

Stormwater Management Report

SUBMIT TO:

**Department of Environmental
Protection and Sustainability**

PROJECT:

**Tidal Wave
MDB230016.00**

PROJECT LOCATION:

**23178 Three Notch Road
California, MD 20619
St. Mary's County**

DEVELOPER:

PJ Land, LLC
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I, Matthew Senenman, P.E., hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 43200, Expiration Date: 12/20/24.

Rev March 19, 2024

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NARRATIVE

Narrative

The project is the new development of 23178 Three Notch Road, located on the northwest side of the intersection of Three Notch Road and Patuxent Beach Road. The total site area is 4.44 acres, although the disturbance area will only be 2.25 acres of the site. The limit of disturbance is comprised of 0.35 acre of existing impervious cover and 1.89 acre of existing pervious cover.

The site generally slopes from northwest to southeast, where there is an existing wetland. The proposed site maintains similar drainage patterns, while treating the vehicular area with micro-bioretenion facilities.

All soils onsite are hydrologic soil group "C" soils as mapped by the U.S. Department of Agriculture, Soil Conservation Service. There are no known streams and the site is not located within a 100-year floodplain. There is a wetland identified on the plans that is not to be disturbed other than minor improvements encroaching the 25' buffer. All existing steep slopes are hatched on the existing conditions plan and are impacted as little as possible. The site encompasses a driveway entrance to existing buildings and wooded area. The existing buildings and site features will be demolished within the extents of the limits of disturbance. The proposed development will be a car wash facility and parking lot, along with associated utilities and landscaping.

Because the limit of disturbance is comprised of more than 16.1% impervious cover, this is a new development. The southern portion of the site is located in the St. Mary's River watershed and the northern part of the site is located in the Patuxent River watershed. Stormwater management requirements include providing water quality treatment for the required ESD volume, and water quantity treatment for the increase in runoff in the 10-year and 100-year storm.

Stormwater - Proposed Conditions – Evaluation of ESD Requirements

The required ESD volume is 4,540 cubic feet based on 1.26 acres of proposed impervious cover and a required impervious area requiring treatment (IART) of 0.91 acre and a P_e of 1.80" for new development. Quality treatment will be provided by micro-bioretenion planters.

The surface micro-bioretenion planters located within the parking lot to the east of the building will treat all of the New Development area (0.91 acre). This practice was chosen because the majority of the site will be covered by the proposed building and parking areas. Sheet flow within the parking lot will be routed to these facilities through curb cuts. Rip rap will be installed at these curb cuts for pre-treatment.

See Table 1 for a summary of the water quality treatment provided:

Table 1. ESD Facility Summary

Drainage Area #	SWM Facility #	Drainage Area (Acres)	To Treatment	Target ESDv	Provided ESDv	Target Volume using Structural Practices	Provided Volume with Structural Practices
BMP-1	Micro-Bioretenention A1	0.459	34%	1555 cf	2414 cf	0 cf	0 cf
BMP-2	Micro-Bioretenention A2	0.459	34%	1555 cf	3159 cf	0 cf	0 cf
BMP-3	Micro-Bioretenention A3	0.423	32%	1431 cf	3019 cf	0 cf	0 cf
	Σ	1.341	100%	4540 cf	8592 cf	0 cf	0 cf
Before Structural Practices							
Required Site Area ESD=			4,540 cf				
Provided Site Area ESD=			8,592 cf				
TOTAL PROVIDED P_E :							
PE = (12 X ESDv) / (Rv X A) =			3.41 inches		2.6" MAX; DRAINAGE EXCEEDS		
TOTAL PROVIDED Q_E :							
Q _E = P _E X R _v =			= 2.6 inches x 0.95 =		1.44 inches		
Maximum Allowable Volume (Pe = 2.6")							

Stormwater - Proposed Conditions – Quantity Analysis

Structural Practices Design Volume	
Step 1: Determine total volume treated by ESD devices =	8592 cfs
Step 2: Calculate rainfall captured and treated by ESD devices = $P_E = (12 * ESDv) / (Rv * A) =$	1.91 in
Step 3: Using Table 5-3 in the MDE manual, determine reduced RCN, by inserting the developed % Impervious and the PE achieved	
Imp % =	56%
RCN _{RED} =	70
Step 4: Calculate S and Runoff QE resulting from reduced RCN	
P ₁ =	1.8 IN
S _{RED} = $(1000 / RCN_{RED}) - 10 =$	4.29
Q _{RED} = $(2.7 - 0.2 * S_{RED})^2 / (2.7 + 0.8 * S_{RED}) =$	0.17 in
Step 5: Calculate Volume of Runoff Resulting from reduced RCN	
V _{RED} = $(Q_{RED} * A) / 12 =$	1386 cf
Step 6: Calculate Volume of Runoff resulting from pre-development RCN	
S _{PRE} = $(1000 / RCN_{PRE}) - 10 =$	4.29
Q _{PRE} = $(2.7 - 0.2 * S_{PRE})^2 / (2.7 + 0.8 * S_{PRE}) =$	0.17 in
V _{PRE} = $(Q_{PRE} * A) / 12 =$	1386 cf
Step 7: Calculate additional management required in structural BMPs	
V _{STR} = V _{RED} - V _{PRE} =	0 cf
Volume Provided by Underground Stormtech Facility	
V _{STECH} =	N/A cf

Sediment Control Design

Sediment control will be provided with a combination of silt fence, silt fence on pavement and inlet protection. Silt fence and silt fence on pavement will wrap the construction areas.

REQUIRED ESD_v VOLUME

Project Name: Tidal Wave
Project Number: MDB230016.00
ESD COMPUTATIONS
Step 1 - Determine ESD Requirements

DATE: 1/29/2024
 BY: SL
 CK: MCS

INITIAL SITE ASSESSMENT (SITE DATA):	
SITE AREA	4.44 Acres
LIMIT OF DISTURBANCE	2.25 Acres
EXISTING IMPERVIOUS PERCENTAGE	0.35 = 15.5% Impervious
PROPOSED IMPERVIOUS PERCENTAGE	1.26 = 55.9% Impervious
DEVELOPMENT CATEGORY	New Development
100% IMPERVIOUS AREA TO BE TREATED	0.35 Acres
NEW IMPERVIOUS AREA TO BE TREATED	0.91 Acres
TOTAL IMPERVIOUS AREA TO BE TREATED	1.26 Acres
DRAINAGE AREA WITHIN HYDROLOGIC GROUP "A"	0.00 Acres = 0.0% of LOD
DRAINAGE AREA WITHIN HYDROLOGIC GROUP "B"	0.00 Acres = 0.0% of LOD
DRAINAGE AREA WITHIN HYDROLOGIC GROUP "C"	2.25 Acres = 100.0% of LOD
DRAINAGE AREA WITHIN HYDROLOGIC GROUP "D"	0.00 Acres = 0.0% of LOD
RCN (ASSUMING WOODS GOOD CONDITION)	RCN = 70
NEW DEVELOPMENT REQUIREMENTS	
A = 100% OF EXISTING IMPERVIOUS =	1.26 Acres
$R_v = 0.05 + 0.009 (\% \text{ IMPERVIOUS}) =$	0.55
$P_E \text{ FOR EXISTING IMPERVIOUS} =$	1.80 inches
REQUIRED $Q_E = P_E \times R_v =$	1.00 inches
REQUIRED $ESD_v = (P_E \times R_v \times A) / 12 =$	4540 cf
TOTAL REQUIRED ESD_v:	
$P_E =$	1.80 inches
$ESD_v = ESD_v (\text{Redev}) =$	4540 cf = 0.104 ac-ft

Sub-Drainage Information

Drainage Area #	SWM Facility #	Drainage Area (Acres)	To Treatment	Target ESDv	Provided ESDv	Target Volume using Structural Practices	Provided Volume with Structural Practices
BMP-1	Micro-Bioretenention A1	0.459	34%	1555 cf	2414 cf	0 cf	0 cf
BMP-2	Micro-Bioretenention A2	0.459	34%	1555 cf	3159 cf	0 cf	0 cf
BMP-3	Micro-Bioretenention A3	0.423	32%	1431 cf	3159 cf	0 cf	0 cf
		Σ	100%	4540 cf	8732 cf	0 cf	0 cf

Before Structural Practices	
Required Site Area ESD=	4,540 cf
Provided Site Area ESD=	8,732 cf
TOTAL PROVIDED P_E:	
$PE = (12 \times ESD_v) / (R_v \times A) =$	3.46 inches
TOTAL PROVIDED Q_E:	
$Q_E = P_E \times R_v =$	1.44 inches
= 2.6 inches x 0.95 =	
Maximum Allowable Volume ($PE = 2.6"$)	

2.6" MAX; DRAINAGE EXCEEDS

MICRO-BIORETENTION DESIGN CALCULATIONS

Step 2 - ESD Design

PROP. BMP A1

Use of Micro-Bioretentation (M-6)

Drainage Area (acres) **0.459 20000** SF
 Proposed Impervious Area **0.459 20000** SF
 Percent Impervious **100.0%**
 Rv **0.950**
 Target ESDv = **1438 CF**

1) WQ Foundation Micro Bio-retention Facility Characteristics

Df = Depth of filter bed and sand layer = **2.00 FT**
 k = Coefficient of permeability = **0.40 FT/DAY**
 Dp = Ponding depth = **1.000 FT**
 Tf = Design filter bed drain time = **3 DAYS**

BIO-RETENTION DIMENSIONS

Af = Surface area of filter bed = **480 SF**

2) Required Surface Area for Filter Bed 0

Af (MIN) = 2% of Total Drainage Area (A) = **400 SF**

480 SF > **400 SF**

3) ESDv Provided

Volume Above Filter Bed

Af = Surface area of filter bed = **480 SF**
 Aw = Area at water surface elevation = **1550 SF**
 Dp = Ponding depth = **2.00 FT**
 Volume = [(Aw+Af)/2]*Dp = **2030 CF**

Volume in Filter Media

Af = Surface area of filter bed = **480 SF**
 Df = Depth of filter bed = **2.00 FT**
 Volume = Af*Df*0.4 = **384 CF**

Volume Provided **2030 CF** + **384 CF** = **2414 CF**

Maximum Allowable Volume (Pe = 2.6")
 ESDv = (Pe*Rv*A)/12 = = **4117 CF**
 USE CALCULATED VOLUME

TOTAL ESDv PROVIDED: = **2414 CF**

TOTAL PE PROVIDED: **1.52 inches**

TOTAL PERFORATED PVC UNDERDRAIN REQUIRED = 5% OF Af: = **24.0 FT**

TOTAL PERFORATED PVC UNDERDRAIN PROVIDED: = **63.0 FT**

Step 2 - ESD Design

PROP. BMP A2

Use of Micro-Bioretentation (M-6)

Drainage Area (acres) 0.459 20000 SF
Proposed Impervious Area 0.352 15313 SF
Percent Impervious 76.6%
Rv 0.739

Target ESDv = 1438 CF

1) WQ Foundation Planter Facility Characteristics

Df = Depth of filter bed and sand layer = 2.00 FT
k = Coefficient of permeability = 0.40 FT/DAY
Dp = Ponding depth = 1.00 FT
Tf = Design filter bed drain time = 3 DAYS

BIO-RETENTION DIMENSIONS

Af = Surface area of filter bed = 1066 SF

2) Required Surface Area for Filter Bed

Af (MIN) = 2% of Total Drainage Area (A) = 400 SF

1066 SF > 400 SF

3) ESDv Provided

Volume Above Filter Bed

Af = Surface area of filter bed = 1066 SF
Aw = Area at water surface elevation = 2009 SF
Dp = Ponding depth = 1.500 FT
Volume = [(Aw+Af)/2]*Dp = 2306 CF

Volume in Filter Media

Af = Surface area of filter bed = 1066 SF
Df = Depth of filter bed = 2.00 FT
Volume = Aw*Df*0.4 = 853 CF

Volume Provided 2306 CF + 853 CF = 3159 CF

Maximum Allowable Volume (Pe = 2.6")

ESDv = (Pe*Rv*A)/12 = 3202 CF
USE CALCULATED VOLUME

TOTAL ESDv PROVIDED:

3159 CF

TOTAL PE PROVIDED:

2.56 inches

TOTAL PERFORATED PVC UNDERDRAIN REQUIRED = 5% OF Af:

53.3 FT

TOTAL PERFORATED PVC UNDERDRAIN PROVIDED:

47.0 FT

Step 2 - ESD Design

PROP. BMP A3

Use of Micro-Bioretenion (M-6)

Drainage Area (acres) 0.423 18407 SF
Proposed Impervious Area 0.332 14465 SF
Percent Impervious 78.6%
Rv 0.757

Target ESDv = 1438 CF

1) WQ Foundation Planter Facility Characteristics

Df = Depth of filter bed and sand layer = 2.00 FT
k = Coefficient of permeability = 0.40 FT/DAY
Dp = Ponding depth = 1.00 FT
Tf = Design filter bed drain time = 3 DAYS

BIO-RETENTION DIMENSIONS

Af = Surface area of filter bed = 1076 SF

2) Required Surface Area for Filter Bed

Af (MIN) = 2% of Total Drainage Area (A) = 368 SF

1076 SF > 368 SF

3) ESDv Provided

Volume Above Filter Bed

Af = Surface area of filter bed = 1076 SF
Aw = Area at water surface elevation = 2010 SF
Dp = Ponding depth = 1.00 FT
Volume = [(Aw+Af)/2]*Dp = 1543 CF

Volume in Filter Media

Af = Surface area of filter bed = 1076 SF
Df = Depth of filter bed = 2.00 FT
Volume = Aw*Df*0.4 = 861 CF

Volume Provided 1543 CF + 861 CF = 2404 CF

Maximum Allowable Volume (Pe = 2.6")

ESDv = (Pe*Rv*A)/12 = 3019 CF
USE CALCULATED VOLUME

TOTAL ESDv PROVIDED:

= 2404 CF

TOTAL PE PROVIDED:

2.07 inches

TOTAL PERFORATED PVC UNDERDRAIN REQUIRED = 5% OF Af:

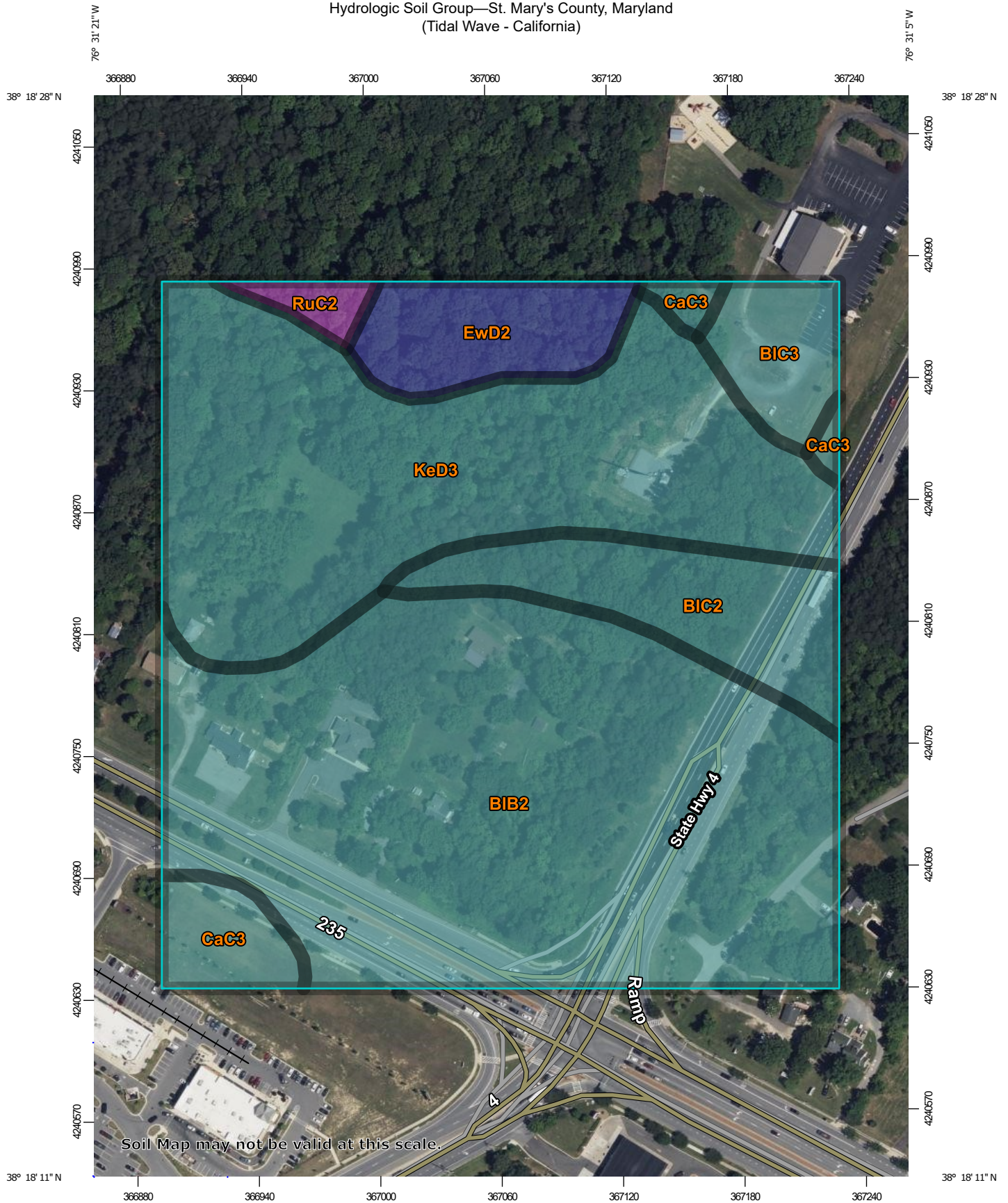
= 53.8 FT

TOTAL PERFORATED PVC UNDERDRAIN PROVIDED:

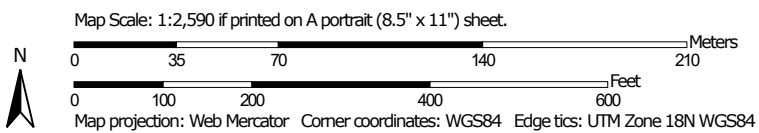
= 46.0 FT

SOILS MAP

Hydrologic Soil Group—St. Mary's County, Maryland
(Tidal Wave - California)




Soil Map may not be valid at this scale.



