STORMWATER REPORT

for

PARKING LOT EXPANSION

located at

3405 HIGHWAY ROUTE 33 & 3454 WEST BANGS AVENUE
BLOCK 3301, LOTS 8 & 12

in

TOWNSHIP OF NEPTUNE
MONMOUTH COUNTY, NJ

has been prepared for

Morgan Medical Properties, LLC

3405 Highway Route 33 2nd Floor
Township of Neptune, NJ 07753

on

October 25, 2024
InSite Project No. 23-2348-01

Andrew Grover, PE
NJPE LIC. No. 47123

InSite Engineering, LLC
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TABLES

APPENDIX

1.0 SUMMARY

On behalf of the Applicant, Morgan Medical Properties LLC, this Stormwater Report was prepared in support of the construction of a parking lot expansion within the 2.603 acre property located at 3405 Highway Route 33 and 3454 W. Bangs Avenue Neptune Township in Monmouth County, New Jersey (Block 3301 Lots 8 & 12). The purpose of this report is to demonstrate the project is in compliance with the Town Municipal Stormwater Management Plan, last revised May 2009.

The proposed project will include a parking lot extension, a porous pavement system and an above ground infiltration basin connected to an existing infiltration system. The proposed project will utilize an existing open space in Block 3301 Lot 12 and will maintain existing drainage patterns as much as practical. The project incorporates stormwater controls designed to provide water quantity, water quality, and groundwater recharge in accordance with the Town ordinance and the New Jersey Stormwater BMP Manual. The proposed project disturbs 0.45 acres and increases impervious area by 0.15 acres.

The stormwater management system and erosion and sediment control measures to be implemented during construction as outlined in the project drawings will reduce the transport of sedimentation off site and maintain the existing water quality and quantity per stormwater requirements.

2.0 SITE DESCRIPTION

2.1 Site Information

The subject property is located within Block 3301, Lot 12 in the Township of Neptune, Monmouth County, New Jersey in the R-2, Residential zoning district. The property is bound by West Bangs Avenue towards the western portion of the property and the existing parking lot and building to the east.

2.2 Existing Conditions

The property is currently vacant land. The overall site generally drains from west to east towards the existing parking lot. The site currently contains two driveways that provided access to a since demolished dwelling. The area of work is approximately 0.45 acres located at the western portion of the property primarily within Lot 12.

2.2.1 Soils

The soil descriptions of the area of work according to the United States Department of Agriculture (USDA) Soil Conservation Service Soil Survey for Monmouth County, NJ is referenced in Appendix A and summarized in the table below.

Table 1: Hydrologic Soil Group Summary

Map Symbol	Description	Hydrologic Soil Group
EvuB	Evesboro sand, 0 to 5 percent slopes	A

2.2.2 Floodplain

According to FEMA's effective Flood Insurance Rate Map (FIRM) for Monmouth County, NJ, Community Panel #34025C0329G, dated 6/15/2022, the area of work is in Zone X. Refer to Appendix A for additional information.

3.0 STORMWATER MANAGEMENT

3.1 Proposed Conditions

According to the Town of Neptune Municipal Stormwater Management Plan (MSWMP), last revised May 2009, the proposed project is not defined as a "major development" considering the limit of disturbance is less than 1 acre and new impervious area is less than 1/4 of an acre. Therefore, groundwater recharge, water quantity, and water quality requirements per the MSWMP and the NJDEP Stormwater Management Rules (NJAC 7:8) are not applicable.

Stormwater management for the proposed project will include an above-ground infiltration system and pervious pavement located at parking locations. Type 'B' inlets routed to the above-ground infiltration system will collect run off from the drive aisles of the parking lot. The stormwater infiltration basin will use an outlet control structure to attenuate the peak flow rates to the required pre-development condition reductions before discharging into the existing larger basin towards the north east portion of the property. The infiltration systems were designed to have a drain down time of less than 72 hours. Refer to Appendix H for additional information.

3.2 Hydrologic Analysis

A hydrologic computer modelling program called HydroCAD was used to calculate the pre- and post-development stormwater peak flow rates. HydroCAD implements the USDA Soil Conservation Service Publication Technical Release (TR-55) "Urban Hydrology for Small Watersheds" to calculate peak flow rates and volumes for each watershed. NOAA Region D rainfall distribution for a 24-hour rain event was used. The overall watershed was broken down into two smaller watersheds with the pervious and impervious surfaces analyzed separately for each watershed. Watershed area, curve number (CN), and time of concentration (Tc) were calculated for each contributing watershed and are summarized in Appendix B.

Rainfall data was obtained from the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Data Server (PFDS). The rainfall data is summarized in the table below.

Table 2: 24-Hour Rainfall Data

Storm Event	NOAA Precipitation
2-year	3.31 inches
10-year	5.07 inches
100-year	8.56 inches

3.3 Water Quantity

Proposed stormwater measures were incorporated so the peak runoff rates for the 2-, 10-, and 100-year 24-hour storm events match the pre-development peak runoff rates. The post-development stormwater runoff must match the pre-development stormwater runoff that is attributable to the portion of the site on which the project is to be constructed. The pre- and post-development peak flow rates are summarized in the table below.

Table 3: Peak Flow Rates Summary (Design Point 1)

Storm Event	Overall Existing Flow Rate (cfs)	Proposed Flow Rate (cfs)
2-year	0.03	0.03
10-year	0.09	0.07
100-year	0.34	0.21

Table 4: Peak Flow Rates Summary (Design Point 2)

Storm Event	Overall Existing Flow Rate (cfs)	Proposed Flow Rate (cfs)
2-year	0.15	0.14
10-year	0.33	0.21
100-year	1.00	0.96

The Drainage Area Maps are provided in Appendix B & C and runoff analysis for both conditions is provided in Appendix D & E. Since there is no increase in stormwater runoff from pre-development conditions to post-development conditions, the site complies with the NJ Soil Erosions and Sedimental Control Standards, specifically the Standards for Offsite Stability.

3.4 Water Quality

According to the Town of Neptune Municipal Stormwater Management Plan (MSWMP), last revised May 2009, the proposed project is not defined as a "major development". Therefore, water quality requirements per the MSWMP and the NJDEP Stormwater Management Rules (NJAC 7:8) are not applicable.

3.5 Groundwater Recharge

According to the Town of Neptune Municipal Stormwater Management Plan (MSWMP), last revised May 2009, the proposed project is not defined as a "major development". Therefore, groundwater recharge requirements per the MSWMP and the NJDEP Stormwater Management Rules (NJAC 7:8) are not applicable

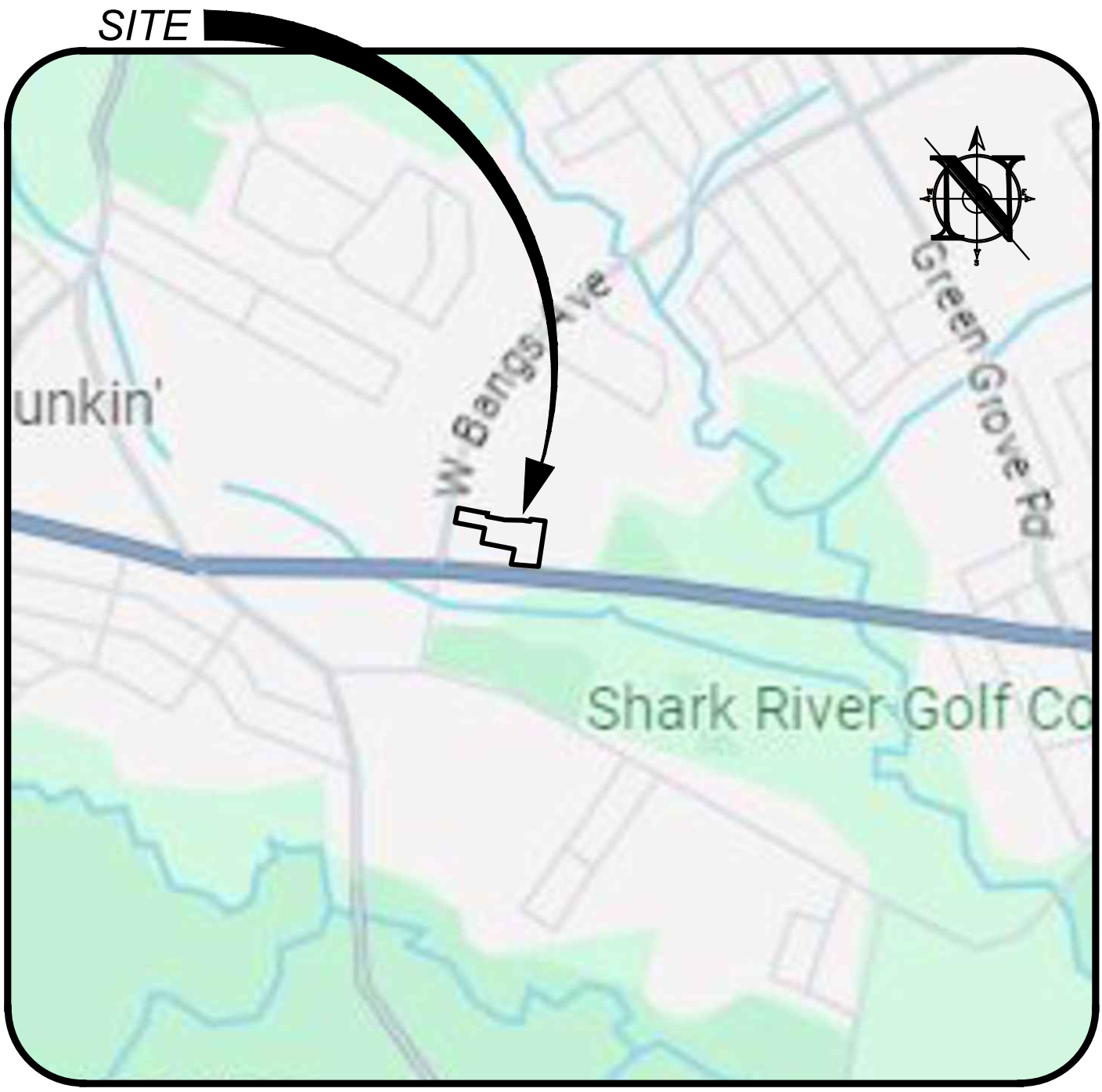
4.0 CONCLUSION

Since the project is not considered a "major development" considering the limit of disturbance and new impervious area, groundwater recharge, water quantity, and water quality requirements per the MSWMP and NJDEP are not applicable. In addition, with no increase in runoff flow the project meets the offsite stability standards as noted in the NJ Standards for Soil Erosion and Sediment Control.

A P P E N D I X A

KEY MAP EXHIBITS:

1. **ROAD MAP**
2. **TAX MAP**
3. **USGS MAP**
4. **SOILS MAP**
5. **PHOTO LOCATION MAP**
6. **EFFECTIVE FEMA MAP**



PLAN

1,000 0 1,000

Scale 1"=1,000'

ROAD MAP EXHIBIT

InSite Engineering, LLC
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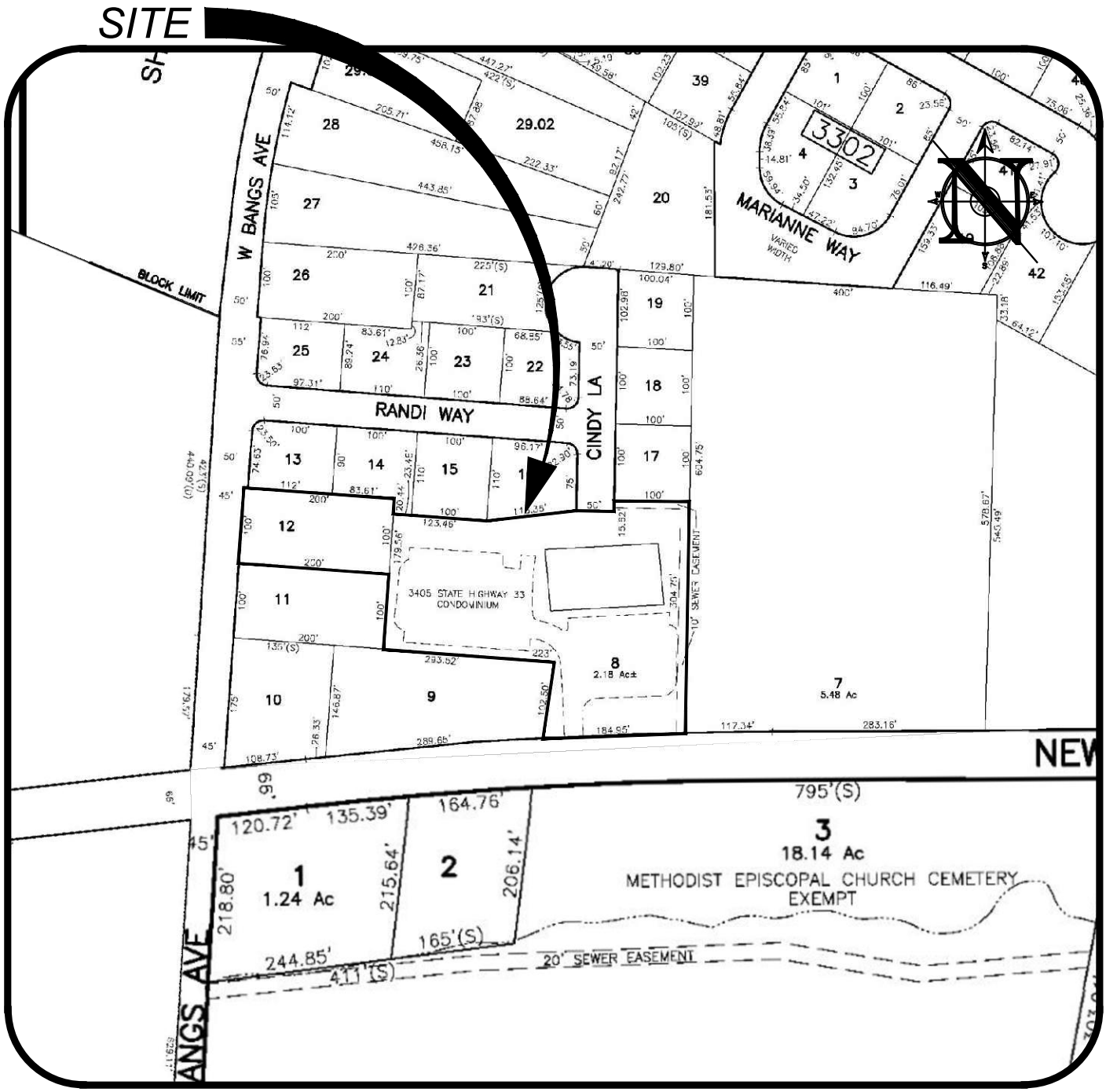
Site Location:
3405 Route 33
Block 3301, Lots 8 & 12
Township of Neptune, Monmouth County, NJ

Reference:
Google Maps- 2024

InSite Project No.
24-2348-01
Drawing No.
24-2348-01r0
Date
June 19, 2024

Revisions



PLAN

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Scale 1"=200'

TAX MAP EXHIBIT

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24GA28083200
1955 ROUTE 34, SUITE 1A
WALL, NJ 07719
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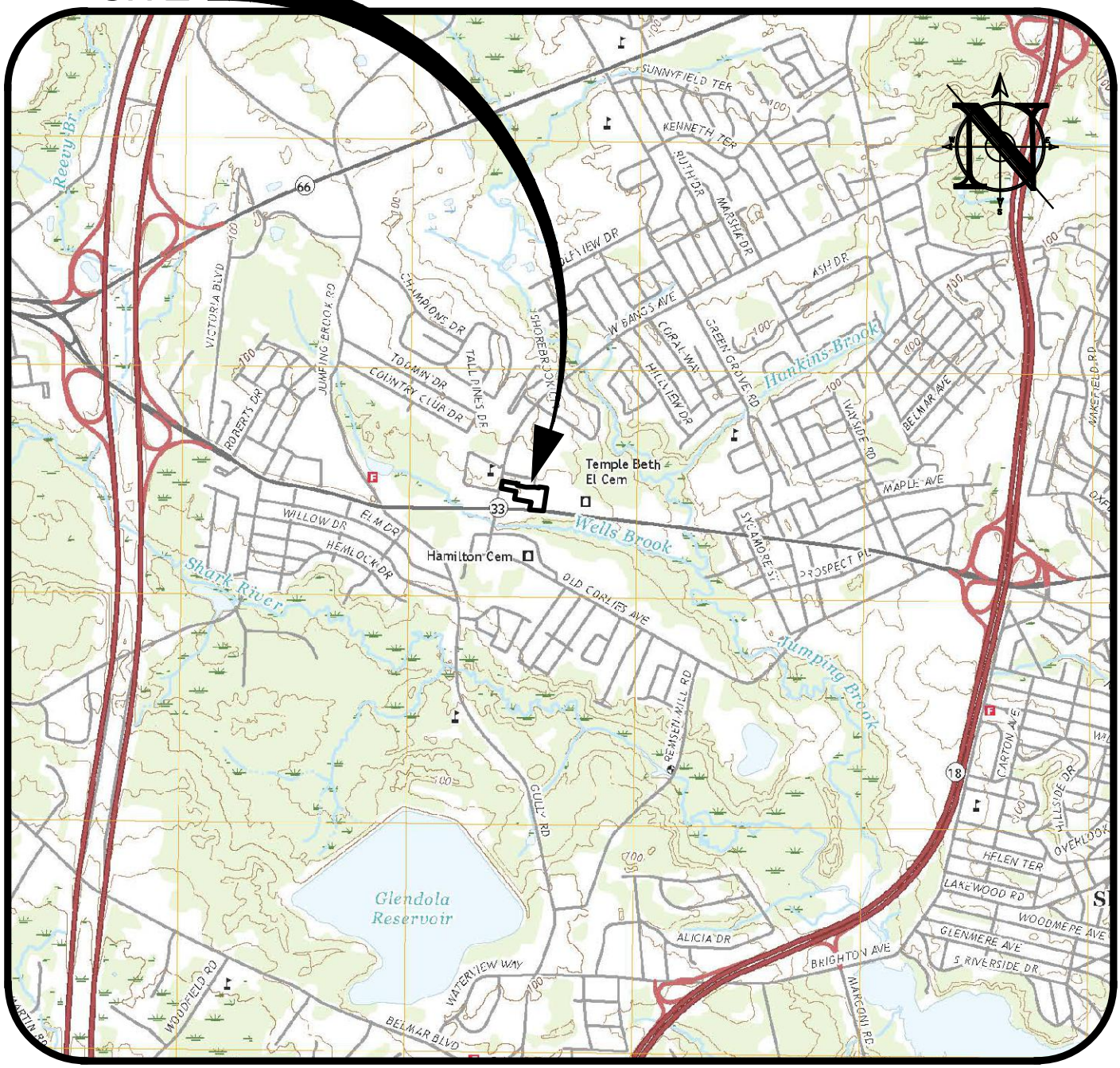
Site Location:
3405 Route 33
Block 3301, Lots 8 & 12
Township of Neptune, Monmouth County, NJ

Reference:
Township of Neptune-Tax Map
Sheet: 33
Date: November 2014

InSite Project No.
24-2348-01
Drawing No.
24-2348-01r0
Date
June 19, 2024

Revisions



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Scale 1"=2,000'

USGS MAP EXHIBIT

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Site Location:
3405 Route 33
Block 3301, Lots 8 & 12
Township of Neptune, Monmouth County, NJ

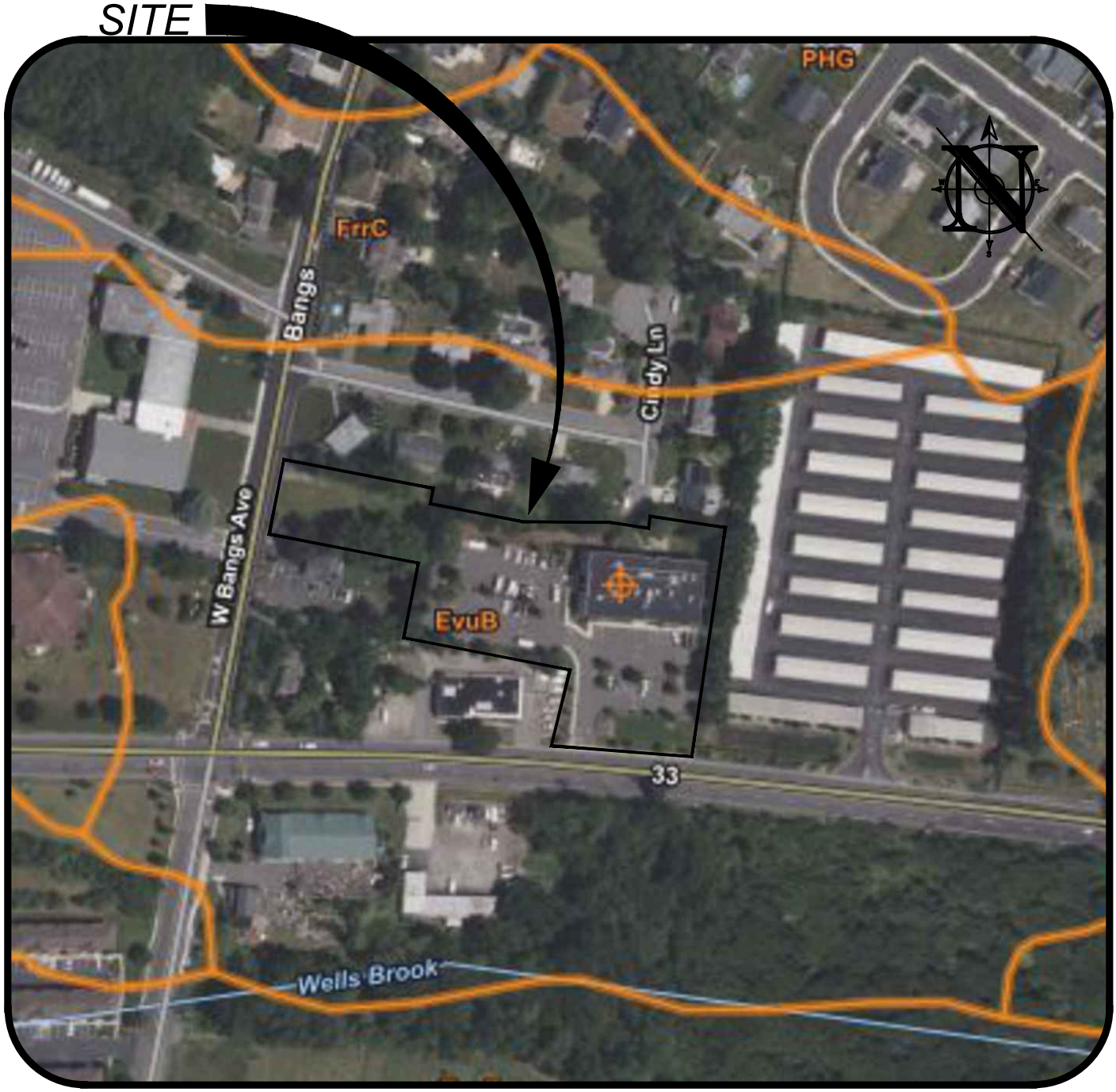
Reference:
US Geological Survey
Asbury Park Quadrangle-2019

InSite Project No.
24-2348-01

Drawing No.
24-2348-01r0

Date
June 19, 2024

Revisions



PLAN

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Scale 1"=200'

Soils Legend

EvuB— Evesboro—Urban land complex, 0 to 5 percent slopes

SOIL MAP EXHIBIT

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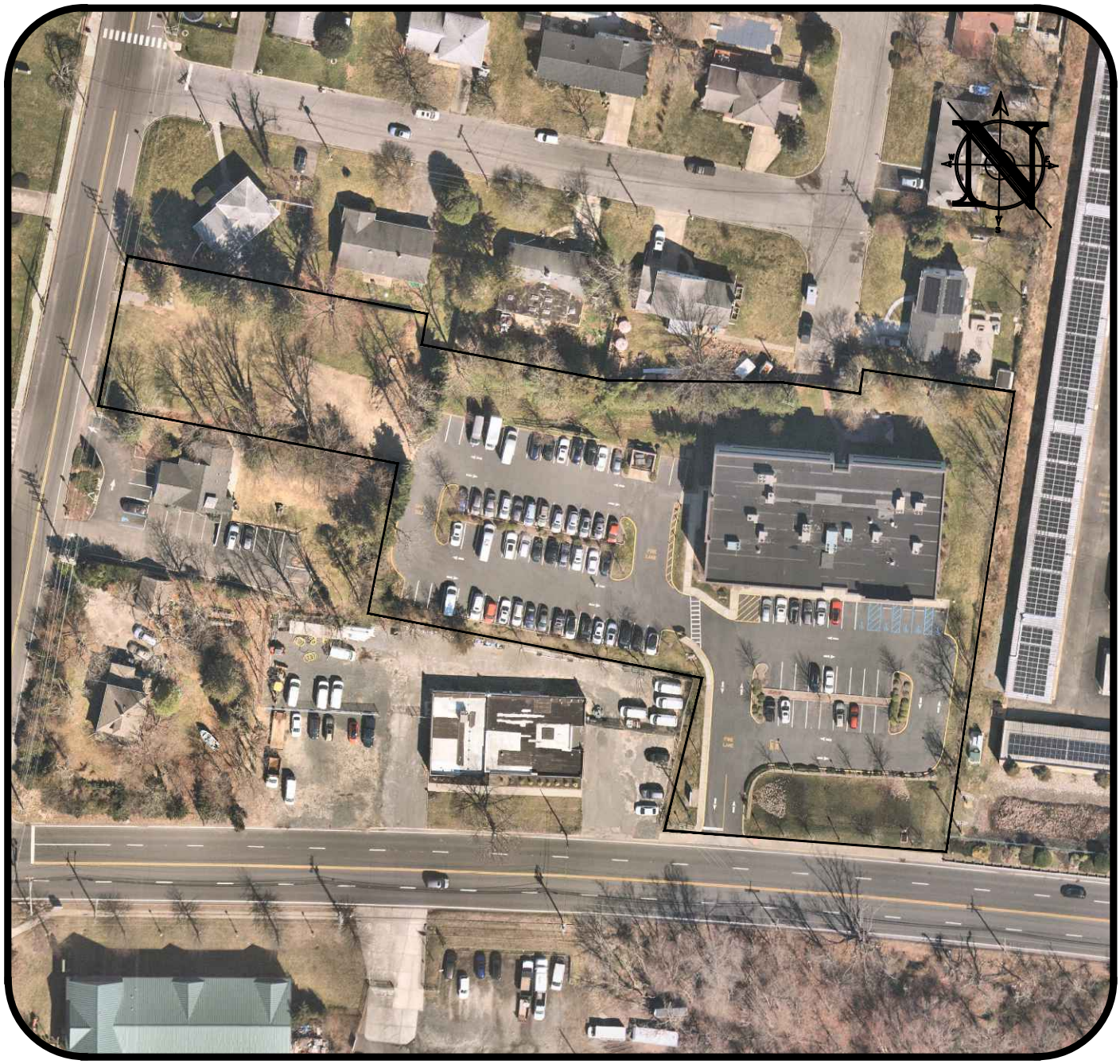
InSite Project No.
24-2348-01
Drawing No.
24-2348-01r0
Date
June 19, 2024

Reference:
United States Department of Agriculture
Natural Resources Conservation Service
Web Soil Survey

Revisions



1 2 3 4 5 6

PLAN

100 0 100

Scale 1"=100'

= PHOTO LOCATION

PHOTO LOCATION MAP EXHIBIT

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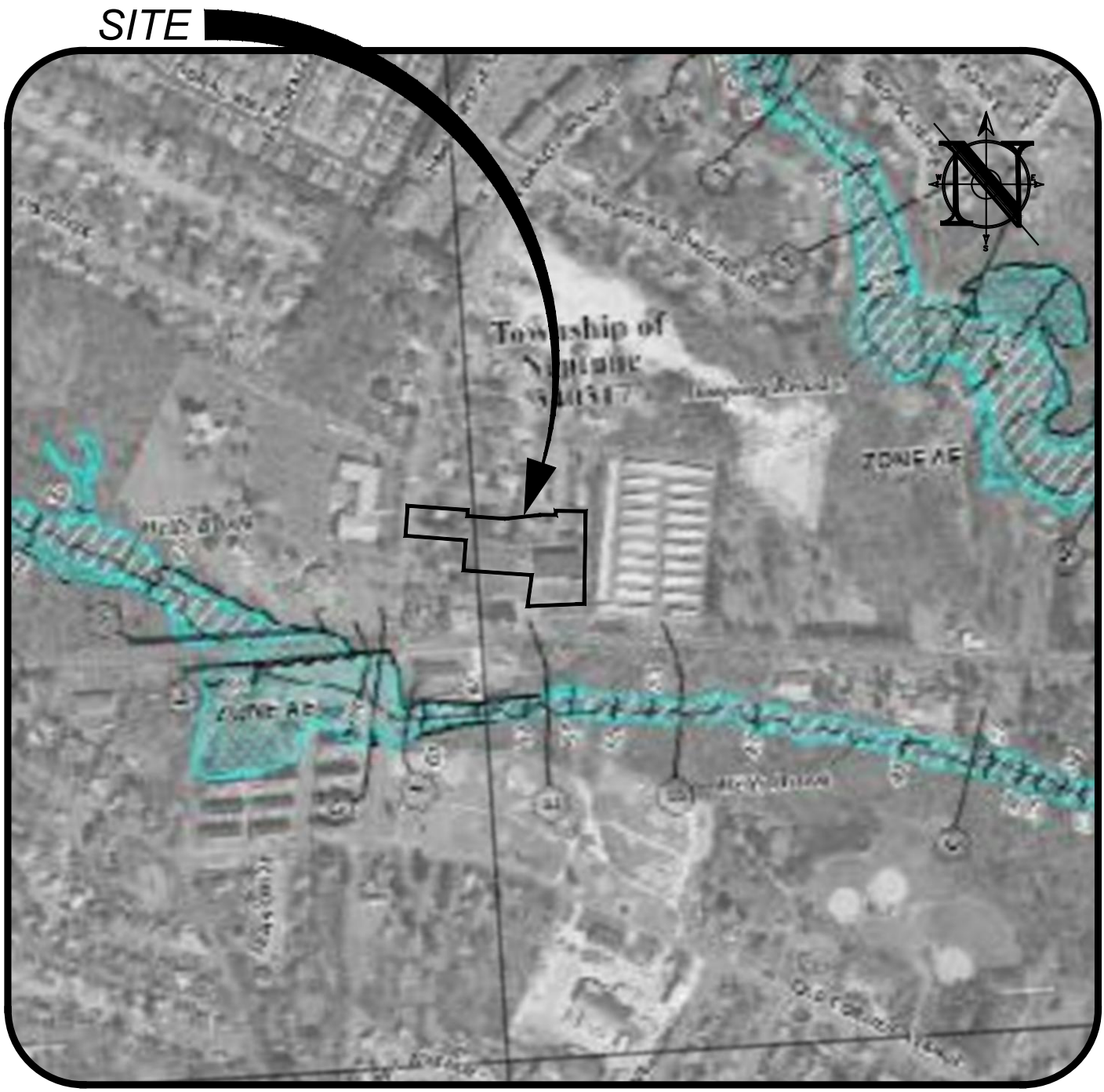
Drawing No.
24-2348-01r0
Date
June 19, 2024

Reference:
NearMap.com
Aerial Image- 2024

Revisions



PLAN

500 0 500

Scale 1"=500'

