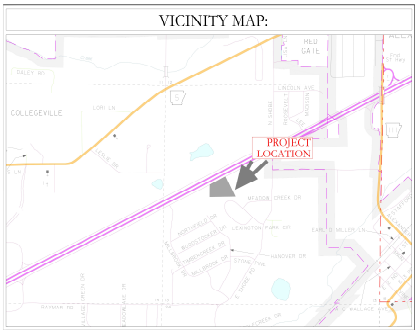
OUTDOOR STORAGE YARD

I-30 FRONTAGE ROAD, SALINE COUNTY, AR

DRAINAGE REPORT

MAY 2025



Owner & Developer

KNOEDL INVESTMENTS, LLC

By:

HOPE CONSULTING
ENGINEERS - SURVEYORS

129 N. Main Street
Benton, Arkansas 72015
PH. (501)315-2626
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PROJECT TITLE

OUTDOOR STORAGE YARD

PROJECT PROPERTY OWNER

KNOEDL INVESTMENTS, LLC

PROJECT LOCATION

I-30 FRONTAGE RD in The City of BRYANT, Saline County, Arkansas

PROJECT DESCRIPTION

The proposed development is on side of the I-30 Frontage road. The total development site area is 4.19 acres.

DRAINAGE ANALYSIS

On Site Drainage- Rational method was used to determine the existing and proposed flows from proposed site. There will be one detention ponds to detain water from this development. Detailed drainage calculations considering the future expected development have been conducted to determine the required detention volumes, ditch and culvert dimensions as required. Summary of the calculations are below:

South Detention Pond

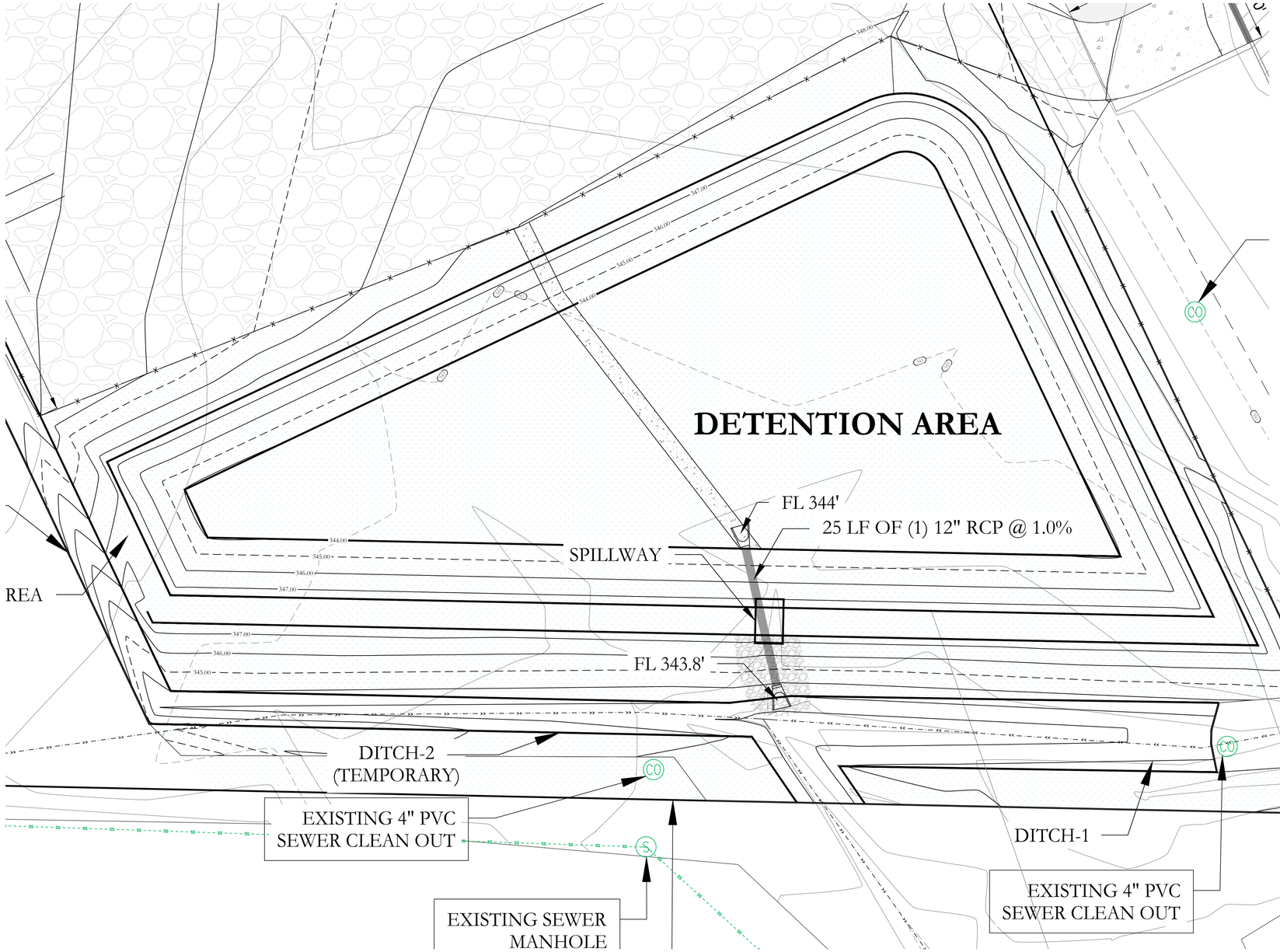
- A detention pond has been proposed on the South side of the property.
- Pre-development area 4.49 acres.
- Post-development area 4.70 acres.
- Considering the existing condition, pre-development runoff coefficient 0.47.
- Post-development cumulative runoff coefficient 0.96.
- Bottom elevation of detention facility is 344.00'.
- One 12" RCP with 1.00% slope is proposed for outflow culvert.

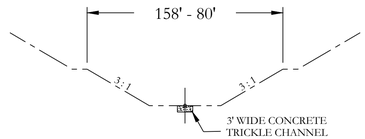
Peak flows for Pre and post development phase of onsite area have been tabulated below-

	Pre-development	Dev. Generated	Post-dev. After detention
	Peak Flow (cfs)	Peak Flow (cfs)	Peak Flow (cfs)
2-Year	7.418	23.19	3.044
5-Year	8.844	27.60	3.636
10- Year	9.965	31.05	3.992
25- Year	11.46	35.65	4.423
50- Year	12.53	39.11	4.681
100- Year	13.57	42.34	4.907

CONCLUSION

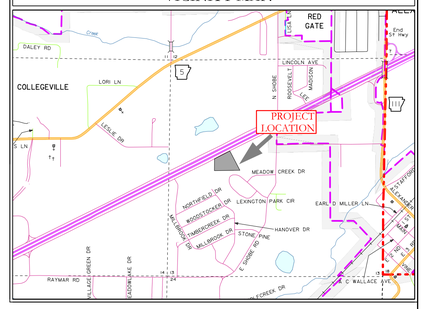
From the drainage calculation, it is seen that there is decrease in flow for all storm events due to the proposed detention pond.

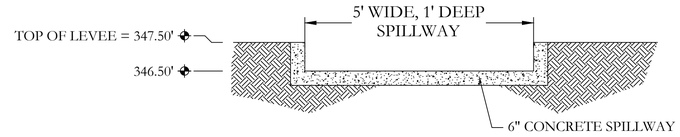




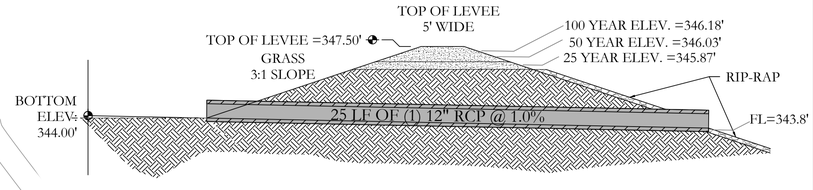
DETENTION PROPOSED SECTION
NTS

VICINITY MAP:

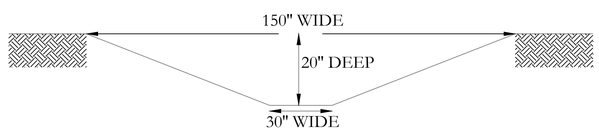




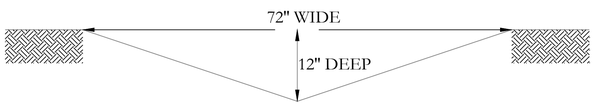
SPILLWAY END VIEW
NTS



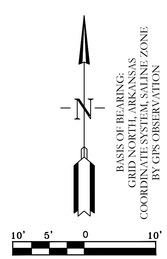
OUTLET SECTION
NTS



DITCH-1 SECTION



DITCH-2 SECTION (TEMPORARY)



811 Know what's below. Call before you dig.

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DETENTION POND MAINTENANCE PLAN

Background
The detention pond is located at the **South** of the subjected property. It is designed to temporarily detain stormwater to meet water quantity criteria before discharging off the property.

Routine Maintenance
Routine maintenance will include but not be limited to:
-Mowing of the bank slopes and area around the pond on a monthly basis during the growing season and as needed during the cooler months.

-The outlet pipe from the pond and other areas will be inspected monthly for debris which could inhibit the proper flow of discharge. Any debris will be removed immediately and disposed of or placed in a location to prevent future maintenance and to not cause impact up or downstream of the structure.

-Trash will be removed from around the pond to prevent entering the pond. Generally, the site should be kept free of loose trash which could be carried off site by wind or rain.

-Inspect the pond and outlet pipe for non-routine maintenance need.

Periodic or Non-Routine Maintenance
The routine inspection of the pond area and discharge pipe will identify needed repairs and non-routine maintenance. These items may include but not be limited to:

-Re-growth of trees on or around the pond bank. These should be cut and removed from the pond area.

-Sediment from the site may accumulate in the pond bottom and reduce the pond to below design volume requirements. The pond should be excavated if the pond bottom elevation reached a level that allows excessive aquatic growth or reduces the pond efficiency such, that the sediments are passing the discharge structure and release off site.

-Stabilization or re-grading of side slopes may be required periodically or after excessive rain events. Any disturbance of slopes should be reseeded or may require installation of erosion control materials until seeding can reestablish adequate grasses to prevent future erosion.

-Any other maintenance or repairs which would minimize other maintenance to the pond or outfall structures.

For questions or concerns about Tract "A", contact at 501-.

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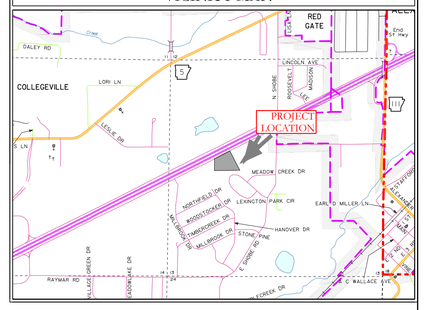
OUTDOOR STORAGE YARD
DETENTION PLAN
I-30 FRONTAGE ROAD, BRYANT, AR

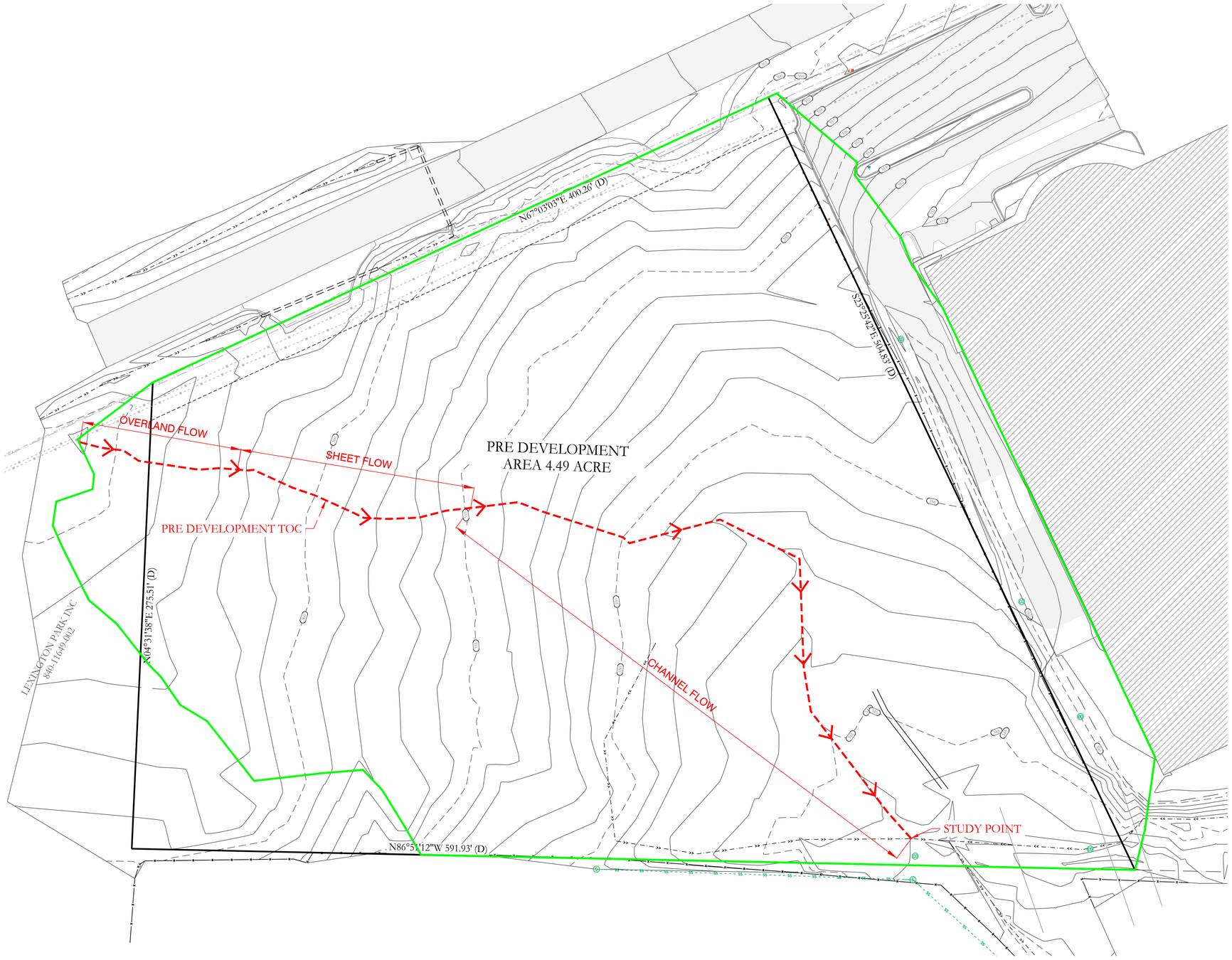
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REVISED:		CHECKED BY:			
SHEET:	C-3.0	SCALE:	1" = 10"		

500	01S	14W	0	13	420	62	1664

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VICINITY MAP:





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BASIS OF BEARING:
GRID NORTH, ARKANSAS
COORDINATE SYSTEM, SALINE ZONE
BY GPS OBSERVATION

30' 15' 0 30'

