

May 31, 2020 (Revised January 28, 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.

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 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 $24\text{-hr } P_{n\text{-yr}}$ (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 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.

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.

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 10 inches/hour.

Design Point Summary	Pre-Development	Post-Development	Units	Satisfied
Design Point 1				
Contributing Watershed Area	5.0	5.0	AC	
		Peak Discharge		
1-year event	2.2	1.9	cfs	√
10-year event	7.8	6.9	cfs	√
100-year event	20.5	19.7	cfs	√

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 water quality treatment of runoff from 0.39 acres of the site's impervious surfaces. This exceeds the water quality volume from the increase in impervious surfaces on the site. 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.

The proposed construction will not increase the approved developed peak discharge rates from the site and will treat the water quality volume from an area that exceeds the increase in impervious areas.

Sincerely,



Troy A. Wojciekowsky, P. E., LEED-AP
Engineer
Attachments:
Soils Information
HydroCAD Report

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



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%
Totals for Area of Interest		1.0	100.0%

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

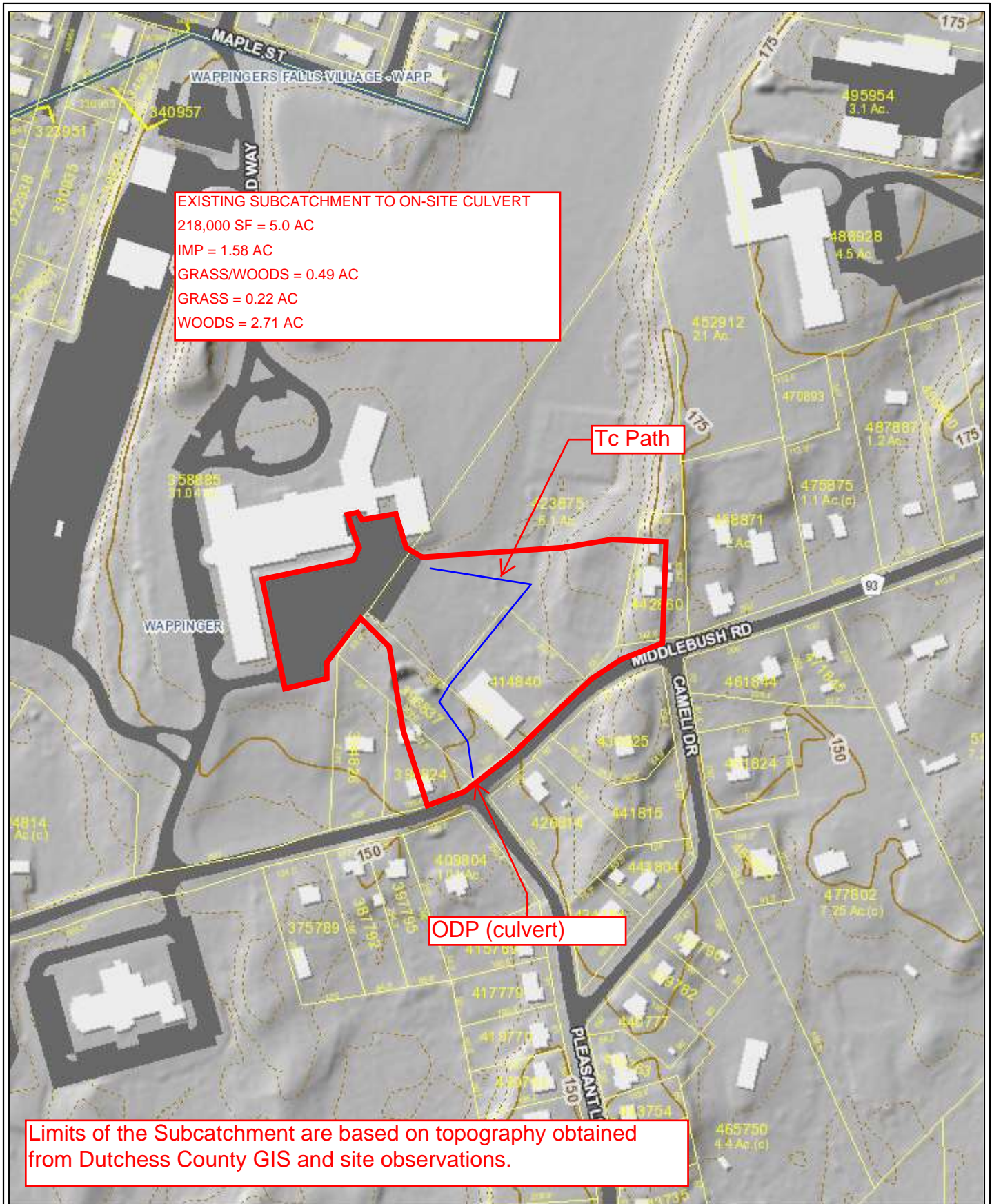
Percent of map unit: 1 percent

Hydric soil rating: Unranked

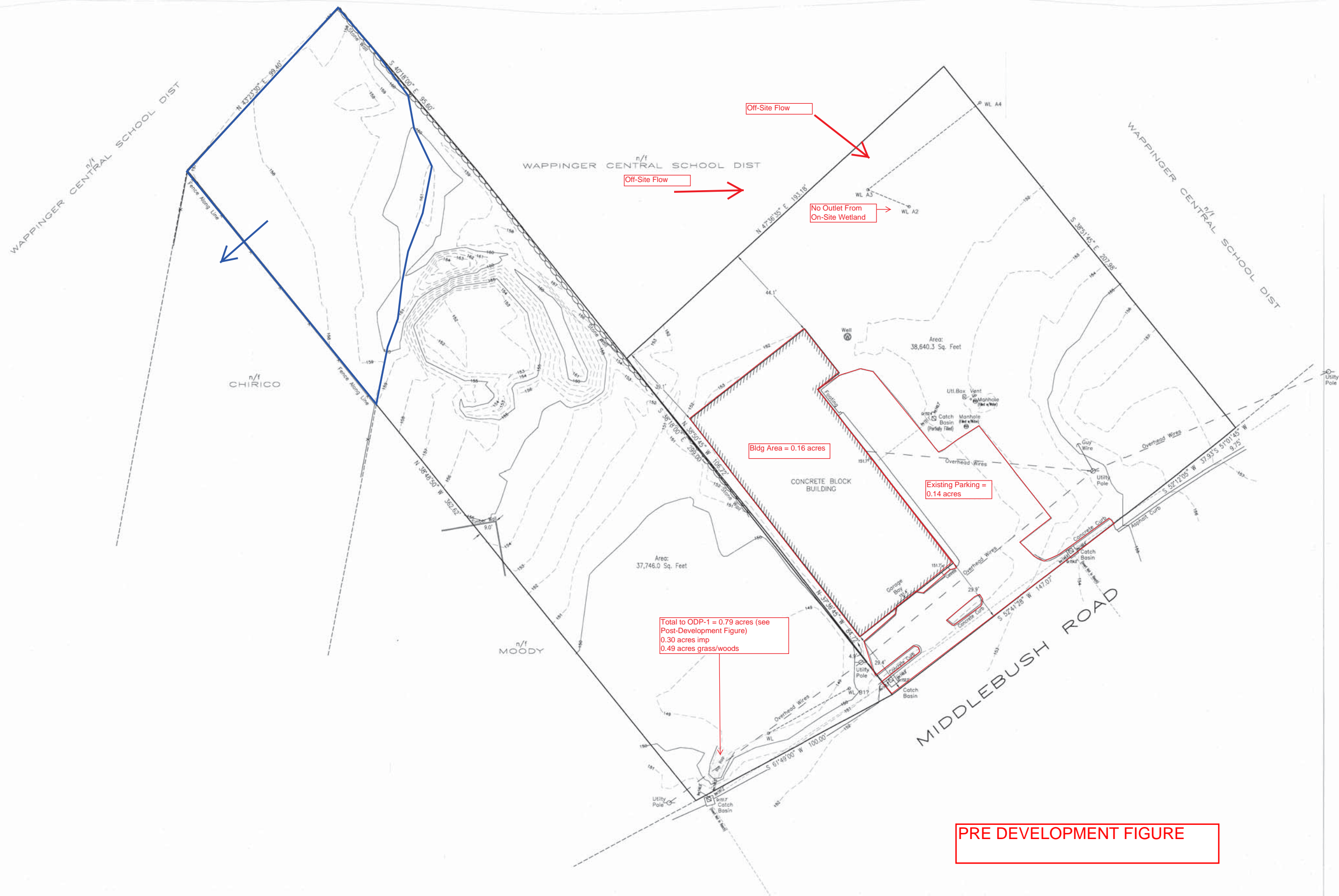
Data Source Information

Soil Survey Area: Dutchess County, New York

Survey Area Data: Version 16, Sep 16, 2019



CS DIRECT



EXISTING CONDITIONS SURVEY

SURVEY AS PREPARED BY ROBERT OICLE DATED NOV. 7, 2017

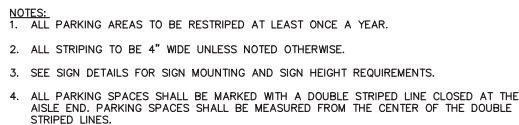
REVISIONS	BY

ALFRED A. CAPPELLI Jr., AIA
ARCHITECT
1136 ROUTE 9 WAPPINGERS FALLS, N.Y. 12590
Phone: (845) 632-6500
acap2102@aol.com

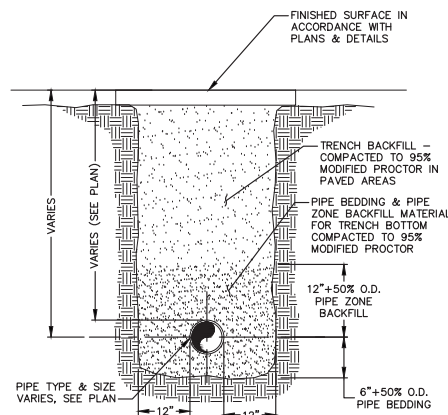
PROPOSED CONTRACTOR STORAGE BUILDING
33 MIDDLEBUSH LLC
33 MIDDLEBUSH ROAD TOWN OF WAPPINGERS, NY

EXISTING CONDITIONS SURVEY

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



TYPICAL HANDICAP PARKING STRIPING DETAIL



PERF. PIPE IN INFILTRATION TRENCH

NOTES:

1. PIPE BEDDING & PIPE ZONE BACKFILL SHALL BE A NATURAL RUN-OF-BANK (R.O.B.) OR A MIXTURE OF CRUSHED STONE & GRAVEL, FREE OF SODI, NONDURABLE PARTICLES, ORGANIC MATERIALS AND ELONGATED PARTICLES, AND SHALL BE WELL GRADUED FROM FINE TO COARSE PARTICLES. BEDDING GRADATIONS SHALL BE APPROVED BY THE ENGINEER AND SHALL MEET THE FOLLOWING GRADATION REQUIREMENTS:

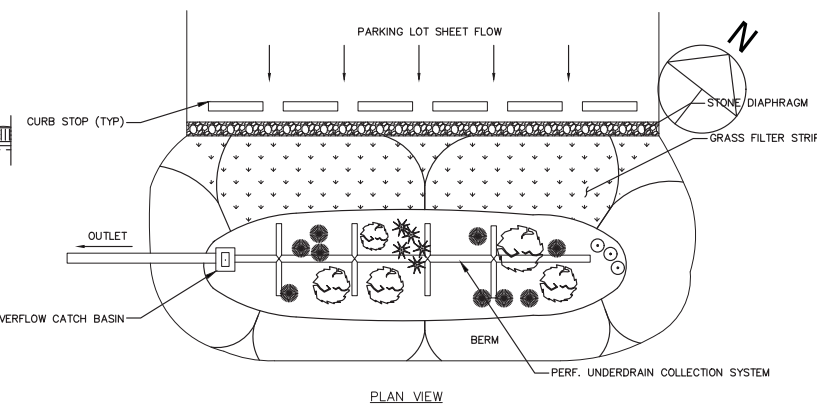
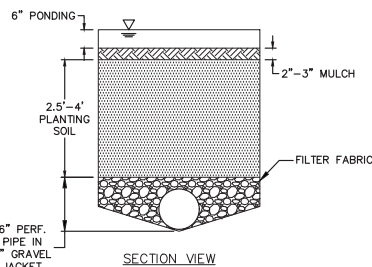
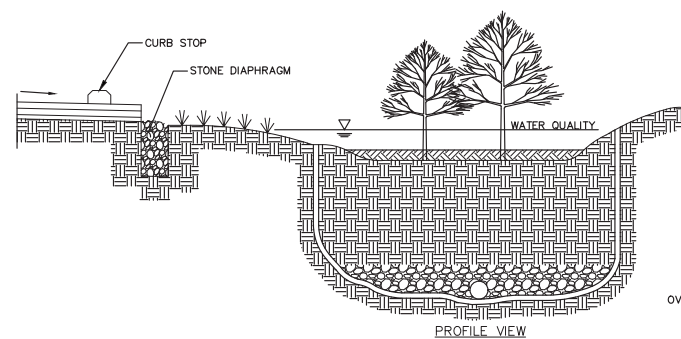
SEIVE DESIGNATION	% PASSING
3/4"	100%
No. 40	0-70%
No. 200	0-10%

2. TRENCH BACKFILL SHALL BE A NATURAL RUN-OF-BANK (R.O.B.) OR PROCESSED GRAVEL, OR EXCAVATED MATERIAL FREE OF SODI, NONDURABLE PARTICLES, ORGANIC MATERIALS AND ELONGATED PARTICLES, AND SHALL BE WELL GRADUED FROM FINE TO COARSE PARTICLES. TRENCH BACKFILL GRADATIONS SHALL BE APPROVED BY THE ENGINEER AND SHALL MEET THE FOLLOWING GRADATION REQUIREMENTS:

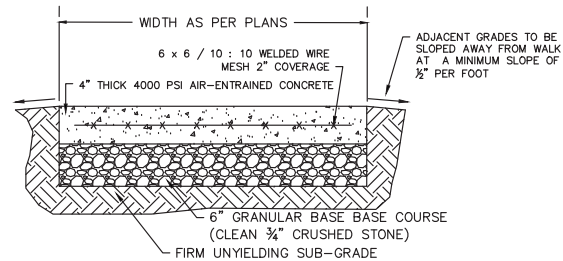
SEIVE DESIGNATION	% PASSING
2"	100%
No. 40	50-85%
No. 200	0-15%

3. INSTALL CONTINUOUS DETECTABLE MARKING TAPE DURING BACKFILLING OF TRENCH FOR UNDERGROUND PIPING. LOCATE TAPE 12" BELOW DETECTABLE MARKING TAPE OVER PIPING, EXCEPT 6" BELOW SUBGRADE UNDER PAVEMENTS & SLAB.

