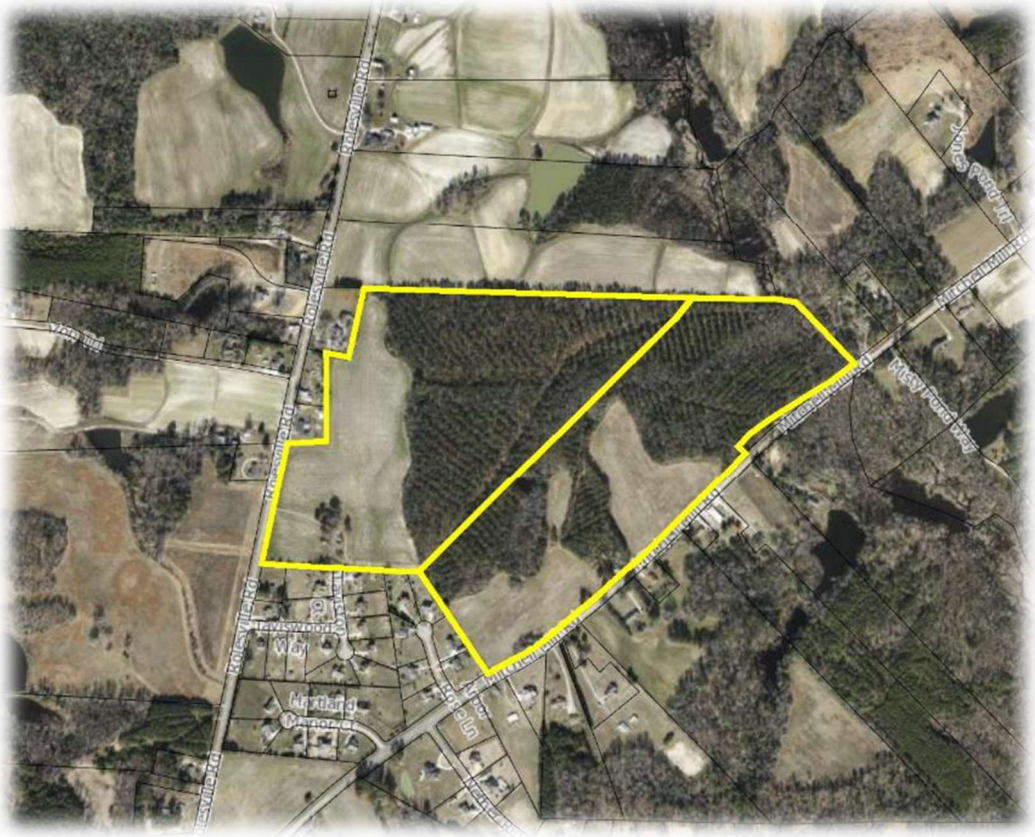
STORMWATER IMPACT ANALYSIS

TIMMONS GROUP
ENGINEERING | DESIGN | TECHNOLOGY

ROLESVILLE CROSSING
ROLESVILLE, NORTH CAROLINA



SEPTEMBER 15, 2021

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09/17/2021

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Stormwater Narrative

Project Background

The Wheeler Tract project is located at 1801 Rolesville Road in Rolesville, Wake County, North Carolina. The property identification numbers (PINs) are 1767-48-3143 and 1767-58-6083. The site consists of approximately 91.39 acres and is mostly grass, pasture, and woods. The predominant existing soils are Rawlings-Rion complex “RgB/RgC/RgD”, Helena sandy loam “HeB”, and “Wedowee-Saw complex “WfB”, in the Hydrologic Soils Groups “C” and “D.” Most of the site drains northeast toward Buffalo Creek in the Neuse River basin. A smaller portion of the site drains toward Harris Creek in the Neuse River Basin. The surface water classification is C;NSW. FIRM Panel 3720176600J indicates the site does contain special flood hazard areas.

Proposed Project Description

This project proposes a mixed residential development consisting of 177 single family lots and 120 townhome lots. A clubhouse, mail kiosk, parking facilities, paved greenway, and five stormwater control measures are also proposed.

There is approximately 0.19 AC of existing impervious cover within the property boundary. The proposed improvements will result in a post-developed impervious cover of 31.40 AC, which represents a net increase of 31.21 AC. Each proposed townhome lot has been allotted 1,500 SF of impervious area. Each proposed single-family lot has been allotted 3,600 SF of impervious area.

Two (2) wet ponds and three (3) extended detention dry ponds are proposed to meet post-developed peak flow requirements. The nutrient loading calculations included in this report show that a nitrogen buy-down is required.

Proposed Stormwater Management

This project shall meet Wake County stormwater requirements in accordance with the County Stormwater Ordinance.

Stormwater Quality Requirements:

Within the Neuse River basin, a nitrogen loading limit of 3.6 lb/ac/yr is imposed on new development. Nitrogen load from new developments that exceeds this limit may be offset with a buy-down payment, provided that no new single family residential development exceeds 6.0 lb/ac/yr and that no townhome, multi-family or commercial development exceeds 10.0 lbs/ac/yr.

Two Wake County Municipal Stormwater Tools have been included to model the Development’s nitrogen loading rates. The single-family portion of the project is modeled in one tool. The townhome portion of the project is modeled in a separate tool. Refer to the Municipal Tools, which indicates that the post-development nitrogen loading rates are less than 6 lbs/ac/yr and 10 lbs/ac/yr, respectively. An offset payment will be made in order to comply with nutrient reduction requirements.

Stormwater Peak Flow Requirements:

Post-developed peak flows cannot exceed pre-developed peak flows during the 1-year, 24-hour storm.

One wet pond and four extended detention dry ponds are proposed to meet this requirement. They are designed in accordance with the NCDEQ Stormwater Design Manual, latest version.

Seasonal High Water Table:

The seasonal high water table ("SHWT") report will be provided with a future submittal. Per DEQ manual, there is a required separation of six inches between the bottom of a dry pond and the SHWT. Per DEQ manual, there is no SHWT requirement for wet ponds.

Methodology for Stormwater Modeling:

A pre-development and post-development hydrologic analysis was completed for the site using the SCS TR 20 method. A hydraulic analysis was completed using Hydraflow modeling software to route these storm events through the proposed detention and outlet structures.

Hydrology:

The SCS TR20 method was used to determine the peak discharge rates for pre-development and post-development conditions, develop runoff hydrographs and size the detention storage for the SCM. Rainfall data used in the design was taken from published NOAA data for the Town of Rolesville (see Stormwater Control Measure Analysis). SCS Runoff curve numbers were based on Table 2-2 in the TR55 manual (see Wake County Hybrid Tool for curve number calculations). The Time of Concentration (Tc) values were determined using the TR55 method for sheet, shallow and concentrated flows, with a minimum Tc of 5 minutes.

Hydraulics:

Computer simulated reservoir routing using Hydraflow modeling software was completed for the 1-year, 10-year, and 100-year storm events utilizing stage-storage and stage-discharge functions. Stage-storage was determined using the proposed grading contours of the detention ponds. Stage-discharge functions were developed using the proposed outlet structures. The outlet structures were designed to attenuate the post-development discharge rates for the 1- and 10-year storm events equal to or less than pre-development levels.

Pre- & Post-Development Runoff Summary:

Analysis Point 1:

SITE CONDITION	STORM EVENT (CFS)		
	1-YR	10-YR	100-YR
PRE-DEVELOPMENT	97.36	258.16	459.85
POST-DEVELOPMENT	57.63	312.50	546.69

Analysis Point 2:

SITE CONDITION	STORM EVENT (CFS)		
	1-YR	10-YR	100-YR
PRE-DEVELOPMENT	7.22	19.07	33.80
POST-DEVELOPMENT	2.94	7.15	12.25

Analysis Point 3:

SITE CONDITION	STORM EVENT (CFS)		
	1-YR	10-YR	100-YR
PRE-DEVELOPMENT	8.08	21.04	37.13
POST-DEVELOPMENT	2.95	6.87	11.52

See Hydraflow Detention Routing Calculations Section for detailed calculations.

Nitrogen Loading Summary

Methodology:

The nutrient loading calculation was performed using the Wake County Municipal Stormwater Tool ("MST"). Two separate tools were used to separate the nutrient loading of the single-family areas and the townhome area. We utilized the townhome post-development drainage area for the pre-development drainage area in order to provide a comparison.

Single-Family Portion

The single-family portion of the development was modeled using the MST. Project data including land cover characteristics and SCM characteristics were entered into the MST. The post-developed TN export summary is as follows (See Single-Family MST for detailed information):

Impervious Area Summary

Total Proposed Impervious Cover = 25.21 AC
Existing Impervious Cover = 0.19 AC
New Impervious Cover = 25.02 AC

Nitrogen Export Summary

Pre-Development Nitrogen Loading Rate = 1.25 lbs/ac/yr
Post-Development Nitrogen Loading Rate (without treatment) = 7.26 lbs/ac/yr
Post-Development Nitrogen Loading Rate (after treatment) = 5.92 lbs/ac/yr

The computed export for the single-family portion of the project is less than 6 lbs/ac/yr. An offset payment will be made to comply with nutrient reduction requirements.

Townhome Portion

The townhome portion of the development was modeled using the MST. Project data including land cover characteristics and SCM characteristics were entered into the MST. The post-developed TN export summary is

as follows (See Townhome MST for detailed information):

Impervious Area Summary

Total Proposed Impervious Cover =	6.65 AC
Existing Impervious Cover =	0.00 AC
New Impervious Cover =	6.65 AC

Nitrogen Export Summary

Pre-Development Nitrogen Loading Rate =	1.20 lbs/ac/yr
Post-Development Nitrogen Loading Rate (without treatment) =	11.01 lbs/ac/yr
Post-Development Nitrogen Loading Rate (after treatment) =	9.91 lbs/ac/yr

The computed export for the townhome portion of the project is less than 10 lbs/ac/yr. An offset payment will be made to comply with nutrient reduction requirements.

Stormwater Control Measure Analysis

SCM Design Calculations

Wake County Municipal Tool

Hydraflow Model

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Project: Wheeler Tract
Calculated By: R. Wingate/P. Barbeau

Project No.: 43398
Date: 7/12/2021

Wet Pond Design Calculations — SCM 1

Pollutant / Nutrient Removal (Per NCDEQ SCM Credit Documents v2017-08-07)

Total Suspended Solids (TSS)	85%
Nitrogen	30%
Phosphorus	30%

Basin Characteristics

Post-Development Drainage Area

Area to Pond

Description	Acres
Impervious Lots	6.90
Impervious R/W	3.79
Managed Pervious	14.58
Offsite Pervious	
Total to Pond	25.28
Pond Basin CN	88

Estimated Impervious

Lots

Description	Area (ft)	% Impervious	Total Area (ac)
Lots	244,600.00	100%	5.62
Parking Lot/Club House	56,000.00	100%	1.29
Subtotal			6.90

Streets and SW

Description	Area (ft)	% Impervious	Total Area
Rights-of-Way	165,284.80	100%	3.79
Subtotal			3.79

Other

Grand Total			10.70

Surface Area to Drainage Area Ratio for Permanent Pool Sizing

Drainage Area to SCM

Impervious Area	Acres
Offsite Impervious Area	0.00
Onsite Impervious Area	10.70
Total Impervious Area	10.70
Total Drainage Area To SCM	25.28
Percent Impervious Area	42%

Required Surface Area of Main Pool

Average Depth (ft) =	3.0
SA/DA Ratio =	1.65
Required SA (ft2) =	18,170
SA as Shown (ft2) =	20,740

SA/DA Ratio from latest NCDEQ Stormwater Design Manual

SA / DA Pond Volumes and Areas (Below Permanent / Normal Pool)

Elevation (ft)	Main Area (sf)	Forebay Area (sf)	Depth (ft)	Main Inc. Vol (cf)	Forebay Inc. Vol (cf)	Total Vol (cf)
364.0				Bottom of Sediment Storage		
365.0	15,215	2,685	0.0	Top of Sediment Storage		

366.0	16,575	2,925	1.0	15,895	2,805	18,700
367.0	17,935	3,165	2.0	17,255	3,045	20,300
368.0	19,295	3,405	3.0	18,615	3,285	42,200
369.0	20,740	3,660	4.0	20,018	3,533	65,750
Total			4.0	71,783	12,668	84,450
Verify the Forebay Volume Is Approximately (15% - 20%) of the Permanent Pool Volume.						**18%**

Water Quality and Quantity Volumes (Above Permanent / Normal Pool)

Elevation (ft)	Main Area (sf)	Forebay Area (sf)	Depth (ft)	Inc Total Vol (cf)	Accum' Total Vol (cf)	
369.0	20,740	3,660	0.00	Permanent Pool Elevation		Notes
370.0	29,600	-	1.00	25,170	25,170	
371.0	32300	-	2.00	30,950	56,120	
371.5	33,650	-	2.50	16,488	72,608	WQE / TPE
372.0	35,000		3.00	33,650	89,770	
373.0	37,850	-	4.00	53,625	126,233	
374.0	40,700	-	5.00	39,275	165,508	
375.0	43,650	-	6.00	42,175	207,683	
376.0	46,600	-	7.00	45,125	252,808	BERM
		-				

Verify the Average Depth of Pool (D_{avg}) - Equation 3.

d_{avg} = [$V_{perm\ pool}$ - [0.5 x Depth $_{max\ over\ shelf}$ x Perimeter $_{perm\ pool}$ x Width $_{submerged\ part\ of\ shelf}$] / $A_{bottom\ of\ shelf}$

V_{perm} =	71,783	C.F. (Main Pond)
$A_{bottom\ shelf}$ =	20,740	S.F. (Main Pond)
Depth of Water $_{over\ shelf}$ =	0.00	FT
Perimeter $_{perm\ pool}$ =	0	L.F. (Main Pond)
Width $_{submerged\ part\ of\ shelf}$ =	0.0	FT
D_{avg} =	3.46	FT
Depth for SA/DA =	**3.00**	**FT (Round D_{av} down to nearest 0.5 ft)**

1.0" Water Quality Runoff Volume Calculation

Using the runoff volume calculations in the "Simple Method" as described by Schueler (1987)

Where: Rv = Runoff Coefficient, in/in

I = Percent Impervious	I=	42.3%
Rv = 0.05 + 0.009(I)	Rv =	0.431
1.0 inch runoff volume (Required)		
Runoff volume, S=(Design rainfall) (Rv) (Drainage Area)		
Design Rainfall =	1.0	inch
Drainage Area =	25.28	acres
Storage Required =	**39,530**	**cu. ft.**

Volume Storage For 1.0" Runoff Above Permanent Pool (Provided)

Depth	PPE SA (SF)	Top Temp Pool SA (SF)	Volume (CF)	Elevation
2.00	20,740	33,650	39,530	371.00

Size Water Quality Orifice for (2-5) Day Drawdown for 1" Runoff Volume

$Q_{1"} = CdA(2gh)^{1/2}$	(Orifice Equation; Cd=0.60)
4.00	Orfice Diameter (inches)
0.61	Driving Head to Centroid of Orfice (ft)
0.19	Q1.0" Drawdown Rate (cfs)
39,530	Water Quality Volume (V_{WQ})
V_{WQ}/(Q1" x 86,400)	Drawdown Time (days)
2.4	**Drawdown Time (days) (2 - 5 days)**

Pond / Riser Data & Elevations

Pond Type	Wet Pond

TSS Removal	85%			
Top of Pond / Berm	376.00	ft		
Secondary Spillway Width	40.00	ft		
Bottom of Secondary Spillway	375.00	ft		
Top of Riser	372.00	ft	(at least 1' Above TPE)	
Riser Type / Size	4X4	ft		
Top of Water Quality / Temp Pool Elev	371.50	ft	(1" Runoff)	
Top of Veg. Shelf	370.00	ft		
Permanent Pool Elevation (Normal Pool)	369.00	ft		
Water Quality Orifice Elevation & Size	369.00	ft		4.00 in
Secondary Orifice Elevation & Size		ft		in
Bottom of Veg. Shelf	369.00	ft		
Top of Sediment Storage / Pond Bottom	365.00	ft		
Bottom of Sediment Storage	364.00	ft	(Min 1 ft)	
Invert Out of Riser	369.00	ft		
Outlet Pipe Size	36.00	in	Diameter RCP	
Outlet Pipe Length & Slope	60.00	ft		0.60 %
Downstream Outlet Elevation	368.60	ft		
1 Yr Water Surface Elev / Peak Flow (CFS)	370.97	ft		4.45 CFS
2 Yr Water Surface Elev Peak Flow (CFS)	371.42	ft		9.60 CFS
10 Yr Water Surface Elev Peak Flow (CFS)	372.89	ft		16.94 CFS
100 Yr Water Surface Elev Peak Flow (CFS)	374.88	ft		39.94 CFS

DRY POND NAME		PROJECT NAME
Dry Pond #2		Wheeler Tract
CALCULATED BY		PROJECT NUMBER
A. Blye		43398

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DRY POND CALCULATIONS

DRY POND NAME: Dry Pond #2

SITE INFORMATION

Drainage Area (A) =	7.95	Acres
Impervious Area =	3.19	Acres
Percent Impervious =	40.13	%

NOTES & FORMULAS

(Drainage Area to Dry Pond - Including Dry Pond)

REQUIRED WATER QUALITY VOLUME

Design Storm (P) =	1.00	inch
R_v Value (R_v)	0.41	
Drainage Area (A) =	7.95	Acres
Water Quality Volume =	0.27	Ac-ft
Required Water Quality Volume =	11865	Cu-ft
25% Add. Volume for Sed. Storage	14831	Cu-ft
Forebay Required?	FOREBAY NOT REQ.	

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

where:
WQ_v = water quality volume in ac-ft
P = 1 inch of rainfall
R_v = 0.05 + 0.009(I), where I= the percent impervious cover
A = drainage area in acres

(Required Storage Volume for Water Quality)
(Minimum Volume Required at Bottom of Proposed Control Weir Spillway)
(If Min. Volume Required is greater than 20,000 Cu-ft: Forebay is Required)

PROVIDED WATER QUALITY VOLUME

Elevation	Contour Area (sf)	Depth (ft)	Incremental Volume (cf)	Cumulative Volume (cf)	Elevation Notes
381.27	0	0.00	0	0	(Bottom Elevation / Water Quality Drawdown Orifice)
382.00	11,815	0.73	4,312	4,312	
383.00	13,703	1.73	12,759	17,071	Secondary Weir Elev. (At or Above Temp Pool Elev.)
384.00	15,661	2.73	14,682	31,753	
385.00	17,685	3.73	16,673	48,426	(Emergency Spillway Crest Elevation)
386.00	19,774	4.73	18,730	67,156	(Top of Embankment Elevation)

Required Water Quality Volume =	14831	Cu-ft	(Required Storage Volume for Water Quality)
Provided Water Quality Volume =	17071	Cu-ft OK	(Cumulative Volume between Temporary Pool & Bottom Elevation)
Design Volume Ponding Depth =	2.73	ft	(Distance from water quality drawdown orifice to the Temporary Pool Elev)

Size Water Quality Orifice for (2-5) Day Drawdown for 1" Runoff Volume

Orifice Diameter	1.50	inches	Water Quality Orifice to Drain Temporary Pool
Driving Head to Centroid of Orifice	0.89	ft	Driving Head (h/3) Distance to Centroid of Orifice
Q1.0" Drawdown Rate	0.06	cfs	Q1" = CdA(2gh)1/2
Provided Water Quality Volume	17071	Cu-ft	(Orifice Equation; Cd=0.60 & h=h/3; Pg 3-13 BMP Manual)
Drawdown Time	3.55	Days OK	Drawdown Time = Provided Water Quality Volume / (Q1" x 86,400)

DRY BASIN ELEVATIONS

Seasonal High Water Elevation	NA	ft
Small Permanent Pool Bottom Elevation	379.27	ft
Bottom / Drawdown Outlet Elevation	381.27	ft
Temporary Pool / Control Weir Elevation	383.00	ft
Top of Control Structure Elevation	383.00	ft
Emergency Spillway Elevation	385.00	ft
Top of Pond / Embankement Elevation	386.00	ft
1-Yr Storm Stage	383.34	ft
10-Yr Storm Stage	384.59	ft
25-Yr Storm Stage	384.99	ft
100-Yr Storm Stage	385.37	ft

DRY POND NAME		PROJECT NAME
Dry Pond #3	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Wheeler Tract
CALCULATED BY		PROJECT NUMBER
R. Wingate		43398

DRY POND CALCULATIONS

DRY POND NAME: Dry Pond #3

SITE INFORMATION

Drainage Area (A) =	13.16	Acres
Impervious Area =	6.65	Acres
Percent Impervious =	50.53	%

NOTES & FORMULAS

(Drainage Area to Dry Pond - Including Dry Pond)

REQUIRED WATER QUALITY VOLUME

Design Storm (P) =	1.00	inch
Rv Value (Rv)	0.50	
Drainage Area (A) =	13.16	Acres
Water Quality Volume =	0.55	Ac-ft
Required Water Quality Volume =	24114	Cu-ft
15% Add. Volume for Sed. Storage	27731	Cu-ft
Forebay Required?	FOREBAY REQUIRED	

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

where:
WQ_v = water quality volume in ac-ft
P = 1 inch of rainfall
R_v = 0.05 + 0.009(I), where I= the percent impervious cover
A = drainage area in acres

(Required Storage Volume for Water Quality)
(Minimum Volume Required at Bottom of Proposed Control Weir Spillway)
(If Min. Volume Required is greater than 20,000 Cu-ft: Forebay is Required)

PROVIDED WATER QUALITY VOLUME

Elevation	Contour Area (sf)	Depth (ft)	Incremental Volume (cf)	Cumulative Volume (cf)	Elevation Notes
339.91	0	0.00	0	0	(Bottom Elevation / Water Quality Drawdown Orifice)
340.00	20	0.09	1	1	
341.00	1,210	1.09	615	616	
342.00	1,792	2.09	1,501	2,117	
343.00	2,491	3.09	2,142	4,258	
344.00	3,287	4.09	2,889	7,147	
345.00	4174	5.09	3,731	10,878	
346.00	5150	6.09	4,662	15,540	
347.00	6214	7.09	5,682	21,222	
348.00	7366	8.09	6,790	28,012	
349.00	8607	9.09	7,987	35,998	Secondary Weir Elev. (At Temp Pool Elev.)
350.00	9936	10.09	9,272	45,270	(Emergency Spillway Crest Elevation)
351.00	11340.00	11.09	10,638	55,908	(Top of Embankment Elevation)

Required Water Quality Volume =	27731	Cu-ft	(Required Storage Volume for Water Quality)
Provided Water Quality Volume =	35998	Cu-ft OK	(Cumulative Volume between Temporary Pool & Bottom Elevation)
Design Volume Ponding Depth =	9.09	ft	(Distance from water quality drawdown orifice to the Temporary Pool Elev)

Size Water Quality Orifice for (2-5) Day Drawdown for 1" Runoff Volume

Orifice Diameter	2.00	inches	Water Quality Orifice to Drain Temporary Pool
Driving Head to Centroid of Orifice	3.00	ft	Driving Head (h/3) Distance to Centroid of Orifice
Q1.0" Drawdown Rate	0.18	cfs	Q1" = CdA(2gh)1/2
Provided Water Quality Volume	35998	Cu-ft	(Orifice Equation; Cd=0.60 & h=h/3; Pg 3-13 BMP Manual)
Drawdown Time	2.29	Days OK	Drawdown Time = Provided Water Quality Volume / (Q1" x 86,400)

DRY BASIN ELEVATIONS

Seasonal High Water Elevation	NA	ft
Small Permanent Pool Bottom Elevation	337.91	ft
Bottom / Drawdown Outlet Elevation	339.91	ft
Temporary Pool / Control Weir Elevation	349.00	ft
Top of Control Structure Elevation	349.00	ft
Emergency Spillway Elevation	350.00	ft
Top of Pond / Embankement Elevation	351.00	ft
1-Yr Storm Stage	349.44	ft
10-Yr Storm Stage	350.32	ft
25-Yr Storm Stage	350.46	ft
100-Yr Storm Stage	350.73	ft

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Project: Wheeler Tract
Calculated By: R. Wingate/P. Barbeau

Project No.: 43398
Date: 7/12/2021

Wet Pond Design Calculations — SCM 4

Pollutant / Nutrient Removal (Per NCDEQ SCM Credit Documents v2017-08-07)

Total Suspended Solids (TSS)	85%
Nitrogen	30%
Phosphorus	30%

Basin Characteristics

Post-Development Drainage Area

Area to Pond

Description	Acres
Impervious Lots	3.42
Impervious R/W	1.94
Managed Pervious	11.69
Offsite Pervious	
Total to Pond	17.05
Pond Basin CN	86

Estimated Impervious

Lots

Description	Area (ft)	% Impervious	Total Area (ac)
Lots	149,100.00	100%	3.42
Subtotal			3.42

Streets and SW

Description	Area (ft)	% Impervious	Total Area
Rights-of-Way	84,500.00	100%	1.94
Subtotal			1.94

Other

Grand Total			5.36

Surface Area to Drainage Area Ratio for Permanent Pool Sizing

Drainage Area to SCM

Impervious Area	Acres
Offsite Impervious Area	0.00
Onsite Impervious Area	5.36
Total Impervious Area	5.36
Total Drainage Area To SCM	17.05
Percent Impervious Area	31%

Required Surface Area of Main Pool

Average Depth (ft) =	4.0
SA/DA Ratio =	0.97
Required SA (ft2) =	7,204
SA as Shown (ft2) =	7,140
SA/DA Ratio from latest NCDEQ Stormwater Design Manual	

SA / DA Pond Volumes and Areas (Below Permanent / Normal Pool)

Elevation (ft)	Main Area (sf)	Forebay Area (sf)	Depth (ft)	Main Inc. Vol (cf)	Forebay Inc. Vol (cf)	Total Vol (cf)
362.0				Bottom of Sediment Storage		
363.0	3,910	690	0.0	Top of Sediment Storage		

364.0	4,505	795	1.0	4,208	743	4,950
365.0	5,100	900	2.0	4,803	848	5,650
366.0	5,780	1,020	3.0	5,440	960	12,050
367.0	6,375	1,125	4.0	6,078	1,073	19,200
368.0	7,140	1,260	5.0	6,758	1,193	27,150
369.0	7,820	1,380	6.0	7,480	1,320	35,950
Total			6.0	34,765	6,135	40,900

Verify the Forebay Volume Is Approximately (15% - 20%) of the Permanent Pool Volume. **18%**

Water Quality and Quantity Volumes (Above Permanent / Normal Pool)

Elevation (ft)	Main Area (sf)	Forebay Area (sf)	Depth (ft)	Inc Total Vol (cf)	Accum' Total Vol (cf)	
369.0	7,820	1,380	0.00	Permanent Pool Elevation		Notes
370.0	11,900	-	1.00	9,860	9,860	
371.0	13350	-	2.00	12,625	22,485	WQE / TPE
372.0	14,900	-	3.00	14,125	36,610	
373.0	16,400		4.00	29,750	52,235	SPILLWAY
374.0	18,000		5.00	32,900	69,510	BERM
		-				

Verify the Average Depth of Pool (D_{avg}) - Equation 3.

d_{avg} = [$V_{perm\ pool}$ - [0.5 x Depth $_{max\ over\ shelf}$ x Perimeter $_{perm\ pool}$ x Width $_{submerged\ part\ of\ shelf}$] / $A_{bottom\ of\ shelf}$

V_{perm} =	34,765	C.F. (Main Pond)
$A_{bottom\ shelf}$ =	7,820	S.F. (Main Pond)
Depth of Water $_{over\ shelf}$ =		FT
Perimeter $_{perm\ pool}$ =		L.F. (Main Pond)
Width $_{submerged\ part\ of\ shelf}$ =		FT
D_{avg} =	4.45	FT
Depth for SA/DA =	**4.00**	**FT (Round D_{av} down to nearest 0.5 ft)**

1.0" Water Quality Runoff Volume Calculation

Using the runoff volume calculations in the "Simple Method" as described by Schueler (1987)

Where: Rv = Runoff Coefficient, in/in

I = Percent Impervious	I=	31.5%
Rv = 0.05 + 0.009(I)	Rv =	0.333
1.0 inch runoff volume (Required)		
Runoff volume, S=(Design rainfall) (Rv) (Drainage Area)		
Design Rainfall =	1.0	inch
Drainage Area =	17.05	acres
Storage Required =	**20,615**	**cu. ft.**

Volume Storage For 1.0" Runoff Above Permanent Pool (Provided)

Depth	PPE SA (SF)	Top Temp Pool SA (SF)	Volume (CF)	Elevation
2.00	7,140	14,900	20,615	371.00

Size Water Quality Orifice for (2-5) Day Drawdown for 1" Runoff Volume

$Q_{1"} = CdA(2gh)^{1/2}$	(Orifice Equation; Cd=0.60)
3.00	Orfice Diameter (inches)
0.63	Driving Head to Centroid of Orfice (ft)
0.11	Q1.0" Drawdown Rate (cfs)
20,615	Water Quality Volume (V_{WQ})
V_{WQ}/(Q1" x 86,400)	Drawdown Time (days)
2.2	**Drawdown Time (days) (2 - 5 days)**

Pond / Riser Data & Elevations

Pond Type	Wet Pond

TSS Removal	85%		
Top of Pond / Berm	374.00 ft		
Secondary Spillway Width	40.00 ft		
Bottom of Secondary Spillway	373.00 ft		
Top of Riser	372.00 ft	(at least 1' Above TPE)	
Riser Type / Size	4X4 ft		
Top of Water Quality / Temp Pool Elev	372.00 ft	(1" Runoff)	
Top of Veg. Shelf	370.00 ft		
Permanent Pool Elevation (Normal Pool)	369.00 ft		
Water Quality Orifice Elevation & Size	369.00 ft		3.00 in
Secondary Orifice Elevation & Size	ft		in
Bottom of Veg. Shelf	369.00 ft		
Top of Sediment Storage / Pond Bottom	363.00 ft		
Bottom of Sediment Storage	362.00 ft	(Min 1 ft)	
Invert Out of Riser	369.00 ft		
Outlet Pipe Size	36.00 in	Diameter RCP	
Outlet Pipe Length & Slope	60.00 ft		0.60 %
Downstream Outlet Elevation	368.60 ft		
1 Yr Water Surface Elev / Peak Flow (CFS)	370.97 ft		4.45 CFS
2 Yr Water Surface Elev Peak Flow (CFS)	371.42 ft		9.60 CFS
10 Yr Water Surface Elev Peak Flow (CFS)	372.89 ft		16.94 CFS
100 Yr Water Surface Elev Peak Flow (CFS)	374.88 ft		39.94 CFS

DRY POND NAME		PROJECT NAME
Dry Pond #5	TIMMONS GROUP ENGINEERING | DESIGN | TECHNOLOGY	Wheeler Tract
CALCULATED BY		PROJECT NUMBER
A. Blye		43398

DRY POND CALCULATIONS

DRY POND NAME: Dry Pond #5

SITE INFORMATION

Drainage Area (A) =	6.60	Acres
Impervious Area =	3.16	Acres
Percent Impervious =	47.88	%

NOTES & FORMULAS

(Drainage Area to Dry Pond - Including Dry Pond)

REQUIRED WATER QUALITY VOLUME

Design Storm (P) =	1.00	inch
Rv Value (Rv)	0.48	
Drainage Area (A) =	6.60	Acres
Water Quality Volume =	0.26	Ac-ft
Required Water Quality Volume =	11522	Cu-ft
25% Add. Volume for Sed. Storage	14402	Cu-ft
Forebay Required?	FOREBAY NOT REQ.	

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

where:
WQ_v = water quality volume in ac-ft
P = 1 inch of rainfall
R_v = 0.05 + 0.009(I), where I= the percent impervious cover
A = drainage area in acres

(Required Storage Volume for Water Quality)
(Minimum Volume Required at Bottom of Proposed Control Weir Spillway)
(If Min. Volume Required is greater than 20,000 Cu-ft: Forebay is Required)

PROVIDED WATER QUALITY VOLUME

Elevation	Contour Area (sf)	Depth (ft)	Incremental Volume (cf)	Cumulative Volume (cf)	Elevation Notes
346.20	0	0.00	0	0	(Bottom Elevation / Water Quality Drawdown Orifice)
347.00	1,036	0.80	414	414	
348.00	1,513	1.80	1,275	1,689	
349.00	2,080	2.80	1,797	3,485	
350.00	2,761	3.80	2,421	5,906	
351.00	3,523	4.80	3,142	9,048	
352.00	4352	5.80	3,938	12,985	
353.00	5250	6.80	4,801	17,786	Secondary Weir Elev. (At Temp Pool Elev.)
354.00	6213	7.80	5,732	23,518	
355.00	7238	8.80	6,726	30,243	
356.00	8322	9.80	7,780	38,023	(Emergency Spillway Crest Elevation)
357.00	9465	10.80	8,894	46,917	(Top of Embankment Elevation)

Required Water Quality Volume =	14402	Cu-ft	(Required Storage Volume for Water Quality)
Provided Water Quality Volume =	17786	Cu-ft OK	(Cumulative Volume between Temporary Pool & Bottom Elevation)
Design Volume Ponding Depth =	6.80	ft	(Distance from water quality drawdown orifice to the Temporary Pool Elev)

Size Water Quality Orifice for (2-5) Day Drawdown for 1" Runoff Volume

Orifice Diameter	1.50	inches	Water Quality Orifice to Drain Temporary Pool
Driving Head to Centroid of Orifice	2.25	ft	Driving Head (h/3) Distance to Centroid of Orifice
Q1.0" Drawdown Rate	0.09	cfs	Q1" = CdA(2gh)1/2
Provided Water Quality Volume	17786	Cu-ft	(Orifice Equation; Cd=0.60 & h=h/3; Pg 3-13 BMP Manual)
Drawdown Time	2.33	Days OK	Drawdown Time = Provided Water Quality Volume / (Q1" x 86,400)

DRY BASIN ELEVATIONS

Seasonal High Water Elevation	NA	ft
Small Permanent Pool Bottom Elevation	344.20	ft
Bottom / Drawdown Outlet Elevation	346.20	ft
Temporary Pool / Control Weir Elevation	353.00	ft
Top of Control Structure Elevation	353.00	ft
Emergency Spillway Elevation	356.00	ft
Top of Pond / Embankement Elevation	357.00	ft
1-Yr Storm Stage	353.25	ft
10-Yr Storm Stage	353.87	ft
25-Yr Storm Stage	354.27	ft
100-Yr Storm Stage	355.20	ft

MUNICIPAL TOOL - SINGLE FAMILY

Towns of Rolesville, Wendell and Zebulon Stormwater Tool Directions

The Wake County Municipal Stormwater Tool is required for all stormwater submittals in Rolesville Wendell, and Zebulon. Engineer will input all data requested that is highlighted in **blue**. Engineer may follow provided links to view calculations used in this tool. Calculations for peak flow, runoff, time of concentration, etc. are for individual drainage areas. Engineer should complete a worksheet for each drainage area within a project limit.

1	Complete SITE DATA worksheet. SITE DATA worksheet should be submitted with preliminary plan submittals and modified and submitted for construction plan submittals. The 2-yr, 24-hr rainfall input will be used for projects requesting LID classification further into the tool. The 10-year, 24-hour rainfall input will be used for potential Downstream Impact Analyses (DIA). Stormwater Narrative should describe the site conditions in pre- and post-development conditions including a description of site improvements and proposed stormwater BMPs.
2	Complete DA worksheets. Most of the site data is inputted by the engineer on the DA worksheets. DA worksheets are designed essentially to account for Ultra-Low, Low, and High Density project requirements per Ordinance standards. DA Worksheets will calculate runoff, time of concentration, peak flow, and volume to be managed per drainage area. Inputs will also be used to calculate the site composite curve numbers for pre and post development, Target Curve Number (TCN), and total nitrogen loading (TN) calculations. This sheet will also calculate required volume management for the 1st inch rainfall for high density projects. 1st inch of runoff should be handled by each DA BMP for High Density projects. Disconnected Impervious - This area will be used to provide an adjusted post development composite curve number ($CN_{adjusted}$) to allow a credit for the use of disconnected impervious. Site plans should clearly indicate areas of disconnected impervious.
3	SITE SUMMARY worksheet summarizes the pre and post runoff, Tc, and peak flow per drainage area based on inputs from DA worksheets. This worksheet denotes the volume required for management per drainage area based on high density requirements. TCN and composite curve numbers for pre and post development are also calculated and summarized. If the TCN is exceeded, this worksheet will calculate total volume to be managed for the entire site based on TCN requirements. Nitrogen Loading: Nitrogen Loading Rate for the site is calculated based on the Hydrologic Soil Groups and site acreages imputed on DA worksheets. This worksheet calculates the total amount of nitrogen loading. Nitrogen total will be used on following BMP worksheets. Note: There are no engineer inputs on this sheet and all exeedances from DA worksheets will be flagged in **red**.
4	DA BMP worksheets require engineer to input proposed BMP information. BMPs are categorized by sub-basins within the drainage area. Engineer should input BMP device name, type, and volume provided. BMP requirements are automatically imported from previous inputs. Engineer should input land uses by sub-basin. Off-site drainage to the sub-basin may also be inputted to allow credit for nitrogen removal (if said drainage is routed through the BMP). BMPs are required in each DA where post-development peak flow is higher than pre-development peak flow. Only under special circumstances will a BMP not be required. In these cases, the engineer must show the following: 1. Total runoff volume for the DA must be less than 10% of the entire site runoff. 2. TN must be handled for the site elsewhere. 3. Runoff must not leave the DA at an erosive velocity. 4. Proposed design must comply with all state and federal regulations. DA BMP worksheets will ensure that proposed BMPs meet requirements for peak flow, TCN, and for Nitrogen. Engineer must input post-BMP discharge. Note: Engineers are required to input post BMP peak flow for the 1-year, 2-year, and 10-year storms for each DA. The SW Design Tool uses the TR-55 method. The TR-55 method is preferred for post BMP calculations. If engineer uses a method/model other than TR-55 for the post-BMP peak discharge and runoff, engineer must also provide pre-development calculations from the method/model (in addition to the SW Design Tool) and pre-development calculations must be within 10% of results computed by the SW Design Tool). A summary sheet should be attached with the submittal to for all inputs used in design.
5	BMP SUMMARY worksheet summarizes the pre and post BMP runoff, and peak flow per drainage area based on inputs from DA BMP worksheets. Nitrogen Loading: Nitrogen mitigated for the site is calculated based on the inputs on DA BMP worksheets. This worksheet calculates the total amount of nitrogen left to be mitigated for the site (Wendell only). Site expansions use the aportioning method. Note: There are no engineer inputs on this sheet and all exeedances from DA BMP worksheets will be flagged in **red**.
6	LID worksheet summarizes the pre and post runoff, Tc, and peak flow per drainage area for the 2-year, 24-hour storm based on inputs from DA and BMP worksheets. This worksheet will determine if design calculations provided meet LID classification. Engineers may wish to modify site design or mitigate with additional BMPs to meet LID Requirements. In that case, DA and BMP worksheets should be modified to meet these requirements and the LID sheet will be updated automatically. If calculation requirements for LID are met, Engineer should complete the *LID CHECKLIST* on **LID** worksheet and provide associated documentation to determine if project meets ALL LID requirements.
7	Downstream Impact Analysis DIA worksheet presents requirements for a downstream impact analysis. Based on engineer inputs, this sheet will report if a DIA is required for the project based on the 10-year storm discharge leaving each discharge point. This stormwater tool does NOT complete the actual downstream impact analyses. A DIA shall be performed at the outlet(s) of the site, and downstream at each tributary junction to the point(s) in the conveyance system where the area of the portion of the site draining into the system is less than or equal to 10 percent of the total drainage area above that point. The outflow hydrograph at these points is to be determined for the pre-development condition. Then, the outflow hydrograph at each of these points is to be determined for the conditions after the site in question has been developed. All hydrographs and inputs should be provided with plan submittal.

MUNICIPAL TOOL - SINGLE FAMILY

SITE DATA

Project Information	
Project Name:	**ROLESVILLE CROSSING**
Applicant:	Timmons Group for Hopper Communities
Applicant Contact Name:	Robert Wingate
Applicant Contact Number:	984-255-2352
Contact Email:	robert.wingate@timmons.com
Municipal Jurisdiction (Select from dropdown menu):	Rolesville
Last Updated:	Monday, July 12, 2021
Site Data:	
Total Site Area (Ac):	78.21
Existing Lake/Pond Area (Ac):	0.28
Proposed Disturbed Area (Ac):	79.64
Impervious Surface Area (acre):	24.69
Type of Development (Select from Dropdown menu):	Residential
Percent Built Upon Area (BUA):	32%
Project Density:	High
Is the proposed project a site expansion?	No
Number of Drainage Areas on Site:	3
NOAA — **1-Year, 24-Hour Storm (inches) (See NOAA Website):**	2.86
2-Year, 24-Hour Storm (inches) (See NOAA Website):	3.46
10-Year, 24-Hour Storm (inches) (See NOAA Website):	5.07
Lot Data (if applicable):	
Total Acreage in Lots:	45.89
Number of Lots:	177
Average Lot Size (SF):	11294.00
Total Impervious Surface Area on Lots (SF):	637200.00
Average Impervious Surface Area Per Lot (SF):	3600.00

Stormwater Narrative (limit to 1,200 characters - attach additional pages with submittal if necessary):

This Municipal Tool spreadsheet is only for the single-family areas. Refer to the other Municipal Tool for the townhomes.

Total Site Description:
Mixed Residential development consisting of 177 single family lots and 120 townhome lots
There are three points of discharge along the boundary of the site. Each point has been analyzed to ensure post-construction runoff rates are equal to or less than existing rates.
The first inch of stormwater runoff will be treated to comply Wake County and State regulations by routing the majority of the runoff through 2 proposed wet ponds and 3 proposed extended detention dry ponds on site.

Each townhome lot has been alloted 1,500 SF of impervious. Each single family lot has been alloted 3,600 SF of impervious. The amenity space has been allotted 9,800 SF of impervious.

