MIDLAND ROAD SUBDIVISION

BRYANT, AR

DRAINAGE REPORT

FOR
City of Bryant, Saline County, AR

MARCH 2023

Owner & Developer: HAVEN'S DEVELOPMENT, LLC
Address: 2615 N. Prickett Road, Suite 5, Bryant AR 72022

By:

HOPE
CONSULTING
ENGINEERS • SURVEYORS

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Narrative & Summary

PROJECT TITLE

Midland Road Subdivision

PROJECT PROPERTY OWNER

Havens Development, LLC

Address: 2615 N. Prickett Road, Suite 5, Bryant AR 72022

PROJECT LOCATION

Midland Road, Bryant, AR

PROJECT DESCRIPTION

The proposed sub divisional development is on Midland Road, Bryant, AR 72002. Total development site area is 49.13 acres.

DRAINAGE ANALYSIS

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

North-West Detention Pond

- Pond is situated on the north-west side of the property.
- Pre-development area 23.93 acres.
- Post-development area 29.93 acres.
- Pre-development runoff coefficient Area-1 0.47.
- Post-development runoff coefficient Area- 0.67.
- Pond has a bottom area of 0.24 acres with bottom elevation of 359.00'.
- One 36'' RCP with 0.5% slope is proposed for outflow culverts.

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

	Pre-development	Post-dev. Without detention	Post-dev. With detention
	Peak Flow (cfs)	Peak Flow (cfs)	Peak Flow (cfs)
2-Year	35.74	46.73	26.85
5-Year	39.44	51.66	31.74
10-Year	47.72	63.08	41.09
25-Year	55.05	72.96	47.98
50-Year	62.73	82.99	54.26
100-Year	67.26	89.41	58.01

South-West Detention Pond

- Pond is situated on the north-east side of the property.
- Pre-development area 15.44 acres.
- Post-development area 15.44 acres.
- Pre-development runoff coefficient 0.47.
- Post-development runoff coefficient 0.67.
- Pond has a bottom area of 0.27 acres with bottom elevation of 351.00'.
- One 24'' RCP with 0.5% slope is proposed for outflow culverts.

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

	Pre-development	Post-dev. Without detention	Post-dev. With detention
	Peak Flow (cfs)	Peak Flow (cfs)	Peak Flow (cfs)
2-Year	15.82	26.41	13.66
5-Year	17.75	29.36	15.58
10-Year	22.22	36.29	19.59
25-Year	25.92	42.14	22.47
50-Year	29.18	47.74	24.67
100-Year	32.08	51.88	25.88

South-East Detention Pond

- Pond is situated on the south-east side of the property.
- Pre-development area 23.57 acres.
- Post-development area 23.57 acres.
- Pre-development runoff coefficient 0.47.
- Post-development runoff coefficient 0.53.
- Pond has a bottom area of 0.17 acres with bottom elevation of 348.00'.
- One 30'' RCP with 0.5% slope is proposed for outflow culverts.

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

	Pre-development	Post-dev. Without detention	Post-dev. With detention
	Peak Flow (cfs)	Peak Flow (cfs)	Peak Flow (cfs)
2-Year	22.25	26.84	21.47
5-Year	25.11	30.15	24.51
10-Year	31.62	37.79	30.67
25-Year	36.97	44.09	35.26
50-Year	41.46	49.61	39.04
100-Year	45.90	54.61	41.80

CONCLUSION

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

Hydrograph Summary Report

NORTHWEST POND

Multi-Hydrograph Plot

Hyd. No. 1

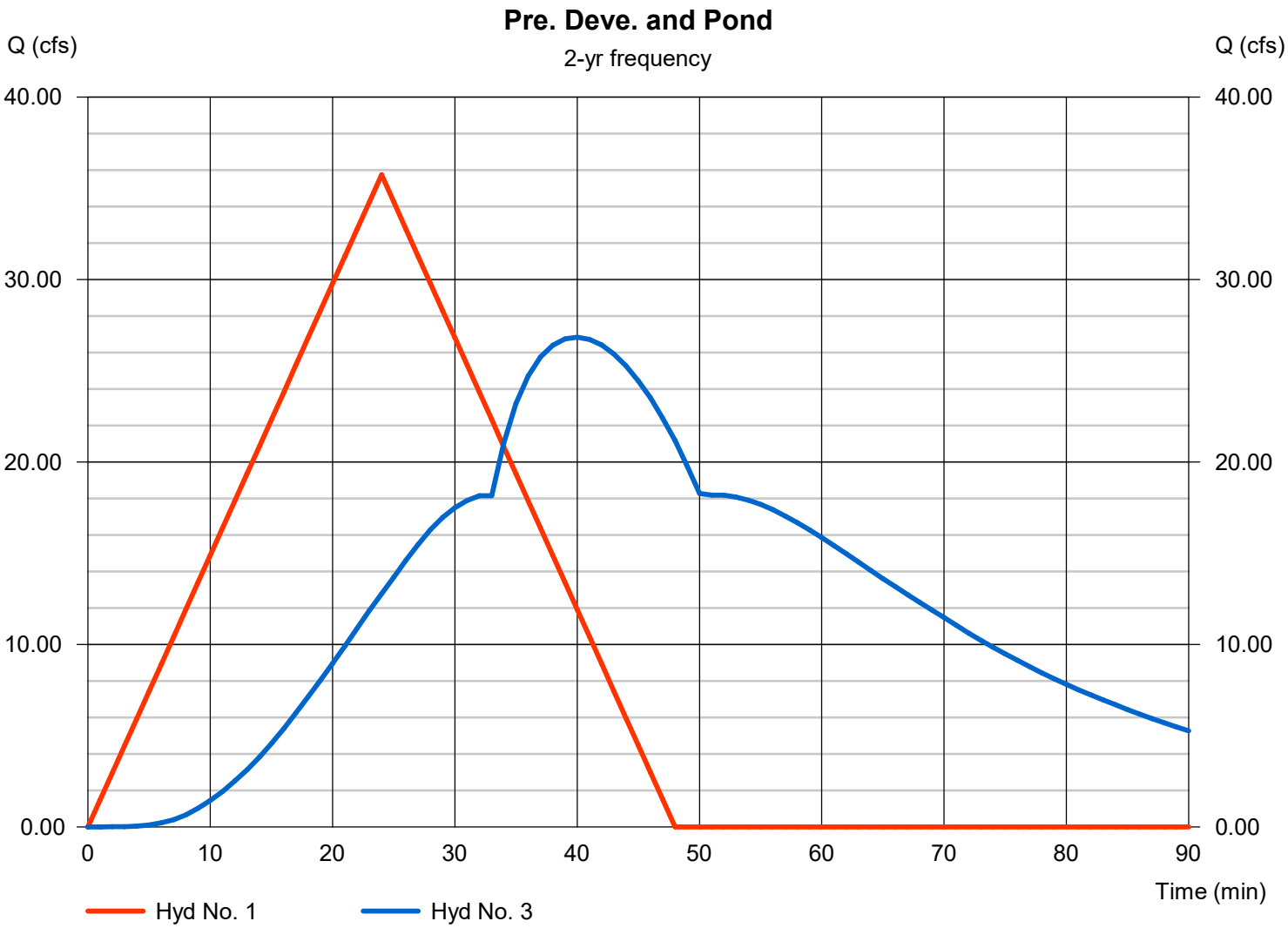
Pre. Deve.

Hydrograph type	=	Rational
Peak discharge	=	35.74 cfs
Time to peak	=	24 min
Hyd. Volume	=	51,466 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	26.85 cfs
Time to peak	=	40 min
Hyd. Volume	=	78,478 cuft



Multi-Hydrograph Plot

Hyd. No. 1

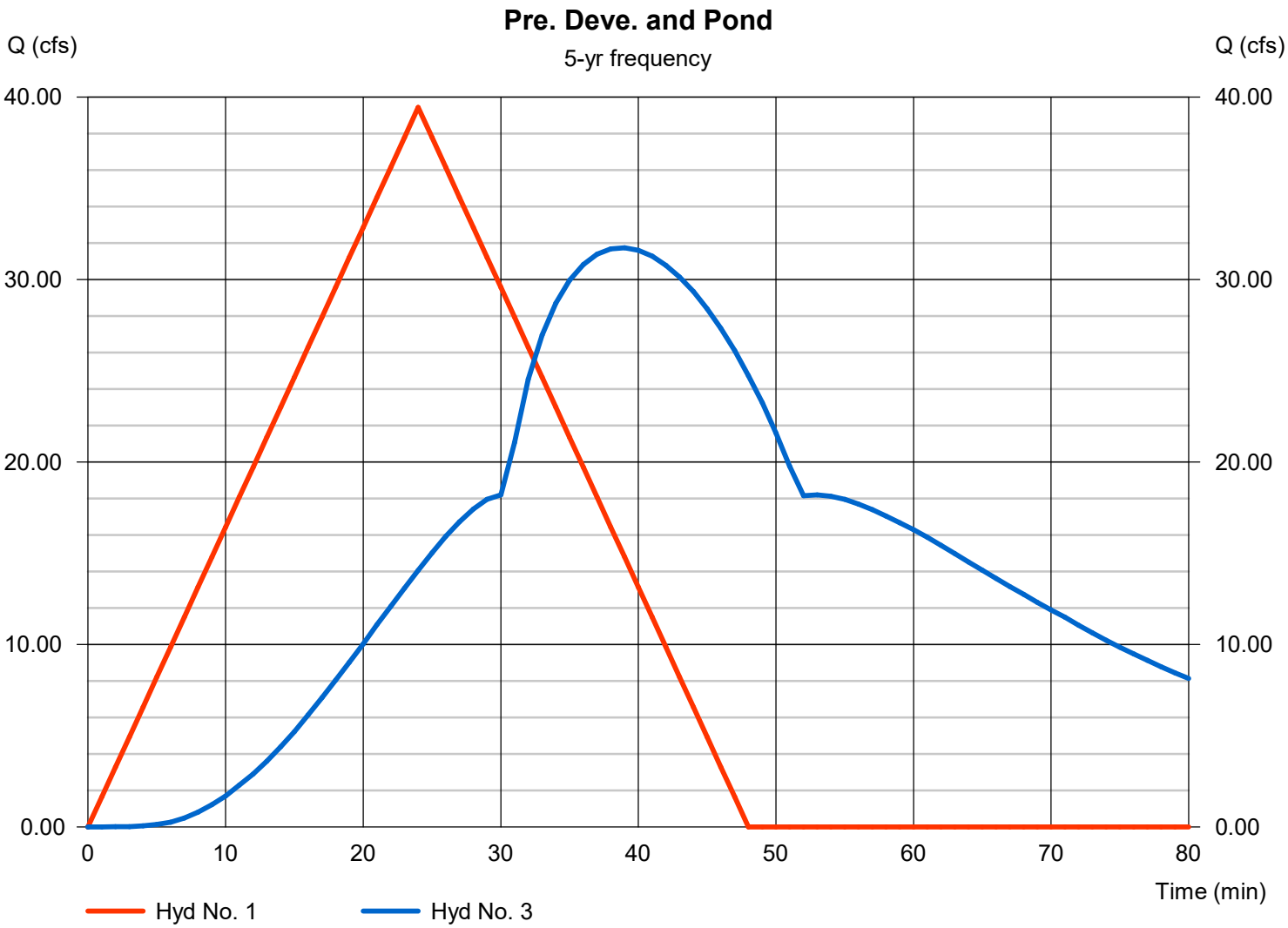
Pre. Deve.

Hydrograph type	=	Rational
Peak discharge	=	39.44 cfs
Time to peak	=	24 min
Hyd. Volume	=	56,792 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	31.74 cfs
Time to peak	=	39 min
Hyd. Volume	=	86,773 cuft



Multi-Hydrograph Plot

Hyd. No. 1

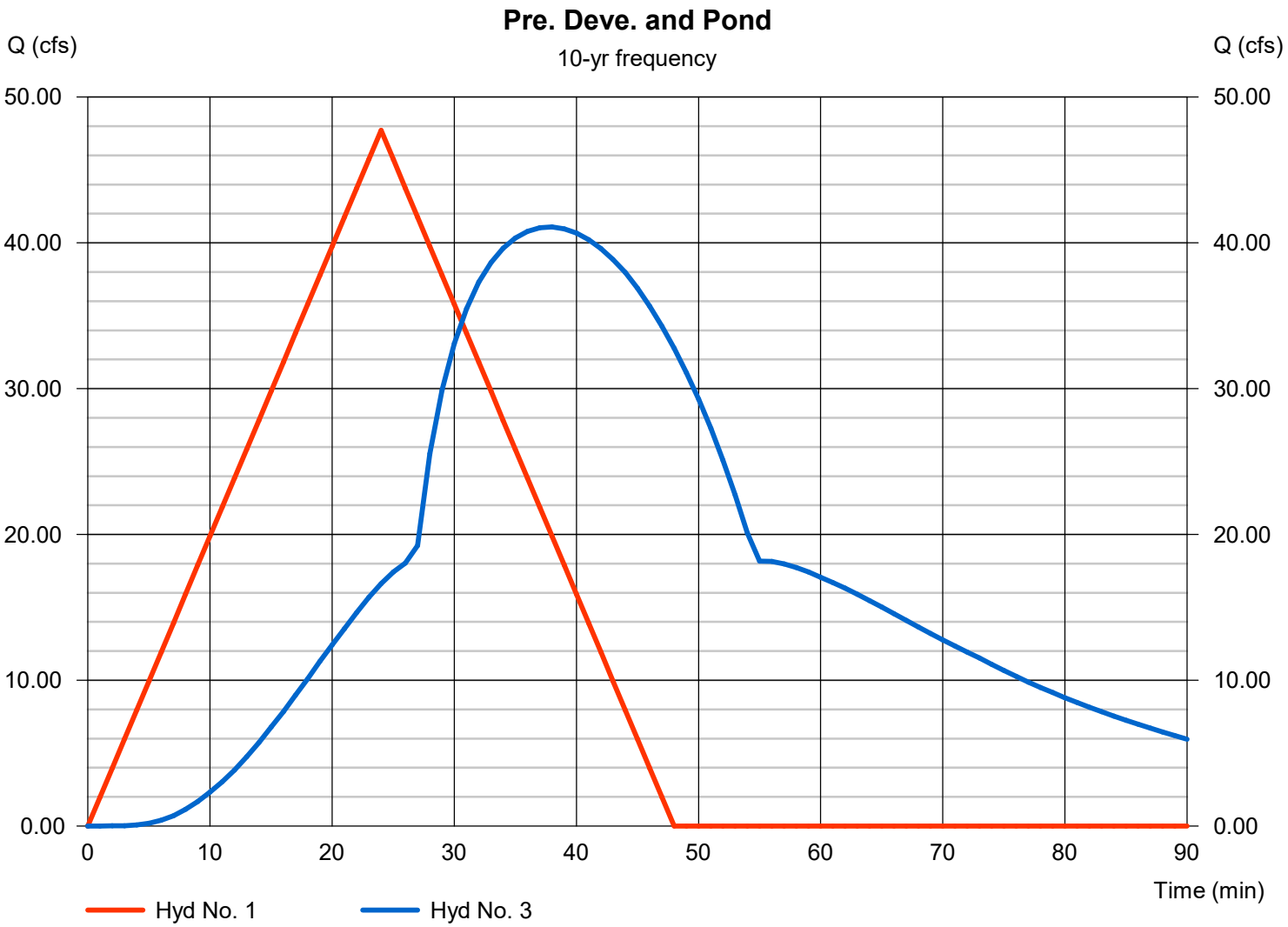
Pre. Deve.

Hydrograph type	=	Rational
Peak discharge	=	47.72 cfs
Time to peak	=	24 min
Hyd. Volume	=	68,715 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	41.09 cfs
Time to peak	=	38 min
Hyd. Volume	=	105,956 cuft



Multi-Hydrograph Plot

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

Hyd. No. 1

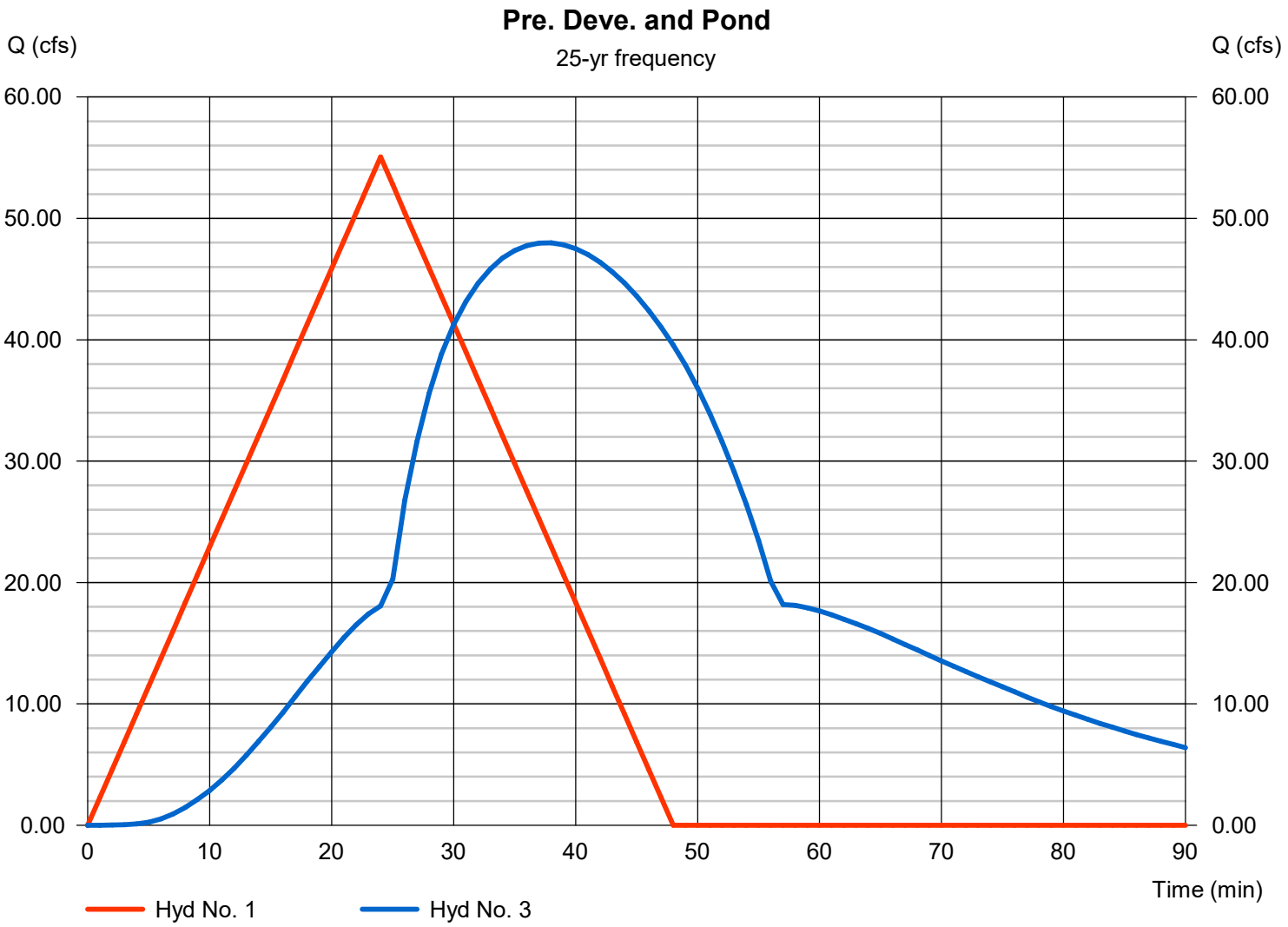
Pre. Deve.

