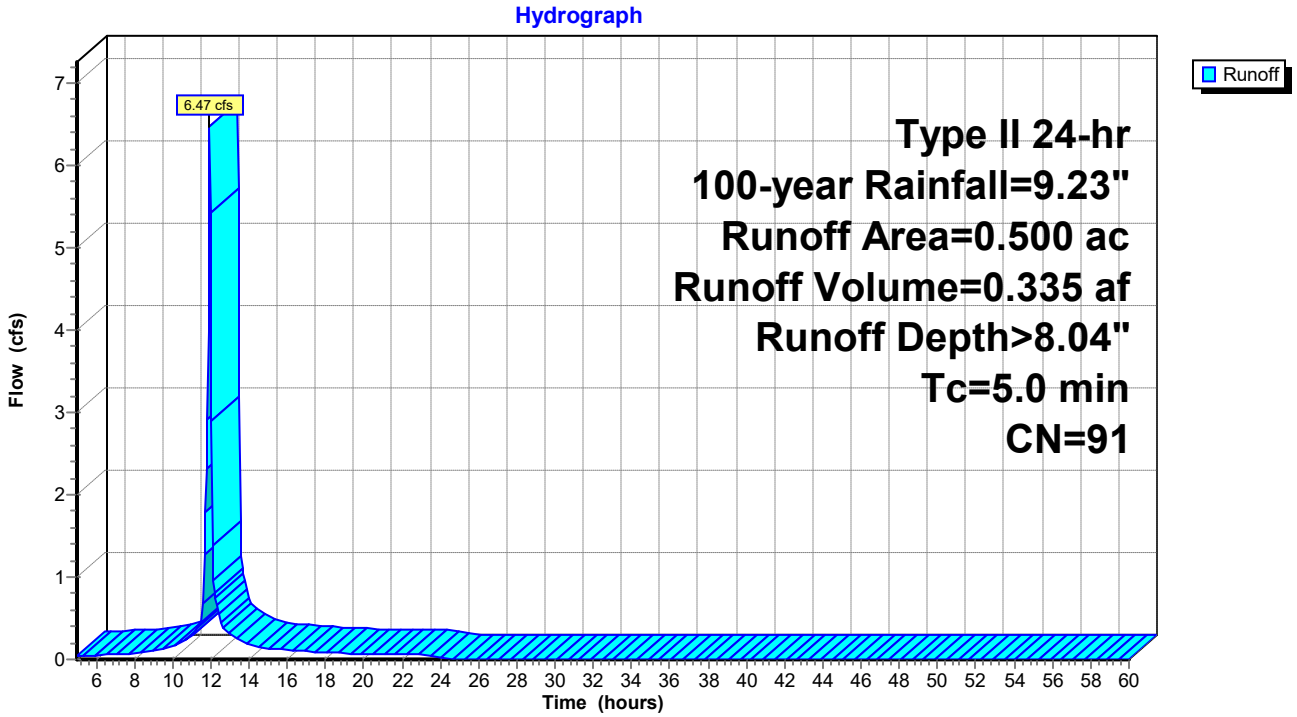
Runoff = 6.47 cfs @ 11.95 hrs, Volume= 0.335 af, Depth> 8.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-year Rainfall=9.23"

	Area (ac)	CN	Description
*	0.500	91	
	0.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 5S: Off-Site



Summary for Pond 3P: Existing Detention

Inflow Area = 12.190 ac, 0.00% Impervious, Inflow Depth > 7.94" for 100-year event
Inflow = 134.50 cfs @ 12.01 hrs, Volume= 8.068 af
Outflow = 115.91 cfs @ 12.06 hrs, Volume= 8.060 af, Atten= 14%, Lag= 3.4 min
Primary = 73.08 cfs @ 12.06 hrs, Volume= 7.468 af
Secondary = 42.83 cfs @ 12.06 hrs, Volume= 0.592 af

Routing by Stor-Ind method, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 1,003.97' @ 12.06 hrs Surf.Area= 22,058 sf Storage= 61,626 cf

Plug-Flow detention time= 46.9 min calculated for 8.059 af (100% of inflow)
Center-of-Mass det. time= 45.4 min (822.5 - 777.1)

Volume	Invert	Avail.Storage	Storage Description
#1	999.00'	88,385 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

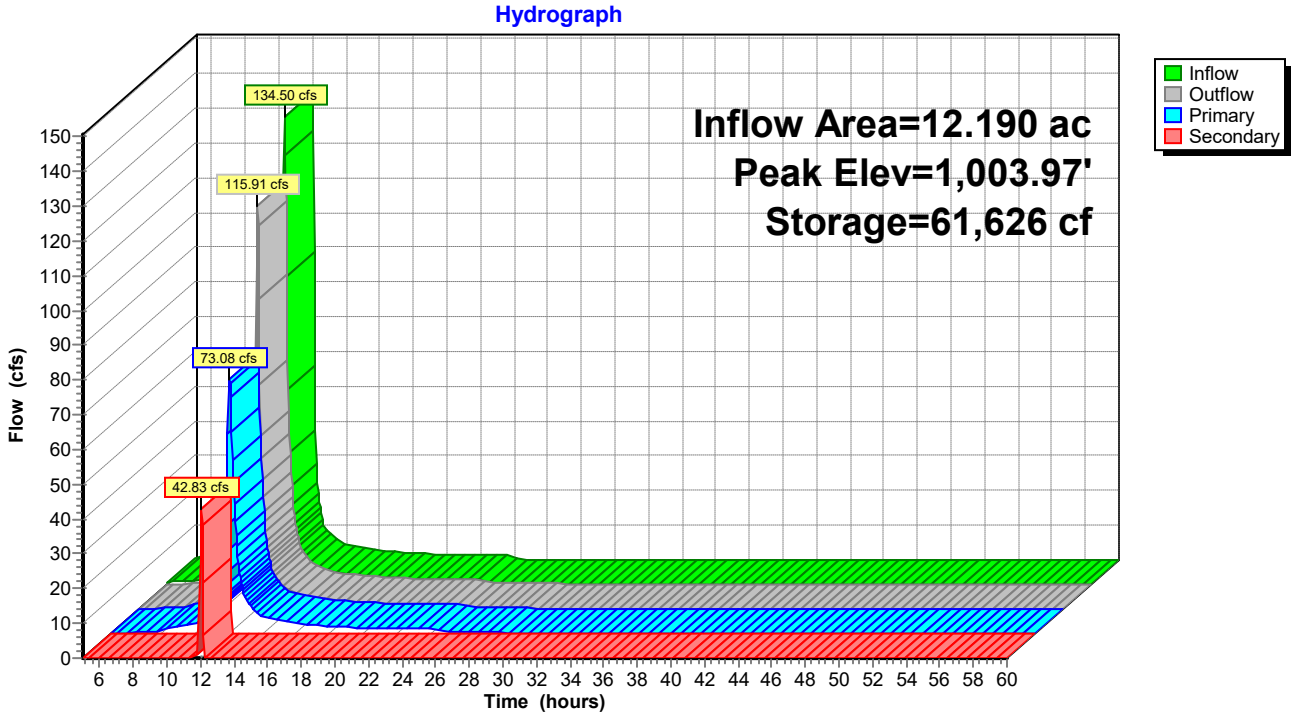
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
999.00	10	0	0
1,000.00	2,580	1,295	1,295
1,001.00	12,035	7,308	8,603
1,002.00	17,125	14,580	23,183
1,003.00	19,500	18,313	41,495
1,004.00	22,140	20,820	62,315
1,005.00	30,000	26,070	88,385

Device	Routing	Invert	Outlet Devices
#1	Primary	999.50'	**30.0" Round CMP_Round 30" X 2.00** L= 40.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 999.50' / 999.00' S= 0.0125 '/' Cc= 0.900 n= 0.025, Flow Area= 4.91 sf
#2	Device 1	999.25'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#3	Device 1	999.50'	**1.0" Vert. Orifice/Grate X 2.00** C= 0.600
#4	Device 1	999.75'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#5	Device 1	1,000.00'	**1.0" Vert. Orifice/Grate X 2.00** C= 0.600
#6	Device 1	1,000.25'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#7	Device 1	1,000.50'	**1.0" Vert. Orifice/Grate X 2.00** C= 0.600
#8	Device 1	1,000.75'	**3.0" Vert. Orifice/Grate X 3.00** C= 0.600
#9	Secondary	1,003.20'	**24.0' long x 22.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#10	Device 1	1,001.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Primary OutFlow Max=72.73 cfs @ 12.06 hrs HW=1,003.95' (Free Discharge)
└─**1=CMP_Round 30"** (Barrel Controls 72.73 cfs @ 7.41 fps)
  ├─**2=Orifice/Grate** (Passes < 0.17 cfs potential flow)
  ├─**3=Orifice/Grate** (Passes < 0.11 cfs potential flow)
  ├─**4=Orifice/Grate** (Passes < 0.16 cfs potential flow)
  ├─**5=Orifice/Grate** (Passes < 0.10 cfs potential flow)
  ├─**6=Orifice/Grate** (Passes < 0.15 cfs potential flow)
  ├─**7=Orifice/Grate** (Passes < 0.10 cfs potential flow)
  ├─**8=Orifice/Grate** (Passes < 1.24 cfs potential flow)
  └─**10=Sharp-Crested Rectangular Weir** (Passes < 76.70 cfs potential flow)

Secondary OutFlow Max=41.07 cfs @ 12.06 hrs HW=1,003.95' (Free Discharge)
└─**9=Broad-Crested Rectangular Weir** (Weir Controls 41.07 cfs @ 2.29 fps)

Pond 3P: Existing Detention



Summary for Pond 4P: Proposed Detention

Inflow Area = 12.390 ac, 0.00% Impervious, Inflow Depth > 8.15" for 100-year event
Inflow = 138.64 cfs @ 12.01 hrs, Volume= 8.411 af
Outflow = 54.00 cfs @ 12.16 hrs, Volume= 8.411 af, Atten= 61%, Lag= 9.4 min
Primary = 54.00 cfs @ 12.16 hrs, Volume= 8.411 af

Routing by Stor-Ind method, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 1,002.77' @ 12.16 hrs Surf.Area= 26,108 sf Storage= 117,746 cf

Plug-Flow detention time= 99.9 min calculated for 8.402 af (100% of inflow)
Center-of-Mass det. time= 100.6 min (873.5 - 773.0)