4. TRENCHING SHALL BE IMPLEMENTED IN ACCORDANCE WITH O.S.H.A. STANDARDS.



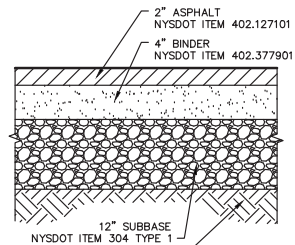
BIO-RETENTION BASIN DETAIL



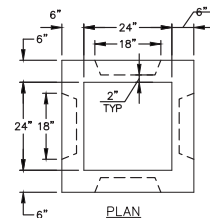
NOTES:

1. EXPANSION JOINTS OF $\frac{1}{2}$ " CELLULOSE OR SIMILAR WITH $\frac{1}{2}$ " RADIUS EDGES SHALL BE PLACED ACROSS THE FULL WIDTH OF WALKWAY, AT INTERVALS NOT TO EXCEED 20' ALONG LENGTH OF SIDEWALK.
2. CONTRACTION JOINTS (ACROSS FULL WIDTH OF WALKWAY) SHALL BE LOCATED AT A MAXIMUM SPACING OF 5' ON CENTER BETWEEN EXPANSION JOINTS.

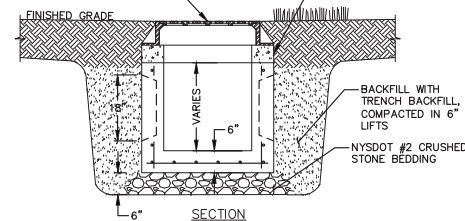
SIDEWALK DETAIL



PARKING PAVEMENT DETAIL



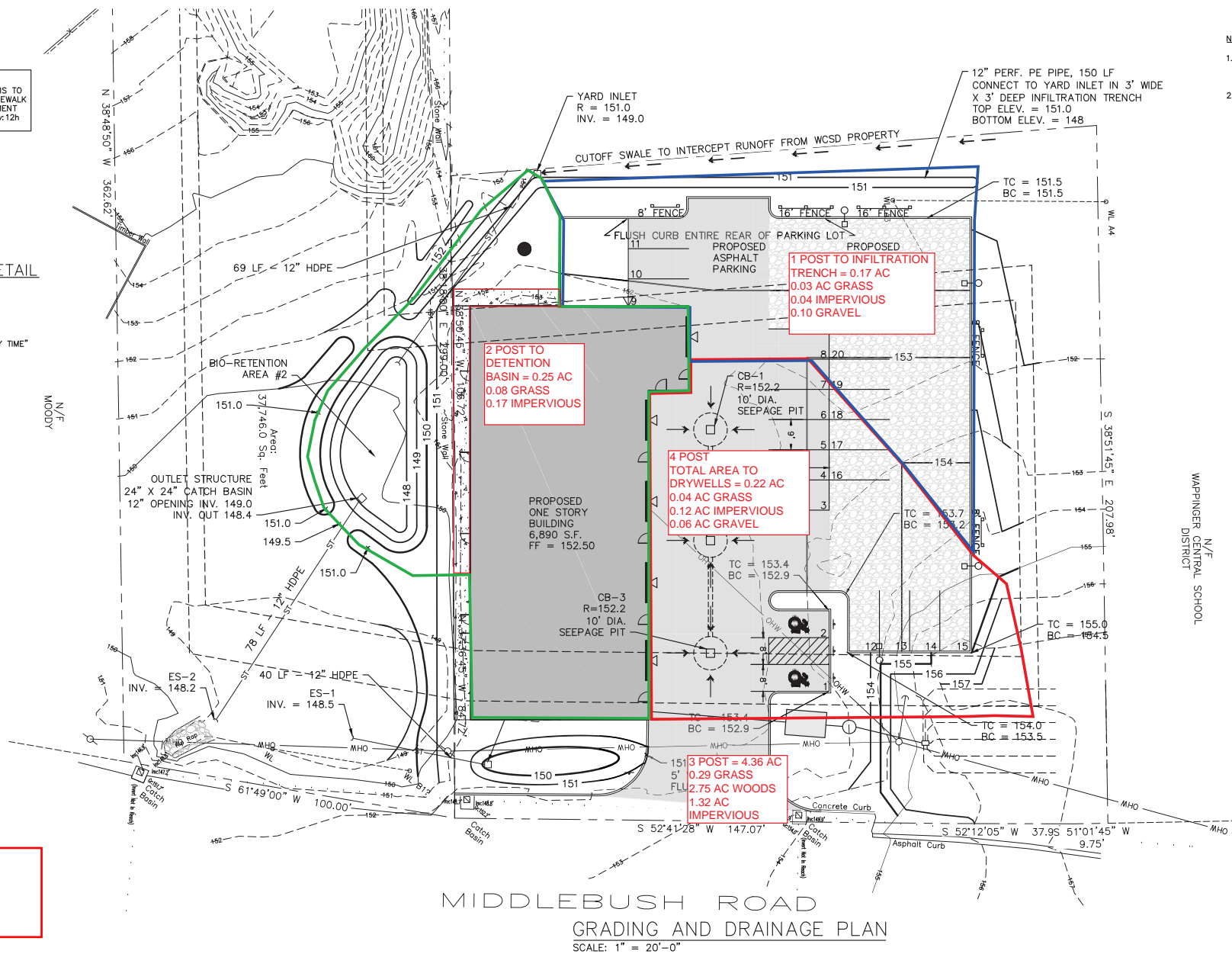
CAST IRON FRAME AND GRATE
NO. 2815 AS MANUFACTURED
BY SYRACUSE CASTINGS OR
APPROVE EQUAL — GRADE ADJUSTMENT



NOTES:

- NOTES:
1. MAX STORM SEWER PIPE FOR YARD INLET DRAIN IS 12".
 2. YARD INLET BASINS HAVING A DEPTH GREATER THAN 48" FROM FINISHED SURFACE TO THE TOP OF THE CONCRETE BASE, SHALL BE PROVIDED WITH STEPS.
 3. YARD INLET BASINS SHALL BE PRECAST CONCRETE.

YARD INLET BASIN



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

[illegible]

<div style="writing-mode: vertical-rl; transform: rotate(180deg);"> <h1>GRADING & DRAINAGE PLAN</h1> </div>	DATE:	12/30/2022
	PROJECT NO.	
	2022-20	
	SCALE:	
	1" = 20'	
	DRAWING NO.	S-4.0

Subcatchment 1 Pre: Total to ODP-1

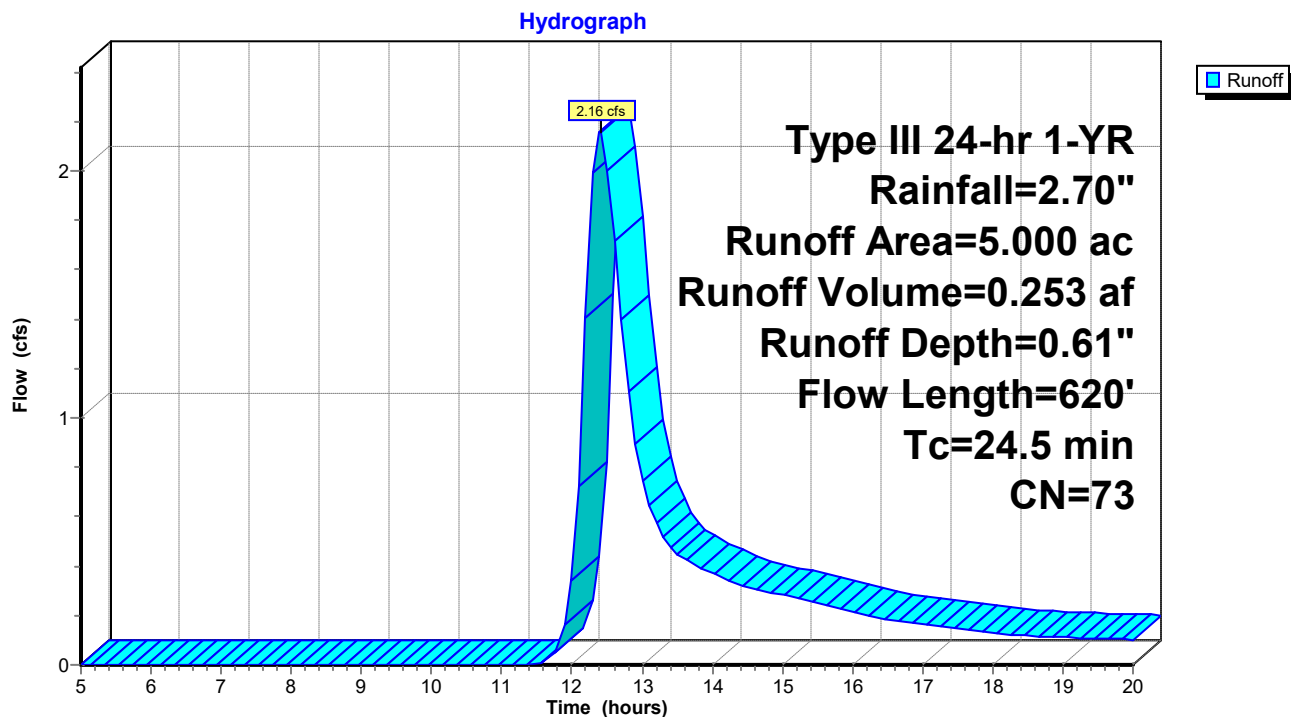
Runoff = 2.16 cfs @ 12.40 hrs, Volume= 0.253 af, Depth= 0.61"

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

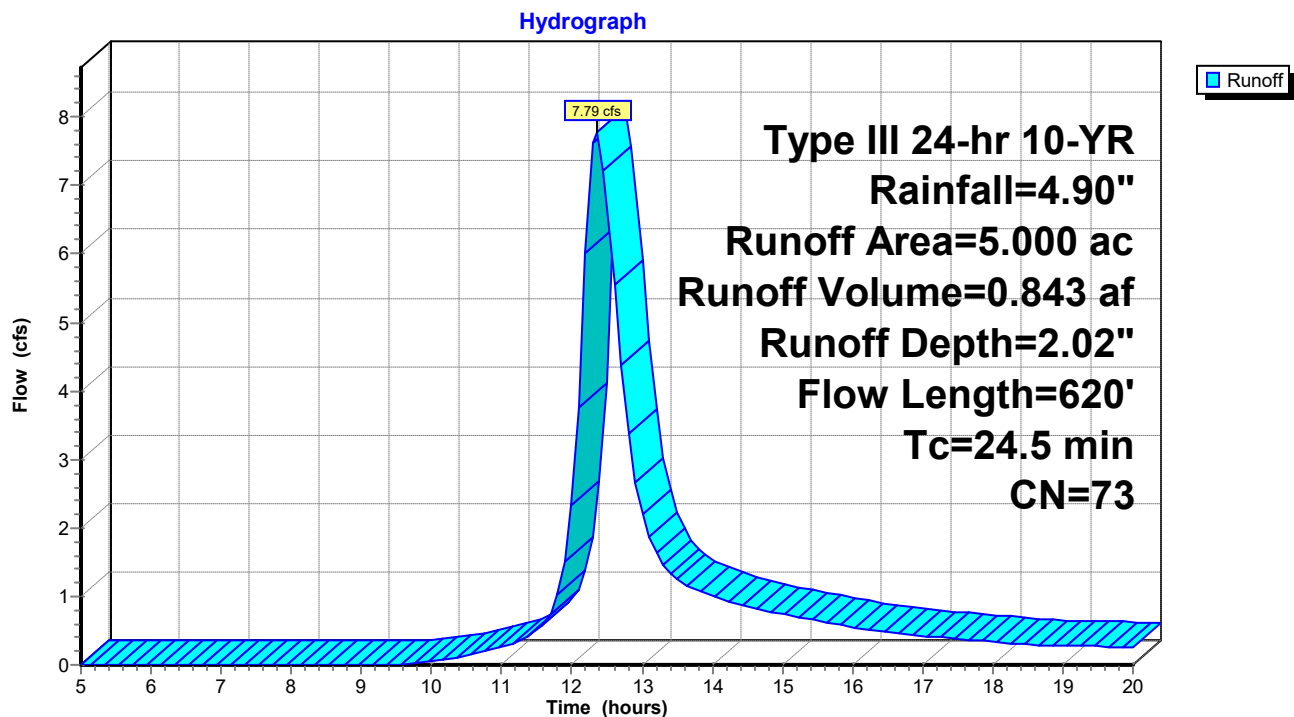
Subcatchment 1 Pre: Total to ODP-1

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

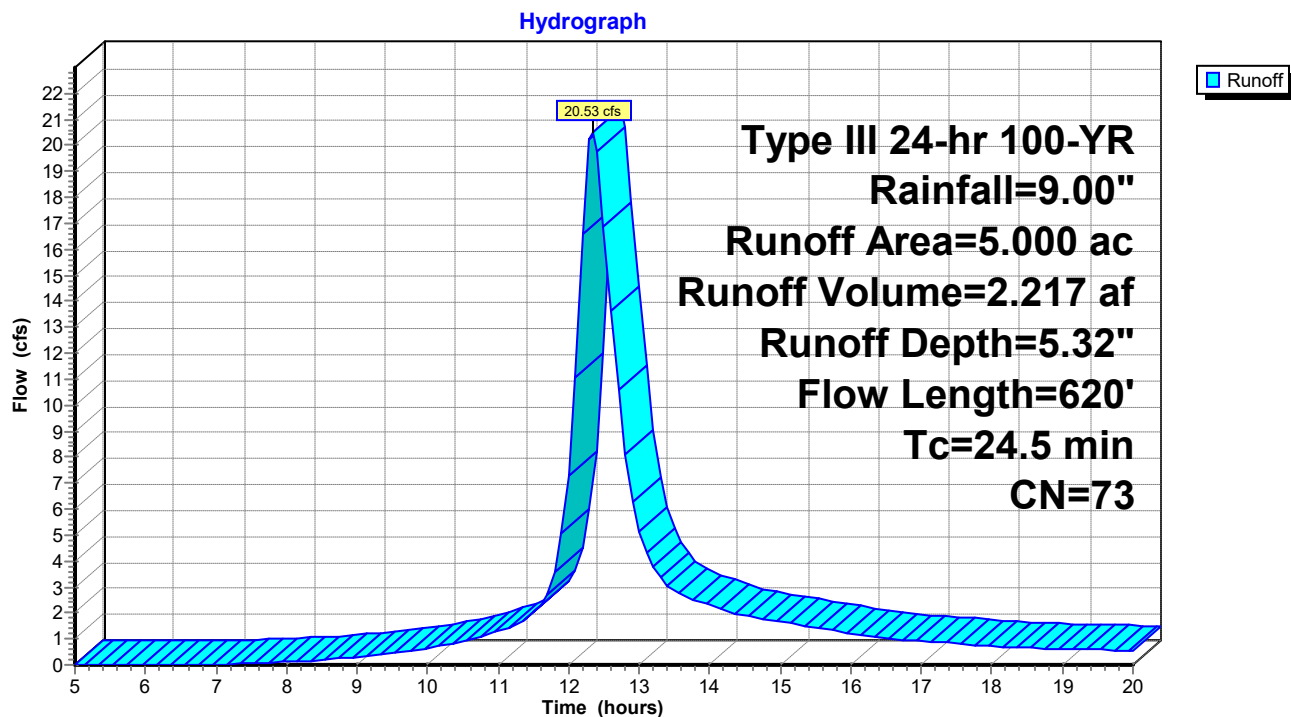
Runoff = 20.53 cfs @ 12.34 hrs, Volume= 2.217 af, Depth= 5.32"

