

May 31, 2020 (Revised September 7, 2023)

**ENGINEER'S LETTER REPORT FOR  
DRAINAGE DESIGN FOR 33 MIDDLEBUSH, LLC  
TOWN OF WAPPINGER, NEW YORK**

The proposed stormwater management facilities have been designed to provide both water quality and quantity controls by detaining, treating, and releasing stormwater runoff at a rate equal to or less than that which existed prior to construction of improvements at the project site.

## **1.0 PROJECT SUMMARY**

The parcel currently contains a masonry building and a limited asphalt parking area. The proposed improvements include reconstruction of a building within the same footprint, asphalt and gravel parking/truck maneuvering area expansion, sidewalk construction, landscaping and utility upgrades. The parcel is currently served by a private water supply well and an underground sanitary sewage disposal system.

The project will involve the removal of existing pervious wooded and grass surfaces for the construction of new impervious surfaces resulting in a net increase in impervious surfaces of approximately 12,630 SF. The project will require the implementation of erosion controls during construction to reduce the impacts of erosion and sedimentation and the installation of permanent stormwater management facilities to control the rate of discharge from the property.

The total disturbance for the project will be 0.9 acres. Therefore, coverage under the NYSDEC General SPDES Permit for Stormwater Discharges from Construction Projects. However, stormwater management facilities have been planned to meet the requirements of the Town of Wappinger and will provide some level of stormwater quality treatment.

## **2.0 SITE DESCRIPTION**

This section briefly describes existing and proposed hydrologic and hydraulic conditions at and around the project site as they relate to surface water management planning considerations. Subsequent sections contain a description of the manner in which site runoff will be managed to minimize effects on areas adjacent to the site.

### **Location**

The parcel proposed to be disturbed for this development project comprises approximately 1.75 acres of land on the north side of Middlebush Road, across from Pleasant Lane. The improvements are proposed on Tax Parcels 6157-01-414840 and 396837. The land in the area surrounding the site consists of mixed uses of residential, institutional and commercial.

The watershed that contributes to the Off-Site Discharge Point (ODP) also includes a portion of the Wappingers Central Schools property and single family residential properties adjacent to the project property.

### **Topography**

The property generally slopes from south to north on the east side of the building and from north to south on the west side of the building. A drainage swale runs along the north side of the building from east to west and drains toward the off-site discharge point consisting of a culvert at the south west corner of the property that transmits flow into the County highway drainage system. Slopes are mostly less than 10% across the site. The adjacent Wappingers Central School property slopes west to east at less than 10% to the wooded area of the project property and adjacent eastern property.

### **Land Cover**

The construction project is on a previously-developed property, consisting of land covers of the building, asphalt parking and wooded/grass areas. The off-site areas that contribute to the ODP are generally paved and grass areas associated with the Wappingers Central School parcel and additional wooded areas

### **Soils**

According to maps from the National Cooperative Soil Survey for Dutchess County, the on-site soils within the project area are classified into the following mapping unit(s):

#### ***Dutchess-Cardigan complex (DwB)***

This soil is characterized as silt loam to a depth of 86 inches. Depth to groundwater and bedrock is greater than 80 inches. The hydrologic soil group is B/C and is characterized with moderate infiltration rates.

A 2-inch per hour infiltration rate was used to model the proposed storm features with infiltration capabilities. This rate will be confirmed with soil testing.

### **Watercourses and Drainage Patterns**

No streams are located on the property. The majority of the property drains to the south west corner discharge point. Off-site areas associated with the Wappingers Central School property generally sheet runoff into the wooded area of the project property and eastern property. This area drains along a ditch on the north side of the project building, and subsequently flows to the 12" RCP culvert at Middlebush. This drainage pattern will be continued with the proposed northern cut off swale/berm.

### **Regulated Wetlands**

ACOE-regulated wetlands are present on the property and adjacent property to the east and are shown on the property survey.

### **Floodplains**

According to FEMA floodplain mapping, no floodplains are located on or adjacent to the property.

### **3.0 METHODOLOGY / NYSDEC UNIFORM SIZING CRITERIA**

The Environmental Protection Agency, New York State Department of Environmental Conservation and Town of Wappinger require the management of stormwater from construction projects to meet standards for water quantity. The project will result in the disturbance of less than one (1) acre and is therefore not subject to water quality treatment standards. However, water quality treatment will be provided for a portion of the runoff. Maintaining water quality involves the removal or reduction of pollutants including suspended solids, phosphates, nitrates and other chemicals generated by development. The water quantity standards require peak flow attenuation and include parameters designed to protect downstream channels, water bodies and properties from erosion and flooding.

### **Rainfall Data**

Rainfall data utilized in the modeling and analysis was taken from the NYSDEC Stormwater Design Manual:

**Table 1 - Precipitation Values**

Storm Event <i>n</i>	90% Rainfall Event*	1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Precipitation 24-hr $P_{n-yr}$ (inches)	1.4	2.7	-	-	4.9	-	-	9.0

### **Hydrologic and Hydraulic Analysis**

The peak rate of stormwater runoff generated from the proposed improvements during the design storms was calculated to determine the required storage volume of the dry detention basin. The time of concentration ( $T_c$ ) and runoff curve numbers (CN) were then calculated for each watershed area. A minimum  $T_c$  of 0.1 hour was selected due to the small area of the watershed. This data was then entered into the *HydroCAD* computer program for analysis. *HydroCAD*, a Computer-Aided-Design (CAD) program, was used to analyze the hydrologic and hydraulic characteristics of a given watershed and associated stormwater management facilities. It utilizes the latest techniques to predict the consequences of any given storm. *HydroCAD* has the capability of computing hydrographs (which represents discharge rates characteristic of specified watershed conditions, precipitation, and geologic factors) combining hydrographs and routing flows through pipes, streams and ponds. *HydroCAD* is used to calculate peak runoff flows and to create hydrographs for the various storm events evaluated for both pre-development and post development conditions.

## **Watershed Description**

### **Existing (Pre-Development) Watershed Conditions**

The study area consists of the portion of the property that will be altered as part of the improvements and the area contributing to the ODP culvert at Middlebush Road. The overall study area is 5.0 acres and the portion impacted by the project is 0.79 acres. All of the effected project area contributes runoff to a 12-inch RCP culvert that transmits flows from the south west corner of the property into the County Highway drainage system. The existing conditions includes an existing 6,700 sf +/- building and 6,100 sf asphalt parking area. The remaining areas are generally wooded/grass areas.

The Off-Site Discharge Point is the 12-inch RCP culvert that accepts runoff from the property and transmits it into the County system along Middlebush Road.

### **Proposed (Post-Development) Watershed Conditions**

The post-development drainage area will be modified by the proposed improvements by converting wooded/grass areas to impervious surfaces related to the parking/truck maneuvering area expansion and sidewalk construction. The net increase in impervious area is 12,630 SF.

The subcatchments are described in the HydroCAD Figure. The subcatchments are generally described:

#### **1 Post: Area to the Infiltration Trench**

This area consists of most of the parking area that will sheet flow runoff to an infiltration trench located to the north side of the parking area and building.

#### **2 Post: Area Direct to the Dry Detention Basin**

This area consists of the existing building and proposed sidewalk along the west side of the building and area of the basin and immediately adjacent.

#### **3 Post: Remaining Area Direct to the ODP**

This area consists of the off-site areas and the portion of the project property not impacted by the proposed construction.

#### **4 Post: Area to Drywells**

This area consists of the asphalt area adjacent to the east side of the building.

The Off-Site Discharge Point is the 12-inch RCP culvert that accepts runoff from the property and transmits it into the County system along Middlebush Road.

## **Proposed Water Quantity and Quality Controls**

### **Water Quantity**

The following table summarize the stormwater management system performance and discharge point parameters as found in the engineering calculations attached. The infiltration trench and drywells were modelled assuming an infiltration rate of 2 inches/hour.



Design Point Summary	Pre-Development	Post-Development	Units	Satisfied
<b>Design Point 1</b>				
Contributing Watershed Area	5.0	5.0	AC	
		Peak Discharge		
1-year event	2.2	1.9	cfs	√
10-year event	7.8	7.3	cfs	√
100-year event	20.5	19.9	cfs	√

The off-site discharge point will not be significantly affected by the proposed project. A minor reduction in peak flow rates to the culvert will occur as a result of the proposed on-site detention. The attached figure indicates that the 12" RCP can pass the 1-yr storm event without significant ponding at the inlet. Larger flows will continue to pond on-site within the wetland until drained by the culvert.

### **Water Quality**

The water quality volume is directly related to the amount of impervious surface created at a site. The water quality volume (**WQv**) is designed to improve water quality by treating 90% of the average annual stormwater runoff volume.

Although water quality treatment is not required, the storm system will provide some level of water quality treatment of runoff from 0.39 acres of the site's impervious surfaces. The stormwater management system is as follows:

1. **Infiltration Trench**

The majority of the runoff from the parking area will sheet flow to the north to a 3'x3' stone infiltration trench. An overflow pipe will transmit larger flows to the dry detention basin.

2. **Dry Wells**

Runoff from asphalt and gravel areas directly adjacent to the east side of the building will flow to three (3) ten ft. diameter drywells. The drywells will collect up to the 100-year runoff volume without surcharge. However, an overflow pipe has been provided to direct surcharges to the bio-retention area.

3. **Dry Detention Basin**

A dry detention basin is proposed on the west side of the building to provide quantity control. The dry detention basin will discharge to the wooded area adjacent to the off-site discharge point.

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The proposed construction will not increase the approved developed peak discharge rates from the site and will provide some water quality treatment from the proposed project.

Sincerely,

A circular red ink seal for a Professional Engineer in the State of New York. The seal contains the text "STATE OF NEW YORK" at the top, "Troy A. Wojciekowsky" in the center, and "073746" at the bottom. The words "LICENSED PROFESSIONAL ENGINEER" are written around the inner border. A large, bold, black handwritten signature, which appears to be "T. Wojciekowsky", is written across the seal.

Troy A. Wojciekowsky, P. E., LEED-AP  
Engineer

Attachments:

Soils Information

HydroCAD Report

Soil Map—Dutchess County, New York  
(33 Middlebush, LLC)



Soil Map may not be valid at this scale.

Map Scale: 1:483 if printed on A landscape (11" x 8.5") sheet.  
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84



Natural Resources  
Conservation Service

Web Soil Survey  
National Cooperative Soil Survey

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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: Dutchess County, New York  
Survey Area Data: Version 16, Sep 16, 2019

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

Date(s) aerial images were photographed: Oct 7, 2013—Feb 26, 2017

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.

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DwB	Dutchess-Cardigan complex, undulating, rocky	1.0	100.0%
<b>Totals for Area of Interest</b>		<b>1.0</b>	<b>100.0%</b>

## Dutchess County, New York

### DwB—Dutchess-Cardigan complex, undulating, rocky

#### Map Unit Setting

*National map unit symbol:* 9rfn

*Elevation:* 50 to 1,000 feet

*Mean annual precipitation:* 41 to 47 inches

*Mean annual air temperature:* 45 to 50 degrees F

*Frost-free period:* 115 to 195 days

*Farmland classification:* All areas are prime farmland

#### Map Unit Composition

*Dutchess and similar soils:* 40 percent

*Cardigan and similar soils:* 30 percent

*Minor components:* 30 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Dutchess

##### Setting

*Landform:* Hills, ridges

*Landform position (two-dimensional):* Summit

*Landform position (three-dimensional):* Crest

*Down-slope shape:* Convex

*Across-slope shape:* Convex

*Parent material:* Loamy till derived mainly from phyllite, slate, schist, and shale

##### Typical profile

*H1 - 0 to 8 inches:* silt loam

*H2 - 8 to 28 inches:* silt loam

*H3 - 28 to 86 inches:* channery silt loam

##### Properties and qualities

*Slope:* 1 to 6 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Well drained

*Capacity of the most limiting layer to transmit water (Ksat):*

Moderately high to high (0.57 to 1.98 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* High (about 9.6 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2e

*Hydrologic Soil Group:* B

*Hydric soil rating:* No

## Description of Cardigan

### Setting

*Landform:* Hills, ridges

*Landform position (two-dimensional):* Summit

*Landform position (three-dimensional):* Crest

*Down-slope shape:* Convex

*Across-slope shape:* Convex

*Parent material:* Loamy till or colluvium derived from phyllite, slate, shale, and schist

### Typical profile

*H1 - 0 to 8 inches:* channery silt loam

*H2 - 8 to 20 inches:* channery loam

*H3 - 20 to 30 inches:* channery silt loam

*H4 - 30 to 34 inches:* unweathered bedrock

### Properties and qualities

*Slope:* 1 to 6 percent

*Depth to restrictive feature:* 20 to 40 inches to lithic bedrock

*Natural drainage class:* Well drained

*Capacity of the most limiting layer to transmit water (Ksat):* Low to moderately low (0.00 to 0.06 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Low (about 4.1 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2e