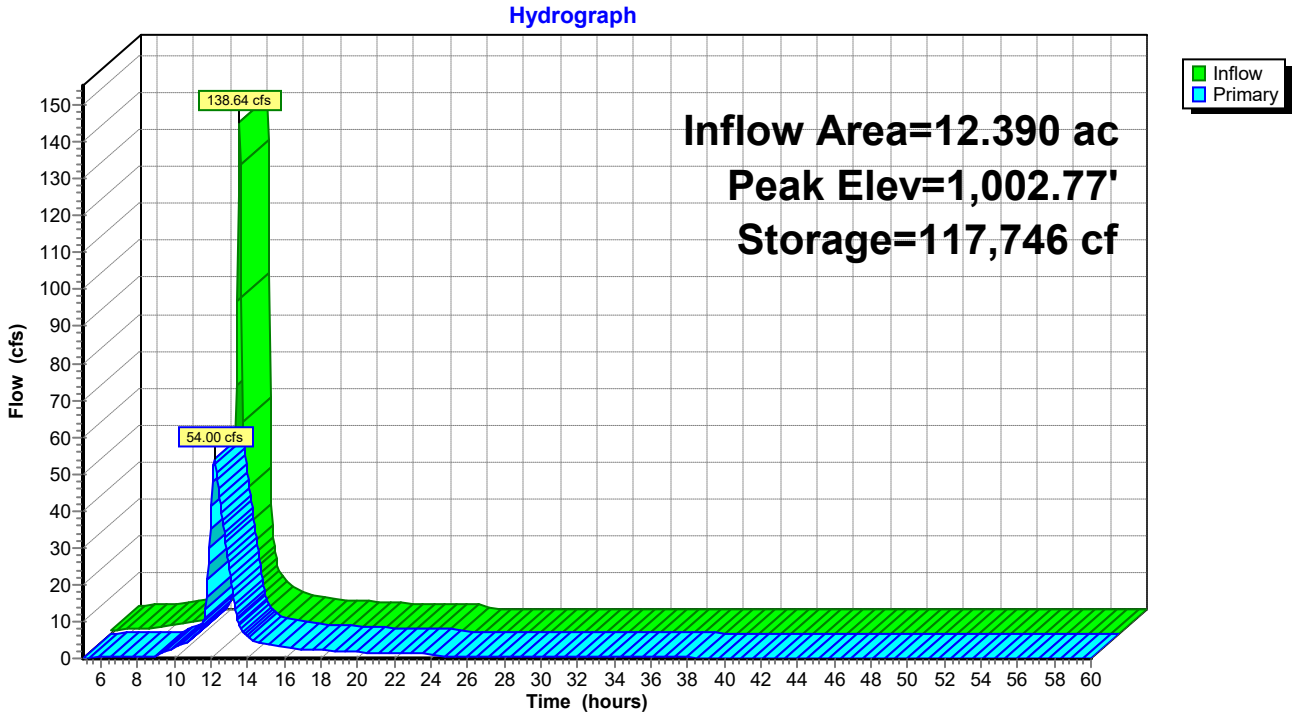
Volume	Invert	Avail.Storage	Storage Description
#1	995.00'	151,776 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.00	31	0	0
996.00	5,670	2,851	2,851
997.00	8,866	7,268	10,119
998.00	14,193	11,530	21,648
1,004.00	29,183	130,128	151,776

Device	Routing	Invert	Outlet Devices
#1	Primary	994.78'	**30.0" Round Culvert** L= 59.3' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 994.78' / 994.28' S= 0.0084 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Device 1	994.83'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	997.75'	**42.0" W x 16.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	1,001.00'	**1.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.7' Crest Height

Primary OutFlow Max=53.81 cfs @ 12.16 hrs HW=1,002.75' (Free Discharge)
└**1=Culvert** (Passes 53.81 cfs of 61.27 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.66 cfs @ 13.44 fps)
  ├**3=Orifice/Grate** (Orifice Controls 46.73 cfs @ 10.01 fps)
  └**4=Sharp-Crested Rectangular Weir** (Weir Controls 6.42 cfs @ 5.65 fps)

Pond 4P: Proposed Detention



Time span=5.00-60.00 hrs, dt=0.05 hrs, 1101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Runoff Area=12.190 ac 0.00% Impervious Runoff Depth=0.58"
Tc=10.0 min CN=90 Runoff=10.74 cfs 0.592 af

Subcatchment 2S: Proposed Runoff Area=12.390 ac 0.00% Impervious Runoff Depth=0.69"
Tc=10.0 min CN=92 Runoff=13.00 cfs 0.715 af

Subcatchment 5S: Off-Site Runoff Area=0.500 ac 0.00% Impervious Runoff Depth=0.64"
Tc=5.0 min CN=91 Runoff=0.57 cfs 0.026 af

Pond 3P: Existing Detention Peak Elev=1,001.18' Storage=10,894 cf Inflow=10.74 cfs 0.592 af
Primary=1.88 cfs 0.585 af Secondary=0.00 cfs 0.000 af Outflow=1.88 cfs 0.585 af

Pond 4P: Proposed Detention Peak Elev=997.75' Storage=18,262 cf Inflow=13.00 cfs 0.715 af
Outflow=0.40 cfs 0.715 af

Total Runoff Area = 25.080 ac Runoff Volume = 1.334 af Average Runoff Depth = 0.64"
100.00% Pervious = 25.080 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Existing

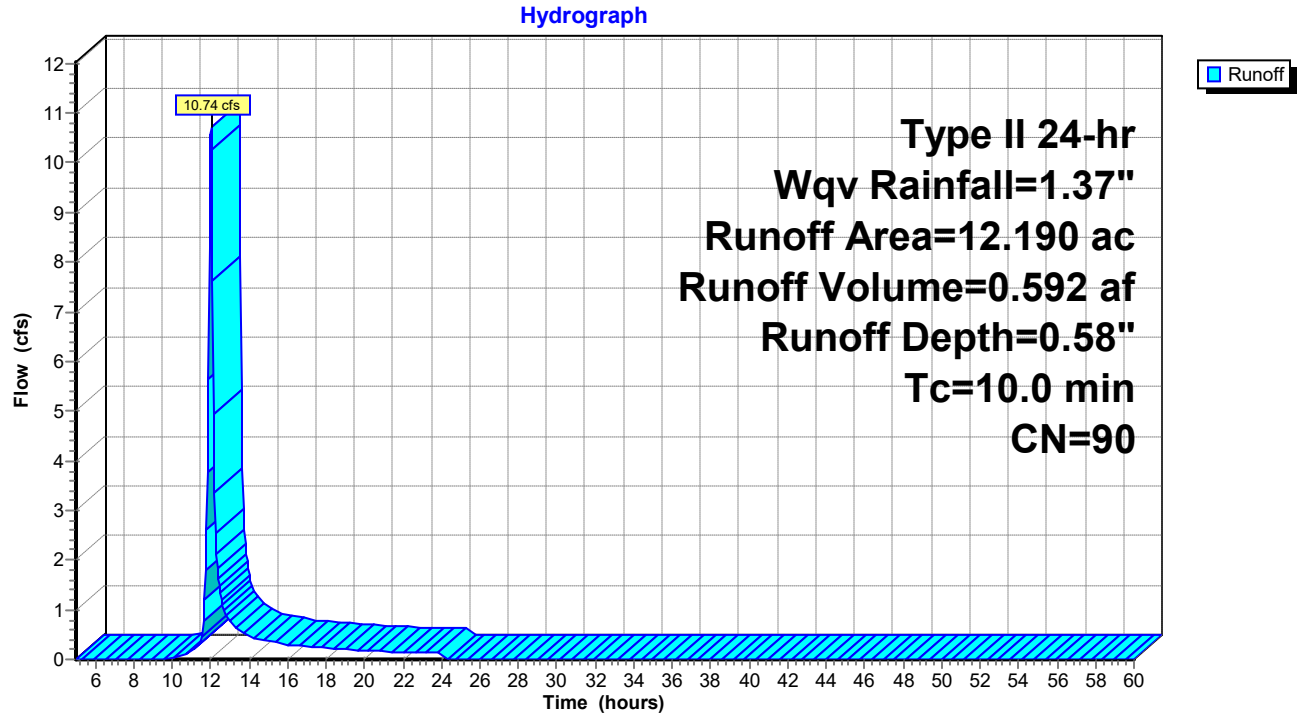
Runoff = 10.74 cfs @ 12.02 hrs, Volume= 0.592 af, Depth= 0.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr Wqv Rainfall=1.37"

	Area (ac)	CN	Description
*	12.190	90	
	12.190		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 1S: Existing



Summary for Subcatchment 2S: Proposed

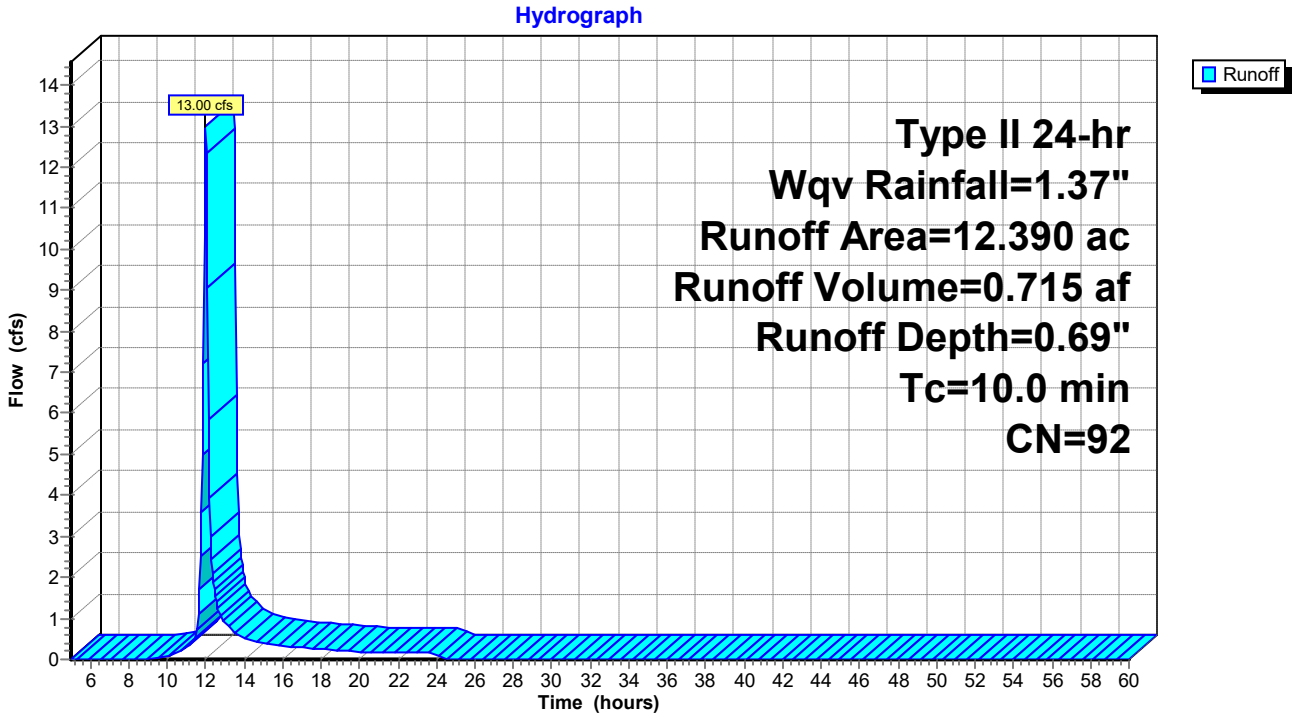
Runoff = 13.00 cfs @ 12.02 hrs, Volume= 0.715 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr Wqv Rainfall=1.37"