Hydrograph type	=	Rational
Peak discharge	=	55.05 cfs
Time to peak	=	24 min
Hyd. Volume	=	79,278 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	47.98 cfs
Time to peak	=	38 min
Hyd. Volume	=	122,548 cuft



Multi-Hydrograph Plot

Hyd. No. 1

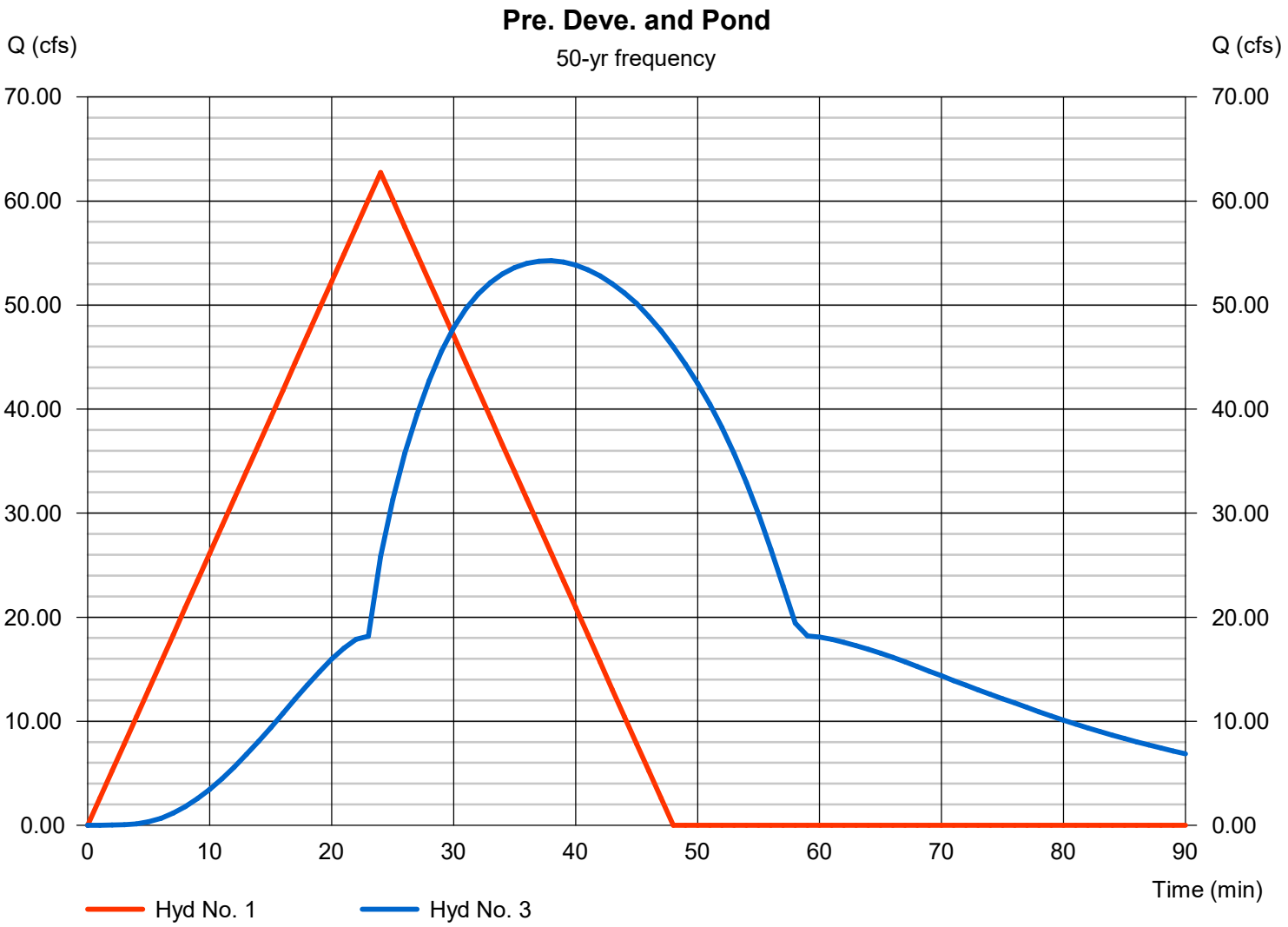
Pre. Deve.

Hydrograph type	=	Rational
Peak discharge	=	62.73 cfs
Time to peak	=	24 min
Hyd. Volume	=	90,330 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	54.26 cfs
Time to peak	=	38 min
Hyd. Volume	=	139,403 cuft



Multi-Hydrograph Plot

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

Hyd. No. 1

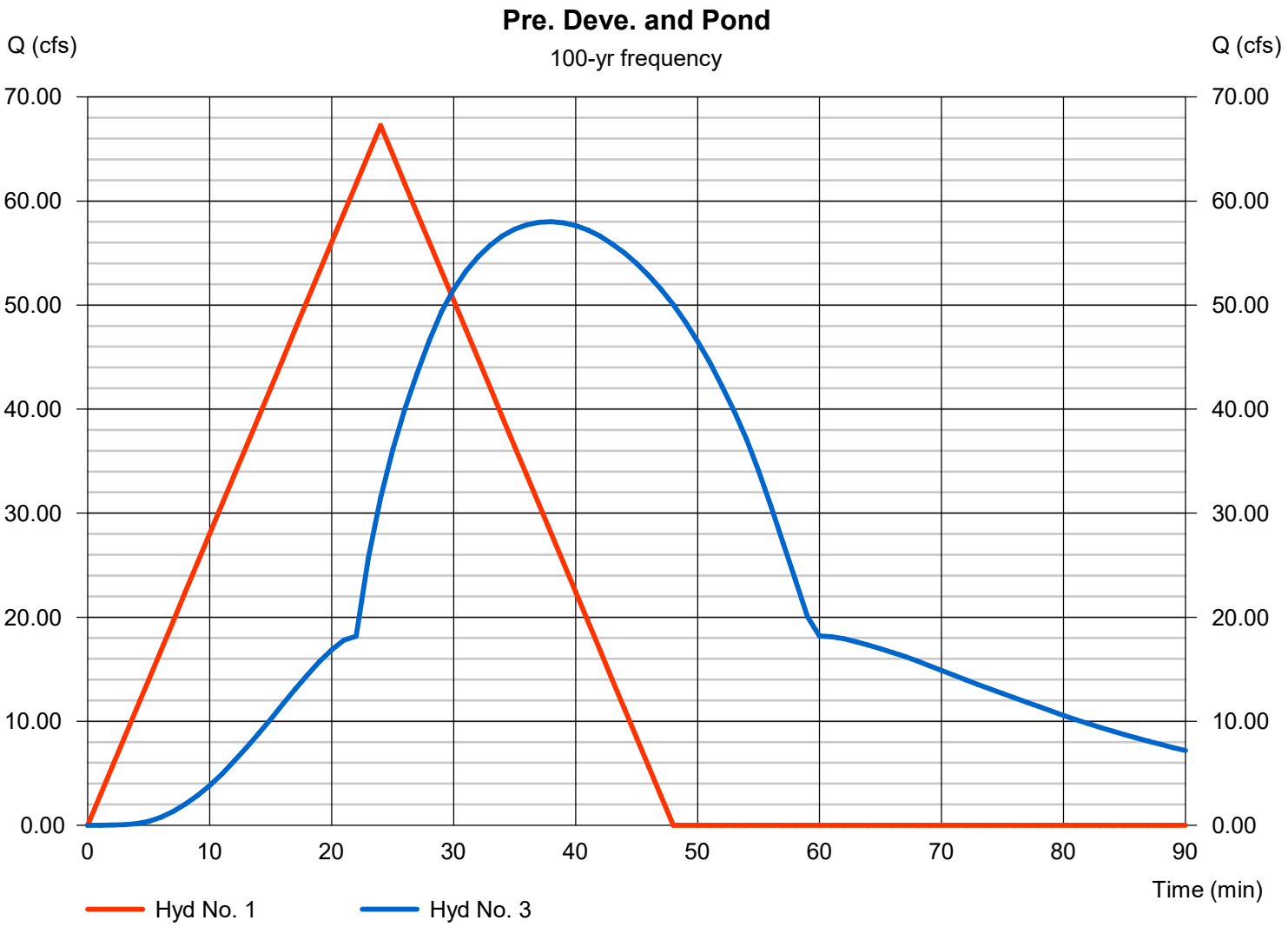
Pre. Deve.

Hydrograph type	=	Rational
Peak discharge	=	67.26 cfs
Time to peak	=	24 min
Hyd. Volume	=	96,854 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	58.01 cfs
Time to peak	=	38 min
Hyd. Volume	=	150,191 cuft



Watershed Model Schematic

Hydrograph Summary Report

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

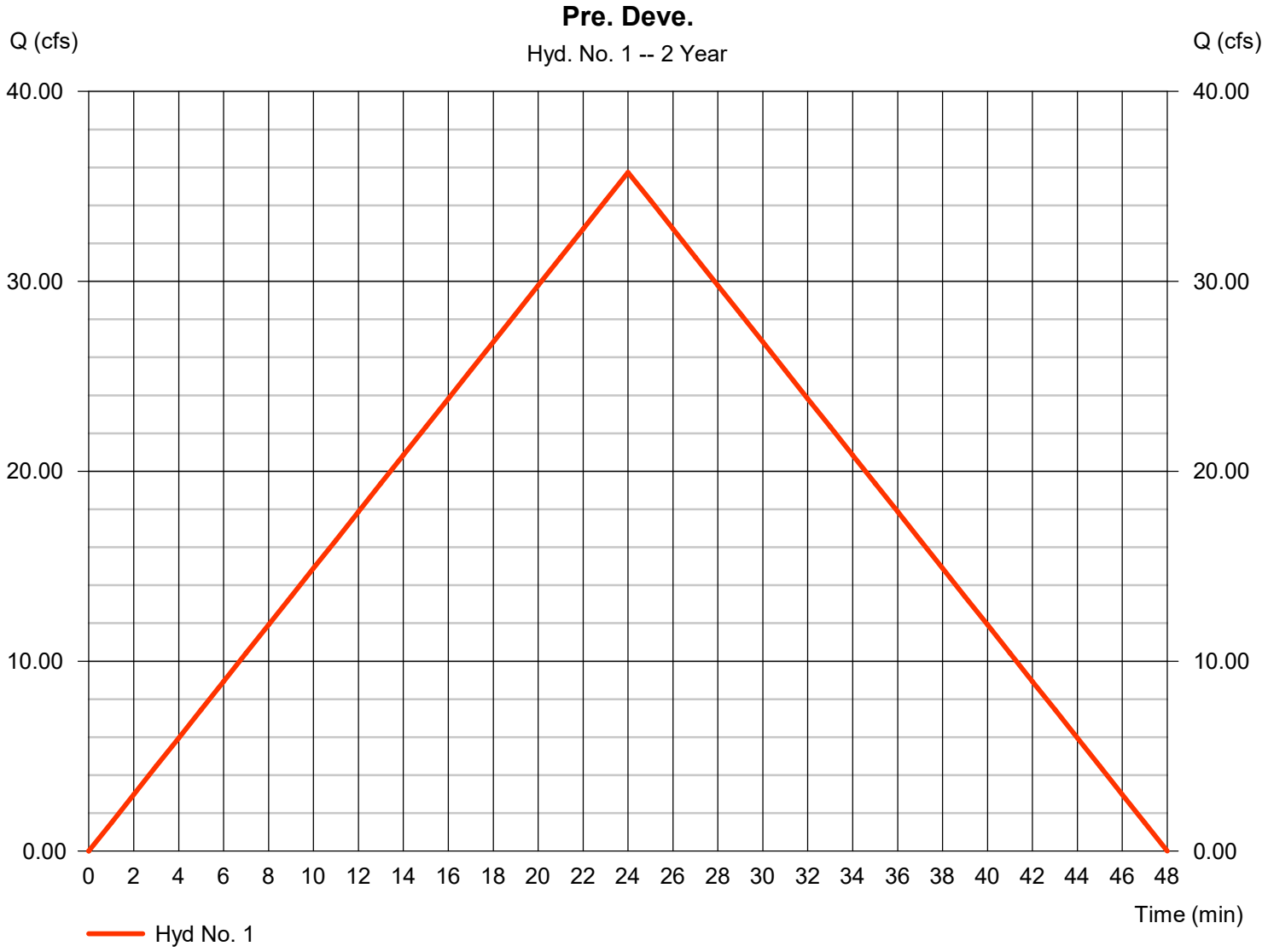
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	35.74	1	24	51,466	------	------	------	Pre. Deve.
2	Rational	46.73	1	28	78,501	------	------	------	Post Deve.
3	Reservoir	26.85	1	40	78,478	2	362.21	41,015	Pond

Hydrograph Report

Hyd. No. 1

Pre. Deve.

Hydrograph type	=	Rational	Peak discharge	=	35.74 cfs
Storm frequency	=	2 yrs	Time to peak	=	24 min
Time interval	=	1 min	Hyd. volume	=	51,466 cuft
Drainage area	=	23.930 ac	Runoff coeff.	=	0.47
Intensity	=	3.178 in/hr	Tc by User	=	24.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



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	Rational	39.44	1	24	56,792	------	------	------	Pre. Deve.
2	Rational	51.66	1	28	86,796	------	------	------	Post Deve.
3	Reservoir	31.74	1	39	86,773	2	362.37	43,438	Pond

Hydrograph Report

Hyd. No. 1

Pre. Deve.

Hydrograph type	=	Rational	Peak discharge	=	39.44 cfs
Storm frequency	=	5 yrs	Time to peak	=	24 min
Time interval	=	1 min	Hyd. volume	=	56,792 cuft
Drainage area	=	23.930 ac	Runoff coeff.	=	0.47
Intensity	=	3.507 in/hr	Tc by User	=	24.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Summary Report

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

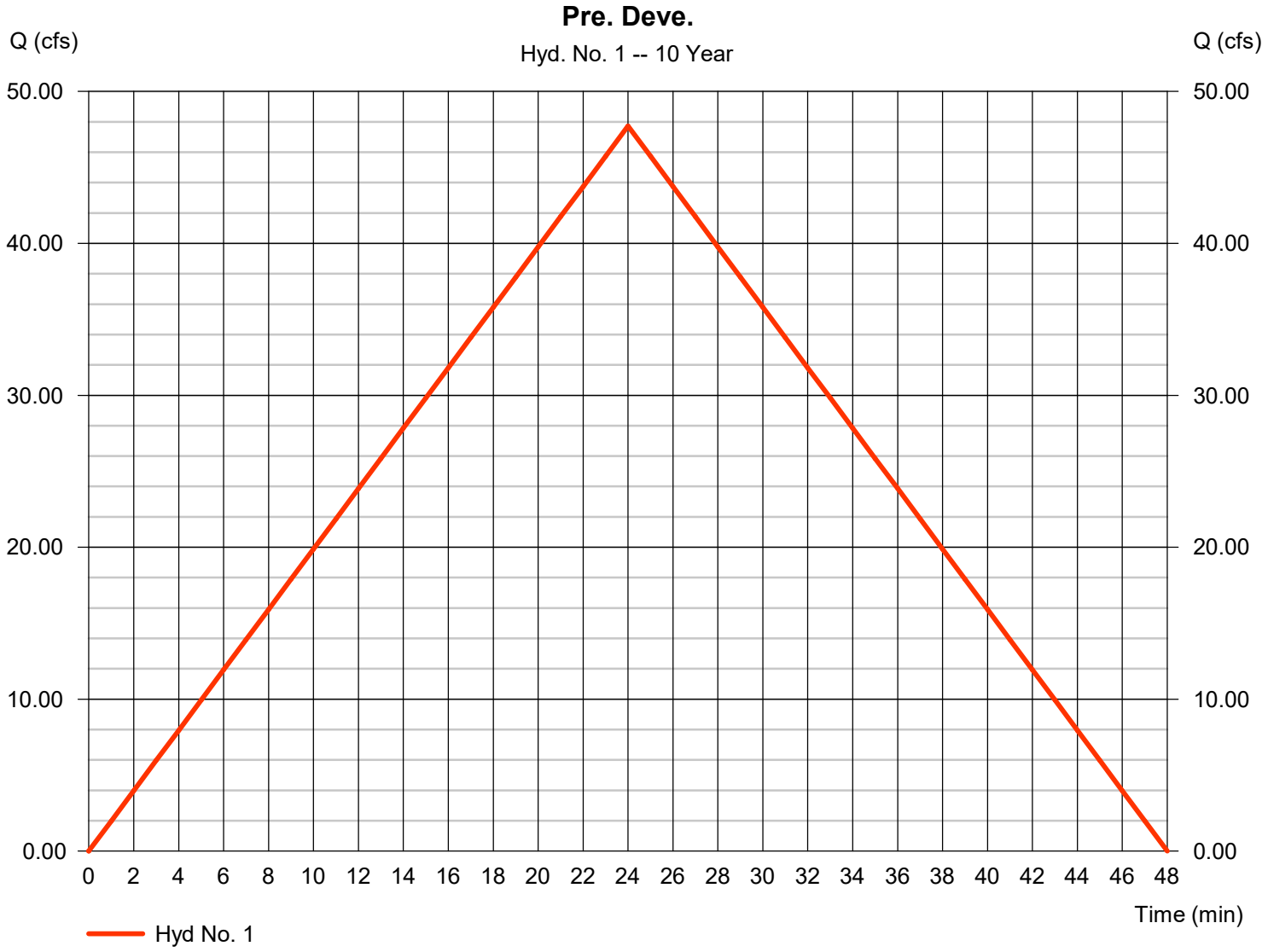
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	47.72	1	24	68,715	------	------	------	Pre. Deve.
2	Rational	63.08	1	28	105,978	------	------	------	Post Deve.
3	Reservoir	41.09	1	38	105,956	2	362.74	49,347	Pond

Hydrograph Report

Hyd. No. 1

Pre. Deve.