EFFECTIVE FEMA FIRM EXHIBIT

InSite Engineering • Surveying • Planning

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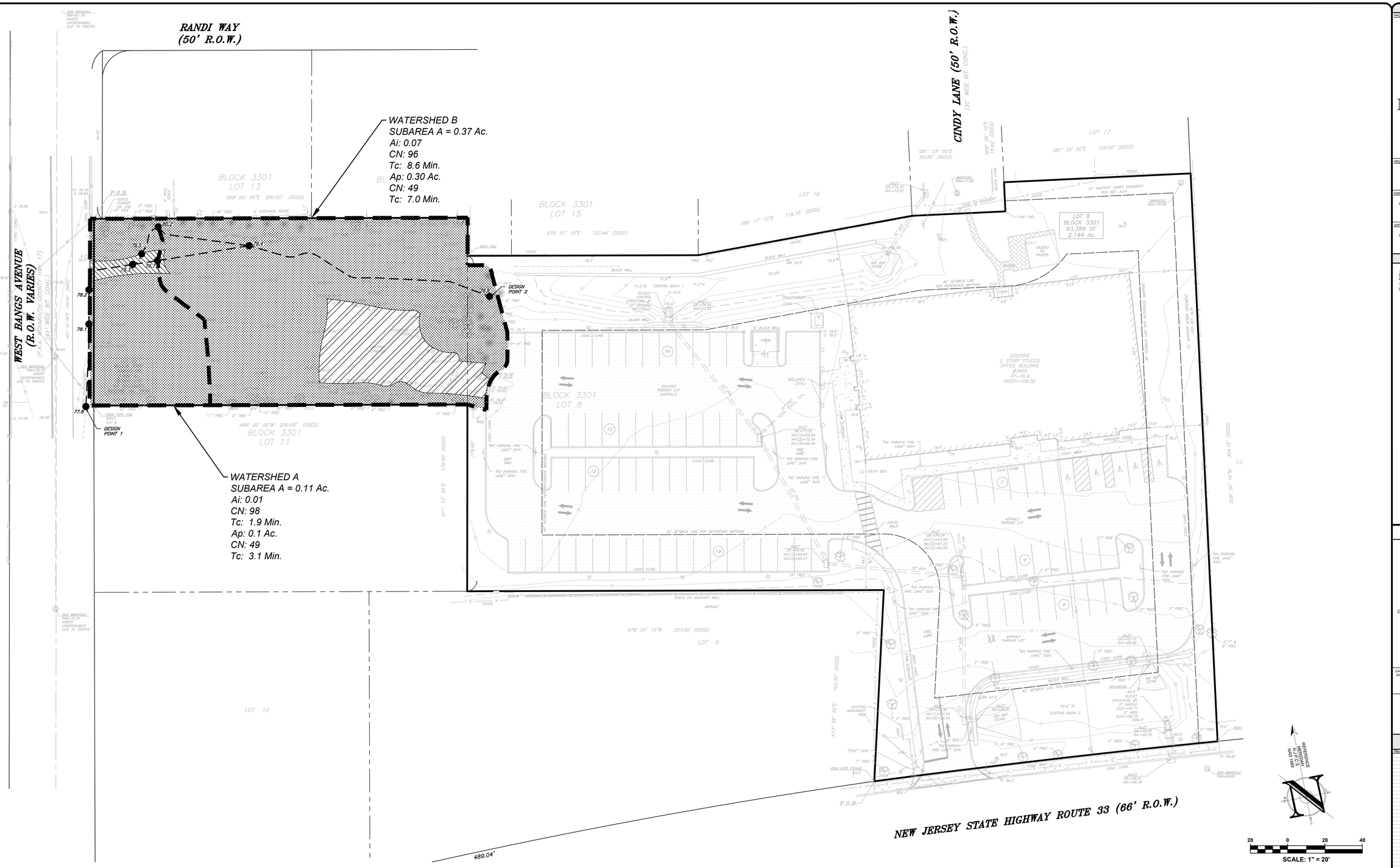
InSite Project No.
24-2348-01
Drawing No.
24-2348-01r0
Date
June 19, 2024

Reference:
Federal Emergency Management Agency
Effective Flood Insurance Rate Map
Map Number: 34025C0329G
Effective Date: June 15, 2022

Revisions

A P P E N D I X B

PRE-DEVELOPMENT DRAINAGE AREA MAPS



EXISTING	LEGEND	PROPOSED
	BOUNDARY LINE	
	CONTOUR LINE	10
+ 46.80	SPOT ELEVATION	+46.80
	BUILDING	
	WALL	
G G	GAS	GAS
W W	WATER	WTR
☐	INLET	■
	STORM	Ⓓ
	SANITARY MAIN	Ⓢ
CO	SANITARY LATERAL	CO
OH	OVERHEAD WIRE	O/H
E E	ELECTRIC	E
T T	TELEPHONE	TEL
	UTILITY POLE	
HYD	HYDRANT	HYD
	SIGN POST	
x x	FENCE	x x
	LIGHT FIXTURE	
	TEST PIT LOCATION	TP-1
	GRADE FLOW ARROW	
	SWALE CENTER LINE	℄

PROJECT INFORMATION

PROJECT NAME:

PARKING
LOT
EXPANSION

PROJECT LOCATION:
BLOCK 3301, LOT 8 & 12
3405 HIGHWAY ROUTE 33
3454 W. BANGS AVE. (CR17)
TOWNSHIP OF NEPTUNE
MONMOUTH COUNTY, NJ

OWNER:
MORGAN MEDICAL PROPERTIES, LLC
3405 HIGHWAY ROUTE 33 2ND FLOOR
TOWNSHIP OF NEPTUNE, NJ 07753

APPLICANT:
MORGAN MEDICAL PROPERTIES, LLC
3405 HIGHWAY ROUTE 33 2ND FLOOR
TOWNSHIP OF NEPTUNE, NJ 07753

APPLICANT'S PROFESSIONALS

SURVEYOR:
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WALL, NJ 07719

CALL BEFORE YOU DIG!
NJ ONE CALL.....800-272-1000
(at least 3 days prior to excavation)

InSite Engineering, LLC
CERTIFICATE OF AUTHORIZATION: 24GA28083200

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PRELIMINARY

ANDREW J. GROVER, P.E.
PROFESSIONAL ENGINEER
NJPE LIC. NO. 47123

REVISIONS

Rev.#	Date	Comment
0	10/25/24	INITIAL RELEASE

SCALE: AS SHOWN	DESIGNED BY: ES
DATE: 10/25/24	DRAWN BY: ES
JOB #: 24-2348-01	CHECKED BY: AJG

☒ NOT FOR CONSTRUCTION

APPROVED BY:

☐ FOR CONSTRUCTION

PLAN INFORMATION

DRAWING TITLE:
PRELIMINARY AND FINAL SITE PLAN

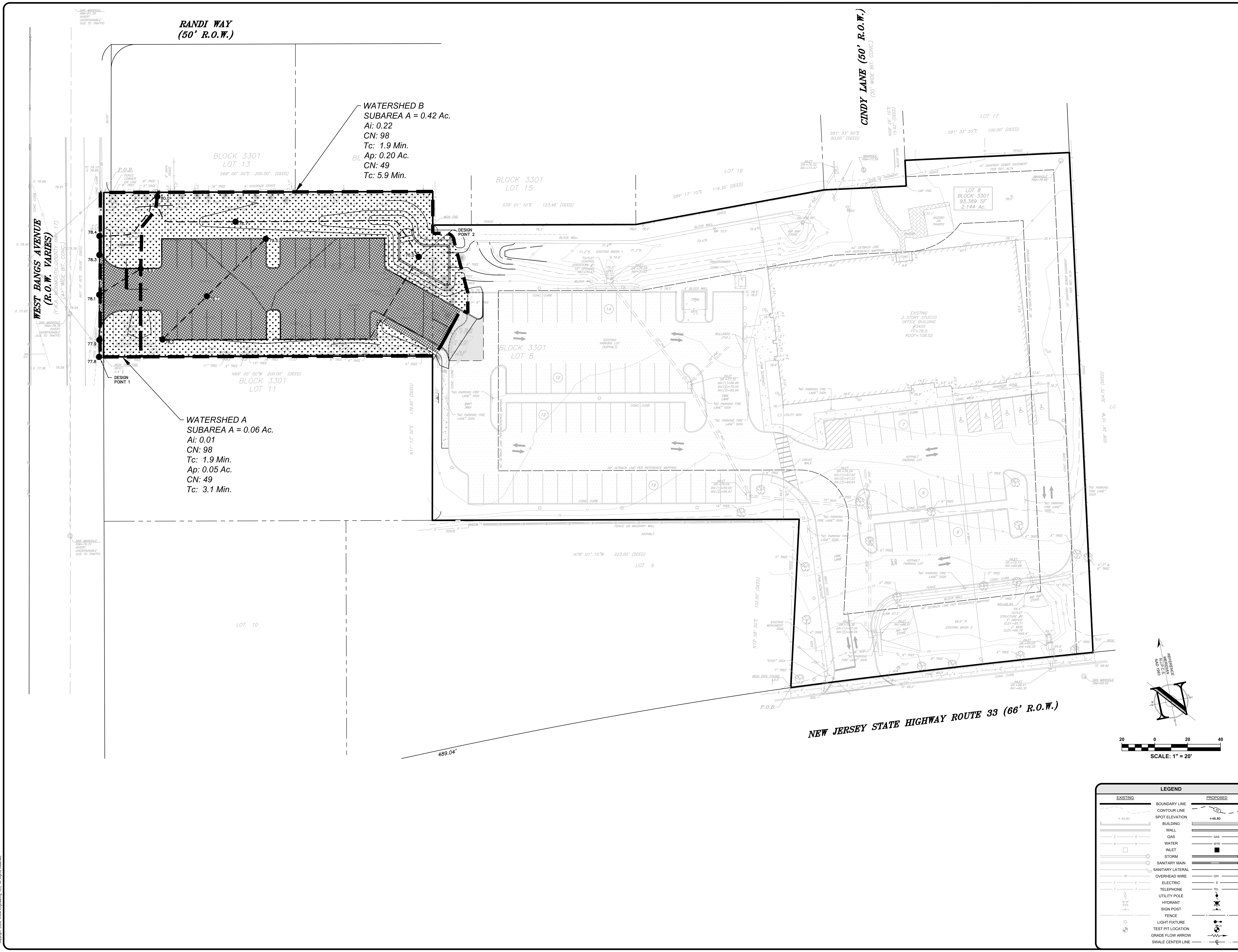
SHEET TITLE:
PRE-DEVELOPMENT DRAINAGE MAP

SHEET NO:
1 OF 1

File: X:\Jobs\2348 - Morgan Medical Properties\24-2348-01 - 3405 Route 33 & 3454 W Bangs Ave_Neptune, NJ\24234801CAD\dwg\Support\Drainage Area\Drainage Area Plan.dwg, --> Pre-Development

A P P E N D I X C

POST-DEVELOPMENT DRAINAGE AREA MAPS



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3454 W. BANGS AVE. (CR17)
TOWNSHIP OF NEPTUNE
MONMOUTH COUNTY, NJ

OWNER:
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3405 HIGHWAY ROUTE 33 2ND FLOOR
TOWNSHIP OF NEPTUNE, NJ 07753

APPLICANT:
MORGAN MEDICAL PROPERTIES, LLC
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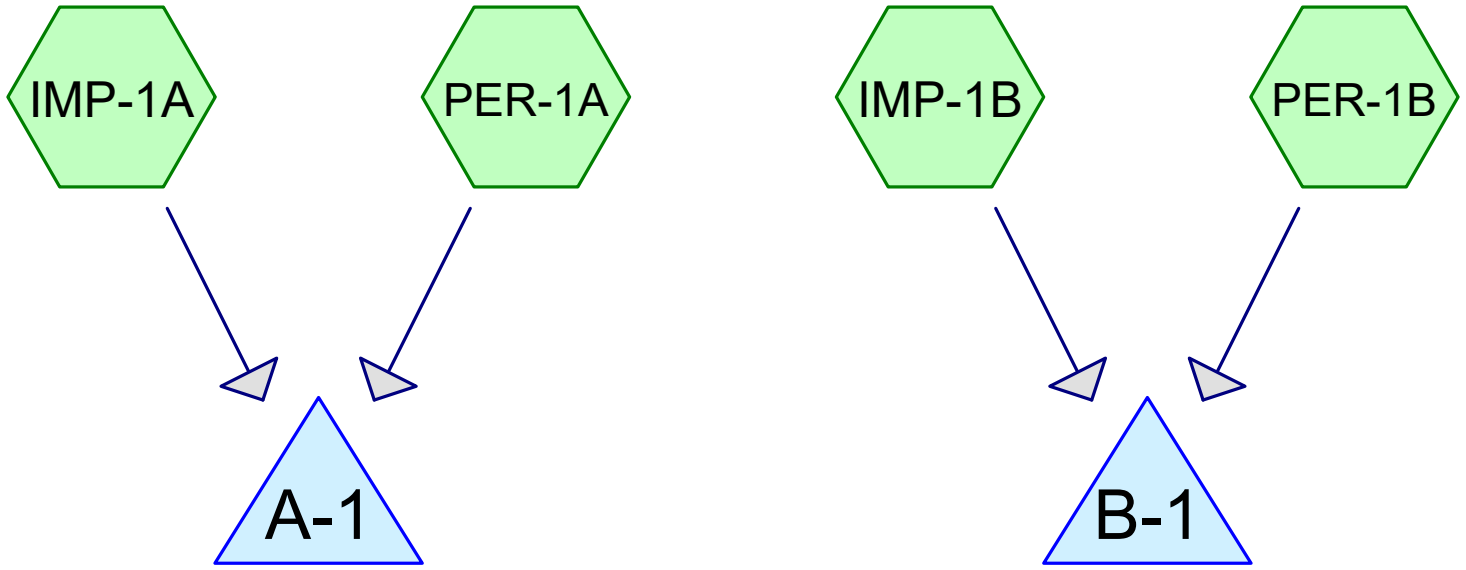
PRELIMINARY AND FINAL SITE PLAN

SHEET TITLE:
POST-DEVELOPMENT DRAINAGE MAP

SHEET NO:
1 OF 1

A P P E N D I X D

PRE-DEVELOPMENT FLOW CALCULATIONS



DESIGN POINT 1

DESIGN POINT 2

Subcat Reach Pond Link

Routing Diagram for Pre Development

Prepared by InSite Engineering, LLC, Printed 11/14/2024

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	NOAA 24-hr	D	Default	24.00	1	3.31	2
2	10-yr	NOAA 24-hr	D	Default	24.00	1	5.07	2
3	100-yr	NOAA 24-hr	D	Default	24.00	1	8.56	2

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentIMP-1A: Runoff Area=0.010 ac 100.00% Impervious Runoff Depth>2.82"
Flow Length=109' Tc=1.4 min CN=98 Runoff=0.03 cfs 0.002 af

SubcatchmentIMP-1B: Runoff Area=0.070 ac 1.43% Impervious Runoff Depth>2.65"
Flow Length=185' Tc=8.6 min CN=96 Runoff=0.15 cfs 0.015 af

SubcatchmentPER-1A: Runoff Area=0.100 ac 0.00% Impervious Runoff Depth>0.10"
Flow Length=122' Tc=3.1 min CN=49 Runoff=0.00 cfs 0.001 af

SubcatchmentPER-1B: Runoff Area=0.300 ac 0.00% Impervious Runoff Depth>0.10"
Flow Length=185' Tc=7.0 min CN=49 Runoff=0.01 cfs 0.002 af

Pond A-1: DESIGN POINT 1 Inflow=0.03 cfs 0.003 af
Primary=0.03 cfs 0.003 af

Pond B-1: DESIGN POINT 2 Inflow=0.15 cfs 0.018 af
Primary=0.15 cfs 0.018 af

Total Runoff Area = 0.480 ac Runoff Volume = 0.021 af Average Runoff Depth = 0.52"
97.71% Pervious = 0.469 ac 2.29% Impervious = 0.011 ac

Summary for Subcatchment IMP-1A:

Runoff = 0.03 cfs @ 12.08 hrs, Volume= 0.002 af, Depth> 2.82"
Routed to Pond A-1 : DESIGN POINT 1

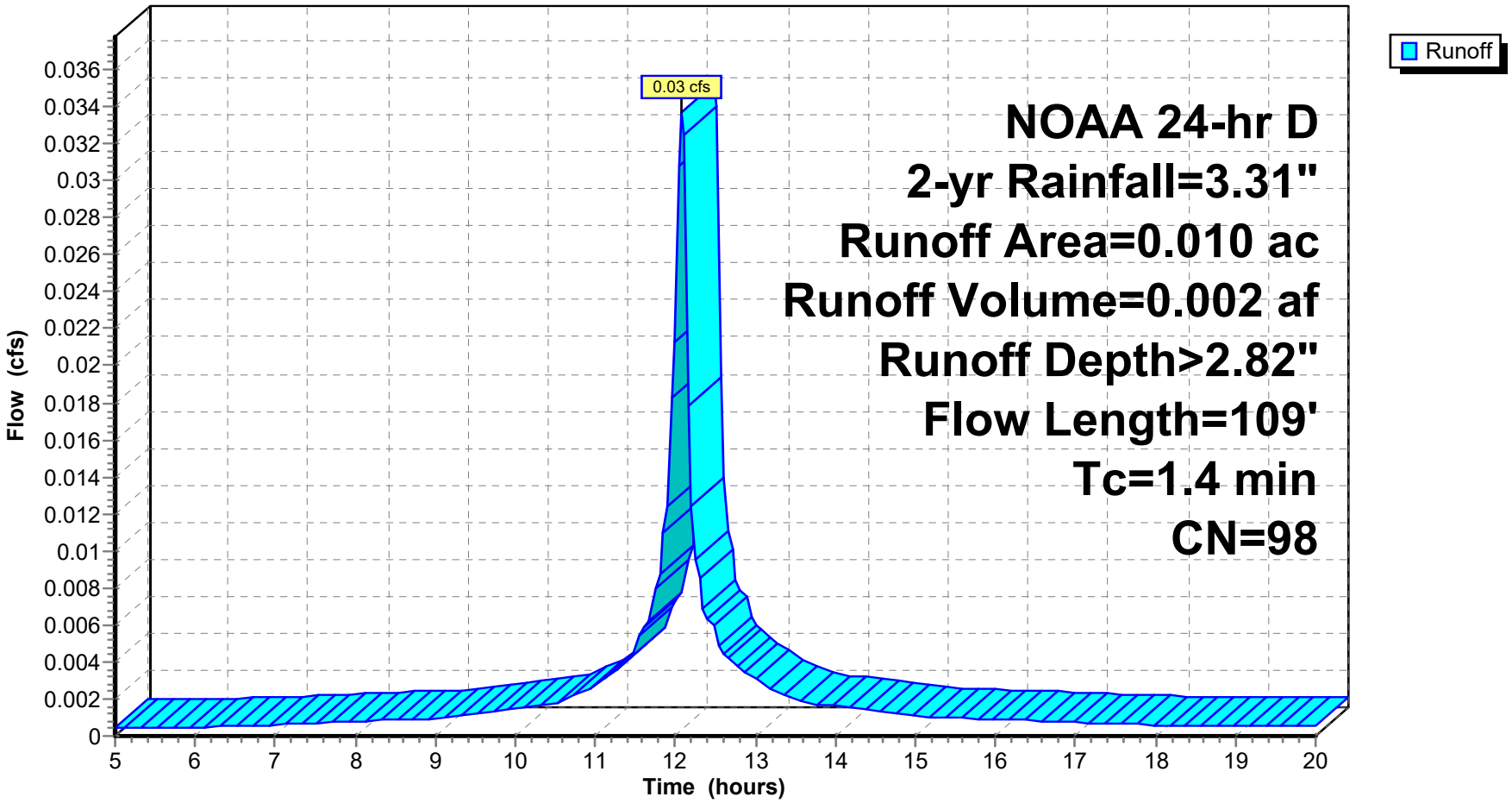
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.31"

Area (ac)	CN	Description
0.010	98	Unconnected pavement, HSG D
0.010		100.00% Impervious Area
0.010		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	47	0.0320	1.45		**Sheet Flow, 79.7-78.2** Smooth surfaces n= 0.011 P2= 3.31"
0.5	18	0.0050	0.57		**Sheet Flow, 78.2-78.1** Smooth surfaces n= 0.011 P2= 3.31"
0.4	44	0.0070	1.70		**Shallow Concentrated Flow, 78.1-77.8** Paved Kv= 20.3 fps
1.4	109	Total			

Subcatchment IMP-1A:

Hydrograph



Summary for Subcatchment IMP-1B:

Runoff = 0.15 cfs @ 12.17 hrs, Volume= 0.015 af, Depth> 2.65"
Routed to Pond B-1 : DESIGN POINT 2

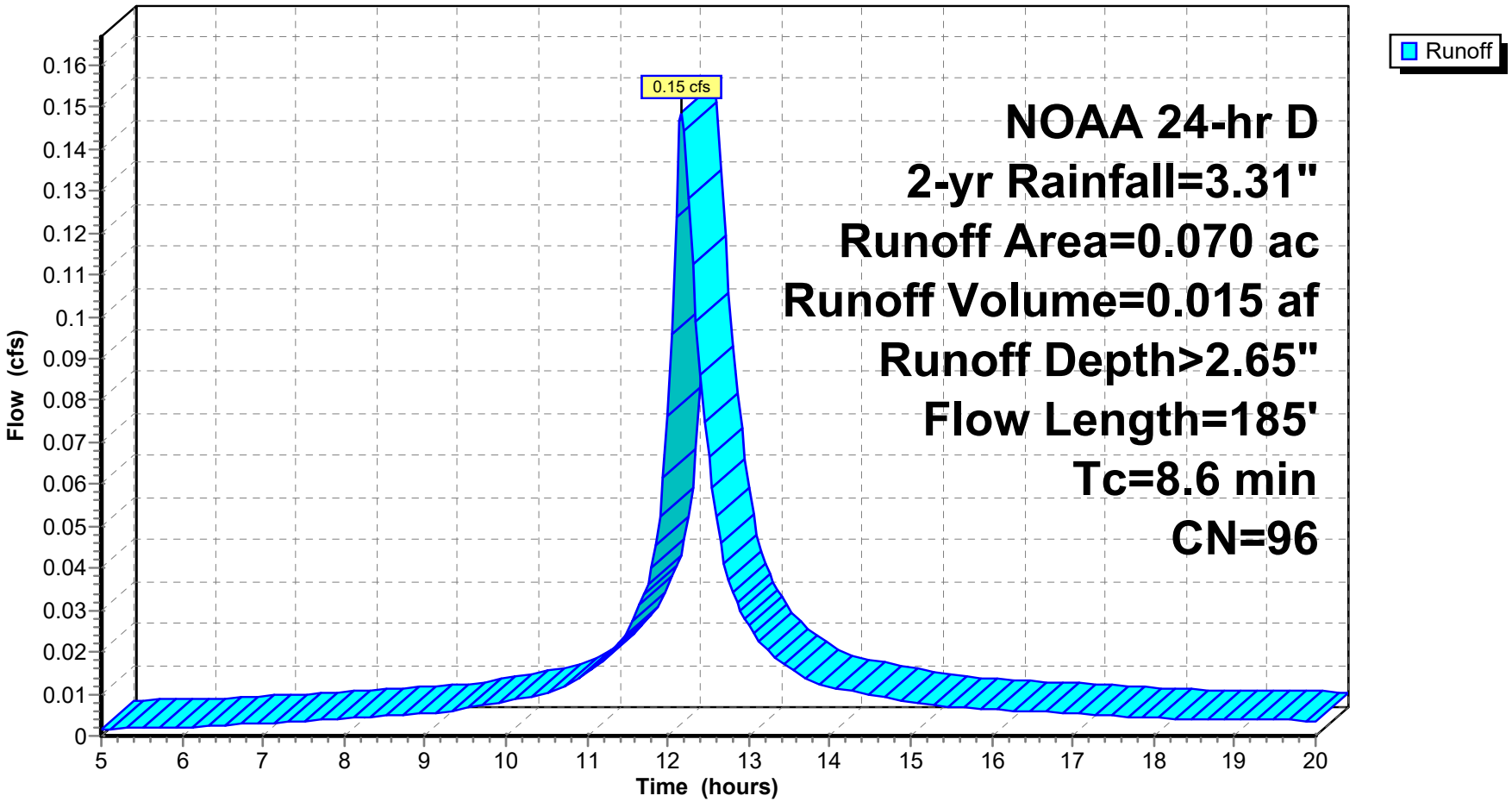
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.31"

Area (ac)	CN	Description
0.001	98	Unconnected pavement, HSG D
0.069	96	Gravel surface, HSG A
0.070	96	Weighted Average
0.069		98.57% Pervious Area
0.001		1.43% Impervious Area
0.001		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	4	0.0080	0.51		**Sheet Flow, 79.7-79.7** Smooth surfaces n= 0.011 P2= 3.31"
7.5	46	0.0080	0.10		**Sheet Flow, 79.7-79.4** Grass: Short n= 0.150 P2= 3.31"
1.0	135	0.0190	2.22		**Shallow Concentrated Flow, 79.4-76.9** Unpaved Kv= 16.1 fps
8.6	185	Total			

Subcatchment IMP-1B:

Hydrograph



Summary for Subcatchment PER-1A:

Runoff = 0.00 cfs @ 12.90 hrs, Volume= 0.001 af, Depth> 0.10"
Routed to Pond A-1 : DESIGN POINT 1

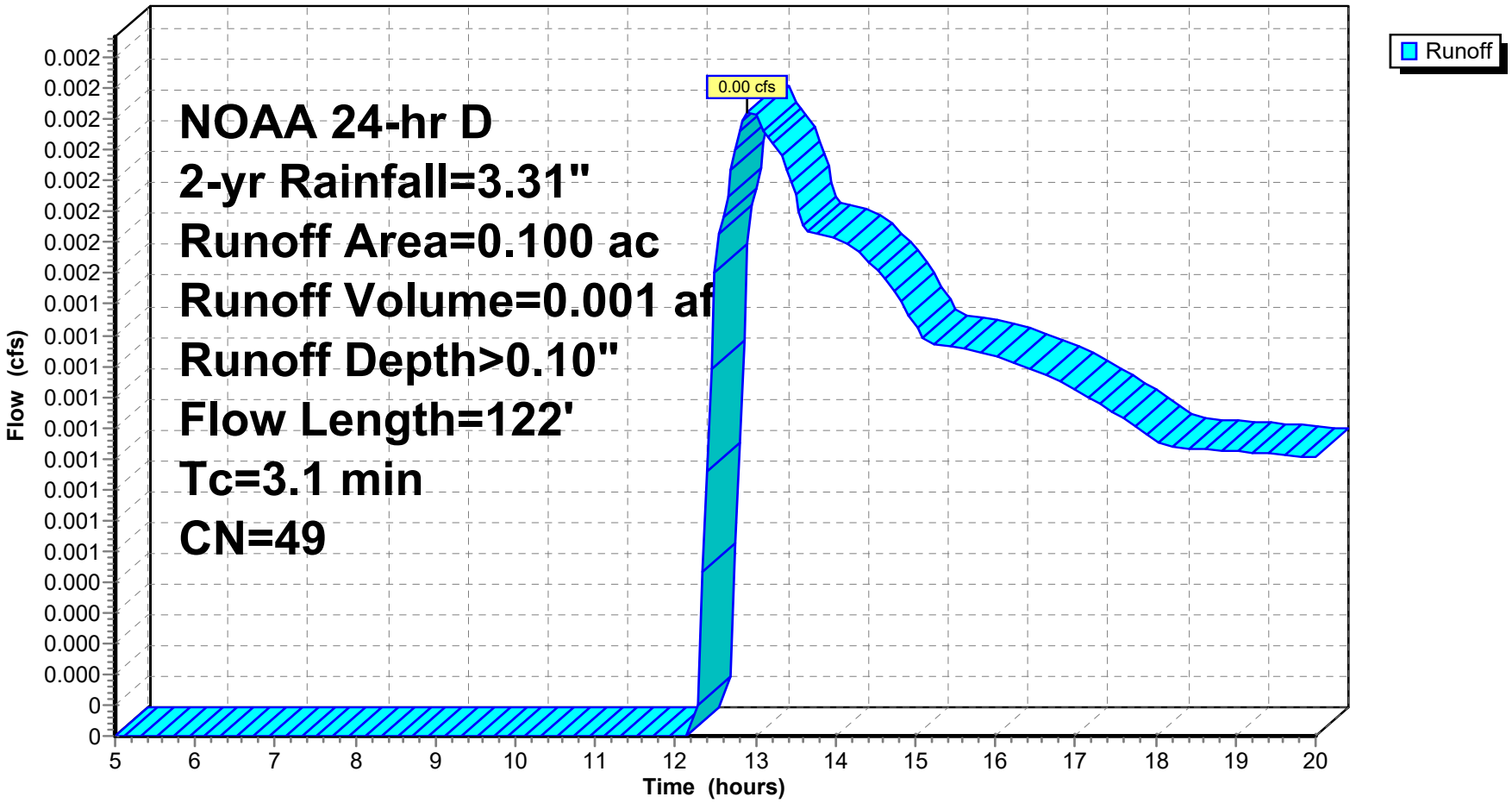
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.31"

Area (ac)	CN	Description
0.100	49	50-75% Grass cover, Fair, HSG A
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	18	0.0390	0.16		**Sheet Flow, 80.2-79.5** Grass: Short n= 0.150 P2= 3.31"
0.1	8	0.0250	0.92		**Sheet Flow, 79.5-79.3** Smooth surfaces n= 0.011 P2= 3.31"
0.4	34	0.0330	1.38		**Sheet Flow, 79.3-78.2** Smooth surfaces n= 0.011 P2= 3.31"
0.7	62	0.0060	1.57		**Shallow Concentrated Flow, 78.2-77.8** Paved Kv= 20.3 fps
3.1	122	Total			

Subcatchment PER-1A:

Hydrograph



Summary for Subcatchment PER-1B:

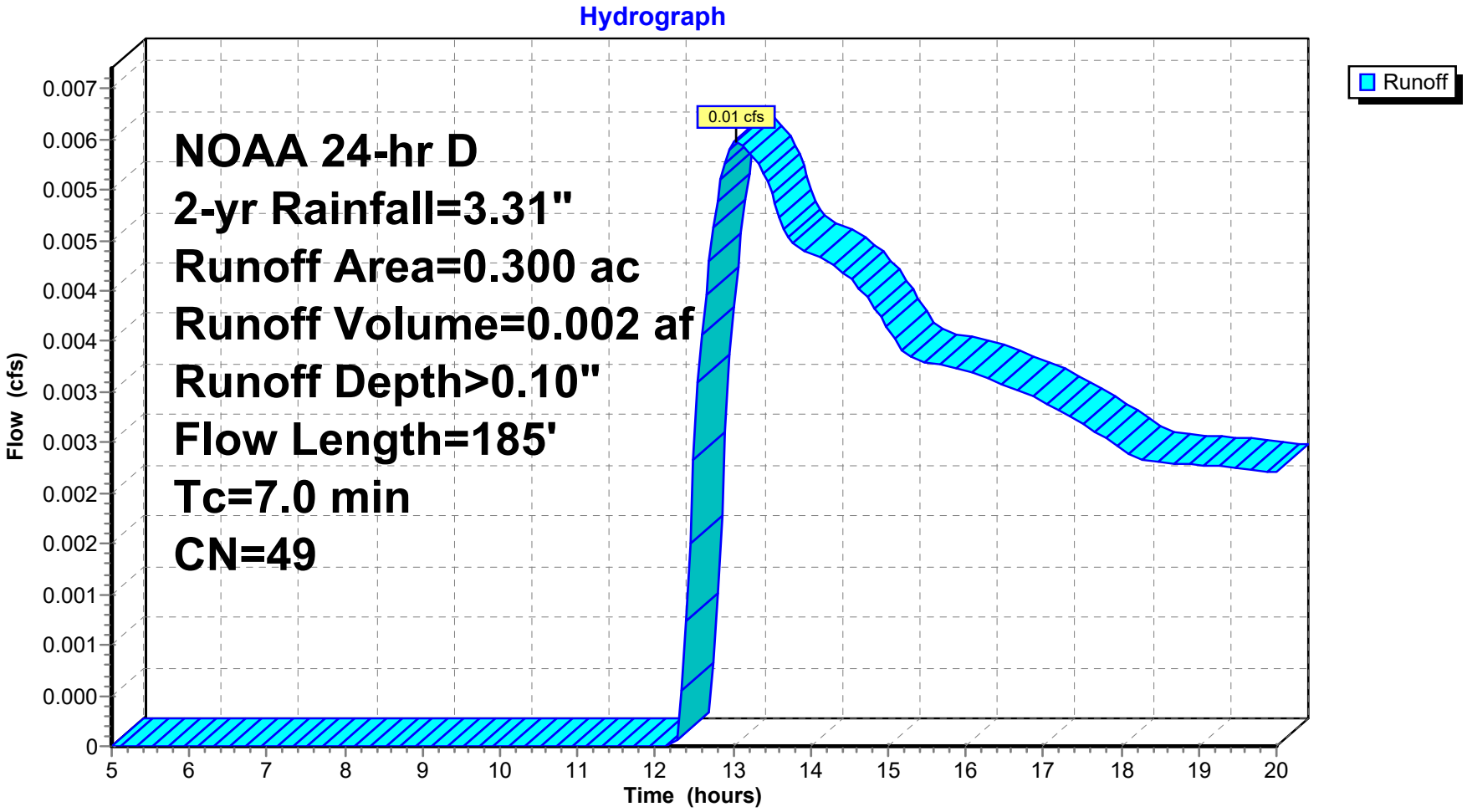
Runoff = 0.01 cfs @ 13.05 hrs, Volume= 0.002 af, Depth> 0.10"
Routed to Pond B-1 : DESIGN POINT 2

