

STORMWATER REPORT

410 Main Street

West Orange

Block 113, Lots 262, 263, 264 & 308

PREPARED BY:

SMBT CONSULTANTS LLC



August 23, 2024

Ali Rangwala, P.E.
NJ License No. GE53255

A. SCOPE OF REPORT:

The purpose of this report is to present the analysis performed in support of the stormwater management design for the proposed building to be constructed on a 0.274 acres parcel of land located at Block 113, Lots 262, 263, 264 & 308 in West Orange, Essex County, New Jersey. This site has a frontage on Main Street. This report has been prepared in accordance with the requirements of the New Jersey Residential Site Improvements Standards (N.J.A.C. 5:21-7), New Jersey Department of Environmental Protection Stormwater Regulations (NJDEP 7:8) and Township of West Orange local ordinances.

B. PROJECT INFORMATION:

The applicant has applied to the Township of West Orange to construct a 3-story building with car parking at first floor & associated walkways. The project will disturb approximately 0.274 acres, of which approximately 0.233 acres will be used for the proposed impervious improvement including proposed building, sidewalk, and driveway. For the purpose of this report, approximately 0.274 acres considered as tributary will be considered for drainage calculations as shown in the attached "Drainage Area Map" (Exhibit 2).

C. DESIGN CRITERIA:

1. Runoff Rate: The stormwater analysis described herein has been performed in accordance with Urban Hydrology for Small Watersheds (Technical Release 55), dated June 1986. The Pre and Post development runoff rates and volumes used in the design were calculated using computer software program Hydraflow Hydrographs Extensions of AutoCAD Civil 3D Version 2024. This program incorporates the methodology used in SCS TR-20 and TR-55 to compute and route flow hydrographs.
2. The proposed Subsurface Infiltration Basin is designed as per New Jersey Stormwater Best Management Practices Manual, Chapter 10.2. The basin is designed to temporarily accommodate the increased runoff volume from post development conditions and make sure the post-development discharge does not exceed the pre-development discharge value for 2, 10, and 100-year storm events.
3. The proposed Subsurface Infiltration Basin is designed as per Township of West Orange section §25-29.4.Q water quality standards.

D. PRE-DEVELOPMENT CONDITION:

The general topography of the site is characterized by a southerly slope. The highest elevation on the drainage area is approximately 258.01 feet and is in the location of the Northwest corner of the site. Therefore, runoff from the site generally drains to the south towards front of the site.

The drainage area in the existing conditions was calculated using the Topographic Survey prepared by Allstate Mapping & Layout company dated December 5, 2023.

The drainage area in the existing conditions was divided in two categories as follows:

1. Open Space (Grass good condition, hydrologic soil group C). CN value = 79, area = 0.19 Ac
2. Existing Impervious surface (driveway, walkways, ex. building). CN value = 98, area = 0.084 Ac

Weighted CN value for whole drainage area = 84.82

The peak discharge and runoff volume calculated from the existing drainage area is as indicated in Table No. 1.

Table No. 1							
Summary of Pre-Development Condition							
(See Exhibit 1 for Stormwater Modeling Report)							
Drainage	Area (ac)	Peak Discharge (cfs)			Runoff Volume (cu ft)		
Area		2-Year	10- Year	100- Year	2-Year	10- Year	100- Year
Combined, CN=84.8	0.274	0.637	1.156	2.183	1,963	3,615	7,023

E. POST-DEVELOPMENT CONDITION:

The drainage area in the proposed conditions was divided in three catch basins:

Basin 1 has categories as follows:

1. Proposed impervious surface (building & walkways). CN value = 98, area = 0.2217 Ac
2. Open Space (Grass good condition, hydrologic soil group C). CN value = 79, area = 0.19 Ac

Weighted CN value for whole drainage area = 96

Basin 2 has categories as follows:

1. Open Space (grass good condition, hydrologic soil group C). CN value = 79, area = 0.0226 Ac
2. Proposed impervious surface (walkway). CN value = 98, area = 0.0099 Ac

Weighted CN value for whole drainage area = 84.8

Basin 3 has categories as follows:

1. Open Space (Grass good condition, hydrologic soil group C). CN value = 79, area = 0.0027 Ac

Total runoff from the proposed improvements will increase due to the increase of proposed impervious surfaces which will replace the existing grass area. The runoff from walkway and lawn areas will be intercepted by catch basins, which is connected to the proposed underground detention system with HDPE storm drains. Runoff from roof drain system will also be directed to the proposed underground detention system. Runoff from Basin 2 & Basin 3 will overflow outside the site.

The peak discharge calculated from the Post-Development drainage area is as indicated in Table No. 2

Table No. 2							
Summary of Post-Development Condition							
(See Exhibit 1 for Stormwater Modeling Report)							
Drainage	Area (ac)	Peak Discharge (cfs)			Runoff Volume (cu ft)		
Area		2-Year	10- Year	100- Year	2-Year	10- Year	100- Year
Basin 1, CN = 96	0.2479	0.843	1.317	2.231	2,477	3,974	6,907
Basin 2, CN = 84.8	0.0325	0.065	0.111	0.200	179	313	583
Basin 3, CN = 79	0.0027	0.005	0.010	0.020	13.6	27.1	56

This increased runoff volume from proposed conditions will be temporarily stored in an underground detention SYSTEM which has an outlet drainage pipe draining into the existing catch basin which is located on Park Drive N.

F. WATER QUALITY VOLUME

According to 25-29.4.Q, water quality volume should be calculated for proposed net increase of motor vehicle surface. Since the proposed parking area will be located on the first floor of the proposed building, which is a covered driveway, and new driveway is much smaller than existing (in pre-development conditions), no increase in motor vehicle surface will be provided with new development.

G. UNDERGROUND DETENSION SYSTEM DESIGN:

The underground detention system is designed to temporarily store the increased runoff from proposed conditions of Basin 1 and making sure that total post-development peak discharge is equal to or less than the pre-development peak discharge. Detention system will be constructed using Stormtech SC-310 chambers. Below are the design metrics of the detention system:

Chamber Model -	SC-310	
Units -	Imperial	
Number of Chambers -	24	
Number of End Caps -	12	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	240.70	ft
Amount of Stone Above Chambers -	12	in
Amount of Stone Below Chambers -	18	in
Area of system -	541	sf

- Outlet Structure:
 - 2x9 INCH.ORIFICE HOLE @ I.E.:243.36
 - 2x9 INCH.ORIFICE HOLE @ I.E.:242.95
 - 5 DIA.ORIFICE HOLE @ I.E.:242.20

Refer to the attached Exhibit 1 – Stormwater Modeling Report and Sheet 7 – Stormwater management plan for design details of the proposed detention system.

Table No. 3			
Comparison of Peak Discharge			
(See Exhibit 1 for Stormwater Modeling Report)			
	Peak Discharge (cfs)		
	2-Year	10-Year	100-Year
Existing Condition	0.637	1.156	2.183
Proposed Condition (Discharge from Detention System + Basin 2 & 3)	0.546	1.063	2.081

H. CONCLUSIONS

The proposed underground detention system as described herein will meet the design objectives set forth in Section C above. As indicated in Table No. 3 above, the discharge from the site in proposed conditions is less than discharge in existing condition for each of the 2, 10, and 100-year rainfall events.

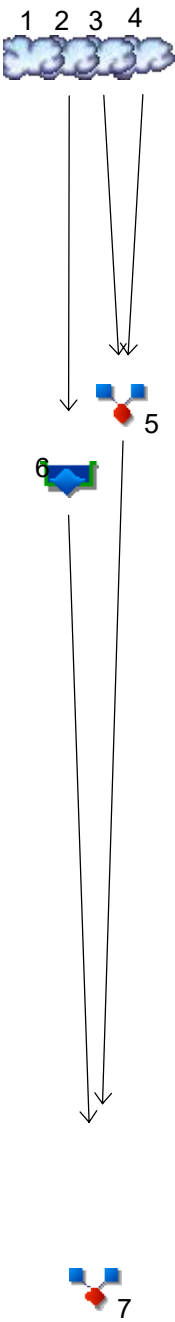
It is my professional opinion that the proposed BMP improvements to the site can be constructed without negatively impacting the offsite drainage.

EXHIBIT 1

**Stormwater Modeling Report prepared using
Hydraflow Hydrograph Extension for
Autodesk Civil 3D Ver 2021**

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024



Legend

Hyd.	Origin	Description
1	SCS Runoff	EX-1
2	SCS Runoff	BASIN 1
3	SCS Runoff	BASIN 2
4	SCS Runoff	BASIN 3
5	Combine	BASIN 2 & 3
6	Reservoir	CHAMBERS
7	Combine	TOTAL POST

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.637	1	725	1,963	-----	-----	-----	EX-1
2	SCS Runoff	0.843	1	722	2,477	-----	-----	-----	BASIN 1
3	SCS Runoff	0.065	1	722	179	-----	-----	-----	BASIN 2
4	SCS Runoff	0.005	1	722	14	-----	-----	-----	BASIN 3
5	Combine	0.070	1	722	193	3, 4	-----	-----	BASIN 2 & 3
6	Reservoir	0.500	1	726	2,349	2	100.77	455	CHAMBERS
7	Combine	0.546	1	726	2,542	5, 6	-----	-----	TOTAL POST
PRE & POST FINALLY.gpw					Return Period: 2 Year			Wednesday, 06 / 5 / 2024	

Hydrograph Report

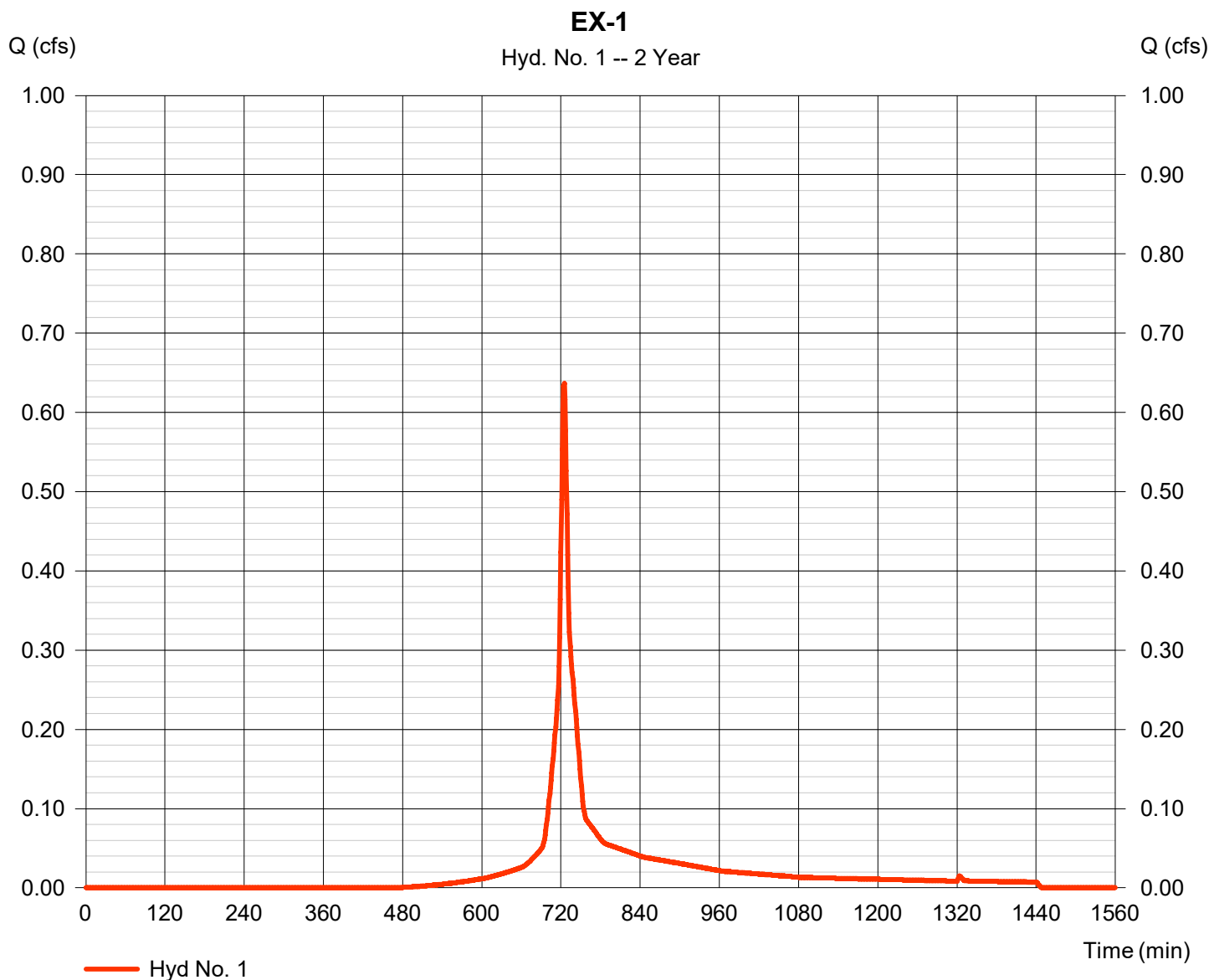
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Wednesday, 06 / 5 / 2024

Hyd. No. 1

EX-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.637 cfs
Storm frequency	= 2 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 1,963 cuft
Drainage area	= 0.274 ac	Curve number	= 84.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.50 min
Total precip.	= 3.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