Hydrograph type	=	Rational	Peak discharge	=	47.72 cfs
Storm frequency	=	10 yrs	Time to peak	=	24 min
Time interval	=	1 min	Hyd. volume	=	68,715 cuft
Drainage area	=	23.930 ac	Runoff coeff.	=	0.47
Intensity	=	4.243 in/hr	Tc by User	=	24.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Summary Report

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

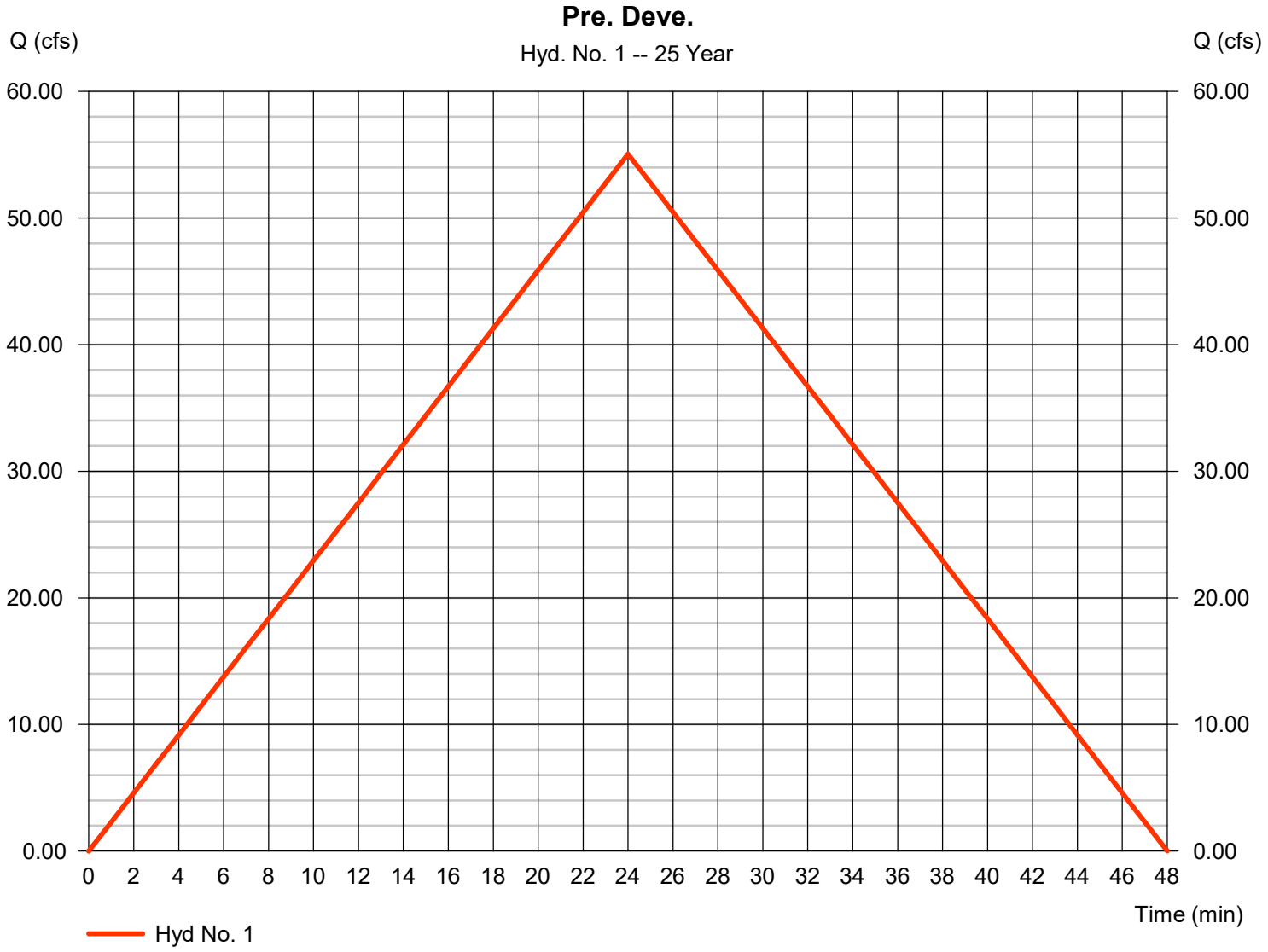
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	55.05	1	24	79,278	------	------	------	Pre. Deve.
2	Rational	72.96	1	28	122,571	------	------	------	Post Deve.
3	Reservoir	47.98	1	38	122,548	2	363.08	54,892	Pond

Hydrograph Report

Hyd. No. 1

Pre. Deve.

Hydrograph type	=	Rational	Peak discharge	=	55.05 cfs
Storm frequency	=	25 yrs	Time to peak	=	24 min
Time interval	=	1 min	Hyd. volume	=	79,278 cuft
Drainage area	=	23.930 ac	Runoff coeff.	=	0.47
Intensity	=	4.895 in/hr	Tc by User	=	24.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Summary Report

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

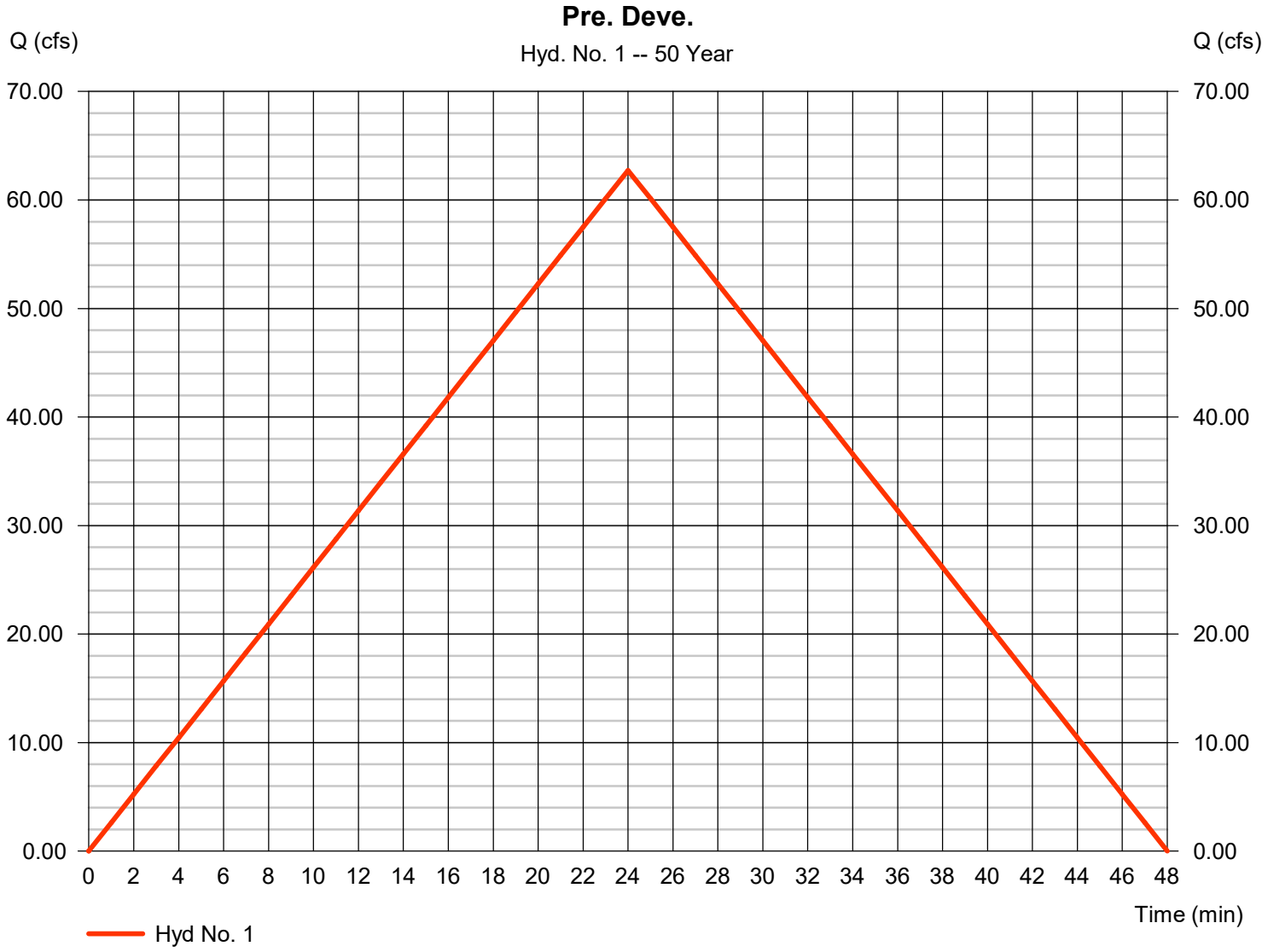
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	62.73	1	24	90,330	------	------	------	Pre. Deve.
2	Rational	82.99	1	28	139,426	------	------	------	Post Deve.
3	Reservoir	54.26	1	38	139,403	2	363.43	60,931	Pond

Hydrograph Report

Hyd. No. 1

Pre. Deve.

Hydrograph type	=	Rational	Peak discharge	=	62.73 cfs
Storm frequency	=	50 yrs	Time to peak	=	24 min
Time interval	=	1 min	Hyd. volume	=	90,330 cuft
Drainage area	=	23.930 ac	Runoff coeff.	=	0.47
Intensity	=	5.577 in/hr	Tc by User	=	24.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Summary Report

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

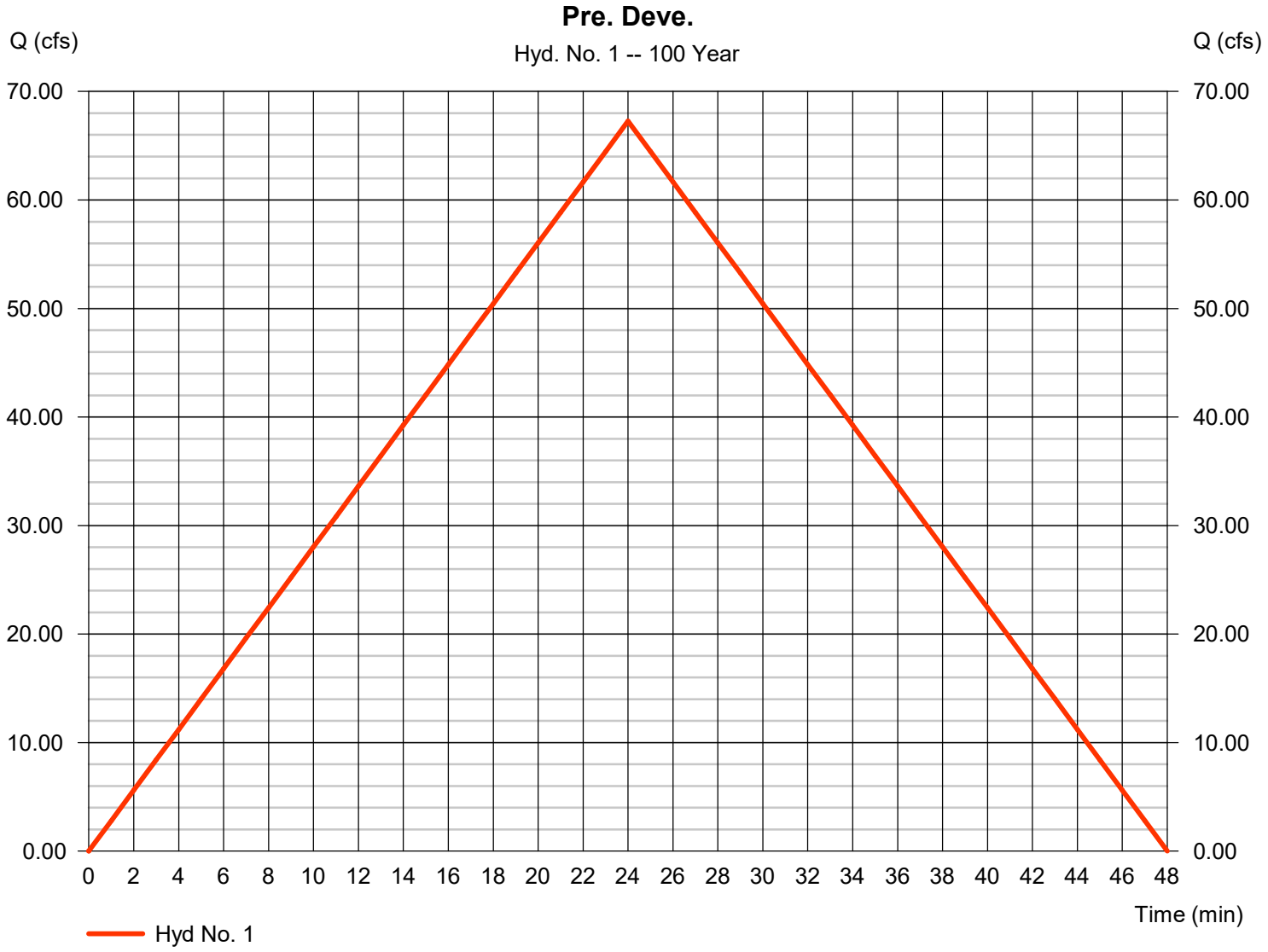
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	67.26	1	24	96,854	------	------	------	Pre. Deve.
2	Rational	89.41	1	28	150,213	------	------	------	Post Deve.
3	Reservoir	58.01	1	38	150,191	2	363.66	64,981	Pond

Hydrograph Report

Hyd. No. 1

Pre. Deve.

Hydrograph type	=	Rational	Peak discharge	=	67.26 cfs
Storm frequency	=	100 yrs	Time to peak	=	24 min
Time interval	=	1 min	Hyd. volume	=	96,854 cuft
Drainage area	=	23.930 ac	Runoff coeff.	=	0.47
Intensity	=	5.980 in/hr	Tc by User	=	24.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



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	59.0468	11.8000	0.8167	--------
3	0.0000	0.0000	0.0000	--------
5	38.3363	7.0000	0.6965	--------
10	46.3641	10.0000	0.6781	--------
25	48.6541	9.8000	0.6523	--------
50	79.0516	13.3000	0.7326	--------
100	54.7483	10.0000	0.6279	--------

File name: Bryant 50.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	5.89	4.76	4.03	3.50	3.11	2.80	2.55	2.35	2.18	2.03	1.91	1.80
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	6.79	5.33	4.45	3.86	3.43	3.10	2.84	2.62	2.45	2.29	2.16	2.05
10	7.39	6.08	5.23	4.62	4.16	3.80	3.51	3.27	3.06	2.89	2.73	2.60
25	8.39	6.94	5.99	5.31	4.80	4.40	4.07	3.80	3.57	3.37	3.20	3.05
50	9.40	7.87	6.83	6.06	5.47	5.00	4.62	4.29	4.02	3.79	3.58	3.40
100	10.00	8.34	7.25	6.47	5.87	5.40	5.02	4.69	4.42	4.19	3.98	3.80

Tc = time in minutes. Values may exceed 60.

