Drainage Report

For

MATHIAS WAREHOUSES

TONTITOWN, ARKANSAS

MAY 2015

PREPARED BY

ENGINEERING SERVICES, INC.
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ITEM DESCRIPTION

Appendix

ENGINEERING SERVICES INC.

Narrative & Summary

ENGINEERING SERVICES INC.

PROJECT OWNER

Maestri Enterprises, LLC
301 Emerald Point Drive
Springdale, Arkansas 72764

PROJECT DEVELOPER

Mathias Properties
P.O. Box 6485
Springdale, Arkansas 72766

PROJECT TITLE

Mathias Warehouses LSD

PROJECT LOCATION

Maestri Subdivision

PROJECT DESCRIPTION

This large scale development of 8.51 acres includes the construction of three warehouses with associated parking and drainage improvements.

DRAINAGE ANALYSIS

A drainage analysis was completed for this site with the study point being an existing drop inlet just to the north of the proposed development on Agnes Drive. This inlet is labeled as Drop Inlet No. 9 in the Maestri Subdivision Street and storm drainage plans. A "C" value of 0.60 was used for the grassed/pervious areas. A "C" value of 0.85 was used for the gravel areas. A "C" value of 0.90 was used for the paved/impervious areas. The following table shows the existing and proposed flows at Drop Inlet No. 9:

Calculated Flow Rates

Frequency (Yr)	Existing Flow (cfs)	Proposed Flow (cfs)	Differnce (cfs)
2	45.42	44.62	-0.80
5	53.72	51.03	-2.69
10	60.21	56.16	-4.05
25	69.58	63.42	-6.16
50	78.64	70.54	-8.10
100	86.37	77.47	-8.90

CONCLUSION

As can be seen from the above table, there is a decrease in flow at Drop Inlet No. 9 due to the installation of the detention pond. Also, all calculations have been completed in accordance with the City of Tontitown Drainage Manual. All calculations contained in this report are based on the assumption that the drainage ways will be maintained and free of debris. It shall be the responsibility of the Property Owner to maintain this system. Neither Engineering Services, Inc. nor the City of Tontitown shall be responsible or held liable for damage due to inadequate maintenance of this drainage system.

CERTIFICATION:

I, Thomas Jason Appel, Registered Professional Engineer No.13828 in the State of Arkansas, hereby certify the drainage studies, reports, calculations, designs, and specifications contained in this report have been prepared in accordance with the requirements of the City of Tontitown. Further, I hereby acknowledge that the review of the drainage studies, reports, calculations, designs, and specifications by the City of Tontitown or its representative cannot and does not relieve me from any professional responsibility or liability.

_____

Jason Appel, P.E.

TIME OF CONCENTRATION

CALCULATIONS

ENGINEERING SERVICES INC.

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	82.0219	15.5000	0.8884	--------
3	0.0000	0.0000	0.0000	--------
5	70.8825	14.1000	0.8108	--------
10	69.2110	13.4000	0.7768	--------
25	68.6885	12.5000	0.7396	--------
50	73.1207	12.4000	0.7235	--------
100	70.2402	11.4000	0.6915	--------

File name: TontitownIDF.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	5.60	4.62	3.94	3.44	3.06	2.76	2.52	2.31	2.14	2.00	1.87	1.76
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	6.48	5.37	4.61	4.05	3.63	3.29	3.02	2.79	2.59	2.43	2.29	2.16
10	7.21	5.98	5.14	4.53	4.07	3.70	3.40	3.15	2.94	2.76	2.60	2.46
25	8.27	6.87	5.92	5.23	4.71	4.29	3.95	3.67	3.43	3.23	3.05	2.89
50	9.26	7.71	6.67	5.90	5.32	4.86	4.48	4.17	3.90	3.67	3.48	3.30
100	10.15	8.44	7.30	6.48	5.85	5.35	4.94	4.61	4.32	4.07	3.86	3.67

Tc = time in minutes. Values may exceed 60.

Precip. file name: Z:\Engineers\Jason\HYDROLOGY\TontitownPCP.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	3.12	0.00	4.56	5.76	7.44	9.12	10.80
SCS 6-Hr	0.00	2.52	0.00	0.00	4.14	0.00	0.00	6.96
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	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

TR55 Tc Worksheet

Hyd. No. 1

EX. AREA A1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.100		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.12		0.00		0.00		
Land slope (%)	= 0.93		0.00		0.00		
Travel Time (min)	**= 13.48**	**+**	**0.00**	**+**	**0.00**	**=**	**13.48**
Shallow Concentrated Flow							
Flow length (ft)	= 750.00		400.00		360.00		
Watercourse slope (%)	= 1.60		1.25		1.11		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.04		2.27		2.14		
Travel Time (min)	**= 6.12**	**+**	**2.93**	**+**	**2.80**	**=**	**11.86**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 25.00 min

TR55 Tc Worksheet

Hyd. No. 2

EX AREA A2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.100		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.12		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 13.09**	**+**	**0.00**	**+**	**0.00**	**=**	**13.09**
Shallow Concentrated Flow							
Flow length (ft)	= 490.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 3.58**	**+**	**0.00**	**+**	**0.00**	**=**	**3.58**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 17.00 min

TR55 Tc Worksheet

Hyd. No. 4

EX AREAS A1 & A3 (POND)

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.100		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.12		0.00		0.00		
Land slope (%)	= 0.92		0.00		0.00		
Travel Time (min)	**= 13.54**	**+**	**0.00**	**+**	**0.00**	**=**	**13.54**
Shallow Concentrated Flow							
Flow length (ft)	= 260.00		0.00		0.00		
Watercourse slope (%)	= 1.31		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.85		0.00		0.00		
Travel Time (min)	**= 2.35**	**+**	**0.00**	**+**	**0.00**	**=**	**2.35**
Channel Flow							
X sectional flow area (sqft)	= 3.00		0.00		0.00		
Wetted perimeter (ft)	= 6.32		0.00		0.00		
Channel slope (%)	= 0.75		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=2.61						
			0.00				
					0.00		
Flow length (ft)	({0})1000.0		0.0		0.0		
Travel Time (min)	**= 6.38**	**+**	**0.00**	**+**	**0.00**	**=**	**6.38**

Total Travel Time, Tc ..... 22.00 min

TR55 Tc Worksheet

Hyd. No. 5

PRO AREAS A1 & A3 (POND)

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.100		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.12		0.00		0.00		
Land slope (%)	= 0.92		0.00		0.00		
Travel Time (min)	**= 13.54**	**+**	**0.00**	**+**	**0.00**	**=**	**13.54**
Shallow Concentrated Flow							
Flow length (ft)	= 260.00		0.00		0.00		
Watercourse slope (%)	= 1.31		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.85		0.00		0.00		
Travel Time (min)	**= 2.35**	**+**	**0.00**	**+**	**0.00**	**=**	**2.35**
Channel Flow							
X sectional flow area (sqft)	= 3.00		0.00		0.00		
Wetted perimeter (ft)	= 6.32		0.00		0.00		
Channel slope (%)	= 0.75		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=2.61						
			0.00				
					0.00		
Flow length (ft)	({0})1000.0		0.0		0.0		
Travel Time (min)	**= 6.38**	**+**	**0.00**	**+**	**0.00**	**=**	**6.38**

Total Travel Time, Tc ..... 22.00 min

TR55 Tc Worksheet

Hyd. No. 7

EX AREA A2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.100		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.12		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 13.09**	**+**	**0.00**	**+**	**0.00**	**=**	**13.09**
Shallow Concentrated Flow							
Flow length (ft)	= 490.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 3.58**	**+**	**0.00**	**+**	**0.00**	**=**	**3.58**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 17.00 min

TR55 Tc Worksheet

Hyd. No. 8

PRO AREA A4

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.100		0.011		0.011		
Flow length (ft)	= 150.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.12		0.00		0.00		
Land slope (%)	= 0.75		0.00		0.00		
Travel Time (min)	**= 14.69**	**+**	**0.00**	**+**	**0.00**	**=**	**14.69**
Shallow Concentrated Flow							
Flow length (ft)	= 530.00		285.00		1040.00		
Watercourse slope (%)	= 1.50		1.05		1.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.98		2.08		2.03		
Travel Time (min)	**= 4.47**	**+**	**2.28**	**+**	**8.53**	**=**	**15.28**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 30.00 min

HYDROGRAPH SUMMARY REPORTS

ENGINEERING SERVICES INC.

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	36.11	1	25	54,169	------	------	------	EX. AREA A1
2	Rational	17.58	1	17	17,936	------	------	------	EX AREA A2
3	Combine	45.42	1	25	72,106	1, 2	------	------	EX FLOWS D.I. No. 9
4	Rational	10.24	1	22	13,515	------	------	------	EX AREAS A1 & A3 (POND)
5	Mod. Rational	13.97	1	22	25,269	------	------	------	PRO AREAS A1 & A3 (POND)
6	Reservoir	13.23	1	31	25,150	5	1296.78	3,491	POND FLOWS
7	Rational	17.58	1	17	17,936	------	------	------	EX AREA A2
8	Rational	27.31	1	30	49,159	------	------	------	PRO AREA A4
9	Combine	44.62	1	29	92,246	6, 7, 8	------	------	PRO FLOWS AT D.I. No. 9

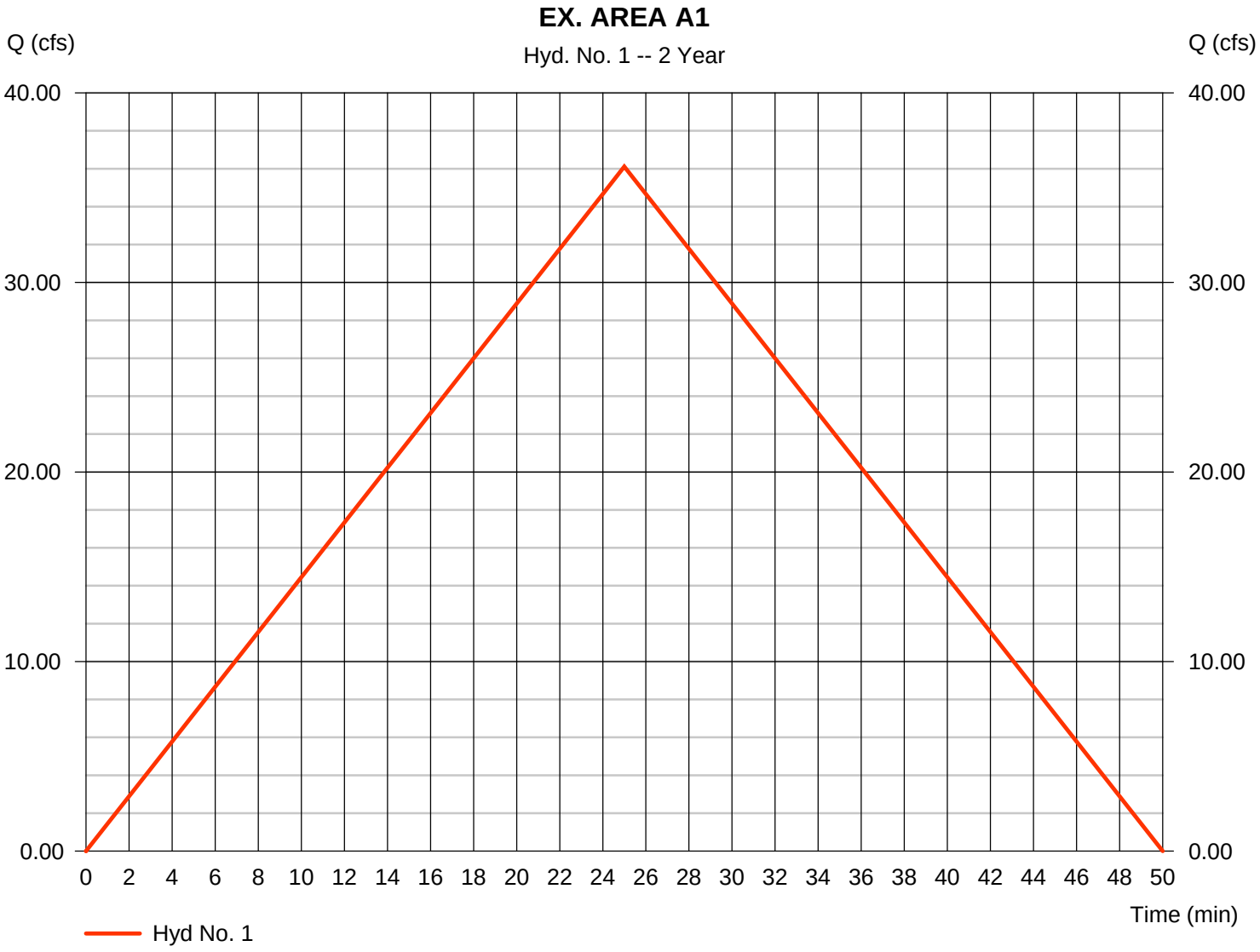
Hydrograph Report

Hyd. No. 1

EX. AREA A1

Hydrograph type	=	Rational	Peak discharge	=	36.11 cfs
Storm frequency	=	2 yrs	Time to peak	=	25 min
Time interval	=	1 min	Hyd. volume	=	54,169 cuft
Drainage area	=	22.690 ac	Runoff coeff.	=	0.52*
Intensity	=	3.061 in/hr	Tc by TR55	=	25.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.660 x 0.85) + (4.970 x 0.90) + (17.060 x 0.40)] / 22.690



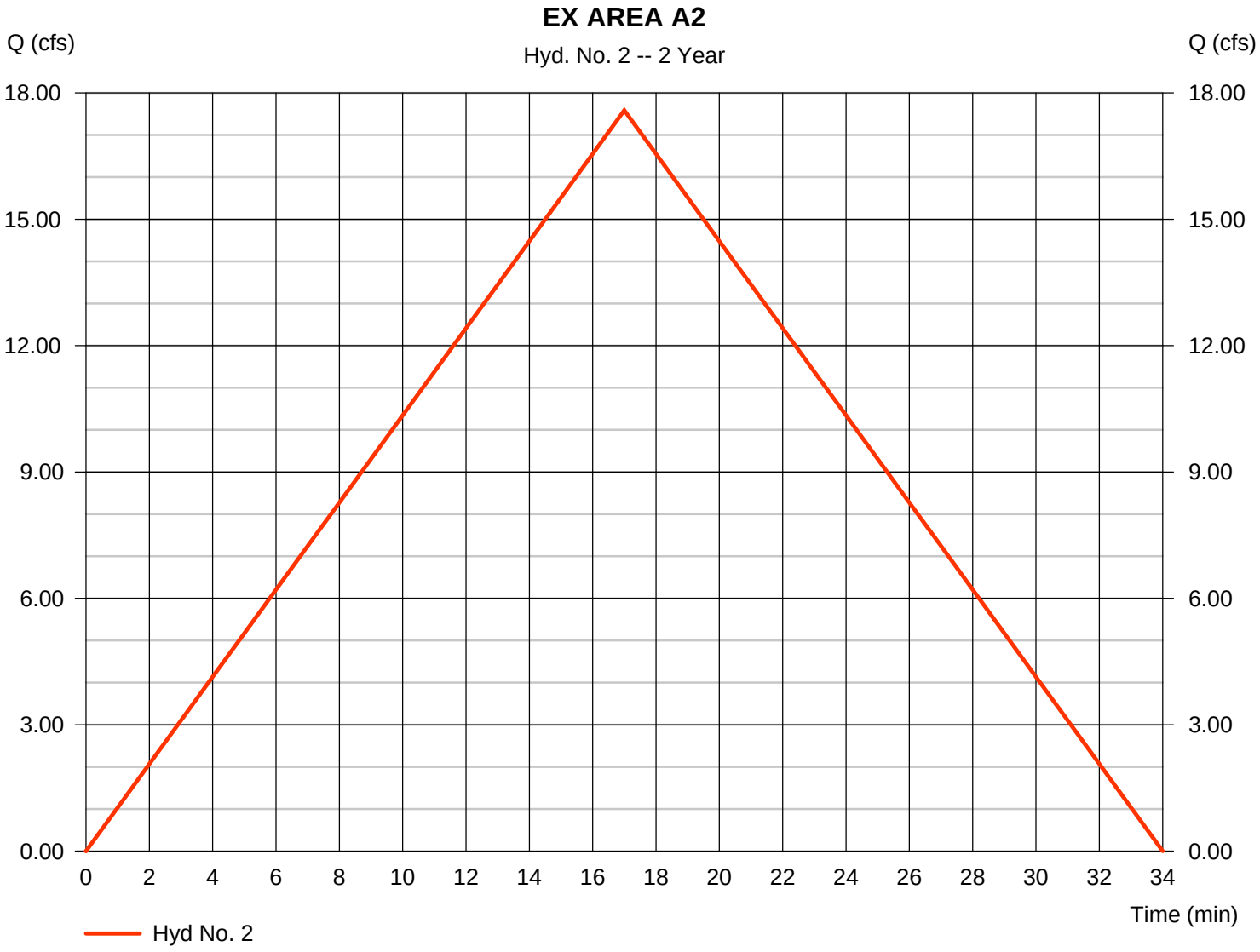
Hydrograph Report

Hyd. No. 2

EX AREA A2

Hydrograph type	=	Rational	Peak discharge	=	17.58 cfs
Storm frequency	=	2 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	17,936 cuft
Drainage area	=	6.300 ac	Runoff coeff.	=	0.75*
Intensity	=	3.722 in/hr	Tc by TR55	=	17.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(4.400 x 0.90) + (1.900 x 0.40)] / 6.300

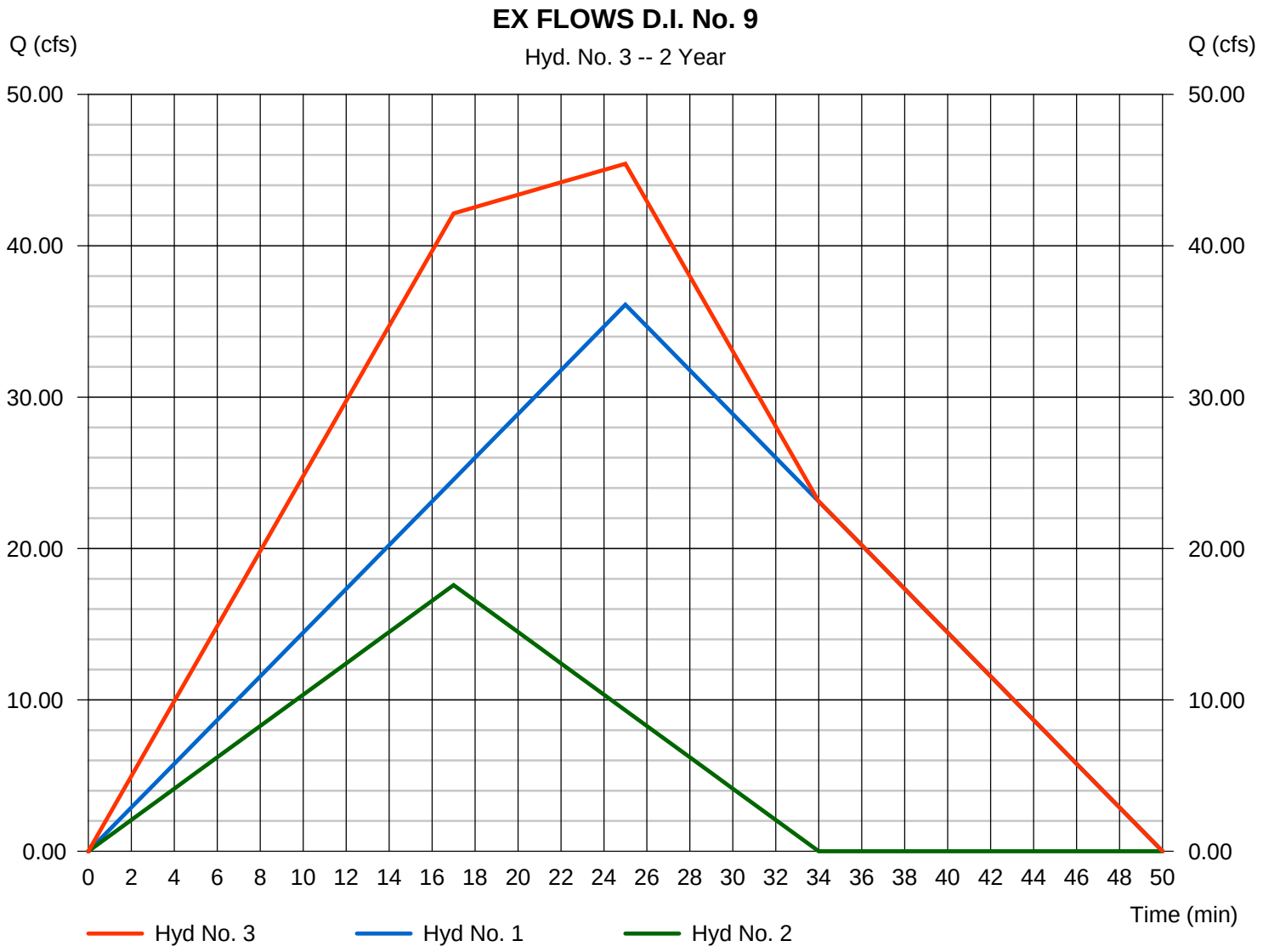


Hydrograph Report

Hyd. No. 3

EX FLOWS D.I. No. 9

Hydrograph type	= Combine	Peak discharge	= 45.42 cfs
Storm frequency	= 2 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 72,106 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 28.990 ac

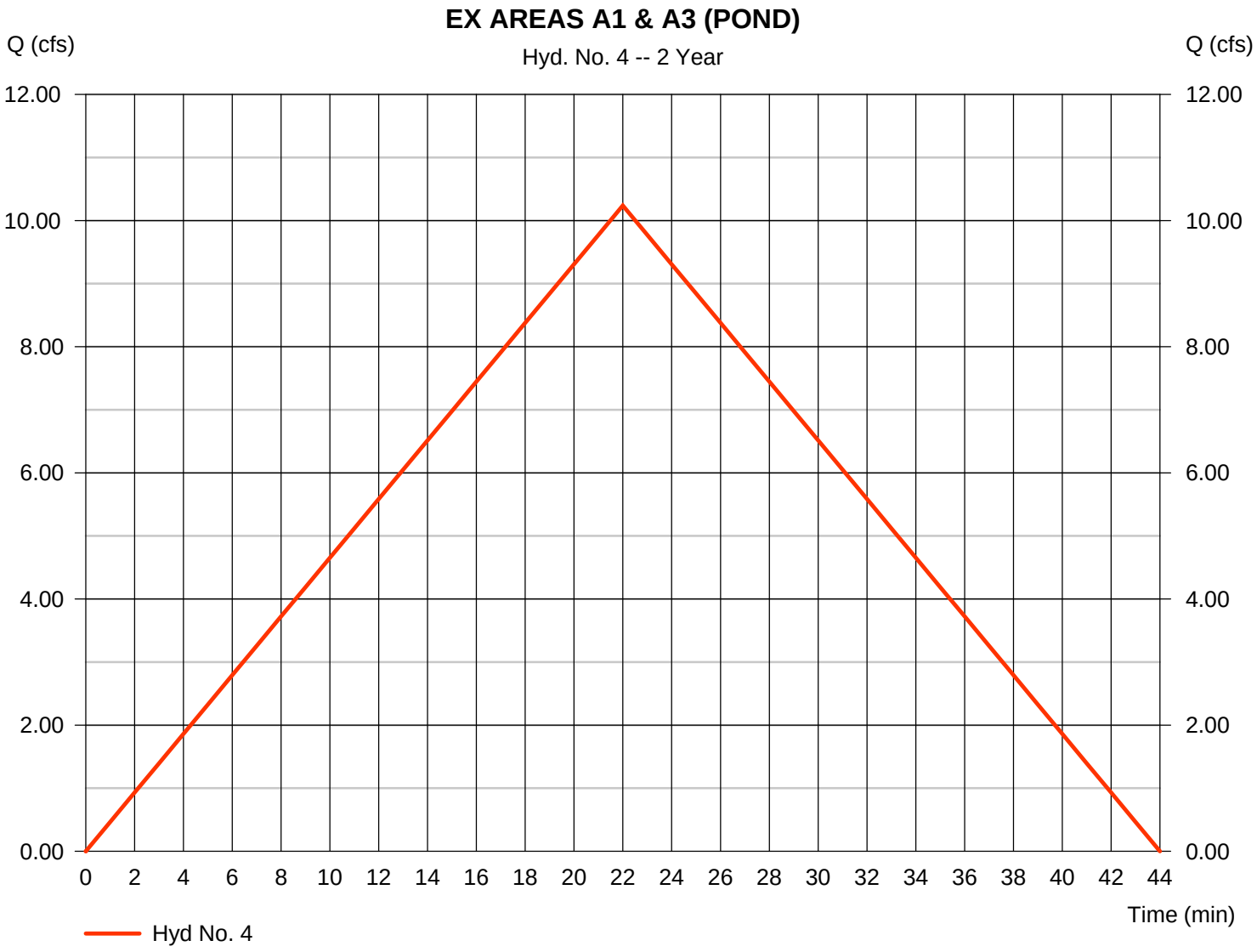


Hydrograph Report

Hyd. No. 4

EX AREAS A1 & A3 (POND)

Hydrograph type	=	Rational	Peak discharge	=	10.24 cfs
Storm frequency	=	2 yrs	Time to peak	=	22 min
Time interval	=	1 min	Hyd. volume	=	13,515 cuft
Drainage area	=	7.810 ac	Runoff coeff.	=	0.4
Intensity	=	3.277 in/hr	Tc by TR55	=	22.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1



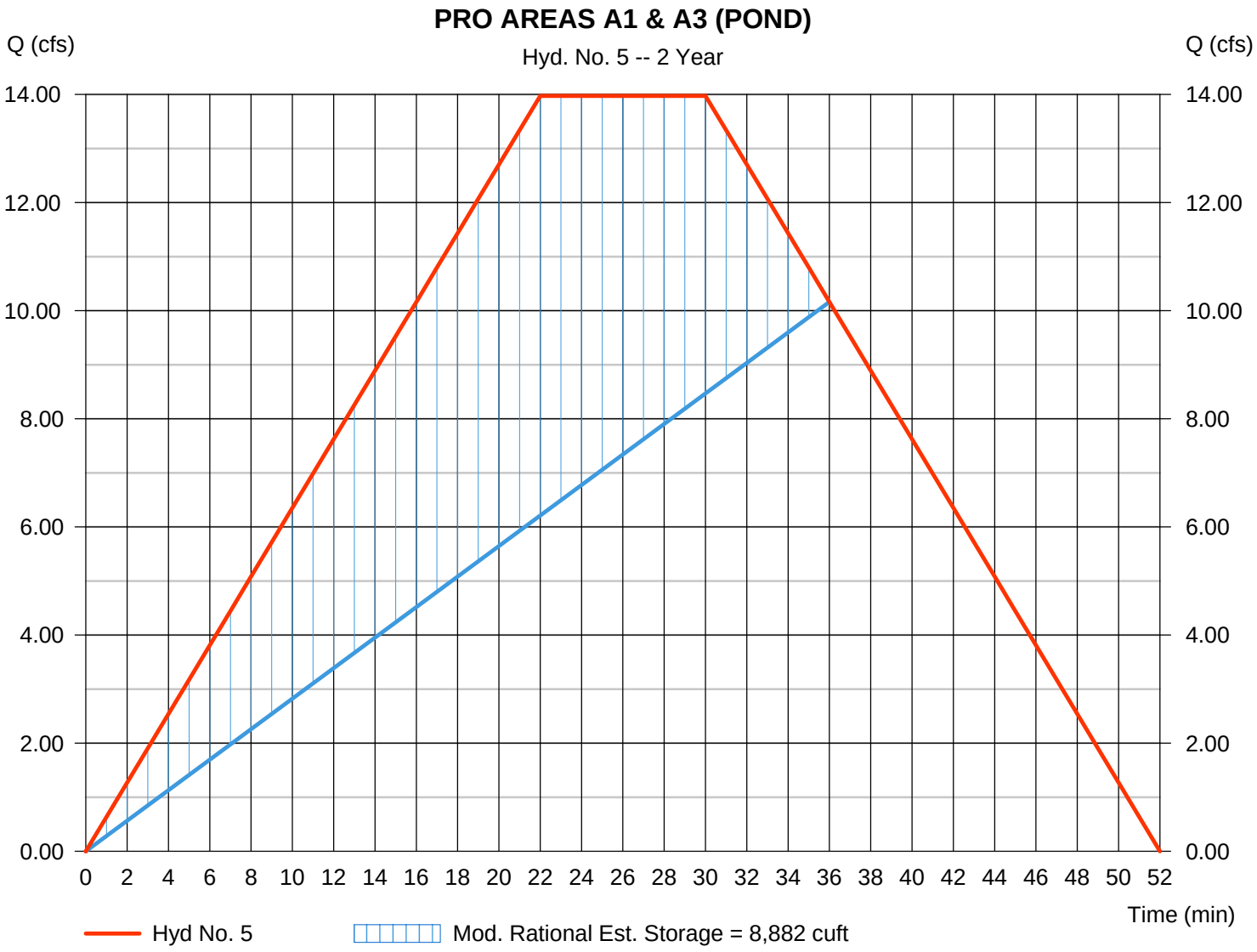
Hydrograph Report

Hyd. No. 5

PRO AREAS A1 & A3 (POND)

Hydrograph type	= Mod. Rational	Peak discharge	= 13.97 cfs
Storm frequency	= 2 yrs	Time to peak	= 22 min
Time interval	= 1 min	Hyd. volume	= 25,269 cuft
Drainage area	= 7.810 ac	Runoff coeff.	= 0.65*
Intensity	= 2.752 in/hr	Tc by TR55	= 22.00 min
IDF Curve	= TontitownIDF.IDF	Storm duration	= 1.4 x Tc
Target Q	=10.37 cfs	Est. Req'd Storage	=8,882 cuft

* Composite (Area/C) = [(4.020 x 0.90) + (3.890 x 0.40)] / 7.810



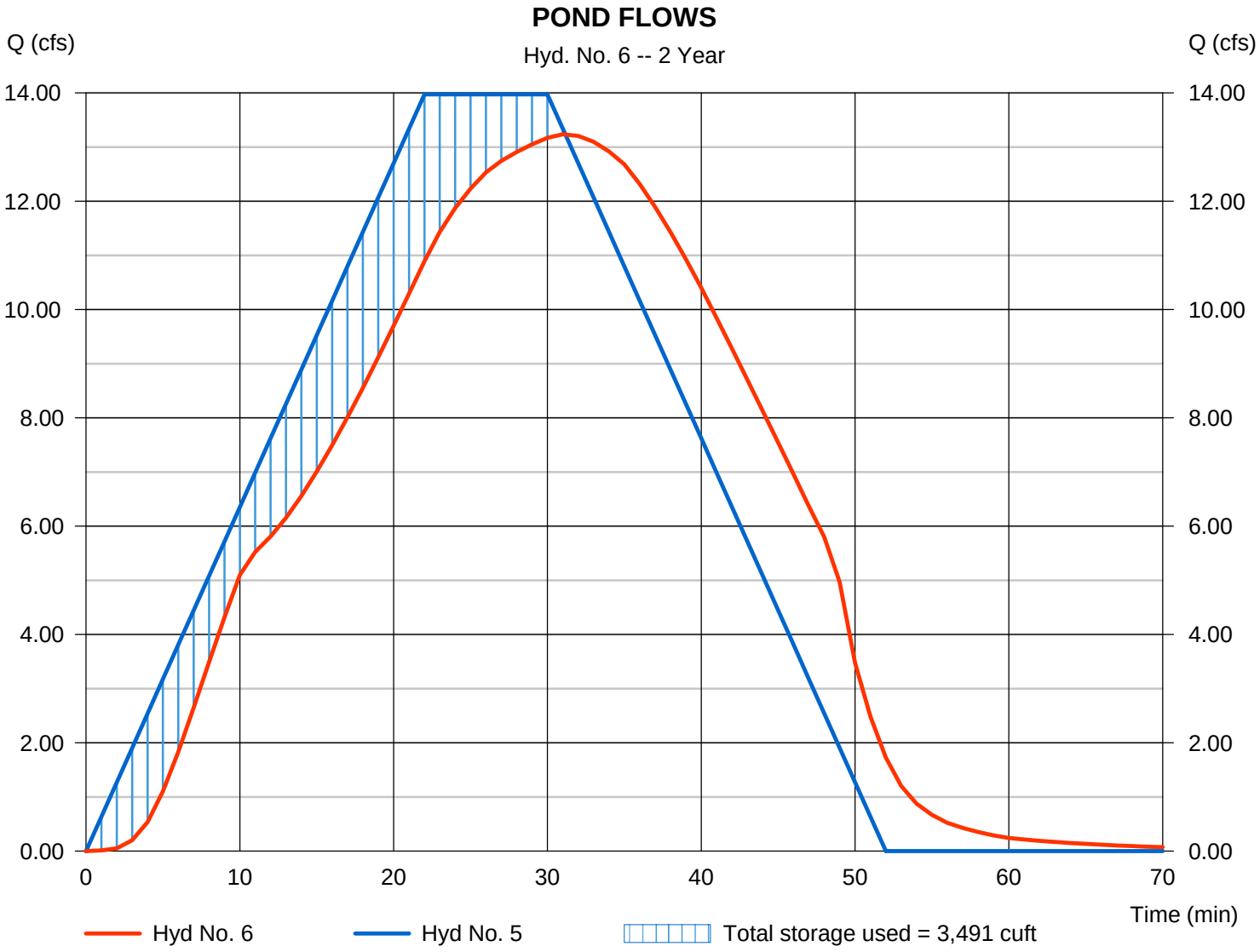
Hydrograph Report

Hyd. No. 6

POND FLOWS

Hydrograph type	=	Reservoir	Peak discharge	=	13.23 cfs
Storm frequency	=	2 yrs	Time to peak	=	31 min
Time interval	=	1 min	Hyd. volume	=	25,150 cuft
Inflow hyd. No.	=	5 - PRO AREAS A1 & A3 (POND)	Max. Elevation	=	1296.78 ft
Reservoir name	=	Pond - Contours	Max. Storage	=	3,491 cuft

Storage Indication method used.