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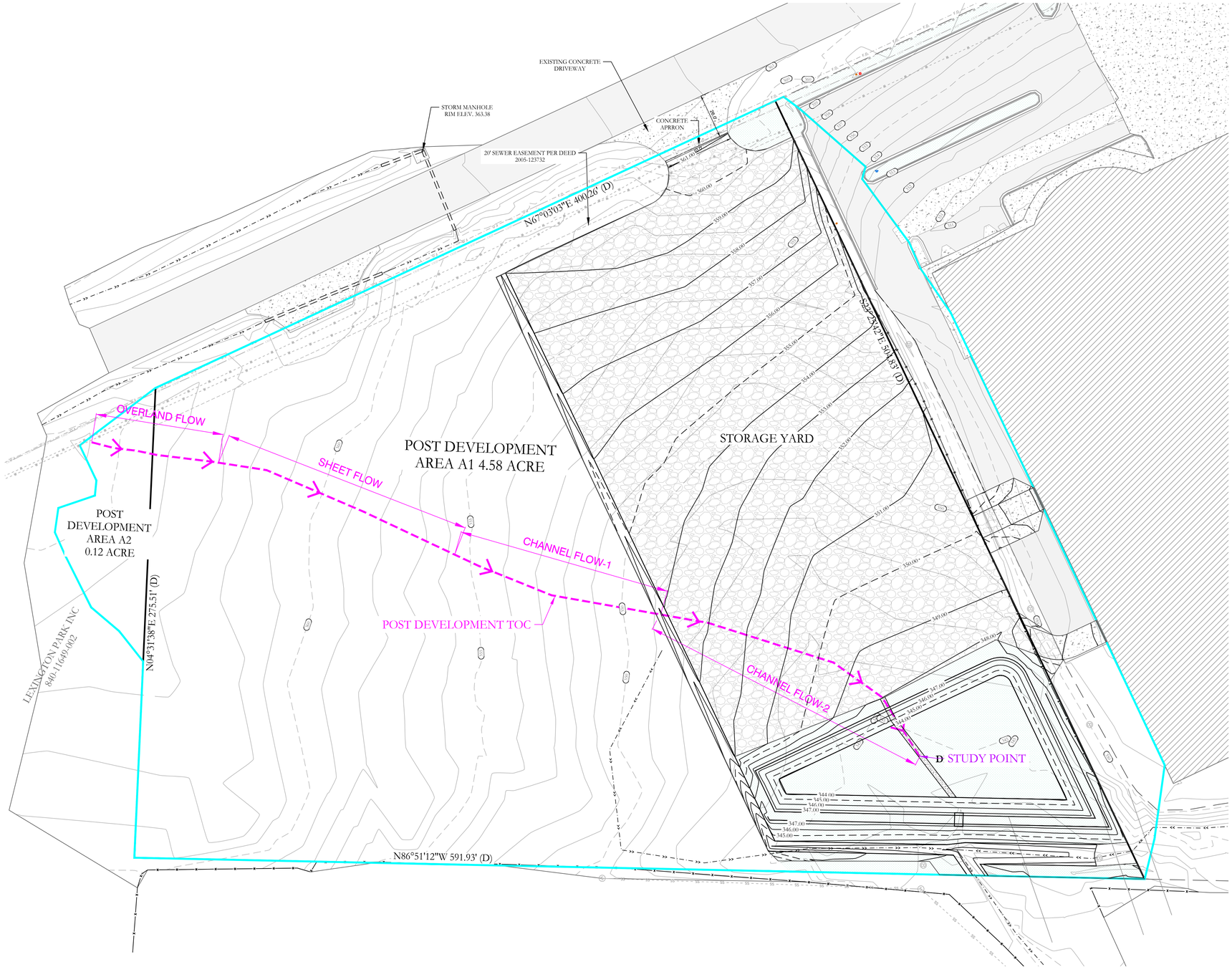
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OUTDOOR STORAGE YARD
PRE DEVELOPMENT DRAINAGE AREA MAP
I-30 FRONTAGE ROAD, BRYANT, AR

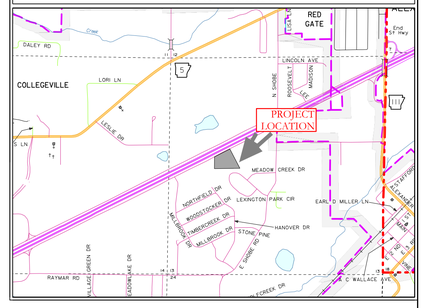
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REVISED:	CHECKED BY:	23-1109	
SHEET: C-3.1	SCALE: 1" = 30"		

500	01S	14W	0	13	420	62	1664

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VICINITY MAP:



POST DEVELOPMENT TIME OF CONCENTRATION

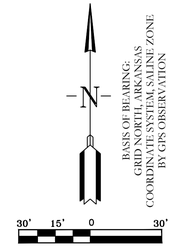
Area (ft2)	204931.0						
Area (Acre)	*4.70*						
Total Length, L (ft)	***535.0***						
Change in Elevation (ft)	*20.0*						
Gross Slope, S (ft/ft)	*0.037*						
N (Roughness Coeff)	*0.150*						
L_i (overland/sheet flow, ft)	75.0						
L_{scs}(shallow concentrated, ft)	150.0	Velocity, V (ft/sec)	Length, L (ft)	Height, h (ft)	Slope, S (ft/ft)	Mannings, n	Hydraulic Radius, R
L_{cs} (channel , ft)	310.0						
$t_i = 0.83\frac{(NL_i)^{0.467}}{S^{0.5}}$, (min)	*5.99*	-	75.0	2.0	*0.027*	0.150	-
$t_{scs} = \frac{L_{scs}}{60V}$, (min) , unpaved *V=16.1345(S^0.5)*	*0.77*	*3.23*	150.0	6.0	*0.040*	-	-
$t_{cs} = \frac{L_{cs}}{60V}$, (min)							
$V = \frac{1.49}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$ Ch1-Future Dev	*0.29*	*7.34*	126.0	7.0	*0.056*	0.023	*0.333*
Ch2-Gravel	*0.61*	*5.01*	184.0	5.0	*0.027*	0.023	*0.321*
Total time of concentration, tc (min)	**7.66**						
USE	**8**						

POST DEVELOPMENT RUNOFF COEFFICIENT

	Area (acer)	C 100 year		100 year
Area A1 (Storage Yard & Future development)	4.58	0.97		4.45
Area A2 (Undeveloped)	0.12	0.47		0.06
Tot A =	4.70		Corr. C =	**0.96**

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BASIS OF BEARING: GRID NORTH, ARKANSAS COORDINATE SYSTEM, SALINE ZONE BY GPS OBSERVATION

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OUTDOOR STORAGE YARD
POST DEVELOPMENT DRAINAGE AREA MAP

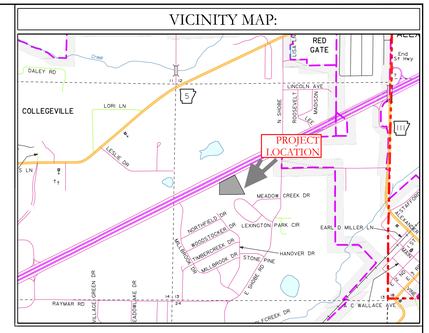
I-30 FRONTAGE ROAD, BRYANT, AR

DATE:	05/16/2025	C.A.D. BY:		DRAWING NUMBER:	23-1109
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12" RCP PIPE Capacity Check

Target Discharge				
Frequency - Duration	Intensity, I (in/hr)	Runoff Coefficient, C	Toal Area, A (ac)	Discharge, Q = CIA (cfs)
100 yr - 5 min	11.20	0.97	0.21	**2.29**

Pipe Capacity Check

$Q = V\,A$

$V = \frac{1.49}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$

	Pipe Dia (in)	Discharge Capacity, Q (cfs)	Velocity, V (ft/sec)	Pipe Dia, (ft)	Area, A (ft^2)	Flow Depth, y (ft)	Length, L (ft)	Elevation, h (ft)	Slope, S (ft/ft)	Mannings, n	Wetted Perimeter, P	Hydraulic Radius, R = A/P
Target Discharge, Q (cfs)	12	2.29										
100%		2.74	3.49	1.00	0.79	1.00	34.0	0.2	0.0059	0.013	3.142	0.250

Pipe Dimenstion

Adequate size

Ditch-1 Size Calculation

Existing Ditch Capacity Calculation

$Q = V\,A$

$V = \frac{1.49}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$

		Velocity, V (ft/sec)	Bottom Width, (ft)	Depth, (ft)	Top Width, (ft)	Ch Side Slope 1:Z	Area, (ft^2)	Slope, S (ft/ft)	Mannings, n	Hydraulic Radius, R
		Existing Channel Dimension								
Existing Channel	55.74	3.72	0.00	1.68	17.84	5.31	14.99	0.0100	0.030	0.648
Existing Channel Capacity, Q =	**55.74**	ft^3/s								

Proposed Ditch Capacity Calculation - DITCH 1

Target Discharge, Q (ft^3/s) **55.7**

$Q = V\,A$

$V = \frac{1.49}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$

		Velocity, V (ft/sec)	Bottom Width, (ft)	Depth, (ft)	Top Width, (ft)	Ch Side Slope 1:Z	Area, (ft^2)	Slope, S (ft/ft)	Mannings, n	Hydraulic Radius, R
		Proposed Channel Dimension								
Ditch 1	60.98	4.86	2.50	1.67	12.52	3.00	12.54	0.0100	0.030	0.969
Discharge Capacity, Q =	**60.98**	ft^3/s								

Adequate size

Ditch-2 Size Calculation

		Velocity, V (ft/sec)	Length, L (ft)	Height, h (ft)	Slope, S (ft/ft)	Mannings, n	Hydraulic Radius, R
Area (ft2)	102056.0						
Area (Acre)	*2.34*						
Total Length, L (ft)	***630.0***						
Change in Elevation (ft)	16.9						
Gross Slope, S (ft/ft)	*0.027*						
N (Coeff. Of roughness, Table 400-3)	*0.600*						
L_1 (overland/sheet flow, ft)	50.0						
L_{sc}(shallow concentrated, ft)	100.0						
L_{ch} (channel , ft)	480.0						
$t_t = 0.83 \frac{(N\,L_t)^{0.667}}{S^{0.5}}$, (min)	*9.21*	-	50.0	1.5	*0.030*	0.600	-
$t_{scs} = \frac{L_{scs}}{60\,V}$, (min) , unpaved							
V=16.1345(S^0.5)	*0.54*	*3.10*	100.0	3.7	*0.037*	-	-
$t_{cs} = \frac{L_{cs}}{60\,V}$, (min)							
$V = \frac{1.49}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$ Ch1	*2.18*	*1.40*	183.0	9.0	*0.049*	0.100	*0.275*
Ch2-Ditch	*0.80*	*6.22*	297.0	12.6	*0.042*	0.030	*0.474*
Total time of concentration, tc (min)	**12.73**						
USE	13						

Design Peak Runoff Rates, Qp (cfs)

tc =	13.00	Runoff		
	Intensity, I (in/hr)	Coefficient, C modified	Toal Area (ac)	Discharge, Q (cfs)
100year	7.69	**0.470**	**2.34 acer**	**8.47**

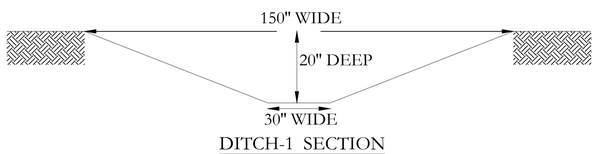
Channel/ Ditch Dimension Calculation

$Q = V\,A$

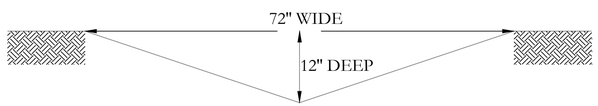
$V = \frac{1.49}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$

		Velocity, V (ft/sec)	Bottom Width, (ft)	Depth, (ft)	Top Width, (ft)	Ch Side Slope 1:Z	Area, (ft^2)	Length, L (ft)	Elevation, h (ft)	Slope, S (ft/ft)	Mannings, n	Hydraulic Radius, R
Total Length, L (ft)	***375.0***											
Total Change in Elevation (ft)	14											
Slope, S (ft/ft)	*0.037*											
Target Discharge, Q (ft^3/s)	***8.5***											
		Channel Dimension										
Ditch 2	*17.51*	*5.84*	0.00	1.00	*6.00*	3	*3.00*	375.0	14.0	*0.0373*	0.030	*0.474*
Discharge Capacity, Q =	**17.51**	ft^3/s										

Adequate size

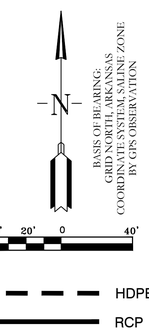


DITCH-1 SECTION



DITCH-2 SECTION (TEMPORARY)

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No. 1931
ARKANSAS



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FOR USE AND BENEFIT OF:
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OUTDOOR STORAGE YARD
DITCH AND PIPE DRAINAGE MAP & CALCULATION
I-30 FRONTAGE ROAD, BRYANT, AR

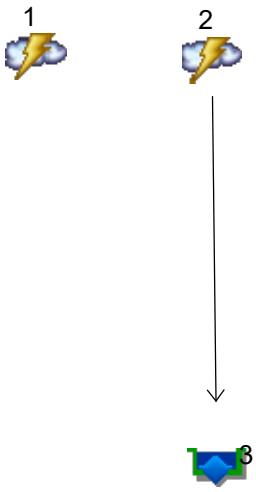
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Hydrograph Summary Report
SOUTH DETENTION

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	Rational	Pre Development
2	Rational	Post Development
3	Reservoir	Detention

Multi-Hydrograph Plot

Hyd. No. 1

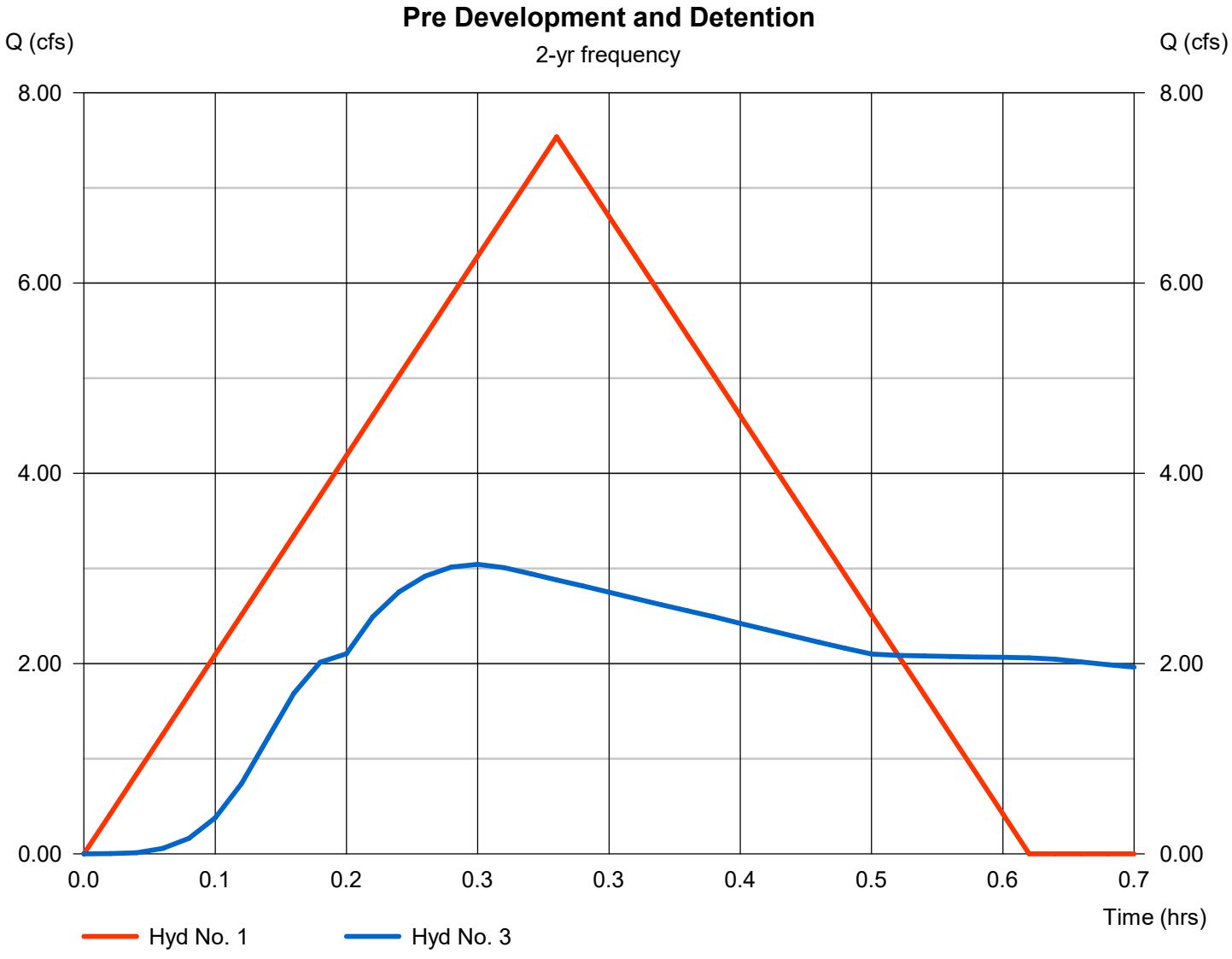
Pre Development

Hydrograph type	=	Rational
Peak discharge	=	7.535 cfs
Time to peak	=	0.30 hrs
Hyd. Volume	=	8,138 cuft

