1500 PLANTATION ROAD – STORMWATER CONCEPT PLAN

STORMWATER CONCEPT NARRATIVE

Located in:

Blacksburg, Virginia

Project Number: 3322.0

Date: October 3, 2022
Revised: January 3, 2023

FORESIGHT DESIGN SERVICES

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1500 Plantation Road – Stormwater Concept Plan

STORMWATER CONCEPT NARRATIVE

INTRODUCTION

The following Stormwater Management Concept Plan has been developed to meet the requirements of Section 18-606, Stormwater Management Concept Plan, of the Code of the Town of Blacksburg, Virginia. The concept plan addressed items (1) through (8) of Section 18-606.

PROJECT DESCRIPTION

The project site is located at 1055 Plantation Road in the Town of Blacksburg, Virginia, and is bounded to the south by Prices Fork Road and to the east by two (2) commercial properties - Holiday Inn Express and Suites Blacksburg and FasMart #3514 convenience store with an attached BP gas station. To the west of the project site lies The Retreat at Blacksburg, a large student housing development, and to the north by Tom's Creek Basin power station. The site includes a single parcel totaling 4.573 acres and the project will include the construction of a large, climate-controlled storage building. The entrance to the site will also serve as a connecting road between Crisp Road to the West at The Retreat and Plantation Road to the East at the Holiday Inn Express.

EXISTING SITE CONDITIONS

The existing site is primarily an undeveloped, wooded site with slopes averaging from 2 to 65 percent as denoted by the Web Soil Survey located in the appendices. However, at the Southern portion of the site adjacent to Prices Fork Road there are two former parking lot areas that remain from a previous development. In addition, there is a small detention pond to the North of these lots which is presumed to have served the previous development.

Stormwater on the site is contained in two primary drainage basins. The northern drainage basin contains the existing former parking areas and drains into the detention pond which discharges to the Northwest through an existing culvert and into the detention pond for The Retreat student housing development. The southern drainage basin contains the undeveloped forested area of the site and exits the property to the North through sheet flow and into an existing creek.

ADJACENT AREAS

There should be no negative effects on any adjacent properties if Erosion and Sediment Control Measures are maintained until permanent stabilization is established.

OFFSITE AREAS

Any offsite areas will have their own separate plans.

SOILS

The USDA soils map shows the project area as a mix of Berks-Groseclose complex (2B) at a 2 to 7 percent slope with an HSG rating of "B", Berks-Groseclose complex (2C) at a 7 to 15 percent slope with an HSG rating of "B", Berks-Lowell-Rayne complex (3D) at a 15 to 25 percent slope with an HSG rating of "B", Berks-Lowell-Rayne complex (3E) at a 25 to 65 percent slope with an HSG rating of "B", Duffield-Ernest complex (11C) at a 7 to 15 percent slope with an HSG rating of "B", Groseclose and Poplimento soils (16B) at a 2 to 7 percent slope with an HSG rating of "C", Groseclose and Poplimento soils (16C) at a 7 to 15 percent slope with an HSG rating of "C", and Groseclose and Poplimento soils (16D) at a 15 to 25 percent slope with an HSG rating of "C". A soils map and soils description are included in the appendices.

CRITICAL AREAS

There is a critical area in the form of a Creek Valley Overlay at the Southern edge of parcel. However, there is no planned disturbance of this area and there should be no adverse impact to this area as long as erosion and sediment control measures are maintained until permanent stabilization is established.

STORMWATER RUNOFF CONSIDERATIONS

Stormwater on the site is contained in two primary drainage basins. The northern drainage basin contains the existing former parking areas and drains into the detention pond which discharges to the Northwest through an existing culvert and into the detention pond for The Retreat student housing development. The southern drainage basin contains the undeveloped forested area of the site and exits the property to the North through sheet flow and into an existing creek.

As the site is developed, the intent is to capture the runoff from the developed area and route it through an underground ADS StormTech system with isolator rows for water quality treatment. This detention system will then discharge to the North into the existing creek/stream area.

Stormwater Quality

In order to meet the phosphorus removal requirements of the Virginia Runoff Removal Method, a single ADS StormTech systems with isolator rows will be utilized to treat the runoff from the development. These manufactured treatment devices achieve a removal rate of 40%. The remaining phosphorous loading will be addressed through the purchase offsite Nutrient Credits. Water Quality calculations have been provided in the appendices, which demonstrate how the following values were determined:

Target Phosphorus Removal Amount	6.04 lb/yr
Phosphorus Removal Achieved in BMPs	3.06 lb/yr
Remaining Phosphorus Load to Address	2.99 lb/yr
Nutrient Credits to be purchased	2.99 lb/yr

Channel Protection

In order to comply with Channel Protection requirements from 9VAC25-870-66-B, section 3a was utilized as the site currently drains to a natural channel. This section requires that the proposed flow rate for the 1-YR storm is detained and reduced below the existing 1-YR storm flow rate. The exact requirement accounts for the increase in proposed volume during the 1-YR storm, as well as an improvement factor. In order to meet the target flowrate, an underground ADS StormTech system is proposed to detain the increased runoff. While one (1) ADS StormTech system may be sufficient, two (2) smaller ADS StormTech systems may be required due to space limitations around the proposed building.

As shown in the peak flowrate summary table below, the target flowrate for the 1-year storm is 0.07 cfs, and is met with a developed flowrate of 0.06 cfs for the 1-year storm.

Flood Protection

In order to comply with Flood Protection requirements from 9VAC25-870-66-C, section 2b was utilized for the drainage area. This section requires the peak flowrate of the 10-YR 24-hour storm post-development to be lower than the predevelopment peak flowrate of the 10-YR event. Downstream stormwater conveyance systems do not require any additional analysis to show compliance with flood protection criteria if this option is utilized. Detailed calculations, including hydrograph modeling, are attached in the appendices. These demonstrate what the required flow rate is, and how it is achieved using flow rate reduction via the proposed detention facilities.

In addition, in order to maintain the benefits of the existing stormwater management facility on the site, the proposed ADS Stormtech system will be upsized by an additional 1,300 cf of storage volume to match the volume of the existing pond. This additional storage will be above that required for the proposed development.

Peak Flowrate Summary

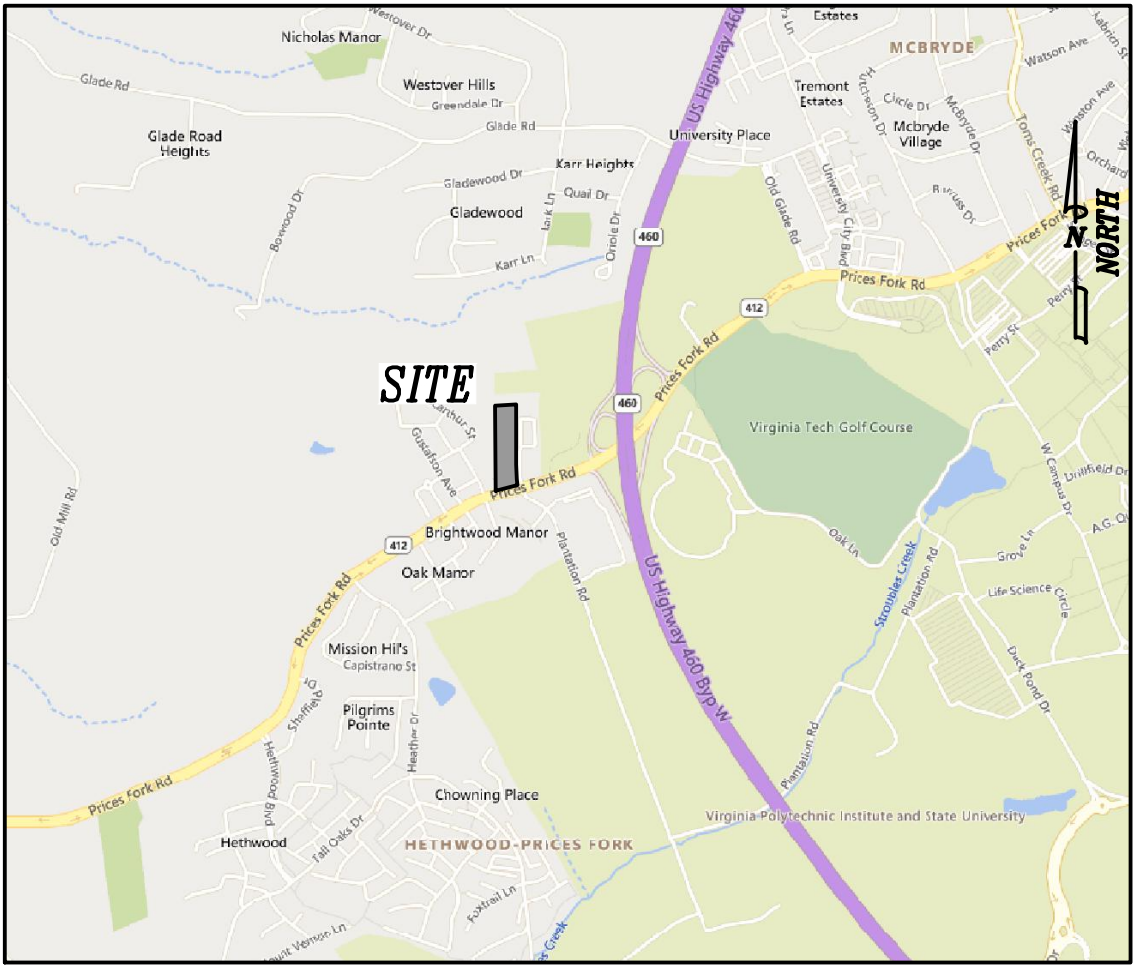
Study Point	Pre-Development			Target	Post-Development		
	1-Year		10-Year	1-Year	1-Year		10-Year
	Runoff (cfs)	*Volume (cf)*	*Runoff (cfs)*	*Runoff (cfs)*	*Runoff (cfs)*	*Volume (cf)*	*Runoff (cfs)*
1	0.73	3,093	7.79	0.07	0.06	24,872	5.29

STORMWATER FACILITY MAINTENANCE CONSIDERATIONS

The proposed ADS StormTech systems will be located adjacent to the proposed building so as to capture the bulk of the proposed impervious area for the development. As such, these systems will be easily accessible by any service vehicles, including vac-trucks that will be utilized to clean out the underground systems.

MAPS

- Location Map
- Soils Map
- Existing DA Map (Macro) – SCS
- Post DA Map (Macro) – SCS



VICINITY MAP:

SCALE: 1"=±2000'

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VICINITY MAP

1800 PRICES FORK ROAD
SITE DEVELOPMENT PLAN
BLACKSBURG, VIRGINIA

REVISIONS

PROJECT TEAM	
PIC	JOHN T. NEEL, PE
PM	MATTHEW P. TOMLINSON, PE
DSGN	CJL/MBL/SAC

DATE	FDS JN	SHEET
09/29/2022	3322	1 OF 1

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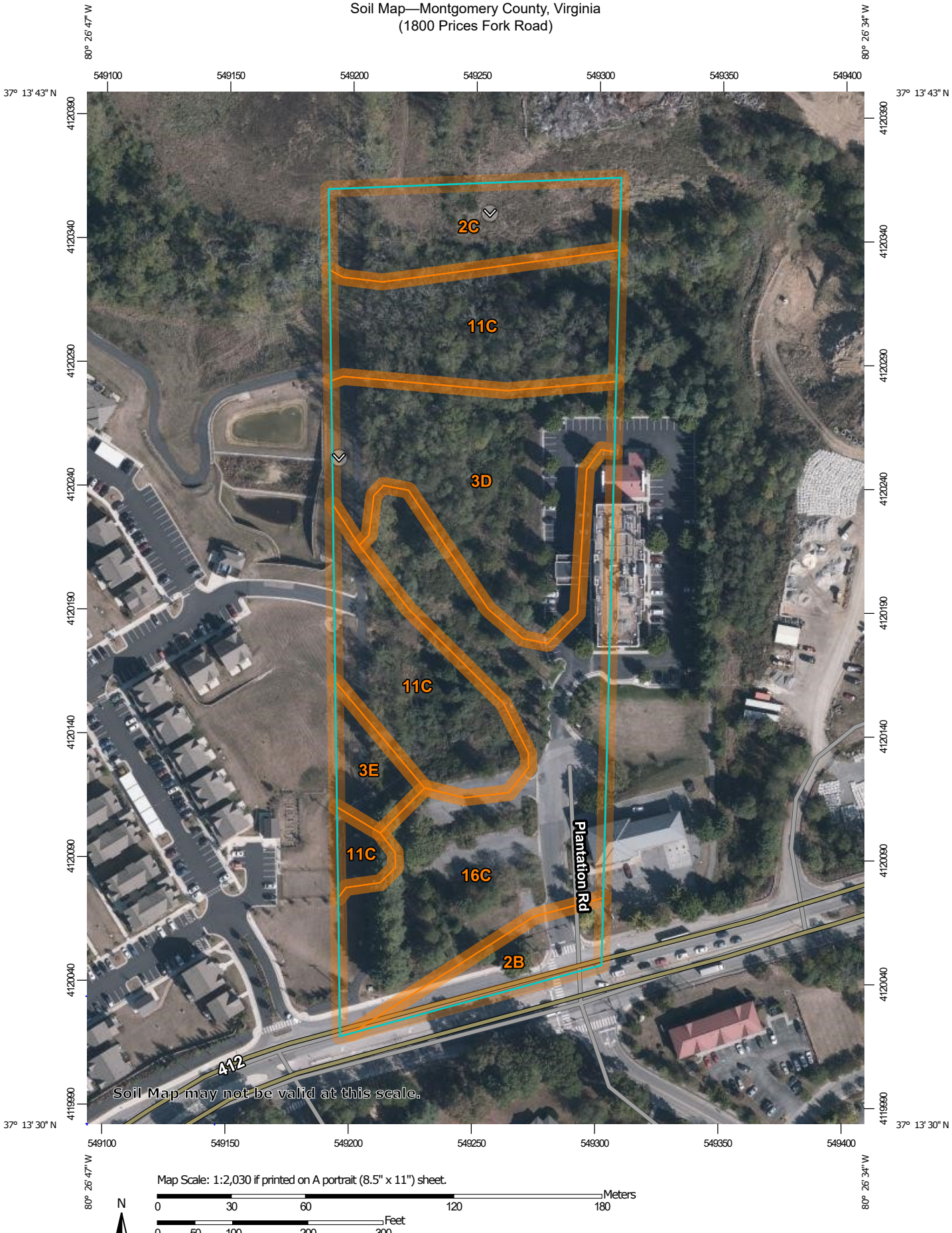
Soil Map—Montgomery County, Virginia
(1800 Prices Fork Road)



Map Scale: 1:2,030 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 30 60 120 180

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

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
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Montgomery County, Virginia
Survey Area Data: Version 14, Sep 14, 2021

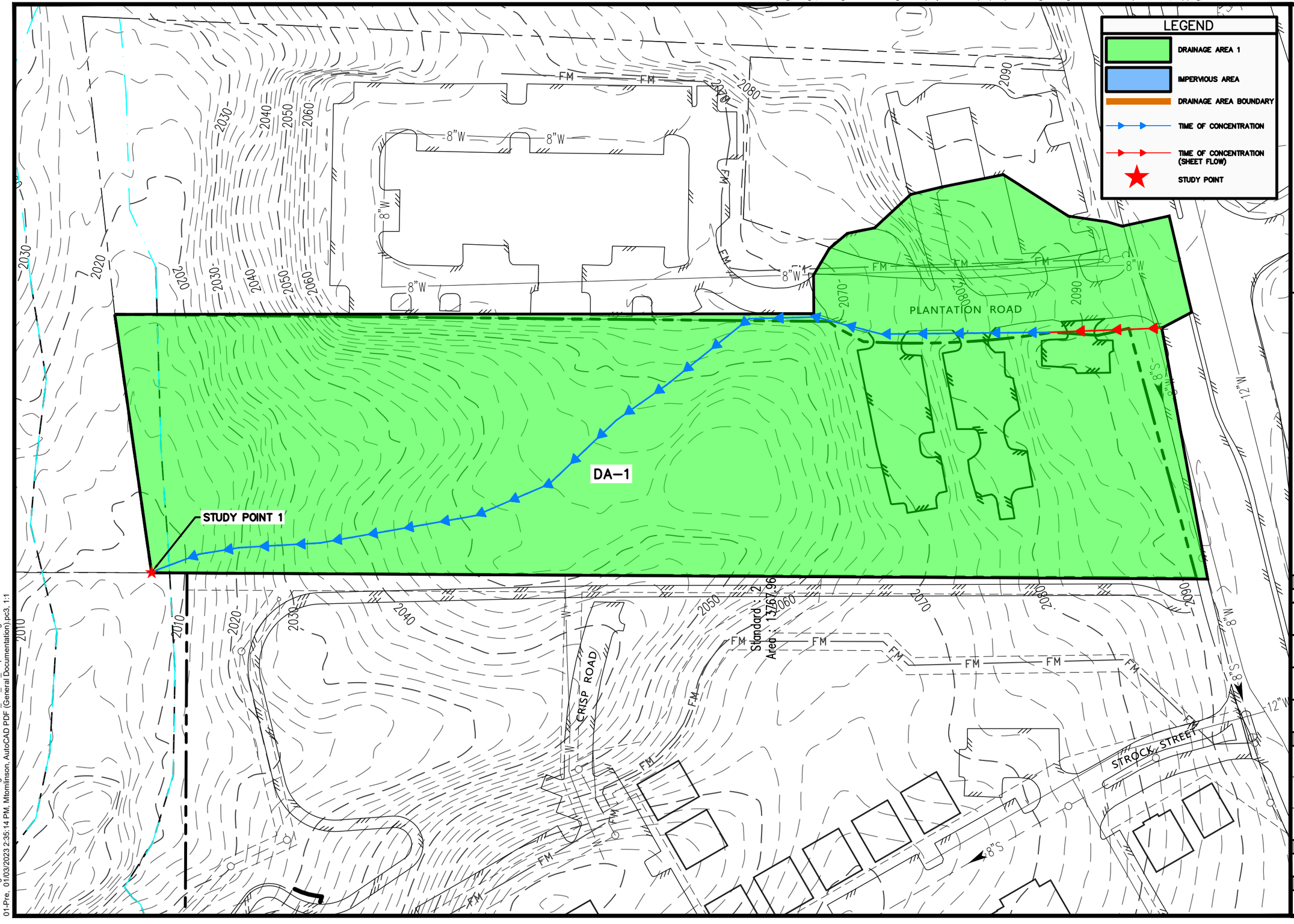
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 29, 2019—Oct 4, 2019

