

DRAINAGE STATEMENT

for

Orange Dev, LLC

Proposed Popeyes Restaurant & Sonic Restaurant

470 Eagle Rock Avenue (CR 611)

Block 153, Lot 38

Township of West Orange

Essex County, NJ

Prepared by:



1904 Main Street
Lake Como, NJ 07719
(732) 974-0198

A handwritten signature in dark ink, appearing to read 'MB', is positioned above a horizontal line.

Matthew J. Bersch, PE
NJ Professional Engineer License #54522

October 2022
Last Revised March 2023
DEC# 1021-99-025

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I. Drainage Statement

This Drainage Statement has been prepared to define and analyze the stormwater drainage conditions that would occur as a result of the improvements to Block 153, Lot 38, as shown on the Township of West Orange Tax Map Sheet No. 84, located in the Township of West Orange, Essex County, New Jersey. In existing conditions, the subject site consists of 0.94 acres (40,971 SF) and is located at 470 Eagle Rock Avenue.

Under existing conditions, the site is developed as a restaurant with associated parking, landscaping and lighting. The existing development has an impervious coverage of 88.3% (36,177 SF) and is located in the B-2 – General Business Zone. The proposed development consists of the demolition of the existing restaurant and the construction of a 2,525 SF Popeyes restaurant with a drive-thru and a 1,616 SF Sonic restaurant with a drive-thru. Additional site amenities include parking, landscaping, lighting and a trash enclosures. As a result of the proposed development, a portion of the previously vacated Fundus Road right-of-way will be incorporated within Lot 38, bringing the total lot area to 1.05 AC (45,713 SF). The proposed development will result in a total impervious coverage of 69.4% (31,732 SF).

The stormwater analysis has been conducted to include the vacated Fundus Road right-of-way in both existing and proposed conditions. This results in an existing impervious coverage of approximately 80.5% (36,782 SF). Therefore, the proposed development will result in a decrease in impervious coverage of approximately 11.1% (5,050 SF) and a decrease in motor vehicle surface area of approximately 4,600 SF. In addition, per the Natural Resources Conservation Service Web Soil Survey, a portion of the property is located within unclassified Urban Land soil. To be conservative, the analysis utilized HSG B in existing conditions and HSG D in proposed.

Based upon the fact that the proposed improvements will result in more than one (1) acre of land disturbance, this project is classified as a “major development” and is subject to compliance with the Stormwater Regulations set forth in NJAC 7:8. However, the proposed project is reducing motor vehicle surface area and impervious coverage from existing to proposed conditions. As such, per NJAC 7:8-5.5, the project is not required to meet the stormwater runoff quality standards as the motor vehicle surface area onsite will not be increased by more than ¼ acre from existing to proposed conditions. As a result, the site has been designed to meet the stormwater runoff quantity and groundwater recharge standards set forth by the Township of West Orange Land Development Ordinance and NJAC 7:8. Per NJAC 7:8-5.6(b).1, the stormwater runoff quantity requirements are met through demonstration that the post-construction runoff hydrographs for the 2, 10- and 100-year storm events do not exceed at any point in time, the pre-construction runoff hydrographs for the same storm events. Per NJAC 7:8-5.4(b).1.i, the groundwater recharge requirements are met through demonstration that greater than one hundred (100) percent of the average annual pre-construction groundwater recharge volume for the site is being maintained, due to the reduction in impervious coverage as a result of the proposed development.

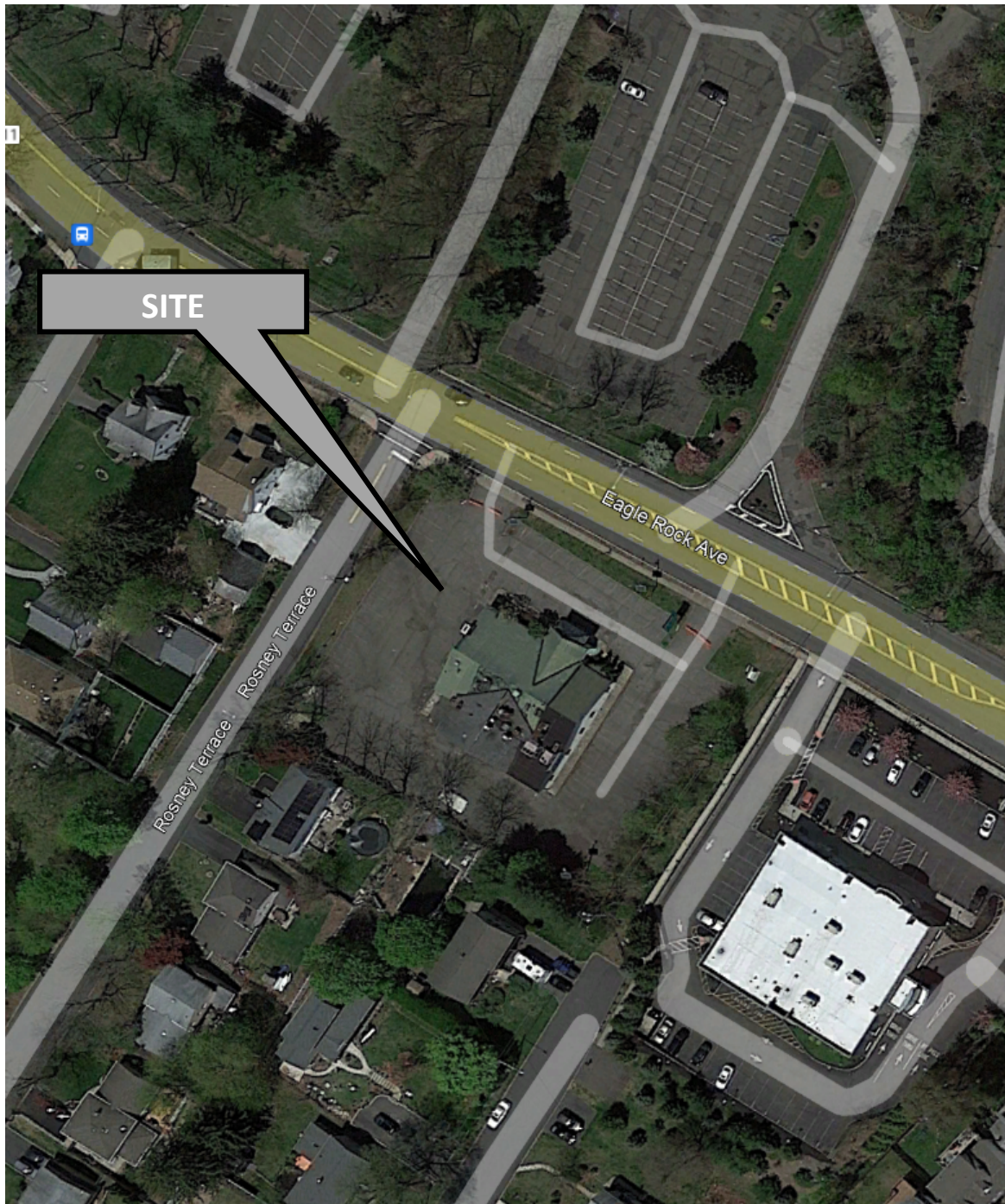
In existing conditions, a majority of the stormwater runoff from the area to be disturbed is conveyed via overland flow to the proposed onsite inlets which connect to the existing stormwater infrastructure within Rosney Terrace. Stormwater runoff from Rosney Terrace ultimately discharges into the existing stormwater infrastructure within Eagle Rock Avenue. The remaining stormwater runoff from the site discharges directly to the existing inlet along Eagle Rock Avenue via overland flow. As such, one point of analysis can be considered for the overall development.

Stormwater runoff resulting from the proposed improvements has been designed to maintain existing drainage patterns. Six (6) additional inlets are proposed within the site to assist in collecting stormwater runoff from impervious areas, which are routed via 12" reinforced concrete pipes to the existing inlet within Rosney Terrace. Due to the reduction in impervious coverage, the volume and peak discharge runoff rates for the 2-, 10- & 100-year design storms have been reduced. As such, there shall be no adverse impacts to the properties located upstream and downstream of the site.

In conclusion, the proposed project has been designed to ensure safe and efficient control of stormwater runoff in a manner that will not adversely impact the existing drainage patterns or adjacent properties. We anticipate that the subject project will not significantly impact the existing drainage infrastructure located within the existing development or the surrounding area.

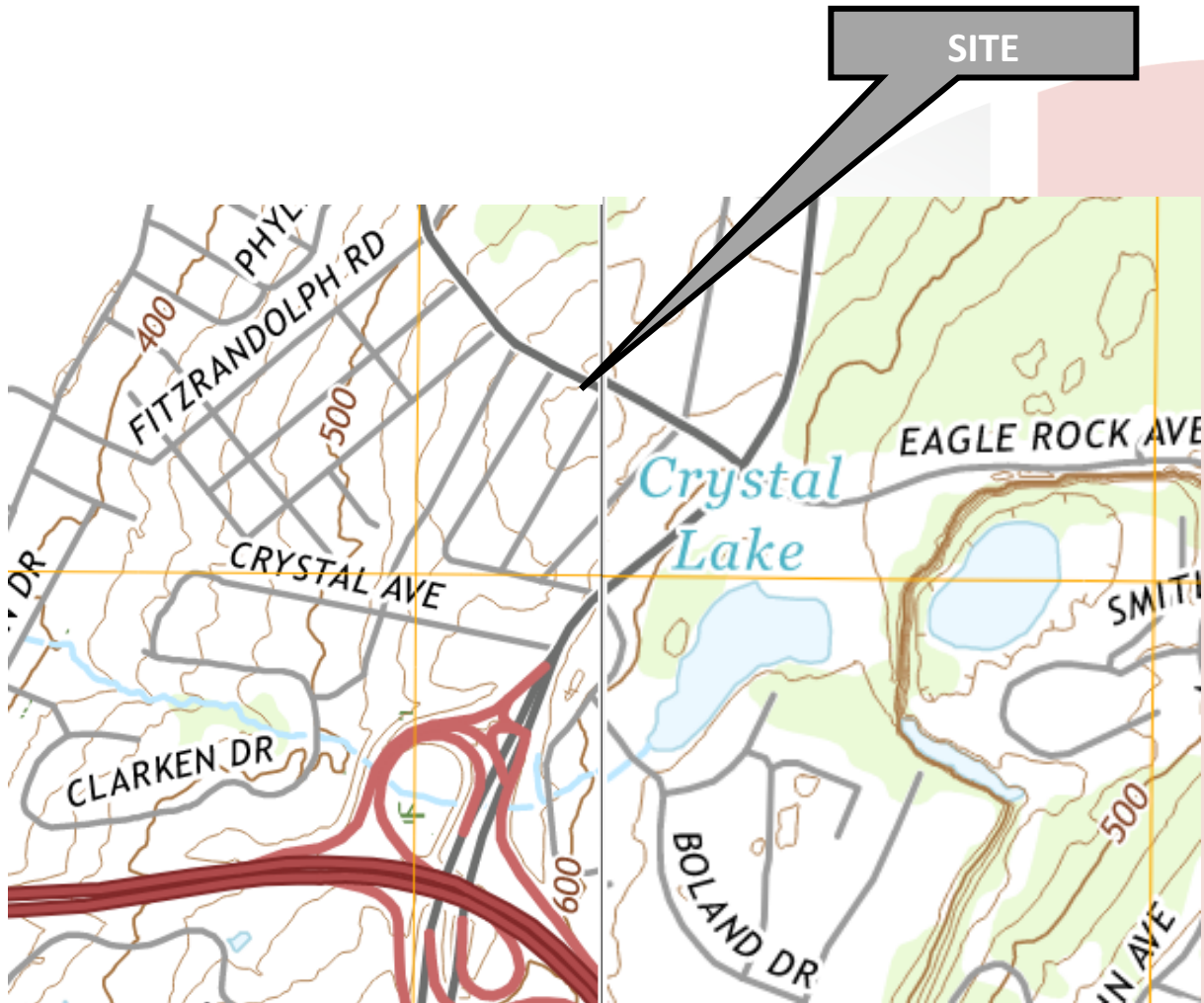
APPENDIX

LOCATION MAP



Location Map

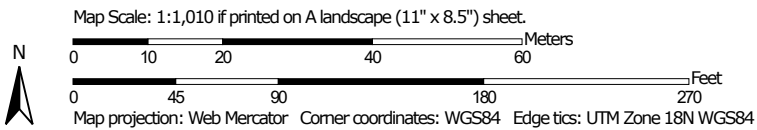
USGS MAP



USGS Map

NRCS WEB SOIL SURVEY

Hydrologic Soil Group—Essex County, New Jersey



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, New Jersey
 Survey Area Data: Version 17, Aug 30, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 9, 2020—Oct 15, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BouC	Boonton - Urban land, Boonton substratum complex, 8 to 15 percent slopes	C	1.3	61.0%
URBONB	Urban land, Boonton substratum, 0 to 8 percent slopes		0.8	39.0%
Totals for Area of Interest			2.1	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

TIME OF CONCENTRATION (TC) CALCULATIONS



1904 Main Street, Lake Como, NJ 07719
(732) 974-0198

Date: 3/30/2023
Project: Proposed Popeyes & Fast Food Restaurant
Project No: 1021-99-025

Calculated By: DG
Checked By: MB

Worksheet 3: Time of Concentration (T_c) Calculations

Land Condition: Existing
Drainage Area: Site

• Sheet Flow :

1. Surface Description
2. Manning's Roughness Coefficient, n
3. Flow Length, L { total $L \leq 100$ ft }
4. Two-Year 24-hour Rainfall, p_2 for ... Essex County
5. Land Slope, s (ft/ft)
6. Travel Time, $T_t = \frac{0.007 (n L)^{0.8}}{p_2^{0.5} s^{0.4}}$

AB	BC	
Dense Grasses	Smooth Surfaces	
0.24	0.011	
27.0 ft	73.0 ft	
3.44 in	3.44 in	
0.074 ft/ft	0.041 ft/ft	
0.048 hr	+ 0.011 hr	+ 0.000 hr = 0.059 hr

• Shallow Concentrated Flow :

7. Surface Description
8. Flow Length, L
9. Watercourse Slope, s
10. Average velocity, V { see Figure 3.1 }
11. Travel Time, $T_t = \frac{L}{3600 V}$

CD		
Paved		
96.0 ft		
0.047 ft/ft		
4.41 ft/s		
0.006 hr	+ 0.000 hr	+ 0.000 hr = 0.006 hr

• Channel Flow :

12. Pipe Diameter, D
13. Cross-Sectional Flow Area, A
14. Wetted Perimeter, p_w
15. Hydraulic Radius, $r = A / p_w$
16. Channel Slope, s
17. Pipe Material
18. Manning's Roughness Coefficient, n
19. Velocity, $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$
20. Flow Length, L
21. Travel Time, $T_t = \frac{L}{3600 V}$
22. Watershed or subarea Time of Concentration, T_c { add T_t in steps 6, 11 and 21 }

DE	EF	
4 in	10 in	
0.087 sf	0.545 sf	
1.0 ft	2.6 ft	
0.1 ft	0.2 ft	
0.037 ft/ft	0.138 ft/ft	
PVC	PVC	
0.010	0.010	
5.47 ft/s	19.45 ft/s	
50.0	21.0	
0.003 hr	+ 0.000 hr	+ 0.000 hr = 0.003 hr
		0.068 hr
		4.1 min



1904 Main Street, Lake Como, NJ 07719
(732) 974-0198

Date: 3/30/2023
Project: Proposed Popeyes & Sonic Restaurant
Project No: 1021-99-025

Calculated By: JD
Checked By: DG/MB

Worksheet 3: Time of Concentration (T_c) Calculations

Land Condition: Proposed
Drainage Area: Site

• Sheet Flow :

1. Surface Description	AB	BC	
2. Manning's Roughness Coefficient, n	Short Grass, Prairie	Smooth Surfaces	
3. Flow Length, L { total $L \leq 100$ ft }	0.15	0.011	
4. Two-Year 24-hour Rainfall, p_2 for .. <u>Essex County</u> ..	52.0 ft	32.0 ft	
5. Land Slope, s (ft/ft)	3.44 in	3.44 in	3.44 in
6. Travel Time, $T_t = \frac{0.007 (n L)^{0.8}}{p_2^{0.5} s^{0.4}}$	0.065 ft/ft	0.030 ft/ft	
	0.058 hr	0.007 hr	0.000 hr = 0.065 hr

• Shallow Concentrated Flow :

