CIVIL ENGINEERING
ENVIRONMENTAL
SURVEYING
LANDSCAPE ARCHITECTURE
GEOTECHNICAL

STORMWATER MANAGEMENT CALCULATIONS

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Celebrating 20 2000-2020
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CN - RUNOFF CURVE NUMBERS (TR55)

Drainage Area	Soil Name HSG	Cover Description	CN	Area (sf)	Area (Ac)	CN*Area	CN (Weighted)
EX-DA	UR(D)	Roof & Concrete	98	105	0.00	0.002	
	Total			105	0.002	0.002	**98**
EX-DA	UR(D)	Open Space (Fair Condition)	84	3,482	0.08	0.067	
	Total			3,482	0.080	0.067	**84**
PROP-DA	UR(D)	Roof & Concrete Gravel	98 91	3,270 317	0.08 0.01	0.074 0.007	
	Total			3,587	0.082	0.080	**97**

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SWM-Design2.gpw

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Tuesday, 03 / 24 / 2020

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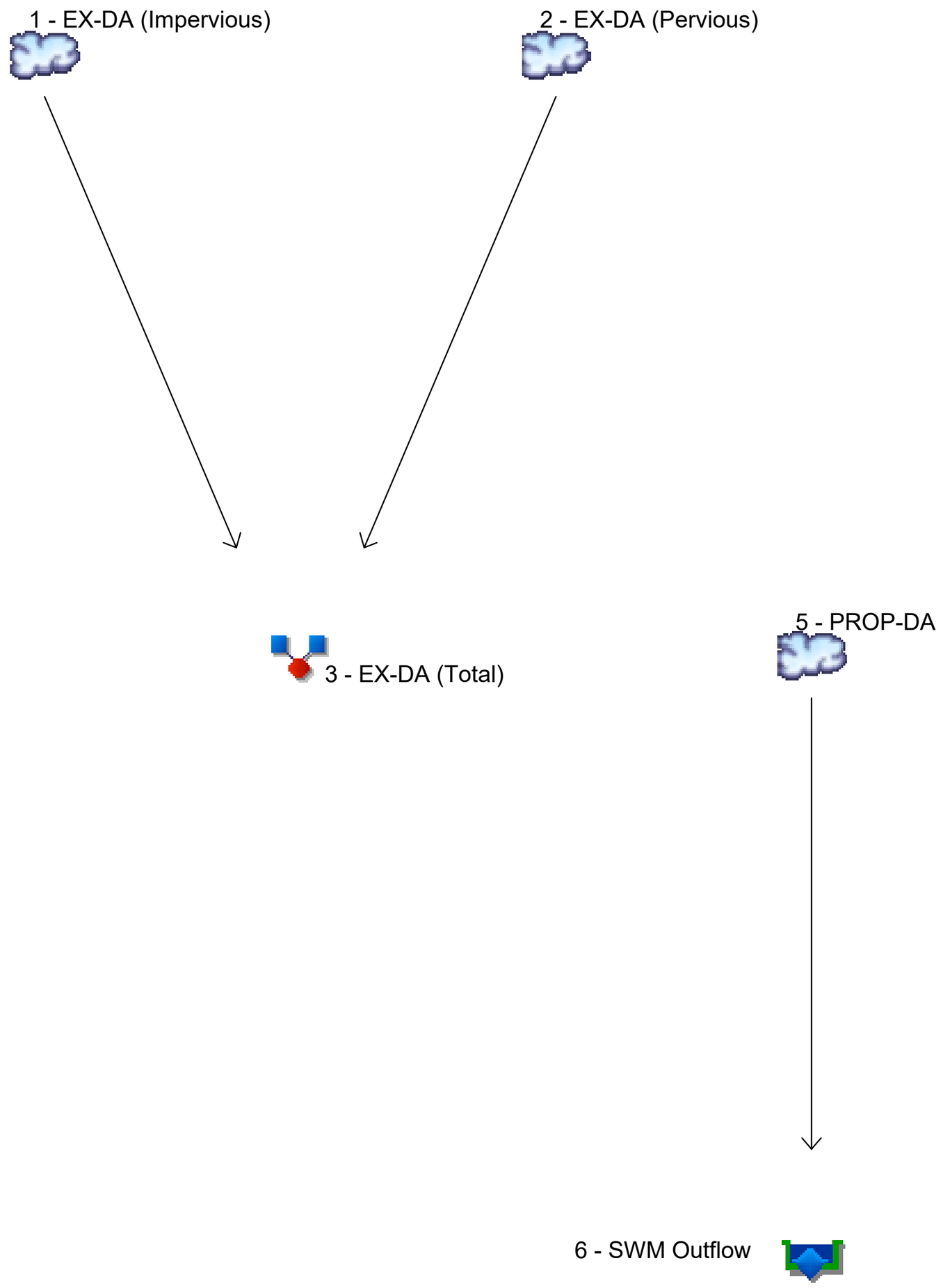
Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020



Legend

Hyd.	Origin	Description
1	SCS Runoff	EX-DA (Impervious)
2	SCS Runoff	EX-DA (Pervious)
3	Combine	EX-DA (Total)
5	SCS Runoff	PROP-DA
6	Reservoir	SWM Outflow

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	0.006	-------	-------	0.009	-------	-------	0.014	EX-DA (Impervious)
2	SCS Runoff	------	-------	0.147	-------	-------	0.270	-------	-------	0.517	EX-DA (Pervious)
3	Combine	1, 2	-------	0.153	-------	-------	0.279	-------	-------	0.532	EX-DA (Total)
5	SCS Runoff	------	-------	0.225	-------	-------	0.349	-------	-------	0.590	PROP-DA
6	Reservoir	5	-------	0.140	-------	-------	0.270	-------	-------	0.514	SWM Outflow

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

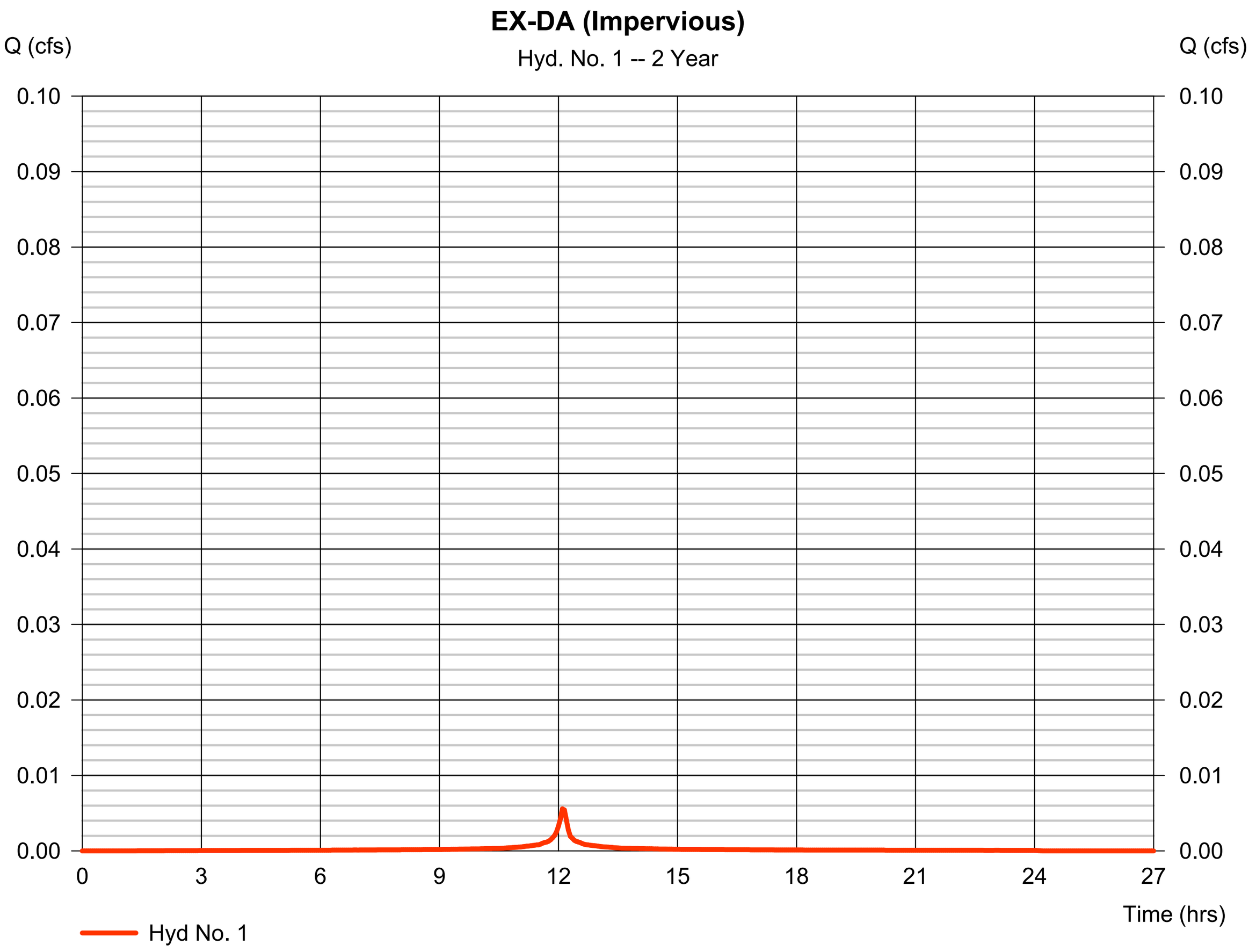
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.006	3	726	22	------	------	------	EX-DA (Impervious)
2	SCS Runoff	0.147	3	729	504	------	------	------	EX-DA (Pervious)
3	Combine	0.153	3	729	526	1, 2	------	------	EX-DA (Total)
5	SCS Runoff	0.225	3	726	853	------	------	------	PROP-DA
6	Reservoir	0.140	3	729	107	5	100.96	92.6	SWM Outflow

Hydrograph Report

Hyd. No. 1

EX-DA (Impervious)

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.006 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	22 cuft
Drainage area	=	0.002 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.40 in	Distribution	=	Custom
Storm duration	=	R:\Hydroflow Standards\NOAA_Data.tcd	Shape factor	=	484