*Hydrologic Soil Group:* C

*Hydric soil rating:* No

## Minor Components

### Georgia

*Percent of map unit:* 10 percent

*Hydric soil rating:* No

### Massena

*Percent of map unit:* 9 percent

*Hydric soil rating:* No

### Nassau

*Percent of map unit:* 9 percent

*Hydric soil rating:* No

### Sun

*Percent of map unit:* 1 percent

*Landform:* Depressions

*Hydric soil rating:* Yes

### Rock outcrop

*Percent of map unit:* 1 percent

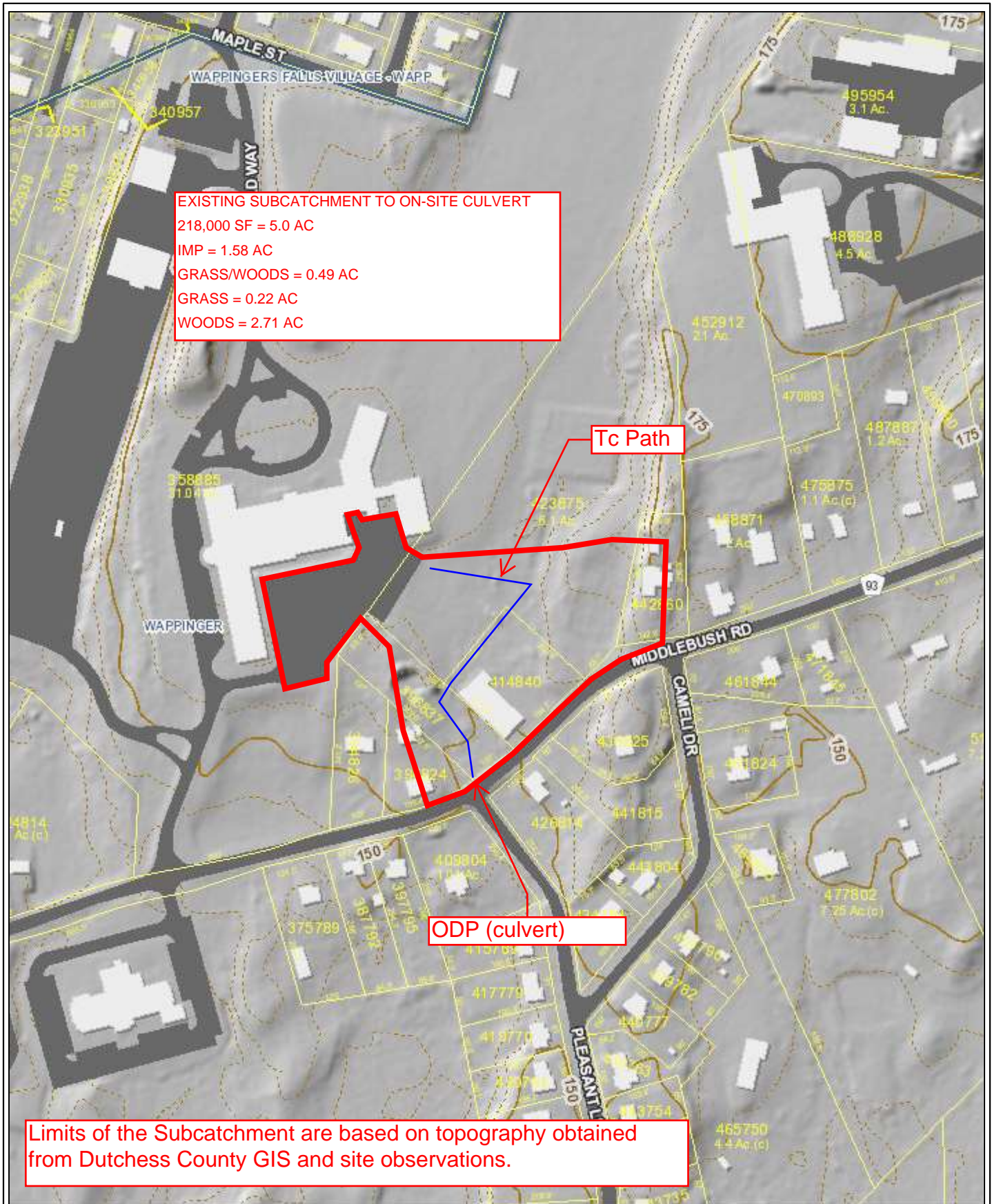
*Hydric soil rating:* Unranked

## Data Source Information

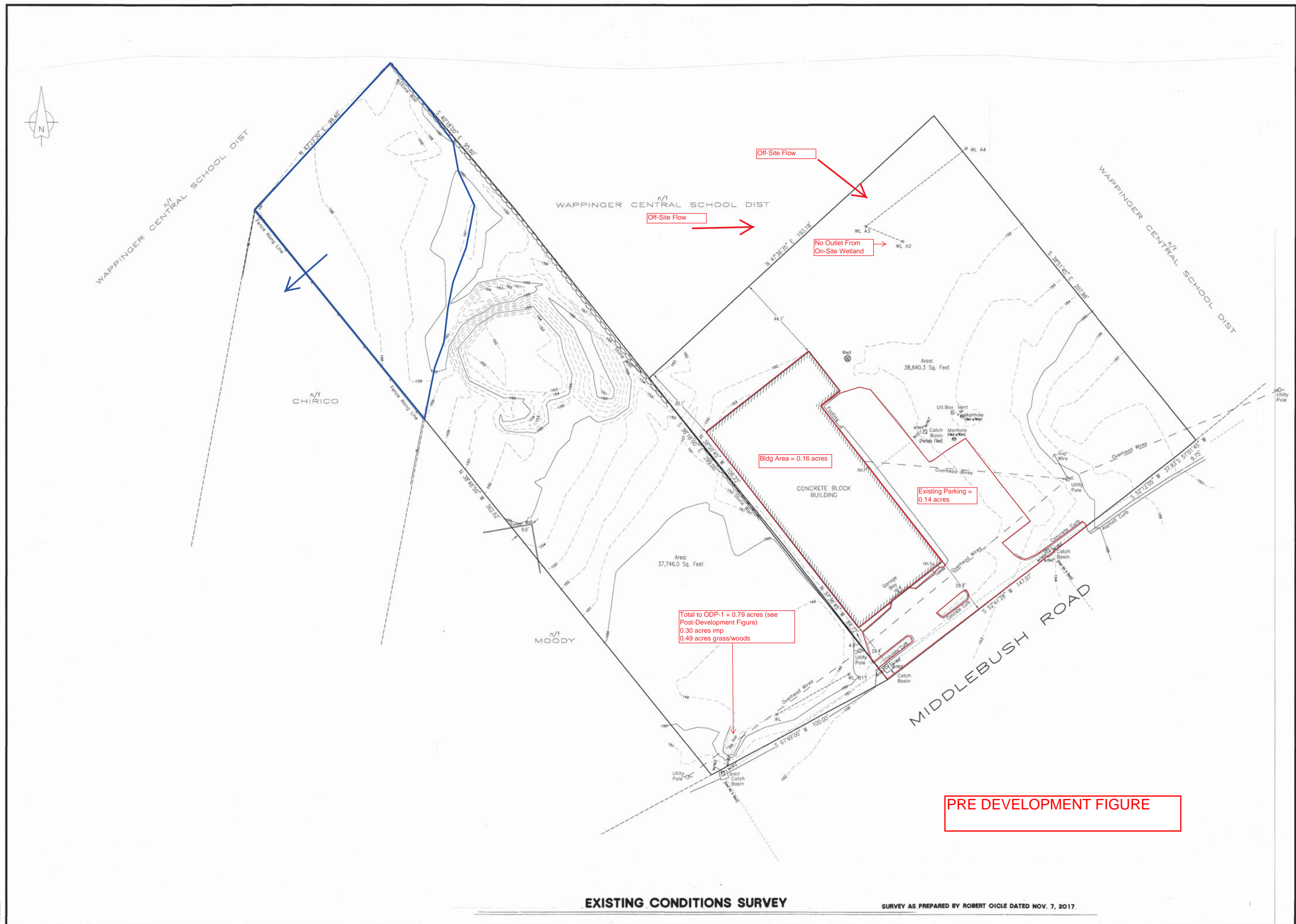
Soil Survey Area: Dutchess County, New York

Survey Area Data: Version 16, Sep 16, 2019









REVISIONS	BY

**ALFRED A. CAPPELLI Jr., AIA**  
**ARCHITECT**

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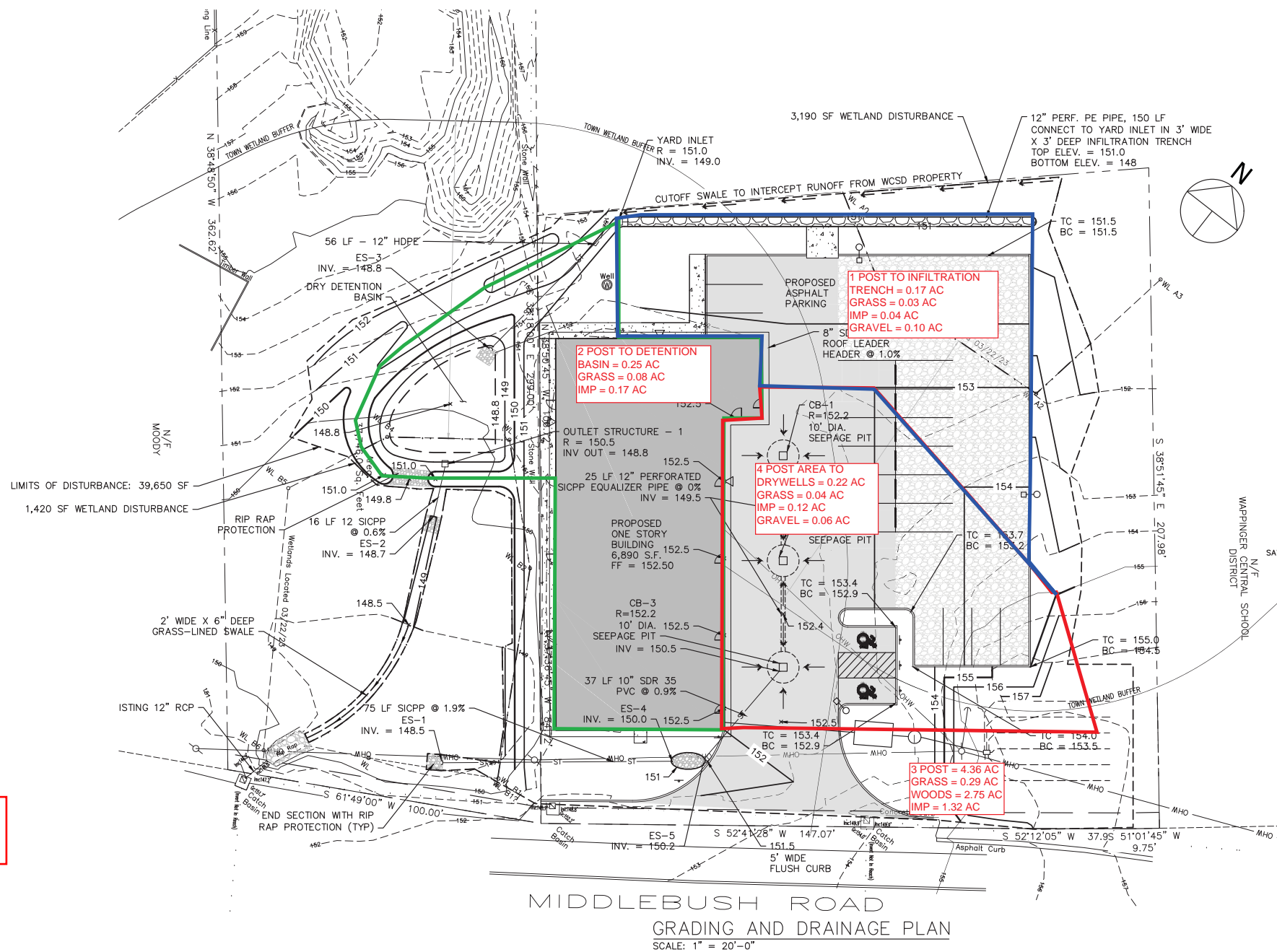
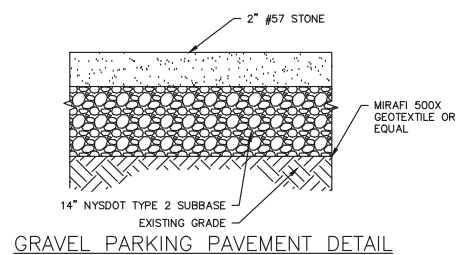
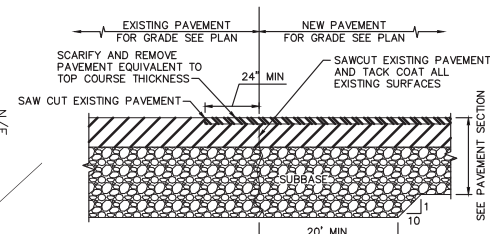
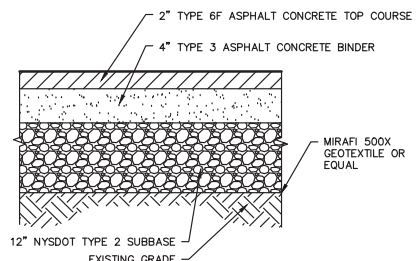
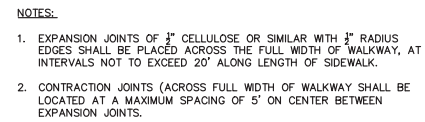
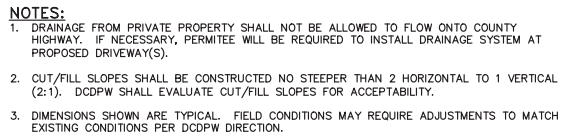
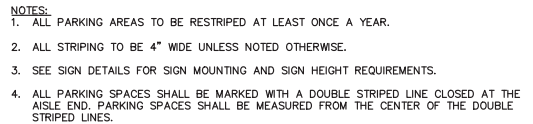
PROPOSED CONTRACTOR STORAGE BUILDING  
**33 MIDDLEBUSH LLC**  
33 MIDDLEBUSH ROAD TOWN OF WAPPINGERS, NY

## EXISTING CONDITIONS SURVEY

DATE	MAR. 1, 2019
SCALE	1" = 20'
DRAWN	AC
JOB	16-034
SHEET	S-2
OF	SHEETS

**S-2**

OF SHEETS



## POST-DEVELOPMENT FIGURE

IT IS A VIOLATION OF NEW YORK STATE EDUCATION LAW FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT IN ANY WAY. IF THIS DOCUMENT IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS SEAL AND THE NOTATION "ALTERED BY" FOLLOWED BY HIS SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

CONTRACTOR STORAGE BUILDING  
33 MIDDLEBUSH LLC  
33 MIDDLEBUSH ROAD  
TOWN OF WAPPINGER, NEW YORK

REVISIONS		
NO.	DATE	DESCRIPTION
1.	2.07.22	PER CONSULTANT COMMENTS
2	9.06.23	PER CONSULTANT COMMENTS

<b>GRADING &amp; DRAINAGE PLAN</b>	2/7/2023
	PROJECT NO.
	2022-20
	SCALE:
	1" = 20'
DRAWING NO.	
S-4.0	

**Subcatchment 1 Pre: Total to ODP-1**

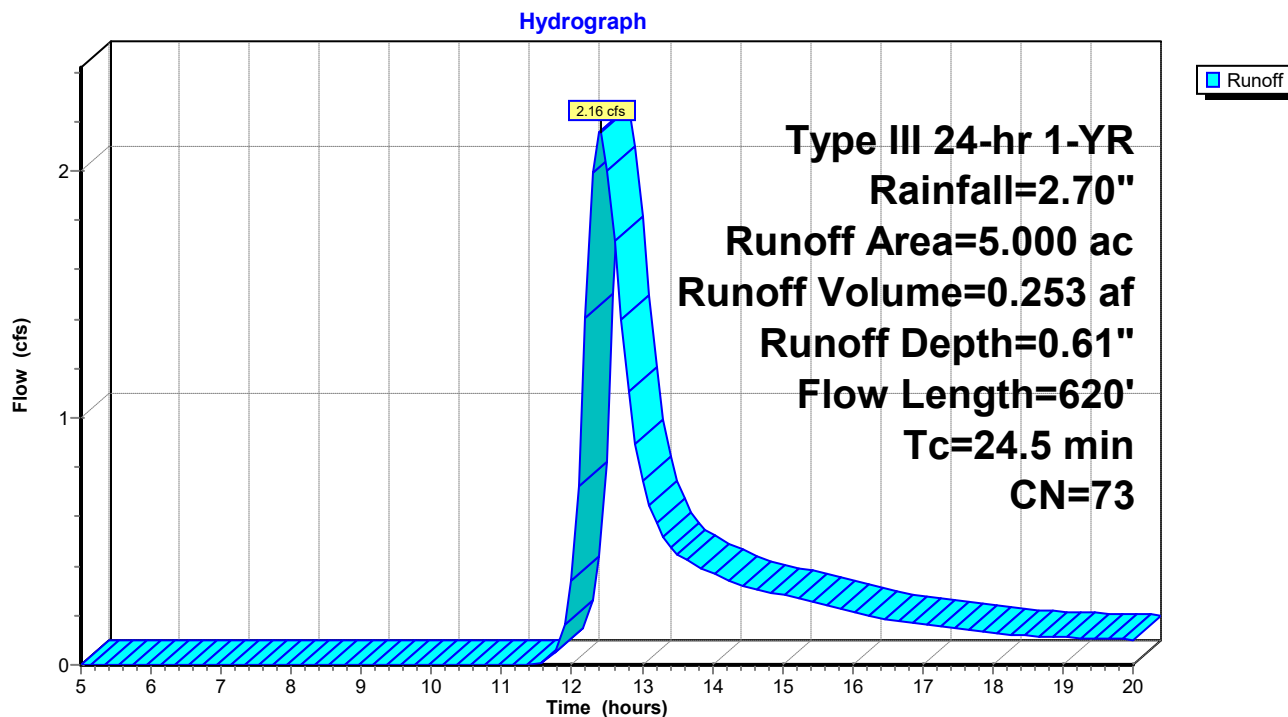
Runoff = 2.16 cfs @ 12.40 hrs, Volume= 0.253 af, Depth= 0.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs

Type III 24-hr 1-YR Rainfall=2.70"

Area (ac)	CN	Description
1.580	98	Paved parking & roofs
0.490	65	Woods/grass comb., Fair, HSG B
0.220	69	50-75% Grass cover, Fair, HSG B
2.710	60	Woods, Fair, HSG B
5.000	73	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0400	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 3.40"
17.3	520	0.0100	0.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.5	620	Total			

**Subcatchment 1 Pre: Total to ODP-1**



### Subcatchment 1 Pre: Total to ODP-1

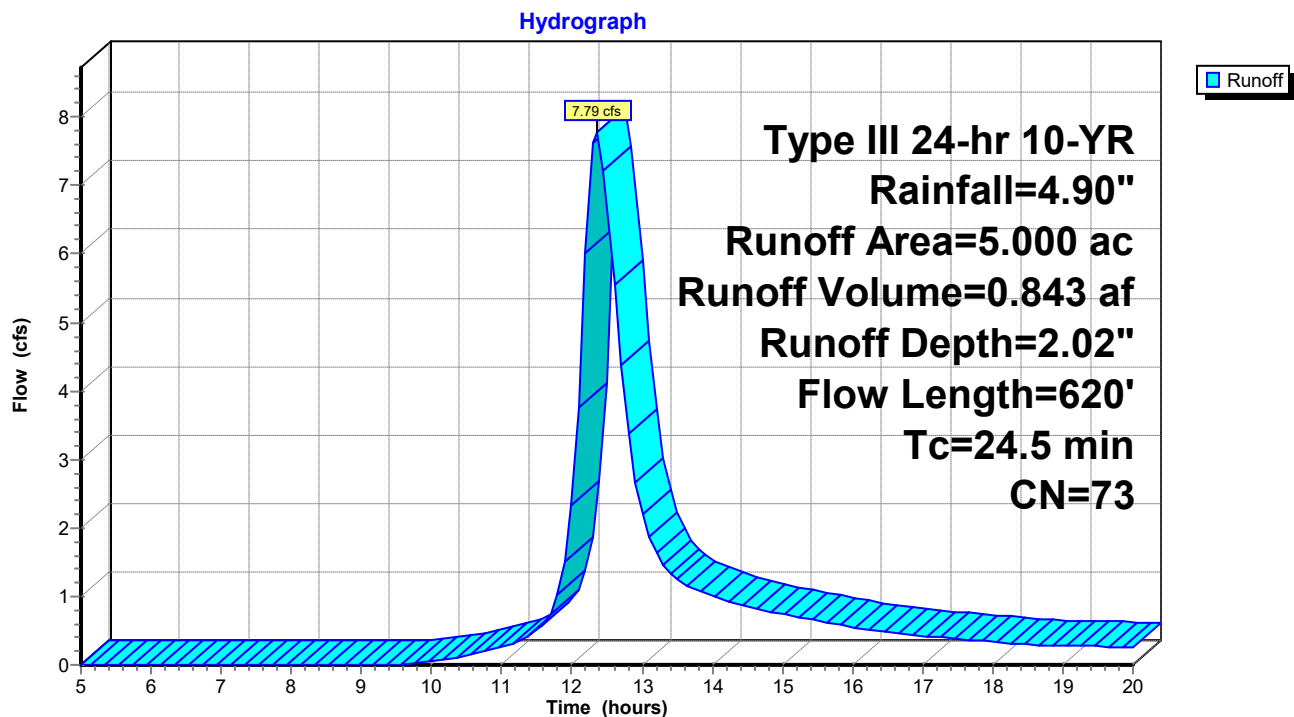
Runoff = 7.79 cfs @ 12.36 hrs, Volume= 0.843 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs  
Type III 24-hr 10-YR Rainfall=4.90"

Area (ac)	CN	Description
1.580	98	Paved parking & roofs
0.490	65	Woods/grass comb., Fair, HSG B
0.220	69	50-75% Grass cover, Fair, HSG B
2.710	60	Woods, Fair, HSG B
5.000	73	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0400	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 3.40"
17.3	520	0.0100	0.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.5	620	Total			