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 Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2B	Berks-Groseclose complex, 2 to 7 percent slopes	0.4	4.7%
2C	Berks-Groseclose complex, 7 to 15 percent slopes	1.0	10.9%
3D	Berks-Lowell-Rayne complex, 15 to 25 percent slopes	2.0	21.3%
3E	Berks-Lowell-Rayne complex, 25 to 65 percent slopes	0.3	3.1%
11C	Duffield-Ernest complex, 7 to 15 percent slopes	2.6	27.9%
16C	Groseclose and Poplimento soils, 7 to 15 percent slopes	3.0	32.1%
Totals for Area of Interest		**9.2**	**100.0%**



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PRE-DEVELOPMENT DA MAP

1055 PRICES FORK ROAD
SITE DEVELOPMENT PLAN

TOWN OF BLACKSBURG, VIRGINIA

REVISIONS		
NO.	COMMENTS	DATE

PROJECT TEAM	
PIC	JOHN T. NEEL, PE
PM	MATTHEW P. TOMLINSON, PE
DESIGN	CJL/MPT/SAC

FDS JOB NO.	ISSUE DATE
3322	01/03/2023

SHEET NUMBER
1 OF 1

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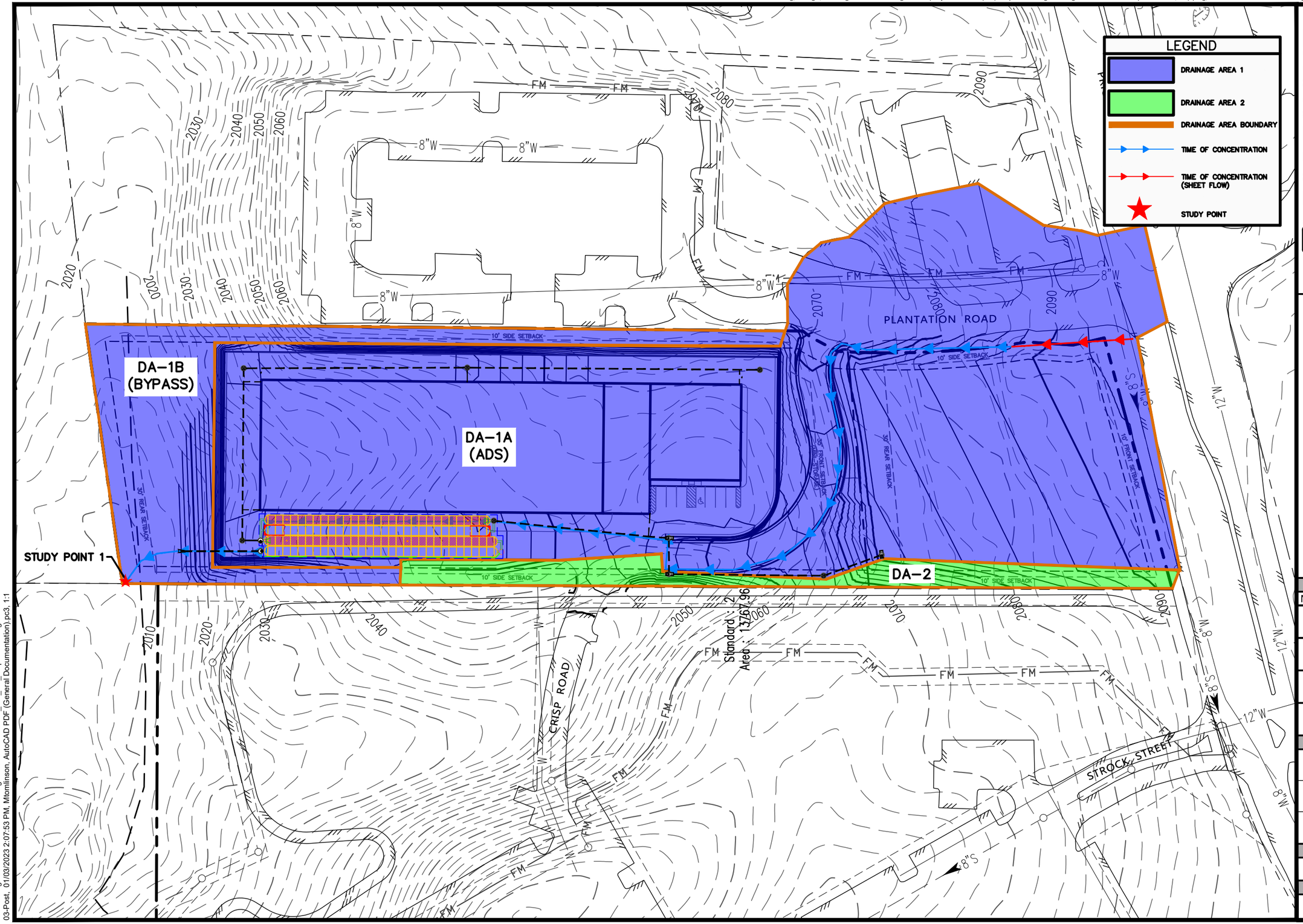

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POST-DEVELOPMENT DA MAP

1055 PRICES FORK ROAD
SITE DEVELOPMENT PLAN

TOWN OF BLACKSBURG, VIRGINIA

REVISIONS		
NO.	COMMENTS	DATE

PROJECT TEAM	
PIC	JOHN T. NEEL, PE
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DESIGN	CJL/MBL/SAC

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1 OF 1

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STORMWATER QUANTITY CALCULATIONS

- Channel Protection Calculations
- HydroCAD Model
- NOAA Atlas 14 Precipitation Data

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1055 Plantation Road
Drainage Area 1

JN: 3322.0
BY: CJL, MPT
DATE: 01/03/23

CHANNEL PROTECTION TO A NATURAL WATERWAY CALCULATIONS - 1-YR 24 HOUR STORM

Site Area =	4.24	AC	*Limits of Disturbance (see definition in 9VAC25-870*
Improvement Factor (I.F.) =	0.8		*Based on Site Area (0.8 if over 1 acre, 0.9 otherwise)*

$Q_{Pre\text{-}developed}$ (Qp) =	0.73	cfs	
$RV_{Pre\text{-}developed}$ (RVp) =	3,092	cf	

Input from Hydrographs

Q_{Forest} (Qf) =	0.02	cfs	
RV_{Forest} (RVf) =	566	cf	

Forest Conditional Comparison		
I.F.*(Qp*RVp)/RVd	0.07	cfs
(Qf*RVf)/RVd	0.00	cfs

Target Flow Rate Determined by Pre-development Equation: I.F.*(Qp*RVp)/RVd

$RV_{Developed}$ from Hydrograph	24,872	cf	*Input from Hydrographs*
Runoff Reduction from VRRM	-	cf	
$RV_{Developed}$ (RVd) =	24,872	cf	

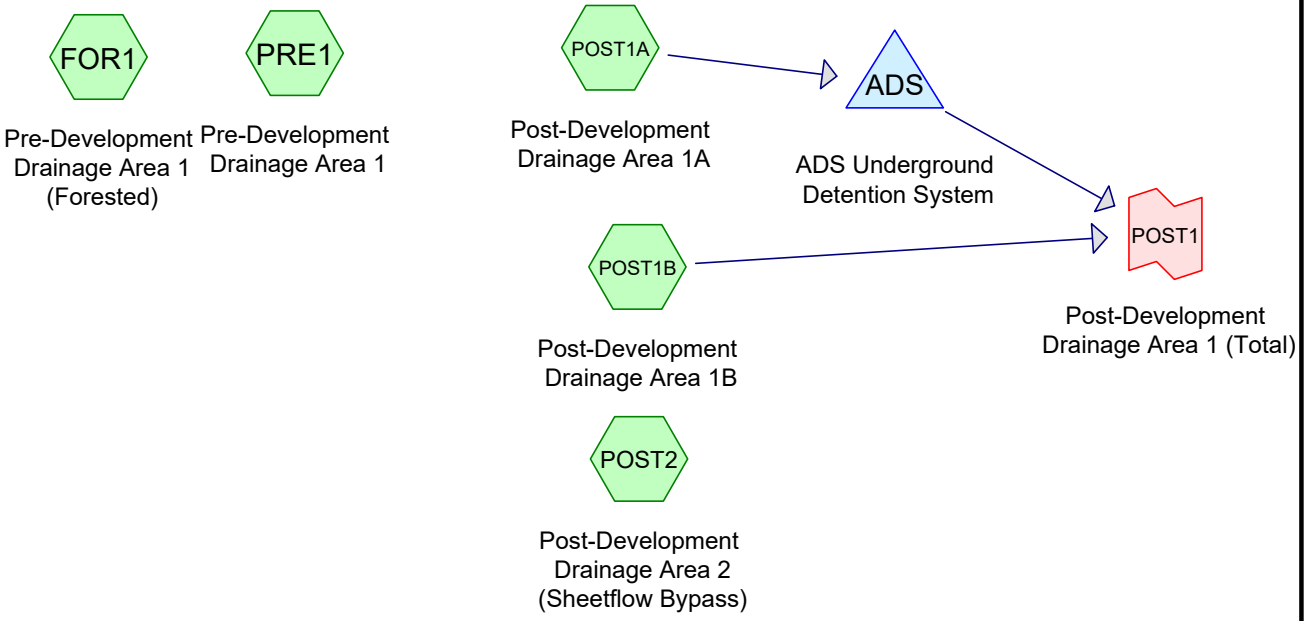
$Q_{Developed}$ Target = 0.07 cfs

$Q_{Developed}$ (Qd) =	0.06	cfs	*Input from Hydrographs*

Qd	IS LESS THAN	I.F.*(Qp*RVp)/RVd
0.06		0.07

$Q_{Developed} \leq$ I.F.*($Q_{Pre\text{-}developed}$* $RV_{Pre\text{-}Developed}$)/$RV_{Developed}$
Under no condition shall $Q_{Developed}$ be greater than $Q_{Pre\text{-}Developed}$ nor shall $Q_{Developed}$ be required to be less than that calculated in the equation (Q_{Forest} * RV_{Forest})/$RV_{Developed}$; where
I.F. (Improvement Factor) equals 0.8 for sites > 1 acre or 0.9 for sites ≤ 1 acre.
$Q_{Developed}$ = The allowable peak flow rate of runoff from the developed site.
$RV_{Developed}$ = The volume of runoff from the site in the developed condition.
$Q_{Pre\text{-}Developed}$ = The peak flow rate of runoff from the site in the pre-developed condition.
$RV_{Pre\text{-}Developed}$ = The volume of runoff from the site in pre-developed condition.
Q_{Forest} = The peak flow rate of runoff from the site in a forested condition.
RV_{Forest} = The volume of runoff from the site in a forested condition; or

*Methodology from 9VAC25-870-66-B-3-a



Subcat Reach Pond Link

Routing Diagram for 3322_SWM_Concept_V2
Prepared by Foresight Design Services, Printed 1/3/2023
HydroCAD® 10.20-2b s/n 08978 © 2021 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-Year	Type II 24-hr		Default	24.00	1	2.25	2
2	2-Year	Type II 24-hr		Default	24.00	1	2.72	2
3	10-Year	Type II 24-hr		Default	24.00	1	4.05	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.518	61	>75% Grass cover, Good, HSG B (POST1A, POST1B, POST2, PRE1)
5.065	98	Impervious (POST1A, POST2, PRE1)
9.952	55	Woods, Good, HSG B (FOR1, POST1B, PRE1)
16.535	**69**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
11.470	HSG B	FOR1, POST1A, POST1B, POST2, PRE1
0.000	HSG C	
0.000	HSG D	
5.065	Other	POST1A, POST2, PRE1
16.535		**TOTAL AREA**

Summary for Subcatchment FOR1: Pre-Development Drainage Area 1 (Forested)

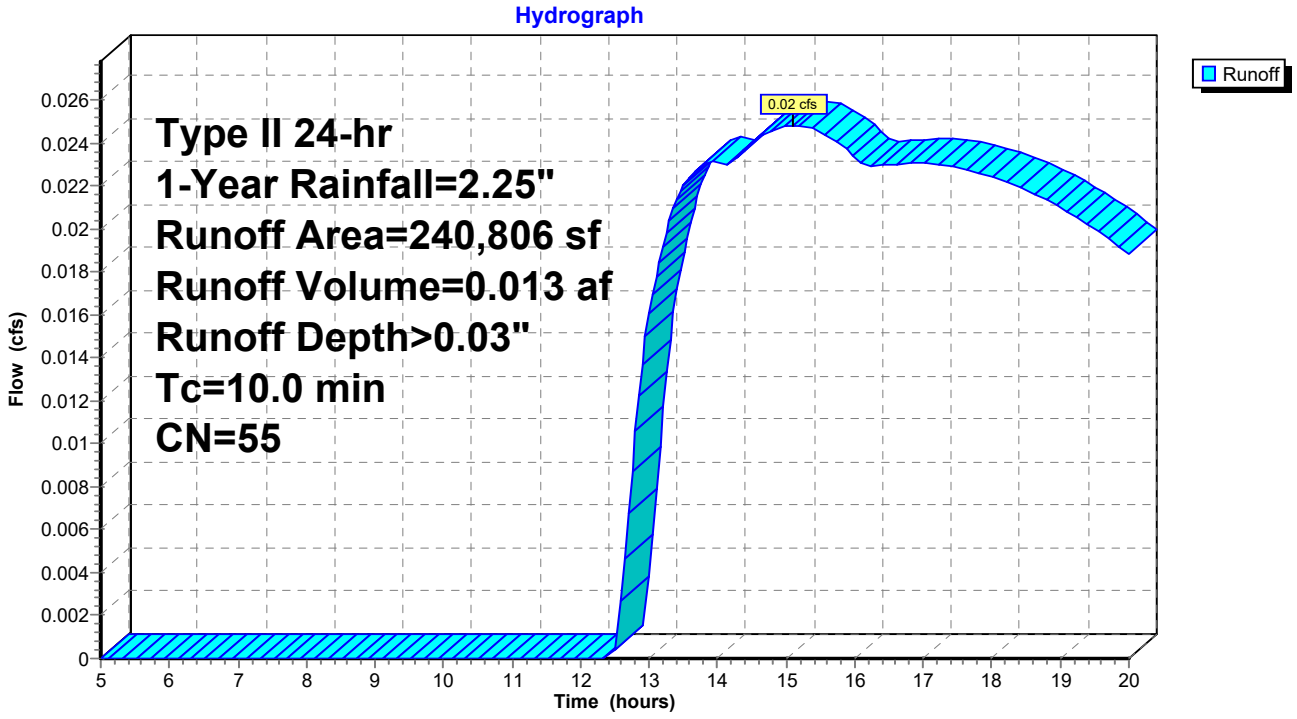
Runoff = 0.02 cfs @ 15.11 hrs, Volume= 0.013 af, Depth> 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-Year Rainfall=2.25"

Area (sf)	CN	Description
165,955	55	Woods, Good, HSG B
47,143	55	Woods, Good, HSG B
27,708	55	Woods, Good, HSG B
240,806	55	Weighted Average
240,806		100.00% Pervious Area

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

Subcatchment FOR1: Pre-Development Drainage Area 1 (Forested)



Summary for Subcatchment POST1A: Post-Development Drainage Area 1A

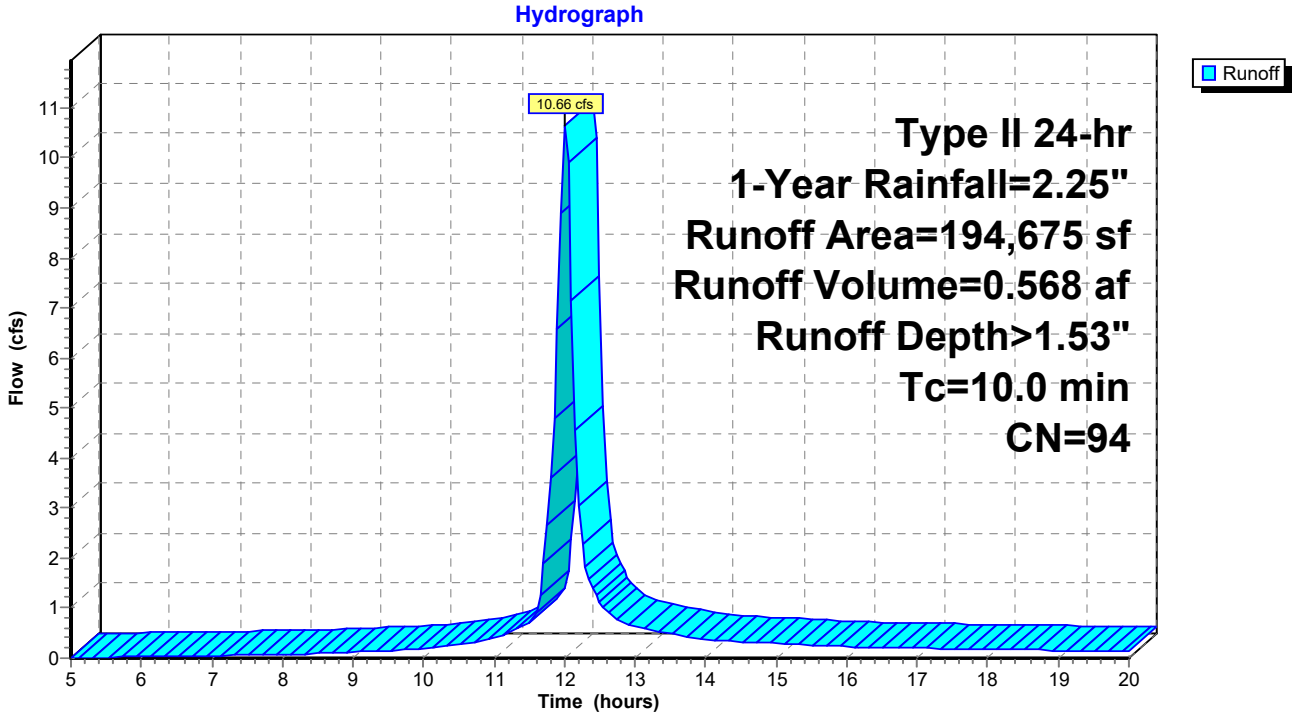
Runoff = 10.66 cfs @ 12.01 hrs, Volume= 0.568 af, Depth> 1.53"
Routed to Pond ADS : ADS Underground Detention System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-Year Rainfall=2.25"

