

Hydraflow Table of Contents

\\hwyasp002\proj\2024\pumpers\summary\2024\2024 from Home\2024 Vault\24-351 Werhle, Tony (Richmond House of Prayer)\24-351.gpw

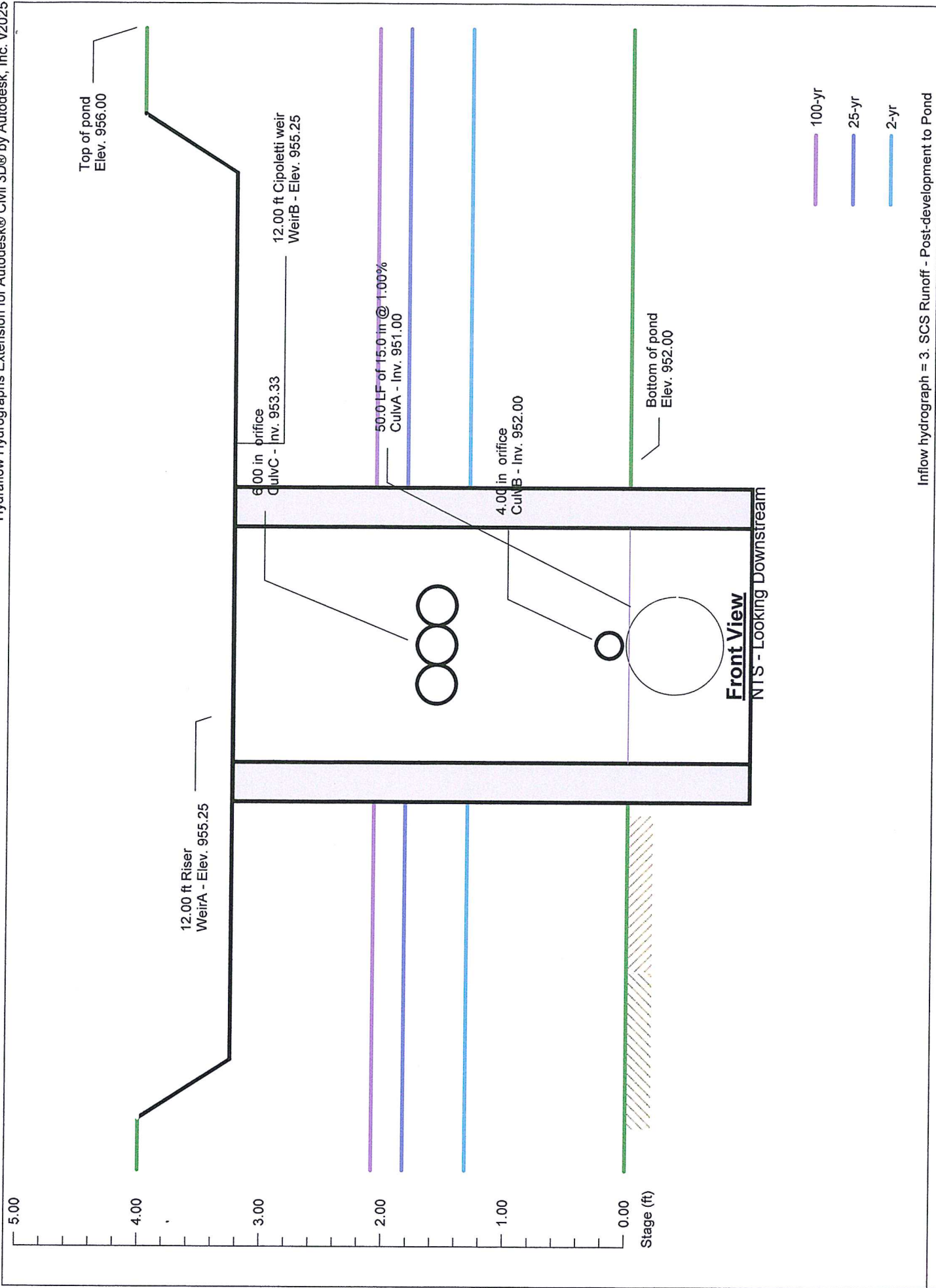
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025

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Pond No. 1 - ABOVE GROUND POND

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Channel Report

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

Tuesday, Nov 19 2024

24-351 EMERGENCY OVERFLOW WEIR

Trapezoidal

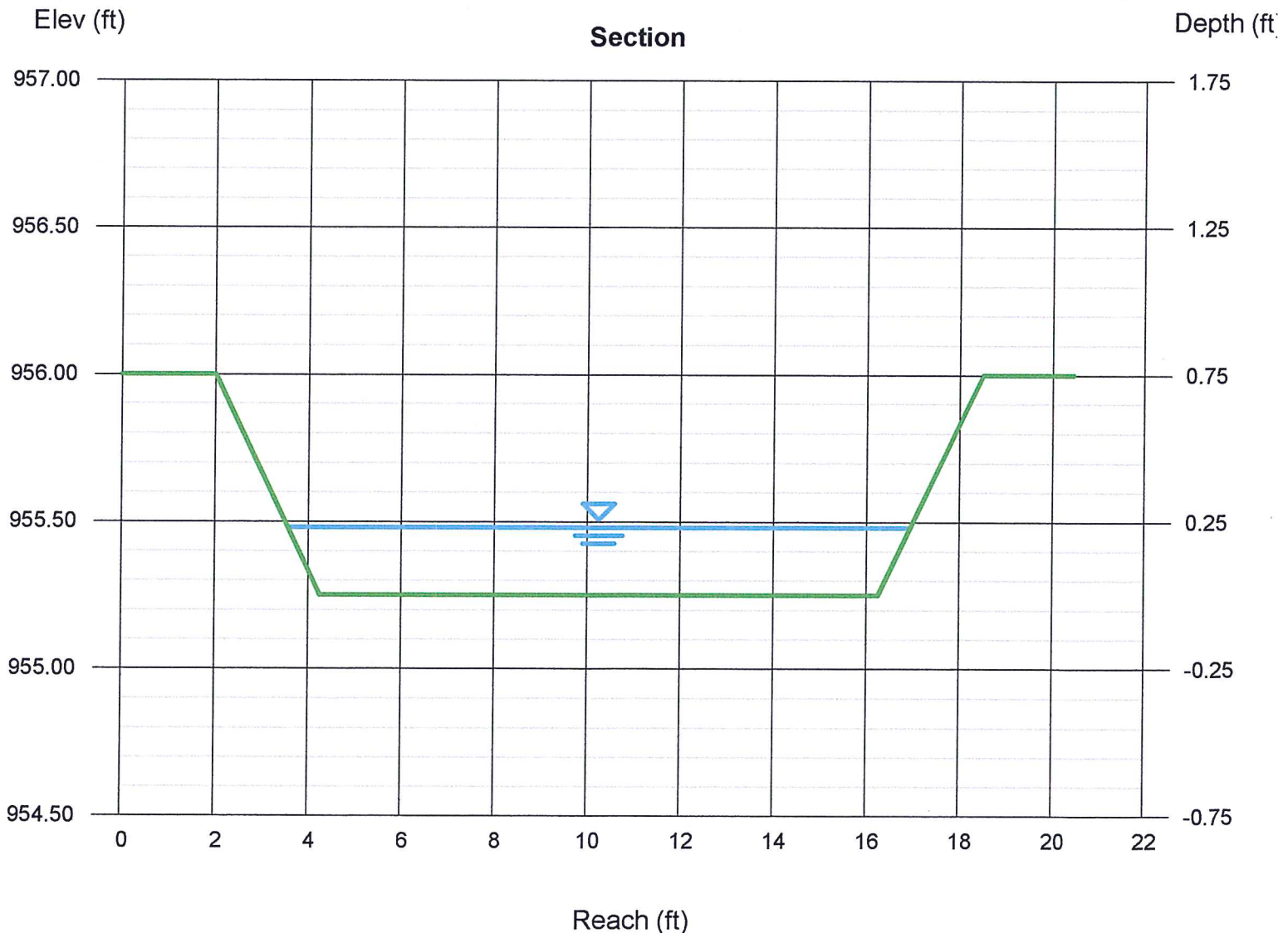
Bottom Width (ft) = 12.00
Side Slopes (z:1) = 3.00, 3.00
Total Depth (ft) = 0.75
Invert Elev (ft) = 955.25
Slope (%) = 0.50
N-Value = 0.013