Precip. file name: C:\Documents and Settings\Will\Desktop\Fleming\fleming.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	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	3.50	0.00	0.00	4.80	5.40	0.00	6.70

SOUTHWEST POND

Multi-Hydrograph Plot

Hyd. No. 1

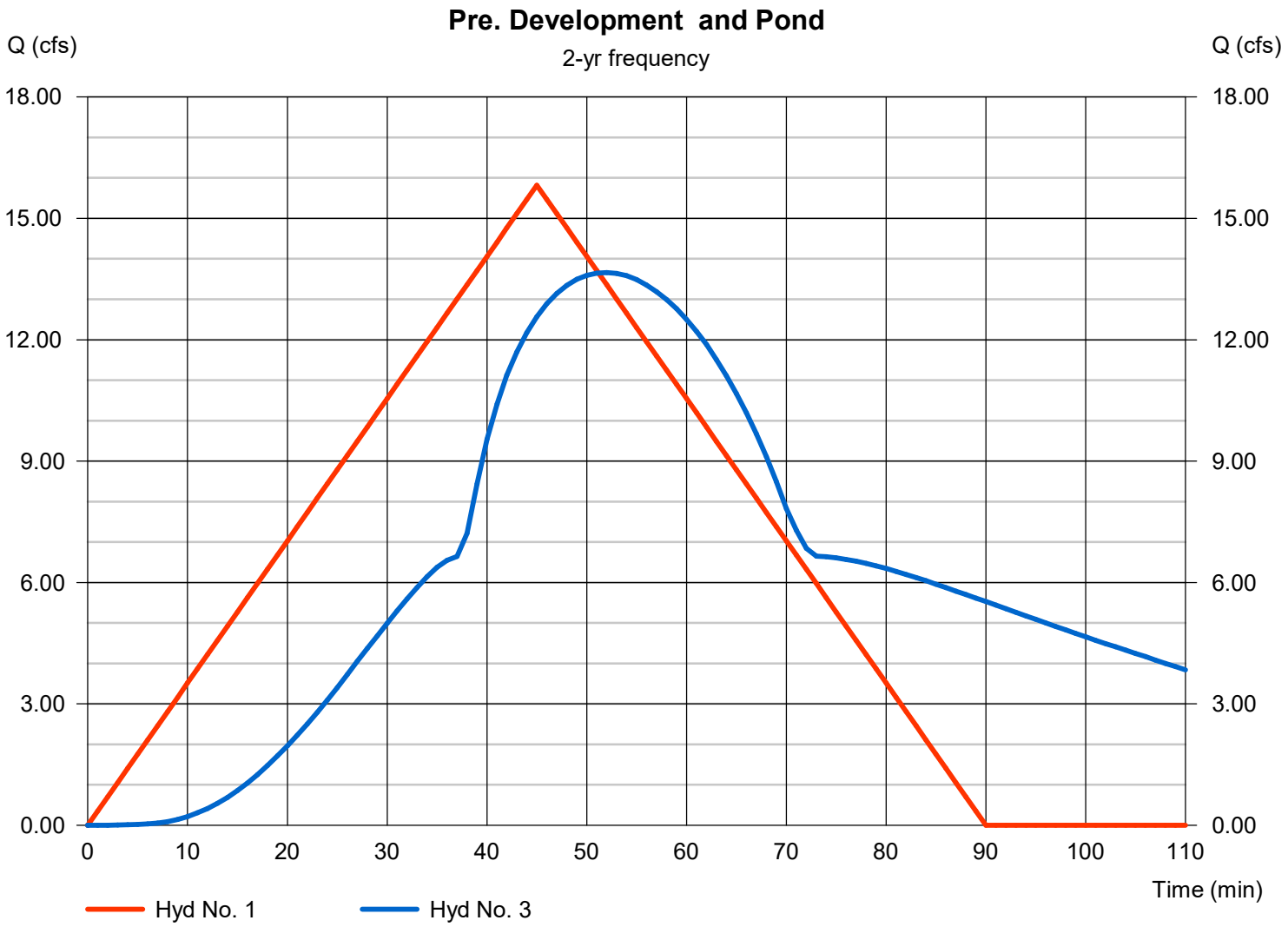
Pre. Development

Hydrograph type	=	Rational
Peak discharge	=	15.82 cfs
Time to peak	=	45 min
Hyd. Volume	=	42,707 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	13.66 cfs
Time to peak	=	52 min
Hyd. Volume	=	55,434 cuft



Multi-Hydrograph Plot

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

Hyd. No. 1

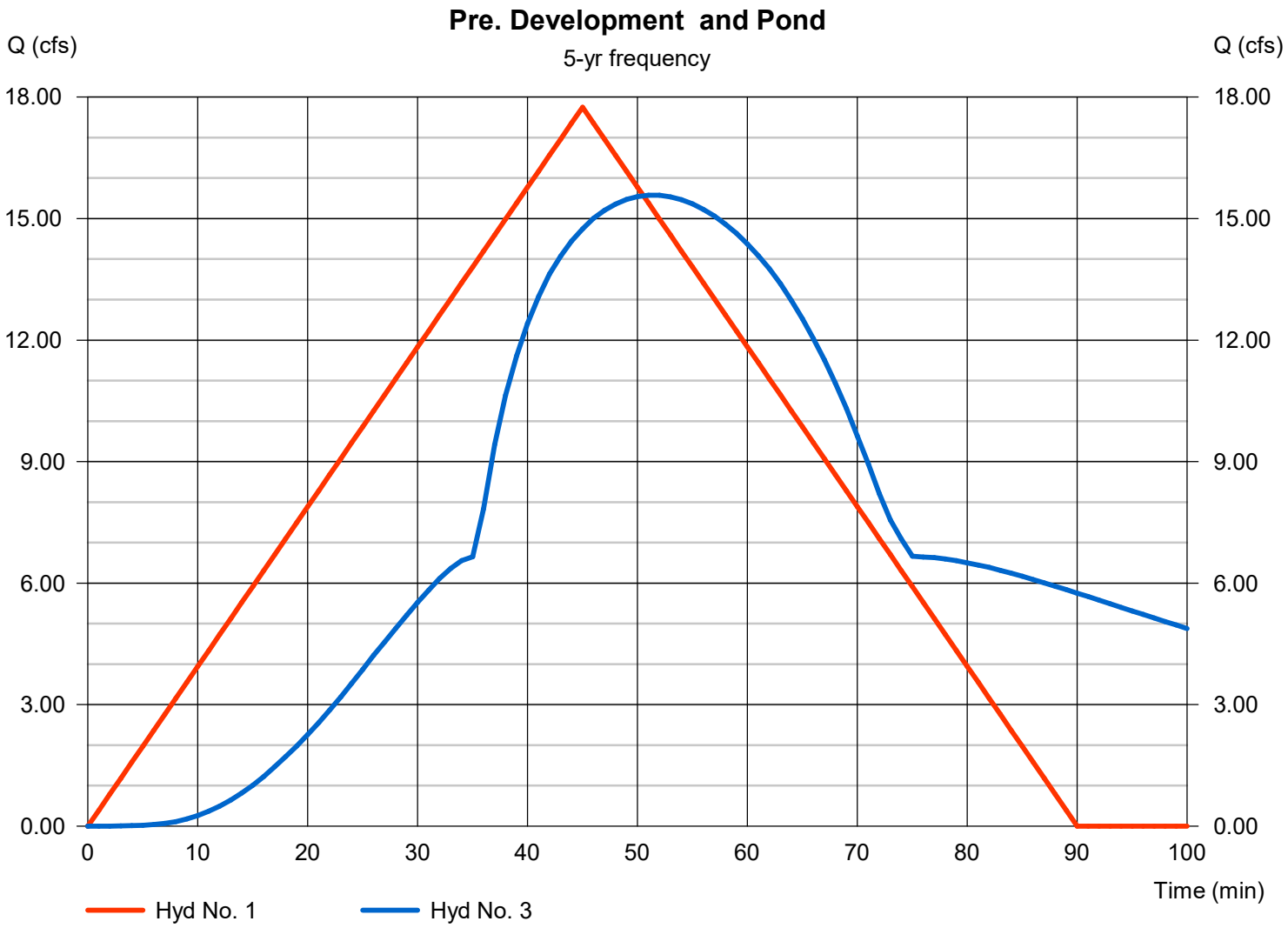
Pre. Development

Hydrograph type	=	Rational
Peak discharge	=	17.75 cfs
Time to peak	=	45 min
Hyd. Volume	=	47,921 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	15.58 cfs
Time to peak	=	51 min
Hyd. Volume	=	61,623 cuft



Multi-Hydrograph Plot

Hyd. No. 1

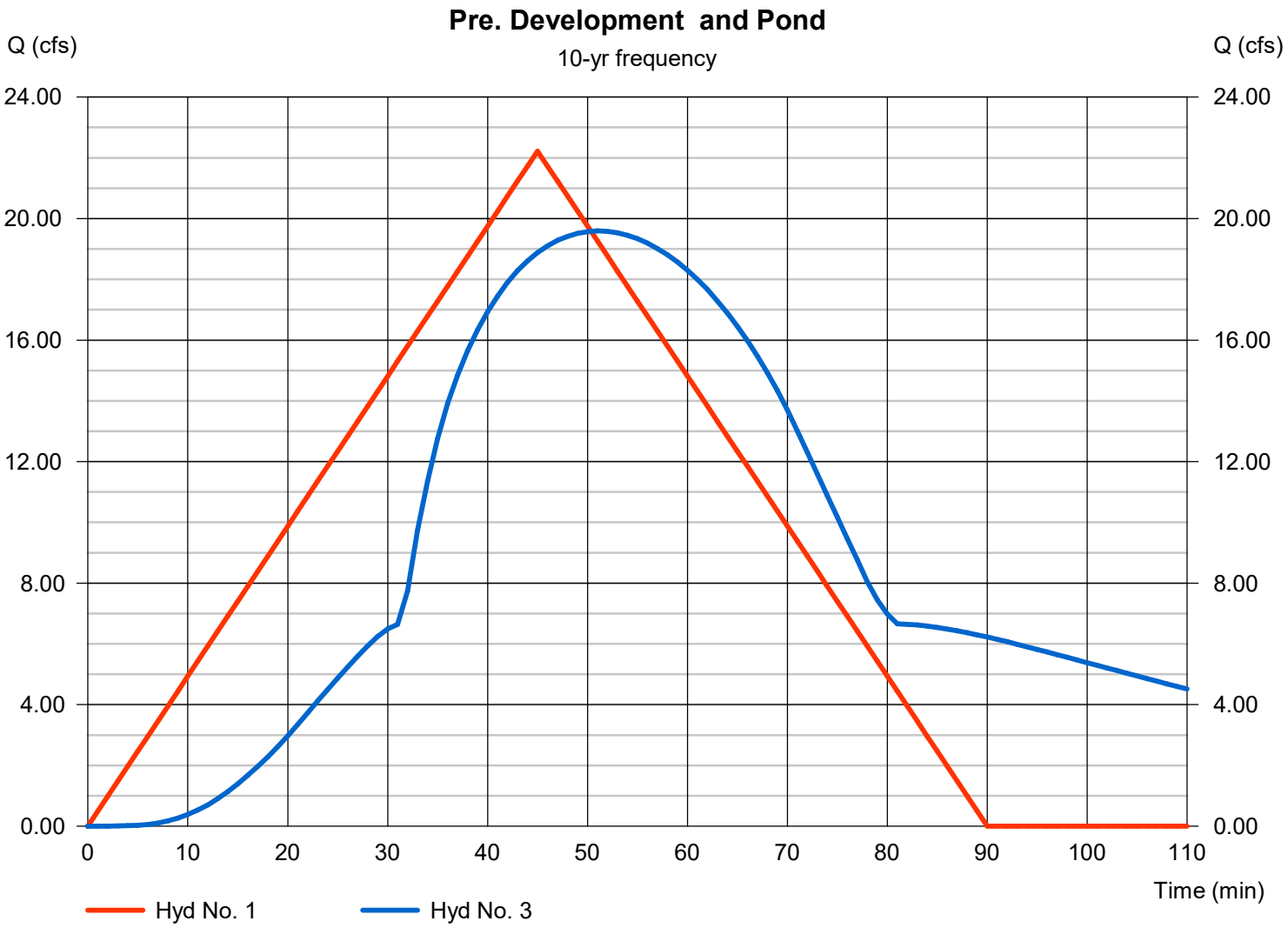
Pre. Development

Hydrograph type	=	Rational
Peak discharge	=	22.22 cfs
Time to peak	=	45 min
Hyd. Volume	=	59,994 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	19.59 cfs
Time to peak	=	51 min
Hyd. Volume	=	76,183 cuft



Multi-Hydrograph Plot

Hyd. No. 1

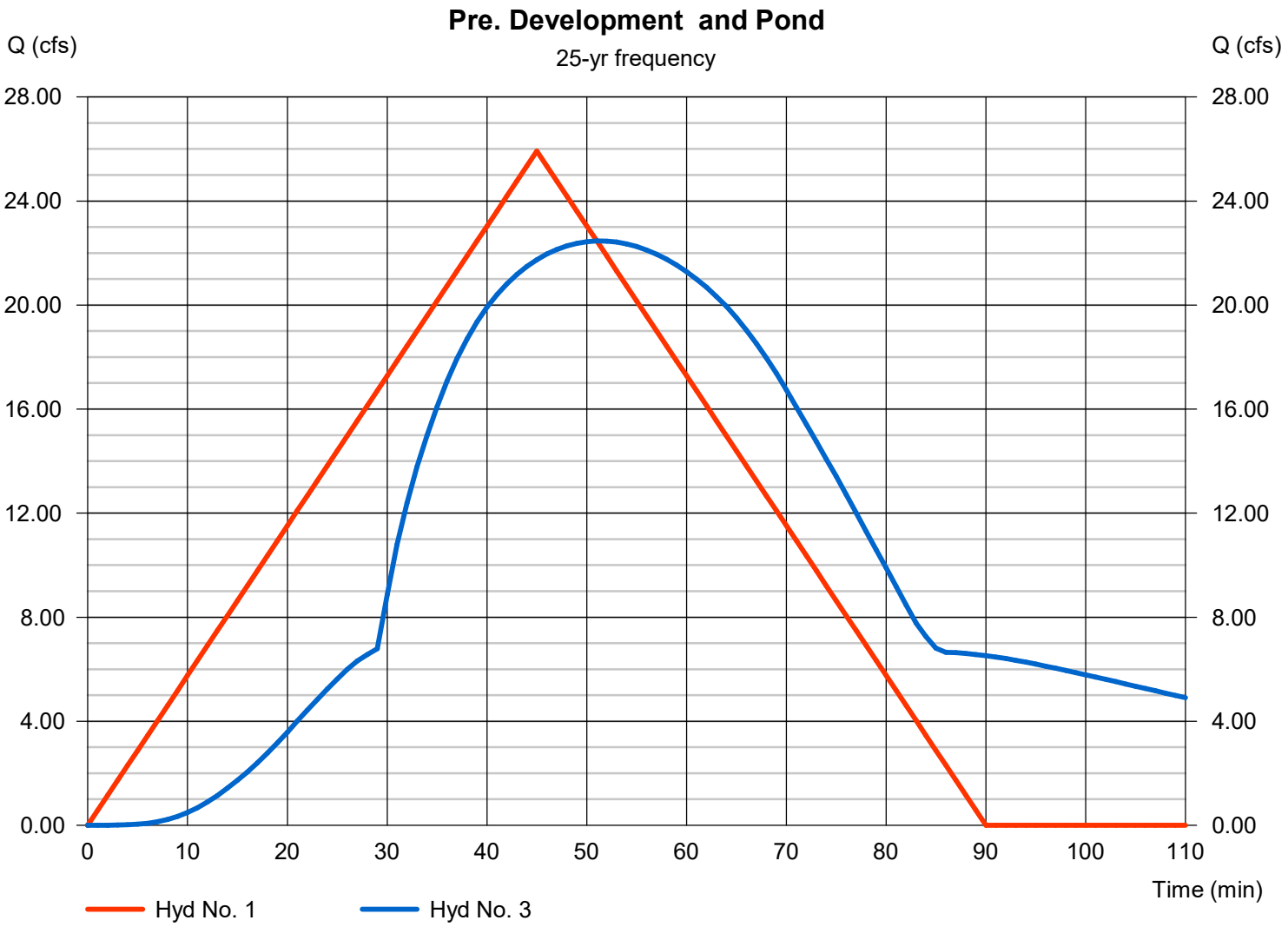
Pre. Development

Hydrograph type	=	Rational
Peak discharge	=	25.92 cfs
Time to peak	=	45 min
Hyd. Volume	=	69,977 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	22.47 cfs
Time to peak	=	51 min
Hyd. Volume	=	88,453 cuft



Multi-Hydrograph Plot

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

Hyd. No. 1

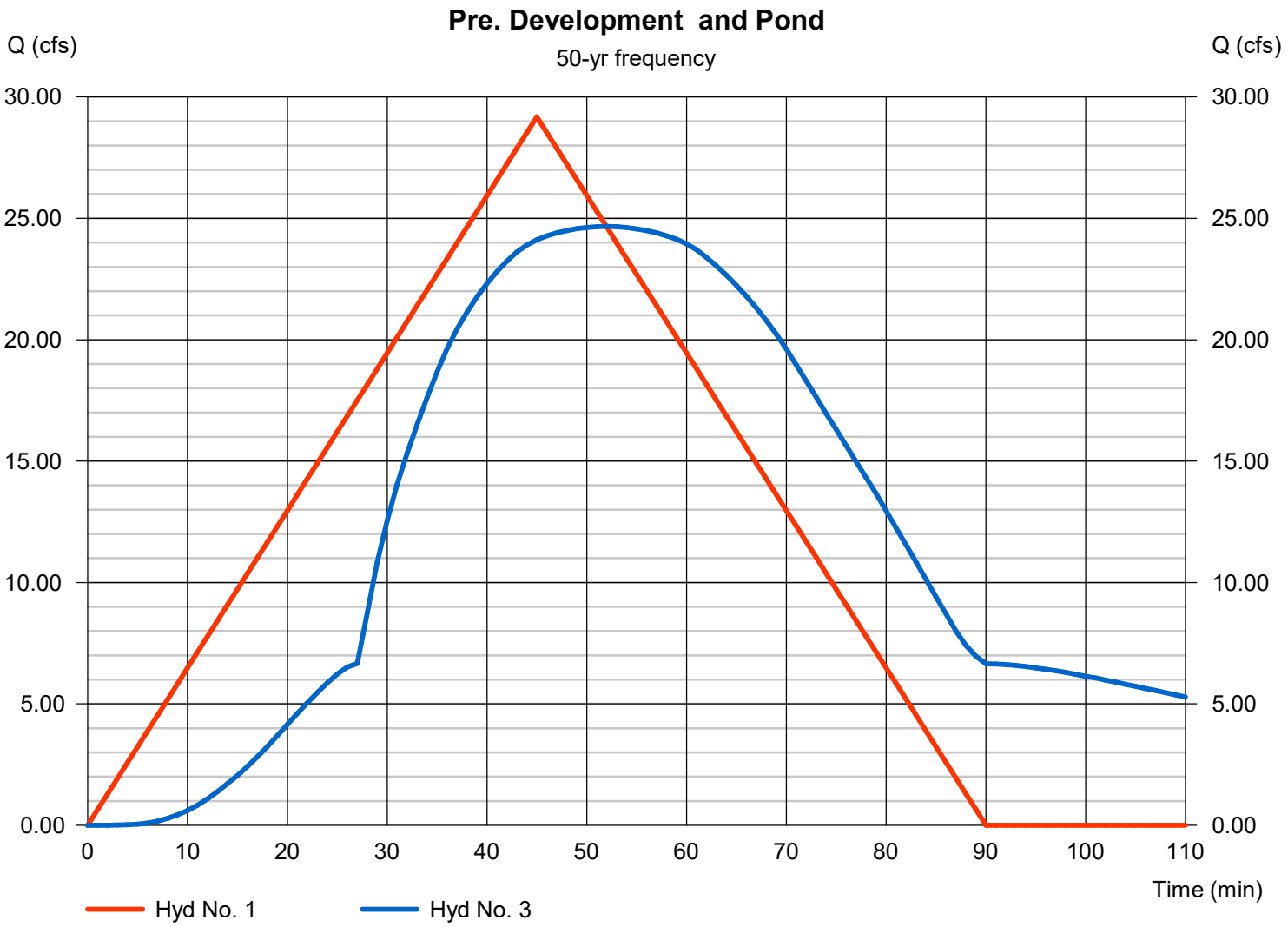
Pre. Development

Hydrograph type	=	Rational
Peak discharge	=	29.18 cfs
Time to peak	=	45 min
Hyd. Volume	=	78,784 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	24.67 cfs
Time to peak	=	52 min
Hyd. Volume	=	100,232 cuft