	Area (ac)	CN	Description
*	12.390	92	
	12.390		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry,**

Subcatchment 2S: Proposed



Summary for Subcatchment 5S: Off-Site

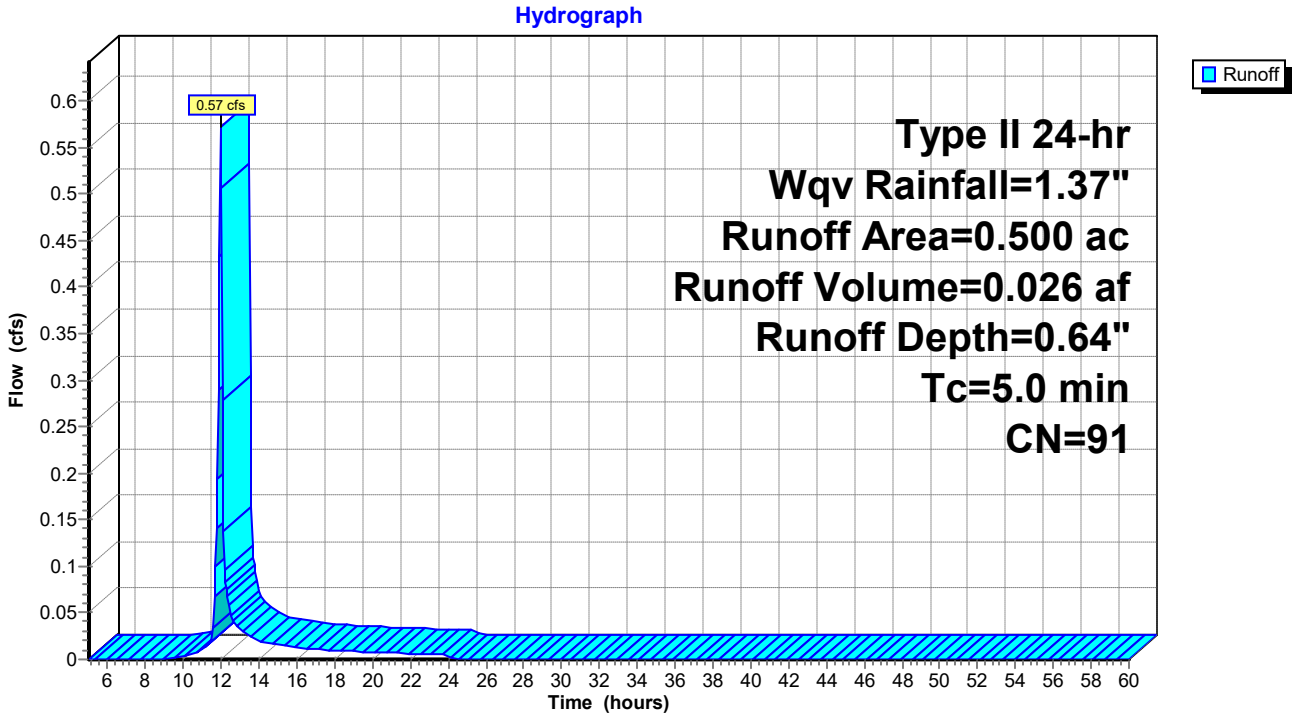
Runoff = 0.57 cfs @ 11.96 hrs, Volume= 0.026 af, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Type II 24-hr Wqv Rainfall=1.37"

	Area (ac)	CN	Description
*	0.500	91	
	0.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 5S: Off-Site



Summary for Pond 3P: Existing Detention

Inflow Area = 12.190 ac, 0.00% Impervious, Inflow Depth = 0.58" for Wqv event
Inflow = 10.74 cfs @ 12.02 hrs, Volume= 0.592 af
Outflow = 1.88 cfs @ 12.34 hrs, Volume= 0.585 af, Atten= 83%, Lag= 19.5 min
Primary = 1.88 cfs @ 12.34 hrs, Volume= 0.585 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 1,001.18' @ 12.34 hrs Surf.Area= 12,968 sf Storage= 10,894 cf

Plug-Flow detention time= 201.2 min calculated for 0.585 af (99% of inflow)
Center-of-Mass det. time= 193.0 min (1,038.2 - 845.1)

Volume	Invert	Avail.Storage	Storage Description
#1	999.00'	88,385 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

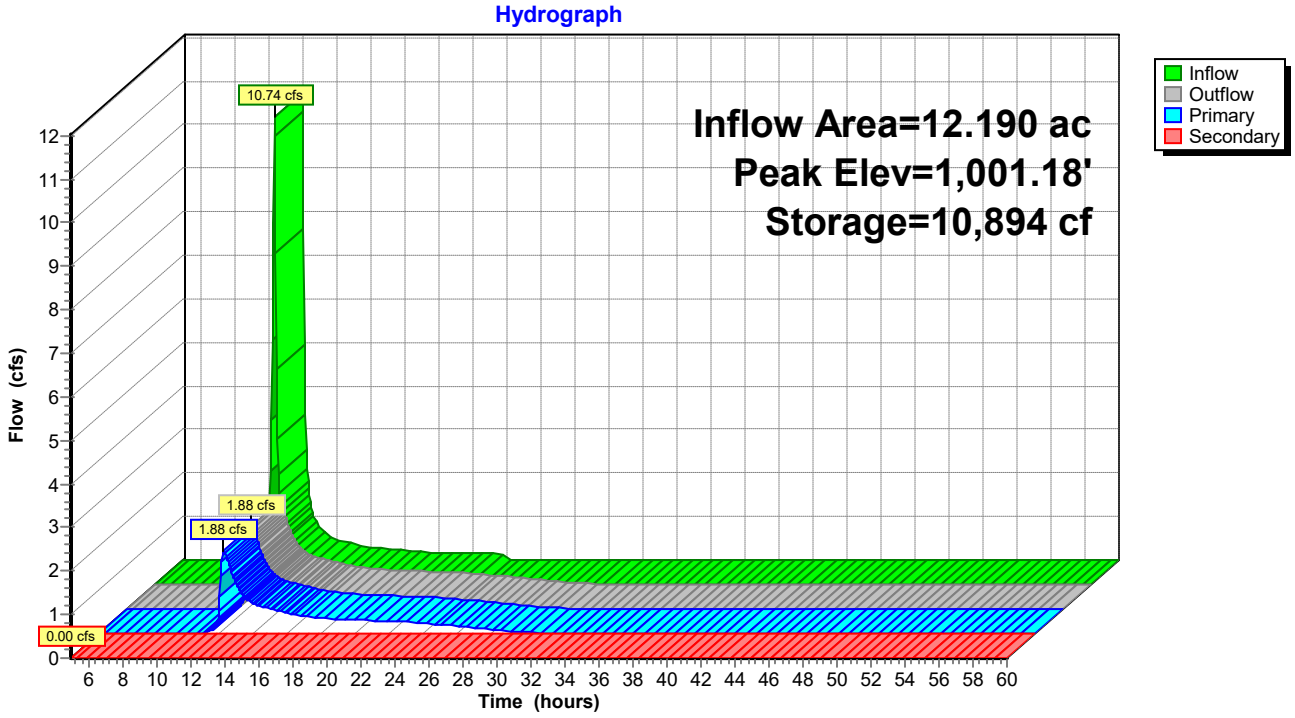
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
999.00	10	0	0
1,000.00	2,580	1,295	1,295
1,001.00	12,035	7,308	8,603
1,002.00	17,125	14,580	23,183
1,003.00	19,500	18,313	41,495
1,004.00	22,140	20,820	62,315
1,005.00	30,000	26,070	88,385

Device	Routing	Invert	Outlet Devices
#1	Primary	999.50'	**30.0" Round CMP_Round 30" X 2.00** L= 40.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 999.50' / 999.00' S= 0.0125 '/' Cc= 0.900 n= 0.025, Flow Area= 4.91 sf
#2	Device 1	999.25'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#3	Device 1	999.50'	**1.0" Vert. Orifice/Grate X 2.00** C= 0.600
#4	Device 1	999.75'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#5	Device 1	1,000.00'	**1.0" Vert. Orifice/Grate X 2.00** C= 0.600
#6	Device 1	1,000.25'	**1.0" Vert. Orifice/Grate X 3.00** C= 0.600
#7	Device 1	1,000.50'	**1.0" Vert. Orifice/Grate X 2.00** C= 0.600
#8	Device 1	1,000.75'	**3.0" Vert. Orifice/Grate X 3.00** C= 0.600
#9	Secondary	1,003.20'	**24.0' long x 22.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#10	Device 1	1,001.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Primary OutFlow Max=1.87 cfs @ 12.34 hrs HW=1,001.18' (Free Discharge)
└─**1=CMP_Round 30"** (Passes 1.87 cfs of 22.64 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.10 cfs @ 6.25 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.07 cfs @ 6.17 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 0.09 cfs @ 5.68 fps)
  ├─**5=Orifice/Grate** (Orifice Controls 0.06 cfs @ 5.14 fps)
  ├─**6=Orifice/Grate** (Orifice Controls 0.07 cfs @ 4.55 fps)
  ├─**7=Orifice/Grate** (Orifice Controls 0.04 cfs @ 3.86 fps)
  ├─**8=Orifice/Grate** (Orifice Controls 0.39 cfs @ 2.67 fps)
  └─**10=Sharp-Crested Rectangular Weir** (Weir Controls 1.04 cfs @ 1.43 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=999.00' (Free Discharge)
└─**9=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Existing Detention