Calculations

Compute by: Known Q
Known Q (cfs) = 8.30

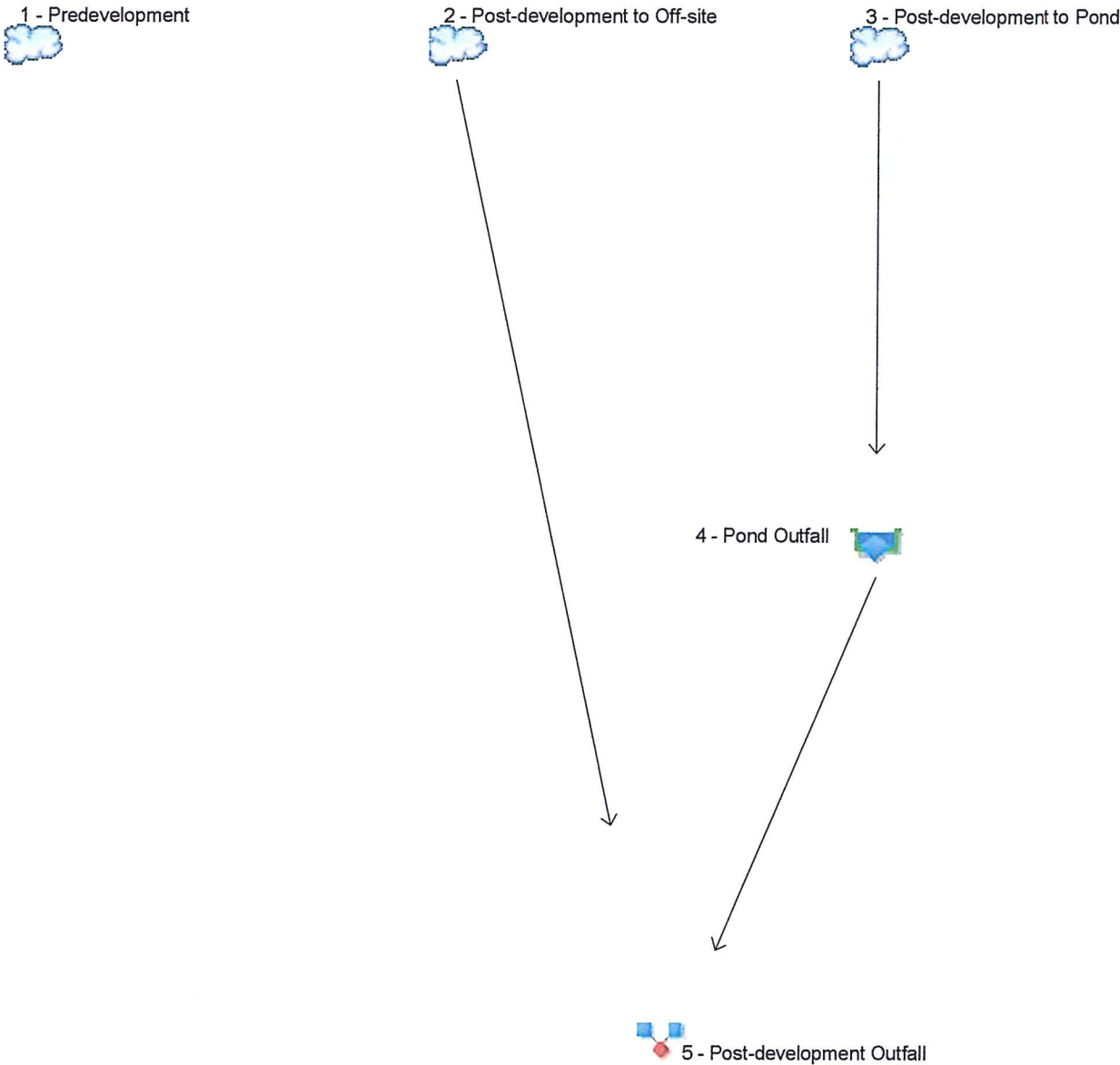
Highlighted

Depth (ft) = 0.23
Q (cfs) = 8.300
Area (sqft) = 2.92
Velocity (ft/s) = 2.84
Wetted Perim (ft) = 13.45
Crit Depth, Yc (ft) = 0.25
Top Width (ft) = 13.38
EGL (ft) = 0.36



Watershed Model Schematic

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Legend

<u>Hyd.</u>	<u>Origin</u>	<u>Description</u>
1	SCS Runoff	Predevelopment
2	SCS Runoff	Post-development to Off-site
3	SCS Runoff	Post-development to Pond
4	Reservoir	Pond Outfall
5	Combine	Post-development Outfall

Hydrograph Report

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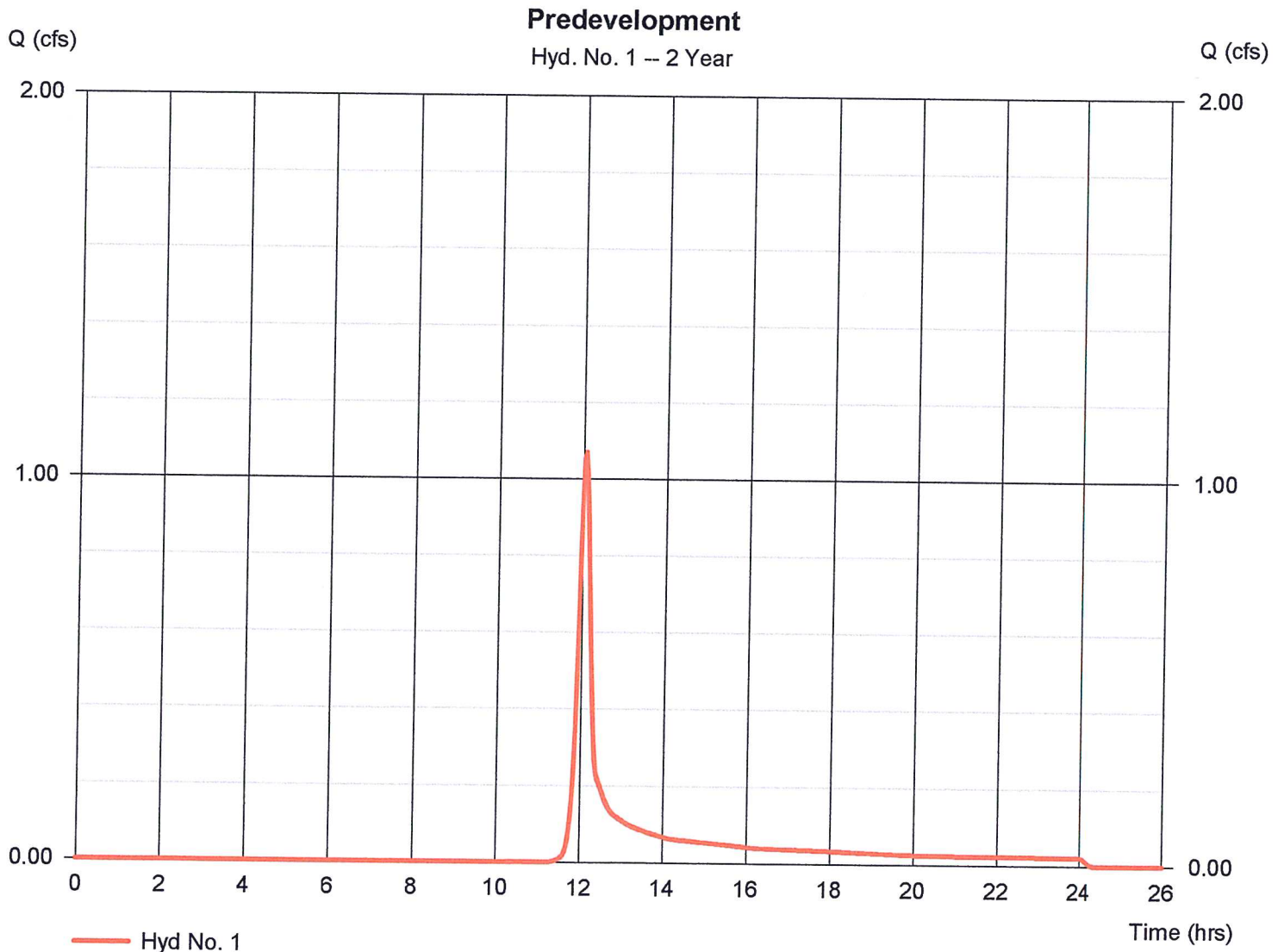
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Hyd. No. 1

Predevelopment

Hydrograph type	= SCS Runoff	Peak discharge	= 1.070 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 3,200 cuft
Drainage area	= 1.110 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.10 min
Total precip.	= 2.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

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Hyd. No. 1

Predevelopment

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>			
Sheet Flow							
Manning's n-value	= 0.150	0.011	0.011				
Flow length (ft)	= 300.0	0.0	0.0				
Two-year 24-hr precip. (in)	= 2.85	0.00	0.00				
Land slope (%)	= 7.00	0.00	0.00				
Travel Time (min)	= 15.15	+	0.00	+	0.00	=	15.15
Shallow Concentrated Flow							
Flow length (ft)	= 0.00	0.00	0.00				
Watercourse slope (%)	= 0.00	0.00	0.00				
Surface description	= Paved	Paved	Paved				
Average velocity (ft/s)	=0.00	0.00	0.00				
Travel Time (min)	= 0.00	+	0.00	+	0.00	=	0.00
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					15.10 min		

Hydrograph Report

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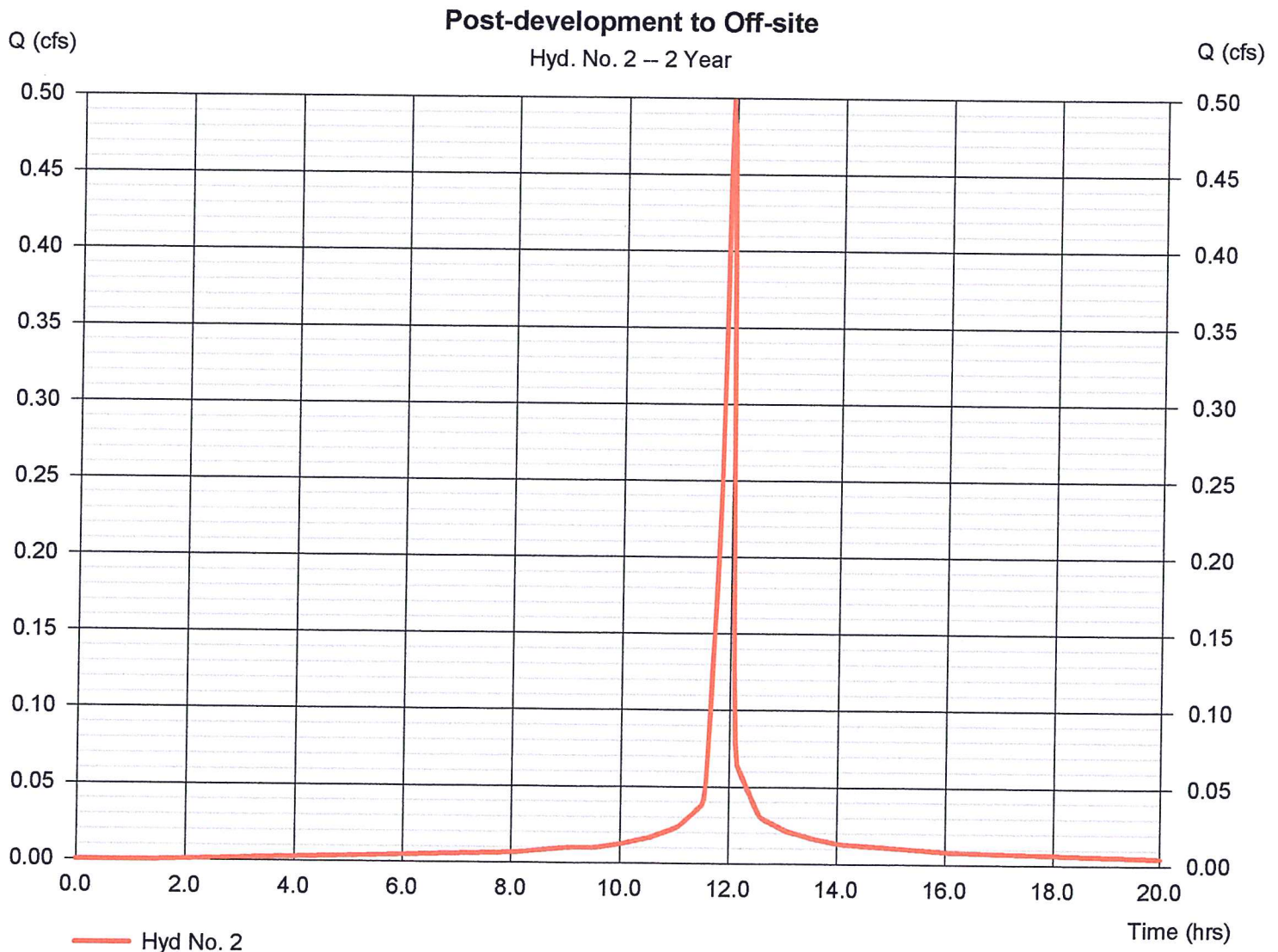
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Hyd. No. 2