### Subcatchment 1 Pre: Total to ODP-1



### Subcatchment 1 Pre: Total to ODP-1

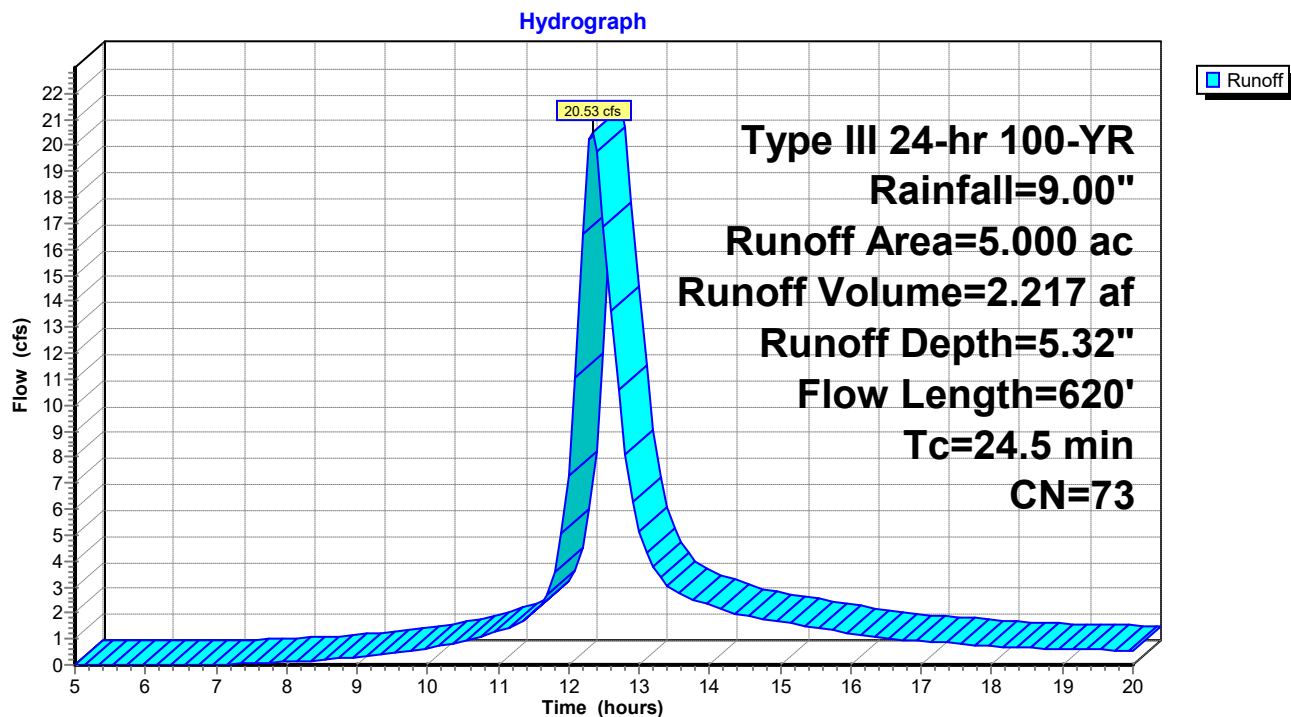
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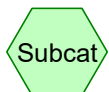
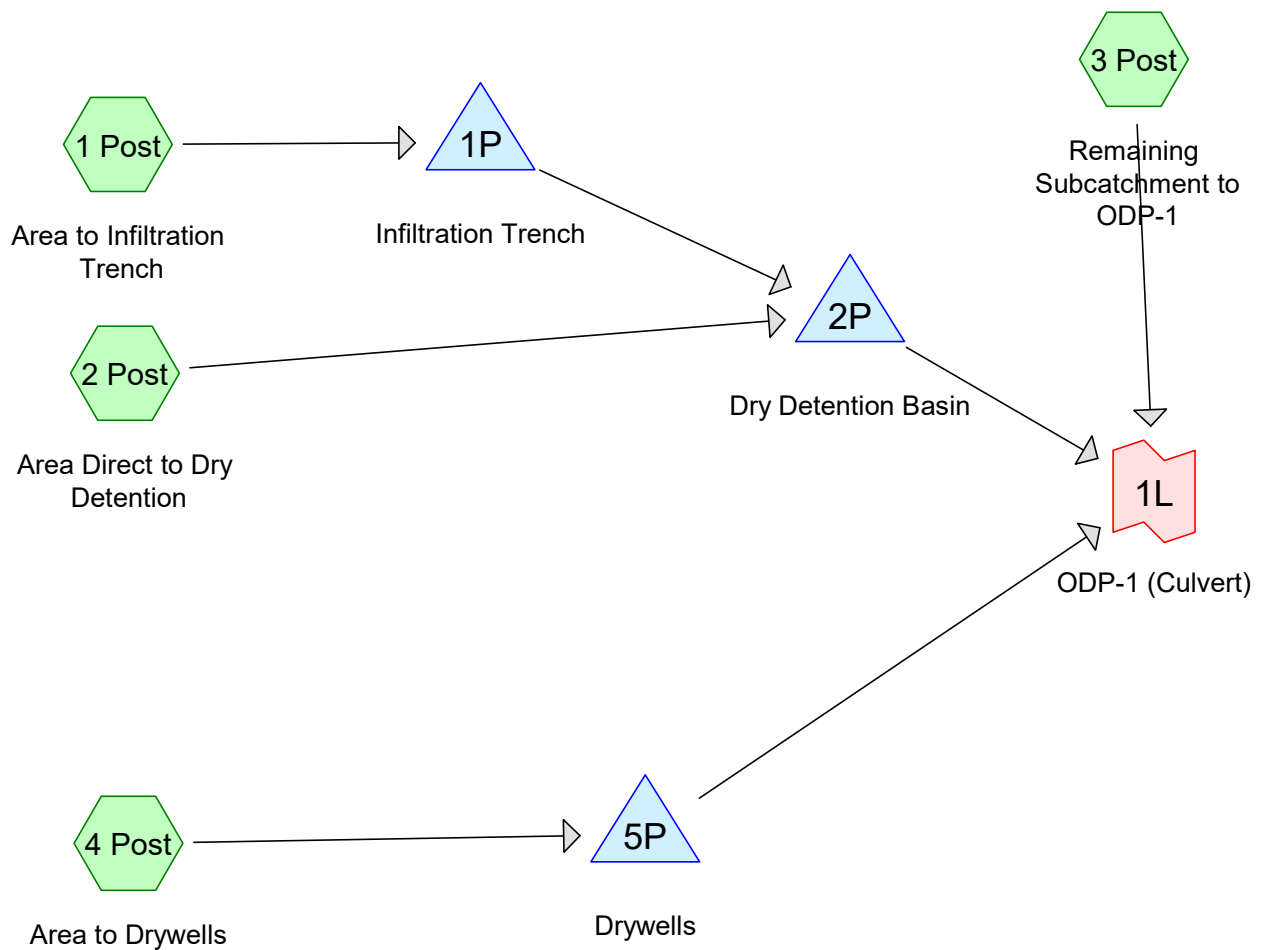
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs  
Type III 24-hr 100-YR Rainfall=9.00"

Area (ac)	CN	Description
1.580	98	Paved parking & roofs
0.490	65	Woods/grass comb., Fair, HSG B
0.220	69	50-75% Grass cover, Fair, HSG B
2.710	60	Woods, Fair, HSG B
5.000	73	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0400	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 3.40"
17.3	520	0.0100	0.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.5	620	Total			

### Subcatchment 1 Pre: Total to ODP-1

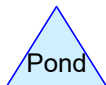




Subcat



Reach



Pond



Link

**Drainage Diagram for 33 Middlebush LLC 20230415 Post Dev**  
 Prepared by TW Engineering, P.C. 9/8/2023  
 HydroCAD® 7.00 s/n 002485 © 1986-2003 Applied Microcomputer Systems

**33 Middlebush LLC 20230415 Post Dev***Type III 24-hr 1-YR Rainfall=2.70"*

Prepared by TW Engineering, P.C.

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9/8/2023

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1 Post: Area to Infiltration Trench**Runoff Area=0.170 ac Runoff Depth=1.24"  
Tc=6.0 min CN=85 Runoff=0.26 cfs 0.018 af**Subcatchment 2 Post: Area Direct to Dry Detention**Runoff Area=0.250 ac Runoff Depth=1.53"  
Tc=6.0 min CN=89 Runoff=0.47 cfs 0.032 af**Subcatchment 3 Post: Remaining Subcatchment to ODP-1**Runoff Area=4.360 ac Runoff Depth=0.57"  
Flow Length=620' Tc=24.5 min CN=72 Runoff=1.74 cfs 0.206 af**Subcatchment 4 Post: Area to Drywells**Runoff Area=0.220 ac Runoff Depth=1.45"  
Tc=6.0 min CN=88 Runoff=0.39 cfs 0.027 af**Pond 1P: Infiltration Trench**Peak Elev=149.14' Storage=258 cf Inflow=0.26 cfs 0.018 af  
Discarded=0.03 cfs 0.016 af Primary=0.06 cfs 0.002 af Outflow=0.08 cfs 0.018 af**Pond 2P: Dry Detention Basin**Peak Elev=149.16' Storage=441 cf Inflow=0.47 cfs 0.034 af  
Outflow=0.18 cfs 0.032 af**Pond 5P: Drywells**Peak Elev=147.29' Storage=0.014 af Inflow=0.39 cfs 0.027 af  
Discarded=0.02 cfs 0.017 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.017 af**Link 1L: ODP-1 (Culvert)**Inflow=1.92 cfs 0.238 af  
Primary=1.92 cfs 0.238 af**Total Runoff Area = 5.000 ac Runoff Volume = 0.282 af Average Runoff Depth = 0.68"**



**33 Middlebush LLC 20230415 Post Dev**

Type III 24-hr 1-YR Rainfall=2.70"

Prepared by TW Engineering, P.C.

Page 3

HydroCAD® 7.00 s/n 002485 © 1986-2003 Applied Microcomputer Systems

9/8/2023

**Subcatchment 1 Post: Area to Infiltration Trench**

Runoff = 0.26 cfs @ 12.09 hrs, Volume= 0.018 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

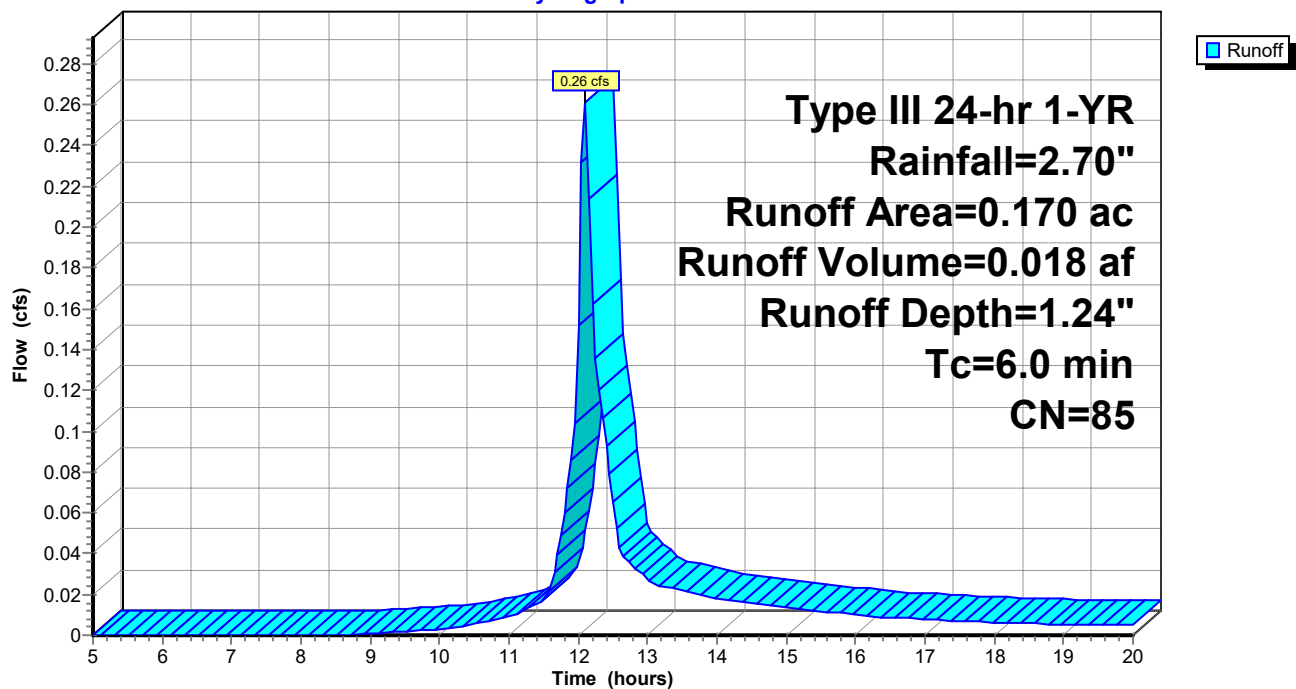
Type III 24-hr 1-YR Rainfall=2.70"

Area (ac)	CN	Description
0.040	98	Paved parking & roofs
0.030	65	Woods/grass comb., Fair, HSG B
0.100	85	Gravel roads, HSG B
0.170	85	Weighted Average

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

**Subcatchment 1 Post: Area to Infiltration Trench**

Hydrograph



### Subcatchment 2 Post: Area Direct to Dry Detention

Runoff = 0.47 cfs @ 12.09 hrs, Volume= 0.032 af, Depth= 1.53"

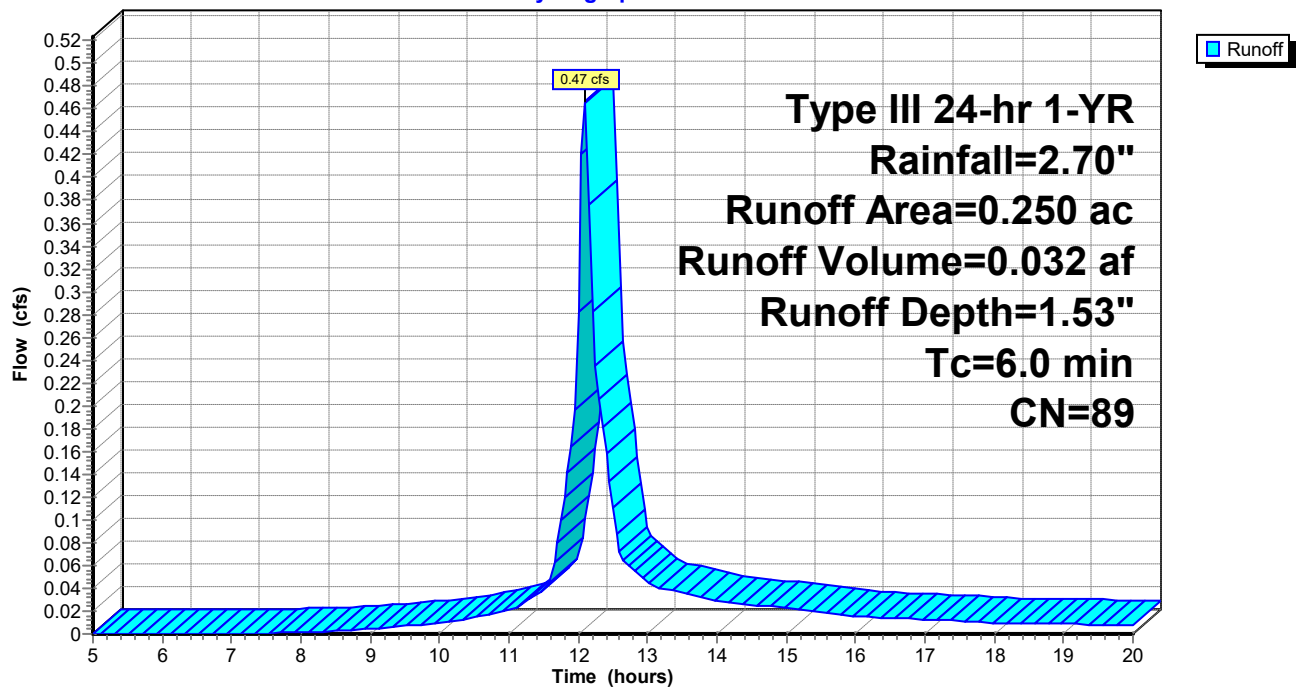
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 1-YR Rainfall=2.70"

Area (ac)	CN	Description
0.170	98	
0.080	69	50-75% Grass cover, Fair, HSG B
0.250	89	Weighted Average

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

### Subcatchment 2 Post: Area Direct to Dry Detention

Hydrograph



**33 Middlebush LLC 20230415 Post Dev**

Type III 24-hr 1-YR Rainfall=2.70"

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**Subcatchment 3 Post: Remaining Subcatchment to ODP-1**