	Area (sf)	CN	Description
	22,758	61	>75% Grass cover, Good, HSG B
*	171,917	98	Impervious
	194,675	94	Weighted Average
	22,758		11.69% Pervious Area
	171,917		88.31% Impervious Area

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

Subcatchment POST1A: Post-Development Drainage Area 1A



Summary for Subcatchment POST1B: Post-Development Drainage Area 1B

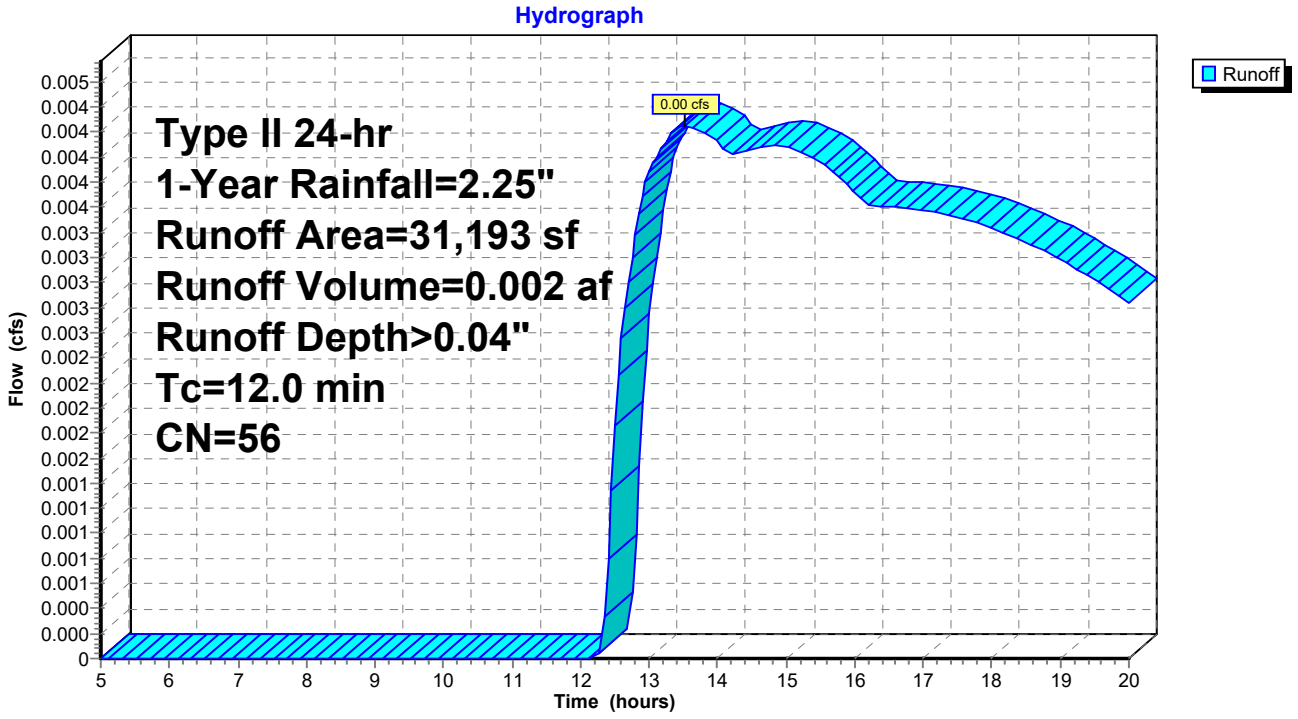
Runoff = 0.00 cfs @ 13.52 hrs, Volume= 0.002 af, Depth> 0.04"
Routed to Link POST1 : Post-Development Drainage Area 1 (Total)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-Year Rainfall=2.25"

Area (sf)	CN	Description
4,456	61	>75% Grass cover, Good, HSG B
26,737	55	Woods, Good, HSG B
31,193	56	Weighted Average
31,193		100.00% Pervious Area

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

Subcatchment POST1B: Post-Development Drainage Area 1B



Summary for Subcatchment POST2: Post-Development Drainage Area 2 (Sheetflow Bypass)

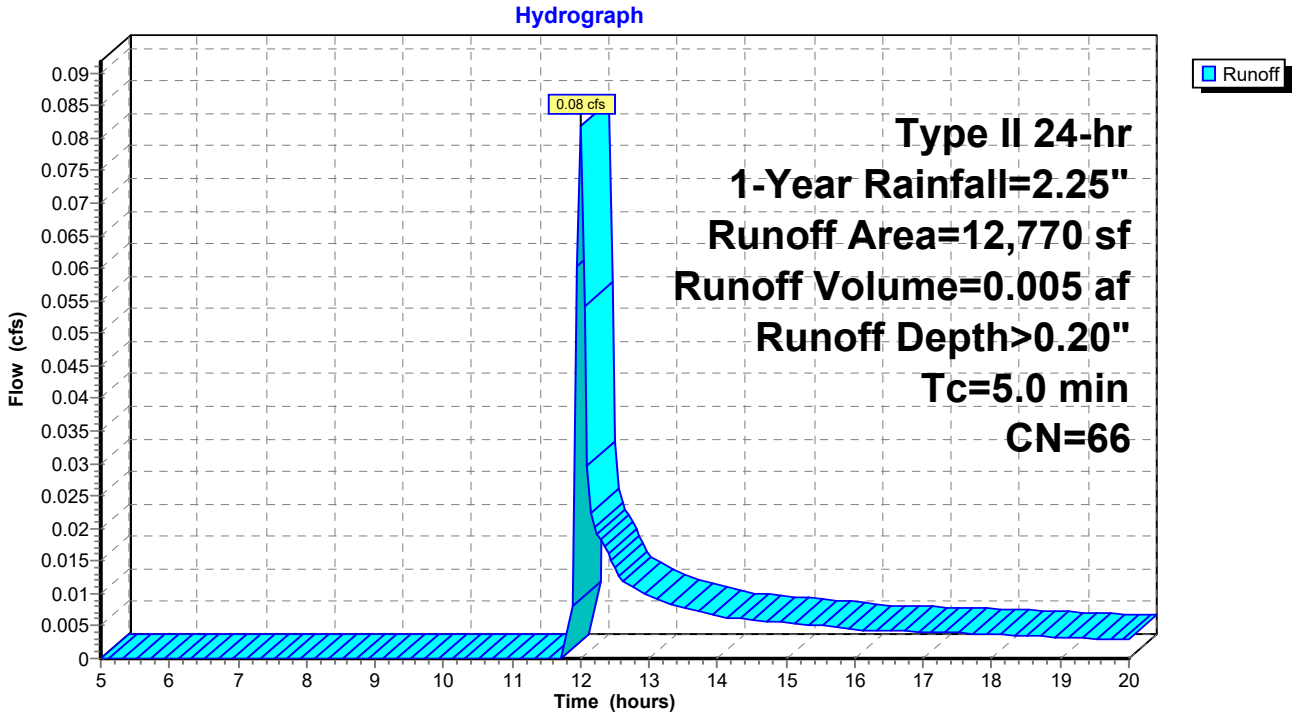
Runoff = 0.08 cfs @ 12.00 hrs, Volume= 0.005 af, Depth> 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-Year Rainfall=2.25"

	Area (sf)	CN	Description
	11,213	61	>75% Grass cover, Good, HSG B
*	1,557	98	Impervious
	12,770	66	Weighted Average
	11,213		87.81% Pervious Area
	1,557		12.19% Impervious Area

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

Subcatchment POST2: Post-Development Drainage Area 2 (Sheetflow Bypass)



Summary for Subcatchment PRE1: Pre-Development Drainage Area 1

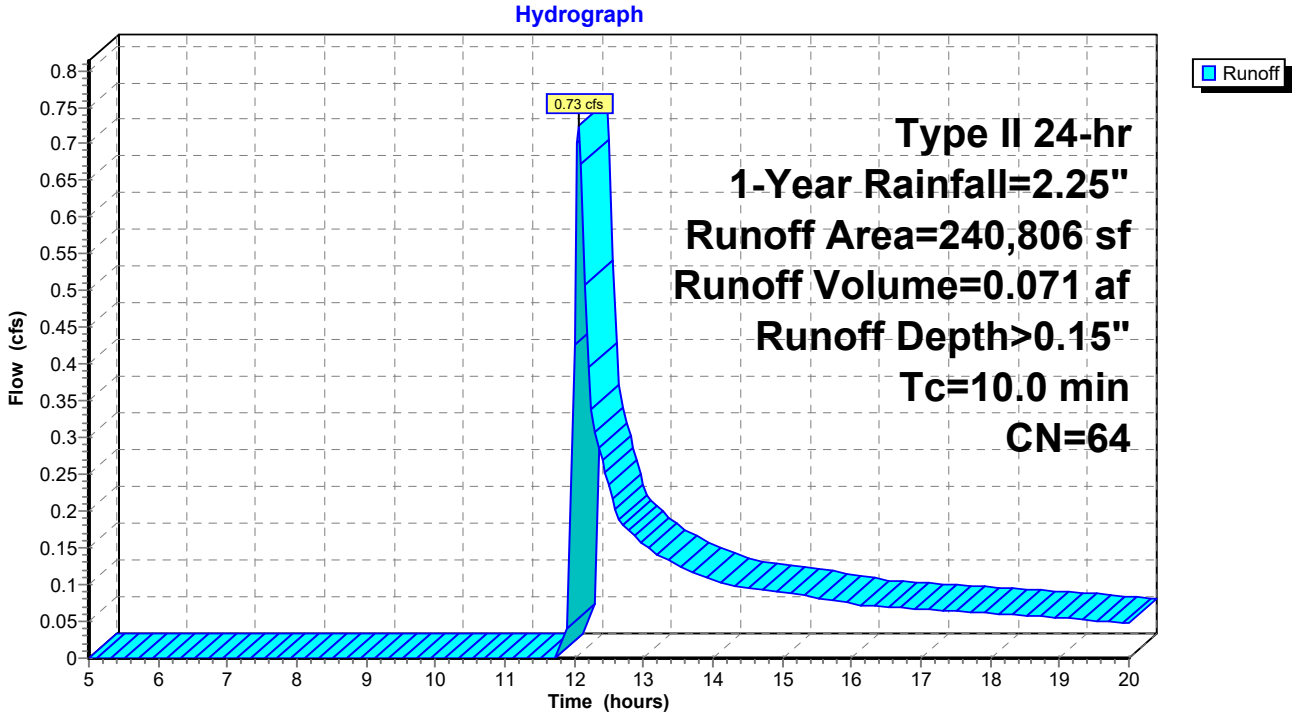
Runoff = 0.73 cfs @ 12.07 hrs, Volume= 0.071 af, Depth> 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-Year Rainfall=2.25"

	Area (sf)	CN	Description
	165,955	55	Woods, Good, HSG B
*	47,143	98	Impervious
	27,708	61	>75% Grass cover, Good, HSG B
	240,806	64	Weighted Average
	193,663		80.42% Pervious Area
	47,143		19.58% Impervious Area

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

Subcatchment PRE1: Pre-Development Drainage Area 1



Summary for Pond ADS: ADS Underground Detention System

Inflow Area = 4.469 ac, 88.31% Impervious, Inflow Depth > 1.53" for 1-Year event
Inflow = 10.66 cfs @ 12.01 hrs, Volume= 0.568 af
Outflow = 0.05 cfs @ 20.00 hrs, Volume= 0.040 af, Atten= 99%, Lag= 479.4 min
Primary = 0.05 cfs @ 20.00 hrs, Volume= 0.040 af
Routed to Link POST1 : Post-Development Drainage Area 1 (Total)

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 2,039.38' @ 20.00 hrs Surf.Area= 7,164 sf Storage= 22,989 cf

Plug-Flow detention time= 371.7 min calculated for 0.040 af (7% of inflow)
Center-of-Mass det. time= 148.7 min (912.5 - 763.8)

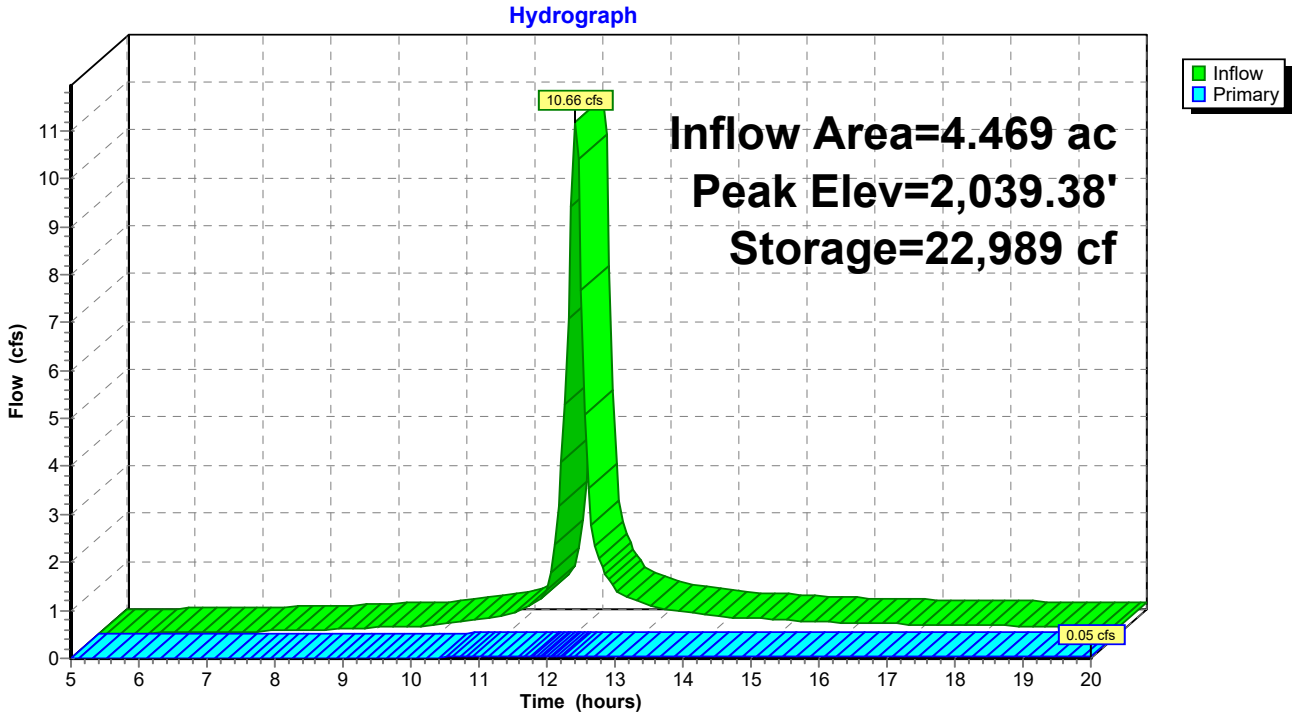
Volume	Invert	Avail.Storage	Storage Description
#1A	2,035.00'	11,438 cf	**28.50'W x 251.36'L x 6.75'H Field A** 48,355 cf Overall - 19,759 cf Embedded = 28,596 cf x 40.0% Voids
#2A	2,035.75'	19,759 cf	**ADS_StormTech MC-7200 +Cap** x 111 Inside #1 Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap 111 Chambers in 3 Rows Cap Storage= 39.5 cf x 2 x 3 rows = 237.0 cf
		31,198 cf	Total Available Storage

