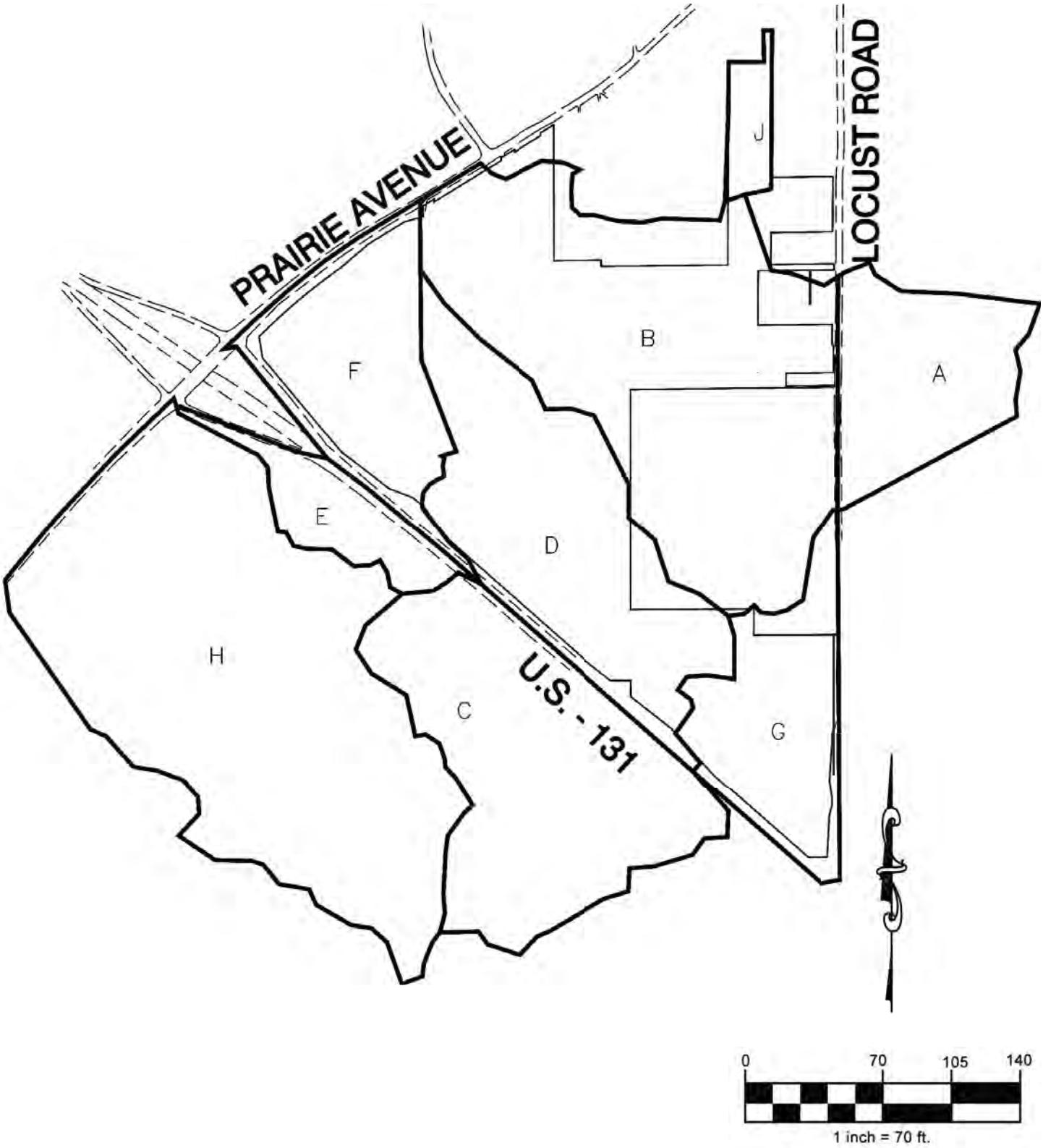
Appendix H

Hydrograph and Drainage Reports

Appendix H

Alternatives A & C Existing Drainage Areas



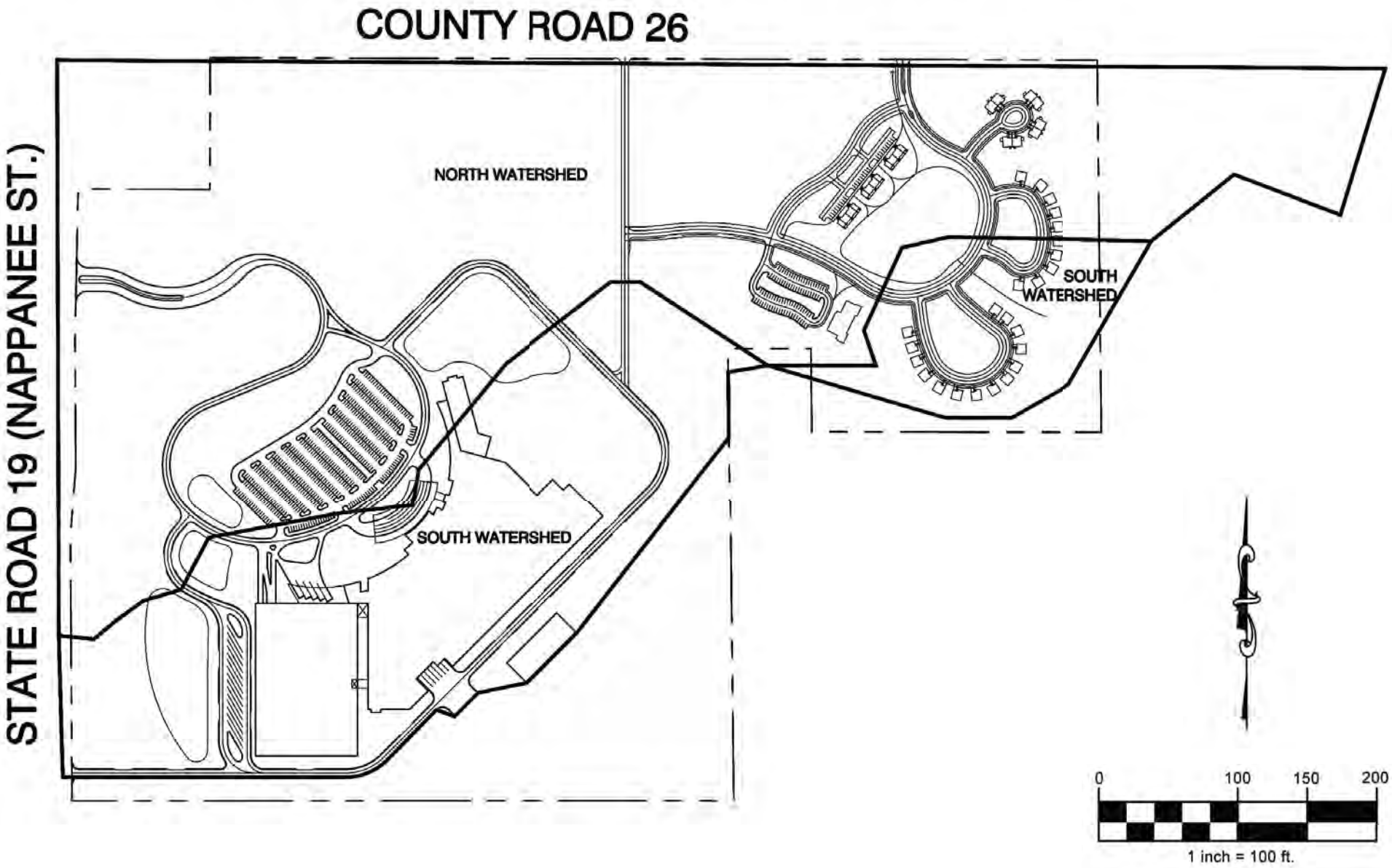
Pokagon South Bend EIS / January 2013

Source: St. Joseph County GIS

South Bend Site Existing Drainage Areas

Appendix H

Alternative B Existing Drainage Area



H-009

Source: Elkhart County GIS

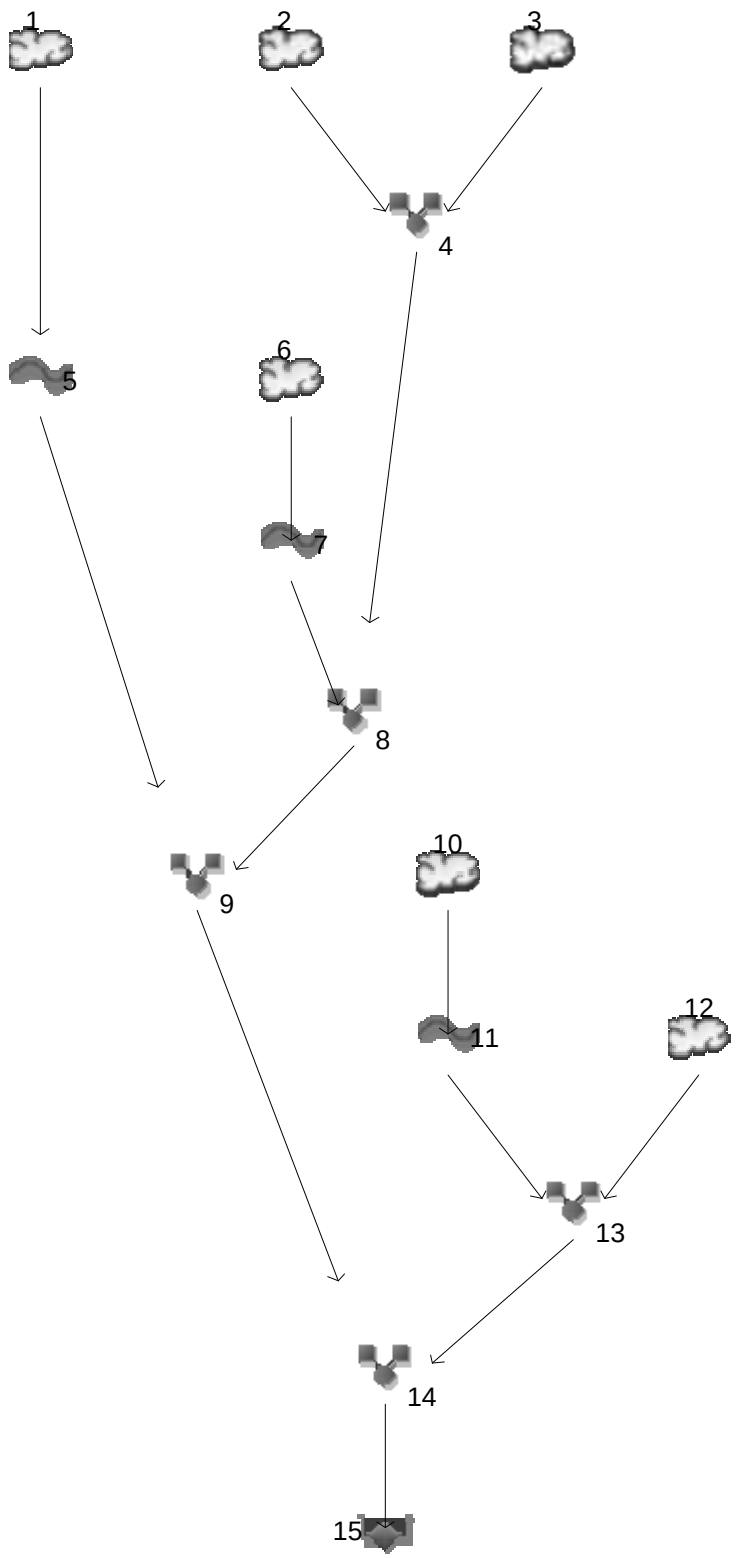
Alternate B Existing Drainage Areas

Appendix H

Alternatives A & C Predevelopment Hydrograph Report

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10



Legend

Hyd.	Origin	Description
1	SCS Runoff	A
2	SCS Runoff	B
3	SCS Runoff	D
4	Combine	B+D
5	Reach	A to B/D
6	SCS Runoff	C
7	Reach	from C
8	Combine	B/C/D
9	Combine	A/B/C/D
10	SCS Runoff	E
11	Reach	from E
12	SCS Runoff	F
13	Combine	E/F
14	Combine	ABCDEF - All
15	Reservoir	Existing Depression

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	31.66	2	740	186,617	------	------	------	A
2	SCS Runoff	66.66	2	766	640,498	------	------	------	B
3	SCS Runoff	58.42	2	742	358,068	------	------	------	D
4	Combine	110.26	2	760	998,566	2, 3	------	------	B+D
5	Reach	29.28	2	750	186,613	1	------	------	A to B/D
6	SCS Runoff	62.54	2	746	406,448	------	------	------	C
7	Reach	57.34	2	756	406,443	6	------	------	from C
8	Combine	167.32	2	758	1,405,009	4, 7	------	------	B/C/D
9	Combine	195.23	2	756	1,591,622	5, 8	------	------	A/B/C/D
10	SCS Runoff	15.01	2	740	88,480	------	------	------	E
11	Reach	14.06	2	748	88,476	10	------	------	from E
12	SCS Runoff	41.89	2	736	214,669	------	------	------	F
13	Combine	53.08	2	738	303,146	11, 12	------	------	E/F
14	Combine	237.77	2	752	1,894,767	9, 13	------	------	ABCDEF - All
15	Reservoir	224.66	2	762	1,894,768	14	736.37	47,750	Existing Depression

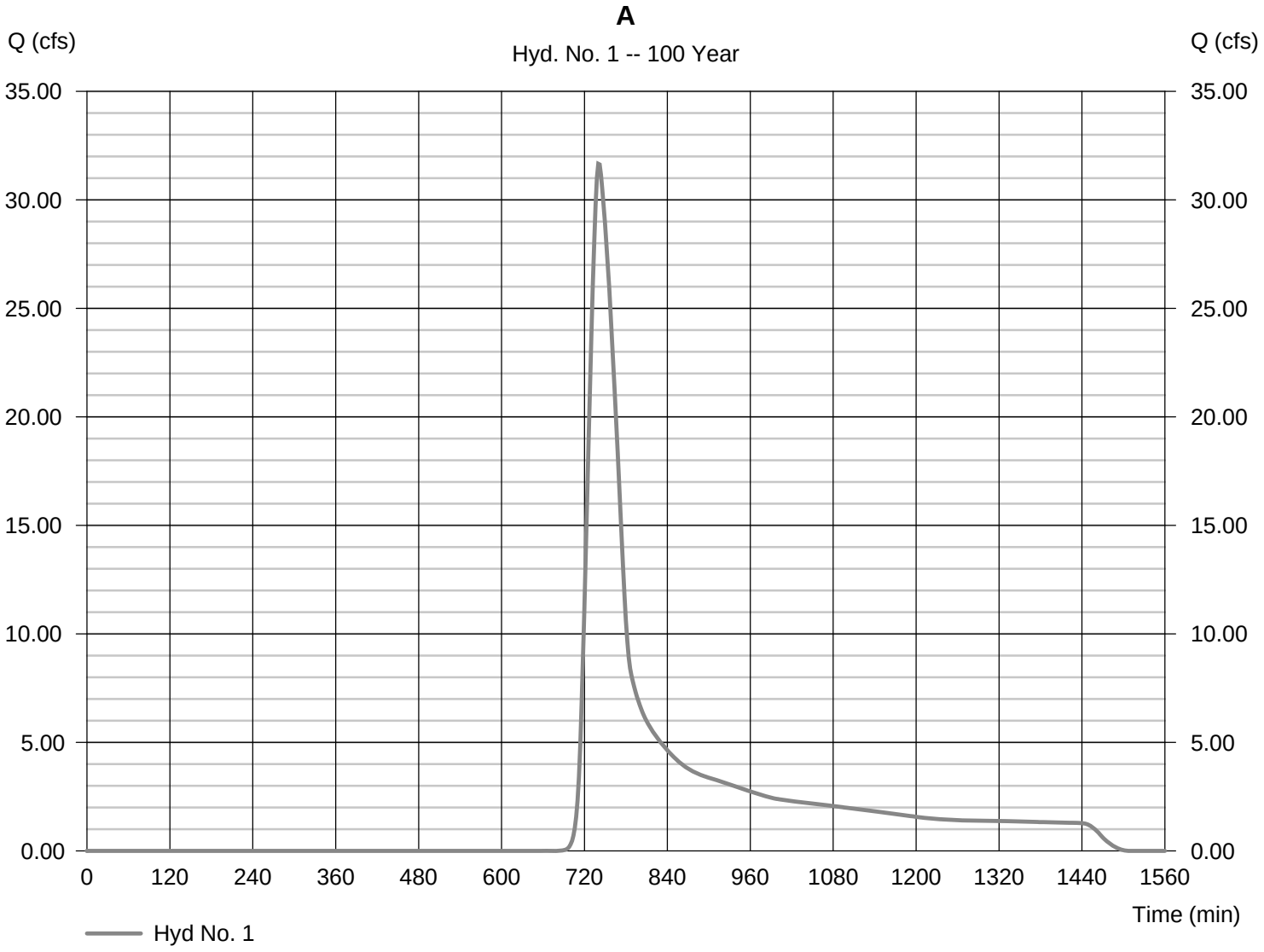
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 1

A

Hydrograph type	= SCS Runoff	Peak discharge	= 31.66 cfs
Storm frequency	= 100 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 186,617 cuft
Drainage area	= 29.760 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 40.80 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No. 1

A

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 7.00		0.00		0.00		
Travel Time (min)	**= 34.49**	**+**	**0.00**	**+**	**0.00**	**=**	**34.49**
Shallow Concentrated Flow							
Flow length (ft)	= 890.00		0.00		0.00		
Watercourse slope (%)	= 2.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.34		0.00		0.00		
Travel Time (min)	**= 6.34**	**+**	**0.00**	**+**	**0.00**	**=**	**6.34**
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 ..... 40.80 min

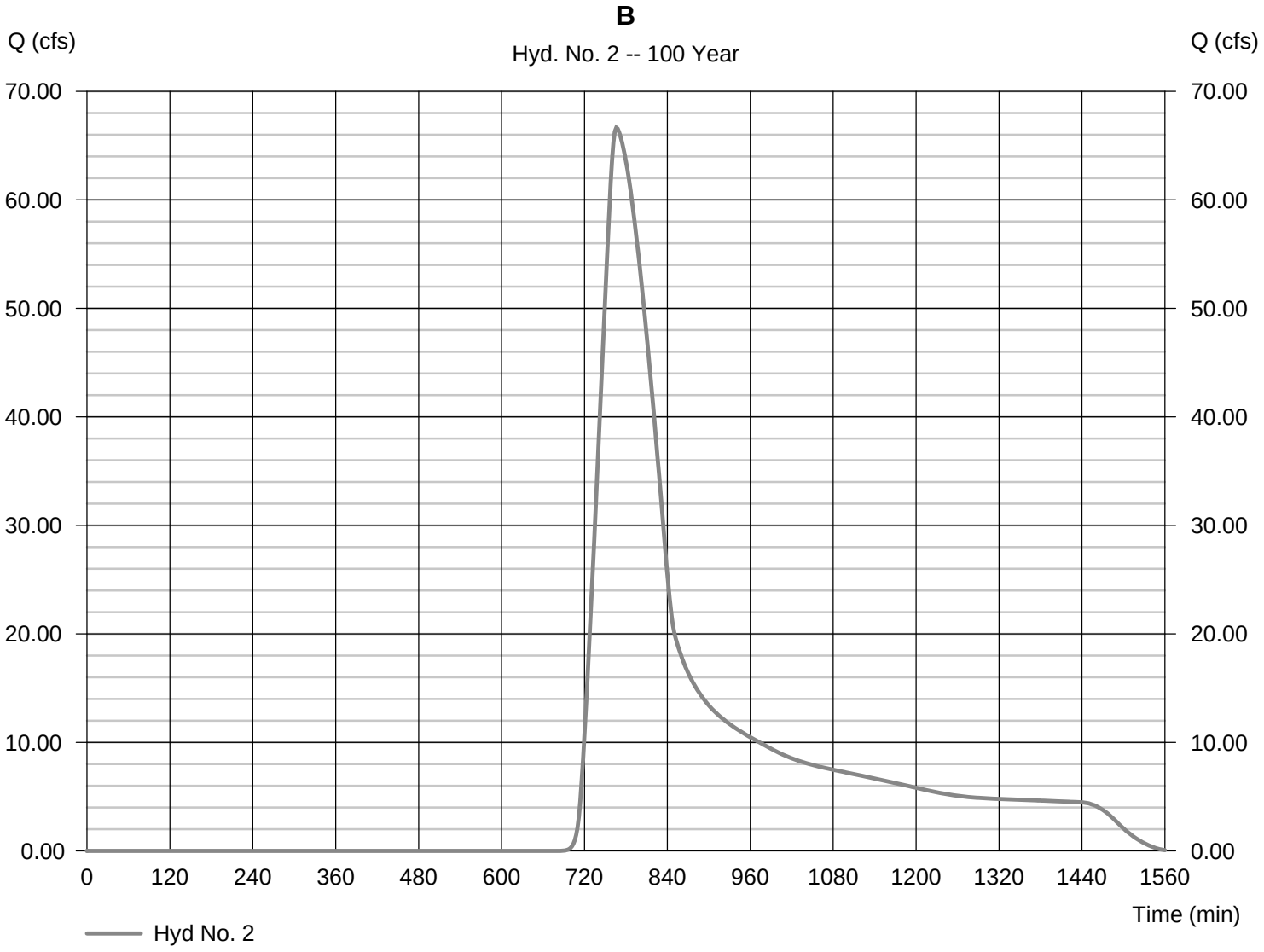
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 2

B

Hydrograph type	=	SCS Runoff	Peak discharge	=	66.66 cfs
Storm frequency	=	100 yrs	Time to peak	=	766 min
Time interval	=	2 min	Hyd. volume	=	640,498 cuft
Drainage area	=	102.610 ac	Curve number	=	55
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	83.10 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No. 2

B

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 2.30		0.00		0.00		
Travel Time (min)	**= 53.84**	**+**	**0.00**	**+**	**0.00**	**=**	**53.84**
Shallow Concentrated Flow							
Flow length (ft)	= 3794.00		0.00		0.00		
Watercourse slope (%)	= 1.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.16		0.00		0.00		
Travel Time (min)	**= 29.21**	**+**	**0.00**	**+**	**0.00**	**=**	**29.21**
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 ..... 83.10 min

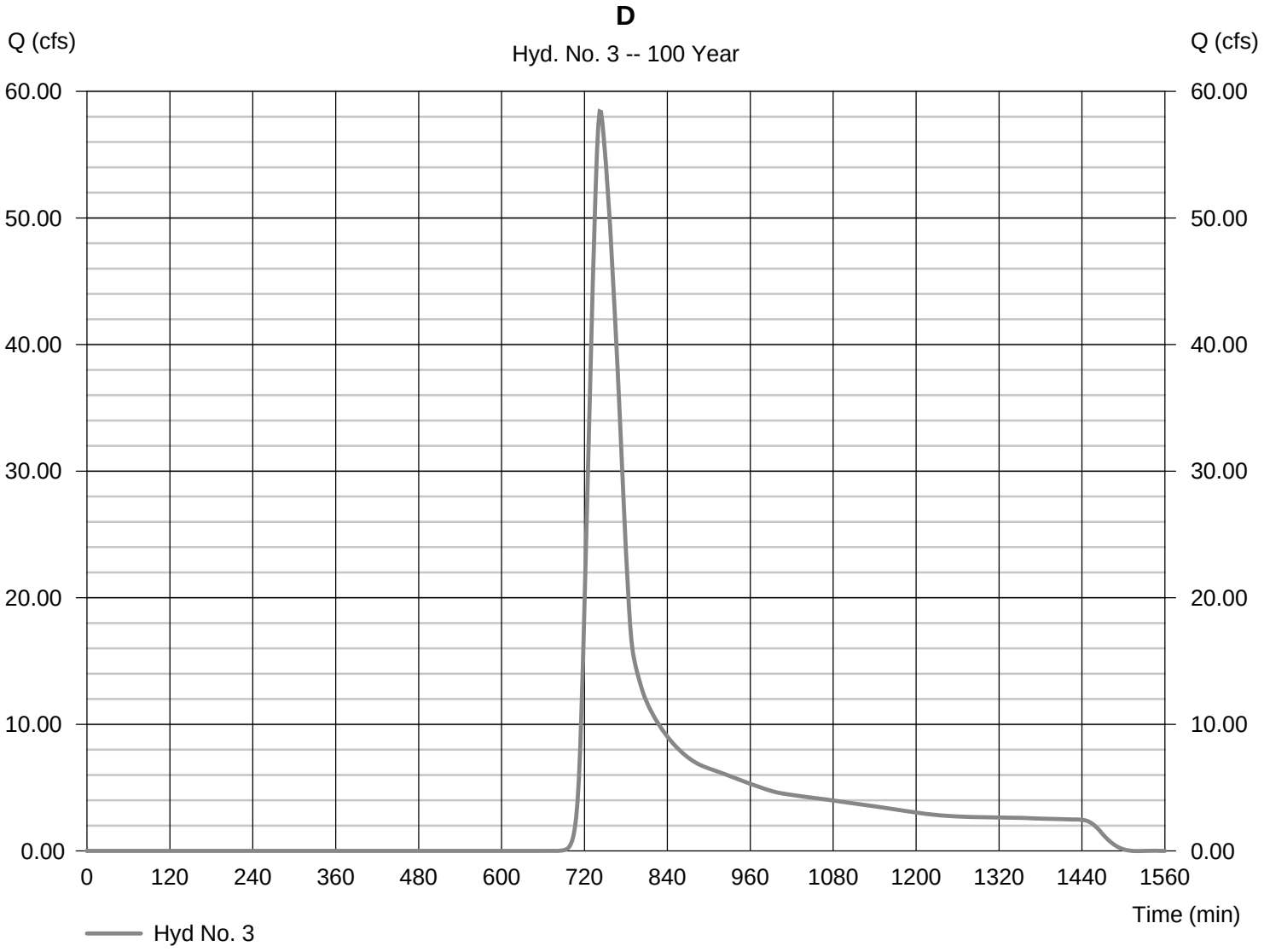
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 3

D

Hydrograph type	=	SCS Runoff	Peak discharge	=	58.42 cfs
Storm frequency	=	100 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	358,068 cuft
Drainage area	=	58.170 ac	Curve number	=	55
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	44.65 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No. 3

D

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 32.70**	**+**	**0.00**	**+**	**0.00**	**=**	**32.70**
Shallow Concentrated Flow							
Flow length (ft)	= 1400.00		0.00		0.00		
Watercourse slope (%)	= 2.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.70		0.00		0.00		
Travel Time (min)	**= 8.64**	**+**	**0.00**	**+**	**0.00**	**=**	**8.64**
Channel Flow							
X sectional flow area (sqft)	= 3.00		0.00		0.00		
Wetted perimeter (ft)	= 3.16		0.00		0.00		
Channel slope (%)	= 1.50		0.00		0.00		
Manning's n-value	= 0.020		0.015		0.015		
Velocity (ft/s)	=8.81						
			0.00				
					0.00		
Flow length (ft)	({0})1750.0		0.0		0.0		
Travel Time (min)	**= 3.31**	**+**	**0.00**	**+**	**0.00**	**=**	**3.31**

Total Travel Time, Tc ..... 44.65 min

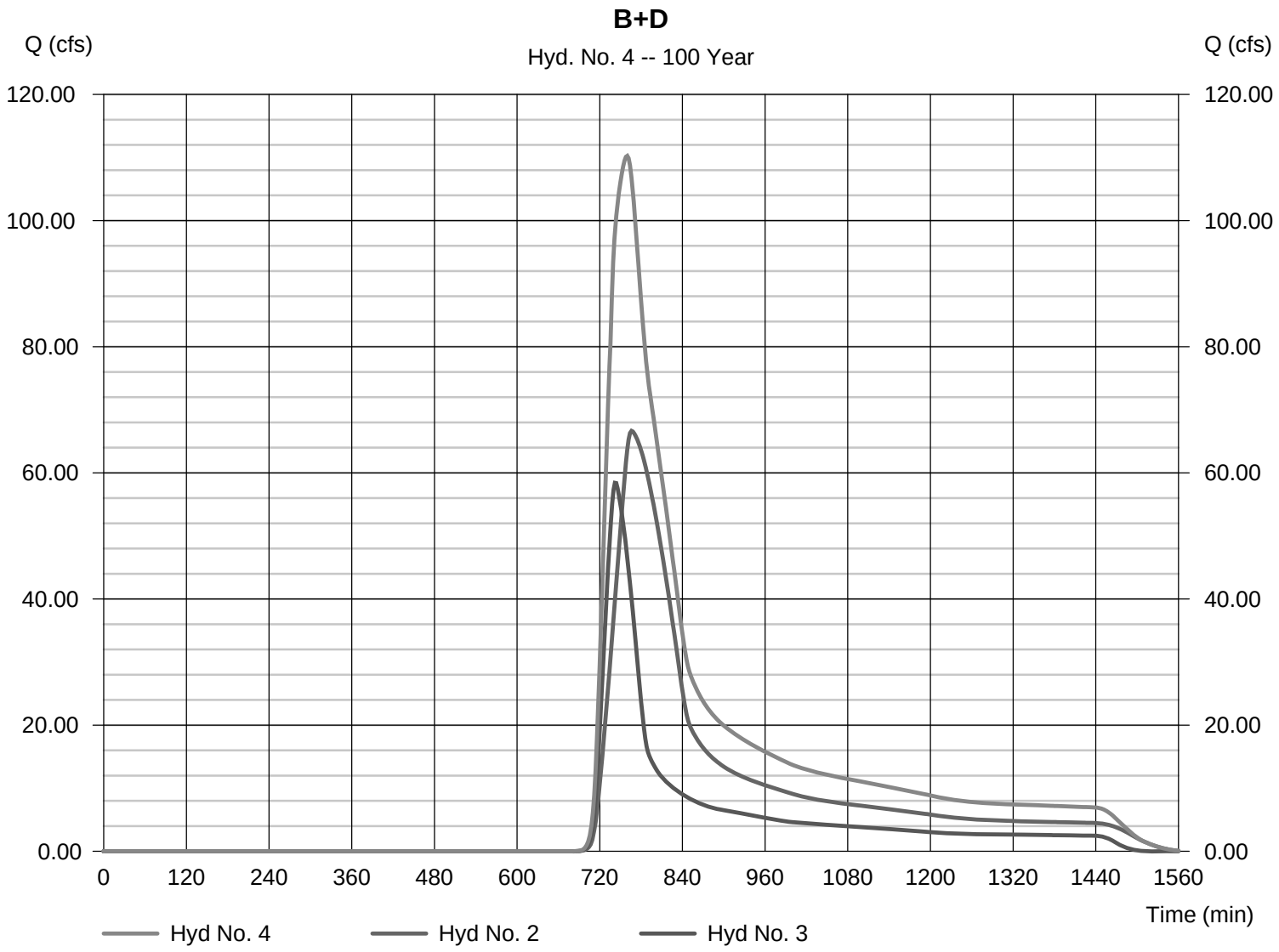
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 4

B+D

Hydrograph type	=	Combine	Peak discharge	=	110.26 cfs
Storm frequency	=	100 yrs	Time to peak	=	760 min
Time interval	=	2 min	Hyd. volume	=	998,566 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	160.780 ac



Hydrograph Report

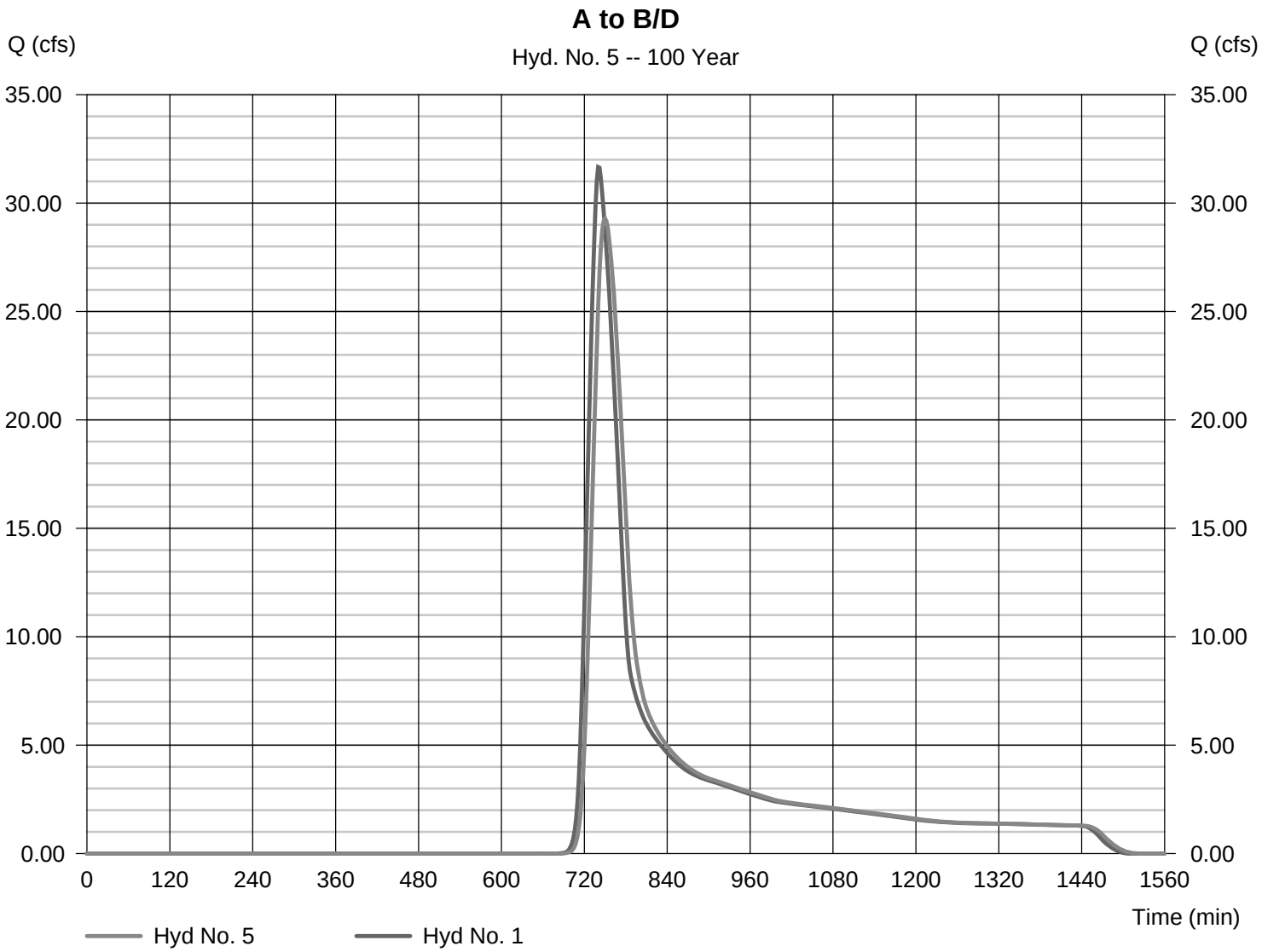
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 5

A to B/D

Hydrograph type	= Reach	Peak discharge	= 29.28 cfs
Storm frequency	= 100 yrs	Time to peak	= 750 min
Time interval	= 2 min	Hyd. volume	= 186,613 cuft
Inflow hyd. No.	= 1 - A	Section type	= Trapezoidal
Reach length	= 1740.0 ft	Channel slope	= 1.2 %
Manning's n	= 0.035	Bottom width	= 5.0 ft
Side slope	= 4.0:1	Max. depth	= 3.0 ft
Rating curve x	= 1.594	Rating curve m	= 1.293
Ave. velocity	= 3.14 ft/s	Routing coeff.	= 0.2454

Modified Att-Kin routing method used.



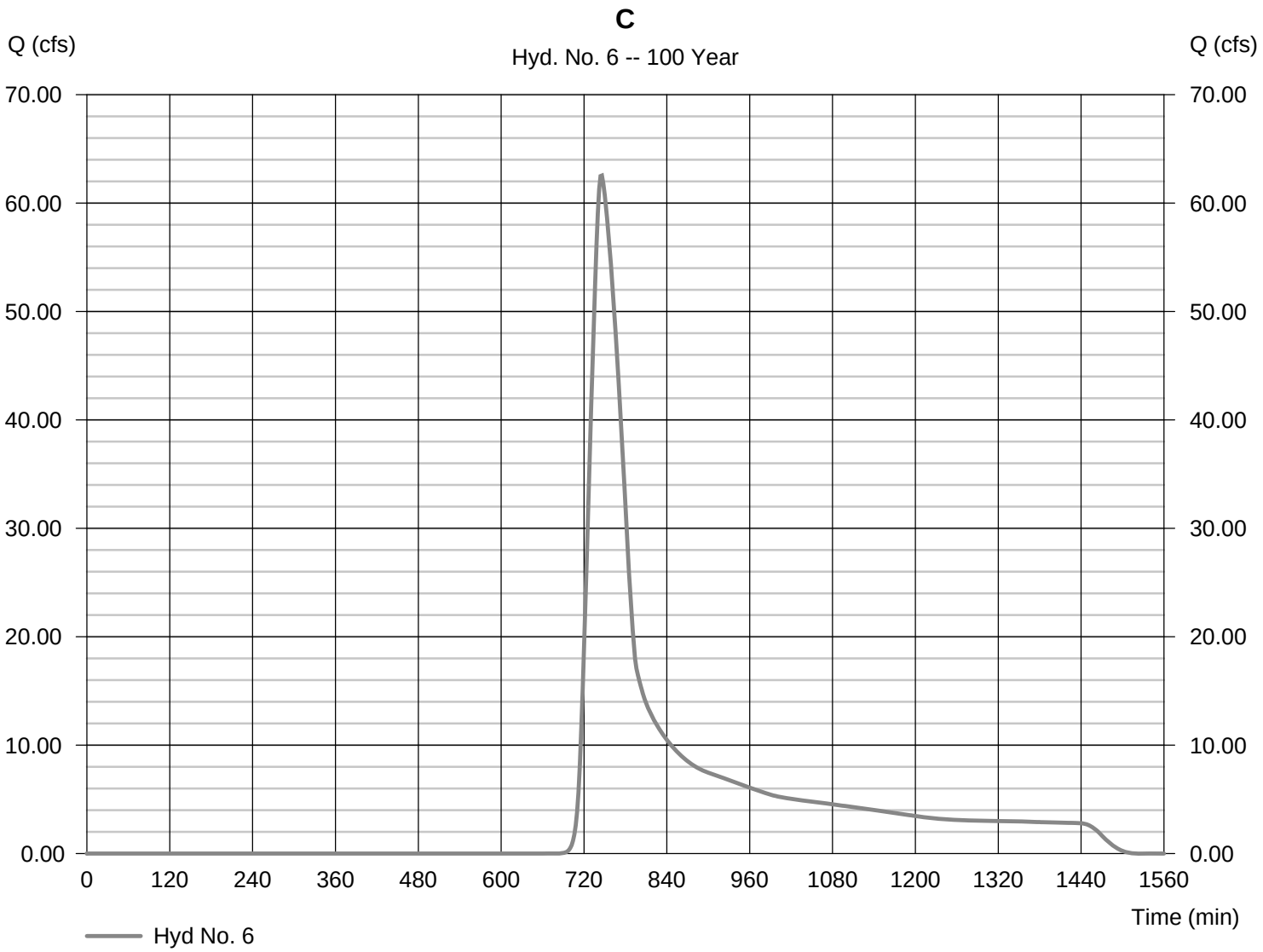
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 6

C

Hydrograph type	= SCS Runoff	Peak discharge	= 62.54 cfs
Storm frequency	= 100 yrs	Time to peak	= 746 min
Time interval	= 2 min	Hyd. volume	= 406,448 cuft
Drainage area	= 65.440 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 48.40 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 6

C

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 6.00		0.00		0.00		
Travel Time (min)	**= 36.69**	**+**	**0.00**	**+**	**0.00**	**=**	**36.69**
Shallow Concentrated Flow							
Flow length (ft)	= 2000.00		0.00		0.00		
Watercourse slope (%)	= 3.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.84		0.00		0.00		
Travel Time (min)	**= 11.73**	**+**	**0.00**	**+**	**0.00**	**=**	**11.73**
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 ..... 48.40 min

Hydrograph Report

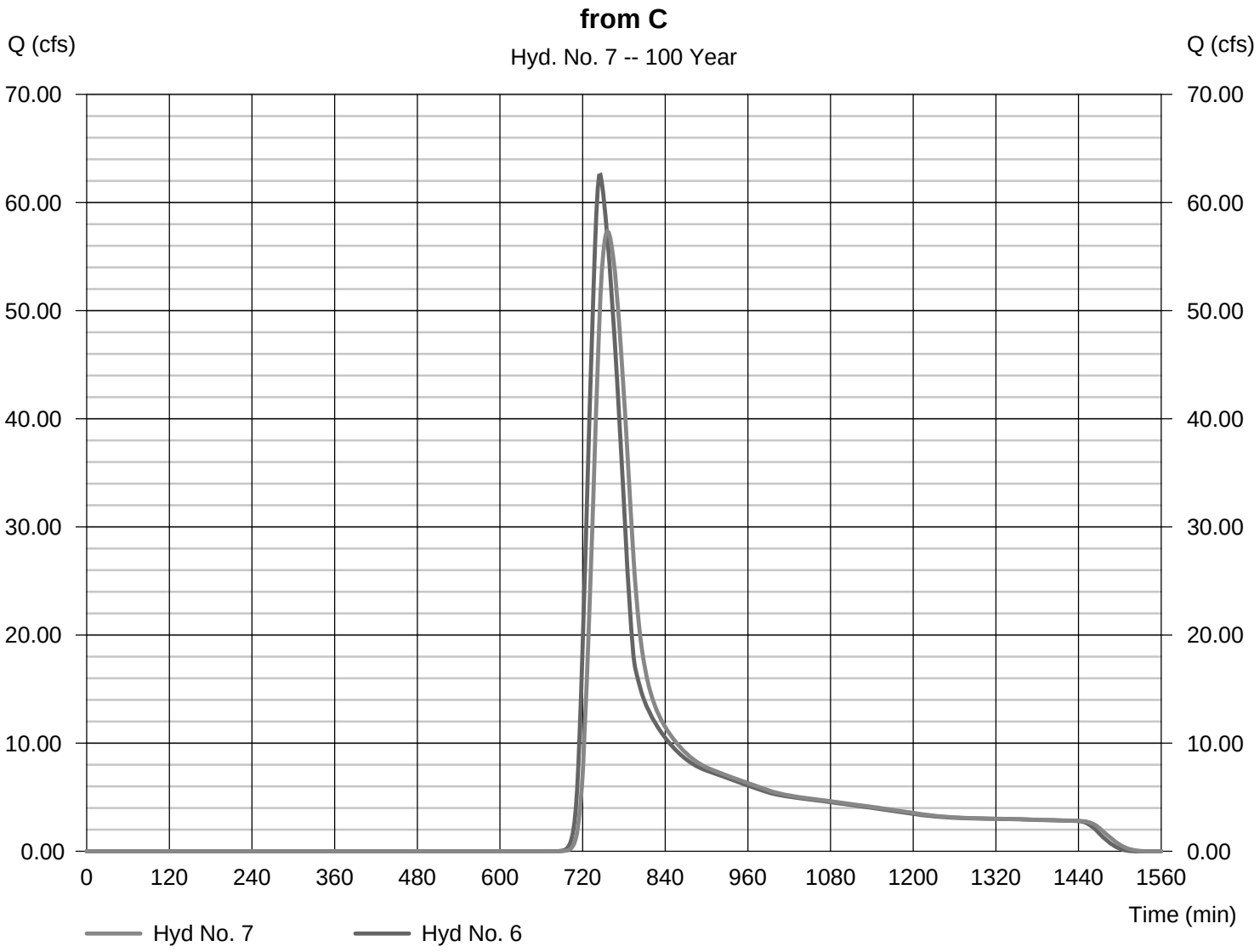
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 7

from C

Hydrograph type	= Reach	Peak discharge	= 57.34 cfs
Storm frequency	= 100 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 406,443 cuft
Inflow hyd. No.	= 6 - C	Section type	= Trapezoidal
Reach length	= 2400.0 ft	Channel slope	= 1.5 %
Manning's n	= 0.035	Bottom width	= 5.0 ft
Side slope	= 4.0:1	Max. depth	= 2.0 ft
Rating curve x	= 1.782	Rating curve m	= 1.257
Ave. velocity	= 3.69 ft/s	Routing coeff.	= 0.2076

Modified Att-Kin routing method used.



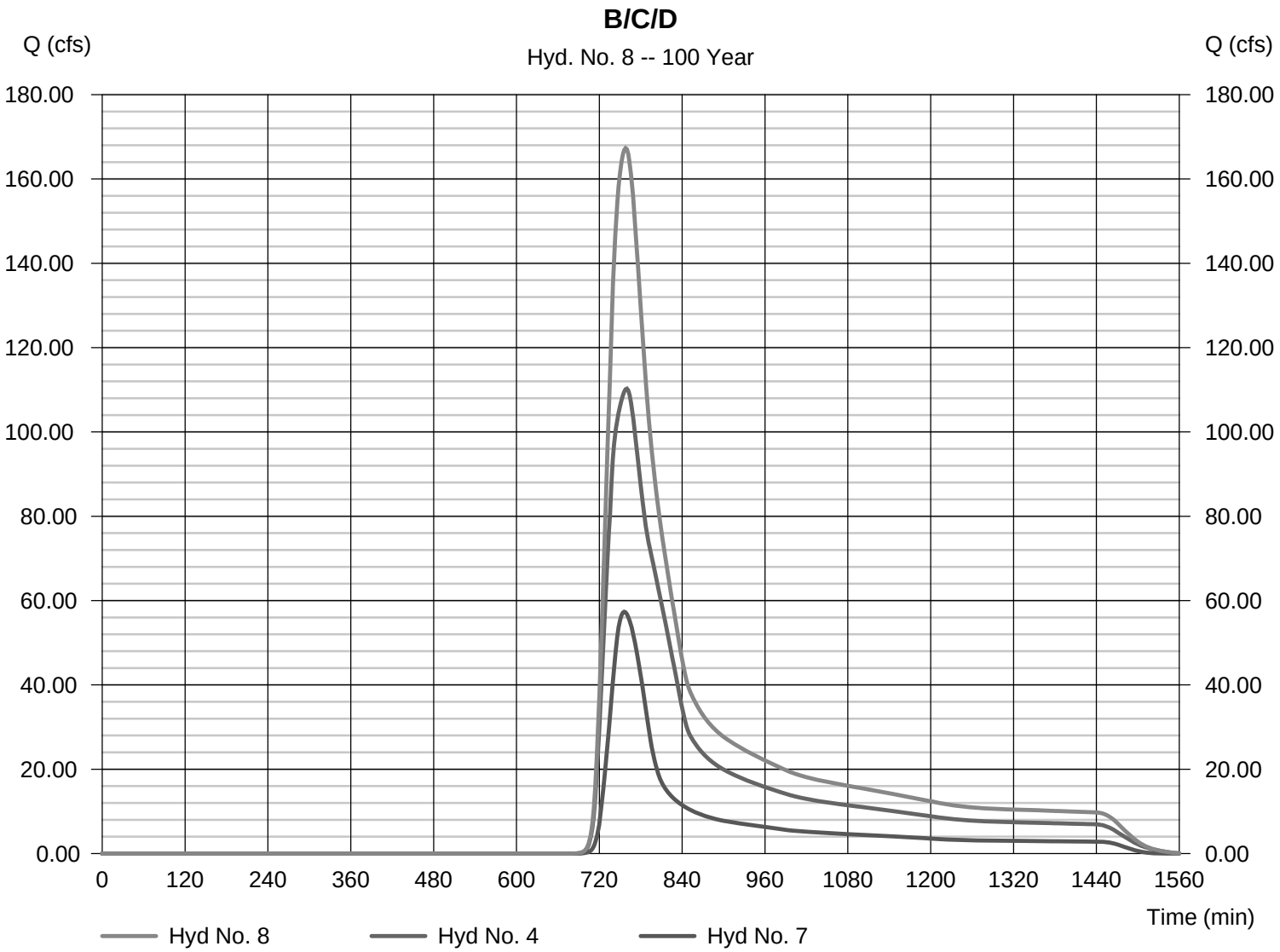
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 8

B/C/D

Hydrograph type	= Combine	Peak discharge	= 167.32 cfs
Storm frequency	= 100 yrs	Time to peak	= 758 min
Time interval	= 2 min	Hyd. volume	= 1,405,009 cuft
Inflow hyds.	= 4, 7	Contrib. drain. area	= 0.000 ac



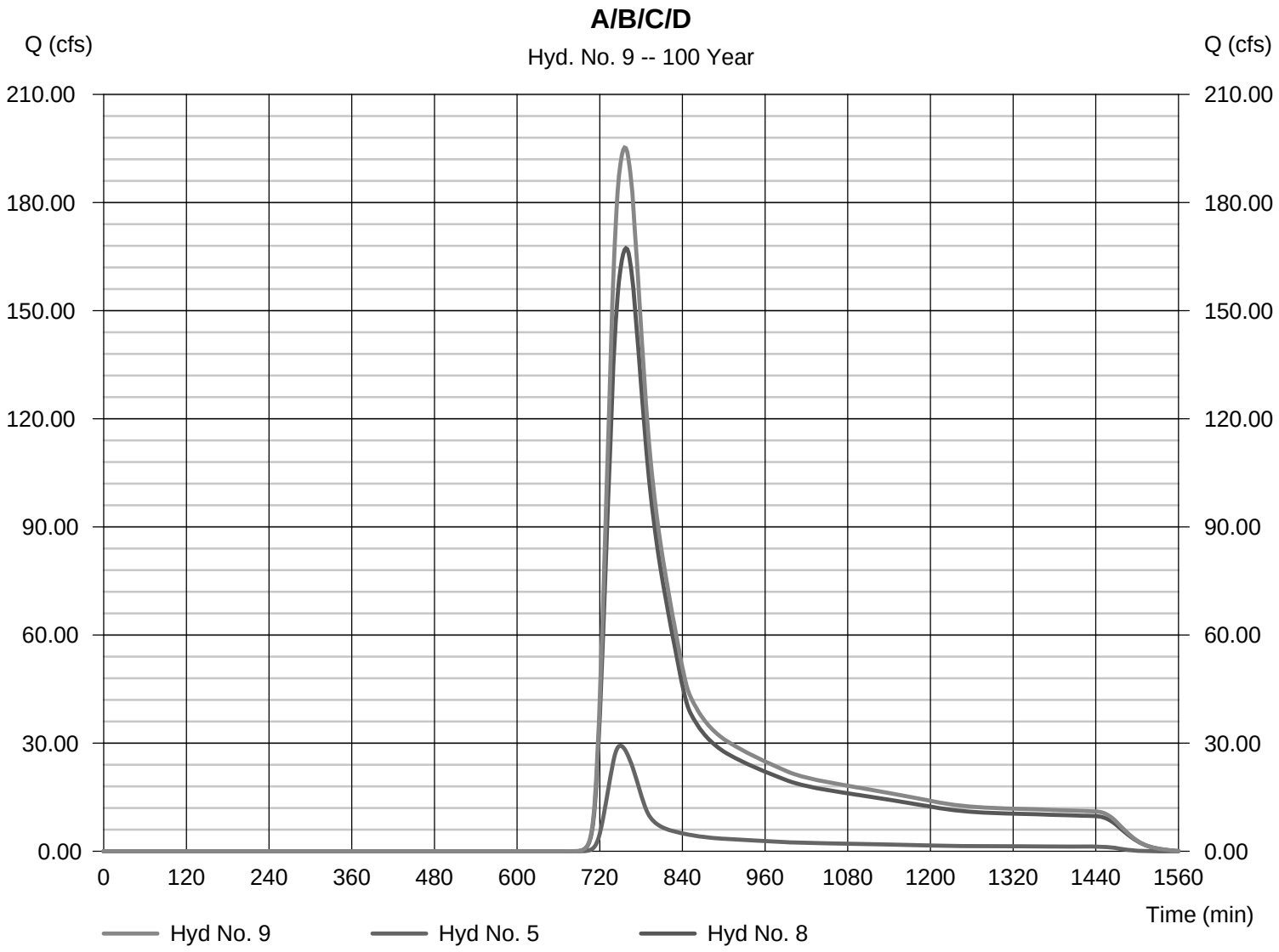
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 9

A/B/C/D

Hydrograph type	= Combine	Peak discharge	= 195.23 cfs
Storm frequency	= 100 yrs	Time to peak	= 756 min
Time interval	= 2 min	Hyd. volume	= 1,591,622 cuft
Inflow hyds.	= 5, 8	Contrib. drain. area	= 0.000 ac



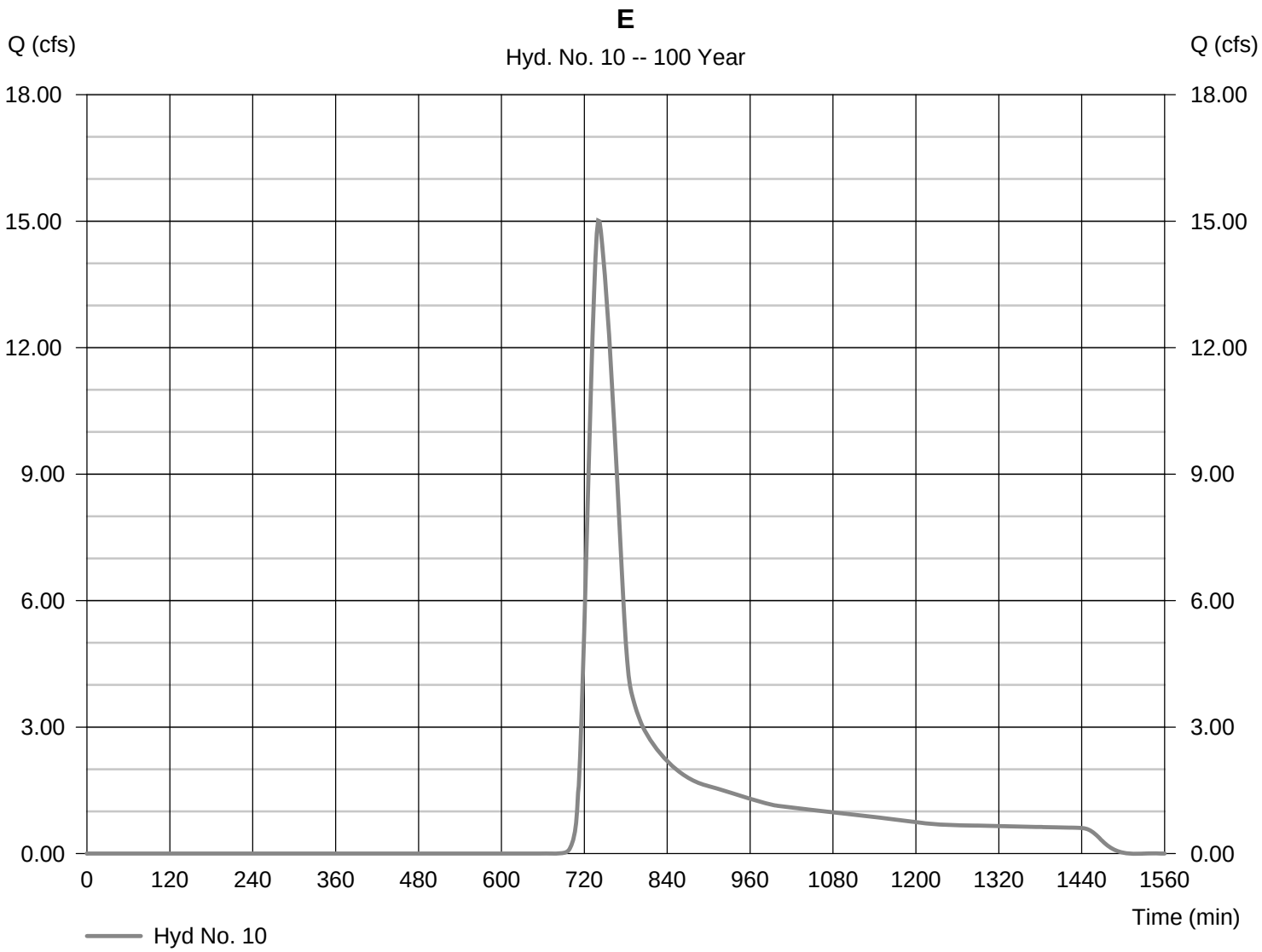
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 10

E

Hydrograph type	= SCS Runoff	Peak discharge	= 15.01 cfs
Storm frequency	= 100 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 88,480 cuft
Drainage area	= 14.110 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 42.20 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 10

E

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 4.70		0.00		0.00		
Travel Time (min)	**= 40.45**	**+**	**0.00**	**+**	**0.00**	**=**	**40.45**
Shallow Concentrated Flow							
Flow length (ft)	= 400.00		0.00		0.00		
Watercourse slope (%)	= 5.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.78		0.00		0.00		
Travel Time (min)	**= 1.76**	**+**	**0.00**	**+**	**0.00**	**=**	**1.76**
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 ..... 42.20 min

Hydrograph Report

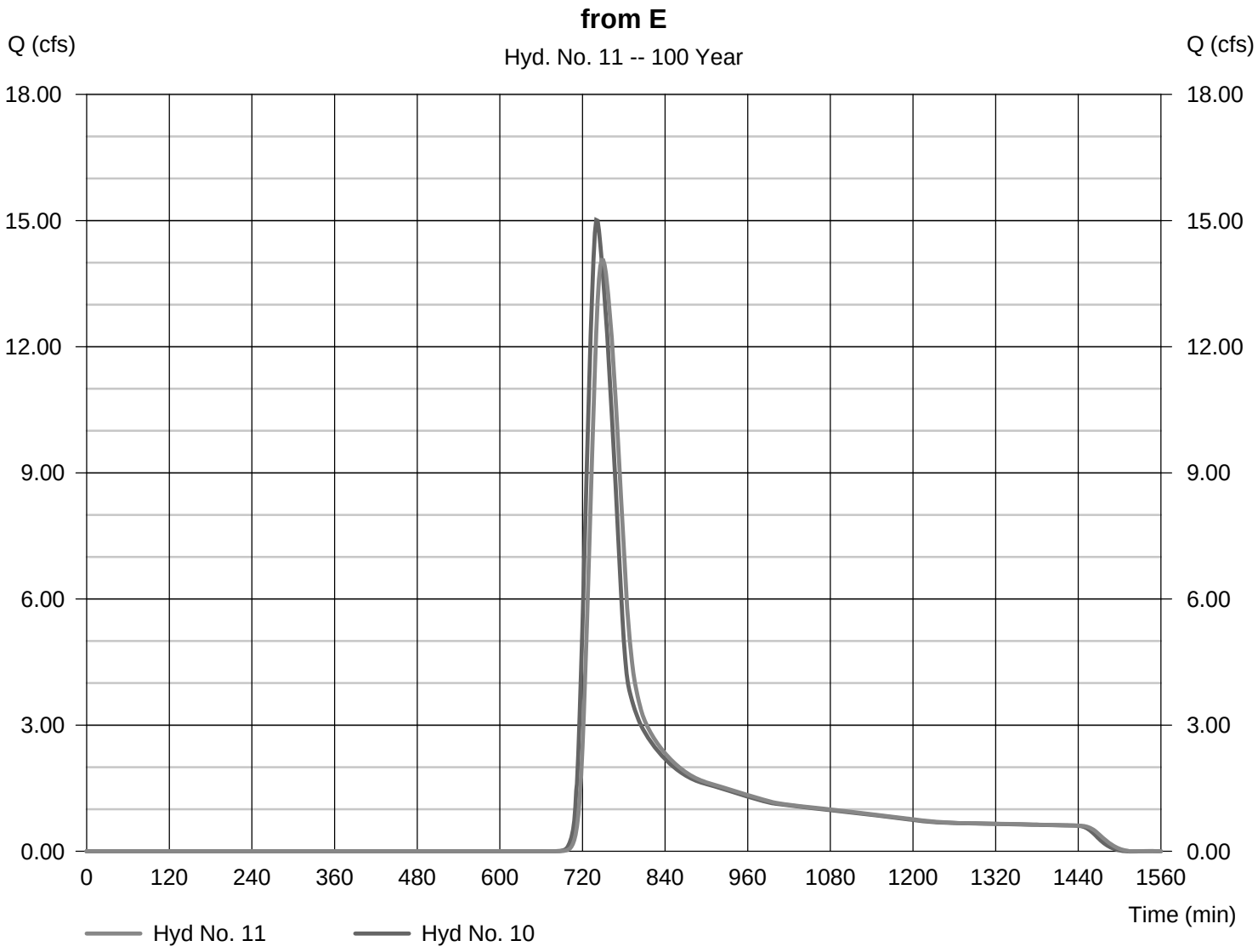
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 11

from E

Hydrograph type	= Reach	Peak discharge	= 14.06 cfs
Storm frequency	= 100 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 88,476 cuft
Inflow hyd. No.	= 10 - E	Section type	= Trapezoidal
Reach length	= 1500.0 ft	Channel slope	= 1.6 %
Manning's n	= 0.035	Bottom width	= 5.0 ft
Side slope	= 4.0:1	Max. depth	= 4.0 ft
Rating curve x	= 1.841	Rating curve m	= 1.310
Ave. velocity	= 3.02 ft/s	Routing coeff.	= 0.2736

Modified Att-Kin routing method used.



