



STORMWATER MANAGEMENT
CALCULATIONS
FOR
BLOCK 3901, LOT 29
MONROE TOWNSHIP
GLOUCESTER COUNTY, NJ

EDA #8146



Joseph H. Maffei, P.E.

6/19/19

Date

N.J.P.E. #37894

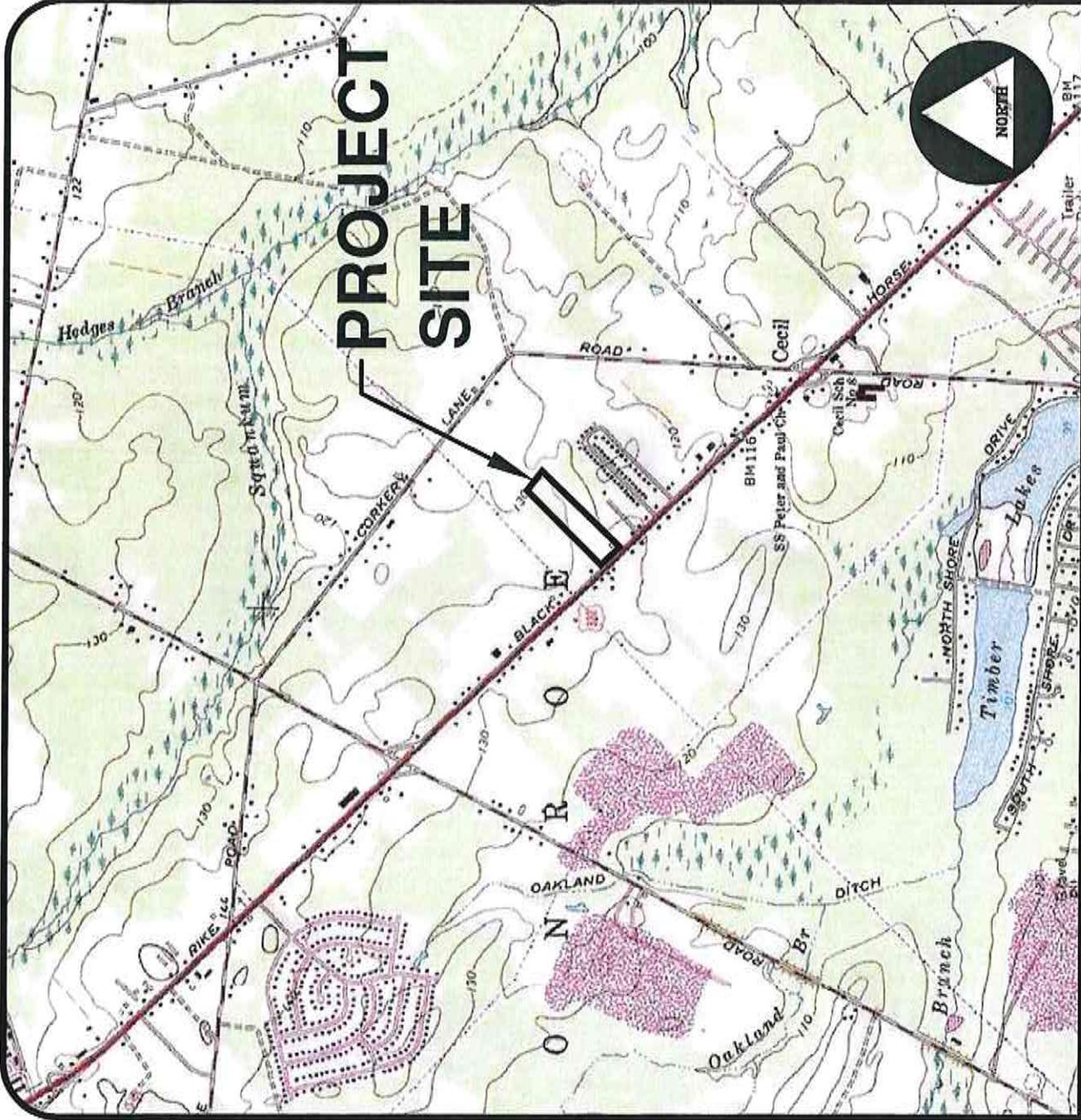
Revised 8/7/19

REVISED 9/30/20

Cambridge Professional Offices

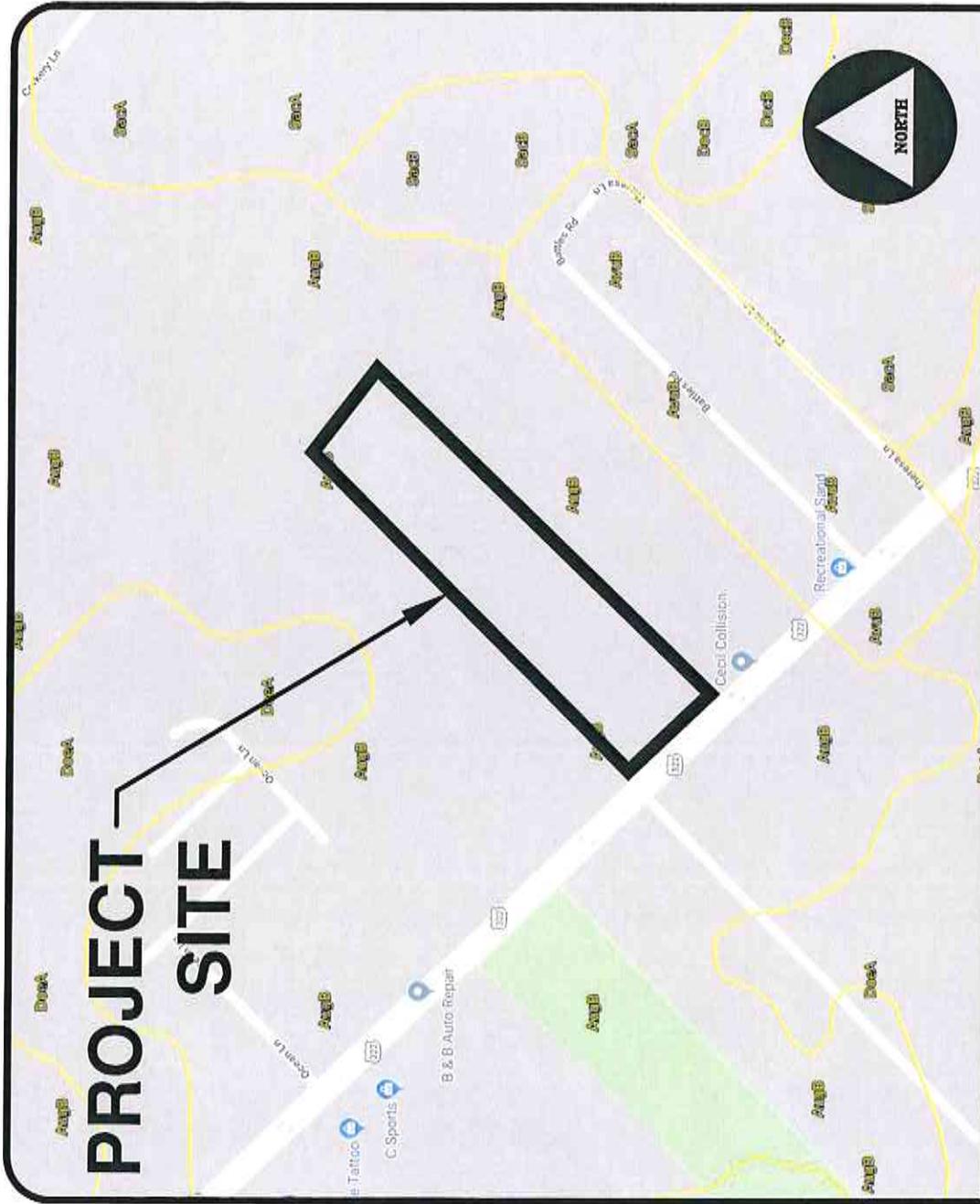
5 Cambridge Drive, Ocean View, New Jersey 08230

PHONE: (609) 390-0332 • FAX: (609) 390-9204



1" = 600'

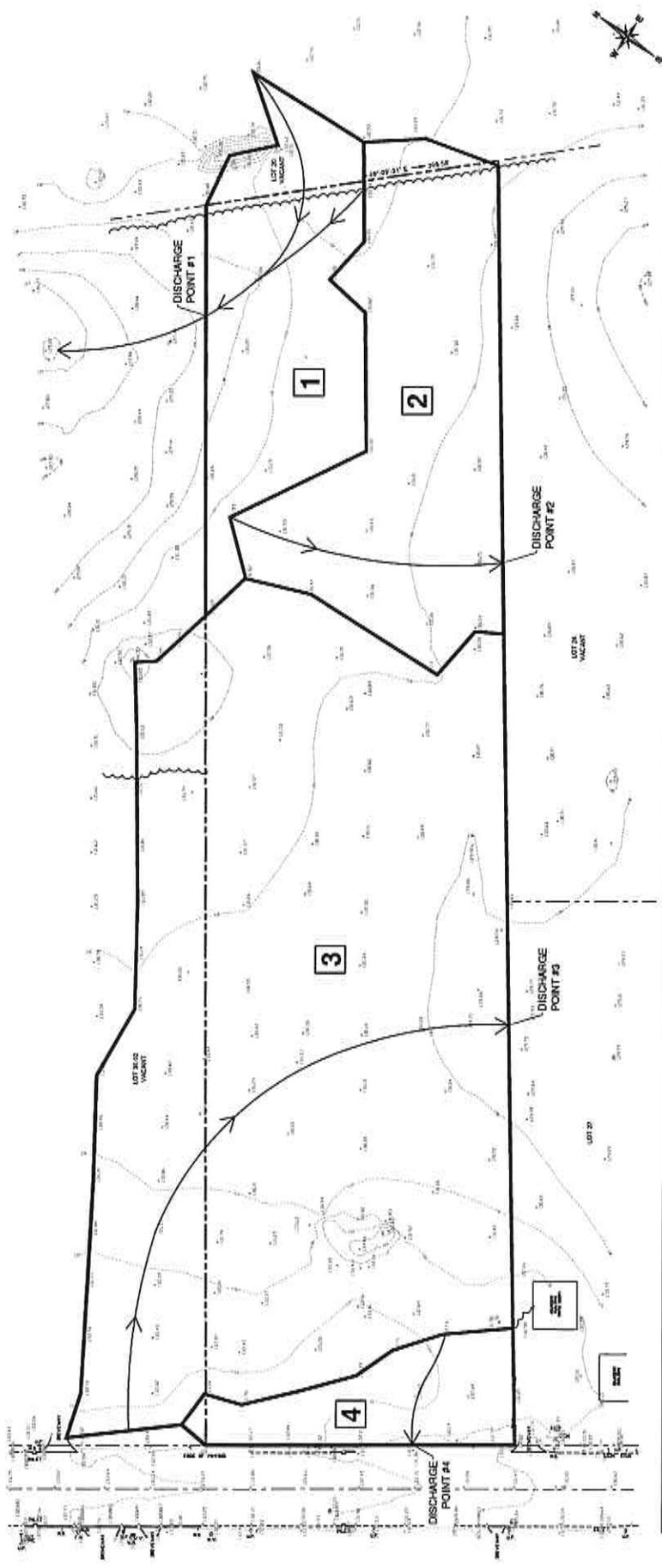
U.S.G.S. MAP



**PROJECT
SITE**

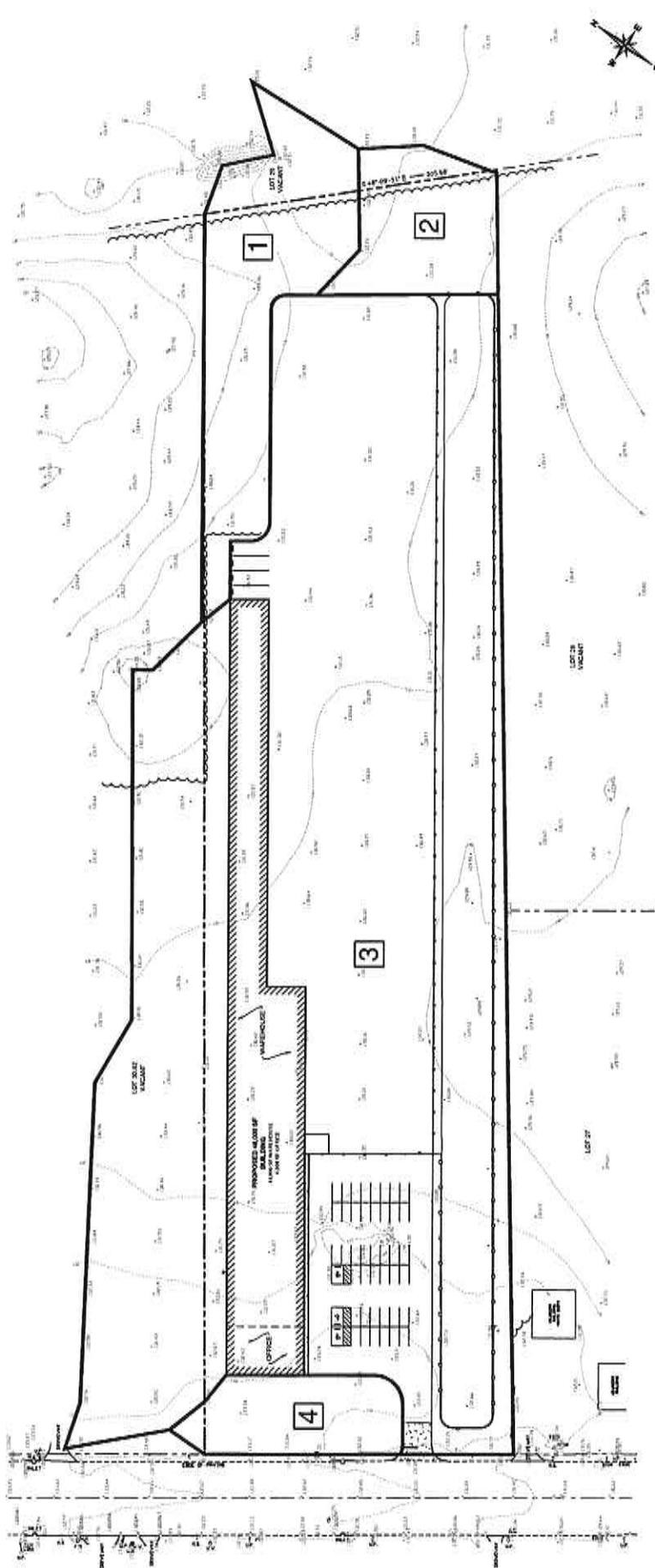
1" = 500'

S.C.D. SOILS MAP



PRE-DEVELOPMENT WATERSHED MAP

1" = 50'



POST DEVELOPMENT WATERSHED MAP

1" = 50'

STORMWATER MANAGEMENT CALCULATIONS

Existing Conditions

The project site consists of an area of 9.29 Acres. The parcel currently consists of woodland and grassland conditions. The soil type for the project site is (AugB) Aura Sandy Loam, 2 to 5 percent slopes.

Drainage Design

The project site consists of four (4) watershed areas:

Watershed #1 consists of woodland and grassland conditions. This watershed is located in the northern rear portion of the project site and drains in a westerly direction. A portion of this watershed is incorporated into Post-Development Watershed #3.

Watershed #2 consists of woodland and grassland conditions. This watershed is located in the southern rear portion of the project site and drains in an easterly direction. A portion of this watershed is incorporated into Post-Development Watershed #3.

Watershed #3 consists of woodland and grassland conditions. This watershed is located in the central portion of the project site and drains in an easterly direction. The majority of the site improvements will be constructed within this watershed, including the stormwater basin.

Watershed #4 consists of gravel, grass and woodland conditions. This watershed is located in the front portion of the project site and drains towards the Black Horse Pike. A portion of this watershed is incorporated into Post-Development Watershed #3.

2-Year Post Development Design Storm Groundwater Recharge

• Pre-Development Storage:	9,878 CF
• Post-Development Storage:	64,892 CF
• Total Storage Required:	55,014 CF
• Total Storage Available:	197,153 CF

Meteorological Data

(New Jersey 24 Hour Rainfall Frequency Data-Gloucester County)

2-Year	3.29 Inches
10-Year	5.09 Inches
100-Year	8.76 Inches

Drainage Calculations

The drainage calculations for the project site were derived using the TR-55 Method of Hydrology Rainfall Type NOAA C Delmarva Unit Hydrograph.

The infiltration basin has been designed to retain the volume created by the difference between the pre-development and post-development conditions for the 2-Year design storm.

<u>Design Storm</u>	<u>Pre-Development Peak Flows Watershed #3</u>	<u>Post-Development Peak Flows</u>	<u>Post-Development Routed Peak Flows</u>	
2-YR	0.46 CFS	12.24 CFS	0.00 CFS	0.00%
10 YR	2.30 CFS	19.26 CFS	0.55 CFS	23.91%
100-YR	8.38 CFS	34.06 CFS	6.68 CFS	79.71%

Spillway Analysis

<u>Design Storm</u>	<u>Velocity</u>
2-YR	0.00 FPS
10-YR	0.88 FPS
100-YR	2.21 FPS

Stability Analysis

- Minimal Stable Slope - Sandy Loam 2% Slope, Actual Downstream Slope 0.9%
- Maximum Discharge Rate for 25-Year Storm Event 10 CFS, Actual Discharge for 25-Year Storm Event 1.98 CFS
- Flow over outlet area shall be less than 0.5 CFS/FT, Actual flow over outlet area 0.44 CFS/FT (1.98 CFS/4.5')

The proposed stormwater storage facility has been designed to release the post-development peak flows for the 2-, 10- and 100-Year design storms below their respective pre-development peak flows.

The proposed infiltration basin was designed to retain the net increase in impervious surfaces for the 10 Year Design Storm as required by The Pinelands Commission.

The proposed stormwater system has been designed to meet the NJDEP Stormwater Management Rules. The Stormwater Management System has been designed to reduce the post-construction load of Total Suspended Solids (TSS) in stormwater runoff generated from the water quality design storm by 80% by utilizing an infiltration basin. The system meets the 80% TSS removal required by the NJDEP Stormwater Management Rules.

Infiltration Basin

80% Removal

Infiltration Basin Storage Volumes

<u>Elevation</u>	<u>Storage Volume</u>
127.25	0 CF
128.00	31,276 CF
129.00	79,388 CF
130.00	134,644 CF
131.00	197,153 CF

	<u>Elevation</u>
Water Quality Design Storm.....	127.74
2-Year Design Storm	128.74
10-Year Design Storm	129.39
100-Year Design Storm	129.92

Pre-Development Conditions – Watershed #1 (1.28 Acres)

<u>Cover Type</u>	<u>CN Value</u>	<u>Area</u>
Woodland	55	1.21 Acres
Grass	61	0.07 Acres

TC = 46.80 Minutes

Post-Development Conditions – Watershed #1 (1.04 Acres)

<u>Cover Type</u>	<u>CN Value</u>	<u>Area</u>
Woodland	55	0.70 Acres
Grass	61	0.34 Acres

TC = 46.80 Minutes

<u>Design Storm</u>	<u>Pre-Development Peak Outflow</u>	<u>Post-Development Peak Outflow</u>
2-YR	0.07 CFS	0.07 CFS
10-YR	0.35 CFS	0.33 CFS
100-YR	1.33 CFS	1.18 CFS

Pre-Development Conditions – Watershed #2 (2.12 Acres)

<u>Cover Type</u>	<u>CN Value</u>	<u>Area</u>
Woodland	55	2.01 Acres
Grass	61	0.11 Acres

TC = 90.10 Minutes

Post-Development Conditions – Watershed #2 (0.50 Acres)

<u>Cover Type</u>	<u>CN Value</u>	<u>Area</u>
Woodland	55	0.39 Acres
Grass	61	0.11 Acres

TC = 45.00 Minutes

<u>Design Storm</u>	<u>Pre-Development Peak Outflow</u>	<u>Post-Development Peak Outflow</u>
2-YR	0.08 CFS	0.03 CFS
10-YR	0.38 CFS	0.15 CFS
100-YR	1.41 CFS	0.56 CFS

Pre-Development Conditions – Watershed #3 (7.41 Acres)

<u>Cover Type</u>	<u>CN Value</u>	<u>Area</u>
Woodland	55	5.65 Acres
Grass	61	1.76 Acres

TC = 43.60 Minutes

Post-Development Conditions – Watershed #3 (9.55 Acres)

<u>Cover Type</u>	<u>CN Value</u>	<u>Area</u>
Impervious	98	5.28 Acres
Woodland	55	0.23 Acres
Grass	61	4.04 Acres

TC = 42.70 Minutes

<u>Design Storm</u>	<u>Pre-Development Peak Outflow</u>	<u>Post-Development Routed Peak Outflow</u>
2-YR	0.46 CFS	0.00 CFS
10-YR	2.30 CFS	0.55 CFS
100-YR	8.38 CFS	6.68 CFS

Pre-Development Conditions – Watershed #4 (0.68 Acres)

<u>Cover Type</u>	<u>CN Value</u>	<u>Area</u>
Woodland	55	0.22 Acres
Grass	61	0.39 Acres
Gravel	85	0.07 Acres

TC = 31.00 Minutes

Post-Development Conditions – Watershed #4 (0.40 Acres)

<u>Cover Type</u>	<u>CN Value</u>	<u>Area</u>
Grass	61	0.40 Acres

TC = 10.70 Minutes

<u>Design Storm</u>	<u>Pre-Development Peak Outflow</u>	<u>Post-Development Peak Outflow</u>
2-YR	0.11 CFS	0.10 CFS
10-YR	0.40 CFS	0.39 CFS
100-YR	1.18 CFS	1.17 CFS

TEST PIT #1

<u>DEPTH</u>	<u>DESCRIPTION</u>
0" - 3"	10YR 4/2 Dark Grayish Brown, Sandy Loam, Subangular Blocky, Friable
3" - 23"	10YR 6/6 Brownish Yellow, Sandy Clay Loam, Subangular Blocky, Friable
23" - 42"	7.5YR 6/6 Reddish Yellow, Sandy Clay Loam, Subangular Blocky, Friable
42" - 53"	10YR 6/6 Brownish Yellow, Sandy Loam, Subangular Blocky, Friable
53" - 68"	10YR 6/6 Brownish Yellow, Sandy Clay Loam, Subangular Blocky, Friable
68" - 79"	10YR 7/6 Yellow, Sandy Loam, Subangular Blocky, Friable
79" - 111"	10YR 7/4 Very Pale Brown, Loamy Sand, Subangular Blocky, Friable
111" - 132"	10YR 7/3 Very Pale Brown, Loamy Sand, Subangular Blocky, Friable w/mottles of 10YR 8/1 White, Few, Fine & Faint & layers of 10YR 5/6 Yellowish Brown, Sandy Loam, Subangular Blocky, Friable

Depth of Seasonal High Water: 111"
Depth of Groundwater: >132"
Date Performed: 5/2/19
Performed By: Christopher J. Carey, LLA

TEST PIT #2

<u>DEPTH</u>	<u>DESCRIPTION</u>
0" - 5"	10YR 4/2 Dark Grayish Brown, Sandy Loam, Subangular Blocky, Friable
5" - 30"	10YR 6/6 Brownish Yellow, Sandy Clay Loam, Subangular Blocky, Friable
30" - 68"	7.5YR 6/8 Reddish Yellow, Sandy Clay Loam, Subangular Blocky, Friable
68" - 105"	7.5YR 6/6 Reddish Yellow, Loamy Sand, Subangular Blocky, Friable
105" - 123"	10YR 7/6 Yellow, Loamy Sand, Subangular Blocky, Friable w/mottles of 10YR 7/1 Light Gray, Few, Fine & Faint

Depth of Seasonal High Water: 105"
Depth of Groundwater: >123"
Date Performed: 5/2/19
Performed By: Christopher J. Carey, LLA

TEST PIT #3

<u>DEPTH</u>	<u>DESCRIPTION</u>
0" - 3"	10YR 4/2 Dark Grayish Brown, Sandy Loam, Subangular Blocky, Friable
3" - 28"	10YR 6/4 Light Yellowish Brown, Sandy Clay Loam, Subangular Blocky, Friable
28" - 47"	10YR 6/6 Brownish Yellow, Sandy Loam, Subangular Blocky, Friable
47" - 72"	10YR 6/6 Brownish Yellow, Sandy Loam, Subangular Blocky, Friable
72" - 80"	10YR 7/6 Yellow, Loamy Sand, Subangular Blocky, Friable
80" - 110"	10YR 7/6 Yellow, Sand, Single Grain, Loose
110" - 125"	10YR 7/6 Yellow, Sand, Single Grain, Loose w/mottles of 10YR 7/1 Light Gray, Few, Fine & Faint

Depth of Seasonal High Water: 110"
Depth of Groundwater: >125"
Date Performed: 5/2/19
Performed By: Christopher J. Carey, LLA

TEST PIT #4

<u>DEPTH</u>	<u>DESCRIPTION</u>
0"- 5"	10YR 4/2 Dark Grayish Brown, Sandy Loam, Subangular Blocky, Friable
5"- 24"	10YR 6/4 Light Yellowish Brown, Sandy Clay Loam, Subangular Blocky, Friable
24"- 67"	10YR 6/6 Brownish Yellow, Sandy Loam, Subangular Blocky, Friable w/40% Coarse Fragments
67"- 104"	10YR 7/6 Yellow, Loamy Sand, Subangular Blocky, Friable
104"- 120"	10YR 7/4 Very Pale Brown, Loamy Sand, Subangular Blocky, Friable w/mottles of 10YR 8/1 White, Few, Fine & Faint
80"- 110"	10YR 7/6 Yellow, Sand, Single Grain, Loose
110"- 125"	10YR 7/6 Yellow, Sand, Single Grain, Loose w/mottles of 10YR 7/1 Light Gray, Few, Fine & Faint

Depth of Seasonal High Water: 104"
Depth of Groundwater: >120"
Date Performed: 5/2/19
Performed By: Christopher J. Carey, LLA