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.31"

Area (ac)	CN	Description
0.300	49	50-75% Grass cover, Fair, HSG A
0.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.0160	0.14		**Sheet Flow, 80.2-79.4**
					Grass: Short n= 0.150 P2= 3.31"
1.0	135	0.0190	2.22		**Shallow Concentrated Flow, 79.4-76.9**
					Unpaved Kv= 16.1 fps
7.0	185	Total			

Subcatchment PER-1B:

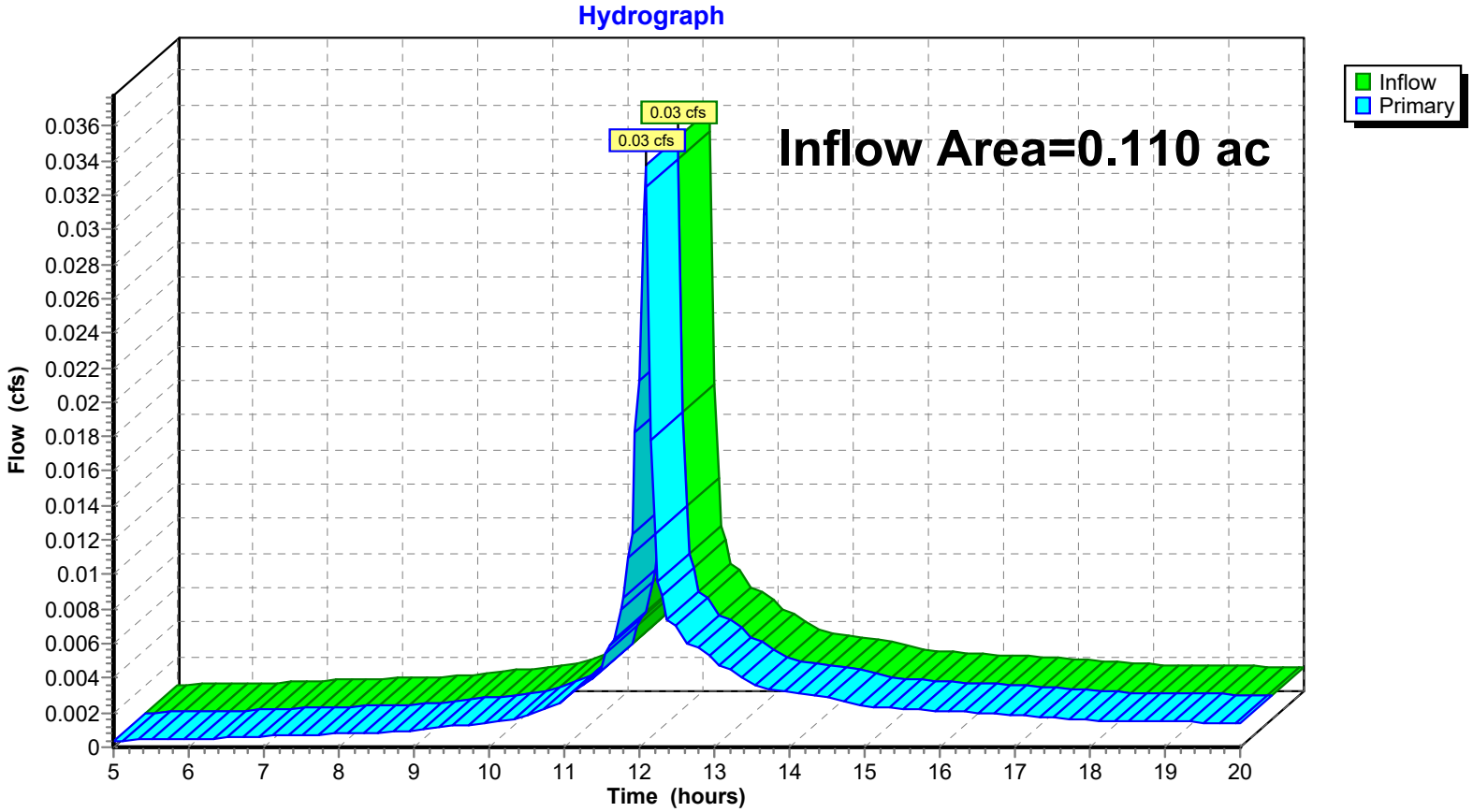


Summary for Pond A-1: DESIGN POINT 1

Inflow Area = 0.110 ac, 9.09% Impervious, Inflow Depth > 0.34" for 2-yr event
Inflow = 0.03 cfs @ 12.08 hrs, Volume= 0.003 af
Primary = 0.03 cfs @ 12.08 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond A-1: DESIGN POINT 1

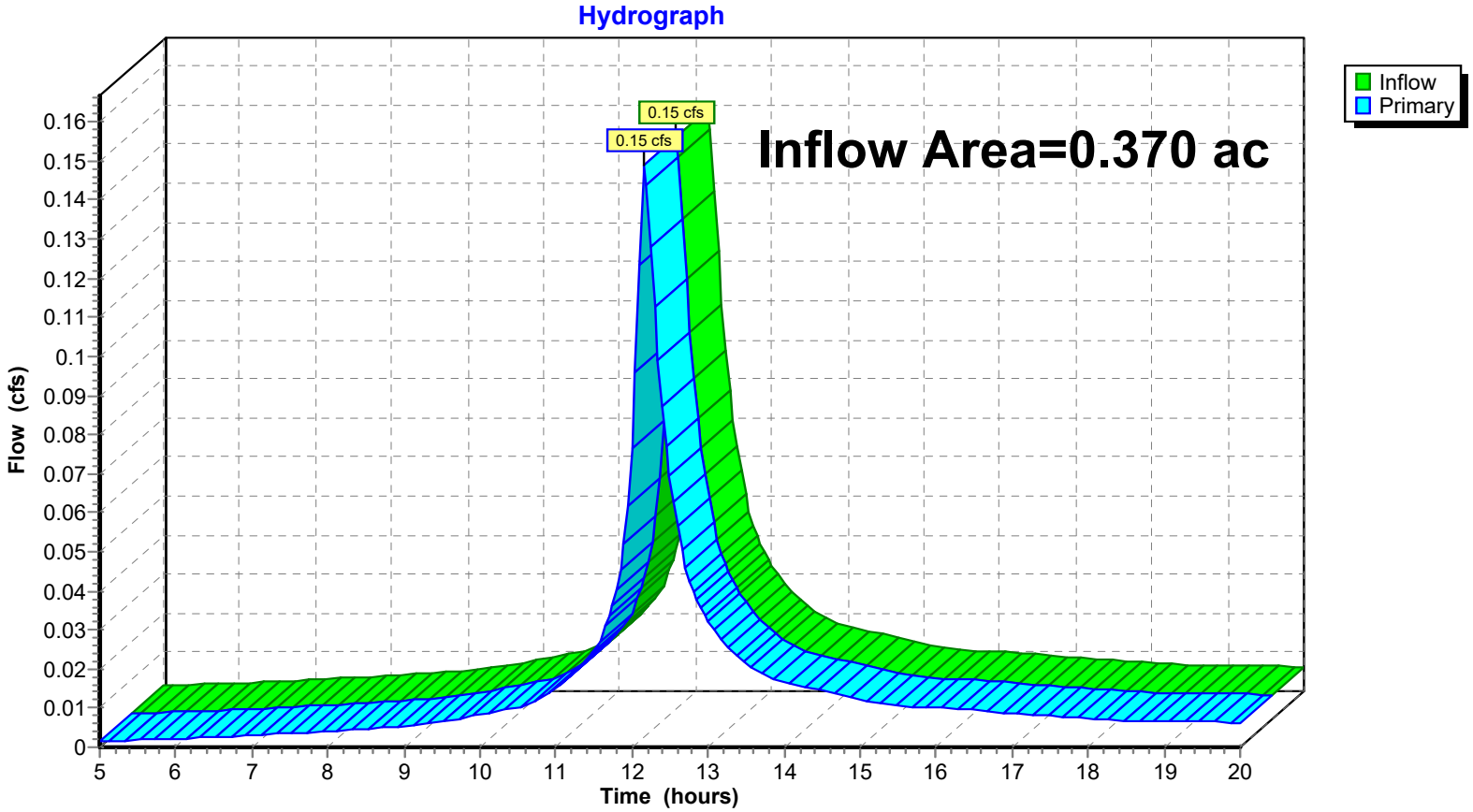


Summary for Pond B-1: DESIGN POINT 2

Inflow Area = 0.370 ac, 0.27% Impervious, Inflow Depth > 0.58" for 2-yr event
Inflow = 0.15 cfs @ 12.17 hrs, Volume= 0.018 af
Primary = 0.15 cfs @ 12.17 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond B-1: DESIGN POINT 2



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentIMP-1A: Runoff Area=0.010 ac 100.00% Impervious Runoff Depth>4.39"
Flow Length=109' Tc=1.4 min CN=98 Runoff=0.05 cfs 0.004 af

SubcatchmentIMP-1B: Runoff Area=0.070 ac 1.43% Impervious Runoff Depth>4.23"
Flow Length=185' Tc=8.6 min CN=96 Runoff=0.23 cfs 0.025 af

SubcatchmentPER-1A: Runoff Area=0.100 ac 0.00% Impervious Runoff Depth>0.56"
Flow Length=122' Tc=3.1 min CN=49 Runoff=0.05 cfs 0.005 af

SubcatchmentPER-1B: Runoff Area=0.300 ac 0.00% Impervious Runoff Depth>0.56"
Flow Length=185' Tc=7.0 min CN=49 Runoff=0.10 cfs 0.014 af

Pond A-1: DESIGN POINT 1 Inflow=0.09 cfs 0.008 af
Primary=0.09 cfs 0.008 af

Pond B-1: DESIGN POINT 2 Inflow=0.33 cfs 0.039 af
Primary=0.33 cfs 0.039 af

Total Runoff Area = 0.480 ac Runoff Volume = 0.047 af Average Runoff Depth = 1.18"
97.71% Pervious = 0.469 ac 2.29% Impervious = 0.011 ac

Summary for Subcatchment IMP-1A:

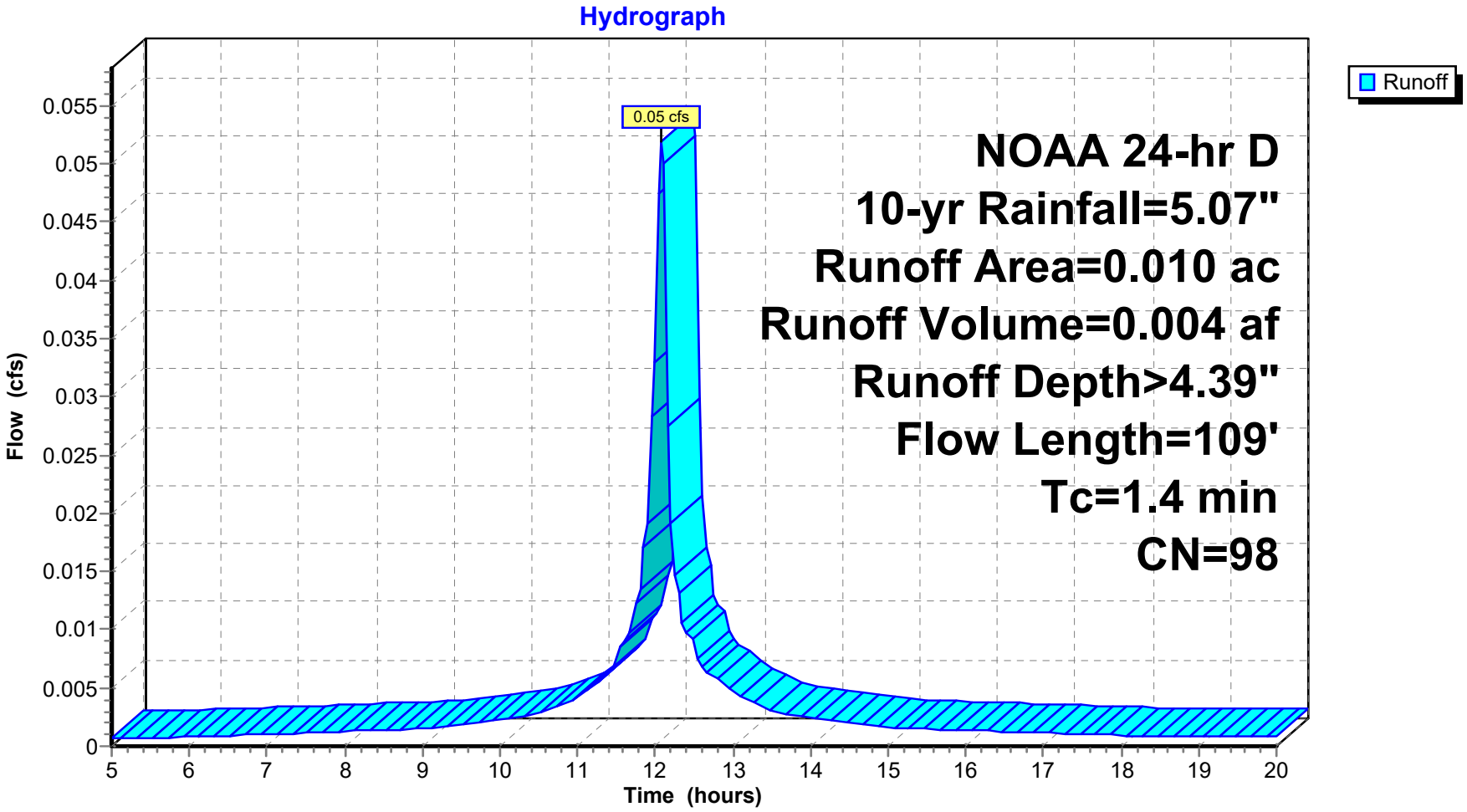
Runoff = 0.05 cfs @ 12.08 hrs, Volume= 0.004 af, Depth> 4.39"
Routed to Pond A-1 : DESIGN POINT 1

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.07"

Area (ac)	CN	Description
0.010	98	Unconnected pavement, HSG D
0.010		100.00% Impervious Area
0.010		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	47	0.0320	1.45		**Sheet Flow, 79.7-78.2** Smooth surfaces n= 0.011 P2= 3.31"
0.5	18	0.0050	0.57		**Sheet Flow, 78.2-78.1** Smooth surfaces n= 0.011 P2= 3.31"
0.4	44	0.0070	1.70		**Shallow Concentrated Flow, 78.1-77.8** Paved Kv= 20.3 fps
1.4	109	Total			

Subcatchment IMP-1A:



Summary for Subcatchment IMP-1B:

Runoff = 0.23 cfs @ 12.17 hrs, Volume= 0.025 af, Depth> 4.23"
Routed to Pond B-1 : DESIGN POINT 2

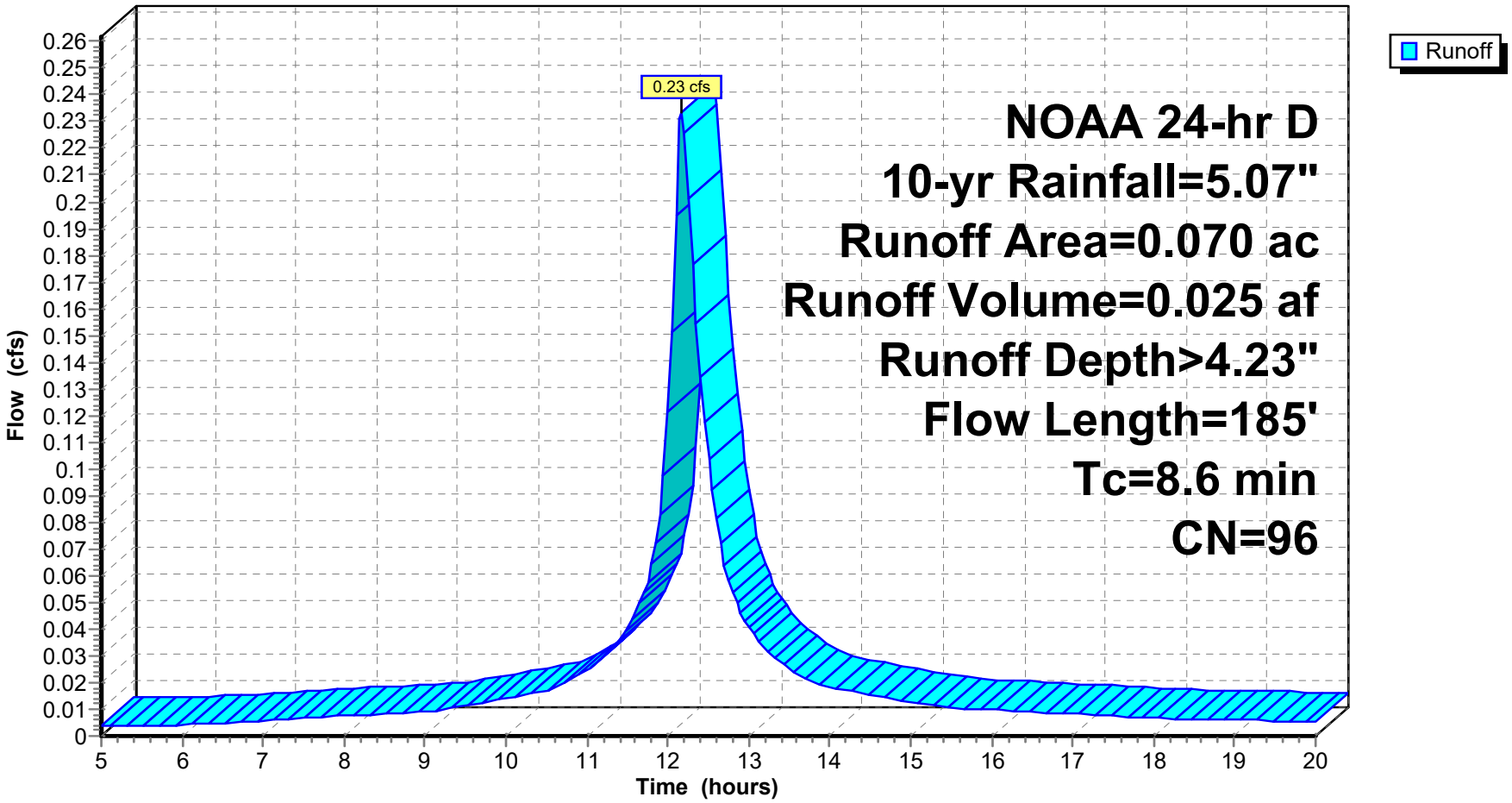
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.07"

Area (ac)	CN	Description
0.001	98	Unconnected pavement, HSG D
0.069	96	Gravel surface, HSG A
0.070	96	Weighted Average
0.069		98.57% Pervious Area
0.001		1.43% Impervious Area
0.001		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	4	0.0080	0.51		**Sheet Flow, 79.7-79.7** Smooth surfaces n= 0.011 P2= 3.31"
7.5	46	0.0080	0.10		**Sheet Flow, 79.7-79.4** Grass: Short n= 0.150 P2= 3.31"
1.0	135	0.0190	2.22		**Shallow Concentrated Flow, 79.4-76.9** Unpaved Kv= 16.1 fps
8.6	185	Total			

Subcatchment IMP-1B:

Hydrograph



Summary for Subcatchment PER-1A:

Runoff = 0.05 cfs @ 12.13 hrs, Volume= 0.005 af, Depth> 0.56"
Routed to Pond A-1 : DESIGN POINT 1

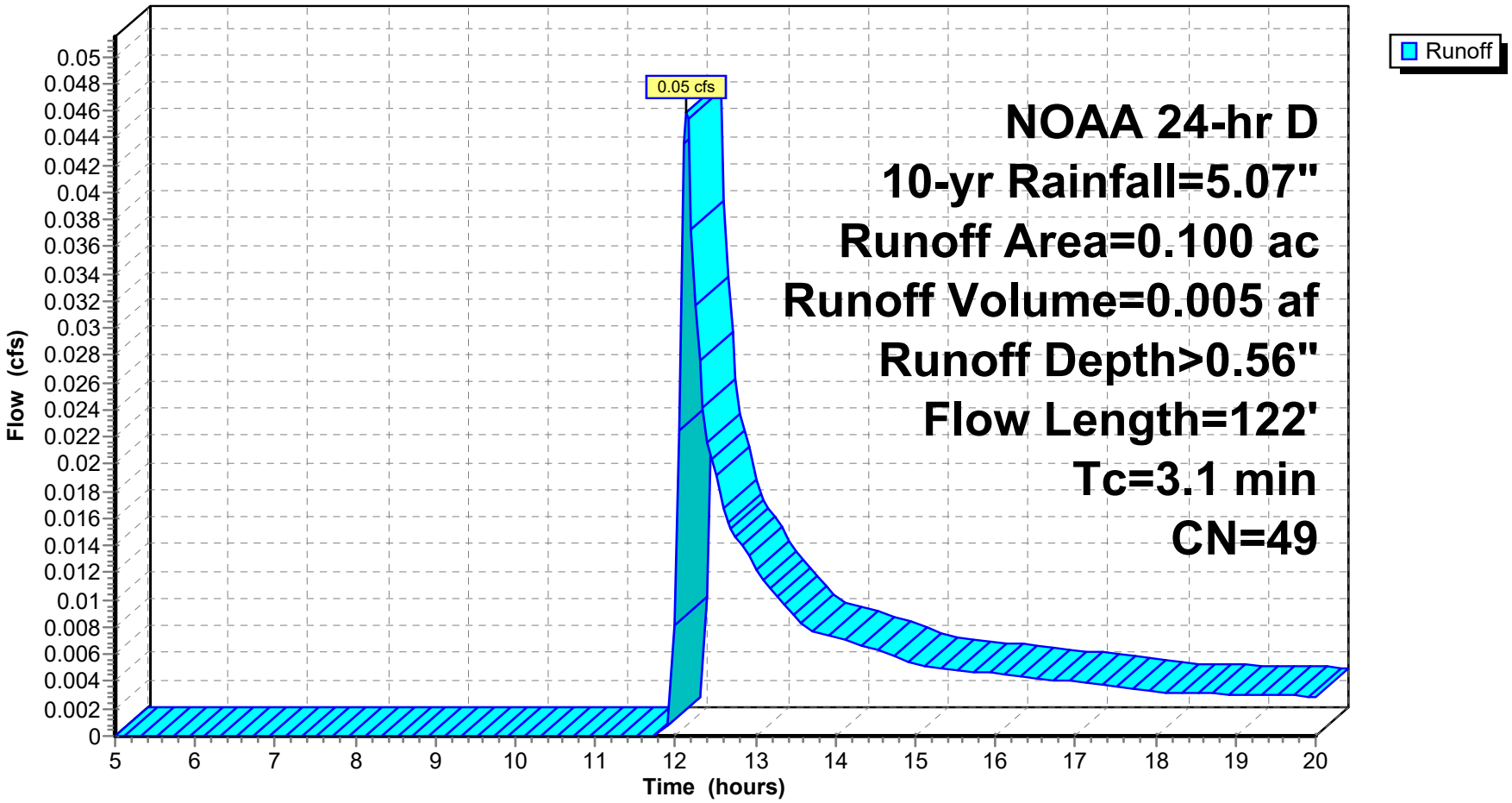
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.07"

Area (ac)	CN	Description
0.100	49	50-75% Grass cover, Fair, HSG A
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	18	0.0390	0.16		**Sheet Flow, 80.2-79.5** Grass: Short n= 0.150 P2= 3.31"
0.1	8	0.0250	0.92		**Sheet Flow, 79.5-79.3** Smooth surfaces n= 0.011 P2= 3.31"
0.4	34	0.0330	1.38		**Sheet Flow, 79.3-78.2** Smooth surfaces n= 0.011 P2= 3.31"
0.7	62	0.0060	1.57		**Shallow Concentrated Flow, 78.2-77.8** Paved Kv= 20.3 fps
3.1	122	Total			

Subcatchment PER-1A:

Hydrograph



Summary for Subcatchment PER-1B:

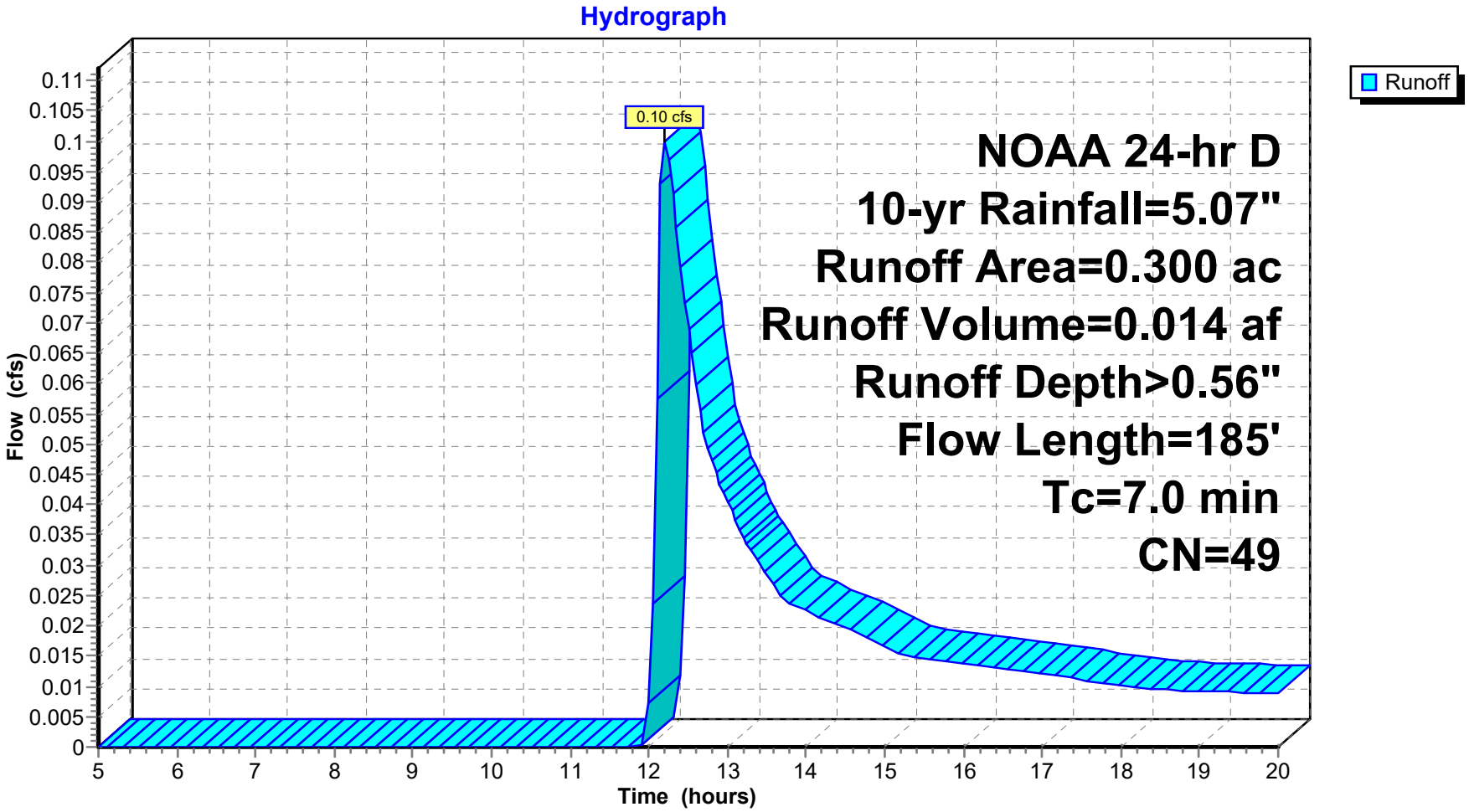
Runoff = 0.10 cfs @ 12.21 hrs, Volume= 0.014 af, Depth> 0.56"
Routed to Pond B-1 : DESIGN POINT 2

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.07"

Area (ac)	CN	Description
0.300	49	50-75% Grass cover, Fair, HSG A
0.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.0160	0.14		**Sheet Flow, 80.2-79.4**
					Grass: Short n= 0.150 P2= 3.31"
1.0	135	0.0190	2.22		**Shallow Concentrated Flow, 79.4-76.9**
					Unpaved Kv= 16.1 fps
7.0	185	Total			

Subcatchment PER-1B:

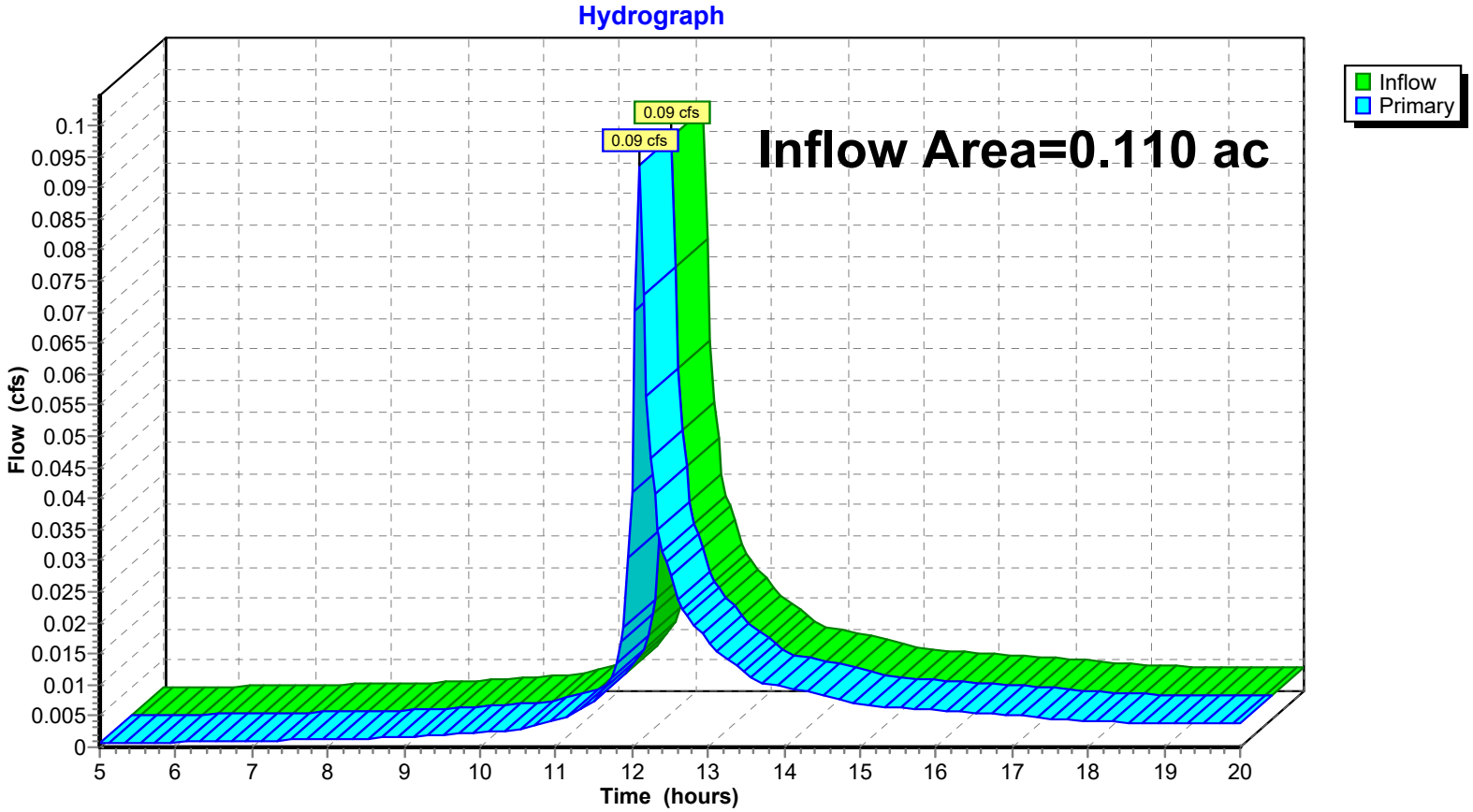


Summary for Pond A-1: DESIGN POINT 1

Inflow Area = 0.110 ac, 9.09% Impervious, Inflow Depth > 0.91" for 10-yr event
Inflow = 0.09 cfs @ 12.10 hrs, Volume= 0.008 af
Primary = 0.09 cfs @ 12.10 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond A-1: DESIGN POINT 1