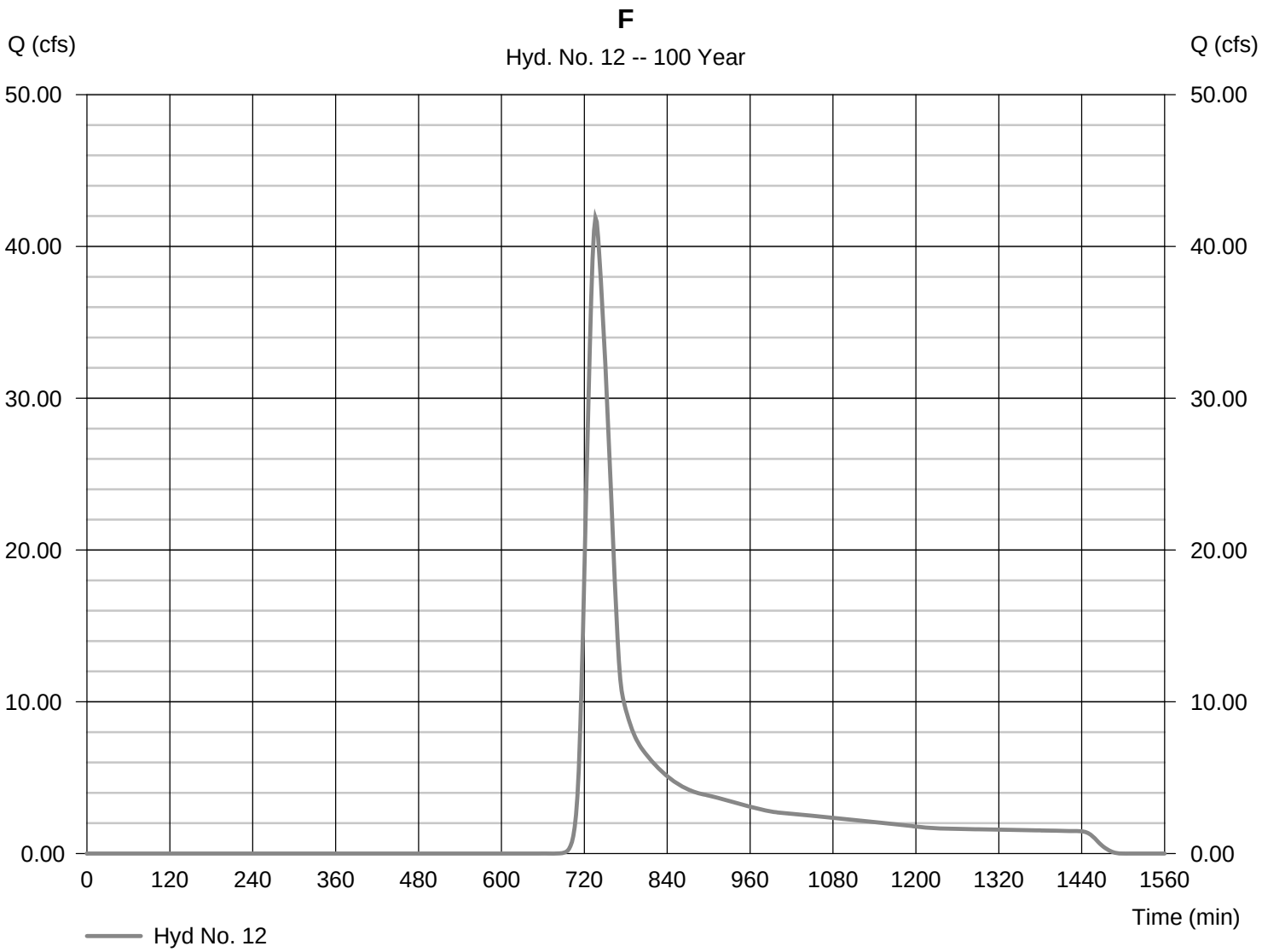
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 12

F

Hydrograph type	=	SCS Runoff	Peak discharge	=	41.89 cfs
Storm frequency	=	100 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	214,669 cuft
Drainage area	=	34.960 ac	Curve number	=	55
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	36.90 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 12

F

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 11.33		0.00		0.00		
Travel Time (min)	**= 28.45**	**+**	**0.00**	**+**	**0.00**	**=**	**28.45**
Shallow Concentrated Flow							
Flow length (ft)	= 1300.00		0.00		0.00		
Watercourse slope (%)	= 2.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.55		0.00		0.00		
Travel Time (min)	**= 8.49**	**+**	**0.00**	**+**	**0.00**	**=**	**8.49**
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 ..... 36.90 min

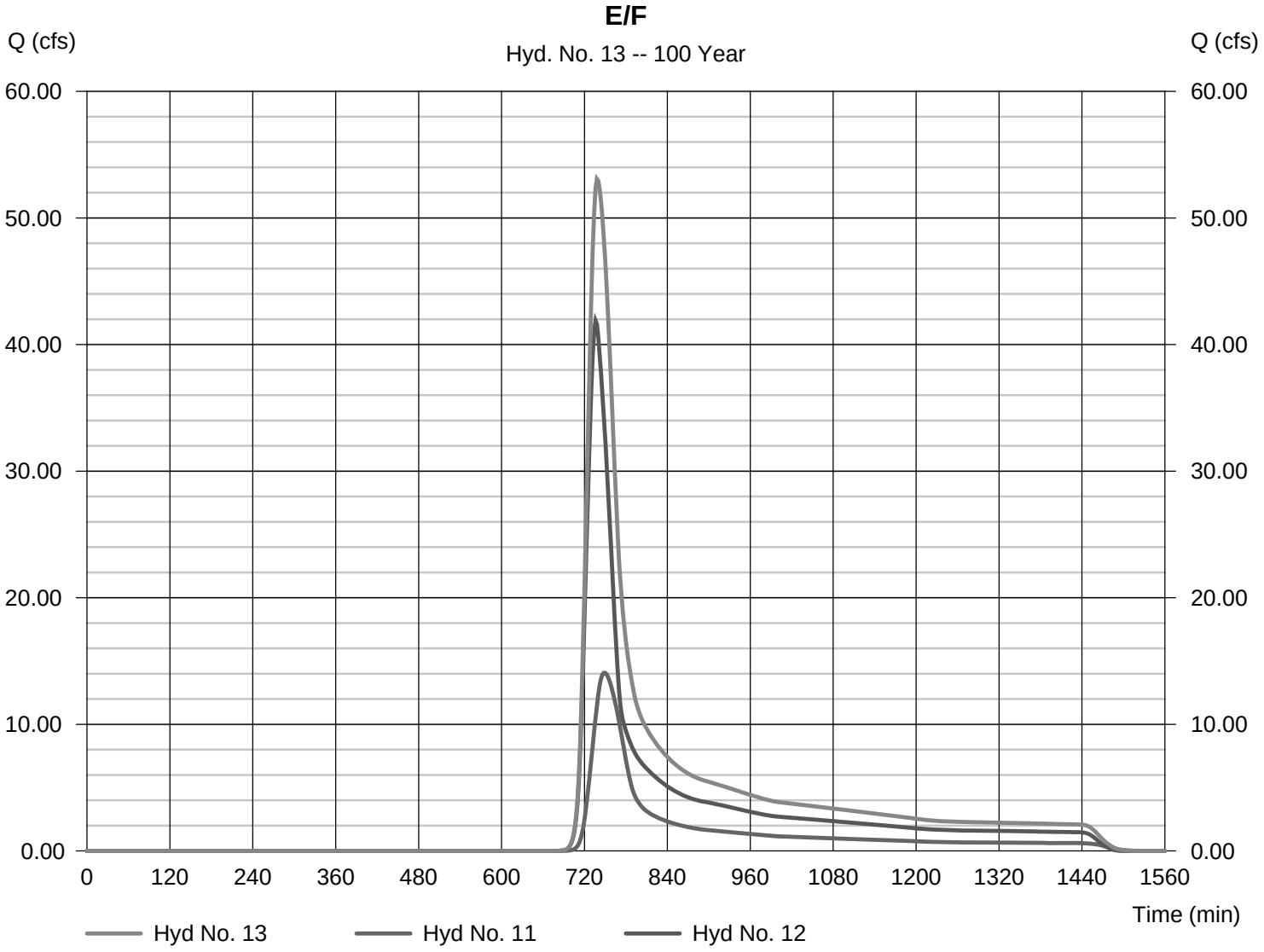
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 13

E/F

Hydrograph type	=	Combine	Peak discharge	=	53.08 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	303,146 cuft
Inflow hyds.	=	11, 12	Contrib. drain. area	=	34.960 ac



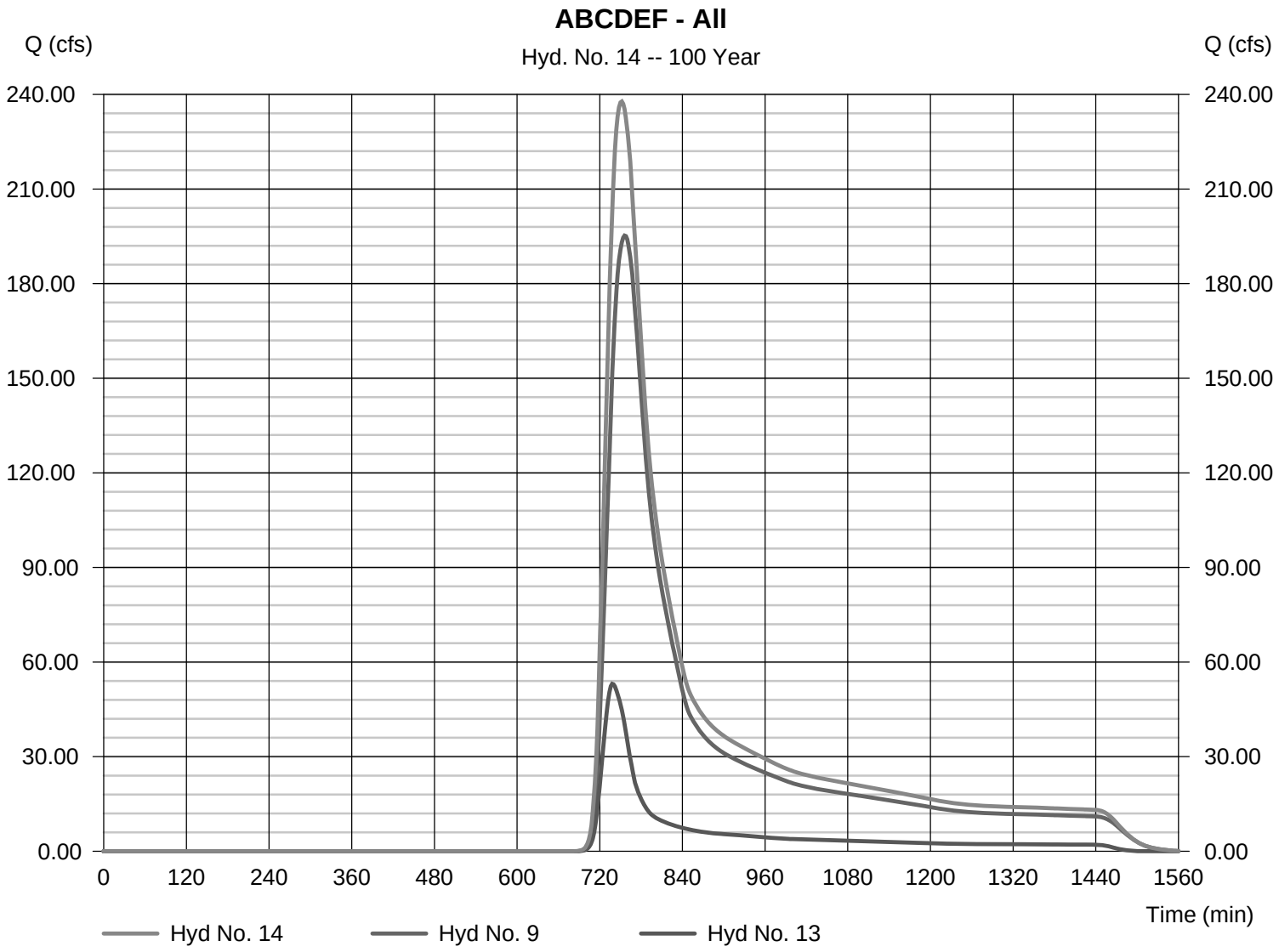
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 14

ABCDEF - All

Hydrograph type	=	Combine	Peak discharge	=	237.77 cfs
Storm frequency	=	100 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	1,894,767 cuft
Inflow hyds.	=	9, 13	Contrib. drain. area	=	0.000 ac



Hydrograph Report

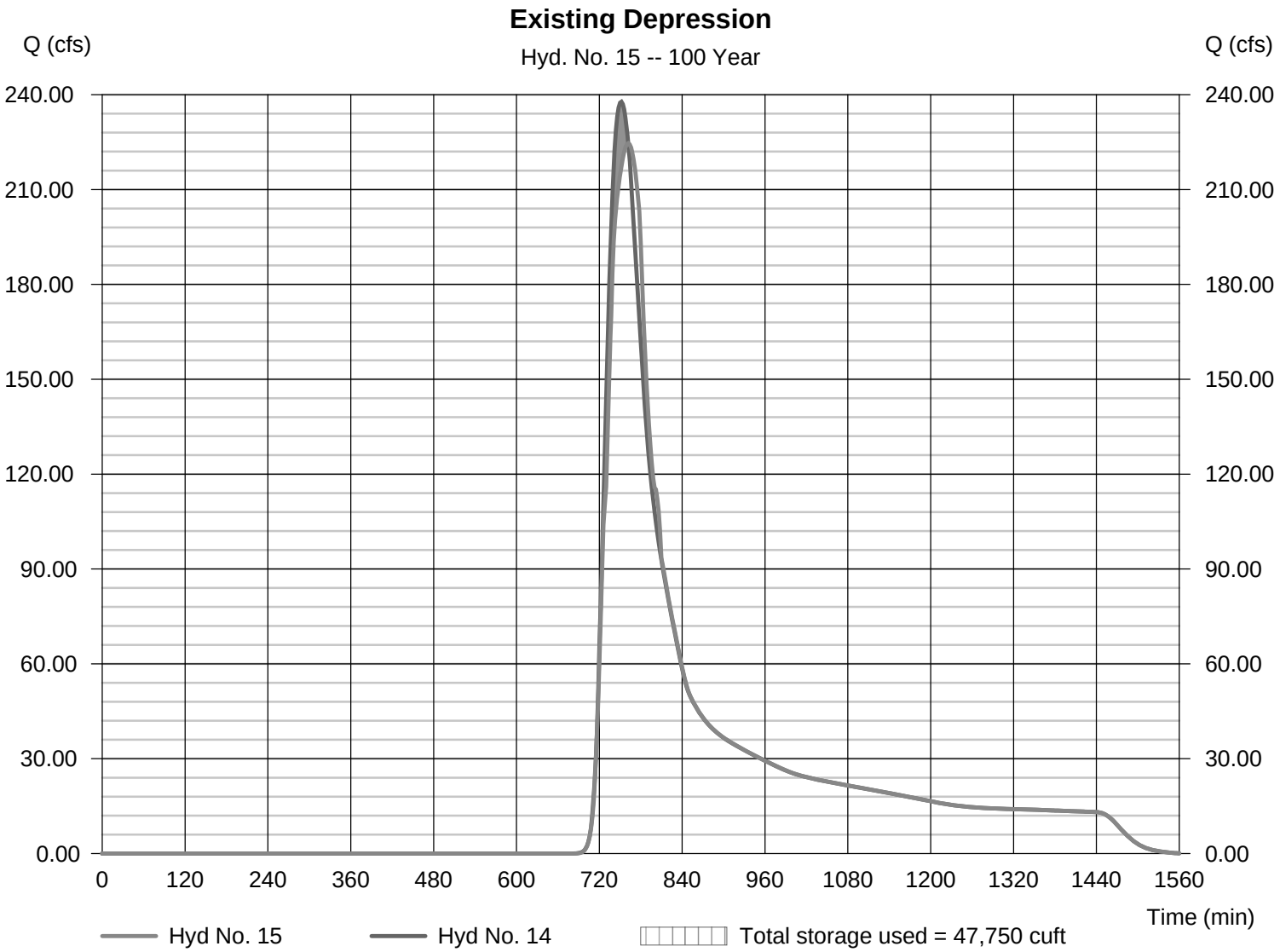
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 15

Existing Depression

Hydrograph type	=	Reservoir	Peak discharge	=	224.66 cfs
Storm frequency	=	100 yrs	Time to peak	=	762 min
Time interval	=	2 min	Hyd. volume	=	1,894,768 cuft
Inflow hyd. No.	=	14 - ABCDEF - All	Max. Elevation	=	736.37 ft
Reservoir name	=	existing depression	Max. Storage	=	47,750 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 1 - existing depression

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 729.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	729.00	100	0	0
1.00	730.00	300	191	191
2.00	731.00	500	396	587
3.00	732.00	700	597	1,184
4.00	733.00	900	798	1,982
5.00	734.00	1,200	1,046	3,028
6.00	735.00	9,429	4,664	7,692
7.00	736.00	31,928	19,567	27,259
8.00	737.00	81,585	54,845	82,104

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 72.00	0.00	0.00	0.00
Span (in)	= 72.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 729.00	0.00	0.00	0.00
Length (ft)	= 140.00	0.00	0.00	0.00
Slope (%)	= 0.35	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.82	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

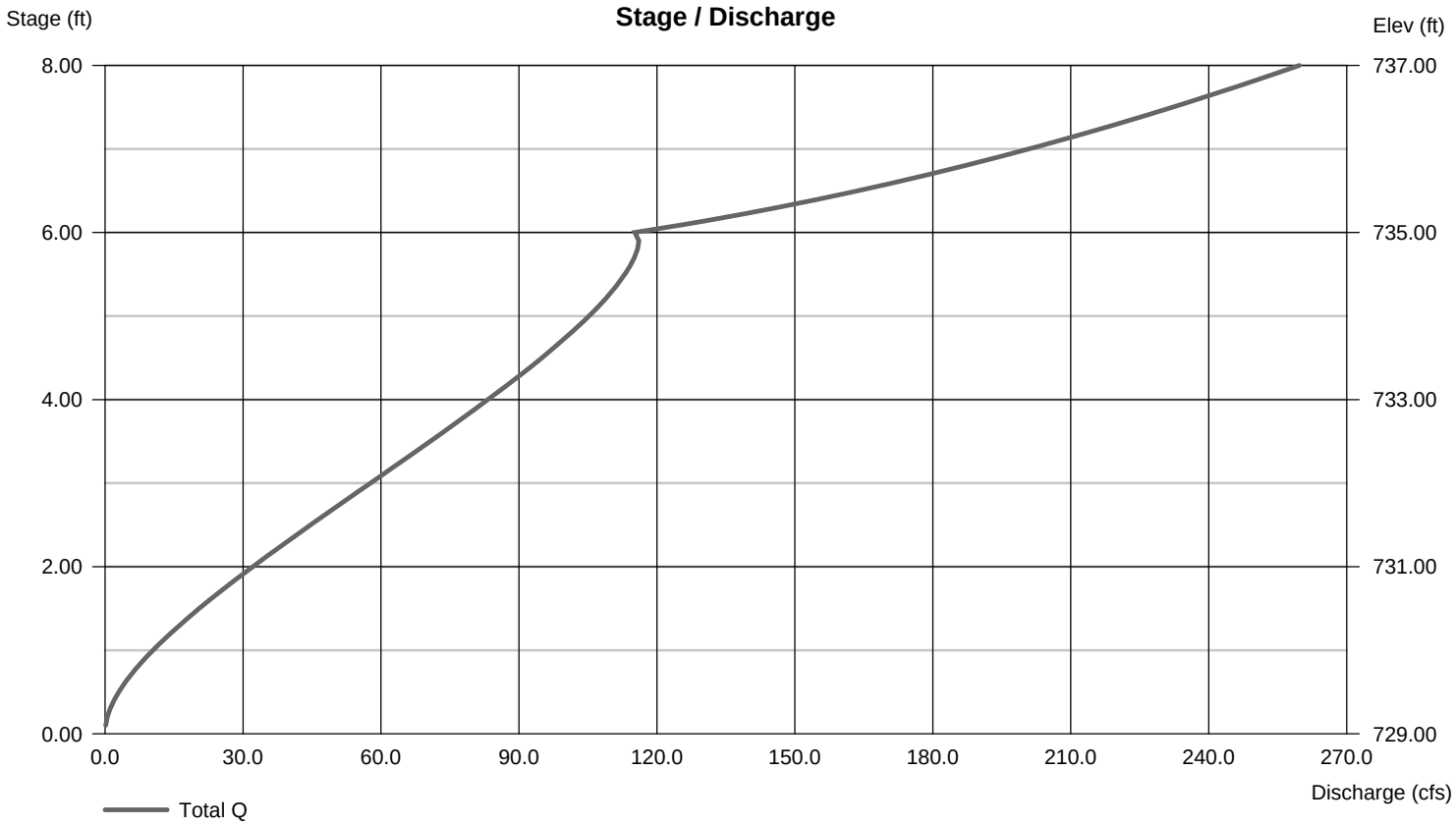
Weir Structures

	[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 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).



Appendix H

Alternatives A & C Residential Predevelopment Hydrograph Report

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Legend

Hyd.	Origin	Description
1	SCS Runoff	J - Existing

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	5.634	2	742	34,533	------	------	------	J - Existing

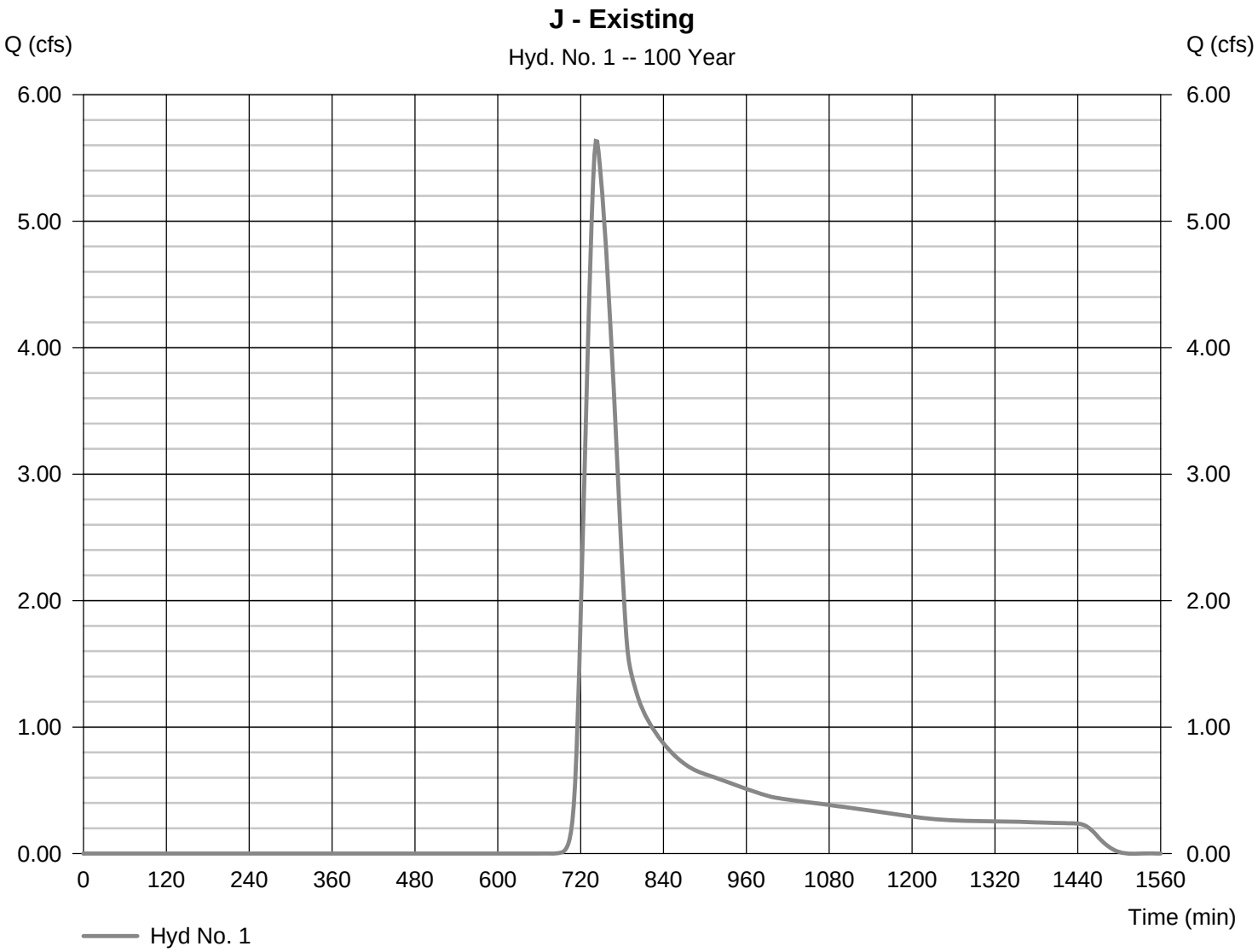
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 1

J - Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 5.634 cfs
Storm frequency	= 100 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 34,533 cuft
Drainage area	= 5.610 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 44.90 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Appendix H

Alternative B Predevelopment Hydrograph Report

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Legend

Hyd.	Origin	Description
1	SCS Runoff	North Watershed
2	SCS Runoff	South Watershed

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	123.48	2	768	1,098,418	------	------	------	North Watershed
2	SCS Runoff	65.63	2	768	583,844	------	------	------	South Watershed

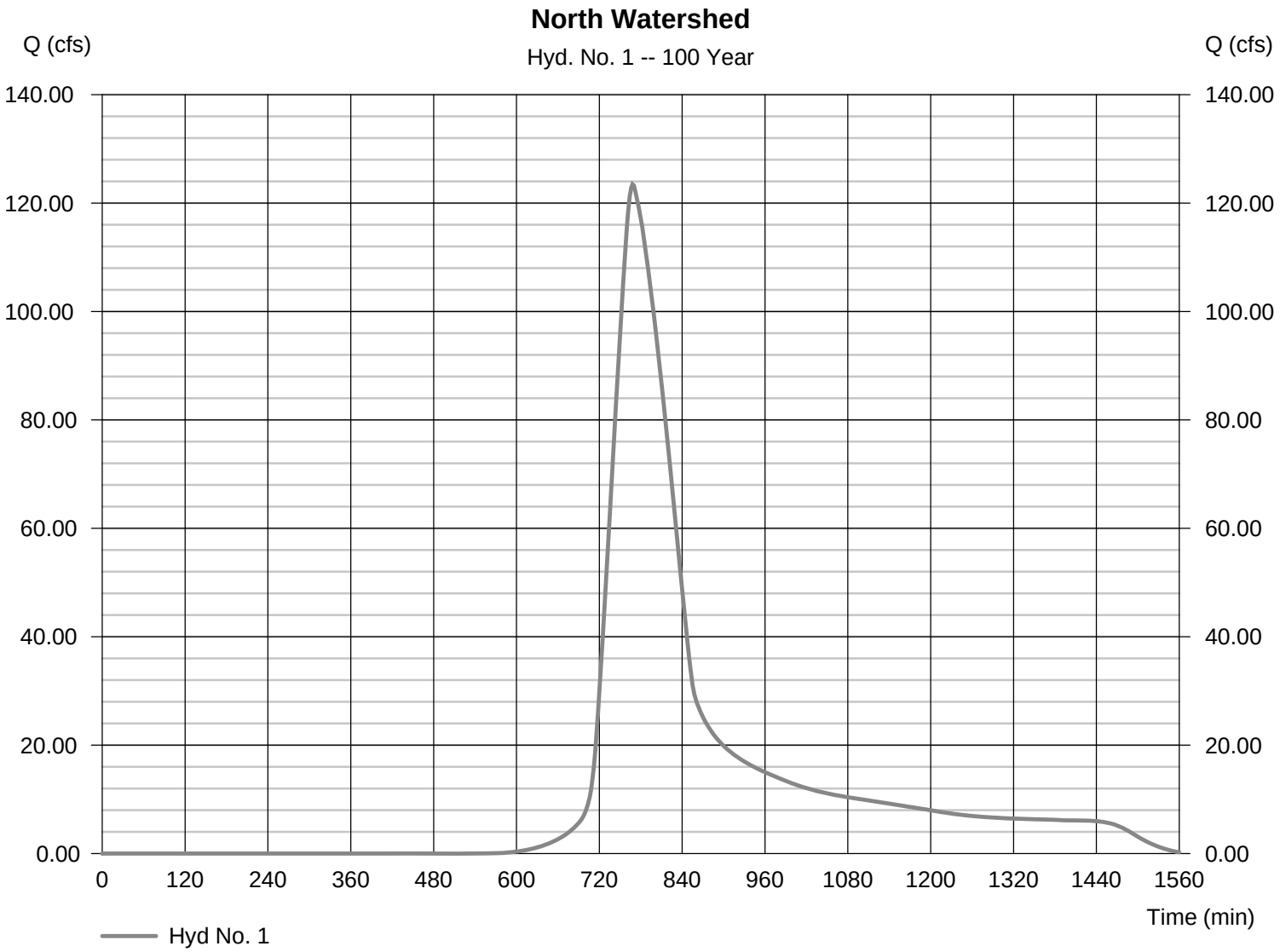
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 1

North Watershed

Hydrograph type	=	SCS Runoff	Peak discharge	=	123.48 cfs
Storm frequency	=	100 yrs	Time to peak	=	768 min
Time interval	=	2 min	Hyd. volume	=	1,098,418 cuft
Drainage area	=	111.000 ac	Curve number	=	70
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	89.00 min
Total precip.	=	5.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 1

North Watershed

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.68		0.00		0.00		
Land slope (%)	= 3.30		0.00		0.00		
Travel Time (min)	**= 46.25**	**+**	**0.00**	**+**	**0.00**	**=**	**46.25**
Shallow Concentrated Flow							
Flow length (ft)	= 3632.00		0.00		0.00		
Watercourse slope (%)	= 0.77		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.42		0.00		0.00		
Travel Time (min)	**= 42.76**	**+**	**0.00**	**+**	**0.00**	**=**	**42.76**
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 ..... 89.00 min

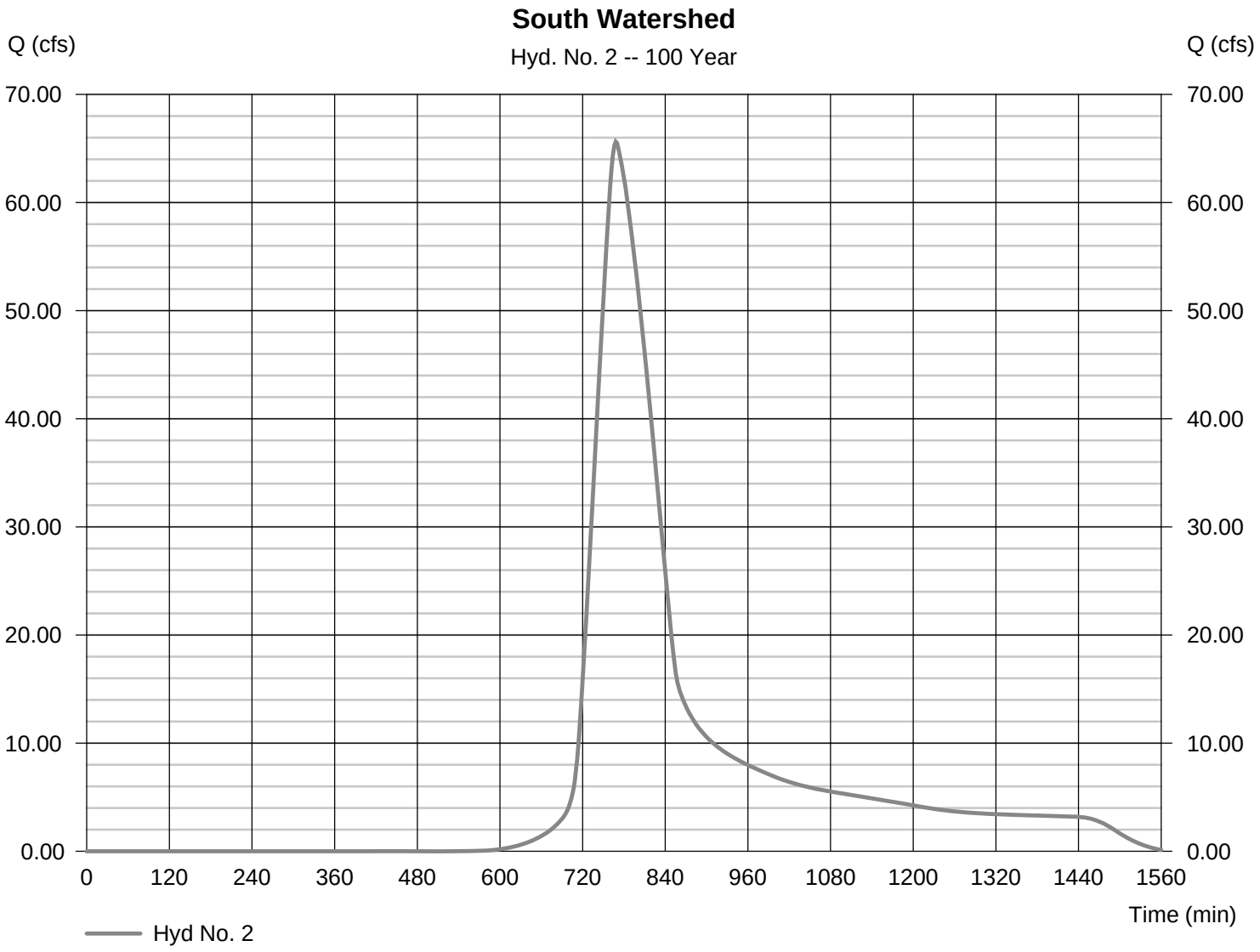
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 2

South Watershed

Hydrograph type	= SCS Runoff	Peak discharge	= 65.63 cfs
Storm frequency	= 100 yrs	Time to peak	= 768 min
Time interval	= 2 min	Hyd. volume	= 583,844 cuft
Drainage area	= 59.000 ac	Curve number	= 70
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 89.10 min
Total precip.	= 5.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 2

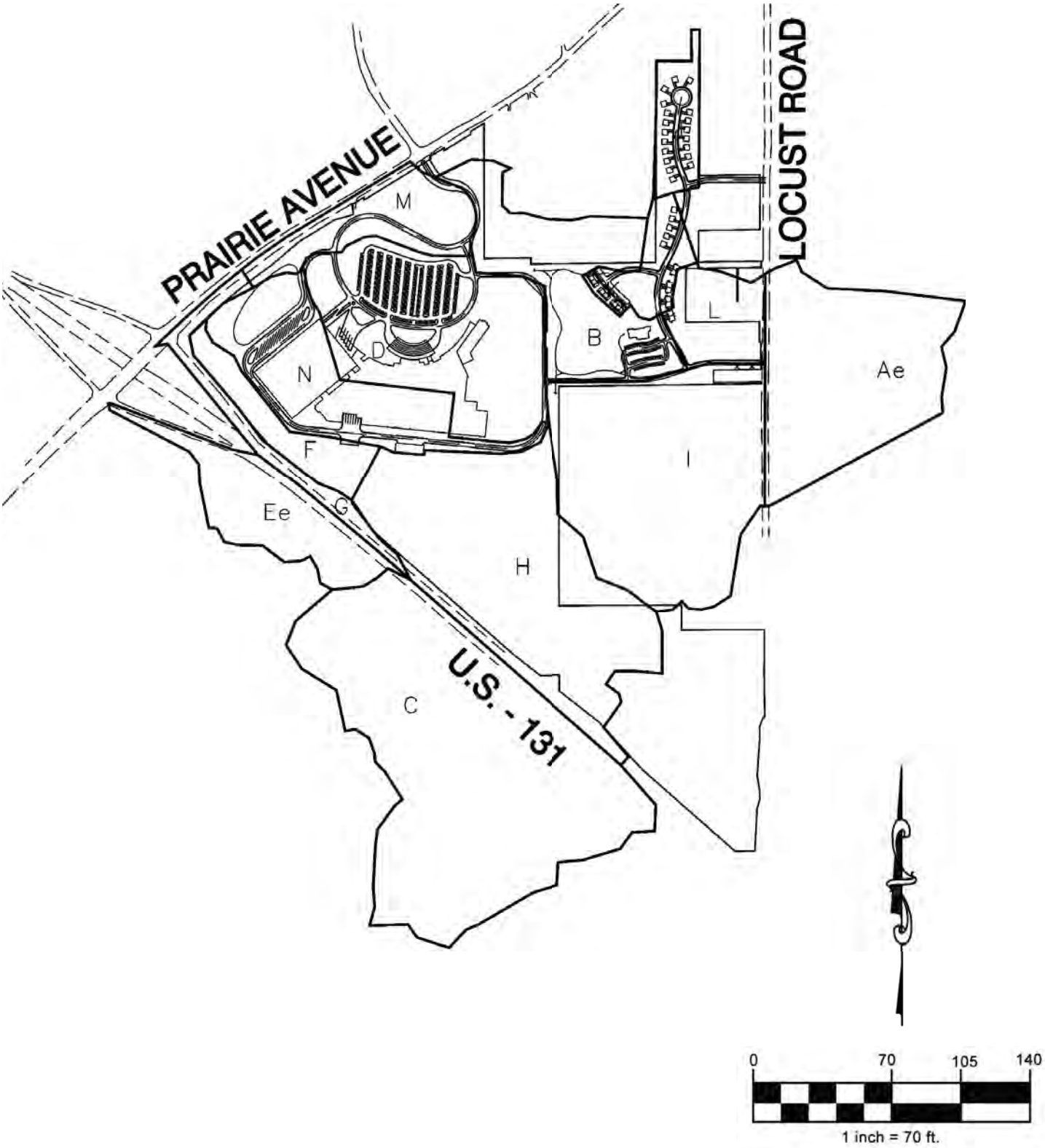
South Watershed

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.68		0.00		0.00		
Land slope (%)	= 1.30		0.00		0.00		
Travel Time (min)	**= 67.14**	**+**	**0.00**	**+**	**0.00**	**=**	**67.14**
Shallow Concentrated Flow							
Flow length (ft)	= 1900.00		0.00		0.00		
Watercourse slope (%)	= 0.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.44		0.00		0.00		
Travel Time (min)	**= 21.94**	**+**	**0.00**	**+**	**0.00**	**=**	**21.94**
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 ..... 89.10 min

Appendix H

Alternative A Proposed Drainage Area

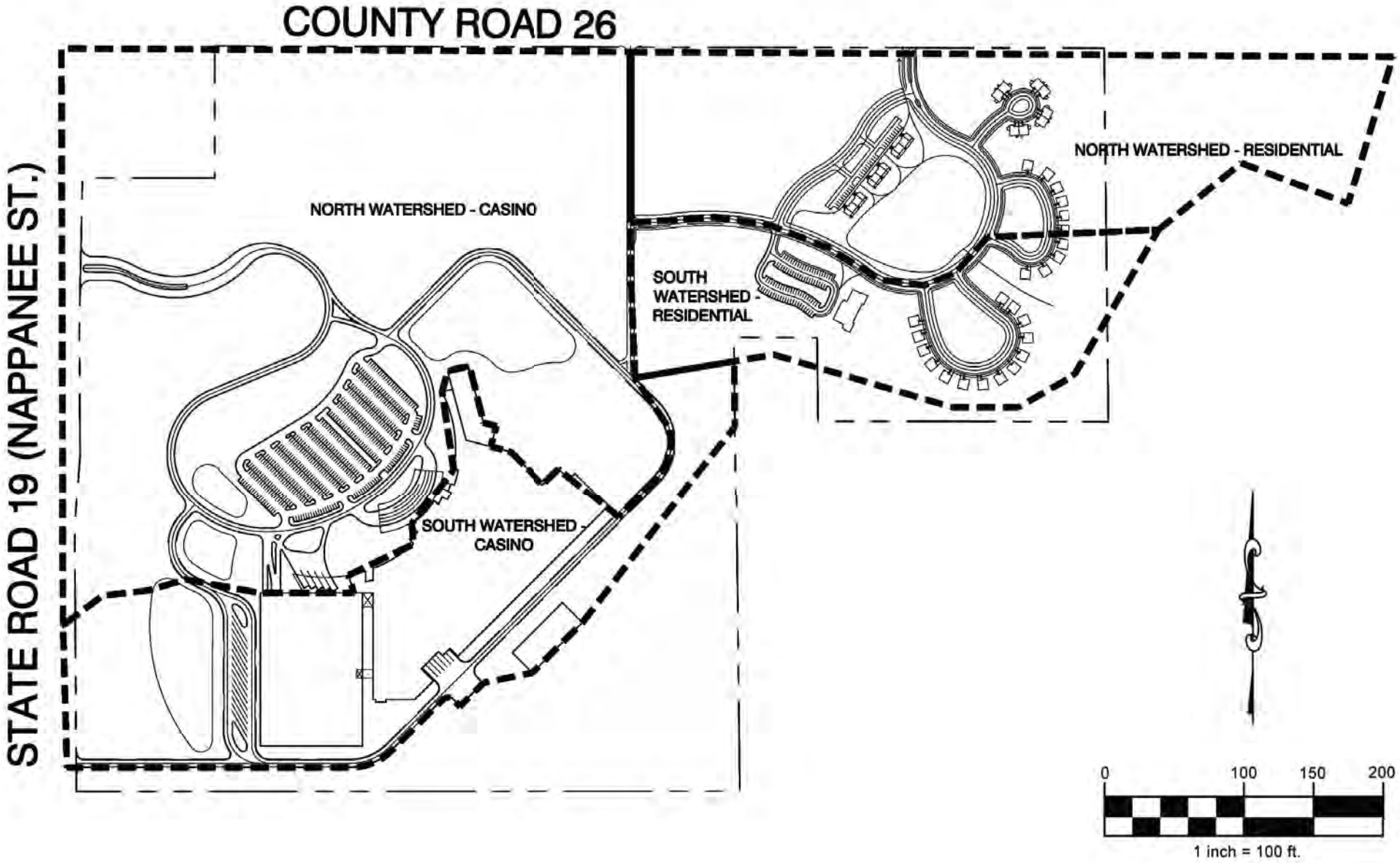


Source: St. Joseph County GIS

Alternate A Proposed Drainage Areas

Appendix H

Alternative B Proposed Drainage Areas

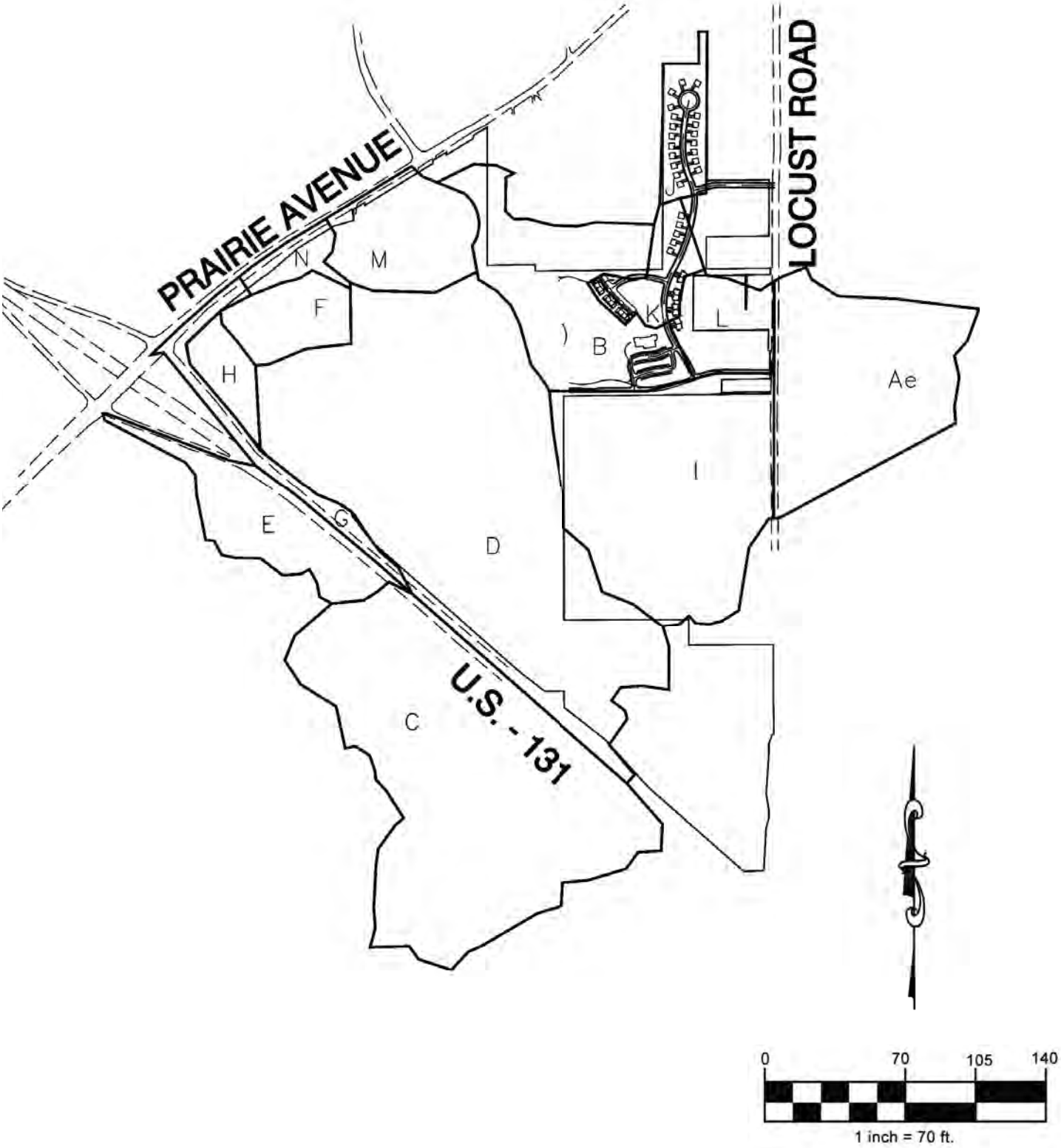


Source: Elkhart County GIS

Alternate B Proposed Drainage Areas

Appendix H

Alternative C Proposed Drainage Areas



Source: St. Joseph County GIS

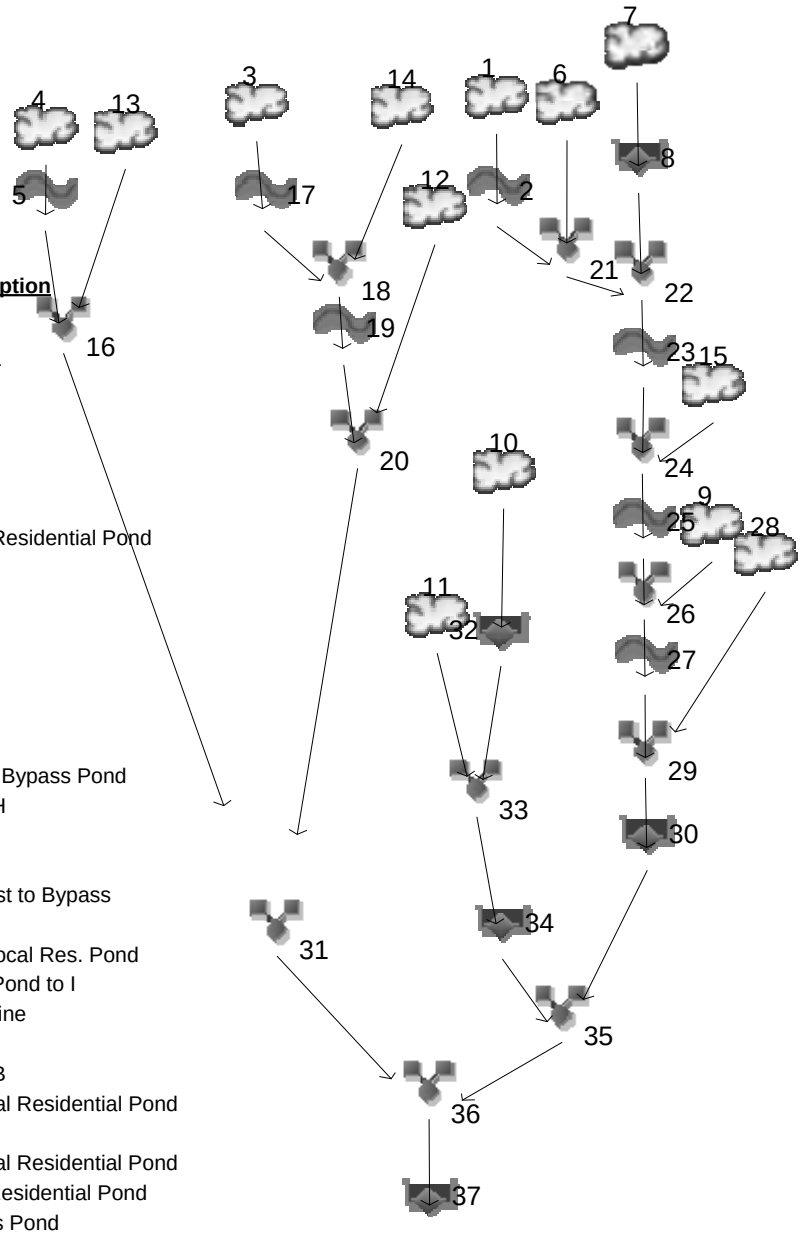
Alternate C Proposed Drainage Areas

Appendix H

Alternative A Proposed Hydrograph Report

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10



Legend

Hyd.	Origin	Description
1	SCS Runoff	Ae
2	Reach	Ae to L
3	SCS Runoff	Ce
4	SCS Runoff	Ee
5	Reach	from E
6	SCS Runoff	L
7	SCS Runoff	K
8	Reservoir	Local Residential Pond
9	SCS Runoff	B
10	SCS Runoff	D
11	SCS Runoff	N
12	SCS Runoff	F
13	SCS Runoff	G
14	SCS Runoff	H
15	SCS Runoff	I
16	Combine	Ee/G - Bypass Pond
17	Reach	Ce to H
18	Combine	Ce/H
19	Reach	to F
20	Combine	Go west to Bypass
21	Combine	Ae/L
22	Combine	Past Local Res. Pond
23	Reach	Local Pond to I
24	Combine	I combine
25	Reach	I to B
26	Combine	I et al/B
27	Reach	To Final Residential Pond
28	SCS Runoff	M
29	Combine	To Final Residential Pond
30	Reservoir	Final Residential Pond
31	Combine	Bypass Pond
32	Reservoir	Initial Casino Pond
33	Combine	N/D pond
34	Reservoir	Main Casino Pond
35	Combine	To Culvert
36	Combine	To Culvert
37	Reservoir	Final Culvert

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	31.66	2	740	186,617	------	------	------	Ae
2	Reach	31.48	2	744	186,616	1	------	------	Ae to L
3	SCS Runoff	62.54	2	746	406,448	------	------	------	Ce
4	SCS Runoff	15.01	2	740	88,480	------	------	------	Ee
5	Reach	14.06	2	748	88,476	4	------	------	from E
6	SCS Runoff	14.86	2	734	67,085	------	------	------	L
7	SCS Runoff	21.35	2	726	73,838	------	------	------	K
8	Reservoir	0.859	2	936	73,793	7	762.76	46,571	Local Residential Pond
9	SCS Runoff	36.60	2	740	195,645	------	------	------	B
10	SCS Runoff	111.13	2	730	444,136	------	------	------	D
11	SCS Runoff	102.84	2	726	363,794	------	------	------	N
12	SCS Runoff	12.79	2	734	58,178	------	------	------	F
13	SCS Runoff	13.73	2	722	37,790	------	------	------	G
14	SCS Runoff	46.81	2	740	275,912	------	------	------	H
15	SCS Runoff	30.84	2	756	247,258	------	------	------	I
16	Combine	17.06	2	724	126,267	5, 13,	------	------	Ee/G - Bypass Pond
17	Reach	60.51	2	752	406,446	3	------	------	Ce to H
18	Combine	103.43	2	748	682,358	14, 17	------	------	Ce/H
19	Reach	100.31	2	754	682,355	18	------	------	to F
20	Combine	107.50	2	752	740,533	12, 19	------	------	Go west to Bypass
21	Combine	43.98	2	742	253,701	2, 6,	------	------	Ae/L
22	Combine	44.75	2	742	327,493	8, 21	------	------	Past Local Res. Pond
23	Reach	44.23	2	746	327,087	22	------	------	Local Pond to I
24	Combine	72.22	2	750	574,344	15, 23	------	------	I combine
25	Reach	69.23	2	758	574,341	24	------	------	I to B
26	Combine	97.94	2	752	769,986	9, 25	------	------	I et al/B
27	Reach	96.48	2	758	769,985	26	------	------	To Final Residential Pond
28	SCS Runoff	20.42	2	738	102,430	------	------	------	M
29	Combine	110.05	2	756	872,415	27, 28	------	------	To Final Residential Pond
30	Reservoir	87.53	2	774	872,412	29	736.00	103,903	Final Residential Pond
31	Combine	123.47	2	752	866,800	16, 20,	------	------	Bypass Pond
32	Reservoir	69.87	2	746	444,117	10	735.71	106,812	Initial Casino Pond
33	Combine	142.83	2	730	807,912	11, 32	------	------	N/D pond
34	Reservoir	30.80	2	802	807,584	33	734.58	366,850	Main Casino Pond

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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
35	Combine	117.64	2	774	1,679,993	30, 34	------	------	To Culvert
36	Combine	225.01	2	760	2,546,798	31, 35	------	------	To Culvert
37	Reservoir	215.63	2	770	2,546,788	36	736.23	39,700	Final Culvert

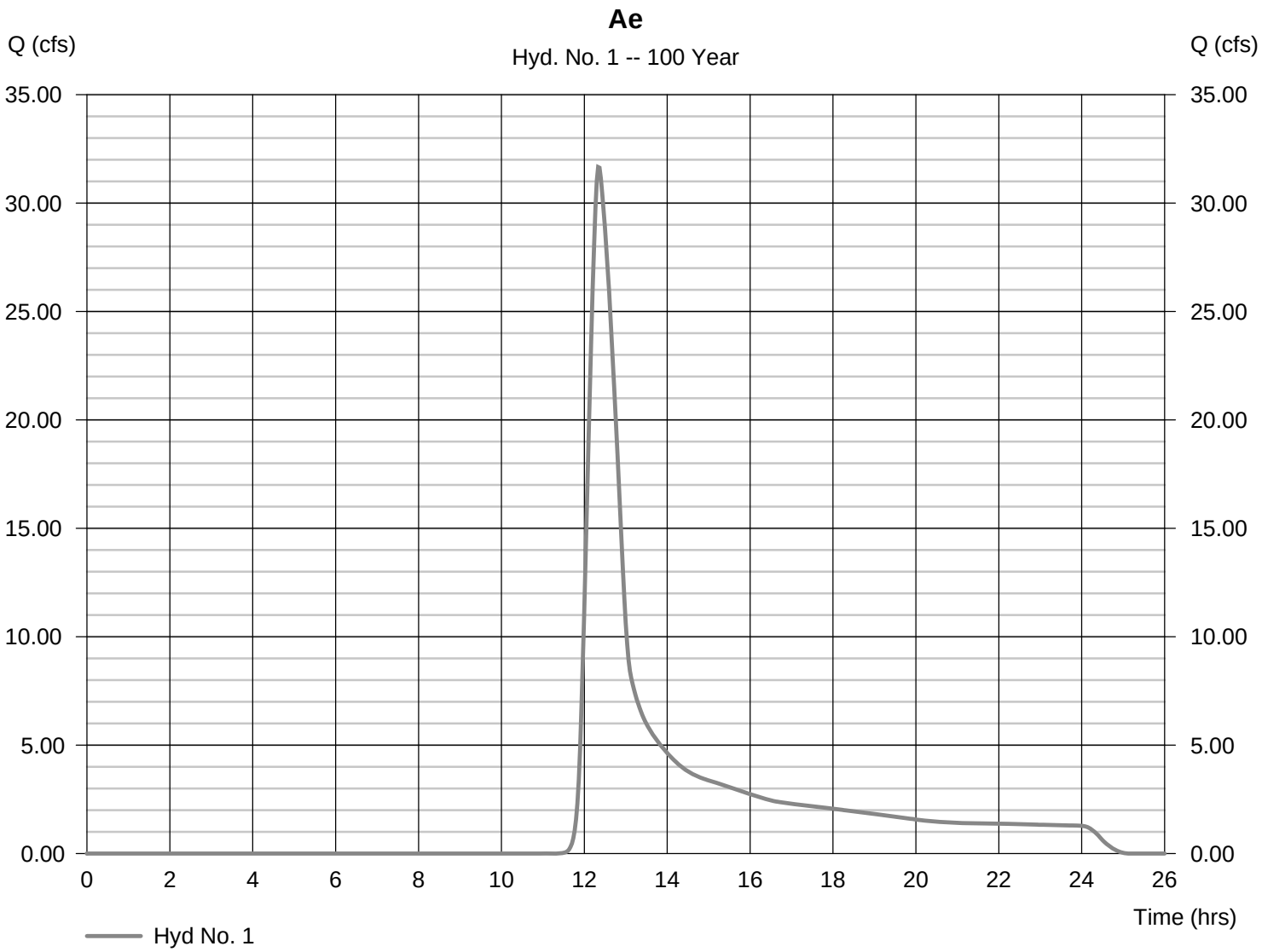
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 1

Ae

Hydrograph type	= SCS Runoff	Peak discharge	= 31.66 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.33 hrs
Time interval	= 2 min	Hyd. volume	= 186,617 cuft
Drainage area	= 29.760 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 40.80 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 1

Ae

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 7.00		0.00		0.00		
Travel Time (min)	**= 34.49**	**+**	**0.00**	**+**	**0.00**	**=**	**34.49**
Shallow Concentrated Flow							
Flow length (ft)	= 890.00		0.00		0.00		
Watercourse slope (%)	= 2.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.34		0.00		0.00		
Travel Time (min)	**= 6.34**	**+**	**0.00**	**+**	**0.00**	**=**	**6.34**
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 ..... 40.80 min

Hydrograph Report

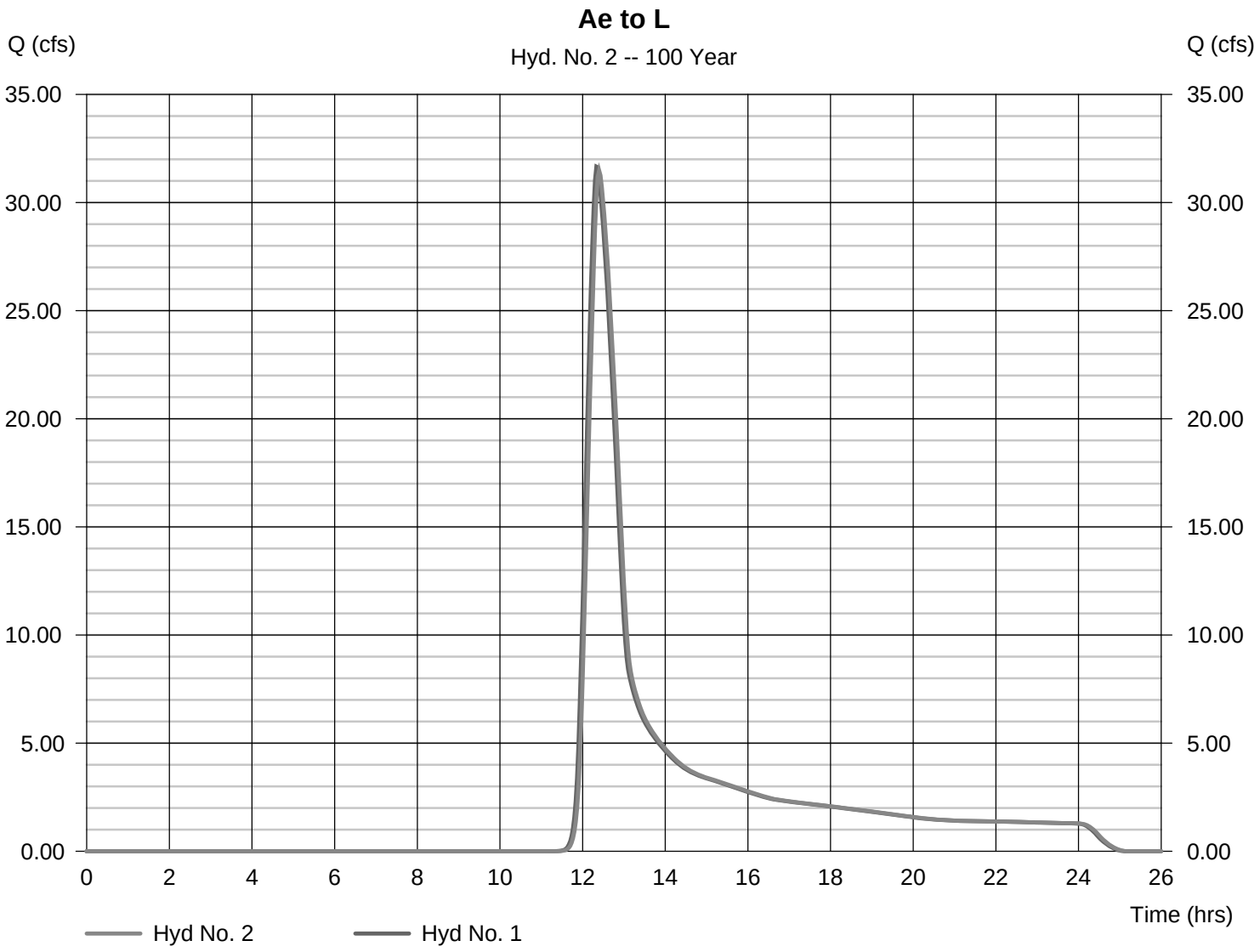
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 2

Ae to L

Hydrograph type	= Reach	Peak discharge	= 31.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 186,616 cuft
Inflow hyd. No.	= 1 - Ae	Section type	= Trapezoidal
Reach length	= 600.0 ft	Channel slope	= 2.0 %
Manning's n	= 0.035	Bottom width	= 5.0 ft
Side slope	= 4.0:1	Max. depth	= 3.0 ft
Rating curve x	= 2.058	Rating curve m	= 1.293
Ave. velocity	= 3.82 ft/s	Routing coeff.	= 0.6615

Modified Att-Kin routing method used.



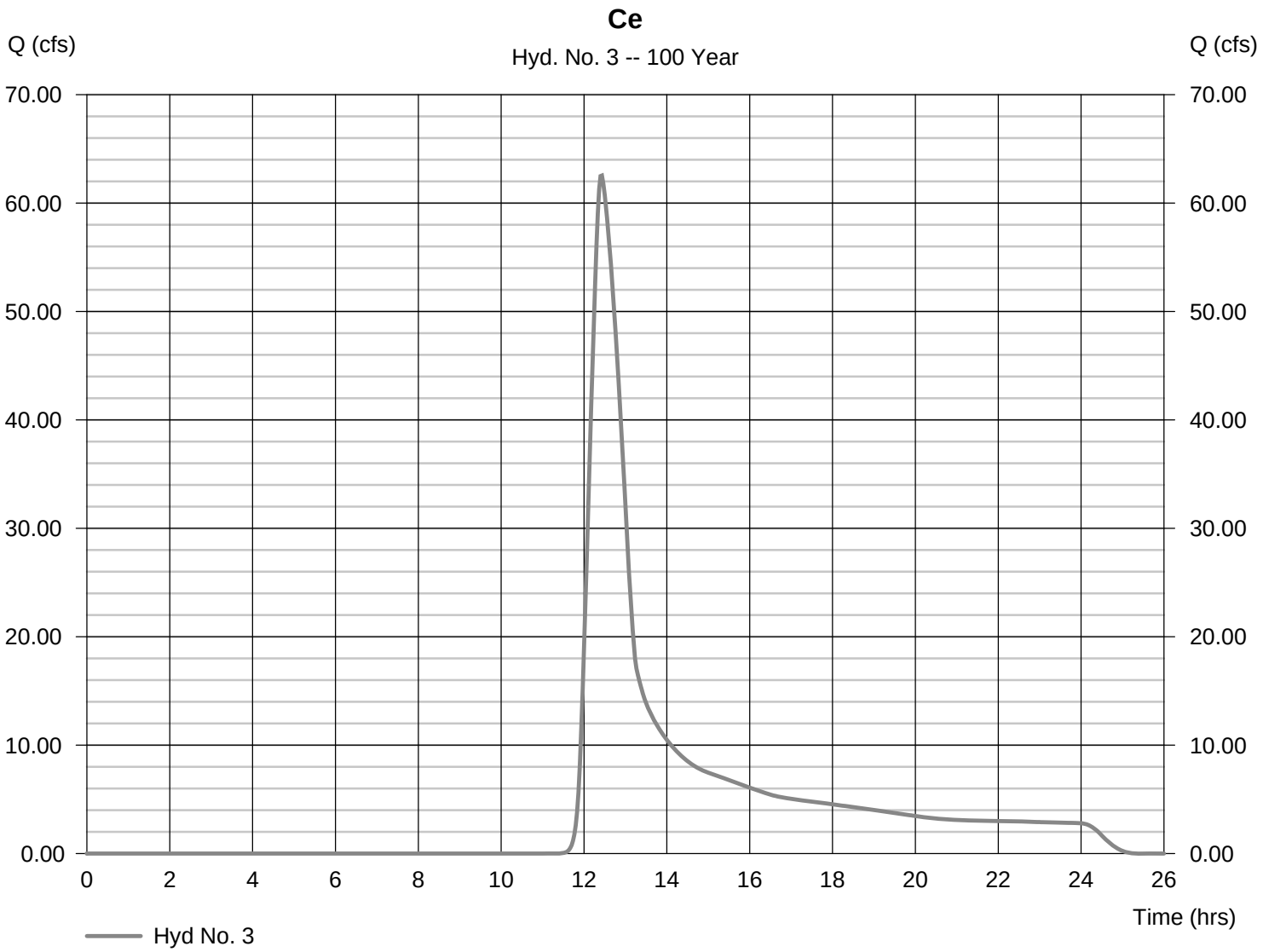
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 3

Ce

Hydrograph type	= SCS Runoff	Peak discharge	= 62.54 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.43 hrs
Time interval	= 2 min	Hyd. volume	= 406,448 cuft
Drainage area	= 65.440 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 48.40 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 3

Ce

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 6.00		0.00		0.00		
Travel Time (min)	**= 36.69**	**+**	**0.00**	**+**	**0.00**	**=**	**36.69**
Shallow Concentrated Flow							
Flow length (ft)	= 2000.00		0.00		0.00		
Watercourse slope (%)	= 3.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.84		0.00		0.00		
Travel Time (min)	**= 11.73**	**+**	**0.00**	**+**	**0.00**	**=**	**11.73**
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 ..... 48.40 min

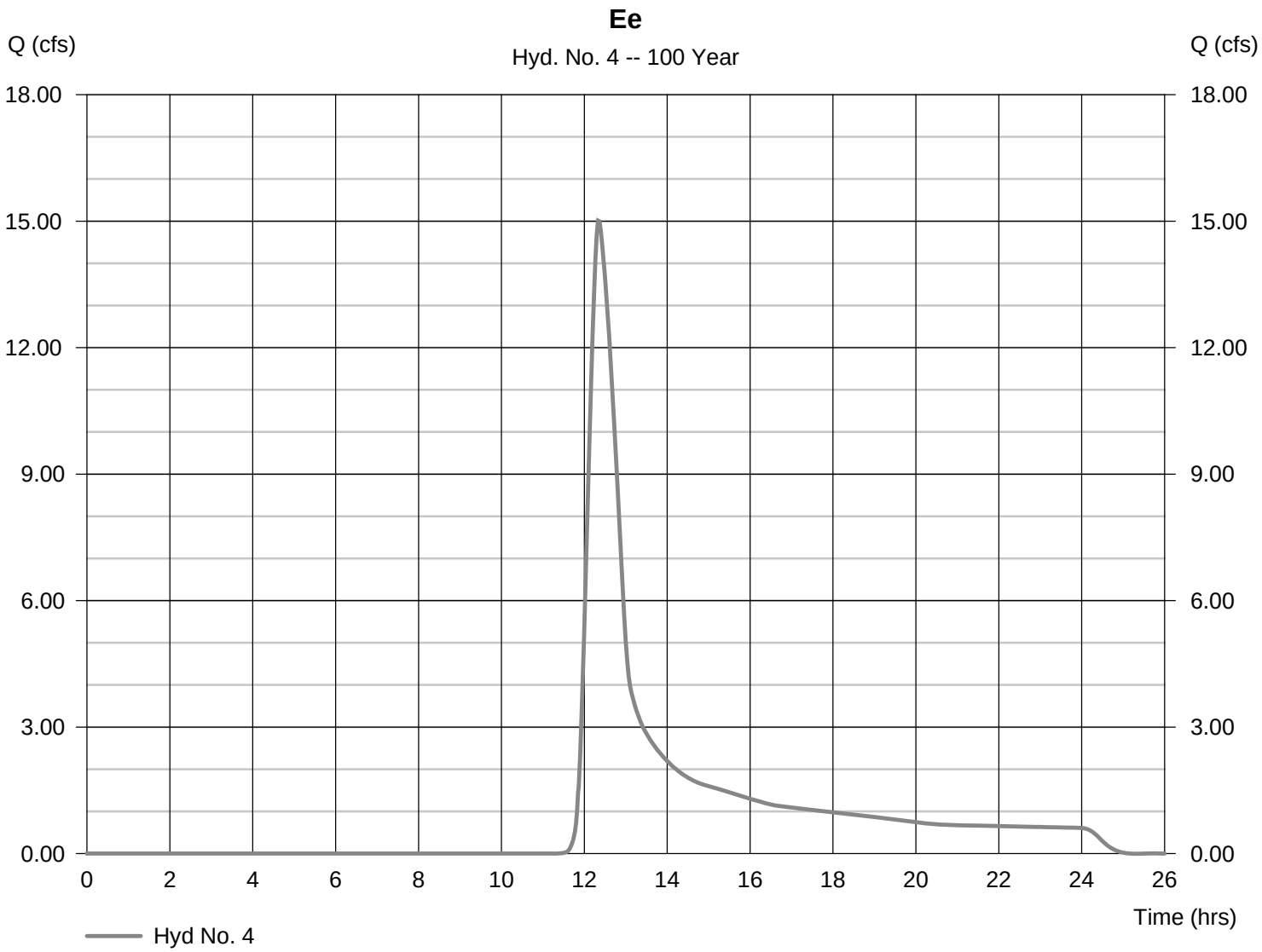
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 4

Ee

Hydrograph type	= SCS Runoff	Peak discharge	= 15.01 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.33 hrs
Time interval	= 2 min	Hyd. volume	= 88,480 cuft
Drainage area	= 14.110 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 42.20 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No. 4

Ee

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 4.70		0.00		0.00		
Travel Time (min)	**= 40.45**	**+**	**0.00**	**+**	**0.00**	**=**	**40.45**
Shallow Concentrated Flow							
Flow length (ft)	= 400.00		0.00		0.00		
Watercourse slope (%)	= 5.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.78		0.00		0.00		
Travel Time (min)	**= 1.76**	**+**	**0.00**	**+**	**0.00**	**=**	**1.76**
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 ..... 42.20 min

Hydrograph Report

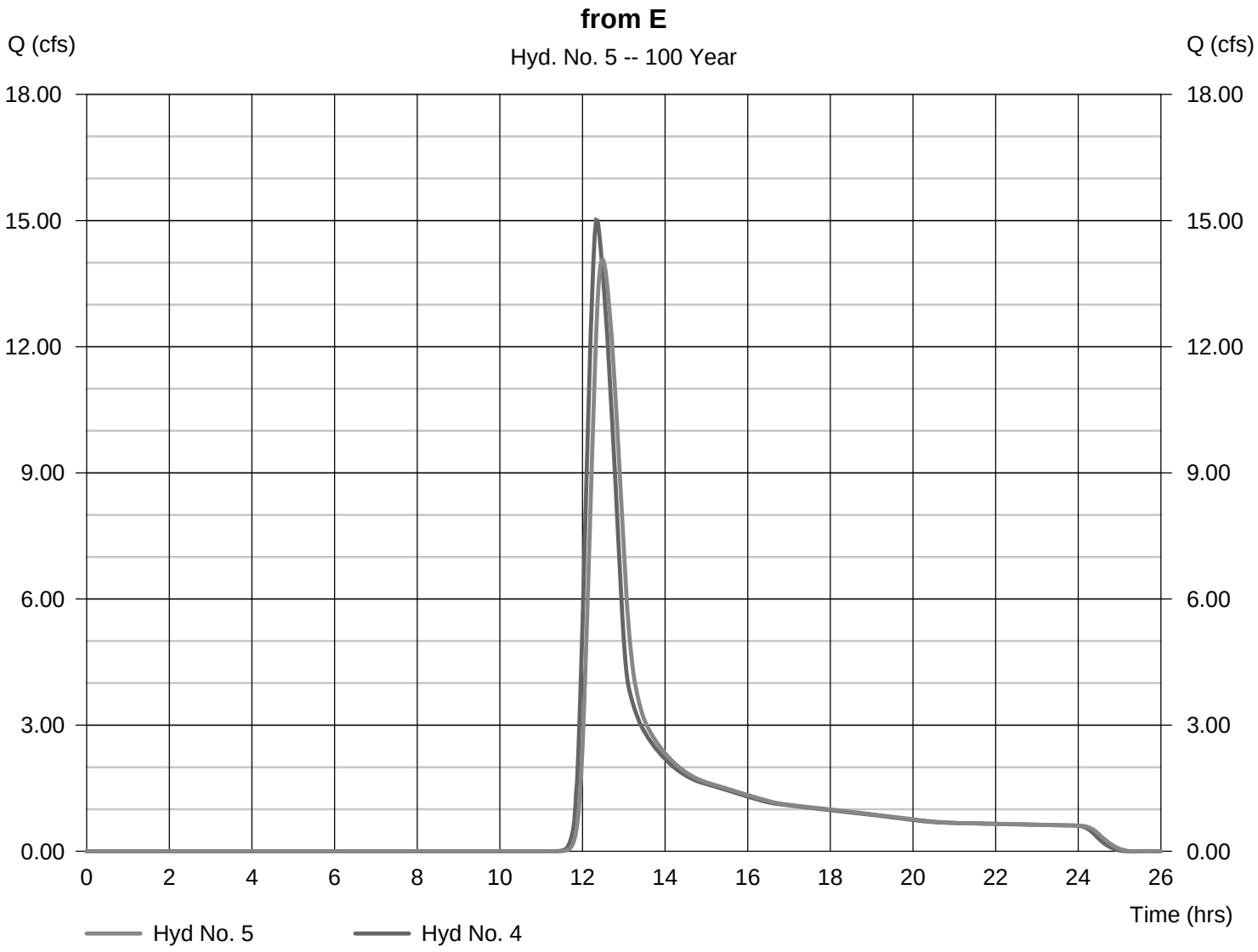
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 5

from E

Hydrograph type	= Reach	Peak discharge	= 14.06 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.47 hrs
Time interval	= 2 min	Hyd. volume	= 88,476 cuft
Inflow hyd. No.	= 4 - Ee	Section type	= Trapezoidal
Reach length	= 1500.0 ft	Channel slope	= 1.6 %
Manning's n	= 0.035	Bottom width	= 5.0 ft
Side slope	= 4.0:1	Max. depth	= 4.0 ft
Rating curve x	= 1.841	Rating curve m	= 1.310
Ave. velocity	= 3.02 ft/s	Routing coeff.	= 0.2736

Modified Att-Kin routing method used.