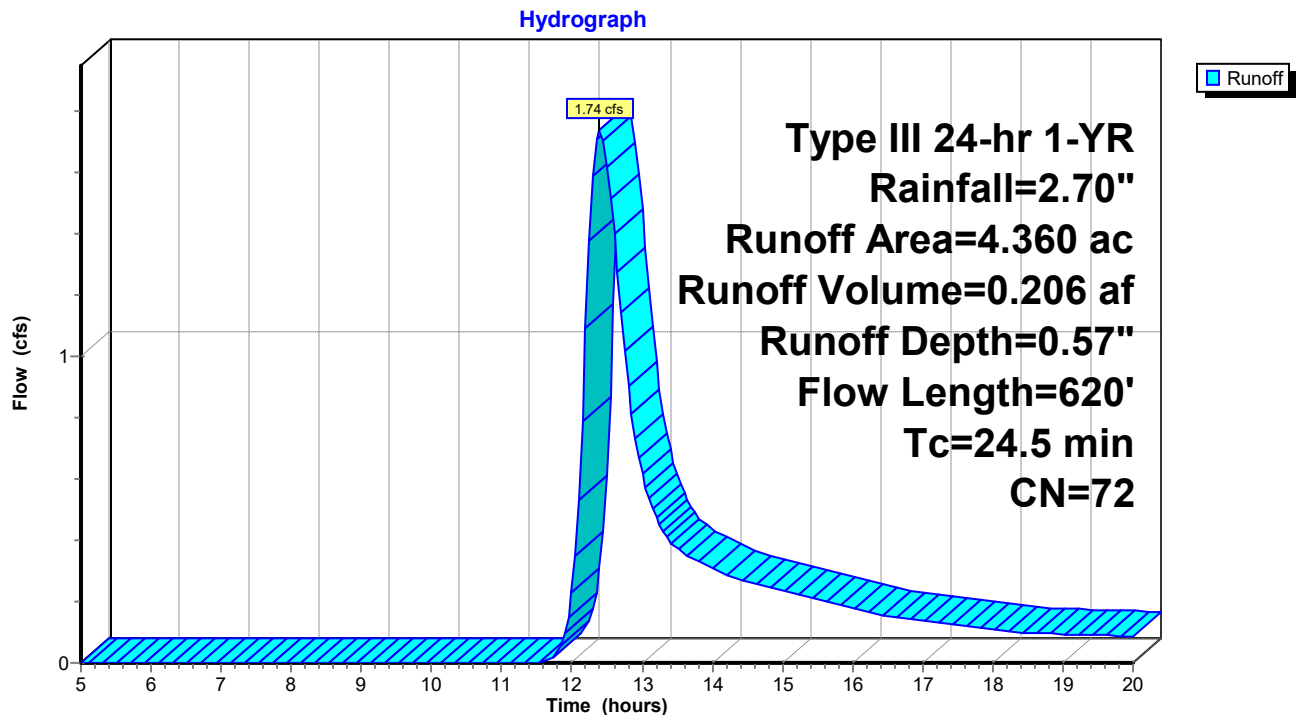
Runoff = 1.74 cfs @ 12.40 hrs, Volume= 0.206 af, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 1-YR Rainfall=2.70"

Area (ac)	CN	Description
1.320	98	Paved roads w/curbs & sewers
0.220	69	50-75% Grass cover, Fair, HSG B
2.750	60	Woods, Fair, HSG B
0.070	61	>75% Grass cover, Good, HSG B
4.360	72	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0400	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 3.40"
17.3	520	0.0100	0.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.5	620	Total			

**Subcatchment 3 Post: Remaining Subcatchment to ODP-1**

**33 Middlebush LLC 20230415 Post Dev**

Type III 24-hr 1-YR Rainfall=2.70"

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**Subcatchment 4 Post: Area to Drywells**

Runoff = 0.39 cfs @ 12.09 hrs, Volume= 0.027 af, Depth= 1.45"

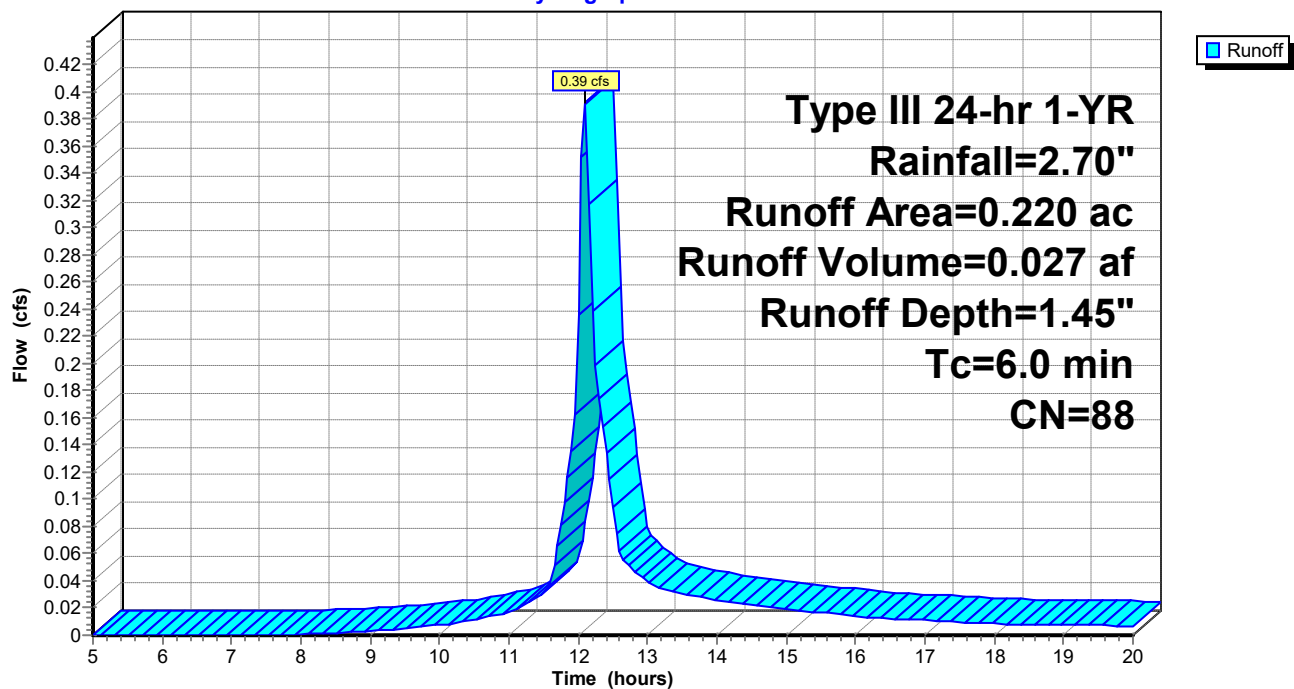
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 1-YR Rainfall=2.70"

Area (ac)	CN	Description
0.120	98	
0.060	85	Gravel roads, HSG B
0.040	61	>75% Grass cover, Good, HSG B
0.220	88	Weighted Average

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

**Subcatchment 4 Post: Area to Drywells**

Hydrograph



### Pond 1P: Infiltration Trench

Inflow Area = 0.170 ac, Inflow Depth = 1.24" for 1-YR event  
 Inflow = 0.26 cfs @ 12.09 hrs, Volume= 0.018 af  
 Outflow = 0.08 cfs @ 12.45 hrs, Volume= 0.018 af, Atten= 69%, Lag= 21.2 min  
 Discarded = 0.03 cfs @ 11.70 hrs, Volume= 0.016 af  
 Primary = 0.06 cfs @ 12.45 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 149.14' @ 12.45 hrs Surf.Area= 564 sf Storage= 258 cf  
 Plug-Flow detention time= 74.6 min calculated for 0.018 af (100% of inflow)  
 Center-of-Mass det. time= 73.7 min ( 870.4 - 796.8 )

#	Invert	Avail.Storage	Storage Description
1	148.00'	677 cf	<b>Custom Stage Data (Prismatic)</b> Listed below 1,692 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.00	564	0	0
151.00	564	1,692	1,692

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	<b>0.002780 fpm Exfiltration over entire Surface area</b>
2	Primary	151.00'	<b>3.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
3	Primary	149.00'	<b>12.0" x 52.0' long Culvert</b> CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 148.80' S= 0.0038 ' / ' n= 0.012 Cc= 0.900

**Discarded OutFlow** Max=0.03 cfs @ 11.70 hrs HW=148.03' (Free Discharge)

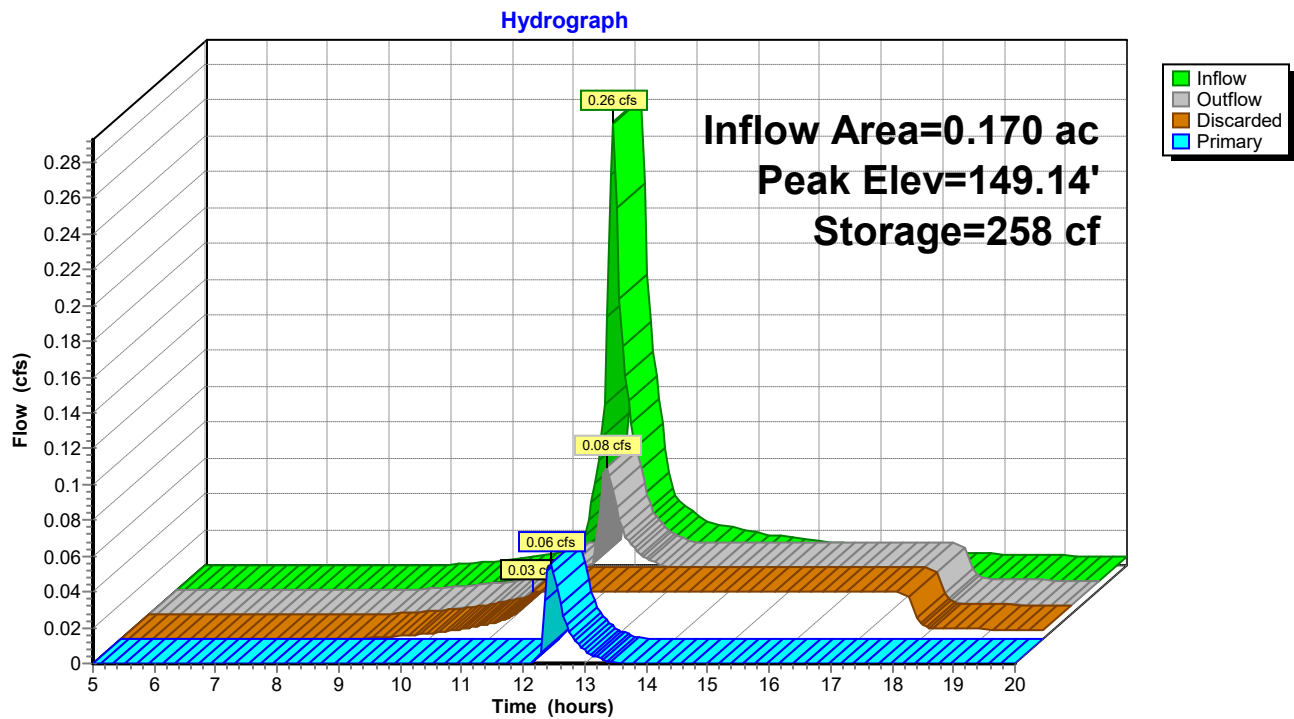
↑ **1=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.06 cfs @ 12.45 hrs HW=149.14' (Free Discharge)

↑ **2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

↑ **3=Culvert** (Barrel Controls 0.06 cfs @ 1.2 fps)

### Pond 1P: Infiltration Trench



### Pond 2P: Dry Detention Basin

Inflow Area = 0.420 ac, Inflow Depth = 0.96" for 1-YR event  
 Inflow = 0.47 cfs @ 12.09 hrs, Volume= 0.034 af  
 Outflow = 0.18 cfs @ 12.46 hrs, Volume= 0.032 af, Atten= 61%, Lag= 22.0 min  
 Primary = 0.18 cfs @ 12.46 hrs, Volume= 0.032 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 149.16' @ 12.46 hrs Surf.Area= 1,280 sf Storage= 441 cf  
 Plug-Flow detention time= 53.4 min calculated for 0.032 af (96% of inflow)  
 Center-of-Mass det. time= 37.6 min ( 820.0 - 782.4 )

#	Invert	Avail.Storage	Storage Description
1	148.80'	3,635 cf	<b>Custom Stage Data (Prismatic)</b> Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.80	900	0	0
149.00	1,200	210	210
150.00	1,700	1,450	1,660
151.00	2,250	1,975	3,635

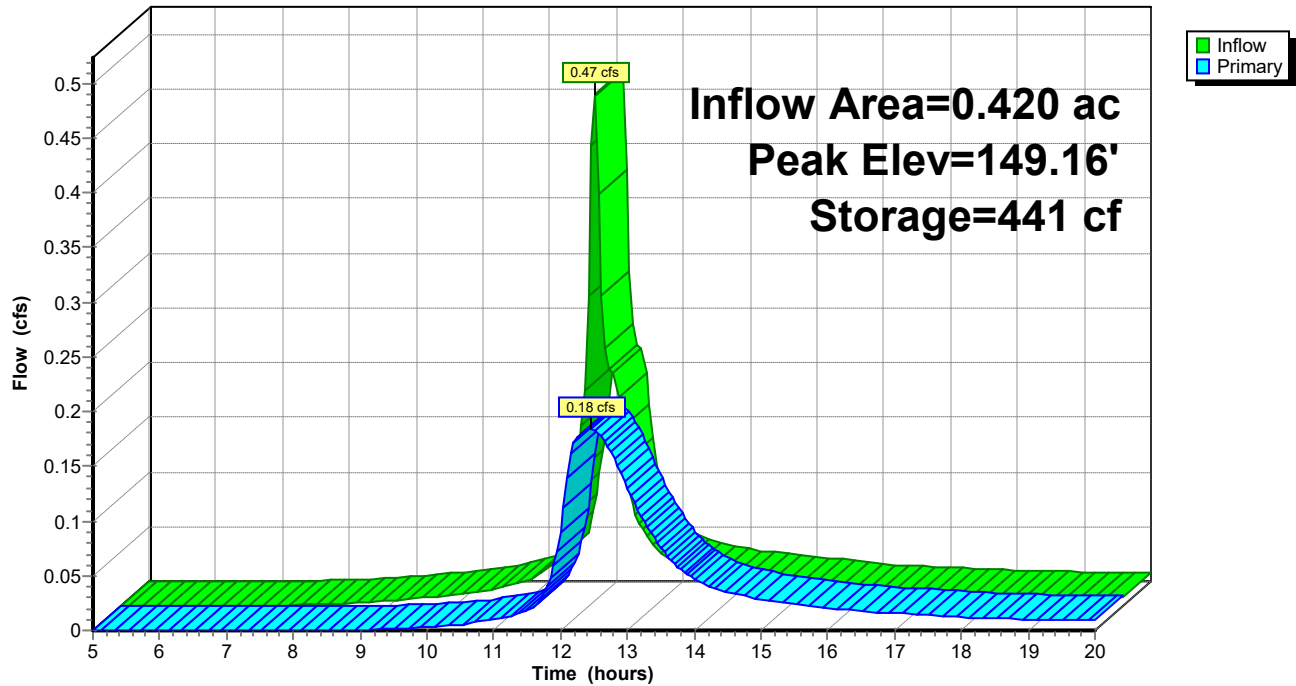
#	Routing	Invert	Outlet Devices
1	Primary	150.10'	<b>12.0' long x 8.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
2	Primary	148.80'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
3	Primary	149.50'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Primary OutFlow** Max=0.18 cfs @ 12.46 hrs HW=149.16' (Free Discharge)

- 1=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)
- 2=Orifice/Grate (Orifice Controls 0.18 cfs @ 2.1 fps)
- 3=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

# Pond 2P: Dry Detention Basin

Hydrograph





**33 Middlebush LLC 20230415 Post Dev**

Type III 24-hr 1-YR Rainfall=2.70"

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**Pond 5P: Drywells**

Inflow Area = 0.220 ac, Inflow Depth = 1.45" for 1-YR event  
 Inflow = 0.39 cfs @ 12.09 hrs, Volume= 0.027 af  
 Outflow = 0.02 cfs @ 11.40 hrs, Volume= 0.017 af, Atten= 95%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 11.40 hrs, Volume= 0.017 af  
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 147.29' @ 14.63 hrs Surf.Area= 0.011 ac Storage= 0.014 af  
 Plug-Flow detention time= 191.0 min calculated for 0.017 af (64% of inflow)  
 Center-of-Mass det. time= 119.5 min ( 906.9 - 787.4 )

#	Invert	Avail.Storage	Storage Description
1	146.00'	0.022 af	<b>10.00'D x 4.00'H Vertical Cone/Cylinder</b> x 3 Inside #2
2	145.00'	0.013 af	<b>14.00'D x 5.00'H Vertical Cone/Cylinder</b> x 3
			0.053 af Overall - 0.022 af Embedded = 0.031 af x 40.0% Voids
			0.034 af Total Available Storage

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	<b>0.002780 fpm Exfiltration over entire Surface area</b>
2	Primary	150.50'	<b>12.0" x 115.0' long Culvert</b> RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 149.00' S= 0.0130 '/' n= 0.012 Cc= 0.900