Storage Group A created with Chamber Wizard

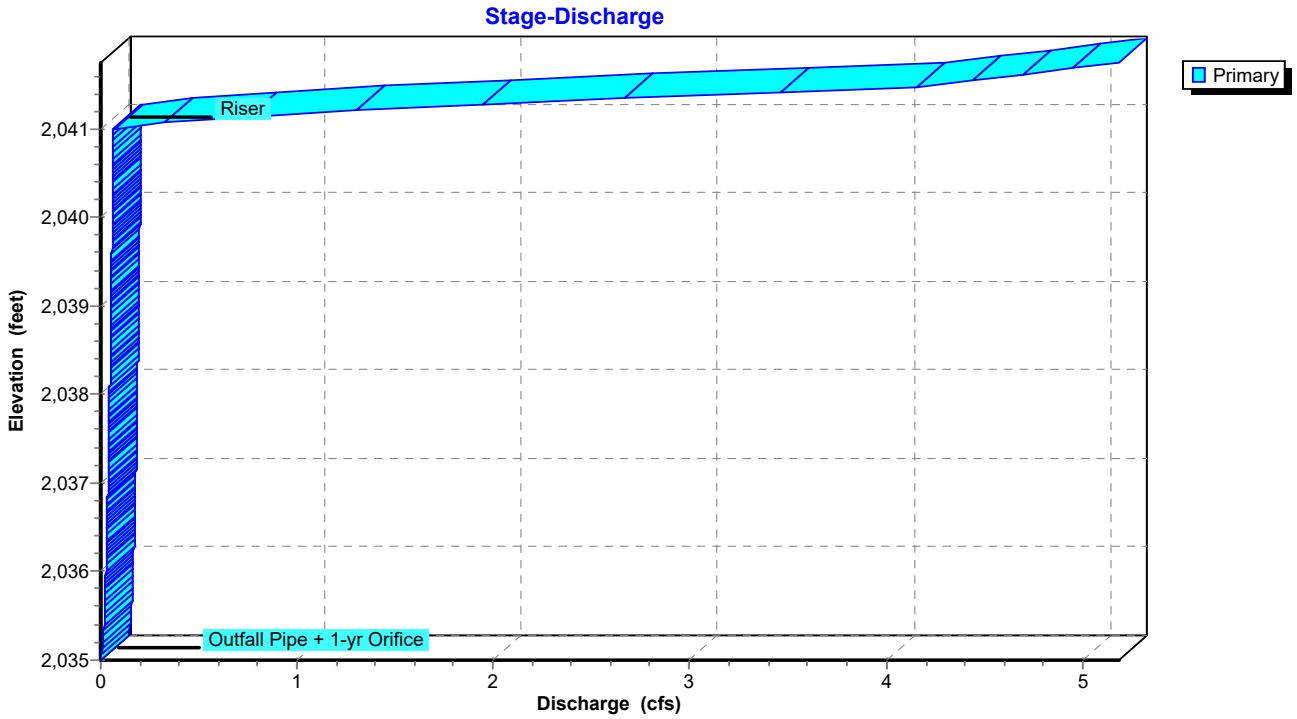
Device	Routing	Invert	Outlet Devices
#1	Primary	2,035.00'	**15.0" Round Outfall Pipe** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 2,035.00' / 2,020.00' S= 0.1500 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#2	Device 1	2,035.00'	**1.0" Vert. 1-yr Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,041.00'	**15.0" Horiz. Riser** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.05 cfs @ 20.00 hrs HW=2,039.38' (Free Discharge)
└**1=Outfall Pipe** (Passes 0.05 cfs of 14.32 cfs potential flow)
  ├**2=1-yr Orifice** (Orifice Controls 0.05 cfs @ 10.03 fps)
  └**3=Riser** (Controls 0.00 cfs)

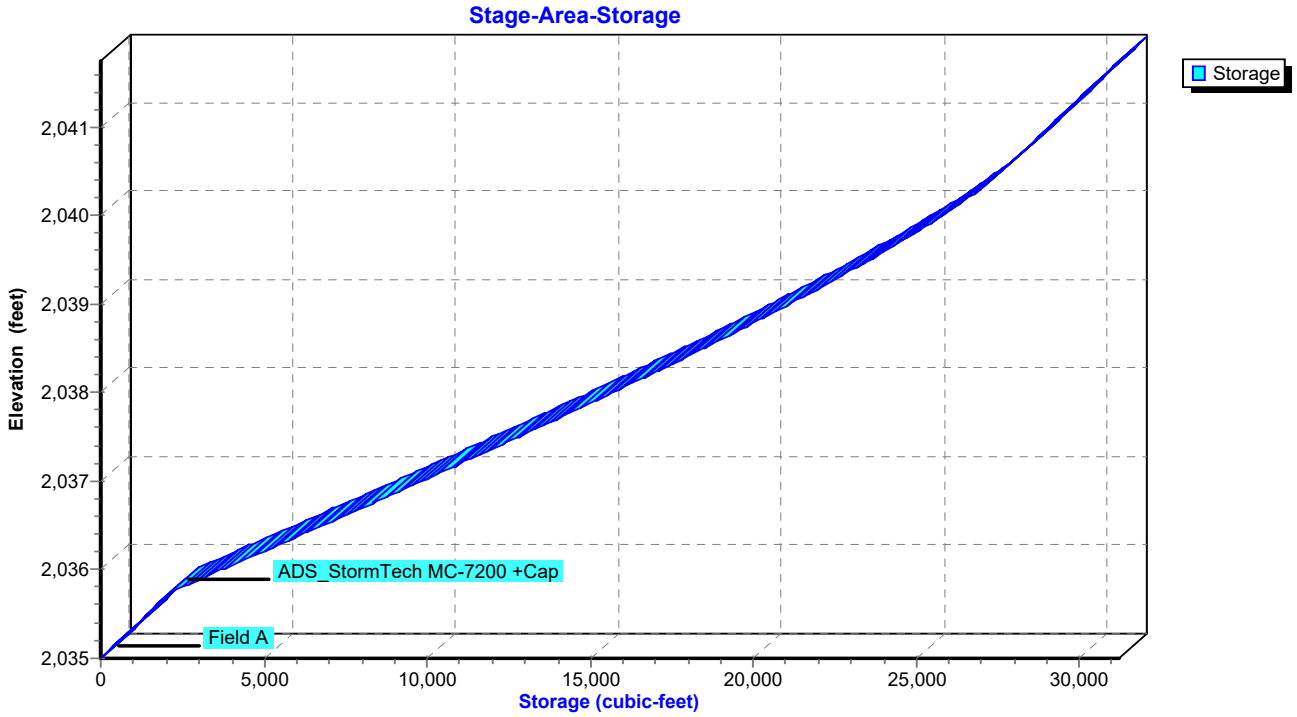
Pond ADS: ADS Underground Detention System



Pond ADS: ADS Underground Detention System



Pond ADS: ADS Underground Detention System

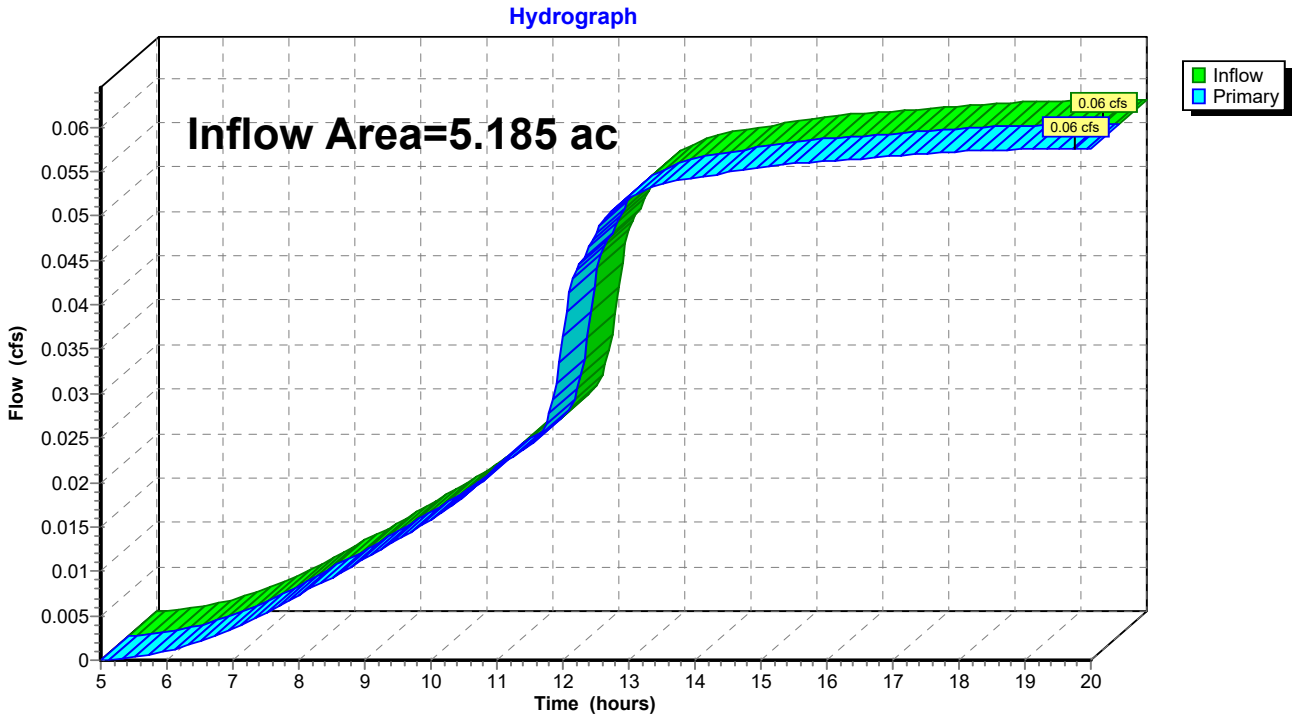


Summary for Link POST1: Post-Development Drainage Area 1 (Total)

Inflow Area = 5.185 ac, 76.11% Impervious, Inflow Depth > 0.10" for 1-Year event
Inflow = 0.06 cfs @ 19.75 hrs, Volume= 0.043 af
Primary = 0.06 cfs @ 19.75 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min

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

Link POST1: Post-Development Drainage Area 1 (Total)



Summary for Subcatchment FOR1: Pre-Development Drainage Area 1 (Forested)

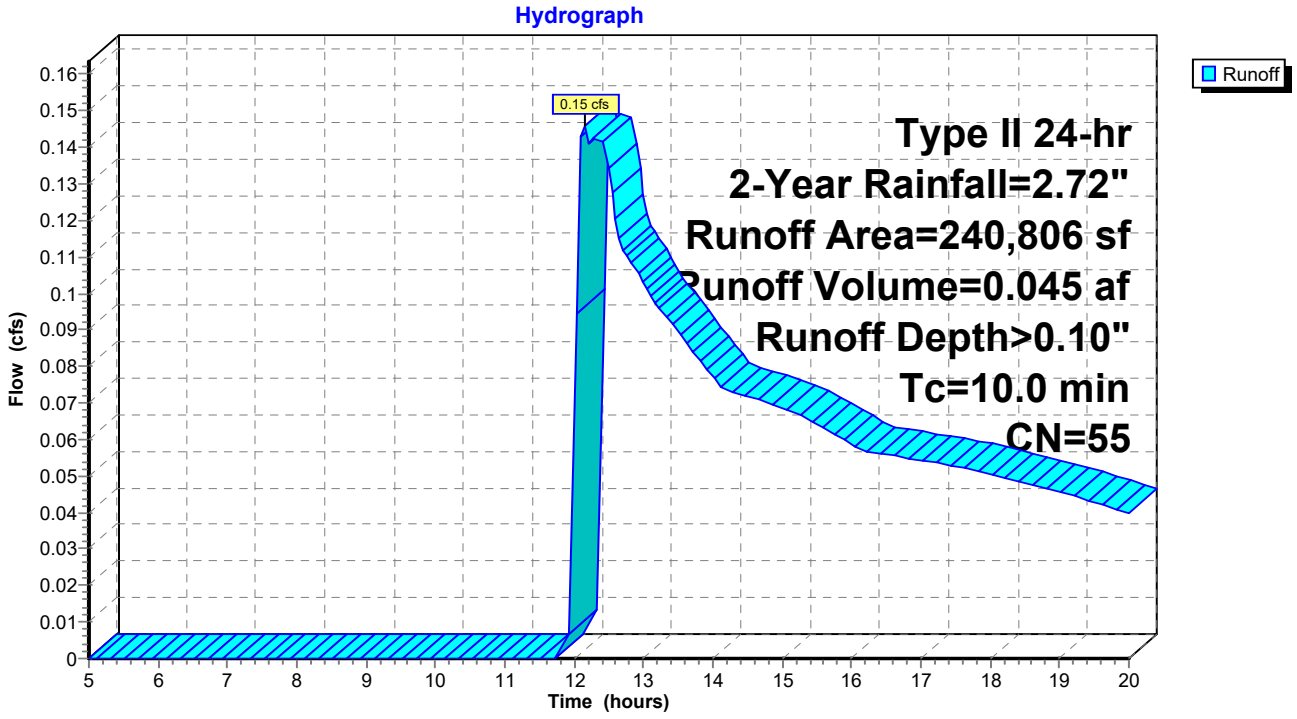
Runoff = 0.15 cfs @ 12.14 hrs, Volume= 0.045 af, Depth> 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.72"

Area (sf)	CN	Description
165,955	55	Woods, Good, HSG B
47,143	55	Woods, Good, HSG B
27,708	55	Woods, Good, HSG B
240,806	55	Weighted Average
240,806		100.00% Pervious Area

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

Subcatchment FOR1: Pre-Development Drainage Area 1 (Forested)



Summary for Subcatchment POST1A: Post-Development Drainage Area 1A

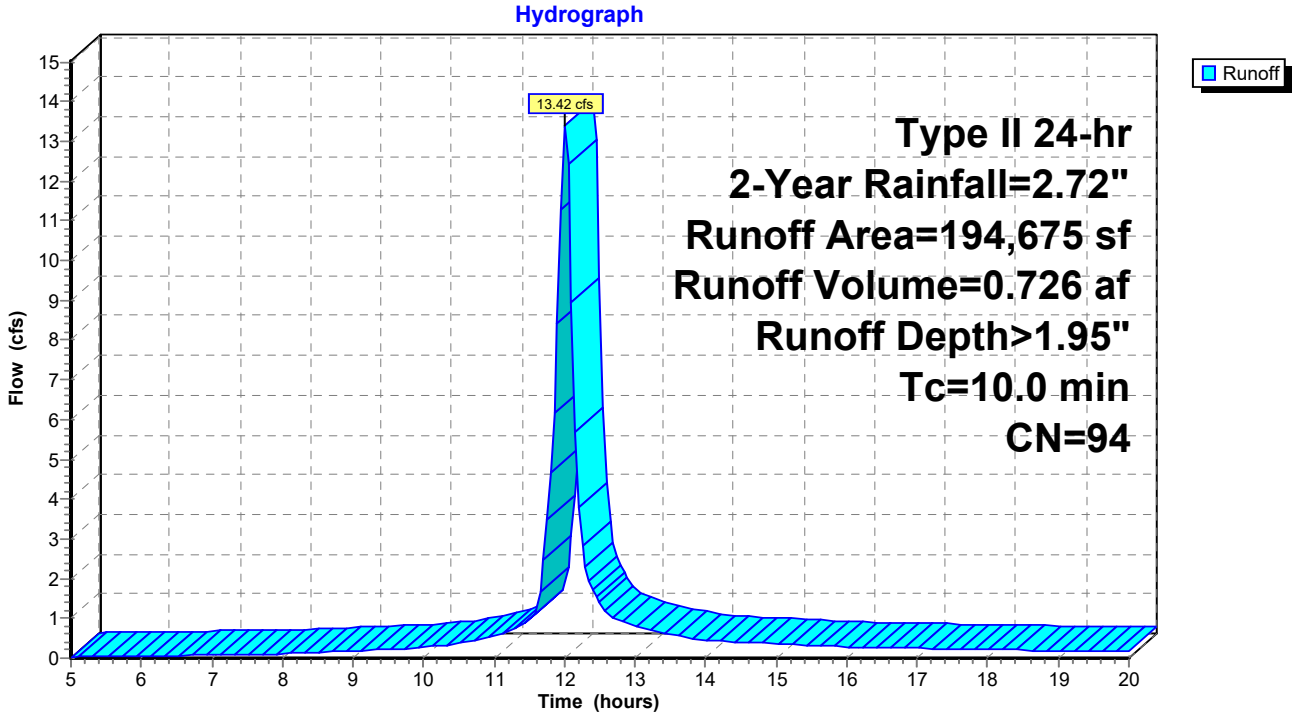
Runoff = 13.42 cfs @ 12.01 hrs, Volume= 0.726 af, Depth> 1.95"
Routed to Pond ADS : ADS Underground Detention System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.72"

	Area (sf)	CN	Description
	22,758	61	>75% Grass cover, Good, HSG B
*	171,917	98	Impervious
	194,675	94	Weighted Average
	22,758		11.69% Pervious Area
	171,917		88.31% Impervious Area

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

Subcatchment POST1A: Post-Development Drainage Area 1A



Summary for Subcatchment POST1B: Post-Development Drainage Area 1B

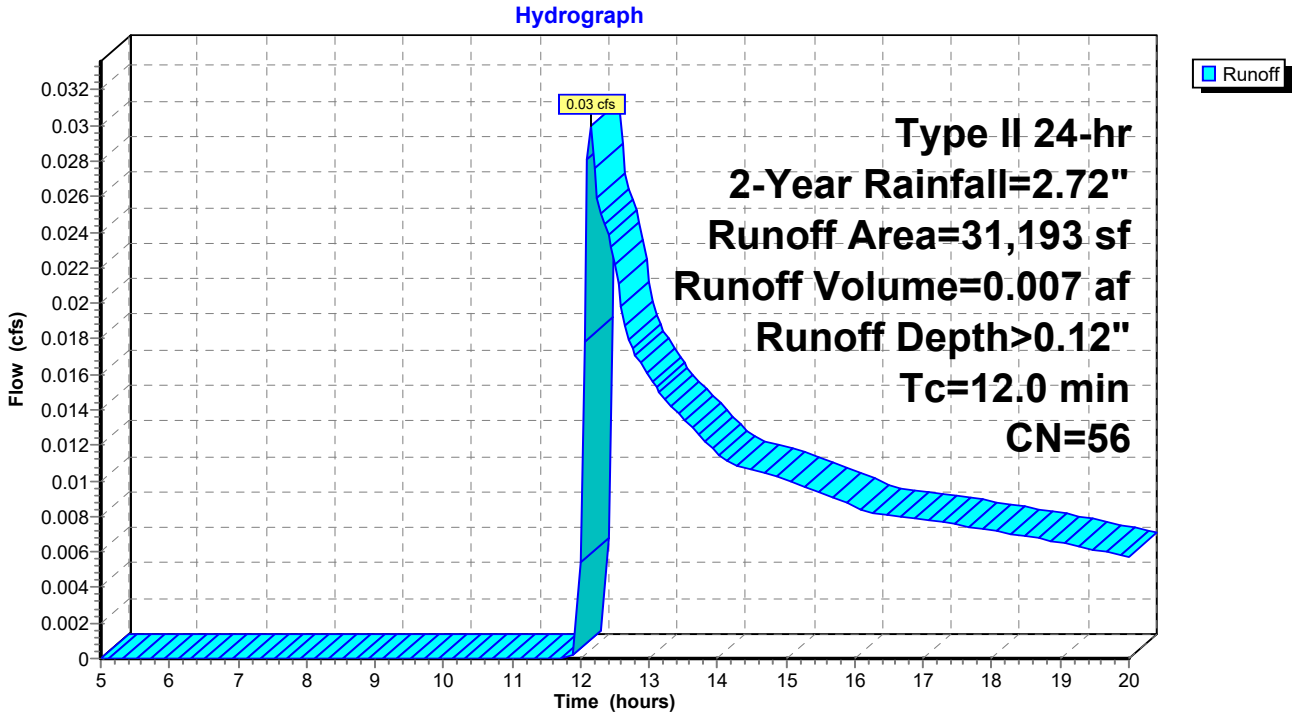
Runoff = 0.03 cfs @ 12.15 hrs, Volume= 0.007 af, Depth> 0.12"
Routed to Link POST1 : Post-Development Drainage Area 1 (Total)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.72"