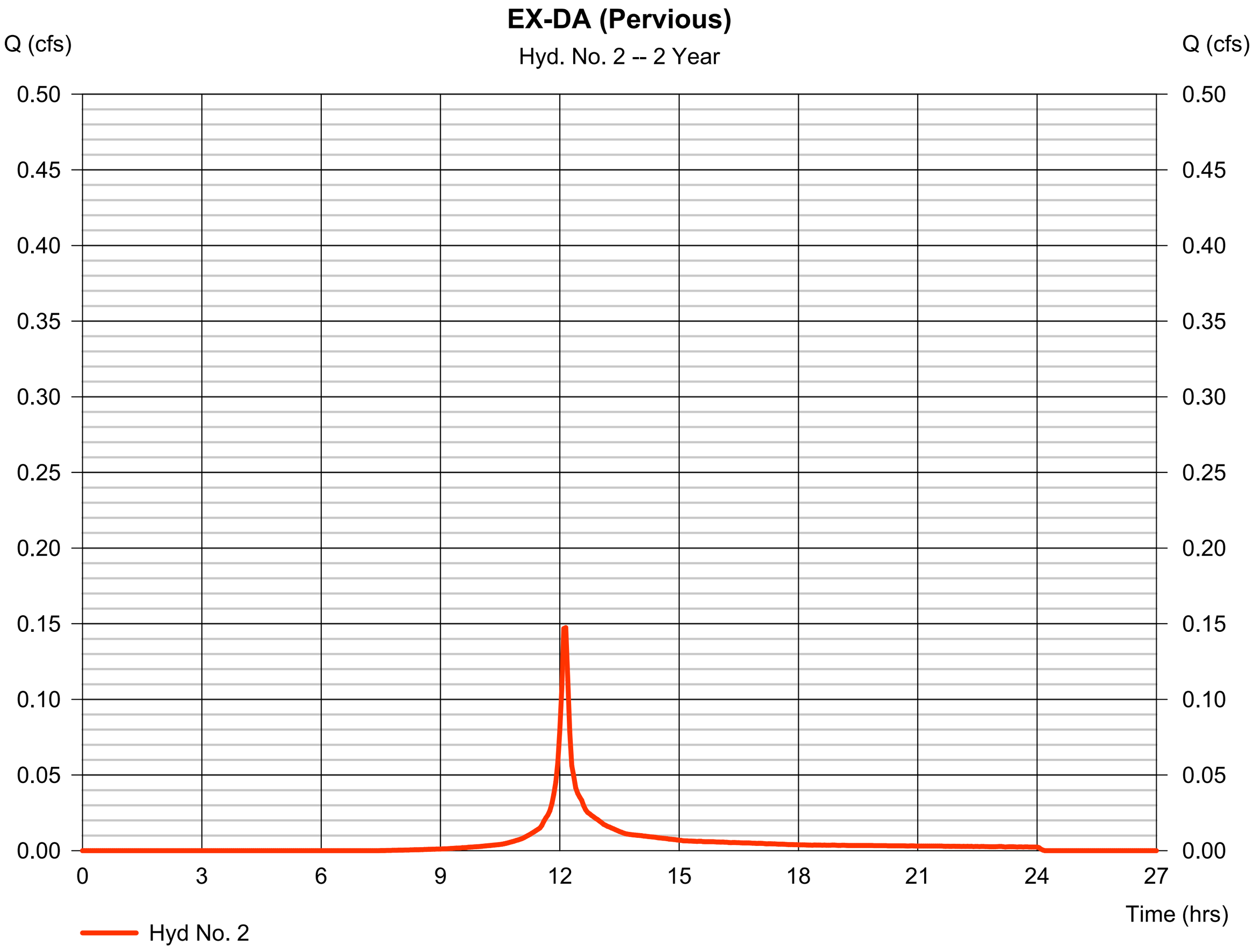


Hydrograph Report

Hyd. No. 2

EX-DA (Pervious)

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.147 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.15 hrs
Time interval	=	3 min	Hyd. volume	=	504 cuft
Drainage area	=	0.080 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.40 in	Distribution	=	Custom
Storm duration	=	R:\Hydroflow Standards\NOAA Data\1 hr.tcd	Shape factor	=	484

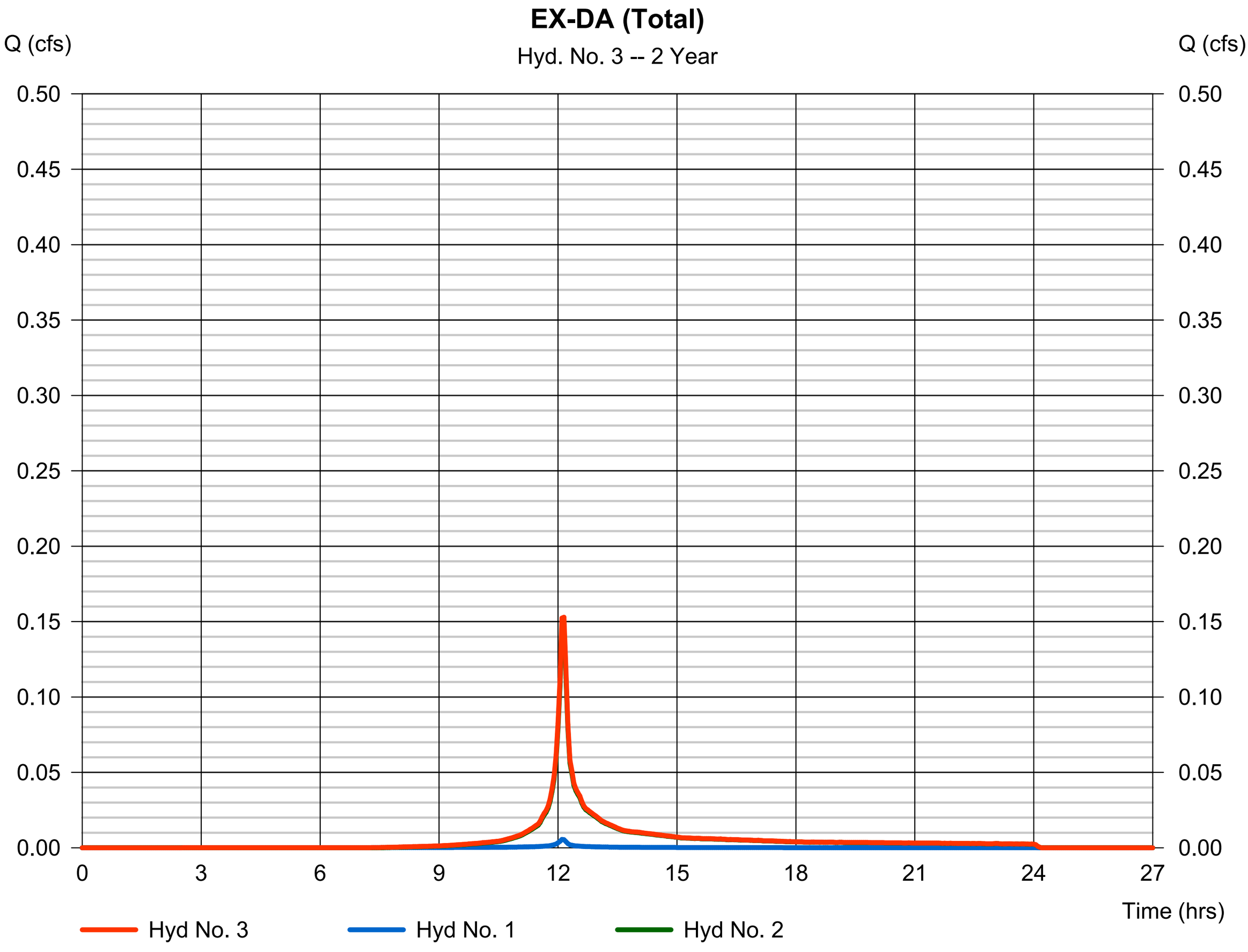


Hydrograph Report

Hyd. No. 3

EX-DA (Total)

Hydrograph type	=	Combine	Peak discharge	=	0.153 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.15 hrs
Time interval	=	3 min	Hyd. volume	=	526 cuft
Inflow hyds.	=	1, 2	Contrib. drain. area	=	0.082 ac

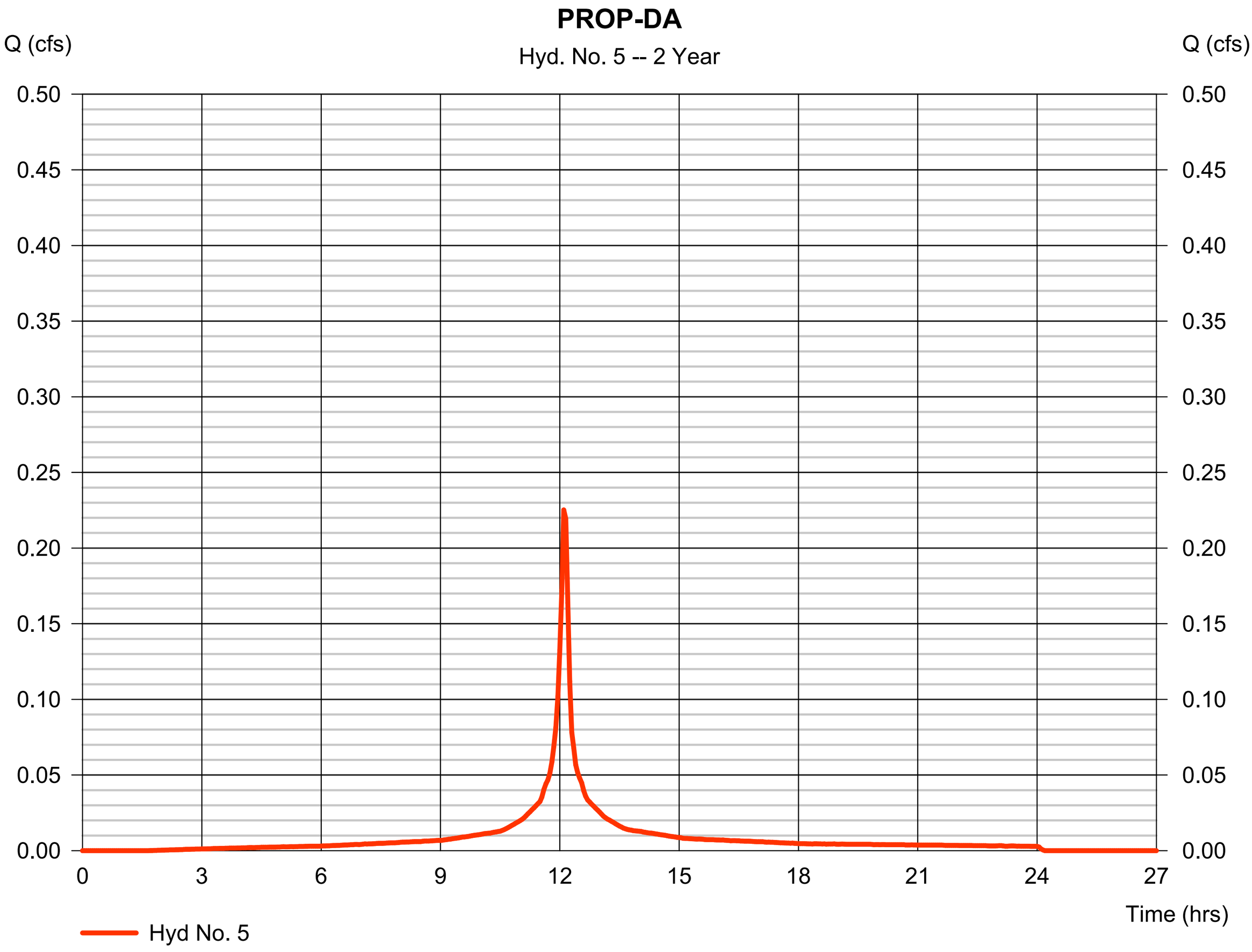


Hydrograph Report

Hyd. No. 5

PROP-DA

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.225 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	853 cuft
Drainage area	=	0.082 ac	Curve number	=	97
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	3.40 in	Distribution	=	Custom
Storm duration	=	R:\Hydroflow Standards\NOAA Data\24hr.cd	Shape factor	=	484



