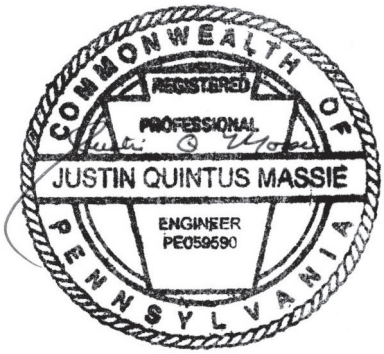
Post Construction Storm Water Management Analysis

For

Upper Dublin Township Building

Upper Dublin Township, Montgomery County, PA

Terraform Engineering, LLC



May 26, 2023

TE # 23015

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POST CONSTRUCTION STORM WATER MANAGEMENT ANALYSIS

FOR

UPPER DUBLIN TOWNSHIP BUILDING

Upper Dublin Township, Montgomery County, Pennsylvania

INTRODUCTION

The Upper Dublin Township Building project is located in Upper Dublin Township, Montgomery County, Pennsylvania. The project consists of the demolition of the existing township building and construction of a new township building and public works building addition along with associated site improvements.

Currently, the project area is on the existing Upper Dublin Township Municipal Campus. The campus has existed since 1964. The project area is currently a municipal campus with the Township Building, Police Facility, Public Works building, lawn areas, and parking/access areas on the campus.

This site is located adjacent to Route 309 and along Loch Alsh Avenue. Runoff drains in a southerly direction offsite and eventually discharges through a culvert under Route 309 to an unnamed tributary of the Wissahickon Creek, which then discharges to the Wissahickon Creek. The Wissahickon Creek has a chapter 93 classification of TSF, MF in this area. The unnamed tributary to the Wissahickon Creek is listed as integrated non-attained on the eMapPA website setup by PA DEP. Impairment is listed as urban runoff/storm sewers (causes: unknown, flow regime modification, siltation); habitat modification (causes: other than hydromodification-habitat alterations).

The PCSM Plan is separate from the E&S plan and is the final plan for construction. This design has been prepared in order to preserve the integrity of stream channels and maintain and protect the physical, biological, and chemical qualities of the receiving stream, prevent an increase in the rate of stormwater runoff, minimize any increase in stormwater runoff volume, minimize impervious areas, maximize the protection of existing drainage features and existing vegetation, minimize land clearing and grading, minimize soil compaction, and utilize structural or non-structural BMPs that prevent or minimize changes in stormwater runoff.

SOIL INFORMATION

The types of soils and their boundaries have been shown on the plans. The following soils, defined by the Soil Conservation Service, may be found in the project area:

LaB – Lansdale Loam, 3 to 8 Percent Slopes
This soil consists of well drained drained soils formed from residuum weathered from sandstone and/or residuum weathered from conglomerate. This soil is not hydric. The soil has

been modeled as Hydrologic Soil Group B.

UdtB– Udorthents, shale and sandstone, 0 to 8 Percent Slopes
This soil consists of well drainage soil from graded areas of sandstone and shale. This soil is not hydric. The soil has been modeled as Hydrologic Soil Group C.

UgB – Urban Land, 0 to 8 percent slopes
Urban Land occurs on where pavement, buildings and other artificial covered areas obscure the original soils. Variability in urban land makes classification of these soils impractical. This soil is not a hydric soil. Urban soils are modeled as Hydrologic Soil Group C.

UusB – Urban Land-Udorthents, shale and sandstone complex, 0 to 8 percent slopes
Urban Land-Udorthents occurs on where pavement, buildings and other artificial covered areas obscure the original soils. Variability in urban land makes classification of these soils impractical. This soil is not a hydric soil. These soils are modeled as Hydrologic Soil Group A.

Refer to the attached Soil Map and the Soils Descriptions in Reference Materials for additional information. Please note that no known geologic or soil conditions are anticipated to cause pollution during construction.

PCSM PLAN PREPARER INFORMATION

Plan Preparer: Justin Q. Massie, P.E.

Formal Education: Penn State
Civil Engineering Curriculum
August 1995 to May 1999
Bachelor of Science, P.E.

Other Training: DEP Stormwater BMP Manual Seminar
November 16-17, 2006
Chapter 102 Update Training
November 3, 2010

Professional Licensure: Pennsylvania Professional Engineer (As of 12/21/2004)

Employment History:Barry Isett & Associates, Inc (May 1999-August 2007)

Current Employer: Terraform Engineering, LLC
484-895-4632

Recent PCSM Plans Prepared:

1. Sandy Run Middle School
   Upper Dublin Township, Montgomery County
   Montgomery County Conservation District

2. Keith Valley Middle School
   Horsham Township, Montgomery County
   Montgomery County Conservation District

PRE-DEVELOPMENT ANALYSIS

In pre-development condition the project site drains to the offsite to two separate discharge points. Discharge point 001is located at the southwestern corner of the property to where a 36" pipe discharges stormwater offsite. This pipe discharges via collection and conveyance systems to the unnamed tributary to the Wissahickon Creek. Discharge point 002 is located at the southeastern portion of the property where a 36" pipe discharges stormwater offsite. This pipe discharged via collection and conveyance system to the unnamed tributary to the Wissahickon Creek.

The Township Ordinance requires that the post-development 1, 2, 10, 50, and 100 year peak runoff rates not exceed respective pre-development peak runoff rates.

The Township and NPDES permit additionally require reduction of the post-development 2 year runoff volume to the pre-development 2 year runoff volume.

POST-DEVELOPMENT ANALYSIS

In the post-development condition the project area continues to drain offsite at the two separate discharge point and ultimately be conveyed to the unnamed tributary to the Wissahickon Creek.

The Area 001 has been reduced in the post-development condition. Therefore, rate and volume control are addressed by the decrease of impervious area to the discharge point.

The areas to discharge point 002 are divided into two separate drainage areas. The Captured 002 drainage area consists of the portion of the property that is captured and infiltrated or routed through the proposed basin. The basin has been design to meet the volume and rate control requirements for discharge point 002. The Bypass 002 area consists of the remainder of the site area that drains to discharge point 002 but is not captured in the proposed basin.

The Basin has been designed with infiltration modeled and verifies that the volume control required for the site has been achieved.

Note that pipe design calculations are provided and verify that there is adequate conveyance.

POST-CONSTRUCTION STORMWATER BMPs

As was noted above, Underground Infiltration/Detention Basin has been designed to control the runoff rate from the areas to discharge point 002 and to infiltrate the difference in runoff volume from the pre and post 2 year storm event from areas to discharge point 002 and meet the water quality requirements of the area to discharge point 002, this will also serve to cool runoff leaving the site. Sump with Snout has been installed on MH 4 to meet water quality requirements of the area to discharge point 001.

THERMAL IMPACTS

The proposed development will result in a slight reduction in actual impervious surface on the site and therefore will not result in thermal impact to the stormwater runoff. The infiltration basin will cool runoff prior to it reaching a downstream watercourse.

CALCULATION METHODOLOGY

Volume calculations are computed with the SCS TR-55 Methodology. Runoff curve numbers are taken from Chapter 2 of the TR-55 manual. Type II rainfall distribution was utilized. Precipitation data is taken from the NOAA data for the latitude/longitude of the site. Rate control calculations were performed utilizing the TR-55 methodology utilizing the Hydraflow Hydrographs program. Time of concentration is calculated using the segmental approach.

CONCLUSIONS

Volume control has been designed to meet the Township and PA DEP NPDES requirements. Rate control is provided to meet the Township requirements. Additionally, water quality BMPs are provided to meet PA DEP's water quality requirements.

SUMMARY SHEET

PROJECT: UPPER DUBLIN TWP CAMPUS DATE: 5/19/23
LOCATION: UPPER DUBLIN TOWNSHIP REVISED:
COUNTY: MONTGOMERY

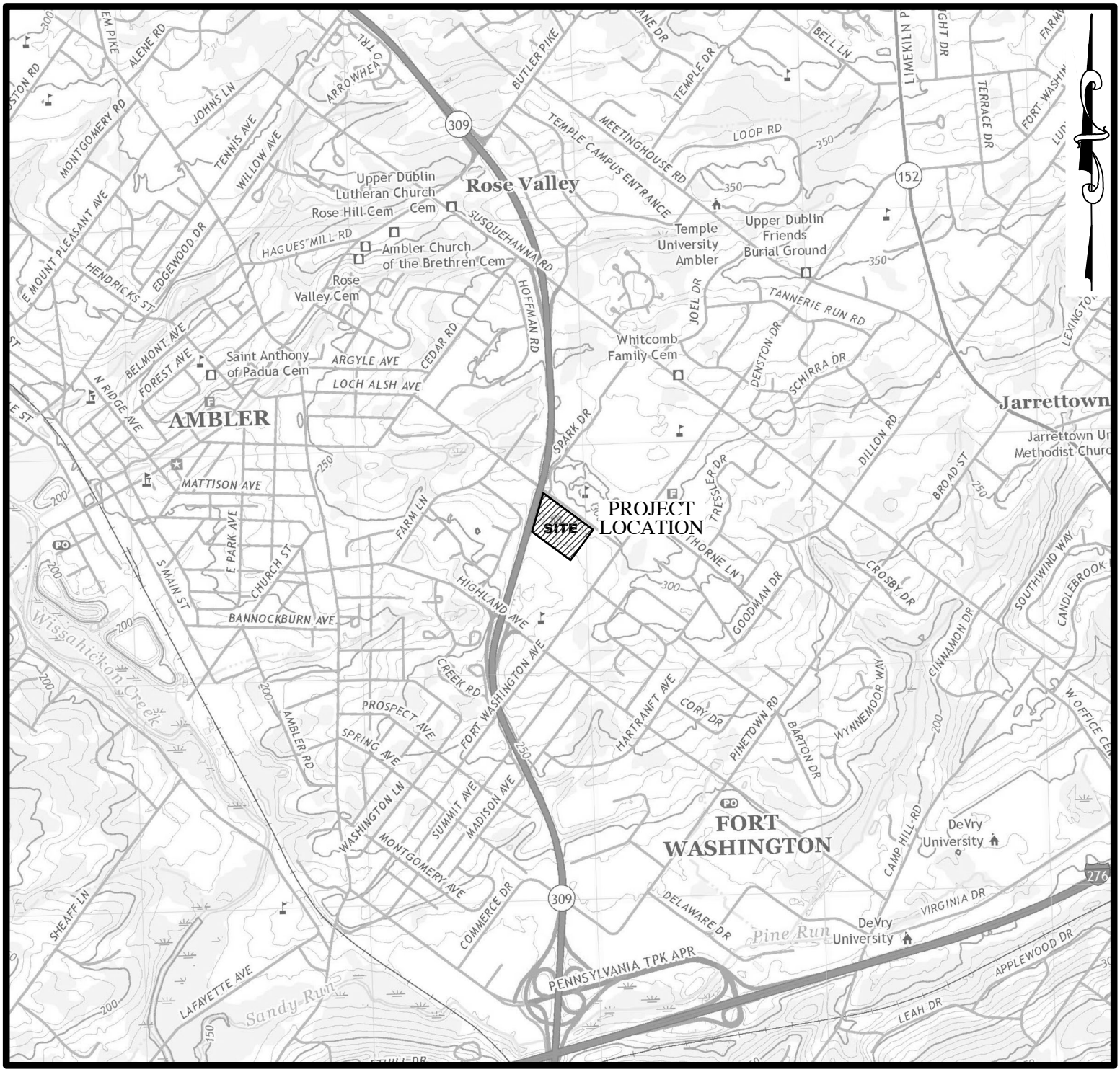
PRE-DEVELOPMENT (FLOW RATES IN CFS)

	FREQUENCY EVENT (YEARS)				
	1	2	10	50	100
PRE AREA 001	11.59	14.84	23.83	34.68	39.98
PRE AREA 002	11.55	14.83	23.94	34.95	40.33

POST-DEVELOPMENT (FLOW RATES IN CFS)

	FREQUENCY EVENT (YEARS)				
	1	2	10	50	100
POST AREA 001	10.66	13.73	22.25	32.56	37.59
AREA 002 BYPASS	9.510	12.22	19.72	28.79	33.21
POST AREA 002 CAPTURED	3.919	4.89	7.545	10.74	12.31
BASIN ROUTED	0.071	0.378	2.332	3.846	4.447
TOTAL POST AREA 002	**9.51**	**12.42**	**22.02**	**32.63**	**37.66**

B. REFERENCE MATERIAL AND SUPPORTING DATA



LAT. 40° 9'6.91"N LONG. 75°12'1.84"W	AMBLER, P.A. MONTGOMERY COUNTY, PA 7.5 MINUTE SERIES (TOPOGRAPHIC)

SCALE: 1" = 2,000'

Terraform Engineering, LLC

SITE LOCATION

UPPER DUBLIN TOWNSHIP BUILDING
801 LOCH ALSH AVE,
FORT WASHINGTON, PA 19034

T:\PROJECTS\23015-UPPER DUBLIN TWP BLDG\DWG\C6-EROSION

NOAA Atlas 14, Volume 2, Version 3
Location name: Township of Upper Dublin, Pennsylvania, USA*
Latitude: 40.152°, Longitude: -75.2009°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.343** (0.314-0.376)	**0.409** (0.374-0.448)	**0.481** (0.439-0.526)	**0.533** (0.486-0.583)	**0.596** (0.540-0.651)	**0.639** (0.576-0.699)	**0.681** (0.611-0.746)	**0.719** (0.642-0.790)	**0.764** (0.676-0.843)	**0.797** (0.700-0.883)
10-min	**0.548** (0.502-0.600)	**0.654** (0.599-0.716)	**0.771** (0.704-0.843)	**0.853** (0.777-0.933)	**0.949** (0.860-1.04)	**1.02** (0.917-1.11)	**1.08** (0.972-1.19)	**1.14** (1.02-1.25)	**1.21** (1.07-1.33)	**1.25** (1.10-1.39)
15-min	**0.686** (0.628-0.751)	**0.822** (0.752-0.900)	**0.975** (0.890-1.07)	**1.08** (0.983-1.18)	**1.20** (1.09-1.31)	**1.29** (1.16-1.41)	**1.37** (1.23-1.50)	**1.44** (1.28-1.58)	**1.52** (1.35-1.68)	**1.58** (1.38-1.75)
30-min	**0.940** (0.861-1.03)	**1.14** (1.04-1.24)	**1.39** (1.26-1.52)	**1.56** (1.43-1.71)	**1.78** (1.62-1.95)	**1.94** (1.75-2.12)	**2.10** (1.88-2.30)	**2.24** (2.00-2.46)	**2.42** (2.14-2.67)	**2.55** (2.24-2.83)
60-min	**1.17** (1.07-1.28)	**1.43** (1.30-1.56)	**1.78** (1.62-1.94)	**2.04** (1.86-2.23)	**2.37** (2.15-2.59)	**2.63** (2.37-2.88)	**2.89** (2.59-3.16)	**3.14** (2.80-3.45)	**3.47** (3.07-3.83)	**3.72** (3.27-4.13)
2-hr	**1.40** (1.28-1.54)	**1.70** (1.55-1.87)	**2.13** (1.94-2.34)	**2.46** (2.23-2.70)	**2.90** (2.62-3.18)	**3.25** (2.91-3.56)	**3.60** (3.21-3.95)	**3.96** (3.50-4.35)	**4.44** (3.88-4.90)	**4.81** (4.16-5.33)
3-hr	**1.54** (1.40-1.69)	**1.86** (1.70-2.05)	**2.34** (2.12-2.58)	**2.71** (2.45-2.98)	**3.20** (2.88-3.52)	**3.59** (3.21-3.95)	**4.00** (3.55-4.40)	**4.41** (3.88-4.86)	**4.97** (4.31-5.51)	**5.41** (4.64-6.01)
6-hr	**1.93** (1.76-2.12)	**2.33** (2.13-2.57)	**2.91** (2.65-3.21)	**3.38** (3.07-3.72)	**4.05** (3.64-4.45)	**4.59** (4.10-5.05)	**5.17** (4.57-5.68)	**5.78** (5.05-6.36)	**6.64** (5.70-7.35)	**7.34** (6.21-8.16)
12-hr	**2.34** (2.14-2.59)	**2.83** (2.59-3.13)	**3.56** (3.25-3.93)	**4.17** (3.79-4.60)	**5.07** (4.55-5.57)	**5.83** (5.18-6.41)	**6.65** (5.84-7.33)	**7.55** (6.54-8.34)	**8.86** (7.51-9.85)	**9.97** (8.30-11.1)
24-hr	**2.72** (2.51-2.97)	**3.28** (3.02-3.58)	**4.12** (3.80-4.49)	**4.83** (4.43-5.25)	**5.85** (5.34-6.35)	**6.72** (6.09-7.28)	**7.65** (6.89-8.29)	**8.67** (7.75-9.39)	**10.2** (8.96-11.0)	**11.4** (9.94-12.4)
2-day	**3.14** (2.88-3.44)	**3.79** (3.47-4.14)	**4.77** (4.37-5.22)	**5.58** (5.09-6.09)	**6.72** (6.11-7.32)	**7.67** (6.94-8.35)	**8.69** (7.81-9.46)	**9.77** (8.72-10.6)	**11.3** (10.0-12.4)	**12.6** (11.0-13.8)
3-day	**3.32** (3.05-3.62)	**4.00** (3.68-4.37)	**5.02** (4.61-5.47)	**5.84** (5.36-6.37)	**7.02** (6.41-7.64)	**7.99** (7.27-8.69)	**9.03** (8.16-9.81)	**10.1** (9.10-11.0)	**11.7** (10.4-12.7)	**13.0** (11.5-14.2)
4-day	**3.50** (3.23-3.81)	**4.21** (3.89-4.59)	**5.26** (4.86-5.73)	**6.11** (5.63-6.65)	**7.32** (6.71-7.95)	**8.32** (7.60-9.02)	**9.37** (8.52-10.2)	**10.5** (9.48-11.4)	**12.1** (10.8-13.1)	**13.4** (11.9-14.5)
7-day	**4.09** (3.80-4.43)	**4.90** (4.55-5.31)	**6.06** (5.62-6.57)	**7.00** (6.49-7.59)	**8.36** (7.71-9.04)	**9.48** (8.71-10.2)	**10.7** (9.74-11.5)	**11.9** (10.8-12.9)	**13.7** (12.4-14.8)	**15.2** (13.6-16.4)
10-day	**4.65** (4.34-5.00)	**5.55** (5.18-5.98)	**6.77** (6.30-7.28)	**7.74** (7.20-8.33)	**9.10** (8.43-9.78)	**10.2** (9.42-11.0)	**11.3** (10.4-12.2)	**12.5** (11.5-13.5)	**14.1** (12.9-15.2)	**15.5** (14.0-16.7)
20-day	**6.28** (5.90-6.70)	**7.45** (7.00-7.95)	**8.89** (8.34-9.49)	**10.0** (9.38-10.7)	**11.5** (10.8-12.3)	**12.7** (11.9-13.6)	**13.9** (12.9-14.8)	**15.1** (14.0-16.1)	**16.8** (15.4-17.9)	**18.0** (16.5-19.3)
30-day	**7.83** (7.40-8.26)	**9.22** (8.72-9.73)	**10.7** (10.2-11.3)	**11.9** (11.3-12.6)	**13.5** (12.7-14.2)	**14.7** (13.8-15.5)	**15.8** (14.8-16.7)	**17.0** (15.9-17.9)	**18.4** (17.2-19.5)	**19.5** (18.1-20.7)
45-day	**9.94** (9.46-10.5)	**11.7** (11.1-12.3)	**13.4** (12.8-14.1)	**14.7** (14.0-15.5)	**16.4** (15.6-17.3)	**17.6** (16.7-18.5)	**18.8** (17.8-19.8)	**19.9** (18.8-20.9)	**21.3** (20.0-22.4)	**22.2** (20.9-23.5)
60-day	**11.9** (11.4-12.5)	**14.0** (13.3-14.7)	**15.9** (15.2-16.7)	**17.4** (16.6-18.3)	**19.2** (18.3-20.2)	**20.5** (19.5-21.6)	**21.8** (20.7-22.9)	**22.9** (21.8-24.1)	**24.3** (23.0-25.6)	**25.3** (23.9-26.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,320 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

Montgomery County, Pennsylvania

BwA—Buckingham silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2dvtx
Elevation: 150 to 950 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 150 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Buckingham and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Buckingham

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Fine-loamy colluvium and old alluvium derived from shale and siltstone

Typical profile

A - 0 to 16 inches: silt loam
Bt - 16 to 40 inches: silt loam
Btx1 - 40 to 48 inches: silty clay loam
Btx2 - 48 to 62 inches: gravelly silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 20 to 40 inches to fragipan; 80 to 99 inches to lithic bedrock
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Ecological site: F148XY025PA - Moist, Triassic, Upland, Mixed Oak - Hardwood - Conifer Forest
Hydric soil rating: No

Minor Components

Penn

Percent of map unit: 13 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Croton

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: Yes

Knauers

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: Yes

LaB—Lansdale loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2dzbs
Elevation: 70 to 1,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lansdale and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lansdale

Setting

Landform: Hillsides
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope

Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and/or residuum weathered from conglomerate

Typical profile

Ap - 0 to 8 inches: loam
Bt - 8 to 34 inches: channery sandy loam
C - 34 to 46 inches: channery sandy loam
R - 46 to 50 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 42 to 60 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 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 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F148XY025PA - Moist, Triassic, Upland, Mixed Oak - Hardwood - Conifer Forest
Hydric soil rating: No

Minor Components

Reaville

Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

UdtB—Udorthents, shale and sandstone, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2dtyn
Elevation: 200 to 1,500 feet
Mean annual precipitation: 36 to 55 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 160 to 214 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, shale and sandstone, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Shale And Sandstone

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Graded areas of sandstone and shale

Typical profile

Ap - 0 to 6 inches: silt loam
C - 6 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 99 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: About 60 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Penn

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Abbottstown

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Bowmansville

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

Readington

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Head slope, side slope, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Reaville

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Croton

Percent of map unit: 1 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: Yes

Berks

Percent of map unit: 1 percent
Landform: Ridges, valleys
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

UgB—Urban land, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2dtyq
Elevation: 800 to 1,500 feet

Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 41 to 62 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition
Urban land: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting
Parent material: Pavement, buildings and other artifically covered areas human transported material

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Minor Components

Udorthents, unstable fill
Percent of map unit: 10 percent
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

UusB—Urban land-Udorthents, shale and sandstone complex, 0 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2dtz9
Elevation: 50 to 950 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 161 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition
Urban land: 80 percent
Udorthents, shale and sandstone, and similar soils: 15 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting
Landform: Hills
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

C - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 99 inches to lithic bedrock
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Description of Udorthents, Shale And Sandstone

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Graded areas of sandstone and shale

Typical profile

A - 0 to 6 inches: very channery loam
C - 6 to 60 inches: very channery silt loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 99 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 6.00 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: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Penn

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

SOIL USE LIMITATIONS AND THEIR RESOLUTIONS

LIMITATIONS PER TABLE E.1 IN PA E&S MANUAL

SOIL NAME	CUTBANKS CAVE	CORROSIVE TO CONCRETE/STEEL	DROUGHTY	EASILY EROSDIBLE	FLOODING	DEPTH TO SATURED ZONE/SEASONAL HIGH WATER TABLE	HYDRIC/HYDRIC INCLUSIONS	LOW STRENGTH/ LANDSLIDE PRONE	SLOW PERCOLATION	PIPING	POOR SOURCE OF TOPSOIL	FROST ACTION	SHRINK-SWELL	POTENTIAL SINKHOLE	PONDING	WETNESS
BUCKINGHAM	X	C/S		X		X	X	X	X	X	X	X				X
LANSDALE LOAM	X	C	X					X	X		X	X				
UDORTHENTS, SHALE AND SANDSTONE	X	C/S	X	X				X	X		X	X				
URBAN LAND	X	C/S	X	X		X	X	X	X	X		X	X	X	X	X
URBAN LAND-UDORTHENTS	X	C/S	X	X				X	X		X	X				

RESOLUTIONS:

1. SOILS SUSEPTIBLE TO CUTBANKS CAVING SHALL PROVIDE TAKE APPROPRIATE PRECAUTIONS TO SAFEGUARD WORKERS DURING ALL TRENCHING AND EXCAVATION OPERATIONS. ALL APPLICABLE OSHA STANDARDS AND REGULATIONS MUST BE IMPLEMENTED AT ALL TIMES.
2. IN SOILS CORROSIVE TO CONCRETE AND/OR STEEL, SUITABLE PRECAUTIONS SHOULD BE TAKEN TO PROTECT ALL UNDERGROUND PIPES, CONDUITS, AND STORAGE TANKS.
3. IN DROUGHTY SOILS PERFORM SOIL TESTS OF TOPSOIL TO DETERMINE THE PROPER APPLICATION OF SOILS AMENDMENTS TO PROMOTE THE GROWTH OF DESIRED FOR VEGETATION.
4. IN EASILY ERODED SOILS VERIFY AND CHECK ON ALL E&S BMP FACILITIES FREQUENTLY. IMMEDIATELY STABILIZE THESE AREAS AND TAKE PRECAUTION TO LIMIT THESE SOILS TIME OF EXPOSURE.
5. IN SOILS PRONE TO FLOODING, TAKE PRECAUTIONS TO PROTECT STRUCTURES FROM THE FLOODING AS APPROPRIATE.
6. IN SOILS INDICATED TO HAVE SHALLOW DEPTHS TO SATURATED ZONES AND/OR SEASONAL HIGH WATER TABLES, IT SHOULD BE ASSUEMD THAT EXCAVATIONS INTO THESE SOILS WILL ENCOUNTER WATER AND APPROPRIATE MEANS TO HANDLE THAT WATER SHOULD BE PROVIDED.
7. IN SOILS INDICATED TO BE HYDRIC OR HAVE HYDRIC INCLUSIONS, IDENTIFY AND AVOID ANY WETALNDS. ALSO, ASSUME EXCAVATIONS INTO THESE SOILS WILL ENCOUNTER WATER AND TAKE APPROPRIATE MEANS TO HANDLE THAT WATER.

8. IN SOILS INDICATED TO HAVE LOW STRENGTH, PRECAUTIONS SHOULD BE TAKEN TO PREVENT SLOPE FAILURES DUE TO IMPROPERT CONSTRUCTION PRACTICES SUCH AS OVER-STEEPENING AND OVERLOADING OF SLOPES, REMOVAL OF LATERAL SUPPORT, AND FAILURE TO PREVENT SATURATION OF SLOPES. PERFORM SOIL TESTING TO DETERMINE SUITABILITY FOR ROAD FILL.
9. IN SOILDS INDICATED TO HAVE SLOW PERCOLATION SOIL TESTING TO CONFIRM INFILTRATION RATES SHOULD BE PERFORMED TO DETERMINE SUITABILITY FOR INFILTRATION BMPs.

10. IN SOIL INDICATED TO BE SUSEPTIBLE TO PIPING, COMPACTION OF SOIL MATERIALS AND SUITABLE TRENCH BEDDING SHALL BE UTILIZED.
11. SOILS INDICATED TO BE POOR SOURCES OF TOPSOIL SHOULD PERFORM SOIL TESTING TO DETERMINE WHAT AMENDMENTS ARE NECESSARY TO PROMOTE VEGETATION GROWTH.
12. SOILS SUSEPTIBLE TO FROST ACTION SHALL TAKE MEASURES TO PREVENT DAMAGE, ESPECIALLY TO ROADWAYS.
13. SOILS PRONE TO PONDING SHALL ENSURE THAT PROPOSED GRADING IS PERFORMED TO ELIMINATE LOW LYING AREAS.
14. SOILS INDICATED TO HAVE ISSUES WITH WETNESS SHALL BE ASSUMED THAT EXCAVATION WILL ENCOUNTER WATER AND APPROPRIATE MEANS TO HANDLE THAT WATER SHALL BE PROVIDED.

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2c Runoff curve numbers for other agricultural lands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4]	48	65	73
Woods—grass combination (orchard or tree farm). [5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.

2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

3 *Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

4 Actual curve number is less than 30; use CN = 30 for runoff computations.

5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

C. PRE-DEVELOPMENT ANALYSIS

TIME OF CONCENTRATION WORKSHEET
SUMMARY - SUBAREAS TIME OF CONCENTRATION
PRE-DEVELOPMENT CONDITIONS

Terraform Engineering, LLC

PROJECT: **UPPER DUBLIN TOWNSHIP CAMPU** JOB # **23015**

LOCATION: UPPER DUBLIN TOWNSHIP DATE: 5/19/2023

COUNTY: MONTGOMERY REVISED:

2 yr rainfall **3.28** PREPARED BY: JQM

	Time of concentration (Tc) or travel time (Tt)																			
	overland					Shallow Concentrated					Channel or Pipe								Total	
Sub area	Length L_1 100 ft. max.	Slope S_1	Manning's n	2 yr rainfall	Tc	Flow Path Cover	Length L_2	Slope S_2	Average Velocity	Tt	Channel or Pipe	Flow Area	Wetted Perimeter	Pipe Diameter	Slope S_3	Manning's n	Length L_3	Tt	S Tc	
	ft.	ft./ft.	n	in.	Min.	U/P	ft.	ft./ft.	ft./s	Min.	C/P	sq.ft.	ft.	in.	ft./ft.	n	ft.	Min.	Min.	Hrs.
001	78	0.020	0.24	3.3	11.6	U	38	0.030	2.8	0.2	P	0.79	3.14	12	0.058	0.013	161	0.2		
	22	0.030	0.24	3.3	3.6				0	0	P	1.77	4.71	18	0.007	0.013	134	0.4		
									0	0	C	2.75	7.16		0.004	0.010	129	0.4		
				0.0	0				0	0	P	7.07	9.42	36	0.036	0.013	226	0.2		
					15.2					0.2								1.2	**16.6**	0.28
002	48	0.026	0.24	3.3	7.1	U	17	0.044	3.4	0.1	P	1.77	4.71	18	0.127	0.012	38	0		
	52	0.044	0.24	3.3	6.1	U	35	0.065	4.1	0.1	P	3.14	6.28	24	0.037	0.012	110	0.1		
				0.0	0	P	63	0.060	5	0.2	P	7.07	9.42	36	0.015	0.013	98	0.1		
				0.0	0	P	82	0.020	2.9	0.5		0.00	0.00					0		
					13.2					0.9								0.2	**14.3**	0.24

Worksheet 2: Runoff Curve Number and Runoff

PROJECT: UPPER DUBLIN TWP CAMPUS
LOCATION: UPPER DUBLIN TOWNSHIP
COUNTY: MONTGOMERY

DATE: 5/19/2023
REVISED:

DRAINAGE AREA: PRE-DEVELOPMENT TO PNT 001

1. RUNOFF CURVE NUMBER

SOIL HYDROLOGIC GROUP	COVER DESCRIPTION	CN	AREA	PRODUCT OF CN x AREA
A	MEADOW	30	0.011	0.330
B	MEADOW	58	0.034	1.972
C	MEADOW	71	1.345	95.495
B/C	IMPERVIOUS	98	3.821	374.458
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
		TOTAL	5.211	472.255

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{472.255}{5.211} =$ 90.626559

Use CN = 90.6

2. RUNOFF		STORM #1	STORM #2	STORM #4	STORM #5	STORM #6	STORM #7
FREQUENCY	yr	1	2	10	25	50	100
RAINFALL, P (24 HOUR)	in	2.72	3.28	4.83	5.85	6.72	7.65
RUNOFF, Q	in	1.78	2.30	3.78	4.77	5.62	6.53

Worksheet 2: Runoff Curve Number and Runoff

PROJECT: UPPER DUBLIN TWP CAMPUS
LOCATION: UPPER DUBLIN TOWNSHIP
COUNTY: MONTGOMERY

DATE: 5/19/2023
REVISED:

DRAINAGE AREA: PRE-DEVELOPMENT ADDITIONAL AREA TO PNT 002

1. RUNOFF CURVE NUMBER

SOIL HYDROLOGIC GROUP	COVER DESCRIPTION	CN	AREA	PRODUCT OF CN x AREA
A	MEADOW	30	0	0.000
B	MEADOW	58	0.01	0.580
C	MEADOW	71	1.51	107.210
B/C	IMIPERVIOUS	98	3.758	368.284
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
		TOTAL	5.278	476.074

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{476.074}{5.278} =$ 90.199697

Use CN = 90.2

2. RUNOFF		STORM #1	STORM #2	STORM #4	STORM #5	STORM #6	STORM #7
FREQUENCY	yr	1	2	10	25	50	100
RAINFALL, P (24 HOUR)	in	2.72	3.28	4.83	5.85	6.72	7.65
RUNOFF, Q	in	1.75	2.26	3.73	4.72	5.57	6.48

Watershed Model Schematic

Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE 001
2	SCS Runoff	PRE 002

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	11.59	14.84	-------	-------	23.83	-------	34.68	39.98	PRE 001
2	SCS Runoff	------	11.55	14.83	-------	-------	23.94	-------	34.95	40.33	PRE 002

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	11.59	2	722	32,795	------	------	------	PRE 001
2	SCS Runoff	11.55	2	722	32,599	------	------	------	PRE 002

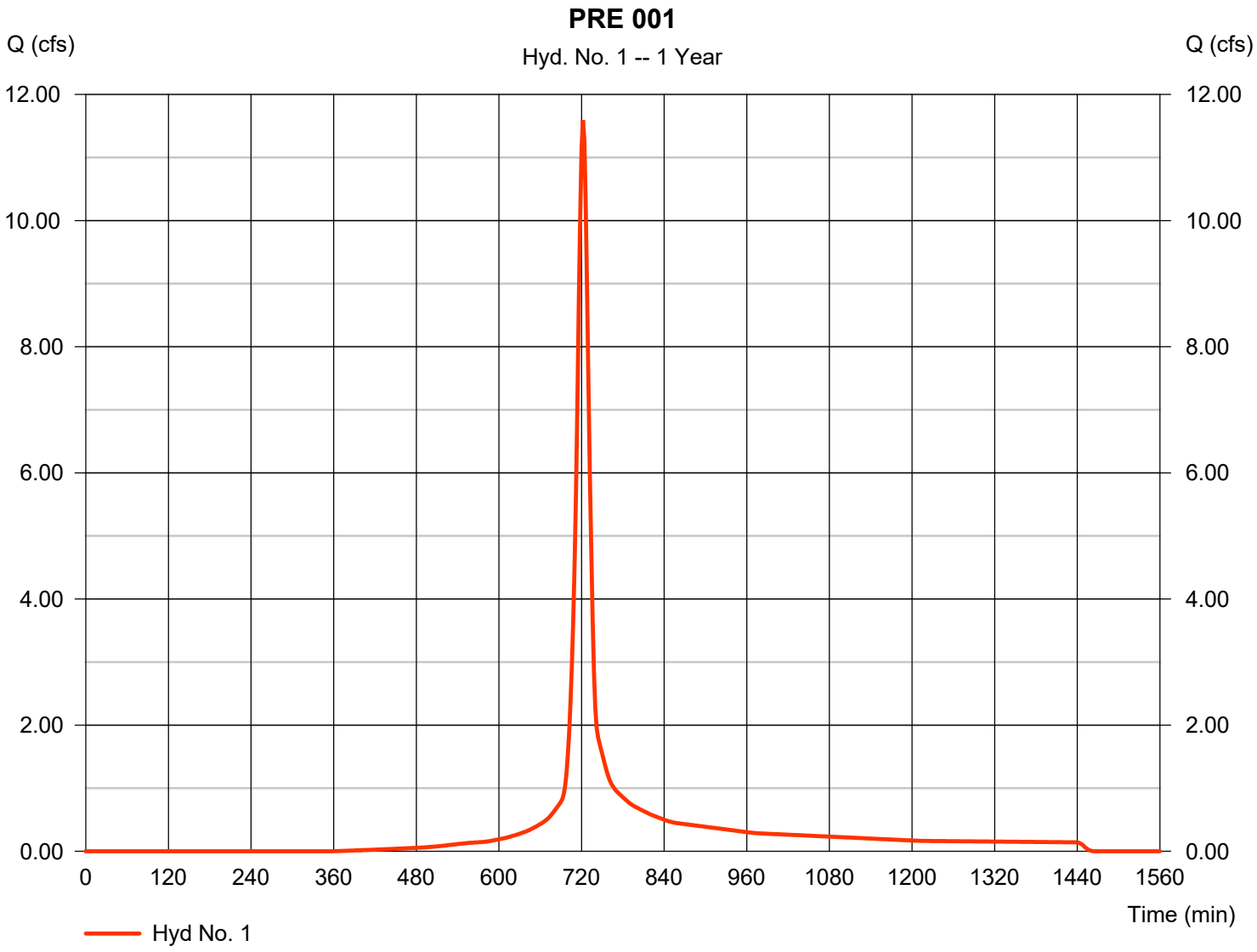
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Monday, 05 / 15 / 2023

Hyd. No. 1

PRE 001

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.59 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	32,795 cuft
Drainage area	=	5.211 ac	Curve number	=	90.6
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	16.60 min
Total precip.	=	2.72 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



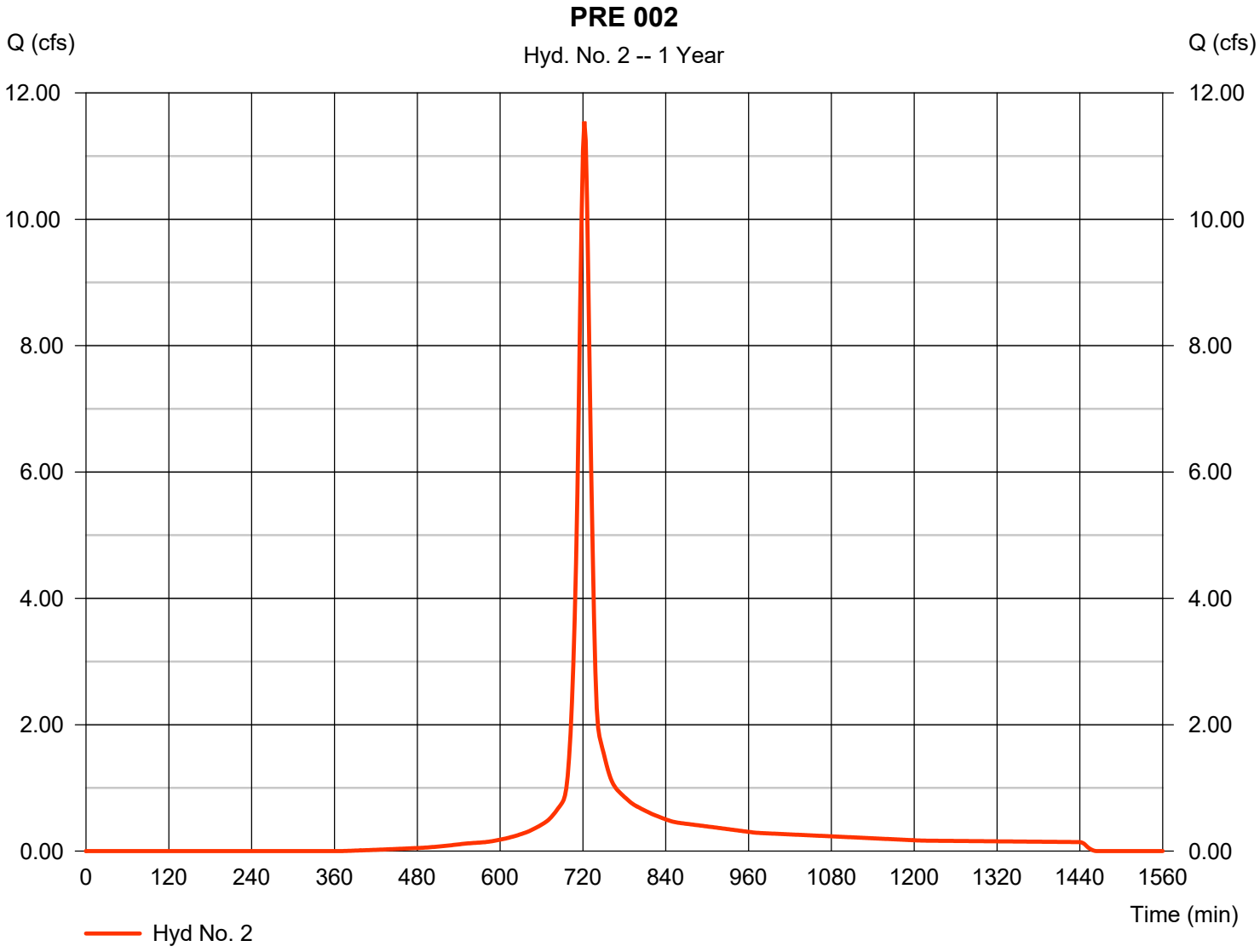
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Monday, 05 / 15 / 2023

Hyd. No. 2

PRE 002

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.55 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	32,599 cuft
Drainage area	=	5.278 ac	Curve number	=	90.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	14.30 min
Total precip.	=	2.72 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	14.84	2	722	42,361	------	------	------	PRE 001
2	SCS Runoff	14.83	2	722	42,231	------	------	------	PRE 002