Hyd. No. 3

Detention

Hydrograph type	=	Reservoir
Peak discharge	=	3.04 cfs
Time to peak	=	0.25 hrs
Hyd. Volume	=	11,152 cuft



Multi-Hydrograph Plot

Hyd. No. 1

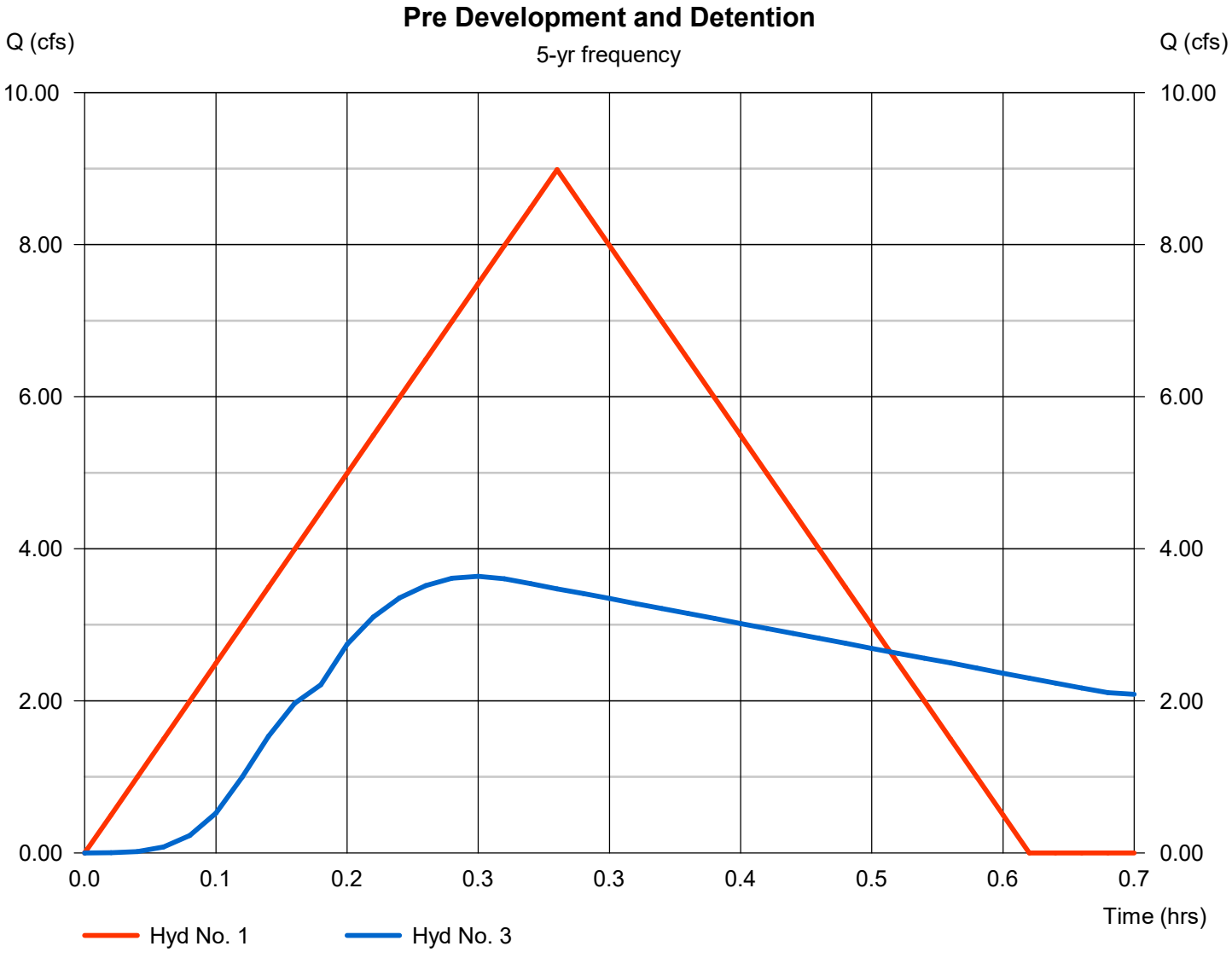
Pre Development

Hydrograph type	=	Rational
Peak discharge	=	8.984 cfs
Time to peak	=	0.30 hrs
Hyd. Volume	=	9,703 cuft

Hyd. No. 3

Detention

Hydrograph type	=	Reservoir
Peak discharge	=	3.64 cfs
Time to peak	=	0.25 hrs
Hyd. Volume	=	13,276 cuft



Multi-Hydrograph Plot

Hyd. No. 1

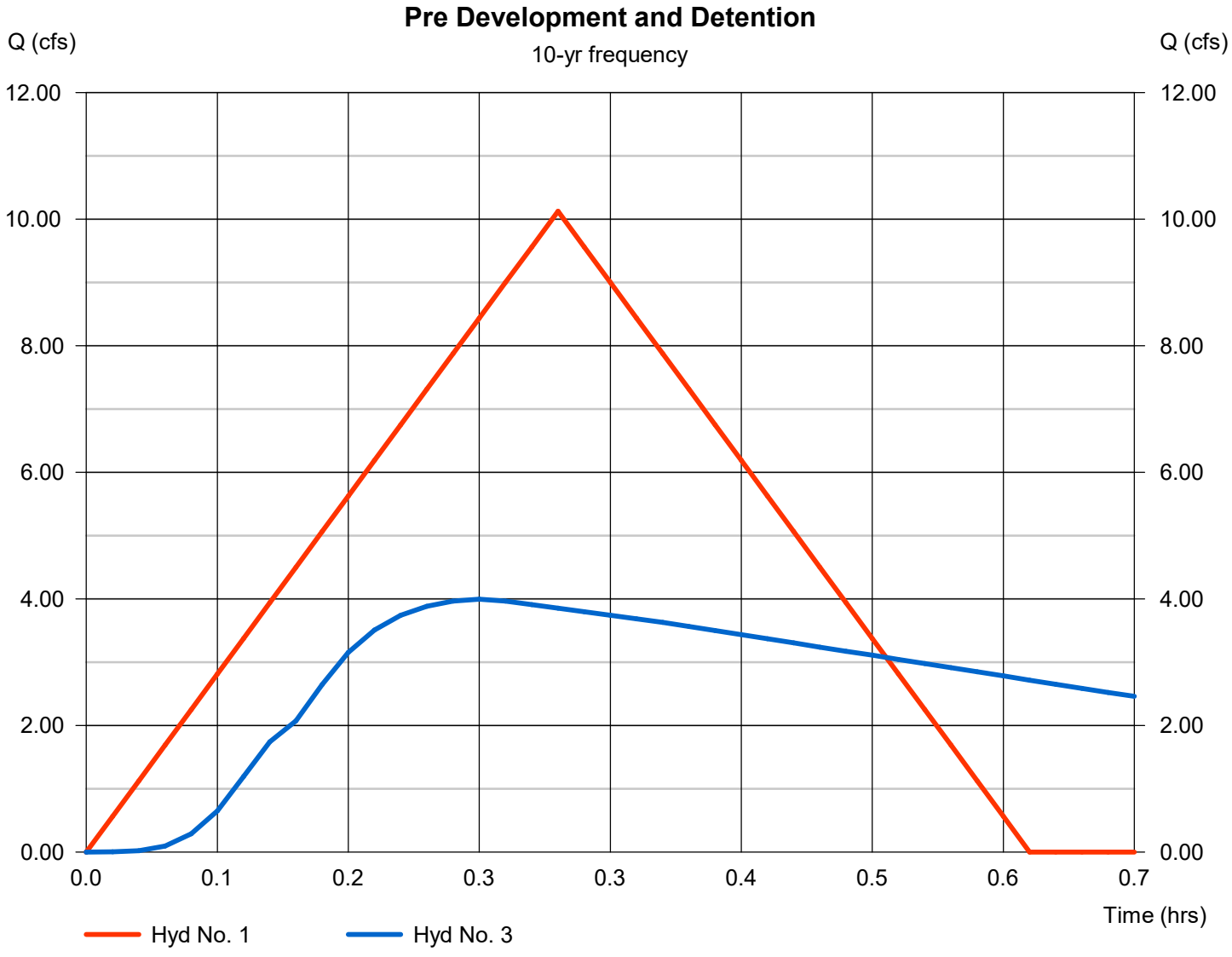
Pre Development

Hydrograph type	=	Rational
Peak discharge	=	10.12 cfs
Time to peak	=	0.30 hrs
Hyd. Volume	=	10,933 cuft

Hyd. No. 3

Detention

Hydrograph type	=	Reservoir
Peak discharge	=	3.99 cfs
Time to peak	=	0.25 hrs
Hyd. Volume	=	14,943 cuft



Multi-Hydrograph Plot

Hyd. No. 1

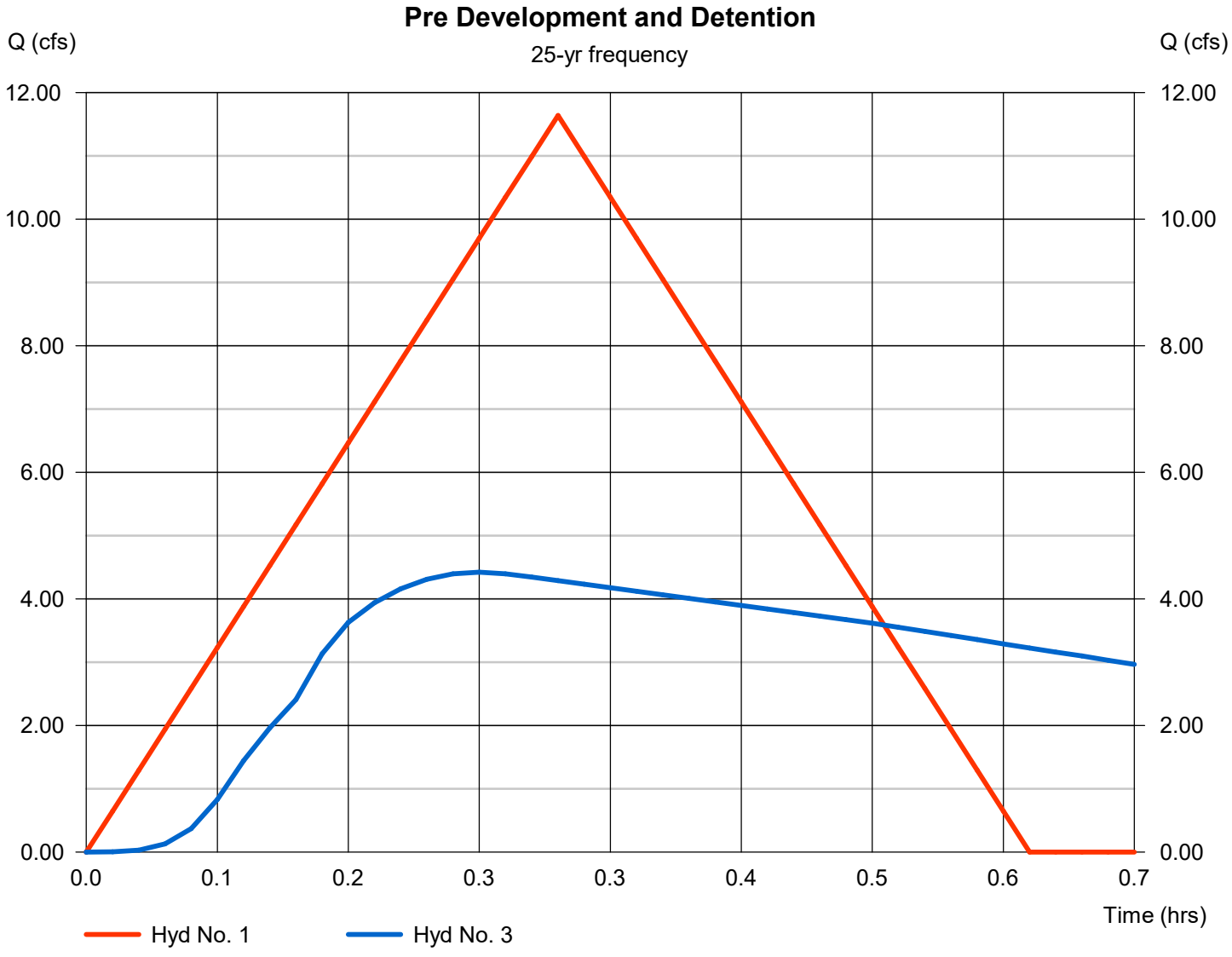
Pre Development

Hydrograph type	=	Rational
Peak discharge	=	11.64 cfs
Time to peak	=	0.30 hrs
Hyd. Volume	=	12,569 cuft

Hyd. No. 3

Detention

Hydrograph type	=	Reservoir
Peak discharge	=	4.42 cfs
Time to peak	=	0.25 hrs
Hyd. Volume	=	17,162 cuft