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





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

Soil Rating Lines


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

Soil Rating Points






 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available


Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: St. Mary's County, Maryland
 Survey Area Data: Version 19, Sep 14, 2022

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

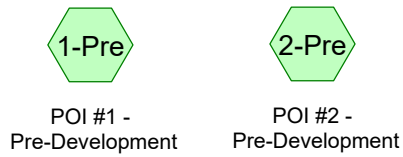
Date(s) aerial images were photographed: May 29, 2022—May 31, 2022

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

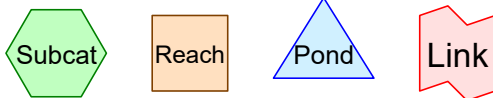
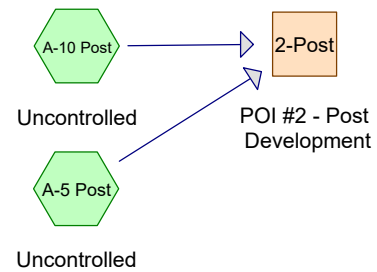
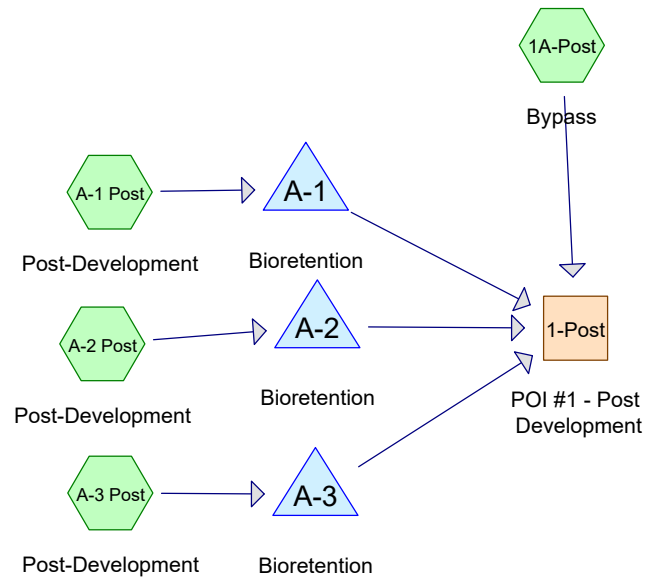
Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BIB2	Beltsville silt loam, 2 to 5 percent slopes, moderately eroded	C	13.5	46.8%
BIC2	Beltsville silt loam, 5 to 10 percent slopes moderately eroded	C	2.4	8.2%
BIC3	Beltsville silt loam, 5 to 10 percent slopes, severely eroded	C	1.1	3.7%
CaC3	Caroline silt loam, 5 to 10 percent slopes, severely eroded	C	1.1	3.7%
EwD2	Evesboro-Westphalia complex, 12 to 20 percent slopes, moderately eroded	B	1.6	5.6%
KeD3	Kempsville fine sandy loam, 10 to 15 percent slopes, severely eroded	C	8.9	31.0%
RuC2	Rumford loamy sand, 5 to 10 percent slopes, moderately eroded	A	0.3	1.1%
Totals for Area of Interest			28.9	100.0%

PRE-DEVELOPMENT



POST-DEVELOPMENT



Routing Diagram for Tidal Wave St. Mary's County - MDB230016.00

Prepared by Bohler Engineers, Printed 3/19/2024

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Tidal Wave St. Mary's County - MDB230016.00

Prepared by Bohler Engineers

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Printed 3/19/2024

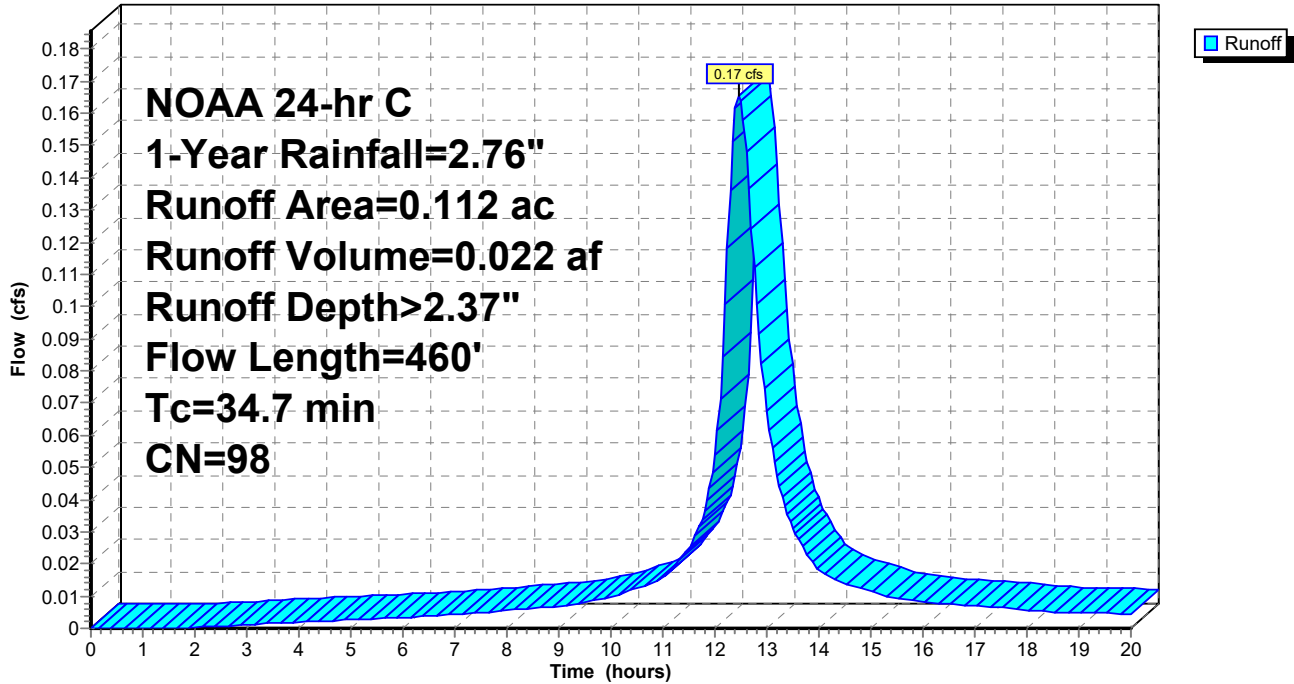
Page 1

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-Year	NOAA 24-hr	C	Default	24.00	1	2.76	2
2	10-Year	NOAA 24-hr	C	Default	24.00	1	5.24	2
3	100-Year	NOAA 24-hr	C	Default	24.00	1	9.02	2

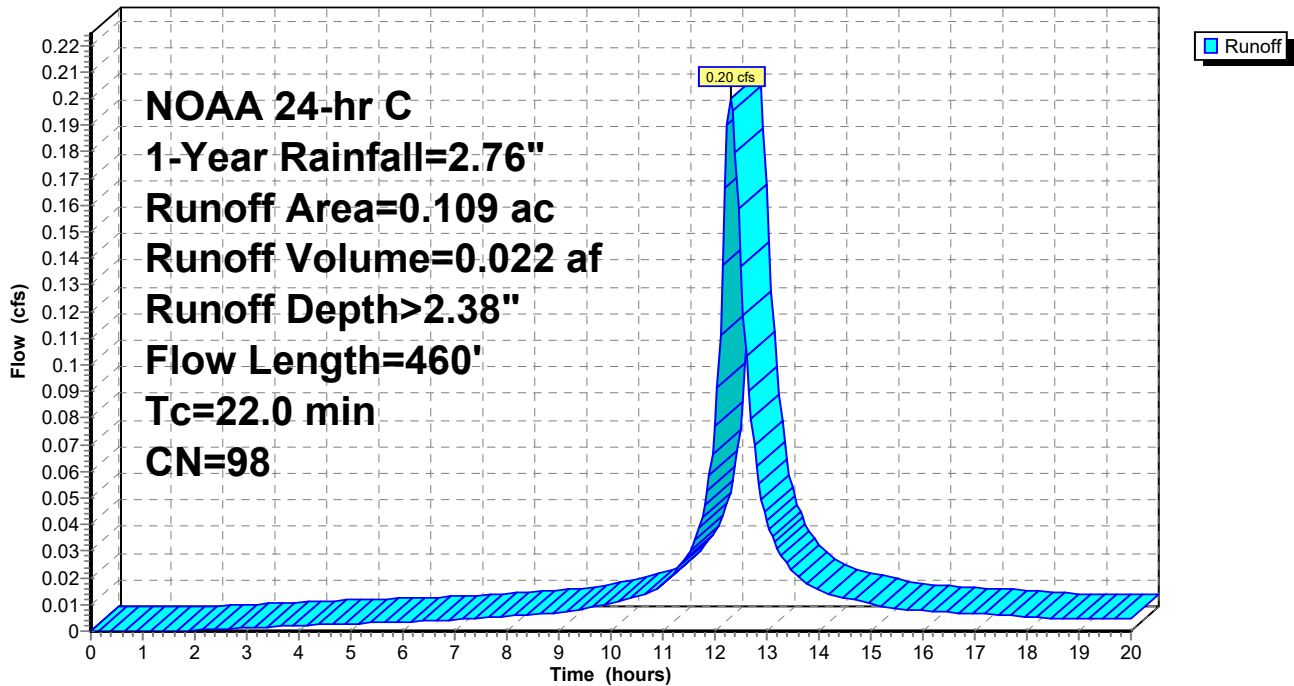
Subcatchment 1-Pre: POI #1 - Pre-Development