Multi-Hydrograph Plot

Hyd. No. 1

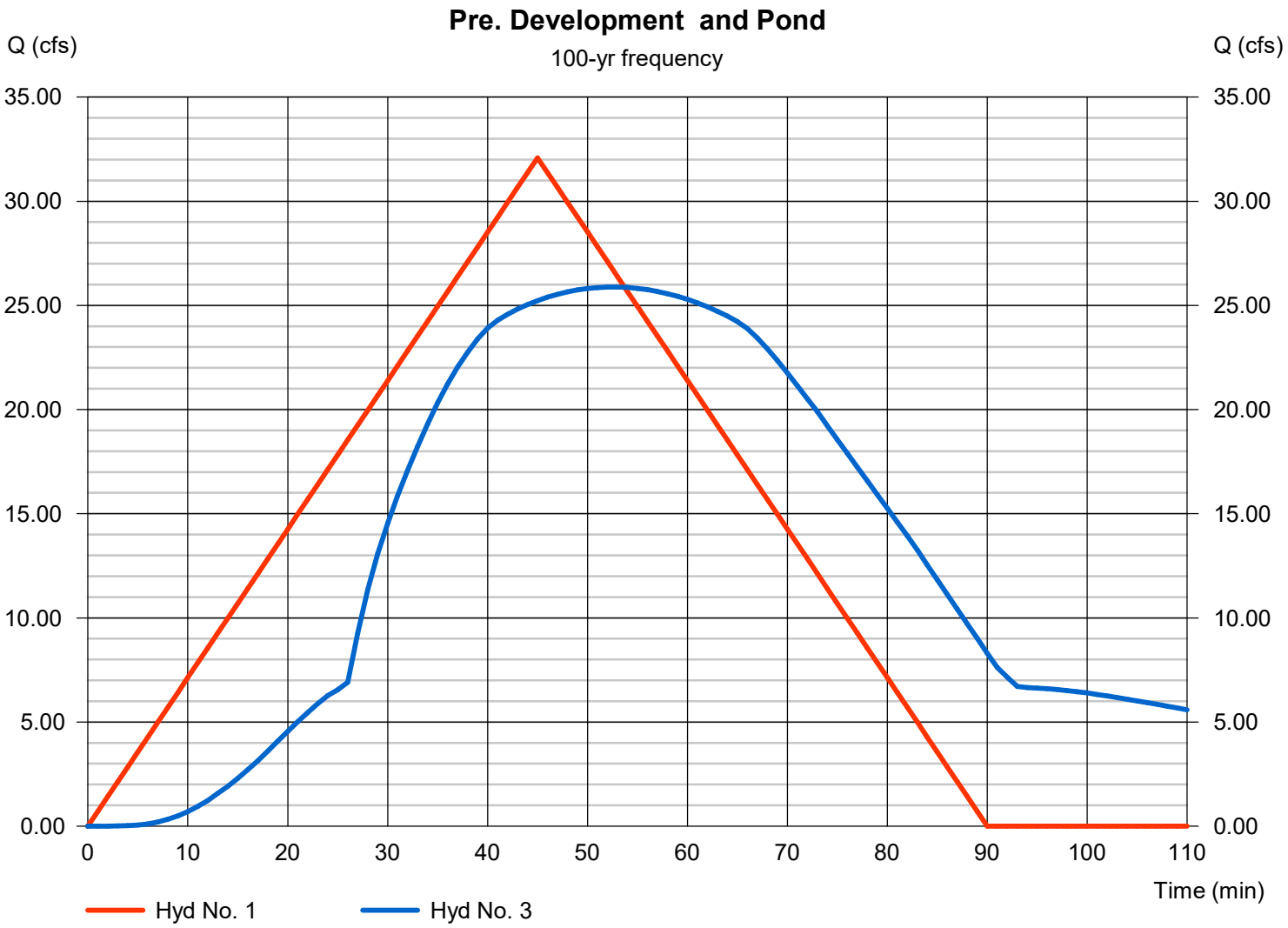
Pre. Development

Hydrograph type	=	Rational
Peak discharge	=	32.08 cfs
Time to peak	=	45 min
Hyd. Volume	=	86,628 cuft

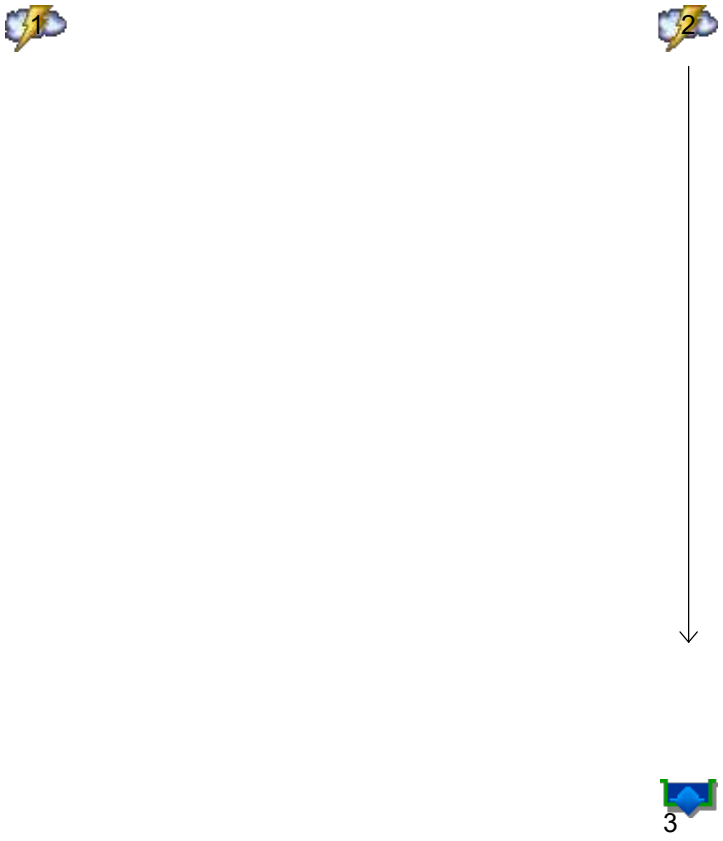
Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	25.88 cfs
Time to peak	=	53 min
Hyd. Volume	=	108,915 cuft



Watershed Model Schematic



Hydrograph Summary Report

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

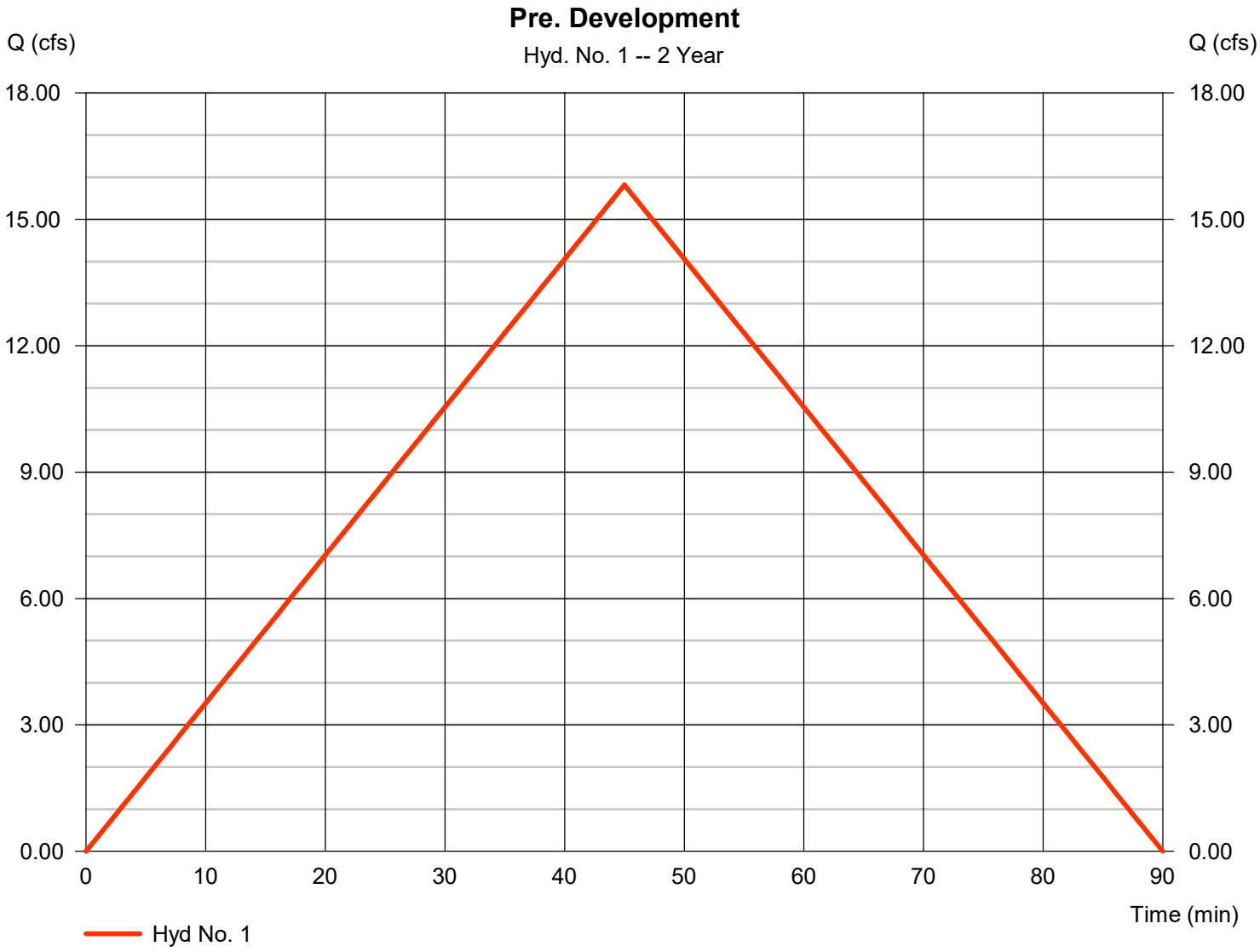
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	15.82	1	45	42,707	------	------	------	Pre. Development
2	Rational	26.41	1	35	55,466	------	------	------	Post Development
3	Reservoir	13.66	1	52	55,434	2	353.41	32,577	Pond

Hydrograph Report

Hyd. No. 1

Pre. Development

Hydrograph type	=	Rational	Peak discharge	=	15.82 cfs
Storm frequency	=	2 yrs	Time to peak	=	45 min
Time interval	=	1 min	Hyd. volume	=	42,707 cuft
Drainage area	=	15.440 ac	Runoff coeff.	=	0.47
Intensity	=	2.180 in/hr	Tc by User	=	45.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



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	Rational	17.75	1	45	47,921	------	------	------	Pre. Development
2	Rational	29.36	1	35	61,654	------	------	------	Post Development
3	Reservoir	15.58	1	51	61,623	2	353.57	35,120	Pond

Hydrograph Report

Hyd. No. 1

Pre. Development

Hydrograph type	=	Rational	Peak discharge	=	17.75 cfs
Storm frequency	=	5 yrs	Time to peak	=	45 min
Time interval	=	1 min	Hyd. volume	=	47,921 cuft
Drainage area	=	15.440 ac	Runoff coeff.	=	0.47
Intensity	=	2.446 in/hr	Tc by User	=	45.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Summary Report

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

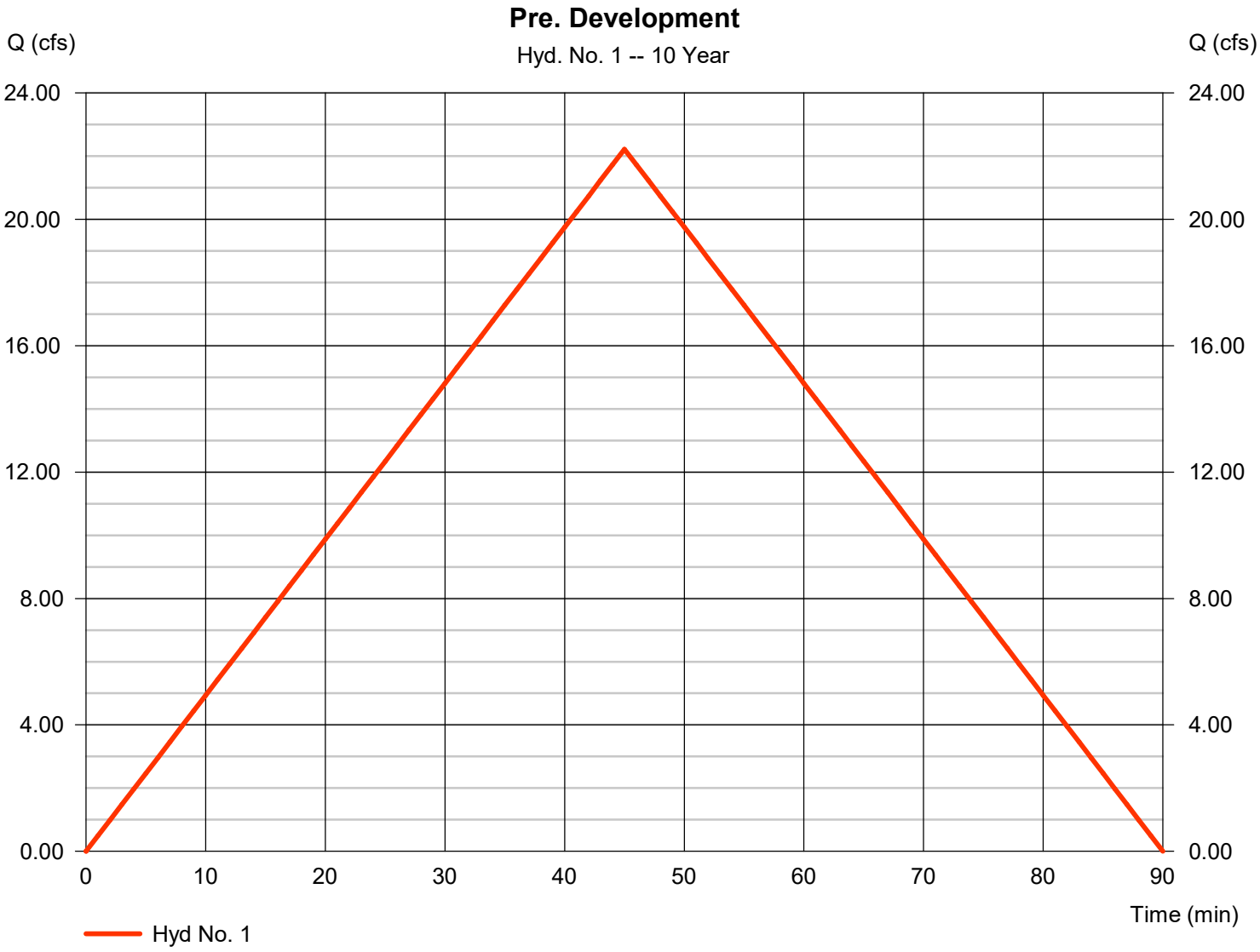
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	22.22	1	45	59,994	------	------	------	Pre. Development
2	Rational	36.29	1	35	76,214	------	------	------	Post Development
3	Reservoir	19.59	1	51	76,183	2	353.97	41,520	Pond

Hydrograph Report

Hyd. No. 1

Pre. Development

Hydrograph type	=	Rational	Peak discharge	=	22.22 cfs
Storm frequency	=	10 yrs	Time to peak	=	45 min
Time interval	=	1 min	Hyd. volume	=	59,994 cuft
Drainage area	=	15.440 ac	Runoff coeff.	=	0.47
Intensity	=	3.062 in/hr	Tc by User	=	45.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



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	Rational	25.92	1	45	69,977	------	------	------	Pre. Development
2	Rational	42.14	1	35	88,484	------	------	------	Post Development
3	Reservoir	22.47	1	51	88,453	2	354.31	47,311	Pond

Hydrograph Report

Hyd. No. 1

Pre. Development

Hydrograph type	=	Rational	Peak discharge	=	25.92 cfs
Storm frequency	=	25 yrs	Time to peak	=	45 min
Time interval	=	1 min	Hyd. volume	=	69,977 cuft
Drainage area	=	15.440 ac	Runoff coeff.	=	0.47
Intensity	=	3.571 in/hr	Tc by User	=	45.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Summary Report