**Discarded OutFlow** Max=0.02 cfs @ 11.40 hrs HW=145.07' (Free Discharge)

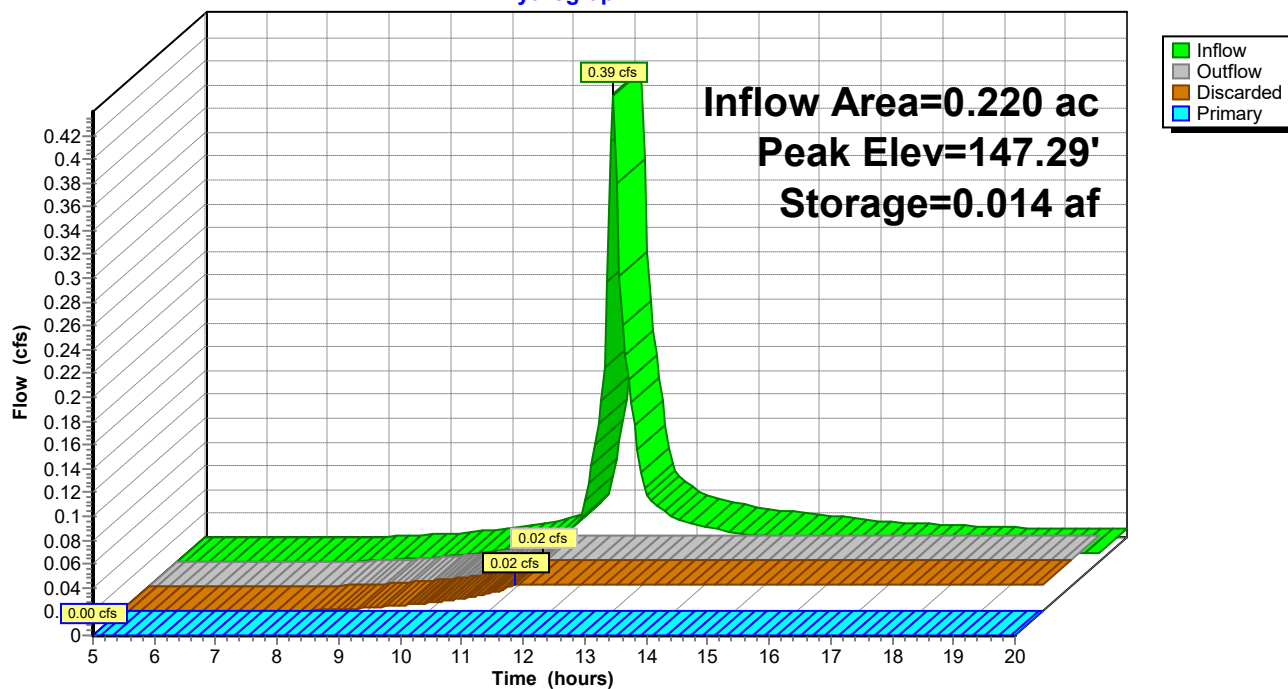
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=145.00' (Free Discharge)

↑**2=Culvert** ( Controls 0.00 cfs)

# Pond 5P: Drywells

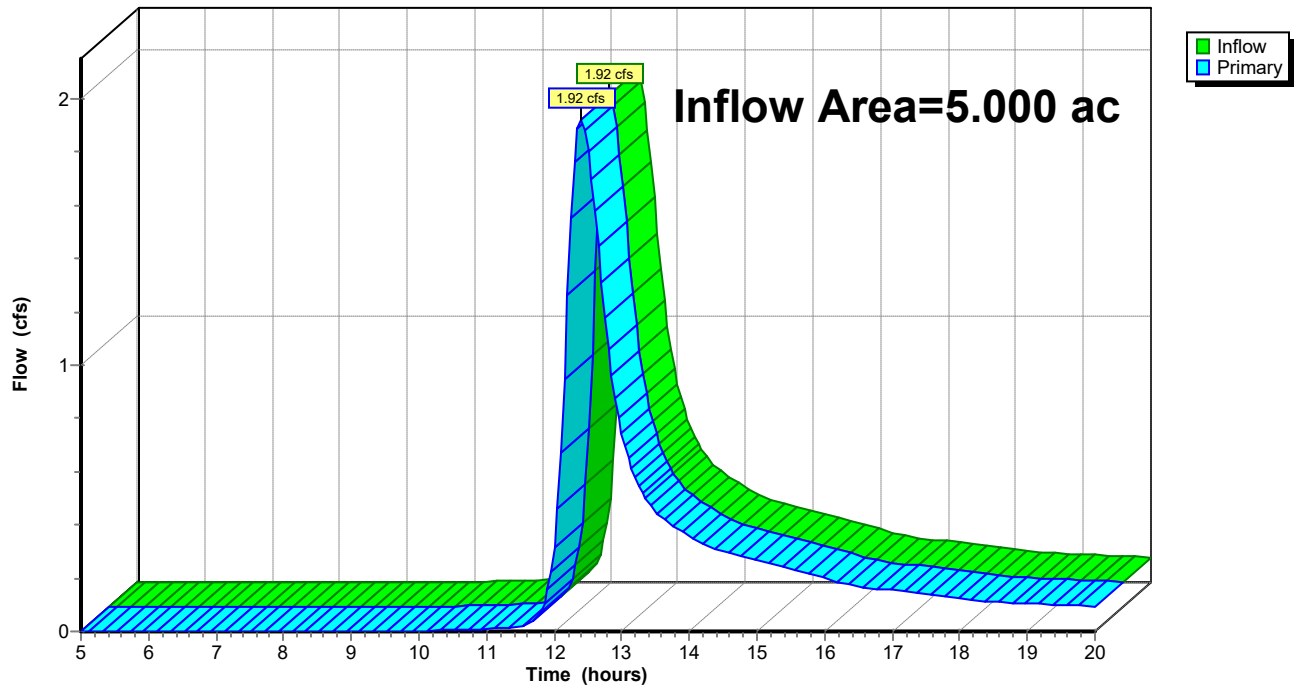
## Hydrograph



**Link 1L: ODP-1 (Culvert)**

Inflow Area = 5.000 ac, Inflow Depth = 0.57" for 1-YR event  
Inflow = 1.92 cfs @ 12.40 hrs, Volume= 0.238 af  
Primary = 1.92 cfs @ 12.40 hrs, Volume= 0.238 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

**Link 1L: ODP-1 (Culvert)****Hydrograph**

**33 Middlebush LLC 20230415 Post Dev***Type III 24-hr 10-YR Rainfall=4.90"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1 Post: Area to Infiltration Trench**Runoff Area=0.170 ac Runoff Depth=3.08"  
Tc=6.0 min CN=85 Runoff=0.63 cfs 0.044 af**Subcatchment 2 Post: Area Direct to Dry Detention**Runoff Area=0.250 ac Runoff Depth=3.47"  
Tc=6.0 min CN=89 Runoff=1.02 cfs 0.072 af**Subcatchment 3 Post: Remaining Subcatchment to ODP-1**Runoff Area=4.360 ac Runoff Depth=1.94"  
Flow Length=620' Tc=24.5 min CN=72 Runoff=6.60 cfs 0.706 af**Subcatchment 4 Post: Area to Drywells**Runoff Area=0.220 ac Runoff Depth=3.37"  
Tc=6.0 min CN=88 Runoff=0.88 cfs 0.062 af**Pond 1P: Infiltration Trench**Peak Elev=149.47' Storage=332 cf Inflow=0.63 cfs 0.044 af  
Discarded=0.03 cfs 0.023 af Primary=0.57 cfs 0.019 af Outflow=0.60 cfs 0.043 af**Pond 2P: Dry Detention Basin**Peak Elev=149.60' Storage=1,077 cf Inflow=1.57 cfs 0.092 af  
Outflow=1.10 cfs 0.090 af**Pond 5P: Drywells**Peak Elev=150.67' Storage=0.034 af Inflow=0.88 cfs 0.062 af  
Discarded=0.02 cfs 0.021 af Primary=0.13 cfs 0.008 af Outflow=0.15 cfs 0.029 af**Link 1L: ODP-1 (Culvert)**Inflow=7.30 cfs 0.804 af  
Primary=7.30 cfs 0.804 af**Total Runoff Area = 5.000 ac Runoff Volume = 0.884 af Average Runoff Depth = 2.12"**

**33 Middlebush LLC 20230415 Post Dev**

Type III 24-hr 10-YR Rainfall=4.90"

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**Subcatchment 1 Post: Area to Infiltration Trench**

Runoff = 0.63 cfs @ 12.09 hrs, Volume= 0.044 af, Depth= 3.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

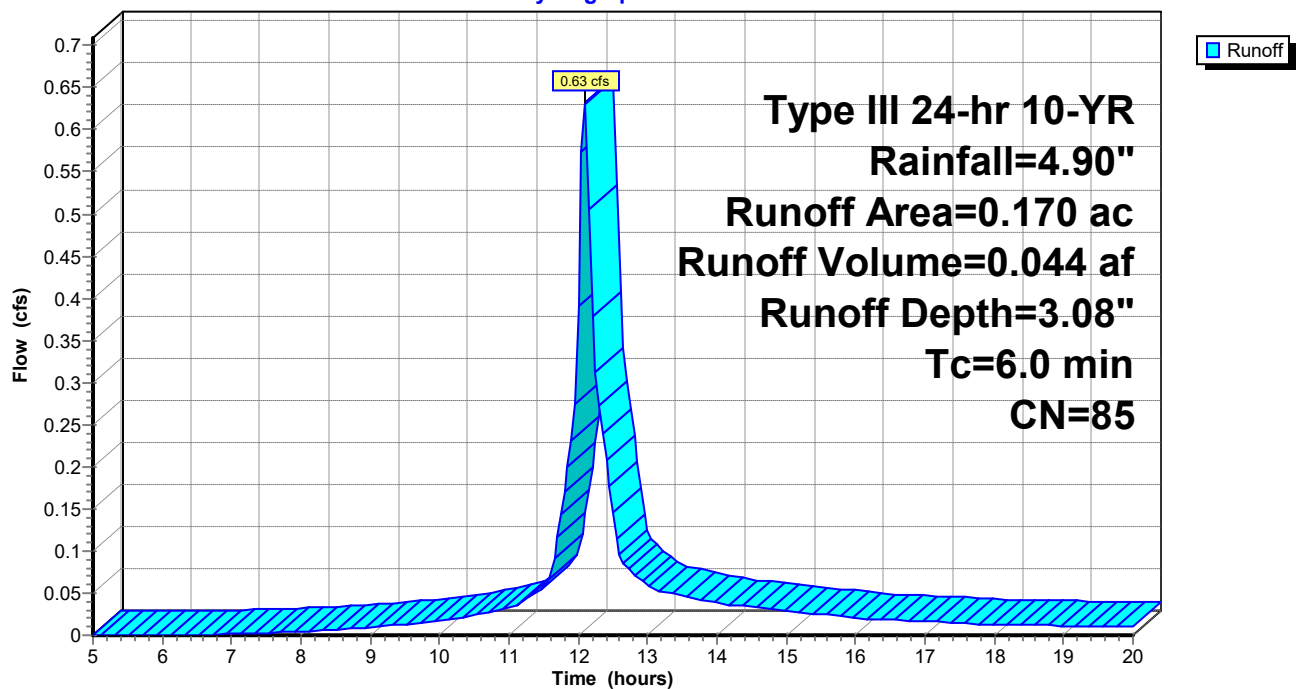
Type III 24-hr 10-YR Rainfall=4.90"

Area (ac)	CN	Description
0.040	98	Paved parking & roofs
0.030	65	Woods/grass comb., Fair, HSG B
0.100	85	Gravel roads, HSG B
0.170	85	Weighted Average

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

**Subcatchment 1 Post: Area to Infiltration Trench**

Hydrograph



### Subcatchment 2 Post: Area Direct to Dry Detention

Runoff = 1.02 cfs @ 12.09 hrs, Volume= 0.072 af, Depth= 3.47"

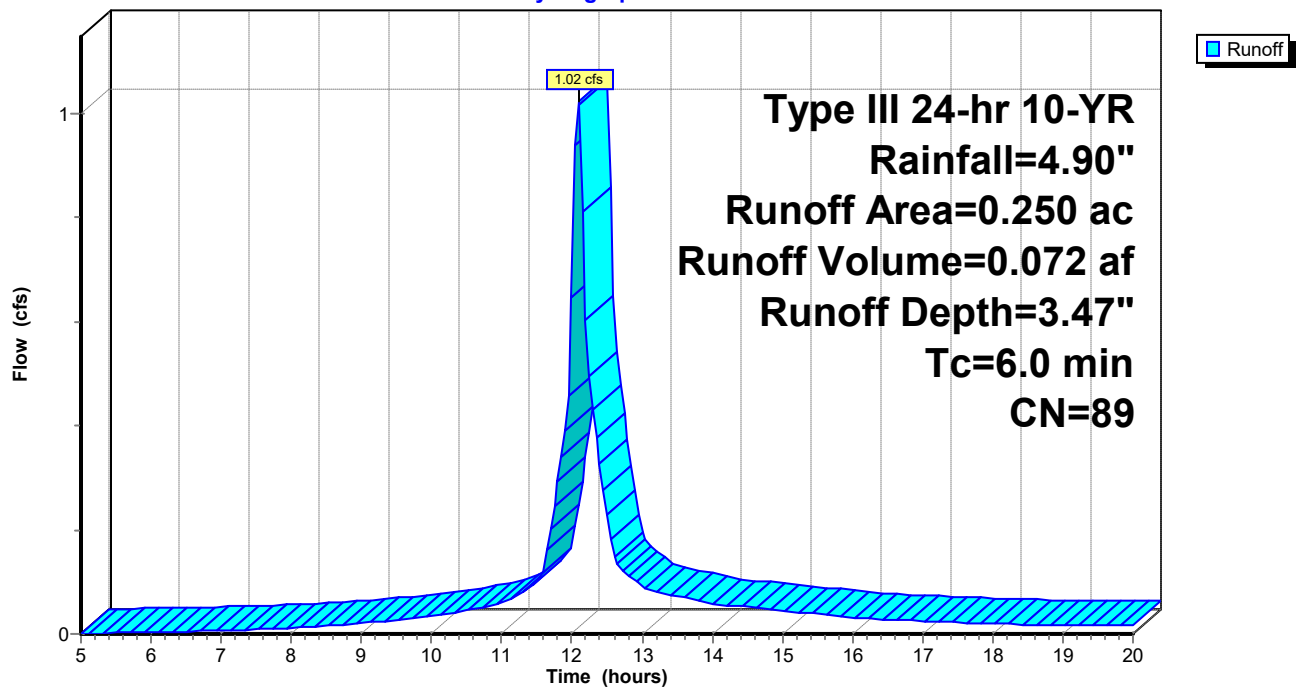
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-YR Rainfall=4.90"

Area (ac)	CN	Description
0.170	98	
0.080	69	50-75% Grass cover, Fair, HSG B
0.250	89	Weighted Average

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

### Subcatchment 2 Post: Area Direct to Dry Detention

Hydrograph



**Subcatchment 3 Post: Remaining Subcatchment to ODP-1**

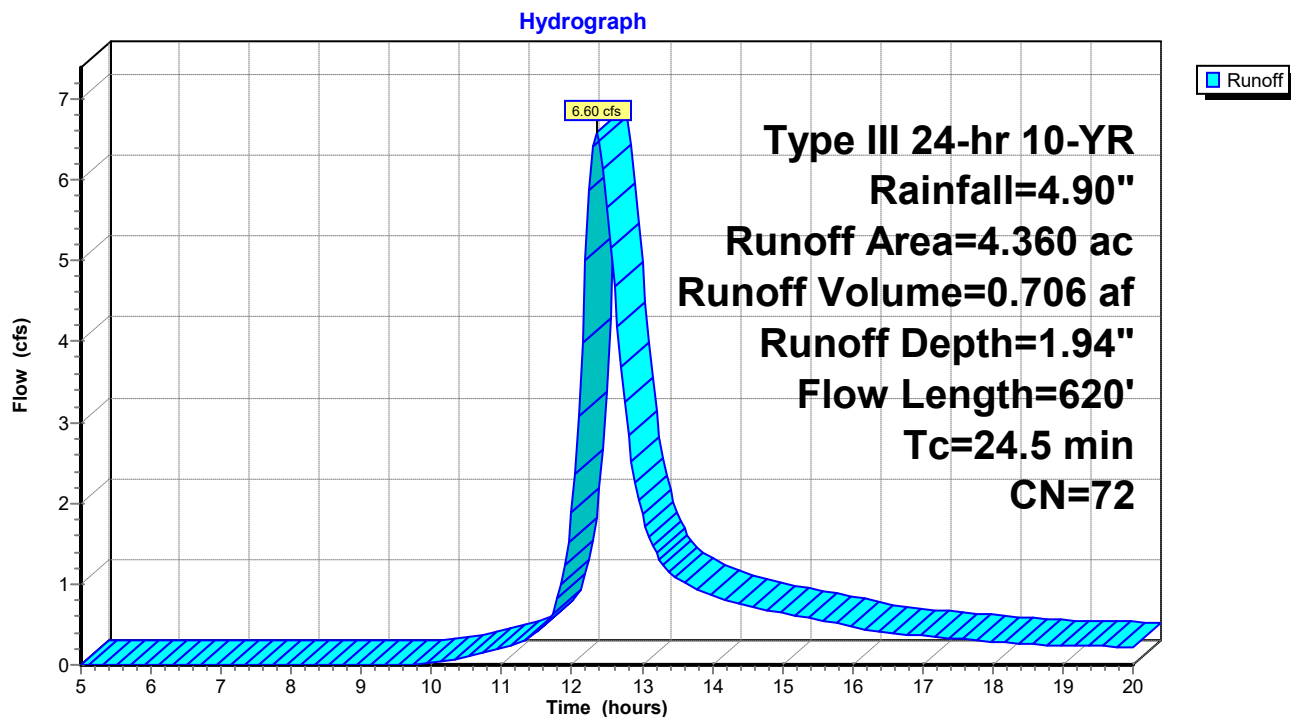
Runoff = 6.60 cfs @ 12.35 hrs, Volume= 0.706 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 10-YR Rainfall=4.90"

Area (ac)	CN	Description
1.320	98	Paved roads w/curbs & sewers
0.220	69	50-75% Grass cover, Fair, HSG B
2.750	60	Woods, Fair, HSG B
0.070	61	>75% Grass cover, Good, HSG B
4.360	72	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0400	0.2		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.40"
17.3	520	0.0100	0.5		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
24.5	620	Total			

**Subcatchment 3 Post: Remaining Subcatchment to ODP-1**

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Type III 24-hr 10-YR Rainfall=4.90"

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**Subcatchment 4 Post: Area to Drywells**

Runoff = 0.88 cfs @ 12.09 hrs, Volume= 0.062 af, Depth= 3.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