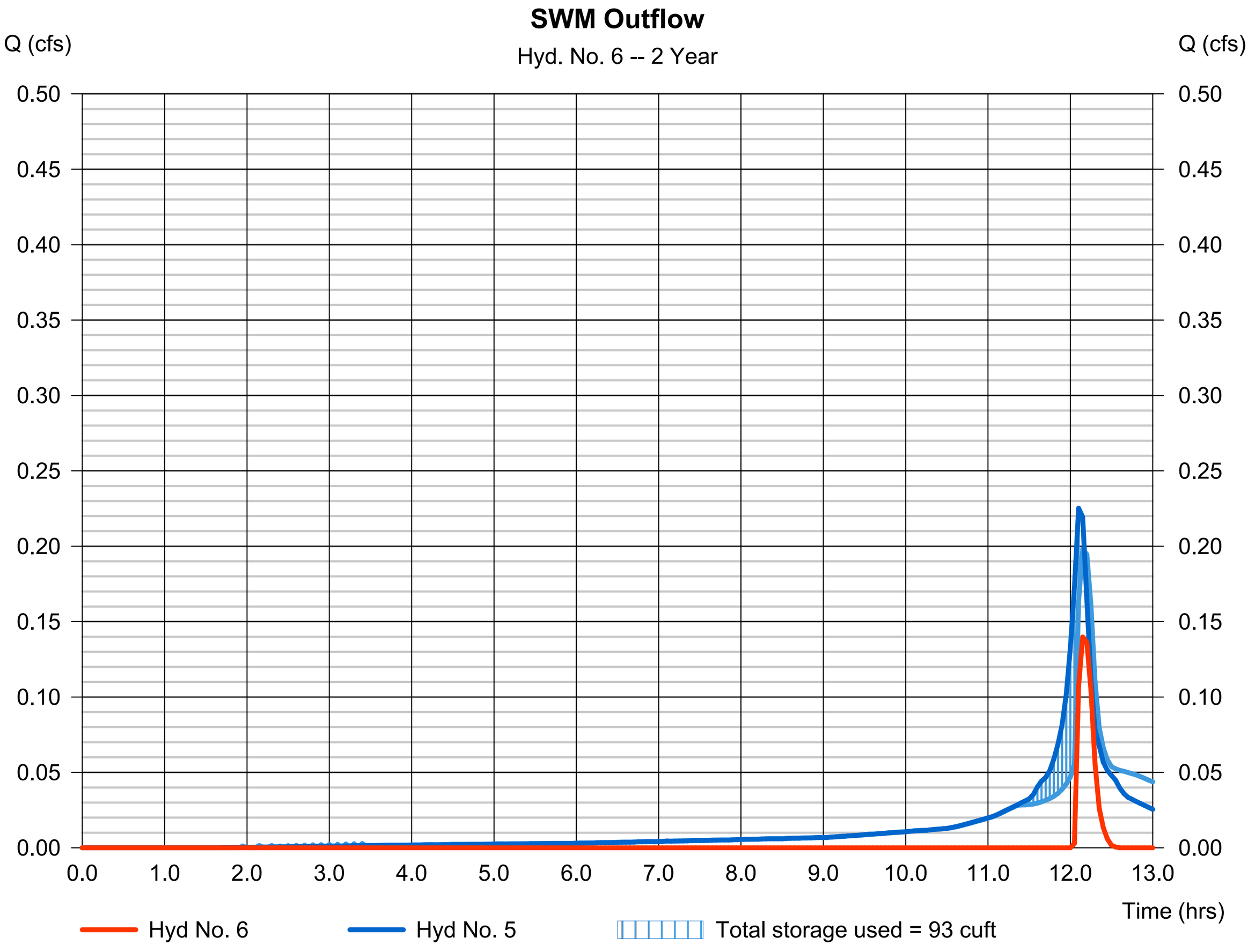
Hydrograph Report

Hyd. No. 6

SWM Outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.140 cfs
Storm frequency	=	2 yrs	Time to peak	=	12.15 hrs
Time interval	=	3 min	Hyd. volume	=	107 cuft
Inflow hyd. No.	=	5 - PROP-DA	Max. Elevation	=	100.96 ft
Reservoir name	=	U/G Chamber	Max. Storage	=	93 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Tuesday, 03 / 24 / 2020

Pond No. 1 - U/G Chamber

Pond Data

UG Chambers -Invert elev. = 100.30 ft, Rise x Span = 1.00 x 1.00 ft, Barrel Len = 40.00 ft, No. Barrels = 1, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 99.30 ft, Width = 3.00 ft, Height = 2.75 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	99.30	n/a	0	0
0.28	99.58	n/a	13	13
0.55	99.85	n/a	13	26
0.82	100.13	n/a	13	40
1.10	100.40	n/a	14	54
1.38	100.68	n/a	19	72
1.65	100.95	n/a	20	92
1.92	101.23	n/a	18	111
2.20	101.50	n/a	14	124
2.48	101.78	n/a	13	138
2.75	102.05	n/a	13	151

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 6.00	2.50	Inactive	0.00
Span (in)	= 6.00	2.50	0.00	0.00
No. Barrels	= 1	2	1	0
Invert El. (ft)	= 100.55	100.60	0.00	0.00
Length (ft)	= 70.00	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	2.00	Inactive	Inactive
Crest El. (ft)	= 101.70	101.30	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 10.000 (by Wet area)
TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	99.30	0.00	0.00	---	---	0.00	0.00	---	---	0.000	---	0.000
0.28	13	99.58	0.00	0.00	---	---	0.00	0.00	---	---	0.033	---	0.033
0.55	26	99.85	0.00	0.00	---	---	0.00	0.00	---	---	0.038	---	0.038
0.82	40	100.13	0.00	0.00	---	---	0.00	0.00	---	---	0.043	---	0.043
1.10	54	100.40	0.00	0.00	---	---	0.00	0.00	---	---	0.048	---	0.048
1.38	72	100.68	0.02 ic	0.02 ic	---	---	0.00	0.00	---	---	0.053	---	0.074
1.65	92	100.95	0.14 ic	0.14 ic	---	---	0.00	0.00	---	---	0.058	---	0.197
1.92	111	101.23	0.21 ic	0.21 ic	---	---	0.00	0.00	---	---	0.063	---	0.269
2.20	124	101.50	0.51 oc	0.08 ic	---	---	0.00	0.43 s	---	---	0.069	---	0.581
2.48	138	101.78	0.62 oc	0.02 ic	---	---	0.20 s	0.39 s	---	---	0.074	---	0.688
2.75	151	102.05	0.69 oc	0.00 ic	---	---	0.38 s	0.22 s	---	---	0.079	---	0.684

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

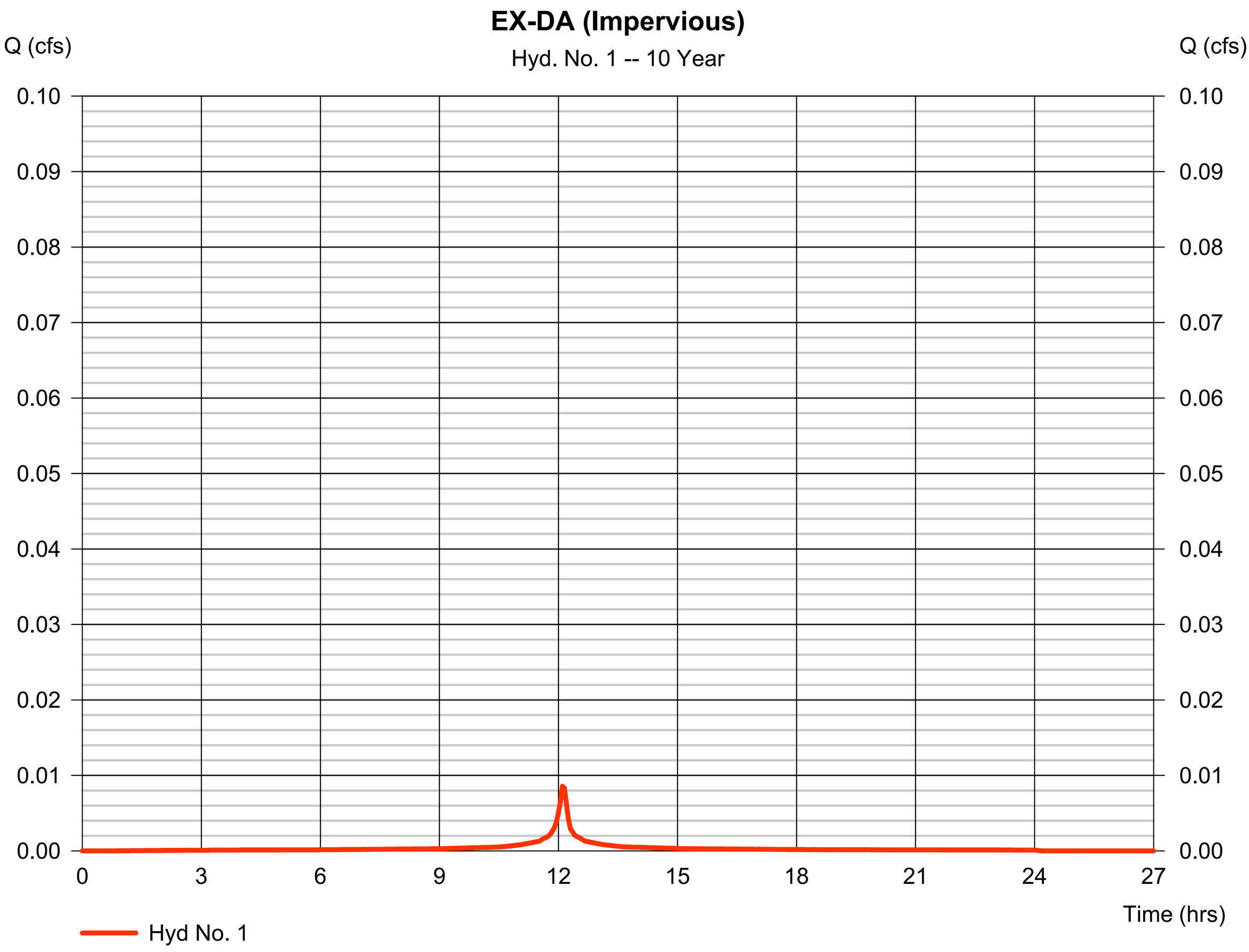
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.009	3	726	34	------	------	------	EX-DA (Impervious)
2	SCS Runoff	0.270	3	726	938	------	------	------	EX-DA (Pervious)
3	Combine	0.279	3	726	972	1, 2	------	------	EX-DA (Total)
5	SCS Runoff	0.349	3	726	1,350	------	------	------	PROP-DA
6	Reservoir	0.270	3	729	286	5	101.34	116	SWM Outflow

Hydrograph Report

Hyd. No. 1

EX-DA (Impervious)

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.009 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	34 cuft
Drainage area	=	0.002 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	5.19 in	Distribution	=	Custom
Storm duration	=	R:\Hydroflow Standards\NOAA_Data.tcd	Shape factor	=	484

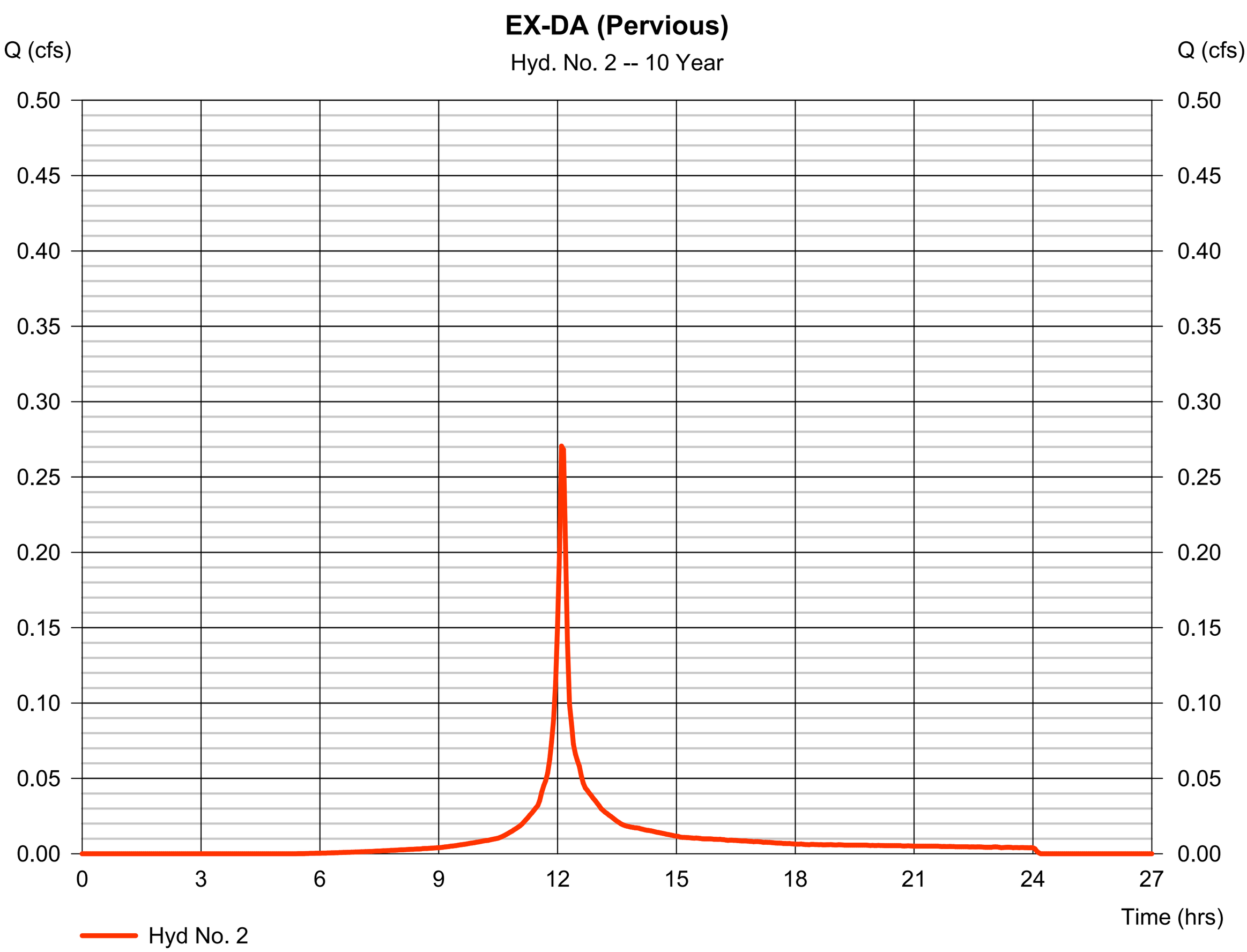


Hydrograph Report

Hyd. No. 2

EX-DA (Pervious)