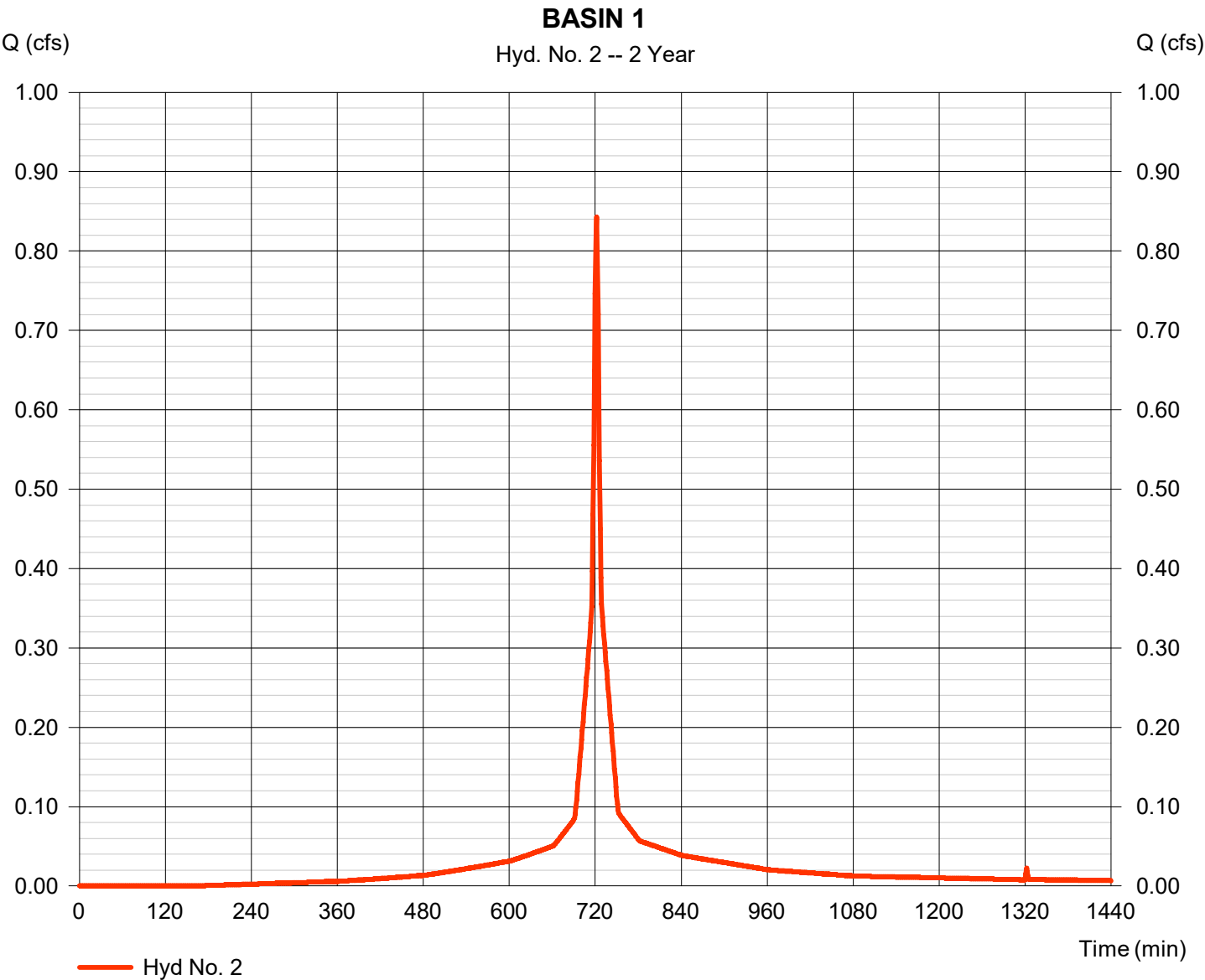


Hydrograph Report

Hyd. No. 2

BASIN 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.843 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 1 min	Hyd. volume	= 2,477 cuft
Drainage area	= 0.248 ac	Curve number	= 95.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 2.00 min
Total precip.	= 3.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

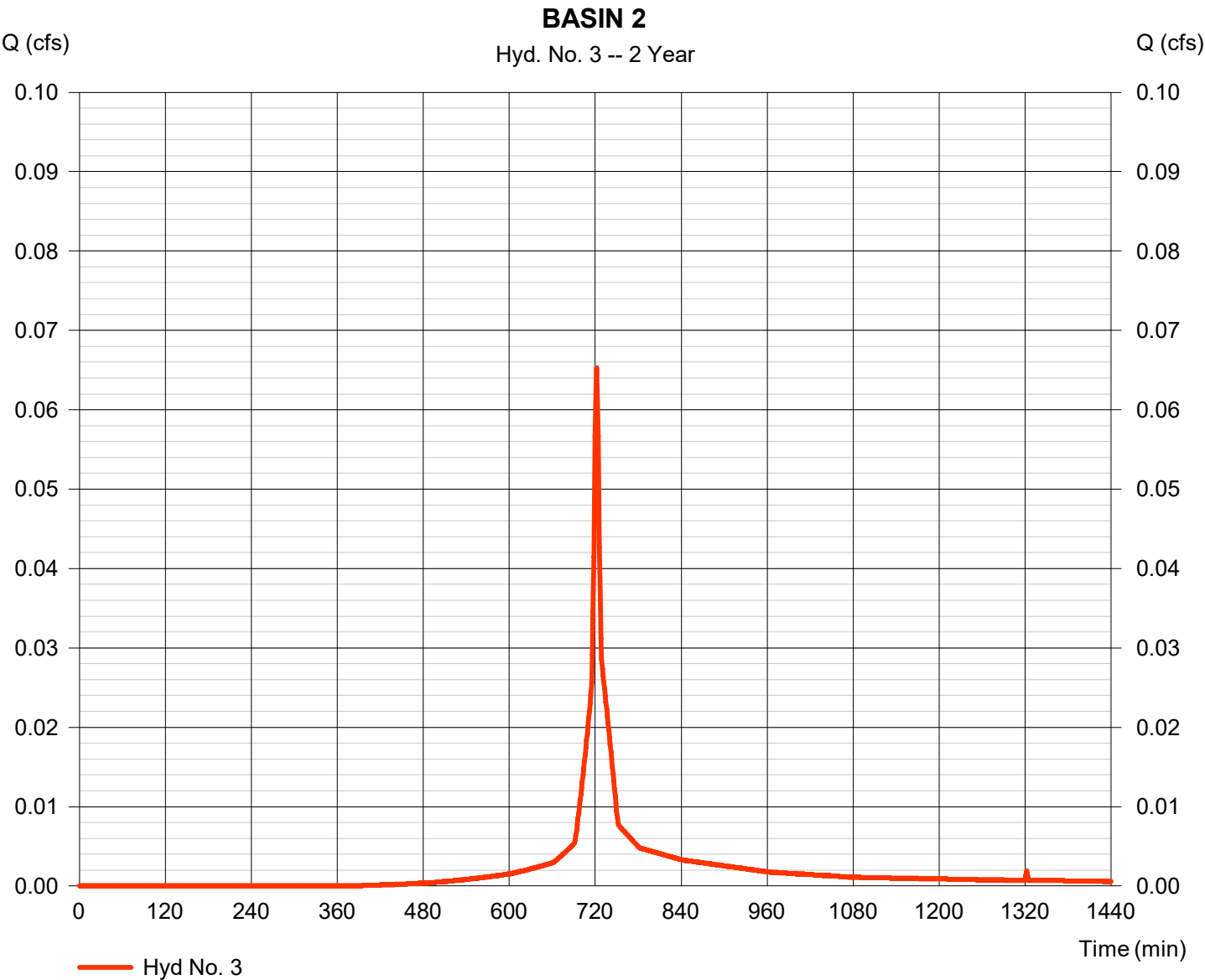


Hydrograph Report

Hyd. No. 3

BASIN 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.065 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	1 min	Hyd. volume	=	179 cuft
Drainage area	=	0.023 ac	Curve number	=	88.9
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	2.00 min
Total precip.	=	3.40 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

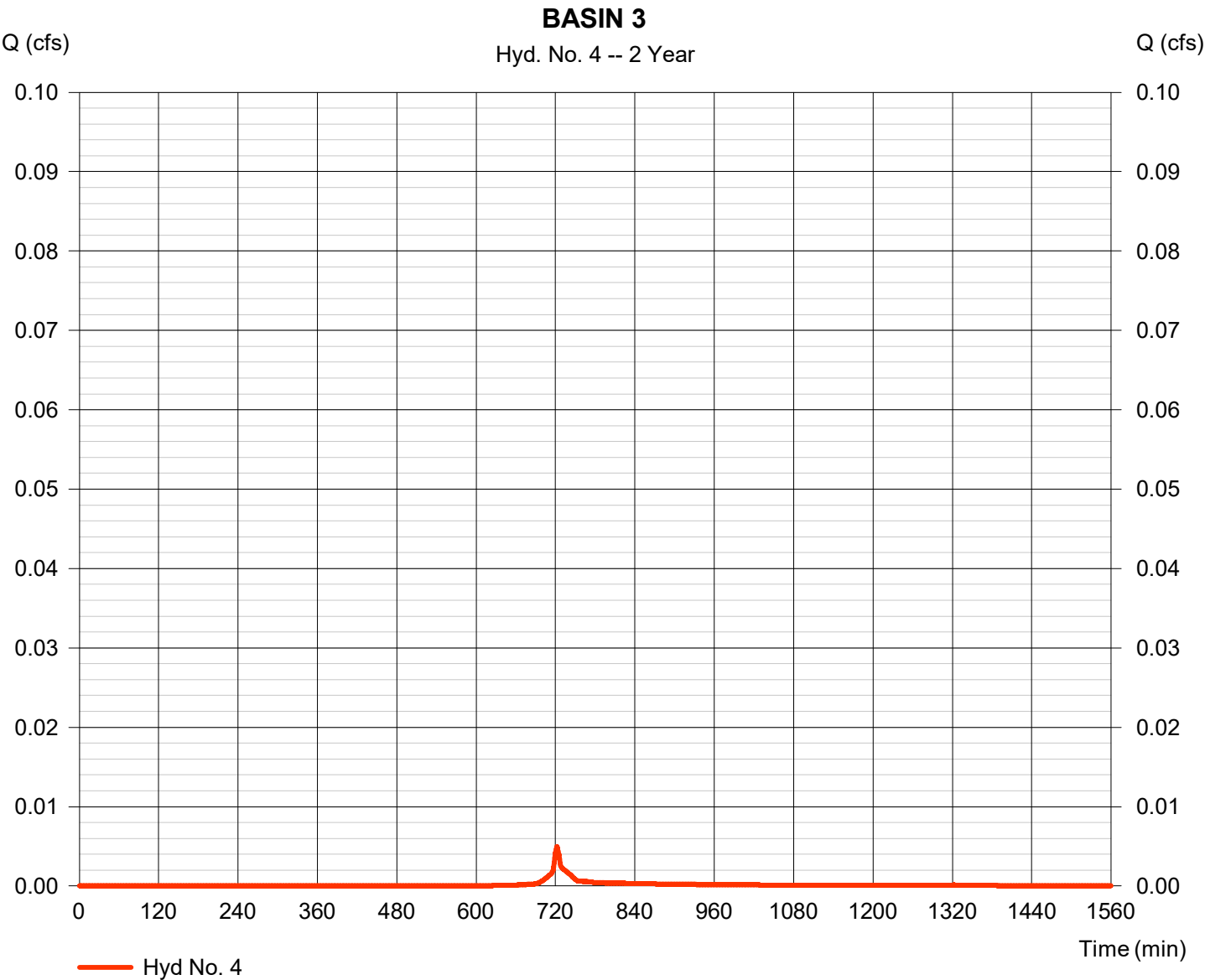


Hydrograph Report

Hyd. No. 4

BASIN 3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.005 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 1 min	Hyd. volume	= 14 cuft
Drainage area	= 0.003 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 2.00 min
Total precip.	= 3.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

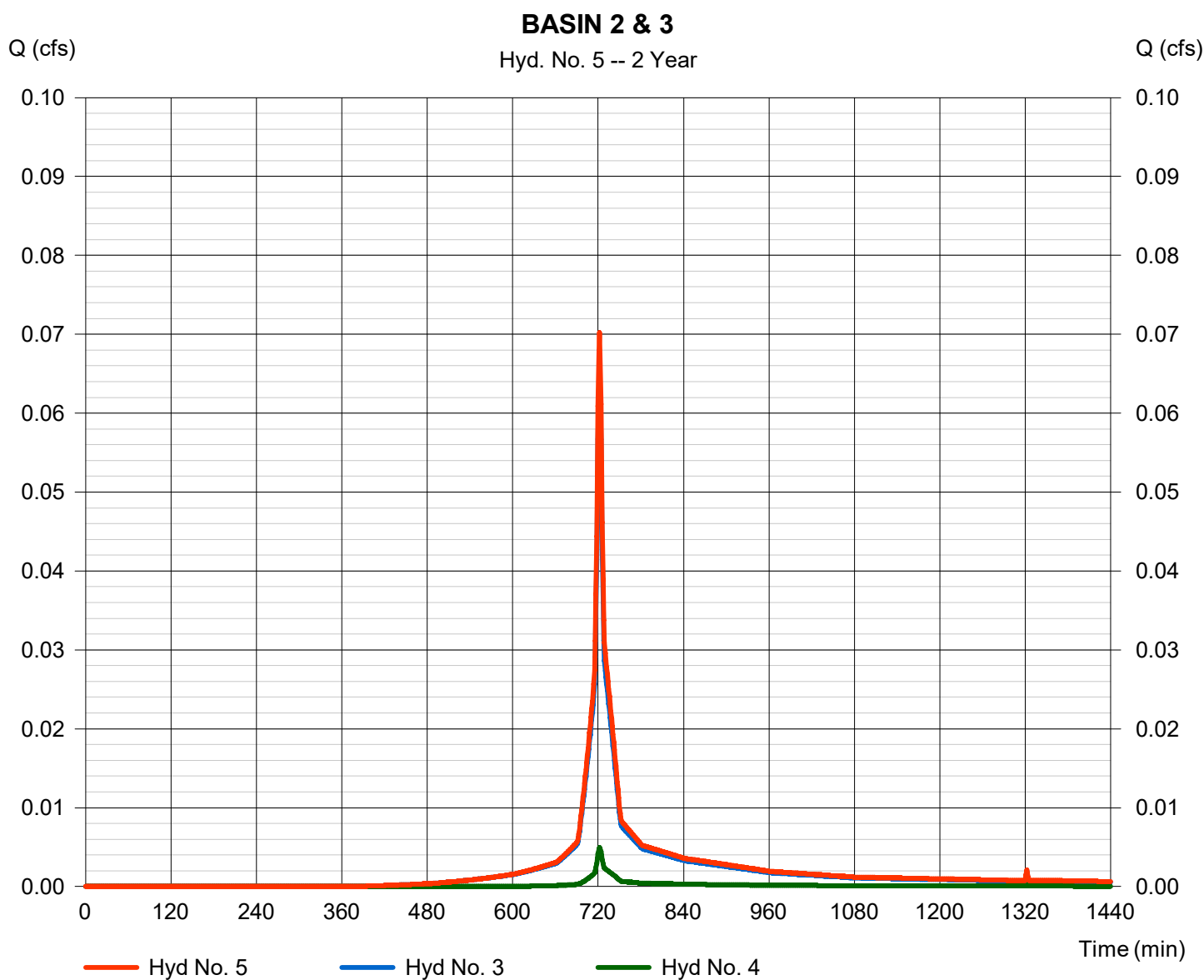
Wednesday, 06 / 5 / 2024

Hyd. No. 5

BASIN 2 & 3

Hydrograph type = Combine
 Storm frequency = 2 yrs
 Time interval = 1 min
 Inflow hyds. = 3, 4