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 1
STORMWATER PRE-POST CALCULATIONS

LAND USE & SITE DATA	PRE-DEVELOPMENT				POST-DEVELOPMENT			
Drainage Area (Acres)=	73.23				79.42			
Site Acreage within Drainage=	69.49				75.05			
One-year, 24-hour rainfall (in)=	2.86							
Two-year, 24-hour rainfall (in)=	3.46							
Ten-year, 24-hour storm (in)=	5.07							
Total Lake/Pond Area (Acres)=	0.28				2.93			
Lake/Pond Area not in the Tc flow path (Acres)=	0.28				1.45			
Site Land Use (acres):	A	B	C	D	A	B	C	D
Pasture								
Woods, Poor Condition								
Woods, Fair Condition								
Woods, Good Condition				9.68				9.38
Open Space, Poor Condition								
Open Space, Fair condition								
Open Space, Good Condition				59.76				40.96
Reforestation (in dedicated OS)								
Connected Impervious				0.05				24.71
Disconnected Impervious								
SITE FLOW	**PRE-DEVELOPMENT T_c**				**POST-DEVELOPMENT Tc**			
Sheet Flow								
Length (ft)=	100.00				50.00			
Slope (ft/ft)=	0.020				0.020			
Surface Cover:	Grass				Grass			
n-value=	0.240				0.240			
T_t (hrs)=	0.252				0.144			
Shallow Flow								
Length (ft)=	950.00				250.00			
Slope (ft/ft)=	0.020				0.020			
Surface Cover:	Unpaved				Unpaved			
Average Velocity (ft/sec)=	2.28				2.28			
T_t (hrs)=	0.12				0.03			
Channel Flow 1								
Length (ft)=	2450.00				870.00			
Slope (ft/ft)=	0.020				0.020			
Cross Sectional Flow Area (ft^2)=	15.00				7.00			
Wetted Perimeter (ft)=	16.50				9.40			
Channel Lining:	Weeds				Concrete, finished			
n-value=	0.040				0.012			
Hydraulic Radius (ft)=	0.91				0.74			
Average Velocity (ft/sec)=	4.94				14.43			
T_t (hrs)=	0.14				0.02			

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 1
STORMWATER PRE-POST CALCULATIONS

Channel Flow 2		
Length (ft)=		2450.00
Slope (ft/ft)=		0.020
Cross Sectional Flow Area (ft^2)=		15.00
Wetted Perimeter (ft)=		16.50
Channel Lining:		Weeds
n-value=		0.040
Hydraulic Radius (ft)=		0.91
Average Velocity (ft/sec)=		4.94
T_t (hrs)=		0.14
Channel Flow 3		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=		
Average Velocity (ft/sec)=		
T_t (hrs)=		
Tc (hrs)=	0.51	0.33
RESULTS	**PRE-DEVELOPMENT**	**POST-DEVELOPMENT**
Composite Curve Number=	80	86
Disconnected Impervious Adjustment		
Disconnected impervious area (acre) =		
$CN_{adjusted\ (1\text{-}year)}$=	**86**	
High Density Only		
Volume of runoff from 1" rainfall for DA HIGH DENSITY REQUIREMENT = (ft^3) =	95,142	
1-year, 24-hour storm (Peak Flow)		
Runoff (inches) = $Q^*_{1\text{-}year}$=	1.12	1.51
Volume of runoff (ft^3) =	283,083	411,528
Volume change (ft^3) =	128,445	
Peak Discharge (cfs)= $Q_{1\text{-}year}$=	65.230	105.726
2-year, 24-hour storm (LID)		
Runoff (inches) = $Q^*_{2\text{-}year}$=	1.58	2.03
Volume of runoff (ft^3) =	397,692	551,971
Peak Discharge (cfs)= $Q_{2\text{-}year}$=	91.639	141.807
10-year, 24-hour storm (DIA)		
Runoff (inches) = $Q^*_{10\text{-}year}$=	2.92	3.49
Volume of runoff (ft^3) =	735,826	879,696
Peak Discharge (cfs)= $Q_{10\text{-}year}$=	169.554	244.086

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 2
STORMWATER PRE-POST CALCULATIONS

LAND USE & SITE DATA	PRE-DEVELOPMENT				POST-DEVELOPMENT			
Drainage Area (Acres)=	5.56				1.91			
Site Acreage within Drainage=	5.56				1.91			
One-year, 24-hour rainfall (in)=	2.86							
Two-year, 24-hour rainfall (in)=	3.46							
Ten-year, 24-hour storm (in)=	5.07							
Total Lake/Pond Area (Acres)=								
Lake/Pond Area not in the Tc flow path (Acres)=								
Site Land Use (acres):	A	B	C	D	A	B	C	D
Pasture								
Woods, Poor Condition								
Woods, Fair Condition								
Woods, Good Condition								
Open Space, Poor Condition								
Open Space, Fair condition								
Open Space, Good Condition				5.42				1.63
Reforestation (in dedicated OS)								
Connected Impervious				0.14				0.28
Disconnected Impervious								
SITE FLOW	**PRE-DEVELOPMENT T_c**				**POST-DEVELOPMENT Tc**			
Sheet Flow								
Length (ft)=	100.00				100.00			
Slope (ft/ft)=	0.020				0.020			
Surface Cover:	Grass				Grass			
n-value=	0.240				0.240			
T_t (hrs)=	0.252				0.252			
Shallow Flow								
Length (ft)=	630.00				500.00			
Slope (ft/ft)=	0.020				0.020			
Surface Cover:	Unpaved				Unpaved			
Average Velocity (ft/sec)=	2.28				2.28			
T_t (hrs)=	0.08				0.06			
Channel Flow 1								
Length (ft)=								
Slope (ft/ft)=								
Cross Sectional Flow Area (ft^2)=								
Wetted Perimeter (ft)=								
Channel Lining:								
n-value=								
Hydraulic Radius (ft)=								
Average Velocity (ft/sec)=								
T_t (hrs)=								

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 2
STORMWATER PRE-POST CALCULATIONS

Channel Flow 2		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=		
Average Velocity (ft/sec)=		
T_t (hrs)=		
Channel Flow 3		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=		
Average Velocity (ft/sec)=		
T_t (hrs)=		
Tc (hrs)=	0.33	0.31
RESULTS	**PRE-DEVELOPMENT**	**POST-DEVELOPMENT**
Composite Curve Number=	80	83
Disconnected Impervious Adjustment		
Disconnected impervious area (acre) =		
$CN_{adjusted\ (1\text{-}year)}$=	**83**	
High Density Only		
Volume of runoff from 1" rainfall for DA HIGH DENSITY REQUIREMENT = (ft^3) =	1,297	
1-year, 24-hour storm (Peak Flow)		
Runoff (inches) = $Q^*_{1\text{-}year}$=	1.17	1.31
Volume of runoff (ft^3) =	23,677	9,090
Volume change (ft^3) =		
Peak Discharge (cfs)= $Q_{1\text{-}year}$=	6.617	2.598
2-year, 24-hour storm (LID)		
Runoff (inches) = $Q^*_{2\text{-}year}$=	1.64	1.80
Volume of runoff (ft^3) =	33,032	12,463
Peak Discharge (cfs)= $Q_{2\text{-}year}$=	9.231	3.562
10-year, 24-hour storm (DIA)		
Runoff (inches) = $Q^*_{10\text{-}year}$=	3.00	3.20
Volume of runoff (ft^3) =	60,464	64,643
Peak Discharge (cfs)= $Q_{10\text{-}year}$=	16.898	6.346

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 3
STORMWATER PRE-POST CALCULATIONS

LAND USE & SITE DATA	PRE-DEVELOPMENT				POST-DEVELOPMENT			
Drainage Area (Acres)=	4.94				1.25			
Site Acreage within Drainage=	4.36				1.25			
One-year, 24-hour rainfall (in)=	2.86							
Two-year, 24-hour rainfall (in)=	3.46							
Ten-year, 24-hour storm (in)=	5.07							
Total Lake/Pond Area (Acres)=	0.00				0.00			
Lake/Pond Area not in the Tc flow path (Acres)=	0.00				0.00			
Site Land Use (acres):	A	B	C	D	A	B	C	D
Pasture								
Woods, Poor Condition								
Woods, Fair Condition								
Woods, Good Condition								
Open Space, Poor Condition								
Open Space, Fair condition								
Open Space, Good Condition				4.36				1.03
Reforestation (in dedicated OS)								
Connected Impervious								0.22
Disconnected Impervious								
SITE FLOW	**PRE-DEVELOPMENT T_c**				**POST-DEVELOPMENT Tc**			
Sheet Flow								
Length (ft)=	50.00				20.00			
Slope (ft/ft)=	0.020				0.020			
Surface Cover:	Grass				Grass			
n-value=	0.240				0.240			
T_t (hrs)=	0.144				0.069			
Shallow Flow								
Length (ft)=	200.00				200.00			
Slope (ft/ft)=	0.020				0.020			
Surface Cover:	Unpaved				Unpaved			
Average Velocity (ft/sec)=	2.28				2.28			
T_t (hrs)=	0.02				0.02			
Channel Flow 1								
Length (ft)=								
Slope (ft/ft)=								
Cross Sectional Flow Area (ft^2)=								
Wetted Perimeter (ft)=								
Channel Lining:								
n-value=								
Hydraulic Radius (ft)=								
Average Velocity (ft/sec)=								
T_t (hrs)=								

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 3
STORMWATER PRE-POST CALCULATIONS

Channel Flow 2		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=		
Average Velocity (ft/sec)=		
T_t (hrs)=		
Channel Flow 3		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=		
Average Velocity (ft/sec)=		
T_t (hrs)=		
Tc (hrs)=	0.17	0.09
RESULTS	**PRE-DEVELOPMENT**	**POST-DEVELOPMENT**
Composite Curve Number=	80	83
Disconnected Impervious Adjustment		
Disconnected impervious area (acre) =		
$CN_{adjusted\ (1\text{-}year)}$=	**83**	
High Density Only		
Volume of runoff from 1" rainfall for DA HIGH DENSITY REQUIREMENT = (ft^3) =	946	
1-year, 24-hour storm (Peak Flow)		
Runoff (inches) = $Q^*_{1\text{-}year}$=	1.15	1.35
Volume of runoff (ft^3) =	18,138	6,107
Volume change (ft^3) =		
Peak Discharge (cfs)= $Q_{1\text{-}year}$=	7.538	2.704
2-year, 24-hour storm (LID)		
Runoff (inches) = $Q^*_{2\text{-}year}$=	1.60	1.84
Volume of runoff (ft^3) =	25,397	8,340
Peak Discharge (cfs)= $Q_{2\text{-}year}$=	10.555	3.692
10-year, 24-hour storm (DIA)		
Runoff (inches) = $Q^*_{10\text{-}year}$=	2.95	3.25
Volume of runoff (ft^3) =	46,753	51,499
Peak Discharge (cfs)= $Q_{10\text{-}year}$=	19.431	6.537

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DA SITE SUMMARY
STORMWATER PRE-POST CALCULATIONS

SITE SUMMARY

DRAINAGE AREA SUMMARIES

DRAINAGE AREA:	DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9	DA10
Pre-Development (1-year, 24-hour storm)										
Runoff (in) = $Q_{pre,1\text{-}year}$ =	1.12	1.17	1.15							
Peak Flow (cfs)=$Q_{1\text{-}year}$ =	65.230	6.617	7.538							
Post-Development (1-year, 24-hour storm)										
Proposed Impervious Surface (acre) =	24.71	0.28	0.22							
Runoff (in)=$Q_{1\text{-}year}$ =	1.51	1.31	1.35							
Peak Flow (cfs)=$Q_{1\text{-}year}$ =	105.726	2.598	2.704							
Increase in volume per DA (ft^3)_1-yr storm=	128,445									
Minimum Volume to be Managed for DA HIGH DENSITY REQUIREMENT = (ft^3) =	95,142	1,297	946							

TARGET CURVE NUMBER (TCN)

Site Data

SITE \SOIL COMPOSITION

HYDROLOGIC SOIL GROUP	Site Area	%	Target CN
A	0.00	0%	N/A
B	0.00	0%	N/A
C	0.00	0%	N/A
D	78.21	100%	N/A

Total Site Area (acres) =	78.21
Percent BUA (Includes Existing Lakes/Pond Areas) =	31%
Project Density =	High
Target Curve Number (TCN) =	N/A
$CN_{adjusted\ (1\text{-}year)}$=	85
Minimum Volume to be Managed (Total Site) Per TCN Requirement= ft^3 =	N/A

Site Nitrogen Loading Data

HSG	TN export coefficient (lbs/ac/yr)	Site Acreage	N Export
Pasture	1.2	0.00	0.00
Woods, Poor Condition	1.6	0.00	0.00
Woods, Fair Condition	1.2	0.00	0.00
Woods, Good Condition	0.8	9.38	7.50
Open Space, Poor Condition	1.0	0.00	0.00
Open Space, Fair Condition	0.8	0.00	0.00
Open Space, Good Condition	0.6	43.62	26.17
Reforestation (in dedicated OS)	0.6	0.00	0.00
Impervious	21.2	25.21	534.45

SITE NITROGEN LOADING RATE (lbs/ac/yr)=	7.26
Nitrogen Load (lbs/yr)=	568.13
TOTAL SITE NITROGEN TO MITIGATE (lbs/yr)_Wendell Only=	286.57

Site Nitrogen Loading Data For Expansions Only

	Existing	New
Impervious(acres)=	NA	NA
"Expansion Area" (acres=)		
Nitrogen Load (lbs/yr)=	NA	NA
SITE NITROGEN LOADING RATE (lbs/ac/yr)=	NA	NA
Total Site loading rate (lbs/ac/yr)		
TOTAL SITE NITROGEN TO MITIGATE (lbs/yr)=	NA	

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 1
BMP CALCULATIONS

DRAINAGE AREA 1 - BMP DEVICES AND ADJUSTMENTS				
DA1 Site Acreage=	75.05			
DA1 Off-Site Acreage=	4.37			
Total Required Storage Volume for Site TCN Requirement (ft^3)=	N/A			
Total Required Storage Volume for DA1 1" Rainfall for High Density (ft^3)=	95,142			
Will site use underground detention/cistern?	No	Enter % of the year water will be reused=	0%	Note: Supporting information/details should be submitted to demonstrate water usage.

ENTER ACREAGE FOR ALL SUB-DRAINAGE AREAS IN DA

HSG	Sub-DA1(a) (Ac)		Sub-DA1(b) (Ac)		Sub-DA1(c) (Ac)		Sub-DA1(d) (Ac)		Sub-DA1(e) (Ac)	
	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Pasture										
Woods, Poor Condition										
Woods, Fair Condition										
Woods, Good Condition										
Open Space, Poor Condition										
Open Space, Fair Condition										
Open Space, Good Condition	14.27	0.31	4.76	1.71	8.97	2.35	3.44		18.90	
Reforestation (in dedicated OS)										
Impervious	10.70		3.19		5.73		3.16		1.93	

Sub-DA1(a) BMP(s)

Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
1	Wet Detention Basin	15,715	42,000	25%	235.59	58.90	60
				0%	176.69	0.00	
				0%	176.69	0.00	
				0%	176.69	0.00	
				0%	176.69	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):		**176.69**					

Sub-DA1(b) BMP(s)

If Sub-DA1(b) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):

Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
2	Dry Extended Detention Basin	3,021		10%	71.51	7.15	48
				0%	64.36	0.00	
				0%	64.36	0.00	
				0%	64.36	0.00	
				0%	64.36	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):		**64.36**					

Sub-DA1 (c) BMP(s)

If Sub-DA1(c) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):

Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
4	Wet Detention Basin	7,113		25%	128.27	32.07	48
				0%	96.20	0.00	
				0%	96.20	0.00	
				0%	96.20	0.00	
				0%	96.20	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):		**96.20**					

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 1
BMP CALCULATIONS

Sub-DA1(d) BMP(s)							
If Sub-DA1(d) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
5	Dry Extended Detention Basin	2,056		10%	69.06	6.91	48
				0%	62.15	0.00	
				0%	62.15	0.00	
				0%	62.15	0.00	
				0%	62.15	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):		**62.15**					

Sub-DA1(e) BMP(s)							
If Sub-DA1(e) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
		5,434		0%	52.26	0.00	
				0%	52.26	0.00	
				0%	52.26	0.00	
				0%	52.26	0.00	
				0%	52.26	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):		**52.26**					

DA1 BMP SUMMARY	
Total Volume Treated (ft^3)=	42,000
Nitrogen Mitigated(lbs)=	105.02
1-year, 24-hour storm	
Post BMP Volume of Runoff (ft^3)$_{(1\text{-year})}$=	369,528
Post BMP Runoff (inches) = $Q^*_{(1\text{-year})}$=	1.36
Post BMP $CN_{(1\text{-year})}$=	83
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	36.860
2-year, 24-hour storm (LID)	
Post BMP Volume of Runoff (ft3)$_{(2\text{-year})}$=	509,971
Post BMP Runoff (inches) = $Q^*_{(2\text{-year})}$=	1.87
Post BMP $CN_{(2\text{-year})}$=	83
Post BMP Peak Discharge (cfs)= $Q_{(2\text{-year})}$=	67.100
10-year, 24-hour storm (DIA)	
Post BMP Volume of Runoff (ft^3)$_{(10\text{-year})}$=	837,696
Post BMP Runoff (inches) = $Q^*_{(10\text{-year})}$=	3.07
Post BMP $CN_{(10\text{-year})}$=	96
Post BMP Peak Discharge (cfs)= $Q_{(10\text{-year})}$=	206.410

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 2
BMP CALCULATIONS

DRAINAGE AREA 1 - BMP DEVICES AND ADJUSTMENTS				
DA2 Site Acreage=	1.91			
DA2 Off-Site Acreage=				
Total Required Storage Volume TCN Requirement (ft^3)=	N/A			
Total Required Storage Volume for DA2 1" Rainfall for High Density (ft3)=	1,297			
Will site use underground detention/cistern?		Enter % of the year water will be reused=		Note: Supporting information/details should be submitted to demonstrate water usage.

ENTER ACREAGE FOR ALL SUB-DRAINAGE AREAS IN DA

HSG	Sub-DA2(a) (Ac)		Sub-DA2(b) (Ac)		Sub-DA2(c) (Ac)		Sub-DA2(d) (Ac)		Sub-DA2(e) (Ac)	
	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Pasture										
Woods, Poor Condition										
Woods, Fair Condition										
Woods, Good Condition										
Open Space, Poor Condition										
Open Space, Fair Condition										
Open Space, Good Condition										
Reforestation (in dedicated OS)										
Impervious										

Sub-DA1(a) BMP(s)

Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

Sub-DA1(b) BMP(s)

If Sub-DA1(b) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

Sub-DA1 (c) BMP(s)

If Sub-DA1(c) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 2
BMP CALCULATIONS

Sub-DA1(d) BMP(s)							
If Sub-DA1(d) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

Sub-DA1(e) BMP(s)							
If Sub-DA1(e) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

DA2 BMP SUMMARY	
Total Volume Treated (ft^3)=	
Nitrogen Mitigated(lbs)=	
1-year, 24-hour storm	
Post BMP Volume of Runoff (ft^3)$_{(1\text{-year})}$=	9,090
Post BMP Runoff (inches) = $Q^*_{(1\text{-year})}$=	1.31
Post BMP $CN_{(1\text{-year})}$=	82
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	2.938
2-year, 24-hour storm (LID)	
Post BMP Volume of Runoff (ft3)$_{(2\text{-year})}$=	12,463
Post BMP Runoff (inches) = $Q^*_{(2\text{-year})}$=	1.80
Post BMP $CN_{(2\text{-year})}$=	82
Post BMP Peak Discharge (cfs)= $Q_{(2\text{-year})}$=	4.043
10-year, 24-hour storm (DIA)	
Post BMP Volume of Runoff (ft^3)$_{(10\text{-year})}$=	64,643
Post BMP Runoff (inches) = $Q^*_{(10\text{-year})}$=	9.32
Post BMP $CN_{(10\text{-year})}$=	98
Post BMP Peak Discharge (cfs)= $Q_{(10\text{-year})}$=	7.151

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 3
BMP CALCULATIONS

DRAINAGE AREA 1 - BMP DEVICES AND ADJUSTMENTS				
DA3 Site Acreage=	1.25			
DA3 Off-Site Acreage=				
Total Required Storage Volume TCN Requirement (ft^3)=	N/A			
Total Required Storage Volume for DA3 1" Rainfall for High Density (ft3)=	946			
Will site use underground detention/cistern?		Enter % of the year water will be reused=		Note: Supporting information/details should be submitted to demonstrate water usage.

ENTER ACREAGE FOR ALL SUB-DRAINAGE AREAS IN DA

HSG	Sub-DA3(a) (Ac)		Sub-DA3(b) (Ac)		Sub-DA3(c) (Ac)		Sub-DA3(d) (Ac)		Sub-DA3(e) (Ac)	
	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Pasture										
Woods, Poor Condition										
Woods, Fair Condition										
Woods, Good Condition										
Open Space, Poor Condition										
Open Space, Fair Condition										
Open Space, Good Condition										
Reforestation (in dedicated OS)										
Impervious										

Sub-DA1(a) BMP(s)

Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

Sub-DA1(b) BMP(s)

If Sub-DA1(b) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

Sub-DA1 (c) BMP(s)

If Sub-DA1(c) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

MUNICIPAL TOOL - SINGLE FAMILY

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 3
BMP CALCULATIONS

Sub-DA1(d) BMP(s)							
If Sub-DA1(d) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

Sub-DA1(e) BMP(s)							
If Sub-DA1(e) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

DA3 BMP SUMMARY	
Total Volume Treated (ft^3)=	
Nitrogen Mitigated(lbs)=	
1-year, 24-hour storm	
Post BMP Volume of Runoff (ft^3)$_{(1\text{-year})}$=	6,107
Post BMP Runoff (inches) = $Q^*_{(1\text{-year})}$=	1.35
Post BMP $CN_{(1\text{-year})}$=	83
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	2.953
2-year, 24-hour storm (LID)	
Post BMP Volume of Runoff (ft3)$_{(2\text{-year})}$=	8,340
Post BMP Runoff (inches) = $Q^*_{(2\text{-year})}$=	1.84
Post BMP $CN_{(2\text{-year})}$=	83
Post BMP Peak Discharge (cfs)= $Q_{(2\text{-year})}$=	3.992
10-year, 24-hour storm (DIA)	
Post BMP Volume of Runoff (ft^3)$_{(10\text{-year})}$=	51,499
Post BMP Runoff (inches) = $Q^*_{(10\text{-year})}$=	11.35
Post BMP $CN_{(10\text{-year})}$=	98
Post BMP Peak Discharge (cfs)= $Q_{(10\text{-year})}$=	6.868

Project Name: ROLESVILLE CROSSING

DA SITE SUMMARY
BMP CALCULATIONS

BMP SUMMARY										
DRAINAGE AREA SUMMARIES										
DRAINAGE AREA:	DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9	DA10
Pre-Development (1-year, 24-hour storm)										
Runoff (in)=$Q^*_{1\text{-year}}$ =	1.12	1.17	1.15							
Peak Flow (cfs)=$Q_{1\text{-year}}$ =	65.230	6.617	7.538							
Post-Development (1-year, 24-hour storm)										
Target Curve Number (TCN) =	NA									
Post BMP Runoff (inches) = $Q^*_{(1\text{-year})}$=	1.36	1.31	1.35							
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	36.860	2.938	2.953							
Post BMP $CN_{(1\text{-year})}$=	83									
Post-BMP Nitrogen Loading										
TOTAL SITE NITROGEN MITIGATED (lbs)=	105.02									
SITE NITROGEN LOADING RATE (lbs/ac/yr)=	5.92									
TOTAL SITE NITROGEN LEFT TO MITIGATE_Wendell Only (lbs)=	**181.55**									

MUNICIPAL TOOL - SINGLE FAMILY

Project Name:	ROLESVILLE CROSSING

LOW IMPACT DEVELOPMENT SUMMARY

DRAINAGE AREA SUMMARIES										
DRAINAGE AREA:	DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9	DA10
Pre-Development										
Runoff (in) = $Q_{pre\_2\text{-}year}$ =	1.58	1.64	1.60							
Total Runoff Volume (ft^3)=	397,692	33,032	25,397							
Peak Flow (cfs)=$Q_{2\text{-}year}$ =	91.639	9.231	10.555							
Post-Development										
2-year, 24-hour storm (LID)										
Post BMP Runoff (inches) = $Q^*_{(2\text{-}year)}$=	1.87	1.80	1.84							
Post BMP Peak Discharge (cfs)= $Q_{(2\text{-}year)}$=	67.100	4.043	3.992							
Post BMP Volume of Runoff $(ft3)_{(2\text{-}year)}$=	509,971	12,463	8,340							
Does Runoff meet LID requirements?	No	Yes	No							
Does Peak Flow meet LID requirements?	Yes	Yes	Yes							
Does Runoff Volume meet LID requirements?	No	Yes	Yes							

SITE SUMMARY	
Site Data	
Target CN =	N/A
Post-Development CN =	83
Does CN meet LID requirements?	

LID CHECKLIST
Complete the below checklist if all requirements have been met above:

LID Narrative (limit to 600 characters - attach additional pages with submittal if necessary):
Describe in detail how the proposed development has utilized "Natural Site Design". Narrative should include the location of site buildings, roads and other land disturbances in the least environmentally-sensitive areas, preservation of steep slopes, and preservation of naturally well draining soils and other hydrologically valuable features.

LID Techniques (check all that apply)
At least **one** of the following techniques must be used to achieve LID classification:

☐	Bioretention
☐	On-site infiltration

Additional LID Techniques (check all that apply)
At least **two** (**one for Wendell**) of the following techniques must be used to achieve LID classification:

☐	Retention of 50% of vegetated area, including open space, landscaping or forests
☐	Use of permeable pavement for all private driveways, private roads, sidewalks and parking areas
☐	Installation of one rain cistern per lot or three rain barrels per lot
☐	Installation of vegetative roofs
☐	Increasing all buffers in the Riparian buffer zone or the Flood Protection Zone, whichever is greater, by 50 feet
☐	Use of reclaimed water for all buildings
☐	Use of innovative LID techniques subject to approval

Project Name:	ROLESVILLE CROSSING

DOWNSTREAM IMPACT ANALYSIS SITE SUMMARY

DRAINAGE AREA SUMMARIES										
DRAINAGE AREA:	DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9	DA10
Pre-Development										
Peak Discharge (cfs)=$Q_{10\text{-year}}$ =	169.55	16.90	19.43							
Volume of Runoff (ft^3)$_{(10\text{-year})}$ =	735,826	60,464	46,753							
Post-Development										
10-year, 24-hour storm (DIA)										
Post BMP Peak Discharge (cfs)= $Q_{(10\text{-year})}$=	206.41	7.15	6.87							
Post BMP Volume of Runoff (ft^3)$_{(10\text{-year})}$=	837,696	64,643	51,499							

MUNICIPAL TOOL - TOWNHOMES

Towns of Rolesville, Wendell and Zebulon Stormwater Tool Directions

The Wake County Municipal Stormwater Tool is required for all stormwater submittals in Rolesville Wendell, and Zebulon. Engineer will input all data requested that is highlighted in **blue**. Engineer may follow provided links to view calculations used in this tool. Calculations for peak flow, runoff, time of concentration, etc. are for individual drainage areas. Engineer should complete a worksheet for each drainage area within a project limit.

1	Complete SITE DATA worksheet. SITE DATA worksheet should be submitted with preliminary plan submittals and modified and submitted for construction plan submittals. The 2-yr, 24-hr rainfall input will be used for projects requesting LID classification further into the tool. The 10-year, 24-hour rainfall input will be used for potential Downstream Impact Analyses (DIA). Stormwater Narrative should describe the site conditions in pre- and post-development conditions including a description of site improvements and proposed stormwater BMPs.
2	Complete DA worksheets. Most of the site data is inputted by the engineer on the DA worksheets. DA worksheets are designed essentially to account for Ultra-Low, Low, and High Density project requirements per Ordinance standards. DA Worksheets will calculate runoff, time of concentration, peak flow, and volume to be managed per drainage area. Inputs will also be used to calculate the site composite curve numbers for pre and post development, Target Curve Number (TCN), and total nitrogen loading (TN) calculations. This sheet will also calculate required volume management for the 1st inch rainfall for high density projects. 1st inch of runoff should be handled by each DA BMP for High Density projects. Disconnected Impervious - This area will be used to provide an adjusted post development composite curve number ($CN_{adjusted}$) to allow a credit for the use of disconnected impervious. Site plans should clearly indicate areas of disconnected impervious.
3	SITE SUMMARY worksheet summarizes the pre and post runoff, Tc, and peak flow per drainage area based on inputs from DA worksheets. This worksheet denotes the volume required for management per drainage area based on high density requirements. TCN and composite curve numbers for pre and post development are also calculated and summarized. If the TCN is exceeded, this worksheet will calculate total volume to be managed for the entire site based on TCN requirements. Nitrogen Loading: Nitrogen Loading Rate for the site is calculated based on the Hydrologic Soil Groups and site acreages imputed on DA worksheets. This worksheet calculates the total amount of nitrogen loading. Nitrogen total will be used on following BMP worksheets. Note: There are no engineer inputs on this sheet and all exeedances from DA worksheets will be flagged in **red**.
4	DA BMP worksheets require engineer to input proposed BMP information. BMPs are categorized by sub-basins within the drainage area. Engineer should input BMP device name, type, and volume provided. BMP requirements are automatically imported from previous inputs. Engineer should input land uses by sub-basin. Off-site drainage to the sub-basin may also be inputted to allow credit for nitrogen removal (if said drainage is routed through the BMP). BMPs are required in each DA where post-development peak flow is higher than pre-development peak flow. Only under special circumstances will a BMP not be required. In these cases, the engineer must show the following: 1. Total runoff volume for the DA must be less than 10% of the entire site runoff. 2. TN must be handled for the site elsewhere. 3. Runoff must not leave the DA at an erosive velocity. 4. Proposed design must comply with all state and federal regulations. DA BMP worksheets will ensure that proposed BMPs meet requirements for peak flow, TCN, and for Nitrogen. Engineer must input post-BMP discharge. Note: Engineers are required to input post BMP peak flow for the 1-year, 2-year, and 10-year storms for each DA. The SW Design Tool uses the TR-55 method. The TR-55 method is preferred for post BMP calculations. If engineer uses a method/model other than TR-55 for the post-BMP peak discharge and runoff, engineer must also provide pre-development calculations from the method/model (in addition to the SW Design Tool) and pre-development calculations must be within 10% of results computed by the SW Design Tool). A summary sheet should be attached with the submittal to for all inputs used in design.
5	BMP SUMMARY worksheet summarizes the pre and post BMP runoff, and peak flow per drainage area based on inputs from DA BMP worksheets. Nitrogen Loading: Nitrogen mitigated for the site is calculated based on the inputs on DA BMP worksheets. This worksheet calculates the total amount of nitrogen left to be mitigated for the site (Wendell only). Site expansions use the aportioning method. Note: There are no engineer inputs on this sheet and all exeedances from DA BMP worksheets will be flagged in **red**.
6	LID worksheet summarizes the pre and post runoff, Tc, and peak flow per drainage area for the 2-year, 24-hour storm based on inputs from DA and BMP worksheets. This worksheet will determine if design calculations provided meet LID classification. Engineers may wish to modify site design or mitigate with additional BMPs to meet LID Requirements. In that case, DA and BMP worksheets should be modified to meet these requirements and the LID sheet will be updated automatically. If calculation requirements for LID are met, Engineer should complete the *LID CHECKLIST* on **LID** worksheet and provide associated documentation to determine if project meets ALL LID requirements.
7	Downstream Impact Analysis DIA worksheet presents requirements for a downstream impact analysis. Based on engineer inputs, this sheet will report if a DIA is required for the project based on the 10-year storm discharge leaving each discharge point. This stormwater tool does NOT complete the actual downstream impact analyses. A DIA shall be performed at the outlet(s) of the site, and downstream at each tributary junction to the point(s) in the conveyance system where the area of the portion of the site draining into the system is less than or equal to 10 percent of the total drainage area above that point. The outflow hydrograph at these points is to be determined for the pre-development condition. Then, the outflow hydrograph at each of these points is to be determined for the conditions after the site in question has been developed. All hydrographs and inputs should be provided with plan submittal.

MUNICIPAL TOOL - TOWNHOMES

SITE DATA

Project Information	
Project Name:	**ROLESVILLE CROSSING**
Applicant:	Timmons Group for Hopper Communities
Applicant Contact Name:	Robert Wingate
Applicant Contact Number:	984-255-2352
Contact Email:	robert.wingate@timmons.com
Municipal Jurisdiction (Select from dropdown menu):	Rolesville
Last Updated:	Monday, July 12, 2021
Site Data:	
Total Site Area (Ac):	13.16 (Equal to post-DA3)
Existing Lake/Pond Area (Ac):	0.00
Proposed Disturbed Area (Ac):	13.16
Impervious Surface Area (acre):	6.71
Type of Development (Select from Dropdown menu):	Residential
Percent Built Upon Area (BUA):	
Project Density:	
Is the proposed project a site expansion?	Yes
Number of Drainage Areas on Site:	1
NOAA — **1-Year, 24-Hour Storm (inches) (See NOAA Website):**	2.86
NOAA — **2-Year, 24-Hour Storm (inches) (See NOAA Website):**	3.46
NOAA — **10-Year, 24-Hour Storm (inches) (See NOAA Website):**	5.07
Lot Data (if applicable):	
Total Acreage in Lots:	5.81
Number of Lots:	120
Average Lot Size (SF):	2259.00
Total Impervious Surface Area on Lots (SF):	180000.00
Average Impervious Surface Area Per Lot (SF):	1500.00

Stormwater Narrative (limit to 1,200 characters - attach additional pages with submittal if necessary):

This Municipal Tool spreadsheet is only for the townhome area. Refer to the other Municipal Tool for the single-family areas.

Mixed Residential development consisting of 177 single family lots and 120 townhome lots
There are three points of discharge along the boundary of the site. Each point has been analyzed to ensure post-construction runoff rates are equal to or less than existing rates.
The first inch of stormwater runoff will be treated to comply Wake County and State regulations by routing the majority of the runoff through 2 proposed wet ponds and 3 proposed extended detention dry ponds on site.

Each townhome lot has been alloted 1,500 SF of impervious. Each single family lot has been alloted 3,600 SF of impervious.

MUNICIPAL TOOL - TOWNHOMES

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 1
STORMWATER PRE-POST CALCULATIONS

LAND USE & SITE DATA	PRE-DEVELOPMENT				POST-DEVELOPMENT			
Drainage Area (Acres)=	13.16				13.16			
Site Acreage within Drainage=	13.16				13.16			
One-year, 24-hour rainfall (in)=	2.86							
Two-year, 24-hour rainfall (in)=	3.46							
Ten-year, 24-hour storm (in)=	5.07							
Total Lake/Pond Area (Acres)=	0.00				0.35			
Lake/Pond Area not in the Tc flow path (Acres)=	0.00				0.00			
Site Land Use (acres):	A	B	C	D	A	B	C	D
Pasture								
Woods, Poor Condition								
Woods, Fair Condition								
Woods, Good Condition				0.00				0.00
Open Space, Poor Condition								
Open Space, Fair condition								
Open Space, Good Condition				13.16				6.51
Reforestation (in dedicated OS)								
Connected Impervious				0.00				6.65
Disconnected Impervious								

SITE FLOW	PRE-DEVELOPMENT T_c	POST-DEVELOPMENT Tc
Sheet Flow		
Length (ft)=	75.00	125.00
Slope (ft/ft)=	0.030	0.020
Surface Cover:	Grass	Grass
n-value=	0.240	0.240
T_t (hrs)=	0.170	0.301
Shallow Flow		
Length (ft)=	770.00	
Slope (ft/ft)=	0.040	
Surface Cover:	Unpaved	
Average Velocity (ft/sec)=	3.23	
T_t (hrs)=	0.07	
Channel Flow 1		
Length (ft)=		1625.00
Slope (ft/ft)=		0.020
Cross Sectional Flow Area (ft^2)=		7.00
Wetted Perimeter (ft)=		9.40

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 1
STORMWATER PRE-POST CALCULATIONS

Channel Lining:		Concrete, finished
n-value=		0.012
Hydraulic Radius (ft)=		0.74
Average Velocity (ft/sec)=		14.43
T_t (hrs)=		0.03

MUNICIPAL TOOL - TOWNHOMES

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 1
STORMWATER PRE-POST CALCULATIONS

Channel Flow 2		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=		
Average Velocity (ft/sec)=		
T_t (hrs)=		
Channel Flow 3		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=		
Average Velocity (ft/sec)=		
T_t (hrs)=		
Tc (hrs)=	0.24	0.33
RESULTS	**PRE-DEVELOPMENT**	**POST-DEVELOPMENT**
Composite Curve Number=	80	89
Disconnected Impervious Adjustment		
Disconnected impervious area (acre) =		
$CN_{adjusted\ (1\text{-}year)}$=	**89**	
High Density Only		
Volume of runoff from 1" rainfall for DA HIGH DENSITY REQUIREMENT = (ft^3) =	24,114	
1-year, 24-hour storm (Peak Flow)		
Runoff (inches) = $Q^*_{1\text{-}year}$=	1.15	1.78
Volume of runoff (ft^3) =	54,746	85,121
Volume change (ft^3) =	30,375	
Peak Discharge (cfs)= $Q_{1\text{-}year}$=	17.643	23.665
2-year, 24-hour storm (LID)		
Runoff (inches) = $Q^*_{2\text{-}year}$=	1.60	2.33
Volume of runoff (ft^3) =	76,657	111,265

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 1
STORMWATER PRE-POST CALCULATIONS

Peak Discharge (cfs)= $Q_{2\text{-year}}$=	24.704	30.933
10-year, 24-hour storm (DIA)		
Runoff (inches) = $Q^*_{10\text{-year}}$=	2.95	3.85
Volume of runoff (ft^3) =	141,116	183,889
Peak Discharge (cfs)= $Q_{10\text{-year}}$=	45.476	51.124

MUNICIPAL TOOL - TOWNHOMES

Project Name: ROLESVILLE CROSSING

DA SITE SUMMARY
STORMWATER PRE-POST CALCULATIONS

SITE SUMMARY

DRAINAGE AREA SUMMARIES

DRAINAGE AREA:	DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9	DA10
Pre-Development (1-year, 24-hour storm)										
Runoff (in) = $Q_{pre,1\text{-}year}$ =	1.15									
Peak Flow (cfs)=$Q_{1\text{-}year}$ =	17.643									
Post-Development (1-year, 24-hour storm)										
Proposed Impervious Surface (acre) =	6.65									
Runoff (in)=$Q_{1\text{-}year}$ =	1.78									
Peak Flow (cfs)=$Q_{1\text{-}year}$ =	23.665									
Increase in volume per DA (ft^3)_1-yr storm=	30,375									
Minimum Volume to be Managed for DA HIGH DENSITY REQUIREMENT = (ft^3) =	24,114									

TARGET CURVE NUMBER (TCN)

Site Data

SITE \SOIL COMPOSITION

HYDROLOGIC SOIL GROUP	Site Area	%	Target CN
A	0.00	0%	N/A
B	0.00	0%	N/A
C	0.00	0%	N/A
D	13.16	100%	N/A

Total Site Area (acres) =	13.16
Percent BUA (Includes Existing Lakes/Pond Areas) =	49%
Project Density =	High
Target Curve Number (TCN) =	N/A
$CN_{adjusted\ (1\text{-}year)}$=	89
Minimum Volume to be Managed (Total Site) Per TCN Requirement= ft^3 =	N/A

Site Nitrogen Loading Data

HSG	TN export coefficient (lbs/ac/yr)	Site Acreage	N Export
Pasture	1.2	0.00	0.00
Woods, Poor Condition	1.6	0.00	0.00
Woods, Fair Condition	1.2	0.00	0.00
Woods, Good Condition	0.8	0.00	0.00
Open Space, Poor Condition	1.0	0.00	0.00
Open Space, Fair Condition	0.8	0.00	0.00
Open Space, Good Condition	0.6	6.51	3.91
Reforestation (in dedicated OS)	0.6	0.00	0.00
Impervious	21.2	6.65	140.98

SITE NITROGEN LOADING RATE (lbs/ac/yr)=	NA
Nitrogen Load (lbs/yr)=	144.89
TOTAL SITE NITROGEN TO MITIGATE (lbs/yr)_Wendell Only=	NA

Site Nitrogen Loading Data For Expansions Only

	Existing	New
Impervious(acres)=		6.65
"Expansion Area" (acres=)	13.16	
Nitrogen Load (lbs/yr)=	0.00	144.89
SITE NITROGEN LOADING RATE (lbs/ac/yr)=	0.00	11.01
Total Site loading rate (lbs/ac/yr)	11.01	
TOTAL SITE NITROGEN TO MITIGATE (lbs/yr)=	97.51	

MUNICIPAL TOOL - TOWNHOMES

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 1
BMP CALCULATIONS

DRAINAGE AREA 1 - BMP DEVICES AND ADJUSTMENTS				
DA1 Site Acreage=	13.16			
DA1 Off-Site Acreage=				
Total Required Storage Volume for Site TCN Requirement (ft^3)=	N/A			
Total Required Storage Volume for DA1 1" Rainfall for High Density (ft^3)=	24,114			
Will site use underground detention/cistern?	No	Enter % of the year water will be reused=	0%	Note: Supporting information/details should be submitted to demonstrate water usage.

ENTER ACREAGE FOR ALL SUB-DRAINAGE AREAS IN DA

HSG	Sub-DA1(a) (Ac)		Sub-DA1(b) (Ac)		Sub-DA1(c) (Ac)		Sub-DA1(d) (Ac)		Sub-DA1(e) (Ac)	
	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Pasture										
Woods, Poor Condition										
Woods, Fair Condition										
Woods, Good Condition										
Open Space, Poor Condition										
Open Space, Fair Condition										
Open Space, Good Condition	6.51									
Reforestation (in dedicated OS)										
Impervious	6.65									

Sub-DA1(a) BMP(s)

Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
3	Dry Extended Detention Basin	24,114		10%	144.89	14.49	48
				0%	130.40	0.00	
				0%	130.40	0.00	
				0%	130.40	0.00	
				0%	130.40	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):		**130.40**					

Sub-DA1(b) BMP(s)

If Sub-DA1(b) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):

Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

Sub-DA1 (c) BMP(s)

If Sub-DA1(c) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):

Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

MUNICIPAL TOOL - TOWNHOMES

Project Name: ROLESVILLE CROSSING

DRAINAGE AREA 1
BMP CALCULATIONS

Sub-DA1(d) BMP(s)							
If Sub-DA1(d) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	49.68
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

Sub-DA1(e) BMP(s)							
If Sub-DA1(e) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

DA1 BMP SUMMARY	
Total Volume Treated (ft^3)=	
Nitrogen Mitigated(lbs)=	14.49
1-year, 24-hour storm	
Post BMP Volume of Runoff (ft^3)$_{(1\text{-year})}$=	85,121
Post BMP Runoff (inches) = $Q^*_{(1\text{-year})}$=	1.78
Post BMP $CN_{(1\text{-year})}$=	89
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	8.400
2-year, 24-hour storm (LID)	
Post BMP Volume of Runoff (ft3)$_{(2\text{-year})}$=	111,265
Post BMP Runoff (inches) = $Q^*_{(2\text{-year})}$=	2.33
Post BMP $CN_{(2\text{-year})}$=	89
Post BMP Peak Discharge (cfs)= $Q_{(2\text{-year})}$=	34.700
10-year, 24-hour storm (DIA)	
Post BMP Volume of Runoff (ft^3)$_{(10\text{-year})}$=	183,889
Post BMP Runoff (inches) = $Q^*_{(10\text{-year})}$=	3.85
Post BMP $CN_{(10\text{-year})}$=	98
Post BMP Peak Discharge (cfs)= $Q_{(10\text{-year})}$=	78.200

Project Name: ROLESVILLE CROSSING

DA SITE SUMMARY
BMP CALCULATIONS

BMP SUMMARY										
DRAINAGE AREA SUMMARIES										
DRAINAGE AREA:	DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9	DA10
Pre-Development (1-year, 24-hour storm)										
Runoff (in)=$Q^*_{1\text{-year}}$ =	1.15									
Peak Flow (cfs)=$Q_{1\text{-year}}$ =	17.643									
Post-Development (1-year, 24-hour storm)										
Target Curve Number (TCN) =	NA									
Post BMP Runoff (inches) = $Q^*_{(1\text{-year})}$=	1.78									
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	8.400									
Post BMP $CN_{(1\text{-year})}$=	89									
Post-BMP Nitrogen Loading										
TOTAL SITE NITROGEN MITIGATED (lbs)=	14.49									
SITE NITROGEN LOADING RATE (lbs/ac/yr)=	9.91									
TOTAL SITE NITROGEN LEFT TO MITIGATE_Wendell Only (lbs)=	**83.02**									

MUNICIPAL TOOL - TOWNHOMES

Project Name:	ROLESVILLE CROSSING

LOW IMPACT DEVELOPMENT SUMMARY

DRAINAGE AREA SUMMARIES										
DRAINAGE AREA:	DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9	DA10
Pre-Development										
Runoff (in) = $Q_{pre\_2\text{-}year}$ =	1.60									
Total Runoff Volume (ft^3)=	76,657									
Peak Flow (cfs)=$Q_{2\text{-}year}$ =	24.704									
Post-Development										
2-year, 24-hour storm (LID)										
Post BMP Runoff (inches) = $Q^*_{(2\text{-}year)}$=	2.33									
Post BMP Peak Discharge (cfs)= $Q_{(2\text{-}year)}$=	34.700									
Post BMP Volume of Runoff $(ft3)_{(2\text{-}year)}$=	111,265									
Does Runoff meet LID requirements?	No									
Does Peak Flow meet LID requirements?	No									
Does Runoff Volume meet LID requirements?	No									

SITE SUMMARY	
Site Data	
Target CN =	N/A
Post-Development CN =	89
Does CN meet LID requirements?	

LID CHECKLIST
Complete the below checklist if all requirements have been met above:

LID Narrative (limit to 600 characters - attach additional pages with submittal if necessary):
Describe in detail how the proposed development has utilized "Natural Site Design". Narrative should include the location of site buildings, roads and other land disturbances in the least environmentally-sensitive areas, preservation of steep slopes, and preservation of naturally well draining soils and other hydrologically valuable features.