7. Surface Description			
8. Flow Length, L			
9. Watercourse Slope, s			
10. Average velocity, V { see Figure 3.1 }			
11. Travel Time, $T_t = \frac{L}{3600 V}$	0.000 hr	0.000 hr	0.000 hr = 0.000 hr

• Channel Flow :

12. Pipe Diameter, D	CD	DE	EF
13. Cross-Sectional Flow Area, A	12 in	12 in	15 in
14. Wetted Perimeter, p_w	0.785 sf	0.785 sf	1.227 sf
15. Hydraulic Radius, $r = A / p_w$	3.1 ft	3.1 ft	3.9 ft
16. Channel Slope, s	0.3 ft	0.3 ft	0.3 ft
17. Pipe Material	0.021 ft/ft	0.025 ft/ft	0.049 ft/ft
18. Manning's Roughness Coefficient, n	RCP	RCP	RCP
19. Velocity, $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$	0.013	0.013	0.013
20. Flow Length, L	6.59 ft/s	7.19 ft/s	11.68 ft/s
21. Travel Time, $T_t = \frac{L}{3600 V}$	93.0	55.0	39.0
22. Watershed or subarea Time of Concentration, T_c { add T_t in steps 6, 11 and 21 }	0.004 hr	0.002 hr	0.001 hr = 0.007 hr
			0.072 hr
			4.3 min

RUNOFF CURVE NUMBER (CN) CALCULATIONS – EXISTING



DYNAMIC ENGINEERING

EXISTING DRAINAGE AREA SUMMARY AND AVERAGE CURVE NUMBER(CN) CALCULATIONS

Project: Proposed Popeye's & Fast Food Restaurant
 Job #: 1021-99-025
 Location: West Orange, NJ

Computed By: DG
 Checked By: MB
 Date: 3/30/2023

Drainage Area	Impervious Area (acre)	Impervious Area (sf)	Curve Number (CN) Used	HSG B - Open Space Area (acre)	HSG B - Open Space Area (sf)	Curve Number (CN) Used	HSG C - Open Space Area (acre)	HSG C - Open Space Area (sf)	Curve Number (CN) Used	Avg. Perv. Curve Number	Total Pervious Area (acres)	Total Area (acres)	TC (Min.)
Study Area Site	0.84	36,782	98	0.07	3,045	61	0.14	5,966	74	70	0.21	1.05	4
Total	0.84	36,782		0.07	3,045		0.14	5,966			0.21	1.05	

Per County Soil Survey -	URBONB	HSG	B	Soil	Urban Land, Boonton substratum, 0 to 8 percent slopes
Per County Soil Survey -	BouC	HSG	C	Soil	Boonton - Urban Land, Boonton substratum complex, 8 to 15 percent slopes

Description	Runoff Curve Number (CN) (HSG B)	Runoff Curve Number (CN) (HSG C)
Impervious Surface	98	98
Open Space (lawn) (good)	61	74

RUNOFF CURVE NUMBER (CN) CALCULATIONS – PROPOSED



PROPOSED DRAINAGE AREA SUMMARY AND AVERAGE CURVE NUMBER(CN) CALCULATIONS

Project: Proposed Popeyes & Fast Food Restaurant
 Job #: 1021-99-025
 Location: West Orange, NJ

Computed By: JD
 Checked By: DG
 Date: 3/30/2023

Drainage Area	Impervious Area (acre)	Impervious Area (sf)	Curve Number (CN) Used	HSG C - Open Space Area (acre)	HSG C - Open Space Area (sf)	Curve Number (CN) Used	HSG D - Open Space Area (acre)	HSG D - Open Space Area (sf)	Curve Number (CN) Used	Avg. Perv. Curve Number	Total Pervious Area (acres)	Total Area (acres)	TC (Min.)
Study Area Site	0.73	31,808	98	0.24	10,603	74	0.07	3,250	80	75	0.32	1.05	4
Total	0.73	31,808		0.24	7,650		0.07	3,250			0.32	1.05	

Per County Soil Survey -	BouC	HSG	C	Soil	Boonton - Urban Land, Boonton substratum complex, 8 to 15 percent slopes
Per County Soil Survey -	URBONB	HSG	D	Soil	Urban Land, Boonton substratum, 0 to 8 percent slopes

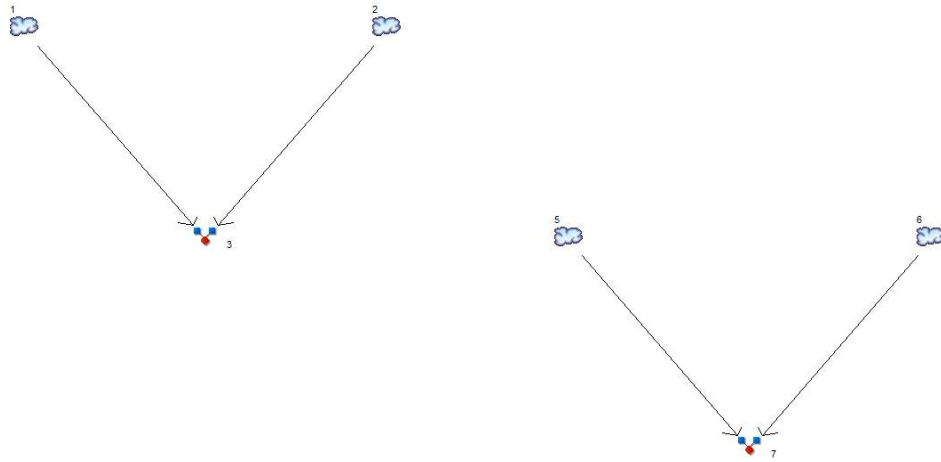
Description	Runoff Curve Number (CN) (HSG C)	Runoff Curve Number (CN) (HSG D)
Impervious Surface	98	98
Open Space (lawn) (good)	74	80

**HYDROGRAPH SUMMARY REPORTS – EXISTING
AND PROPOSED CONDITIONS 2 YR. 10 YR. & 100
YR.**

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Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.1



Legend

<u>Hyd.</u>	<u>Origin</u>	<u>Description</u>
1	SCS Runoff	Existing Site (Impervious)
2	SCS Runoff	Existing Site (Pervious)
3	Combine	Existing Total
5	SCS Runoff	Proposed Site (Impervious)
6	SCS Runoff	Proposed Site (Pervious)
7	Combine	Proposed Total

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	-----	-----	2.696	-----	-----	4.116	-----	-----	6.851	Existing Site (Impervious)
2	SCS Runoff	-----	-----	0.224	-----	-----	0.533	-----	-----	1.215	Existing Site (Pervious)
3	Combine	1, 2	-----	2.913	-----	-----	4.640	-----	-----	8.056	Existing Total
5	SCS Runoff	-----	-----	2.343	-----	-----	3.577	-----	-----	5.953	Proposed Site (Impervious)
6	SCS Runoff	-----	-----	0.460	-----	-----	0.973	-----	-----	2.048	Proposed Site (Pervious)
7	Combine	5, 6	-----	2.795	-----	-----	4.538	-----	-----	7.991	Proposed Total

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.1

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	2.696	1	725	9,778	---	----	-----	Existing Site (Impervious)
2	SCS Runoff	0.224	1	726	740	---	----	-----	Existing Site (Pervious)
3	Combine	2.913	1	725	10,518	1, 2	----	-----	Existing Total
5	SCS Runoff	2.343	1	725	8,497	---	----	-----	Proposed Site (Impervious)
6	SCS Runoff	0.460	1	726	1,463	---	----	-----	Proposed Site (Pervious)
7	Combine	2.795	1	726	9,960	5, 6	----	-----	Proposed Total
2023-04-03 2, 10, 100 yr.gpw					Return Period: 2 Year			Wednesday, Apr 5, 2023	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Wednesday, Apr 5, 2023

Hyd. No. 1

Existing Site (Impervious)

Hydrograph type = SCS Runoff

Storm frequency = 2 yrs

Time interval = 1 min

Drainage area = 0.840 ac

Basin Slope = 0.0 %

Tc method = USER

Total precip. = 3.44 in

Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 2.696 cfs

Time to peak = 725 min

Hyd. volume = 9,778 cuft

Curve number = 98

Hydraulic length = 0 ft

Time of conc. (Tc) = 4.00 min

Distribution = Custom

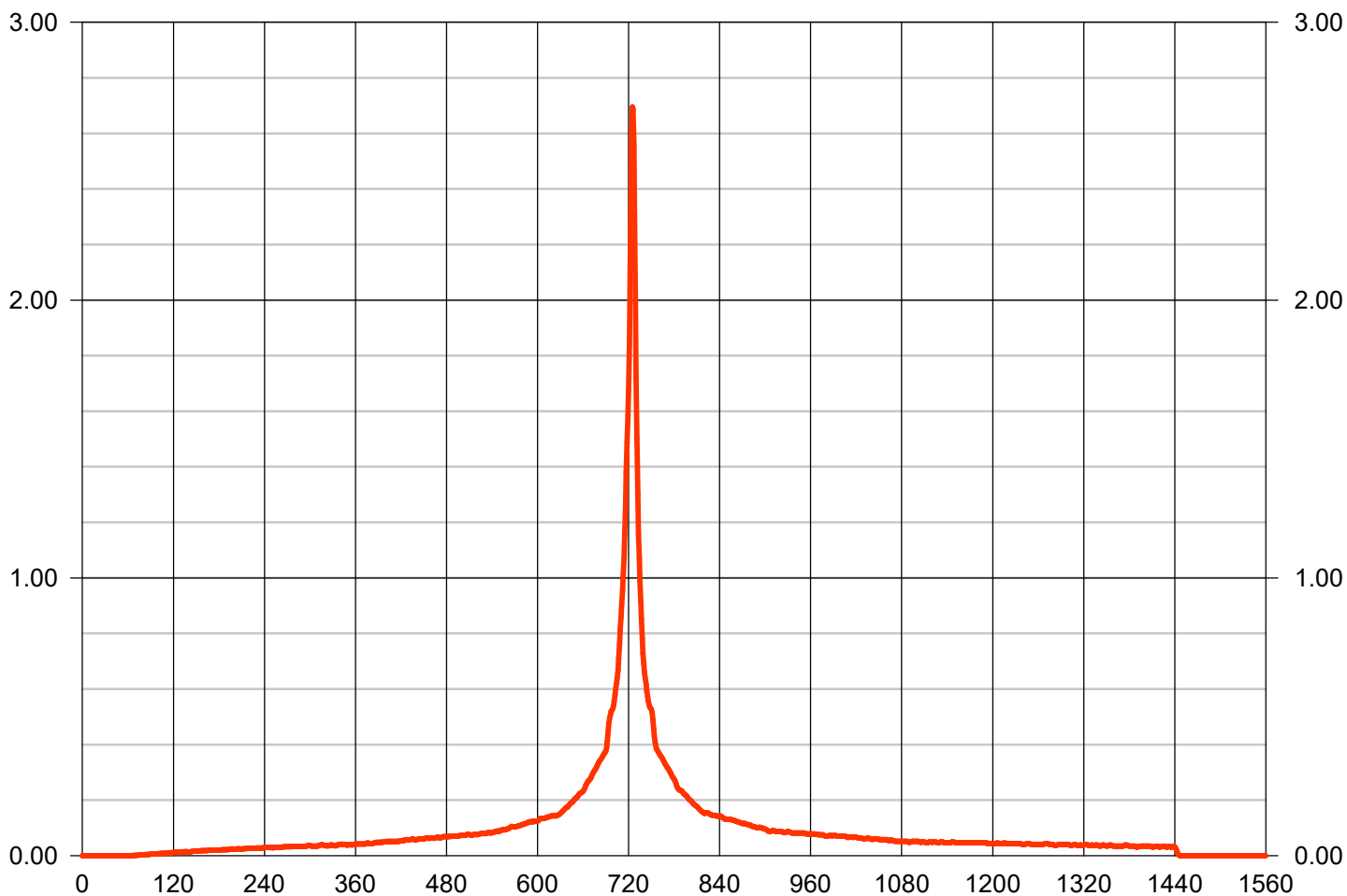
Shape factor = 484

Existing Site (Impervious)

Q (cfs)

Hyd. No. 1 -- 2 Year

Q (cfs)



— Hyd No. 1

Time (min)

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Wednesday, Apr 5, 2023

Hyd. No. 2

Existing Site (Pervious)