Peak discharge = 0.070 cfs
 Time to peak = 722 min
 Hyd. volume = 193 cuft
 Contrib. drain. area = 0.026 ac



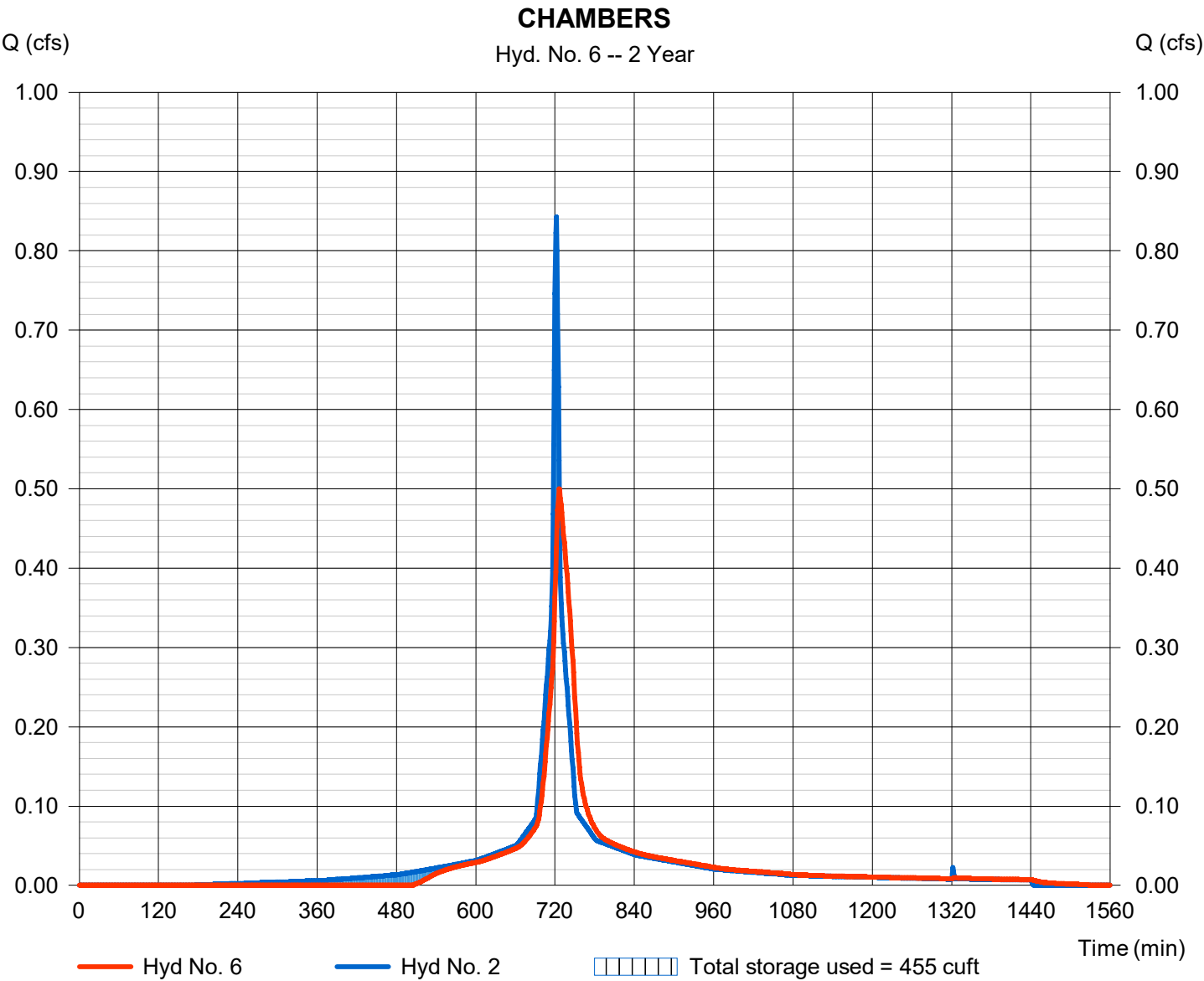
Hydrograph Report

Hyd. No. 6

CHAMBERS

Hydrograph type	= Reservoir	Peak discharge	= 0.500 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 2,349 cuft
Inflow hyd. No.	= 2 - BASIN 1	Max. Elevation	= 100.77 ft
Reservoir name	= CHAMBERS	Max. Storage	= 455 cuft

Storage Indication method used.



Pond No. 1 - CHAMBERS

Pond Data

UG Chambers -Invert elev. = 100.00 ft , Rise x Span = 1.15 x 2.30 ft , Barrel Len = 7.12 ft , No. Barrels = 24 , Slope = 0.00% , Headers = No
Encasement -Invert elev. = 99.50 ft , Width = 3.33 ft , Height = 2.33 ft , Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	99.50	n/a	0	0
0.23	99.73	n/a	53	53
0.47	99.97	n/a	53	106
0.70	100.20	n/a	100	206
0.93	100.43	n/a	106	312
1.17	100.67	n/a	101	413
1.40	100.90	n/a	93	506
1.63	101.13	n/a	78	584
1.86	101.36	n/a	54	637
2.10	101.60	n/a	53	690
2.33	101.83	n/a	53	743

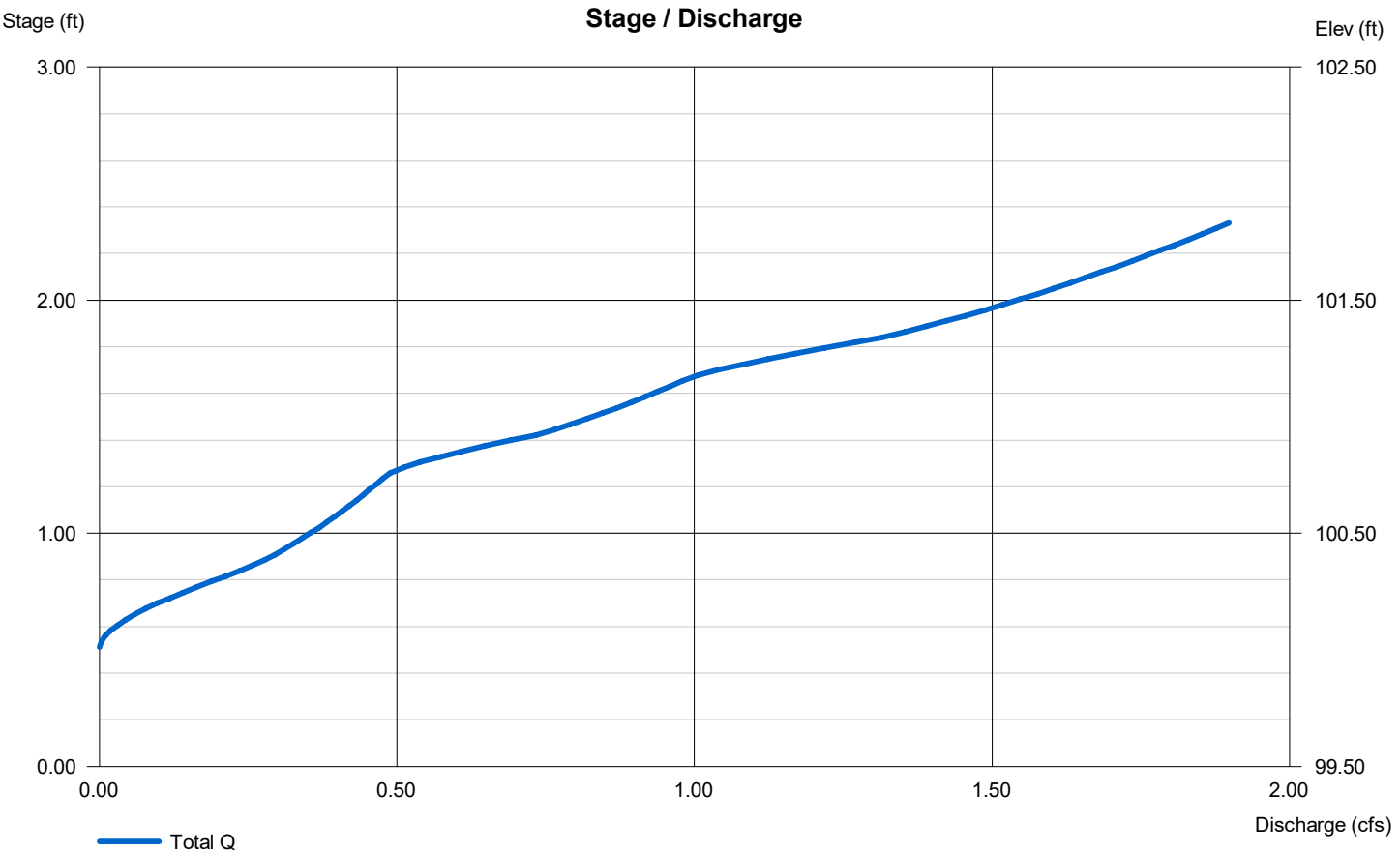
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 5.00	2.00	2.00	0.00
Span (in)	= 5.00	9.00	9.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 100.00	100.75	101.16	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	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	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	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).



Hydrograph Report

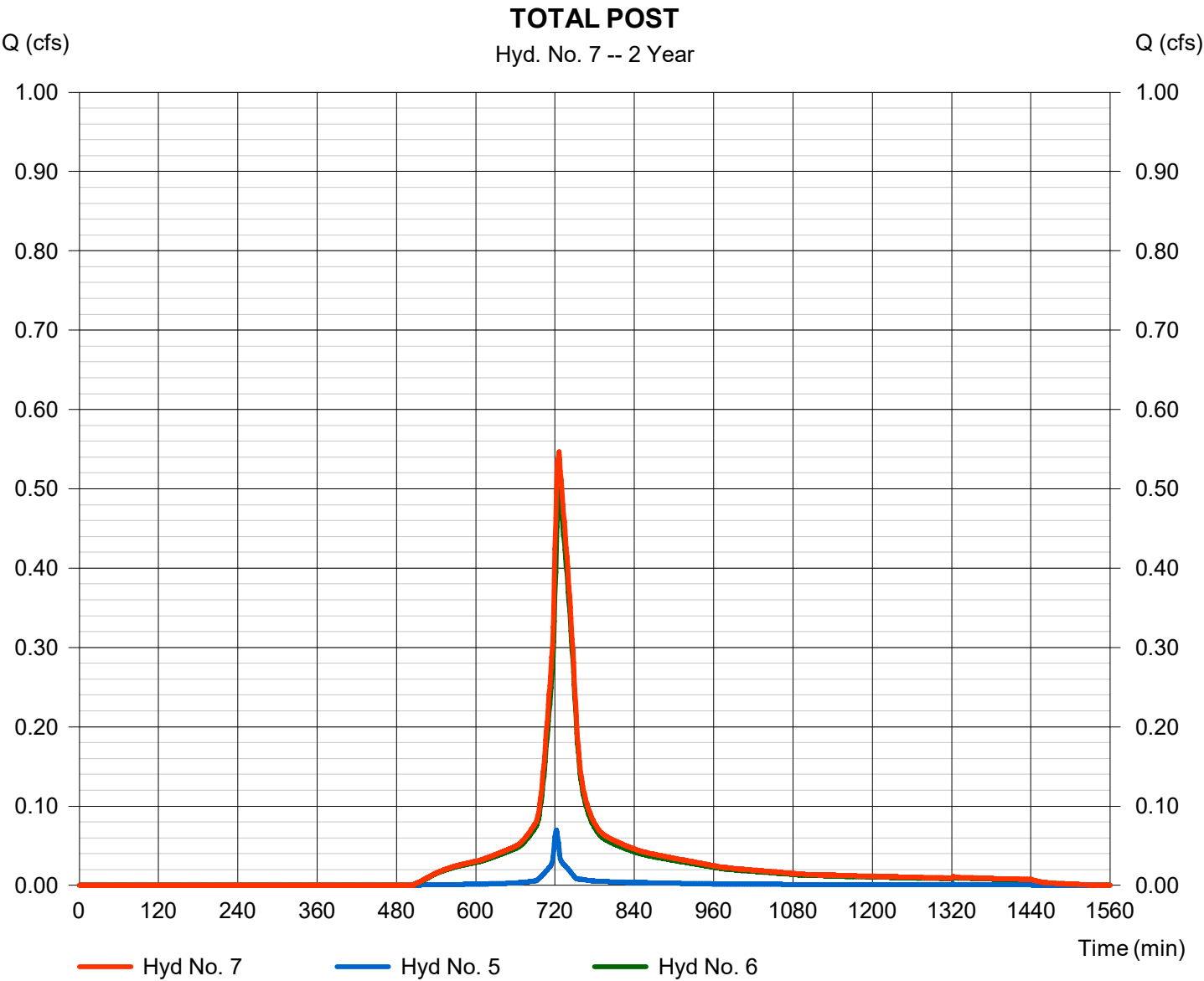
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Wednesday, 06 / 5 / 2024

Hyd. No. 7

TOTAL POST

Hydrograph type	= Combine	Peak discharge	= 0.546 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 1 min	Hyd. volume	= 2,542 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