Summary for Pond 4P: Proposed Detention

Inflow Area = 12.390 ac, 0.00% Impervious, Inflow Depth = 0.69" for Wqv event
Inflow = 13.00 cfs @ 12.02 hrs, Volume= 0.715 af
Outflow = 0.40 cfs @ 15.23 hrs, Volume= 0.715 af, Atten= 97%, Lag= 192.8 min
Primary = 0.40 cfs @ 15.23 hrs, Volume= 0.715 af

Routing by Stor-Ind method, Time Span= 5.00-60.00 hrs, dt= 0.05 hrs
Peak Elev= 997.75' @ 15.23 hrs Surf.Area= 12,859 sf Storage= 18,262 cf

Plug-Flow detention time= 532.8 min calculated for 0.714 af (100% of inflow)
Center-of-Mass det. time= 533.0 min (1,366.1 - 833.1)

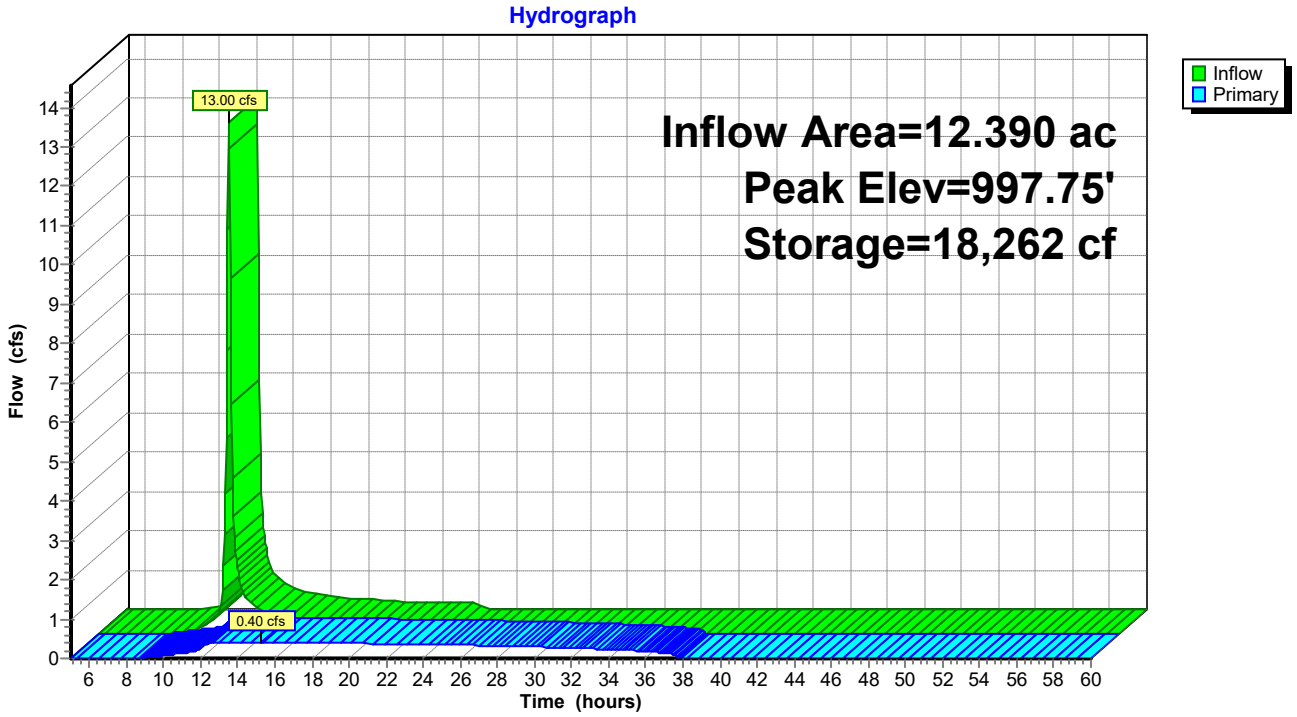
Volume	Invert	Avail.Storage	Storage Description
#1	995.00'	151,776 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
995.00	31	0	0
996.00	5,670	2,851	2,851
997.00	8,866	7,268	10,119
998.00	14,193	11,530	21,648
1,004.00	29,183	130,128	151,776

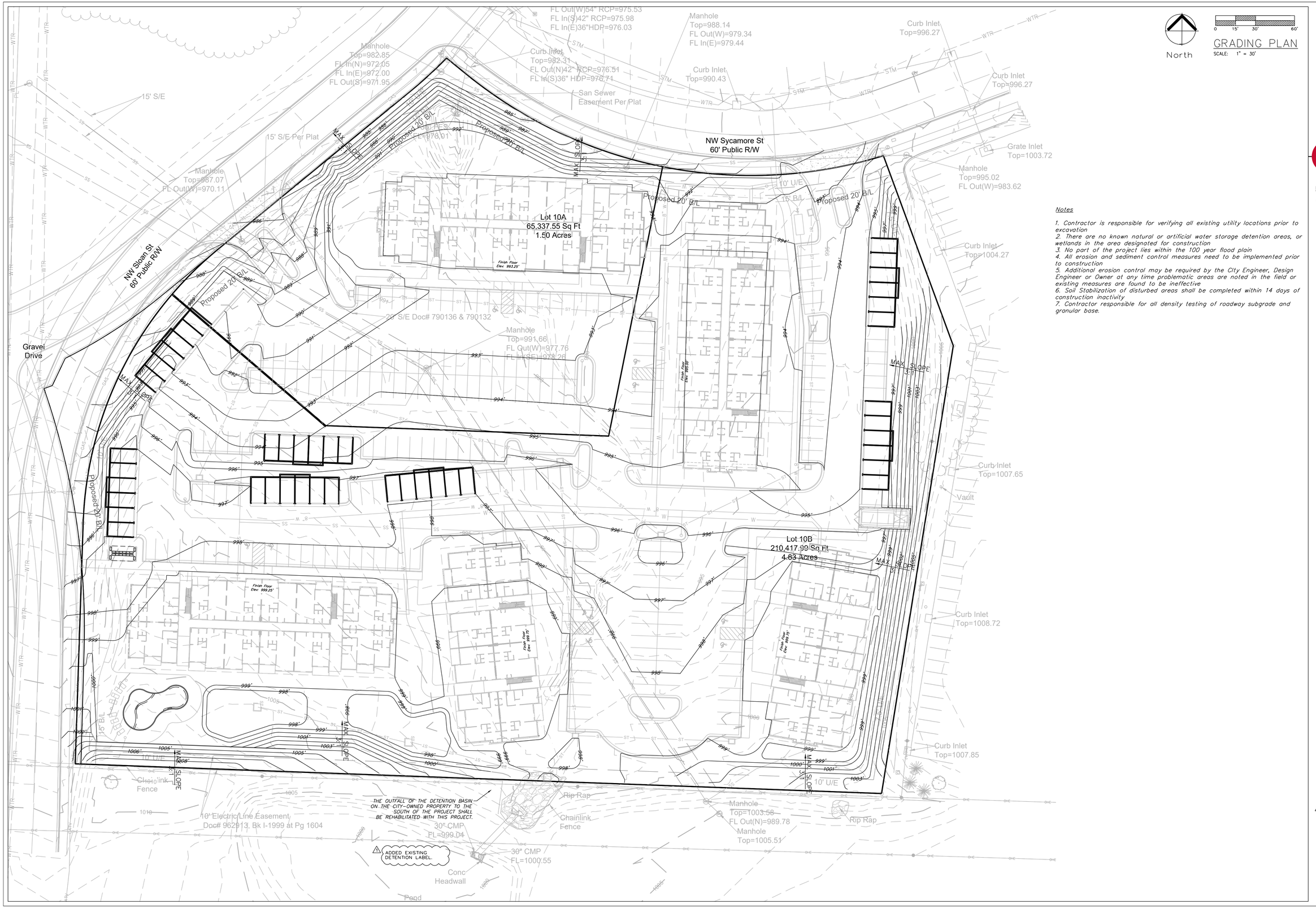
Device	Routing	Invert	Outlet Devices
#1	Primary	994.78'	**30.0" Round Culvert** L= 59.3' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 994.78' / 994.28' S= 0.0084 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Device 1	994.83'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	997.75'	**42.0" W x 16.0" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	1,001.00'	**1.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.7' Crest Height

Primary OutFlow Max=0.40 cfs @ 15.23 hrs HW=997.75' (Free Discharge)
└**1=Culvert** (Passes 0.40 cfs of 30.23 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.40 cfs @ 8.05 fps)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: Proposed Detention



Appendix A2



Notes

1. Contractor is responsible for verifying all existing utility locations prior to excavation
2. There are no known natural or artificial water storage detention areas, or wetlands in the area designated for construction
3. No part of the project lies within the 100 year flood plain
4. All erosion and sediment control measures need to be implemented prior to construction
5. Additional erosion control may be required by the CIty Engineer, Design Engineer or Owner at any time problematic areas are noted in the field or existing measures are found to be ineffective
6. Soil Stabilization of disturbed areas shall be completed within 14 days of construction inactivity
7. Contractor responsible for all density testing of roadway subgrade and granular base.