Hydrograph type = SCS Runoff

Storm frequency = 2 yrs

Time interval = 1 min

Drainage area = 0.210 ac

Basin Slope = 0.0 %

Tc method = USER

Total precip. = 3.44 in

Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 0.224 cfs

Time to peak = 726 min

Hyd. volume = 740 cuft

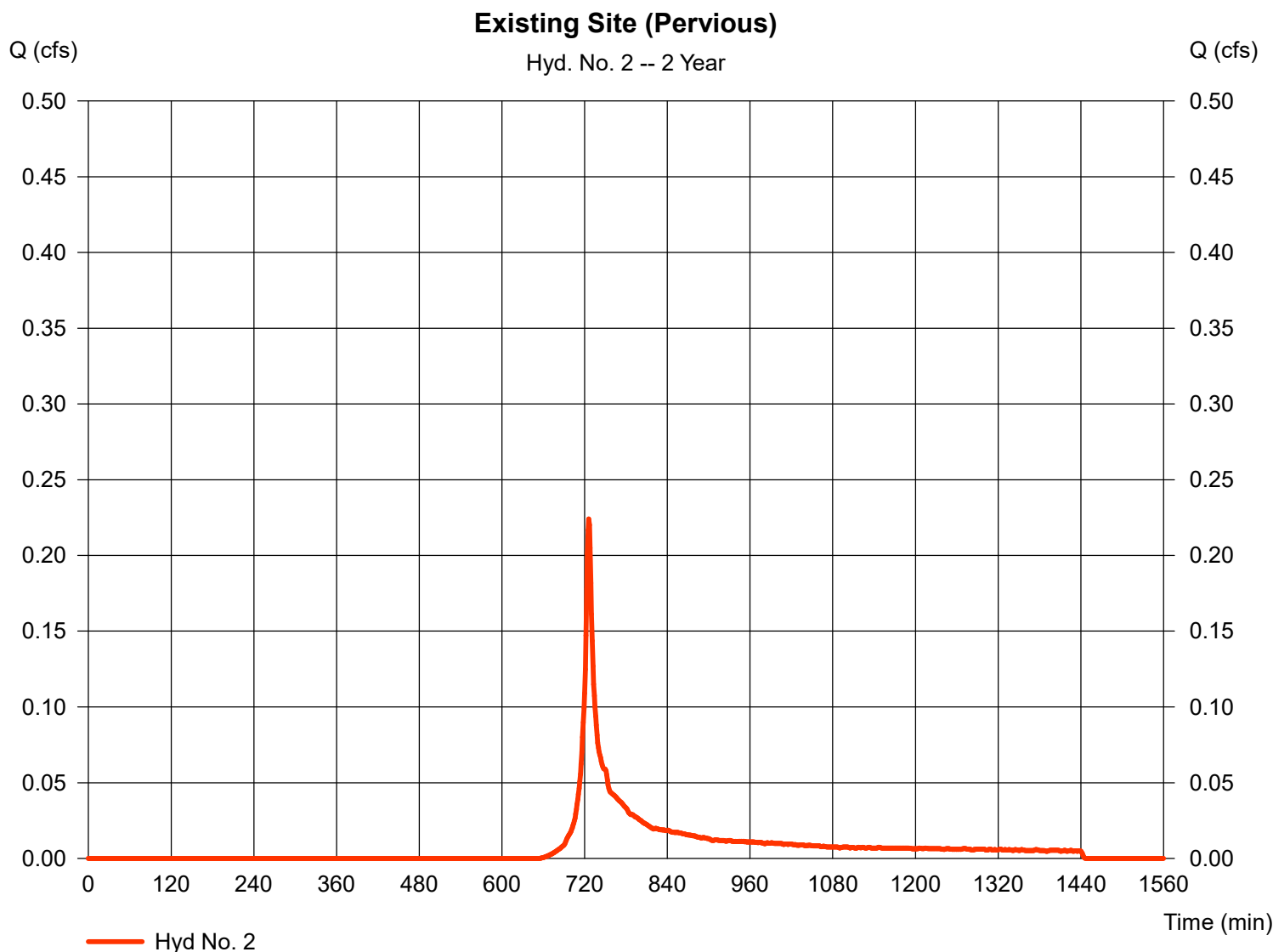
Curve number = 70

Hydraulic length = 0 ft

Time of conc. (Tc) = 4.00 min

Distribution = Custom

Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

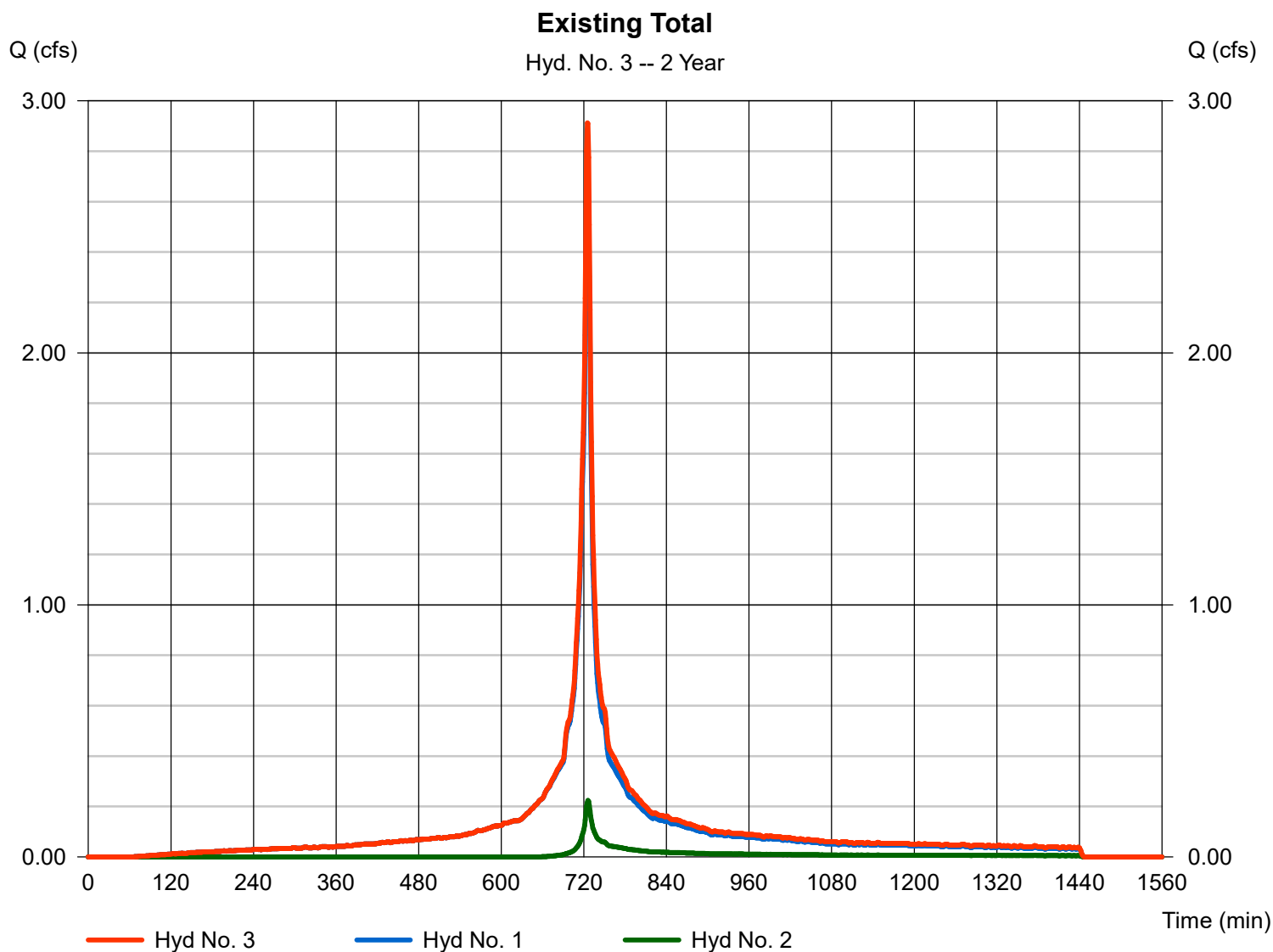
Wednesday, Apr 5, 2023

Hyd. No. 3

Existing Total

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

Peak discharge = 2.913 cfs
Time to peak = 725 min
Hyd. volume = 10,518 cuft
Contrib. drain. area = 1.050 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Wednesday, Apr 5, 2023

Hyd. No. 5

Proposed Site (Impervious)

Hydrograph type = SCS Runoff

Storm frequency = 2 yrs

Time interval = 1 min

Drainage area = 0.730 ac

Basin Slope = 0.0 %

Tc method = USER

Total precip. = 3.44 in

Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 2.343 cfs

Time to peak = 725 min

Hyd. volume = 8,497 cuft

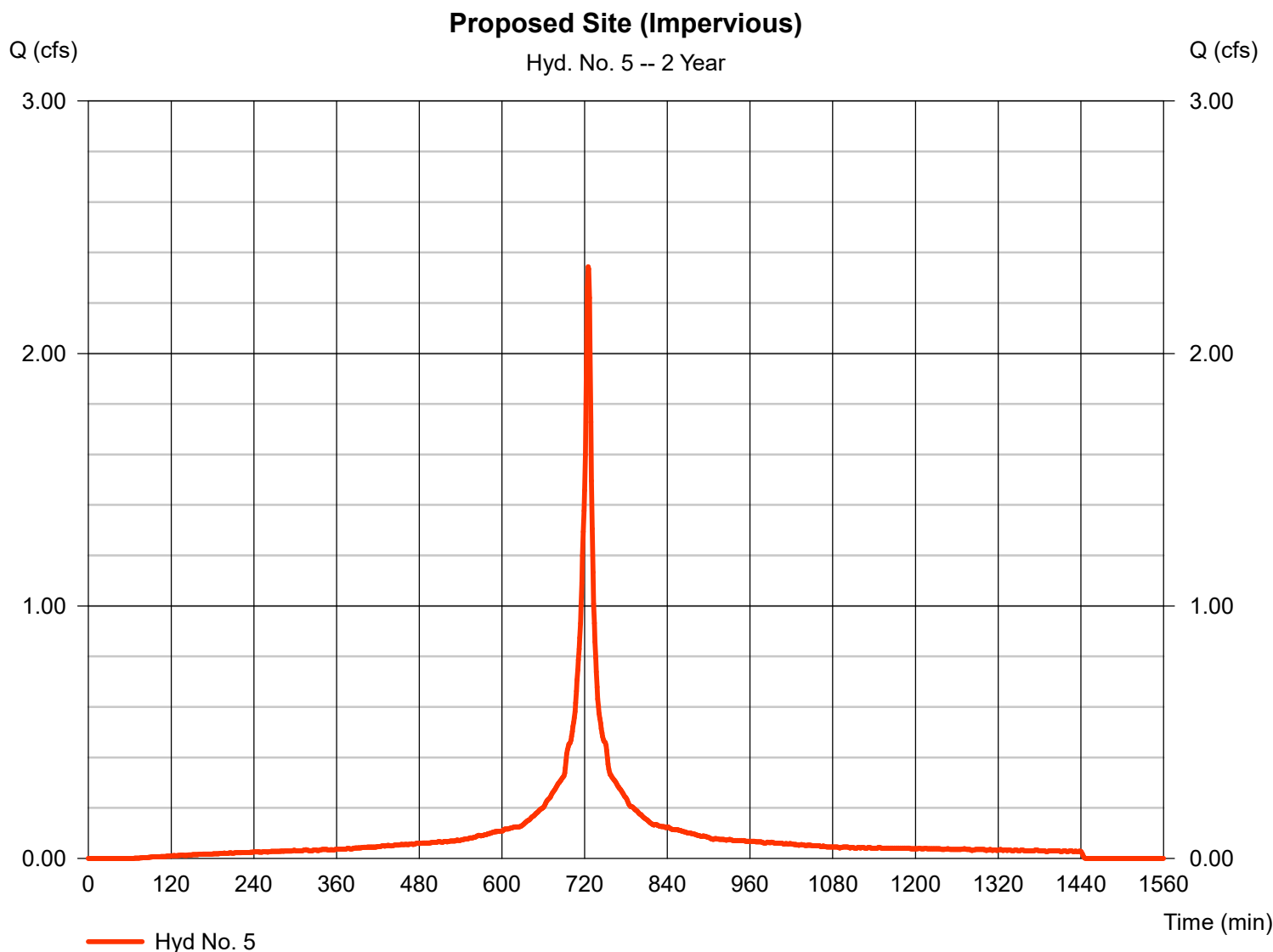
Curve number = 98

Hydraulic length = 0 ft

Time of conc. (Tc) = 4.00 min

Distribution = Custom

Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Wednesday, Apr 5, 2023

Hyd. No. 6

Proposed Site (Pervious)

Hydrograph type = SCS Runoff

Storm frequency = 2 yrs

Time interval = 1 min

Drainage area = 0.320 ac

Basin Slope = 0.0 %

Tc method = USER

Total precip. = 3.44 in

Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 0.460 cfs

Time to peak = 726 min

Hyd. volume = 1,463 cuft

Curve number = 75

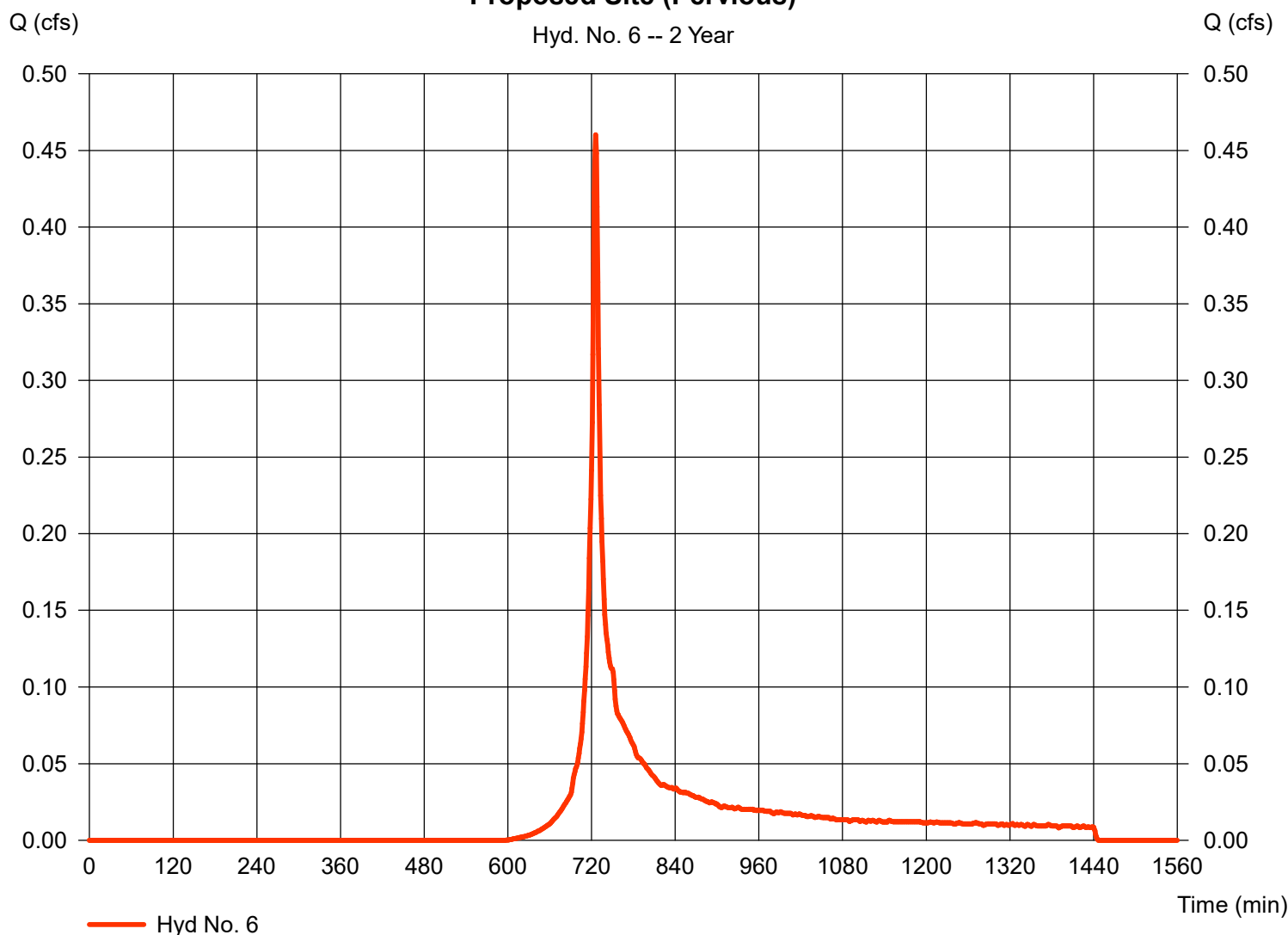
Hydraulic length = 0 ft

Time of conc. (Tc) = 4.00 min

Distribution = Custom

Shape factor = 484

Proposed Site (Pervious)



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

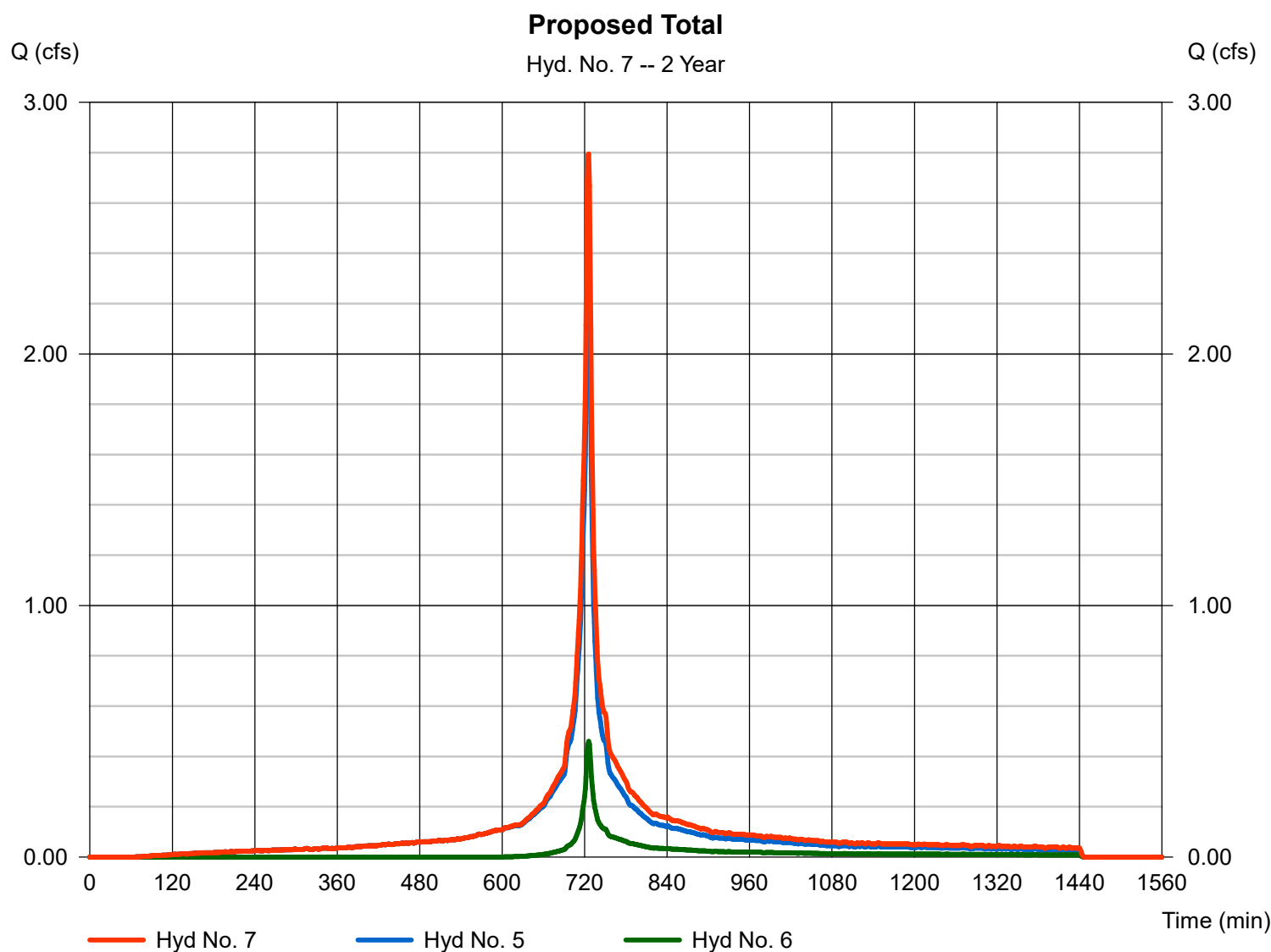
Wednesday, Apr 5, 2023

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 1 min
Inflow hyds. = 5, 6

Peak discharge = 2.795 cfs
Time to peak = 726 min
Hyd. volume = 9,960 cuft
Contrib. drain. area = 1.050 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.1