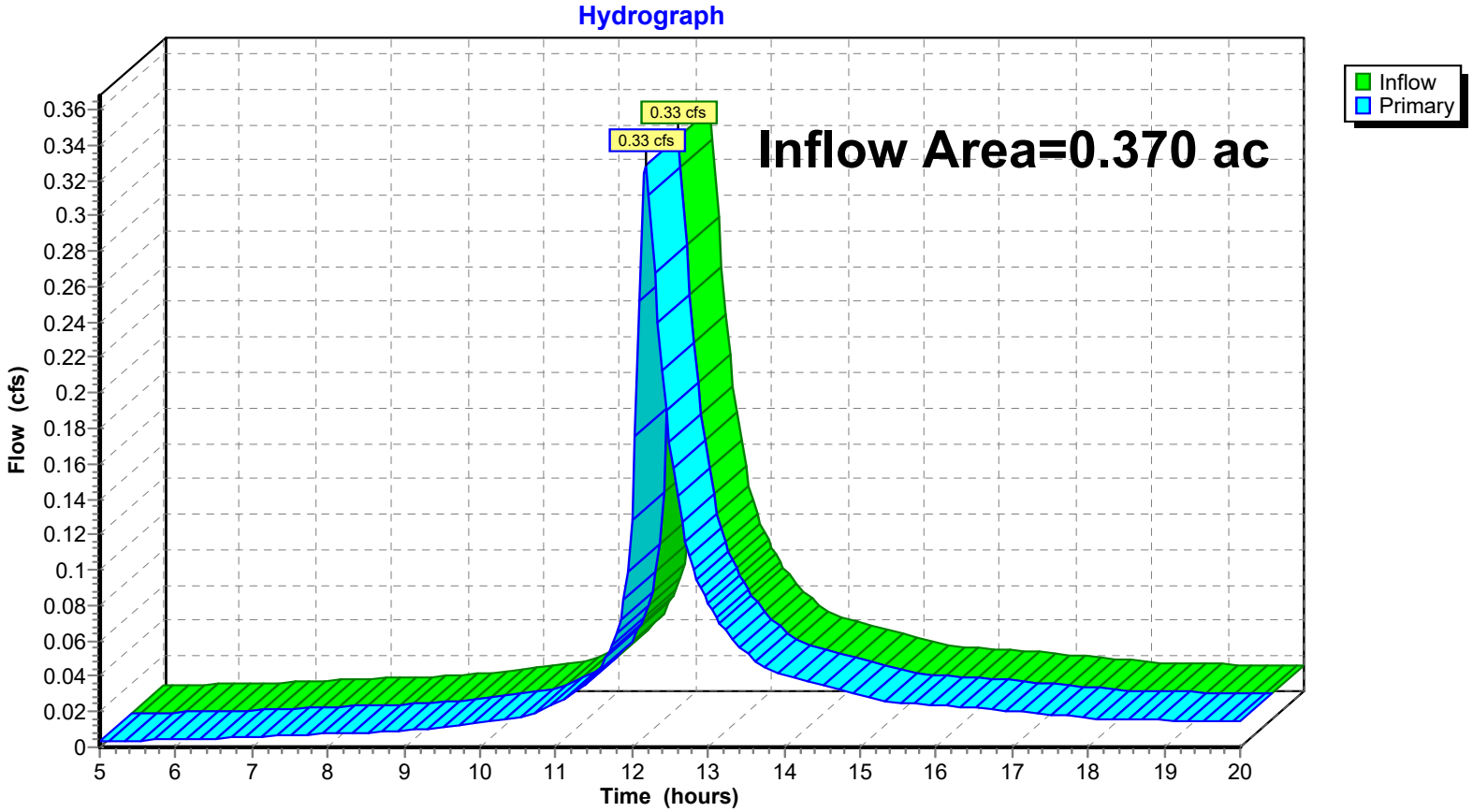


Summary for Pond B-1: DESIGN POINT 2

Inflow Area = 0.370 ac, 0.27% Impervious, Inflow Depth > 1.25" for 10-yr event
Inflow = 0.33 cfs @ 12.18 hrs, Volume= 0.039 af
Primary = 0.33 cfs @ 12.18 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond B-1: DESIGN POINT 2



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentIMP-1A: Runoff Area=0.010 ac 100.00% Impervious Runoff Depth>7.48"
Flow Length=109' Tc=1.4 min CN=98 Runoff=0.09 cfs 0.006 af

SubcatchmentIMP-1B: Runoff Area=0.070 ac 1.43% Impervious Runoff Depth>7.36"
Flow Length=185' Tc=8.6 min CN=96 Runoff=0.40 cfs 0.043 af

SubcatchmentPER-1A: Runoff Area=0.100 ac 0.00% Impervious Runoff Depth>2.21"
Flow Length=122' Tc=3.1 min CN=49 Runoff=0.26 cfs 0.018 af

SubcatchmentPER-1B: Runoff Area=0.300 ac 0.00% Impervious Runoff Depth>2.20"
Flow Length=185' Tc=7.0 min CN=49 Runoff=0.60 cfs 0.055 af

Pond A-1: DESIGN POINT 1 Inflow=0.34 cfs 0.025 af
Primary=0.34 cfs 0.025 af

Pond B-1: DESIGN POINT 2 Inflow=1.00 cfs 0.098 af
Primary=1.00 cfs 0.098 af

Total Runoff Area = 0.480 ac Runoff Volume = 0.123 af Average Runoff Depth = 3.06"
97.71% Pervious = 0.469 ac 2.29% Impervious = 0.011 ac

Summary for Subcatchment IMP-1A:

Runoff = 0.09 cfs @ 12.08 hrs, Volume= 0.006 af, Depth> 7.48"
Routed to Pond A-1 : DESIGN POINT 1

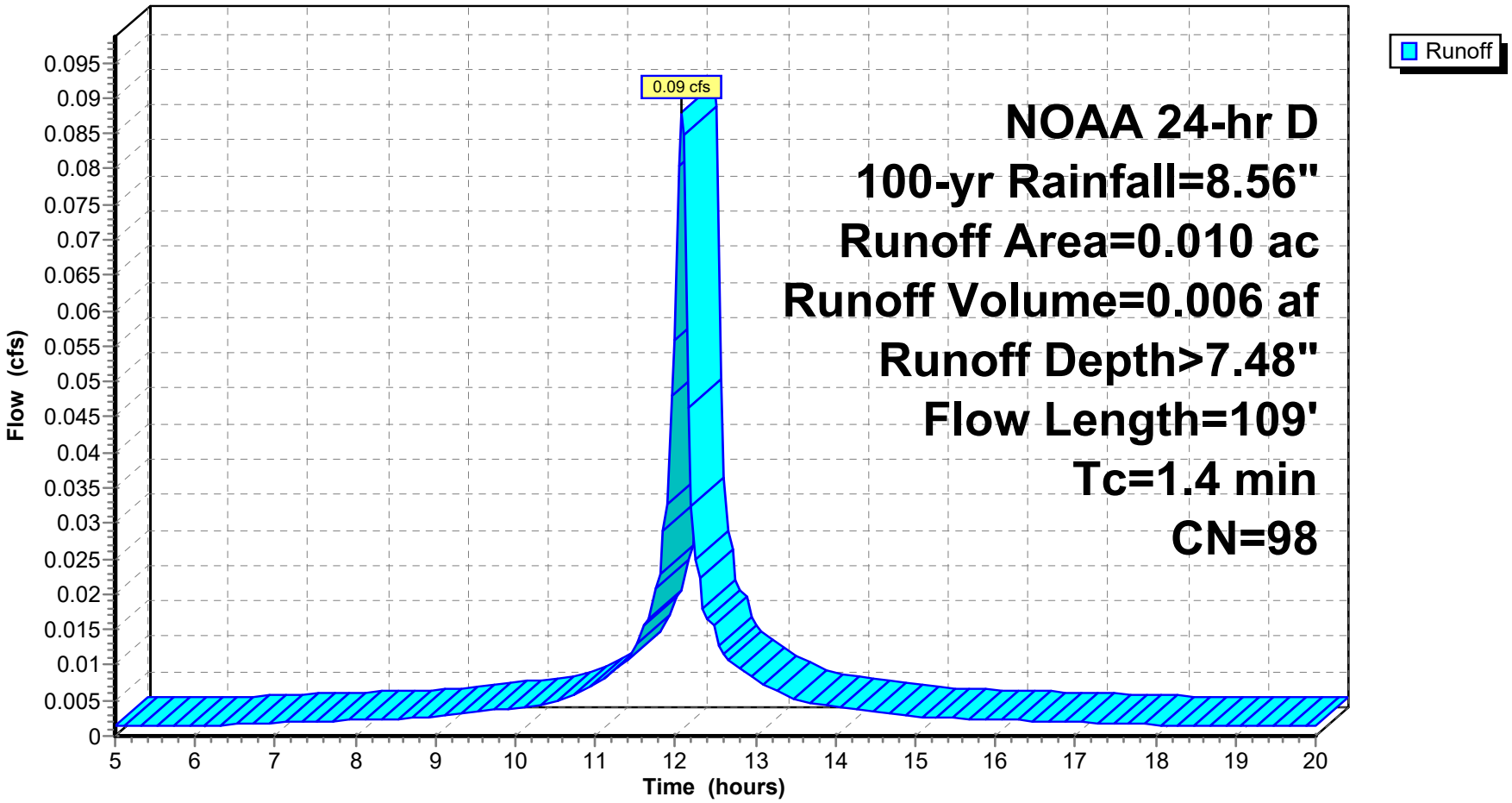
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.56"

Area (ac)	CN	Description
0.010	98	Unconnected pavement, HSG D
0.010		100.00% Impervious Area
0.010		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	47	0.0320	1.45		**Sheet Flow, 79.7-78.2** Smooth surfaces n= 0.011 P2= 3.31"
0.5	18	0.0050	0.57		**Sheet Flow, 78.2-78.1** Smooth surfaces n= 0.011 P2= 3.31"
0.4	44	0.0070	1.70		**Shallow Concentrated Flow, 78.1-77.8** Paved Kv= 20.3 fps
1.4	109	Total			

Subcatchment IMP-1A:

Hydrograph



Summary for Subcatchment IMP-1B:

Runoff = 0.40 cfs @ 12.17 hrs, Volume= 0.043 af, Depth> 7.36"
Routed to Pond B-1 : DESIGN POINT 2

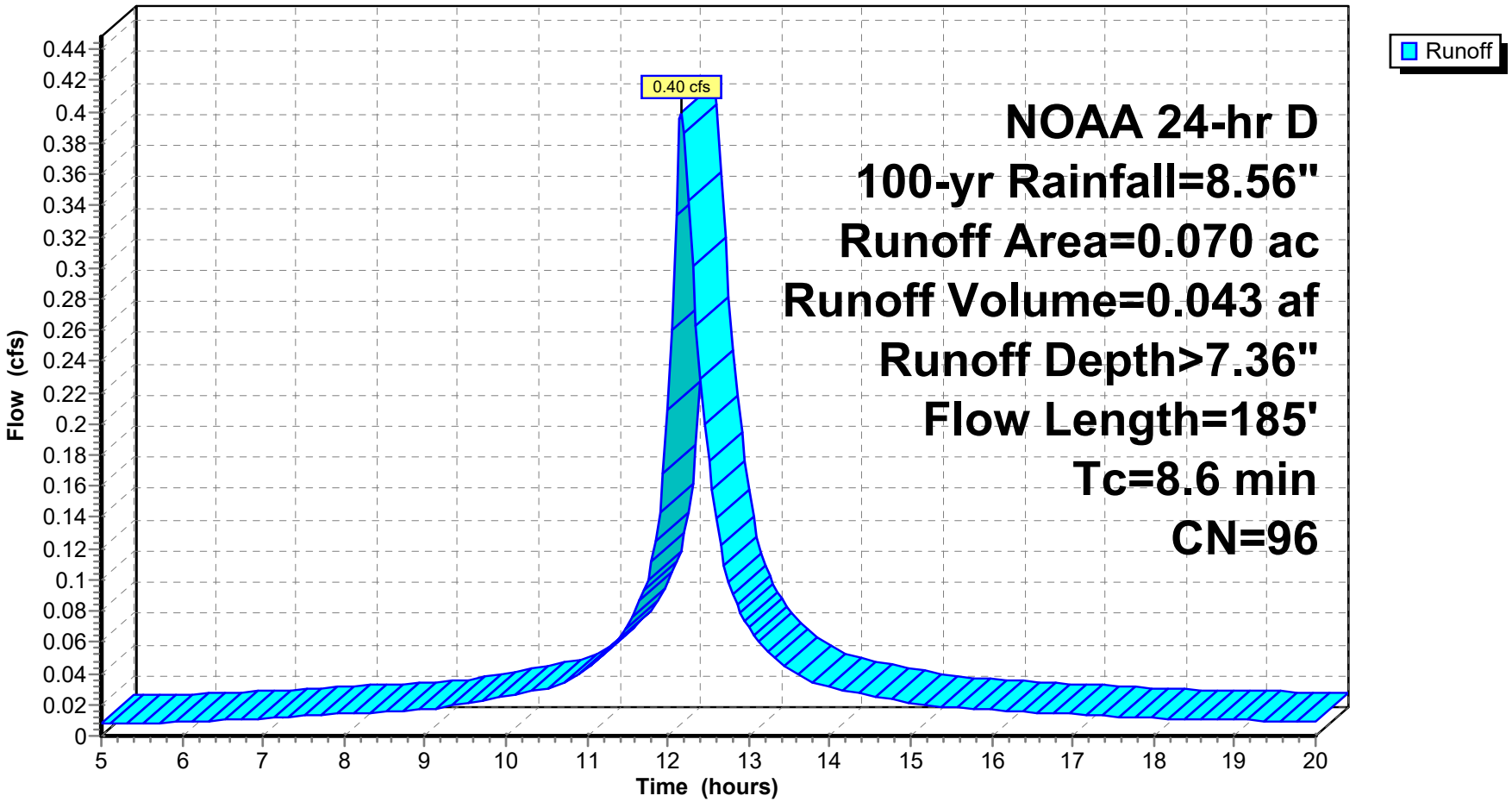
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.56"

Area (ac)	CN	Description
0.001	98	Unconnected pavement, HSG D
0.069	96	Gravel surface, HSG A
0.070	96	Weighted Average
0.069		98.57% Pervious Area
0.001		1.43% Impervious Area
0.001		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	4	0.0080	0.51		**Sheet Flow, 79.7-79.7** Smooth surfaces n= 0.011 P2= 3.31"
7.5	46	0.0080	0.10		**Sheet Flow, 79.7-79.4** Grass: Short n= 0.150 P2= 3.31"
1.0	135	0.0190	2.22		**Shallow Concentrated Flow, 79.4-76.9** Unpaved Kv= 16.1 fps
8.6	185	Total			

Subcatchment IMP-1B:

Hydrograph



Summary for Subcatchment PER-1A:

Runoff = 0.26 cfs @ 12.11 hrs, Volume= 0.018 af, Depth> 2.21"
Routed to Pond A-1 : DESIGN POINT 1

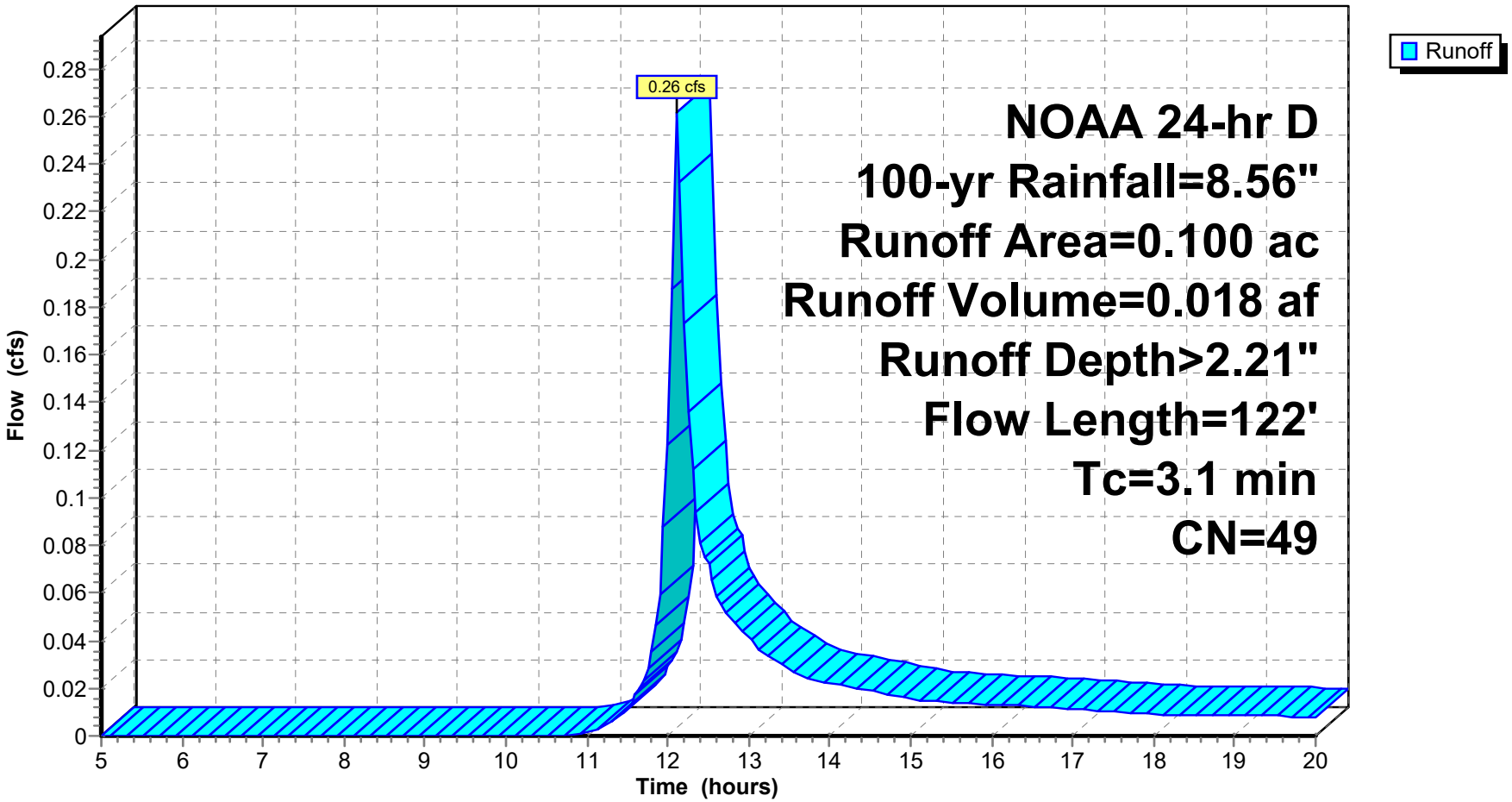
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.56"

Area (ac)	CN	Description
0.100	49	50-75% Grass cover, Fair, HSG A
0.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	18	0.0390	0.16		**Sheet Flow, 80.2-79.5** Grass: Short n= 0.150 P2= 3.31"
0.1	8	0.0250	0.92		**Sheet Flow, 79.5-79.3** Smooth surfaces n= 0.011 P2= 3.31"
0.4	34	0.0330	1.38		**Sheet Flow, 79.3-78.2** Smooth surfaces n= 0.011 P2= 3.31"
0.7	62	0.0060	1.57		**Shallow Concentrated Flow, 78.2-77.8** Paved Kv= 20.3 fps
3.1	122	Total			

Subcatchment PER-1A:

Hydrograph



Summary for Subcatchment PER-1B:

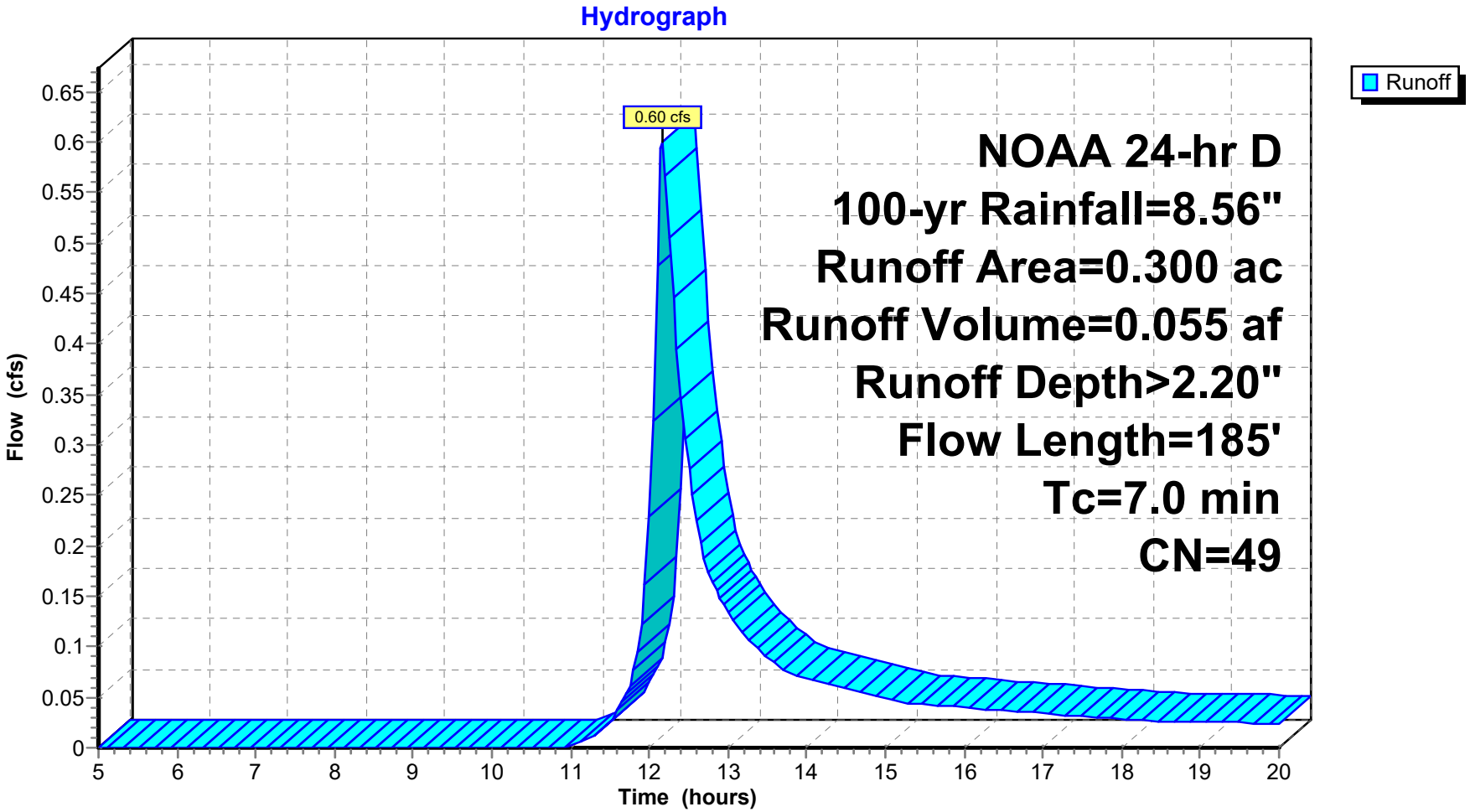
Runoff = 0.60 cfs @ 12.17 hrs, Volume= 0.055 af, Depth> 2.20"
Routed to Pond B-1 : DESIGN POINT 2

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.56"

Area (ac)	CN	Description
0.300	49	50-75% Grass cover, Fair, HSG A
0.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.0160	0.14		**Sheet Flow, 80.2-79.4**
					Grass: Short n= 0.150 P2= 3.31"
1.0	135	0.0190	2.22		**Shallow Concentrated Flow, 79.4-76.9**
					Unpaved Kv= 16.1 fps
7.0	185	Total			

Subcatchment PER-1B:

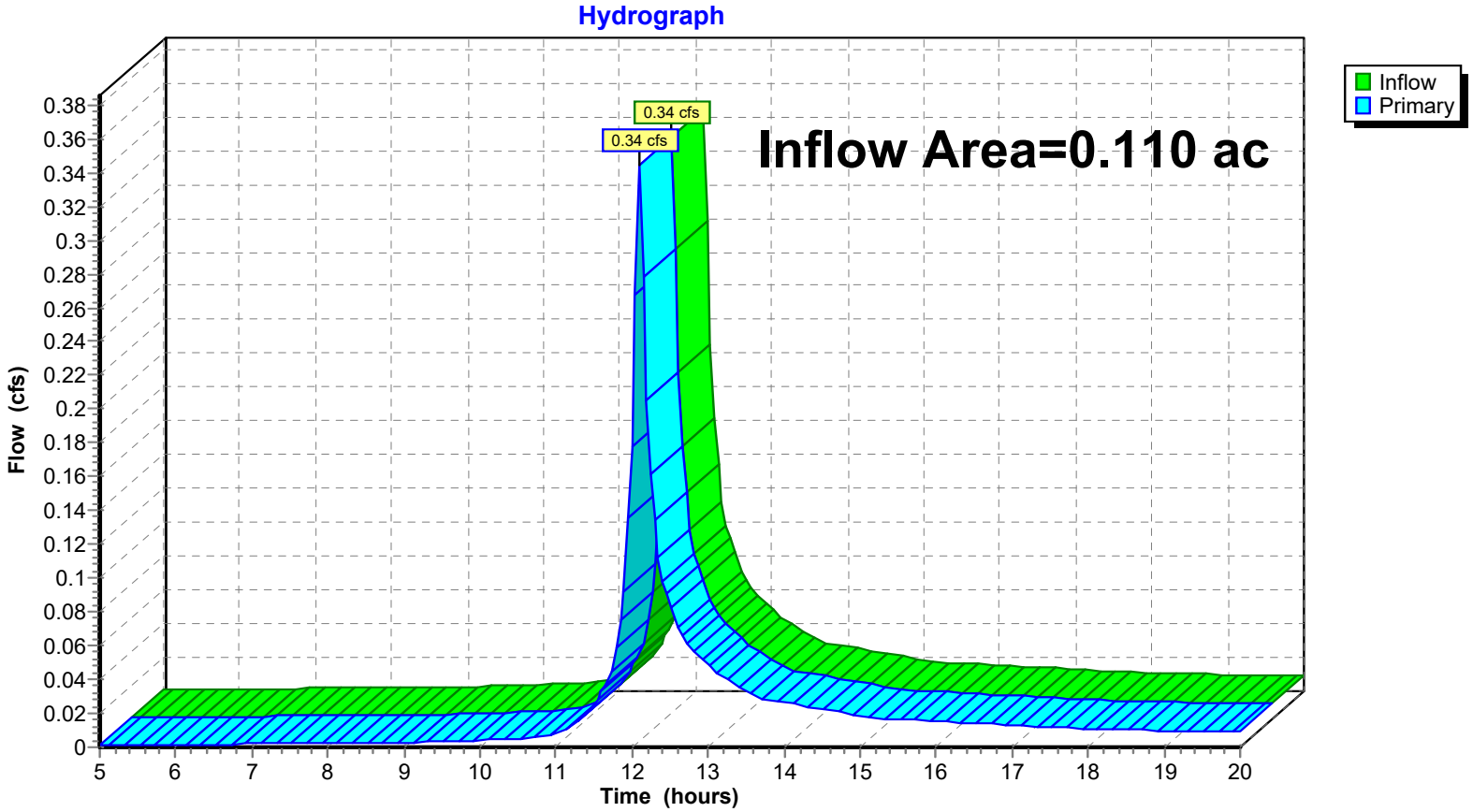


Summary for Pond A-1: DESIGN POINT 1

Inflow Area = 0.110 ac, 9.09% Impervious, Inflow Depth > 2.69" for 100-yr event
Inflow = 0.34 cfs @ 12.10 hrs, Volume= 0.025 af
Primary = 0.34 cfs @ 12.10 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond A-1: DESIGN POINT 1

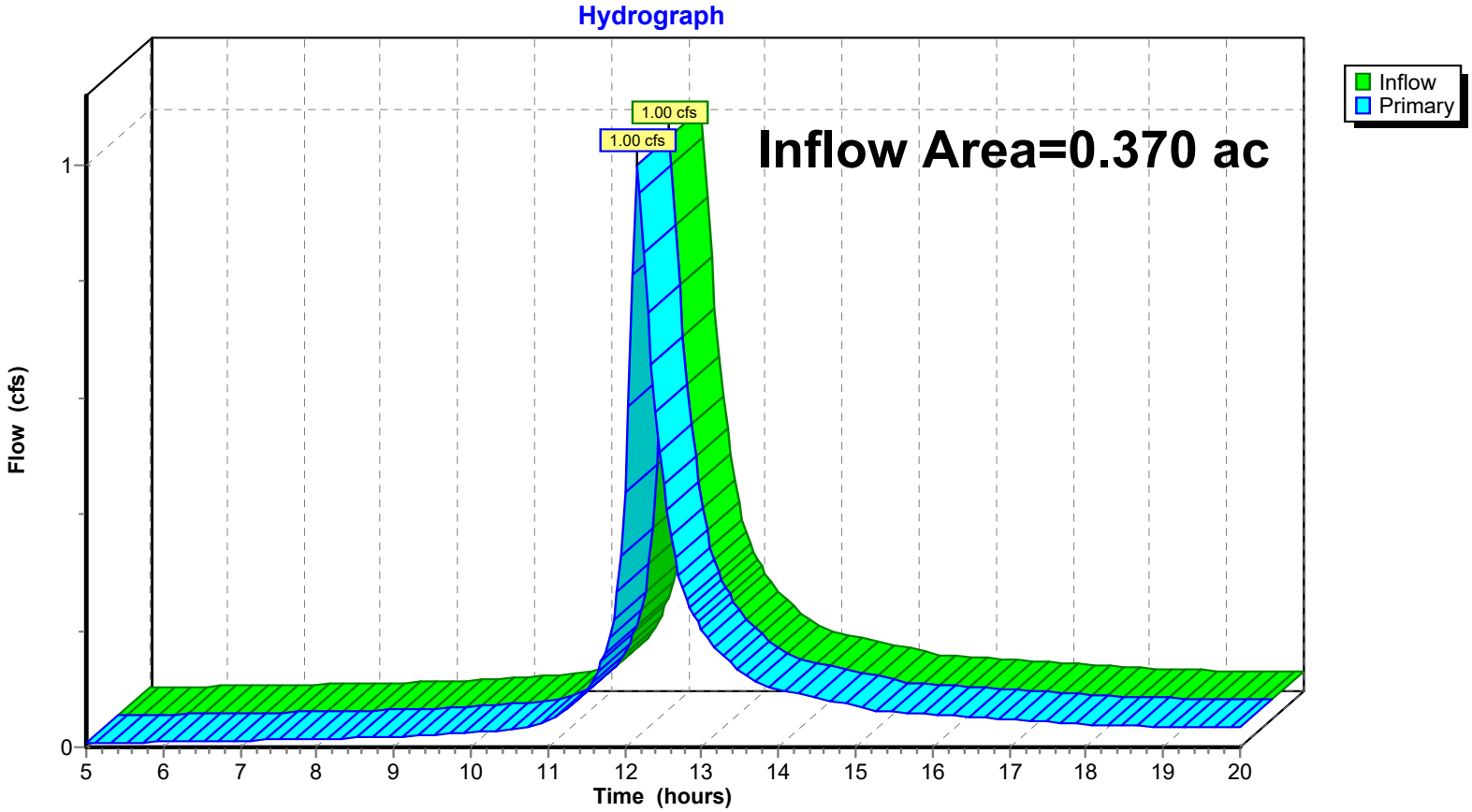


Summary for Pond B-1: DESIGN POINT 2

Inflow Area = 0.370 ac, 0.27% Impervious, Inflow Depth > 3.18" for 100-yr event
Inflow = 1.00 cfs @ 12.17 hrs, Volume= 0.098 af
Primary = 1.00 cfs @ 12.17 hrs, Volume= 0.098 af, Atten= 0%, Lag= 0.0 min