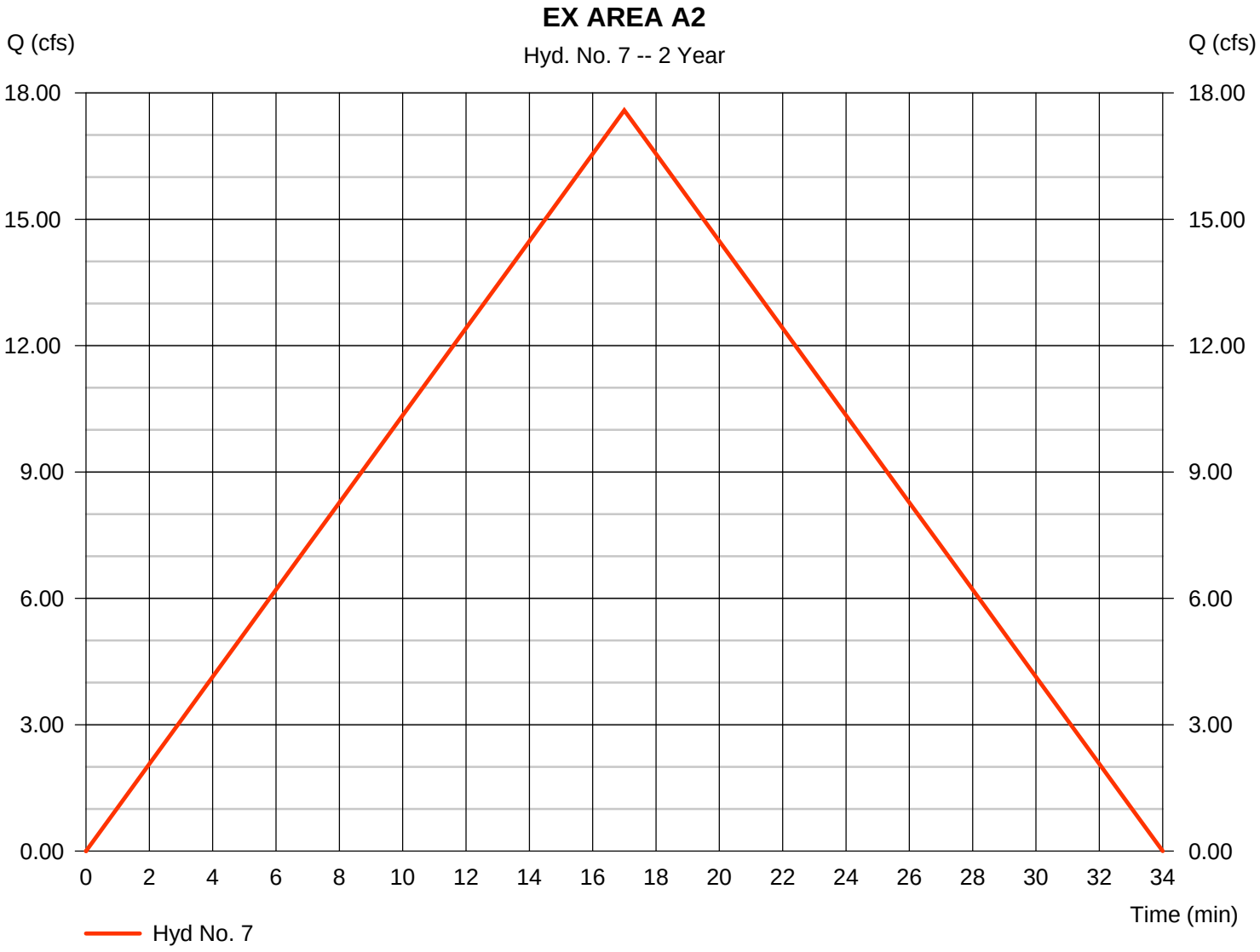
Hydrograph Report

Hyd. No. 7

EX AREA A2

Hydrograph type	=	Rational	Peak discharge	=	17.58 cfs
Storm frequency	=	2 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	17,936 cuft
Drainage area	=	6.300 ac	Runoff coeff.	=	0.75*
Intensity	=	3.722 in/hr	Tc by TR55	=	17.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(4.400 x 0.90) + (1.900 x 0.40)] / 6.300



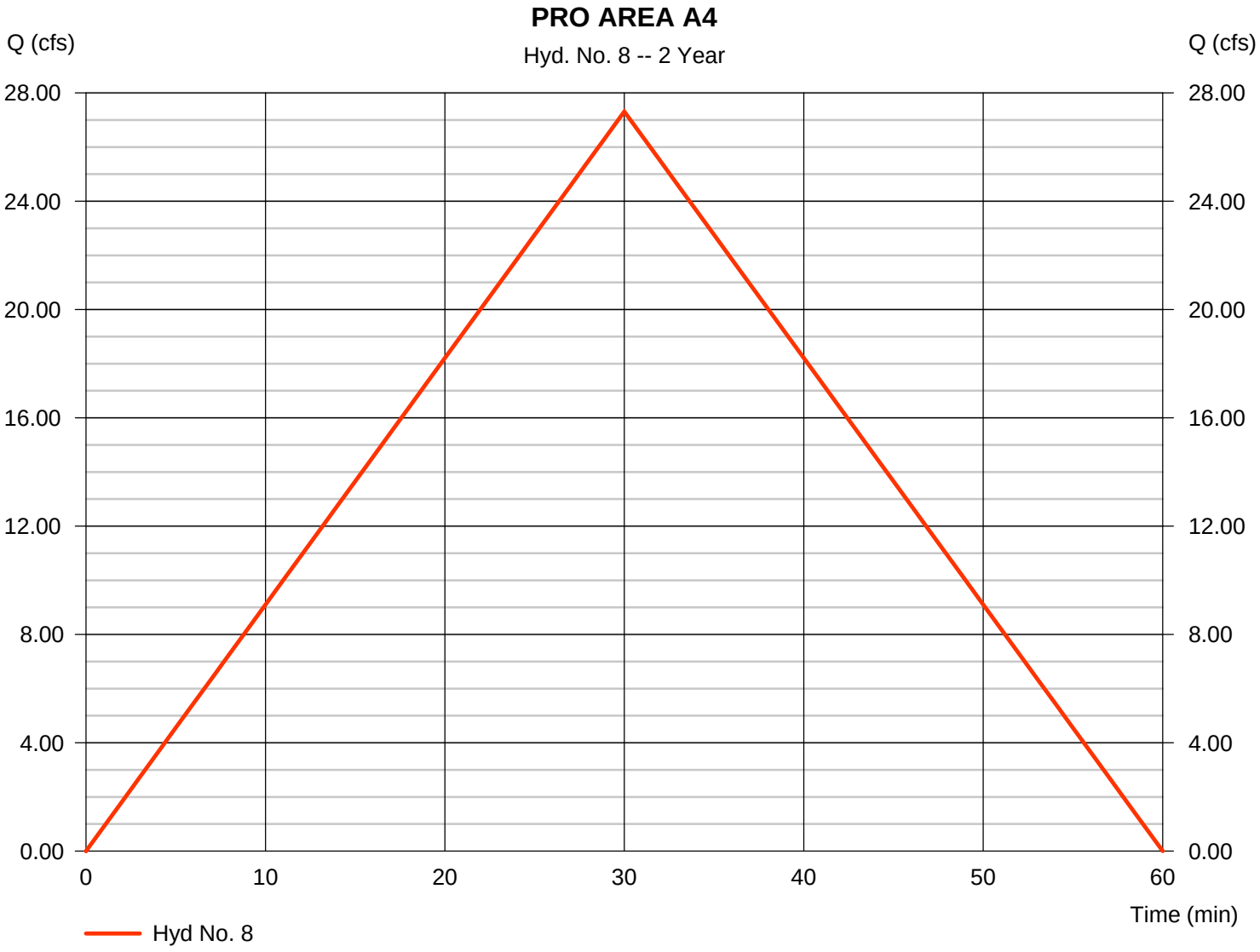
Hydrograph Report

Hyd. No. 8

PRO AREA A4

Hydrograph type	=	Rational	Peak discharge	=	27.31 cfs
Storm frequency	=	2 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	49,159 cuft
Drainage area	=	15.960 ac	Runoff coeff.	=	0.62*
Intensity	=	2.760 in/hr	Tc by TR55	=	30.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(6.540 x 0.90) + (0.660 x 0.85) + (8.660 x 0.40)] / 15.960

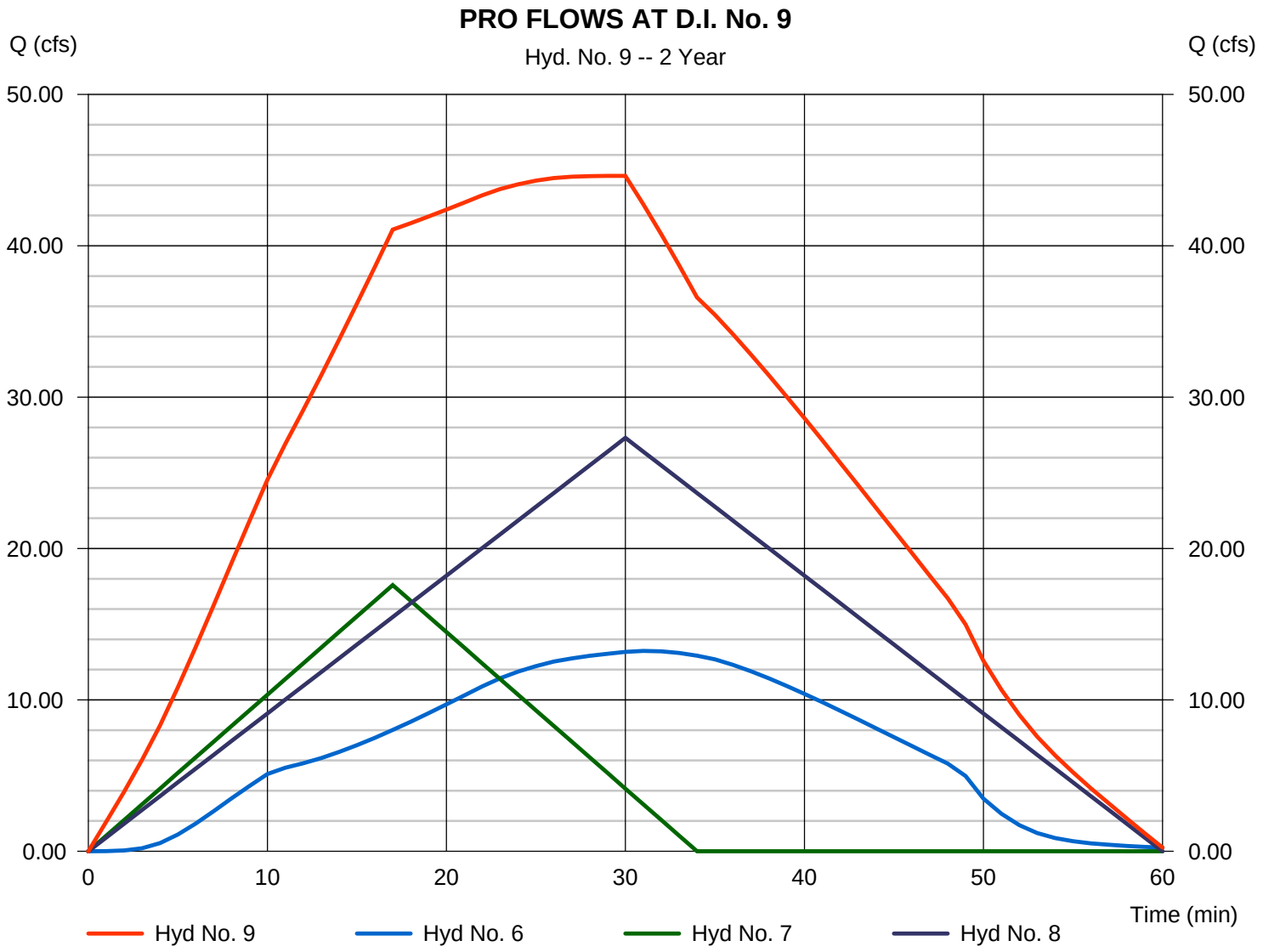


Hydrograph Report

Hyd. No. 9

PRO FLOWS AT D.I. No. 9

Hydrograph type	= Combine	Peak discharge	= 44.62 cfs
Storm frequency	= 2 yrs	Time to peak	= 29 min
Time interval	= 1 min	Hyd. volume	= 92,246 cuft
Inflow hyds.	= 6, 7, 8	Contrib. drain. area	= 22.260 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	42.80	1	25	64,195	------	------	------	EX. AREA A1
2	Rational	20.63	1	17	21,047	------	------	------	EX AREA A2
3	Combine	53.72	1	25	85,241	1, 2	------	------	EX FLOWS D.I. No. 9
4	Rational	12.09	1	22	15,958	------	------	------	EX AREAS A1 & A3 (POND)
5	Mod. Rational	14.58	1	22	33,287	------	------	------	PRO AREAS A1 & A3 (POND)
6	Reservoir	13.63	1	33	33,233	5	1297.01	4,276	POND FLOWS
7	Rational	20.63	1	17	21,047	------	------	------	EX AREA A2
8	Rational	32.56	1	30	58,599	------	------	------	PRO AREA A4
9	Combine	51.03	1	28	112,879	6, 7, 8	------	------	PRO FLOWS AT D.I. No. 9

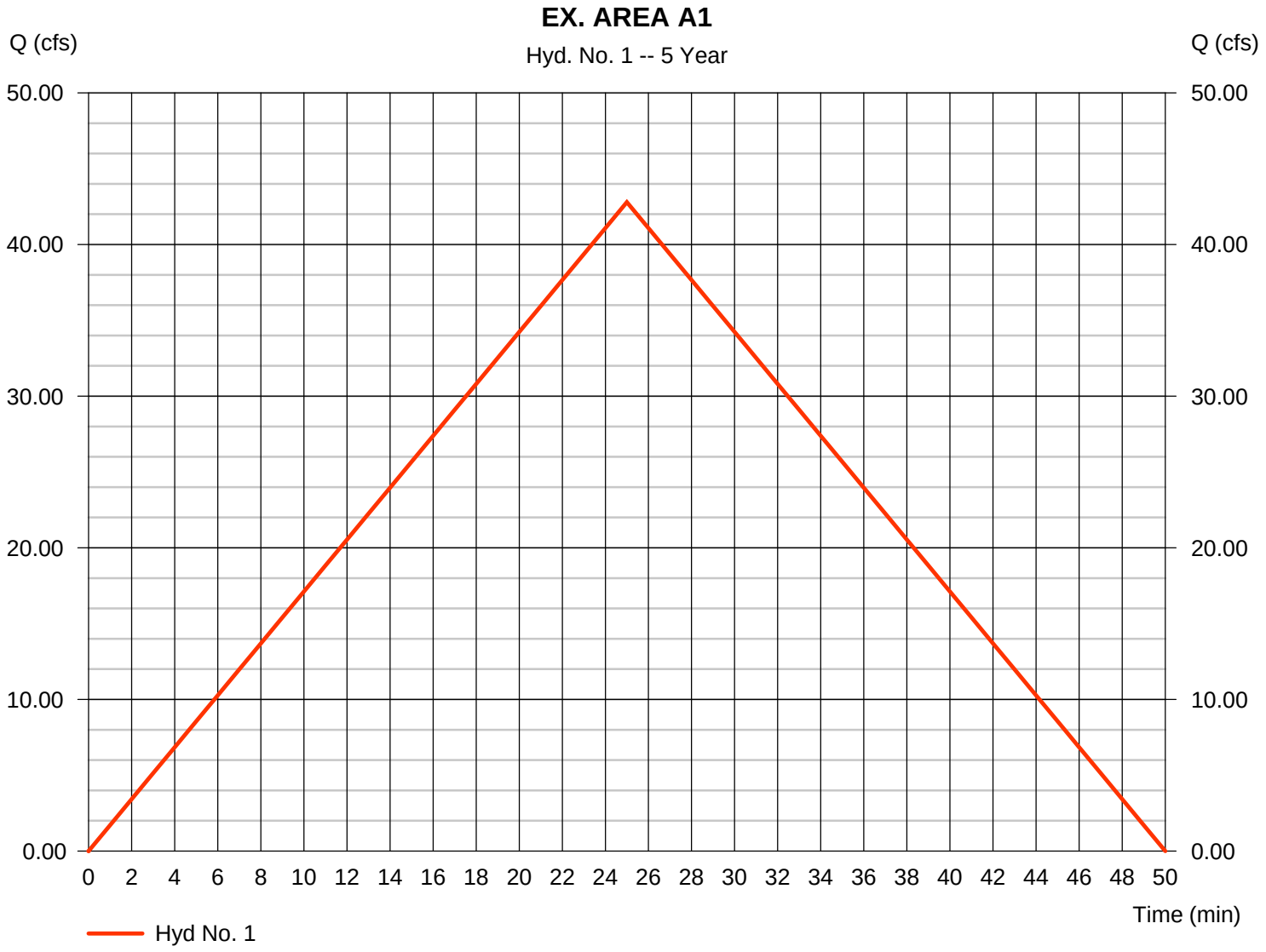
Hydrograph Report

Hyd. No. 1

EX. AREA A1

Hydrograph type	=	Rational	Peak discharge	=	42.80 cfs
Storm frequency	=	5 yrs	Time to peak	=	25 min
Time interval	=	1 min	Hyd. volume	=	64,195 cuft
Drainage area	=	22.690 ac	Runoff coeff.	=	0.52*
Intensity	=	3.627 in/hr	Tc by TR55	=	25.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.660 x 0.85) + (4.970 x 0.90) + (17.060 x 0.40)] / 22.690



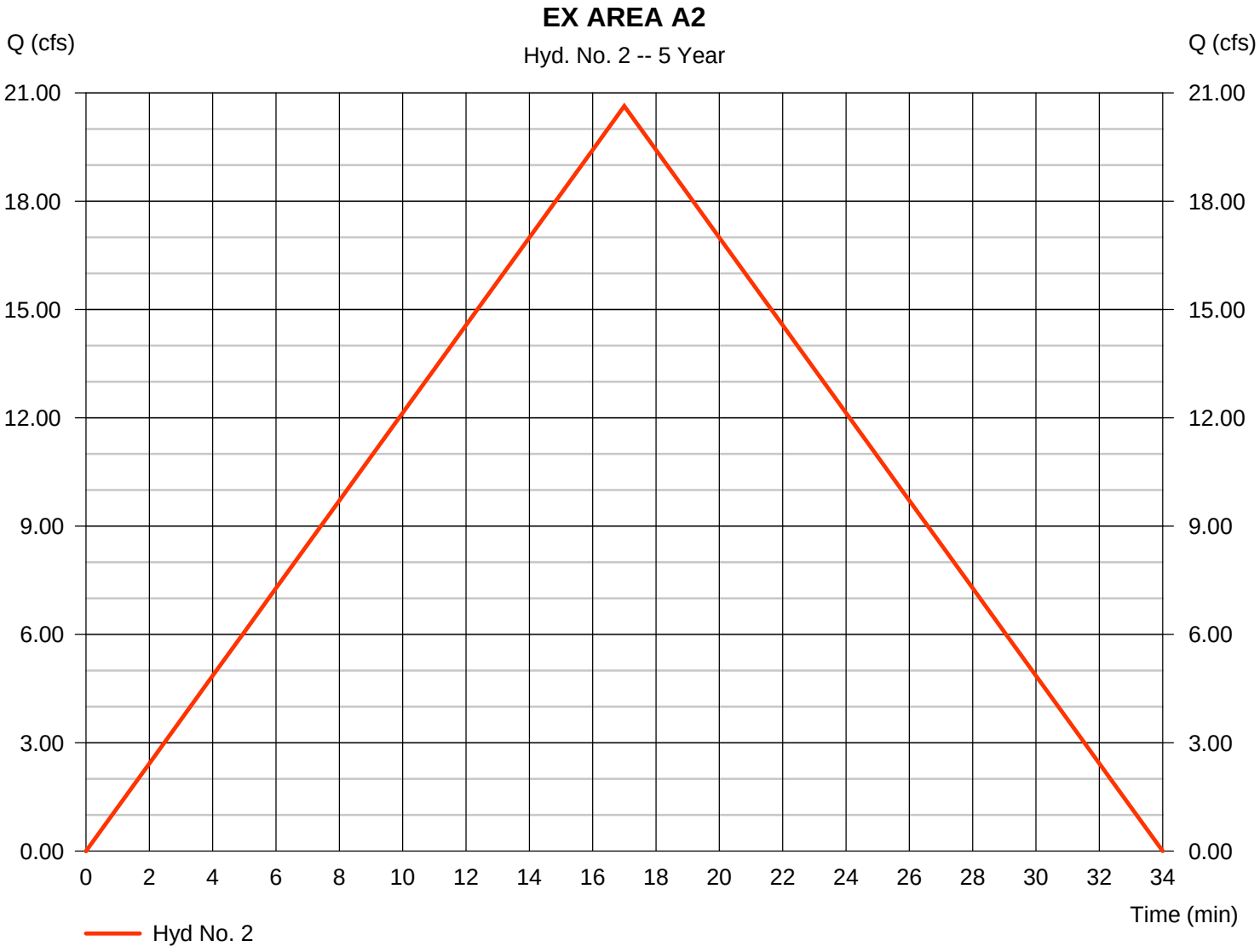
Hydrograph Report

Hyd. No. 2

EX AREA A2

Hydrograph type	=	Rational	Peak discharge	=	20.63 cfs
Storm frequency	=	5 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	21,047 cuft
Drainage area	=	6.300 ac	Runoff coeff.	=	0.75*
Intensity	=	4.367 in/hr	Tc by TR55	=	17.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(4.400 x 0.90) + (1.900 x 0.40)] / 6.300

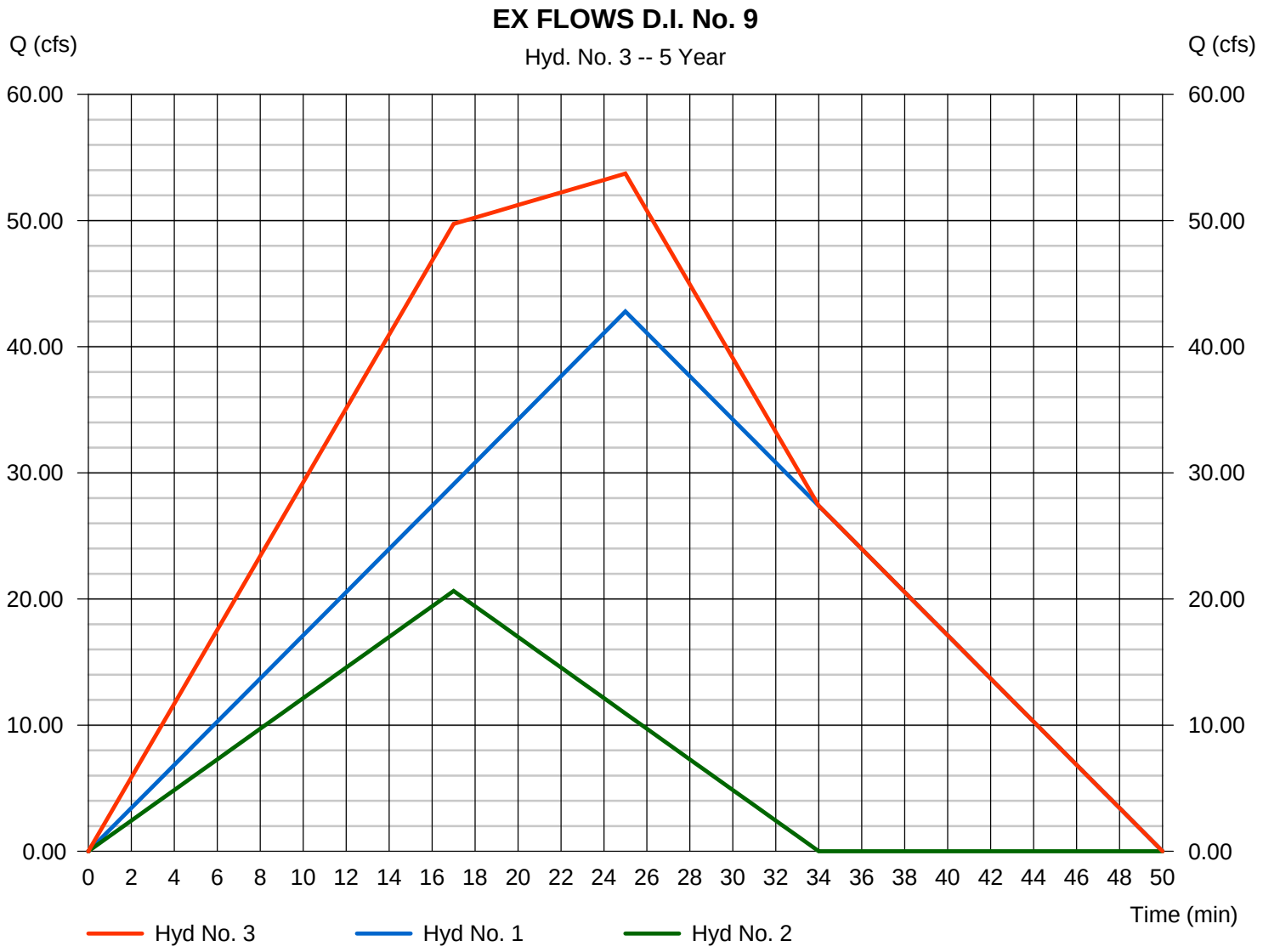


Hydrograph Report

Hyd. No. 3

EX FLOWS D.I. No. 9

Hydrograph type	= Combine	Peak discharge	= 53.72 cfs
Storm frequency	= 5 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 85,241 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 28.990 ac

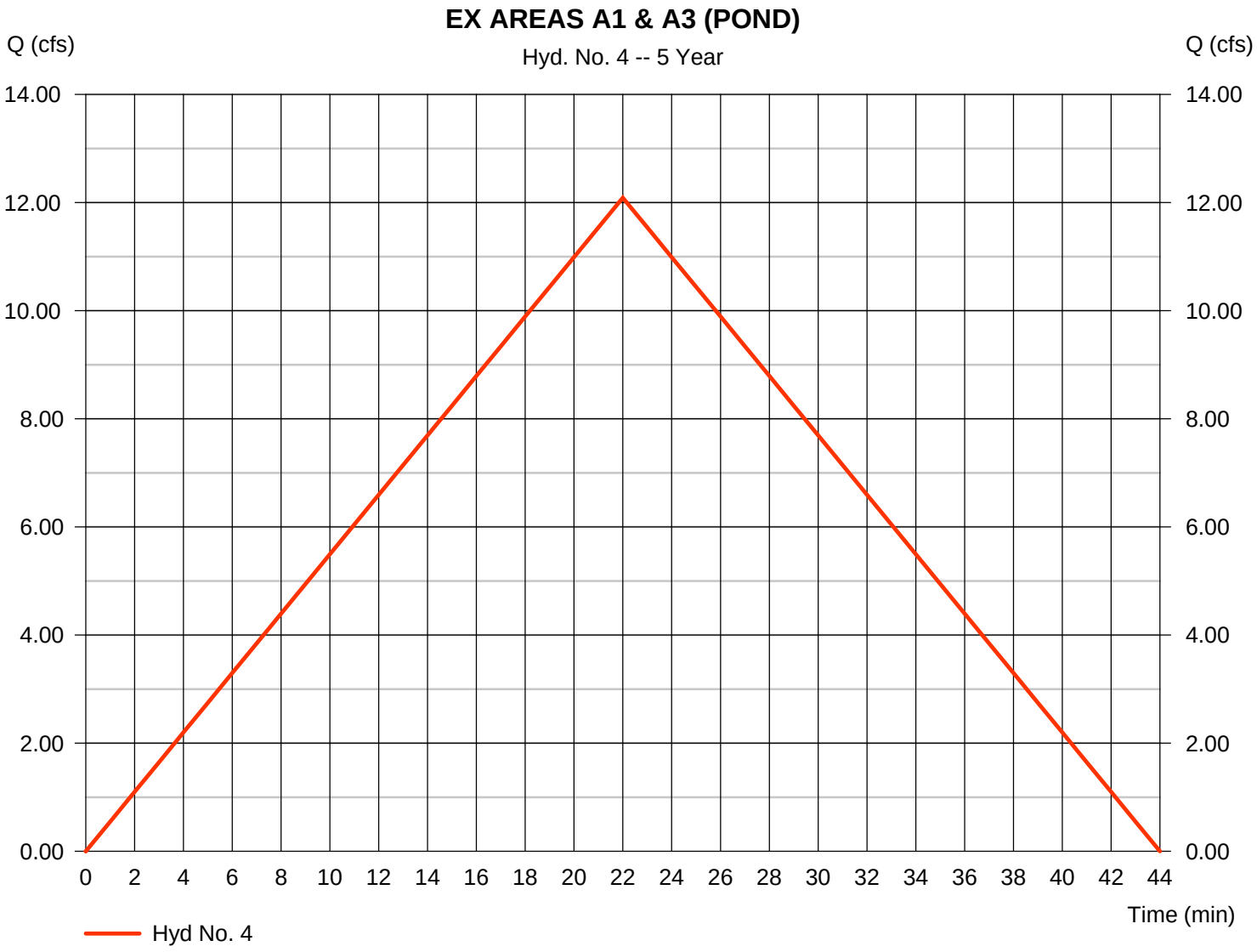


Hydrograph Report

Hyd. No. 4

EX AREAS A1 & A3 (POND)