TEST PIT #5

<u>DEPTH</u>	<u>DESCRIPTION</u>
0"- 7"	10YR 4/2 Dark Grayish Brown, Sandy Loam, Subangular Blocky, Friable
7"- 42"	10YR 6/4 Light Yellowish Brown, Sandy Clay, Massive & Firm
42"- 65"	7.5YR 6/6 Reddish Yellow, Sandy Loam, Subangular Blocky, Friable
65"- 84"	7.5YR 7/6 Reddish Yellow, Loamy Sand, Subangular Blocky, Friable
84"- 96"	10YR 7/6 Yellow, Loamy Sand, Subangular Blocky, Friable
96"- 120"	10YR 6/4 Light Yellowish Brown, Loamy Sand, Subangular Blocky, Friable w/mottles of 8/1 White, Few, Fine & Faint

Depth of Seasonal High Water: 96"
Depth of Groundwater: >120"
Date Performed: 5/2/19
Performed By: Christopher J. Carey, LLA

TEST PIT #6

<u>DEPTH</u>	<u>DESCRIPTION</u>
0"- 6"	10YR 4/2 Dark Grayish Brown, Sandy Loam, Subangular Blocky, Friable
6"- 26"	10YR 6/6 Brownish Yellow, Sandy Clay Loam, Subangular Blocky, Friable
26"- 35"	10YR 6/4 Light Yellowish Brown, Sandy Loam, Subangular Blocky, Friable
35"- 80"	10YR 6/6 Brownish Yellow, Sandy Loam, Subangular Blocky, Friable
80"- 108"	10YR 7/4 Very Pale Brown, Loamy Sand, Subangular Blocky, Friable
108"- 135"	10YR 7/3 Very Pale Brown, Loamy Sand, Subangular Blocky, Friable w/mottles of 8/1 White, Common, Medium & Distinct

Depth of Seasonal High Water: 108"
Depth of Groundwater: >135"
Date Performed: 5/2/19
Performed By: Christopher J. Carey, LLA

TEST PIT #7

<u>DEPTH</u>	<u>DESCRIPTION</u>
0"- 5"	10YR 4/2 Dark Grayish Brown, Sandy Loam, Subangular Blocky, Friable
5"- 24"	10YR 6/6 Brownish Yellow, Sandy Clay Loam, Subangular Blocky, Friable
24"- 88"	7.5YR 6/6 Reddish Yellow, Sandy Clay Loam, Subangular Blocky, Friable
88"- 120"	10YR 6/6 Brownish Yellow, Sandy Clay Loam, Subangular Blocky, Friable
120"- 132"	10YR 7/4 Very Pale Brown, Loamy Sand, Subangular Blocky, Friable w/mottles of 10YR 7/1 Light Gray, Few, Fine & Faint

Depth of Seasonal High Water: 120"
Depth of Groundwater: >132"
Date Performed: 5/2/19
Performed By: Christopher J. Carey, LLA

CJC/tt



Pre-Dev WS #1



Pre-Dev WS #2



Pre-Dev WS #3



Pre-Dev WS #4



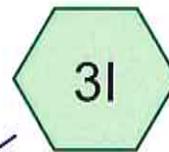
Post-Dev WS #1



Post-Dev WS #2



Post-Dev WS #4



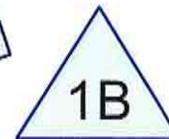
Post-Dev WS #3
Impervious



Post-Dev WS #3
Pervious



Pervious/Impervious
Hydrograph



Stormwater Basin #1



**PRE DEVELOPMENT
WATERSHED #1**

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	3.29	2
2	10-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	5.05	2
3	100-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	8.55	2

Summary for Subcatchment 1E: Pre-Dev WS #1

Runoff = 0.07 cfs @ 13.38 hrs, Volume= 0.030 af, Depth= 0.28"

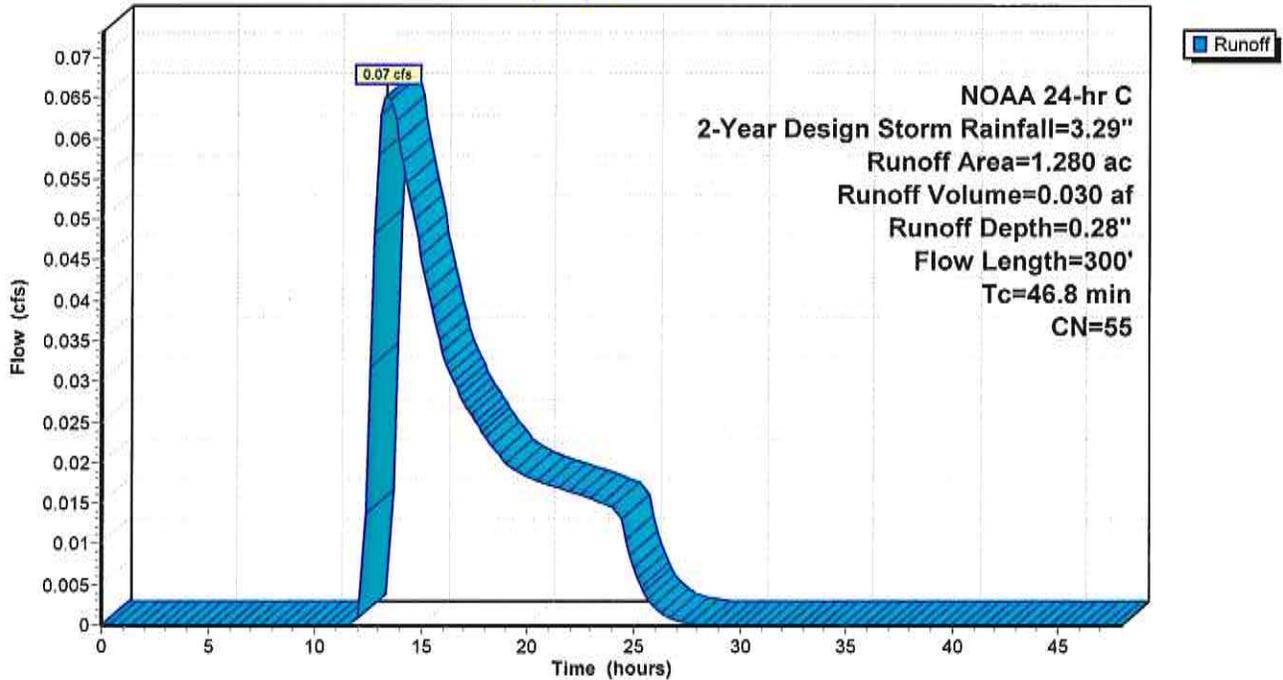
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 2-Year Design Storm Rainfall=3.29"

Area (ac)	CN	Description
* 1.210	55	woodland
* 0.070	61	grass
1.280	55	Weighted Average
1.280		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0	140	0.0064	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
26.8	160	0.0285	0.10		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
46.8	300	Total			

Subcatchment 1E: Pre-Dev WS #1

Hydrograph



Summary for Subcatchment 1E: Pre-Dev WS #1

Runoff = 0.35 cfs @ 12.93 hrs, Volume= 0.107 af, Depth= 1.00"

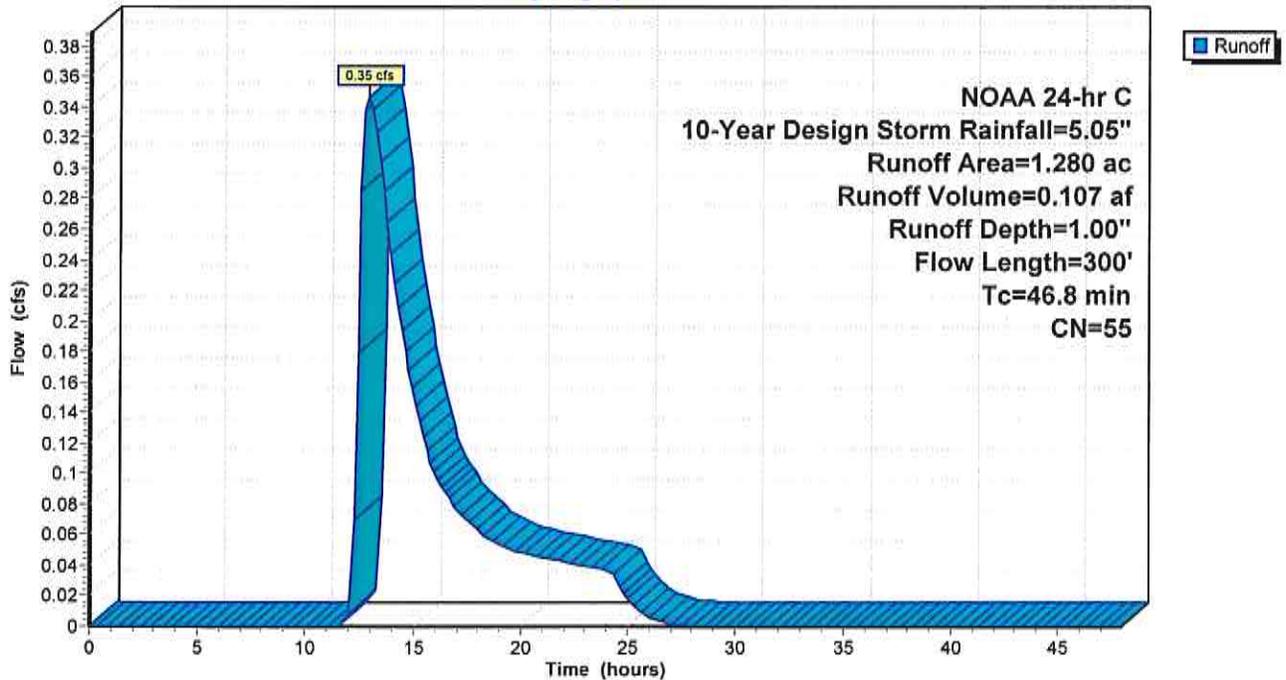
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 10-Year Design Storm Rainfall=5.05"

Area (ac)	CN	Description
* 1.210	55	woodland
* 0.070	61	grass
1.280	55	Weighted Average
1.280		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0	140	0.0064	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
26.8	160	0.0285	0.10		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
46.8	300	Total			

Subcatchment 1E: Pre-Dev WS #1

Hydrograph



Summary for Subcatchment 1E: Pre-Dev WS #1

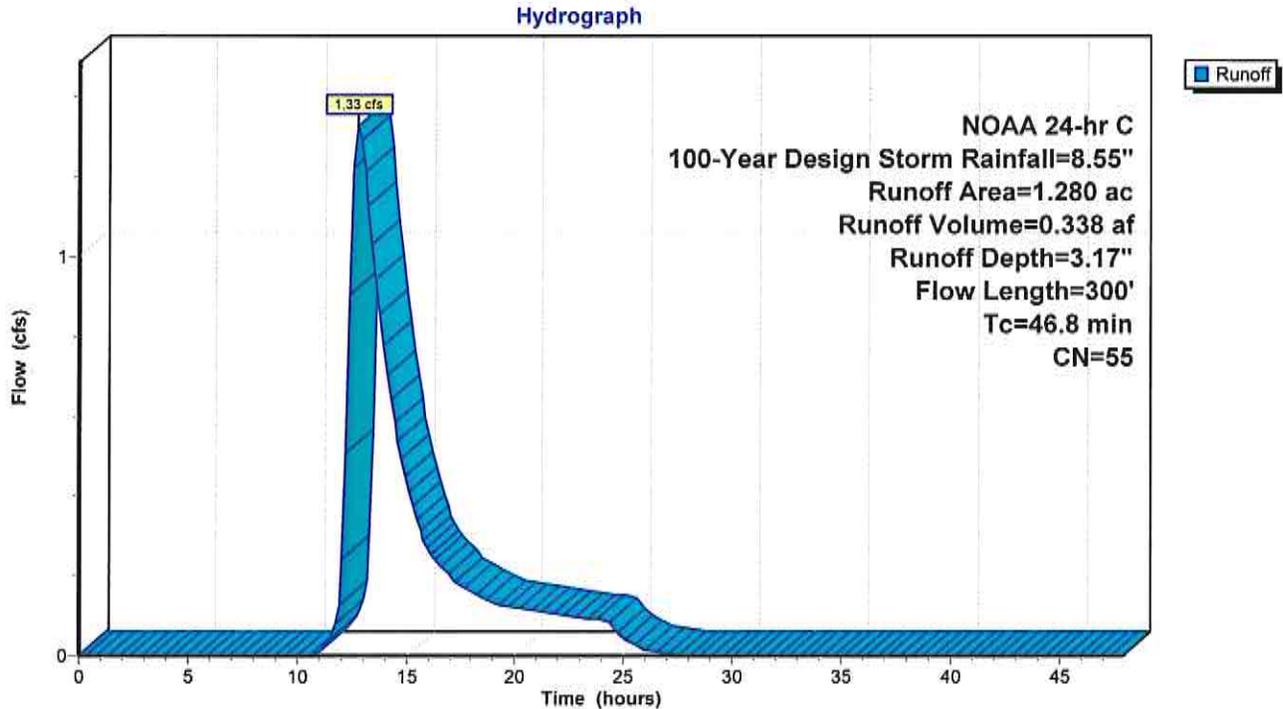
Runoff = 1.33 cfs @ 12.79 hrs, Volume= 0.338 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 100-Year Design Storm Rainfall=8.55"

Area (ac)	CN	Description
* 1.210	55	woodland
* 0.070	61	grass
1.280	55	Weighted Average
1.280		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0	140	0.0064	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
26.8	160	0.0285	0.10		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
46.8	300	Total			

Subcatchment 1E: Pre-Dev WS #1



**PRE DEVELOPMENT
WATERSHED #2**

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	3.29	2
2	10-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	5.05	2
3	100-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	8.55	2

Summary for Subcatchment 2E: Pre-Dev WS #2

Runoff = 0.08 cfs @ 14.24 hrs, Volume= 0.049 af, Depth= 0.28"

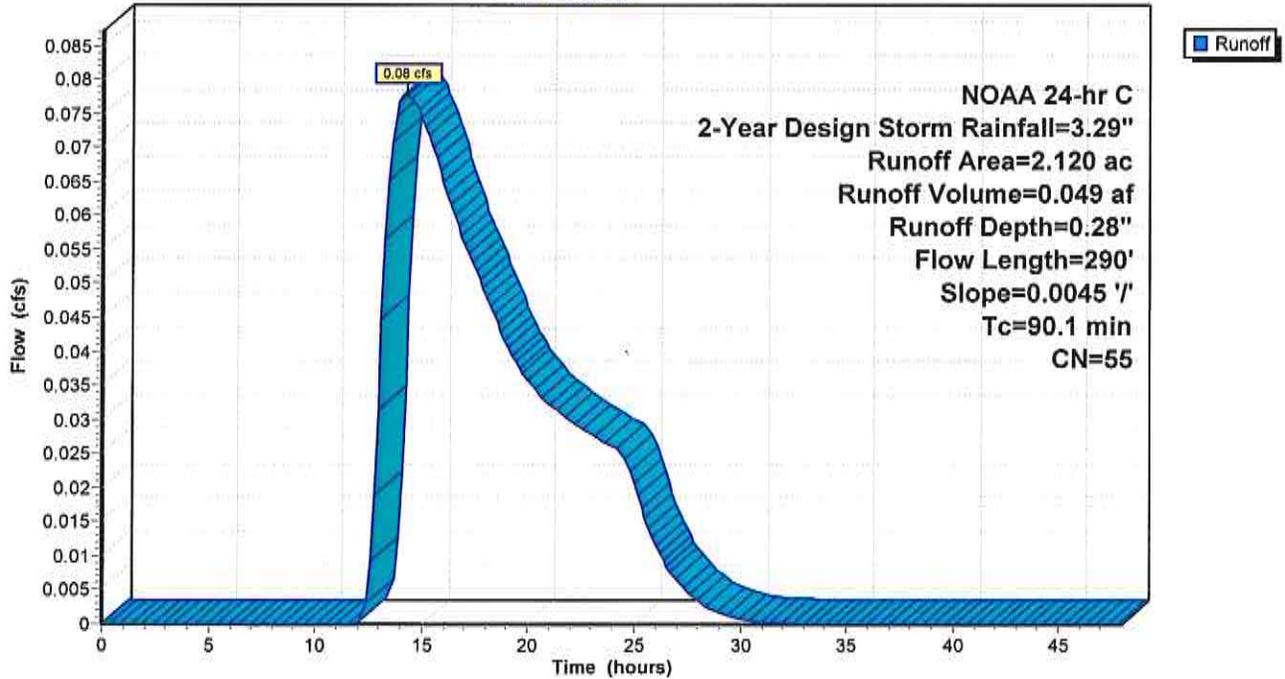
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 2-Year Design Storm Rainfall=3.29"

	Area (ac)	CN	Description
*	2.010	55	woodland
*	0.110	61	grass
	2.120	55	Weighted Average
	2.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
90.1	290	0.0045	0.05		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"

Subcatchment 2E: Pre-Dev WS #2

Hydrograph



Summary for Subcatchment 2E: Pre-Dev WS #2

Runoff = 0.38 cfs @ 13.64 hrs, Volume= 0.178 af, Depth= 1.00"

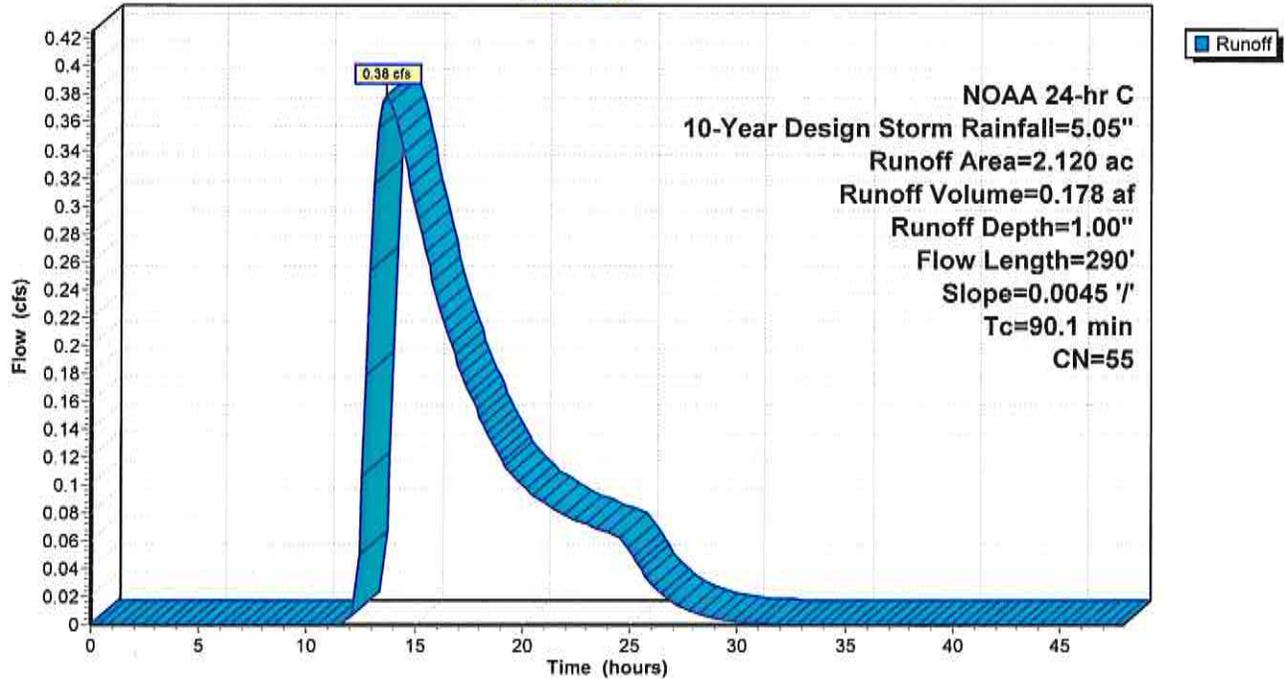
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 10-Year Design Storm Rainfall=5.05"

Area (ac)	CN	Description
* 2.010	55	woodland
* 0.110	61	grass
2.120	55	Weighted Average
2.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
90.1	290	0.0045	0.05		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"

Subcatchment 2E: Pre-Dev WS #2

Hydrograph



Summary for Subcatchment 2E: Pre-Dev WS #2

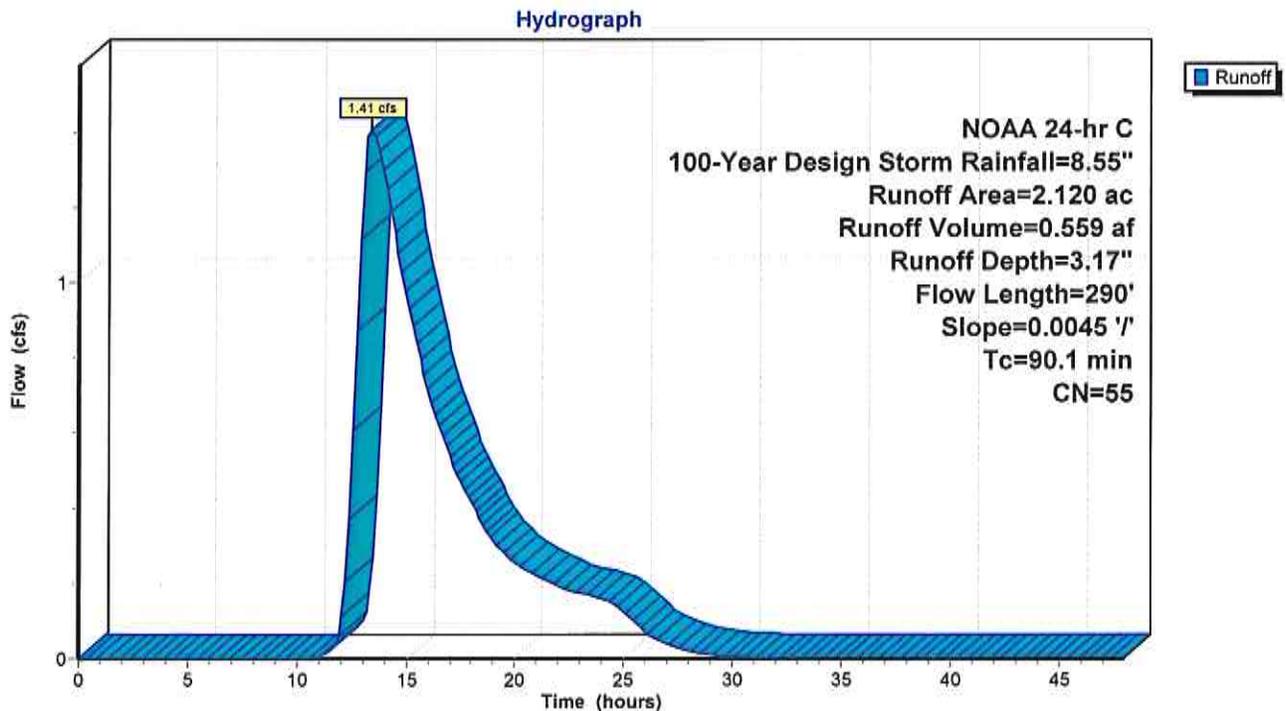
Runoff = 1.41 cfs @ 13.43 hrs, Volume= 0.559 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 100-Year Design Storm Rainfall=8.55"

Area (ac)	CN	Description
* 2.010	55	woodland
* 0.110	61	grass
2.120	55	Weighted Average
2.120		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
90.1	290	0.0045	0.05		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"

Subcatchment 2E: Pre-Dev WS #2



**PRE DEVELOPMENT
WATERSHED #3**

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	3.29	2
2	10-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	5.05	2
3	100-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	8.55	2

Summary for Subcatchment 3E: Pre-Dev WS #3

Runoff = 0.46 cfs @ 13.24 hrs, Volume= 0.190 af, Depth= 0.31"

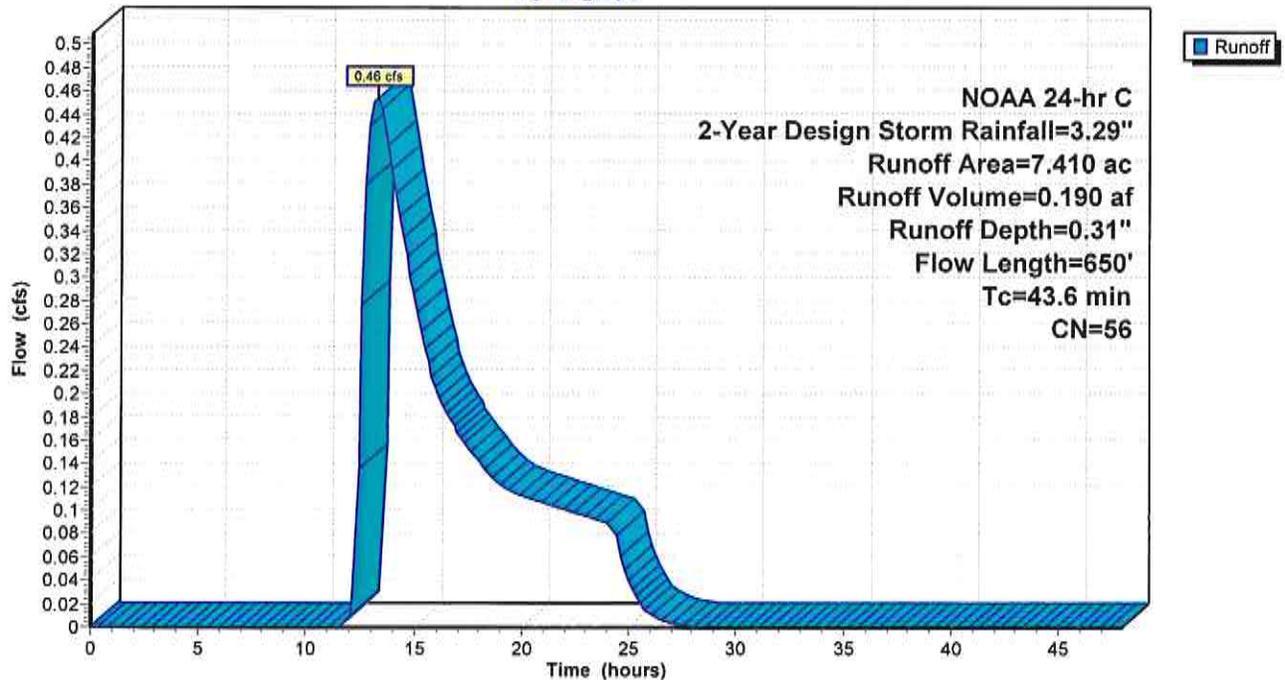
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 2-Year Design Storm Rainfall=3.29"