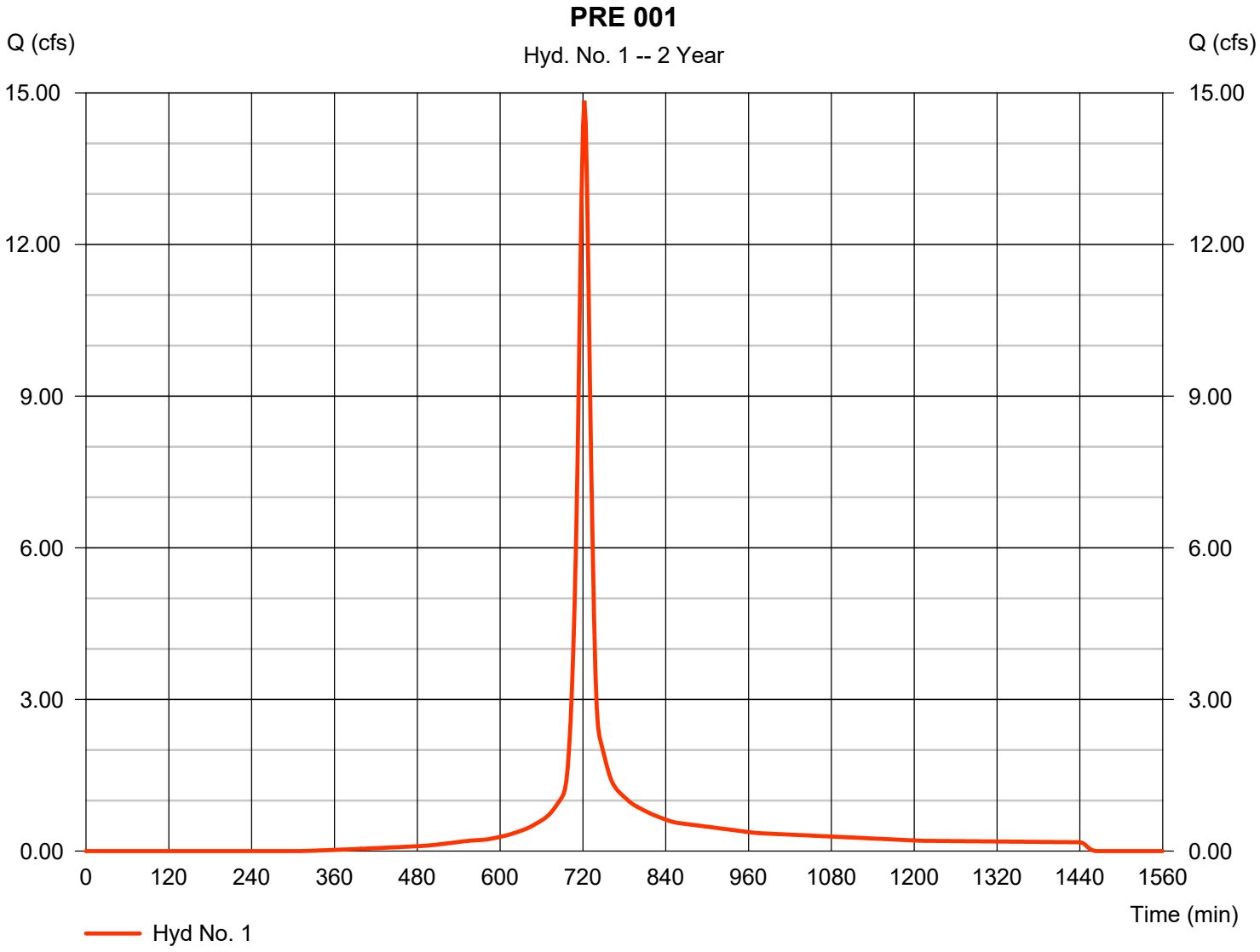
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Monday, 05 / 15 / 2023

Hyd. No. 1

PRE 001

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.84 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	42,361 cuft
Drainage area	=	5.211 ac	Curve number	=	90.6
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	16.60 min
Total precip.	=	3.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



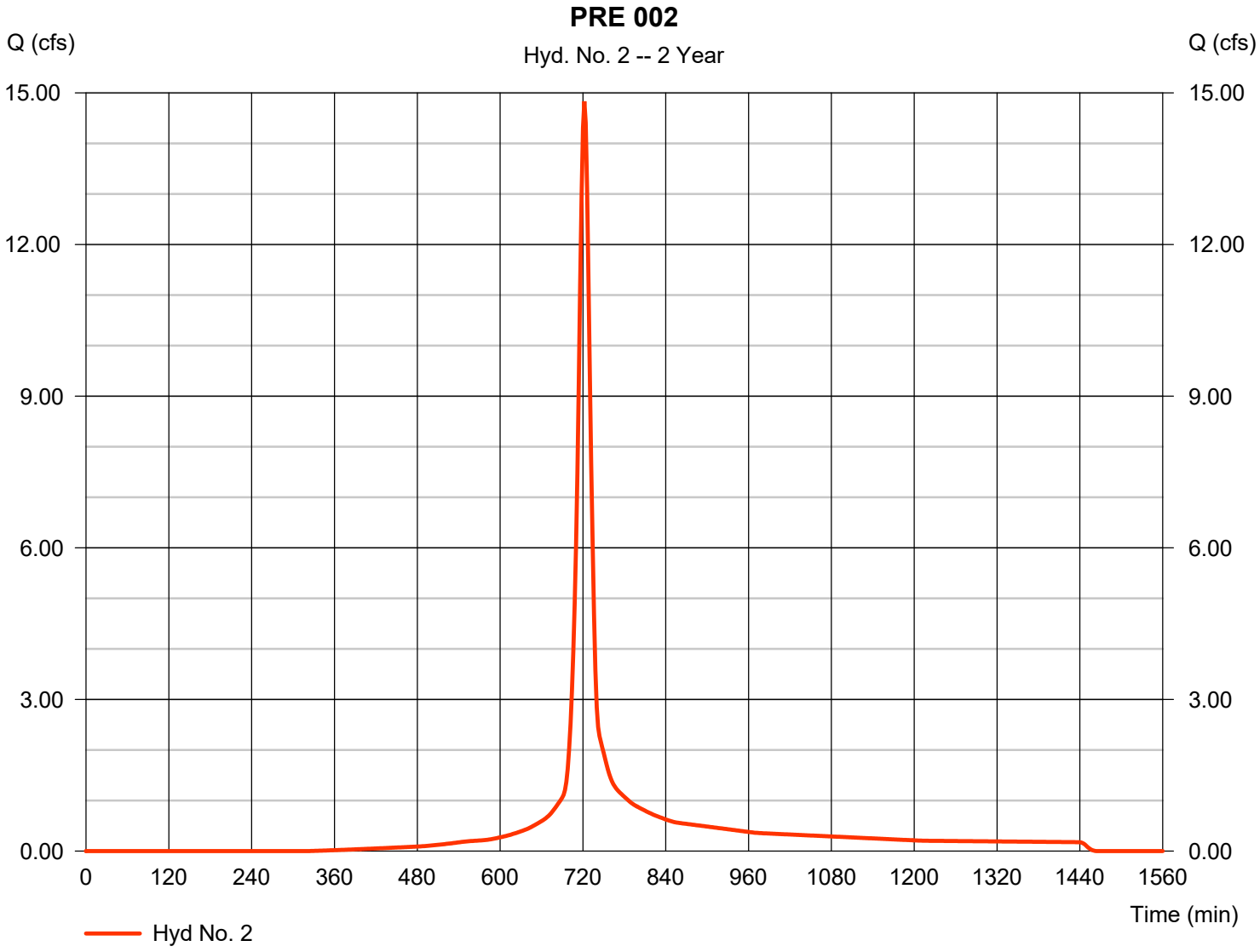
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Monday, 05 / 15 / 2023

Hyd. No. 2

PRE 002

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.83 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	42,231 cuft
Drainage area	=	5.278 ac	Curve number	=	90.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	14.30 min
Total precip.	=	3.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	23.83	2	722	69,625	------	------	------	PRE 001
2	SCS Runoff	23.94	2	722	69,740	------	------	------	PRE 002

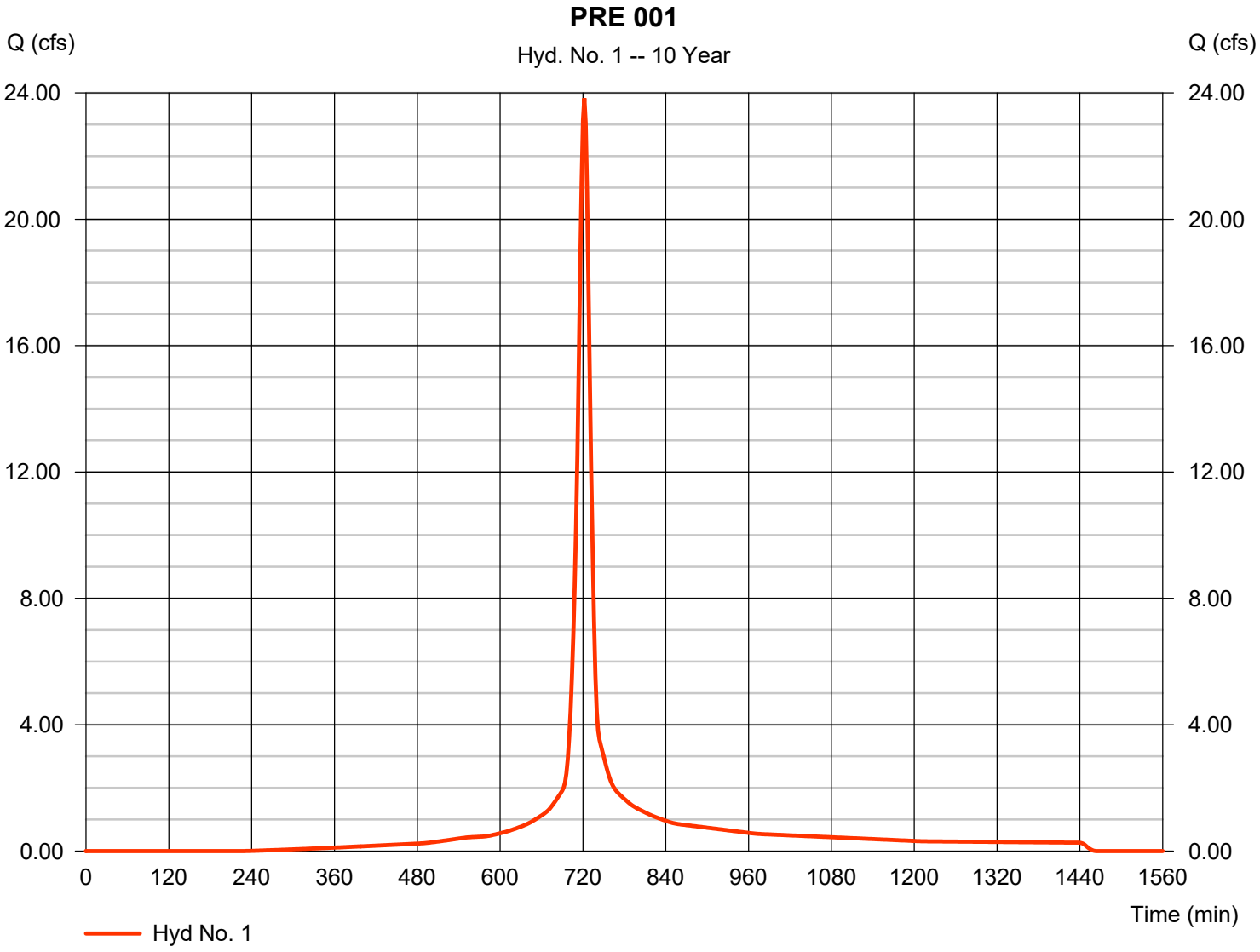
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Monday, 05 / 15 / 2023

Hyd. No. 1

PRE 001

Hydrograph type	=	SCS Runoff	Peak discharge	=	23.83 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	69,625 cuft
Drainage area	=	5.211 ac	Curve number	=	90.6
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	16.60 min
Total precip.	=	4.83 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



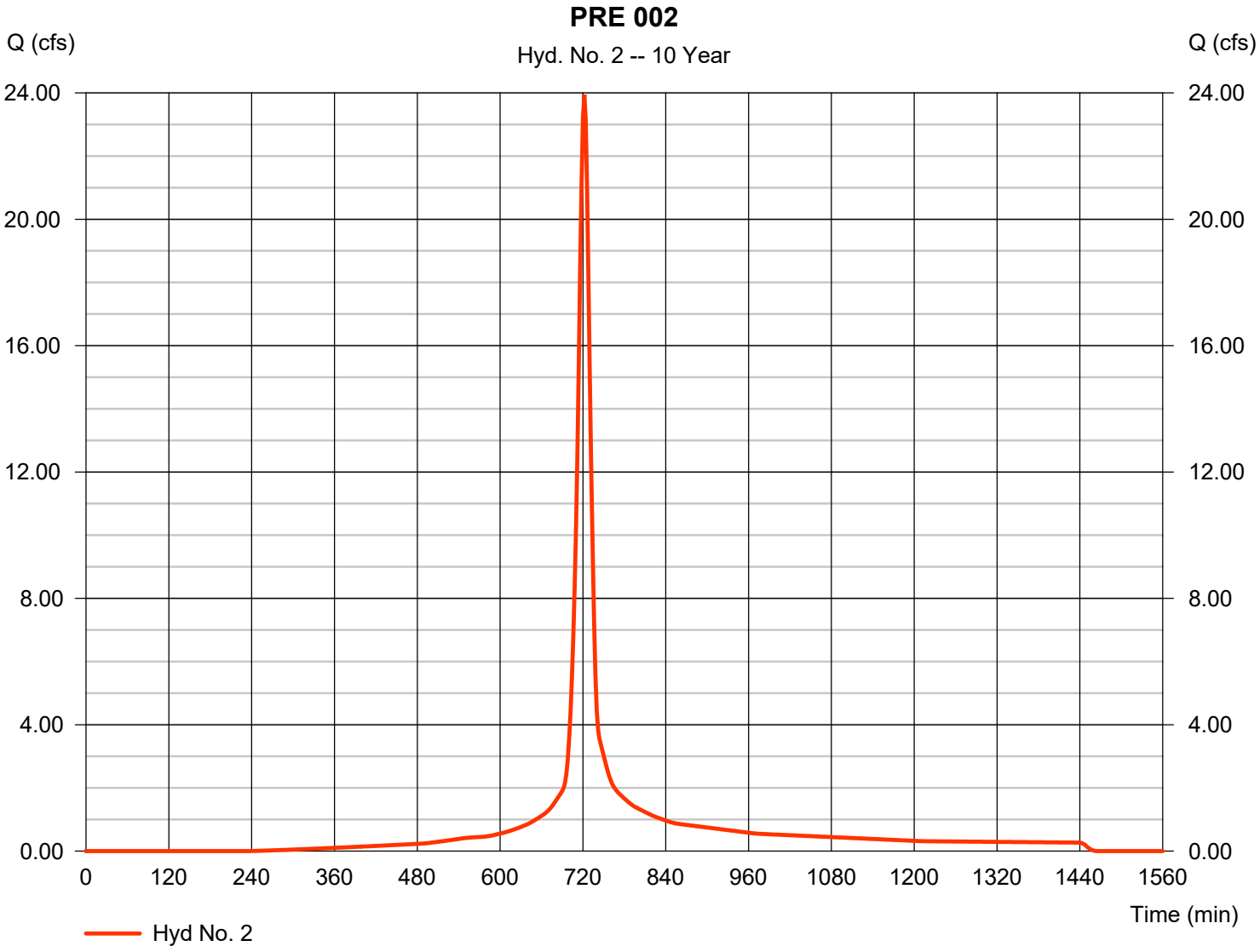
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Monday, 05 / 15 / 2023

Hyd. No. 2

PRE 002

Hydrograph type	=	SCS Runoff	Peak discharge	=	23.94 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	69,740 cuft
Drainage area	=	5.278 ac	Curve number	=	90.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	14.30 min
Total precip.	=	4.83 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	34.68	2	722	103,604	------	------	------	PRE 001
2	SCS Runoff	34.95	2	722	104,082	------	------	------	PRE 002

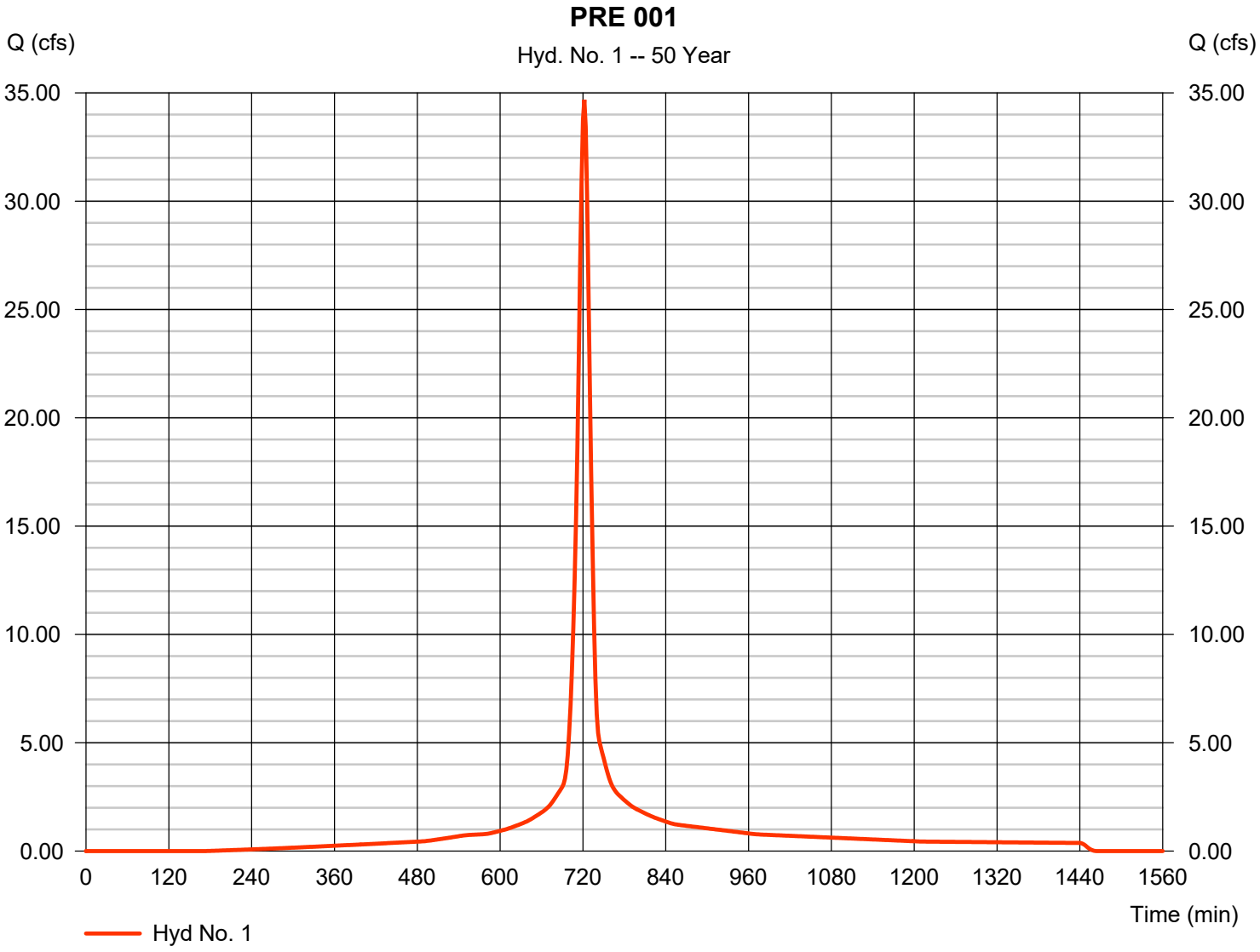
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Monday, 05 / 15 / 2023

Hyd. No. 1

PRE 001

Hydrograph type	=	SCS Runoff	Peak discharge	=	34.68 cfs
Storm frequency	=	50 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	103,604 cuft
Drainage area	=	5.211 ac	Curve number	=	90.6
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	16.60 min
Total precip.	=	6.72 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



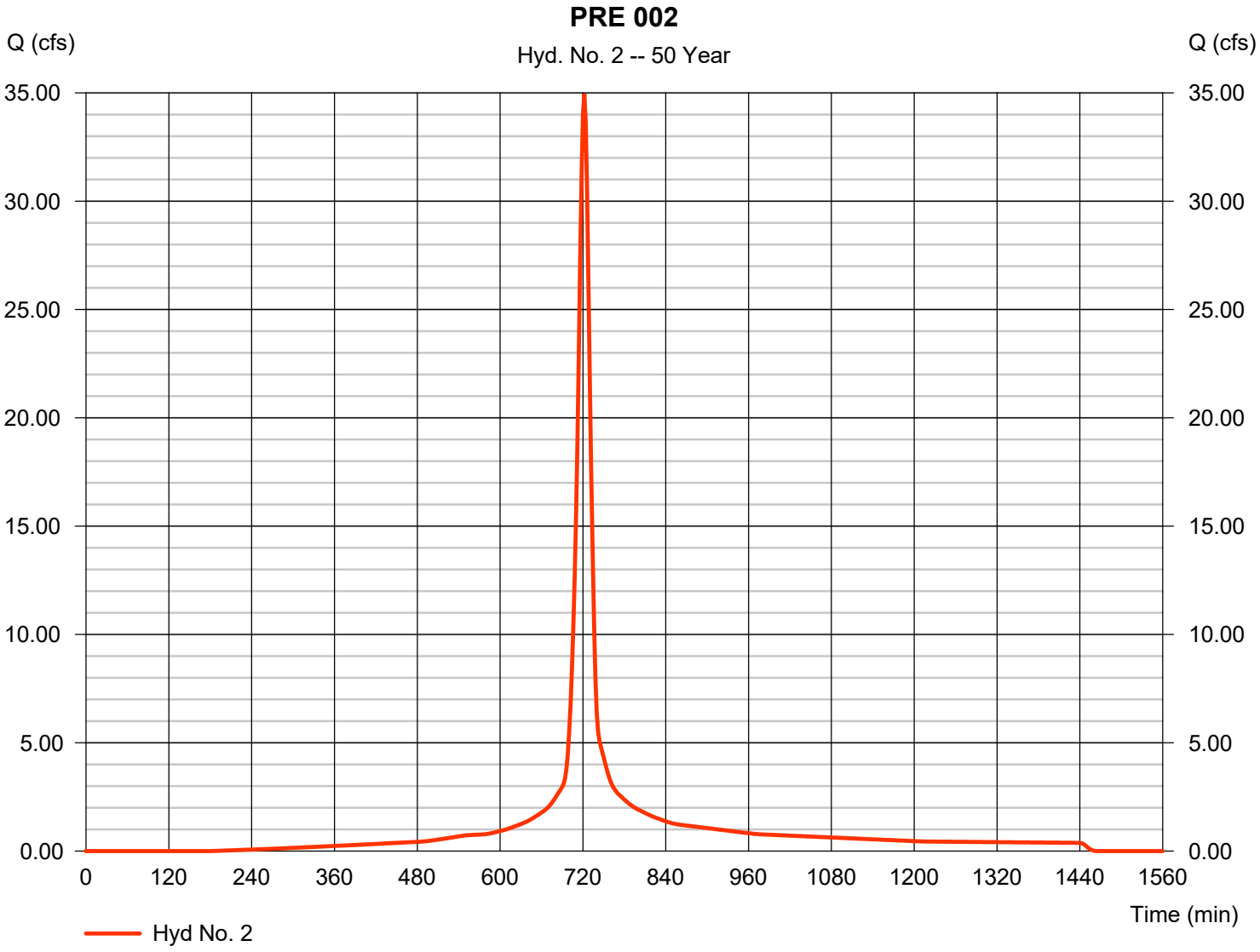
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Monday, 05 / 15 / 2023

Hyd. No. 2

PRE 002

Hydrograph type	=	SCS Runoff	Peak discharge	=	34.95 cfs
Storm frequency	=	50 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	104,082 cuft
Drainage area	=	5.278 ac	Curve number	=	90.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	14.30 min
Total precip.	=	6.72 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	39.98	2	722	120,468	------	------	------	PRE 001
2	SCS Runoff	40.33	2	722	121,137	------	------	------	PRE 002

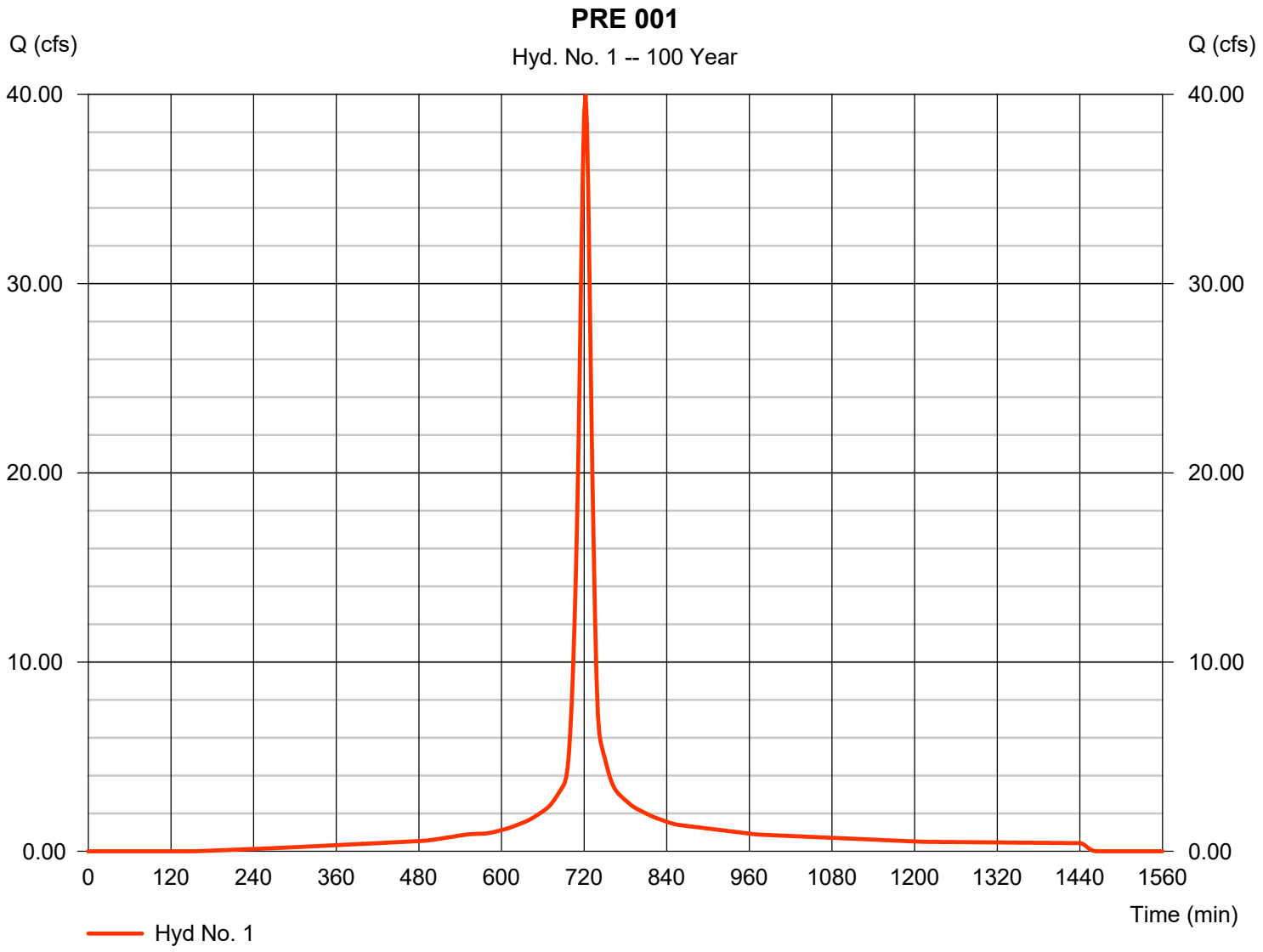
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Monday, 05 / 15 / 2023

Hyd. No. 1

PRE 001

Hydrograph type	=	SCS Runoff	Peak discharge	=	39.98 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	120,468 cuft
Drainage area	=	5.211 ac	Curve number	=	90.6
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	16.60 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



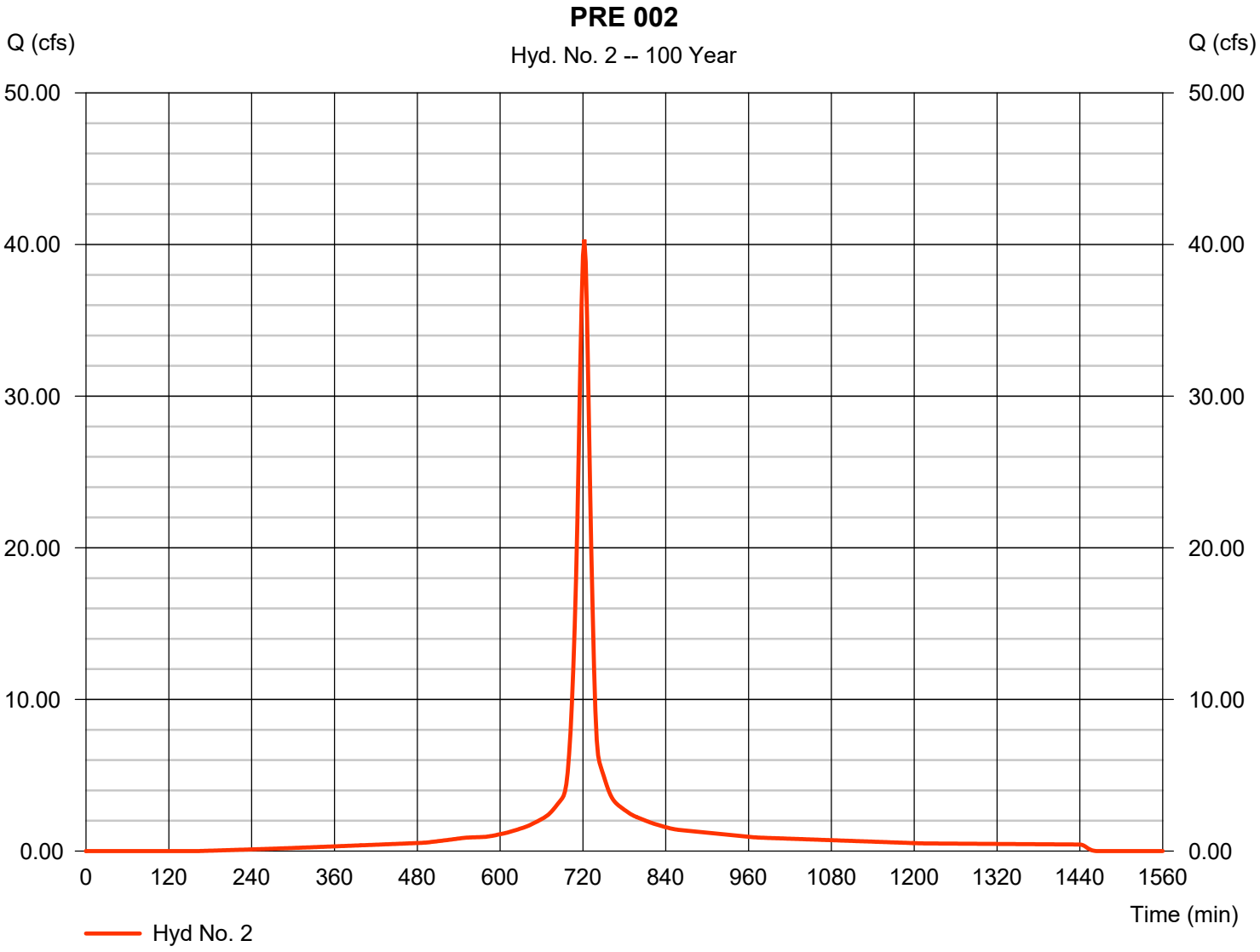
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Monday, 05 / 15 / 2023

Hyd. No. 2

PRE 002

Hydrograph type	=	SCS Runoff	Peak discharge	=	40.33 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	121,137 cuft
Drainage area	=	5.278 ac	Curve number	=	90.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	14.30 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



D. POST-DEVELOPMENT ANALYSIS

TIME OF CONCENTRATION WORKSHEET
SUMMARY - SUBAREAS TIME OF CONCENTRATION
POST-DEVELOPMENT CONDITIONS

Terraform Engineering, LLC

PROJECT: **UPPER DUBLIN TOWNSHIP CAMPU** JOB # **23015**

LOCATION: UPPER DUBLIN TOWNSHIP DATE: 5/19/2023

COUNTY: MONTGOMERY REVISED:

2 yr rainfall **3.28** PREPARED BY: JQM

	Time of concentration (Tc) or travel time (Tt)																			
	overland					Shallow Concentrated					Channel or Pipe								Total	
Sub area	Length L_1 100 ft. max.	Slope S_1	Manning's n	2 yr rainfall	Tc	Flow Path Cover	Length L_2	Slope S_2	Average Velocity	Tt	Channel or Pipe	Flow Area	Wetted Perimeter	Pipe Diameter	Slope S_3	Manning's n	Length L_3	Tt	S Tc	
	ft.	ft./ft.	n	in.	Min.	U/P	ft.	ft./ft.	ft./s	Min.	C/P	sq.ft.	ft.	in.	ft./ft.	n	ft.	Min.	Min.	Hrs.
001	100	0.020	0.24	3.3	14.1	U	56	0.020	2.3	0.4		23.00	26.32					0		
				0.0	0	U	70	0.333	9.3	0.1		0.00	0.00					0		
				0.0	0				0	0		0.00	0.00					0		
				0.0	0				0	0		0.00	0.00					0		
					14.1					0.5								0	**14.6**	0.24
002 BYP	48	0.026	0.24	3.3	7.1	U	17	0.044	3.4	0.1	P	1.77	4.71	18	0.127	0.012	38	0		
	52	0.044	0.24	3.3	6.1	U	73	0.065	4.1	0.3	P	3.14	6.28	24	0.037	0.012	110	0.1		
				0.0	0	P	108	0.032	3.6	0.5	P	7.07	9.42	36	0.015	0.013	98	0.1		
					13.2					0.9								0.2	**14.3**	0.24

Worksheet 2: Runoff Curve Number and Runoff

PROJECT: UPPER DUBLIN TWP CAMPUS
LOCATION: UPPER DUBLIN TOWNSHIP
COUNTY: MONTGOMERY

DATE: 5/19/2023
REVISED:

DRAINAGE AREA: POST-DEVELOPMENT TO PNT 001

1. RUNOFF CURVE NUMBER

SOIL HYDROLOGIC GROUP	COVER DESCRIPTION	CN	AREA	PRODUCT OF CN x AREA
A	LAWN	39	0.010	0.390
B	LAWN	61	0.035	2.135
C	LAWN	74	1.591	117.734
B/C	IMPERVIOUS	98	3.300	323.400
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
		TOTAL	4.936	443.659

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{443.659}{4.936} =$ 89.882293

Use CN = 89.9

2. RUNOFF

		STORM #1	STORM #2	STORM #4	STORM #5	STORM #6	STORM #7
FREQUENCY	yr	1	2	10	25	50	100
RAINFALL, P (24 HOUR)	in	2.72	3.28	4.83	5.85	6.72	7.65
RUNOFF, Q	in	1.72	2.23	3.70	4.69	5.54	6.45

Worksheet 2: Runoff Curve Number and Runoff

PROJECT: UPPER DUBLIN TWP CAMPUS
LOCATION: UPPER DUBLIN TOWNSHIP
COUNTY: MONTGOMERY

DATE: 5/19/2023
REVISED:

DRAINAGE AREA: POST-DEVELOPMENT BYPASS 002

1. RUNOFF CURVE NUMBER

SOIL HYDROLOGIC GROUP	COVER DESCRIPTION	CN	AREA	PRODUCT OF CN x AREA
A	MEADOW	30	0	0.000
B	MEADOW	58	0.010	0.580
C	MEADOW	71	1.238	87.898
B/C	IMIPERVIOUS	98	3.099	303.702
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
		TOTAL	4.347	392.180

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{392.18}{4.347} =$ 90.218542

Use CN = 90.2

2. RUNOFF		STORM #1	STORM #2	STORM #4	STORM #5	STORM #6	STORM #7
FREQUENCY	yr	1	2	10	25	50	100
RAINFALL, P (24 HOUR)	in	2.72	3.28	4.83	5.85	6.72	7.65
RUNOFF, Q	in	1.75	2.26	3.73	4.72	5.57	6.48

Worksheet 2: Runoff Curve Number and Runoff

PROJECT: UPPER DUBLIN TWP CAMPUS
LOCATION: UPPER DUBLIN TOWNSHIP
COUNTY: MONTGOMERY

DATE: 5/19/2023
REVISED:

DRAINAGE AREA: POST-DEVELOPMENT CAPTURED 002

1. RUNOFF CURVE NUMBER

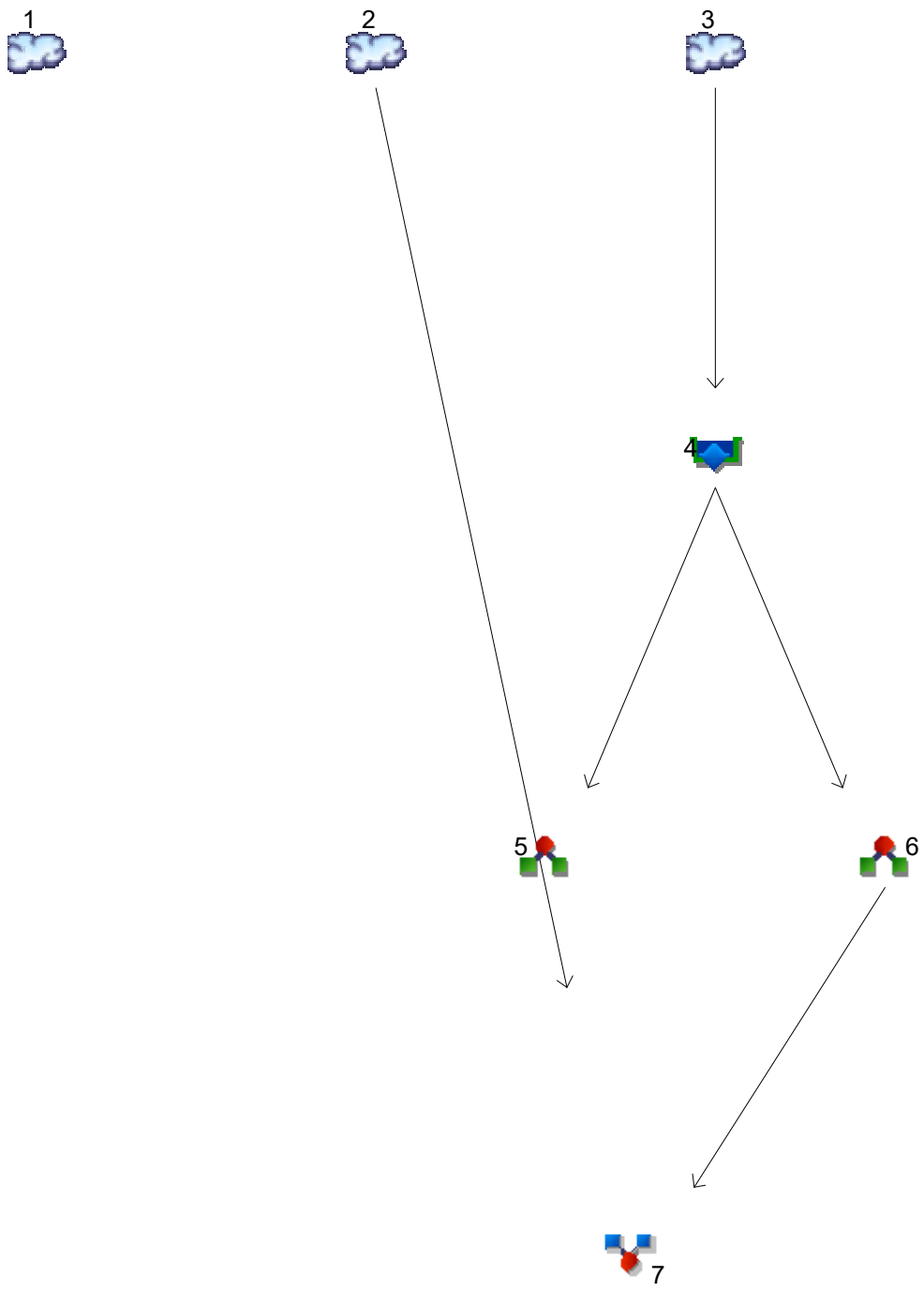
SOIL HYDROLOGIC GROUP	COVER DESCRIPTION	CN	AREA	PRODUCT OF CN x AREA
A	MEADOW	30	0	0.000
B	MEADOW	58	0.000	0.000
C	MEADOW	71	0.207	14.697
B/C	IMIPERVIOUS	98	0.999	97.902
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
				0.000
		TOTAL	1.206	112.599