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.270 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	938 cuft
Drainage area	=	0.080 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	5.19 in	Distribution	=	Custom
Storm duration	=	R:\Hydroflow Standards\NOAA Data\1 hr.tcd	Shape factor	=	484

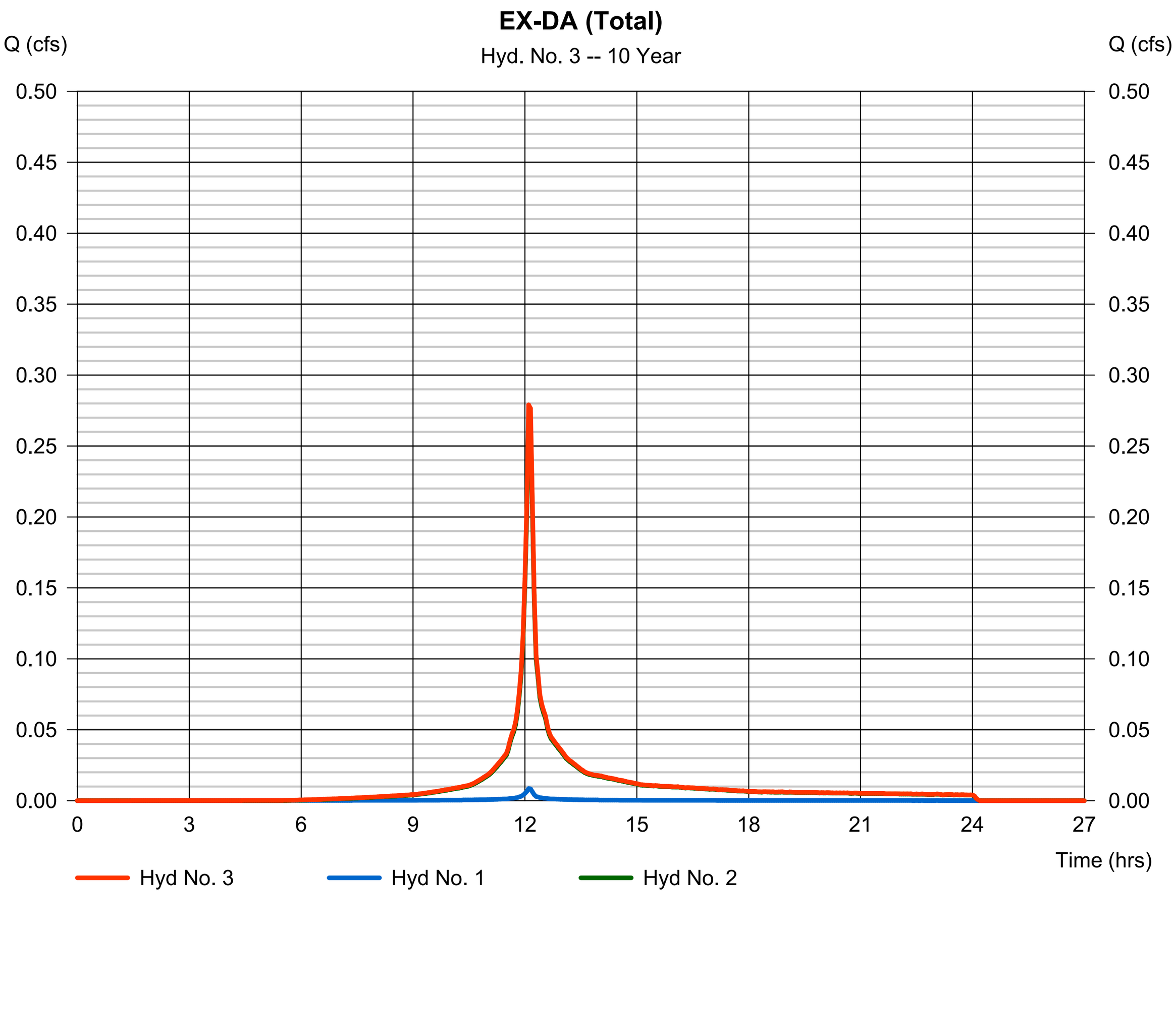


Hydrograph Report

Hyd. No. 3

EX-DA (Total)

Hydrograph type	= Combine	Peak discharge	= 0.279 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 972 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 0.082 ac

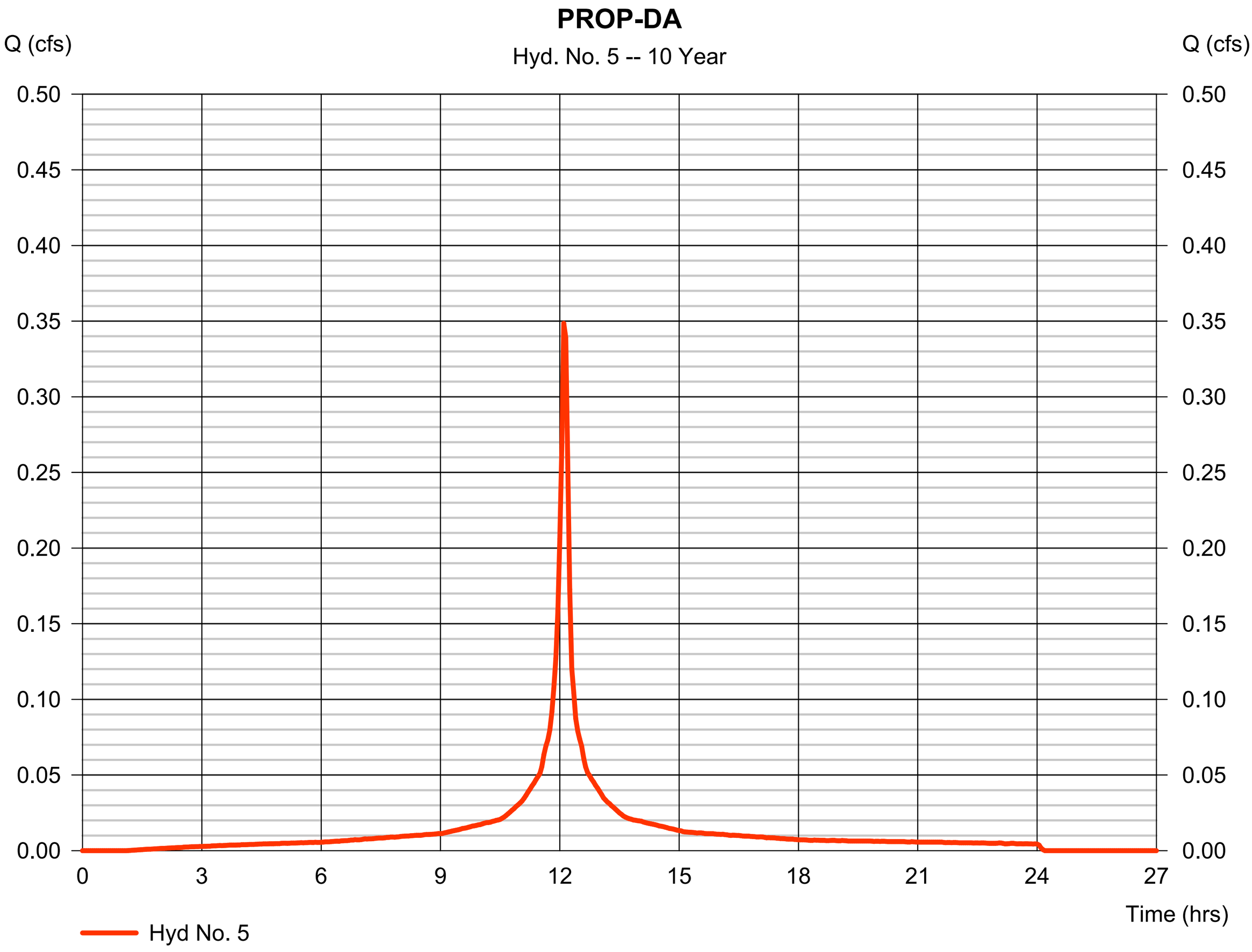


Hydrograph Report

Hyd. No. 5

PROP-DA

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.349 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	1,350 cuft
Drainage area	=	0.082 ac	Curve number	=	97
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	5.19 in	Distribution	=	Custom
Storm duration	=	R:\Hydroflow Standards\NOAA_Data.tcd	Shape factor	=	484



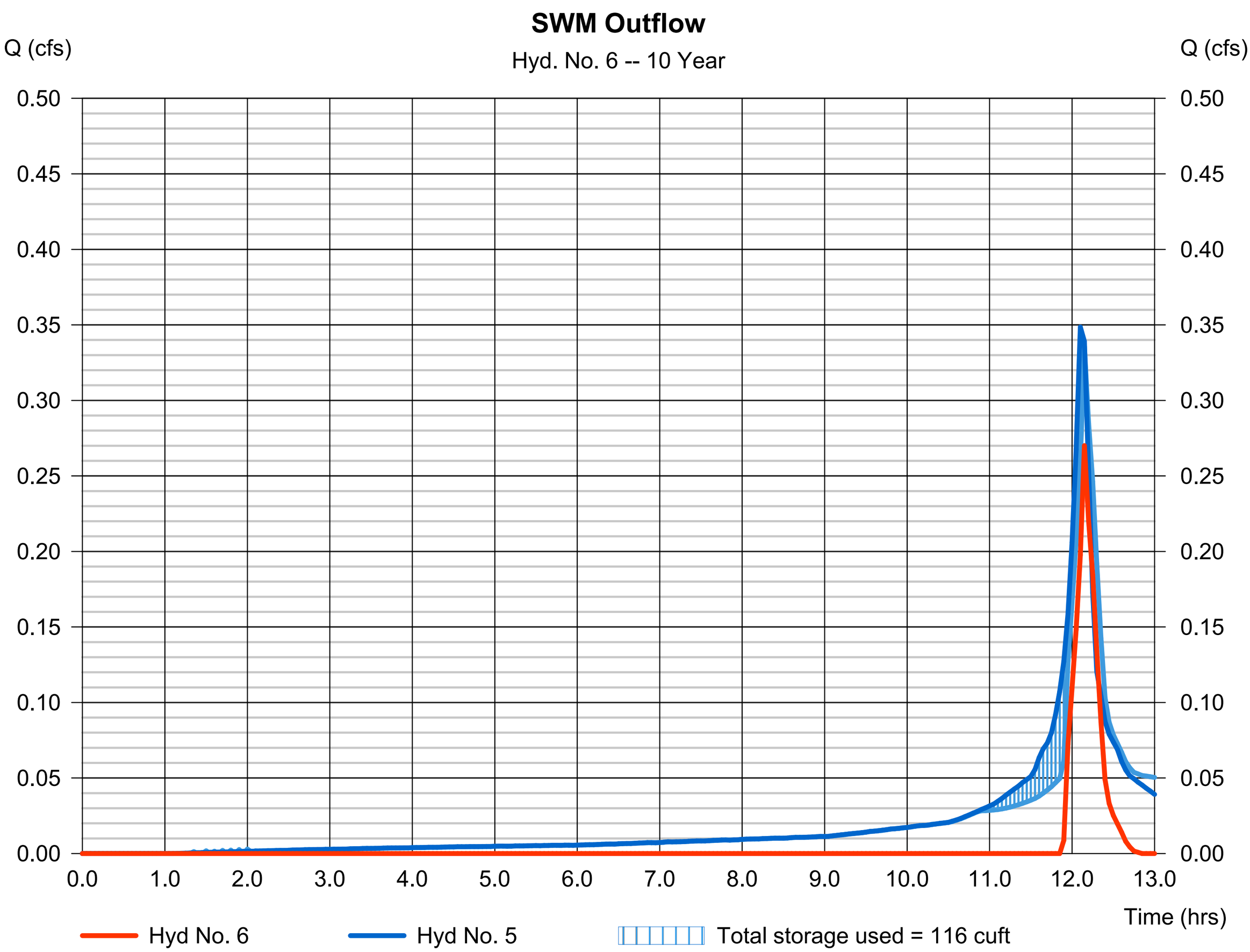
Hydrograph Report

Hyd. No. 6

SWM Outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.270 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.15 hrs
Time interval	=	3 min	Hyd. volume	=	286 cuft
Inflow hyd. No.	=	5 - PROP-DA	Max. Elevation	=	101.34 ft
Reservoir name	=	U/G Chamber	Max. Storage	=	116 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