Area (ac)	CN	Description
* 5.650	55	woodland
* 1.760	61	grass
7.410	56	Weighted Average
7.410		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	170	0.0067	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
14.7	130	0.0118	0.15		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
6.0	350	0.0037	0.98		Shallow Concentrated Flow, woodland Unpaved Kv= 16.1 fps
43.6	650	Total			

Subcatchment 3E: Pre-Dev WS #3

Hydrograph



Summary for Subcatchment 3E: Pre-Dev WS #3

Runoff = 2.30 cfs @ 12.83 hrs, Volume= 0.659 af, Depth= 1.07"

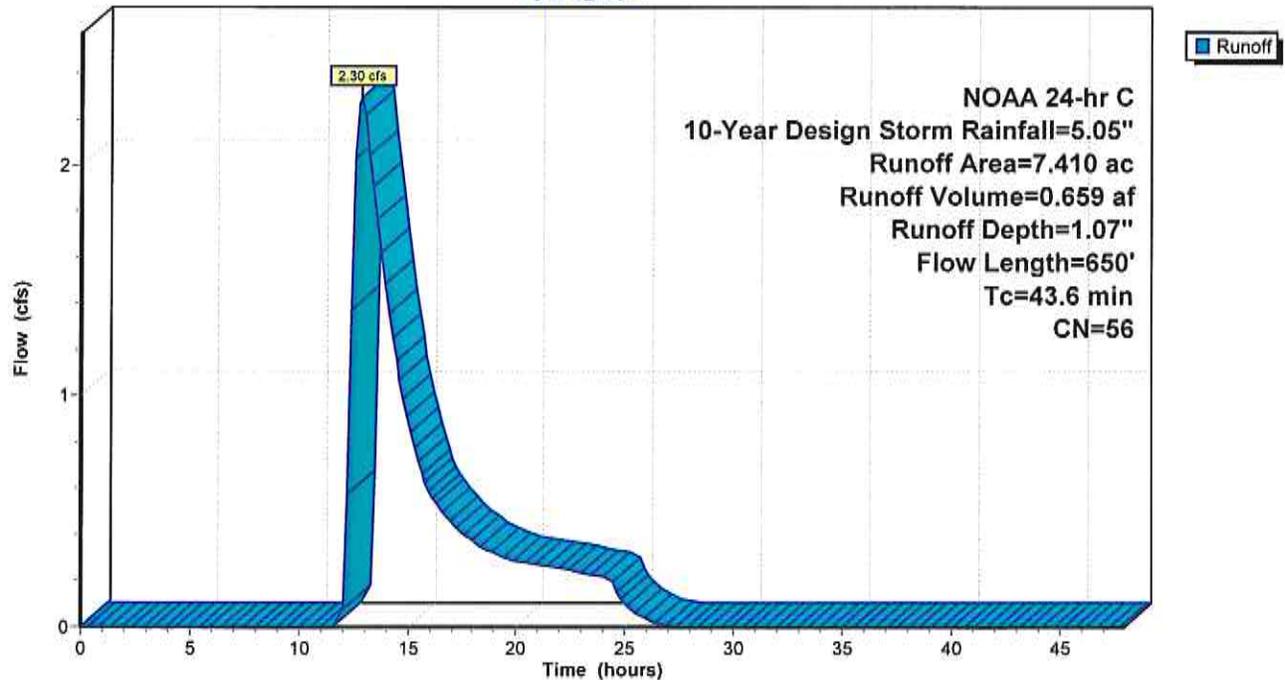
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 10-Year Design Storm Rainfall=5.05"

Area (ac)	CN	Description
* 5.650	55	woodland
* 1.760	61	grass
7.410	56	Weighted Average
7.410		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	170	0.0067	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
14.7	130	0.0118	0.15		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
6.0	350	0.0037	0.98		Shallow Concentrated Flow, woodland Unpaved Kv= 16.1 fps
43.6	650	Total			

Subcatchment 3E: Pre-Dev WS #3

Hydrograph



Summary for Subcatchment 3E: Pre-Dev WS #3

Runoff = 8.38 cfs @ 12.74 hrs, Volume= 2.027 af, Depth= 3.28"

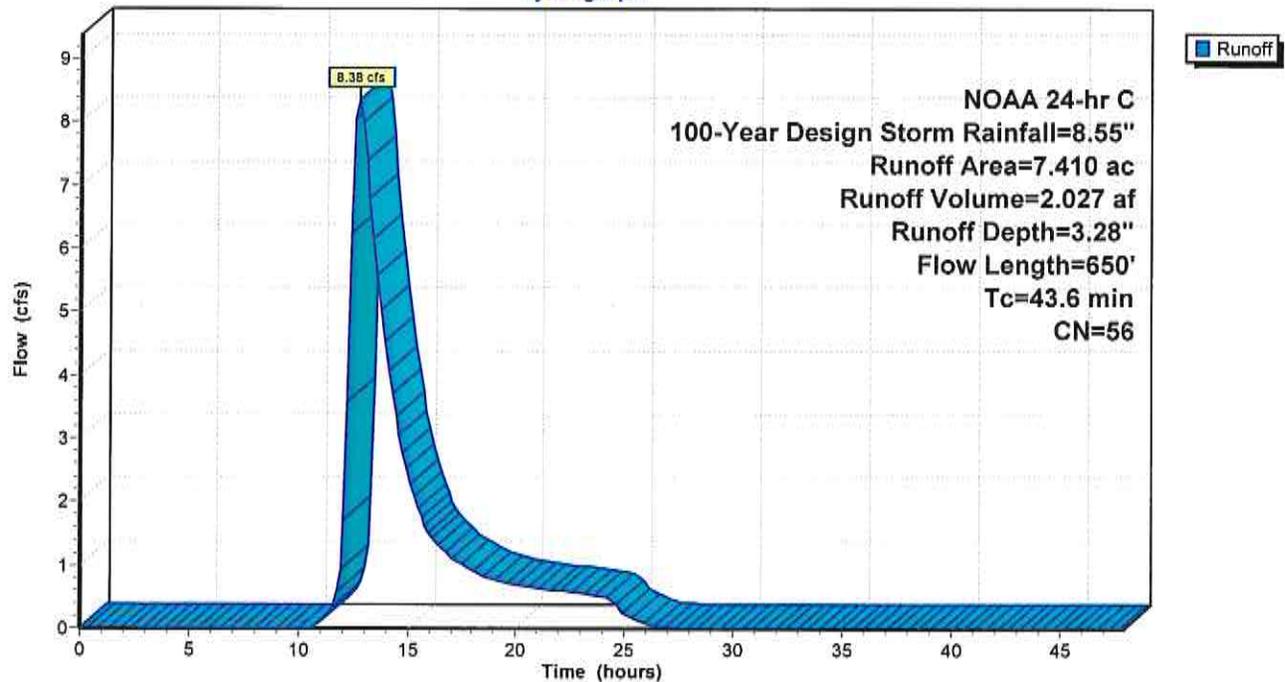
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 100-Year Design Storm Rainfall=8.55"

Area (ac)	CN	Description
* 5.650	55	woodland
* 1.760	61	grass
7.410	56	Weighted Average
7.410		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	170	0.0067	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
14.7	130	0.0118	0.15		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
6.0	350	0.0037	0.98		Shallow Concentrated Flow, woodland Unpaved Kv= 16.1 fps
43.6	650	Total			

Subcatchment 3E: Pre-Dev WS #3

Hydrograph



**PRE DEVELOPMENT
WATERSHED #4**

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	3.29	2
2	10-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	5.05	2
3	100-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	8.55	2

Summary for Subcatchment 4E: Pre-Dev WS #4

Runoff = 0.11 cfs @ 12.72 hrs, Volume= 0.029 af, Depth= 0.52"

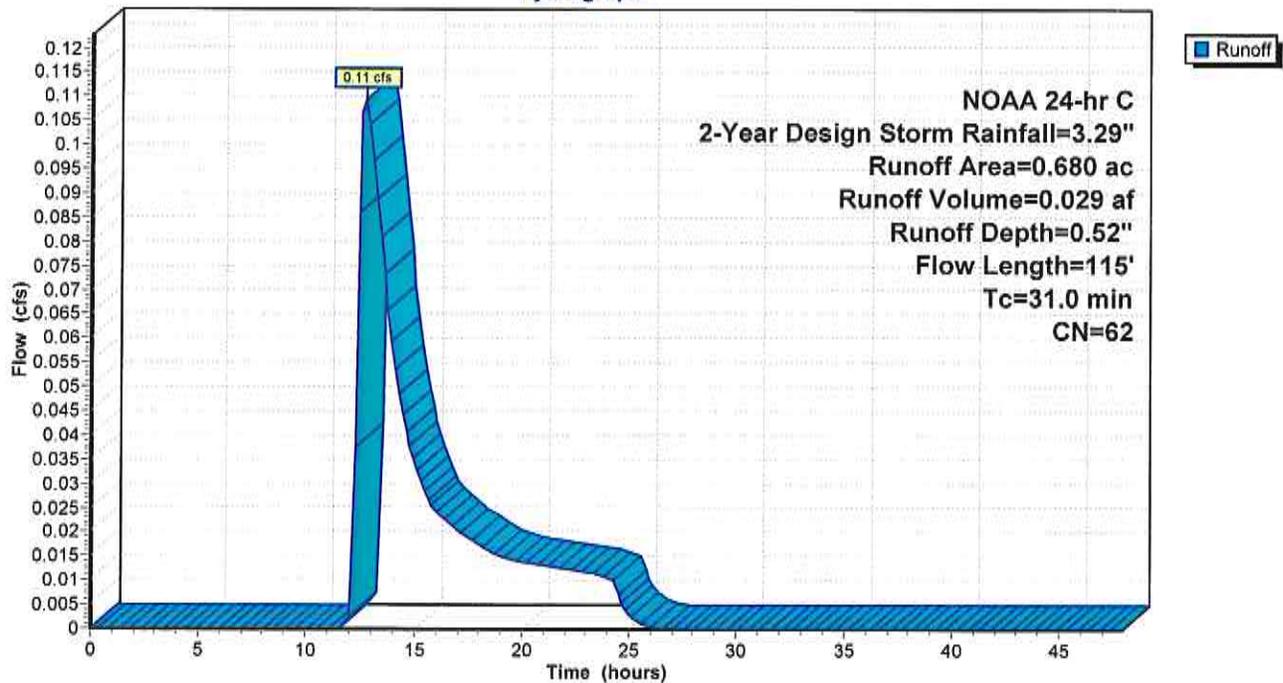
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 2-Year Design Storm Rainfall=3.29"

Area (ac)	CN	Description
* 0.220	55	woodland
* 0.390	61	grass
* 0.070	85	gravel
0.680	62	Weighted Average
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	65	0.0034	0.04		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
0.5	50	0.0370	1.55		Sheet Flow, gravel Smooth surfaces n= 0.011 P2= 3.29"
31.0	115	Total			

Subcatchment 4E: Pre-Dev WS #4

Hydrograph



Summary for Subcatchment 4E: Pre-Dev WS #4

Runoff = 0.40 cfs @ 12.60 hrs, Volume= 0.083 af, Depth= 1.47"

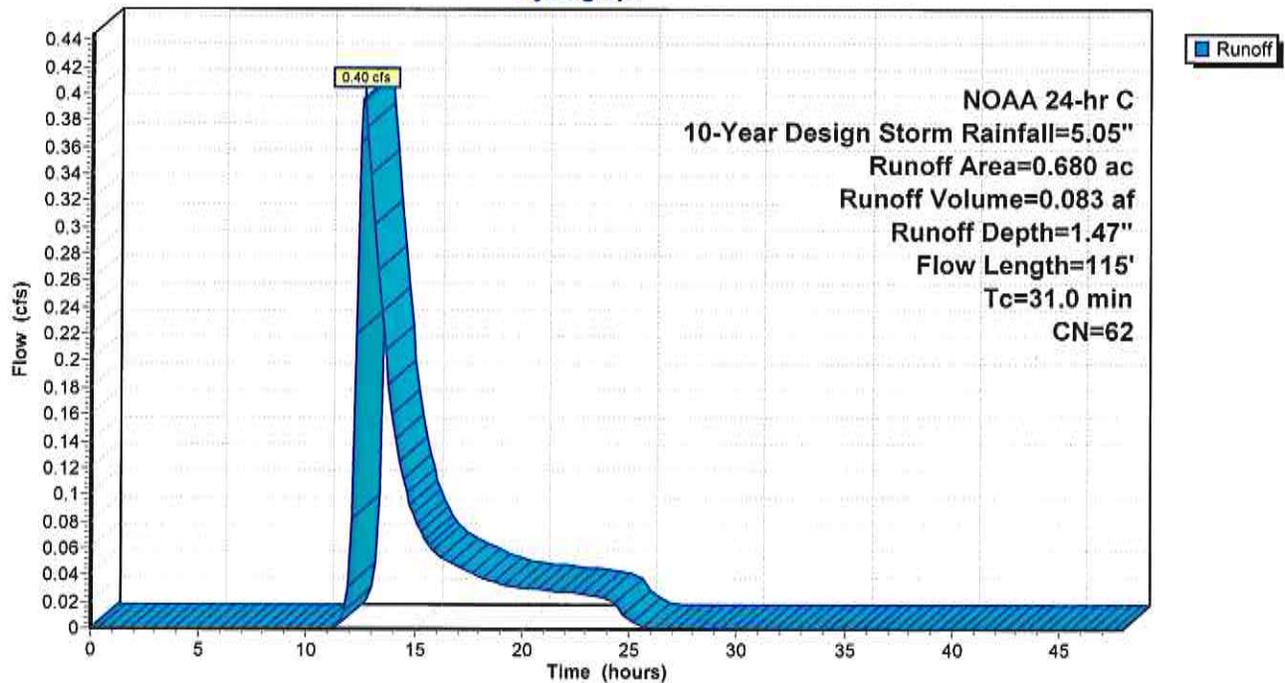
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 10-Year Design Storm Rainfall=5.05"

Area (ac)	CN	Description
* 0.220	55	woodland
* 0.390	61	grass
* 0.070	85	gravel
0.680	62	Weighted Average
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	65	0.0034	0.04		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
0.5	50	0.0370	1.55		Sheet Flow, gravel Smooth surfaces n= 0.011 P2= 3.29"
31.0	115	Total			

Subcatchment 4E: Pre-Dev WS #4

Hydrograph



Summary for Subcatchment 4E: Pre-Dev WS #4

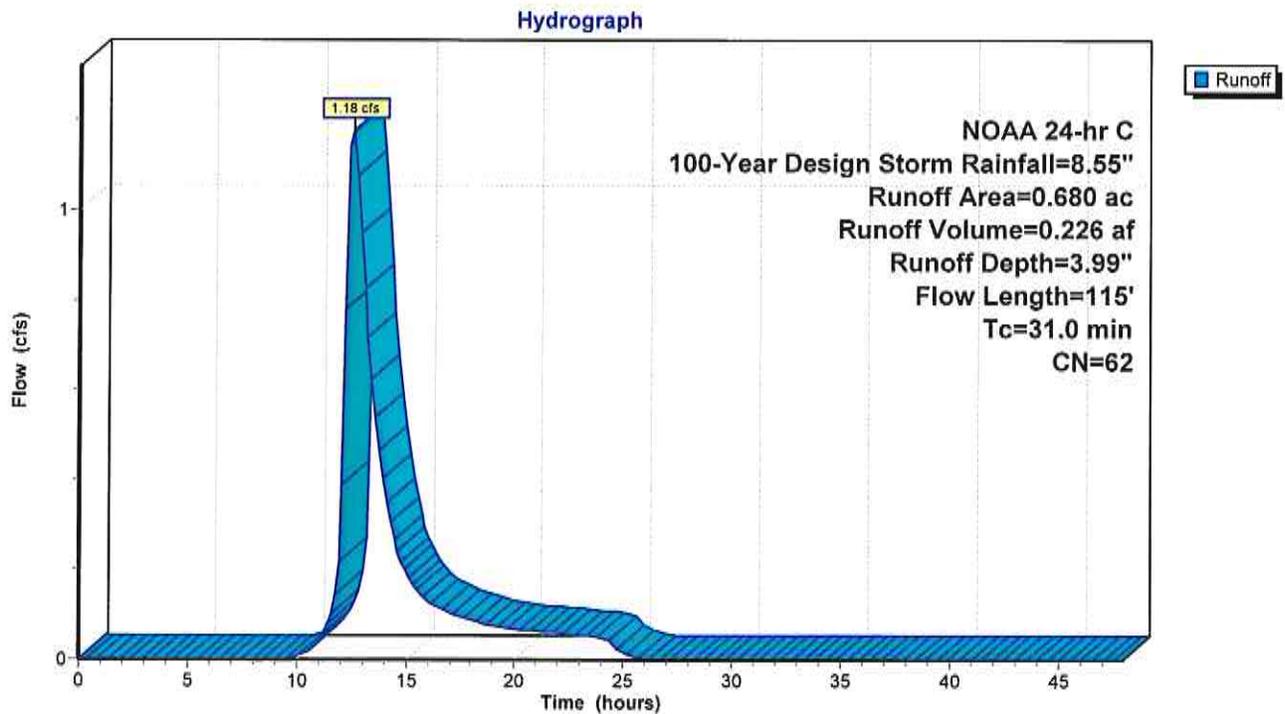
Runoff = 1.18 cfs @ 12.54 hrs, Volume= 0.226 af, Depth= 3.99"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 100-Year Design Storm Rainfall=8.55"

Area (ac)	CN	Description
* 0.220	55	woodland
* 0.390	61	grass
* 0.070	85	gravel
0.680	62	Weighted Average
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.5	65	0.0034	0.04		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
0.5	50	0.0370	1.55		Sheet Flow, gravel Smooth surfaces n= 0.011 P2= 3.29"
31.0	115	Total			

Subcatchment 4E: Pre-Dev WS #4



POST DEVELOPMENT WATERSHED #1

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	3.29	2
2	10-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	5.05	2
3	100-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	8.55	2
4	Water Quality Design Storm	NJ DEP 2-hr		Default	2.00	1	1.25	2

Summary for Subcatchment 1P: Post-Dev WS #1

Runoff = 0.07 cfs @ 13.23 hrs, Volume= 0.029 af, Depth= 0.34"

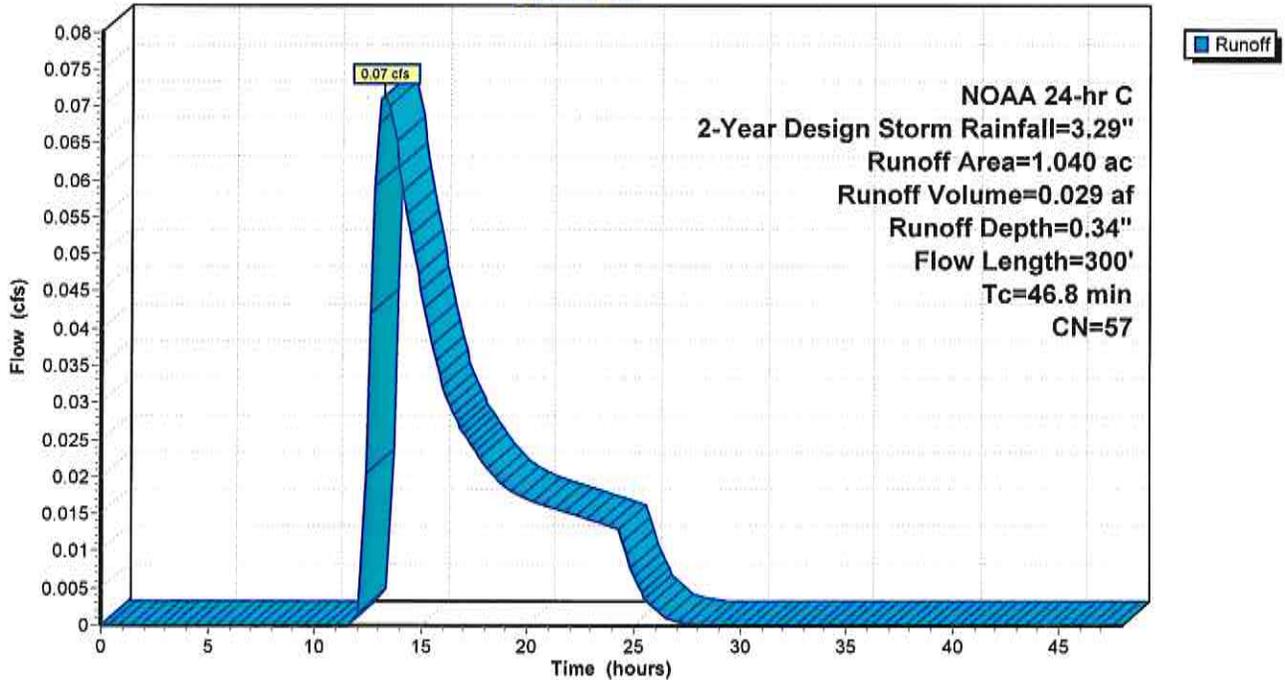
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 2-Year Design Storm Rainfall=3.29"

Area (ac)	CN	Description
* 0.700	55	woodland
* 0.340	61	grass
1.040	57	Weighted Average
1.040		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0	140	0.0064	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
26.8	160	0.0285	0.10		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
46.8	300	Total			

Subcatchment 1P: Post-Dev WS #1

Hydrograph



Summary for Subcatchment 1P: Post-Dev WS #1

Runoff = 0.33 cfs @ 12.89 hrs, Volume= 0.098 af, Depth= 1.13"

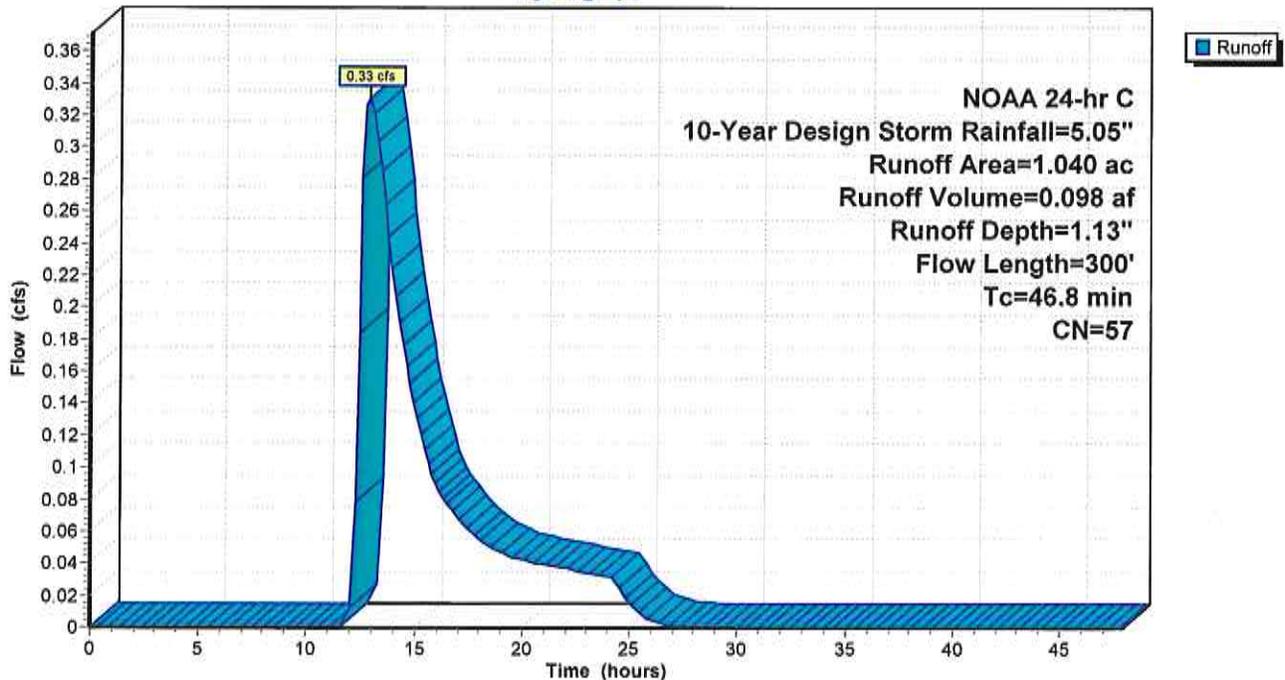
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 10-Year Design Storm Rainfall=5.05"

Area (ac)	CN	Description
* 0.700	55	woodland
* 0.340	61	grass
1.040	57	Weighted Average
1.040		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0	140	0.0064	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
26.8	160	0.0285	0.10		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
46.8	300	Total			

Subcatchment 1P: Post-Dev WS #1

Hydrograph



Summary for Subcatchment 1P: Post-Dev WS #1

Runoff = 1.18 cfs @ 12.79 hrs, Volume= 0.295 af, Depth= 3.40"