Hydrograph type	=	Rational	Peak discharge	=	12.09 cfs
Storm frequency	=	5 yrs	Time to peak	=	22 min
Time interval	=	1 min	Hyd. volume	=	15,958 cuft
Drainage area	=	7.810 ac	Runoff coeff.	=	0.4
Intensity	=	3.870 in/hr	Tc by TR55	=	22.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1



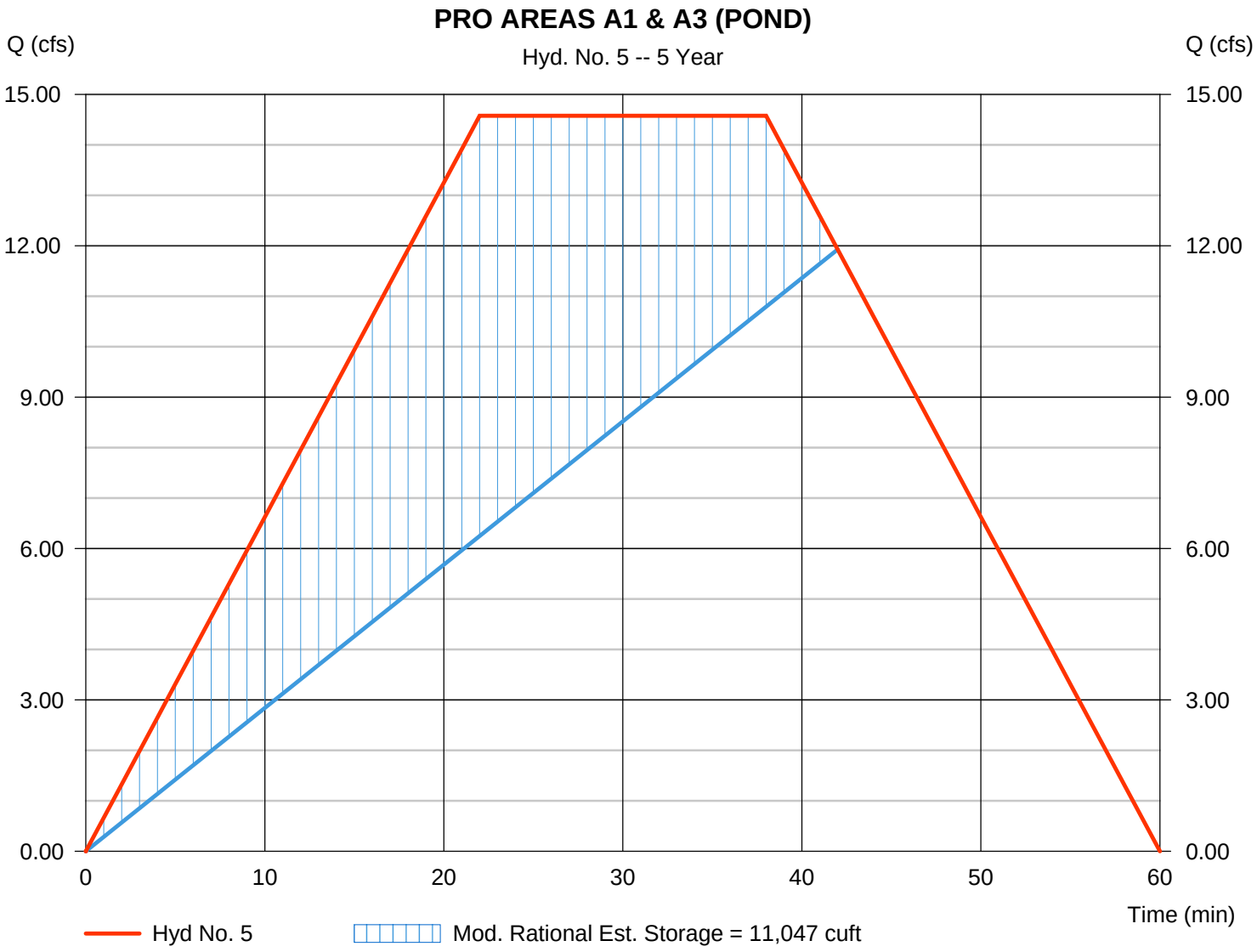
Hydrograph Report

Hyd. No. 5

PRO AREAS A1 & A3 (POND)

Hydrograph type	= Mod. Rational	Peak discharge	= 14.58 cfs
Storm frequency	= 5 yrs	Time to peak	= 22 min
Time interval	= 1 min	Hyd. volume	= 33,287 cuft
Drainage area	= 7.810 ac	Runoff coeff.	= 0.65*
Intensity	= 2.871 in/hr	Tc by TR55	= 22.00 min
IDF Curve	= TontitownIDF.IDF	Storm duration	= 1.7 x Tc
Target Q	=12.24 cfs	Est. Req'd Storage	=11,047 cuft

* Composite (Area/C) = [(4.020 x 0.90) + (3.890 x 0.40)] / 7.810



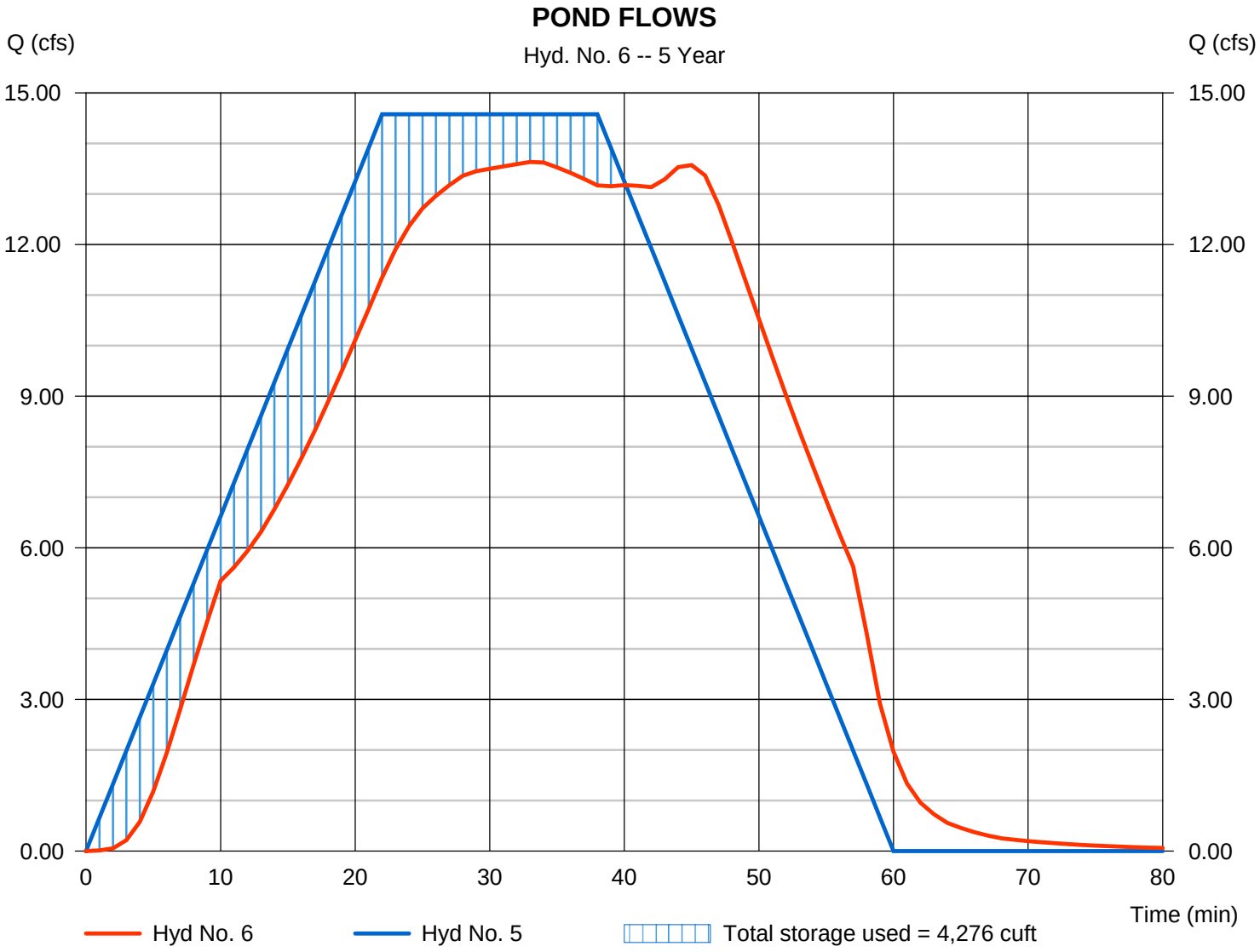
Hydrograph Report

Hyd. No. 6

POND FLOWS

Hydrograph type	=	Reservoir	Peak discharge	=	13.63 cfs
Storm frequency	=	5 yrs	Time to peak	=	33 min
Time interval	=	1 min	Hyd. volume	=	33,233 cuft
Inflow hyd. No.	=	5 - PRO AREAS A1 & A3 (POND)	Max. Elevation	=	1297.01 ft
Reservoir name	=	Pond - Contours	Max. Storage	=	4,276 cuft

Storage Indication method used.



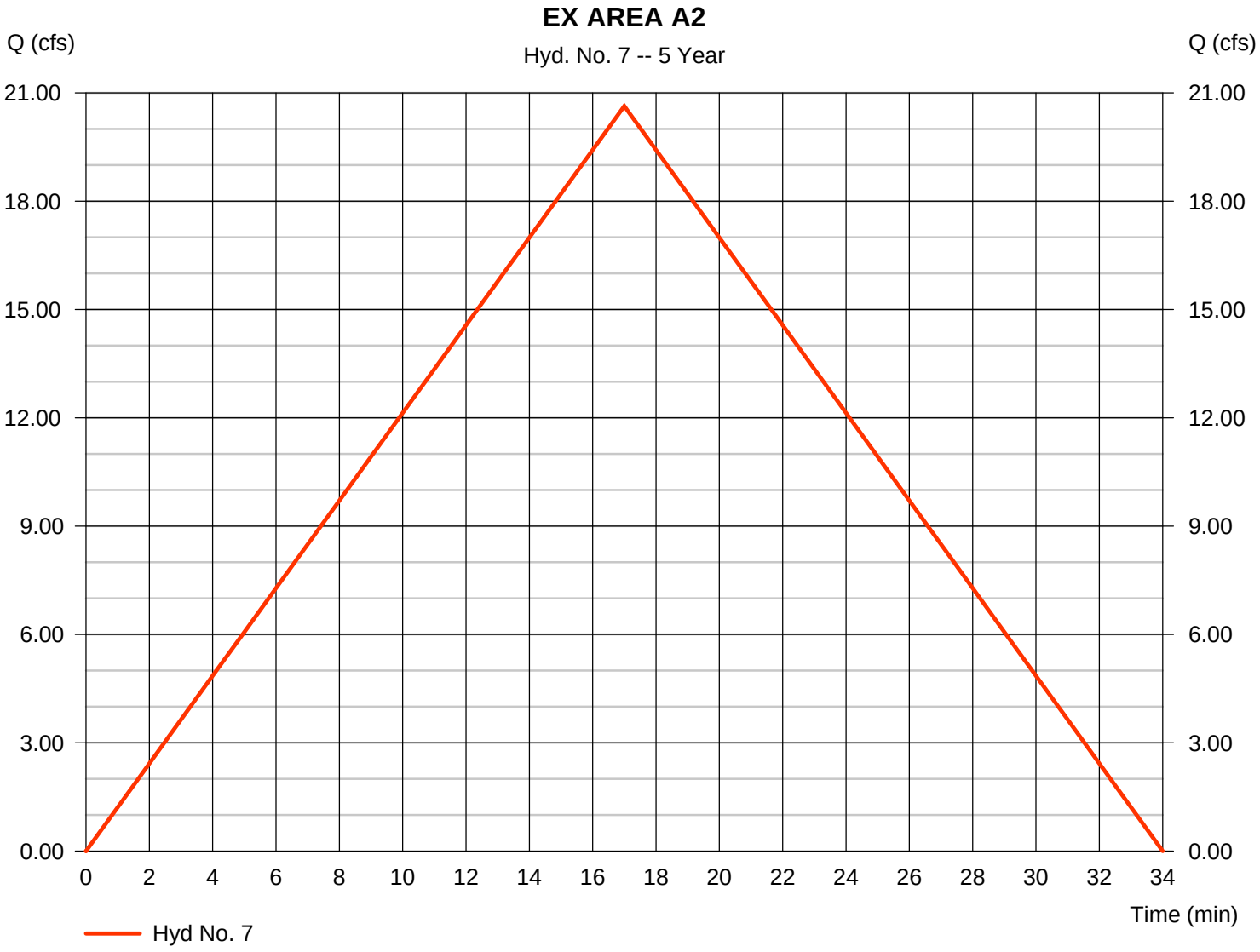
Hydrograph Report

Hyd. No. 7

EX AREA A2

Hydrograph type	=	Rational	Peak discharge	=	20.63 cfs
Storm frequency	=	5 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	21,047 cuft
Drainage area	=	6.300 ac	Runoff coeff.	=	0.75*
Intensity	=	4.367 in/hr	Tc by TR55	=	17.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(4.400 x 0.90) + (1.900 x 0.40)] / 6.300



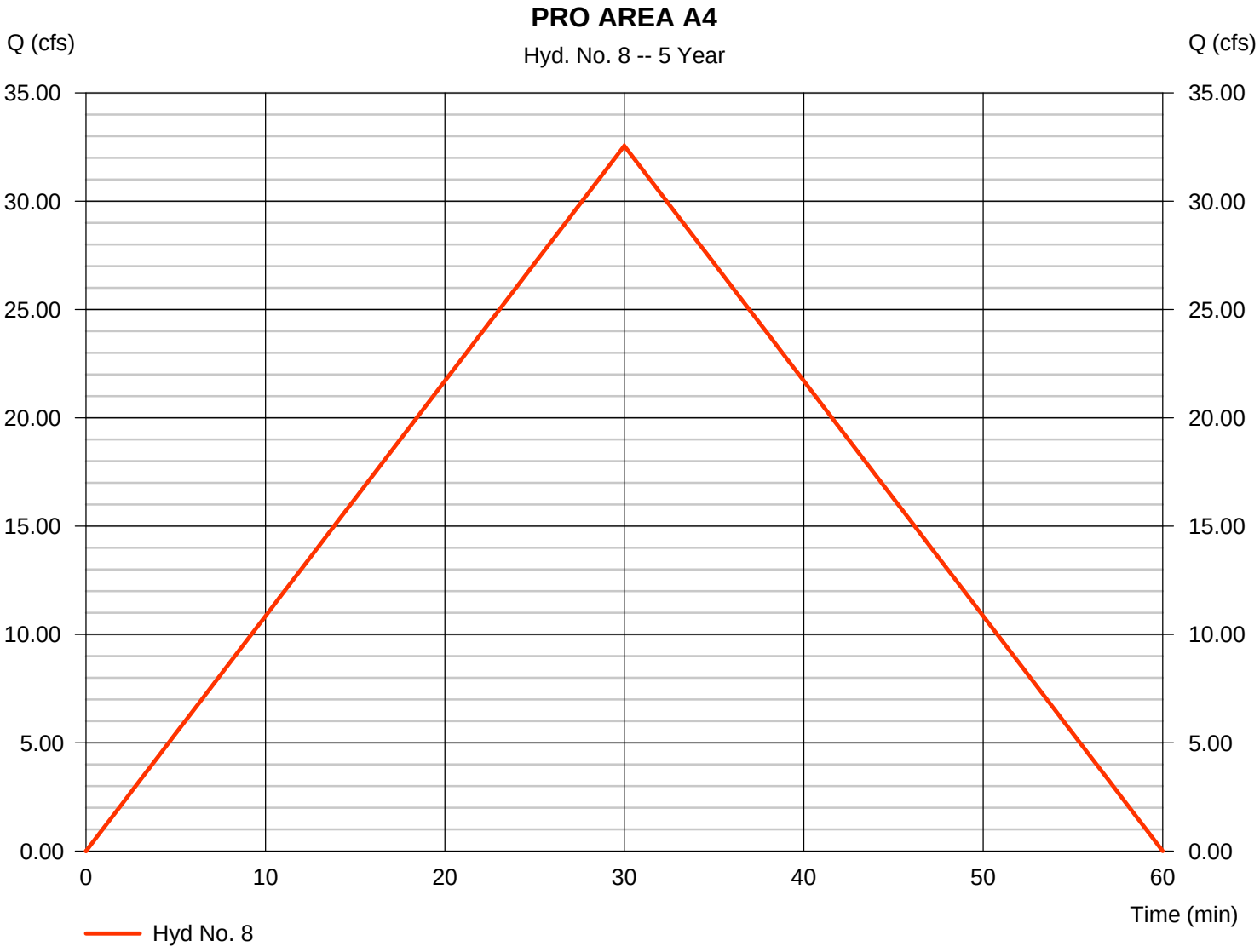
Hydrograph Report

Hyd. No. 8

PRO AREA A4

Hydrograph type	=	Rational	Peak discharge	=	32.56 cfs
Storm frequency	=	5 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	58,599 cuft
Drainage area	=	15.960 ac	Runoff coeff.	=	0.62*
Intensity	=	3.290 in/hr	Tc by TR55	=	30.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(6.540 x 0.90) + (0.660 x 0.85) + (8.660 x 0.40)] / 15.960

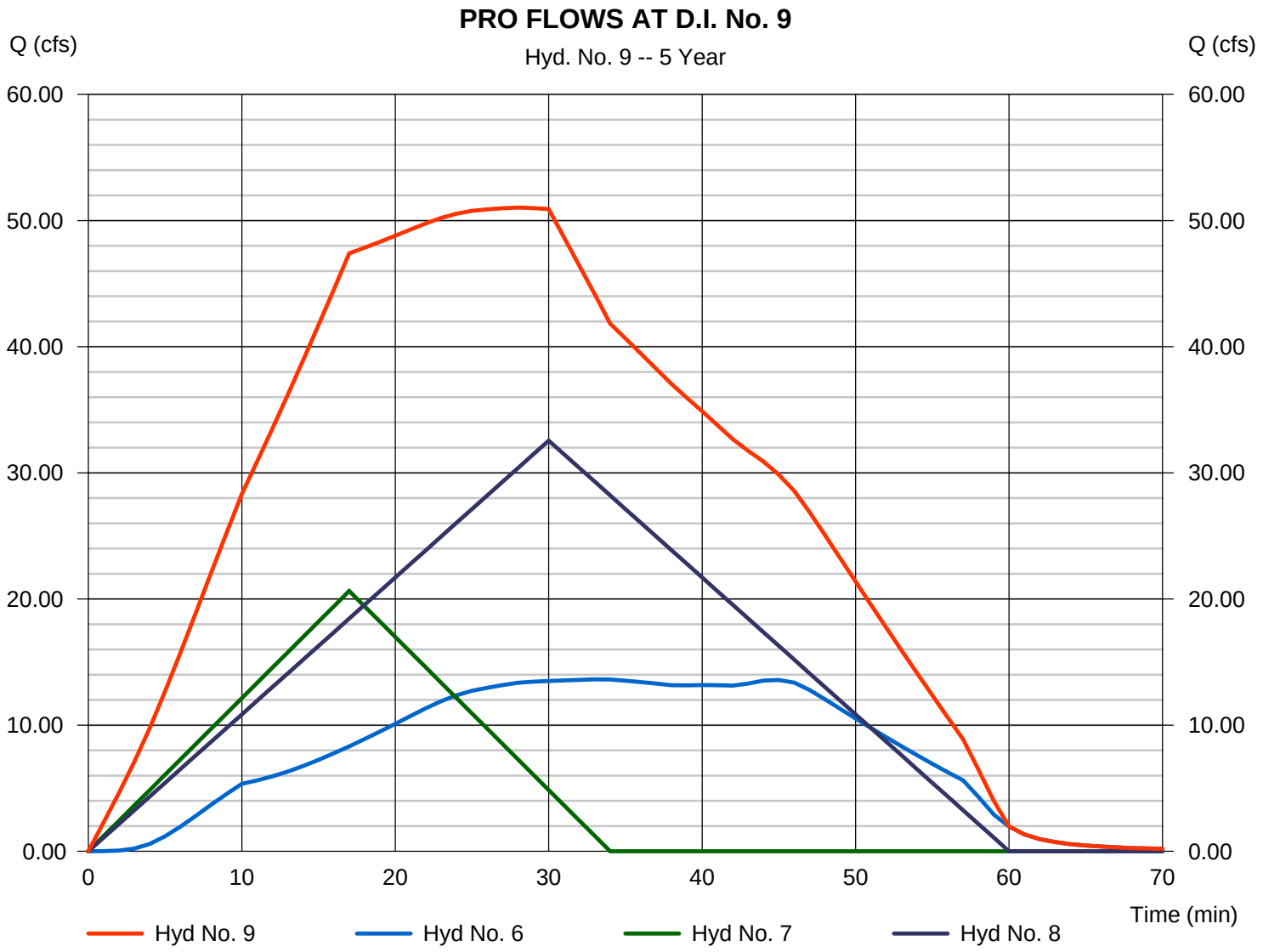


Hydrograph Report

Hyd. No. 9

PRO FLOWS AT D.I. No. 9

Hydrograph type	= Combine	Peak discharge	= 51.03 cfs
Storm frequency	= 5 yrs	Time to peak	= 28 min
Time interval	= 1 min	Hyd. volume	= 112,879 cuft
Inflow hyds.	= 6, 7, 8	Contrib. drain. area	= 22.260 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	48.01	1	25	72,015	------	------	------	EX. AREA A1
2	Rational	23.05	1	17	23,513	------	------	------	EX AREA A2
3	Combine	60.21	1	25	95,528	1, 2	------	------	EX FLOWS D.I. No. 9
4	Rational	13.54	1	22	17,874	------	------	------	EX AREAS A1 & A3 (POND)
5	Mod. Rational	15.73	1	22	38,824	------	------	------	PRO AREAS A1 & A3 (POND)
6	Reservoir	14.29	1	43	38,691	5	1297.23	5,684	POND FLOWS
7	Rational	23.05	1	17	23,513	------	------	------	EX AREA A2
8	Rational	36.61	1	30	65,902	------	------	------	PRO AREA A4
9	Combine	56.16	1	25	128,106	6, 7, 8	------	------	PRO FLOWS AT D.I. No. 9

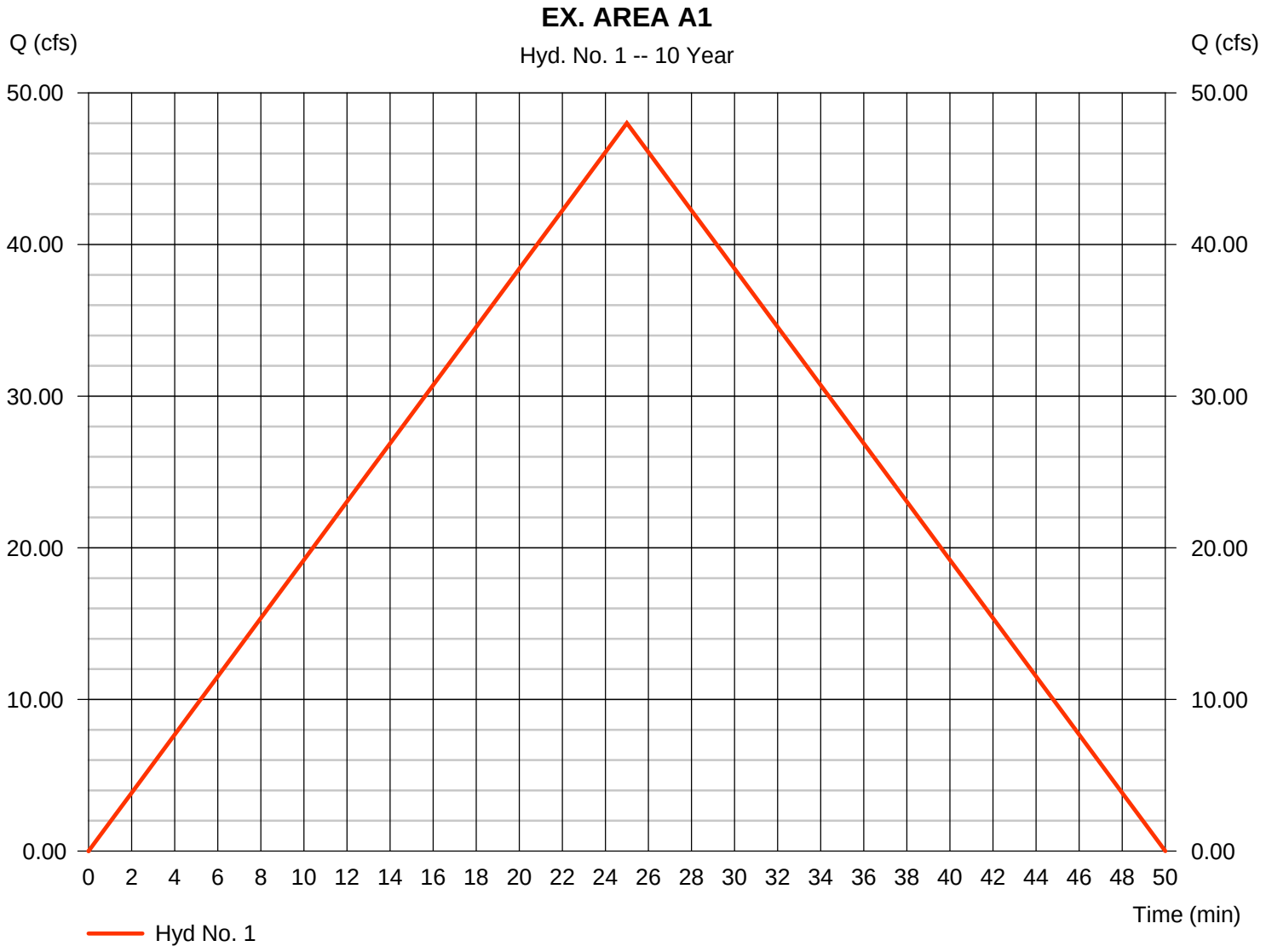
Hydrograph Report

Hyd. No. 1

EX. AREA A1

Hydrograph type	=	Rational	Peak discharge	=	48.01 cfs
Storm frequency	=	10 yrs	Time to peak	=	25 min
Time interval	=	1 min	Hyd. volume	=	72,015 cuft
Drainage area	=	22.690 ac	Runoff coeff.	=	0.52*
Intensity	=	4.069 in/hr	Tc by TR55	=	25.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.660 x 0.85) + (4.970 x 0.90) + (17.060 x 0.40)] / 22.690



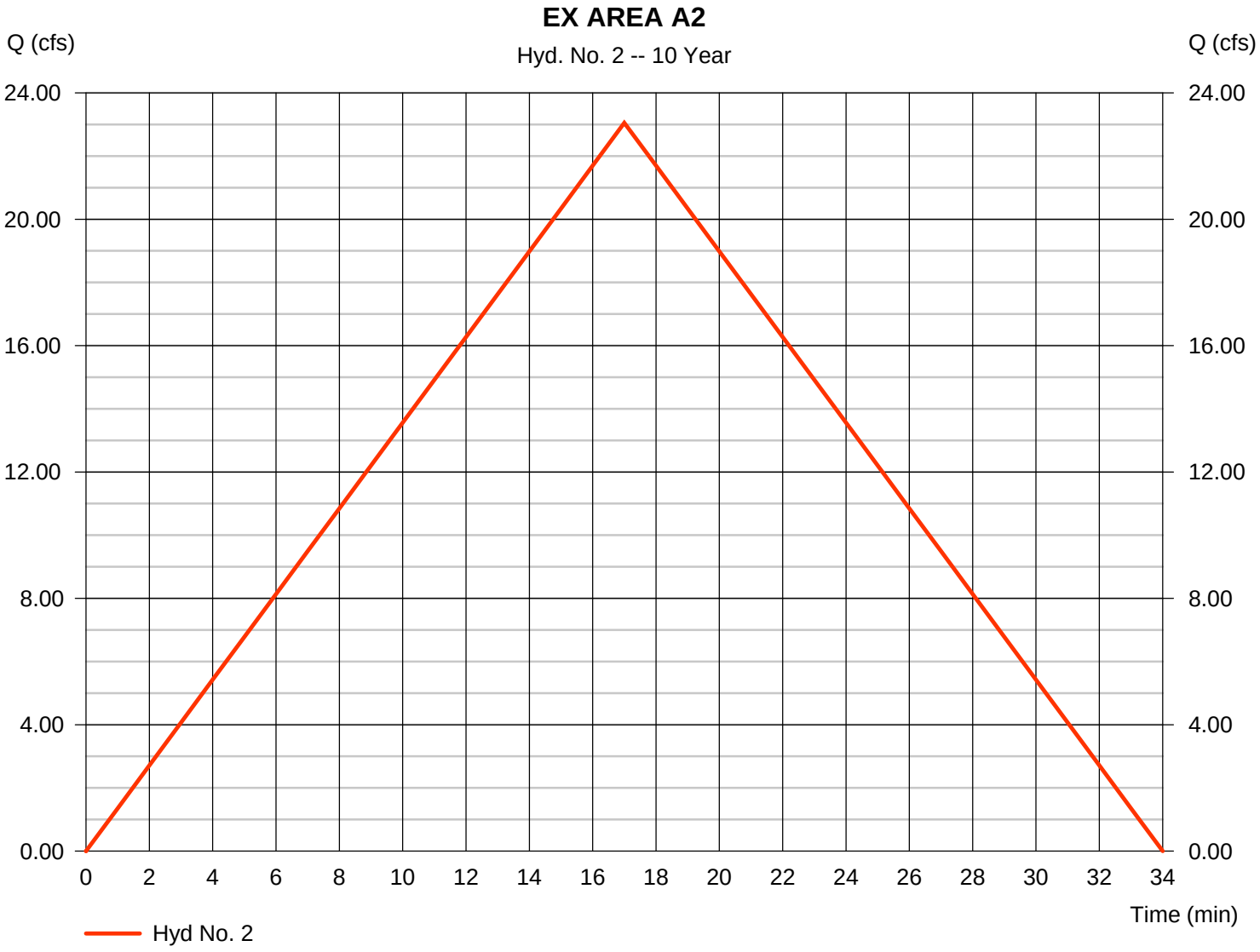
Hydrograph Report

Hyd. No. 2

EX AREA A2

Hydrograph type	=	Rational	Peak discharge	=	23.05 cfs
Storm frequency	=	10 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	23,513 cuft
Drainage area	=	6.300 ac	Runoff coeff.	=	0.75*
Intensity	=	4.879 in/hr	Tc by TR55	=	17.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(4.400 x 0.90) + (1.900 x 0.40)] / 6.300