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{112.599}{1.206} =$ 93.365672

Use CN = 93.4

2. RUNOFF		STORM #1	STORM #2	STORM #4	STORM #5	STORM #6	STORM #7
FREQUENCY	yr	1	2	10	25	50	100
RAINFALL, P (24 HOUR)	in	2.72	3.28	4.83	5.85	6.72	7.65
RUNOFF, Q	in	2.02	2.56	4.07	5.08	5.94	6.86

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	POST-DEV 001
2	SCS Runoff	POST 002 BYPASS
3	SCS Runoff	POST 002 CAPTURED
4	Reservoir	BASIN ROUTING
5	Diversion1	INFILTRATION
6	Diversion2	BASIN ROUTED FLOWS
7	Combine	TOTAL POST-DEV 002

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	10.66	13.73	-------	-------	22.25	-------	32.56	37.59	POST-DEV 001
2	SCS Runoff	------	9.510	12.22	-------	-------	19.72	-------	28.79	33.21	POST 002 BYPASS
3	SCS Runoff	------	3.919	4.889	-------	-------	7.545	-------	10.74	12.31	POST 002 CAPTURED
4	Reservoir	3	0.196	0.504	-------	-------	2.462	-------	3.980	4.583	BASIN ROUTING
5	Diversion1	4	0.125	0.126	-------	-------	0.129	-------	0.133	0.135	INFILTRATION
6	Diversion2	4	0.071	0.378	-------	-------	2.332	-------	3.846	4.447	BASIN ROUTED FLOWS
7	Combine	2, 6	9.510	12.42	-------	-------	22.02	-------	32.63	37.66	TOTAL POST-DEV 002

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	10.66	2	722	30,059	------	------	------	POST-DEV 001
2	SCS Runoff	9.510	2	722	26,849	------	------	------	POST 002 BYPASS
3	SCS Runoff	3.919	2	716	8,307	------	------	------	POST 002 CAPTURED
4	Reservoir	0.196	2	776	8,306	3	287.13	4,151	BASIN ROUTING
5	Diversion1	0.125	2	776	7,852	4	------	------	INFILTRATION
6	Diversion2	0.071	2	776	454	4	------	------	BASIN ROUTED FLOWS
7	Combine	9.510	2	722	27,302	2, 6	------	------	TOTAL POST-DEV 002

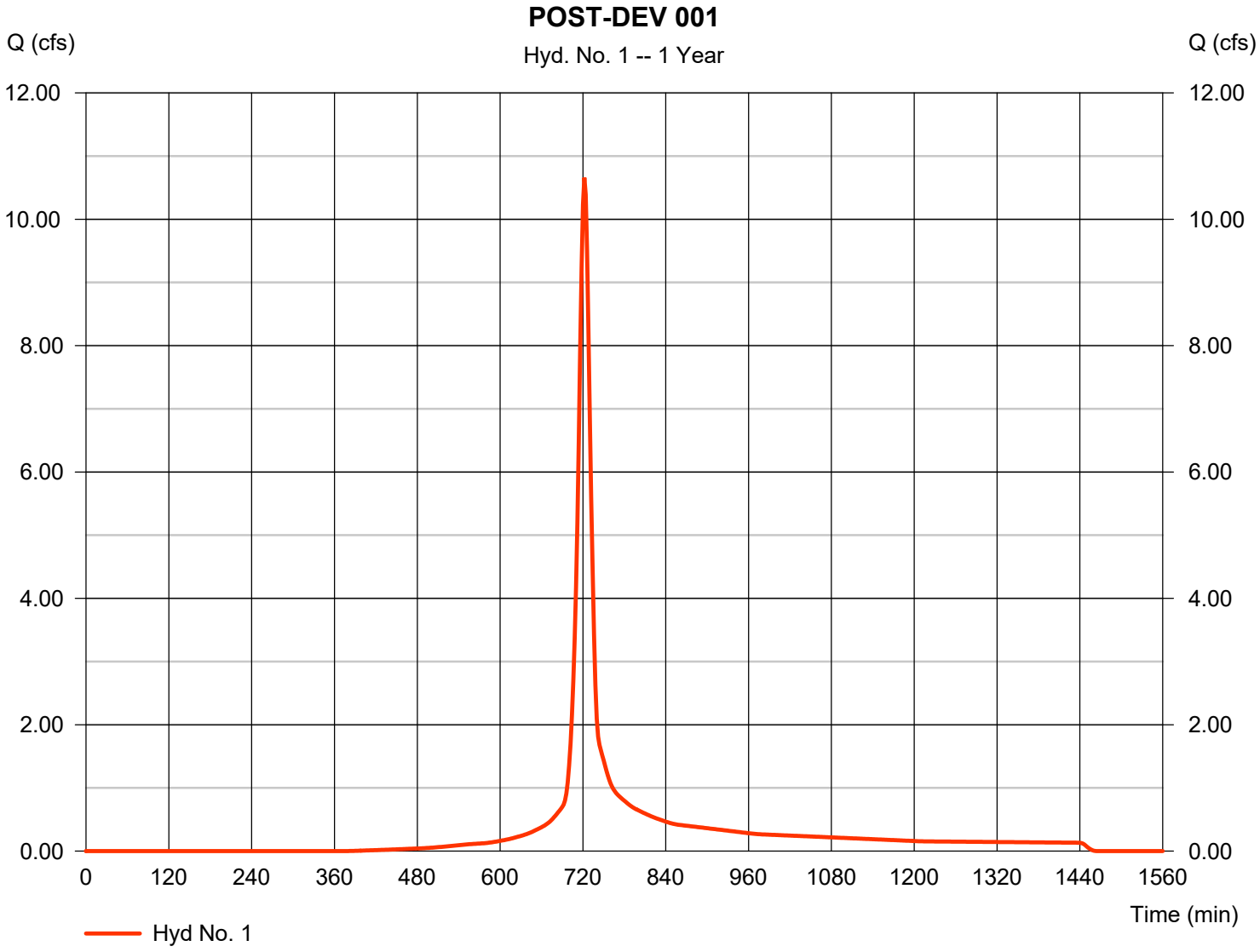
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 1

POST-DEV 001

Hydrograph type	= SCS Runoff	Peak discharge	= 10.66 cfs
Storm frequency	= 1 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 30,059 cuft
Drainage area	= 4.936 ac	Curve number	= 89.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 2.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

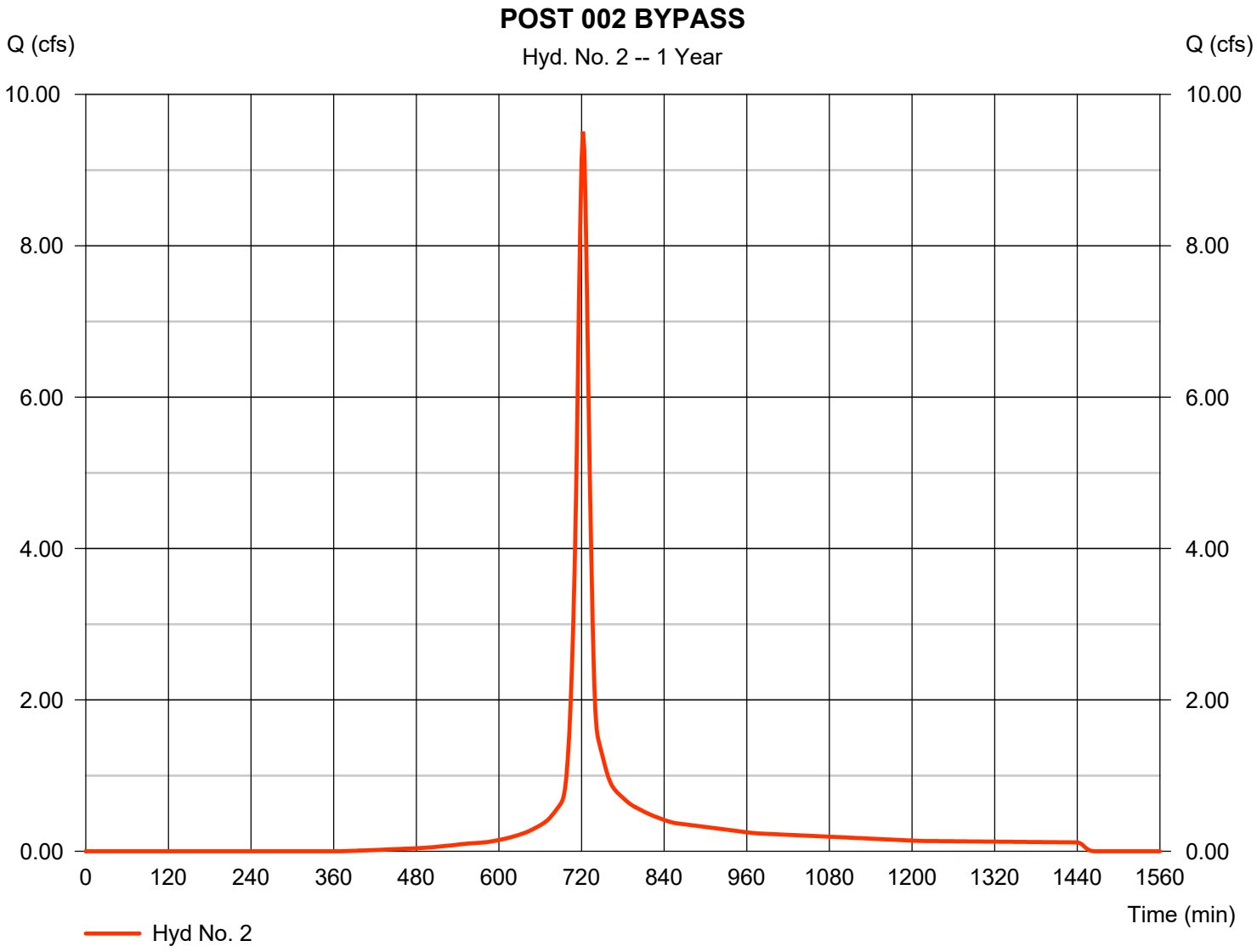


Hydrograph Report

Hyd. No. 2

POST 002 BYPASS

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.510 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	26,849 cuft
Drainage area	=	4.347 ac	Curve number	=	90.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	14.30 min
Total precip.	=	2.72 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



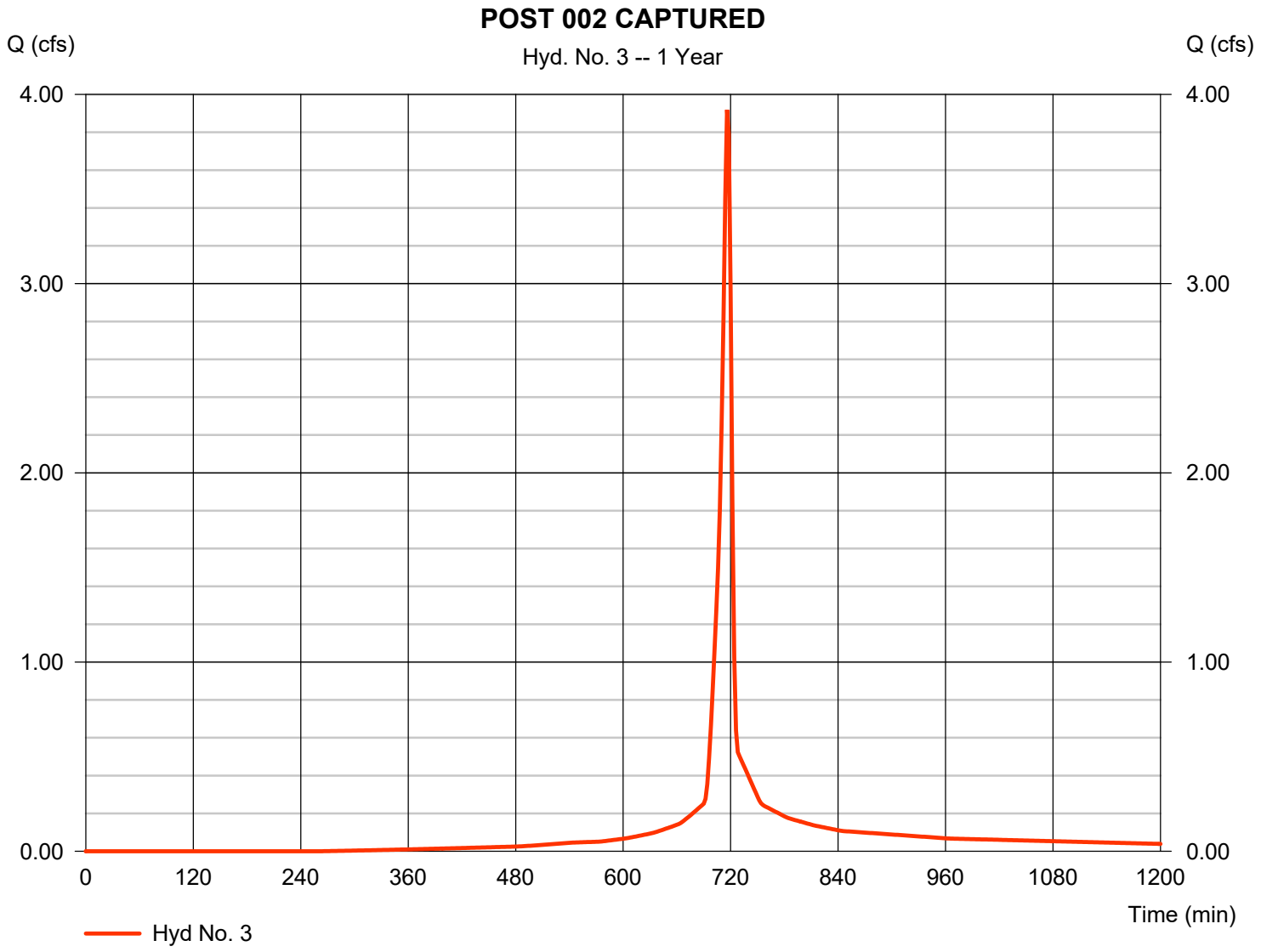
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 3

POST 002 CAPTURED

Hydrograph type	= SCS Runoff	Peak discharge	= 3.919 cfs
Storm frequency	= 1 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 8,307 cuft
Drainage area	= 1.206 ac	Curve number	= 93.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 2.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

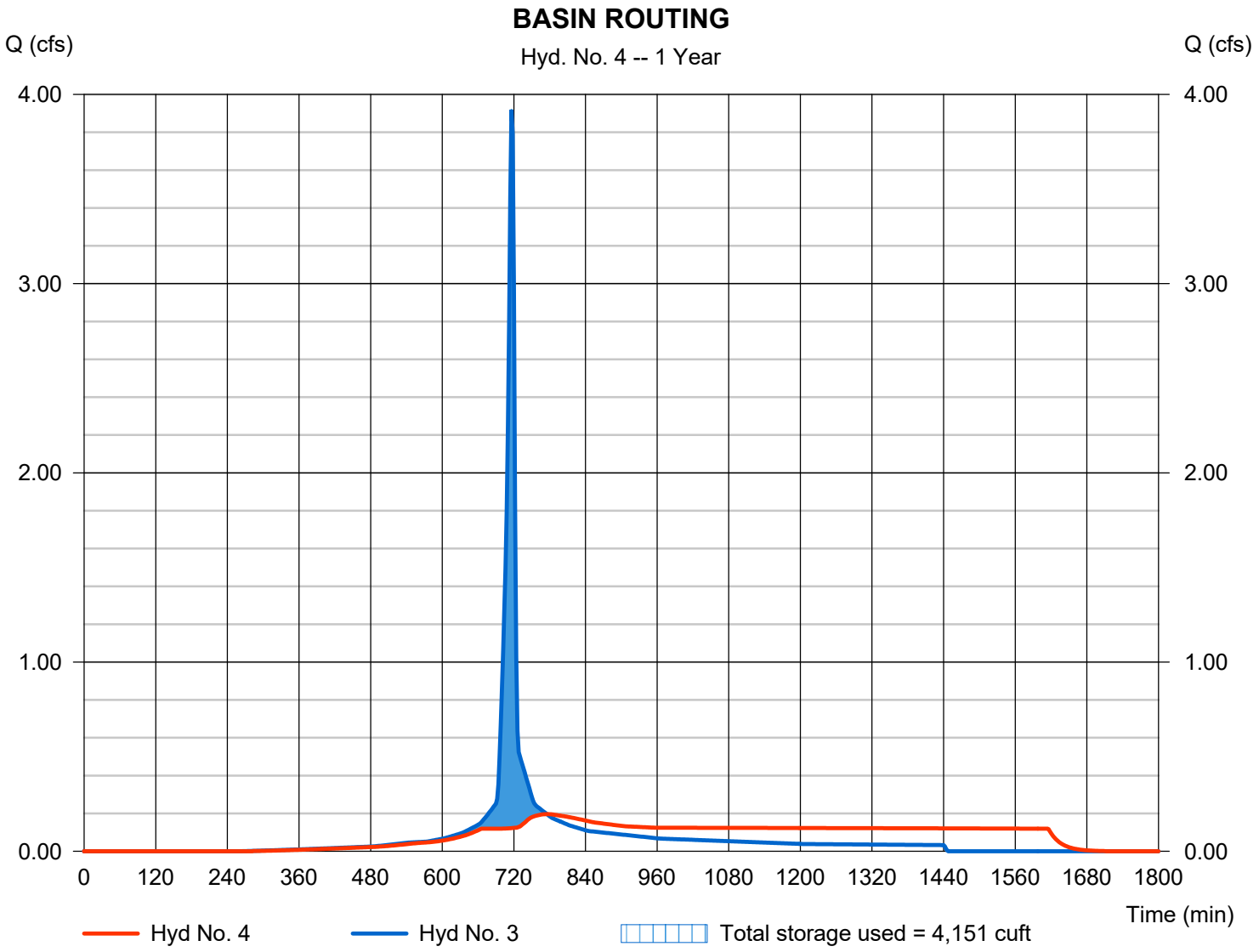
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 4

BASIN ROUTING

Hydrograph type	=	Reservoir	Peak discharge	=	0.196 cfs
Storm frequency	=	1 yrs	Time to peak	=	776 min
Time interval	=	2 min	Hyd. volume	=	8,306 cuft
Inflow hyd. No.	=	3 - POST 002 CAPTURED	Max. Elevation	=	287.13 ft
Reservoir name	=	BASIN	Max. Storage	=	4,151 cuft

Storage Indication method used. Outflow includes exfiltration.



Pond Report

Pond No. 1 - BASIN

Pond Data

UG Chambers -Invert elev. = 286.50 ft, Rise x Span = 1.50 x 1.50 ft, Barrel Len = 204.93 ft, No. Barrels = 1, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 286.00 ft, Width = 44.00 ft, Height = 4.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	286.00	n/a	0	0
0.40	286.40	n/a	1,443	1,443
0.80	286.80	n/a	1,474	2,917
1.20	287.20	n/a	1,512	4,428
1.60	287.60	n/a	1,514	5,943
2.00	288.00	n/a	1,490	7,432
2.40	288.40	n/a	1,443	8,875
2.80	288.80	n/a	1,443	10,318
3.20	289.20	n/a	1,443	11,761
3.60	289.60	n/a	1,443	13,204
4.00	290.00	n/a	1,443	14,647

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 287.00	0.00	0.00	0.00
Length (ft)	= 48.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	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) = 0.570 (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).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	286.00	0.00	---	---	---	---	---	---	---	0.000	---	0.000
0.04	144	286.04	0.00	---	---	---	---	---	---	---	0.119	---	0.119
0.08	289	286.08	0.00	---	---	---	---	---	---	---	0.119	---	0.119
0.12	433	286.12	0.00	---	---	---	---	---	---	---	0.120	---	0.120
0.16	577	286.16	0.00	---	---	---	---	---	---	---	0.120	---	0.120
0.20	721	286.20	0.00	---	---	---	---	---	---	---	0.120	---	0.120
0.24	866	286.24	0.00	---	---	---	---	---	---	---	0.120	---	0.120
0.28	1,010	286.28	0.00	---	---	---	---	---	---	---	0.120	---	0.120
0.32	1,154	286.32	0.00	---	---	---	---	---	---	---	0.121	---	0.121
0.36	1,299	286.36	0.00	---	---	---	---	---	---	---	0.121	---	0.121
0.40	1,443	286.40	0.00	---	---	---	---	---	---	---	0.121	---	0.121
0.44	1,590	286.44	0.00	---	---	---	---	---	---	---	0.121	---	0.121
0.48	1,738	286.48	0.00	---	---	---	---	---	---	---	0.122	---	0.122
0.52	1,885	286.52	0.00	---	---	---	---	---	---	---	0.122	---	0.122
0.56	2,033	286.56	0.00	---	---	---	---	---	---	---	0.122	---	0.122
0.60	2,180	286.60	0.00	---	---	---	---	---	---	---	0.122	---	0.122
0.64	2,327	286.64	0.00	---	---	---	---	---	---	---	0.122	---	0.122
0.68	2,475	286.68	0.00	---	---	---	---	---	---	---	0.123	---	0.123
0.72	2,622	286.72	0.00	---	---	---	---	---	---	---	0.123	---	0.123
0.76	2,770	286.76	0.00	---	---	---	---	---	---	---	0.123	---	0.123
0.80	2,917	286.80	0.00	---	---	---	---	---	---	---	0.123	---	0.123
0.84	3,068	286.84	0.00	---	---	---	---	---	---	---	0.124	---	0.124
0.88	3,219	286.88	0.00	---	---	---	---	---	---	---	0.124	---	0.124
0.92	3,370	286.92	0.00	---	---	---	---	---	---	---	0.124	---	0.124
0.96	3,522	286.96	0.00	---	---	---	---	---	---	---	0.124	---	0.124
1.00	3,673	287.00	0.00	---	---	---	---	---	---	---	0.124	---	0.124
1.04	3,824	287.04	0.01 ic	---	---	---	---	---	---	---	0.125	---	0.132
1.08	3,975	287.08	0.03 ic	---	---	---	---	---	---	---	0.125	---	0.153
1.12	4,126	287.12	0.06 ic	---	---	---	---	---	---	---	0.125	---	0.188
1.16	4,277	287.16	0.11 ic	---	---	---	---	---	---	---	0.125	---	0.236
1.20	4,428	287.20	0.17 ic	---	---	---	---	---	---	---	0.125	---	0.296
1.24	4,580	287.24	0.24 ic	---	---	---	---	---	---	---	0.126	---	0.368

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BASIN

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
1.28	4,731	287.28	0.32 ic	---	---	---	---	---	---	---	0.126	---	0.450
1.32	4,883	287.32	0.42 ic	---	---	---	---	---	---	---	0.126	---	0.544
1.36	5,034	287.36	0.52 ic	---	---	---	---	---	---	---	0.126	---	0.647
1.40	5,186	287.40	0.63 ic	---	---	---	---	---	---	---	0.127	---	0.759
1.44	5,337	287.44	0.75 ic	---	---	---	---	---	---	---	0.127	---	0.880
1.48	5,489	287.48	0.88 ic	---	---	---	---	---	---	---	0.127	---	1.007
1.52	5,640	287.52	1.01 ic	---	---	---	---	---	---	---	0.127	---	1.142
1.56	5,791	287.56	1.15 ic	---	---	---	---	---	---	---	0.127	---	1.281
1.60	5,943	287.60	1.30 ic	---	---	---	---	---	---	---	0.128	---	1.427
1.64	6,092	287.64	1.45 ic	---	---	---	---	---	---	---	0.128	---	1.574
1.68	6,241	287.68	1.60 ic	---	---	---	---	---	---	---	0.128	---	1.726
1.72	6,390	287.72	1.75 ic	---	---	---	---	---	---	---	0.128	---	1.879
1.76	6,539	287.76	1.90 ic	---	---	---	---	---	---	---	0.128	---	2.031
1.80	6,688	287.80	2.05 ic	---	---	---	---	---	---	---	0.129	---	2.180
1.84	6,837	287.84	2.20 ic	---	---	---	---	---	---	---	0.129	---	2.328
1.88	6,985	287.88	2.34 ic	---	---	---	---	---	---	---	0.129	---	2.468
1.92	7,134	287.92	2.47 ic	---	---	---	---	---	---	---	0.129	---	2.599
1.96	7,283	287.96	2.59 ic	---	---	---	---	---	---	---	0.130	---	2.715
2.00	7,432	288.00	2.53 oc	---	---	---	---	---	---	---	0.130	---	2.656
2.04	7,577	288.04	2.63 oc	---	---	---	---	---	---	---	0.130	---	2.759
2.08	7,721	288.08	2.73 oc	---	---	---	---	---	---	---	0.130	---	2.859
2.12	7,865	288.12	2.82 oc	---	---	---	---	---	---	---	0.130	---	2.955
2.16	8,010	288.16	2.92 oc	---	---	---	---	---	---	---	0.131	---	3.048
2.20	8,154	288.20	3.01 oc	---	---	---	---	---	---	---	0.131	---	3.138
2.24	8,298	288.24	3.09 oc	---	---	---	---	---	---	---	0.131	---	3.225
2.28	8,442	288.28	3.18 oc	---	---	---	---	---	---	---	0.131	---	3.310
2.32	8,587	288.32	3.26 oc	---	---	---	---	---	---	---	0.132	---	3.393
2.36	8,731	288.36	3.34 oc	---	---	---	---	---	---	---	0.132	---	3.474
2.40	8,875	288.40	3.42 oc	---	---	---	---	---	---	---	0.132	---	3.553
2.44	9,020	288.44	3.50 oc	---	---	---	---	---	---	---	0.132	---	3.630
2.48	9,164	288.48	3.57 oc	---	---	---	---	---	---	---	0.132	---	3.705
2.52	9,308	288.52	3.65 oc	---	---	---	---	---	---	---	0.133	---	3.779
2.56	9,453	288.56	3.72 oc	---	---	---	---	---	---	---	0.133	---	3.851
2.60	9,597	288.60	3.79 oc	---	---	---	---	---	---	---	0.133	---	3.922
2.64	9,741	288.64	3.86 oc	---	---	---	---	---	---	---	0.133	---	3.992
2.68	9,885	288.68	3.93 oc	---	---	---	---	---	---	---	0.133	---	4.061
2.72	10,030	288.72	3.99 oc	---	---	---	---	---	---	---	0.134	---	4.128
2.76	10,174	288.76	4.06 oc	---	---	---	---	---	---	---	0.134	---	4.194
2.80	10,318	288.80	4.13 oc	---	---	---	---	---	---	---	0.134	---	4.259
2.84	10,463	288.84	4.19 oc	---	---	---	---	---	---	---	0.134	---	4.324
2.88	10,607	288.88	4.25 oc	---	---	---	---	---	---	---	0.135	---	4.387
2.92	10,751	288.92	4.31 oc	---	---	---	---	---	---	---	0.135	---	4.449
2.96	10,896	288.96	4.38 oc	---	---	---	---	---	---	---	0.135	---	4.511
3.00	11,040	289.00	4.44 oc	---	---	---	---	---	---	---	0.135	---	4.571
3.04	11,184	289.04	4.50 oc	---	---	---	---	---	---	---	0.135	---	4.631
3.08	11,328	289.08	4.55 oc	---	---	---	---	---	---	---	0.136	---	4.690
3.12	11,473	289.12	4.61 oc	---	---	---	---	---	---	---	0.136	---	4.748
3.16	11,617	289.16	4.67 oc	---	---	---	---	---	---	---	0.136	---	4.806
3.20	11,761	289.20	4.73 oc	---	---	---	---	---	---	---	0.136	---	4.862
3.24	11,906	289.24	4.78 oc	---	---	---	---	---	---	---	0.136	---	4.919
3.28	12,050	289.28	4.84 oc	---	---	---	---	---	---	---	0.137	---	4.974
3.32	12,194	289.32	4.89 oc	---	---	---	---	---	---	---	0.137	---	5.029
3.36	12,338	289.36	4.95 oc	---	---	---	---	---	---	---	0.137	---	5.083
3.40	12,483	289.40	5.00 oc	---	---	---	---	---	---	---	0.137	---	5.137
3.44	12,627	289.44	5.05 oc	---	---	---	---	---	---	---	0.138	---	5.190
3.48	12,771	289.48	5.10 oc	---	---	---	---	---	---	---	0.138	---	5.243
3.52	12,916	289.52	5.16 oc	---	---	---	---	---	---	---	0.138	---	5.295
3.56	13,060	289.56	5.21 oc	---	---	---	---	---	---	---	0.138	---	5.346
3.60	13,204	289.60	5.26 oc	---	---	---	---	---	---	---	0.138	---	5.397
3.64	13,349	289.64	5.31 oc	---	---	---	---	---	---	---	0.139	---	5.448
3.68	13,493	289.68	5.36 oc	---	---	---	---	---	---	---	0.139	---	5.498
3.72	13,637	289.72	5.41 oc	---	---	---	---	---	---	---	0.139	---	5.547
3.76	13,781	289.76	5.46 oc	---	---	---	---	---	---	---	0.139	---	5.597
3.80	13,926	289.80	5.51 oc	---	---	---	---	---	---	---	0.140	---	5.645
3.84	14,070	289.84	5.55 oc	---	---	---	---	---	---	---	0.140	---	5.694
3.88	14,214	289.88	5.60 oc	---	---	---	---	---	---	---	0.140	---	5.742
3.92	14,359	289.92	5.65 oc	---	---	---	---	---	---	---	0.140	---	5.789
3.96	14,503	289.96	5.70 oc	---	---	---	---	---	---	---	0.140	---	5.836
4.00	14,647	290.00	5.74 oc	---	---	---	---	---	---	---	0.141	---	5.883

...End

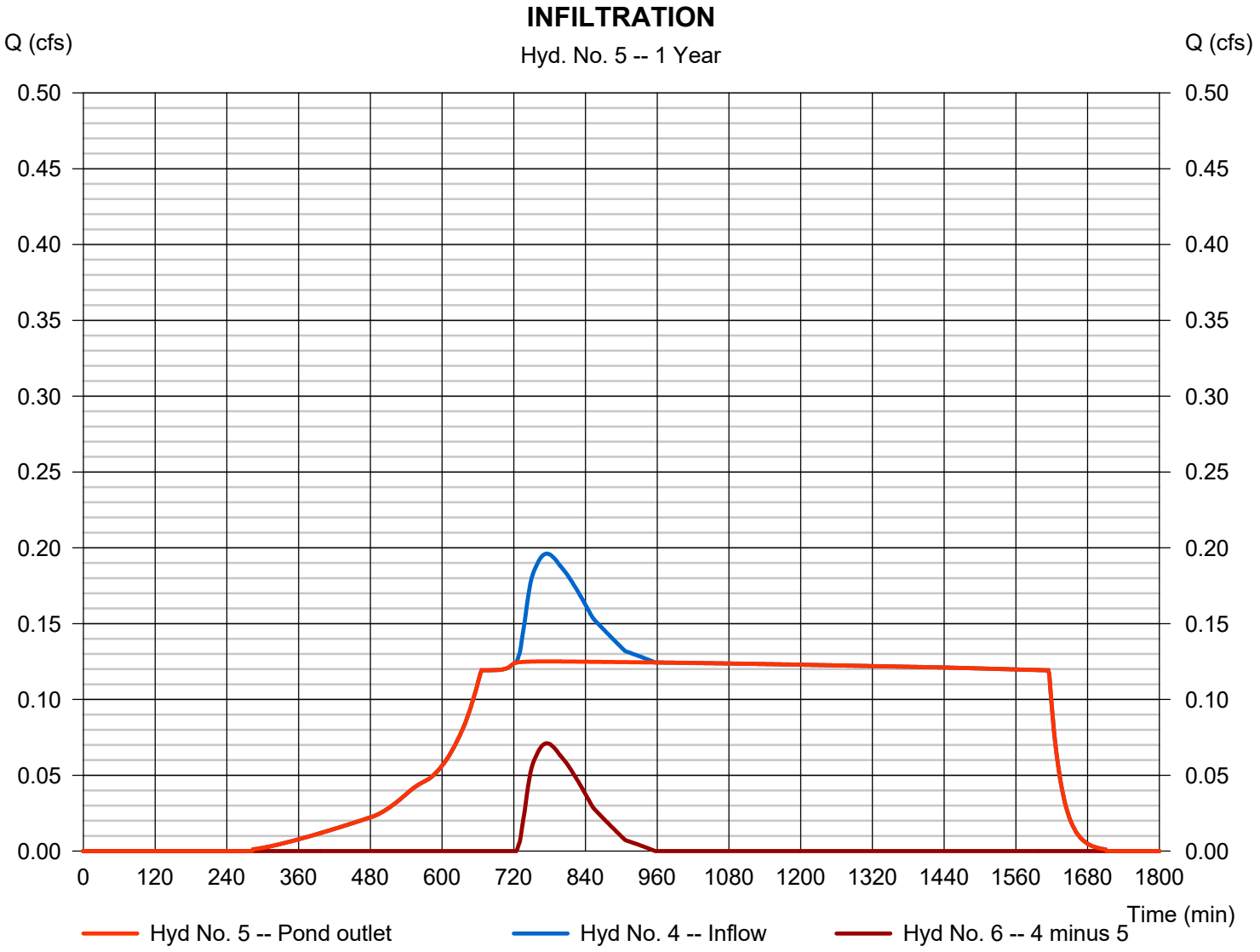
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 5

INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.125 cfs
Storm frequency	= 1 yrs	Time to peak	= 776 min
Time interval	= 2 min	Hyd. volume	= 7,852 cuft
Inflow hydrograph	= 4 - BASIN ROUTING	2nd diverted hyd.	= 6
Diversion method	= Pond - BASIN	Pond structure	= Exfiltration

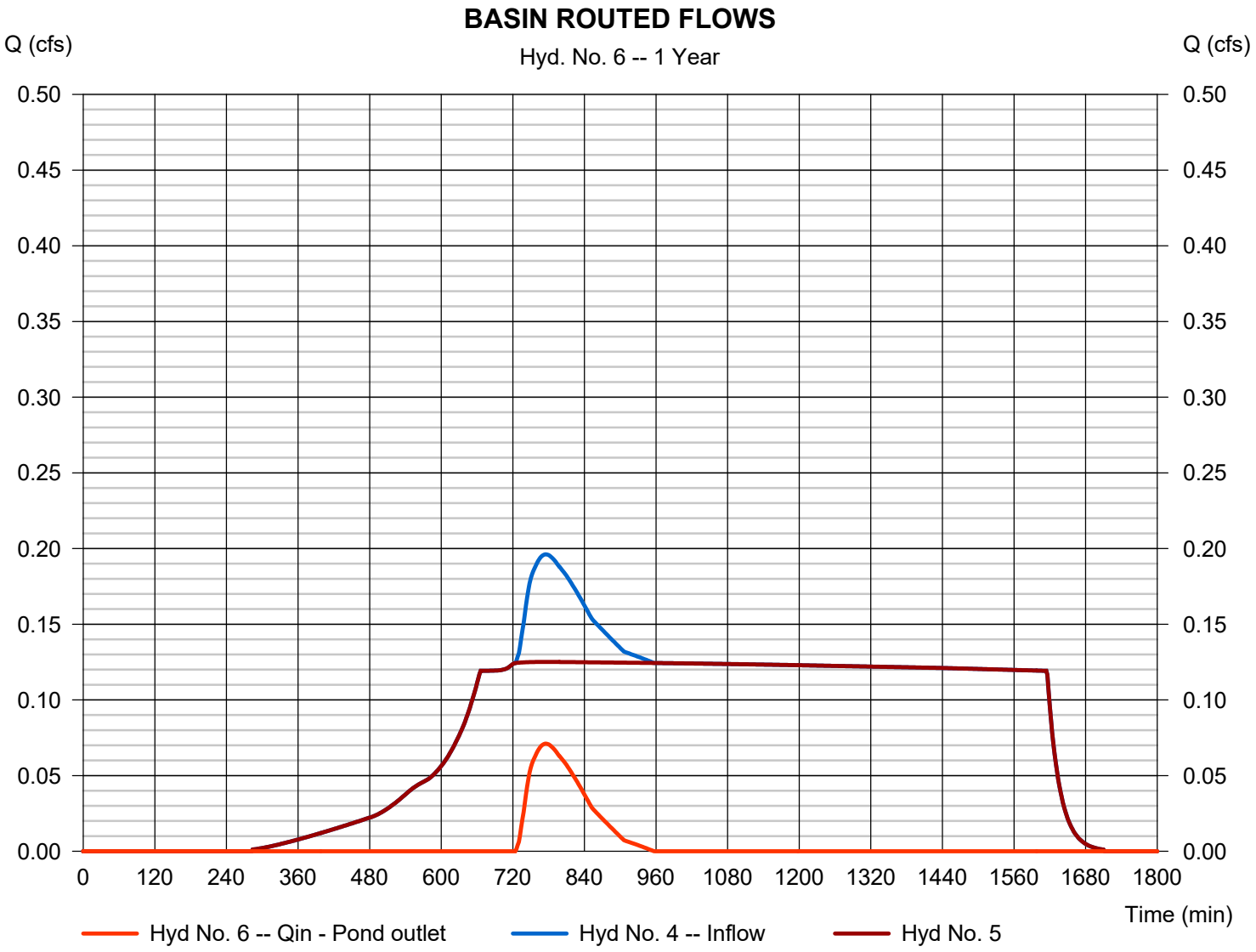


Hydrograph Report

Hyd. No. 6

BASIN ROUTED FLOWS

Hydrograph type	= Diversion2	Peak discharge	= 0.071 cfs
Storm frequency	= 1 yrs	Time to peak	= 776 min
Time interval	= 2 min	Hyd. volume	= 454 cuft
Inflow hydrograph	= 4 - BASIN ROUTING	2nd diverted hyd.	= 5
Diversion method	= Pond - BASIN	Pond structure	= Exfiltration

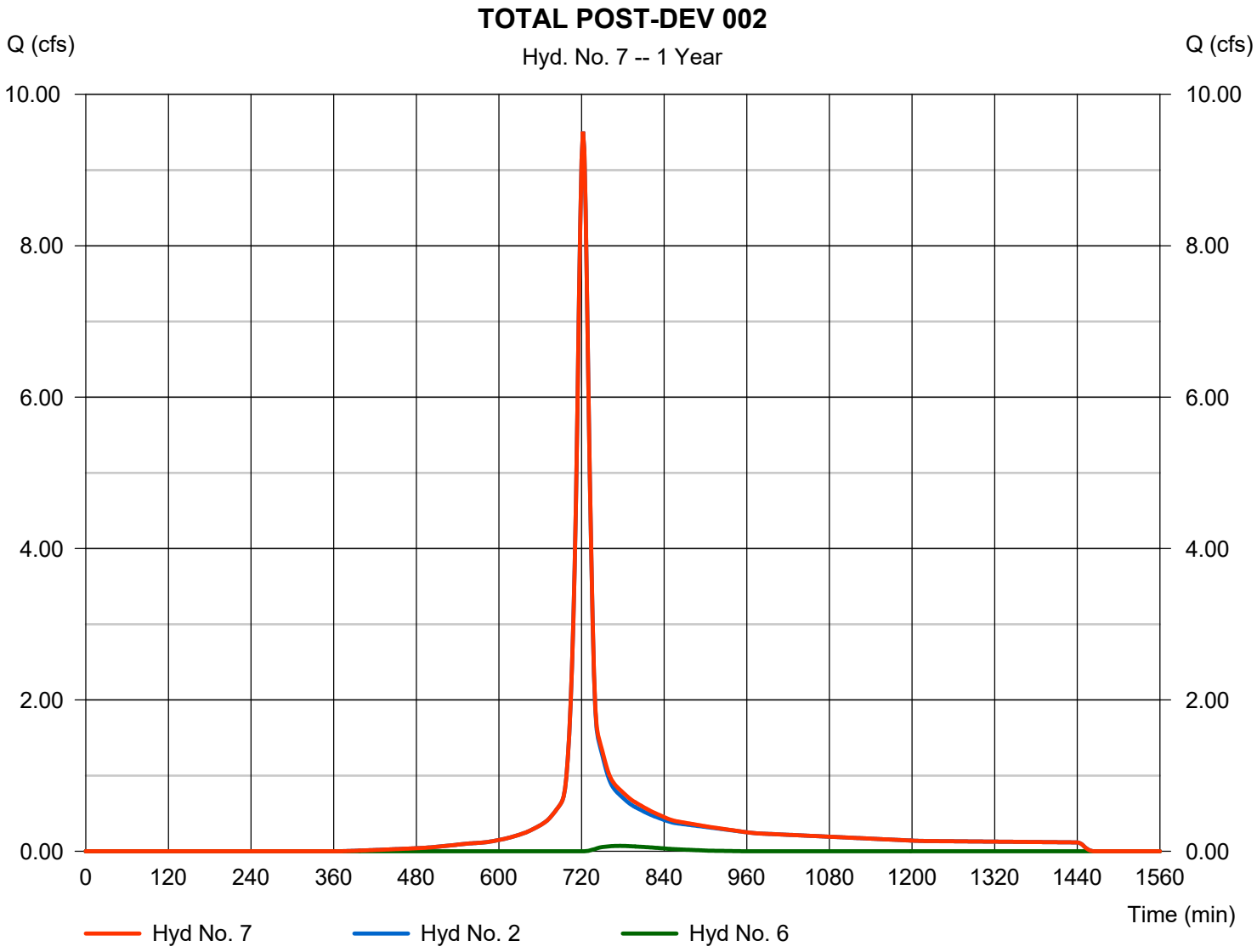


Hydrograph Report

Hyd. No. 7

TOTAL POST-DEV 002

Hydrograph type	= Combine	Peak discharge	= 9.510 cfs
Storm frequency	= 1 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 27,302 cuft
Inflow hyds.	= 2, 6	Contrib. drain. area	= 4.347 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	13.73	2	722	39,025	------	------	------	POST-DEV 001
2	SCS Runoff	12.22	2	722	34,782	------	------	------	POST 002 BYPASS
3	SCS Runoff	4.889	2	716	10,514	------	------	------	POST 002 CAPTURED
4	Reservoir	0.504	2	738	10,513	3	287.30	4,818	BASIN ROUTING
5	Diversion1	0.126	2	738	8,598	4	------	------	INFILTRATION
6	Diversion2	0.378	2	738	1,915	4	------	------	BASIN ROUTED FLOWS
7	Combine	12.42	2	722	36,697	2, 6	------	------	TOTAL POST-DEV 002