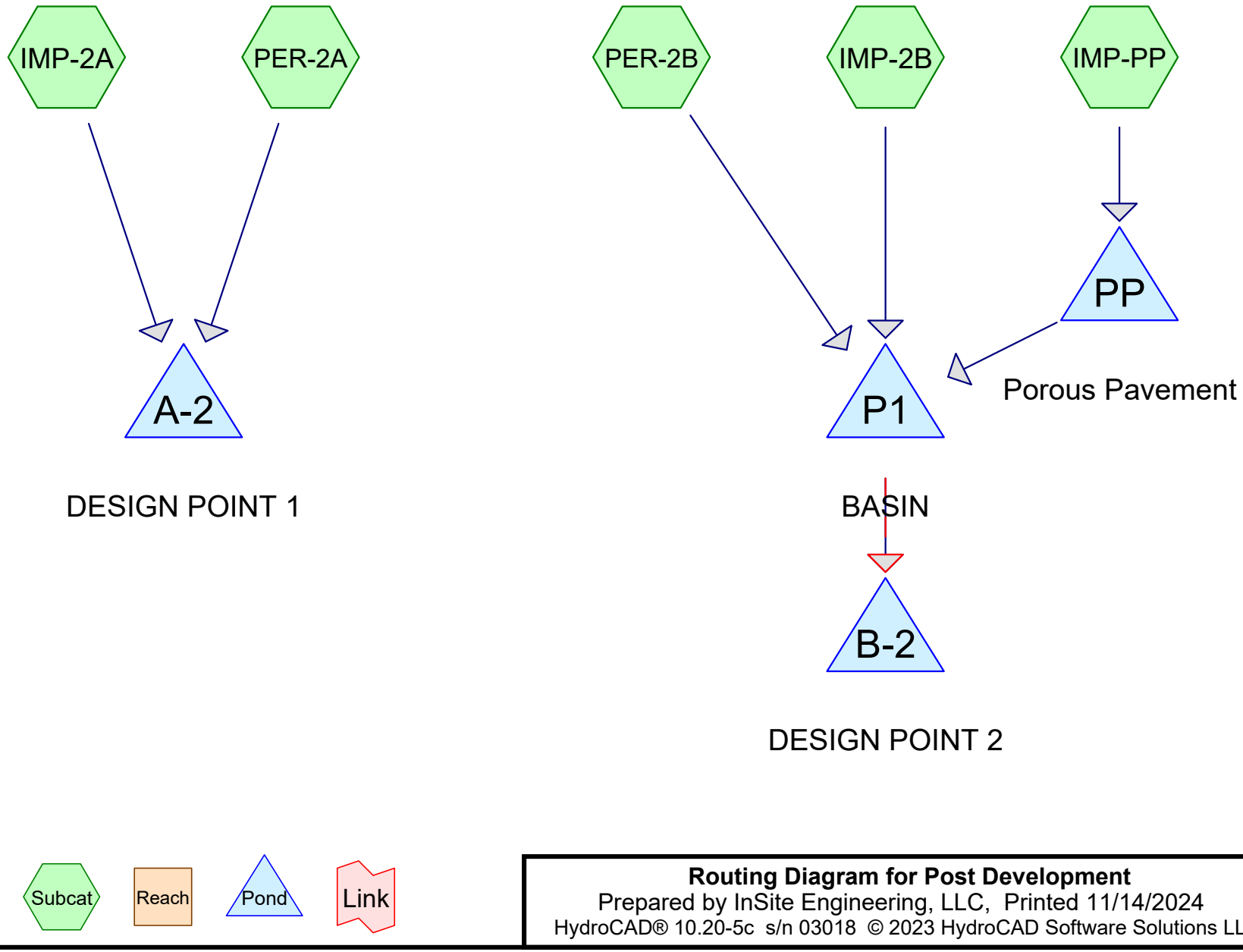
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond B-1: DESIGN POINT 2



A P P E N D I X E

POST-DEVELOPMENT FLOW CALCULATIONS



Routing Diagram for Post Development
Prepared by InSite Engineering, LLC, Printed 11/14/2024

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	NOAA 24-hr	D	Default	24.00	1	3.31	2
2	10-yr	NOAA 24-hr	D	Default	24.00	1	5.07	2
3	100-yr	NOAA 24-hr	D	Default	24.00	1	8.56	2

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentIMP-2A: Runoff Area=0.010 ac 100.00% Impervious Runoff Depth>2.82"
Tc=1.4 min CN=98 Runoff=0.03 cfs 0.002 af

SubcatchmentIMP-2B: Runoff Area=0.120 ac 100.00% Impervious Runoff Depth>2.82"
Flow Length=272' Tc=1.9 min CN=98 Runoff=0.39 cfs 0.028 af

SubcatchmentIMP-PP: Runoff Area=0.100 ac 100.00% Impervious Runoff Depth>2.82"
Tc=1.9 min CN=98 Runoff=0.33 cfs 0.023 af

SubcatchmentPER-2A: Runoff Area=0.050 ac 0.00% Impervious Runoff Depth>0.10"
Tc=3.1 min CN=49 Runoff=0.00 cfs 0.000 af

SubcatchmentPER-2B: Runoff Area=0.200 ac 0.00% Impervious Runoff Depth>0.10"
Flow Length=173' Tc=5.9 min CN=49 Runoff=0.00 cfs 0.002 af

Pond A-2: DESIGN POINT 1 Inflow=0.03 cfs 0.003 af
Primary=0.03 cfs 0.003 af

Pond B-2: DESIGN POINT 2 Inflow=0.14 cfs 0.020 af
Primary=0.14 cfs 0.020 af

Pond P1: BASIN Peak Elev=75.22' Storage=630 cf Inflow=0.39 cfs 0.030 af
Primary=0.14 cfs 0.020 af Secondary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.020 af

Pond PP: Porous Pavement Peak Elev=0.59' Storage=0.023 af Inflow=0.33 cfs 0.023 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 0.480 ac Runoff Volume = 0.056 af Average Runoff Depth = 1.40"
52.08% Pervious = 0.250 ac 47.92% Impervious = 0.230 ac

Summary for Subcatchment IMP-2A:

Runoff = 0.03 cfs @ 12.08 hrs, Volume= 0.002 af, Depth> 2.82"
Routed to Pond A-2 : DESIGN POINT 1

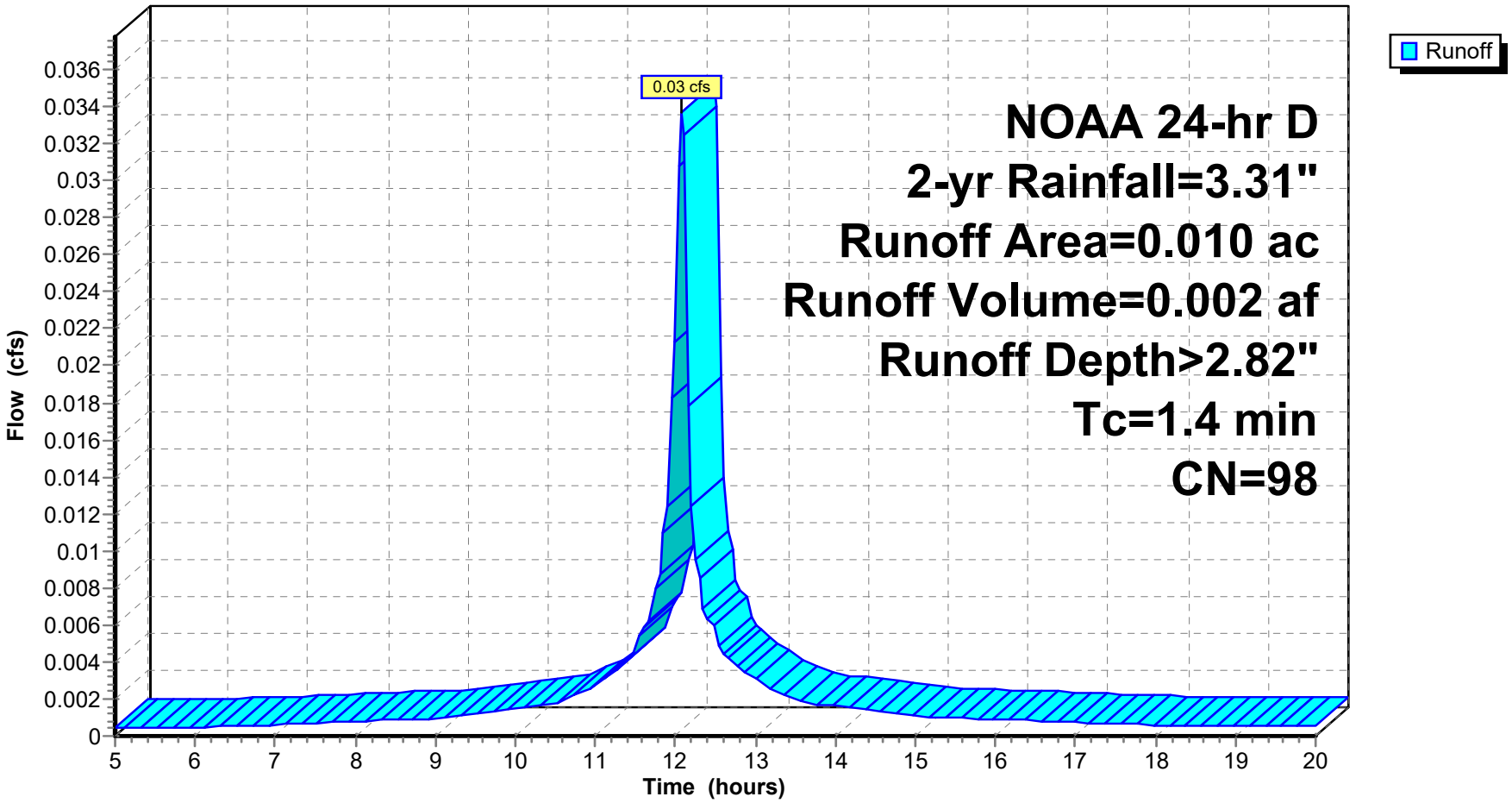
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.31"

Area (ac)	CN	Description
0.010	98	Unconnected pavement, HSG D
0.010		100.00% Impervious Area
0.010		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4					**Direct Entry, 1.4**

Subcatchment IMP-2A:

Hydrograph



Summary for Subcatchment IMP-2B:

Runoff = 0.39 cfs @ 12.09 hrs, Volume= 0.028 af, Depth> 2.82"
Routed to Pond P1 : BASIN

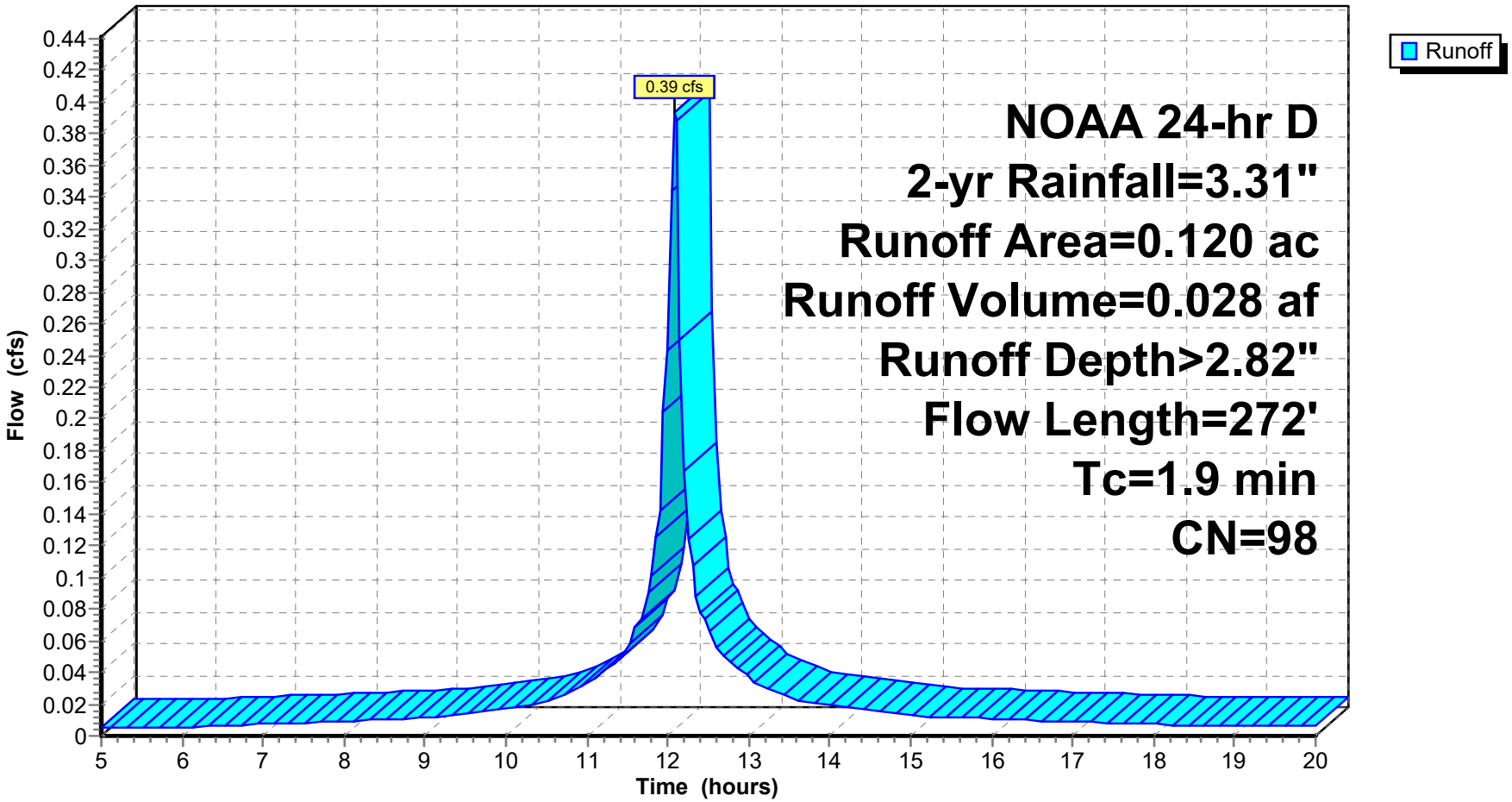
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.31"

Area (ac)	CN	Description
0.120	98	Unconnected pavement, HSG D
0.120		100.00% Impervious Area
0.120		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0148	1.08		**Sheet Flow, 79.5-78.7** Smooth surfaces n= 0.011 P2= 3.31"
0.3	38	0.0148	2.47		**Shallow Concentrated Flow, 78.7-78.2** Paved Kv= 20.3 fps
0.8	184	0.0050	4.03	4.95	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
1.9	272	Total			

Subcatchment IMP-2B:

Hydrograph



Summary for Subcatchment IMP-PP:

Runoff = 0.33 cfs @ 12.09 hrs, Volume= 0.023 af, Depth> 2.82"
Routed to Pond PP : Porous Pavement

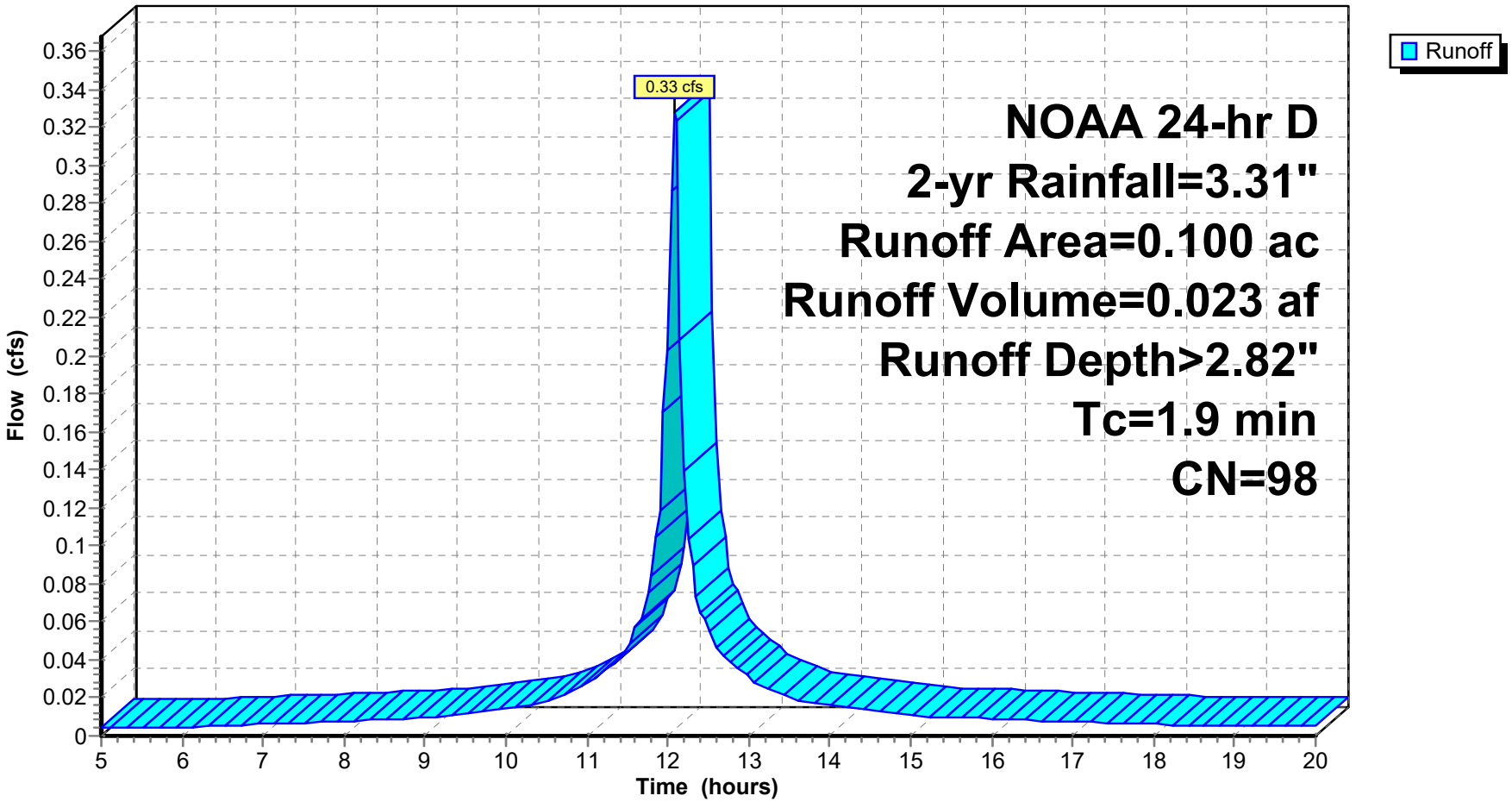
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.31"

Area (ac)	CN	Description
0.100	98	Unconnected pavement, HSG D
0.100		100.00% Impervious Area
0.100		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9					**Direct Entry,**

Subcatchment IMP-PP:

Hydrograph



Summary for Subcatchment PER-2A:

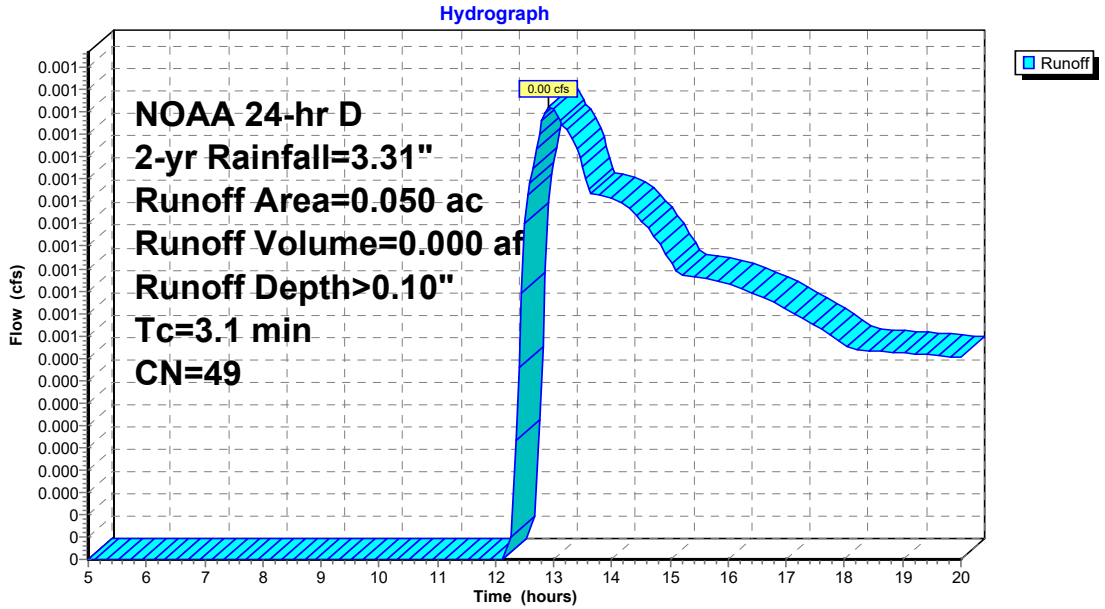
Runoff = 0.00 cfs @ 12.90 hrs, Volume= 0.000 af, Depth> 0.10"
Routed to Pond A-2 : DESIGN POINT 1

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.31"

Area (ac)	CN	Description
0.050	49	50-75% Grass cover, Fair, HSG A
0.050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1					**Direct Entry, 3.1**

Subcatchment PER-2A:



Summary for Subcatchment PER-2B:

Runoff = 0.00 cfs @ 13.03 hrs, Volume= 0.002 af, Depth> 0.10"
Routed to Pond P1 : BASIN

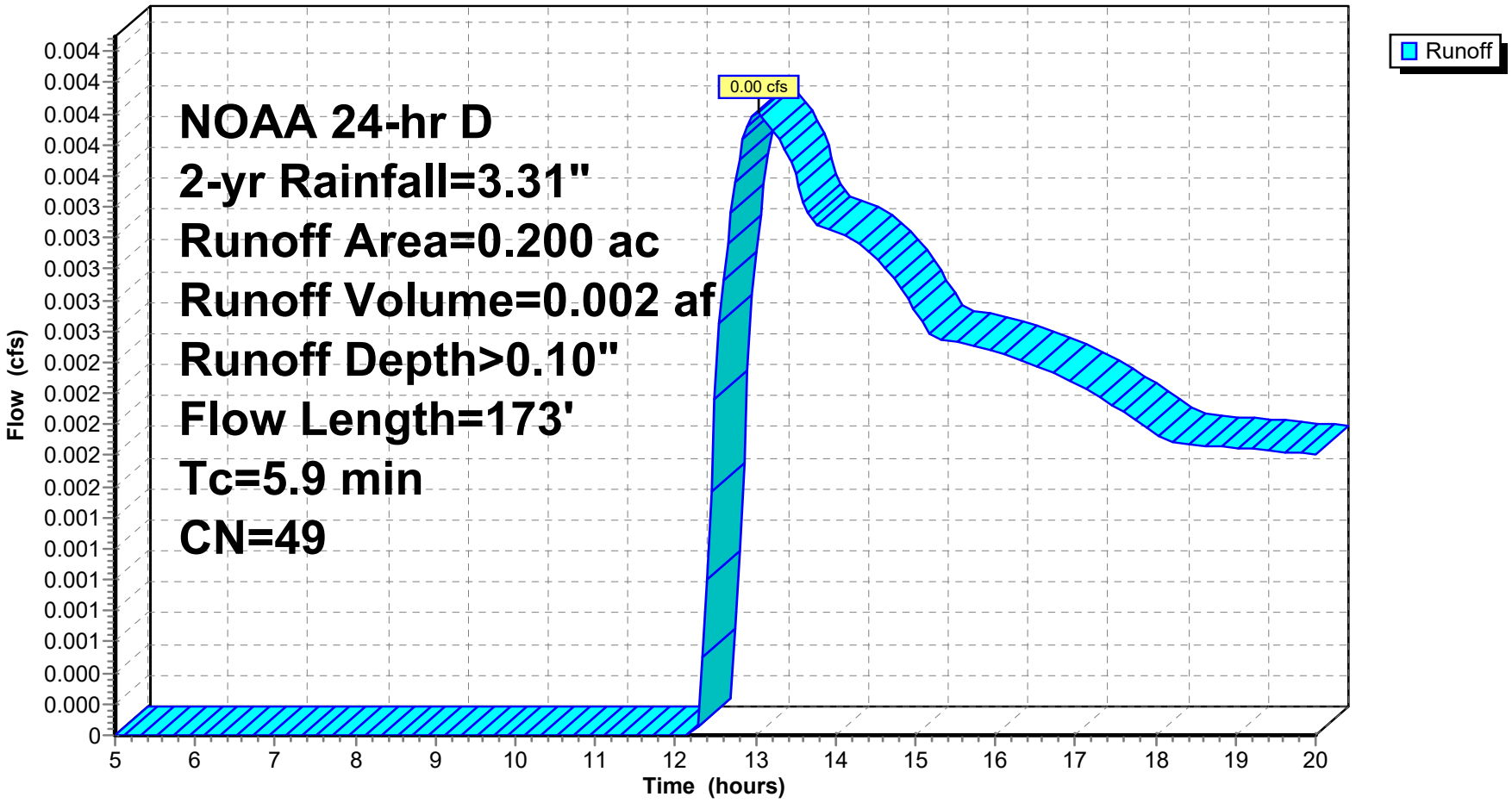
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.31"

Area (ac)	CN	Description
0.200	49	50-75% Grass cover, Fair, HSG A
0.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0260	0.17		**Sheet Flow, 80.0-78.7**
					Grass: Short n= 0.150 P2= 3.31"
0.9	123	0.0219	2.38		**Shallow Concentrated Flow, 78.7-76**
					Unpaved Kv= 16.1 fps
5.9	173	Total			

Subcatchment PER-2B:

Hydrograph

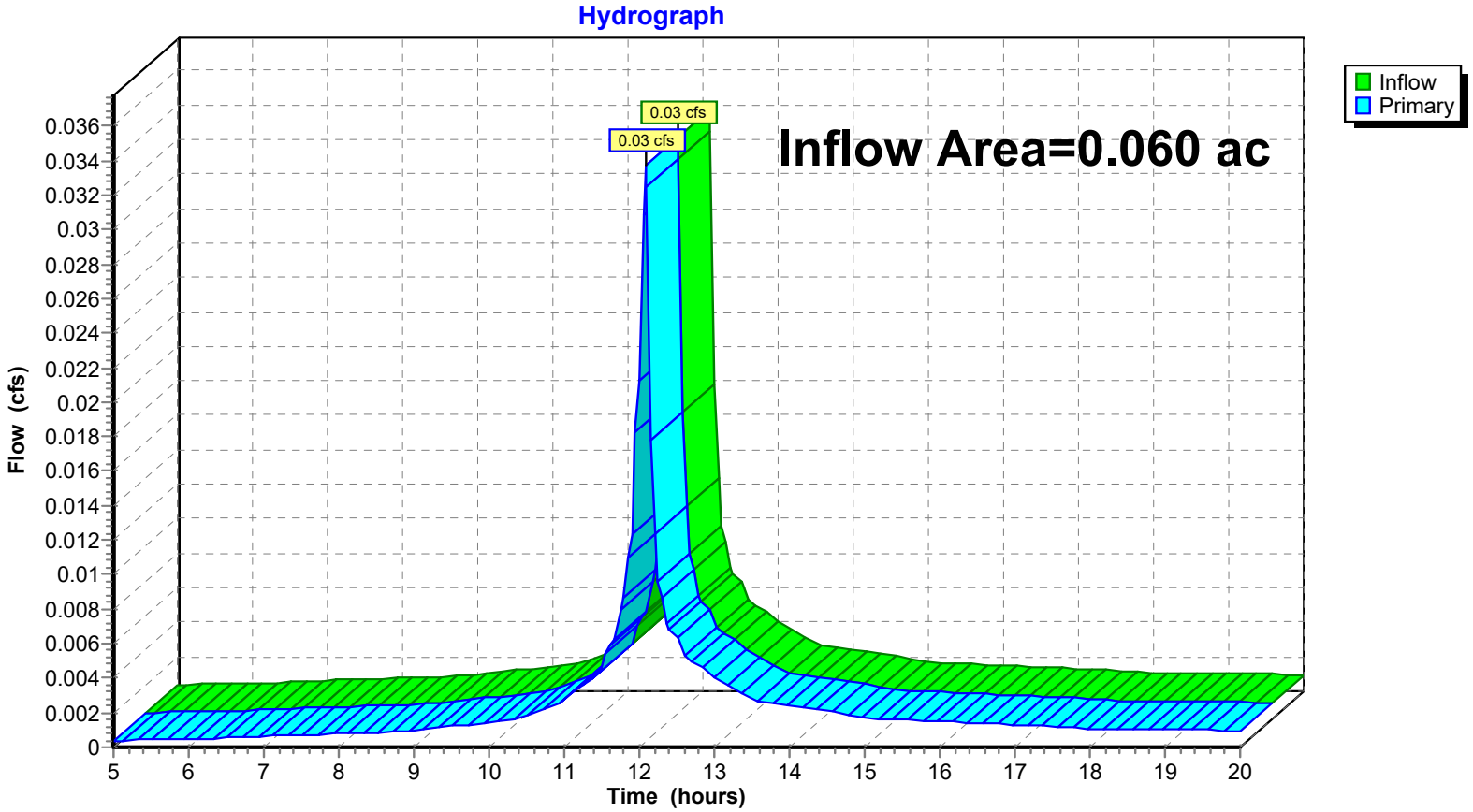


Summary for Pond A-2: DESIGN POINT 1

Inflow Area = 0.060 ac, 16.67% Impervious, Inflow Depth > 0.55" for 2-yr event
Inflow = 0.03 cfs @ 12.08 hrs, Volume= 0.003 af
Primary = 0.03 cfs @ 12.08 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond A-2: DESIGN POINT 1

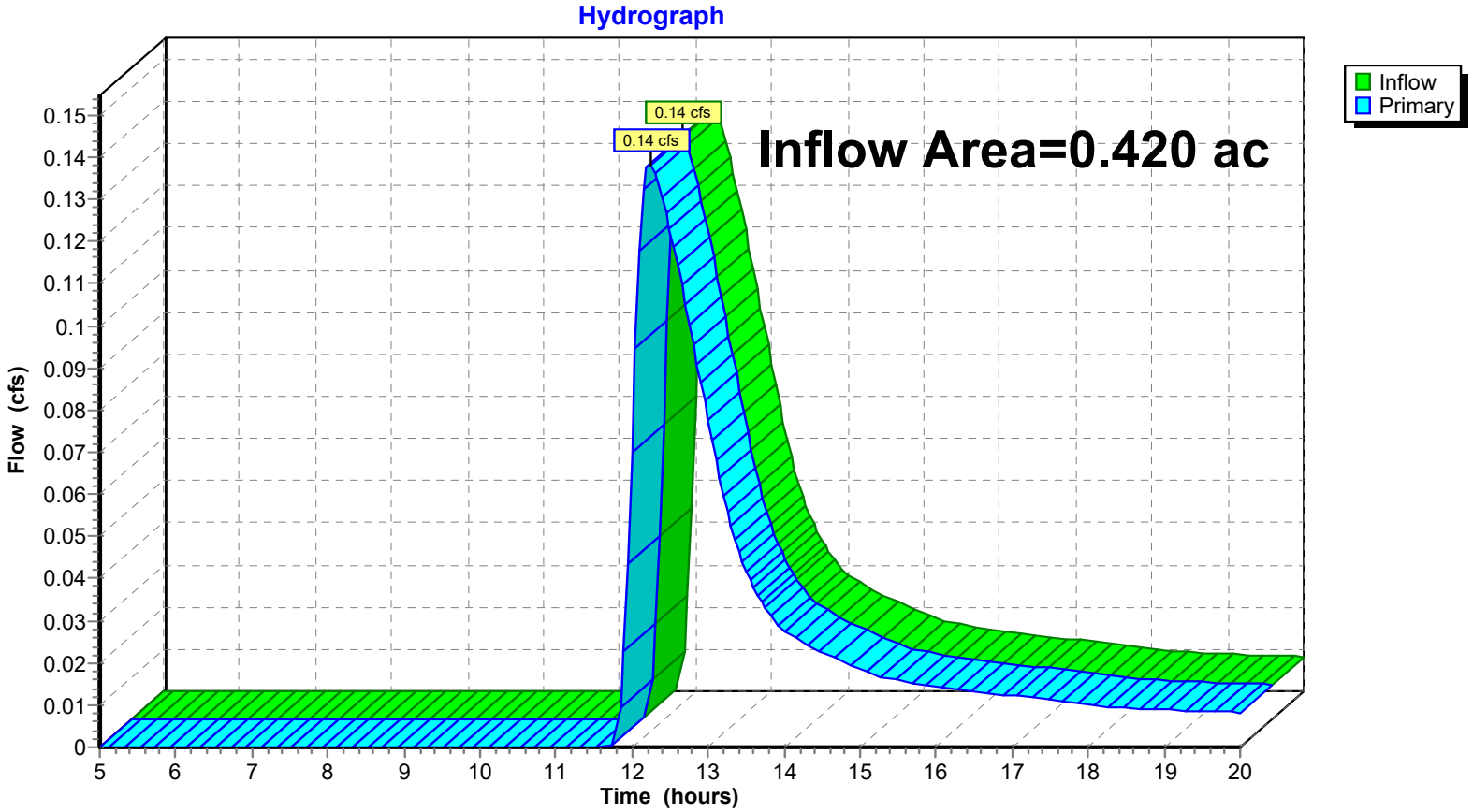


Summary for Pond B-2: DESIGN POINT 2

Inflow Area = 0.420 ac, 52.38% Impervious, Inflow Depth > 0.58" for 2-yr event
Inflow = 0.14 cfs @ 12.24 hrs, Volume= 0.020 af
Primary = 0.14 cfs @ 12.24 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond B-2: DESIGN POINT 2