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	4.116	1	725	15,194	----	-----	-----	Existing Site (Impervious)
2	SCS Runoff	0.533	1	726	1,678	----	-----	-----	Existing Site (Pervious)
3	Combine	4.640	1	725	16,871	1, 2	-----	-----	Existing Total
5	SCS Runoff	3.577	1	725	13,204	----	-----	-----	Proposed Site (Impervious)
6	SCS Runoff	0.973	1	726	3,054	----	-----	-----	Proposed Site (Pervious)
7	Combine	4.538	1	725	16,258	5, 6	-----	-----	Proposed Total
2023-04-03 2, 10, 100 yr.gpw					Return Period: 10 Year			Wednesday, Apr 5, 2023	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Wednesday, Apr 5, 2023

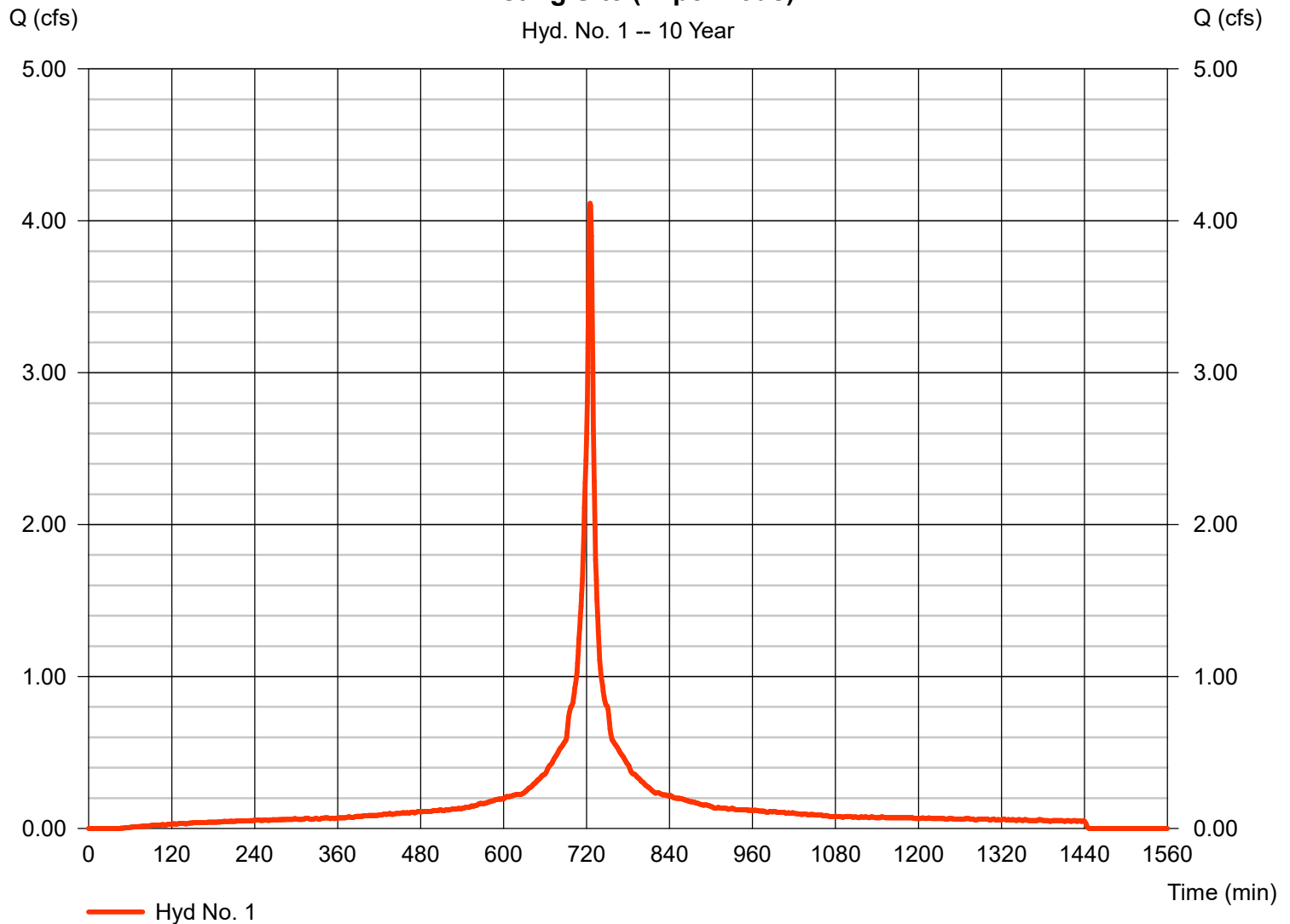
Hyd. No. 1

Existing Site (Impervious)

Hydrograph type = SCS Runoff
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 0.840 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 5.22 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 4.116 cfs
 Time to peak = 725 min
 Hyd. volume = 15,194 cuft
 Curve number = 98
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 4.00 min
 Distribution = Custom
 Shape factor = 484

Existing Site (Impervious)



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

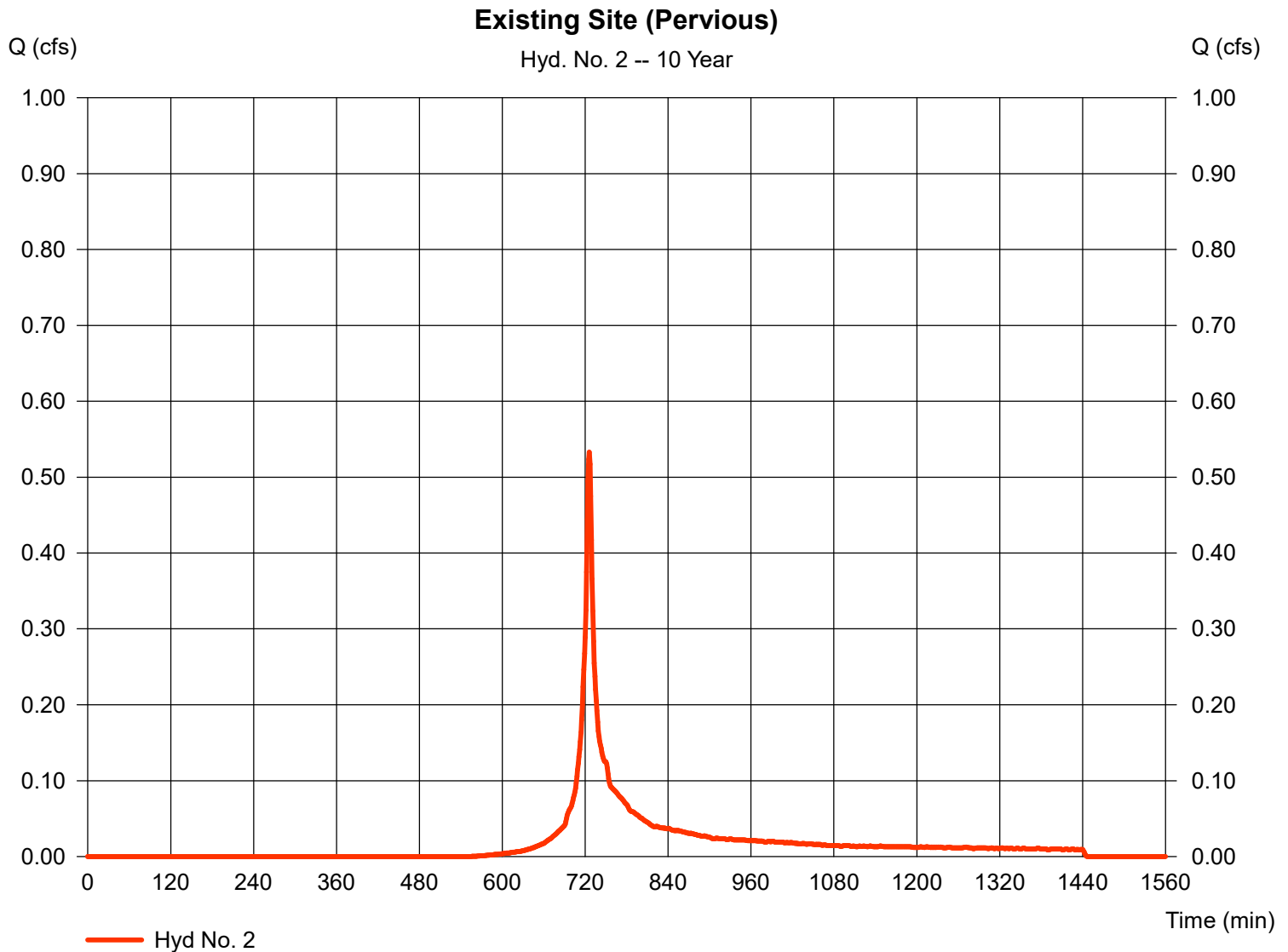
Wednesday, Apr 5, 2023

Hyd. No. 2

Existing Site (Pervious)

Hydrograph type = SCS Runoff
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 0.210 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 5.22 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 0.533 cfs
 Time to peak = 726 min
 Hyd. volume = 1,678 cuft
 Curve number = 70
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 4.00 min
 Distribution = Custom
 Shape factor = 484



Hydrograph Report

13

Hydraflow Hydrographs by Intelisolve v9.1

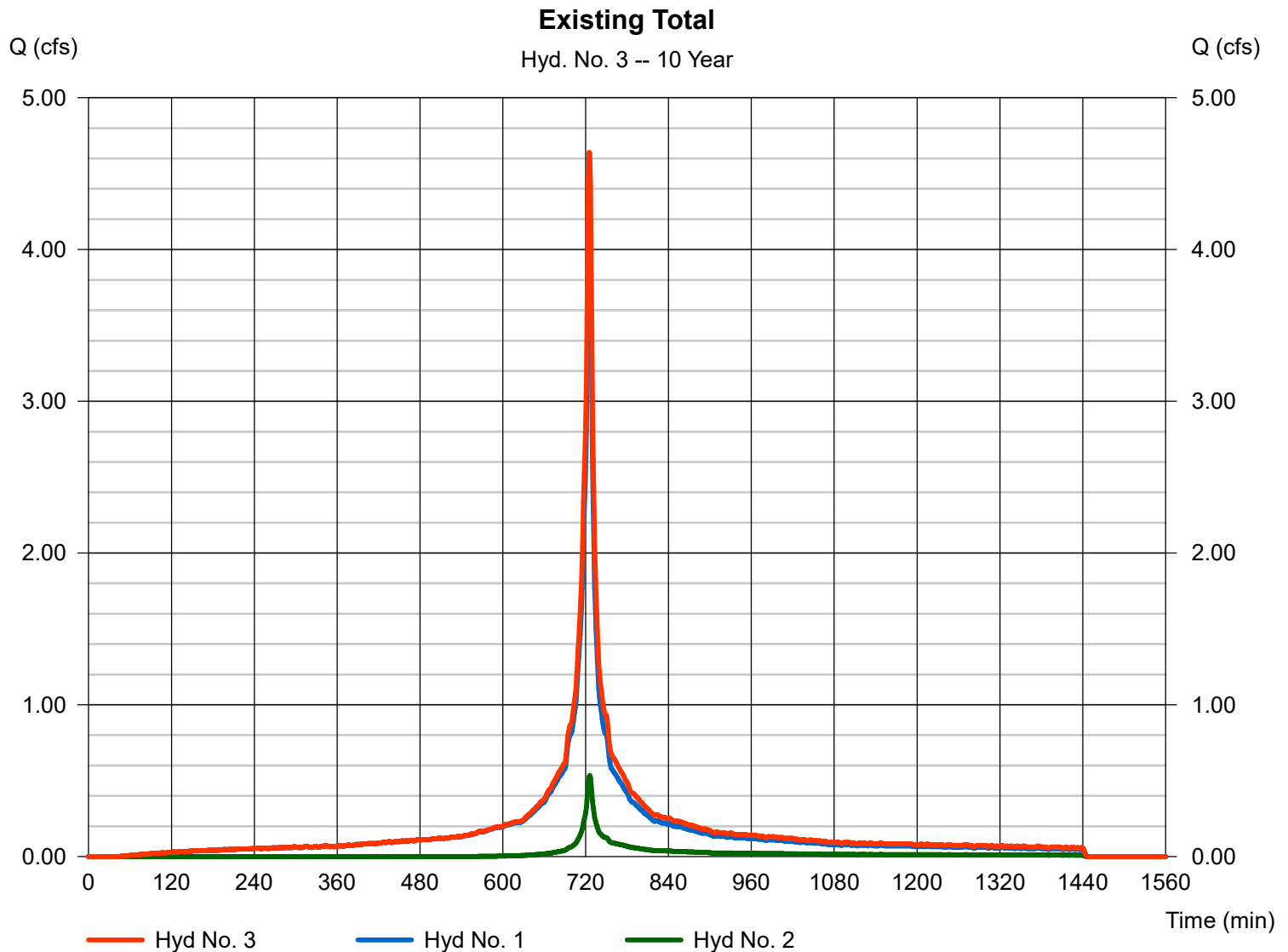
Wednesday, Apr 5, 2023

Hyd. No. 3

Existing Total

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 1 min
Inflow hyds. = 1, 2

Peak discharge = 4.640 cfs
Time to peak = 725 min
Hyd. volume = 16,871 cuft
Contrib. drain. area = 1.050 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

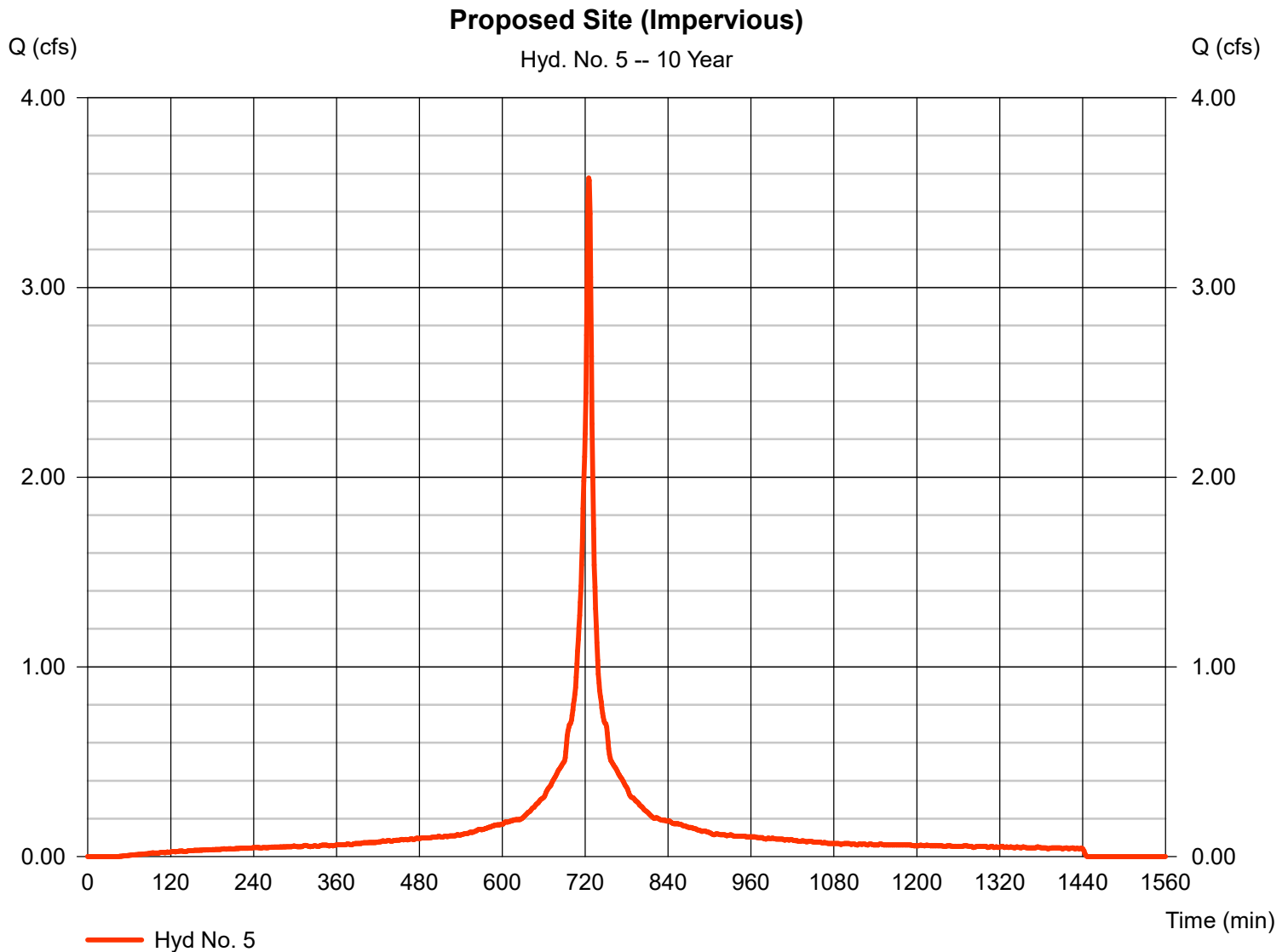
Wednesday, Apr 5, 2023

Hyd. No. 5

Proposed Site (Impervious)