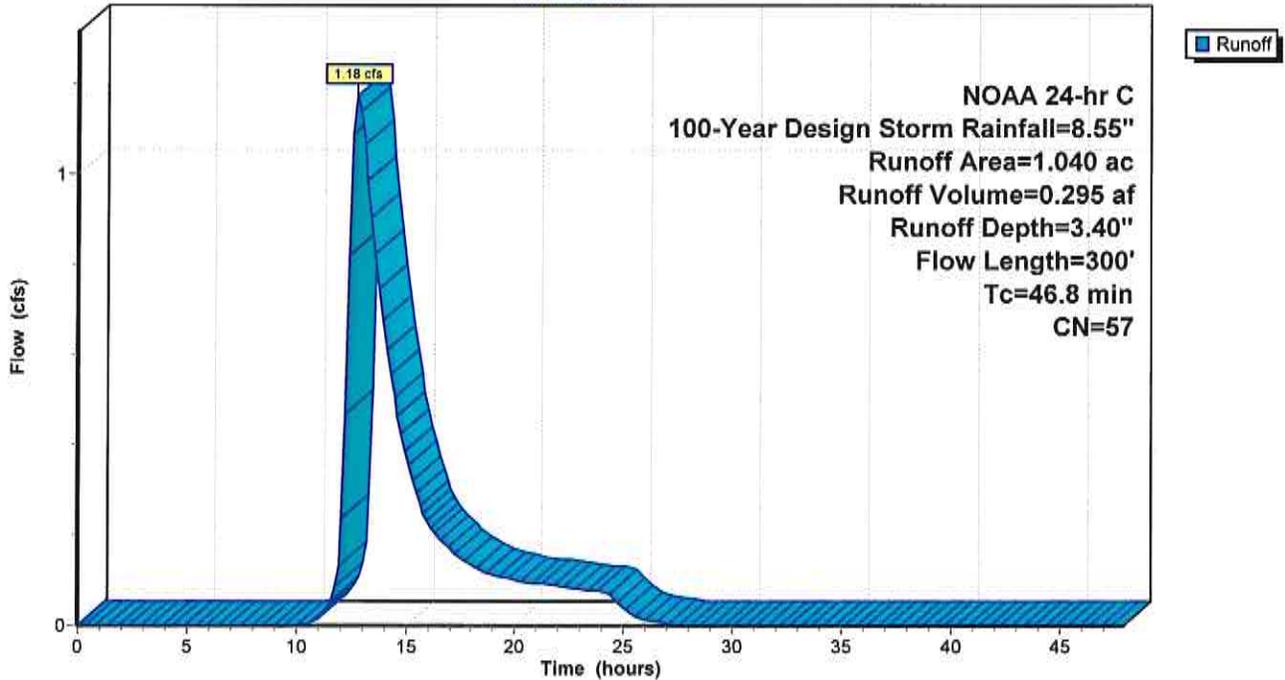
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 100-Year Design Storm Rainfall=8.55"

Area (ac)	CN	Description
* 0.700	55	woodland
* 0.340	61	grass
1.040	57	Weighted Average
1.040		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0	140	0.0064	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
26.8	160	0.0285	0.10		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
46.8	300	Total			

Subcatchment 1P: Post-Dev WS #1

Hydrograph



Summary for Subcatchment 1P: Post-Dev WS #1

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

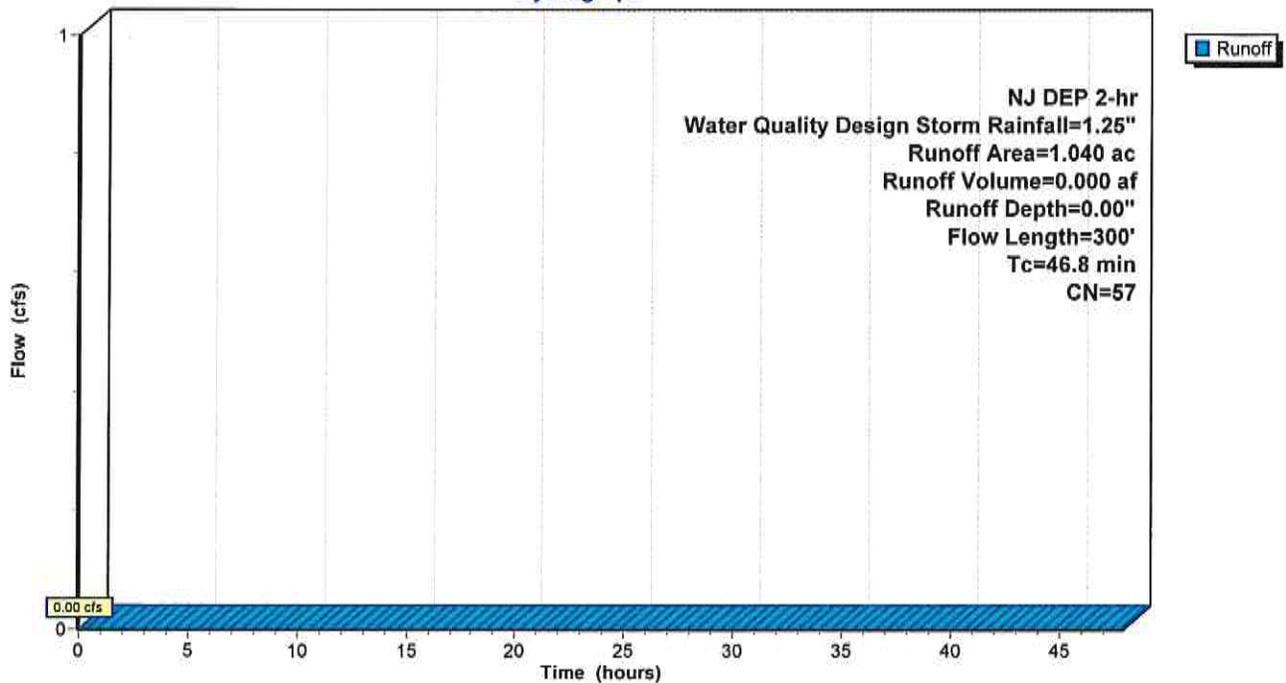
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NJ DEP 2-hr Water Quality Design Storm Rainfall=1.25"

Area (ac)	CN	Description
* 0.700	55	woodland
* 0.340	61	grass
1.040	57	Weighted Average
1.040		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0	140	0.0064	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
26.8	160	0.0285	0.10		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
46.8	300	Total			

Subcatchment 1P: Post-Dev WS #1

Hydrograph



Post-Development Watershed #2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	3.29	2
2	10-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	5.05	2
3	100-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	8.55	2
4	Water Quality Design Storm	NJ DEP 2-hr		Default	2.00	1	1.25	2

Summary for Subcatchment 2P: Post-Dev WS #2

Runoff = 0.03 cfs @ 13.27 hrs, Volume= 0.013 af, Depth= 0.31"

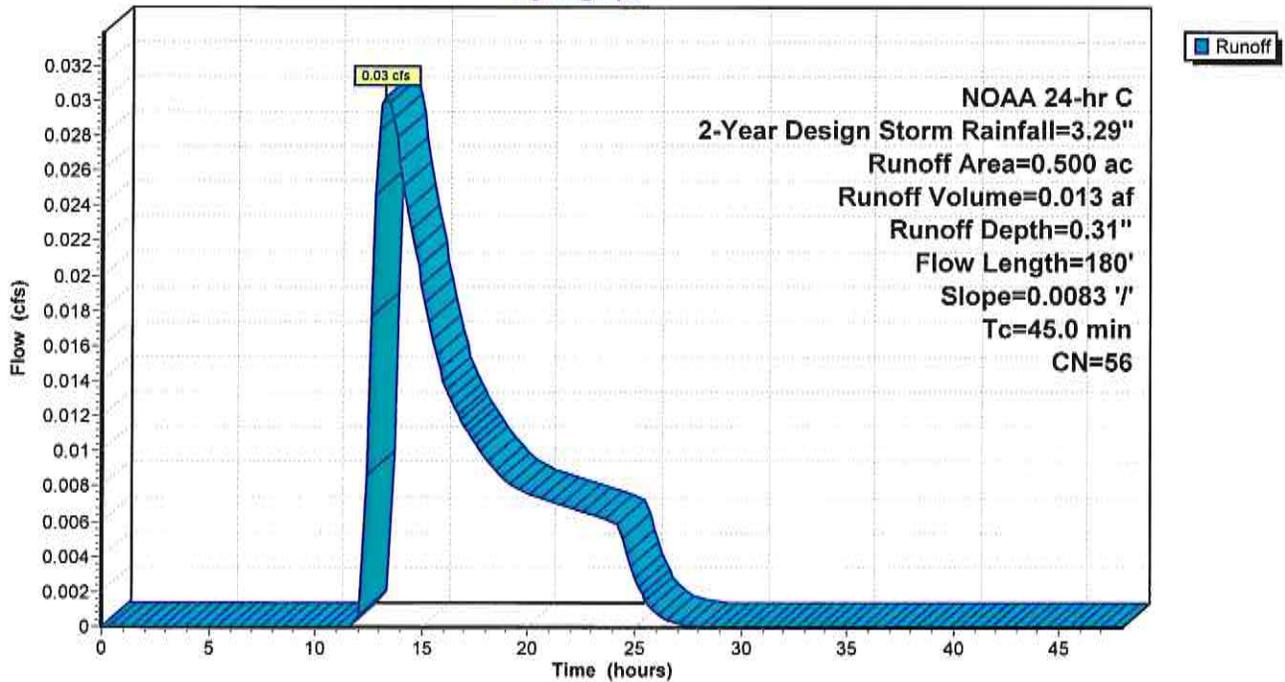
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 2-Year Design Storm Rainfall=3.29"

Area (ac)	CN	Description
* 0.390	55	woodland
* 0.110	61	grass
0.500	56	Weighted Average
0.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0083	0.11		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
37.1	130	0.0083	0.06		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
45.0	180	Total			

Subcatchment 2P: Post-Dev WS #2

Hydrograph



Summary for Subcatchment 2P: Post-Dev WS #2

Runoff = 0.15 cfs @ 12.87 hrs, Volume= 0.044 af, Depth= 1.07"

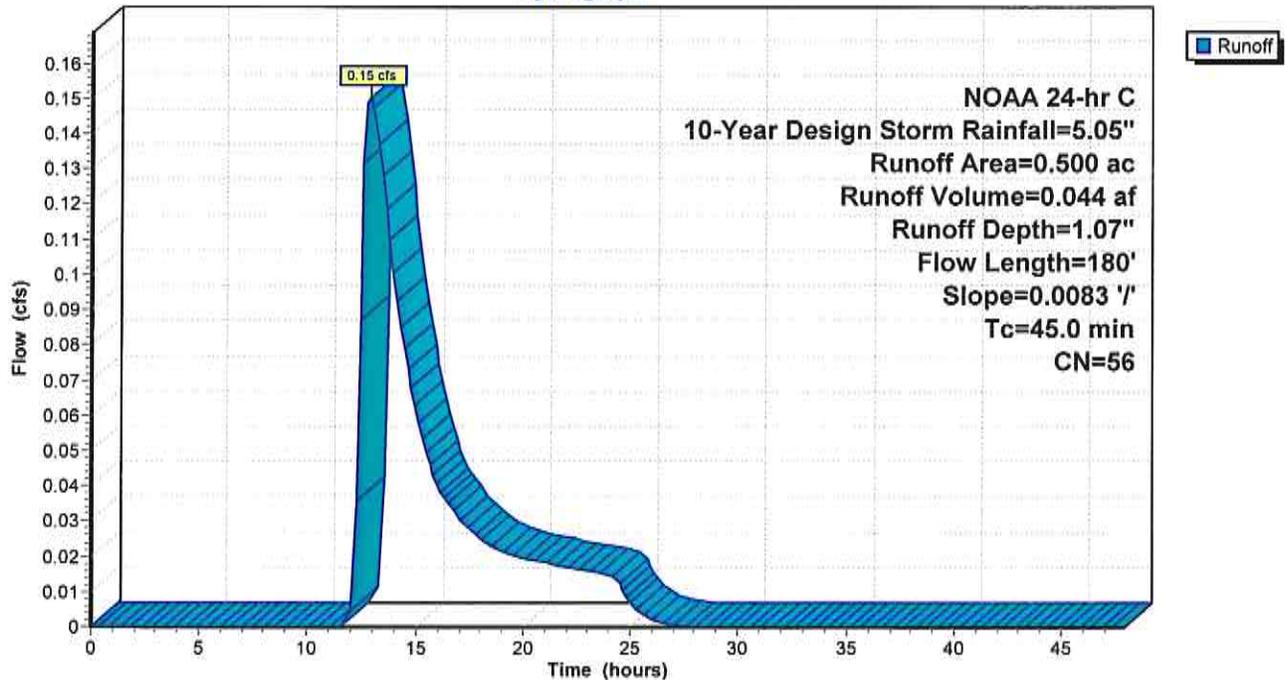
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 10-Year Design Storm Rainfall=5.05"

Area (ac)	CN	Description
* 0.390	55	woodland
* 0.110	61	grass
0.500	56	Weighted Average
0.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0083	0.11		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
37.1	130	0.0083	0.06		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
45.0	180	Total			

Subcatchment 2P: Post-Dev WS #2

Hydrograph



Summary for Subcatchment 2P: Post-Dev WS #2

Runoff = 0.56 cfs @ 12.76 hrs, Volume= 0.137 af, Depth= 3.28"

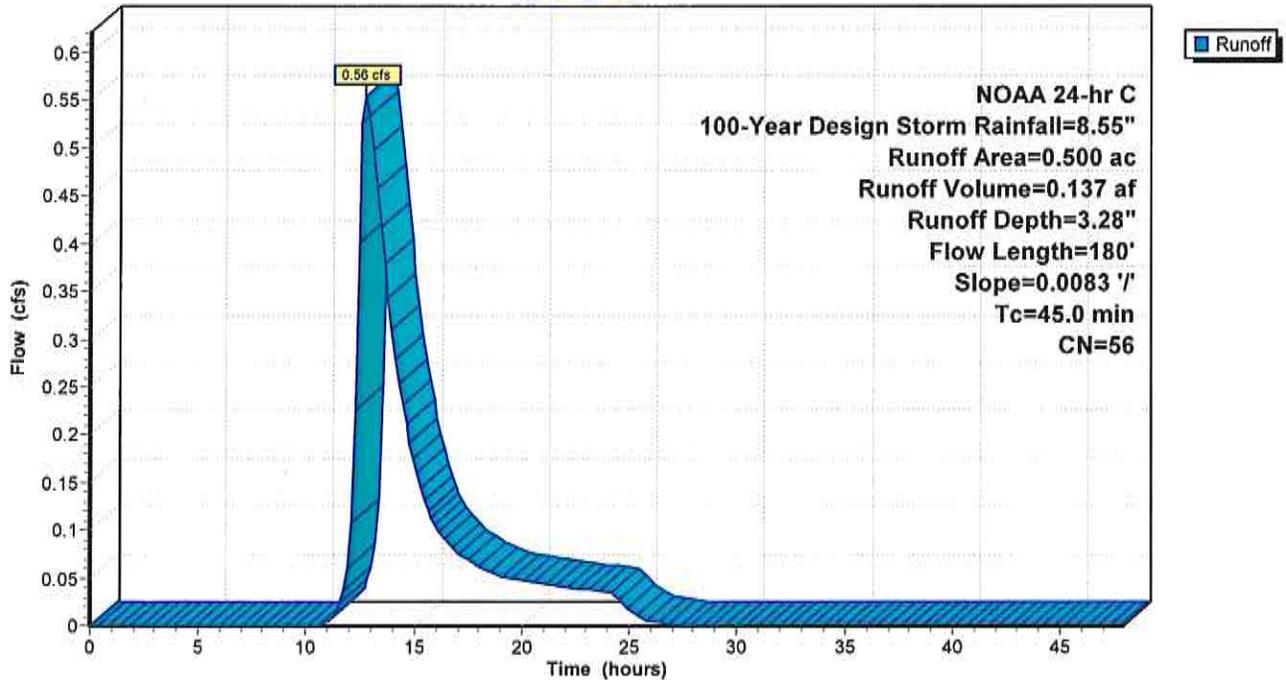
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 100-Year Design Storm Rainfall=8.55"

Area (ac)	CN	Description
* 0.390	55	woodland
* 0.110	61	grass
0.500	56	Weighted Average
0.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0083	0.11		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
37.1	130	0.0083	0.06		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
45.0	180	Total			

Subcatchment 2P: Post-Dev WS #2

Hydrograph



Summary for Subcatchment 2P: Post-Dev WS #2

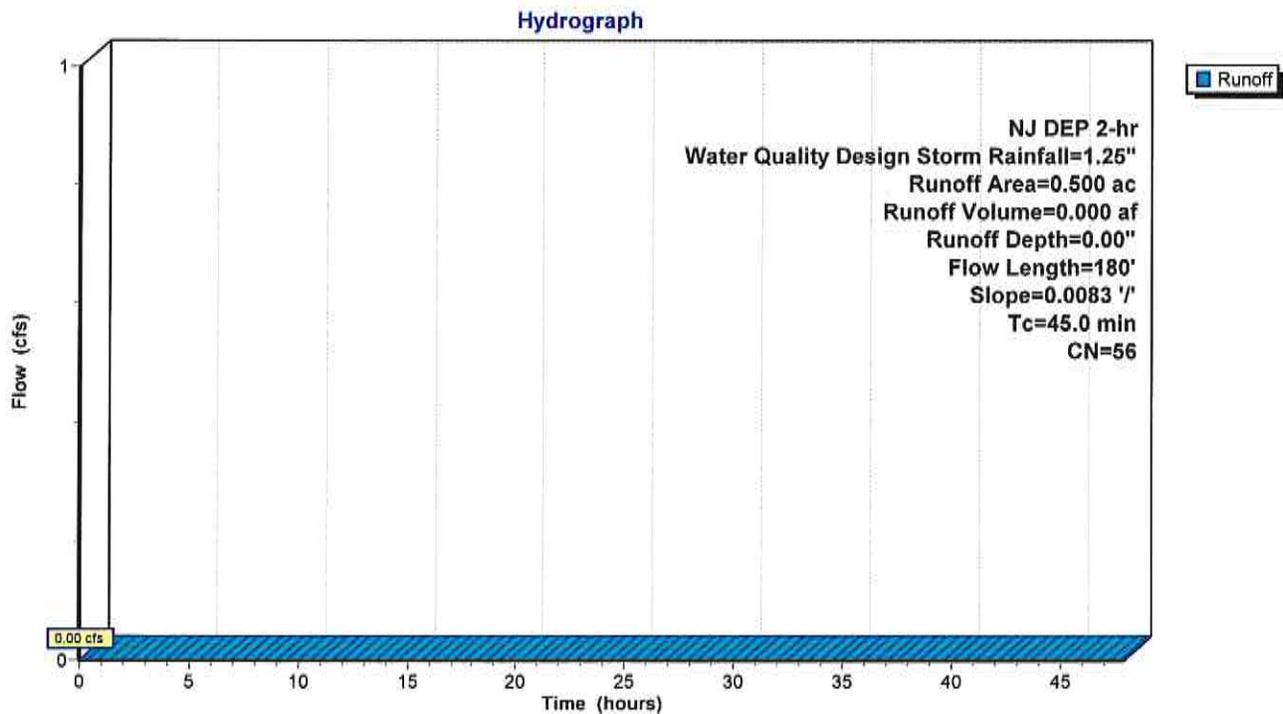
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NJ DEP 2-hr Water Quality Design Storm Rainfall=1.25"

Area (ac)	CN	Description
* 0.390	55	woodland
* 0.110	61	grass
0.500	56	Weighted Average
0.500		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0083	0.11		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
37.1	130	0.0083	0.06		Sheet Flow, woodland Woods: Light underbrush n= 0.400 P2= 3.29"
45.0	180	Total			

Subcatchment 2P: Post-Dev WS #2



Post-Development Watershed #3

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	3.29	2
2	10-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	5.05	2
3	100-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	8.55	2
4	Water Quality Design Storm	NJ DEP 2-hr		Default	2.00	1	1.25	2

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	3P	0.00	0.00	250.0	0.0050	0.012	15.0	0.0	0.0

Summary for Subcatchment 3P: Post-Dev WS #3 Pervious

Runoff = 0.51 cfs @ 12.96 hrs, Volume= 0.171 af, Depth= 0.48"

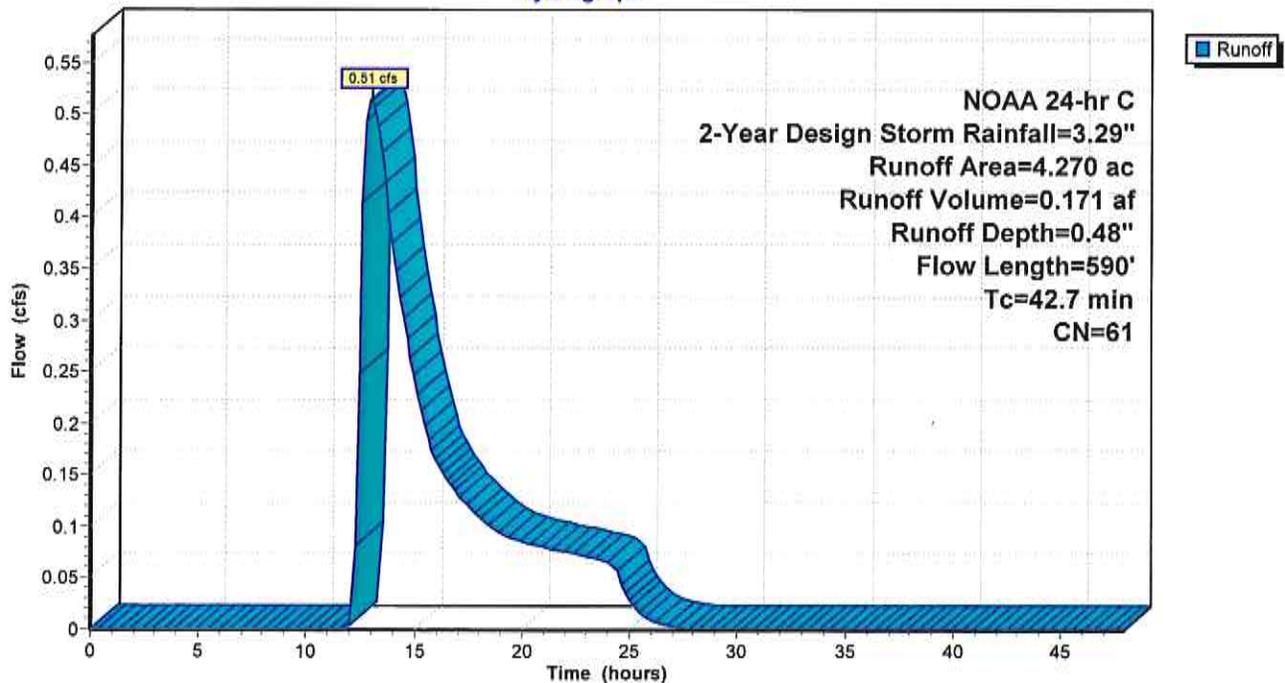
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 2-Year Design Storm Rainfall=3.29"

Area (ac)	CN	Description
* 0.230	55	woodland
* 4.040	61	grass
4.270	61	Weighted Average
4.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	170	0.0067	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
18.8	170	0.0110	0.15		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
1.0	250	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
42.7	590	Total			

Subcatchment 3P: Post-Dev WS #3 Pervious

Hydrograph



Summary for Subcatchment 3P: Post-Dev WS #3 Pervious

Runoff = 1.92 cfs @ 12.78 hrs, Volume= 0.498 af, Depth= 1.40"

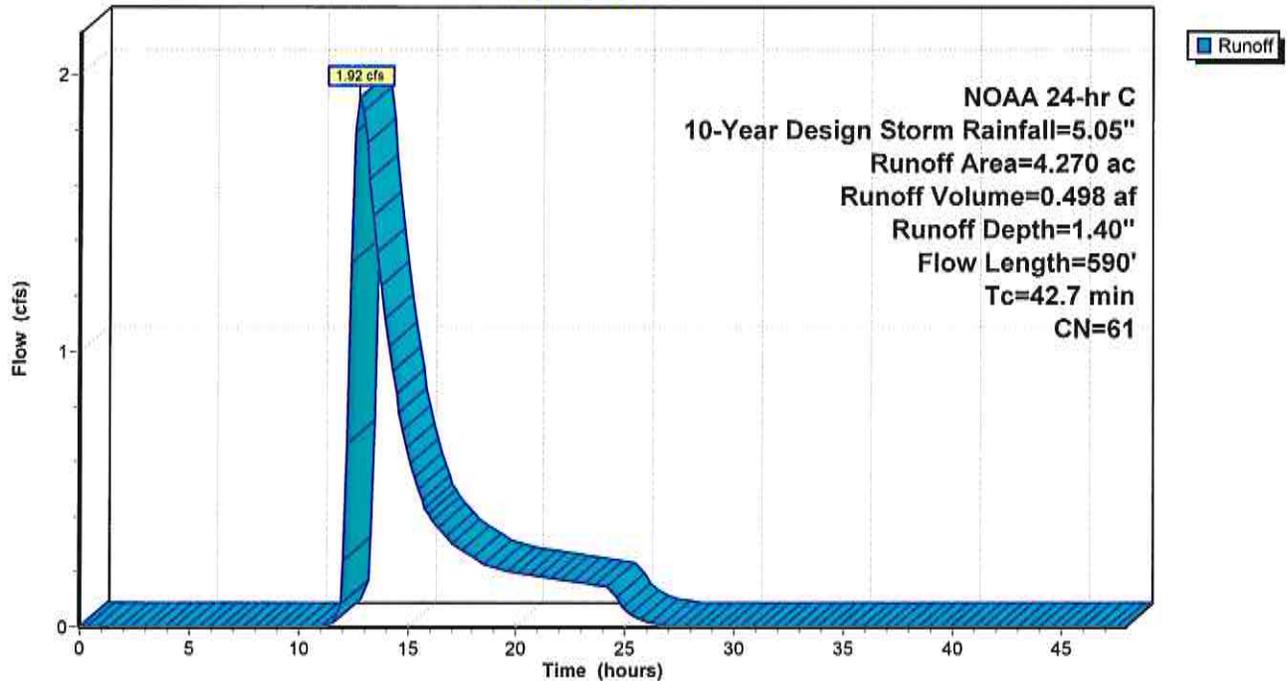
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 10-Year Design Storm Rainfall=5.05"

Area (ac)	CN	Description
* 0.230	55	woodland
* 4.040	61	grass
4.270	61	Weighted Average
4.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	170	0.0067	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
18.8	170	0.0110	0.15		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
1.0	250	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
42.7	590	Total			