Area (sf)	CN	Description
4,456	61	>75% Grass cover, Good, HSG B
26,737	55	Woods, Good, HSG B
31,193	56	Weighted Average
31,193		100.00% Pervious Area

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

Subcatchment POST1B: Post-Development Drainage Area 1B



Summary for Subcatchment POST2: Post-Development Drainage Area 2 (Sheetflow Bypass)

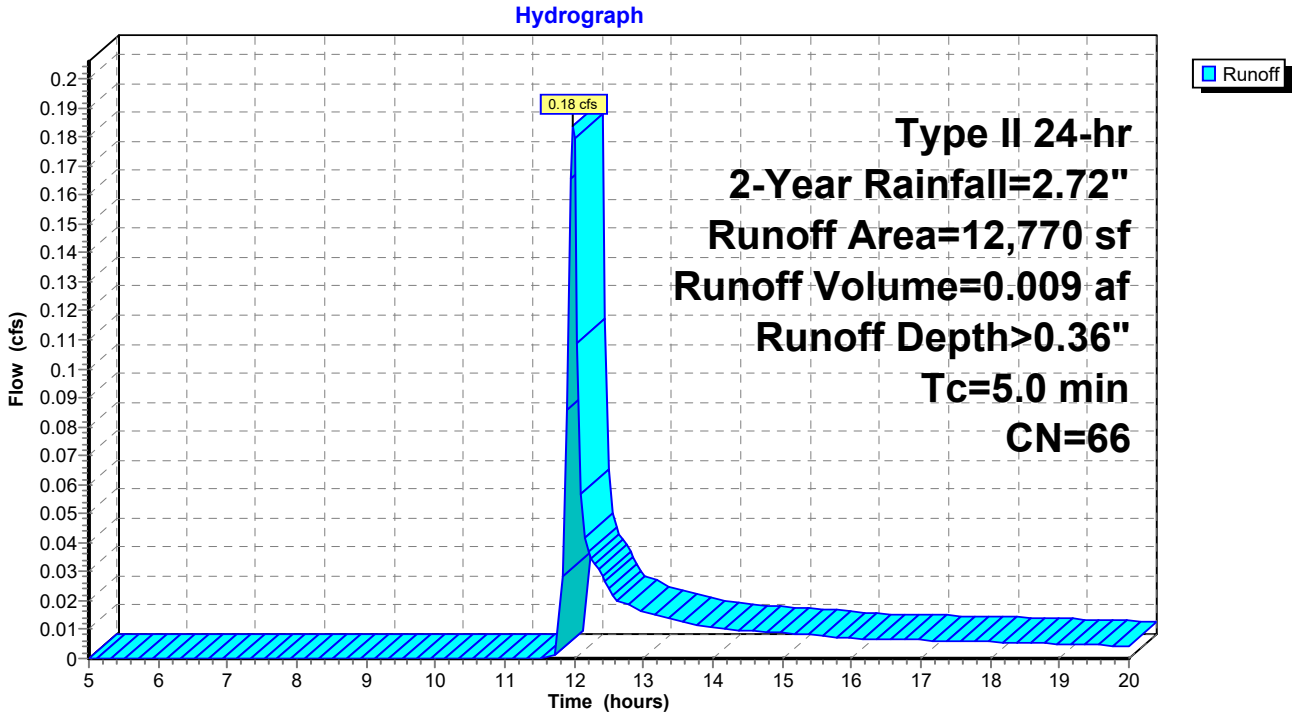
Runoff = 0.18 cfs @ 11.98 hrs, Volume= 0.009 af, Depth> 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.72"

	Area (sf)	CN	Description
	11,213	61	>75% Grass cover, Good, HSG B
*	1,557	98	Impervious
	12,770	66	Weighted Average
	11,213		87.81% Pervious Area
	1,557		12.19% Impervious Area

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

Subcatchment POST2: Post-Development Drainage Area 2 (Sheetflow Bypass)



Summary for Subcatchment PRE1: Pre-Development Drainage Area 1

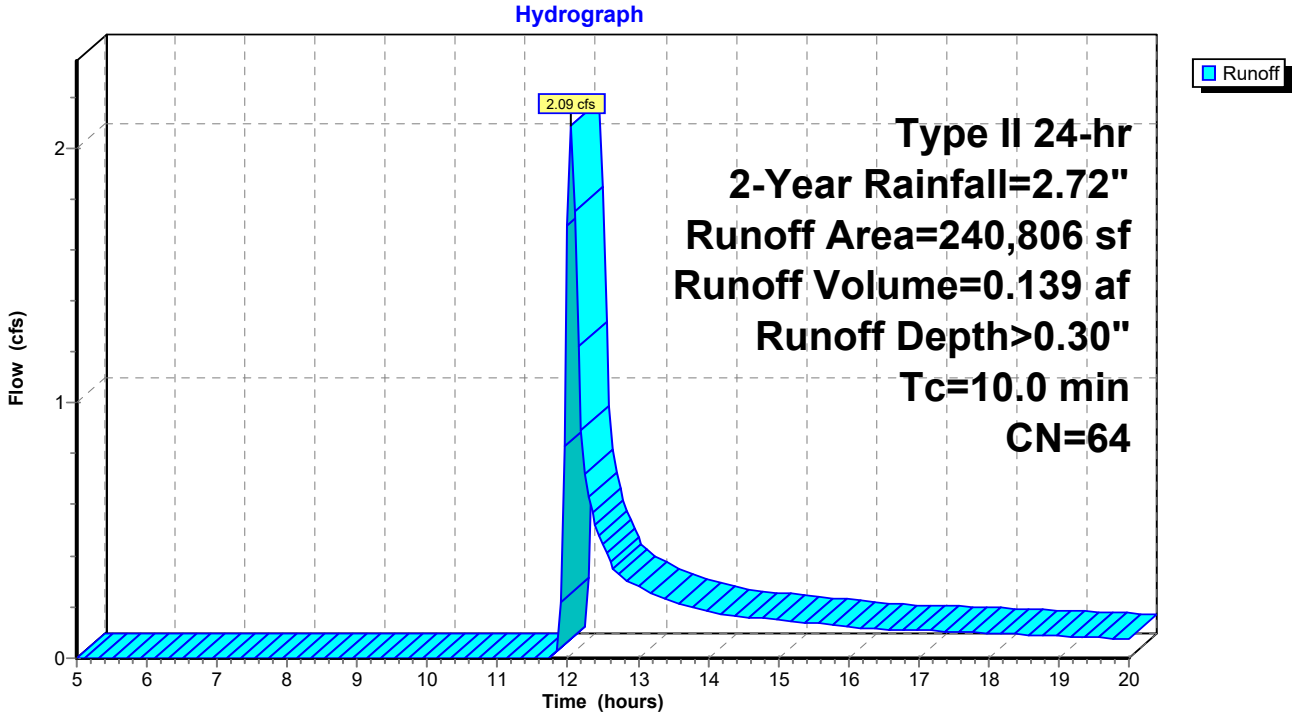
Runoff = 2.09 cfs @ 12.05 hrs, Volume= 0.139 af, Depth> 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.72"

	Area (sf)	CN	Description
	165,955	55	Woods, Good, HSG B
*	47,143	98	Impervious
	27,708	61	>75% Grass cover, Good, HSG B
	240,806	64	Weighted Average
	193,663		80.42% Pervious Area
	47,143		19.58% Impervious Area

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

Subcatchment PRE1: Pre-Development Drainage Area 1



Summary for Pond ADS: ADS Underground Detention System

Inflow Area = 4.469 ac, 88.31% Impervious, Inflow Depth > 1.95" for 2-Year event
Inflow = 13.42 cfs @ 12.01 hrs, Volume= 0.726 af
Outflow = 0.17 cfs @ 19.48 hrs, Volume= 0.057 af, Atten= 99%, Lag= 448.3 min
Primary = 0.17 cfs @ 19.48 hrs, Volume= 0.057 af
Routed to Link POST1 : Post-Development Drainage Area 1 (Total)

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 2,041.03' @ 19.48 hrs Surf.Area= 7,164 sf Storage= 29,145 cf

Plug-Flow detention time= 424.1 min calculated for 0.057 af (8% of inflow)
Center-of-Mass det. time= 190.2 min (948.6 - 758.4)

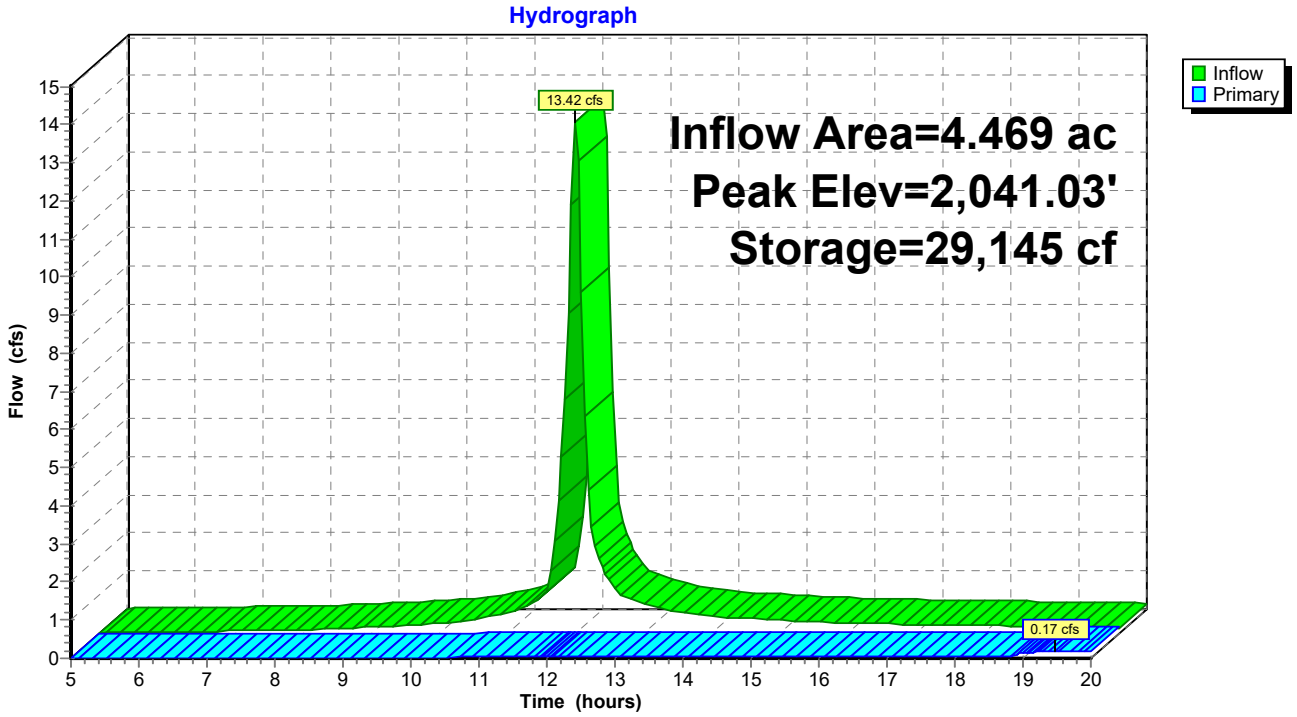
Volume	Invert	Avail.Storage	Storage Description
#1A	2,035.00'	11,438 cf	**28.50'W x 251.36'L x 6.75'H Field A** 48,355 cf Overall - 19,759 cf Embedded = 28,596 cf x 40.0% Voids
#2A	2,035.75'	19,759 cf	**ADS_StormTech MC-7200 +Cap** x 111 Inside #1 Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap 111 Chambers in 3 Rows Cap Storage= 39.5 cf x 2 x 3 rows = 237.0 cf
		31,198 cf	Total Available Storage

Storage Group A created with Chamber Wizard

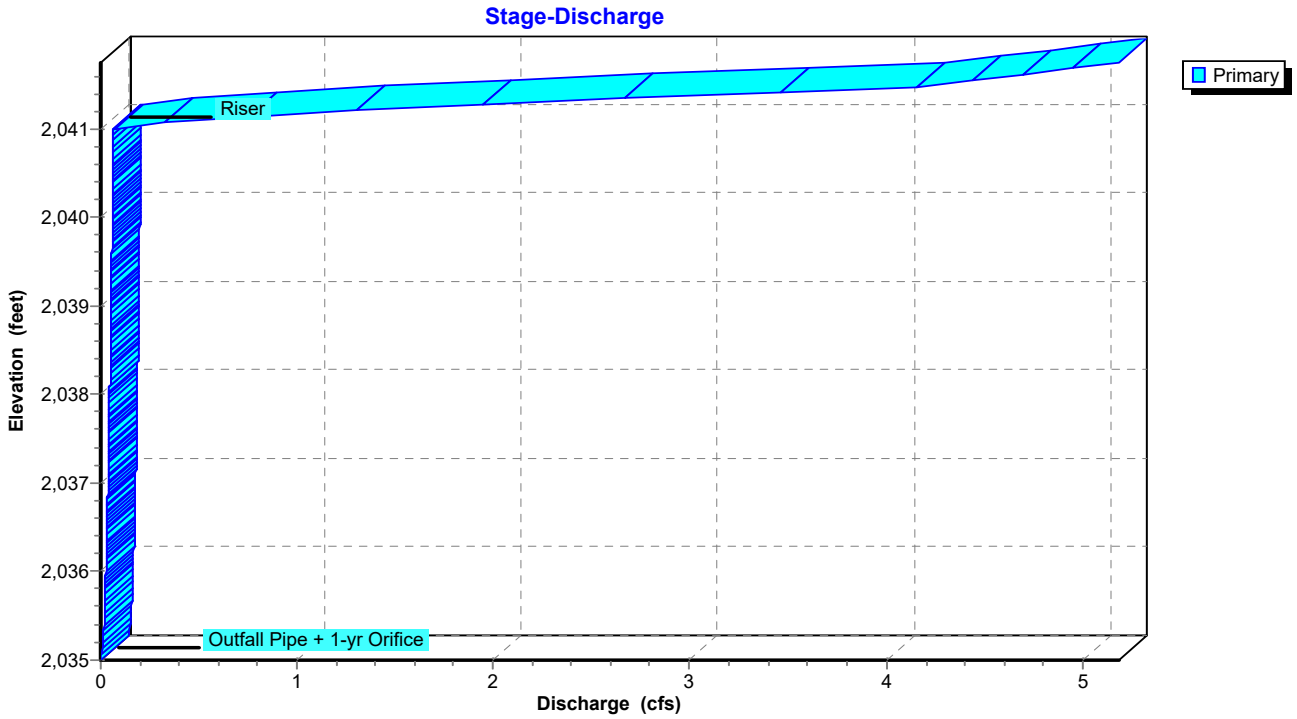
Device	Routing	Invert	Outlet Devices
#1	Primary	2,035.00'	**15.0" Round Outfall Pipe** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 2,035.00' / 2,020.00' S= 0.1500 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#2	Device 1	2,035.00'	**1.0" Vert. 1-yr Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,041.00'	**15.0" Horiz. Riser** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.14 cfs @ 19.48 hrs HW=2,041.03' (Free Discharge)
└**1=Outfall Pipe** (Passes 0.14 cfs of 17.18 cfs potential flow)
  ├**2=1-yr Orifice** (Orifice Controls 0.06 cfs @ 11.79 fps)
  └**3=Riser** (Weir Controls 0.08 cfs @ 0.60 fps)