LID Techniques (check all that apply)
At least **one** of the following techniques must be used to achieve LID classification:

☐	Bioretention
☐	On-site infiltration

Additional LID Techniques (check all that apply)
At least **two** (**one for Wendell**) of the following techniques must be used to achieve LID classification:

☐	Retention of 50% of vegetated area, including open space, landscaping or forests
☐	Use of permeable pavement for all private driveways, private roads, sidewalks and parking areas
☐	Installation of one rain cistern per lot or three rain barrels per lot
☐	Installation of vegetative roofs
☐	Increasing all buffers in the Riparian buffer zone or the Flood Protection Zone, whichever is greater, by 50 feet
☐	Use of reclaimed water for all buildings
☐	Use of innovative LID techniques subject to approval

Project Name:	ROLESVILLE CROSSING

DOWNSTREAM IMPACT ANALYSIS SITE SUMMARY

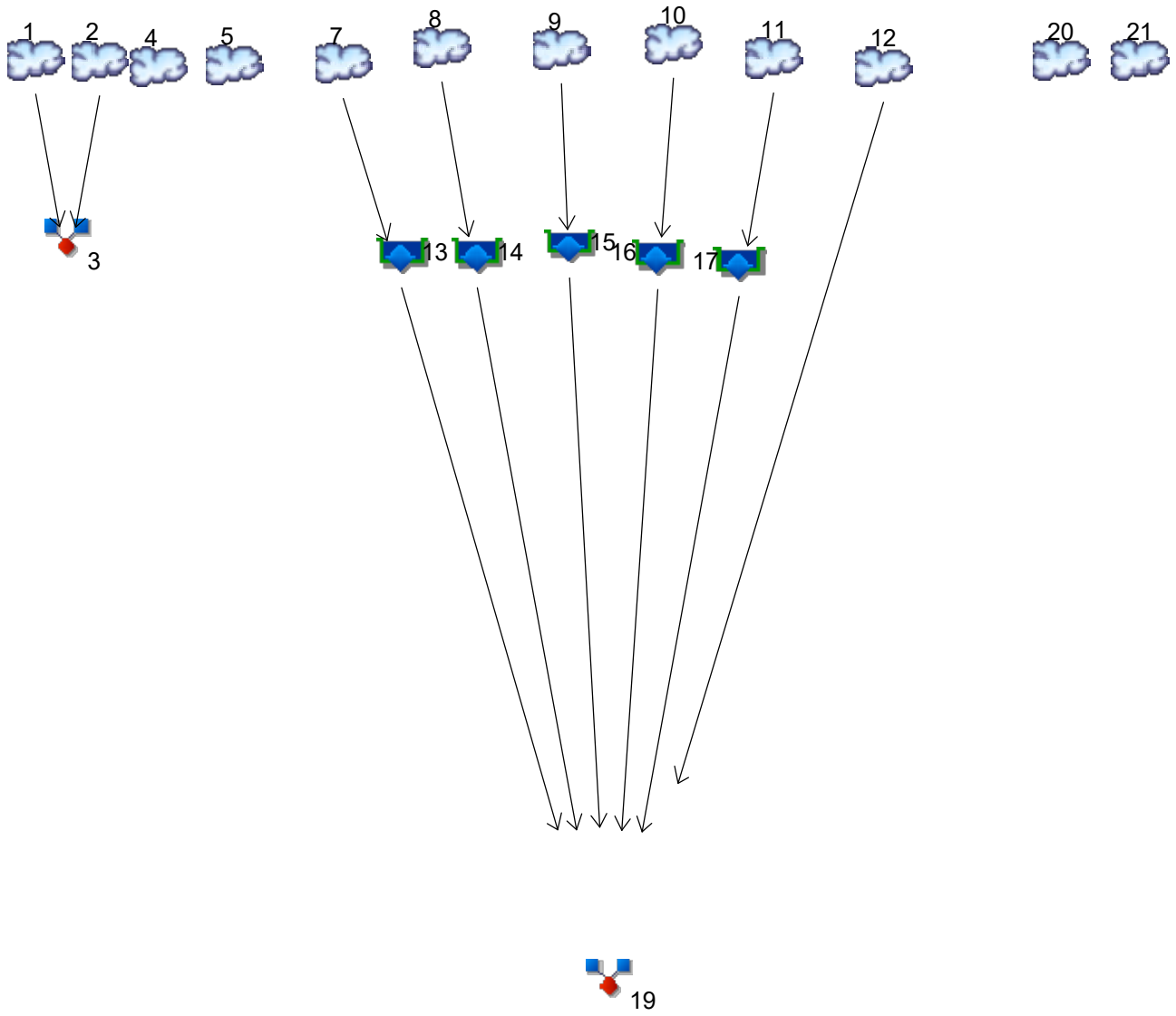
DRAINAGE AREA SUMMARIES										
DRAINAGE AREA:	DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9	DA10
Pre-Development										
Peak Discharge (cfs)=$Q_{10\text{-year}}$ =	45.48									
Volume of Runoff (ft^3)$_{(10\text{-year})}$ =	141,116									
Post-Development										
10-year, 24-hour storm (DIA)										
Post BMP Peak Discharge (cfs)= $Q_{(10\text{-year})}$=	78.20									
Post BMP Volume of Runoff (ft^3)$_{(10\text{-year})}$=	183,889									

Hydraflow Table of Contents

43398.gpw

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Wednesday, 09 / 15 / 2021

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	DA1.1 - PRE
2	SCS Runoff	DA1.2 - PRE
3	Combine	DA1 - PRE
4	SCS Runoff	DA3 - PRE
5	SCS Runoff	DA4 - PRE
7	SCS Runoff	TO SCM 1
8	SCS Runoff	TO SCM 2
9	SCS Runoff	TO SCM 3
10	SCS Runoff	TO SCM 4
11	SCS Runoff	TO SCM 5
12	SCS Runoff	DA2 (BYPASS)
13	Reservoir	Pond 1
14	Reservoir	Pond 2
15	Reservoir	Pond 3
16	Reservoir	Pond 4
17	Reservoir	Pond 5
19	Combine	DA1 - POST
20	SCS Runoff	DA3 - POST
21	SCS Runoff	DA4 - POST

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	------	78.46	111.42	-------	-------	207.43	268.18	-------	368.69	DA1.1 - PRE
2	SCS Runoff	------	19.80	28.49	-------	-------	53.99	70.29	-------	97.37	DA1.2 - PRE
3	Combine	1, 2	97.36	138.75	-------	-------	258.16	333.71	-------	459.85	DA1 - PRE
4	SCS Runoff	------	7.224	10.28	-------	-------	19.07	24.62	-------	33.80	DA3 - PRE
5	SCS Runoff	------	8.078	11.40	-------	-------	21.04	27.11	-------	37.13	DA4 - PRE
7	SCS Runoff	------	71.48	93.23	-------	-------	151.95	187.56	-------	245.29	TO SCM 1
8	SCS Runoff	------	25.05	33.25	-------	-------	55.64	69.31	-------	91.51	TO SCM 2
9	SCS Runoff	------	38.60	49.92	-------	-------	80.35	98.75	-------	128.57	TO SCM 3
10	SCS Runoff	------	46.22	60.80	-------	-------	100.40	124.48	-------	163.56	TO SCM 4
11	SCS Runoff	------	19.51	25.23	-------	-------	40.60	49.90	-------	64.97	TO SCM 5
12	SCS Runoff	------	21.03	29.90	-------	-------	55.76	72.17	-------	99.33	DA2 (BYPASS)
13	Reservoir	7	3.504	9.968	-------	-------	58.79	86.49	-------	124.48	Pond 1
14	Reservoir	8	0.098	0.360	-------	-------	7.130	30.17	-------	60.89	Pond 2
15	Reservoir	9	12.35	37.74	-------	-------	78.19	96.76	-------	126.14	Pond 3
16	Reservoir	10	24.35	31.11	-------	-------	79.59	111.27	-------	156.07	Pond 4
17	Reservoir	11	7.363	21.15	-------	-------	39.50	48.68	-------	63.14	Pond 5
19	Combine	12, 13, 14, 15, 16, 17,	61.29	113.60	-------	-------	277.83	395.86	-------	565.57	DA1 - POST
20	SCS Runoff	------	2.938	4.043	-------	-------	7.151	9.083	-------	12.25	DA3 - POST
21	SCS Runoff	------	2.953	3.992	-------	-------	6.868	8.637	-------	11.52	DA4 - POST

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

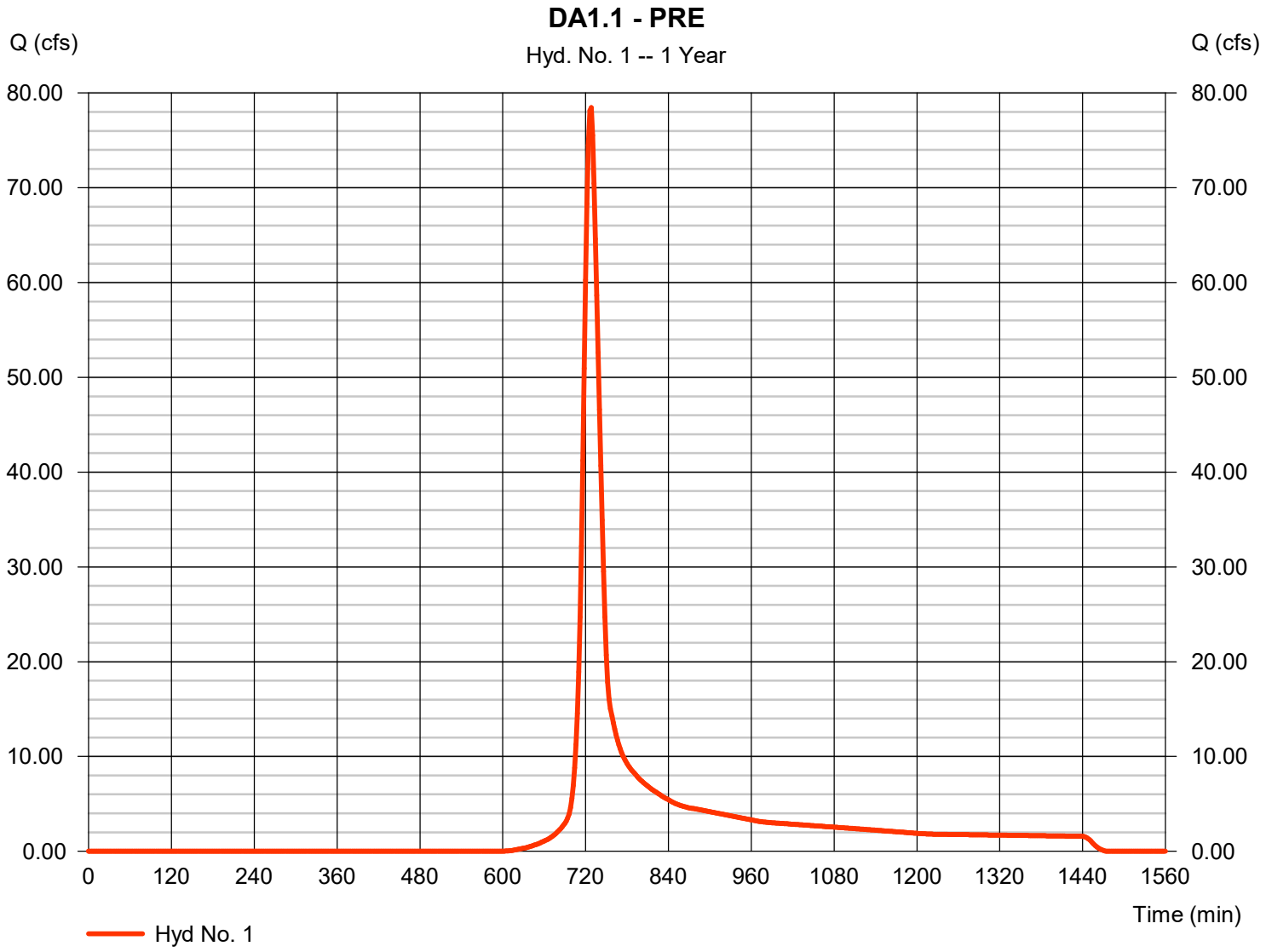
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	78.46	2	728	277,812	------	------	------	DA1.1 - PRE
2	SCS Runoff	19.80	2	732	82,006	------	------	------	DA1.2 - PRE
3	Combine	97.36	2	728	359,818	1, 2	------	------	DA1 - PRE
4	SCS Runoff	7.224	2	726	23,130	------	------	------	DA3 - PRE
5	SCS Runoff	8.078	2	722	21,193	------	------	------	DA4 - PRE
7	SCS Runoff	71.48	2	716	145,704	------	------	------	TO SCM 1
8	SCS Runoff	25.05	2	716	50,731	------	------	------	TO SCM 2
9	SCS Runoff	38.60	2	716	79,076	------	------	------	TO SCM 3
10	SCS Runoff	46.22	2	716	93,851	------	------	------	TO SCM 4
11	SCS Runoff	19.51	2	716	39,960	------	------	------	TO SCM 5
12	SCS Runoff	21.03	2	732	86,445	------	------	------	DA2 (BYPASS)
13	Reservoir	3.504	2	782	143,269	7	371.86	86,830	Pond 1
14	Reservoir	0.098	2	1444	26,220	8	383.36	46,663	Pond 2
15	Reservoir	12.35	2	724	78,532	9	349.37	38,211	Pond 3
16	Reservoir	24.35	2	722	93,676	10	371.71	36,444	Pond 4
17	Reservoir	7.363	2	724	38,388	11	353.26	19,287	Pond 5
19	Combine	61.29	2	724	466,530	12, 13, 14, 15, 16, 17,	------	------	DA1 - POST
20	SCS Runoff	2.938	2	724	9,254	------	------	------	DA3 - POST
21	SCS Runoff	2.953	2	716	5,964	------	------	------	DA4 - POST

Hydrograph Report

Hyd. No. 1

DA1.1 - PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	78.46 cfs
Storm frequency	=	1 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	277,812 cuft
Drainage area	=	65.610 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	22.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

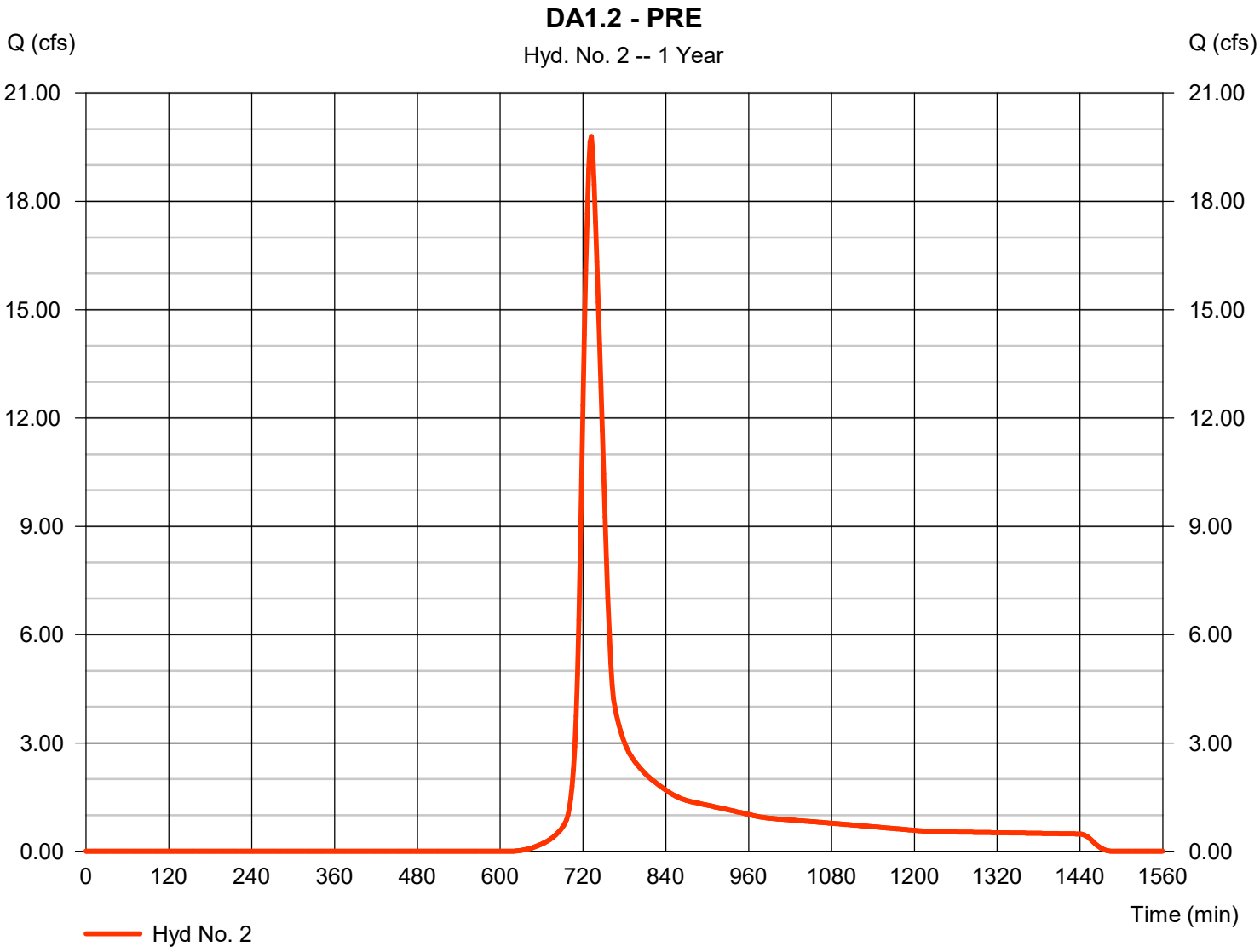


Hydrograph Report

Hyd. No. 2

DA1.2 - PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	19.80 cfs
Storm frequency	=	1 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	82,006 cuft
Drainage area	=	20.780 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	30.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

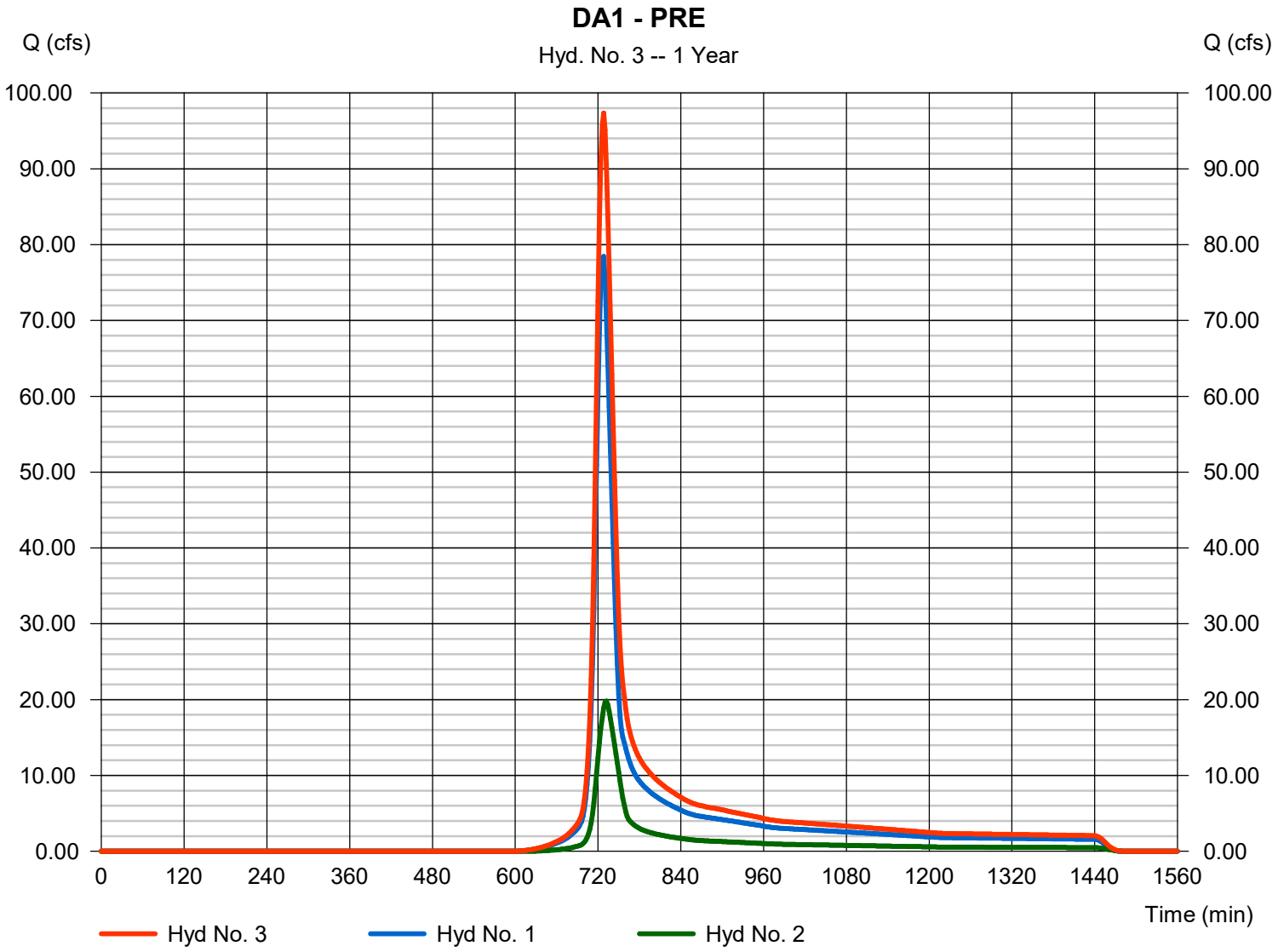


Hydrograph Report

Hyd. No. 3

DA1 - PRE

Hydrograph type	= Combine	Peak discharge	= 97.36 cfs
Storm frequency	= 1 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 359,818 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 86.390 ac

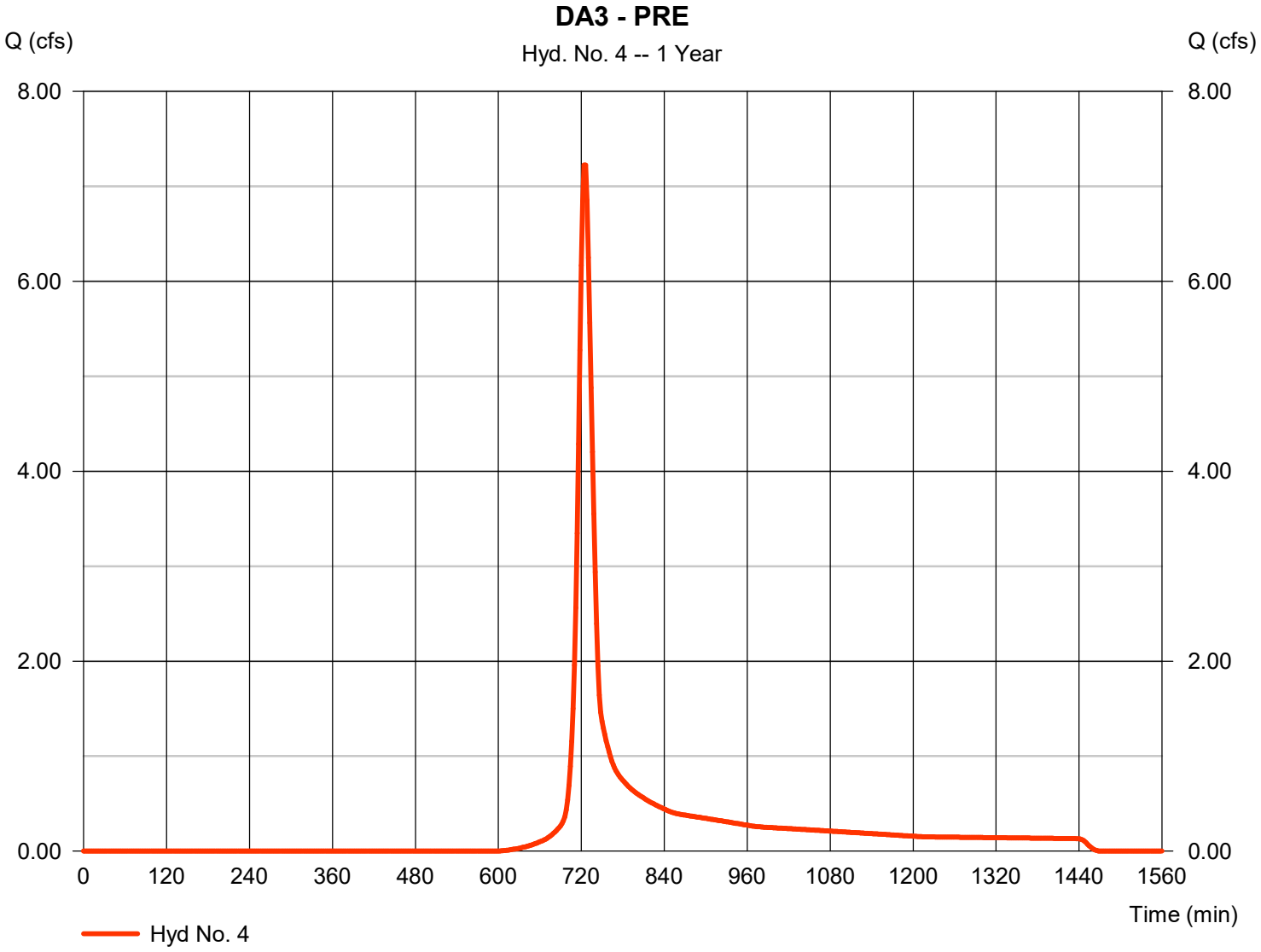


Hydrograph Report

Hyd. No. 4

DA3 - PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.224 cfs
Storm frequency	=	1 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	23,130 cuft
Drainage area	=	5.560 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	20.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

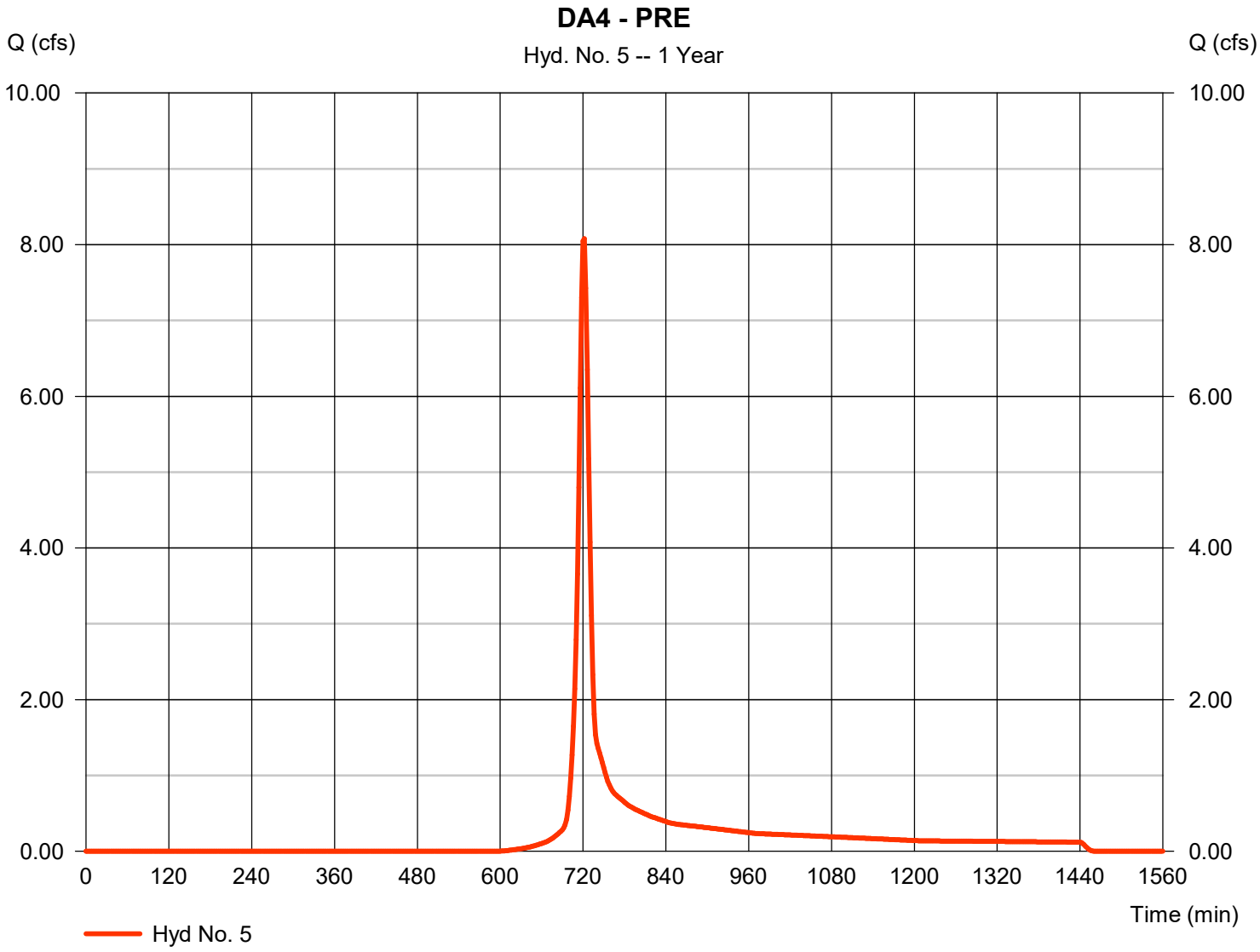


Hydrograph Report

Hyd. No. 5

DA4 - PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 8.078 cfs
Storm frequency	= 1 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 21,193 cuft
Drainage area	= 4.940 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 2.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



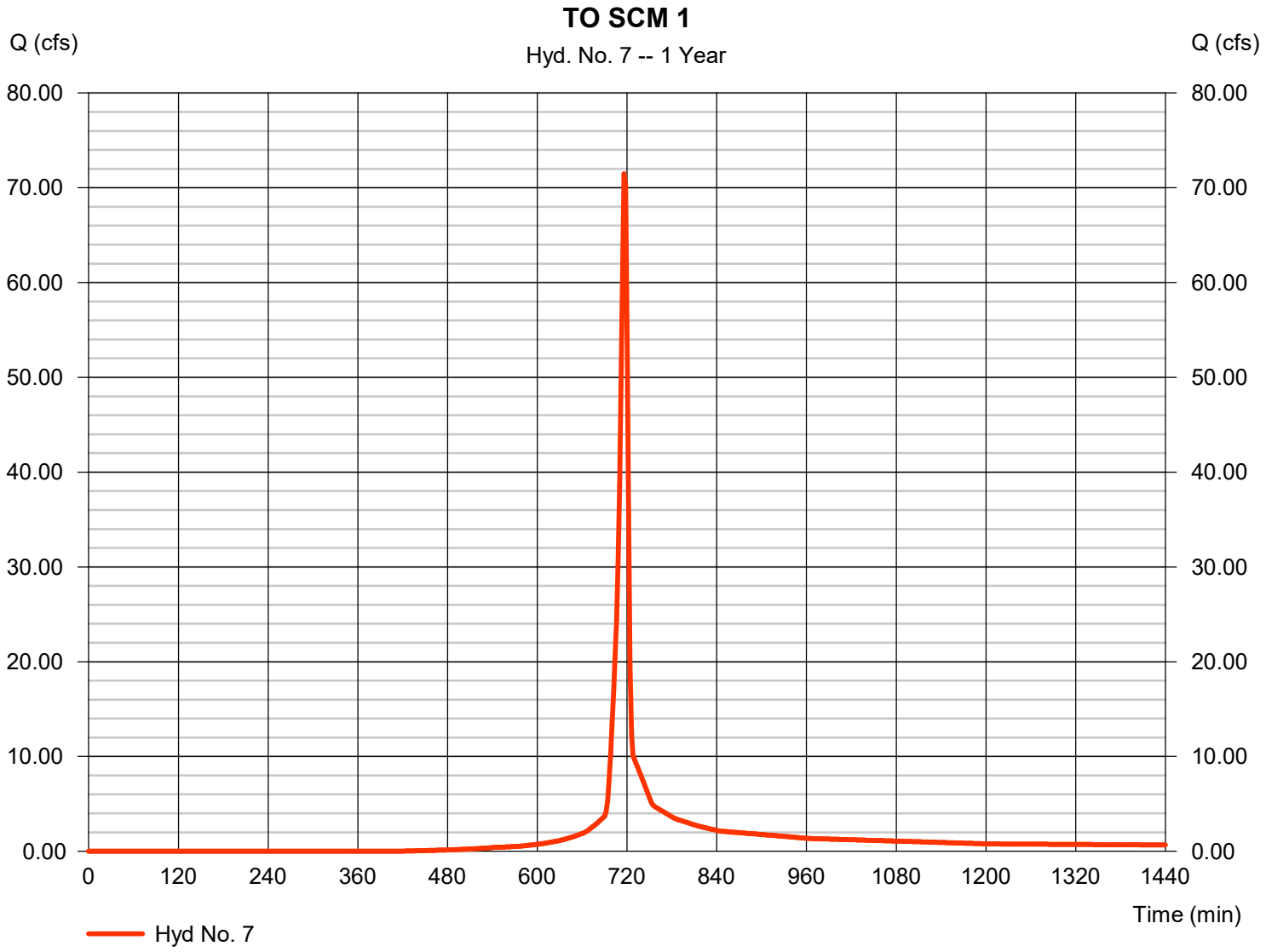
Hydrograph Report

Hyd. No. 7

TO SCM 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	71.48 cfs
Storm frequency	=	1 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	145,704 cuft
Drainage area	=	25.270 ac	Curve number	=	88*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.790 x 98) + (7.460 x 98) + (14.020 x 80)] / 25.270



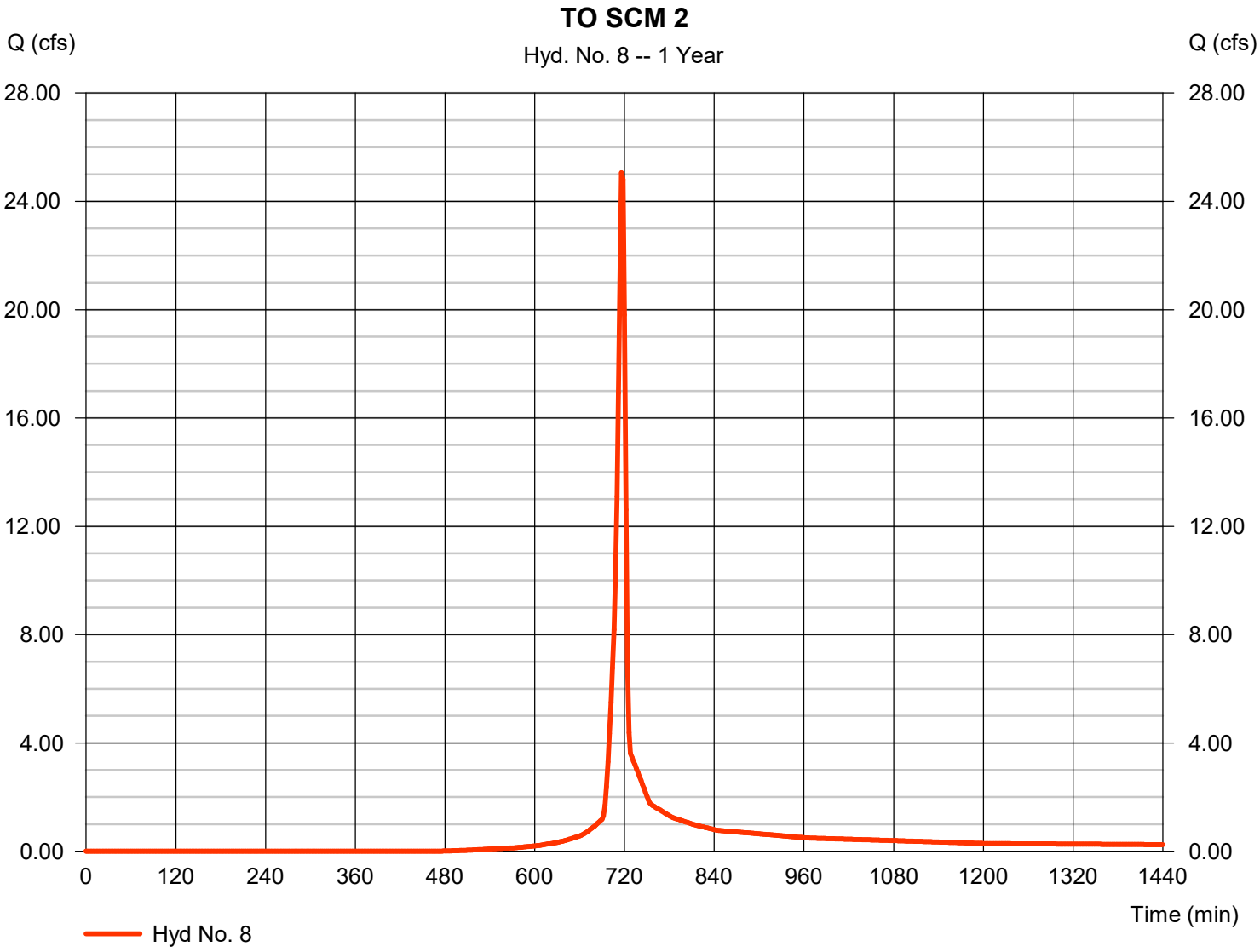
Hydrograph Report

Hyd. No. 8

TO SCM 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	25.05 cfs
Storm frequency	=	1 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	50,731 cuft
Drainage area	=	9.660 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.100 x 98) + (2.090 x 98) + (6.470 x 80)] / 9.660



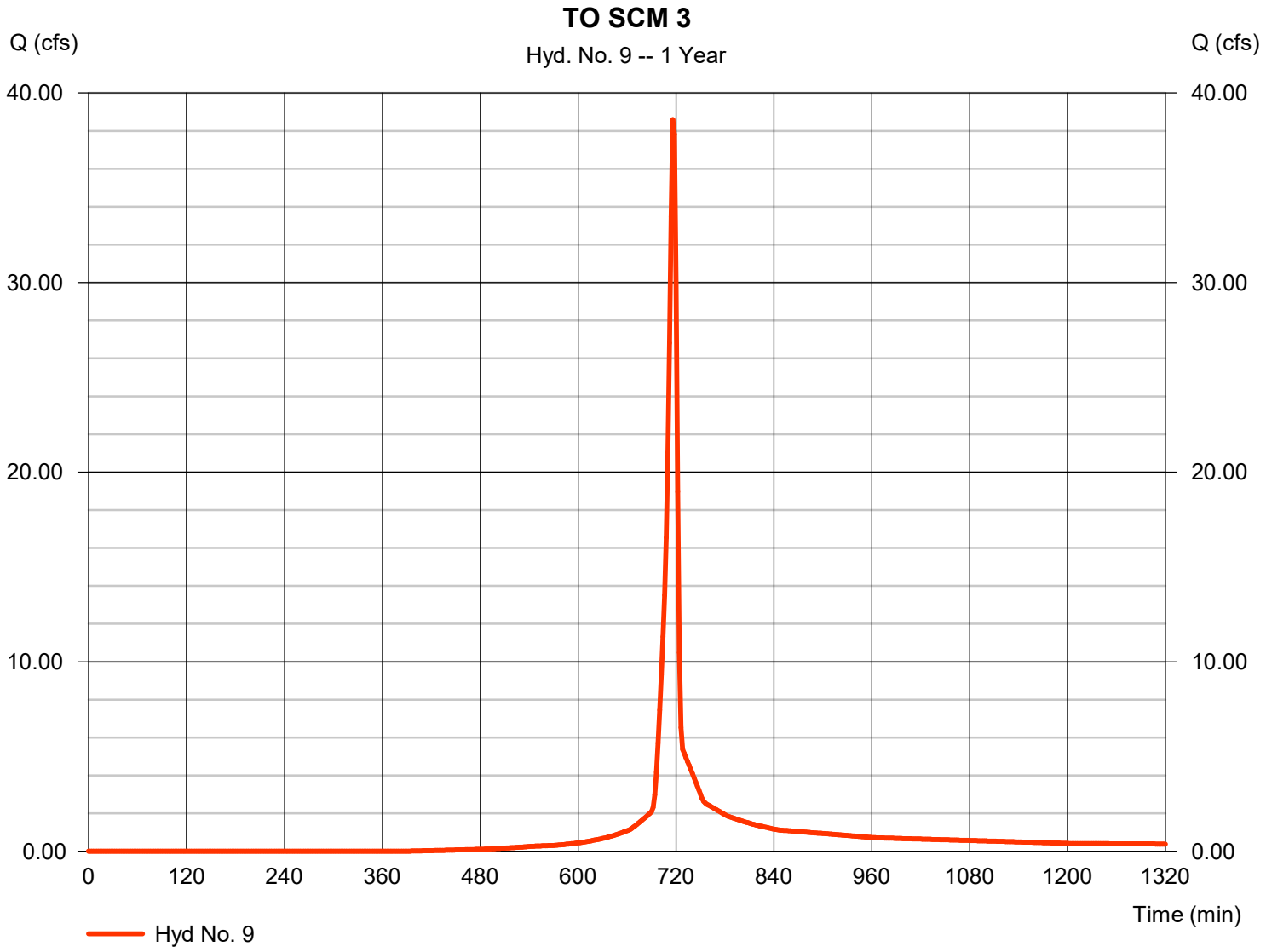
Hydrograph Report

Hyd. No. 9

TO SCM 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	38.60 cfs
Storm frequency	=	1 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	79,076 cuft
Drainage area	=	13.100 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.820 x 98) + (3.860 x 98) + (6.420 x 80)] / 13.100



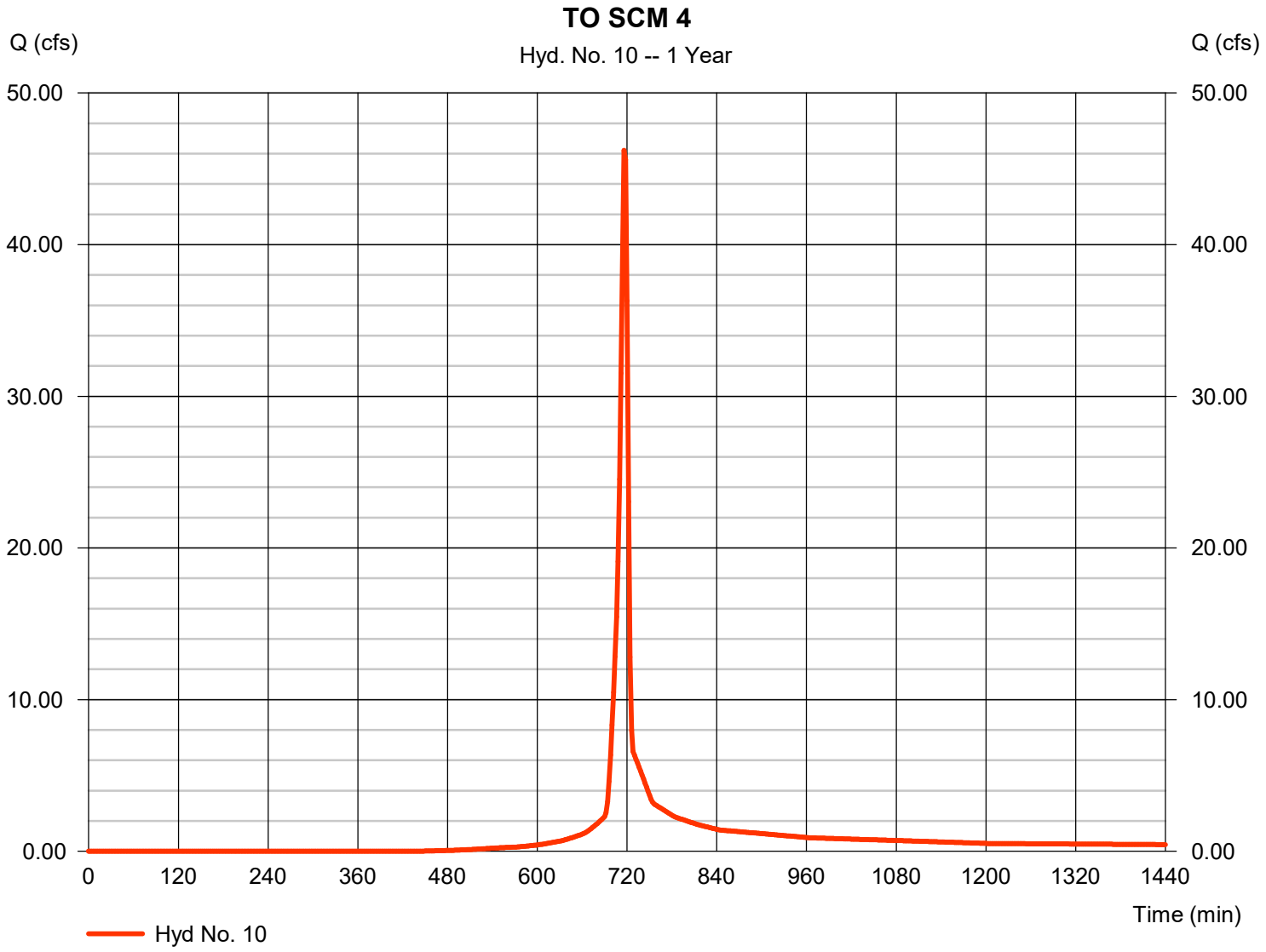
Hydrograph Report

Hyd. No. 10

TO SCM 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	46.22 cfs
Storm frequency	=	1 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	93,851 cuft
Drainage area	=	17.050 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.940 x 98) + (4.220 x 98) + (10.890 x 80)] / 17.050



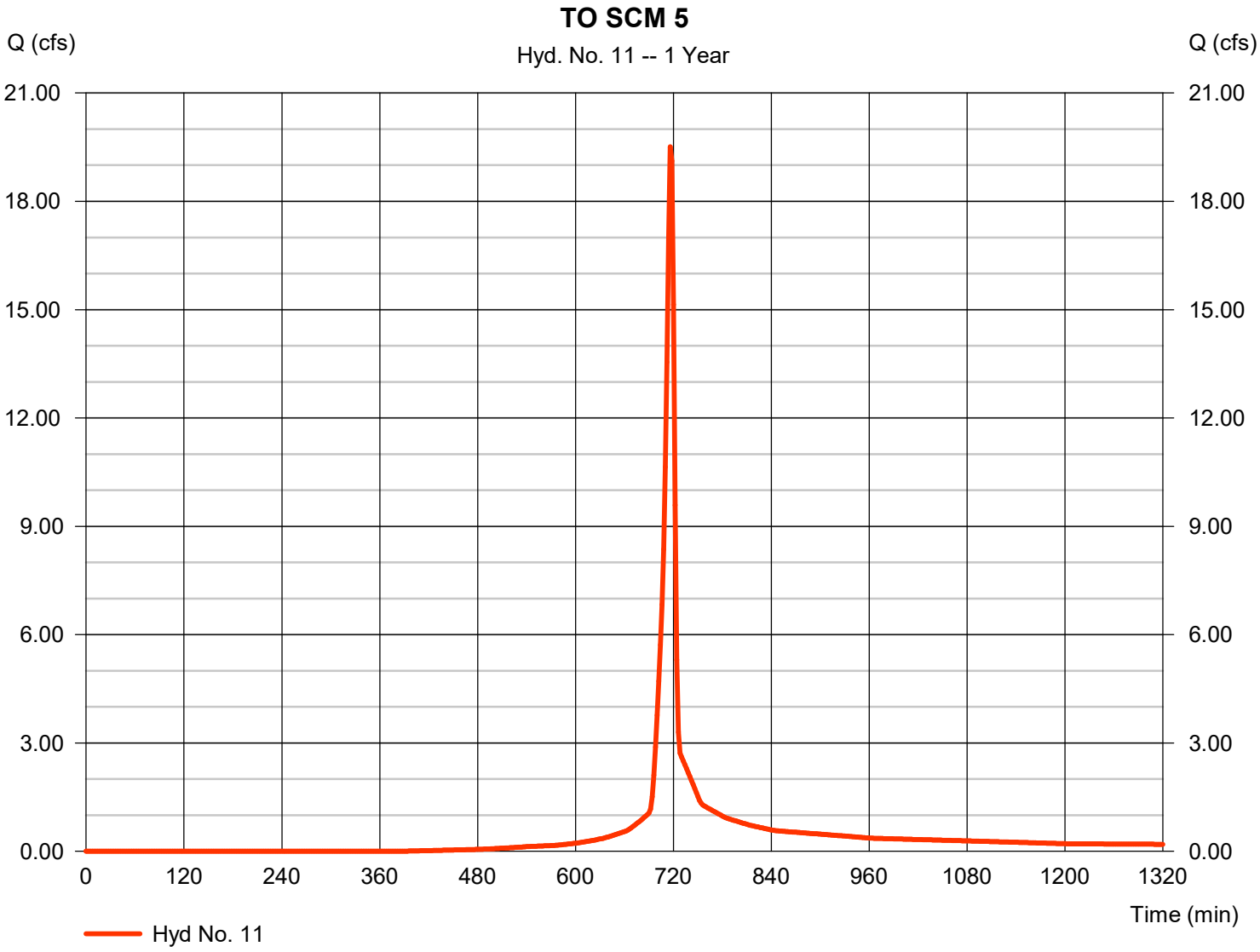
Hydrograph Report

Hyd. No. 11

TO SCM 5

Hydrograph type	=	SCS Runoff	Peak discharge	=	19.51 cfs
Storm frequency	=	1 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	39,960 cuft
Drainage area	=	6.620 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.380 x 98) + (2.000 x 98) + (3.240 x 80)] / 6.620

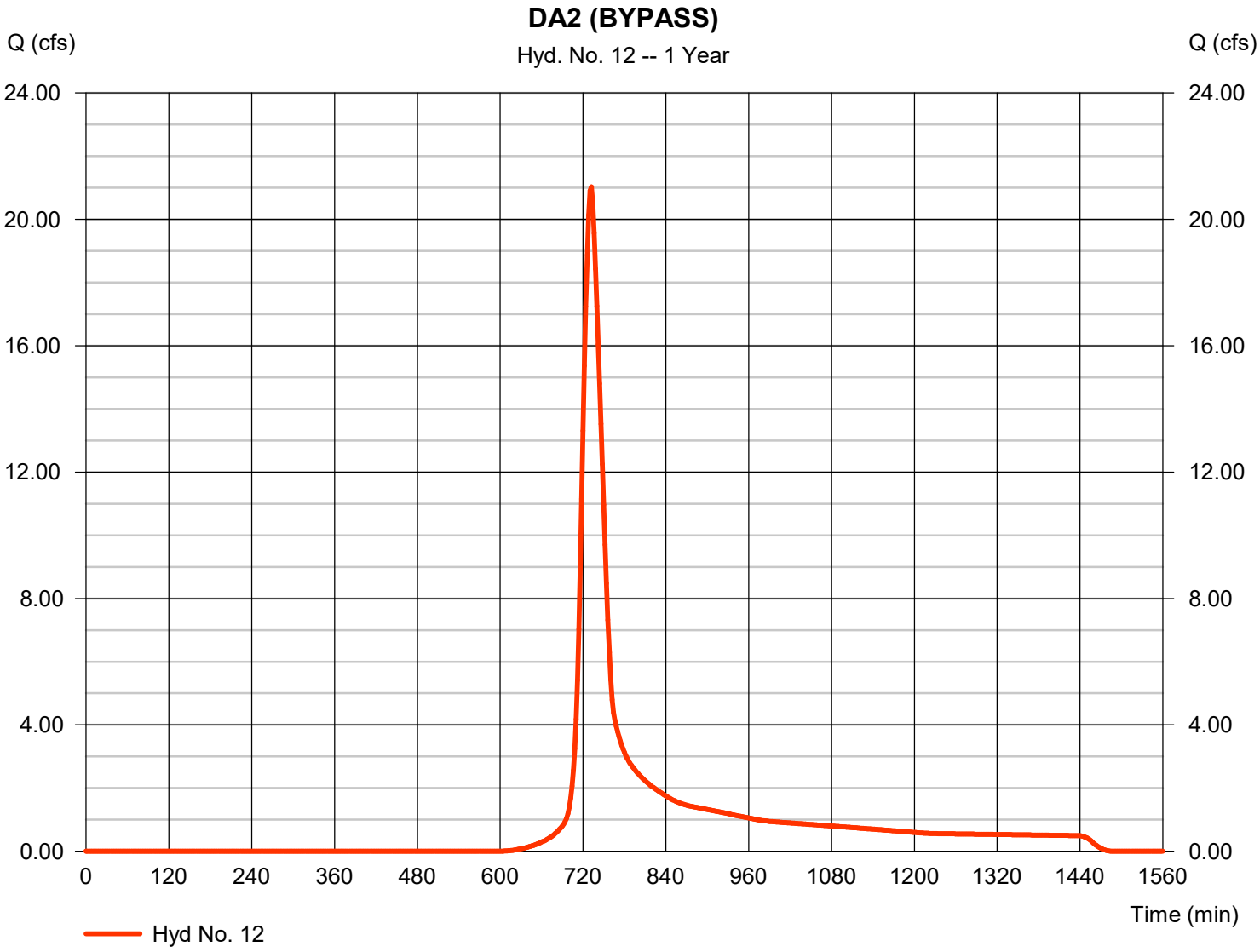


Hydrograph Report

Hyd. No. 12

DA2 (BYPASS)