Hydrograph type = SCS Runoff
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 0.730 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 5.22 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 3.577 cfs
 Time to peak = 725 min
 Hyd. volume = 13,204 cuft
 Curve number = 98
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 4.00 min
 Distribution = Custom
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

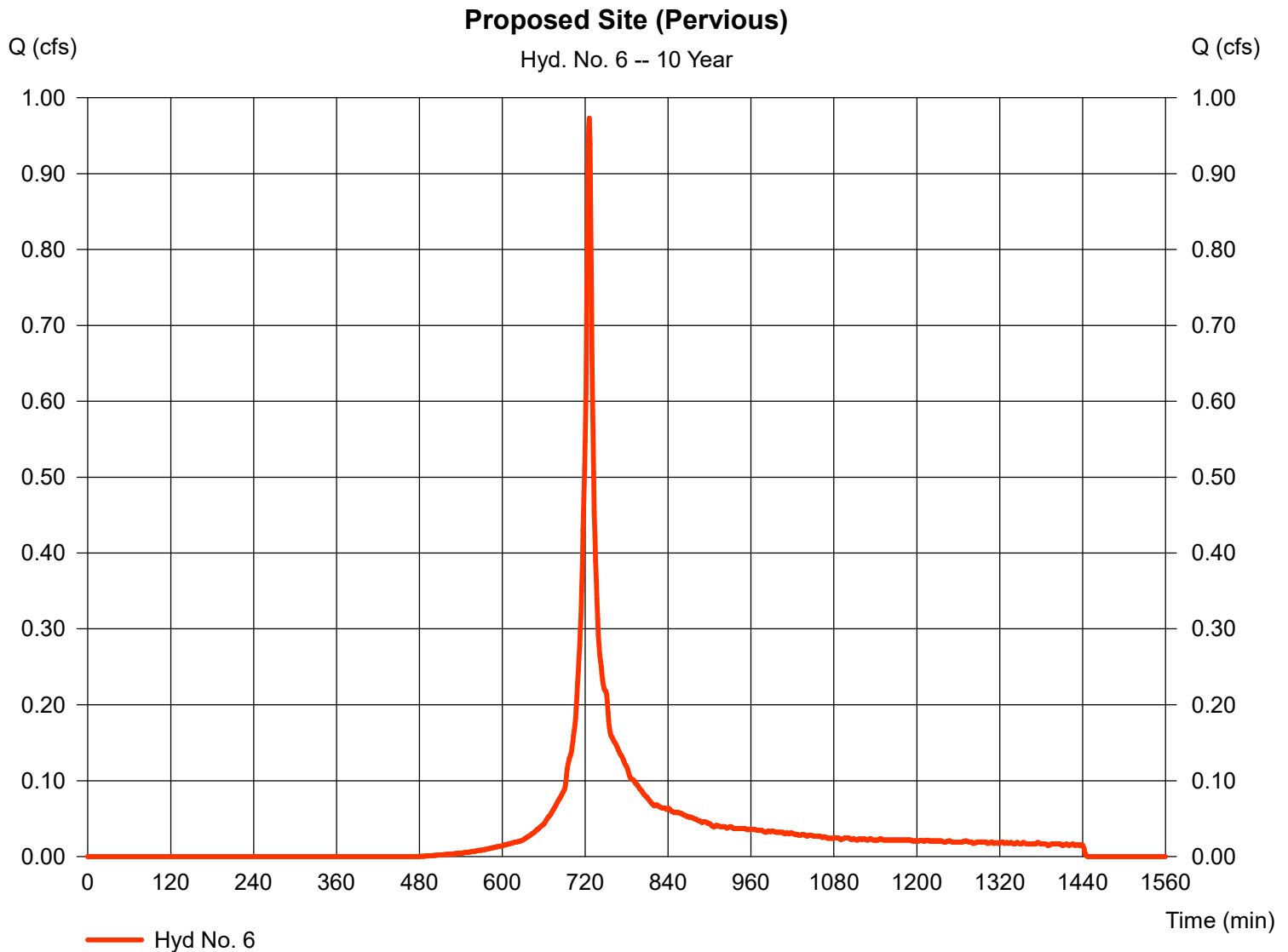
Wednesday, Apr 5, 2023

Hyd. No. 6

Proposed Site (Pervious)

Hydrograph type = SCS Runoff
 Storm frequency = 10 yrs
 Time interval = 1 min
 Drainage area = 0.320 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 5.22 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 0.973 cfs
 Time to peak = 726 min
 Hyd. volume = 3,054 cuft
 Curve number = 75
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 4.00 min
 Distribution = Custom
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

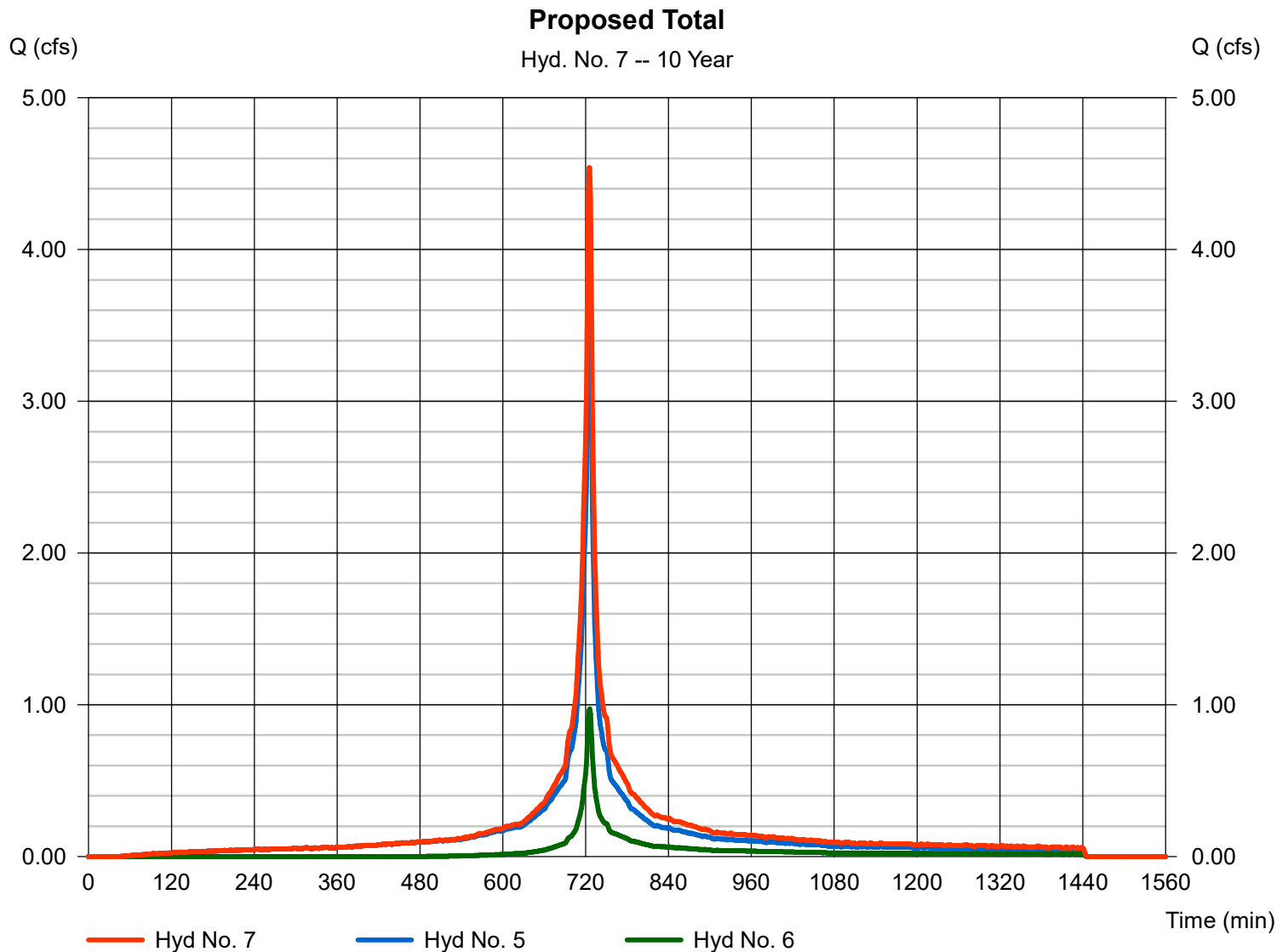
Wednesday, Apr 5, 2023

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 1 min
Inflow hyds. = 5, 6

Peak discharge = 4.538 cfs
Time to peak = 725 min
Hyd. volume = 16,258 cuft
Contrib. drain. area = 1.050 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.1

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	6.851	1	725	25,674	---	-----	-----	Existing Site (Impervious)
2	SCS Runoff	1.215	1	726	3,839	---	-----	-----	Existing Site (Pervious)
3	Combine	8.056	1	725	29,513	1, 2	-----	-----	Existing Total
5	SCS Runoff	5.953	1	725	22,312	---	-----	-----	Proposed Site (Impervious)
6	SCS Runoff	2.048	1	726	6,553	---	-----	-----	Proposed Site (Pervious)
7	Combine	7.991	1	725	28,864	5, 6	-----	-----	Proposed Total
2023-04-03 2, 10, 100 yr.gpw					Return Period: 100 Year			Wednesday, Apr 5, 2023	

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

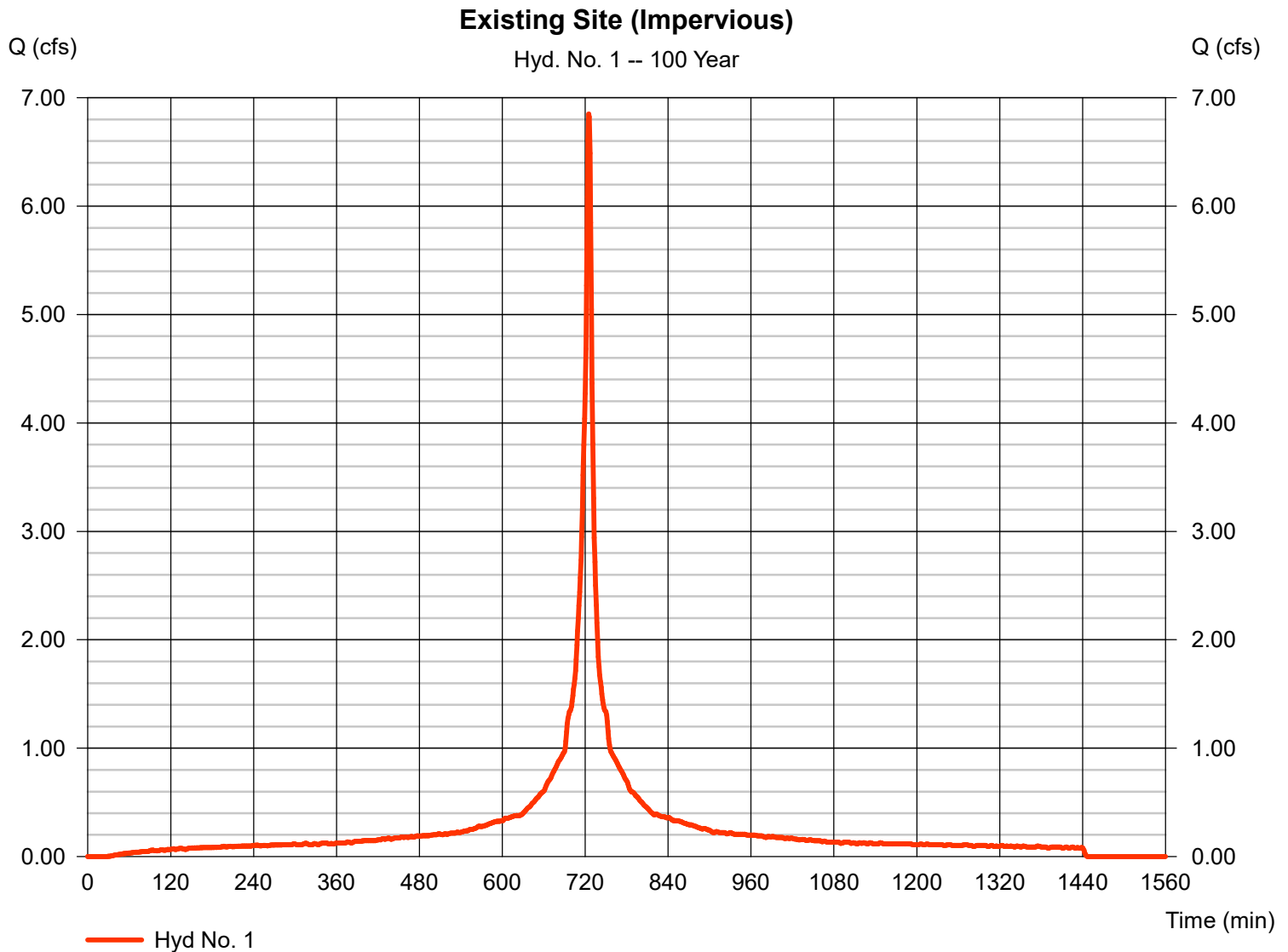
Wednesday, Apr 5, 2023

Hyd. No. 1

Existing Site (Impervious)

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 0.840 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 8.66 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 6.851 cfs
 Time to peak = 725 min
 Hyd. volume = 25,674 cuft
 Curve number = 98
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 4.00 min
 Distribution = Custom
 Shape factor = 484

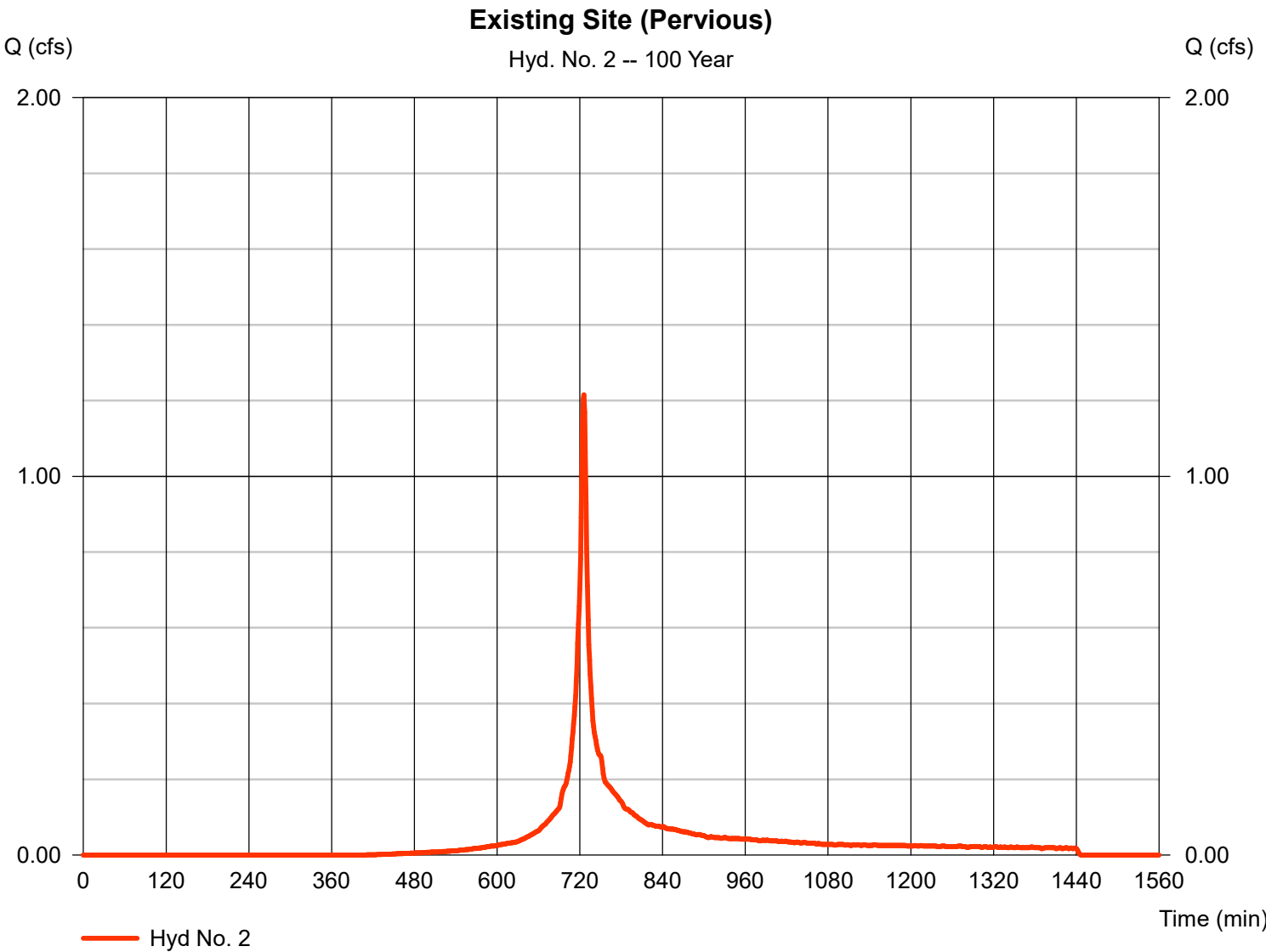


Hydrograph Report

Hyd. No. 2

Existing Site (Pervious)