Post-development to Off-site

Hydrograph type	= SCS Runoff	Peak discharge	= 0.499 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,159 cuft
Drainage area	= 0.130 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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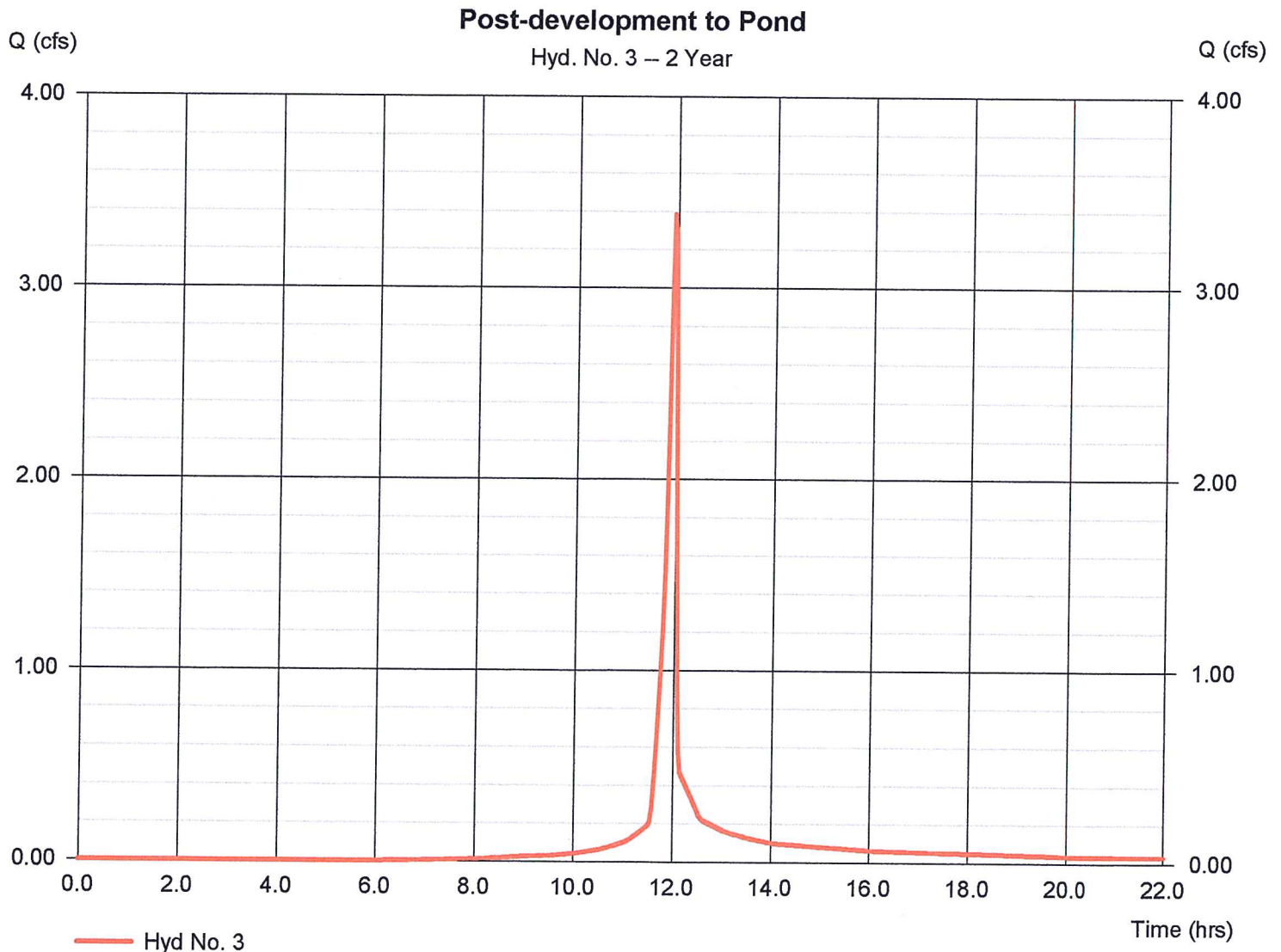
Tuesday, 11 / 19 / 2024

Hyd. No. 3

Post-development to Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 3.386 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 6,976 cuft
Drainage area	= 1.110 ac	Curve number	= 90*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.350 \times 74) + (0.760 \times 98)] / 1.110$



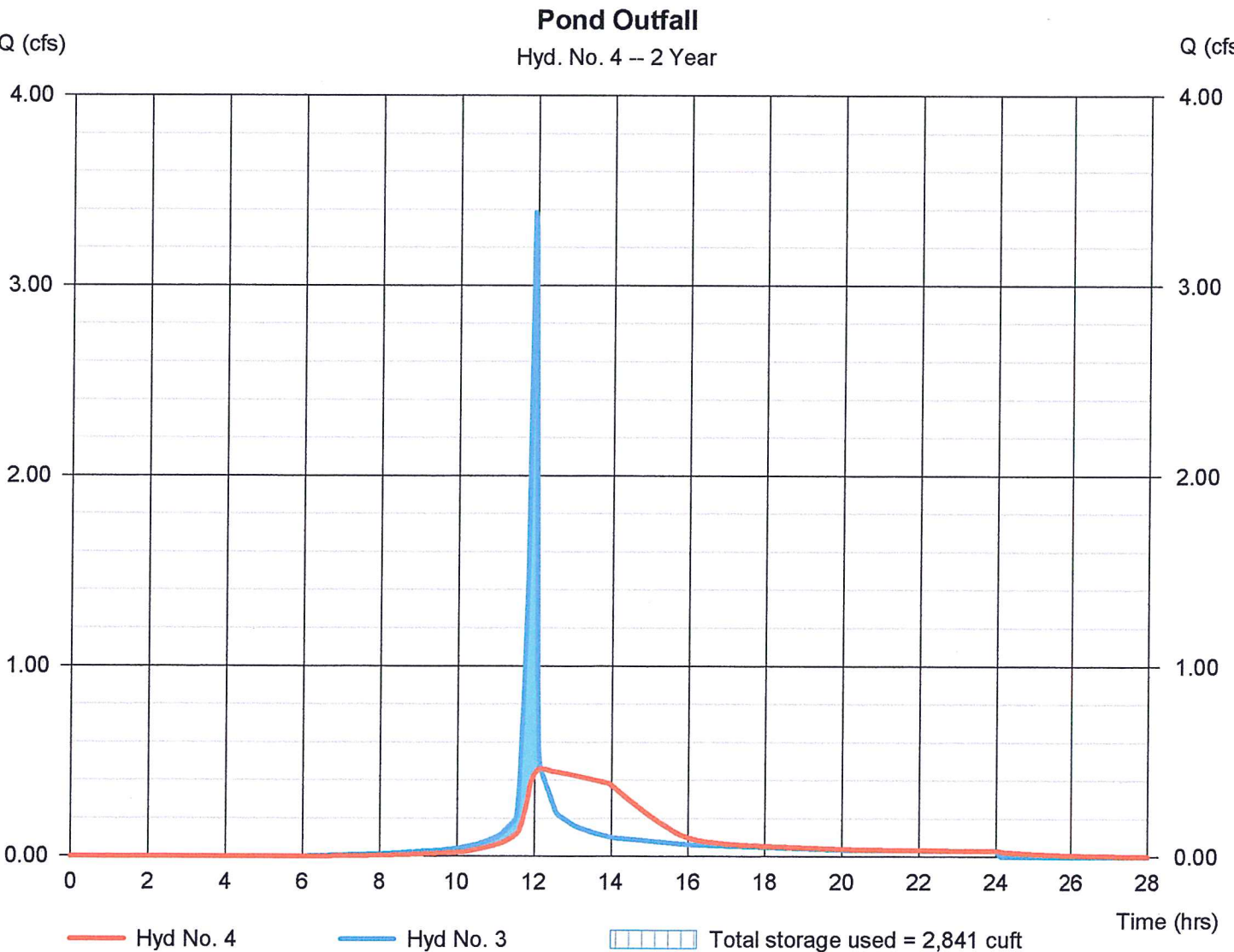
Hydrograph Report

Hyd. No. 4

Pond Outfall

Hydrograph type	= Reservoir	Peak discharge	= 0.458 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 6,971 cuft
Inflow hyd. No.	= 3 - Post-development to Pond	Max. Elevation	= 953.32 ft
Reservoir name	= ABOVE GROUND POND	Max. Storage	= 2,841 cuft

Storage Indication method used.



Pond Report

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

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Pond No. 1 - ABOVE GROUND POND

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 952.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	952.00	00	0	0
1.00	953.00	2,747	1,374	1,374
2.00	954.00	6,502	4,625	5,998
3.00	955.00	9,784	8,143	14,141
4.00	956.00	11,040	10,412	24,553

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	4.00	6.00	0.00
Span (in)	= 15.00	4.00	6.00	0.00
No. Barrels	= 1	1	3	0
Invert El. (ft)	= 951.00	952.00	953.33	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.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	12.00	0.00	0.00
Crest El. (ft)	= 955.25	955.25	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Ciplti	---	---
Multi-Stage	= Yes	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).