Hydrograph type	=	SCS Runoff	Peak discharge	=	21.03 cfs
Storm frequency	=	1 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	86,445 cuft
Drainage area	=	20.780 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	30.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



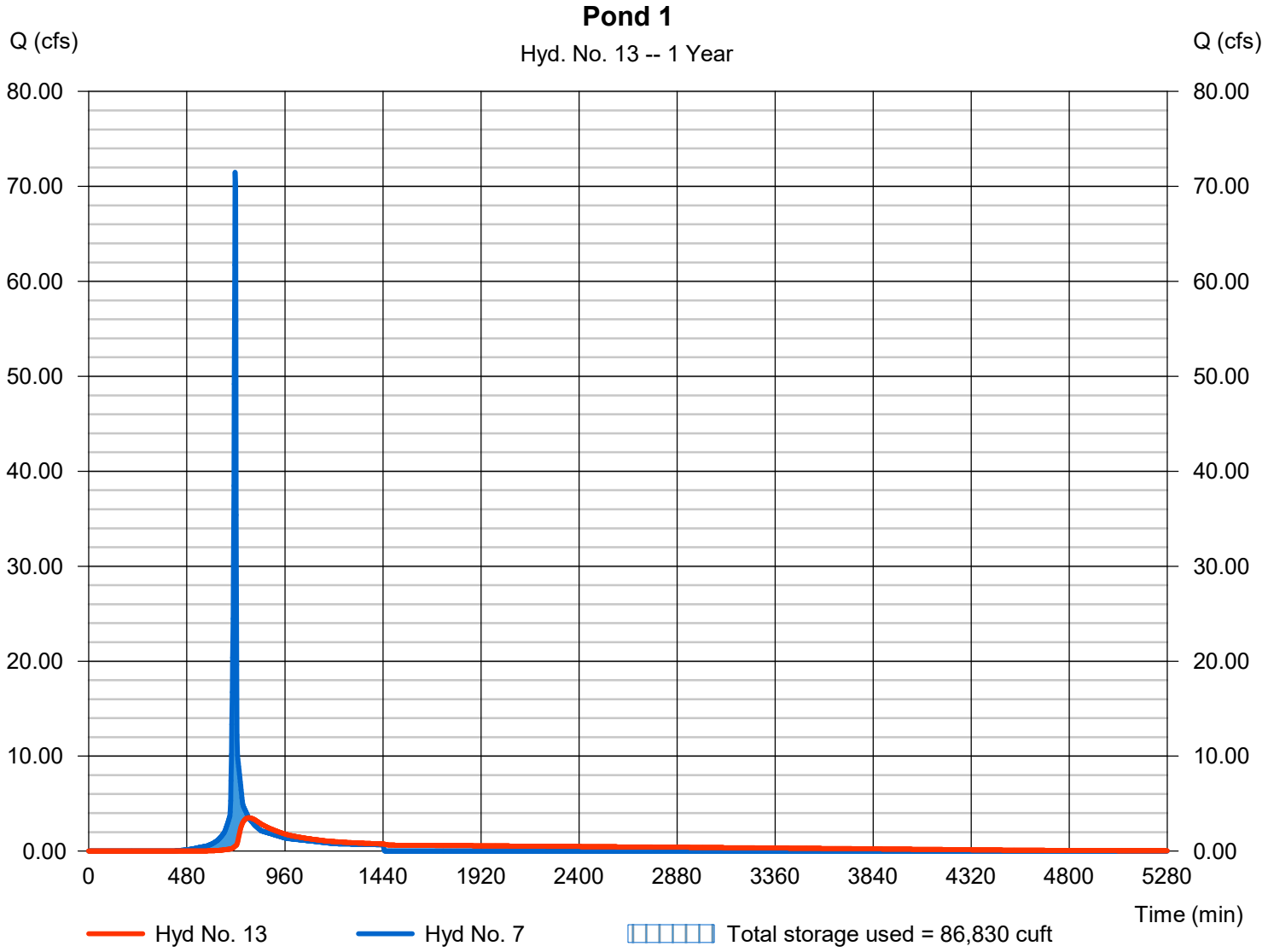
Hydrograph Report

Hyd. No. 13

Pond 1

Hydrograph type	=	Reservoir	Peak discharge	=	3.504 cfs
Storm frequency	=	1 yrs	Time to peak	=	782 min
Time interval	=	2 min	Hyd. volume	=	143,269 cuft
Inflow hyd. No.	=	7 - TO SCM 1	Max. Elevation	=	371.86 ft
Reservoir name	=	Wet Pond 1	Max. Storage	=	86,830 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Wet Pond 1

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 369.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	369.00	24,400	0	0
1.00	370.00	29,600	27,000	27,000
2.00	371.00	32,300	30,950	57,950
3.00	372.00	35,000	33,650	91,600
4.00	373.00	37,850	36,425	128,025
5.00	374.00	40,700	39,275	167,300
6.00	375.00	43,650	42,175	209,475
7.00	376.00	46,600	45,125	254,600

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 48.00	4.00	0.00	0.00
Span (in)	= 48.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 369.00	369.00	0.00	0.00
Length (ft)	= 82.00	1.00	0.00	0.00
Slope (%)	= 0.60	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)	= 12.00	4.00	45.00	0.00
Crest El. (ft)	= 372.50	371.50	375.00	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= Rect	Rect	Broad	---
Multi-Stage	= Yes	Yes	No	No

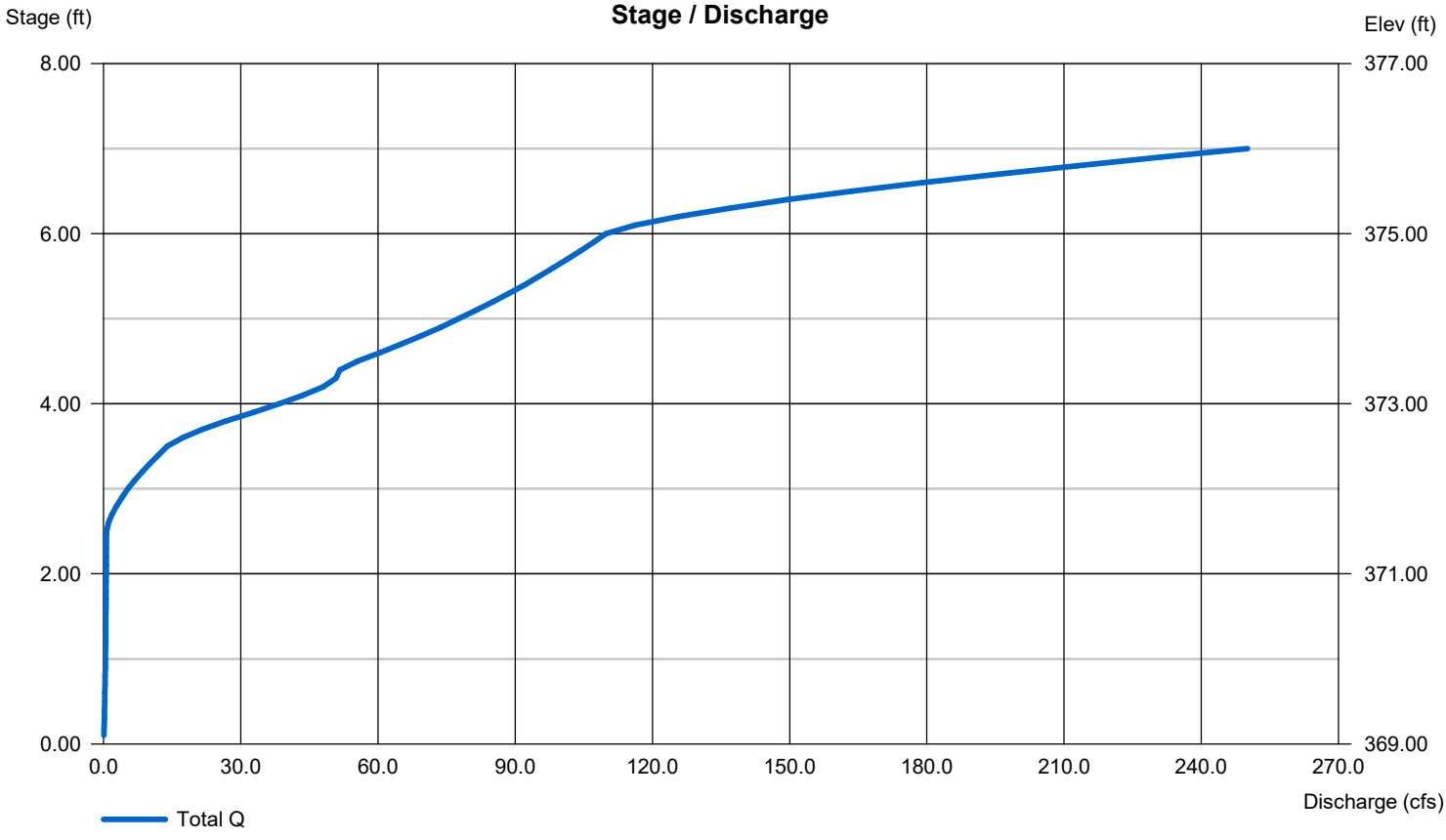
Exfil.(in/hr) = 0.000 (by Wet area)

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).

[A] DISCHARGE PIPE
[B] PEAK FLOW DRAWDOWN ORIFICE

[A] TOP OF RISER
[B] PEAK FLOW WEIR
[C] EMERGENCY SPILLWAY



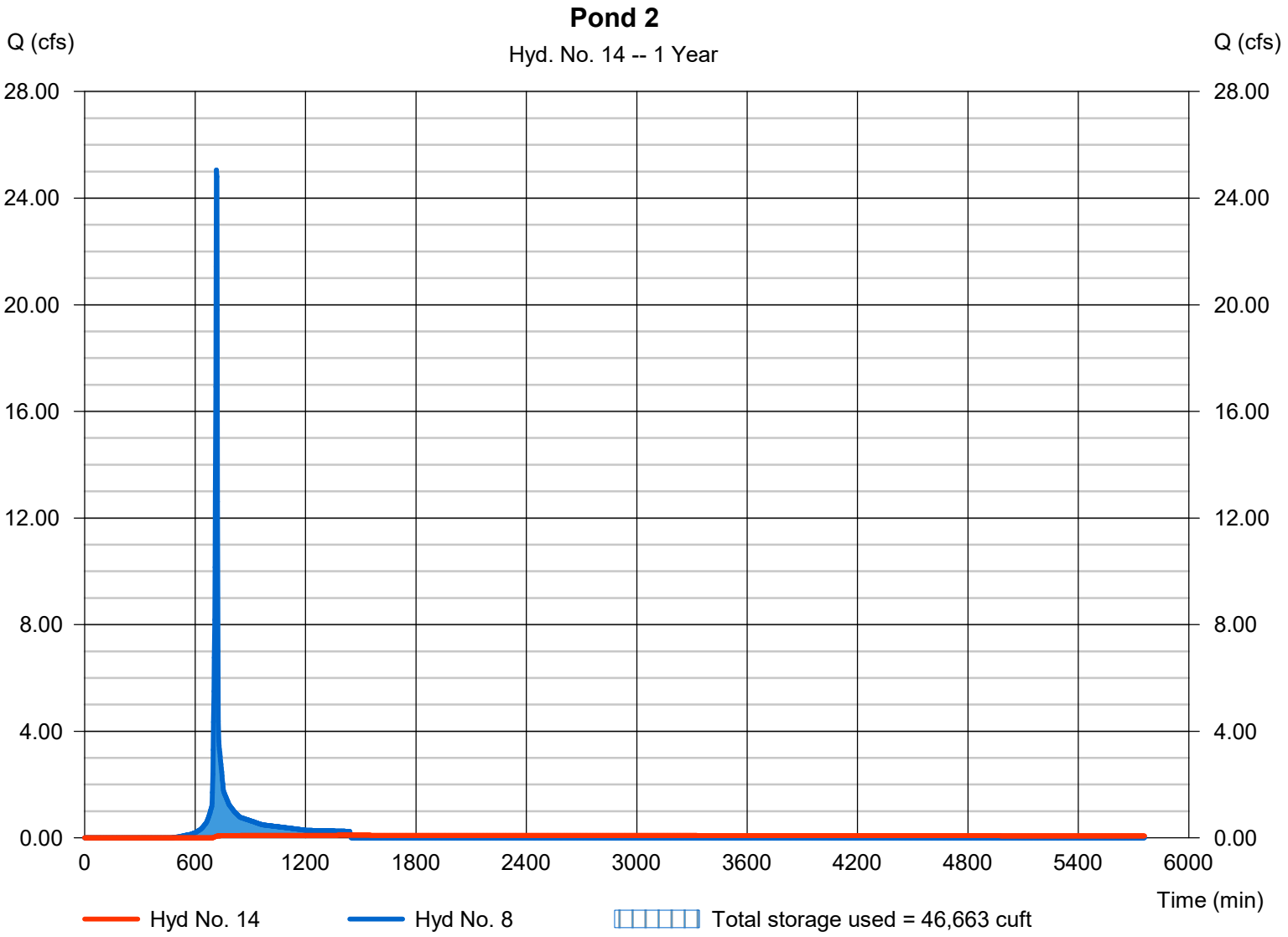
Hydrograph Report

Hyd. No. 14

Pond 2

Hydrograph type	=	Reservoir	Peak discharge	=	0.098 cfs
Storm frequency	=	1 yrs	Time to peak	=	1444 min
Time interval	=	2 min	Hyd. volume	=	26,220 cuft
Inflow hyd. No.	=	8 - TO SCM 2	Max. Elevation	=	383.36 ft
Reservoir name	=	Dry Pond 2	Max. Storage	=	46,663 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Dry Pond 2

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 380.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	380.00	900	0	0
1.00	381.00	13,990	7,445	7,445
2.00	382.00	16,076	15,033	22,478
3.00	383.00	18,226	17,151	39,629
4.00	384.00	20,440	19,333	58,962
5.00	385.00	22,721	21,581	80,543
6.00	386.00	25,071	23,896	104,439
6.50	386.50	26,273	12,836	117,275

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 42.00	1.50	0.00	0.00
Span (in)	= 42.00	1.50	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 380.50	380.55	0.00	0.00
Length (ft)	= 86.00	0.00	0.00	0.00
Slope (%)	= 0.40	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)	= 16.00	20.00	0.00	0.00
Crest El. (ft)	= 384.00	385.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= Rect	Broad	---	---
Multi-Stage	= Yes	No	No	No

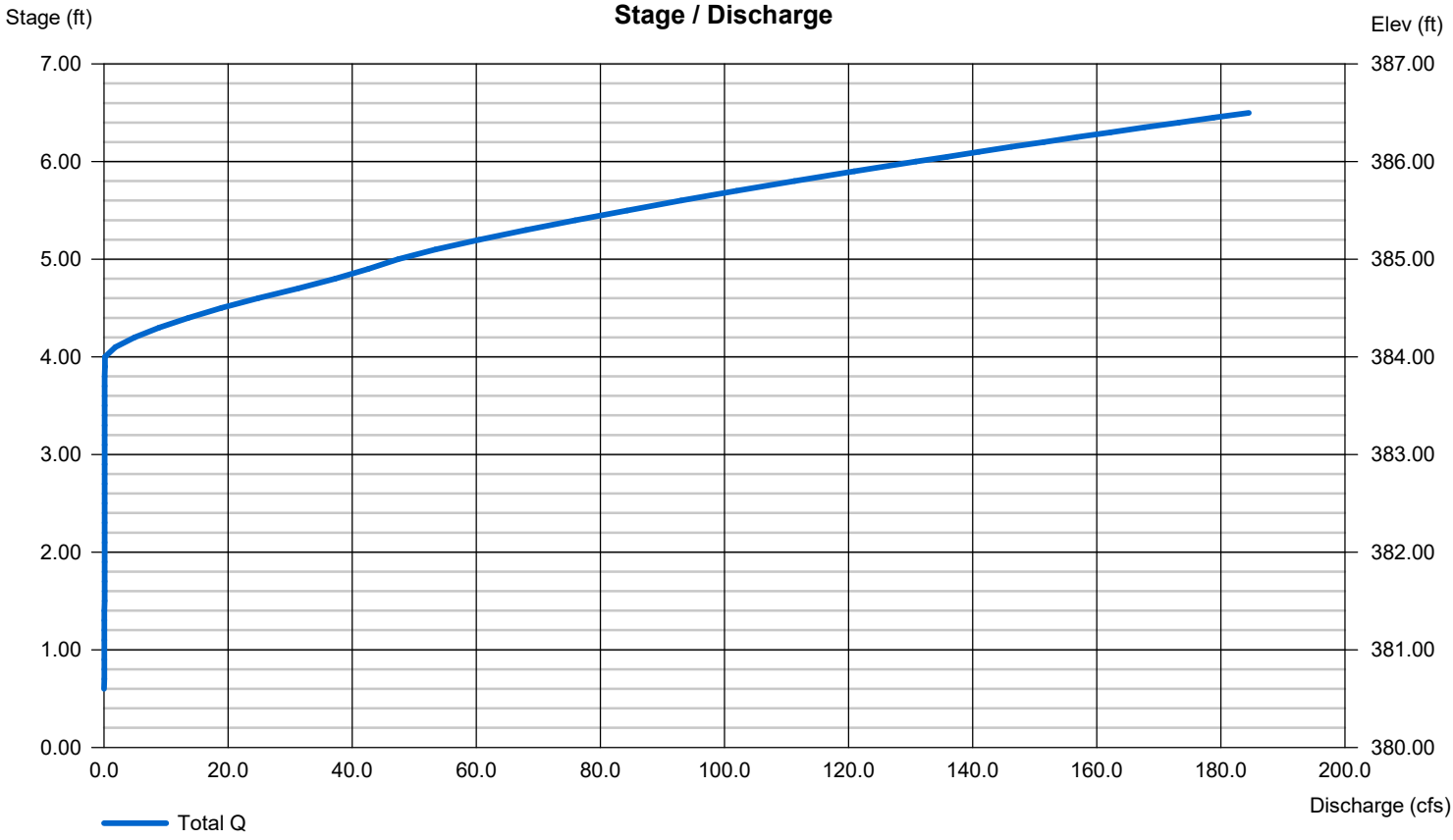
Exfil.(in/hr) = 0.000 (by Wet area)

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).

[A] DISCHARGE PIPE
[B] DRAWDOWN ORIFICE

[A] TOP OF RISER
[B] EMERGENCY SPILLWAY



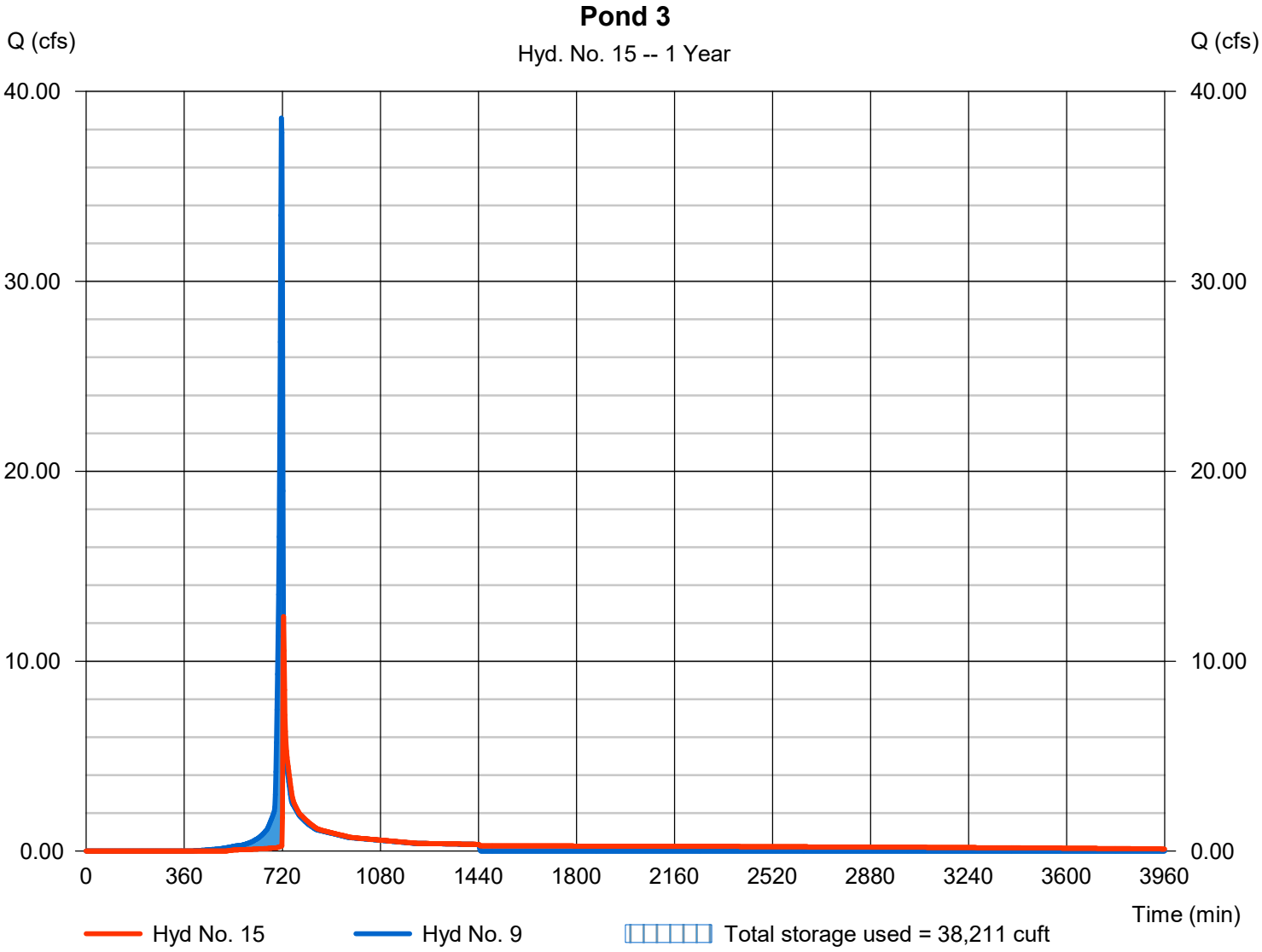
Hydrograph Report

Hyd. No. 15

Pond 3

Hydrograph type	=	Reservoir	Peak discharge	=	12.35 cfs
Storm frequency	=	1 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	78,532 cuft
Inflow hyd. No.	=	9 - TO SCM 3	Max. Elevation	=	349.37 ft
Reservoir name	=	Dry Pond 3	Max. Storage	=	38,211 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Dry Pond 3

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 341.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	341.00	00	0	0
1.00	342.00	1,792	896	896
2.00	343.00	2,491	2,142	3,038
3.00	344.00	3,287	2,889	5,927
4.00	345.00	4,174	3,731	9,657
5.00	346.00	5,150	4,662	14,319
6.00	347.00	6,214	5,682	20,001
7.00	348.00	7,366	6,790	26,791
8.00	349.00	8,607	7,986	34,777
9.00	350.00	9,936	9,271	44,049
10.00	351.00	11,340	10,638	54,687
10.50	351.50	12,066	5,852	60,538

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 48.00	2.00	0.00	0.00
Span (in)	= 48.00	2.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 341.59	341.60	0.00	0.00
Length (ft)	= 150.00	1.00	0.00	0.00
Slope (%)	= 0.40	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)	= 16.00	35.00	0.00	0.00
Crest El. (ft)	= 349.00	350.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= Rect	Broad	---	---
Multi-Stage	= Yes	No	No	No

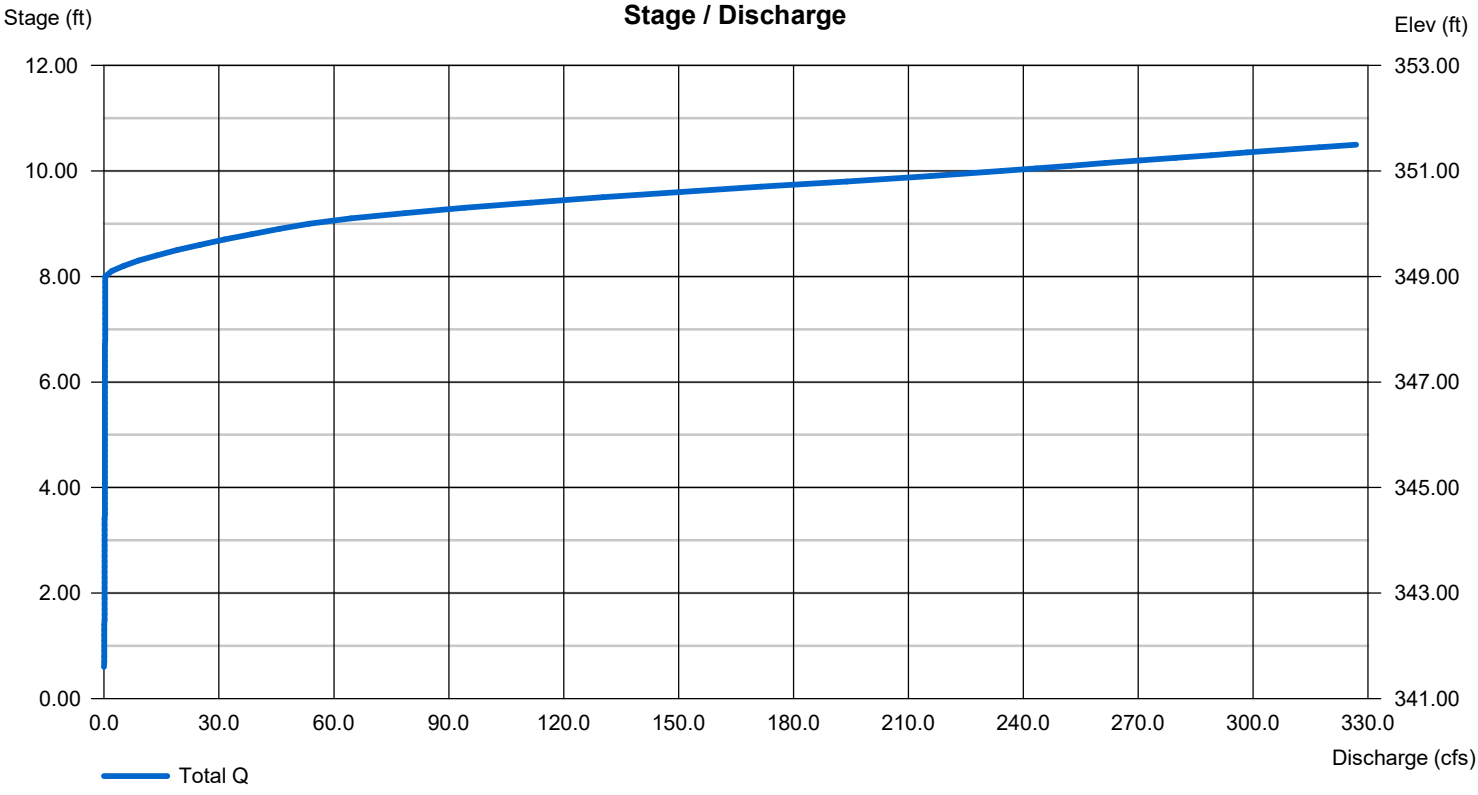
Exfil.(in/hr) = 0.000 (by Wet area)

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).

[A] DISCHARGE PIPE
[B] DRAWDOWN ORIFICE

[A] TOP OF RISER
[B] EMERGENCY SPILLWAY



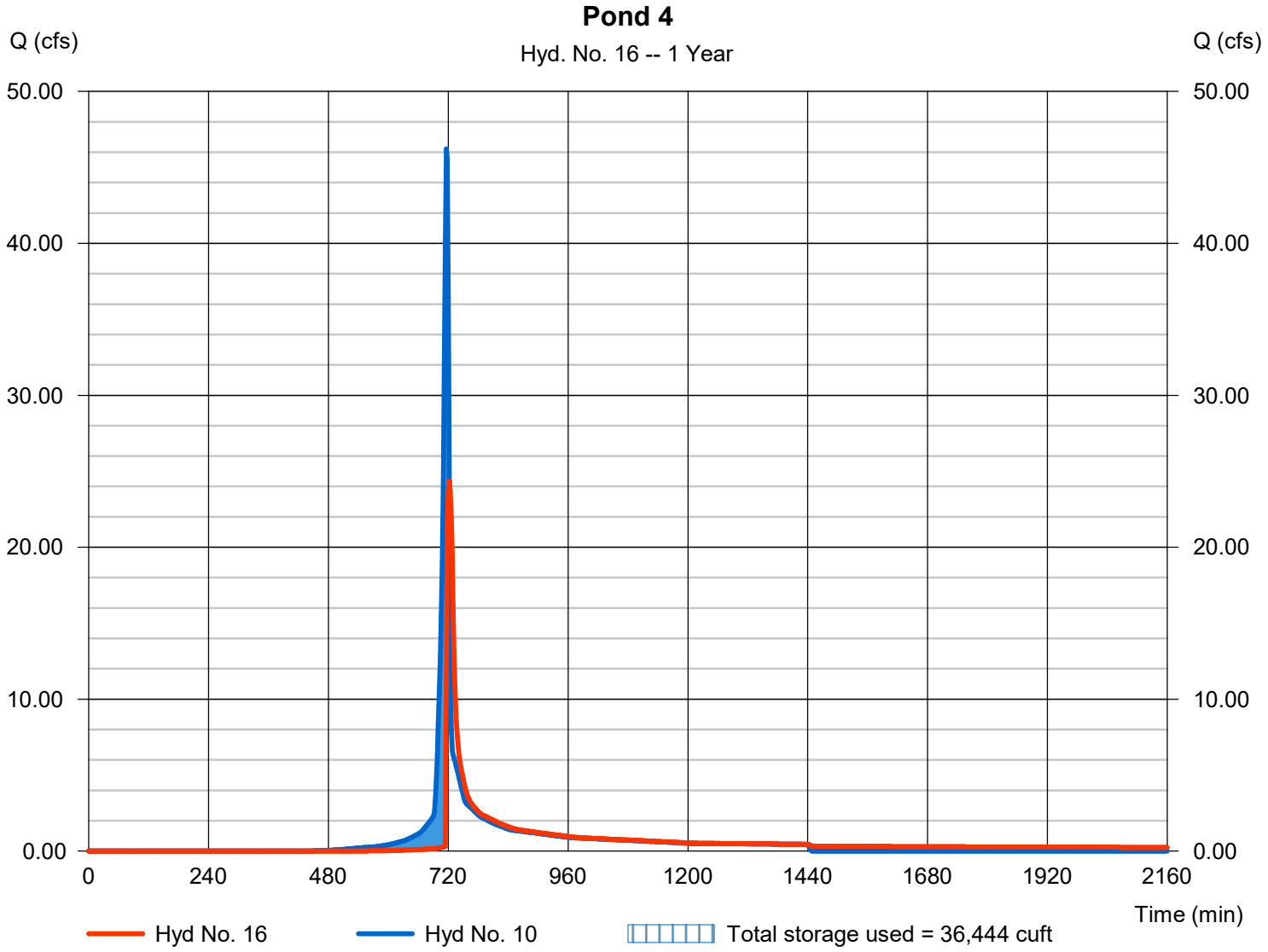
Hydrograph Report

Hyd. No. 16

Pond 4

Hydrograph type	=	Reservoir	Peak discharge	=	24.35 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	93,676 cuft
Inflow hyd. No.	=	10 - TO SCM 4	Max. Elevation	=	371.71 ft
Reservoir name	=	Wet Pond 4	Max. Storage	=	36,444 cuft

Storage Indication method used.



Pond Report

Pond No. 4 - Wet Pond 4

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 369.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	369.00	10,270	0	0
1.00	370.00	13,100	11,685	11,685
2.00	371.00	14,638	13,869	25,554
3.00	372.00	16,216	15,427	40,981
4.00	373.00	17,852	17,034	58,015
5.00	374.00	19,545	18,699	76,714

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 48.00	3.00	0.00	0.00
Span (in)	= 48.00	3.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 369.00	369.00	0.00	0.00
Length (ft)	= 20.00	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	No	No

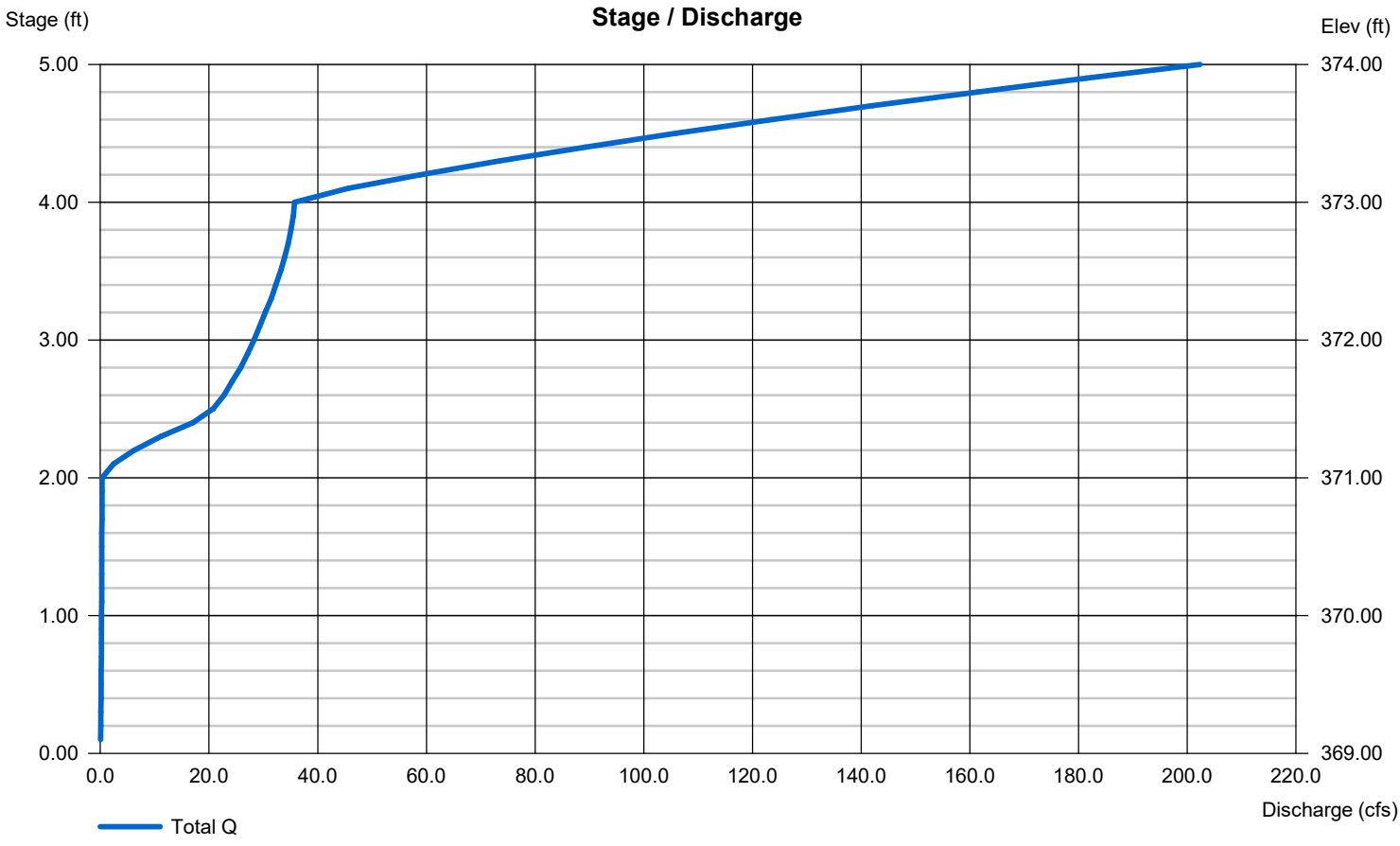
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	0.00	45.00	0.00
Crest El. (ft)	= 371.00	0.00	373.00	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	---	Broad	---
Multi-Stage	= Yes	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).

[A] DISCHARGE PIPE
[B] PEAK FLOW DRAWDOWN ORIFICE

[A] TOP OF RISER
[C] EMERGENCY SPILLWAY



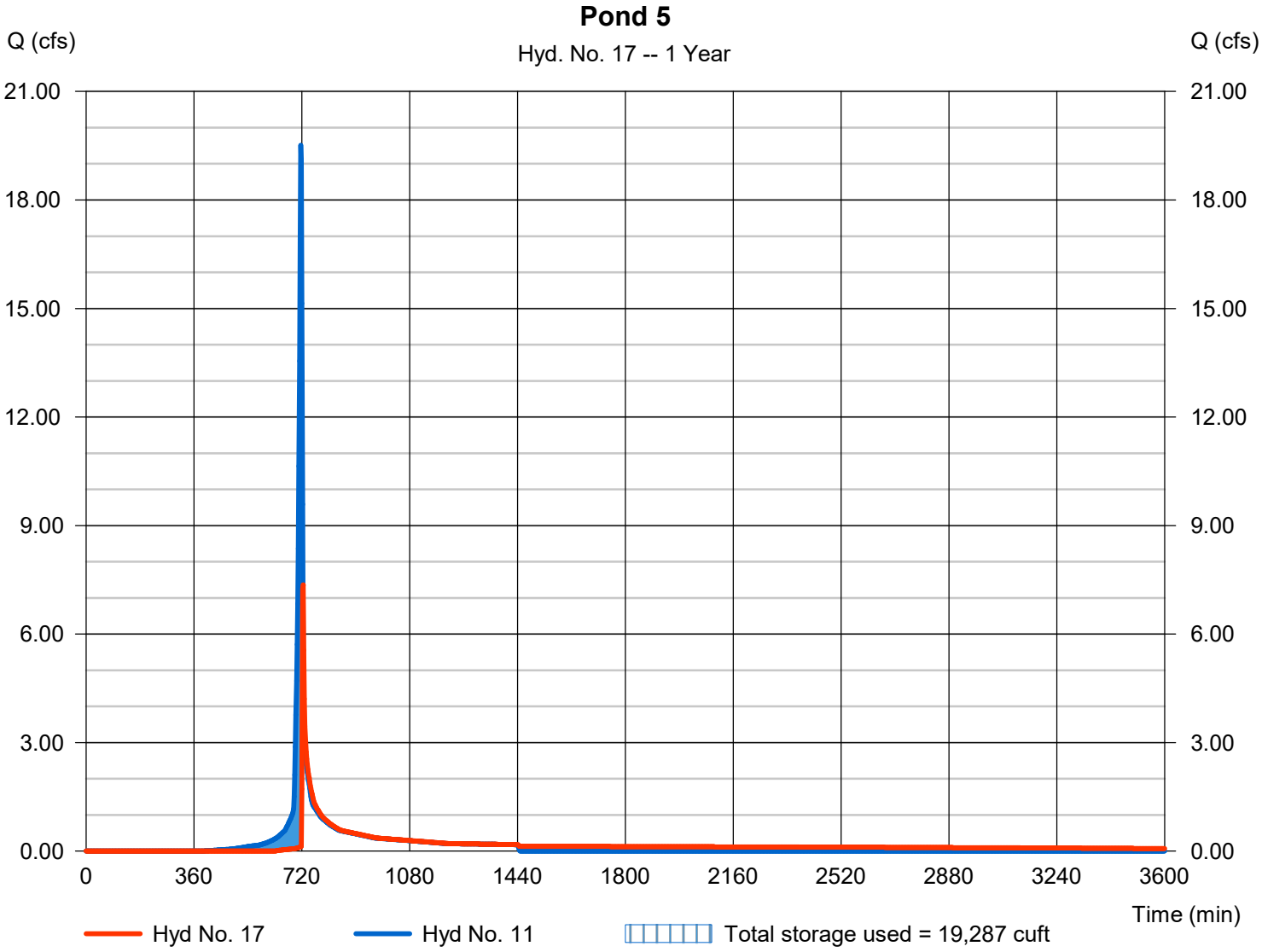
Hydrograph Report

Hyd. No. 17

Pond 5

Hydrograph type	=	Reservoir	Peak discharge	=	7.363 cfs
Storm frequency	=	1 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	38,388 cuft
Inflow hyd. No.	=	11 - TO SCM 5	Max. Elevation	=	353.26 ft
Reservoir name	=	Dry Pond 5	Max. Storage	=	19,287 cuft

Storage Indication method used.



Pond Report

Pond No. 5 - Dry Pond 5

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 346.20 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	346.20	00	0	0
0.80	347.00	1,036	414	414
1.80	348.00	1,513	1,274	1,688
2.80	349.00	2,080	1,796	3,485
3.80	350.00	2,761	2,421	5,905
4.80	351.00	3,523	3,142	9,047
5.80	352.00	4,352	3,937	12,985
6.80	353.00	5,250	4,801	17,786
7.80	354.00	6,213	5,731	23,517
8.80	355.00	7,238	6,725	30,242
9.80	356.00	8,322	7,780	38,022
10.80	357.00	9,465	8,893	46,915
11.30	357.50	10,058	4,881	51,796

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 42.00	1.50	0.00	0.00
Span (in)	= 42.00	1.50	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 347.85	347.90	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.60	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

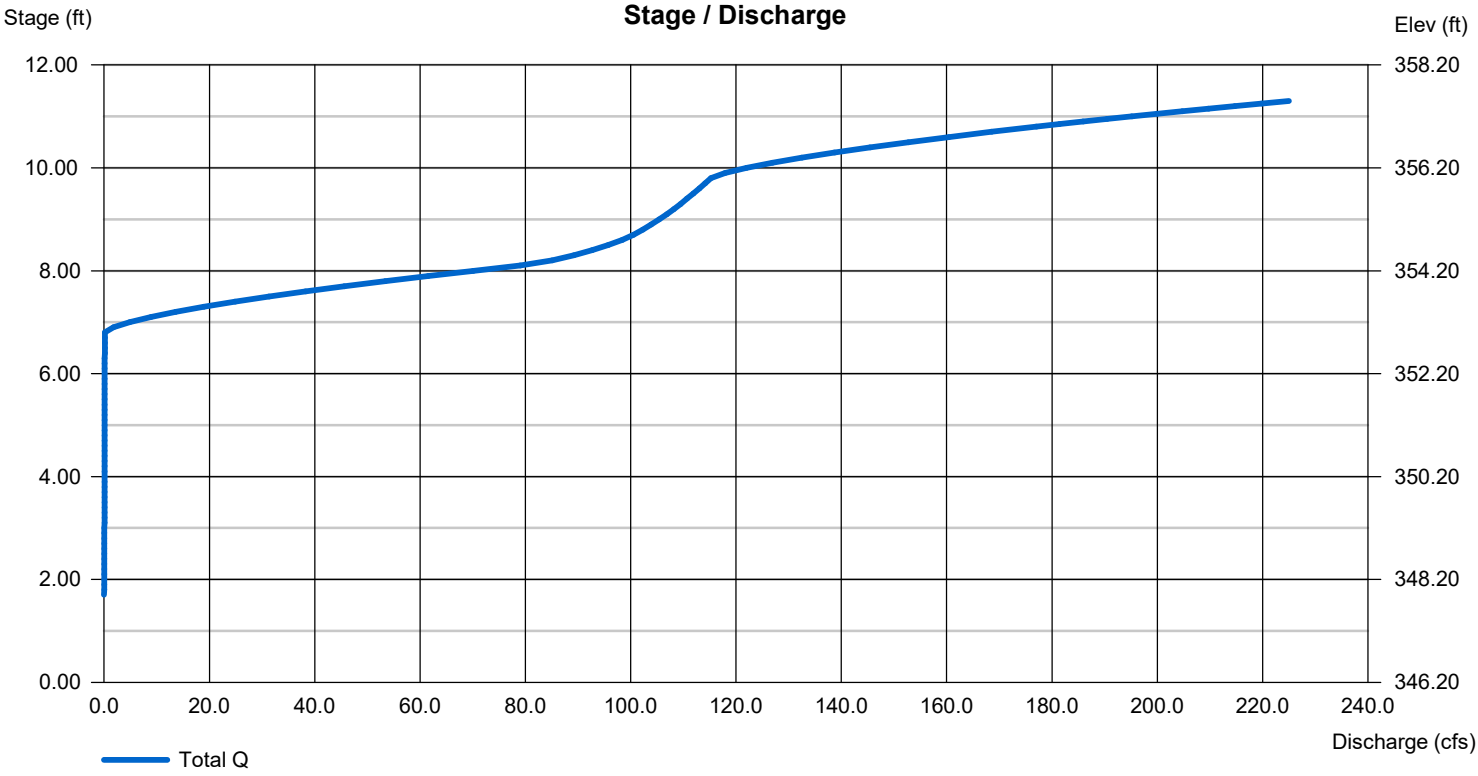
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	20.00	0.00	0.00
Crest El. (ft)	= 353.00	356.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= Rect	Broad	---	---
Multi-Stage	= Yes	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).