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.215 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	1 min	Hyd. volume	=	3,839 cuft
Drainage area	=	0.210 ac	Curve number	=	70
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	4.00 min
Total precip.	=	8.66 in	Distribution	=	Custom
Storm duration	=	NOAA Atlas 14 Type-D.cds	Shape factor	=	484



Hydrograph Report

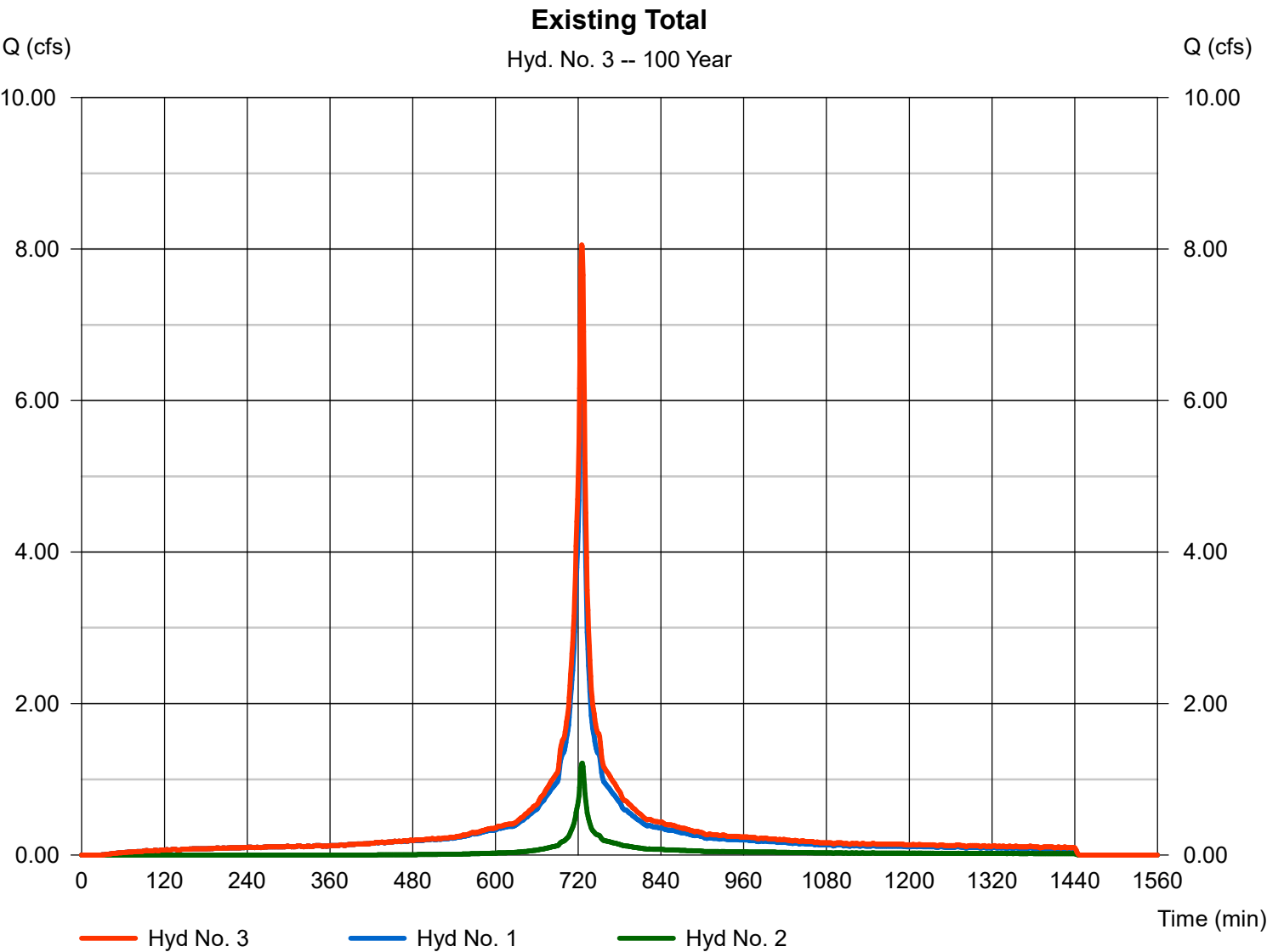
Hydraflow Hydrographs by Intelisolve v9.1

Wednesday, Apr 5, 2023

Hyd. No. 3

Existing Total

Hydrograph type	= Combine	Peak discharge	= 8.056 cfs
Storm frequency	= 100 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 29,513 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.050 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

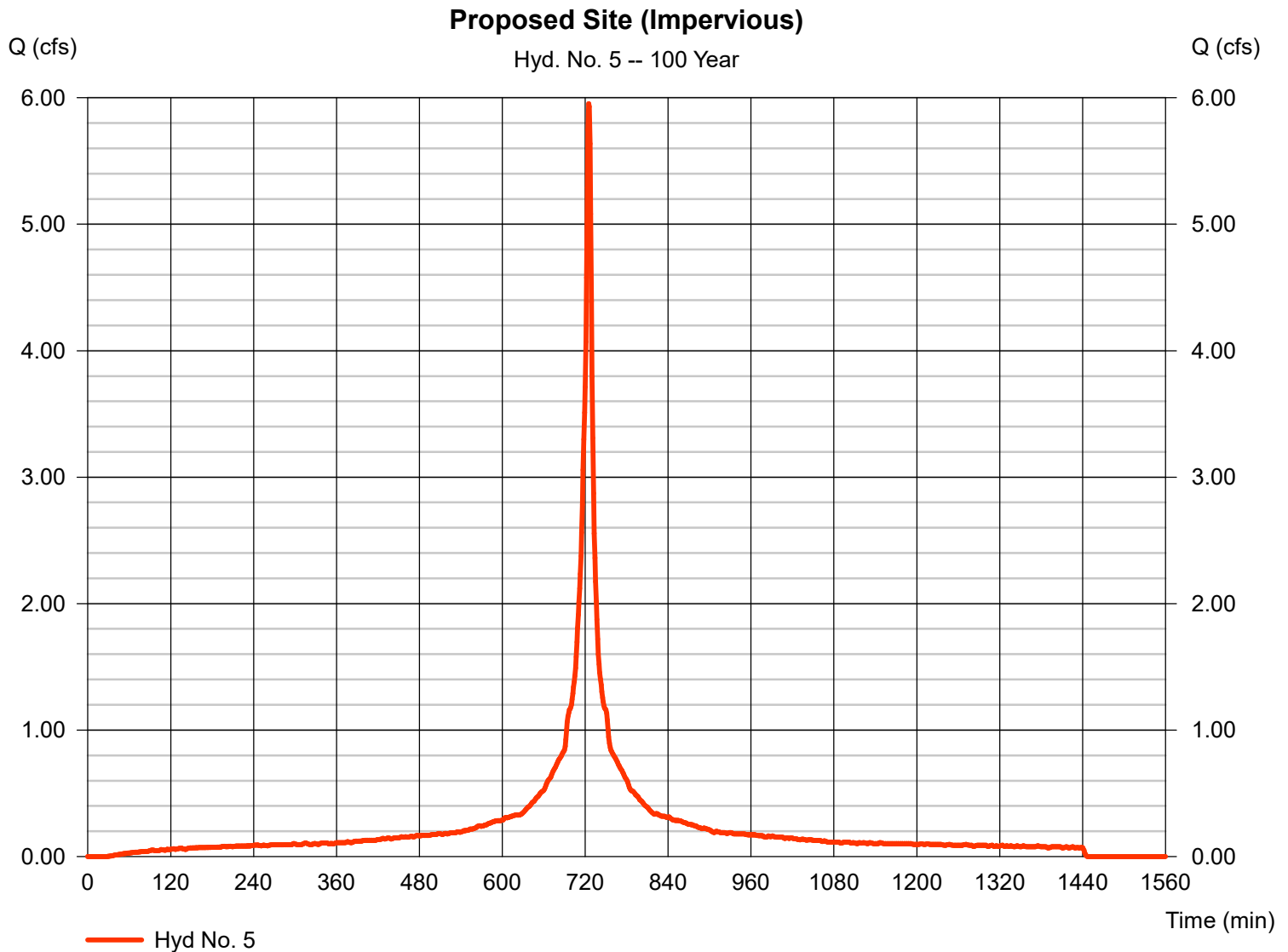
Wednesday, Apr 5, 2023

Hyd. No. 5

Proposed Site (Impervious)

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 0.730 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 8.66 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 5.953 cfs
 Time to peak = 725 min
 Hyd. volume = 22,312 cuft
 Curve number = 98
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 4.00 min
 Distribution = Custom
 Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

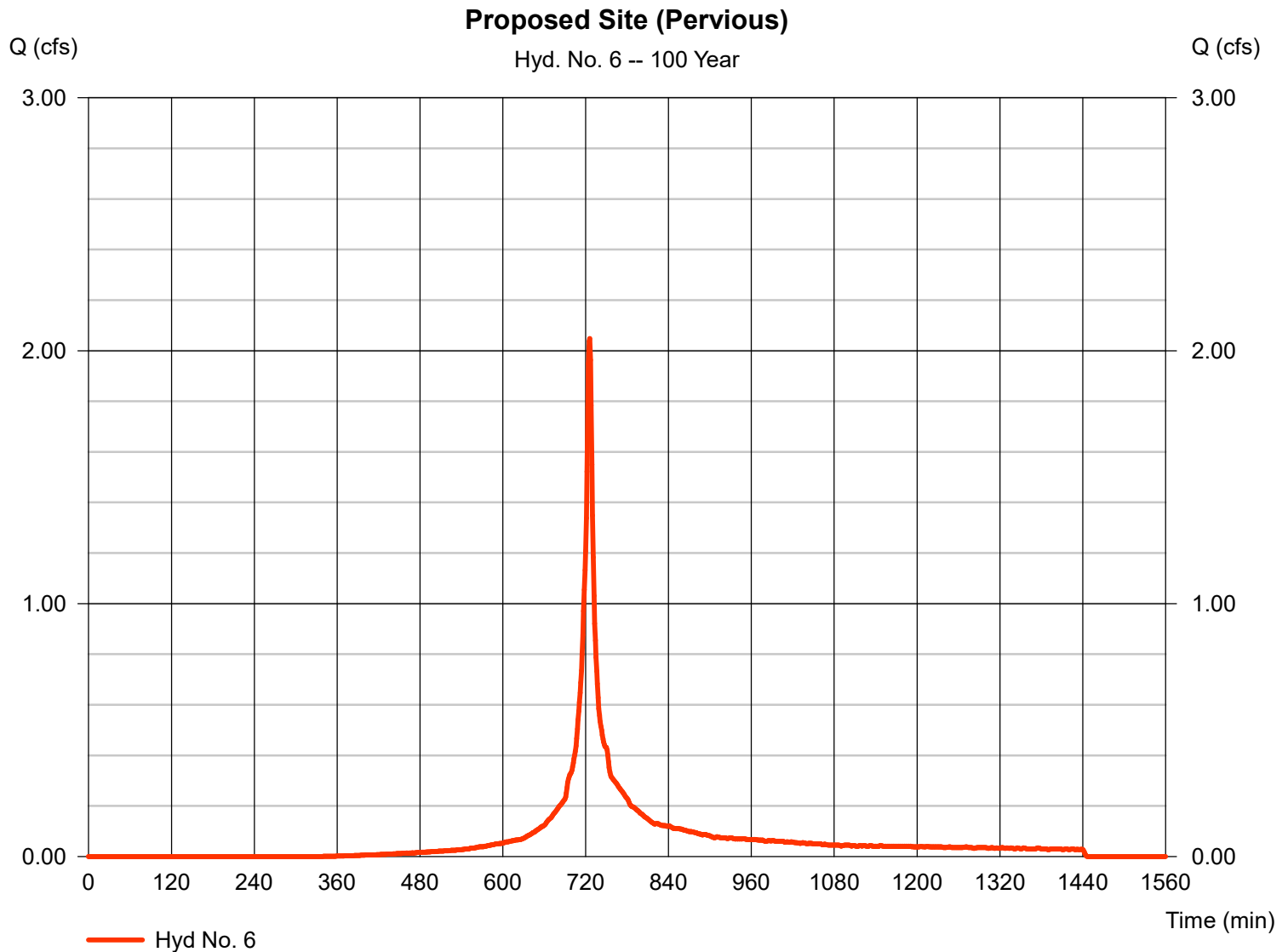
Wednesday, Apr 5, 2023

Hyd. No. 6

Proposed Site (Pervious)

Hydrograph type = SCS Runoff
 Storm frequency = 100 yrs
 Time interval = 1 min
 Drainage area = 0.320 ac
 Basin Slope = 0.0 %
 Tc method = USER
 Total precip. = 8.66 in
 Storm duration = NOAA Atlas 14 Type-D.cds

Peak discharge = 2.048 cfs
 Time to peak = 726 min
 Hyd. volume = 6,553 cuft
 Curve number = 75
 Hydraulic length = 0 ft
 Time of conc. (Tc) = 4.00 min
 Distribution = Custom
 Shape factor = 484