Hydrograph Report

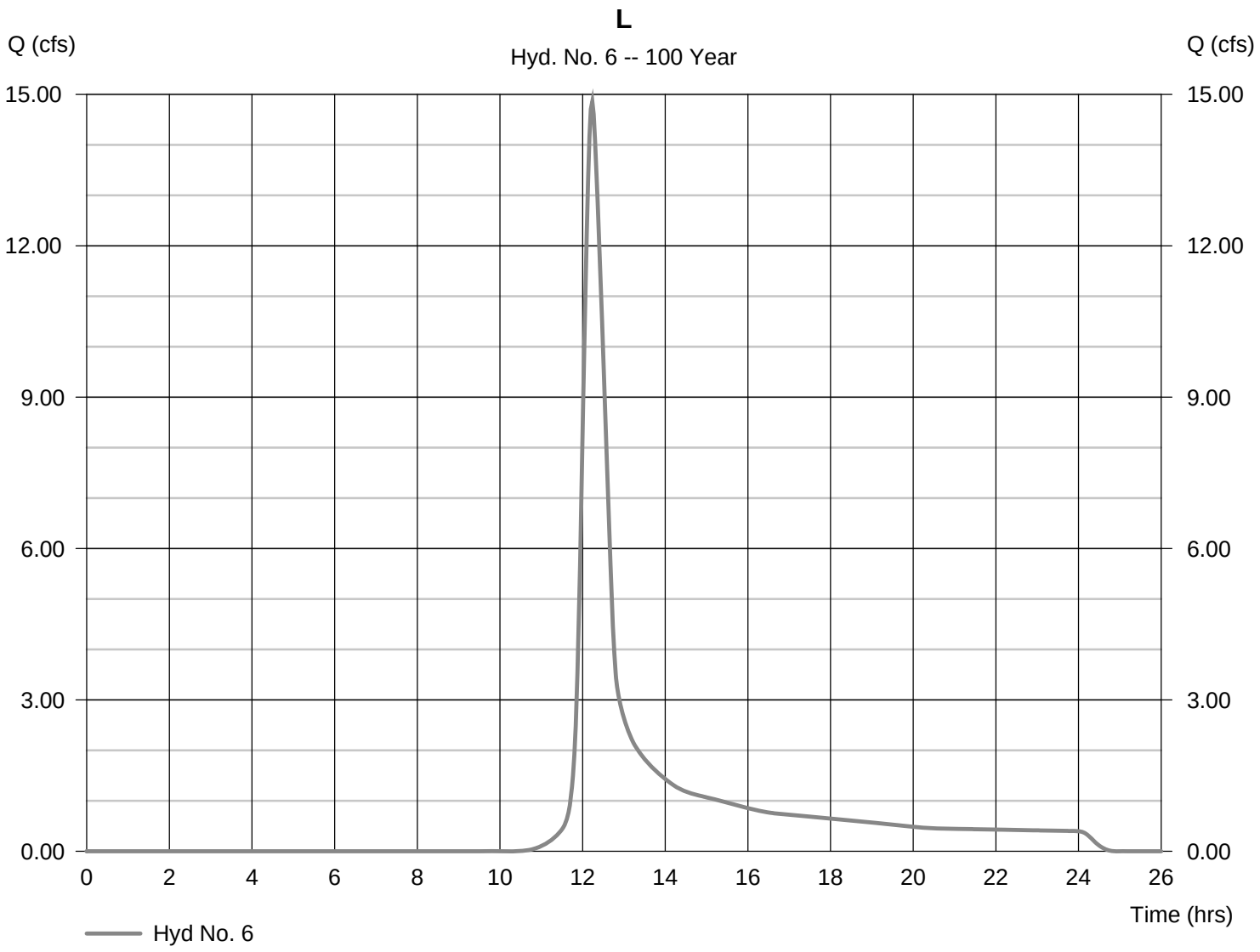
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 6

L

Hydrograph type	= SCS Runoff	Peak discharge	= 14.86 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 67,085 cuft
Drainage area	= 7.870 ac	Curve number	= 62*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 32.90 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.200 x 98) + (7.670 x 61)] / 7.870



TR55 Tc Worksheet

Hyd. No. 6

L

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 8.60		0.00		0.00		
Travel Time (min)	**= 30.68**	**+**	**0.00**	**+**	**0.00**	**=**	**30.68**
Shallow Concentrated Flow							
Flow length (ft)	= 300.00		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)	**= 2.19**	**+**	**0.00**	**+**	**0.00**	**=**	**2.19**
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 ..... 32.90 min

Hydrograph Report

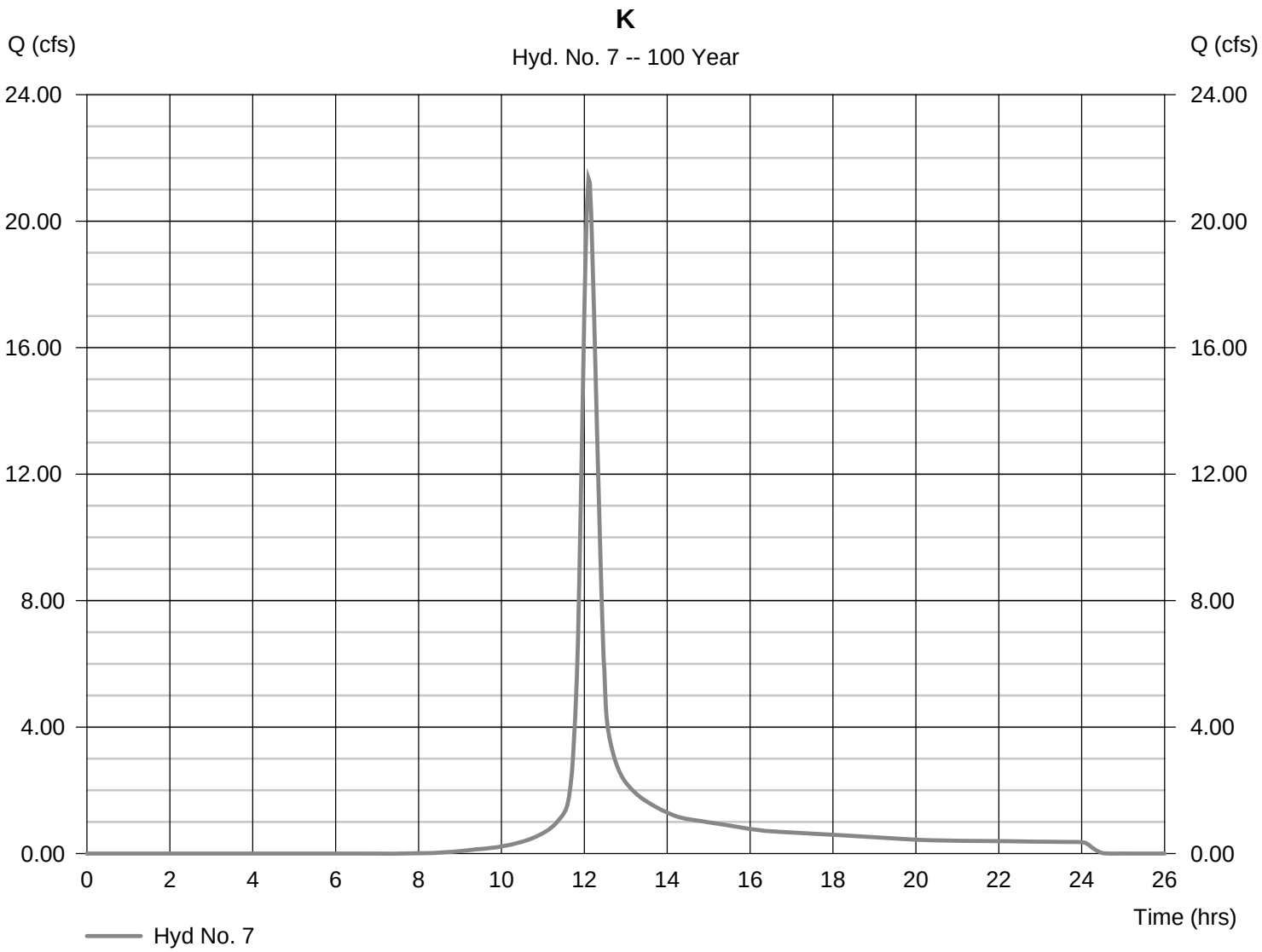
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 7

K

Hydrograph type	=	SCS Runoff	Peak discharge	=	21.35 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	73,838 cuft
Drainage area	=	5.940 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.40 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.860 x 98) + (4.080 x 61)] / 5.940



TR55 Tc Worksheet

Hyd. No. 7

K

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 140.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 19.86**	**+**	**0.00**	**+**	**0.00**	**=**	**19.86**
Shallow Concentrated Flow							
Flow length (ft)	= 600.00		0.00		0.00		
Watercourse slope (%)	= 3.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.79		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 ..... 23.40 min

Hydrograph Report

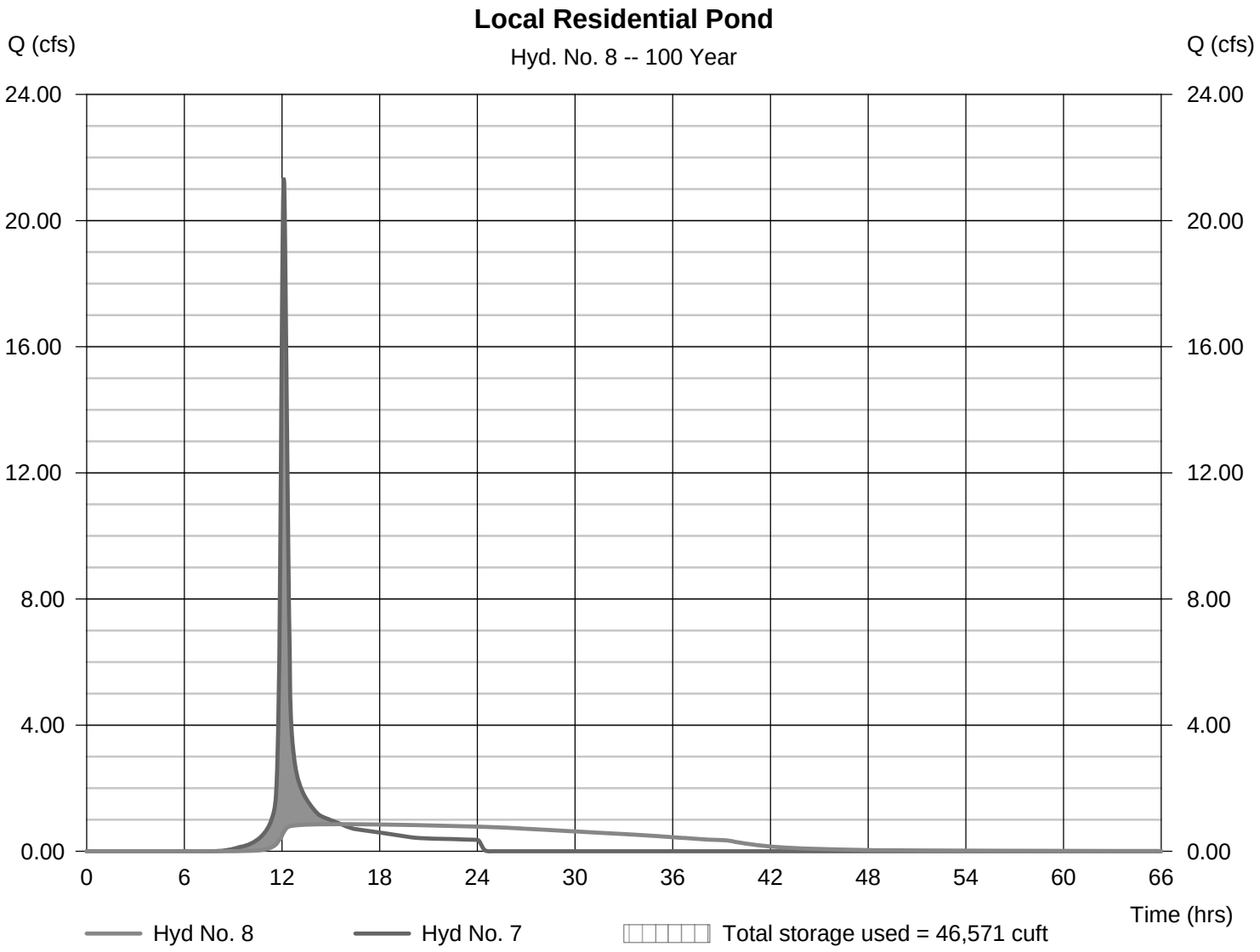
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 8

Local Residential Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.859 cfs
Storm frequency	= 100 yrs	Time to peak	= 15.60 hrs
Time interval	= 2 min	Hyd. volume	= 73,793 cuft
Inflow hyd. No.	= 7 - K	Max. Elevation	= 762.76 ft
Reservoir name	= local residential pond	Max. Storage	= 46,571 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 3 - local residential pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 760.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	760.00	12,035	0	0
1.00	761.00	15,342	13,654	13,654
2.00	762.00	18,877	17,077	30,731
3.00	763.00	22,638	20,727	51,458
4.00	764.00	26,626	24,603	76,061

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 6.00	0.00	0.00	0.00
Span (in)	= 6.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 760.00	0.00	0.00	0.00
Length (ft)	= 100.00	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

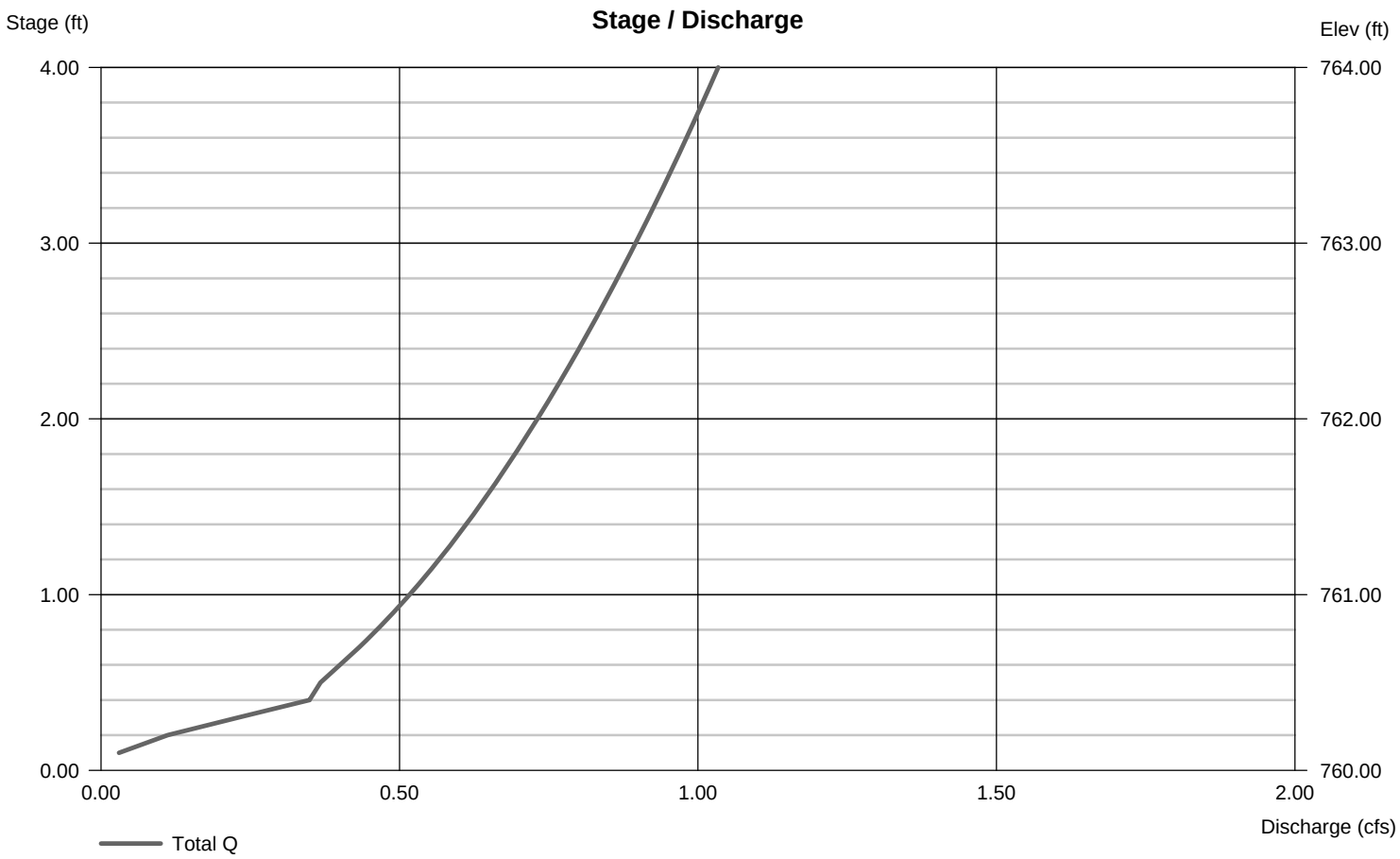
Weir Structures

	[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).



Hydrograph Report

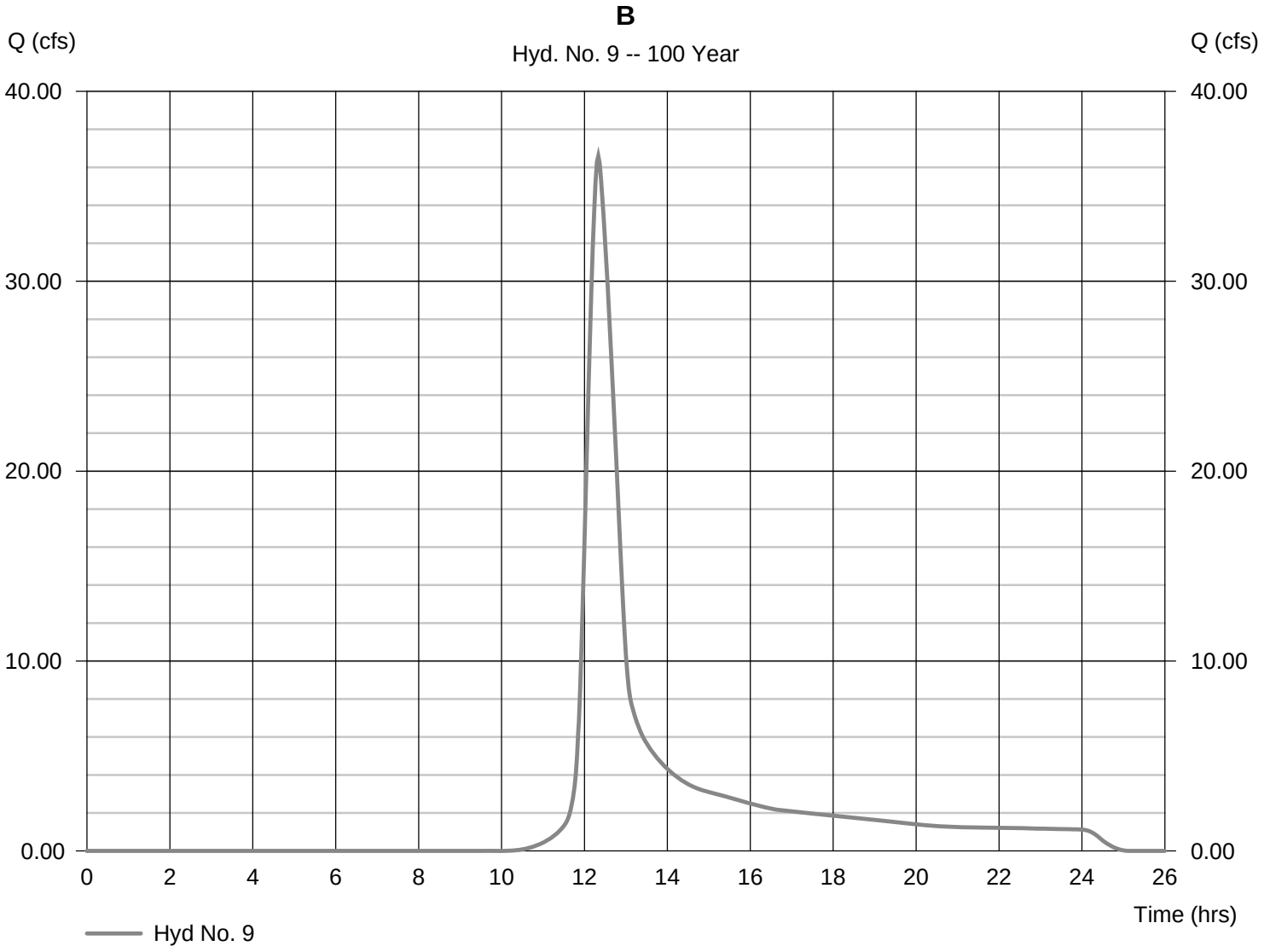
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 9

B

Hydrograph type	=	SCS Runoff	Peak discharge	=	36.60 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.33 hrs
Time interval	=	2 min	Hyd. volume	=	195,645 cuft
Drainage area	=	21.340 ac	Curve number	=	64*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	43.40 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.960 x 98) + (19.380 x 61)] / 21.340



TR55 Tc Worksheet

Hyd. No. 9

B

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 8.60		0.00		0.00		
Travel Time (min)	**= 30.68**	**+**	**0.00**	**+**	**0.00**	**=**	**30.68**
Shallow Concentrated Flow							
Flow length (ft)	= 1400.00		0.00		0.00		
Watercourse slope (%)	= 1.30		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.84		0.00		0.00		
Travel Time (min)	**= 12.68**	**+**	**0.00**	**+**	**0.00**	**=**	**12.68**
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 ..... 43.40 min

Hydrograph Report

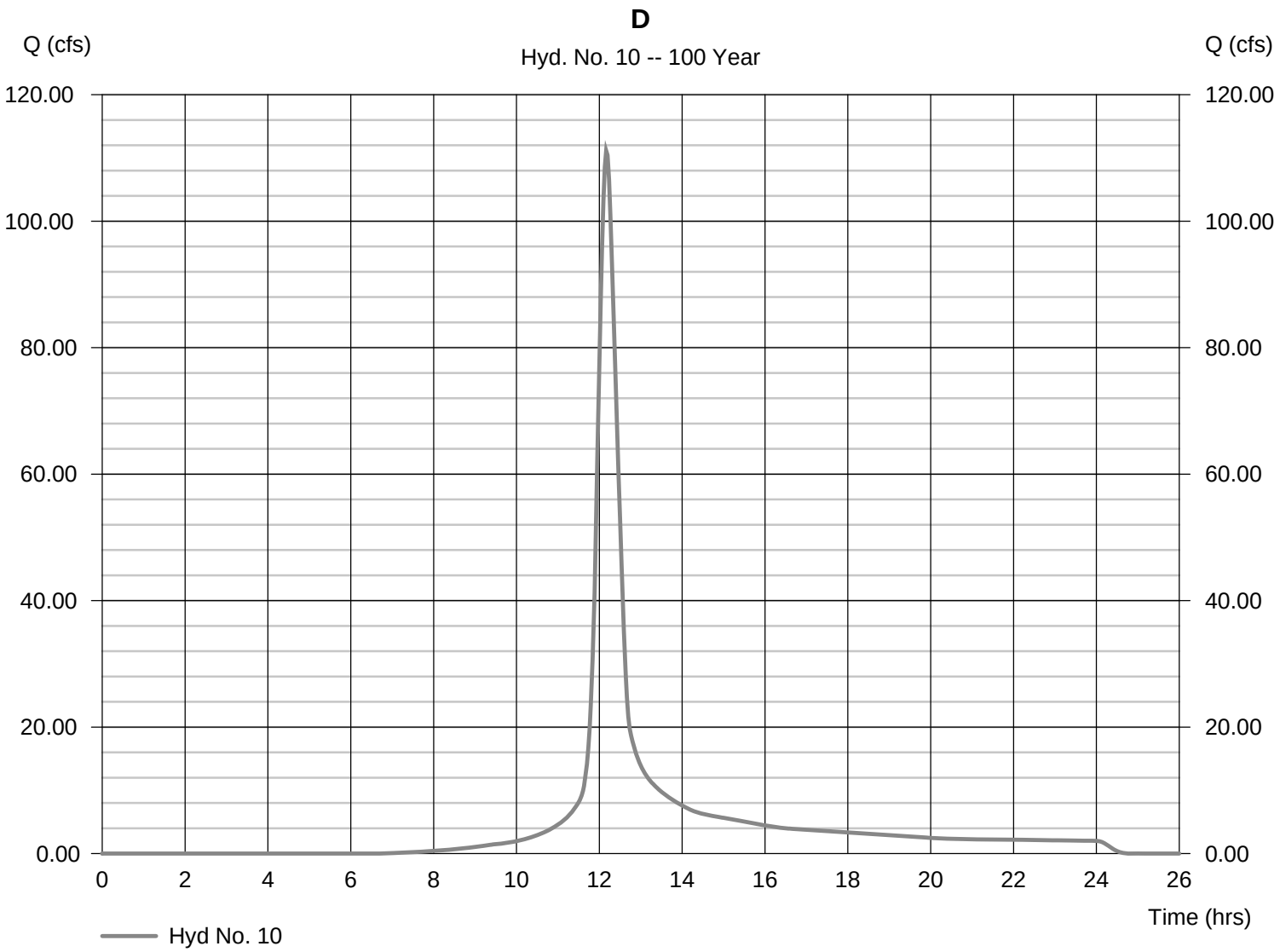
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 10

D

Hydrograph type	= SCS Runoff	Peak discharge	= 111.13 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 444,136 cuft
Drainage area	= 31.600 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.90 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(14.590 x 98) + (17.010 x 61)] / 31.600



TR55 Tc Worksheet

Hyd. No. 10

D

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 0.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 0.00		0.00		0.00		
Land slope (%)	= 0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Shallow Concentrated Flow							
Flow length (ft)	= 2650.00		0.00		0.00		
Watercourse slope (%)	= 0.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.53		0.00		0.00		
Travel Time (min)	**= 28.85**	**+**	**0.00**	**+**	**0.00**	**=**	**28.85**
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 ..... 28.90 min

Hydrograph Report

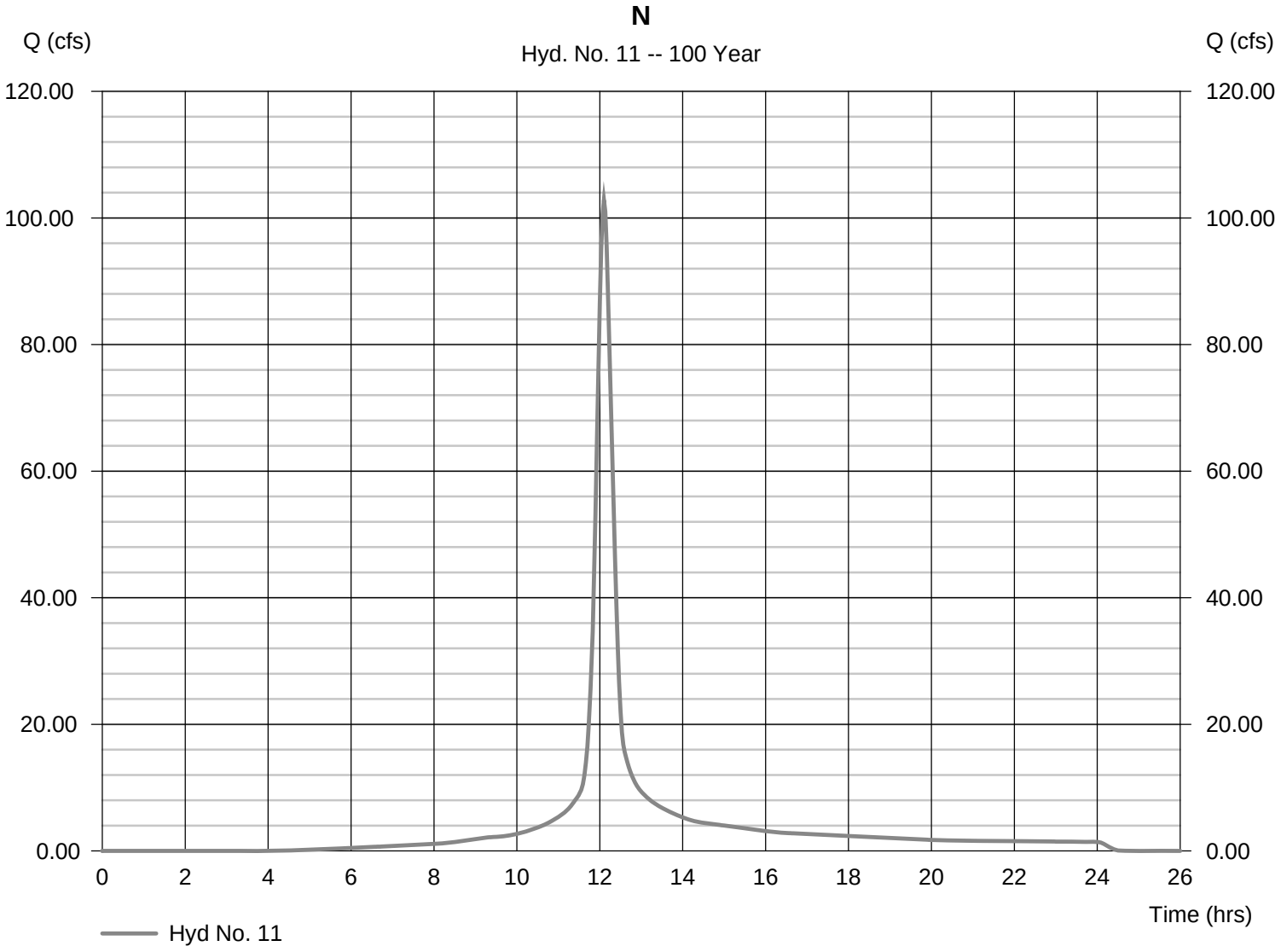
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 11

N

Hydrograph type	= SCS Runoff	Peak discharge	= 102.84 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 363,794 cuft
Drainage area	= 20.370 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 21.70 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(14.110 x 98) + (6.260 x 61)] / 20.370



TR55 Tc Worksheet

Hyd. No. 11

N

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 0.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 0.00		0.00		0.00		
Land slope (%)	= 0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Shallow Concentrated Flow							
Flow length (ft)	= 2100.00		0.00		0.00		
Watercourse slope (%)	= 1.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.61		0.00		0.00		
Travel Time (min)	**= 21.69**	**+**	**0.00**	**+**	**0.00**	**=**	**21.69**
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 ..... 21.70 min

Hydrograph Report

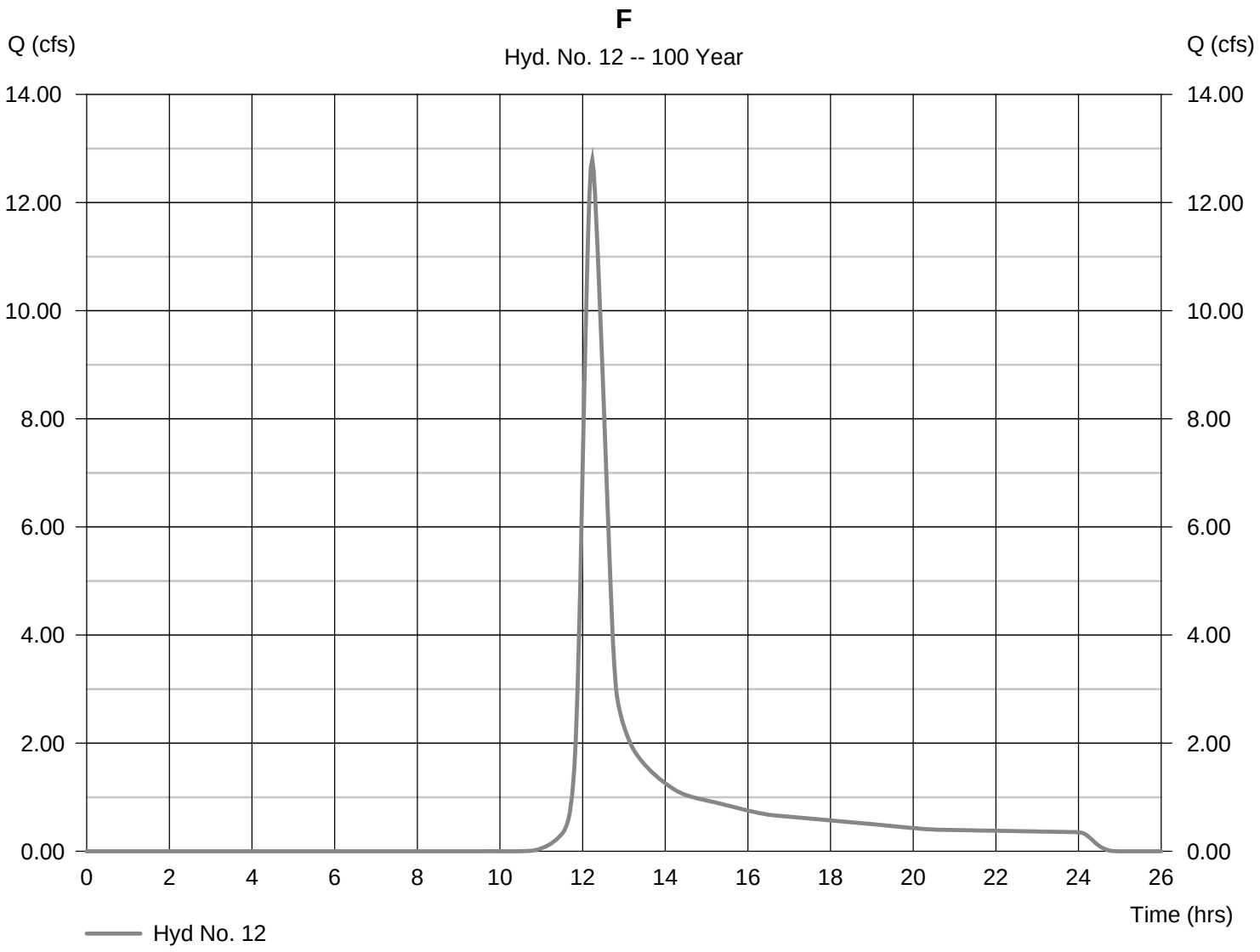
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 12

F

Hydrograph type	= SCS Runoff	Peak discharge	= 12.79 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 58,178 cuft
Drainage area	= 7.100 ac	Curve number	= 61*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 32.30 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = + (7.100 x 61)] / 7.100



TR55 Tc Worksheet

Hyd. No. 12

F

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 11.30		0.00		0.00		
Travel Time (min)	**= 27.51**	**+**	**0.00**	**+**	**0.00**	**=**	**27.51**
Shallow Concentrated Flow							
Flow length (ft)	= 140.00		0.00		0.00		
Watercourse slope (%)	= 5.70		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.85		0.00		0.00		
Travel Time (min)	**= 0.61**	**+**	**0.00**	**+**	**0.00**	**=**	**0.61**
Channel Flow							
X sectional flow area (sqft)	= 12.00		0.00		0.00		
Wetted perimeter (ft)	= 10.90		0.00		0.00		
Channel slope (%)	= 0.40		0.00		0.00		
Manning's n-value	= 0.025		0.015		0.015		
Velocity (ft/s)	=4.02						
			0.00				
					0.00		
Flow length (ft)	({0})1000.0		0.0		0.0		
Travel Time (min)	**= 4.15**	**+**	**0.00**	**+**	**0.00**	**=**	**4.15**

Total Travel Time, Tc ..... 32.30 min

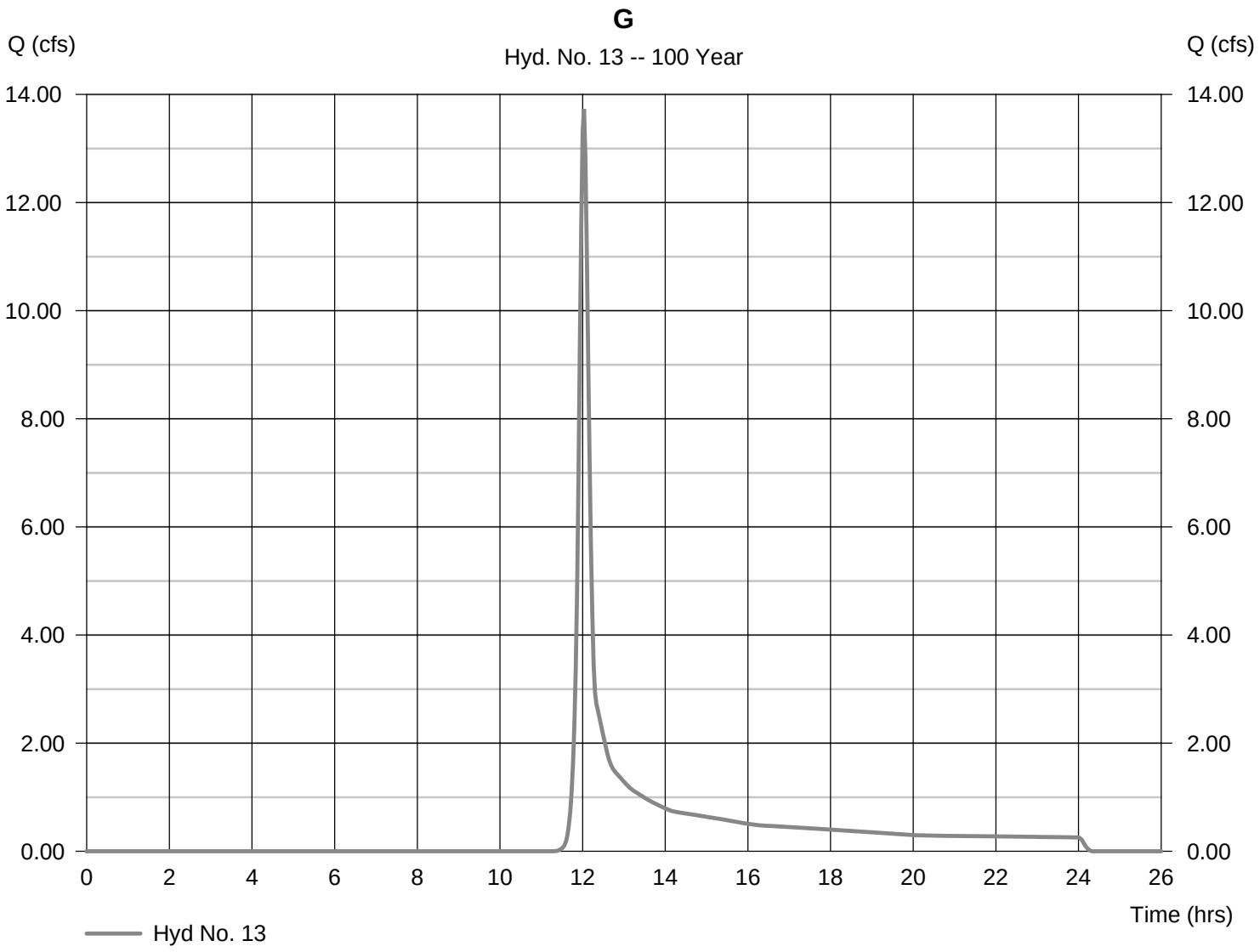
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 13

G

Hydrograph type	= SCS Runoff	Peak discharge	= 13.73 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 37,790 cuft
Drainage area	= 5.900 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



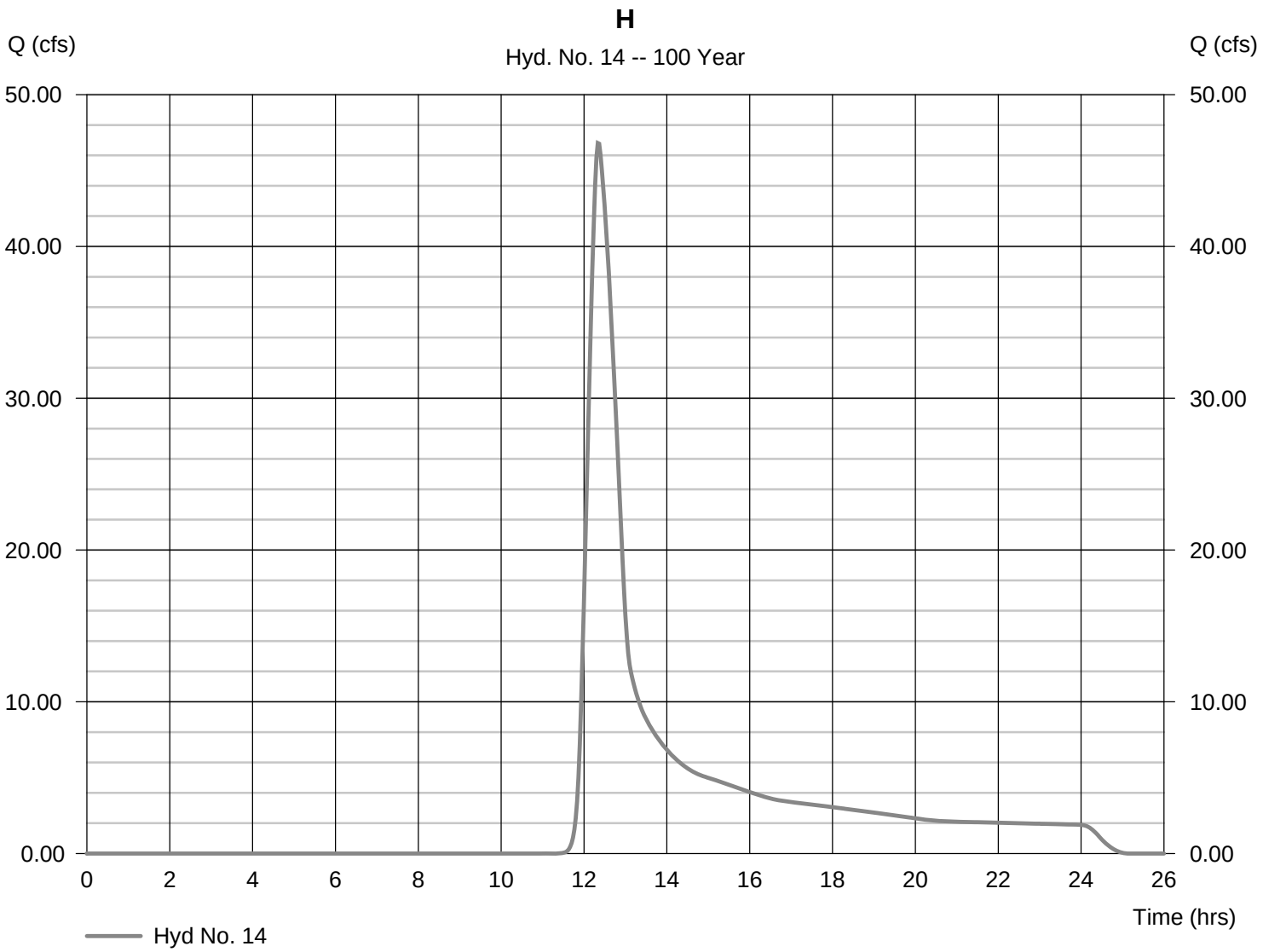
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 14

H

Hydrograph type	=	SCS Runoff	Peak discharge	=	46.81 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.33 hrs
Time interval	=	2 min	Hyd. volume	=	275,912 cuft
Drainage area	=	44.000 ac	Curve number	=	55
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	41.00 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 14

H

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 31.58**	**+**	**0.00**	**+**	**0.00**	**=**	**31.58**
Shallow Concentrated Flow							
Flow length (ft)	= 1400.00		0.00		0.00		
Watercourse slope (%)	= 2.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.70		0.00		0.00		
Travel Time (min)	**= 8.64**	**+**	**0.00**	**+**	**0.00**	**=**	**8.64**
Channel Flow							
X sectional flow area (sqft)	= 3.00		0.00		0.00		
Wetted perimeter (ft)	= 3.16		0.00		0.00		
Channel slope (%)	= 1.50		0.00		0.00		
Manning's n-value	= 0.020		0.015		0.015		
Velocity (ft/s)	=8.81						
			0.00				
					0.00		
Flow length (ft)	({0})400.0		0.0		0.0		
Travel Time (min)	**= 0.76**	**+**	**0.00**	**+**	**0.00**	**=**	**0.76**

Total Travel Time, Tc ..... 41.00 min

Hydrograph Report

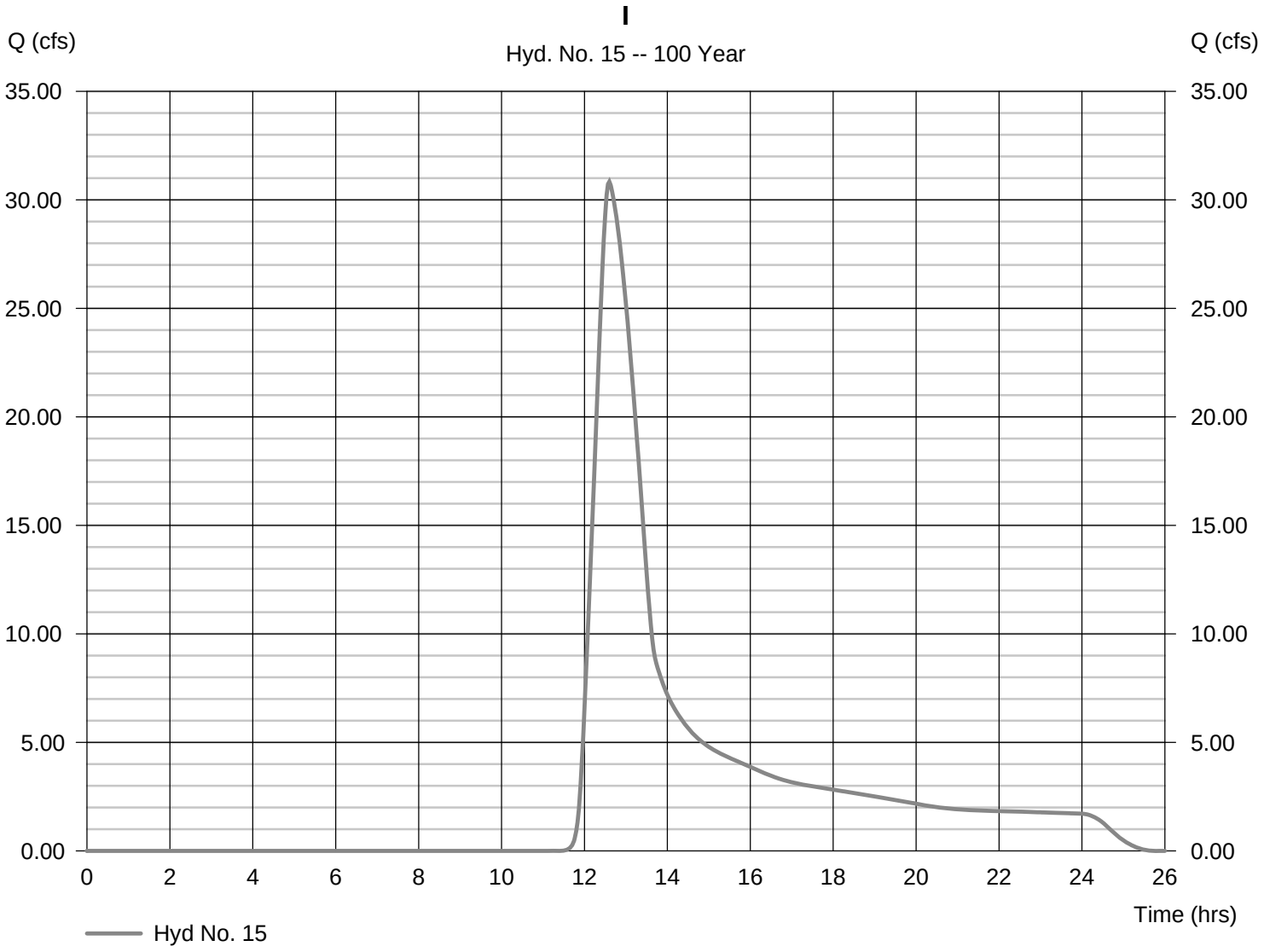
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 15

I

Hydrograph type	=	SCS Runoff	Peak discharge	=	30.84 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.60 hrs
Time interval	=	2 min	Hyd. volume	=	247,258 cuft
Drainage area	=	40.060 ac	Curve number	=	55*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	64.30 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.400 x 98) + (39.660 x 55)] / 40.060



TR55 Tc Worksheet

Hyd. No. 15

I

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 2.30		0.00		0.00		
Travel Time (min)	**= 52.00**	**+**	**0.00**	**+**	**0.00**	**=**	**52.00**
Shallow Concentrated Flow							
Flow length (ft)	= 1600.00		0.00		0.00		
Watercourse slope (%)	= 1.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.16		0.00		0.00		
Travel Time (min)	**= 12.32**	**+**	**0.00**	**+**	**0.00**	**=**	**12.32**
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 ..... 64.30 min

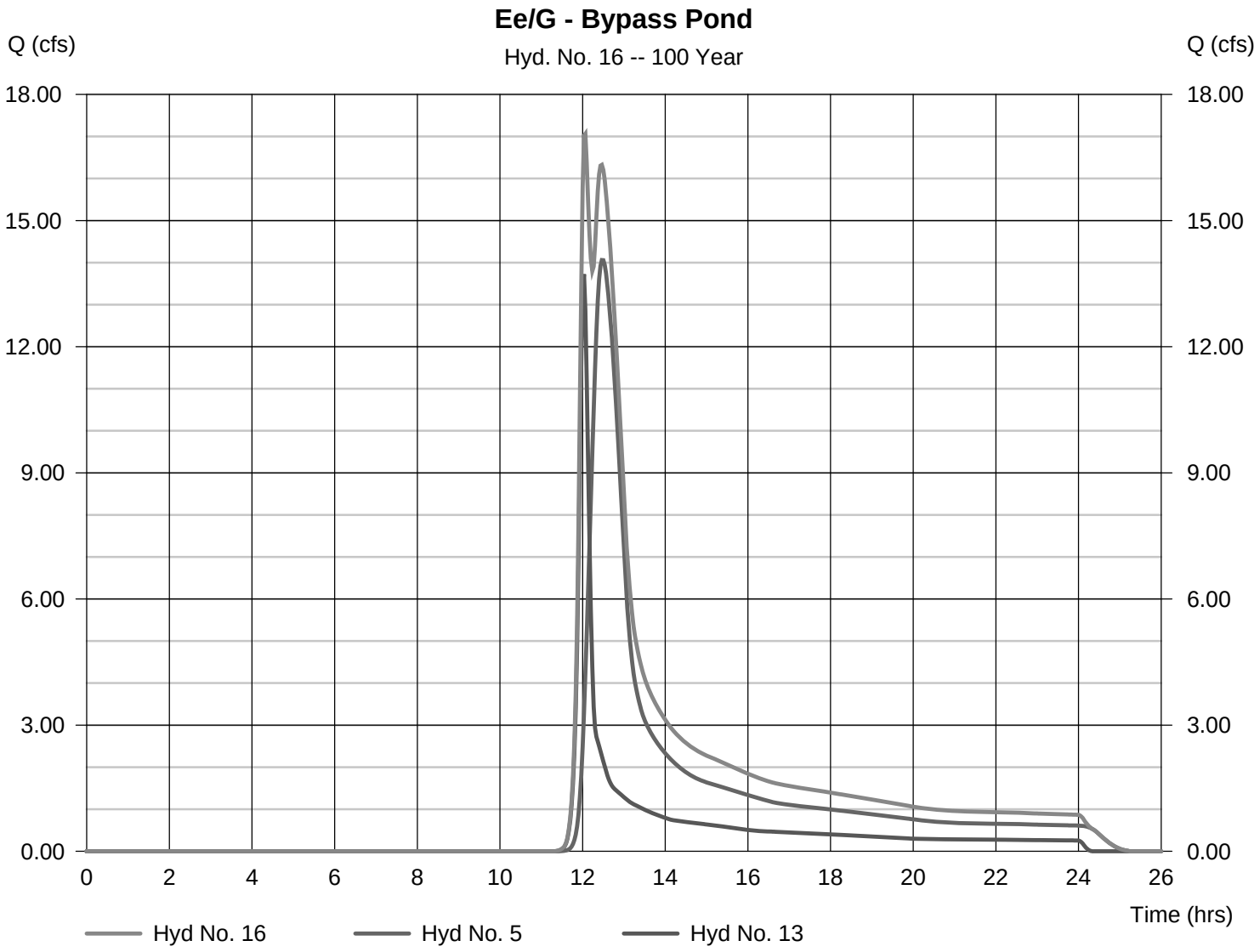
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 16

Ee/G - Bypass Pond

Hydrograph type	= Combine	Peak discharge	= 17.06 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 126,267 cuft
Inflow hyds.	= 5, 13	Contrib. drain. area	= 5.900 ac



Hydrograph Report

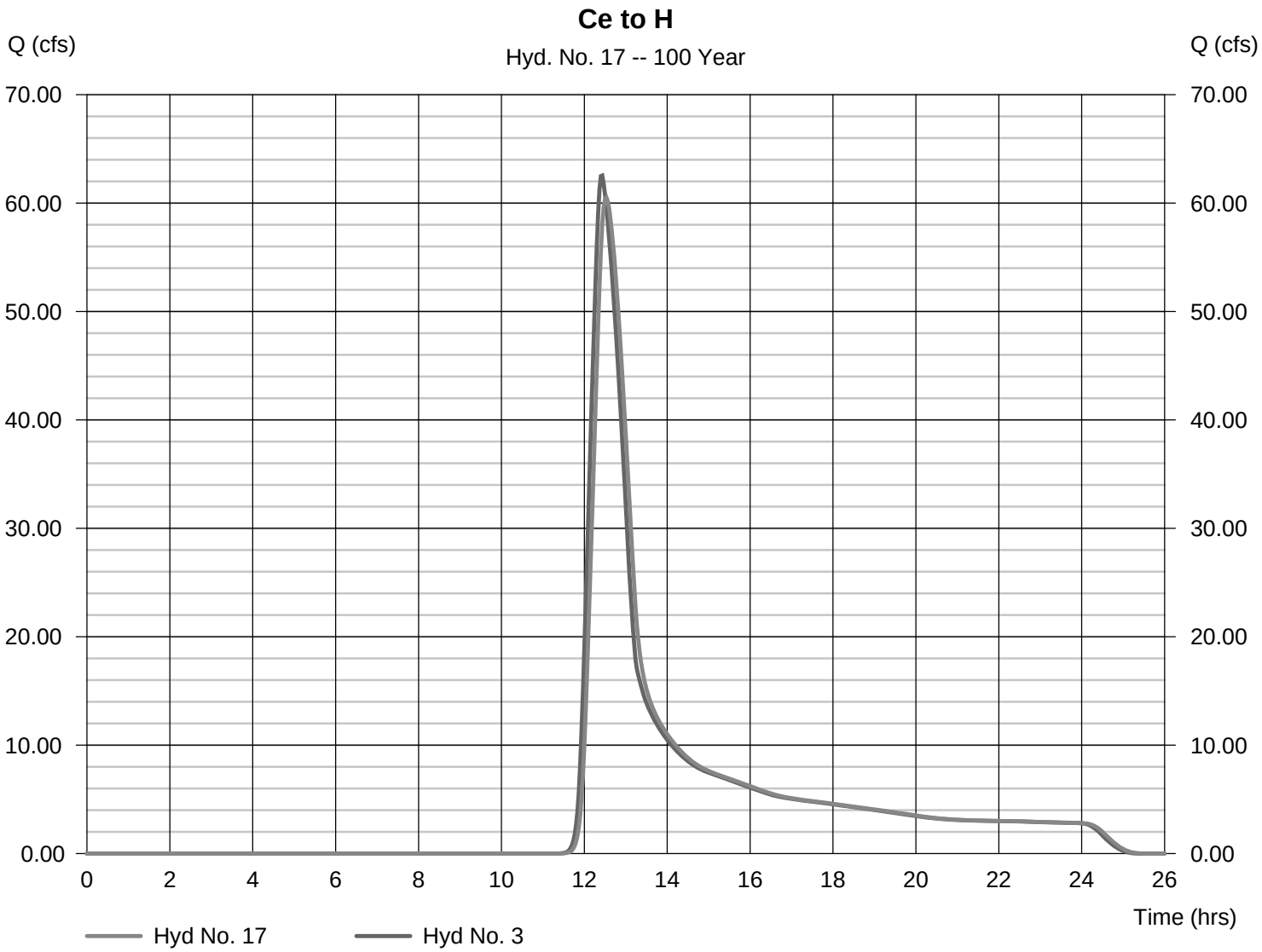
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 17

Ce to H

Hydrograph type	= Reach	Peak discharge	= 60.51 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.53 hrs
Time interval	= 2 min	Hyd. volume	= 406,446 cuft
Inflow hyd. No.	= 3 - Ce	Section type	= Trapezoidal
Reach length	= 1300.0 ft	Channel slope	= 1.5 %
Manning's n	= 0.035	Bottom width	= 5.0 ft
Side slope	= 4.0:1	Max. depth	= 2.0 ft
Rating curve x	= 1.782	Rating curve m	= 1.257
Ave. velocity	= 3.69 ft/s	Routing coeff.	= 0.3523

Modified Att-Kin routing method used.



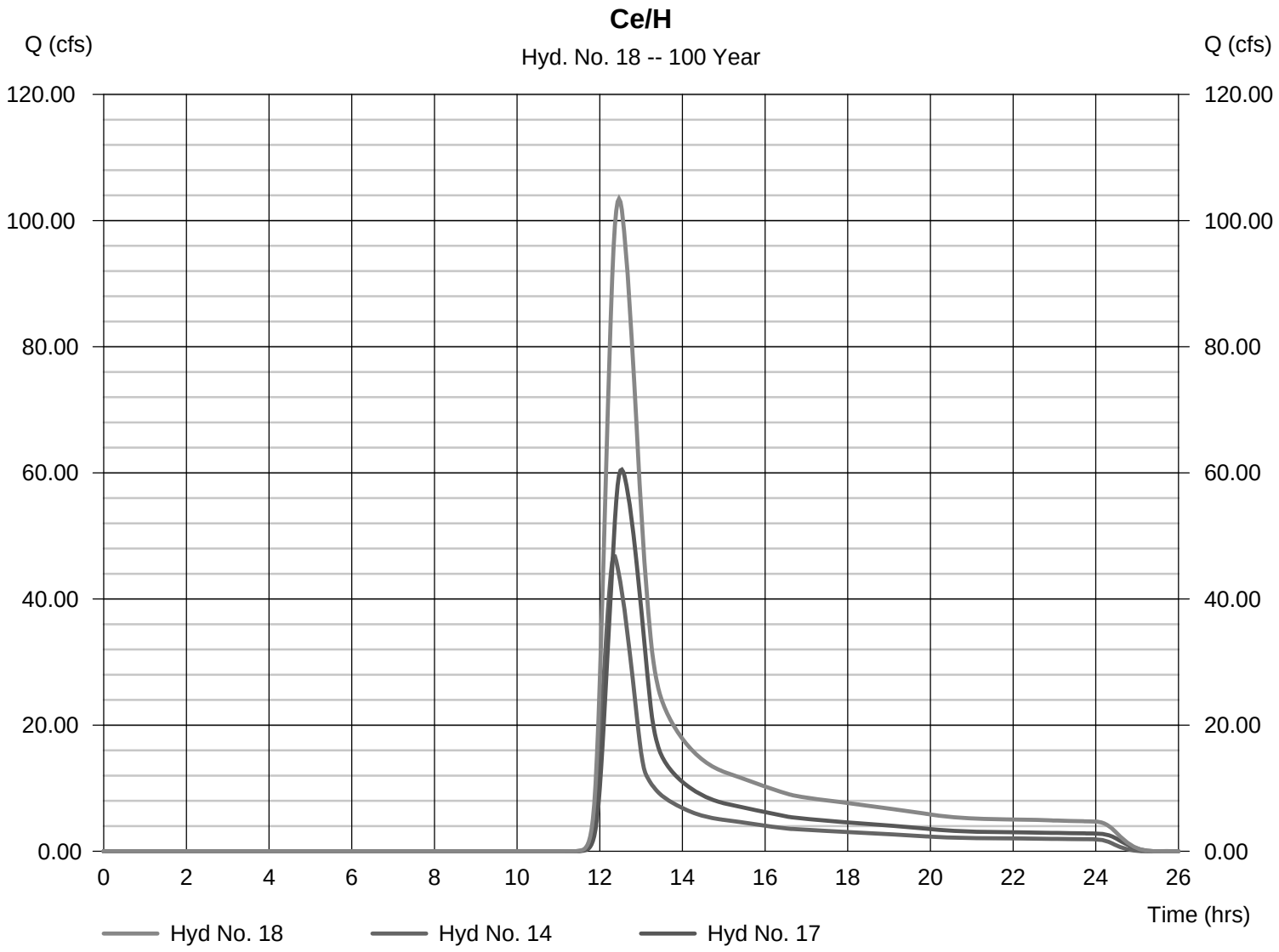
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 18

Ce/H

Hydrograph type	=	Combine	Peak discharge	=	103.43 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.47 hrs
Time interval	=	2 min	Hyd. volume	=	682,358 cuft
Inflow hyds.	=	14, 17	Contrib. drain. area	=	44.000 ac



Hydrograph Report

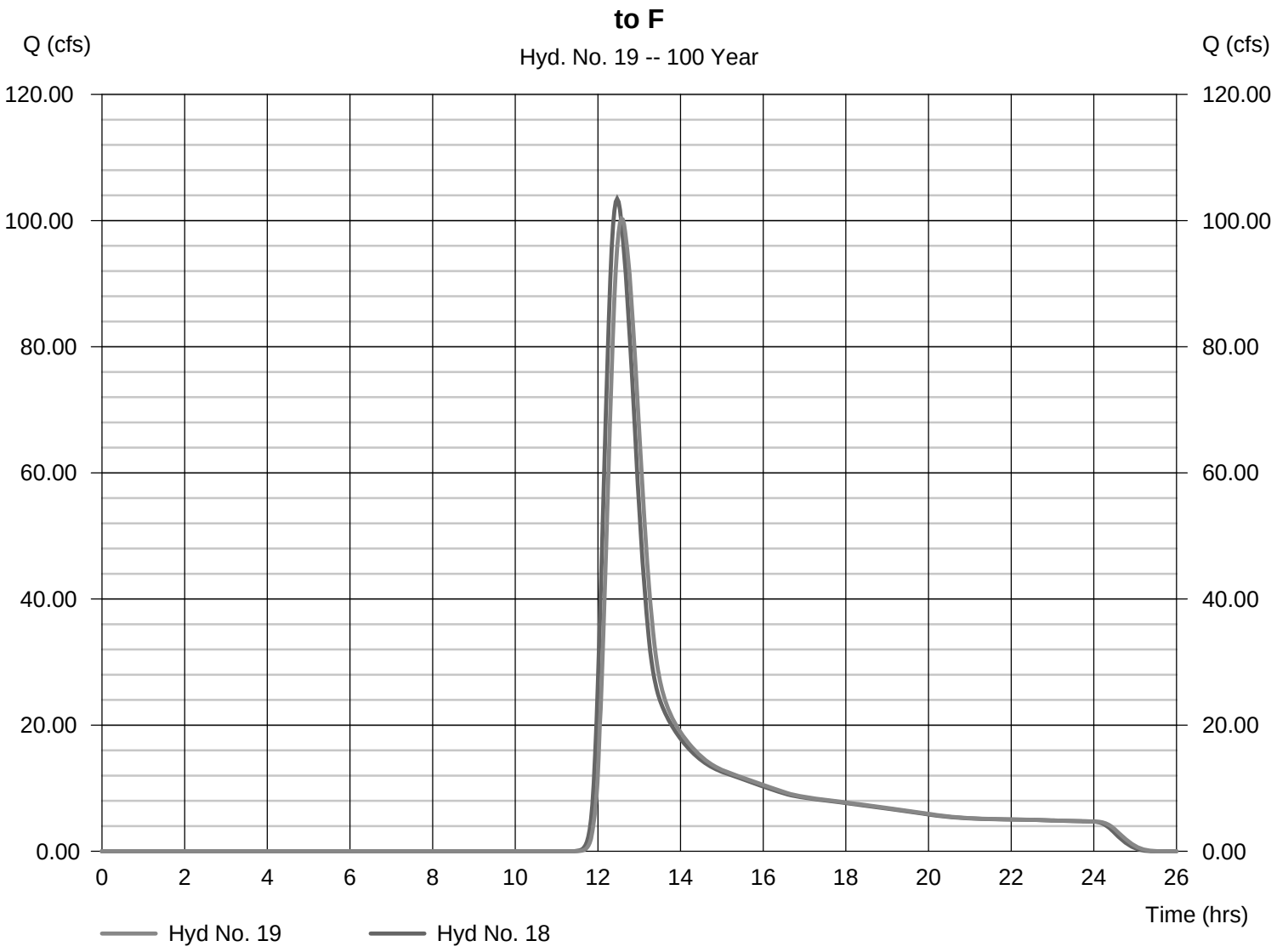
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 19

to F

Hydrograph type	= Reach	Peak discharge	= 100.31 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.57 hrs
Time interval	= 2 min	Hyd. volume	= 682,355 cuft
Inflow hyd. No.	= 18 - Ce/H	Section type	= Trapezoidal
Reach length	= 1200.0 ft	Channel slope	= 0.4 %
Manning's n	= 0.025	Bottom width	= 2.0 ft
Side slope	= 4.0:1	Max. depth	= 2.0 ft
Rating curve x	= 2.374	Rating curve m	= 1.107
Ave. velocity	= 3.42 ft/s	Routing coeff.	= 0.3183

Modified Att-Kin routing method used.