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

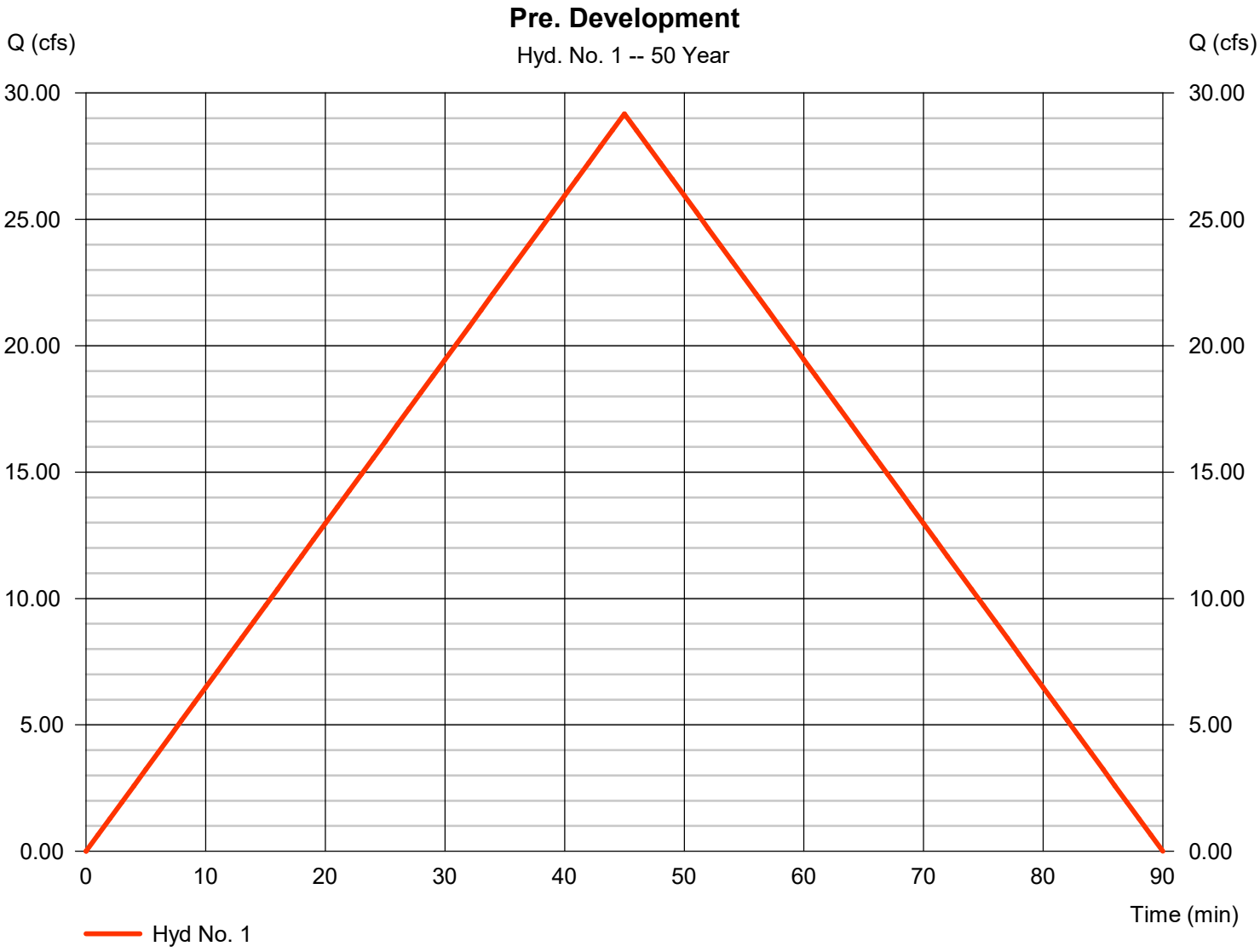
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	29.18	1	45	78,784	------	------	------	Pre. Development
2	Rational	47.74	1	35	100,263	------	------	------	Post Development
3	Reservoir	24.67	1	52	100,232	2	354.66	53,278	Pond

Hydrograph Report

Hyd. No. 1

Pre. Development

Hydrograph type	=	Rational	Peak discharge	=	29.18 cfs
Storm frequency	=	50 yrs	Time to peak	=	45 min
Time interval	=	1 min	Hyd. volume	=	78,784 cuft
Drainage area	=	15.440 ac	Runoff coeff.	=	0.47
Intensity	=	4.021 in/hr	Tc by User	=	45.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



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	Rational	32.08	1	45	86,628	------	------	------	Pre. Development
2	Rational	51.88	1	35	108,947	------	------	------	Post Development
3	Reservoir	25.88	1	53	108,915	2	354.93	58,104	Pond

Hydrograph Report

Hyd. No. 1

Pre. Development

Hydrograph type	=	Rational	Peak discharge	=	32.08 cfs
Storm frequency	=	100 yrs	Time to peak	=	45 min
Time interval	=	1 min	Hyd. volume	=	86,628 cuft
Drainage area	=	15.440 ac	Runoff coeff.	=	0.47
Intensity	=	4.421 in/hr	Tc by User	=	45.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



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	59.0468	11.8000	0.8167	--------
3	0.0000	0.0000	0.0000	--------
5	38.3363	7.0000	0.6965	--------
10	46.3641	10.0000	0.6781	--------
25	48.6541	9.8000	0.6523	--------
50	79.0516	13.3000	0.7326	--------
100	54.7483	10.0000	0.6279	--------

File name: Bryant 50.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	5.89	4.76	4.03	3.50	3.11	2.80	2.55	2.35	2.18	2.03	1.91	1.80
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	6.79	5.33	4.45	3.86	3.43	3.10	2.84	2.62	2.45	2.29	2.16	2.05
10	7.39	6.08	5.23	4.62	4.16	3.80	3.51	3.27	3.06	2.89	2.73	2.60
25	8.39	6.94	5.99	5.31	4.80	4.40	4.07	3.80	3.57	3.37	3.20	3.05
50	9.40	7.87	6.83	6.06	5.47	5.00	4.62	4.29	4.02	3.79	3.58	3.40
100	10.00	8.34	7.25	6.47	5.87	5.40	5.02	4.69	4.42	4.19	3.98	3.80

Tc = time in minutes. Values may exceed 60.

Precip. file name: C:\Documents and Settings\Will\Desktop\Fleming\fleming.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	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	3.50	0.00	0.00	4.80	5.40	0.00	6.70

SOUTHEAST POND

Multi-Hydrograph Plot

Hyd. No. 1

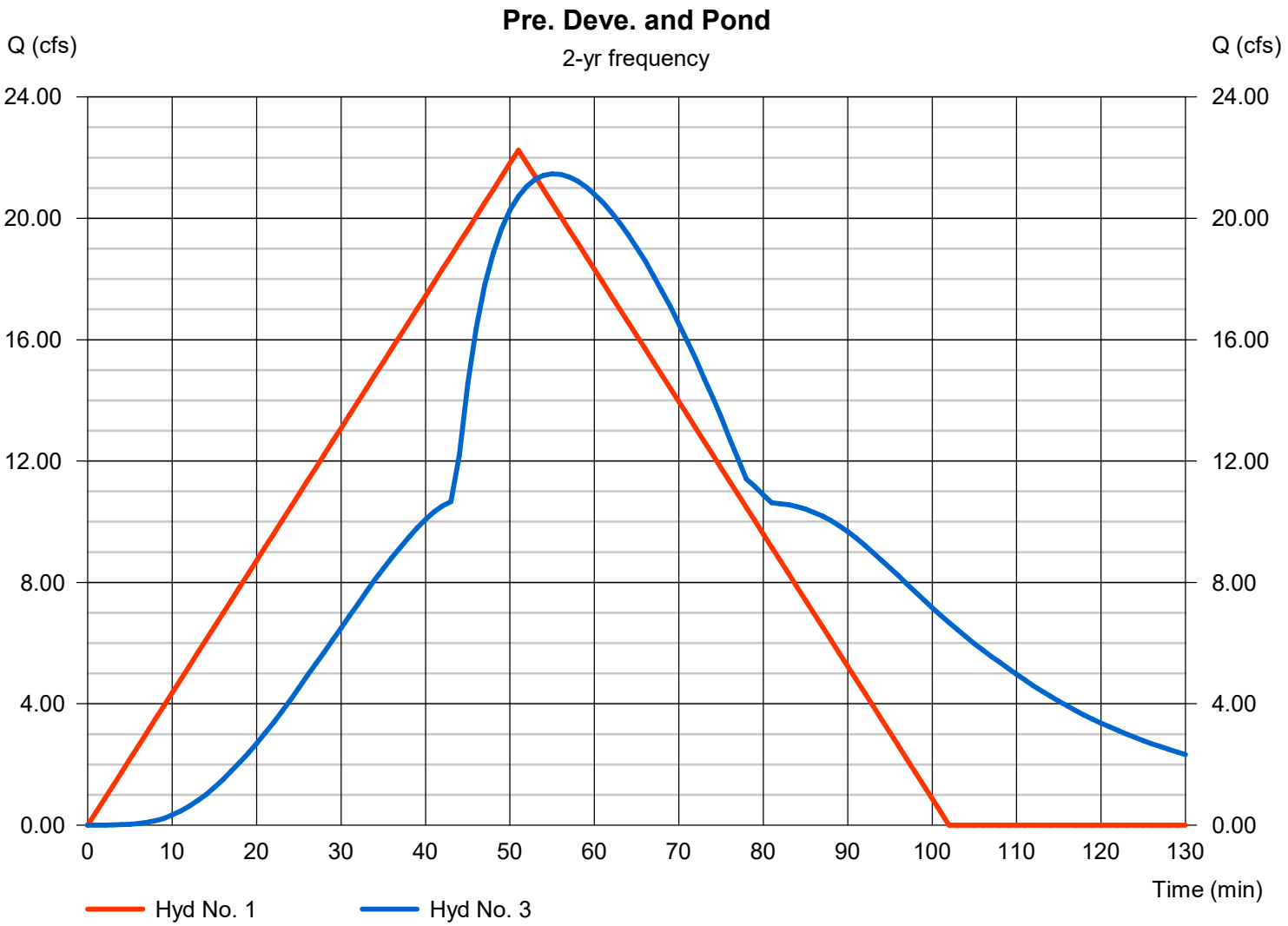
Pre. Deve.

Hydrograph type	=	Rational
Peak discharge	=	22.25 cfs
Time to peak	=	51 min
Hyd. Volume	=	68,070 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	21.47 cfs
Time to peak	=	55 min
Hyd. Volume	=	74,070 cuft



Multi-Hydrograph Plot

Hyd. No. 1

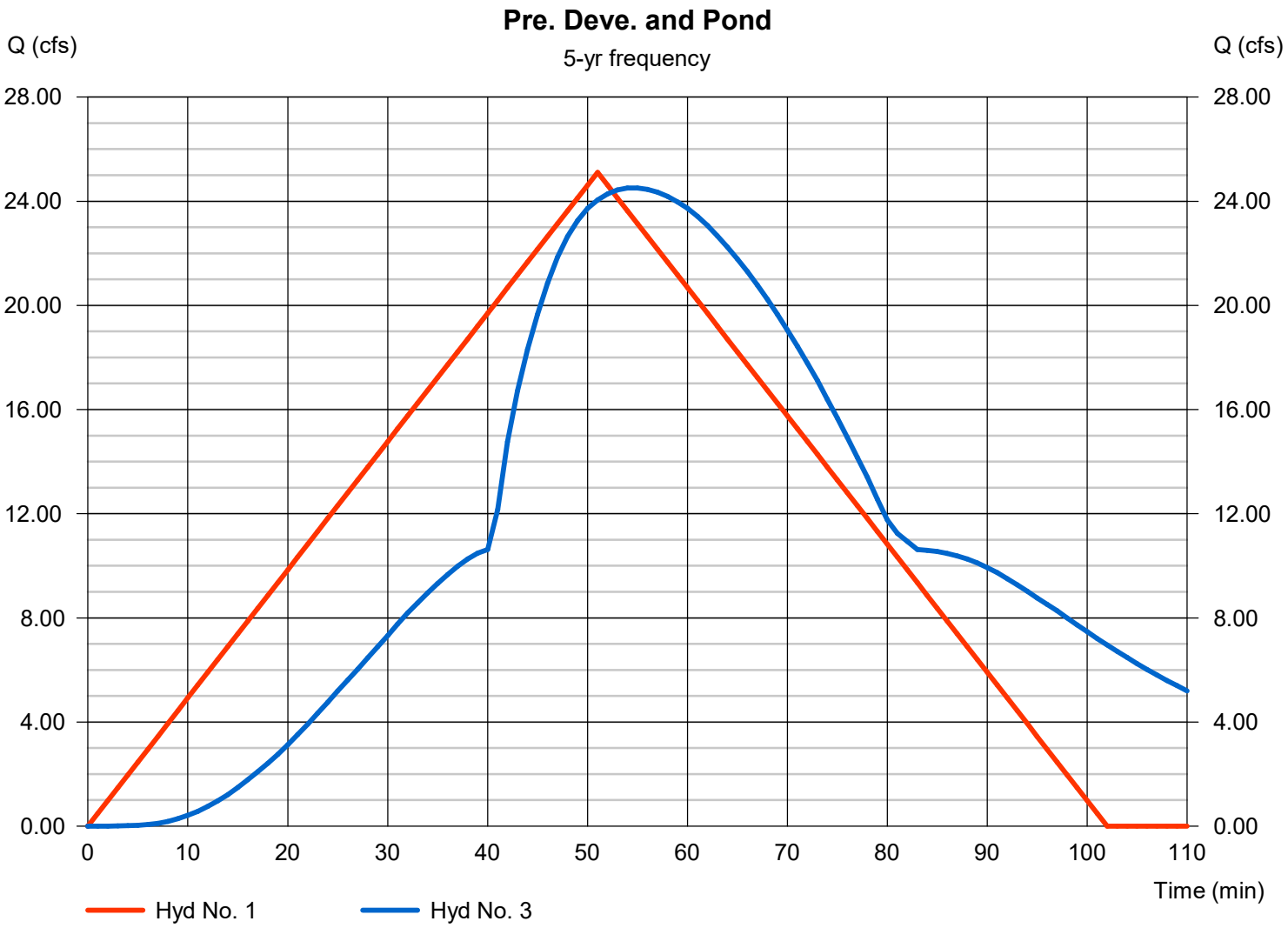
Pre. Deve.

Hydrograph type	=	Rational
Peak discharge	=	25.11 cfs
Time to peak	=	51 min
Hyd. Volume	=	76,836 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	24.51 cfs
Time to peak	=	55 min
Hyd. Volume	=	83,197 cuft



Multi-Hydrograph Plot

Hyd. No. 1

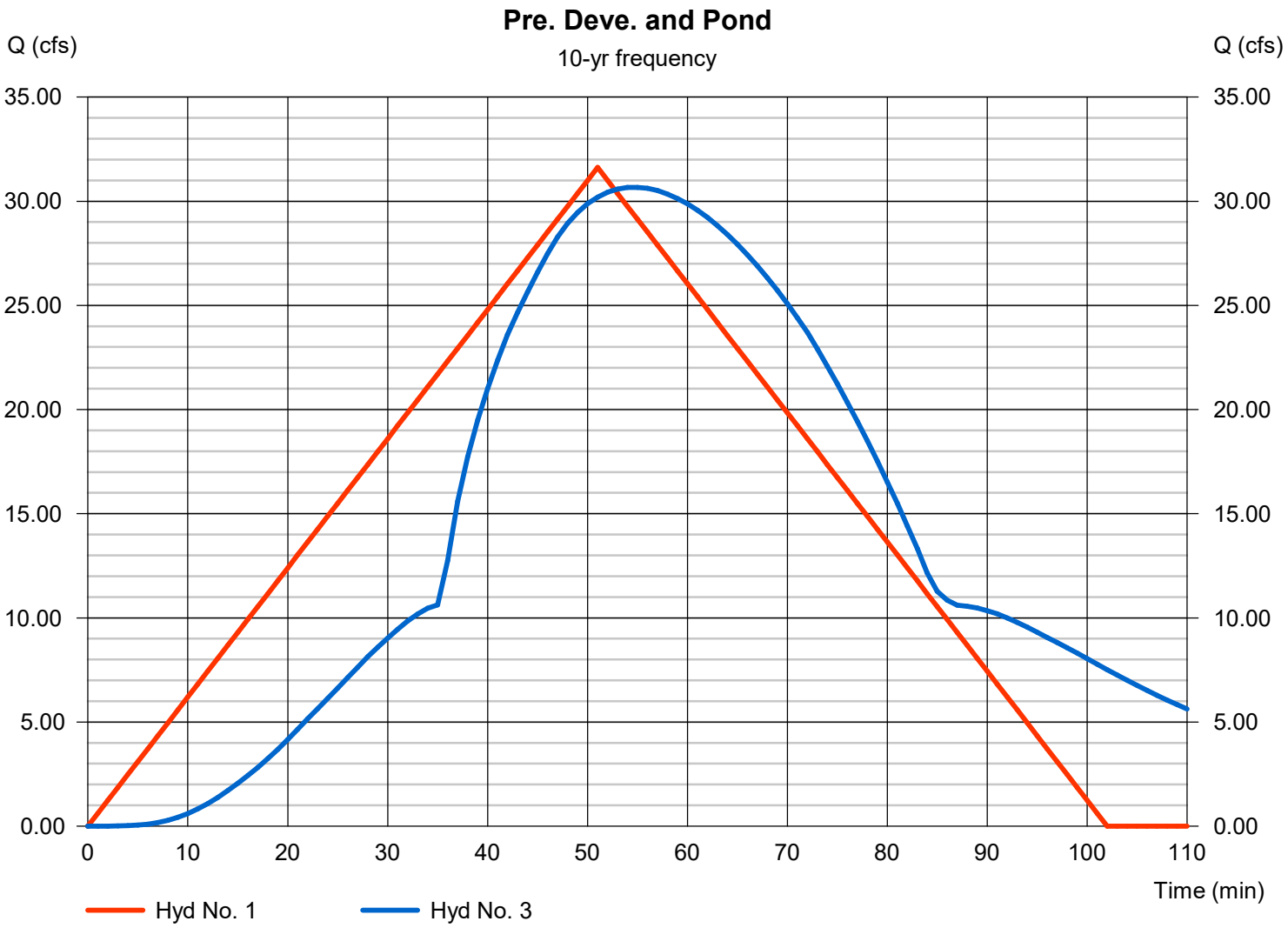
Pre. Deve.