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Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri

Project: DOUGLAS STATION LSMO
Issue Date: August 11, 2023

Grading Plan
Construction Plans for:
Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri

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MATTHEW J. SCHLICHT
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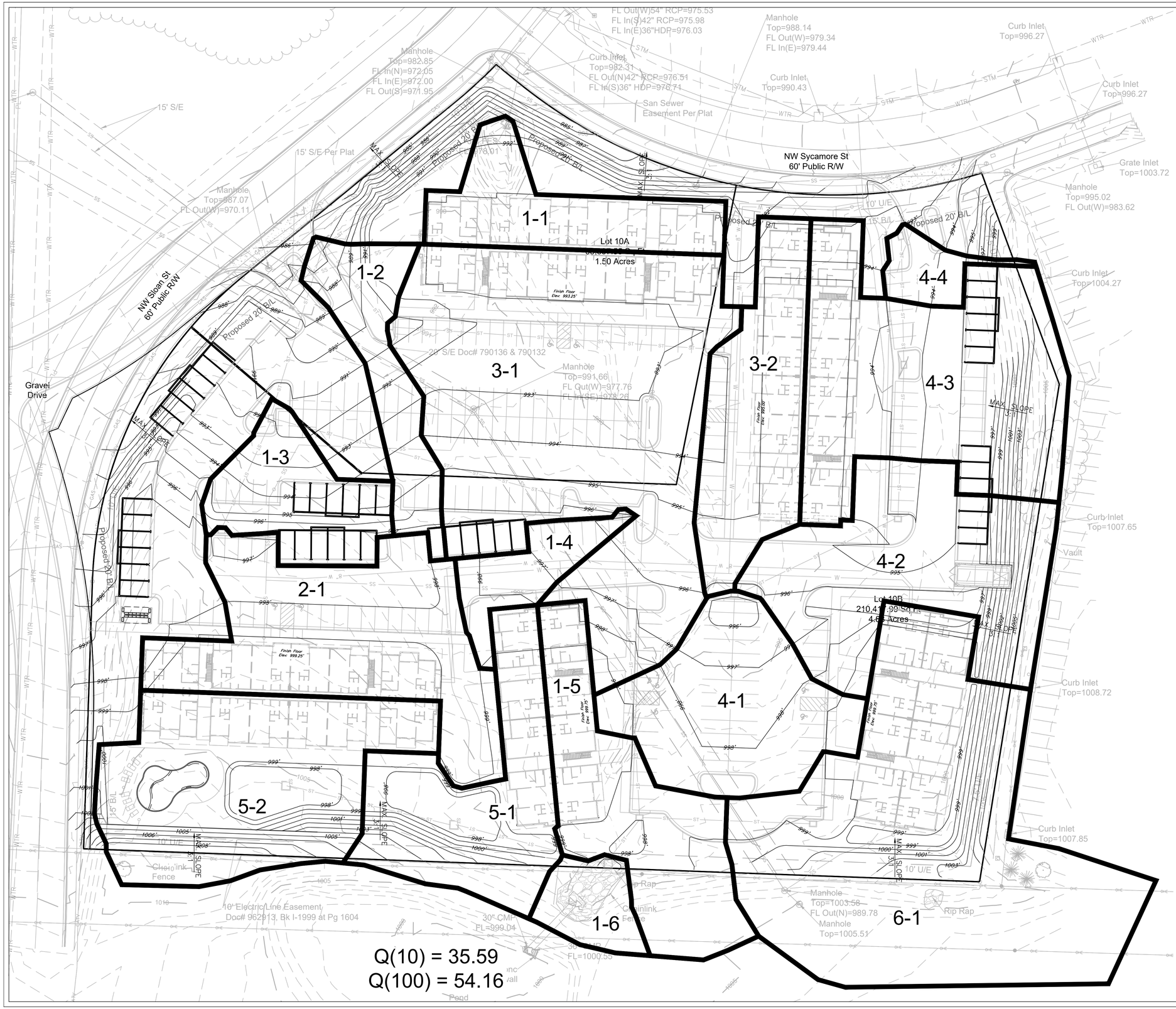
C.200



APWA STORM DRAINAGE "TC" COMPUTATIONS FOR: DOUGLAS STATION (LSMO)

TC COMPUTATION

AREA ID	TOTAL SQ.FT	TOTAL ACRES	WTRSHD LENGTH	UP ELEV	DN ELEV	Cal Overland Flow T(t)	Used Min 5 Max 15 T(t)	Cal Channel One T(t)	Cal Channel Two T(t)	Total T@ 10	Intensity 10 I	Intensity 100 I	CFS 10 Q	CFS 100 Q	K 1.25	AREA ID
POST																POST
1-1	8941	0.21	232.00	993.75	989.00	4.2	5.0	1.1	0.0	6.1	7.0	9.9	0.95	1.67		1-1
1-2	7710	0.18	205.00	997.25	986.25	4.6	5.0	0.4	0.0	5.4	7.2	10.2	0.85	1.49		1-2
1-3	8221	0.19	150.00	997.00	992.00	2.2	5.0	0.6	0.0	5.6	7.2	10.1	0.89	1.57		1-3
1-4	4385	0.10	158.00	999.00	996.00	2.7	5.0	0.7	0.0	5.7	7.2	10.1	0.48	0.83		1-4
1-5	14772	0.34	121.00	1005.00	998.00	3.6	5.0	0.2	0.0	5.2	7.3	10.2	1.63	2.86		1-5
1-6	3575	0.08	65.00	1026.25	999.00	6.1	6.1	0.0	0.0	6.1	7.0	9.9	0.38	0.67		1-6
2-1	20721	0.48	293.00	999.50	996.00	1.8	6.3	1.8	0.0	8.1	6.5	9.2	2.04	3.60		2-1
3-1	44340	1.02	350.00	999.50	990.50	2.7	5.0	1.0	0.0	6.6	6.8	9.6	4.59	8.07		3-1
3-2	12979	0.30	164.00	996.00	993.80	2.8	7.9	0.4	0.0	8.3	6.5	9.1	1.27	2.24		3-2
4-1	15656	0.36	150.00	999.50	993.00	3.7	5.7	0.2	0.0	5.9	7.1	10.0	1.62	2.85		4-1
4-2	20425	0.47	153.00	996.00	993.50	4.3	5.0	0.3	0.0	5.3	7.3	10.2	2.25	4.01		4-2
4-3	24522	0.56	165.00	1006.00	993.50	4.3	5.0	0.3	0.0	5.3	7.3	10.2	2.70	4.74		4-3
4-4	2438	0.06	65.00	995.00	993.25	4.6	5.0		0.0	5.0	7.4	10.3	0.27	0.48		4-4
5-1	14125	0.32	75.00	999.25	997.00	0.0	0.0		0.0	5.0	7.4	10.3	1.57	2.76		5-1
5-2	21986	0.50	125.00	1000.50	996.50	6.3	6.3	0.1	0.0	6.4	7.0	9.8	2.32	4.08		5-2
6-1	41482	0.95	233.00	1009.00	998.00	3.3	4.5	0.7	0.0	5.7	7.1	10.0	4.49	7.89		6-1

yellow areas are self computing
overwrite if necessary

TOTAL WATERSHED

Surface types: Asph/Conc/Bus/Com Dirt Grass/Park Lake MultiFam SingFam Undev Other
SURFACE CODES A B D G L M S U Z
"C" Values 0.90 0.87 0.60 0.30 0.90 0.66 0.51 0.3

Overwrite Length - DnElev or Slope if necessary

OVERLAND FLOW - 100' MAX

SURFACE CODE	"C" VALUE	OVRLND LENGTH	UP ELEV	DN ELEV	SLOPE %											
M	0.66	35.0	993.8	993.25	1.4	P	197.0	993.3	989.0	2.16						
M	0.66	100.0	997.3	992.00	5.3	P	105.0	992.0	986.3	5.48						
M	0.66	28.0	997.0	995.00	7.1	P	122.0	995.0	992.0	2.46						
M	0.66	48.0	999.0	998.00	2.1	P	110.0	998.0	996.0	1.82						
M	0.66	80.0	1005.0	999.00	7.5	P	41.0	999.0	998.0	2.44						
M	0.66	65.0	1026.3	1025.50	1.2	U	0.0	1025.5	999.0							
M	0.66	100.0	999.5	997.50	2.0	P	193.0	997.5	996.0	0.78						
M	0.66	100.0	998.5	995.60	3.9	P	290.0	995.6	990.5	1.76						
M	0.66	100.0	996.0	995.00	1.0	P	64.0	995.0	993.8	1.88						
M	0.66	100.0	999.0	996.25	2.8	P	38.0	996.3	995.0	2.29						
M	0.66	100.0	999.0	997.00	2.0	P	51.0	997.0	996.5	2.23						
M	0.66	87.0	1006.0	997.00	10.3	P	78.0	997.0	993.5	4.49						
M	0.66	65.0	995.0	993.25	2.7	P	0.0	993.3	993.3							
M	0.66	75.0	999.3	997.00	3.0	P	0.0	997.0	997.0							
M	0.66	100.0	1000.5	998.50	2.0	P	25.0	998.5	996.5	8.00						
M	0.66	100.0	1009.0	1003.50	5.5	U	133.0	1003.5	998.0	4.14						

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Surveying LS-218
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Engineering 6254
Nebraska
Engineering CA2821

Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri

Project: DOUGLAS STATION LSMO
Issue Date: August 11, 2023

Drainage Map
Construction Plans for:
Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri

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KS PE 19071
OK PE 25226
NE PE E-14335

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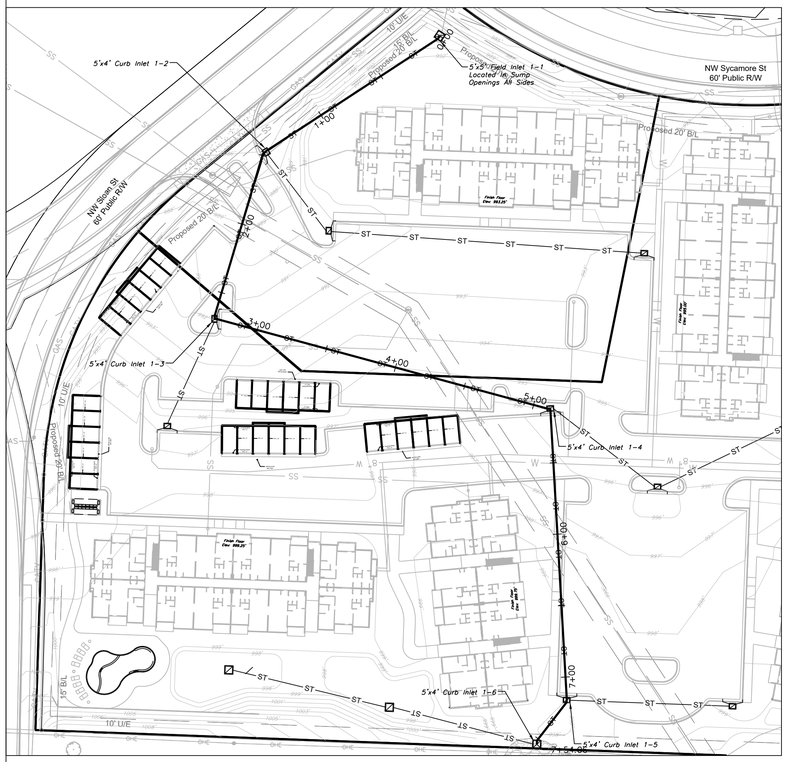
STORM SEWER PLAN AND PROFILE

SCALE: 1" = 50'

0 25' 50' 100'