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	952.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
0.10	137	952.10	3.58 ic	0.02 ic	0.00	---	0.00	0.00	---	---	---	---	0.024
0.20	275	952.20	3.58 ic	0.08 ic	0.00	---	0.00	0.00	---	---	---	---	0.083
0.30	412	952.30	3.58 ic	0.15 ic	0.00	---	0.00	0.00	---	---	---	---	0.154
0.40	549	952.40	3.58 ic	0.20 ic	0.00	---	0.00	0.00	---	---	---	---	0.203
0.50	687	952.50	3.58 ic	0.24 ic	0.00	---	0.00	0.00	---	---	---	---	0.243
0.60	824	952.60	3.58 ic	0.28 ic	0.00	---	0.00	0.00	---	---	---	---	0.277
0.70	961	952.70	3.58 ic	0.31 ic	0.00	---	0.00	0.00	---	---	---	---	0.307
0.80	1,099	952.80	3.58 ic	0.33 ic	0.00	---	0.00	0.00	---	---	---	---	0.334
0.90	1,236	952.90	3.58 ic	0.36 ic	0.00	---	0.00	0.00	---	---	---	---	0.360
1.00	1,374	953.00	3.58 ic	0.38 ic	0.00	---	0.00	0.00	---	---	---	---	0.384
1.10	1,836	953.10	3.58 ic	0.41 ic	0.00	---	0.00	0.00	---	---	---	---	0.406
1.20	2,298	953.20	3.58 ic	0.43 ic	0.00	---	0.00	0.00	---	---	---	---	0.427
1.30	2,761	953.30	3.58 ic	0.45 ic	0.00	---	0.00	0.00	---	---	---	---	0.447
1.40	3,223	953.40	3.58 ic	0.47 ic	0.05 ic	---	0.00	0.00	---	---	---	---	0.512
1.50	3,686	953.50	3.58 ic	0.49 ic	0.25 ic	---	0.00	0.00	---	---	---	---	0.738
1.60	4,148	953.60	3.58 ic	0.50 ic	0.58 ic	---	0.00	0.00	---	---	---	---	1.086
1.70	4,611	953.70	3.58 ic	0.52 ic	0.97 ic	---	0.00	0.00	---	---	---	---	1.489
1.80	5,073	953.80	3.58 ic	0.54 ic	1.34 ic	---	0.00	0.00	---	---	---	---	1.879
1.90	5,536	953.90	3.58 ic	0.55 ic	1.60 ic	---	0.00	0.00	---	---	---	---	2.157
2.00	5,998	954.00	3.58 ic	0.57 ic	1.84 ic	---	0.00	0.00	---	---	---	---	2.407
2.10	6,812	954.10	3.58 ic	0.58 ic	2.04 ic	---	0.00	0.00	---	---	---	---	2.629
2.20	7,627	954.20	3.58 ic	0.60 ic	2.23 ic	---	0.00	0.00	---	---	---	---	2.832
2.30	8,441	954.30	3.58 ic	0.61 ic	2.41 ic	---	0.00	0.00	---	---	---	---	3.020
2.40	9,255	954.40	3.58 ic	0.63 ic	2.57 ic	---	0.00	0.00	---	---	---	---	3.196
2.50	10,069	954.50	3.58 ic	0.64 ic	2.72 ic	---	0.00	0.00	---	---	---	---	3.362
2.60	10,884	954.60	3.58 ic	0.66 ic	2.86 ic	---	0.00	0.00	---	---	---	---	3.519
2.70	11,698	954.70	3.69 ic	0.67 ic	3.00 ic	---	0.00	0.00	---	---	---	---	3.670
2.80	12,512	954.80	3.81 ic	0.68 ic	3.13 ic	---	0.00	0.00	---	---	---	---	3.814
2.90	13,327	954.90	3.95 ic	0.69 ic	3.26 ic	---	0.00	0.00	---	---	---	---	3.952
3.00	14,141	955.00	4.10 ic	0.71 ic	3.38 ic	---	0.00	0.00	---	---	---	---	4.087
3.10	15,182	955.10	4.22 ic	0.72 ic	3.50 ic	---	0.00	0.00	---	---	---	---	4.216
3.20	16,223	955.20	4.35 oc	0.73 ic	3.61 ic	---	0.00	0.00	---	---	---	---	4.340
3.30	17,265	955.30	4.88 oc	0.72 ic	3.72 ic	---	0.45	0.45	---	---	---	---	5.326
3.40	18,306	955.40	6.79 oc	0.65 ic	3.83 ic	---	2.32	2.32	---	---	---	---	9.113
3.50	19,347	955.50	9.02 oc	0.52 ic	3.50 ic	---	4.99	4.99	---	---	---	---	14.01
3.60	20,388	955.60	10.83 ic	0.33 ic	2.23 ic	---	8.27	8.27	---	---	---	---	19.10
3.70	21,429	955.70	11.60 ic	0.20 ic	1.32 ic	---	10.08 s	12.06	---	---	---	---	23.66

Continues on next page...

ABOVE GROUND POND

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
3.80	22,471	955.80	11.88 ic	0.15 ic	1.03 ic	---	10.70 s	16.29	---	---	---	---	28.17
3.90	23,512	955.90	12.09 ic	0.12 ic	0.84 ic	---	11.13 s	20.93	---	---	---	---	33.02
4.00	24,553	956.00	12.27 ic	0.10 ic	0.70 ic	---	11.47 s	25.95	---	---	---	---	38.23

...End

Hydrograph Report

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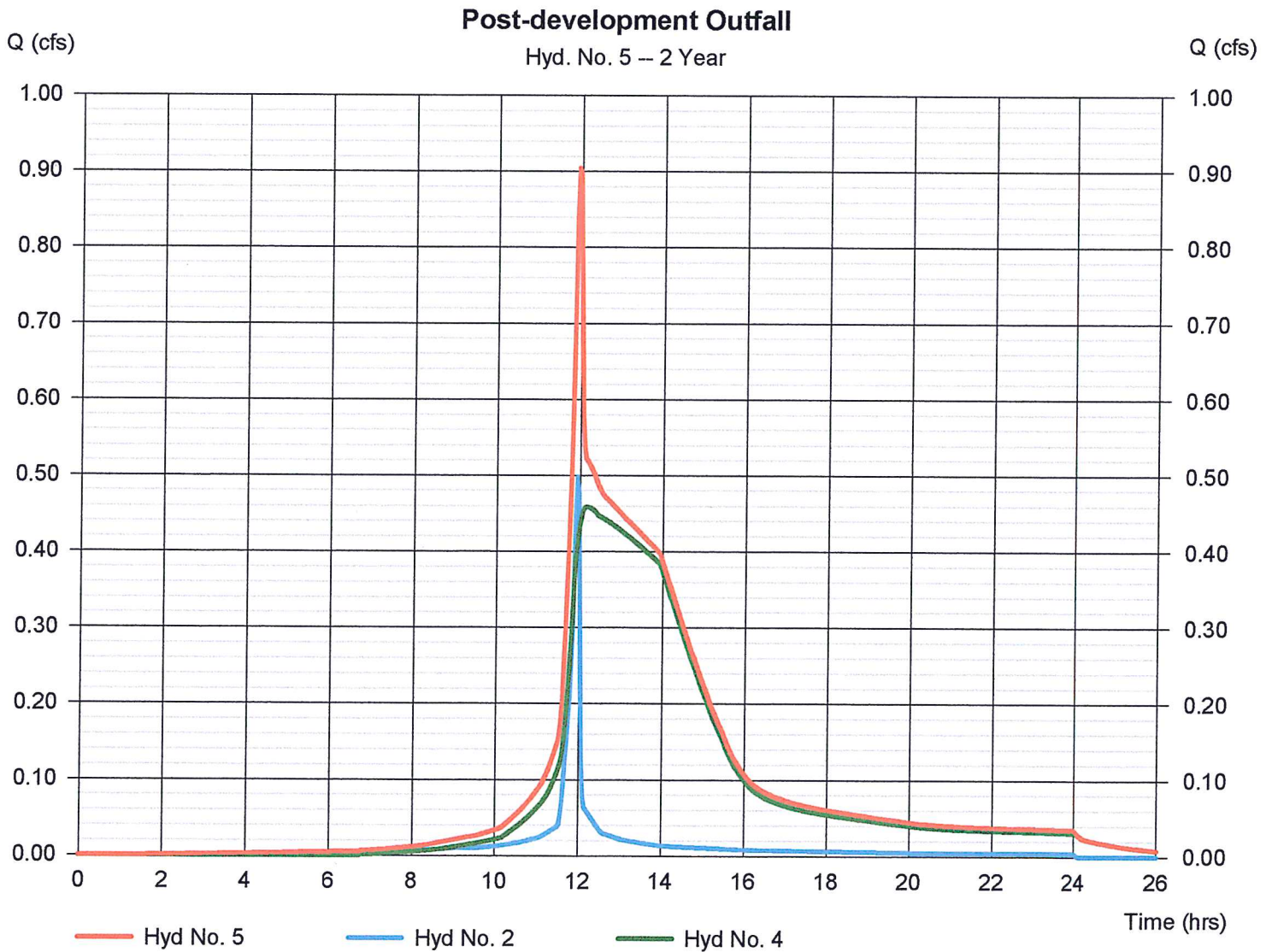
Tuesday, 11 / 19 / 2024

Hyd. No. 5

Post-development Outfall

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 2, 4

Peak discharge = 0.905 cfs
Time to peak = 11.93 hrs
Hyd. volume = 8,129 cuft
Contrib. drain. area = 0.130 ac