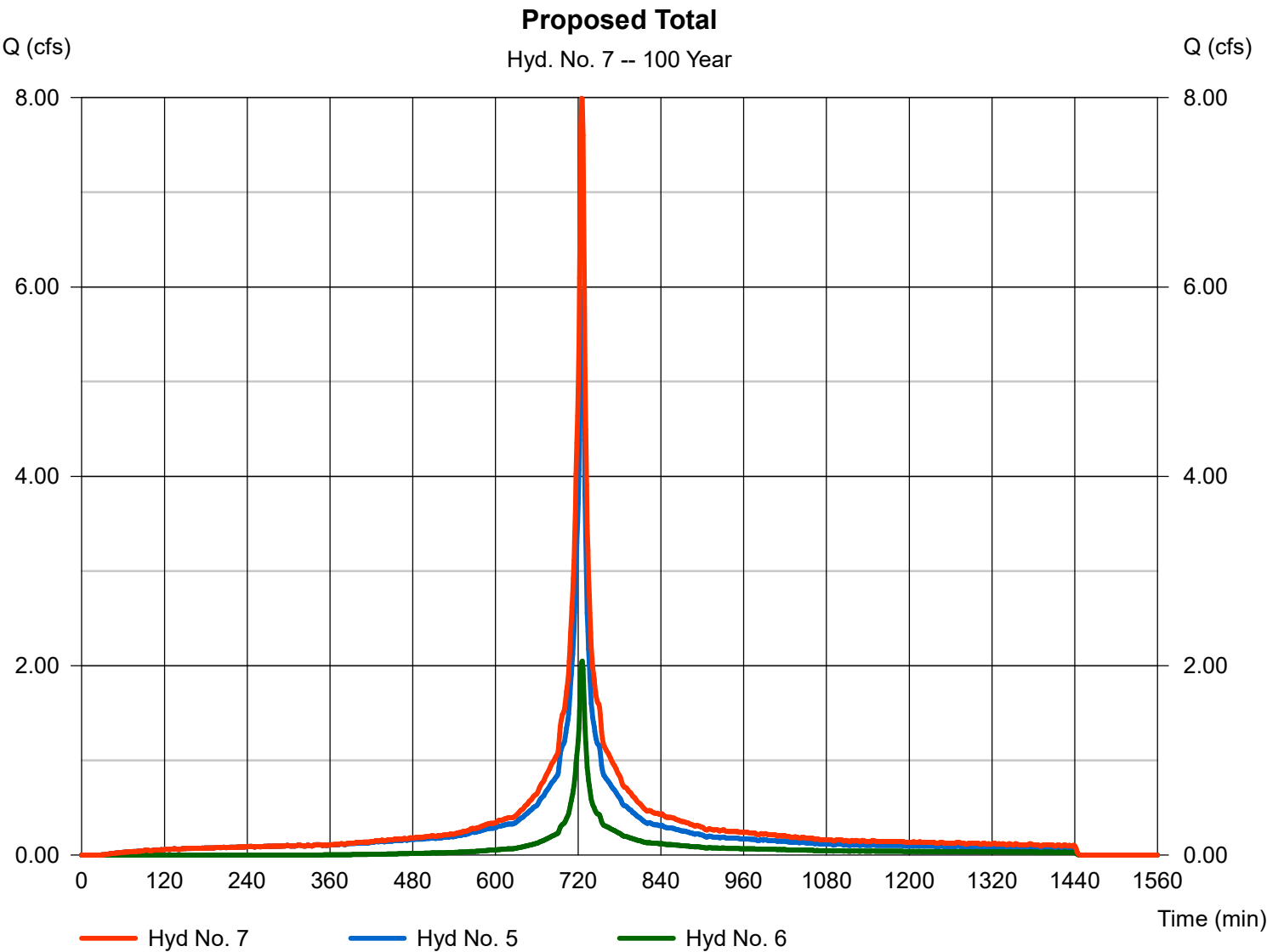


Hydrograph Report

Hyd. No. 7

Proposed Total

Hydrograph type	= Combine	Peak discharge	= 7.991 cfs
Storm frequency	= 100 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 28,864 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 1.050 ac



Hydraflow Rainfall Report

Hydraflow Hydrographs by Intelisolve v9.1

Wednesday, Apr 5, 2023

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	-----
2	69.8703	13.1000	0.8658	-----
3	0.0000	0.0000	0.0000	-----
5	79.2597	14.6000	0.8369	-----
10	88.2351	15.5000	0.8279	-----
25	102.6072	16.5000	0.8217	-----
50	114.8193	17.2000	0.8199	-----
100	127.1596	17.8000	0.8186	-----

File name: SampleFHA.idf

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

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.69	4.61	3.89	3.38	2.99	2.69	2.44	2.24	2.07	1.93	1.81	1.70
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	6.57	5.43	4.65	4.08	3.65	3.30	3.02	2.79	2.59	2.42	2.27	2.15
10	7.24	6.04	5.21	4.59	4.12	3.74	3.43	3.17	2.95	2.77	2.60	2.46
25	8.25	6.95	6.03	5.34	4.80	4.38	4.02	3.73	3.48	3.26	3.07	2.91
50	9.04	7.65	6.66	5.92	5.34	4.87	4.49	4.16	3.88	3.65	3.44	3.25
100	9.83	8.36	7.30	6.50	5.87	5.36	4.94	4.59	4.29	4.03	3.80	3.60

T_c = time in minutes. Values may exceed 60.

Precip. file name: Essex County.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	3.44	0.00	0.00	5.22	6.44	0.00	8.66
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	1.25	3.44	0.00	0.00	5.22	6.44	0.00	8.66

**MULTI-HYDROGRAPH PLOT – EXISTING AND
PROPOSED SUPERIMPOSED 2 YR. 10 YR & 100 YR.**

Multi-Hydrograph Plot

Hyd. No. 3

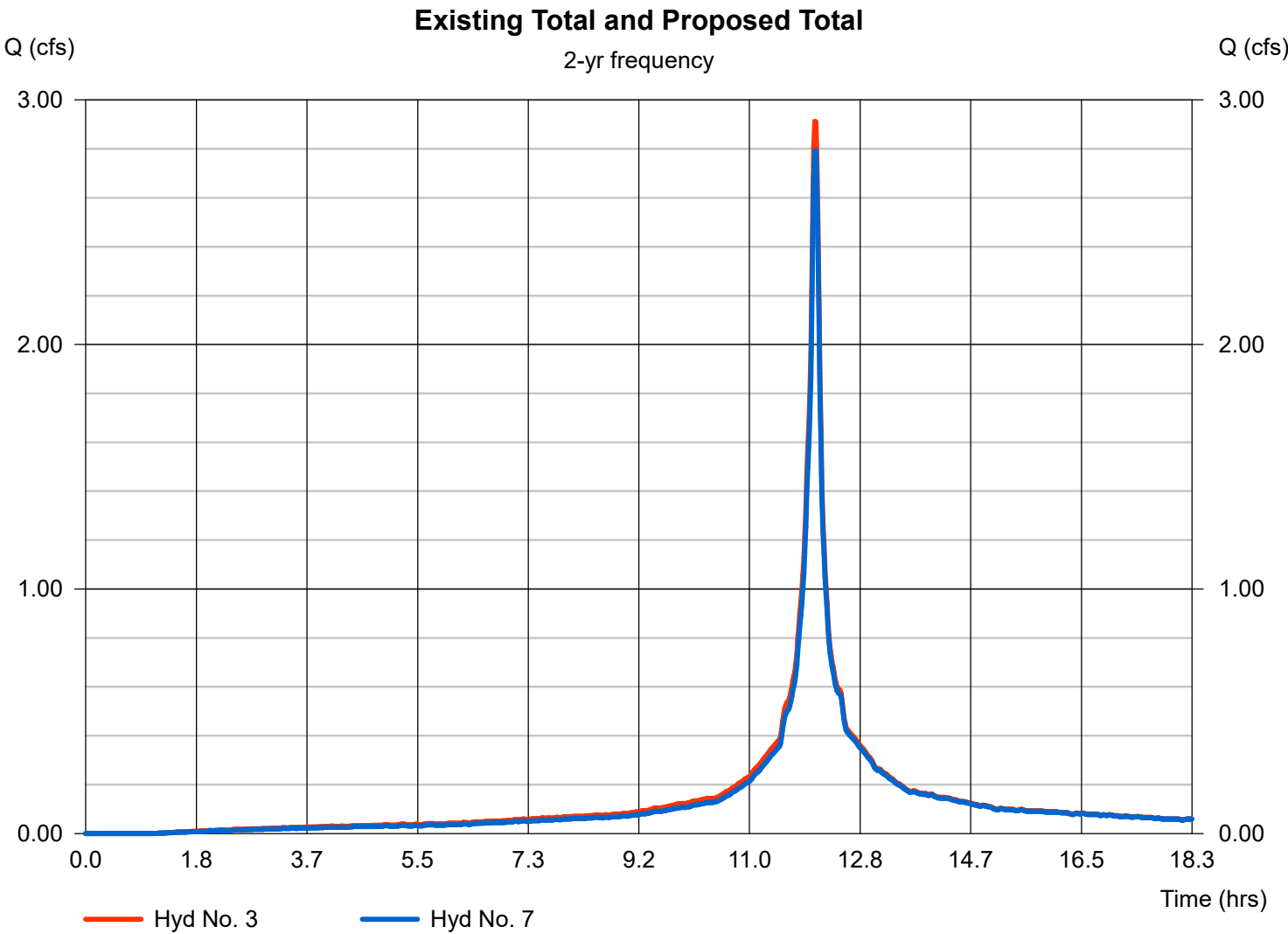
Existing Total

Hydrograph type = Combine
Peak discharge = 2.913 cfs
Time to peak = 12.08 hrs
Hyd. Volume = 10,518 cuft

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Peak discharge = 2.79 cfs
Time to peak = 12.10 hrs
Hyd. Volume = 9,960 cuft



Multi-Hydrograph Plot

Hyd. No. 3

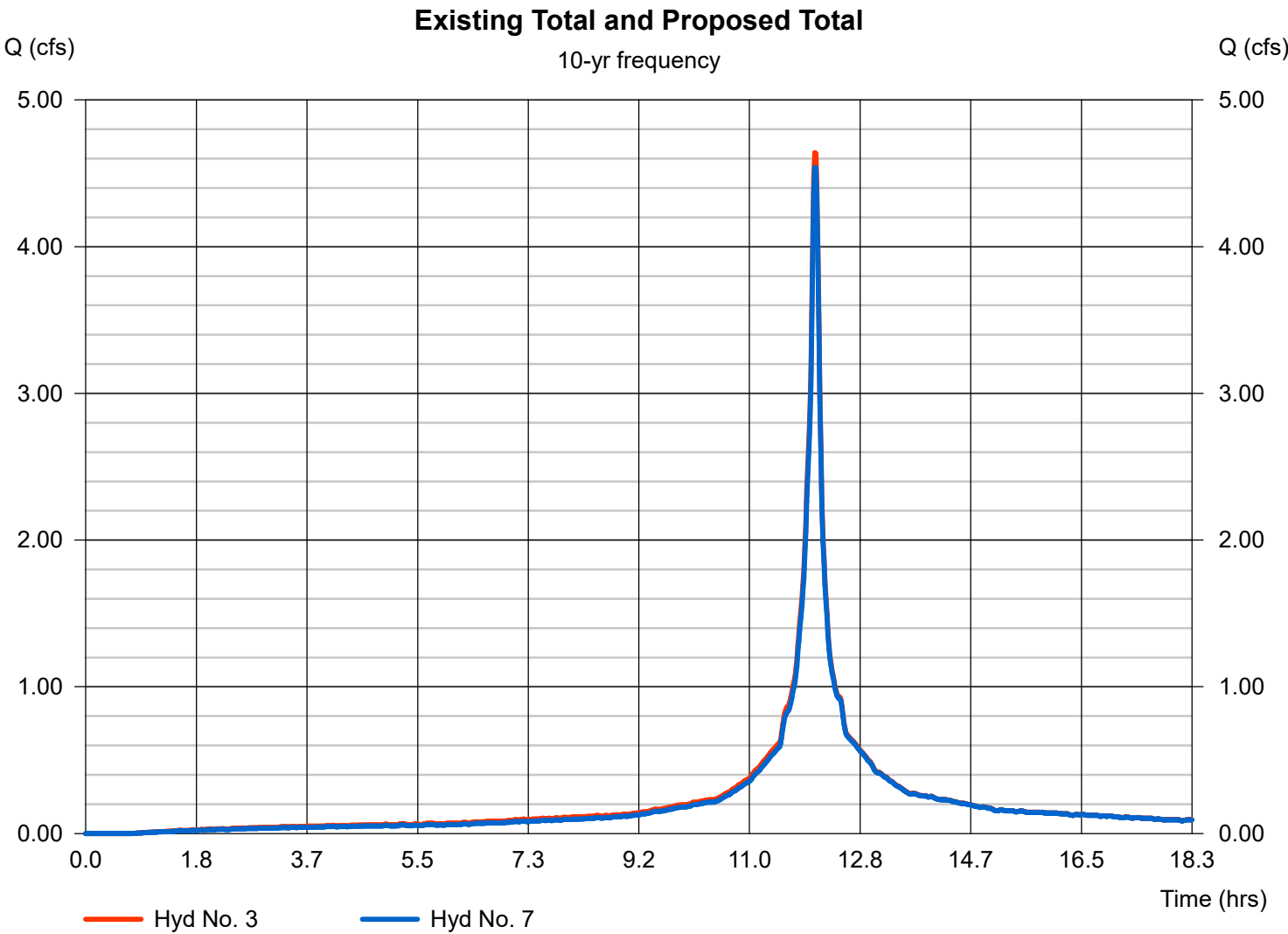
Existing Total

Hydrograph type = Combine
Peak discharge = 4.640 cfs
Time to peak = 12.08 hrs
Hyd. Volume = 16,871 cuft

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Peak discharge = 4.54 cfs
Time to peak = 12.08 hrs
Hyd. Volume = 16,258 cuft



Multi-Hydrograph Plot

Hyd. No. 3

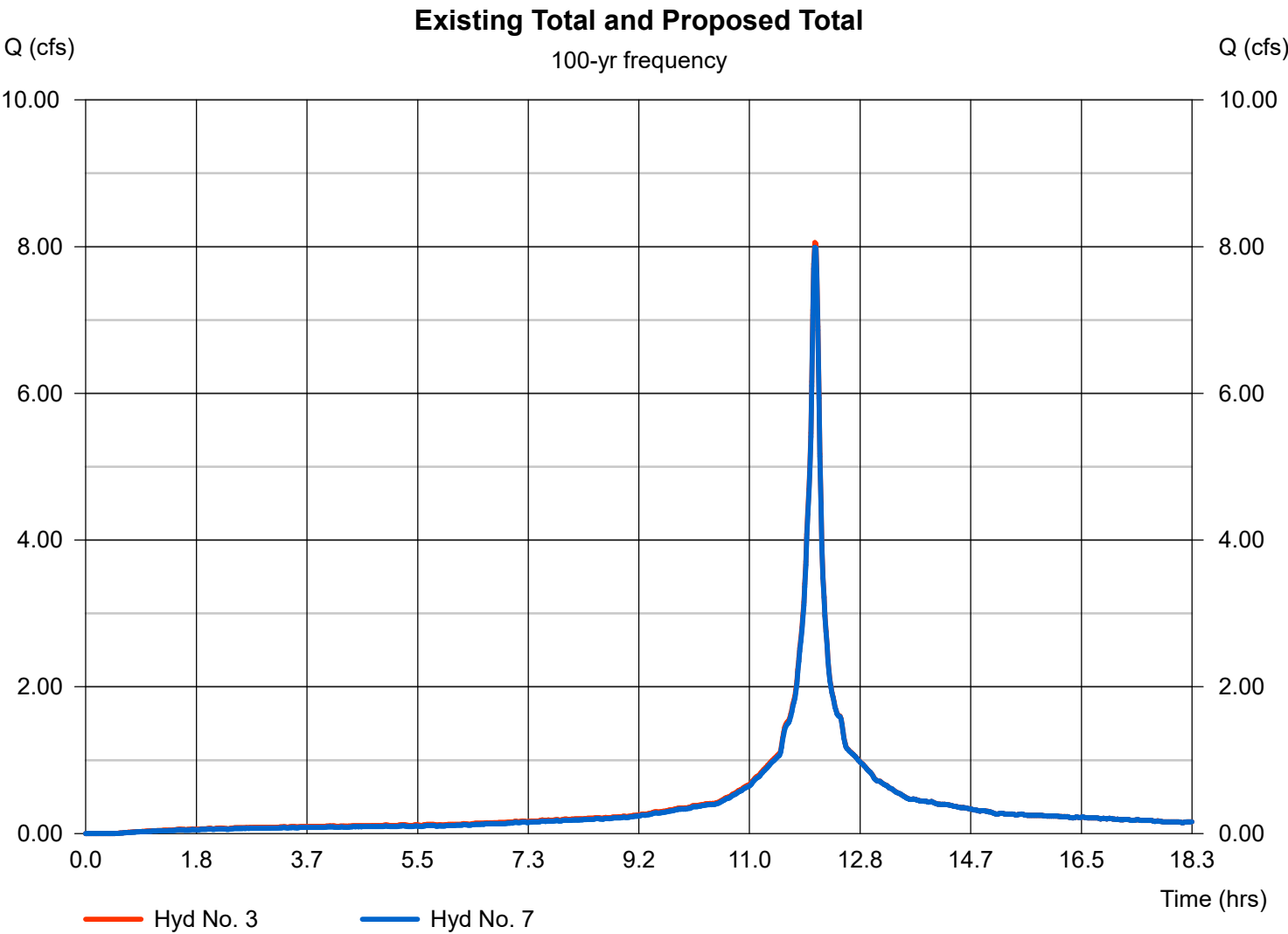
Existing Total

Hydrograph type = Combine
Peak discharge = 8.056 cfs
Time to peak = 12.08 hrs
Hyd. Volume = 29,513 cuft

Hyd. No. 7

Proposed Total

Hydrograph type = Combine
Peak discharge = 7.99 cfs
Time to peak = 12.08 hrs
Hyd. Volume = 28,864 cuft



