

DRAINAGE REPORT

Prepared for

**Walter and Katherine Bostian
425 South Riverside Drive**

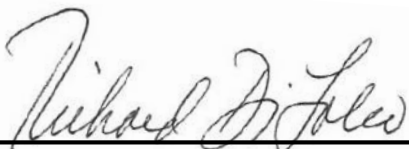
**BLOCK 5408
LOT 17**

**NEPTUNE TOWNSHIP
MONMOUTH COUNTY, NJ**

Prepared by

**JKR ENGINEERING AND PLANNING SERVICE, LLC
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December 2023



**Richard DiFolco, PE, PP
NJ PE Lic. # 24343
NJ PP Lic.# 2606**

TABLE OF CONTENTS

OVERVIEW	3
PROJECT LOCATION	3
PROJECT DESCRIPTION	3
EXISTING CONDITIONS	4
PROPOSED CONDITIONS	7
SUMMARY AND COMPARISON	7
SURFACE DRAINAGE	8
STORMWATER MANAGEMENT	8
FLOOD ZONES	8
CONCLUSION	9
<u>APPENDIX</u>	10
Aerial Map.....	11
Tax Map.....	12
Soils Map.....	13
Flood Map.....	14
State Planning Area Map.....	15
Existing Drainage Area Map.....	16
Proposed Drainage Area Map.....	17
Existing and Proposed Runoff Hydrographs.....	

OVERVIEW

This report is submitted in support of a development application for Walter and Katherine Bostian for their property located at #425 South Riverside Drive in the Shark River Hills section of the Township. The property is known as Lot 17 in Block 5408 as shown on Sheet 54 of the Neptune Township tax map.

PROJECT LOCATION

The property is located in the R-2 Low Density Single-Family Residential Zone where single-family residential is a permitted use. The site has frontages on three streets: South Riverside Drive, Vernon Avenue and Tremont Drive. The surrounding area consists of single-family residential uses. The site is located in close proximity to the Shark River (tidal) and while the majority of the site is elevated above the 100 year flood elevation (FEMA Zone AE-Elev.10), the existing Township streets and right-of-way areas fronting the site, and open yard areas of the proposed residential lots vary from elevation 4 to elevation 10. All proposed structures are elevated above the 100 year flood level and no basements are proposed.

PROJECT DESCRIPTION

The 1.21 acre subject property is the site of a 50 year old residential estate containing a 7,000 square foot ranch dwelling, a 65 foot long outdoor pool and patio areas, and a full sized recreational basketball court. The site has frontage on three paved and improved Township streets, South Riverside Drive, Vernon Avenue and Tremont Drive and no new streets are proposed. The site is cleared, graded and contains open lawn areas and is not wooded. The owner/applicant proposes to demolish all existing structures and improvements currently at the site and subdivide the property into four lots, retaining the South Riverside Drive portion of the site for construction of his personal residence. Three other residential lots, which all front on existing streets, will be proposed for sale. No new municipal road improvements are required or proposed. Proposed site improvements will include curb repair at new driveway curb cuts and the planting of shade trees along the three street frontages. All new utilities will be placed underground.

EXISTING CONDITIONS

The existing developed site contains 19,030 square feet (0.437 acres) of impervious coverage comprised of roof area, patios, walkways, driveway and sport court. The soil type is Udorthents (HSG D). The existing motor vehicle surface consists of the driveway area (1,044 sq ft). The balance of the site is comprised of pervious graded lawn and yard areas and contains 33,470 square feet (0.768 acres). The quantity of site runoff generated from the site in the existing condition is not significant and can be approximated by the TR-55 method using a CN of 98 for the impervious areas and a CN of 80 for lawn areas. A time of concentration of 5 minutes is assumed for impervious areas and pervious areas. The updated July 2023 future rainfall intensity values are used.

- ii. N.J.A.C. 7:8-5.7(c)2 and N.J.A.C. 7:8-5.7(d)2 both allow an alternative to calculating the current and projected rainfall precipitation depths by using separate rainfall totals for each county. The 24-hour county rainfall amount provided by NRCS is duplicated here and can be found online at:

<https://www.nrcs.usda.gov/sites/default/files/2022-09/NJ%2024%20Hour%20Rainfall%20Data.pdf>.

Table 5-1: County-Specific, New Jersey 24-Hour Rainfall Frequency Data

<u>NEW JERSEY 24 HOUR RAINFALL FREQUENCY DATA</u>							
Rainfall amounts in Inches							
County	1 year	2 year	5 year	10 year	25 year	50 year	100 year
Atlantic	2.72	3.31	4.30	5.16	6.46	7.61	8.90
Bergen	2.75	3.34	4.27	5.07	6.28	7.32	8.47
Burlington	2.77	3.36	4.34	5.18	6.45	7.56	8.81
Camden	2.73	3.31	4.25	5.06	6.28	7.34	8.52
Cape May	2.67	3.25	4.22	5.07	6.34	7.47	8.73
Cumberland	2.69	3.27	4.25	5.09	6.37	7.49	8.76
Essex	2.85	3.44	4.40	5.22	6.44	7.49	8.66
Gloucester	2.71	3.29	4.24	5.05	6.29	7.36	8.55
Hudson	2.73	3.31	4.23	5.02	6.19	7.20	8.31
Hunterdon	2.80	3.38	4.26	5.00	6.09	7.02	8.03
Mercer	2.74	3.31	4.23	5.01	6.19	7.20	8.33
Middlesex	2.76	3.35	4.30	5.12	6.36	7.43	8.63
Monmouth	2.79	3.38	4.38	5.23	6.53	7.66	8.94
Morris	2.94	3.54	4.47	5.24	6.37	7.32	8.35
Ocean	2.81	3.42	4.45	5.33	6.68	7.87	9.20
Passaic	2.87	3.47	4.42	5.23	6.43	7.47	8.62
Salem	2.69	3.26	4.20	5.00	6.22	7.28	8.45
Somerset	2.76	3.34	4.25	5.01	6.15	7.13	8.21
Sussex	2.68	3.22	4.02	4.70	5.72	6.60	7.58
Union	2.80	3.39	4.35	5.17	6.42	7.49	8.69
Warren	2.78	3.34	4.18	4.89	5.93	6.83	7.82

Notes: The average point rainfall amounts listed above were developed from data contained in NOAA Atlas 14 Volume 2.

Point rainfall estimates for specific locations may be obtained from the Precipitation Frequency Data Server located at <http://www.nws.noaa.gov/ohd/hdsc/>

For most hydrologic design procedures, the rainfall amounts listed above may be rounded to the nearest tenth of an inch.

- b. N.J.A.C.7:8-5.7(c) requires the precipitation depths of the current 2-, 10- and 100-year storm events be determined by multiplying the NOAA rainfall data with the current precipitation adjustment factors in Table 5-5 at N.J.A.C.7:8-5.7(c)2. N.J.A.C.7:8-5.7(d) requires the precipitation depths of the projected 2-, 10- and 100-year storm events be determined by multiplying the NOAA rainfall data with the future precipitation change factors in Table 5-6 at N.J.A.C.7:8-5.7(d). Table 5-5 and Table 5-6 from the Rules are reproduced below.

Current Precipitation Adjustment Factors at N.J.A.C. 7:8-5.7(c) as Table 5-5

County	Current Precipitation Adjustment Factors		
	2-year Design Storm	10-year Design Storm	100-year Design Storm
Atlantic	1.01	1.02	1.03
Bergen	1.01	1.03	1.06
Burlington	0.99	1.01	1.04
Camden	1.03	1.04	1.05
Cape May	1.03	1.03	1.04
Cumberland	1.03	1.03	1.01
Essex	1.01	1.03	1.06
Gloucester	1.05	1.06	1.06
Hudson	1.03	1.05	1.09
Hunterdon	1.02	1.05	1.13
Mercer	1.01	1.02	1.04
Middlesex	1.00	1.01	1.03
Monmouth	1.00	1.01	1.02
Morris	1.01	1.03	1.06
Ocean	1.00	1.01	1.03
Passaic	1.00	1.02	1.05
Salem	1.02	1.03	1.03
Somerset	1.00	1.03	1.09
Sussex	1.03	1.04	1.07
Union	1.01	1.03	1.06
Warren	1.02	1.07	1.15

Future Precipitation Change Factors at N.J.A.C. 7:8-5.7(d) as Table 5-6

County	Future Precipitation Change Factors		
	2-year Design Storm	10-year Design Storm	100-year Design Storm
Atlantic	1.22	1.24	1.39
Bergen	1.20	1.23	1.37
Burlington	1.17	1.18	1.32
Camden	1.18	1.22	1.39
Cape May	1.21	1.24	1.32
Cumberland	1.20	1.21	1.39
Essex	1.19	1.22	1.33
Gloucester	1.19	1.23	1.41
Hudson	1.19	1.19	1.23
Hunterdon	1.19	1.23	1.42
Mercer	1.16	1.17	1.36
Middlesex	1.19	1.21	1.33
Monmouth	1.19	1.19	1.26
Morris	1.23	1.28	1.46
Ocean	1.18	1.19	1.24
Passaic	1.21	1.27	1.50
Salem	1.20	1.23	1.32
Somerset	1.19	1.24	1.48
Sussex	1.24	1.29	1.50
Union	1.20	1.23	1.35
Warren	1.20	1.25	1.37

2 yr = 3.38x1.0x1.19=4.02 10 yr = 5.23x1.01x1.19=6.29 100 yr =8.94x1.02x1.26=11.49

The following runoff rates/volumes from impervious areas and pervious areas (calculated separately and summed) are distributed across the site and reach the existing Township storm sewer system:

2 yr = 1.048cfs/11,627cf 10 yr =1.787cfs/20,669cf 100 yr =3.470cfs/42,384cf

Surface runoff is presently directed to the three frontage streets via sheet flow where the Township has an existing storm water collection system with street inlets located at the corner of Vernon Avenue and South Riverside Drive, Tremont Drive and South Riverside Drive and along Vernon Avenue opposite Sheldon Avenue.

PROPOSED CONDITIONS

The proposed developed site contains 17,703 square feet (0.406 acres) of impervious coverage comprised of roof area, patios, walkways and driveways. There is a decrease in the amount of impervious coverage when compared to the existing condition. The soil type is Udorthents (HSG D). The proposed motor vehicle surface consists of the four driveway areas (3,517 sq ft). There is less than ¼ acre of new motor vehicle surface being created. The balance of the site is comprised of pervious graded lawn and yard areas and contains 34,797 square feet (0.799 acres). The quantity of site runoff generated from the site in the proposed condition is not significant and can be approximated by the TR-55 method using a CN of 98 for the impervious areas and a CN of 80 for lawn areas. A time of concentration of 5 minutes is assumed for impervious areas and pervious areas. The updated July 2023 future rainfall intensity values are used.

$$2 \text{ yr} = 3.38 \times 1.0 \times 1.19 = 4.02 \quad 10 \text{ yr} = 5.23 \times 1.01 \times 1.19 = 6.29 \quad 100 \text{ yr} = 8.94 \times 1.02 \times 1.26 = 11.49$$

The following runoff rates/volumes from impervious areas (calculated separately and summed) are distributed across the site and reach the existing Township storm sewer system:

$$2 \text{ yr} = 1.039 \text{ cfs} / 11,435 \text{ cf} \quad 10 \text{ yr} = 1.779 \text{ cfs} / 20,445 \text{ cf} \quad 100 \text{ yr} = 3.465 \text{ cfs} / 42,128 \text{ cf}$$

Surface runoff will be directed to the three frontage streets via sheet flow where the Township has an existing storm water collection system with street inlets located at the corner of Vernon Avenue and South Riverside Drive, Tremont Drive and South Riverside Drive and along Vernon Avenue opposite Sheldon Avenue.

SUMMARY AND COMPARISON

The existing vs. proposed flow rates and volumes are almost identical and show that no detrimental drainage impacts from the proposed development would be expected. The small scale of development, proximity to the final discharge point and with no new streets being constructed, also supports this conclusion.

SURFACE DRAINAGE

The site surface drainage sheet flows to all three fronting streets and is collected by the Township existing storm sewer system prior to being discharged under South Riverside Drive to the Shark River. The application notes that the developer will jet and clean the adjacent storm sewer system located at Tremont Drive and South Riverside Drive to insure optimum performance of the existing storm sewer system. The existing drainage patterns of the site will be maintained and the proposed grading plan directs surface water from the residential lots via sheet flow to the existing streets, no new storm drainage piping is proposed. No impacts to the Township drainage system are anticipated.

STORMWATER MANAGEMENT

The proposed development does not meet the site disturbance or impervious cover criteria of a major development as relates to storm water therefor the storm water management regulations do not apply to this site.

The proposed development is not a Major Development project, is located in Metropolitan Planning Area – PA 1 and is not required to provide groundwater recharge, however recharge will be provided through the infiltration provided over the lawn and landscaped areas.

FLOOD ZONES

The site is located close to the Shark River. According to FEMA MAP 34025C0341G (effective 6/15/2022) the associated flood zones on the site are Zone X, Zone AE 10, and Zone AE 11. The Shark River is designated as Zone VE 12. Proposed dwellings are elevated a minimum of one foot above the designated flood zone elevation. Proposed first floor elevations are set at elevation 14.25+ (NAVD88). No basements are proposed. Flood vents will be installed within the crawl spaces for each dwelling.

The site will require a CAFRA permit for the subdivision of property and construction of the four dwellings. An application will be filed with the NJDEP for this approval.

CONCLUSION

In summary, the proposed residential development is of small scale, is maintaining the existing local drainage pattern, is supported by an existing storm drain system and will result in a 'de minimis' drainage impact on the site and the surrounding area.