Hydrograph Report

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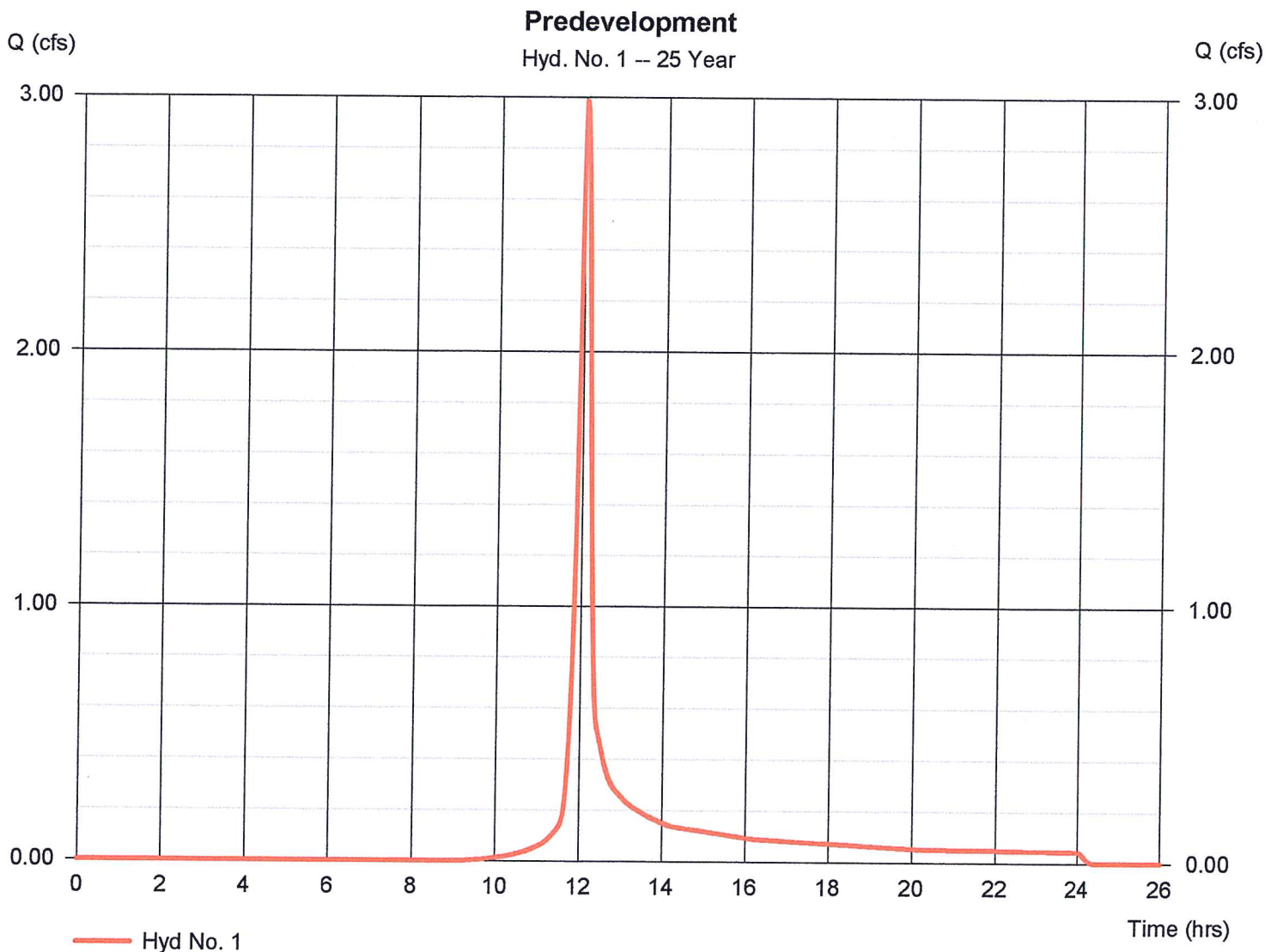
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Hyd. No. 1

Predevelopment

Hydrograph type	= SCS Runoff	Peak discharge	= 2.985 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 8,419 cuft
Drainage area	= 1.110 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.10 min
Total precip.	= 4.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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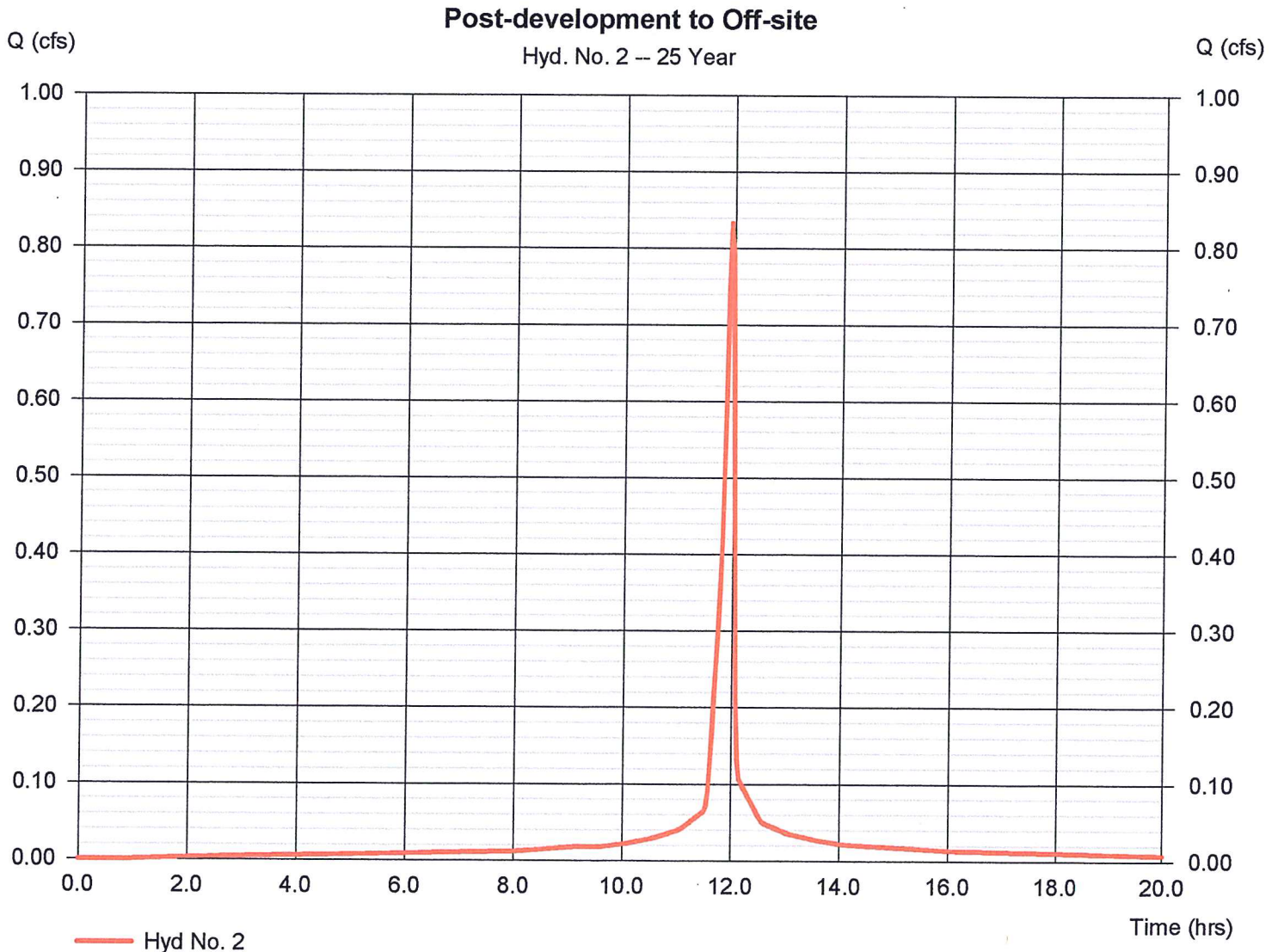
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Hyd. No. 2

Post-development to Off-site

Hydrograph type	= SCS Runoff	Peak discharge	= 0.833 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,984 cuft
Drainage area	= 0.130 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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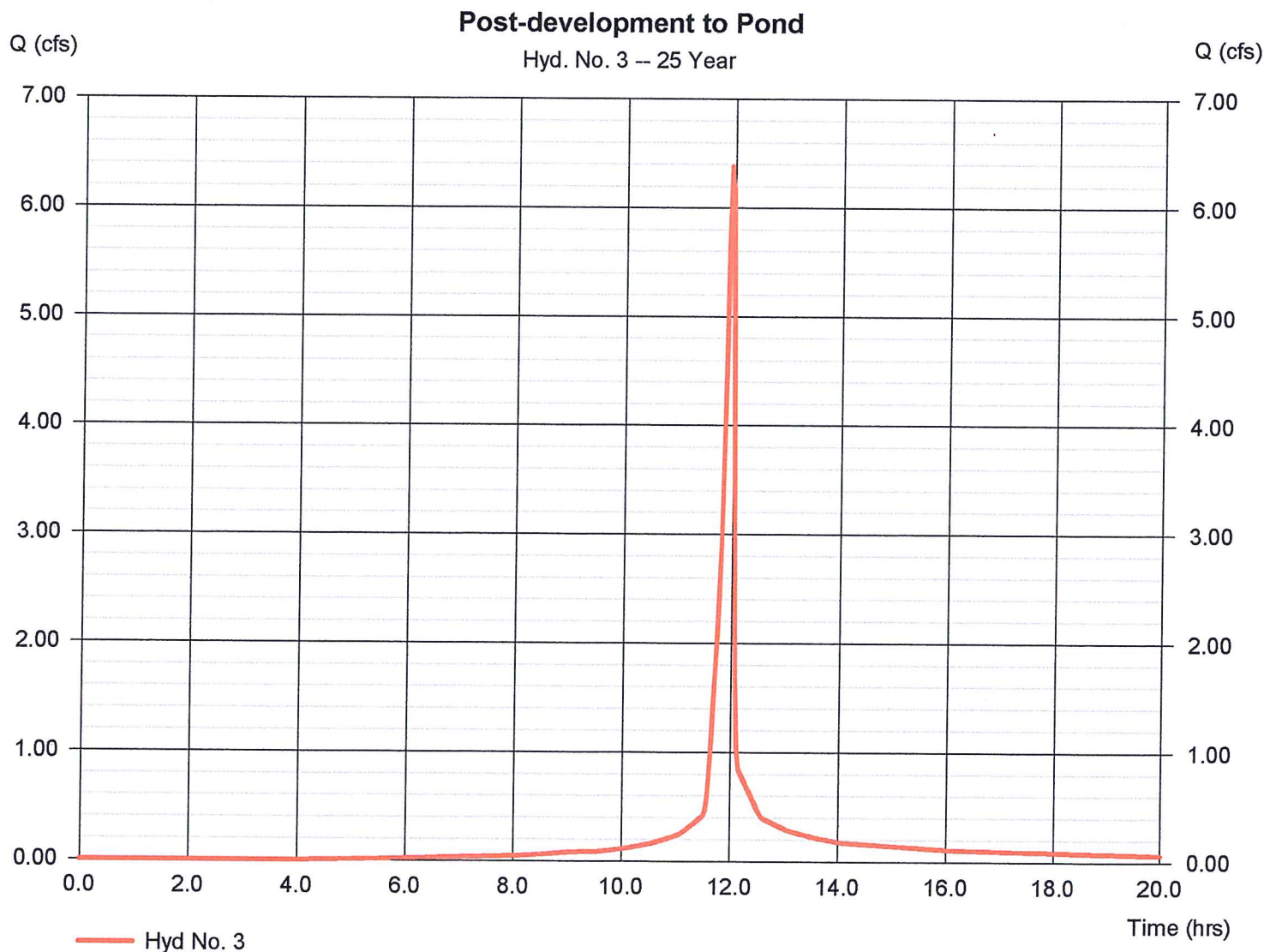
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Hyd. No. 3