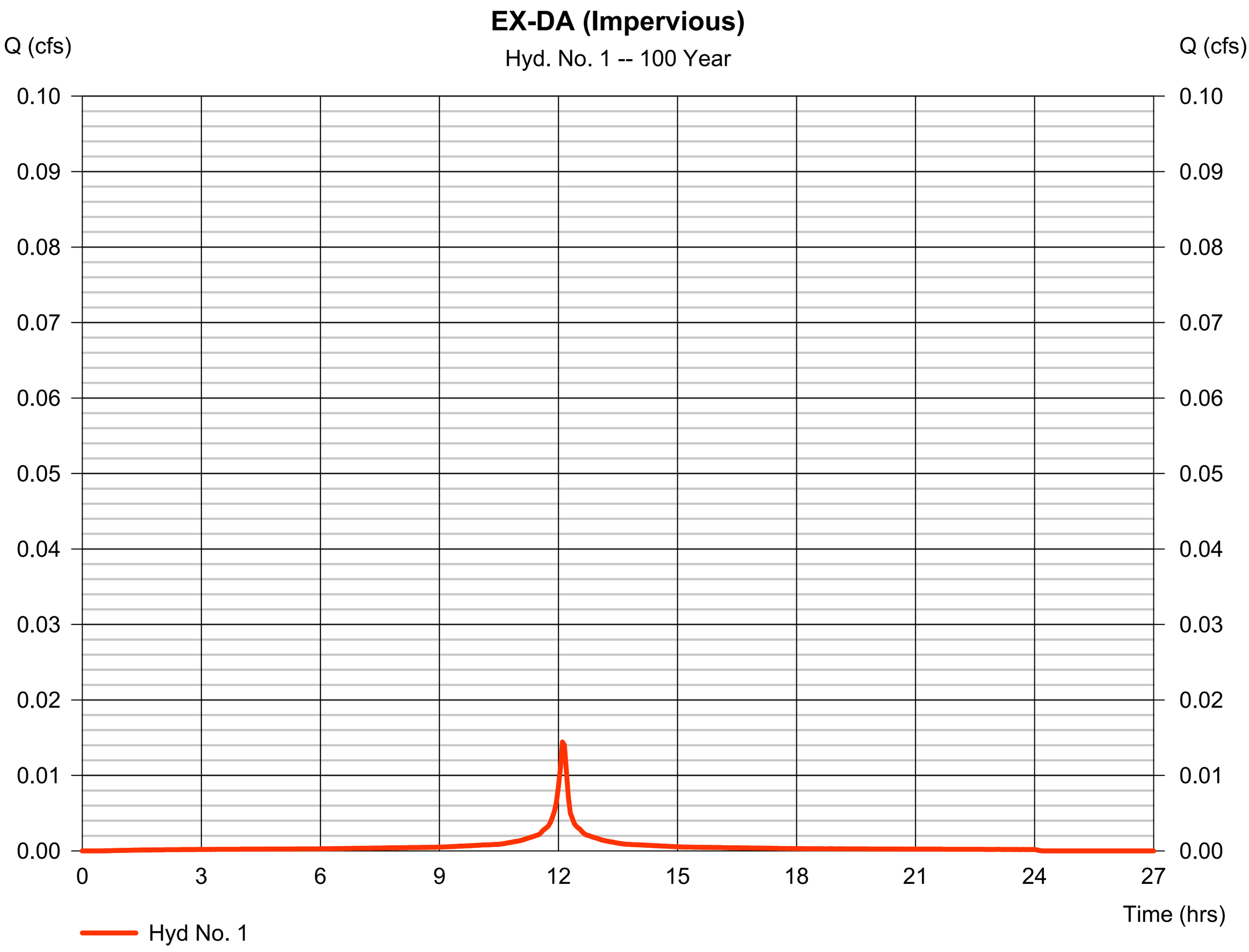
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.014	3	726	58	------	------	------	EX-DA (Impervious)
2	SCS Runoff	0.517	3	726	1,848	------	------	------	EX-DA (Pervious)
3	Combine	0.532	3	726	1,906	1, 2	------	------	EX-DA (Total)
5	SCS Runoff	0.590	3	726	2,333	------	------	------	PROP-DA
6	Reservoir	0.514	3	729	730	5	101.50	125	SWM Outflow

Hydrograph Report

Hyd. No. 1

EX-DA (Impervious)

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.014 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	58 cuft
Drainage area	=	0.002 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	8.72 in	Distribution	=	Custom
Storm duration	=	R:\Hydroflow Standards\NOAA_1.tcd	Shape factor	=	484

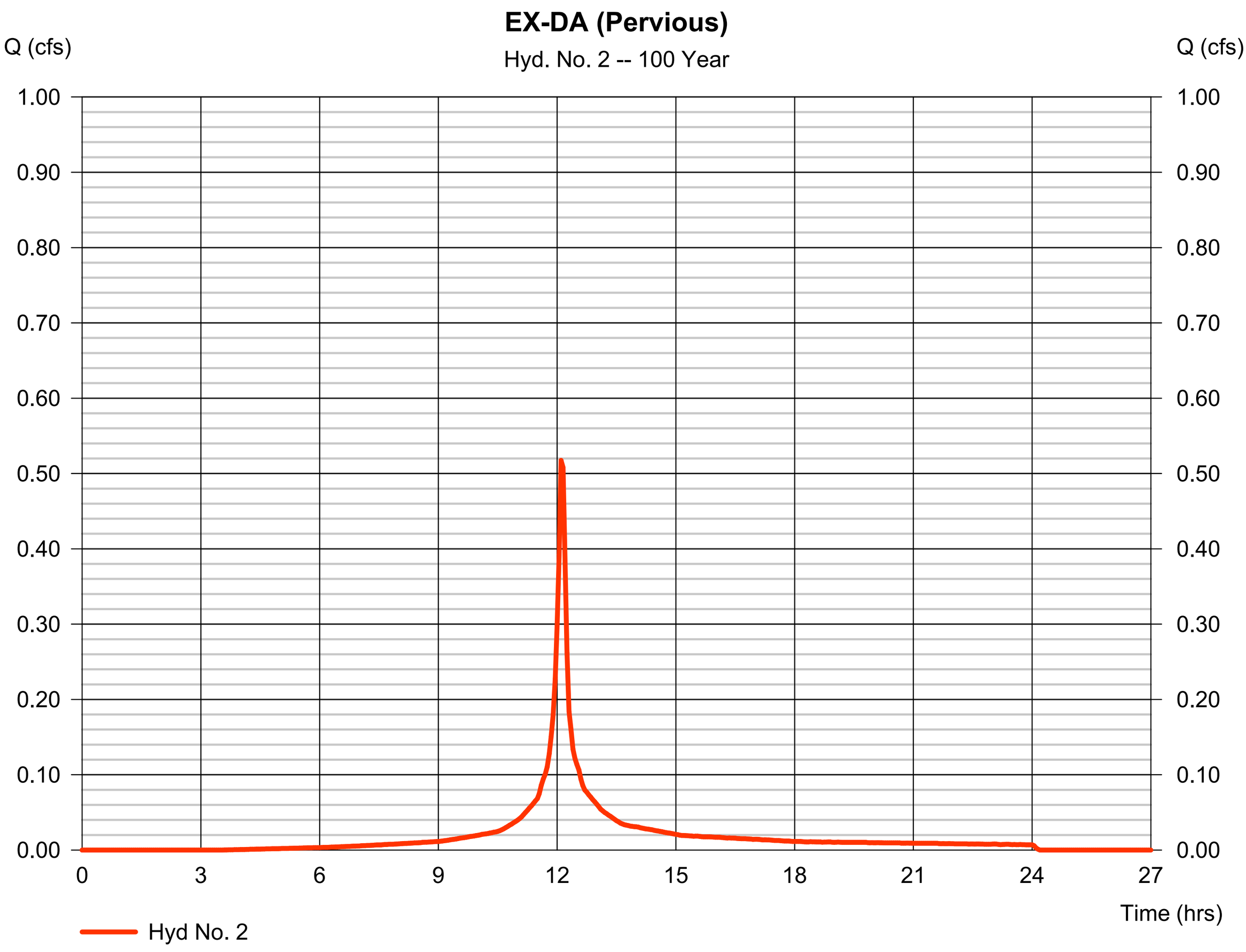


Hydrograph Report

Hyd. No. 2

EX-DA (Pervious)

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.517 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	1,848 cuft
Drainage area	=	0.080 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	8.72 in	Distribution	=	Custom
Storm duration	=	R:\Hydroflow Standards\NOAA Data\100_1hr.csv	Shape factor	=	484

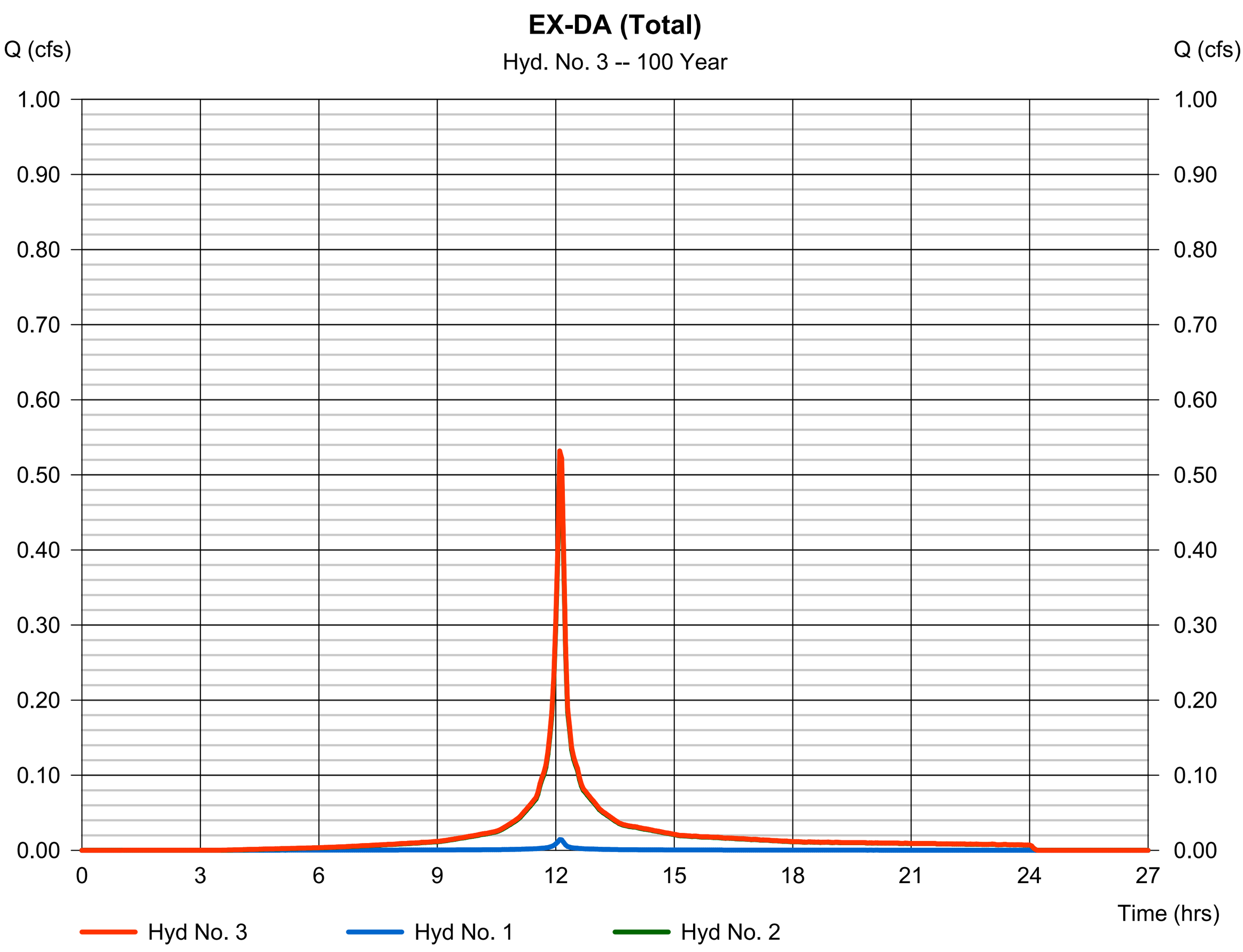


Hydrograph Report

Hyd. No. 3

EX-DA (Total)