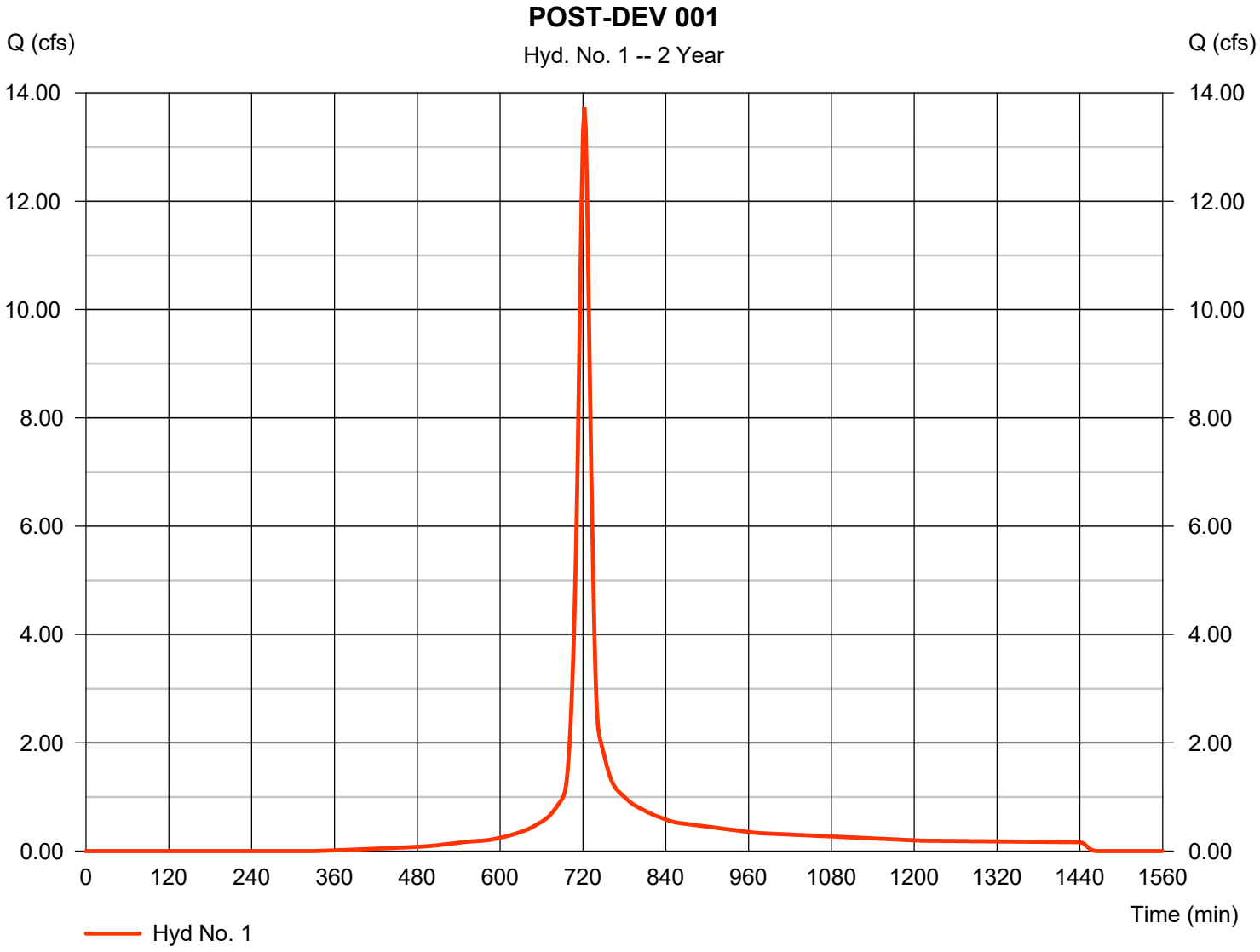
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 1

POST-DEV 001

Hydrograph type	= SCS Runoff	Peak discharge	= 13.73 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 39,025 cuft
Drainage area	= 4.936 ac	Curve number	= 89.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 3.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



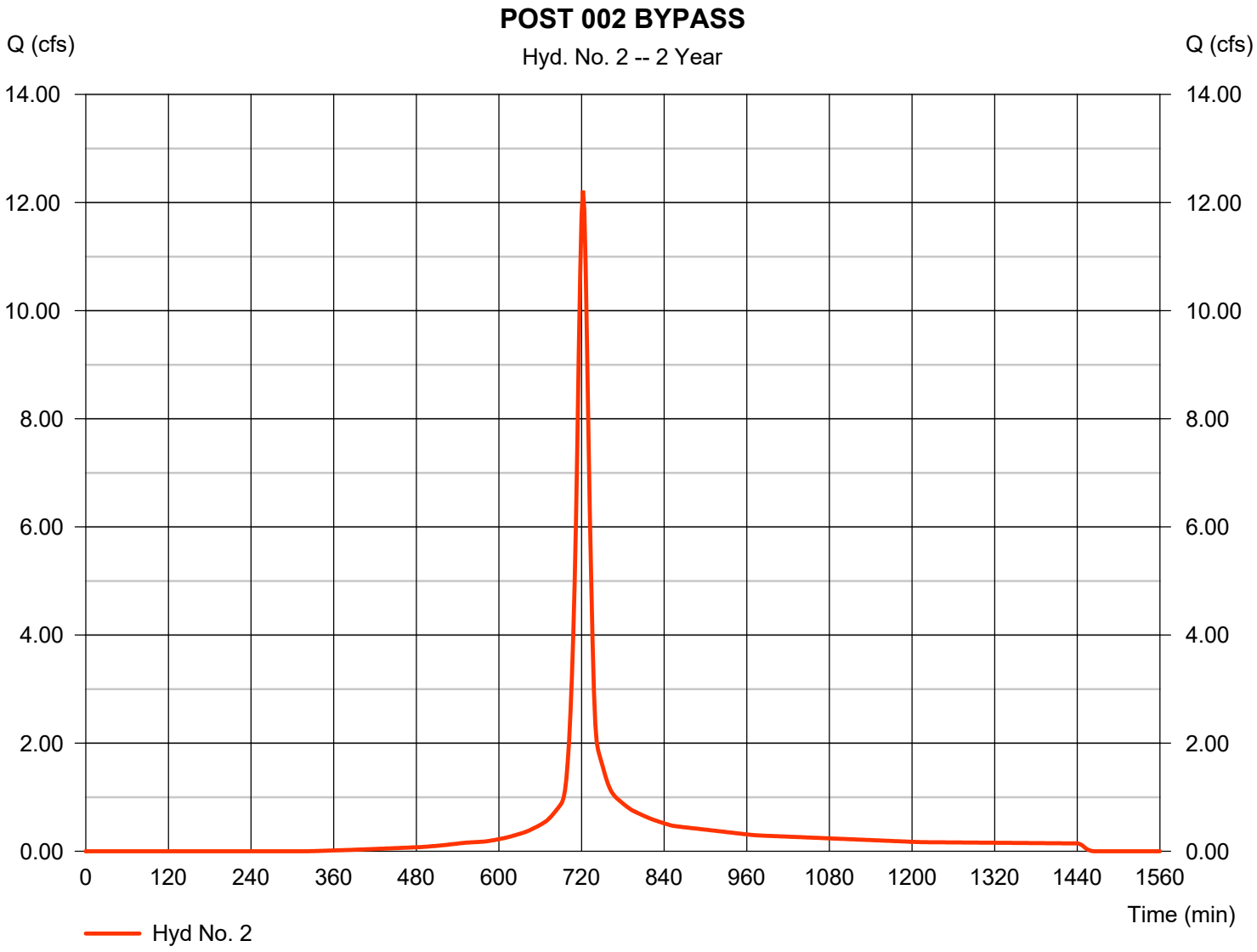
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 2

POST 002 BYPASS

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.22 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	34,782 cuft
Drainage area	=	4.347 ac	Curve number	=	90.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	14.30 min
Total precip.	=	3.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

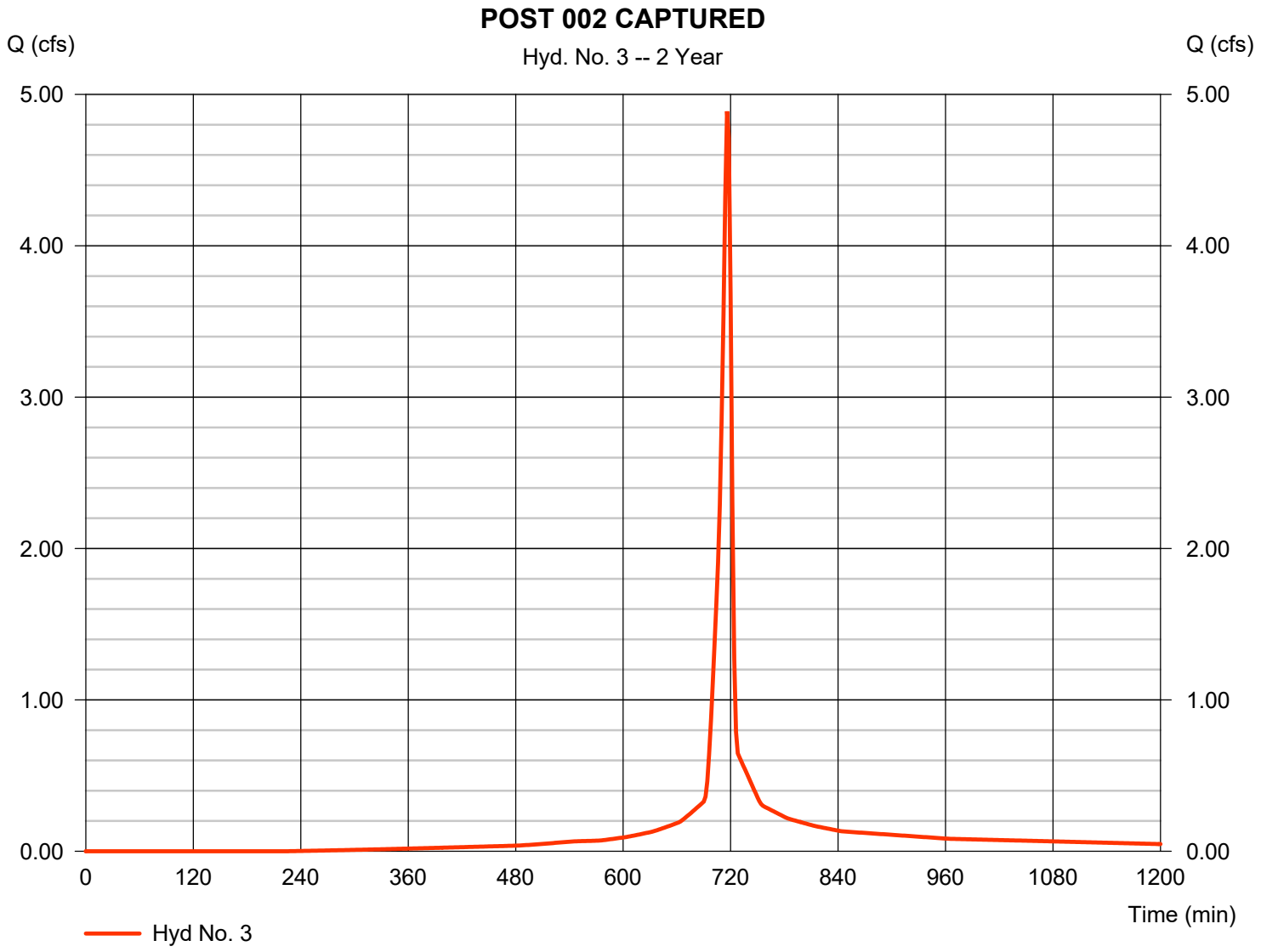


Hydrograph Report

Hyd. No. 3

POST 002 CAPTURED

Hydrograph type	= SCS Runoff	Peak discharge	= 4.889 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 10,514 cuft
Drainage area	= 1.206 ac	Curve number	= 93.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

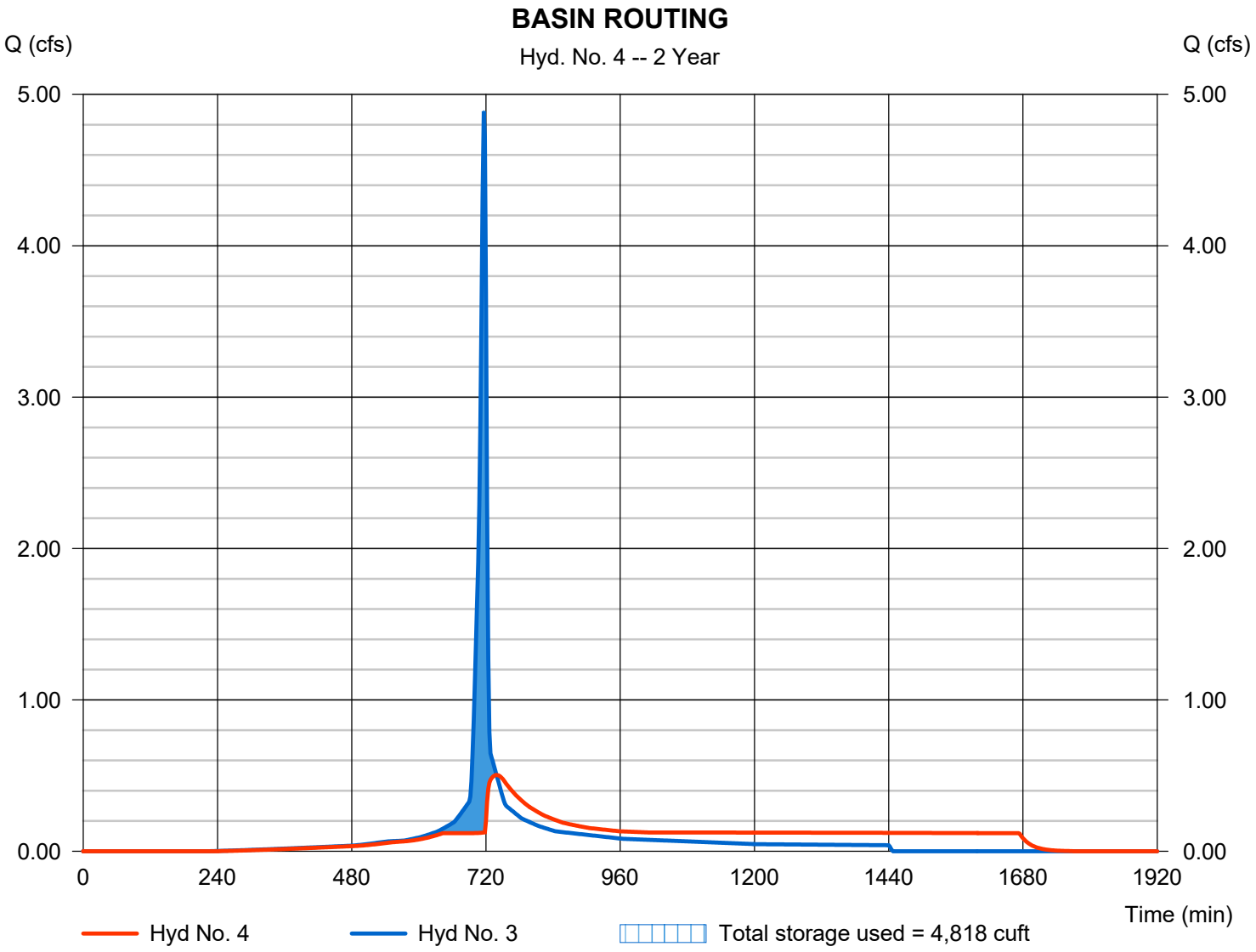
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 4

BASIN ROUTING

Hydrograph type	= Reservoir	Peak discharge	= 0.504 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 10,513 cuft
Inflow hyd. No.	= 3 - POST 002 CAPTURED	Max. Elevation	= 287.30 ft
Reservoir name	= BASIN	Max. Storage	= 4,818 cuft

Storage Indication method used. Outflow includes exfiltration.



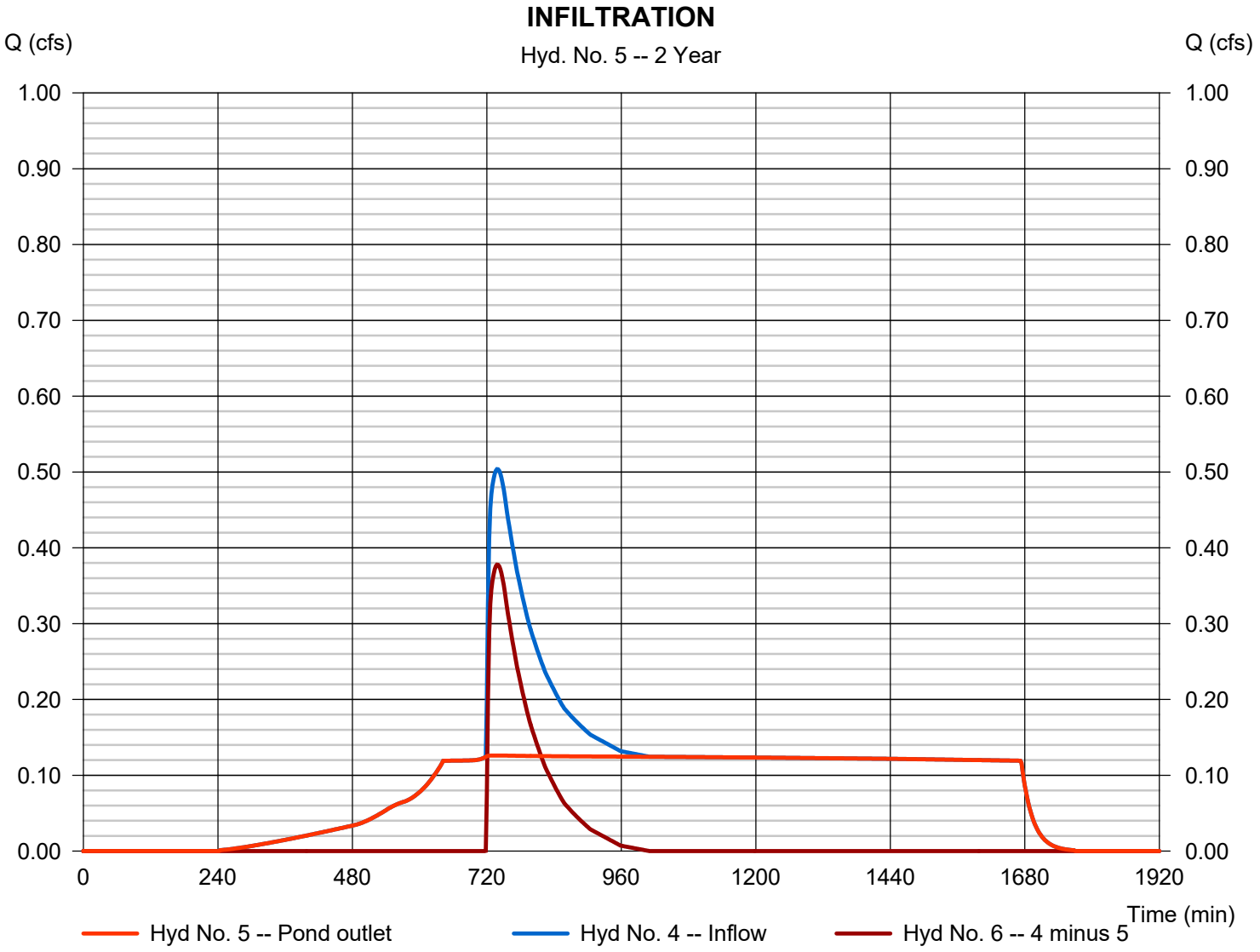
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 5

INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.126 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 8,598 cuft
Inflow hydrograph	= 4 - BASIN ROUTING	2nd diverted hyd.	= 6
Diversion method	= Pond - BASIN	Pond structure	= Exfiltration



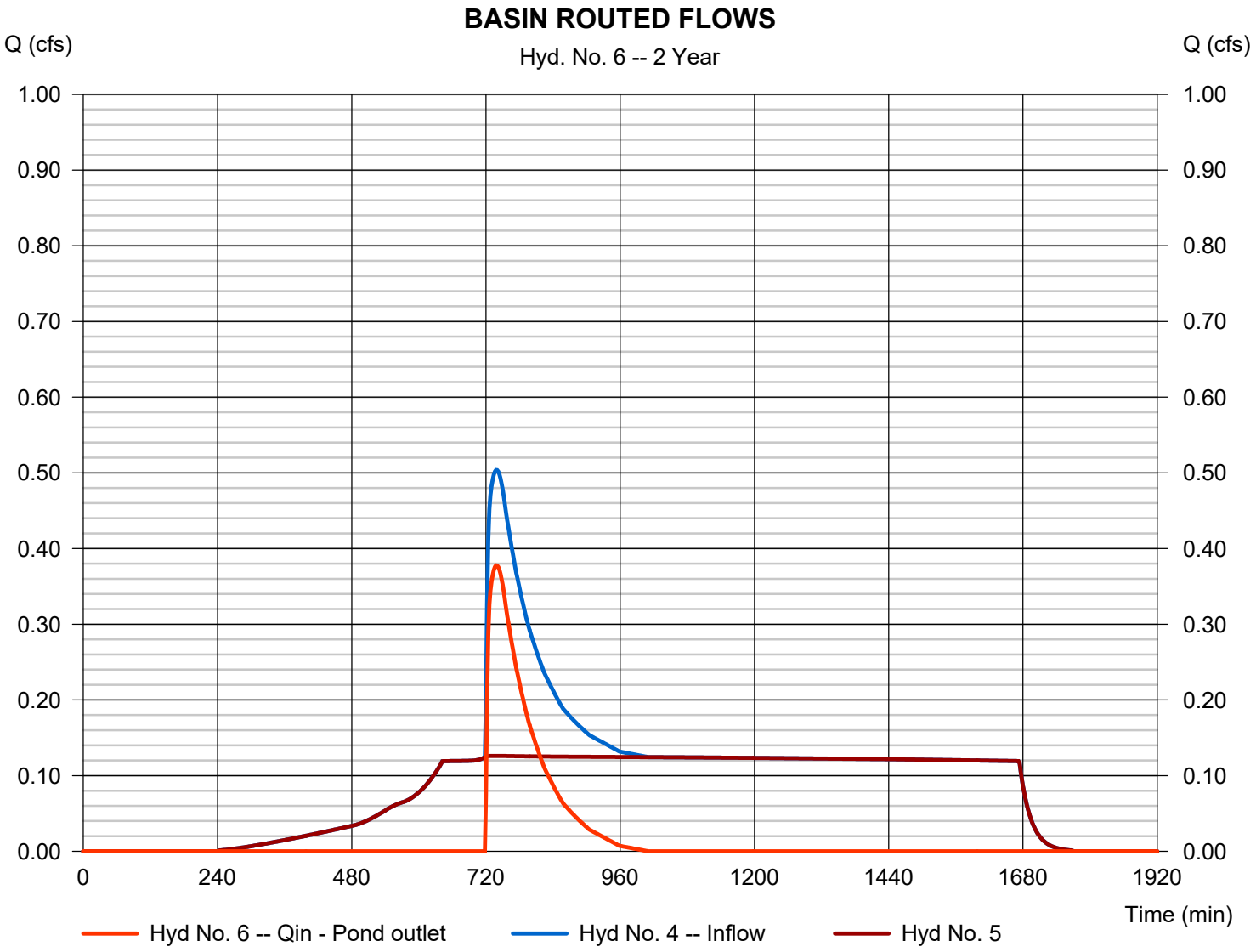
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 6

BASIN ROUTED FLOWS

Hydrograph type	= Diversion2	Peak discharge	= 0.378 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 1,915 cuft
Inflow hydrograph	= 4 - BASIN ROUTING	2nd diverted hyd.	= 5
Diversion method	= Pond - BASIN	Pond structure	= Exfiltration

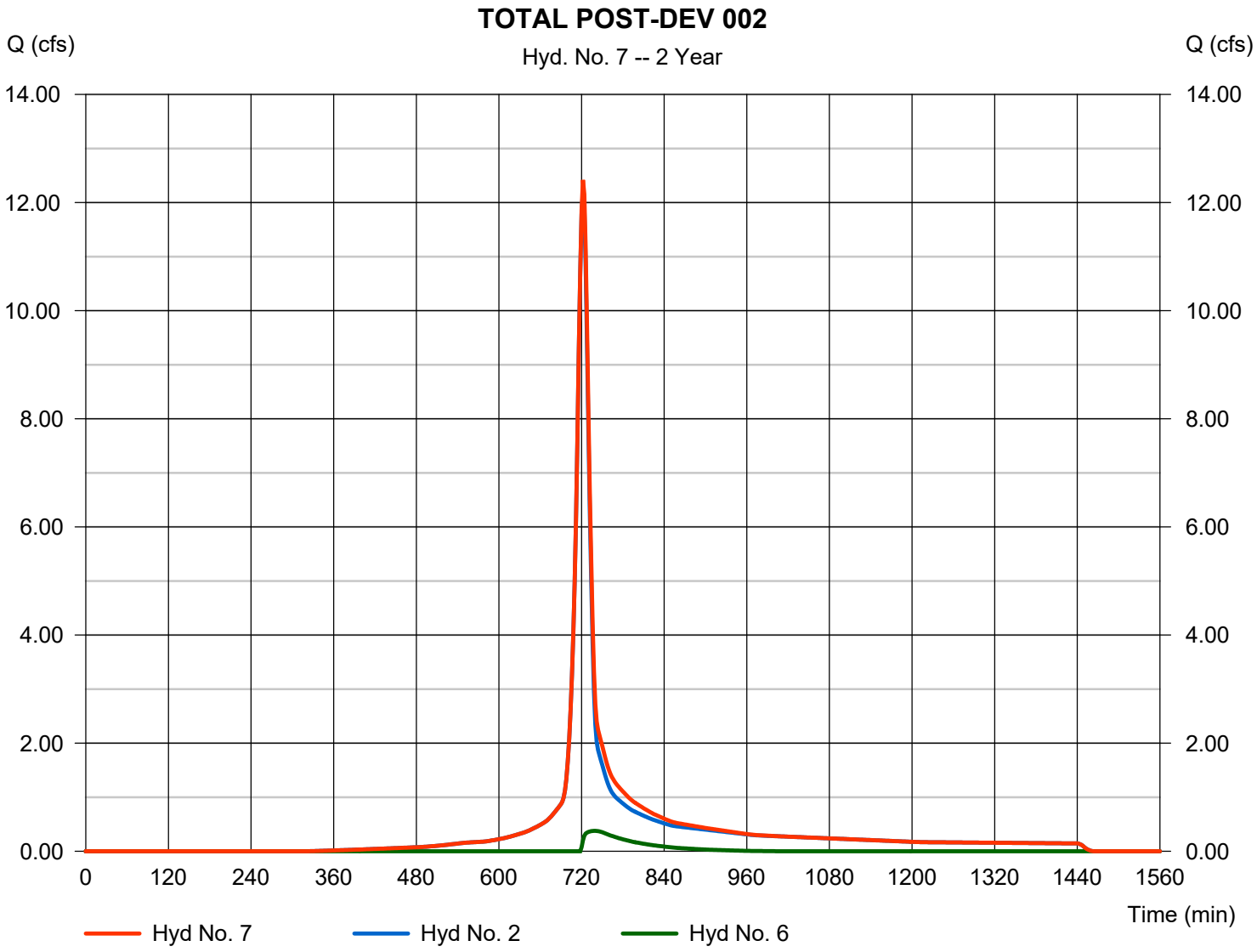


Hydrograph Report

Hyd. No. 7

TOTAL POST-DEV 002

Hydrograph type	= Combine	Peak discharge	= 12.42 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 36,697 cuft
Inflow hyds.	= 2, 6	Contrib. drain. area	= 4.347 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	22.25	2	722	64,676	------	------	------	POST-DEV 001
2	SCS Runoff	19.72	2	722	57,438	------	------	------	POST 002 BYPASS
3	SCS Runoff	7.545	2	716	16,723	------	------	------	POST 002 CAPTURED
4	Reservoir	2.462	2	724	16,722	3	287.88	6,979	BASIN ROUTING
5	Diversion1	0.129	2	724	10,230	4	------	------	INFILTRATION
6	Diversion2	2.332	2	724	6,492	4	------	------	BASIN ROUTED FLOWS
7	Combine	22.02	2	722	63,930	2, 6	------	------	TOTAL POST-DEV 002

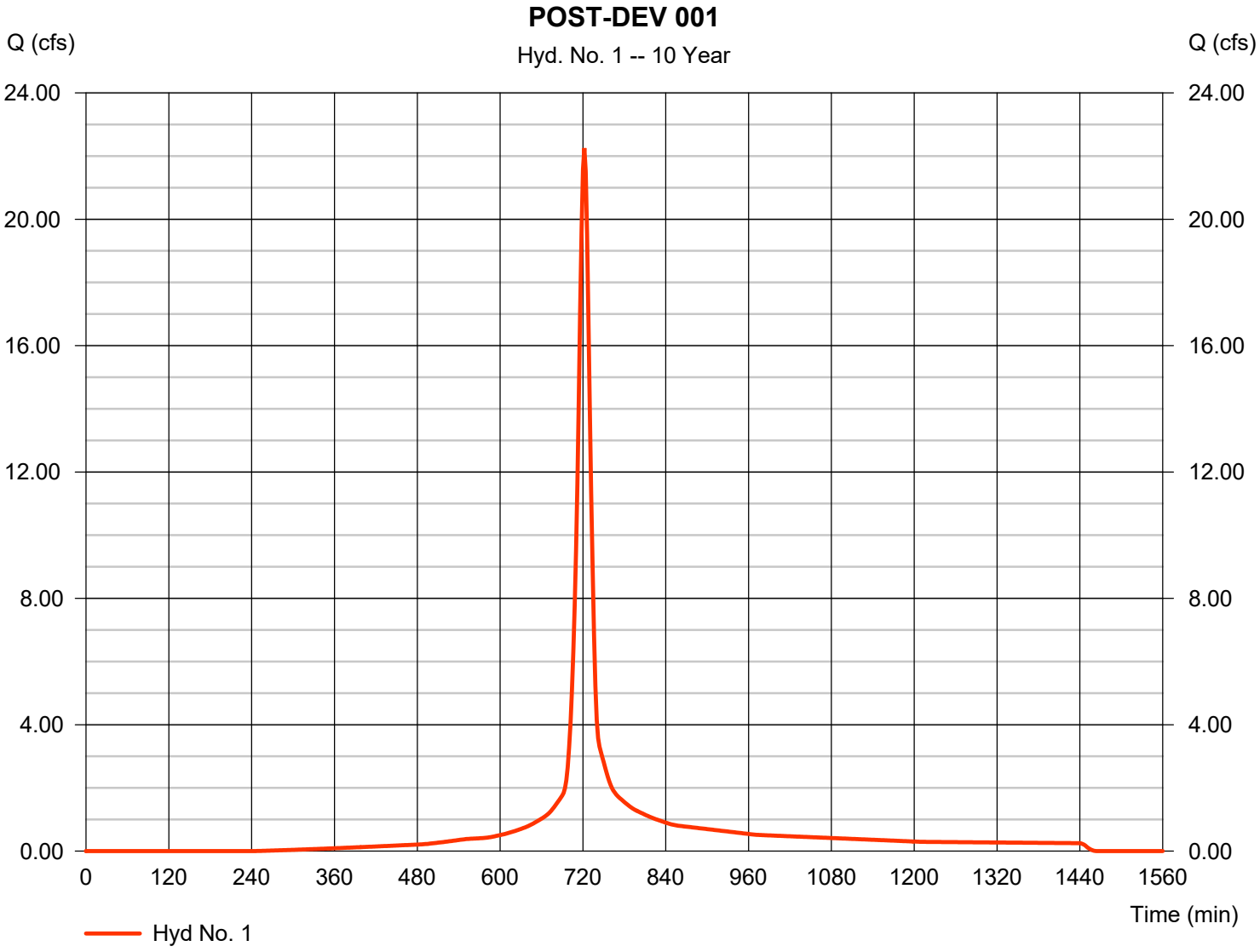
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 1

POST-DEV 001

Hydrograph type	= SCS Runoff	Peak discharge	= 22.25 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 64,676 cuft
Drainage area	= 4.936 ac	Curve number	= 89.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 4.83 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



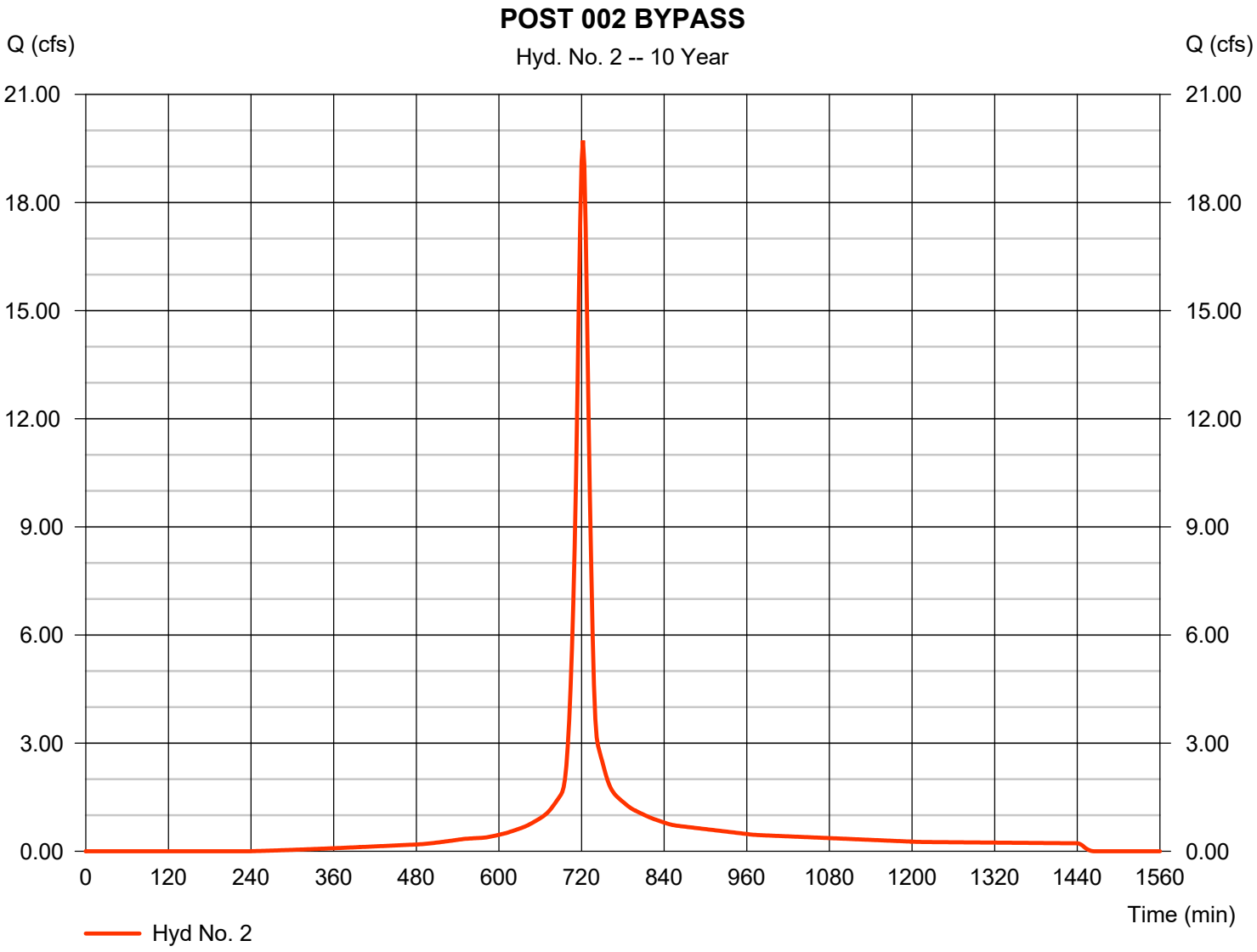
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 2

POST 002 BYPASS

Hydrograph type	=	SCS Runoff	Peak discharge	=	19.72 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	57,438 cuft
Drainage area	=	4.347 ac	Curve number	=	90.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	14.30 min
Total precip.	=	4.83 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

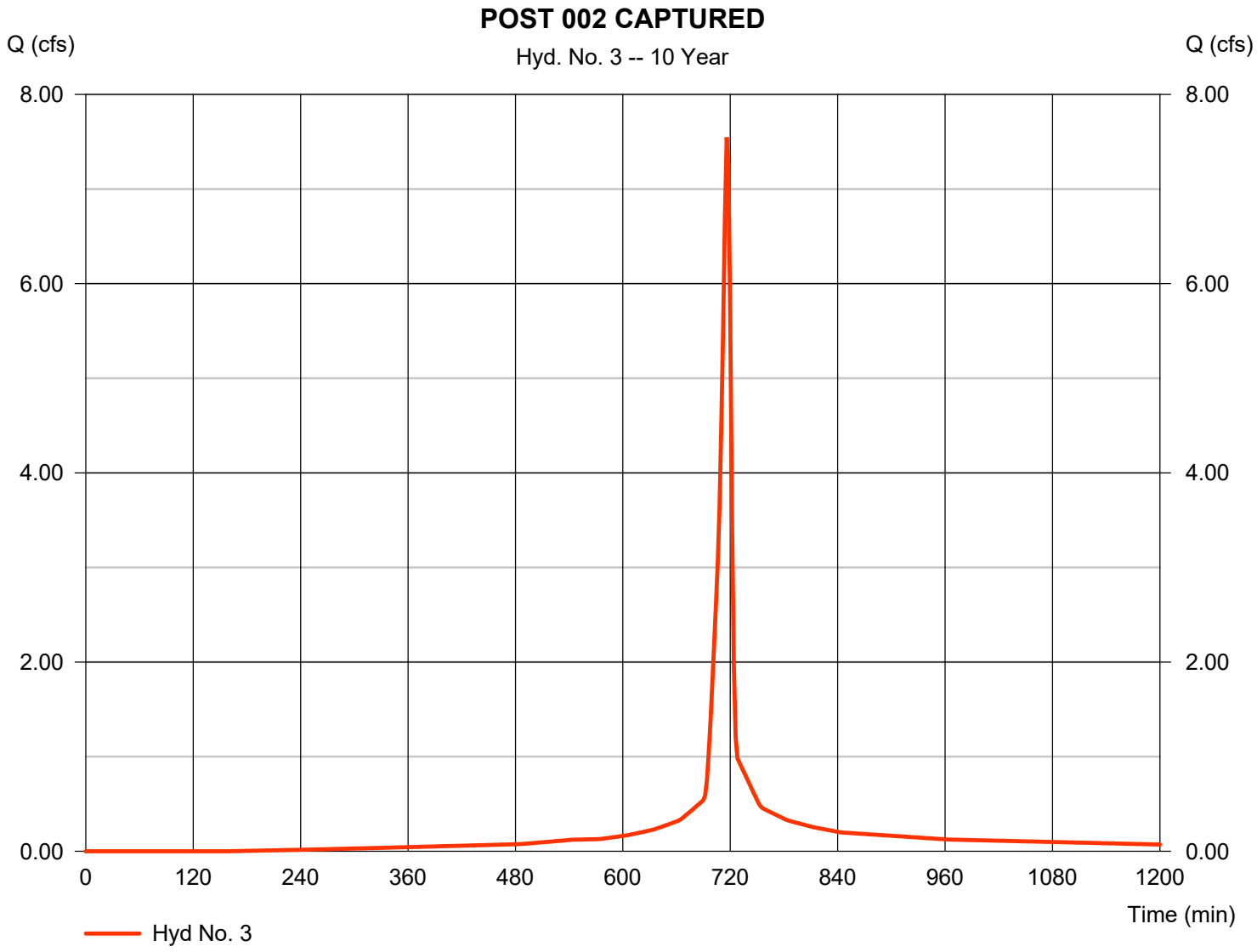


Hydrograph Report

Hyd. No. 3

POST 002 CAPTURED

Hydrograph type	= SCS Runoff	Peak discharge	= 7.545 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 16,723 cuft
Drainage area	= 1.206 ac	Curve number	= 93.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.83 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

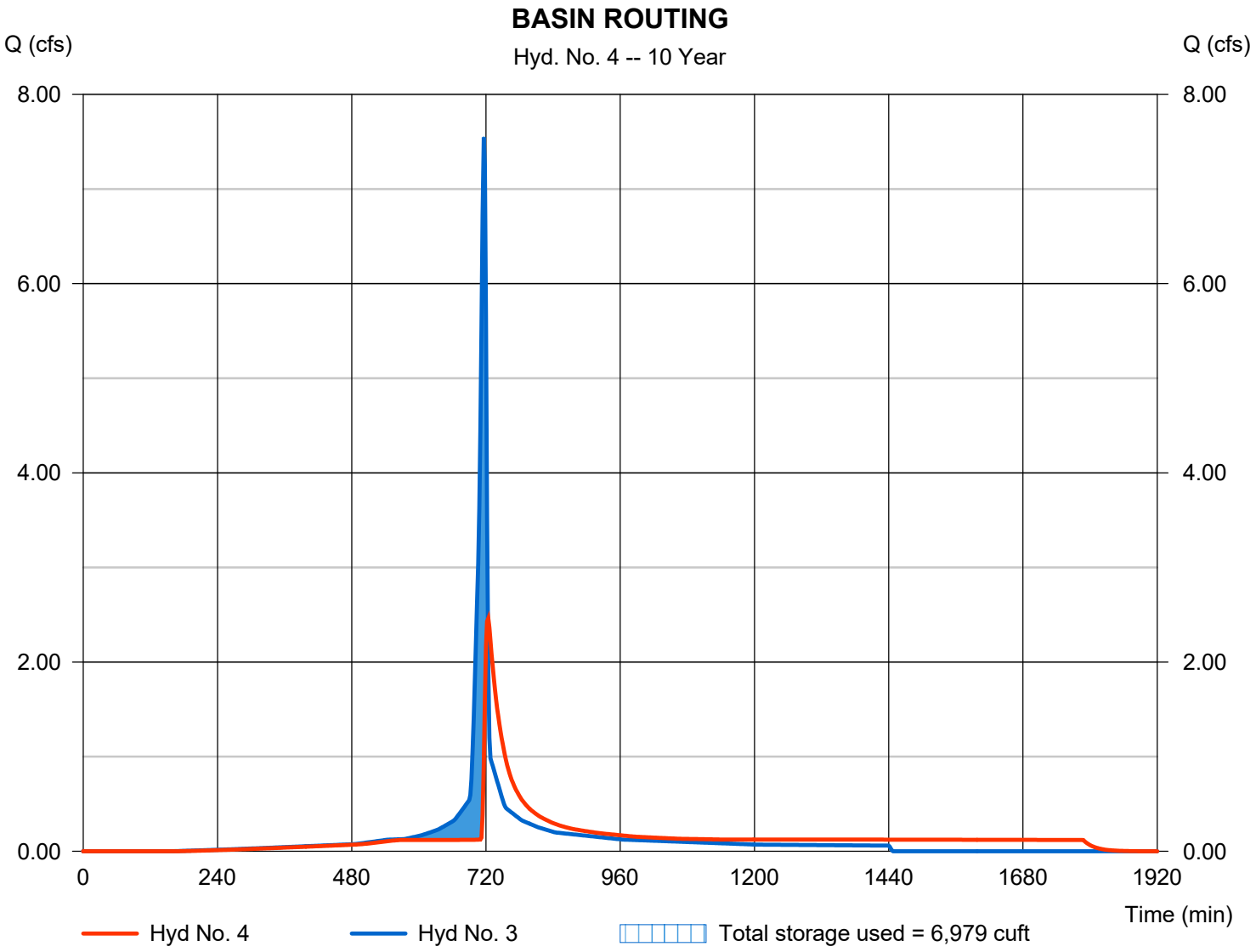
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 4

BASIN ROUTING

Hydrograph type	= Reservoir	Peak discharge	= 2.462 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 16,722 cuft
Inflow hyd. No.	= 3 - POST 002 CAPTURED	Max. Elevation	= 287.88 ft
Reservoir name	= BASIN	Max. Storage	= 6,979 cuft

Storage Indication method used. Outflow includes exfiltration.