Post-development to Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 6.379 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 13,624 cuft
Drainage area	= 1.110 ac	Curve number	= 90*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.350 \times 74) + (0.760 \times 98)] / 1.110$



Hydrograph Report

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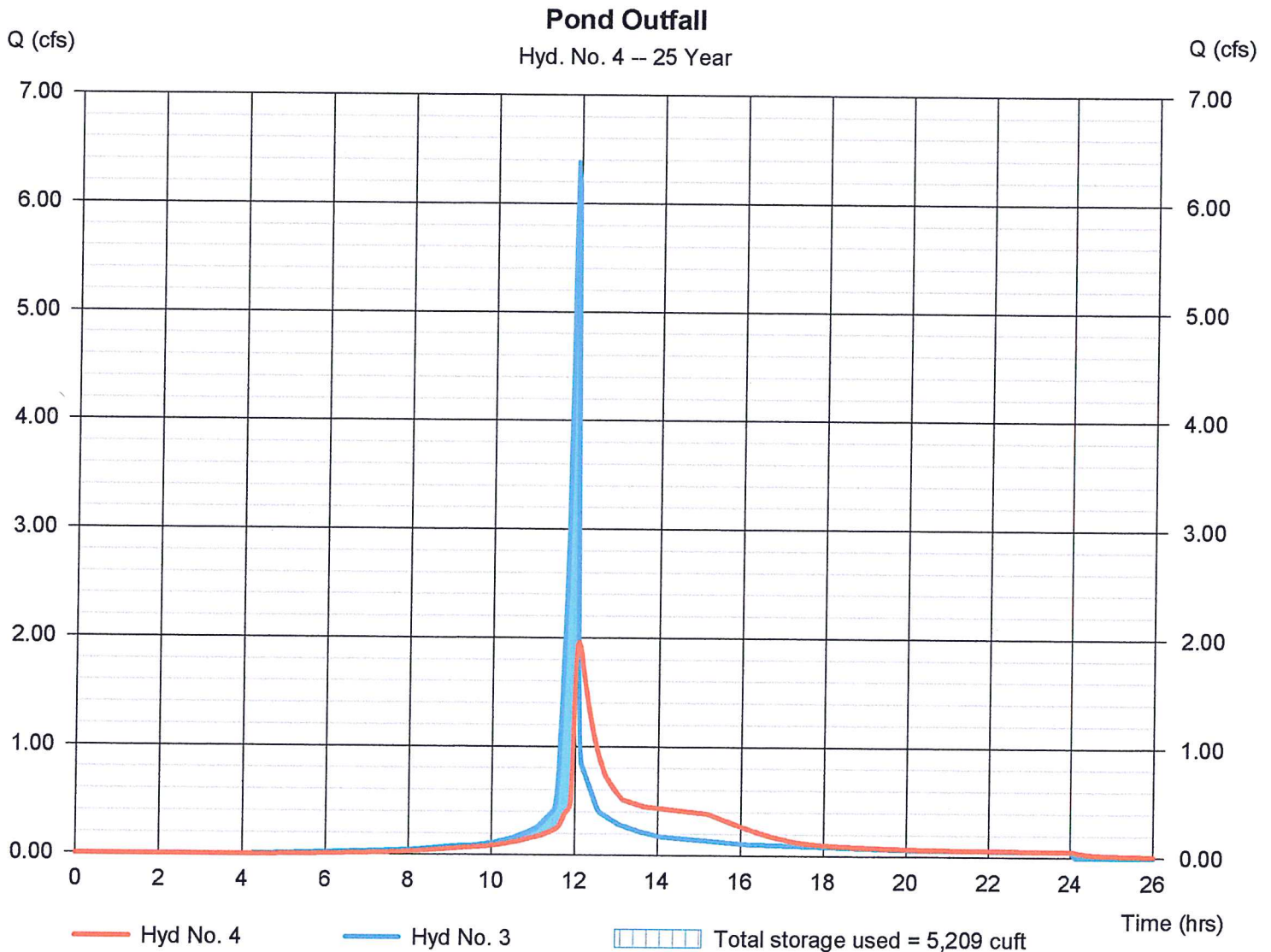
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Hyd. No. 4

Pond Outfall

Hydrograph type	= Reservoir	Peak discharge	= 1.961 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 13,619 cuft
Inflow hyd. No.	= 3 - Post-development to Pond	Max. Elevation	= 953.83 ft
Reservoir name	= ABOVE GROUND POND	Max. Storage	= 5,209 cuft

Storage Indication method used.



Hydrograph Report

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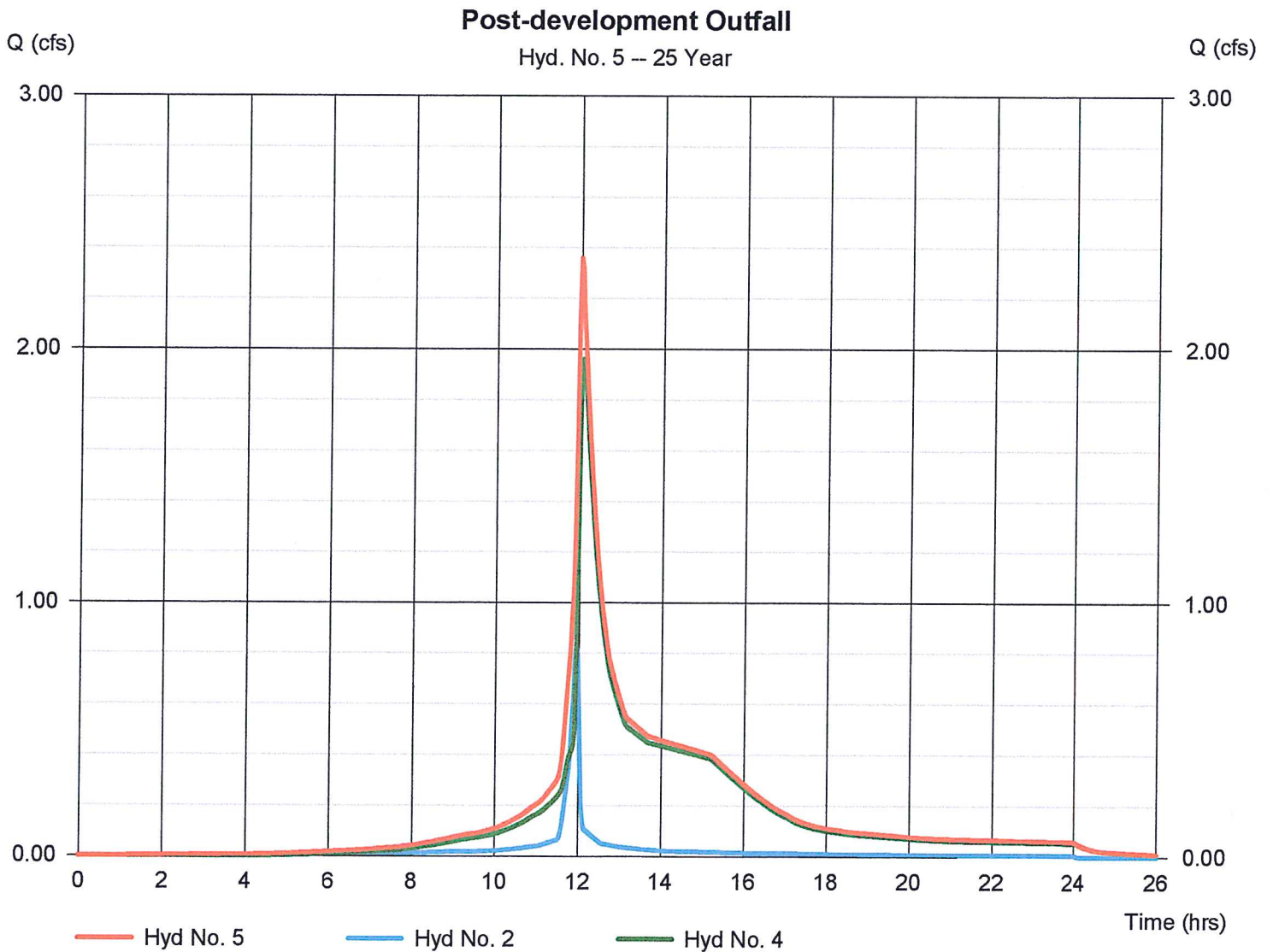
Tuesday, 11 / 19 / 2024

Hyd. No. 5

Post-development Outfall

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 2 min
Inflow hyds. = 2, 4

Peak discharge = 2.360 cfs
Time to peak = 12.00 hrs
Hyd. volume = 15,602 cuft
Contrib. drain. area = 0.130 ac