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	1.156	1	724	3,615	-----	-----	-----	EX-1
2	SCS Runoff	1.317	1	722	3,974	-----	-----	-----	BASIN 1
3	SCS Runoff	0.111	1	722	313	-----	-----	-----	BASIN 2
4	SCS Runoff	0.010	1	722	27	-----	-----	-----	BASIN 3
5	Combine	0.121	1	722	340	3, 4	-----	-----	BASIN 2 & 3
6	Reservoir	0.971	1	725	3,846	2	101.14	587	CHAMBERS
7	Combine	1.063	1	725	4,186	5, 6	-----	-----	TOTAL POST
PRE & POST FINALLY.gpw					Return Period: 10 Year			Wednesday, 06 / 5 / 2024	

Hydrograph Report

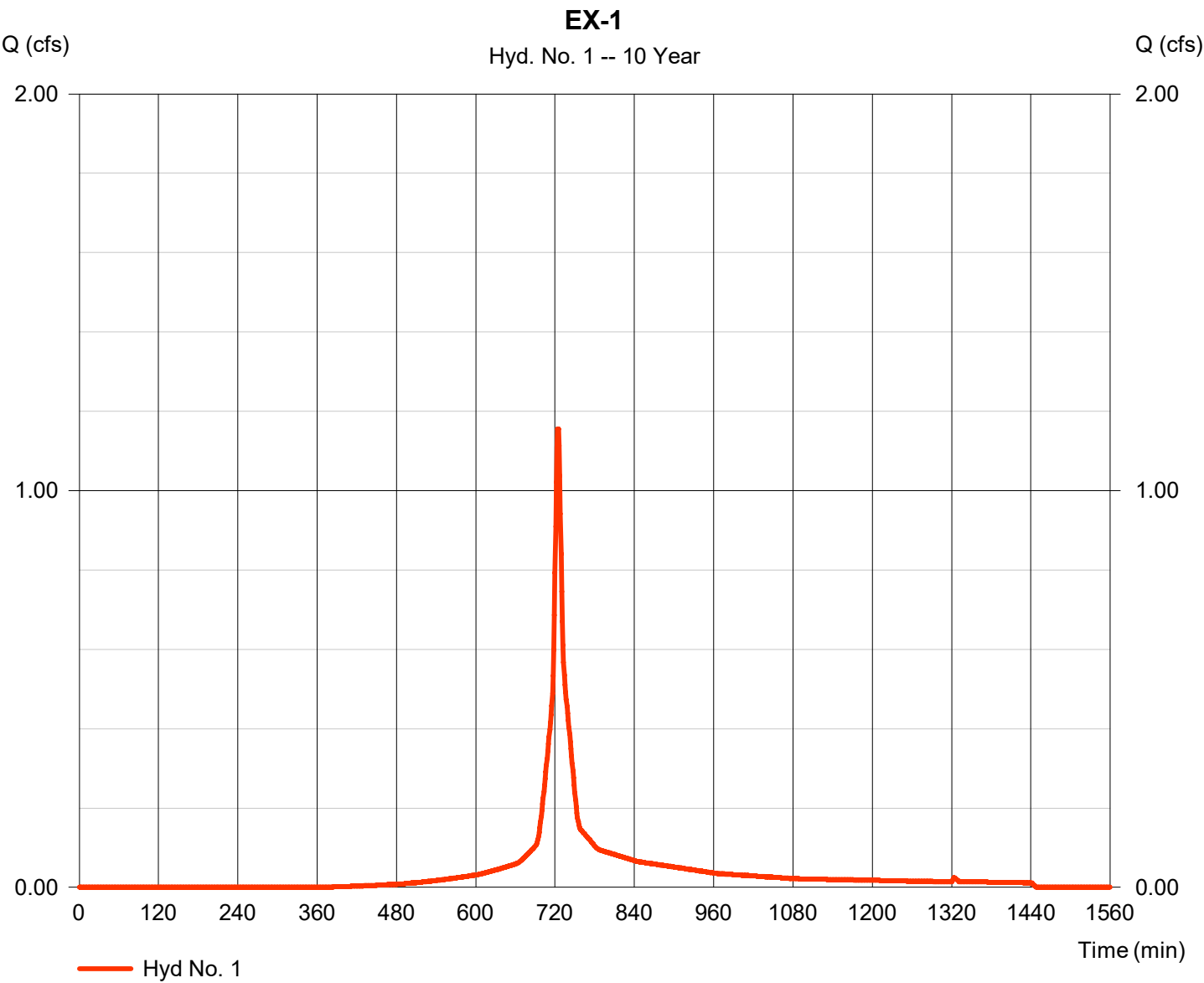
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Wednesday, 06 / 5 / 2024

Hyd. No. 1

EX-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.156 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	3,615 cuft
Drainage area	=	0.274 ac	Curve number	=	84.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	5.19 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

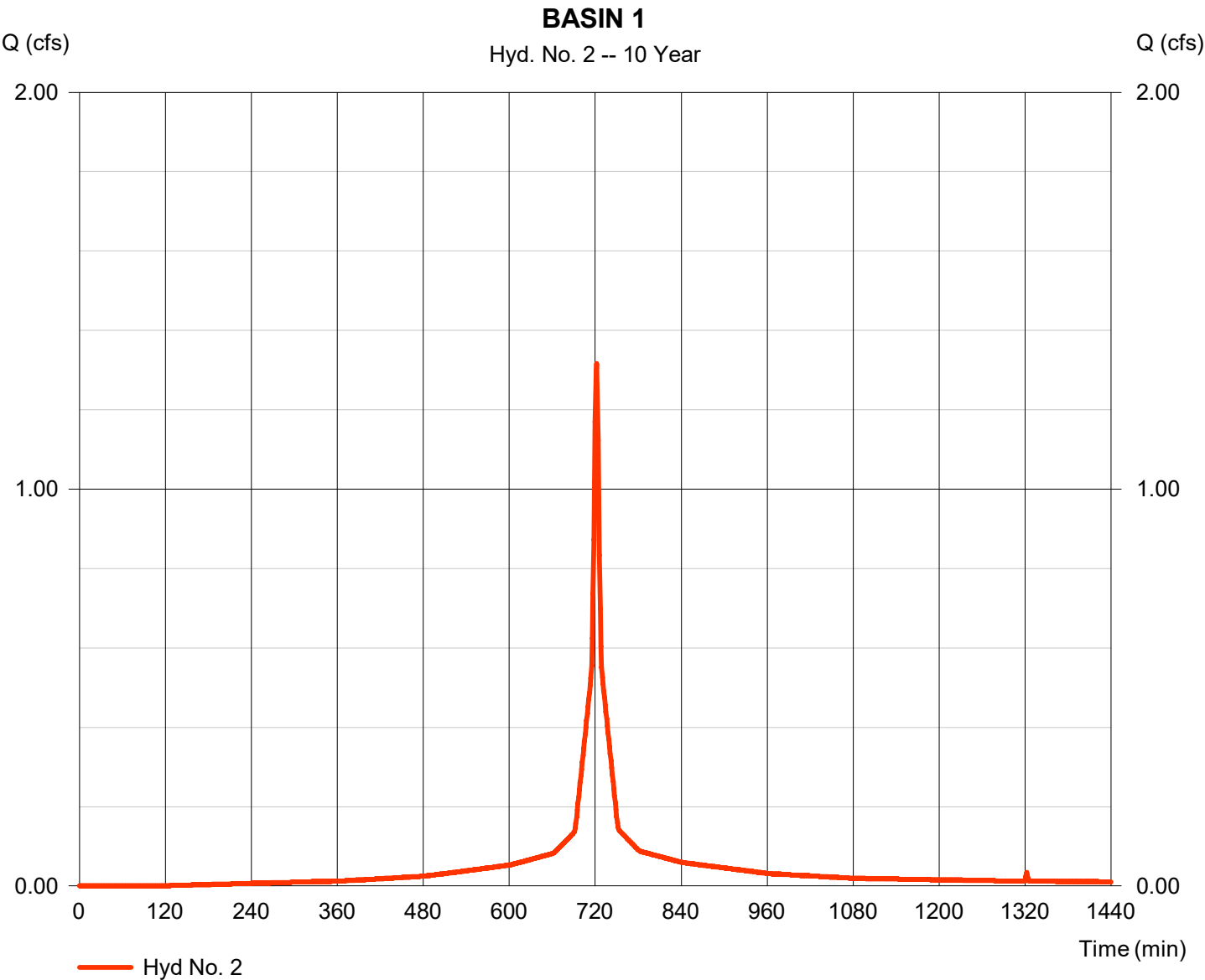


Hydrograph Report

Hyd. No. 2

BASIN 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.317 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	1 min	Hyd. volume	=	3,974 cuft
Drainage area	=	0.248 ac	Curve number	=	95.9
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	2.00 min
Total precip.	=	5.19 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

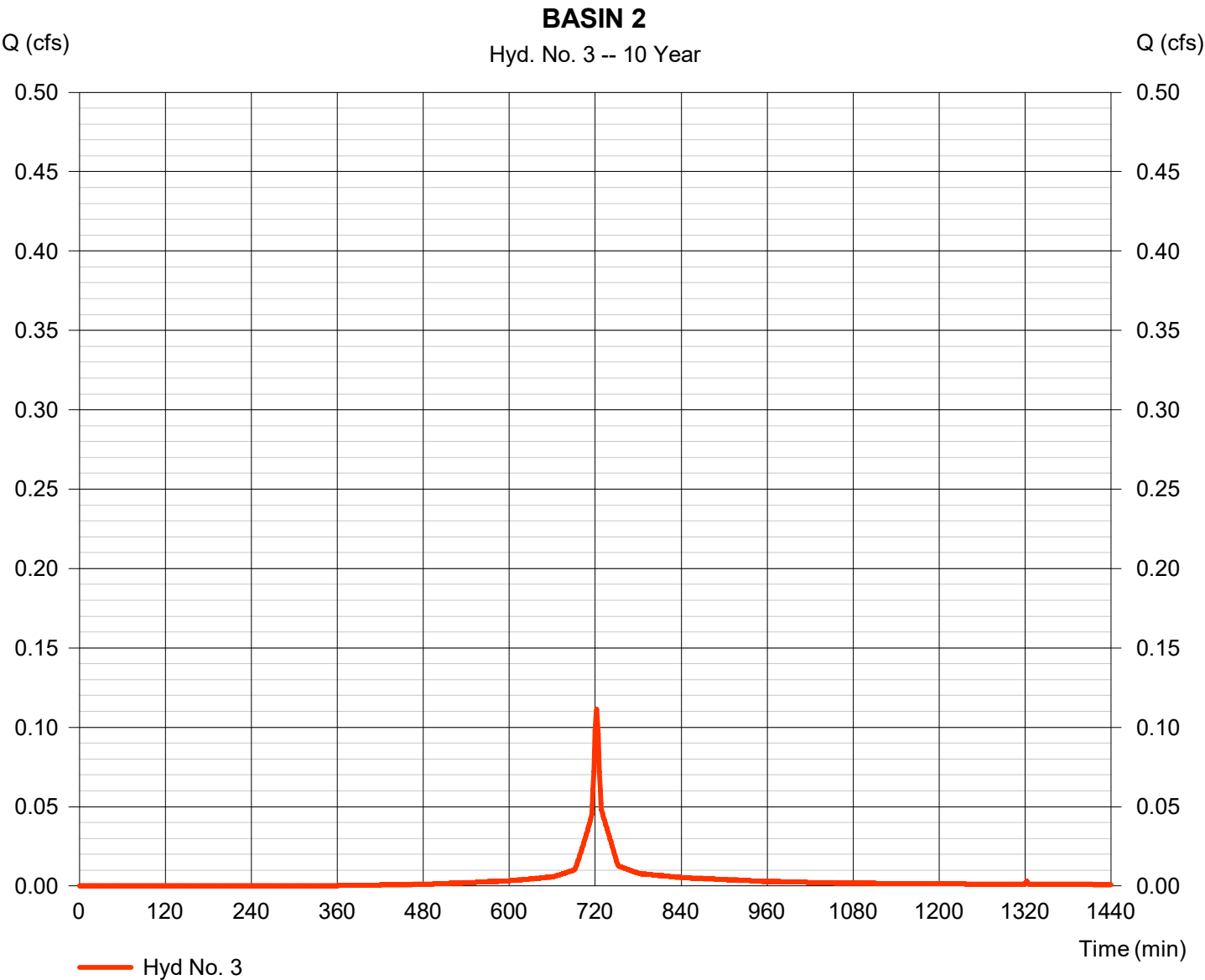


Hydrograph Report

Hyd. No. 3

BASIN 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.111 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	1 min	Hyd. volume	=	313 cuft
Drainage area	=	0.023 ac	Curve number	=	88.9
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	2.00 min
Total precip.	=	5.19 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