Hydrograph type	= Combine	Peak discharge	= 0.532 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 3 min	Hyd. volume	= 1,906 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 0.082 ac

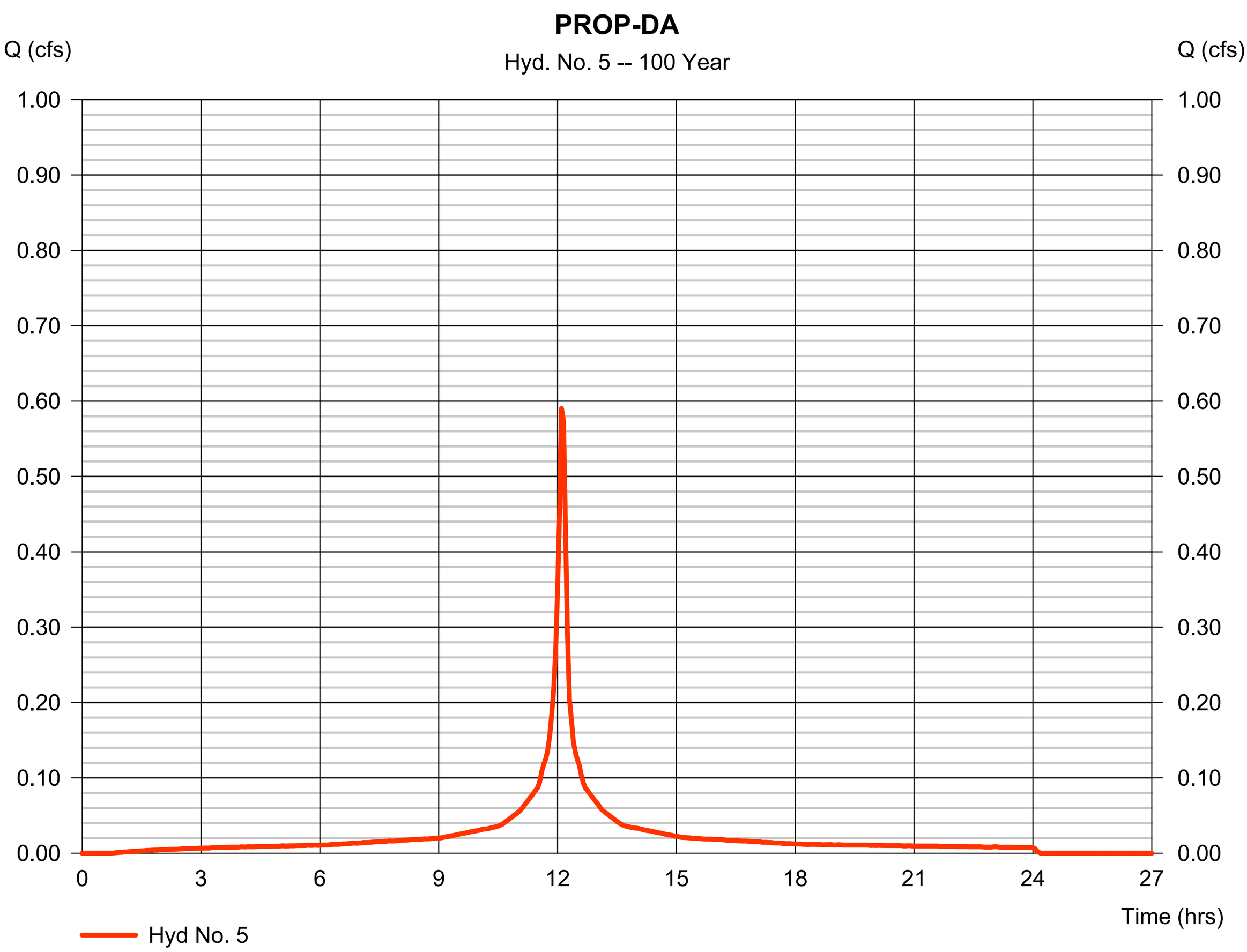


Hydrograph Report

Hyd. No. 5

PROP-DA

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.590 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	3 min	Hyd. volume	=	2,333 cuft
Drainage area	=	0.082 ac	Curve number	=	97
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	8.72 in	Distribution	=	Custom
Storm duration	=	R:\Hydroflow Standards\NOAA_Data.tcd	Shape factor	=	484



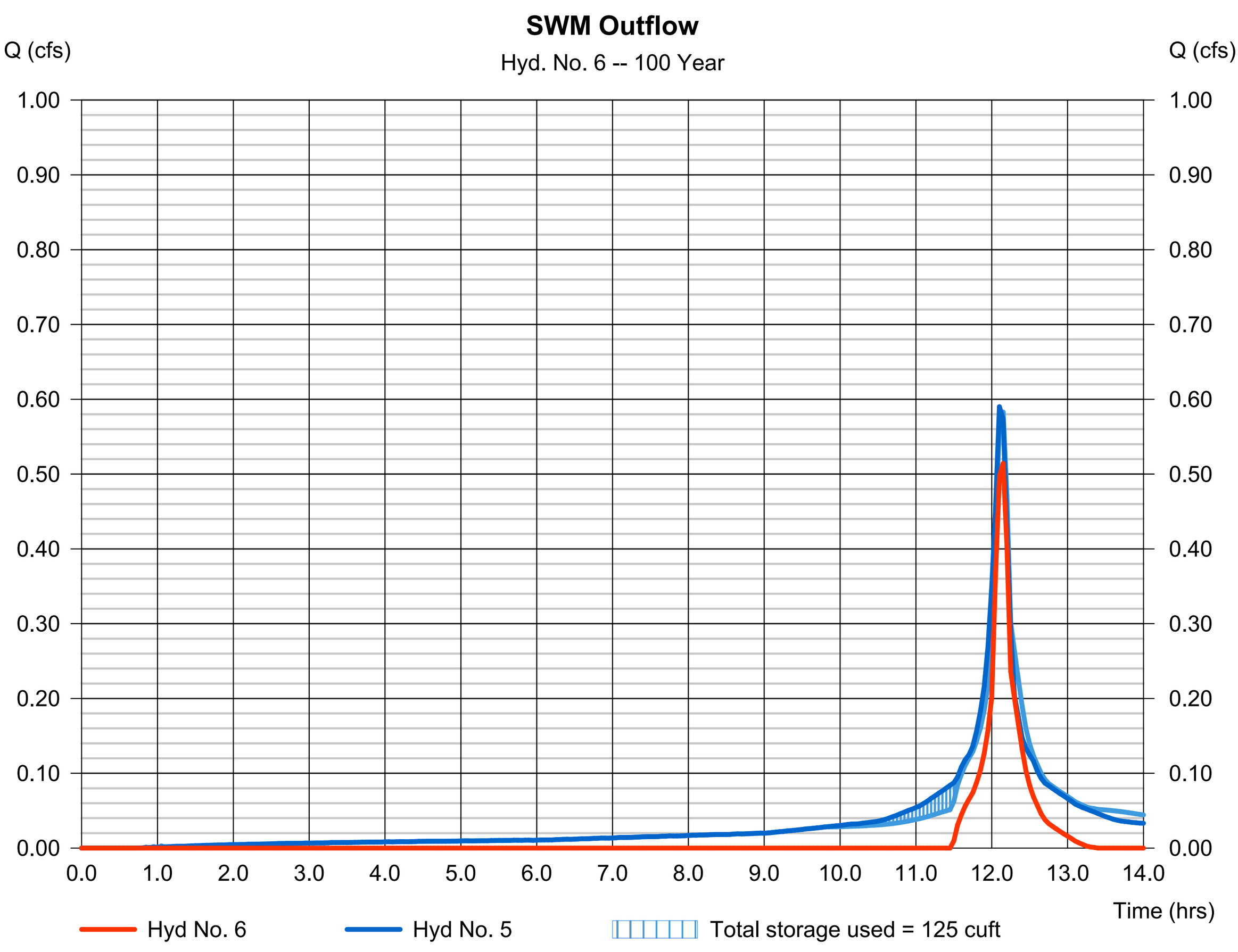
Hydrograph Report

Hyd. No. 6

SWM Outflow

Hydrograph type	=	Reservoir	Peak discharge	=	0.514 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.15 hrs
Time interval	=	3 min	Hyd. volume	=	730 cuft
Inflow hyd. No.	=	5 - PROP-DA	Max. Elevation	=	101.50 ft
Reservoir name	=	U/G Chamber	Max. Storage	=	125 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	69.8703	13.1000	0.8658	--------
3	0.0000	0.0000	0.0000	--------
5	79.2597	14.6000	0.8369	--------
10	88.2351	15.5000	0.8279	--------
25	102.6072	16.5000	0.8217	--------
50	114.8193	17.2000	0.8199	--------
100	127.1596	17.8000	0.8186	--------

File name: SampleFHA.idf

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.69	4.61	3.89	3.38	2.99	2.69	2.44	2.24	2.07	1.93	1.81	1.70
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.57	5.43	4.65	4.08	3.65	3.30	3.02	2.79	2.59	2.42	2.27	2.15
10	7.24	6.04	5.21	4.59	4.12	3.74	3.43	3.17	2.95	2.77	2.60	2.46
25	8.25	6.95	6.03	5.34	4.80	4.38	4.02	3.73	3.48	3.26	3.07	2.91
50	9.04	7.65	6.66	5.92	5.34	4.87	4.49	4.16	3.88	3.65	3.44	3.25
100	9.83	8.36	7.30	6.50	5.87	5.36	4.94	4.59	4.29	4.03	3.80	3.60

Tc = time in minutes. Values may exceed 60.