Hydrograph Report

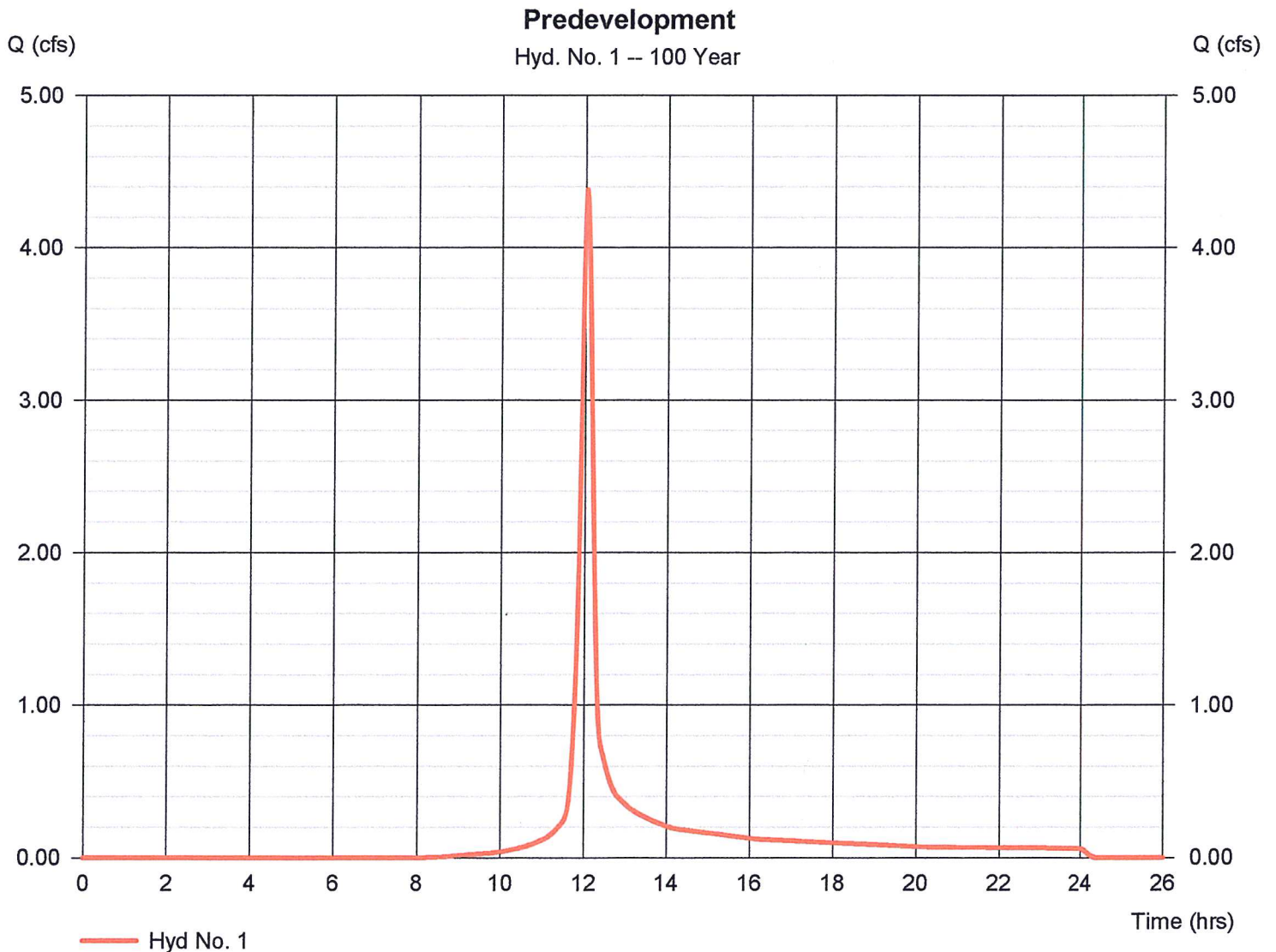
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Tuesday, 11 / 19 / 2024

Hyd. No. 1

Predevelopment

Hydrograph type	= SCS Runoff	Peak discharge	= 4.381 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 12,281 cuft
Drainage area	= 1.110 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.10 min
Total precip.	= 5.93 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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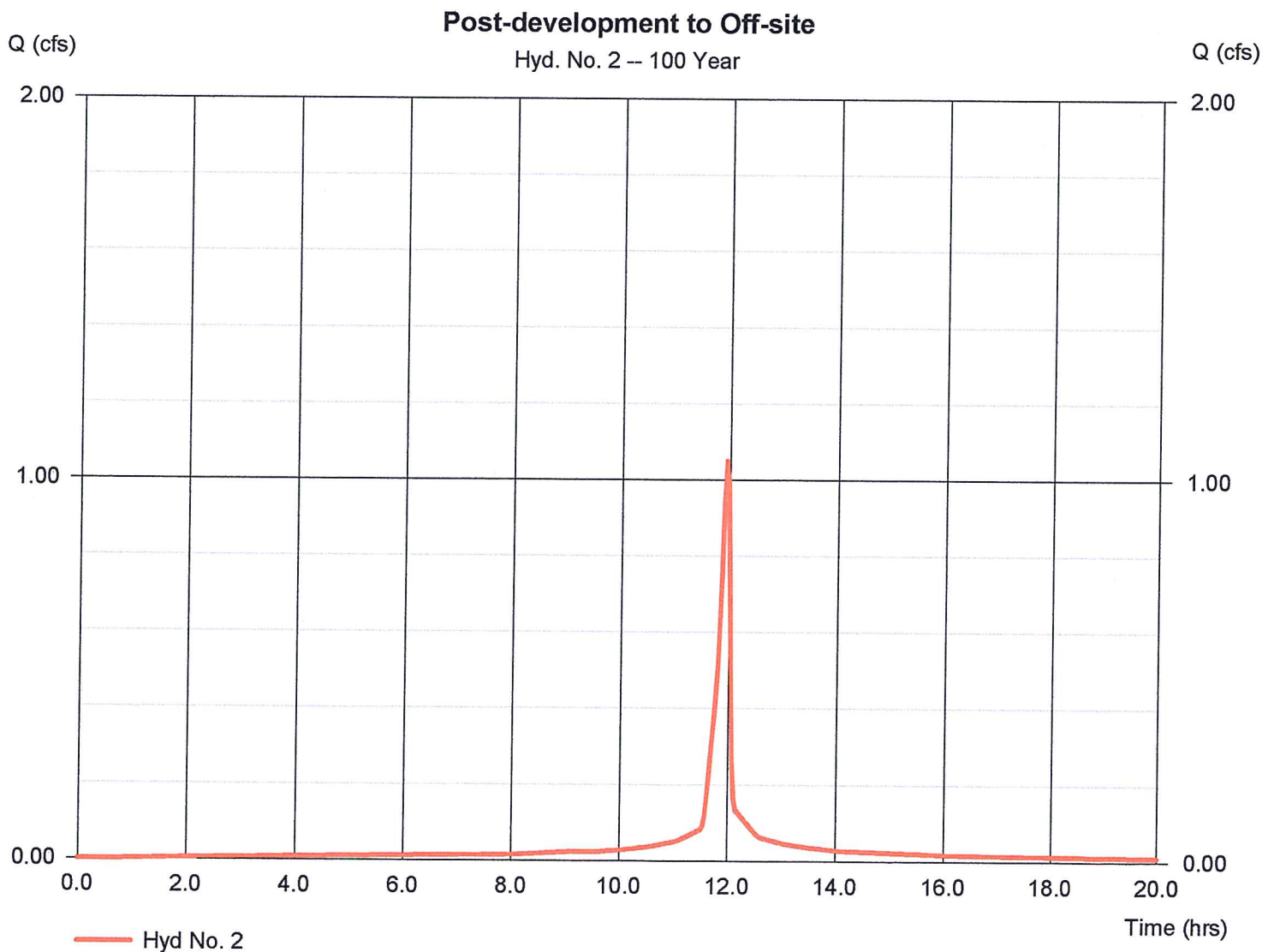
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Tuesday, 11 / 19 / 2024

Hyd. No. 2

Post-development to Off-site

Hydrograph type	= SCS Runoff	Peak discharge	= 1.049 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,518 cuft
Drainage area	= 0.130 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.93 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

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

Tuesday, 11 / 19 / 2024

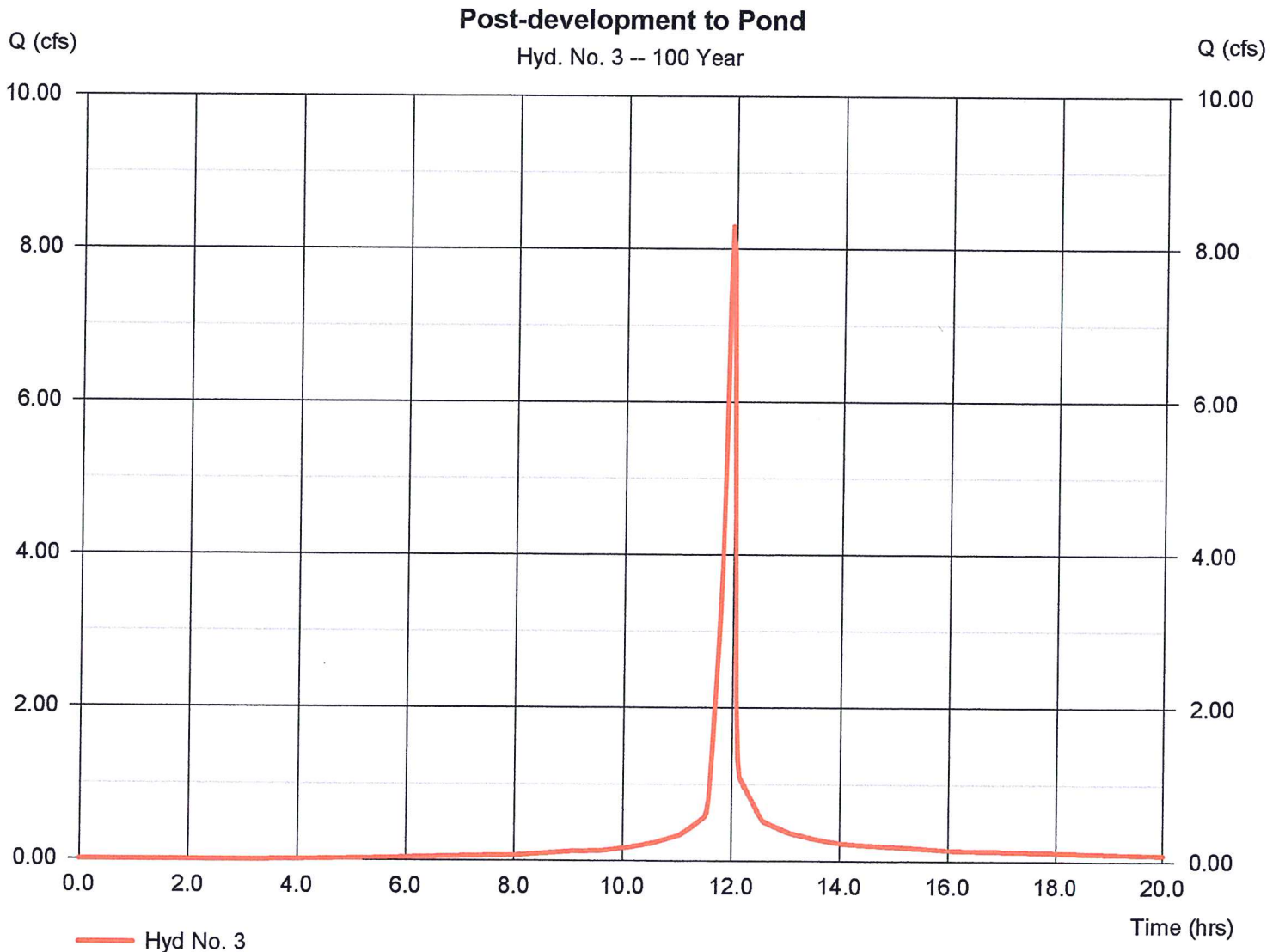
Hyd. No. 3

Post-development to Pond

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 1.110 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.93 in
Storm duration = 24 hrs