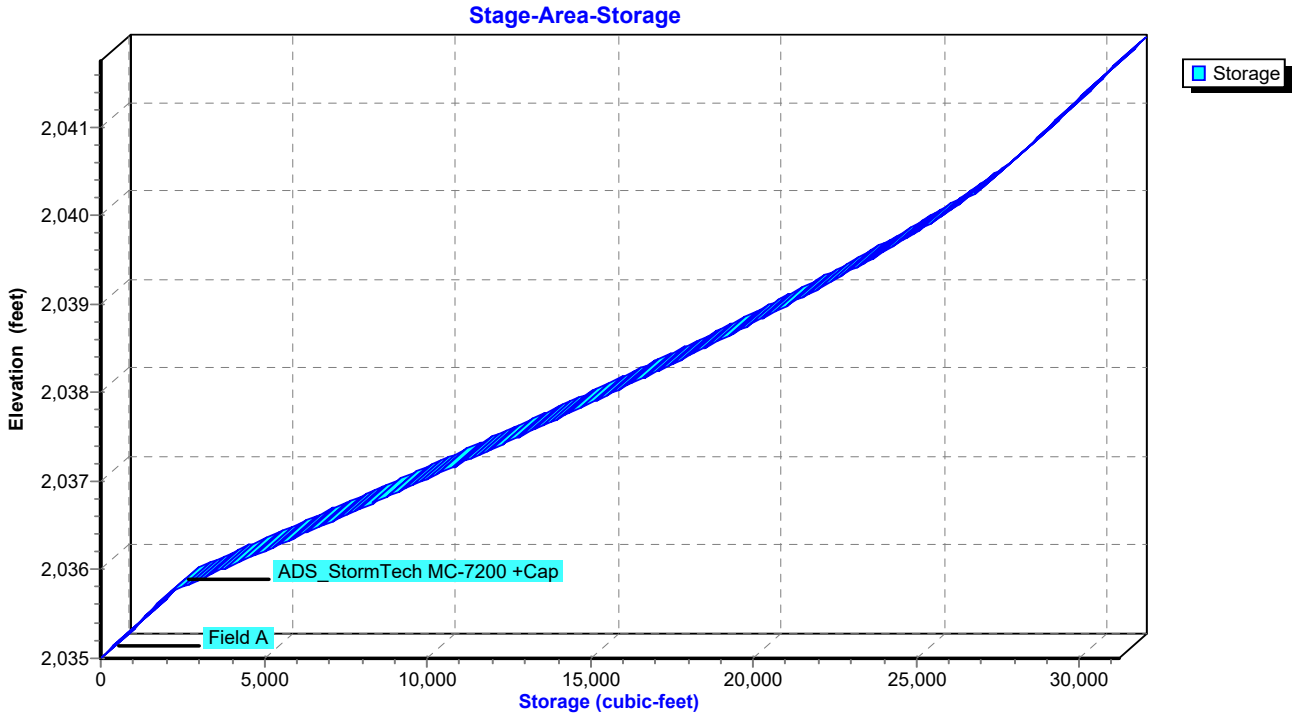
Pond ADS: ADS Underground Detention System



Pond ADS: ADS Underground Detention System



Pond ADS: ADS Underground Detention System

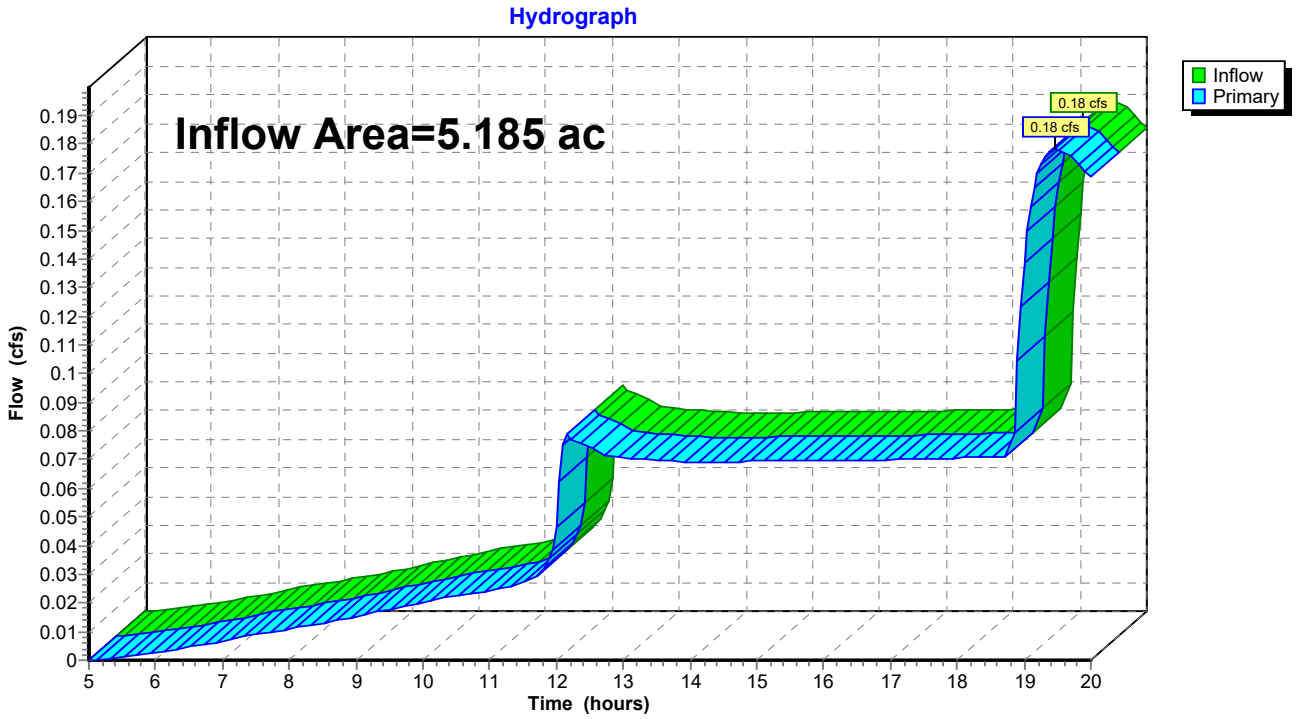


Summary for Link POST1: Post-Development Drainage Area 1 (Total)

Inflow Area = 5.185 ac, 76.11% Impervious, Inflow Depth > 0.15" for 2-Year event
Inflow = 0.18 cfs @ 19.47 hrs, Volume= 0.064 af
Primary = 0.18 cfs @ 19.47 hrs, Volume= 0.064 af, Atten= 0%, Lag= 0.0 min

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

Link POST1: Post-Development Drainage Area 1 (Total)



Summary for Subcatchment FOR1: Pre-Development Drainage Area 1 (Forested)

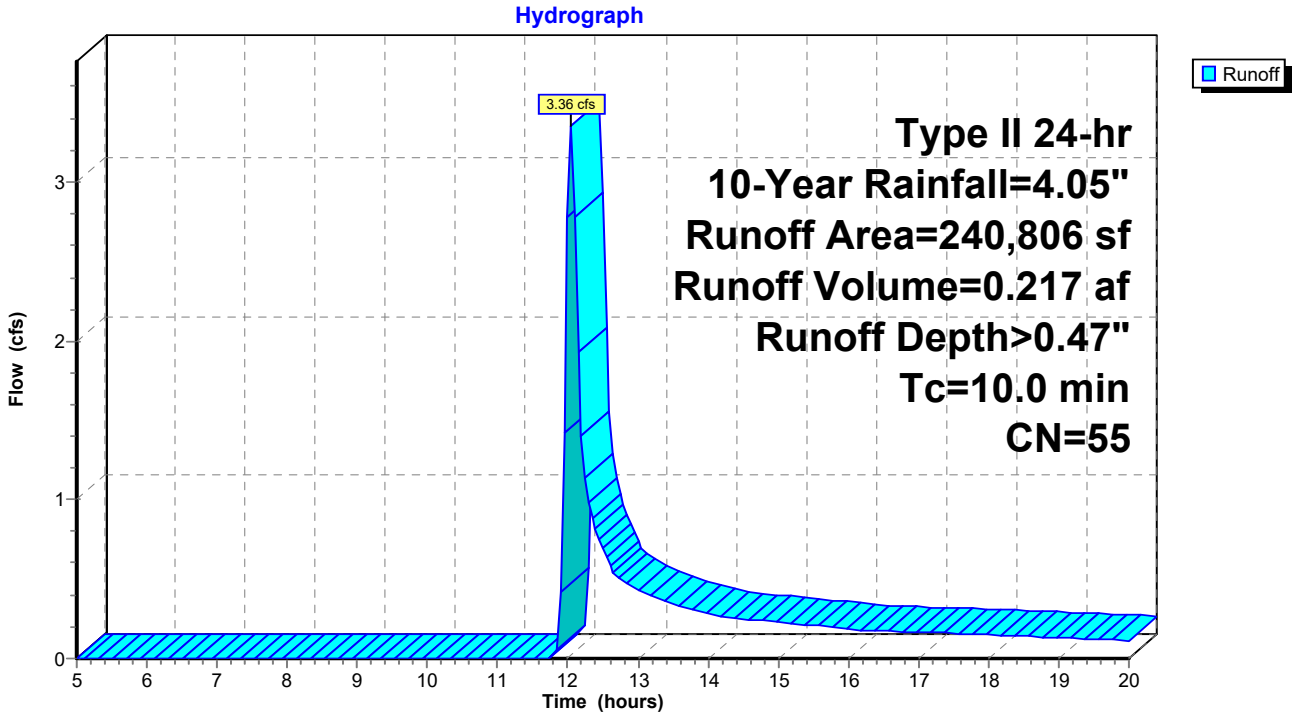
Runoff = 3.36 cfs @ 12.05 hrs, Volume= 0.217 af, Depth> 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.05"

Area (sf)	CN	Description
165,955	55	Woods, Good, HSG B
47,143	55	Woods, Good, HSG B
27,708	55	Woods, Good, HSG B
240,806	55	Weighted Average
240,806		100.00% Pervious Area

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

Subcatchment FOR1: Pre-Development Drainage Area 1 (Forested)



Summary for Subcatchment POST1A: Post-Development Drainage Area 1A

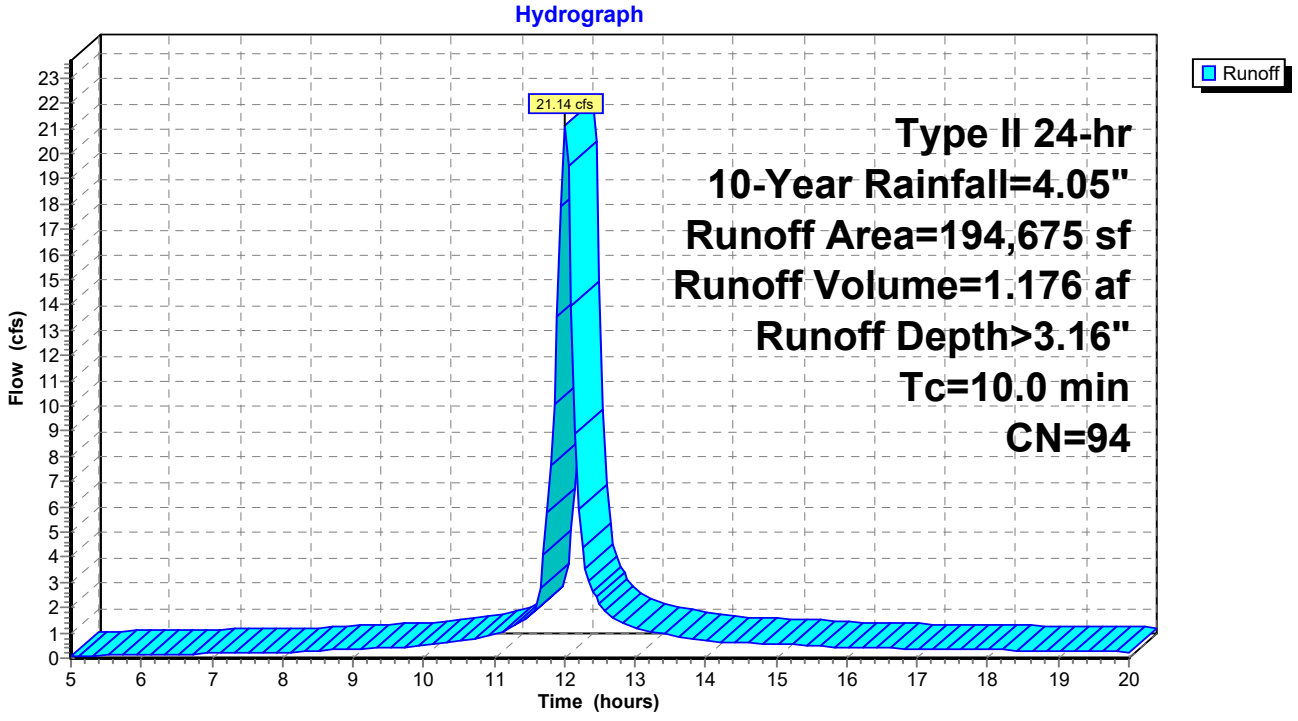
Runoff = 21.14 cfs @ 12.01 hrs, Volume= 1.176 af, Depth> 3.16"
Routed to Pond ADS : ADS Underground Detention System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.05"

	Area (sf)	CN	Description
	22,758	61	>75% Grass cover, Good, HSG B
*	171,917	98	Impervious
	194,675	94	Weighted Average
	22,758		11.69% Pervious Area
	171,917		88.31% Impervious Area

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

Subcatchment POST1A: Post-Development Drainage Area 1A



Summary for Subcatchment POST1B: Post-Development Drainage Area 1B

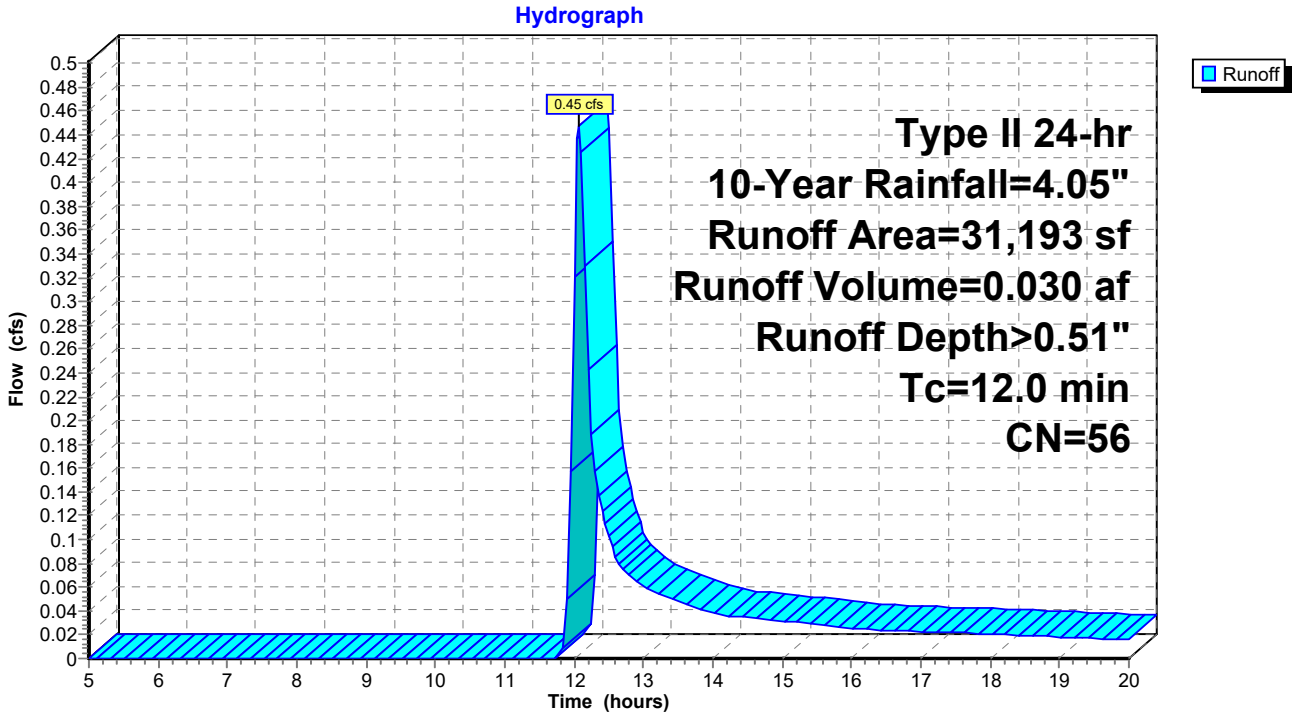
Runoff = 0.45 cfs @ 12.07 hrs, Volume= 0.030 af, Depth> 0.51"
Routed to Link POST1 : Post-Development Drainage Area 1 (Total)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.05"

Area (sf)	CN	Description
4,456	61	>75% Grass cover, Good, HSG B
26,737	55	Woods, Good, HSG B
31,193	56	Weighted Average
31,193		100.00% Pervious Area

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

Subcatchment POST1B: Post-Development Drainage Area 1B



Summary for Subcatchment POST2: Post-Development Drainage Area 2 (Sheetflow Bypass)

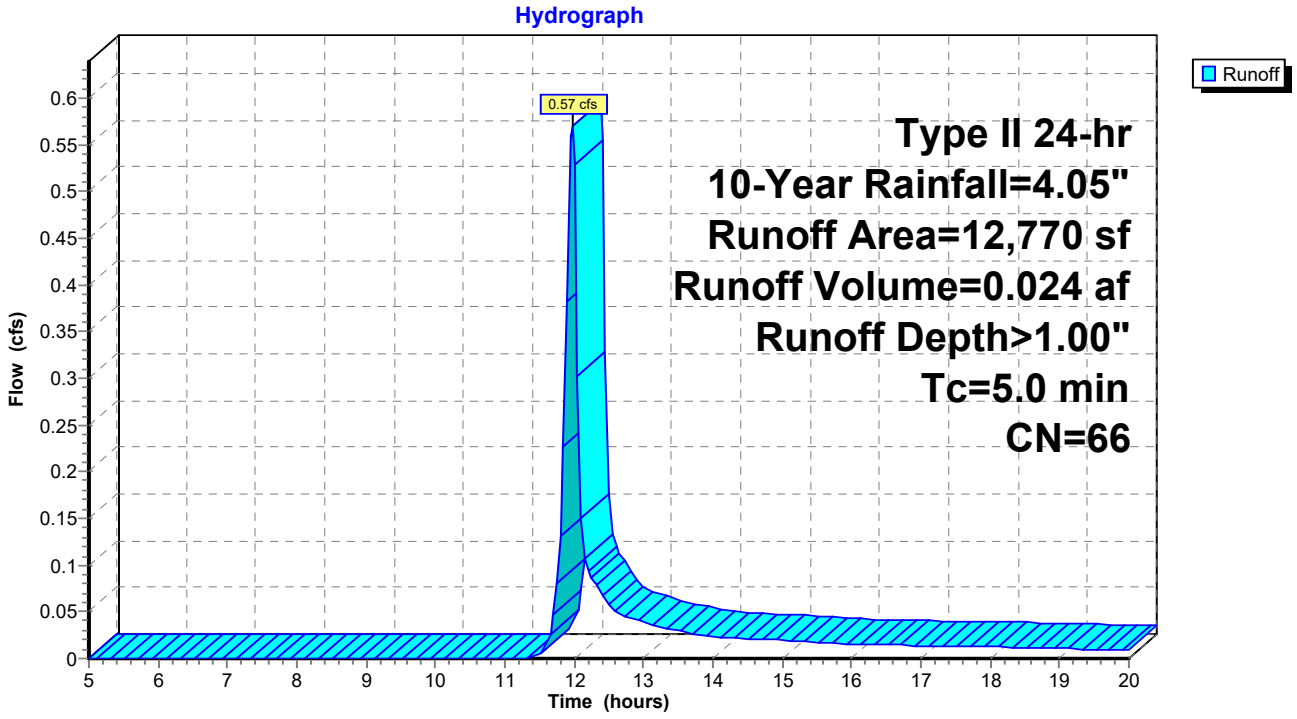
Runoff = 0.57 cfs @ 11.97 hrs, Volume= 0.024 af, Depth> 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.05"