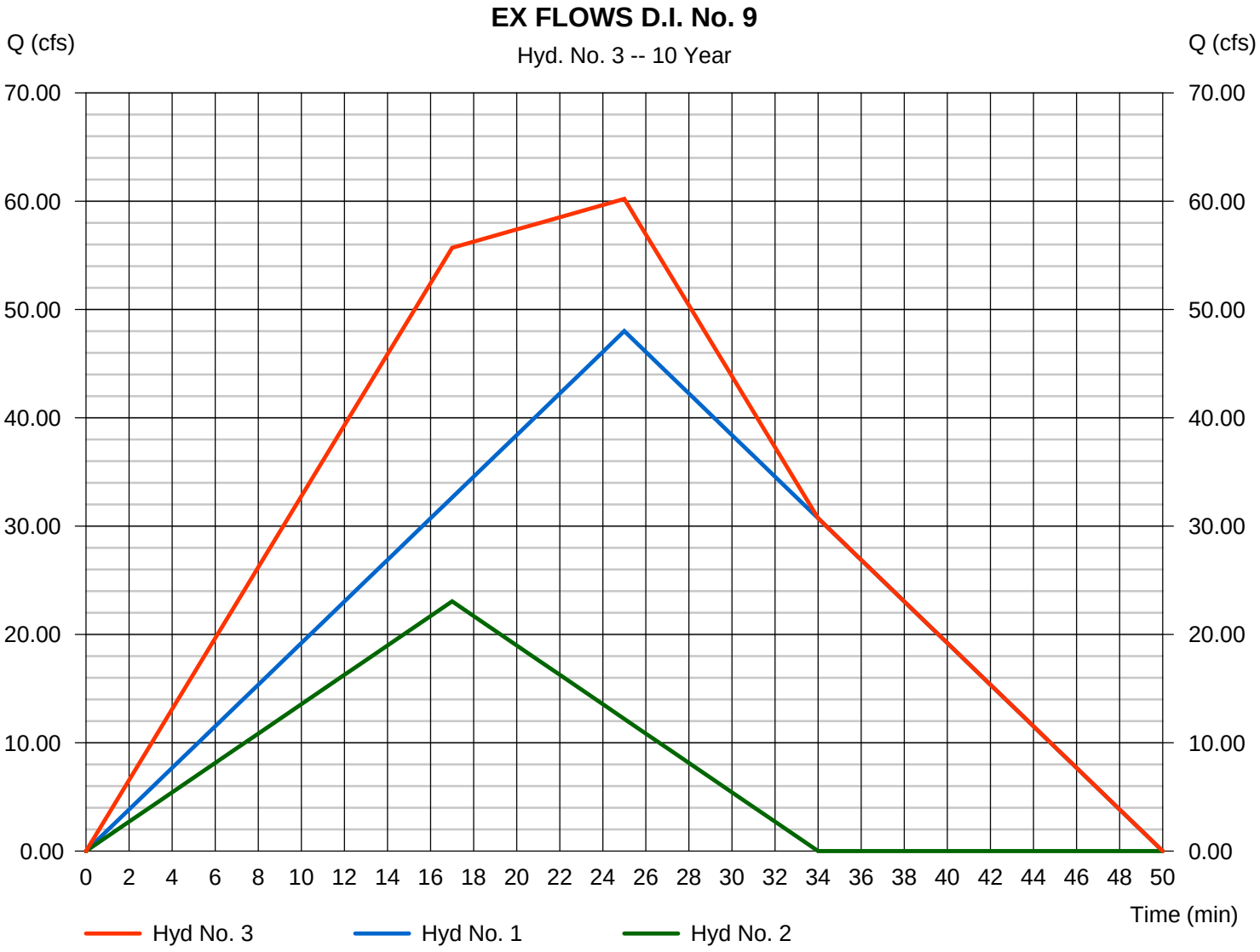


Hydrograph Report

Hyd. No. 3

EX FLOWS D.I. No. 9

Hydrograph type	= Combine	Peak discharge	= 60.21 cfs
Storm frequency	= 10 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 95,528 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 28.990 ac

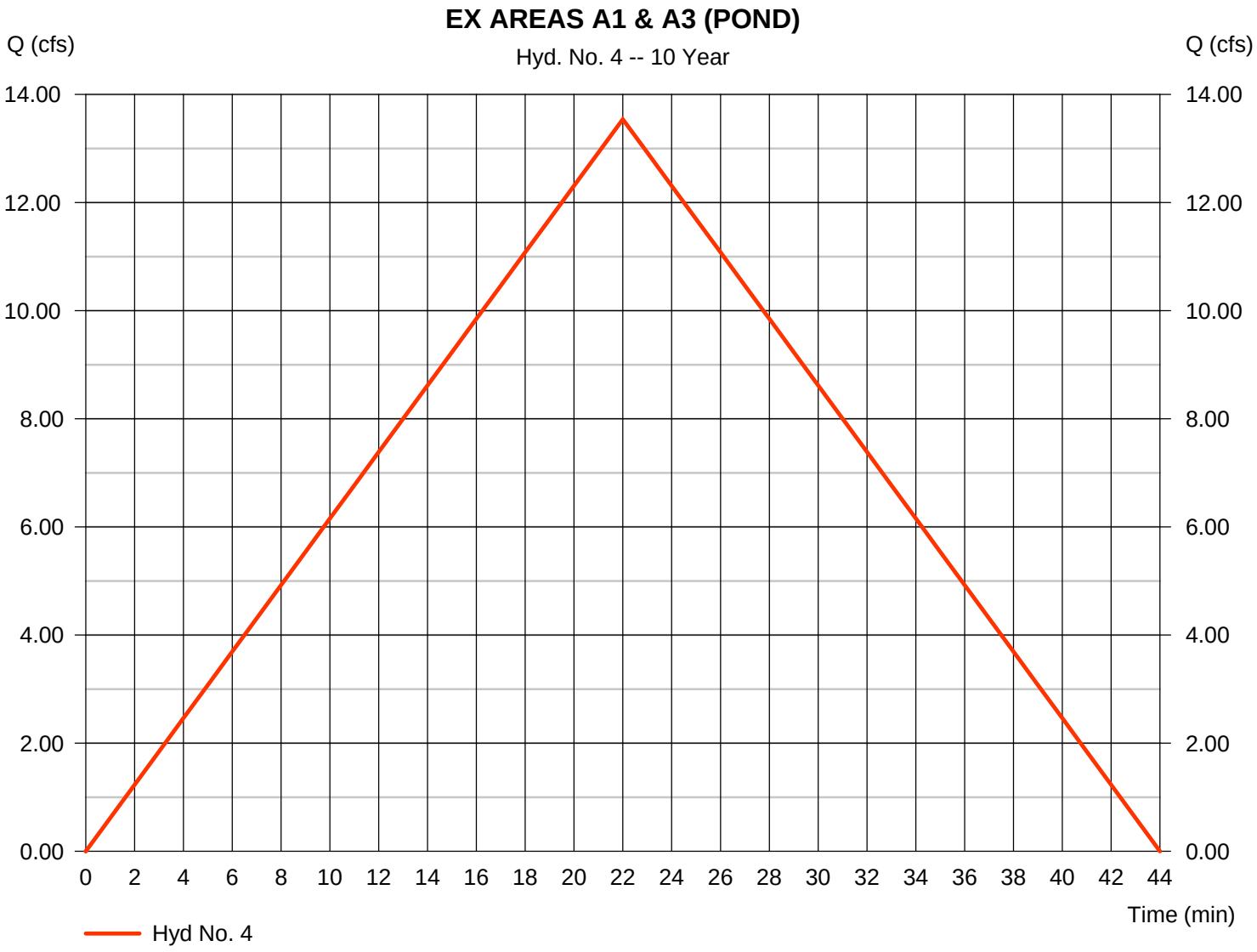


Hydrograph Report

Hyd. No. 4

EX AREAS A1 & A3 (POND)

Hydrograph type	=	Rational	Peak discharge	=	13.54 cfs
Storm frequency	=	10 yrs	Time to peak	=	22 min
Time interval	=	1 min	Hyd. volume	=	17,874 cuft
Drainage area	=	7.810 ac	Runoff coeff.	=	0.4
Intensity	=	4.334 in/hr	Tc by TR55	=	22.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1



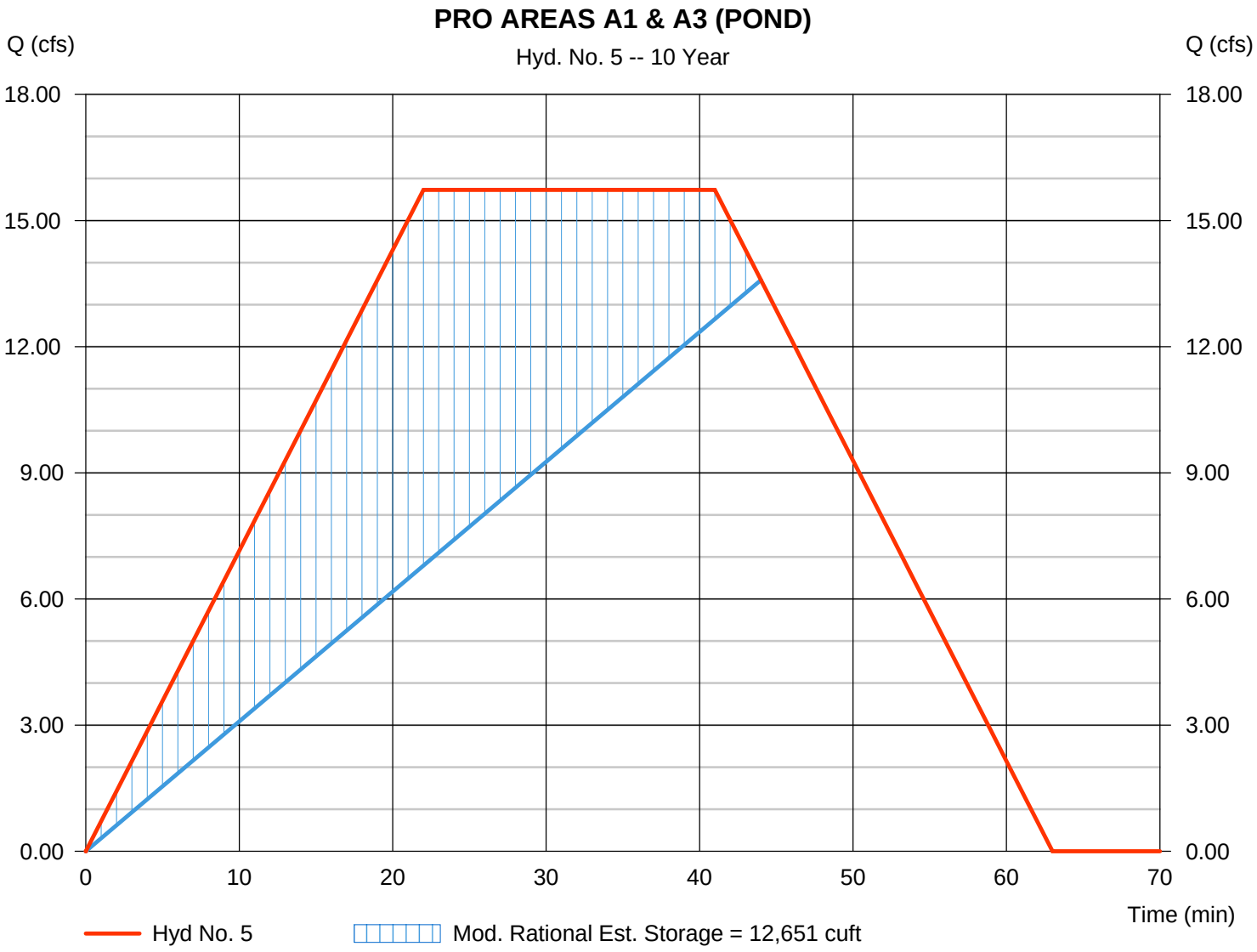
Hydrograph Report

Hyd. No. 5

PRO AREAS A1 & A3 (POND)

Hydrograph type	= Mod. Rational	Peak discharge	= 15.73 cfs
Storm frequency	= 10 yrs	Time to peak	= 22 min
Time interval	= 1 min	Hyd. volume	= 38,824 cuft
Drainage area	= 7.810 ac	Runoff coeff.	= 0.65*
Intensity	= 3.098 in/hr	Tc by TR55	= 22.00 min
IDF Curve	= TontitownIDF.IDF	Storm duration	= 1.9 x Tc
Target Q	=13.71 cfs	Est. Req'd Storage	=12,651 cuft

* Composite (Area/C) = [(4.020 x 0.90) + (3.890 x 0.40)] / 7.810



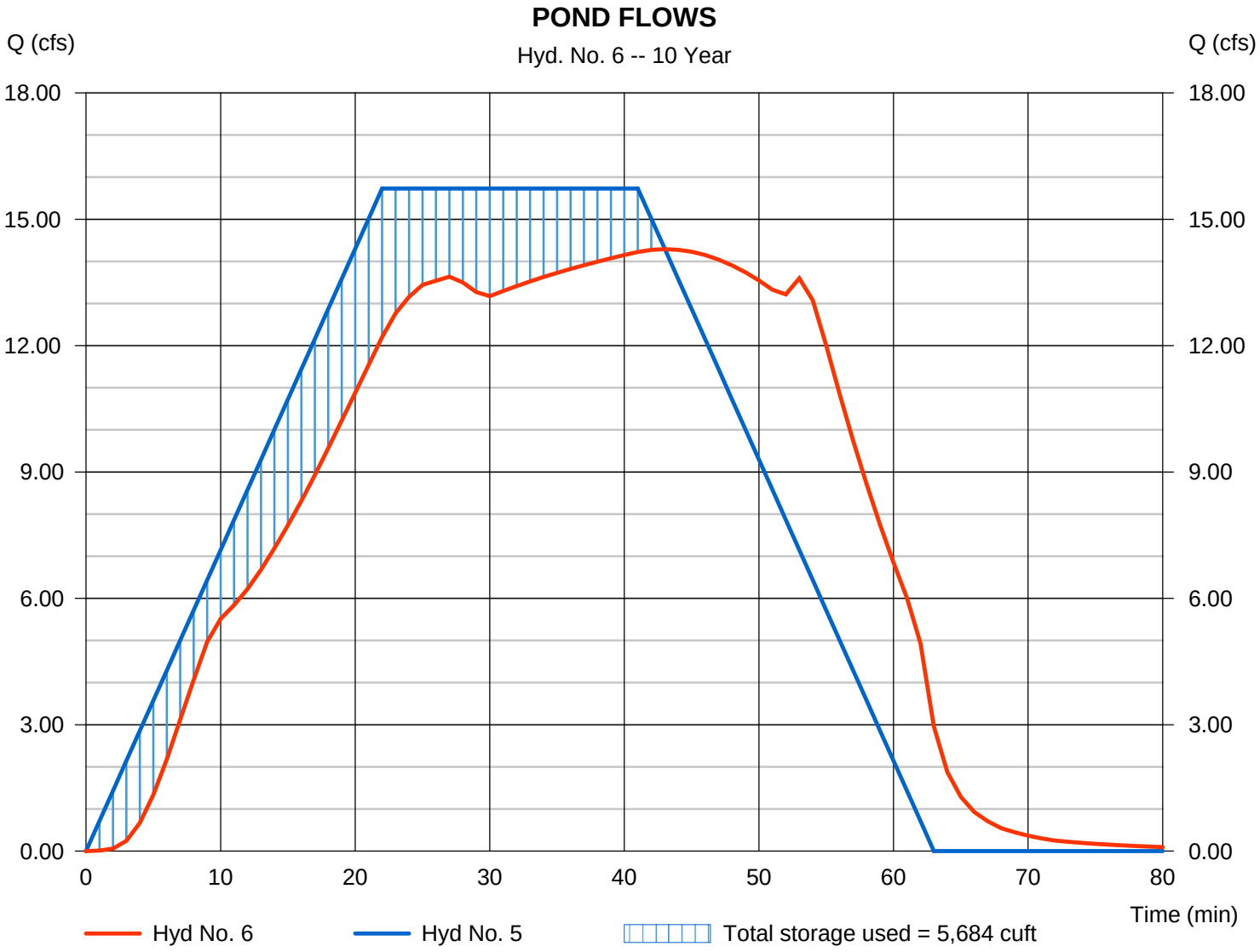
Hydrograph Report

Hyd. No. 6

POND FLOWS

Hydrograph type	=	Reservoir	Peak discharge	=	14.29 cfs
Storm frequency	=	10 yrs	Time to peak	=	43 min
Time interval	=	1 min	Hyd. volume	=	38,691 cuft
Inflow hyd. No.	=	5 - PRO AREAS A1 & A3 (POND)	Max. Elevation	=	1297.23 ft
Reservoir name	=	Pond - Contours	Max. Storage	=	5,684 cuft

Storage Indication method used.



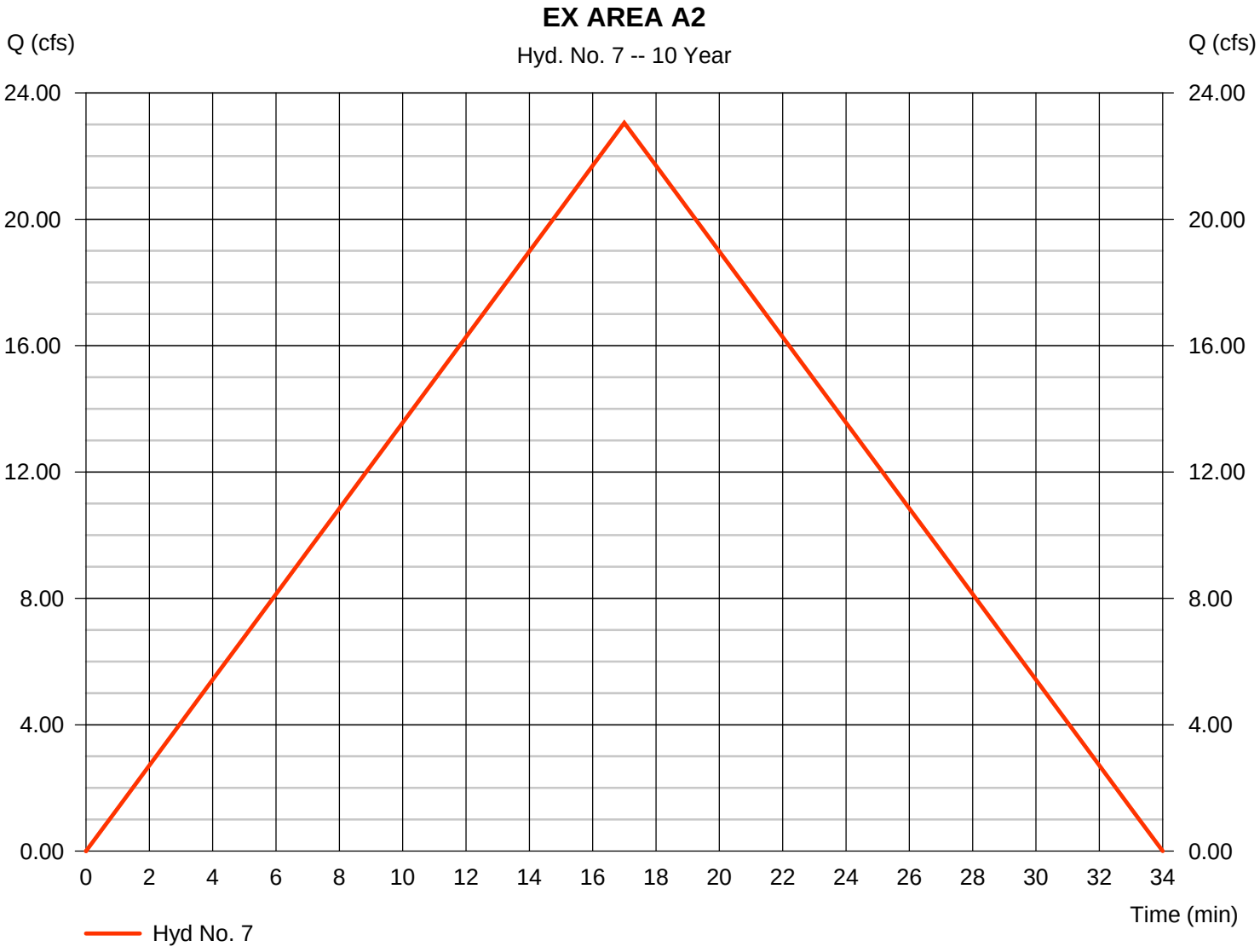
Hydrograph Report

Hyd. No. 7

EX AREA A2

Hydrograph type	=	Rational	Peak discharge	=	23.05 cfs
Storm frequency	=	10 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	23,513 cuft
Drainage area	=	6.300 ac	Runoff coeff.	=	0.75*
Intensity	=	4.879 in/hr	Tc by TR55	=	17.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(4.400 x 0.90) + (1.900 x 0.40)] / 6.300



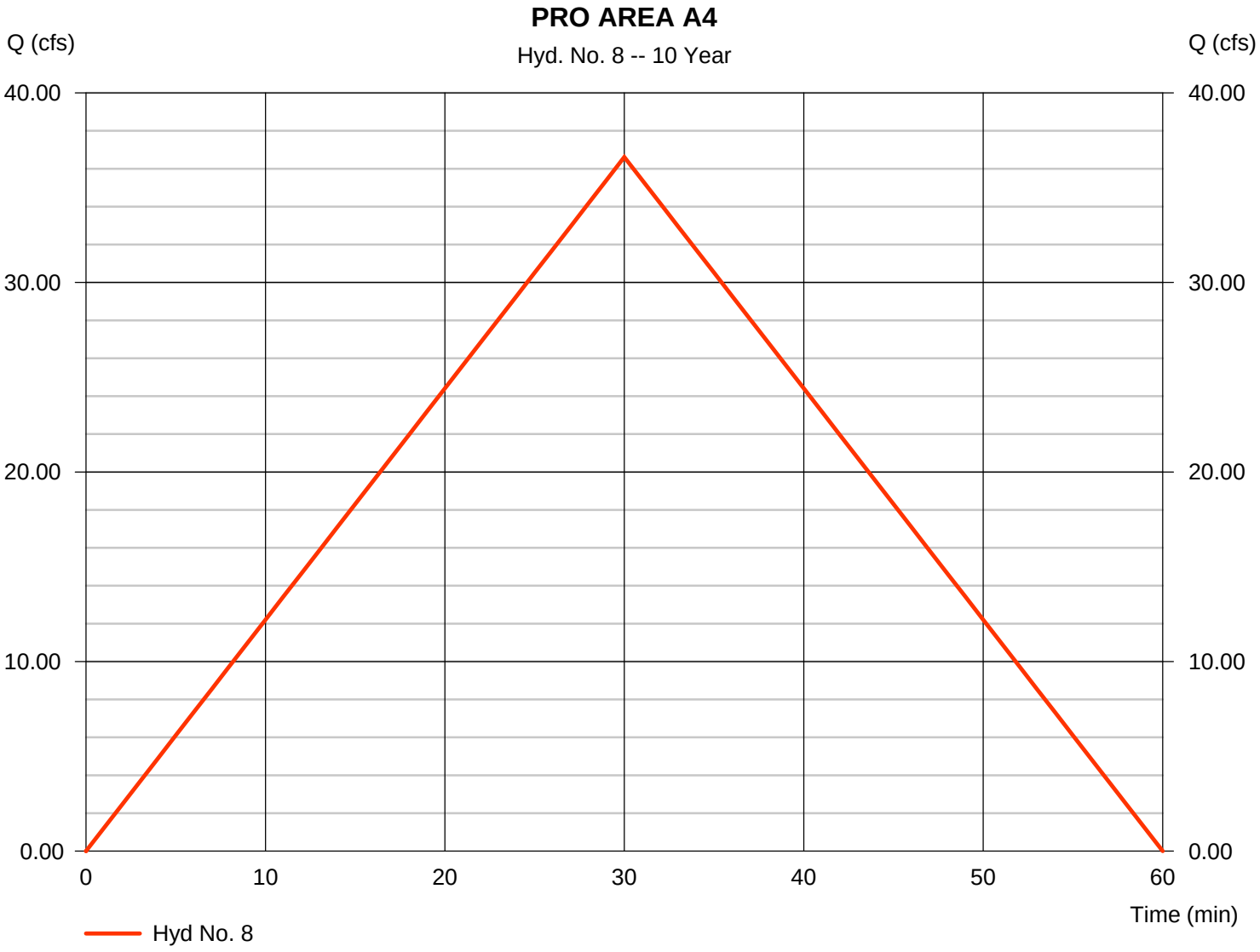
Hydrograph Report

Hyd. No. 8

PRO AREA A4

Hydrograph type	=	Rational	Peak discharge	=	36.61 cfs
Storm frequency	=	10 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	65,902 cuft
Drainage area	=	15.960 ac	Runoff coeff.	=	0.62*
Intensity	=	3.700 in/hr	Tc by TR55	=	30.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(6.540 x 0.90) + (0.660 x 0.85) + (8.660 x 0.40)] / 15.960

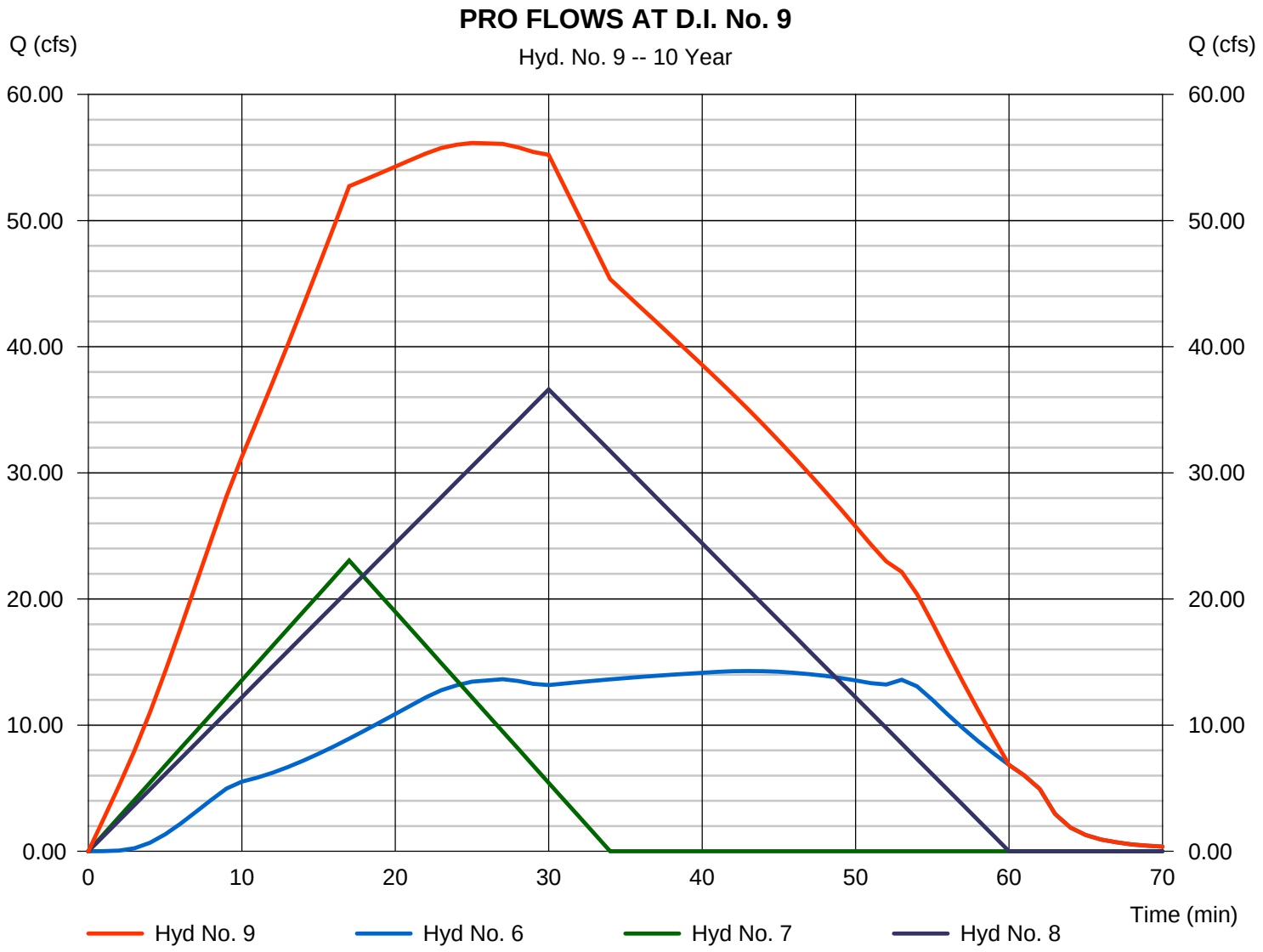


Hydrograph Report

Hyd. No. 9

PRO FLOWS AT D.I. No. 9

Hydrograph type	=	Combine	Peak discharge	=	56.16 cfs
Storm frequency	=	10 yrs	Time to peak	=	25 min
Time interval	=	1 min	Hyd. volume	=	128,106 cuft
Inflow hyds.	=	6, 7, 8	Contrib. drain. area	=	22.260 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	55.53	1	25	83,290	------	------	------	EX. AREA A1
2	Rational	26.55	1	17	27,086	------	------	------	EX AREA A2
3	Combine	69.58	1	25	110,376	1, 2	------	------	EX FLOWS D.I. No. 9
4	Rational	15.64	1	22	20,641	------	------	------	EX AREAS A1 & A3 (POND)
5	Mod. Rational	18.33	1	22	45,254	------	------	------	PRO AREAS A1 & A3 (POND)
6	Reservoir	16.07	1	44	45,099	5	1297.61	8,143	POND FLOWS
7	Rational	26.55	1	17	27,086	------	------	------	EX AREA A2
8	Rational	42.45	1	30	76,411	------	------	------	PRO AREA A4
9	Combine	63.42	1	22	148,595	6, 7, 8	------	------	PRO FLOWS AT D.I. No. 9