Hydrograph

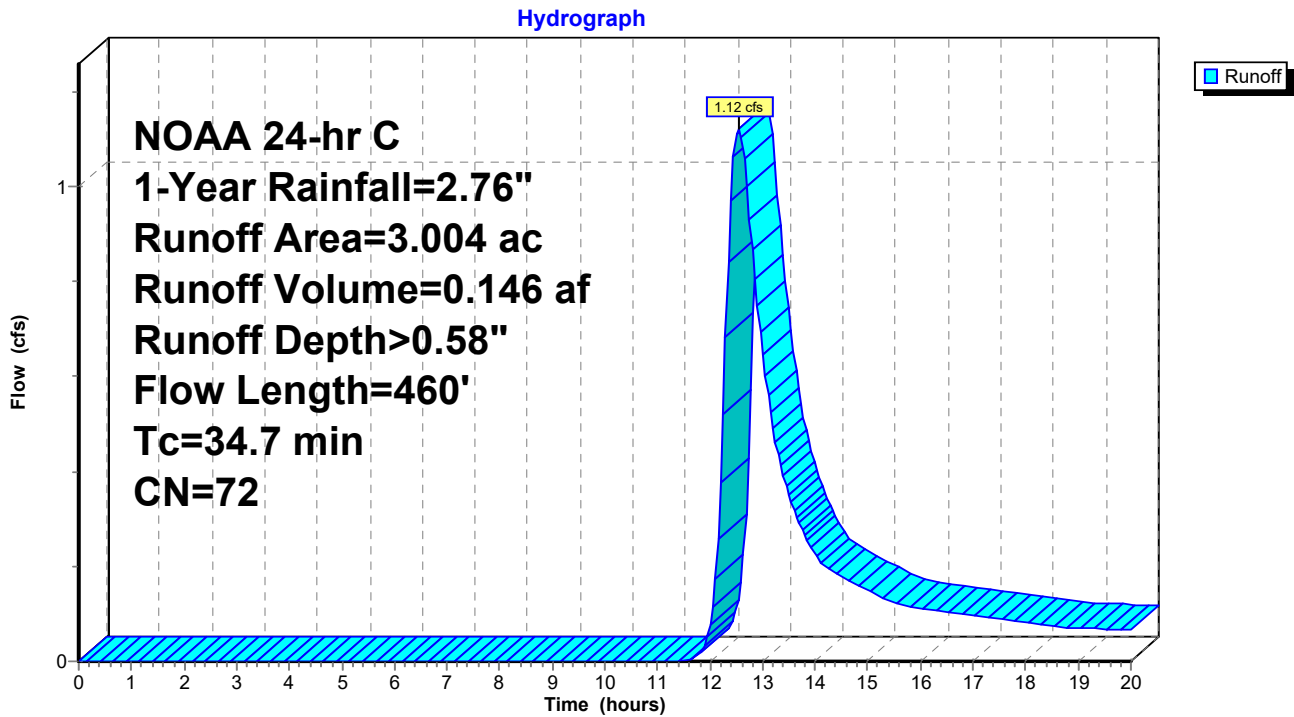


Subcatchment 1A-Post: Bypass

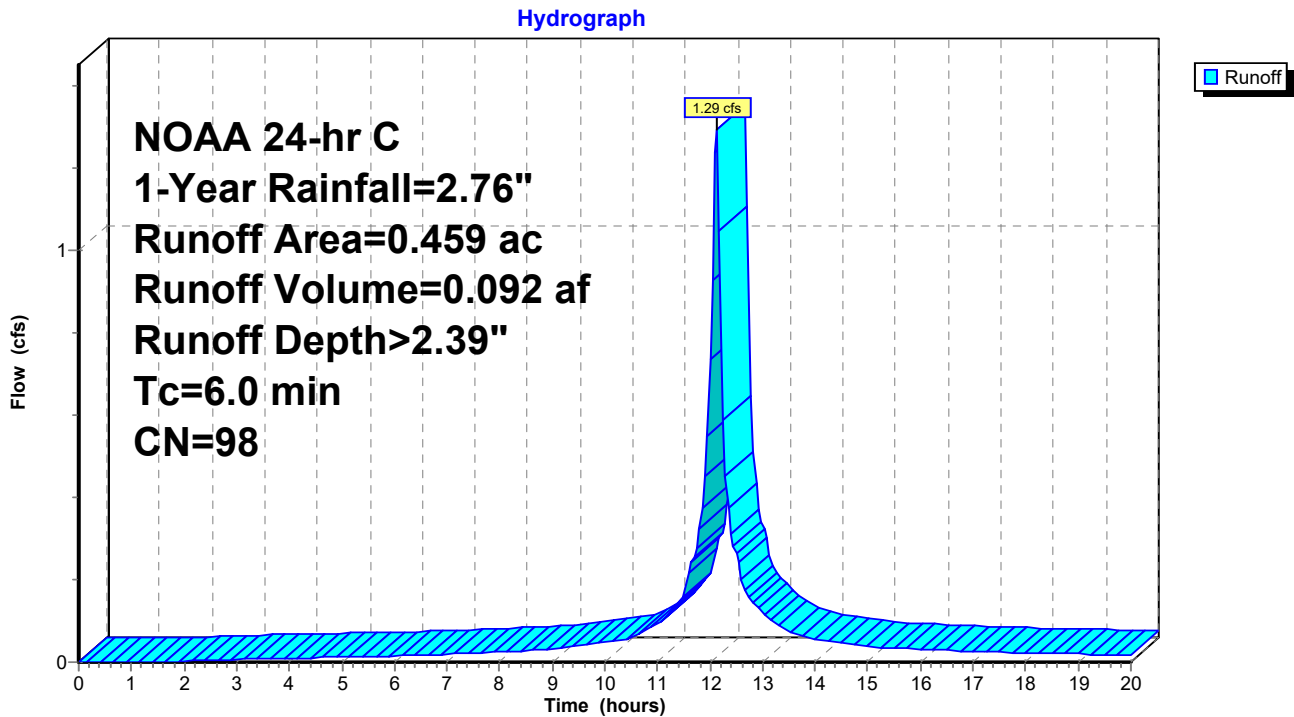
Hydrograph



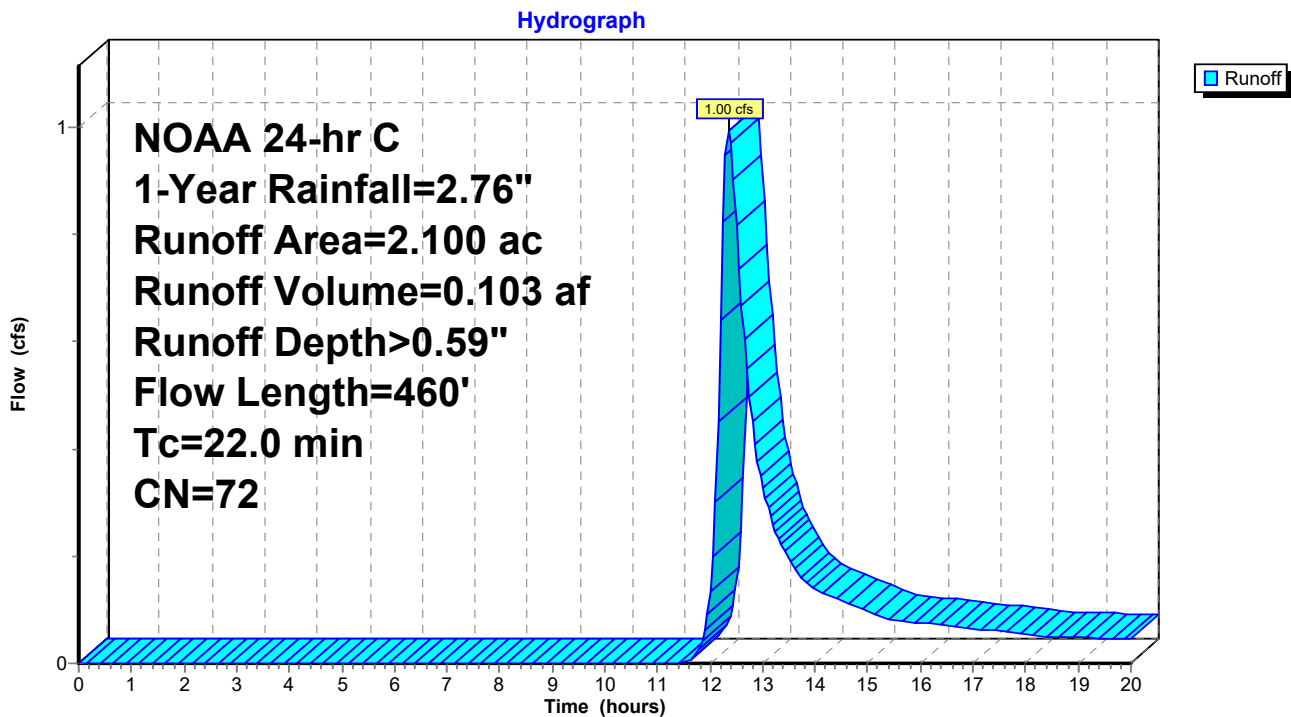
Subcatchment 2-Pre: POI #2 - Pre-Development