APPENDIX

Aerial Map

Tax Map

Soil Map

Flood Map

State Planning Area Map

Existing Drainage Map

Proposed Drainage Map

AERIAL MAP - 425 SOUTH RIVERSIDE DRIVE

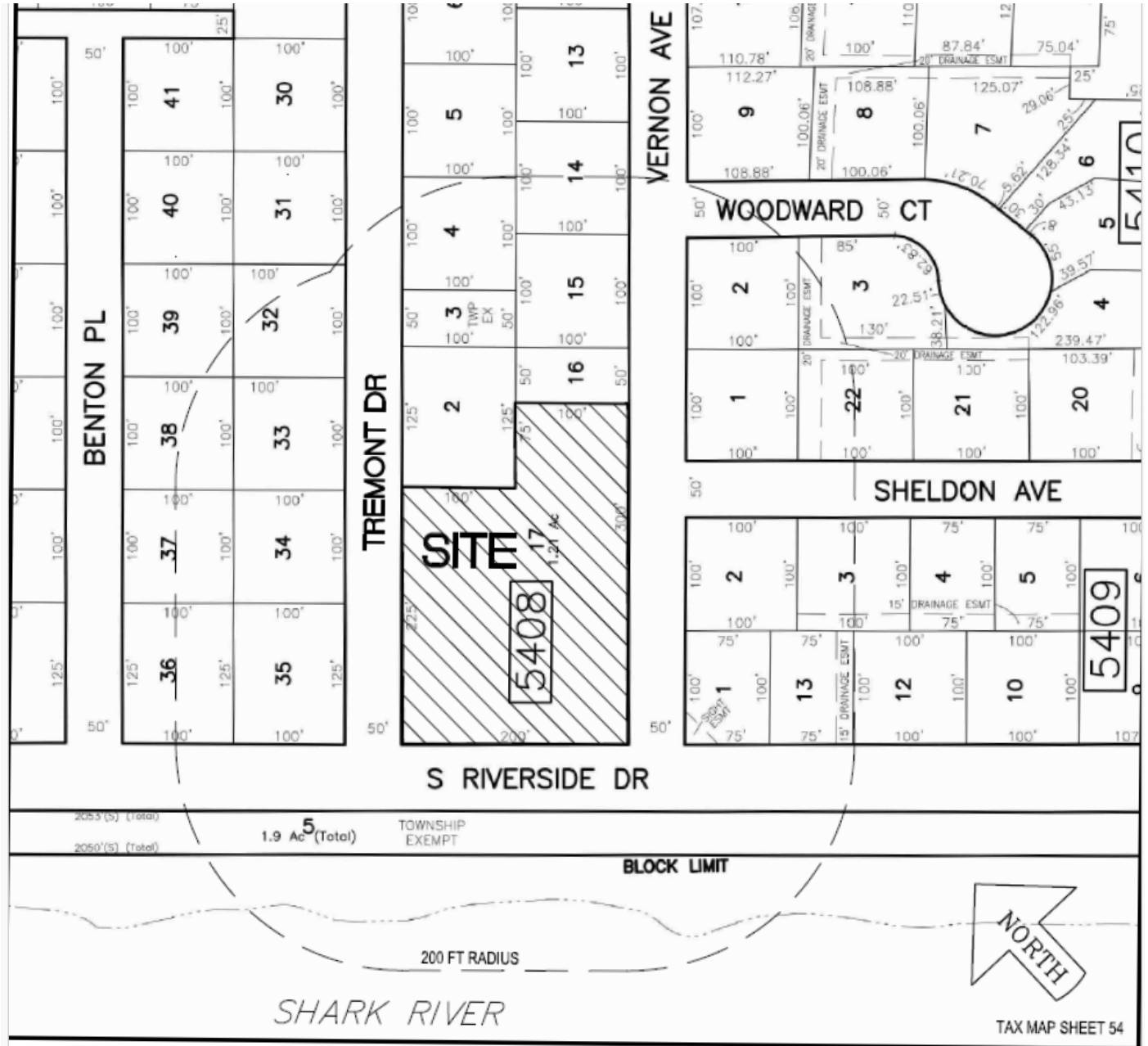
SOURCE: NEARMAP 2023



VIEW FROM NORTH

TAX MAP - BLOCK 5408 LOT 17

SOURCE: SHEET 54 NEPTUNE TWP



SOIL MAP – UdaB Udorthents

SOURCE: USDA



Description of Udorthents

Setting

Landform: Low hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fill and/or disturbed original soil material

Typical profile

A - 0 to 12 inches: loam
C - 12 to 72 inches: loamy sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
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: Moderate (about 6.7 inches)