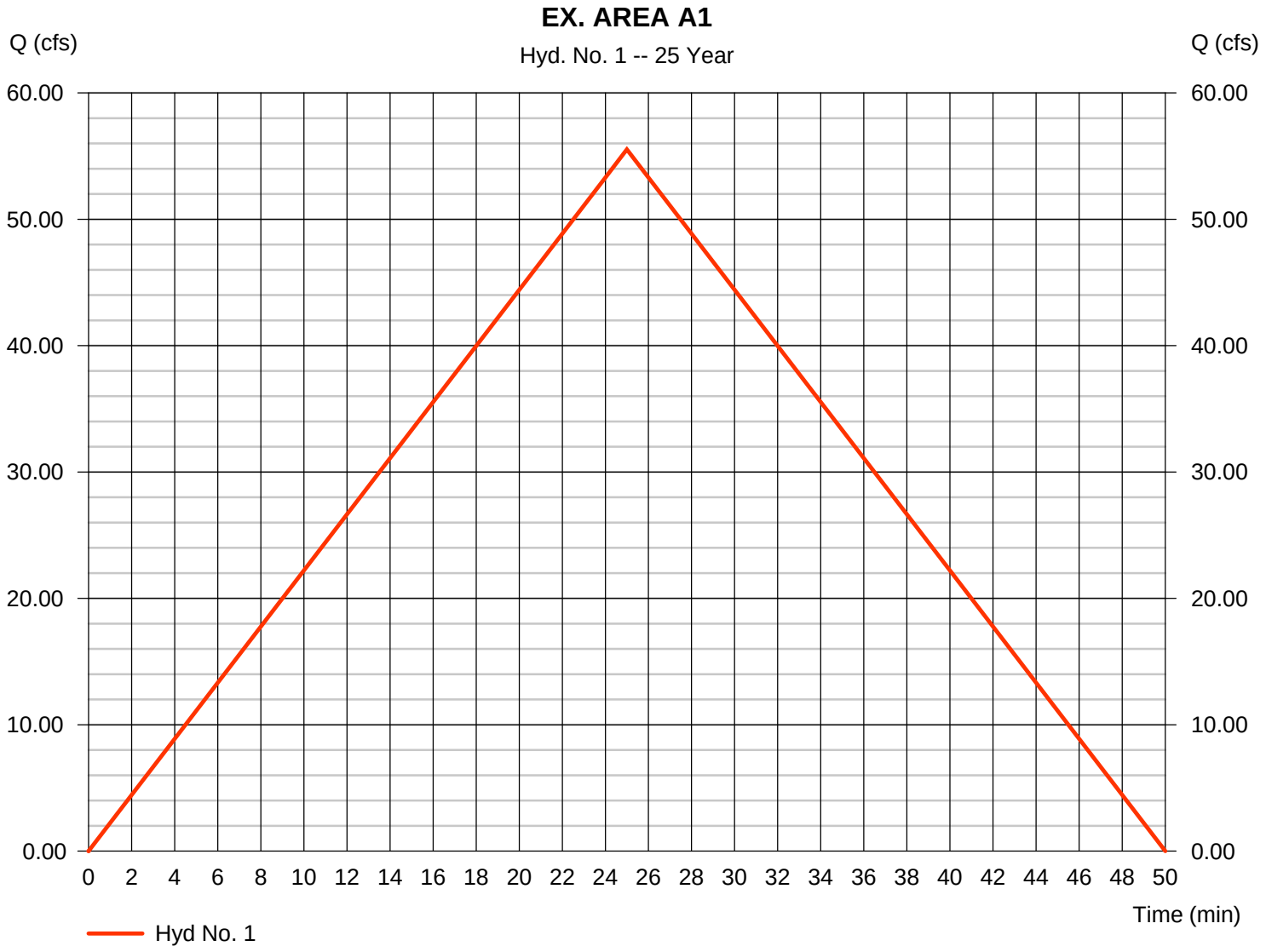
Hydrograph Report

Hyd. No. 1

EX. AREA A1

Hydrograph type	=	Rational	Peak discharge	=	55.53 cfs
Storm frequency	=	25 yrs	Time to peak	=	25 min
Time interval	=	1 min	Hyd. volume	=	83,290 cuft
Drainage area	=	22.690 ac	Runoff coeff.	=	0.52*
Intensity	=	4.706 in/hr	Tc by TR55	=	25.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.660 x 0.85) + (4.970 x 0.90) + (17.060 x 0.40)] / 22.690



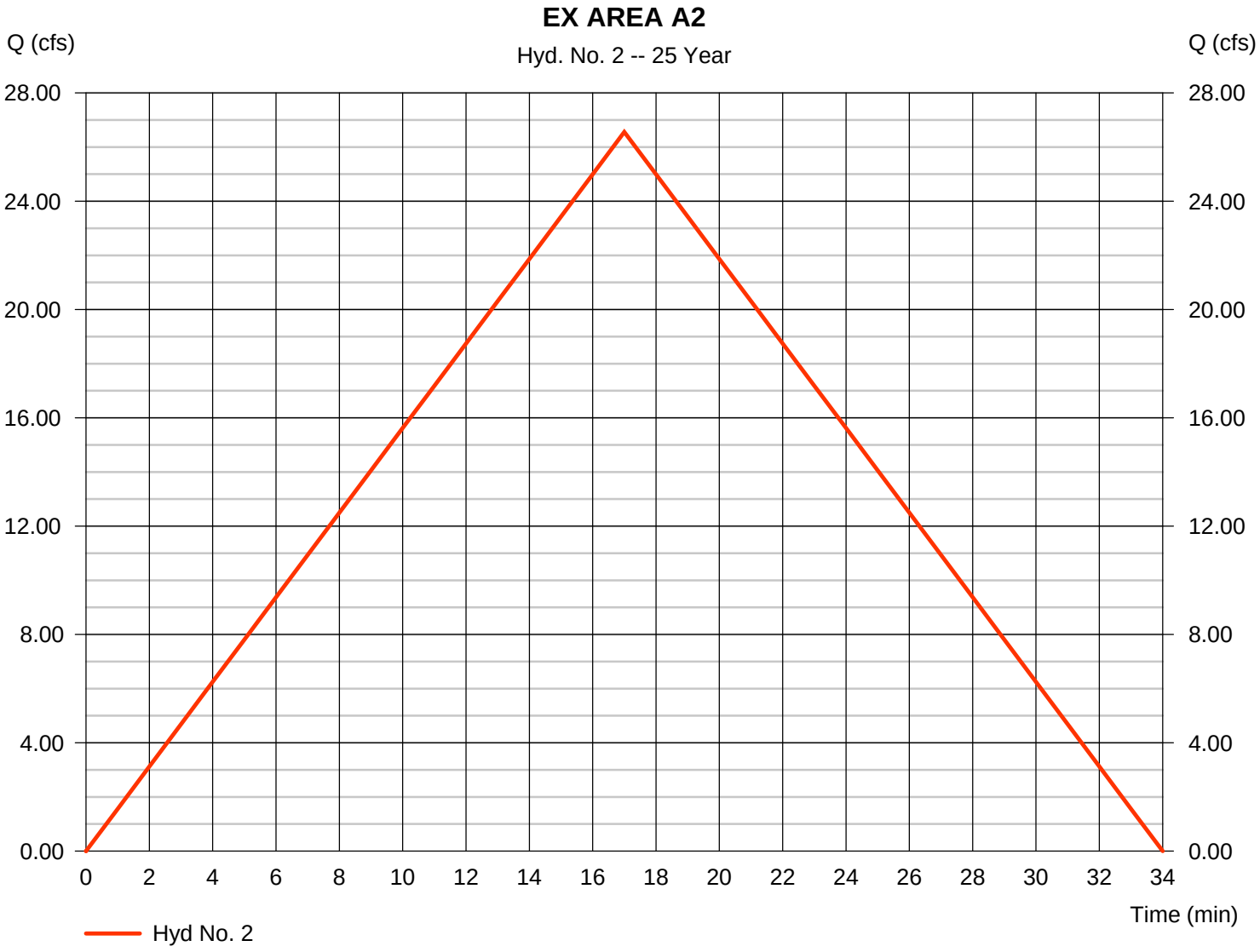
Hydrograph Report

Hyd. No. 2

EX AREA A2

Hydrograph type	=	Rational	Peak discharge	=	26.55 cfs
Storm frequency	=	25 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	27,086 cuft
Drainage area	=	6.300 ac	Runoff coeff.	=	0.75*
Intensity	=	5.620 in/hr	Tc by TR55	=	17.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(4.400 x 0.90) + (1.900 x 0.40)] / 6.300

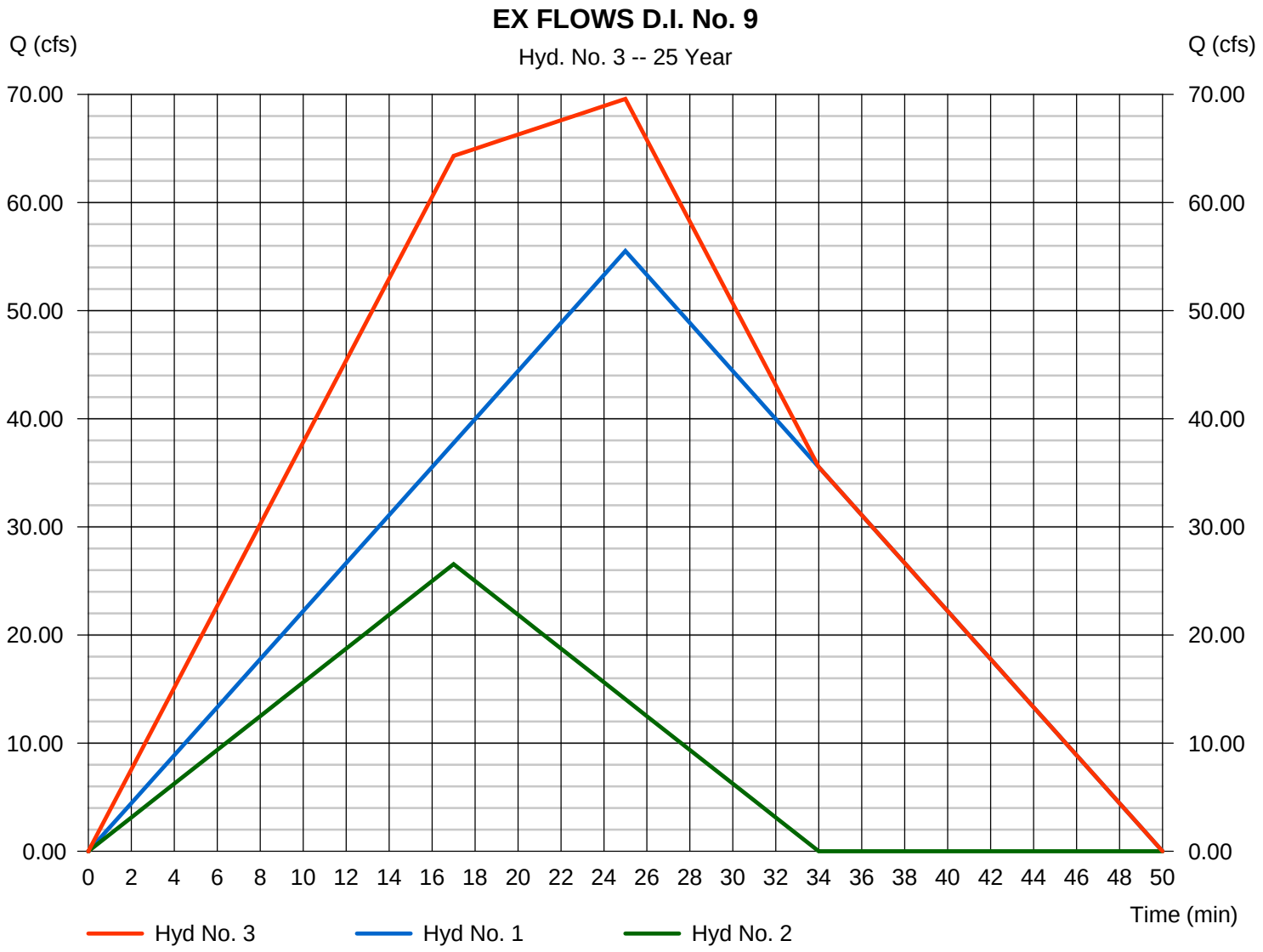


Hydrograph Report

Hyd. No. 3

EX FLOWS D.I. No. 9

Hydrograph type	= Combine	Peak discharge	= 69.58 cfs
Storm frequency	= 25 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 110,376 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 28.990 ac

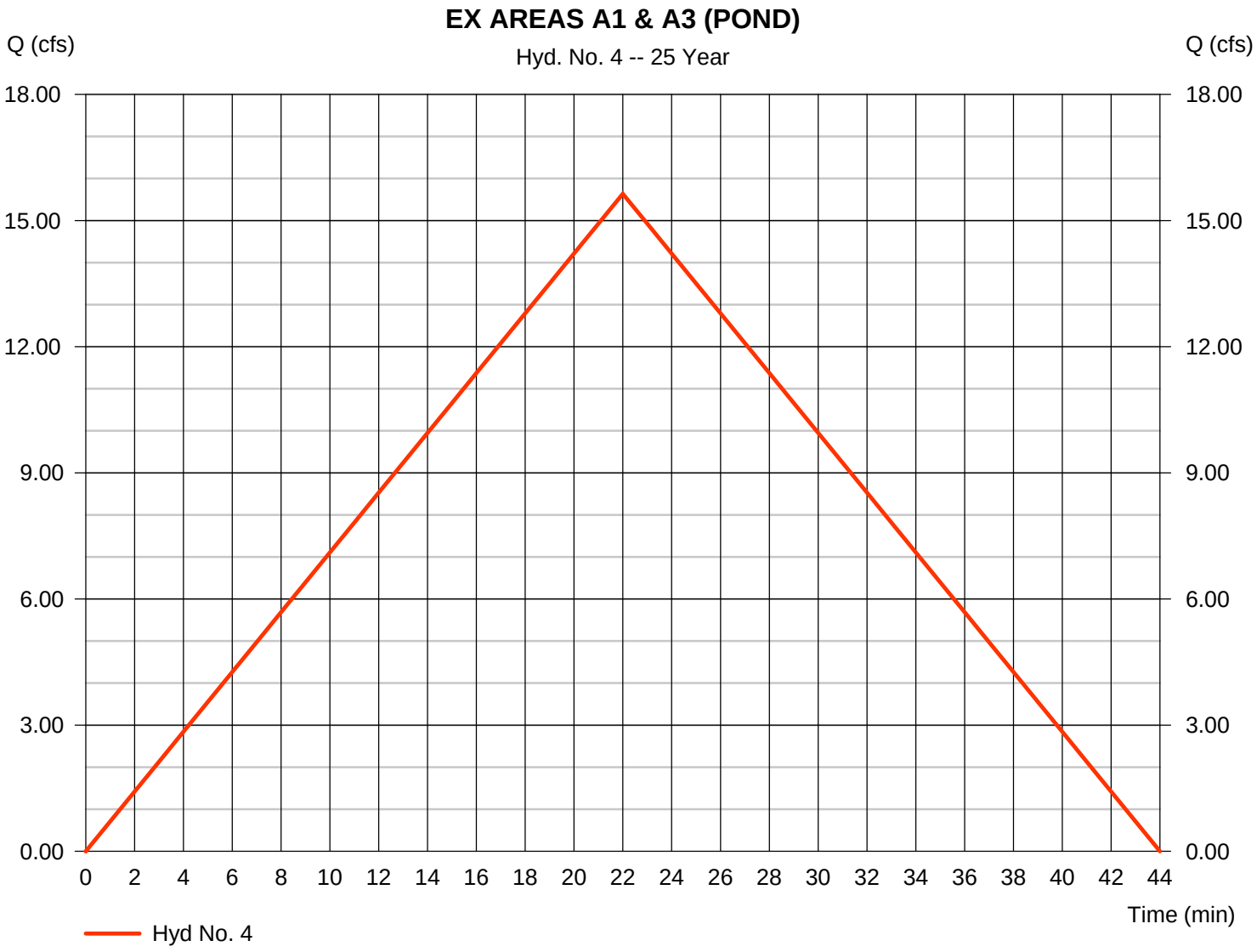


Hydrograph Report

Hyd. No. 4

EX AREAS A1 & A3 (POND)

Hydrograph type	=	Rational	Peak discharge	=	15.64 cfs
Storm frequency	=	25 yrs	Time to peak	=	22 min
Time interval	=	1 min	Hyd. volume	=	20,641 cuft
Drainage area	=	7.810 ac	Runoff coeff.	=	0.4
Intensity	=	5.005 in/hr	Tc by TR55	=	22.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1



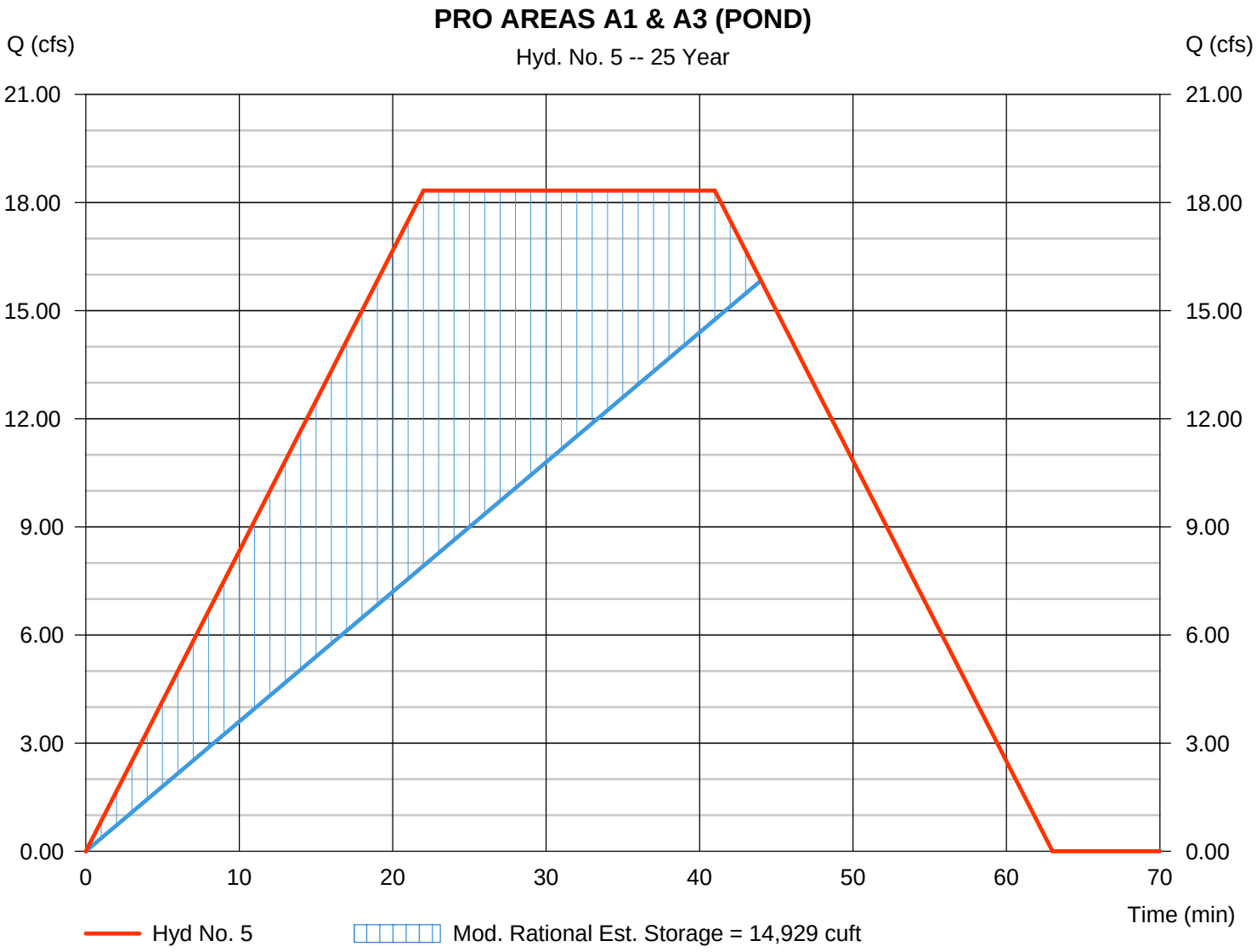
Hydrograph Report

Hyd. No. 5

PRO AREAS A1 & A3 (POND)

Hydrograph type	= Mod. Rational	Peak discharge	= 18.33 cfs
Storm frequency	= 25 yrs	Time to peak	= 22 min
Time interval	= 1 min	Hyd. volume	= 45,254 cuft
Drainage area	= 7.810 ac	Runoff coeff.	= 0.65*
Intensity	= 3.611 in/hr	Tc by TR55	= 22.00 min
IDF Curve	= TontitownIDF.IDF	Storm duration	= 1.9 x Tc
Target Q	=15.84 cfs	Est. Req'd Storage	=14,929 cuft

* Composite (Area/C) = [(4.020 x 0.90) + (3.890 x 0.40)] / 7.810



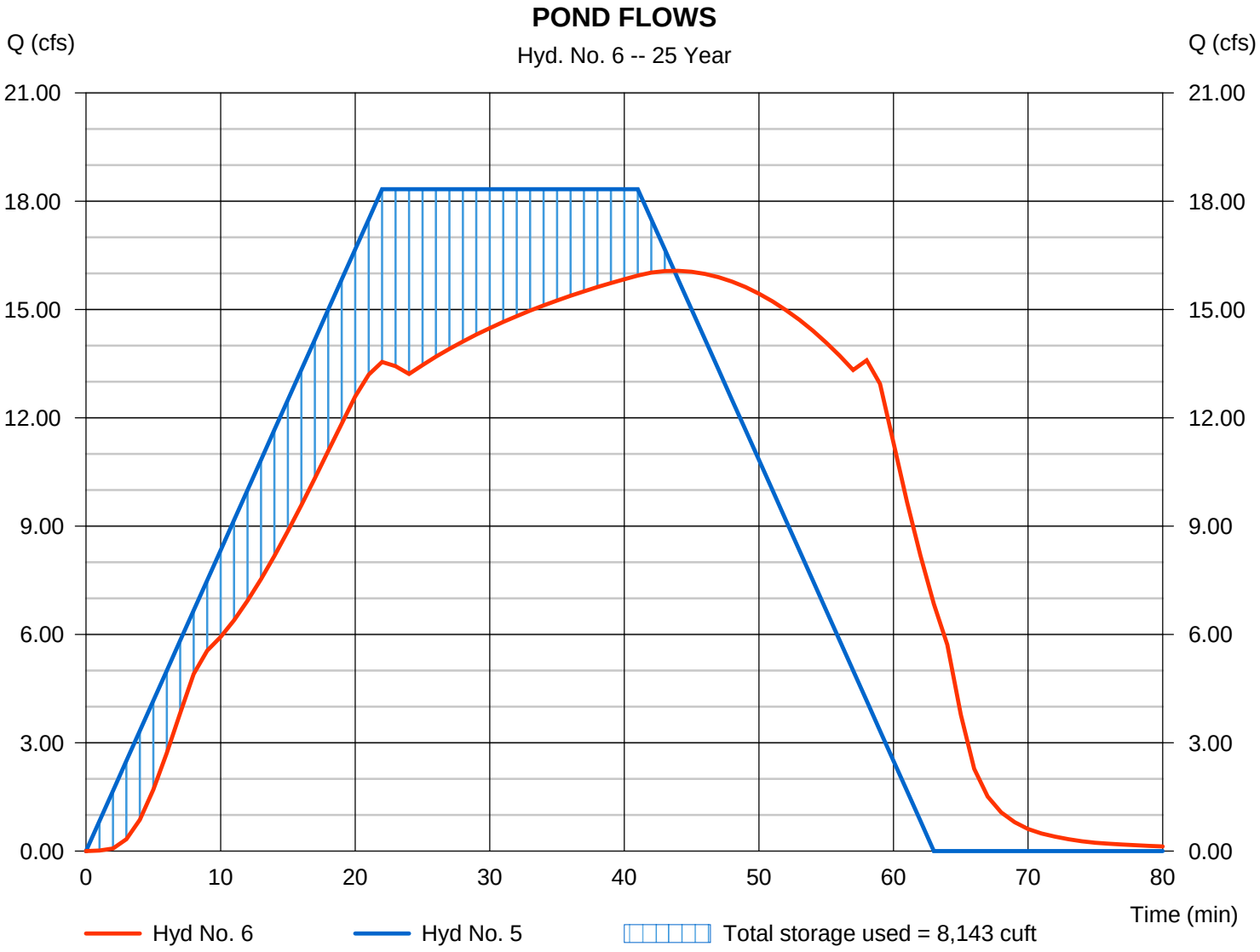
Hydrograph Report

Hyd. No. 6

POND FLOWS

Hydrograph type	=	Reservoir	Peak discharge	=	16.07 cfs
Storm frequency	=	25 yrs	Time to peak	=	44 min
Time interval	=	1 min	Hyd. volume	=	45,099 cuft
Inflow hyd. No.	=	5 - PRO AREAS A1 & A3 (POND)	Max. Elevation	=	1297.61 ft
Reservoir name	=	Pond - Contours	Max. Storage	=	8,143 cuft

Storage Indication method used.



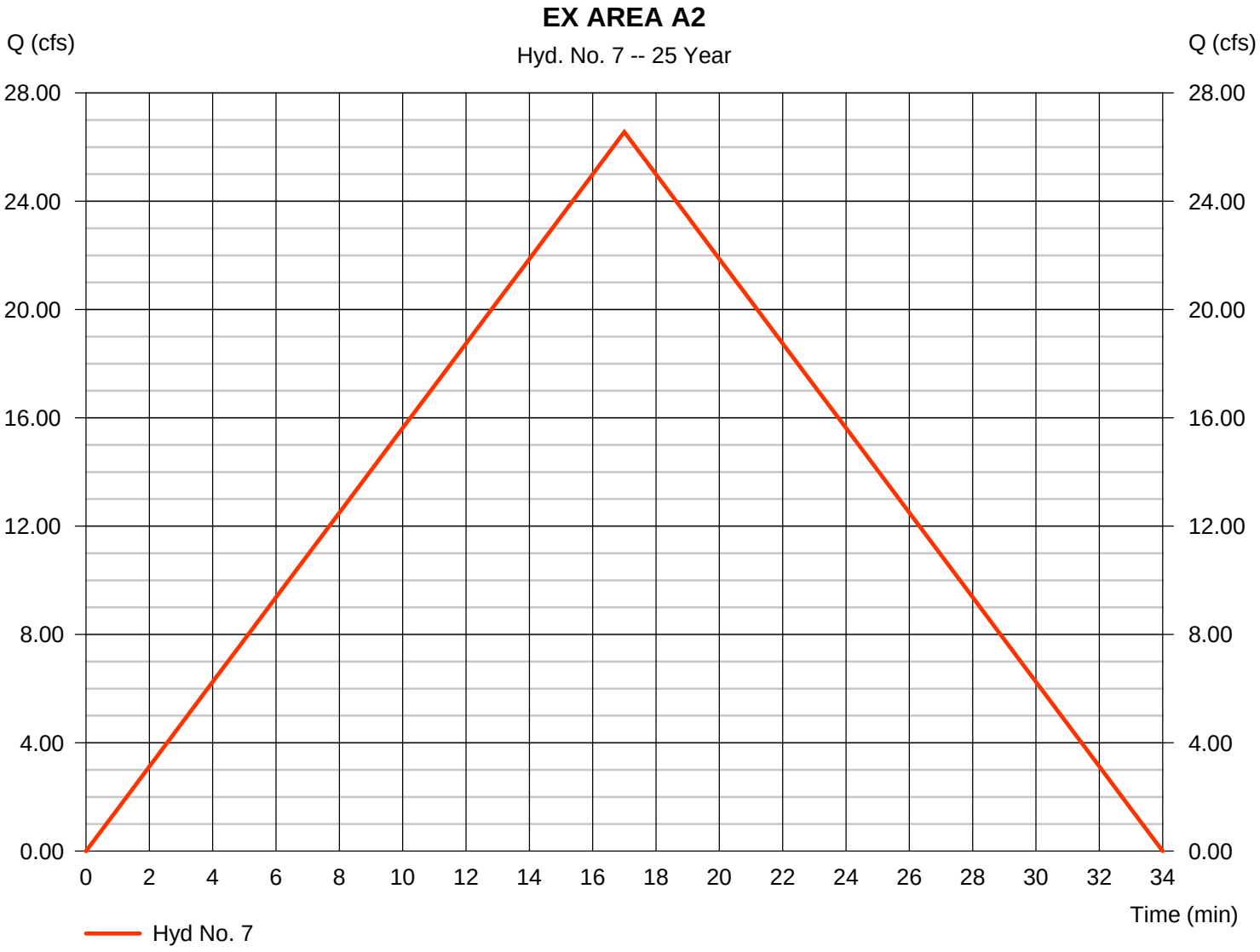
Hydrograph Report

Hyd. No. 7

EX AREA A2

Hydrograph type	=	Rational	Peak discharge	=	26.55 cfs
Storm frequency	=	25 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	27,086 cuft
Drainage area	=	6.300 ac	Runoff coeff.	=	0.75*
Intensity	=	5.620 in/hr	Tc by TR55	=	17.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(4.400 x 0.90) + (1.900 x 0.40)] / 6.300