Multi-Hydrograph Plot

Hyd. No. 1

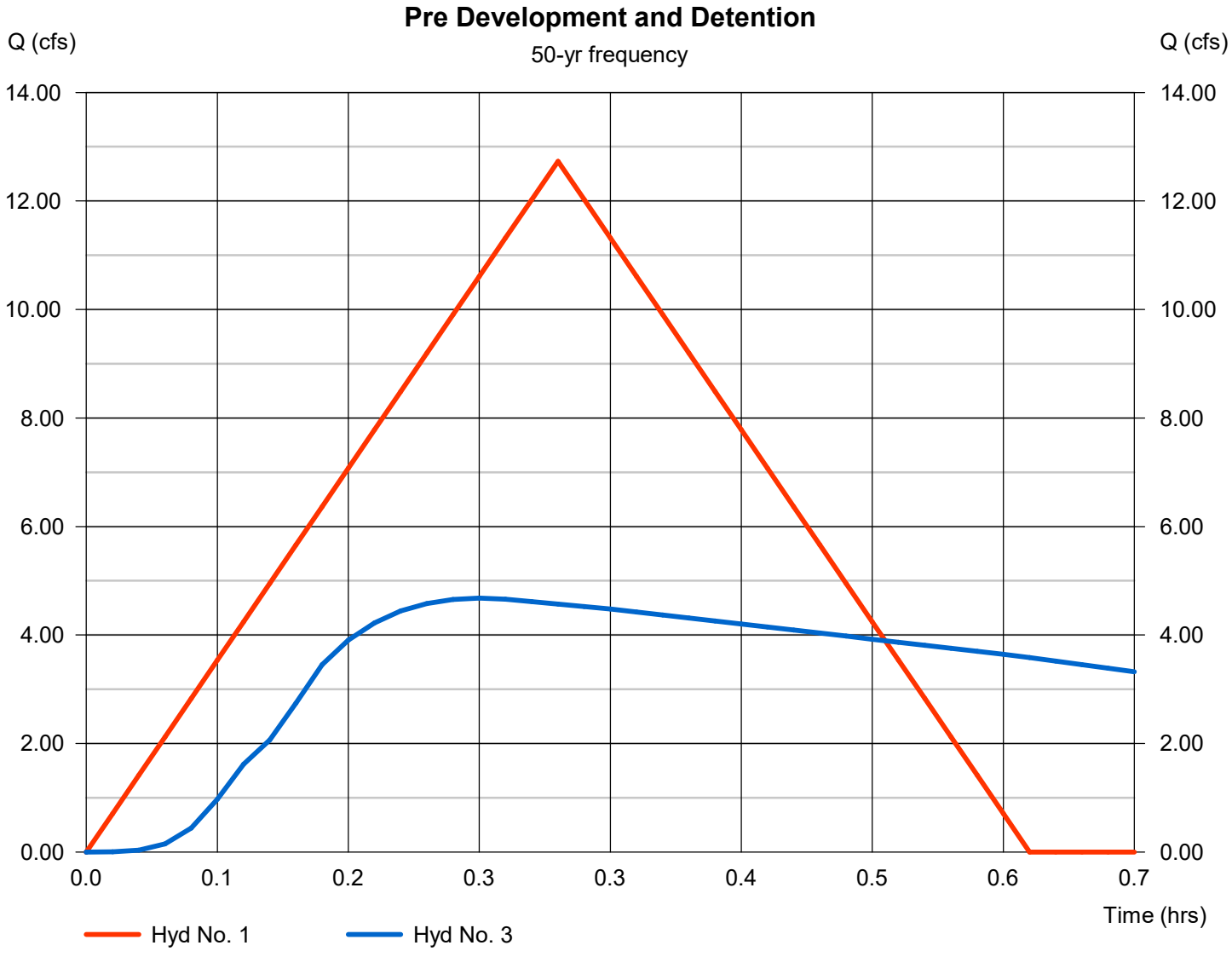
Pre Development

Hydrograph type	=	Rational
Peak discharge	=	12.73 cfs
Time to peak	=	0.30 hrs
Hyd. Volume	=	13,751 cuft

Hyd. No. 3

Detention

Hydrograph type	=	Reservoir
Peak discharge	=	4.68 cfs
Time to peak	=	0.25 hrs
Hyd. Volume	=	18,830 cuft



Multi-Hydrograph Plot

Hyd. No. 1

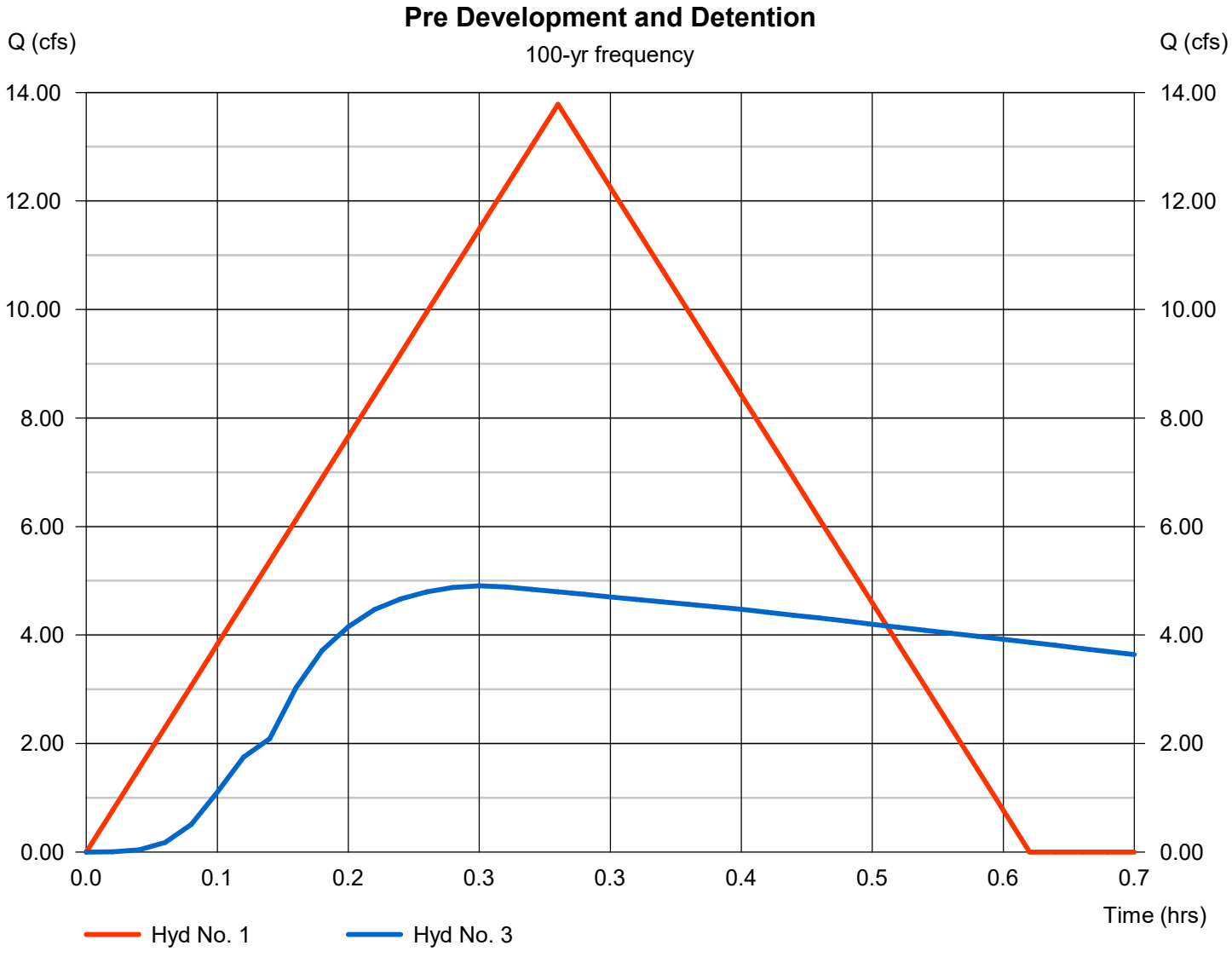
Pre Development

Hydrograph type	=	Rational
Peak discharge	=	13.78 cfs
Time to peak	=	0.30 hrs
Hyd. Volume	=	14,883 cuft

Hyd. No. 3

Detention

Hydrograph type	=	Reservoir
Peak discharge	=	4.91 cfs
Time to peak	=	0.25 hrs
Hyd. Volume	=	20,388 cuft



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	Rational	------	-------	7.535	-------	8.984	10.12	11.64	12.73	13.78	Pre Development
2	Rational	------	-------	23.30	-------	27.72	31.20	35.82	39.29	42.54	Post Development
3	Reservoir	2	-------	3.044	-------	3.636	3.992	4.423	4.681	4.907	Detention

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025

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	Rational	7.535	1	18	8,138	------	------	------	Pre Development
2	Rational	23.30	1	8	11,184	------	------	------	Post Development
3	Reservoir	3.044	1	15	11,152	2	345.28	9,832	Detention

Hydrograph Report

Hyd. No. 1

Pre Development

Hydrograph type	=	Rational	Peak discharge	=	7.535 cfs
Storm frequency	=	2 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	8,138 cuft
Drainage area	=	4.490 ac	Runoff coeff.	=	0.47
Intensity	=	3.571 in/hr	Tc by User	=	18.00 min
IDF Curve	=	Bryant, Arkansas, USA (La 34 33 Pelco in 92 45 69).IDF			1/1

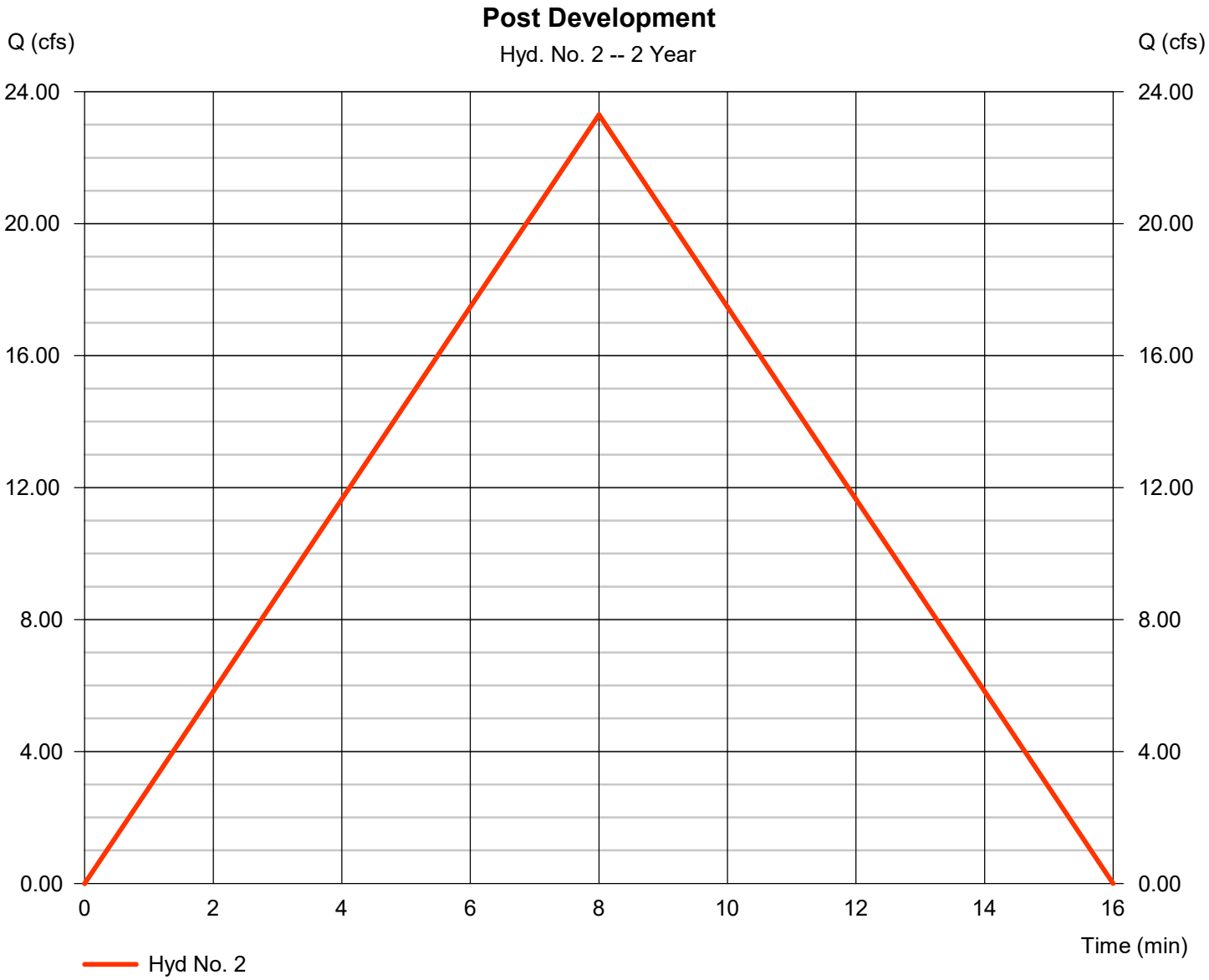


Hydrograph Report

Hyd. No. 2

Post Development

Hydrograph type	=	Rational	Peak discharge	=	23.30 cfs
Storm frequency	=	2 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	11,184 cuft
Drainage area	=	4.700 ac	Runoff coeff.	=	0.96
Intensity	=	5.164 in/hr	Tc by User	=	8.00 min
IDF Curve	=	Bryant, Arkansas, USA (La 34.53 Rec-92f4569).IDF			1/1



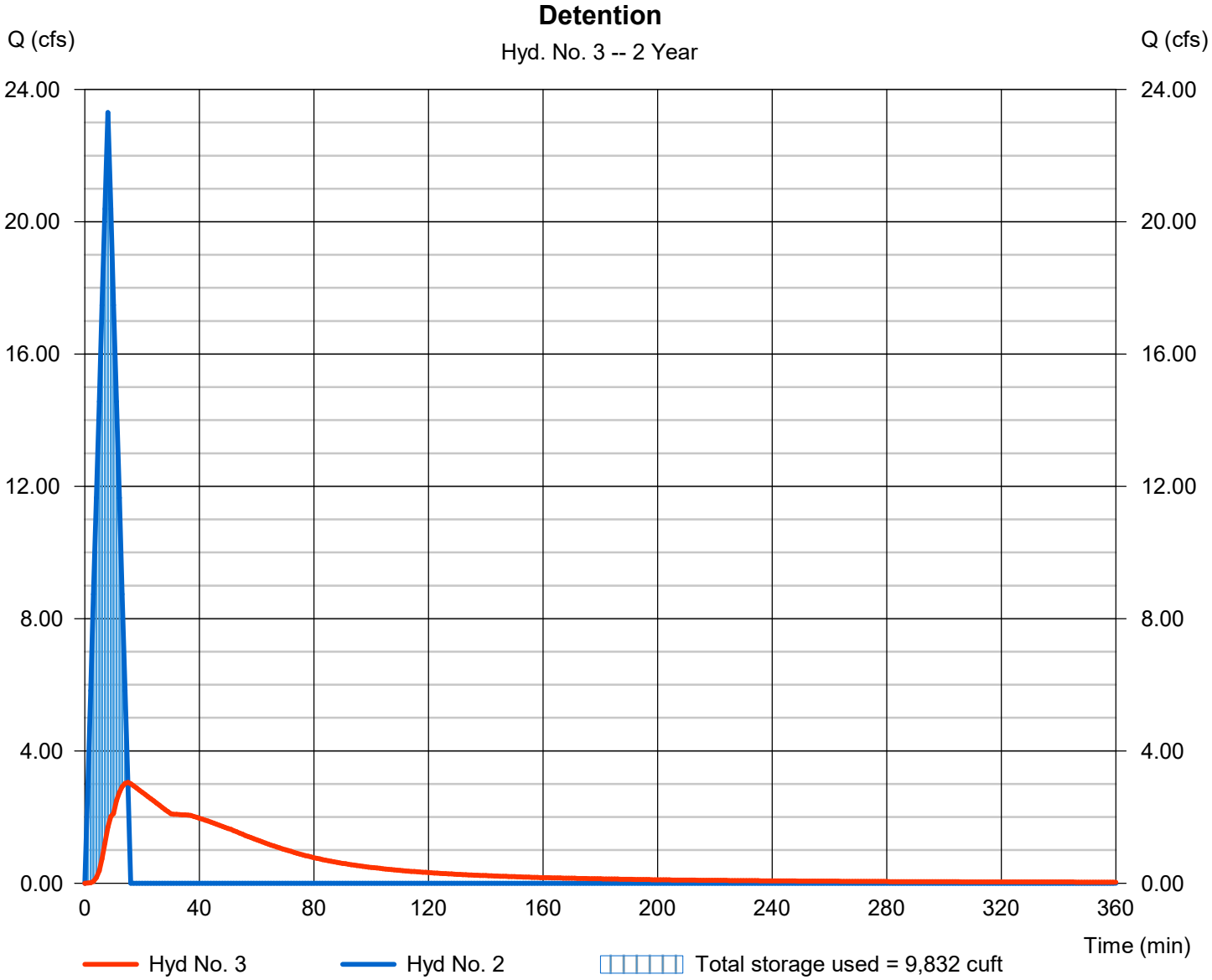
Hydrograph Report

Hyd. No. 3

Detention

Hydrograph type	=	Reservoir	Peak discharge	=	3.044 cfs
Storm frequency	=	2 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	11,152 cuft
Inflow hyd. No.	=	2 - Post Development	Max. Elevation	=	345.28 ft
Reservoir name	=	Pond	Max. Storage	=	9,832 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 344.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	344.00	6,800	0	0
0.50	344.50	7,411	3,551	3,551
1.50	345.50	8,687	8,040	11,591
2.50	346.50	10,035	9,352	20,943
3.50	347.50	11,456	10,737	31,680

