

DRAINAGE CALCULATIONS

FOR

232 COUNTY ROAD

(BLOCK 63 – LOT 5)

BOROUGH OF DEMAREST, BERGEN COUNTY, NEW JERSEY

Prepared By:



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Certificate of Authorization Number 24GA28108300

Date: August 07, 2026

Project Number: 4660



Matthew G. Clark, P.E.

N.J. Professional Engineer License No. 40394

Impervious Area Summary:

Existing = 15,119 sf. (onsite)
Proposed = 20,772 sf. (onsite)

Difference = (20,772 sf. – 15,119 sf.) = + 5,653 sf. (0.130 ac.)

Regulated Motor Vehicle Area Summary:

Existing = 5,827 sf. (onsite)
Proposed = 9,026 sf. (onsite)

Difference = (9,026 sf. – 5,827 sf.) = + 3,119 sf. (0.073 ac.)

Ultimate Disturbance Summary:

Proposed = 0.943 ac.

(Refer to the soil erosion & sediment control plan sheet)

Design:

Since the ultimate disturbance is less than 1 acre, the increase in impervious area is less than 0.25 acres and the increase in the regulated motor vehicle surface is less than 0.25 acres the project is not classified as a “major development” per the Bergen County Standards for Sustainable Land Development – Site Plans, the Borough of Demarest “Chapter 149” Stormwater Control code, and NJAC 7:8 (July 17, 2023).

The site has been designed so that the post developed peak rate of storm water runoff for the 2, 10, 25 & 100-year storm events is less than the pre-developed condition. A subsurface detention system (36” HDPE pipe) is proposed as part of the design.

Subsurface Detention System:

Soil Type: HSG “A”

C = 0.99 (Impervious areas including pavers)
C = 0.57 (Gravel)
C = 0.15 (Pervious areas including lans, landscaped, etc...)

Existing Conditions (see attached map):

Lot Area = 71,979.70 sf. (1.652 ac.):

- Gravel area = 2,668 sf.
- Impervious area = 12,451 sf.
- Pervious area = 58,860.70 sf.

$Cw = (2,668 \times 0.57) + (12,451 \times 0.99) + (58,860.70 \times 0.15) / 71,979.70 = 0.32$

Tc = 13.02 min. = 13 min. (see attached map & worksheets)

Proposed Conditions (see attached map):

Lot Area to Subsurface Detention System = 34,372 sf. (0.789 ac.):

- Impervious area = 19,945 sf.
- Pervious area = 14,427 sf.

$$C_w = (19,945 \times 0.99) + (14,427 \times 0.15) / 34,372 = 0.64$$

T_c = 10 min. (Minimum)

Lot Area to "Bypass" Subsurface Detention System = 37,607.70 sf. (0.863 ac.):

- Impervious area = 827 sf.
- Pervious area = 36,780.70 sf.

$$C_w = (827 \times 0.99) + (36,780.70 \times 0.15) / 37,607.70 = 0.17$$

T_c = 13.23 min. = 13 min. (see attached map & worksheets)

Stormwater Summary Table

<u>Storm Event</u>	<u>Existing Peak Flow (cfs.)</u>	<u>Proposed Bypass Flow (cfs.)</u>	<u>Target Flow from Pond (cfs.)</u>	<u>Routed Peak Flow from Pond (cfs.)</u>	<u>Maximum Water Surface Elevation (ft.)</u>	<u>Maximum Storage (cf.)</u>
2 Year	1.982	0.550	1.432	1.277	41.00	369
10 Year	2.655	0.737	1.918	1.730	41.37	582
25 Year	3.027	0.840	2.187	1.956	41.57	701
100 Year	3.667	1.018	2.649	2.349	41.99	944

Note:

Target flow from pond, for the 2-, 10-, 25- & 100-year storm events = (existing peak flow – proposed bypass flow).

Pipe Capacity Statement:

Based on:

25-year storm event

T_c = 10 minutes therefore I = 6.7 in/ hr

For Entire Site (Peak Flow Rate):

$$C_w = (20,772 \times 0.99) + (51,025.70 \times 0.15) / 71,979.70 = 0.39$$

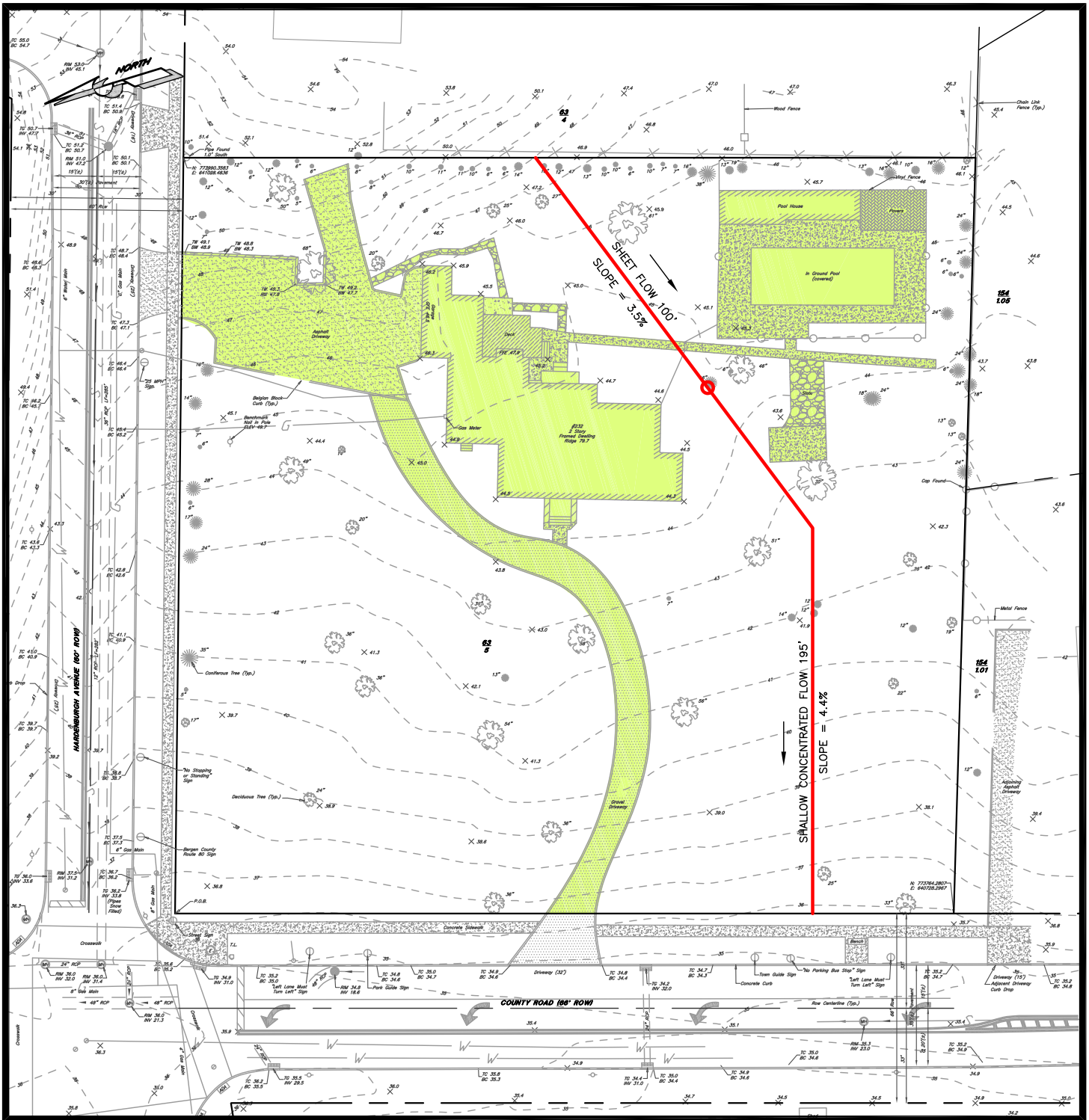
Area = A = 0.450 acres

$$Q = CIA = (0.39) (6.7 \text{ in/hr}) (1.652 \text{ ac}) = 4.32 \text{ cfs.}$$

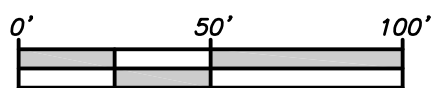
Pipe Capacity (For Pipes to Detention System):

12" HDPE at 1.0% - Capacity = 4.63 cfs.

15" HDPE at 1.0% - Capacity = 8.39 cfs.

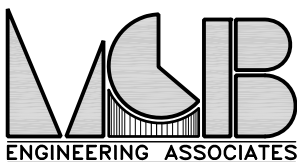


232 COUNTY ROAD
EXISTING CONDITIONS



GRAPHIC SCALE
 SCALE: 1"=100' ±

IMPERVIOUS AREA



MCB ENGINEERING ASSOCIATES, L.L.C.

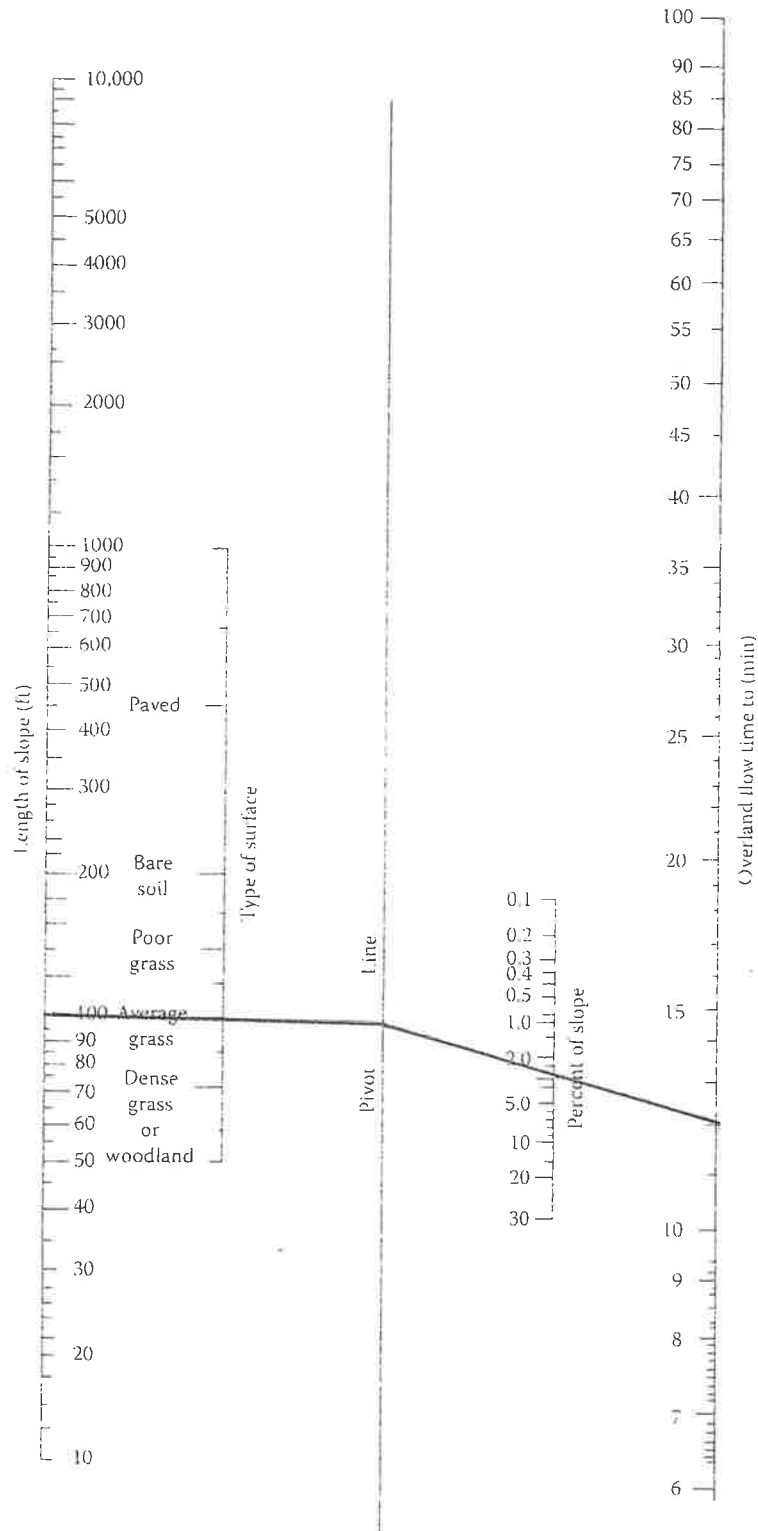
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Email: mcbea@mcbea.com – Certificate of Authorization No. 24GA28108300

PROJ. No.4660

Existing to

**Example 3.8**

A 5 acre (2.0 hectare) shed main flow of flow path is entirely Kirby equations a intensity of 4 in./h

Solution

a. Kirpich equation

Multiply the

b. Izzard equation
For dense
Input

c. Kirby equation
From Table

d. Figure 3.17
Draw a
surface" line
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Note that the
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3.5.2 OTHER METHODS**3.5.2.1 SCS Method**

The Soil Conservation Service
This method, which
of concentration
shallow concentration

FIGURE 3.17 New Jersey Highway Authority—Garden State Parkway (1957). Time of concentration nomograph.

existing to

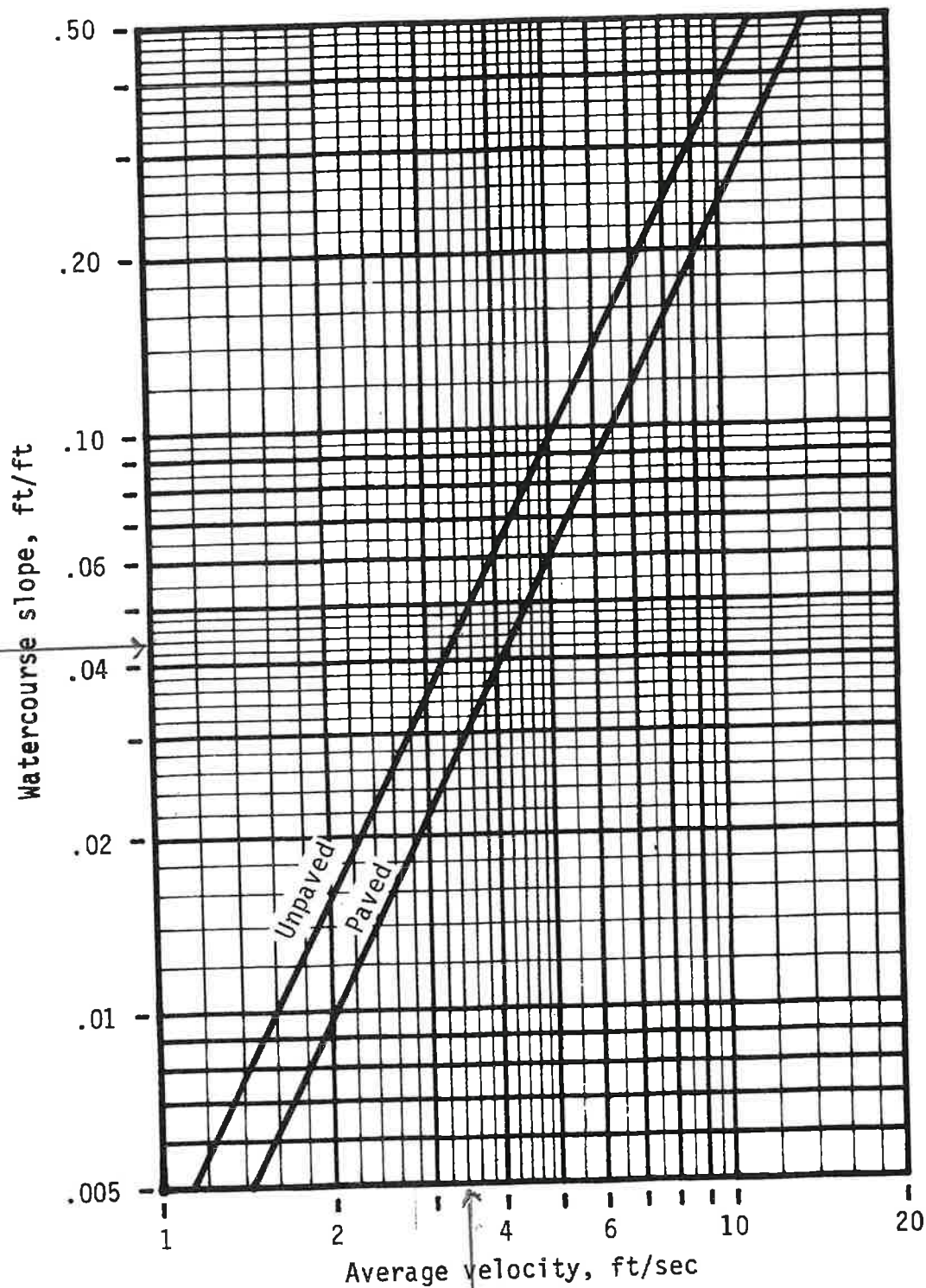
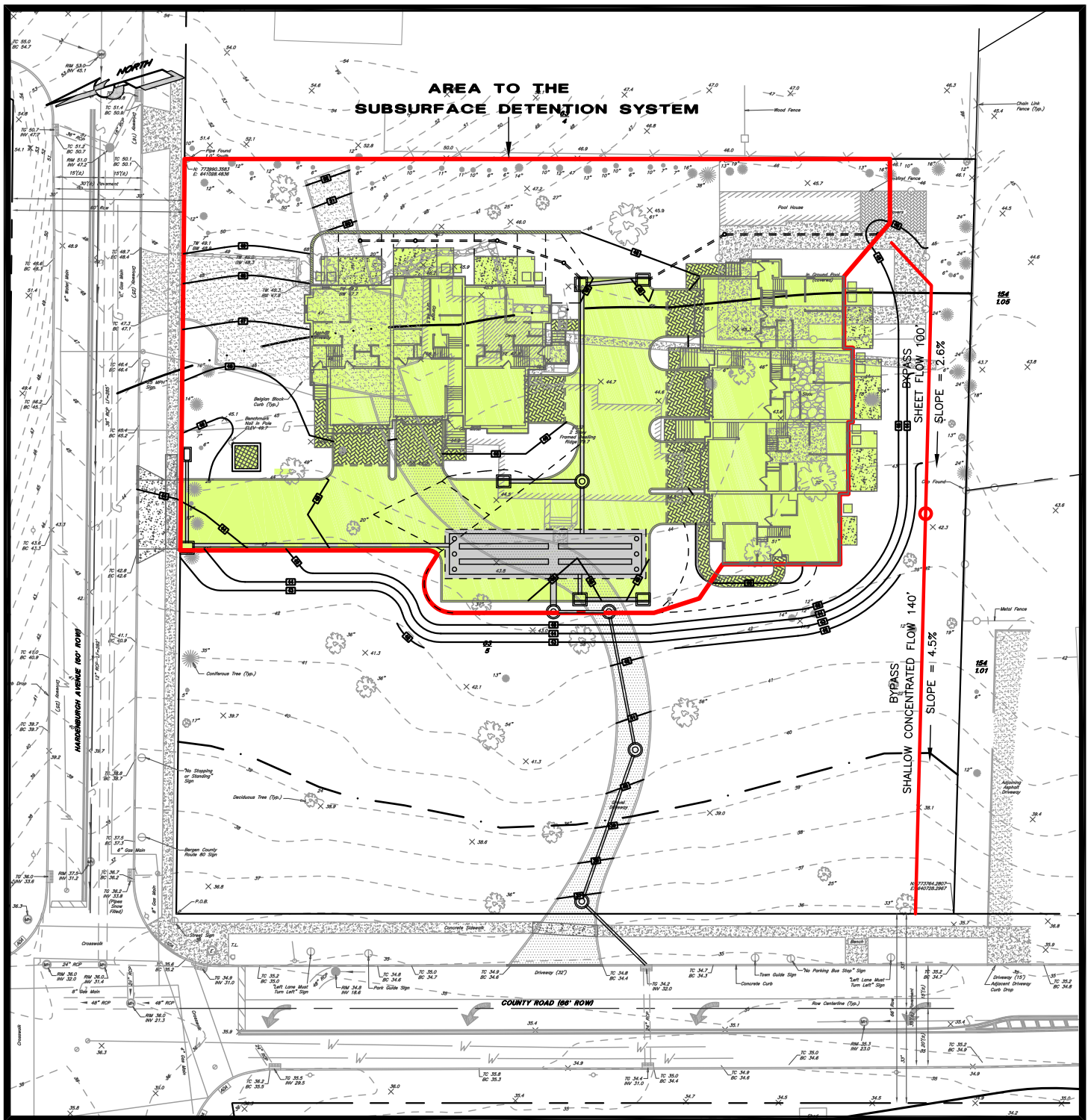


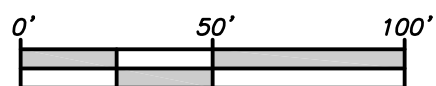
Figure 4-10 Average velocities for estimating travel time for shallow concentrated flow. (Courtesy of Soil Conservation Service, Technical Release 55.)

$$t_{\text{shallow}} = \frac{195 \text{ Ft}}{3.2 \text{ Ft/s}} = 60.9 \text{ sec} = 1.02 \text{ min}$$



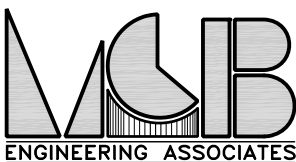
232 COUNTY ROAD

PROPOSED CONDITIONS



GRAPHIC SCALE
SCALE: 1"=100' ±

IMPERVIOUS AREA



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PROPOSED t_c
(BYPASS)

Example 3.8

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Solution

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Multiply th

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c. Kirby equa
 From T_c

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3.5.2 OTHER M

3.5.2.1 SCS Me

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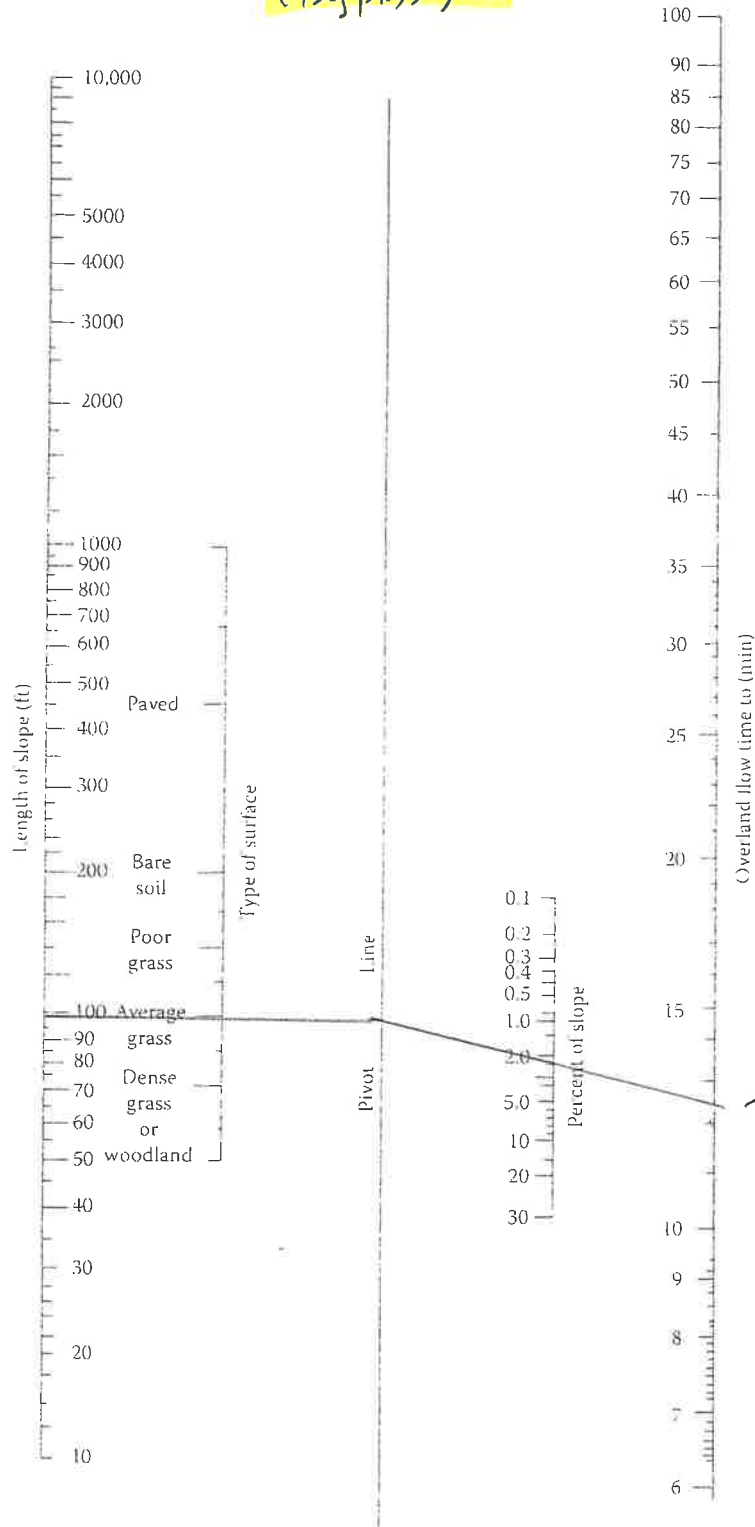


FIGURE 3.17 New Jersey Highway Authority—Garden State Parkway (1957). Time of concentration nomograph.

Proposed t_c

(By Pass)

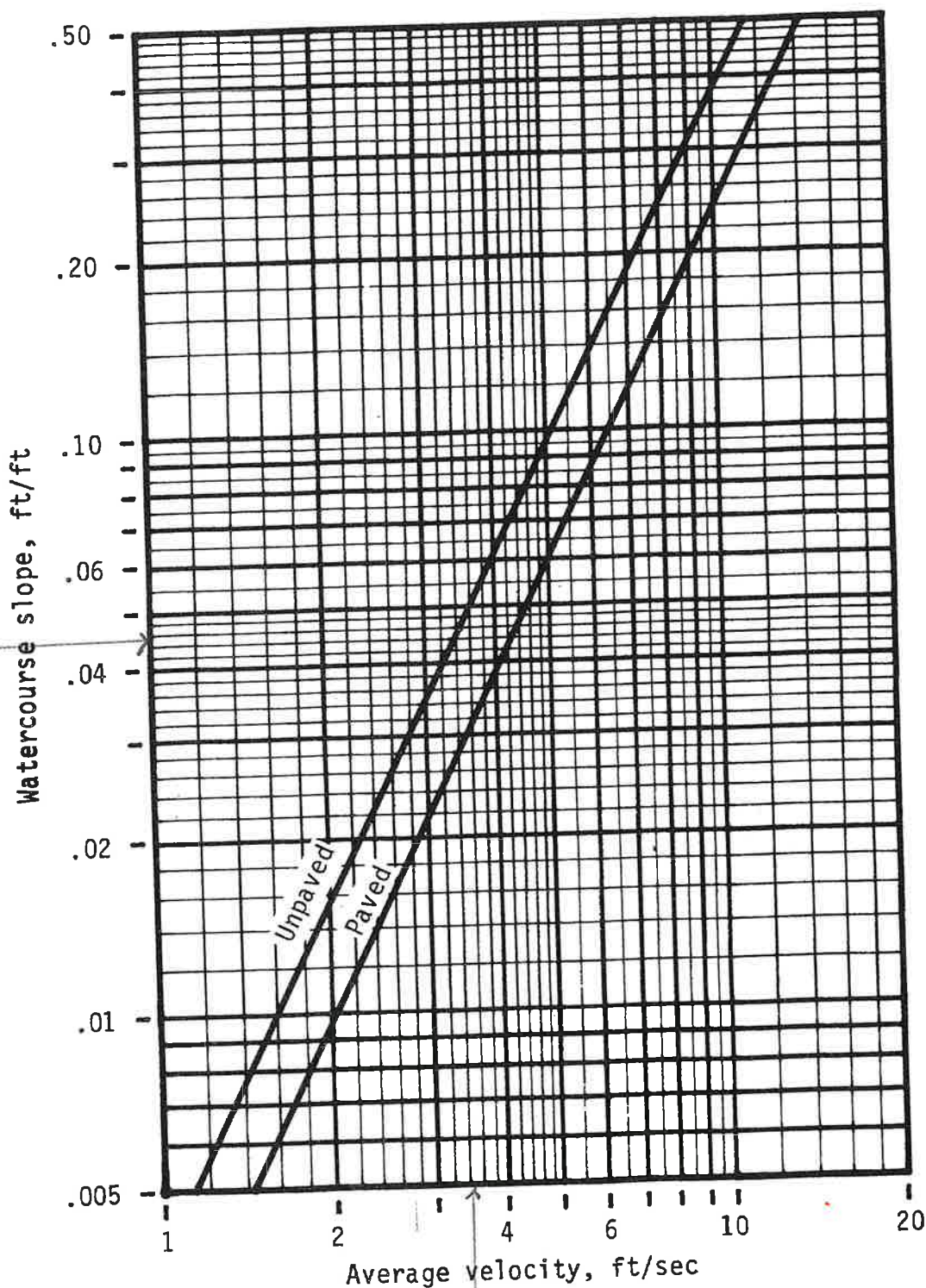


Figure 4-10 Average velocities for estimating travel time for shallow concentrated flow. (Courtesy of Soil Conservation Service, Technical Release 55.)

3.2 ft/s

$$t_{\text{shallow}} = \frac{140 \text{ ft}}{3.2 \text{ ft/s}} = 43.75 \text{ s}$$

$$= 0.73 \text{ min}$$

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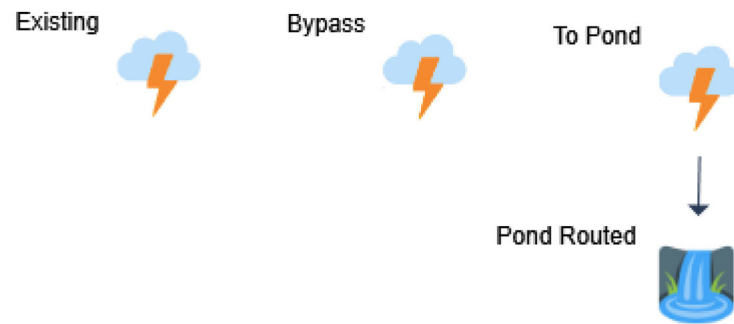
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Basin Model

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Hydrograph by Return Period

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[illegible]

Hydrograph 2-yr Summary

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08-07-2026

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Hydrograph Report

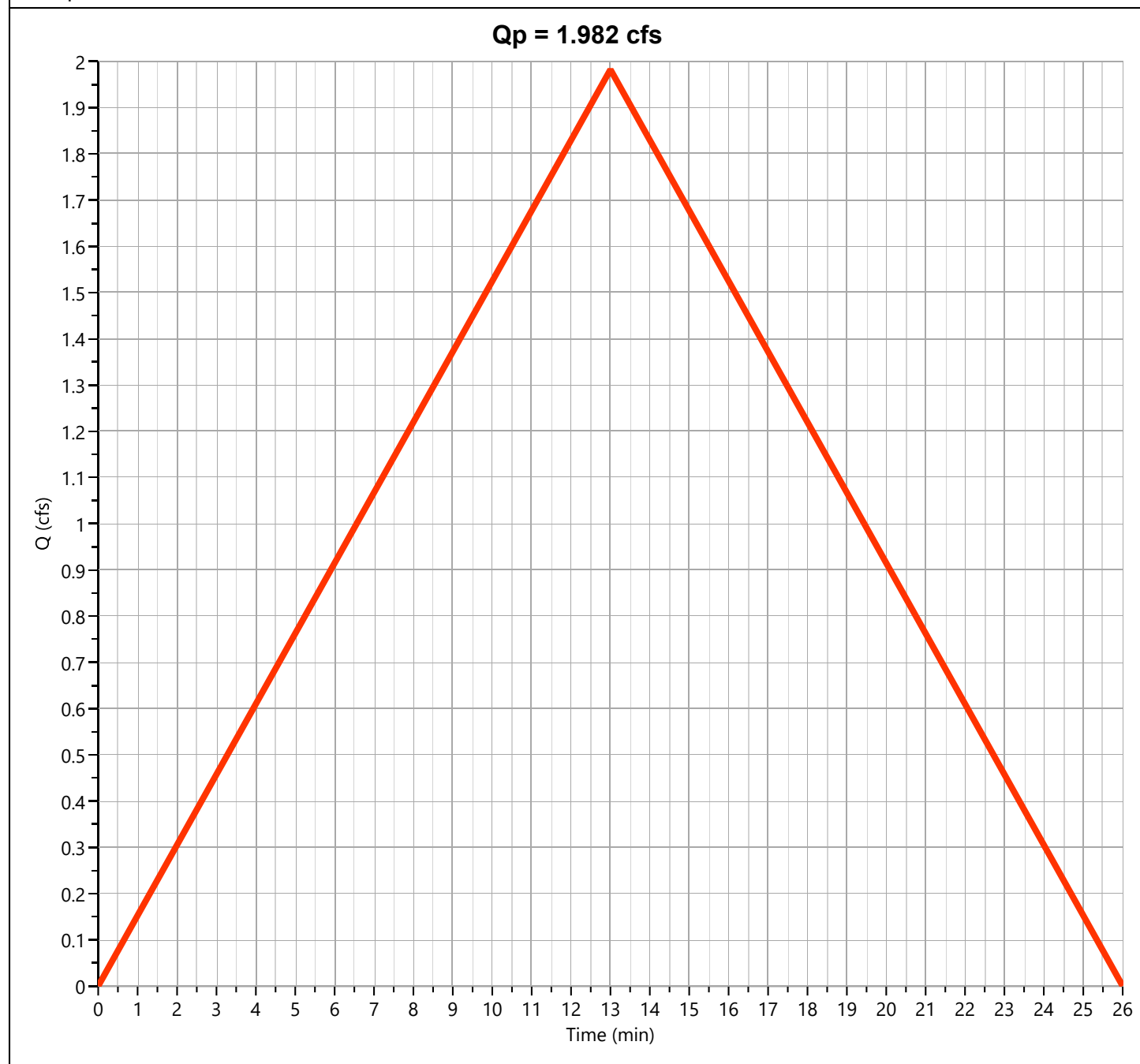
Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

Existing

Hyd. No. 1

Hydrograph Type	= Rational	Peak Flow	= 1.982 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.22 hrs
Time Interval	= 1 min	Runoff Volume	= 1,546 cuft
Drainage Area	= 1.652 ac	Runoff Coeff.	= 0.32
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
IDF Curve	= NJ RSIS 2017 IDF.idf	Intensity	= 3.75 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1



Hydrograph Report

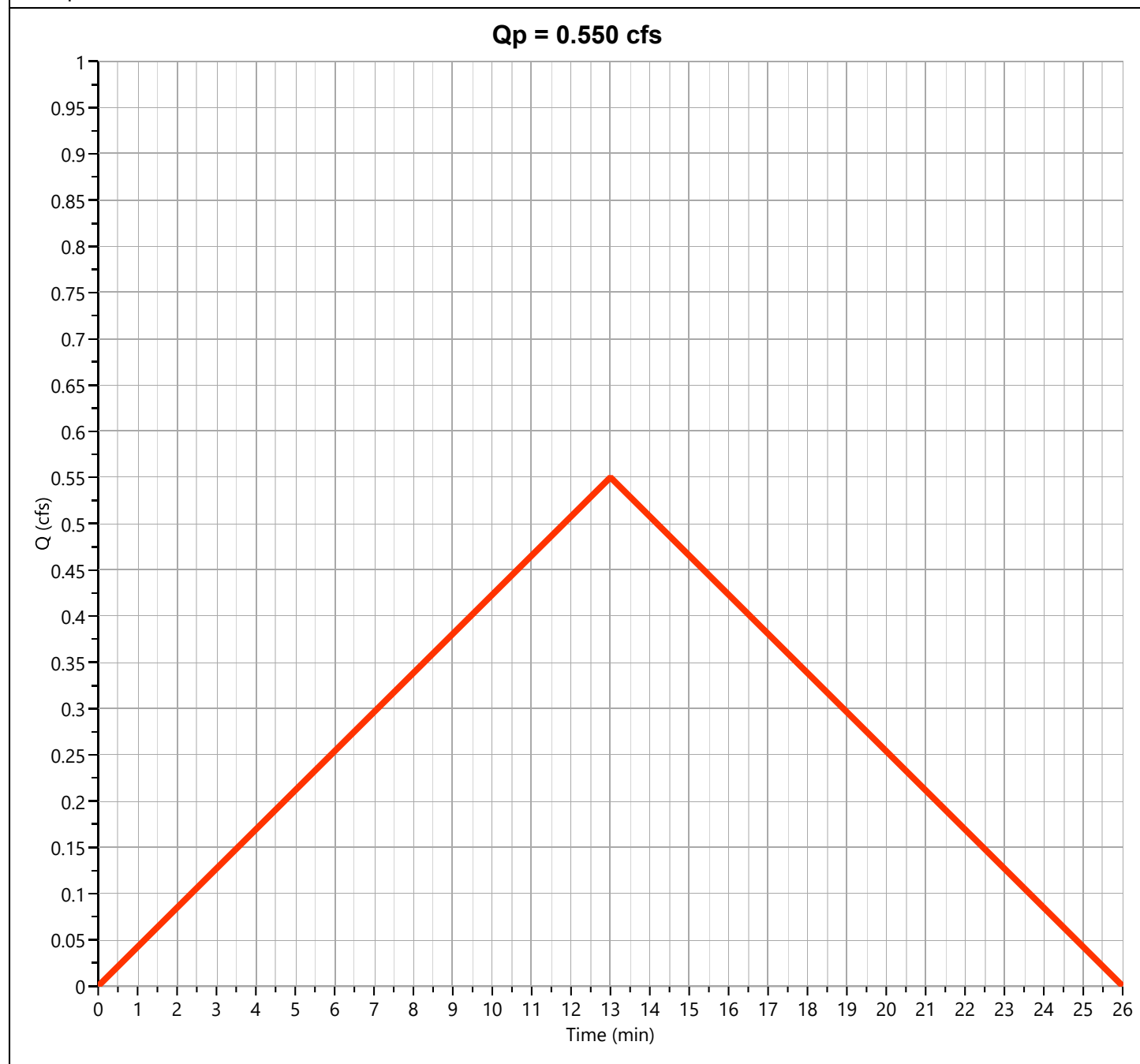
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08-07-2026

Bypass

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 0.550 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.22 hrs
Time Interval	= 1 min	Runoff Volume	= 429 cuft
Drainage Area	= 0.863 ac	Runoff Coeff.	= 0.17
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
IDF Curve	= NJ RSIS 2017 IDF.idf	Intensity	= 3.75 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1



Hydrograph Report

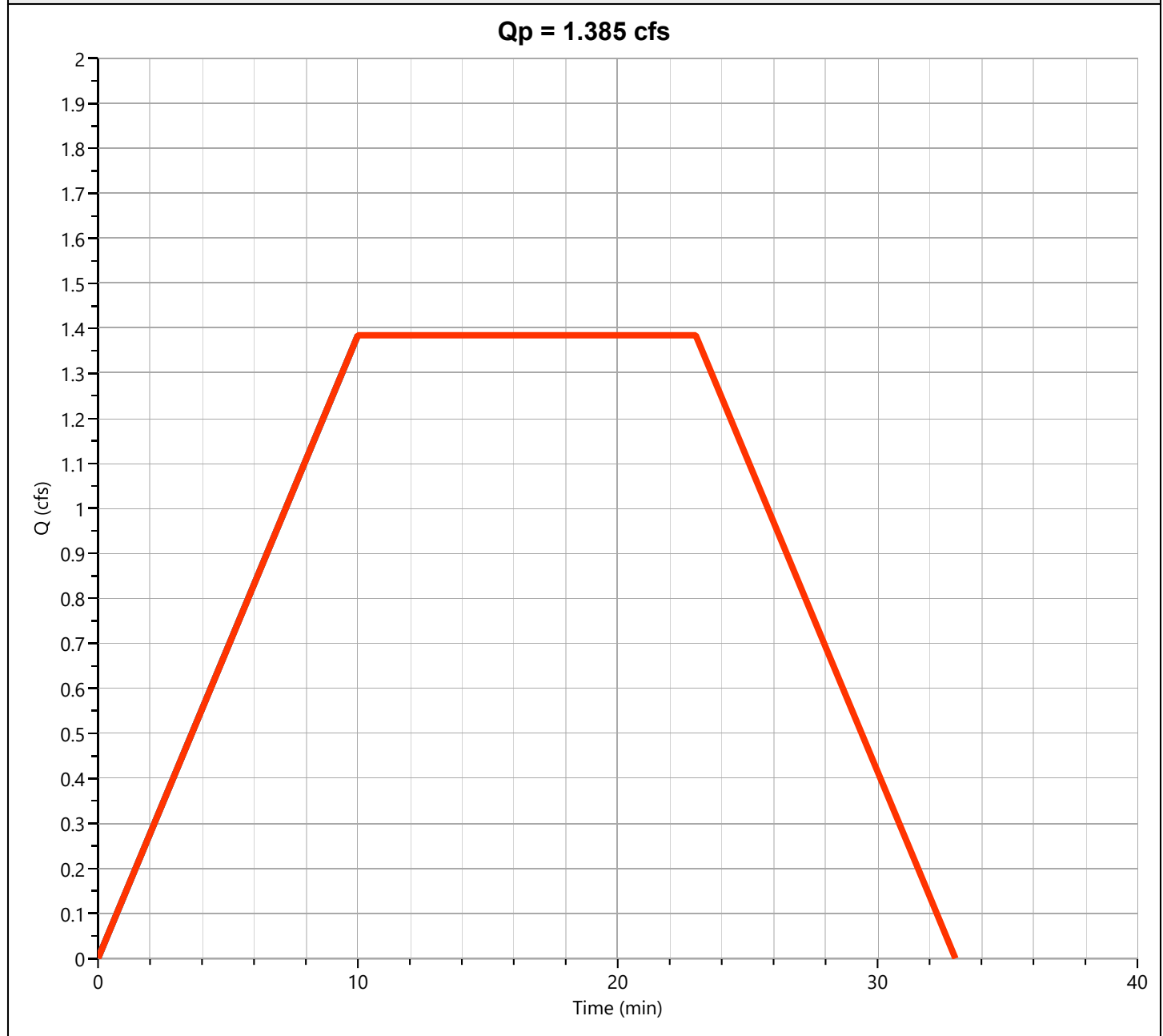
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To Pond

Hyd. No. 3

Hydrograph Type	= Mod Rational	Peak Flow	= 1.385 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 1,994 cuft
Drainage Area	= 0.789 ac	Runoff Coeff.	= 0.64
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF.idf	Intensity	= 2.74 in/hr
Freq. Corr. Factor	= 1.00	Storm Duration	= 2.4 x Tc
Target Q	= 1.400 cfs	Required Storage	= 608 cuft



Hydrograph Report

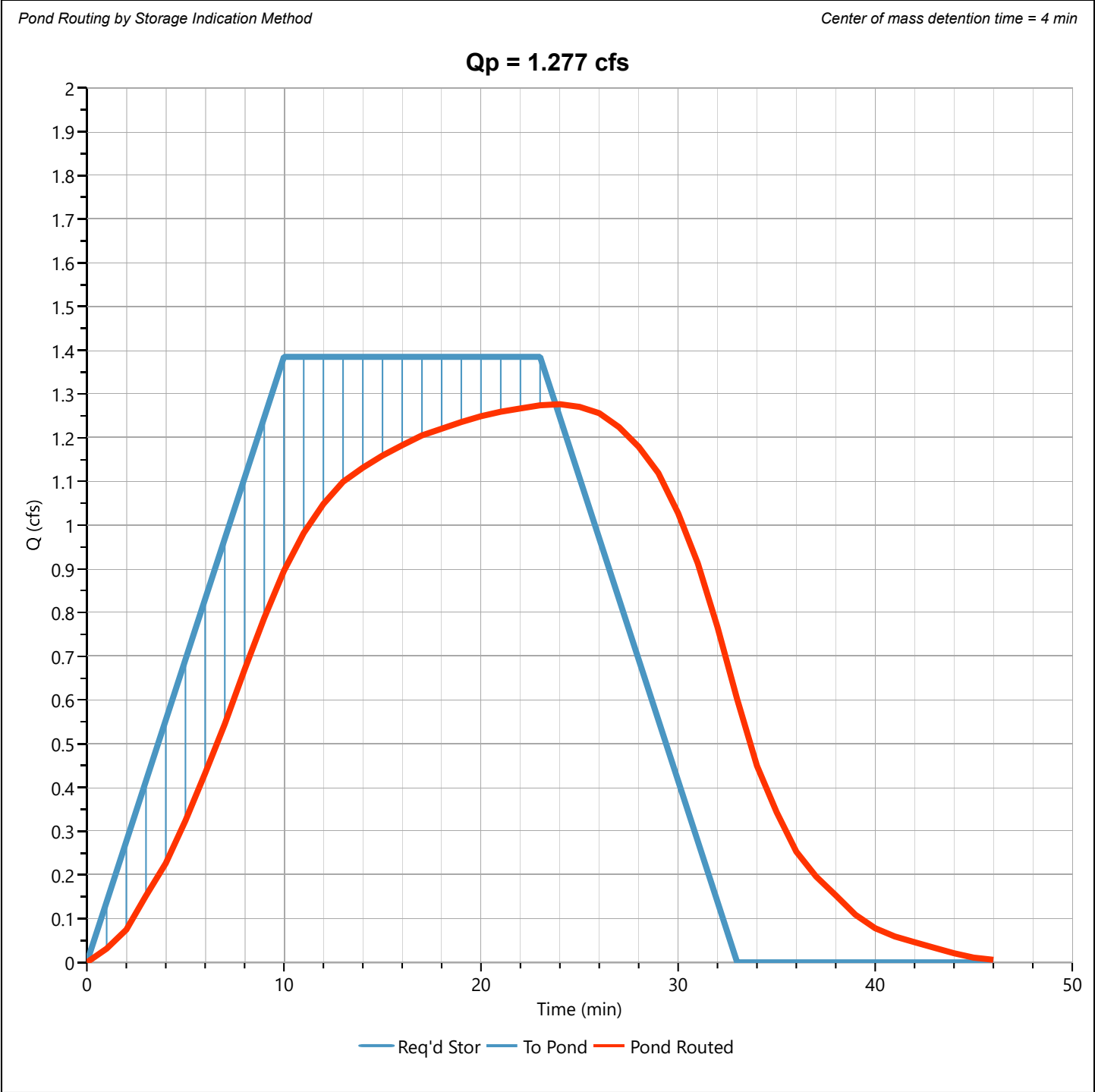
Hydrology Studio v 3.0.0.44

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Pond Routed

Hyd. No. 4

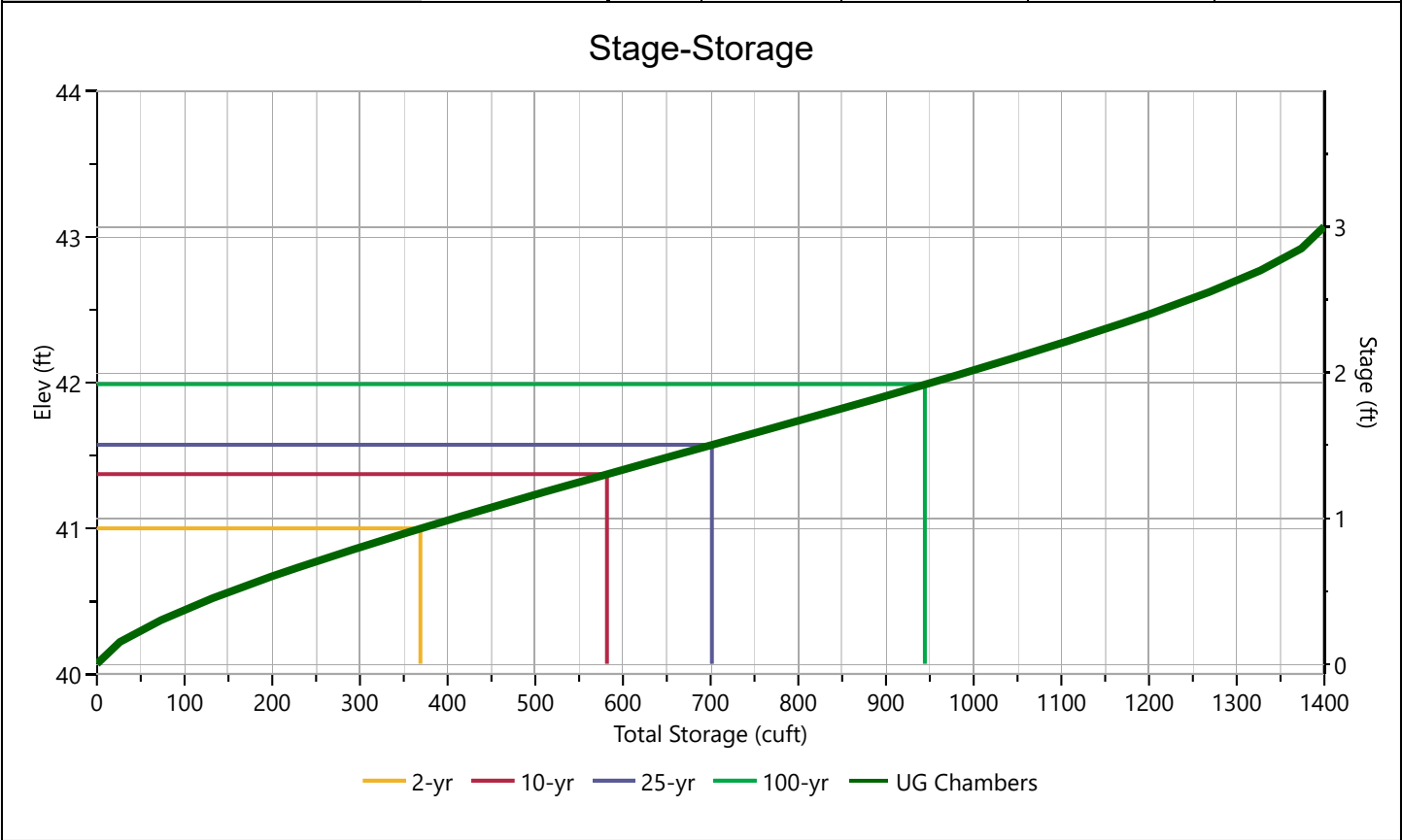
Hydrograph Type	= Pond Route	Peak Flow	= 1.277 cfs
Storm Frequency	= 2-yr	Time to Peak	= 0.40 hrs
Time Interval	= 1 min	Hydrograph Volume	= 1,911 cuft
Inflow Hydrograph	= 3 - To Pond	Max. Elevation	= 41.00 ft
Pond Name	= Pond 1	Max. Storage	= 369 cuft



Pond 1

Stage-Storage

Underground Chambers		Stage / Storage Table				
Description	Input	Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
Invert Elev Down, ft	40.07	0.00	40.07	n/a	0.000	0.000
Chamber Rise, ft	3.00	0.15	40.22	n/a	26.2	26.2
Chamber Shape	Circular	0.30	40.37	n/a	46.8	73.0
Chamber Span, ft	3.00	0.45	40.52	n/a	58.7	132
Barrel Length, ft	60.00	0.60	40.67	n/a	67.7	199
No. Barrels	3	0.75	40.82	n/a	74.4	274
Barrel Slope, %	0.00	0.90	40.97	n/a	79.5	353
Headers, y/n	Yes	1.05	41.12	n/a	83.6	437
Stone Encasement, y/n	No	1.20	41.27	n/a	86.0	523
Encasement Bottom Elevation, ft	0.00	1.35	41.42	n/a	88.3	611
Encasement Width per Chamber, ft	0.00	1.50	41.57	n/a	88.8	700
Encasement Depth, ft	0.00	1.65	41.72	n/a	88.8	789
Encasement Voids, %	40.00	1.80	41.87	n/a	88.3	877
		1.95	42.02	n/a	86.0	963
		2.10	42.17	n/a	83.6	1,047
		2.25	42.32	n/a	79.5	1,126
		2.40	42.47	n/a	74.4	1,201
		2.55	42.62	n/a	67.7	1,268
		2.70	42.77	n/a	58.8	1,327
		2.85	42.92	n/a	46.6	1,374
		3.00	43.07	n/a	26.1	1,400

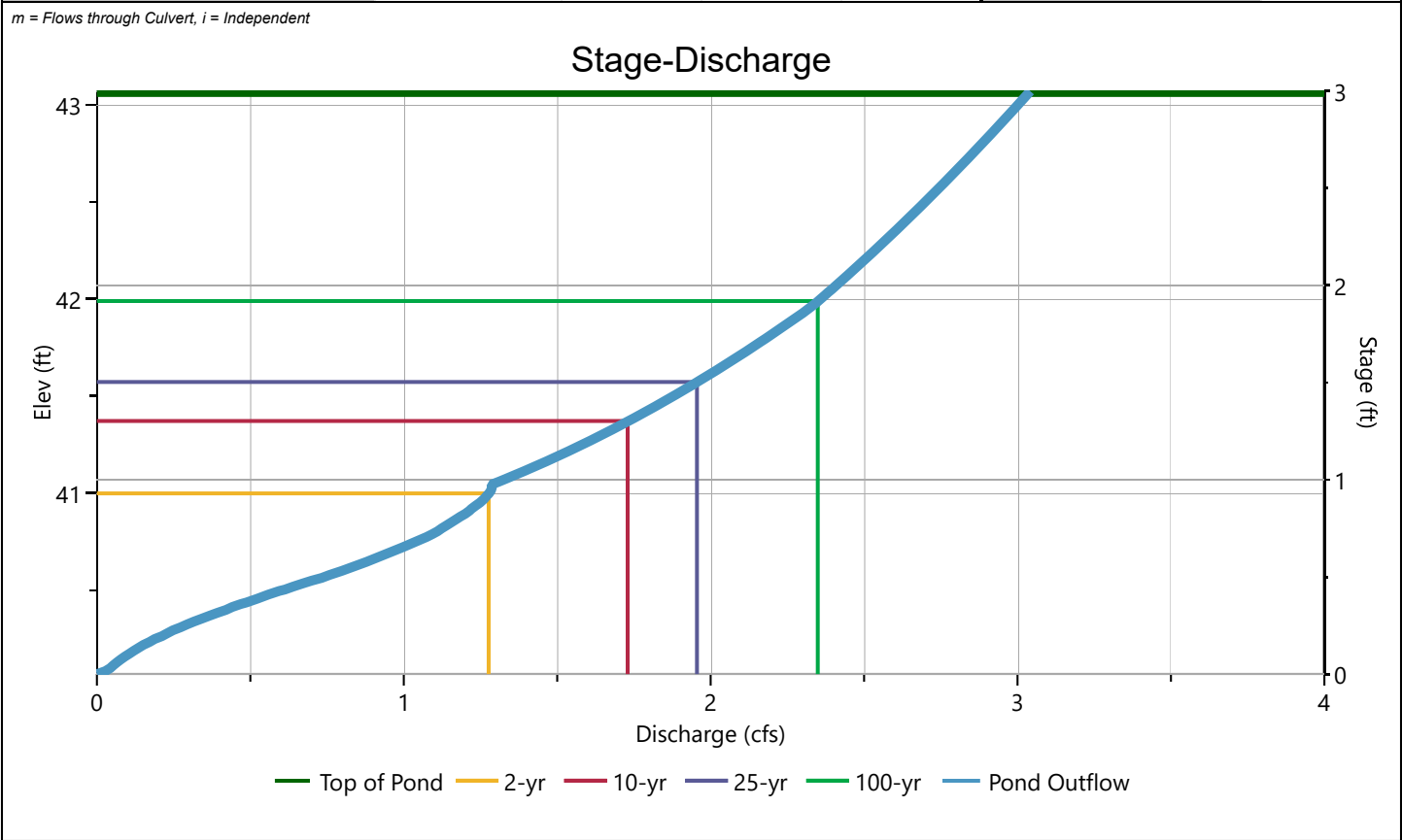


Pond 1

Stage-Discharge

Culvert / Orifices	Cir Culvert	Orifice			Perforated Riser
		1 (m)	2	3	
Rise, in	10	10			Hole Diameter, in
Span, in	10	10			No. holes
No. Barrels	1	1			Invert Elevation, ft
Invert Elevation, ft	39.97	39.97			Height, ft
Orifice Coefficient, Co	0.60	0.60			Orifice Coefficient, Co
Length, ft	16				
Barrel Slope, %	1				
N-Value, n	0.010				
Weirs	Riser	Weir			Ancillary
		1	2	3	
Shape / Type					Exfiltration, in/hr
Crest Elevation, ft					
Crest Length, ft					
Angle, deg					
Weir Coefficient, Cw					

m = Flows through Culvert, i = Independent



Pond Report

Project Name: 4660
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Hydrology Studio v 3.0.0.44

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Pond 1

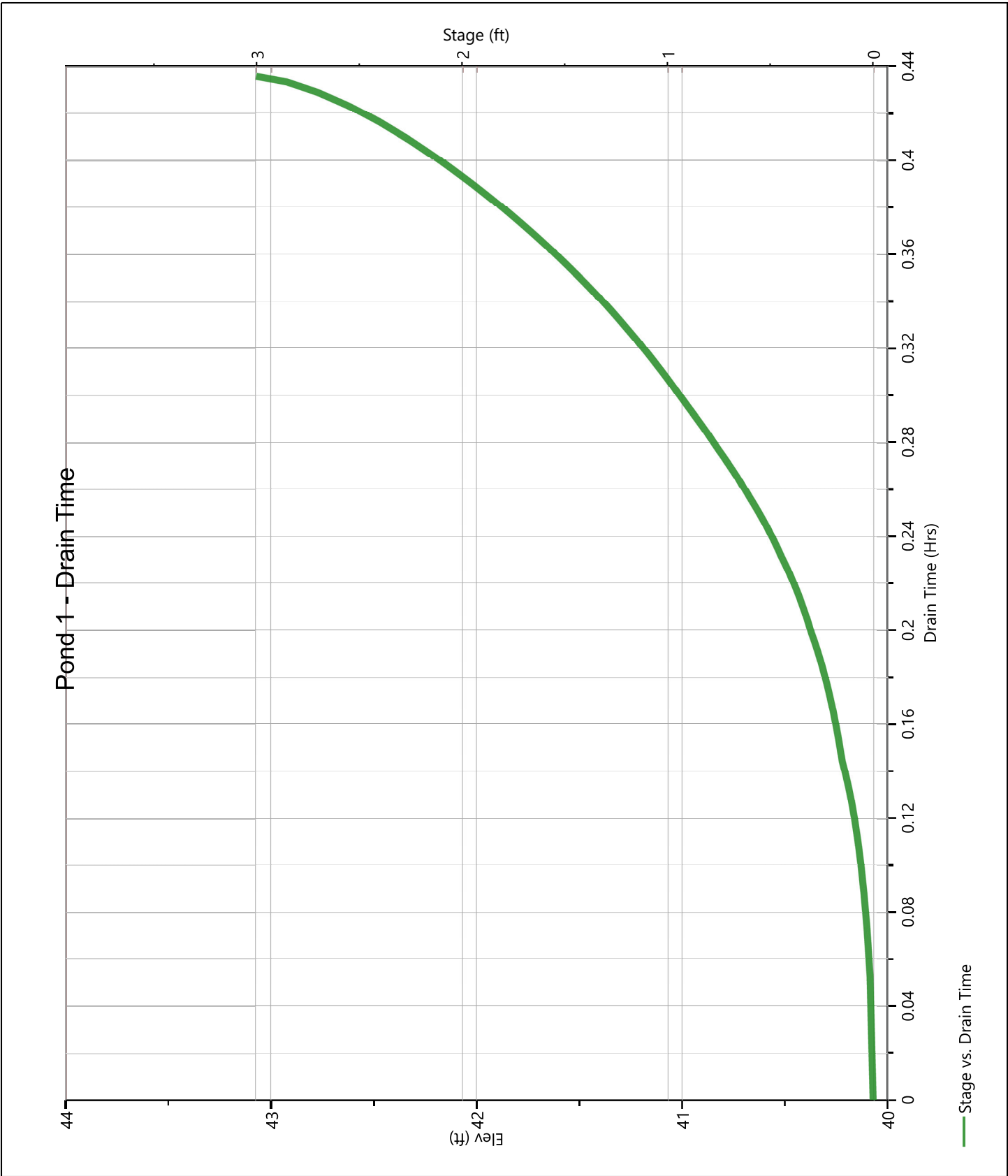
Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	40.07	0.000	0.000	0.000										0.000
0.15	40.22	26.2	0.151 ic	0.151										0.151
0.30	40.37	73.0	0.367 ic	0.367										0.367
0.45	40.52	132	0.640 ic	0.640										0.640
0.60	40.67	199	0.915 oc	0.915										0.915
0.75	40.82	274	1.124 oc	1.124										1.124
0.90	40.97	353	1.261 oc	1.261										1.261
1.05	41.12	437	1.401 oc	1.401										1.401
1.20	41.27	523	1.606 oc	1.606										1.606
1.35	41.42	611	1.788 oc	1.788										1.788
1.50	41.57	700	1.953 oc	1.953										1.953
1.65	41.72	789	2.105 oc	2.105										2.105
1.80	41.87	877	2.247 oc	2.247										2.247
1.95	42.02	963	2.373 ic	2.373										2.373
2.10	42.17	1,047	2.479 ic	2.479										2.479
2.25	42.32	1,126	2.582 ic	2.582										2.582
2.40	42.47	1,201	2.680 ic	2.680										2.680
2.55	42.62	1,268	2.775 ic	2.775										2.775
2.70	42.77	1,327	2.866 ic	2.866										2.866
2.85	42.92	1,374	2.955 ic	2.955										2.955
3.00	43.07	1,400	3.041 ic	3.041										3.041

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

Pond 1

Pond Drawdown



Hydrology Studio v 3.0.0.44

08-07-2026

[illegible]

Hydrograph Report

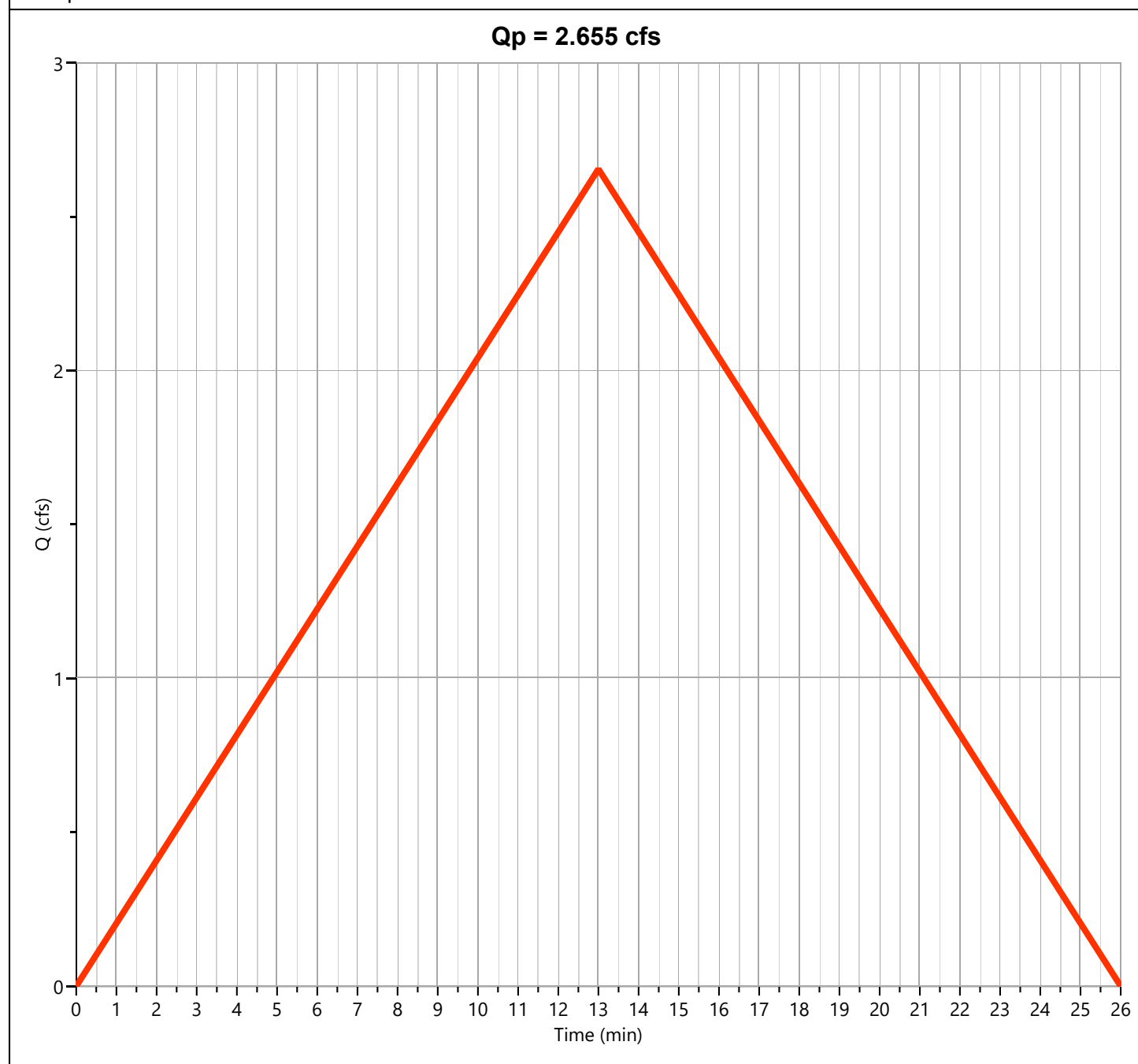
Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

Existing

Hyd. No. 1

Hydrograph Type	= Rational	Peak Flow	= 2.655 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.22 hrs
Time Interval	= 1 min	Runoff Volume	= 2,071 cuft
Drainage Area	= 1.652 ac	Runoff Coeff.	= 0.32
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
IDF Curve	= NJ RSIS 2017 IDF.idf	Intensity	= 5.02 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1



Hydrograph Report

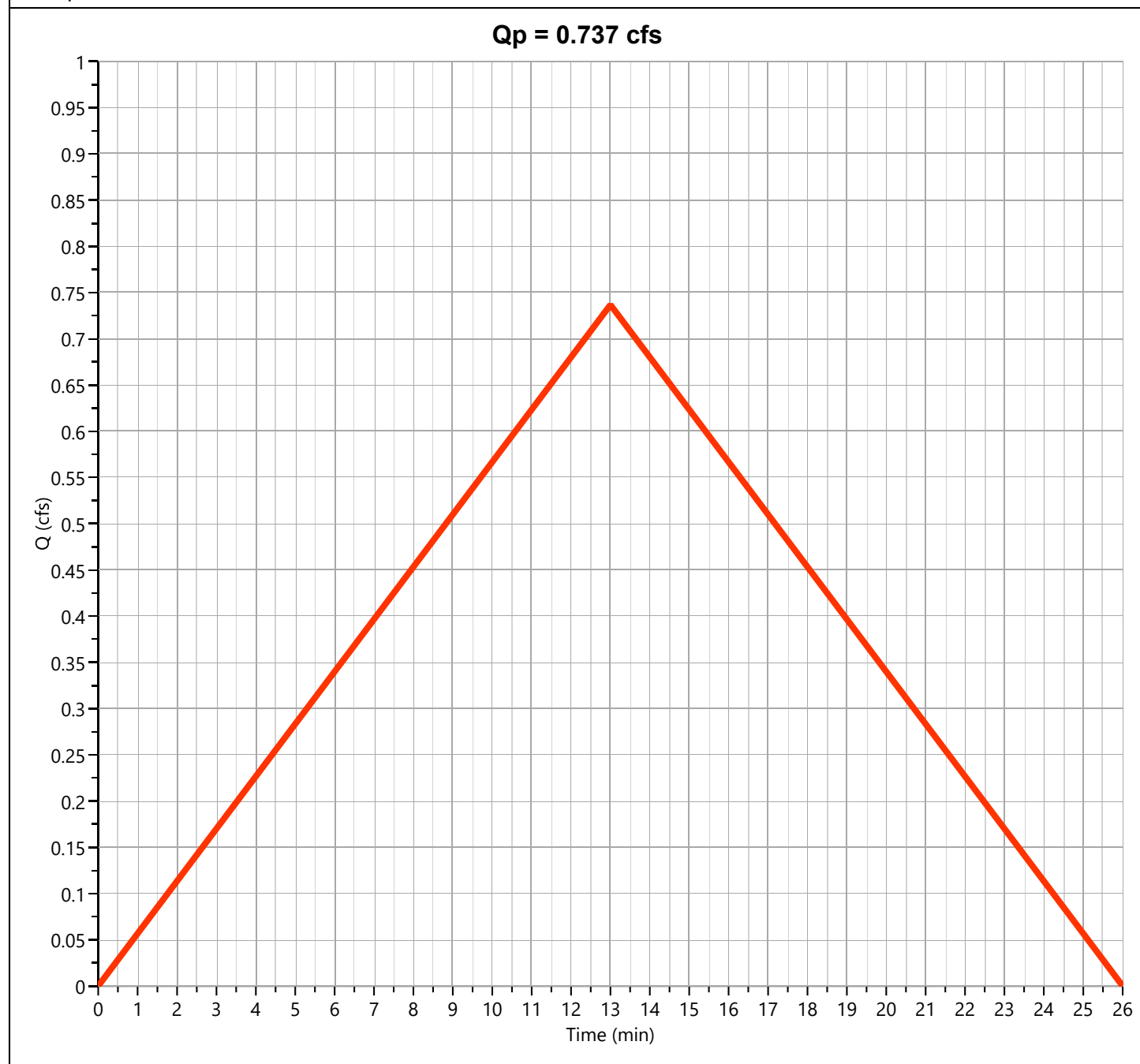
Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

Bypass

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 0.737 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.22 hrs
Time Interval	= 1 min	Runoff Volume	= 575 cuft
Drainage Area	= 0.863 ac	Runoff Coeff.	= 0.17
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
IDF Curve	= NJ RSIS 2017 IDF.idf	Intensity	= 5.02 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1



Hydrograph Report

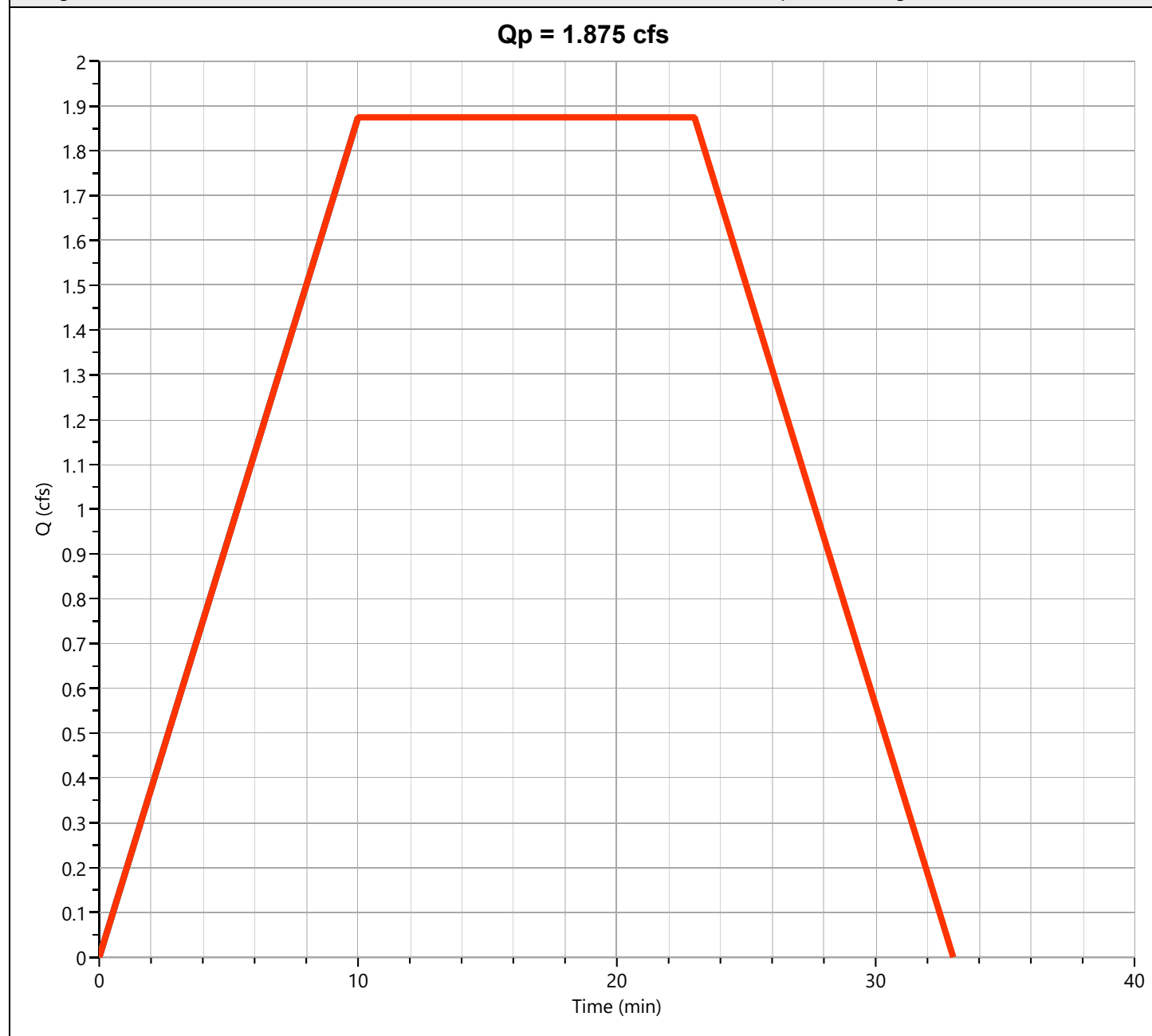
Hydrology Studio v 3.0.0.44

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08-07-2026

To Pond

Hyd. No. 3

Hydrograph Type	= Mod Rational	Peak Flow	= 1.875 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 2,700 cuft
Drainage Area	= 0.789 ac	Runoff Coeff.	= 0.64
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF.idf	Intensity	= 3.71 in/hr
Freq. Corr. Factor	= 1.00	Storm Duration	= 2.4 x Tc
Target Q	= 1.900 cfs	Required Storage	= 819 cuft



Hydrograph Report

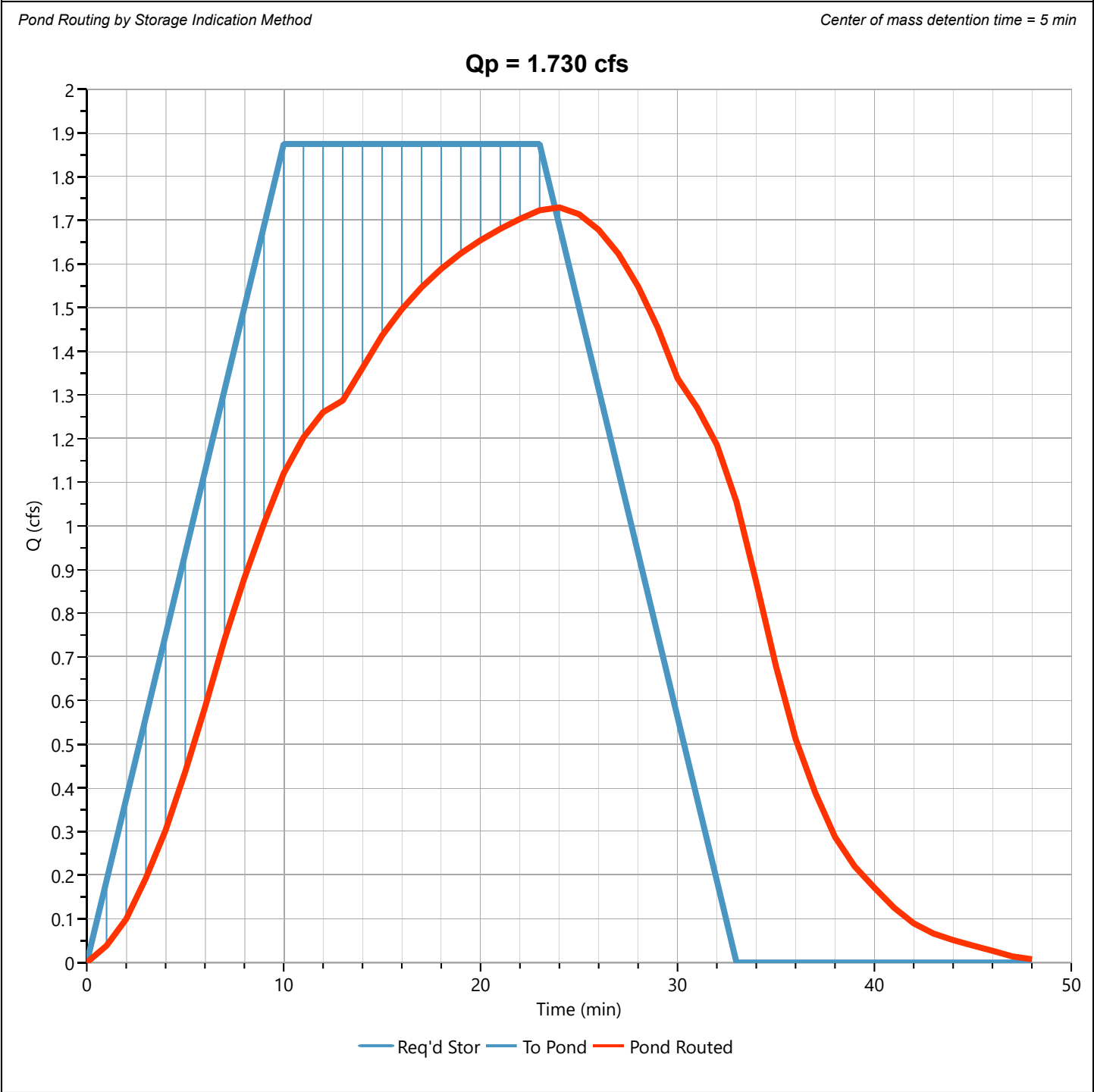
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08-07-2026

Pond Routed

Hyd. No. 4

Hydrograph Type	= Pond Route	Peak Flow	= 1.730 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.40 hrs
Time Interval	= 1 min	Hydrograph Volume	= 2,587 cuft
Inflow Hydrograph	= 3 - To Pond	Max. Elevation	= 41.37 ft
Pond Name	= Pond 1	Max. Storage	= 582 cuft



Hydrograph 25-yr Summary

Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

[illegible]

Hydrograph Report

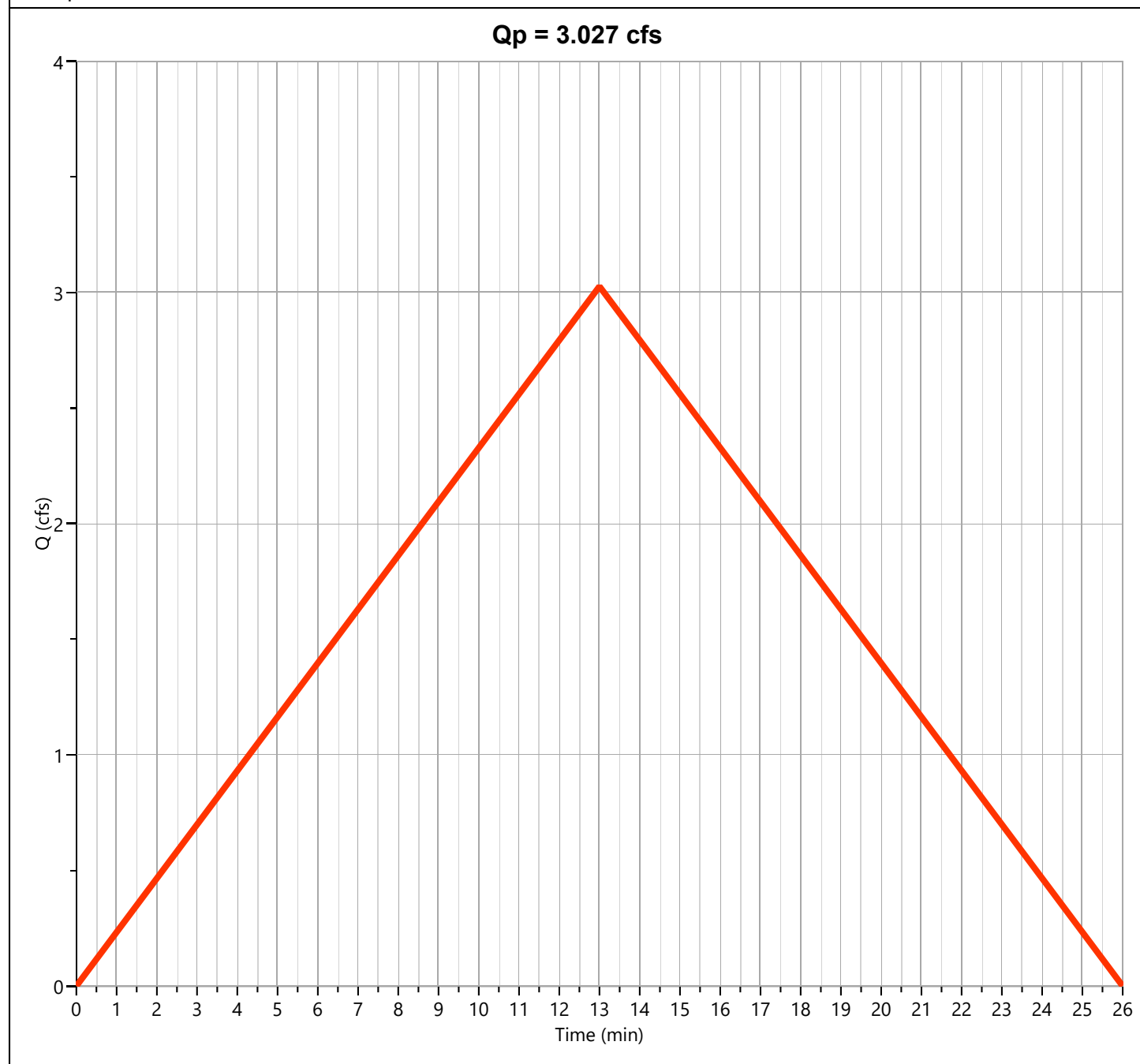
Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

Existing

Hyd. No. 1

Hydrograph Type	= Rational	Peak Flow	= 3.027 cfs
Storm Frequency	= 25-yr	Time to Peak	= 0.22 hrs
Time Interval	= 1 min	Runoff Volume	= 2,361 cuft
Drainage Area	= 1.652 ac	Runoff Coeff.	= 0.32
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
IDF Curve	= NJ RSIS 2017 IDF.idf	Intensity	= 5.73 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1



Hydrograph Report

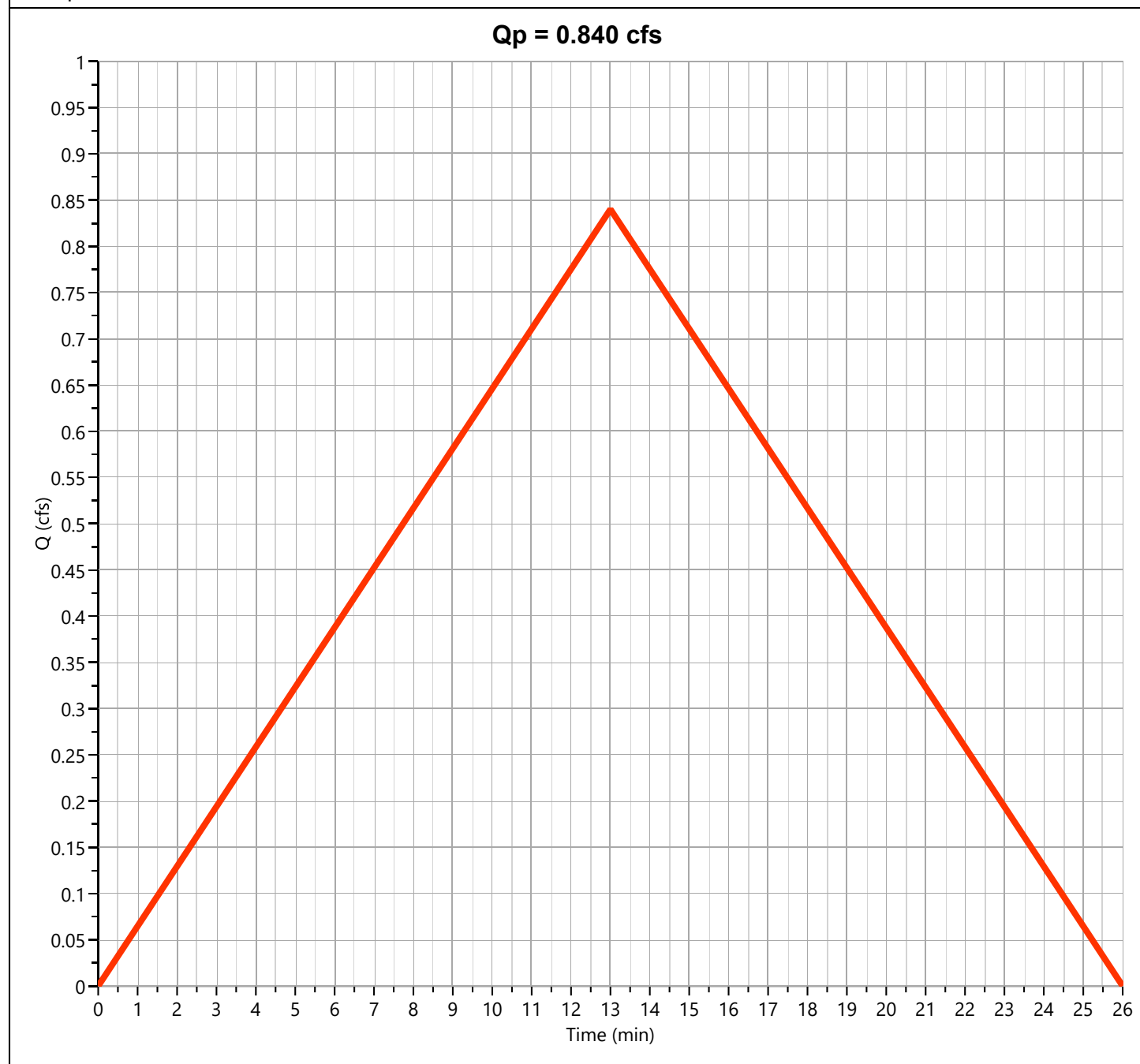
Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

Bypass

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 0.840 cfs
Storm Frequency	= 25-yr	Time to Peak	= 0.22 hrs
Time Interval	= 1 min	Runoff Volume	= 655 cuft
Drainage Area	= 0.863 ac	Runoff Coeff.	= 0.17
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
IDF Curve	= NJ RSIS 2017 IDF.idf	Intensity	= 5.73 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1



Hydrograph Report

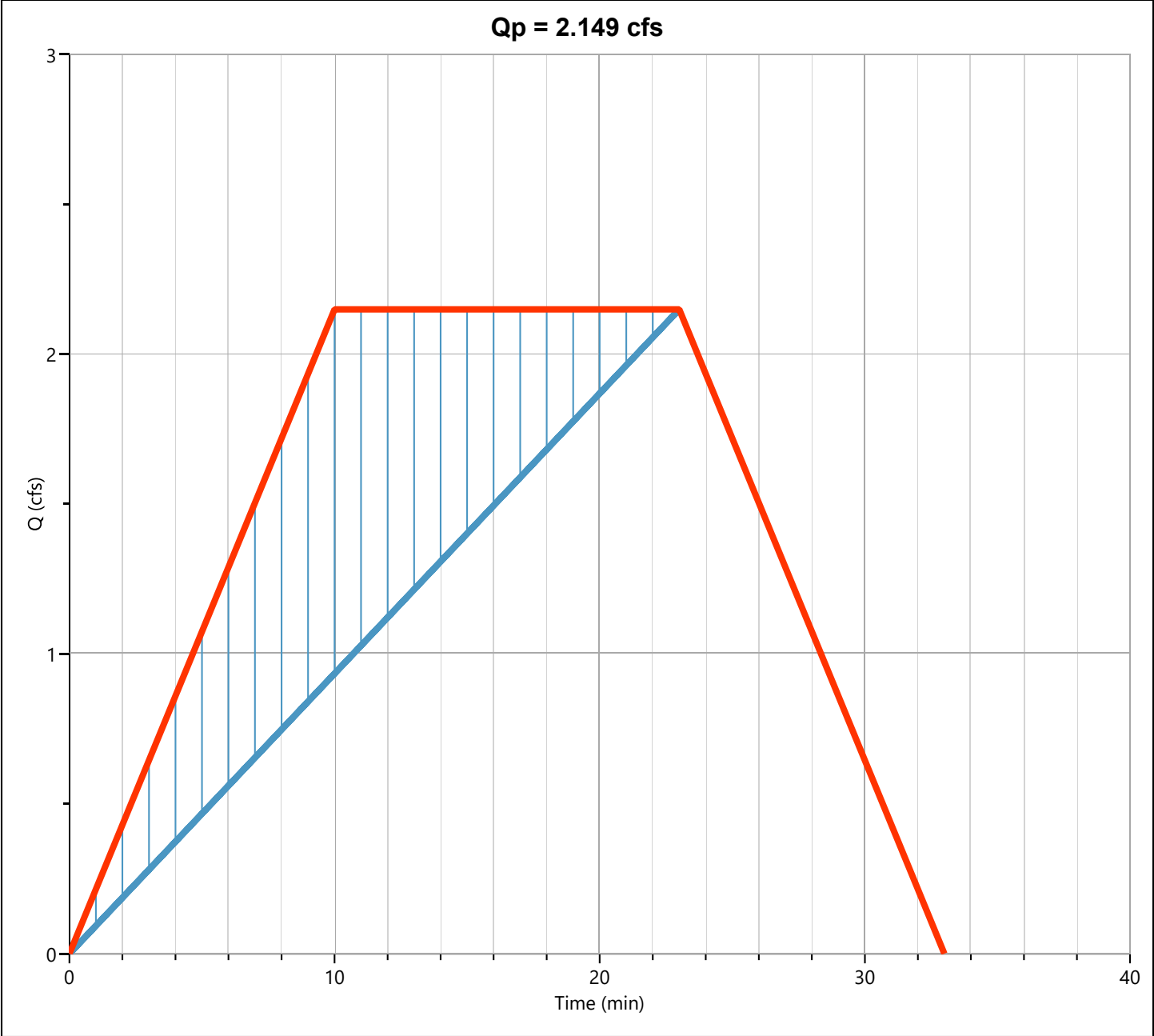
Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

To Pond

Hyd. No. 3

Hydrograph Type	= Mod Rational	Peak Flow	= 2.149 cfs
Storm Frequency	= 25-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 3,095 cuft
Drainage Area	= 0.789 ac	Runoff Coeff.	= 0.64
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF.idf	Intensity	= 4.26 in/hr
Freq. Corr. Factor	= 1.00	Storm Duration	= 2.4 x Tc
Target Q	= 2.100 cfs	Required Storage	= 1,016 cuft



Hydrograph Report

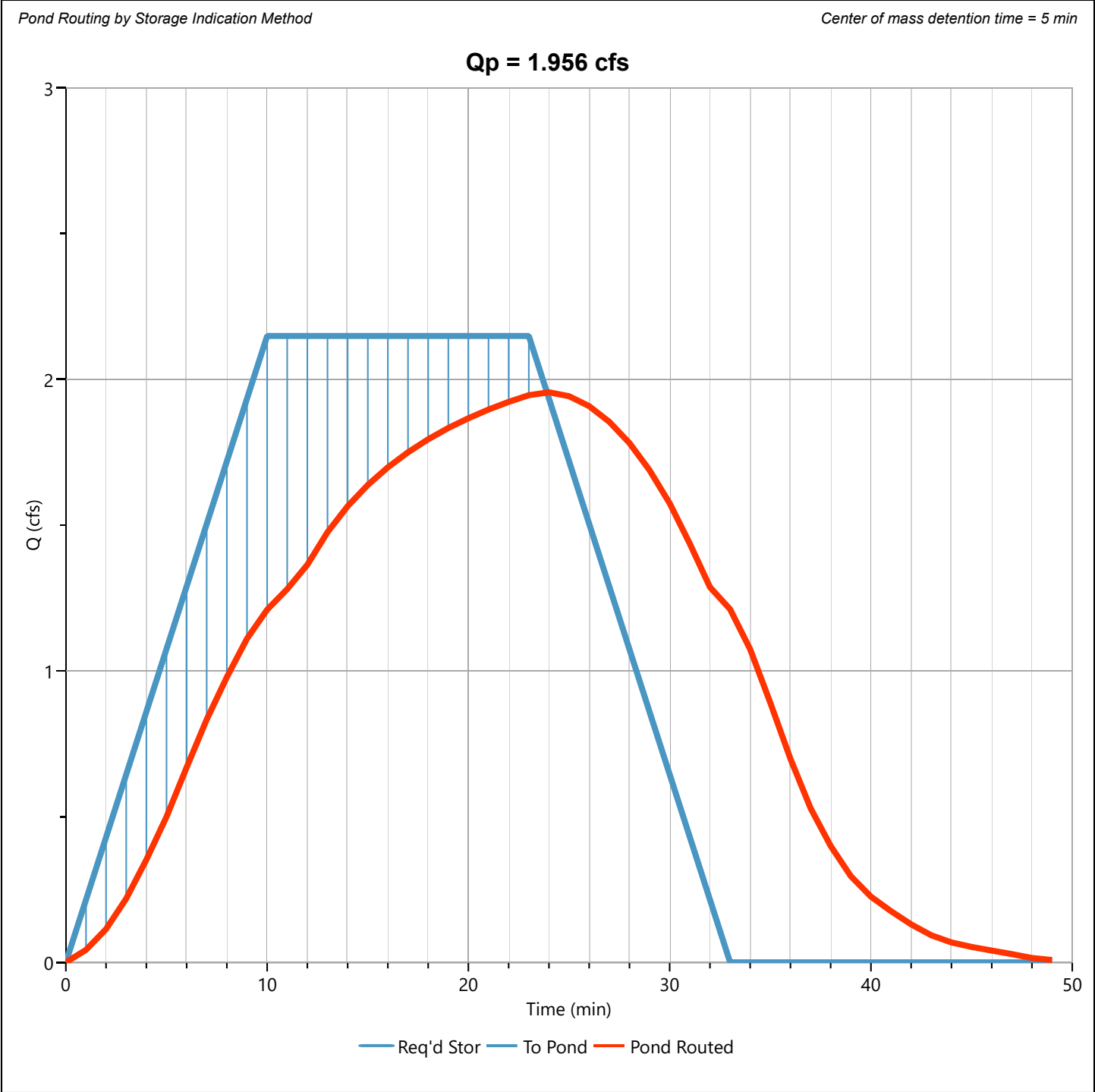
Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

Pond Routed

Hyd. No. 4

Hydrograph Type	= Pond Route	Peak Flow	= 1.956 cfs
Storm Frequency	= 25-yr	Time to Peak	= 0.40 hrs
Time Interval	= 1 min	Hydrograph Volume	= 2,966 cuft
Inflow Hydrograph	= 3 - To Pond	Max. Elevation	= 41.57 ft
Pond Name	= Pond 1	Max. Storage	= 701 cuft



Hydrograph 100-yr Summary

Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

[illegible]

Hydrograph Report

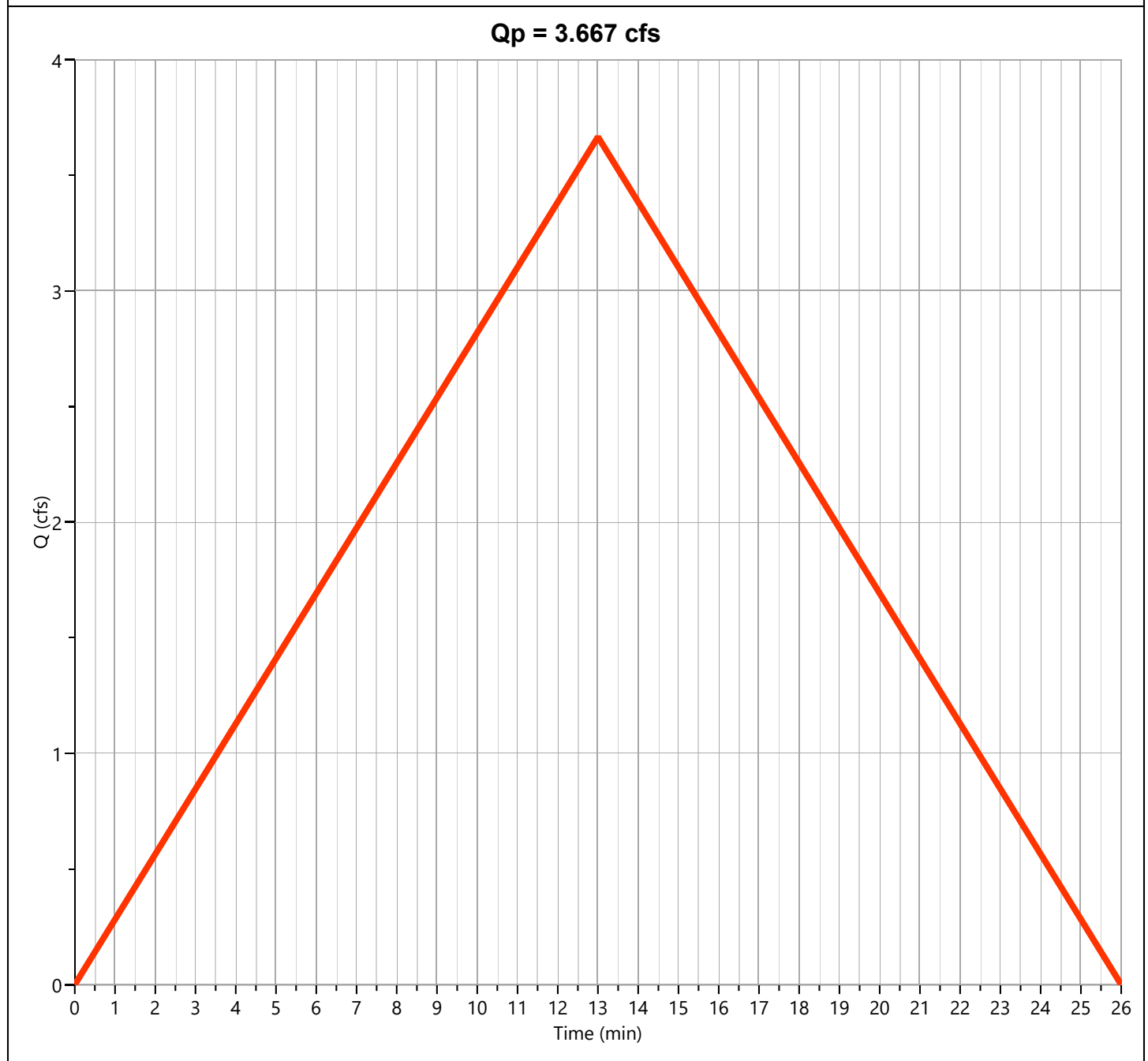
Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

Existing

Hyd. No. 1

Hydrograph Type	= Rational	Peak Flow	= 3.667 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.22 hrs
Time Interval	= 1 min	Runoff Volume	= 2,860 cuft
Drainage Area	= 1.652 ac	Runoff Coeff.	= 0.32
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
IDF Curve	= NJ RSIS 2017 IDF.idf	Intensity	= 6.94 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1



Hydrograph Report

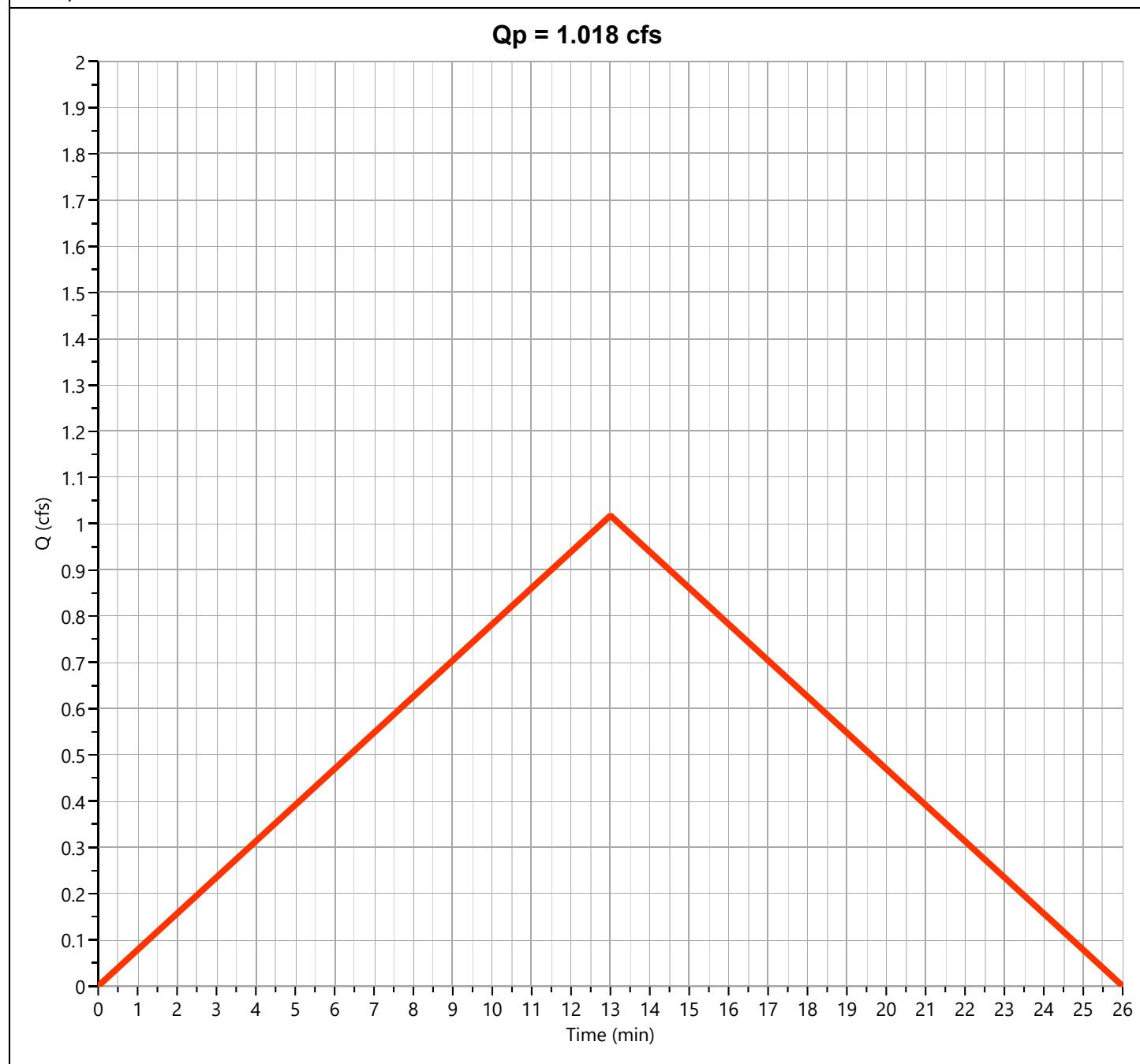
Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

Bypass

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 1.018 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.22 hrs
Time Interval	= 1 min	Runoff Volume	= 794 cuft
Drainage Area	= 0.863 ac	Runoff Coeff.	= 0.17
Tc Method	= User	Time of Conc. (Tc)	= 13.0 min
IDF Curve	= NJ RSIS 2017 IDF.idf	Intensity	= 6.94 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1



Hydrograph Report

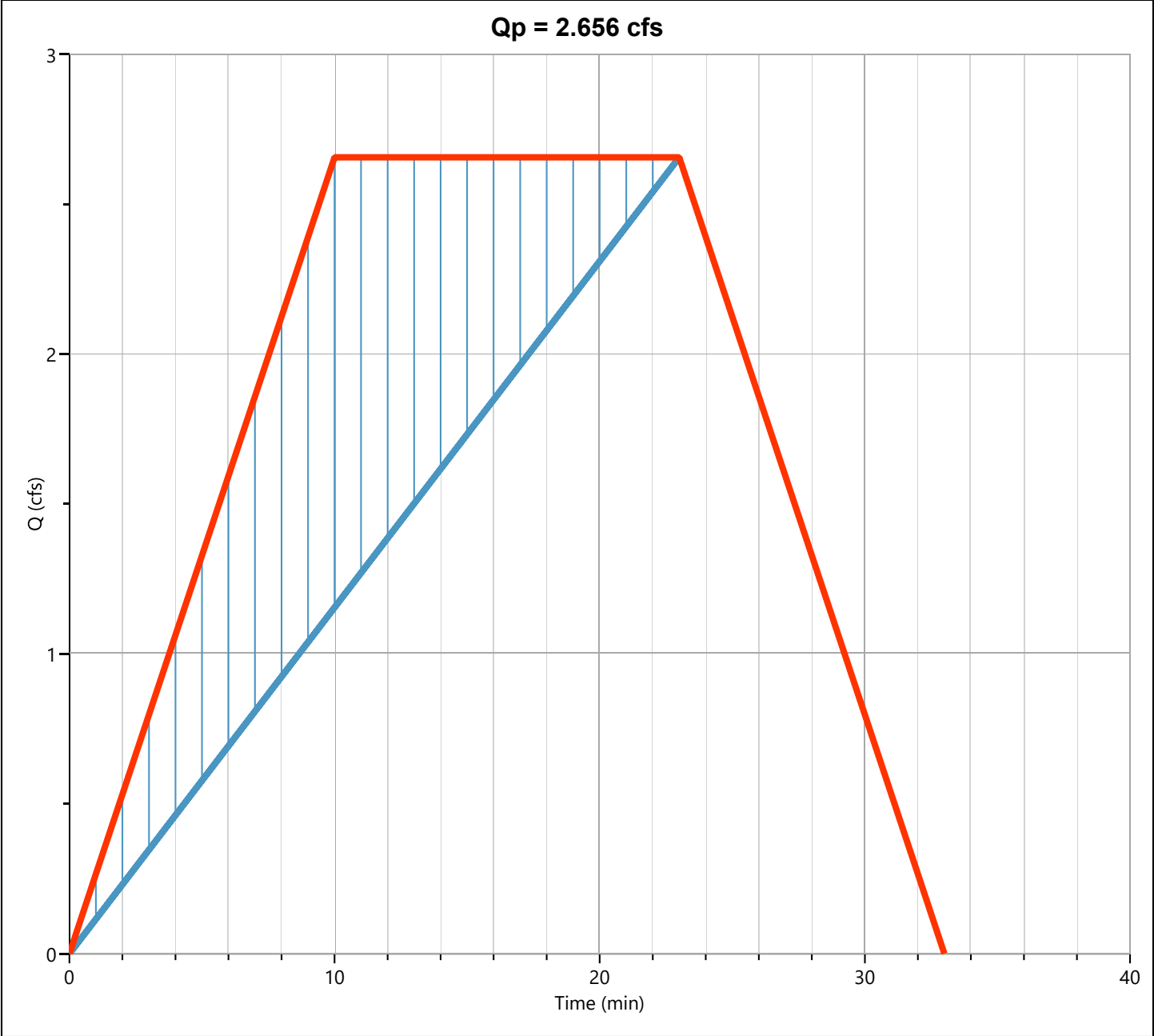
Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

To Pond

Hyd. No. 3

Hydrograph Type	= Mod Rational	Peak Flow	= 2.656 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.17 hrs
Time Interval	= 1 min	Runoff Volume	= 3,825 cuft
Drainage Area	= 0.789 ac	Runoff Coeff.	= 0.64
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
IDF Curve	= NJ RSIS 2017 IDF.idf	Intensity	= 5.26 in/hr
Freq. Corr. Factor	= 1.00	Storm Duration	= 2.4 x Tc
Target Q	= 2.600 cfs	Required Storage	= 1,251 cuft



Hydrograph Report

Hydrology Studio v 3.0.0.44

Project Name: 4660
File: 4660 - Hydrology Studio - 2026-08-07.hys
08-07-2026

Pond Routed

Hyd. No. 4

Hydrograph Type	= Pond Route	Peak Flow	= 2.349 cfs
Storm Frequency	= 100-yr	Time to Peak	= 0.40 hrs
Time Interval	= 1 min	Hydrograph Volume	= 3,666 cuft
Inflow Hydrograph	= 3 - To Pond	Max. Elevation	= 41.99 ft
Pond Name	= Pond 1	Max. Storage	= 944 cuft