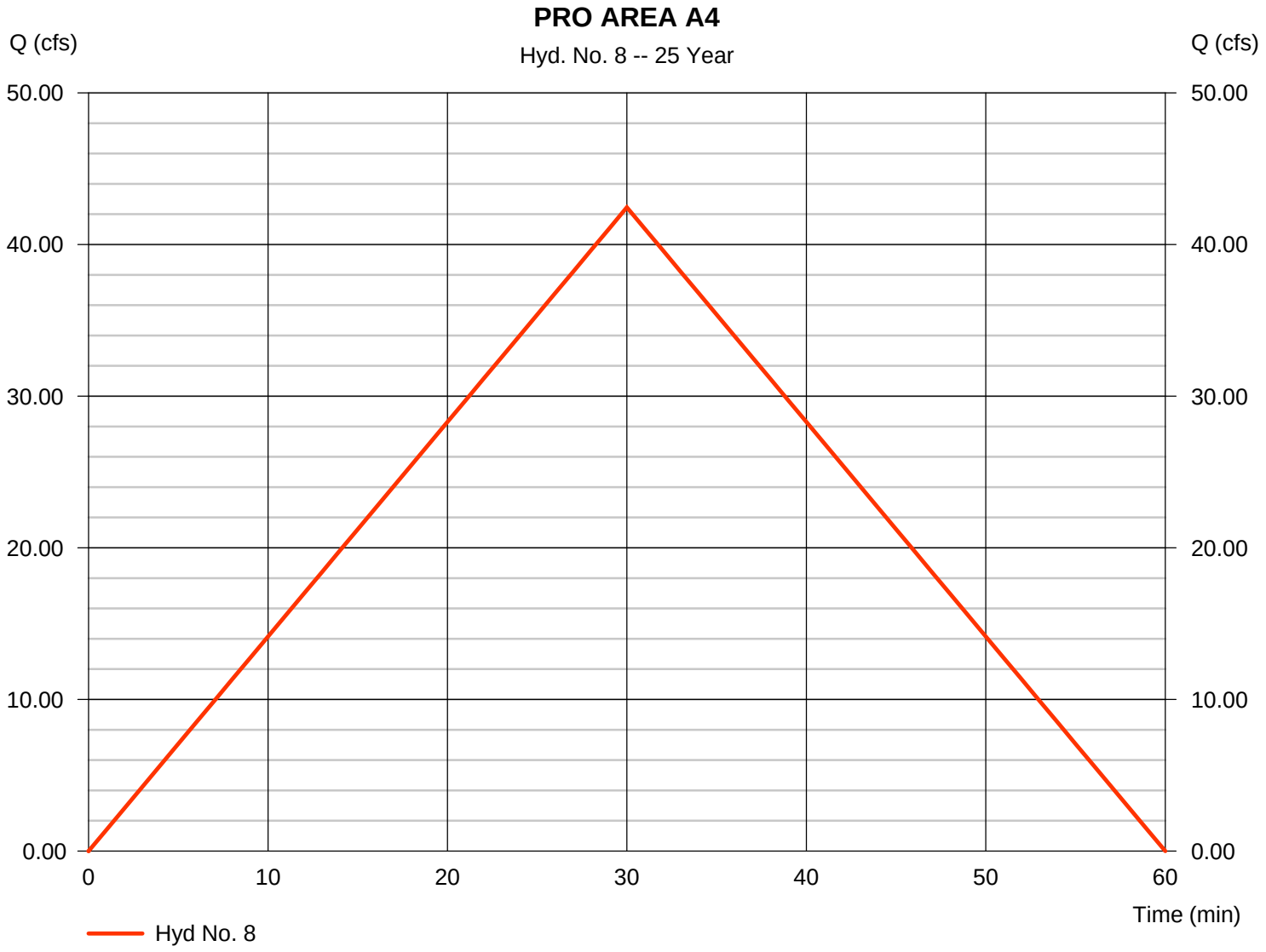
Hydrograph Report

Hyd. No. 8

PRO AREA A4

Hydrograph type	=	Rational	Peak discharge	=	42.45 cfs
Storm frequency	=	25 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	76,411 cuft
Drainage area	=	15.960 ac	Runoff coeff.	=	0.62*
Intensity	=	4.290 in/hr	Tc by TR55	=	30.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(6.540 x 0.90) + (0.660 x 0.85) + (8.660 x 0.40)] / 15.960

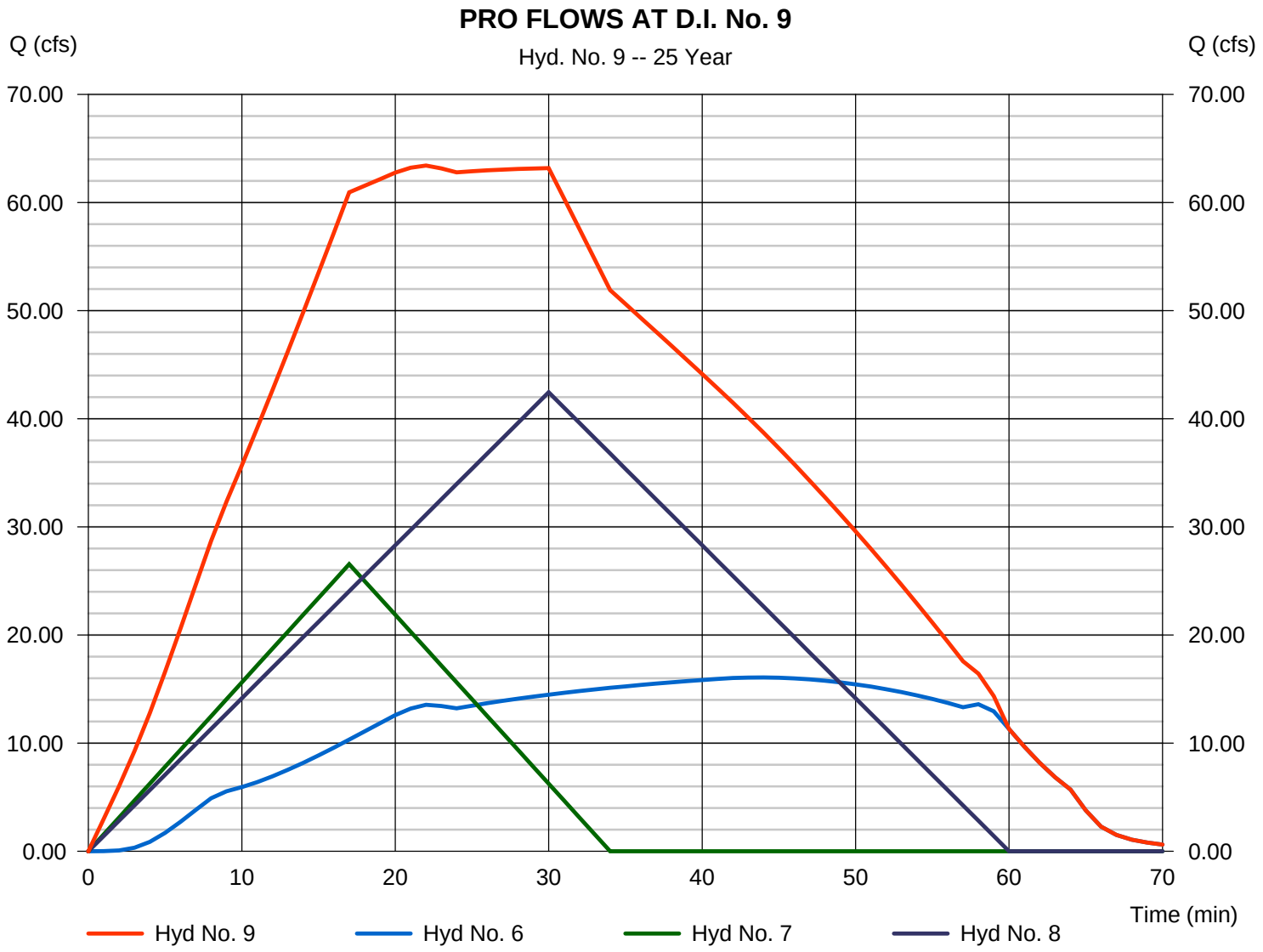


Hydrograph Report

Hyd. No. 9

PRO FLOWS AT D.I. No. 9

Hydrograph type	=	Combine	Peak discharge	=	63.42 cfs
Storm frequency	=	25 yrs	Time to peak	=	22 min
Time interval	=	1 min	Hyd. volume	=	148,595 cuft
Inflow hyds.	=	6, 7, 8	Contrib. drain. area	=	22.260 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	62.79	1	25	94,187	------	------	------	EX. AREA A1
2	Rational	29.93	1	17	30,527	------	------	------	EX AREA A2
3	Combine	78.64	1	25	124,715	1, 2	------	------	EX FLOWS D.I. No. 9
4	Rational	17.66	1	22	23,314	------	------	------	EX AREAS A1 & A3 (POND)
5	Mod. Rational	20.30	1	22	52,519	------	------	------	PRO AREAS A1 & A3 (POND)
6	Reservoir	17.55	1	46	52,372	5	1297.97	10,408	POND FLOWS
7	Rational	29.93	1	17	30,527	------	------	------	EX AREA A2
8	Rational	48.09	1	30	86,563	------	------	------	PRO AREA A4
9	Combine	70.54	1	30	169,462	6, 7, 8	------	------	PRO FLOWS AT D.I. No. 9

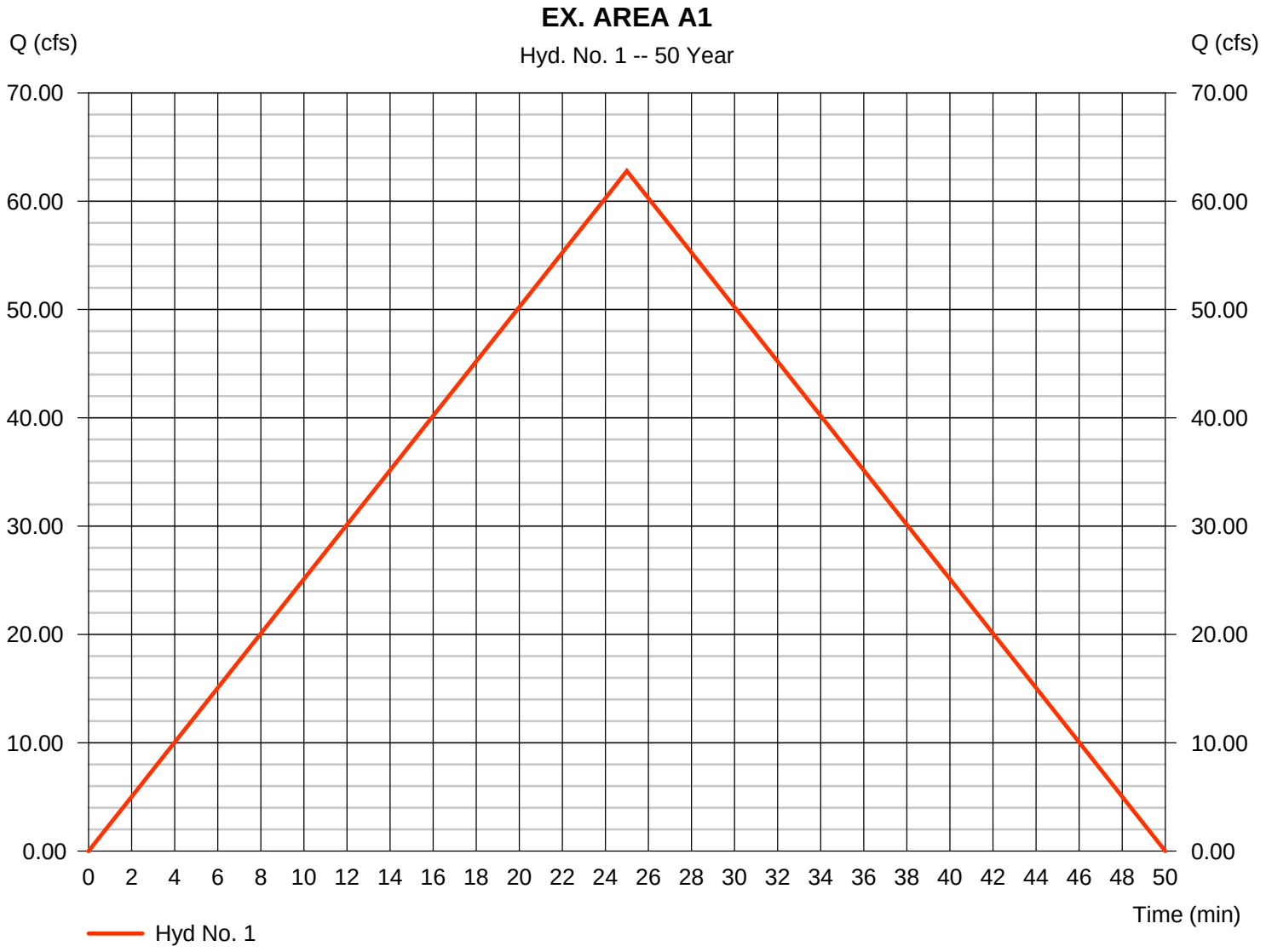
Hydrograph Report

Hyd. No. 1

EX. AREA A1

Hydrograph type	=	Rational	Peak discharge	=	62.79 cfs
Storm frequency	=	50 yrs	Time to peak	=	25 min
Time interval	=	1 min	Hyd. volume	=	94,187 cuft
Drainage area	=	22.690 ac	Runoff coeff.	=	0.52*
Intensity	=	5.322 in/hr	Tc by TR55	=	25.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.660 x 0.85) + (4.970 x 0.90) + (17.060 x 0.40)] / 22.690



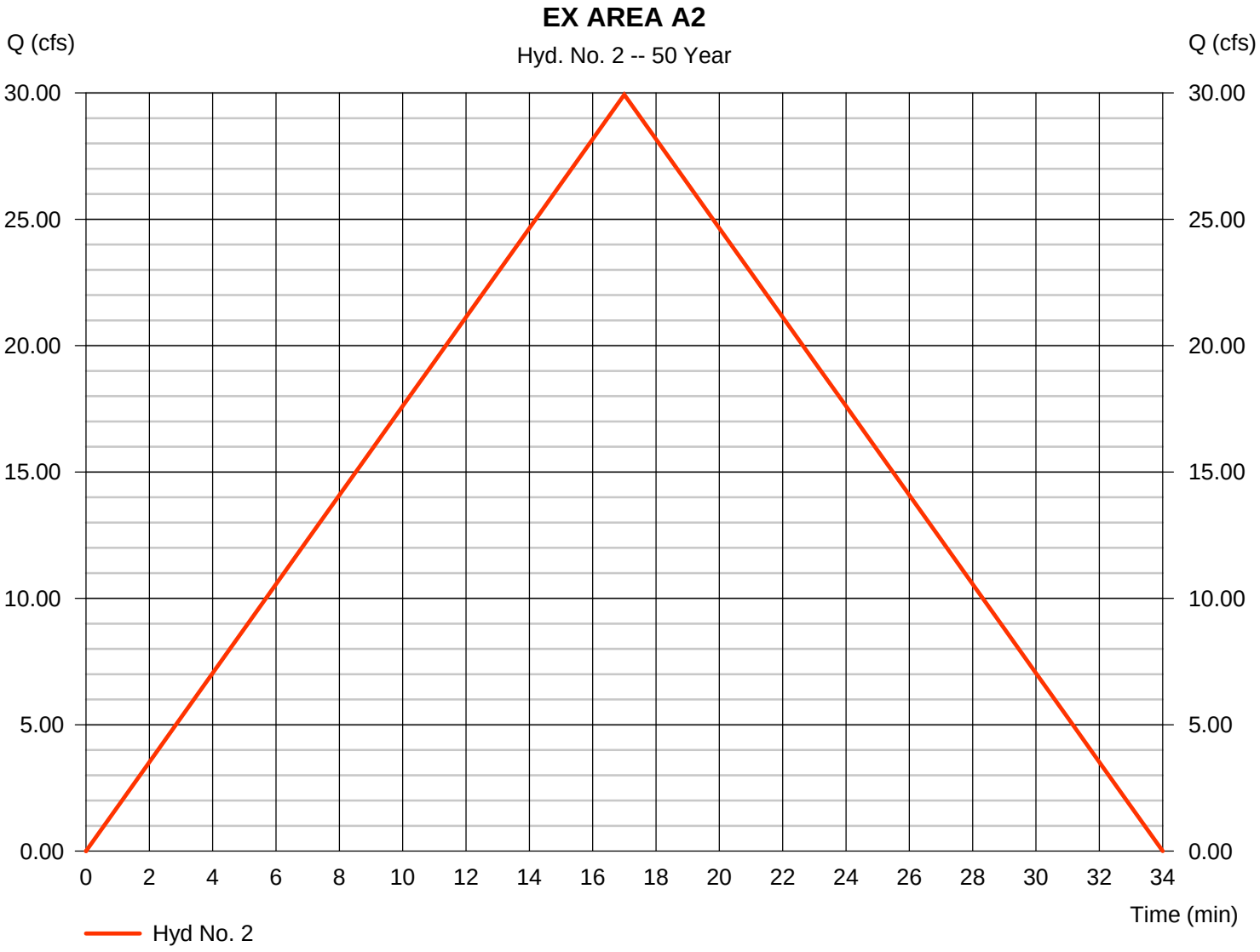
Hydrograph Report

Hyd. No. 2

EX AREA A2

Hydrograph type	=	Rational	Peak discharge	=	29.93 cfs
Storm frequency	=	50 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	30,527 cuft
Drainage area	=	6.300 ac	Runoff coeff.	=	0.75*
Intensity	=	6.334 in/hr	Tc by TR55	=	17.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(4.400 x 0.90) + (1.900 x 0.40)] / 6.300

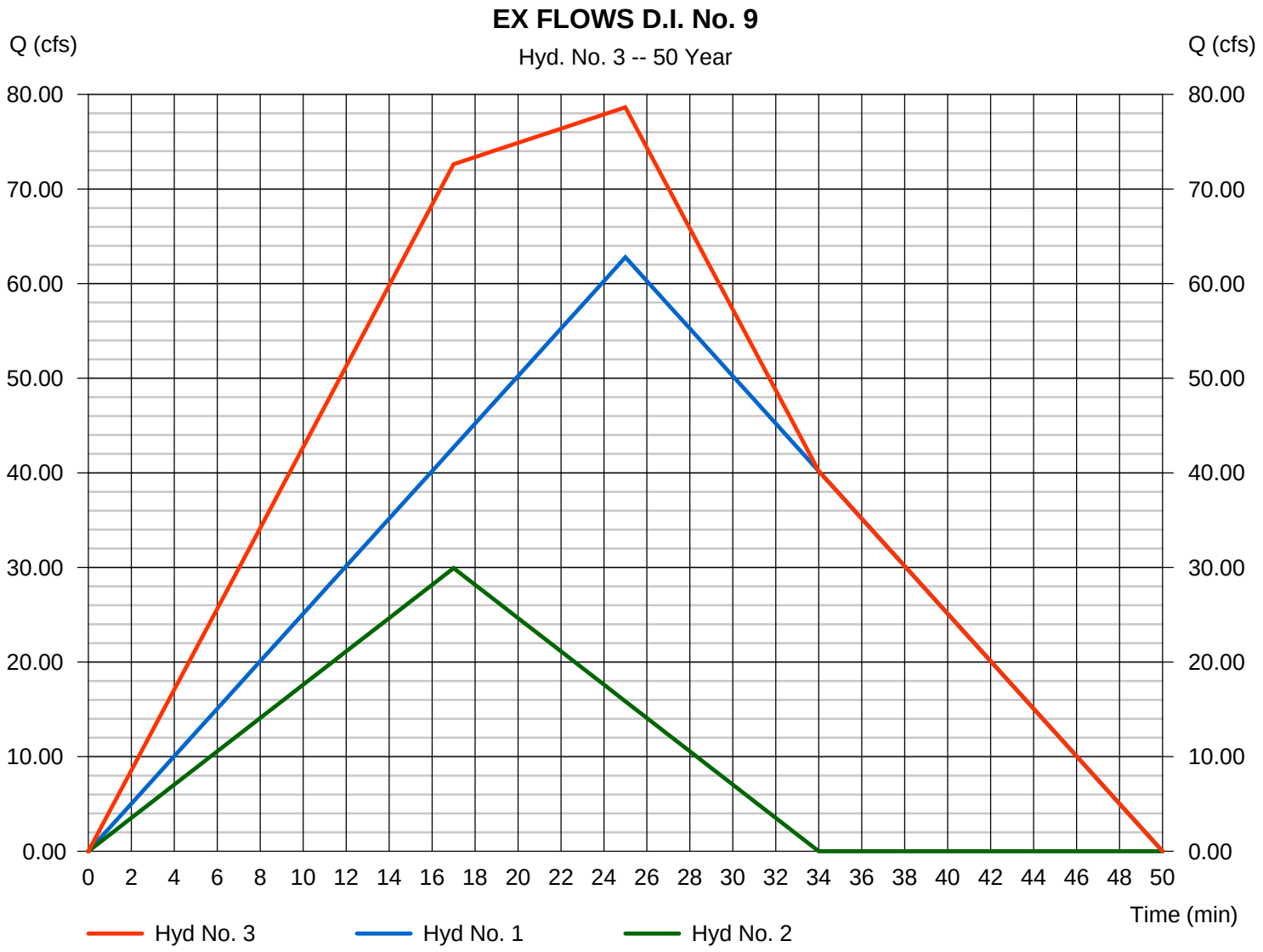


Hydrograph Report

Hyd. No. 3

EX FLOWS D.I. No. 9

Hydrograph type	= Combine	Peak discharge	= 78.64 cfs
Storm frequency	= 50 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 124,715 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 28.990 ac

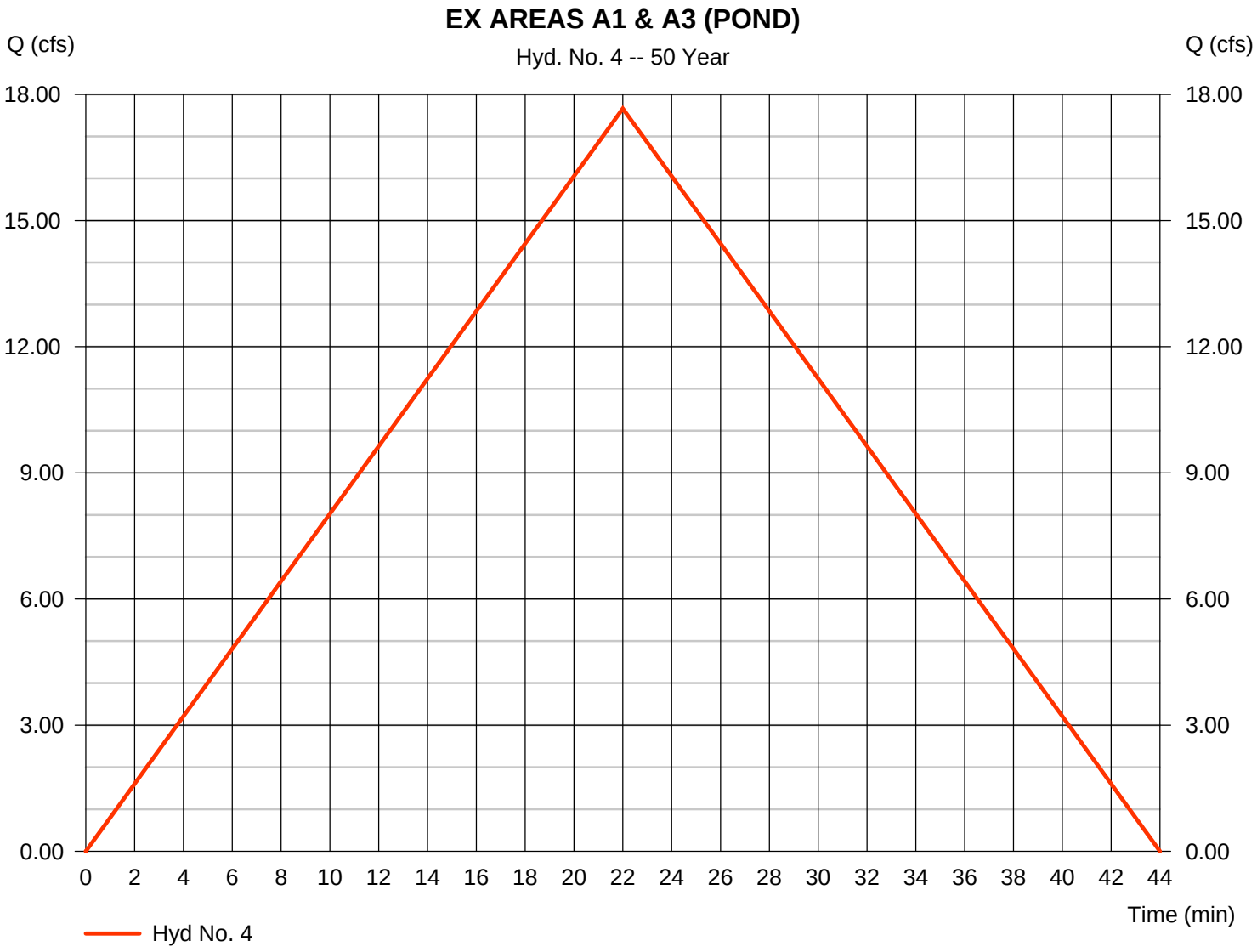


Hydrograph Report

Hyd. No. 4

EX AREAS A1 & A3 (POND)

Hydrograph type	=	Rational	Peak discharge	=	17.66 cfs
Storm frequency	=	50 yrs	Time to peak	=	22 min
Time interval	=	1 min	Hyd. volume	=	23,314 cuft
Drainage area	=	7.810 ac	Runoff coeff.	=	0.4
Intensity	=	5.654 in/hr	Tc by TR55	=	22.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1



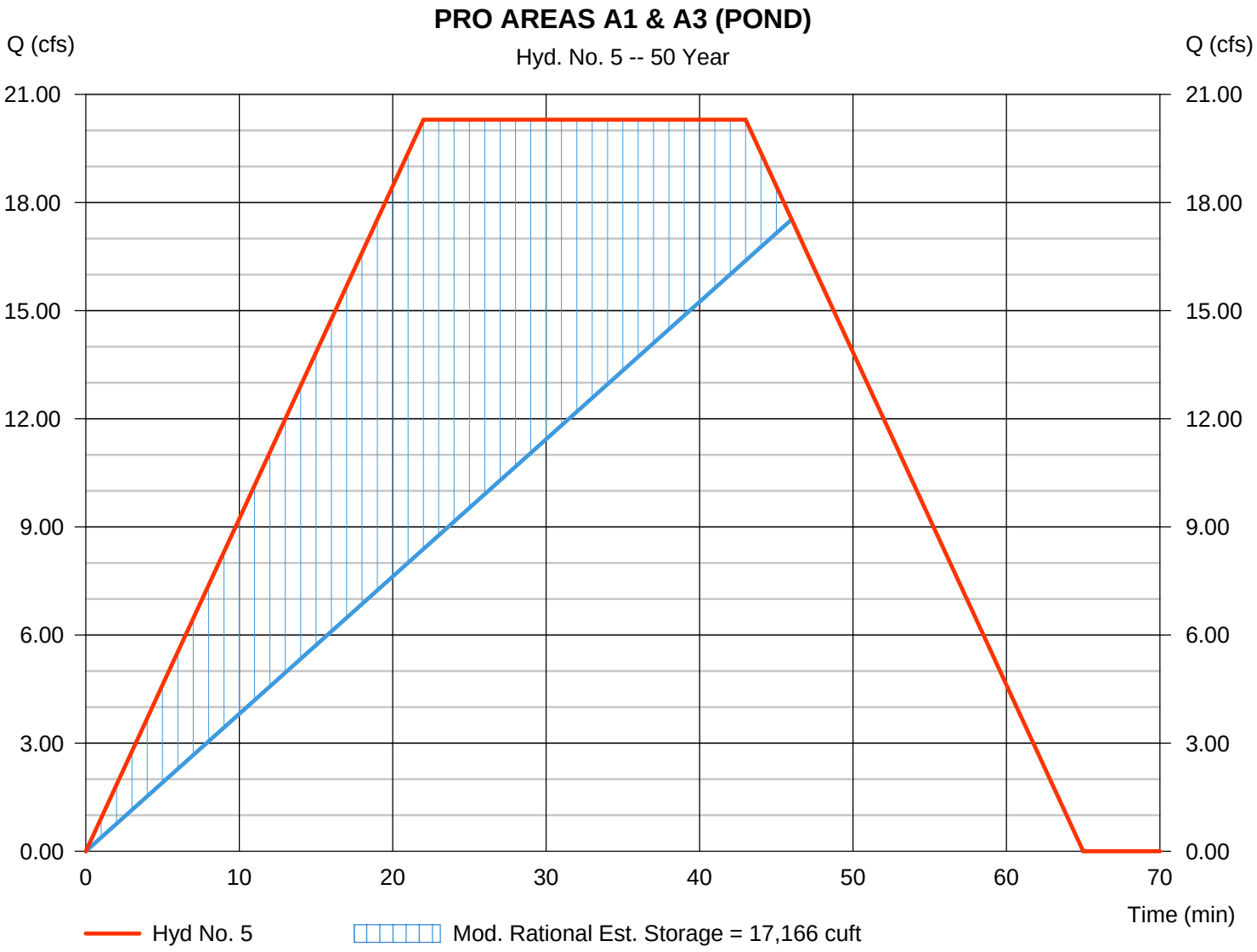
Hydrograph Report

Hyd. No. 5

PRO AREAS A1 & A3 (POND)

Hydrograph type	= Mod. Rational	Peak discharge	= 20.30 cfs
Storm frequency	= 50 yrs	Time to peak	= 22 min
Time interval	= 1 min	Hyd. volume	= 52,519 cuft
Drainage area	= 7.810 ac	Runoff coeff.	= 0.65*
Intensity	= 3.999 in/hr	Tc by TR55	= 22.00 min
IDF Curve	= TontitownIDF.IDF	Storm duration	= 2.0 x Tc
Target Q	=17.89 cfs	Est. Req'd Storage	=17,166 cuft

* Composite (Area/C) = [(4.020 x 0.90) + (3.890 x 0.40)] / 7.810



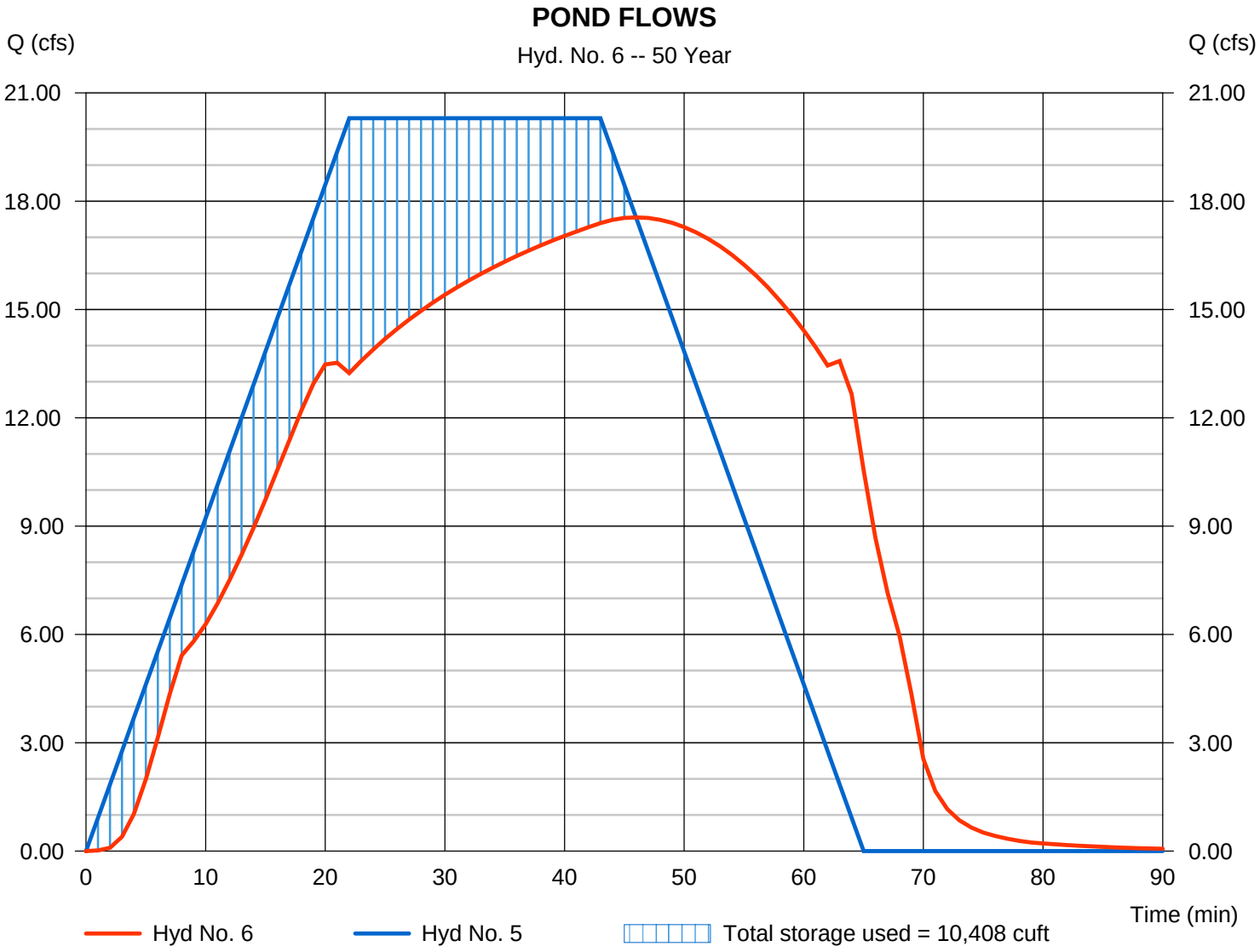
Hydrograph Report

Hyd. No. 6

POND FLOWS

Hydrograph type	=	Reservoir	Peak discharge	=	17.55 cfs
Storm frequency	=	50 yrs	Time to peak	=	46 min
Time interval	=	1 min	Hyd. volume	=	52,372 cuft
Inflow hyd. No.	=	5 - PRO AREAS A1 & A3 (POND)	Max. Elevation	=	1297.97 ft
Reservoir name	=	Pond - Contours	Max. Storage	=	10,408 cuft

Storage Indication method used.