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 344.00	0.00	0.00	0.00
Length (ft)	= 25.00	0.00	0.00	0.00
Slope (%)	= 1.00	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

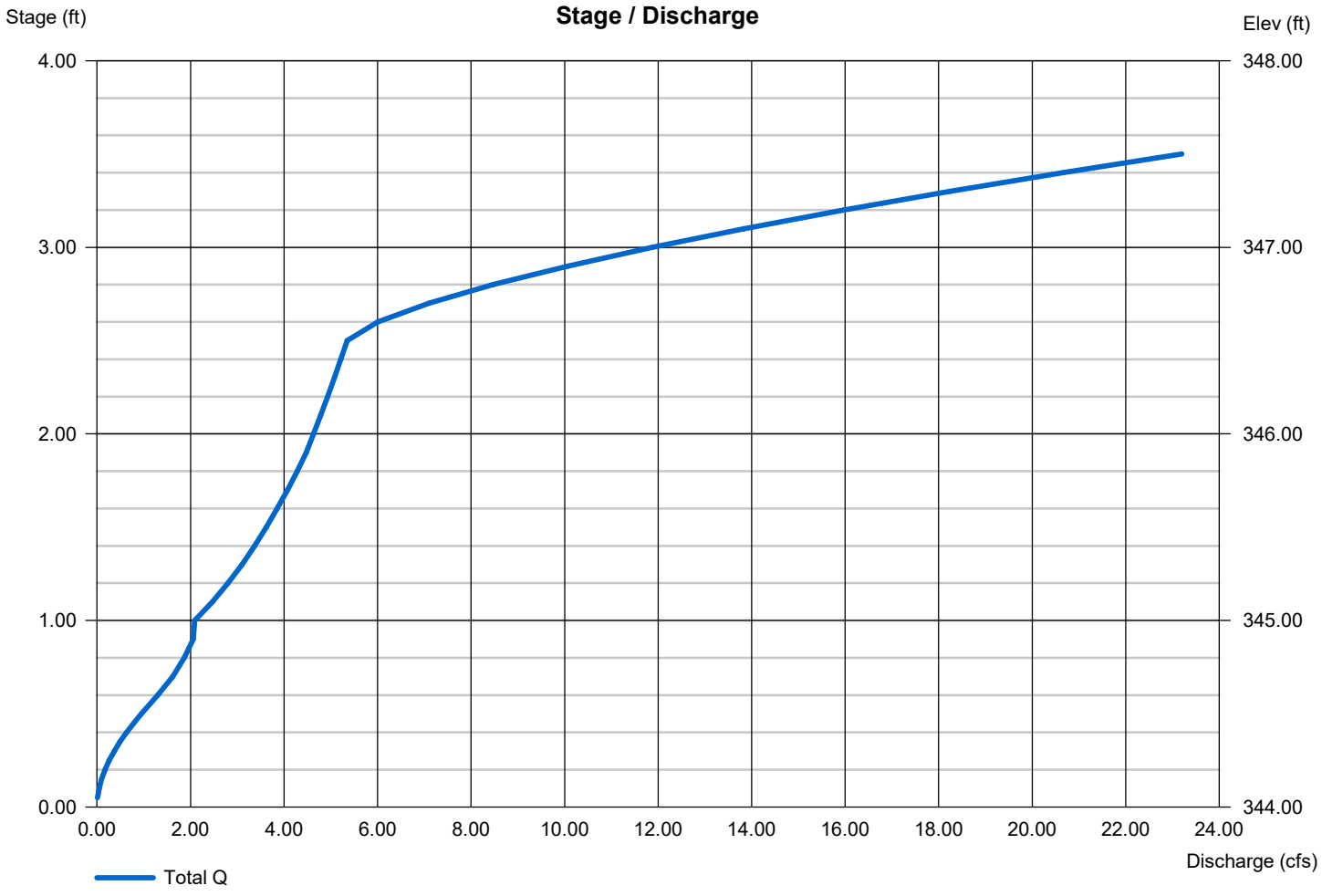
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	0.00	0.00	0.00
Crest El. (ft)	= 346.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
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).



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025

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	Rational	8.984	1	18	9,703	------	------	------	Pre Development
2	Rational	27.72	1	8	13,308	------	------	------	Post Development
3	Reservoir	3.636	1	15	13,276	2	345.51	11,662	Detention

Hydrograph Report

Hyd. No. 1

Pre Development

Hydrograph type	=	Rational	Peak discharge	=	8.984 cfs
Storm frequency	=	5 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	9,703 cuft
Drainage area	=	4.490 ac	Runoff coeff.	=	0.47
Intensity	=	4.257 in/hr	Tc by User	=	18.00 min
IDF Curve	=	Bryant, Arkansas, USA (La 34 33 Rec in 92 45 69).IDF			1/1

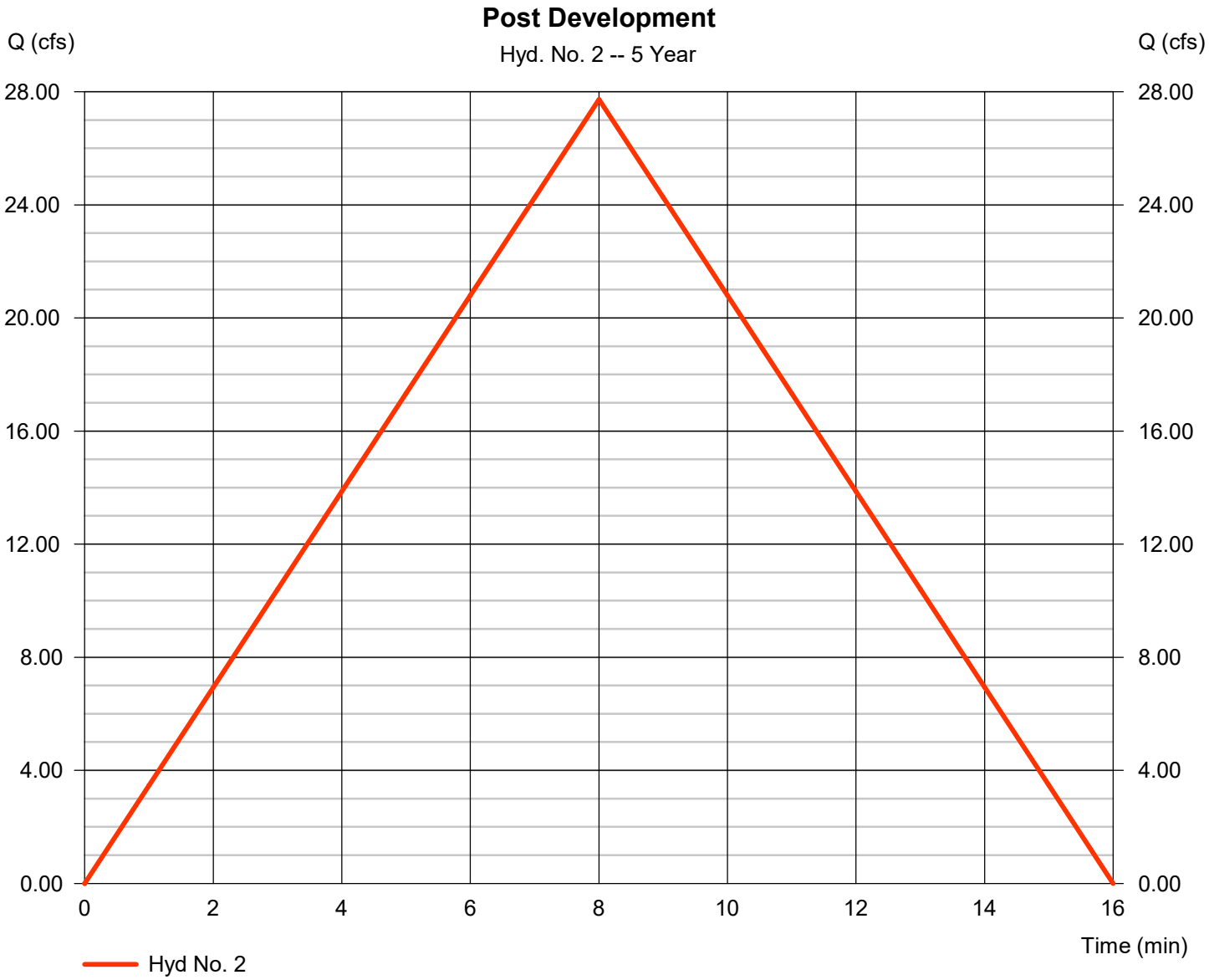


Hydrograph Report

Hyd. No. 2

Post Development

Hydrograph type	=	Rational	Peak discharge	=	27.72 cfs
Storm frequency	=	5 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	13,308 cuft
Drainage area	=	4.700 ac	Runoff coeff.	=	0.96
Intensity	=	6.145 in/hr	Tc by User	=	8.00 min
IDF Curve	=	Bryant, Arkansas, USA (La 34 33 Rainfall-92f4569).IDF			1/1



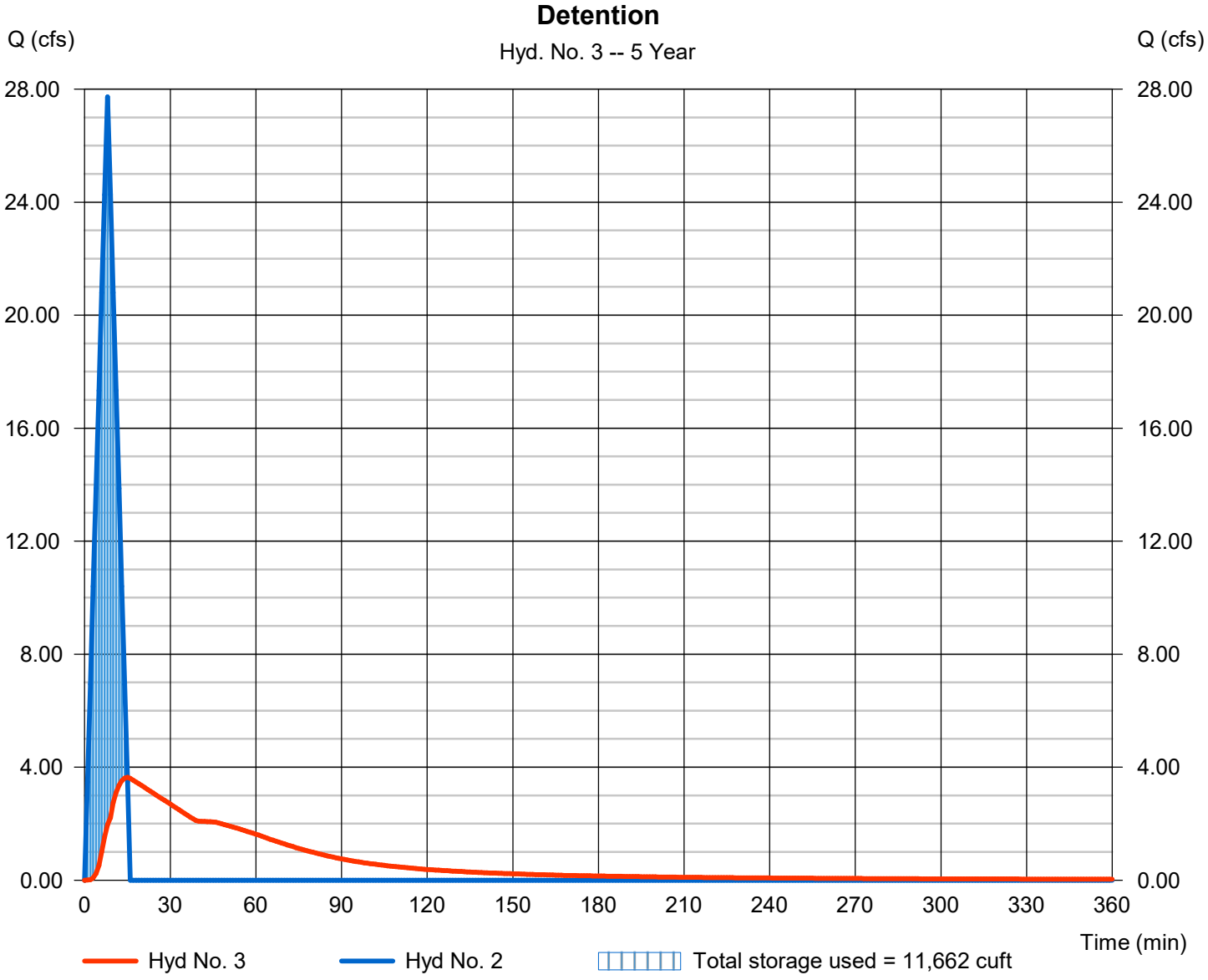
Hydrograph Report

Hyd. No. 3

Detention

Hydrograph type	=	Reservoir	Peak discharge	=	3.636 cfs
Storm frequency	=	5 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	13,276 cuft
Inflow hyd. No.	=	2 - Post Development	Max. Elevation	=	345.51 ft
Reservoir name	=	Pond	Max. Storage	=	11,662 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025

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	Rational	10.12	1	18	10,933	------	------	------	Pre Development
2	Rational	31.20	1	8	14,974	------	------	------	Post Development
3	Reservoir	3.992	1	15	14,943	2	345.66	13,120	Detention

Hydrograph Report

Hyd. No. 1

Pre Development

Hydrograph type	=	Rational	Peak discharge	=	10.12 cfs
Storm frequency	=	10 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	10,933 cuft
Drainage area	=	4.490 ac	Runoff coeff.	=	0.47
Intensity	=	4.797 in/hr	Tc by User	=	18.00 min
IDF Curve	=	Bryant, Arkansas, USA (La 34 33 Rec in 92 45 69).IDF			1/1