Precip. file name: R:\Hydroflow Standards\UnionCounty.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.40	0.00	4.50	5.19	0.00	7.30	8.72
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	2.75	0.00	0.00	6.50	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	2.75	0.00	0.00	6.50	0.00
Custom	1.25	3.40	0.00	2.80	5.19	0.00	6.00	8.72

NOAA Atlas 14, Volume 2, Version 3
Location name: Cranford, New Jersey, USA*
Latitude: 40.6569°, Longitude: -74.3033°
Elevation: 78.54 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.334 (0.306-0.367)	0.398 (0.364-0.437)	0.472 (0.430-0.517)	0.524 (0.477-0.575)	0.588 (0.533-0.645)	0.634 (0.572-0.694)	0.678 (0.609-0.743)	0.718 (0.641-0.788)	0.768 (0.679-0.845)	0.804 (0.706-0.887)
10-min	0.534 (0.489-0.586)	0.637 (0.583-0.699)	0.755 (0.688-0.829)	0.838 (0.763-0.920)	0.938 (0.850-1.03)	1.01 (0.911-1.11)	1.08 (0.967-1.18)	1.14 (1.02-1.25)	1.22 (1.07-1.34)	1.27 (1.11-1.40)
15-min	0.667 (0.611-0.733)	0.801 (0.733-0.879)	0.955 (0.871-1.05)	1.06 (0.965-1.16)	1.19 (1.08-1.30)	1.28 (1.15-1.40)	1.36 (1.22-1.49)	1.44 (1.28-1.58)	1.53 (1.35-1.68)	1.59 (1.40-1.75)
30-min	0.915 (0.837-1.00)	1.11 (1.01-1.21)	1.36 (1.24-1.49)	1.54 (1.40-1.69)	1.76 (1.60-1.93)	1.92 (1.74-2.11)	2.09 (1.87-2.29)	2.24 (2.00-2.45)	2.43 (2.15-2.68)	2.58 (2.26-2.84)
60-min	1.14 (1.04-1.25)	1.39 (1.27-1.52)	1.74 (1.59-1.91)	2.00 (1.82-2.19)	2.34 (2.13-2.57)	2.61 (2.35-2.86)	2.87 (2.58-3.15)	3.14 (2.80-3.44)	3.49 (3.09-3.84)	3.76 (3.30-4.15)
2-hr	1.40 (1.27-1.54)	1.70 (1.55-1.88)	2.16 (1.96-2.38)	2.51 (2.27-2.77)	3.00 (2.70-3.31)	3.41 (3.05-3.75)	3.82 (3.39-4.21)	4.26 (3.75-4.69)	4.86 (4.24-5.37)	5.35 (4.62-5.91)
3-hr	1.56 (1.42-1.72)	1.90 (1.73-2.10)	2.41 (2.19-2.66)	2.81 (2.55-3.10)	3.36 (3.03-3.70)	3.81 (3.41-4.20)	4.28 (3.81-4.71)	4.76 (4.20-5.25)	5.44 (4.74-6.00)	5.98 (5.17-6.61)
6-hr	2.00 (1.82-2.22)	2.43 (2.22-2.69)	3.08 (2.80-3.40)	3.61 (3.26-3.97)	4.36 (3.91-4.79)	4.99 (4.44-5.47)	5.66 (5.00-6.20)	6.38 (5.58-6.99)	7.42 (6.40-8.13)	8.28 (7.06-9.09)
12-hr	2.48 (2.26-2.74)	3.01 (2.75-3.33)	3.84 (3.49-4.23)	4.53 (4.10-4.98)	5.55 (4.98-6.07)	6.43 (5.72-7.01)	7.38 (6.49-8.04)	8.43 (7.33-9.19)	9.98 (8.52-10.9)	11.3 (9.50-12.3)
24-hr	2.81 (2.59-3.05)	3.40 (3.14-3.70)	4.36 (4.03-4.75)	5.19 (4.77-5.64)	6.43 (5.87-6.98)	7.51 (6.81-8.15)	8.72 (7.82-9.46)	10.1 (8.91-10.9)	12.1 (10.5-13.2)	13.8 (11.9-15.1)
2-day	3.31 (3.04-3.62)	4.00 (3.68-4.38)	5.12 (4.70-5.59)	6.05 (5.53-6.60)	7.42 (6.75-8.09)	8.60 (7.77-9.37)	9.87 (8.85-10.8)	11.3 (9.99-12.3)	13.3 (11.6-14.7)	15.1 (13.0-16.7)
3-day	3.49 (3.21-3.81)	4.22 (3.88-4.61)	5.37 (4.93-5.86)	6.32 (5.79-6.89)	7.71 (7.03-8.39)	8.89 (8.05-9.67)	10.2 (9.13-11.1)	11.5 (10.3-12.6)	13.6 (11.9-14.9)	15.2 (13.2-16.8)
4-day	3.66 (3.38-3.99)	4.43 (4.09-4.83)	5.62 (5.17-6.12)	6.60 (6.05-7.18)	8.00 (7.31-8.70)	9.18 (8.34-9.98)	10.4 (9.40-11.4)	11.8 (10.5-12.9)	13.8 (12.1-15.1)	15.4 (13.4-17.0)
7-day	4.33 (4.01-4.68)	5.20 (4.82-5.62)	6.46 (5.98-6.98)	7.50 (6.93-8.11)	8.99 (8.26-9.72)	10.2 (9.34-11.1)	11.6 (10.5-12.5)	13.0 (11.6-14.1)	15.0 (13.2-16.4)	16.6 (14.5-18.3)
10-day	4.95 (4.61-5.33)	5.92 (5.51-6.37)	7.24 (6.73-7.80)	8.33 (7.73-8.97)	9.87 (9.11-10.6)	11.1 (10.2-12.0)	12.5 (11.4-13.5)	13.9 (12.5-15.0)	15.8 (14.1-17.3)	17.4 (15.4-19.1)
20-day	6.69 (6.28-7.13)	7.94 (7.45-8.47)	9.47 (8.88-10.1)	10.7 (9.99-11.4)	12.3 (11.5-13.1)	13.6 (12.6-14.5)	14.9 (13.7-15.9)	16.2 (14.9-17.4)	17.9 (16.3-19.3)	19.3 (17.4-20.8)
30-day	8.33 (7.88-8.81)	9.84 (9.31-10.4)	11.5 (10.9-12.2)	12.8 (12.1-13.5)	14.4 (13.6-15.2)	15.7 (14.7-16.6)	16.9 (15.8-17.9)	18.1 (16.9-19.2)	19.6 (18.2-20.9)	20.7 (19.1-22.2)
45-day	10.6 (10.0-11.2)	12.5 (11.8-13.1)	14.4 (13.6-15.1)	15.8 (15.0-16.6)	17.7 (16.7-18.6)	19.1 (18.0-20.1)	20.4 (19.2-21.5)	21.7 (20.3-22.9)	23.3 (21.7-24.7)	24.5 (22.7-26.1)
60-day	12.7 (12.1-13.3)	14.9 (14.2-15.6)	17.0 (16.2-17.9)	18.6 (17.7-19.5)	20.6 (19.5-21.6)	22.0 (20.8-23.2)	23.3 (22.1-24.6)	24.6 (23.2-26.0)	26.1 (24.5-27.7)	27.2 (25.4-28.9)

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

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

Please refer to NOAA Atlas 14 document for more information.

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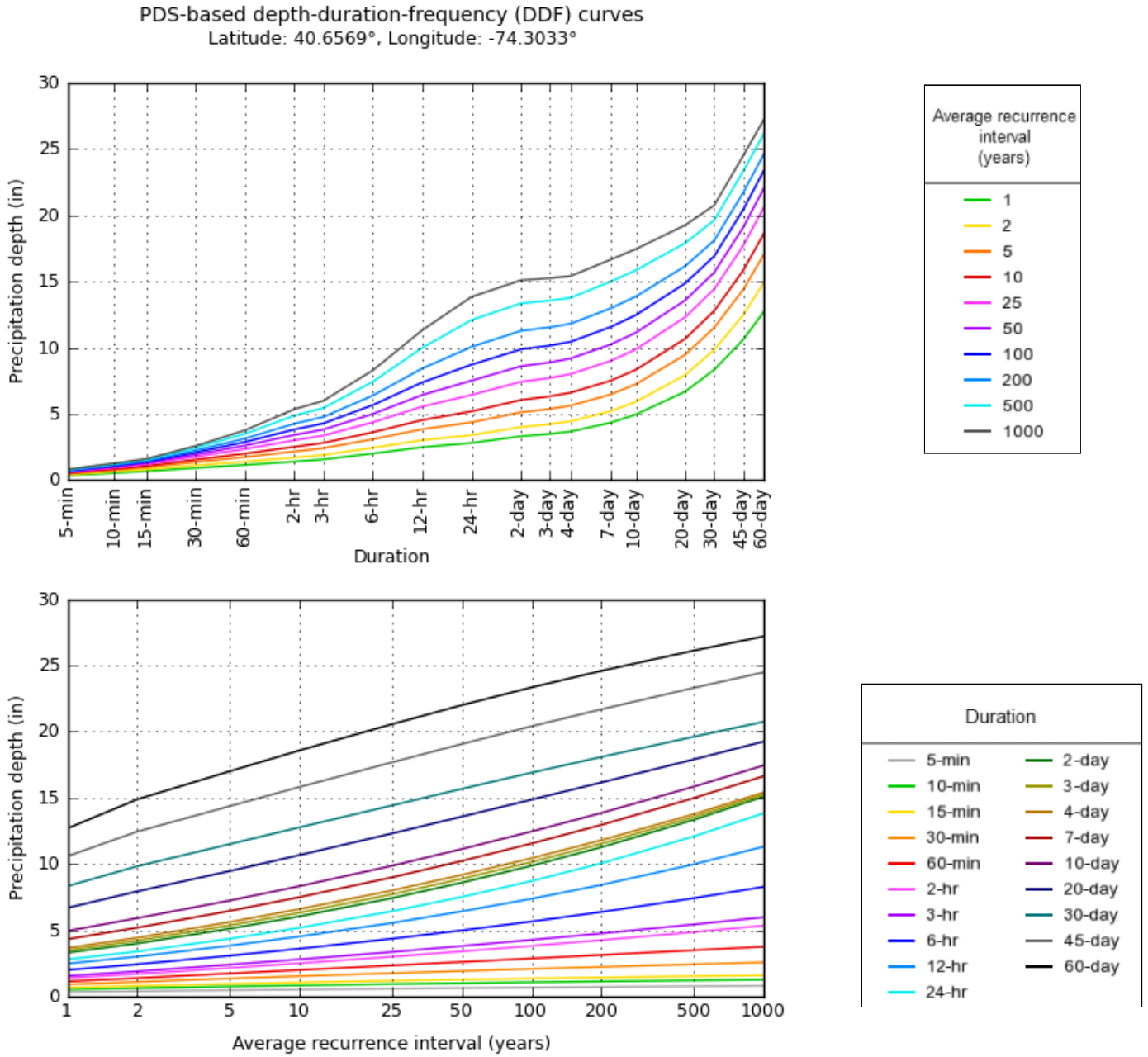
PF graphical