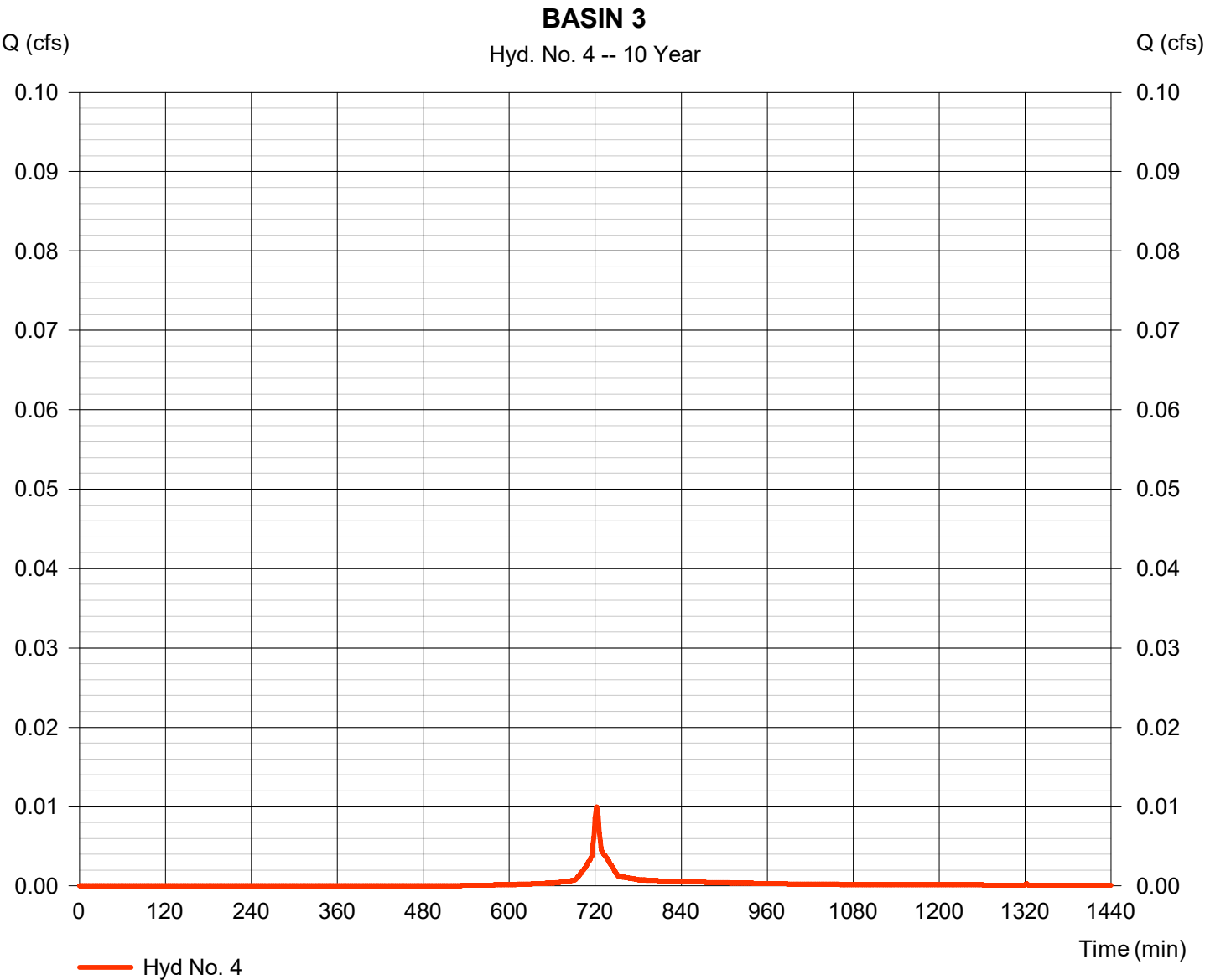


Hydrograph Report

Hyd. No. 4

BASIN 3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.010 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 1 min	Hyd. volume	= 27 cuft
Drainage area	= 0.003 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 2.00 min
Total precip.	= 5.19 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

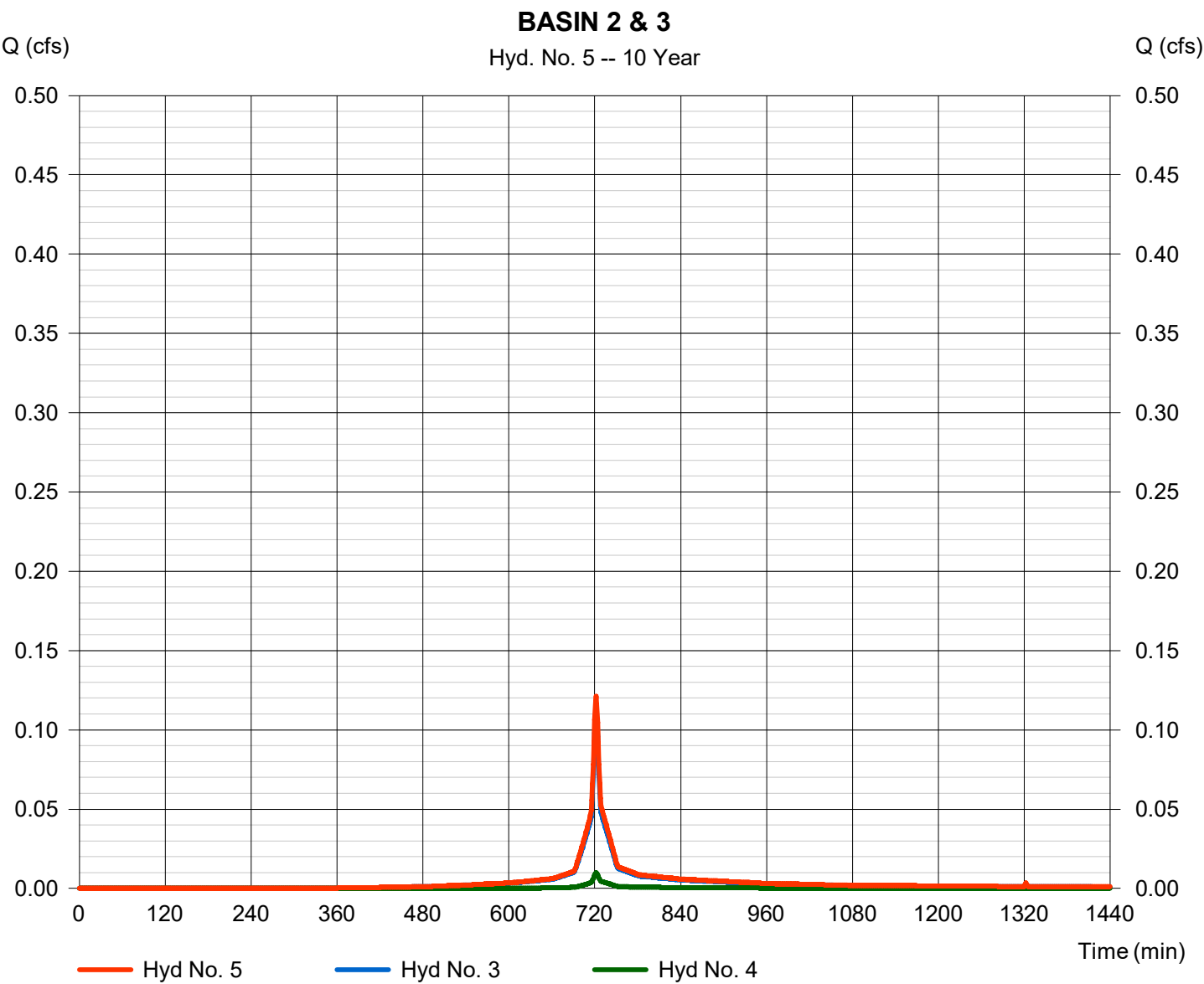


Hydrograph Report

Hyd. No. 5

BASIN 2 & 3

Hydrograph type	= Combine	Peak discharge	= 0.121 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 1 min	Hyd. volume	= 340 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 0.026 ac



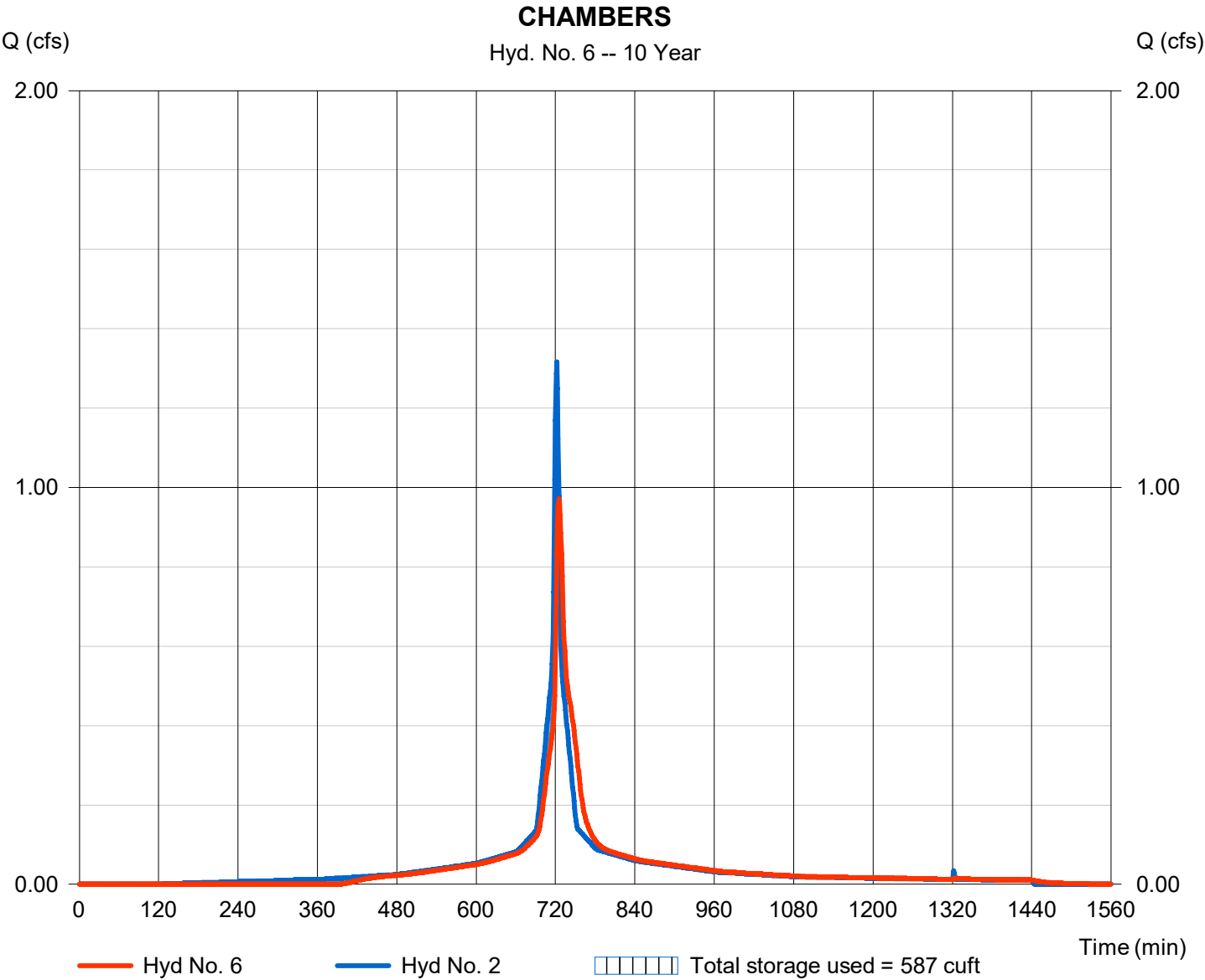
Hydrograph Report

Hyd. No. 6

CHAMBERS

Hydrograph type	= Reservoir	Peak discharge	= 0.971 cfs
Storm frequency	= 10 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 3,846 cuft
Inflow hyd. No.	= 2 - BASIN 1	Max. Elevation	= 101.14 ft
Reservoir name	= CHAMBERS	Max. Storage	= 587 cuft

Storage Indication method used.

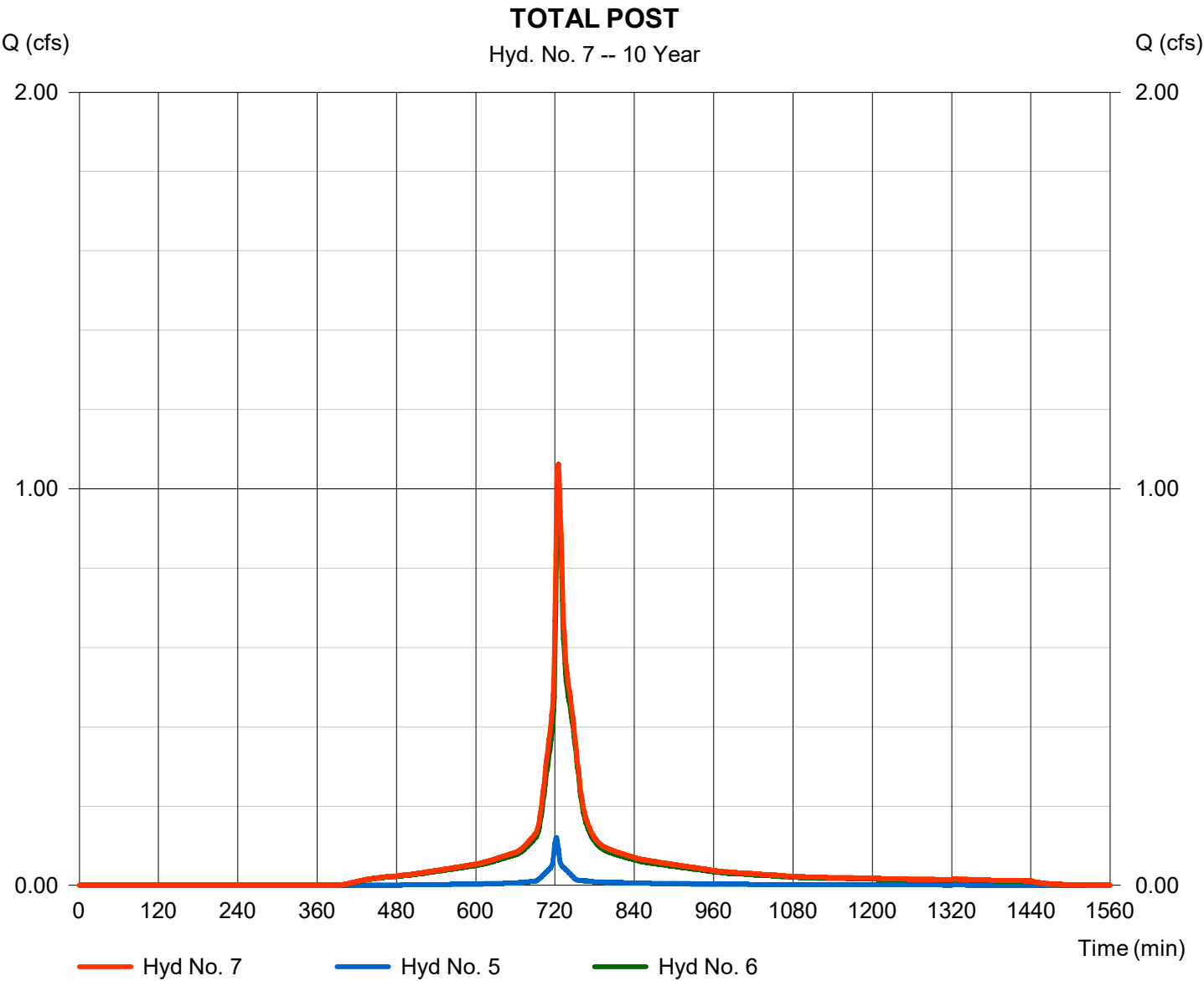


Hydrograph Report

Hyd. No. 7

TOTAL POST

Hydrograph type	= Combine	Peak discharge	= 1.063 cfs
Storm frequency	= 10 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 4,186 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