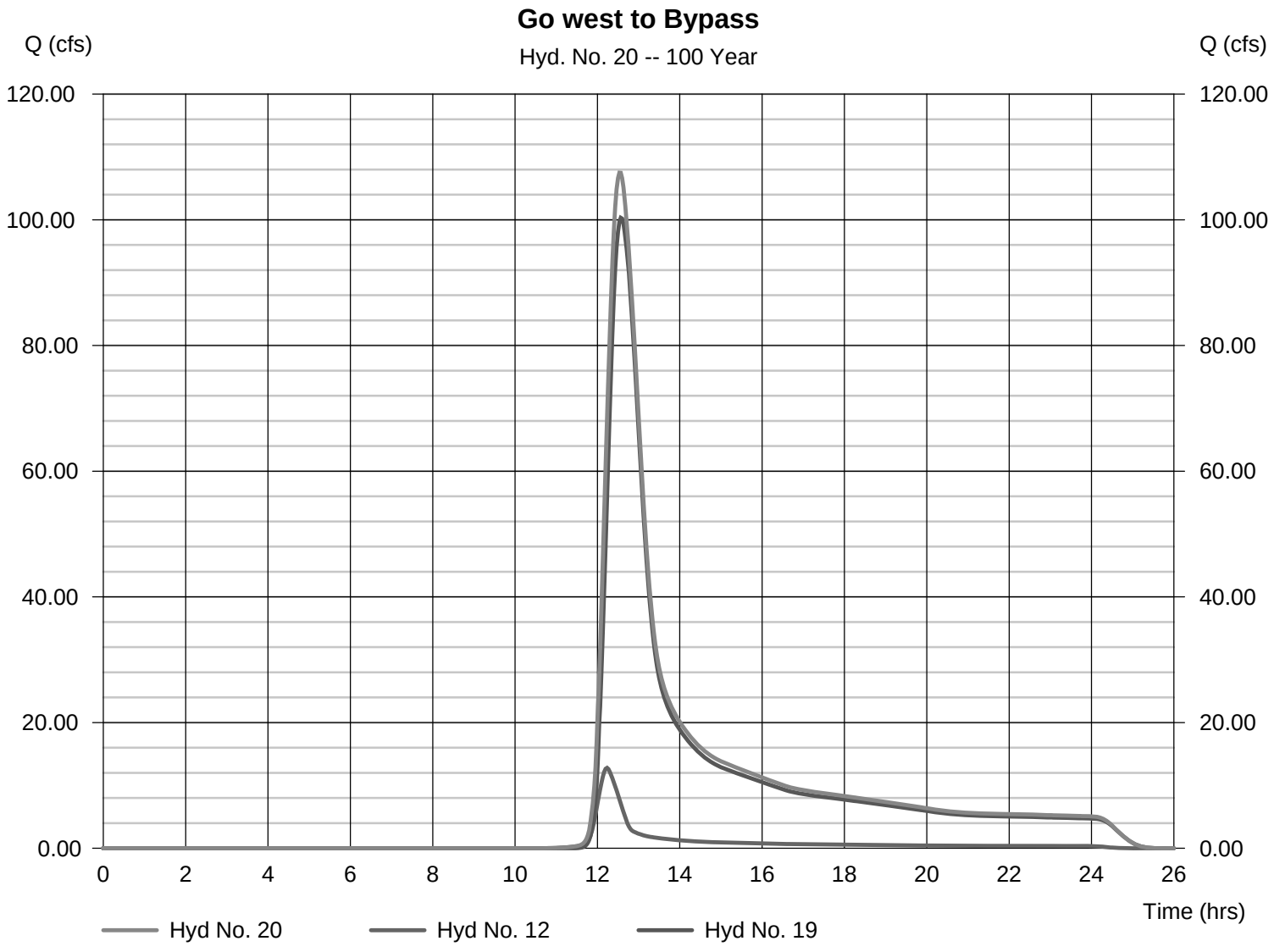
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 20

Go west to Bypass

Hydrograph type	=	Combine	Peak discharge	=	107.50 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.53 hrs
Time interval	=	2 min	Hyd. volume	=	740,533 cuft
Inflow hyds.	=	12, 19	Contrib. drain. area	=	7.100 ac



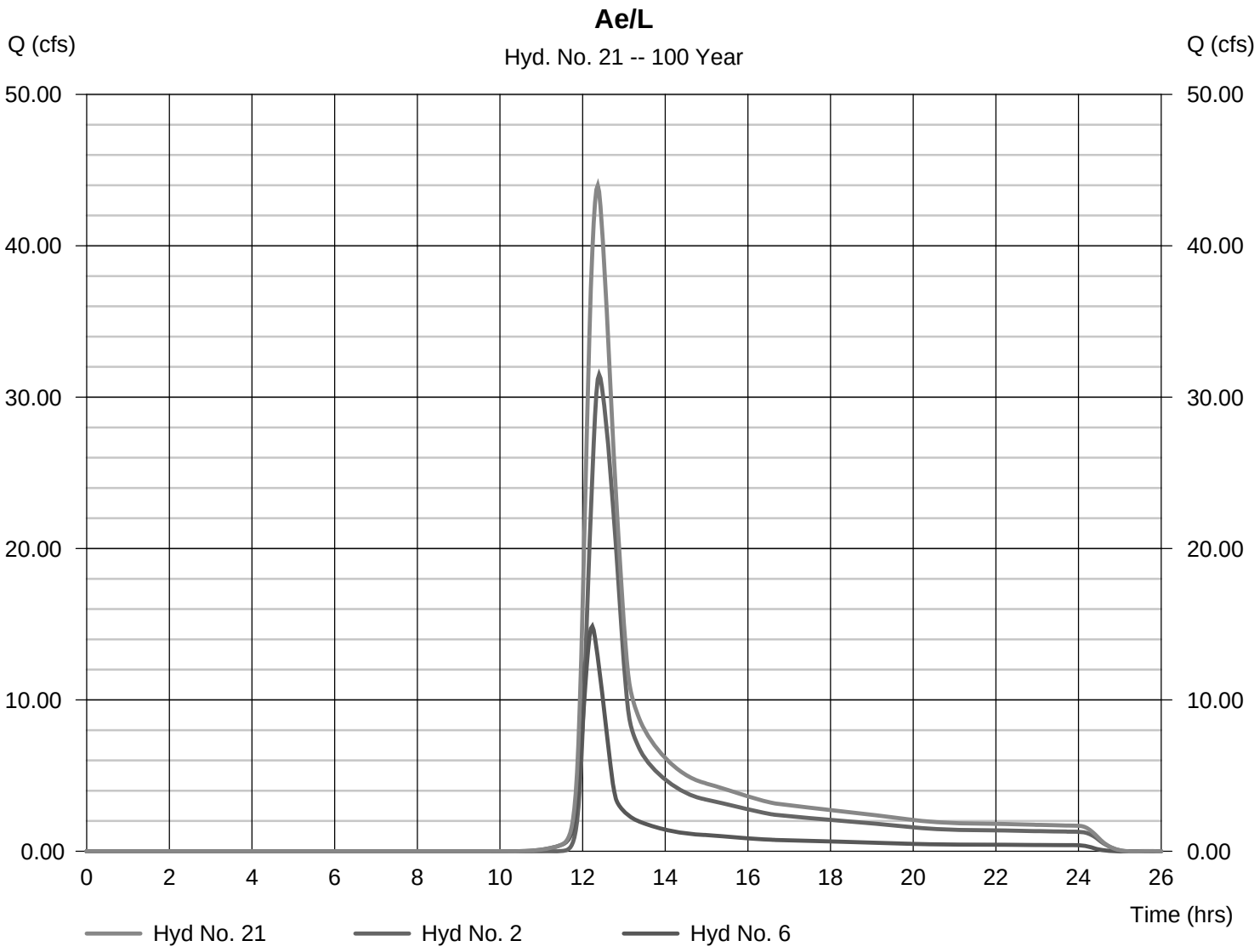
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 21

Ae/L

Hydrograph type	=	Combine	Peak discharge	=	43.98 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.37 hrs
Time interval	=	2 min	Hyd. volume	=	253,701 cuft
Inflow hyds.	=	2, 6	Contrib. drain. area	=	7.870 ac



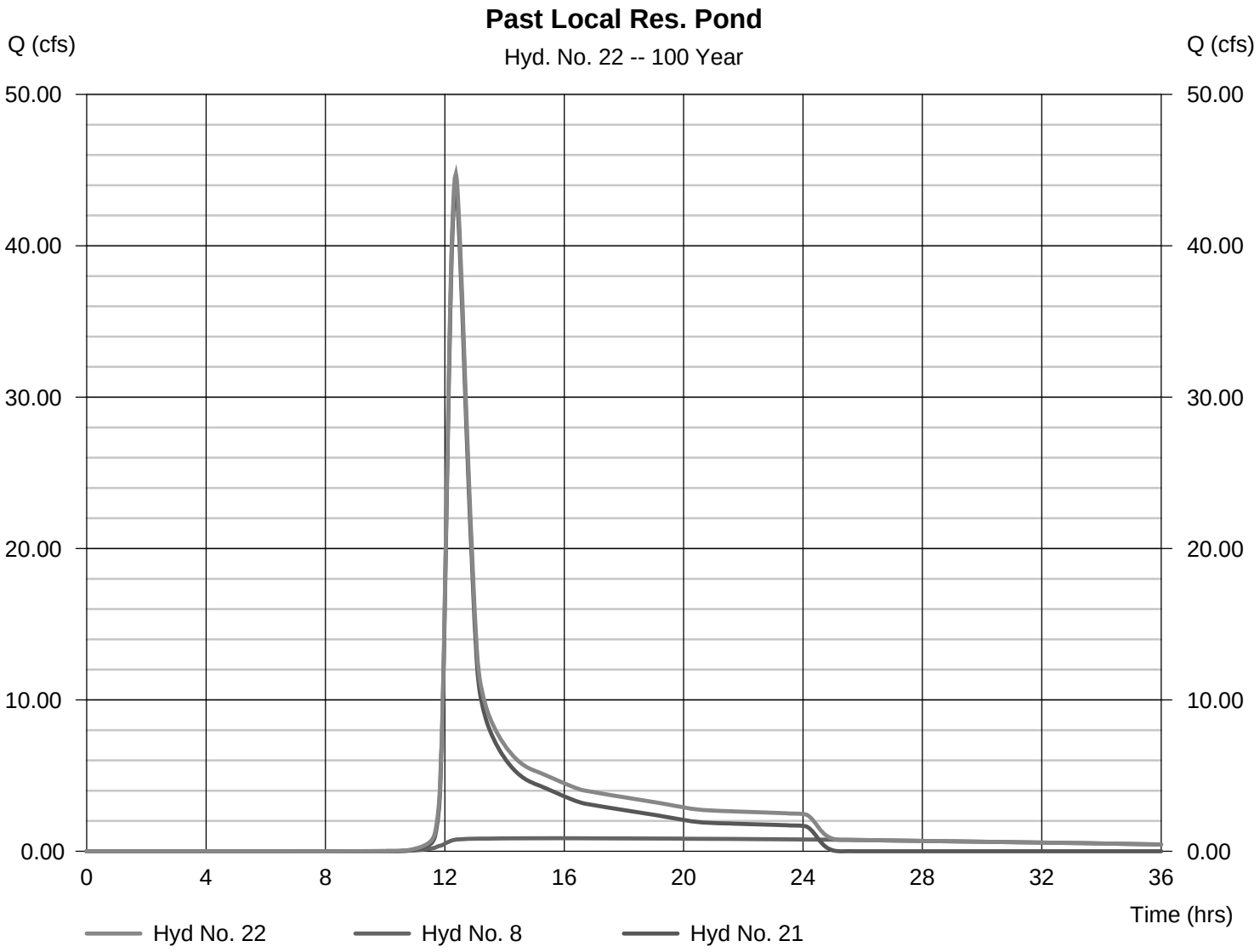
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 22

Past Local Res. Pond

Hydrograph type	= Combine	Peak discharge	= 44.75 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.37 hrs
Time interval	= 2 min	Hyd. volume	= 327,493 cuft
Inflow hyds.	= 8, 21	Contrib. drain. area	= 0.000 ac



Hydrograph Report

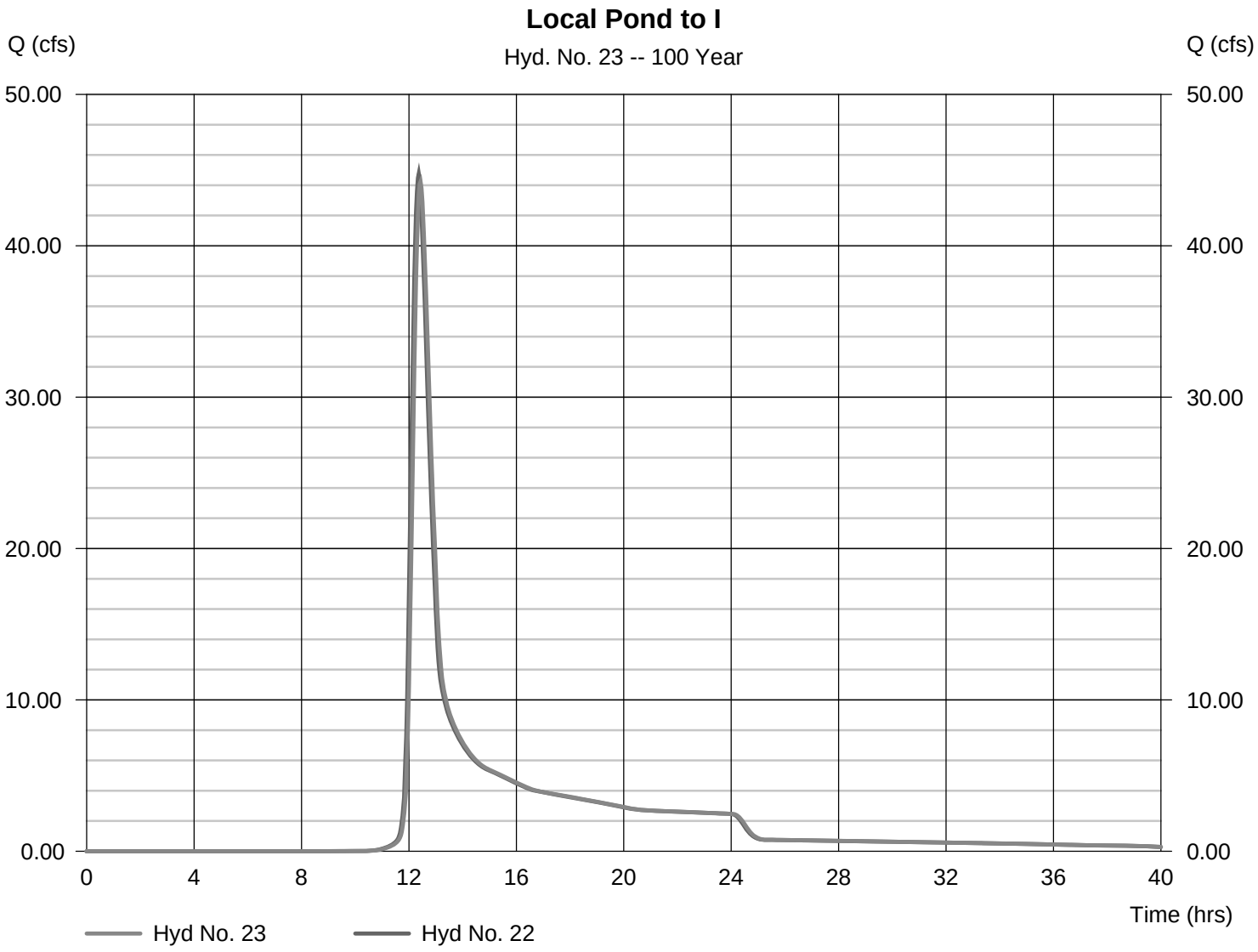
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 23

Local Pond to I

Hydrograph type	= Reach	Peak discharge	= 44.23 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.43 hrs
Time interval	= 2 min	Hyd. volume	= 327,087 cuft
Inflow hyd. No.	= 22 - Past Local Res. Pond	Section type	= Trapezoidal
Reach length	= 710.0 ft	Channel slope	= 0.4 %
Manning's n	= 0.025	Bottom width	= 5.0 ft
Side slope	= 2.0:1	Max. depth	= 2.0 ft
Rating curve x	= 1.288	Rating curve m	= 1.346
Ave. velocity	= 3.21 ft/s	Routing coeff.	= 0.5342

Modified Att-Kin routing method used.



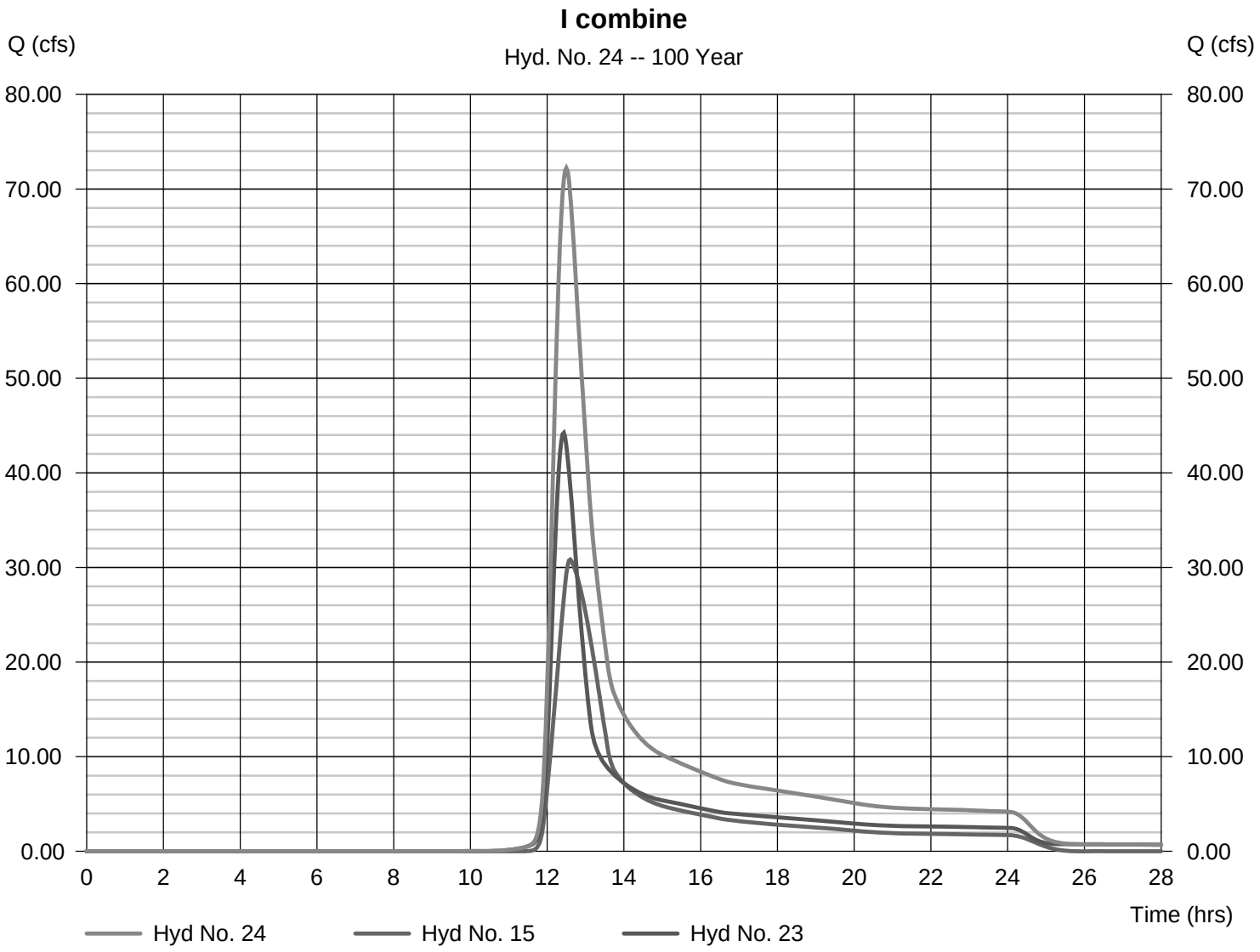
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 24

I combine

Hydrograph type	=	Combine	Peak discharge	=	72.22 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.50 hrs
Time interval	=	2 min	Hyd. volume	=	574,344 cuft
Inflow hyds.	=	15, 23	Contrib. drain. area	=	40.060 ac



Hydrograph Report

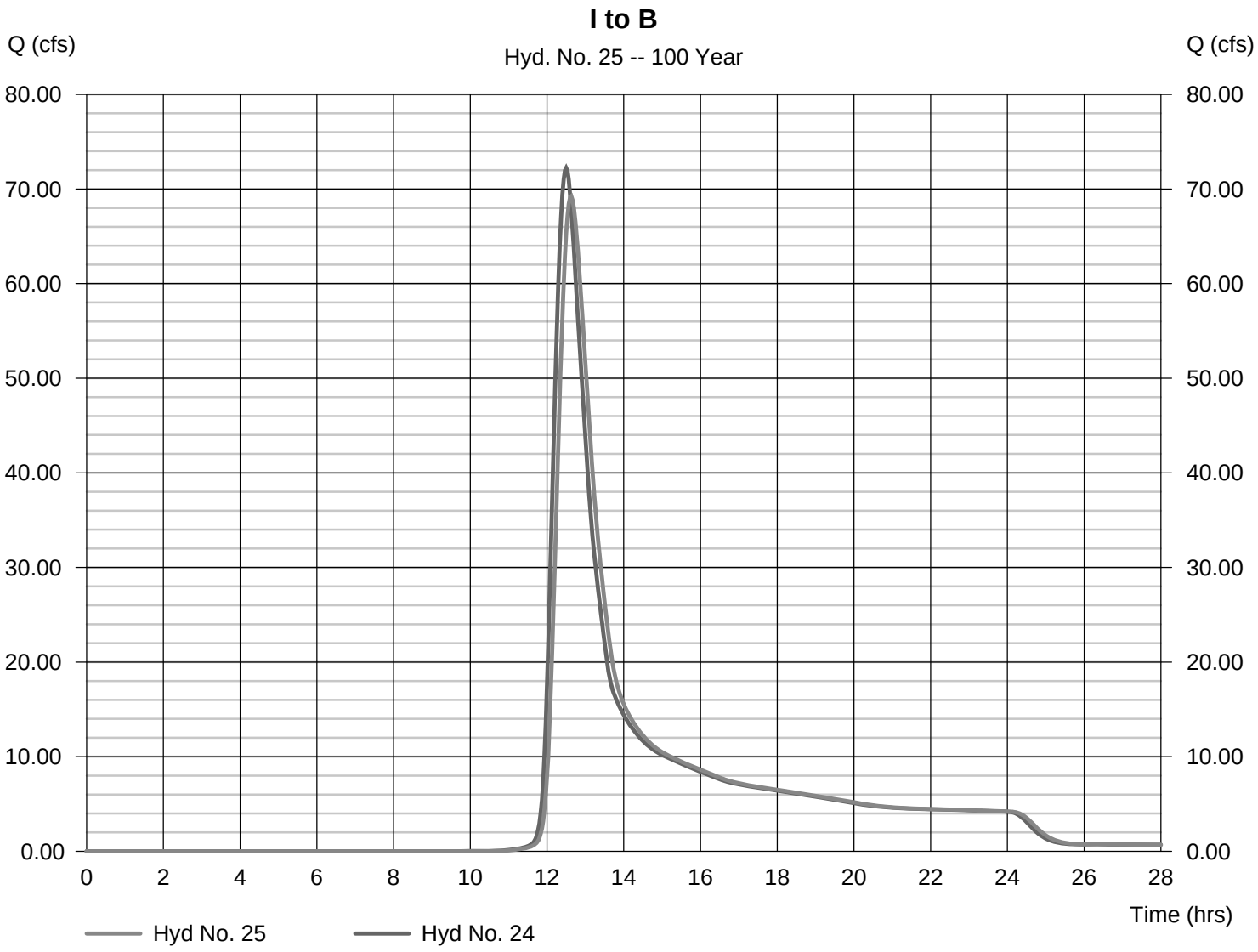
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 25

I to B

Hydrograph type	= Reach	Peak discharge	= 69.23 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.63 hrs
Time interval	= 2 min	Hyd. volume	= 574,341 cuft
Inflow hyd. No.	= 24 - I combine	Section type	= Trapezoidal
Reach length	= 1200.0 ft	Channel slope	= 0.7 %
Manning's n	= 0.040	Bottom width	= 2.0 ft
Side slope	= 4.0:1	Max. depth	= 2.0 ft
Rating curve x	= 1.963	Rating curve m	= 1.107
Ave. velocity	= 2.78 ft/s	Routing coeff.	= 0.2668

Modified Att-Kin routing method used.



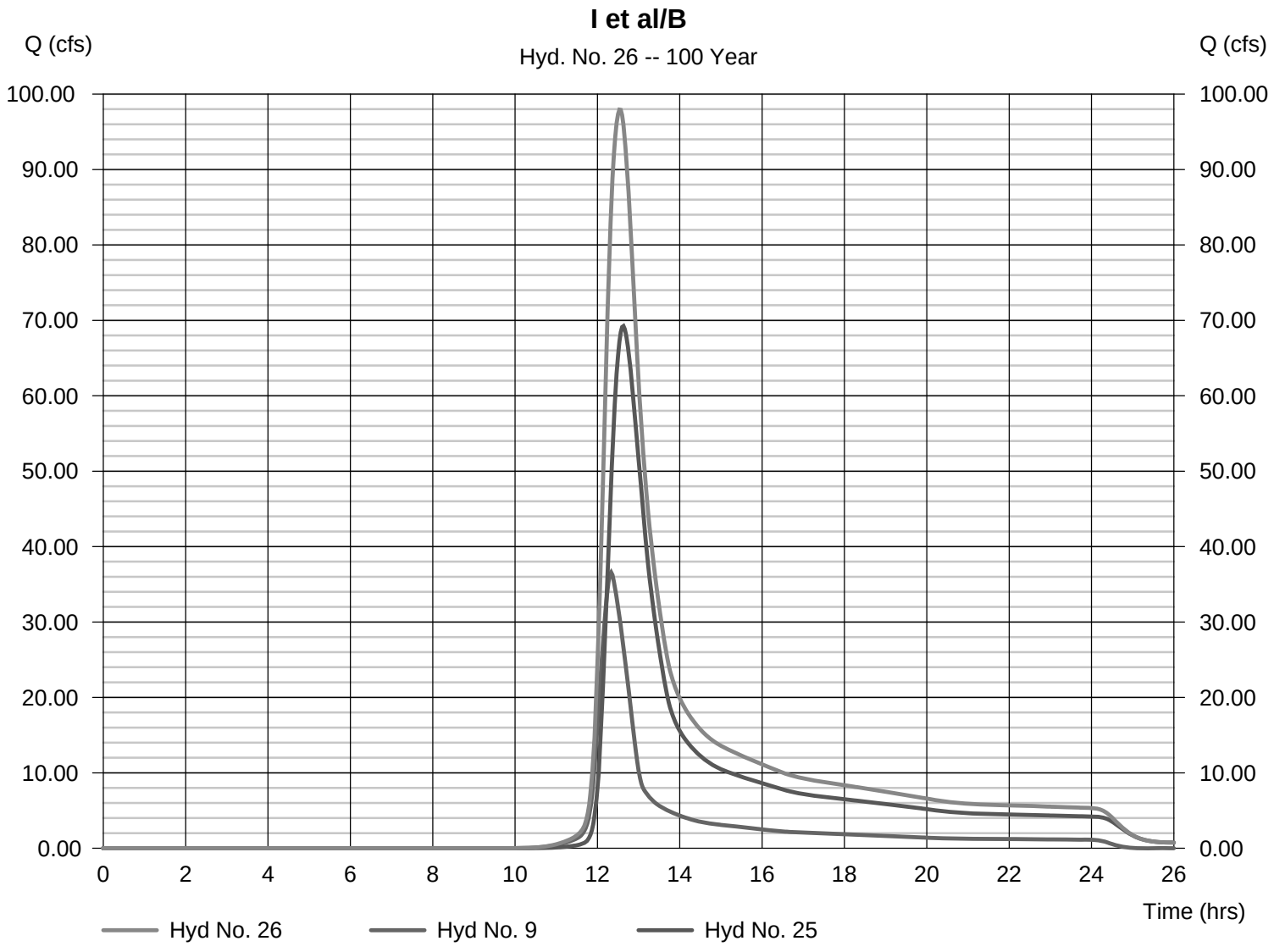
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 26

I et al/B

Hydrograph type	=	Combine	Peak discharge	=	97.94 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.53 hrs
Time interval	=	2 min	Hyd. volume	=	769,986 cuft
Inflow hyds.	=	9, 25	Contrib. drain. area	=	21.340 ac



Hydrograph Report

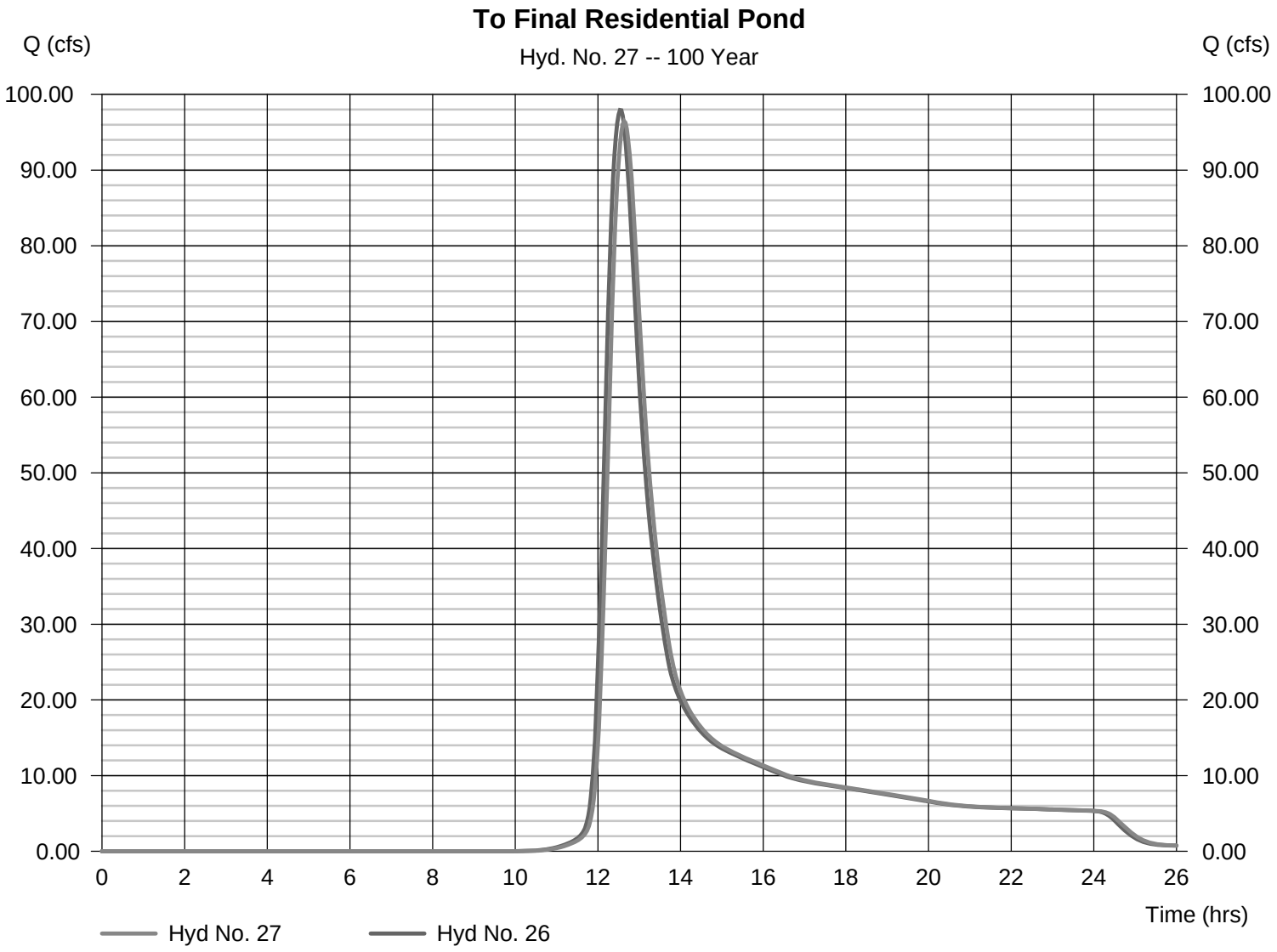
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 27

To Final Residential Pond

Hydrograph type	= Reach	Peak discharge	= 96.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.63 hrs
Time interval	= 2 min	Hyd. volume	= 769,985 cuft
Inflow hyd. No.	= 26 - I et al/B	Section type	= Trapezoidal
Reach length	= 1000.0 ft	Channel slope	= 1.0 %
Manning's n	= 0.040	Bottom width	= 2.0 ft
Side slope	= 4.0:1	Max. depth	= 2.0 ft
Rating curve x	= 2.346	Rating curve m	= 1.107
Ave. velocity	= 3.36 ft/s	Routing coeff.	= 0.3653

Modified Att-Kin routing method used.



Hydrograph Report

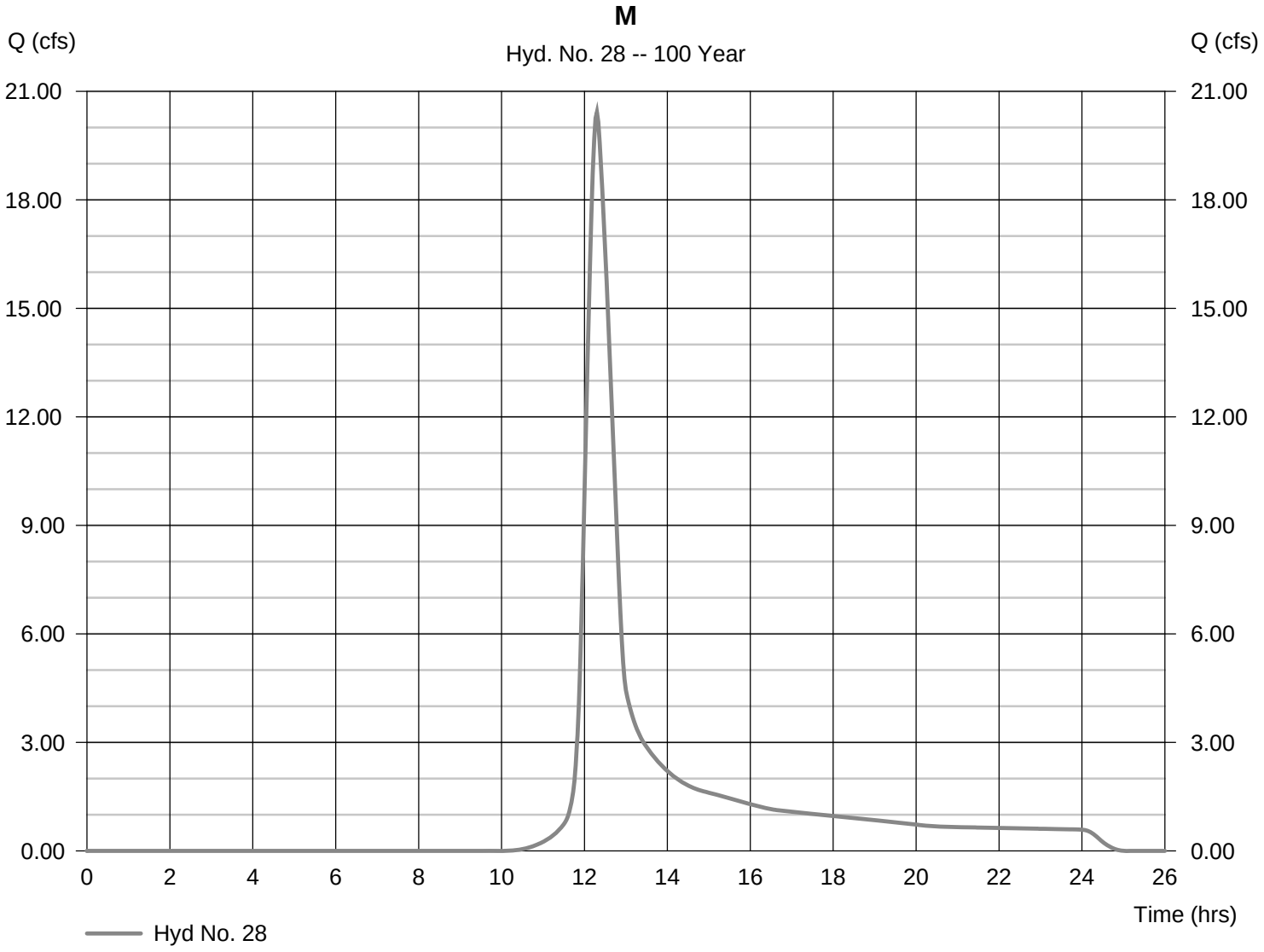
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 28

M

Hydrograph type	= SCS Runoff	Peak discharge	= 20.42 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 102,430 cuft
Drainage area	= 11.280 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.70 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.770 x 98) + (10.510 x 61)] / 11.280



TR55 Tc Worksheet

Hyd. No. 28

M

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 7.00		0.00		0.00		
Travel Time (min)	**= 33.32**	**+**	**0.00**	**+**	**0.00**	**=**	**33.32**
Shallow Concentrated Flow							
Flow length (ft)	= 675.00		0.00		0.00		
Watercourse slope (%)	= 2.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.55		0.00		0.00		
Travel Time (min)	**= 4.41**	**+**	**0.00**	**+**	**0.00**	**=**	**4.41**
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 ..... 37.70 min

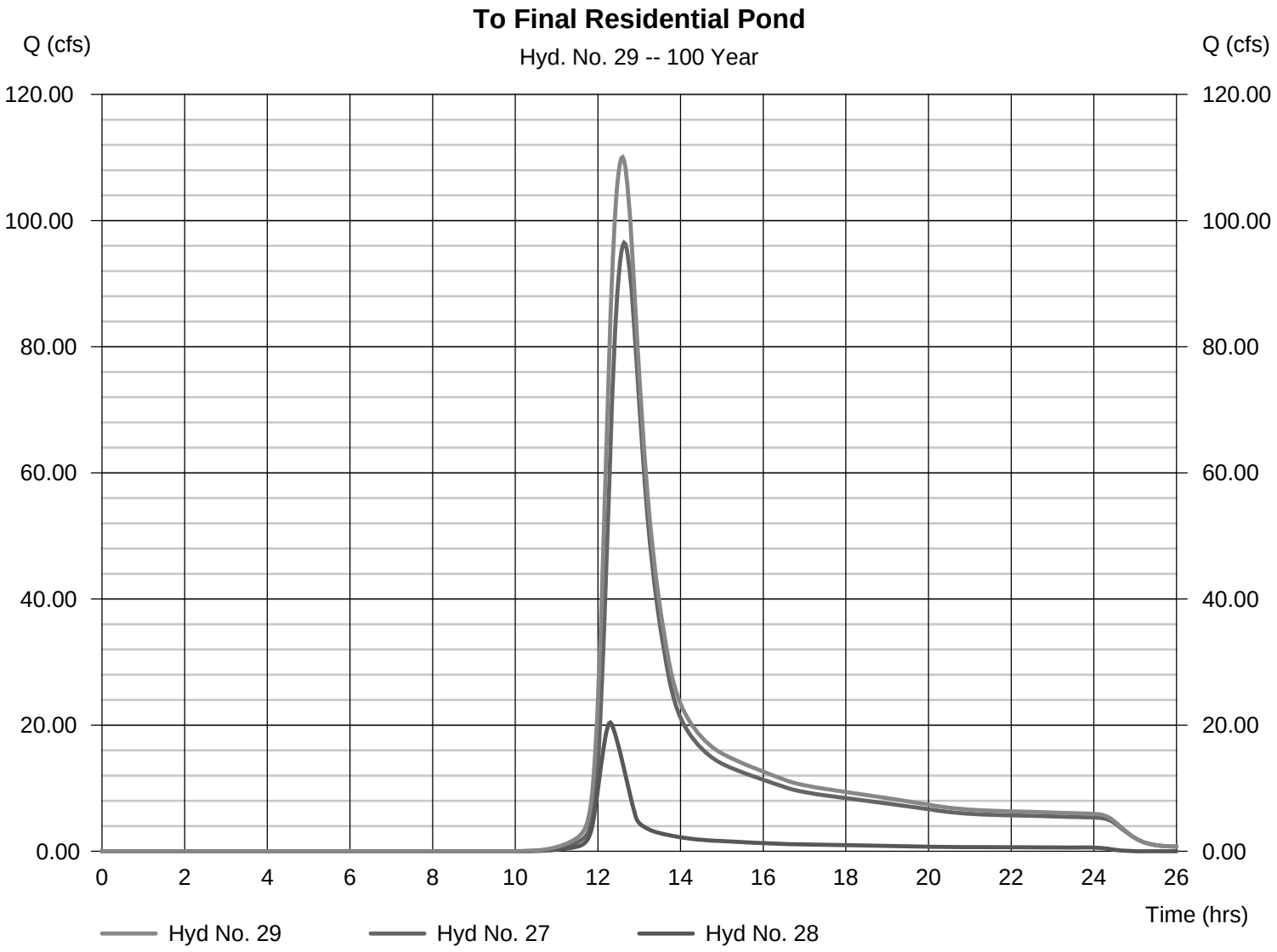
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 29

To Final Residential Pond

Hydrograph type	=	Combine	Peak discharge	=	110.05 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.60 hrs
Time interval	=	2 min	Hyd. volume	=	872,415 cuft
Inflow hyds.	=	27, 28	Contrib. drain. area	=	11.280 ac



Hydrograph Report

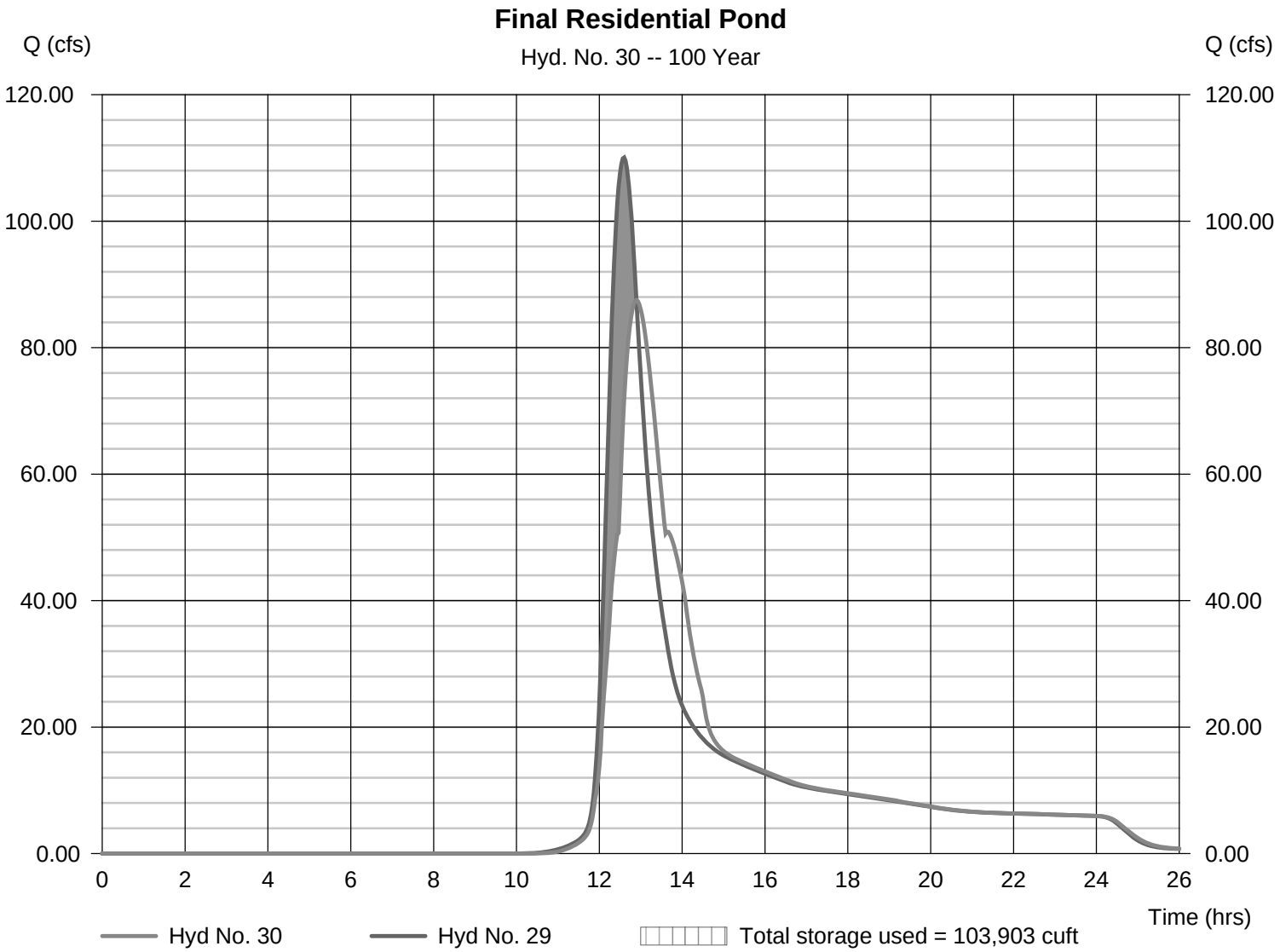
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 30

Final Residential Pond

Hydrograph type	=	Reservoir	Peak discharge	=	87.53 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.90 hrs
Time interval	=	2 min	Hyd. volume	=	872,412 cuft
Inflow hyd. No.	=	29 - To Final Residential Pond	Max. Elevation	=	736.00 ft
Reservoir name	=	final residential pond	Max. Storage	=	103,903 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 4 - final residential pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 731.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	731.00	1,900	0	0
1.00	732.00	3,800	2,795	2,795
2.00	733.00	13,052	7,964	10,759
3.00	734.00	27,406	19,788	30,548
4.00	735.00	36,352	31,771	62,319
5.00	736.00	47,066	41,590	103,908

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 48.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 731.00	0.00	0.00	0.00
Length (ft)	= 100.00	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

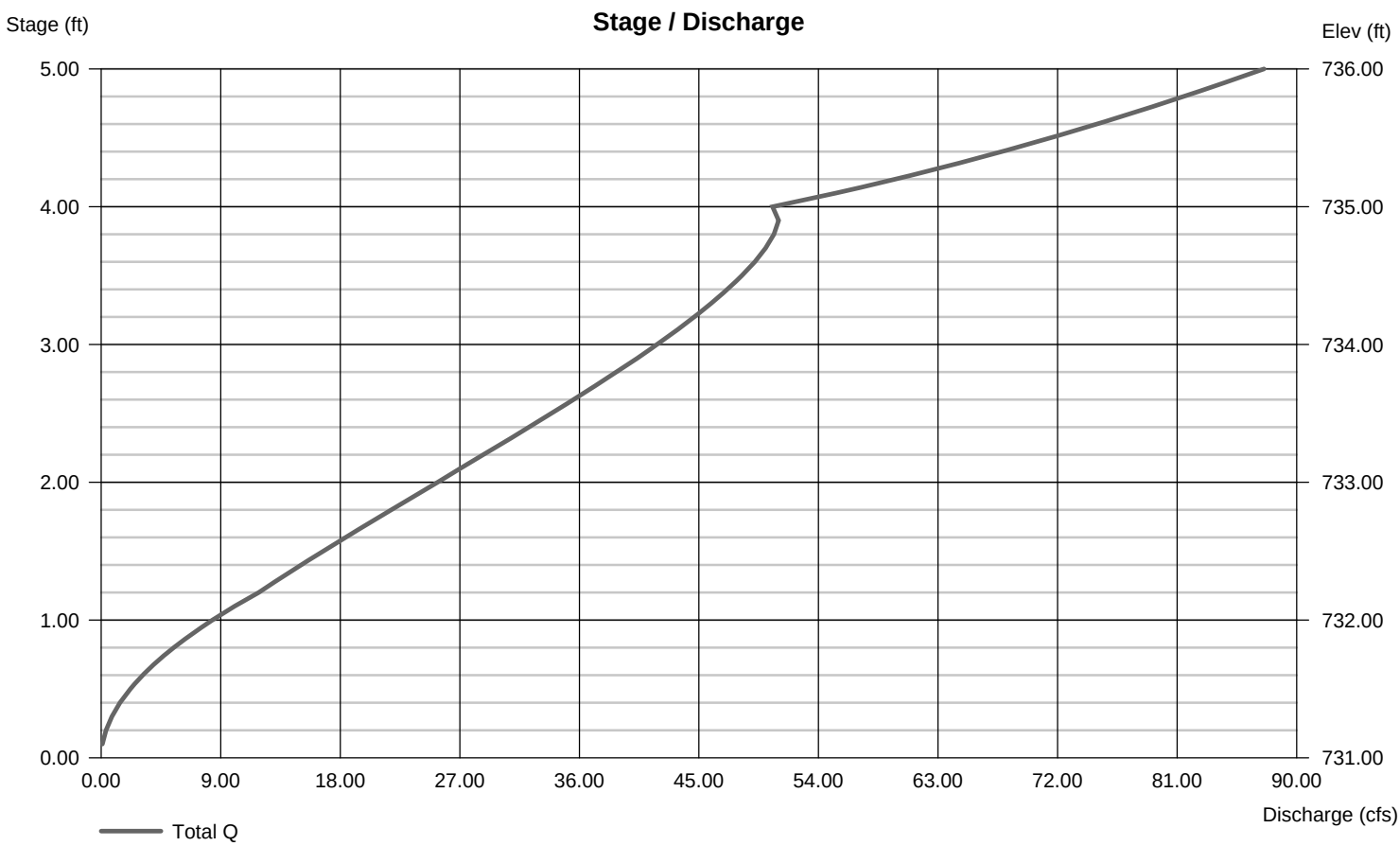
Weir Structures

	[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).



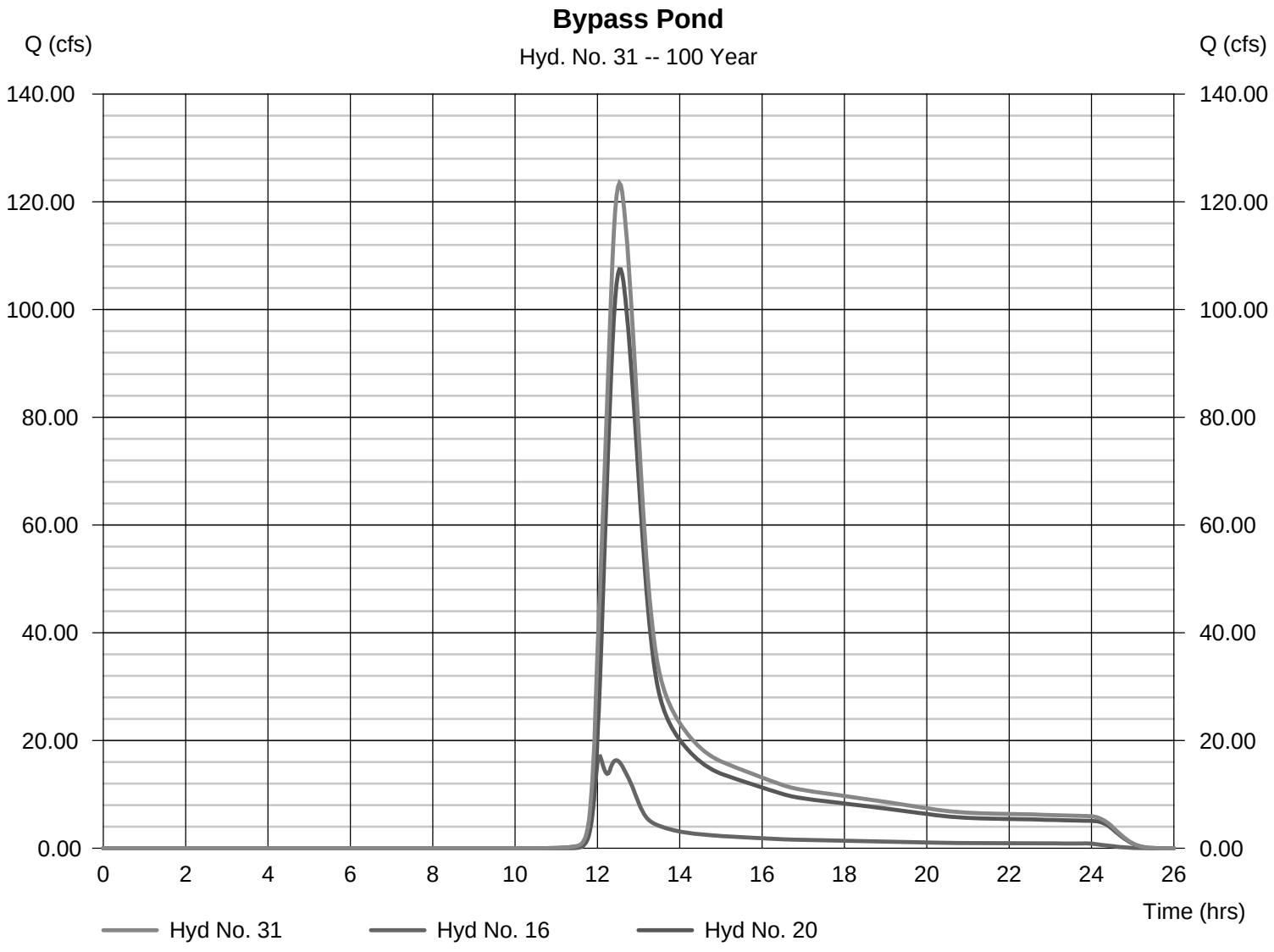
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 31

Bypass Pond

Hydrograph type	=	Combine	Peak discharge	=	123.47 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.53 hrs
Time interval	=	2 min	Hyd. volume	=	866,800 cuft
Inflow hyds.	=	16, 20	Contrib. drain. area	=	0.000 ac



Hydrograph Report

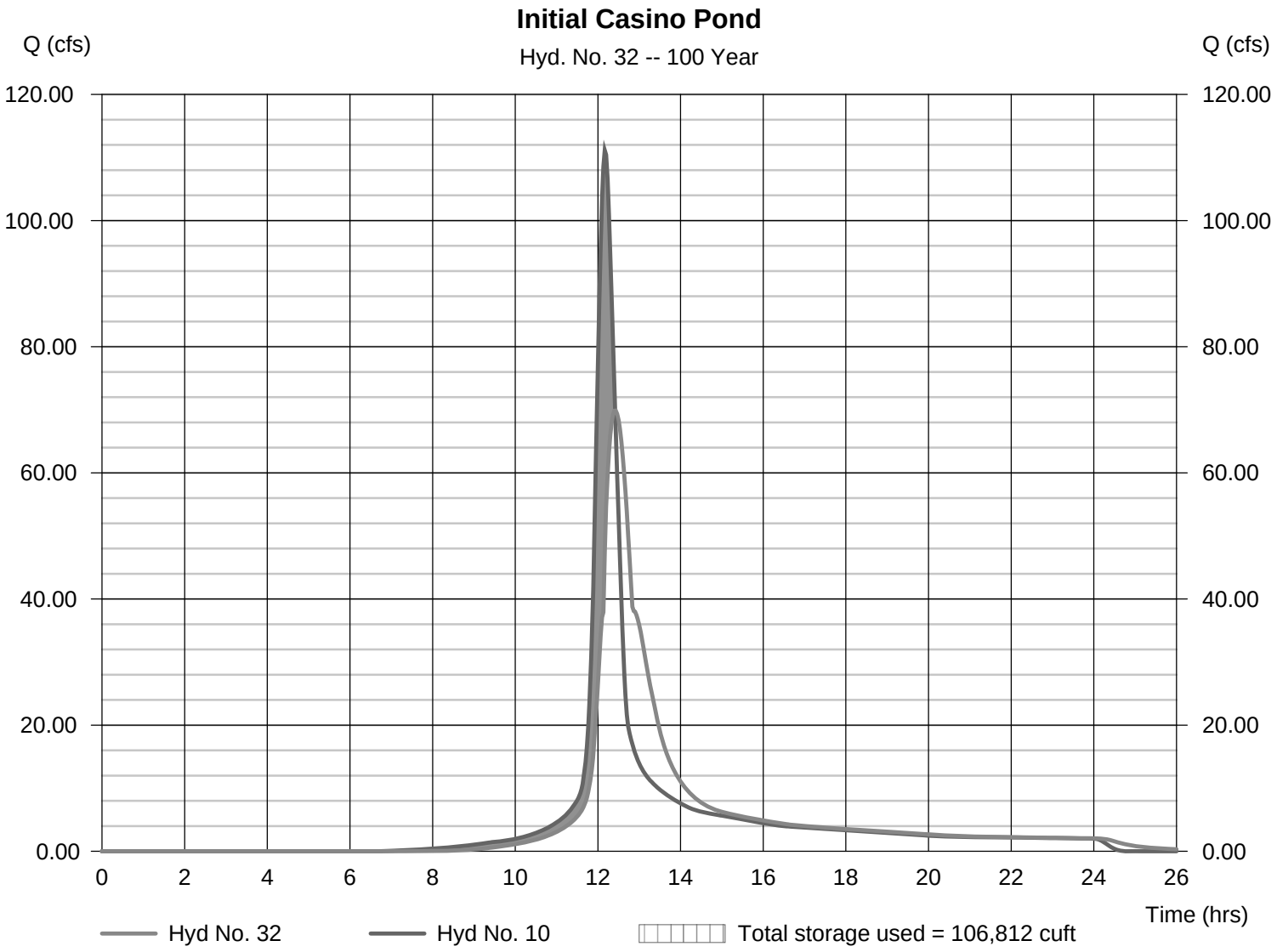
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 32

Initial Casino Pond

Hydrograph type	= Reservoir	Peak discharge	= 69.87 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.43 hrs
Time interval	= 2 min	Hyd. volume	= 444,117 cuft
Inflow hyd. No.	= 10 - D	Max. Elevation	= 735.71 ft
Reservoir name	= initial casino pond	Max. Storage	= 106,812 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 5 - initial casino pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 731.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	731.00	14,285	0	0
1.00	732.00	17,526	15,876	15,876
2.00	733.00	20,997	19,233	35,110
3.00	734.00	24,700	22,821	57,931
4.00	735.00	28,634	26,640	84,571
5.00	736.00	34,238	31,391	115,962

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 42.00	0.00	0.00	0.00
Span (in)	= 42.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 731.00	0.00	0.00	0.00
Length (ft)	= 100.00	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

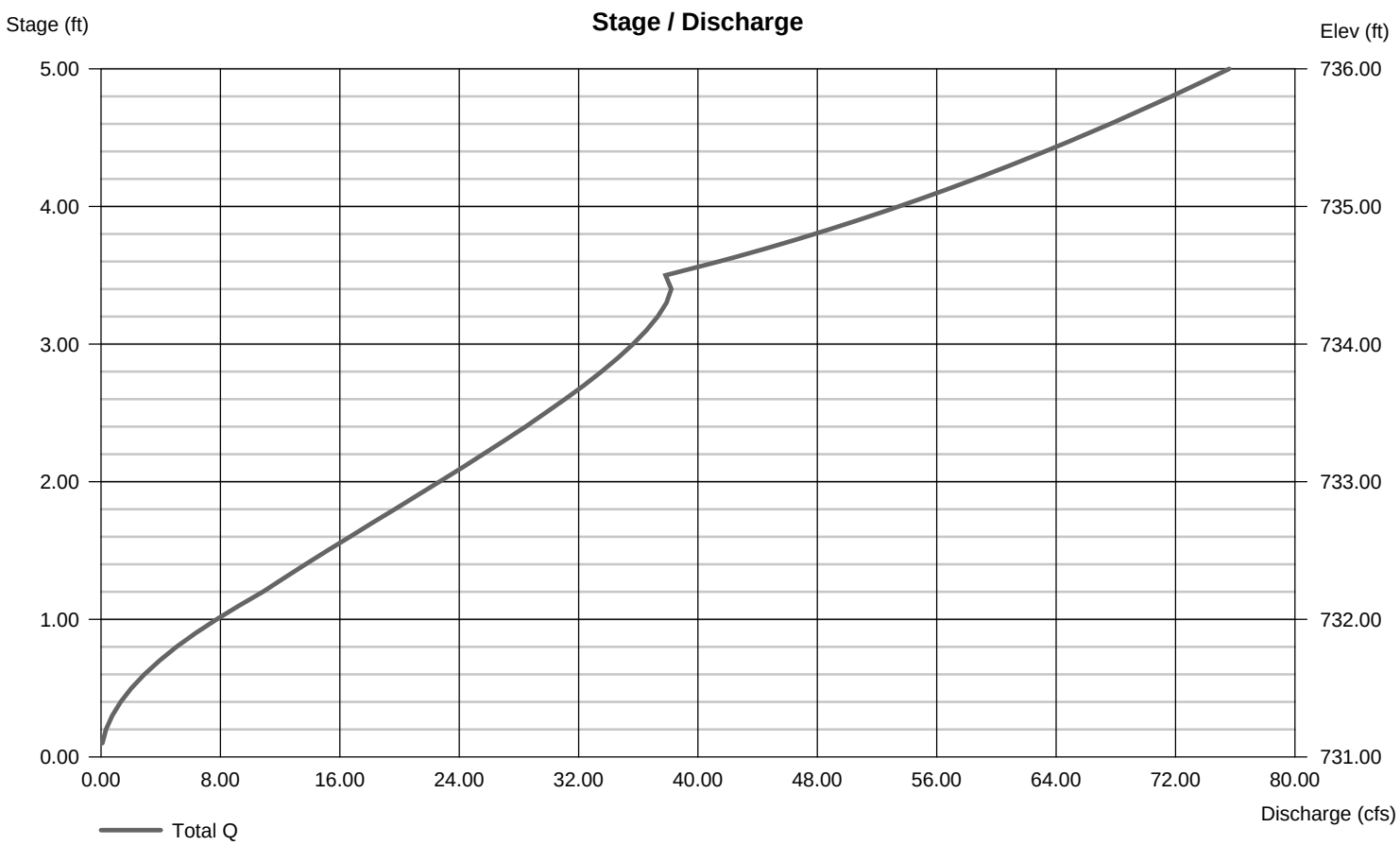
Weir Structures

	[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).