Hydrograph type	=	Rational
Peak discharge	=	31.62 cfs
Time to peak	=	51 min
Hyd. Volume	=	96,757 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	30.67 cfs
Time to peak	=	55 min
Hyd. Volume	=	104,270 cuft



Multi-Hydrograph Plot

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

Hyd. No. 1

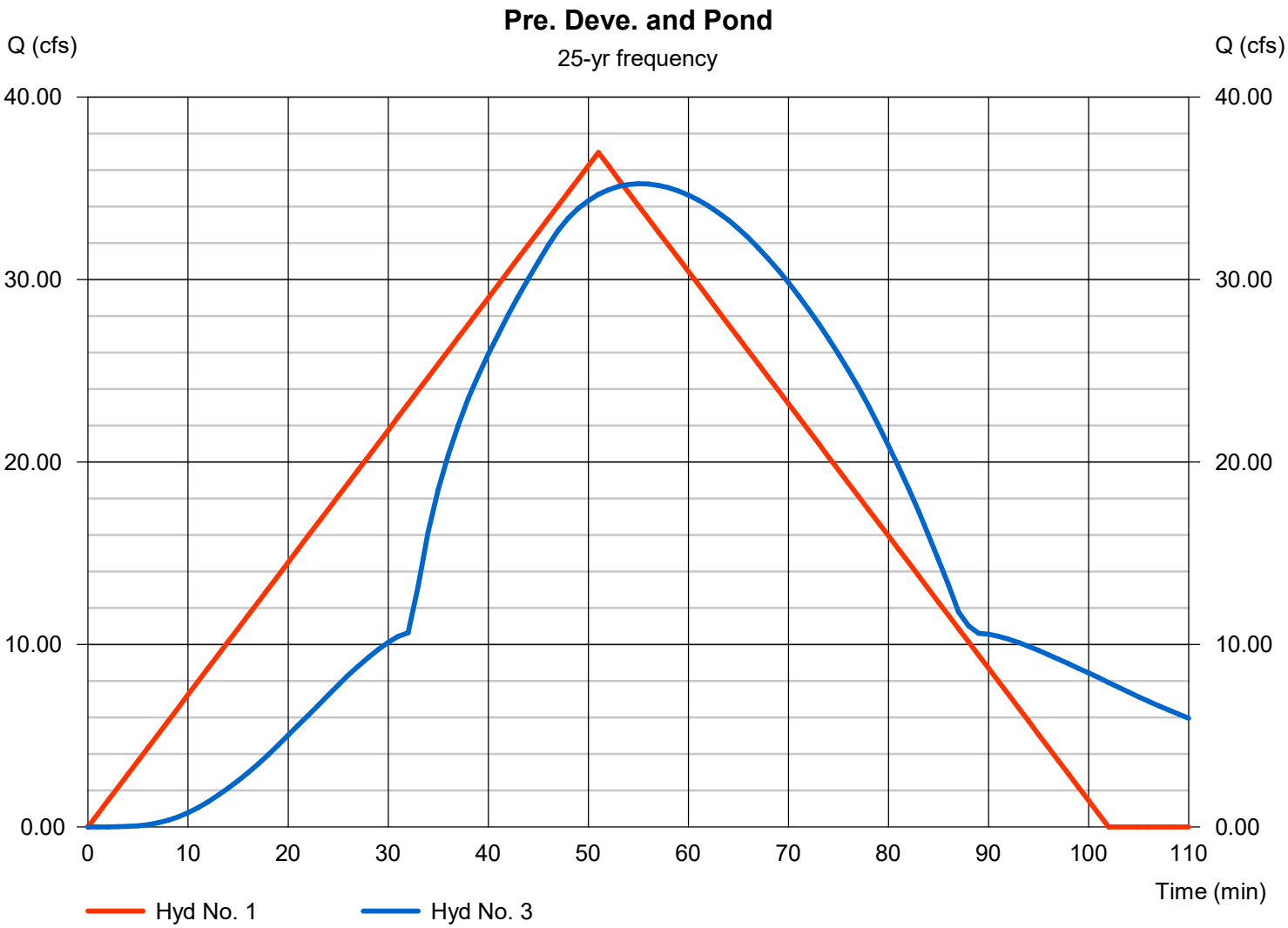
Pre. Deve.

Hydrograph type	=	Rational
Peak discharge	=	36.97 cfs
Time to peak	=	51 min
Hyd. Volume	=	113,133 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	35.26 cfs
Time to peak	=	55 min
Hyd. Volume	=	121,675 cuft



Multi-Hydrograph Plot

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

Hyd. No. 1

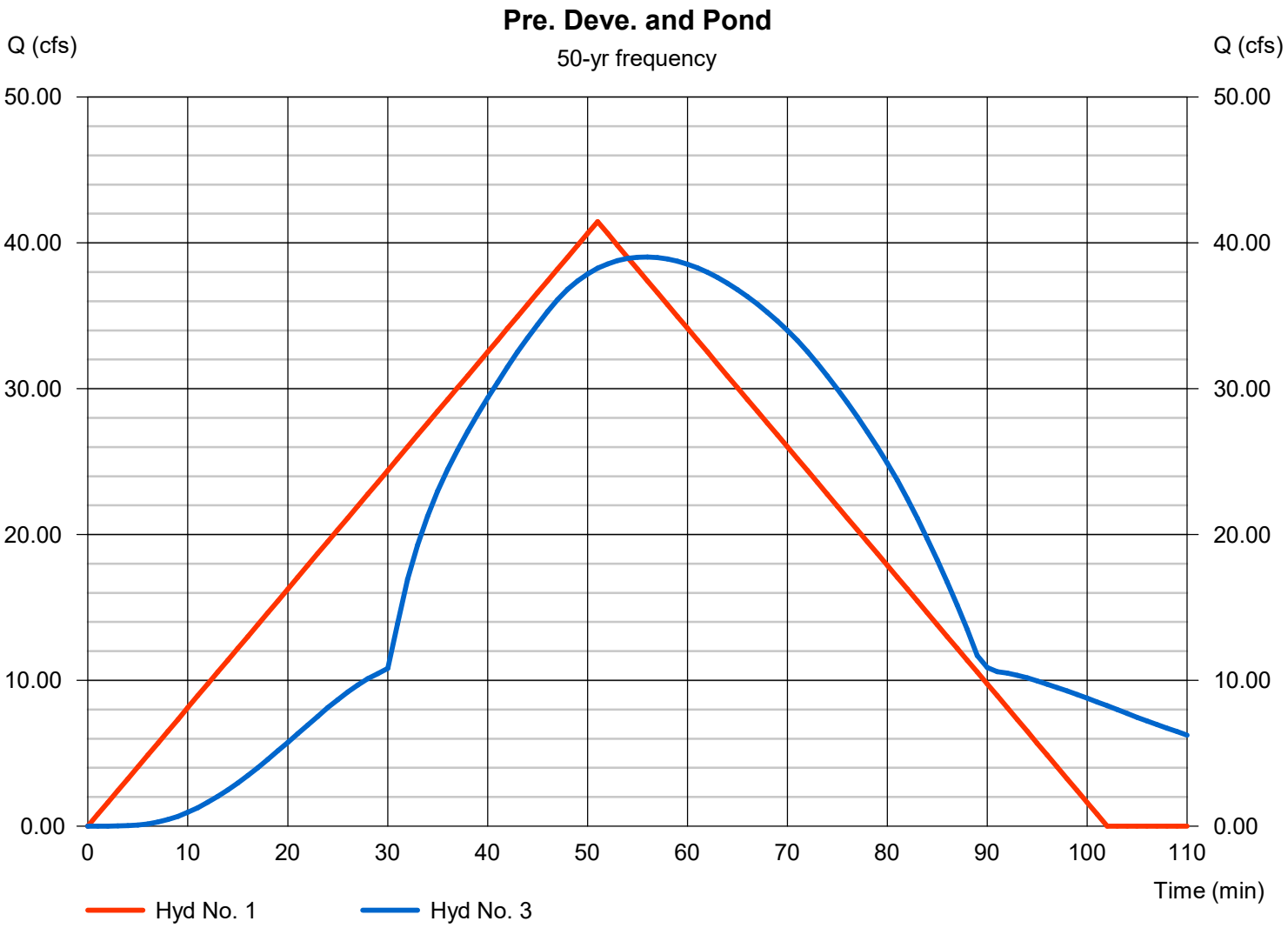
Pre. Deve.

Hydrograph type	=	Rational
Peak discharge	=	41.46 cfs
Time to peak	=	51 min
Hyd. Volume	=	126,864 cuft

Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	39.04 cfs
Time to peak	=	56 min
Hyd. Volume	=	136,900 cuft



Multi-Hydrograph Plot

Hyd. No. 1

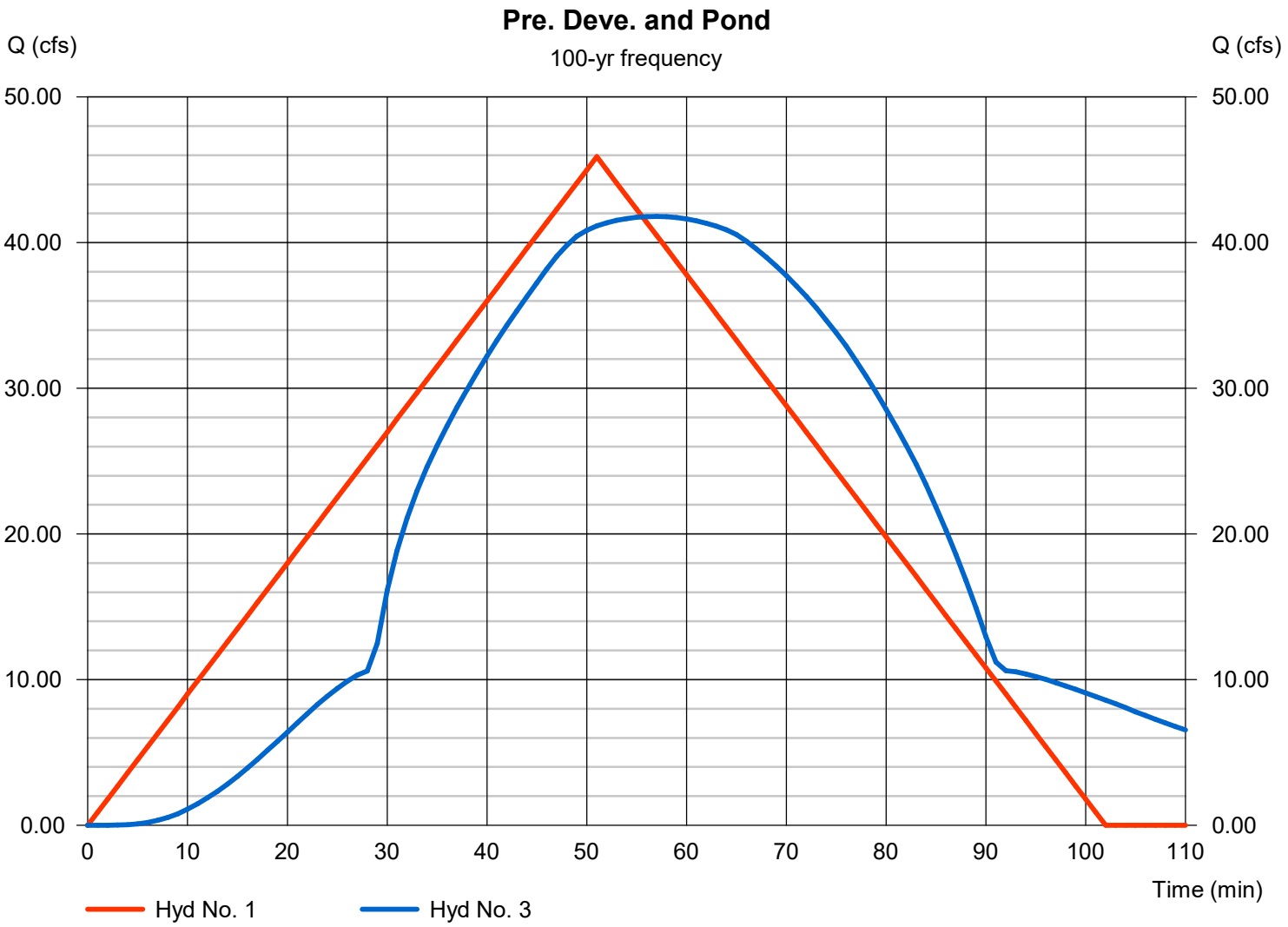
Pre. Deve.

Hydrograph type	=	Rational
Peak discharge	=	45.90 cfs
Time to peak	=	51 min
Hyd. Volume	=	140,441 cuft

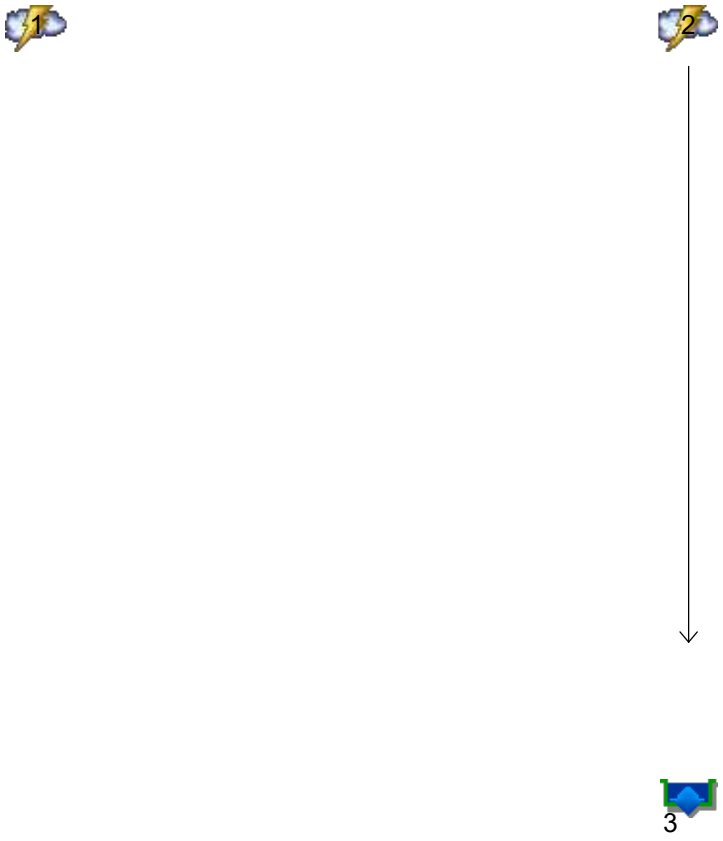
Hyd. No. 3

Pond

Hydrograph type	=	Reservoir
Peak discharge	=	41.80 cfs
Time to peak	=	57 min
Hyd. Volume	=	150,705 cuft



Watershed Model Schematic



Hydrograph Summary Report

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

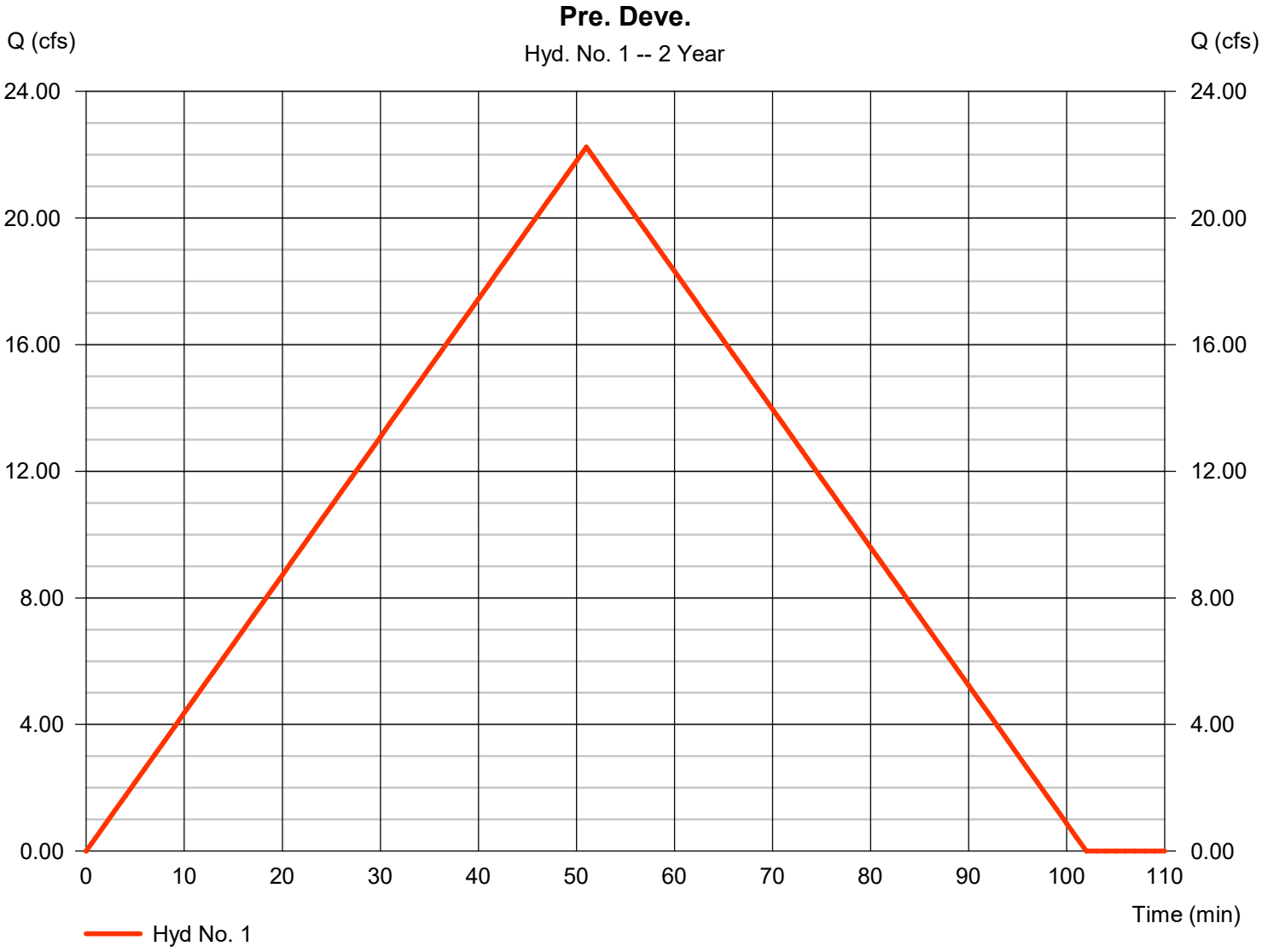
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	22.25	1	51	68,070	------	------	------	Pre. Deve.
2	Rational	26.84	1	46	74,088	------	------	------	Post Deve.
3	Reservoir	21.47	1	55	74,070	2	350.89	26,424	Pond

Hydrograph Report

Hyd. No. 1

Pre. Deve.