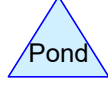
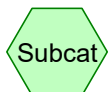
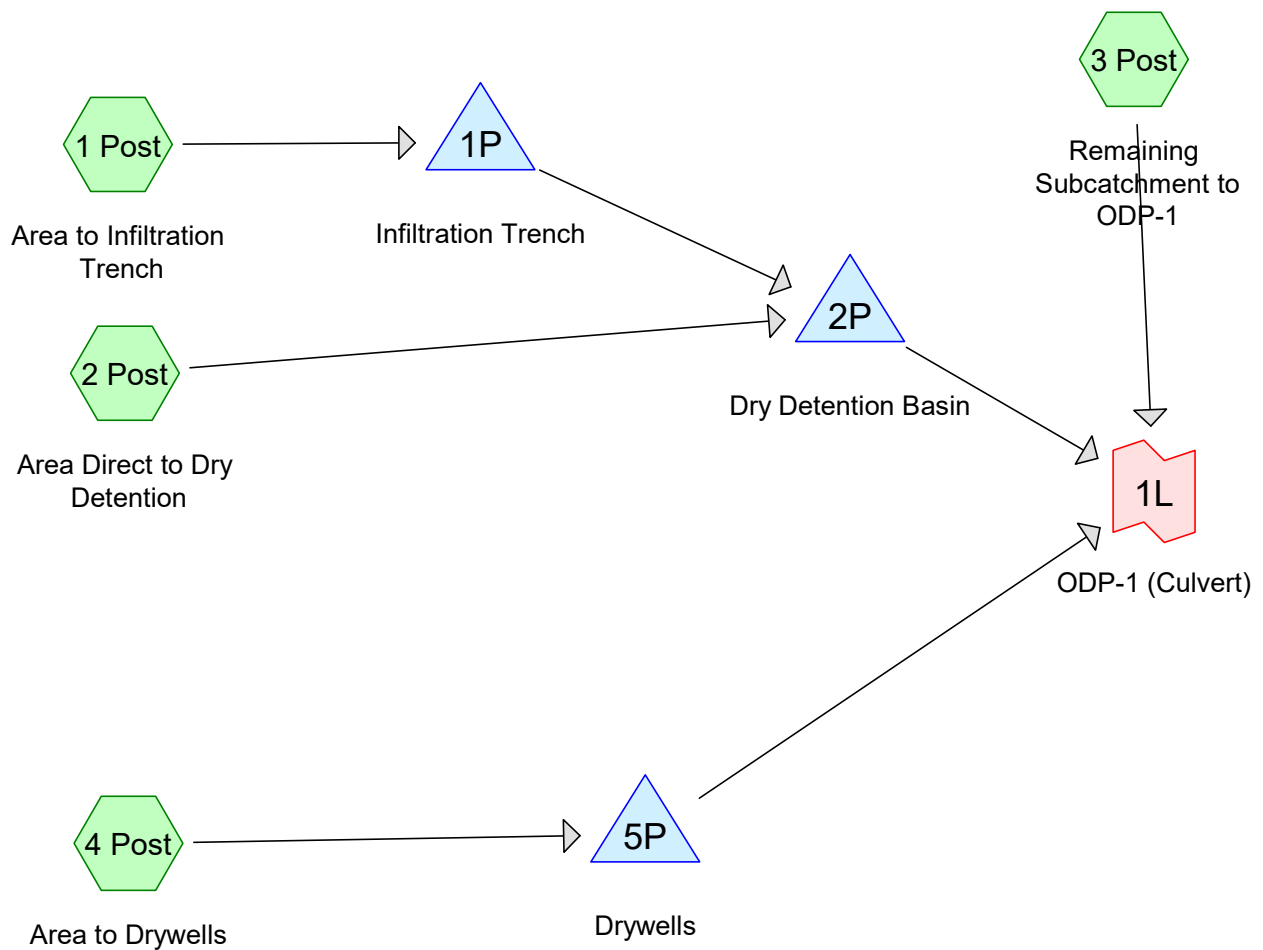
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type III 24-hr 100-YR Rainfall=9.00"

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





33 Middlebush LLC 20230205 Post Dev*Type III 24-hr 1-YR Rainfall=2.70"*

Prepared by TW Engineering, P.C.

Page 2

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

2/10/2023

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 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 TrenchRunoff Area=0.170 ac Runoff Depth=1.24"
Tc=6.0 min CN=85 Runoff=0.25 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=0.45 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=1.73 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=0.38 cfs 0.027 af**Pond 1P: Infiltration Trench**Peak Elev=148.30' Storage=67 cf Inflow=0.25 cfs 0.018 af
Discarded=0.13 cfs 0.018 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.018 af**Pond 2P: Dry Detention Basin**Peak Elev=148.79' Storage=408 cf Inflow=0.45 cfs 0.032 af
Outflow=0.20 cfs 0.030 af**Pond 5P: Drywells**Peak Elev=146.19' Storage=0.006 af Inflow=0.38 cfs 0.027 af
Discarded=0.11 cfs 0.027 af Primary=0.00 cfs 0.000 af Outflow=0.11 cfs 0.027 af**Link 1L: ODP-1 (Culvert)**Inflow=1.92 cfs 0.236 af
Primary=1.92 cfs 0.236 af**Total Runoff Area = 5.000 ac Runoff Volume = 0.282 af Average Runoff Depth = 0.68"**

33 Middlebush LLC 20230205 Post Dev

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

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Page 3

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Subcatchment 1 Post: Area to Infiltration Trench

Runoff = 0.25 cfs @ 12.10 hrs, Volume= 0.018 af, Depth= 1.24"

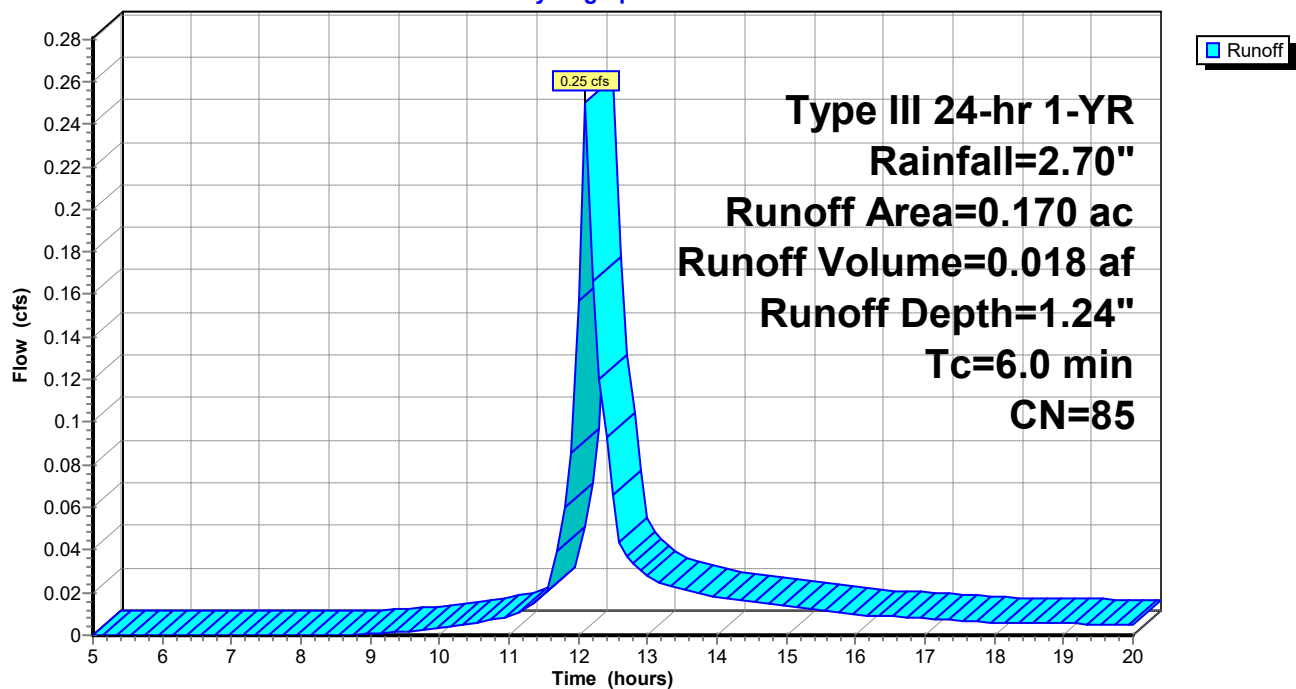
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type III 24-hr 1-YR Rainfall=2.70"

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 = 0.45 cfs @ 12.10 hrs, Volume= 0.032 af, Depth= 1.53"

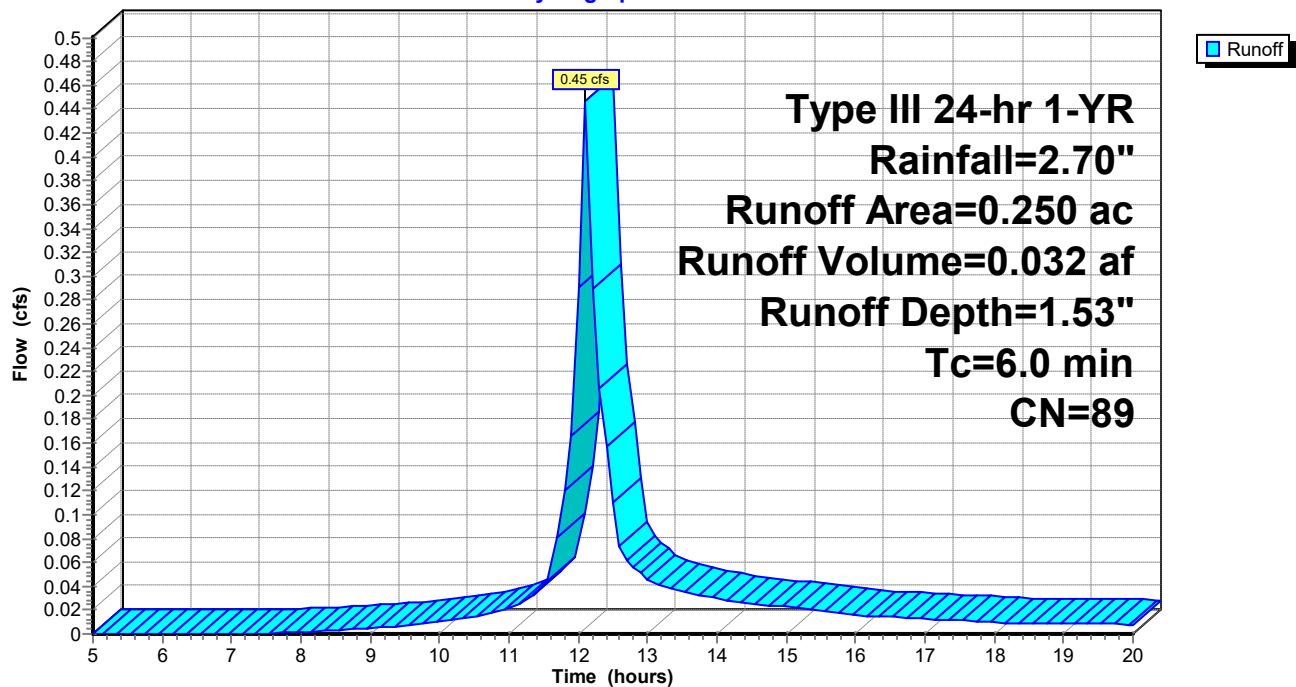
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type III 24-hr 1-YR Rainfall=2.70"

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



Subcatchment 3 Post: Remaining Subcatchment to ODP-1

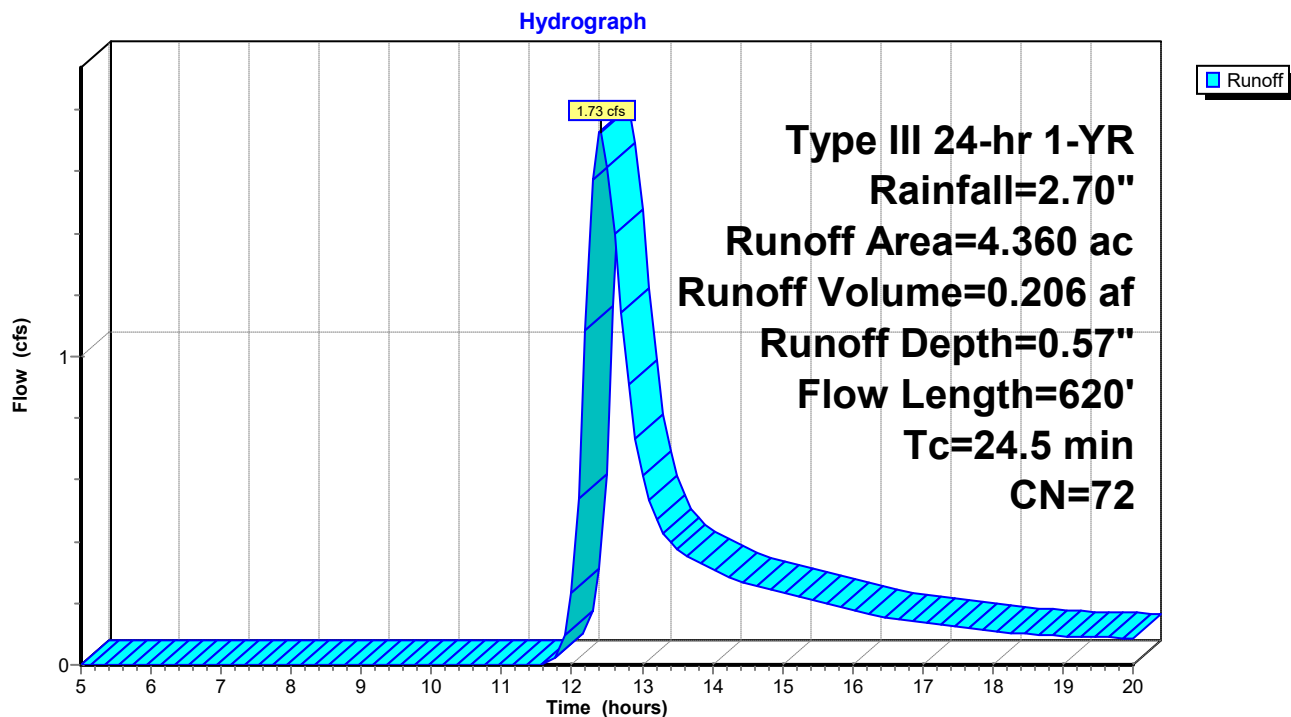
Runoff = 1.73 cfs @ 12.41 hrs, Volume= 0.206 af, Depth= 0.57"

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



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

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Page 6

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Subcatchment 4 Post: Area to Drywells

Runoff = 0.38 cfs @ 12.10 hrs, Volume= 0.027 af, Depth= 1.45"