	Area (sf)	CN	Description
	11,213	61	>75% Grass cover, Good, HSG B
*	1,557	98	Impervious
	12,770	66	Weighted Average
	11,213		87.81% Pervious Area
	1,557		12.19% Impervious Area

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

Subcatchment POST2: Post-Development Drainage Area 2 (Sheetflow Bypass)



Summary for Subcatchment PRE1: Pre-Development Drainage Area 1

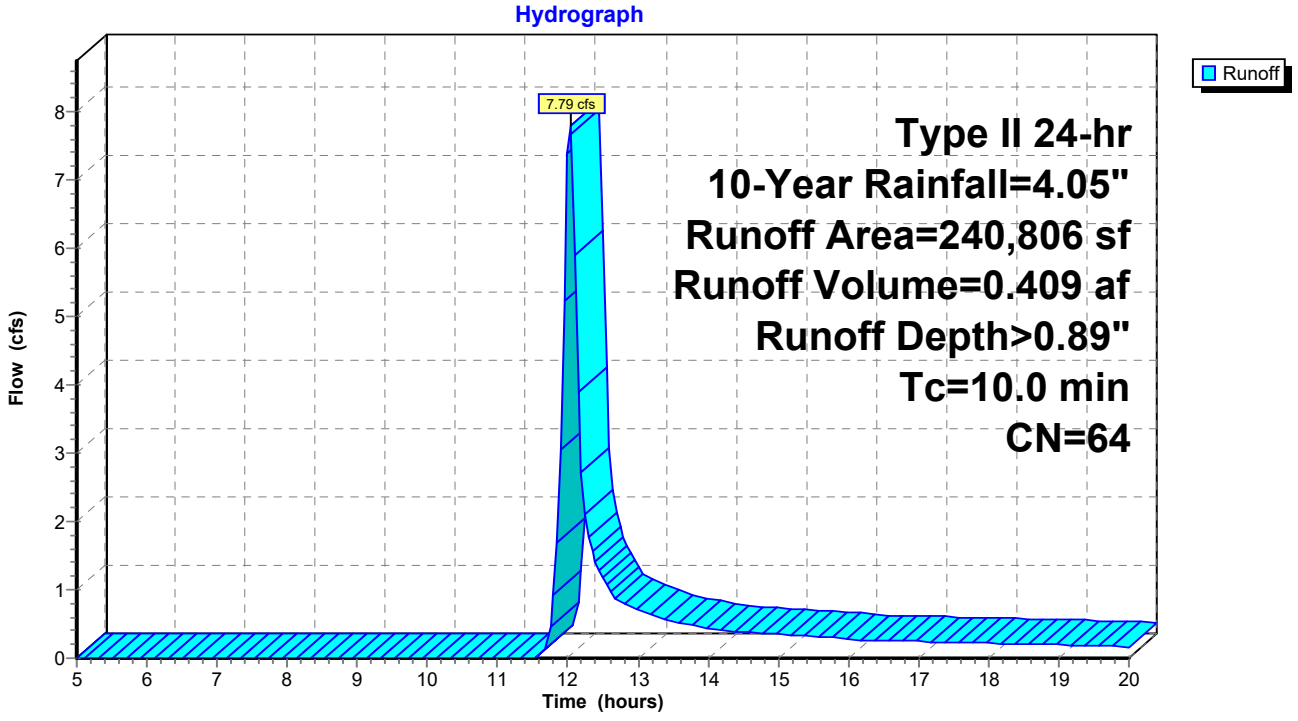
Runoff = 7.79 cfs @ 12.03 hrs, Volume= 0.409 af, Depth> 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.05"

	Area (sf)	CN	Description
	165,955	55	Woods, Good, HSG B
*	47,143	98	Impervious
	27,708	61	>75% Grass cover, Good, HSG B
	240,806	64	Weighted Average
	193,663		80.42% Pervious Area
	47,143		19.58% Impervious Area

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

Subcatchment PRE1: Pre-Development Drainage Area 1



Summary for Pond ADS: ADS Underground Detention System

Inflow Area = 4.469 ac, 88.31% Impervious, Inflow Depth > 3.16" for 10-Year event
Inflow = 21.14 cfs @ 12.01 hrs, Volume= 1.176 af
Outflow = 5.03 cfs @ 12.23 hrs, Volume= 0.506 af, Atten= 76%, Lag= 13.4 min
Primary = 5.03 cfs @ 12.23 hrs, Volume= 0.506 af
Routed to Link POST1 : Post-Development Drainage Area 1 (Total)

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 2,041.71' @ 12.23 hrs Surf.Area= 7,164 sf Storage= 31,070 cf

Plug-Flow detention time= 194.2 min calculated for 0.504 af (43% of inflow)
Center-of-Mass det. time= 102.4 min (851.5 - 749.1)

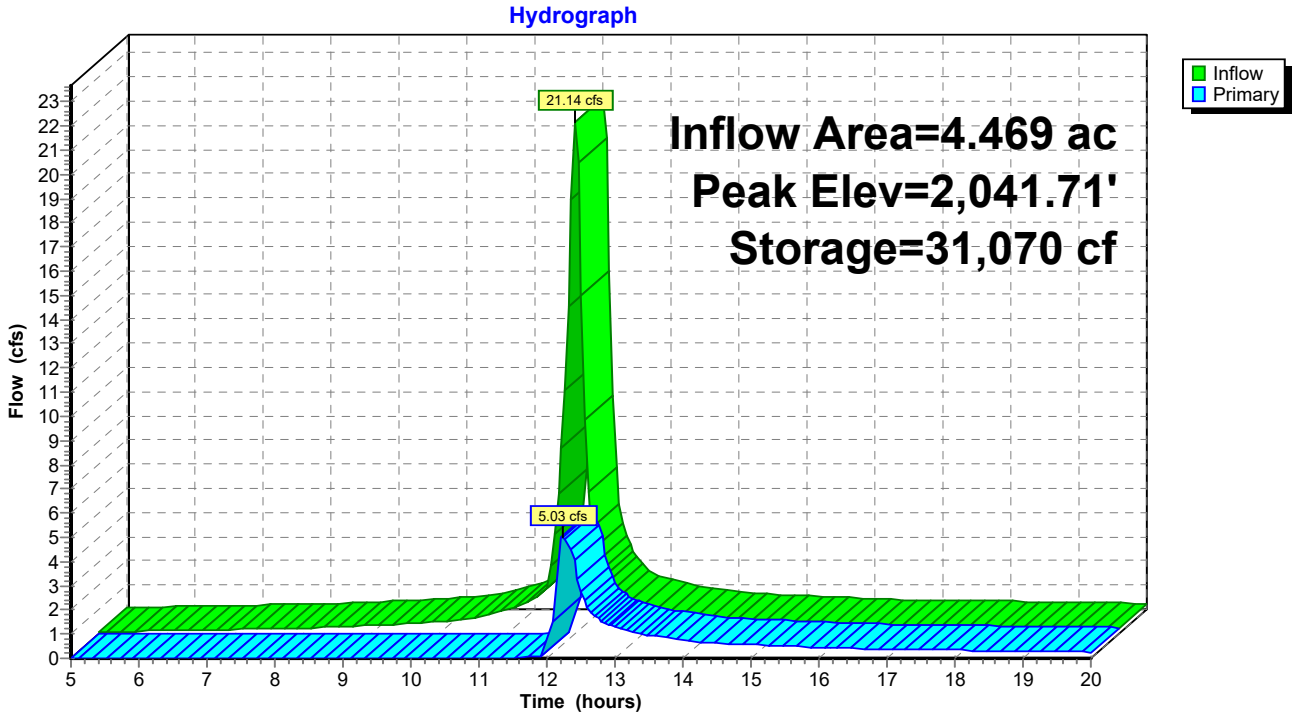
Volume	Invert	Avail.Storage	Storage Description
#1A	2,035.00'	11,438 cf	**28.50'W x 251.36'L x 6.75'H Field A** 48,355 cf Overall - 19,759 cf Embedded = 28,596 cf x 40.0% Voids
#2A	2,035.75'	19,759 cf	**ADS_StormTech MC-7200 +Cap** x 111 Inside #1 Effective Size= 91.2"W x 60.0"H => 26.68 sf x 6.59'L = 175.9 cf Overall Size= 100.0"W x 60.0"H x 6.95'L with 0.36' Overlap 111 Chambers in 3 Rows Cap Storage= 39.5 cf x 2 x 3 rows = 237.0 cf
		31,198 cf	Total Available Storage

Storage Group A created with Chamber Wizard

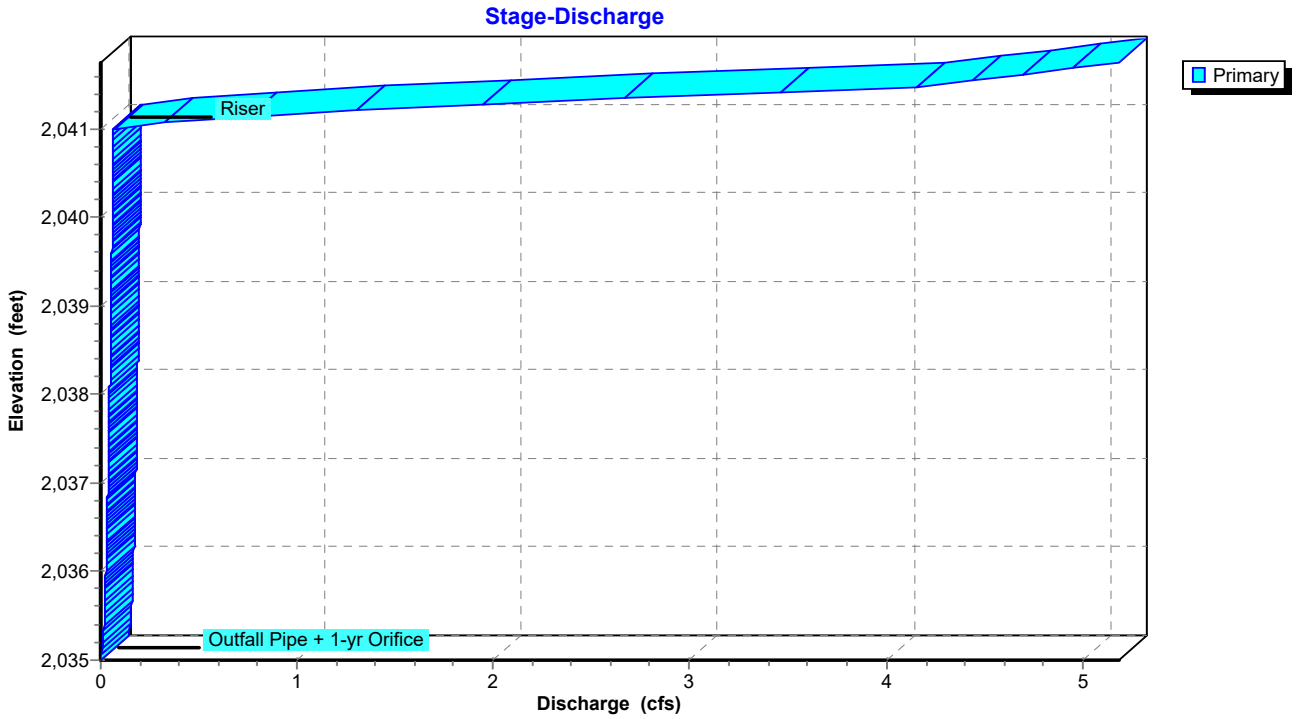
Device	Routing	Invert	Outlet Devices
#1	Primary	2,035.00'	**15.0" Round Outfall Pipe** L= 100.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 2,035.00' / 2,020.00' S= 0.1500 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#2	Device 1	2,035.00'	**1.0" Vert. 1-yr Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	2,041.00'	**15.0" Horiz. Riser** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.00 cfs @ 12.23 hrs HW=2,041.70' (Free Discharge)
└**1=Outfall Pipe** (Passes 5.00 cfs of 18.20 cfs potential flow)
  ├**2=1-yr Orifice** (Orifice Controls 0.07 cfs @ 12.42 fps)
  └**3=Riser** (Orifice Controls 4.94 cfs @ 4.02 fps)

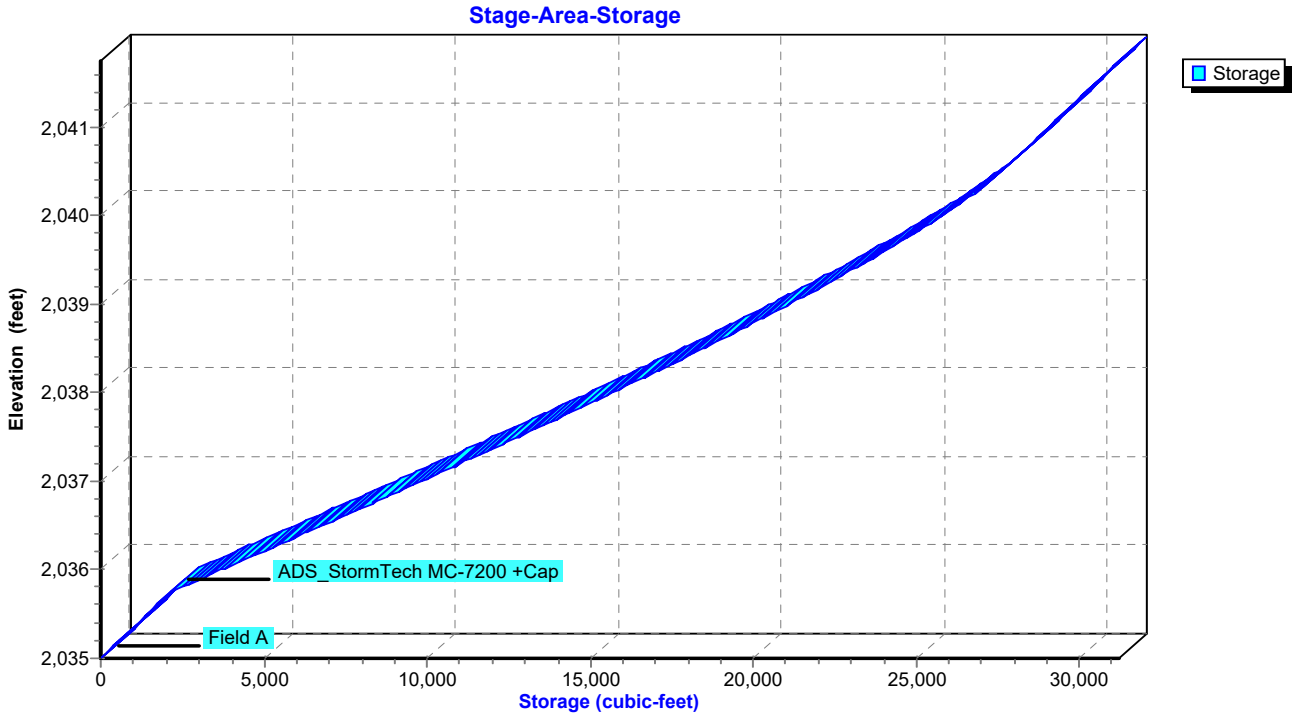
Pond ADS: ADS Underground Detention System



Pond ADS: ADS Underground Detention System



Pond ADS: ADS Underground Detention System

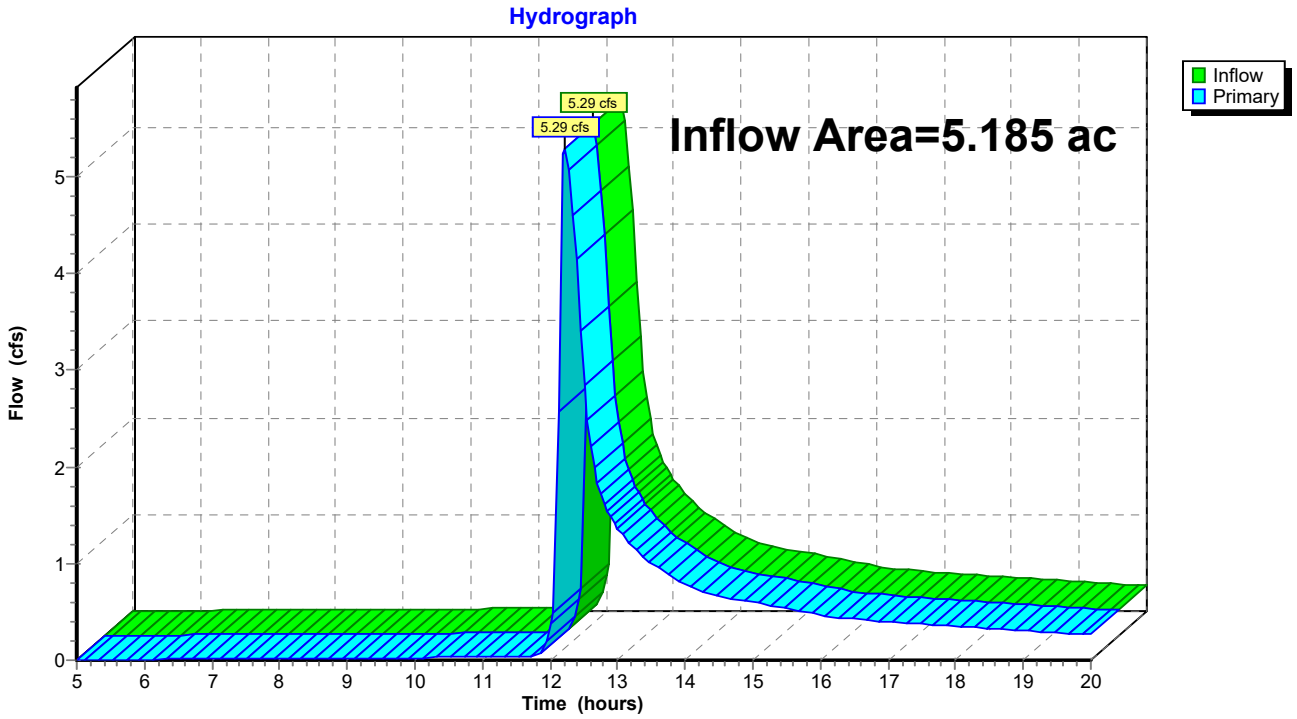


Summary for Link POST1: Post-Development Drainage Area 1 (Total)