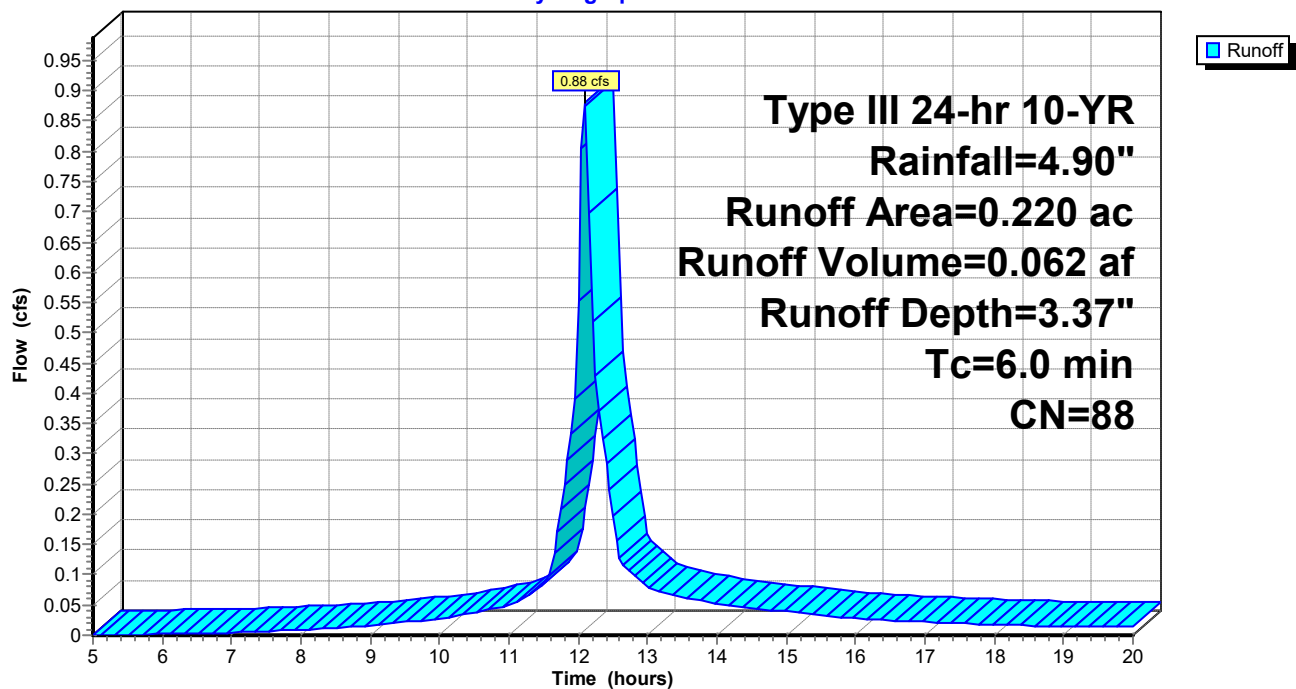
Type III 24-hr 10-YR Rainfall=4.90"

Area (ac)	CN	Description
0.120	98	
0.060	85	Gravel roads, HSG B
0.040	61	>75% Grass cover, Good, HSG B
0.220	88	Weighted Average

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

**Subcatchment 4 Post: Area to Drywells**

Hydrograph





### Pond 1P: Infiltration Trench

Inflow Area = 0.170 ac, Inflow Depth = 3.08" for 10-YR event  
 Inflow = 0.63 cfs @ 12.09 hrs, Volume= 0.044 af  
 Outflow = 0.60 cfs @ 12.12 hrs, Volume= 0.043 af, Atten= 5%, Lag= 1.9 min  
 Discarded = 0.03 cfs @ 10.75 hrs, Volume= 0.023 af  
 Primary = 0.57 cfs @ 12.12 hrs, Volume= 0.019 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 149.47' @ 12.12 hrs Surf.Area= 564 sf Storage= 332 cf  
 Plug-Flow detention time= 53.1 min calculated for 0.043 af (98% of inflow)  
 Center-of-Mass det. time= 43.6 min ( 819.4 - 775.8 )

#	Invert	Avail.Storage	Storage Description
1	148.00'	677 cf	<b>Custom Stage Data (Prismatic)</b> Listed below 1,692 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.00	564	0	0
151.00	564	1,692	1,692

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	<b>0.002780 fpm Exfiltration over entire Surface area</b>
2	Primary	151.00'	<b>3.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
3	Primary	149.00'	<b>12.0" x 52.0' long Culvert</b> CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 148.80' S= 0.0038 '/ n= 0.012 Cc= 0.900

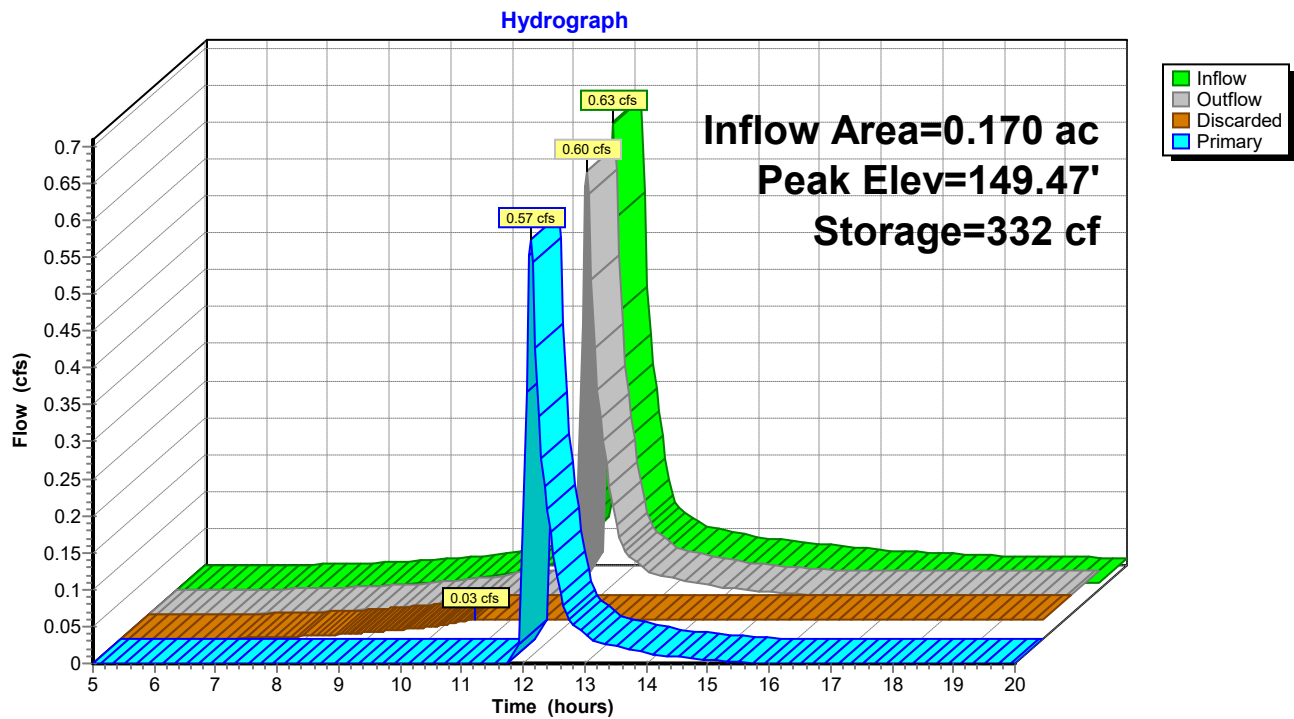
**Discarded OutFlow** Max=0.03 cfs @ 10.75 hrs HW=148.03' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.55 cfs @ 12.12 hrs HW=149.46' (Free Discharge)

↑ **2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

↑ **3=Culvert** (Barrel Controls 0.55 cfs @ 2.3 fps)

**Pond 1P: Infiltration Trench**

### Pond 2P: Dry Detention Basin

Inflow Area = 0.420 ac, Inflow Depth = 2.62" for 10-YR event  
 Inflow = 1.57 cfs @ 12.10 hrs, Volume= 0.092 af  
 Outflow = 1.10 cfs @ 12.21 hrs, Volume= 0.090 af, Atten= 30%, Lag= 6.7 min  
 Primary = 1.10 cfs @ 12.21 hrs, Volume= 0.090 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 149.60' @ 12.21 hrs Surf.Area= 1,499 sf Storage= 1,077 cf  
 Plug-Flow detention time= 42.4 min calculated for 0.089 af (97% of inflow)  
 Center-of-Mass det. time= 33.8 min ( 795.4 - 761.6 )

#	Invert	Avail.Storage	Storage Description
1	148.80'	3,635 cf	<b>Custom Stage Data (Prismatic)</b> Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.80	900	0	0
149.00	1,200	210	210
150.00	1,700	1,450	1,660
151.00	2,250	1,975	3,635

#	Routing	Invert	Outlet Devices
1	Primary	150.10'	<b>12.0' long x 8.0' breadth Broad-Crested Rectangular Weir</b> 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
2	Primary	148.80'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
3	Primary	149.50'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

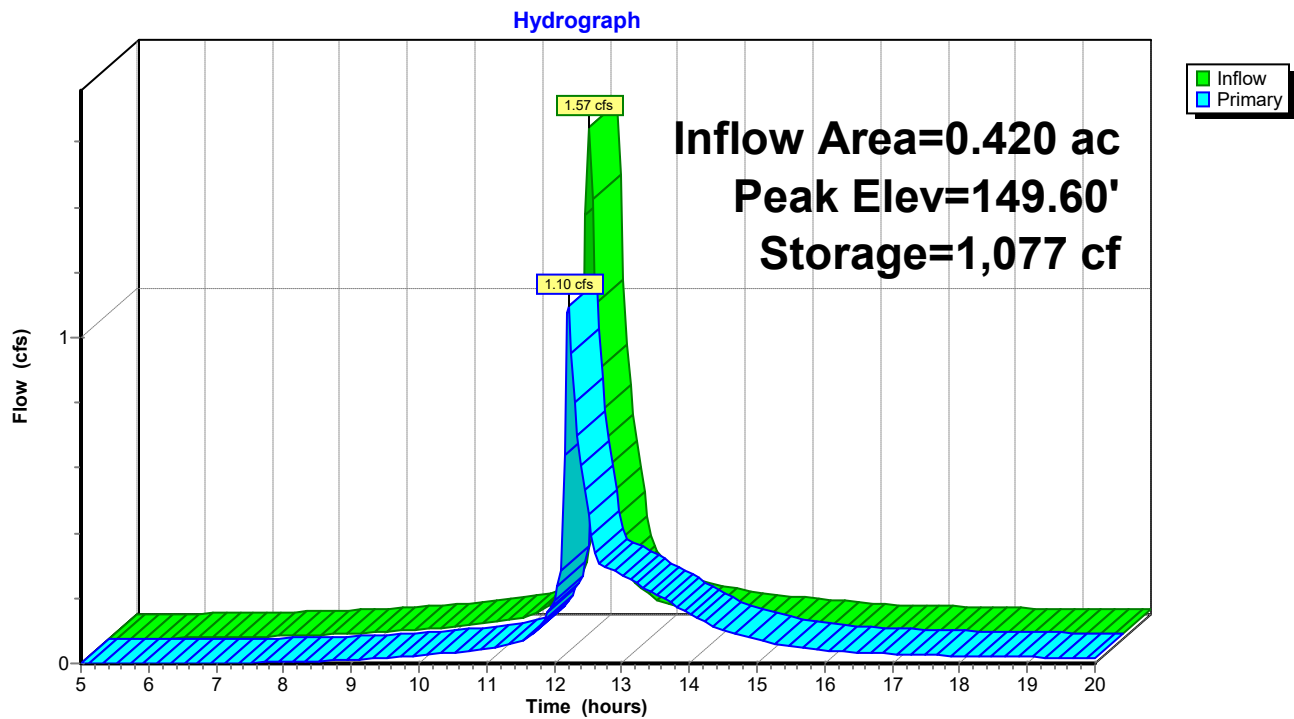
**Primary OutFlow** Max=1.04 cfs @ 12.21 hrs HW=149.59' (Free Discharge)

1=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

2=Orifice/Grate (Orifice Controls 0.33 cfs @ 3.8 fps)

3=Broad-Crested Rectangular Weir (Weir Controls 0.70 cfs @ 0.8 fps)

Pond 2P: Dry Detention Basin



### Pond 5P: Drywells

Inflow Area = 0.220 ac, Inflow Depth = 3.37" for 10-YR event  
 Inflow = 0.88 cfs @ 12.09 hrs, Volume= 0.062 af  
 Outflow = 0.15 cfs @ 12.85 hrs, Volume= 0.029 af, Atten= 83%, Lag= 45.6 min  
 Discarded = 0.02 cfs @ 9.65 hrs, Volume= 0.021 af  
 Primary = 0.13 cfs @ 12.85 hrs, Volume= 0.008 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 150.67' @ 12.85 hrs Surf.Area= 0.011 ac Storage= 0.034 af  
 Plug-Flow detention time= 161.2 min calculated for 0.029 af (47% of inflow)  
 Center-of-Mass det. time= 73.4 min ( 840.8 - 767.4 )

#	Invert	Avail.Storage	Storage Description
1	146.00'	0.022 af	<b>10.00'D x 4.00'H Vertical Cone/Cylinder</b> x 3 Inside #2
2	145.00'	0.013 af	<b>14.00'D x 5.00'H Vertical Cone/Cylinder</b> x 3
			0.053 af Overall - 0.022 af Embedded = 0.031 af x 40.0% Voids
			0.034 af Total Available Storage

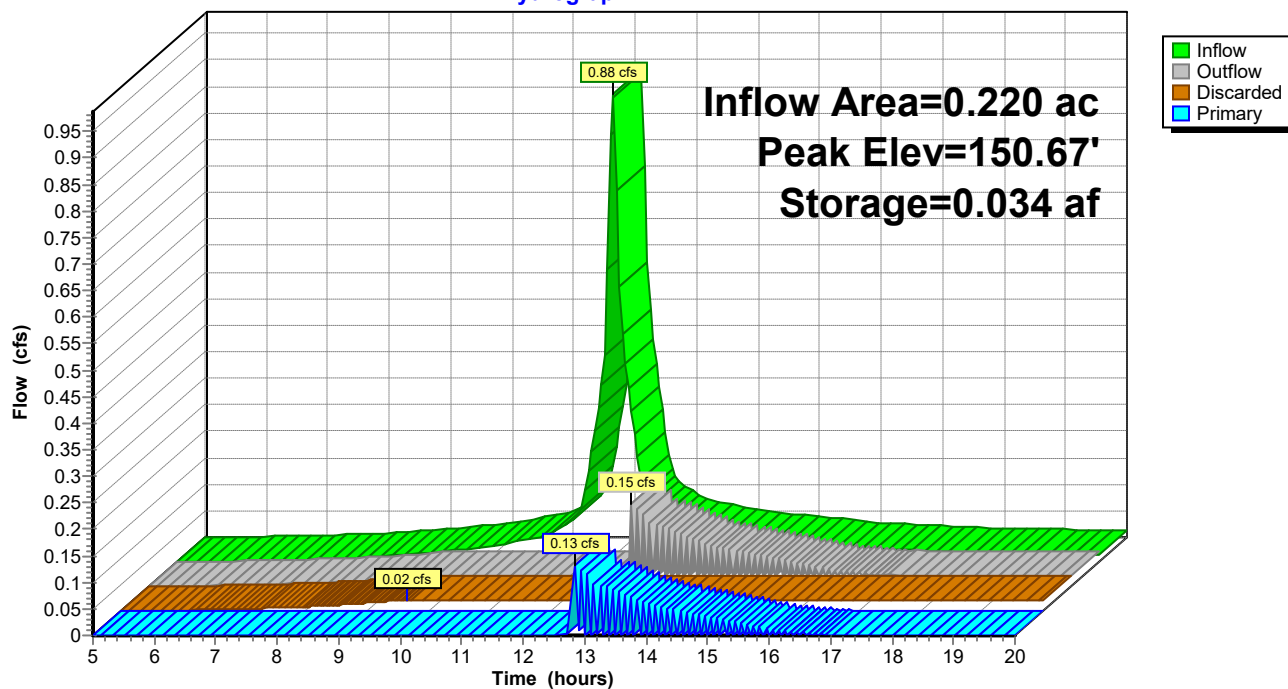
#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	<b>0.002780 fpm Exfiltration over entire Surface area</b>
2	Primary	150.50'	<b>12.0" x 115.0' long Culvert</b> RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 149.00' S= 0.0130 '/' n= 0.012 Cc= 0.900

**Discarded OutFlow** Max=0.02 cfs @ 9.65 hrs HW=145.07' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.13 cfs @ 12.85 hrs HW=150.67' (Free Discharge)

↑**2=Culvert** (Inlet Controls 0.13 cfs @ 1.4 fps)