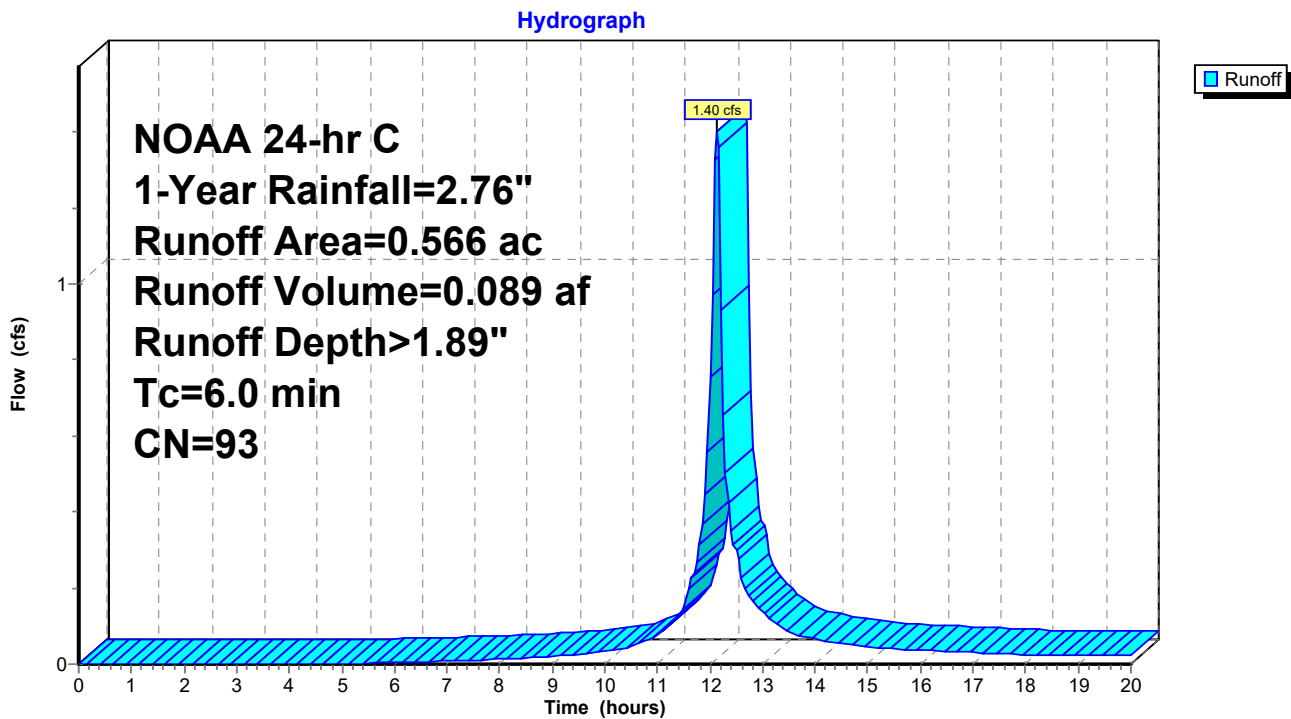
Subcatchment A-1 Post: Post-Development



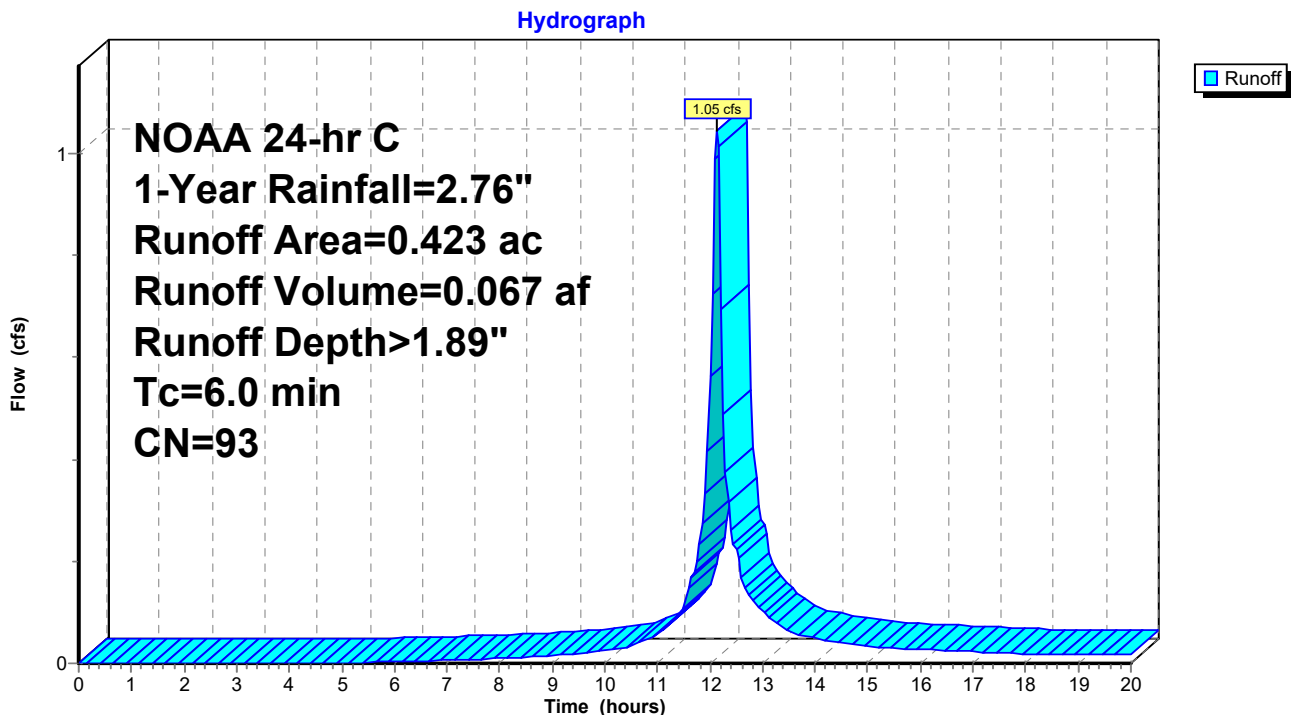
Subcatchment A-10 Post: Uncontrolled



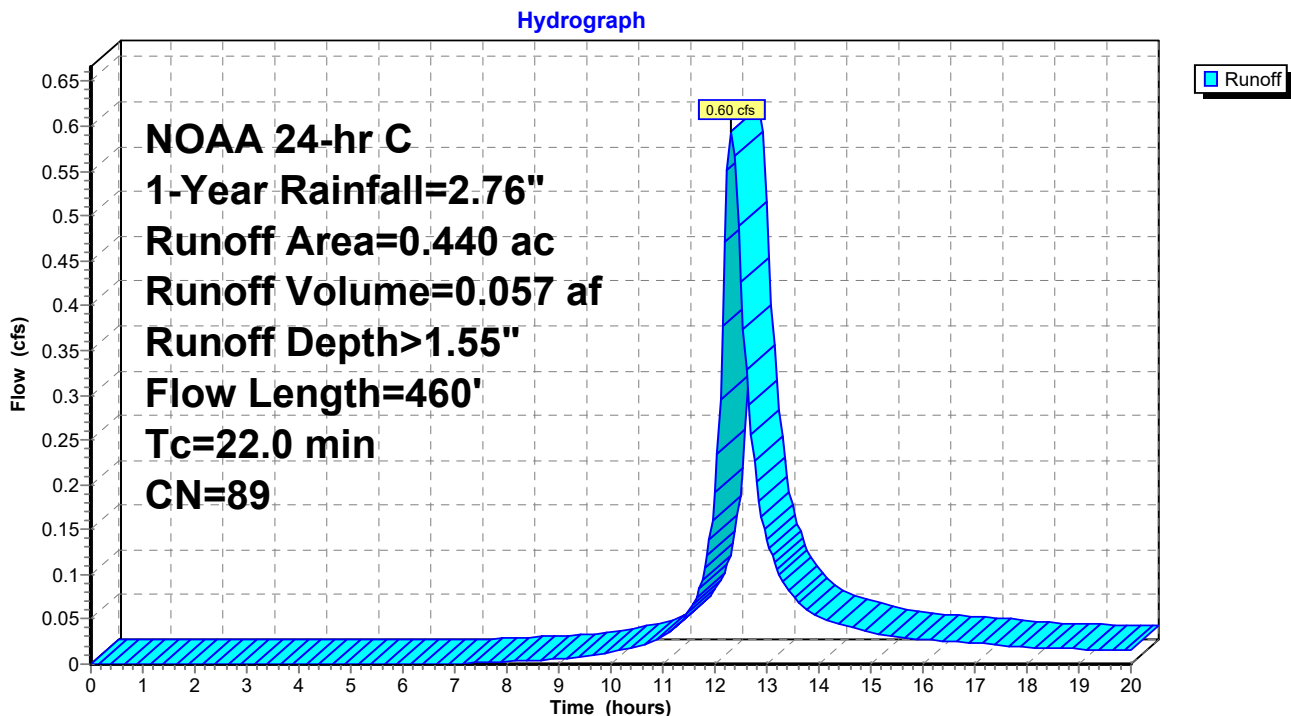
Subcatchment A-2 Post: Post-Development



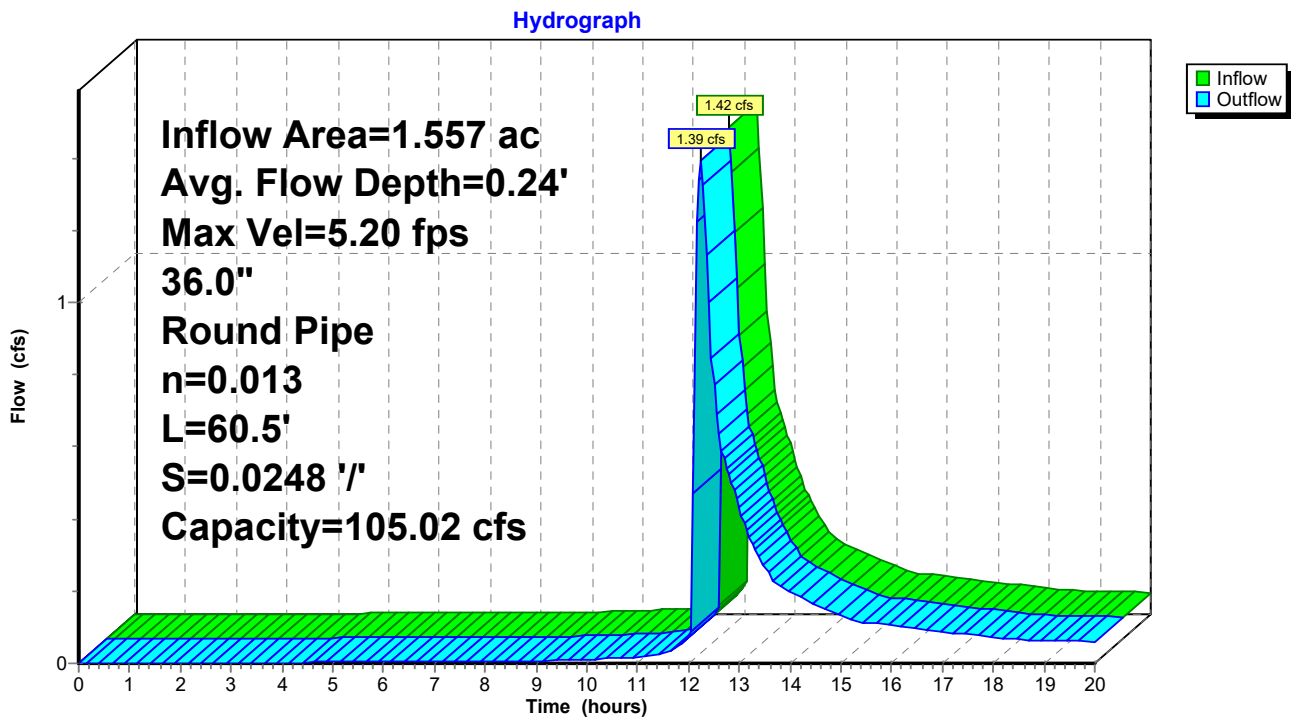
Subcatchment A-3 Post: Post-Development



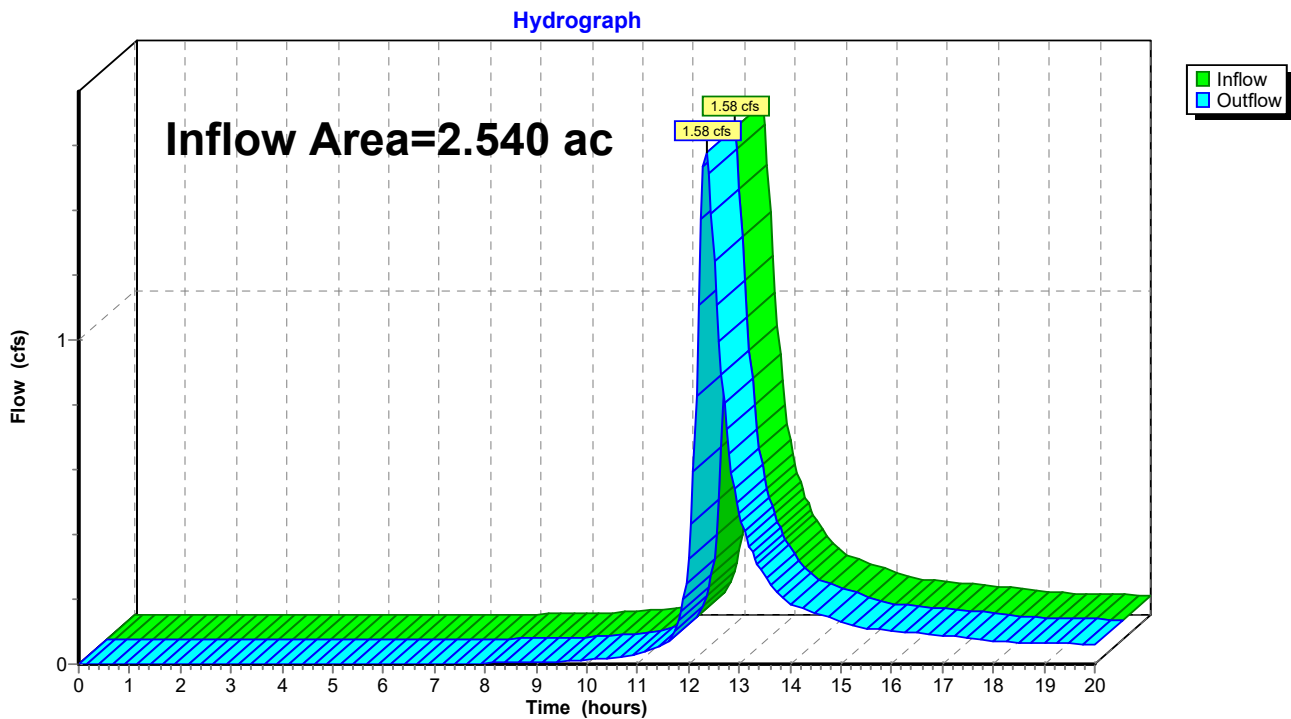
Subcatchment A-5 Post: Uncontrolled



Reach 1-Post: POI #1 - Post Development

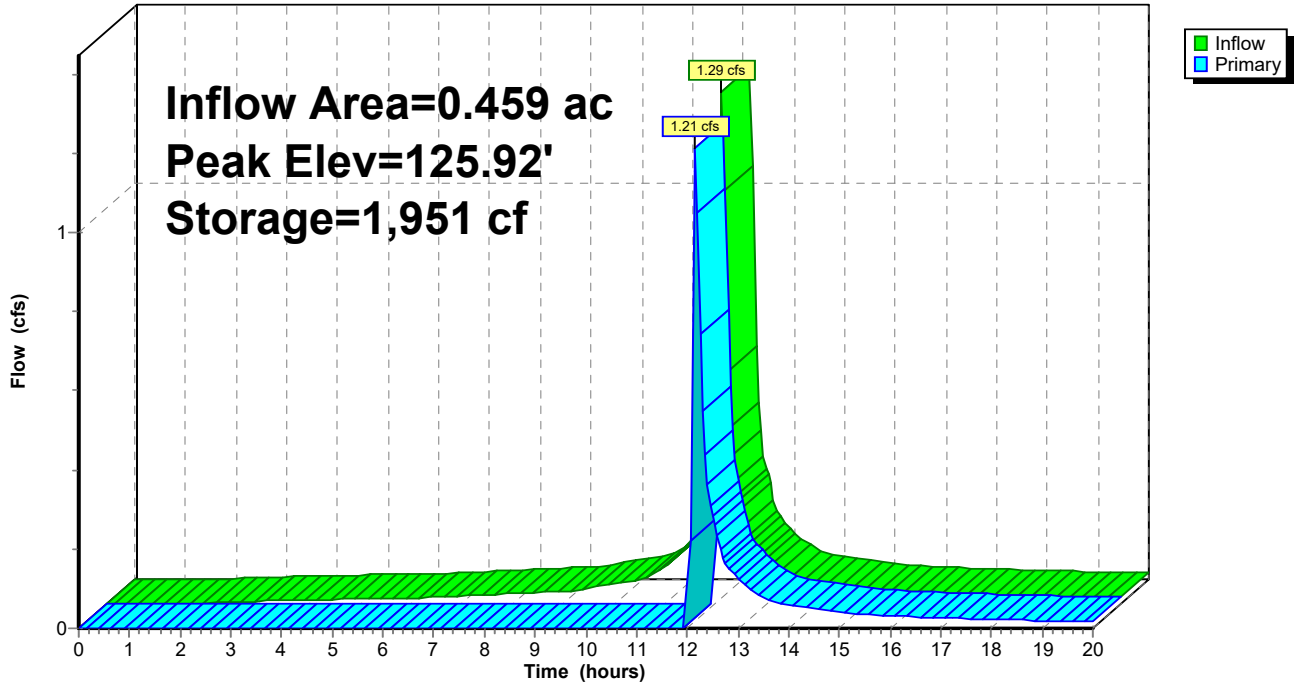


Reach 2-Post: POI #2 - Post Development



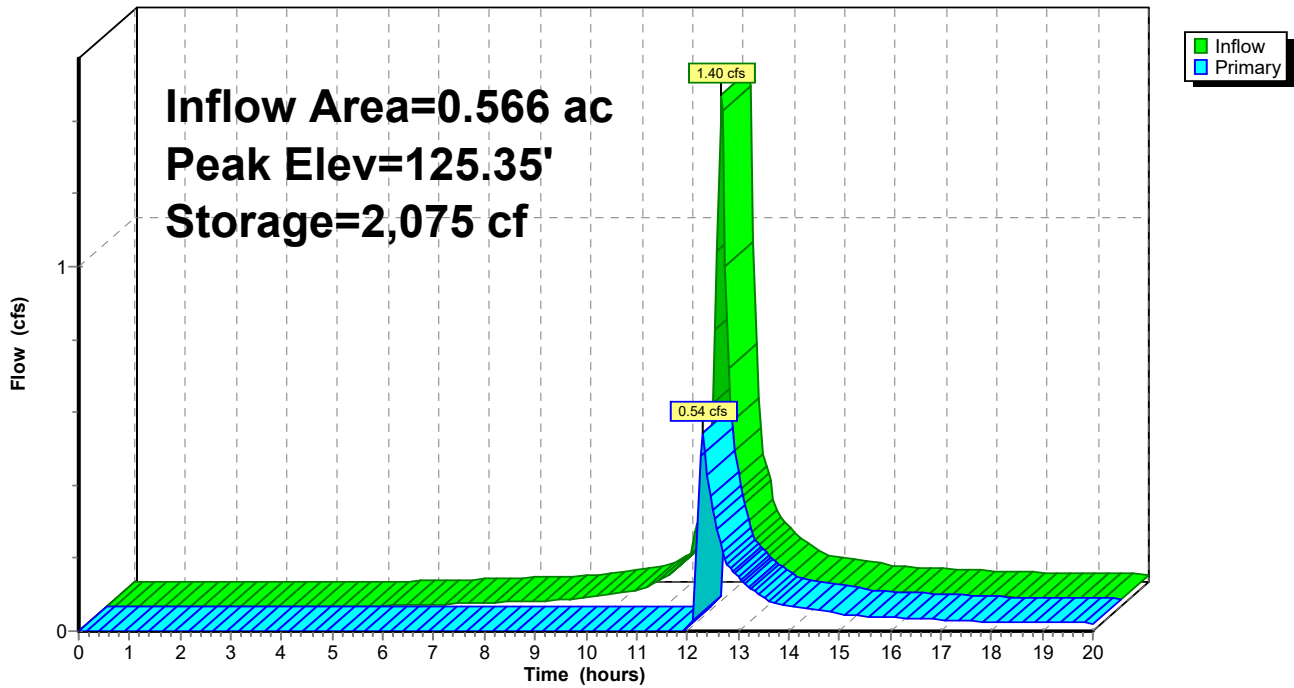
Pond A-1: Bioretention

Hydrograph



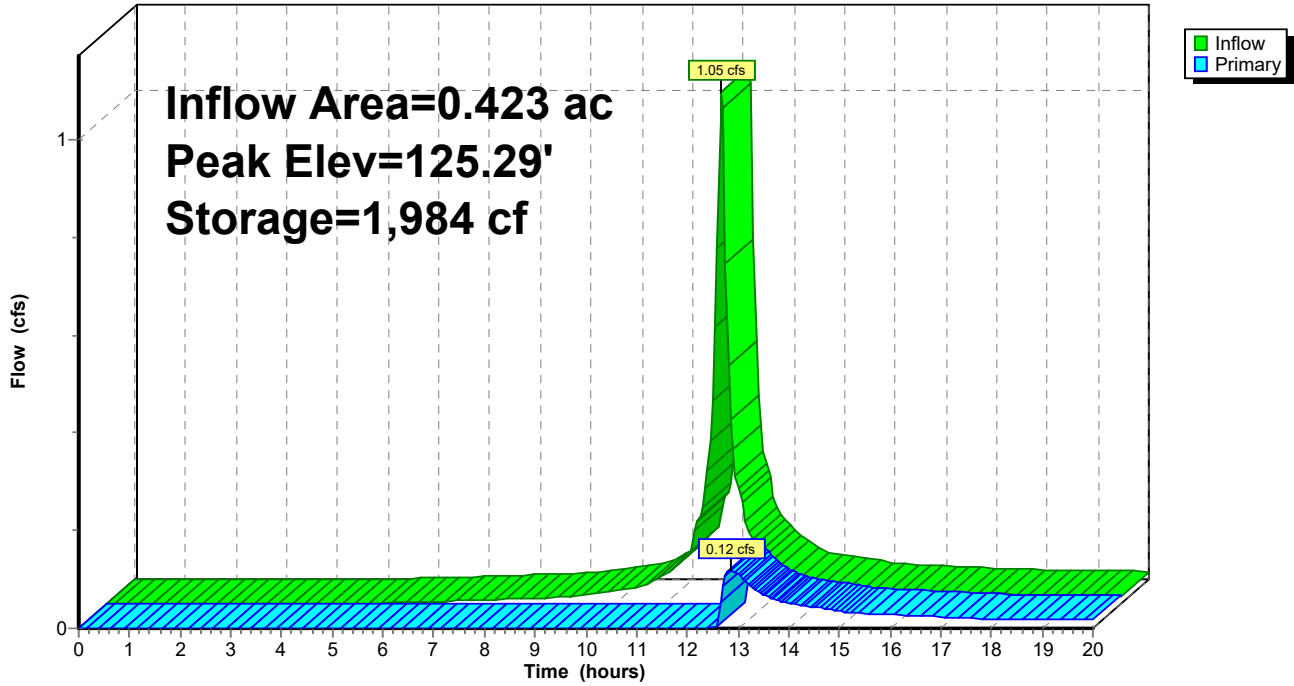
Pond A-2: Bioretention

Hydrograph



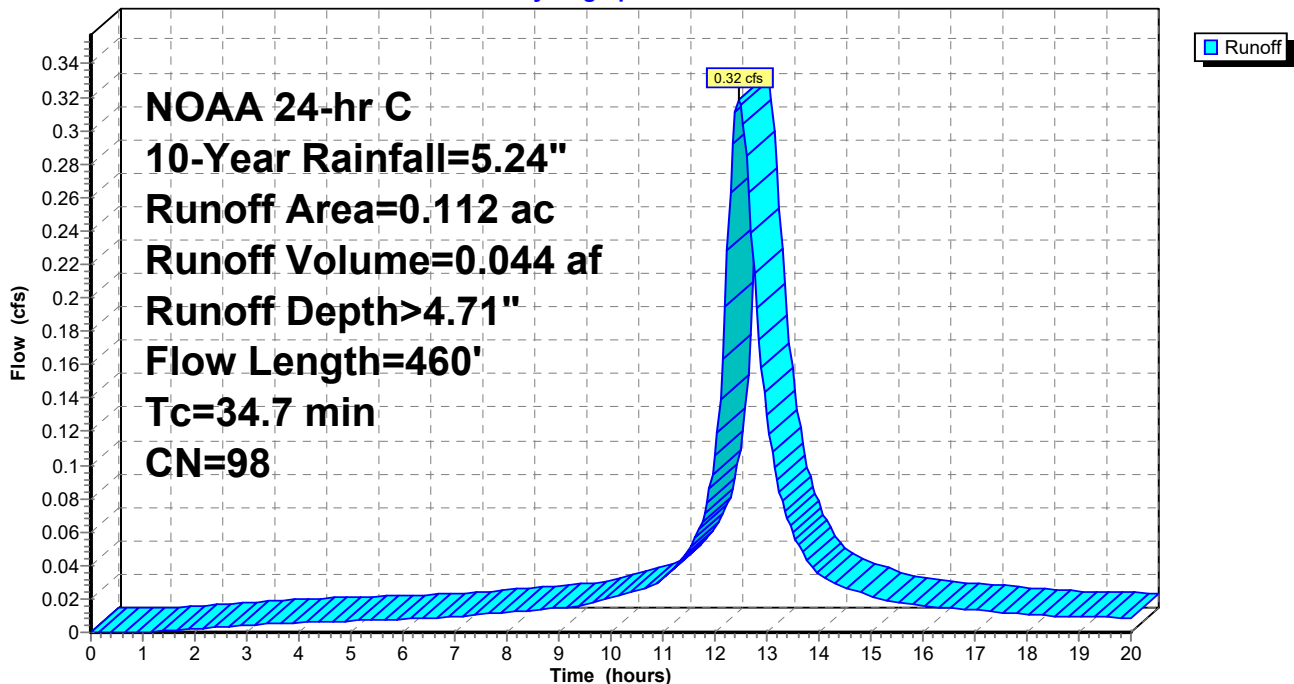
Pond A-3: Bioretention

Hydrograph



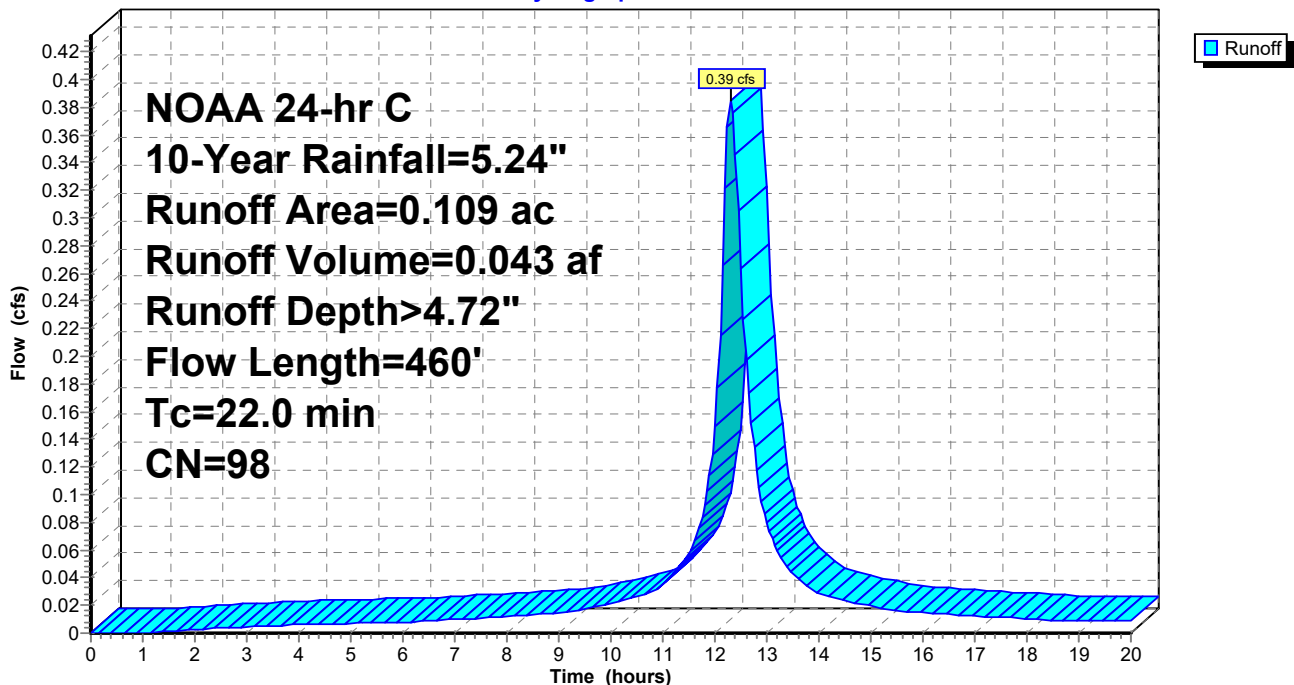
Subcatchment 1-Pre: POI #1 - Pre-Development