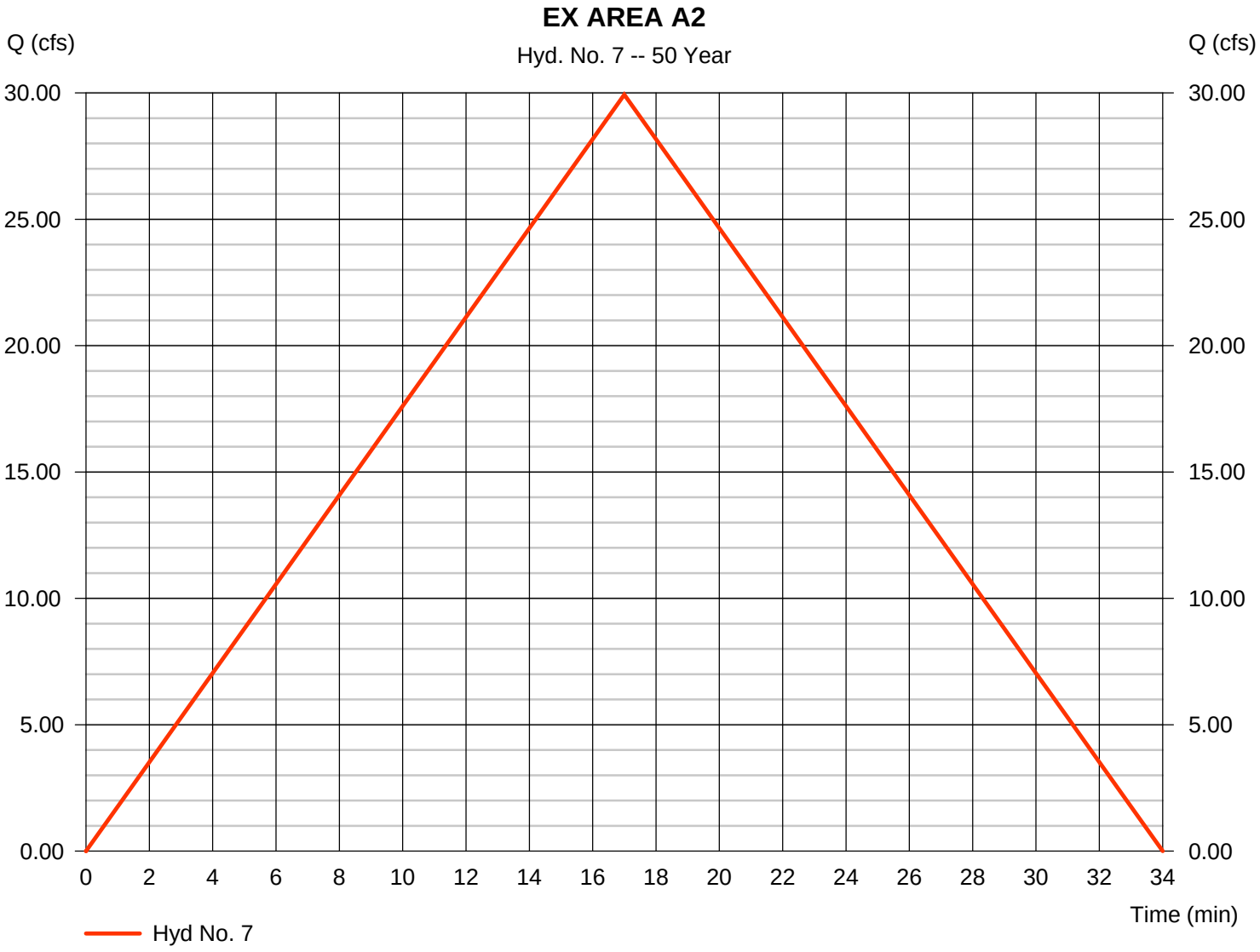
Hydrograph Report

Hyd. No. 7

EX AREA A2

Hydrograph type	=	Rational	Peak discharge	=	29.93 cfs
Storm frequency	=	50 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	30,527 cuft
Drainage area	=	6.300 ac	Runoff coeff.	=	0.75*
Intensity	=	6.334 in/hr	Tc by TR55	=	17.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(4.400 x 0.90) + (1.900 x 0.40)] / 6.300



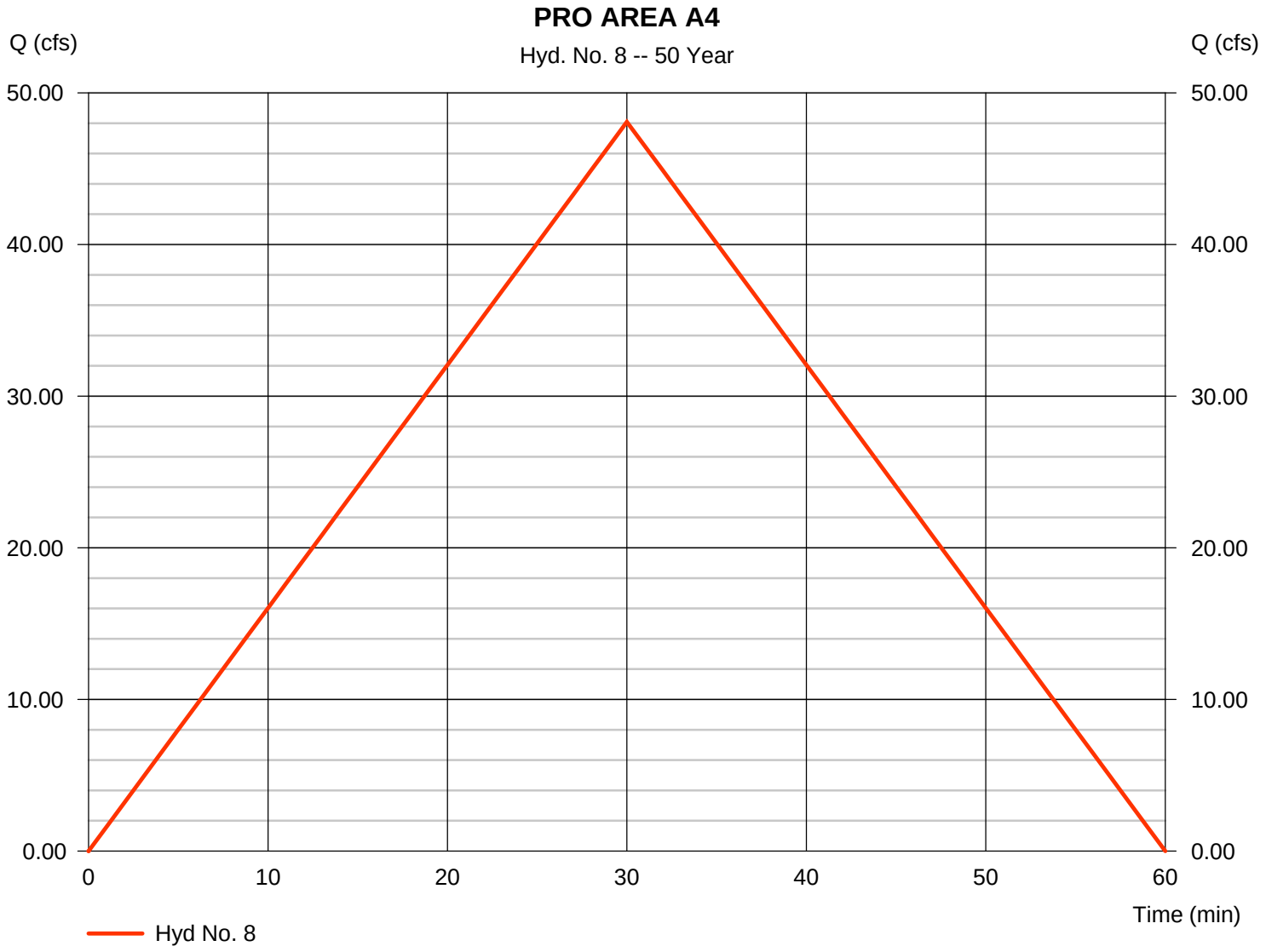
Hydrograph Report

Hyd. No. 8

PRO AREA A4

Hydrograph type	=	Rational	Peak discharge	=	48.09 cfs
Storm frequency	=	50 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	86,563 cuft
Drainage area	=	15.960 ac	Runoff coeff.	=	0.62*
Intensity	=	4.860 in/hr	Tc by TR55	=	30.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(6.540 x 0.90) + (0.660 x 0.85) + (8.660 x 0.40)] / 15.960

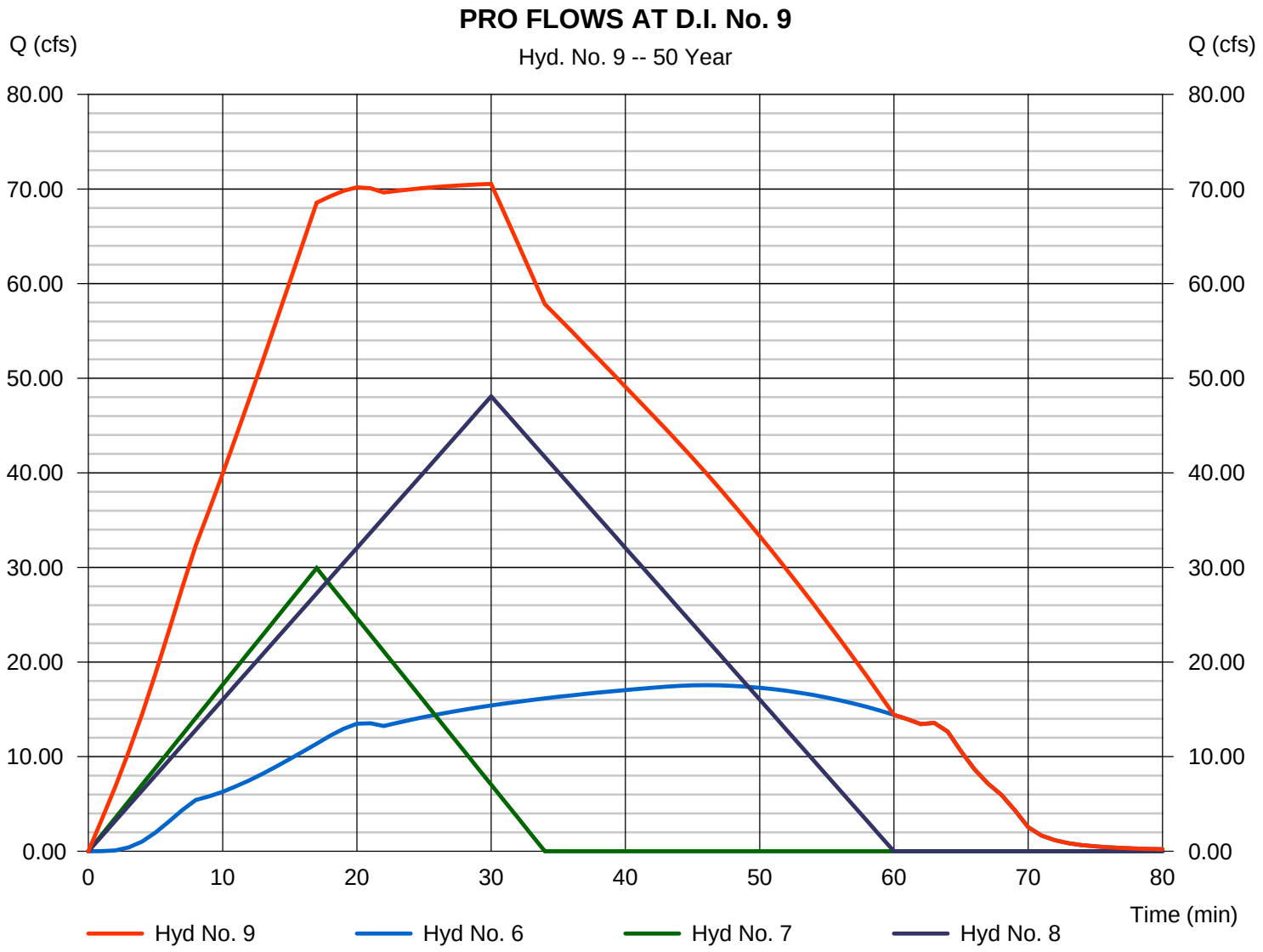


Hydrograph Report

Hyd. No. 9

PRO FLOWS AT D.I. No. 9

Hydrograph type	=	Combine	Peak discharge	=	70.54 cfs
Storm frequency	=	50 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	169,462 cuft
Inflow hyds.	=	6, 7, 8	Contrib. drain. area	=	22.260 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	69.00	1	25	103,500	------	------	------	EX. AREA A1
2	Rational	32.81	1	17	33,462	------	------	------	EX AREA A2
3	Combine	86.37	1	25	136,962	1, 2	------	------	EX FLOWS D.I. No. 9
4	Rational	19.39	1	22	25,593	------	------	------	EX AREAS A1 & A3 (POND)
5	Mod. Rational	23.37	1	22	56,150	------	------	------	PRO AREAS A1 & A3 (POND)
6	Reservoir	18.76	1	44	56,093	5	1298.28	13,215	POND FLOWS
7	Rational	32.81	1	17	33,462	------	------	------	EX AREA A2
8	Rational	52.94	1	30	95,291	------	------	------	PRO AREA A4
9	Combine	77.47	1	30	184,845	6, 7, 8	------	------	PRO FLOWS AT D.I. No. 9

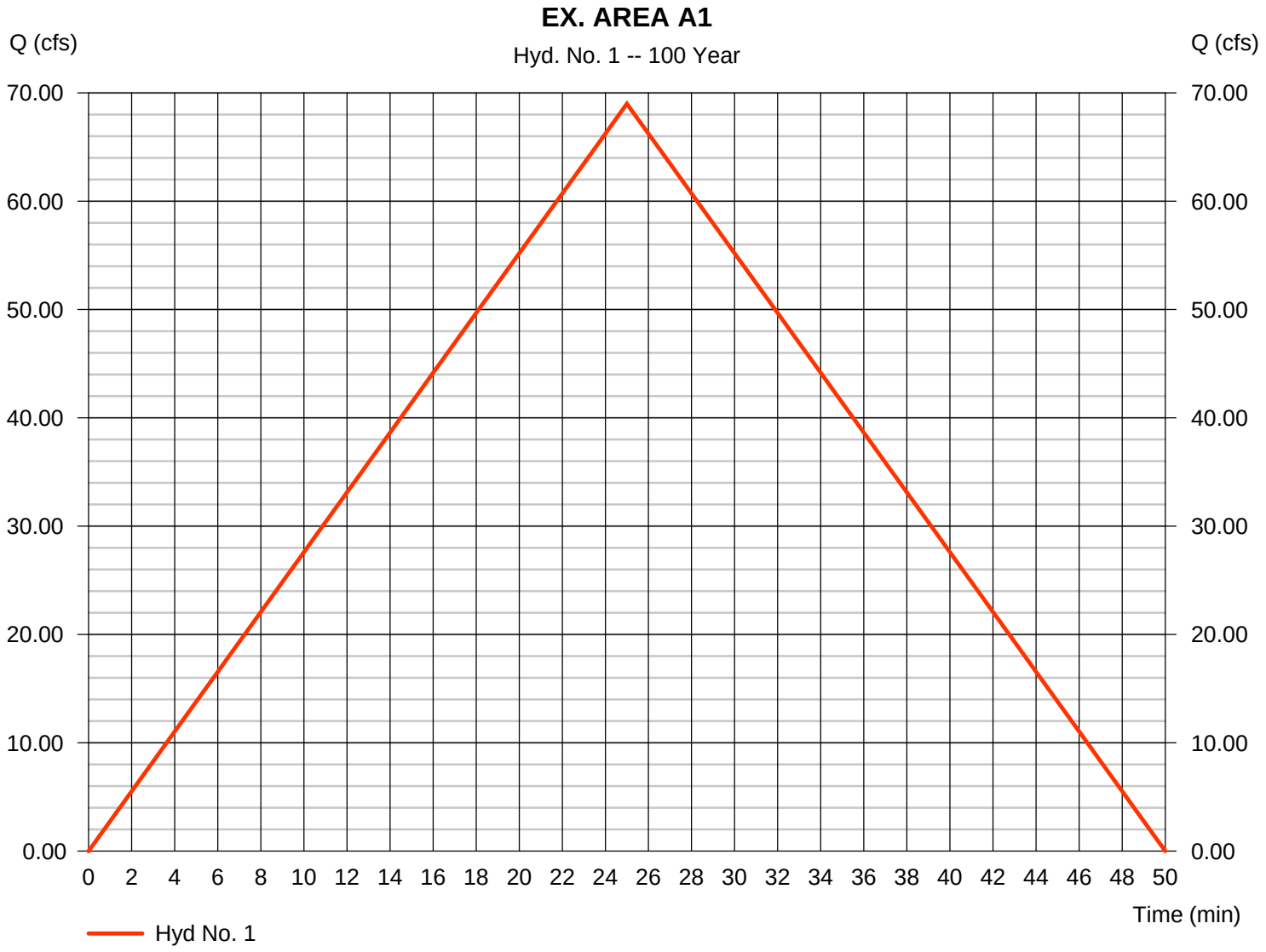
Hydrograph Report

Hyd. No. 1

EX. AREA A1

Hydrograph type	=	Rational	Peak discharge	=	69.00 cfs
Storm frequency	=	100 yrs	Time to peak	=	25 min
Time interval	=	1 min	Hyd. volume	=	103,500 cuft
Drainage area	=	22.690 ac	Runoff coeff.	=	0.52*
Intensity	=	5.848 in/hr	Tc by TR55	=	25.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(0.660 x 0.85) + (4.970 x 0.90) + (17.060 x 0.40)] / 22.690



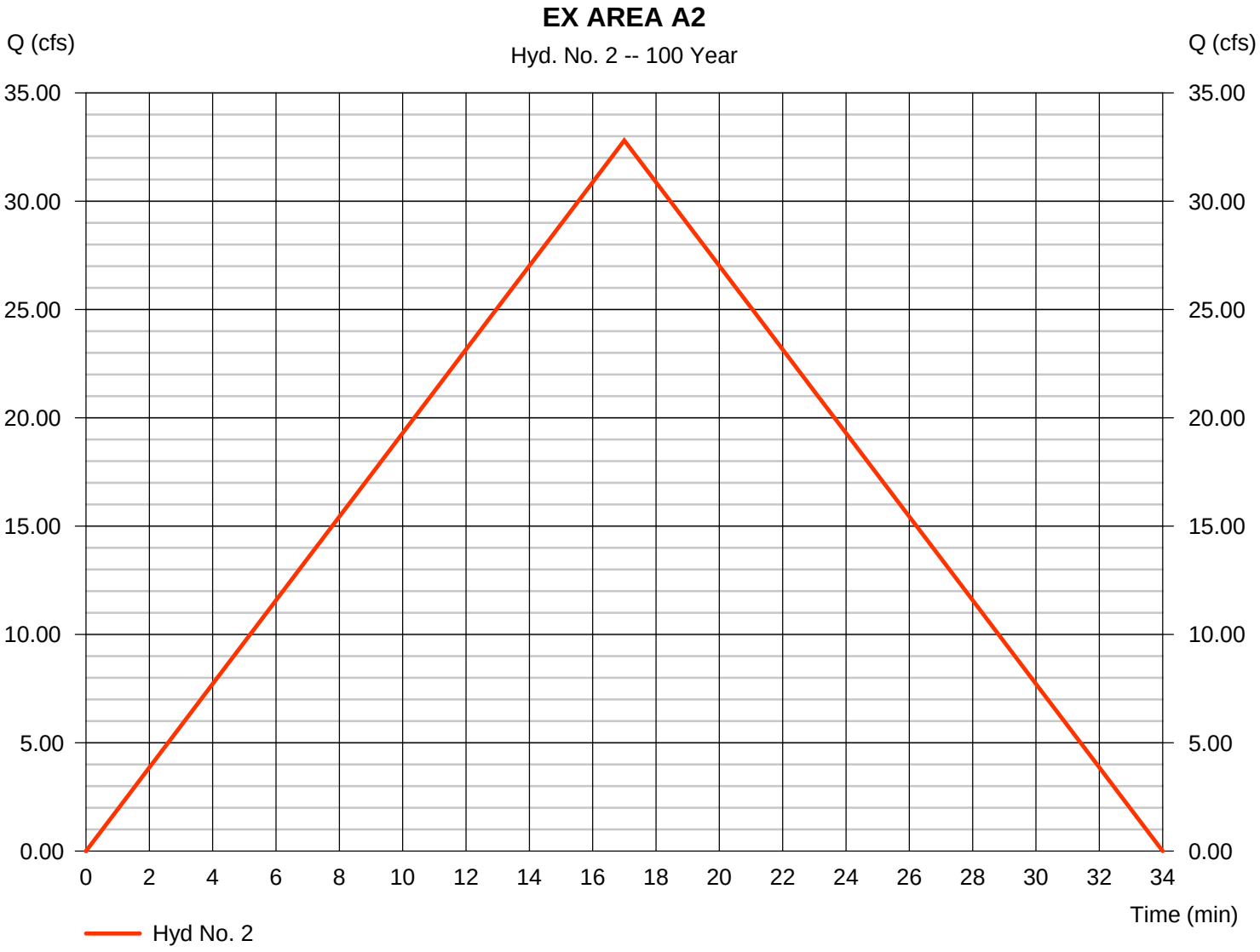
Hydrograph Report

Hyd. No. 2

EX AREA A2

Hydrograph type	=	Rational	Peak discharge	=	32.81 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	33,462 cuft
Drainage area	=	6.300 ac	Runoff coeff.	=	0.75*
Intensity	=	6.943 in/hr	Tc by TR55	=	17.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(4.400 x 0.90) + (1.900 x 0.40)] / 6.300

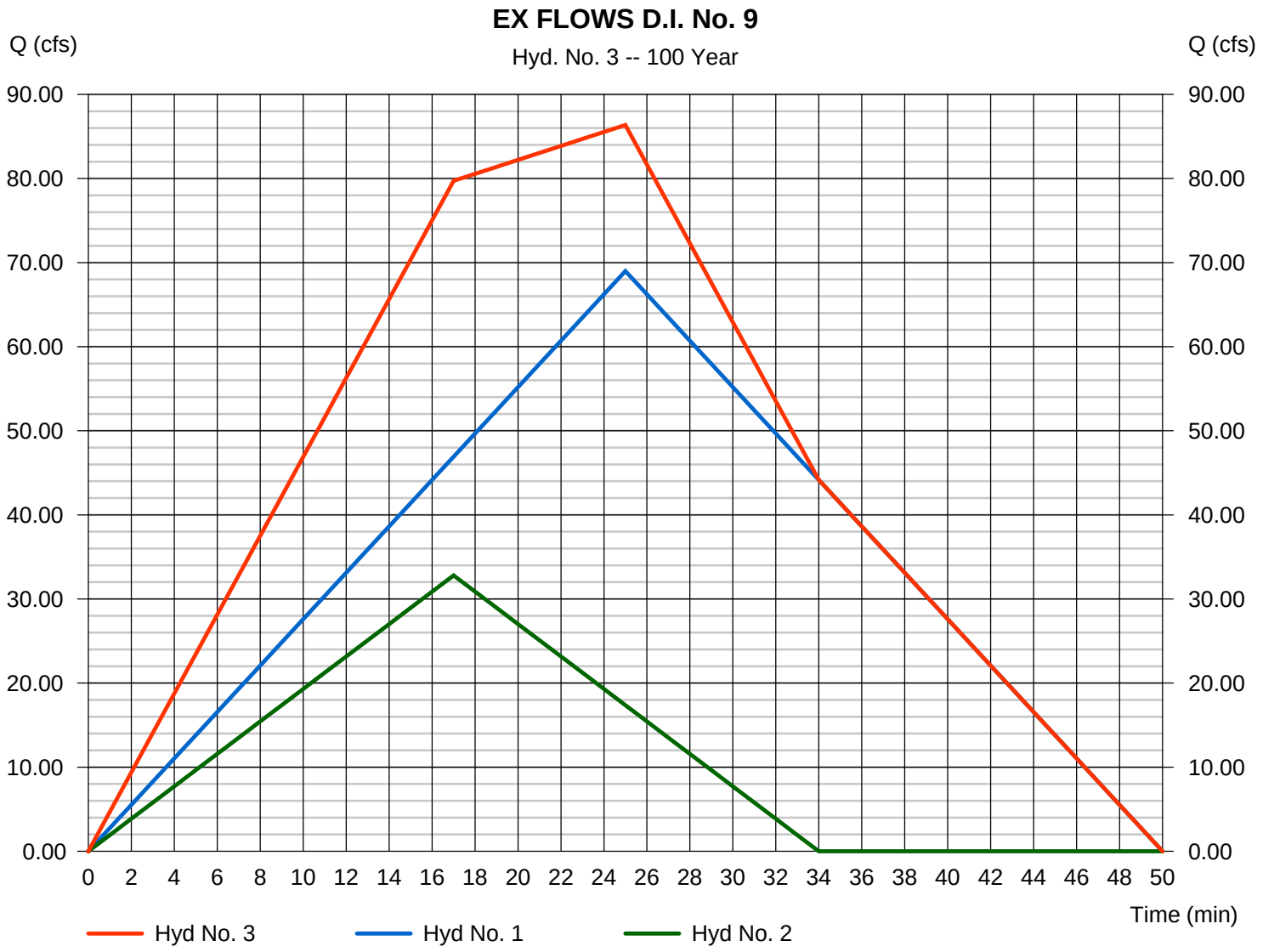


Hydrograph Report

Hyd. No. 3

EX FLOWS D.I. No. 9

Hydrograph type	= Combine	Peak discharge	= 86.37 cfs
Storm frequency	= 100 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 136,962 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 28.990 ac

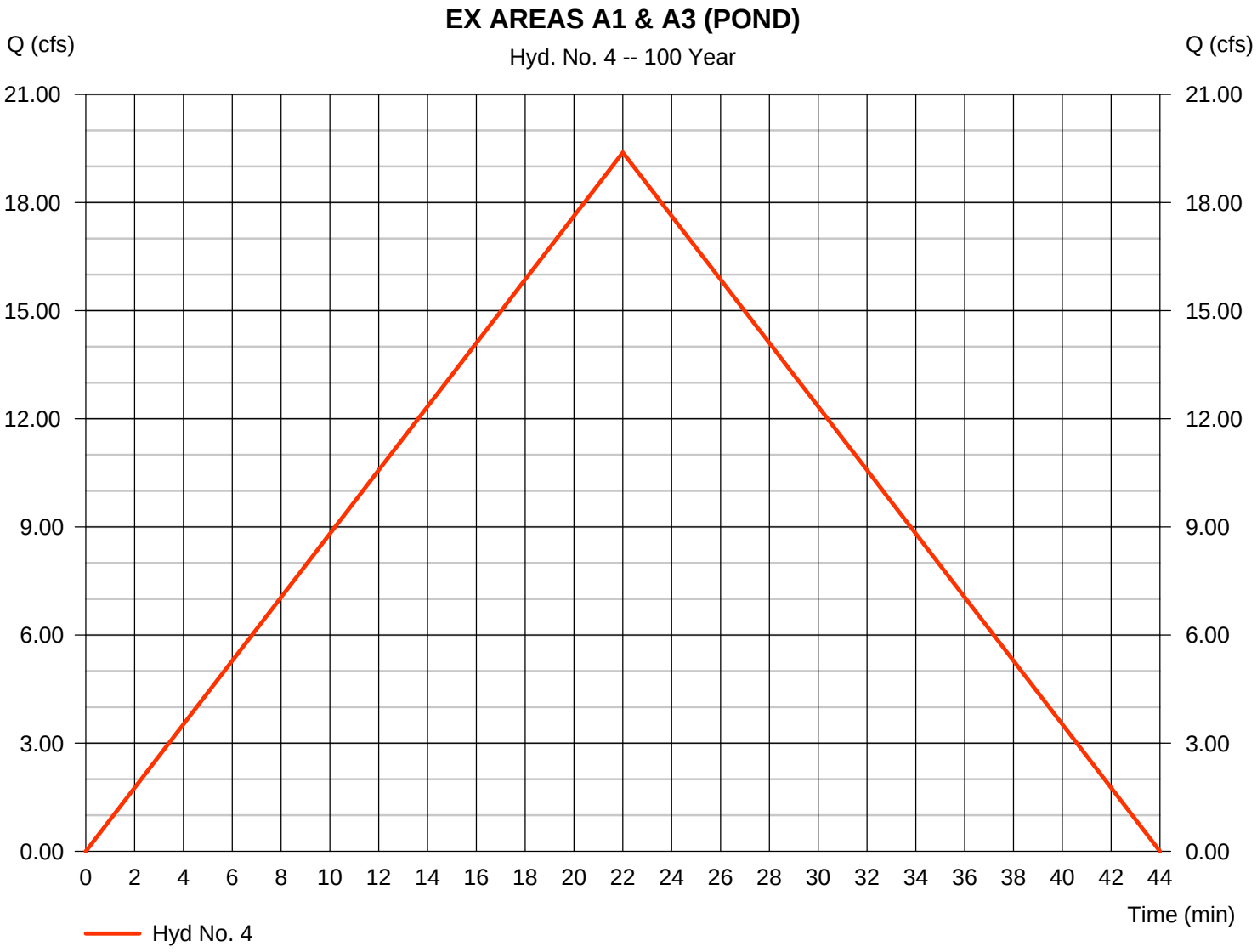


Hydrograph Report

Hyd. No. 4

EX AREAS A1 & A3 (POND)