North



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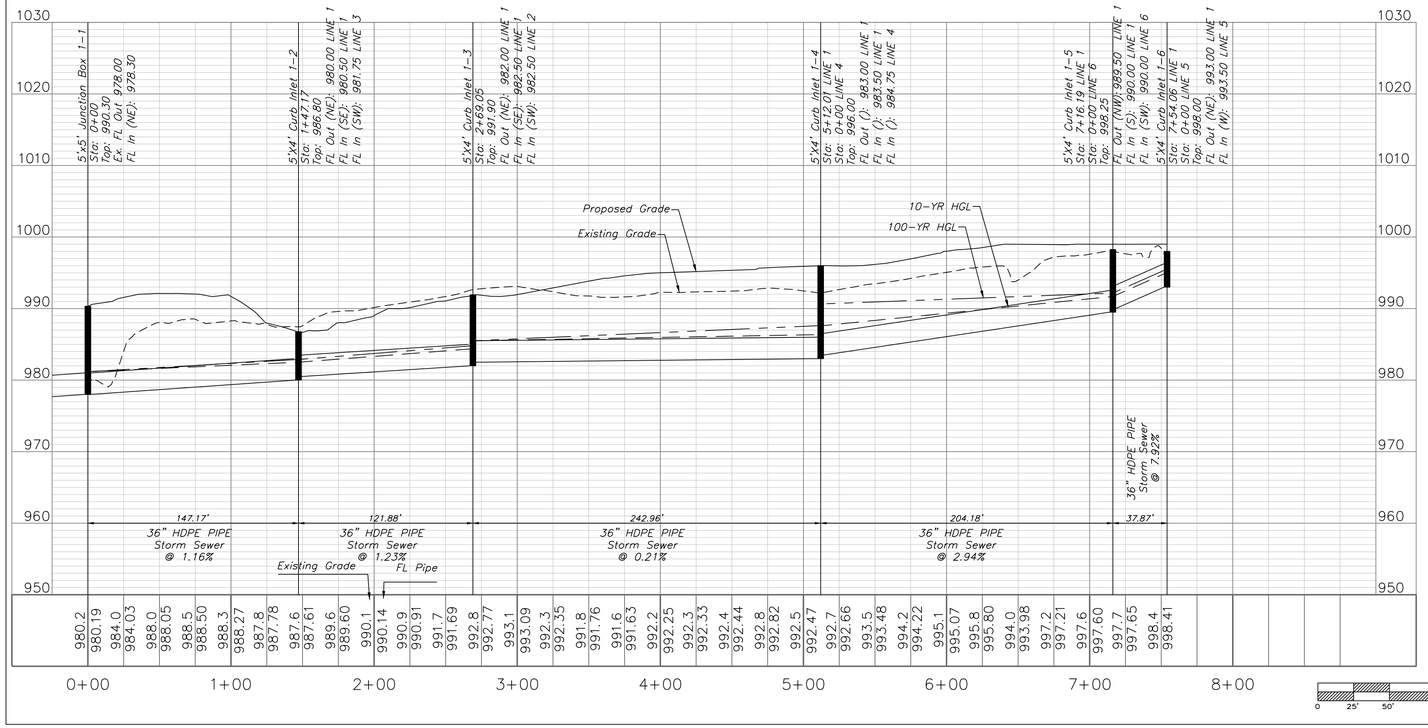


STORM SEWER PLAN AND PROFILE

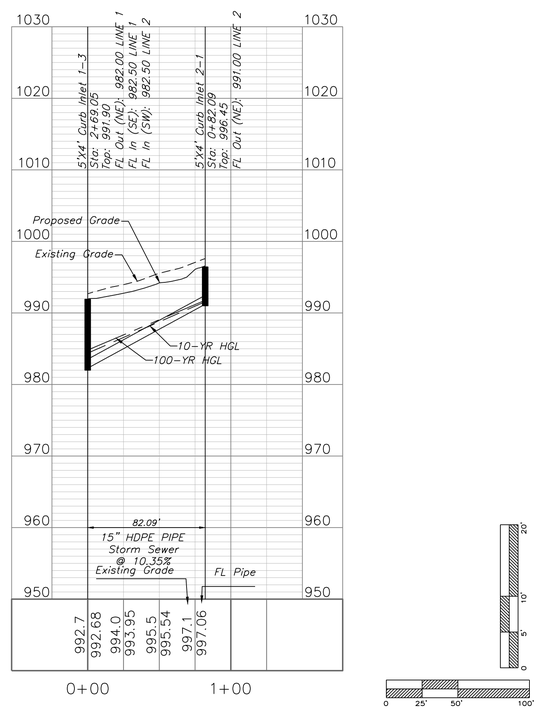
SCALE: 1" = 50'

0 25' 50' 100'

North

REVISED SCALE.

STORM LINE 2



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Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri

Project: DOUGLAS STATION LSMO

Issue Date: August 11, 2023

Storm Sewer Plan and Profile
Construction Plans for:
Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri

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0 25' 50' 100'

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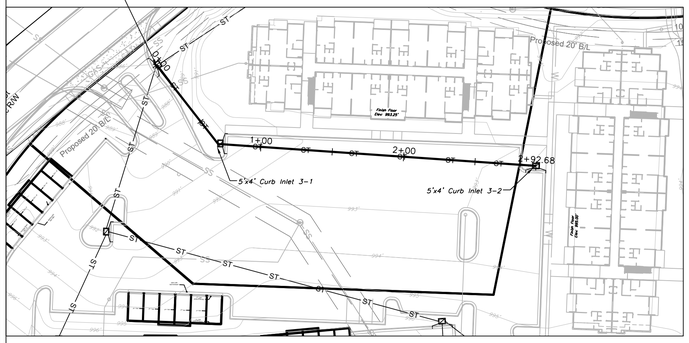
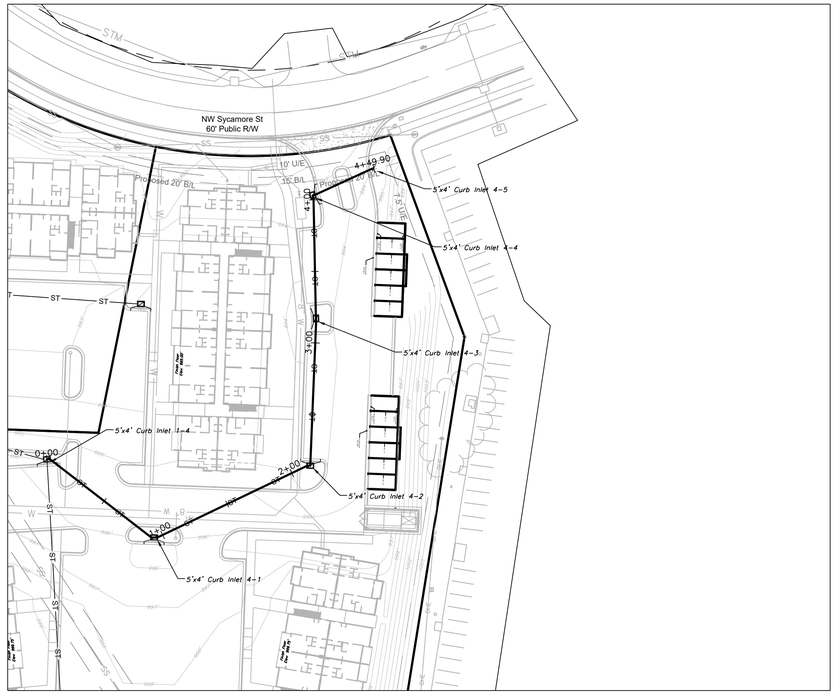


STORM SEWER PLAN AND PROFILE

SCALE: 1" = 50'

0 25' 50' 100'

North



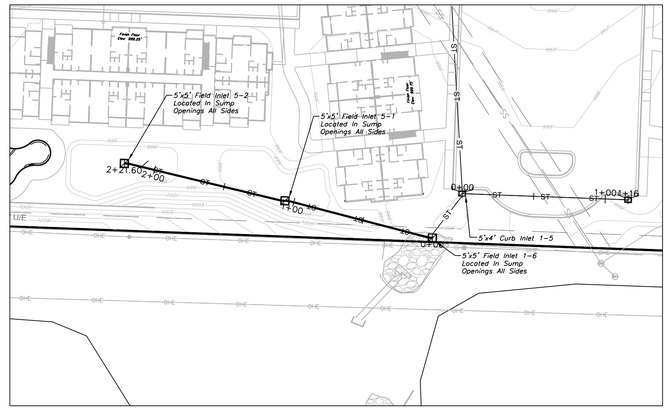
STORM SEWER PLAN AND PROFILE

SCALE: 1" = 50'

0 25' 50' 100'

North

REVISED SCALE.



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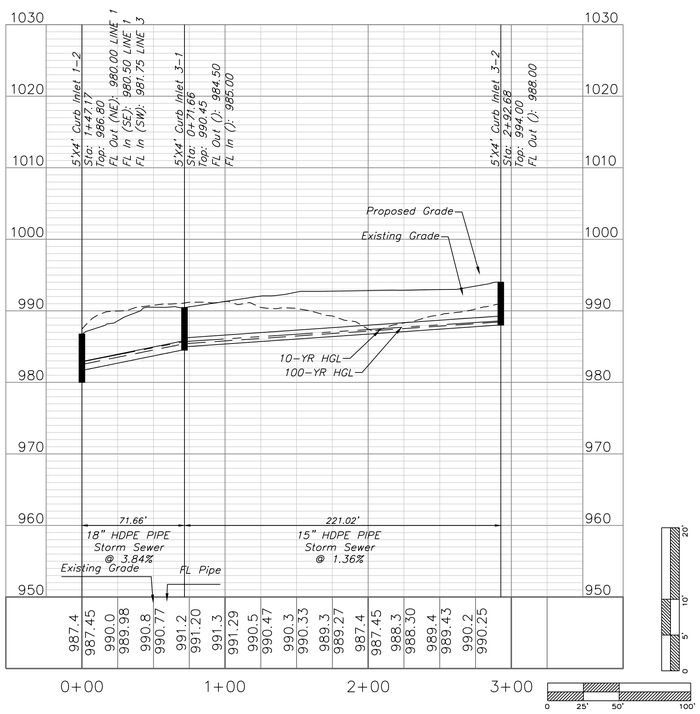