Hydrograph

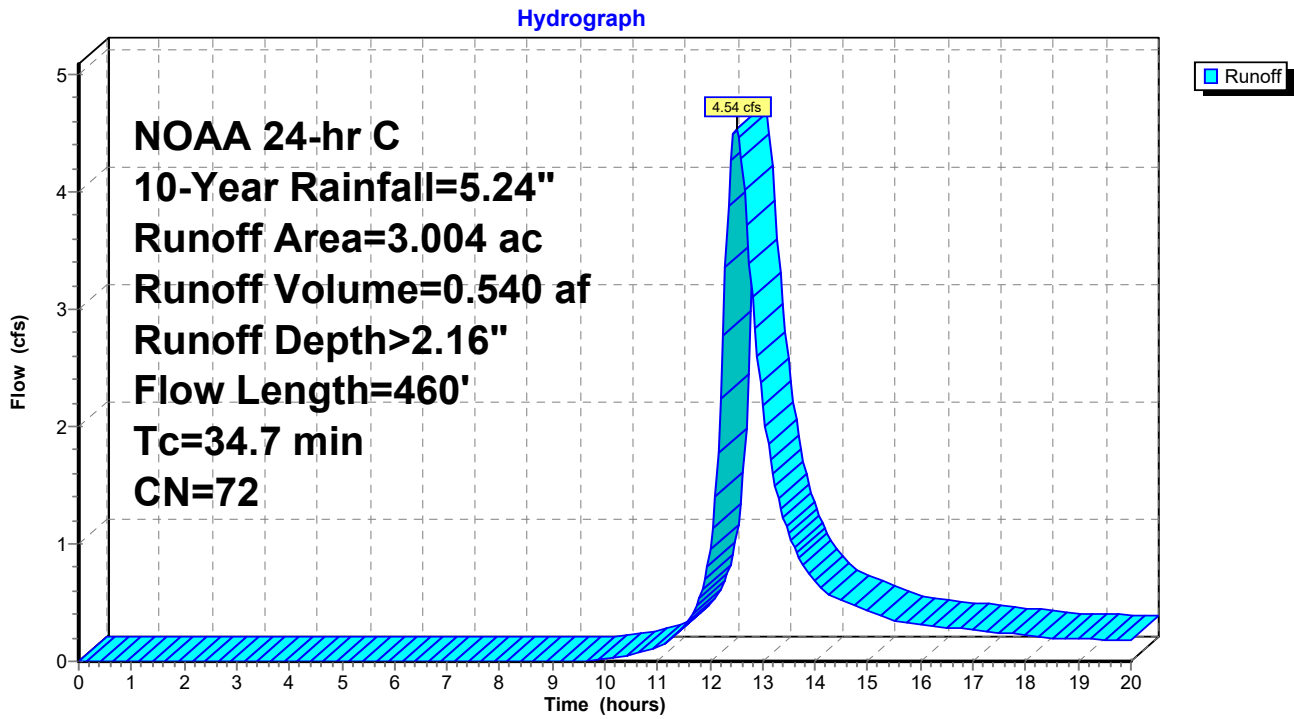


Subcatchment 1A-Post: Bypass

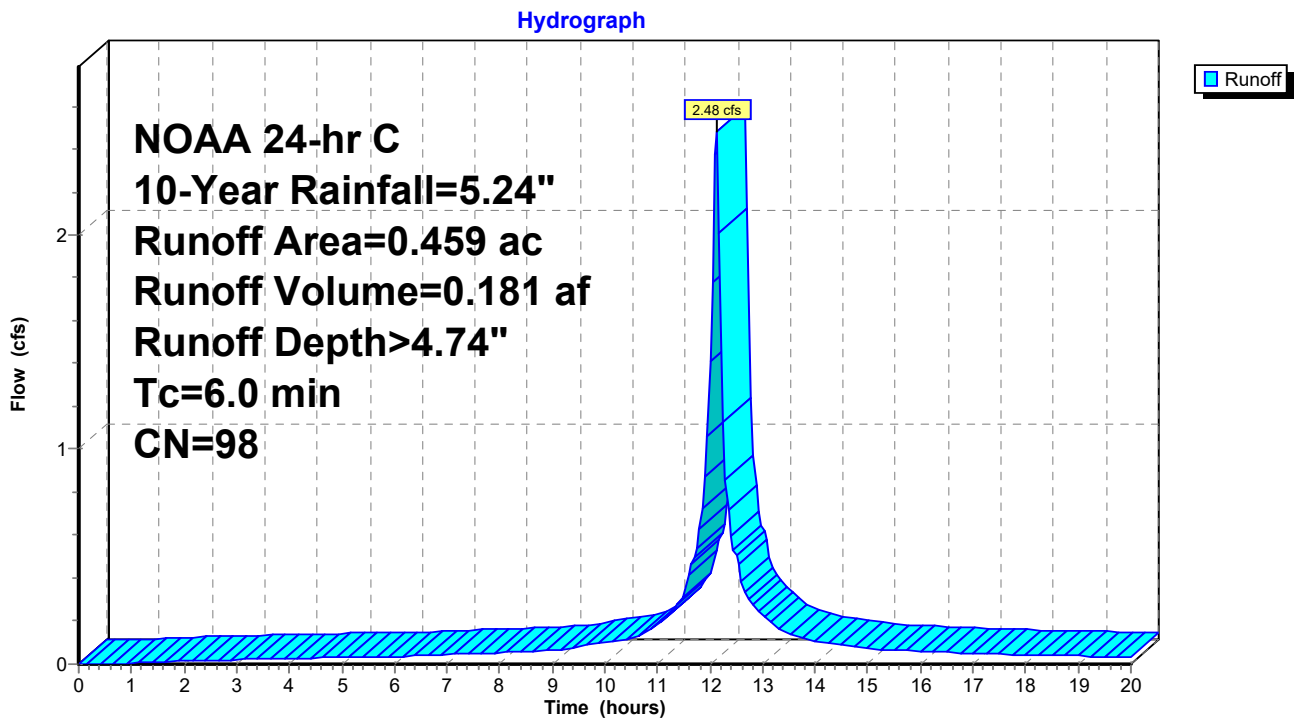
Hydrograph



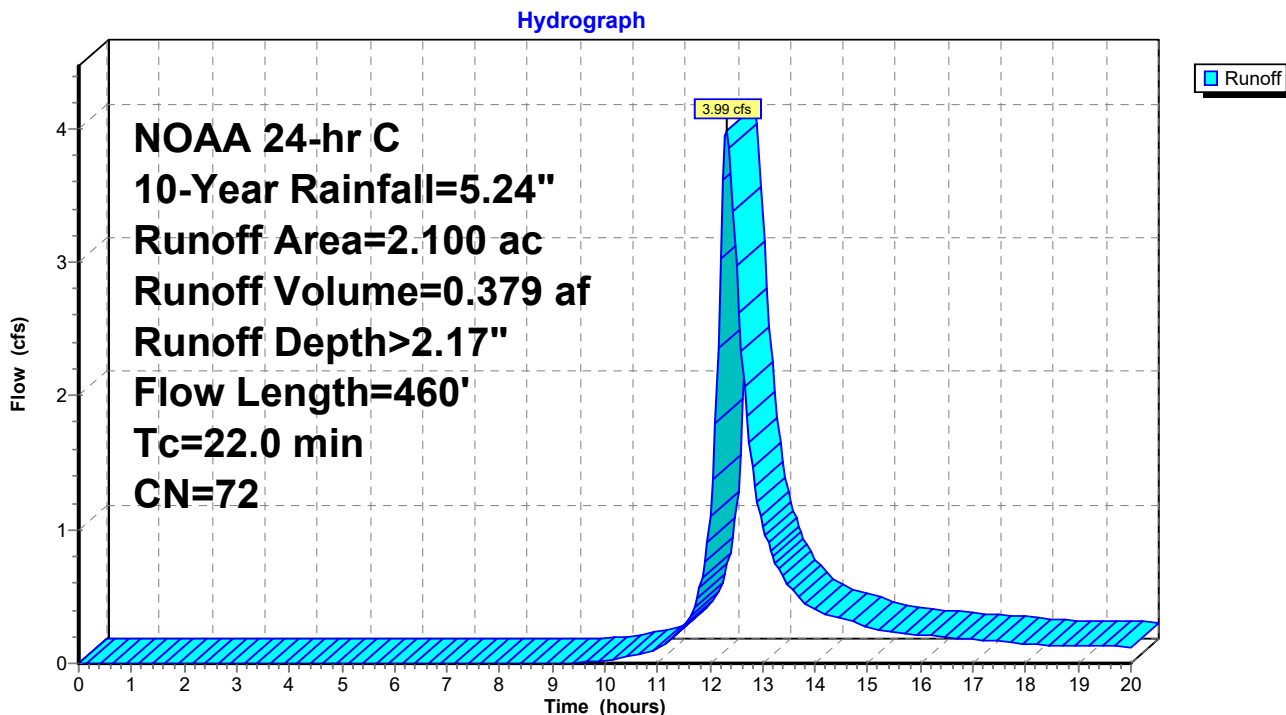
Subcatchment 2-Pre: POI #2 - Pre-Development