Subcatchment 3P: Post-Dev WS #3 Pervious

Hydrograph



Summary for Subcatchment 3P: Post-Dev WS #3 Pervious

[47] Hint: Peak is 120% of capacity of segment #3

Runoff = 5.92 cfs @ 12.71 hrs, Volume= 1.377 af, Depth= 3.87"

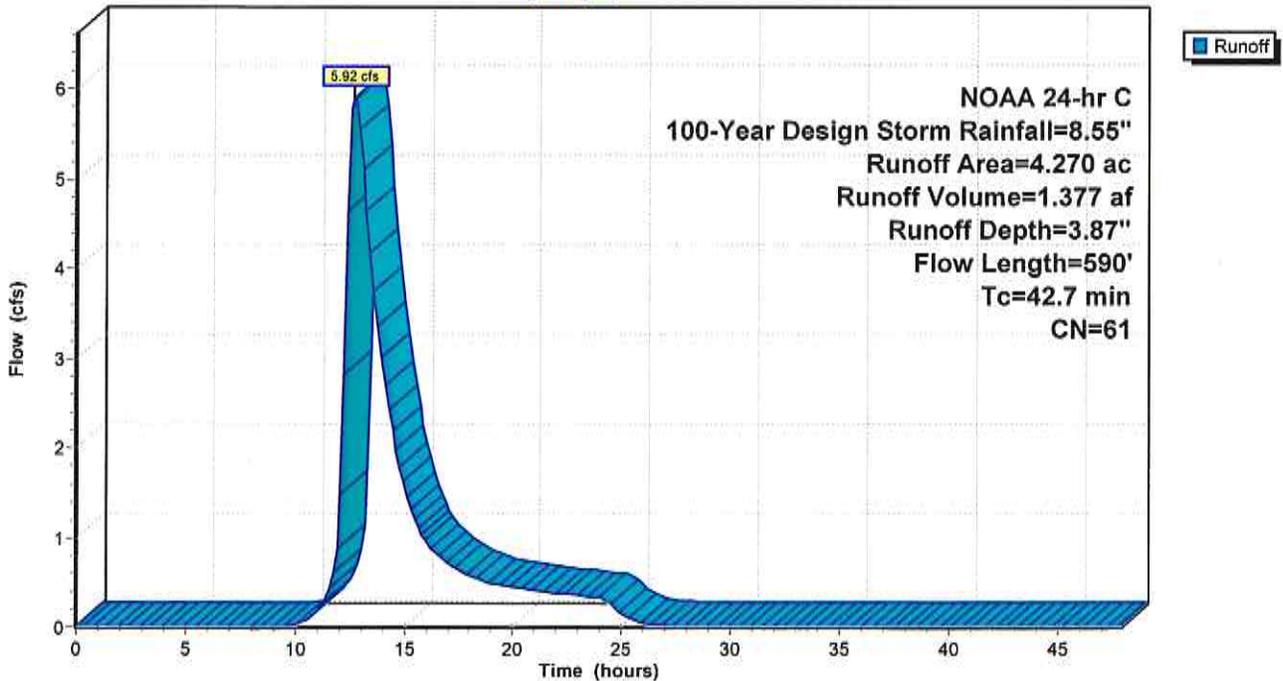
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 100-Year Design Storm Rainfall=8.55"

Area (ac)	CN	Description
* 0.230	55	woodland
* 4.040	61	grass
4.270	61	Weighted Average
4.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	170	0.0067	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
18.8	170	0.0110	0.15		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
1.0	250	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
42.7	590	Total			

Subcatchment 3P: Post-Dev WS #3 Pervious

Hydrograph



Summary for Subcatchment 3P: Post-Dev WS #3 Pervious

[45] Hint: Runoff=Zero

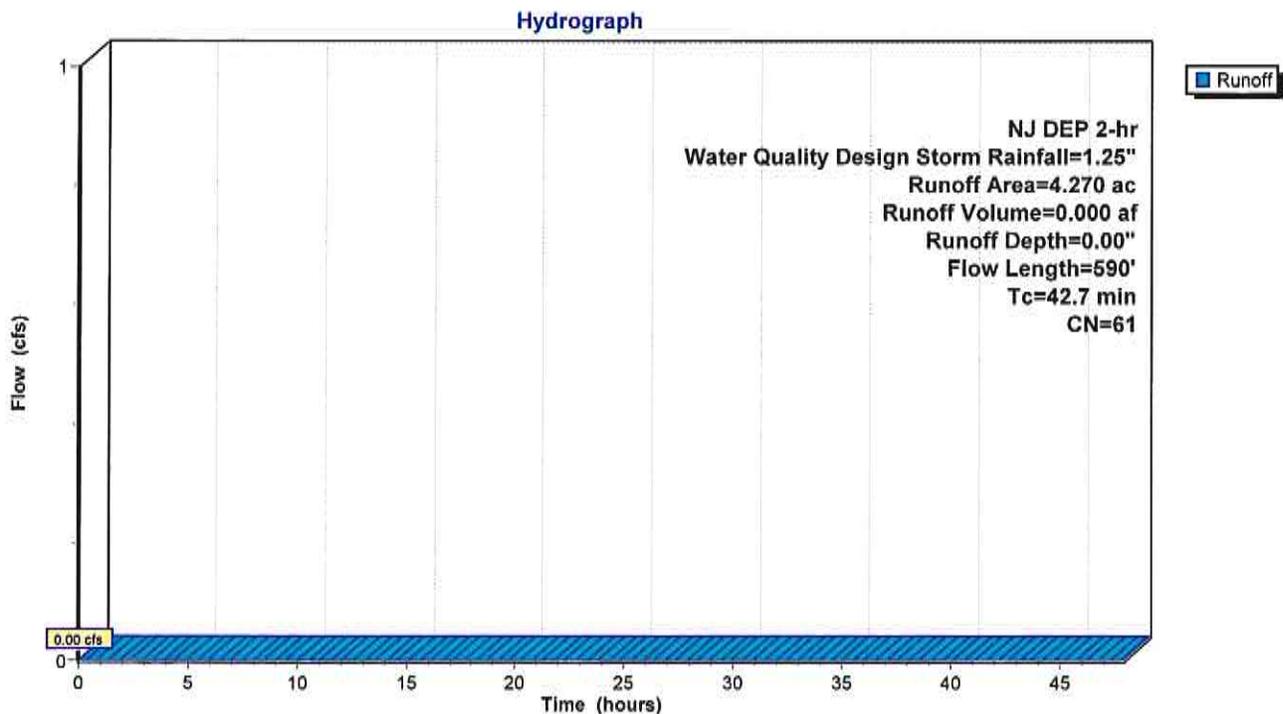
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NJ DEP 2-hr Water Quality Design Storm Rainfall=1.25"

Area (ac)	CN	Description
* 0.230	55	woodland
* 4.040	61	grass
4.270	61	Weighted Average
4.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	170	0.0067	0.12		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
18.8	170	0.0110	0.15		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"
1.0	250	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
42.7	590	Total			

Subcatchment 3P: Post-Dev WS #3 Pervious



Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	3.29	2
2	10-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	5.05	2
3	100-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	8.55	2
4	Water Quality Design Storm	NJ DEP 2-hr		Default	2.00	1	1.25	2

Summary for Subcatchment 3I: Post-Dev WS #3 Impervious

[49] Hint: Tc<2dt may require smaller dt

Runoff = 12.20 cfs @ 12.14 hrs, Volume= 1.345 af, Depth= 3.06"

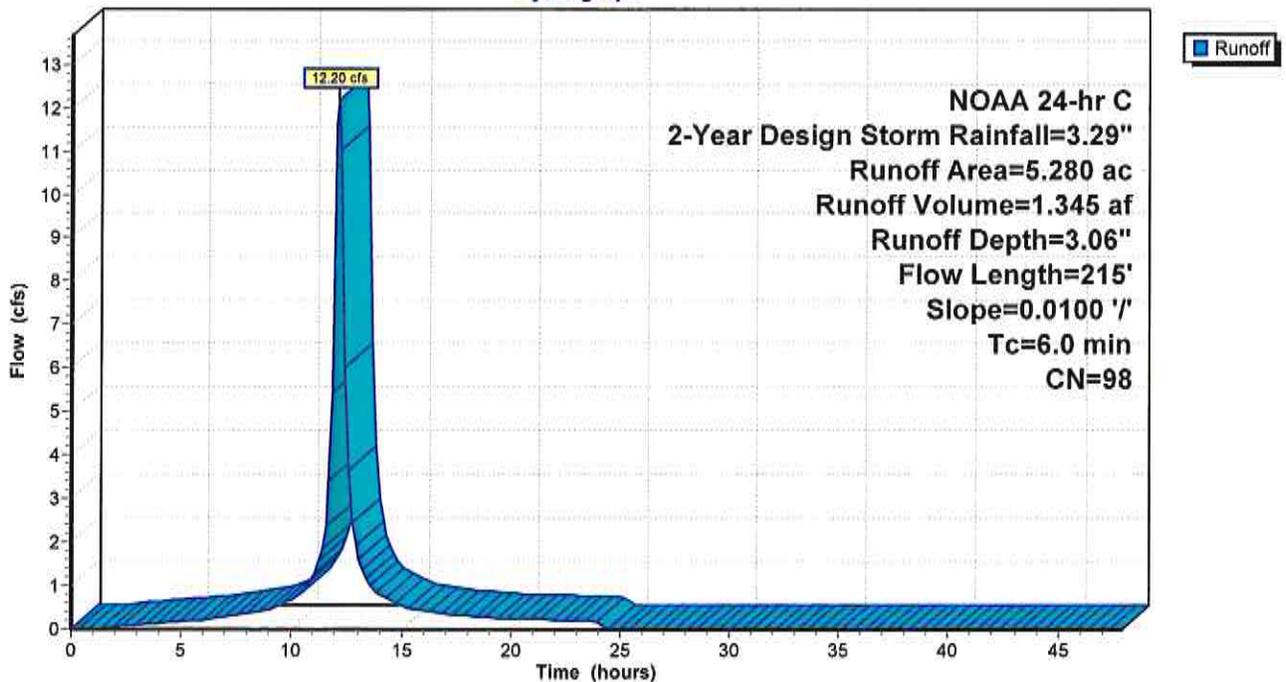
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 2-Year Design Storm Rainfall=3.29"

Area (ac)	CN	Description
* 5.280	98	impervious
5.280		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	215	0.0100	1.23		Sheet Flow, impervious Smooth surfaces n= 0.011 P2= 3.29"
2.9	215	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 3I: Post-Dev WS #3 Impervious

Hydrograph



Summary for Subcatchment 3I: Post-Dev WS #3 Impervious

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 18.88 cfs @ 12.14 hrs, Volume= 2.118 af, Depth= 4.81"

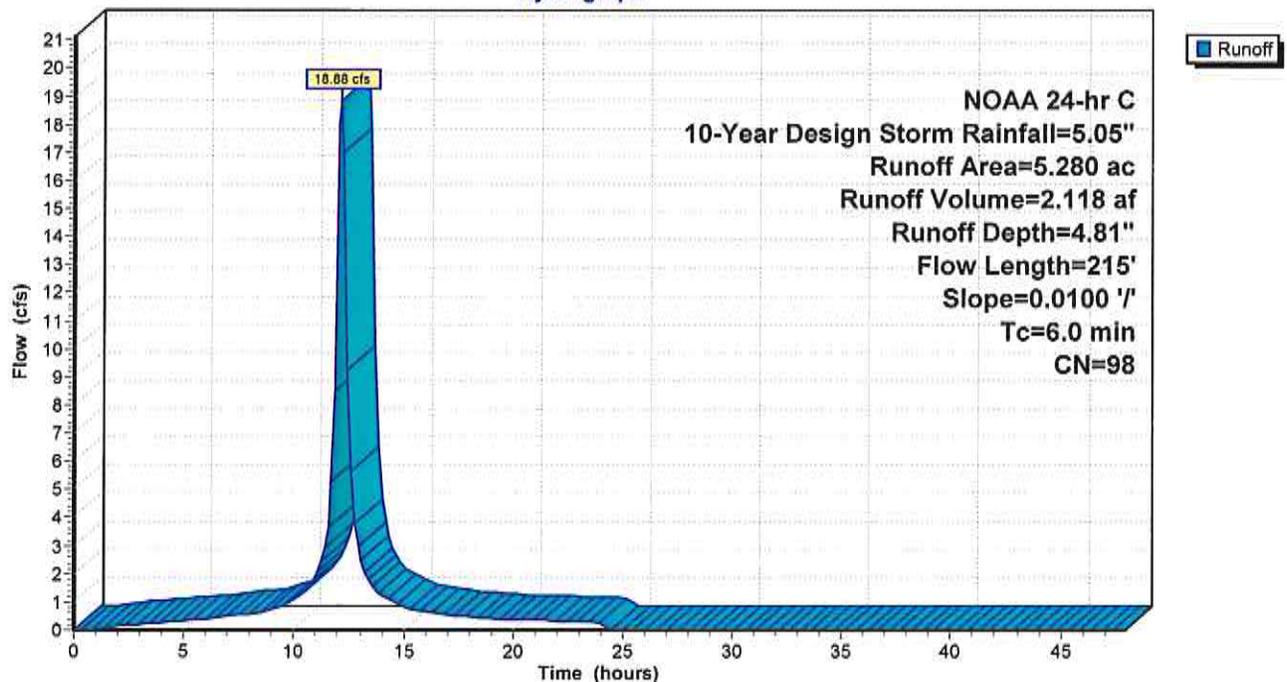
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, $dt= 0.17$ hrs
 NOAA 24-hr C 10-Year Design Storm Rainfall=5.05"

Area (ac)	CN	Description
* 5.280	98	impervious
5.280		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	215	0.0100	1.23		Sheet Flow, impervious Smooth surfaces n= 0.011 P2= 3.29"
2.9	215	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 3I: Post-Dev WS #3 Impervious

Hydrograph



Summary for Subcatchment 3I: Post-Dev WS #3 Impervious

[49] Hint: Tc<2dt may require smaller dt

Runoff = 32.09 cfs @ 12.14 hrs, Volume= 3.656 af, Depth= 8.31"

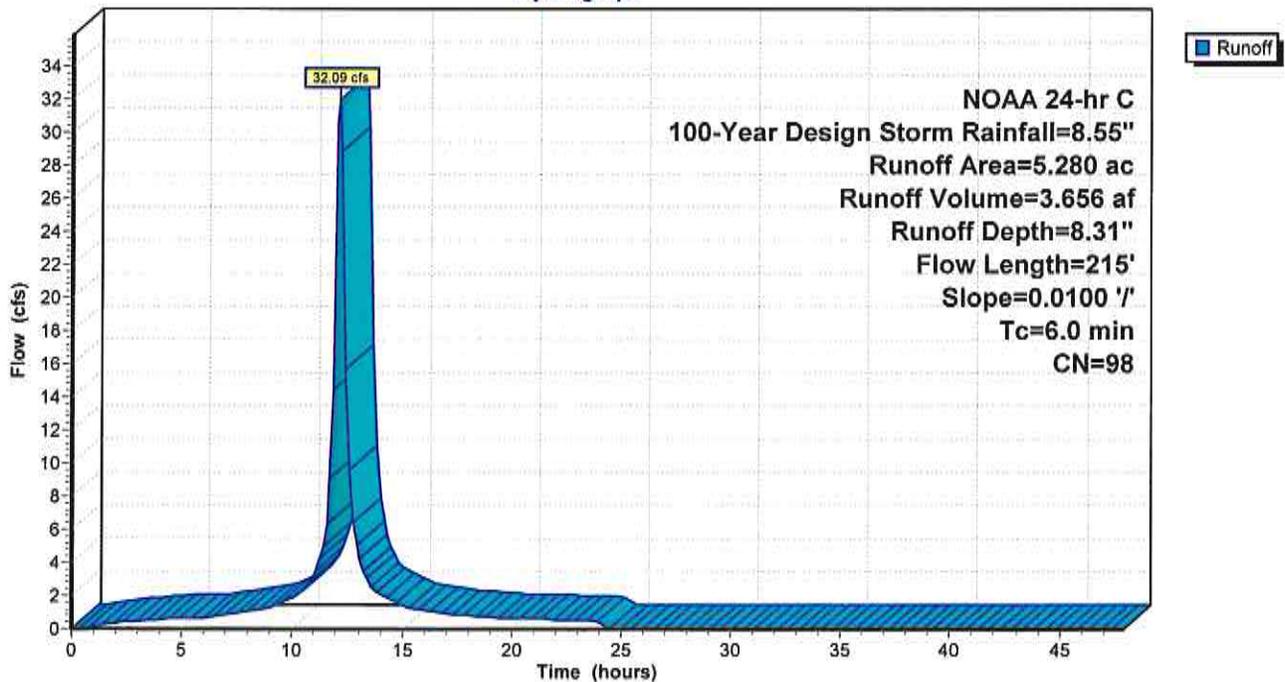
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 100-Year Design Storm Rainfall=8.55"

Area (ac)	CN	Description
* 5.280	98	impervious
5.280		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	215	0.0100	1.23		Sheet Flow, Impervious Smooth surfaces n= 0.011 P2= 3.29"
2.9	215	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 3I: Post-Dev WS #3 Impervious

Hydrograph



Summary for Subcatchment 3I: Post-Dev WS #3 Impervious

[49] Hint: $T_c < 2dt$ may require smaller dt

Runoff = 10.39 cfs @ 1.15 hrs, Volume= 0.455 af, Depth= 1.03"

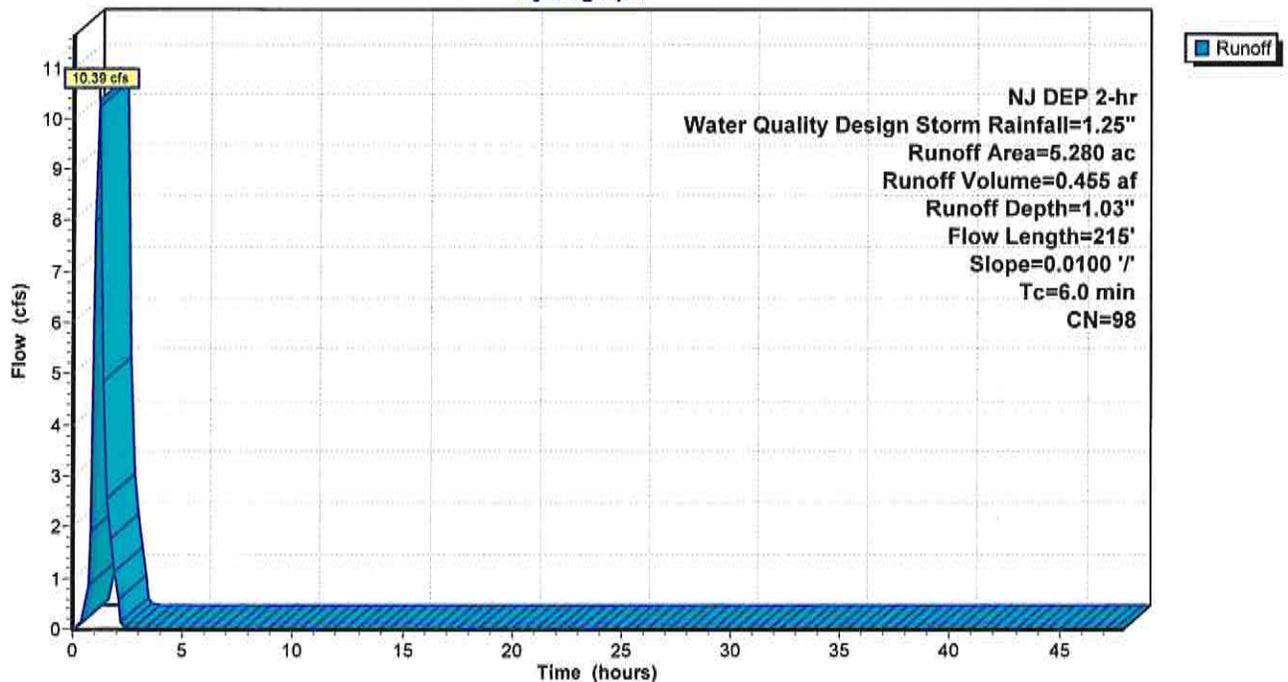
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, $dt= 0.17$ hrs
 NJ DEP 2-hr Water Quality Design Storm Rainfall=1.25"

Area (ac)	CN	Description
* 5.280	98	impervious
5.280		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	215	0.0100	1.23		Sheet Flow, impervious Smooth surfaces n= 0.011 P2= 3.29"
2.9	215	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 3I: Post-Dev WS #3 Impervious

Hydrograph



Rainfall Events Listing

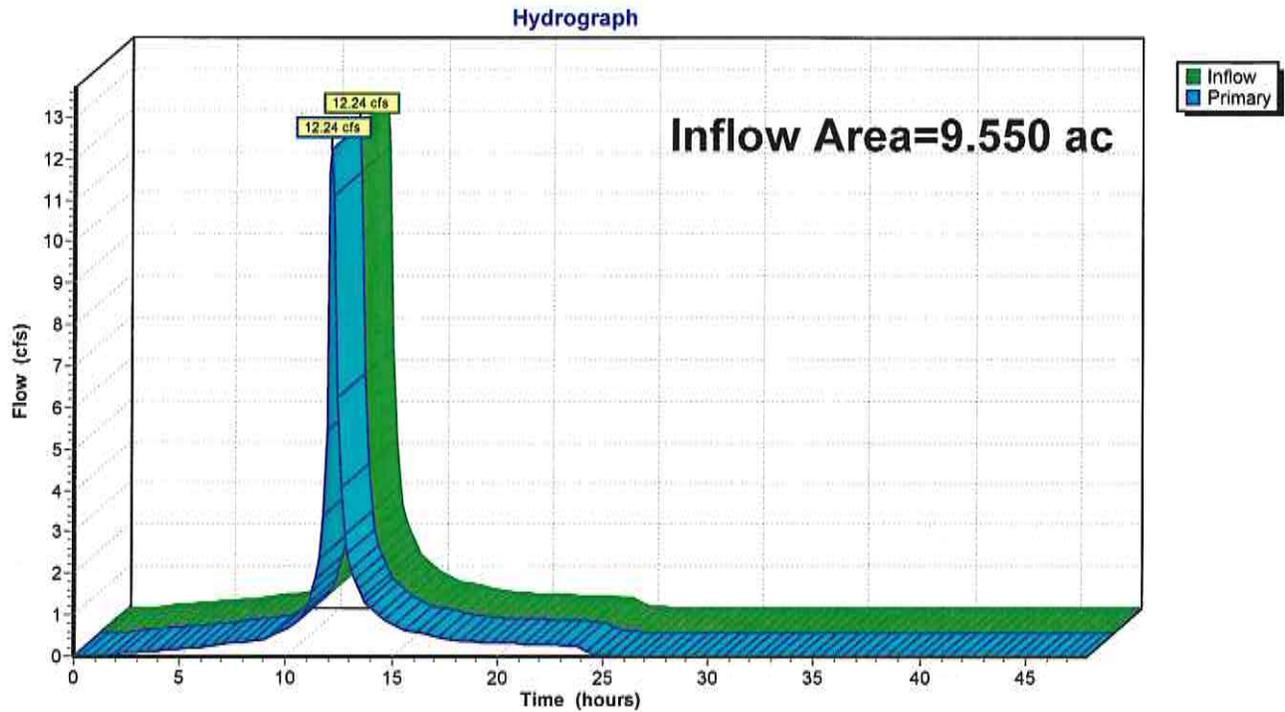
Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	3.29	2
2	10-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	5.05	2
3	100-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	8.55	2
4	Water Quality Design Storm	NJ DEP 2-hr		Default	2.00	1	1.25	2

Summary for Link 3L: Pervious/Impervious Hydrograph

Inflow Area = 9.550 ac, 55.29% Impervious, Inflow Depth = 1.91" for 2-Year Design Storm event
Inflow = 12.24 cfs @ 12.14 hrs, Volume= 1.516 af
Primary = 12.24 cfs @ 12.14 hrs, Volume= 1.516 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs

Link 3L: Pervious/Impervious Hydrograph



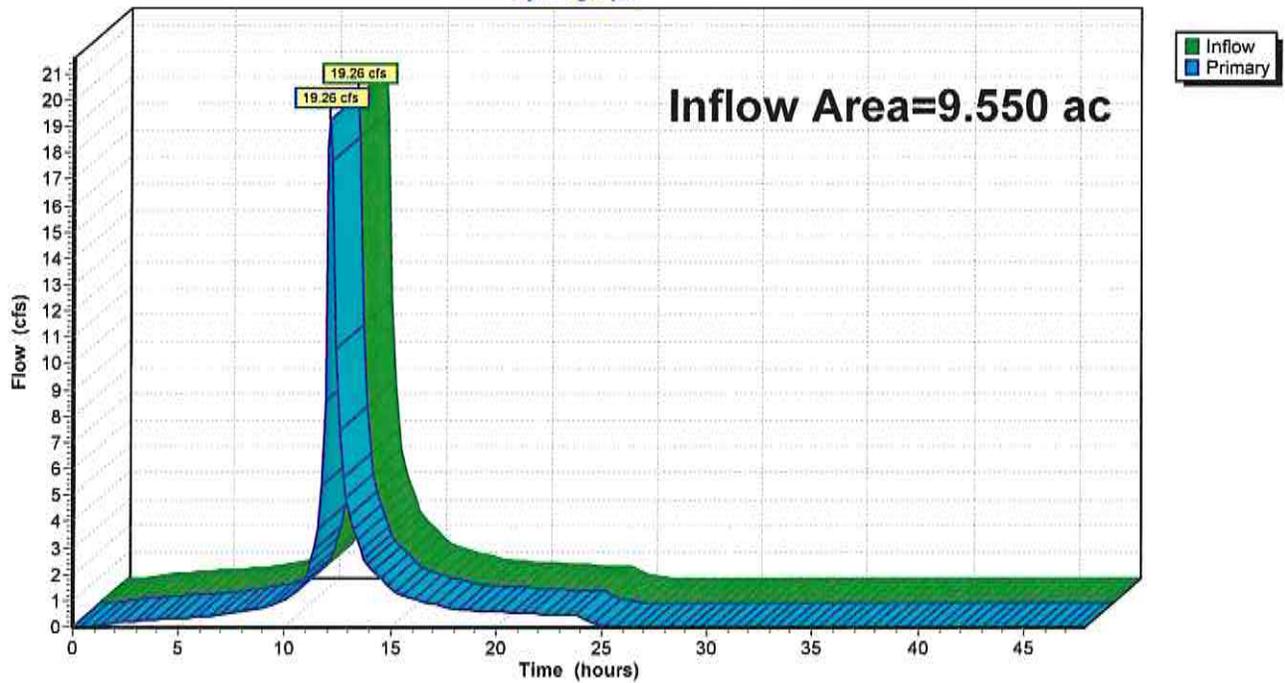
Summary for Link 3L: Pervious/Impervious Hydrograph