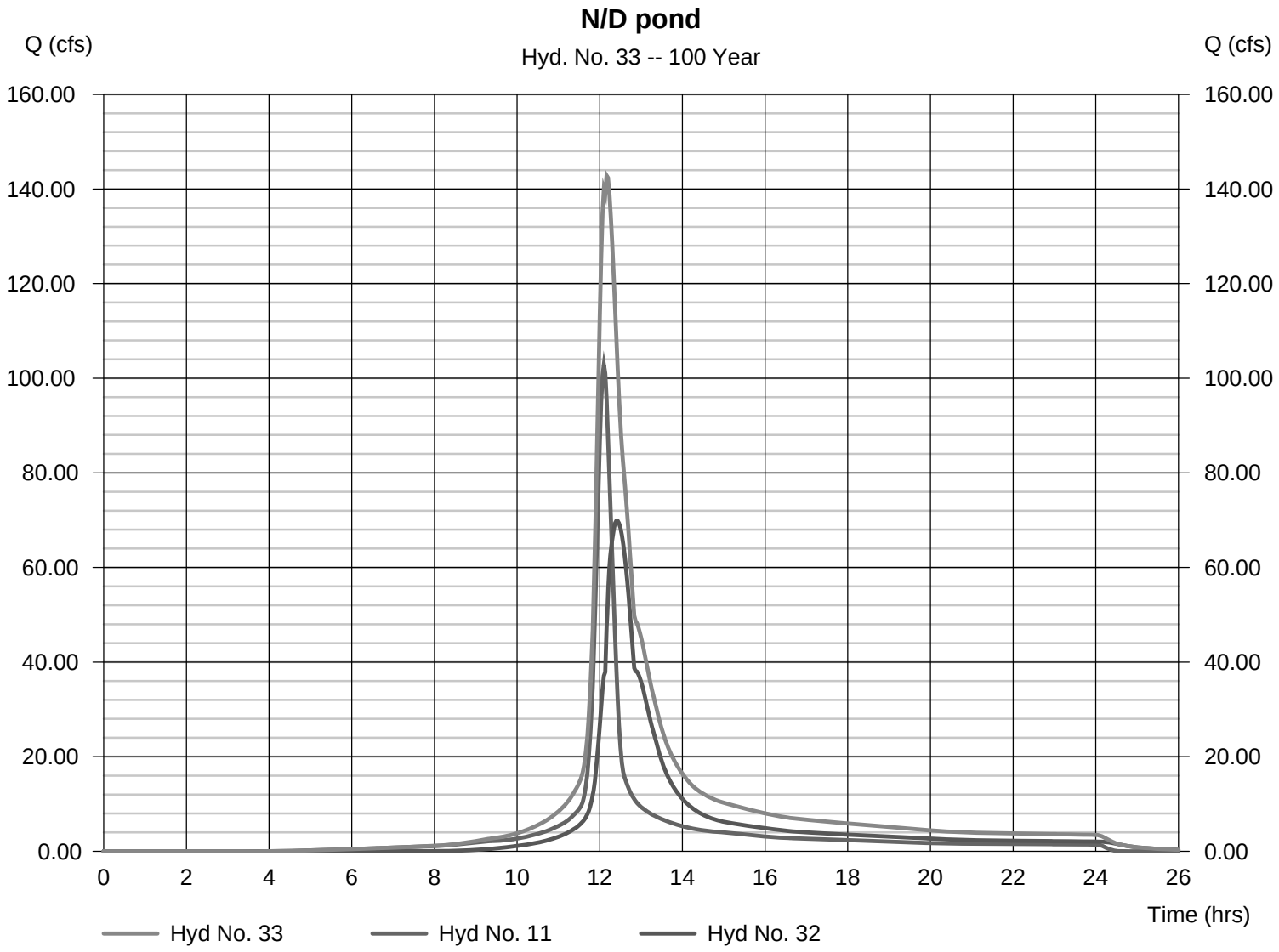
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 33

N/D pond

Hydrograph type	=	Combine	Peak discharge	=	142.83 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	807,912 cuft
Inflow hyds.	=	11, 32	Contrib. drain. area	=	20.370 ac



Hydrograph Report

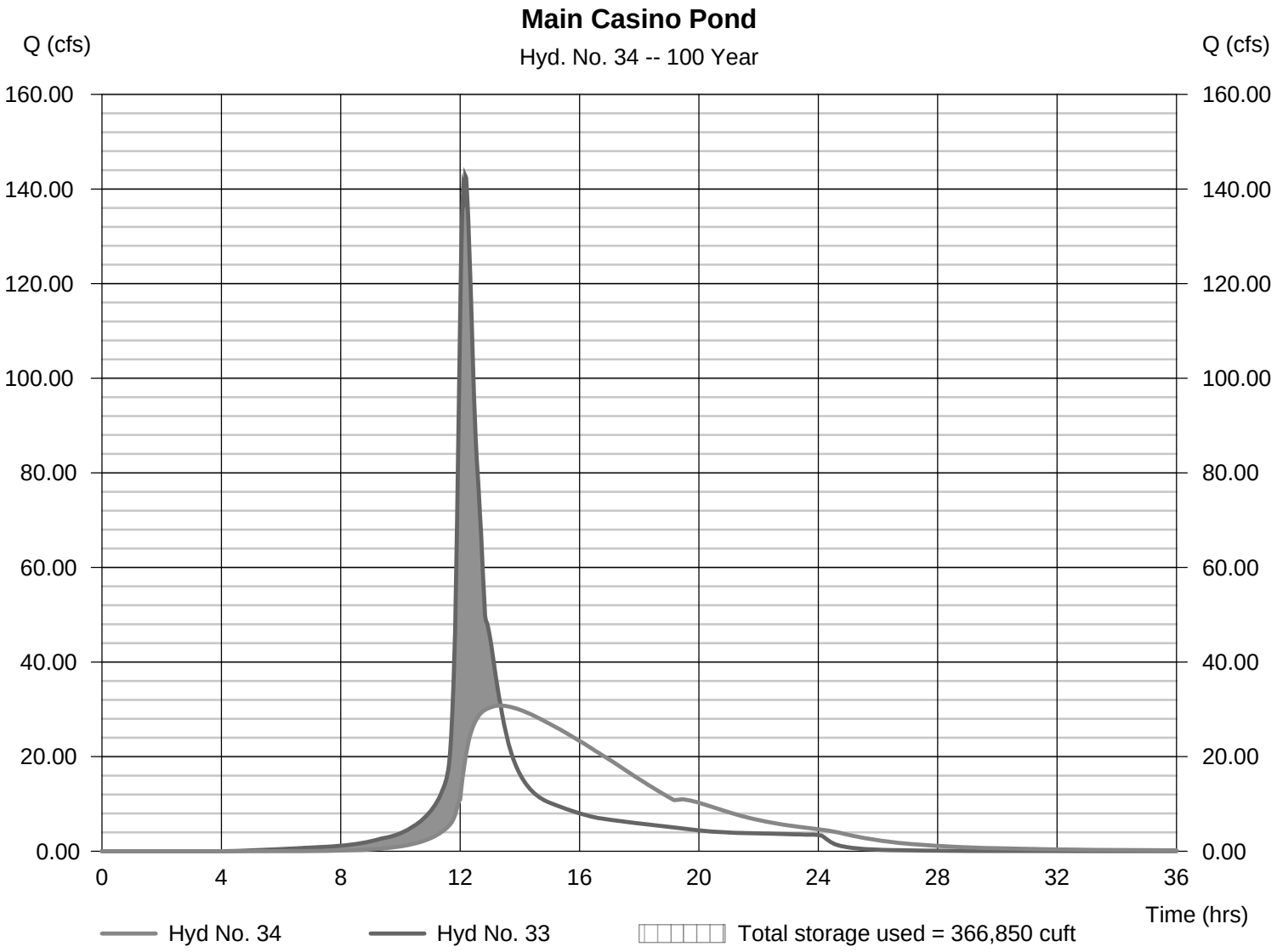
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 34

Main Casino Pond

Hydrograph type	=	Reservoir	Peak discharge	=	30.80 cfs
Storm frequency	=	100 yrs	Time to peak	=	13.37 hrs
Time interval	=	2 min	Hyd. volume	=	807,584 cuft
Inflow hyd. No.	=	33 - N/D pond	Max. Elevation	=	734.58 ft
Reservoir name	=	Main Casino Pond	Max. Storage	=	366,850 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 2 - Main Casino Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 729.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	729.00	49,256	0	0
1.00	730.00	54,870	52,033	52,033
2.00	731.00	60,668	57,739	109,772
3.00	732.00	66,648	63,628	173,400
4.00	733.00	72,808	69,698	243,098
5.00	734.00	79,148	75,948	319,046
6.00	735.00	85,671	82,380	401,426
7.00	736.00	92,375	88,993	490,419

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)	= 729.00	0.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.82	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

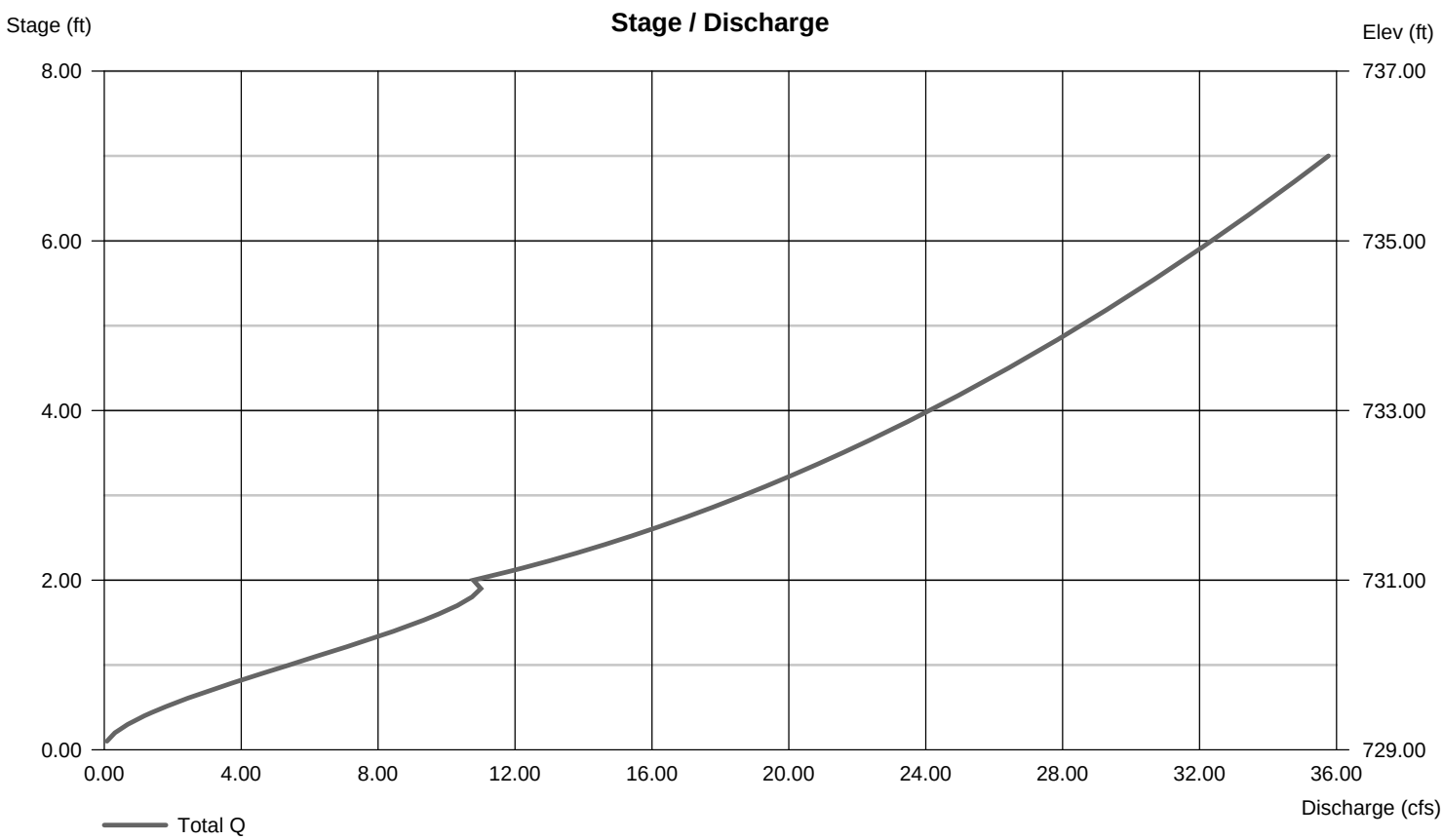
Weir Structures

	[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).



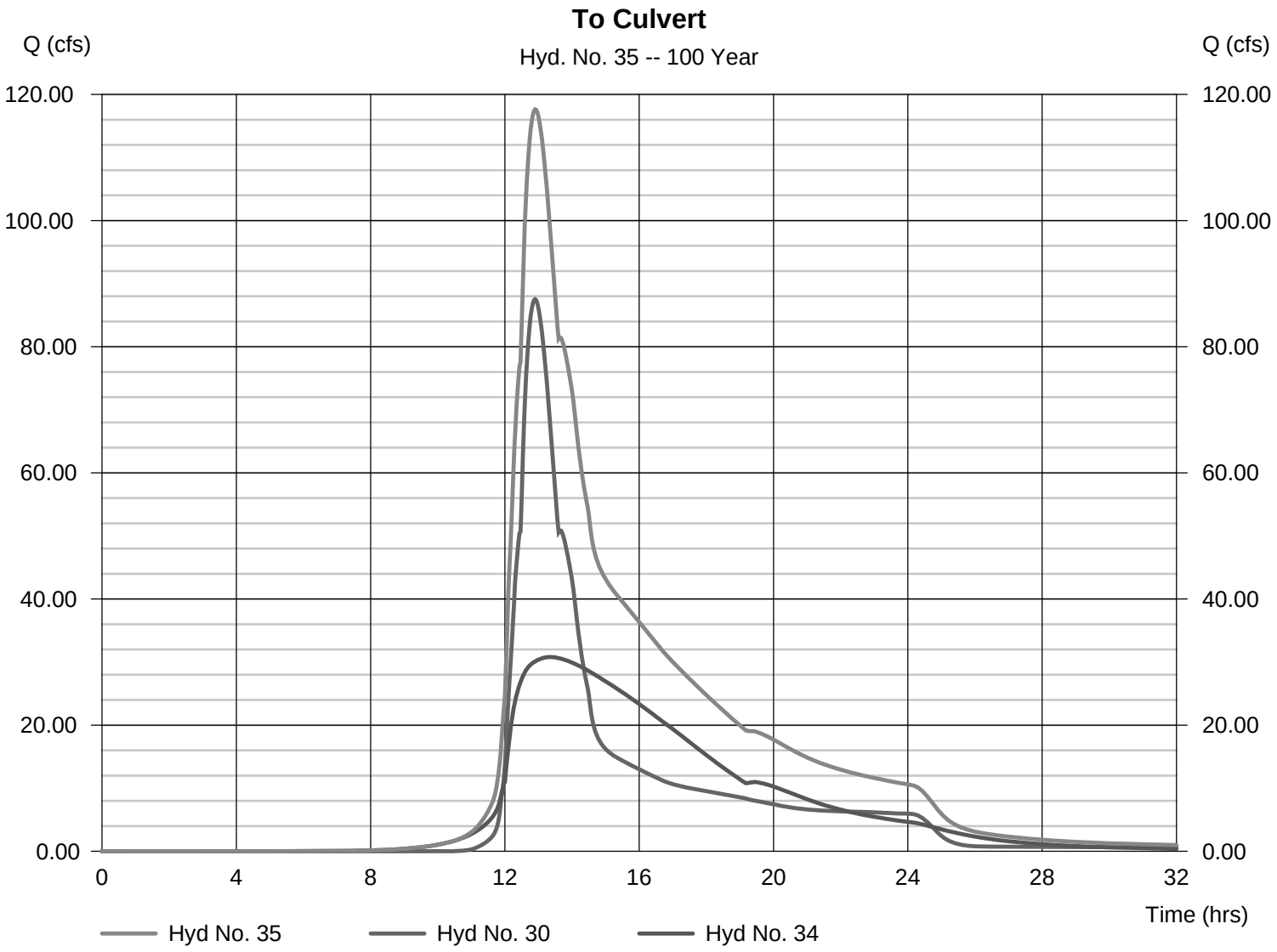
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 35

To Culvert

Hydrograph type	=	Combine	Peak discharge	=	117.64 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.90 hrs
Time interval	=	2 min	Hyd. volume	=	1,679,993 cuft
Inflow hyds.	=	30, 34	Contrib. drain. area	=	0.000 ac



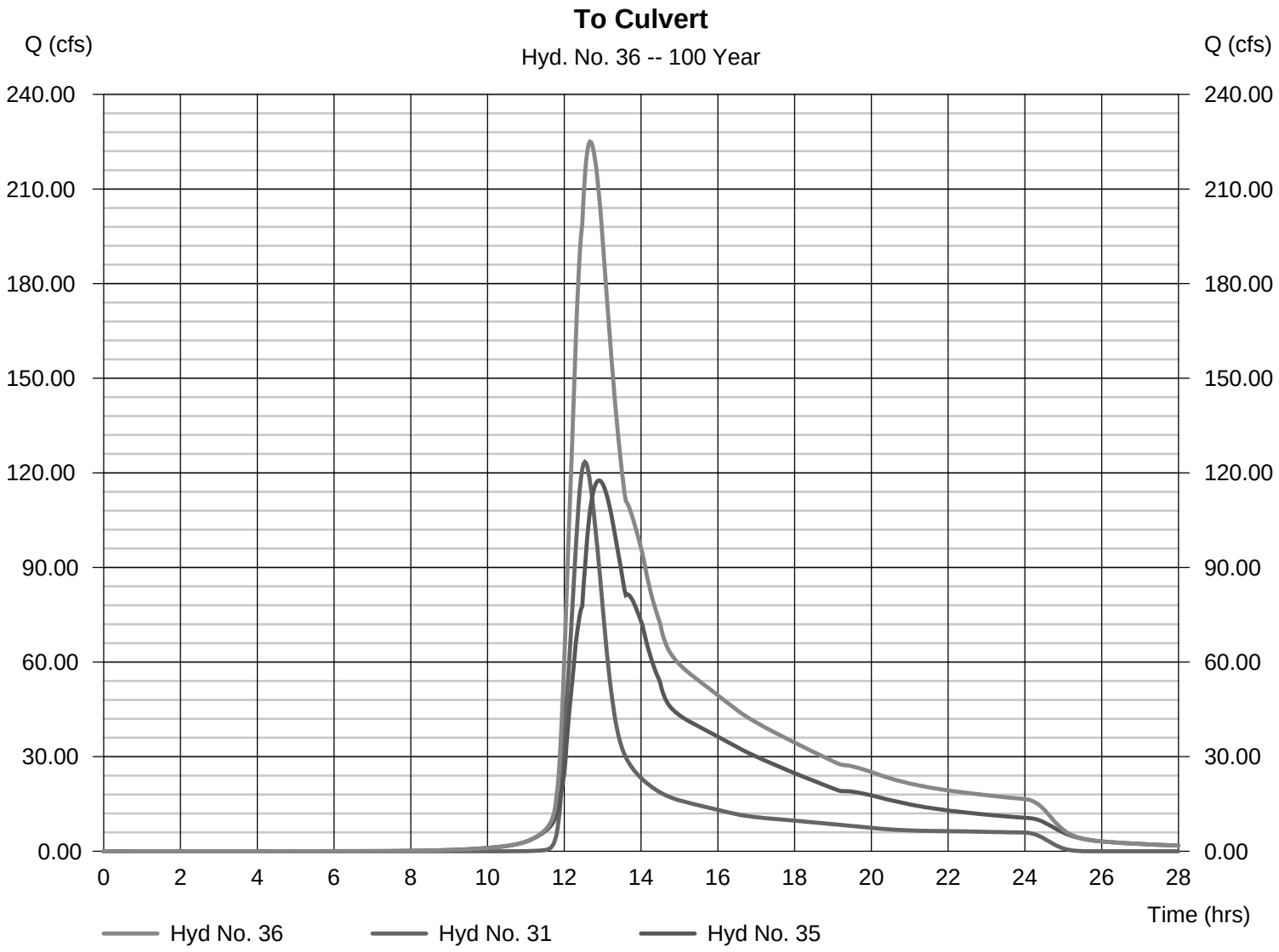
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 36

To Culvert

Hydrograph type	= Combine	Peak discharge	= 225.01 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.67 hrs
Time interval	= 2 min	Hyd. volume	= 2,546,798 cuft
Inflow hyds.	= 31, 35	Contrib. drain. area	= 0.000 ac



Hydrograph Report

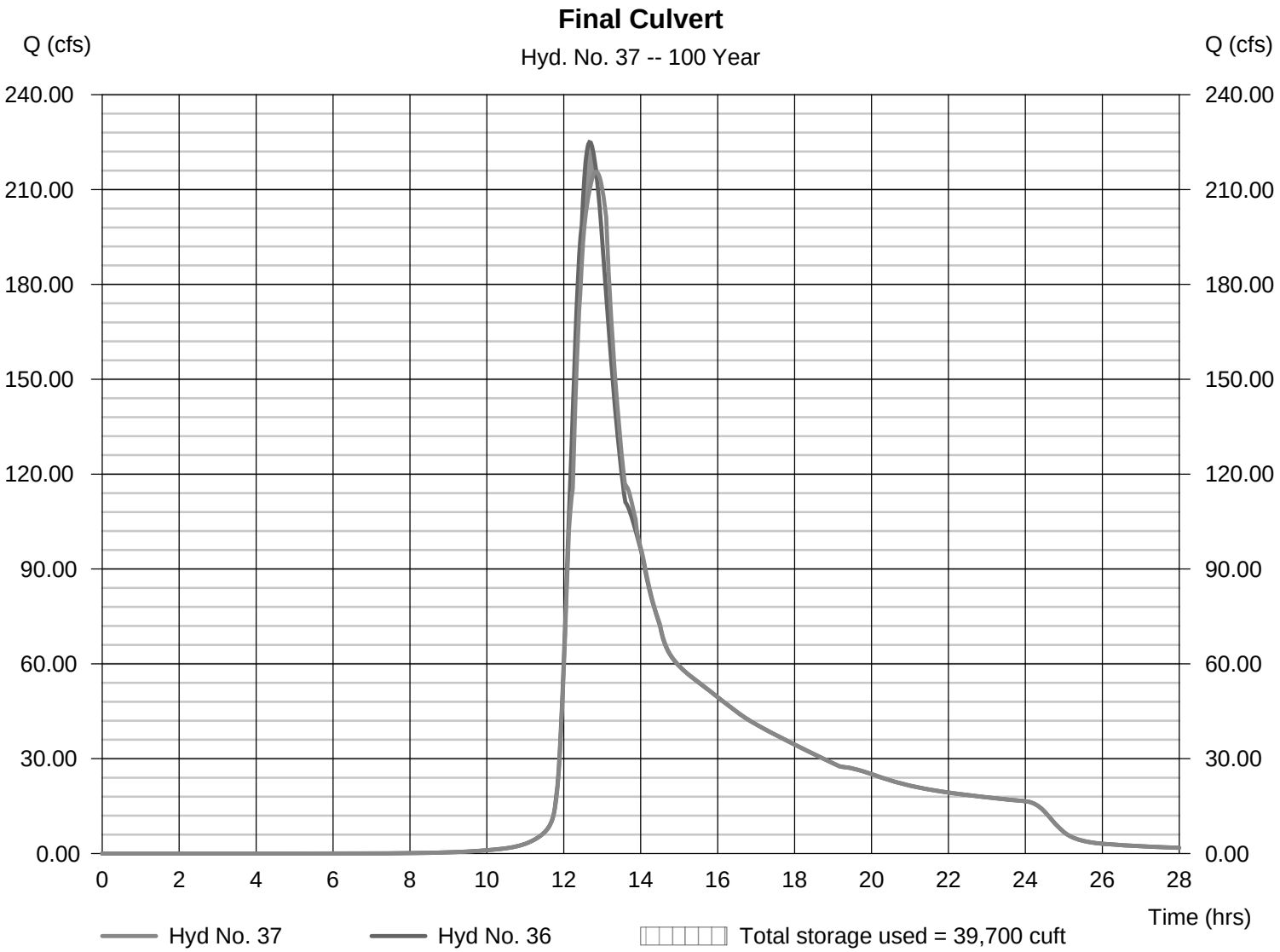
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 37

Final Culvert

Hydrograph type	=	Reservoir	Peak discharge	=	215.63 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.83 hrs
Time interval	=	2 min	Hyd. volume	=	2,546,788 cuft
Inflow hyd. No.	=	36 - To Culvert	Max. Elevation	=	736.23 ft
Reservoir name	=	existing depression	Max. Storage	=	39,700 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 1 - existing depression

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 729.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	729.00	100	0	0
1.00	730.00	300	191	191
2.00	731.00	500	396	587
3.00	732.00	700	597	1,184
4.00	733.00	900	798	1,982
5.00	734.00	1,200	1,046	3,028
6.00	735.00	9,429	4,664	7,692
7.00	736.00	31,928	19,567	27,259
8.00	737.00	81,595	54,849	82,108

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 72.00	0.00	0.00	0.00
Span (in)	= 72.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 729.00	0.00	0.00	0.00
Length (ft)	= 140.00	0.00	0.00	0.00
Slope (%)	= 0.35	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.82	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

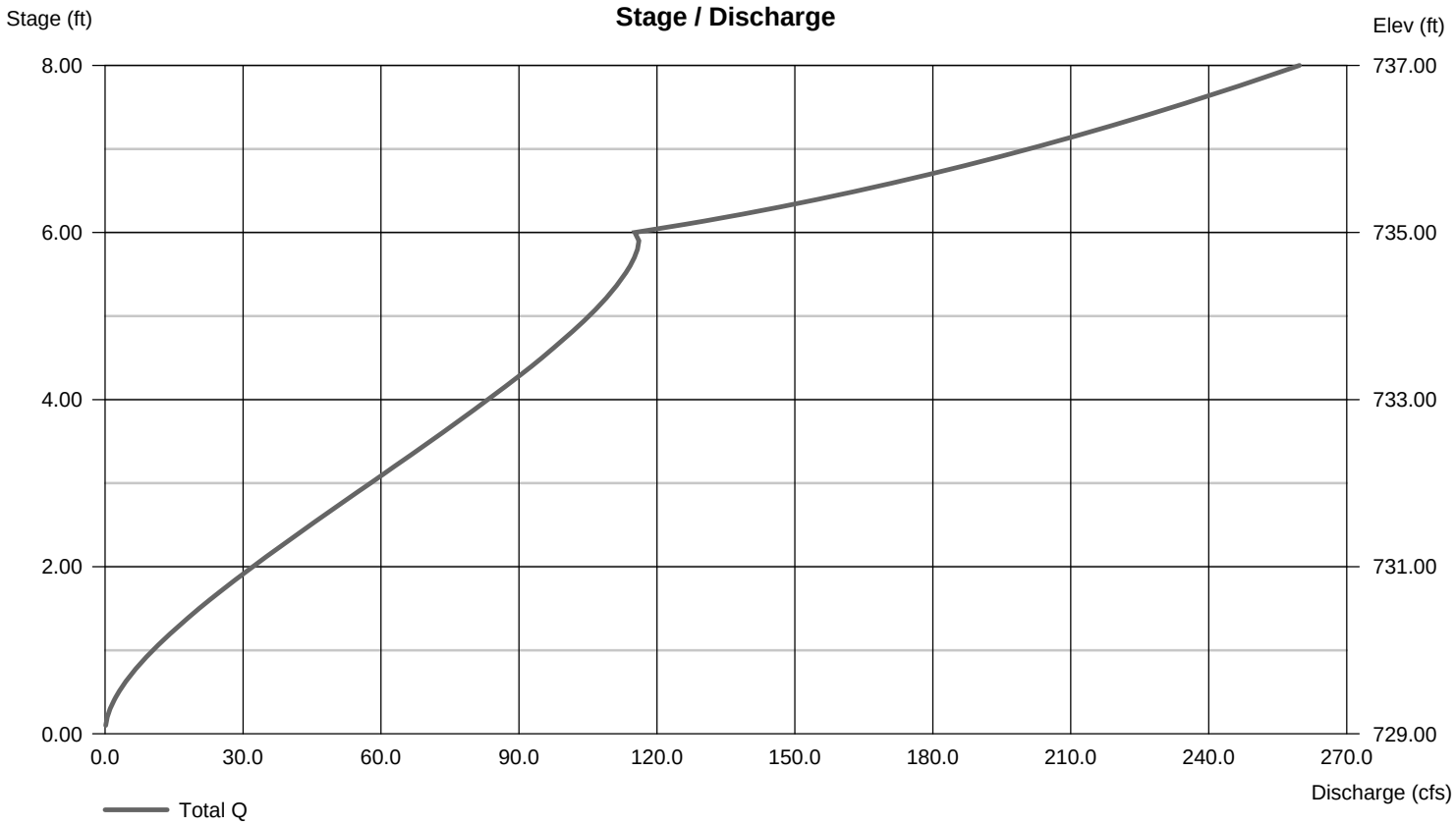
Weir Structures

	[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 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).



Appendix H

Alternatives A & C Residential Proposed Hydrograph Report

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Legend

Hyd.	Origin	Description
1	SCS Runoff	J - Proposed
2	Reservoir	Proposed Pond

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	21.69	2	722	60,942	------	------	------	J - Proposed
2	Reservoir	5.444	2	738	60,936	1	755.93	20,622	Proposed Pond

Hydrograph Report

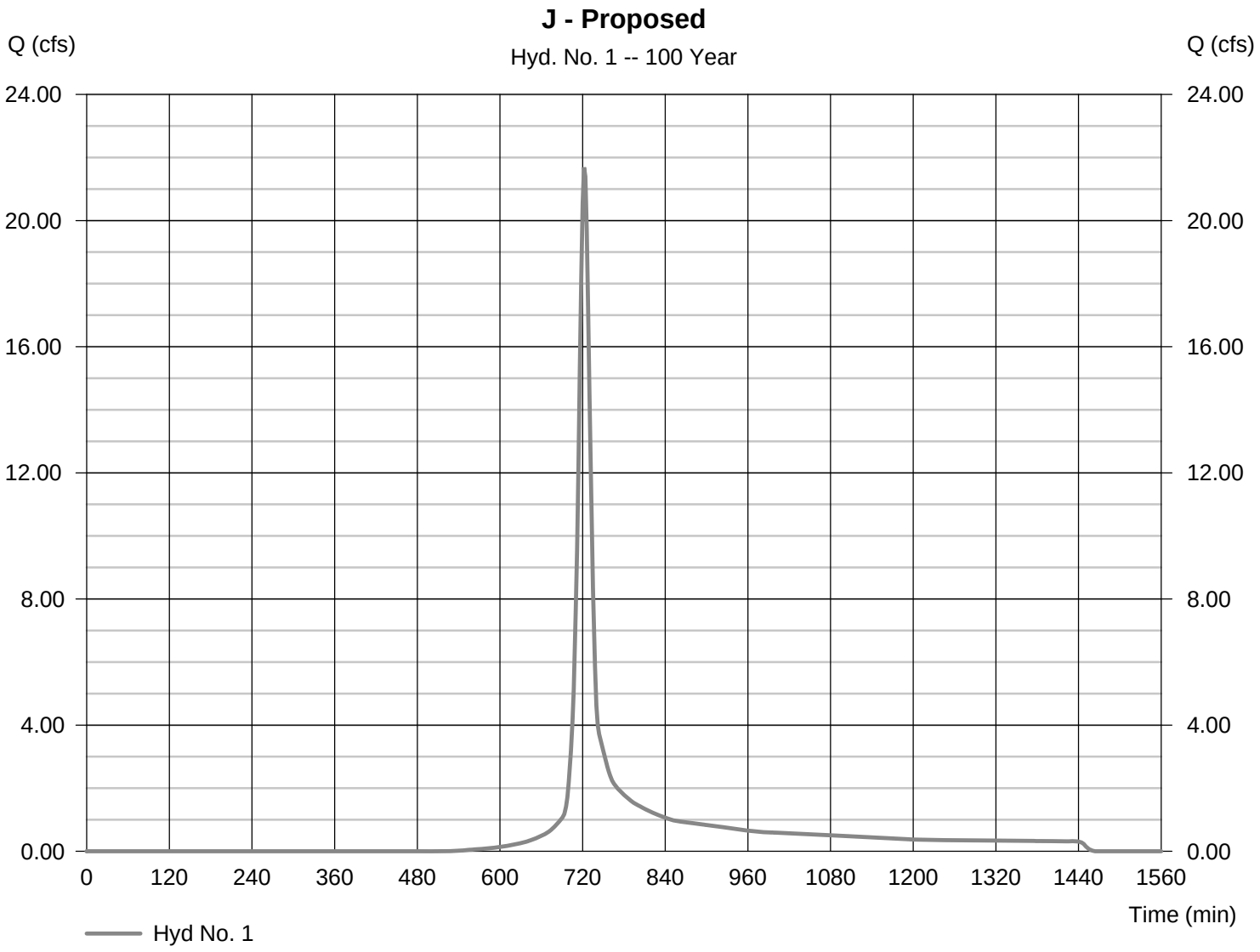
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 1

J - Proposed

Hydrograph type	= SCS Runoff	Peak discharge	= 21.69 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 60,942 cuft
Drainage area	= 5.610 ac	Curve number	= 70*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.360 x 98) + (4.250 x 61)] / 5.610



Hydrograph Report

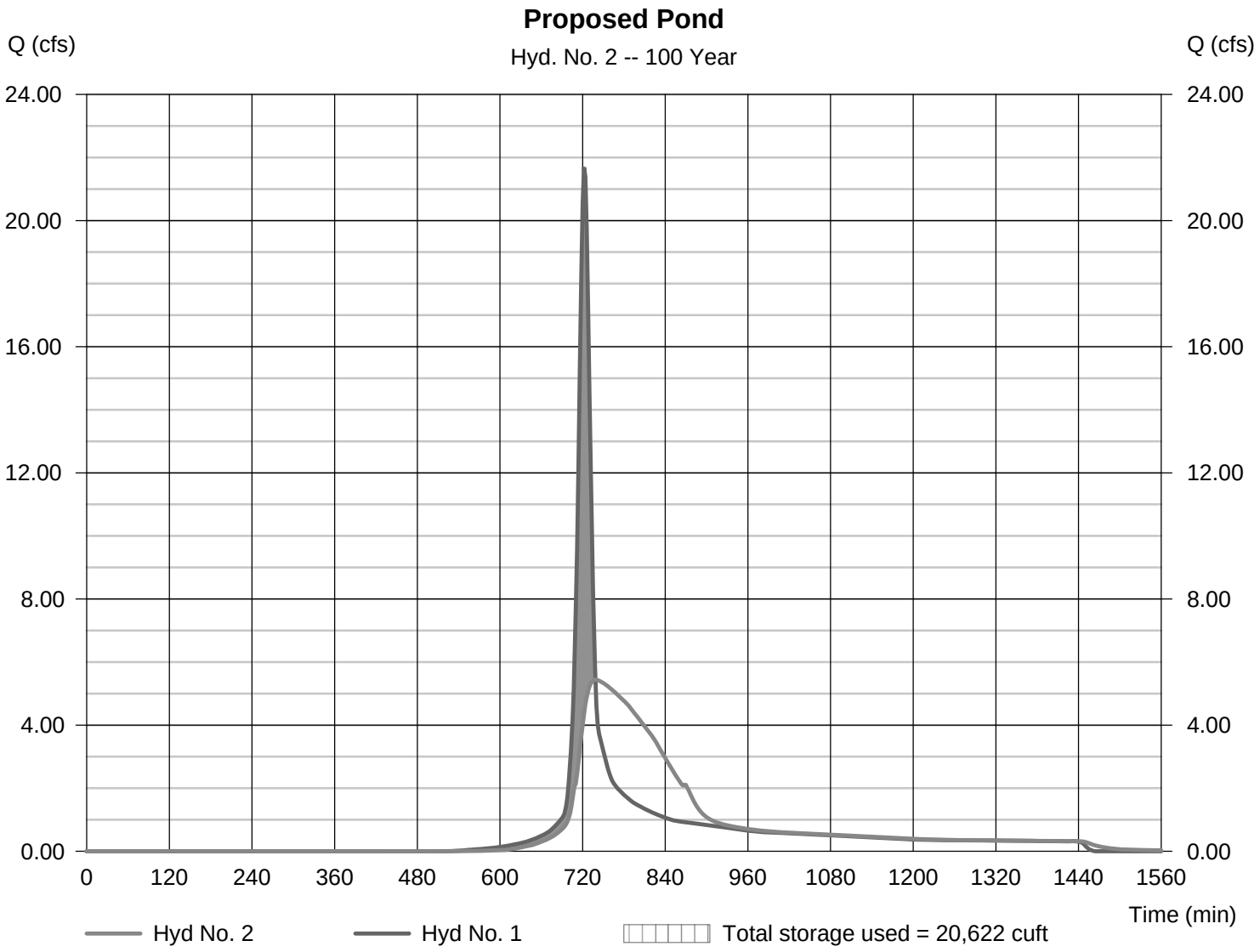
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 2

Proposed Pond

Hydrograph type	=	Reservoir	Peak discharge	=	5.444 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	60,936 cuft
Inflow hyd. No.	=	1 - J - Proposed	Max. Elevation	=	755.93 ft
Reservoir name	=	Proposed Residential Pond	Max. Storage	=	20,622 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 1 - Proposed Residential Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 752.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	752.00	2,344	0	0
1.00	753.00	3,770	3,029	3,029
2.00	754.00	5,259	4,493	7,522
3.00	755.00	6,810	6,017	13,539
4.00	756.00	8,423	7,601	21,141

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)	= 752.00	0.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.82	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

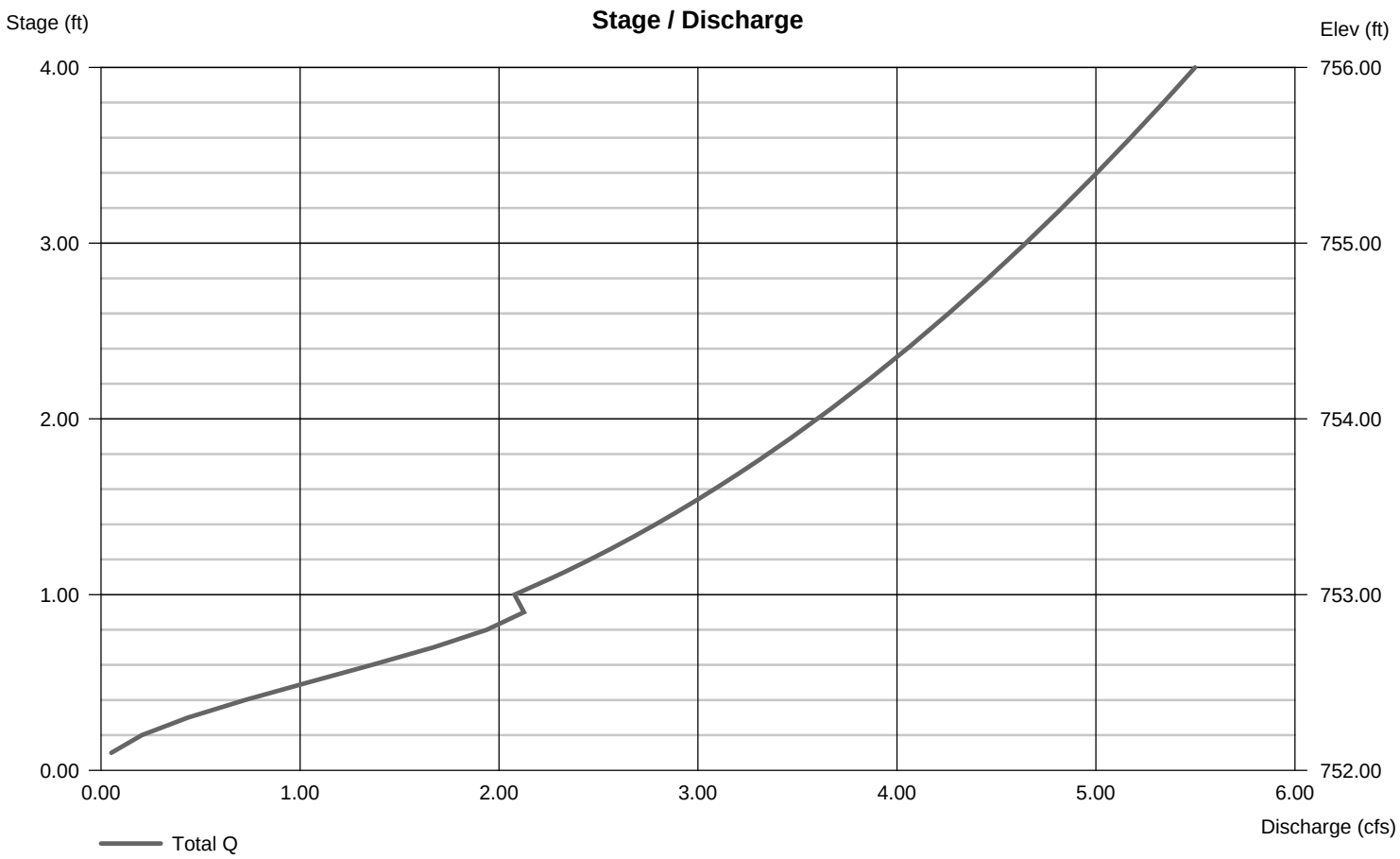
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	0.00	0.00	0.00
Crest El. (ft)	= 756.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

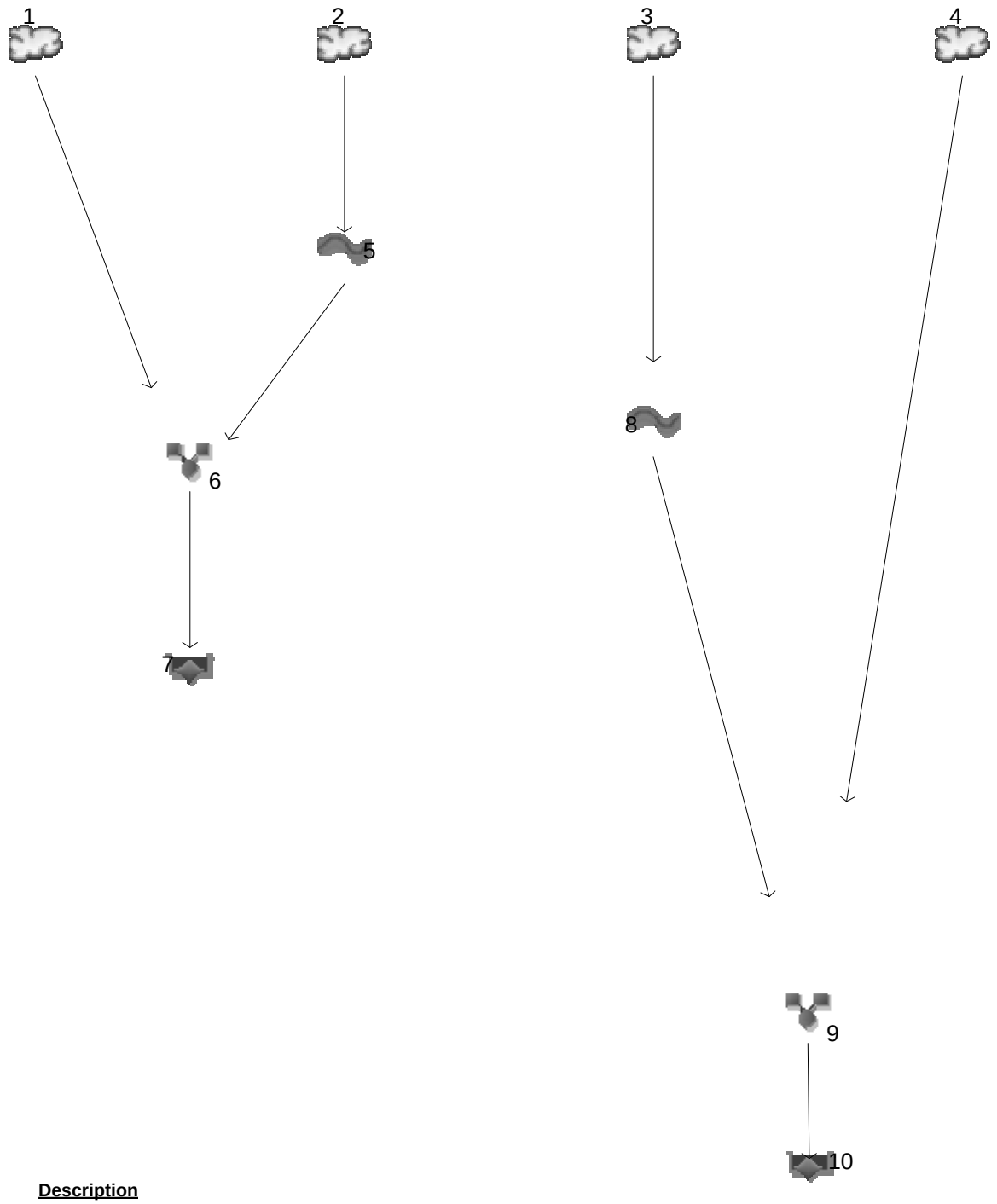


Appendix H

Alternative B Proposed Hydrograph Report

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10



Legend

Hyd.	Origin	Description
1	SCS Runoff	North Casino
2	SCS Runoff	North Residential
3	SCS Runoff	South Residential
4	SCS Runoff	South - Casino
5	Reach	from Northeast
6	Combine	North Watershed
7	Reservoir	North Pond
8	Reach	South Reach
9	Combine	To South Pond
10	Reservoir	to South Pond

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	249.52	2	730	997,320	------	------	------	North Casino
2	SCS Runoff	61.19	2	756	442,417	------	------	------	North Residential
3	SCS Runoff	32.80	2	758	245,946	------	------	------	South Residential
4	SCS Runoff	131.63	2	730	537,671	------	------	------	South - Casino
5	Reach	51.98	2	774	442,406	2	------	------	from Northeast
6	Combine	266.42	2	732	1,439,727	1, 5	------	------	North Watershed
7	Reservoir	53.38	2	816	1,438,450	6	791.77	654,118	North Pond
8	Reach	28.03	2	776	245,936	3	------	------	South Reach
9	Combine	140.26	2	730	783,607	4, 8	------	------	To South Pond
10	Reservoir	30.64	2	812	782,867	9	794.95	359,404	to South Pond

Hydrograph Report

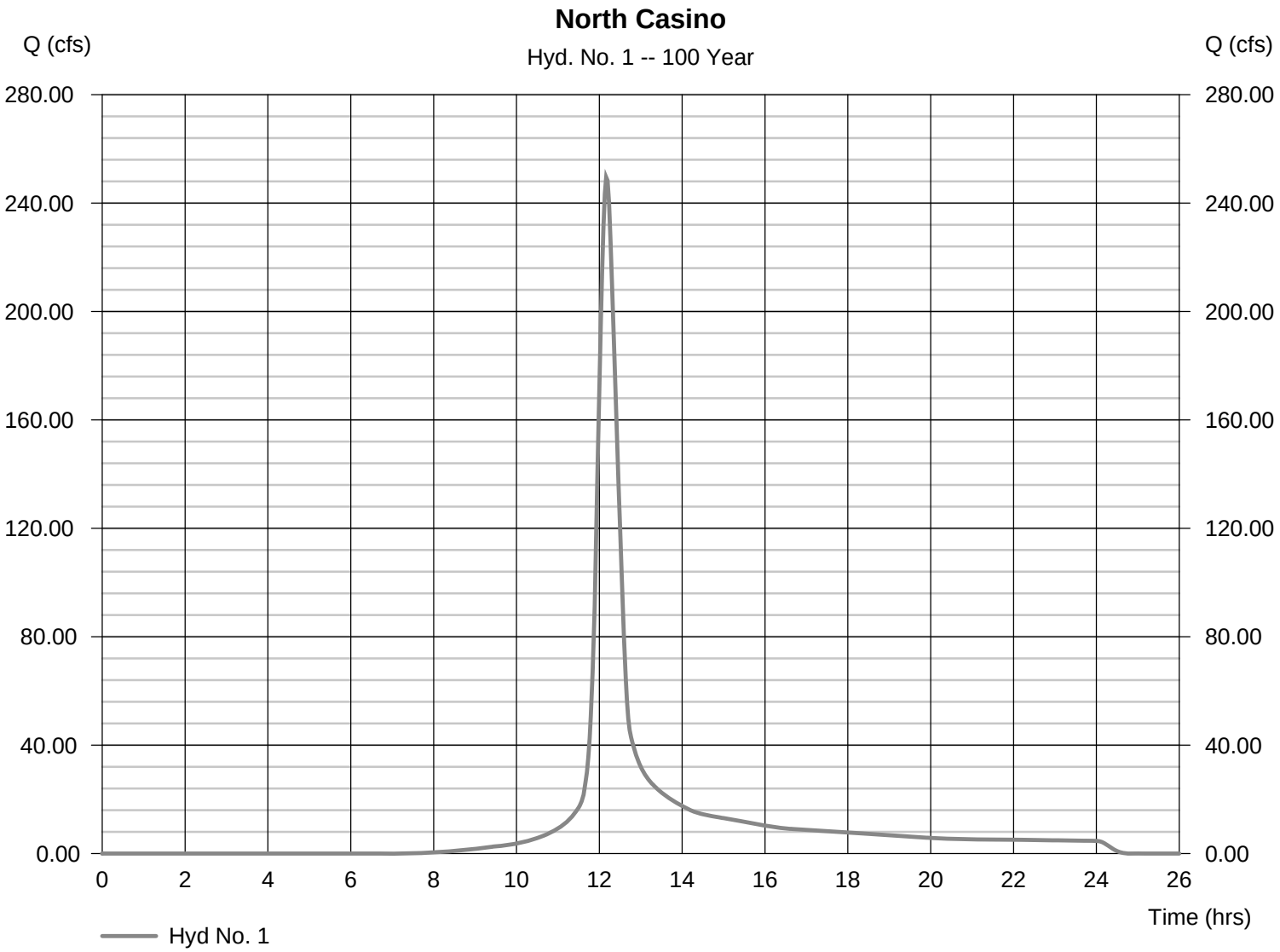
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 1

North Casino

Hydrograph type	= SCS Runoff	Peak discharge	= 249.52 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 997,320 cuft
Drainage area	= 81.000 ac	Curve number	= 77*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 29.20 min
Total precip.	= 5.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(11.300 x 98) + (69.700 x 74)] / 81.000



TR55 Tc Worksheet

Hyd. No. 1

North Casino

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 0.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 0.00		0.00		0.00		
Land slope (%)	= 0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Shallow Concentrated Flow							
Flow length (ft)	= 2000.00		0.00		0.00		
Watercourse slope (%)	= 0.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.14		0.00		0.00		
Travel Time (min)	**= 29.22**	**+**	**0.00**	**+**	**0.00**	**=**	**29.22**
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 ..... 29.20 min

Hydrograph Report

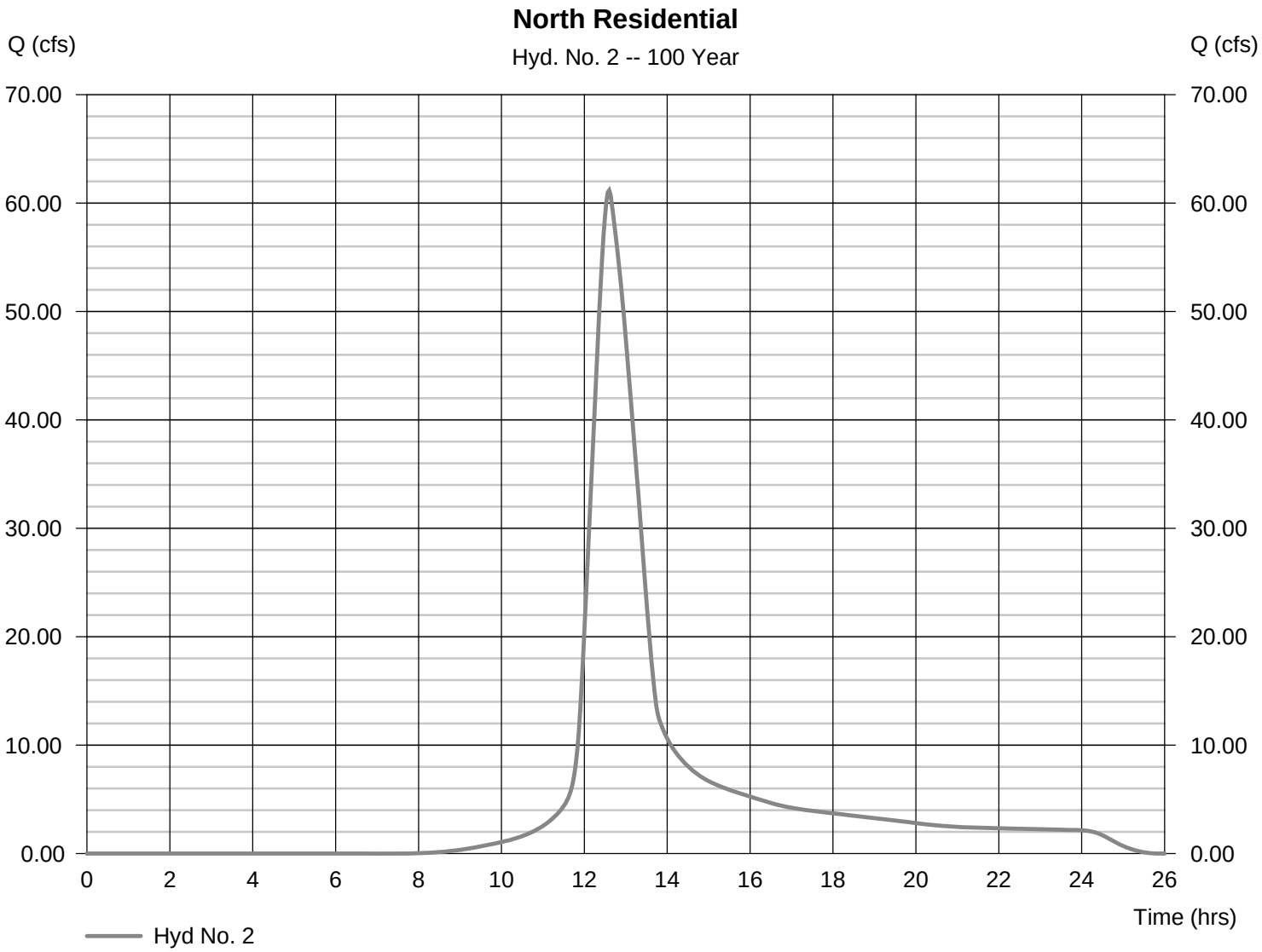
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 2

North Residential

Hydrograph type	= SCS Runoff	Peak discharge	= 61.19 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.60 hrs
Time interval	= 2 min	Hyd. volume	= 442,417 cuft
Drainage area	= 37.000 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 70.40 min
Total precip.	= 5.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.250 x 98) + (33.750 x 74)] / 37.000



TR55 Tc Worksheet

Hyd. No. 2

North Residential

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.68		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 49.55**	**+**	**0.00**	**+**	**0.00**	**=**	**49.55**
Shallow Concentrated Flow							
Flow length (ft)	= 2300.00		0.00		0.00		
Watercourse slope (%)	= 1.30		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.84		0.00		0.00		
Travel Time (min)	**= 20.84**	**+**	**0.00**	**+**	**0.00**	**=**	**20.84**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 70.40 min

Hydrograph Report

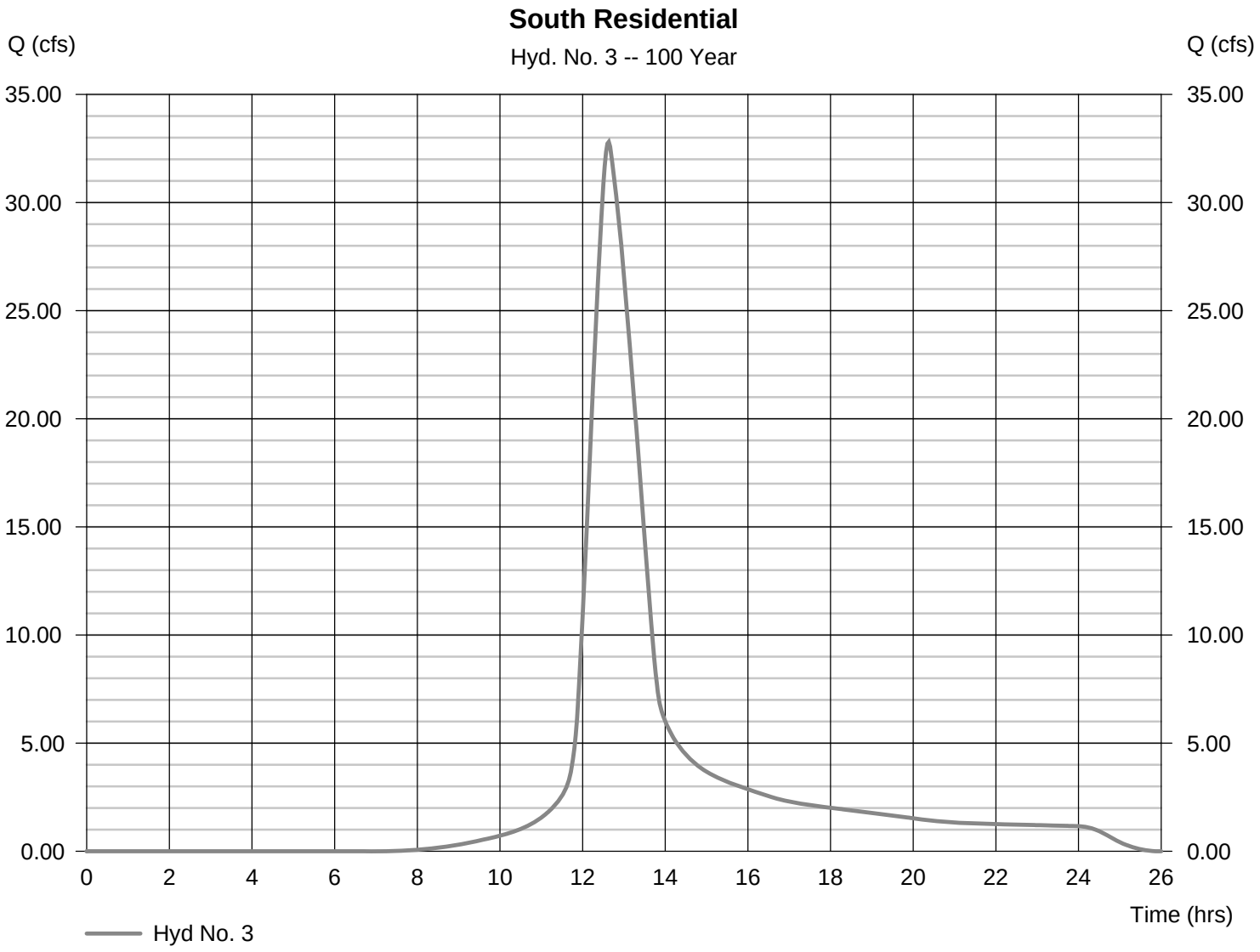
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 3

South Residential

Hydrograph type	= SCS Runoff	Peak discharge	= 32.80 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.63 hrs
Time interval	= 2 min	Hyd. volume	= 245,946 cuft
Drainage area	= 19.300 ac	Curve number	= 78*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 72.80 min
Total precip.	= 5.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.500 x 98) + (15.800 x 74)] / 19.300



TR55 Tc Worksheet

Hyd. No. 3

South Residential

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.68		0.00		0.00		
Land slope (%)	= 7.00		0.00		0.00		
Travel Time (min)	**= 34.24**	**+**	**0.00**	**+**	**0.00**	**=**	**34.24**
Shallow Concentrated Flow							
Flow length (ft)	= 2360.00		0.00		0.00		
Watercourse slope (%)	= 0.40		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.02		0.00		0.00		
Travel Time (min)	**= 38.55**	**+**	**0.00**	**+**	**0.00**	**=**	**38.55**
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 ..... 72.80 min

Hydrograph Report

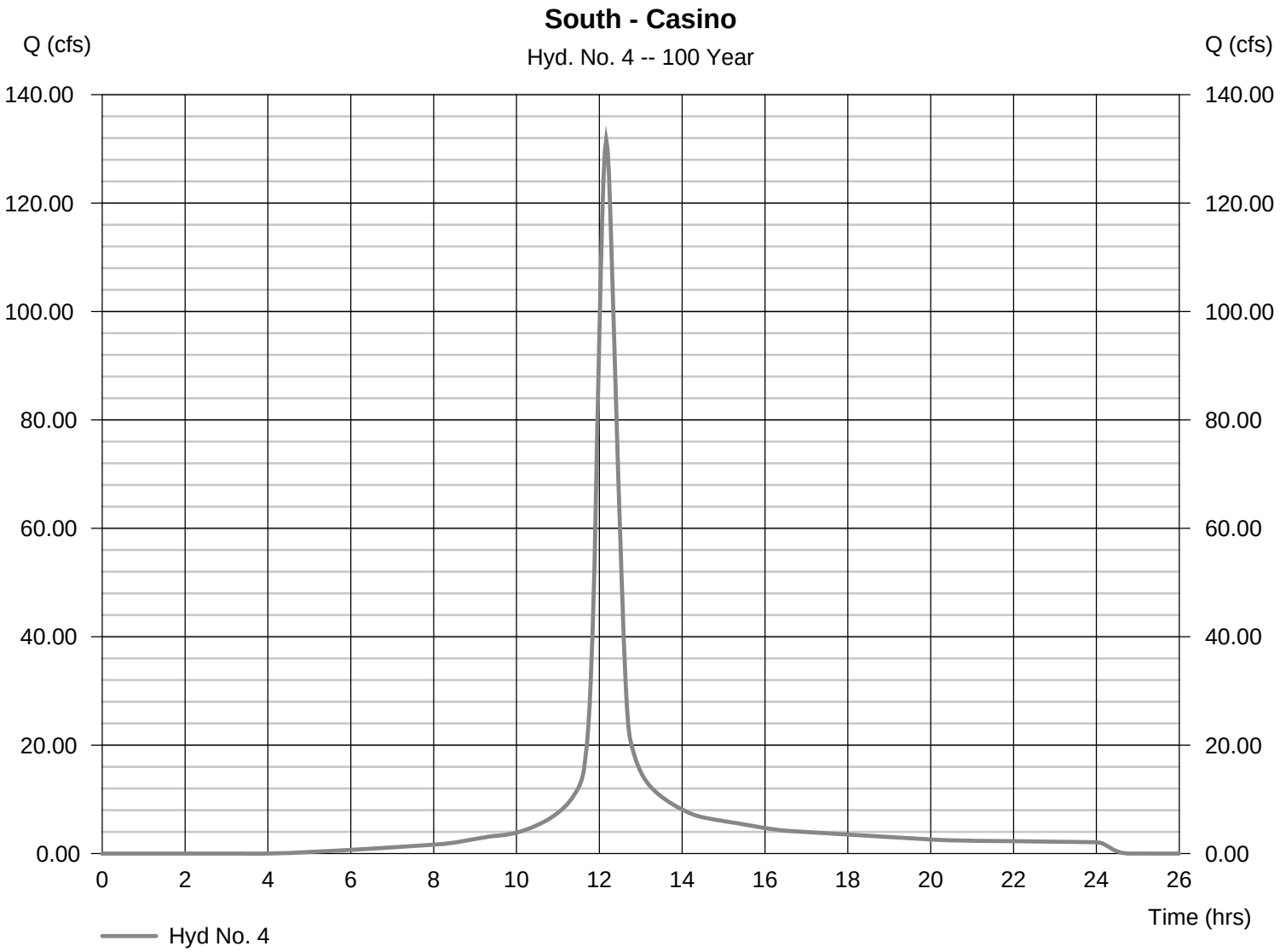
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 4

South - Casino

Hydrograph type	= SCS Runoff	Peak discharge	= 131.63 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 537,671 cuft
Drainage area	= 32.700 ac	Curve number	= 88*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 30.00 min
Total precip.	= 5.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(19.000 x 98) + (13.700 x 74)] / 32.700



Hydrograph Report

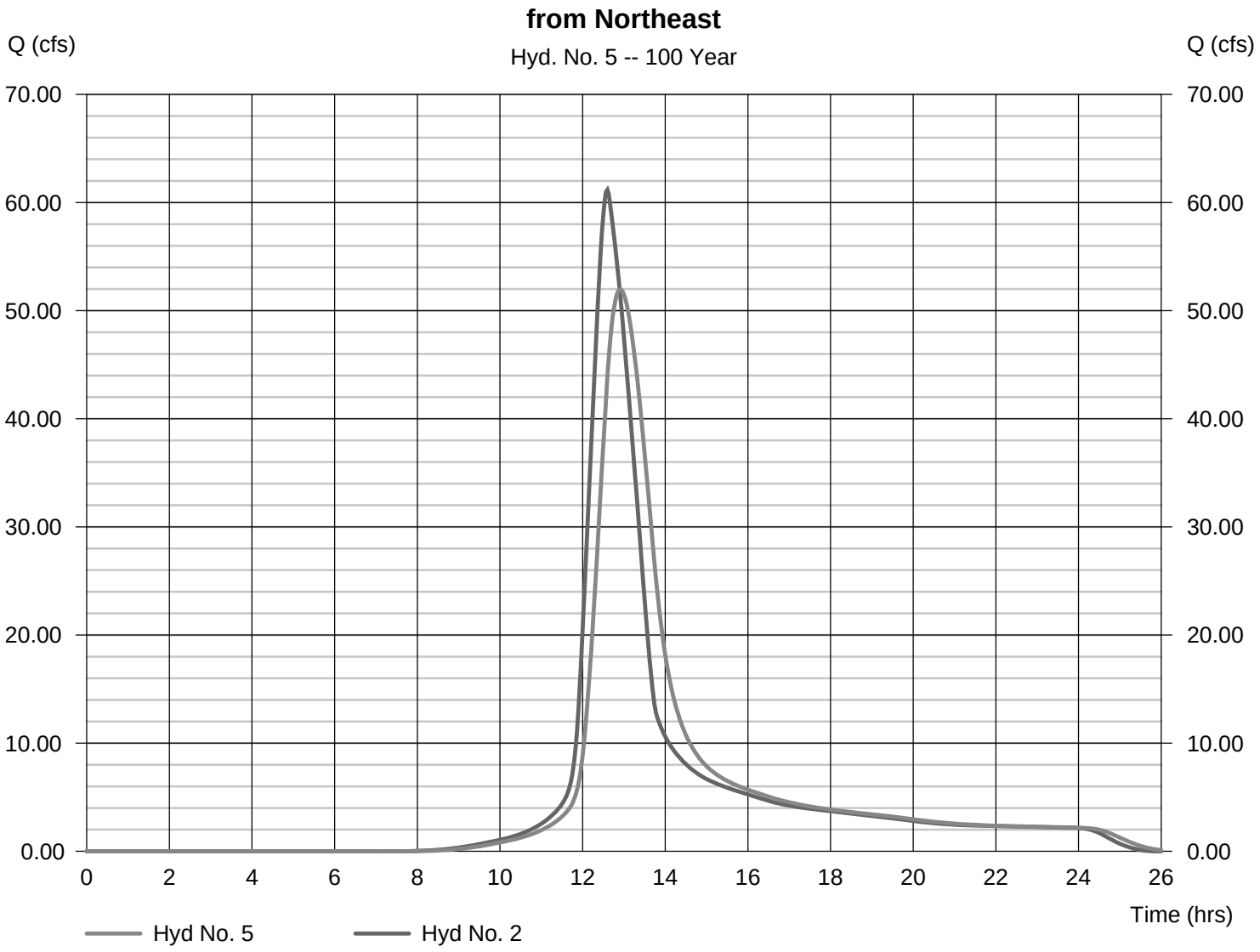
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 5

from Northeast

Hydrograph type	=	Reach	Peak discharge	=	51.98 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.90 hrs
Time interval	=	2 min	Hyd. volume	=	442,406 cuft
Inflow hyd. No.	=	2 - North Residential	Section type	=	Trapezoidal
Reach length	=	2000.0 ft	Channel slope	=	0.5 %
Manning's n	=	0.025	Bottom width	=	15.0 ft
Side slope	=	20.0:1	Max. depth	=	2.0 ft
Rating curve x	=	0.692	Rating curve m	=	1.208
Ave. velocity	=	1.50 ft/s	Routing coeff.	=	0.1030

Modified Att-Kin routing method used.