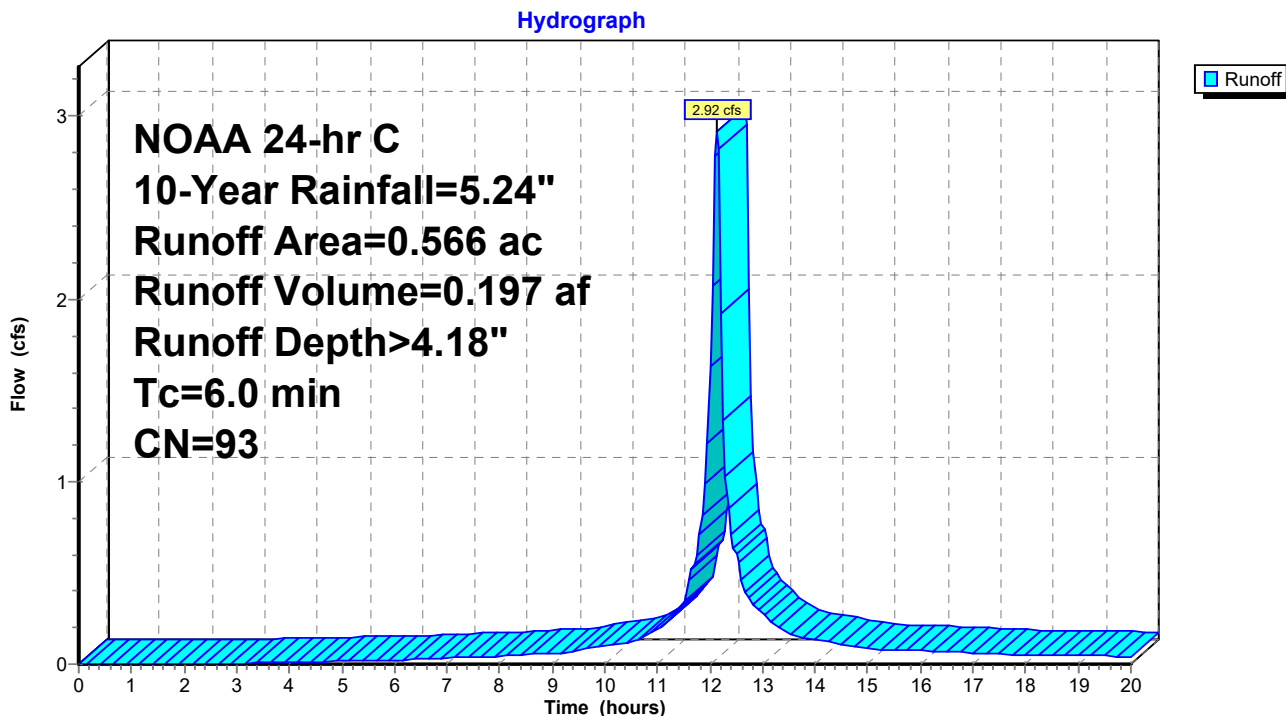
Subcatchment A-1 Post: Post-Development



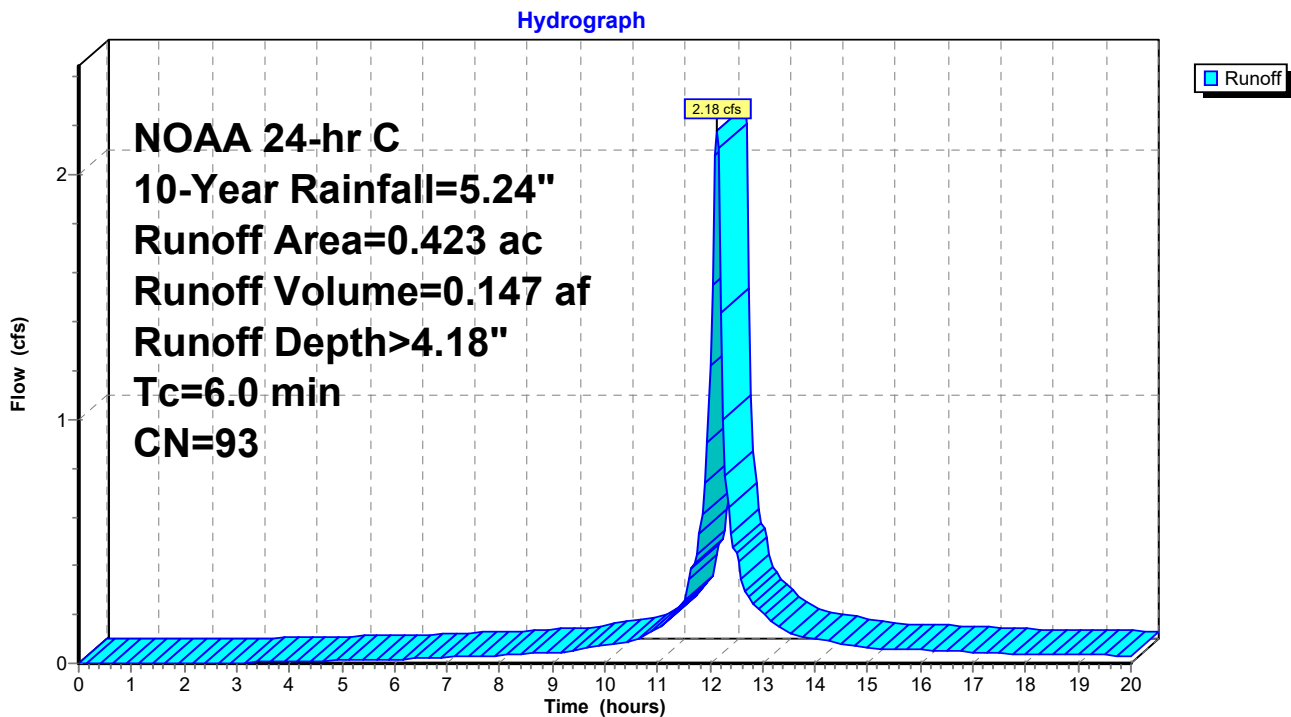
Subcatchment A-10 Post: Uncontrolled



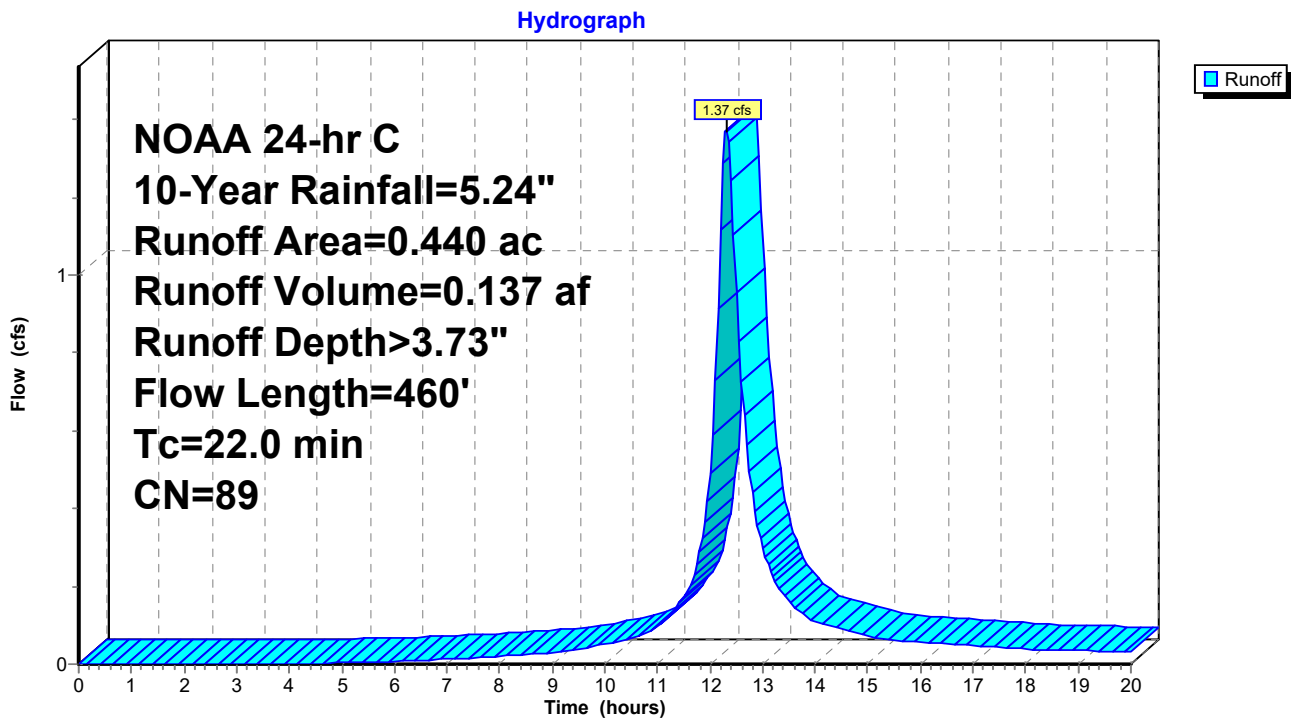
Subcatchment A-2 Post: Post-Development



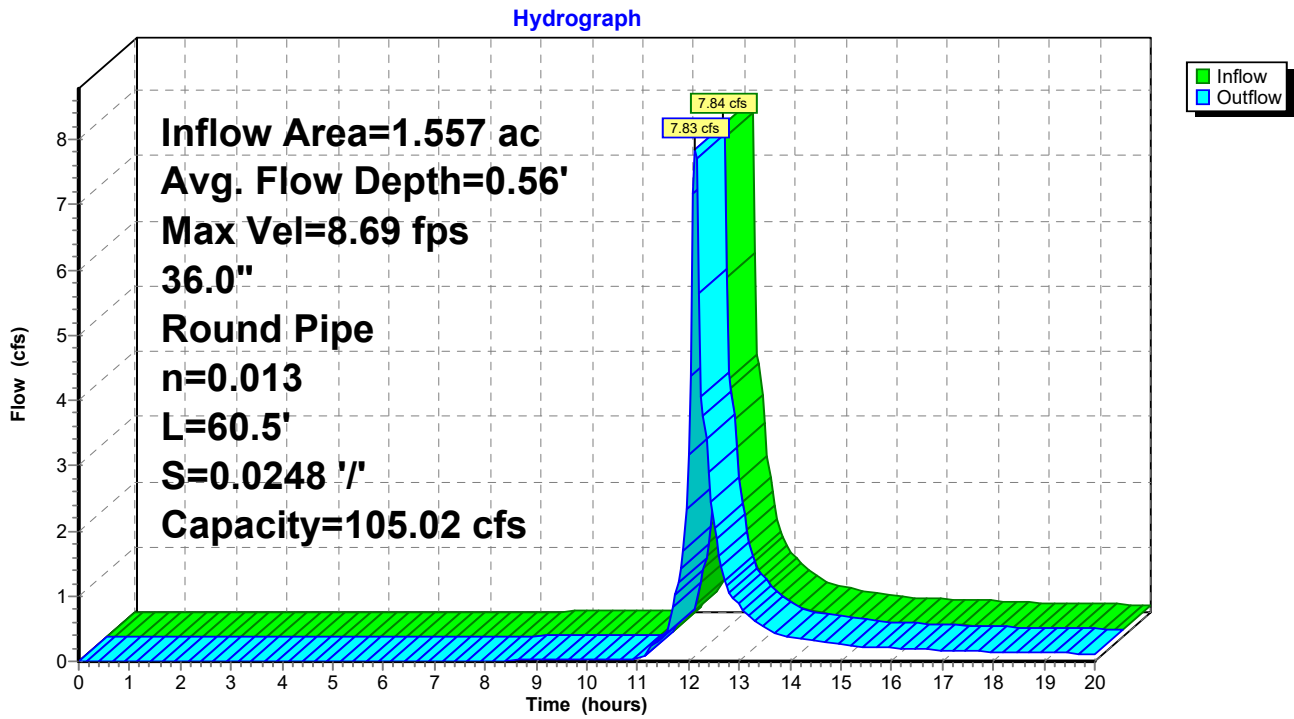
Subcatchment A-3 Post: Post-Development



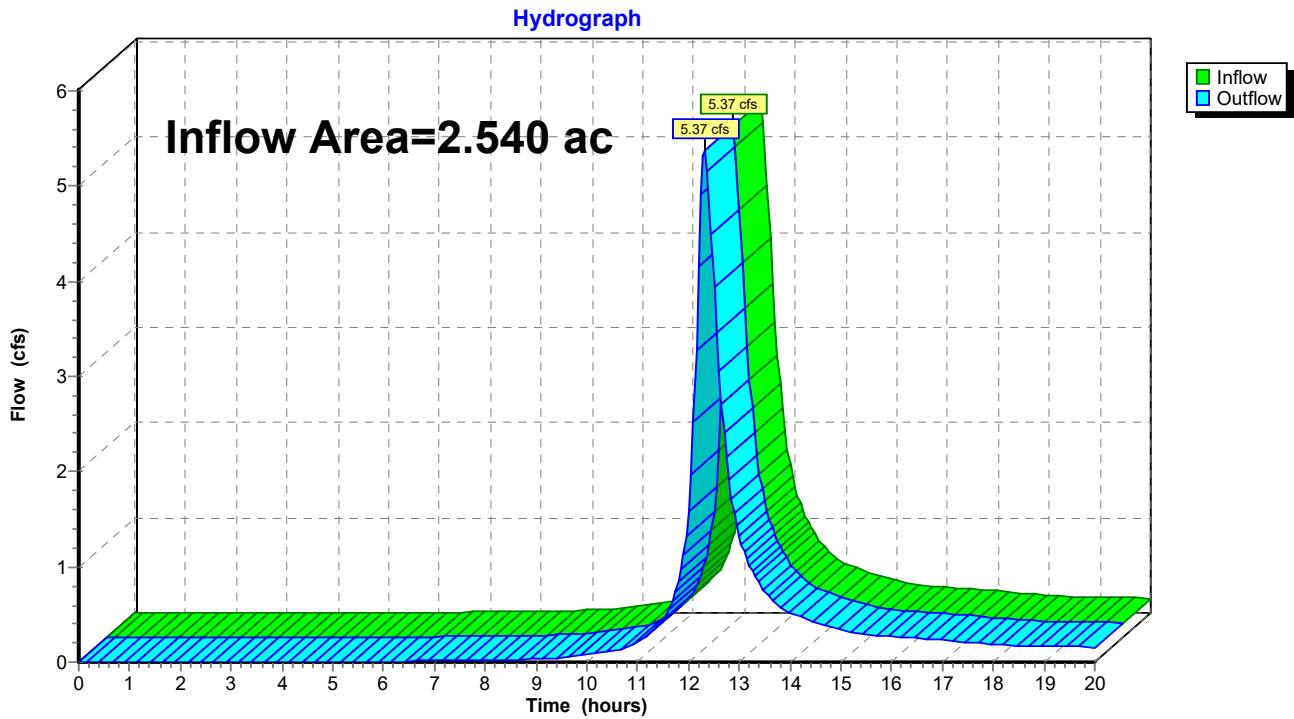
Subcatchment A-5 Post: Uncontrolled



Reach 1-Post: POI #1 - Post Development

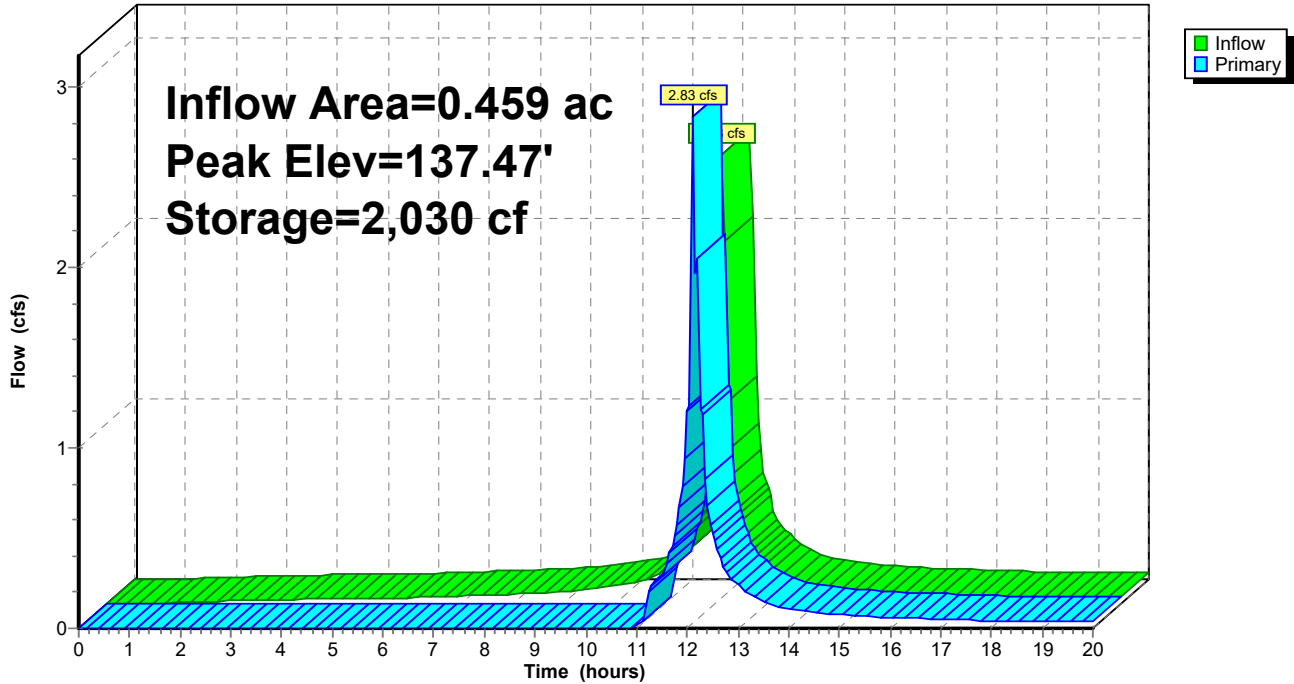


Reach 2-Post: POI #2 - Post Development