[A] DISCHARGE PIPE
[B] DRAWDOWN ORIFICE

[A] TOP OF RISER
[B] EMERGENCY SPILLWAY

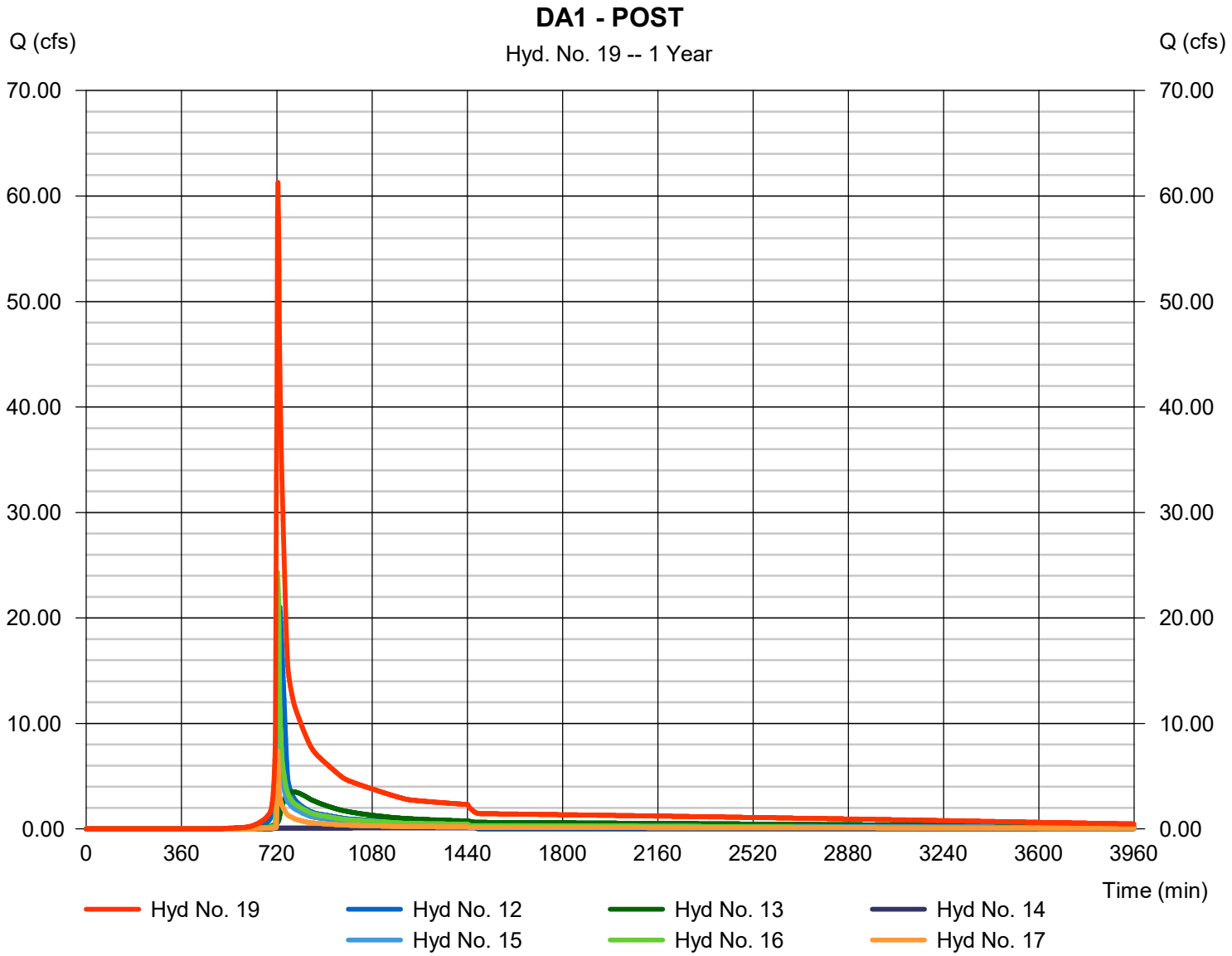


Hydrograph Report

Hyd. No. 19

DA1 - POST

Hydrograph type	= Combine	Peak discharge	= 61.29 cfs
Storm frequency	= 1 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 466,530 cuft
Inflow hyds.	= 12, 13, 14, 15, 16, 17	Contrib. drain. area	= 20.780 ac

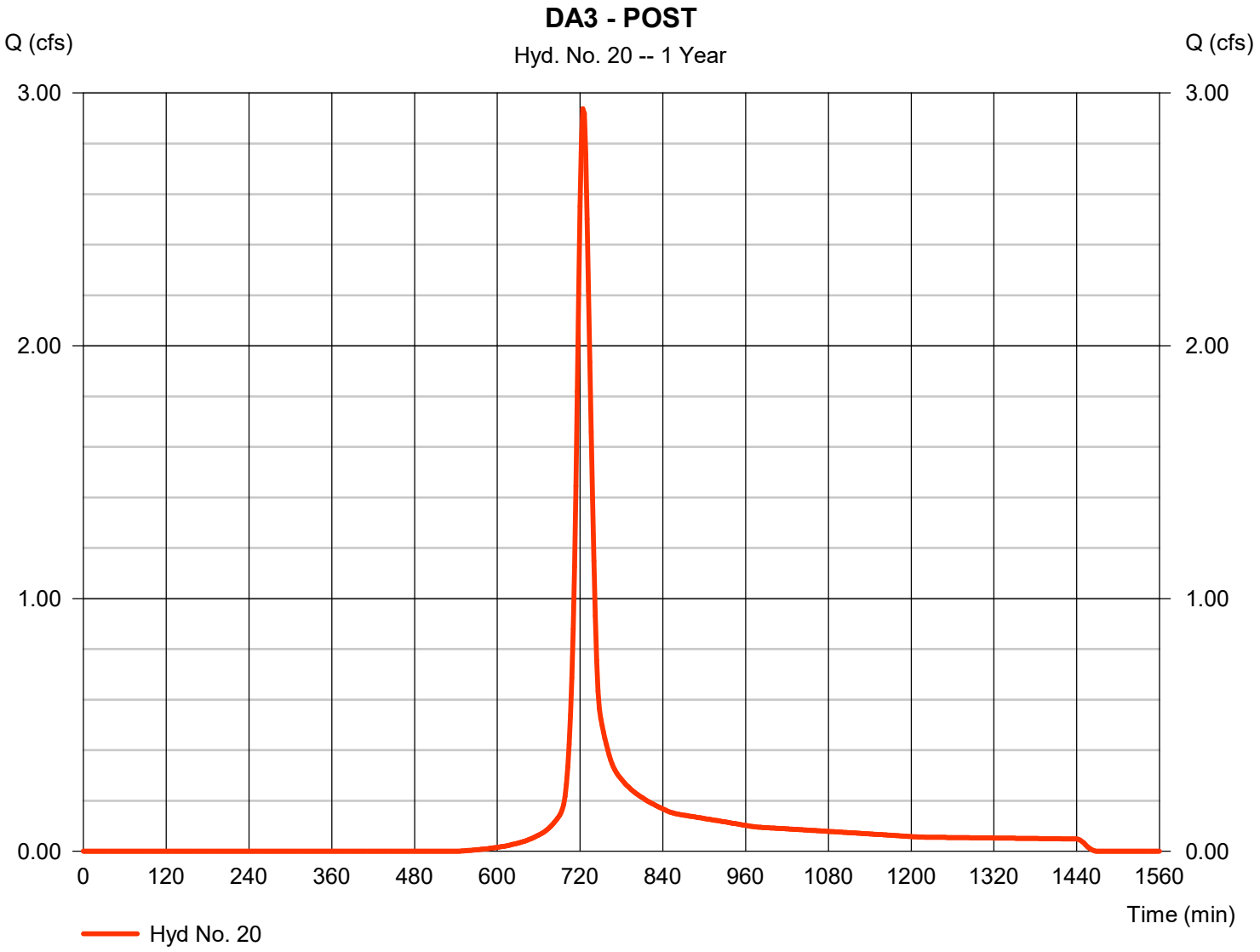


Hydrograph Report

Hyd. No. 20

DA3 - POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.938 cfs
Storm frequency	=	1 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	9,254 cuft
Drainage area	=	1.910 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	19.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

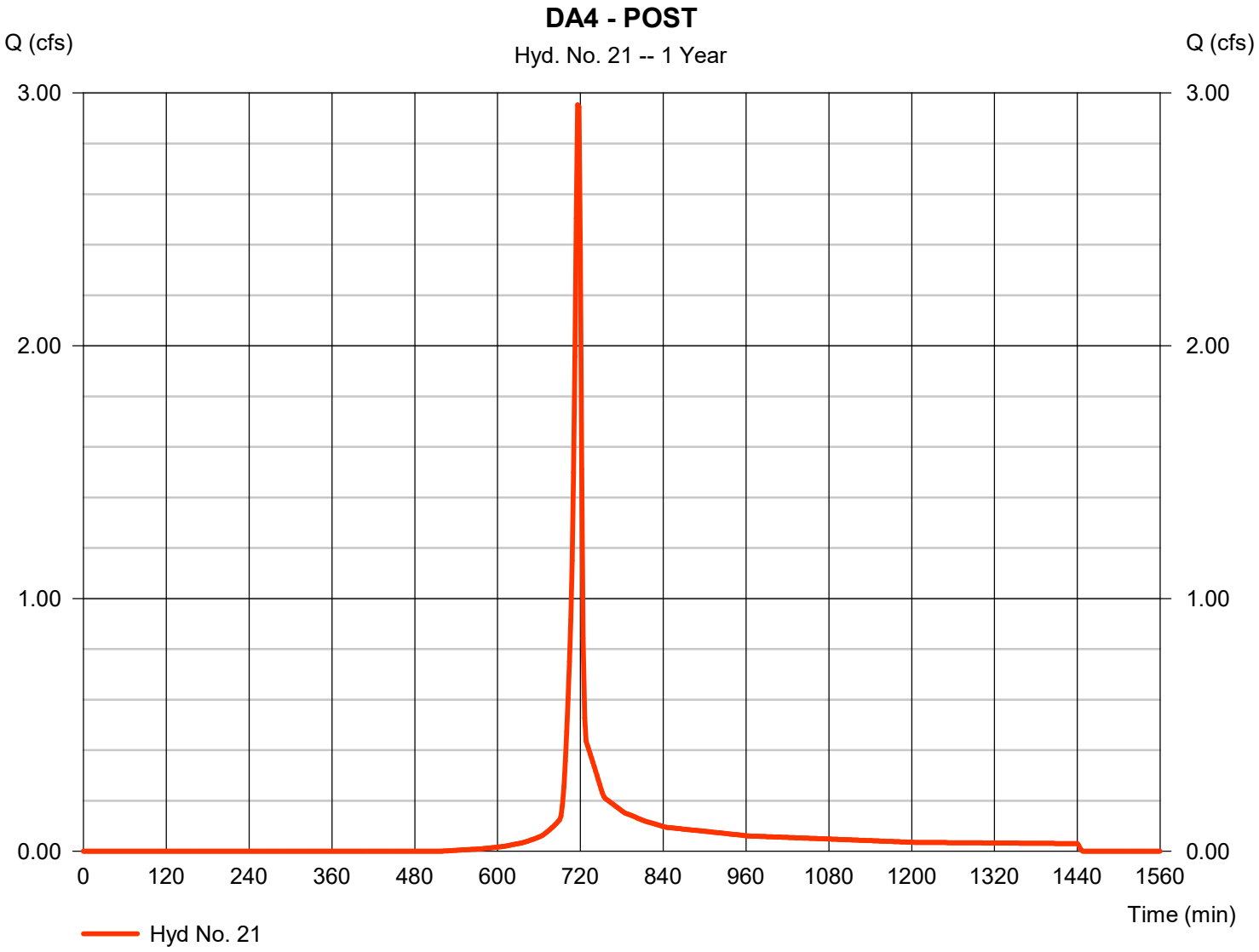


Hydrograph Report

Hyd. No. 21

DA4 - POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.953 cfs
Storm frequency	=	1 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	5,964 cuft
Drainage area	=	1.250 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

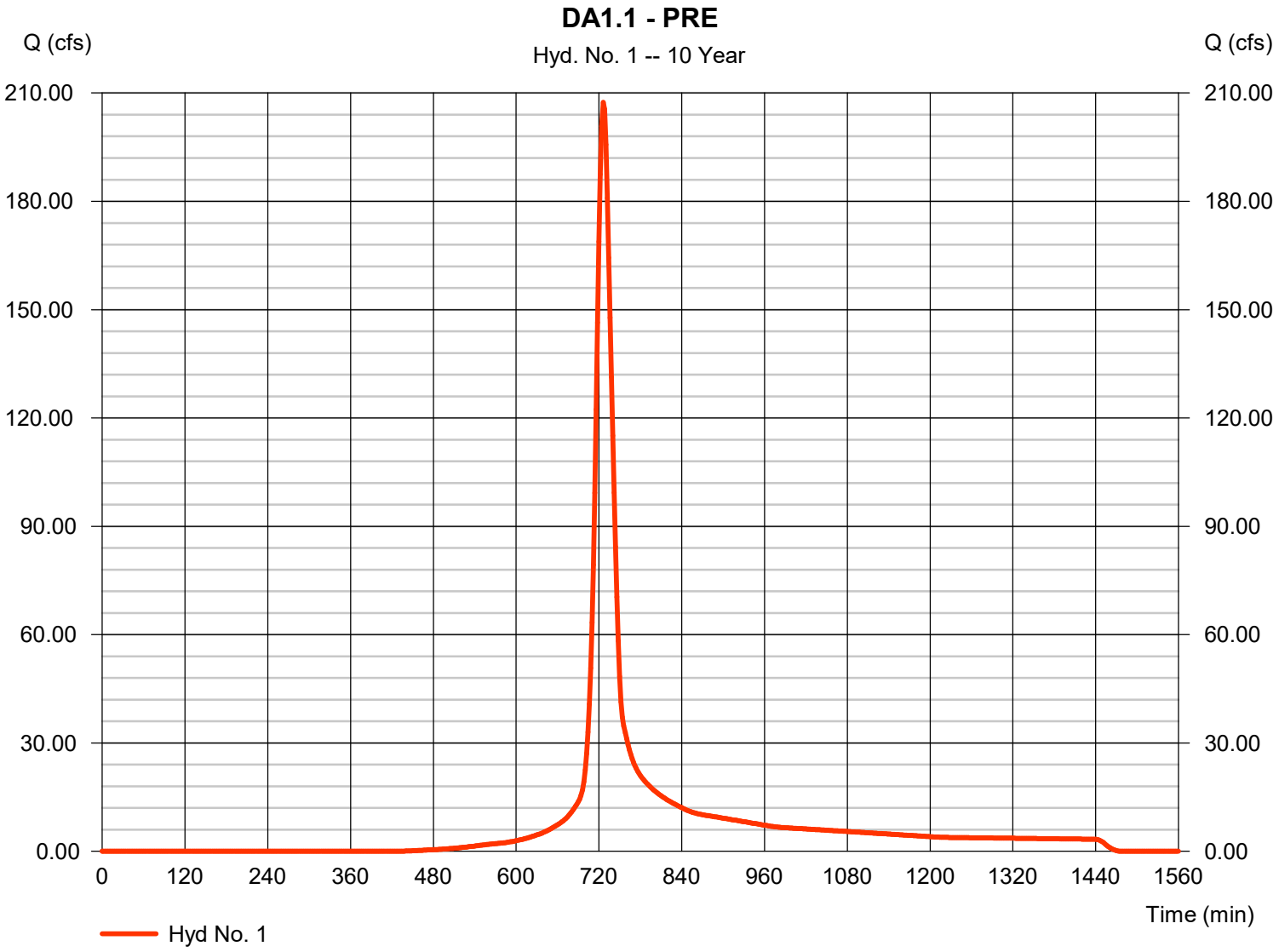
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	207.43	2	726	716,105	------	------	------	DA1.1 - PRE
2	SCS Runoff	53.99	2	730	215,885	------	------	------	DA1.2 - PRE
3	Combine	258.16	2	728	931,989	1, 2	------	------	DA1 - PRE
4	SCS Runoff	19.07	2	724	59,620	------	------	------	DA3 - PRE
5	SCS Runoff	21.04	2	720	54,627	------	------	------	DA4 - PRE
7	SCS Runoff	151.95	2	716	321,238	------	------	------	TO SCM 1
8	SCS Runoff	55.64	2	716	116,124	------	------	------	TO SCM 2
9	SCS Runoff	80.35	2	716	171,145	------	------	------	TO SCM 3
10	SCS Runoff	100.40	2	716	210,814	------	------	------	TO SCM 4
11	SCS Runoff	40.60	2	716	86,487	------	------	------	TO SCM 5
12	SCS Runoff	55.76	2	730	222,826	------	------	------	DA2 (BYPASS)
13	Reservoir	58.79	2	722	318,721	7	373.57	150,282	Pond 1
14	Reservoir	7.130	2	730	82,114	8	384.26	64,504	Pond 2
15	Reservoir	78.19	2	718	170,602	9	350.20	46,161	Pond 3
16	Reservoir	79.59	2	720	210,638	10	373.34	64,342	Pond 4
17	Reservoir	39.50	2	718	84,915	11	353.82	22,469	Pond 5
19	Combine	277.83	2	720	1,089,816	12, 13, 14, 15, 16, 17,	------	------	DA1 - POST
20	SCS Runoff	7.151	2	724	22,447	------	------	------	DA3 - POST
21	SCS Runoff	6.868	2	716	14,185	------	------	------	DA4 - POST

Hydrograph Report

Hyd. No. 1

DA1.1 - PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	207.43 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	716,105 cuft
Drainage area	=	65.610 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	22.00 min
Total precip.	=	5.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

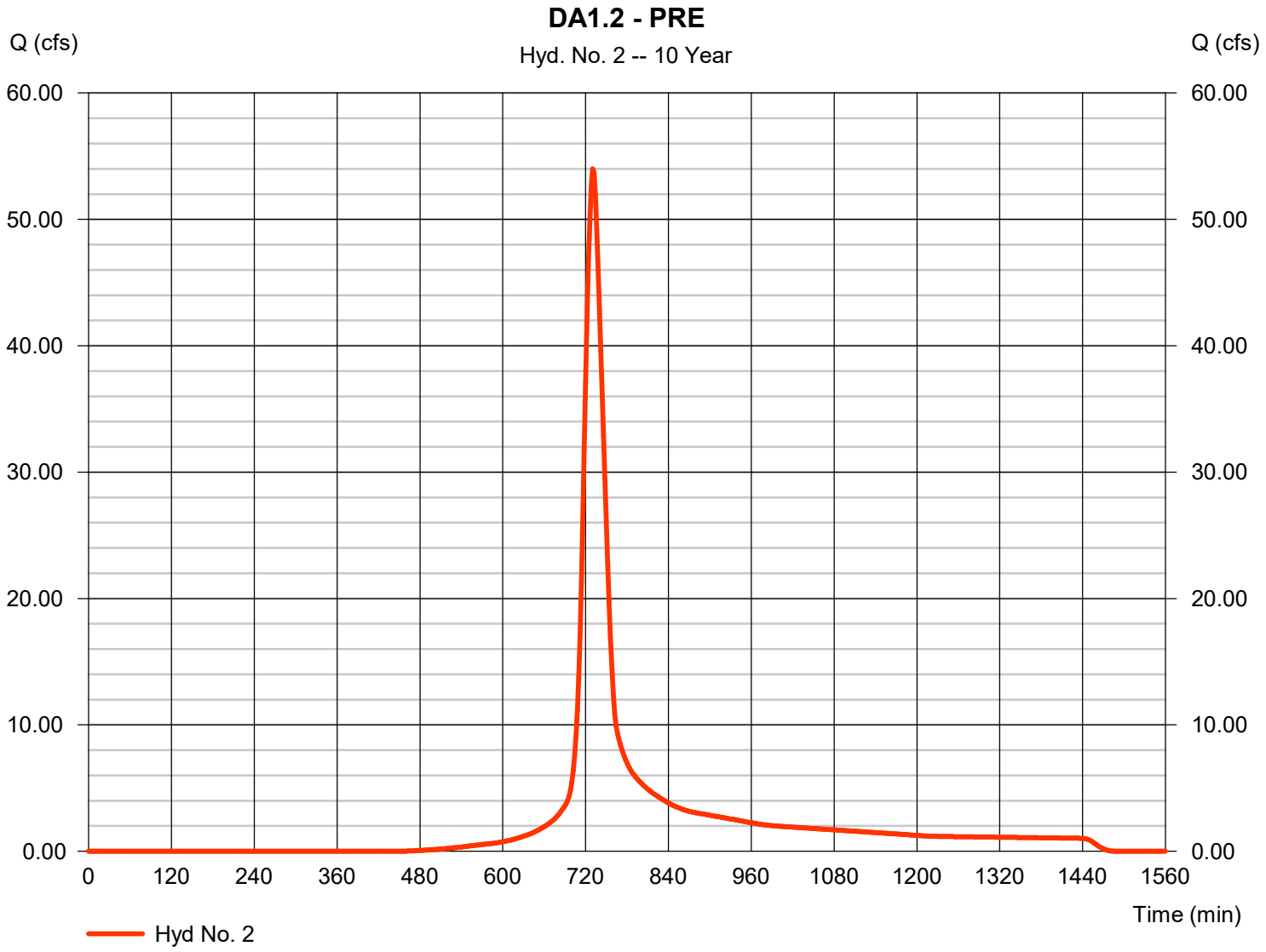


Hydrograph Report

Hyd. No. 2

DA1.2 - PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	53.99 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	215,885 cuft
Drainage area	=	20.780 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	30.00 min
Total precip.	=	5.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

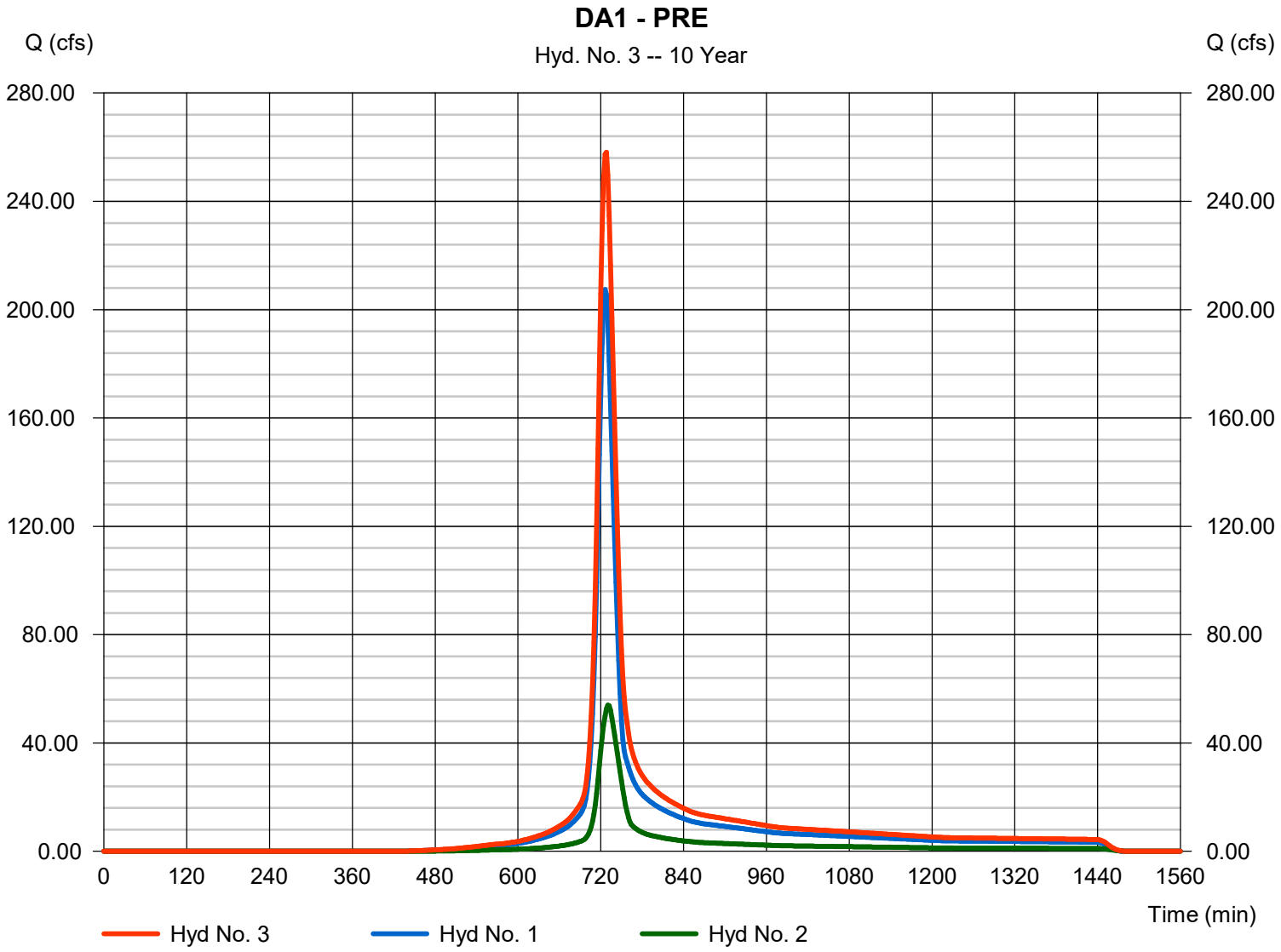


Hydrograph Report

Hyd. No. 3

DA1 - PRE

Hydrograph type	= Combine	Peak discharge	= 258.16 cfs
Storm frequency	= 10 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 931,989 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 86.390 ac

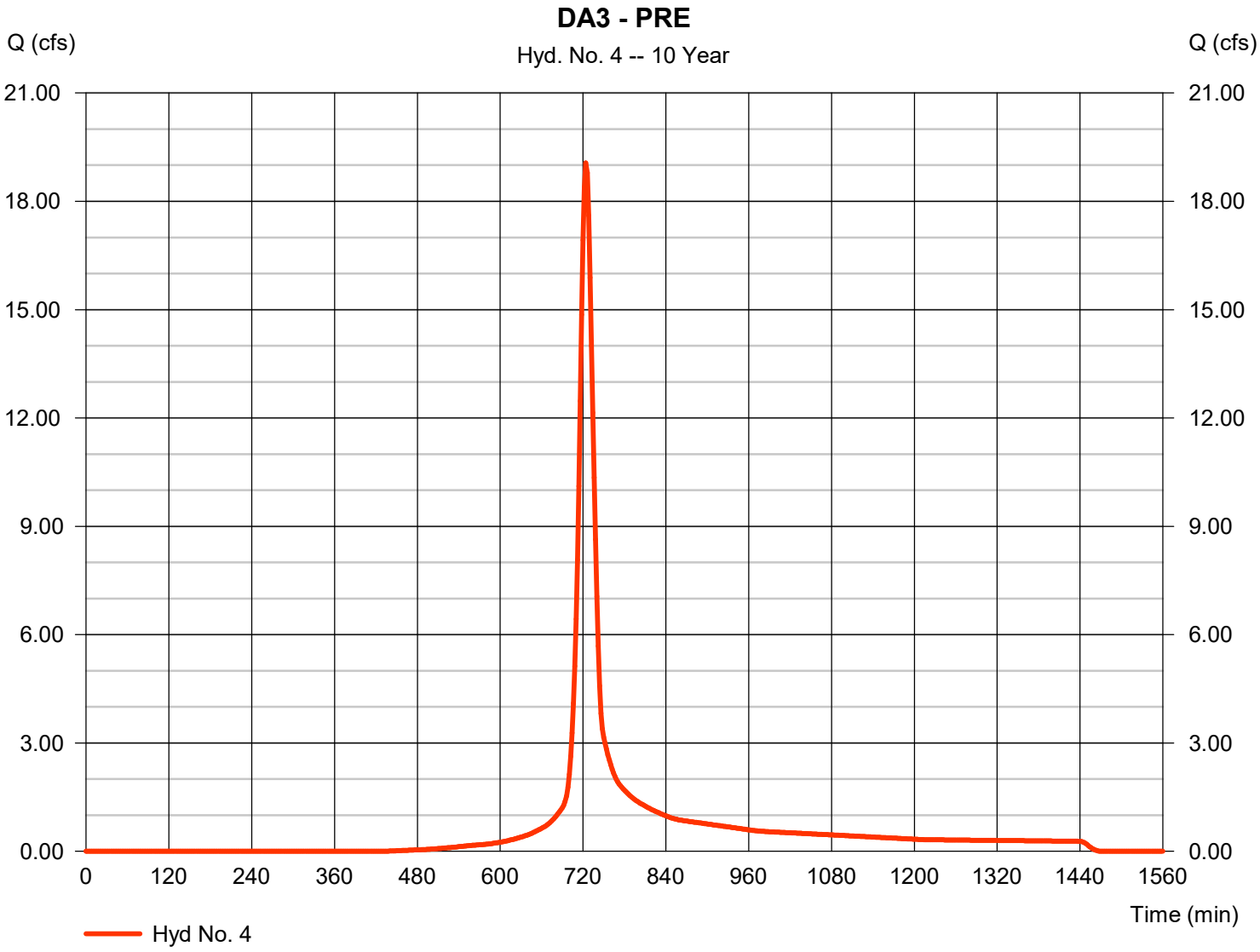


Hydrograph Report

Hyd. No. 4

DA3 - PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	19.07 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	59,620 cuft
Drainage area	=	5.560 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	20.00 min
Total precip.	=	5.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

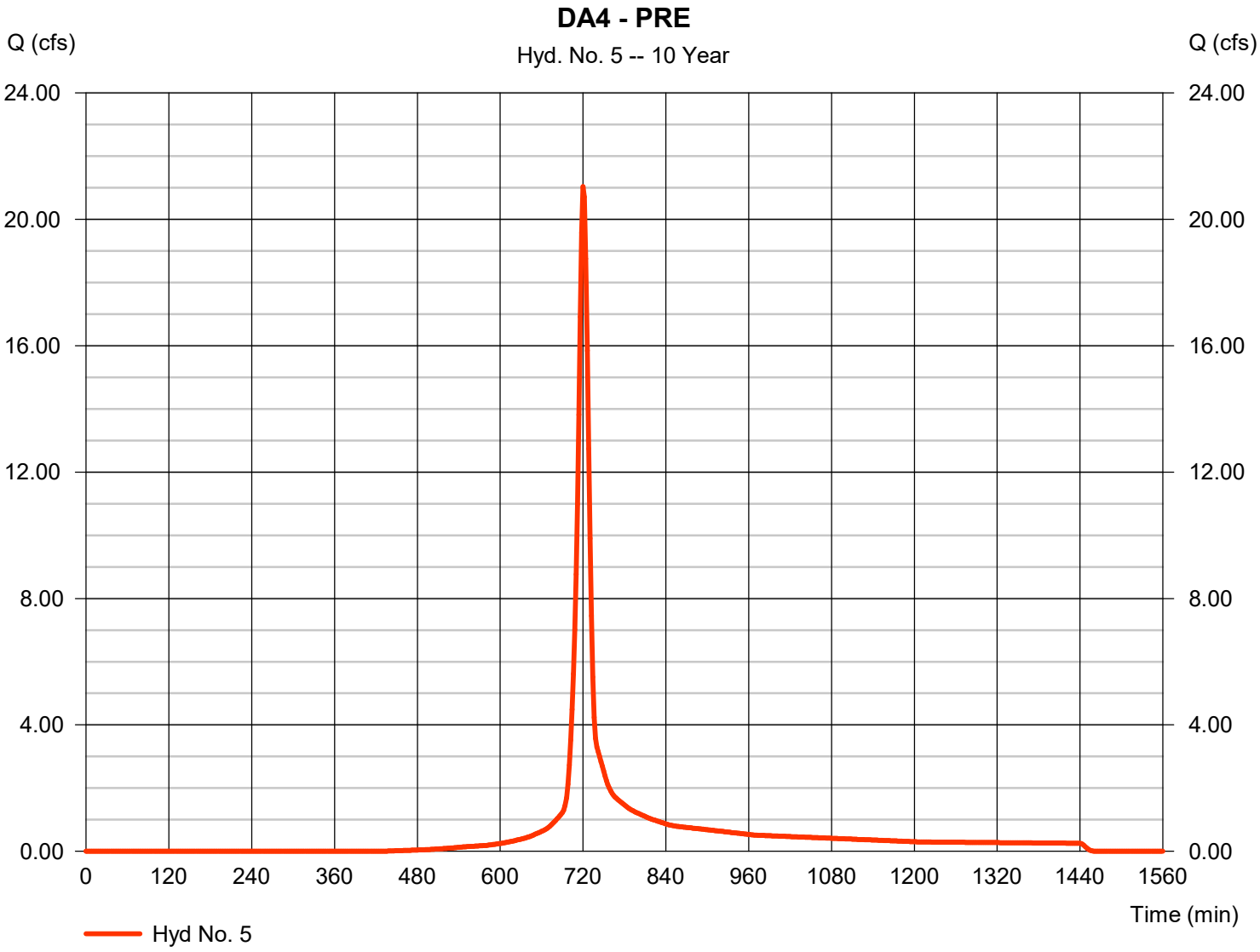


Hydrograph Report

Hyd. No. 5

DA4 - PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	21.04 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	54,627 cuft
Drainage area	=	4.940 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



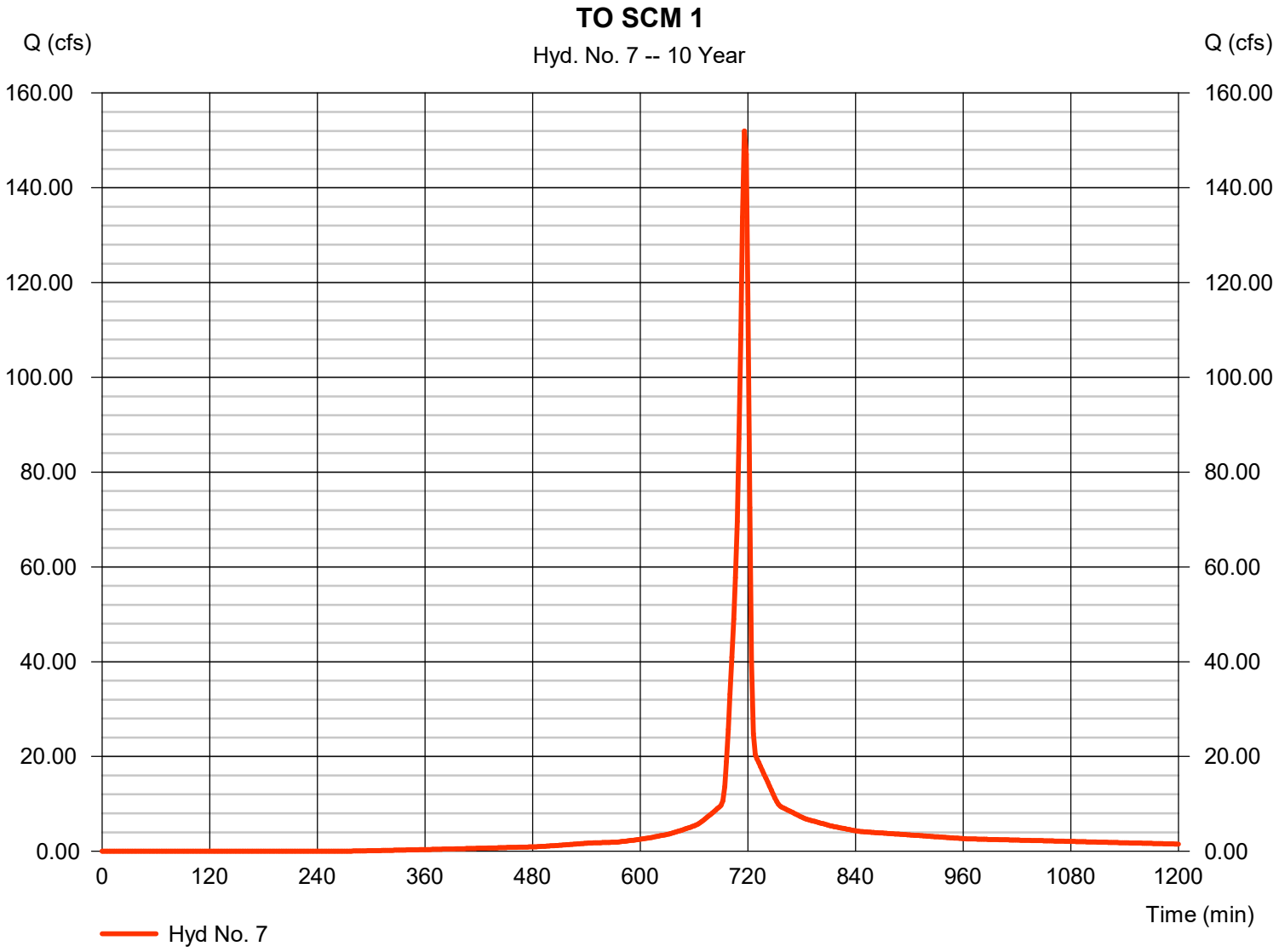
Hydrograph Report

Hyd. No. 7

TO SCM 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	151.95 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	321,238 cuft
Drainage area	=	25.270 ac	Curve number	=	88*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.790 x 98) + (7.460 x 98) + (14.020 x 80)] / 25.270



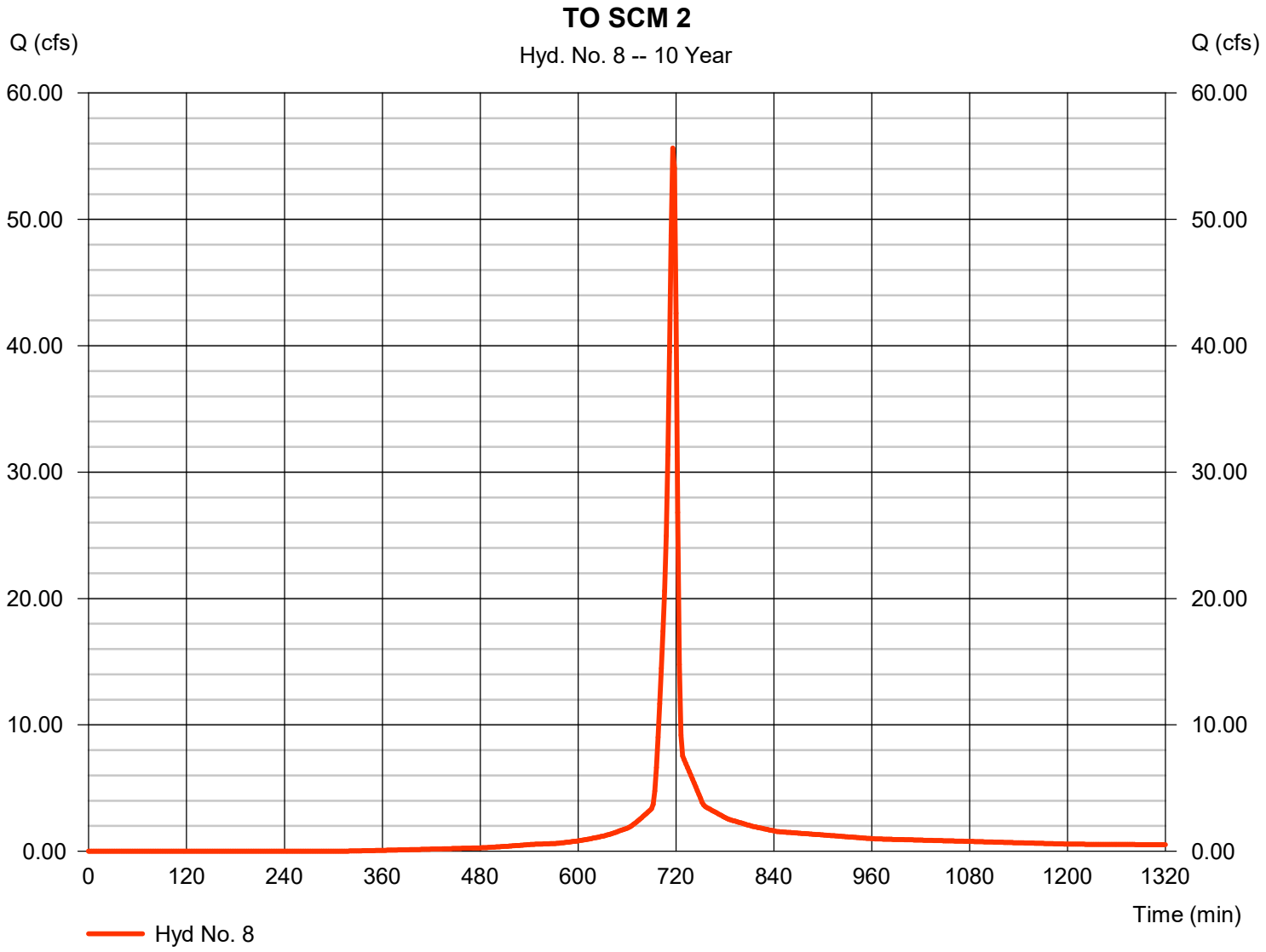
Hydrograph Report

Hyd. No. 8

TO SCM 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	55.64 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	116,124 cuft
Drainage area	=	9.660 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.100 x 98) + (2.090 x 98) + (6.470 x 80)] / 9.660



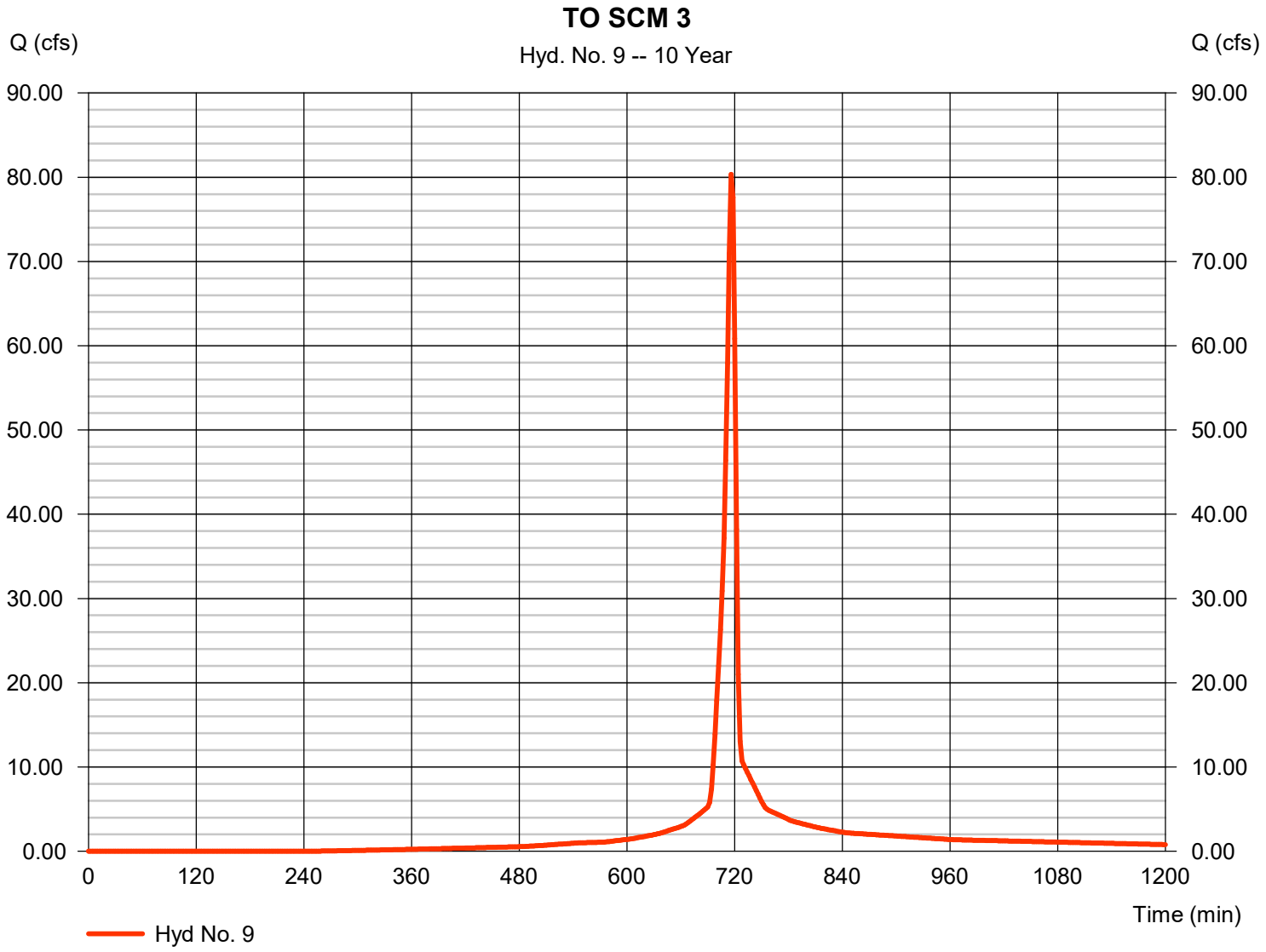
Hydrograph Report

Hyd. No. 9

TO SCM 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	80.35 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	171,145 cuft
Drainage area	=	13.100 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.820 x 98) + (3.860 x 98) + (6.420 x 80)] / 13.100