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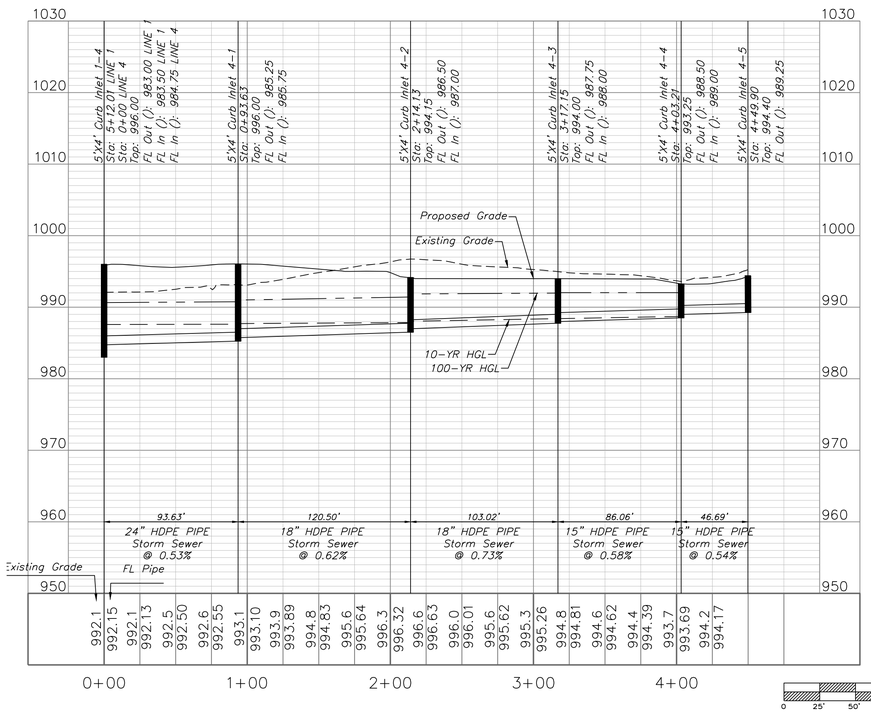

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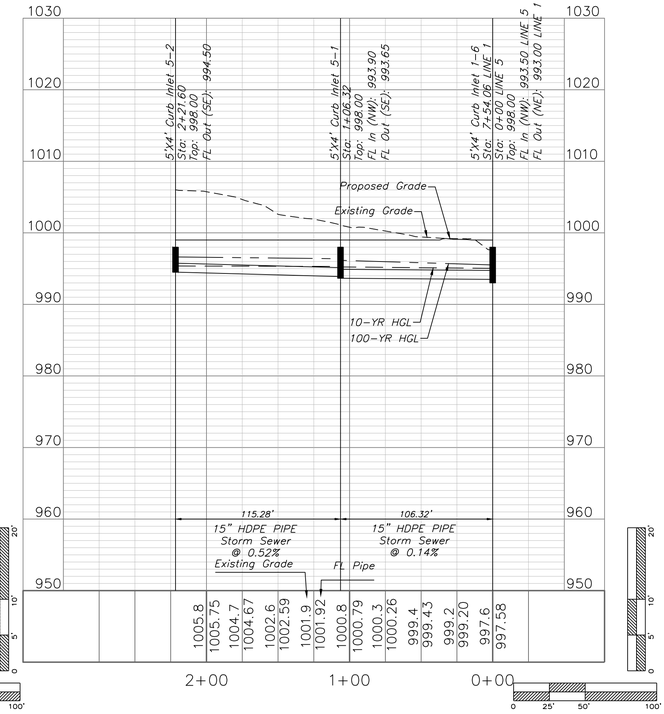

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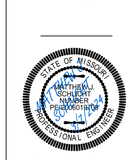
Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri

Project: DOUGLAS STATION LSMO

Issue Date: August 11, 2023

Storm Sewer Plan and Profile
Construction Plans for:
Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri



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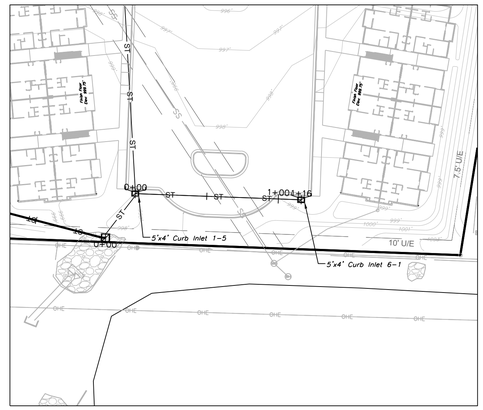
STORM SEWER PLAN AND PROFILE

SCALE: 1" = 50'

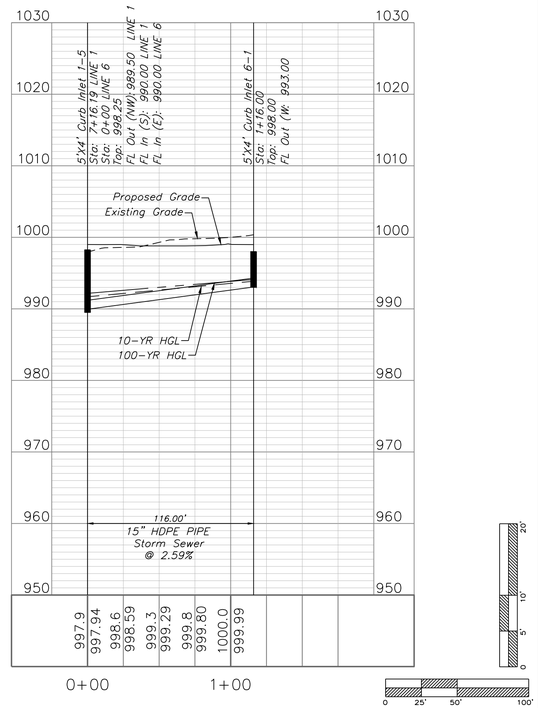
0 25' 50' 100'

1 REVISED SCALE.

North



STORM LINE 6



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Douglas Station Commercial Park
Lee's Summit, Jackson County, Missouri

Project: DOUGLAS STATION LSMO

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Lee's Summit, Jackson County, Missouri

STATE OF MISSOURI
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NUMBER PE-2006019708
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Channel Report

Appendix A3

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Sep 11 2024

Overflow Spillway

Trapezoidal

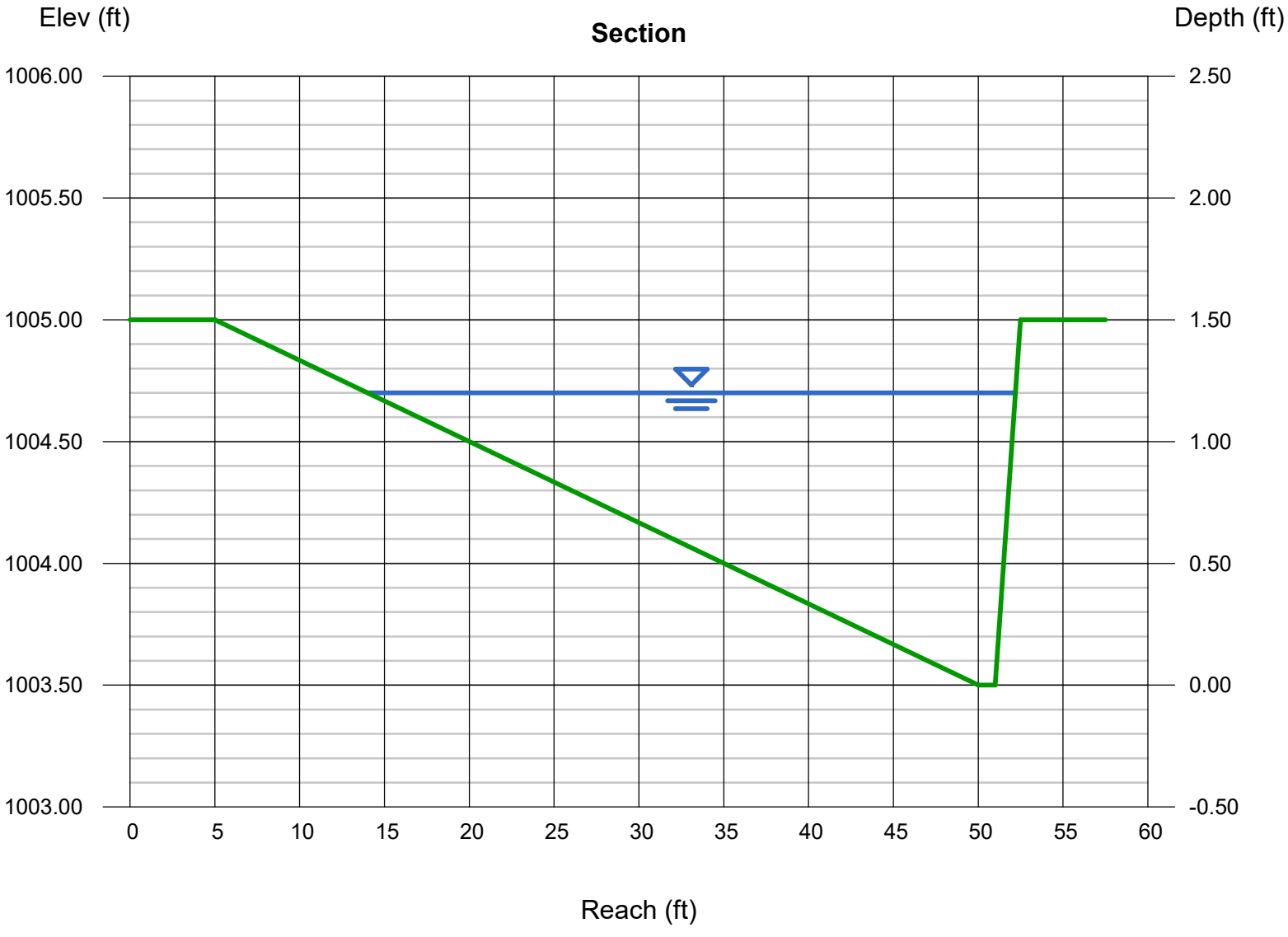
Bottom Width (ft)	= 1.00
Side Slopes (z:1)	= 30.00, 1.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 1003.50
Slope (%)	= 1.00
N-Value	= 0.015