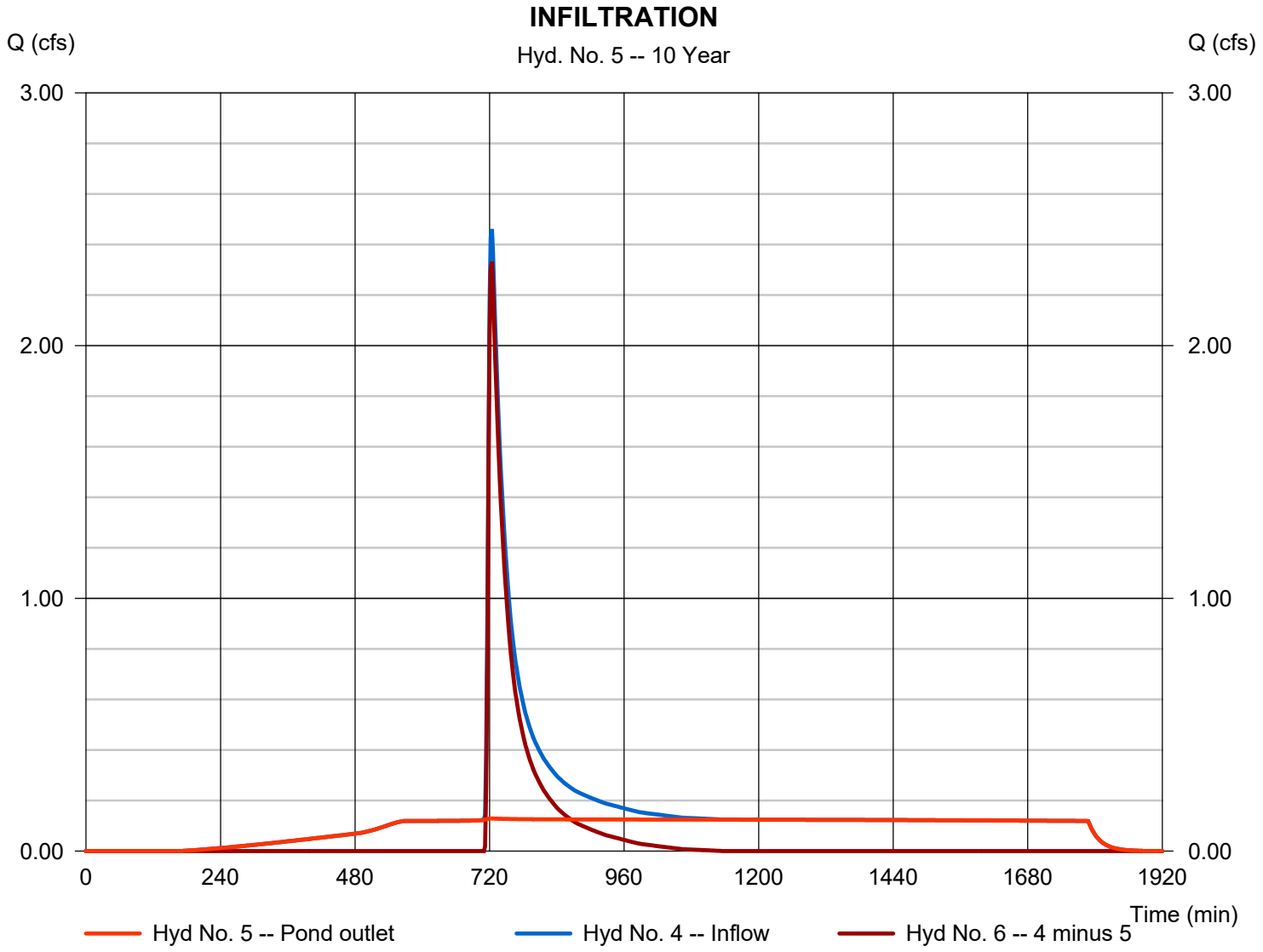


Hydrograph Report

Hyd. No. 5

INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.129 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 10,230 cuft
Inflow hydrograph	= 4 - BASIN ROUTING	2nd diverted hyd.	= 6
Diversion method	= Pond - BASIN	Pond structure	= Exfiltration

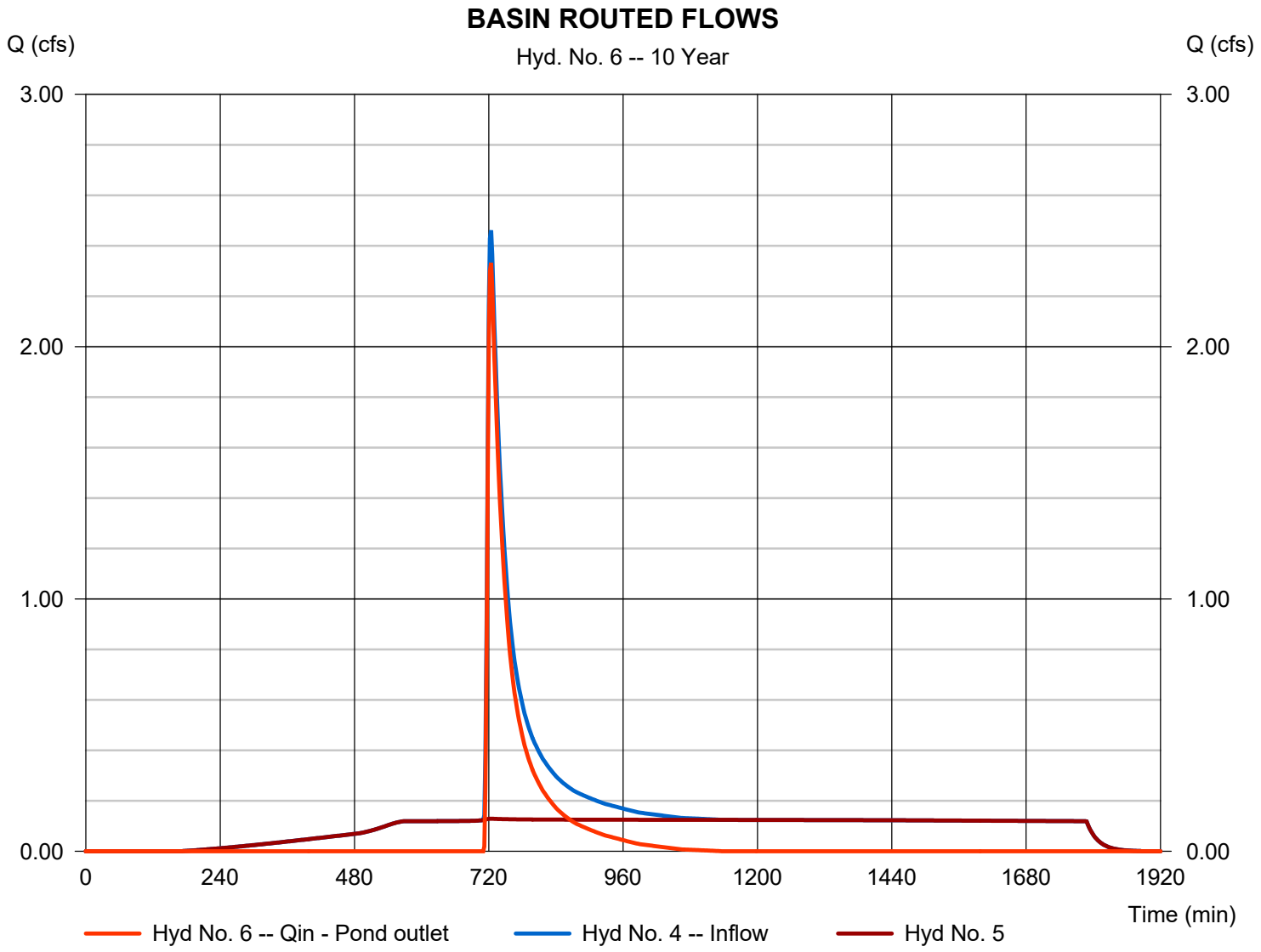


Hydrograph Report

Hyd. No. 6

BASIN ROUTED FLOWS

Hydrograph type	= Diversion2	Peak discharge	= 2.332 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 6,492 cuft
Inflow hydrograph	= 4 - BASIN ROUTING	2nd diverted hyd.	= 5
Diversion method	= Pond - BASIN	Pond structure	= Exfiltration

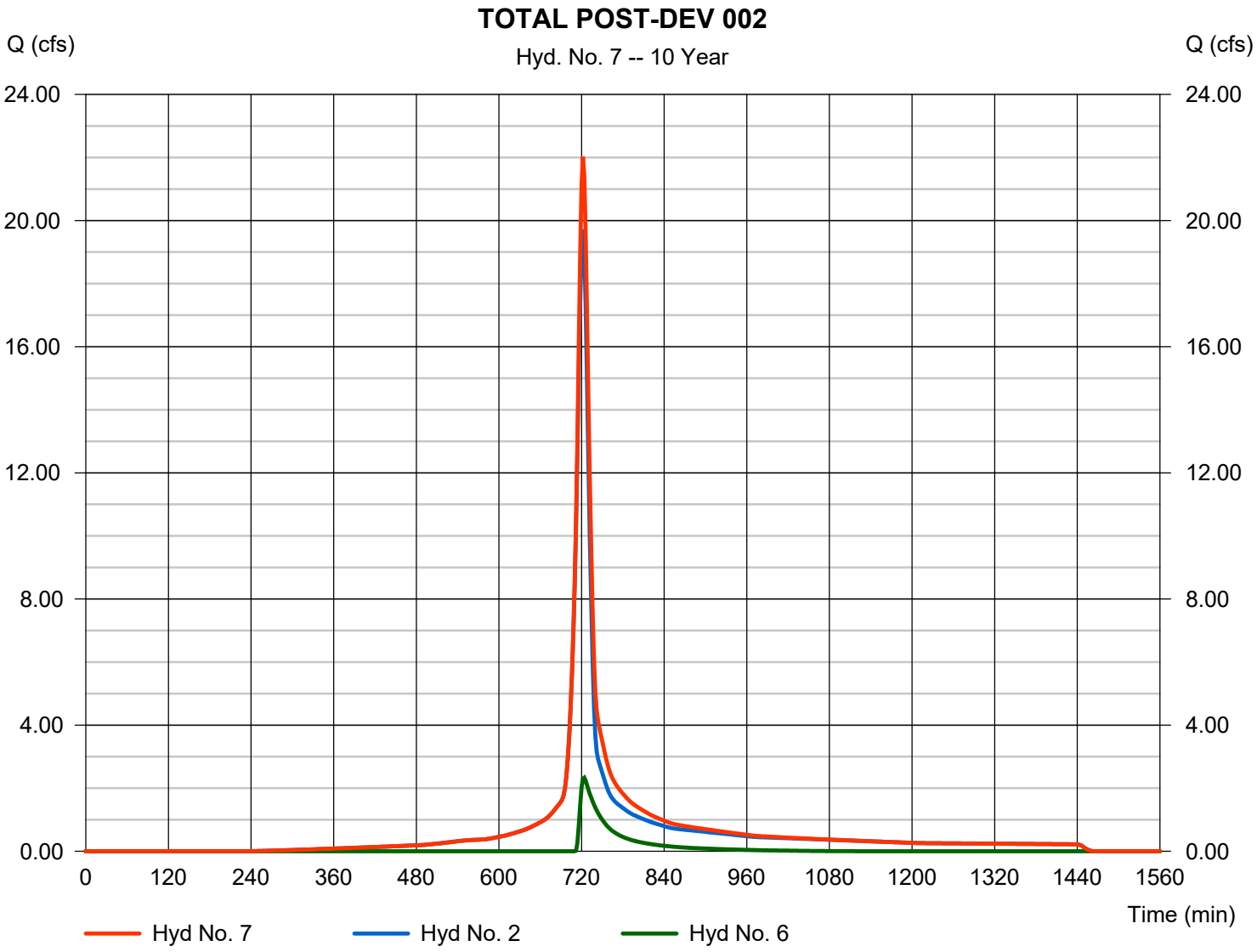


Hydrograph Report

Hyd. No. 7

TOTAL POST-DEV 002

Hydrograph type	= Combine	Peak discharge	= 22.02 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 63,930 cuft
Inflow hyds.	= 2, 6	Contrib. drain. area	= 4.347 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	32.56	2	722	96,739	------	------	------	POST-DEV 001
2	SCS Runoff	28.79	2	722	85,722	------	------	------	POST 002 BYPASS
3	SCS Runoff	10.74	2	716	24,381	------	------	------	POST 002 CAPTURED
4	Reservoir	3.980	2	722	24,380	3	288.63	9,715	BASIN ROUTING
5	Diversion1	0.133	2	722	11,648	4	------	------	INFILTRATION
6	Diversion2	3.846	2	722	12,732	4	------	------	BASIN ROUTED FLOWS
7	Combine	32.63	2	722	98,454	2, 6	------	------	TOTAL POST-DEV 002

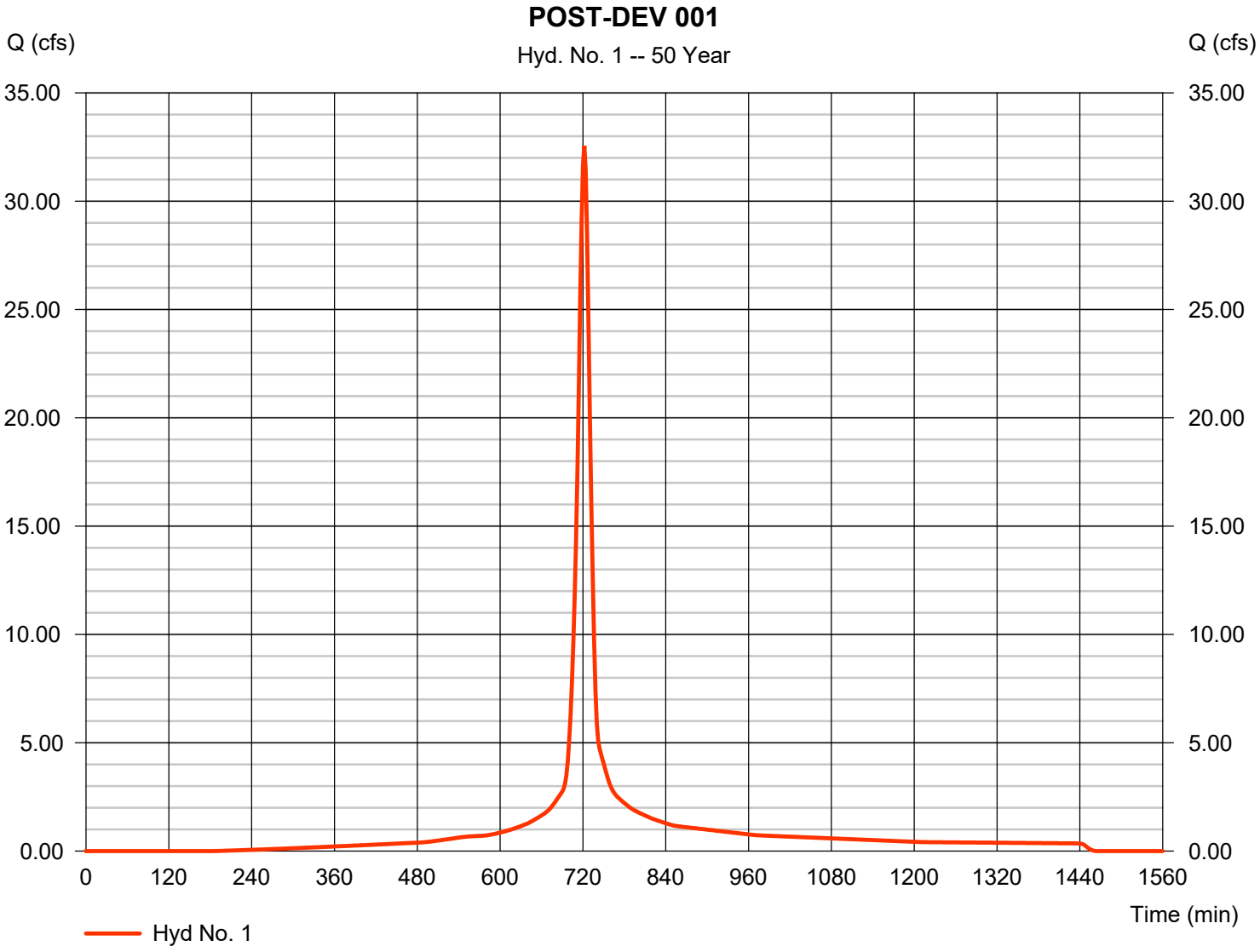
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 1

POST-DEV 001

Hydrograph type	= SCS Runoff	Peak discharge	= 32.56 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 96,739 cuft
Drainage area	= 4.936 ac	Curve number	= 89.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



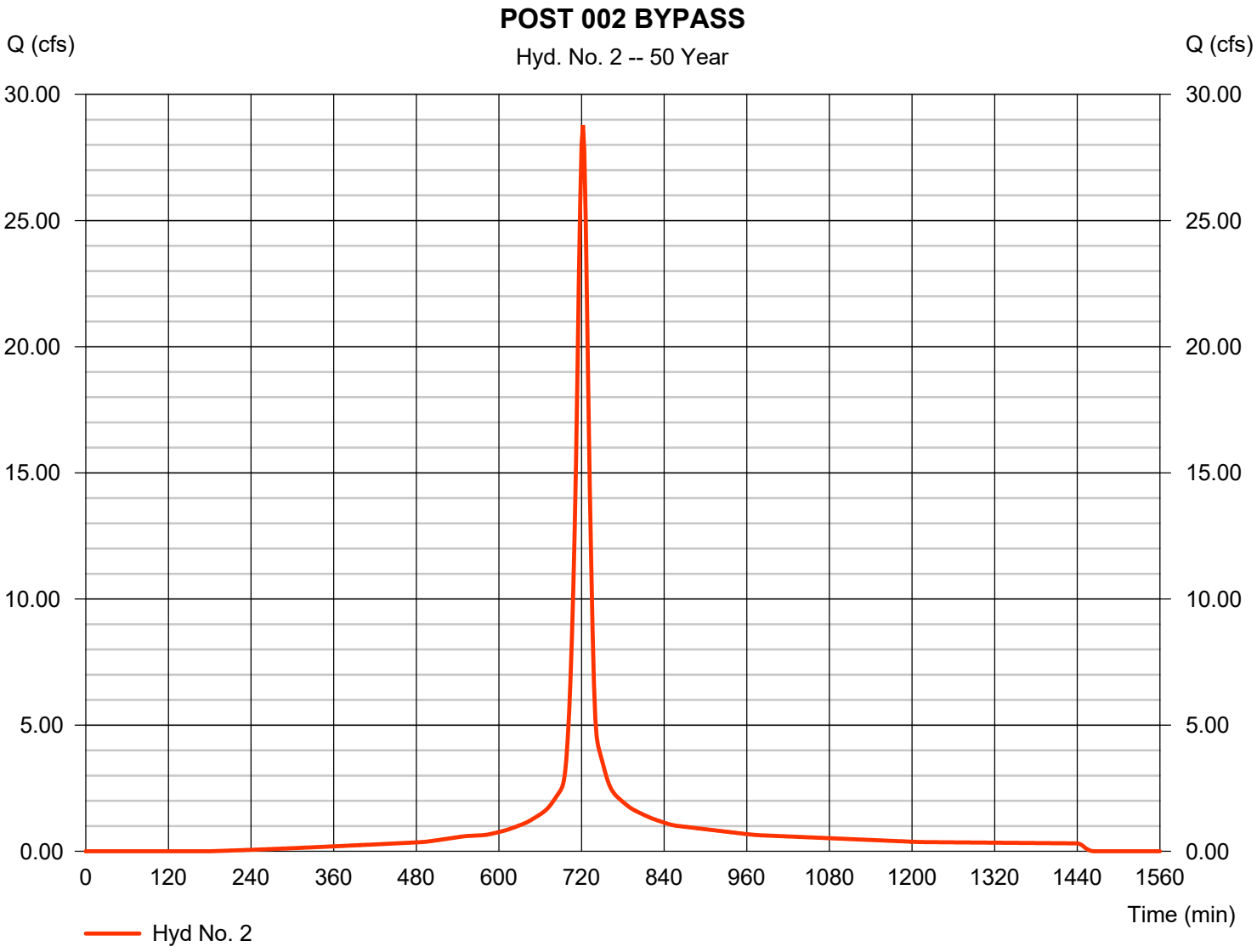
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 2

POST 002 BYPASS

Hydrograph type	=	SCS Runoff	Peak discharge	=	28.79 cfs
Storm frequency	=	50 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	85,722 cuft
Drainage area	=	4.347 ac	Curve number	=	90.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	14.30 min
Total precip.	=	6.72 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



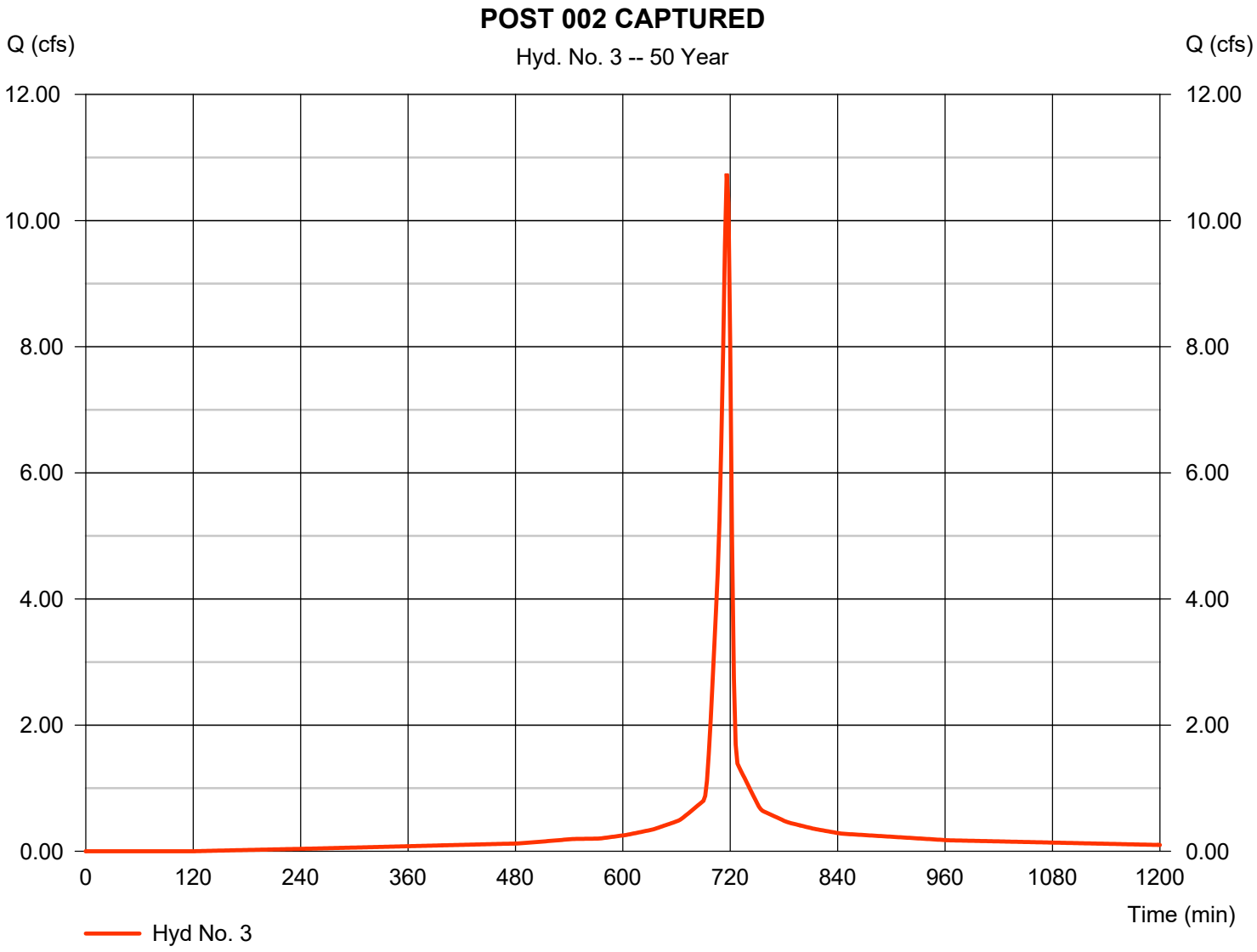
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 3

POST 002 CAPTURED

Hydrograph type	= SCS Runoff	Peak discharge	= 10.74 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 24,381 cuft
Drainage area	= 1.206 ac	Curve number	= 93.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.72 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

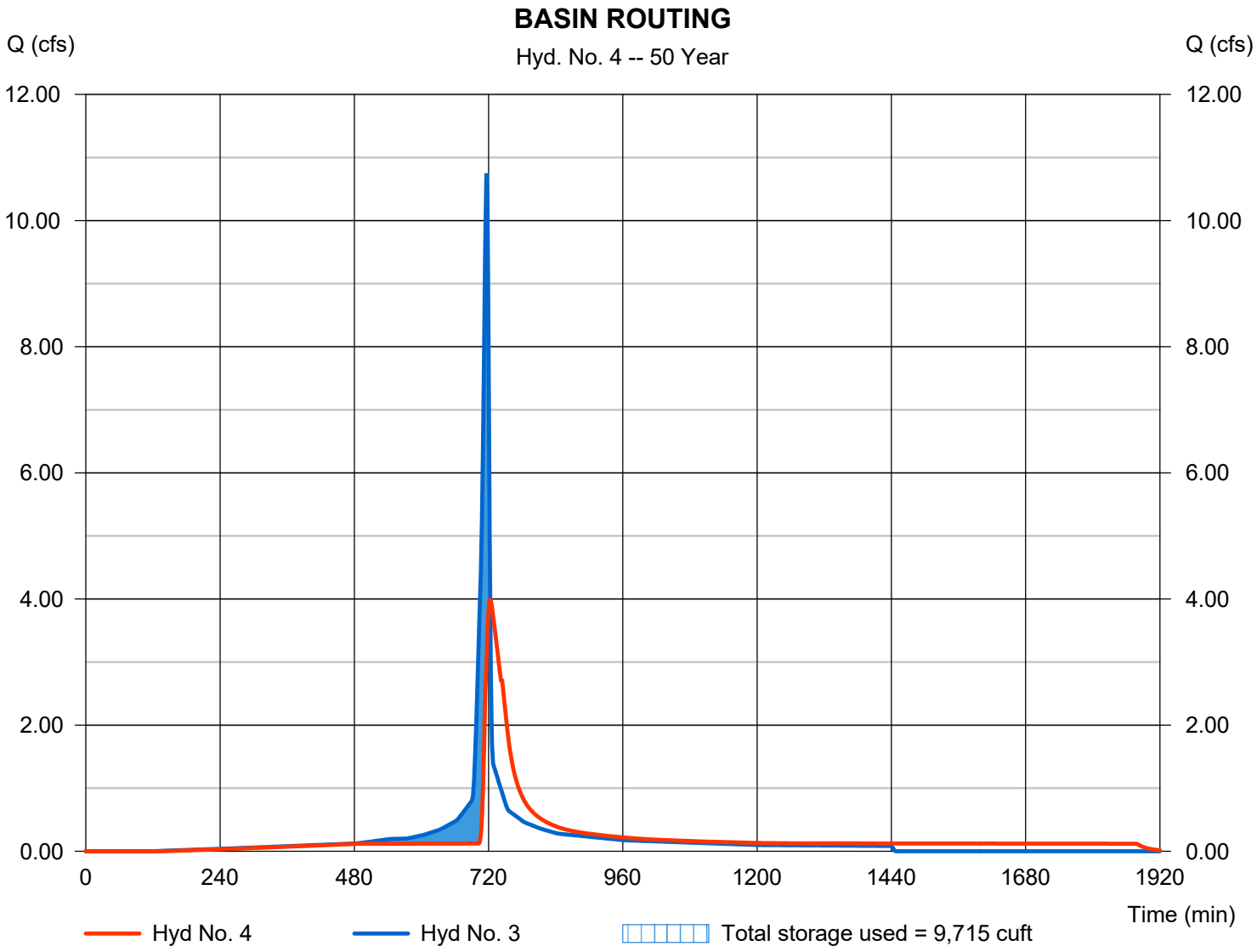
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 4

BASIN ROUTING

Hydrograph type	=	Reservoir	Peak discharge	=	3.980 cfs
Storm frequency	=	50 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	24,380 cuft
Inflow hyd. No.	=	3 - POST 002 CAPTURED	Max. Elevation	=	288.63 ft
Reservoir name	=	BASIN	Max. Storage	=	9,715 cuft

Storage Indication method used. Outflow includes exfiltration.

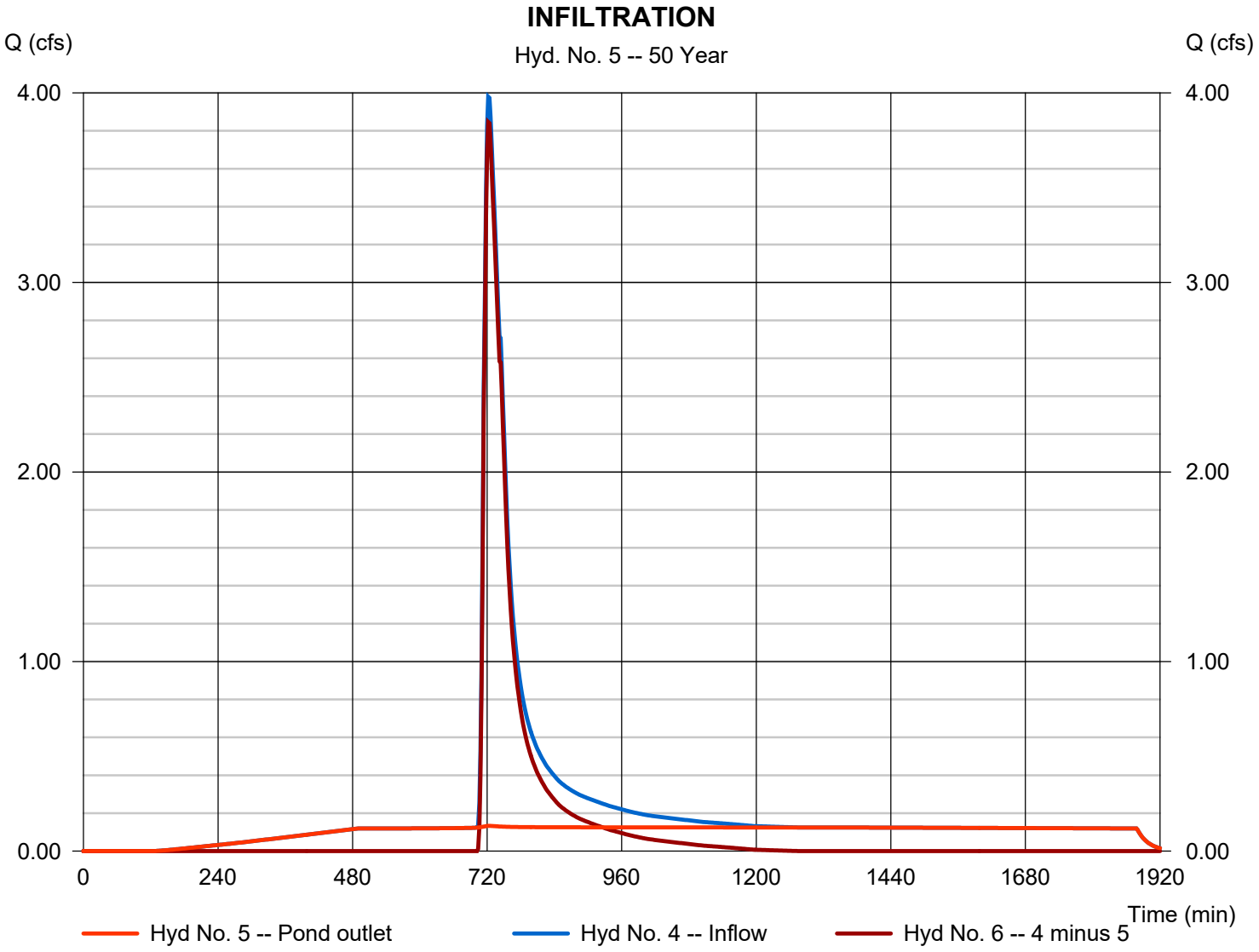


Hydrograph Report

Hyd. No. 5

INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.133 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 11,648 cuft
Inflow hydrograph	= 4 - BASIN ROUTING	2nd diverted hyd.	= 6
Diversion method	= Pond - BASIN	Pond structure	= Exfiltration

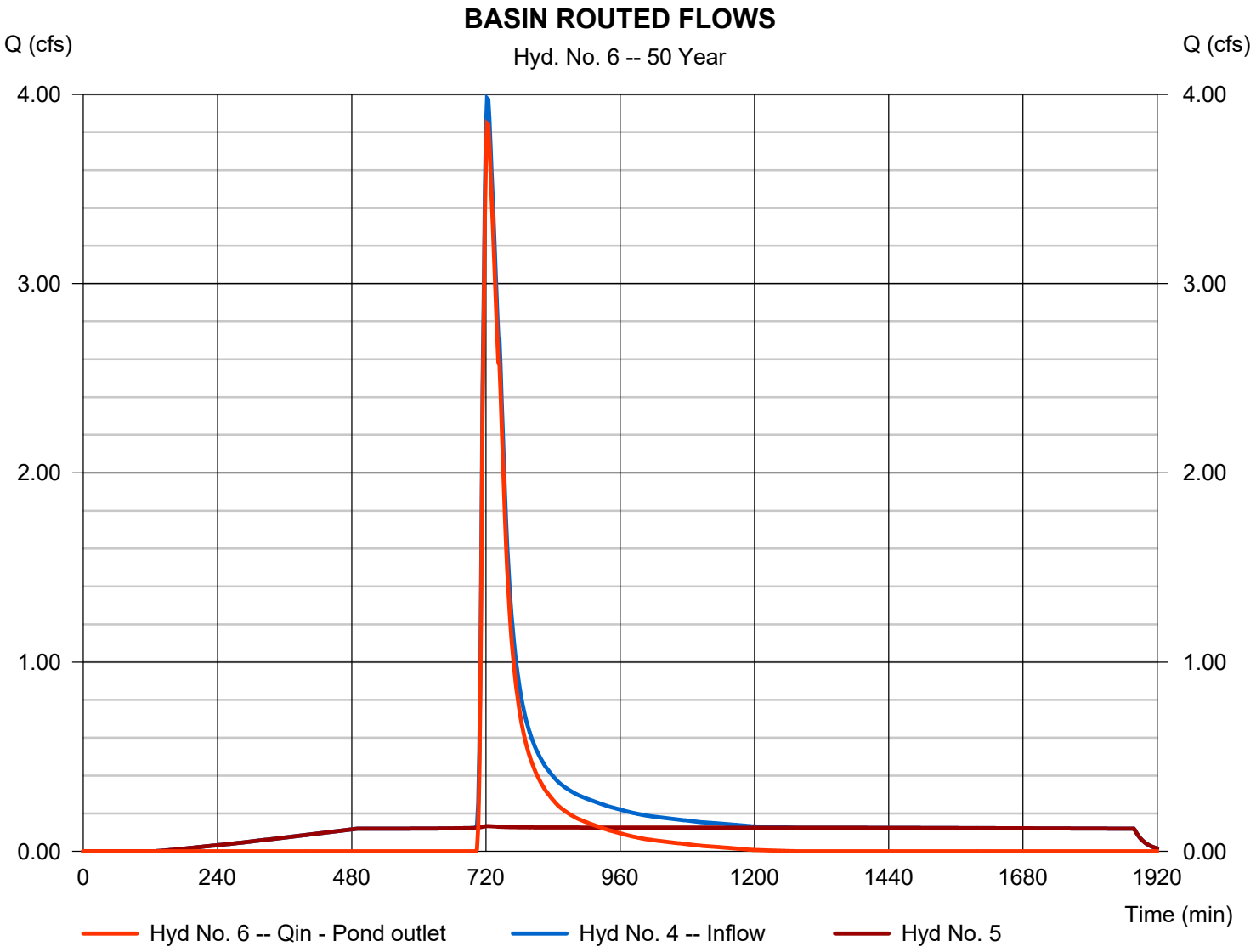


Hydrograph Report

Hyd. No. 6

BASIN ROUTED FLOWS

Hydrograph type	= Diversion2	Peak discharge	= 3.846 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 12,732 cuft
Inflow hydrograph	= 4 - BASIN ROUTING	2nd diverted hyd.	= 5
Diversion method	= Pond - BASIN	Pond structure	= Exfiltration