Summary for Pond P1: BASIN

Inflow Area = 0.420 ac, 52.38% Impervious, Inflow Depth > 0.85" for 2-yr event
Inflow = 0.39 cfs @ 12.09 hrs, Volume= 0.030 af
Outflow = 0.14 cfs @ 12.24 hrs, Volume= 0.020 af, Atten= 65%, Lag= 9.1 min
Primary = 0.14 cfs @ 12.24 hrs, Volume= 0.020 af
Routed to Pond B-2 : DESIGN POINT 2
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Pond B-2 : DESIGN POINT 2

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 75.22' @ 12.24 hrs Surf.Area= 535 sf Storage= 630 cf

Plug-Flow detention time= 168.4 min calculated for 0.020 af (68% of inflow)
Center-of-Mass det. time= 88.9 min (836.6 - 747.7)

Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	1,750 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

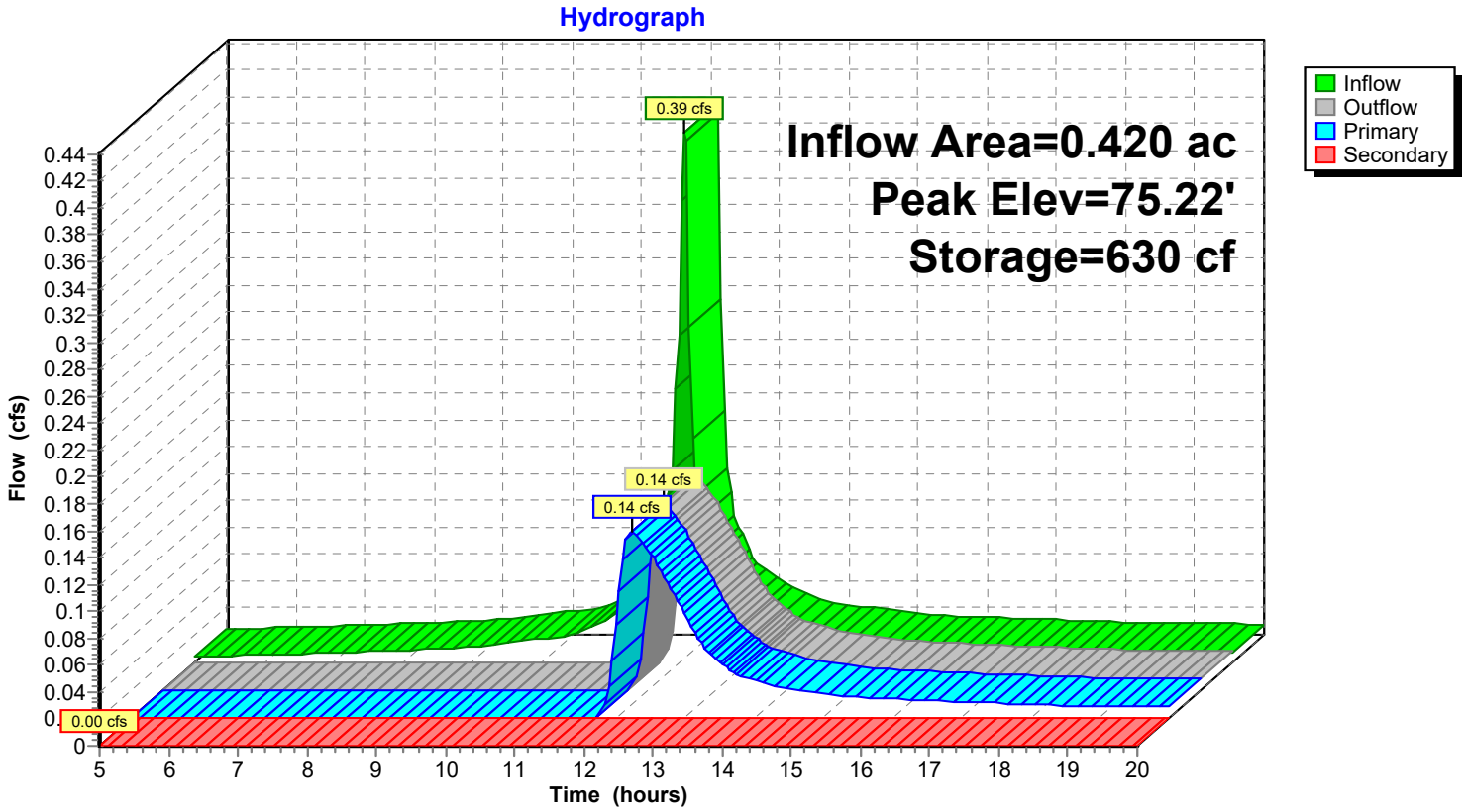
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
74.00	502	0	0	502
75.00	528	515	515	587
76.00	559	543	1,058	675
77.00	833	691	1,750	964

Device	Routing	Invert	Outlet Devices
#1	Primary	74.00'	**15.0" Round Culvert** L= 54.0' Ke= 0.500 Inlet / Outlet Invert= 74.00' / 73.00' S= 0.0185 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	74.75'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	76.00'	**1.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	76.50'	**22.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	76.50'	**6.0' long Broad-Crested Rectangular Weir** Head (feet) 0.50 Coef. (English) 2.70

Primary OutFlow Max=0.14 cfs @ 12.24 hrs HW=75.22' (Free Discharge)
└─**1=Culvert** (Passes 0.14 cfs of 4.57 cfs potential flow)
  └─**2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 2.81 fps)
  └─**3=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=74.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond P1: BASIN



Summary for Pond PP: Porous Pavement

Inflow Area = 0.100 ac,100.00% Impervious, Inflow Depth > 2.82" for 2-yr event
Inflow = 0.33 cfs @ 12.09 hrs, Volume= 0.023 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

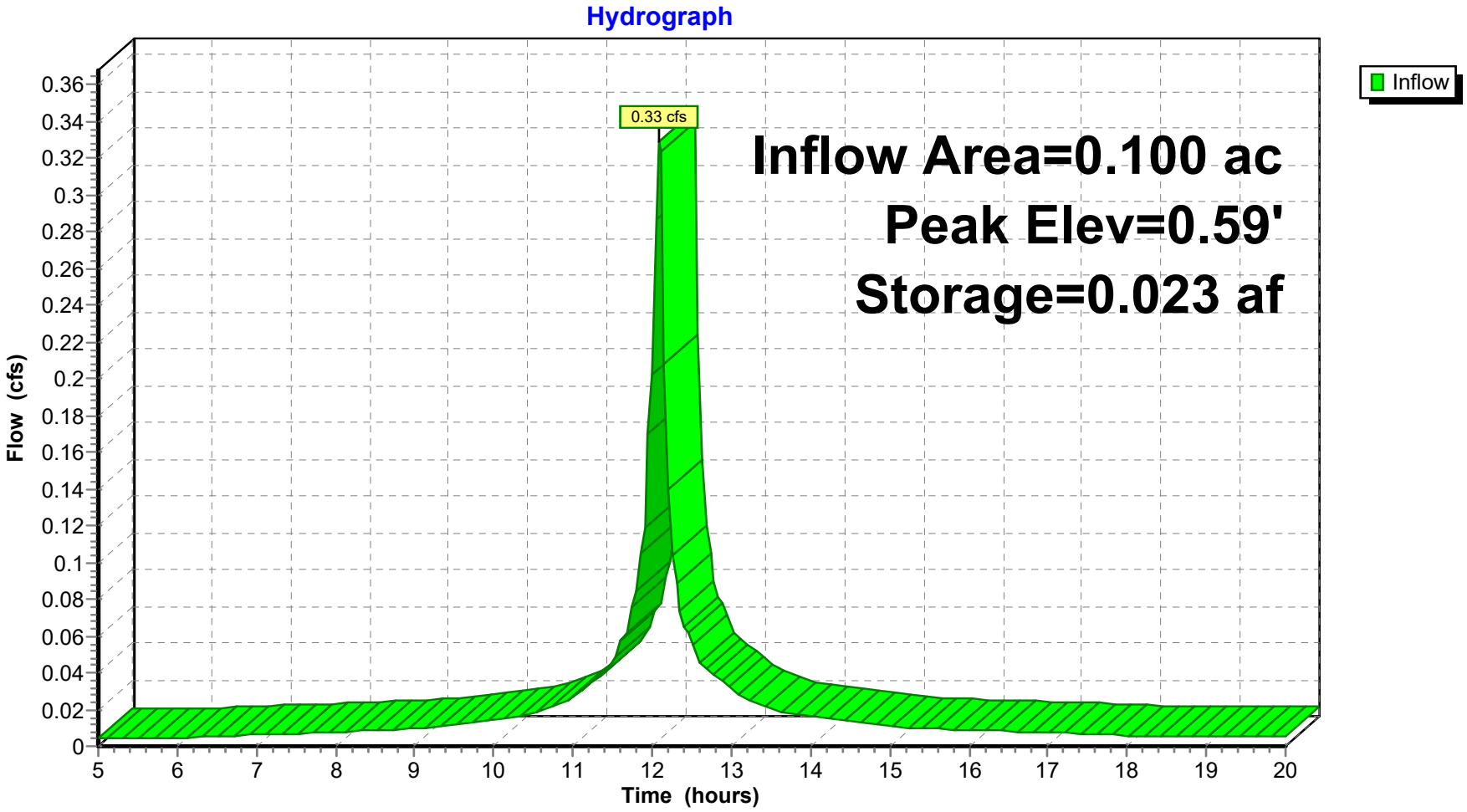
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.59' @ 20.00 hrs Surf.Area= 0.100 ac Storage= 0.023 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.080 af	**Custom Stage Data (Conic)** Listed below (Recalc) 0.200 af Overall x 40.0% Voids

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
0.00	0.100	0.000	0.000	0.100
2.00	0.100	0.200	0.200	0.111

Pond PP: Porous Pavement



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentIMP-2A: Runoff Area=0.010 ac 100.00% Impervious Runoff Depth>4.39"
Tc=1.4 min CN=98 Runoff=0.05 cfs 0.004 af

SubcatchmentIMP-2B: Runoff Area=0.120 ac 100.00% Impervious Runoff Depth>4.39"
Flow Length=272' Tc=1.9 min CN=98 Runoff=0.61 cfs 0.044 af

SubcatchmentIMP-PP: Runoff Area=0.100 ac 100.00% Impervious Runoff Depth>4.39"
Tc=1.9 min CN=98 Runoff=0.51 cfs 0.037 af

SubcatchmentPER-2A: Runoff Area=0.050 ac 0.00% Impervious Runoff Depth>0.56"
Tc=3.1 min CN=49 Runoff=0.02 cfs 0.002 af

SubcatchmentPER-2B: Runoff Area=0.200 ac 0.00% Impervious Runoff Depth>0.56"
Flow Length=173' Tc=5.9 min CN=49 Runoff=0.07 cfs 0.009 af

Pond A-2: DESIGN POINT 1 Inflow=0.07 cfs 0.006 af
Primary=0.07 cfs 0.006 af

Pond B-2: DESIGN POINT 2 Inflow=0.21 cfs 0.043 af
Primary=0.21 cfs 0.043 af

Pond P1: BASIN Peak Elev=75.68' Storage=880 cf Inflow=0.65 cfs 0.053 af
Primary=0.21 cfs 0.043 af Secondary=0.00 cfs 0.000 af Outflow=0.21 cfs 0.043 af

Pond PP: Porous Pavement Peak Elev=0.91' Storage=0.037 af Inflow=0.51 cfs 0.037 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 0.480 ac Runoff Volume = 0.096 af Average Runoff Depth = 2.39"
52.08% Pervious = 0.250 ac 47.92% Impervious = 0.230 ac

Summary for Subcatchment IMP-2A:

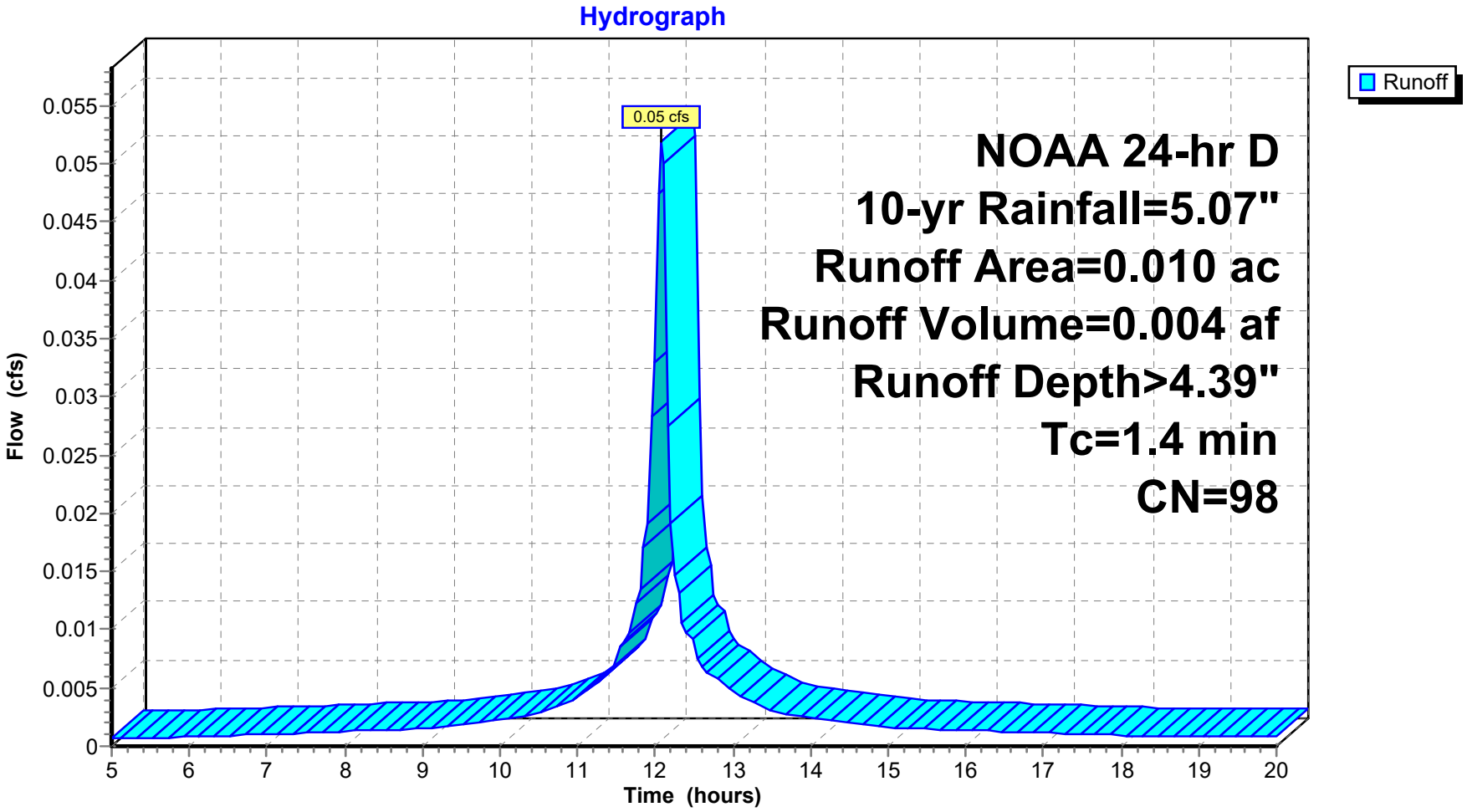
Runoff = 0.05 cfs @ 12.08 hrs, Volume= 0.004 af, Depth> 4.39"
Routed to Pond A-2 : DESIGN POINT 1

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.07"

Area (ac)	CN	Description
0.010	98	Unconnected pavement, HSG D
0.010		100.00% Impervious Area
0.010		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4					**Direct Entry, 1.4**

Subcatchment IMP-2A:



Summary for Subcatchment IMP-2B:

Runoff = 0.61 cfs @ 12.09 hrs, Volume= 0.044 af, Depth> 4.39"
Routed to Pond P1 : BASIN

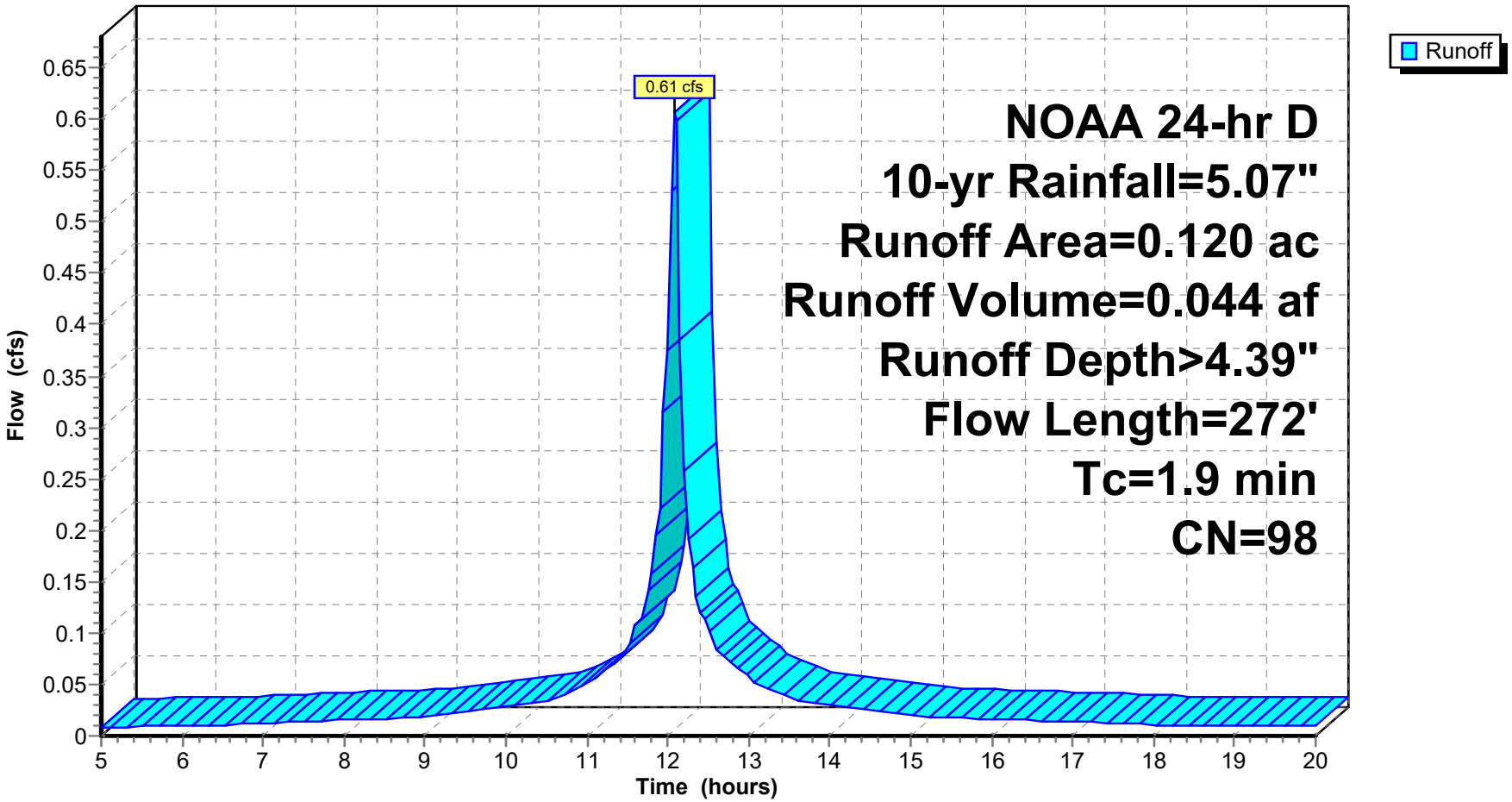
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.07"

Area (ac)	CN	Description
0.120	98	Unconnected pavement, HSG D
0.120		100.00% Impervious Area
0.120		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0148	1.08		**Sheet Flow, 79.5-78.7** Smooth surfaces n= 0.011 P2= 3.31"
0.3	38	0.0148	2.47		**Shallow Concentrated Flow, 78.7-78.2** Paved Kv= 20.3 fps
0.8	184	0.0050	4.03	4.95	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
1.9	272	Total			

Subcatchment IMP-2B:

Hydrograph



Summary for Subcatchment IMP-PP:

Runoff = 0.51 cfs @ 12.09 hrs, Volume= 0.037 af, Depth> 4.39"
Routed to Pond PP : Porous Pavement

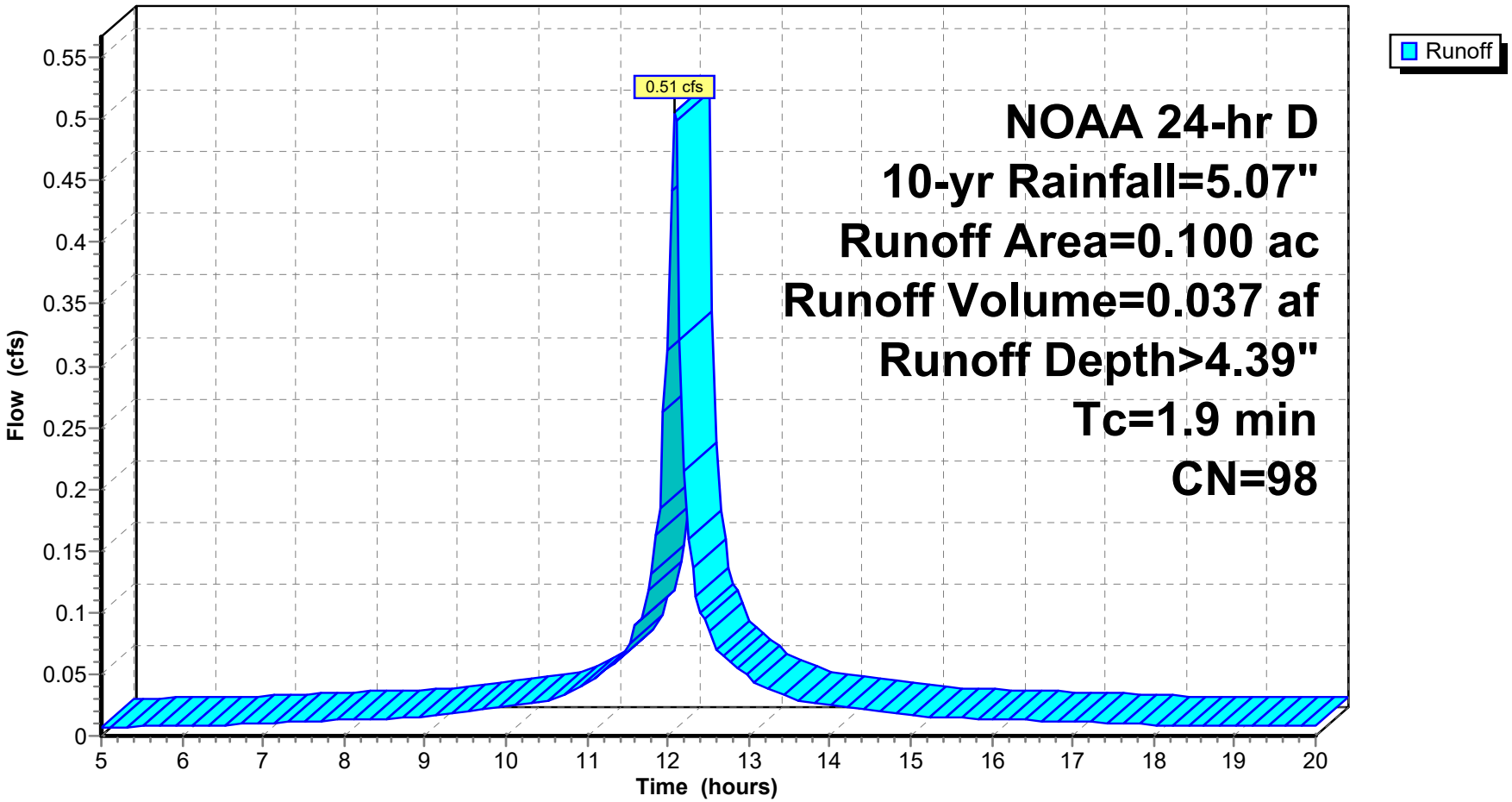
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.07"

Area (ac)	CN	Description
0.100	98	Unconnected pavement, HSG D
0.100		100.00% Impervious Area
0.100		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9					**Direct Entry,**

Subcatchment IMP-PP:

Hydrograph



Summary for Subcatchment PER-2A:

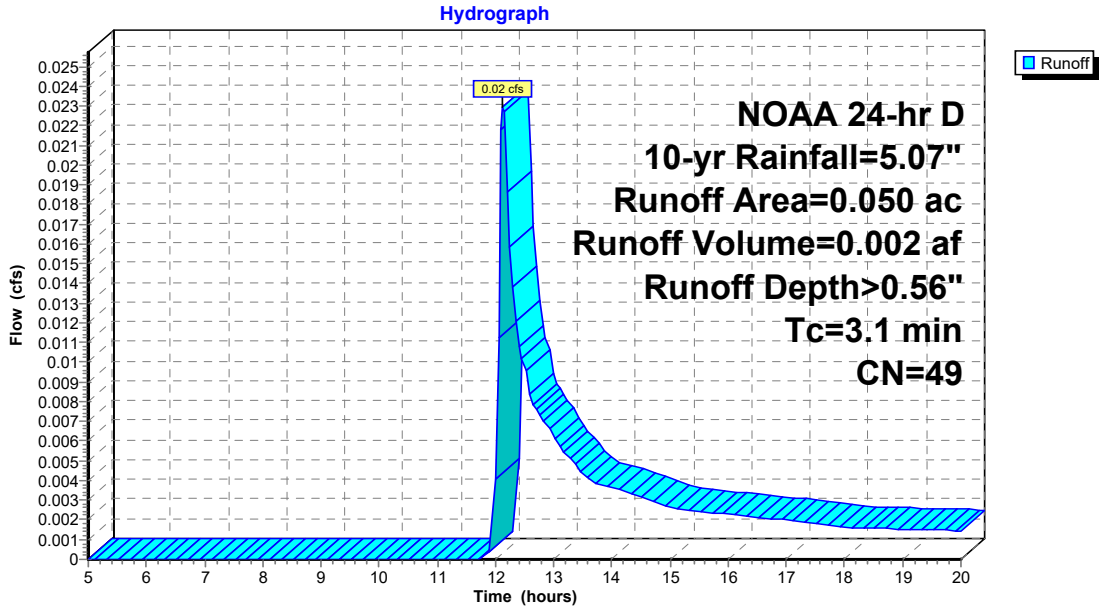
Runoff = 0.02 cfs @ 12.13 hrs, Volume= 0.002 af, Depth> 0.56"
Routed to Pond A-2 : DESIGN POINT 1

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.07"

Area (ac)	CN	Description
0.050	49	50-75% Grass cover, Fair, HSG A
0.050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1					**Direct Entry, 3.1**

Subcatchment PER-2A:



Summary for Subcatchment PER-2B:

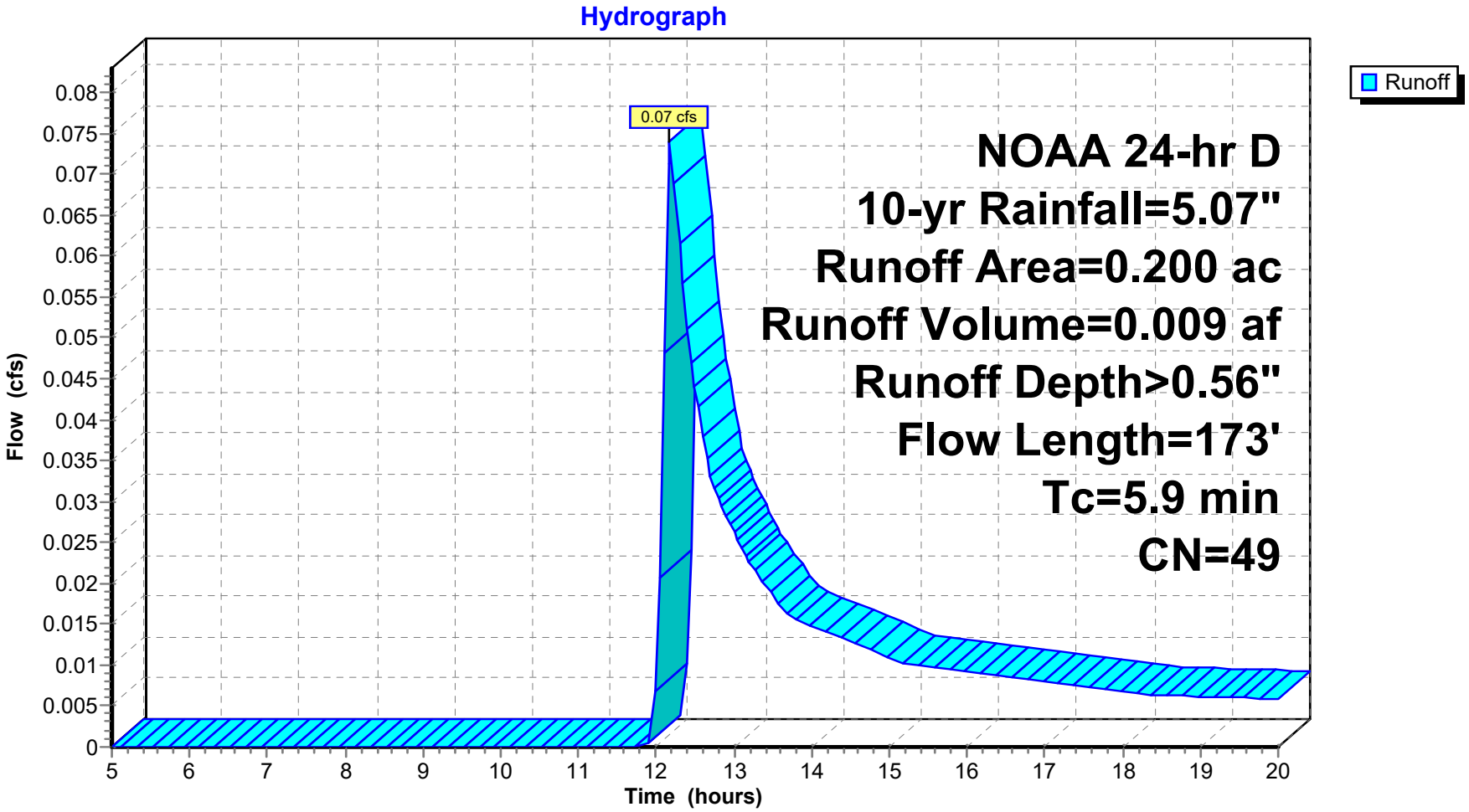
Runoff = 0.07 cfs @ 12.17 hrs, Volume= 0.009 af, Depth> 0.56"
Routed to Pond P1 : BASIN