Inflow Area = 9.550 ac, 55.29% Impervious, Inflow Depth = 3.29" for 10-Year Design Storm event
Inflow = 19.26 cfs @ 12.15 hrs, Volume= 2.616 af
Primary = 19.26 cfs @ 12.15 hrs, Volume= 2.616 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs

Link 3L: Pervious/Impervious Hydrograph

Hydrograph

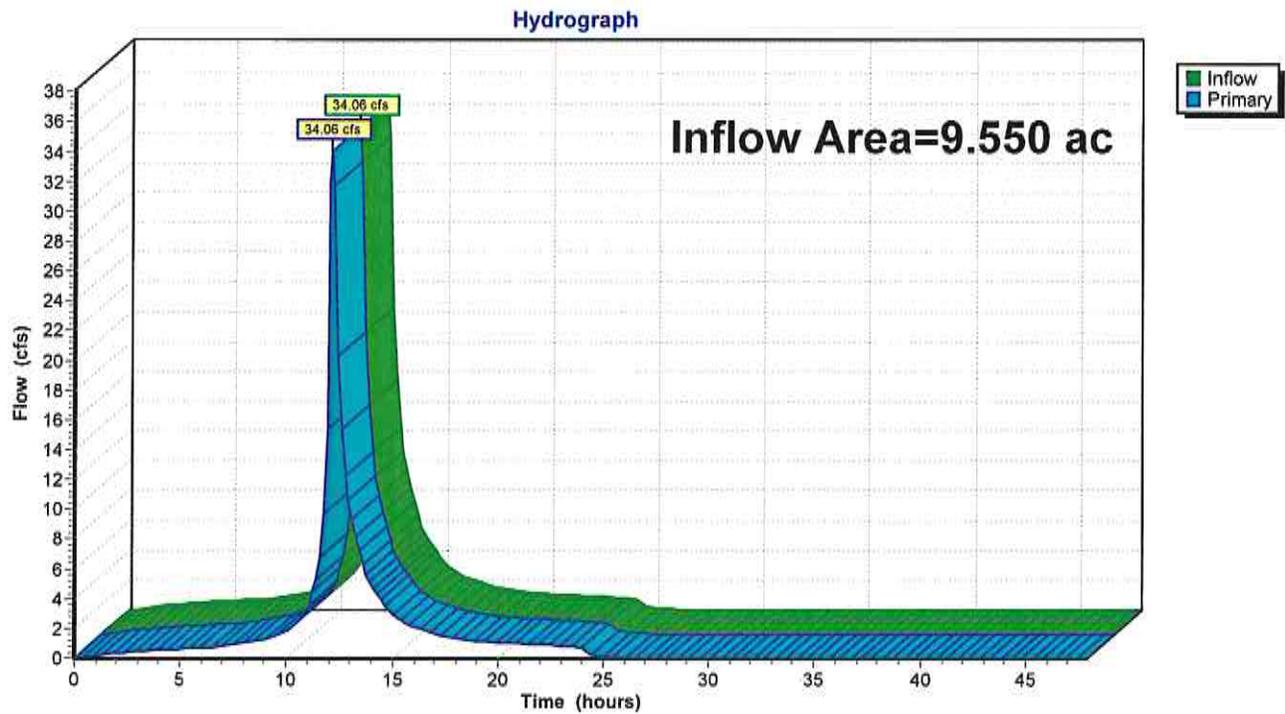


Summary for Link 3L: Pervious/Impervious Hydrograph

Inflow Area = 9.550 ac, 55.29% Impervious, Inflow Depth = 6.32" for 100-Year Design Storm event
Inflow = 34.06 cfs @ 12.15 hrs, Volume= 5.033 af
Primary = 34.06 cfs @ 12.15 hrs, Volume= 5.033 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs

Link 3L: Pervious/Impervious Hydrograph

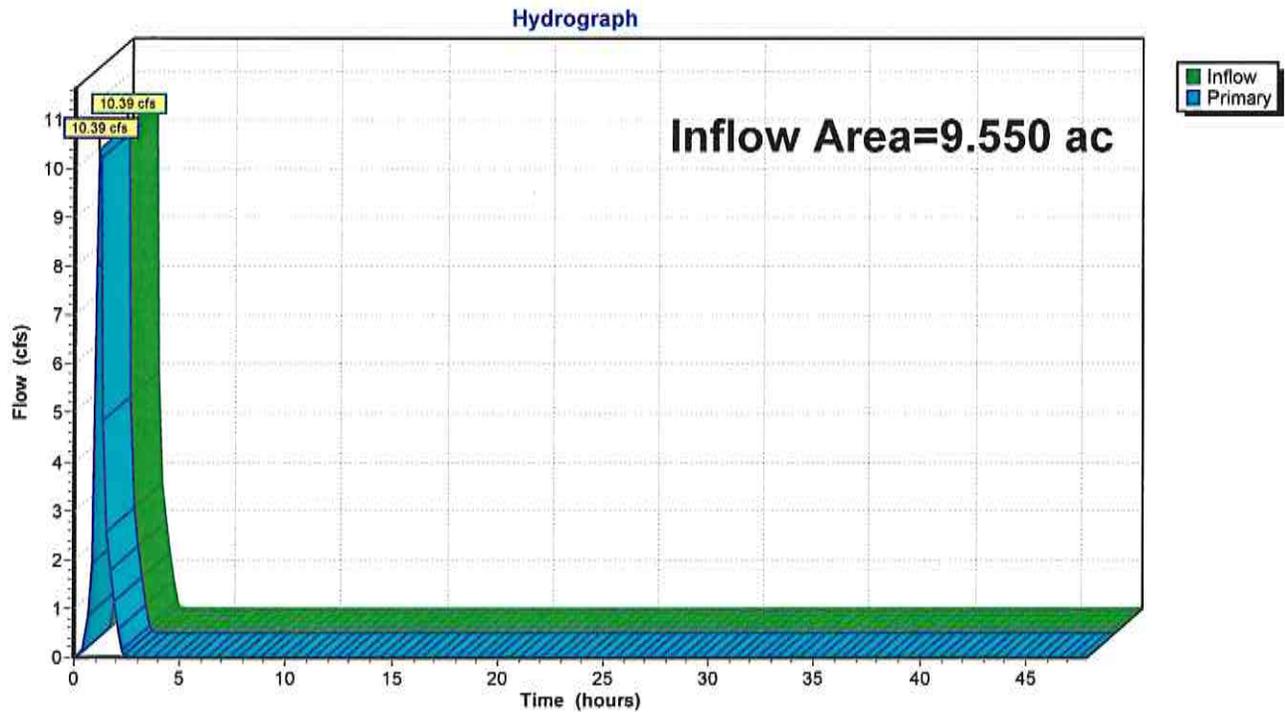


Summary for Link 3L: Pervious/Impervious Hydrograph

Inflow Area = 9.550 ac, 55.29% Impervious, Inflow Depth = 0.57" for Water Quality Design Storm event
Inflow = 10.39 cfs @ 1.15 hrs, Volume= 0.455 af
Primary = 10.39 cfs @ 1.15 hrs, Volume= 0.455 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs

Link 3L: Pervious/Impervious Hydrograph



Post-Development Watershed #4

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	3.29	2
2	10-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	5.05	2
3	100-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	8.55	2
4	Water Quality Design Storm	NJ DEP 2-hr		Default	2.00	1	1.25	2

Summary for Subcatchment 4P: Post-Dev WS #4

Runoff = 0.10 cfs @ 12.32 hrs, Volume= 0.016 af, Depth= 0.48"

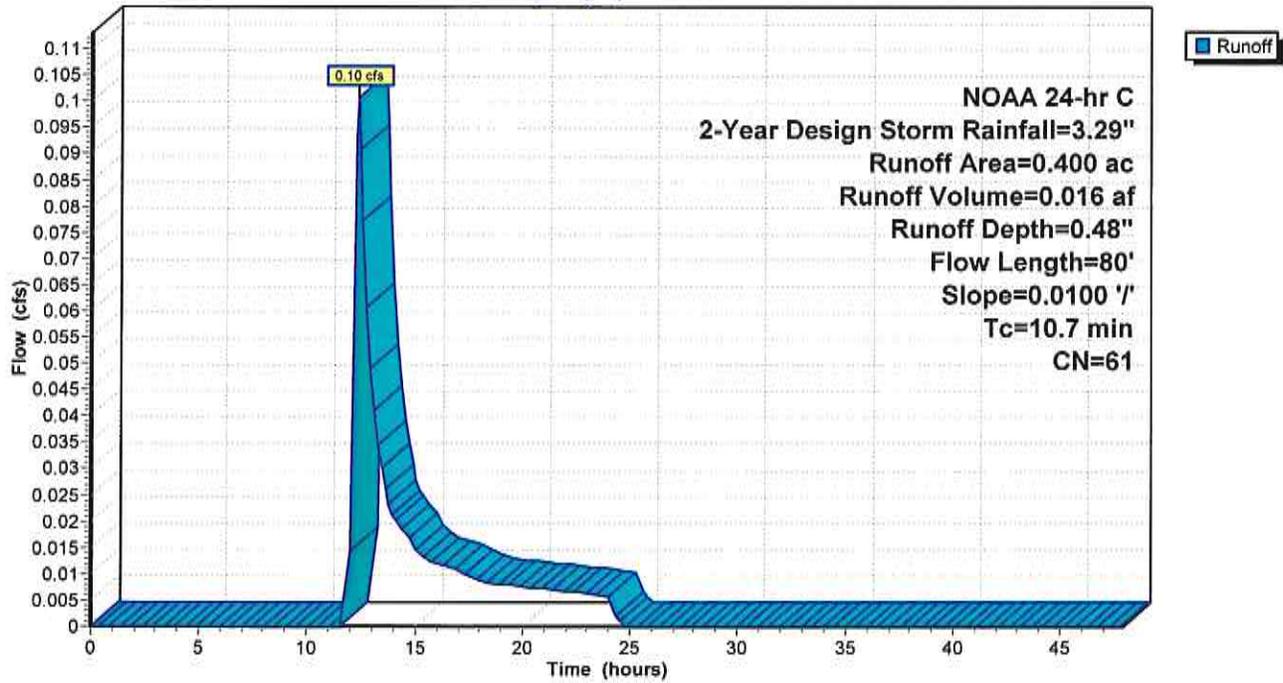
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 2-Year Design Storm Rainfall=3.29"

Area (ac)	CN	Description
* 0.400	61	grass
0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	80	0.0100	0.13		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"

Subcatchment 4P: Post-Dev WS #4

Hydrograph



Summary for Subcatchment 4P: Post-Dev WS #4

Runoff = 0.39 cfs @ 12.28 hrs, Volume= 0.047 af, Depth= 1.40"

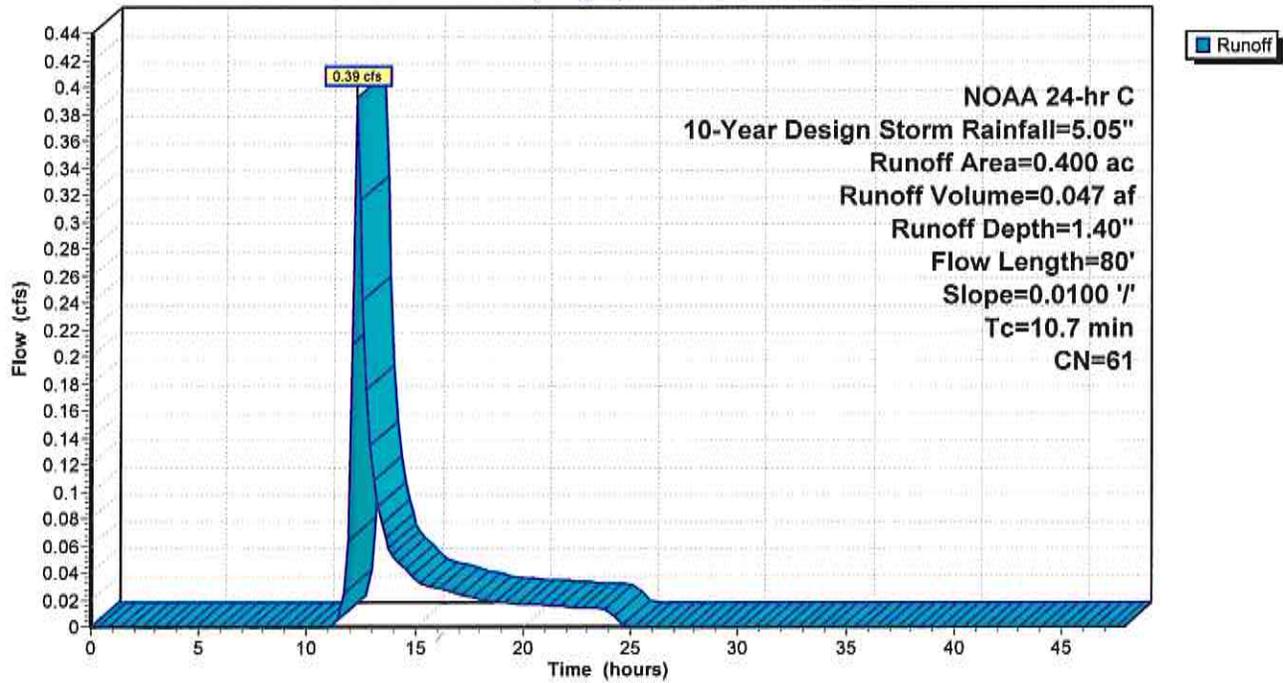
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 10-Year Design Storm Rainfall=5.05"

Area (ac)	CN	Description
* 0.400	61	grass
0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	80	0.0100	0.13		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"

Subcatchment 4P: Post-Dev WS #4

Hydrograph



Summary for Subcatchment 4P: Post-Dev WS #4

Runoff = 1.17 cfs @ 12.26 hrs, Volume= 0.129 af, Depth= 3.87"

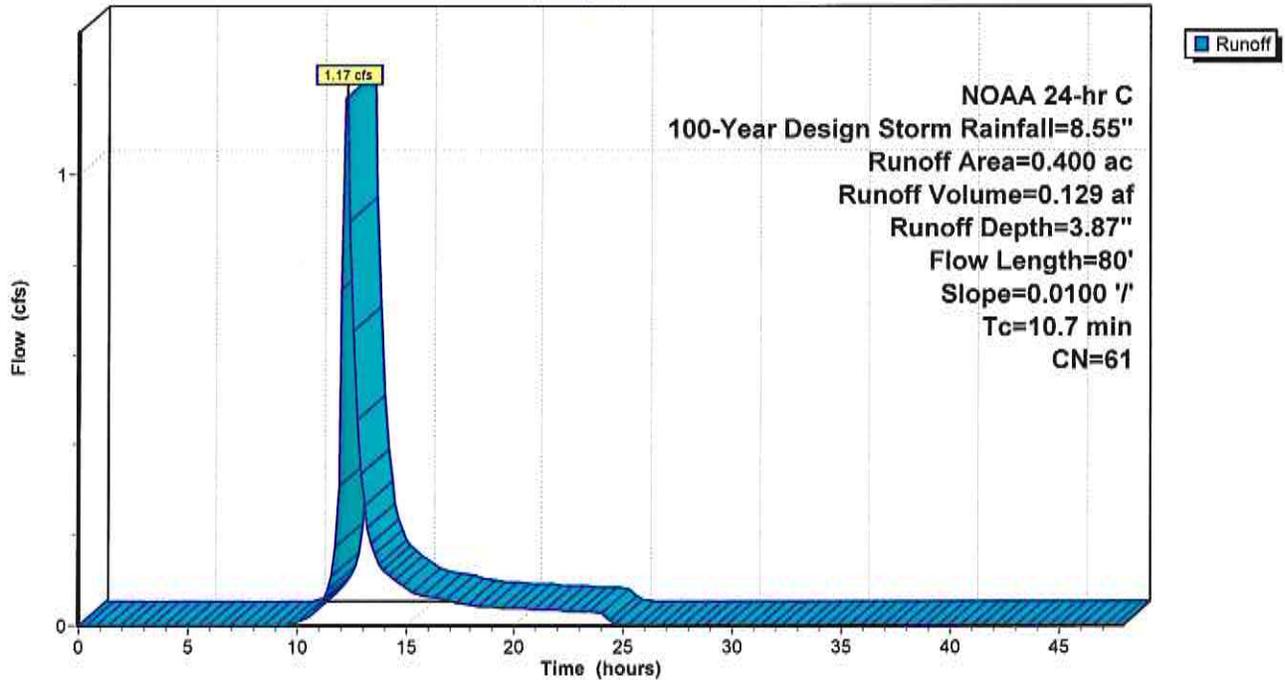
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NOAA 24-hr C 100-Year Design Storm Rainfall=8.55"

Area (ac)	CN	Description
* 0.400	61	grass
0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	80	0.0100	0.13		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"

Subcatchment 4P: Post-Dev WS #4

Hydrograph



Summary for Subcatchment 4P: Post-Dev WS #4

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

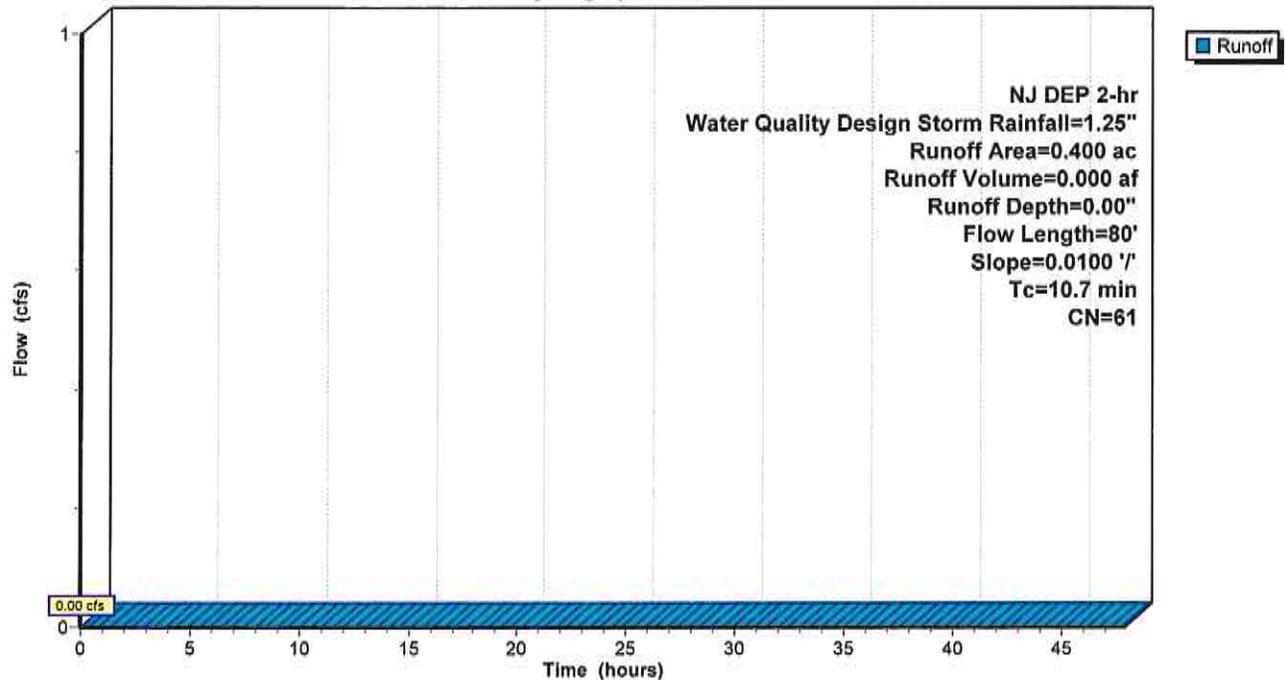
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 NJ DEP 2-hr Water Quality Design Storm Rainfall=1.25"

Area (ac)	CN	Description
* 0.400	61	grass
0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	80	0.0100	0.13		Sheet Flow, grass Grass: Short n= 0.150 P2= 3.29"

Subcatchment 4P: Post-Dev WS #4

Hydrograph



Basin Routing

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	3.29	2
2	10-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	5.05	2
3	25 Year Design Storm	NOAA 24-hr	C	Default	24.00	1	6.29	2
4	100-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	8.55	2
5	Water Quality Design Storm	NJ DEP 2-hr		Default	2.00	1	1.25	2

Summary for Pond 1B: Stormwater Basin #1

Inflow Area = 9.550 ac, 55.29% Impervious, Inflow Depth = 1.91" for 2-Year Design Storm event
 Inflow = 12.24 cfs @ 12.14 hrs, Volume= 1.516 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 Peak Elev= 128.74' @ 28.90 hrs Surf.Area= 1.142 ac Storage= 1.516 af

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

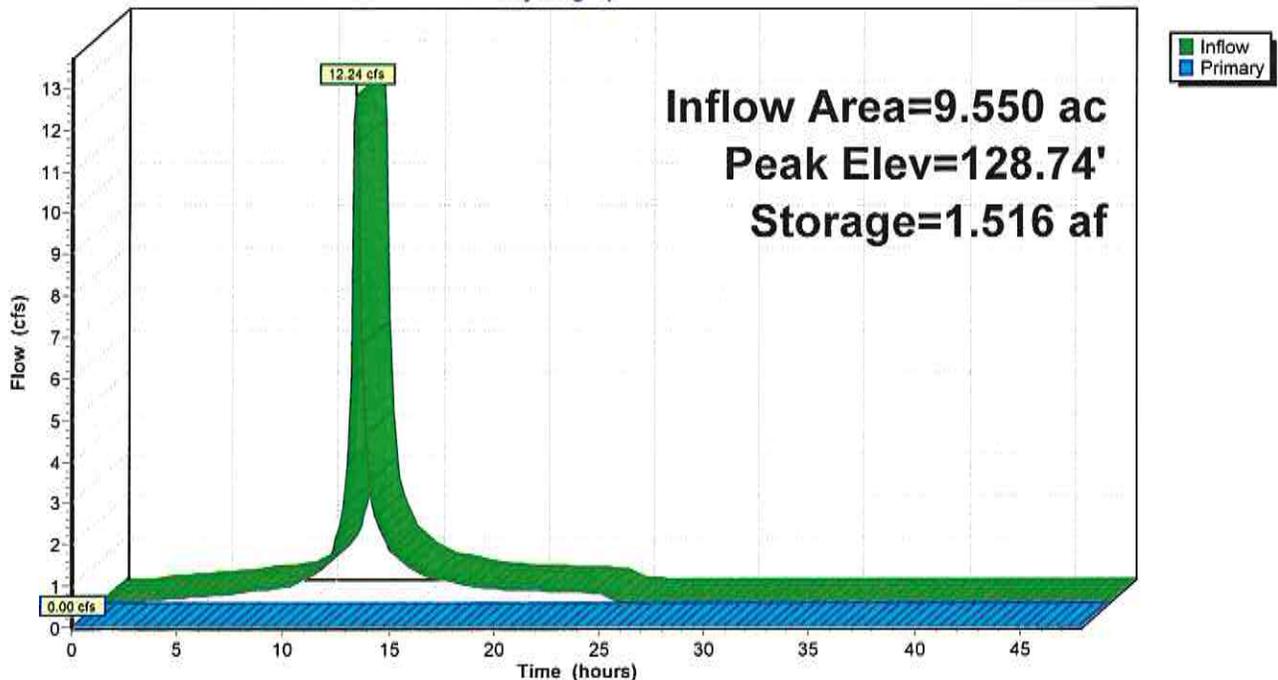
Volume	Invert	Avail.Storage	Storage Description
#1	127.25'	4.527 af	34.00'W x 1,150.00'L x 3.75'H Prismatic Z=3.0

Device	Routing	Invert	Outlet Devices
#1	Primary	129.25'	4.5' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=127.25' (Free Discharge)
 1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 1B: Stormwater Basin #1

Hydrograph



Summary for Pond 1B: Stormwater Basin #1

Inflow Area = 9.550 ac, 55.29% Impervious, Inflow Depth = 3.29" for 10-Year Design Storm event
 Inflow = 19.26 cfs @ 12.15 hrs, Volume= 2.616 af
 Outflow = 0.55 cfs @ 20.74 hrs, Volume= 0.486 af, Atten= 97%, Lag= 515.9 min
 Primary = 0.55 cfs @ 20.74 hrs, Volume= 0.486 af

Routing by Stor-Ind method, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 Peak Elev= 129.39' @ 20.74 hrs Surf.Area= 1.250 ac Storage= 2.295 af

Plug-Flow detention time= 887.7 min calculated for 0.484 af (19% of inflow)
 Center-of-Mass det. time= 612.3 min (1,399.5 - 787.2)