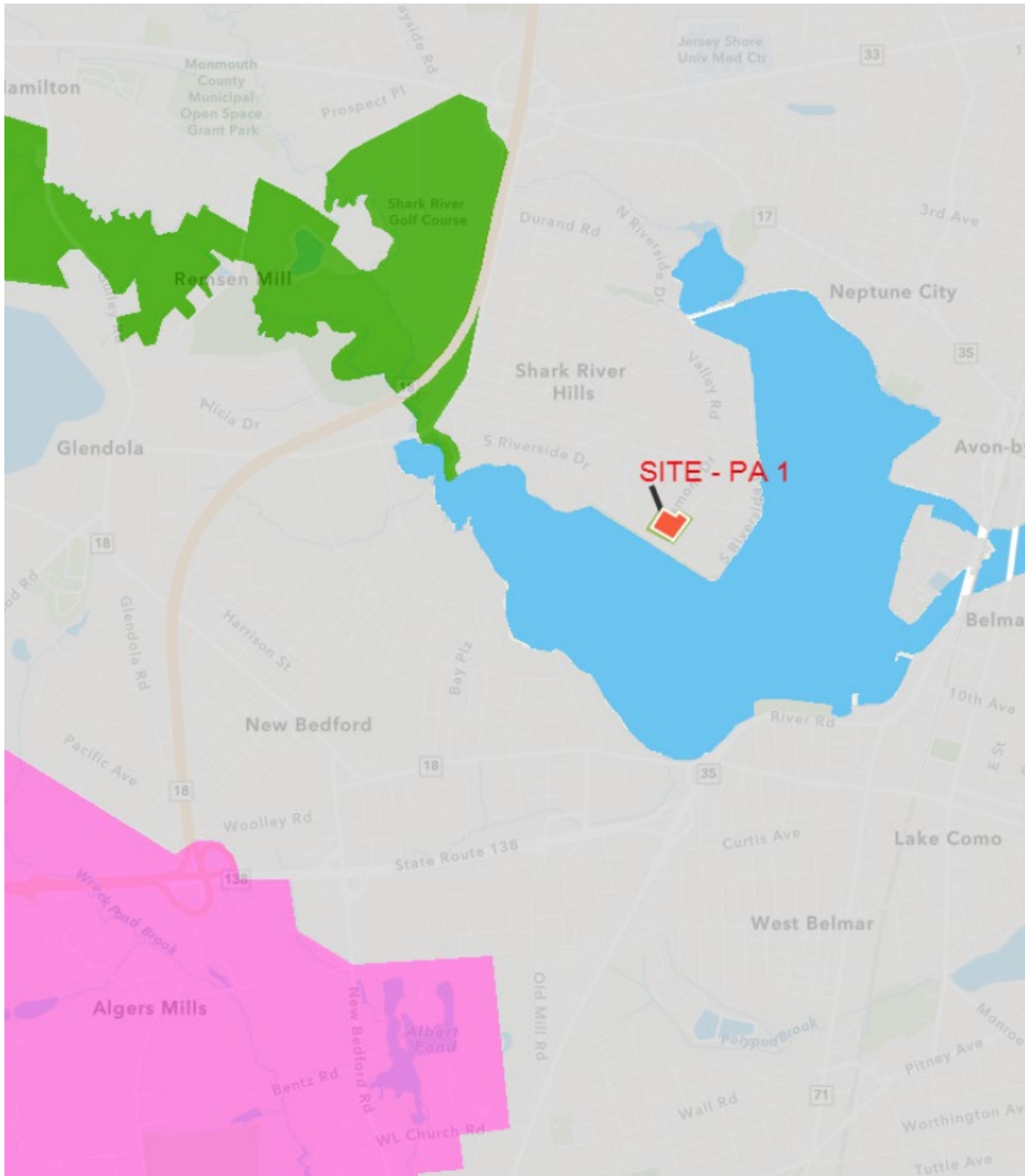
FLOOD MAP

SOURCE: FEMA



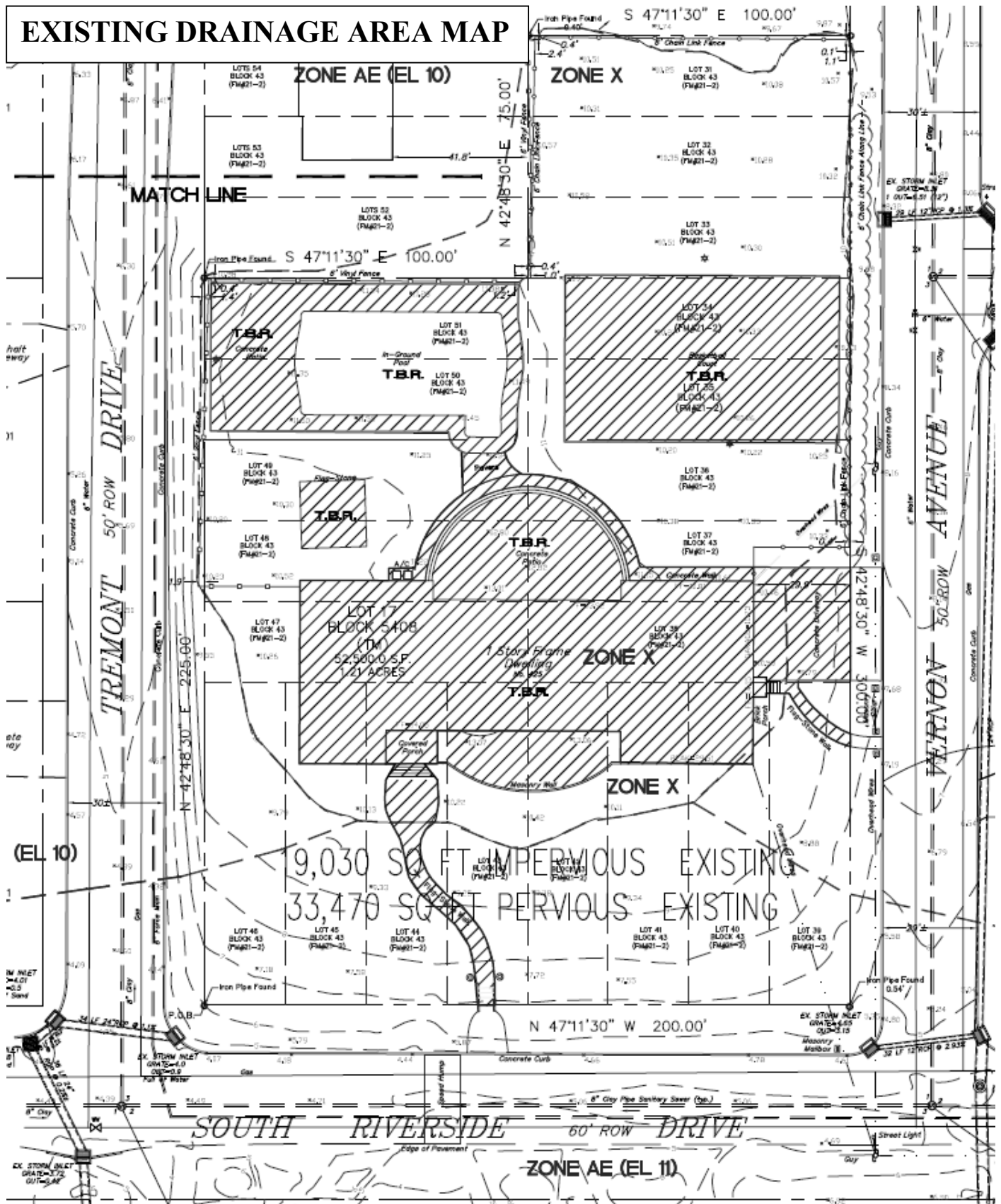
STATE PLANNING AREA MAP

SOURCE: NJDEP-GEOMAP

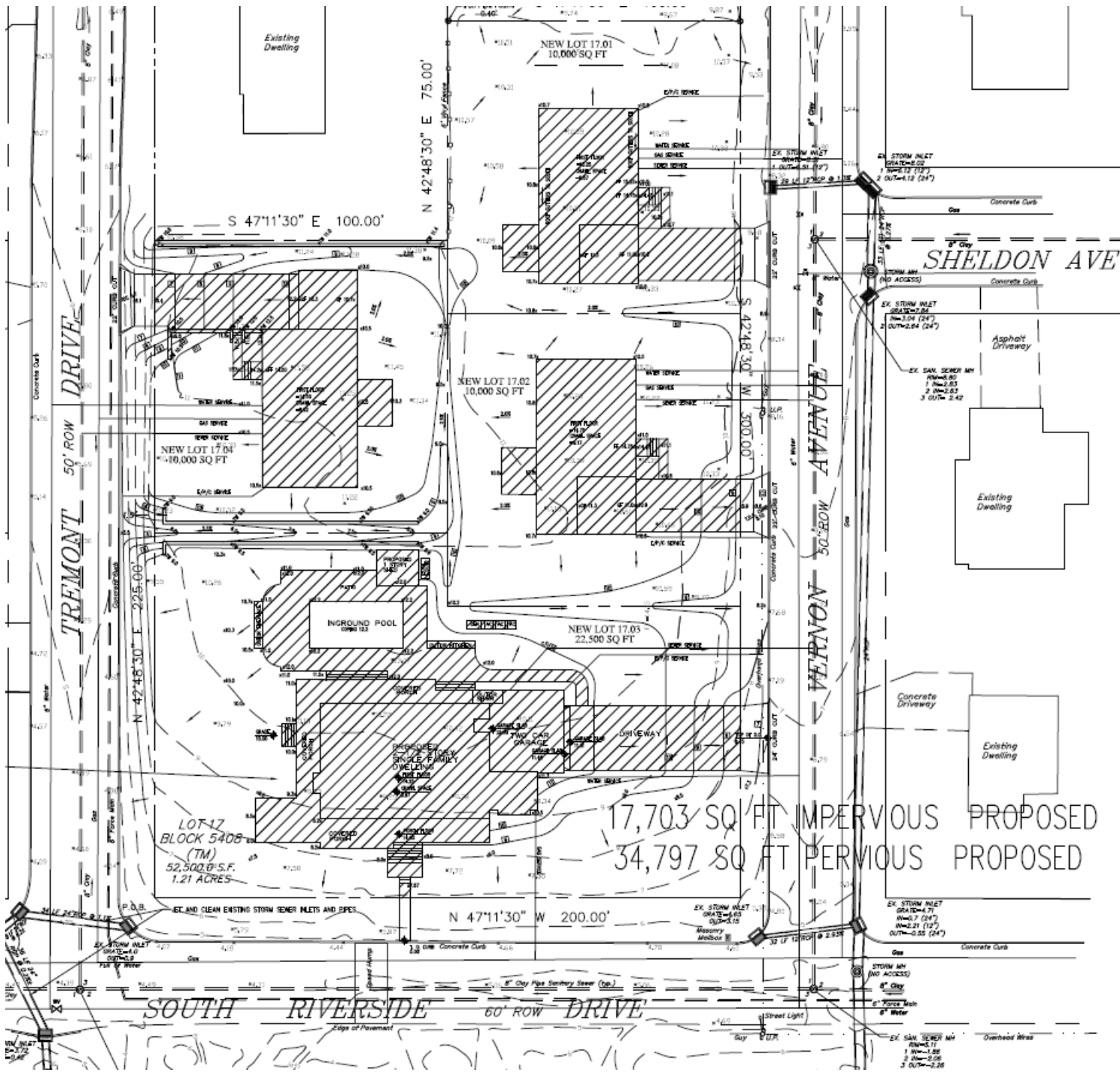


Metropolitan Planning Area (PA 1)

EXISTING DRAINAGE AREA MAP



PROPOSED DRAINAGE AREA MAP



Hydrograph Return Period Recap

Hydrow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	-----	-----	0.456	-----	-----	0.716	-----	-----	1.309	existing impervious
2	SCS Runoff	-----	-----	0.592	-----	-----	1.071	-----	-----	2.162	existing pervious
3	Combine	1, 2	-----	1.048	-----	-----	1.787	-----	-----	3.470	existing condition
5	SCS Runoff	-----	-----	0.424	-----	-----	0.665	-----	-----	1.216	proposed impervious
6	SCS Runoff	-----	-----	0.615	-----	-----	1.115	-----	-----	2.249	proposed pervious
7	Combine	5, 6	-----	1.039	-----	-----	1.779	-----	-----	3.465	<no description>

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

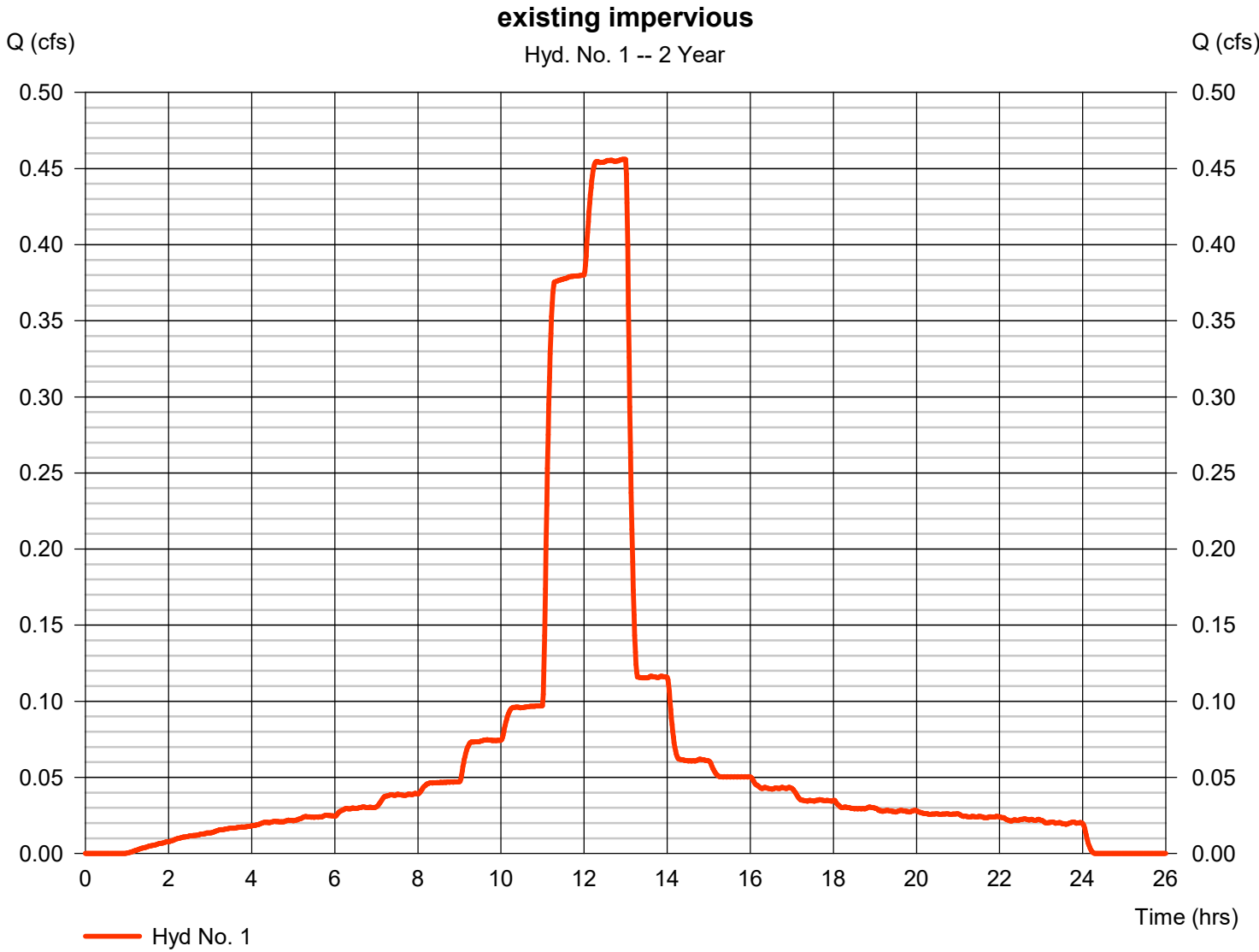
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	0.456	1	778	5,945	----	----	----	existing impervious	
2	SCS Runoff	0.592	1	780	5,682	----	----	----	existing pervious	
3	Combine	1.048	1	780	11,627	1, 2	----	----	existing condition	
5	SCS Runoff	0.424	1	778	5,524	----	----	----	proposed impervious	
6	SCS Runoff	0.615	1	780	5,911	----	----	----	proposed pervious	
7	Combine	1.039	1	780	11,435	5, 6	----	----	<no description>	
J:\795 RIVER AVE BELMAR\425 so riverside runoff					Runoff Period: 2 Year			Wednesday, 12 / 20 / 2023		

Hydrograph Report

Hyd. No. 1

existing impervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.456 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.97 hrs
Time interval	= 1 min	Hyd. volume	= 5,945 cuft
Drainage area	= 0.437 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.02 in	Distribution	= Custom
Storm duration	= J:\763 HOWELL RT 33 MALE SHOPS TRADE CONTRACTOR BUSINESS SITE		

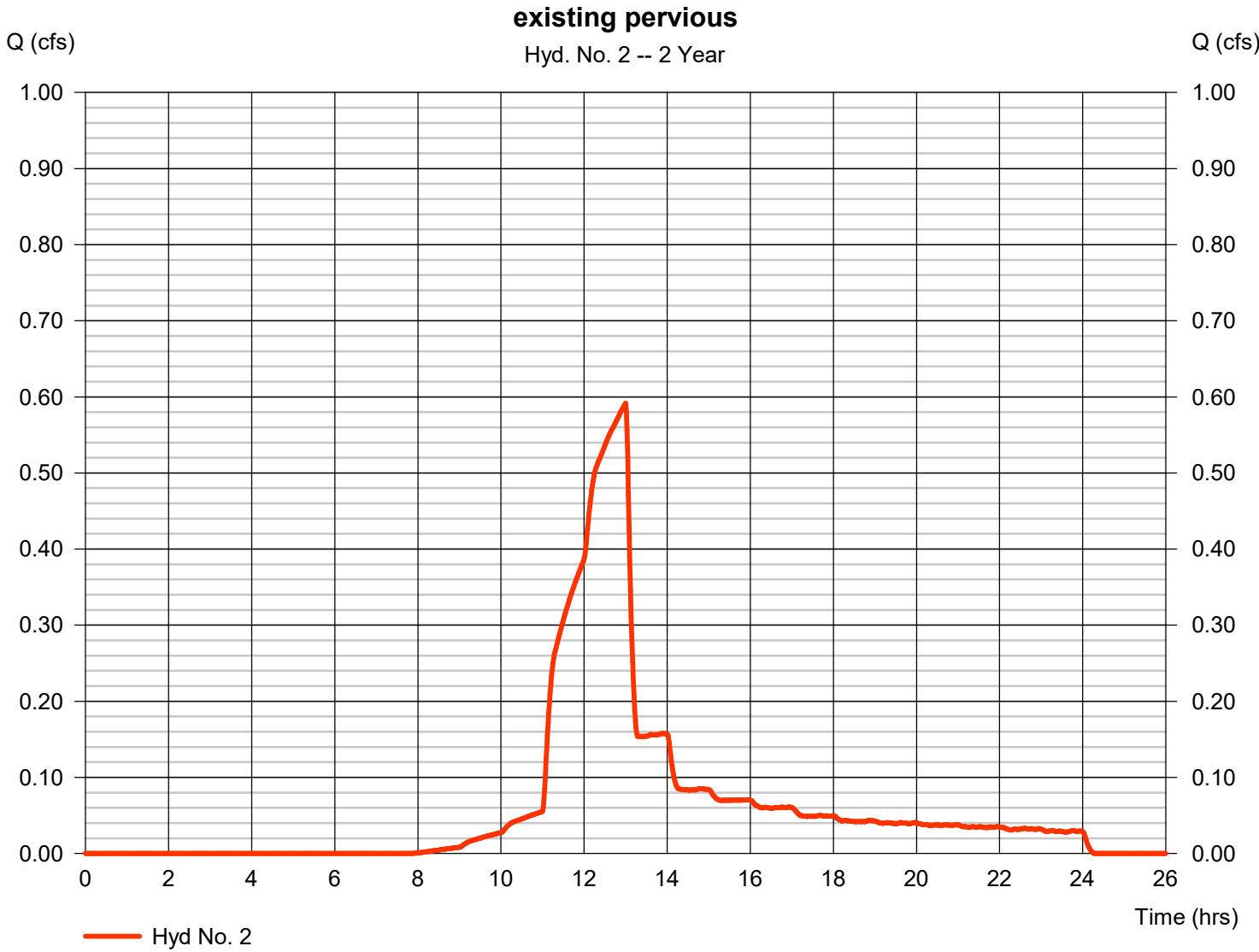


Hydrograph Report

Hyd. No. 2

existing pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.592 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.00 hrs
Time interval	= 1 min	Hyd. volume	= 5,682 cuft
Drainage area	= 0.768 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.02 in	Distribution	= Custom
Storm duration	= J:\763 HOWELL RT 33 MALE SHOPS TRADE CONTRACTOR BUSINESS SIT		