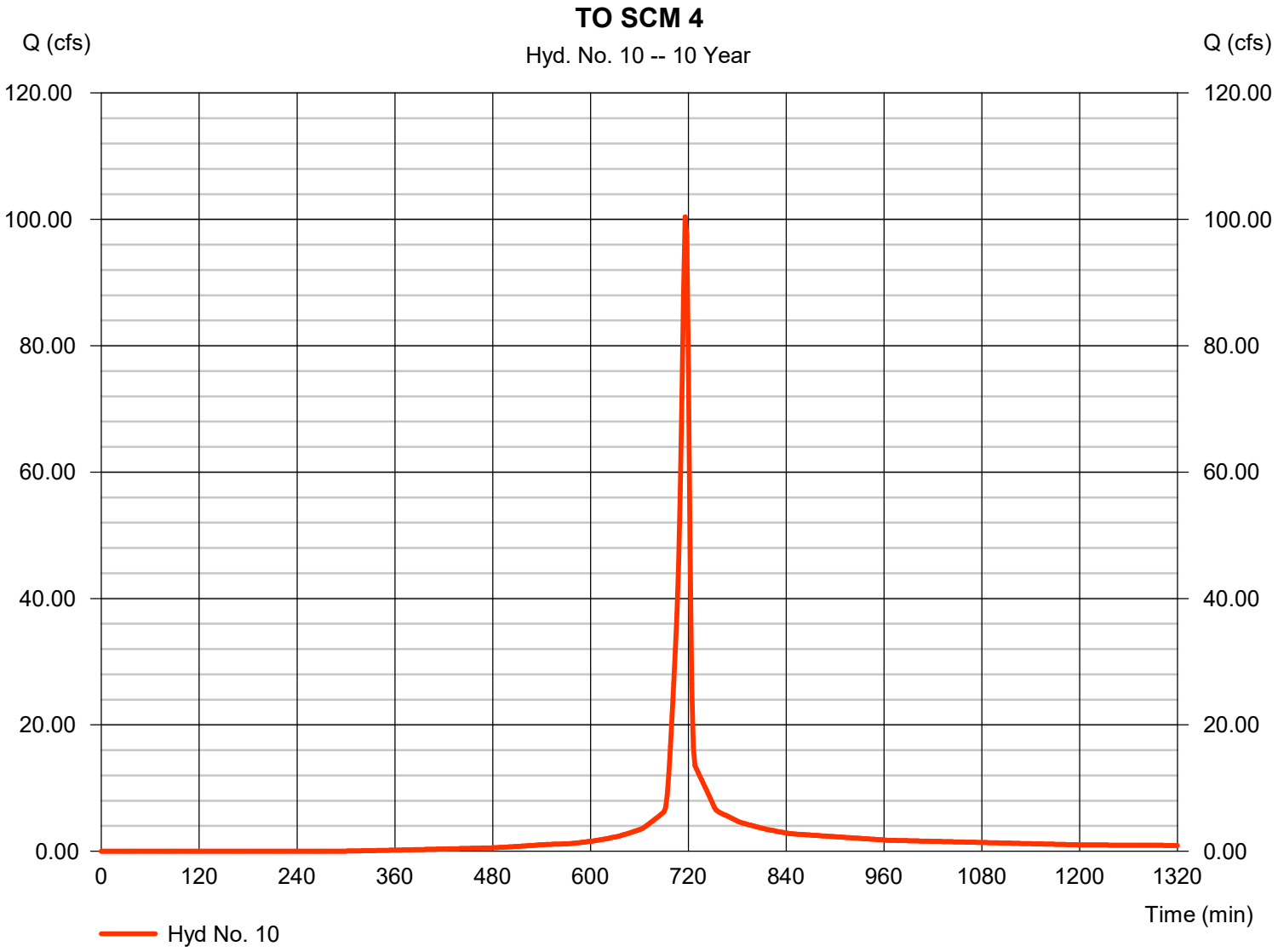
Hydrograph Report

Hyd. No. 10

TO SCM 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	100.40 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	210,814 cuft
Drainage area	=	17.050 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.940 x 98) + (4.220 x 98) + (10.890 x 80)] / 17.050



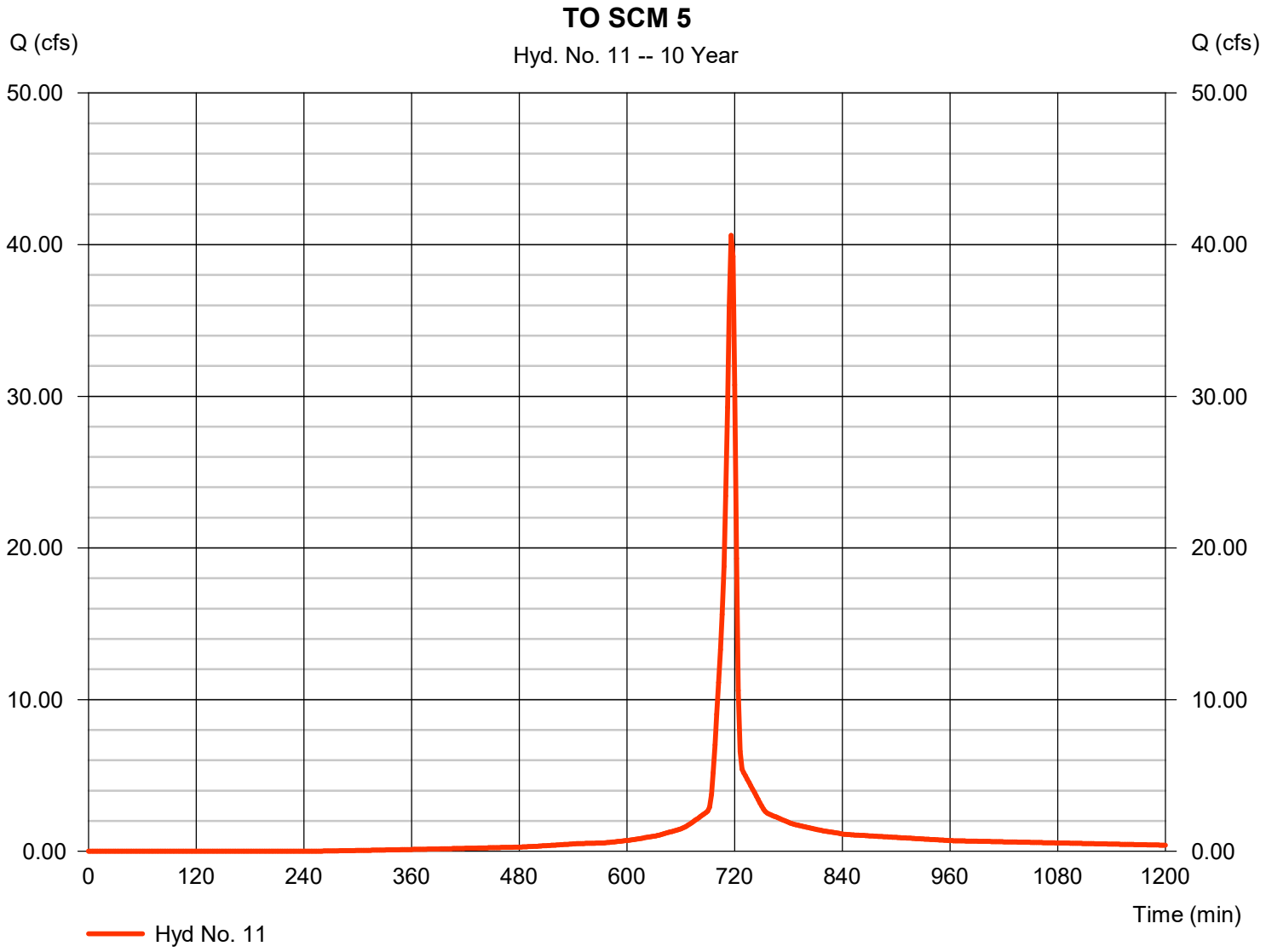
Hydrograph Report

Hyd. No. 11

TO SCM 5

Hydrograph type	=	SCS Runoff	Peak discharge	=	40.60 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	86,487 cuft
Drainage area	=	6.620 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.380 x 98) + (2.000 x 98) + (3.240 x 80)] / 6.620

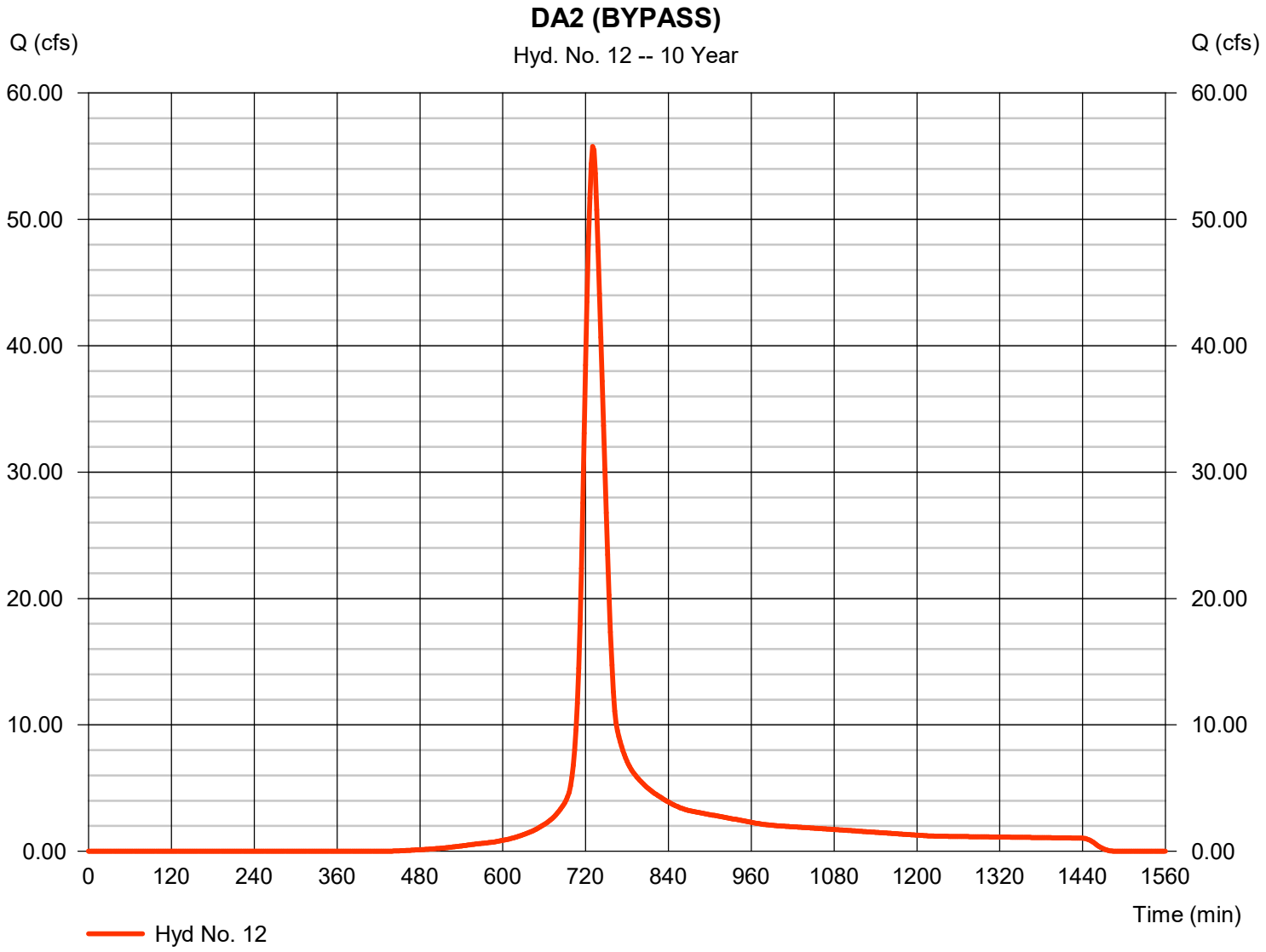


Hydrograph Report

Hyd. No. 12

DA2 (BYPASS)

Hydrograph type	=	SCS Runoff	Peak discharge	=	55.76 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	222,826 cuft
Drainage area	=	20.780 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	30.00 min
Total precip.	=	5.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



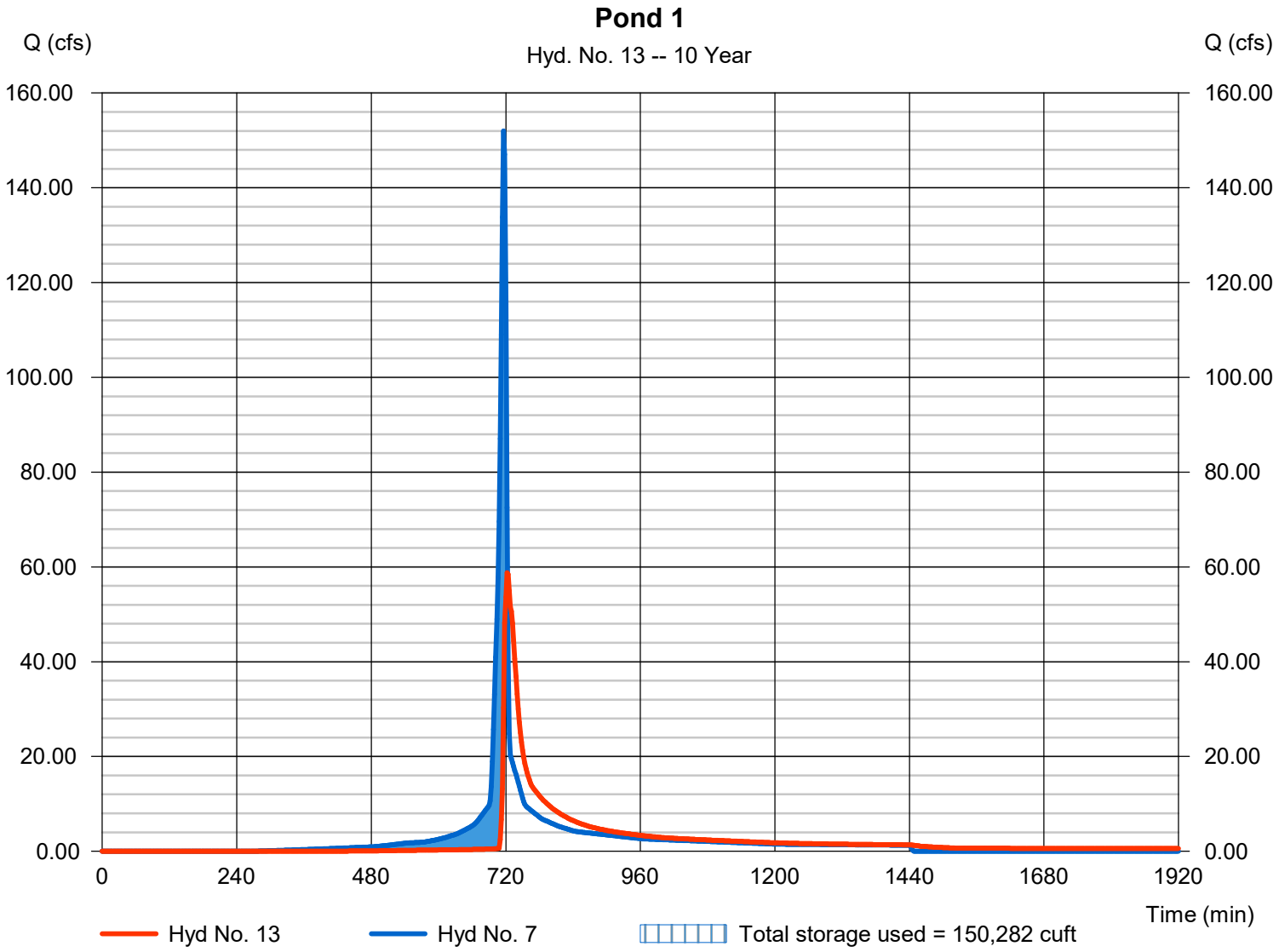
Hydrograph Report

Hyd. No. 13

Pond 1

Hydrograph type	= Reservoir	Peak discharge	= 58.79 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 318,721 cuft
Inflow hyd. No.	= 7 - TO SCM 1	Max. Elevation	= 373.57 ft
Reservoir name	= Wet Pond 1	Max. Storage	= 150,282 cuft

Storage Indication method used.



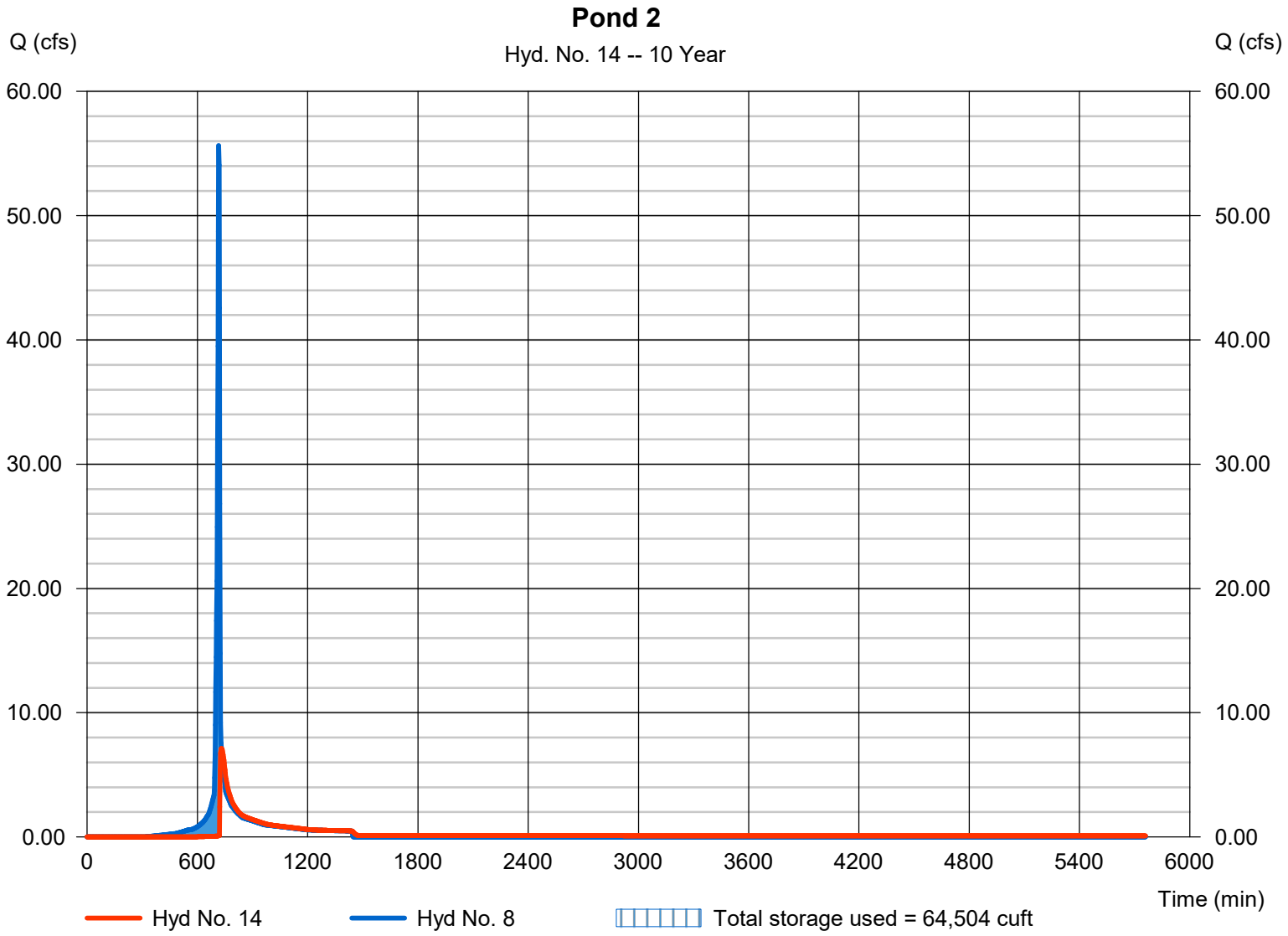
Hydrograph Report

Hyd. No. 14

Pond 2

Hydrograph type	=	Reservoir	Peak discharge	=	7.130 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	82,114 cuft
Inflow hyd. No.	=	8 - TO SCM 2	Max. Elevation	=	384.26 ft
Reservoir name	=	Dry Pond 2	Max. Storage	=	64,504 cuft

Storage Indication method used.



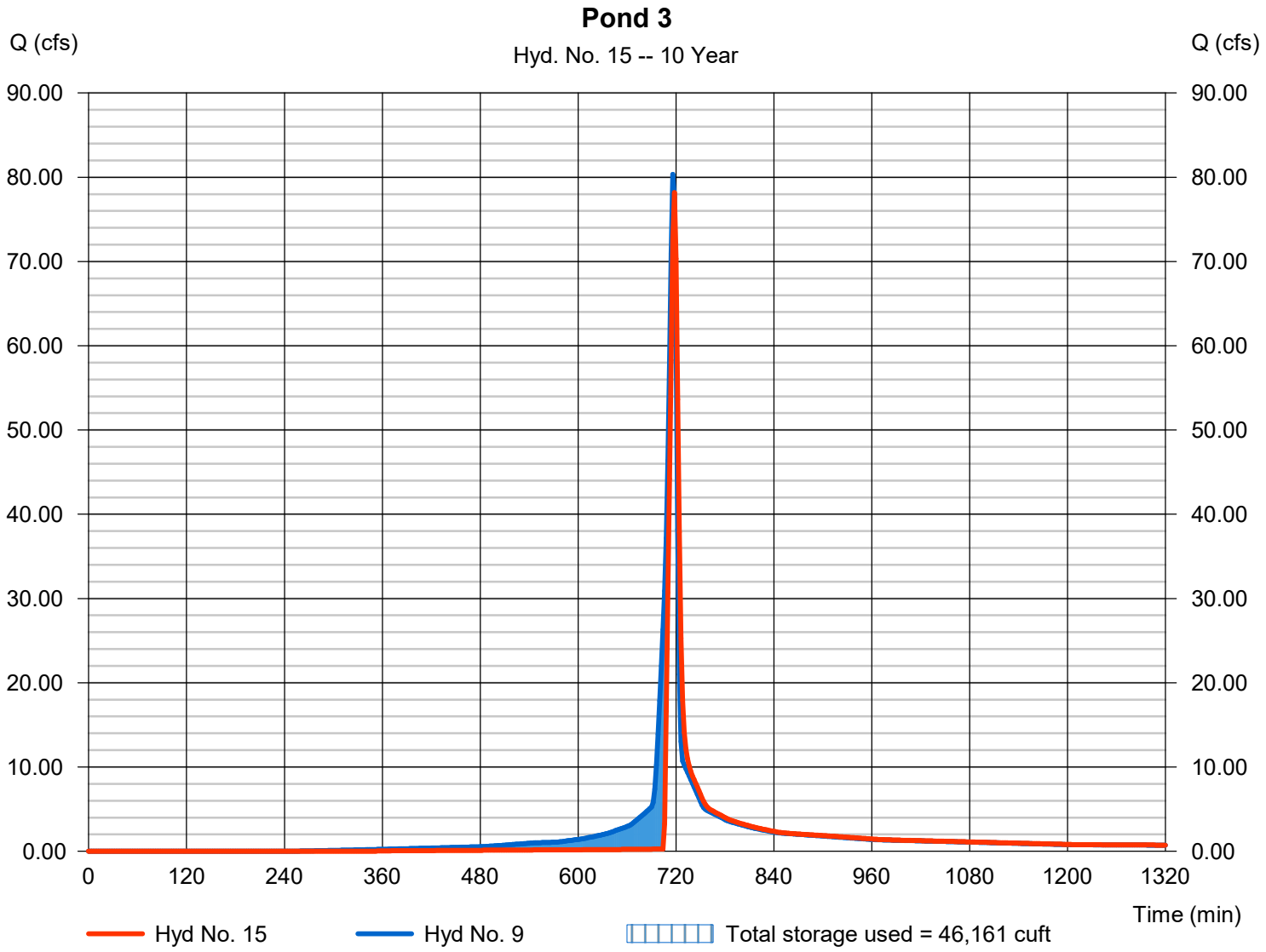
Hydrograph Report

Hyd. No. 15

Pond 3

Hydrograph type	=	Reservoir	Peak discharge	=	78.19 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	170,602 cuft
Inflow hyd. No.	=	9 - TO SCM 3	Max. Elevation	=	350.20 ft
Reservoir name	=	Dry Pond 3	Max. Storage	=	46,161 cuft

Storage Indication method used.



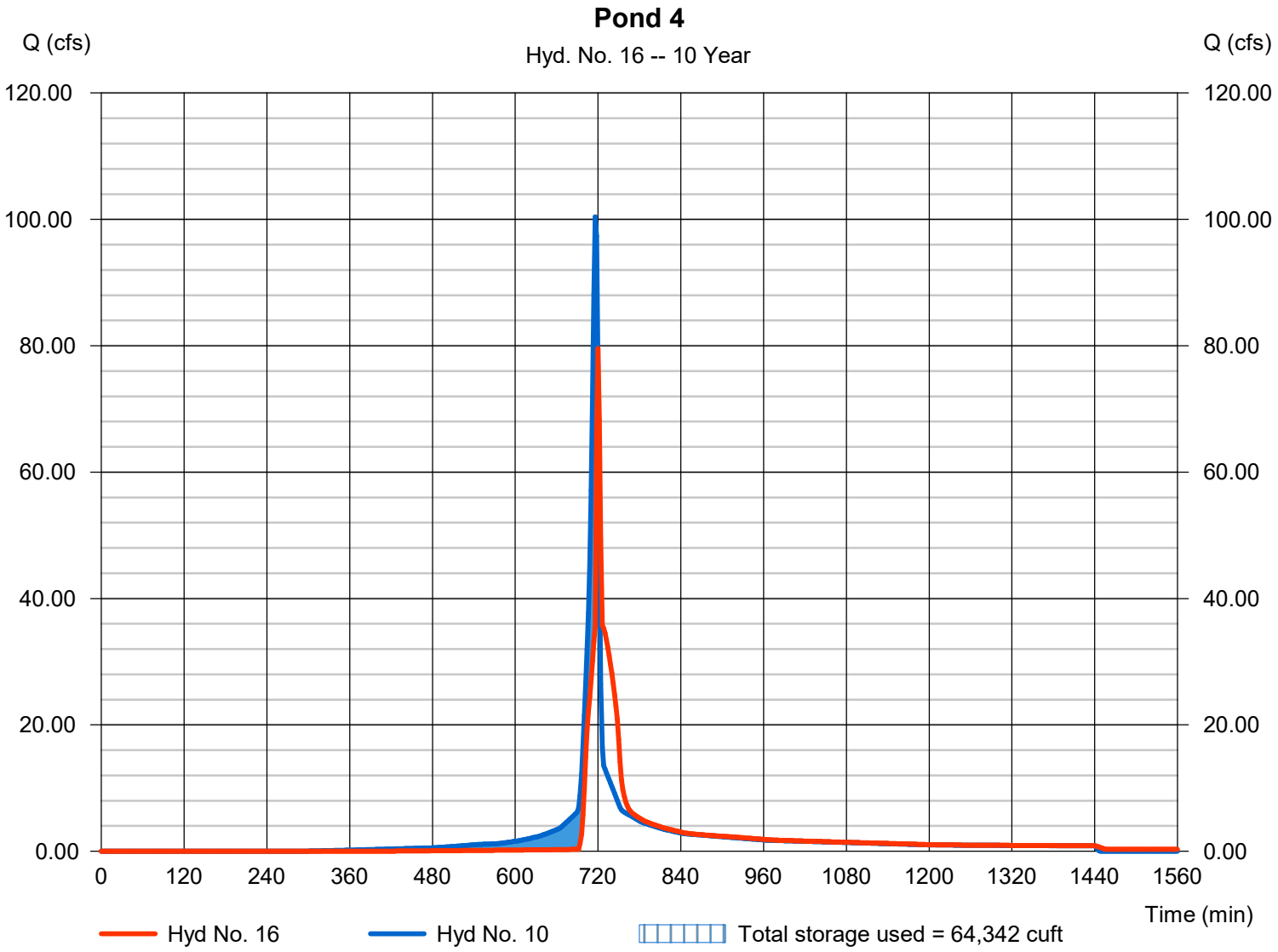
Hydrograph Report

Hyd. No. 16

Pond 4

Hydrograph type	= Reservoir	Peak discharge	= 79.59 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 210,638 cuft
Inflow hyd. No.	= 10 - TO SCM 4	Max. Elevation	= 373.34 ft
Reservoir name	= Wet Pond 4	Max. Storage	= 64,342 cuft

Storage Indication method used.



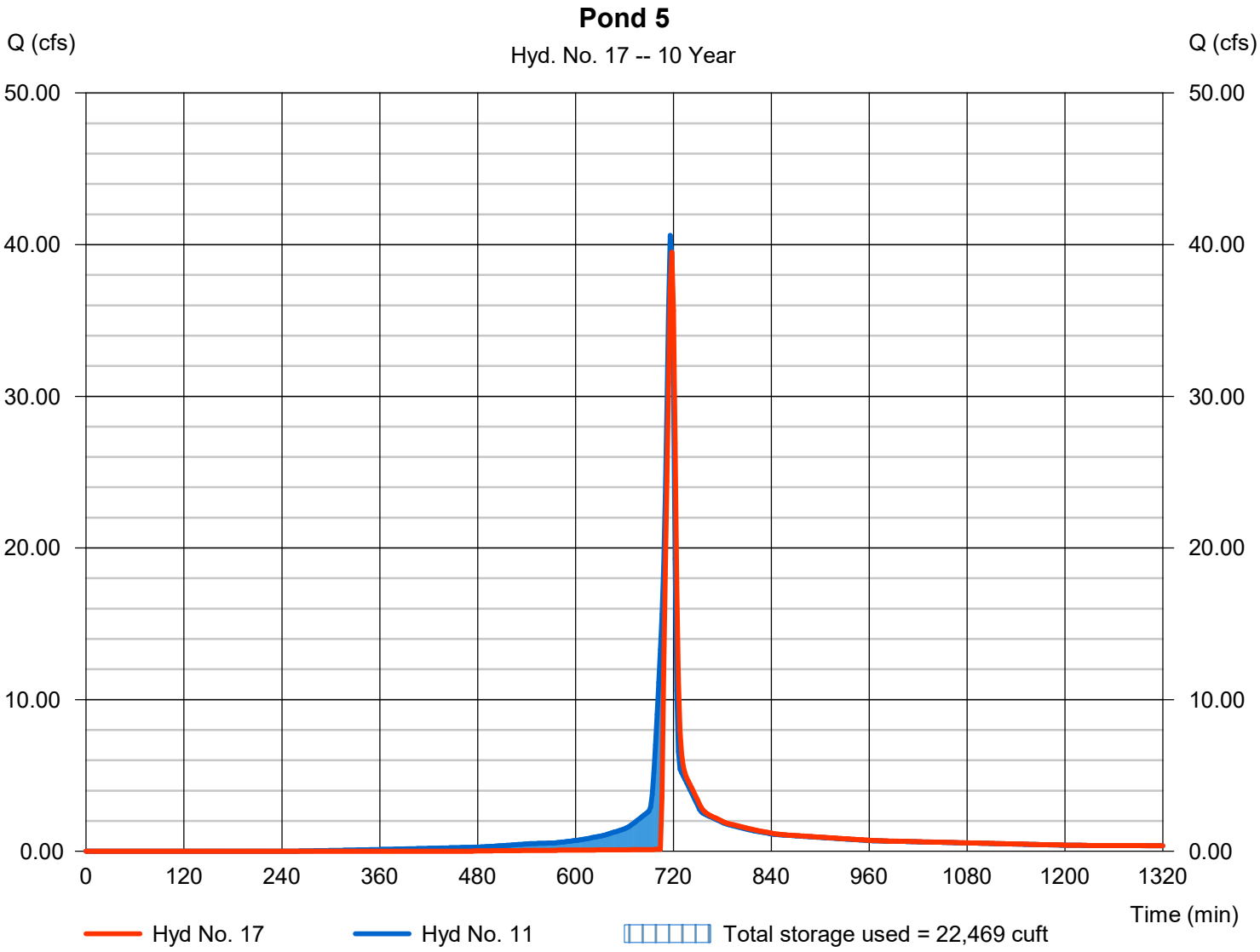
Hydrograph Report

Hyd. No. 17

Pond 5

Hydrograph type	=	Reservoir	Peak discharge	=	39.50 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	84,915 cuft
Inflow hyd. No.	=	11 - TO SCM 5	Max. Elevation	=	353.82 ft
Reservoir name	=	Dry Pond 5	Max. Storage	=	22,469 cuft

Storage Indication method used.

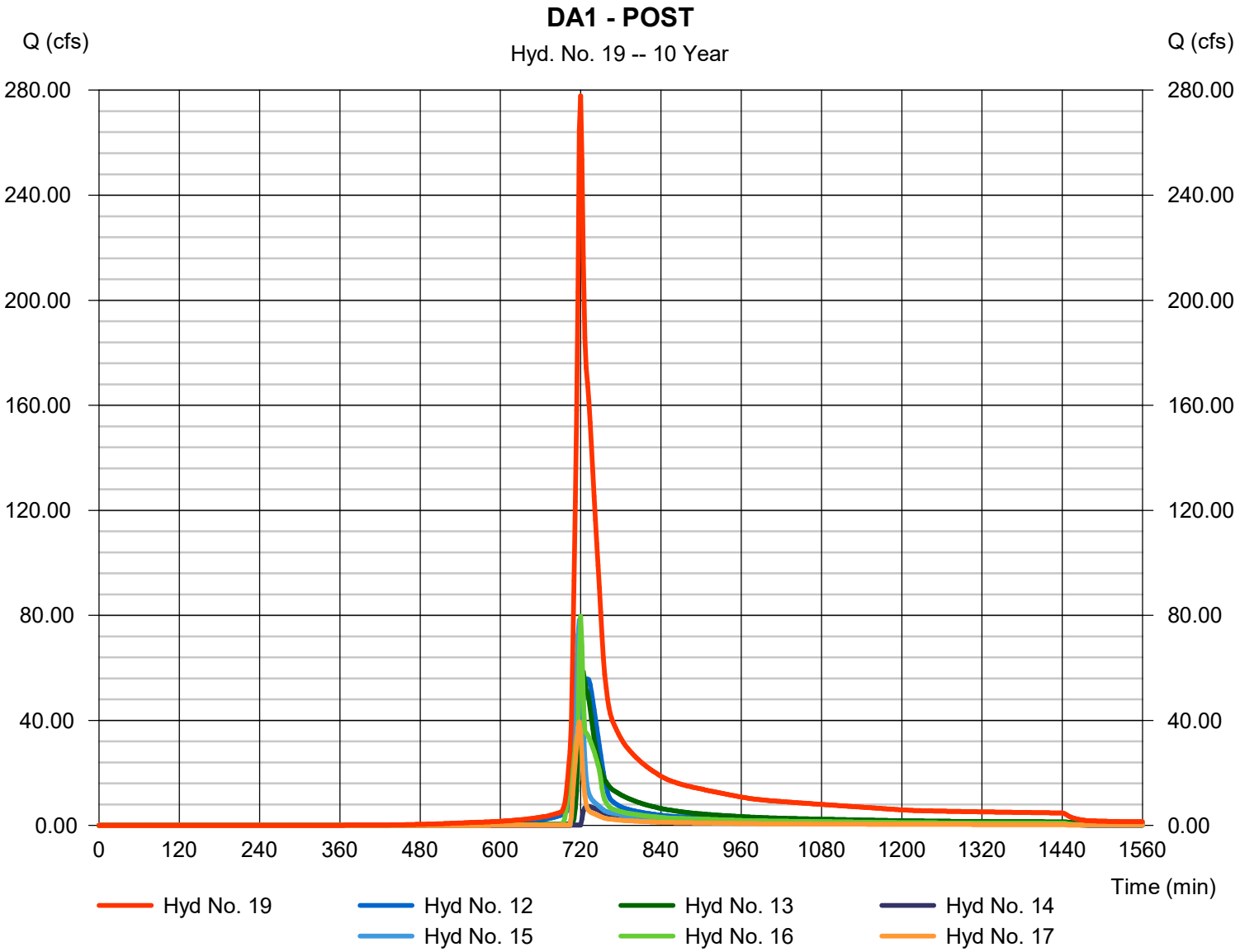


Hydrograph Report

Hyd. No. 19

DA1 - POST

Hydrograph type	= Combine	Peak discharge	= 277.83 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 1,089,816 cuft
Inflow hyds.	= 12, 13, 14, 15, 16, 17	Contrib. drain. area	= 20.780 ac

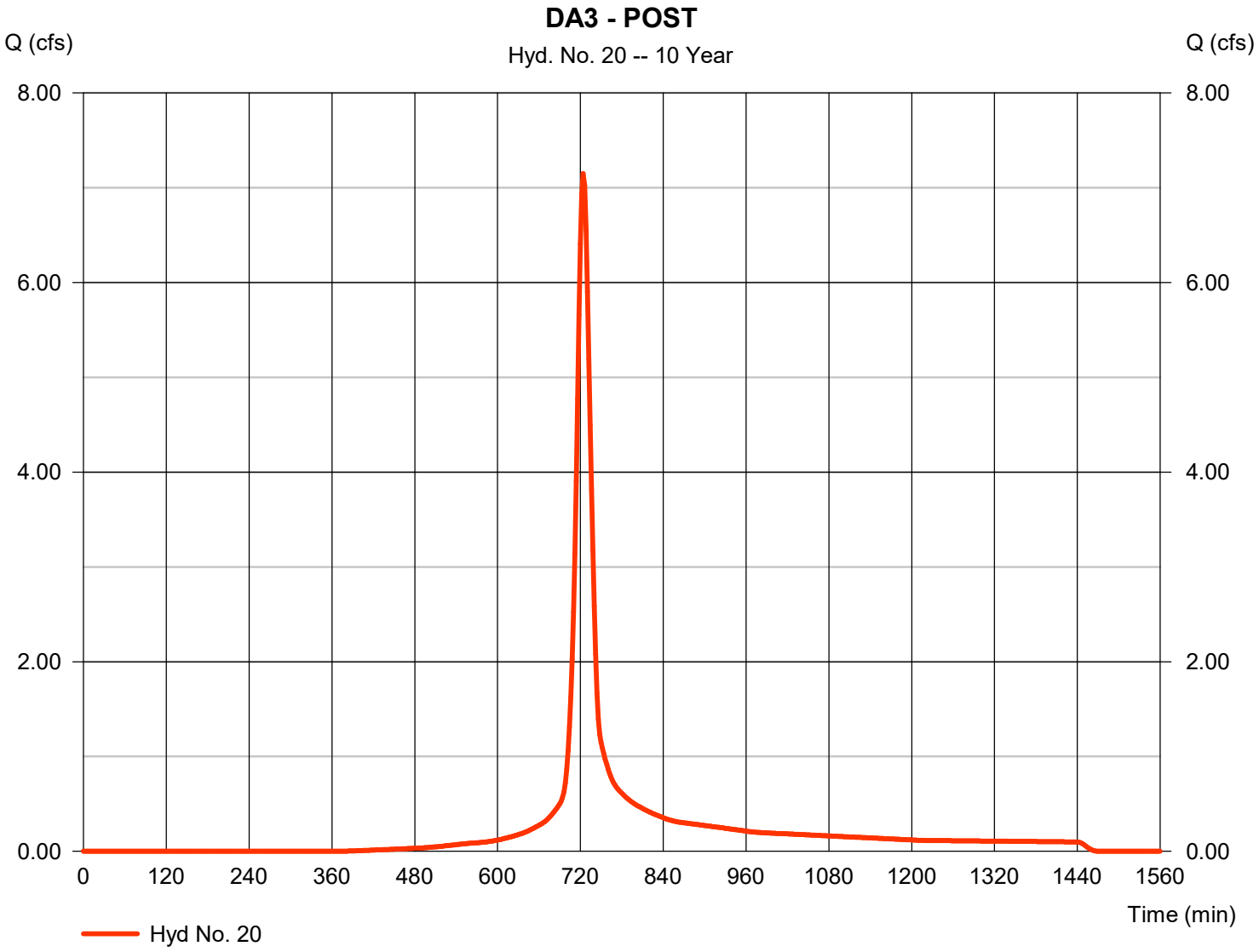


Hydrograph Report

Hyd. No. 20

DA3 - POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.151 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	22,447 cuft
Drainage area	=	1.910 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	19.00 min
Total precip.	=	5.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

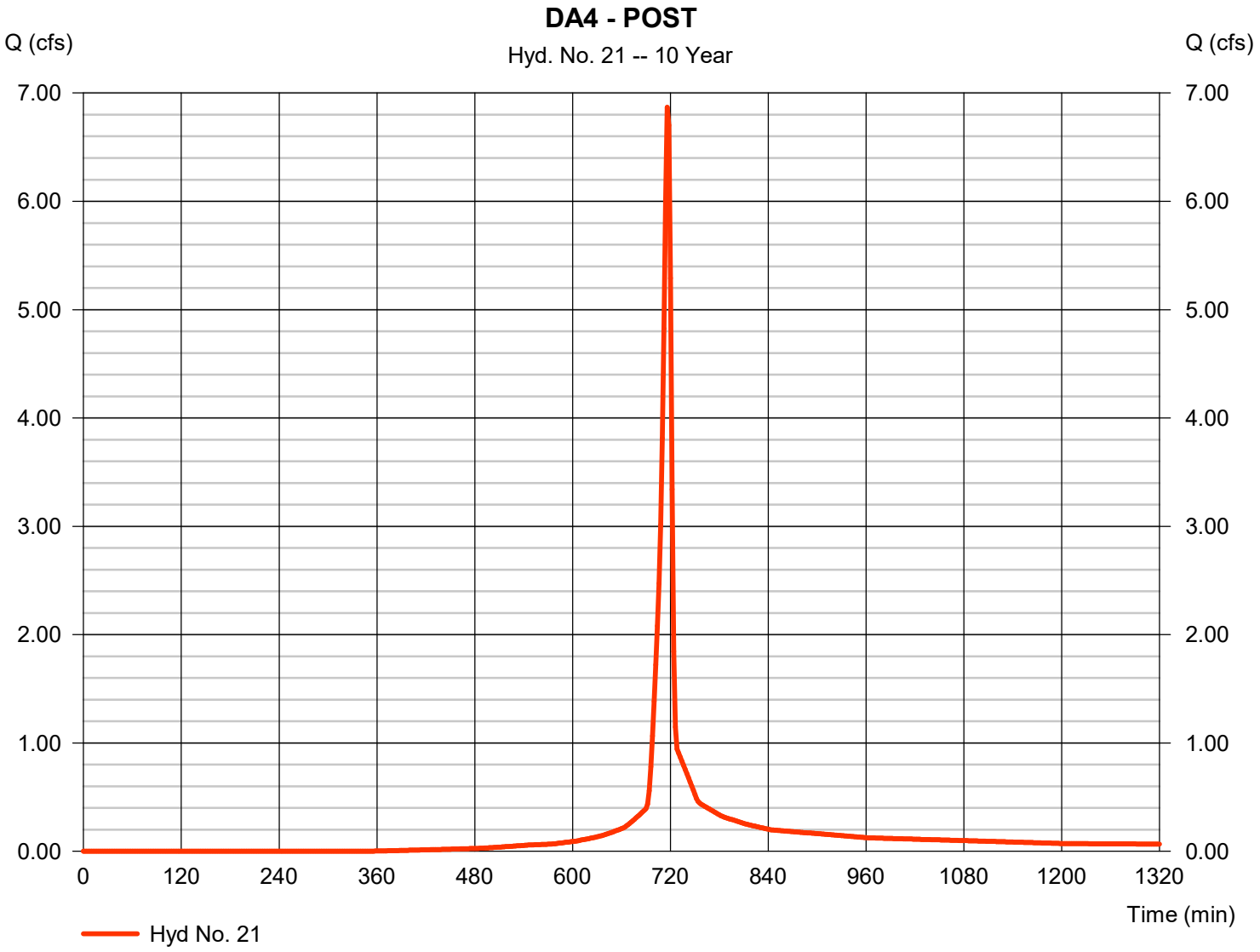


Hydrograph Report

Hyd. No. 21

DA4 - POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.868 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	14,185 cuft
Drainage area	=	1.250 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.07 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

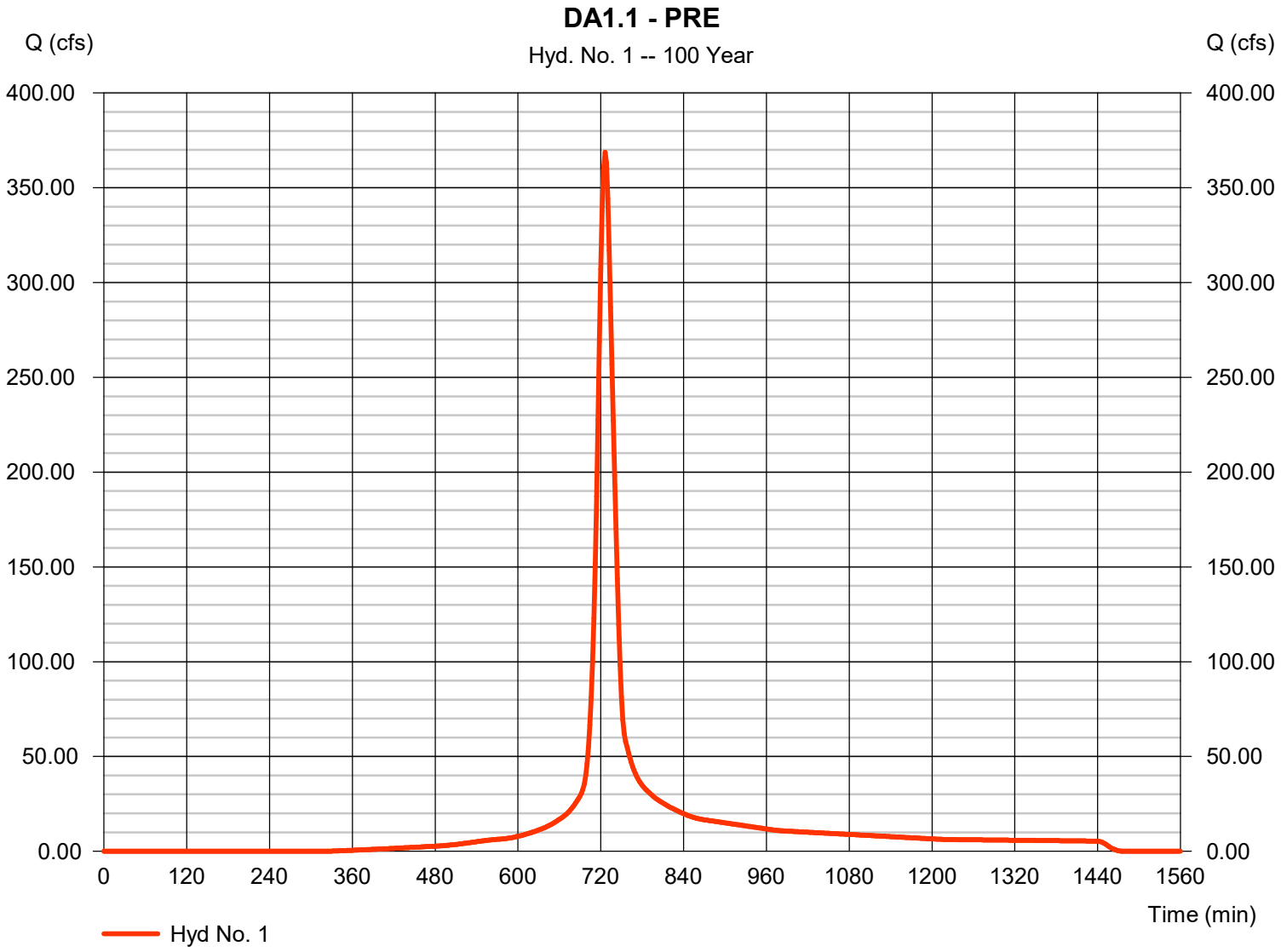
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	368.69	2	726	1,284,246	------	------	------	DA1.1 - PRE
2	SCS Runoff	97.37	2	730	390,953	------	------	------	DA1.2 - PRE
3	Combine	459.85	2	726	1,675,198	1, 2	------	------	DA1 - PRE
4	SCS Runoff	33.80	2	724	106,922	------	------	------	DA3 - PRE
5	SCS Runoff	37.13	2	720	97,968	------	------	------	DA4 - PRE
7	SCS Runoff	245.29	2	716	535,449	------	------	------	TO SCM 1
8	SCS Runoff	91.51	2	716	197,000	------	------	------	TO SCM 2
9	SCS Runoff	128.57	2	716	282,807	------	------	------	TO SCM 3
10	SCS Runoff	163.56	2	716	354,483	------	------	------	TO SCM 4
11	SCS Runoff	64.97	2	716	142,915	------	------	------	TO SCM 5
12	SCS Runoff	99.33	2	730	399,610	------	------	------	DA2 (BYPASS)
13	Reservoir	124.48	2	722	532,894	7	375.19	218,014	Pond 1
14	Reservoir	60.89	2	720	162,940	8	385.21	85,469	Pond 2
15	Reservoir	126.14	2	718	282,264	9	350.48	49,134	Pond 3
16	Reservoir	156.07	2	718	354,306	10	373.77	72,459	Pond 4
17	Reservoir	63.14	2	718	141,343	11	354.12	24,314	Pond 5
19	Combine	565.57	2	718	1,873,357	12, 13, 14, 15, 16, 17,	------	------	DA1 - POST
20	SCS Runoff	12.25	2	724	39,130	------	------	------	DA3 - POST
21	SCS Runoff	11.52	2	716	24,502	------	------	------	DA4 - POST