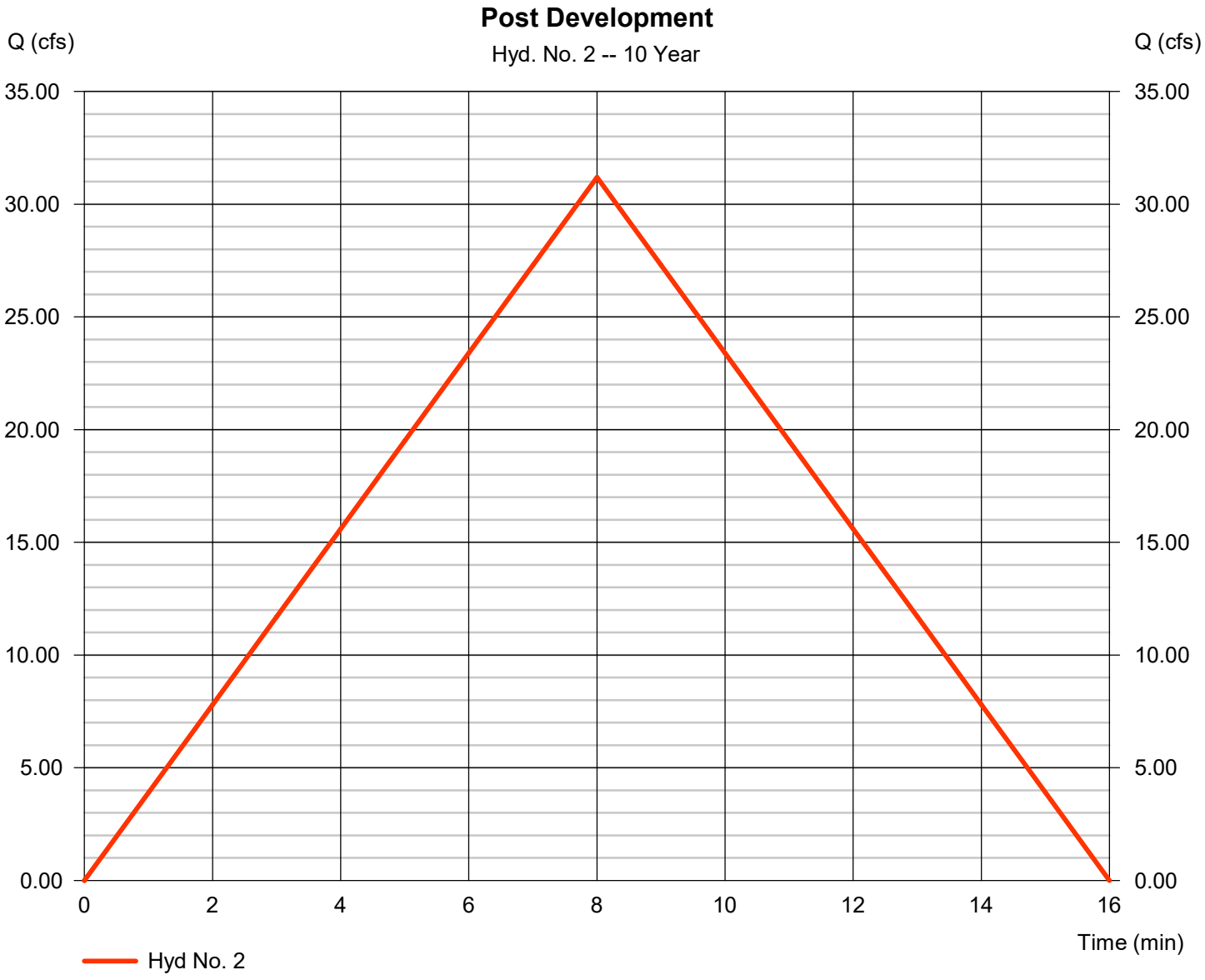


Hydrograph Report

Hyd. No. 2

Post Development

Hydrograph type	=	Rational	Peak discharge	=	31.20 cfs
Storm frequency	=	10 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	14,974 cuft
Drainage area	=	4.700 ac	Runoff coeff.	=	0.96
Intensity	=	6.914 in/hr	Tc by User	=	8.00 min
IDF Curve	=	Bryant, Arkansas, USA (La 34 33 Rel imi 92 45 69).IDF			1/1



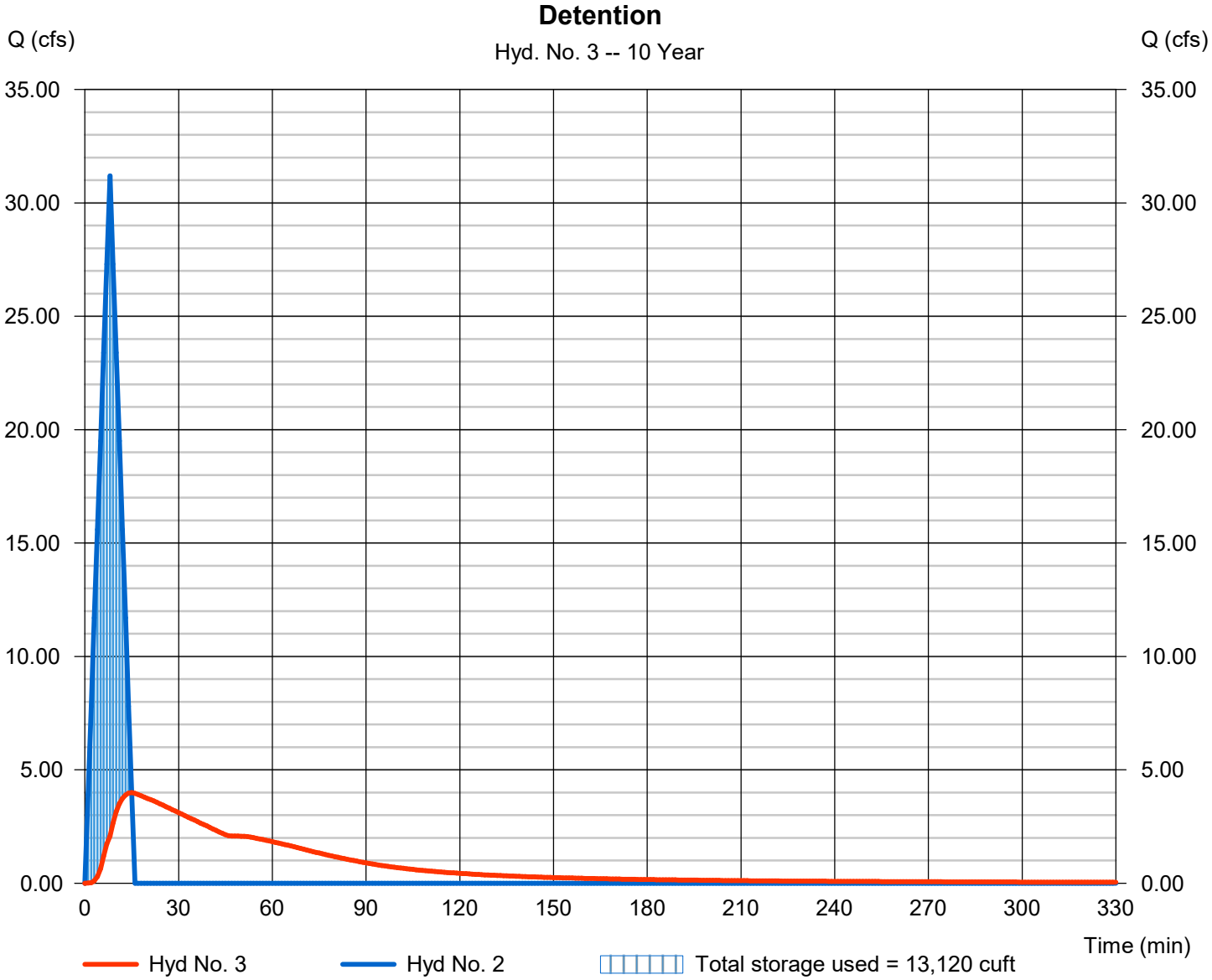
Hydrograph Report

Hyd. No. 3

Detention

Hydrograph type	=	Reservoir	Peak discharge	=	3.992 cfs
Storm frequency	=	10 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	14,943 cuft
Inflow hyd. No.	=	2 - Post Development	Max. Elevation	=	345.66 ft
Reservoir name	=	Pond	Max. Storage	=	13,120 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025

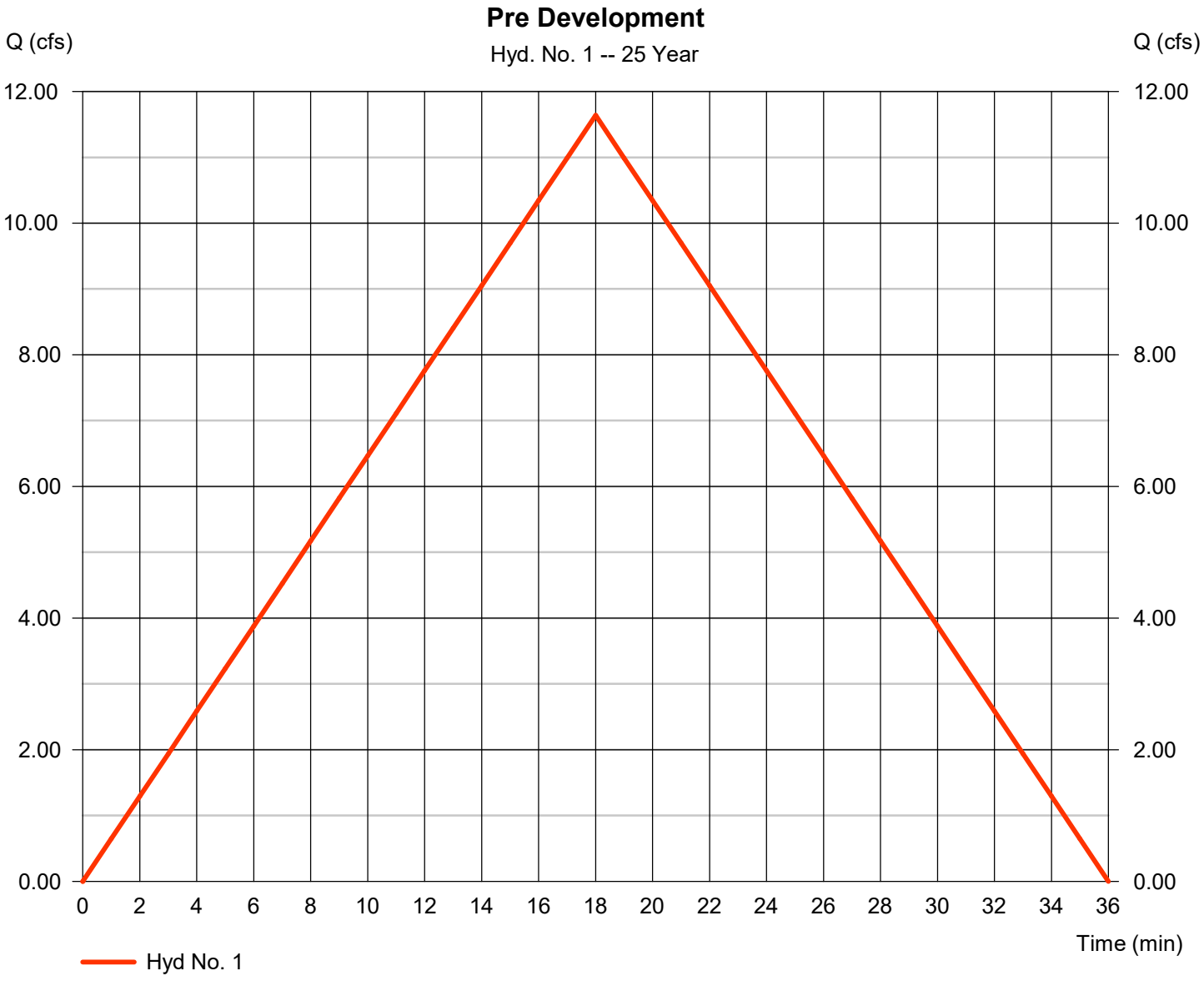
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	11.64	1	18	12,569	------	------	------	Pre Development
2	Rational	35.82	1	8	17,193	------	------	------	Post Development
3	Reservoir	4.423	1	15	17,162	2	345.87	15,083	Detention

Hydrograph Report

Hyd. No. 1

Pre Development

Hydrograph type	=	Rational	Peak discharge	=	11.64 cfs
Storm frequency	=	25 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	12,569 cuft
Drainage area	=	4.490 ac	Runoff coeff.	=	0.47
Intensity	=	5.515 in/hr	Tc by User	=	18.00 min
IDF Curve	=	Bryant, Arkansas, USA (La 34.63 Reclined 92f4569).IDF			1/1

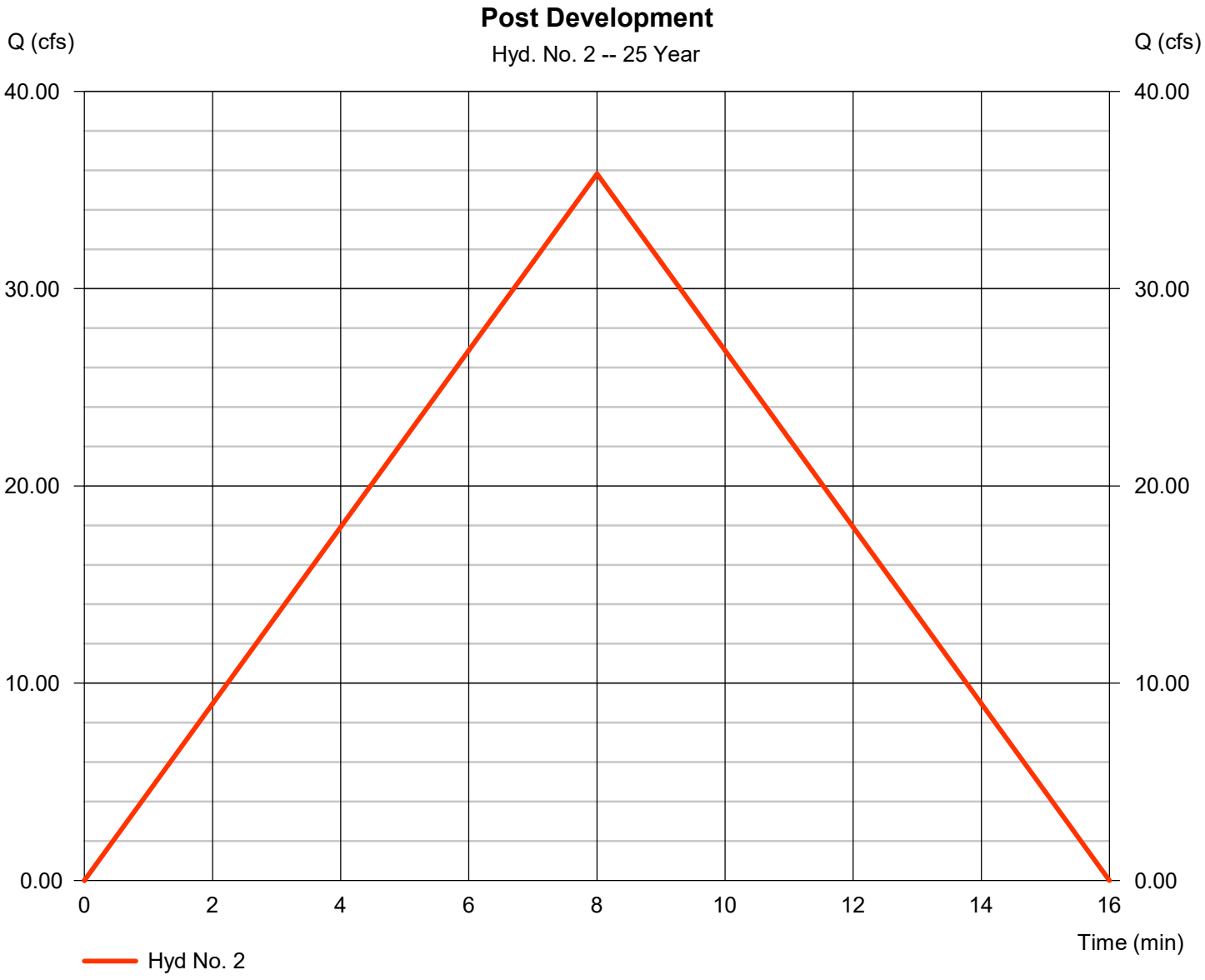


Hydrograph Report

Hyd. No. 2

Post Development

Hydrograph type	=	Rational	Peak discharge	=	35.82 cfs
Storm frequency	=	25 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	17,193 cuft
Drainage area	=	4.700 ac	Runoff coeff.	=	0.96
Intensity	=	7.939 in/hr	Tc by User	=	8.00 min
IDF Curve	=	Bryant, Arkansas, USA (La 34 34 Rainfall 92f4569).IDF			1/1