Hydrograph Report

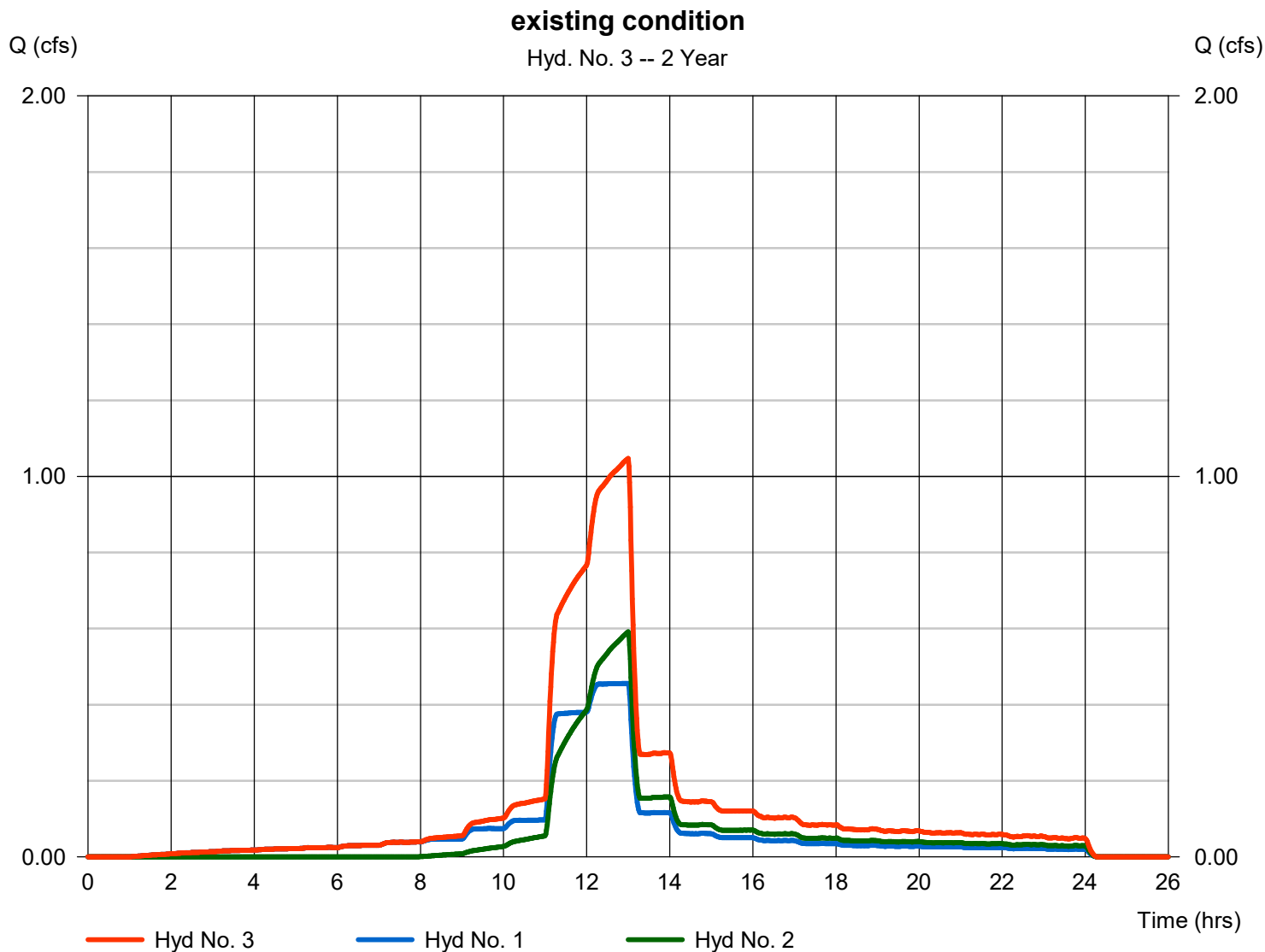
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Wednesday, 12 / 20 / 2023

Hyd. No. 3

existing condition

Hydrograph type	= Combine	Peak discharge	= 1.048 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.00 hrs
Time interval	= 1 min	Hyd. volume	= 11,627 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 1.205 ac



Hydrograph Report

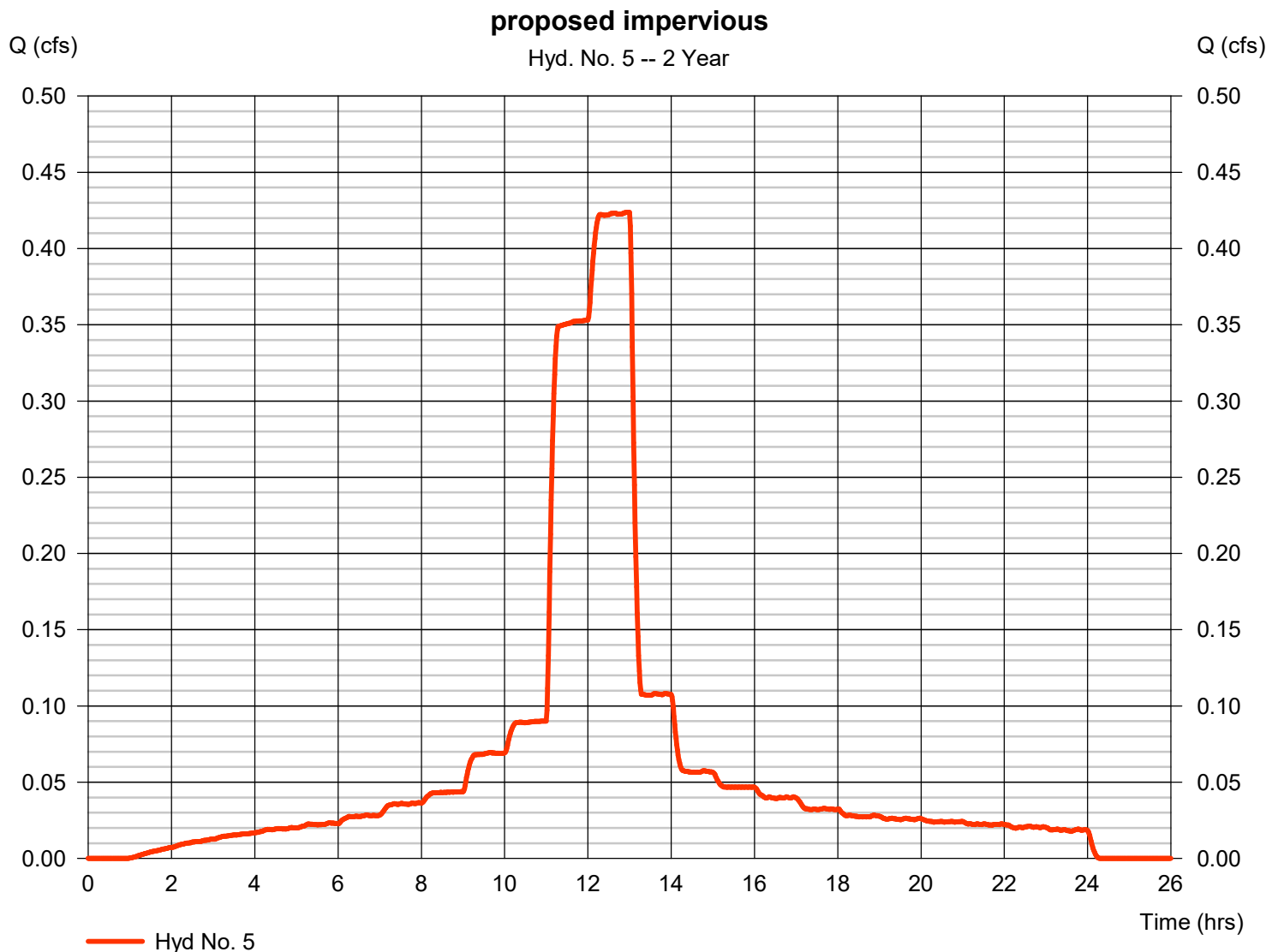
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Wednesday, 12 / 20 / 2023

Hyd. No. 5

proposed impervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.424 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.97 hrs
Time interval	= 1 min	Hyd. volume	= 5,524 cuft
Drainage area	= 0.406 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.02 in	Distribution	= Custom
Storm duration	= J:\763 HOWELL RT 33 MALE SHOPS TRADE CONTRACTOR BUSINESS SITE		



Hydrograph Report

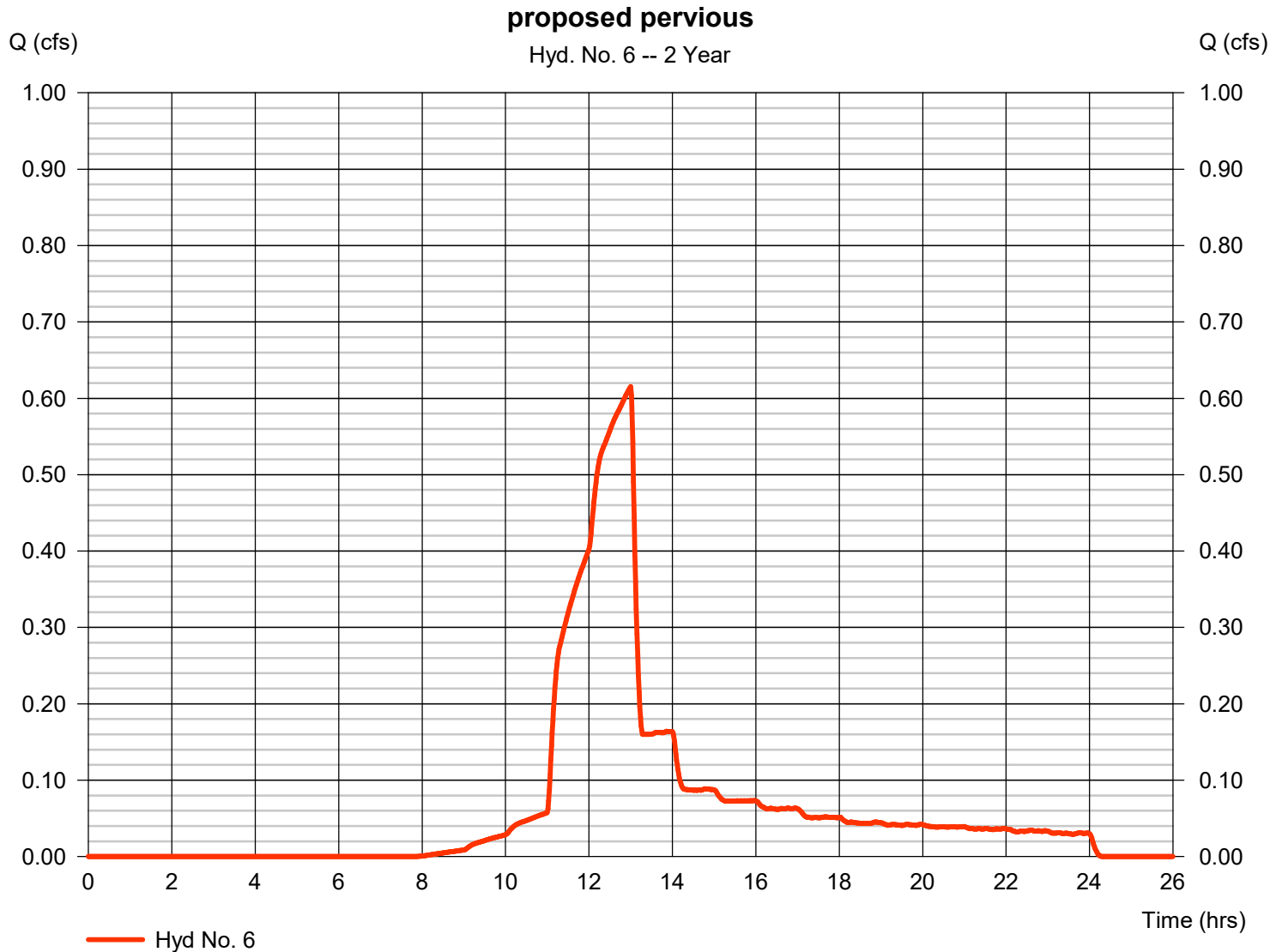
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Wednesday, 12 / 20 / 2023

Hyd. No. 6

proposed pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.615 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.00 hrs
Time interval	= 1 min	Hyd. volume	= 5,911 cuft
Drainage area	= 0.799 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.02 in	Distribution	= Custom
Storm duration	= J:\763 HOWELL RT 33 MALE SHOPS TR		

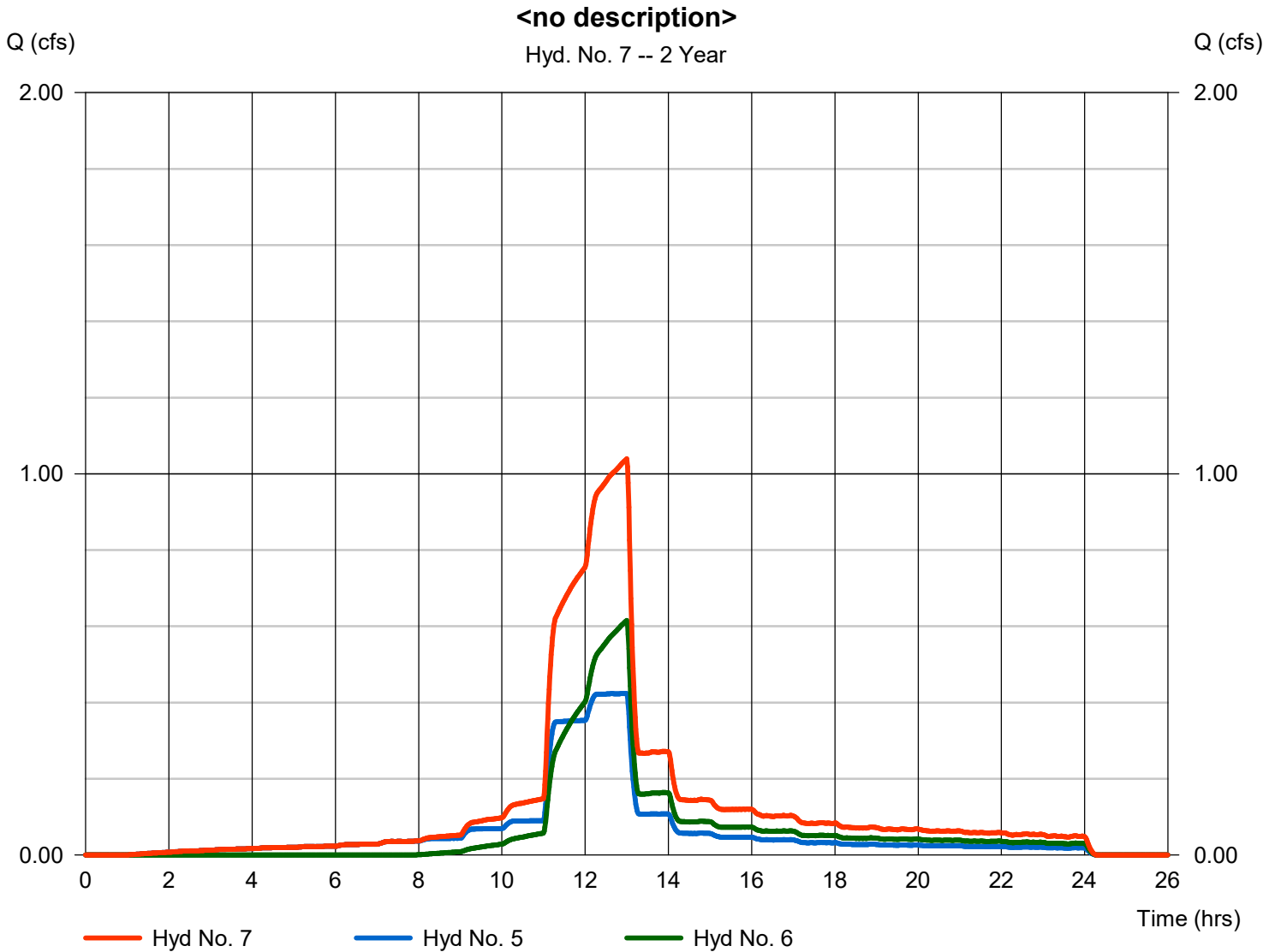


Hydrograph Report

Hyd. No. 7

<no description>

Hydrograph type	= Combine	Peak discharge	= 1.039 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.00 hrs
Time interval	= 1 min	Hyd. volume	= 11,435 cuft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 1.205 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	0.716	1	778	9,505	----	----	----	existing impervious
2	SCS Runoff	1.071	1	780	11,163	----	----	----	existing pervious
3	Combine	1.787	1	780	20,669	1, 2	----	----	existing condition
5	SCS Runoff	0.665	1	778	8,831	----	----	----	proposed impervious
6	SCS Runoff	1.115	1	780	11,614	----	----	----	proposed pervious
7	Combine	1.779	1	780	20,445	5, 6	----	----	<no description>