**STORMWATER COLLECTION SYSTEM
CLACULATIONS (PIPE SIZING)**



DYNAMIC ENGINEERING

Stormwater Collection System Calculations

Project: Proposed Popeyes & Fast Food Restaurant

Job #: 1021-99-025

Location: West Orange, NJ

Design Storm: 25 Year

Computed By: DG

Checked By: MB

Date: 3/30/2023

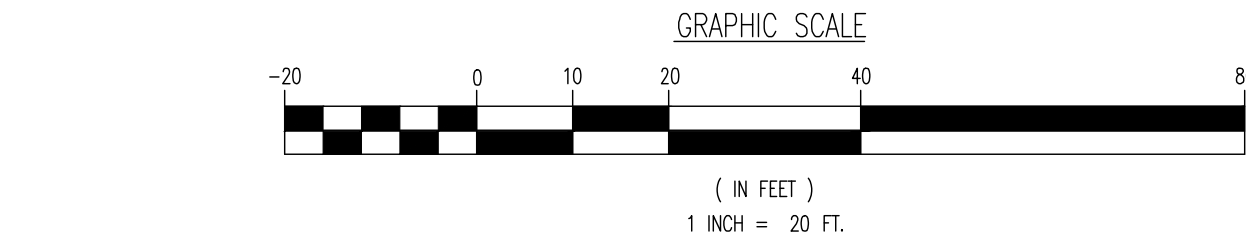
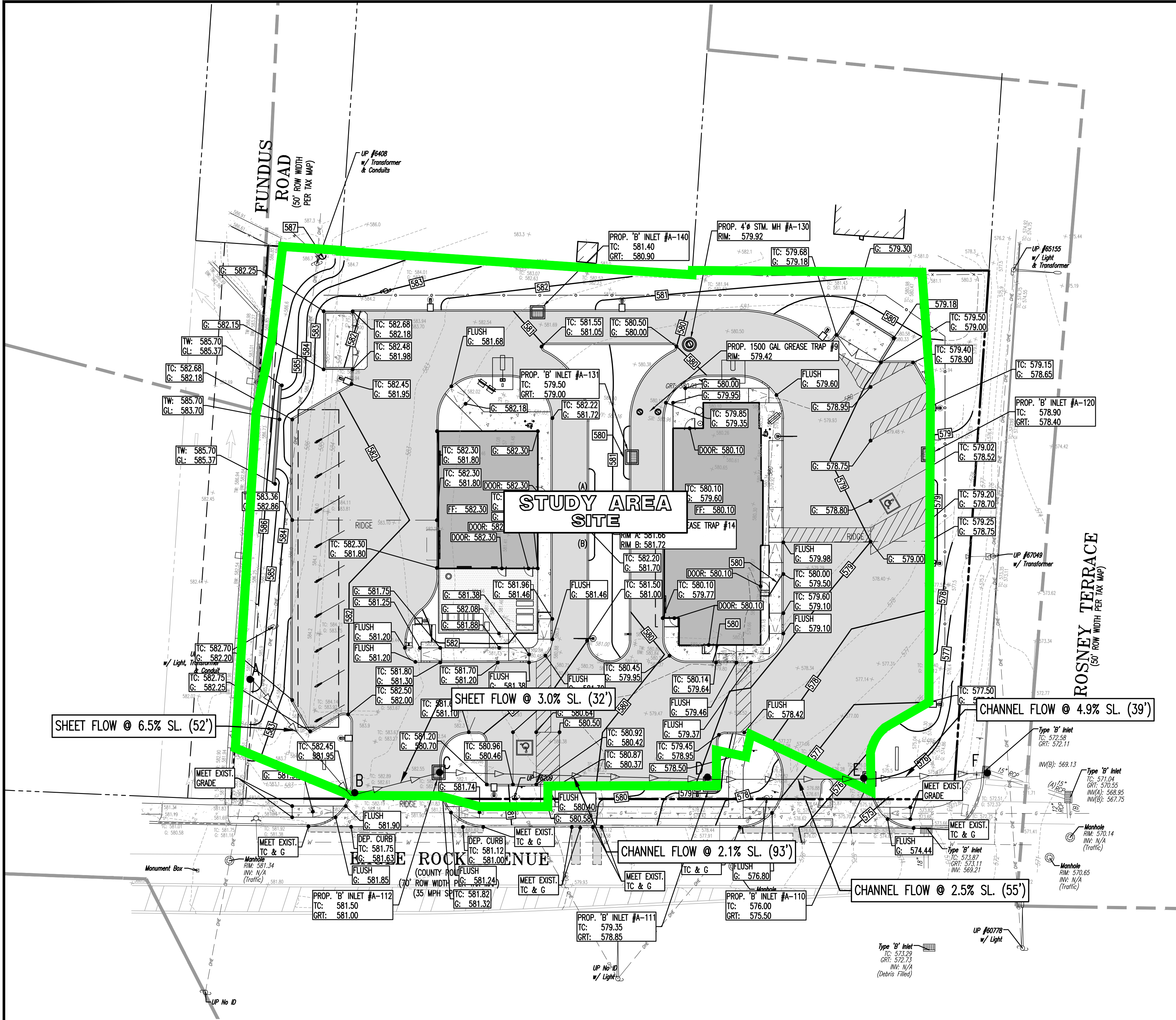
NOTES:

- 1) Design method used is Rational Method, unless otherwise noted.
- 2) Refer to Weighted Runoff Coefficient table for calculation of incremental areas and C values

PIPE SECTION		SUBCATCHMENT AREA	INCREMENTAL		CUMULATIVE	TIME OF CONCENTRATION			I	PEAK RUNOFF		PIPING INPUT			PIPING DATA		
FROM	TO	Area (Acres)	"C"	A x C Ac	A x C (acres)	Tc to Inlet (min)	Tc in Pipe (min.)	Final Tc (min)	(In/Hr)	Q to Inlet (CFS)	Q cum. for Pipe (CFS)	Dia. (In)	Length (Ft)	Man. "n"	Slope (ft/ft)	Pipe Capacity (cfs)	Pipe Velocity (fps)
Inlet A-112	Inlet A-111	0.17	0.81	0.14	0.14	10.00	0.23	10.00	6.80	0.95	0.95	12	93.0	0.013	0.0214	5.21	6.64
Inlet A-111	Inlet A-110	0.11	0.89	0.10	0.24	10.00	0.13	10.23	6.80	0.68	1.63	12	55.0	0.013	0.0254	5.68	7.24
Inlet A-131	Inlet A-140	0.14	0.78	0.11	0.11	10.00	0.22	10.00	6.80	0.75	0.75	12	60.0	0.013	0.0101	3.58	4.56
Inlet A-140	Manhole A-130	0.20	0.73	0.15	0.26	10.00	0.20	10.22	6.80	1.02	1.77	12	53.0	0.013	0.0099	3.54	4.51
Sonic Roof	Manhole A-130	0.04	0.95	0.04	0.04	10.00	0.15	10.00	6.80	0.27	0.27	6	80.0	0.010	0.0550	1.71	8.71
Manhole A-130	Inlet A-120	0.00	0.00	0.00	0.30	10.00	0.33	10.42	6.80	0.00	2.04	12	91.0	0.013	0.0101	3.58	4.56
Inlet A-120	Inlet A-110	0.18	0.74	0.13	0.43	10.00	0.30	10.75	6.68	0.87	2.87	12	114.0	0.013	0.0201	5.05	6.43
Inlet A-110	Existing Inlet	0.11	0.94	0.10	0.77	10.00	0.09	11.05	6.56	0.66	5.05	15	39.0	0.013	0.0205	9.25	7.54

DRAINAGE & INLET AREA MAPS

Plotted: 04/05/23 - 3:54 PM, By: areyes, - Product Ver: 24.2a (LMS Tech)
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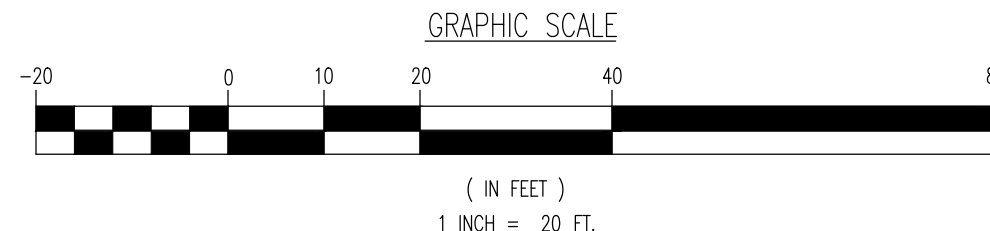
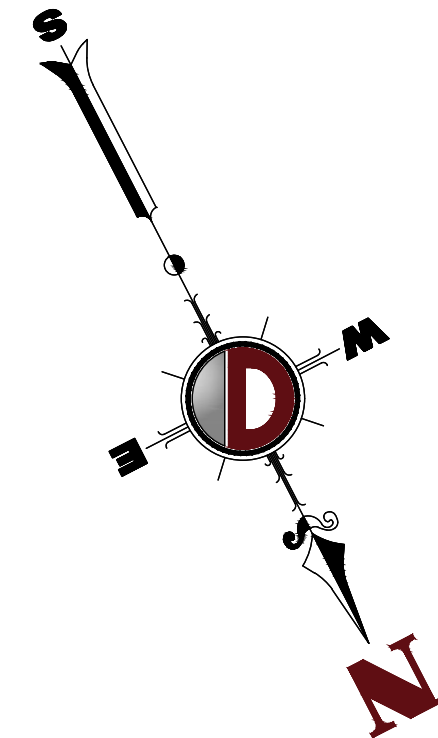
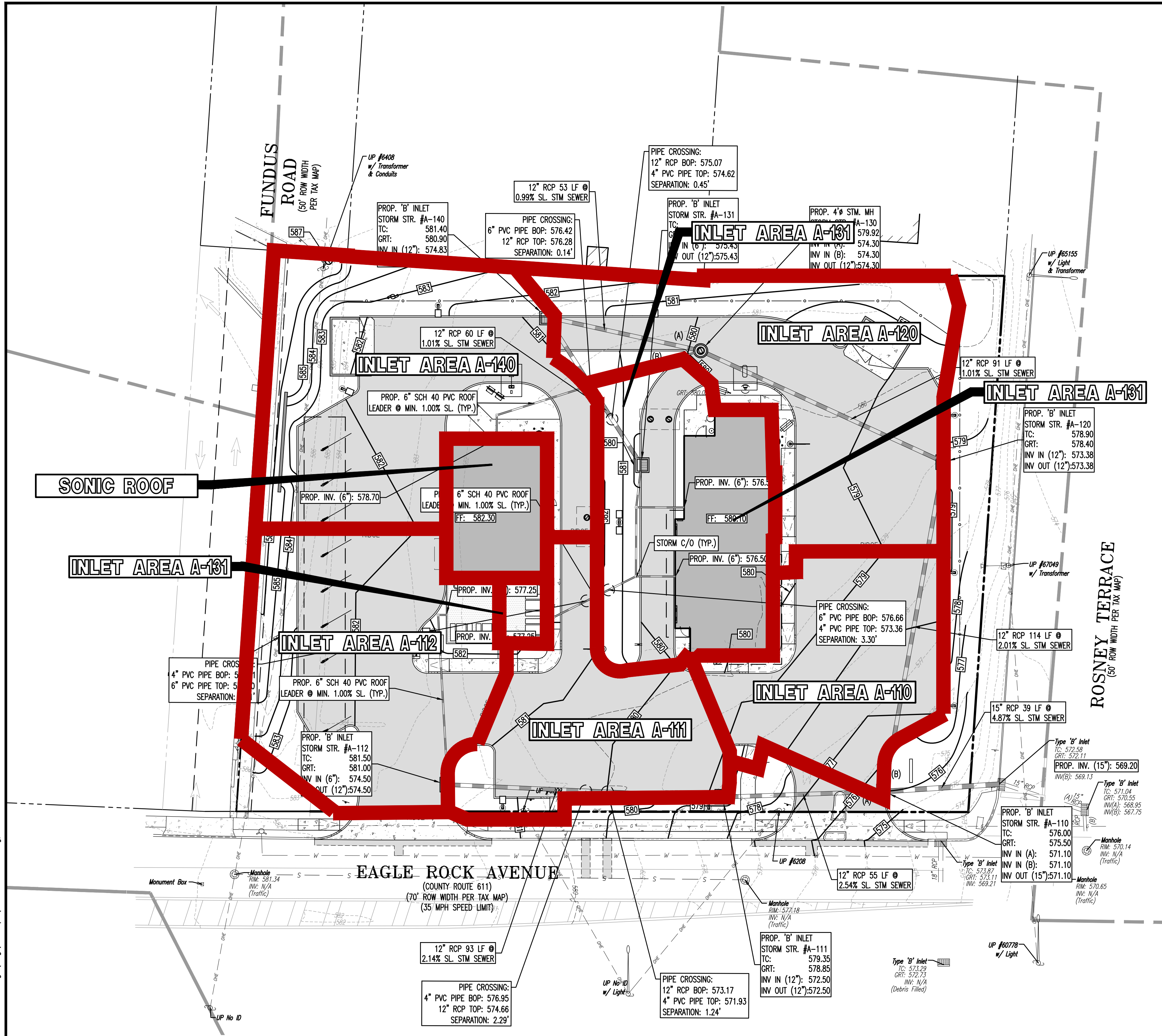


THIS PLAN SET IS FOR PERMITTING PURPOSES ONLY AND MAY NOT BE USED FOR CONSTRUCTION

DYNAMIC ENGINEERING LAND DEVELOPMENT CONSULTING • PERMITTING • GEOTECHNICAL • ENVIRONMENTAL • SURVEY • PLANNING & ZONING Lake Como, New Jersey T: 732.974.0198 Chester, New Jersey T: 908.879.9229 Newark, New Jersey T: 973.353.7200 Toms River, New Jersey T: 732.974.0198 Allen, Texas T: 972.334.2100 Austin, Texas T: 512.244.2044 Houston, Texas T: 281.789.6400 Delray Beach, Florida T: 561.921.8570 Newtown, Pennsylvania T: 267.683.0276 Philadelphia, Pennsylvania T: 215.253.4868 Bethlehem, Pennsylvania T: 610.396.4400	
TITLE: PROPOSED DRAINAGE AREA MAP	
PROJECT: ORANGE DEV, LLC PROPOSED POPEYE'S & SONIC RESTAURANT 470 EAGLE ROCK AVENUE (CR-611) TOWNSHIP OF WEST ORANGE, ESSEX COUNTY, NEW JERSEY	JOB No: 1021-99-025 DATE: 11/09/2022 DRAWN BY: PSD DESIGNED BY: DG/MWW CHECKED BY: MJB CHECKED BY: -
MATTHEW J. BERSCH PROFESSIONAL ENGINEER NEW JERSEY LICENSE No. 54522	ROBERT P. FREUD PROFESSIONAL ENGINEER NEW JERSEY LICENSE No. 41938
811 PROTECT YOURSELF ALL STATES REQUIRE NOTIFICATION OF CONCRETE, REBAR, OR ANY OTHER PREPARED TO LOCATE THE SERVICE LINES BEFORE ANY EXCAVATION. FOR STATE SPECIFIC DIRECT PHONE NUMBERS VISIT: WWW.CALL811.COM	
2 OF 3 Rev. # 2	

Plotted: 04/05/23 - 10:43 AM, By: areyes, - Product Ver: 24.2s (LMS Tech)
File: \\decpc.local\decpc\Users\areyes\OneDrive\Projects\1021_Parkin_Network, LLC\99-025 West Orange Dwg\DA Maps\102199025\AMZ.dwg, ---> 03 INLET AREA MAP

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TITLE: INLET AREA MAP	
PROJECT: ORANGE DEV, LLC PROPOSED POPEYE'S & SONIC RESTAURANT BLOCK 153, LOT 38 470 EAGLE ROCK AVENUE (CR-611) TOWNSHIP OF WEST ORANGE, ESSEX COUNTY, NEW JERSEY	JOB No: 1021-99-025 DATE: 11/09/2022 DRAWN BY: PSD SCALE: (H) 1"=20' (V) DESIGNED BY: DG/MMW SHEET No: CHECKED BY: MJB 3 OF 3 CHECKED BY: - Rev. # 2
MATTHEW J. BERSCH PROFESSIONAL ENGINEER NEW JERSEY LICENSE No. 54522	ROBERT P. FREUD PROFESSIONAL ENGINEER NEW JERSEY LICENSE No. 41938
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