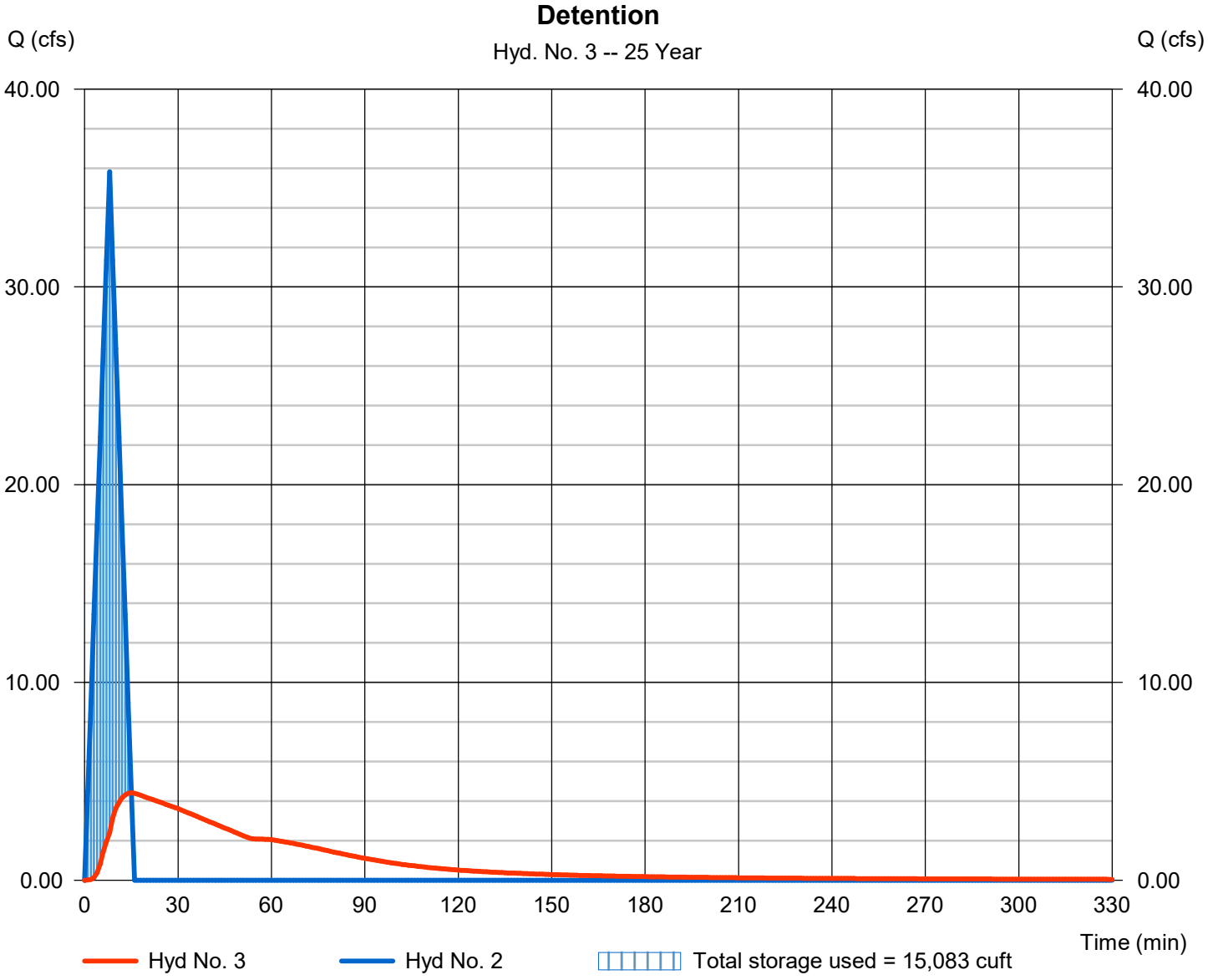
Hydrograph Report

Hyd. No. 3

Detention

Hydrograph type	=	Reservoir	Peak discharge	=	4.423 cfs
Storm frequency	=	25 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	17,162 cuft
Inflow hyd. No.	=	2 - Post Development	Max. Elevation	=	345.87 ft
Reservoir name	=	Pond	Max. Storage	=	15,083 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025

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	Rational	12.73	1	18	13,751	------	------	------	Pre Development
2	Rational	39.29	1	8	18,861	------	------	------	Post Development
3	Reservoir	4.681	1	15	18,830	2	346.03	16,576	Detention

Hydrograph Report

Hyd. No. 1

Pre Development

Hydrograph type	=	Rational	Peak discharge	=	12.73 cfs
Storm frequency	=	50 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	13,751 cuft
Drainage area	=	4.490 ac	Runoff coeff.	=	0.47
Intensity	=	6.034 in/hr	Tc by User	=	18.00 min
IDF Curve	=	Bryant, Arkansas, USA (La 34 33 Reclined 92 45 69).IDF			1/1

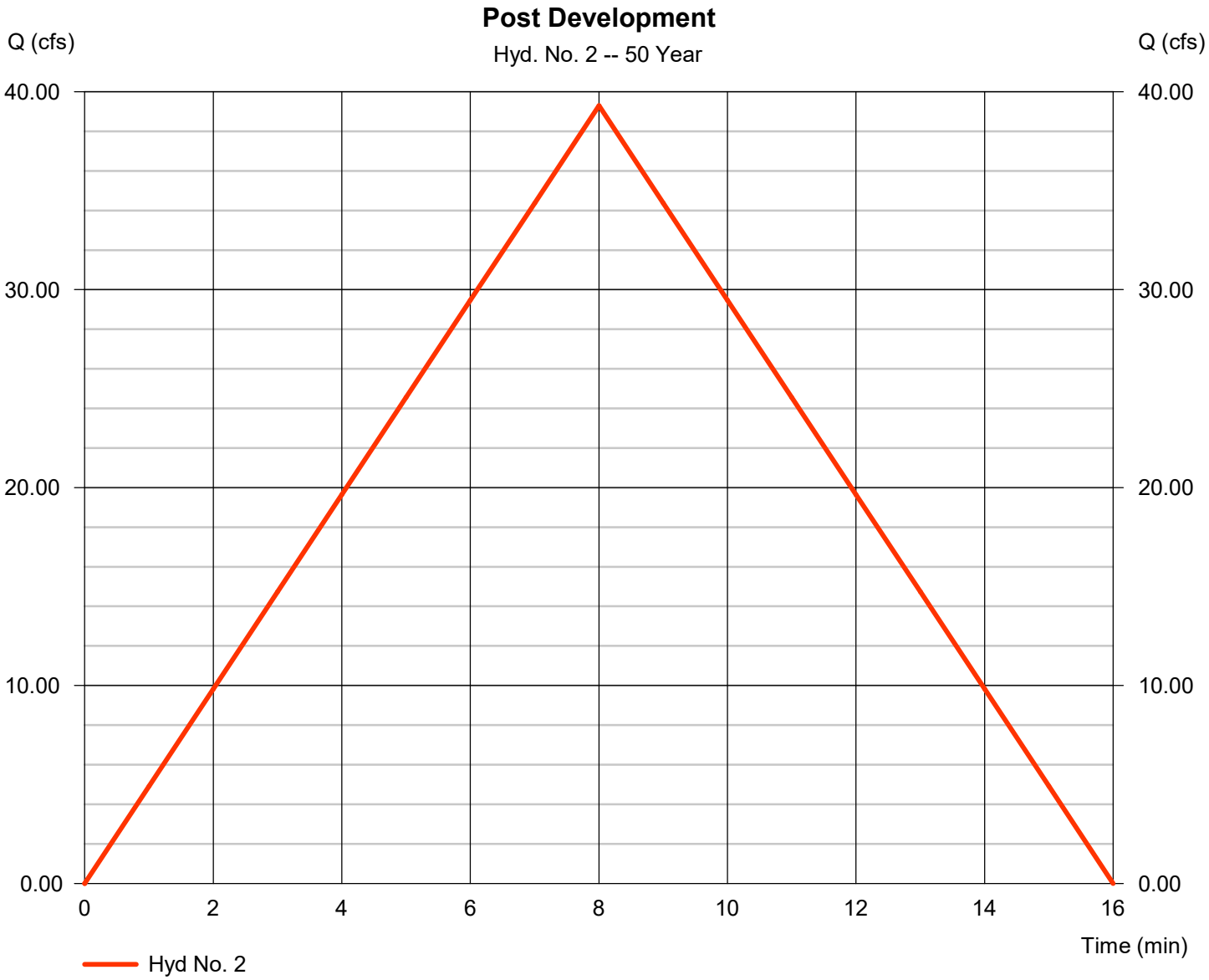


Hydrograph Report

Hyd. No. 2

Post Development

Hydrograph type	=	Rational	Peak discharge	=	39.29 cfs
Storm frequency	=	50 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	18,861 cuft
Drainage area	=	4.700 ac	Runoff coeff.	=	0.96
Intensity	=	8.709 in/hr	Tc by User	=	8.00 min
IDF Curve	=	Bryant, Arkansas, USA (La 34.63 Rd - 92f4569).IDF	Asc/Rec limit	=	1/1



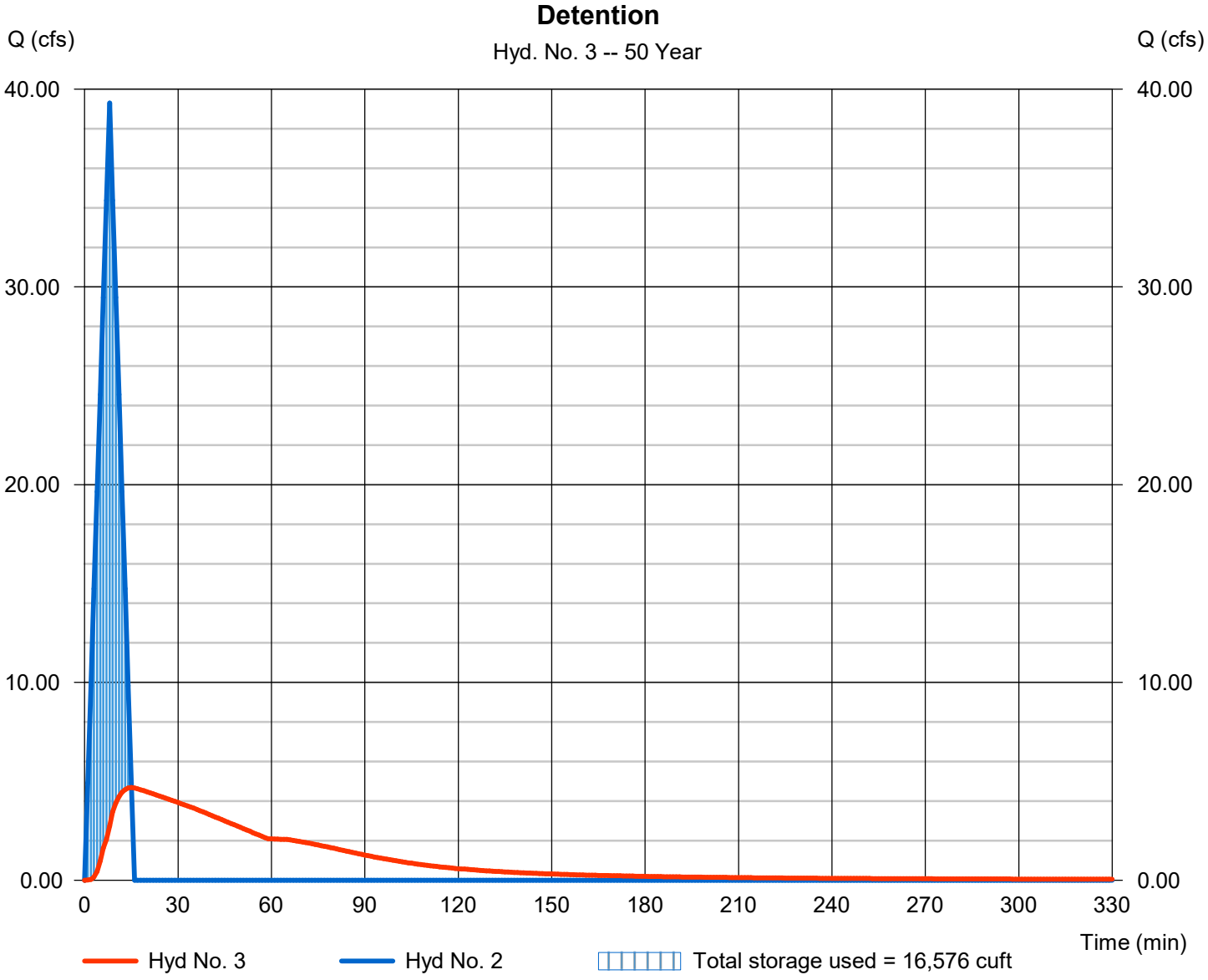
Hydrograph Report

Hyd. No. 3

Detention

Hydrograph type	=	Reservoir	Peak discharge	=	4.681 cfs
Storm frequency	=	50 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	18,830 cuft
Inflow hyd. No.	=	2 - Post Development	Max. Elevation	=	346.03 ft
Reservoir name	=	Pond	Max. Storage	=	16,576 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025

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	Rational	13.78	1	18	14,883	------	------	------	Pre Development
2	Rational	42.54	1	8	20,419	------	------	------	Post Development
3	Reservoir	4.907	1	15	20,388	2	346.18	17,991	Detention

Hydrograph Report

Hyd. No. 1

Pre Development

Hydrograph type	=	Rational	Peak discharge	=	13.78 cfs
Storm frequency	=	100 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	14,883 cuft
Drainage area	=	4.490 ac	Runoff coeff.	=	0.47
Intensity	=	6.530 in/hr	Tc by User	=	18.00 min
IDF Curve	=	Bryant, Arkansas, USA (La 34 33 Rel - 92 45 69).IDF			1/1