Hydrograph Report

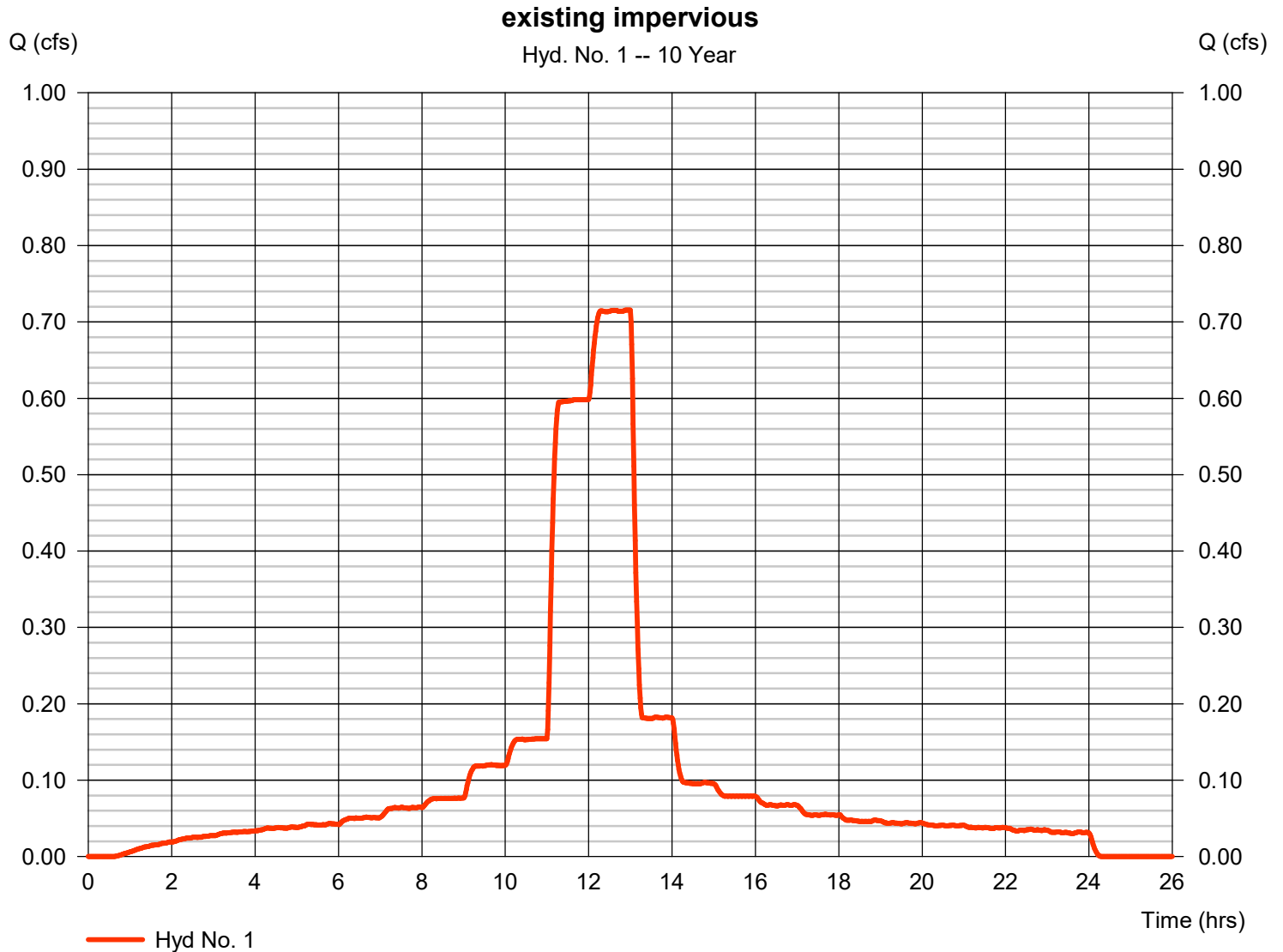
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Wednesday, 12 / 20 / 2023

Hyd. No. 1

existing impervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.716 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.97 hrs
Time interval	= 1 min	Hyd. volume	= 9,505 cuft
Drainage area	= 0.437 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.29 in	Distribution	= Custom
Storm duration	= J:\763 HOWELL RT 33 MALE SDR 2023 TRADE CONTRACTOR BUSINESS SIT		



Hydrograph Report

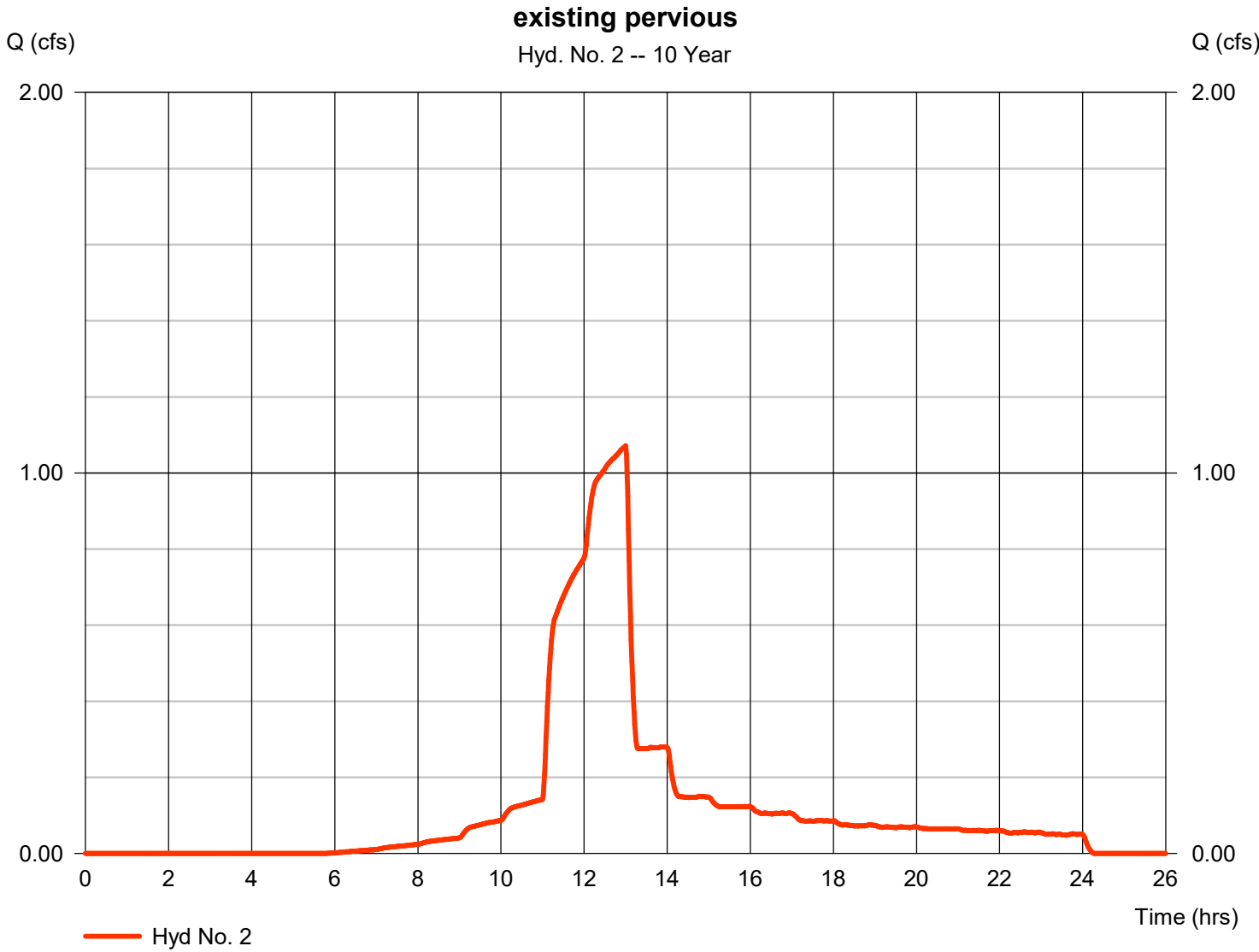
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Wednesday, 12 / 20 / 2023

Hyd. No. 2

existing pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 1.071 cfs
Storm frequency	= 10 yrs	Time to peak	= 13.00 hrs
Time interval	= 1 min	Hyd. volume	= 11,163 cuft
Drainage area	= 0.768 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.29 in	Distribution	= Custom
Storm duration	= J:\763 HOWELL RT 33 MALE SDR 2023 TRADE CONTRACTOR BUSINESS SIT		



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

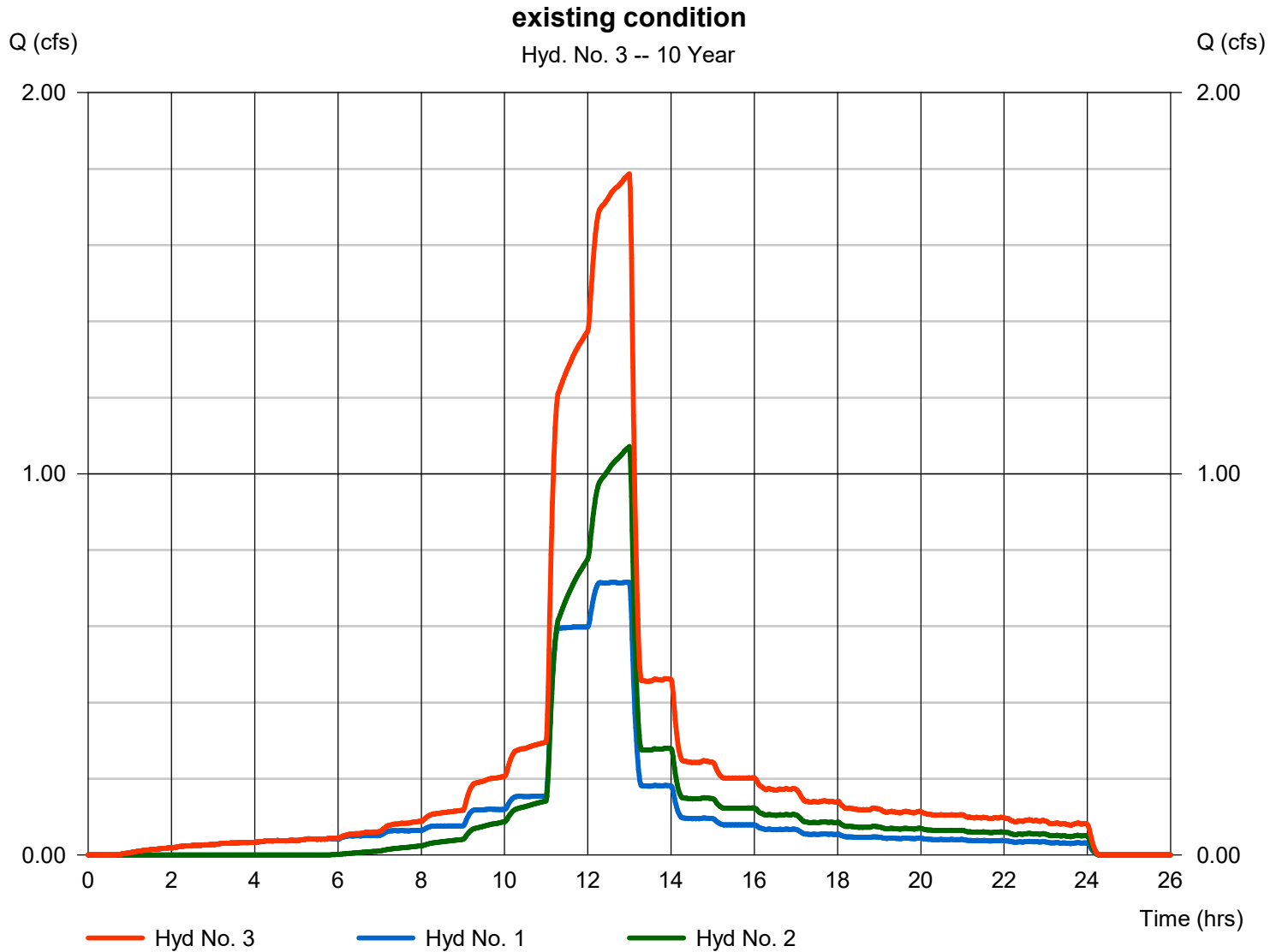
Wednesday, 12 / 20 / 2023

Hyd. No. 3

existing condition

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

Peak discharge = 1.787 cfs
Time to peak = 13.00 hrs
Hyd. volume = 20,669 cuft
Contrib. drain. area = 1.205 ac