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Mon Feb 24 15:25:54 2020

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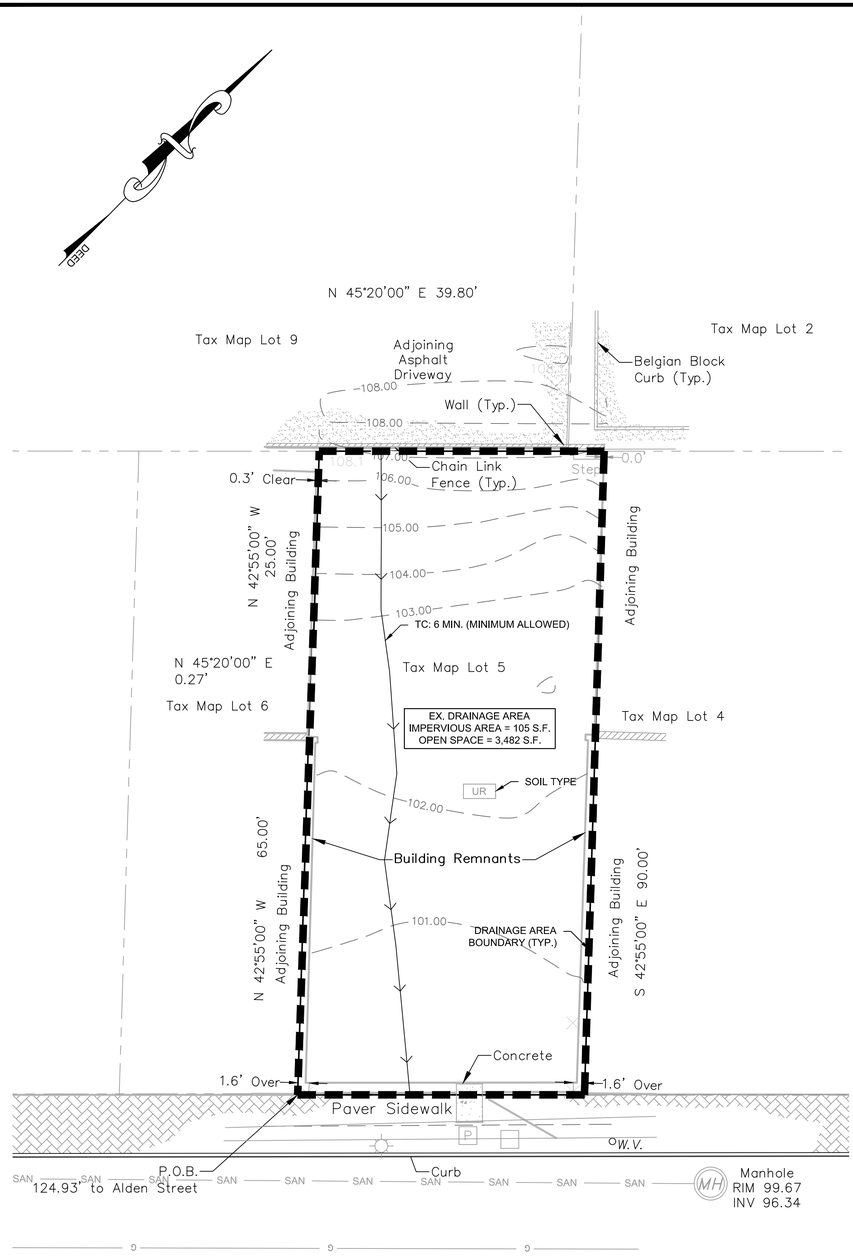
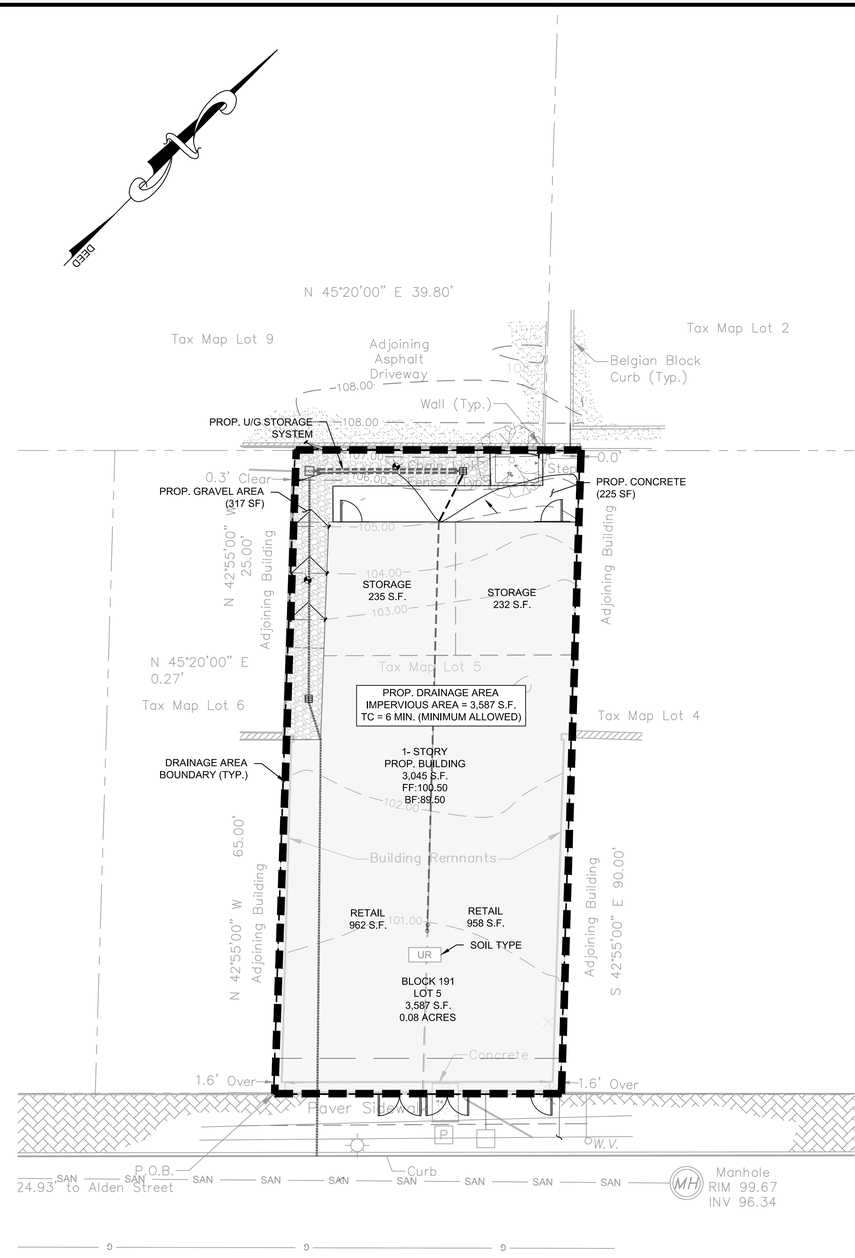
Maps & aerials

Small scale terrain



North Union Avenue
(55' Wide)

PRE-DEVELOPMENT DRAINAGE AREA MAP
SCALE 1"=10'



North Union Avenue
(55' Wide)

POST-DEVELOPMENT DRAINAGE AREA MAP
SCALE 1"=10'

0 10 20 Feet
SCALE:1":10'

U/G STORAGE SYSTEM DISCHARGE		
STORM	PEAK BASIN DISCHARGE	MAX. STORAGE
2-YEAR	0.140 CFS	92.6 CF
10-YEAR	0.270 CFS	116 CF
100-YEAR	0.514 CFS	125 CF

LEGEND: SOIL GROUPS		
SOIL GROUP SYMBOL	SOIL GROUP NAME	HYDROLOGIC SOIL GROUP
UR	URBAN LAND	D

SOIL INFORMATION SHOWN ABOVE PER NATURAL RESOURCE CONSERVATION SERVICE WEB SOIL SURVEY MAPPING

E&LP
140 WEST MAIN STREET HIGH BRIDGE, NJ 08829
PH. 908-238-0544 FAX. 908-238-9572
A PROFESSIONAL ASSOCIATION
CERTIFICATE OF AUTHORIZATION NO.: 24GA28021500 EXP. 8/31/2020

NO.	REVISION	BY	DATE
1	PER TOWNSHIP COMMENTS	AA	03/26/20

03/26/2020
DATE

WAYNE J. INGRAM
PROFESSIONAL ENGINEER
N.J. P.E. NO. 24GB04258200

PROJECT:

TANNA RETAIL
111-115 NORTH UNION AVENUE
BLOCK 191; LOT 5
CRANFORD TOWNSHIP

UNION COUNTY NEW JERSEY

TITLE:

DRAINAGE AREA MAP

JOB NO.:	19194	DRAWING NO.:	1
SCALE:	1"=10'		
DESIGNED:	JZ		
CHECKED:	ADR		
FILENAME:	EXDA.DWG		
DATE:	10/29/2019		

140 West Main Street
High Bridge, NJ 08829
T: 908.238.0544 F: 908.238.9572

200 American Metro Blvd
Suite 114
Hamilton, NJ 08619
T: 609.454.3433 F: 908.238.9572

22 N. 3rd Street | Philadelphia, PA 19106

Municipality: Cranford Township Block: 191 Lot: 5

Soil Log and Interpretation

1 Soil Log #: SL-1 Date of Soil Log: 03/12/20 Method: Profile Pit

2 Log:

Depth (inches)	Munsell Color Name & Symbol; Estimated Textural Class; Estimated Volume % Coarse Fragments; Structure; Consistence; Mottling Abundance, Size and Contrast
0 - 15"	Topsoil;
15 - 60"	2.5YR 3/6; Sandy Loam; 10% Gravel, 15% Cobble; SAB, Moist, Friable
60 - 120"	2.5YR 4/8; Sandy Clay Loam; 10% Gravel, 15% Cobble, 10% Stone: SAB, Moist, Friable

3 Ground Water Observations:

_____ Seepage Observed - Depth (inches): _____

_____ Pit Flooded - Depth (inches): _____ after _____ hours of observation

4 Soil Limiting Zones (Check ALL applicable categories):

_____ Fractured Rock Substratum - Depth to Top: _____

_____ Massive Rock Substratum - Depth to Top: _____

_____ Excessively Coarse Horizon - Depth Top to Bottom: _____

_____ Excessively Coarse Substratum - Depth to Top: _____

_____ Hydraulically Restrictive Horizon - Depth Top to Bottom: _____

_____ Hydraulically Restrictive Substratum - Depth to Top: _____

_____ Perched Zone of Saturation - Depth Top to Bottom: _____

_____ Regional Zone of Saturation - Depth to Top: _____

5 I hereby certify that the information furnished on this form is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

Signature of Site Evaluator: _____ Date: _____

Signature and Seal of Professional Engineer: _____

License #: 24GE0419500 Date: _____

140 West Main Street
High Bridge, NJ 08829
T: 908.238.0544 F: 908.238.9572

200 American Metro Blvd
Suite 114
Hamilton, NJ 08619
T: 609.454.3433 F: 908.238.9572

22 N. 3rd Street | Philadelphia, PA 19106

Municipality: Cranford Township Block: 191 Lot: 5

Soil Log and Interpretation

1 Soil Log #: SL-2 Date of Soil Log: 03/12/20 Method: Profile Pit

2 Log:

Depth (inches)	Munsell Color Name & Symbol; Estimated Textural Class; Estimated Volume % Coarse Fragments; Structure; Consistence; Mottling Abundance, Size and Contrast
0 - 12"	Topsoil;
12 - 40"	2.5YR 3/6; Sandy Loam; 10% Gravel, 15% Cobble; SAB, Moist, Friable
40 - 115"	2.5YR 4/8; Sandy Clay Loam; 10% Gravel, 20% Cobble; SAB, Moist, Friable

3 Ground Water Observations:

_____ Seepage Observed - Depth (inches): _____

_____ Pit Flooded - Depth (inches): _____ after _____ hours of observation

4 Soil Limiting Zones (Check ALL applicable categories):

_____ Fractured Rock Substratum - Depth to Top: _____

_____ Massive Rock Substratum - Depth to Top: _____

_____ Excessively Coarse Horizon - Depth Top to Bottom: _____

_____ Excessively Coarse Substratum - Depth to Top: _____

_____ Hydraulically Restrictive Horizon - Depth Top to Bottom: _____

_____ Hydraulically Restrictive Substratum - Depth to Top: _____

_____ Perched Zone of Saturation - Depth Top to Bottom: _____

_____ Regional Zone of Saturation - Depth to Top: _____

5 I hereby certify that the information furnished on this form is true and accurate. I am aware that falsification of data is a violation of the Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.) and is subject to penalties as prescribed in N.J.A.C. 7:14-8.

Signature of Site Evaluator: _____ Date: _____

Signature and Seal of Professional Engineer: _____

License #: 24GE0419500 Date: _____

Engineering & Land Planning Associates

Project:	Tanna Commercial	Date:	3/12/2020
Location:	111 North Union Ave, Cranford, NJ	Sample:	IN PLACE
Test By:	Annika Asplund		SL-1 @ 110"

L=	4.500	T1=	38
H1=	6.000	T2=	38
H2=	4.500	T3=	72
r=	1.125	T4=	56
R=	1.125	T5=	67
		T(sec.)=	67
		T(min.)=	1.12

Soil Permeability: 69.56

Soil Class: K5

Disturbed

Tube Weight	698
Gross Weight	1,165
Net Weight	467
Sample Vol. (in³)	17.88328125
(cm³)	293.1069797
Bulk Density	1.593274921
	min. 1.2 gr/cm³

Engineering & Land Planning Associates

Project:	Tanna Commercial	Date:	3/12/2020
Location:	111 North Union Ave, Cranford, NJ	Sample:	IN PLACE
Test By:	Annika Asplund		SL-2 @ 110"

L=	4.500	T1=	43
H1=	6.000	T2=	56
H2=	4.500	T3=	57
r=	0.750	T4=	62
R=	0.750	T5=	65
		T(sec.)=	65
		T(min.)=	1.08

Soil Permeability: 71.70

Soil Class: K5

Disturbed

Tube Weight	251
Gross Weight	665
Net Weight	414
Sample Vol. (in³)	7.948125
(cm³)	130.2697688
Bulk Density	3.178020534

min. 1.2 gr/cm³