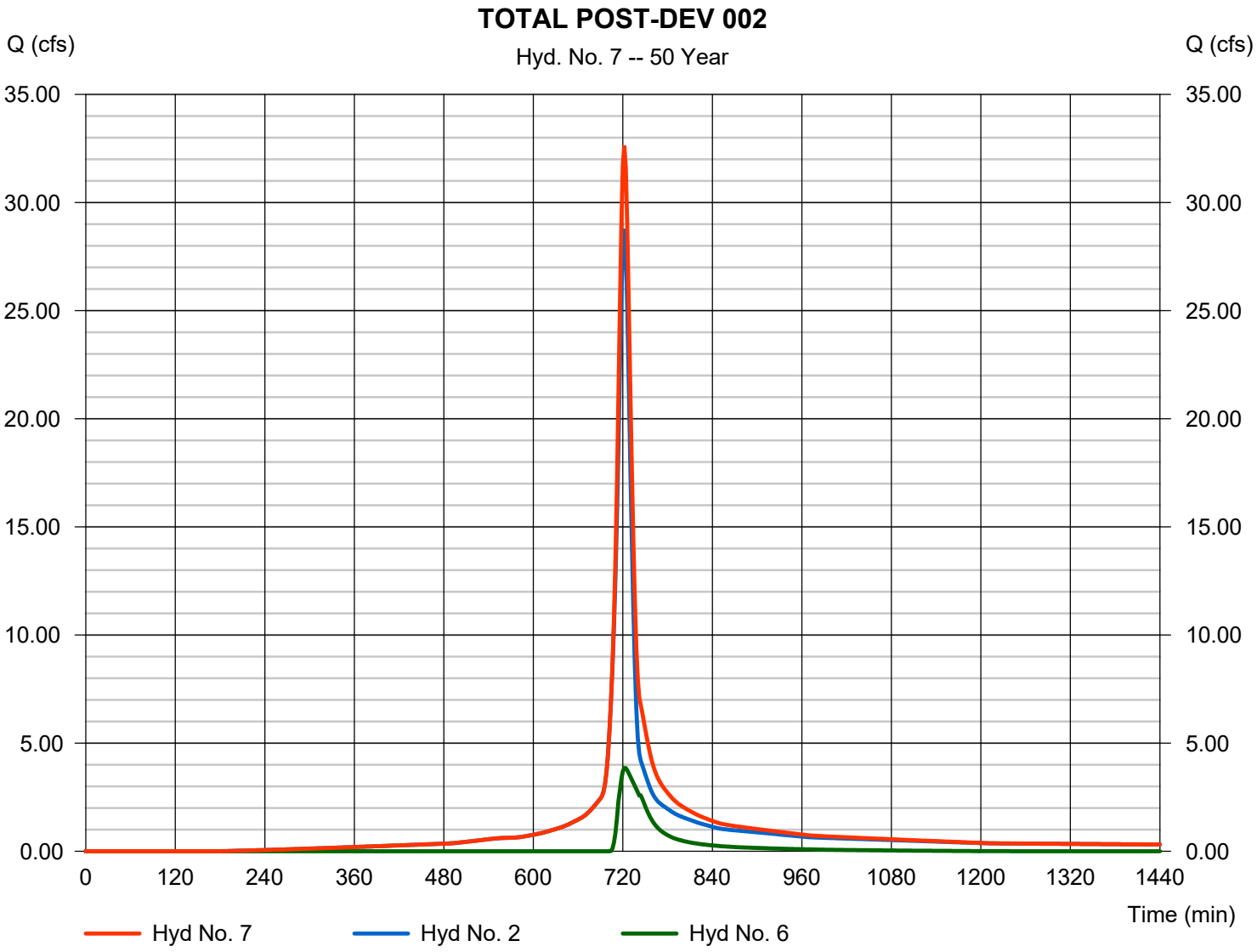


Hydrograph Report

Hyd. No. 7

TOTAL POST-DEV 002

Hydrograph type	= Combine	Peak discharge	= 32.63 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 98,454 cuft
Inflow hyds.	= 2, 6	Contrib. drain. area	= 4.347 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

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	37.59	2	722	112,671	------	------	------	POST-DEV 001
2	SCS Runoff	33.21	2	722	99,769	------	------	------	POST 002 BYPASS
3	SCS Runoff	12.31	2	716	28,166	------	------	------	POST 002 CAPTURED
4	Reservoir	4.583	2	722	28,165	3	289.01	11,068	BASIN ROUTING
5	Diversion1	0.135	2	722	12,176	4	------	------	INFILTRATION
6	Diversion2	4.447	2	722	15,989	4	------	------	BASIN ROUTED FLOWS
7	Combine	37.66	2	722	115,758	2, 6	------	------	TOTAL POST-DEV 002

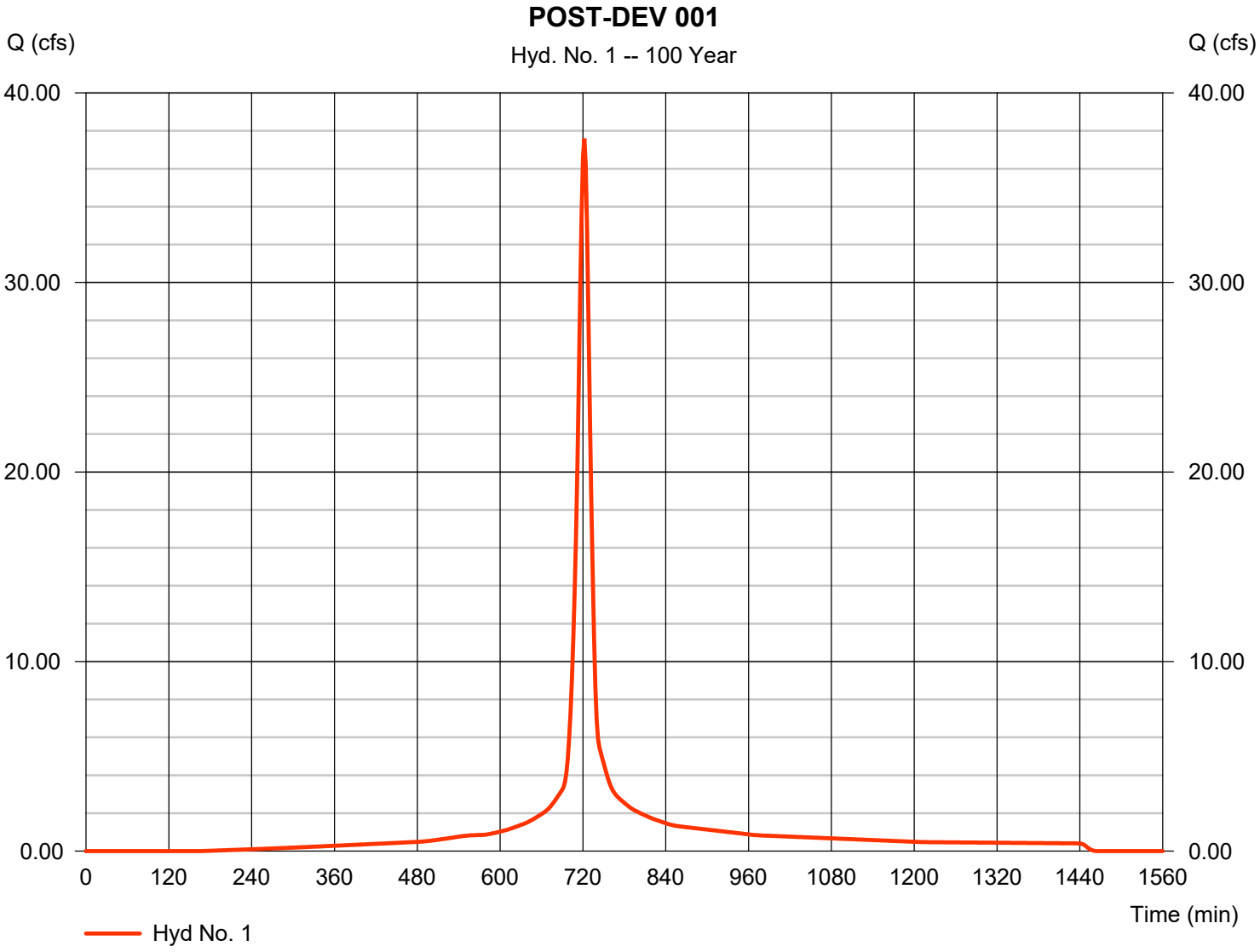
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 1

POST-DEV 001

Hydrograph type	= SCS Runoff	Peak discharge	= 37.59 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 112,671 cuft
Drainage area	= 4.936 ac	Curve number	= 89.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 7.65 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



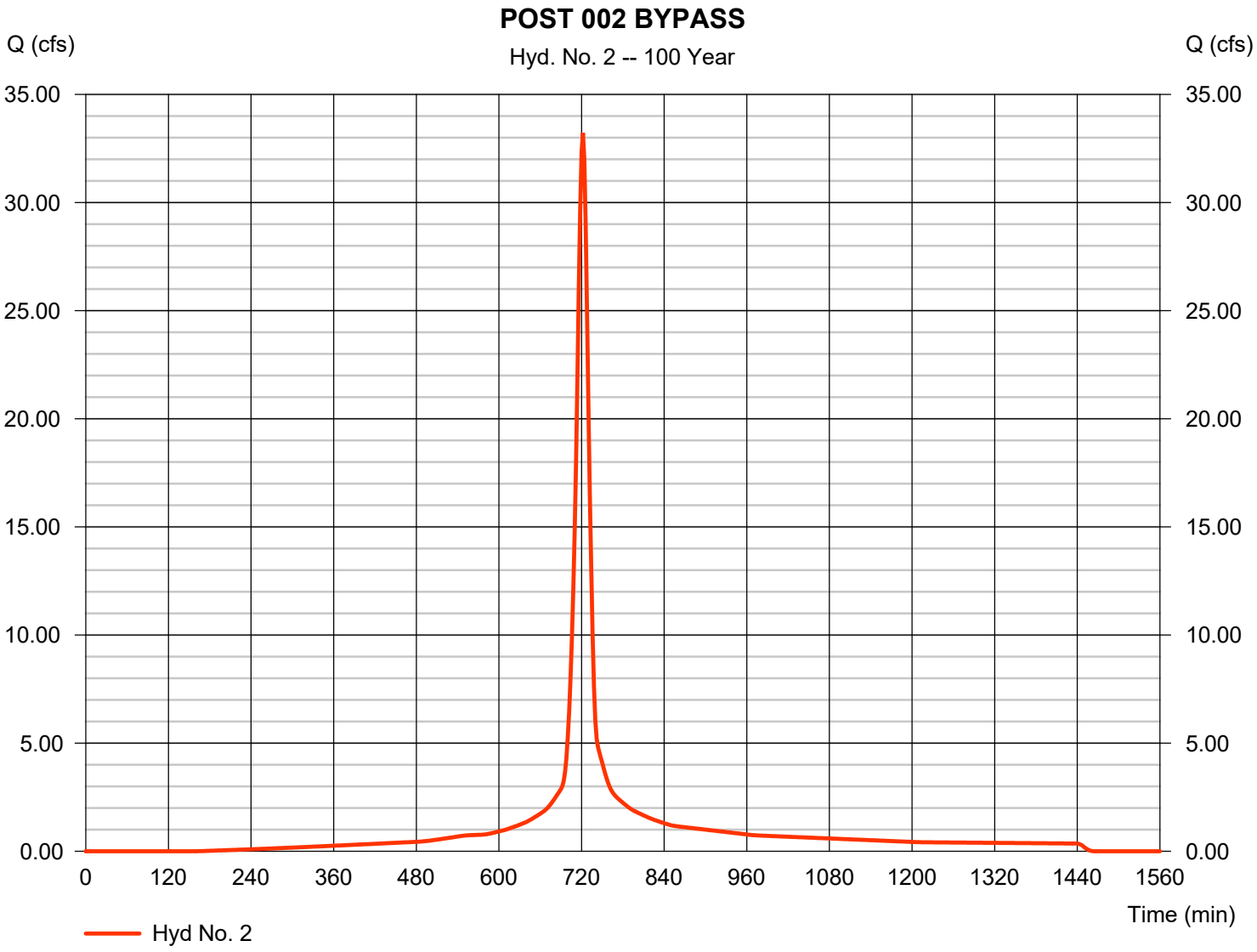
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 2

POST 002 BYPASS

Hydrograph type	=	SCS Runoff	Peak discharge	=	33.21 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	99,769 cuft
Drainage area	=	4.347 ac	Curve number	=	90.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	14.30 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



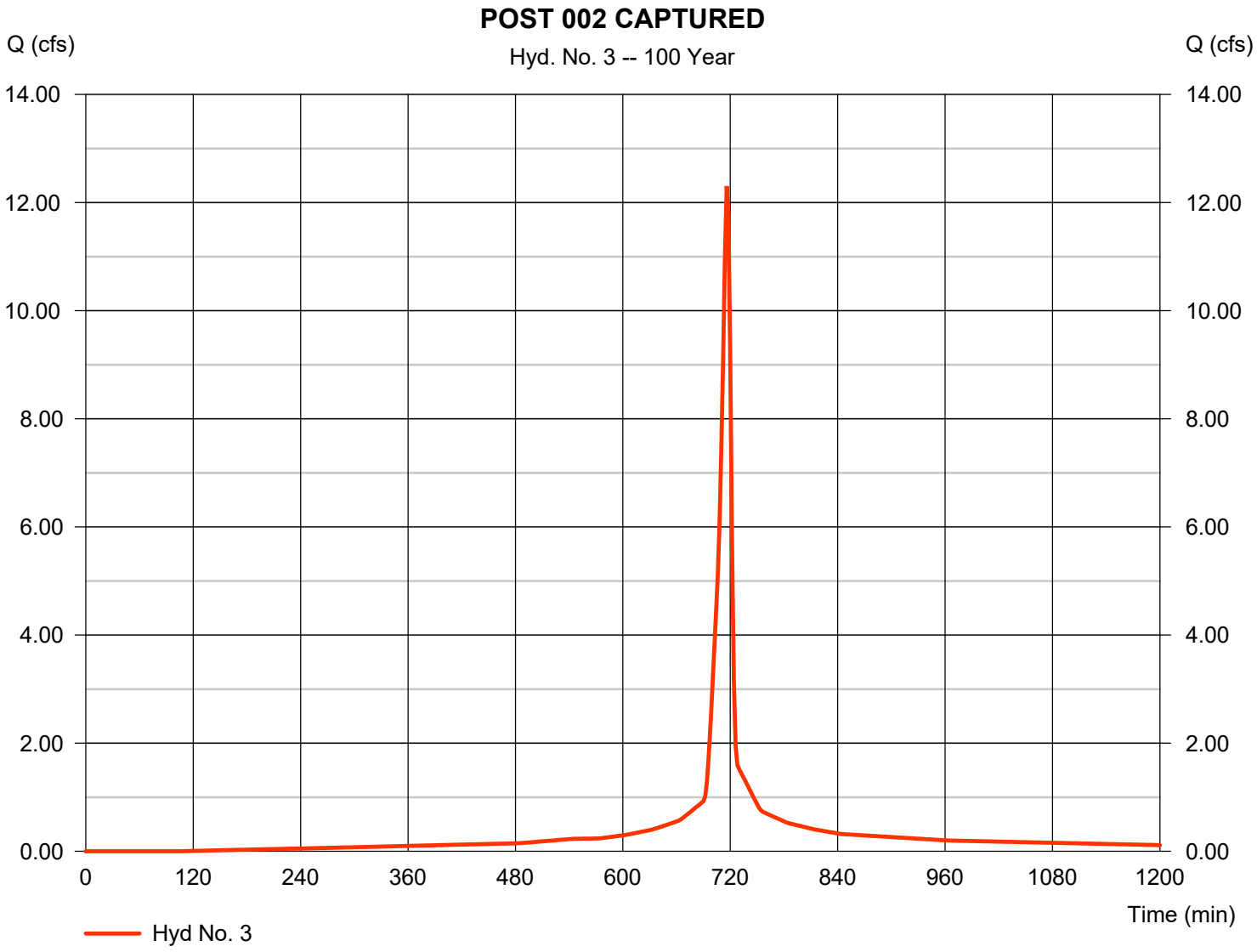
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 3

POST 002 CAPTURED

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.31 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	28,166 cuft
Drainage area	=	1.206 ac	Curve number	=	93.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	6.00 min
Total precip.	=	7.65 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Report

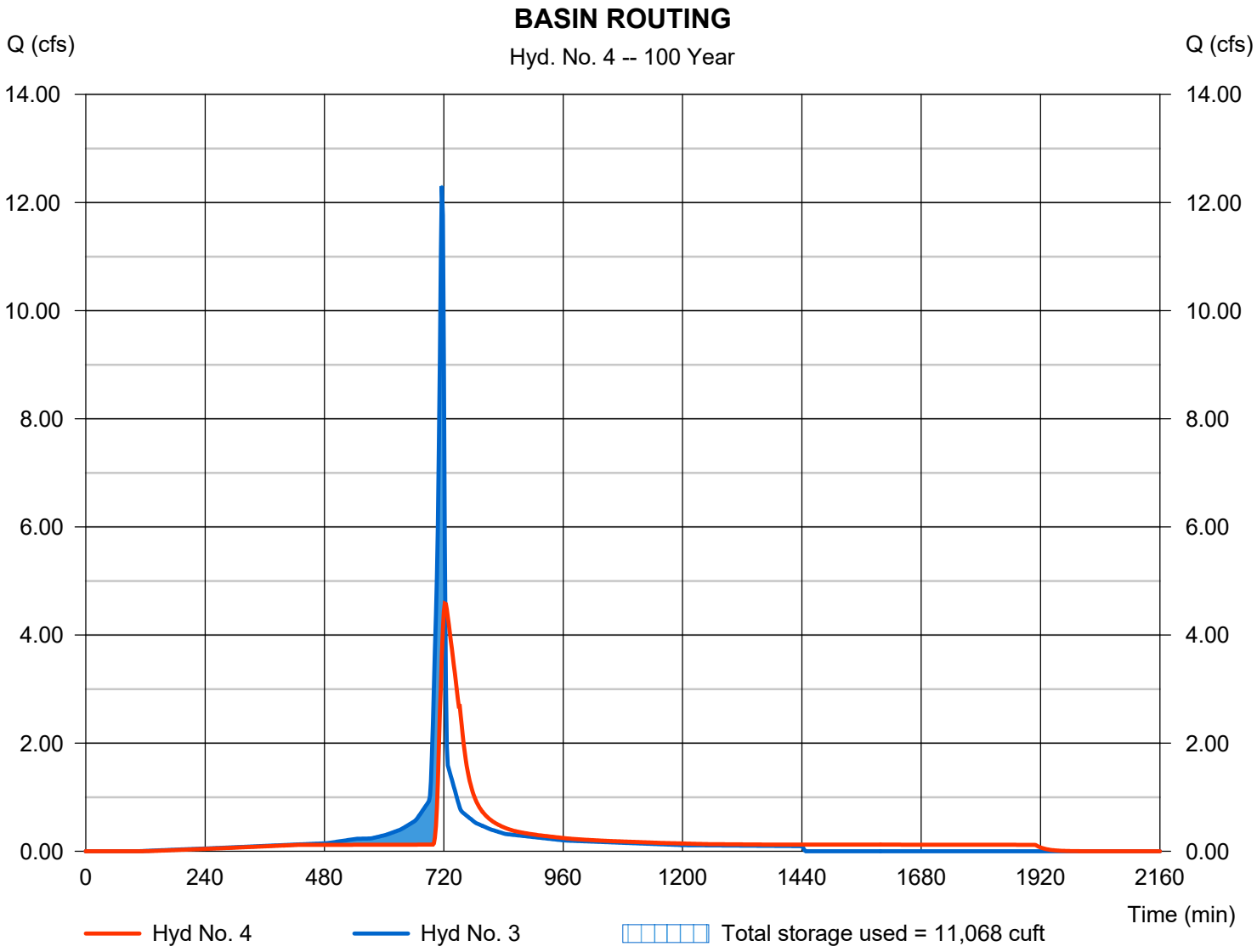
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 05 / 17 / 2023

Hyd. No. 4

BASIN ROUTING

Hydrograph type	= Reservoir	Peak discharge	= 4.583 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 28,165 cuft
Inflow hyd. No.	= 3 - POST 002 CAPTURED	Max. Elevation	= 289.01 ft
Reservoir name	= BASIN	Max. Storage	= 11,068 cuft

Storage Indication method used. Outflow includes exfiltration.

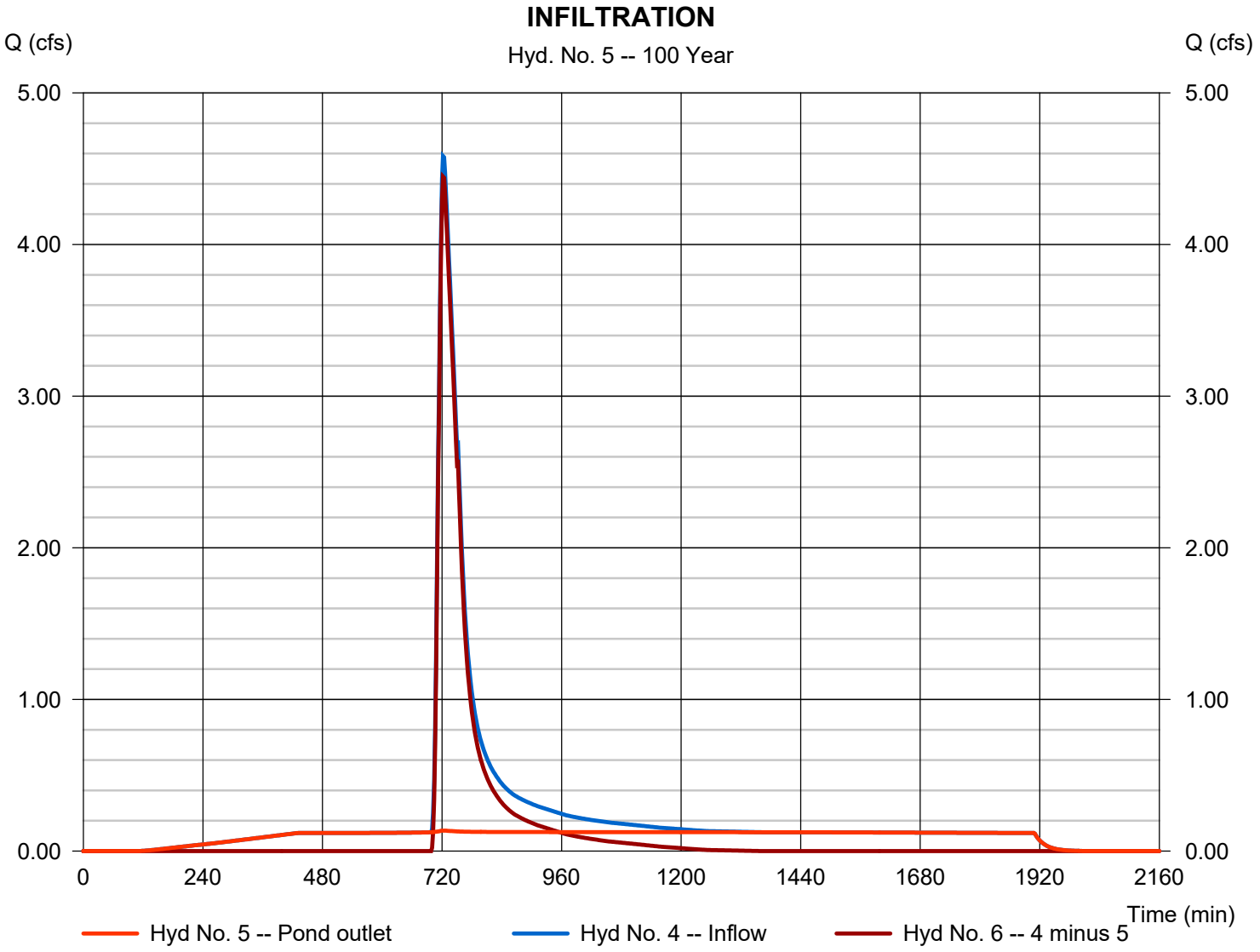


Hydrograph Report

Hyd. No. 5

INFILTRATION

Hydrograph type	= Diversion1	Peak discharge	= 0.135 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 12,176 cuft
Inflow hydrograph	= 4 - BASIN ROUTING	2nd diverted hyd.	= 6
Diversion method	= Pond - BASIN	Pond structure	= Exfiltration

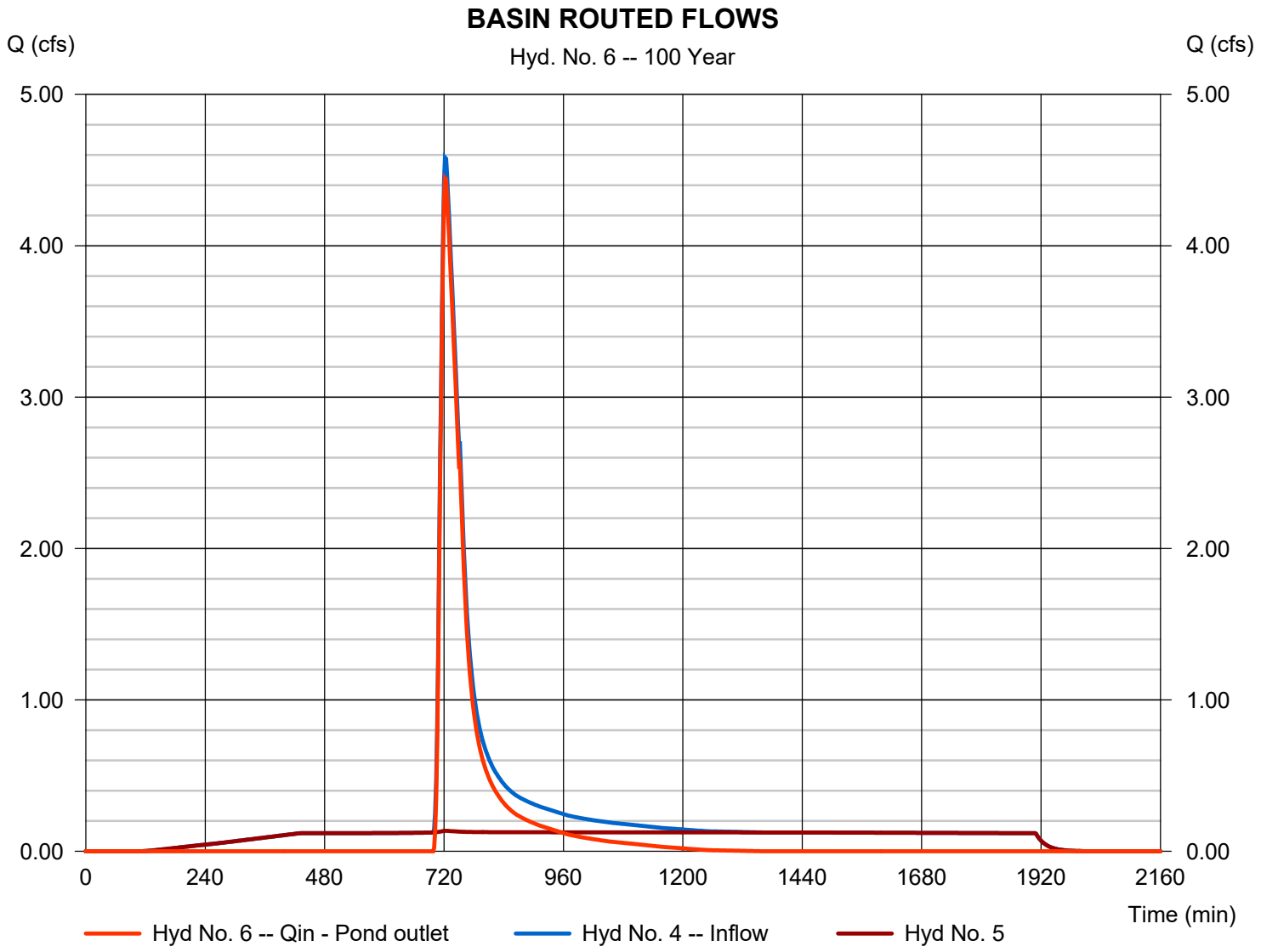


Hydrograph Report

Hyd. No. 6

BASIN ROUTED FLOWS

Hydrograph type	= Diversion2	Peak discharge	= 4.447 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 15,989 cuft
Inflow hydrograph	= 4 - BASIN ROUTING	2nd diverted hyd.	= 5
Diversion method	= Pond - BASIN	Pond structure	= Exfiltration

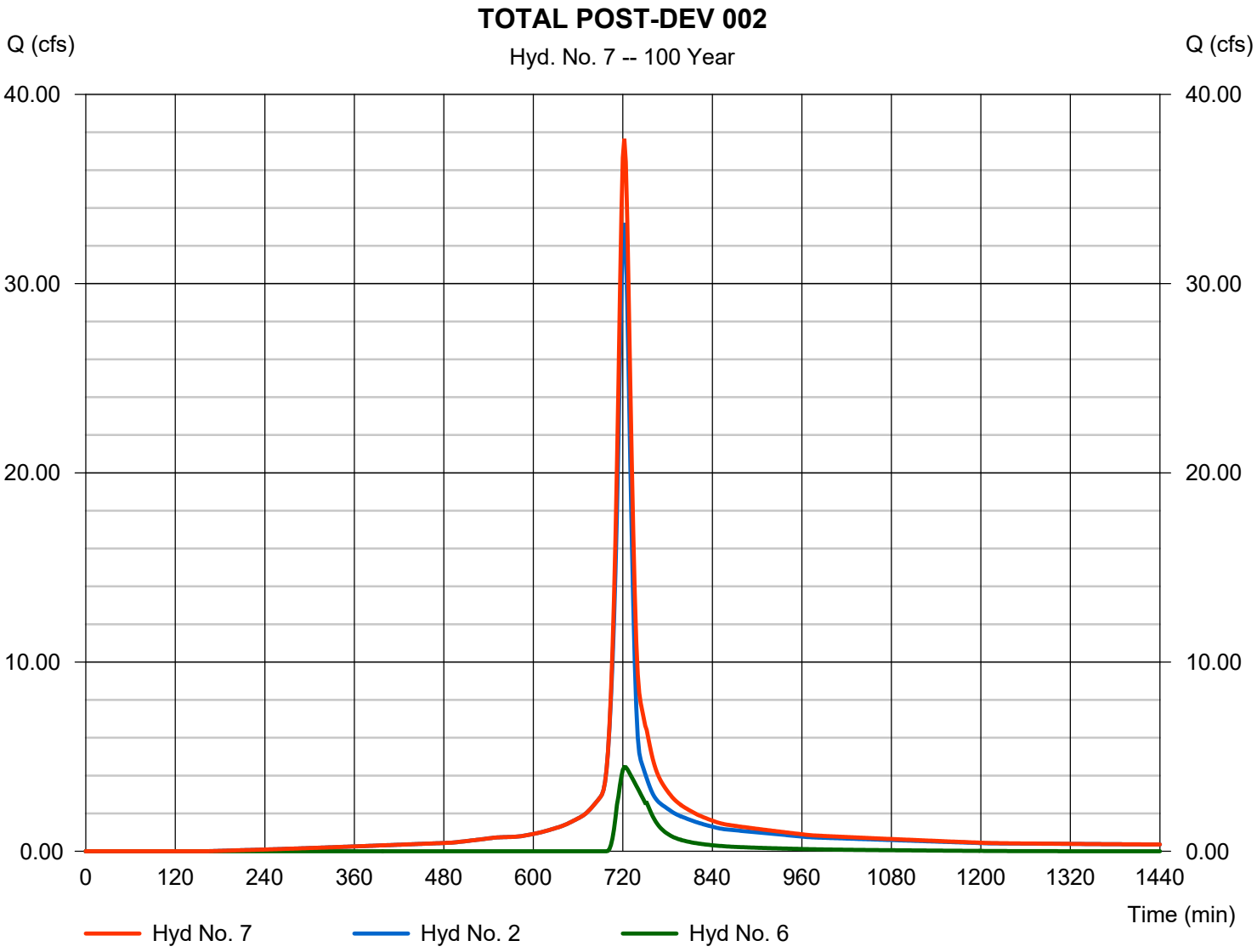


Hydrograph Report

Hyd. No. 7

TOTAL POST-DEV 002

Hydrograph type	= Combine	Peak discharge	= 37.66 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 115,758 cuft
Inflow hyds.	= 2, 6	Contrib. drain. area	= 4.347 ac



E. VOLUME CONTROL CALCULATIONS

DISCHARGE POINT 001

Volume Management

Project: Upper Dublin Township

Instructions | General | *Volume* | Rate | Quality

2-Year / 24-Hour Storm Event (NOAA Atlas 14): **3.28** inches

Alternative 2-Year / 24-Hour Storm Event _____ inches

Alternative Source: _____

Pre-Construction Conditions: *No. Rows:* **4** ☐ *Exempt from Meadow in Good Condition* ☑ *Automatically Calculate CN, Ia, Runoff and Volume*

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Pervious as Meadow	0.00	B	58	1.448	0.37	3
Pervious as Meadow	1.16	C	71	0.817	0.93	3,888
Impervious as Meadow	0.44	C	71	0.817	0.93	1,473
Impervious Areas: Institutional	1.75	C	98	0.041	3.05	19,402
TOTAL (ACRES):	**3.35**				**TOTAL (CF):**	**24,766**

Post-Construction Conditions: *No. Rows:* **3**

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	0.00	B	61	1.279	0.48	3
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	1.41	C	74	0.703	1.09	5,562
Impervious Areas: Institutional	1.66	C	98	0.041	3.05	18,384
TOTAL (ACRES):	**3.07**				**TOTAL (CF):**	**23,949**

NET CHANGE IN VOLUME TO MANAGE (CF): -816

Non-Structural BMP Volume Credits:

☐ Tree Planting Credit

☐ Other (attach calculations):

Structural BMP Volume Credits: *No. Structural BMPs:* 1 *Start BMP Numbering at:* 1

DP No.	BMP No.	BMP Name	MRC?	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegeta-ted?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
001	1	Water Quality Filters & Hydrodynamic Devices	-	Off-Site	0.95	9,331								
												Totals:		

INFILTRATION & ET CREDITS (CF):

NET CHANGE IN VOLUME TO MANAGE (CF): -816

TOTAL CREDITS (CF):

VOLUME REQUIREMENT SATISFIED

Terraform Engineering, LLC

JOB # 23015
DATE: 5/15/23
REVISED:

PROJECT: UPPER DUBLIN TWP BUILDING
LOCATION: UPPER DUBLIN TWP
COUNTY: MONTGOMERY

100 YR / 24 HR ANALYSIS OF RUNOFF VOLUME

PER DEP / BEST MANAGEMENT PRACTICES

$$Q = Pe = \frac{(P - Ia)^2}{P + .8S}$$

$S = 1000 / CN - 10$

$Ia = .2S$

$P =$ 3.28 inches

POST-DEVLOPMENT MH 4 SNOUT BMP ID 1 (ALL DISTURBED AREAS)

	ACRES	CN
IMPERVIOUS	0.786	98
LAWN (C)	0.159	74

$S_{IMP} =$ 1000 / 98 - 10 = 0.20

$Q_{IMP} = P_e =$ $\frac{(3.28 - .2 \times 0.2)^2}{(3.28 + .8 \times 0.2)}$

$P_{e\ IMP} =$ 3.05 inches

$Volume_{IMP} = P_e \times Area =$ 8,702.20 FT^3

0.1998 ACRE FT

$S_{LAWN\ (C)} =$ 1000 / 74 - 10 = 3.51

$Q_{LAWN\ (C)} = P_e =$ $\frac{(3.28 - .2 \times 3.51)^2}{(3.28 + .8 \times 3.51)}$

$P_{e\ LAWN\ (C)} =$ 1.09 inches

$Volume_{LAWN\ (C)} = P_e \times Area =$ 629.12 FT^3

0.0144 ACRE FT

Total 2 Year Volume Into Basin = 9,331 FT3 0.214 AC-FT

DISCHARGE POINT 002

Volume Management

Project: Upper Dublin Township

Instructions | General | *Volume* | Rate | Quality

2-Year / 24-Hour Storm Event (NOAA Atlas 14): **3.28** inches

Alternative 2-Year / 24-Hour Storm Event [ ] inches

Alternative Source: [ ]

Pre-Construction Conditions: *No. Rows:* **3** ☐ *Exempt from Meadow in Good Condition* ☑ *Automatically Calculate CN, Ia, Runoff and Volume*

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Pervious as Meadow	1.00	C	71	0.817	0.93	3,377
Impervious as Meadow	0.42	C	71	0.817	0.93	1,416
Impervious Areas: Institutional	1.69	C	98	0.041	3.05	18,649
TOTAL (ACRES):	**3.11**				**TOTAL (CF):**	**23,442**

Post-Construction Conditions: *No. Rows:* **3**

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	0.00	B	61	1.279	0.48	2
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	0.90	C	74	0.703	1.09	3,579
Impervious Areas: Institutional	2.49	C	98	0.041	3.05	27,510
TOTAL (ACRES):	**3.39**				**TOTAL (CF):**	**31,090**

NET CHANGE IN VOLUME TO MANAGE (CF): **7,648**

Non-Structural BMP Volume Credits:

☐ Tree Planting Credit

☐ Other (attach calculations):

Structural BMP Volume Credits: *No. Structural BMPs:* **1** *Start BMP Numbering at:* **2**

DP No.	BMP No.	BMP Name	MRC?	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegeta-ted?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
002	2	Infiltration Basin	-	Off-Site	1.21	11,879	9,017	0.57	22	No	1.0	3,341	**7,967**	
												Totals:	**7,967**	

INFILTRATION & ET CREDITS (CF): **7,967**

NET CHANGE IN VOLUME TO MANAGE (CF): **7,648**

TOTAL CREDITS (CF): **7,967**

VOLUME REQUIREMENT SATISFIED

Terraform Engineering, LLC

JOB # 23015
DATE: 4/21/23
REVISED:

PROJECT: UPPER DUBLIN TWP BUILDING
LOCATION: UPPER DUBLIN TWP
COUNTY: MONTGOMERY

100 YR / 24 HR ANALYSIS OF RUNOFF VOLUME

PER DEP / BEST MANAGEMENT PRACTICES

$$Q = Pe = \frac{(P - Ia)^2}{P + .8S}$$

$S = 1000 / CN - 10$

$Ia = .2S$

$P =$ 3.28 inches

POST-DEVLOPMENT TO BASIN BMP ID 2 (ALL AREAS DISTURBED)

	ACRES	CN
IMPERVIOUS	0.999	98
LAWN (C)	0.207	74

$S_{IMP} =$ $1000 / 98 - 10 =$ 0.20

$Q_{IMP} = P_e =$ $\frac{(3.28 - .2 \times 0.2)^2}{(3.28 + .8 \times 0.2)}$

$P_{e\ IMP} =$ 3.05 inches

$Volume_{IMP} = P_e \times Area =$ 11,060.43 FT^3

0.2539 ACRE FT

$S_{LAWN\ (C)} =$ $1000 / 74 - 10 =$ 3.51

$Q_{LAWN\ (C)} = P_e =$ $\frac{(3.28 - .2 \times 3.51)^2}{(3.28 + .8 \times 3.51)}$

$P_{e\ LAWN\ (C)} =$ 1.09 inches

$Volume_{LAWN\ (C)} = P_e \times Area =$ 819.04 FT^3

0.0188 ACRE FT

Total 2 Year Volume Into Basin = 11,879 FT3 0.273 AC-FT

INFILTRATION CALCULATIONS

INFILTRATION CALCULATIONS ARE PROVIDED AS REQUIRED BY NPDES PERMITTING FOR THE 2 YEAR STORM EVENT

UPPER DUBLIN TWP AREA 002 VOLUME CONTROL REQUIREMENT

EXISTING CONDITION VOLUME = 23,442 CF
PROPOSED CONDITION VOLUME = 31,090 CF
DIFFERENCE = **7,648** CF

INFILTRATION/DETENTION BASIN (BMP ID 2)

INFILTRATION DURING STORM = **8598** CF (SEE HYDROGRAPH SHEET FOR 2 YR STORM)

INFILTRATION/DETENTION BASIN 1

BOTTOM AREA = 9017 SF

SOIL TEST DATA

6 TESTS WERE PERFORMED PER EEI INFILTRATION LETTER

DR101-A = 1.50 IN/HR
DR-101B = 1.25 IN/HR
DR-102A = 0.75 IN/HR
DR-102B = 0.50 IN/HR
DR-103A= 2.00
DR-103B= 1.50
GEOMEAN= 1.132 IN/HR

USE A SAFETY FACTOR OF 2 ON INFILTRATION RATE

INFILTRATION RATE = 0.57 IN/HR

INFILT. BED DEWATERING TIME (HR) = 22.5 (VOLUME/BOTTOM AREA*INFILTRATION RATE)

F. WATER QUALITY ANALYSIS

DISCHARGE POINT 001

Water Quality

Project: Upper Dublin Township

PRINT

Instructions | General | Volume | Rate | *Quality*

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Pervious as Meadow	Grassland/Herbaceous	0.00	B	3	48.8	0.22	2.30	0.01	0.00	0.00
Pervious as Meadow	Grassland/Herbaceous	1.16	C	3,888	48.8	0.22	2.30	11.85	0.05	0.56
Impervious as Meadow	Grassland/Herbaceous	0.44	C	1,473	48.8	0.22	2.30	4.49	0.02	0.21
Impervious Areas: Institutional	Institutional	1.75	C	19,402	67.5	0.14	1.21	81.76	0.17	1.47
	TOTAL (ACRES):	**3.35**					**TOTALS:**	**98.11**	**0.24**	**2.24**

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	0.00	B	3	78.0	0.25	1.25	0.02	0.00	0.00

Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	1.41	C	5,562	78.0	0.25	1.25	27.09	0.09	0.43
Impervious Areas: Institutional	Institutional	1.66	C	18,384	67.5	0.14	1.21	77.47	0.16	1.39
	TOTAL (ACRES):	**3.07**					**TOTALS:**	**104.58**	**0.25**	**1.82**

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS):	**6.47**	**0.00**	**0.00**

☐ **Characterize Undetained Areas (for Untreated Stormwater)**

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)

Non-Structural BMP Water Quality Credits:

☐ Pervious Undetained Area Credit

☐ Other (attach calculations)

Structural BMP Water Quality Credits:

☐ *Use default BMP Outflows and Median BMP Outflow Concentrations*

DP No.	BMP No.	BMP Name	MRC?	BMP DA (acres)	Vol. Routed to BMP (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN
001	1	Water Quality Filters & Hydrodynamic Devices	-	0.95	9,331			9,331	40.92	0.147	1.21	23.84	0.09	0.71

	TSS	TP	TN
POLLUTANT LOADS FROM STRUCTURAL BMP (TREATED) OUTFLOWS (LBS):	**23.84**	**0.09**	**0.71**
POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):	**63.84**	**0.15**	**1.11**

NON-STRUCTURAL BMP WATER QUALITY CREDITS (LBS):			
NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):	**87.68**	**0.24**	**1.82**
POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):	**98.11**	**0.24**	**2.24**

WATER QUALITY REQUIREMENT SATISFIED

CERTIFICATION

I certify under penalty of law and subject to the penalties of 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify that the structure, function, and calculations contained in this spreadsheet have not been modified in comparison to the spreadsheet DEP has posted to its website or, if modifications were made, an explanation of the modifications made is attached to this spreadsheet.