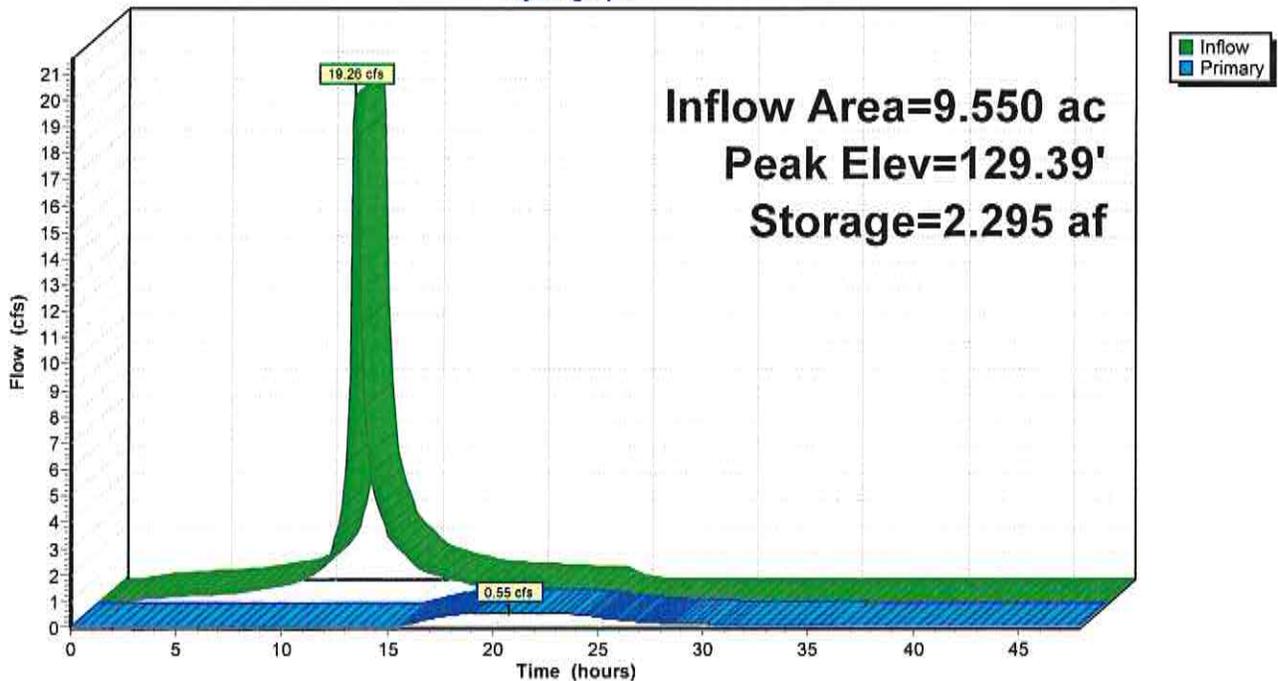
Volume	Invert	Avail.Storage	Storage Description
#1	127.25'	4.527 af	34.00'W x 1,150.00'L x 3.75'H Prismatoid Z=3.0

Device	Routing	Invert	Outlet Devices
#1	Primary	129.25'	4.5' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.55 cfs @ 20.74 hrs HW=129.39' (Free Discharge)
 1=Broad-Crested Rectangular Weir (Weir Controls 0.55 cfs @ 0.88 fps)

Pond 1B: Stormwater Basin #1

Hydrograph



Summary for Pond 1B: Stormwater Basin #1

Inflow Area = 9.550 ac, 55.29% Impervious, Inflow Depth = 4.33" for 25 Year Design Storm event
 Inflow = 24.43 cfs @ 12.15 hrs, Volume= 3.446 af
 Outflow = 1.98 cfs @ 15.03 hrs, Volume= 1.316 af, Atten= 92%, Lag= 172.7 min
 Primary = 1.98 cfs @ 15.03 hrs, Volume= 1.316 af

Routing by Stor-Ind method, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 Peak Elev= 129.57' @ 15.03 hrs Surf.Area= 1.280 ac Storage= 2.522 af

Plug-Flow detention time= 553.2 min calculated for 1.311 af (38% of inflow)
 Center-of-Mass det. time= 383.6 min (1,171.5 - 787.9)

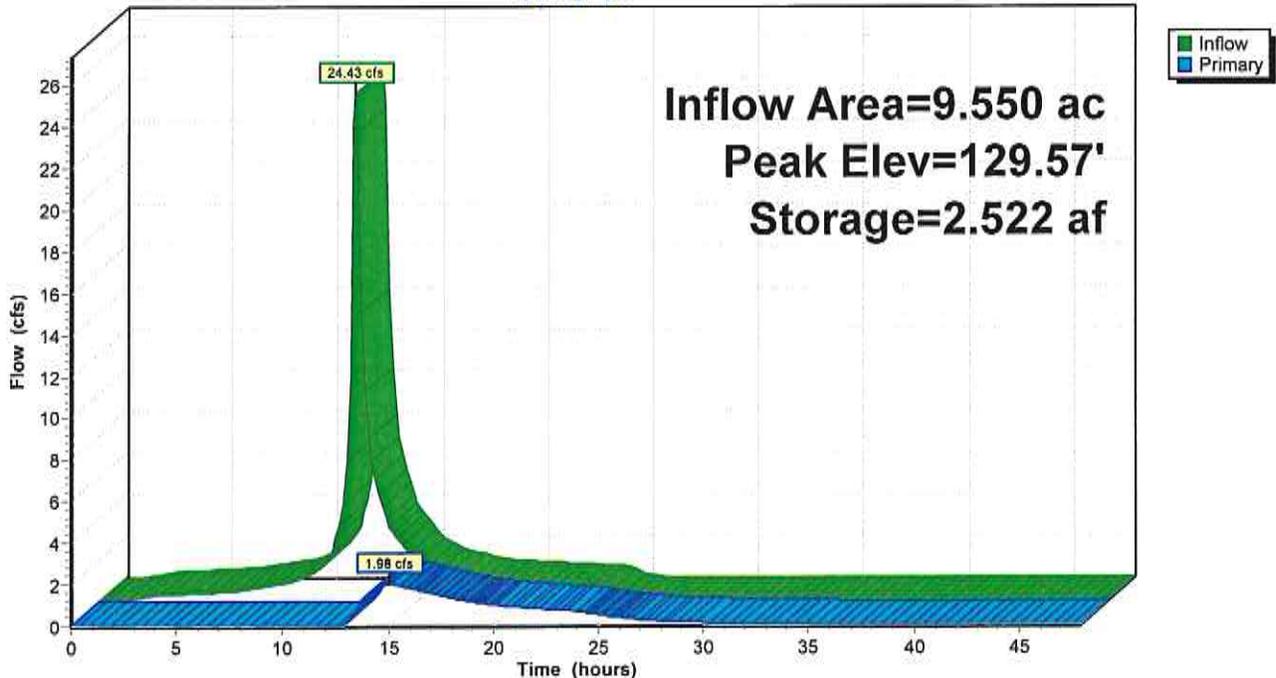
Volume	Invert	Avail.Storage	Storage Description
#1	127.25'	4.527 af	34.00'W x 1,150.00'L x 3.75'H Prismaoid Z=3.0

Device	Routing	Invert	Outlet Devices
#1	Primary	129.25'	4.5' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=1.97 cfs @ 15.03 hrs HW=129.57' (Free Discharge)
 ↳1=Broad-Crested Rectangular Weir (Weir Controls 1.97 cfs @ 1.38 fps)

Pond 1B: Stormwater Basin #1

Hydrograph



Summary for Pond 1B: Stormwater Basin #1

Inflow Area = 9.550 ac, 55.29% Impervious, Inflow Depth = 6.32" for 100-Year Design Storm event
 Inflow = 34.06 cfs @ 12.15 hrs, Volume= 5.033 af
 Outflow = 6.68 cfs @ 13.54 hrs, Volume= 2.902 af, Atten= 80%, Lag= 83.3 min
 Primary = 6.68 cfs @ 13.54 hrs, Volume= 2.902 af

Routing by Stor-Ind method, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 Peak Elev= 129.92' @ 13.54 hrs Surf.Area= 1.339 ac Storage= 2.986 af

Plug-Flow detention time= 384.5 min calculated for 2.902 af (58% of inflow)
 Center-of-Mass det. time= 254.2 min (1,042.4 - 788.2)

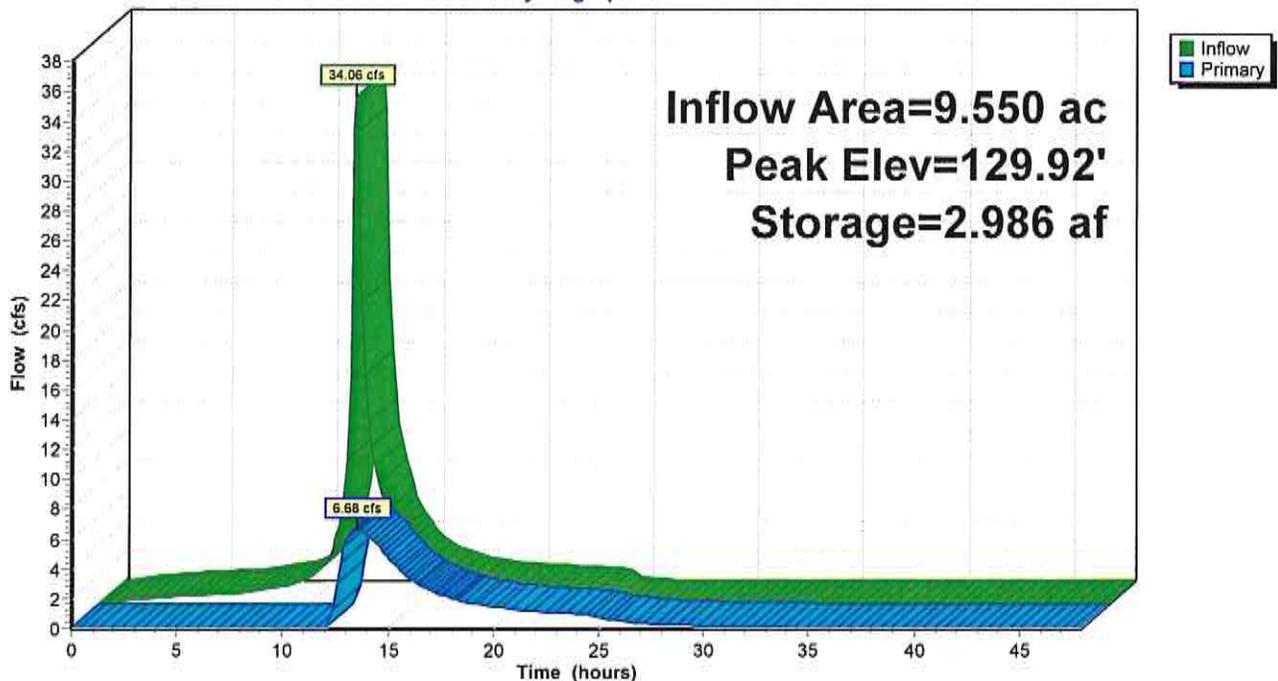
Volume	Invert	Avail.Storage	Storage Description
#1	127.25'	4.527 af	34.00'W x 1,150.00'L x 3.75'H Prismatoid Z=3.0

Device	Routing	Invert	Outlet Devices
#1	Primary	129.25'	4.5' long x 6.0' breadth Broad-Crested Rectangular Weir
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			
2.50 3.00 3.50 4.00 4.50 5.00 5.50			
Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65			
2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83			

Primary OutFlow Max=6.66 cfs @ 13.54 hrs HW=129.92' (Free Discharge)
 1=Broad-Crested Rectangular Weir (Weir Controls 6.66 cfs @ 2.21 fps)

Pond 1B: Stormwater Basin #1

Hydrograph



Summary for Pond 1B: Stormwater Basin #1

Inflow Area = 9.550 ac, 55.29% Impervious, Inflow Depth = 0.57" for Water Quality Design Storm event
 Inflow = 10.39 cfs @ 1.15 hrs, Volume= 0.455 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 Peak Elev= 127.74' @ 2.89 hrs Surf.Area= 0.977 ac Storage= 0.455 af

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

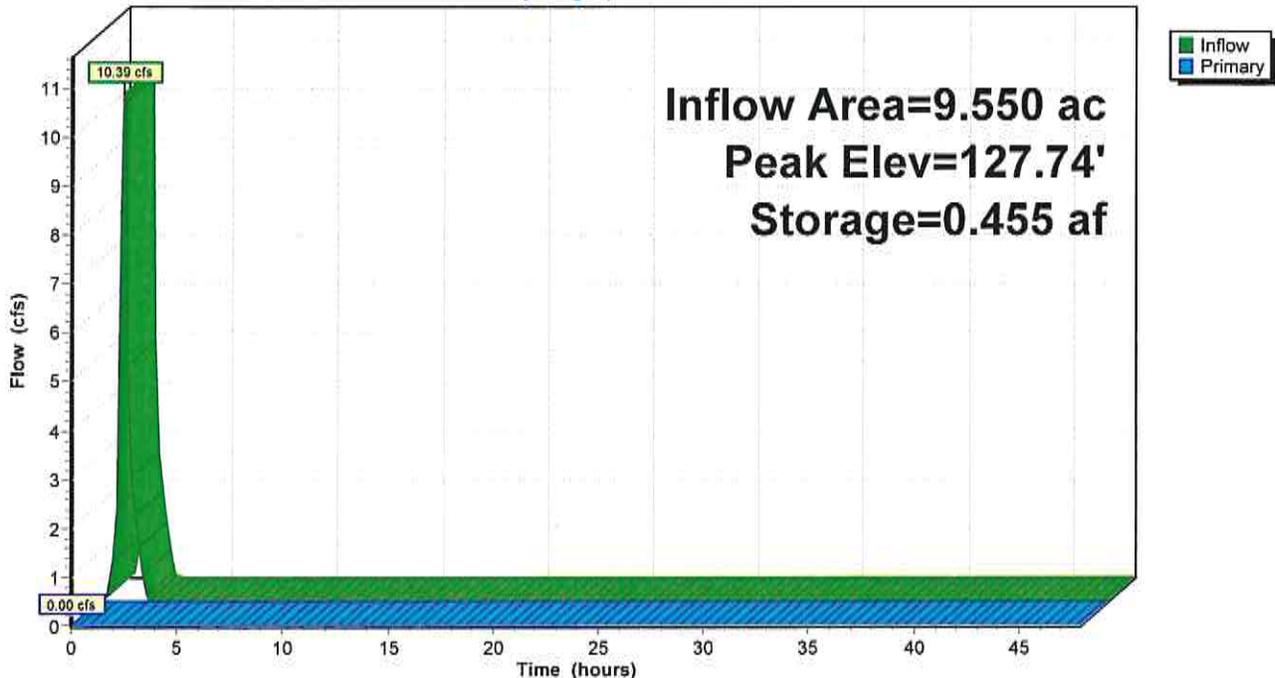
Volume	Invert	Avail.Storage	Storage Description
#1	127.25'	4.527 af	34.00'W x 1,150.00'L x 3.75'H Prismatic Z=3.0

Device	Routing	Invert	Outlet Devices
#1	Primary	129.25'	4.5' long x 6.0' breadth Broad-Crested Rectangular Weir
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			
2.50 3.00 3.50 4.00 4.50 5.00 5.50			
Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65			
2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83			

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=127.25' (Free Discharge)
 1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 1B: Stormwater Basin #1

Hydrograph



Basin Routing

10-Year Design Storm

**For The Net Increase
In Impervious Surfaces**

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-Year Design Storm	NOAA 24-hr	C	Default	24.00	1	5.05	2

Summary for Pond 1B: Stormwater Basin #1

Inflow Area = 5.280 ac, 100.00% Impervious, Inflow Depth = 4.81" for 10-Year Design Storm event
 Inflow = 18.88 cfs @ 12.14 hrs, Volume= 2.118 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-47.94 hrs, dt= 0.17 hrs
 Peak Elev= 129.25' @ 24.82 hrs Surf.Area= 1.226 ac Storage= 2.118 af

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

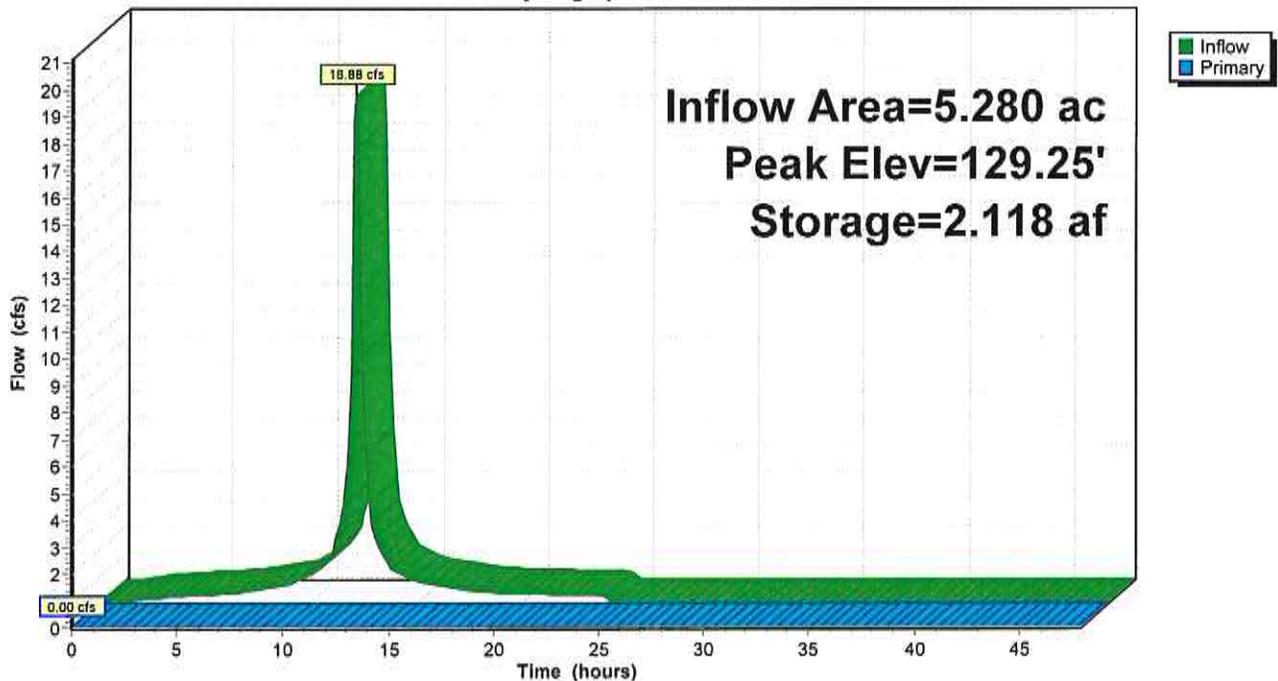
Volume	Invert	Avail.Storage	Storage Description
#1	127.25'	4.527 af	34.00'W x 1,150.00'L x 3.75'H Prismatoid Z=3.0

Device	Routing	Invert	Outlet Devices
#1	Primary	129.25'	4.5' long x 6.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=127.25' (Free Discharge)
 1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 1B: Stormwater Basin #1

Hydrograph



Pre-Development Runoff

Calculate Volume For The 2 Year Design Storm

Grass/Landscaping

$$S = \frac{1000 - 10}{CN} = \frac{1000 - 10}{61} = 6.39 \text{ Inches}$$

$$0.2S = 0.20 (6.39) = 1.28 \text{ Inches}$$

$$0.8S = 0.80 (6.39) = 5.11 \text{ Inches}$$

$$\text{Volume (Q)} = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{(3.29 - 1.28)^2}{3.29 + 5.11}$$

$$Q = .48 \text{ Inches}$$

$$\text{Runoff Volume} = \frac{.48 (.60) 43,560}{12}$$

$$\text{Runoff Volume} = 1,045.44 \text{ CF}$$

Pre-Development Runoff

Calculate Volume For The 2 Year Design Storm

Woodland

$$S = \frac{1000 - 10}{CN} = \frac{1000 - 10}{55} = 8.18 \text{ Inches}$$

$$0.2S = 0.20 (8.18) = 1.64 \text{ Inches}$$

$$0.8S = 0.80 (8.18) = 6.54 \text{ Inches}$$

$$\text{Volume (Q)} = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{(3.29 - 1.64)^2}{3.29 + 6.54}$$

$$Q = .28 \text{ Inches}$$

$$\text{Runoff Volume} = \frac{.28 (8.69) 43,560}{12}$$

$$\text{Runoff Volume} = 8,832.52 \text{ CF}$$

Post-Development Runoff

Calculate Volume For The 2 Year Design Storm

Impervious Area

$$S = \frac{1000 - 10}{CN} = \frac{1000}{98} - 10 = 0.20 \text{ Inches}$$

$$0.2S = 0.20 (0.20) = 0.04 \text{ Inches}$$

$$0.8S = 0.80 (0.20) = 0.16 \text{ Inches}$$

$$\text{Volume (Q)} = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{(3.29 - 0.04)^2}{3.29 + 0.16}$$

$$Q = 3.06 \text{ Inches}$$

$$\text{Runoff Volume} = \frac{3.06 (5.28) 43,560}{12}$$

$$\text{Runoff Volume} = 58,649 \text{ CF}$$

Post-Development Runoff

Calculate Volume For The 2 Year Design Storm

Grass/Landscaping

$$S = \frac{1000 - 10}{CN} = \frac{1000 - 10}{61} = 6.39 \text{ Inches}$$

$$0.2S = 0.20 (6.39) = 1.28 \text{ Inches}$$

$$0.8S = 0.80 (6.39) = 5.11 \text{ Inches}$$

$$\text{Volume (Q)} = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{(3.29 - 1.28)^2}{3.29 + 5.11}$$

$$Q = .48 \text{ Inches}$$

$$\text{Runoff Volume} = \frac{.48 (3) 43,560}{12}$$

$$\text{Runoff Volume} = 5,227.2 \text{ CF}$$

Post-Development Runoff

Calculate Volume For The 2 Year Design Storm

Woodland

$$S = \frac{1000 - 10}{CN} = \frac{1000}{55} - 10 = 8.18 \text{ Inches}$$

$$0.2S = 0.20 (8.18) = 1.64 \text{ Inches}$$

$$0.8S = 0.80 (8.18) = 6.54 \text{ Inches}$$

$$\text{Volume (Q)} = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{(3.29 - 1.64)^2}{3.29 + 6.54}$$

$$Q = .28 \text{ Inches}$$

$$\text{Runoff Volume} = \frac{.28 (1.00) 43,560}{12}$$

$$\text{Runoff Volume} = 1,016 \text{ CF}$$

Post-Development Runoff

Calculate Volume For The Water Quality Design Storm

Impervious Area

$$S = \frac{1000 - 10}{CN} = \frac{1000 - 10}{98} = 0.20 \text{ Inches}$$

$$0.2S = 0.20 (0.20) = 0.04 \text{ Inches}$$

$$0.8S = 0.80 (0.20) = 0.16 \text{ Inches}$$

$$\text{Volume (Q)} = \frac{(P - 0.2S) 2}{P + 0.8S} = \frac{(1.25 - 0.04) 2}{1.25 + 0.16}$$

$$Q = 1.04 \text{ Inches}$$

$$\text{Runoff Volume} = \frac{1.04 (5.28) 43,560}{12}$$

$$\text{Runoff Volume} = 19,933 \text{ CF}$$

Post-Development Runoff

Calculate Volume For The 10 Year Design Storm

Impervious Area

$$S = \frac{1000 - 10}{CN} = \frac{1000}{98} - 10 = 0.20 \text{ Inches}$$

$$0.2S = 0.20 (0.20) = 0.04 \text{ Inches}$$

$$0.8S = 0.80 (0.20) = 0.16 \text{ Inches}$$

$$\text{Volume (Q)} = \frac{(P - 0.2S)^2}{P + 0.8S} = \frac{(5.05 - 0.04)^2}{5.05 + 0.16}$$

$$Q = 4.82 \text{ Inches}$$

$$\text{Runoff Volume} = \frac{4.82 (5.28) 43,560}{12}$$

$$\text{Runoff Volume} = 92,382 \text{ CF}$$

**Calculate Time For The Infiltration Basin To Infiltrate
The 100 Year Post-Development Storm**

Infiltration Basin

Use 6 Inches / Hour

**Utilize A Safety Factor of (2) Two
Design Rate Use 3 Inches / Hour**

Area of Infiltration Basin Bottom = 225,000 S.F.

$$\frac{3.00 \text{ Inches}}{\text{Hour}} \times \frac{24 \text{ Hours}}{\text{Day}} \times \frac{1 \text{ Foot}}{12 \text{ In.}} \times 225,000 \text{ S.F.} =$$

$$24 \text{ Hours} = 225,000 \text{ CF}$$

$$72 \text{ Hours} = 675,000 \text{ CF}$$

$$100 \text{ Yr Post Development Storage Volume} = 216,439 \text{ CF}$$

**The 100 Year Post Development Storm Is Infiltrated In
23.09 Hours.**

**GROUNDWATER RECHARGE MOUNDING ANALYSIS
BLOCK 3901, LOT 29
MONROE TOWNSHIP, GLOUCESTER COUNTY, NJ
(1-YEAR ANALYSIS)**

EDA #8146

- | | | | | |
|----|------------------------------|---|---|------------------------------|
| 1. | Recharge Rate (ft./day) | = | $\frac{45}{1 \text{ Year}} \cdot \frac{1 \text{ Year}}{365 \text{ days}} \cdot \frac{1'}{12''}$ | |
| | | = | 0.01 ft./day | |
| 2. | Transmissivity (ft/day) | = | Permeability of most restrictive native soil x saturated thickness (level of infiltration to ESHWT) | |
| | | = | $\left[\left(\frac{6''}{hr.} \right) \left(\frac{24hr.}{1day} \right) \right]$ | |
| | | = | 12.0 feet/day | |
| 3. | Specific Yield (gravel/sand) | = | 0.16 to 0.20 (Use 0.15) | |
| 4. | Beginning Time | = | 365 days | |
| | Final Time | = | 365 days | |
| | Time Increment | = | 365 days | |
| 5. | Time of Cut Off | = | 365 days | |
| 6. | Beginning Distance | = | 0' | |
| | Final Distance | = | 100' | |
| | Distance Increment | = | 10' | |
| 7. | Depth to ESHWT | = | 8.0' | |
| 8. | Width | = | 34' } | Bottom of Infiltration Basin |
| | | | } | |
| 9. | Length | = | 1150' } | |

Groundwater Recharge Mounding Analysis
 Block 3901, Lot 29, Monroe Township, Cape May County, NJ
 EDA #8146

10.	Angle from Length of Axis	=	0'
	Recharge Rate	=	0.01 ft./day
	Transmissivity	=	12.0 SF/day
	Specific Yield	=	.15
	Beginning Time	=	365 days
	Final Time	=	365 days
	Time of Increment	=	365 days
	Time of Cut Off	=	365 days
	Beginning Distance	=	0 ft.
	Final Distance	=	100 ft.
	Distance Increment	=	10 ft.
	Depth	=	8.0'
	Width	=	34'
	Length	=	1150'
	Angle	=	0 Degrees

Results Display

<u>Time</u> <u>(Days)</u>	<u>Distance</u> <u>(Ft.)</u>	<u>Height</u> <u>(Ft.)</u>
365	0	1.518
365	10	1.518
365	20	1.517
365	30	1.517
365	40	1.516
365	50	1.515
365	60	1.513
365	70	1.512
365	80	1.510
365	90	1.508
365	100	1.505

Groundwater Recharge Mounding Analysis
Block 3901, Lot 29, Monroe Township, Cape May County, NJ
EDA #8146

Groundwater Mounding Analysis (1 Year Analysis)

Site Plan: White & Blue, LLC
Block 3901, Lot 29, Monroe Township, Gloucester County, NJ

A groundwater mounding analysis was performed in association with the proposed infiltration basin. The analysis was conducted within a timeframe of 365 days (1 year) with a recharge rate of 45 inches of rainfall. It has been determined that, at this rate, over a distance of 100 feet that the height or elevation of the seasonal high water elevation will increase by 1.50 feet (approximately 18 inches).