**Pond 5P: Drywells****Hydrograph**

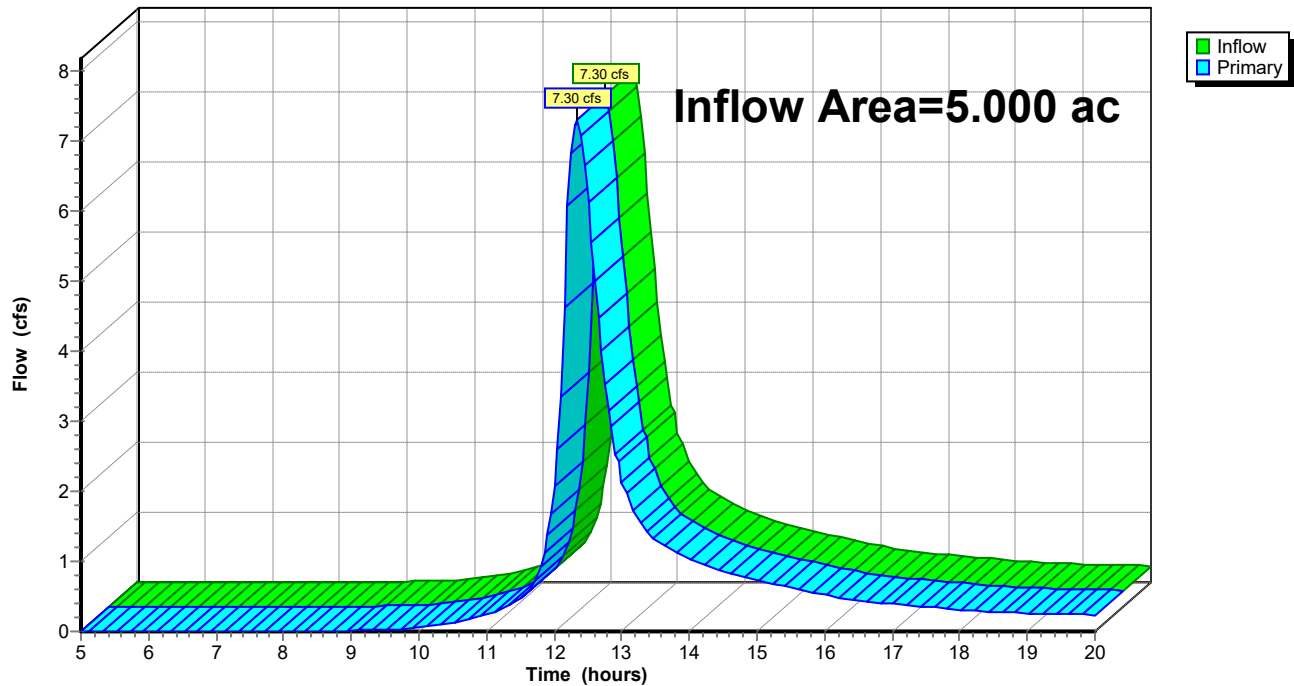
### Link 1L: ODP-1 (Culvert)

Inflow Area = 5.000 ac, Inflow Depth = 1.93" for 10-YR event  
 Inflow = 7.30 cfs @ 12.34 hrs, Volume= 0.804 af  
 Primary = 7.30 cfs @ 12.34 hrs, Volume= 0.804 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

### Link 1L: ODP-1 (Culvert)

Hydrograph



**33 Middlebush LLC 20230415 Post Dev***Type III 24-hr 100-YR Rainfall=9.00"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1 Post: Area to Infiltration Trench**Runoff Area=0.170 ac Runoff Depth=6.79"  
Tc=6.0 min CN=85 Runoff=1.34 cfs 0.096 af**Subcatchment 2 Post: Area Direct to Dry Detention**Runoff Area=0.250 ac Runoff Depth=7.24"  
Tc=6.0 min CN=89 Runoff=2.05 cfs 0.151 af**Subcatchment 3 Post: Remaining Subcatchment to ODP-1**Runoff Area=4.360 ac Runoff Depth=5.20"  
Flow Length=620' Tc=24.5 min CN=72 Runoff=17.59 cfs 1.889 af**Subcatchment 4 Post: Area to Drywells**Runoff Area=0.220 ac Runoff Depth=7.13"  
Tc=6.0 min CN=88 Runoff=1.79 cfs 0.131 af**Pond 1P: Infiltration Trench**Peak Elev=149.75' Storage=394 cf Inflow=1.34 cfs 0.096 af  
Discarded=0.03 cfs 0.028 af Primary=1.27 cfs 0.064 af Outflow=1.30 cfs 0.092 af**Pond 2P: Dry Detention Basin**Peak Elev=149.73' Storage=1,273 cf Inflow=3.30 cfs 0.214 af  
Outflow=3.18 cfs 0.212 af**Pond 5P: Drywells**Peak Elev=151.27' Storage=0.034 af Inflow=1.79 cfs 0.131 af  
Discarded=0.02 cfs 0.025 af Primary=1.98 cfs 0.072 af Outflow=2.00 cfs 0.097 af**Link 1L: ODP-1 (Culvert)**Inflow=19.91 cfs 2.172 af  
Primary=19.91 cfs 2.172 af**Total Runoff Area = 5.000 ac Runoff Volume = 2.266 af Average Runoff Depth = 5.44"**



**33 Middlebush LLC 20230415 Post Dev**

Type III 24-hr 100-YR Rainfall=9.00"

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**Subcatchment 1 Post: Area to Infiltration Trench**

Runoff = 1.34 cfs @ 12.09 hrs, Volume= 0.096 af, Depth= 6.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

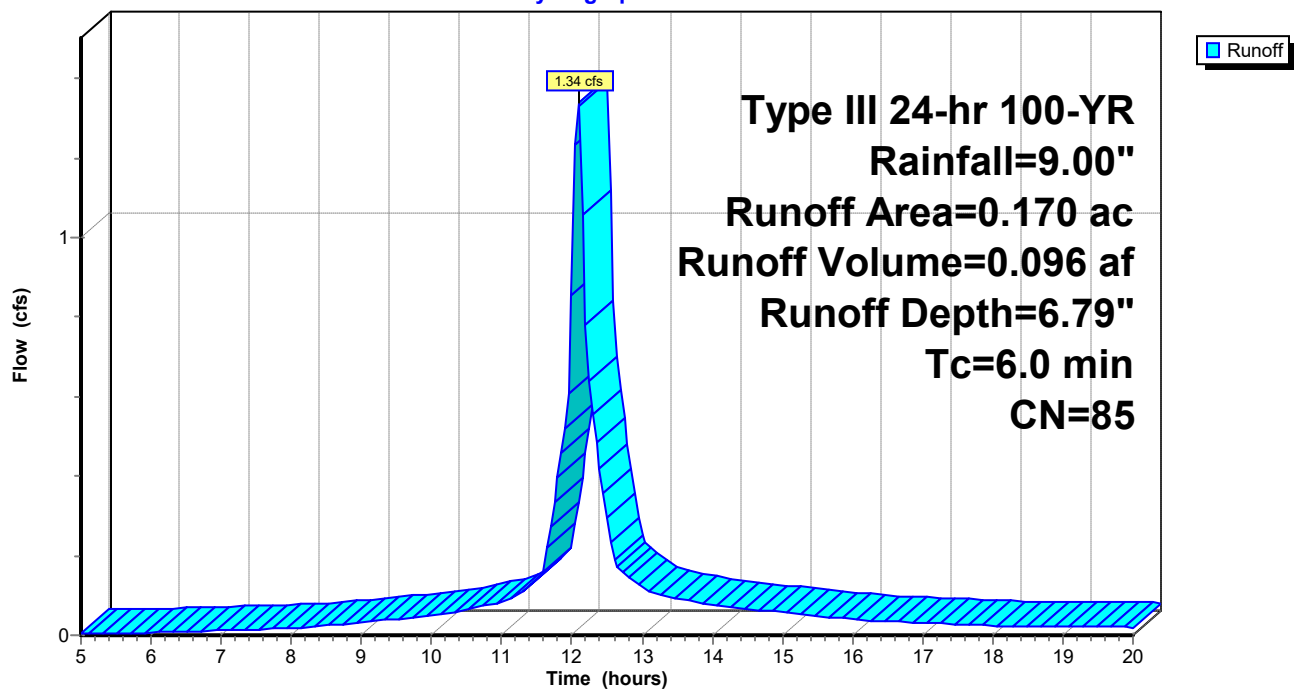
Type III 24-hr 100-YR Rainfall=9.00"

Area (ac)	CN	Description
0.040	98	Paved parking & roofs
0.030	65	Woods/grass comb., Fair, HSG B
0.100	85	Gravel roads, HSG B
0.170	85	Weighted Average

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

**Subcatchment 1 Post: Area to Infiltration Trench**

Hydrograph



### Subcatchment 2 Post: Area Direct to Dry Detention

Runoff = 2.05 cfs @ 12.09 hrs, Volume= 0.151 af, Depth= 7.24"

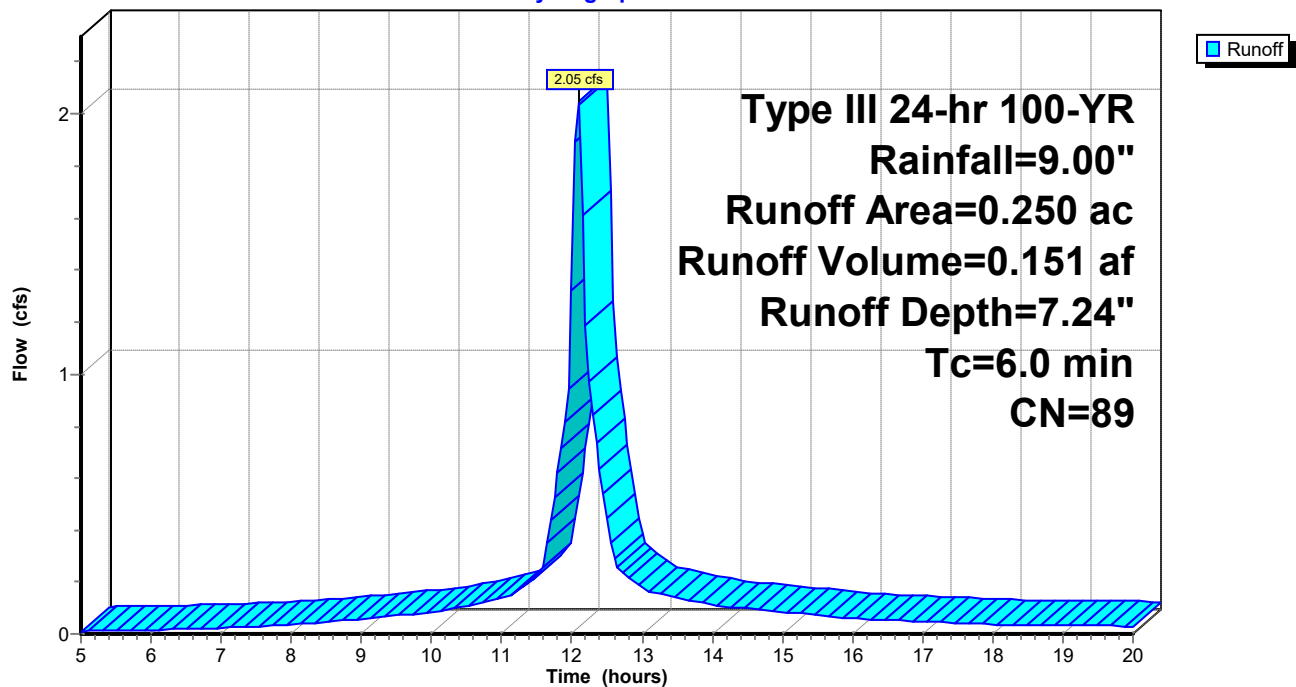
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=9.00"

Area (ac)	CN	Description
0.170	98	
0.080	69	50-75% Grass cover, Fair, HSG B
0.250	89	Weighted Average

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

### Subcatchment 2 Post: Area Direct to Dry Detention

Hydrograph



### Subcatchment 3 Post: Remaining Subcatchment to ODP-1

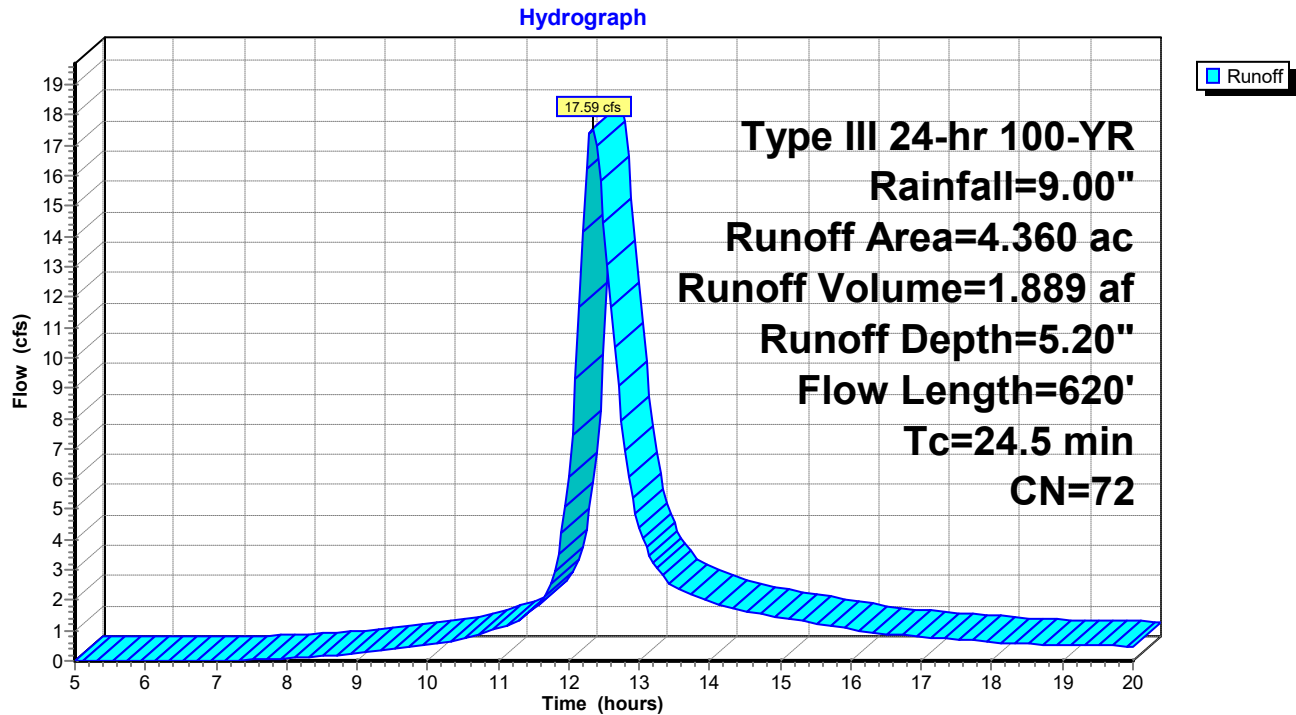
Runoff = 17.59 cfs @ 12.34 hrs, Volume= 1.889 af, Depth= 5.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-YR Rainfall=9.00"

Area (ac)	CN	Description
1.320	98	Paved roads w/curbs & sewers
0.220	69	50-75% Grass cover, Fair, HSG B
2.750	60	Woods, Fair, HSG B
0.070	61	>75% Grass cover, Good, HSG B
4.360	72	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0400	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 3.40"
17.3	520	0.0100	0.5		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
24.5	620	Total			

### Subcatchment 3 Post: Remaining Subcatchment to ODP-1



**33 Middlebush LLC 20230415 Post Dev**

Type III 24-hr 100-YR Rainfall=9.00"

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**Subcatchment 4 Post: Area to Drywells**

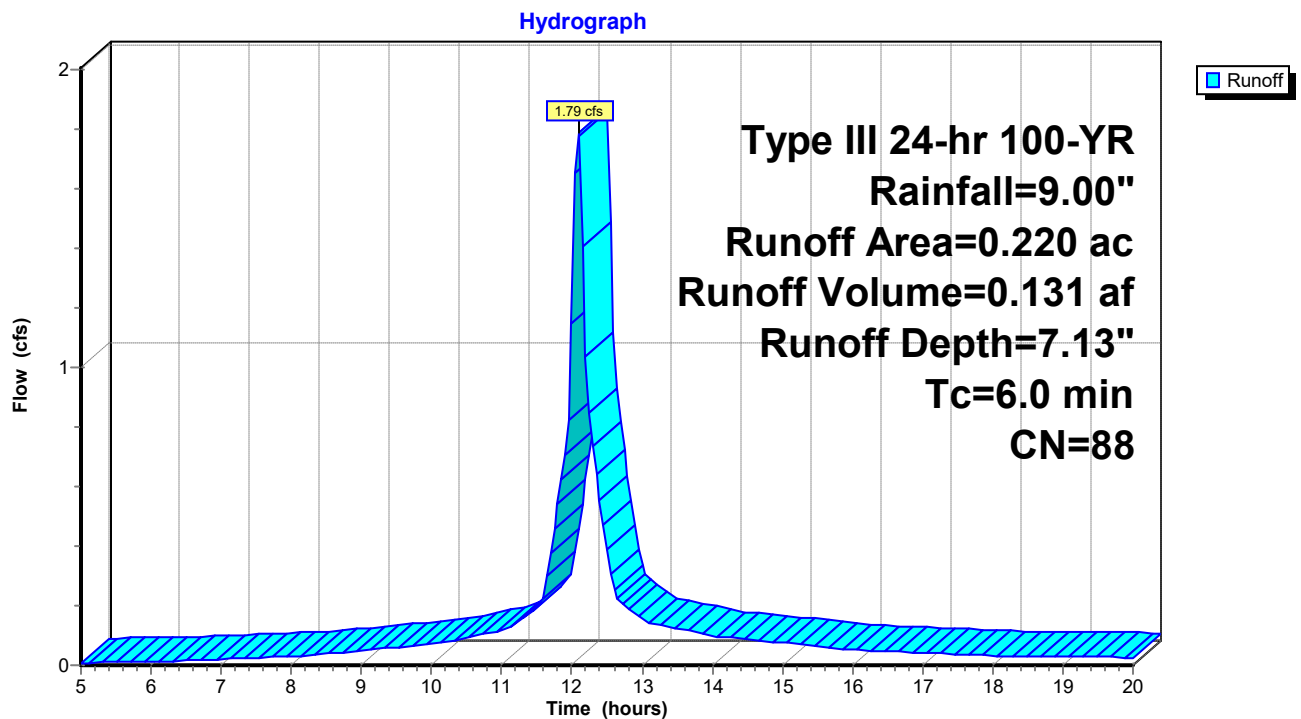
Runoff = 1.79 cfs @ 12.09 hrs, Volume= 0.131 af, Depth= 7.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Type III 24-hr 100-YR Rainfall=9.00"