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.07"

Area (ac)	CN	Description
0.200	49	50-75% Grass cover, Fair, HSG A
0.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0260	0.17		**Sheet Flow, 80.0-78.7** Grass: Short n= 0.150 P2= 3.31"
0.9	123	0.0219	2.38		**Shallow Concentrated Flow, 78.7-76** Unpaved Kv= 16.1 fps
5.9	173	Total			

Subcatchment PER-2B:

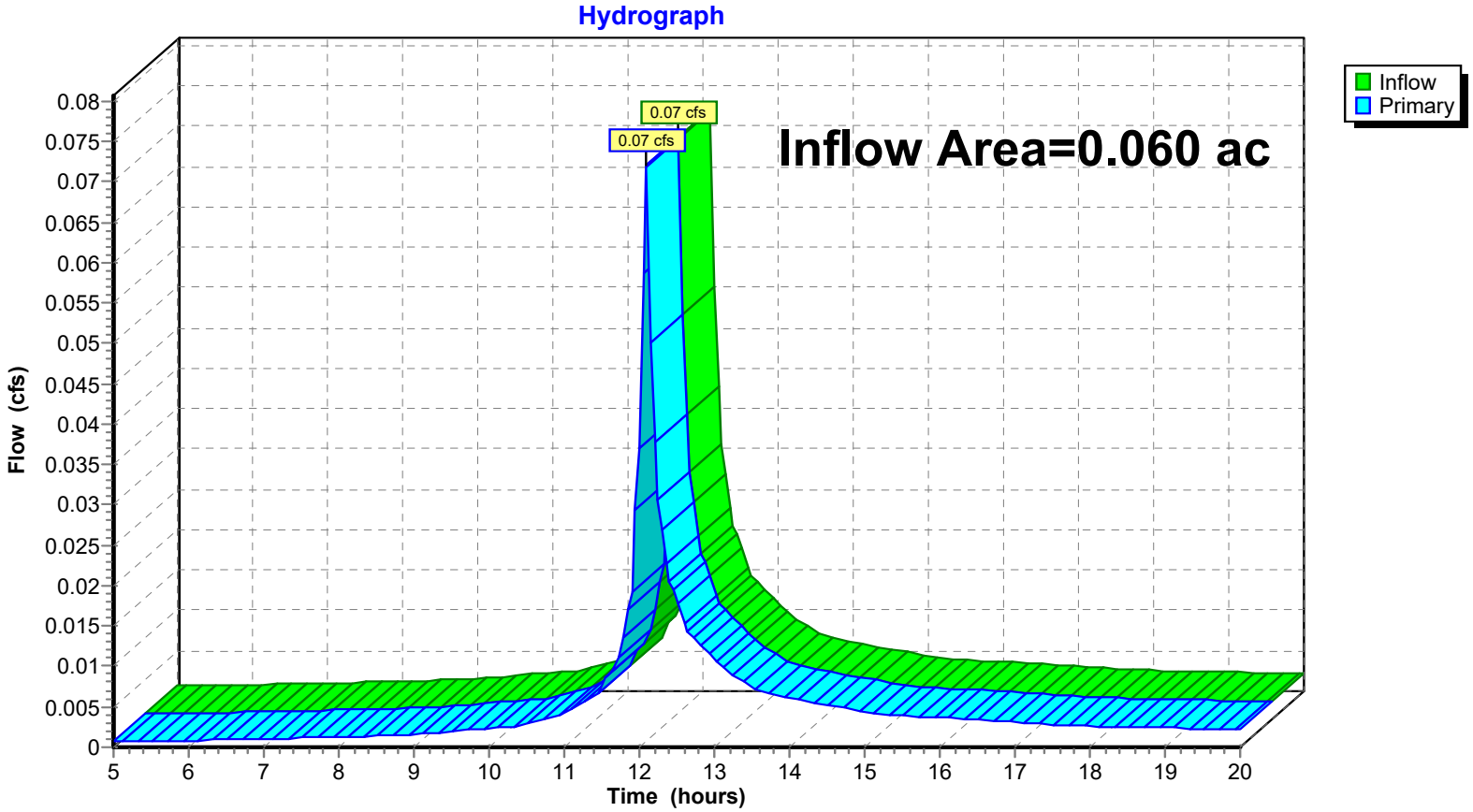


Summary for Pond A-2: DESIGN POINT 1

Inflow Area = 0.060 ac, 16.67% Impervious, Inflow Depth > 1.20" for 10-yr event
Inflow = 0.07 cfs @ 12.09 hrs, Volume= 0.006 af
Primary = 0.07 cfs @ 12.09 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond A-2: DESIGN POINT 1

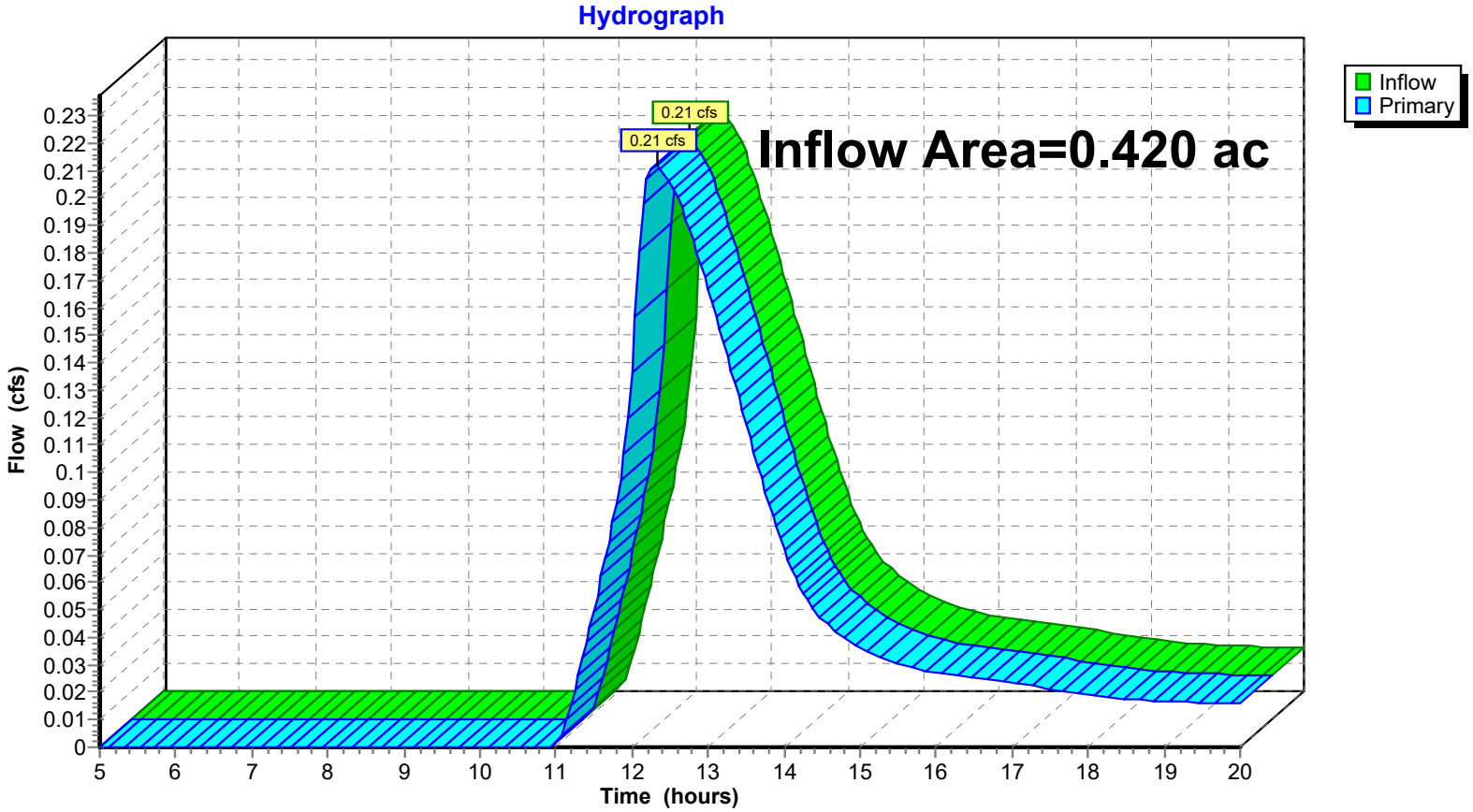


Summary for Pond B-2: DESIGN POINT 2

Inflow Area = 0.420 ac, 52.38% Impervious, Inflow Depth > 1.24" for 10-yr event
Inflow = 0.21 cfs @ 12.32 hrs, Volume= 0.043 af
Primary = 0.21 cfs @ 12.32 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond B-2: DESIGN POINT 2



Summary for Pond P1: BASIN

Inflow Area = 0.420 ac, 52.38% Impervious, Inflow Depth > 1.52" for 10-yr event
Inflow = 0.65 cfs @ 12.09 hrs, Volume= 0.053 af
Outflow = 0.21 cfs @ 12.32 hrs, Volume= 0.043 af, Atten= 67%, Lag= 13.7 min
Primary = 0.21 cfs @ 12.32 hrs, Volume= 0.043 af
Routed to Pond B-2 : DESIGN POINT 2
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Pond B-2 : DESIGN POINT 2

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 75.68' @ 12.32 hrs Surf.Area= 549 sf Storage= 880 cf

Plug-Flow detention time= 128.5 min calculated for 0.043 af (81% of inflow)
Center-of-Mass det. time= 70.7 min (828.1 - 757.4)

Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	1,750 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

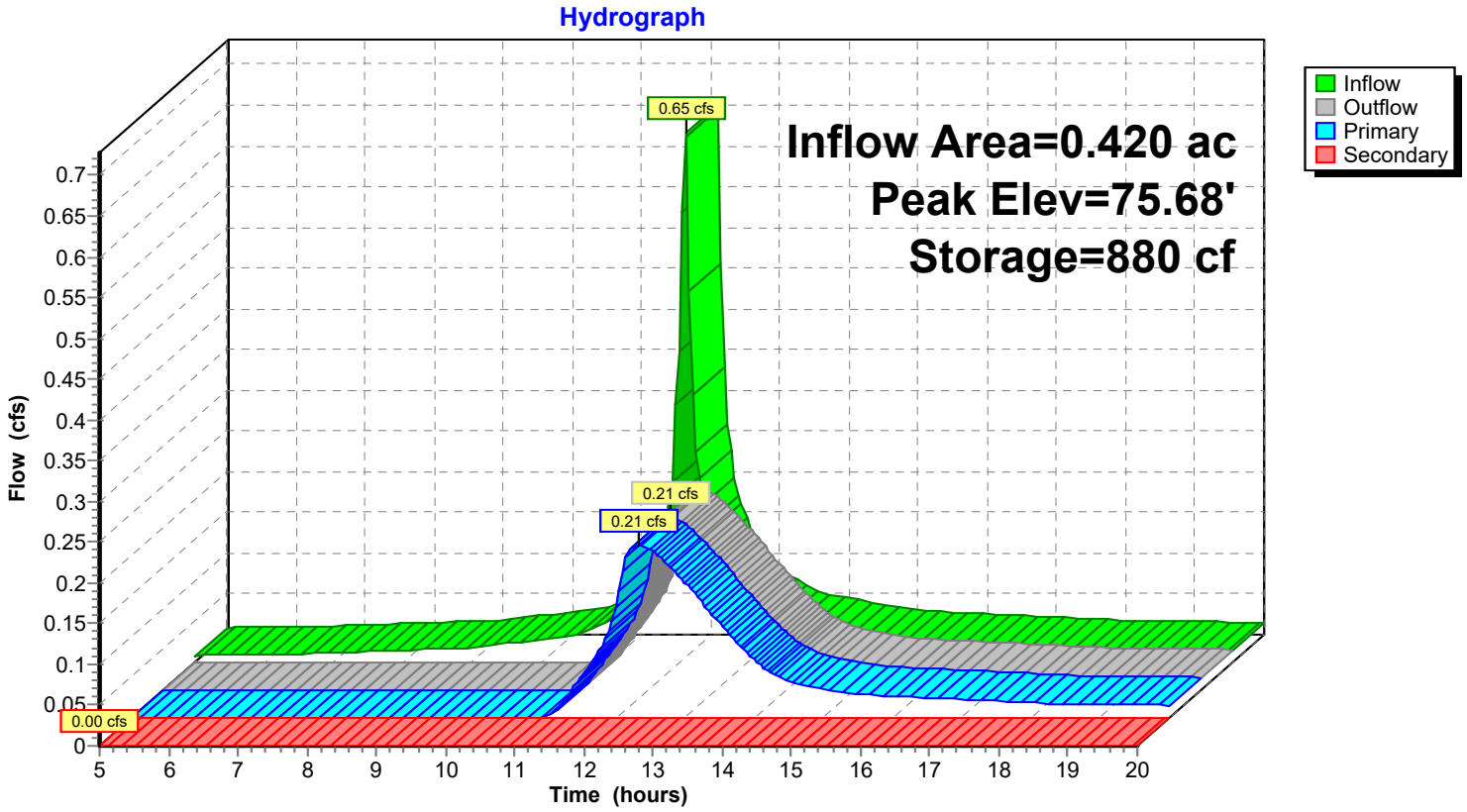
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
74.00	502	0	0	502
75.00	528	515	515	587
76.00	559	543	1,058	675
77.00	833	691	1,750	964

Device	Routing	Invert	Outlet Devices
#1	Primary	74.00'	**15.0" Round Culvert** L= 54.0' Ke= 0.500 Inlet / Outlet Invert= 74.00' / 73.00' S= 0.0185 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	74.75'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	76.00'	**1.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	76.50'	**22.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	76.50'	**6.0' long Broad-Crested Rectangular Weir** Head (feet) 0.50 Coef. (English) 2.70

Primary OutFlow Max=0.21 cfs @ 12.32 hrs HW=75.68' (Free Discharge)
└─**1=Culvert** (Passes 0.21 cfs of 6.06 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.21 cfs @ 4.31 fps)
  ├─**3=Sharp-Crested Rectangular Weir**(Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=74.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond P1: BASIN



Summary for Pond PP: Porous Pavement

Inflow Area = 0.100 ac,100.00% Impervious, Inflow Depth > 4.39" for 10-yr event
Inflow = 0.51 cfs @ 12.09 hrs, Volume= 0.037 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

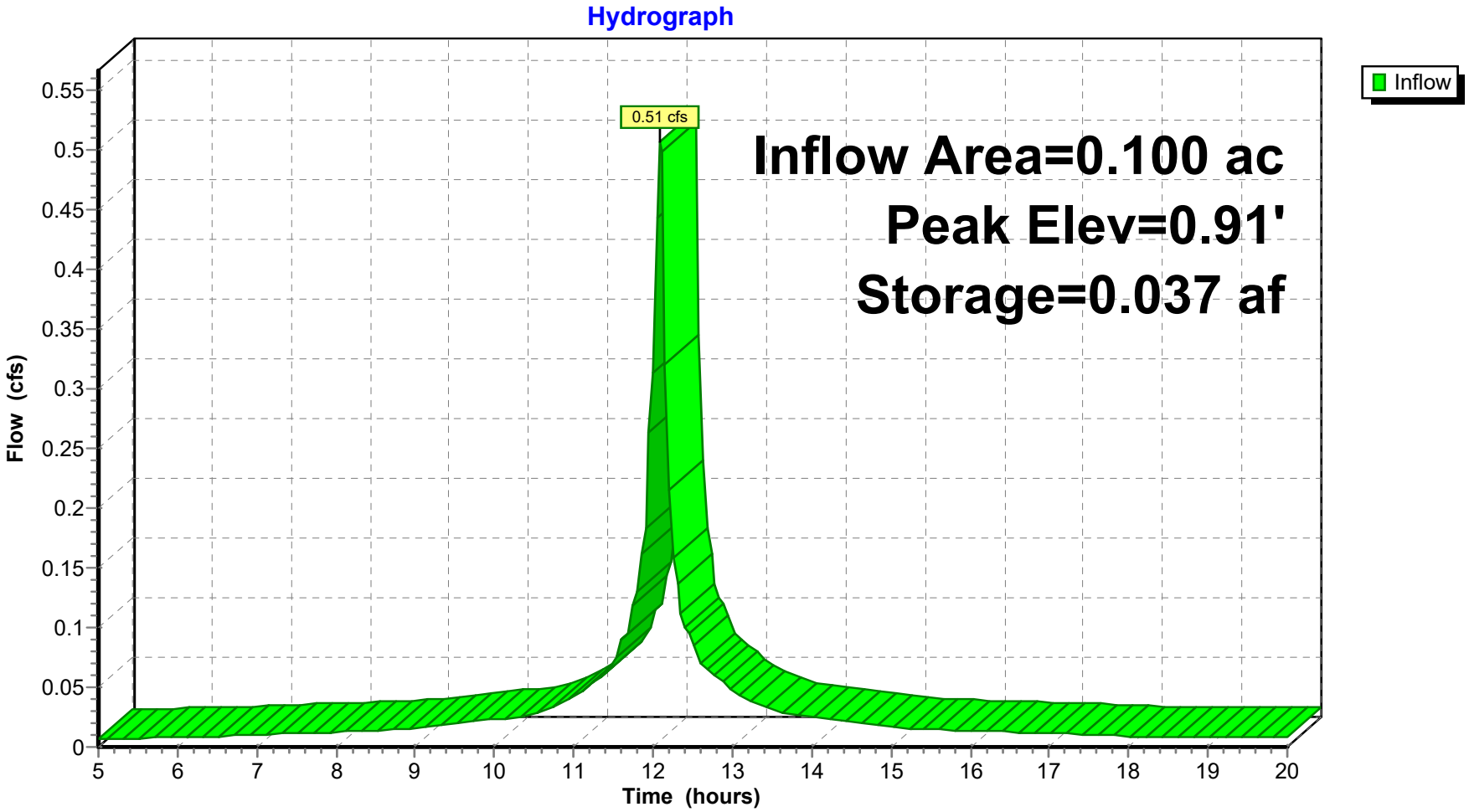
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 0.91' @ 20.00 hrs Surf.Area= 0.100 ac Storage= 0.037 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.080 af	**Custom Stage Data (Conic)** Listed below (Recalc) 0.200 af Overall x 40.0% Voids

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
0.00	0.100	0.000	0.000	0.100
2.00	0.100	0.200	0.200	0.111

Pond PP: Porous Pavement



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentIMP-2A: Runoff Area=0.010 ac 100.00% Impervious Runoff Depth>7.48"
Tc=1.4 min CN=98 Runoff=0.09 cfs 0.006 af

SubcatchmentIMP-2B: Runoff Area=0.120 ac 100.00% Impervious Runoff Depth>7.48"
Flow Length=272' Tc=1.9 min CN=98 Runoff=1.03 cfs 0.075 af

SubcatchmentIMP-PP: Runoff Area=0.100 ac 100.00% Impervious Runoff Depth>7.48"
Tc=1.9 min CN=98 Runoff=0.86 cfs 0.062 af

SubcatchmentPER-2A: Runoff Area=0.050 ac 0.00% Impervious Runoff Depth>2.21"
Tc=3.1 min CN=49 Runoff=0.13 cfs 0.009 af

SubcatchmentPER-2B: Runoff Area=0.200 ac 0.00% Impervious Runoff Depth>2.20"
Flow Length=173' Tc=5.9 min CN=49 Runoff=0.43 cfs 0.037 af

Pond A-2: DESIGN POINT 1 Inflow=0.21 cfs 0.015 af
Primary=0.21 cfs 0.015 af

Pond B-2: DESIGN POINT 2 Inflow=0.96 cfs 0.101 af
Primary=0.96 cfs 0.101 af

Pond P1: BASIN Peak Elev=76.37' Storage=1,280 cf Inflow=1.38 cfs 0.112 af
Primary=0.96 cfs 0.101 af Secondary=0.00 cfs 0.000 af Outflow=0.96 cfs 0.101 af

Pond PP: Porous Pavement Peak Elev=1.56' Storage=0.062 af Inflow=0.86 cfs 0.062 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 0.480 ac Runoff Volume = 0.189 af Average Runoff Depth = 4.73"
52.08% Pervious = 0.250 ac 47.92% Impervious = 0.230 ac

Summary for Subcatchment IMP-2A:

Runoff = 0.09 cfs @ 12.08 hrs, Volume= 0.006 af, Depth> 7.48"
Routed to Pond A-2 : DESIGN POINT 1

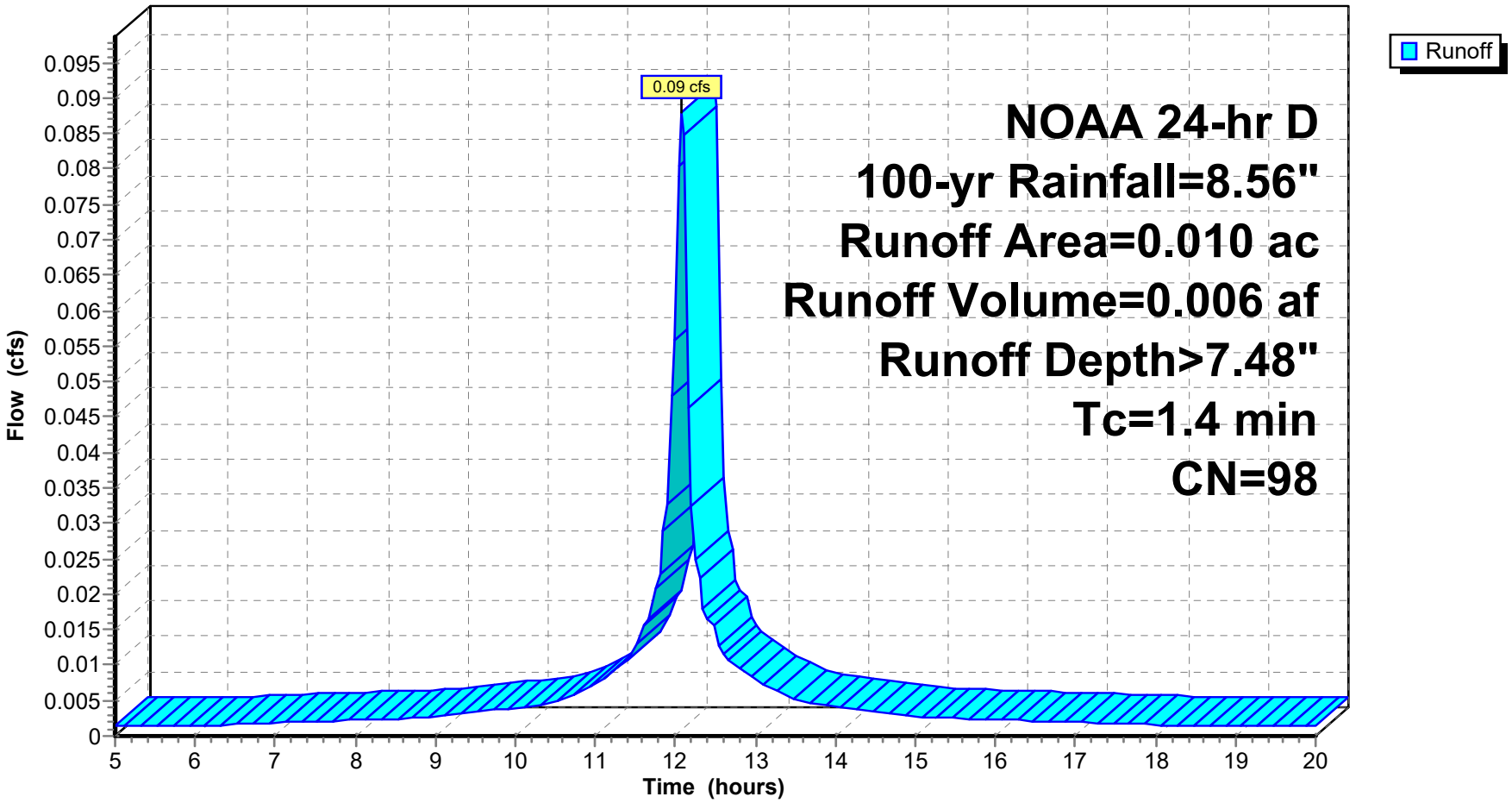
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.56"

Area (ac)	CN	Description
0.010	98	Unconnected pavement, HSG D
0.010		100.00% Impervious Area
0.010		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4					**Direct Entry, 1.4**

Subcatchment IMP-2A:

Hydrograph



Summary for Subcatchment IMP-2B:

Runoff = 1.03 cfs @ 12.09 hrs, Volume= 0.075 af, Depth> 7.48"
Routed to Pond P1 : BASIN

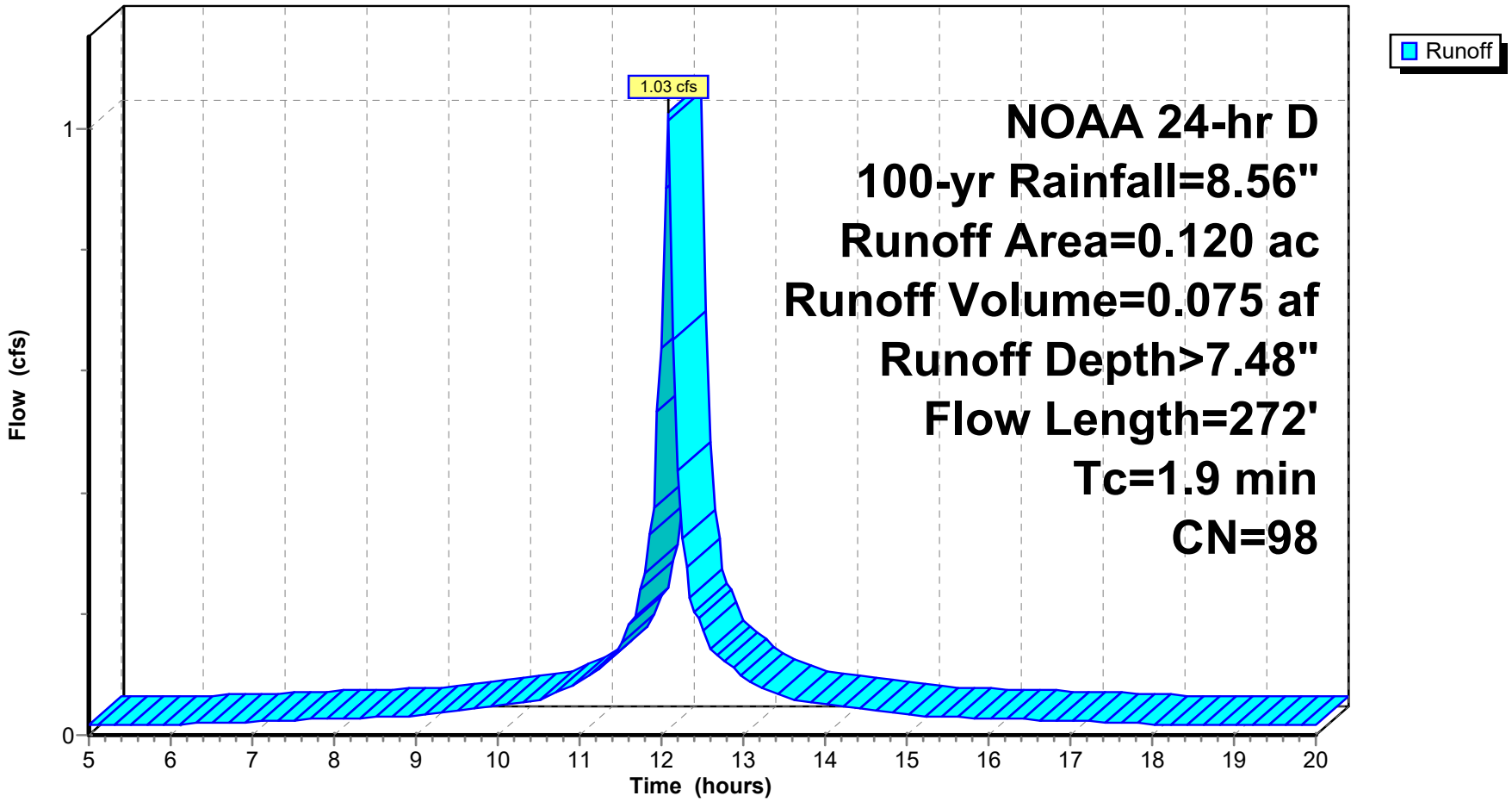
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.56"

Area (ac)	CN	Description
0.120	98	Unconnected pavement, HSG D
0.120		100.00% Impervious Area
0.120		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	50	0.0148	1.08		**Sheet Flow, 79.5-78.7** Smooth surfaces n= 0.011 P2= 3.31"
0.3	38	0.0148	2.47		**Shallow Concentrated Flow, 78.7-78.2** Paved Kv= 20.3 fps
0.8	184	0.0050	4.03	4.95	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
1.9	272	Total			

Subcatchment IMP-2B:

Hydrograph



Summary for Subcatchment IMP-PP:

Runoff = 0.86 cfs @ 12.09 hrs, Volume= 0.062 af, Depth> 7.48"
Routed to Pond PP : Porous Pavement

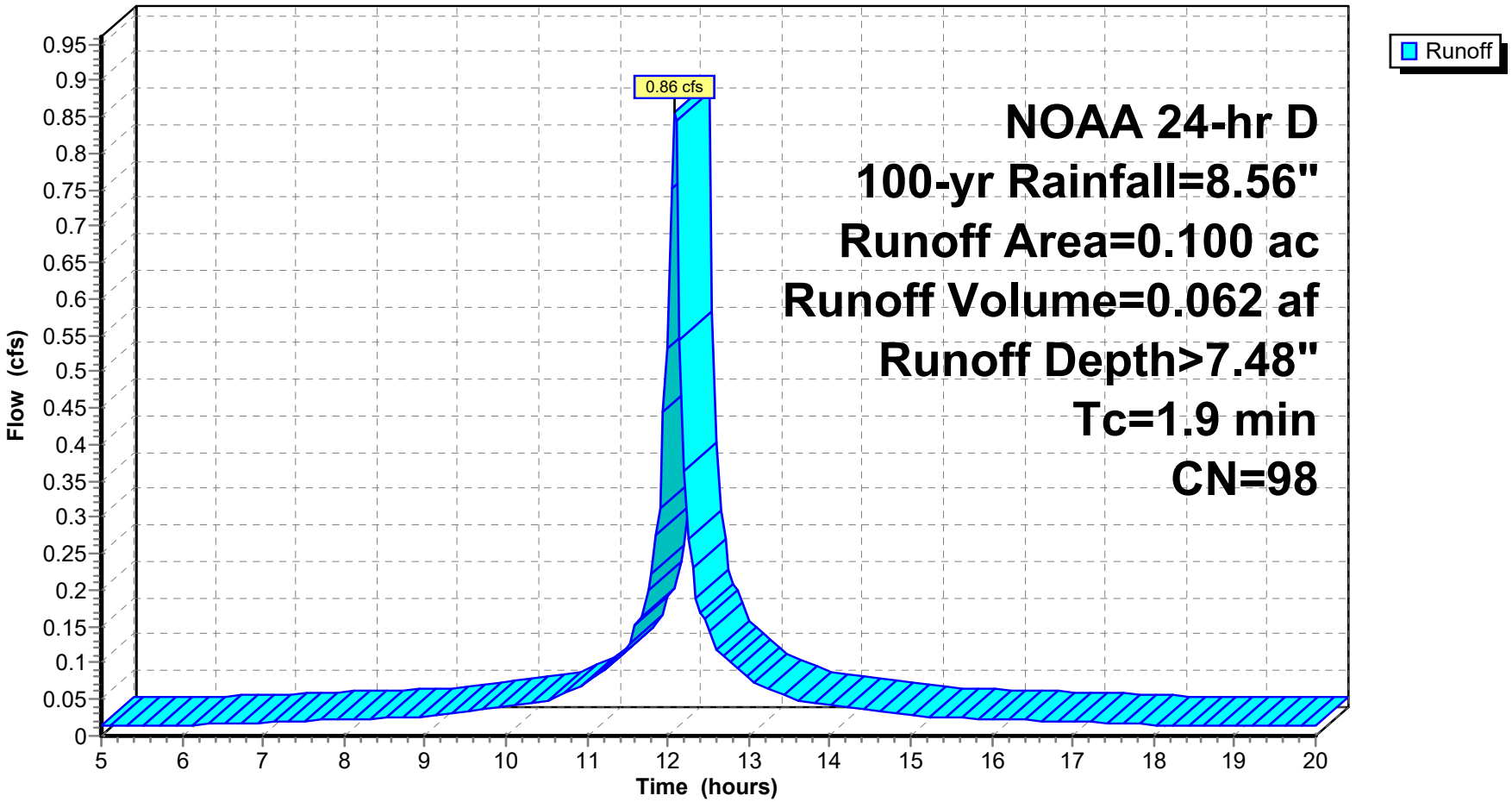
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.56"