Justin Massie	5/15/2023
Spreadsheet User Name	Date

DISCHARGE POINT 002

Water Quality

Project: Upper Dublin Township

PRINT

Instructions | General | Volume | Rate | *Quality*

Pre-Construction Pollutant Loads:

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Pervious as Meadow	Grassland/Herbaceous	1.00	C	3,377	48.8	0.22	2.30	10.29	0.05	0.48
Impervious as Meadow	Grassland/Herbaceous	0.42	C	1,416	48.8	0.22	2.30	4.31	0.02	0.20
Impervious Areas: Institutional	Institutional	1.69	C	18,649	67.5	0.14	1.21	78.59	0.16	1.41
	TOTAL (ACRES):	**3.11**					**TOTALS:**	**93.20**	**0.23**	**2.10**

Post-Construction Pollutant Loads (without BMPs):

Land Cover (from Volume Worksheet)	Land Cover for Water Quality	Area (acres)	Soil Group	Runoff Volume (cf)	Pollutant Conc. (mg/L)			Pollutant Loads (lbs)		
					TSS	TP	TN	TSS	TP	TN
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	0.00	B	2	78.0	0.25	1.25	0.01	0.00	0.00
Open Space (Lawns, Parks, Golf Courses, Cemeteries, Etc.) - Good Condition (Grass Cover > 75%)	Open Space	0.90	C	3,579	78.0	0.25	1.25	17.43	0.06	0.28

Impervious Areas: Institutional	Institutional	2.49	C	27,510	67.5	0.14	1.21	115.93	0.24	2.08
	TOTAL (ACRES):	**3.39**					**TOTALS:**	**133.37**	**0.30**	**2.36**

POLLUTANT LOAD REDUCTION REQUIREMENTS (LBS):	**40.17**	**0.07**	**0.26**

☐ **Characterize Undetained Areas (for Untreated Stormwater)**

Land Cover	Area (acres)	Soil Group	CN	Ia (in)	Q Runoff (in)	Runoff Volume (cf)

Non-Structural BMP Water Quality Credits:

☐ Pervious Undetained Area Credit

☐ Other (attach calculations)

Structural BMP Water Quality Credits:

☐ *Use default BMP Outflows and Median BMP Outflow Concentrations*

DP No.	BMP No.	BMP Name	MRC?	BMP DA (acres)	Vol. Routed to BMP (CF)	Inf. & ET Credits (CF)	Capture & Buffer Credits (CF)	Outflow (CF)	Outflow Conc. (mg/L)			Pollutant Loads (lbs)		
									TSS	TP	TN	TSS	TP	TN
002	2	Infiltration Basin	-	1.21	11,879	7,967		3,912	10	0.148	0.96	2.44	0.04	0.23

	TSS	TP	TN
POLLUTANT LOADS FROM STRUCTURAL BMP (TREATED) OUTFLOWS (LBS):	**2.44**	**0.04**	**0.23**
POLLUTANT LOADS FROM UNTREATED STORMWATER (LBS):	**82.41**	**0.18**	**1.46**
NON-STRUCTURAL BMP WATER QUALITY CREDITS (LBS):			
NET POLLUTANT LOADS FROM SITE, POST-CONSTRUCTION (LBS):	**84.85**	**0.22**	**1.69**
POLLUTANT LOADS FROM SITE, PRE-CONSTRUCTION (LBS):	**93.20**	**0.23**	**2.10**

CERTIFICATION

I certify under penalty of law and subject to the penalties of 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I further certify that the structure, function, and calculations contained in this spreadsheet have not been modified in comparison to the spreadsheet DEP has posted to its website or, if modifications were made, an explanation of the modifications made is attached to this spreadsheet.

Justin Massie	5/15/2023
Spreadsheet User Name	Date

G. COLLECTION AND CONVEYANCE SYSTEM DESIGN

Terraform Engineering, LLC

SUBAREAS COEFFICIENTS AND SURFACE FLOWS

PROJECT: **UPPER DUBLIN TWP BLDG**

LOCATION: UPPER DUBLIN TWP

COUNTY: MONTGOMERY

* RAINFALL REGION **V**

DESIGN STORM **100** YR FREQUENCY

JOB # **23015**

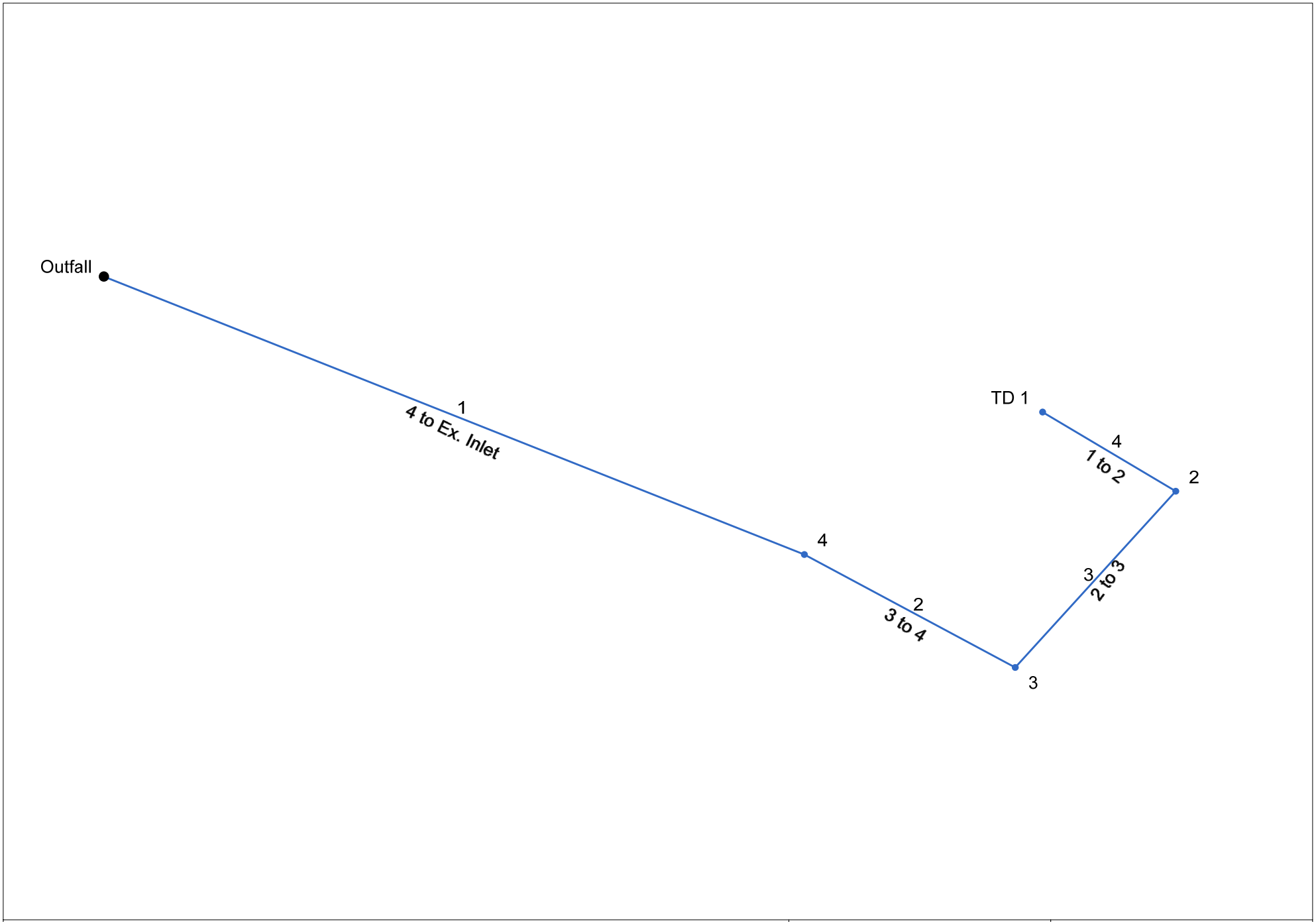
DATE 5/19/2023

REVISED:

POST-DEVELOPMENT CONDITIONS

INLET #	TYPE						AREA	COMP.	C X A	Tc (Min.)			IND. Q		COMMENTS
COVER TYPE		IMP	LAWN				(Acres)	C	INC.	IND.	T_T	S	I (in./hr.)	Q (cfs)	
C COEFFICIENTS		0.95	0.35												
TD 1	TD	0.544	0.159				0.703	0.81	0.572	5		5.0	8.19	4.68	
MH 3	MH	0.255					0.255	0.95	0.242	5		5.0	8.19	1.98	
INLET 5	C	0.193	0.013				0.206	0.91	0.188	5		5.0	8.19	1.54	
INLET 6	C	0.288					0.288	0.95	0.274	5		5.0	8.19	2.24	
INLET 7	C	0.363					0.363	0.95	0.345	5		5.0	8.19	2.83	
INLET 8	C	0.114					0.114	0.95	0.108	5		5.0	8.19	0.88	
INLET 9	C	0.130	0.047				0.177	0.79	0.140	5		5.0	8.19	1.15	
INLET 10	C	0.060	0.159				0.219	0.52	0.113	5		5.0	8.19	0.93	
INLET 11	C	0.070					0.070	0.95	0.067	5		5.0	8.19	0.54	
INLET 12	C	0.013					0.013	0.95	0.012	5		5.0	8.19	0.10	

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: TD1 to Ex Inlet.stm	Number of lines: 4	Date: 5/16/2023

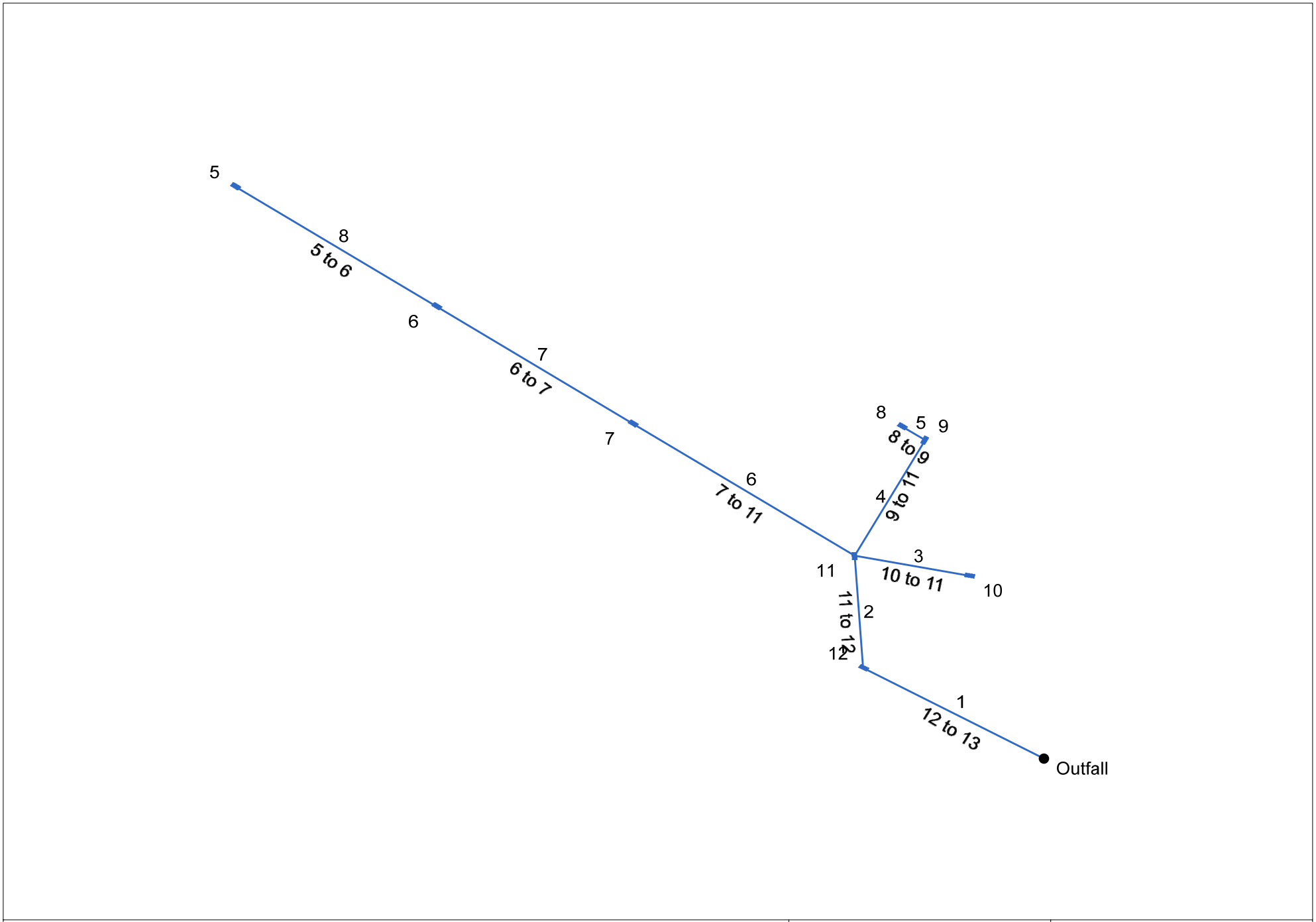
Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	313.643	0.00	0.96	0.00	0.00	0.81	0.0	6.1	7.9	6.39	7.00	5.21	15	1.00	269.58	272.72	271.39	273.97	275.26	279.84	4 to Ex. Inlet
2	1	101.643	0.26	0.96	0.95	0.25	0.81	5.0	5.8	7.9	6.47	7.01	6.25	15	1.00	273.66	274.68	274.61	275.70	279.84	280.00	3 to 4
3	2	108.965	0.00	0.70	0.00	0.00	0.57	0.0	5.3	8.1	4.59	4.92	4.56	15	0.50	274.78	275.32	275.74	276.28	280.00	279.06	2 to 3
4	3	66.553	0.70	0.70	0.81	0.57	0.57	5.0	5.0	8.2	4.64	4.93	3.99	15	0.50	275.42	275.75	276.60	276.83	279.06	278.75	1 to 2

Project File: TD1 to Ex Inlet.stm | Number of lines: 4 | Run Date: 5/17/2023

NOTES:Intensity = 84.09 / (Inlet time + 15.40) ^ 0.77; Return period =Yrs. 100 ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: INL 5 to INL 13.stm	Number of lines: 8	Date: 5/16/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	88.148	0.01	1.45	0.95	0.01	1.25	5.0	8.5	7.2	9.03	11.37	6.15	18	1.00	273.31	274.19	274.47	275.35	280.73	280.65	12 to 13
2	1	57.567	0.07	1.44	0.95	0.07	1.24	5.0	8.3	7.3	9.01	11.42	6.44	18	1.01	274.29	274.87	275.35	276.03	280.65	279.30	11 to 12
3	2	48.700	0.22	0.22	0.52	0.11	0.11	5.0	5.0	8.2	0.94	7.99	2.95	18	0.49	276.47	276.71	276.82	277.07	279.30	279.71	10 to 11
4	2	66.054	0.18	0.29	0.79	0.14	0.25	5.0	5.4	8.1	1.99	11.37	4.19	18	1.00	275.85	276.51	276.27	277.04	279.30	279.65	9 to 11
5	4	11.958	0.11	0.11	0.95	0.10	0.10	5.0	5.0	8.2	0.86	11.40	2.42	18	1.00	276.61	276.73	277.04	277.07	279.65	279.73	8 to 9
6	2	114.190	0.36	0.86	0.95	0.34	0.81	5.0	7.8	7.4	6.00	8.04	4.79	18	0.50	274.97	275.54	276.03	276.49	279.30	279.35	7 to 11
7	6	101.333	0.29	0.50	0.95	0.28	0.47	5.0	7.0	7.6	3.56	8.07	3.47	18	0.50	275.64	276.15	276.69	276.87	279.35	279.45	6 to 7
8	7	103.661	0.21	0.21	0.91	0.19	0.19	5.0	5.0	8.2	1.56	8.06	2.79	18	0.50	276.25	276.77	276.87	277.24	279.45	279.77	5 to 6

Project File: INL 5 to INL 13.stm | Number of lines: 8 | Run Date: 5/16/2023

NOTES:Intensity = 84.09 / (Inlet time + 15.40) ^ 0.77; Return period =Yrs. 100 ; c = cir e = ellip b = box

Terraform Engineering, LLC

SUBAREAS COEFFICIENTS AND SURFACE FLOWS

PROJECT: **UPPER DUBLIN TWP BLDG**

LOCATION: UPPER DUBLIN TWP

COUNTY: MONTGOMERY

* RAINFALL REGION **V**

DESIGN STORM **100** YR FREQUENCY

JOB # **23015**

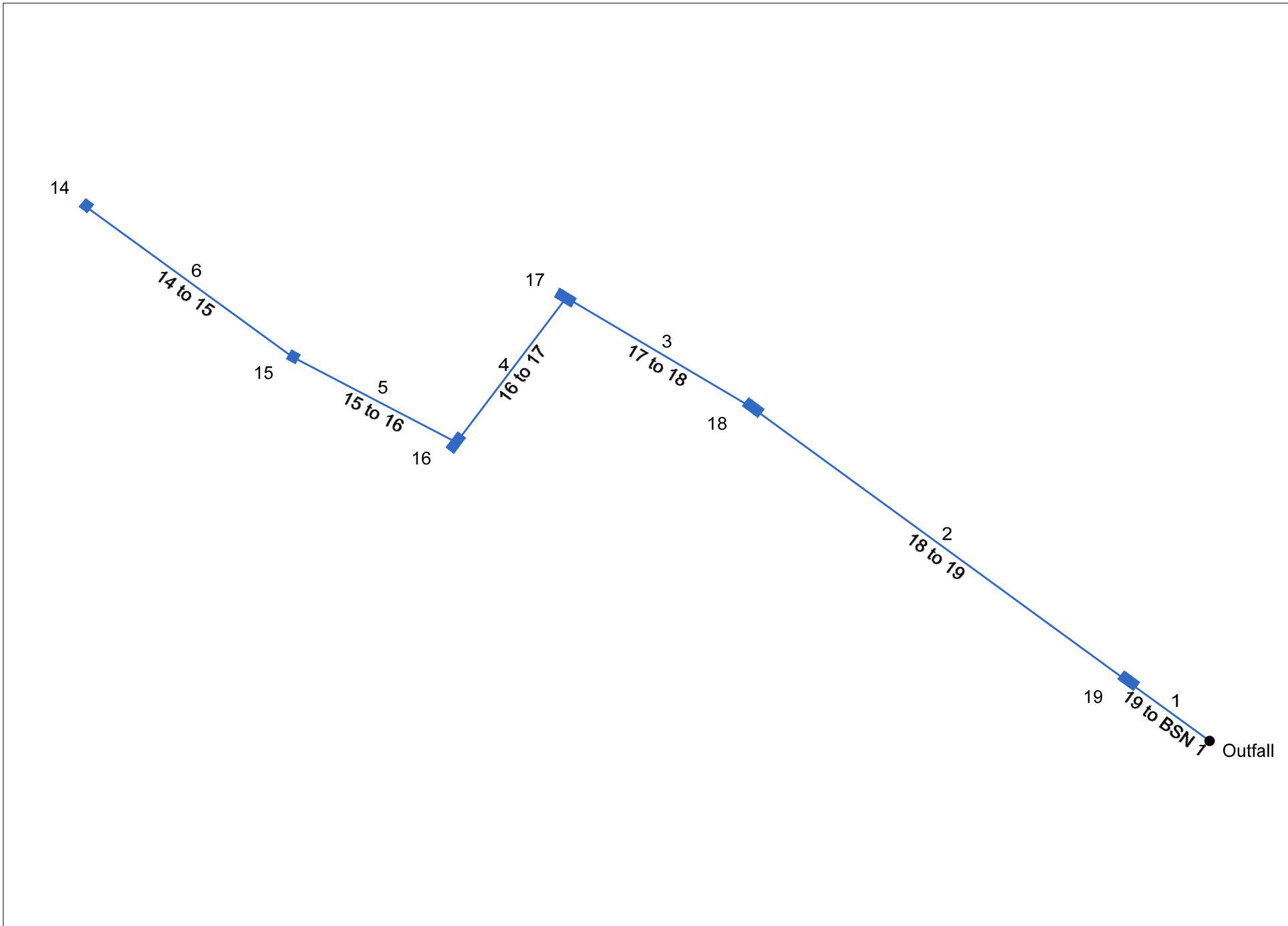
DATE 5/19/2023

REVISED:

POST-DEVELOPMENT CONDITIONS

INLET #	TYPE						AREA	COMP.	C X A	Tc (Min.)			IND. Q		COMMENTS
COVER TYPE		IMP	LAWN				(Acres)	C	INC.	IND.	T_T	S	I (in./hr.)	Q (cfs)	
C COEFFICIENTS		0.95	0.35												
YD 14	YD	0.127					0.127	0.95	0.121	5		5.0	8.19	0.99	
YD 15	YD	0.026					0.026	0.95	0.025	5		5.0	8.19	0.20	
INLET 16	C	0.208	0.021				0.229	0.90	0.205	5.0		5.0	8.19	1.68	
INLET 17	C	0.025	0.004				0.029	0.86	0.025	5		5.0	8.19	0.20	
INLET 18	C	0.069	0.007				0.076	0.89	0.068	5		5.0	8.19	0.56	
INLET 19	C	0.063	0.006				0.069	0.90	0.062	5		5.0	8.19	0.51	
INLET 20	C	0.101	0.020				0.121	0.85	0.103	5		5.0	8.19	0.84	
INLET 21	C	0.075	0.013				0.088	0.86	0.076	5		5.0	8.19	0.62	
INLET 22	C	0.316	0.108				0.424	0.80	0.338	5		5.0	8.19	2.77	
INLET 23	M		0.178				0.178	0.35	0.062	5		5.0	8.19	0.51	
INLET 24	C	0.028					0.028	0.95	0.027	5		5.0	8.19	0.22	
INLET 25	C	0.109	0.016				0.125	0.87	0.109	5		5.0	8.19	0.89	
INLET 27	C	0.260	0.097				0.357	0.79	0.281	5		5.0	8.19	2.30	
INLET 28	C	0.064	0.022				0.086	0.80	0.069	5		5.0	8.19	0.57	
INLET 30	C	0.147	0.017				0.164	0.89	0.146	5		5.0	8.19	1.20	

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: YD 14 to BSN 1.stm	Number of lines: 6	Date: 5/16/2023

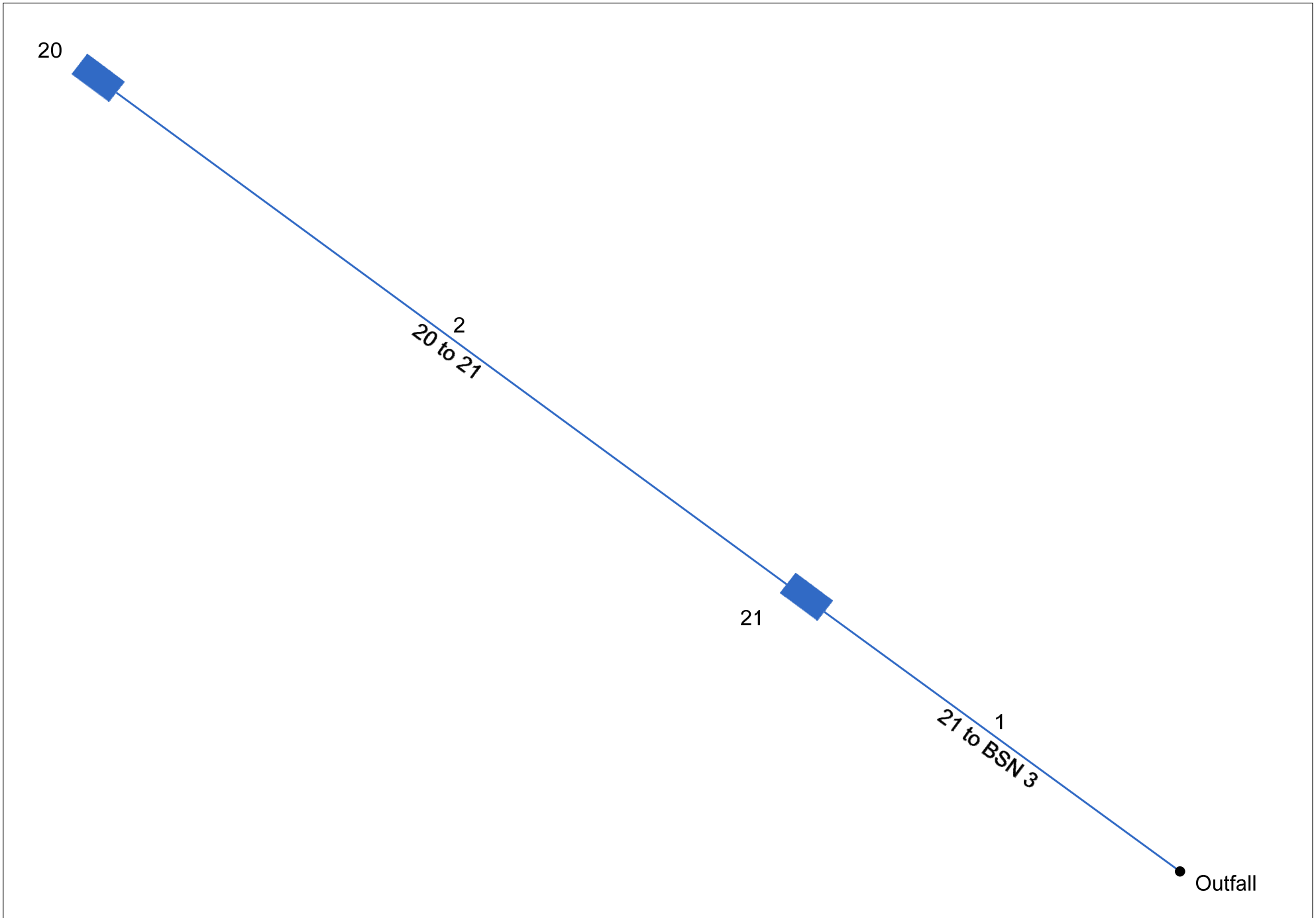
Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	19.771	0.07	0.56	0.90	0.06	0.51	5.0	8.9	7.1	3.61	11.44	2.11	18	1.01	287.49	287.69	289.01	289.02	292.37	292.58	19 to BSN 1
2	1	90.229	0.08	0.49	0.89	0.07	0.44	5.0	8.2	7.3	3.25	8.03	3.08	18	0.50	287.79	288.24	289.06	288.93	292.58	292.51	18 to 19
3	2	42.019	0.03	0.41	0.86	0.02	0.38	5.0	7.8	7.4	2.79	8.04	4.04	18	0.50	288.34	288.55	288.95	289.18	292.51	291.64	17 to 18
4	3	35.385	0.23	0.38	0.90	0.21	0.35	5.0	7.4	7.5	2.64	18.64	4.27	18	2.68	288.65	289.60	289.18	290.22	291.64	292.76	16 to 17
5	4	35.783	0.03	0.15	0.95	0.02	0.15	5.0	6.5	7.7	1.13	11.41	2.56	18	1.01	289.70	290.06	290.22	290.46	292.76	294.50	15 to 16
6	5	50.000	0.13	0.13	0.95	0.12	0.12	5.0	5.0	8.2	0.99	8.04	3.00	18	0.50	291.25	291.50	291.60	291.87	294.50	294.50	14 to 15

Project File: YD 14 to BSN 1.stm | Number of lines: 6 | Run Date: 5/16/2023

NOTES:Intensity = 84.09 / (Inlet time + 15.40) ^ 0.77; Return period =Yrs. 100 ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: INL 20 to BSN 3.stm	Number of lines: 2	Date: 5/16/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	38.001	0.09	0.21	0.86	0.08	0.18	5.0	7.5	7.5	1.34	11.38	3.18	18	1.00	289.00	289.38	289.43	289.81	292.12	292.48	21 to BSN 3
2	1	72.000	0.12	0.12	0.85	0.10	0.10	5.0	5.0	8.2	0.84	11.38	2.84	18	1.00	289.48	290.20	289.81	290.54	292.48	293.19	20 to 21

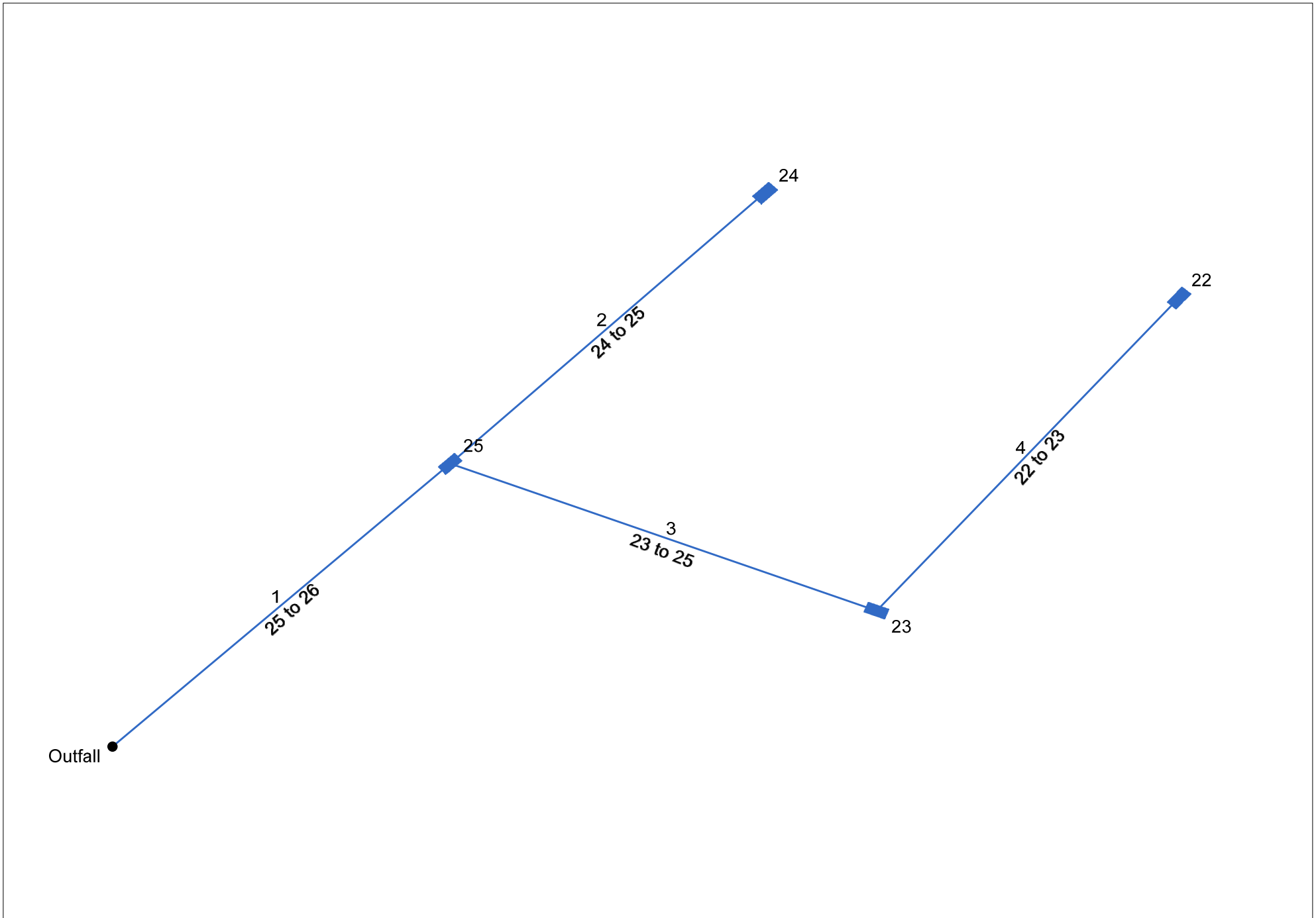
Project File: INL 20 to BSN 3.stm

Number of lines: 2

Run Date: 5/16/2023

NOTES:Intensity = 84.09 / (Inlet time + 15.40) ^ 0.77; Return period =Yrs. 100 ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: INL 22 to INL 26.stm	Number of lines: 4	Date: 5/17/2023

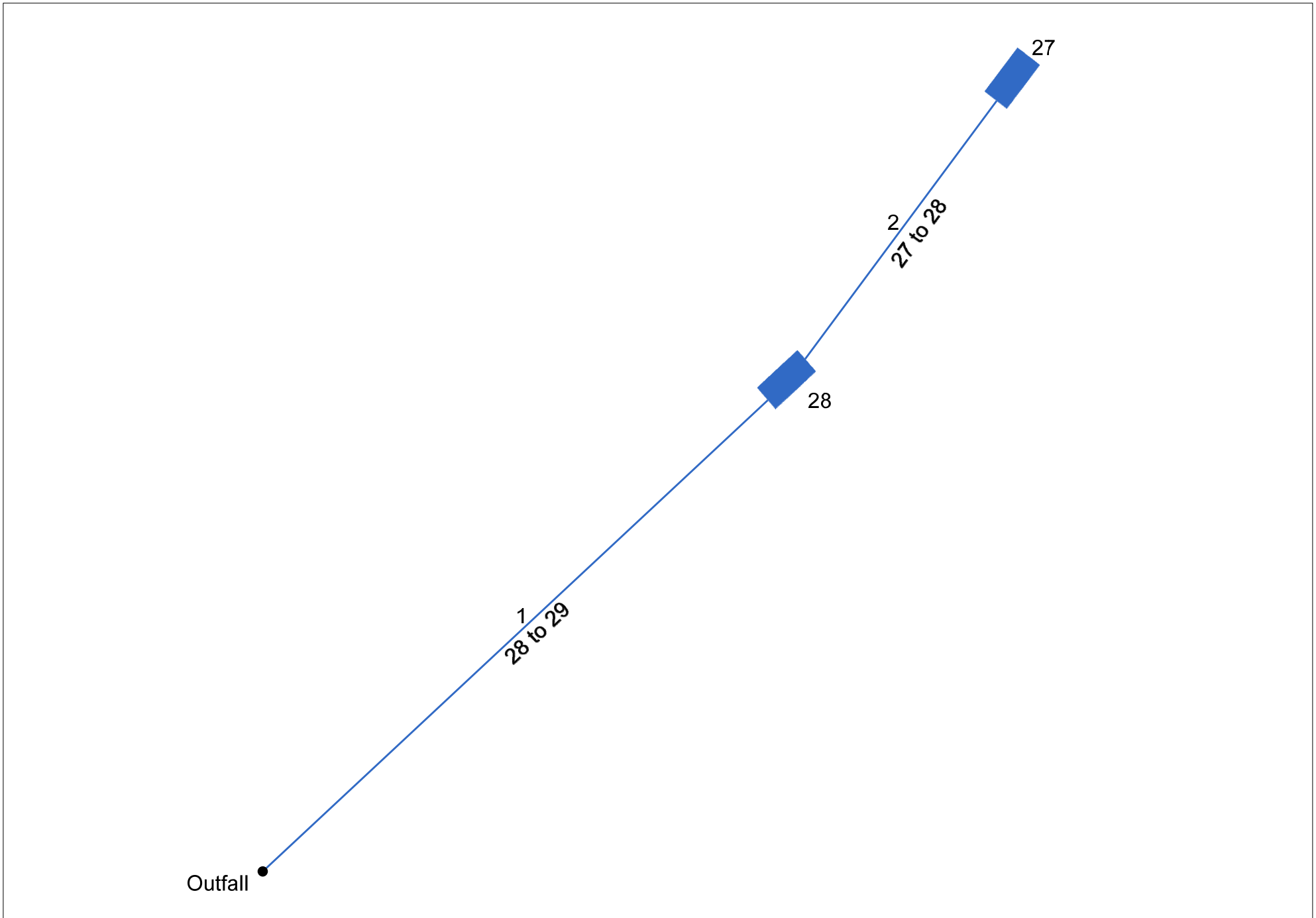
Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	77.806	0.13	0.76	0.87	0.11	0.54	5.0	14.9	6.0	3.23	12.64	4.12	18	1.23	279.57	280.53	280.25	281.21	282.57	284.42	25 to 26
2	1	73.370	0.03	0.03	0.95	0.03	0.03	5.0	5.0	8.2	0.22	11.35	1.14	18	0.99	280.63	281.36	281.21	281.53	284.42	287.47	24 to 25
3	1	77.165	0.18	0.60	0.35	0.06	0.40	5.0	5.8	7.9	3.19	11.36	4.08	18	1.00	280.53	281.30	281.21	281.98	284.42	285.93	23 to 25
4	3	77.550	0.42	0.42	0.80	0.34	0.34	5.0	5.0	8.2	2.78	11.41	4.17	18	1.01	281.40	282.18	281.98	282.81	285.93	289.13	22 to 23

Project File: INL 22 to INL 26.stm | Number of lines: 4 | Run Date: 5/17/2023

NOTES:Intensity = 84.09 / (Inlet time + 15.40) ^ 0.77; Return period =Yrs. 100 ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: INL 27 to INL 29.stm	Number of lines: 2	Date: 5/17/2023

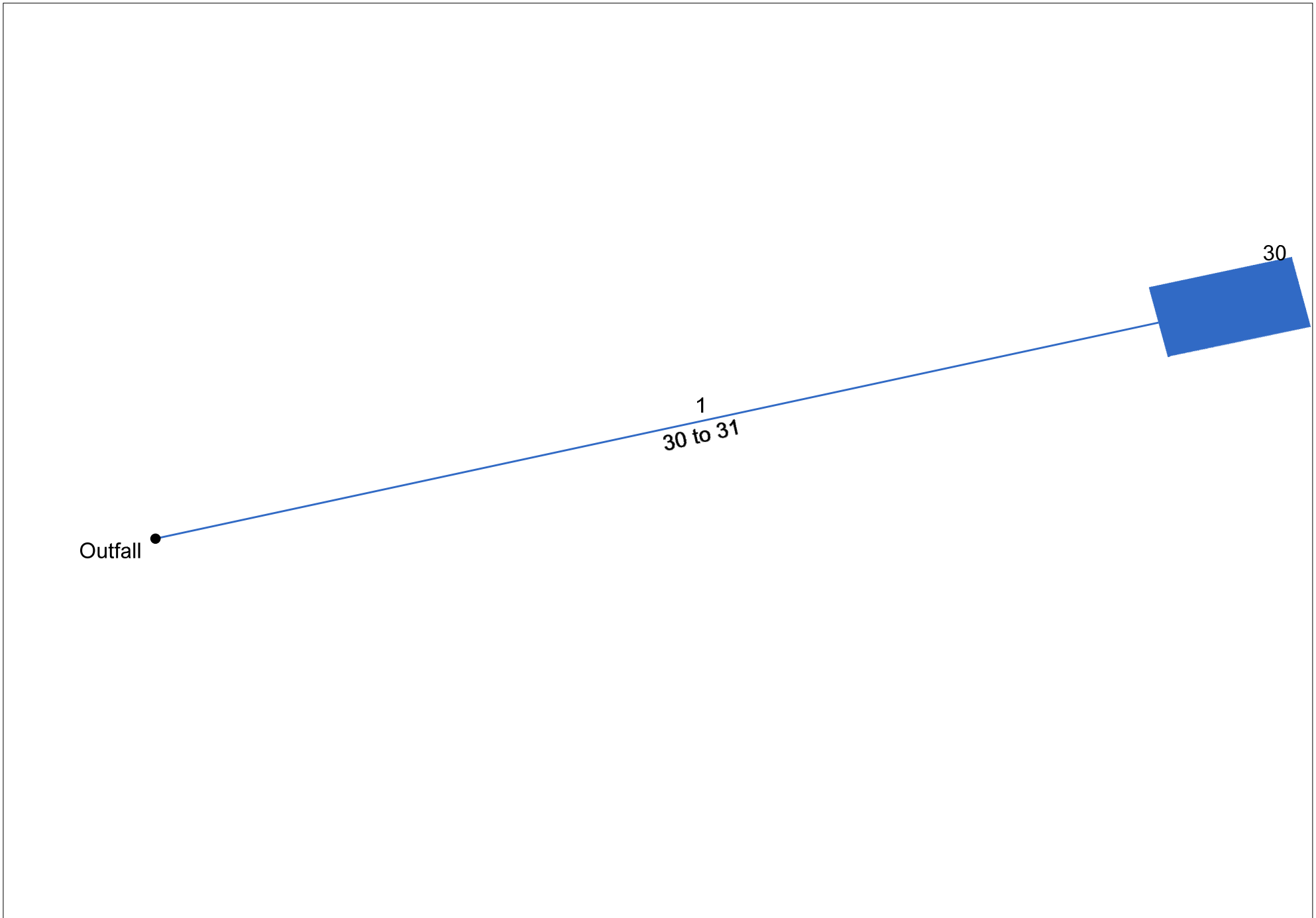
Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	50.056	0.09	0.44	0.80	0.07	0.35	5.0	5.1	8.1	2.85	3.86	4.69	12	1.00	276.36	276.86	277.08	277.58	279.45	279.88	28 to 29
2	1	26.115	0.36	0.36	0.79	0.28	0.28	5.0	5.0	8.2	2.31	3.85	4.38	12	1.00	276.96	277.22	277.58	277.87	279.88	280.14	27 to 28

Project File: INL 27 to INL 29.stm | Number of lines: 2 | Run Date: 5/17/2023

NOTES:Intensity = 84.09 / (Inlet time + 15.40) ^ 0.77; Return period =Yrs. 100 ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: INL 30 to EW 31.stm	Number of lines: 1	Date: 5/19/2023

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	29.101	0.16	0.16	0.89	0.15	0.15	5.0	5.0	8.2	1.19	2.77	3.38	12	0.52	277.34	277.49	277.80	277.95	279.01	279.78	30 to 31

Project File: INL 30 to EW 31.stm | Number of lines: 1 | Run Date: 5/19/2023

NOTES:Intensity = 84.09 / (Inlet time + 15.40) ^ 0.77; Return period =Yrs. 100 ; c = cir e = ellip b = box

H. SOIL TESTING

EARTH ENGINEERING INCORPORATED
Geotechnical Engineers & Geologists

May 9, 2023
EEI Project Number: 35923.01

Mr. Jonathan Bleemer
Upper Dublin Township
370 Commerce Drive
Fort Washington, Pennsylvania 19034
TEL #: 215.643.1600, X3222
JBleemer@UpperDublin.Net

c/o

Mr. Zach Zazo, PMP, CDT, LEED AP
D'HUY Engineering
One East Broad Street
Bethlehem, Pennsylvania 18018
TEL #: 610.865.3000
ZSZ@DHUY.com

Re: Infiltration Investigation Summary Letter
UDT – Admin. & Police Garage
Upper Dublin Township,
Montgomery County, Pennsylvania

Dear Mr. Bleemer:

Earth Engineering Incorporated (EEI) completed an Infiltration Investigation at the above-referenced site. The objective of this project was to determine characteristics of the subsurface soils, depth to limiting zones and in-situ infiltration rates at the locations. The scope of work for this project included the excavation of exploratory test pits to identify possible limiting zones and to characterize the subsurface profile. Following the limiting zone investigation, infiltration testing was performed using the double ring infiltrometer method in accordance with the Pennsylvania Stormwater Best Management Practices (BMP) Manual, Appendix C, Protocol 1. This Summary Letter presents the results of our work.