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

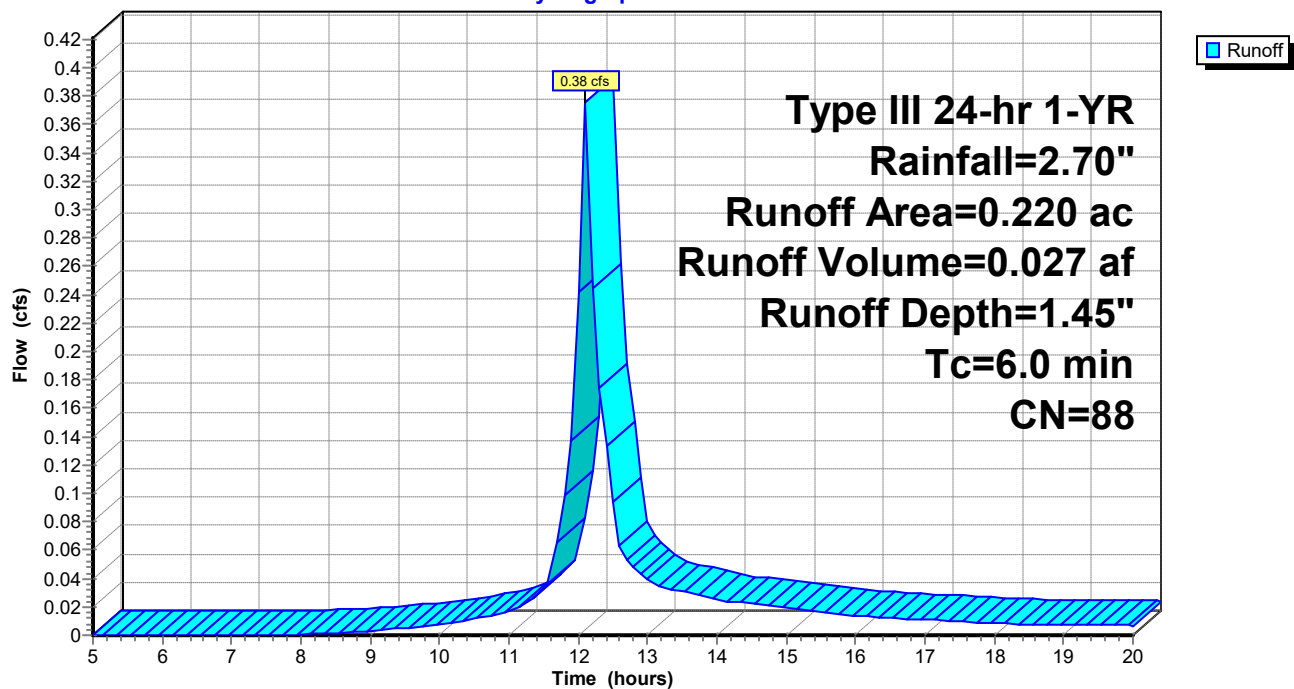
Type III 24-hr 1-YR Rainfall=2.70"

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 = 0.25 cfs @ 12.10 hrs, Volume= 0.018 af
 Outflow = 0.13 cfs @ 12.00 hrs, Volume= 0.018 af, Atten= 47%, Lag= 0.0 min
 Discarded = 0.13 cfs @ 12.00 hrs, Volume= 0.018 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= 0.10 hrs

Peak Elev= 148.30' @ 12.28 hrs Surf.Area= 564 sf Storage= 67 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= (not calculated)

#	Invert	Avail.Storage	Storage Description
1	148.00'	677 cf	Custom Stage Data (Prismatic) 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'	0.014000 fpm Exfiltration over entire Surface area
2	Primary	151.00'	3.0' long x 10.0' breadth Broad-Crested Rectangular Weir 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	150.00'	12.0" x 176.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 149.00' S= 0.0057 '/' n= 0.012 Cc= 0.900

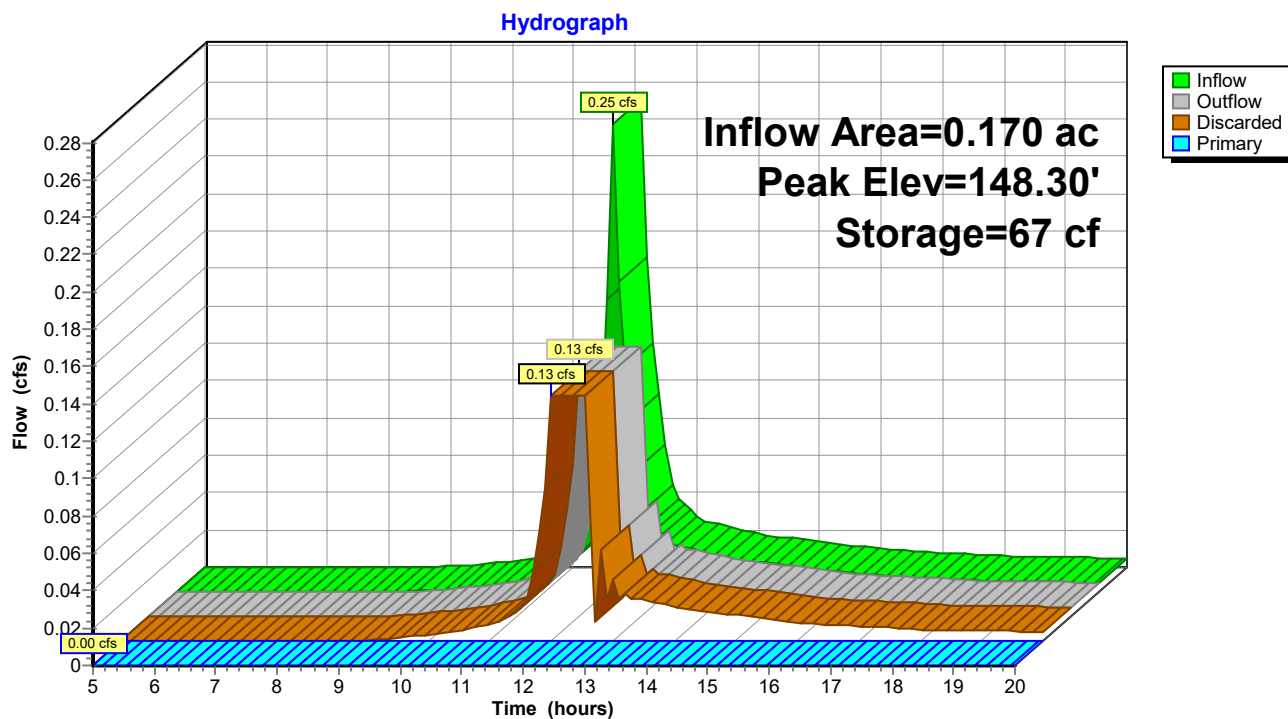
Discarded OutFlow Max=0.13 cfs @ 12.00 hrs HW=148.04' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=148.00' (Free Discharge)

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

↑ **3=Culvert** (Controls 0.00 cfs)

Pond 1P: Infiltration Trench

33 Middlebush LLC 20230205 Post Dev

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

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Page 9

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Pond 2P: Dry Detention Basin

Inflow Area = 0.420 ac, Inflow Depth = 0.91" for 1-YR event
 Inflow = 0.45 cfs @ 12.10 hrs, Volume= 0.032 af
 Outflow = 0.20 cfs @ 12.33 hrs, Volume= 0.030 af, Atten= 56%, Lag= 13.8 min
 Primary = 0.20 cfs @ 12.33 hrs, Volume= 0.030 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
 Peak Elev= 148.79' @ 12.33 hrs Surf.Area= 1,129 sf Storage= 408 cf
 Plug-Flow detention time= 52.8 min calculated for 0.030 af (96% of inflow)
 Center-of-Mass det. time= 36.3 min (820.4 - 784.1)

#	Invert	Avail.Storage	Storage Description
1	148.40'	4,518 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.40	800	0	0
149.00	1,310	633	633
150.00	1,930	1,620	2,253
151.00	2,600	2,265	4,518

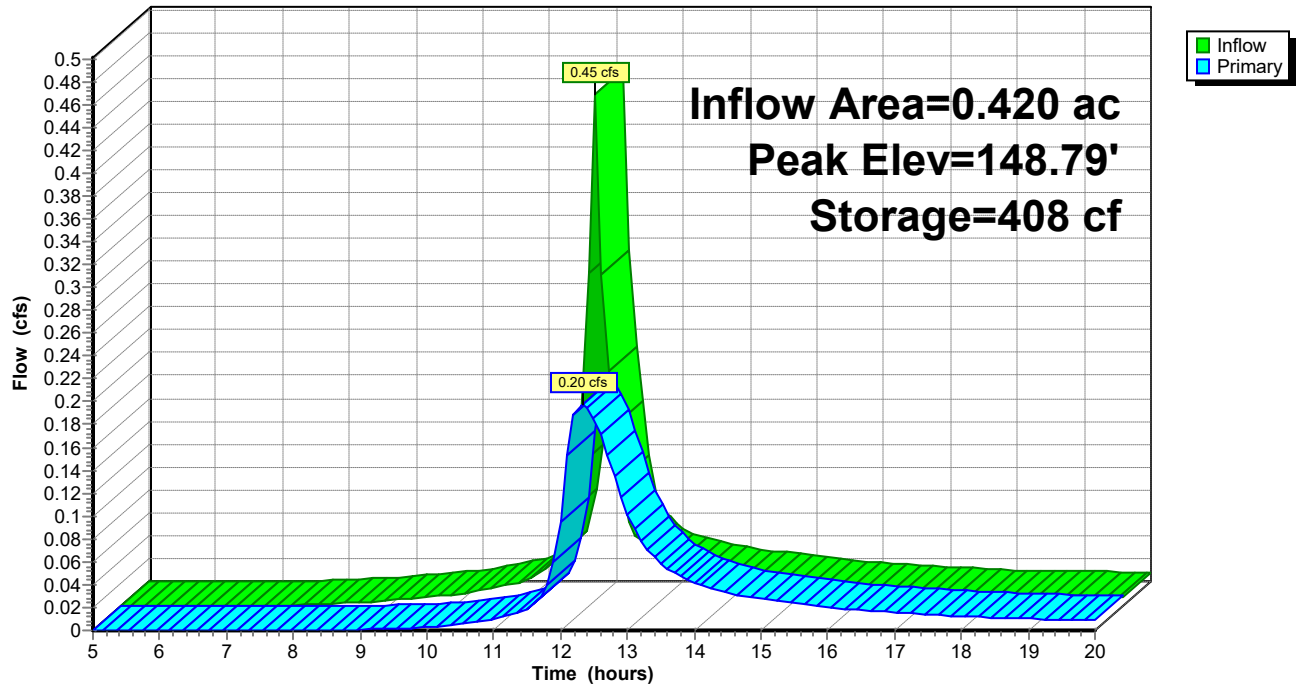
#	Routing	Invert	Outlet Devices
1	Primary	150.10'	12.0' long x 8.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
2	Primary	148.40'	4.0" Vert. Orifice/Grate C= 0.600
3	Primary	149.00'	12.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.20 cfs @ 12.33 hrs HW=148.78' (Free Discharge)

- 1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
- 2=Orifice/Grate (Orifice Controls 0.20 cfs @ 2.2 fps)
- 3=Orifice/Grate (Controls 0.00 cfs)

Pond 2P: Dry Detention Basin

Hydrograph



33 Middlebush LLC 20230205 Post Dev

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

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Page 11

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Pond 5P: Drywells

Inflow Area = 0.220 ac, Inflow Depth = 1.45" for 1-YR event
 Inflow = 0.38 cfs @ 12.10 hrs, Volume= 0.027 af
 Outflow = 0.11 cfs @ 11.90 hrs, Volume= 0.027 af, Atten= 71%, Lag= 0.0 min
 Discarded = 0.11 cfs @ 11.90 hrs, Volume= 0.027 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= 0.10 hrs
 Peak Elev= 146.19' @ 12.47 hrs Surf.Area= 0.011 ac Storage= 0.006 af
 Plug-Flow detention time= 13.5 min calculated for 0.026 af (99% of inflow)
 Center-of-Mass det. time= 13.2 min (800.8 - 787.6)

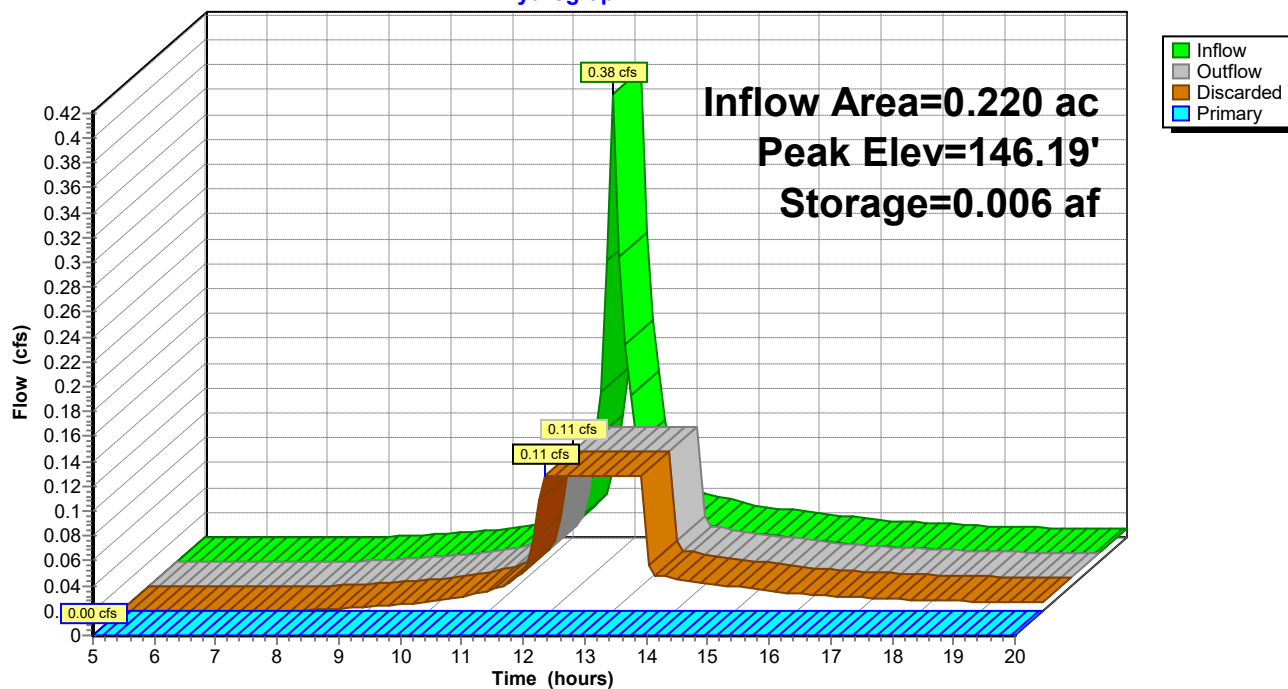
#	Invert	Avail.Storage	Storage Description
1	146.00'	0.022 af	10.00'D x 4.00'H Vertical Cone/Cylinder x 3 Inside #2
2	145.00'	0.013 af	14.00'D x 5.00'H Vertical Cone/Cylinder x 3
			0.053 af Overall - 0.022 af Embedded = 0.031 af x 40.0% Voids
			0.034 af Total Available Storage

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	0.014000 fpm Exfiltration over entire Surface area
2	Primary	150.50'	12.0" x 115.0' long Culvert RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 149.00' S= 0.0130 '/' n= 0.012 Cc= 0.900

Discarded OutFlow Max=0.11 cfs @ 11.90 hrs HW=145.09' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.11 cfs)**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=145.00' (Free Discharge)↑**2=Culvert** (Controls 0.00 cfs)