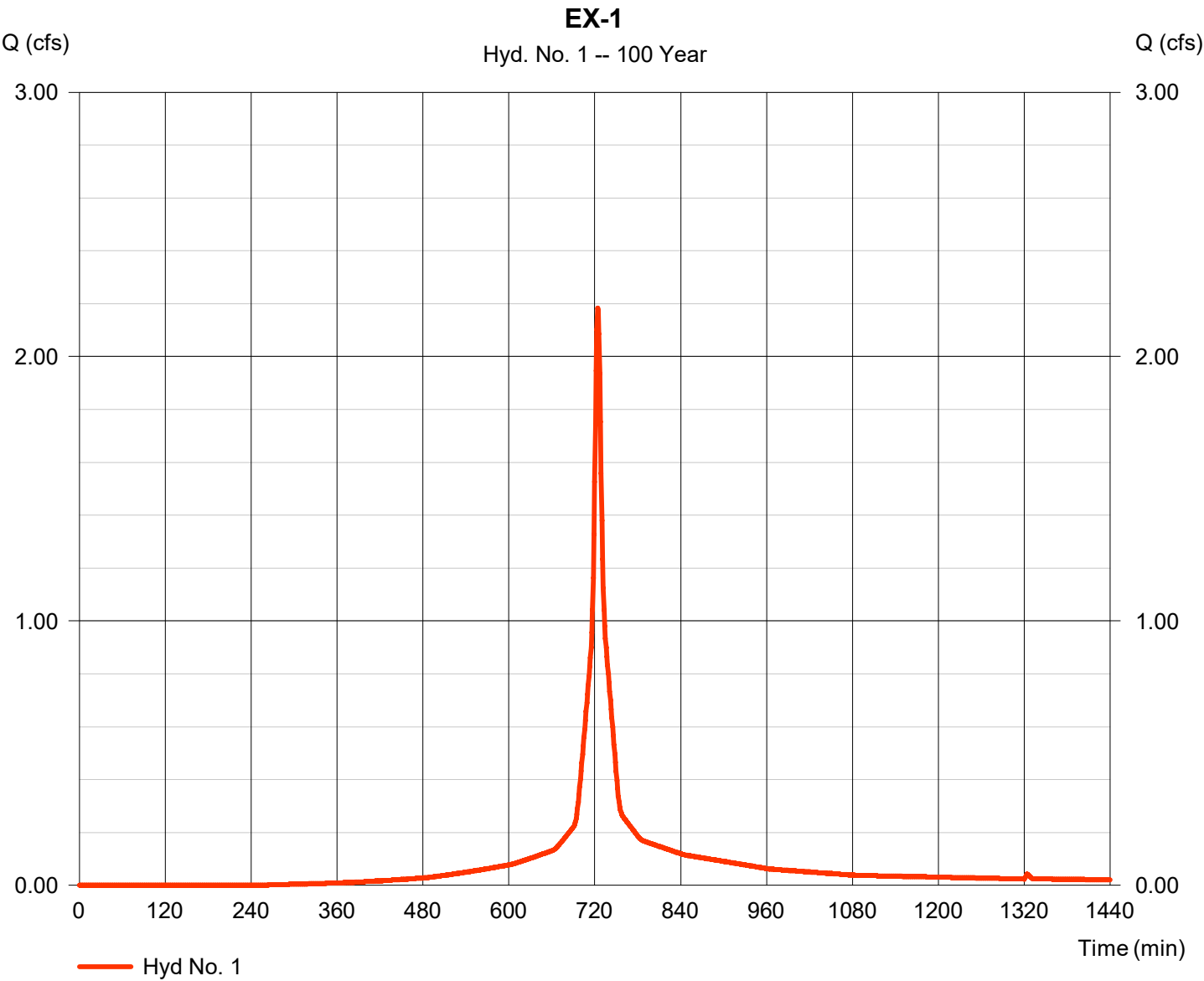
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.183	1	724	7,023	-----	-----	-----	EX-1
2	SCS Runoff	2.231	1	722	6,907	-----	-----	-----	BASIN 1
3	SCS Runoff	0.200	1	722	583	-----	-----	-----	BASIN 2
4	SCS Runoff	0.020	1	722	56	-----	-----	-----	BASIN 3
5	Combine	0.220	1	722	639	3, 4	-----	-----	BASIN 2 & 3
6	Reservoir	1.893	1	724	6,779	2	101.82	742	CHAMBERS
7	Combine	2.081	1	724	7,418	5, 6	-----	-----	TOTAL POST
PRE & POST FINALLY.gpw					Return Period: 100 Year			Wednesday, 06 / 5 / 2024	

Hydrograph Report

Hyd. No. 1

EX-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.183 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	1 min	Hyd. volume	=	7,023 cuft
Drainage area	=	0.274 ac	Curve number	=	84.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.50 min
Total precip.	=	8.68 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

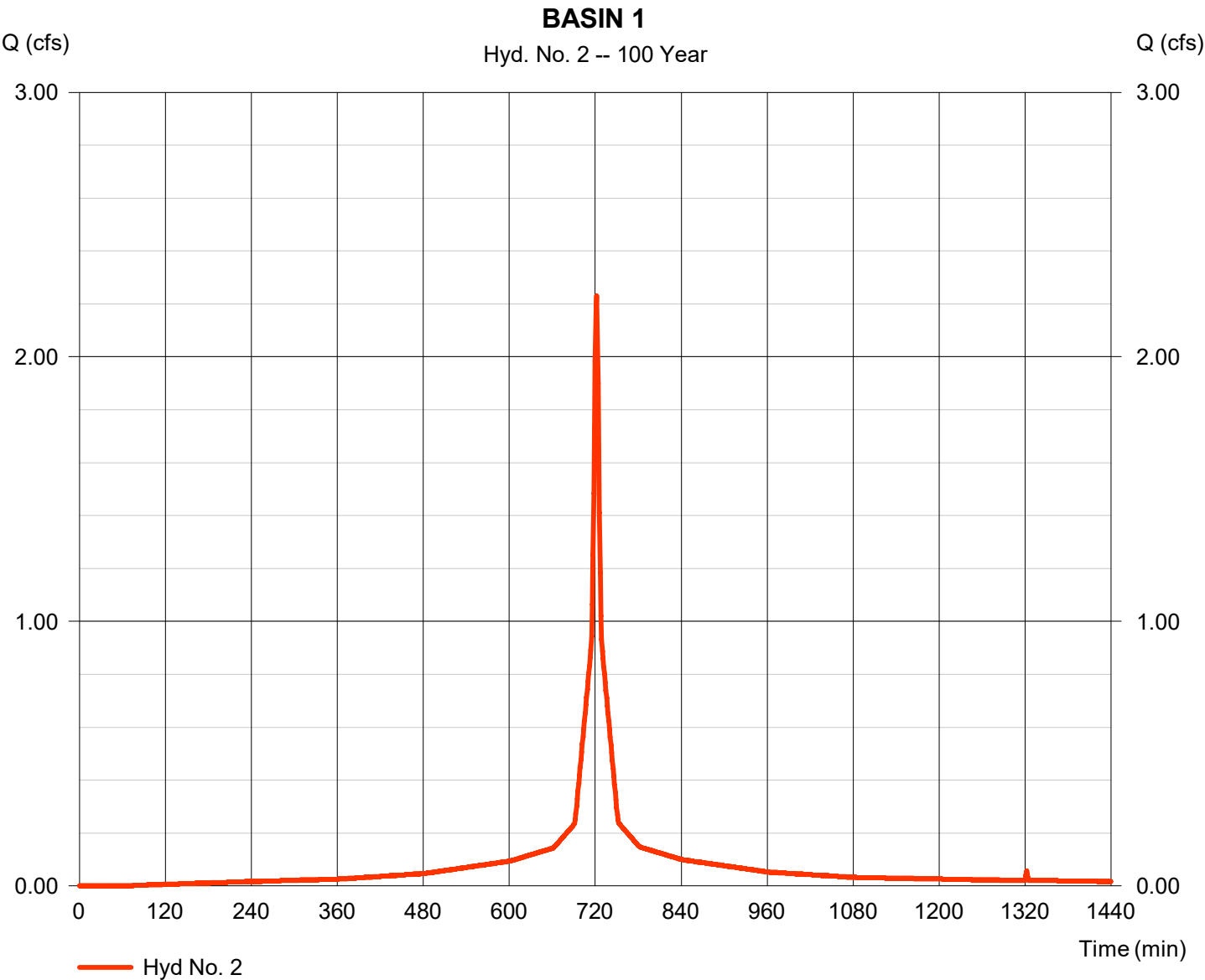


Hydrograph Report

Hyd. No. 2

BASIN 1

Hydrograph type	= SCS Runoff	Peak discharge	= 2.231 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 1 min	Hyd. volume	= 6,907 cuft
Drainage area	= 0.248 ac	Curve number	= 95.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 2.00 min
Total precip.	= 8.68 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

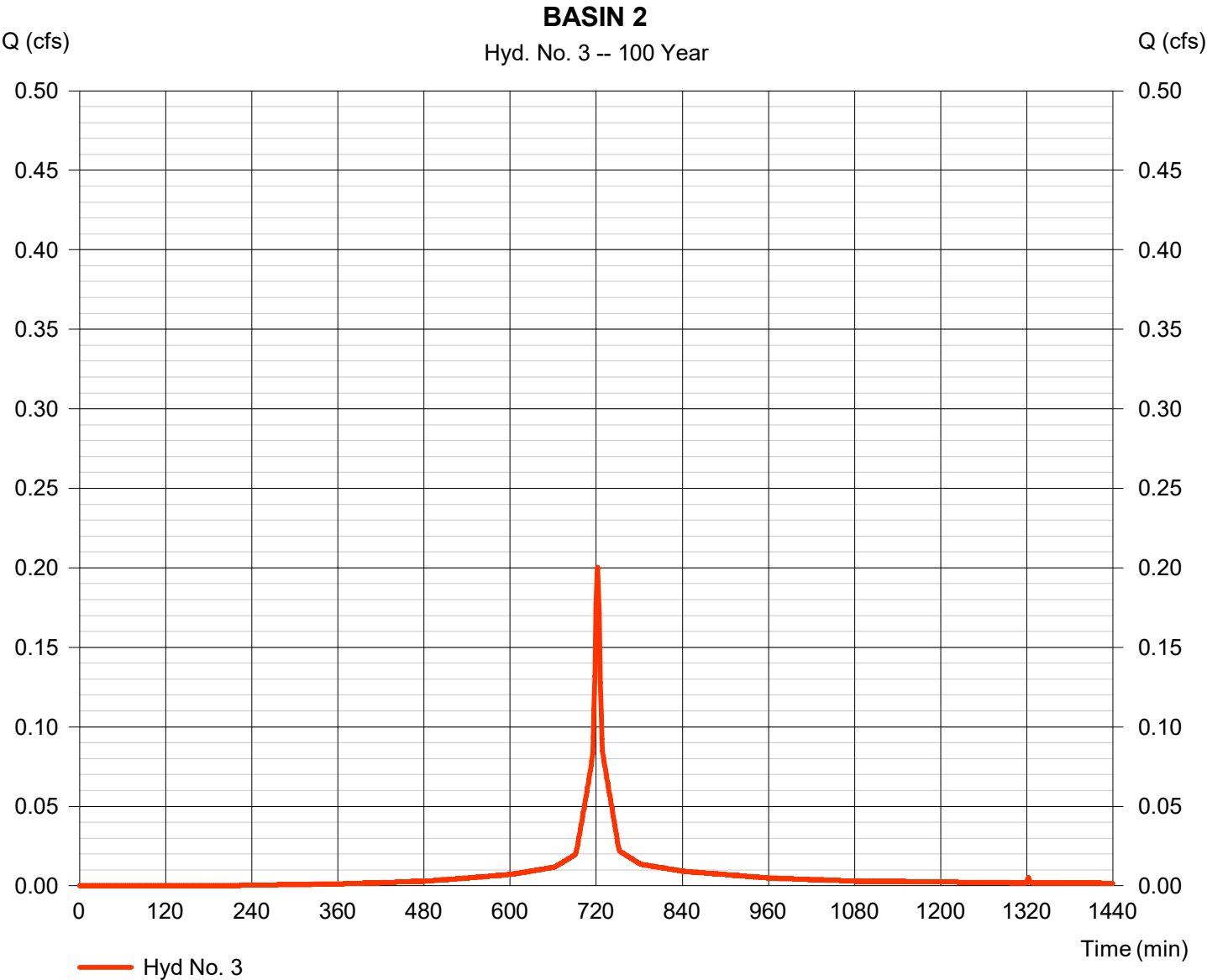


Hydrograph Report

Hyd. No. 3

BASIN 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.200 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 1 min	Hyd. volume	= 583 cuft
Drainage area	= 0.023 ac	Curve number	= 88.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 2.00 min
Total precip.	= 8.68 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