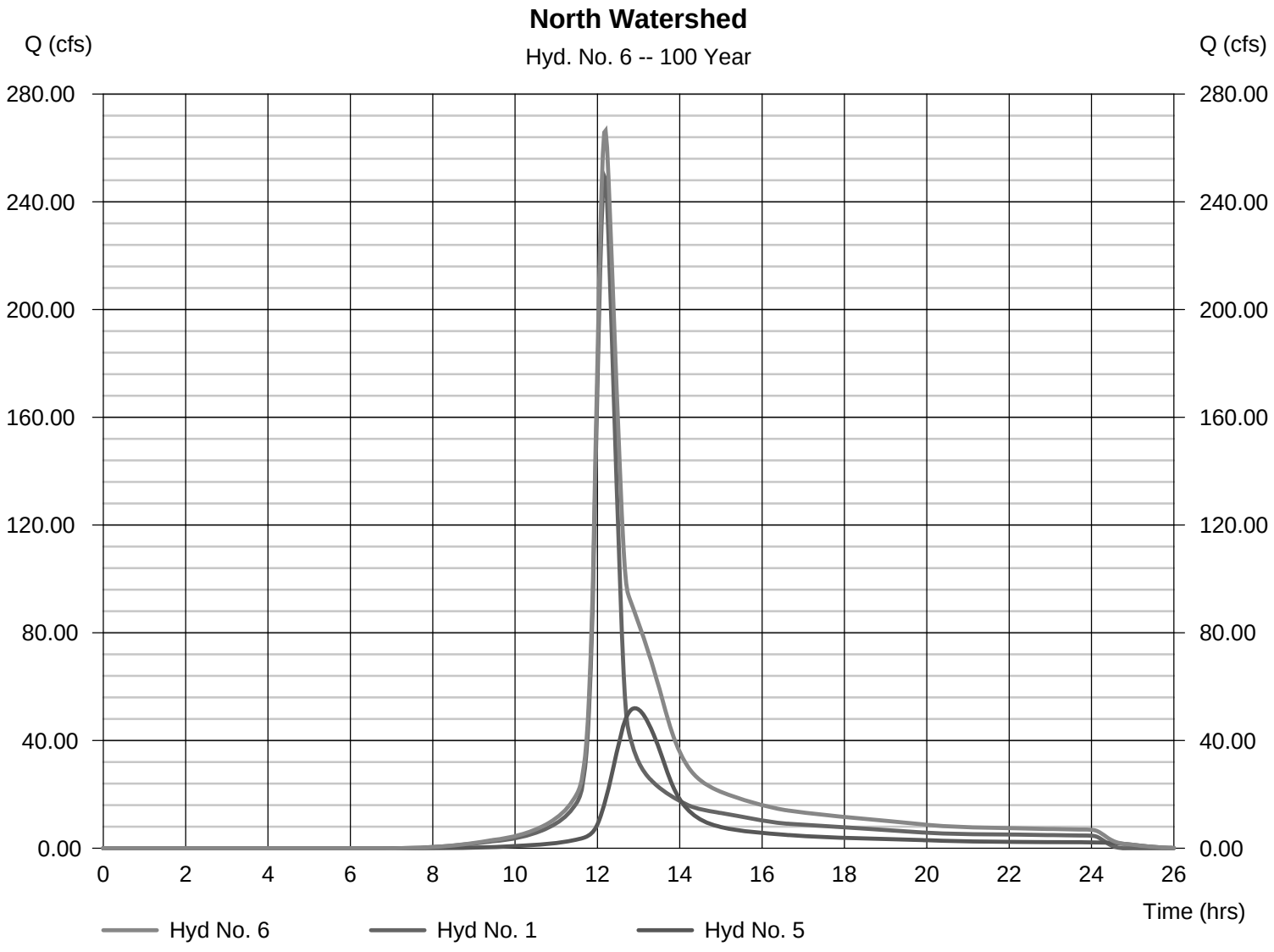
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 6

North Watershed

Hydrograph type	=	Combine	Peak discharge	=	266.42 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.20 hrs
Time interval	=	2 min	Hyd. volume	=	1,439,727 cuft
Inflow hyds.	=	1, 5	Contrib. drain. area	=	81.000 ac



Hydrograph Report

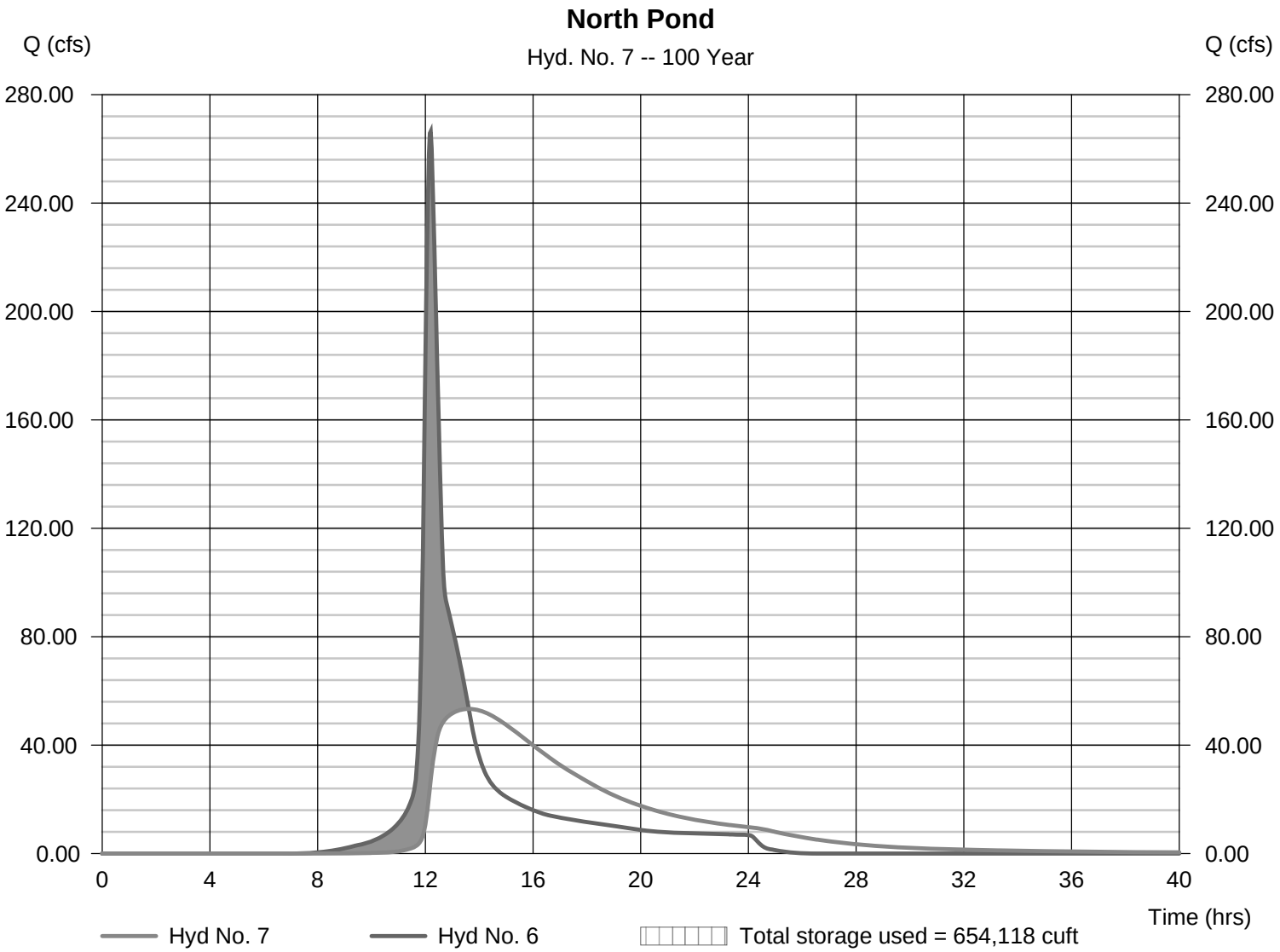
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 7

North Pond

Hydrograph type	=	Reservoir	Peak discharge	=	53.38 cfs
Storm frequency	=	100 yrs	Time to peak	=	13.60 hrs
Time interval	=	2 min	Hyd. volume	=	1,438,450 cuft
Inflow hyd. No.	=	6 - North Watershed	Max. Elevation	=	791.77 ft
Reservoir name	=	North Pond	Max. Storage	=	654,118 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 1 - North Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 788.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	788.00	154,548	0	0
2.00	790.00	169,521	323,921	323,921
4.00	792.00	203,326	372,298	696,219

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 48.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 788.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.84	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

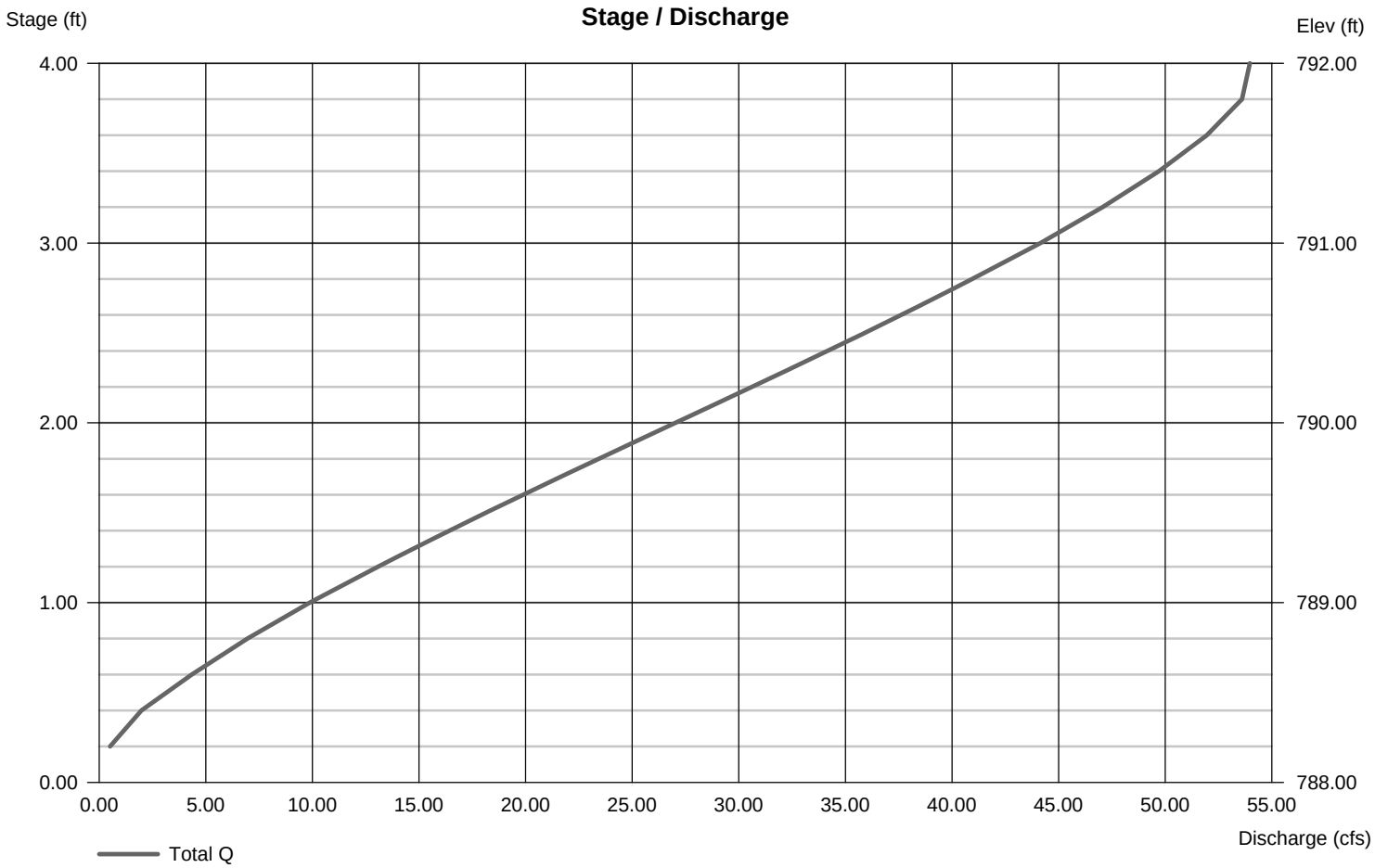
Weir Structures

	[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).



Hydrograph Report

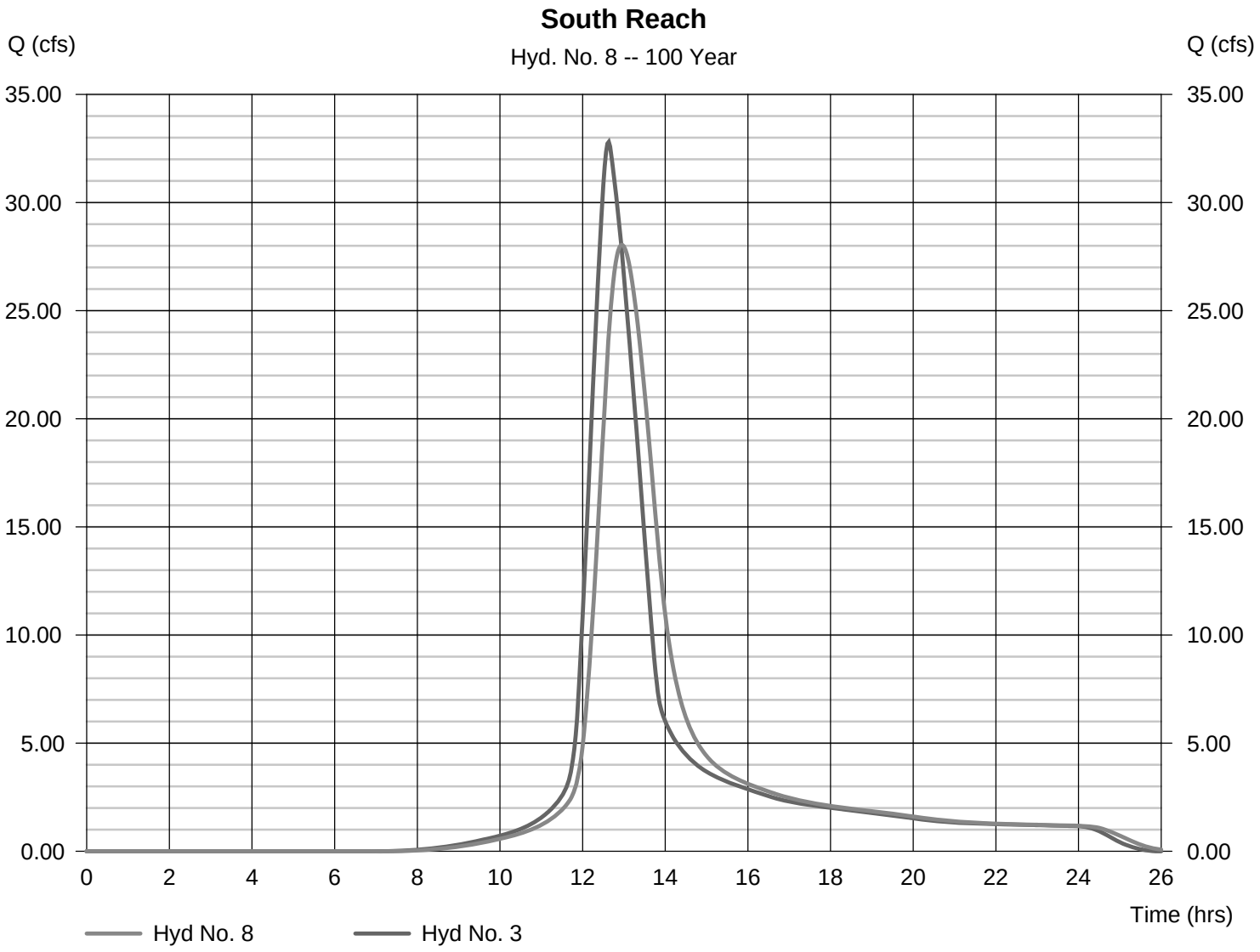
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 8

South Reach

Hydrograph type	= Reach	Peak discharge	= 28.03 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.93 hrs
Time interval	= 2 min	Hyd. volume	= 245,936 cuft
Inflow hyd. No.	= 3 - South Residential	Section type	= Trapezoidal
Reach length	= 2485.0 ft	Channel slope	= 0.4 %
Manning's n	= 0.040	Bottom width	= 2.0 ft
Side slope	= 4.0:1	Max. depth	= 2.0 ft
Rating curve x	= 1.484	Rating curve m	= 1.107
Ave. velocity	= 2.00 ft/s	Routing coeff.	= 0.1016

Modified Att-Kin routing method used.



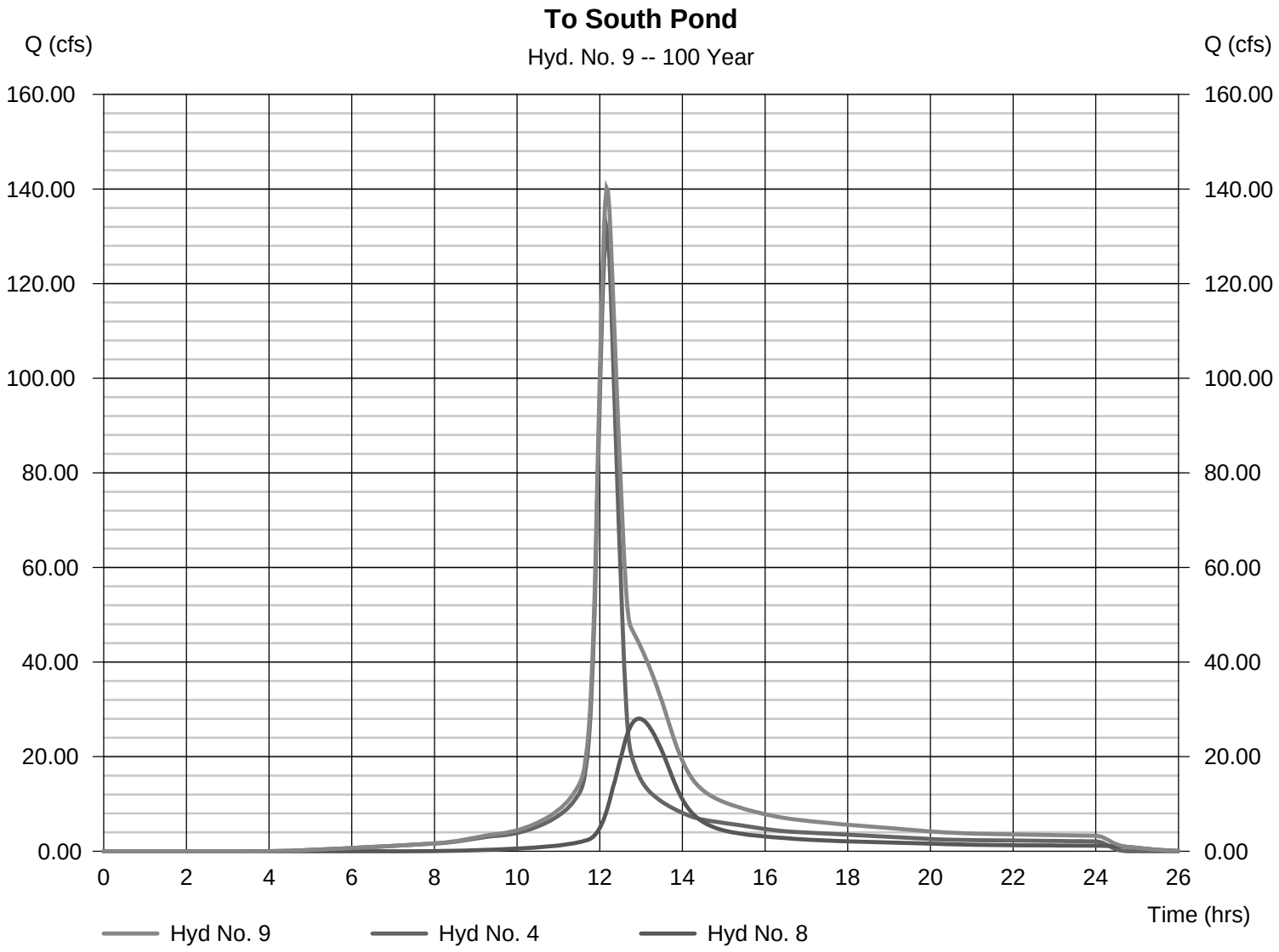
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 9

To South Pond

Hydrograph type	=	Combine	Peak discharge	=	140.26 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	783,607 cuft
Inflow hyds.	=	4, 8	Contrib. drain. area	=	32.700 ac



Hydrograph Report

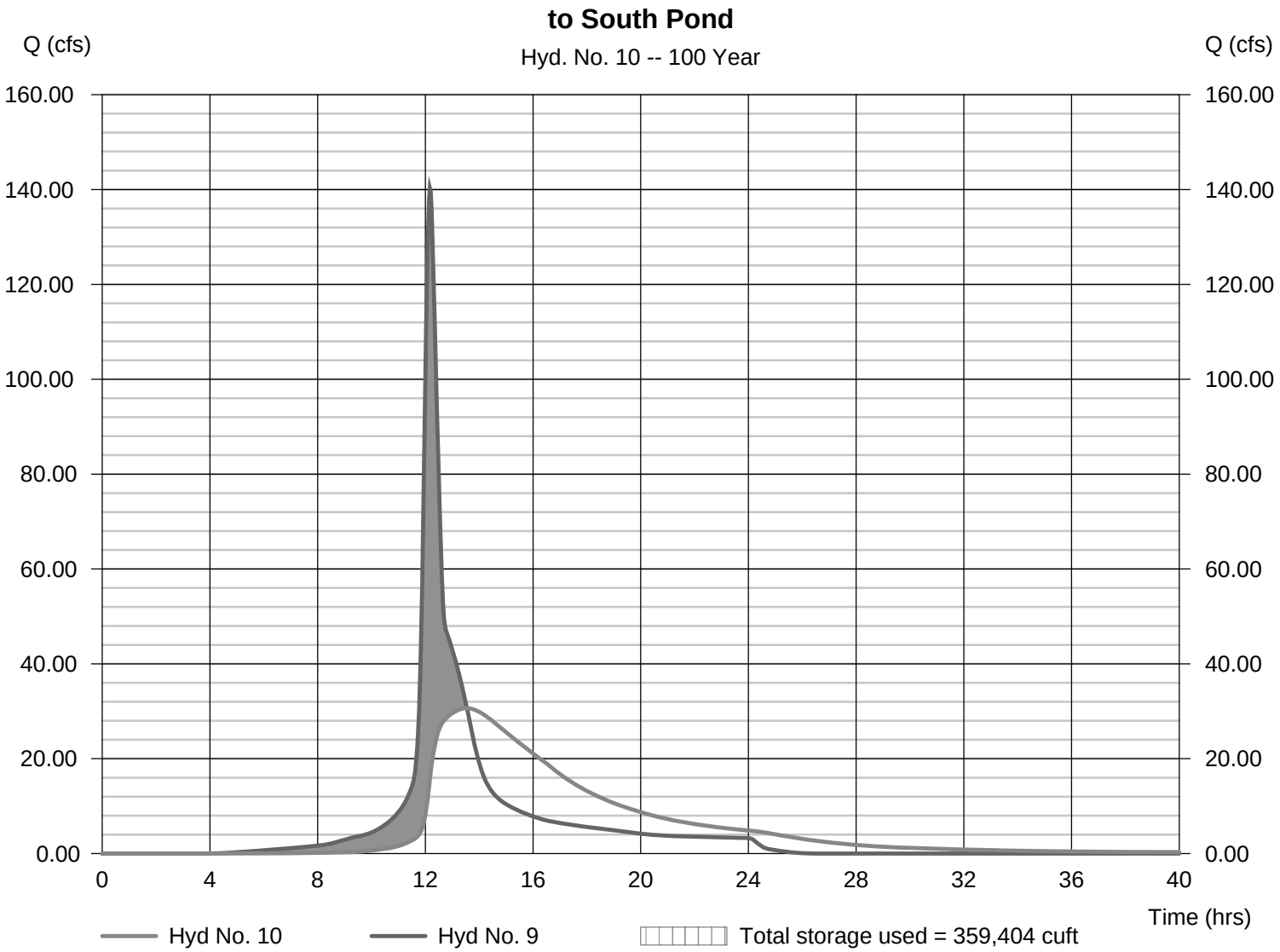
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 10

to South Pond

Hydrograph type	=	Reservoir	Peak discharge	=	30.64 cfs
Storm frequency	=	100 yrs	Time to peak	=	13.53 hrs
Time interval	=	2 min	Hyd. volume	=	782,867 cuft
Inflow hyd. No.	=	9 - To South Pond	Max. Elevation	=	794.95 ft
Reservoir name	=	South Pond	Max. Storage	=	359,404 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 2 - South Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 792.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	792.00	107,423	0	0
2.00	794.00	117,134	224,465	224,465
4.00	796.00	168,774	284,312	508,777
6.00	798.00	170,000	338,739	847,516

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 48.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 792.00	0.00	0.00	0.00
Length (ft)	= 50.00	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

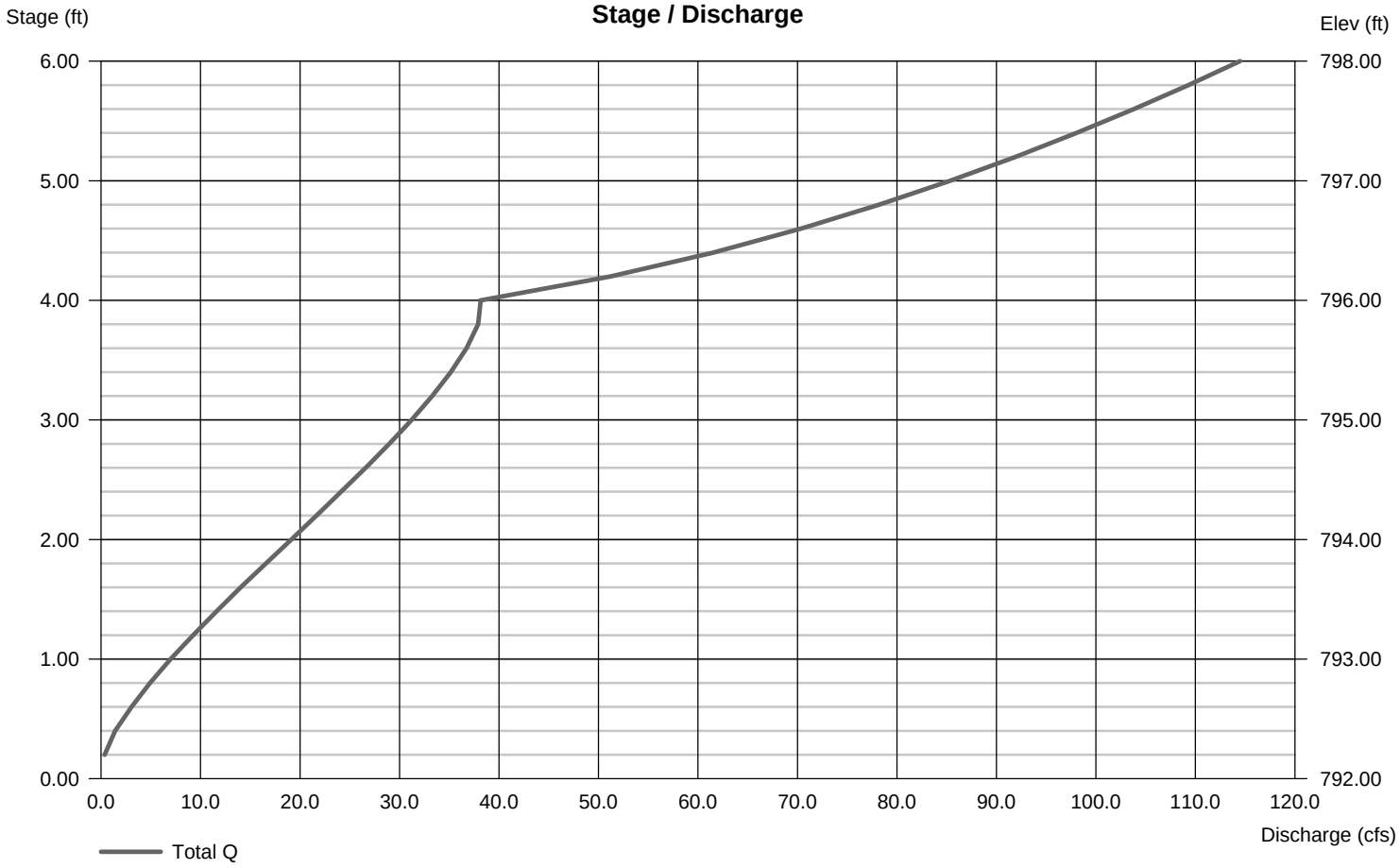
Weir Structures

	[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).

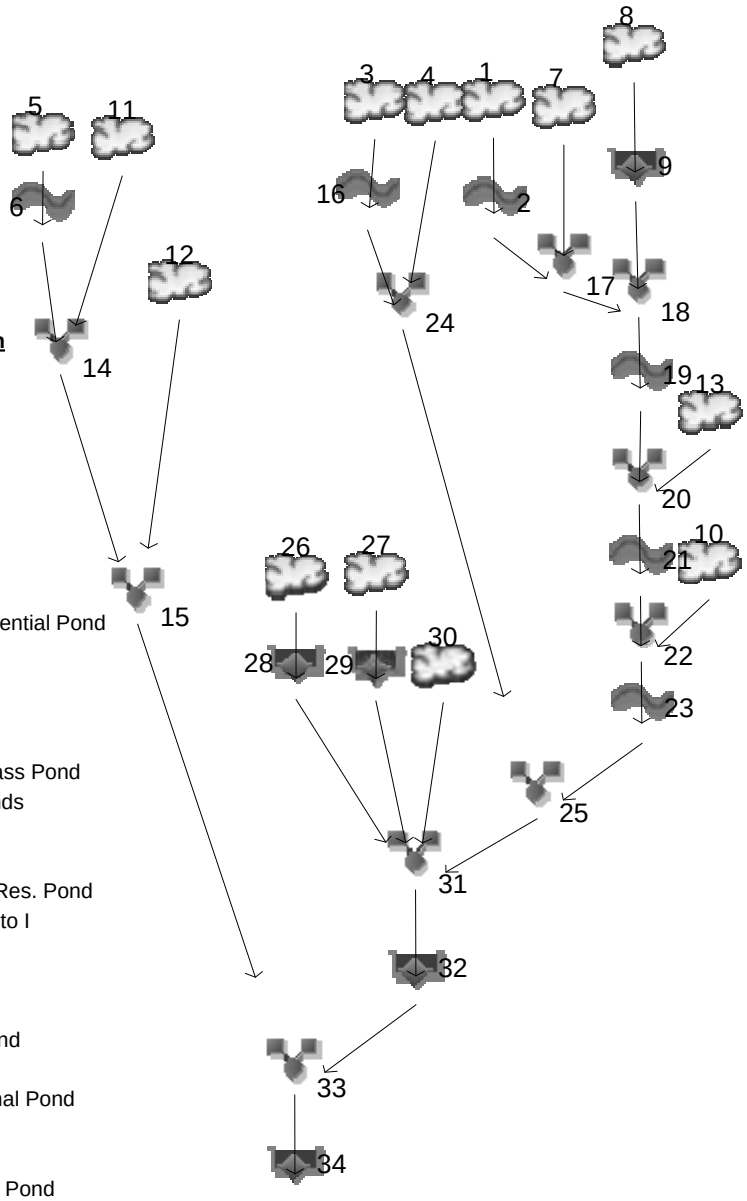


Appendix H

Alternative C Proposed Hydrograph Report

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10



Legend

Hyd.	Origin	Description
1	SCS Runoff	Ae
2	Reach	Ae to L
3	SCS Runoff	Ce
4	SCS Runoff	D
5	SCS Runoff	Ee
6	Reach	from E
7	SCS Runoff	L
8	SCS Runoff	K
9	Reservoir	Local Residential Pond
10	SCS Runoff	B
11	SCS Runoff	G
12	SCS Runoff	H
13	SCS Runoff	I
14	Combine	Ee/G - Bypass Pond
15	Combine	Bypass Ponds
16	Reach	Ce to D
17	Combine	Ae/L
18	Combine	Past Local Res. Pond
19	Reach	Local Pond to I
20	Combine	I combine
21	Reach	I to B
22	Combine	I et al/B
23	Reach	To Final Pond
24	Combine	Ce/D
25	Combine	Direct to Final Pond
26	SCS Runoff	F
27	SCS Runoff	M
28	Reservoir	Gas Station Pond
29	Reservoir	Shopping Center Pond
30	SCS Runoff	N
31	Combine	To Final Pond
32	Reservoir	Final Pond
33	Combine	To Culvert
34	Reservoir	To Culvert

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	31.66	2	740	186,617	------	------	------	Ae
2	Reach	31.48	2	744	186,616	1	------	------	Ae to L
3	SCS Runoff	62.54	2	746	406,448	------	------	------	Ce
4	SCS Runoff	84.94	2	742	520,636	------	------	------	D
5	SCS Runoff	15.01	2	740	88,480	------	------	------	Ee
6	Reach	14.06	2	748	88,476	5	------	------	from E
7	SCS Runoff	14.86	2	734	67,085	------	------	------	L
8	SCS Runoff	21.35	2	726	73,838	------	------	------	K
9	Reservoir	0.859	2	936	73,793	8	762.76	46,571	Local Residential Pond
10	SCS Runoff	41.04	2	740	219,391	------	------	------	B
11	SCS Runoff	13.73	2	722	37,790	------	------	------	G
12	SCS Runoff	5.662	2	744	34,071	------	------	------	H
13	SCS Runoff	30.84	2	756	247,258	------	------	------	I
14	Combine	17.06	2	724	126,267	6, 11,	------	------	Ee/G - Bypass Pond
15	Combine	21.94	2	746	160,338	12, 14	------	------	Bypass Ponds
16	Reach	58.52	2	754	406,443	3	------	------	Ce to D
17	Combine	43.98	2	742	253,701	2, 7,	------	------	Ae/L
18	Combine	44.75	2	742	327,493	9, 17	------	------	Past Local Res. Pond
19	Reach	44.23	2	746	327,087	18	------	------	Local Pond to I
20	Combine	72.22	2	750	574,344	13, 19	------	------	I combine
21	Reach	69.23	2	758	574,341	20	------	------	I to B
22	Combine	101.67	2	752	793,732	10, 21	------	------	I et al/B
23	Reach	99.57	2	758	793,729	22	------	------	To Final Pond
24	Combine	137.85	2	748	927,080	4, 16,	------	------	Ce/D
25	Combine	232.20	2	752	1,720,809	23, 24	------	------	Direct to Final Pond
26	SCS Runoff	35.00	2	722	98,307	------	------	------	F
27	SCS Runoff	64.88	2	722	183,259	------	------	------	M
28	Reservoir	0.251	2	1450	65,278	26	734.75	87,446	Gas Station Pond
29	Reservoir	3.500	2	812	181,598	27	734.92	109,440	Shopping Center Pond
30	SCS Runoff	9.509	2	722	27,294	------	------	------	N
31	Combine	237.24	2	752	1,994,979	25, 28, 29, 30	------	------	To Final Pond
32	Reservoir	188.30	2	772	1,993,665	31	739.30	214,107	Final Pond
33	Combine	203.65	2	768	2,154,003	15, 32	------	------	To Culvert
34	Reservoir	201.67	2	774	2,153,983	33	736.01	27,897	To Culvert

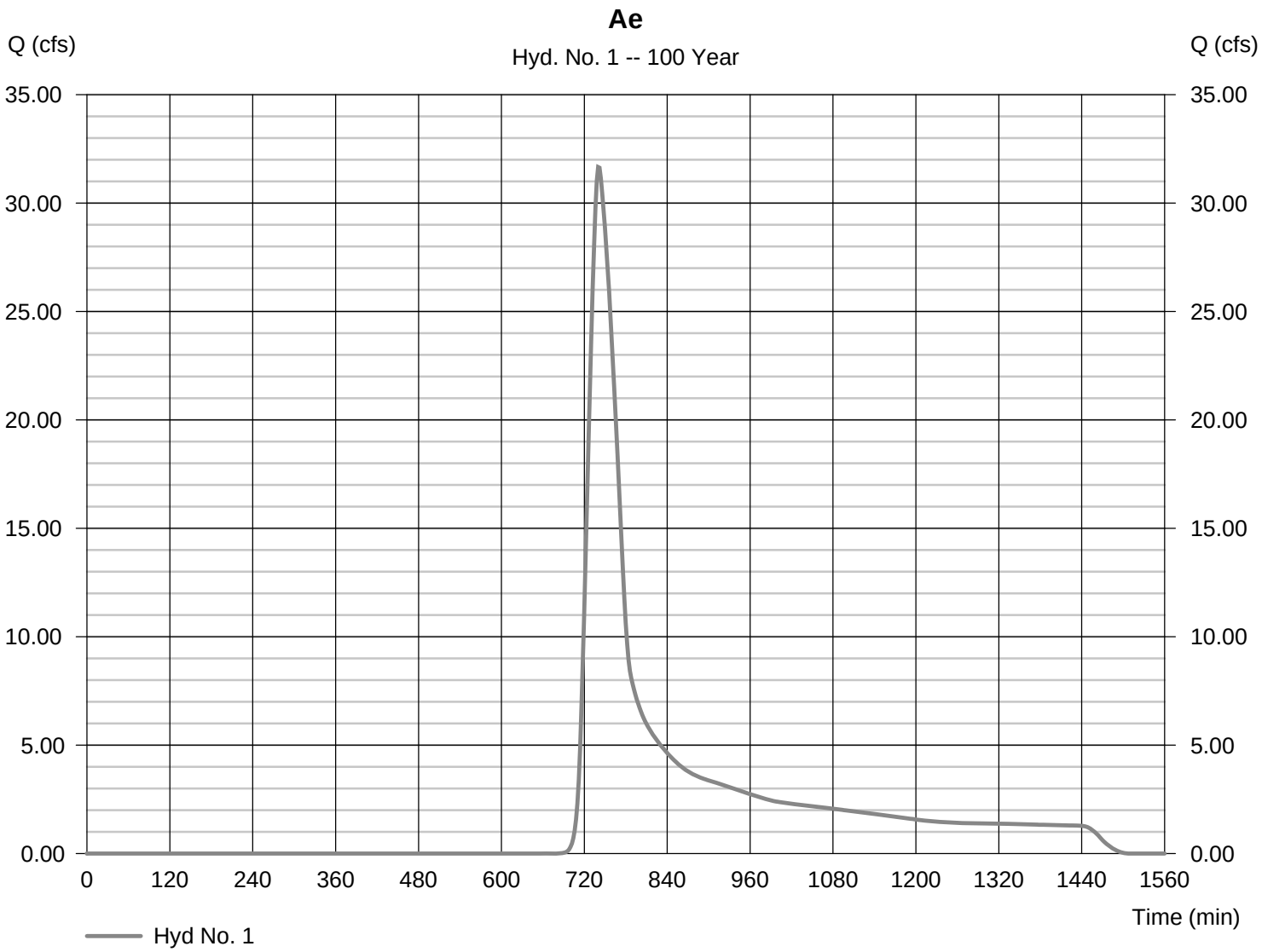
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 1

Ae

Hydrograph type	= SCS Runoff	Peak discharge	= 31.66 cfs
Storm frequency	= 100 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 186,617 cuft
Drainage area	= 29.760 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 40.80 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No. 1

Ae

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 7.00		0.00		0.00		
Travel Time (min)	**= 34.49**	**+**	**0.00**	**+**	**0.00**	**=**	**34.49**
Shallow Concentrated Flow							
Flow length (ft)	= 890.00		0.00		0.00		
Watercourse slope (%)	= 2.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.34		0.00		0.00		
Travel Time (min)	**= 6.34**	**+**	**0.00**	**+**	**0.00**	**=**	**6.34**
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 ..... 40.80 min

Hydrograph Report

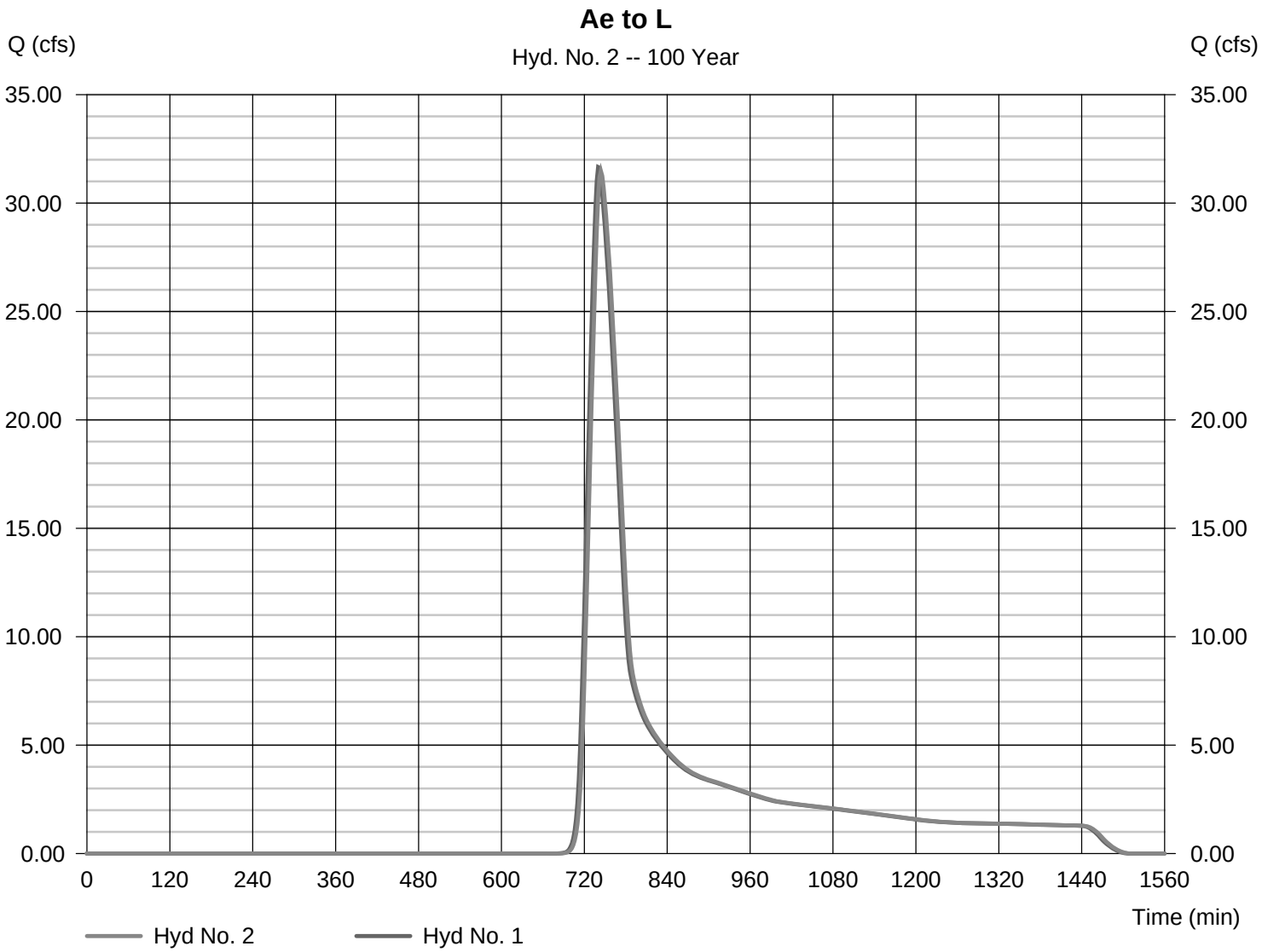
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 2

Ae to L

Hydrograph type	= Reach	Peak discharge	= 31.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 186,616 cuft
Inflow hyd. No.	= 1 - Ae	Section type	= Trapezoidal
Reach length	= 600.0 ft	Channel slope	= 2.0 %
Manning's n	= 0.035	Bottom width	= 5.0 ft
Side slope	= 4.0:1	Max. depth	= 3.0 ft
Rating curve x	= 2.058	Rating curve m	= 1.293
Ave. velocity	= 3.82 ft/s	Routing coeff.	= 0.6615

Modified Att-Kin routing method used.



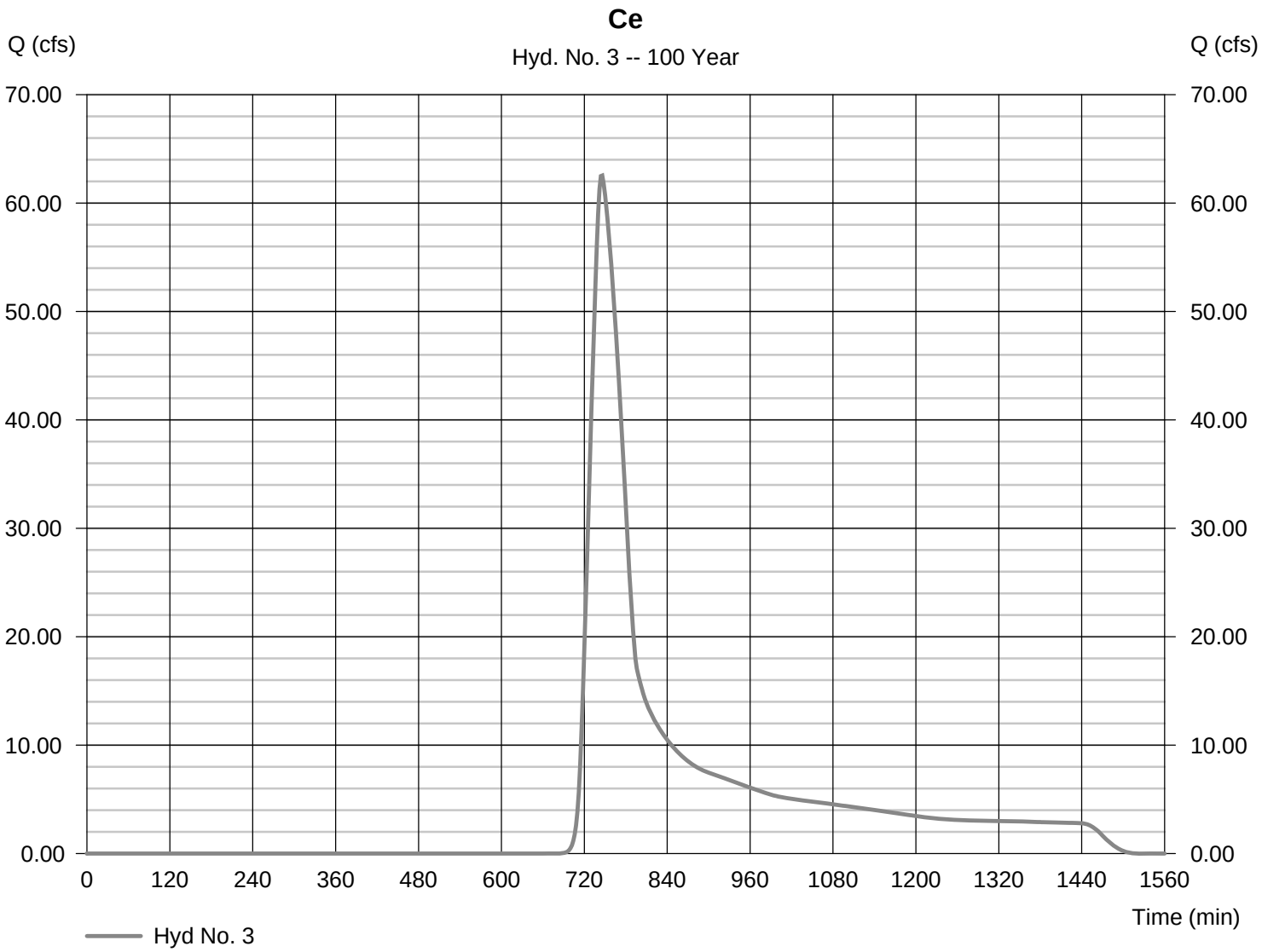
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 3

Ce

Hydrograph type	= SCS Runoff	Peak discharge	= 62.54 cfs
Storm frequency	= 100 yrs	Time to peak	= 746 min
Time interval	= 2 min	Hyd. volume	= 406,448 cuft
Drainage area	= 65.440 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 48.40 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 3

Ce

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 6.00		0.00		0.00		
Travel Time (min)	**= 36.69**	**+**	**0.00**	**+**	**0.00**	**=**	**36.69**
Shallow Concentrated Flow							
Flow length (ft)	= 2000.00		0.00		0.00		
Watercourse slope (%)	= 3.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.84		0.00		0.00		
Travel Time (min)	**= 11.73**	**+**	**0.00**	**+**	**0.00**	**=**	**11.73**
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 ..... 48.40 min

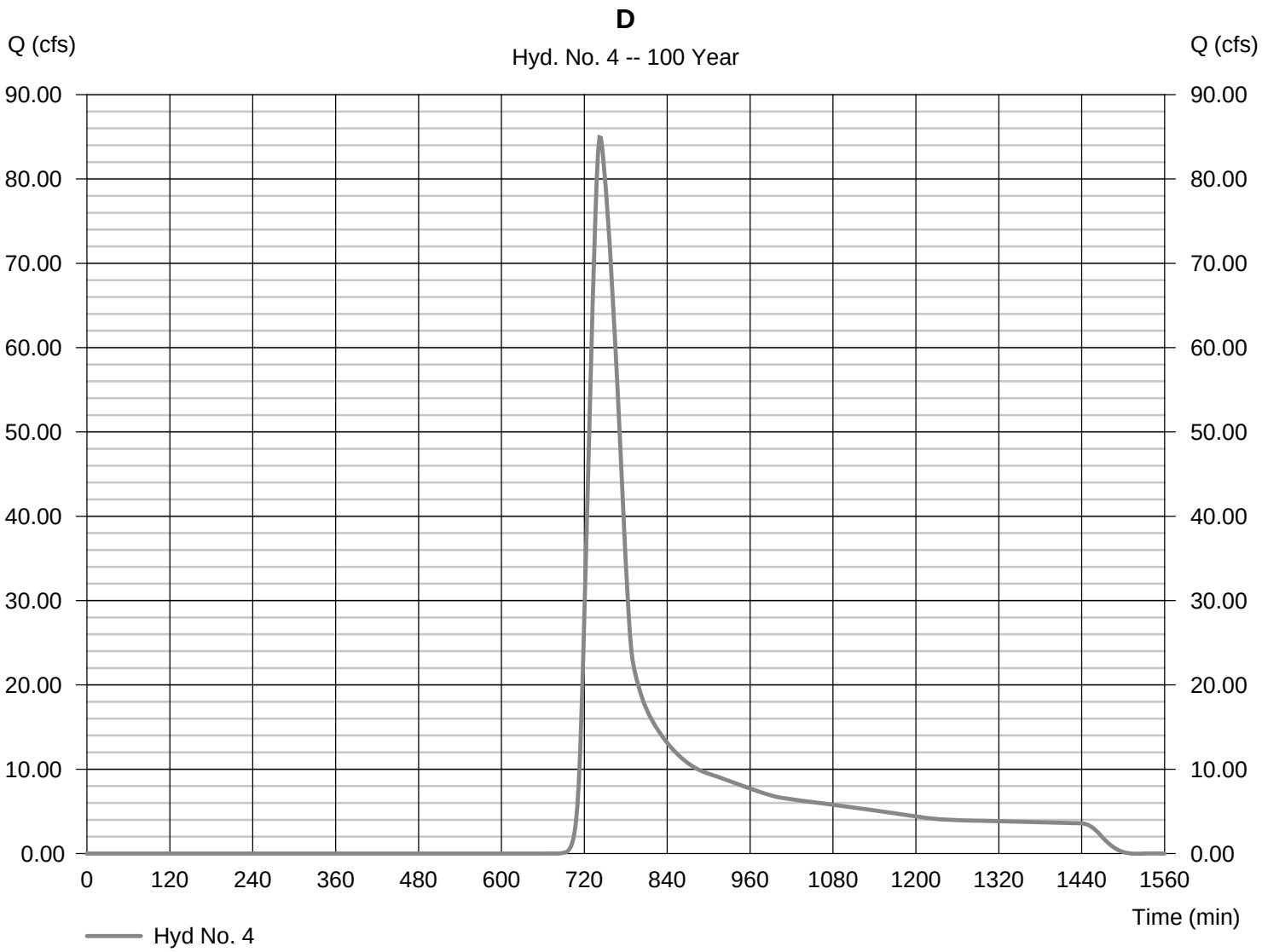
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 4

D

Hydrograph type	= SCS Runoff	Peak discharge	= 84.94 cfs
Storm frequency	= 100 yrs	Time to peak	= 742 min
Time interval	= 2 min	Hyd. volume	= 520,636 cuft
Drainage area	= 84.580 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 46.10 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 4

D

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 31.58**	**+**	**0.00**	**+**	**0.00**	**=**	**31.58**
Shallow Concentrated Flow							
Flow length (ft)	= 1200.00		0.00		0.00		
Watercourse slope (%)	= 3.70		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.10		0.00		0.00		
Travel Time (min)	**= 6.44**	**+**	**0.00**	**+**	**0.00**	**=**	**6.44**
Channel Flow							
X sectional flow area (sqft)	= 15.00		0.00		0.00		
Wetted perimeter (ft)	= 30.00		0.00		0.00		
Channel slope (%)	= 1.50		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=3.82						
			0.00				
					0.00		
Flow length (ft)	({0})1850.0		0.0		0.0		
Travel Time (min)	**= 8.06**	**+**	**0.00**	**+**	**0.00**	**=**	**8.06**

Total Travel Time, Tc ..... 46.10 min

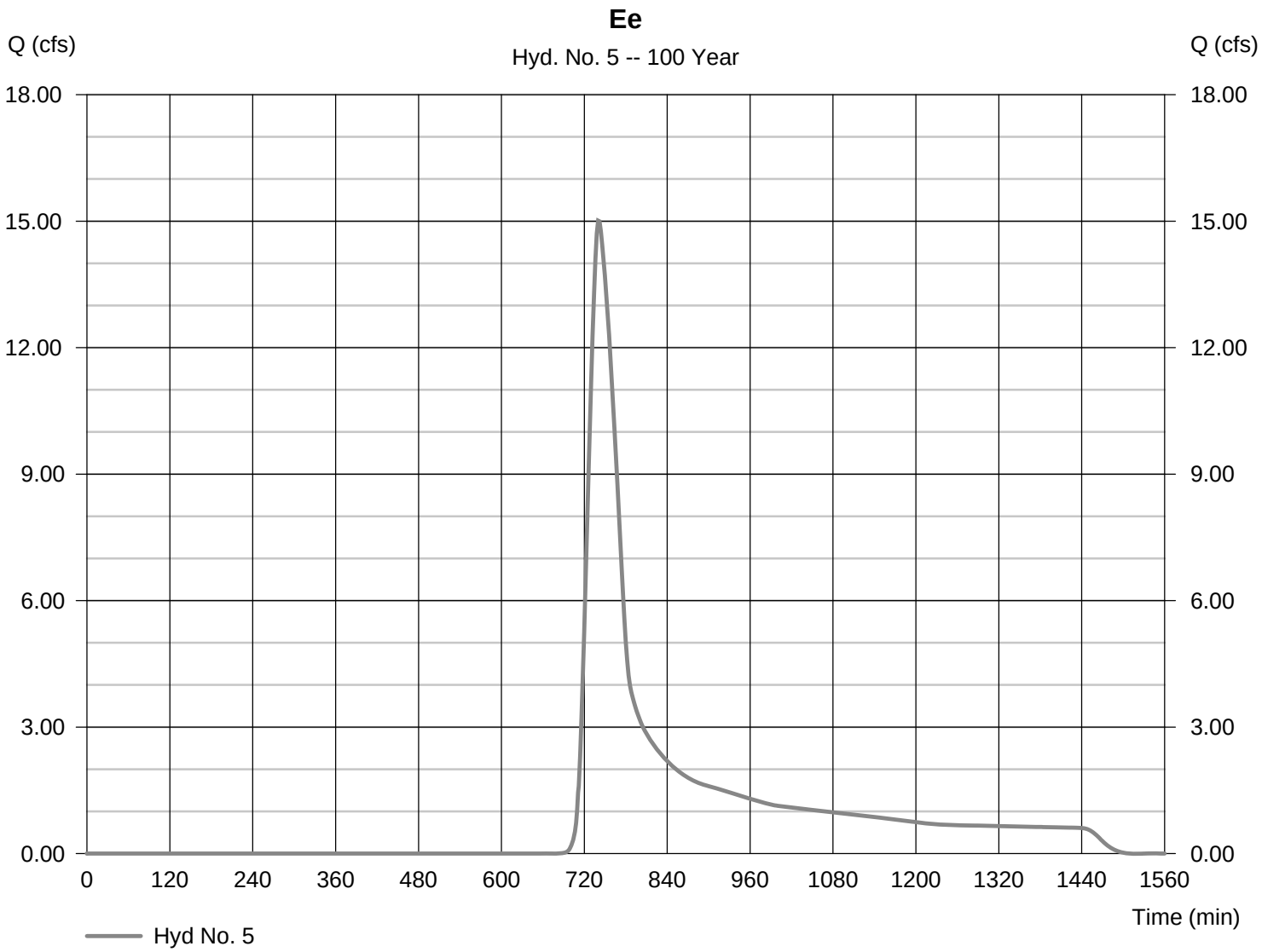
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 5

Ee

Hydrograph type	= SCS Runoff	Peak discharge	= 15.01 cfs
Storm frequency	= 100 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 88,480 cuft
Drainage area	= 14.110 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 42.20 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 5

Ee

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 4.70		0.00		0.00		
Travel Time (min)	**= 40.45**	**+**	**0.00**	**+**	**0.00**	**=**	**40.45**
Shallow Concentrated Flow							
Flow length (ft)	= 400.00		0.00		0.00		
Watercourse slope (%)	= 5.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.78		0.00		0.00		
Travel Time (min)	**= 1.76**	**+**	**0.00**	**+**	**0.00**	**=**	**1.76**
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 ..... 42.20 min

Hydrograph Report

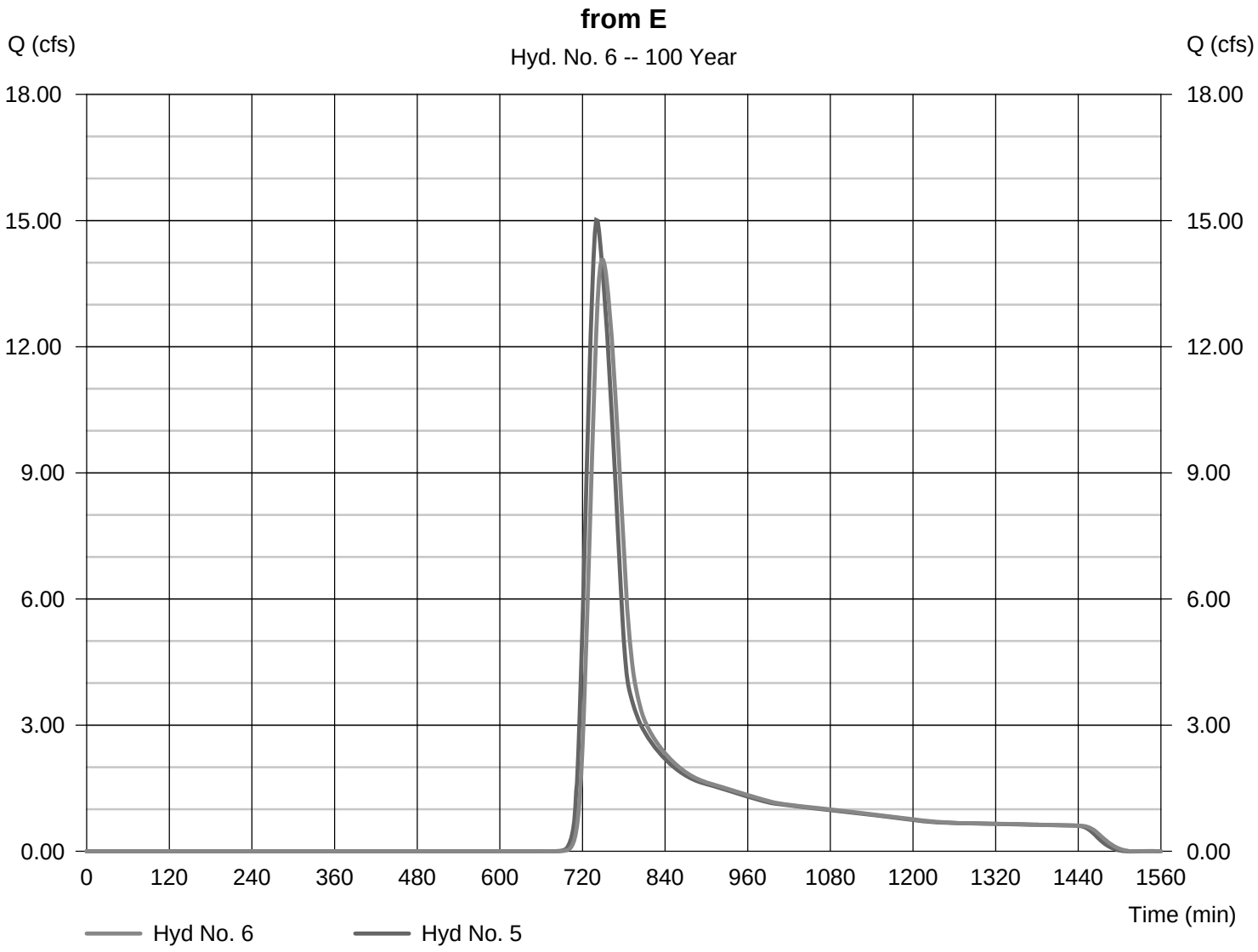
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 6

from E

Hydrograph type	= Reach	Peak discharge	= 14.06 cfs
Storm frequency	= 100 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 88,476 cuft
Inflow hyd. No.	= 5 - Ee	Section type	= Trapezoidal
Reach length	= 1500.0 ft	Channel slope	= 1.6 %
Manning's n	= 0.035	Bottom width	= 5.0 ft
Side slope	= 4.0:1	Max. depth	= 4.0 ft
Rating curve x	= 1.841	Rating curve m	= 1.310
Ave. velocity	= 3.02 ft/s	Routing coeff.	= 0.2736

Modified Att-Kin routing method used.