I. PROJECT DESCRIPTIONS

Based on information provided by Terraform Engineering, LLC (Terraform), six (6) locations were requested to be tested for infiltration characteristics at the site. At each of the testing locations, the surface elevations were extrapolated by EEI utilizing the topographic contours depicted on the *Existing Conditions & Demolition Plan*, prepared by Godshall Kane O'Rourke Architects, LLC (GKO) and subsequently provided to EEI. The proposed infiltration testing depths were provided to EEI by Terraform and are presented in Table I. The proposed infiltration locations were field located by a representative of the EEI based on the provided plan. The locations of the proposed infiltration areas are shown on the *Infiltration Location Plan,* EEI Drawing Number: 35923.01-A-101, included with this Letter.

TABLE I
INFILTRATION ELEVATIONS

Infiltration Location Number	*Ground Surface Elevation, ft.	Proposed Infiltration Elevation, ft.	Proposed Infiltration Depth, ft.
TP-101	289.0	286.0	3.0
TP-102	289.0	286.0	3.0
TP-103	290.0	286.0	4.0
TP-104	279.5	277.0	2.5
TP-105	280.0	277.0	3.0
TP-106	292.0	289.0	3.0

Notes: **The ground surface elevations of the infiltration locations were extrapolated by EEI utilizing the topographic contours depicted on the Existing Conditions & Demolition Plan, prepared by GKO.*

II. SITE DESCRIPTIONS

The site is located at 801 Loch Alsh Avenue in Upper Dublin Township, Montgomery County, Pennsylvania. The site is bordered by Loch Alsh Avenue and the Upper Dublin High School to the northeast, athletic fields and Fort Washington Avenue to the southeast, an athletic field and Fort Washington Elementary School to the southwest, and Pennsylvania State Route 33 (PA 33) to the northwest. Infiltration locations TP-101, TP-102, TP-103, and TP-106 were situated within the grass areas throughout the parking area located in the northern and northwestern portion of the site. Infiltration locations TP-104 and TP-105 were situated within the grass area bordering the parking lot located in the western portion of the site. In general, the topography of the site slopes gently downward from a high point along Loch Alsh Avenue to the south and southwest. Plate 1, included with this Letter, shows the general location of the site on a topographic map of the area. The following photographs show the site conditions at the time of testing:

Photograph 1 – Looking West towards Test Pit Locations TP-101 & TP-102

Photograph 2 – Looking North towards Test Pit Location TP-103

Photograph 3 – Looking South towards Test Pit Locations TP-104 & TP-105

Photograph 4 – Looking Southeast from Test Pit Location TP-106

III. SUBSURFACE CONDITIONS

A.) Geology

According to the Commonwealth of Pennsylvania, Department of Conservation and Natural Resources, *PA DCNR Interactive Map*, reprinted April 28, 2023, the site is mapped within the Triassic Period Stockton Formation (Geologic Symbol: Trs). Plate 1, included with this Letter, shows the location of the site on a bedrock geology map of the area.

As noted in the Commonwealth of Pennsylvania, Topographic and Geologic Survey, *Engineering Characteristics of The Rocks of Pennsylvania*, Fourth (4^{th}) Series, Revised 1982, the Stockton Formation (Trs) is composed of beds of red to purplish-red sandstone, shale, and siltstone, along with light gray to buff-colored arkosic sandstone. The bedding within this formation is typically well developed and thin to flaggy. Joints are moderately developed and have a seamy to platy pattern. The formation is highly fractured, which are very closely spaced, vertical and open. This rock type is slightly resistant to weathering, yet highly weathered to a moderate depth, and the overlying soil mantle is typically thin. Rapid disintegration of the rock results in very small, pencil-like, platy fragments. Excavation is moderately easy. The Stockton Formation has good surface drainage, and high to moderate total effective porosity and permeability. Primary porosity occurs in the weathered portion of the rock, while joint and bedding plane openings provide a secondary porosity in unweathered rock. Localized groundwater springs are a common occurrence within the fractured bedrock of the Stockton Formation.

B.) Soil

The United States Department of Agriculture, Natural Resources Conservation Service, Pennsylvania*, Web Soil Survey*, accessed April 28, 2023, indicates that site is mapped within the Urban land (Soil Symbol: UgB). Plate 3, included with this Letter, shows the location of the site on a soil map of the area.

According to the United States Department of Agriculture, Natural Resources Conservation Service, Pennsylvania*, Web Soil Survey*, *Map Unit Description – Montgomery County, Pennsylvania, Version 17, September 2022,* the Urban land (UgB) consists of 90 percent Urban land and similar soils, and 10 percent minor components (Udorthents, unstable fill). Mean annual precipitation is 36 to 46 inches and mean annual air temperature is 41 to 62 degrees F. The parent material can be described as pavement, building, and other artificially covered areas human transported material.

IV. FIELD INVESTIGATION AND DISCUSSION

A.) Exploratory Test Pits

As part of the field investigation, six (6) exploratory test pits, designated as TP-101 through TP-106, were excavated at the site at the proposed infiltration areas. The purpose of the exploratory testing was to determine the depth to groundwater, evaluate for signs of a seasonal high groundwater level, determine soil type and investigate potential limiting zones. A limiting zone is defined as a horizon or condition of the soil or underlying strata which includes:

A. A seasonal high water table, whether perched or regional, determined by direct observation of the water table or soil mottling.

B. Rock with open joints, fractures or solution channels, masses of loose rock fragments including gravel, with insufficient fine soil to fill the voids between the fragments.

C. Rock formation, other stratum, or soil conditions which are so slowly permeable that it effectively limits the downward passage of water.

The test pits were conducted at the site on May 3, 2023. Monitoring of the excavation operation was provided by a representative of EEI. The test pits were performed by a representative of Wayne Carmint Landscaping, Incorporated, utilizing a Kubota U35-4 Mini-Excavator, equipped with a 24-inch wide bucket. During the test pit excavation, moisture content, limiting zones, and variations in the soil composition were documented. The locations of the test pits are shown on the *Infiltration Location Plan*. *Soil Description Logs*, containing depths and descriptions of the materials encountered, are also included with this Letter.

The test pits were conducted to depths ranging from 4.5 to 6.0 feet below the existing ground surface. Bucket refusal, which is typically interpreted as the excavation equipment encountering the bedrock surface, was not encountered at any of the test pit locations conducted to the depths achieved. Hard excavating, which is indicative of very dense conditions and/or weathered rock, was also not encountered at any of the test pit locations. Finally, groundwater was not encountered at any of the test pit locations. It is noted that groundwater observations were made at the time of the infiltration investigation, and that groundwater elevations fluctuate with daily, seasonal, and climatic variations. FILL material was encountered at each of the test pit locations. The FILL material encountered within test pit location TP-102, contained construction materials in the form of trace amount of reinforcing steel. Where encountered, the FILL material extended to a depth of 2.7 feet below the existing ground surface. The soil descriptions, strata depth, and relative densities are shown on the *Soil Description Logs,* included within this Letter.

B.) Limiting Zones

Based upon visual classifications of the soils encountered, as well as the excavation rates observed, evidence of limiting zones were not encountered within any of the test pit locations conducted to the depths achieved. Therefore, EEI performed the infiltration testing at the proposed testing depths shown in Table I.

C.) Infiltration Methods

Following completion of the exploratory test pits, double ring infiltration testing was completed. To perform a Double Ring Infiltrometer (DRI) test, the soil is excavated to the infiltration depth. The DRI is seated into the soil approximately two (2) inches. The DRI is presoaked immediately prior to the start of the test. Water is poured into the sealed casing and the water level is readjusted every 30 minutes, for 1 hour. The drop in the water level in the center ring during the last 30 minutes of the final presoak period is applied to the following to determine the time interval between readings for each infiltration test hole;

- If less than two (2) inches of water infiltrated from the DRI, the interval for readings during the test should be 30 minutes.

- If two (2) or more inches of water infiltrated from the DRI, the interval for readings during the test should be reduced to 10 minutes.

After the final presoaking period, water in the DRI is again adjusted to the top of the rings and readjusted when necessary after each reading and the drop of water column in the center ring is measured over time.

The test continues until either the readings become stabilized or for a total of eight (8) readings. A stabilized rate of drop means a difference of ¼ inch or less of drop between the highest and lowest readings of four (4) consecutive readings.

V. INFILTRATION TEST RESULTS

Six (6) locations were tested for infiltration using the Double Ring Infiltrometer method. At each infiltration location, two (2) double ring infiltrometer tests were performed. Table II summarizes the infiltration data for each test location. Detailed field information is shown on the *Double Ring Infiltrometer Results Logs*, included with this Letter.

TABLE II
INFILTRATION RATES AT TEST LOCATIONS

Test Hole Number	*Ground Surface Elevation, ft.	Infiltration Depth, ft.	Test Interval, min.	Final Drop in Water Level, in.	*Raw Infiltration Rate, in./hr.
DR-101A	289.0	3.0	30	0.750	1.50
DR-101B	289.0	3.0	30	0.625	1.25
DR-102A	289.0	3.0	30	0.375	0.75
DR-102B	289.0	3.0	30	0.250	0.50
DR-103A	290.0	4.0	30	1.000	2.00

TABLE II
INFILTRATION RATES AT TEST LOCATIONS

Test Hole Number	*Ground Surface Elevation, ft.	Infiltration Depth, ft.	Test Interval, min.	Final Drop in Water Level, in.	*Raw Infiltration Rate, in./hr.
DR-103B	290.0	4.0	30	0.750	1.50
DR-104A	279.5	2.5	30	0.125	0.25
DR-104B	279.5	2.5	30	0.125	0.25
DR-105A	280.0	3.0	30	0.125	0.25
DR-105B	280.0	3.0	30	0.188	0.38
DR-106A	292.0	3.0	30	0.250	0.50
DR-106B	292.0	3.0	30	0.375	0.75

Notes: **The ground surface elevations of the infiltration locations were extrapolated by EEI utilizing the topographic contours depicted on the Existing Conditions & Demolition Plan, prepared by GKO.*

*** In accordance with the PA BMP Manual, a safety factor should be used for design purposes. For this site and based on the soil types encountered, EEI recommends a safety factor of **3**.*

VI. LIMITATIONS

The information contained in this Letter is based upon the subsurface data collected and on details stated within this Letter. Should conditions arise which differ from those specifically stated herein, our office should be notified immediately so that our recommendations can be reviewed and revised, if necessary.

It is emphasized that this analysis was made for the specified testing locations at the Upper Dublin Township Administration and Police Garage located 801 Loch Alsh in Upper Dublin Township, Montgomery County, Pennsylvania. Earth Engineering Incorporated does not assume any responsibility for the use of this Letter for a site other than the one specifically addressed in this Letter.

Respectfully submitted,
Earth Engineering, Incorporated

David M. Fink
Project Manager ~ Lehigh Valley Division

Paul J. Creneti, P.G.
Director ~ Lehigh Valley Division

Attachments
https://eengineering.sharepoint.com/sites/EarthEngineeringInc/Shared Documents/Projects/35000/35923.01 - UDT Admin Police Garage - LV DRI/LETTER/35923.01 - UDT Admin-Police-Garage - Infiltration Summary Letter.doc

pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES
Visit us at http://www.dcnr.state.pa.us

EARTH
ENGINEERING
INCORPORATED
Geotechnical Engineers & Geologists

Ambler Quadrangle
Map created on Fri Apr 28 2023

PLATE 1 - TOPOGRAPHIC MAP OF SITE

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Geotechnical Engineers & Geologists

Created using PA DCNR Map Viewer

Ambler Quadrangle
Map created on Fri Apr 28 2023

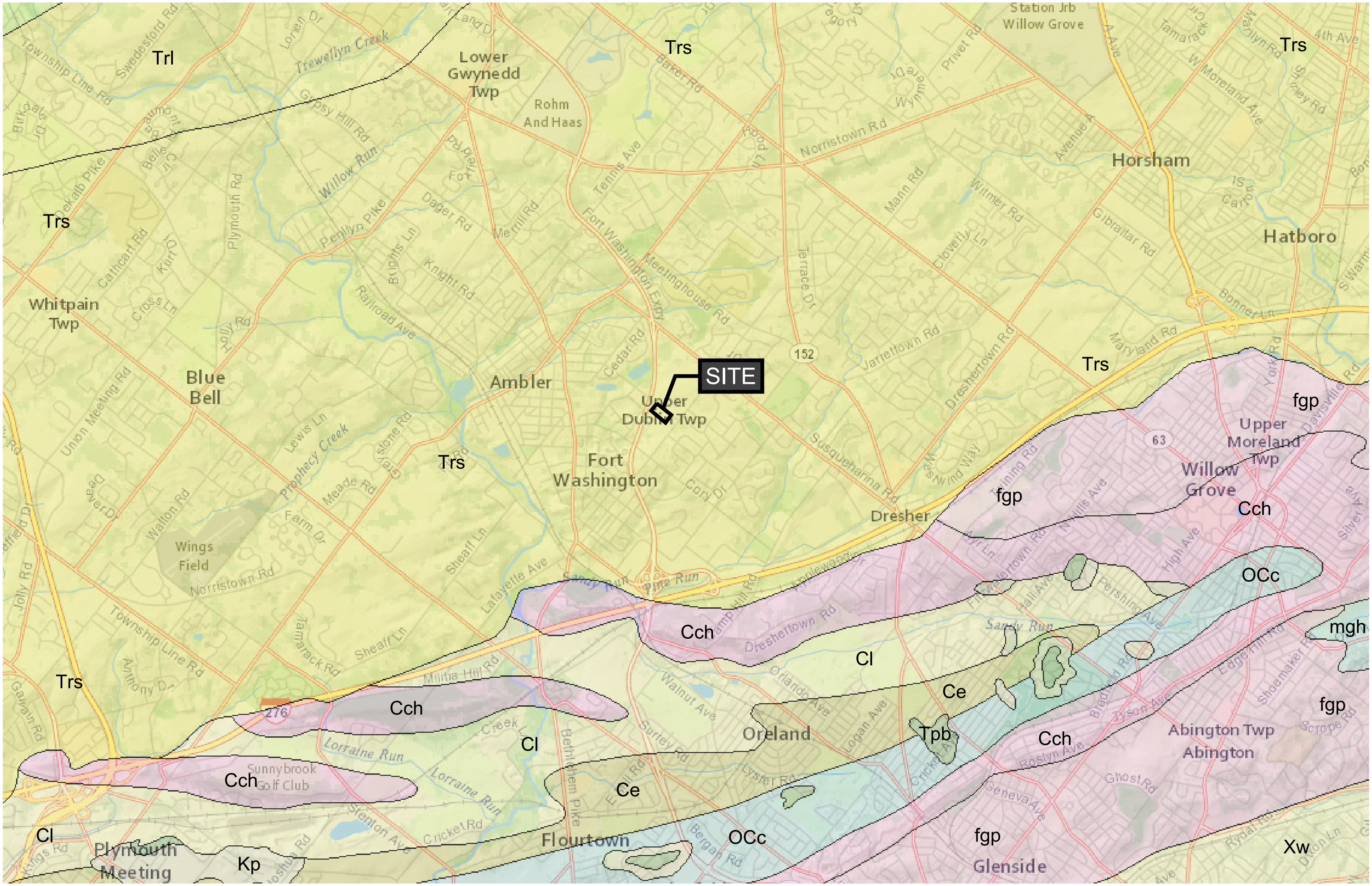
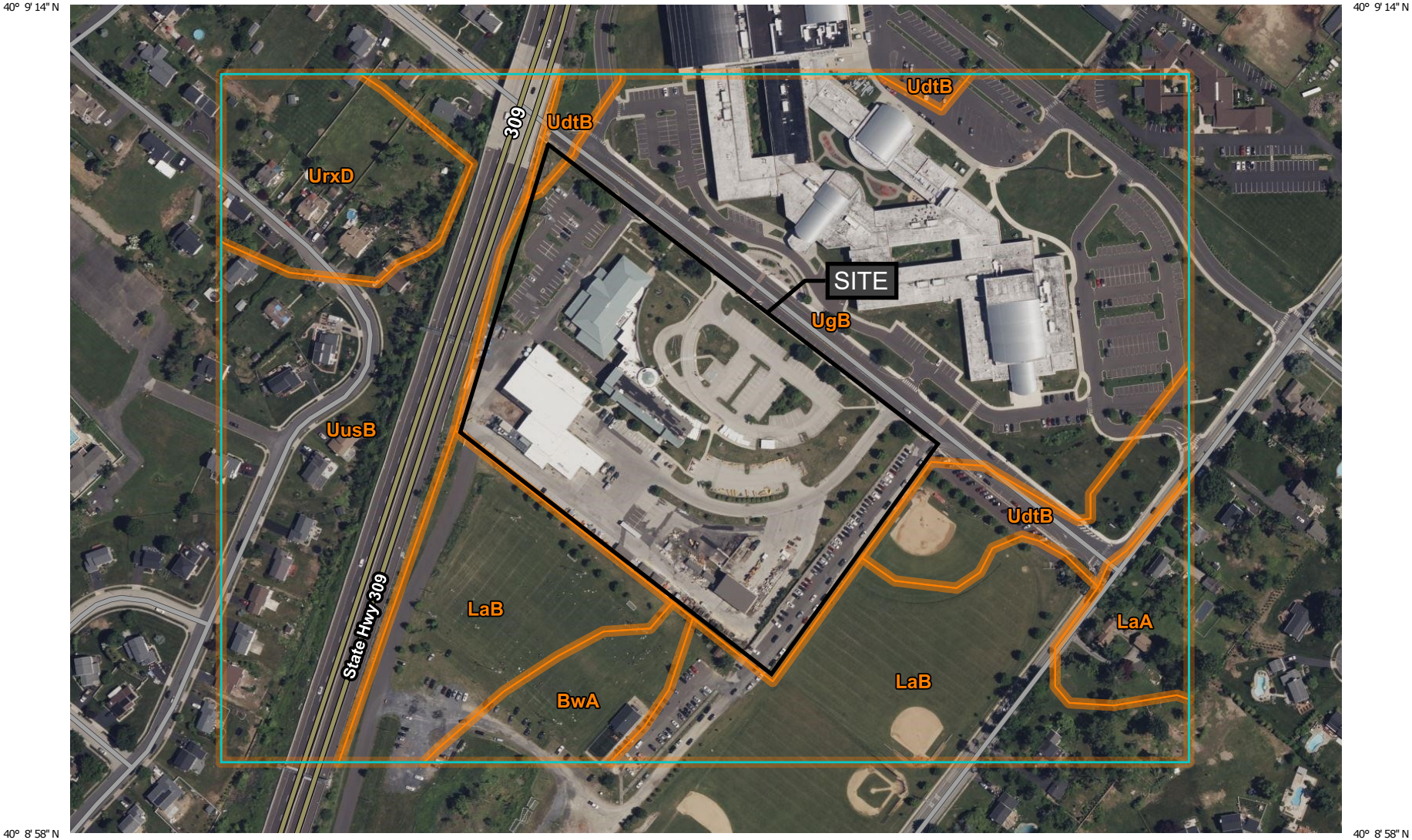


PLATE 2 - BEDROCK GEOLOGY MAP OF SITE

EARTH ENGINEERING INCORPORATED
Geotechnical Engineers & Geologists

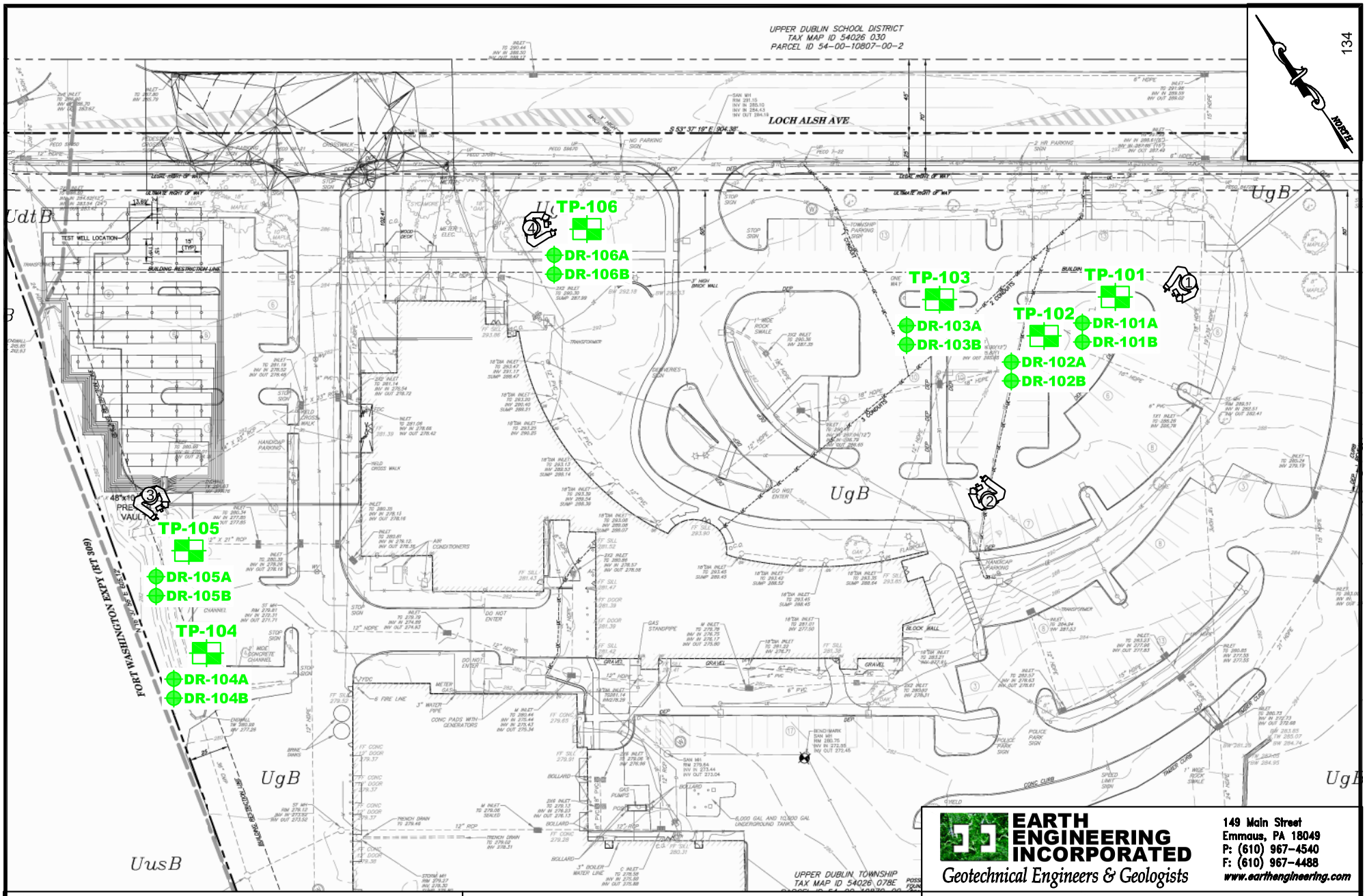


Soil Map—Montgomery County, Pennsylvania

USDA Natural Resources Conservation Service

PLATE 3 - SOILS MAP OF THE SITE

Web Soil Survey
National Cooperative Soil Survey
Map Created Fri Apr 28 2023



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GRAPHIC SCALE

80 60 40 20 0 80 160

(IN FEET)
1 inch = 80 feet

KEY:

TP-100 — INDICATES TEST PIT LOCATION

DR-100A — INDICATES DOUBLE RING INFILTROMETER LOCATION

INDICATES PHOTOGRAPH LOCATION (REFER TO LETTER)

BASE PLAN PROVIDED BY TERRAFORM ENGINEERING, LLC

INFILTRATION LOCATION PLAN
UDT - ADMIN. & POLICE GARAGE

PREPARED FOR

UPPER DUBLIN TOWNSHIP

UPPER DUBLIN TOWNSHIP, MONTGOMERY COUNTY, PENNSYLVANIA

Scale:	Date:	Drawn By:	Checked By:
1" = 80'	5/09/23	DMF	JLM
Drawing Number: 35923.01-A-101			Approved By: PJC

DOUBLE RING INFILTROMETER RESULTS

Test Hole Number	Surface Elevation (ft.)	*Infiltration Depth (ft.)	Drop in Water during Presoak Period (in.)		Testing Interval (Minutes)	Drop in Water at Time Interval (in.)								** Infiltration Rate
			30 min.	60 min.		1	2	3	4	5	6	7	8	Inches/Hour
DR-101A	289.0	3.0	1.500	1.000	30	0.750	0.750	0.750	0.750					1.50
DR-101B	289.0	3.0	1.375	0.875	30	0.750	0.625	0.625	0.625					1.25
DR-102A	289.0	3.0	0.625	0.375	30	0.375	0.375	0.375	0.375					0.75
DR-102B	289.0	3.0	0.375	0.250	30	0.250	0.250	0.250	0.250					0.50
DR-103A	290.0	4.0	1.750	1.375	30	1.000	1.000	1.000	1.000					2.00
DR-103B	290.0	4.0	1.500	1.125	30	1.000	0.750	0.750	0.750					1.50
DR-104A	279.5	2.5	0.375	0.250	30	0.125	0.125	0.125	0.125					0.25
DR-104B	279.5	2.5	0.500	0.250	30	0.125	0.125	0.125	0.125					0.25
DR-105A	280.0	3.0	0.250	0.125	30	0.125	0.125	0.125	0.125					0.25
DR-105B	280.0	3.0	0.500	0.375	30	0.250	0.250	0.188	0.188					0.38
DR-106A	292.0	3.0	0.375	0.250	30	0.250	0.250	0.250	0.250					0.50
DR-106B	292.0	3.0	1.250	0.875	30	0.500	0.375	0.375	0.375					0.75

* Infiltration depths were measured from existing site grades at the time of the investigation.

** In accordance with the PA BMP Manual, a Safety Factor should be applied. Based on the soil types, EEI recommends a Safety Factor of **3** for this site.

Indicates the final reading that was used to determine the infiltration rate at the corresponding location.

EARTH ENGINEERING INCORPORATED

Geotechnical Engineers & Geologists

149 Main Street

Emmaus, Pennsylvania 18049

www.earthengineering.com *eei@earthengineering.com*

INFILTRATION TESTING LOG

Project Name: UDT - Admin. & Police Garage

Project Number: 35923.01

Date of Testing: 5/3/2023

EEI Representative: D. Fink & B. Stone

EEI Client: Upper Dublin Township

Compiled By: D. Fink

Sheet Number: 1 of 1

Soil Description Log

Test Pit Location: TP-101
Surface Elevation: 289.0'
Equipment Used: Kubota U35-4 Mini-Excavator
Excavating Company: Wayne Carmint Landscaping, Incorporated
Total Depth: 5.0'

Ground Cover / Land Use: Overgrown Grass Island in Parking Lot
Limiting Zone: None Observed (>5.0')
Initial Water Depth: Dry **Time:** 0.0 hrs. **Date:** 5/3/2023
Subsequent Water Depth: Dry **Time:** 4.0 hrs. **Date:** 5/3/2023
Additional Notes: Proposed Infiltration Testing Depth (Elevation): 3.0' (286.0')
Actual Infiltration Testing Depth (Elevation): 3.0' (286.0')

Profile Description

	Depth (ft.)	Boundary	Matrix Color	Redox Features	Mottle Color	Texture	Structure	Consistence	Remarks
1	0.0 to 0.3	smooth abrupt	black	---	---	silt loam	strong fine granular	very friable	(topsoil - 3") easy excavating, soft, moist: with fine roots
2	0.3 to 1.2	smooth abrupt	light brown	---	---	clay loam	moderate fine subangular blocky	friable	(fill) easy excavating, soft to medium stiff, moist
3	1.2 to 4.6	smooth clear	brown	---	---	gravelly sandy loam	moderate fine subangular blocky	friable	easy excavating, medium dense, moist; with gravel (20%)
5	4.6 to 5.0	---	gray brown	---	---	gravelly loamy sand	moderate fine subangular blocky	friable	easy excavating, medium dense, moist; with gravel (20%)
									End of Test Pit

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Project Name: UDT - Admin. & Police Garage
Project Number: 35923.01
Date of Testing: 5/3/2023
EEI Representative: D. Fink
EEI Client: Upper Dublin Township
Compiled by: D. Fink
Sheet Number: 1 of 8

Soil Description Log

Test Pit Location: TP-102
Surface Elevation: 289.0'
Equipment Used: Kubota U35-4 Mini-Excavator
Excavating Company: Wayne Carmint Landscaping, Incorporated
Total Depth: 5.0'

Ground Cover / Land Use: Overgrown Grass Island in Parking Lot
Limiting Zone: None Observed (>5.0')
Initial Water Depth: Dry **Time:** 0.0 hrs. **Date:** 5/3/2023
Subsequent Water Depth: Dry **Time:** 4.0 hrs. **Date:** 5/3/2023
Additional Notes: Proposed Infiltration Testing Depth (Elevation): 3.0' (286.0')
Actual Infiltration Testing Depth (Elevation): 3.0' (286.0')

Profile Description

	Depth (ft.)	Boundary	Matrix Color	Redox Features	Mottle Color	Texture	Structure	Consistence	Remarks
1	0.0 to 0.2	smooth abrupt	black	---	---	silt loam	moderate fine granular	very friable	(topsoil - 2") easy excavating, soft, moist: with fine roots
2	0.2 to 2.7	wavy clear	brown	---	---	clay loam	moderate medium subangular blocky	friable	(fill) easy excavating, soft to medium stiff, moist; with trace construction materials (reinforcing steel)
3	2.7 to 5.0	---	brown	---	---	gravelly sandy loam	moderate medium subangular blocky	friable	easy excavating, medium dense, moist; with gravel (20%)
									End of Test Pit

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Project Name: UDT - Admin. & Police Garage
Project Number: 35923.01
Date of Testing: 5/3/2023
EEI Representative: D. Fink
EEI Client: Upper Dublin Township
Compiled by: D. Fink
Sheet Number: 2 of 8

Soil Description Log

Test Pit Location: TP-103
Surface Elevation: 290.0'
Equipment Used: Kubota U35-4 Mini-Excavator
Excavating Company: Wayne Carmint Landscaping, Incorporated
Total Depth: 6.0'

Ground Cover / Land Use: Grass Island in Parking Lot
Limiting Zone: None Observed (>6.0')
Initial Water Depth: Dry **Time:** 0.0 hrs. **Date:** 5/3/2023
Subsequent Water Depth: Dry **Time:** 4.0 hrs. **Date:** 5/3/2023
Additional Notes: Proposed Infiltration Testing Depth (Elevation): 4.0' (286.0')
Actual Infiltration Testing Depth (Elevation): 4.0' (286.0')

	Profile Description								
	Depth (ft.)	Boundary	Matrix Color	Redox Features	Mottle Color	Texture	Structure	Consistence	Remarks
1	0.0 to 0.7	smooth clear	dark brown	---	---	silt loam	moderate fine granular	very friable	(topsoil - 8") easy excavating, soft, moist: with fine roots
2	0.7 to 3.0	smooth abrupt	gray brown	---	---	gravelly sandy loam	moderate fine subangular blocky	friable	(fill) easy excavating, medium dense, moist; with gravel (25%)
3	3.0 to 6.0	---	gray brown	---	---	sandy loam	moderate medium subangular blocky	friable	easy excavating, medium dense, moist
									End of Test Pit

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Soil Description Log

Test Pit Location: TP-104
Surface Elevation: 279.5'
Equipment Used: Kubota U35-4 Mini-Excavator
Excavating Company: Wayne Carmint Landscaping, Incorporated
Total Depth: 4.5'

Ground Cover / Land Use: Grass Area Adjacent to Parking Lot and Swale
Limiting Zone: None Observed (>4.5')
Initial Water Depth: Dry **Time:** 0.0 hrs. **Date:** 5/3/2023
Subsequent Water Depth: Dry **Time:** 4.0 hrs. **Date:** 5/3/2023
Additional Notes: Proposed Infiltration Testing Depth (Elevation): 2.5' (277.0')
Actual Infiltration Testing Depth (Elevation): 2.5' (277.0')

Profile Description

	Depth (ft.)	Boundary	Matrix Color	Redox Features	Mottle Color	Texture	Structure	Consistence	Remarks
1	0.0 to 0.5	smooth abrupt	dark brown	---	---	silt loam	strong fine granular	very friable	(topsoil - 6") easy excavating, soft, moist: with fine roots
2	0.5 to 1.6	smooth abrupt	brown	---	---	gravelly clay loam	moderate fine subangular blocky	friable	(fill) easy excavating, loose to medium dense, moist; with gravel (25%)
3	1.6 to 3.0	wavy clear	light brown	---	---	silt loam	moderate fine subangular blocky	firm	easy excavating, medium stiff to stiff, moist
5	3.0 to 4.5	---	gray & light brown	---	---	very cobbly sandy loam	moderate medium subangular blocky	firm	moderate excavating, dense, moist; with cobbles (35%) and some gravel (10%)
									End of Test Pit

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Compiled by: D. Fink
Sheet Number: 6 of 8

Soil Description Log

Test Pit Location: TP-105
Surface Elevation: 280.0'
Equipment Used: Kubota U35-4 Mini-Excavator
Excavating Company: Wayne Carmint Landscaping, Incorporated
Total Depth: 5.0'

Ground Cover / Land Use: Grass Area Adjacent to Parking Lot and Swale
Limiting Zone: None Observed (>5.0')
Initial Water Depth: Dry **Time:** 0.0 hrs. **Date:** 5/3/2023
Subsequent Water Depth: Dry **Time:** 4.0 hrs. **Date:** 5/3/2023
Additional Notes: Proposed Infiltration Testing Depth (Elevation): 3.0' (277.0')
Actual Infiltration Testing Depth (Elevation): 3.0' (277.0')

Profile Description

	Depth (ft.)	Boundary	Matrix Color	Redox Features	Mottle Color	Texture	Structure	Consistence	Remarks
1	0.0 to 0.2	wavy abrupt	dark brown	---	---	silt loam	strong fine granular	very friable	(topsoil - 2") easy excavating, soft, moist: with fine roots
2	0.2 to 1.5	wavy abrupt	brown	---	---	clay loam	moderate medium subangular blocky	very friable	(fill) easy excavating, soft, moist
3	1.5 to 4.0	wavy clear	brown	---	---	clay loam	moderate fine subangular blocky	friable	easy excavating, medium stiff to stiff, moist; with some gravel (10%)
5	4.0 to 5.0	---	gray brown	---	---	cobbly sandy loam	moderate medium subangular blocky	friable	easy excavating, dense, moist; with cobbles (25%) and trace gravel (5%)
									End of Test Pit

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Sheet Number: 7 of 8

Soil Description Log

Test Pit Location: TP-106
Surface Elevation: 292.0'
Equipment Used: Kubota U35-4 Mini-Excavator
Excavating Company: Wayne Carmint Landscaping, Incorporated
Total Depth: 5.0'

Ground Cover / Land Use: Grass Area Adjacent to Loch Alsh Avenue
Limiting Zone: None Observed (>5.0')
Initial Water Depth: Dry **Time:** 0.0 hrs. **Date:** 5/3/2023
Subsequent Water Depth: Dry **Time:** 4.0 hrs. **Date:** 5/3/2023
Additional Notes: Proposed Infiltration Testing Depth (Elevation): 3.0' (289.0')
Actual Infiltration Testing Depth (Elevation): 3.0' (289.0')

Profile Description

	Depth (ft.)	Boundary	Matrix Color	Redox Features	Mottle Color	Texture	Structure	Consistence	Remarks
1	0.0 to 0.4	smooth clear	brown	---	---	silt loam	moderate fine granular	friable	(topsoil - 5") easy excavating, soft, moist: with fine roots
2	0.4 to 2.6	smooth abrupt	light brown to brown	---	---	clay loam	moderate fine subangular blocky	friable	(fill) easy excavating, medium stiff, moist; with some gravel (10%)
3	2.6 to 5.0	---	brown	---	---	silt loam	moderate medium subangular blocky	firm	easy excavating, medium stiff to stiff, moist
									End of Test Pit

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