Area (ac)	CN	Description
0.100	98	Unconnected pavement, HSG D
0.100		100.00% Impervious Area
0.100		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9					**Direct Entry,**

Subcatchment IMP-PP:

Hydrograph



Summary for Subcatchment PER-2A:

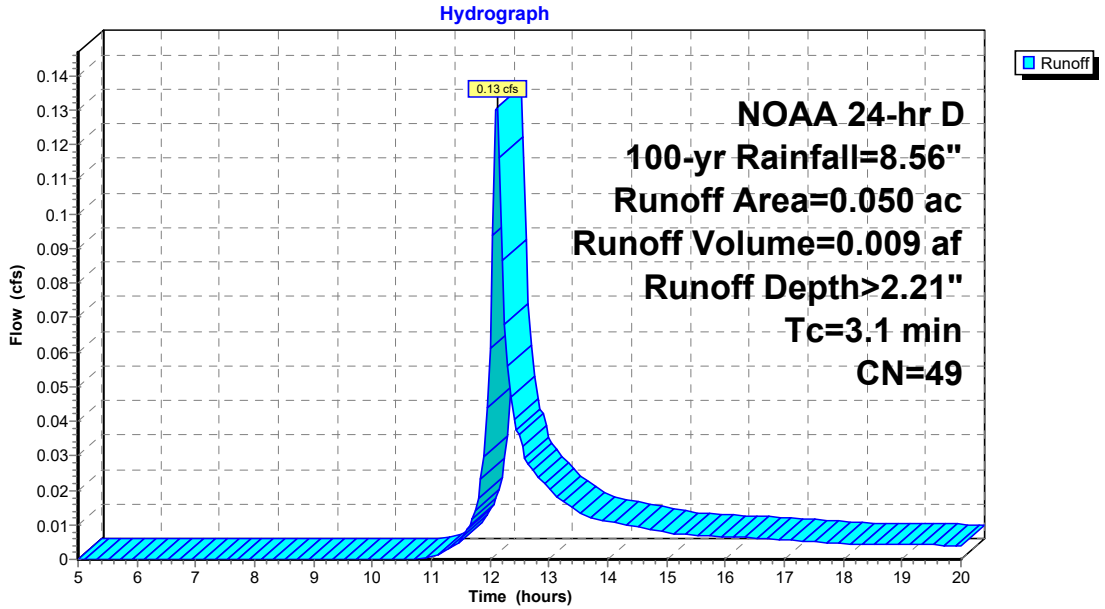
Runoff = 0.13 cfs @ 12.11 hrs, Volume= 0.009 af, Depth> 2.21"
Routed to Pond A-2 : DESIGN POINT 1

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.56"

Area (ac)	CN	Description
0.050	49	50-75% Grass cover, Fair, HSG A
0.050		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1					**Direct Entry, 3.1**

Subcatchment PER-2A:



Summary for Subcatchment PER-2B:

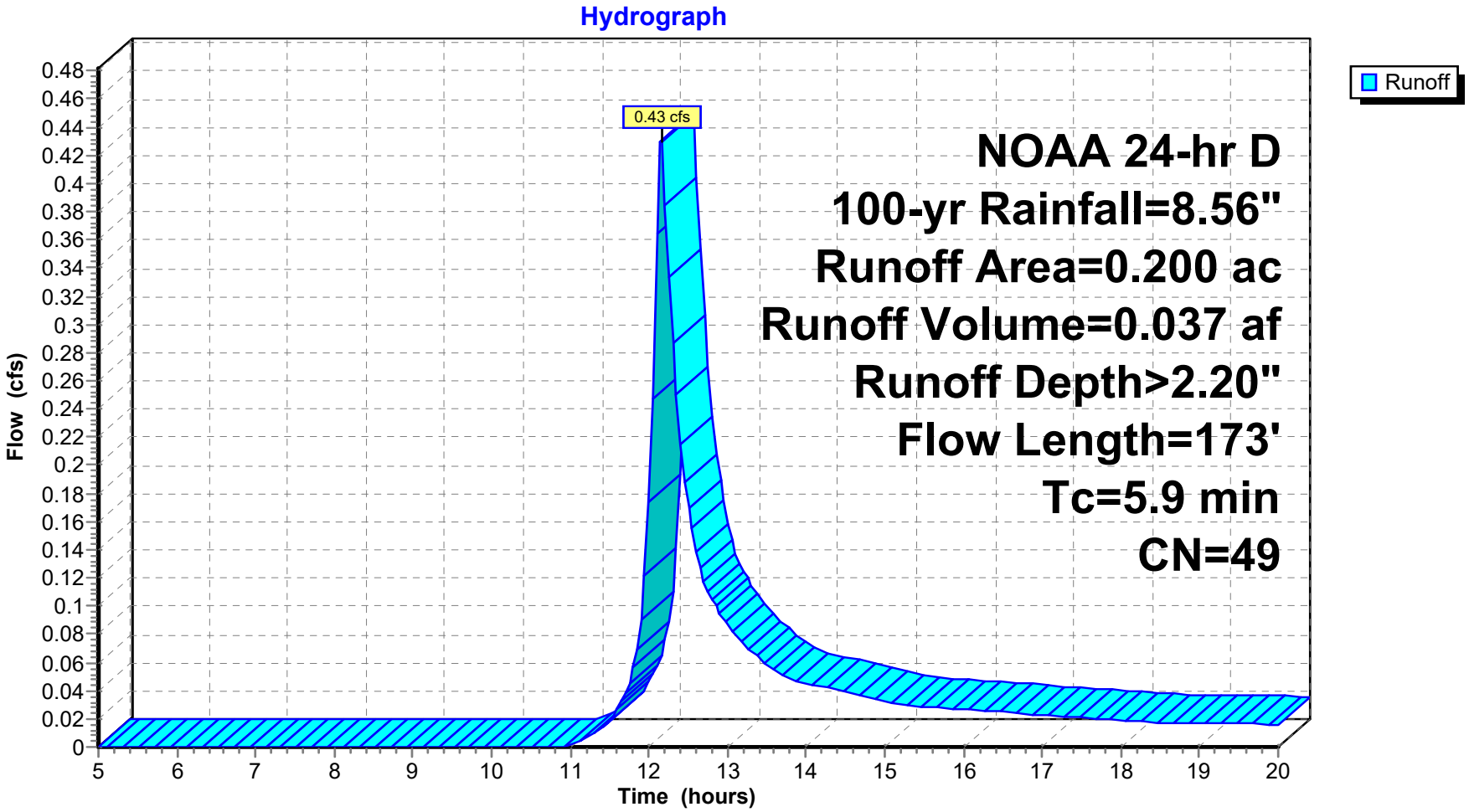
Runoff = 0.43 cfs @ 12.15 hrs, Volume= 0.037 af, Depth> 2.20"
Routed to Pond P1 : BASIN

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.56"

Area (ac)	CN	Description
0.200	49	50-75% Grass cover, Fair, HSG A
0.200		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0260	0.17		**Sheet Flow, 80.0-78.7**
					Grass: Short n= 0.150 P2= 3.31"
0.9	123	0.0219	2.38		**Shallow Concentrated Flow, 78.7-76**
					Unpaved Kv= 16.1 fps
5.9	173	Total			

Subcatchment PER-2B:

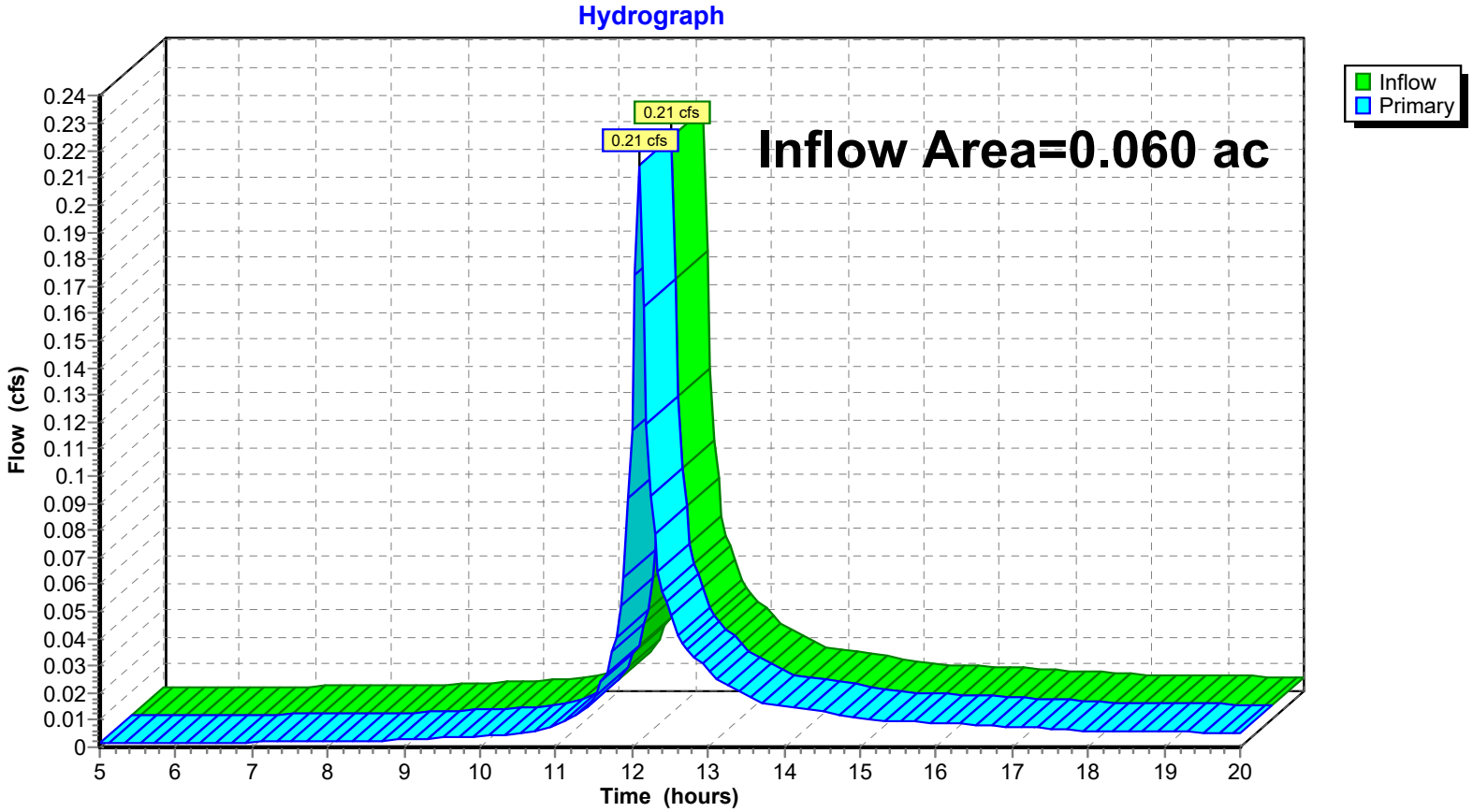


Summary for Pond A-2: DESIGN POINT 1

Inflow Area = 0.060 ac, 16.67% Impervious, Inflow Depth > 3.09" for 100-yr event
Inflow = 0.21 cfs @ 12.10 hrs, Volume= 0.015 af
Primary = 0.21 cfs @ 12.10 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond A-2: DESIGN POINT 1

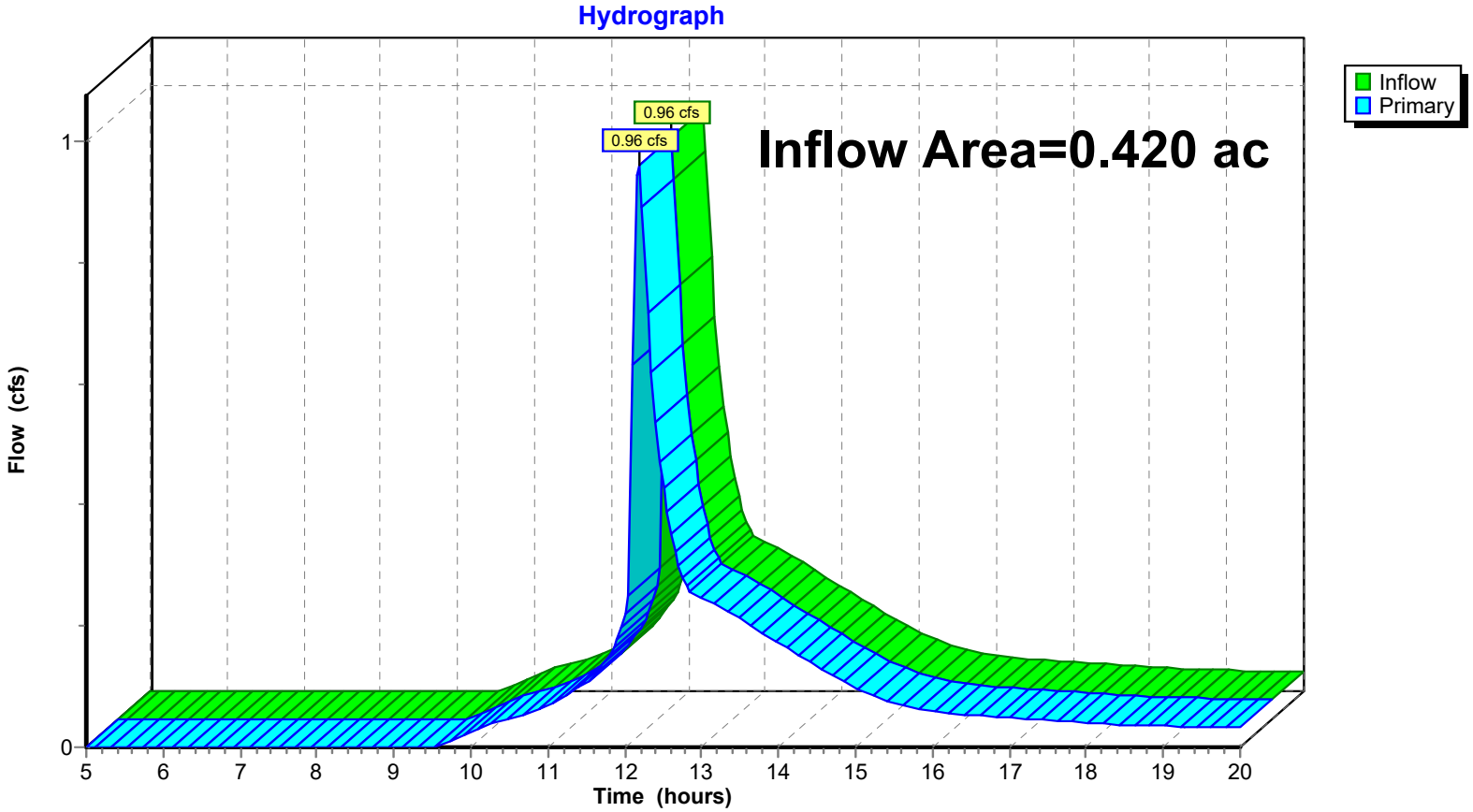


Summary for Pond B-2: DESIGN POINT 2

Inflow Area = 0.420 ac, 52.38% Impervious, Inflow Depth > 2.89" for 100-yr event
Inflow = 0.96 cfs @ 12.18 hrs, Volume= 0.101 af
Primary = 0.96 cfs @ 12.18 hrs, Volume= 0.101 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond B-2: DESIGN POINT 2



Summary for Pond P1: BASIN

Inflow Area = 0.420 ac, 52.38% Impervious, Inflow Depth > 3.19" for 100-yr event
Inflow = 1.38 cfs @ 12.10 hrs, Volume= 0.112 af
Outflow = 0.96 cfs @ 12.18 hrs, Volume= 0.101 af, Atten= 30%, Lag= 4.8 min
Primary = 0.96 cfs @ 12.18 hrs, Volume= 0.101 af
Routed to Pond B-2 : DESIGN POINT 2
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Routed to Pond B-2 : DESIGN POINT 2

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 76.37' @ 12.18 hrs Surf.Area= 653 sf Storage= 1,280 cf

Plug-Flow detention time= 84.5 min calculated for 0.101 af (90% of inflow)
Center-of-Mass det. time= 50.8 min (815.0 - 764.2)

Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	1,750 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

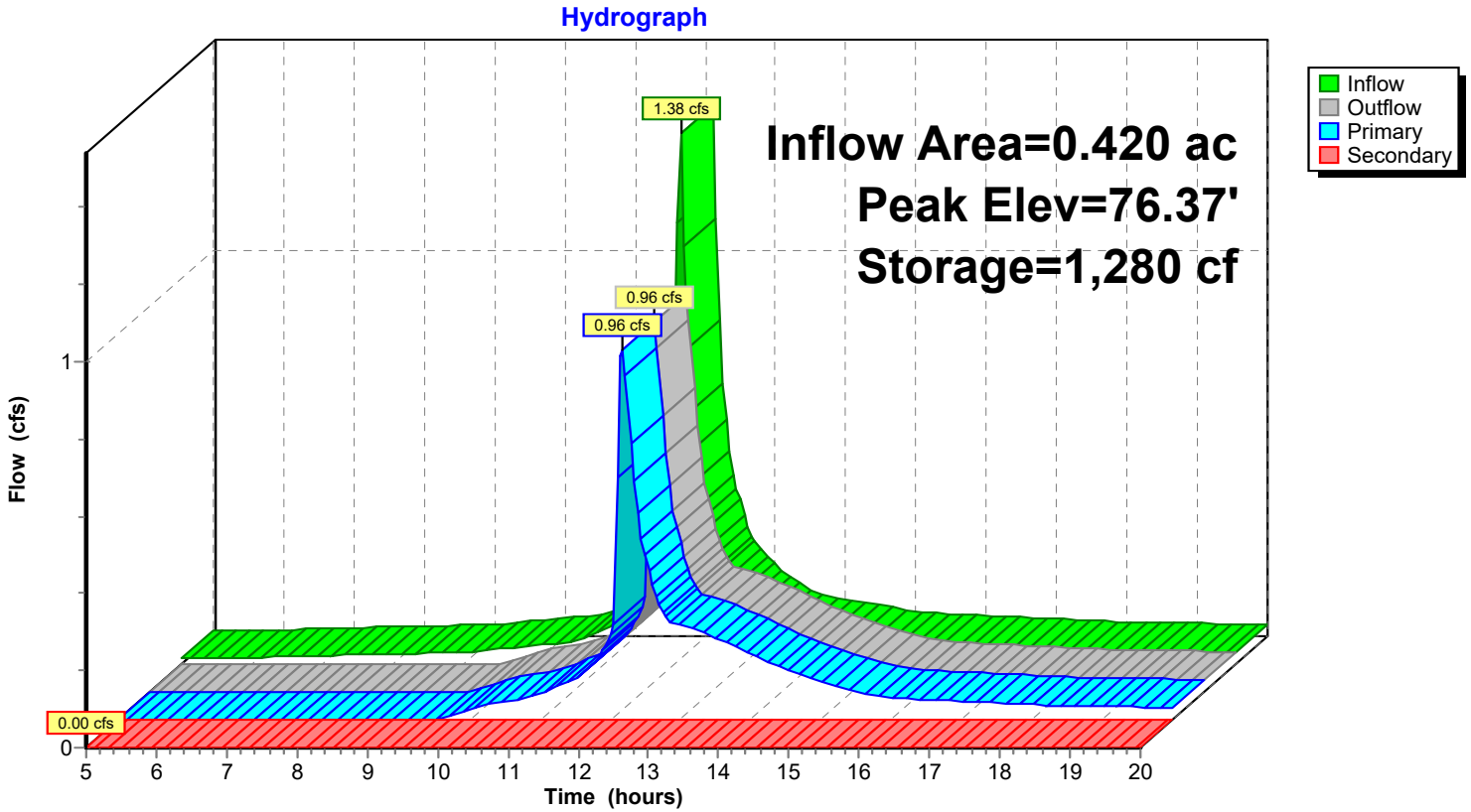
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
74.00	502	0	0	502
75.00	528	515	515	587
76.00	559	543	1,058	675
77.00	833	691	1,750	964

Device	Routing	Invert	Outlet Devices
#1	Primary	74.00'	**15.0" Round Culvert** L= 54.0' Ke= 0.500 Inlet / Outlet Invert= 74.00' / 73.00' S= 0.0185 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	74.75'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	76.00'	**1.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	76.50'	**22.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	76.50'	**6.0' long Broad-Crested Rectangular Weir** Head (feet) 0.50 Coef. (English) 2.70

Primary OutFlow Max=0.95 cfs @ 12.18 hrs HW=76.36' (Free Discharge)
└─**1=Culvert** (Passes 0.95 cfs of 7.78 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.29 cfs @ 5.87 fps)
  ├─**3=Sharp-Crested Rectangular Weir**(Weir Controls 0.66 cfs @ 1.96 fps)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=74.00' (Free Discharge)
└─**5=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond P1: BASIN



Summary for Pond PP: Porous Pavement

Inflow Area = 0.100 ac,100.00% Impervious, Inflow Depth > 7.48" for 100-yr event
Inflow = 0.86 cfs @ 12.09 hrs, Volume= 0.062 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

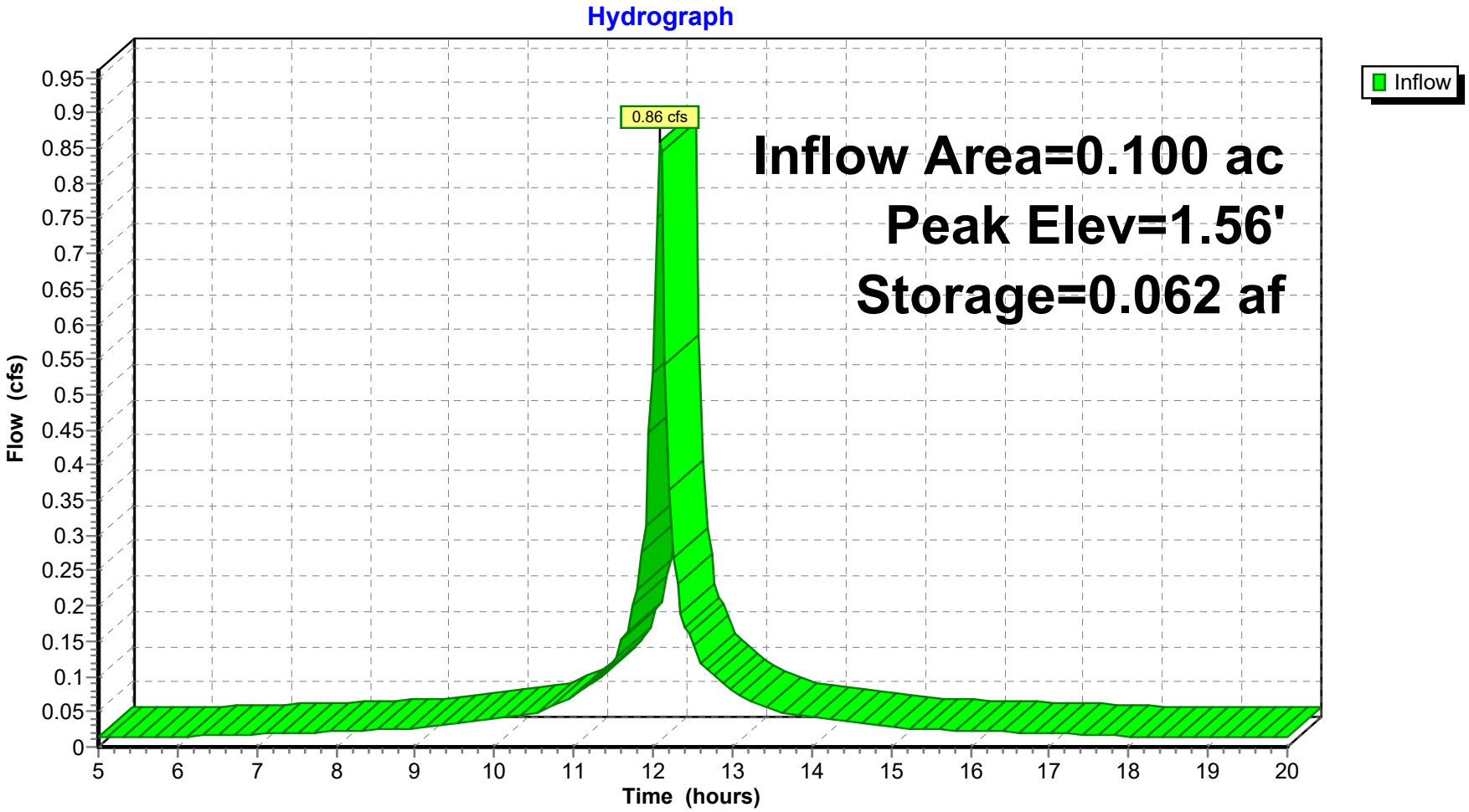
Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 1.56' @ 20.00 hrs Surf.Area= 0.100 ac Storage= 0.062 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	0.080 af	**Custom Stage Data (Conic)** Listed below (Recalc) 0.200 af Overall x 40.0% Voids

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
0.00	0.100	0.000	0.000	0.100
2.00	0.100	0.200	0.200	0.111

Pond PP: Porous Pavement



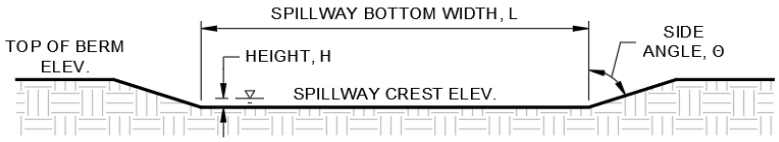
A P P E N D I X F

EMERGENCY SPILLWAY

Project Name	Parking Lot Expansion
Location	Neptune Township
Project ID	24-2348-01
Date	10/25/2024
Prepared By	ES

EMERGENCY SPILLWAY CALCULATIONS

Basin ID: Infiltration Basin



$$Discharge, Q = 2.7LH^{3/2}$$

Q_{100} Inflow to Basin	1.4	cfs
Top of Berm Elevation	78	
Spillway Crest Elevation	76.5	
Spillway Bottom Width, L	6	ft
Spillway Side Slope	3	:1

Side Angle, Θ	71.6	deg
Height, H	0.20	ft
Freeboard	1.30	ft
Flow Area Over Spillway	1.3	sf
Velocity Over Spillway	1.1	ft/s

Table 12-1: Allowable Velocities for Various Soils

Soil Texture	Allowable Velocity (ft/sec)
Sand	1.8
Sandy loam	2.5
Silt loam (also high lime clay), loam	3.0
Sandy clay loam	3.5
Clay loam	4.0
Clay, fine gravel, graded loam to gravel	5.0
Cobbles	5.5
Shale (non-weathered)	6.0

Existing Soil Type: Sand

Allowable Velocity 1.8 ft/s

Is the velocity over the spillway less than or equal to the allowable velocity? **Yes**

Is there at least 12" of freeboard? **Yes**

Use
L = 6 ft

A P P E N D I X G

CONDUIT OUTLET PROTECTION

Project Name	Parking Lot Expansion
Location	Neptune Township
Project ID	24-2348-01
Date	10/25/2024
Prepared By	ES

CONDUIT OUTLET PROTECTION CALCULATIONS

Structure ID	FES 100		
Pipe Diameter	15 in		
W_o	1.25 ft		
D_o	1.25 ft		
Unit Discharge			
Q_{25}	0.90 cfs	$q = \frac{Q}{W_o}$	
W_o	1.25 ft		
Unit Discharge, q	0.72 cfs		
Tailwater, Tw	1 ft	(equal to 2-year WSEL)	
		(if cannot calculate, Tw = $0.2D_o$)	
		Is Tw < 1/2 D_o?	**No**
Tw < 1/2 D_o			
D_o	1.25 ft	$L_a = 1.8\left(\frac{q}{D_o^{0.5}}\right) + 7D_o$	
q	0.72 cfs		
Length of Apron, L_a	9.91 ft		
W_o	1.25 ft	$W_a = 3W_o + L_a$	
L_a	10.00 ft		
Width of Apron, W_a	13.75 ft		
Tw ≥ 1/2 D_o			
D_o	1.25 ft	$L_a = 3\left(\frac{q}{D_o^{0.5}}\right)$	
q	0.72 cfs		
Length of Apron, L_a	1.93 ft		
W_o	1.25 ft	$W_a = 3W_o + 0.4L_a$	**Use**
L_a	2.00 ft		**La = 2 ft**
Width of Apron, W_a	4.55 ft		**Wa = 5 ft**
Horizontal Apron			
Tw	1.00 ft	$d_{50} = \frac{0.02}{Tw} q^{1.33}$	
q	0.72 ft		
			Use
d_{50}	0.01 ft	(6" min)	**D_{50} = 6 in**
		$Apron\ Thickness, t = d_{50} * 2$	**t = 12 in**

Project Name	Parking Lot Expansion
Location	Neptune Township
Project ID	24-2348-01
Date	10/25/2024
Prepared By	ES

CONDUIT OUTLET PROTECTION CALCULATIONS

Structure ID	FES 101		
Pipe Diameter	12	in	
W_o	1.00	ft	
D_o	1.00	ft	

Unit Discharge

Q_{100} (OUTFLOW)	0.90	cfs	$q = \frac{Q}{W_o}$
W_o	1.00	ft	
Unit Discharge, q	0.90	cfs	

Tailwater, Tw	0.5	ft	(equal to 2-year WSEL) (if cannot calculate, Tw = $0.2D_o$)

Is Tw < 1/2 D_o? **No**

Tw < 1/2 D_o

D_o	1.00	ft	$L_a = 1.8\left(\frac{q}{D_o^{0.5}}\right) + 7D_o$
q	0.90	cfs	
Length of Apron, L_a	8.62	ft	
W_o	1.00	ft	$W_a = 3W_o + L_a$
L_a	9.00	ft	
Width of Apron, W_a	12.00	ft	

Tw ≥ 1/2 D_o

D_o	1.00	ft	$L_a = 3\left(\frac{q}{D_o^{0.5}}\right)$
q	0.90	cfs	
Length of Apron, L_a	2.70	ft	
W_o	1.00	ft	$W_a = 3W_o + 0.4L_a$
L_a	3.00	ft	
Width of Apron, W_a	4.20	ft	

Use
La = 3 ft
Wa = 5 ft

Horizontal Apron

Tw	0.50	ft	$d_{50} = \frac{0.02}{Tw} q^{1.33}$
q	0.90	ft	
d_{50}	0.03	ft	(6" min)

$Apron\ Thickness, t = d_{50} * 2$

Use
D_{50} = 6 in
t = 12 in

A P P E N D I X H

DRAIN DOWN TIME CALCULATIONS

Project Name	Parking Lot Expansion
Location	Township of Neptune
Project ID	24-2348-01
Date	10/25/2024
Prepared By	ES

DRAIN DOWN TIME CALCULATIONS

Basin ID: Infiltration Basin

$$Drain\ Time = \frac{Volume}{Infiltration\ Rate\ x\ Design\ Permeability\ Rate}$$

Volume Below Emergency Spillway[1]	2,422	cf
Infiltration Area	833	sf
Design Permeability Rate	1	in/hr

Drain Time = 2.9 hr

Less than 72 hours YES

[1] Volume below emergency spillway assumes outlet control structure fails and entire volume is infiltrated

Project Name	Parking Lot Expansion
Location	Township of Neptune
Project ID	24-2348-01
Date	10/25/2024
Prepared By	ES

DRAIN DOWN TIME CALCULATIONS

Basin ID: Porous Pavement

$$Drain\ Time = \frac{Volume}{Infiltration\ Rate\ x\ Design\ Permeability\ Rate}$$

Volume Below Emergency Spillway[1]	8,712	cf
Infiltration Area	4,356	sf
Design Permeability Rate	1	in/hr

Drain Time = 2.0 hr

Less than 72 hours YES

[1] Volume below emergency spillway assumes outlet control structure fails and entire volume is infiltrated