Hydrograph Report

Hyd. No. 1

DA1.1 - PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	368.69 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	1,284,246 cuft
Drainage area	=	65.610 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	22.00 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

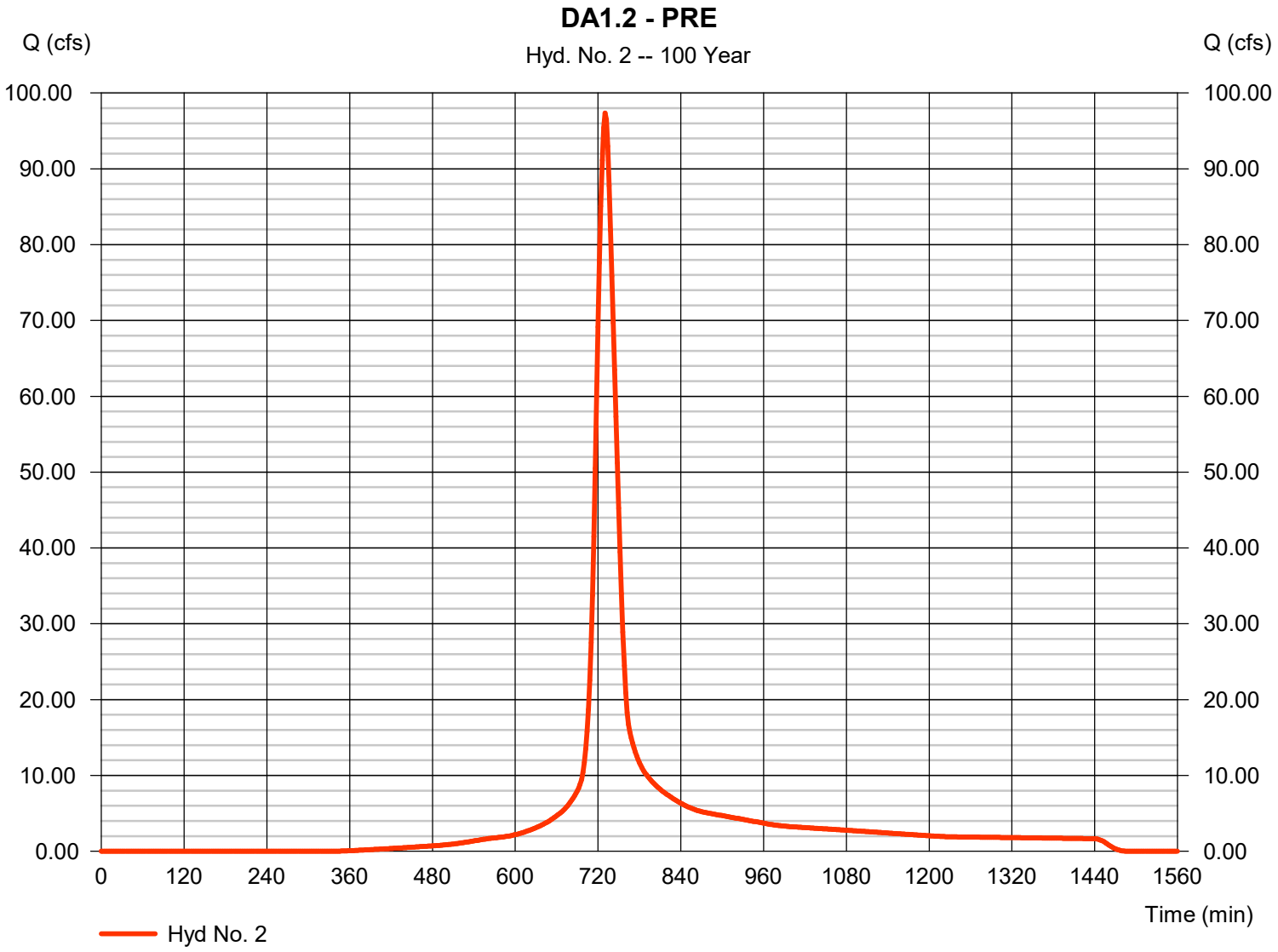


Hydrograph Report

Hyd. No. 2

DA1.2 - PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	97.37 cfs
Storm frequency	=	100 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	390,953 cuft
Drainage area	=	20.780 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	30.00 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

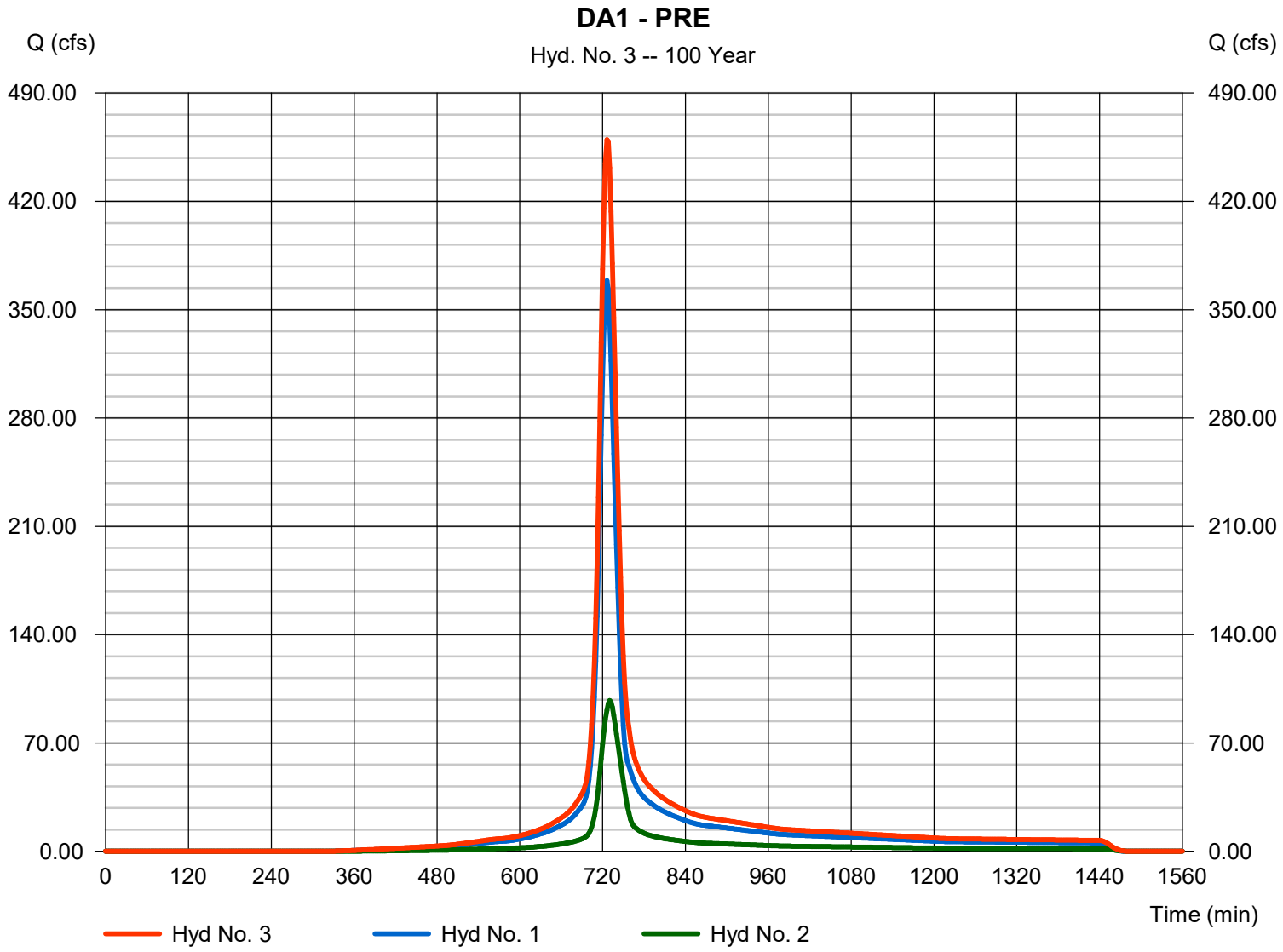


Hydrograph Report

Hyd. No. 3

DA1 - PRE

Hydrograph type	= Combine	Peak discharge	= 459.85 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 1,675,198 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 86.390 ac

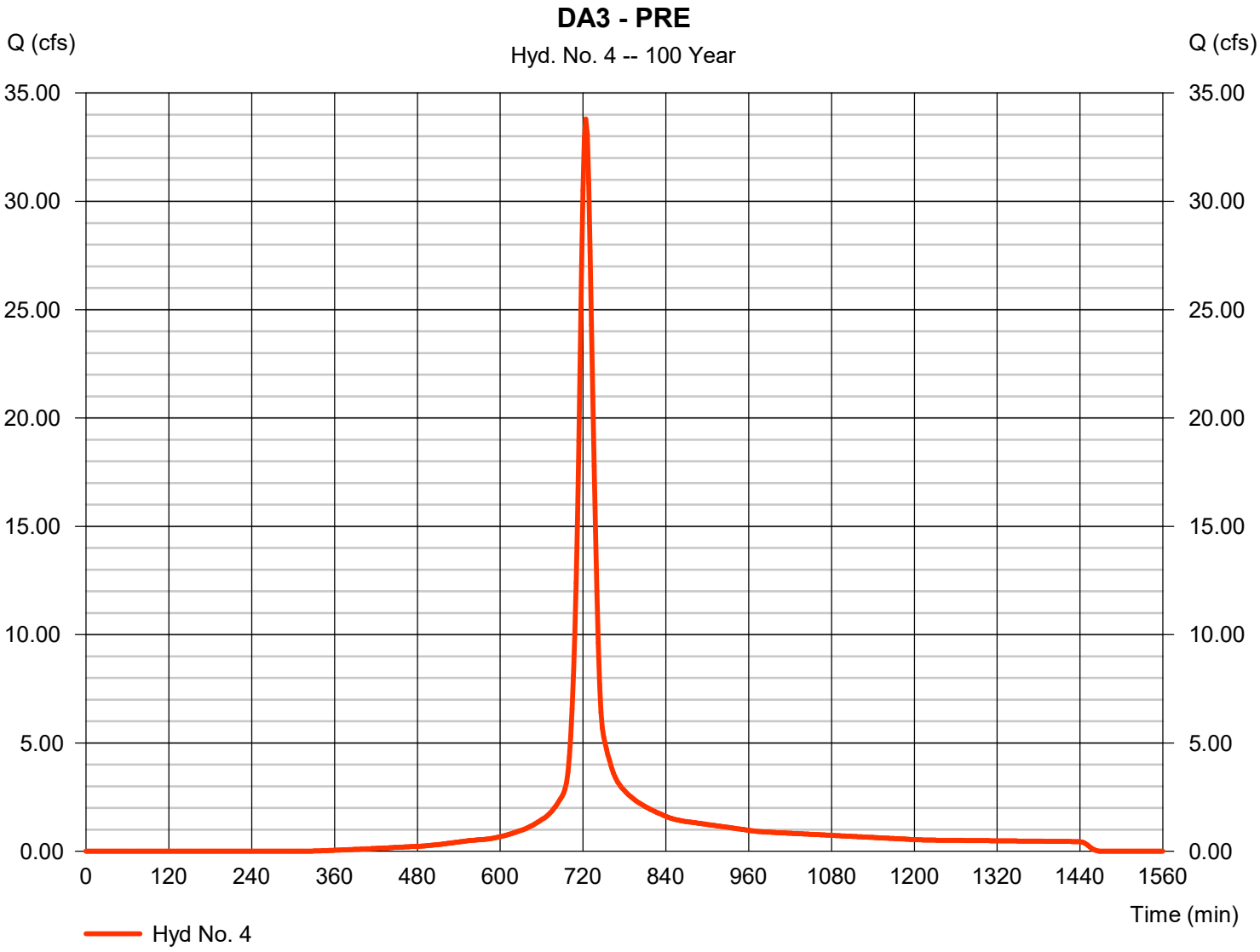


Hydrograph Report

Hyd. No. 4

DA3 - PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	33.80 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	106,922 cuft
Drainage area	=	5.560 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	20.00 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

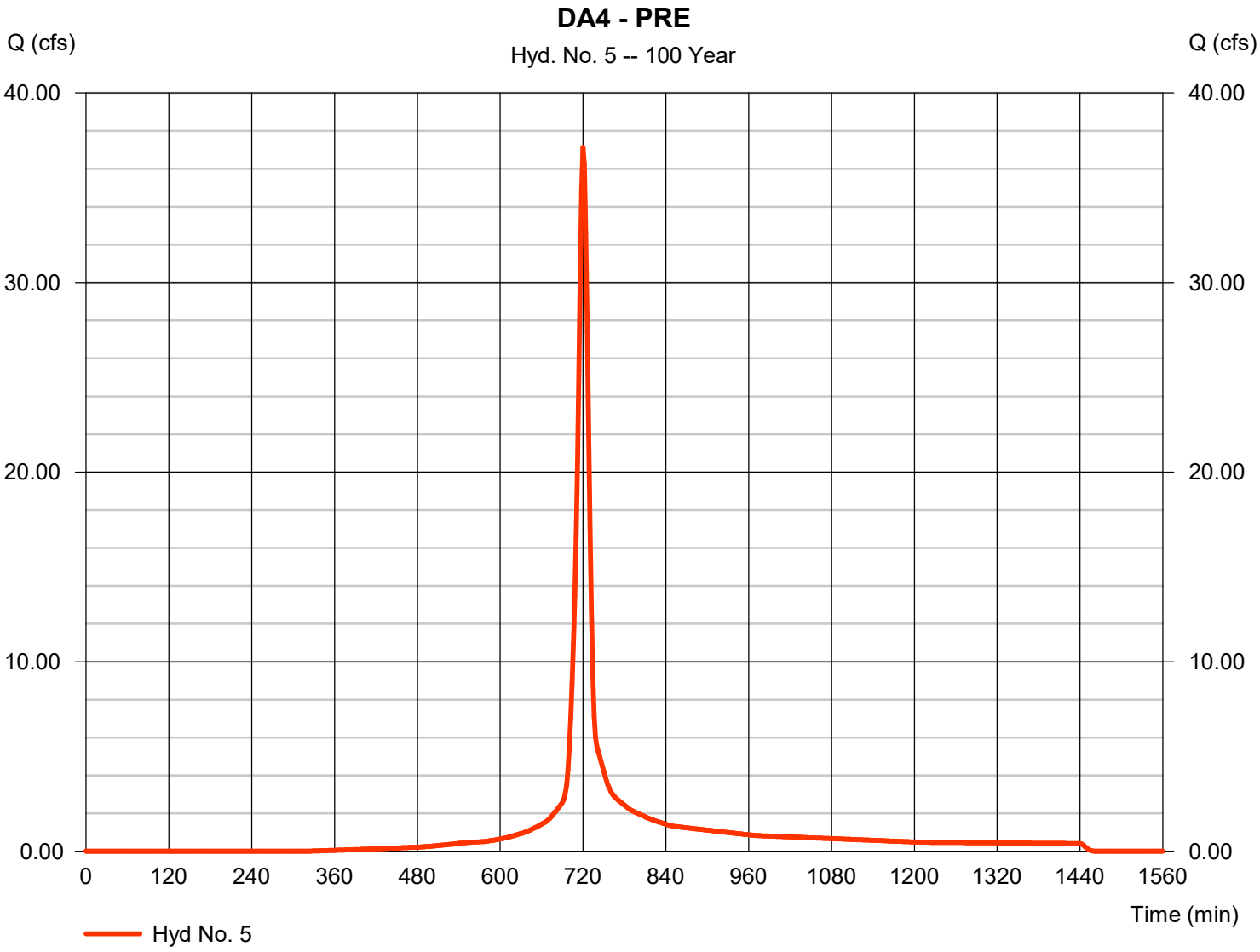


Hydrograph Report

Hyd. No. 5

DA4 - PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	37.13 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	97,968 cuft
Drainage area	=	4.940 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



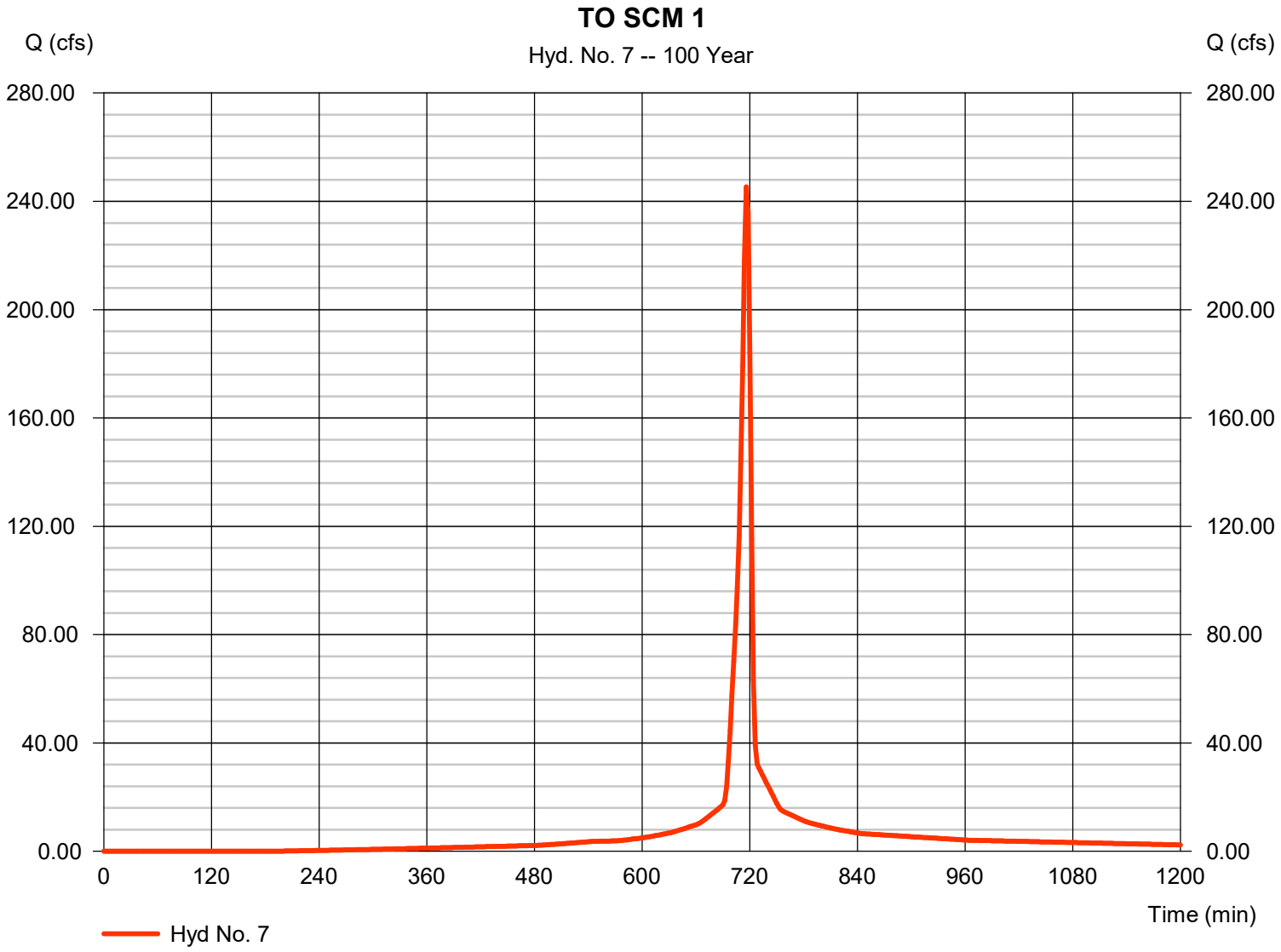
Hydrograph Report

Hyd. No. 7

TO SCM 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	245.29 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	535,449 cuft
Drainage area	=	25.270 ac	Curve number	=	88*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.790 x 98) + (7.460 x 98) + (14.020 x 80)] / 25.270



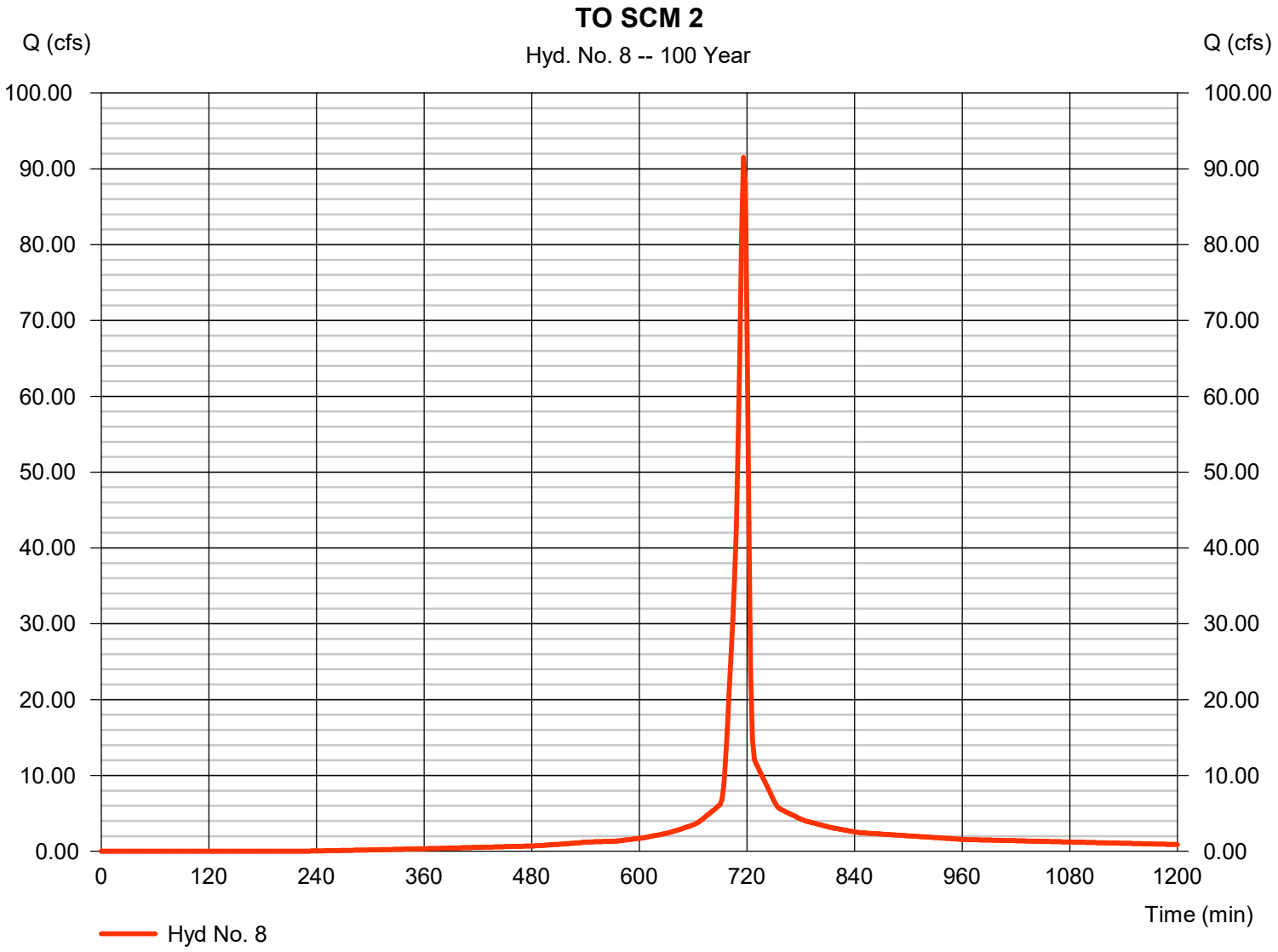
Hydrograph Report

Hyd. No. 8

TO SCM 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	91.51 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	197,000 cuft
Drainage area	=	9.660 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.100 x 98) + (2.090 x 98) + (6.470 x 80)] / 9.660



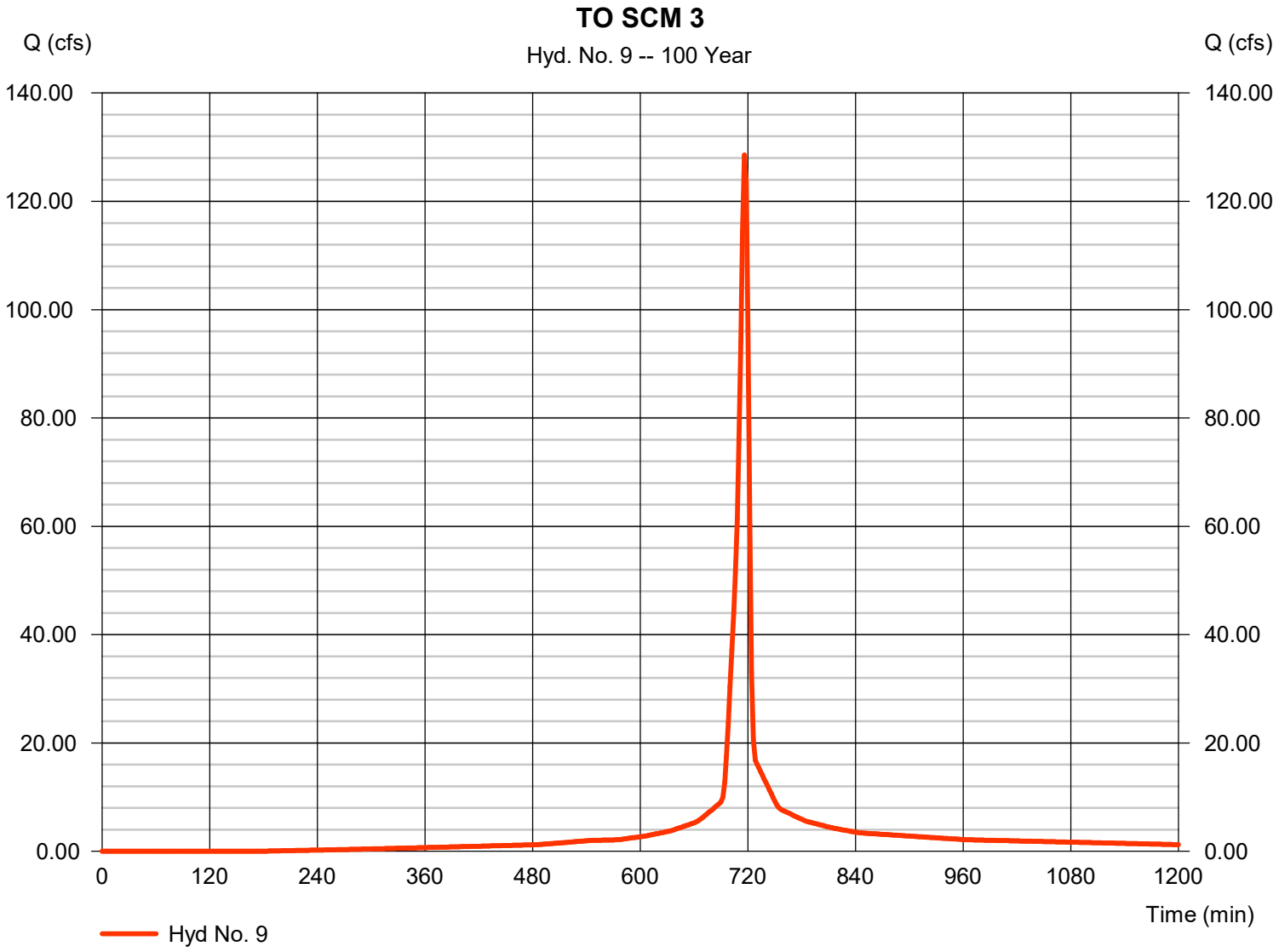
Hydrograph Report

Hyd. No. 9

TO SCM 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	128.57 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	282,807 cuft
Drainage area	=	13.100 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.820 x 98) + (3.860 x 98) + (6.420 x 80)] / 13.100



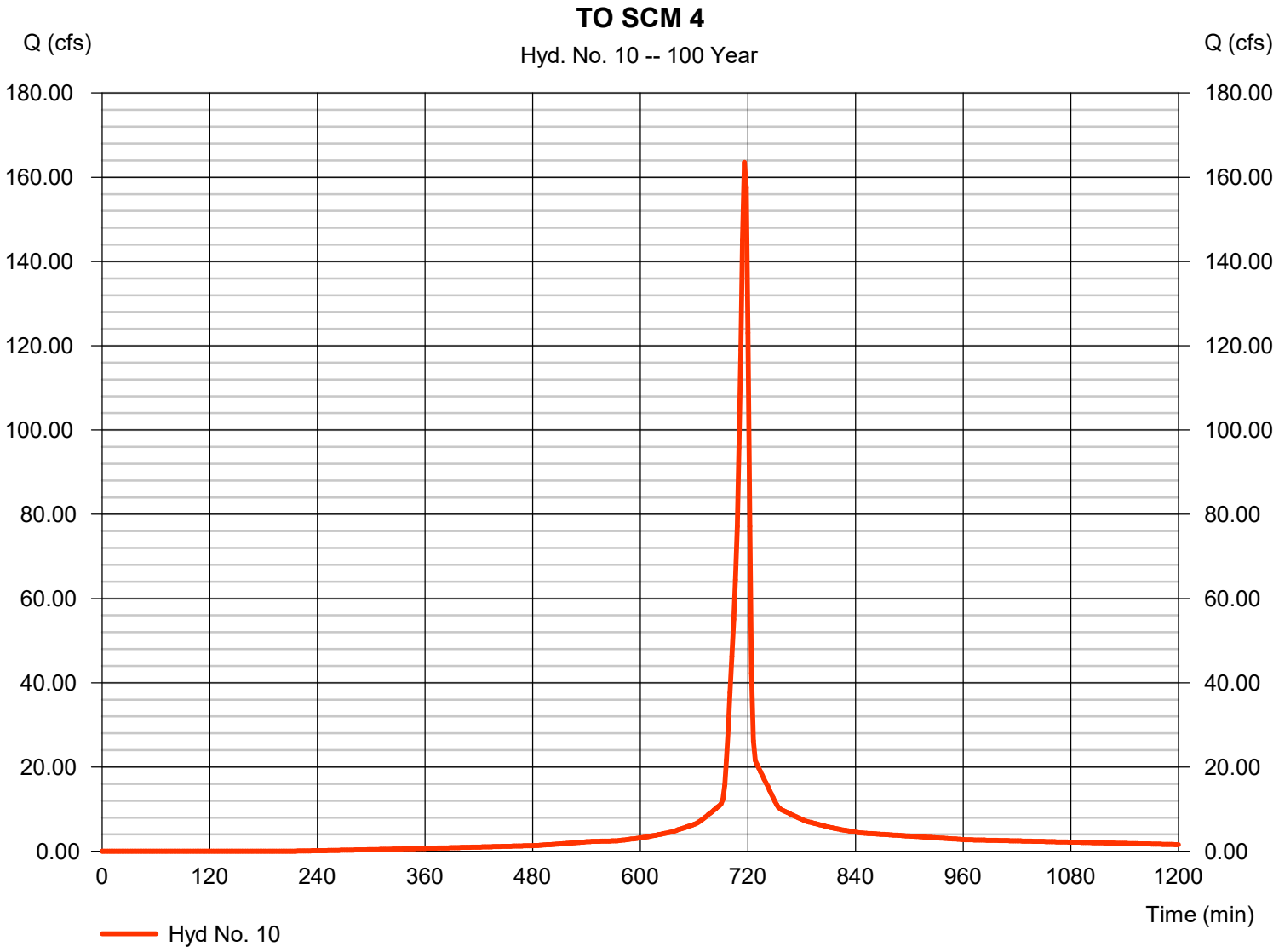
Hydrograph Report

Hyd. No. 10

TO SCM 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	163.56 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	354,483 cuft
Drainage area	=	17.050 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.940 x 98) + (4.220 x 98) + (10.890 x 80)] / 17.050



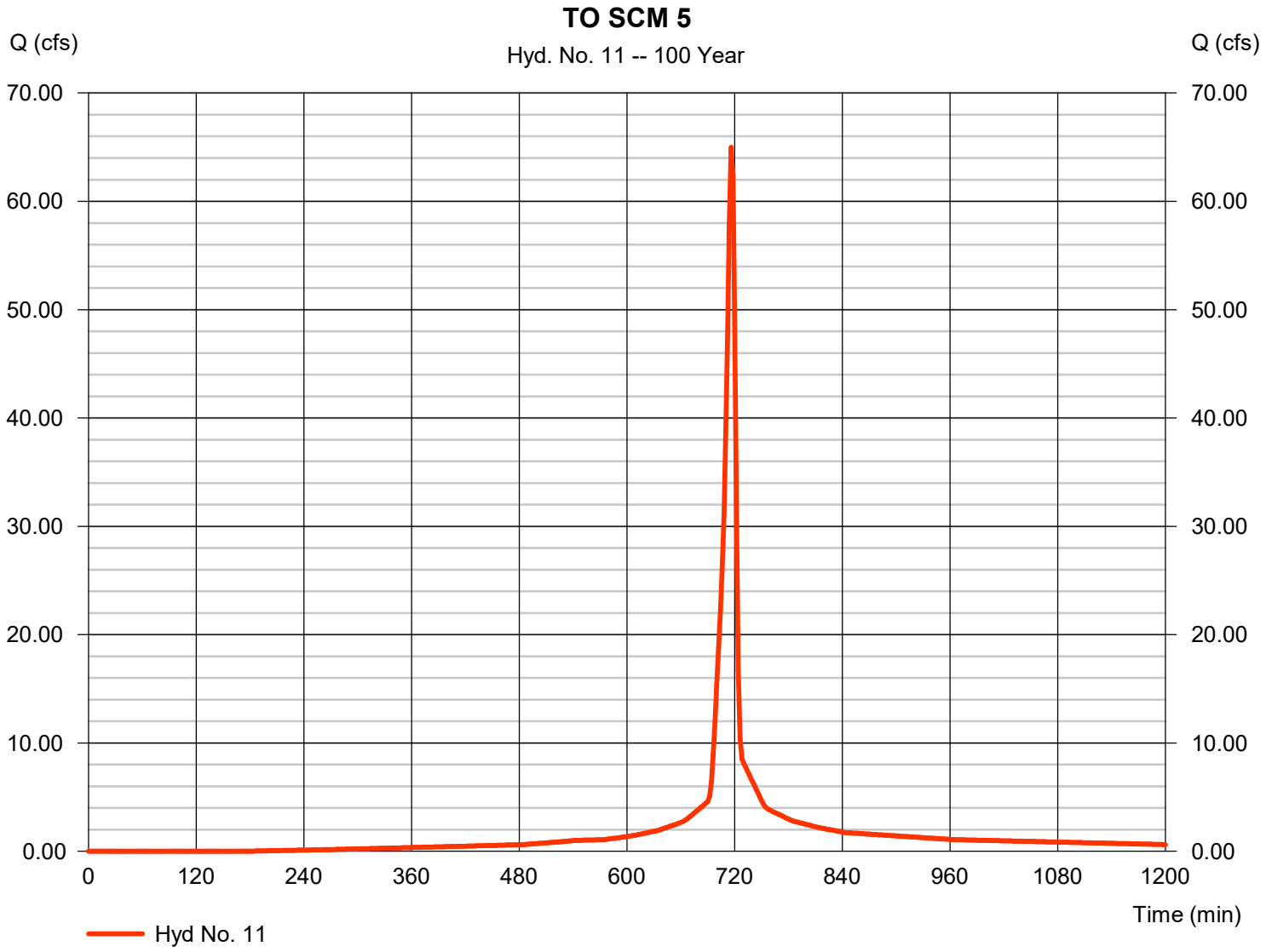
Hydrograph Report

Hyd. No. 11

TO SCM 5

Hydrograph type	=	SCS Runoff	Peak discharge	=	64.97 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	142,915 cuft
Drainage area	=	6.620 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.380 x 98) + (2.000 x 98) + (3.240 x 80)] / 6.620

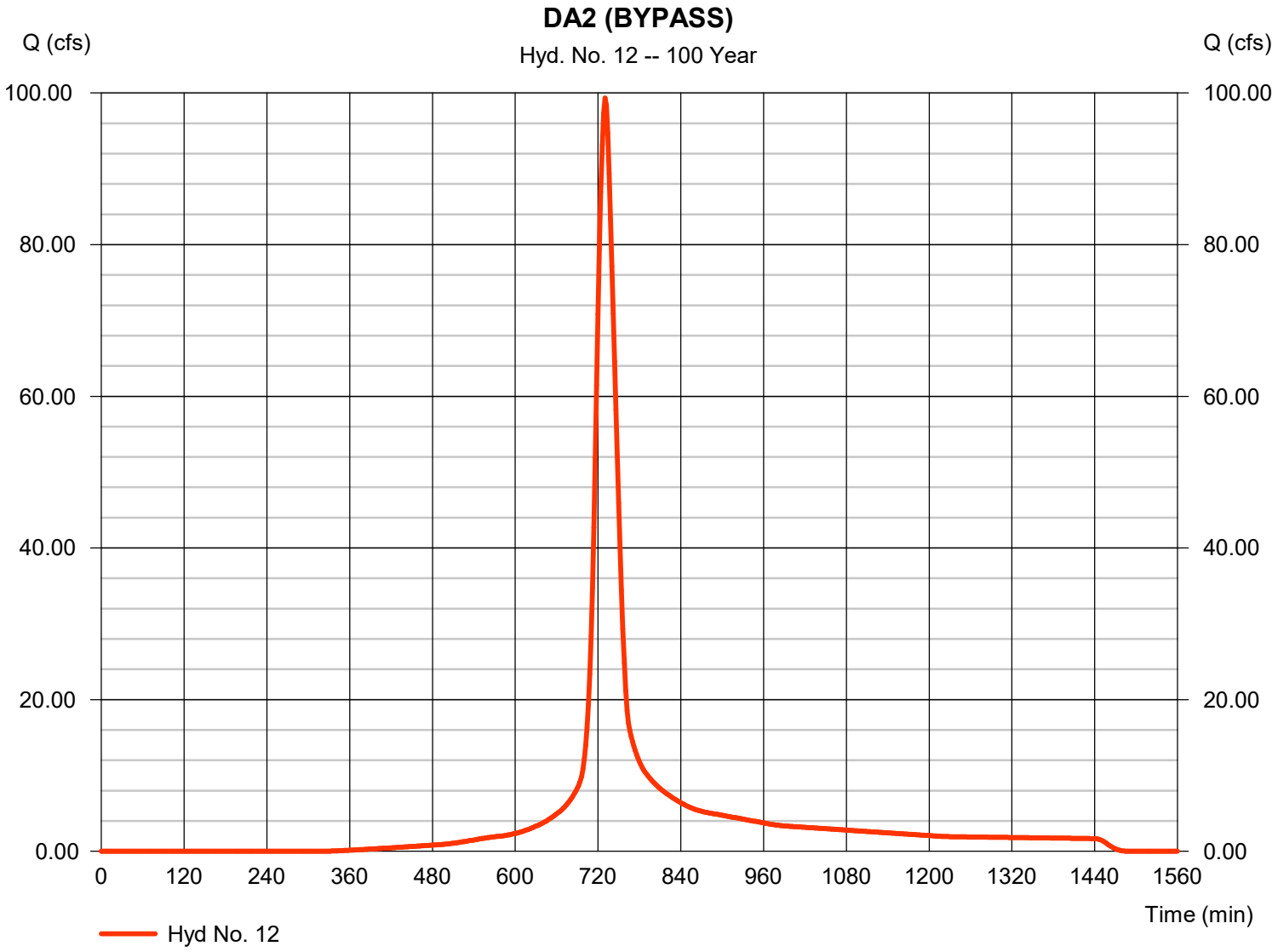


Hydrograph Report

Hyd. No. 12

DA2 (BYPASS)

Hydrograph type	= SCS Runoff	Peak discharge	= 99.33 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 399,610 cuft
Drainage area	= 20.780 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 30.00 min
Total precip.	= 7.65 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



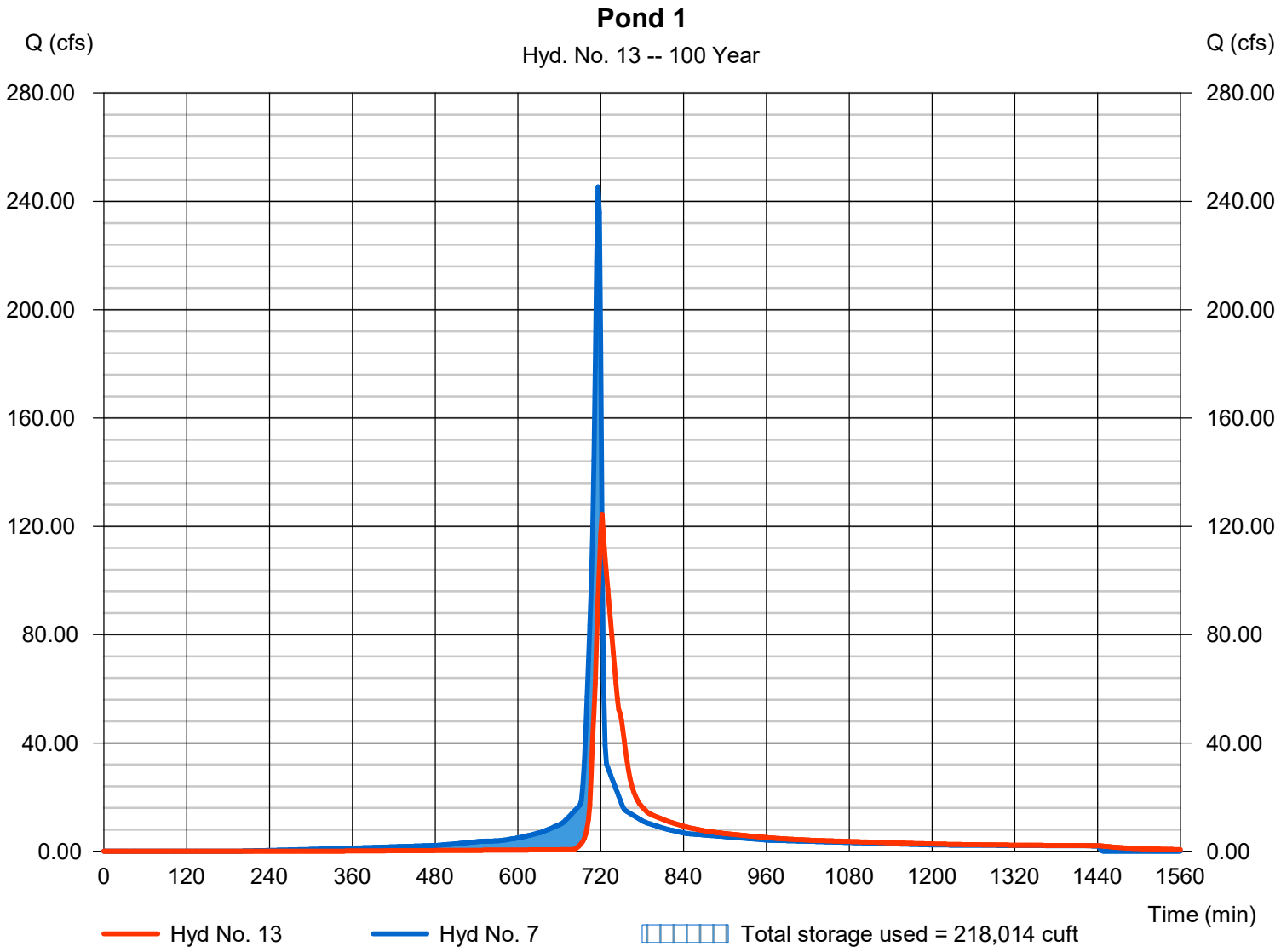
Hydrograph Report

Hyd. No. 13

Pond 1

Hydrograph type	=	Reservoir	Peak discharge	=	124.48 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	532,894 cuft
Inflow hyd. No.	=	7 - TO SCM 1	Max. Elevation	=	375.19 ft
Reservoir name	=	Wet Pond 1	Max. Storage	=	218,014 cuft

Storage Indication method used.