This slight increase will have little or no impact on the basin bottom or the surrounding adjacent properties, adjacent water bodies, wetlands or subsurface structures. It has been determined that seasonal high water is at elevation 122.50. Groundwater mounding associated with the proposed infiltration basin will increase this elevation to 124.00, well below the proposed basin bottom elevation of 125.00.

LOW IMPACT DEVELOPMENT TECHNIQUES

It is the intent of the applicant to develop the 9.29 acre site with a 48,000 SF commercial building along with an adjacent parking lot & outside storage area. The post-development stormwater flows will be treated and dissipated through a proposed infiltration basin.

The following non-structural stormwater management strategies have been employed:

1. "Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss."

The proposed grading of the site has been designed to be at a minimum to reduce the amount of clearing and erosion while helping to maintain water quality.

2. "Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces."

The amount of impervious surfaces proposed has been designed to be at a minimum while still meeting the parking and circulation requirements of the Monroe Township Ordinance. Vegetative swales have been incorporated into the stormwater design adjacent to the parking lot to disconnect the flow of runoff from impervious surfaces and to pretreat stormwater flows prior to entering the basin.

3. "Maximize the protection of natural drainage features and vegetation."

The site has been designed to maximize the protection of natural drainage features by locating the proposed infiltration system at the natural lowpoint of the site while maintaining the existing drainage patterns.

4. "Minimize the decrease in preconstruction time of concentration."

The stormwater calculations and stormwater system was designed to minimize the decrease in the pre-development time of concentration by utilizing several locations and types of systems to promote infiltration and dissipation of stormwater flows.

5. "Minimize land disturbance including clearing and grading."

The clearing and grading has been designed to be at a minimum while still meeting the stormwater, parking and circulation requirements of the Monroe Township Ordinance.

6. "Minimize soil compaction."

Soil compaction will be minimized on the site. The site shall be graded with lightweight and practical excavation equipment. All construction equipment shall be operated outside of the limits of the basin infiltration areas.

7. "Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimize the use of lawns, fertilizers and pesticides."

The site shall be landscaped with low maintenance native plant material. The use of lawns, fertilizers and pesticides shall be at a minimum.

8. "Provide vegetated open channel conveyance systems discharge into and through stable vegetated areas."

The stormwater design incorporates the preservation of existing woodland area at the rear of the property. Vegetative swales have been incorporated into the stormwater design adjacent to the parking lot to disconnect the flow of runoff from impervious surfaces.

9. "Provide preventative source controls."

The proposed stormwater inlet system has been designed with catch basin traps to prevent discharge of trash and debris into the infiltration system. The infiltration basin has been designed with a sediment forebay to prevent trash, debris and sediment from entering the infiltration system.

CALCULATION OF COMPOSITE "C" VALUES

AREA 1 Rpe to Inlet #1

AREA = 6000 SF = 0.18 AC

IMPERVIOUS / ROADWAY 0.99 X 0.18 = 0.178

GRASS / LANDSCAPING 0.25 X _____ = _____

WOODLAND 0.15 X _____ = _____

TOTAL _____ 0.178

COMPOSITE "C" VALUE 0.178 ÷ 0.18 = 0.99

CALCULATION OF COMPOSITE "C" VALUES

AREA 2 inlet #1 to inlet #5

AREA = 86467 SF = 1.99 AC

IMPERVIOUS / ROADWAY 0.99 X _____ = _____

GRASS / LANDSCAPING 0.25 X 1.99 = 0.50

WOODLAND 0.15 X _____ = _____

TOTAL _____ = 0.50

COMPOSITE "C" VALUE 0.50 ÷ 1.99 = 0.25

CALCULATION OF COMPOSITE "C" VALUES

AREA 3 inlet #5 to outfall #1

AREA = 36344 SF = 0.83 AC

IMPERVIOUS / ROADWAY 0.99 X 0.79 = 0.78

GRASS / LANDSCAPING 0.25 X 0.04 = 0.01

WOODLAND 0.15 X _____ = _____

TOTAL _____ = 0.79

COMPOSITE "C" VALUE 0.79 ÷ 0.83 = 0.95

CALCULATION OF COMPOSITE "C" VALUES

AREA 4 Pipe to inlet #3

AREA = 8000 SF = 0.18 AC

IMPERVIOUS / ROADWAY 0.99 X 0.18 = 0.178

GRASS / LANDSCAPING 0.25 X _____ = _____

WOODLAND 0.15 X _____ = _____

TOTAL _____ = 0.178

COMPOSITE "C" VALUE 0.178 ÷ 0.18 = 0.99

CALCULATION OF COMPOSITE "C" VALUES

AREA 5 inlet #3 to outfall #3

AREA = 22395 SF = 0.51

IMPERVIOUS / ROADWAY 0.99 X 0.47 = 0.47

GRASS / LANDSCAPING 0.25 X 0.04 = 0.01

WOODLAND 0.15 X _____ = _____

TOTAL _____ 0.48

COMPOSITE "C" VALUE 0.48 ÷ 0.51 = 0.94

6/16

CALCULATION OF COMPOSITE "C" VALUES

AREA 6 To inlet #4

AREA = 36344 SF = 0.83

IMPERVIOUS / ROADWAY 0.99 X 0.79 = 0.78

GRASS / LANDSCAPING 0.25 X 0.04 = 0.01

WOODLAND 0.15 X _____ = _____

TOTAL _____ = 0.79

COMPOSITE "C" VALUE 0.79 ÷ 0.83 = 0.95

CALCULATION OF COMPOSITE "C" VALUES

AREA 7 Pipe to inlet #2

AREA = 4000 SF = 0.09 AC

IMPERVIOUS / ROADWAY 0.99 X 0.09 = 0.089

GRASS / LANDSCAPING 0.25 X _____ = _____

WOODLAND 0.15 X _____ = _____

TOTAL _____ 0.089

COMPOSITE "C" VALUE 0.089 + 0.09 = 0.99

CALCULATION OF COMPOSITE "C" VALUES

AREA 8 ≈ 2 to inlet #2

AREA = 4000 SF = 0.09

IMPERVIOUS / ROADWAY 0.99 X 0.09 = 0.089

GRASS / LANDSCAPING 0.25 X _____ = _____

WOODLAND 0.15 X _____ = _____

TOTAL _____ 0.089

COMPOSITE "C" VALUE 0.089 ÷ 0.09 = 0.99

CALCULATION OF COMPOSITE "C" VALUES

AREA 9 inlet #2 to inlet #4

AREA = 11204 SF = 0.28 AC

IMPERVIOUS / ROADWAY 0.99 X _____ = _____

GRASS / LANDSCAPING 0.25 X 0.11 = 0.03

WOODLAND 0.15 X 0.17 = 0.03

TOTAL _____ = 0.06

COMPOSITE "C" VALUE 0.06 + 0.28 = 0.21

CALCULATION OF COMPOSITE "C" VALUES

AREA 10 inlet #10 to outfall #4

AREA = 40301 SF = 0.93 AC

IMPERVIOUS / ROADWAY 0.99 X 0.89 = 0.88

GRASS / LANDSCAPING 0.25 X 0.04 = 0.01

WOODLAND 0.15 X _____ = _____

TOTAL _____ = 0.89

COMPOSITE "C" VALUE 0.89 + 0.93 = 0.96

CALCULATION OF COMPOSITE "C" VALUES

AREA 11 inlet #7 to outfall #5

AREA = 40616 SF = 0.93 AC

IMPERVIOUS / ROADWAY 0.99 X 0.89 = 0.88

GRASS / LANDSCAPING 0.25 X 0.04 = 0.01

WOODLAND 0.15 X _____ = _____

TOTAL _____ = 0.89

COMPOSITE "C" VALUE 0.89 ÷ 0.93 = 0.96

CALCULATION OF COMPOSITE "C" VALUES

AREA 12 met #8 to outfall #6

AREA = 37481 SF = 0.86 AC

IMPERVIOUS / ROADWAY 0.99 X 0.82 = 0.81

GRASS / LANDSCAPING 0.25 X 0.04 = 0.01

WOODLAND 0.15 X _____ = _____

TOTAL _____ = 0.82

COMPOSITE "C" VALUE 0.82 ÷ 0.86 = 0.95

LINE NUMBER	BEGIN	END	INCREMENTS OF AREA ACRES	"C"	"CA"	TIME OF CONCENTRATION	STORM	"L"	"D"	SLOPE	PIPE DIAMETER	VELOCITY (F.P.S.)	LENGTH OF LINE	TIME FLOW (MIN.)	CAPACITY C.F.S.	
1																
2	Pipe inlet #1	inlet #1	0.18	0.99	0.18	7.27	25	7.75	1.40	0.5%	16"	3.98	191'	1.27	2.01	Q/cap = 0.70 1.08
3	inlet #1	inlet #5	2.17	0.31	0.47	7.49	25	7.75	5.19	0.25%	18"	4.21	224'	1.49	6.83	Q/cap = 0.75 1.07
4	inlet #5	outfall #1	3.0	0.55	1.05	7.59	25	7.75	12.79	1.0%	18"	8.5	15'	0.10	13.65	Q/cap = 0.94 1.104
5																
6	Pipe inlet #3	inlet #3	0.18	0.99	0.18	8.89	25	7.75	1.40	0.32%	10"	3.16	433	2.29	1.56	Q/cap = 0.90 1.103
7	inlet #3	outfall #3	0.69	0.96	0.66	8.99	25	7.75	5.11	1.0%	15"	7.04	15'	0.10	8.39	Q/cap = 0.61 1.03
8																
9	inlet #4	outfall #2	0.83	0.94	0.78	6.10	25	7.75	6.05	1.0%	15"	7.38	15'	0.10	8.39	Q/cap = 0.72 1.108
10																
11	Pipe inlet #2	inlet #2	0.09	0.99	0.09	7.06	25	7.75	0.70	0.5%	10"	3.32	159'	1.06	2.01	Q/cap = 0.55 0.90
12	SI inlet #2	inlet #2	0.09	0.99	0.09	7.25	25	7.75	0.70	0.5%	10"	3.32	188'	1.25	2.01	Q/cap = 0.35 0.90

D = CIA
 Q = CFS
 I = INTENSITY (IN/HR)
 C = RUNOFF COEFFICIENT
 A = AREA (ACRES)

JOB NAME White + Blue LLC
 JOB NO. 8146 PAGE 14 OF 16
 CALCULATED BY MAT DATE 10/7/20
 VERIFIED BY _____ DATE _____

ENGINEERING DESIGN
 A S S O C I A T E S . P . A .
 engineers • planners • landscape architects
 Cambridge professional offices
 5 Cambridge drive • ocean view, new jersey 08220
 (609) 390-0332 • fax (609) 390-9204

LINE NUMBER	BEGIN	END	INCREMENTS OF AREA ACRES	"C"	"CA"	TIME OF CONCENTRATION	STORM	"I"	"Q"	SLOPE	PIPE DIAMETER	VELOCITY (F.P.S.)	LENGTH OF LINE	TIME FLOW (MIN.)	CAPACITY C.F.S.	Q = CIA Q = CFS I = INTENSITY (IN/HR) C = RUNOFF COEFFICIENT A = AREA (ACRES)
1	inlet #2	inlet #6	0.46	0.52	0.24	7.19	25	7.75	1.86	0.3%	15"	3.52	224'	1.49	9.59	Q/cap = 0.41 0.94
2	inlet #0	outfall #4	1.39	0.94	1.31	7.59	25	7.75	10.15	1.0%	18"	8.42	15'	0.10	13.65	Q/cap = 0.74 1.09
3																
4	inlet #7	outfall #5	0.93	0.94	0.89	6.10	25	7.75	6.90	1.0%	15"	7.53	15'	0.10	8.37	Q/cap = 0.82 1.101
5																
6	inlet #8	outfall #6	0.84	0.95	0.82	6.10	25	7.75	6.34	1.0%	15"	7.52	15'	0.10	8.37	Q/cap = 0.76 1.10
7																
8																
9																
10																
11																
12																

JOB NAME White + Blue LLC
 JOB NO. 8146 PAGE 15 OF 16
 CALCULATED BY MAJ DATE 10/7/20
 VERIFIED BY _____ DATE _____

or other approved methods may be employed.

TABLE 7.1 TYPICAL RUNOFF COEFFICIENTS (C VALUES) FOR 100-YEAR FREQUENCY STORM				
LAND-USE DESCRIPTION	HYDROLOGIC SOIL GROUP			
	A	B	C	D
Cultivated land: without conservation treatment	0.49	0.67	0.81	0.88
with conservation treatment	0.27	0.43	0.61	0.67
Pasture or range land: poor condition	0.38	0.63	0.78	0.84
good condition	NA	0.25	0.51	0.65
Meadow: good condition	NA	NA	0.44	0.61
Wood or forest land: thin stand, poor cover, no mulch	NA	NA	0.59	0.79
good cover	NA	NA	0.45	0.59
Open spaces, lawns, parks, golf courses, cemeteries: good condition, grass cover on 75% or more of area	NA	0.25	0.51	0.65
fair condition, grass cover on 50-75% of area	NA	0.45	0.63	0.74
Commercial and business areas (85% impervious)	0.84	0.90	0.93	0.96
Industrial districts (72% impervious)	0.67	0.81	0.88	0.92
Residential:				
<u>Average lot size</u> <u>Average impervious</u>				
1/8 acre 65%	0.59	0.76	0.86	0.90
1/4 acre 38%	0.25	0.55	0.70	0.80
1/3 acre 30%	NA	0.49	0.67	0.78
1/2 acre 25%	NA	0.45	0.65	0.76
1 acre 20%	NA	0.41	0.63	0.74
Paved parking lots, roofs, driveways, etc.	0.99	0.99	0.99	0.99
Streets and roads:				
paved with curbs and storm sewers	0.99	0.99	0.99	0.99
gravel	0.57	0.76	0.84	0.88
dirt	0.49	0.69	0.80	0.84
NOTE:	NA denotes information is not available; design engineers should rely on another authoritative source.			
SOURCE:	<i>Technical Manual for Land Use Regulation Program</i> , Department of Environmental Protection, Bureaus of Inland and Coastal Regulations, Stream Encroachment Permits (Trenton, New Jersey, revised September 1995), p. 12.			

APPENDIX B

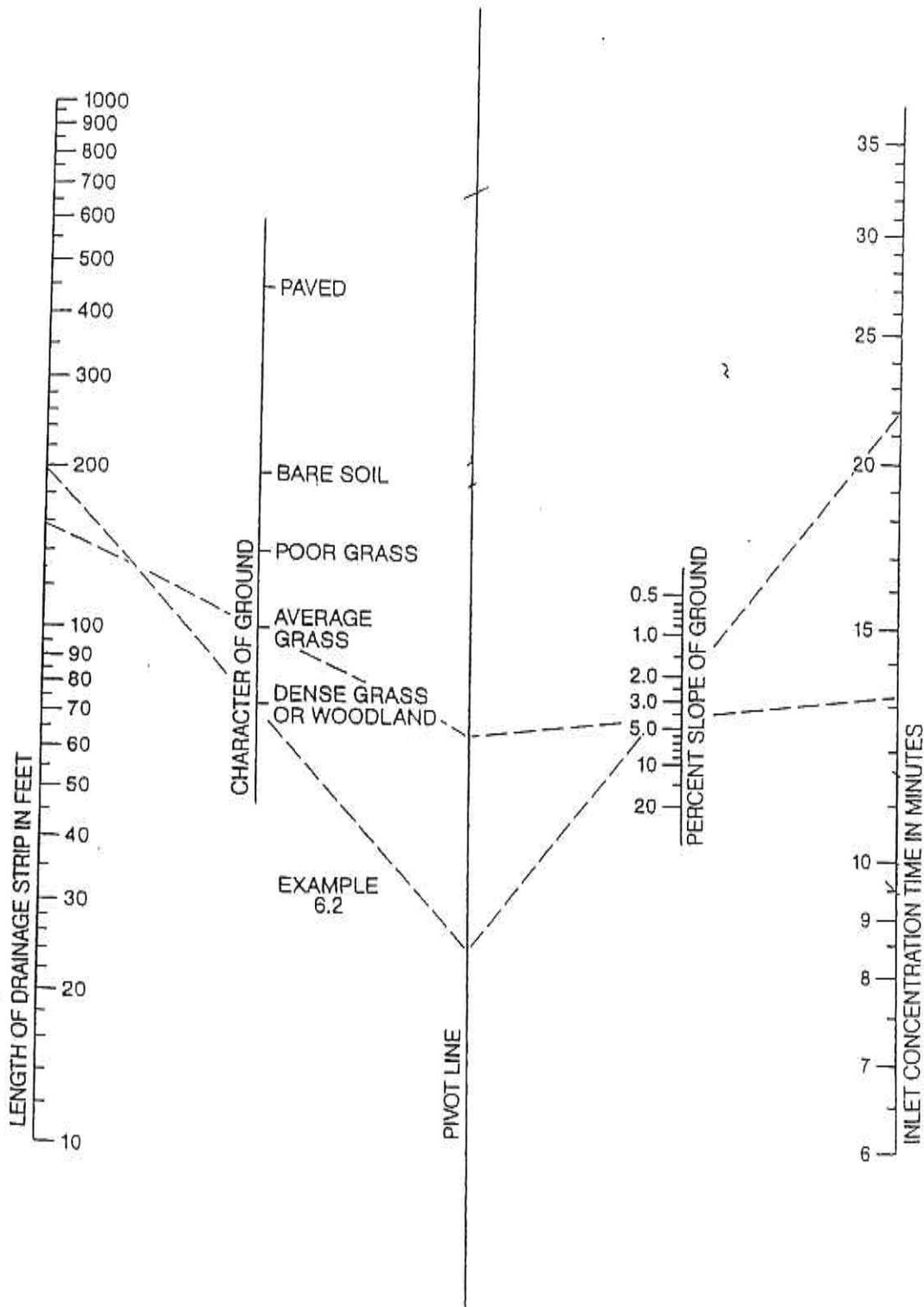
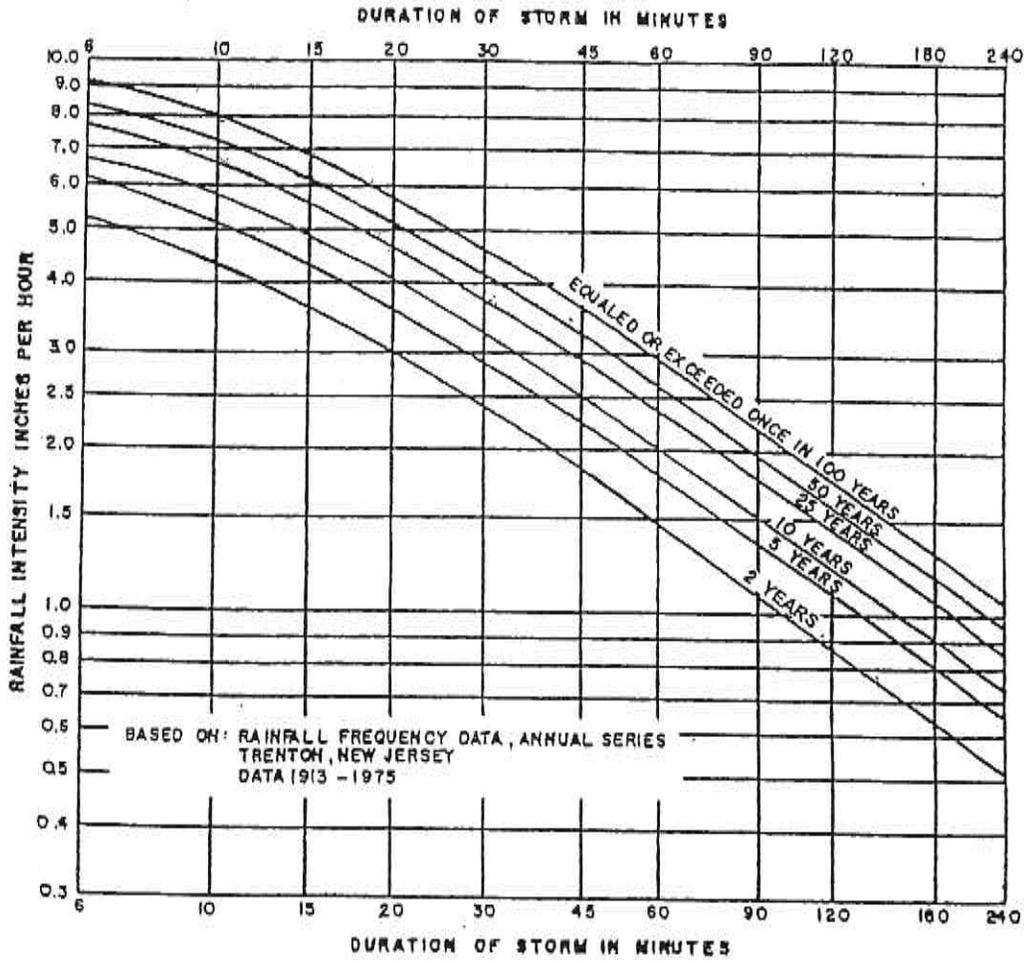


Fig 6.13 NOMOGRAPH FOR OVERLAND FLOW TIME

FIGURE 7.2 RAINFALL INTENSITY CURVES



Note: Adapted from Figure 2.1-2 in the NJDEP *Technical Manual for Stream Encroachment Permits*.

Calculate Stone Apron #1 Size

$$Q = 12.79 \text{ CFS}$$

$$T_w > 1/2 D_o$$

Calculate Length

$$L_a = \frac{3q}{D_o^{1/2}}$$

$$L_a = 20.89 \text{ FT}$$

Calculate Width

$$W = 3W_o + 0.40L_a$$

$$W = 12.86 \text{ FT}$$

Calculate D50 Stone Size

$$D_{50} = \frac{0.02}{T_w} (q^{1.33})$$

$$D_{50} = 1.15 \text{ FT}$$

Use 14" Diameter Stone

Calculate Stone Apron #2 Size

$$Q = 6.05 \text{ CFS}$$

$$T_w > 1/2 D_o$$

Calculate Length

$$L_a = \frac{3q}{D_o^{1/2}}$$

$$L_a = 12.98 \text{ FT}$$

Calculate Width

$$W = 3W_o + 0.40L_a$$

$$W = 8.94 \text{ FT}$$

Calculate D50 Stone Size

$$D_{50} = \frac{0.02}{T_w} (q^{1.33})$$

$$D_{50} = 0.65 \text{ FT}$$

Use 9" Diameter Stone

Calculate Stone Apron #3 Size

$$Q = 5.11 \text{ CFS}$$

$$T_w > 1/2 D_o$$

Calculate Length

$$L_a = \frac{3q}{D_o^{1/2}}$$

$$L_a = 10.97 \text{ FT}$$

Calculate Width

$$W = 3W_o + 0.40L_a$$

$$W = 8.13 \text{ FT}$$

Calculate D50 Stone Size

$$D_{50} = \frac{0.02}{T_w} (q^{1.33})$$

$$D_{50} = 0.52 \text{ FT}$$

Use 6" Diameter Stone

Calculate Stone Apron #4 Size

$$Q = 10.15 \text{ CFS}$$

$$T_w > 1/2 D_o$$

Calculate Length

$$L_a = \frac{3q}{D_o^{1/2}}$$

$$L_a = 16.58 \text{ FT}$$

Calculate Width

$$W = 3W_o + 0.40L_a$$

$$W = 11.13 \text{ FT}$$

Calculate D50 Stone Size

$$D_{50} = \frac{0.02}{T_w} (q^{1.33})$$

$$D_{50} = 0.85 \text{ FT}$$

Use 12" Diameter Stone

Calculate Stone Apron #5 Size

$$Q = 6.90 \text{ CFS}$$

$$T_w > 1/2 D_o$$

Calculate Length

$$L_a = \frac{3q}{D_o^{1/2}}$$

$$L_a = 14.81 \text{ FT}$$

Calculate Width

$$W = 3W_o + 0.40L_a$$

$$W = 9.67 \text{ FT}$$

Calculate D50 Stone Size

$$D_{50} = \frac{0.02}{T_w} (q^{1.33})$$

$$D_{50} = 0.78 \text{ FT}$$

Use 12" Diameter Stone

Calculate Stone Apron #6 Size

$$Q = 6.36 \text{ CFS}$$

$$T_w > 1/2 D_o$$

Calculate Length

$$L_a = \frac{3q}{D_o^{1/2}}$$

$$L_a = 13.66 \text{ FT}$$

Calculate Width

$$W = 3W_o + 0.40L_a$$

$$W = 9.21 \text{ FT}$$

Calculate D50 Stone Size

$$D_{50} = \frac{0.02}{T_w} (q^{1.33})$$

$$D_{50} = 0.70 \text{ FT}$$

Use 9" Diameter Stone