Calculations

Compute by:	Q vs Depth
No. Increments	= 10

Highlighted

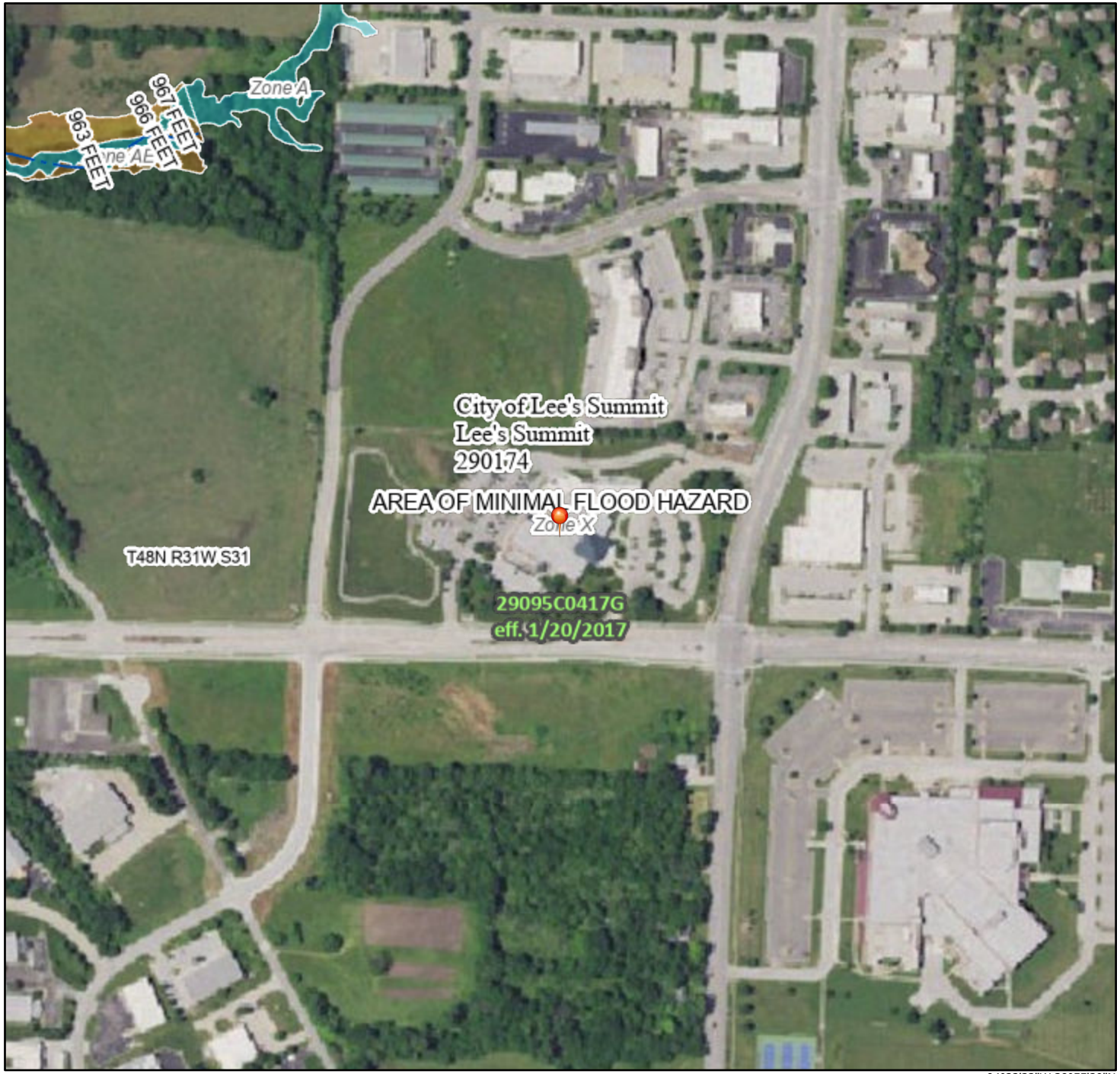
Depth (ft)	= 1.20
Q (cfs)	= 167.10
Area (sqft)	= 23.52
Velocity (ft/s)	= 7.10
Wetted Perim (ft)	= 38.72
Crit Depth, Yc (ft)	= 1.46
Top Width (ft)	= 38.20
EGL (ft)	= 1.98



National Flood Hazard Layer FIRMette

FEMA

94°23'11"W 38°56'7"N



94°22'33"W 38°55'39"N

Feet

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

Appendix A4

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
- 17.5 — Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

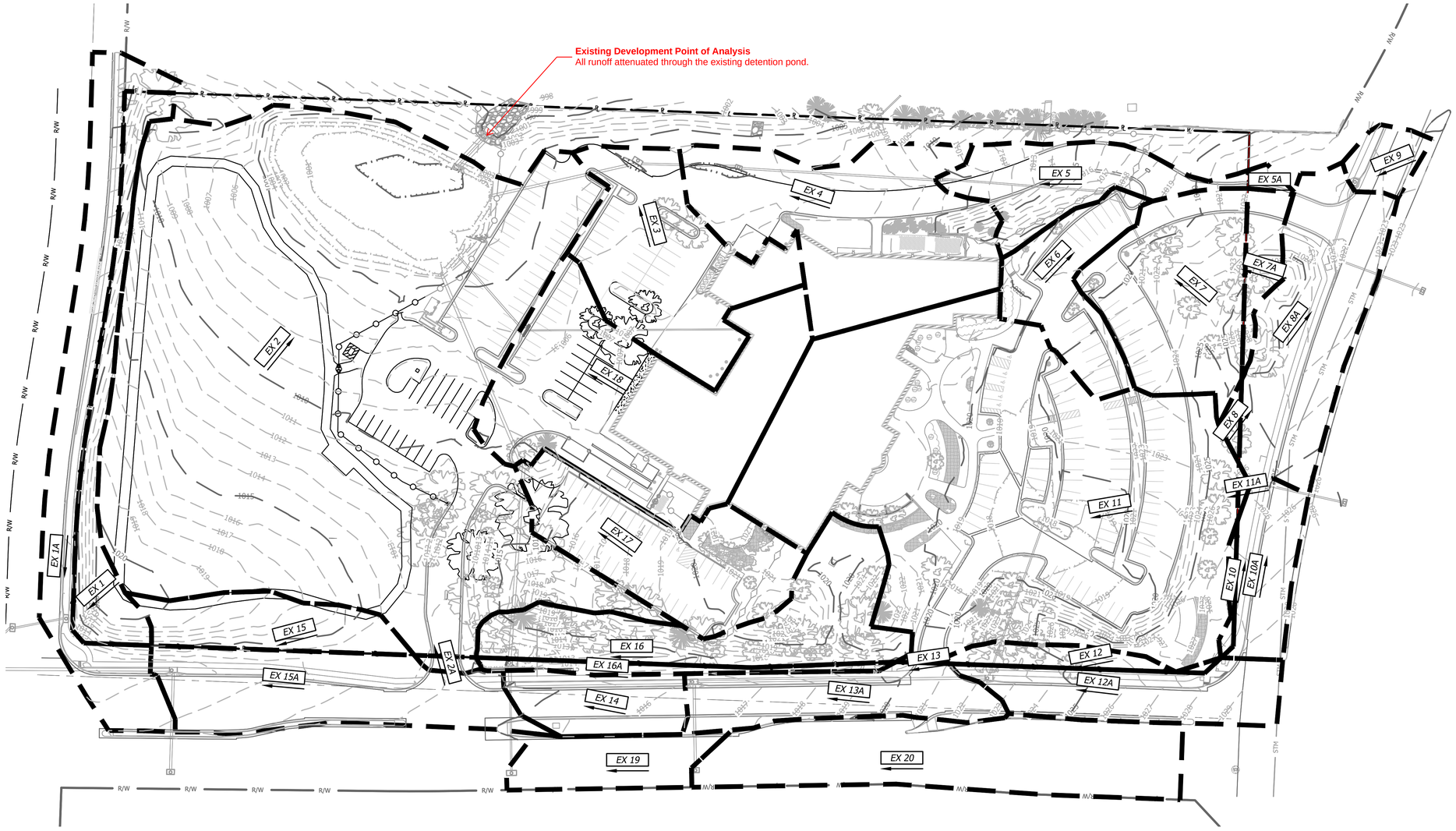
N

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 8/27/2024 at 1:29 PM 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.



DRAINAGE LEGEND

- DRAINAGE AREA BOUNDARY
- Field — AREA/DIRECTION OF DRAINAGE BOUNDARY
- 980 — EXISTING GRADE MAJOR CONTOUR
- 982 — EXISTING GRADE MINOR CONTOUR
- ℄ — PROPERTY LINE
- R/W — RIGHT-OF-WAY LINE

N

GRAPHIC SCALE
50 0 50

EXISTING DRAINAGE MAP

HOEFER WELKER
4622 PENNSYLVANIA AVENUE
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KANSAS CITY, MO 64112
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LEE'S SUMMIT JOINT OPERATIONS FACILITY
2 NE TUDOR RD
LEE'S SUMMIT, MISSOURI 64086

PRELIMINARY DEVELOPMENT PLAN

REVISION DATES:
REV 1: 2024-08-27

INTERIM REVIEW ONLY
(Document Incomplete)
Not to be used for regulatory approval, permit, or construction.

Architect Of Record:
Hoefer Welker

PROFESSIONAL SEAL

C5.0

ISSUE DATE: JULY 25, 2024
HOEFER WELKER #: 138191

Propesed Development Point of Analysis
All runoff attenuated through the proposed detention pond.

PROP 1A
PROP 1
PROP 2
PROP 3
PROP 4
PROP 5
PROP 5B
PROP 6
PROP 7
PROP 7A
PROP 8
PROP 8A
PROP 9
PROP 10
PROP 10A
PROP 11
PROP 12
PROP 13
PROP 13A
PROP 14
PROP 15
PROP 16
PROP 16A
PROP 17
PROP 18
PROP 18A
PROP 19
PROP 19A
PROP 20
PROP 21
PROP 21A
PROP 22
PROP 22A
PROP 23
PROP 23A
PROP 24
PROP 24A
PROP 25
PROP 26

DRAINAGE LEGEND

- DRAINAGE AREA BOUNDARY
- Field — AREA/DIRECTION OF DRAINAGE BOUNDARY
- 980 — PROPOSED FINISH GRADE MAJOR CONTOUR
- 982 — PROPOSED FINISH GRADE MINOR CONTOUR
- 980 — EXISTING GRADE MAJOR CONTOUR
- 982 — EXISTING GRADE MINOR CONTOUR
- STM — PROPOSED STORM SEWER LINE
- RD — PROPOSED ROOF LINE DRAIN
- PL — PROPERTY LINE
- R/W — RIGHT-OF-WAY LINE

N

GRAPHIC SCALE
50 0 50

PROPOSED DRAINAGE MAP

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