Hydrograph Report

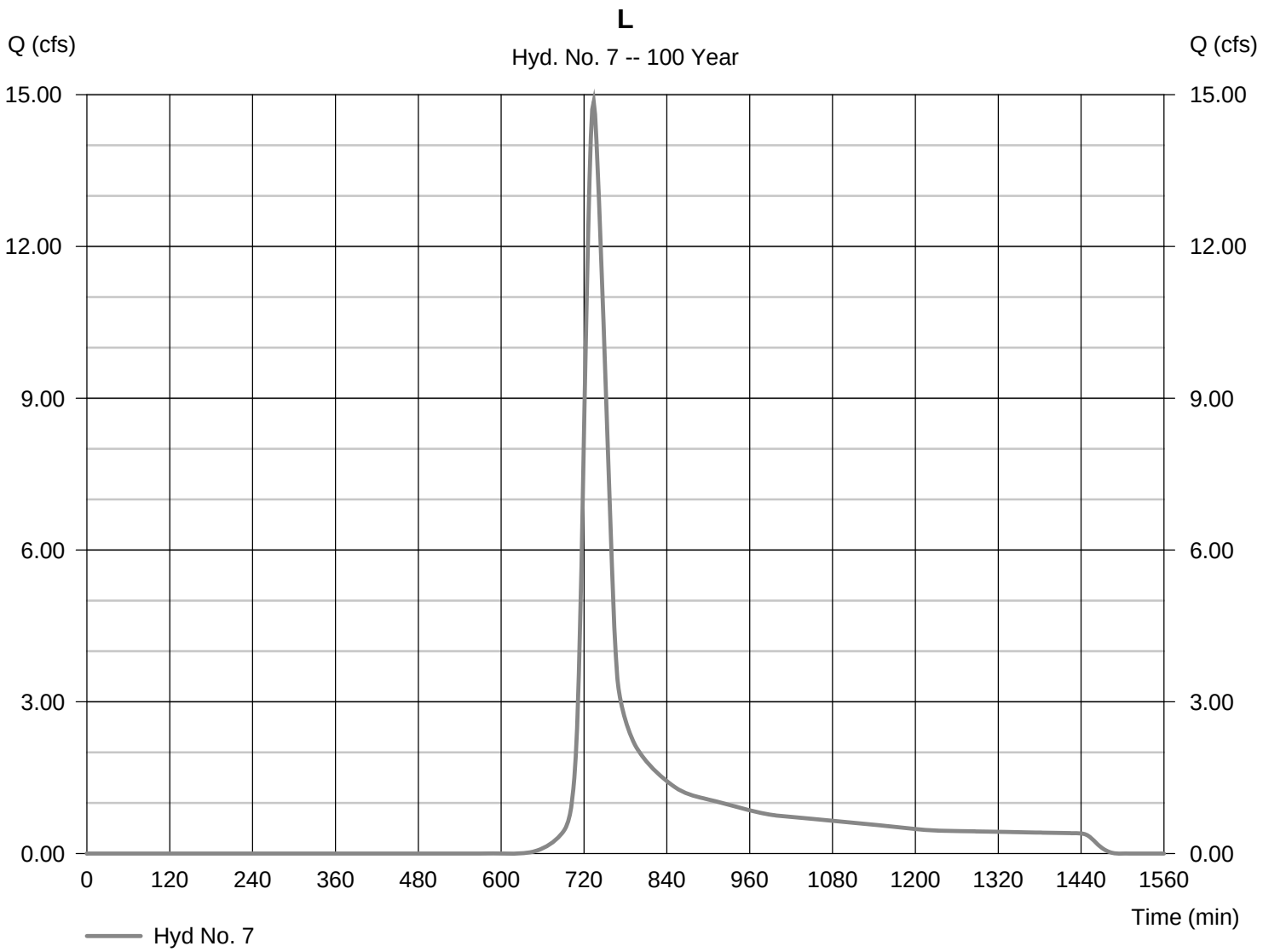
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 7

L

Hydrograph type	= SCS Runoff	Peak discharge	= 14.86 cfs
Storm frequency	= 100 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 67,085 cuft
Drainage area	= 7.870 ac	Curve number	= 62*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 32.90 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.200 x 98) + (7.670 x 61)] / 7.870



TR55 Tc Worksheet

Hyd. No. 7

L

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 8.60		0.00		0.00		
Travel Time (min)	**= 30.68**	**+**	**0.00**	**+**	**0.00**	**=**	**30.68**
Shallow Concentrated Flow							
Flow length (ft)	= 300.00		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)	**= 2.19**	**+**	**0.00**	**+**	**0.00**	**=**	**2.19**
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 ..... 32.90 min

Hydrograph Report

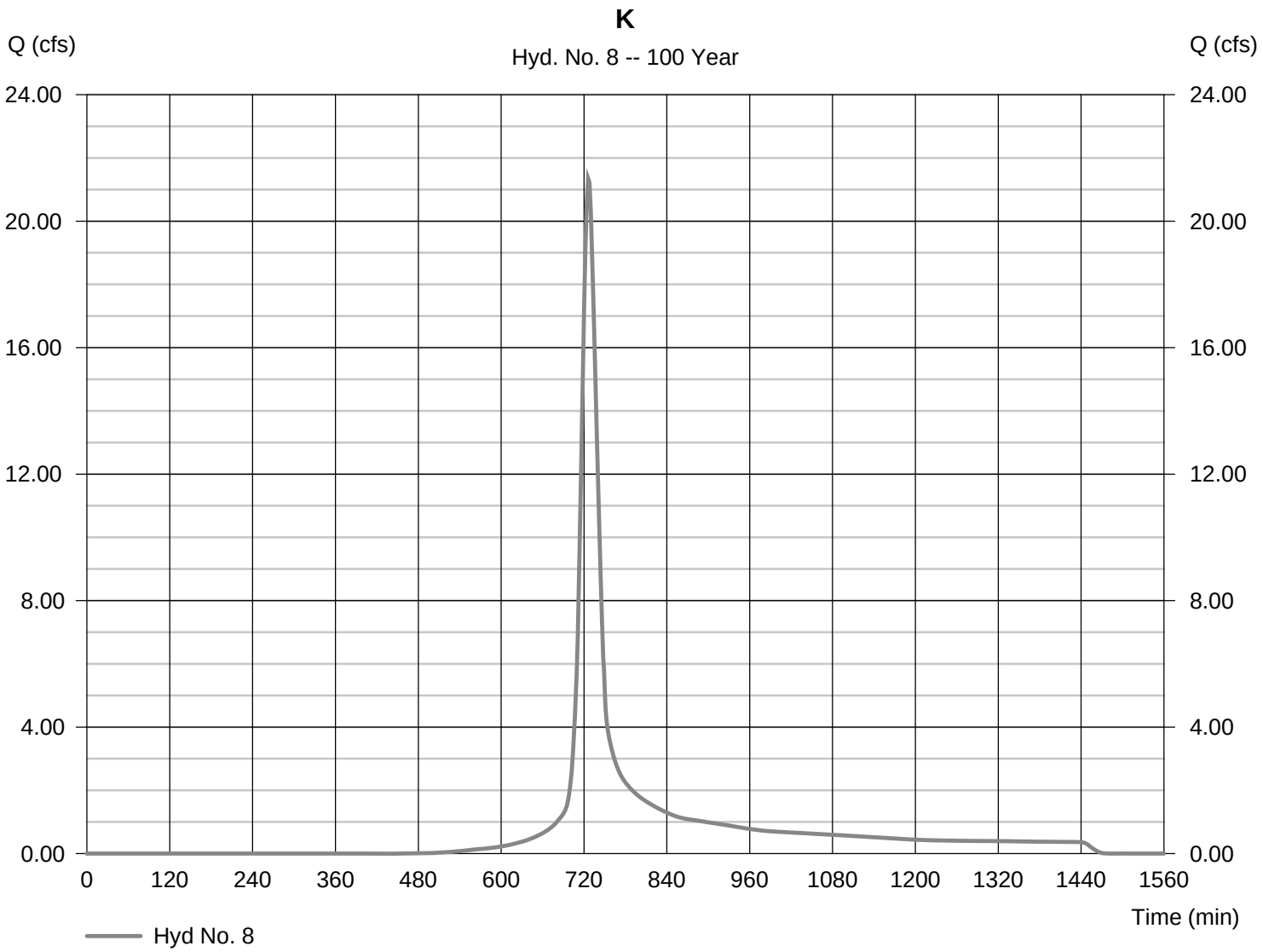
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 8

K

Hydrograph type	=	SCS Runoff	Peak discharge	=	21.35 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	73,838 cuft
Drainage area	=	5.940 ac	Curve number	=	73*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.40 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.860 x 98) + (4.080 x 61)] / 5.940



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No. 8

K

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 140.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 19.86**	**+**	**0.00**	**+**	**0.00**	**=**	**19.86**
Shallow Concentrated Flow							
Flow length (ft)	= 600.00		0.00		0.00		
Watercourse slope (%)	= 3.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.79		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 ..... 23.40 min

Hydrograph Report

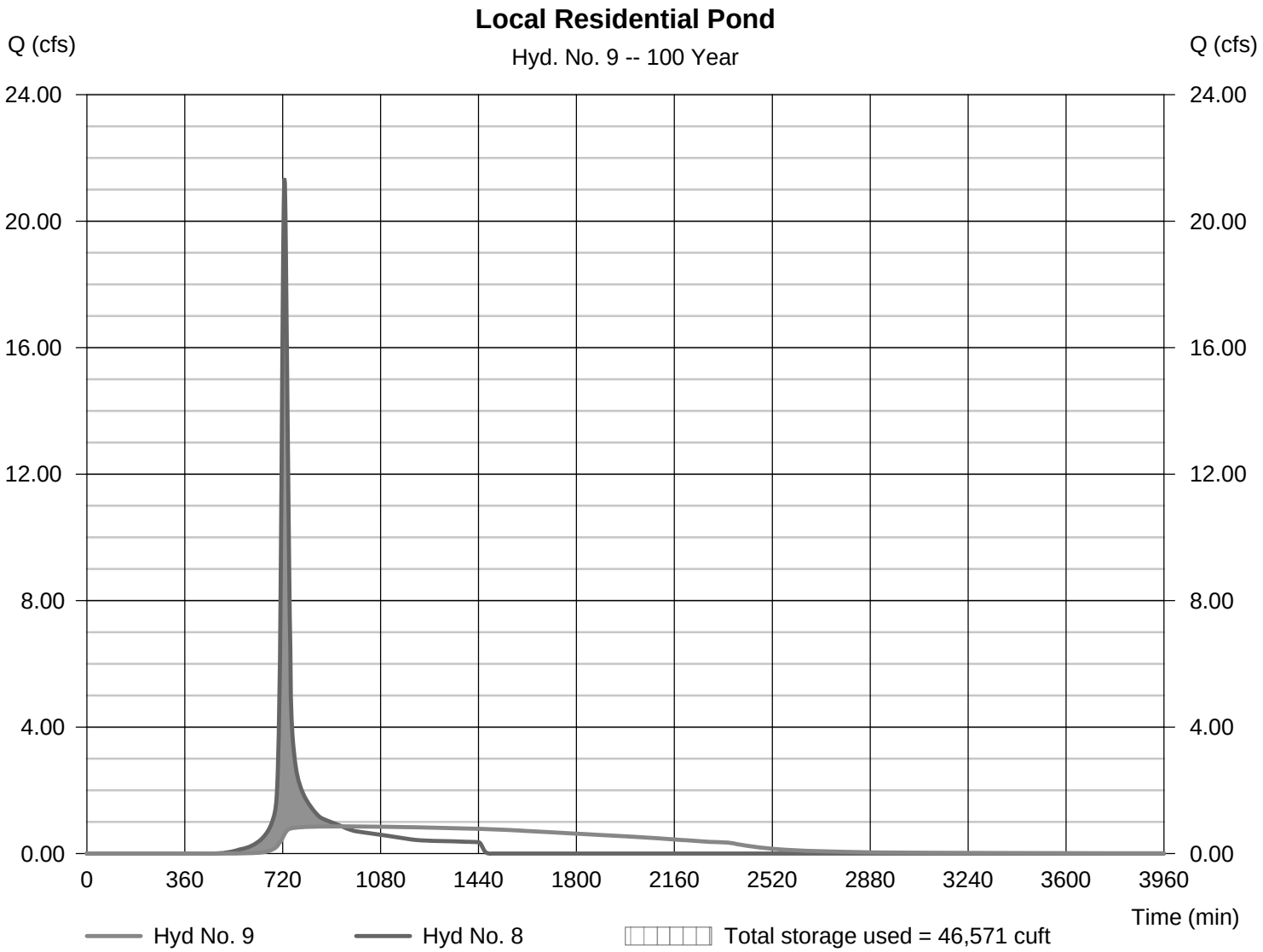
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 9

Local Residential Pond

Hydrograph type	=	Reservoir	Peak discharge	=	0.859 cfs
Storm frequency	=	100 yrs	Time to peak	=	936 min
Time interval	=	2 min	Hyd. volume	=	73,793 cuft
Inflow hyd. No.	=	8 - K	Max. Elevation	=	762.76 ft
Reservoir name	=	local residential pond	Max. Storage	=	46,571 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 3 - local residential pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 760.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	760.00	12,035	0	0
1.00	761.00	15,342	13,654	13,654
2.00	762.00	18,877	17,077	30,731
3.00	763.00	22,638	20,727	51,458
4.00	764.00	26,626	24,603	76,061

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 6.00	0.00	0.00	0.00
Span (in)	= 6.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 760.00	0.00	0.00	0.00
Length (ft)	= 100.00	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

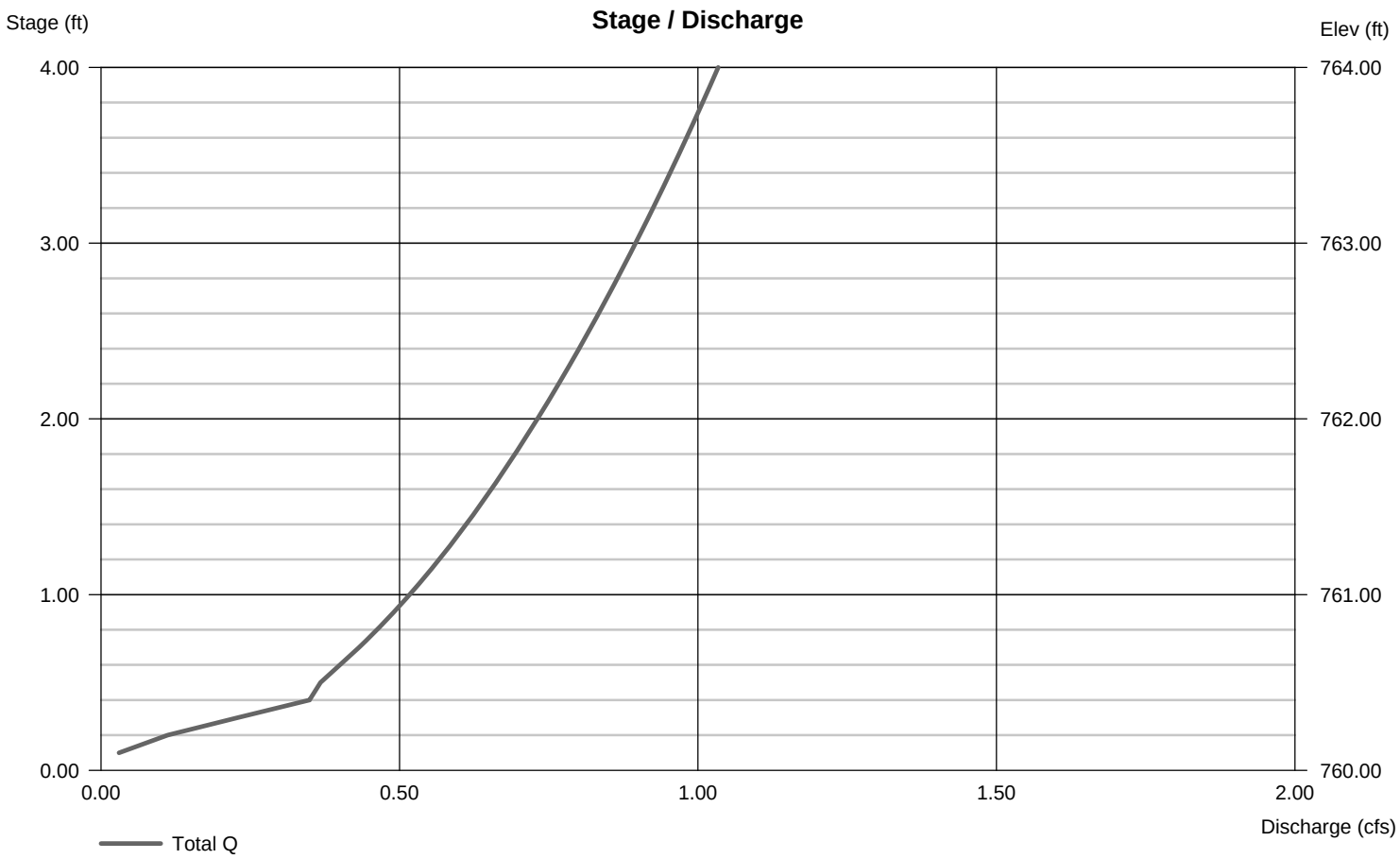
Weir Structures

	[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).



Hydrograph Report

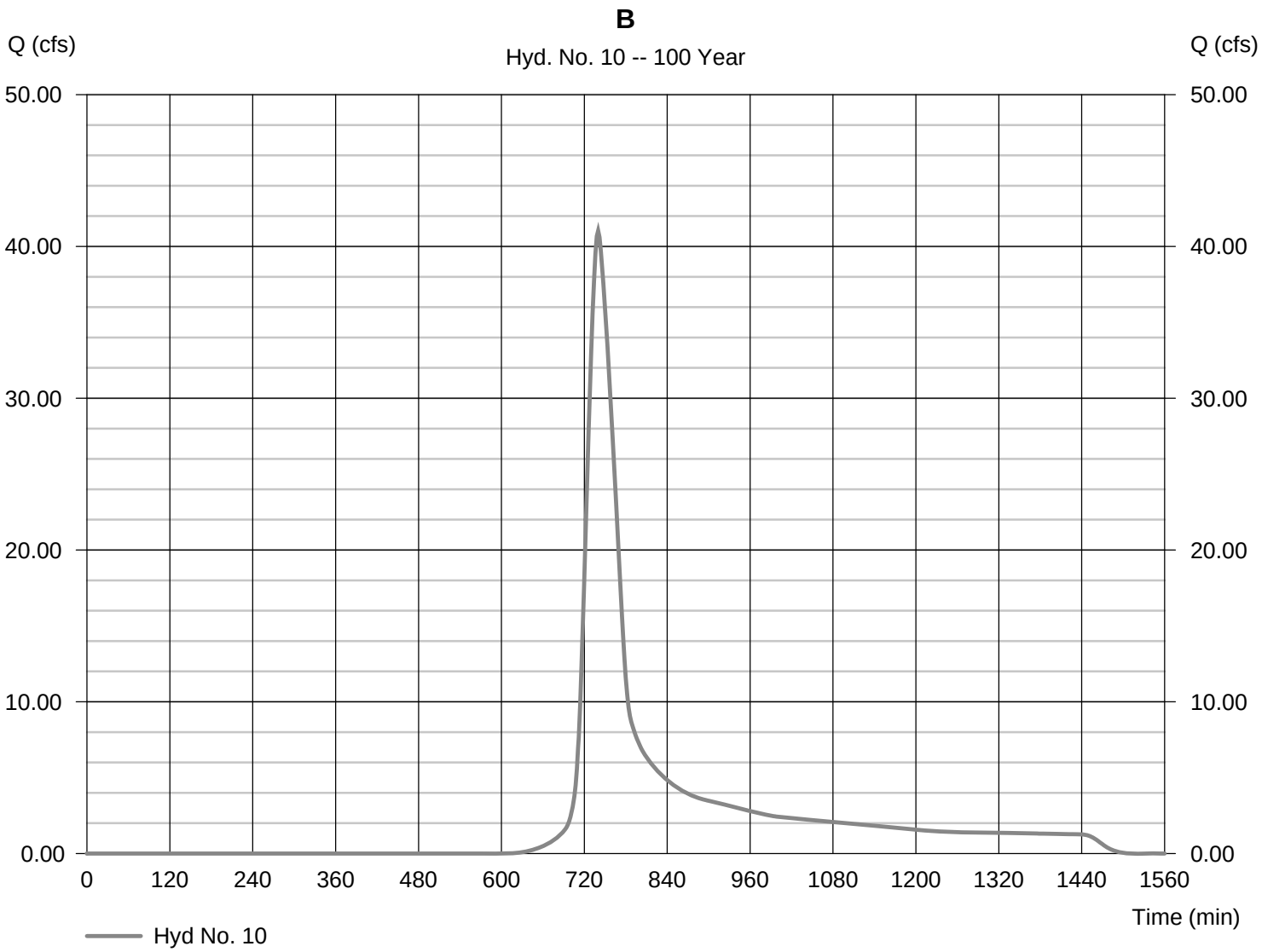
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 10

B

Hydrograph type	=	SCS Runoff	Peak discharge	=	41.04 cfs
Storm frequency	=	100 yrs	Time to peak	=	740 min
Time interval	=	2 min	Hyd. volume	=	219,391 cuft
Drainage area	=	23.930 ac	Curve number	=	64*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	43.40 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.960 x 98) + (21.970 x 61)] / 23.930



TR55 Tc Worksheet

Hyd. No. 10

B

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 8.60		0.00		0.00		
Travel Time (min)	**= 30.68**	**+**	**0.00**	**+**	**0.00**	**=**	**30.68**
Shallow Concentrated Flow							
Flow length (ft)	= 1400.00		0.00		0.00		
Watercourse slope (%)	= 1.30		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.84		0.00		0.00		
Travel Time (min)	**= 12.68**	**+**	**0.00**	**+**	**0.00**	**=**	**12.68**
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 ..... 43.40 min

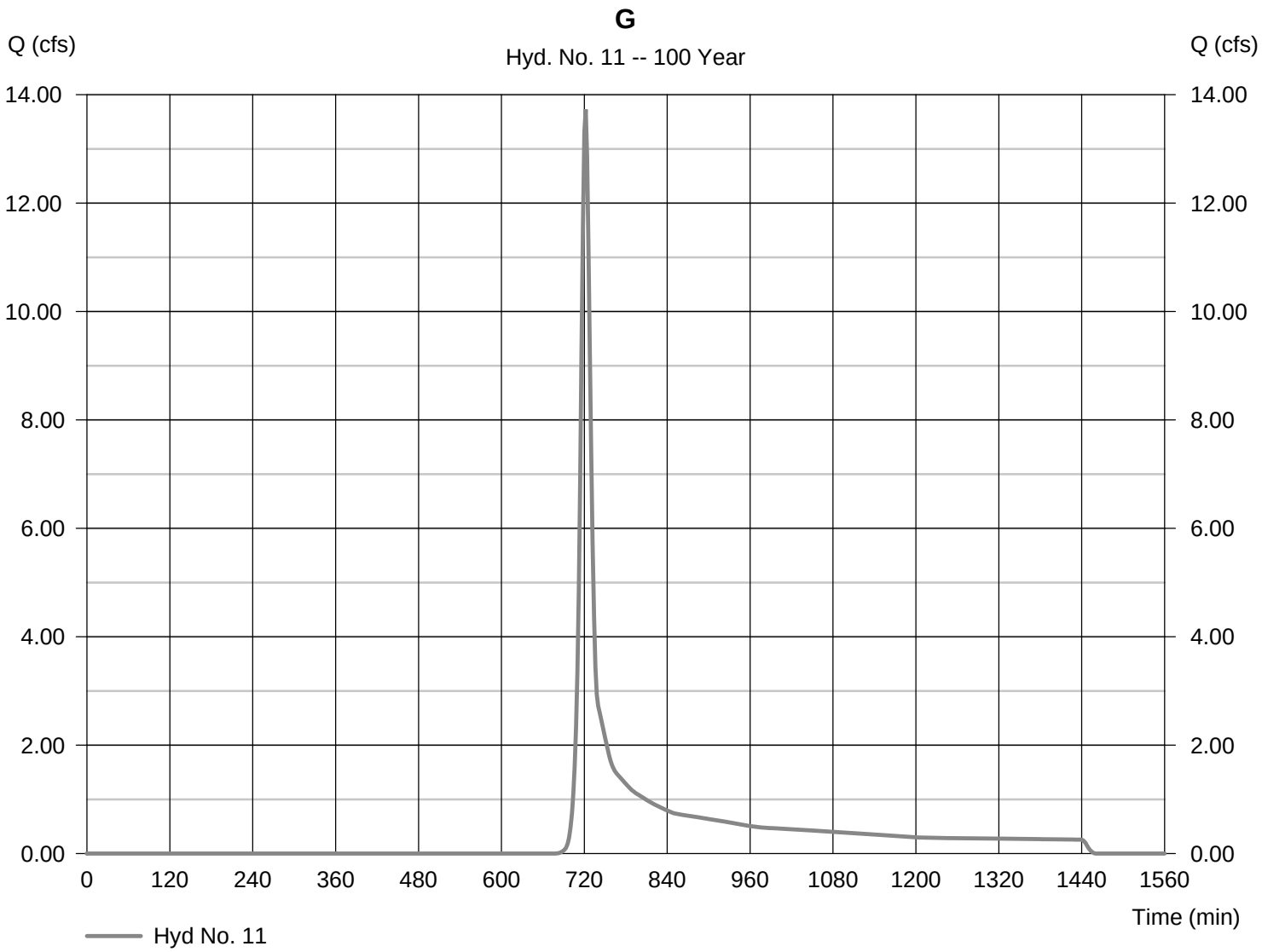
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 11

G

Hydrograph type	= SCS Runoff	Peak discharge	= 13.73 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 37,790 cuft
Drainage area	= 5.900 ac	Curve number	= 55
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



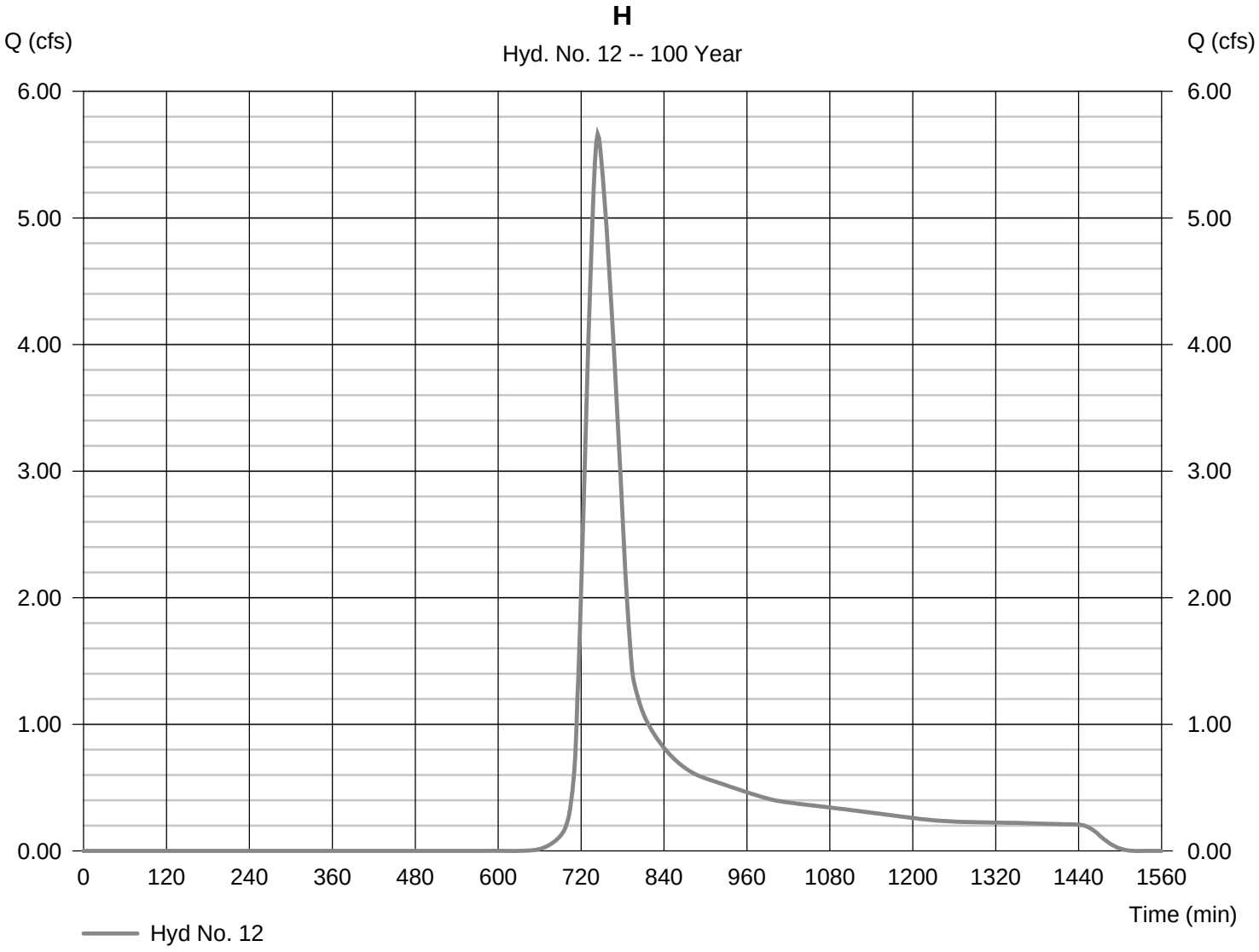
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 12

H

Hydrograph type	= SCS Runoff	Peak discharge	= 5.662 cfs
Storm frequency	= 100 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 34,071 cuft
Drainage area	= 4.210 ac	Curve number	= 61
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 50.50 min
Total precip.	= 6.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 12

H

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 2.80		0.00		0.00		
Travel Time (min)	**= 48.07**	**+**	**0.00**	**+**	**0.00**	**=**	**48.07**
Shallow Concentrated Flow							
Flow length (ft)	= 400.00		0.00		0.00		
Watercourse slope (%)	= 2.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.70		0.00		0.00		
Travel Time (min)	**= 2.47**	**+**	**0.00**	**+**	**0.00**	**=**	**2.47**
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 ..... 50.50 min

Hydrograph Report

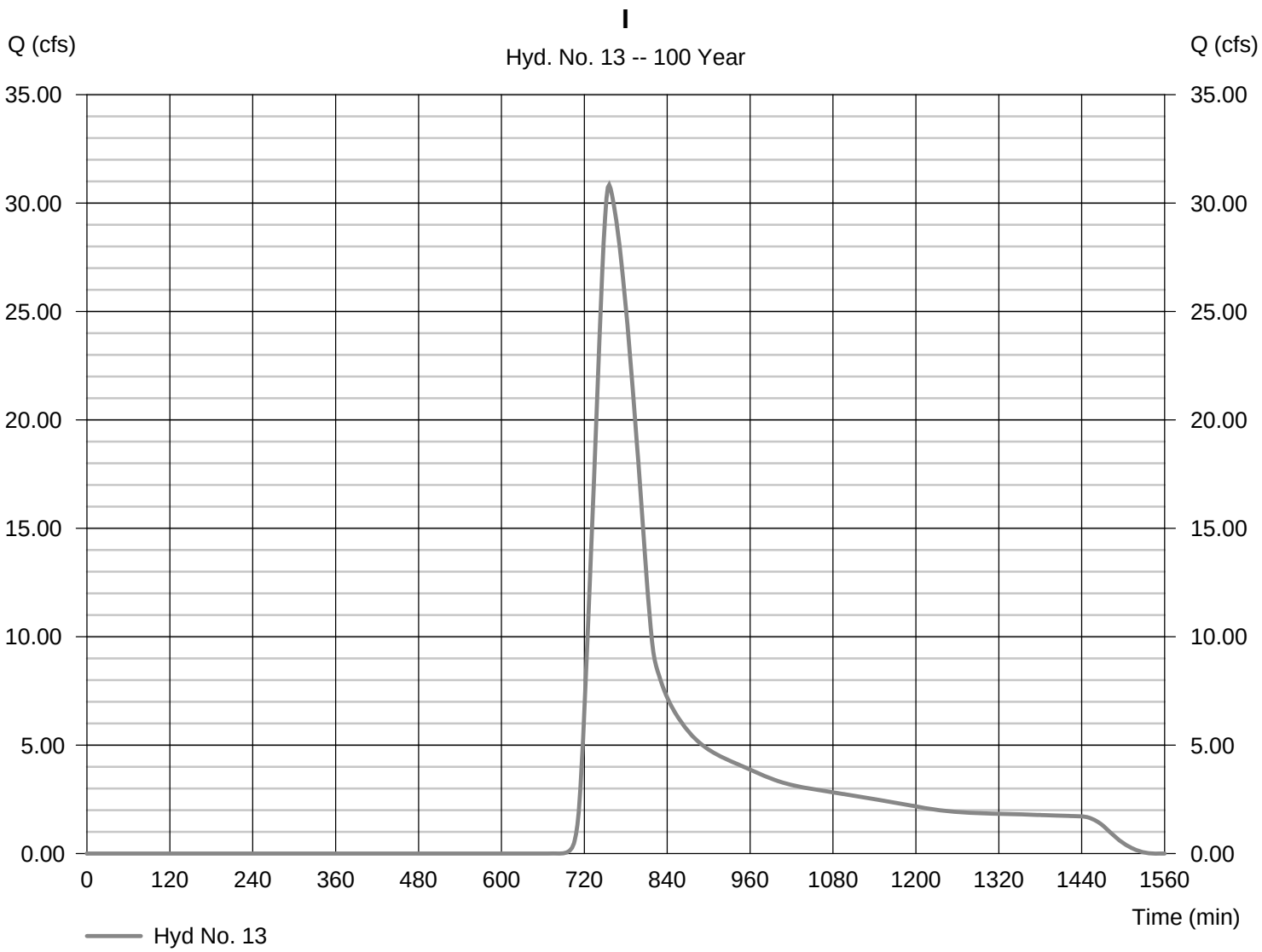
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 13

I

Hydrograph type	=	SCS Runoff	Peak discharge	=	30.84 cfs
Storm frequency	=	100 yrs	Time to peak	=	756 min
Time interval	=	2 min	Hyd. volume	=	247,258 cuft
Drainage area	=	40.060 ac	Curve number	=	55*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	64.30 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.400 x 98) + (39.660 x 55)] / 40.060



TR55 Tc Worksheet

Hyd. No. 13

I

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.83		0.00		0.00		
Land slope (%)	= 2.30		0.00		0.00		
Travel Time (min)	**= 52.00**	**+**	**0.00**	**+**	**0.00**	**=**	**52.00**
Shallow Concentrated Flow							
Flow length (ft)	= 1600.00		0.00		0.00		
Watercourse slope (%)	= 1.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.16		0.00		0.00		
Travel Time (min)	**= 12.32**	**+**	**0.00**	**+**	**0.00**	**=**	**12.32**
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 ..... 64.30 min

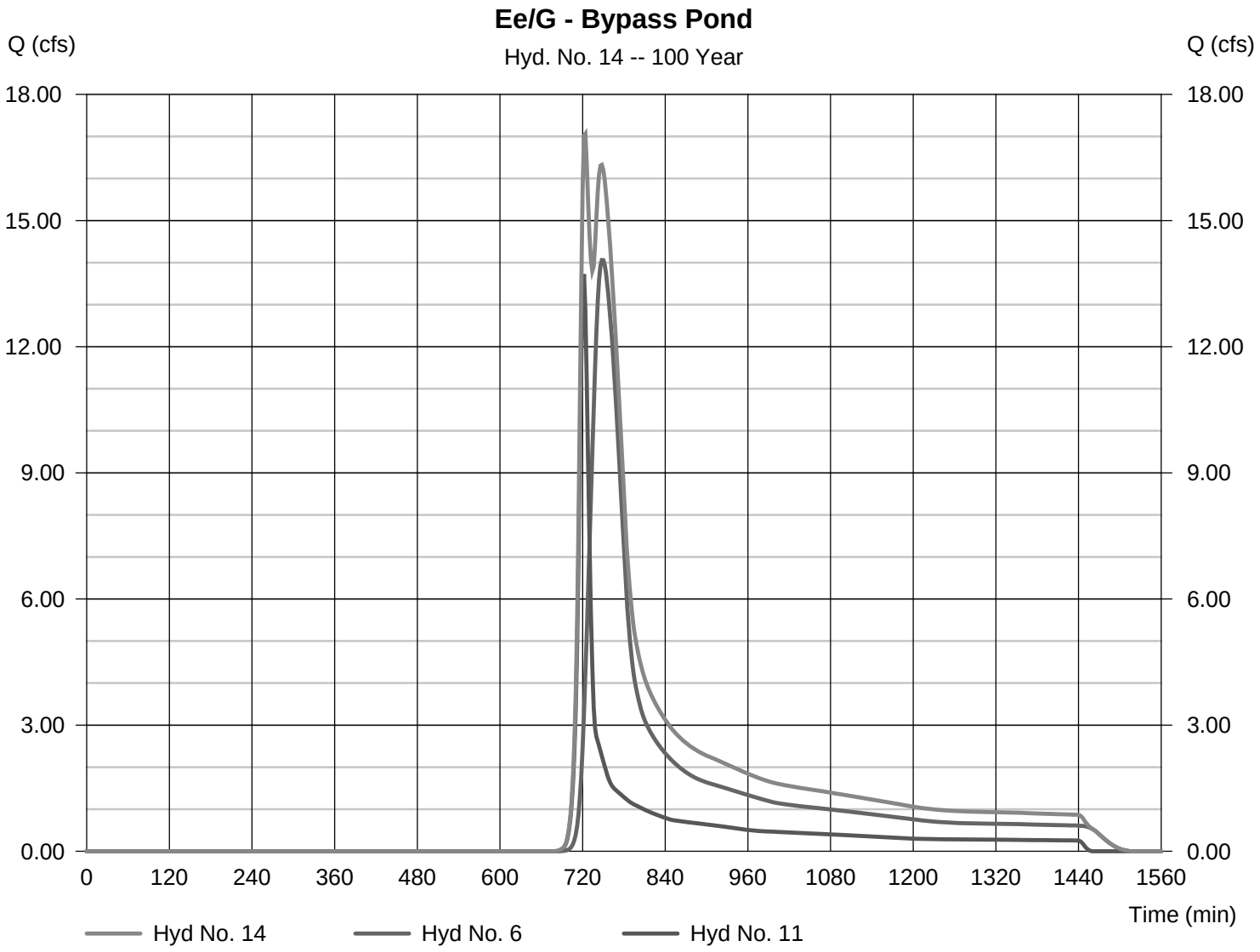
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 14

Ee/G - Bypass Pond

Hydrograph type	= Combine	Peak discharge	= 17.06 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 126,267 cuft
Inflow hyds.	= 6, 11	Contrib. drain. area	= 5.900 ac



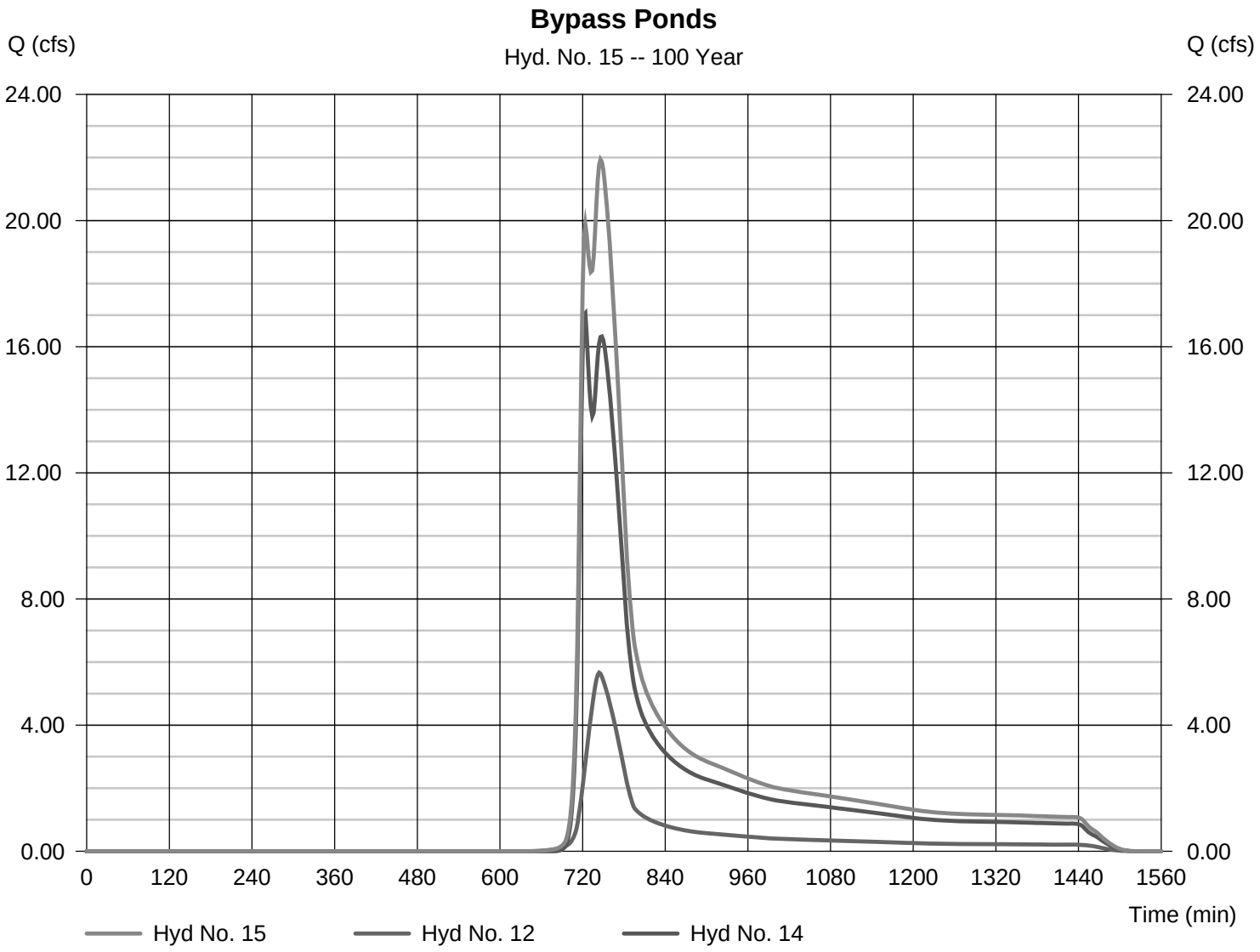
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 15

Bypass Ponds

Hydrograph type	=	Combine	Peak discharge	=	21.94 cfs
Storm frequency	=	100 yrs	Time to peak	=	746 min
Time interval	=	2 min	Hyd. volume	=	160,338 cuft
Inflow hyds.	=	12, 14	Contrib. drain. area	=	4.210 ac



Hydrograph Report

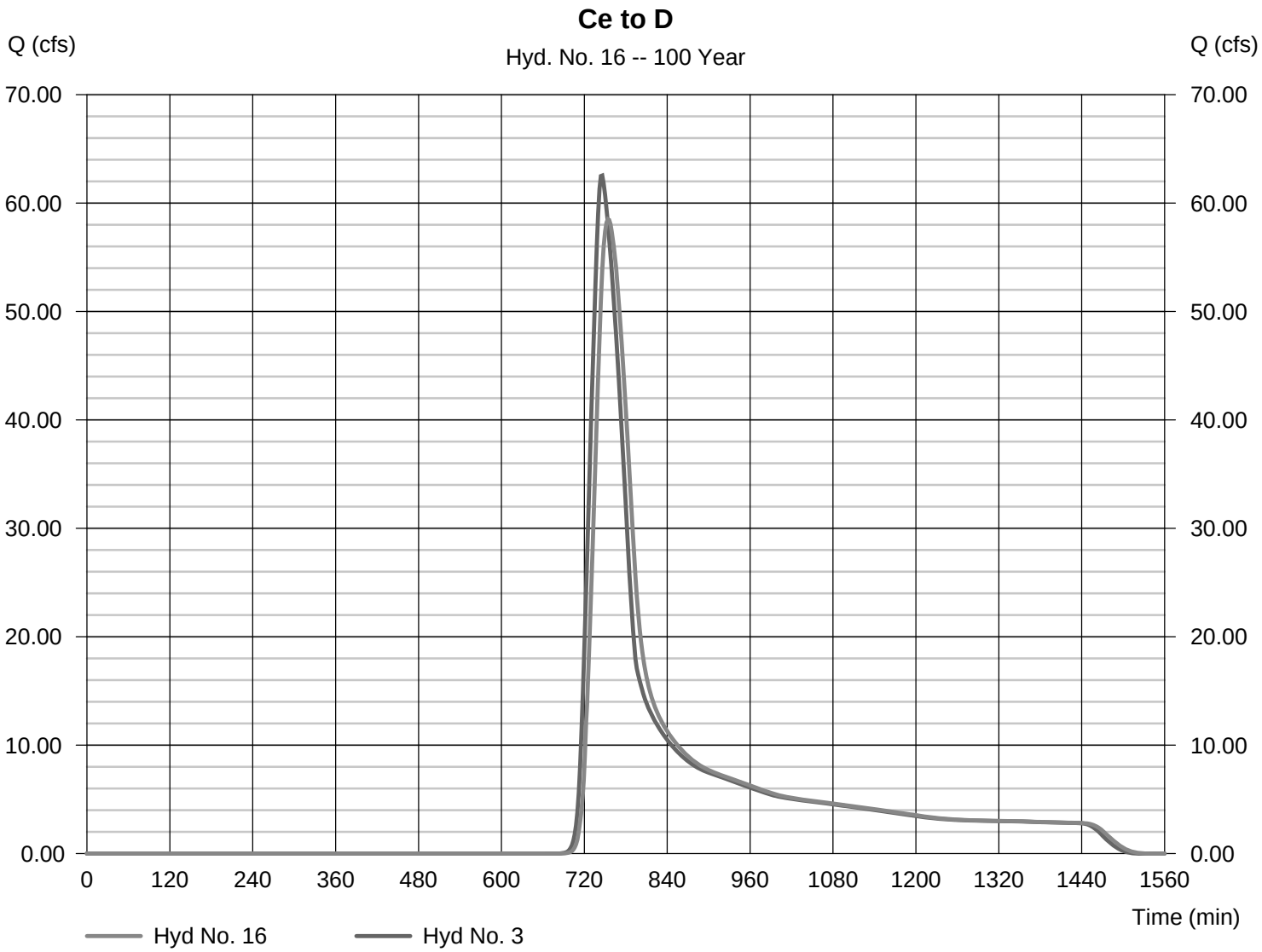
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 16

Ce to D

Hydrograph type	= Reach	Peak discharge	= 58.52 cfs
Storm frequency	= 100 yrs	Time to peak	= 754 min
Time interval	= 2 min	Hyd. volume	= 406,443 cuft
Inflow hyd. No.	= 3 - Ce	Section type	= Trapezoidal
Reach length	= 2000.0 ft	Channel slope	= 1.5 %
Manning's n	= 0.035	Bottom width	= 5.0 ft
Side slope	= 4.0:1	Max. depth	= 2.0 ft
Rating curve x	= 1.782	Rating curve m	= 1.257
Ave. velocity	= 3.69 ft/s	Routing coeff.	= 0.2440

Modified Att-Kin routing method used.



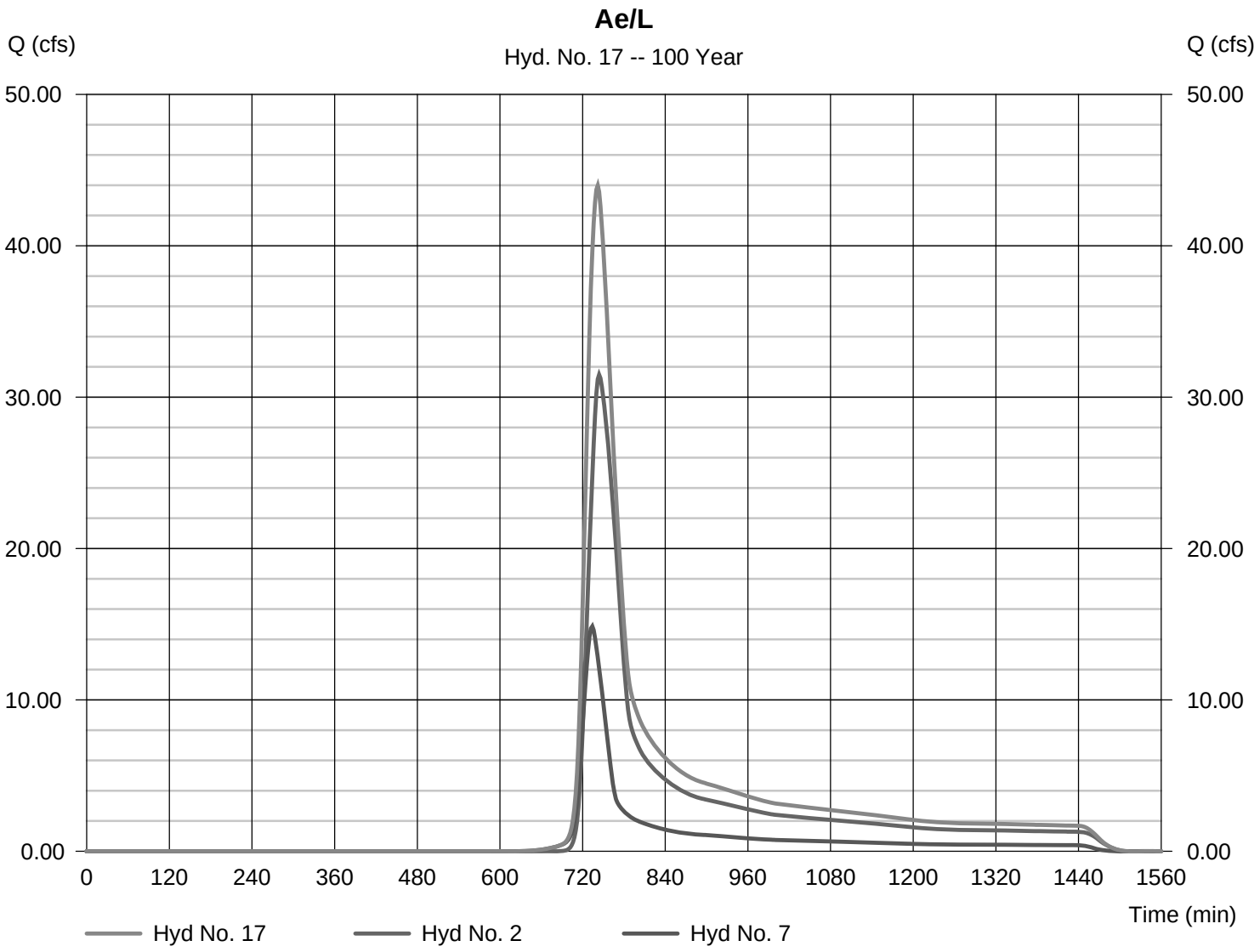
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 17

Ae/L

Hydrograph type	=	Combine	Peak discharge	=	43.98 cfs
Storm frequency	=	100 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	253,701 cuft
Inflow hyds.	=	2, 7	Contrib. drain. area	=	7.870 ac



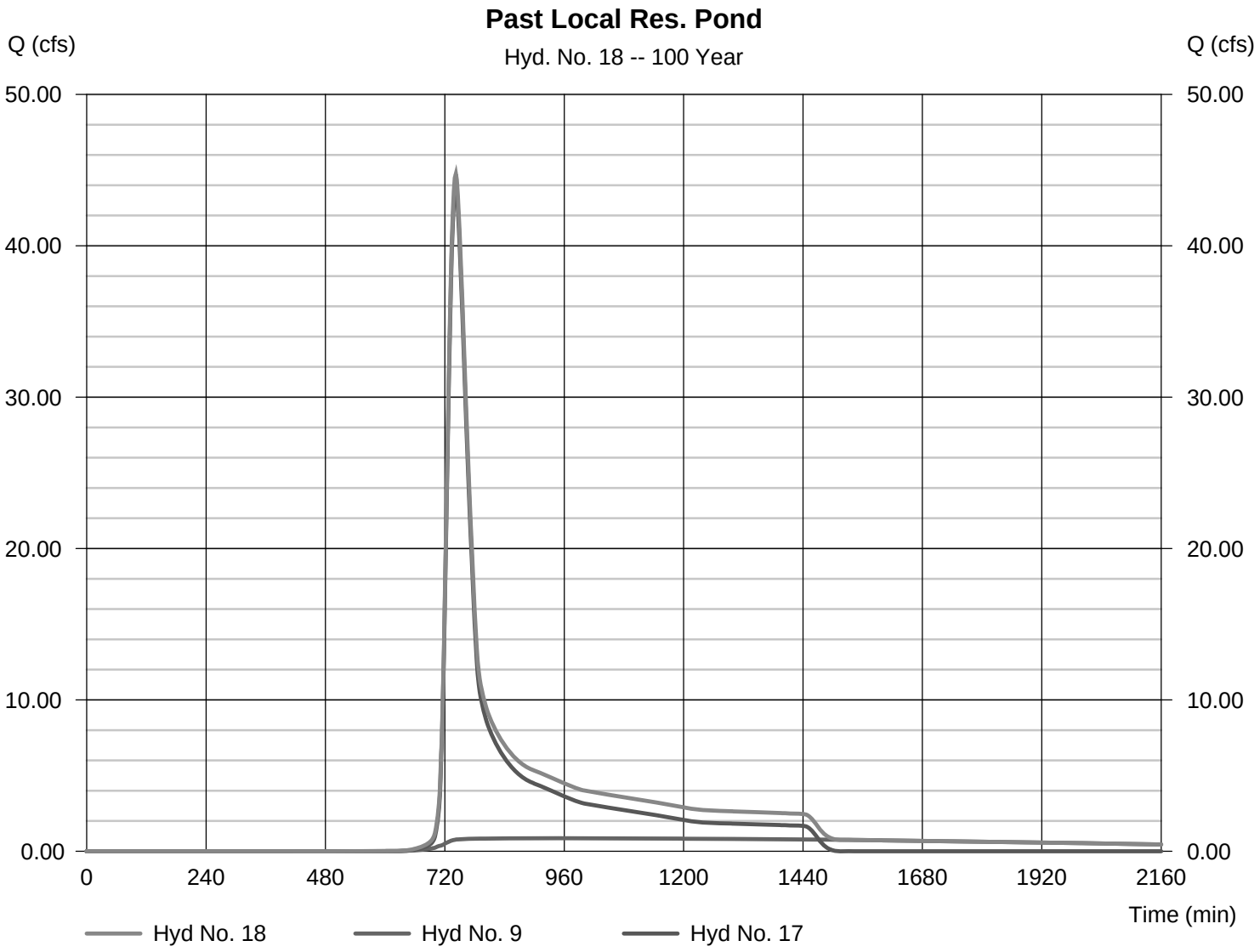
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 18

Past Local Res. Pond

Hydrograph type	=	Combine	Peak discharge	=	44.75 cfs
Storm frequency	=	100 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	327,493 cuft
Inflow hyds.	=	9, 17	Contrib. drain. area	=	0.000 ac



Hydrograph Report

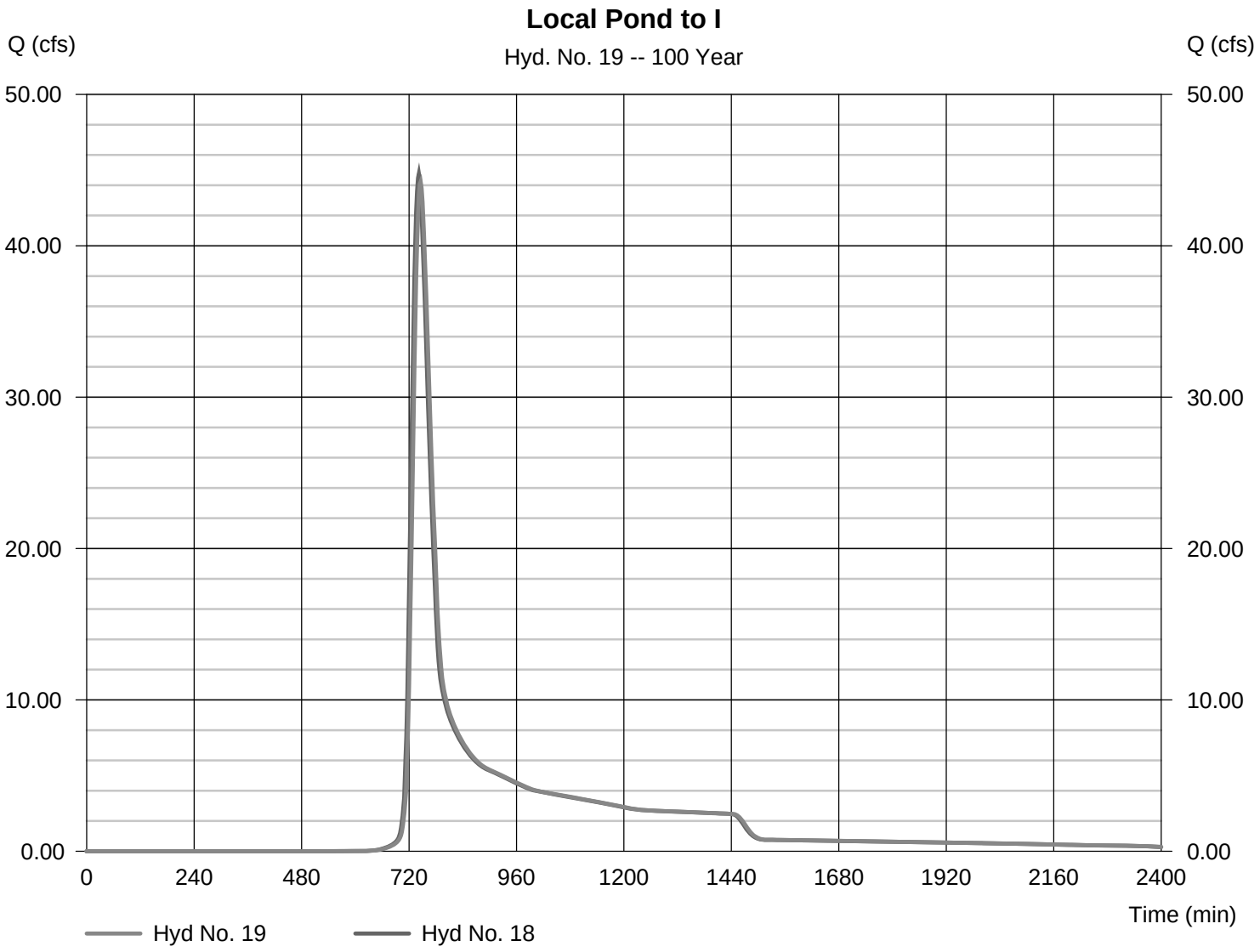
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 19

Local Pond to I

Hydrograph type	=	Reach	Peak discharge	=	44.23 cfs
Storm frequency	=	100 yrs	Time to peak	=	746 min
Time interval	=	2 min	Hyd. volume	=	327,087 cuft
Inflow hyd. No.	=	18 - Past Local Res. Pond	Section type	=	Trapezoidal
Reach length	=	710.0 ft	Channel slope	=	0.4 %
Manning's n	=	0.025	Bottom width	=	5.0 ft
Side slope	=	2.0:1	Max. depth	=	2.0 ft
Rating curve x	=	1.288	Rating curve m	=	1.346
Ave. velocity	=	3.21 ft/s	Routing coeff.	=	0.5342

Modified Att-Kin routing method used.



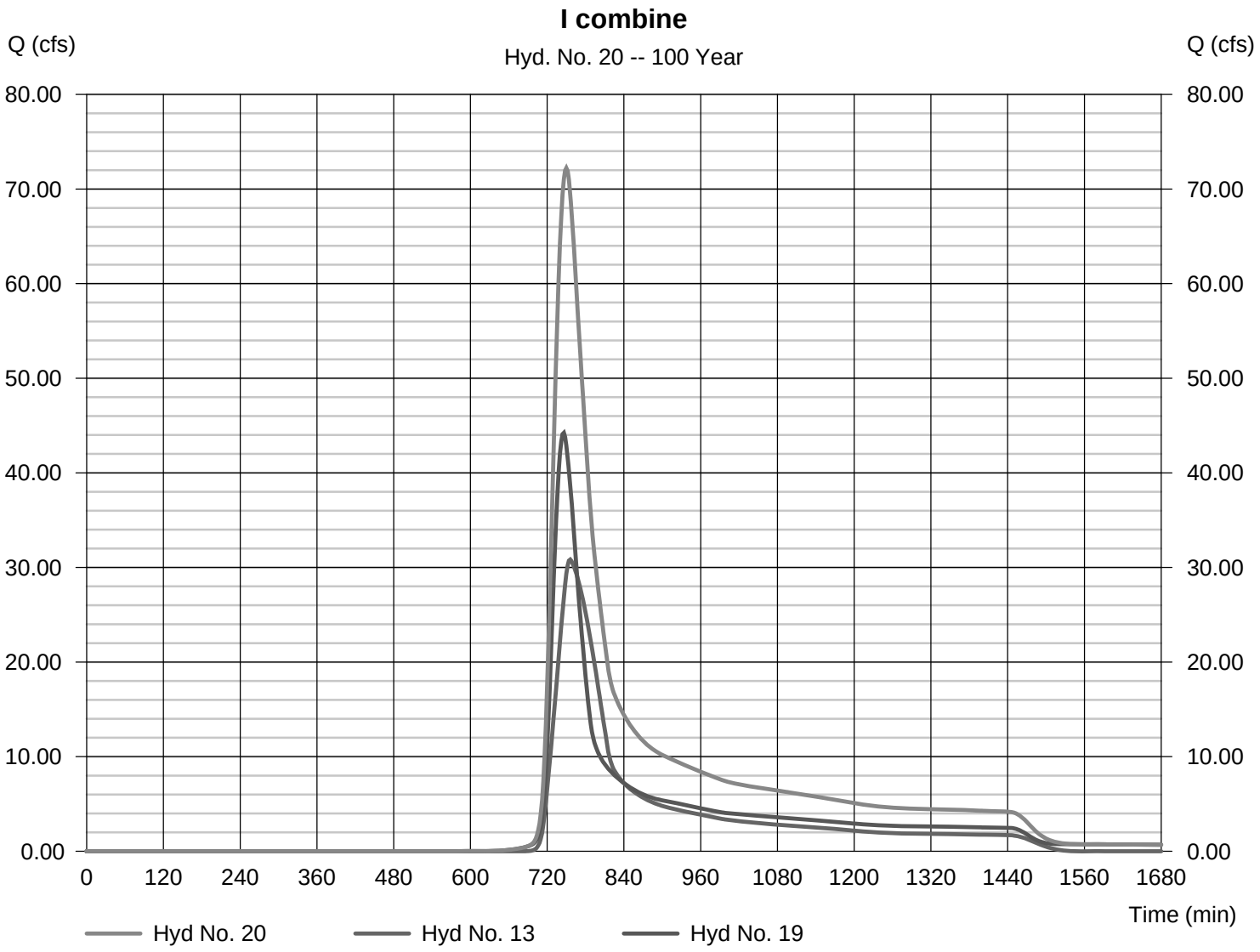
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 20

I combine

Hydrograph type	=	Combine	Peak discharge	=	72.22 cfs
Storm frequency	=	100 yrs	Time to peak	=	750 min
Time interval	=	2 min	Hyd. volume	=	574,344 cuft
Inflow hyds.	=	13, 19	Contrib. drain. area	=	40.060 ac



Hydrograph Report

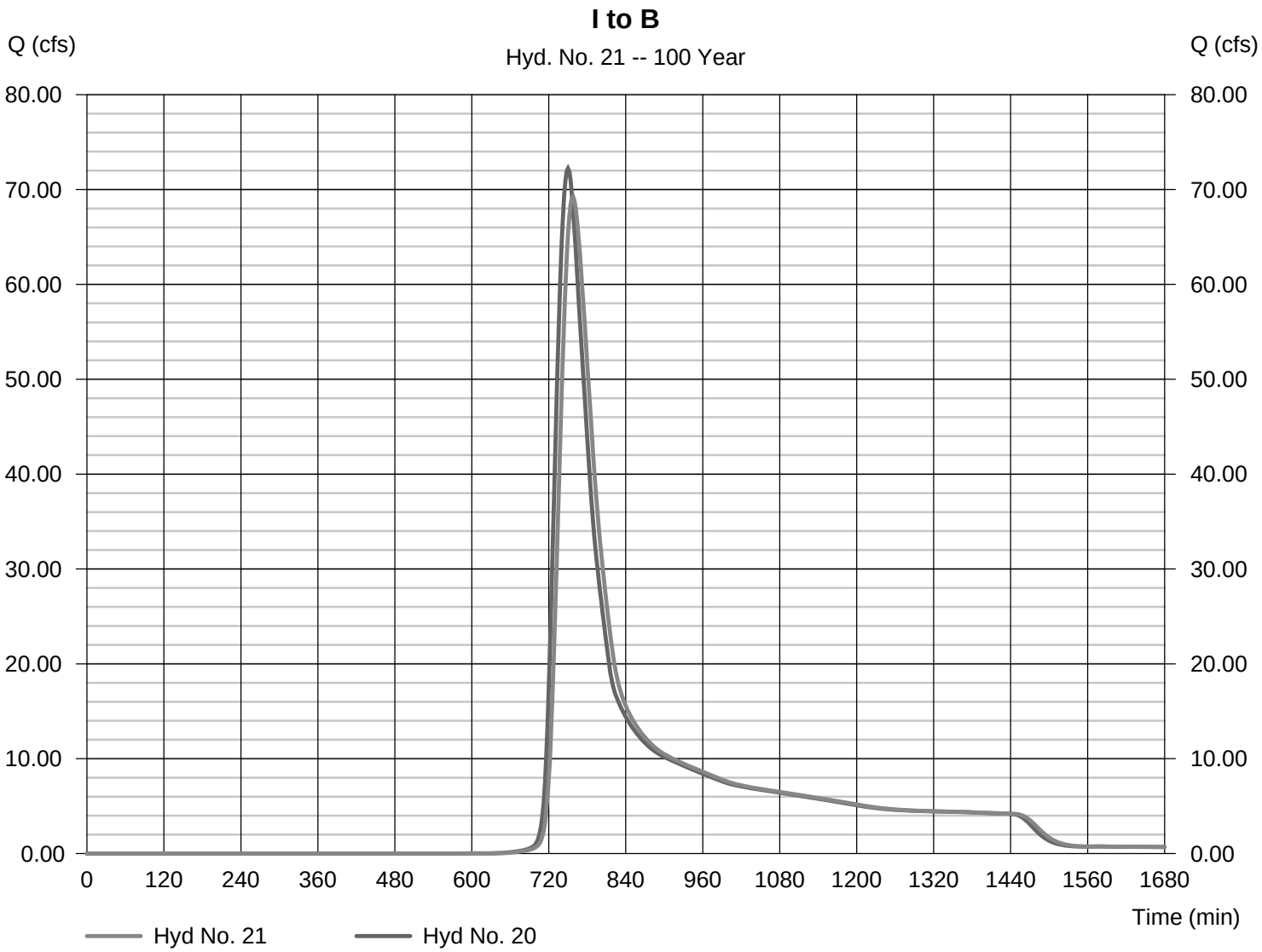
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 21

I to B

Hydrograph type	= Reach	Peak discharge	= 69.23 cfs
Storm frequency	= 100 yrs	Time to peak	= 758 min
Time interval	= 2 min	Hyd. volume	= 574,341 cuft
Inflow hyd. No.	= 20 - I combine	Section type	= Trapezoidal
Reach length	= 1200.0 ft	Channel slope	= 0.7 %
Manning's n	= 0.040	Bottom width	= 2.0 ft
Side slope	= 4.0:1	Max. depth	= 2.0 ft
Rating curve x	= 1.963	Rating curve m	= 1.107
Ave. velocity	= 2.78 ft/s	Routing coeff.	= 0.2668

Modified Att-Kin routing method used.