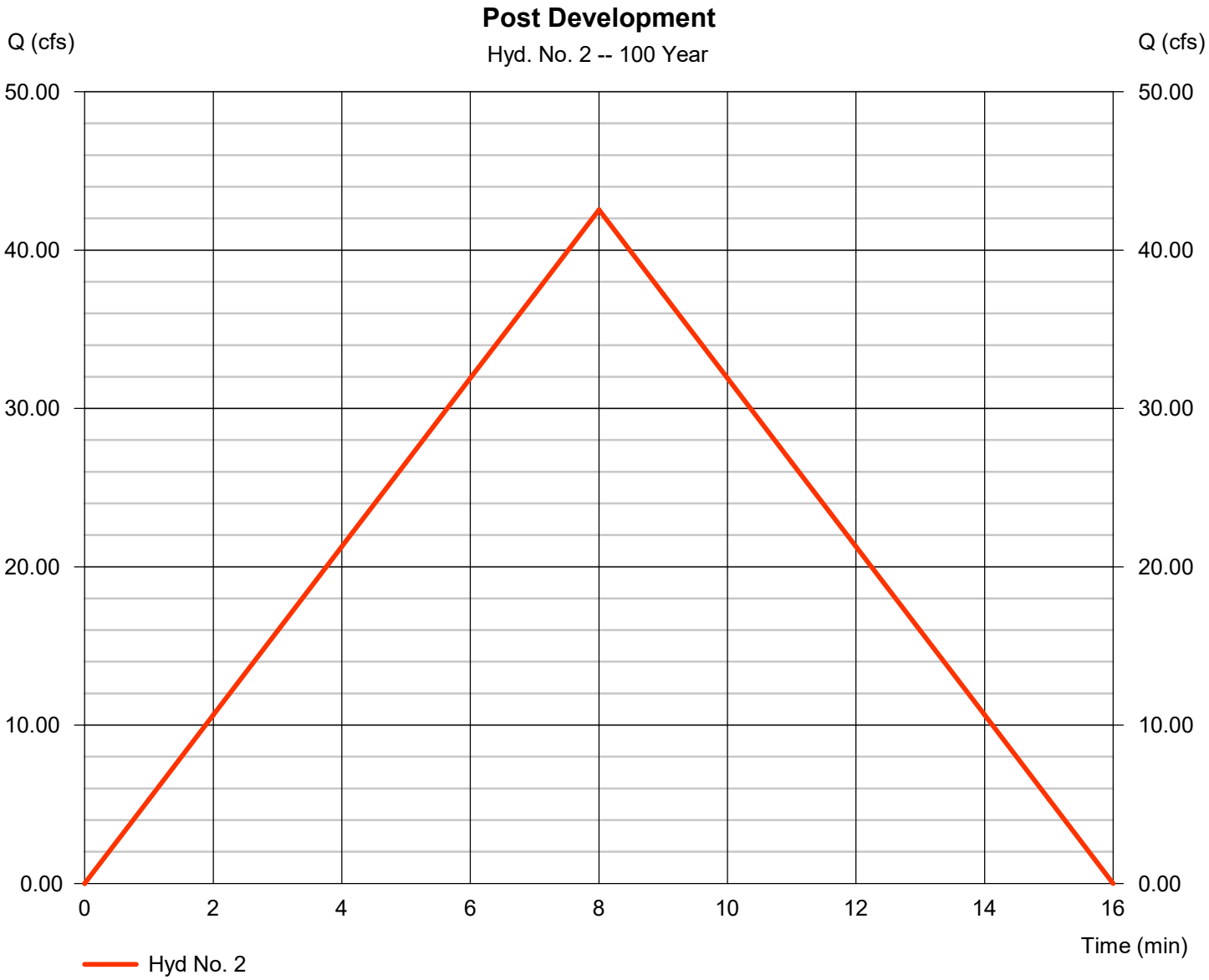


Hydrograph Report

Hyd. No. 2

Post Development

Hydrograph type	=	Rational	Peak discharge	=	42.54 cfs
Storm frequency	=	100 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	20,419 cuft
Drainage area	=	4.700 ac	Runoff coeff.	=	0.96
Intensity	=	9.428 in/hr	Tc by User	=	8.00 min
IDF Curve	=	Bryant, Arkansas, USA (La 34 33 Rel - 92f4569).IDF	Asc/Rec limit	=	1/1



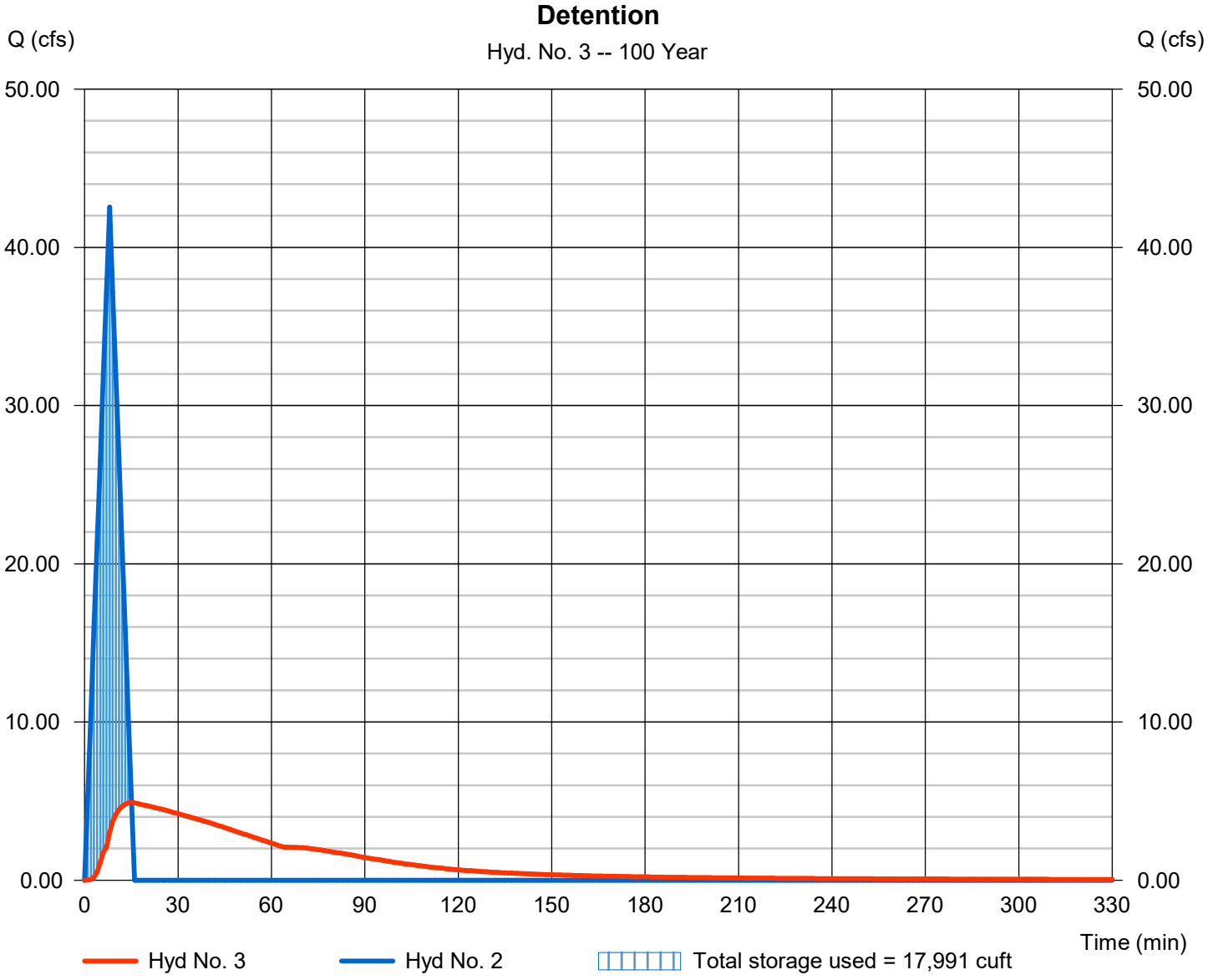
Hydrograph Report

Hyd. No. 3

Detention

Hydrograph type	=	Reservoir	Peak discharge	=	4.907 cfs
Storm frequency	=	100 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	20,388 cuft
Inflow hyd. No.	=	2 - Post Development	Max. Elevation	=	346.18 ft
Reservoir name	=	Pond	Max. Storage	=	17,991 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	27.5237	5.1000	0.6504	--------
3	0.0000	0.0000	0.0000	--------
5	34.4145	5.5000	0.6620	--------
10	39.6208	5.7000	0.6670	--------
25	45.2262	5.7000	0.6648	--------
50	46.6831	5.2000	0.6507	--------
100	47.7305	4.8000	0.6362	--------

File name: Bryant, Arkansas, USA (La 34.6349 Lo -92.4569).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	6.12	4.71	3.91	3.38	3.01	2.72	2.49	2.31	2.16	2.03	1.92	1.82
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	7.26	5.61	4.66	4.03	3.58	3.24	2.97	2.75	2.57	2.41	2.28	2.16
10	8.15	6.31	5.25	4.54	4.04	3.65	3.34	3.10	2.89	2.71	2.56	2.43
25	9.36	7.25	6.03	5.23	4.64	4.20	3.85	3.56	3.33	3.12	2.95	2.80
50	10.30	7.94	6.60	5.72	5.08	4.60	4.22	3.91	3.65	3.43	3.24	3.08
100	11.17	8.60	7.14	6.19	5.51	4.99	4.58	4.25	3.97	3.74	3.54	3.36

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.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	0.00	2.20	0.00	3.30	4.25	5.77	6.80	7.95
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

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NOAA Atlas 14, Volume 9, Version 2
Location name: Bryant, Arkansas, USA*
Latitude: 34.6349°, Longitude: -92.4569°
Elevation: 350 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

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PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**5.40** (4.36-6.64)	**6.12** (4.93-7.52)	**7.26** (5.83-8.94)	**8.17** (6.53-10.1)	**9.38** (7.22-11.9)	**10.3** (7.76-13.2)	**11.2** (8.15-14.7)	**12.0** (8.42-16.2)	**13.1** (8.84-18.1)	**13.9** (9.17-19.6)
10-min	**3.95** (3.19-4.85)	**4.48** (3.61-5.50)	**5.31** (4.27-6.55)	**5.98** (4.78-7.40)	**6.87** (5.29-8.69)	**7.53** (5.68-9.67)	**8.17** (5.96-10.7)	**8.79** (6.17-11.9)	**9.58** (6.48-13.3)	**10.2** (6.71-14.3)
15-min	**3.22** (2.59-3.95)	**3.64** (2.93-4.48)	**4.32** (3.47-5.32)	**4.86** (3.88-6.02)	**5.59** (4.30-7.07)	**6.12** (4.62-7.86)	**6.64** (4.85-8.72)	**7.15** (5.02-9.64)	**7.79** (5.27-10.8)	**8.26** (5.46-11.7)
30-min	**2.39** (1.93-2.94)	**2.72** (2.19-3.34)	**3.24** (2.60-3.99)	**3.65** (2.92-4.52)	**4.20** (3.23-5.31)	**4.60** (3.47-5.91)	**4.99** (3.64-6.55)	**5.37** (3.77-7.23)	**5.84** (3.95-8.09)	**6.18** (4.09-8.73)
60-min	**1.60** (1.29-1.97)	**1.82** (1.46-2.23)	**2.16** (1.73-2.66)	**2.43** (1.94-3.01)	**2.80** (2.16-3.55)	**3.08** (2.33-3.96)	**3.36** (2.45-4.42)	**3.63** (2.55-4.90)	**3.98** (2.69-5.51)	**4.23** (2.80-5.98)
2-hr	**1.00** (0.817-1.22)	**1.14** (0.922-1.38)	**1.35** (1.09-1.65)	**1.52** (1.22-1.87)	**1.76** (1.37-2.21)	**1.93** (1.47-2.47)	**2.11** (1.55-2.76)	**2.29** (1.62-3.07)	**2.52** (1.71-3.47)	**2.69** (1.79-3.77)
3-hr	**0.753** (0.615-0.913)	**0.850** (0.694-1.03)	**1.01** (0.822-1.23)	**1.14** (0.926-1.40)	**1.33** (1.04-1.67)	**1.47** (1.13-1.87)	**1.61** (1.20-2.10)	**1.76** (1.25-2.36)	**1.95** (1.34-2.69)	**2.10** (1.40-2.94)
6-hr	**0.453** (0.373-0.545)	**0.514** (0.424-0.620)	**0.618** (0.508-0.746)	**0.707** (0.577-0.857)	**0.834** (0.660-1.04)	**0.935** (0.723-1.19)	**1.04** (0.776-1.35)	**1.15** (0.822-1.53)	**1.29** (0.893-1.77)	**1.41** (0.946-1.96)
12-hr	**0.265** (0.220-0.316)	**0.305** (0.253-0.364)	**0.374** (0.309-0.447)	**0.433** (0.357-0.521)	**0.520** (0.416-0.649)	**0.590** (0.461-0.746)	**0.664** (0.500-0.859)	**0.741** (0.536-0.984)	**0.848** (0.590-1.16)	**0.932** (0.630-1.29)
24-hr	**0.155** (0.130-0.184)	**0.180** (0.151-0.214)	**0.223** (0.186-0.265)	**0.261** (0.216-0.311)	**0.316** (0.255-0.392)	**0.361** (0.284-0.454)	**0.409** (0.311-0.526)	**0.459** (0.335-0.607)	**0.530** (0.371-0.719)	**0.586** (0.399-0.803)
2-day	**0.091** (0.077-0.107)	**0.105** (0.088-0.123)	**0.129** (0.109-0.152)	**0.150** (0.126-0.178)	**0.182** (0.148-0.224)	**0.208** (0.165-0.259)	**0.235** (0.180-0.300)	**0.264** (0.194-0.347)	**0.305** (0.215-0.411)	**0.337** (0.231-0.459)
3-day	**0.066** (0.056-0.077)	**0.076** (0.065-0.089)	**0.093** (0.079-0.109)	**0.108** (0.091-0.128)	**0.130** (0.106-0.160)	**0.148** (0.118-0.184)	**0.167** (0.128-0.212)	**0.187** (0.138-0.244)	**0.214** (0.152-0.288)	**0.236** (0.162-0.321)
4-day	**0.053** (0.045-0.062)	**0.061** (0.052-0.071)	**0.074** (0.063-0.087)	**0.086** (0.072-0.101)	**0.103** (0.084-0.125)	**0.116** (0.093-0.144)	**0.131** (0.101-0.165)	**0.146** (0.108-0.190)	**0.167** (0.118-0.223)	**0.183** (0.126-0.248)
7-day	**0.035** (0.030-0.040)	**0.040** (0.034-0.046)	**0.048** (0.041-0.056)	**0.055** (0.047-0.064)	**0.065** (0.054-0.079)	**0.074** (0.059-0.090)	**0.082** (0.063-0.103)	**0.091** (0.067-0.117)	**0.103** (0.073-0.136)	**0.112** (0.078-0.151)
10-day	**0.028** (0.024-0.032)	**0.031** (0.027-0.036)	**0.037** (0.032-0.043)	**0.042** (0.036-0.049)	**0.050** (0.041-0.060)	**0.055** (0.045-0.067)	**0.061** (0.048-0.076)	**0.067** (0.050-0.087)	**0.076** (0.054-0.100)	**0.082** (0.057-0.110)
20-day	**0.018** (0.016-0.021)	**0.020** (0.018-0.023)	**0.024** (0.020-0.027)	**0.026** (0.023-0.030)	**0.030** (0.025-0.036)	**0.033** (0.027-0.040)	**0.036** (0.028-0.044)	**0.039** (0.029-0.049)	**0.043** (0.031-0.056)	**0.046** (0.032-0.061)
30-day	**0.015** (0.013-0.017)	**0.016** (0.014-0.019)	**0.019** (0.016-0.022)	**0.021** (0.018-0.024)	**0.024** (0.020-0.028)	**0.026** (0.021-0.031)	**0.028** (0.022-0.034)	**0.030** (0.022-0.038)	**0.032** (0.023-0.042)	**0.034** (0.024-0.046)
45-day	**0.012** (0.010-0.014)	**0.013** (0.012-0.015)	**0.015** (0.013-0.017)	**0.017** (0.015-0.019)	**0.019** (0.016-0.023)	**0.021** (0.017-0.025)	**0.022** (0.018-0.027)	**0.024** (0.018-0.030)	**0.026** (0.019-0.034)	**0.027** (0.019-0.036)
60-day	**0.010** (0.009-0.011)	**0.011** (0.010-0.013)	**0.013** (0.012-0.015)	**0.015** (0.013-0.017)	**0.017** (0.014-0.020)	**0.018** (0.015-0.022)	**0.020** (0.016-0.024)	**0.021** (0.016-0.027)	**0.023** (0.017-0.030)	**0.024** (0.017-0.032)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical