

Hydrological Calculations Summary

Boat Storage Facilities

59 Military Investments, LLC – Lot C10&11 – 0.83 acres

Section 42 -T-8-S, R-14-E

St. Tammany Parish, LA

The rational method was used to determine existing and proposed peak flows to size the on-site detention stormwater pond in the parking lot.

The rational method is based on the following:

$$Q = CIA$$

Q = peak runoff rate, cfs

I = average rainfall intensity

A = drainage area, acres

1.0 Summary of Hydrograph Flows (See attached hydrograph report)

1. Existing Conditions:

Area = 0.83 acres

Tc= 14 min (TR55 Sheet)

C = 0.45

25 – Year Storm

Total Pre-Existing Flow = 2.93 cfs

2. Developed Conditions

Area = 0.83 acres

Tc= 5 min

C = 0.75

25 – Year Storm

Total Post-Construction Flow = 7.52 cfs

6" pvc outflow = 2.34 cfs

2.0 Conclusion

The parking lot area will be designed to control and obtain the onsite drainage flow with an outflow 6" pvc = 2.34 cfs at 21.36 ft.

$(2.93 - 2.34)/2.93 = 20\%$ reduction

3.0 Appendices

Hydrograph Reports

Pre Existing Flow

Post Construction Flow

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25 - Year

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Hydrograph 10-yr Summary

Project Name: 59 Military Investments

Hydrology Studio v 3.0.0.24

07-18-2022

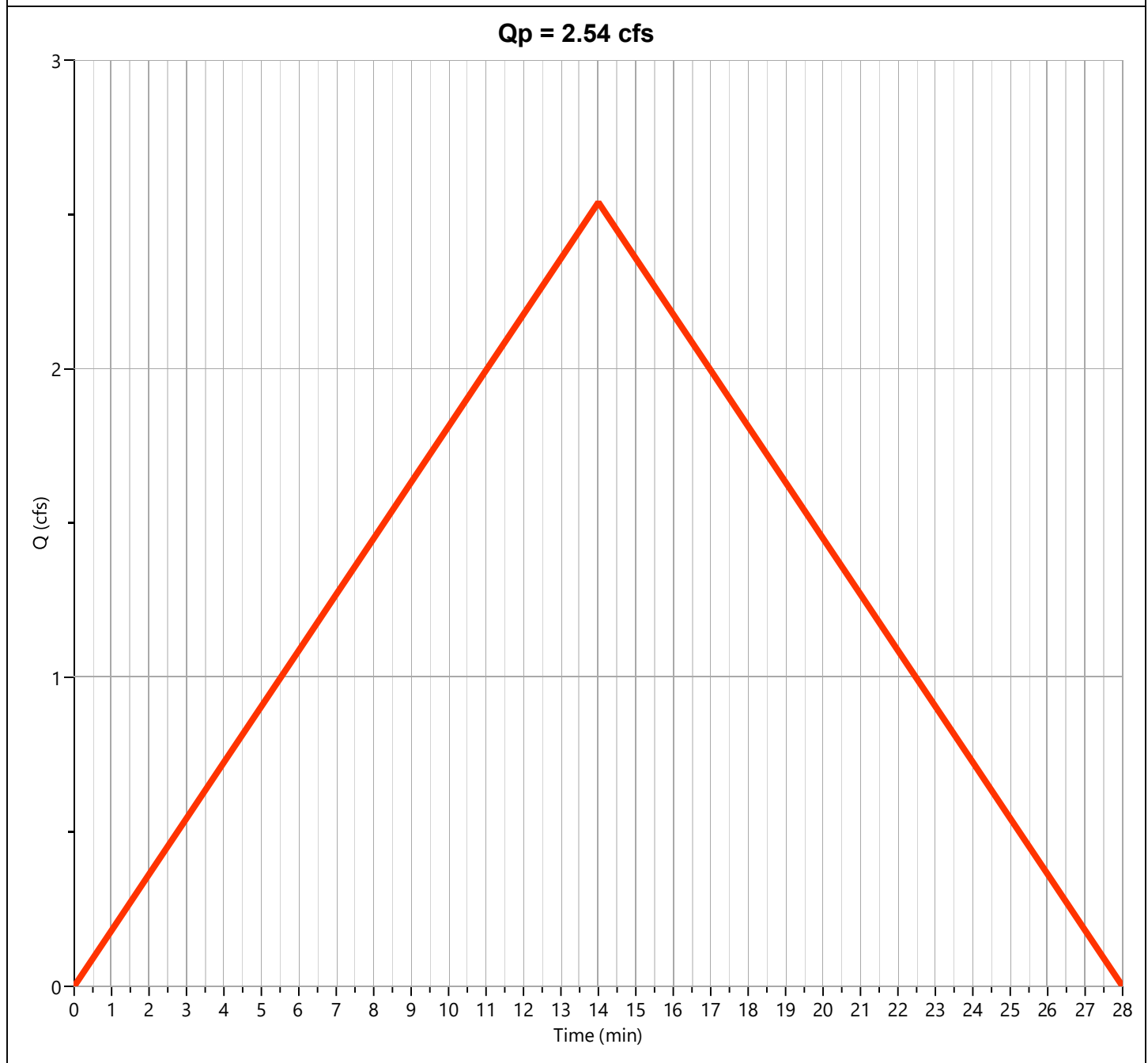
Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre Existing	2.539	0.23	2,132	---		
2	Rational	Post Development	6.406	0.08	1,922	---		
3	Pond Route	Route	2.320	0.13	1,938	2	21.19	841

Hydrograph Report

Pre Existing

Hyd. No. 1

Hydrograph Type	= Rational	Peak Flow	= 2.539 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.23 hrs
Time Interval	= 1 min	Runoff Volume	= 2,132 cuft
Drainage Area	= 0.83 ac	Runoff Coeff.	= 0.45
Tc Method	= TR55 (See Worksheet)	Time of Conc. (Tc)	= 14.0 min
IDF Curve	= SampleIDF-Louisiana.idf	Intensity	= 6.80 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1



Tc by TR55 Worksheet

Existing Rational

Hyd. No. 1

Description	Segments			Tc (min)
	A	B	C	
Sheet Flow				
Description				
Manning's n	0.200	0.013	0.013	
Flow Length (ft)	100			
2-yr, 24-hr Precip. (in)	4.48	2.28	2.28	
Land Slope (%)	1			
Travel Time (min)	13.75	0.00	0.00	13.75
Shallow Concentrated Flow				
Flow Length (ft)				
Watercourse Slope (%)	0.00	0.00	0.00	
Surface Description	Paved	Paved	Paved	
Average Velocity (ft/s)				
Travel Time (min)	0.00	0.00	0.00	0.00
Channel Flow				
X-sectional Flow Area (sqft)				
Wetted Perimeter (ft)				
Channel Slope (%)				
Manning's n	0.013	0.013	0.013	
Velocity (ft/s)				
Flow Length (ft)				
Travel Time (min)	0.00	0.00	0.00	0.00
Total Travel Time				14 min

Hydrograph Report

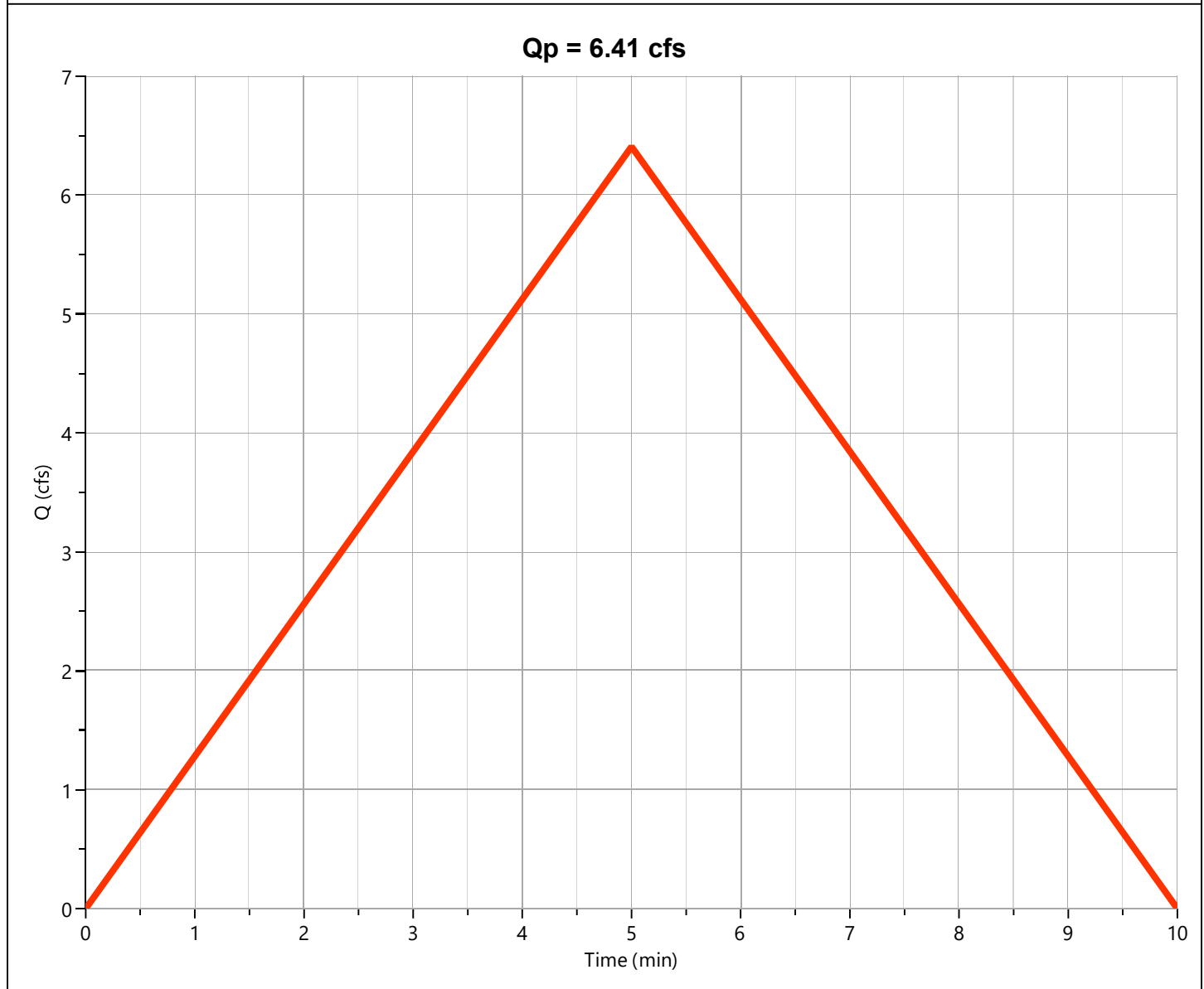
Post Development

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 6.406 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.08 hrs
Time Interval	= 1 min	Runoff Volume	= 1,922 cuft
Drainage Area	= 0.83 ac	Runoff Coeff.	= 0.75*
Tc Method	= User	Time of Conc. (Tc)	= 5.0 min
IDF Curve	= SampleIDF-Louisiana.idf	Intensity	= 10.29 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

* Composite C Worksheet

AREA (ac)	C	DESCRIPTION
0.55	0.90	impervious
0.28	0.45	grass
0.83	0.75	



Hydrograph Report

Route

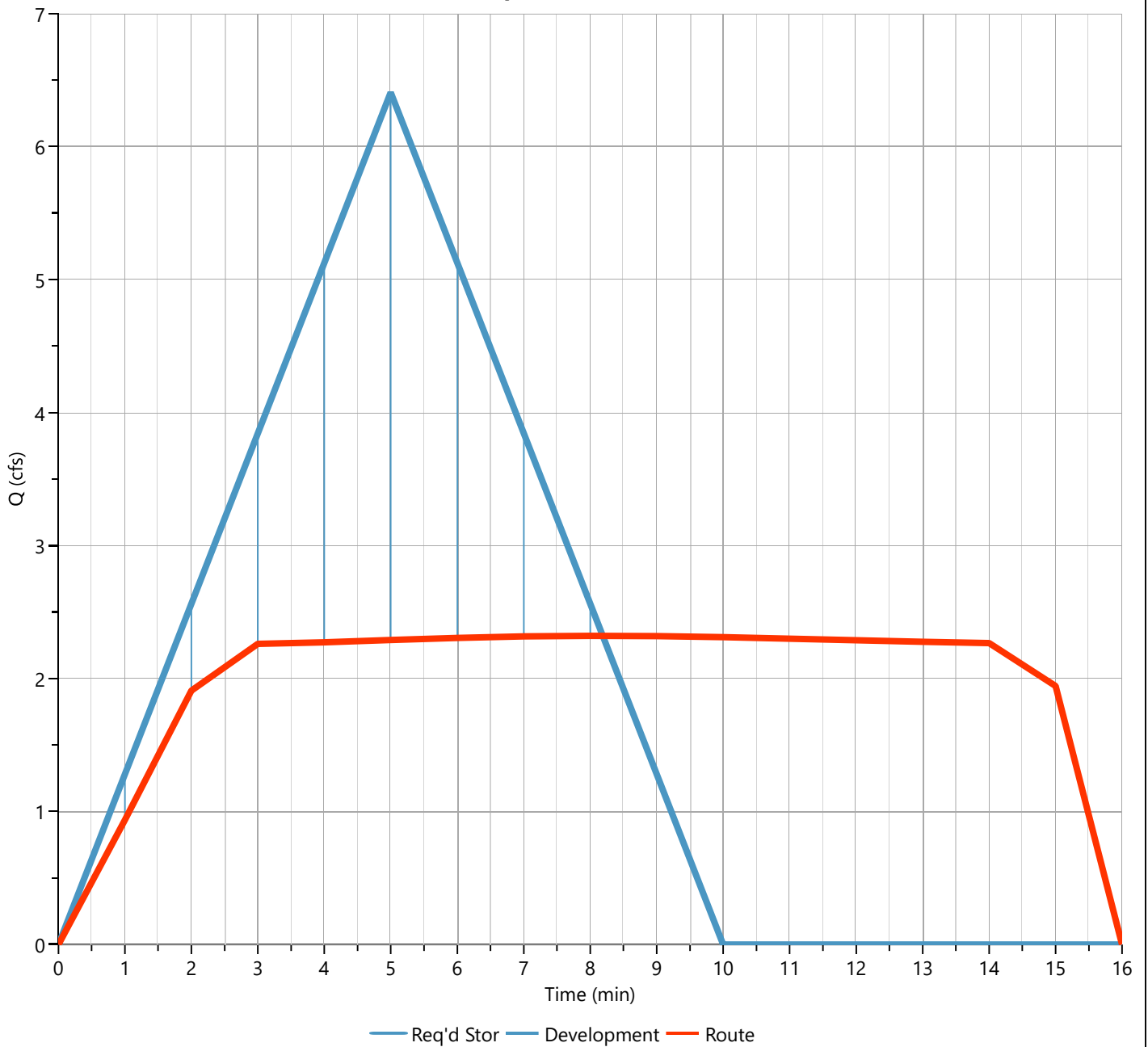
Hyd. No. 3

Hydrograph Type	= Pond Route	Peak Flow	= 2.320 cfs
Storm Frequency	= 10-yr	Time to Peak	= 0.13 hrs
Time Interval	= 1 min	Hydrograph Volume	= 1,938 cuft
Inflow Hydrograph	= 2 - Development	Max. Elevation	= 21.19 ft
Pond Name	= Pond 1	Max. Storage	= 841 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 3 min

Qp = 2.32 cfs



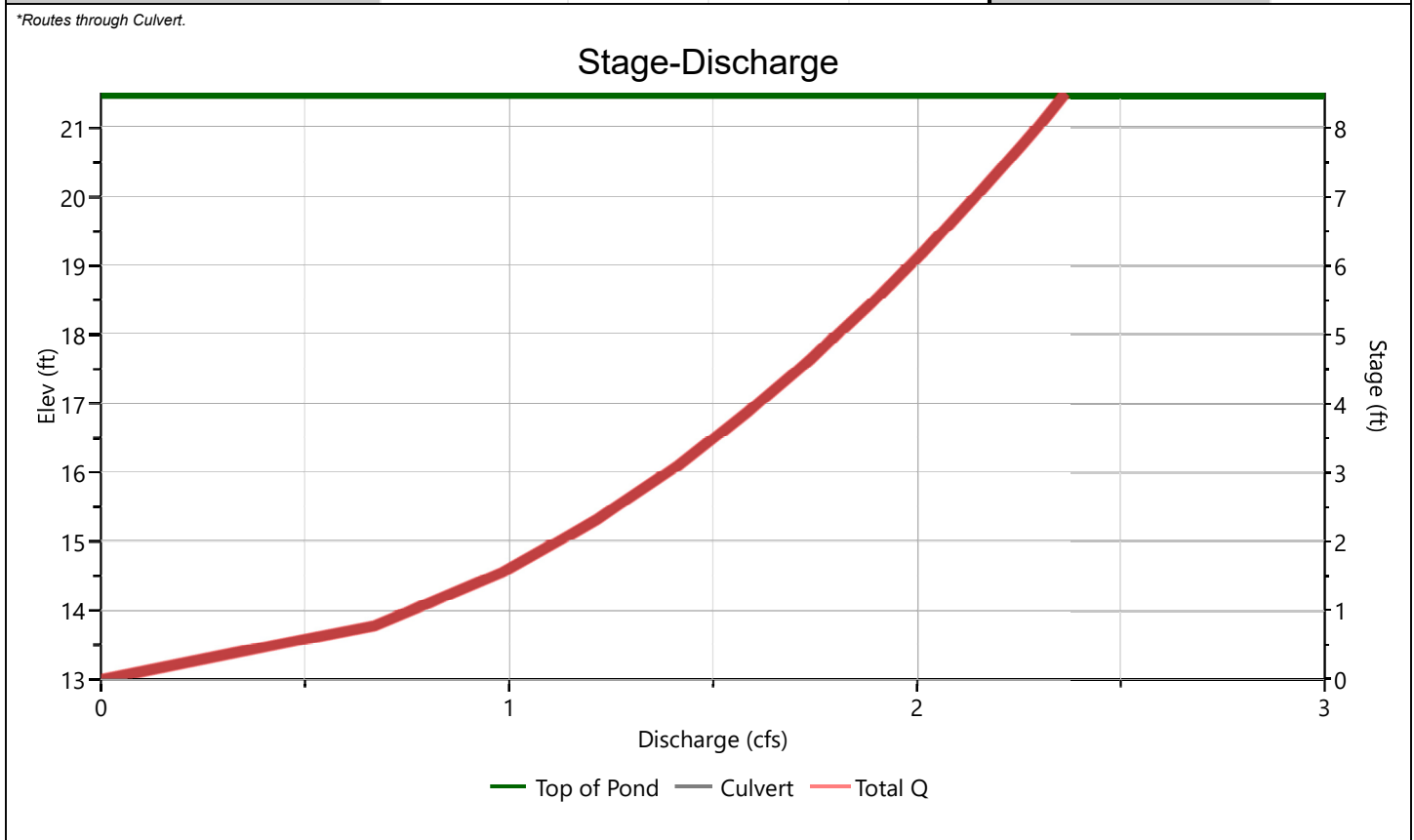
Pond Report

Pond 1

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser
		1	2	3	
Rise, in	6				Hole Diameter, in
Span, in	6				No. holes
No. Barrels	1				Invert Elevation, ft
Invert Elevation, ft	13.00				Height, ft
Orifice Coefficient, Co	0.60				Orifice Coefficient, Co
Length, ft	40				
Barrel Slope, %	1				
N-Value, n	0.011				
Weirs	Riser*	Weirs			Ancillary
		1	2	3	
Shape / Type					Exfiltration, in/hr
Crest Elevation, ft					
Crest Length, ft					
Angle, deg					
Weir Coefficient, Cw					

*Routes through Culvert.



Pond Report

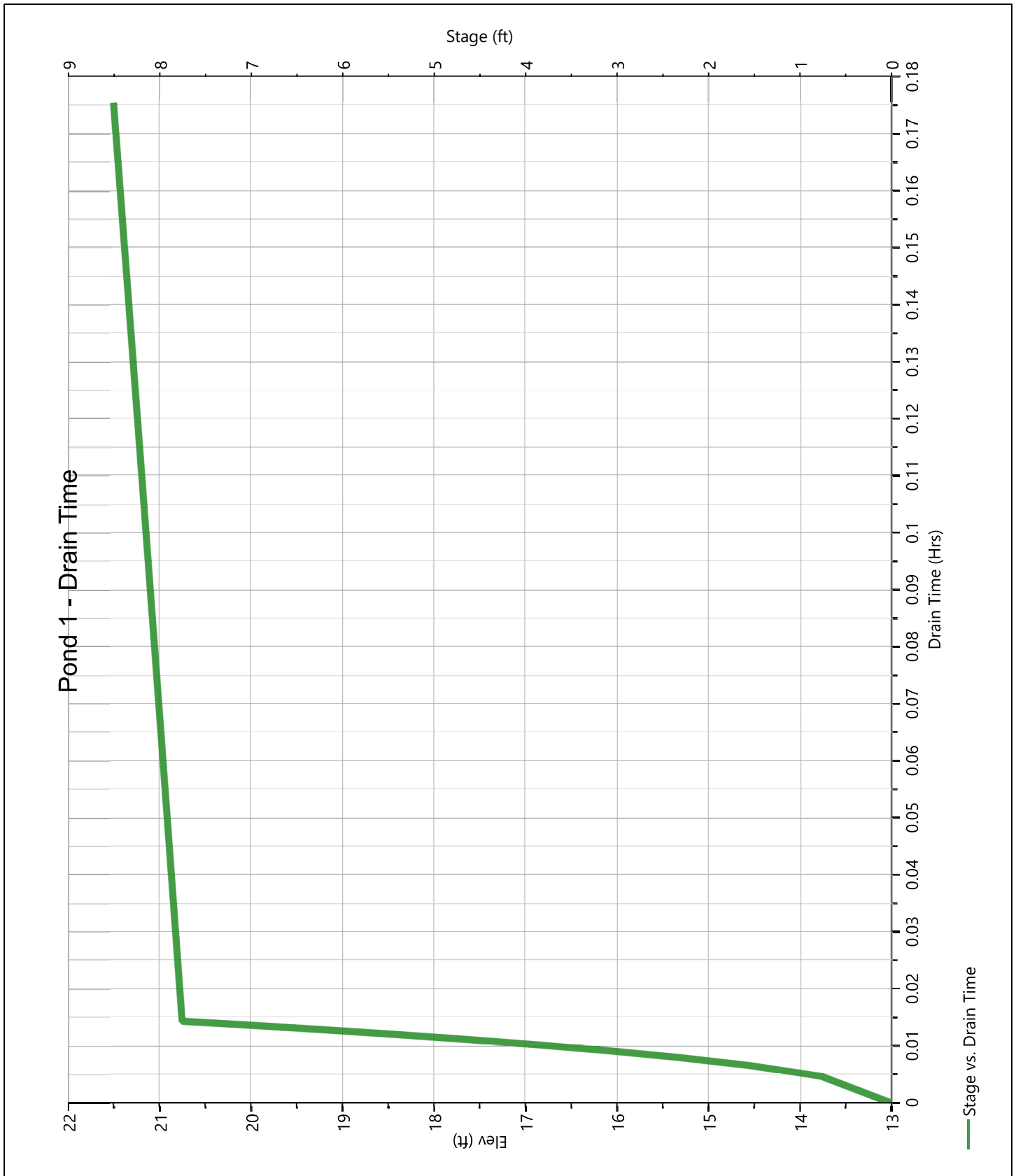
Pond 1

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	13.00	0.000	0.000											0.000
7.75	20.75	56.0	2.256 oc											2.256
8.50	21.50	1,397	2.364 oc											2.364

Pond 1

Pond Drawdown



Design Storm Report

Custom Storm filename:

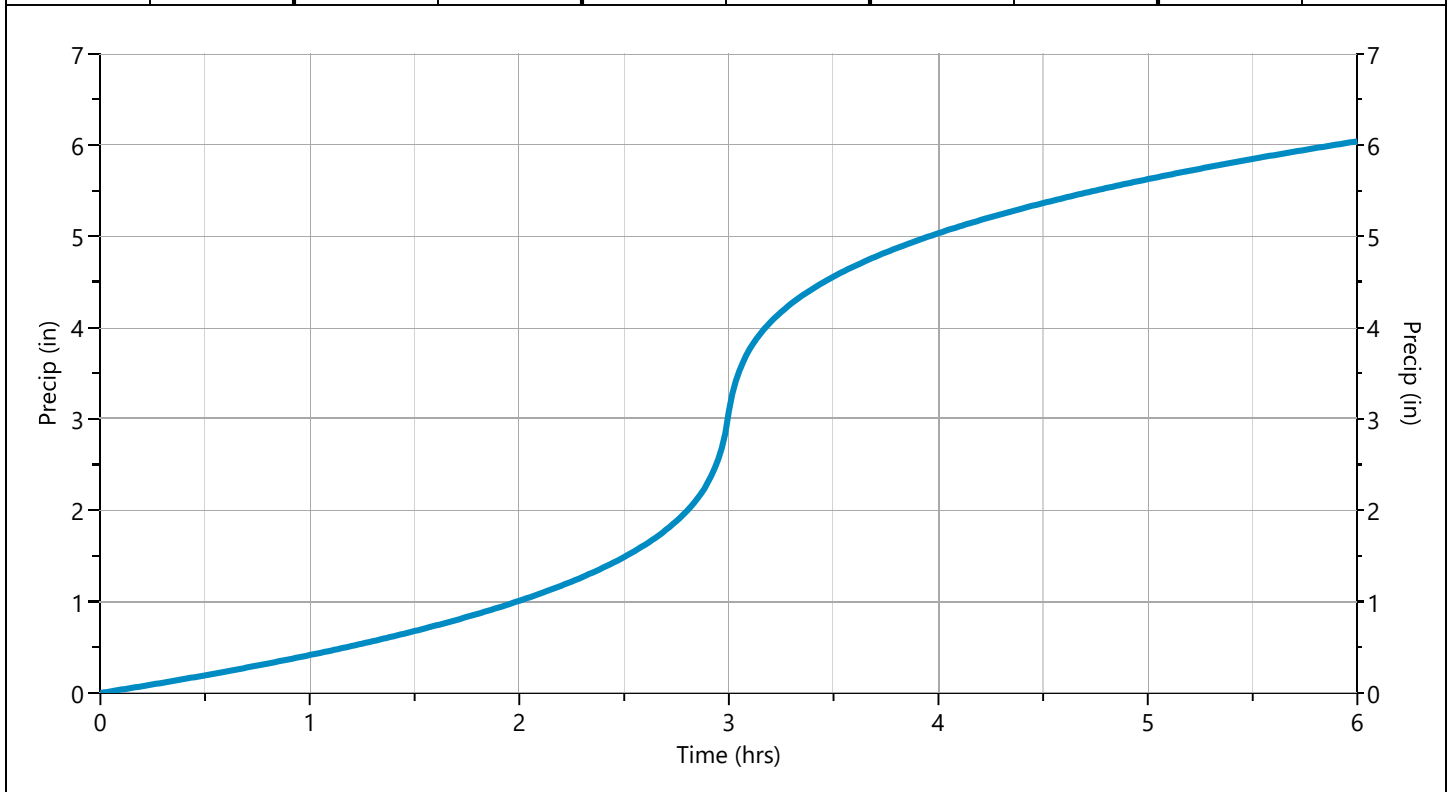
Hydrology Studio v 3.0.0.24

07-18-2022

Storm Distribution: IDF Based - Synthetic, 6-hr

Storm Duration	Total Rainfall Volume (in)								
	1-yr	2-yr	3-yr	5-yr	✓ 10-yr	25-yr	50-yr	100-yr	
6 hrs	3.64	4.08	0	4.98	6.04	7.57	9.09	10.81	

Incremental Rainfall Distribution, 10-yr									
Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
2.50	0.020525	2.68	0.028395	2.87	0.052729	3.05	0.110043	3.23	0.036295
2.52	0.021021	2.70	0.029516	2.88	0.057883	3.07	0.090971	3.25	0.034477
2.53	0.021549	2.72	0.030752	2.90	0.064343	3.08	0.077824	3.27	0.032862
2.55	0.022110	2.73	0.032121	2.92	0.072678	3.10	0.068228	3.28	0.031419
2.57	0.022708	2.75	0.033647	2.93	0.083842	3.12	0.060920	3.30	0.030119
2.58	0.023348	2.77	0.035358	2.95	0.099545	3.13	0.055169	3.32	0.028943
2.60	0.024035	2.78	0.037294	2.97	0.123175	3.15	0.050523	3.33	0.027872
2.62	0.024774	2.80	0.039502	2.98	0.162405	3.17	0.046690	3.35	0.026893
2.63	0.025571	2.82	0.042047	3.00	0.238587	3.18	0.043471	3.37	0.025993
2.65	0.026433	2.83	0.045013	3.02	0.193346	3.20	0.040727	3.38	0.025164
2.67	0.027371	2.85	0.048519	3.03	0.140037	3.22	0.038360	3.40	0.024398



Hydrograph 25-yr Summary

Project Name: 59 Military Investments

Hydrology Studio v 3.0.0.24

07-18-2022

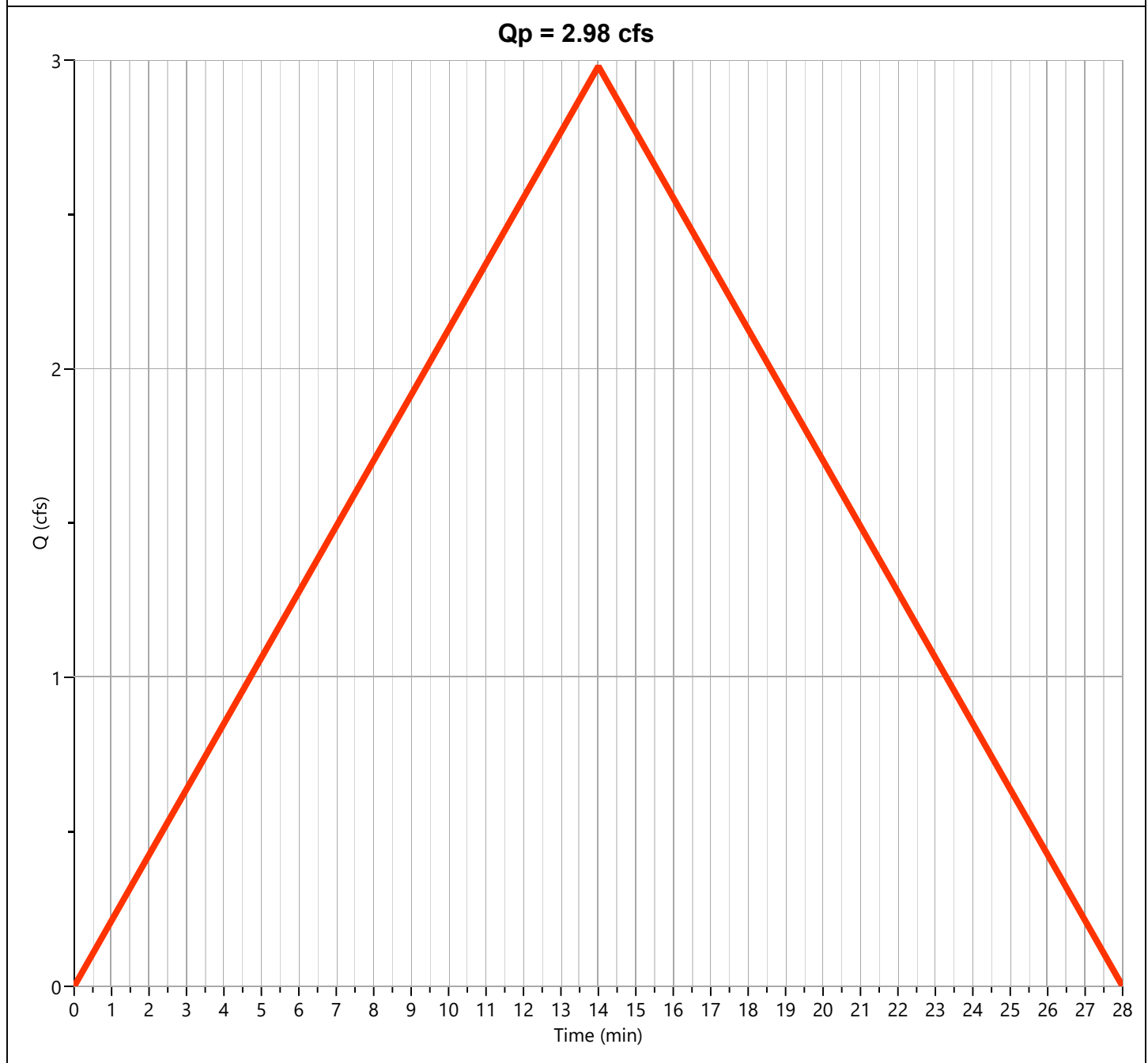
Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	Rational	Pre Existing	2.979	0.23	2,502	---		
2	Rational	Post Development	7.517	0.08	2,255	---		
3	Pond Route	Route	2.342	0.13	2,266	2	21.36	1,121

Hydrograph Report

Pre Existing

Hyd. No. 1

Hydrograph Type	= Rational	Peak Flow	= 2.979 cfs
Storm Frequency	= 25-yr	Time to Peak	= 0.23 hrs
Time Interval	= 1 min	Runoff Volume	= 2,502 cuft
Drainage Area	= 0.83 ac	Runoff Coeff.	= 0.45
Tc Method	= TR55 (See Worksheet)	Time of Conc. (Tc)	= 14.0 min
IDF Curve	= SampleIDF-Louisiana.idf	Intensity	= 7.98 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1



Hydrograph Report

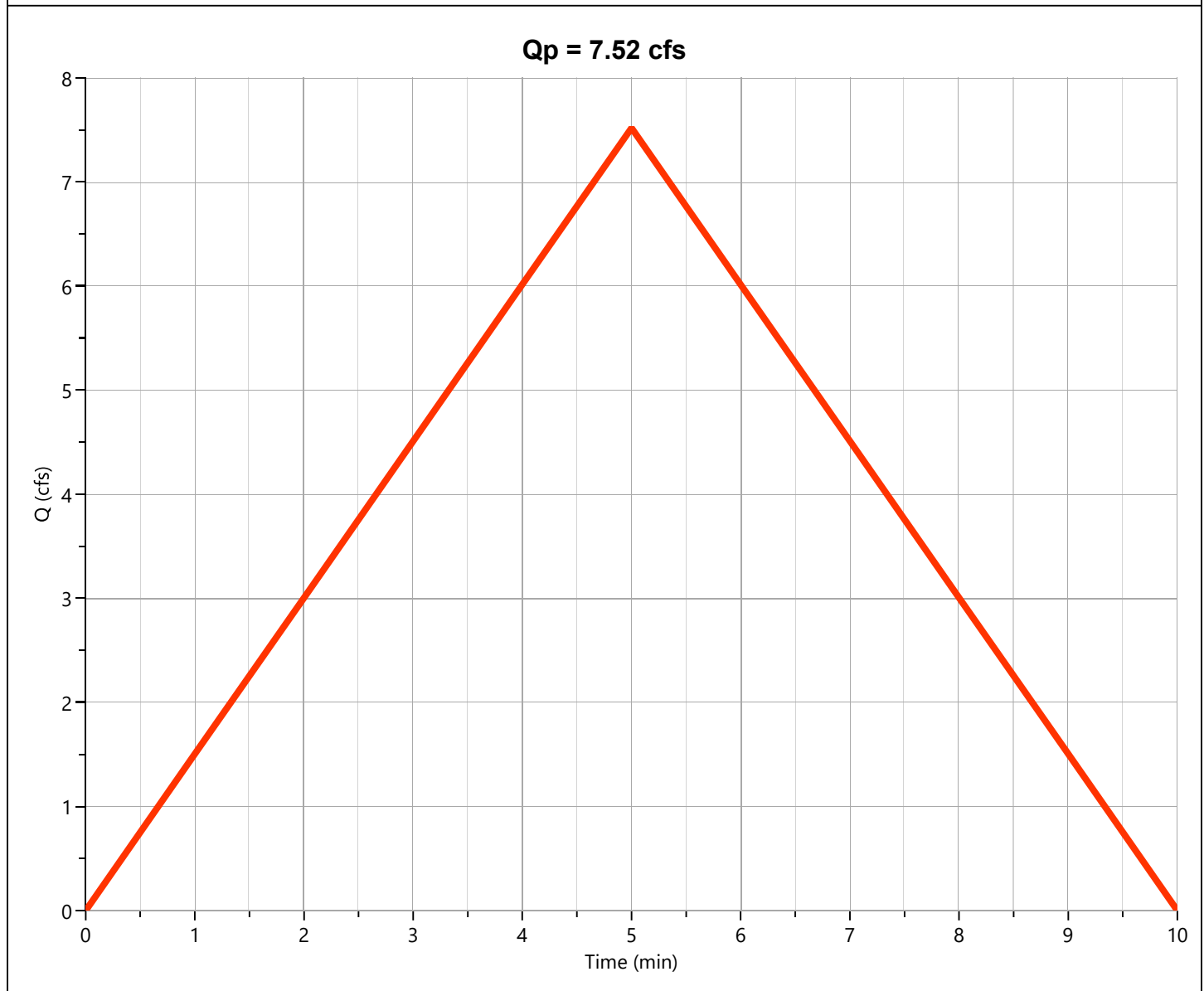
Post Development

Hyd. No. 2

Hydrograph Type	= Rational	Peak Flow	= 7.517 cfs
Storm Frequency	= 25-yr	Time to Peak	= 0.08 hrs
Time Interval	= 1 min	Runoff Volume	= 2,255 cuft
Drainage Area	= 0.83 ac	Runoff Coeff.	= 0.75*
Tc Method	= User	Time of Conc. (Tc)	= 5.0 min
IDF Curve	= SampleIDF-Louisiana.idf	Intensity	= 12.08 in/hr
Freq. Corr. Factor	= 1.00	Asc/Rec Limb Factors	= 1/1

* Composite C Worksheet

AREA (ac)	C	DESCRIPTION
0.55	0.90	impervious
0.28	0.45	grass
0.83	0.75	



Hydrograph Report

Route

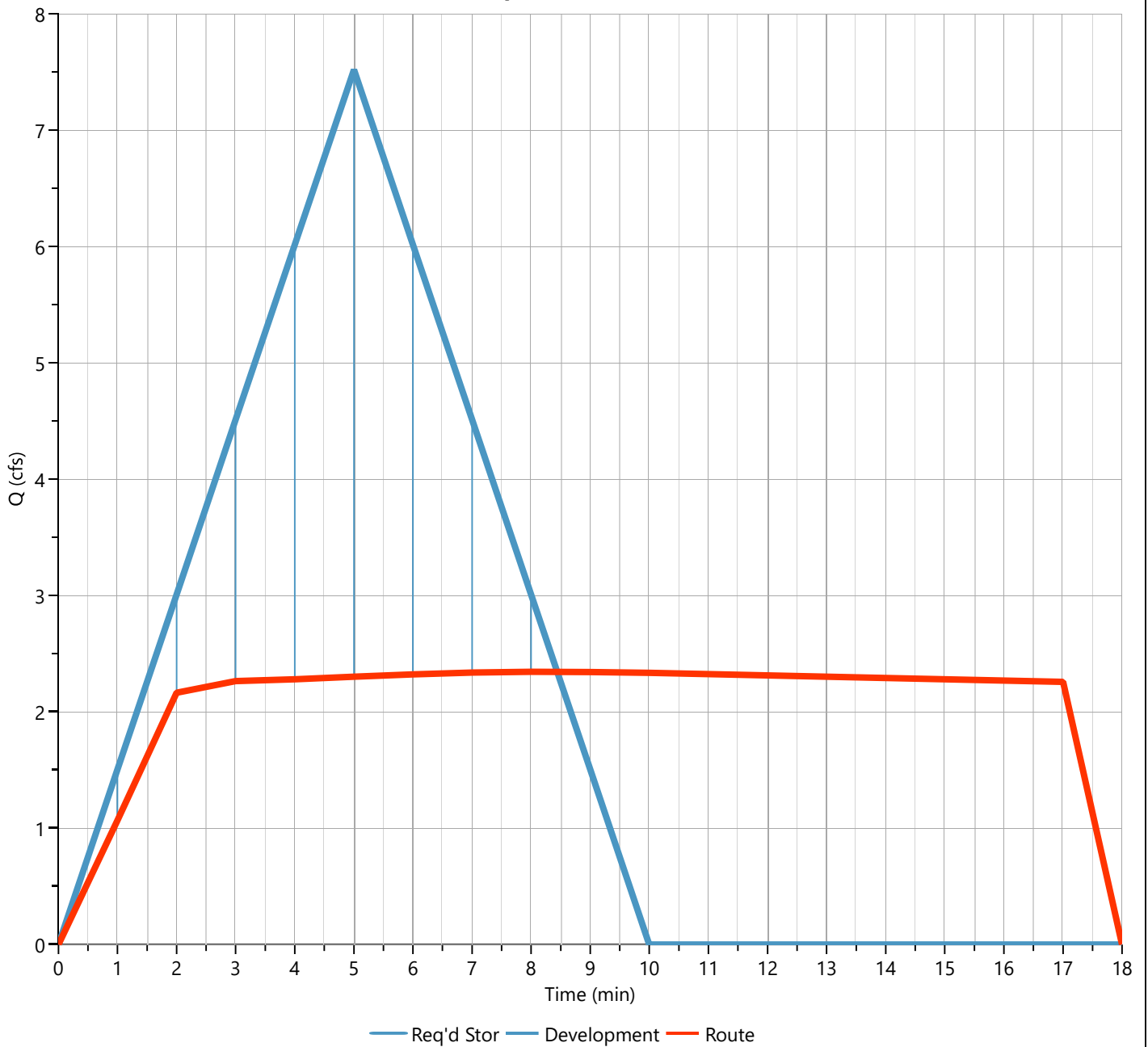
Hyd. No. 3

Hydrograph Type	= Pond Route	Peak Flow	= 2.342 cfs
Storm Frequency	= 25-yr	Time to Peak	= 0.13 hrs
Time Interval	= 1 min	Hydrograph Volume	= 2,266 cuft
Inflow Hydrograph	= 2 - Development	Max. Elevation	= 21.36 ft
Pond Name	= Pond 1	Max. Storage	= 1,121 cuft

Pond Routing by Storage Indication Method

Center of mass detention time = 4 min

Qp = 2.34 cfs



Design Storm Report

Custom Storm filename:

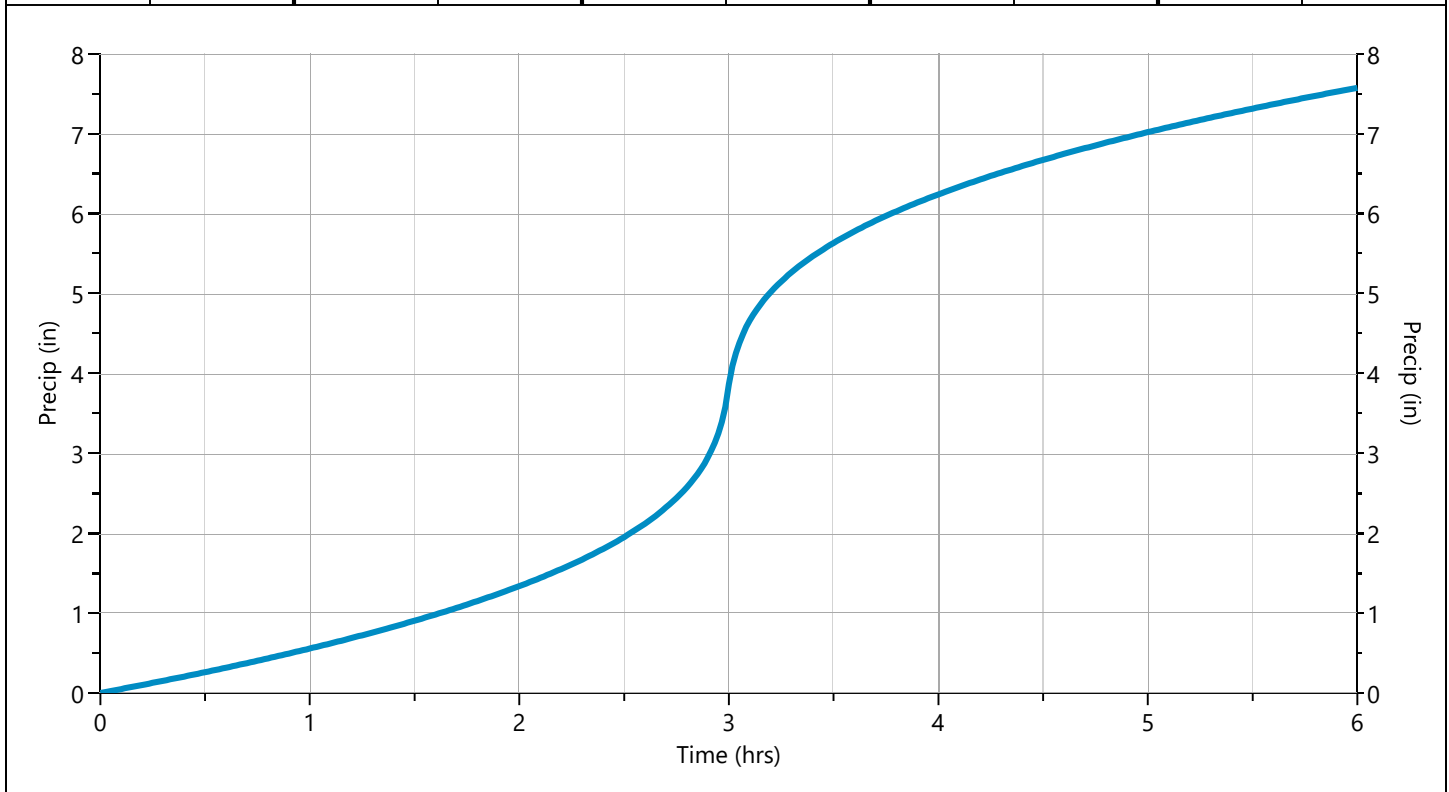
Hydrology Studio v 3.0.0.24

07-18-2022

Storm Distribution: IDF Based - Synthetic, 6-hr

Storm Duration	Total Rainfall Volume (in)								
	1-yr	2-yr	3-yr	5-yr	10-yr	✓ 25-yr	50-yr	100-yr	
6 hrs	3.64	4.08	0	4.98	6.04	7.57	9.09	10.81	

Incremental Rainfall Distribution, 25-yr									
Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
2.50	0.025906	2.68	0.035144	2.87	0.062990	3.05	0.128181	3.23	0.044267
2.52	0.026495	2.70	0.036447	2.88	0.068828	3.07	0.106345	3.25	0.042178
2.53	0.027119	2.72	0.037879	2.90	0.076138	3.08	0.091404	3.27	0.040318
2.55	0.027782	2.73	0.039462	2.92	0.085573	3.10	0.080535	3.28	0.038650
2.57	0.028488	2.75	0.041221	2.93	0.098234	3.12	0.072266	3.30	0.037146
2.58	0.029243	2.77	0.043191	2.95	0.116135	3.13	0.065755	3.32	0.035781
2.60	0.030050	2.78	0.045413	2.97	0.143358	3.15	0.060488	3.33	0.034536
2.62	0.030917	2.80	0.047941	2.98	0.189532	3.17	0.056135	3.35	0.033395
2.63	0.031850	2.82	0.050847	3.00	0.283393	3.18	0.052471	3.37	0.032345
2.65	0.032859	2.83	0.054227	3.02	0.226946	3.20	0.049342	3.38	0.031375
2.67	0.033953	2.85	0.058213	3.03	0.163042	3.22	0.046635	3.40	0.030475



IDF Report

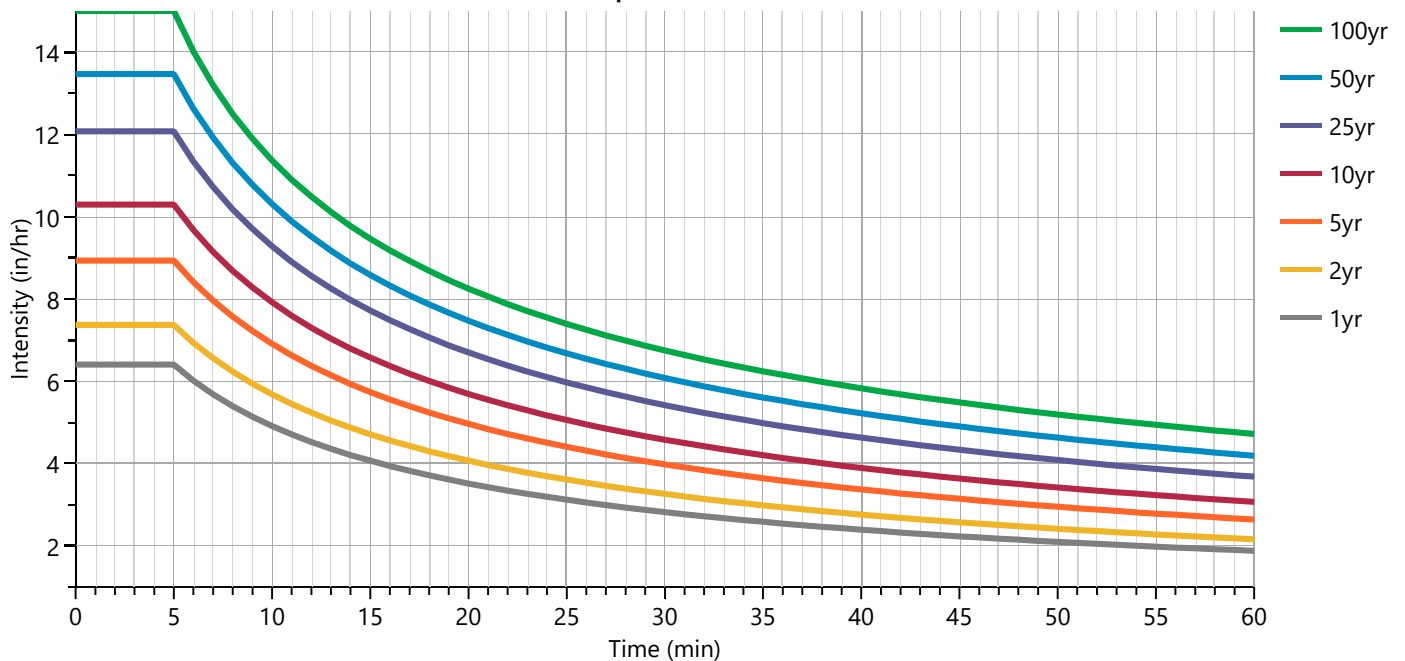
Equation Coefficients	Intensity = B / (Tc + D)^E (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
B	28.9467	36.1415	0.0000	44.4487	45.5656	48.1686	47.2579	45.6023	
D	5.0000	5.6000	0.0000	5.8000	5.0000	4.4000	3.6000	2.6000	
E	0.6550	0.6734	0.0000	0.6744	0.6462	0.6175	0.5835	0.5483	