Hydrograph Report

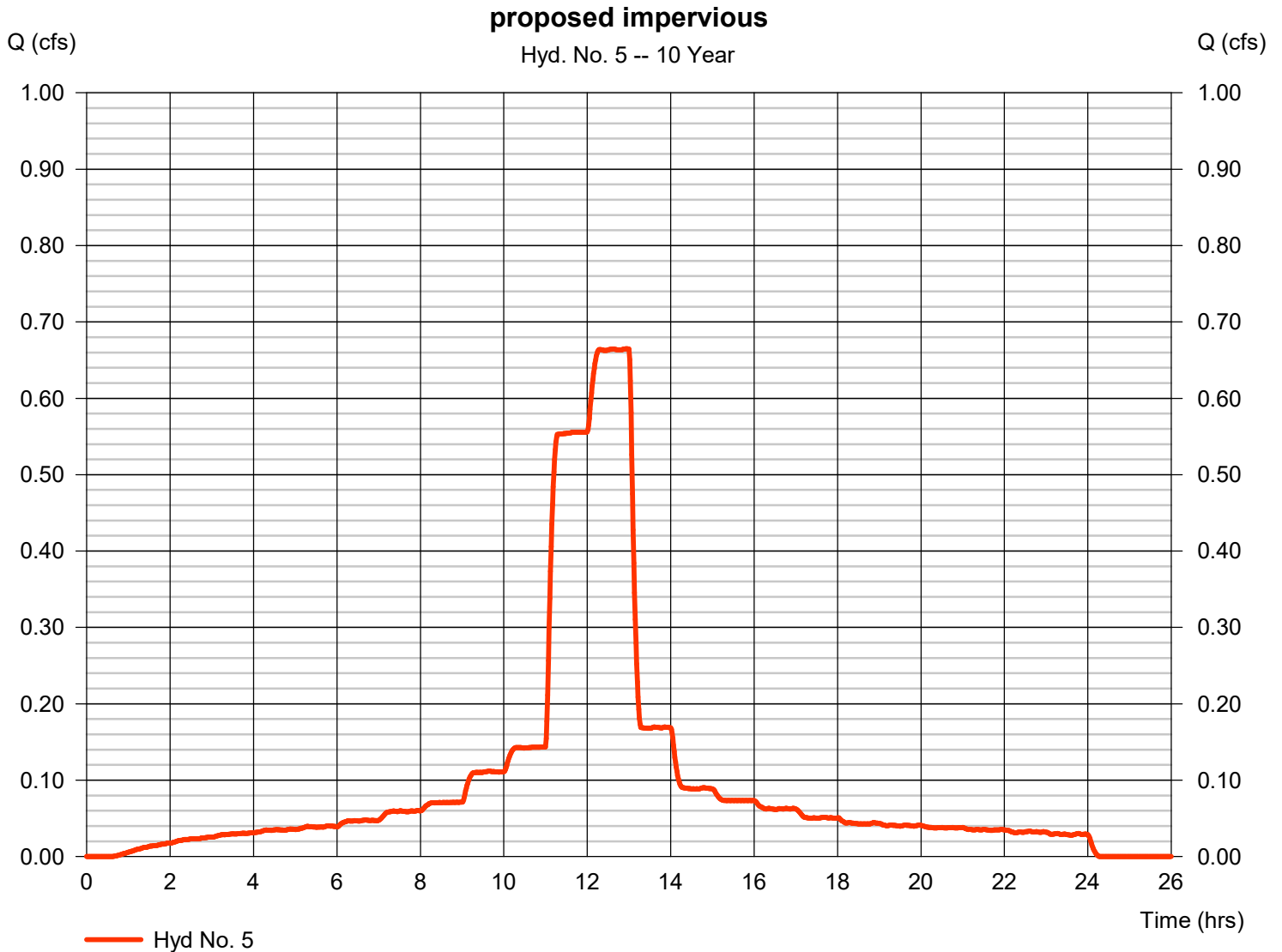
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Wednesday, 12 / 20 / 2023

Hyd. No. 5

proposed impervious

Hydrograph type	= SCS Runoff	Peak discharge	= 0.665 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.97 hrs
Time interval	= 1 min	Hyd. volume	= 8,831 cuft
Drainage area	= 0.406 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.29 in	Distribution	= Custom
Storm duration	= J:\763 HOWELL RT 33 MALE SHOPS TRADE CONTRACTOR BUSINESS SITE		



Hydrograph Report

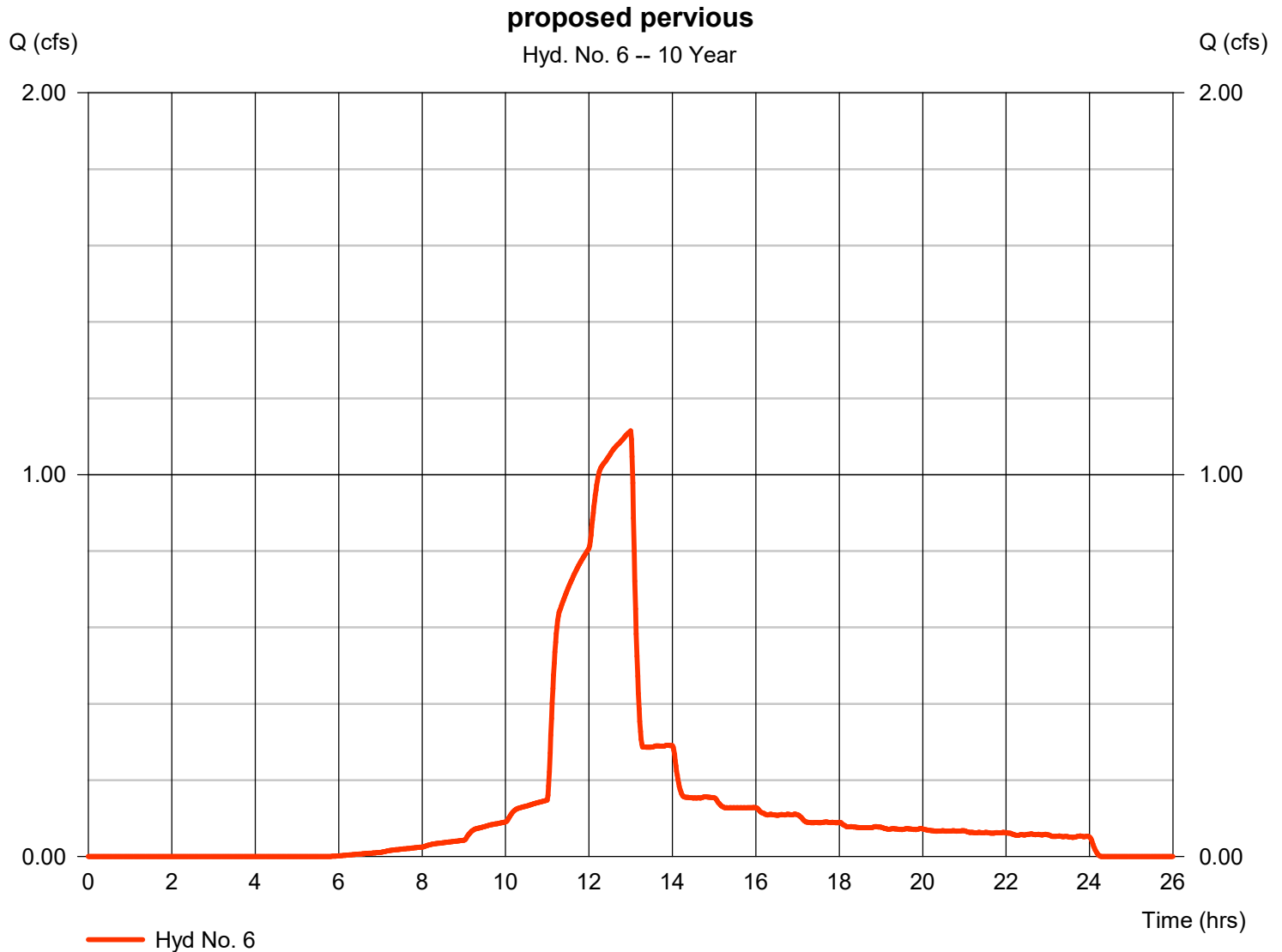
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Wednesday, 12 / 20 / 2023

Hyd. No. 6

proposed pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 1.115 cfs
Storm frequency	= 10 yrs	Time to peak	= 13.00 hrs
Time interval	= 1 min	Hyd. volume	= 11,614 cuft
Drainage area	= 0.799 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.29 in	Distribution	= Custom
Storm duration	= J:\763 HOWELL RT 33 MALE SDR 2023 TRADE CONTRACTOR BUSINESS SITE		



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

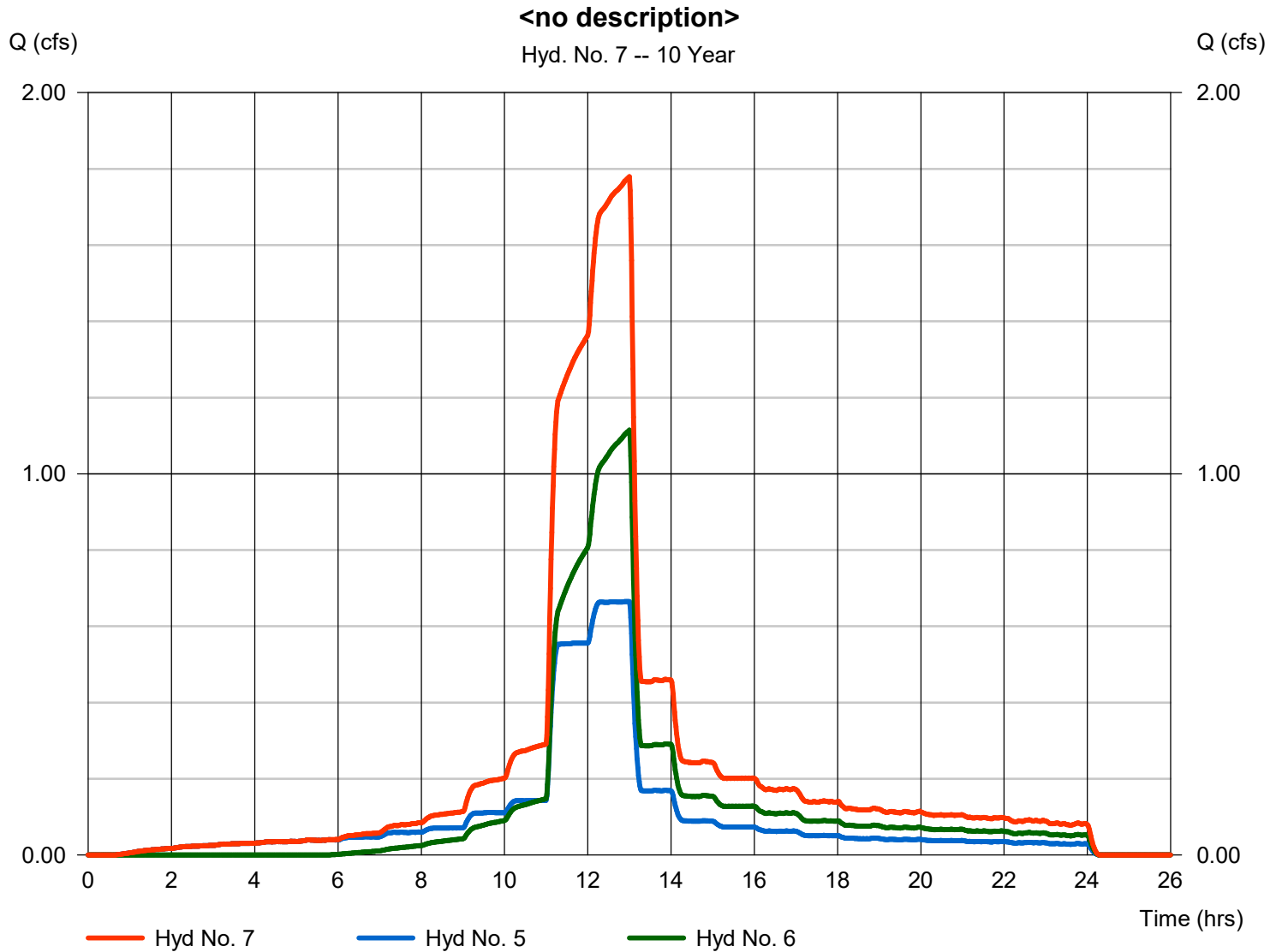
Wednesday, 12 / 20 / 2023

Hyd. No. 7

<no description>

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

Peak discharge = 1.779 cfs
Time to peak = 13.00 hrs
Hyd. volume = 20,445 cuft
Contrib. drain. area = 1.205 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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	1.309	1	778	17,669	----	----	----	existing impervious	
2	SCS Runoff	2.162	1	780	24,715	----	----	----	existing pervious	
3	Combine	3.470	1	780	42,384	1, 2	----	----	existing condition	
5	SCS Runoff	1.216	1	778	16,415	----	----	----	proposed impervious	
6	SCS Runoff	2.249	1	780	25,713	----	----	----	proposed pervious	
7	Combine	3.465	1	780	42,128	5, 6	----	----	<no description>	
J:\795 RIVER AVE BELMAR\425 so riverside runoff					Return Period: 100 Year			Wednesday, 12 / 20 / 2023		