Hydrograph type	=	Rational	Peak discharge	=	19.39 cfs
Storm frequency	=	100 yrs	Time to peak	=	22 min
Time interval	=	1 min	Hyd. volume	=	25,593 cuft
Drainage area	=	7.810 ac	Runoff coeff.	=	0.4
Intensity	=	6.206 in/hr	Tc by TR55	=	22.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1



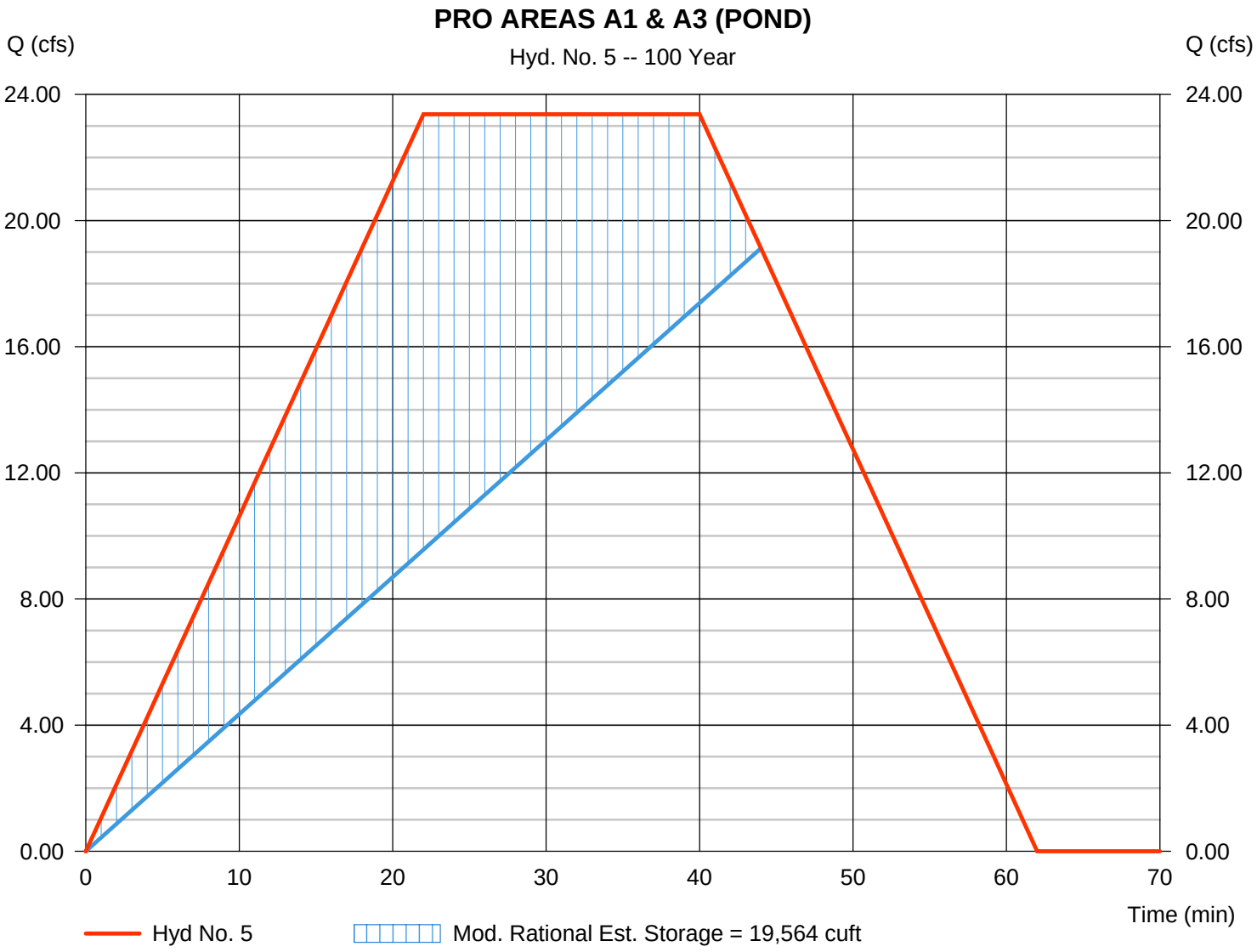
Hydrograph Report

Hyd. No. 5

PRO AREAS A1 & A3 (POND)

Hydrograph type	= Mod. Rational	Peak discharge	= 23.37 cfs
Storm frequency	= 100 yrs	Time to peak	= 22 min
Time interval	= 1 min	Hyd. volume	= 56,150 cuft
Drainage area	= 7.810 ac	Runoff coeff.	= 0.65*
Intensity	= 4.604 in/hr	Tc by TR55	= 22.00 min
IDF Curve	= TontitownIDF.IDF	Storm duration	= 1.8 x Tc
Target Q	=19.64 cfs	Est. Req'd Storage	=19,564 cuft

* Composite (Area/C) = [(4.020 x 0.90) + (3.890 x 0.40)] / 7.810



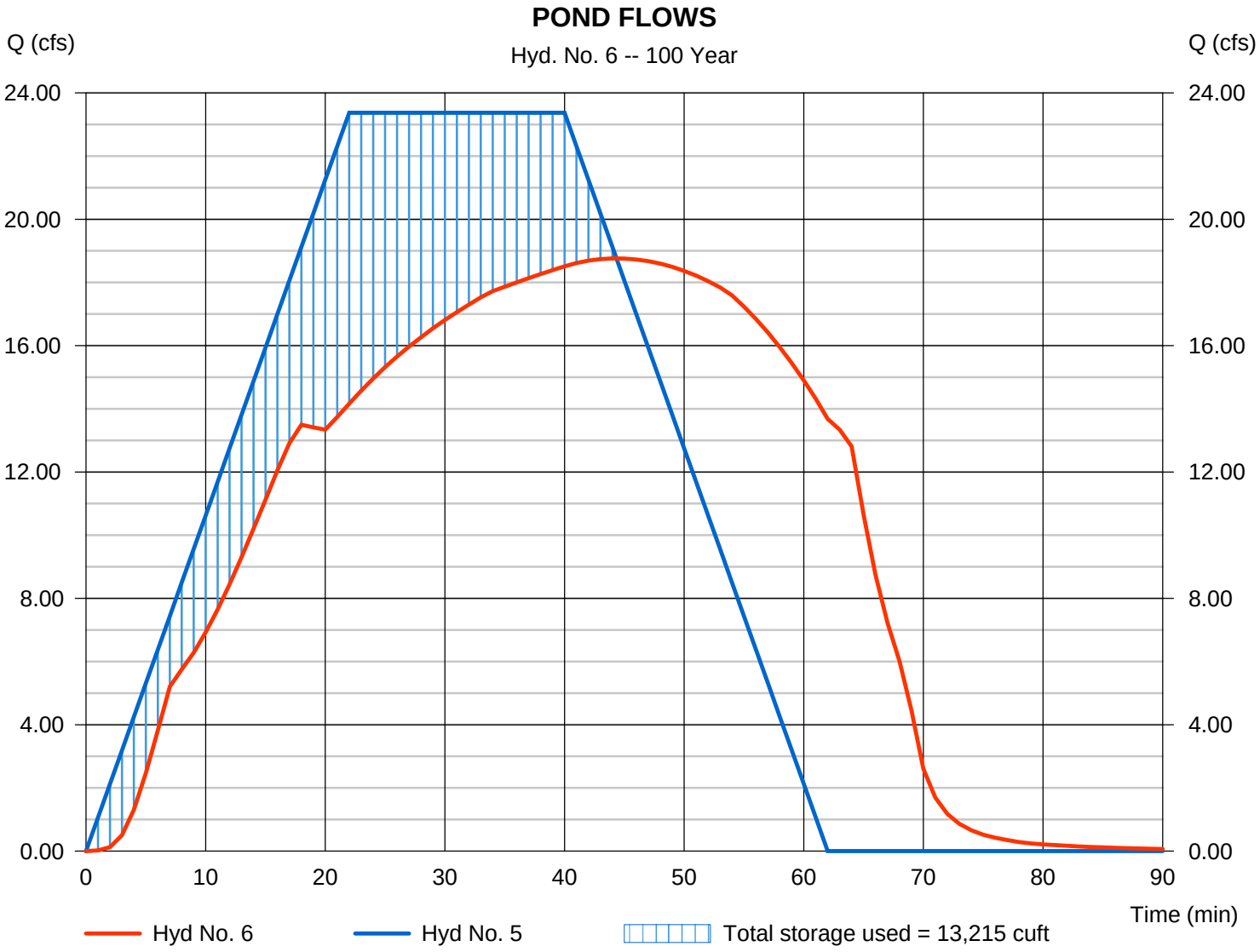
Hydrograph Report

Hyd. No. 6

POND FLOWS

Hydrograph type	=	Reservoir	Peak discharge	=	18.76 cfs
Storm frequency	=	100 yrs	Time to peak	=	44 min
Time interval	=	1 min	Hyd. volume	=	56,093 cuft
Inflow hyd. No.	=	5 - PRO AREAS A1 & A3 (POND)	Max. Elevation	=	1298.28 ft
Reservoir name	=	Pond - Contours	Max. Storage	=	13,215 cuft

Storage Indication method used.



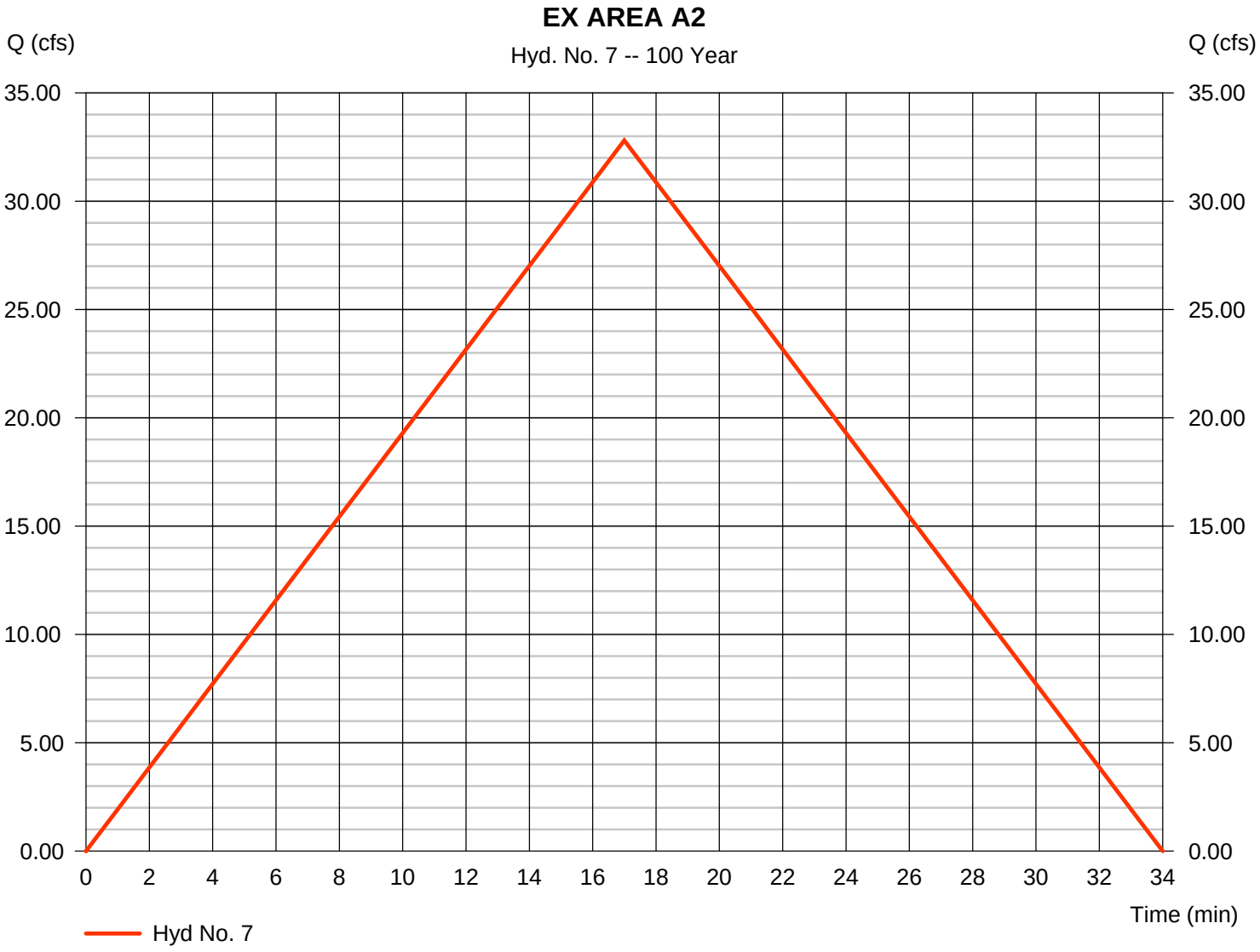
Hydrograph Report

Hyd. No. 7

EX AREA A2

Hydrograph type	=	Rational	Peak discharge	=	32.81 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	33,462 cuft
Drainage area	=	6.300 ac	Runoff coeff.	=	0.75*
Intensity	=	6.943 in/hr	Tc by TR55	=	17.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(4.400 x 0.90) + (1.900 x 0.40)] / 6.300



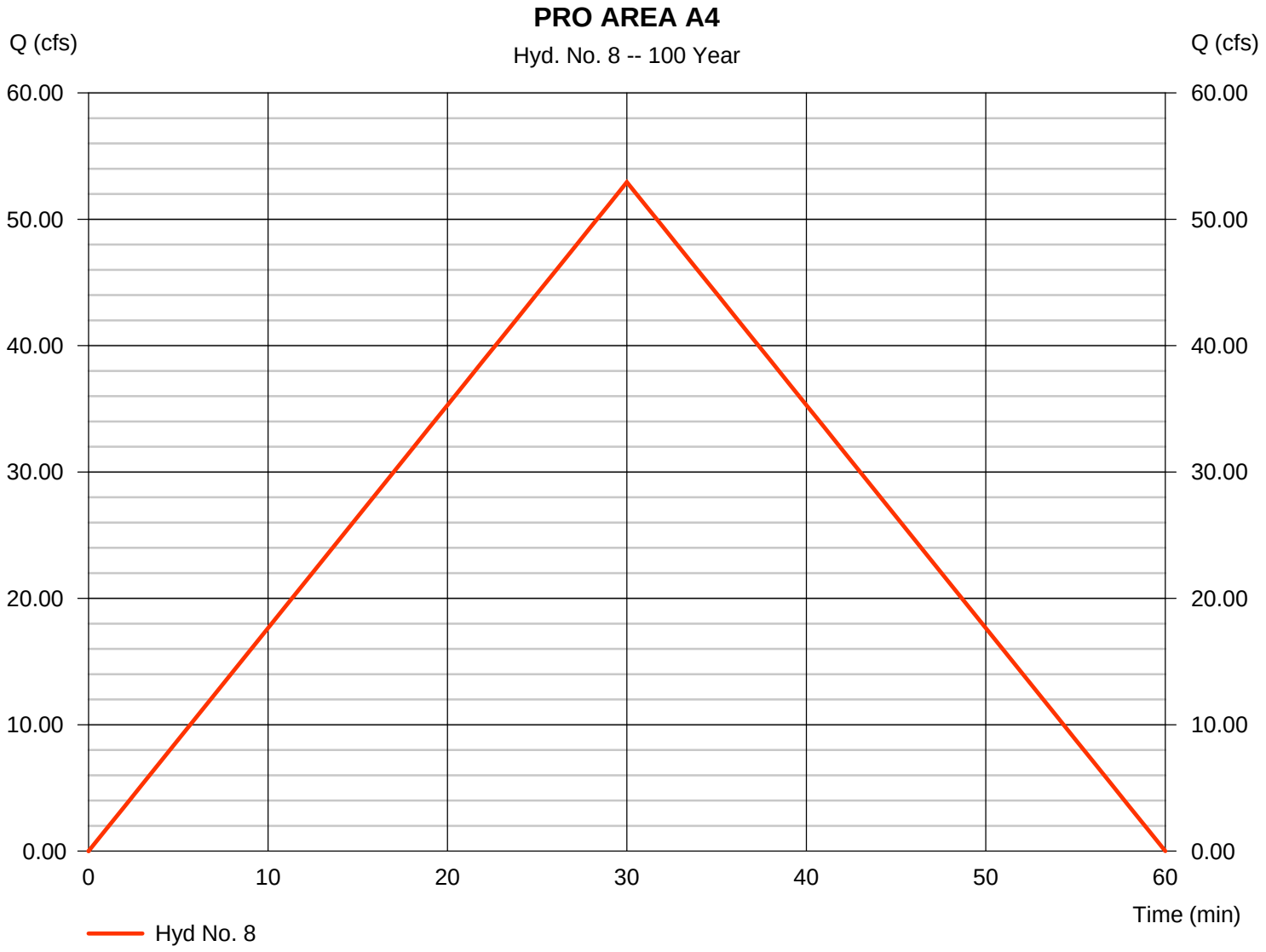
Hydrograph Report

Hyd. No. 8

PRO AREA A4

Hydrograph type	=	Rational	Peak discharge	=	52.94 cfs
Storm frequency	=	100 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	95,291 cuft
Drainage area	=	15.960 ac	Runoff coeff.	=	0.62*
Intensity	=	5.350 in/hr	Tc by TR55	=	30.00 min
IDF Curve	=	TontitownIDF.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(6.540 x 0.90) + (0.660 x 0.85) + (8.660 x 0.40)] / 15.960

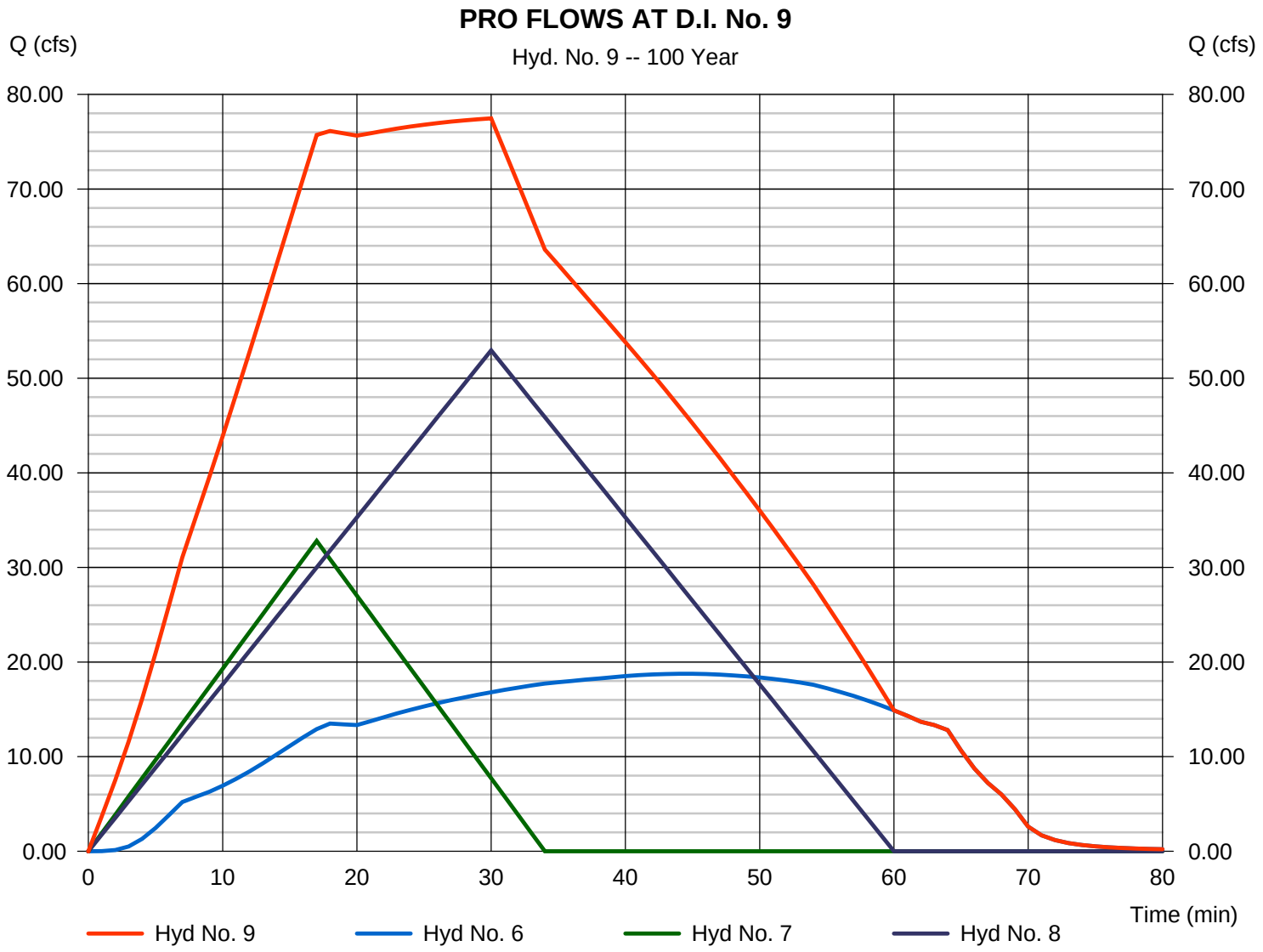


Hydrograph Report

Hyd. No. 9

PRO FLOWS AT D.I. No. 9

Hydrograph type	=	Combine	Peak discharge	=	77.47 cfs
Storm frequency	=	100 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	184,845 cuft
Inflow hyds.	=	6, 7, 8	Contrib. drain. area	=	22.260 ac



DETENTION POND REPORT

ENGINEERING SERVICES INC.

Pond Report

Pond No. 1 - Pond - Contours

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 1295.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1295.00	01	0	0
1.00	1296.00	1,852	927	927
2.00	1297.00	4,750	3,301	4,228
3.00	1298.00	8,040	6,395	10,623
4.00	1299.00	10,590	9,315	19,938
5.00	1300.00	13,800	12,195	32,133

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1295.00	0.00	0.00	0.00
Length (ft)	= 245.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

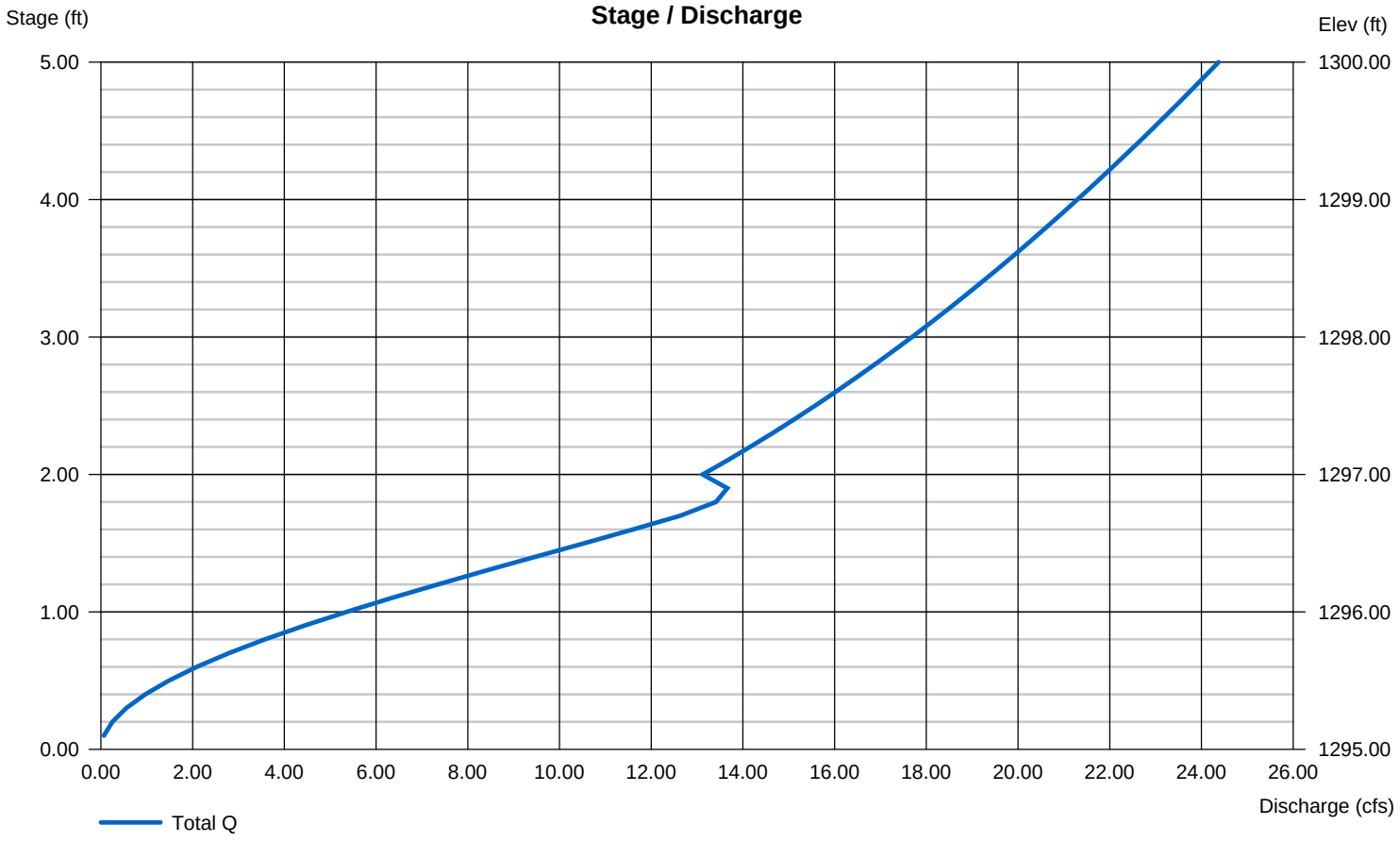
Weir Structures

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



APPENDIX

ENGINEERING SERVICES INC.

EXISTING DRAINAGE AREA MAP

ENGINEERING SERVICES INC.

PLAT PAG####
PP ####

REVISION	DATE	DESCRIPTION

EXISTING DRAINAGE MAP

MATHIAS MAESTRI SUBDIVISION

TONTITOWN, ARAKANSAS

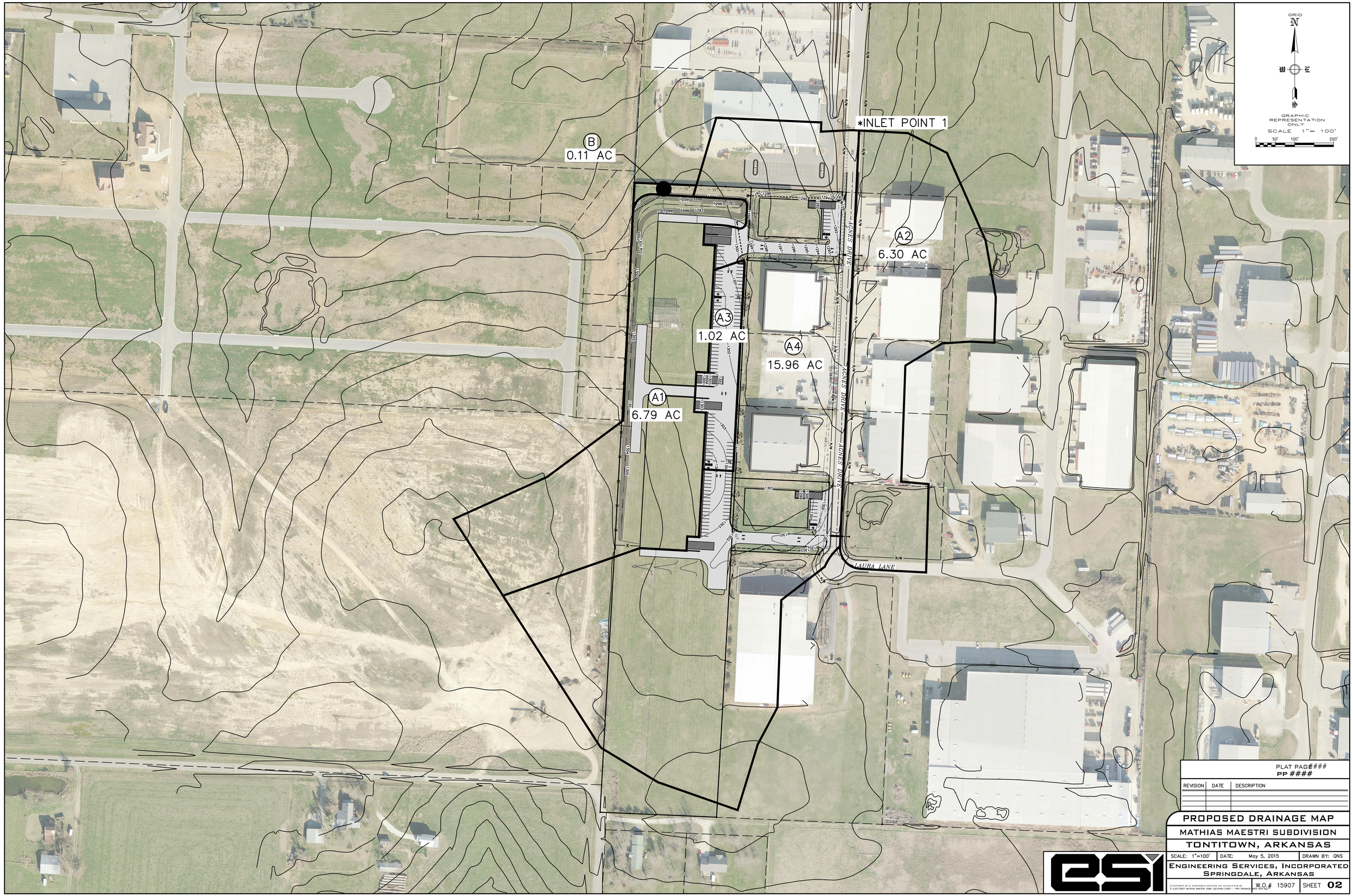
SCALE: 1"=100' | DATE: March 18, 2015 | DRAWN BY: QNS

ENGINEERING SERVICES, INCORPORATED
SPRINGDALE, ARKANSAS

W.O.# 15907 | SHEET 01

PROPOSED DRAINAGE AREA MAP

ENGINEERING SERVICES INC.



PLAT PAG#### PP ####

REVISION	DATE	DESCRIPTION

PROPOSED DRAINAGE MAP

MATHIAS MAESTRI SUBDIVISION

TONTITOWN, ARKANSAS

SCALE: 1"=100' | DATE: May 5, 2015 | DRAWN BY: QNS

ENGINEERING SERVICES, INCORPORATED
SPRINGDALE, ARKANSAS

W.O.# 15907 | SHEET 02