Hydrograph type	=	Rational	Peak discharge	=	22.25 cfs
Storm frequency	=	2 yrs	Time to peak	=	51 min
Time interval	=	1 min	Hyd. volume	=	68,070 cuft
Drainage area	=	23.570 ac	Runoff coeff.	=	0.47
Intensity	=	2.008 in/hr	Tc by User	=	51.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



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	Rational	25.11	1	51	76,836	------	------	------	Pre. Deve.
2	Rational	30.15	1	46	83,215	------	------	------	Post Deve.
3	Reservoir	24.51	1	55	83,197	2	351.04	28,121	Pond

Hydrograph Report

Hyd. No. 1

Pre. Deve.

Hydrograph type	=	Rational	Peak discharge	=	25.11 cfs
Storm frequency	=	5 yrs	Time to peak	=	51 min
Time interval	=	1 min	Hyd. volume	=	76,836 cuft
Drainage area	=	23.570 ac	Runoff coeff.	=	0.47
Intensity	=	2.267 in/hr	Tc by User	=	51.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Summary Report

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

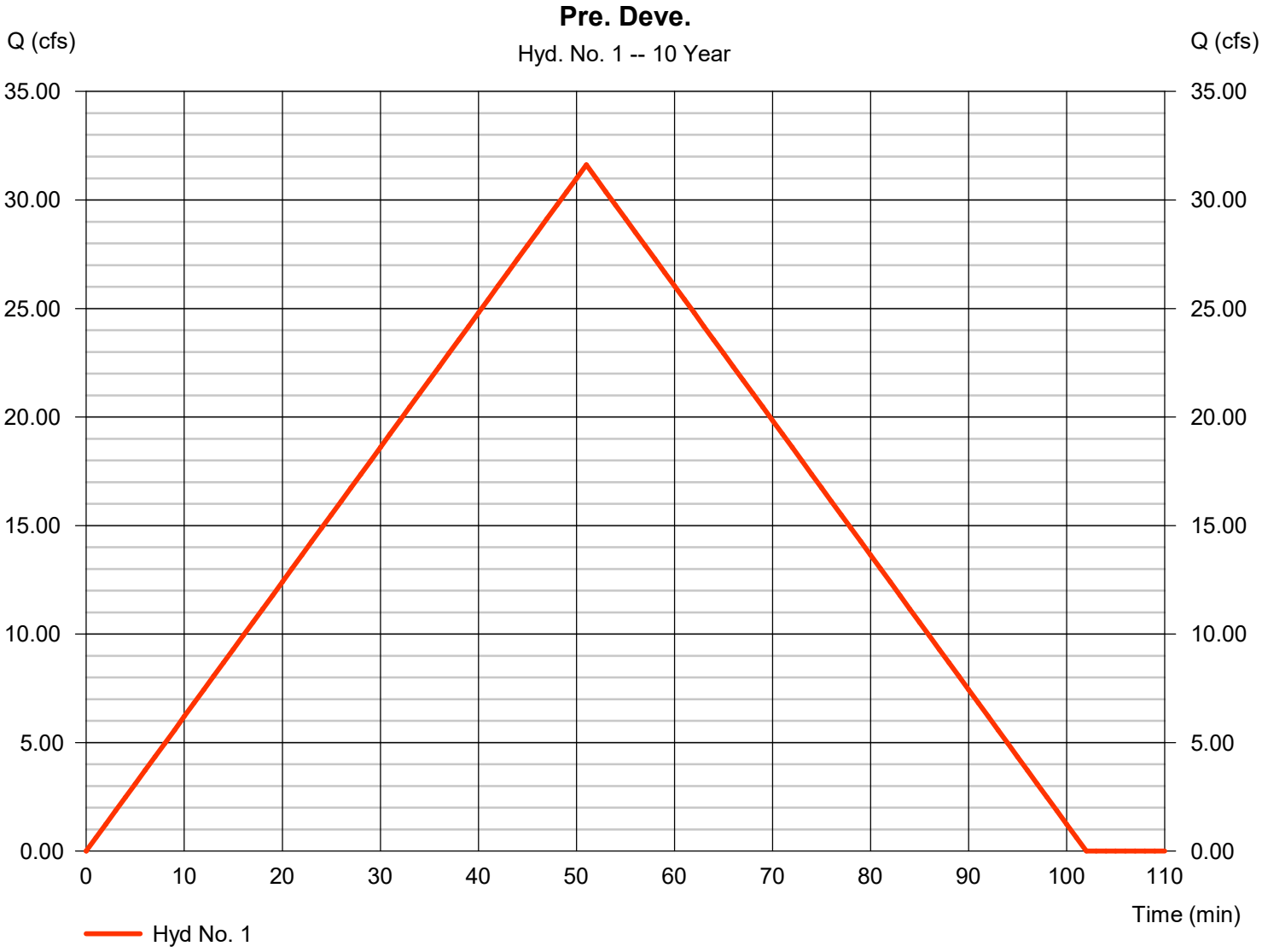
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	31.62	1	51	96,757	------	------	------	Pre. Deve.
2	Rational	37.79	1	46	104,288	------	------	------	Post Deve.
3	Reservoir	30.67	1	55	104,270	2	351.42	32,448	Pond

Hydrograph Report

Hyd. No. 1

Pre. Deve.

Hydrograph type	=	Rational	Peak discharge	=	31.62 cfs
Storm frequency	=	10 yrs	Time to peak	=	51 min
Time interval	=	1 min	Hyd. volume	=	96,757 cuft
Drainage area	=	23.570 ac	Runoff coeff.	=	0.47
Intensity	=	2.854 in/hr	Tc by User	=	51.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



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	Rational	36.97	1	51	113,133	------	------	------	Pre. Deve.
2	Rational	44.09	1	46	121,693	------	------	------	Post Deve.
3	Reservoir	35.26	1	55	121,675	2	351.76	36,431	Pond

Hydrograph Report

Hyd. No. 1

Pre. Deve.

Hydrograph type	=	Rational	Peak discharge	=	36.97 cfs
Storm frequency	=	25 yrs	Time to peak	=	51 min
Time interval	=	1 min	Hyd. volume	=	113,133 cuft
Drainage area	=	23.570 ac	Runoff coeff.	=	0.47
Intensity	=	3.337 in/hr	Tc by User	=	51.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Summary Report

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

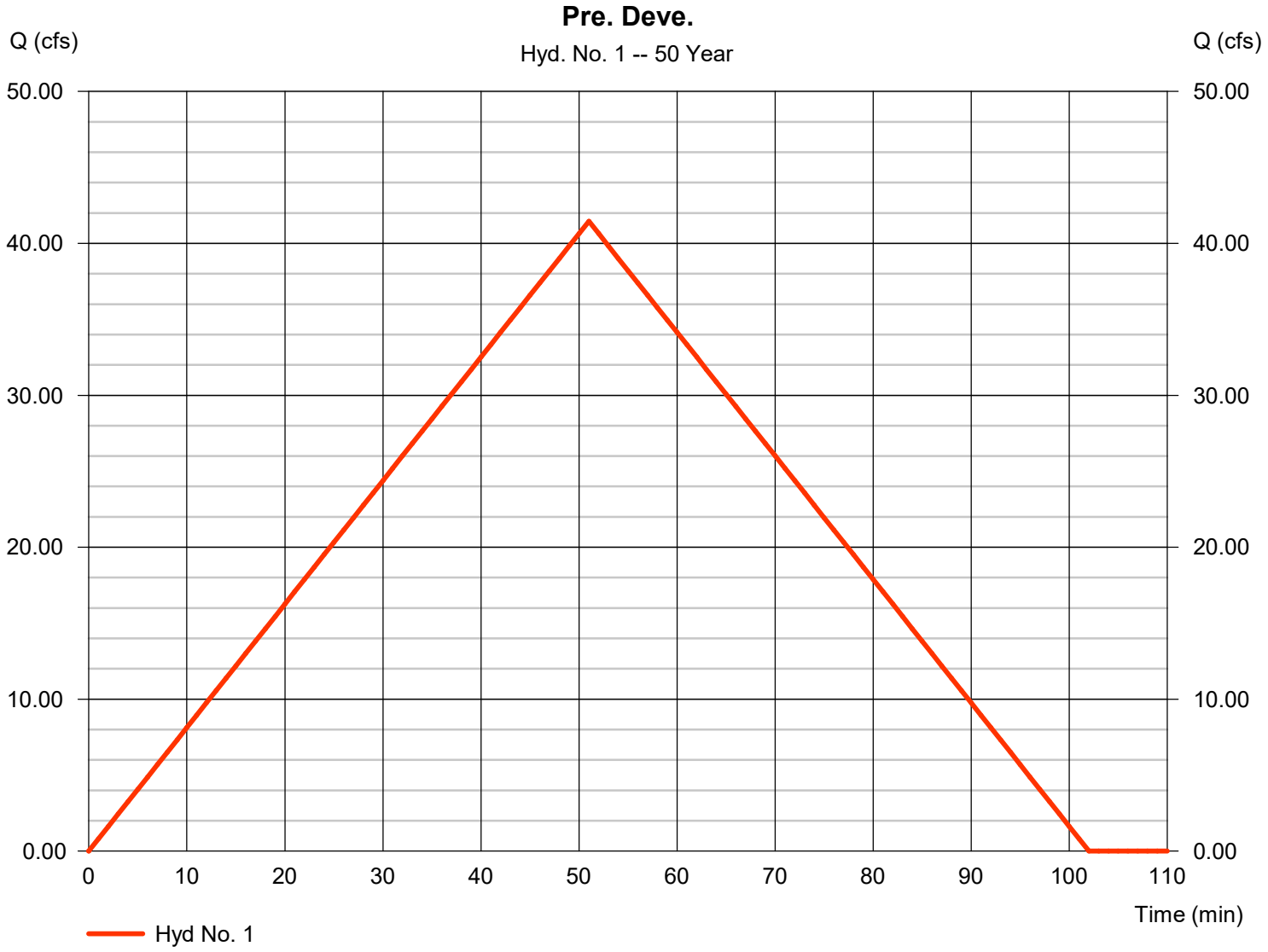
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	41.46	1	51	126,864	------	------	------	Pre. Deve.
2	Rational	49.61	1	46	136,918	------	------	------	Post Deve.
3	Reservoir	39.04	1	56	136,900	2	352.07	40,262	Pond

Hydrograph Report

Hyd. No. 1

Pre. Deve.

Hydrograph type	=	Rational	Peak discharge	=	41.46 cfs
Storm frequency	=	50 yrs	Time to peak	=	51 min
Time interval	=	1 min	Hyd. volume	=	126,864 cuft
Drainage area	=	23.570 ac	Runoff coeff.	=	0.47
Intensity	=	3.742 in/hr	Tc by User	=	51.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Summary Report

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

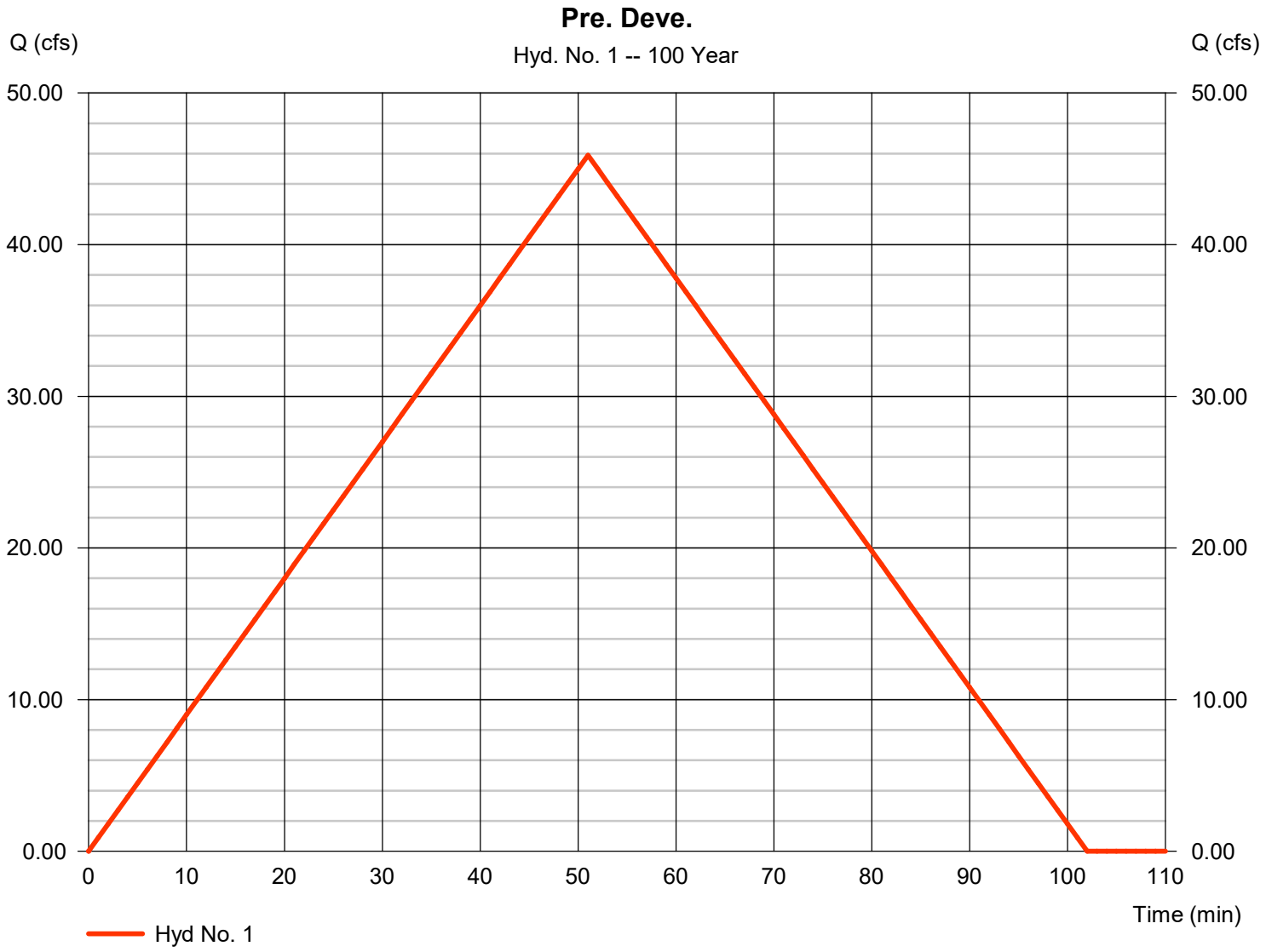
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	45.90	1	51	140,441	------	------	------	Pre. Deve.
2	Rational	54.61	1	46	150,723	------	------	------	Post Deve.
3	Reservoir	41.80	1	57	150,705	2	352.38	44,142	Pond

Hydrograph Report

Hyd. No. 1

Pre. Deve.

Hydrograph type	=	Rational	Peak discharge	=	45.90 cfs
Storm frequency	=	100 yrs	Time to peak	=	51 min
Time interval	=	1 min	Hyd. volume	=	140,441 cuft
Drainage area	=	23.570 ac	Runoff coeff.	=	0.47
Intensity	=	4.143 in/hr	Tc by User	=	51.00 min
IDF Curve	=	Bryant 50.IDF	Asc/Rec limb fact	=	1/1



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	59.0468	11.8000	0.8167	--------
3	0.0000	0.0000	0.0000	--------
5	38.3363	7.0000	0.6965	--------
10	46.3641	10.0000	0.6781	--------
25	48.6541	9.8000	0.6523	--------
50	79.0516	13.3000	0.7326	--------
100	54.7483	10.0000	0.6279	--------

File name: Bryant 50.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	5.89	4.76	4.03	3.50	3.11	2.80	2.55	2.35	2.18	2.03	1.91	1.80
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	6.79	5.33	4.45	3.86	3.43	3.10	2.84	2.62	2.45	2.29	2.16	2.05
10	7.39	6.08	5.23	4.62	4.16	3.80	3.51	3.27	3.06	2.89	2.73	2.60
25	8.39	6.94	5.99	5.31	4.80	4.40	4.07	3.80	3.57	3.37	3.20	3.05
50	9.40	7.87	6.83	6.06	5.47	5.00	4.62	4.29	4.02	3.79	3.58	3.40
100	10.00	8.34	7.25	6.47	5.87	5.40	5.02	4.69	4.42	4.19	3.98	3.80

Tc = time in minutes. Values may exceed 60.

Precip. file name: C:\Documents and Settings\Will\Desktop\Fleming\fleming.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	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	3.50	0.00	0.00	4.80	5.40	0.00	6.70