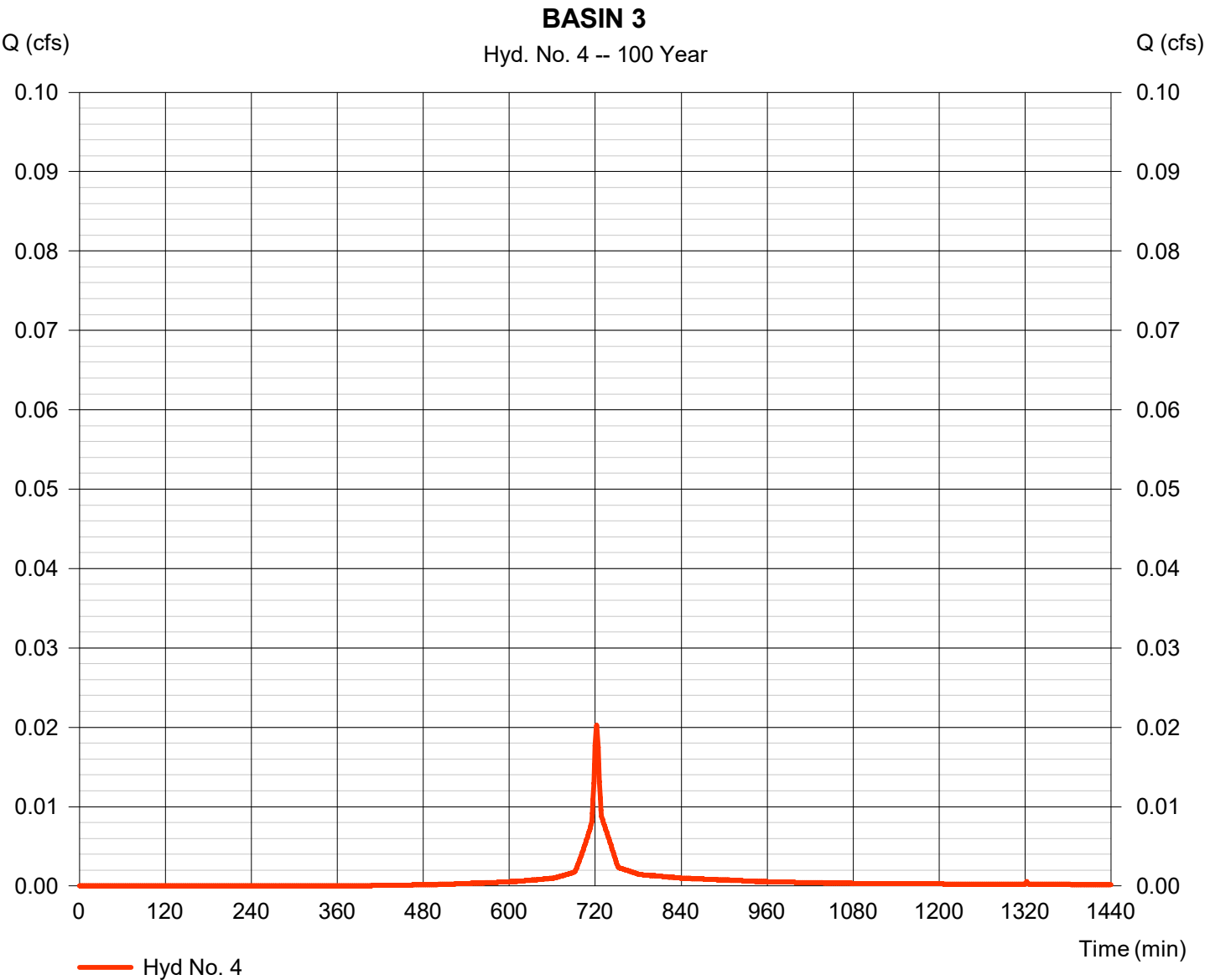


Hydrograph Report

Hyd. No. 4

BASIN 3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.020 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 1 min	Hyd. volume	= 56 cuft
Drainage area	= 0.003 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 2.00 min
Total precip.	= 8.68 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

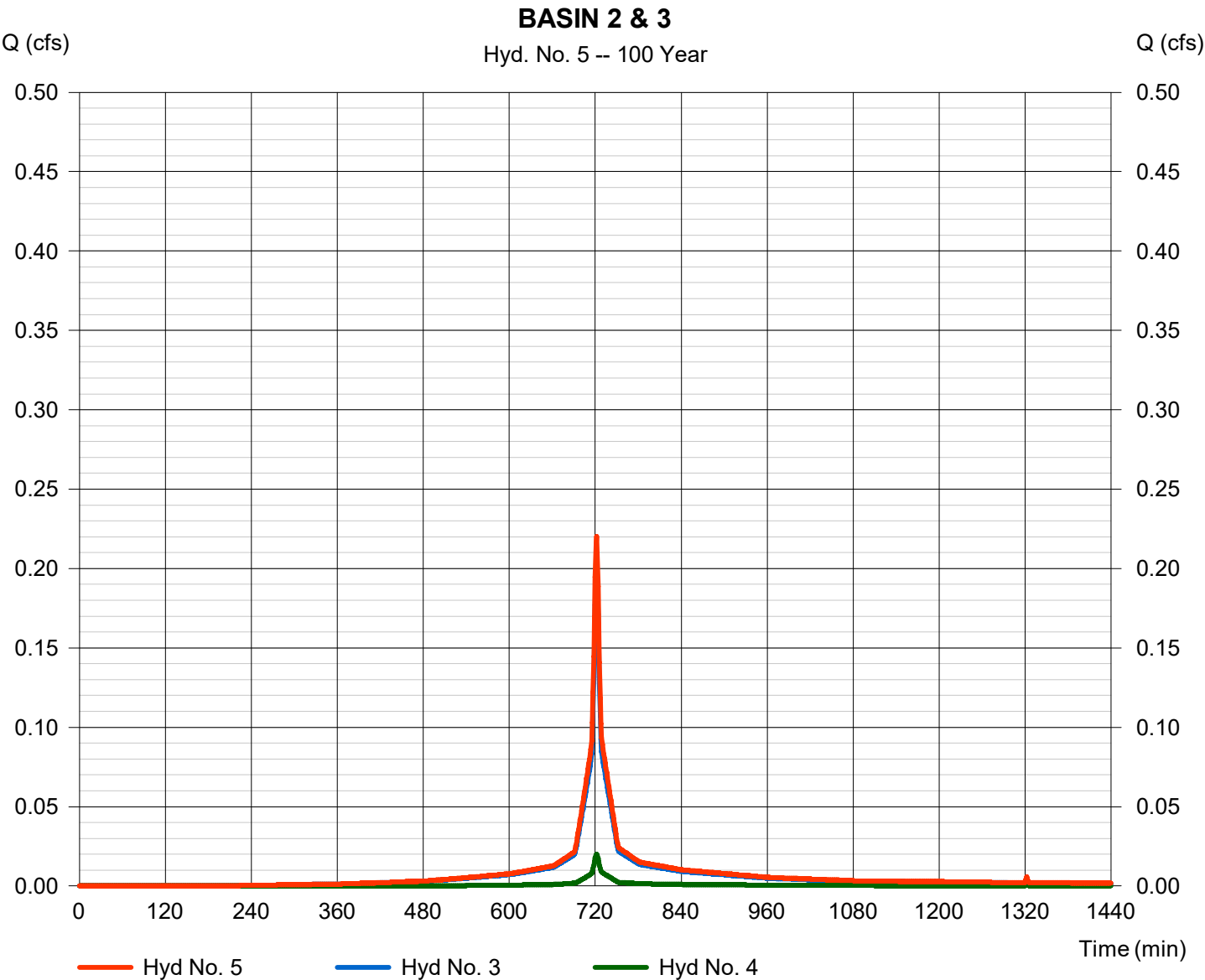
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Wednesday, 06 / 5 / 2024

Hyd. No. 5

BASIN 2 & 3

Hydrograph type	= Combine	Peak discharge	= 0.220 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 1 min	Hyd. volume	= 639 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 0.026 ac



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

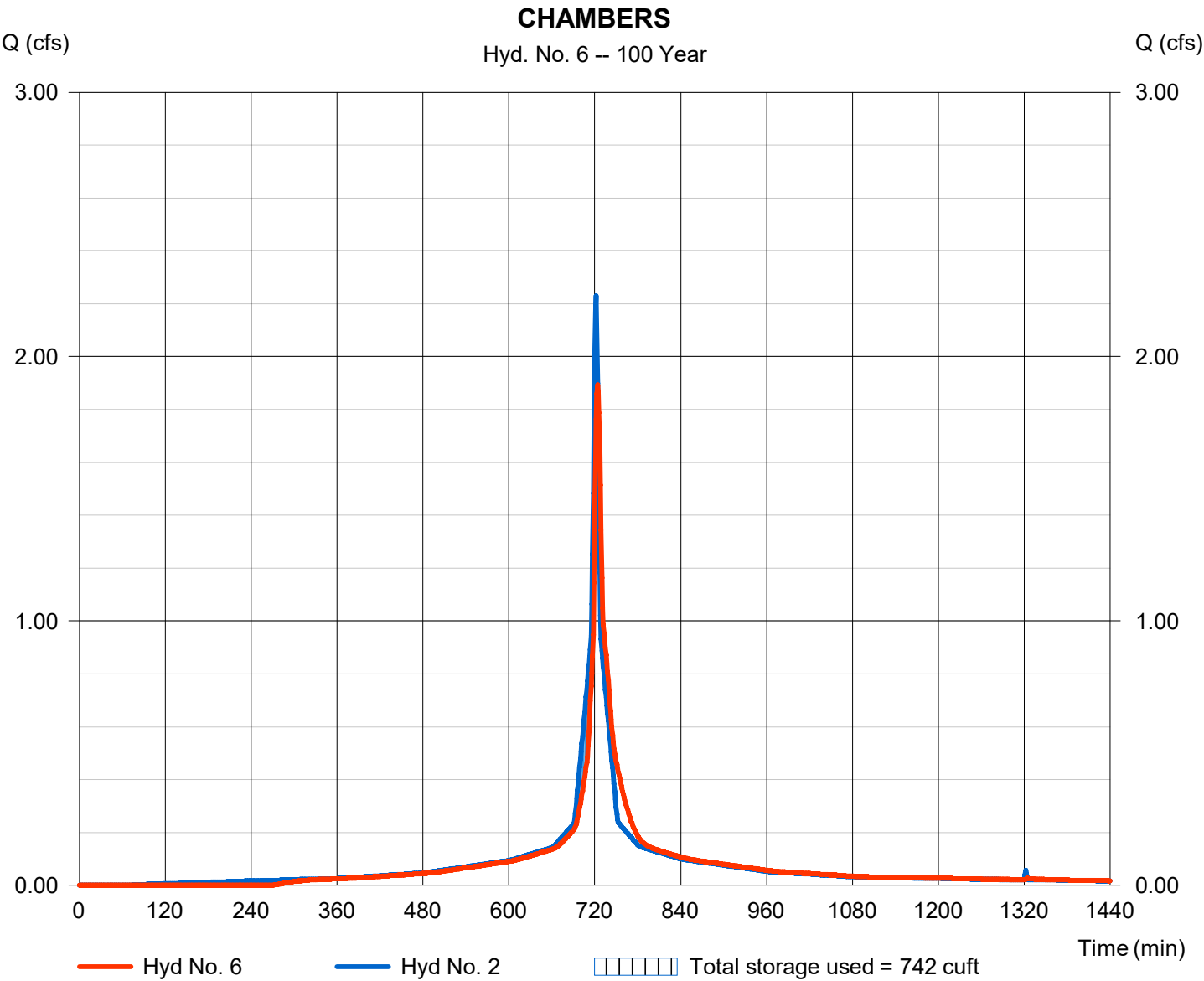
Wednesday, 06 / 5 / 2024

Hyd. No. 6

CHAMBERS

Hydrograph type	= Reservoir	Peak discharge	= 1.893 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 1 min	Hyd. volume	= 6,779 cuft
Inflow hyd. No.	= 2 - BASIN 1	Max. Elevation	= 101.82 ft
Reservoir name	= CHAMBERS	Max. Storage	= 742 cuft

Storage Indication method used.



Hydrograph Report

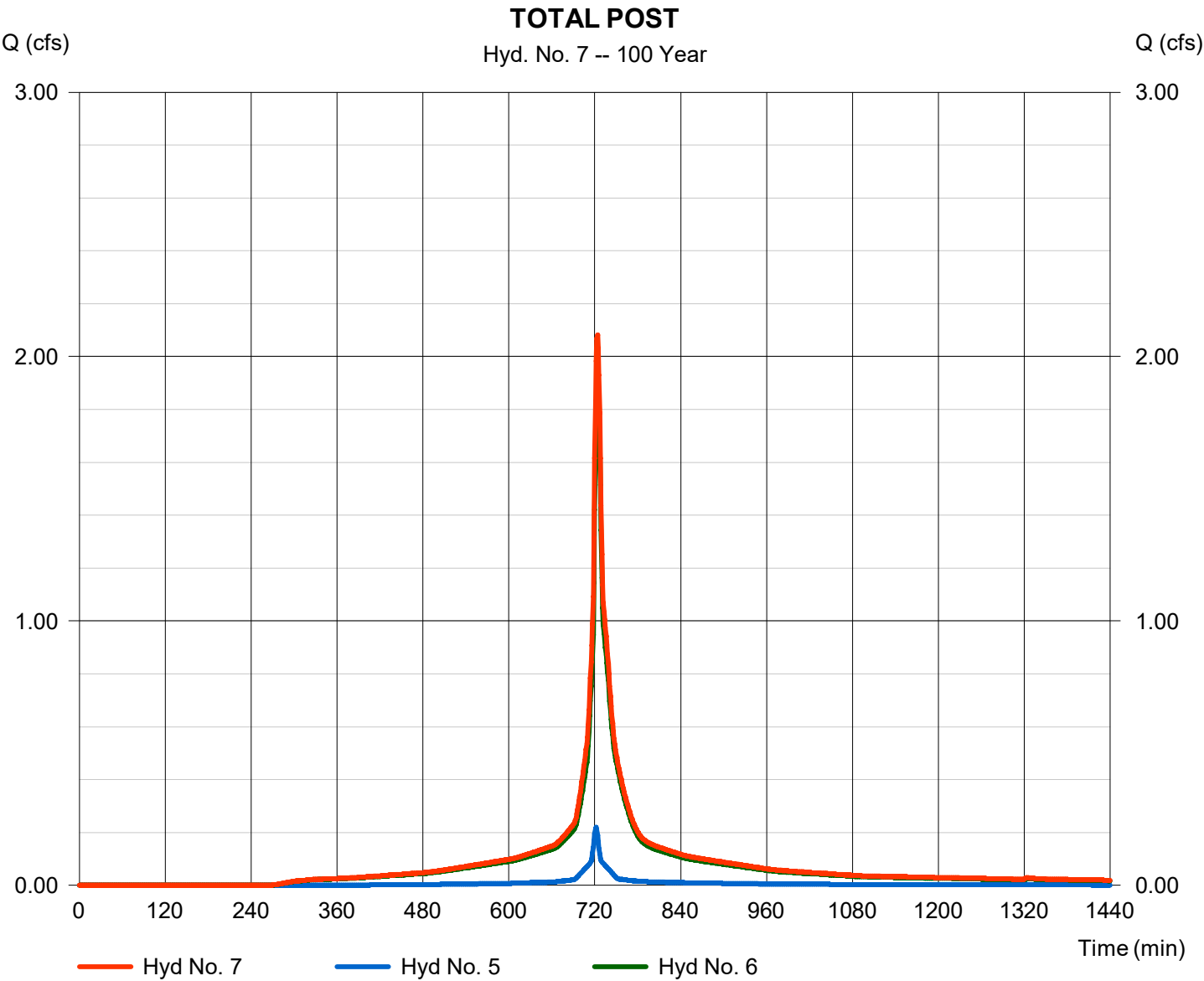
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Wednesday, 06 / 5 / 2024