Pond 5P: Drywells

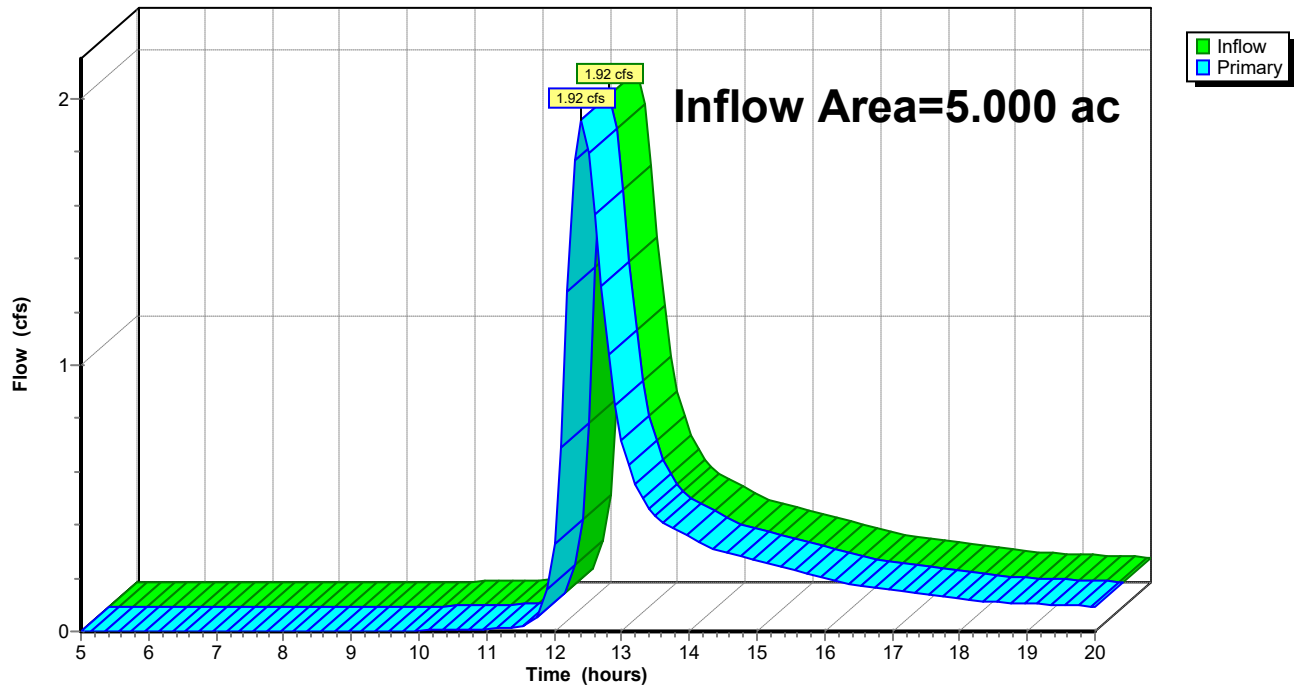
Hydrograph



Link 1L: ODP-1 (Culvert)

Inflow Area = 5.000 ac, Inflow Depth = 0.57" for 1-YR event
Inflow = 1.92 cfs @ 12.41 hrs, Volume= 0.236 af
Primary = 1.92 cfs @ 12.41 hrs, Volume= 0.236 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs

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

33 Middlebush LLC 20230205 Post Dev*Type III 24-hr 10-YR Rainfall=4.90"*

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Page 14

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Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 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 TrenchRunoff Area=0.170 ac Runoff Depth=3.08"
Tc=6.0 min CN=85 Runoff=0.61 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=0.98 cfs 0.072 af**Subcatchment 3 Post: Remaining Subcatchment to ODP-1**Runoff Area=4.360 ac Runoff Depth=1.95"
Flow Length=620' Tc=24.5 min CN=72 Runoff=6.52 cfs 0.707 af**Subcatchment 4 Post: Area to Drywells**Runoff Area=0.220 ac Runoff Depth=3.37"
Tc=6.0 min CN=88 Runoff=0.84 cfs 0.062 af**Pond 1P: Infiltration Trench**Peak Elev=150.12' Storage=478 cf Inflow=0.61 cfs 0.044 af
Discarded=0.13 cfs 0.043 af Primary=0.04 cfs 0.001 af Outflow=0.18 cfs 0.044 af**Pond 2P: Dry Detention Basin**Peak Elev=149.15' Storage=884 cf Inflow=0.98 cfs 0.073 af
Outflow=0.43 cfs 0.071 af**Pond 5P: Drywells**Peak Elev=148.34' Storage=0.022 af Inflow=0.84 cfs 0.062 af
Discarded=0.11 cfs 0.062 af Primary=0.00 cfs 0.000 af Outflow=0.11 cfs 0.062 af**Link 1L: ODP-1 (Culvert)**Inflow=6.94 cfs 0.778 af
Primary=6.94 cfs 0.778 af**Total Runoff Area = 5.000 ac Runoff Volume = 0.885 af Average Runoff Depth = 2.12"**

33 Middlebush LLC 20230205 Post Dev

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

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Page 15

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Subcatchment 1 Post: Area to Infiltration Trench

Runoff = 0.61 cfs @ 12.10 hrs, Volume= 0.044 af, Depth= 3.08"

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

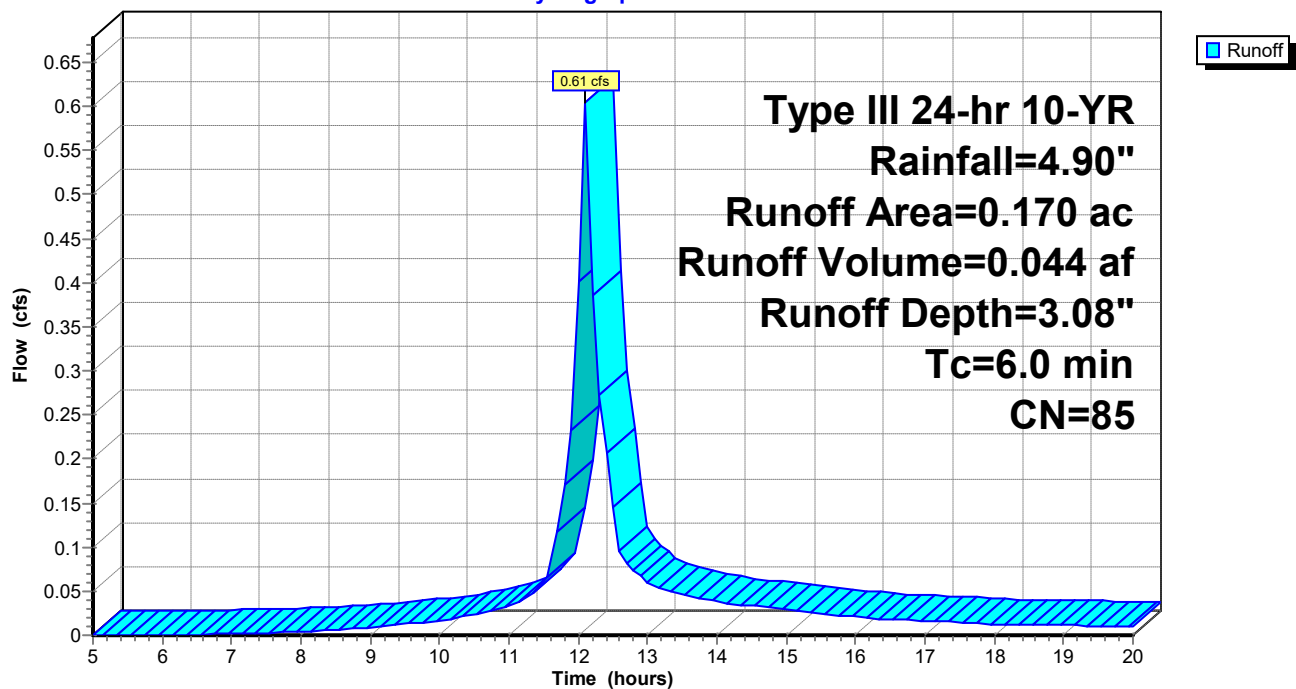
Type III 24-hr 10-YR Rainfall=4.90"

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 = 0.98 cfs @ 12.10 hrs, Volume= 0.072 af, Depth= 3.47"

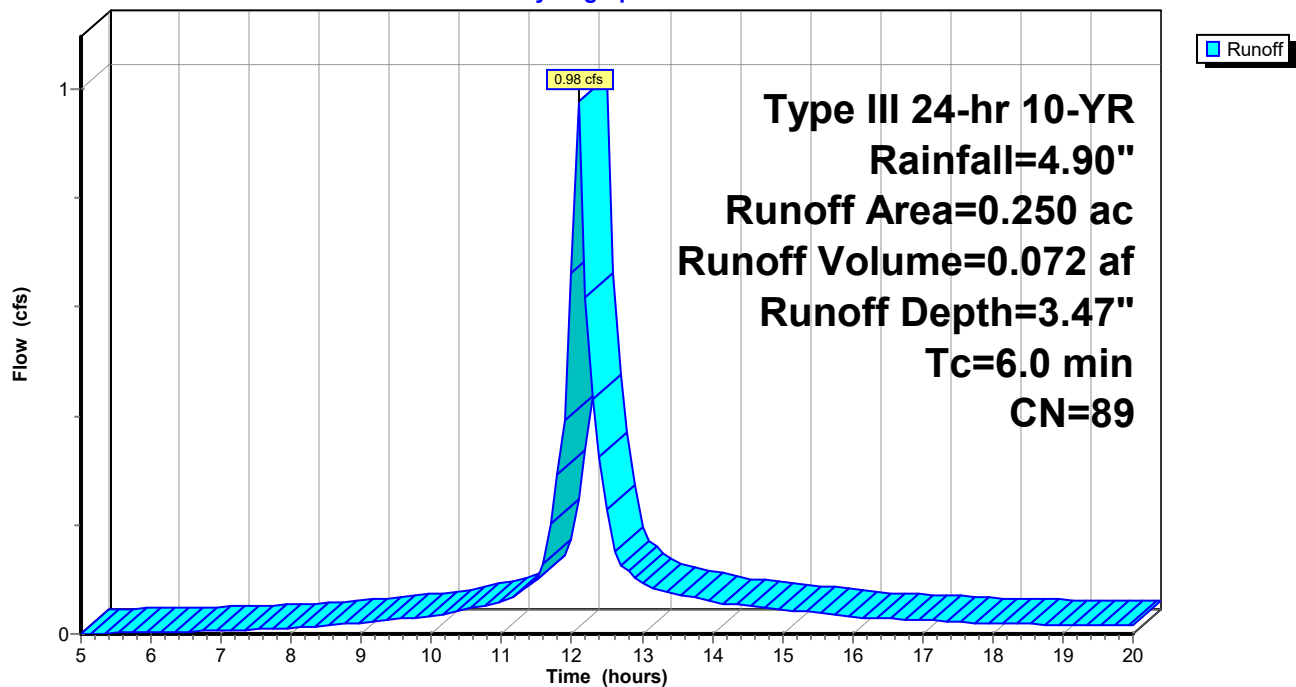
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type III 24-hr 10-YR Rainfall=4.90"

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 = 6.52 cfs @ 12.36 hrs, Volume= 0.707 af, Depth= 1.95"

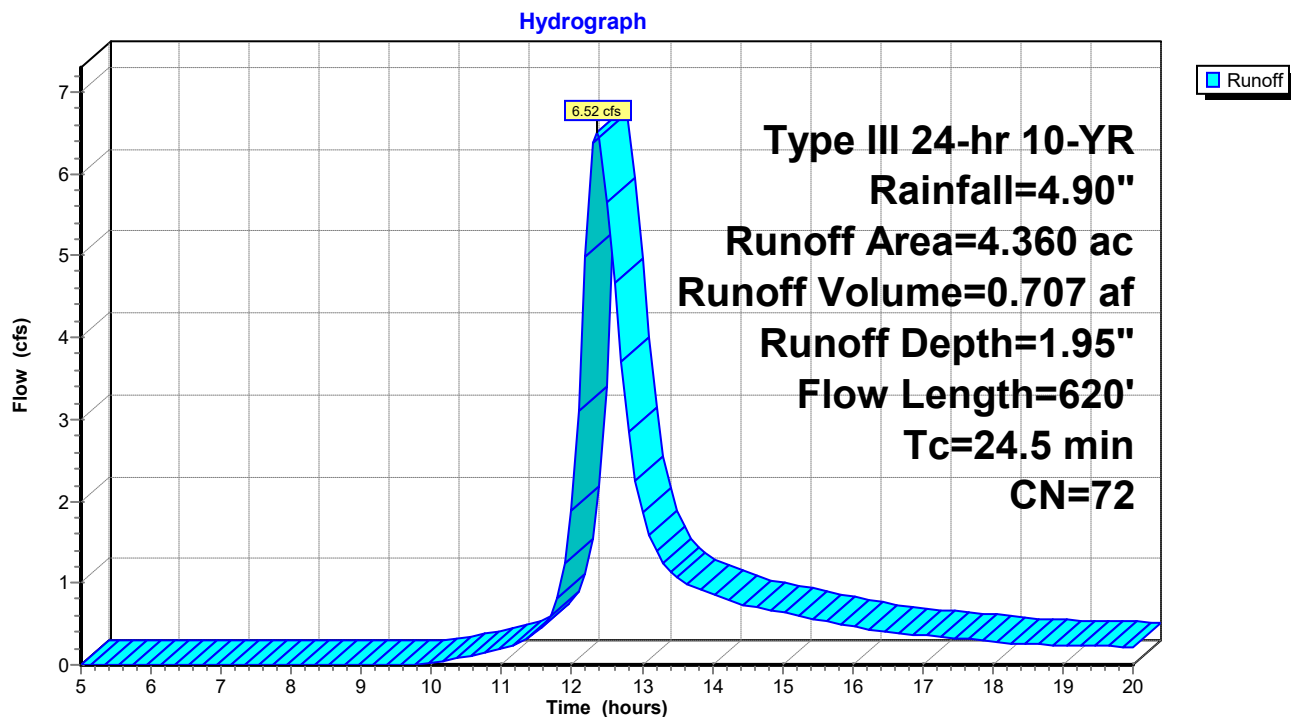
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs

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

Area (ac)	CN	Description
1.320	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



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

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Page 18

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Subcatchment 4 Post: Area to Drywells

Runoff = 0.84 cfs @ 12.10 hrs, Volume= 0.062 af, Depth= 3.37"