Peak discharge = 8.300 cfs
Time to peak = 11.93 hrs
Hyd. volume = 18,048 cuft
Curve number = 90*
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484

* Composite (Area/CN) = $[(0.350 \times 74) + (0.760 \times 98)] / 1.110$



Hydrograph Report

22

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

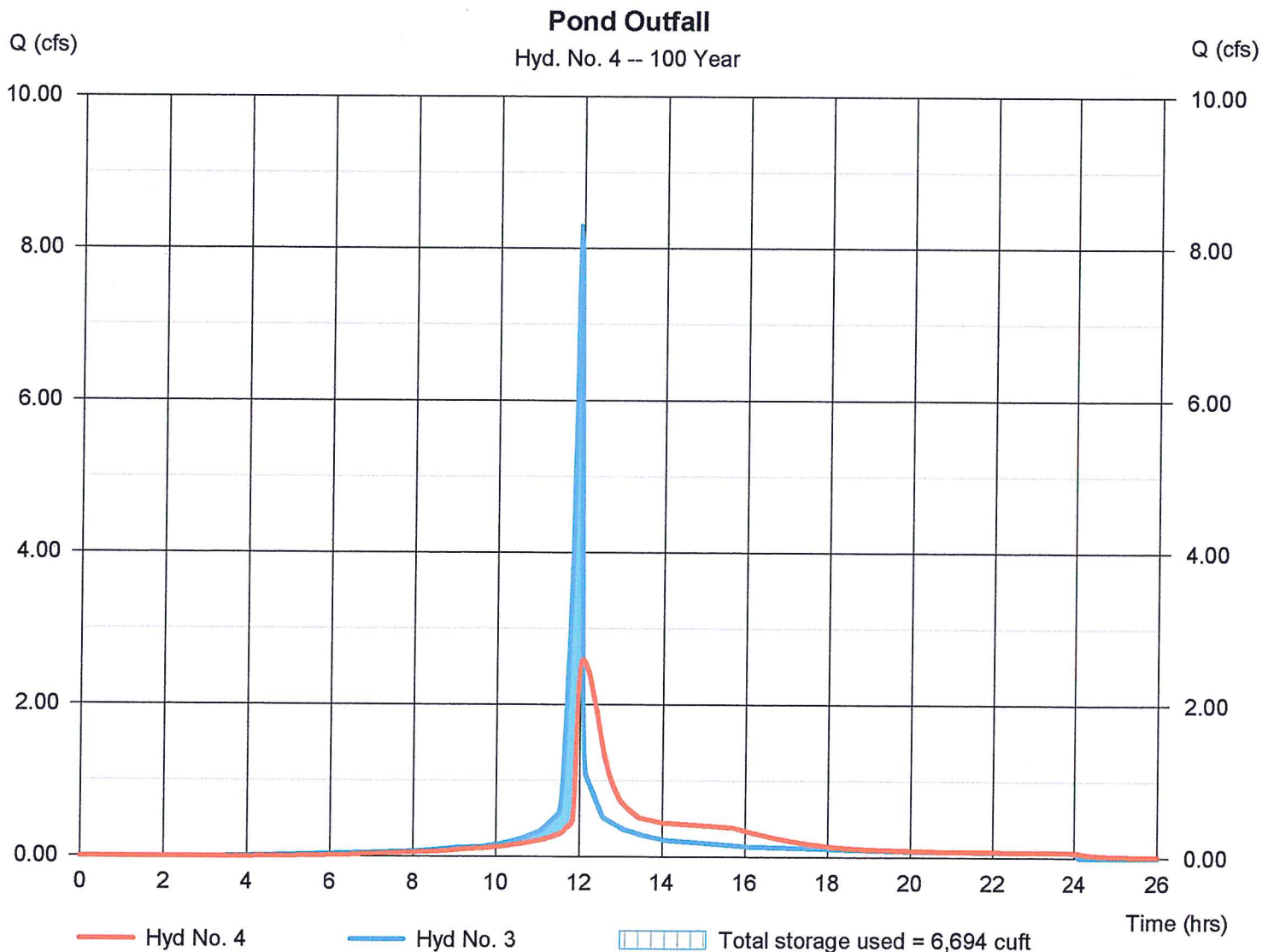
Tuesday, 11 / 19 / 2024

Hyd. No. 4

Pond Outfall

Hydrograph type	= Reservoir	Peak discharge	= 2.597 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 18,042 cuft
Inflow hyd. No.	= 3 - Post-development to Pond	Max. Elevation	= 954.09 ft
Reservoir name	= ABOVE GROUND POND	Max. Storage	= 6,694 cuft

Storage Indication method used.



Hydrograph Report

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

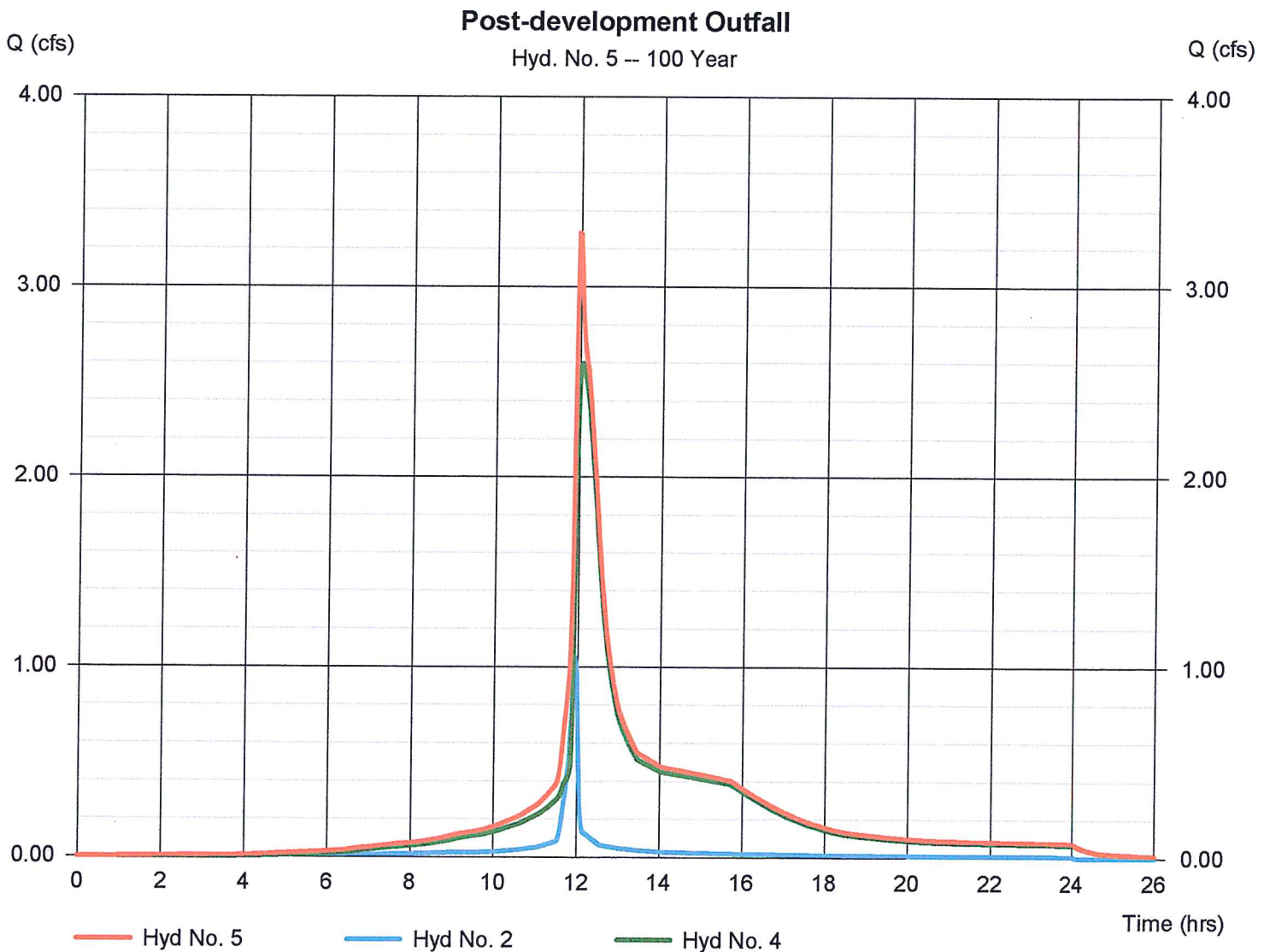
Tuesday, 11 / 19 / 2024

Hyd. No. 5

Post-development Outfall

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 2, 4

Peak discharge = 3.285 cfs
Time to peak = 11.97 hrs
Hyd. volume = 20,560 cuft
Contrib. drain. area = 0.130 ac



Hydraflow Rainfall Report

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

Tuesday, 11 / 19 / 2024

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	54.7619	12.8000	0.8990	-----
2	53.0270	11.7000	0.8506	-----
3	0.0000	0.0000	0.0000	-----
5	65.2973	13.0000	0.8490	-----
10	61.8937	12.3000	0.8065	-----
25	53.6236	10.7000	0.7395	-----
50	0.0000	0.0000	0.0000	-----
100	46.1309	9.0000	0.6567	-----

File name: Richmond, KY.IDF

$$\text{Intensity} = B / (T_c + D)^E$$

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	4.12	3.29	2.76	2.38	2.09	1.87	1.69	1.55	1.43	1.32	1.24	1.16
2	4.84	3.87	3.24	2.80	2.47	2.22	2.02	1.85	1.71	1.59	1.49	1.40
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	5.61	4.56	3.86	3.36	2.98	2.68	2.44	2.24	2.08	1.94	1.82	1.71
10	6.21	5.06	4.30	3.75	3.34	3.02	2.76	2.54	2.36	2.21	2.08	1.96
25	7.00	5.70	4.86	4.26	3.81	3.46	3.18	2.94	2.74	2.57	2.43	2.30
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	8.15	6.67	5.72	5.05	4.55	4.16	3.84	3.58	3.36	3.17	3.00	2.86

Tc = time in minutes. Values may exceed 60.

spydy\OneDrive\Documents\Abacus Work from Home\Hydrology Files\NOAA City of Richmond Mod Low 2022.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	2.85	0.00	3.30	4.25	4.72	6.80	5.93
SCS 6-Hr	0.00	2.15	0.00	0.00	2.60	0.00	0.00	4.69
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