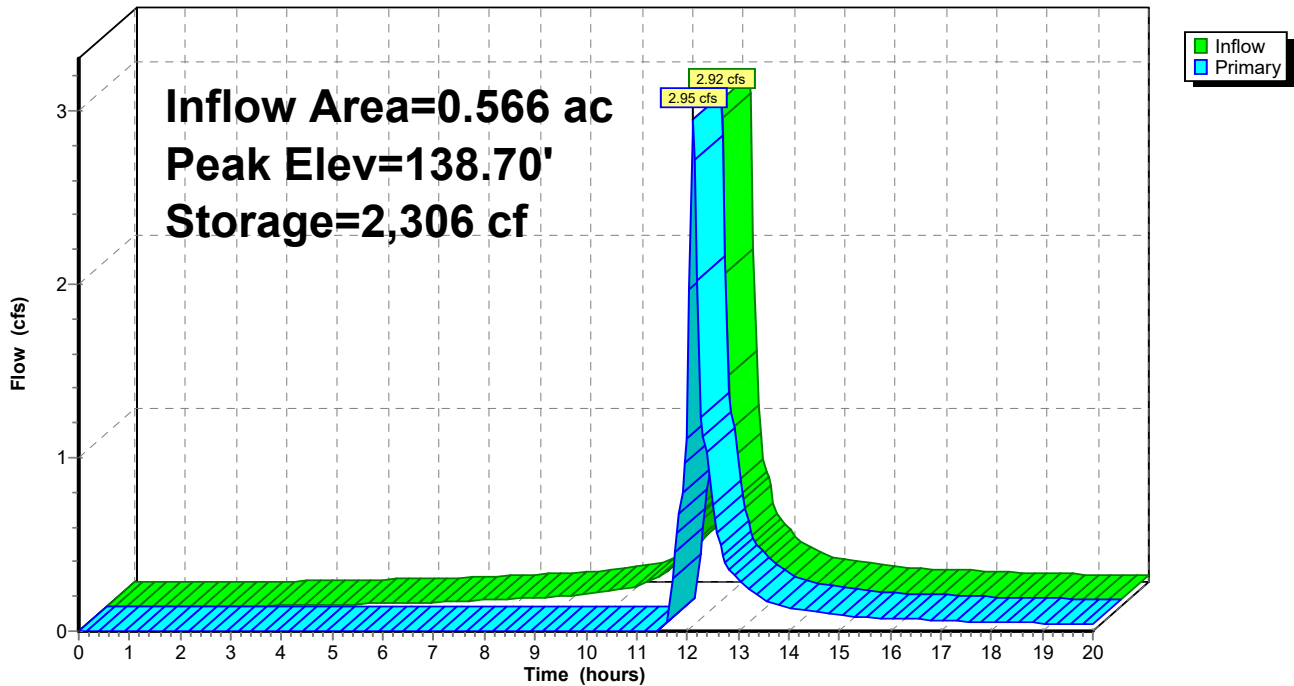
Pond A-1: Bioretention

Hydrograph



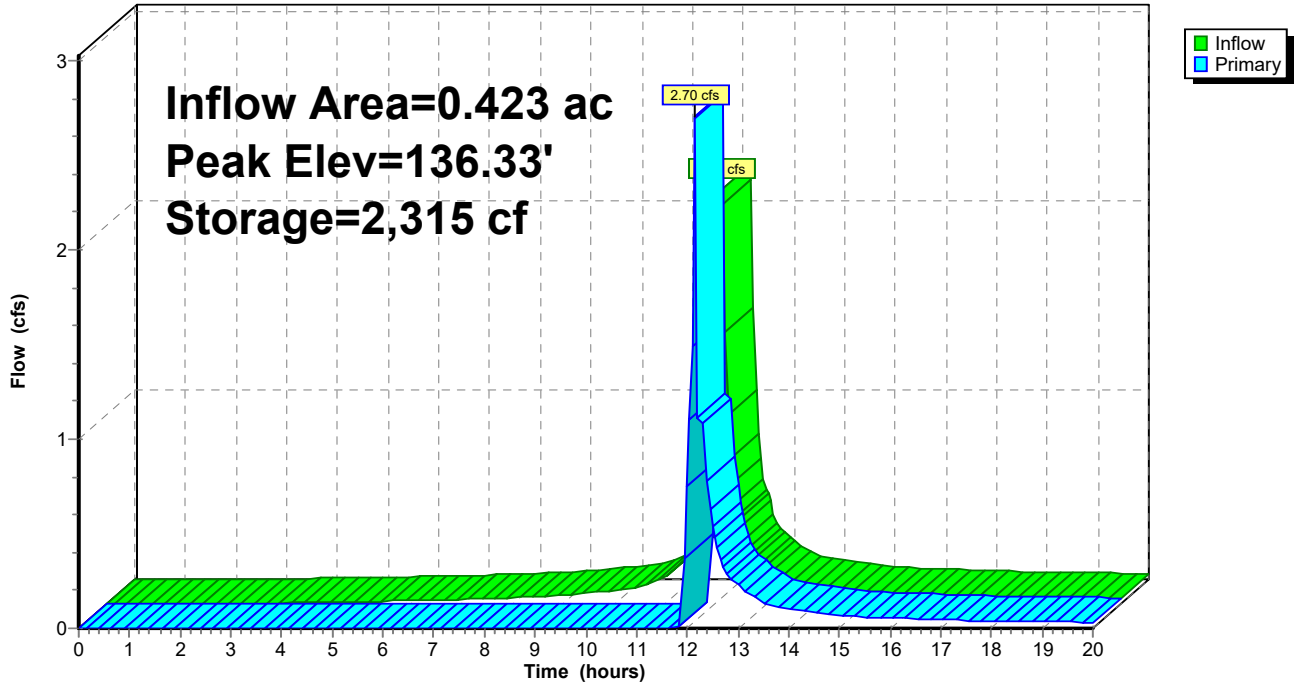
Pond A-2: Bioretention

Hydrograph



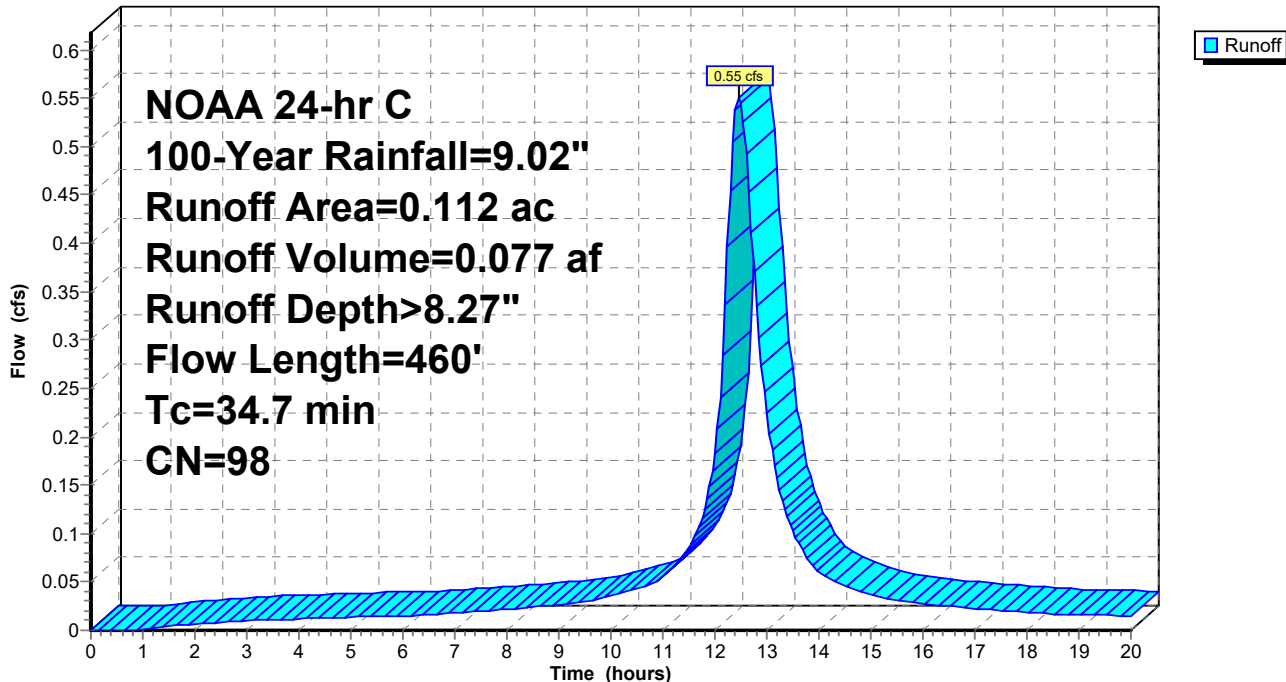
Pond A-3: Bioretention

Hydrograph



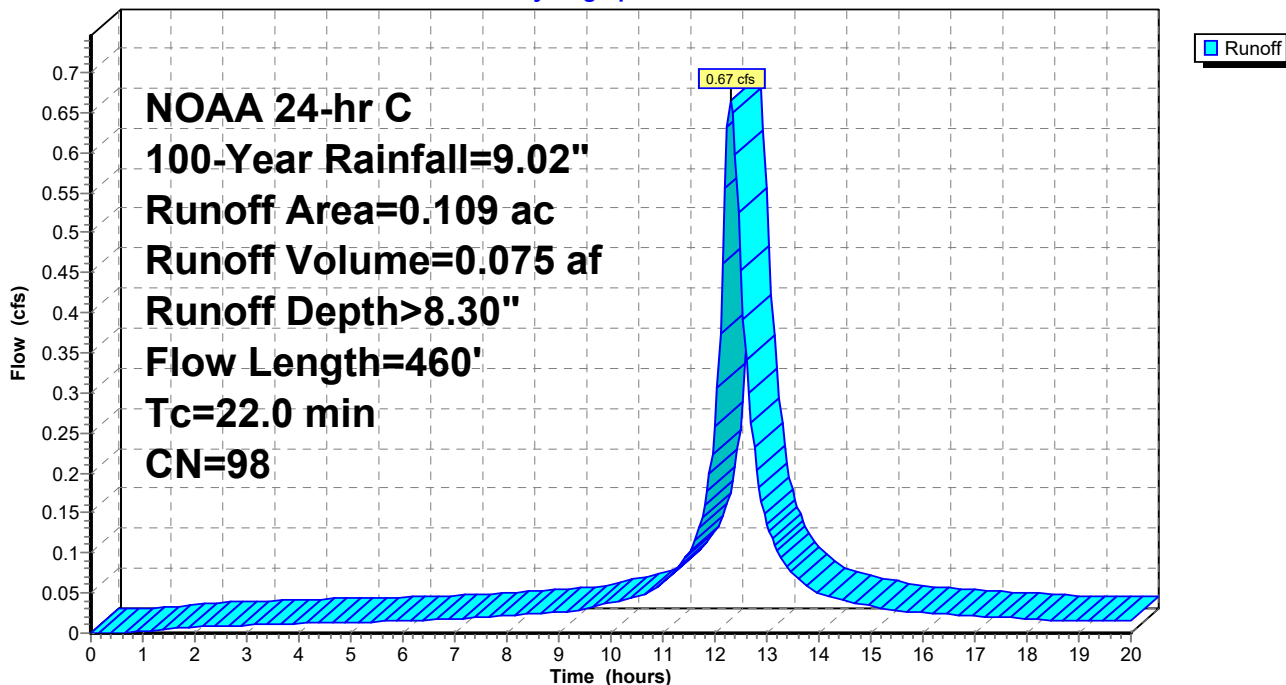
Subcatchment 1-Pre: POI #1 - Pre-Development

Hydrograph



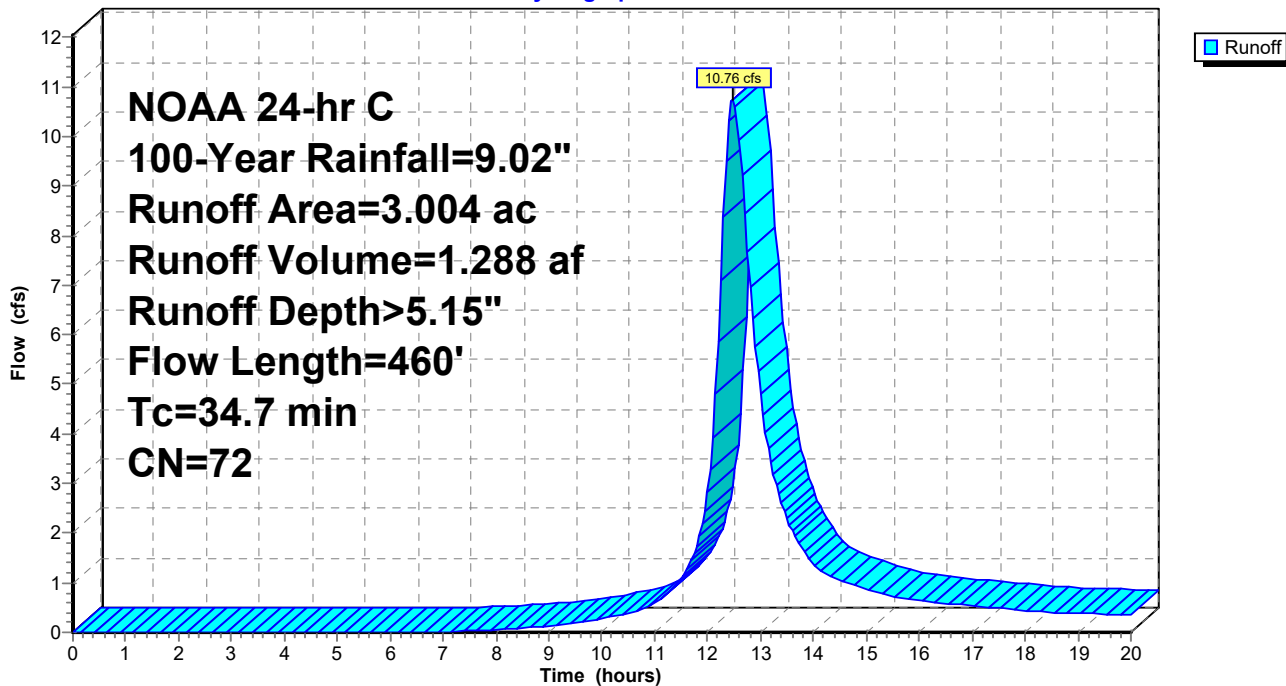
Subcatchment 1A-Post: Bypass

Hydrograph



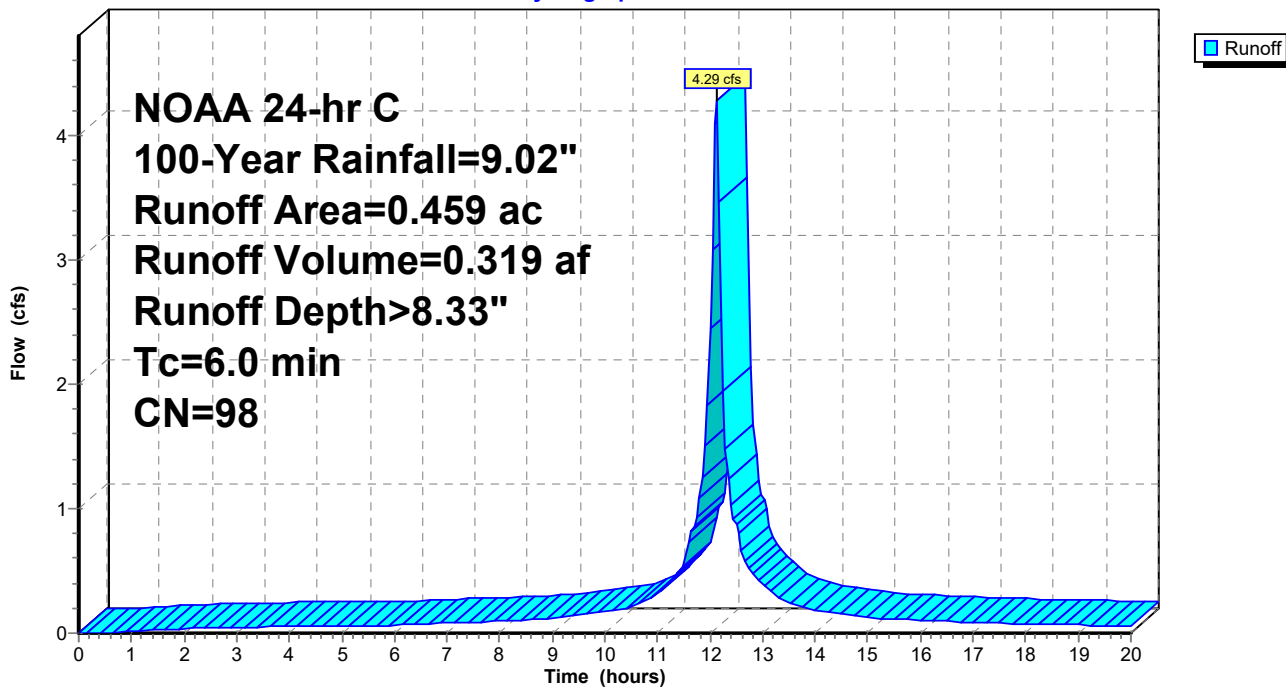
Subcatchment 2-Pre: POI #2 - Pre-Development