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

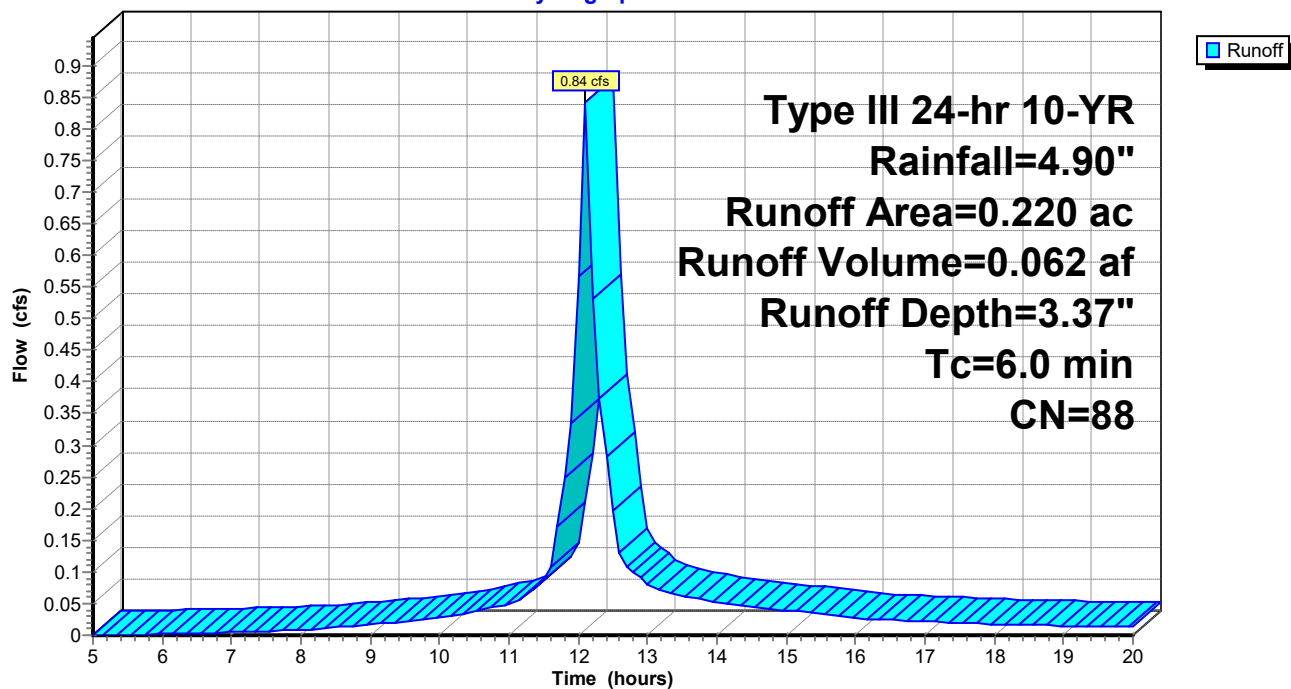
Type III 24-hr 10-YR Rainfall=4.90"

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 = 0.61 cfs @ 12.10 hrs, Volume= 0.044 af
 Outflow = 0.18 cfs @ 12.47 hrs, Volume= 0.044 af, Atten= 71%, Lag= 22.2 min
 Discarded = 0.13 cfs @ 11.80 hrs, Volume= 0.043 af
 Primary = 0.04 cfs @ 12.47 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs

Peak Elev= 150.12' @ 12.46 hrs Surf.Area= 564 sf Storage= 478 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= (not calculated)

#	Invert	Avail.Storage	Storage Description
1	148.00'	677 cf	Custom Stage Data (Prismatic) 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'	0.014000 fpm Exfiltration over entire Surface area
2	Primary	151.00'	3.0' long x 10.0' breadth Broad-Crested Rectangular Weir 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	150.00'	12.0" x 176.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 149.00' S= 0.0057 ' / ' n= 0.012 Cc= 0.900

Discarded OutFlow Max=0.13 cfs @ 11.80 hrs HW=148.06' (Free Discharge)

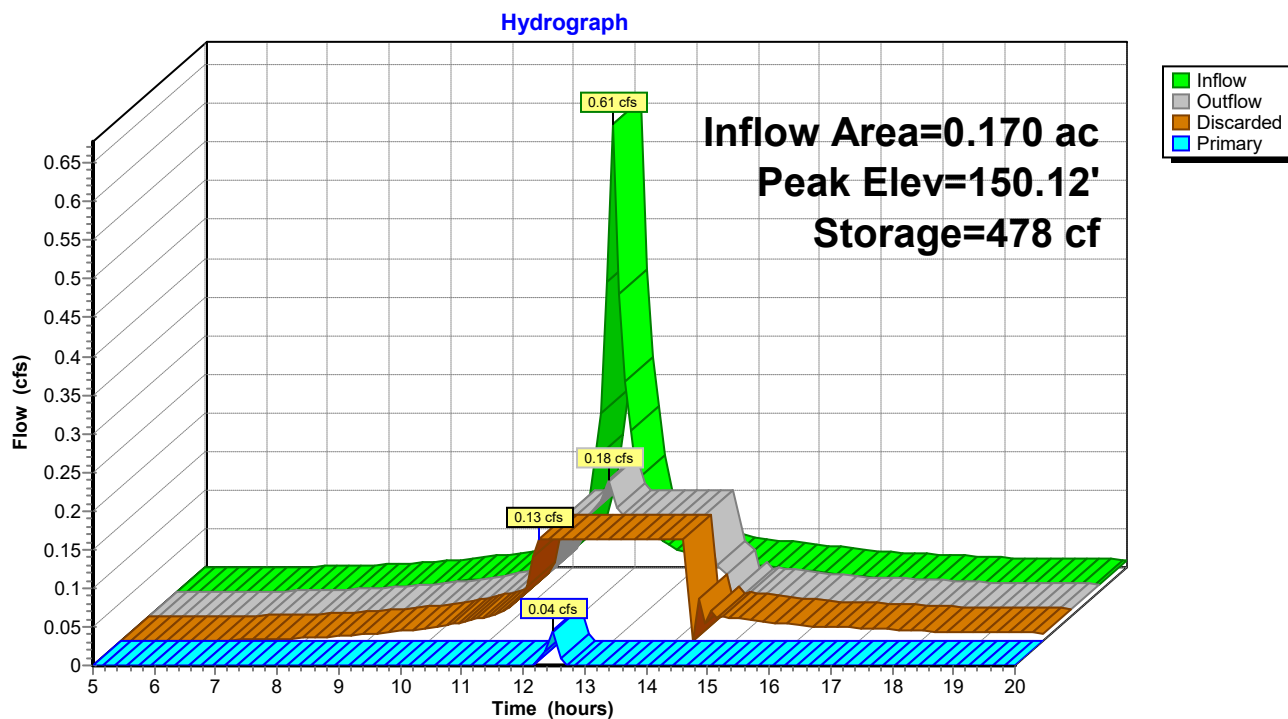
↑ **1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.04 cfs @ 12.47 hrs HW=150.11' (Free Discharge)

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

↑ **3=Culvert** (Barrel Controls 0.04 cfs @ 1.3 fps)

Pond 1P: Infiltration Trench



Pond 2P: Dry Detention Basin

Inflow Area = 0.420 ac, Inflow Depth = 2.09" for 10-YR event
 Inflow = 0.98 cfs @ 12.10 hrs, Volume= 0.073 af
 Outflow = 0.43 cfs @ 12.33 hrs, Volume= 0.071 af, Atten= 56%, Lag= 14.2 min
 Primary = 0.43 cfs @ 12.33 hrs, Volume= 0.071 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
 Peak Elev= 149.15' @ 12.33 hrs Surf.Area= 1,406 sf Storage= 884 cf
 Plug-Flow detention time= 44.6 min calculated for 0.071 af (97% of inflow)
 Center-of-Mass det. time= 33.9 min (798.3 - 764.4)

#	Invert	Avail.Storage	Storage Description
1	148.40'	4,518 cf	Custom Stage Data (Prismatic) Listed below

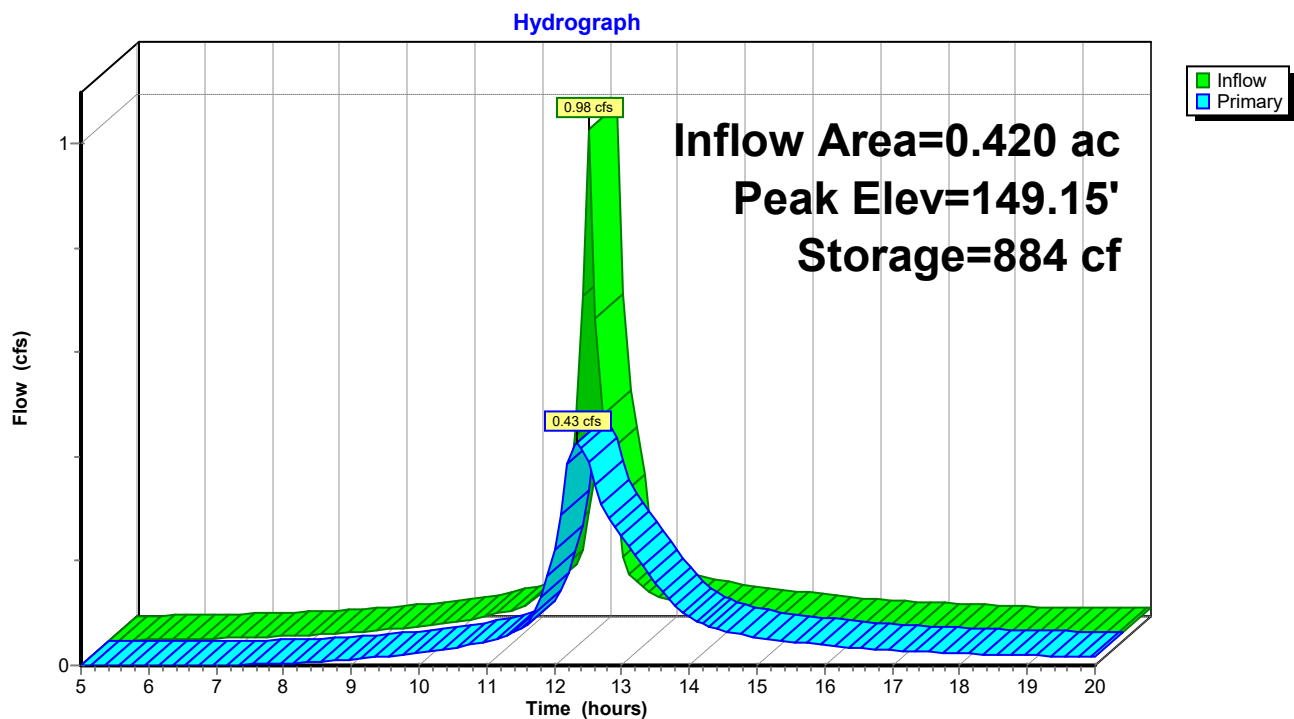
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.40	800	0	0
149.00	1,310	633	633
150.00	1,930	1,620	2,253
151.00	2,600	2,265	4,518

#	Routing	Invert	Outlet Devices
1	Primary	150.10'	12.0' long x 8.0' 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) 2.43 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	148.40'	4.0" Vert. Orifice/Grate C= 0.600
3	Primary	149.00'	12.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.42 cfs @ 12.33 hrs HW=149.15' (Free Discharge)

- 1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
- 2=Orifice/Grate (Orifice Controls 0.32 cfs @ 3.7 fps)
- 3=Orifice/Grate (Orifice Controls 0.10 cfs @ 1.3 fps)

Pond 2P: Dry Detention Basin



33 Middlebush LLC 20230205 Post Dev

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

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Page 23

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Pond 5P: Drywells

Inflow Area = 0.220 ac, Inflow Depth = 3.37" for 10-YR event
 Inflow = 0.84 cfs @ 12.10 hrs, Volume= 0.062 af
 Outflow = 0.11 cfs @ 11.70 hrs, Volume= 0.062 af, Atten= 87%, Lag= 0.0 min
 Discarded = 0.11 cfs @ 11.70 hrs, Volume= 0.062 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= 0.10 hrs
 Peak Elev= 148.34' @ 12.73 hrs Surf.Area= 0.011 ac Storage= 0.022 af
 Plug-Flow detention time= 65.8 min calculated for 0.062 af (100% of inflow)
 Center-of-Mass det. time= 65.6 min (833.2 - 767.6)

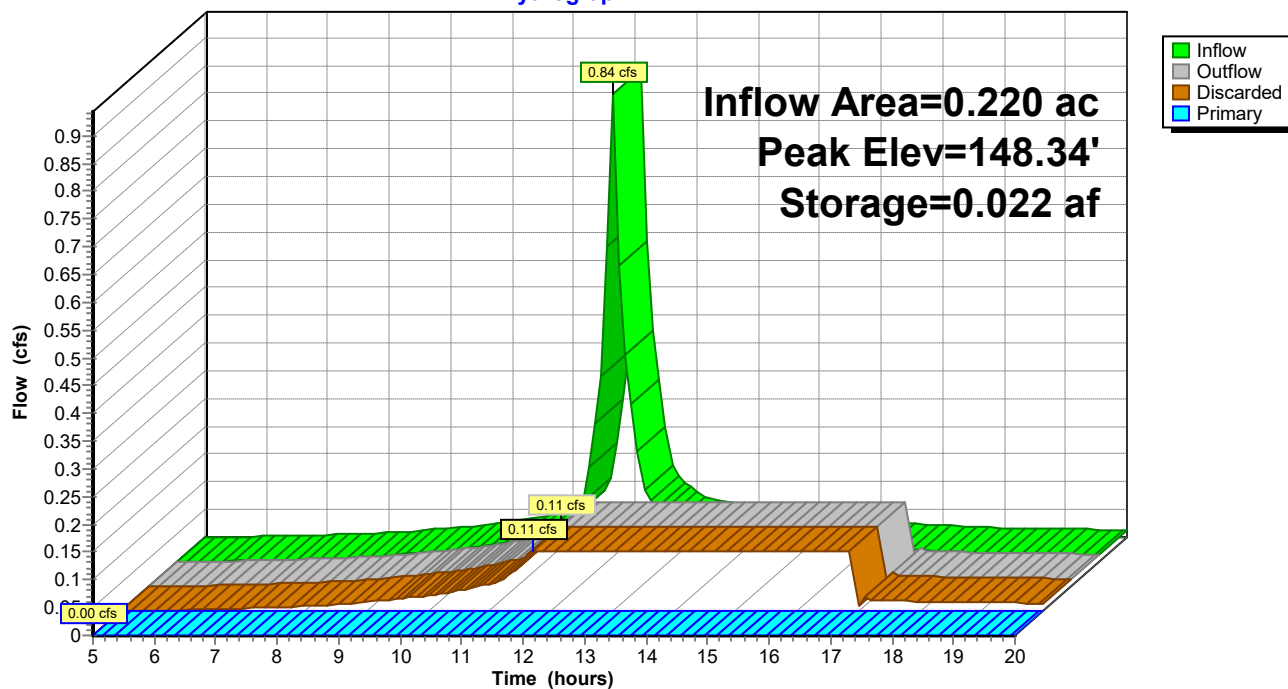
#	Invert	Avail.Storage	Storage Description
1	146.00'	0.022 af	10.00'D x 4.00'H Vertical Cone/Cylinder x 3 Inside #2
2	145.00'	0.013 af	14.00'D x 5.00'H Vertical Cone/Cylinder x 3
			0.053 af Overall - 0.022 af Embedded = 0.031 af x 40.0% Voids
			0.034 af Total Available Storage

#	Routing	Invert	Outlet Devices
1	Discarded	0.00'	0.014000 fpm Exfiltration over entire Surface area
2	Primary	150.50'	12.0" x 115.0' long Culvert RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 149.00' S= 0.0130 '/' n= 0.012 Cc= 0.900

Discarded OutFlow Max=0.11 cfs @ 11.70 hrs HW=145.13' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.11 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