Minimum Tc = 5 minutes

Tc (min)	Intensity Values (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
Cf	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
5	6.41	7.37	0	8.93	10.29	12.08	13.47	15.00	
10	4.91	5.68	0	6.91	7.92	9.28	10.31	11.37	
15	4.07	4.71	0	5.74	6.58	7.72	8.59	9.46	
20	3.52	4.07	0	4.96	5.69	6.70	7.47	8.25	
25	3.12	3.61	0	4.40	5.06	5.97	6.68	7.40	
30	2.82	3.26	0	3.98	4.58	5.42	6.08	6.75	
35	2.58	2.98	0	3.64	4.20	4.98	5.61	6.24	
40	2.39	2.76	0	3.37	3.89	4.63	5.22	5.83	
45	2.23	2.57	0	3.14	3.64	4.33	4.90	5.48	
50	2.10	2.41	0	2.95	3.42	4.08	4.63	5.19	
55	1.98	2.28	0	2.78	3.23	3.87	4.40	4.94	
60	1.88	2.16	0	2.64	3.07	3.68	4.19	4.72	

Cf = Correction Factor applied to Rational Method runoff coefficient.

Sample IDF Curves



Precipitation Report

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active						✓	✓		
SCS Storms	> SCS Dimensionless Storms								
SCS 6hr		1.20	1.50	0	1.86	2.18	2.64	3.01	3.41
Type I, 24-hr		0	0	0	0	0	0	0	0
Type IA, 24-hr		0	0	0	0	0	0	0	0
Type II, 24-hr		1.82	2.28	0	2.85	3.31	3.94	4.43	4.94
Type II FL, 24-hr		0	0	0	0	0	0	0	0
Type III, 24-hr		0	0	0	0	0	0	0	0
Synthetic Storms	> IDF-Based Synthetic Storms								
1-hr		1.88	2.16	0	2.64	3.07	3.68	4.19	4.72
2-hr		2.45	2.79	0	3.41	4.02	4.90	5.69	6.53
3-hr		2.84	3.22	0	3.93	4.69	5.77	6.77	7.87
6-hr	✓	3.64	4.08	0	4.98	6.04	7.57	9.09	10.81
12-hr		4.65	5.14	0	6.28	7.75	9.91	12.17	14.81
24-hr		5.92	6.46	0	7.89	9.93	12.94	16.26	20.28
Huff Distribution	> 1st Quartile (0 to 6 hrs)								
1-hr		0.76	0.98	0	1.33	1.61	2.01	2.34	2.69
2-hr		0.89	1.14	0	1.50	1.80	2.24	2.60	2.99
3-hr		0.98	1.24	0	1.59	1.90	2.33	2.68	3.07
6-hr		1.20	1.50	0	1.86	2.18	2.64	3.01	3.41
Huff Distribution	> 2nd Quartile (>6 to 12 hrs)								
8-hr		0	0	0	0	0	0	0	0
12-hr		0	0	0	0	0	0	0	0
Huff Distribution	> 3rd Quartile (>12 to 24 hrs)								
18-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0
Custom Storms	> Custom Storm Distributions								
My Custom Storm 1		0	0	0	0	0	0	0	0
My Custom Storm 2		0	0	0	0	0	0	0	0
My Custom Storm 3		0	0	0	0	0	0	0	0
My Custom Storm 4		0	0	0	0	0	0	0	0
My Custom Storm 5		0	0	0	0	0	0	0	0
My Custom Storm 6		0	0	0	0	0	0	0	0
My Custom Storm 7		0	0	0	0	0	0	0	0
My Custom Storm 8		0	0	0	0	0	0	0	0
My Custom Storm 9		0	0	0	0	0	0	0	0
My Custom Storm 10		0	0	0	0	0	0	0	0

Precipitation Report Cont'd

Precipitation filename: SamplePrecip.pcp

Rainfall totals in Inches

07-18-2022

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active						✓	✓		
Huff Indiana	> Indianapolis								
30-min		0.99	1.19	0	1.44	1.63	1.89	2.08	2.28
1-hr		1.21	1.46	0	1.81	2.08	2.45	2.75	3.06
2-hr		1.46	1.77	0	2.22	2.57	3.05	3.44	3.85
3-hr		1.57	1.90	0	2.38	2.76	3.30	3.75	4.21
6-hr		1.92	2.31	0	2.88	3.36	4.01	4.56	5.13
12-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0
Huff Indiana	> Evansville								
30-min		0.99	1.19	0	1.44	1.63	1.89	2.08	2.28
1-hr		1.21	1.46	0	1.81	2.08	2.45	2.75	3.06
2-hr		1.46	1.77	0	2.22	2.57	3.05	3.44	3.85
3-hr		1.57	1.90	0	2.38	2.76	3.30	3.75	4.21
6-hr		1.92	2.31	0	2.88	3.36	4.01	4.56	5.13
12-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0
Huff Indiana	> Fort Wayne								
30-min		0.99	1.19	0	1.44	1.63	1.89	2.08	2.28
1-hr		1.21	1.46	0	1.81	2.08	2.45	2.75	3.06
2-hr		1.46	1.77	0	2.22	2.57	3.05	3.44	3.85
3-hr		1.57	1.90	0	2.38	2.76	3.30	3.75	4.21
6-hr		1.92	2.31	0	2.88	3.36	4.01	4.56	5.13
12-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0
Huff Indiana	> South Bend								
30-min		0.99	1.19	0	1.44	1.63	1.89	2.08	2.28
1-hr		1.21	1.46	0	1.81	2.08	2.45	2.75	3.06
2-hr		1.46	1.77	0	2.22	2.57	3.05	3.44	3.85
3-hr		1.57	1.90	0	2.38	2.76	3.30	3.75	4.21
6-hr		1.92	2.31	0	2.88	3.36	4.01	4.56	5.13
12-hr		0	0	0	0	0	0	0	0
24-hr		0	0	0	0	0	0	0	0

Precipitation Report Cont'd

Rainfall totals in Inches

07-18-2022

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Active						✓	✓		
NRCS Storms	> NRCS Dimensionless Storms								
NRCS MSE3, 24-hr		2.72	3.27	0	4.07	4.72	5.63	6.37	7.15
NRCS MSE4, 24-hr		2.72	3.27	0	4.07	4.72	5.63	6.37	7.15
NRCS MSE3, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
NRCS MSE4, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
NRCS MSE5, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
NRCS MSE6, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
NOAA-A, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
NOAA-B, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
NOAA-C, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
NOAA-D, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
NRCC-A, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
NRCC-B, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
NRCC-C, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
NRCC-D, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
CA-1, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
CA-2, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
CA-3, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
CA-4, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
CA-5, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
CA-6, 24-hr		4.82	5.74	0	7.35	8.76	10.80	12.50	14.30
FDOT Storms	> Florida DOT Storms								
FDOT, 1-hr		0	0	0	0	0	0	0	0
FDOT, 2-hr		0	0	0	0	0	0	0	0
FDOT, 4-hr		0	0	0	0	0	0	0	0
FDOT, 8-hr		0	0	0	0	0	0	0	0
FDOT, 24-hr		0	0	0	0	0	0	0	0
FDOT, 72-hr		0	0	0	0	0	0	0	0
SFWMD, 72-hr		0	0	0	0	0	0	0	0
Austin Storms	> Austin Frequency Storms								
Austin Zone 1, 24-hr		0	0	0	0	0	0	0	0
Austin Zone 2, 24-hr		0	0	0	0	0	0	0	0