Area (ac)	CN	Description
0.120	98	
0.060	85	Gravel roads, HSG B
0.040	61	>75% Grass cover, Good, HSG B
0.220	88	Weighted Average

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

**Subcatchment 4 Post: Area to Drywells**

**Pond 1P: Infiltration Trench**

Inflow Area = 0.170 ac, Inflow Depth = 6.79" for 100-YR event  
 Inflow = 1.34 cfs @ 12.09 hrs, Volume= 0.096 af  
 Outflow = 1.30 cfs @ 12.11 hrs, Volume= 0.092 af, Atten= 3%, Lag= 1.3 min  
 Discarded = 0.03 cfs @ 8.70 hrs, Volume= 0.028 af  
 Primary = 1.27 cfs @ 12.11 hrs, Volume= 0.064 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 149.75' @ 12.11 hrs Surf.Area= 564 sf Storage= 394 cf  
 Plug-Flow detention time= 32.7 min calculated for 0.092 af (95% of inflow)  
 Center-of-Mass det. time= 14.4 min ( 772.0 - 757.5 )

#	Invert	Avail.Storage	Storage Description
1	148.00'	677 cf	<b>Custom Stage Data (Prismatic)</b> Listed below 1,692 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.00	564	0	0
151.00	564	1,692	1,692

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	<b>0.002780 fpm Exfiltration over entire Surface area</b>
2	Primary	151.00'	<b>3.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
3	Primary	149.00'	<b>12.0" x 52.0' long Culvert</b> CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 148.80' S= 0.0038 '/' n= 0.012 Cc= 0.900

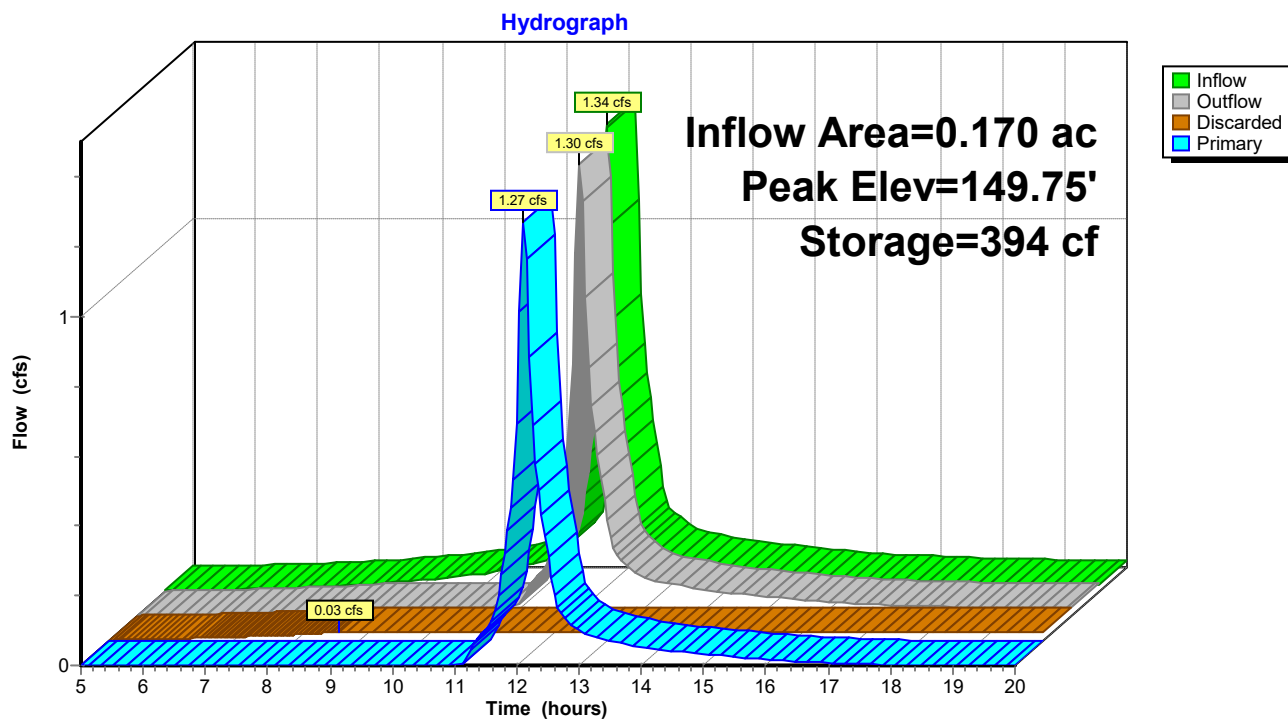
**Discarded OutFlow** Max=0.03 cfs @ 8.70 hrs HW=148.03' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=1.24 cfs @ 12.11 hrs HW=149.74' (Free Discharge)

↑ **2=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

↑ **3=Culvert** (Barrel Controls 1.24 cfs @ 2.8 fps)

**Pond 1P: Infiltration Trench**

### Pond 2P: Dry Detention Basin

Inflow Area = 0.420 ac, Inflow Depth = 6.13" for 100-YR event  
 Inflow = 3.30 cfs @ 12.10 hrs, Volume= 0.214 af  
 Outflow = 3.18 cfs @ 12.12 hrs, Volume= 0.212 af, Atten= 3%, Lag= 1.3 min  
 Primary = 3.18 cfs @ 12.12 hrs, Volume= 0.212 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 149.73' @ 12.12 hrs Surf.Area= 1,567 sf Storage= 1,273 cf  
 Plug-Flow detention time= 29.7 min calculated for 0.211 af (98% of inflow)  
 Center-of-Mass det. time= 24.2 min ( 775.5 - 751.3 )

#	Invert	Avail.Storage	Storage Description
1	148.80'	3,635 cf	<b>Custom Stage Data (Prismatic)</b> Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.80	900	0	0
149.00	1,200	210	210
150.00	1,700	1,450	1,660
151.00	2,250	1,975	3,635

#	Routing	Invert	Outlet Devices
1	Primary	150.10'	<b>12.0' long x 8.0' breadth Broad-Crested Rectangular Weir</b> 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) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
2	Primary	148.80'	<b>4.0" Vert. Orifice/Grate</b> C= 0.600
3	Primary	149.50'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

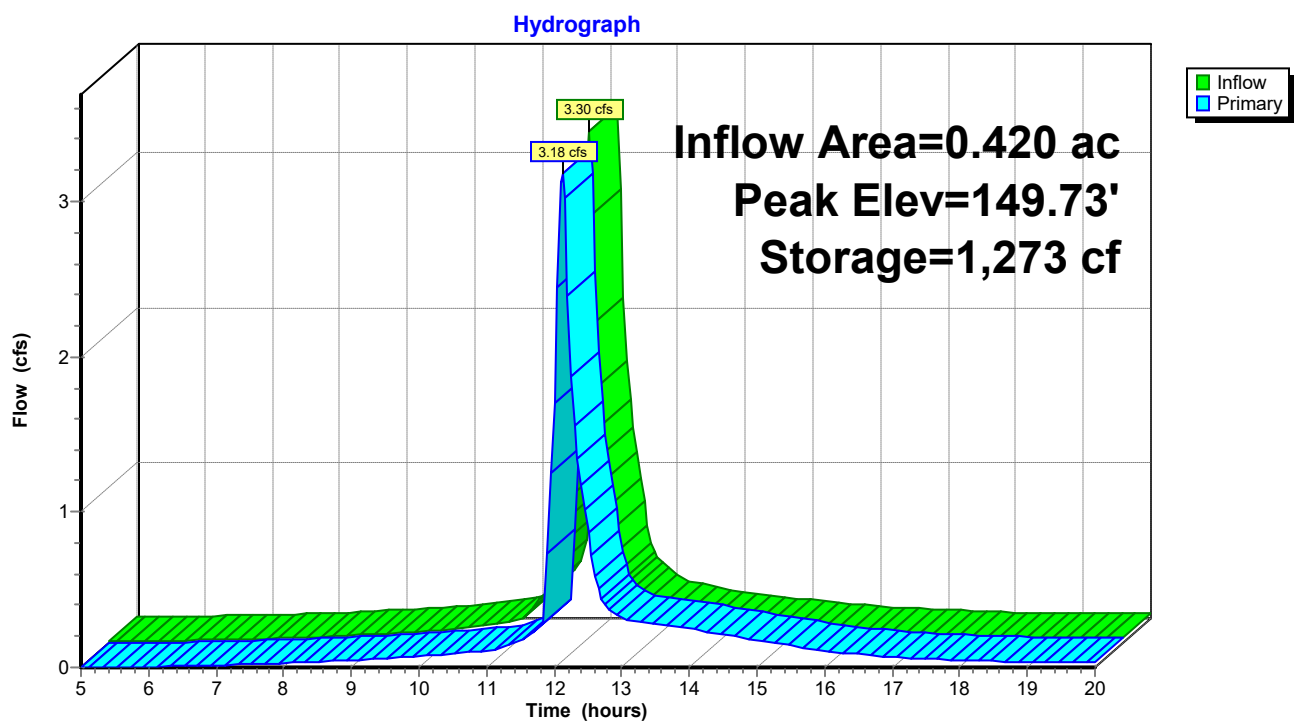
**Primary OutFlow** Max=3.09 cfs @ 12.12 hrs HW=149.73' (Free Discharge)

1=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

2=Orifice/Grate (Orifice Controls 0.37 cfs @ 4.2 fps)

3=Broad-Crested Rectangular Weir (Weir Controls 2.72 cfs @ 1.2 fps)

# Pond 2P: Dry Detention Basin





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Type III 24-hr 100-YR Rainfall=9.00"

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**Pond 5P: Drywells**

Inflow Area = 0.220 ac, Inflow Depth = 7.13" for 100-YR event  
 Inflow = 1.79 cfs @ 12.09 hrs, Volume= 0.131 af  
 Outflow = 2.00 cfs @ 12.06 hrs, Volume= 0.097 af, Atten= 0%, Lag= 0.0 min  
 Discarded = 0.02 cfs @ 7.35 hrs, Volume= 0.025 af  
 Primary = 1.98 cfs @ 12.06 hrs, Volume= 0.072 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 151.27' @ 12.05 hrs Surf.Area= 0.011 ac Storage= 0.034 af  
 Plug-Flow detention time= 93.0 min calculated for 0.096 af (74% of inflow)  
 Center-of-Mass det. time= 30.5 min ( 782.1 - 751.6 )

#	Invert	Avail.Storage	Storage Description
1	146.00'	0.022 af	<b>10.00'D x 4.00'H Vertical Cone/Cylinder</b> x 3 Inside #2
2	145.00'	0.013 af	<b>14.00'D x 5.00'H Vertical Cone/Cylinder</b> x 3
			0.053 af Overall - 0.022 af Embedded = 0.031 af x 40.0% Voids
			0.034 af Total Available Storage

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	<b>0.002780 fpm Exfiltration over entire Surface area</b>
2	Primary	150.50'	<b>12.0" x 115.0' long Culvert</b> RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 149.00' S= 0.0130 '/' n= 0.012 Cc= 0.900

**Discarded OutFlow** Max=0.02 cfs @ 7.35 hrs HW=145.07' (Free Discharge)

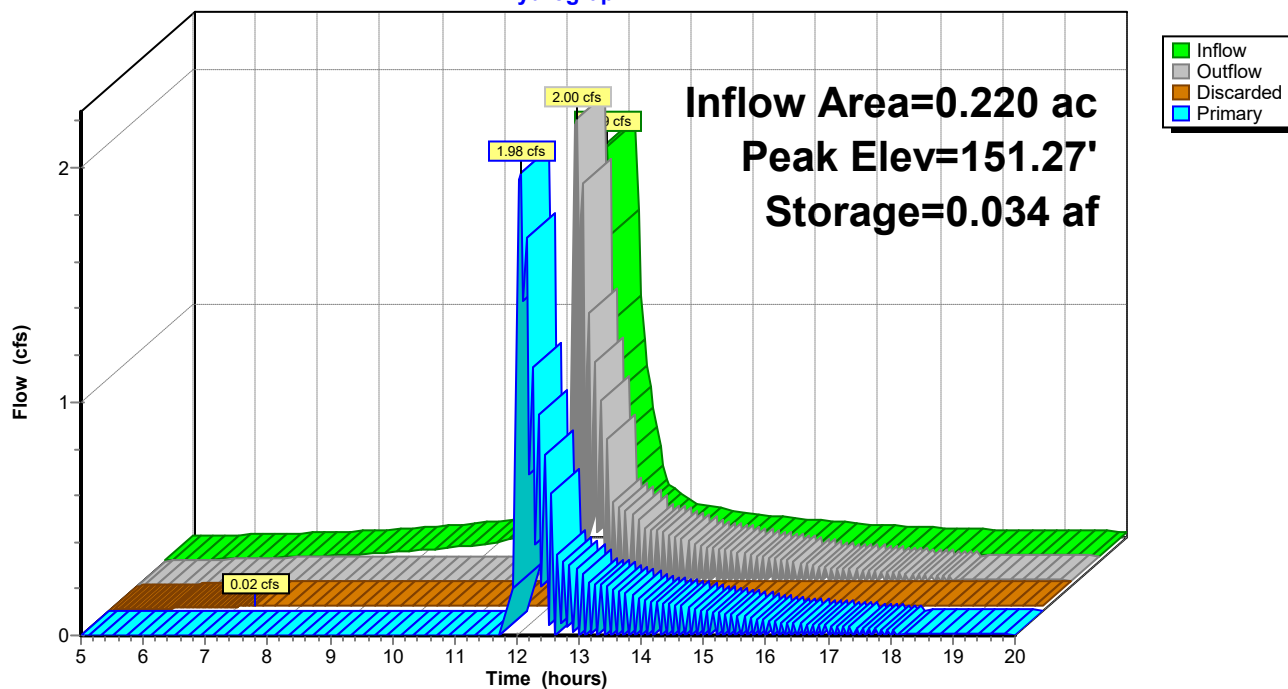
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=1.85 cfs @ 12.06 hrs HW=151.25' (Free Discharge)

↑**2=Culvert** (Inlet Controls 1.85 cfs @ 2.9 fps)

# Pond 5P: Drywells

Hydrograph



**Link 1L: ODP-1 (Culvert)**

Inflow Area = 5.000 ac, Inflow Depth = 5.21" for 100-YR event  
Inflow = 19.91 cfs @ 12.34 hrs, Volume= 2.172 af  
Primary = 19.91 cfs @ 12.34 hrs, Volume= 2.172 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

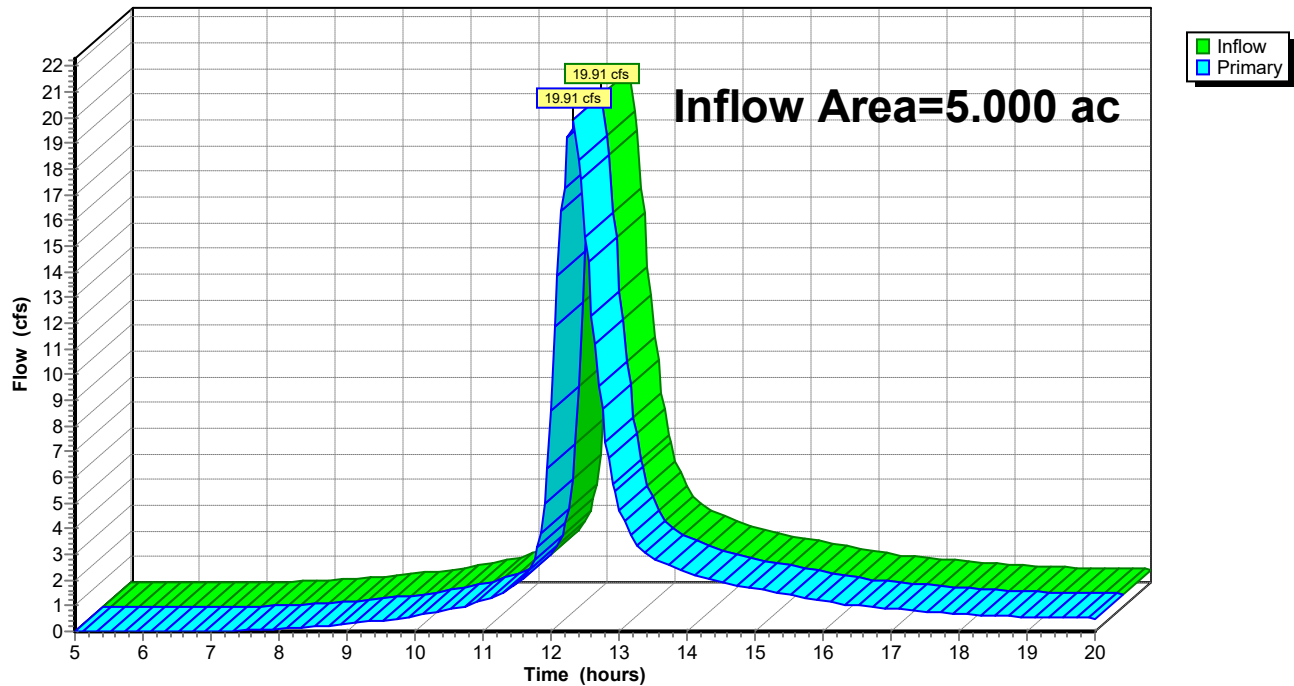
**Link 1L: ODP-1 (Culvert)****Hydrograph**

Figure 42

OFF-SITE DISCHARGE POINT  
(EXISTING 12" RCP)

**CULVERT CAPACITY  
12-INCH DIAMETER PIPE**