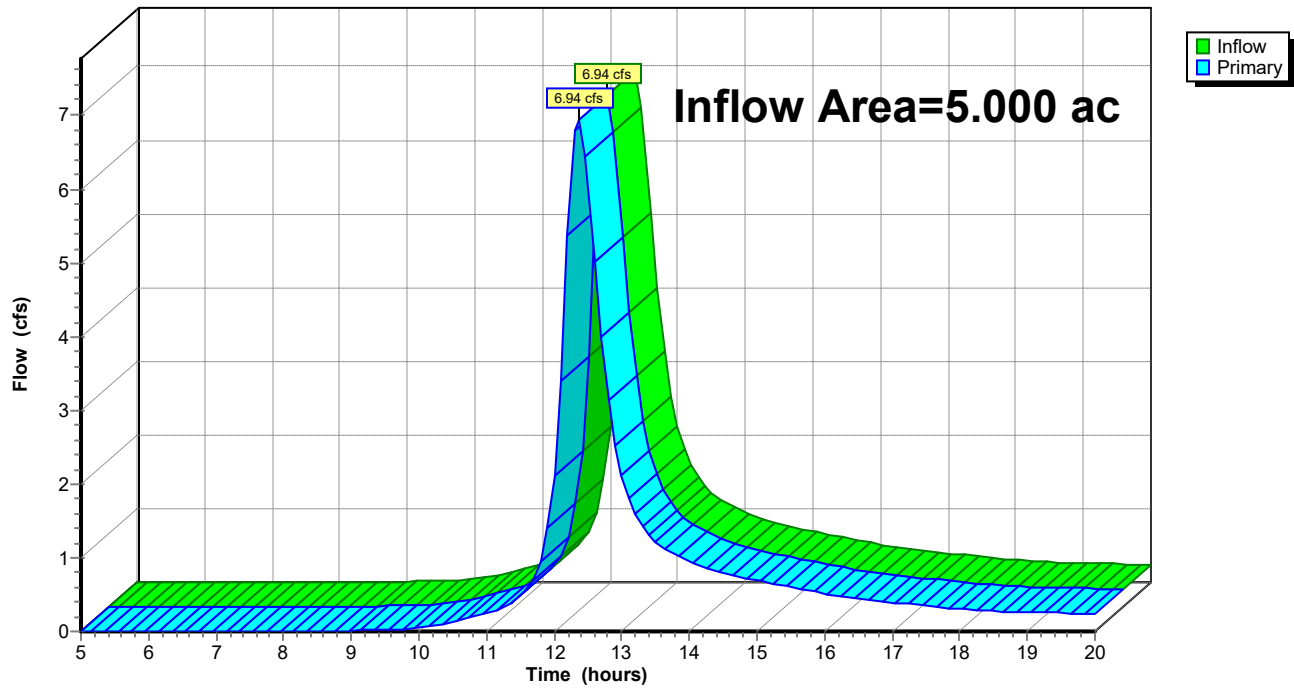
Link 1L: ODP-1 (Culvert)

Inflow Area = 5.000 ac, Inflow Depth = 1.87" for 10-YR event
 Inflow = 6.94 cfs @ 12.36 hrs, Volume= 0.778 af
 Primary = 6.94 cfs @ 12.36 hrs, Volume= 0.778 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs

Link 1L: ODP-1 (Culvert)

Hydrograph



33 Middlebush LLC 20230205 Post Dev*Type III 24-hr 100-YR Rainfall=9.00"*

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Page 26

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2/10/2023

Time span=5.00-20.00 hrs, dt=0.10 hrs, 151 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 TrenchRunoff Area=0.170 ac Runoff Depth=6.79"
Tc=6.0 min CN=85 Runoff=1.28 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=1.96 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=17.54 cfs 1.890 af**Subcatchment 4 Post: Area to Drywells**Runoff Area=0.220 ac Runoff Depth=7.13"
Tc=6.0 min CN=88 Runoff=1.71 cfs 0.131 af**Pond 1P: Infiltration Trench**Peak Elev=150.67' Storage=603 cf Inflow=1.28 cfs 0.096 af
Discarded=0.13 cfs 0.070 af Primary=1.14 cfs 0.026 af Outflow=1.27 cfs 0.096 af**Pond 2P: Dry Detention Basin**Peak Elev=149.69' Storage=1,747 cf Inflow=3.05 cfs 0.177 af
Outflow=2.07 cfs 0.174 af**Pond 5P: Drywells**Peak Elev=151.14' Storage=0.034 af Inflow=1.71 cfs 0.131 af
Discarded=0.11 cfs 0.100 af Primary=1.46 cfs 0.026 af Outflow=1.57 cfs 0.126 af**Link 1L: ODP-1 (Culvert)**Inflow=19.71 cfs 2.090 af
Primary=19.71 cfs 2.090 af**Total Runoff Area = 5.000 ac Runoff Volume = 2.268 af Average Runoff Depth = 5.44"**

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

Page 27

2/10/2023

Subcatchment 1 Post: Area to Infiltration Trench

Runoff = 1.28 cfs @ 12.10 hrs, Volume= 0.096 af, Depth= 6.79"

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

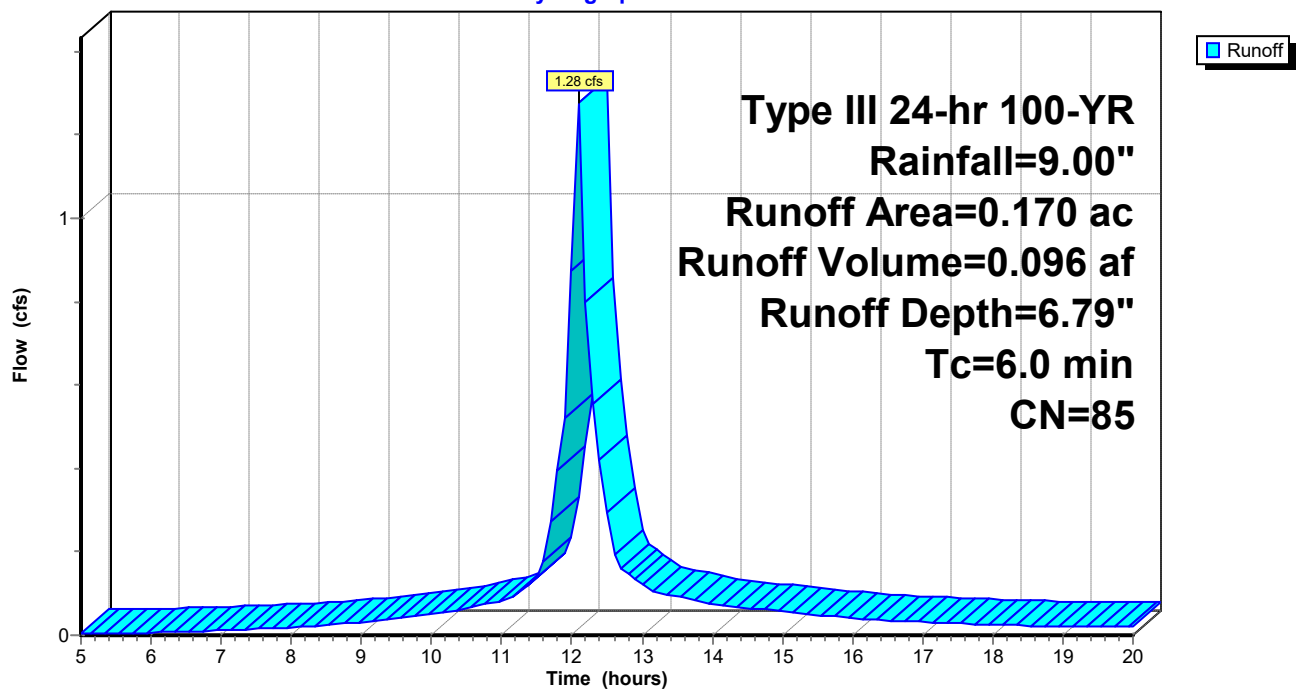
Type III 24-hr 100-YR Rainfall=9.00"

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 = 1.96 cfs @ 12.09 hrs, Volume= 0.151 af, Depth= 7.24"

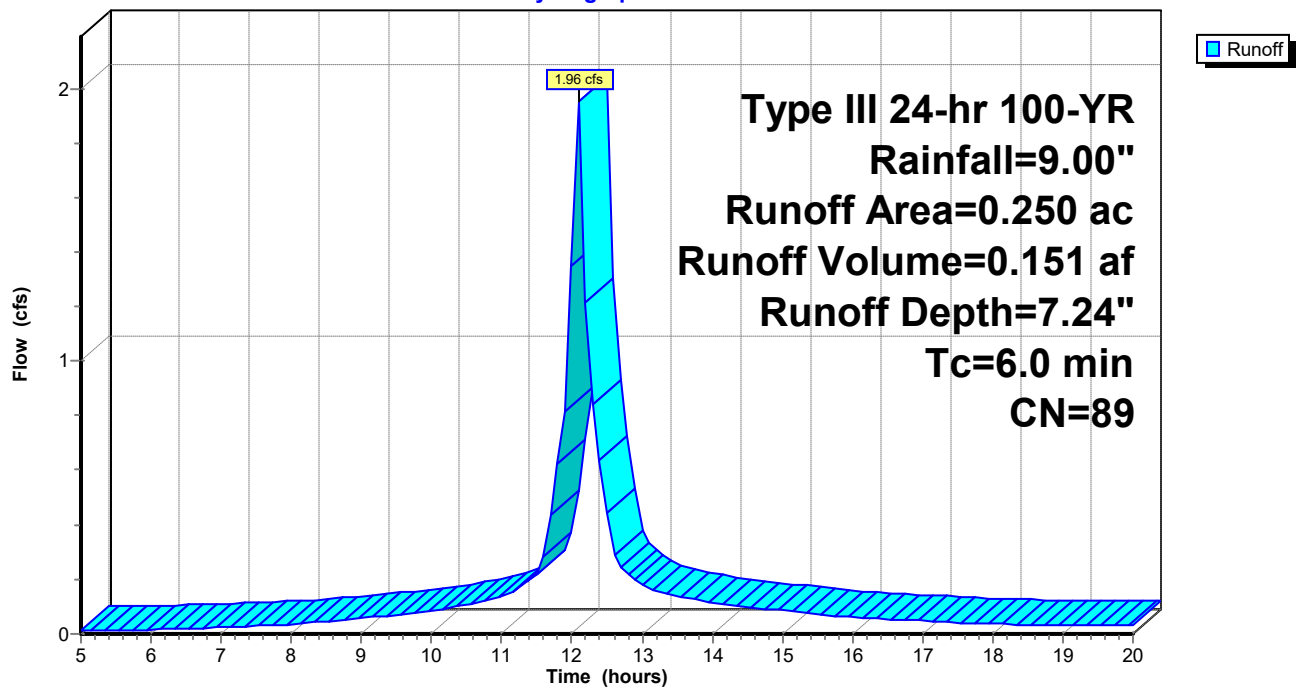
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
Type III 24-hr 100-YR Rainfall=9.00"

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



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

Page 29

2/10/2023

Subcatchment 3 Post: Remaining Subcatchment to ODP-1

Runoff = 17.54 cfs @ 12.34 hrs, Volume= 1.890 af, Depth= 5.20"

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

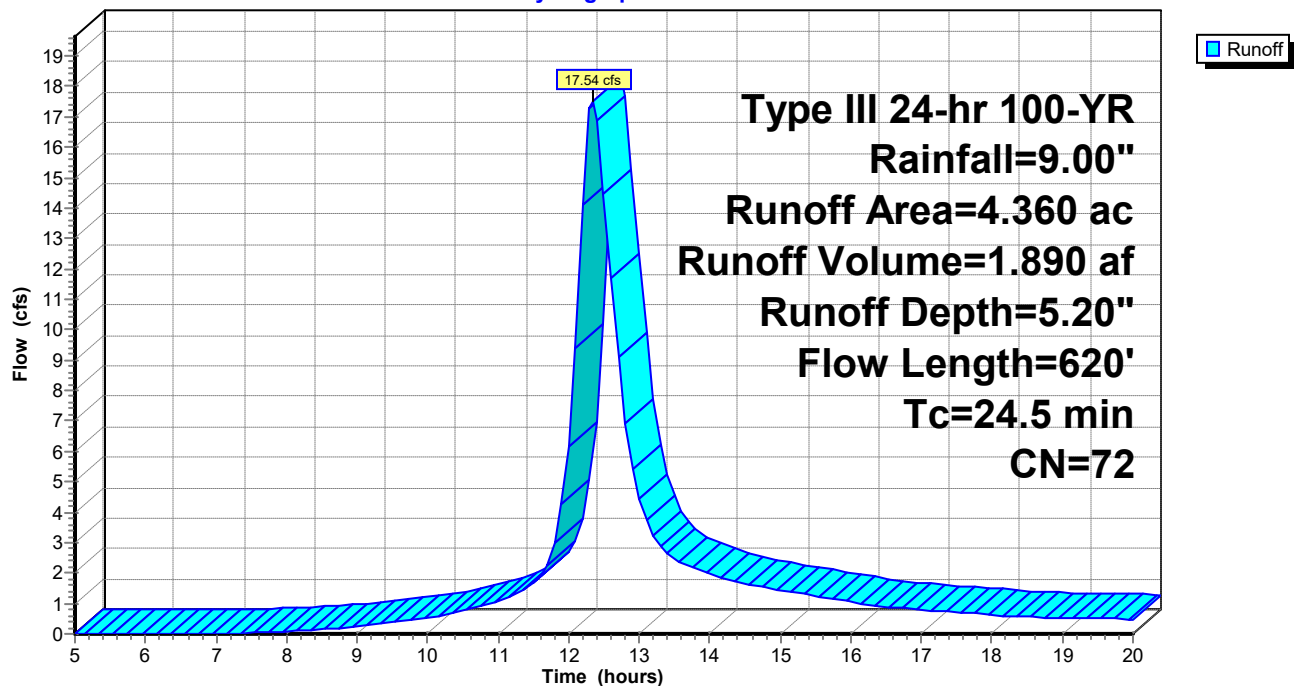
Type III 24-hr 100-YR Rainfall=9.00"

Area (ac)	CN	Description
1.320	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