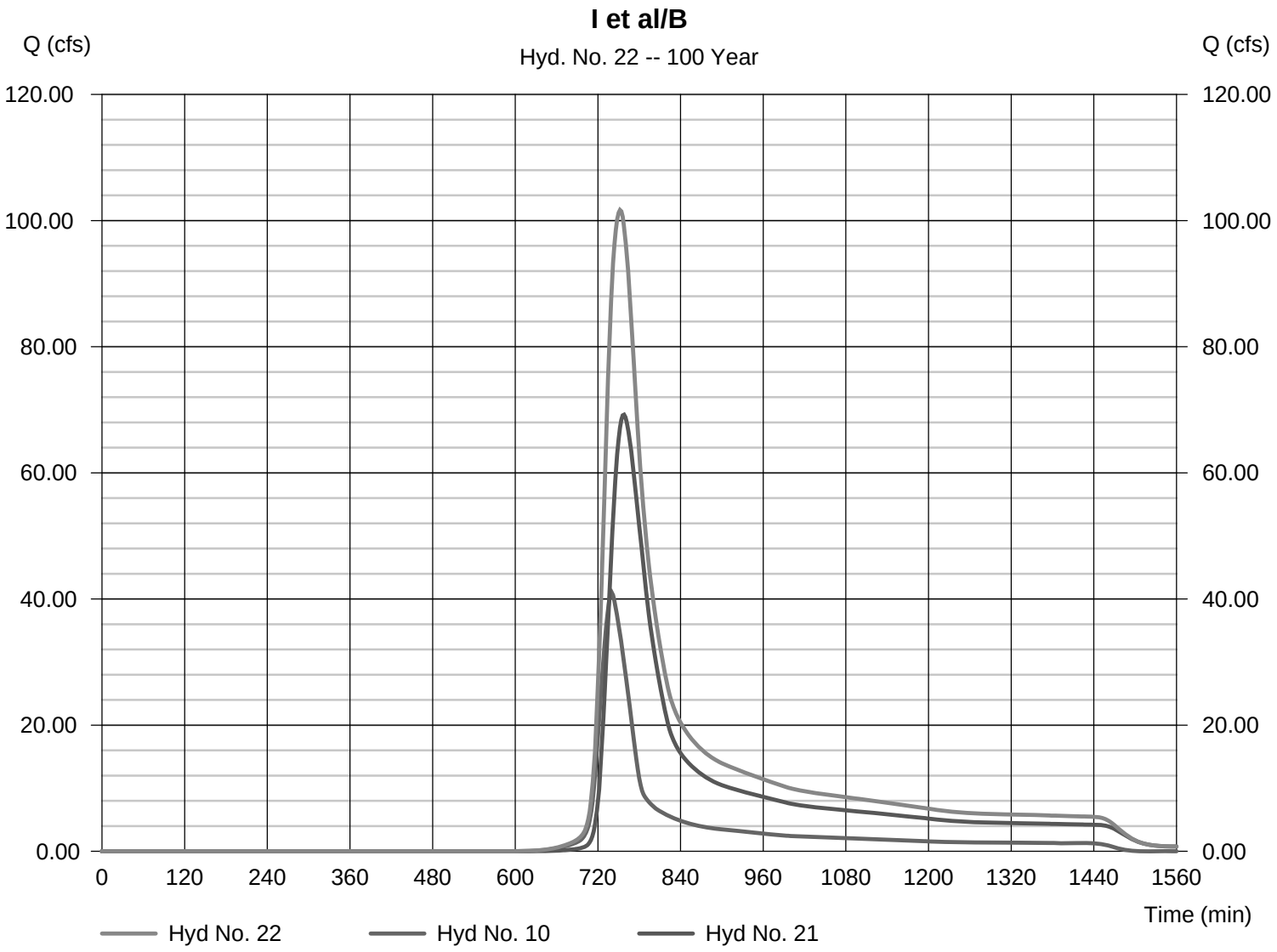
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 22

I et al/B

Hydrograph type	=	Combine	Peak discharge	=	101.67 cfs
Storm frequency	=	100 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	793,732 cuft
Inflow hyds.	=	10, 21	Contrib. drain. area	=	23.930 ac



Hydrograph Report

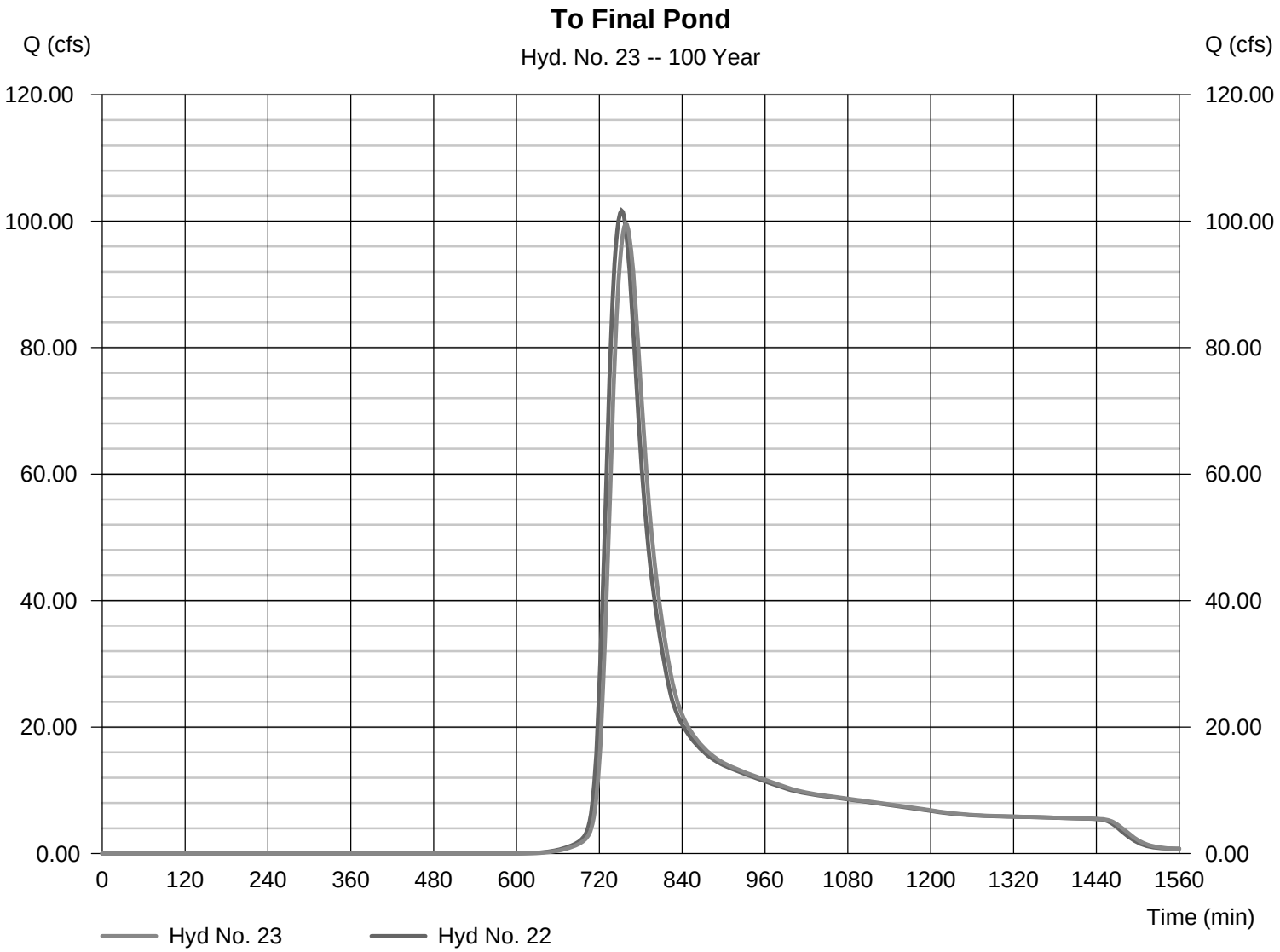
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 23

To Final Pond

Hydrograph type	=	Reach	Peak discharge	=	99.57 cfs
Storm frequency	=	100 yrs	Time to peak	=	758 min
Time interval	=	2 min	Hyd. volume	=	793,729 cuft
Inflow hyd. No.	=	22 - I et al/B	Section type	=	Trapezoidal
Reach length	=	850.0 ft	Channel slope	=	0.5 %
Manning's n	=	0.040	Bottom width	=	2.0 ft
Side slope	=	4.0:1	Max. depth	=	2.0 ft
Rating curve x	=	1.659	Rating curve m	=	1.107
Ave. velocity	=	2.47 ft/s	Routing coeff.	=	0.3235

Modified Att-Kin routing method used.



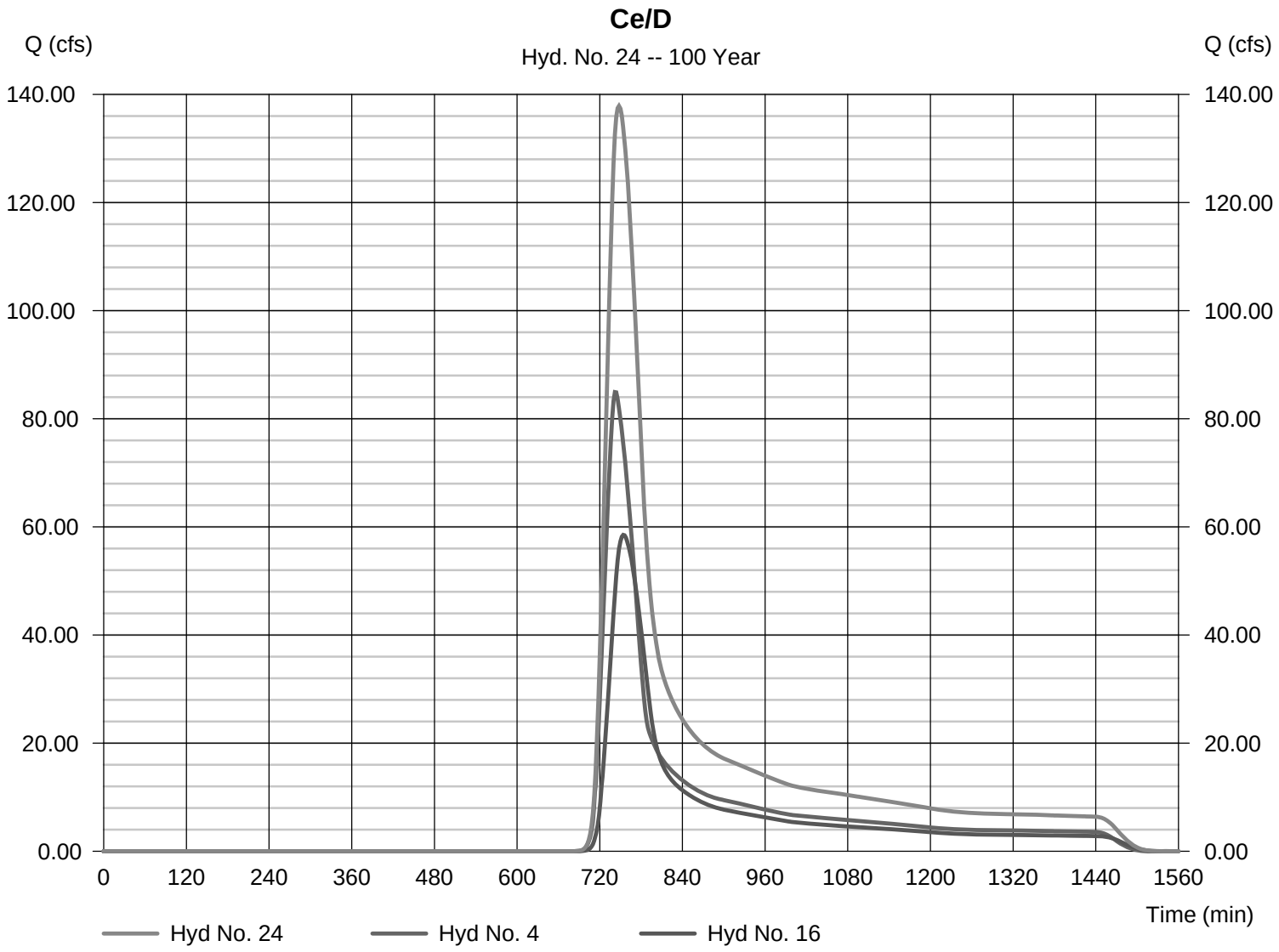
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 24

Ce/D

Hydrograph type	= Combine	Peak discharge	= 137.85 cfs
Storm frequency	= 100 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 927,080 cuft
Inflow hyds.	= 4, 16	Contrib. drain. area	= 84.580 ac



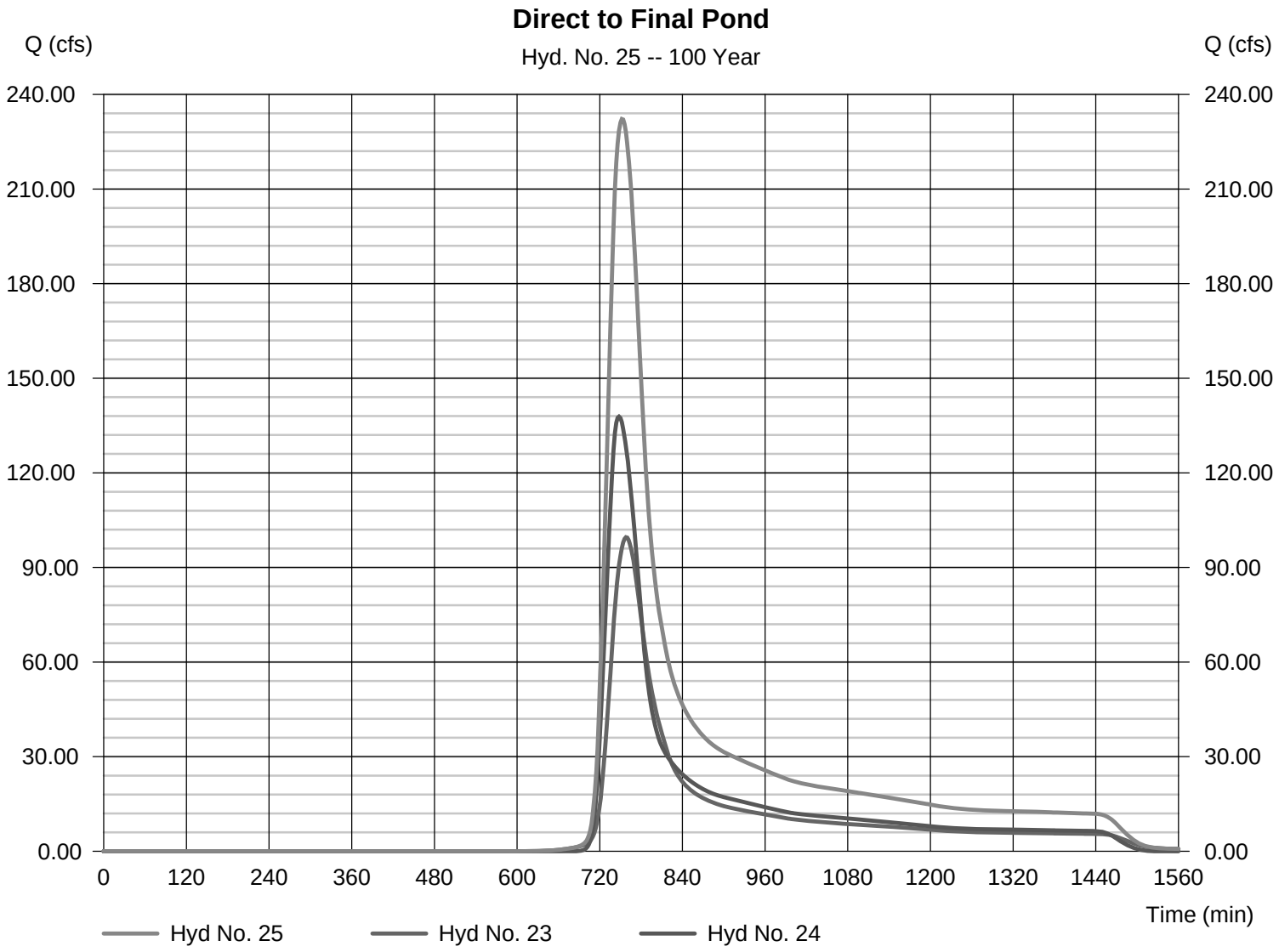
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 25

Direct to Final Pond

Hydrograph type	=	Combine	Peak discharge	=	232.20 cfs
Storm frequency	=	100 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	1,720,809 cuft
Inflow hyds.	=	23, 24	Contrib. drain. area	=	0.000 ac



Hydrograph Report

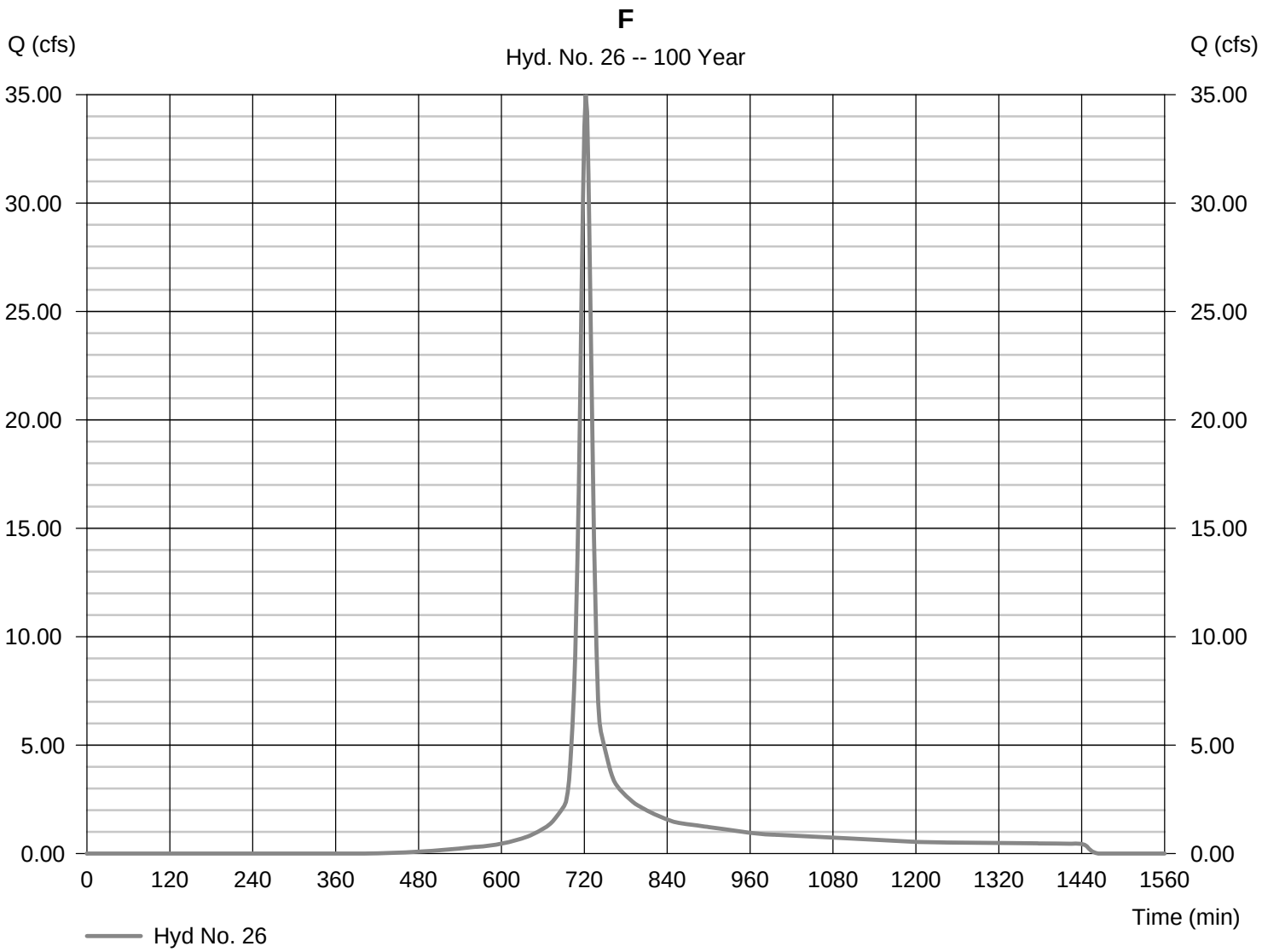
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 26

F

Hydrograph type	=	SCS Runoff	Peak discharge	=	35.00 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	98,307 cuft
Drainage area	=	7.370 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.00 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.160 x 98) + (4.210 x 61)] / 7.370



Hydrograph Report

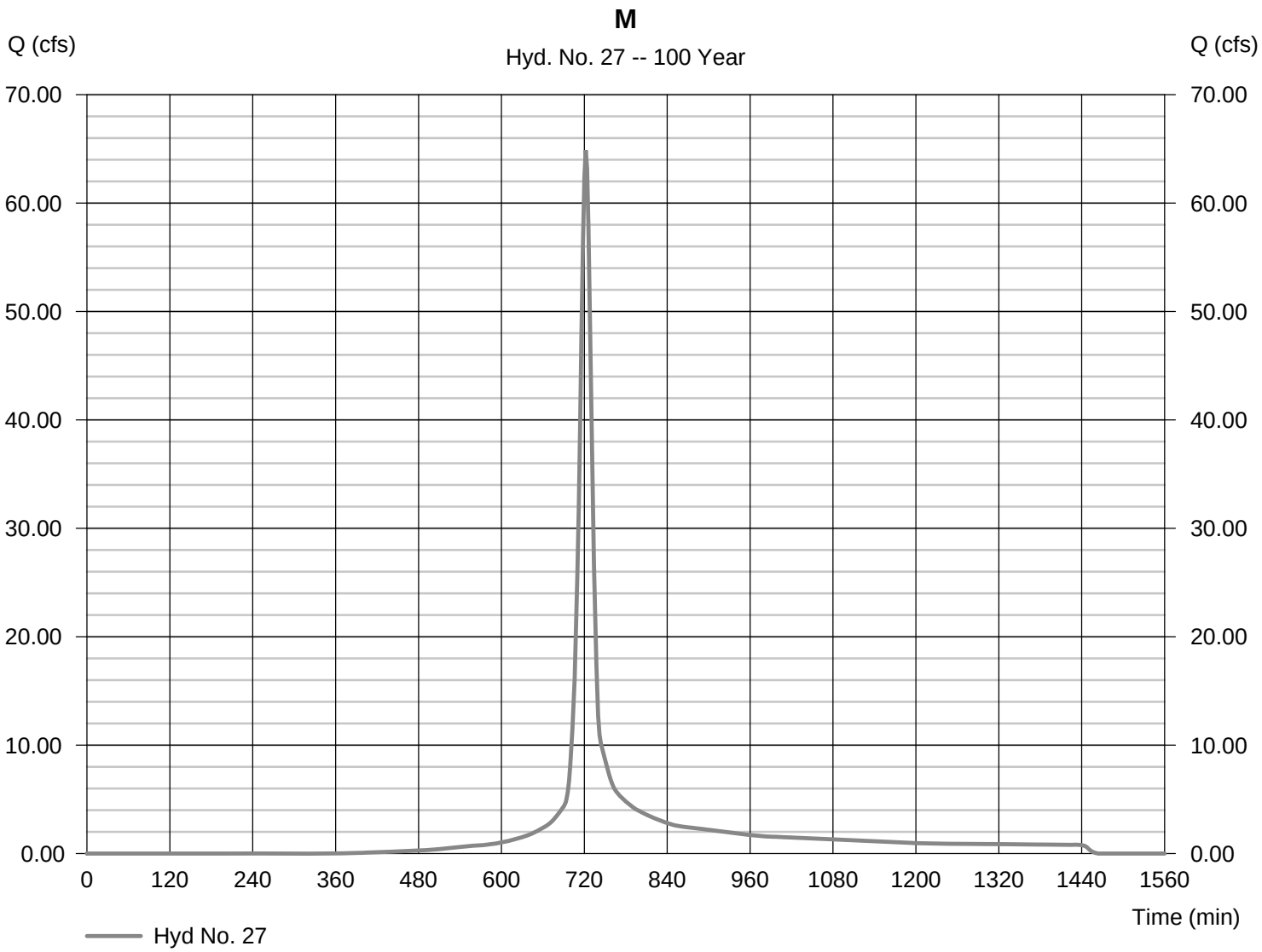
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 27

M

Hydrograph type	=	SCS Runoff	Peak discharge	=	64.88 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	183,259 cuft
Drainage area	=	12.690 ac	Curve number	=	80*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.00 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(6.400 x 98) + (6.290 x 61)] / 12.690



Hydrograph Report

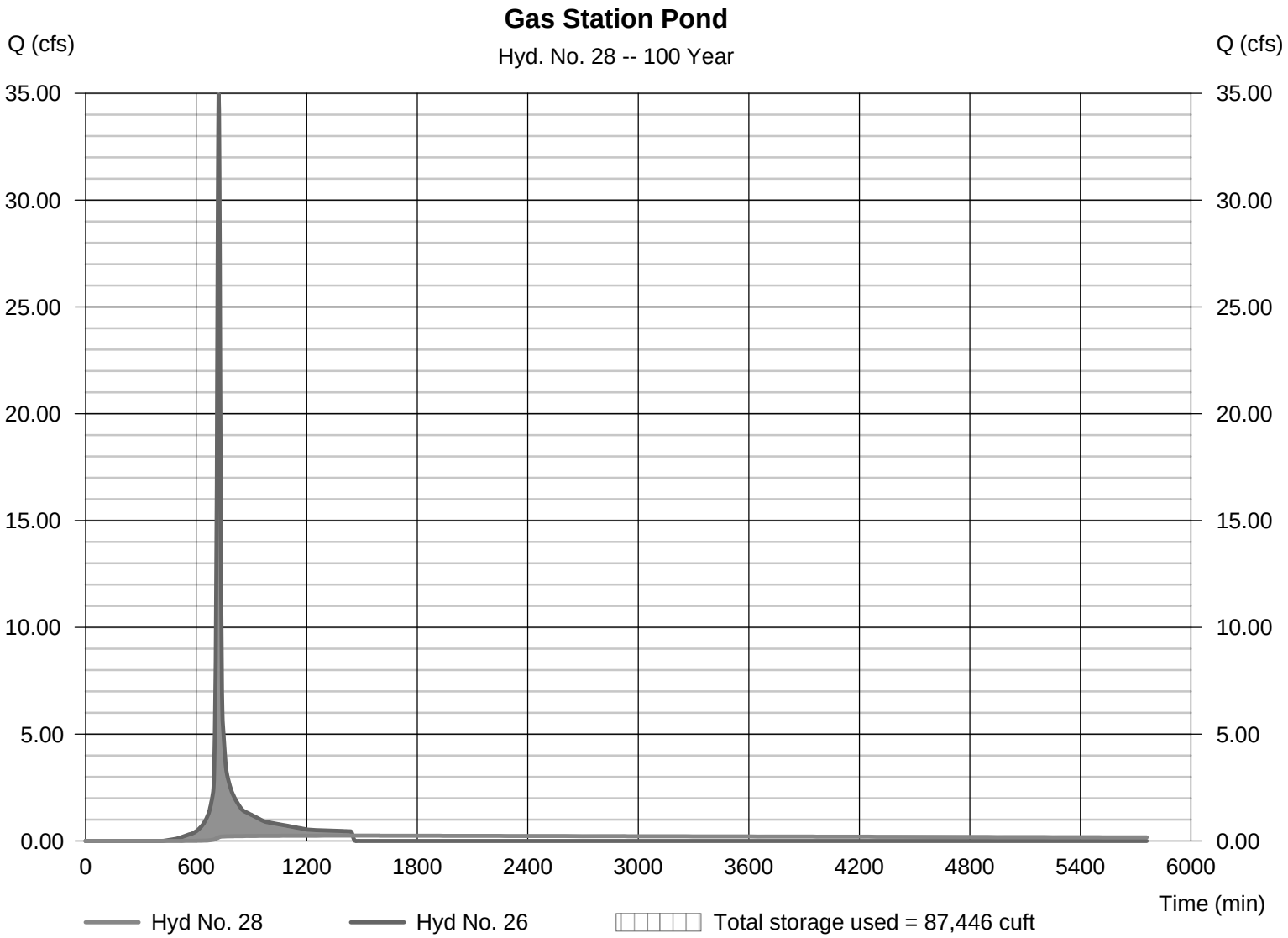
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 28

Gas Station Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.251 cfs
Storm frequency	= 100 yrs	Time to peak	= 1450 min
Time interval	= 2 min	Hyd. volume	= 65,278 cuft
Inflow hyd. No.	= 26 - F	Max. Elevation	= 734.75 ft
Reservoir name	= Gas Station Pond	Max. Storage	= 87,446 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 4 - Gas Station Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 733.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	733.00	45,398	0	0
1.00	734.00	50,401	47,873	47,873
2.00	735.00	55,649	52,998	100,871
3.00	736.00	61,122	58,358	159,229
4.00	737.00	66,820	63,943	223,173
5.00	738.00	72,751	69,757	292,930

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 4.00	0.00	0.00	0.00
Span (in)	= 4.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 733.00	0.00	0.00	0.00
Length (ft)	= 100.00	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

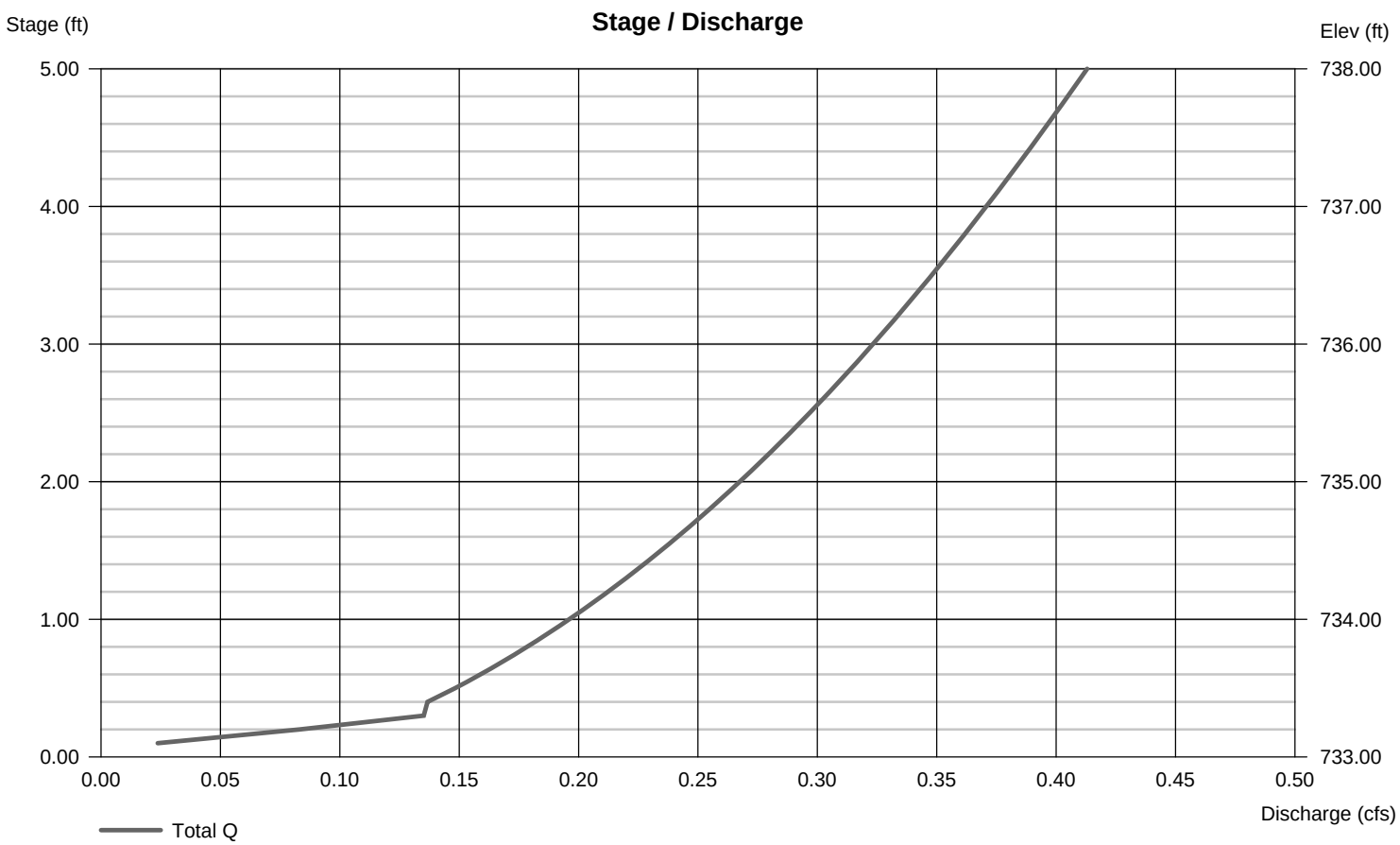
Weir Structures

	[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 Contour)

TW Elev. (ft) = 0.00

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



Hydrograph Report

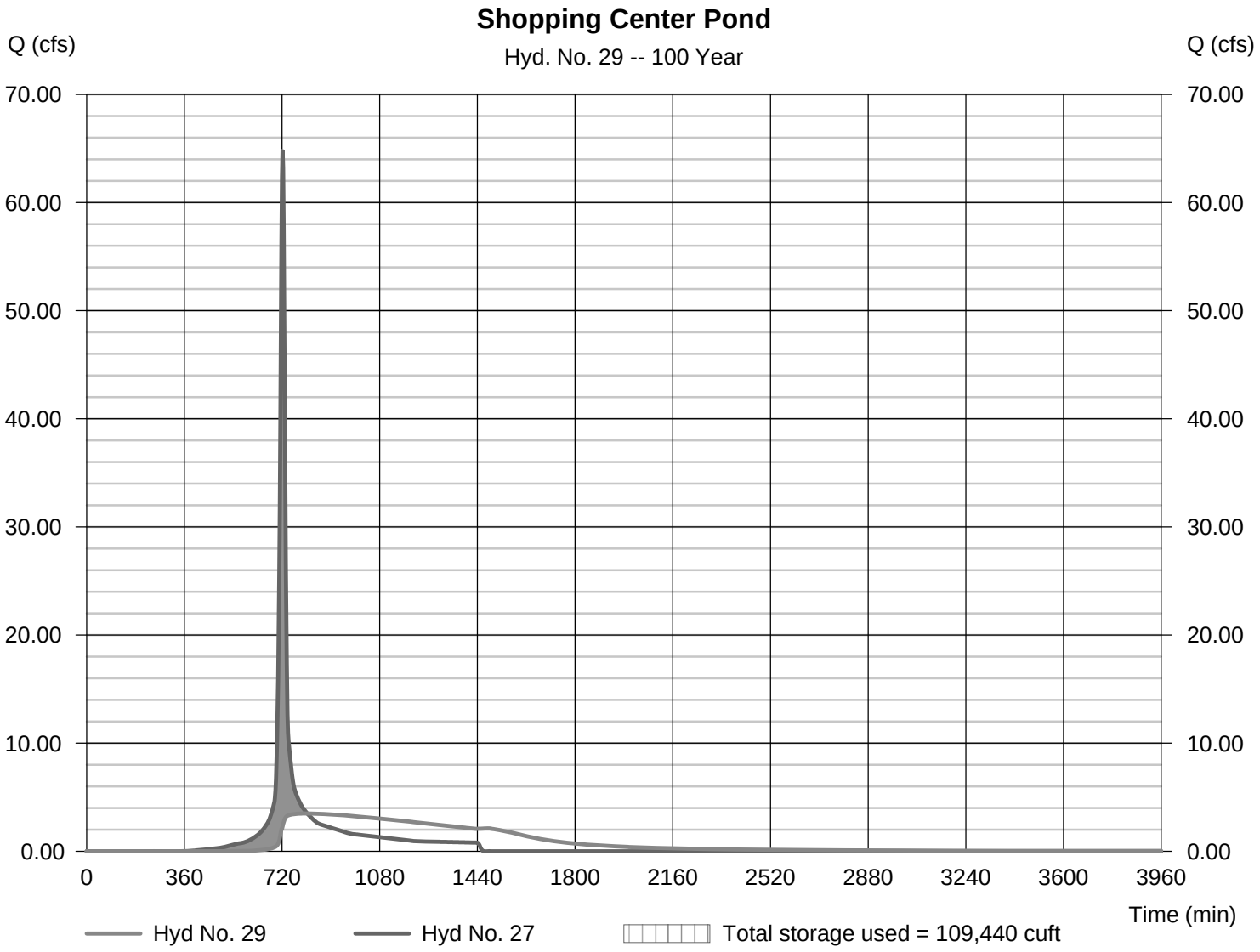
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 29

Shopping Center Pond

Hydrograph type	= Reservoir	Peak discharge	= 3.500 cfs
Storm frequency	= 100 yrs	Time to peak	= 812 min
Time interval	= 2 min	Hyd. volume	= 181,598 cuft
Inflow hyd. No.	= 27 - M	Max. Elevation	= 734.92 ft
Reservoir name	= Shopping Center Pond	Max. Storage	= 109,440 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 5 - Shopping Center Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 733.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	733.00	51,348	0	0
1.00	734.00	57,147	54,216	54,216
2.00	735.00	63,185	60,135	114,351
3.00	736.00	69,449	66,286	180,637
4.00	737.00	75,940	72,663	253,300
5.00	738.00	82,665	79,271	332,571

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)	= 733.00	0.00	0.00	0.00
Length (ft)	= 100.00	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

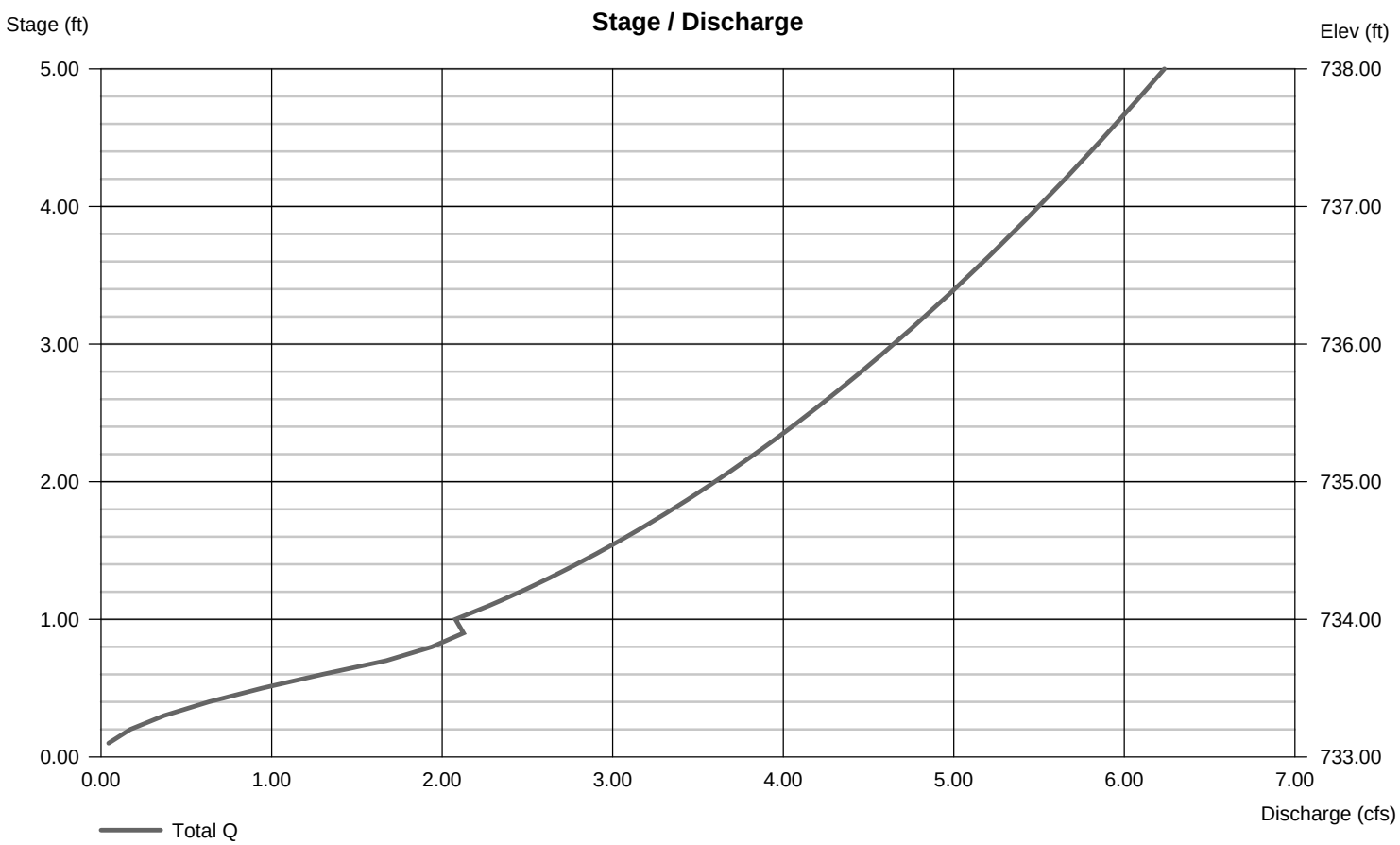
Weir Structures

	[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 Contour)

TW Elev. (ft) = 0.00

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



Hydrograph Report

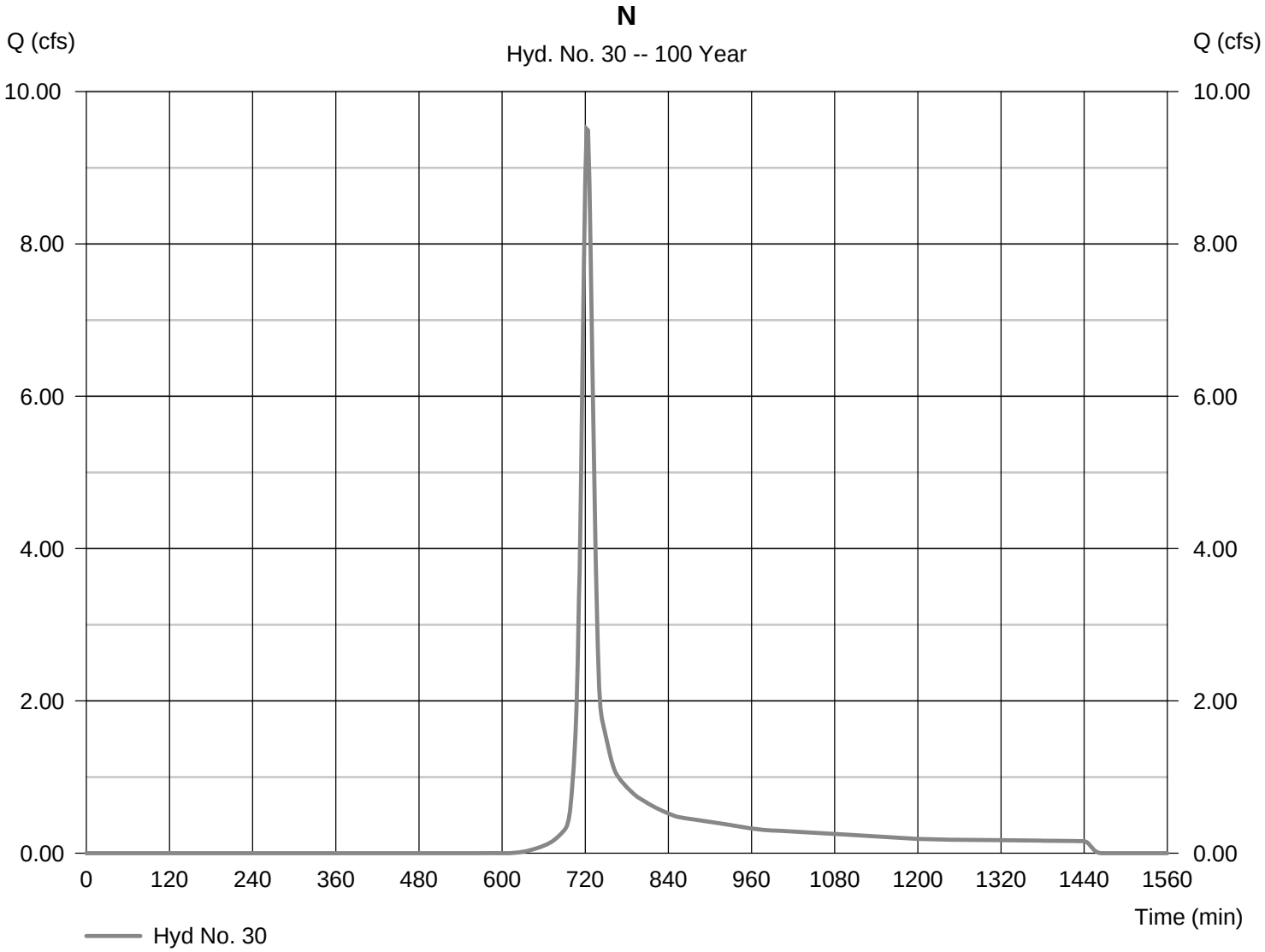
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 30

N

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.509 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	27,294 cuft
Drainage area	=	3.200 ac	Curve number	=	63*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.00 min
Total precip.	=	6.33 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.210 x 98) + (2.990 x 61)] / 3.200



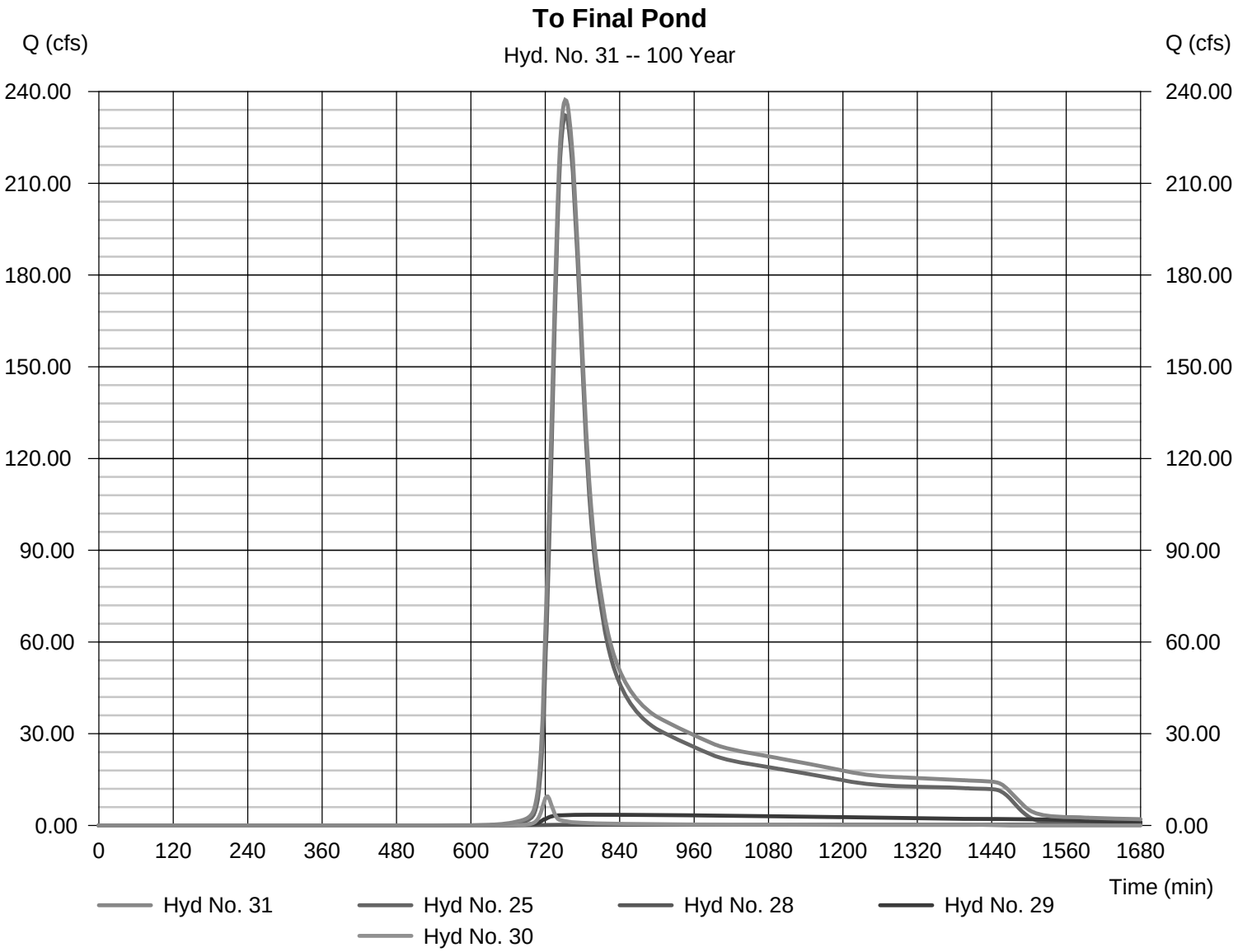
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 31

To Final Pond

Hydrograph type	=	Combine	Peak discharge	=	237.24 cfs
Storm frequency	=	100 yrs	Time to peak	=	752 min
Time interval	=	2 min	Hyd. volume	=	1,994,979 cuft
Inflow hyds.	=	25, 28, 29, 30	Contrib. drain. area	=	3.200 ac



Hydrograph Report

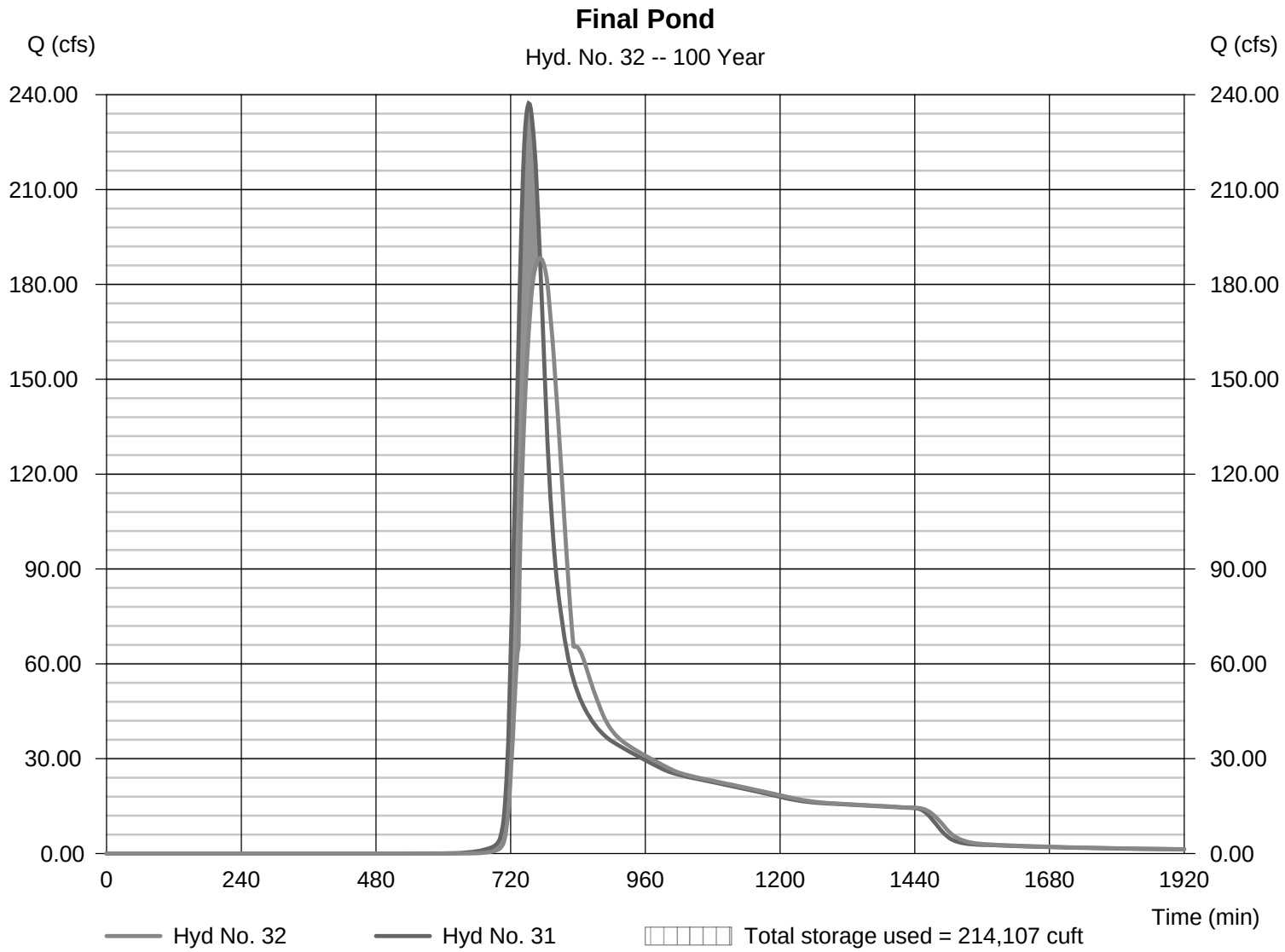
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 32

Final Pond

Hydrograph type	=	Reservoir	Peak discharge	=	188.30 cfs
Storm frequency	=	100 yrs	Time to peak	=	772 min
Time interval	=	2 min	Hyd. volume	=	1,993,665 cuft
Inflow hyd. No.	=	31 - To Final Pond	Max. Elevation	=	739.30 ft
Reservoir name	=	Final Pond	Max. Storage	=	214,107 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 6 - Final Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 731.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	731.00	8,442	0	0
1.00	732.00	11,773	10,060	10,060
2.00	733.00	15,343	13,517	23,578
3.00	734.00	19,138	17,204	40,782
4.00	735.00	23,158	21,114	61,896
5.00	736.00	27,413	25,253	87,149
6.00	737.00	37,657	32,397	119,545
7.00	738.00	40,550	39,091	158,636
8.00	739.00	43,540	42,032	200,668
9.00	740.00	46,648	45,081	245,748

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 54.00	0.00	0.00	0.00
Span (in)	= 54.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 731.00	0.00	0.00	0.00
Length (ft)	= 100.00	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

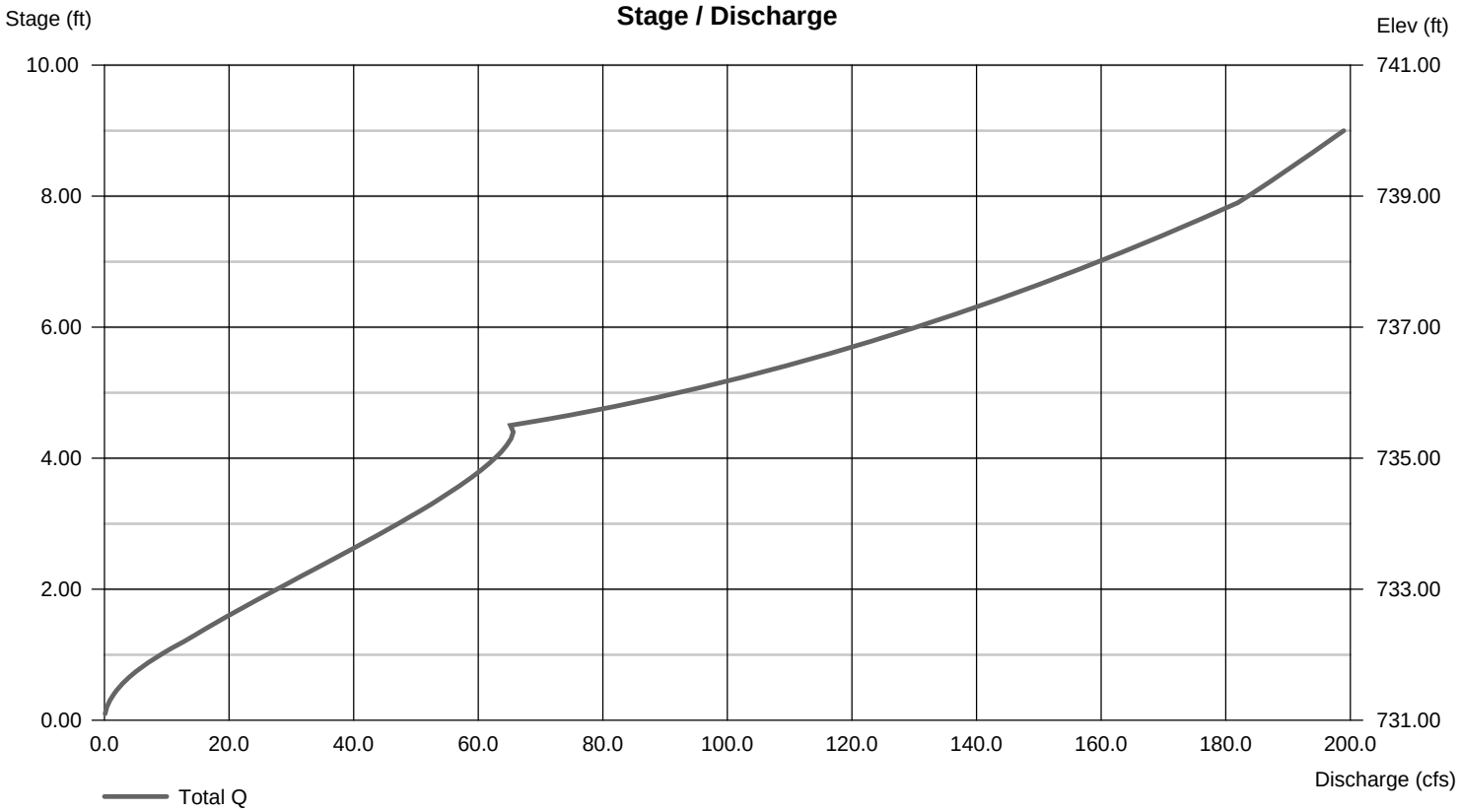
Weir Structures

	[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).



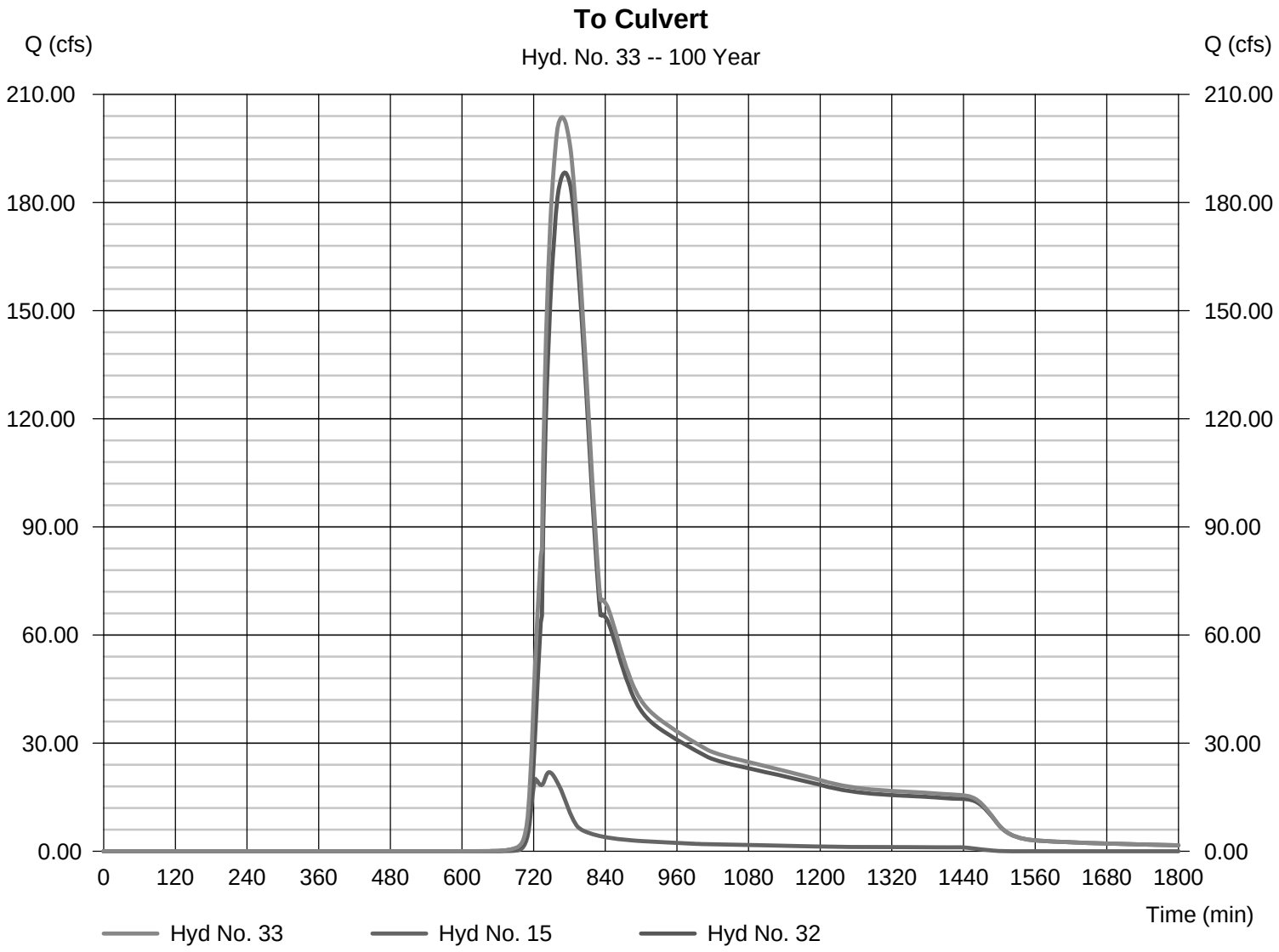
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 33

To Culvert

Hydrograph type	=	Combine	Peak discharge	=	203.65 cfs
Storm frequency	=	100 yrs	Time to peak	=	768 min
Time interval	=	2 min	Hyd. volume	=	2,154,003 cuft
Inflow hyds.	=	15, 32	Contrib. drain. area	=	0.000 ac



Hydrograph Report

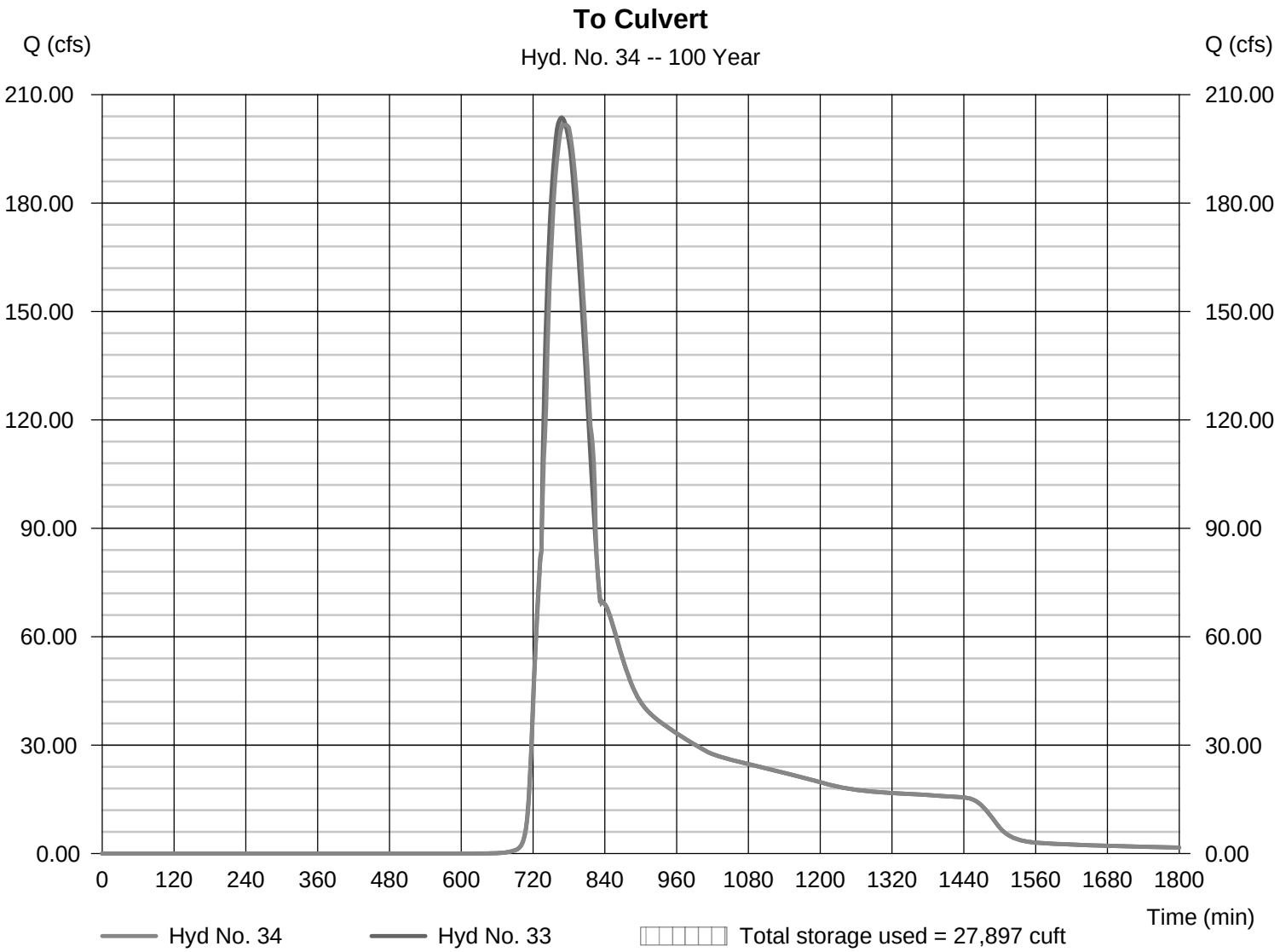
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Hyd. No. 34

To Culvert

Hydrograph type	= Reservoir	Peak discharge	= 201.67 cfs
Storm frequency	= 100 yrs	Time to peak	= 774 min
Time interval	= 2 min	Hyd. volume	= 2,153,983 cuft
Inflow hyd. No.	= 33 - To Culvert	Max. Elevation	= 736.01 ft
Reservoir name	= existing depression	Max. Storage	= 27,897 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Friday, 03 / 8 / 2013

Pond No. 1 - existing depression

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 729.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	729.00	100	0	0
1.00	730.00	300	191	191
2.00	731.00	500	396	587
3.00	732.00	700	597	1,184
4.00	733.00	900	798	1,982
5.00	734.00	1,200	1,046	3,028
6.00	735.00	9,429	4,664	7,692
7.00	736.00	31,928	19,567	27,259
8.00	737.00	81,595	54,849	82,108

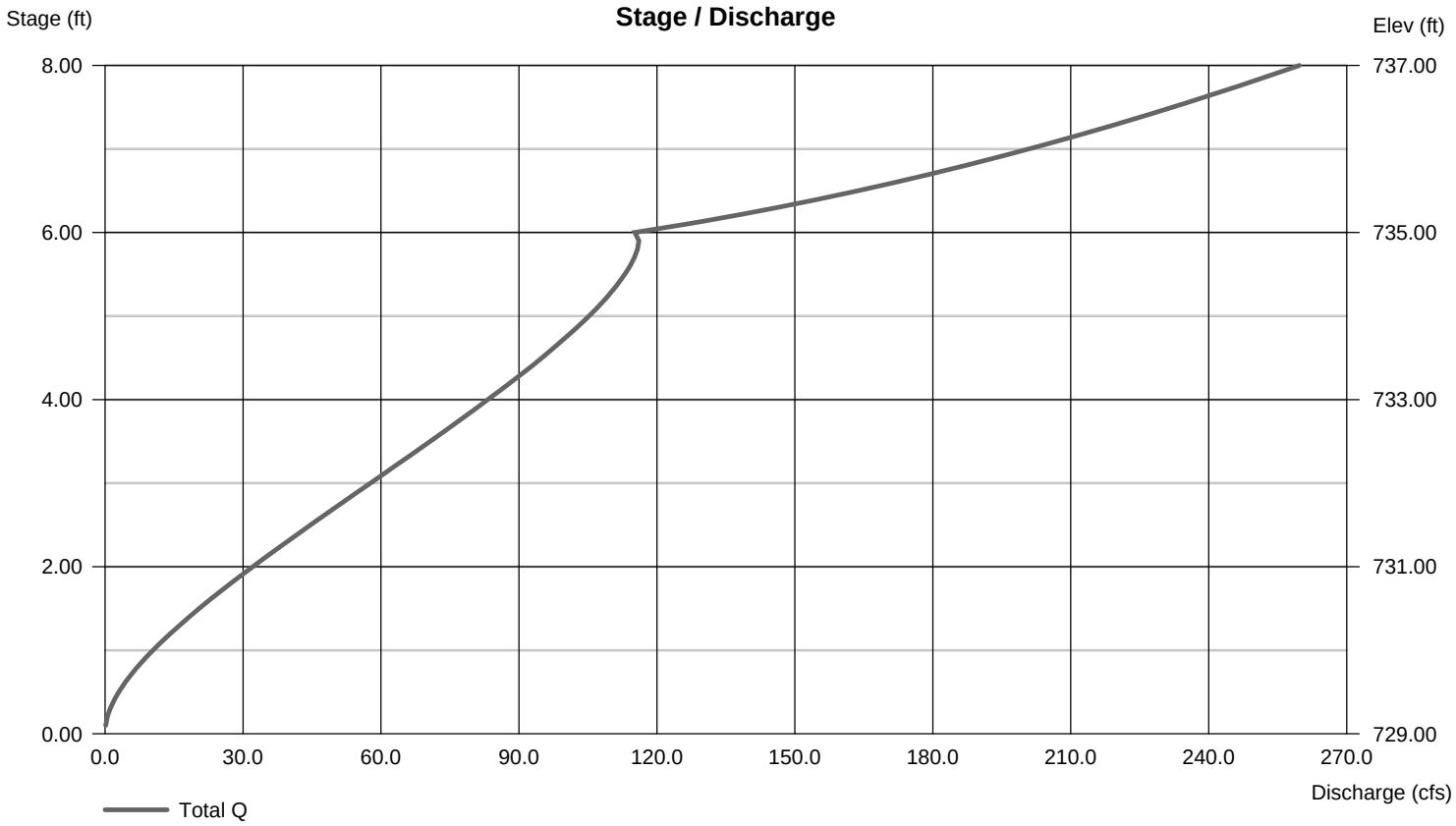
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 72.00	0.00	0.00	0.00
Span (in)	= 72.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 729.00	0.00	0.00	0.00
Length (ft)	= 140.00	0.00	0.00	0.00
Slope (%)	= 0.35	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.82	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 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).