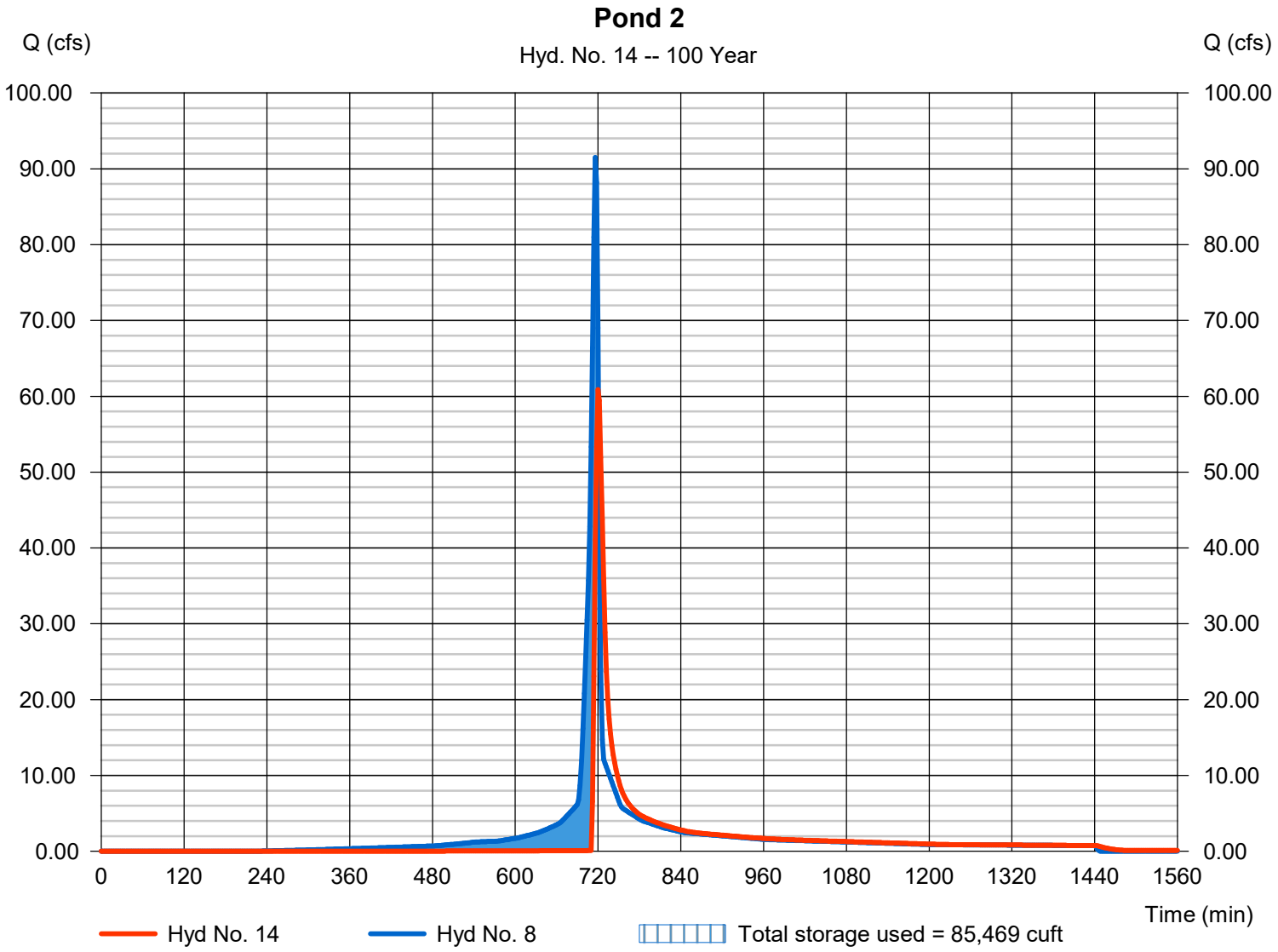
Hydrograph Report

Hyd. No. 14

Pond 2

Hydrograph type	=	Reservoir	Peak discharge	=	60.89 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	162,940 cuft
Inflow hyd. No.	=	8 - TO SCM 2	Max. Elevation	=	385.21 ft
Reservoir name	=	Dry Pond 2	Max. Storage	=	85,469 cuft

Storage Indication method used.



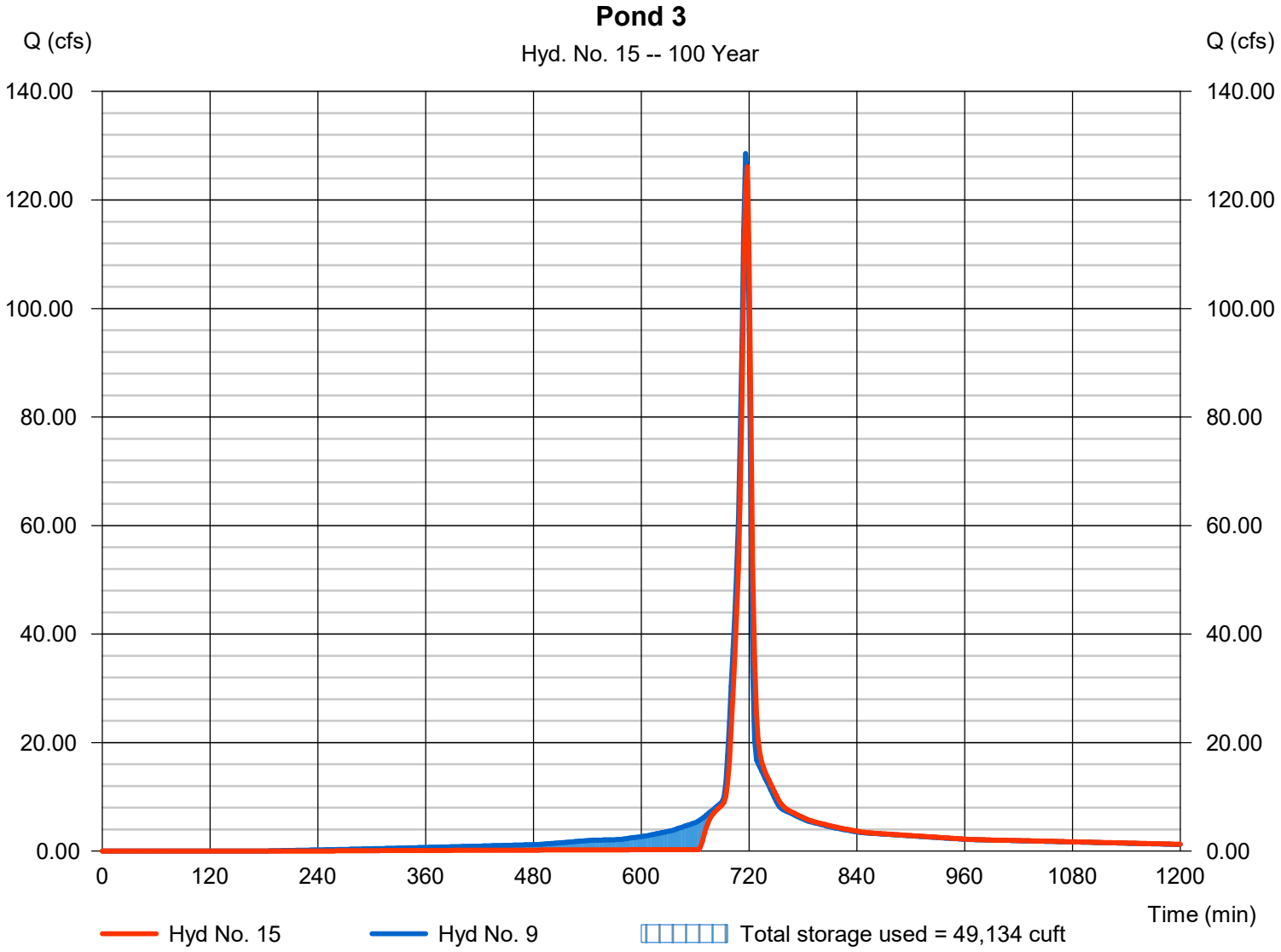
Hydrograph Report

Hyd. No. 15

Pond 3

Hydrograph type	=	Reservoir	Peak discharge	=	126.14 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	282,264 cuft
Inflow hyd. No.	=	9 - TO SCM 3	Max. Elevation	=	350.48 ft
Reservoir name	=	Dry Pond 3	Max. Storage	=	49,134 cuft

Storage Indication method used.



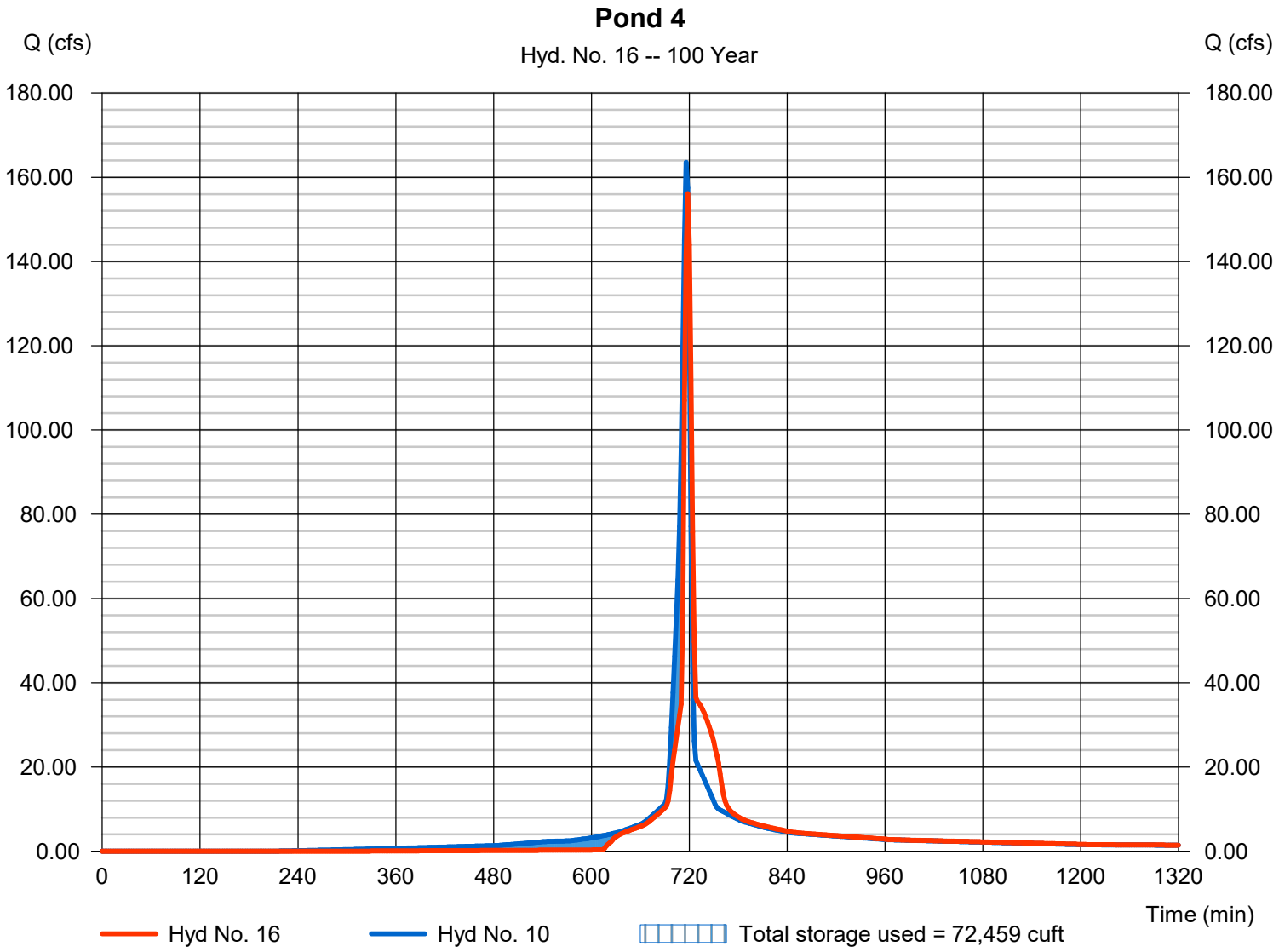
Hydrograph Report

Hyd. No. 16

Pond 4

Hydrograph type	=	Reservoir	Peak discharge	=	156.07 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	354,306 cuft
Inflow hyd. No.	=	10 - TO SCM 4	Max. Elevation	=	373.77 ft
Reservoir name	=	Wet Pond 4	Max. Storage	=	72,459 cuft

Storage Indication method used.



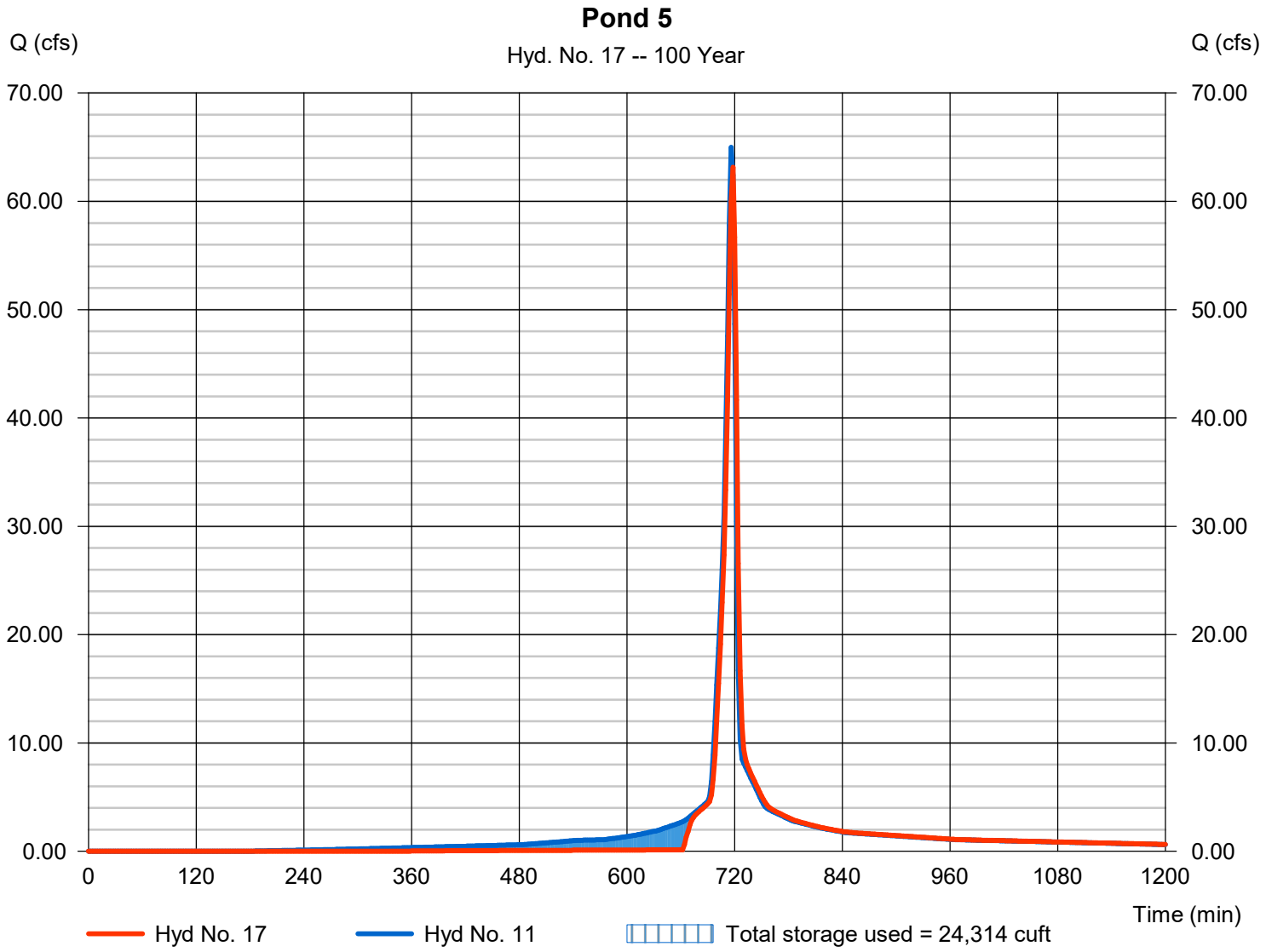
Hydrograph Report

Hyd. No. 17

Pond 5

Hydrograph type	=	Reservoir	Peak discharge	=	63.14 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	141,343 cuft
Inflow hyd. No.	=	11 - TO SCM 5	Max. Elevation	=	354.12 ft
Reservoir name	=	Dry Pond 5	Max. Storage	=	24,314 cuft

Storage Indication method used.

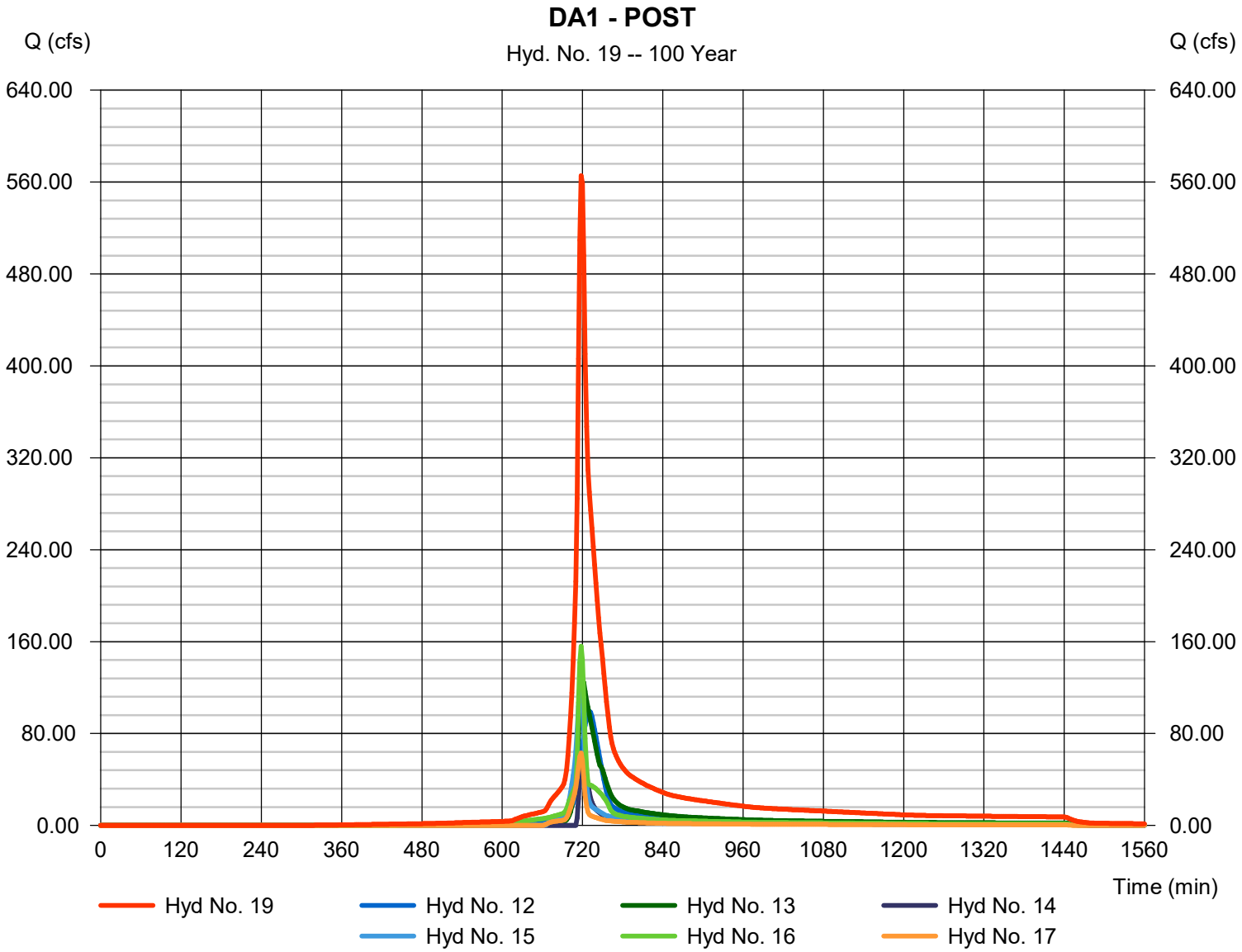


Hydrograph Report

Hyd. No. 19

DA1 - POST

Hydrograph type	= Combine	Peak discharge	= 565.57 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,873,357 cuft
Inflow hyds.	= 12, 13, 14, 15, 16, 17	Contrib. drain. area	= 20.780 ac

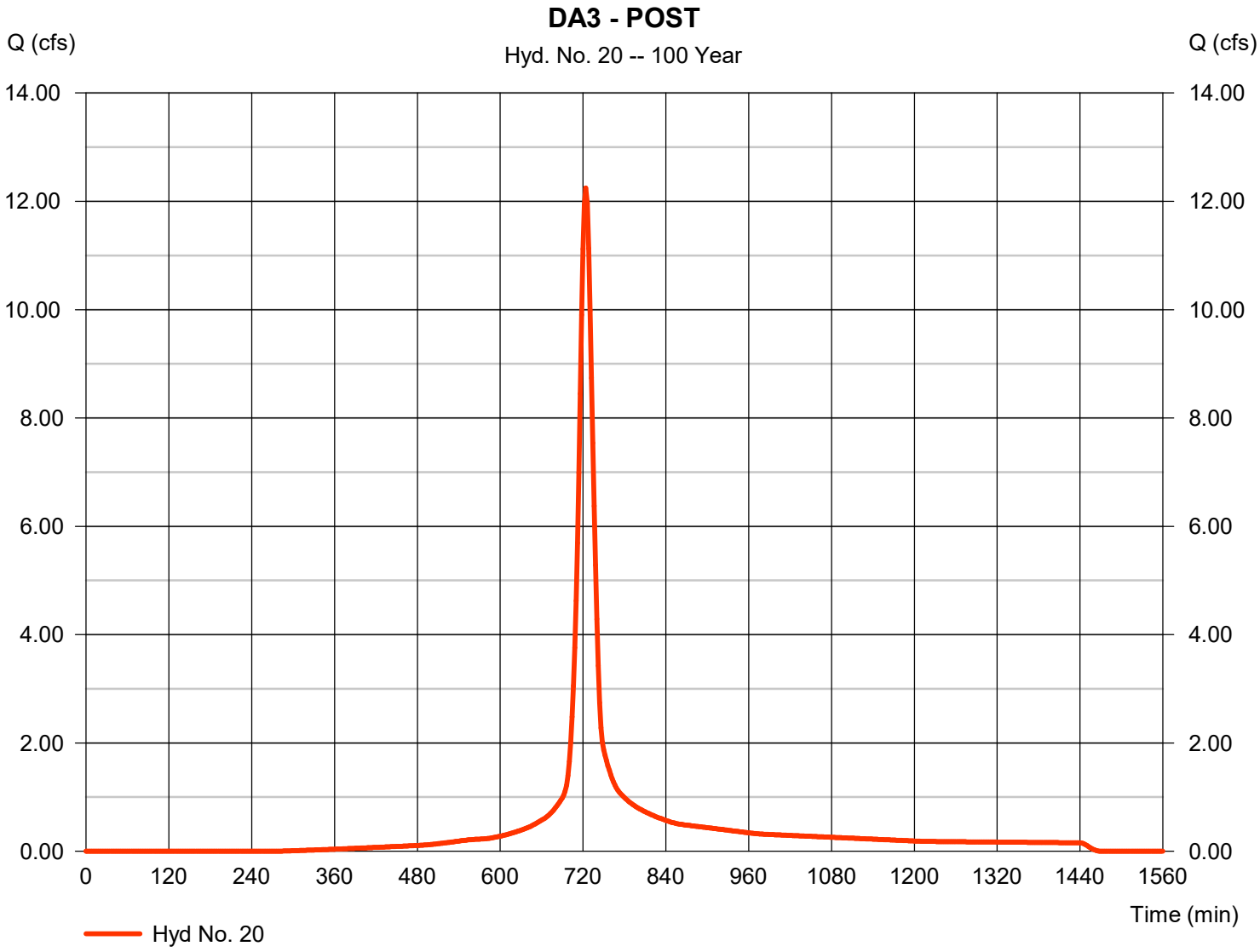


Hydrograph Report

Hyd. No. 20

DA3 - POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.25 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	39,130 cuft
Drainage area	=	1.910 ac	Curve number	=	83
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	19.00 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

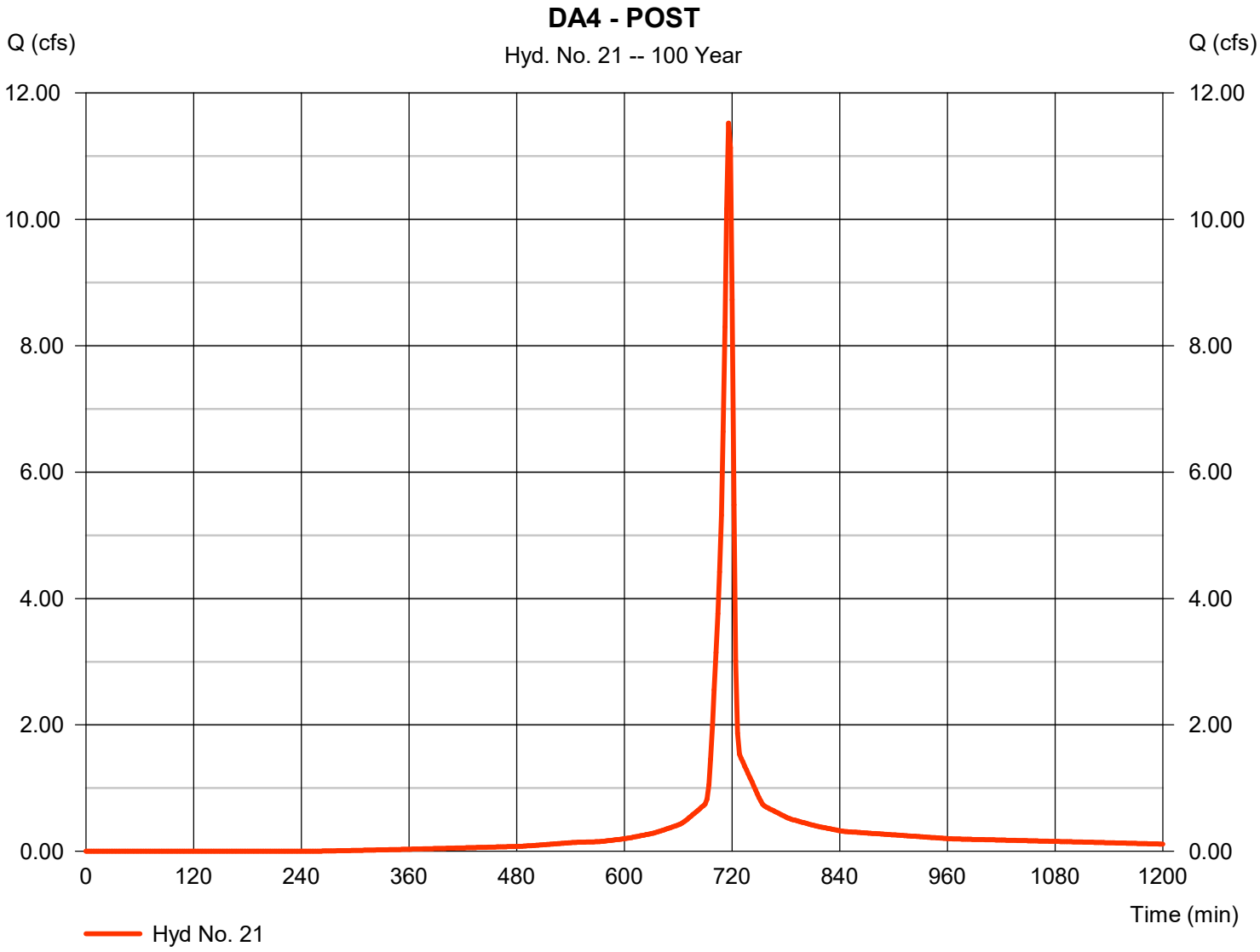


Hydrograph Report

Hyd. No. 21

DA4 - POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.52 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	24,502 cuft
Drainage area	=	1.250 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	59.3109	12.3000	0.8785	--------
2	70.6470	12.8000	0.8790	--------
3	0.0000	0.0000	0.0000	--------
5	0.0000	0.0000	0.0000	--------
10	71.9967	12.5000	0.8049	--------
25	62.3565	11.1000	0.7398	--------
50	0.0000	0.0000	0.0000	--------
100	52.4893	9.2000	0.6566	--------

File name: 43398.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	4.85	3.88	3.25	2.80	2.47	2.21	2.00	1.83	1.69	1.57	1.47	1.38
2	5.62	4.52	3.80	3.29	2.90	2.60	2.36	2.16	2.00	1.86	1.74	1.63
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	7.19	5.87	5.00	4.37	3.89	3.52	3.22	2.97	2.76	2.58	2.43	2.29
25	7.98	6.53	5.58	4.90	4.39	3.99	3.67	3.40	3.17	2.98	2.81	2.66
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	9.19	7.54	6.48	5.73	5.16	4.72	4.36	4.07	3.82	3.60	3.41	3.25

Tc = time in minutes. Values may exceed 60.

Precip. file name: S:\332\43398-Wheeler_Tract\Calc\Stm\1_Hydraflow\43398.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	2.86	3.46	0.00	0.00	5.07	6.05	0.00	7.65
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	0.00	0.00	0.00	0.00	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	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Maps

NOAA Rainfall Data

USGS Map

FEMA FIRM Maps

Wake County 1970 Soil Map

Pre/Post Development Drainage Area Maps

NOAA Atlas 14, Volume 2, Version 3
Location name: Zebulon, North Carolina, USA*
Latitude: 35.8857°, Longitude: -78.4429°
Elevation: 377.03 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	0.404 (0.370-0.442)	0.469 (0.430-0.512)	0.534 (0.489-0.583)	0.600 (0.549-0.655)	0.666 (0.607-0.727)	0.720 (0.652-0.784)	0.767 (0.691-0.835)	0.809 (0.725-0.883)	0.856 (0.760-0.935)	0.898 (0.791-0.983)
10-min	0.645 (0.591-0.706)	0.750 (0.687-0.819)	0.855 (0.783-0.933)	0.960 (0.878-1.05)	1.06 (0.967-1.16)	1.15 (1.04-1.25)	1.22 (1.10-1.33)	1.28 (1.15-1.40)	1.35 (1.20-1.48)	1.41 (1.25-1.55)
15-min	0.806 (0.738-0.883)	0.942 (0.864-1.03)	1.08 (0.991-1.18)	1.21 (1.11-1.32)	1.35 (1.23-1.47)	1.45 (1.32-1.58)	1.54 (1.39-1.68)	1.62 (1.45-1.77)	1.70 (1.51-1.86)	1.78 (1.56-1.94)
30-min	1.11 (1.01-1.21)	1.30 (1.19-1.42)	1.54 (1.41-1.68)	1.76 (1.61-1.92)	1.99 (1.82-2.17)	2.19 (1.98-2.38)	2.36 (2.13-2.57)	2.52 (2.26-2.75)	2.71 (2.41-2.96)	2.88 (2.53-3.15)
60-min	1.38 (1.26-1.51)	1.63 (1.50-1.79)	1.97 (1.81-2.15)	2.29 (2.10-2.50)	2.66 (2.42-2.90)	2.96 (2.69-3.23)	3.25 (2.93-3.54)	3.53 (3.17-3.86)	3.89 (3.46-4.25)	4.20 (3.70-4.59)
2-hr	1.61 (1.46-1.78)	1.92 (1.75-2.10)	2.34 (2.13-2.57)	2.75 (2.49-3.02)	3.24 (2.92-3.54)	3.67 (3.29-4.01)	4.08 (3.64-4.46)	4.51 (3.99-4.93)	5.06 (4.44-5.53)	5.55 (4.83-6.09)
3-hr	1.71 (1.55-1.89)	2.03 (1.86-2.24)	2.49 (2.26-2.74)	2.95 (2.67-3.24)	3.50 (3.16-3.85)	4.00 (3.59-4.39)	4.50 (4.00-4.94)	5.02 (4.43-5.50)	5.72 (4.99-6.27)	6.35 (5.48-6.98)
6-hr	2.05 (1.87-2.26)	2.44 (2.23-2.69)	2.99 (2.72-3.28)	3.54 (3.22-3.89)	4.23 (3.82-4.63)	4.85 (4.36-5.31)	5.48 (4.88-5.98)	6.14 (5.41-6.69)	7.03 (6.12-7.67)	7.86 (6.75-8.59)
12-hr	2.41 (2.21-2.66)	2.87 (2.64-3.15)	3.54 (3.24-3.88)	4.22 (3.85-4.62)	5.07 (4.59-5.54)	5.86 (5.26-6.38)	6.65 (5.92-7.24)	7.51 (6.61-8.16)	8.70 (7.53-9.45)	9.80 (8.36-10.7)
24-hr	2.86 (2.66-3.09)	3.46 (3.22-3.73)	4.36 (4.05-4.70)	5.07 (4.70-5.46)	6.05 (5.59-6.52)	6.83 (6.29-7.36)	7.65 (7.01-8.24)	8.49 (7.76-9.16)	9.66 (8.78-10.4)	10.6 (9.58-11.5)
2-day	3.32 (3.08-3.57)	3.99 (3.72-4.30)	4.99 (4.64-5.38)	5.78 (5.36-6.22)	6.86 (6.34-7.39)	7.72 (7.11-8.31)	8.61 (7.90-9.27)	9.53 (8.71-10.3)	10.8 (9.81-11.7)	11.8 (10.7-12.8)
3-day	3.52 (3.28-3.77)	4.23 (3.94-4.54)	5.26 (4.90-5.64)	6.07 (5.64-6.51)	7.19 (6.66-7.71)	8.08 (7.46-8.67)	9.00 (8.28-9.67)	9.95 (9.12-10.7)	11.3 (10.3-12.1)	12.3 (11.2-13.3)
4-day	3.72 (3.47-3.98)	4.46 (4.17-4.77)	5.52 (5.16-5.90)	6.36 (5.93-6.80)	7.52 (6.98-8.04)	8.45 (7.81-9.03)	9.40 (8.66-10.1)	10.4 (9.53-11.1)	11.7 (10.7-12.6)	12.8 (11.6-13.8)
7-day	4.32 (4.04-4.61)	5.15 (4.82-5.50)	6.30 (5.89-6.72)	7.21 (6.73-7.69)	8.46 (7.87-9.03)	9.46 (8.78-10.1)	10.5 (9.70-11.2)	11.5 (10.6-12.4)	13.0 (11.9-14.0)	14.2 (12.9-15.2)
10-day	4.92 (4.61-5.24)	5.85 (5.49-6.24)	7.06 (6.61-7.52)	8.00 (7.48-8.52)	9.28 (8.66-9.89)	10.3 (9.58-11.0)	11.3 (10.5-12.1)	12.4 (11.4-13.2)	13.8 (12.7-14.8)	14.9 (13.7-16.0)
20-day	6.59 (6.20-7.02)	7.79 (7.33-8.30)	9.24 (8.68-9.83)	10.4 (9.74-11.0)	11.9 (11.2-12.7)	13.2 (12.3-14.0)	14.4 (13.4-15.3)	15.6 (14.5-16.7)	17.4 (16.0-18.6)	18.7 (17.2-20.0)
30-day	8.19 (7.72-8.70)	9.64 (9.09-10.2)	11.2 (10.6-11.9)	12.5 (11.7-13.3)	14.1 (13.3-15.0)	15.4 (14.4-16.4)	16.7 (15.6-17.7)	17.9 (16.7-19.1)	19.6 (18.2-21.0)	20.9 (19.3-22.4)
45-day	10.4 (9.89-11.0)	12.2 (11.6-12.9)	14.0 (13.3-14.8)	15.4 (14.6-16.3)	17.2 (16.3-18.2)	18.6 (17.6-19.7)	20.0 (18.8-21.1)	21.3 (20.0-22.5)	23.1 (21.6-24.5)	24.4 (22.8-25.9)
60-day	12.5 (11.9-13.2)	14.6 (13.9-15.4)	16.6 (15.7-17.4)	18.1 (17.2-19.0)	20.1 (19.0-21.1)	21.5 (20.4-22.7)	22.9 (21.7-24.2)	24.3 (22.9-25.7)	26.1 (24.6-27.7)	27.5 (25.8-29.1)

[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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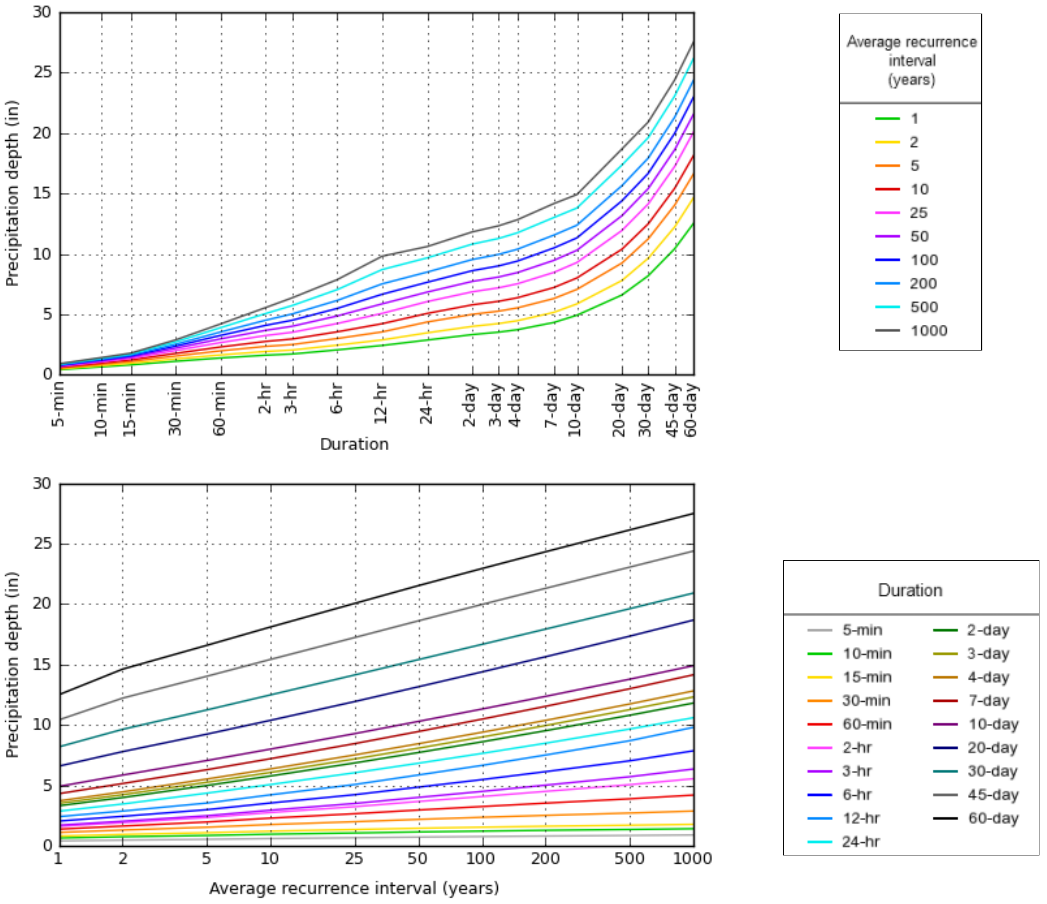
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 35.8857°, Longitude: -78.4429°



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Thu Jan 21 12:15:12 2021

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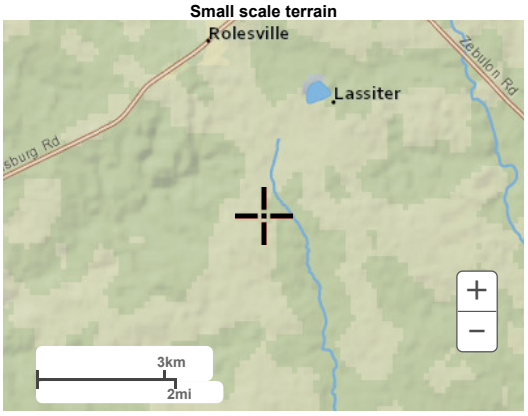
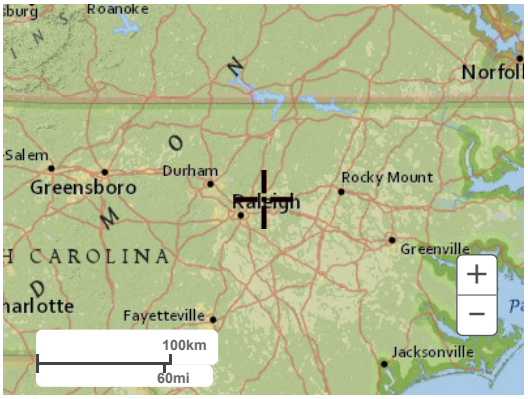
Maps & aerials

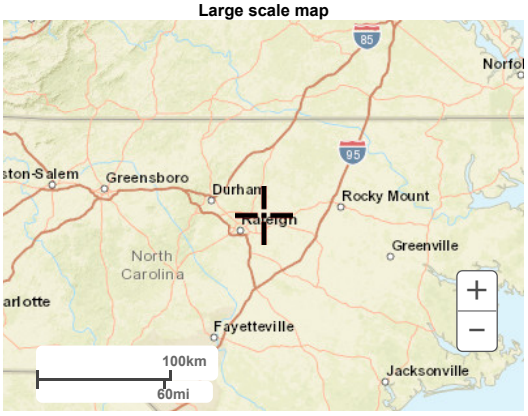
Small scale terrain



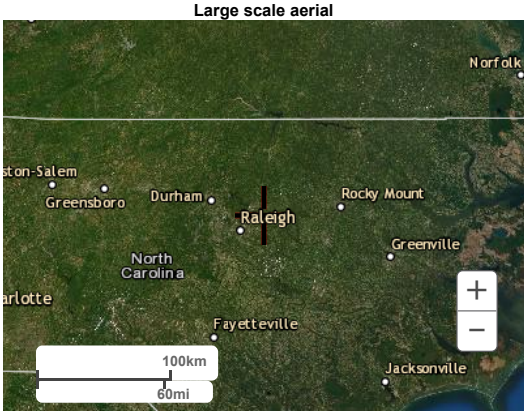
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

ROLESVILLE QUADRANGLE
NORTH CAROLINA
7.5-MINUTE SERIES

SITE

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid: Universal Transverse Mercator, Zone 17S
10 000-foot ticks: North Carolina Coordinate System of 1983

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, June 2014
Roads..... U.S. Census Bureau, 2015 - 2016
Names.....GNIS, 2016
Hydrography.....National Hydrography Dataset, 2014
Contours.....National Elevation Dataset, 2008
Boundaries.....Multiple sources; see metadata file 1972 - 2016

Wetlands.....FWS National Wetlands Inventory 1977 - 2014

UTM GRID AND 2016 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
QV
Grid Zone Designation
17S

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the
National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19

NORTH CAROLINA
QUADRANGLE LOCATION

ADJOINING QUADRANGLES
1 Grissom
2 Franklinton
3 Louisburg
4 Wake Forest
5 Bunn West
6 Raleigh East
7 Knightdale
8 Zebulon

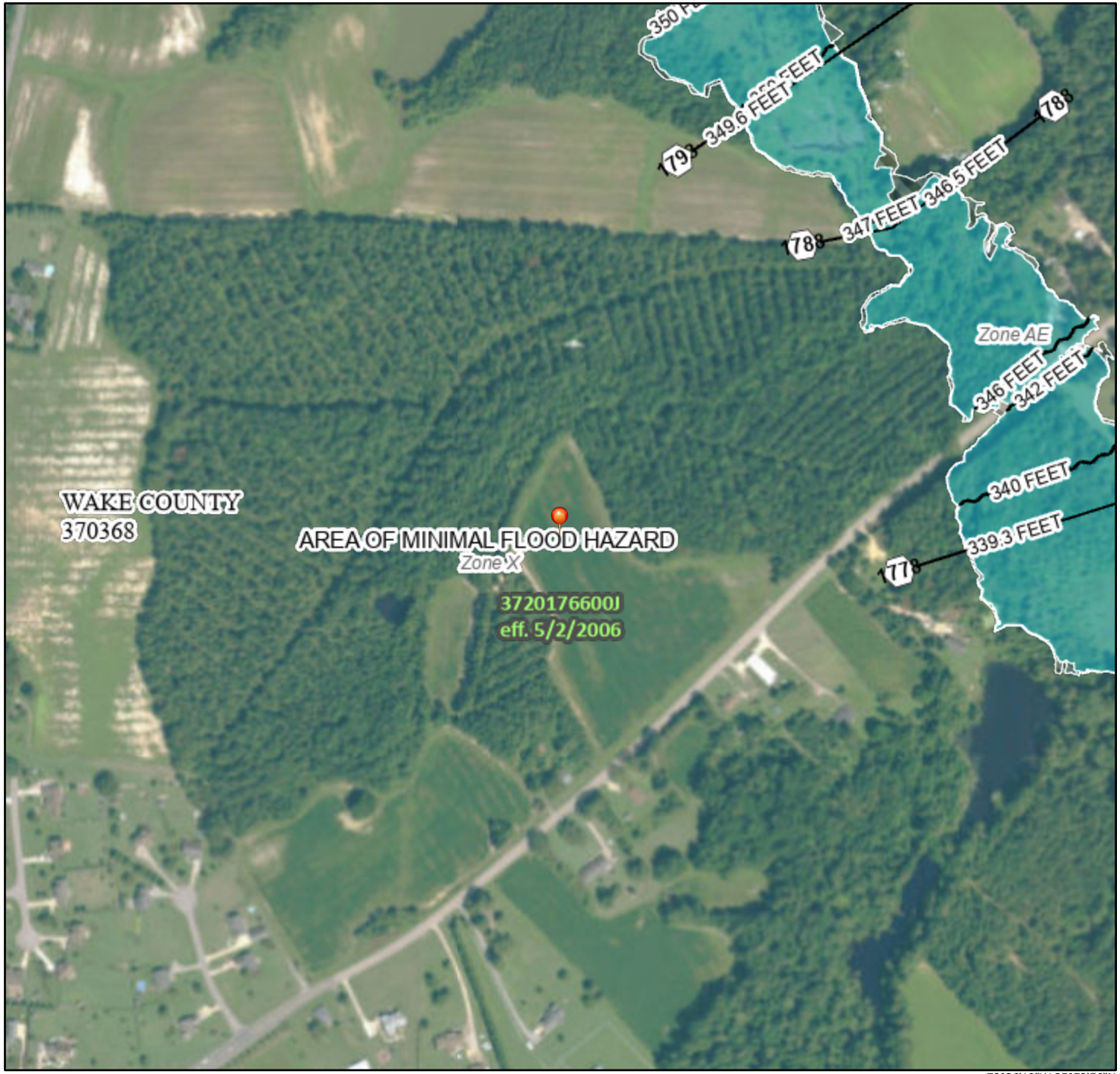
ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

ROLESVILLE, NC
2016

NSN 7643016379170
NGA REF NO. USGSX24K38453

National Flood Hazard Layer FIRMette

78°26'48"W 35°53'25"N



78°26'10"W 35°52'56"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/15/2021 at 7:32 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

WAKE COUNTY, NORTH CAROLINA — SHEET NUMBER 32

32

N

1 Mile

5000 Feet

Scale 1:15840

(Joins sheet 23)

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 42)

SITE AREA

Fowlers Crossroads

Penny Hill Lake

Fowler Creek

Buffalo Creek

Perrys Pond

Hominy Creek

PRE-DEVELOPMENT DRAINAGE AREAS

WHEELER TRACT - July 12, 2021

0 150 300 Feet

TIMMONS GROUP

S:\332-43398-Wheeler_Tract\DWG\Sheet\Exhibit\43398-332C-EX-HYDR-PRE.dwg | Plotted on 7/12/2021 4:01 PM | by April Blye

POST-DEVELOPMENT DRAINAGE AREAS

WHEELER TRACT - July 12, 2021

0 150 300
Feet

TIMMONS GROUP