Hydrograph



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

Page 30

2/10/2023

Subcatchment 4 Post: Area to Drywells

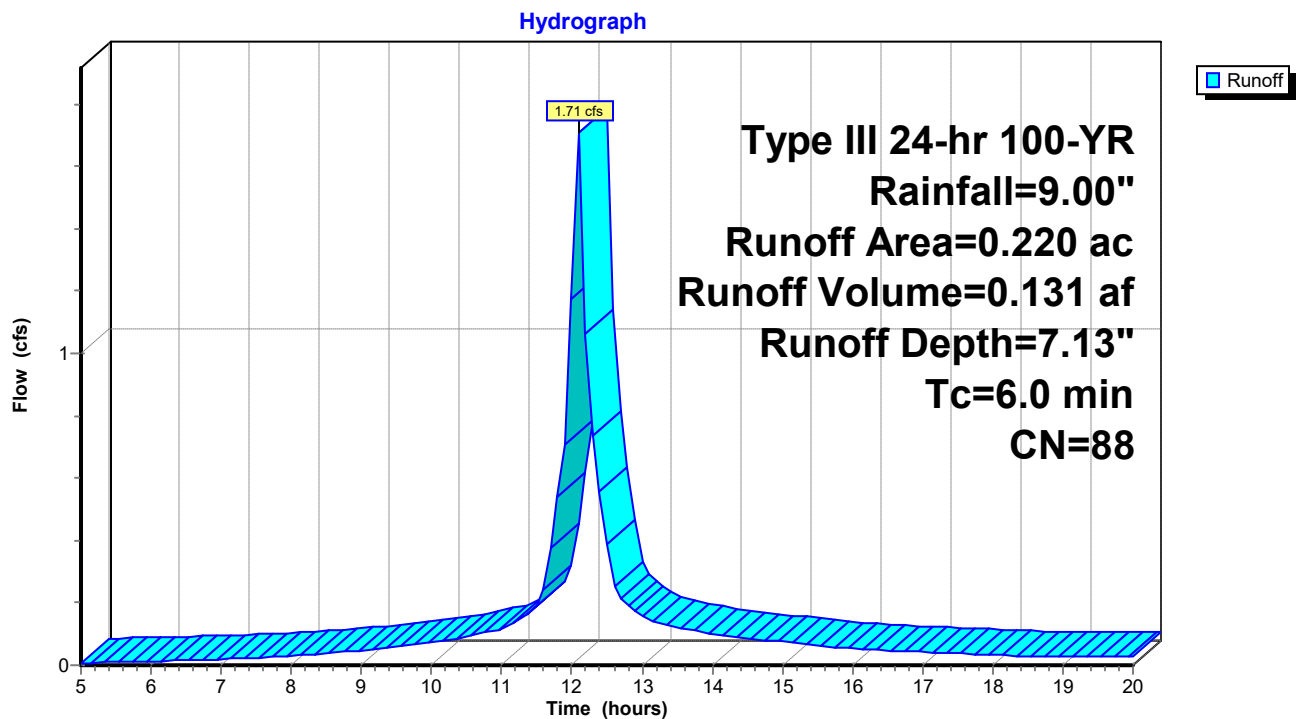
Runoff = 1.71 cfs @ 12.10 hrs, Volume= 0.131 af, Depth= 7.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.10 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 = 1.28 cfs @ 12.10 hrs, Volume= 0.096 af
 Outflow = 1.27 cfs @ 12.13 hrs, Volume= 0.096 af, Atten= 0%, Lag= 2.2 min
 Discarded = 0.13 cfs @ 11.50 hrs, Volume= 0.070 af
 Primary = 1.14 cfs @ 12.13 hrs, Volume= 0.026 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
 Peak Elev= 150.67' @ 12.14 hrs Surf.Area= 564 sf Storage= 603 cf
 Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= (not calculated)

#	Invert	Avail.Storage	Storage Description
1	148.00'	677 cf	Custom Stage Data (Prismatic) 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'	0.014000 fpm Exfiltration over entire Surface area
2	Primary	151.00'	3.0' long x 10.0' breadth Broad-Crested Rectangular Weir 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	150.00'	12.0" x 176.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 149.00' S= 0.0057 '/' n= 0.012 Cc= 0.900

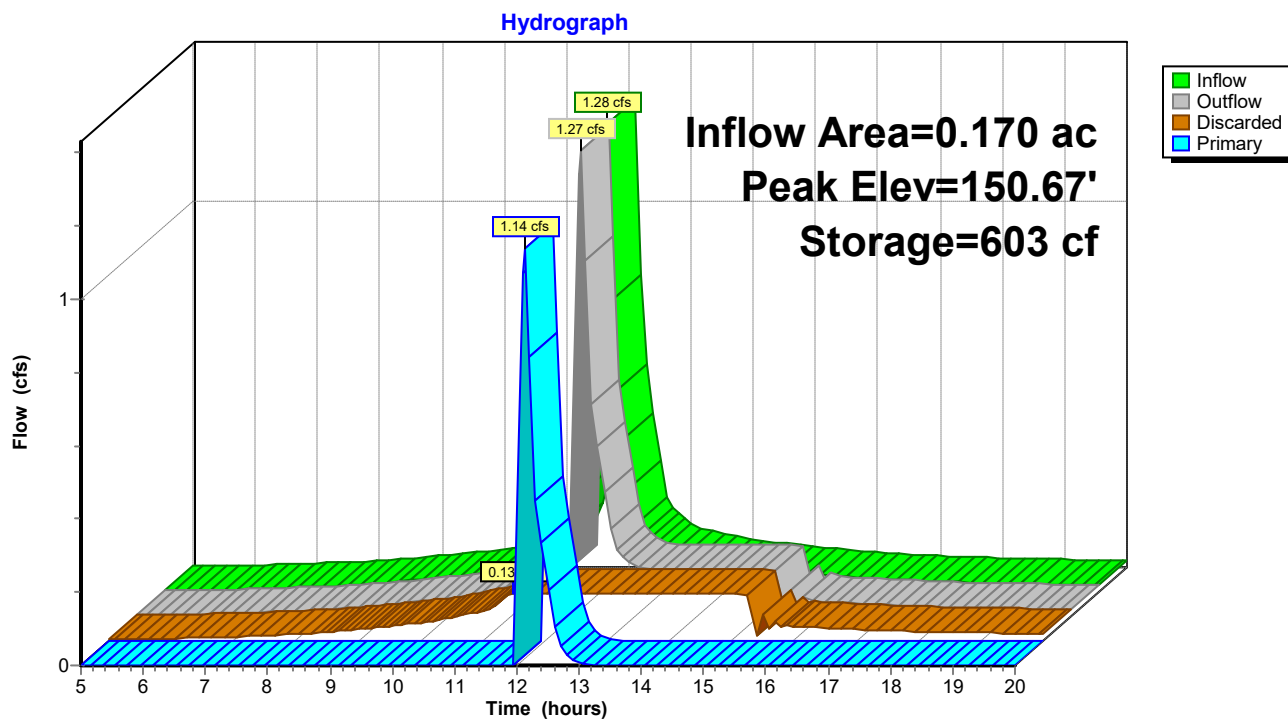
Discarded OutFlow Max=0.13 cfs @ 11.50 hrs HW=148.03' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=1.00 cfs @ 12.13 hrs HW=150.59' (Free Discharge)

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

↑ **3=Culvert** (Inlet Controls 1.00 cfs @ 2.1 fps)

Pond 1P: Infiltration Trench

Pond 2P: Dry Detention Basin

Inflow Area = 0.420 ac, Inflow Depth = 5.05" for 100-YR event
 Inflow = 3.05 cfs @ 12.11 hrs, Volume= 0.177 af
 Outflow = 2.07 cfs @ 12.23 hrs, Volume= 0.174 af, Atten= 32%, Lag= 6.8 min
 Primary = 2.07 cfs @ 12.23 hrs, Volume= 0.174 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
 Peak Elev= 149.69' @ 12.23 hrs Surf.Area= 1,736 sf Storage= 1,747 cf
 Plug-Flow detention time= 31.3 min calculated for 0.173 af (98% of inflow)
 Center-of-Mass det. time= 24.6 min (772.3 - 747.6)

#	Invert	Avail.Storage	Storage Description
1	148.40'	4,518 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.40	800	0	0
149.00	1,310	633	633
150.00	1,930	1,620	2,253
151.00	2,600	2,265	4,518

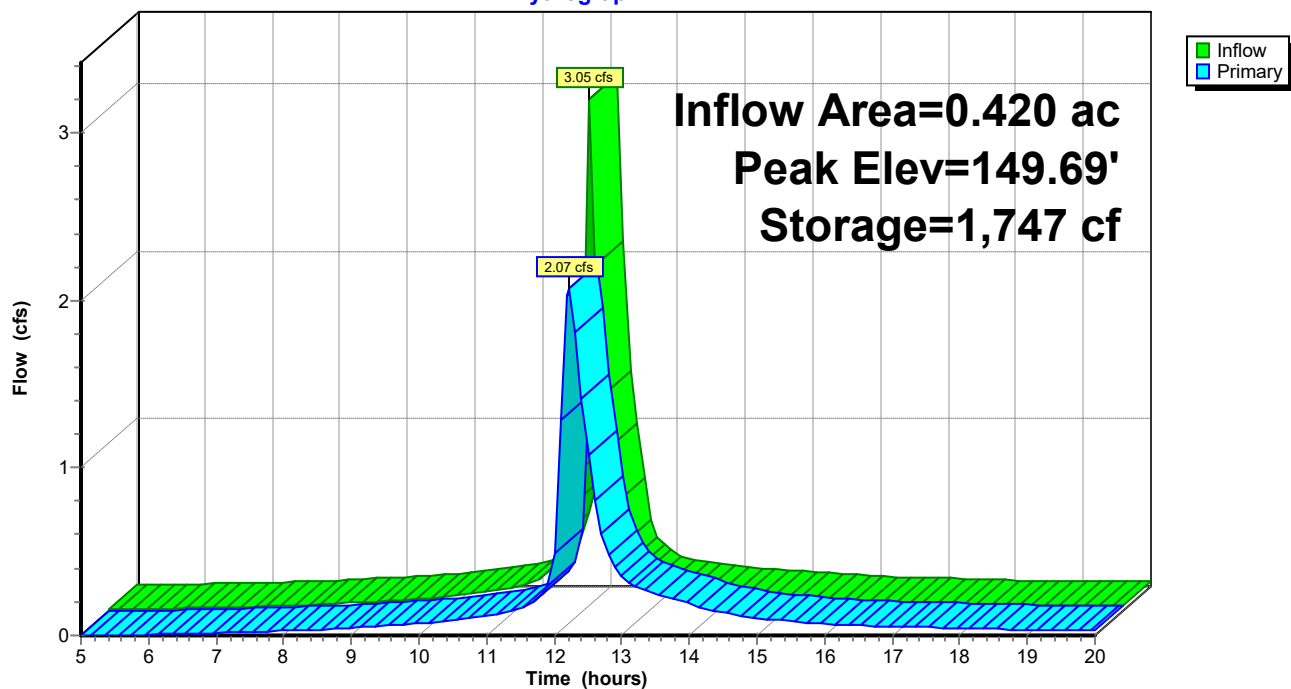
#	Routing	Invert	Outlet Devices
1	Primary	150.10'	12.0' long x 8.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74
2	Primary	148.40'	4.0" Vert. Orifice/Grate C= 0.600
3	Primary	149.00'	12.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=1.97 cfs @ 12.23 hrs HW=149.66' (Free Discharge)

- 1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
- 2=Orifice/Grate (Orifice Controls 0.44 cfs @ 5.0 fps)
- 3=Orifice/Grate (Orifice Controls 1.53 cfs @ 2.8 fps)

Pond 2P: Dry Detention Basin

Hydrograph



33 Middlebush LLC 20230205 Post Dev

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

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Page 35

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Pond 5P: Drywells

Inflow Area = 0.220 ac, Inflow Depth = 7.13" for 100-YR event
 Inflow = 1.71 cfs @ 12.10 hrs, Volume= 0.131 af
 Outflow = 1.57 cfs @ 12.20 hrs, Volume= 0.126 af, Atten= 8%, Lag= 6.4 min
 Discarded = 0.11 cfs @ 10.90 hrs, Volume= 0.100 af
 Primary = 1.46 cfs @ 12.20 hrs, Volume= 0.026 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs
 Peak Elev= 151.14' @ 12.20 hrs Surf.Area= 0.011 ac Storage= 0.034 af
 Plug-Flow detention time= 95.9 min calculated for 0.126 af (97% of inflow)
 Center-of-Mass det. time= 82.0 min (833.7 - 751.7)

#	Invert	Avail.Storage	Storage Description
1	146.00'	0.022 af	10.00'D x 4.00'H Vertical Cone/Cylinder x 3 Inside #2
2	145.00'	0.013 af	14.00'D x 5.00'H Vertical Cone/Cylinder 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'	0.014000 fpm Exfiltration over entire Surface area
2	Primary	150.50'	12.0" x 115.0' long Culvert RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 149.00' S= 0.0130 '/' n= 0.012 Cc= 0.900

Discarded OutFlow Max=0.11 cfs @ 10.90 hrs HW=145.07' (Free Discharge)

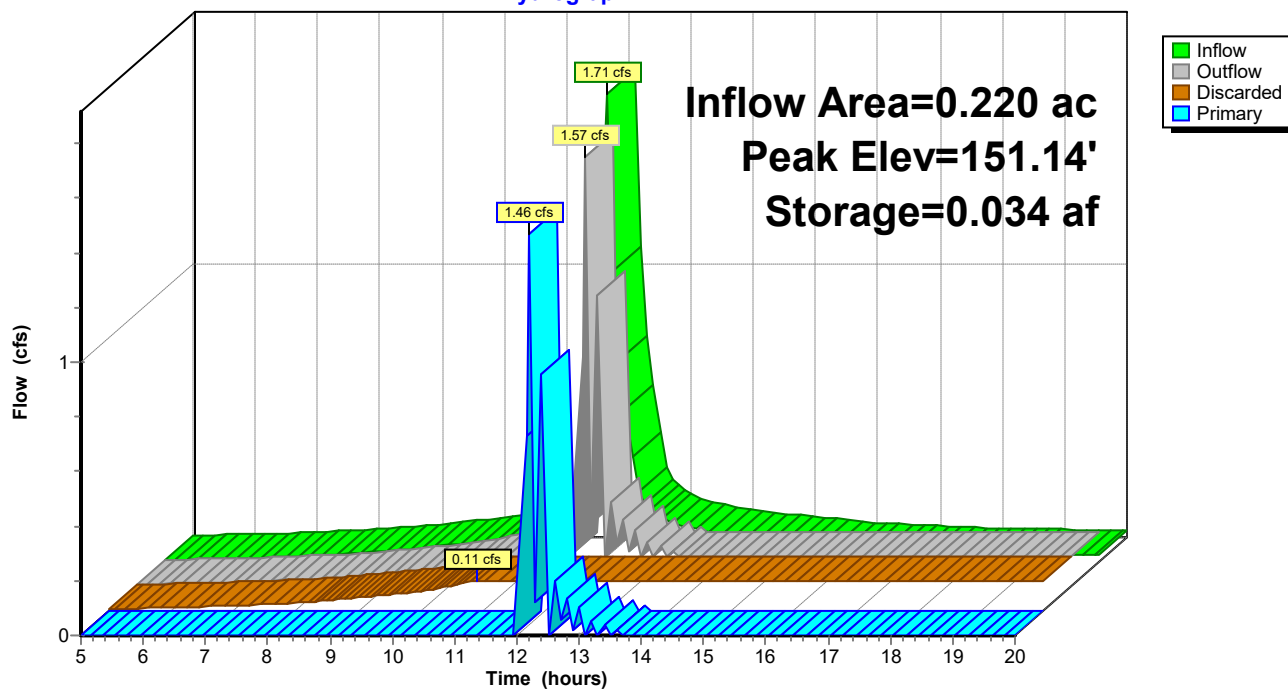
↑ **1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=1.42 cfs @ 12.20 hrs HW=151.13' (Free Discharge)

↑ **2=Culvert** (Inlet Controls 1.42 cfs @ 2.7 fps)

Pond 5P: Drywells

Hydrograph



Link 1L: ODP-1 (Culvert)

Inflow Area = 5.000 ac, Inflow Depth = 5.02" for 100-YR event
 Inflow = 19.71 cfs @ 12.35 hrs, Volume= 2.090 af
 Primary = 19.71 cfs @ 12.35 hrs, Volume= 2.090 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.10 hrs

Link 1L: ODP-1 (Culvert)

Hydrograph