Hydrograph Report

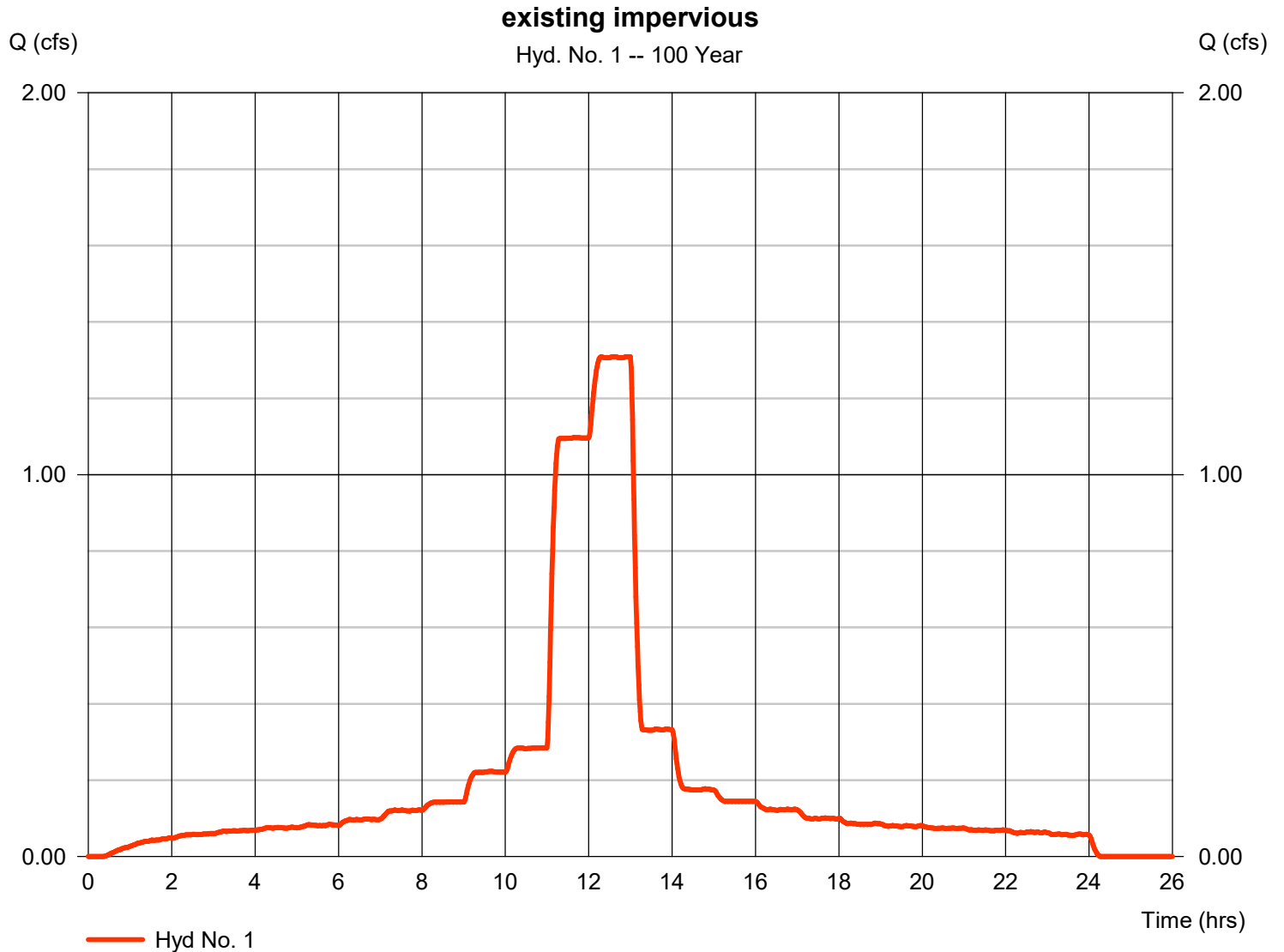
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Wednesday, 12 / 20 / 2023

Hyd. No. 1

existing impervious

Hydrograph type	= SCS Runoff	Peak discharge	= 1.309 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.97 hrs
Time interval	= 1 min	Hyd. volume	= 17,669 cuft
Drainage area	= 0.437 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 11.49 in	Distribution	= Custom
Storm duration	= J:\763 HOWELL RT 33 MALE STAFF TR		



Hydrograph Report

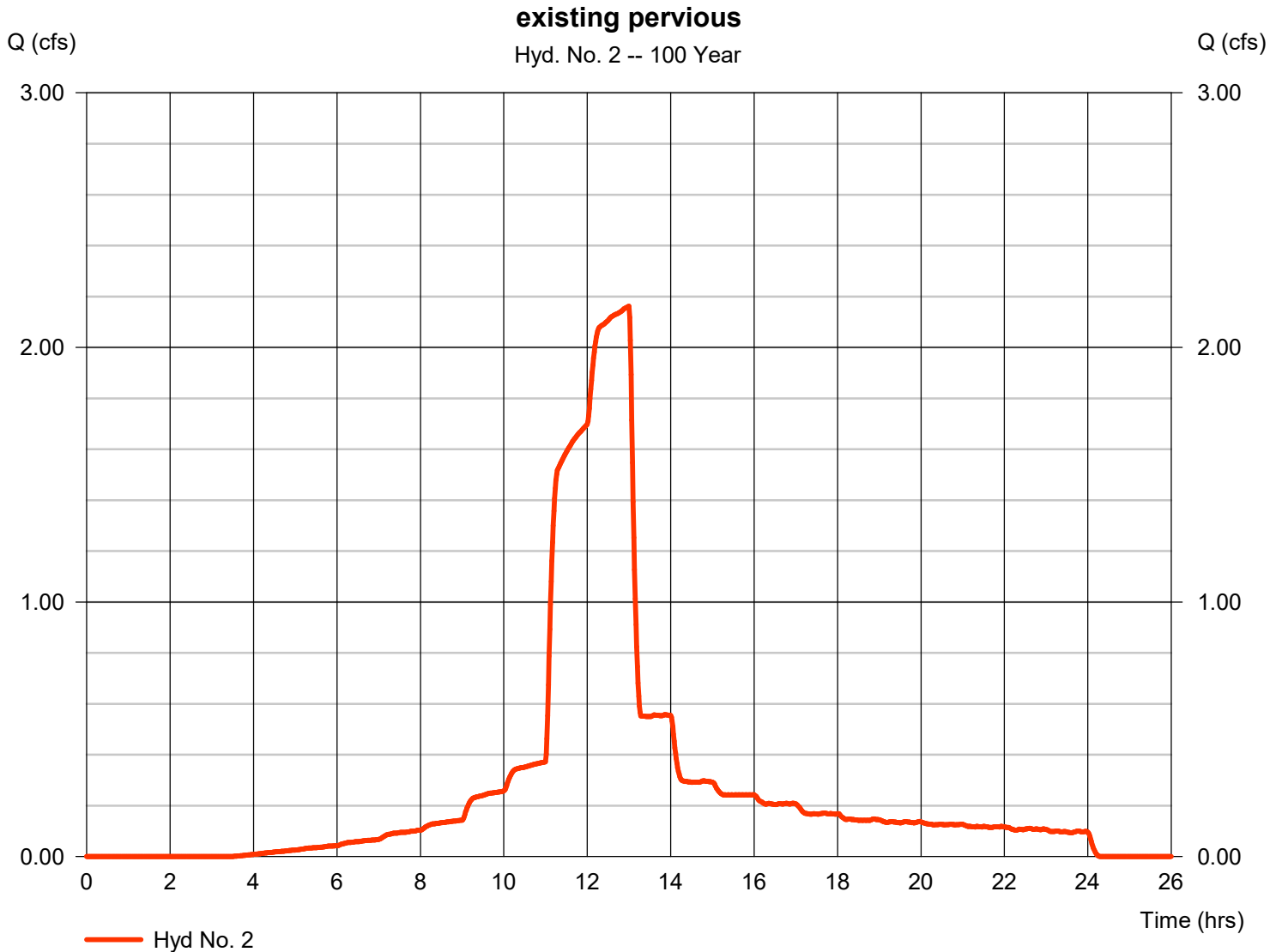
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Wednesday, 12 / 20 / 2023

Hyd. No. 2

existing pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 2.162 cfs
Storm frequency	= 100 yrs	Time to peak	= 13.00 hrs
Time interval	= 1 min	Hyd. volume	= 24,715 cuft
Drainage area	= 0.768 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 11.49 in	Distribution	= Custom
Storm duration	= J:\763 HOWELL RT 33 MALE SHOPS TRADE CONTRACTOR BUSINESS SITE		



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

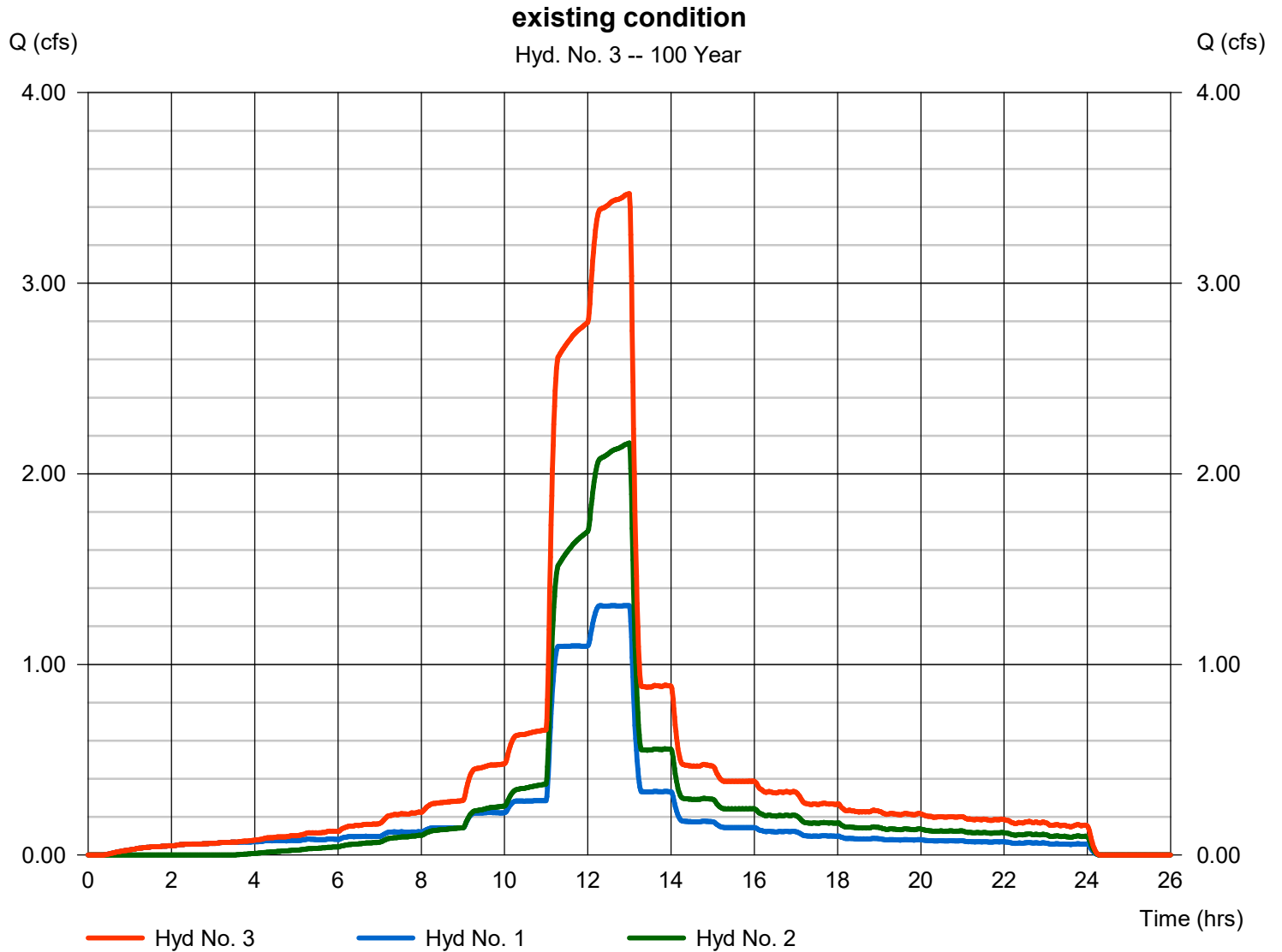
Wednesday, 12 / 20 / 2023

Hyd. No. 3

existing condition

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 1 min
Inflow hyds. = 1, 2

Peak discharge = 3.470 cfs
Time to peak = 13.00 hrs
Hyd. volume = 42,384 cuft
Contrib. drain. area = 1.205 ac