Hyd. No. 7

TOTAL POST

Hydrograph type	= Combine	Peak discharge	= 2.081 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 1 min	Hyd. volume	= 7,418 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 0.000 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	51.6722	12.5000	0.8924	-----
2	56.7443	12.2000	0.8684	-----
3	0.0000	0.0000	0.0000	-----
5	61.1805	12.3000	0.8343	-----
10	60.5661	11.9000	0.8001	-----
25	52.2230	10.2000	0.7325	-----
50	49.0956	9.5000	0.6946	-----
100	45.0912	8.5000	0.6541	-----

File name: SampleFHA.idf

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	4.02	3.21	2.68	2.31	2.04	1.82	1.65	1.51	1.39	1.29	1.20	1.13
2	4.80	3.84	3.22	2.78	2.45	2.20	2.00	1.83	1.69	1.57	1.47	1.38
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.67	4.59	3.88	3.37	2.99	2.69	2.45	2.25	2.09	1.95	1.83	1.72
10	6.31	5.13	4.35	3.79	3.38	3.05	2.79	2.57	2.39	2.23	2.10	1.98
25	7.12	5.78	4.91	4.30	3.85	3.49	3.20	2.97	2.77	2.60	2.45	2.32
50	7.66	6.24	5.32	4.68	4.20	3.82	3.52	3.27	3.05	2.87	2.72	2.58
100	8.22	6.69	5.72	5.04	4.53	4.14	3.82	3.56	3.34	3.15	2.98	2.84

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.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	2.81	3.40	0.00	4.36	5.19	6.42	7.49	8.68
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.94	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Watershed Model Schematic..... 1

2 - Year

Summary Report..... 2

Hydrograph Reports..... 3

 Hydrograph No. 1, SCS Runoff, EX-1..... 3

 Hydrograph No. 2, SCS Runoff, BASIN 1..... 4

 Hydrograph No. 3, SCS Runoff, BASIN 2..... 5

 Hydrograph No. 4, SCS Runoff, BASIN 3..... 6

 Hydrograph No. 5, Combine, BASIN 2 & 3..... 7

 Hydrograph No. 6, Reservoir, CHAMBERS..... 8

 Pond Report - CHAMBERS..... 9

 Hydrograph No. 7, Combine, TOTAL POST..... 10

10 - Year

Summary Report..... 11

Hydrograph Reports..... 12

 Hydrograph No. 1, SCS Runoff, EX-1..... 12

 Hydrograph No. 2, SCS Runoff, BASIN 1..... 13

 Hydrograph No. 3, SCS Runoff, BASIN 2..... 14

 Hydrograph No. 4, SCS Runoff, BASIN 3..... 15

 Hydrograph No. 5, Combine, BASIN 2 & 3..... 16

 Hydrograph No. 6, Reservoir, CHAMBERS..... 17

 Hydrograph No. 7, Combine, TOTAL POST..... 18

100 - Year

Summary Report..... 19

Hydrograph Reports..... 20

 Hydrograph No. 1, SCS Runoff, EX-1..... 20

 Hydrograph No. 2, SCS Runoff, BASIN 1..... 21

 Hydrograph No. 3, SCS Runoff, BASIN 2..... 22

 Hydrograph No. 4, SCS Runoff, BASIN 3..... 23

 Hydrograph No. 5, Combine, BASIN 2 & 3..... 24

 Hydrograph No. 6, Reservoir, CHAMBERS..... 25

 Hydrograph No. 7, Combine, TOTAL POST..... 26

IDF Report..... 27

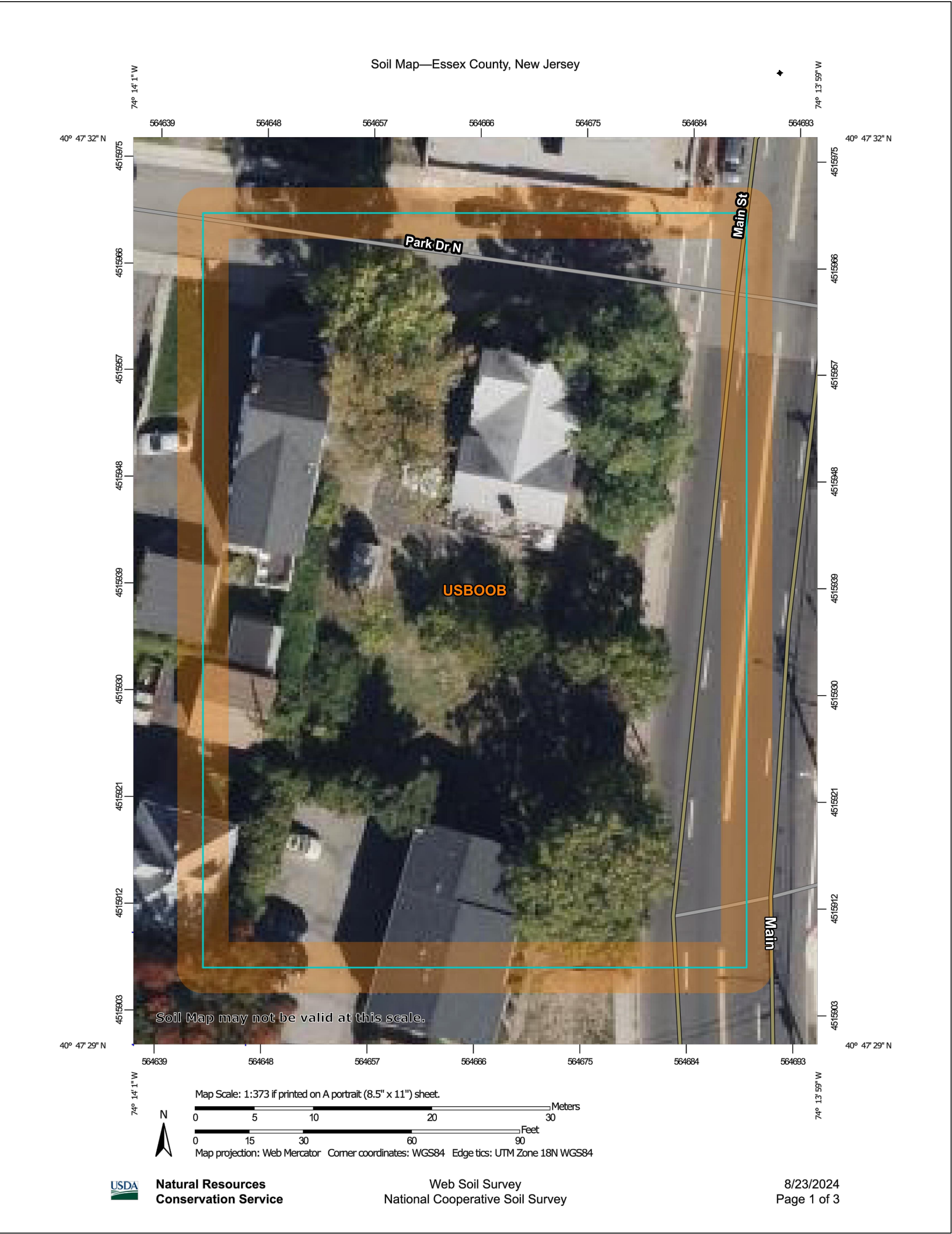
EXHIBIT 2

Drainage Area Maps

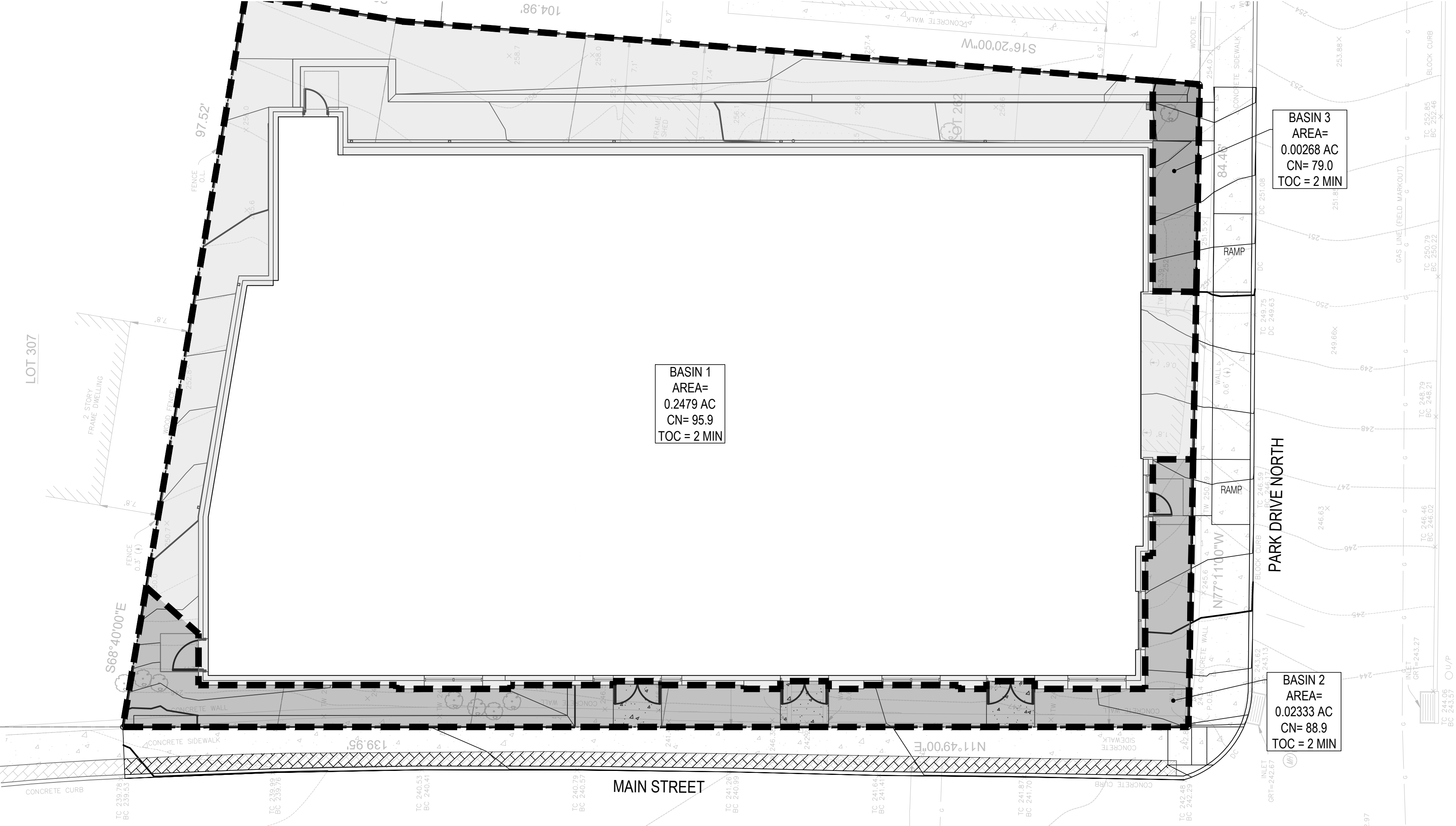
PRE DEVELOPMENT DRAINAGE AREA MAP



SOIL DATA



POST DEVELOPMENT DRAINAGE AREA MAP



Essex County, New Jersey

USBOOB—Urban land, Boonton substratum - Boonton complex, red sandstone lowland, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: w9c3
Elevation: 0 to 560 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land, boonton red sandstone lowland substratum: 60 percent
Boonton, red sandstone lowland, and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land, Boonton Red Sandstone Lowland Substratum

Setting

Landform: Ground moraines
Landform position (three-dimensional): Lower third of mountainflank
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Surface covered by pavement, concrete, buildings, and other structures underlain by disturbed and natural soil material

Typical profile

H1 - 0 to 12 inches: material
H2 - 12 to 67 inches: gravelly loam
2CB - 67 to 83 inches: gravelly sandy loam

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Description of Boonton, Red Sandstone Lowland

Setting

Landform: Ground moraines
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy till derived from sandstone and shale

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material

A - 1 to 3 inches: silt loam
BE - 3 to 10 inches: loam
Bw - 10 to 27 inches: gravelly loam
Bx1 - 27 to 40 inches: gravelly fine sandy loam
Bx2 - 40 to 67 inches: gravelly fine sandy loam
BCx - 67 to 83 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 36 inches to fragipan
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Udorthents, boonton red sandstone lowland substratum
Percent of map unit: 10 percent
Landform: Ground moraines
Landform position (three-dimensional): Lower third of mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Essex County, New Jersey
Survey Area Data: Version 19, Aug 29, 2023