Hydrograph



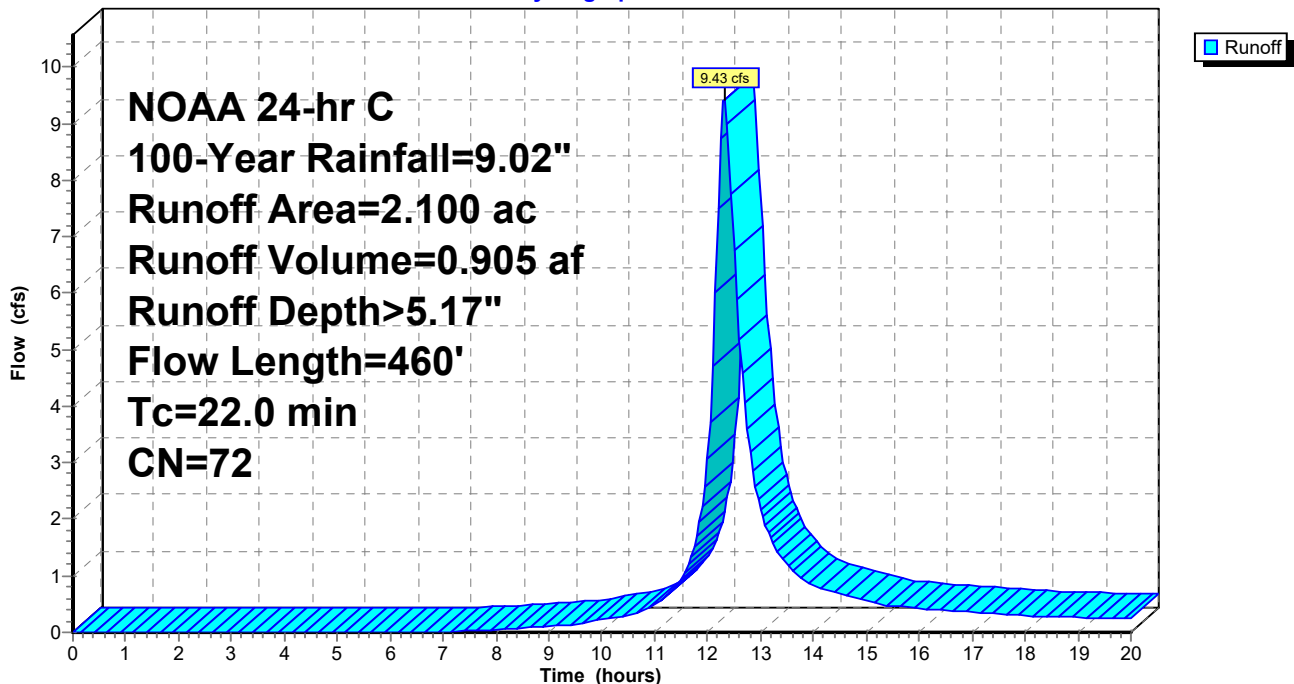
Subcatchment A-1 Post: Post-Development

Hydrograph



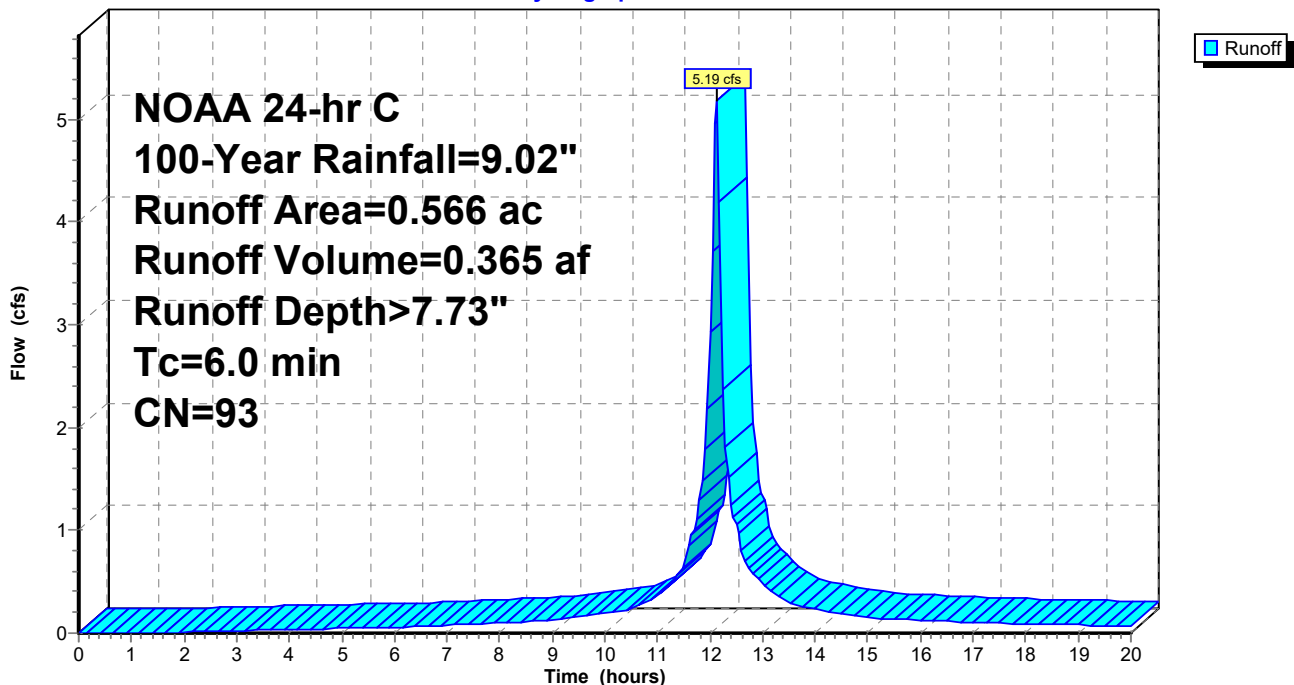
Subcatchment A-10 Post: Uncontrolled

Hydrograph

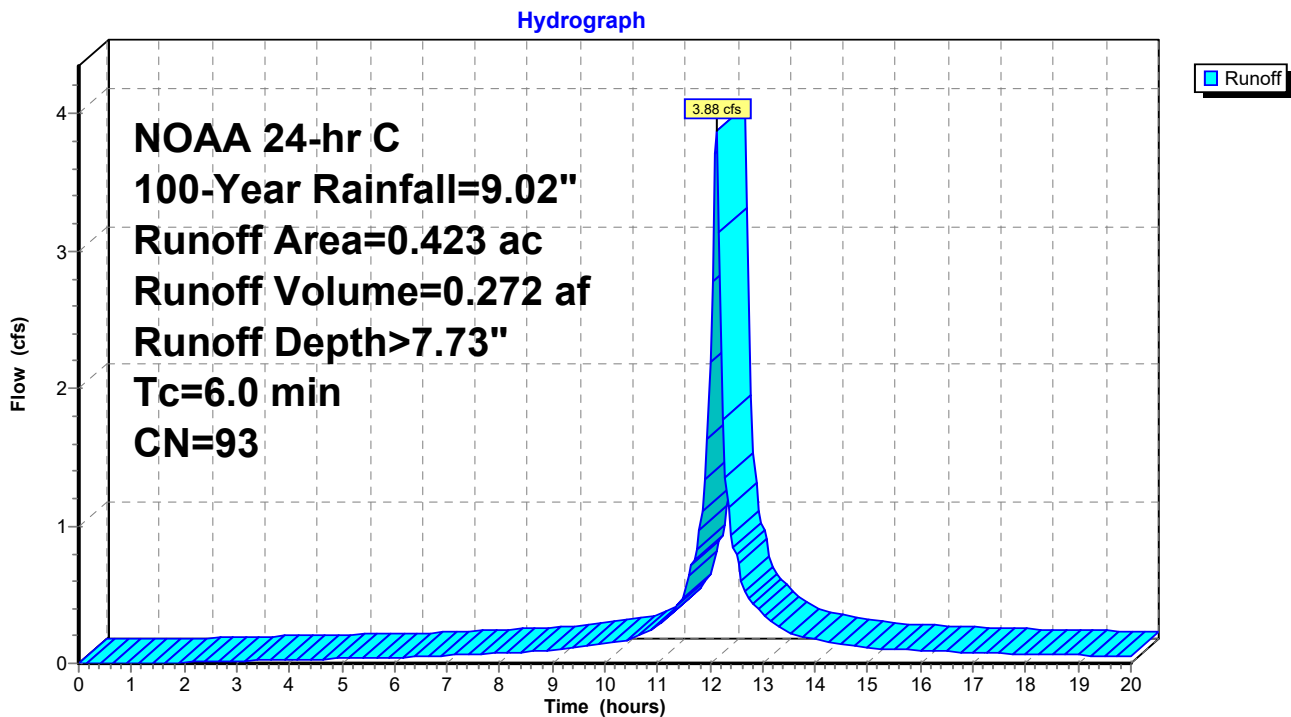


Subcatchment A-2 Post: Post-Development

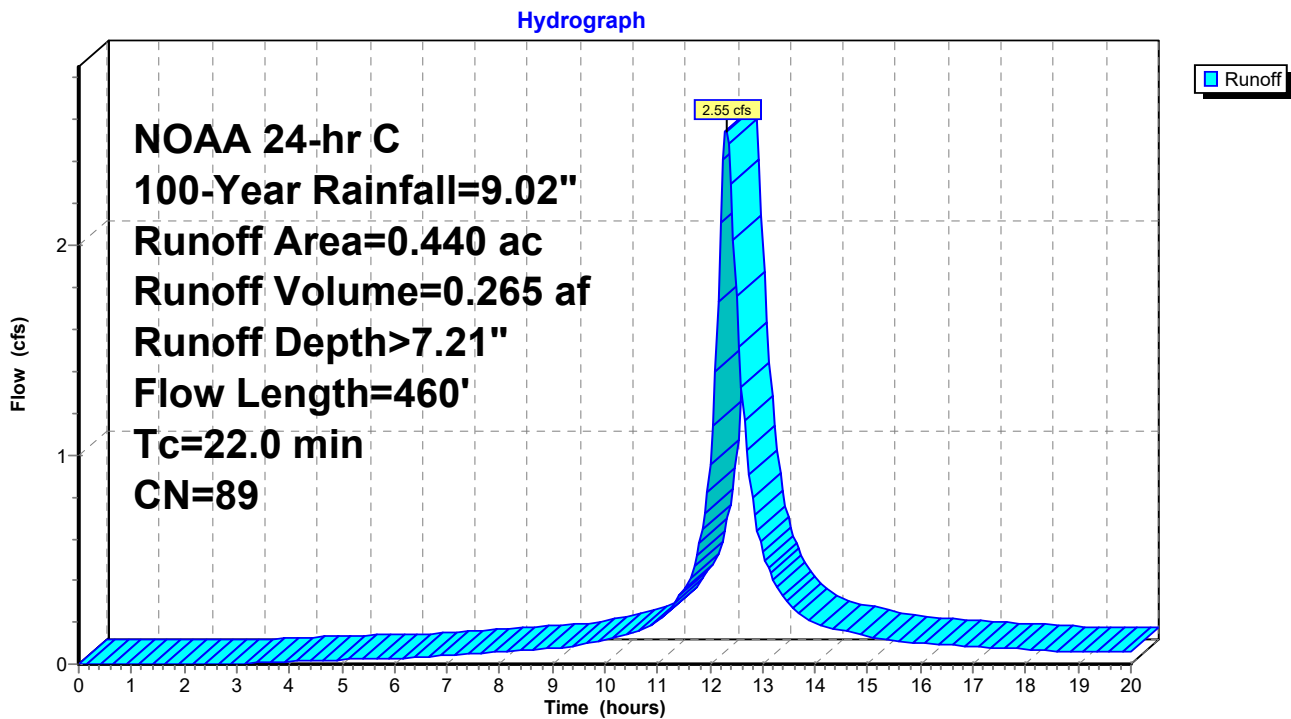
Hydrograph



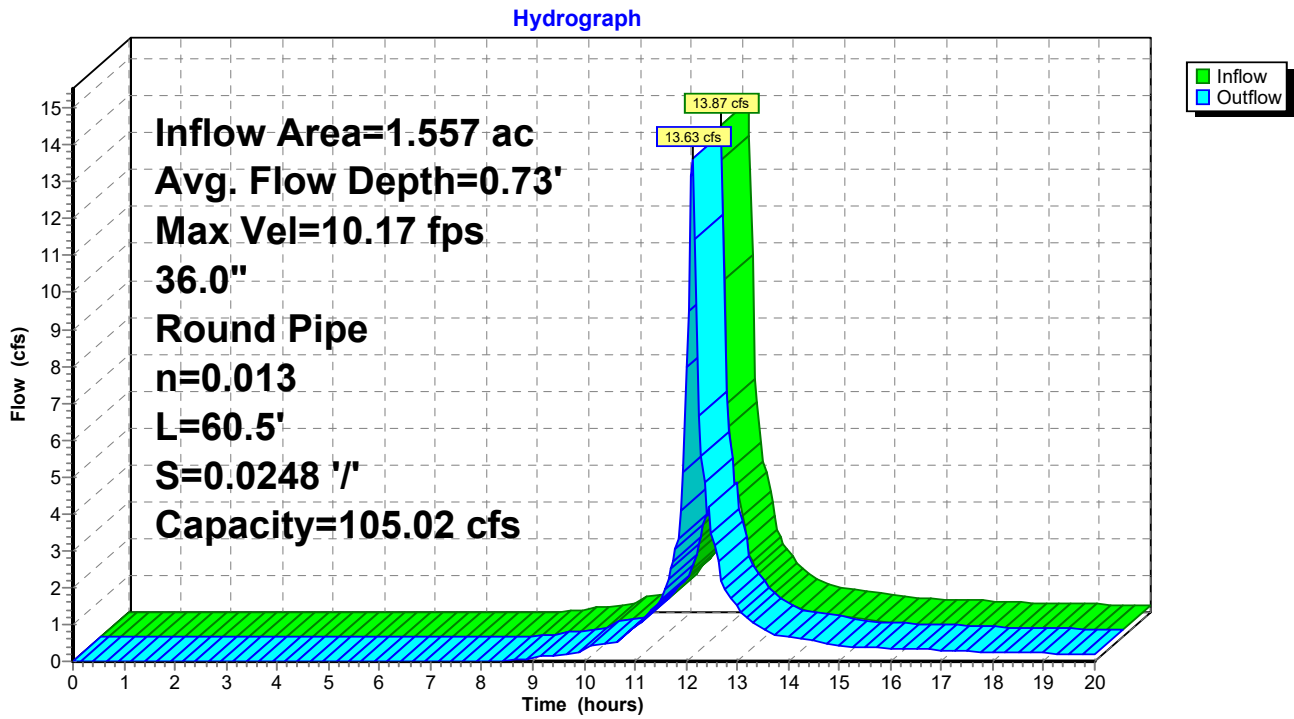
Subcatchment A-3 Post: Post-Development



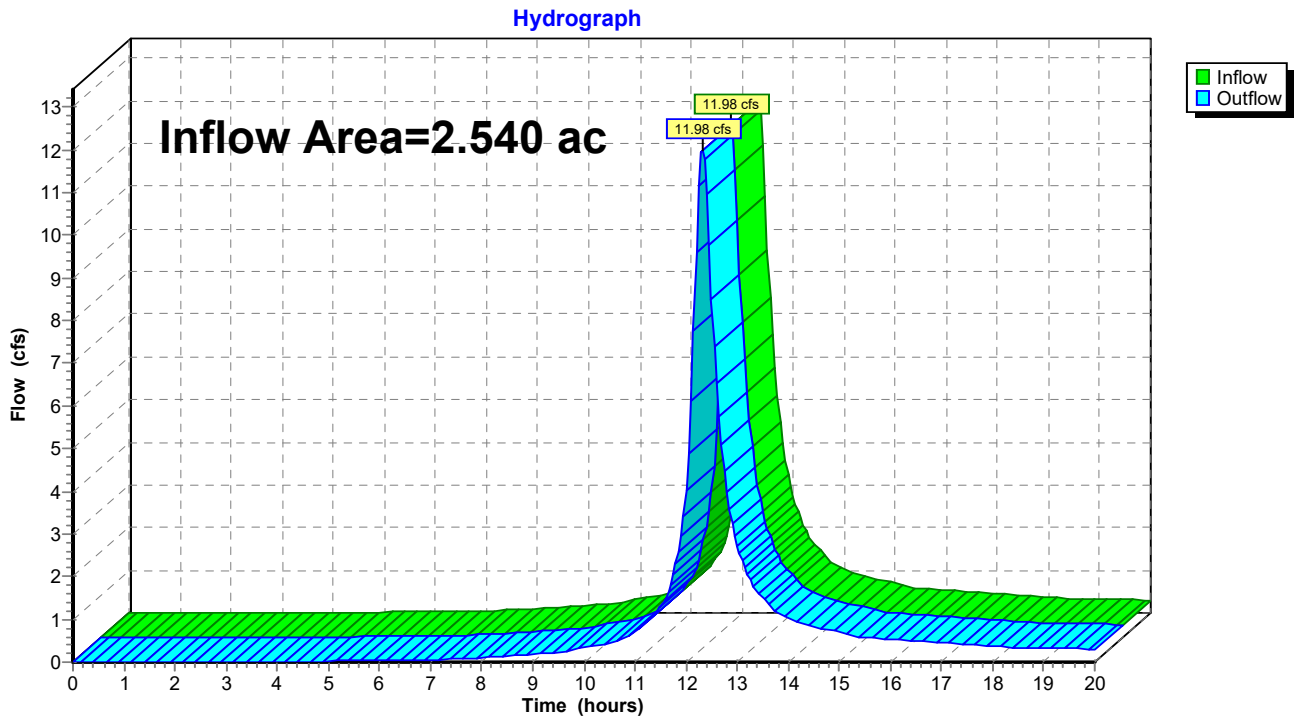
Subcatchment A-5 Post: Uncontrolled



Reach 1-Post: POI #1 - Post Development

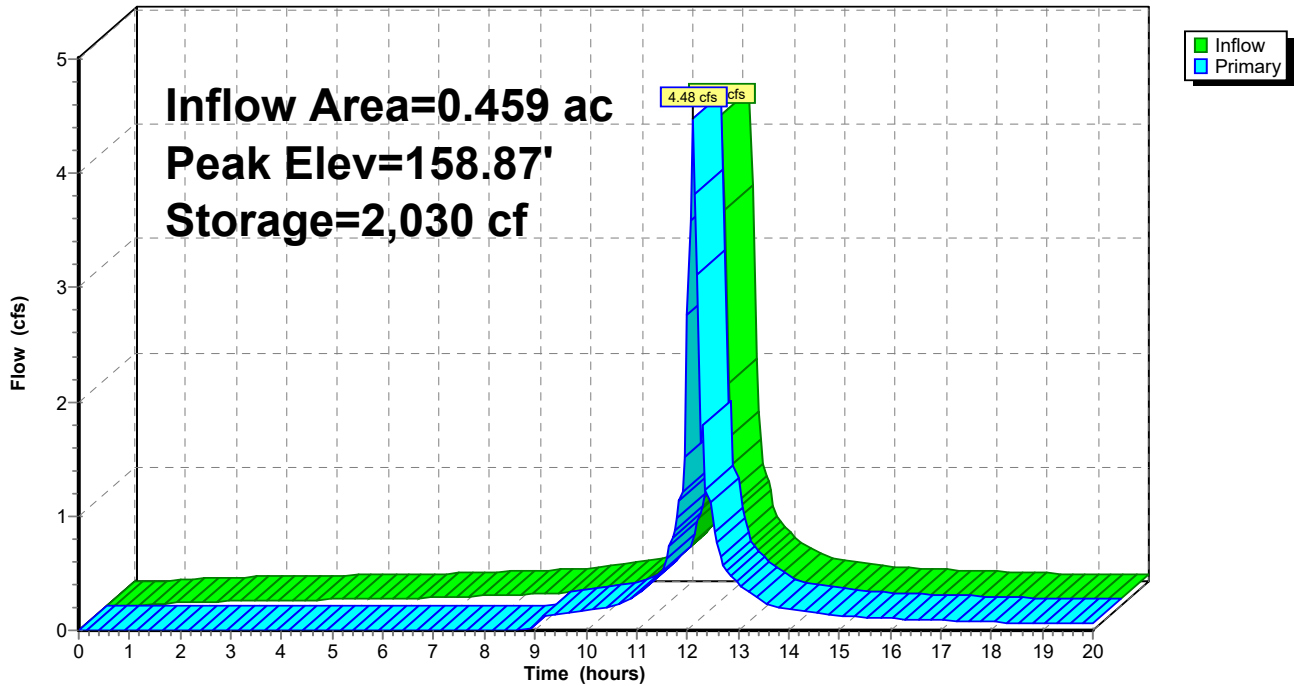


Reach 2-Post: POI #2 - Post Development



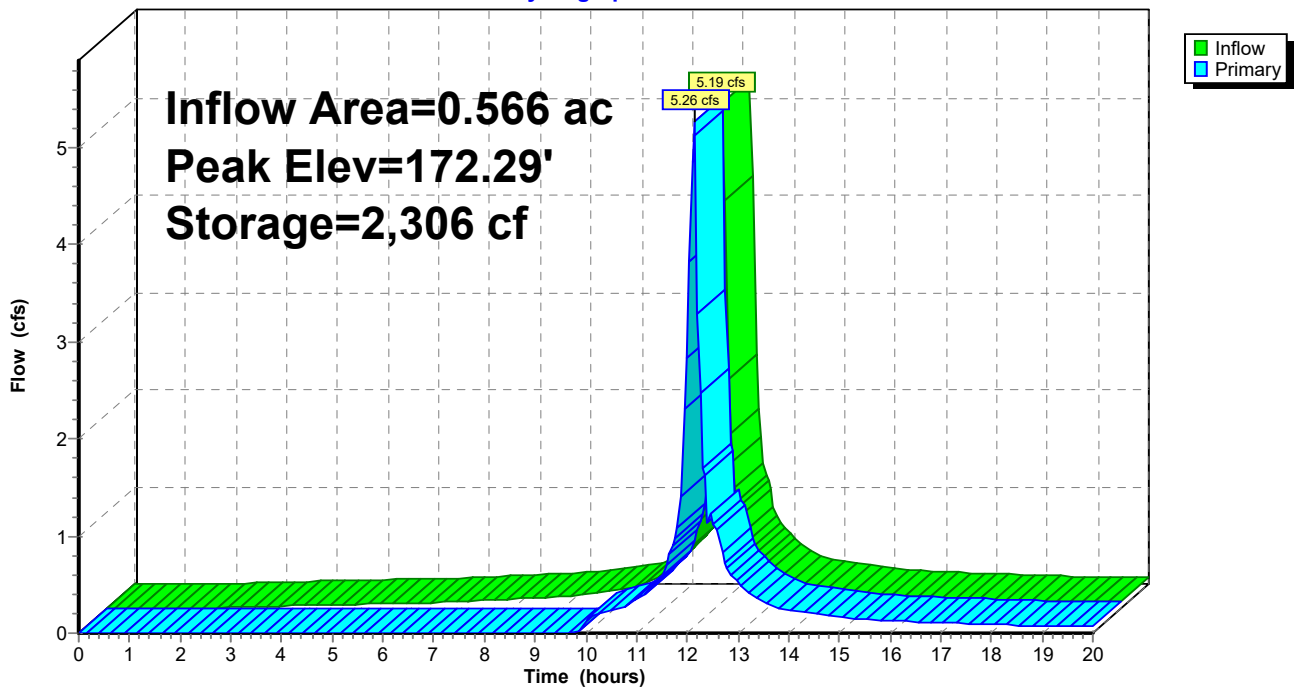
Pond A-1: Bioretention

Hydrograph



Pond A-2: Bioretention

Hydrograph



Pond A-3: Bioretention

Hydrograph