Hydrograph Report

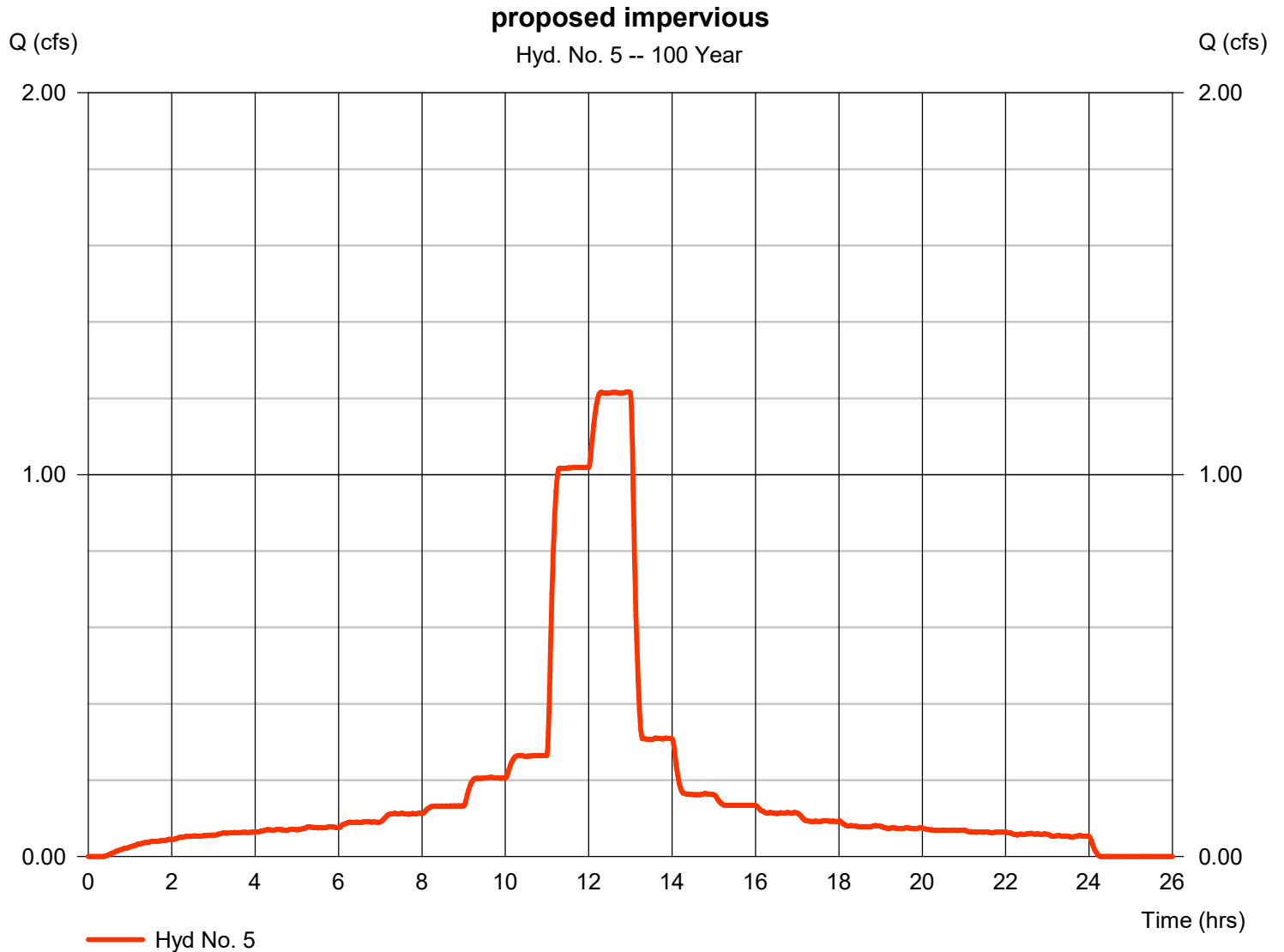
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Wednesday, 12 / 20 / 2023

Hyd. No. 5

proposed impervious

Hydrograph type	= SCS Runoff	Peak discharge	= 1.216 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.97 hrs
Time interval	= 1 min	Hyd. volume	= 16,415 cuft
Drainage area	= 0.406 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 11.49 in	Distribution	= Custom
Storm duration	= J:\763 HOWELL RT 33 MALE STATION TRADE CONTRACTOR BUSINESS SITE		

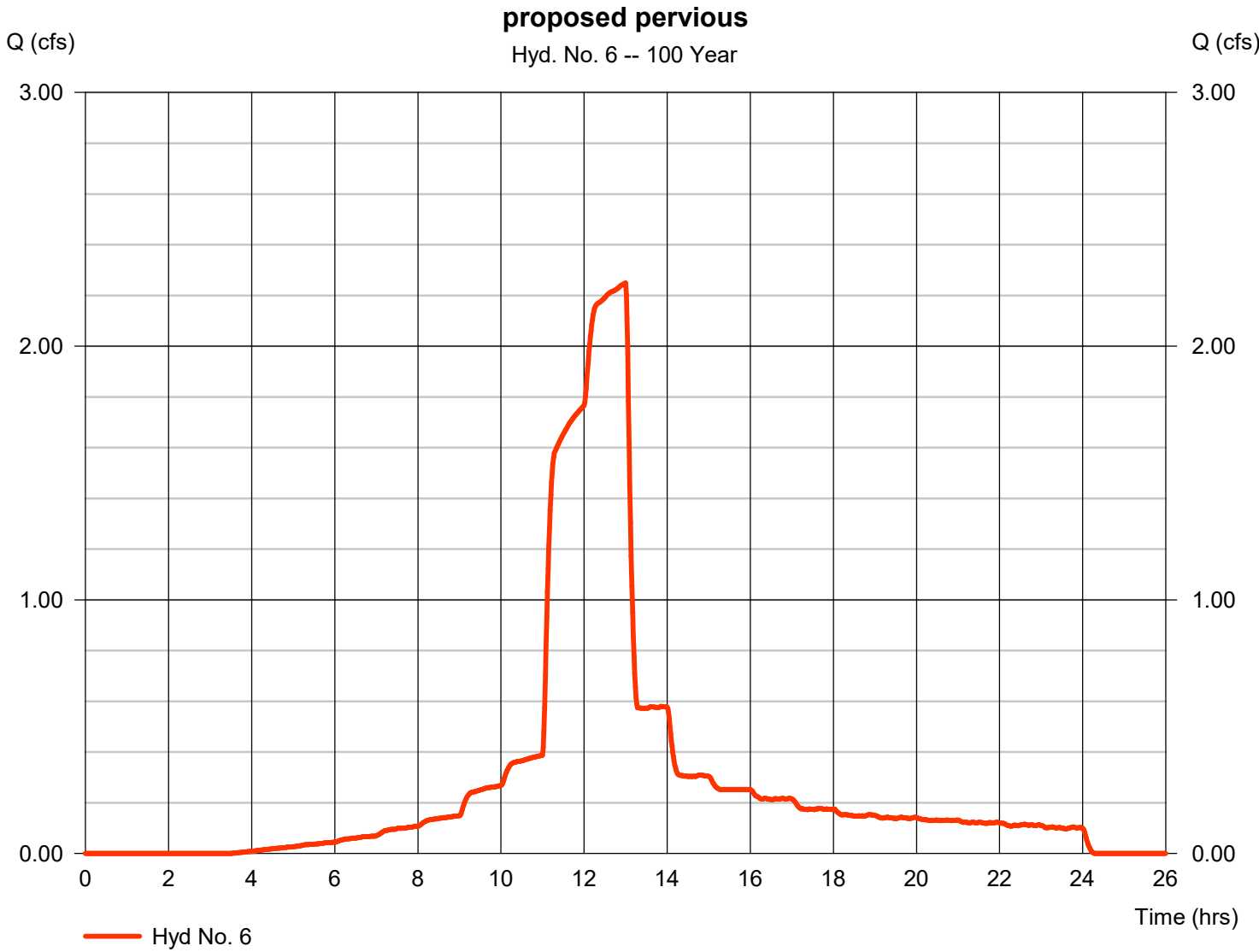


Hydrograph Report

Hyd. No. 6

proposed pervious

Hydrograph type	= SCS Runoff	Peak discharge	= 2.249 cfs
Storm frequency	= 100 yrs	Time to peak	= 13.00 hrs
Time interval	= 1 min	Hyd. volume	= 25,713 cuft
Drainage area	= 0.799 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 11.49 in	Distribution	= Custom
Storm duration	= J:\763 HOWELL RT 33 MALE SHOPS TRADE CONTRACTOR BUSINESS SITE		



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

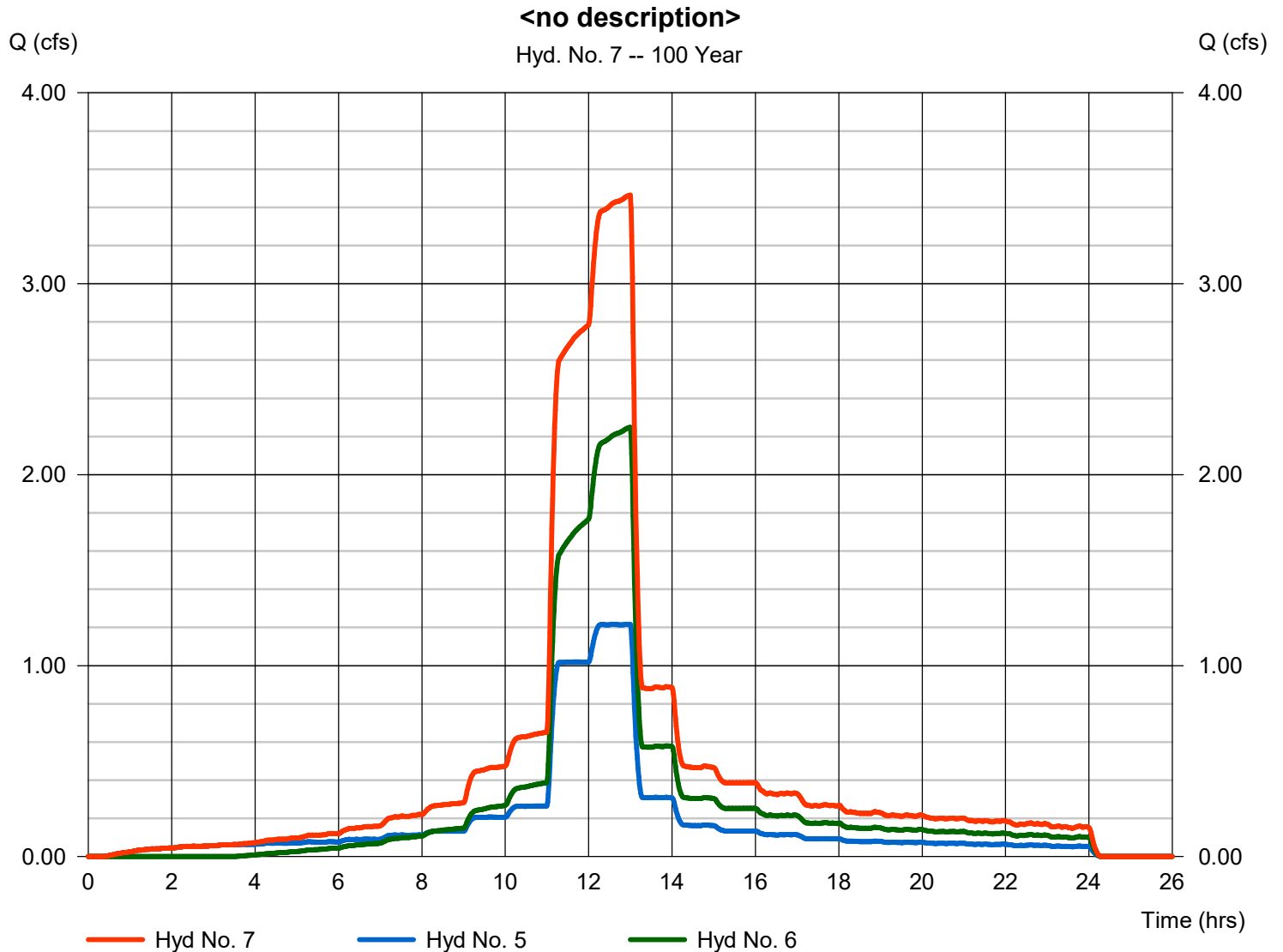
Wednesday, 12 / 20 / 2023

Hyd. No. 7

<no description>

Hydrograph type = Combine
 Storm frequency = 100 yrs
 Time interval = 1 min
 Inflow hyds. = 5, 6

Peak discharge = 3.465 cfs
 Time to peak = 13.00 hrs
 Hyd. volume = 42,128 cuft
 Contrib. drain. area = 1.205 ac



Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Wednesday, 12 / 20 / 2023

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	51.6066	12.5000	0.8820	-----
2	60.4231	12.7000	0.8718	-----
3	0.0000	0.0000	0.0000	-----
5	65.5675	12.8000	0.8385	-----
10	66.3444	12.6000	0.8081	-----
25	58.0444	11.1000	0.7423	-----
50	54.6664	10.4000	0.7036	-----
100	48.3757	9.1000	0.6533	-----

File name: idf data canaan church.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	4.13	3.31	2.77	2.39	2.11	1.89	1.71	1.57	1.45	1.35	1.26	1.18
2	4.93	3.97	3.34	2.89	2.55	2.29	2.08	1.91	1.76	1.64	1.53	1.44
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	5.86	4.76	4.03	3.51	3.12	2.81	2.56	2.36	2.18	2.04	1.91	1.80
10	6.54	5.34	4.54	3.97	3.54	3.20	2.93	2.70	2.51	2.34	2.20	2.08
25	7.38	6.04	5.15	4.53	4.05	3.68	3.38	3.13	2.92	2.74	2.59	2.45
50	7.98	6.55	5.61	4.95	4.44	4.05	3.73	3.47	3.24	3.05	2.89	2.74
100	8.59	7.04	6.05	5.35	4.82	4.41	4.08	3.80	3.57	3.37	3.19	3.04

T_c = time in minutes. Values may exceed 60.

Precip. file name: J:\858 walt shark river hills\new rainfall rates 2023.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	4.02	0.00	0.00	6.24	6.60	0.00	11.29
SCS 6-Hr	0.00	2.44	0.00	0.00	3.62	4.38	0.00	5.71
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	4.02	0.00	0.00	6.29	6.60	0.00	11.49