Inflow Area = 5.185 ac, 76.11% Impervious, Inflow Depth > 1.24" for 10-Year event
Inflow = 5.29 cfs @ 12.22 hrs, Volume= 0.536 af
Primary = 5.29 cfs @ 12.22 hrs, Volume= 0.536 af, Atten= 0%, Lag= 0.0 min

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

Link POST1: Post-Development Drainage Area 1 (Total)



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NOAA Atlas 14, Volume 2, Version 3
Location name: Blacksburg, Virginia, USA*
Latitude: 37.2256°, Longitude: -80.4444°
Elevation: 2095.2 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.294** (0.267-0.326)	**0.351** (0.318-0.389)	**0.421** (0.380-0.466)	**0.472** (0.425-0.521)	**0.534** (0.477-0.590)	**0.576** (0.511-0.638)	**0.618** (0.544-0.687)	**0.656** (0.571-0.732)	**0.701** (0.602-0.790)	**0.734** (0.622-0.833)
10-min	**0.470** (0.426-0.520)	**0.561** (0.508-0.622)	**0.674** (0.609-0.747)	**0.754** (0.679-0.834)	**0.850** (0.760-0.940)	**0.917** (0.814-1.02)	**0.982** (0.864-1.09)	**1.04** (0.905-1.16)	**1.11** (0.952-1.25)	**1.16** (0.979-1.31)
15-min	**0.588** (0.532-0.651)	**0.706** (0.639-0.782)	**0.853** (0.771-0.945)	**0.954** (0.859-1.06)	**1.08** (0.963-1.19)	**1.16** (1.03-1.29)	**1.24** (1.09-1.38)	**1.31** (1.14-1.47)	**1.40** (1.20-1.57)	**1.45** (1.23-1.65)
30-min	**0.806** (0.730-0.892)	**0.975** (0.882-1.08)	**1.21** (1.10-1.34)	**1.38** (1.25-1.53)	**1.60** (1.43-1.76)	**1.75** (1.55-1.94)	**1.90** (1.67-2.11)	**2.04** (1.78-2.28)	**2.22** (1.91-2.50)	**2.35** (1.99-2.67)
60-min	**1.00** (0.910-1.11)	**1.22** (1.11-1.36)	**1.55** (1.40-1.72)	**1.80** (1.62-1.99)	**2.13** (1.90-2.35)	**2.37** (2.10-2.63)	**2.62** (2.30-2.91)	**2.86** (2.49-3.20)	**3.19** (2.74-3.59)	**3.43** (2.91-3.89)
2-hr	**1.16** (1.06-1.29)	**1.41** (1.28-1.56)	**1.81** (1.64-1.99)	**2.10** (1.90-2.32)	**2.50** (2.24-2.76)	**2.80** (2.49-3.11)	**3.11** (2.74-3.46)	**3.42** (2.98-3.83)	**3.83** (3.29-4.33)	**4.14** (3.51-4.72)
3-hr	**1.25** (1.14-1.38)	**1.51** (1.38-1.67)	**1.92** (1.75-2.11)	**2.23** (2.03-2.46)	**2.65** (2.39-2.92)	**2.98** (2.66-3.29)	**3.32** (2.93-3.67)	**3.66** (3.19-4.07)	**4.11** (3.52-4.63)	**4.46** (3.77-5.07)
6-hr	**1.53** (1.41-1.67)	**1.84** (1.70-2.02)	**2.31** (2.12-2.52)	**2.68** (2.46-2.93)	**3.20** (2.90-3.50)	**3.63** (3.26-3.97)	**4.07** (3.60-4.47)	**4.53** (3.96-5.00)	**5.17** (4.42-5.78)	**5.68** (4.76-6.41)
12-hr	**1.85** (1.71-2.02)	**2.23** (2.05-2.43)	**2.78** (2.56-3.03)	**3.24** (2.97-3.53)	**3.90** (3.54-4.24)	**4.45** (3.99-4.85)	**5.04** (4.46-5.53)	**5.68** (4.93-6.27)	**6.61** (5.59-7.39)	**7.38** (6.10-8.33)
24-hr	**2.25** (2.09-2.43)	**2.72** (2.53-2.93)	**3.45** (3.20-3.71)	**4.05** (3.75-4.36)	**4.91** (4.52-5.28)	**5.64** (5.16-6.05)	**6.42** (5.83-6.89)	**7.26** (6.54-7.80)	**8.49** (7.54-9.14)	**9.51** (8.36-10.3)
2-day	**2.67** (2.49-2.88)	**3.24** (3.01-3.49)	**4.08** (3.79-4.39)	**4.76** (4.41-5.12)	**5.73** (5.28-6.15)	**6.54** (5.99-7.02)	**7.39** (6.73-7.94)	**8.30** (7.50-8.93)	**9.61** (8.58-10.4)	**10.7** (9.44-11.6)
3-day	**2.84** (2.65-3.06)	**3.44** (3.20-3.69)	**4.32** (4.02-4.64)	**5.03** (4.67-5.40)	**6.04** (5.58-6.48)	**6.87** (6.32-7.37)	**7.76** (7.09-8.32)	**8.69** (7.88-9.34)	**10.0** (8.98-10.8)	**11.1** (9.86-12.0)
4-day	**3.01** (2.81-3.23)	**3.64** (3.40-3.90)	**4.56** (4.26-4.89)	**5.30** (4.94-5.69)	**6.36** (5.89-6.80)	**7.21** (6.65-7.72)	**8.12** (7.44-8.70)	**9.09** (8.25-9.74)	**10.5** (9.38-11.2)	**11.6** (10.3-12.5)
7-day	**3.51** (3.27-3.76)	**4.22** (3.94-4.53)	**5.24** (4.88-5.62)	**6.04** (5.62-6.48)	**7.15** (6.63-7.67)	**8.05** (7.43-8.63)	**8.98** (8.24-9.64)	**9.95** (9.07-10.7)	**11.3** (10.2-12.2)	**12.4** (11.1-13.4)
10-day	**4.04** (3.78-4.31)	**4.84** (4.54-5.17)	**5.92** (5.54-6.32)	**6.75** (6.30-7.20)	**7.86** (7.31-8.38)	**8.73** (8.09-9.31)	**9.61** (8.87-10.3)	**10.5** (9.64-11.2)	**11.7** (10.7-12.5)	**12.6** (11.4-13.6)
20-day	**5.50** (5.19-5.83)	**6.54** (6.17-6.93)	**7.83** (7.38-8.29)	**8.83** (8.31-9.35)	**10.2** (9.55-10.8)	**11.2** (10.5-11.9)	**12.3** (11.4-13.0)	**13.3** (12.4-14.2)	**14.7** (13.6-15.7)	**15.8** (14.5-16.9)
30-day	**6.83** (6.46-7.22)	**8.08** (7.64-8.54)	**9.49** (8.96-10.0)	**10.6** (9.95-11.1)	**11.9** (11.2-12.6)	**13.0** (12.2-13.7)	**14.0** (13.1-14.8)	**15.0** (14.0-15.9)	**16.3** (15.1-17.3)	**17.2** (15.9-18.3)
45-day	**8.65** (8.21-9.11)	**10.2** (9.65-10.7)	**11.8** (11.2-12.4)	**13.0** (12.3-13.6)	**14.5** (13.7-15.2)	**15.6** (14.7-16.4)	**16.6** (15.6-17.5)	**17.6** (16.5-18.6)	**18.9** (17.6-20.0)	**19.8** (18.4-21.0)
60-day	**10.4** (9.91-10.9)	**12.2** (11.6-12.8)	**13.9** (13.2-14.6)	**15.2** (14.4-15.9)	**16.7** (15.9-17.6)	**17.9** (16.9-18.8)	**18.9** (17.9-19.9)	**19.9** (18.8-20.9)	**21.1** (19.8-22.2)	**21.9** (20.5-23.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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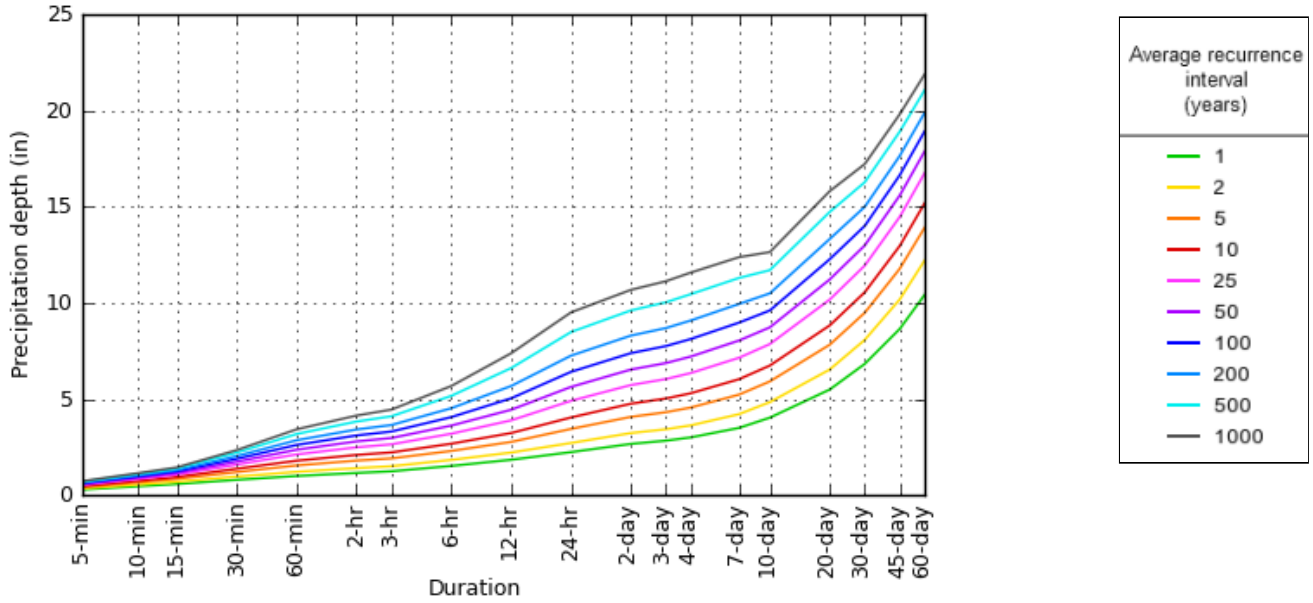
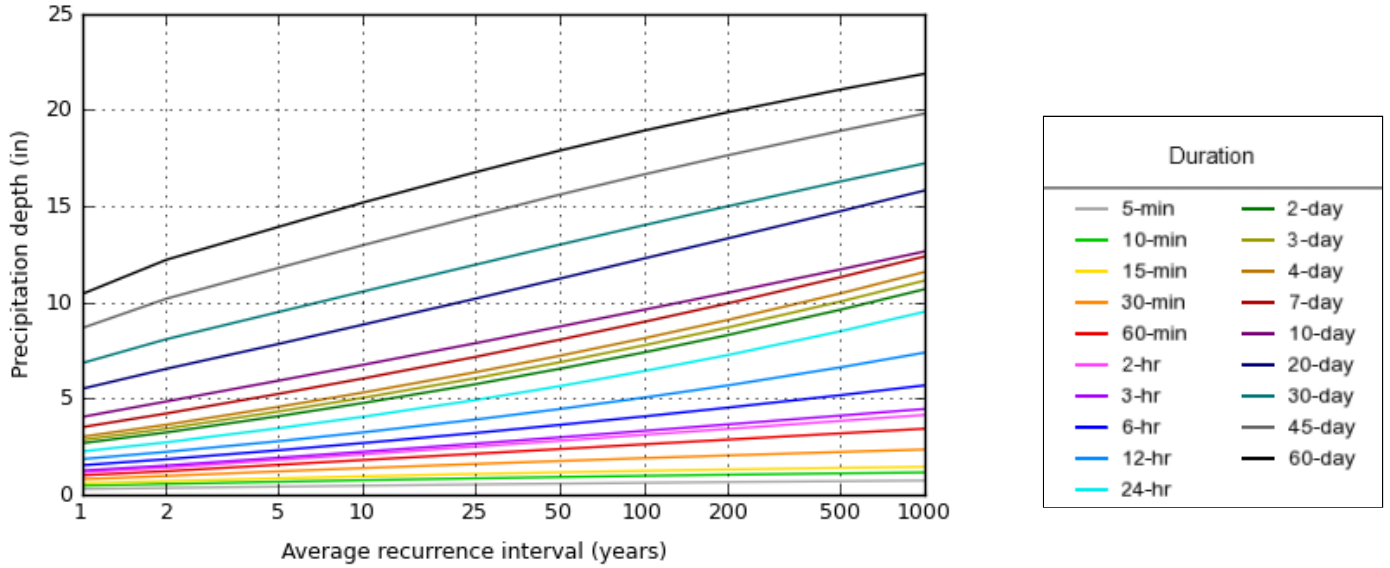
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 37.2256°, Longitude: -80.4444°





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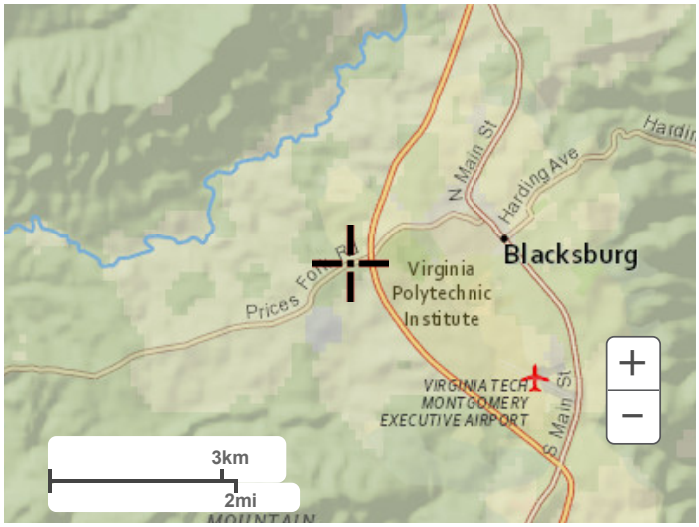
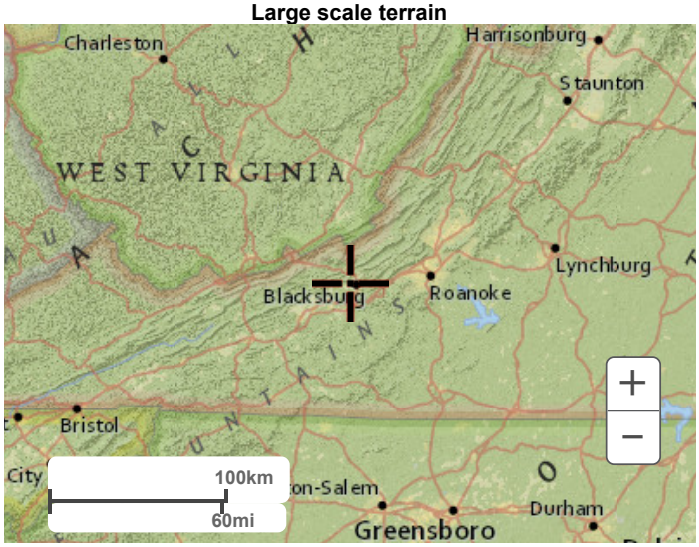
Maps & aerials

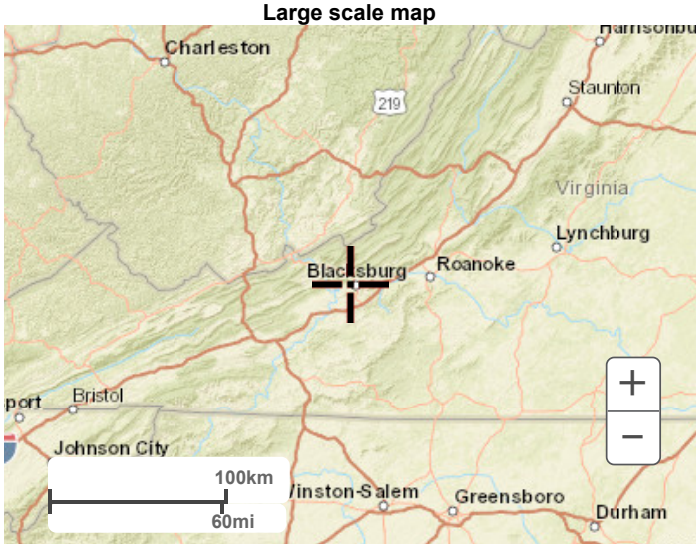
Small scale terrain



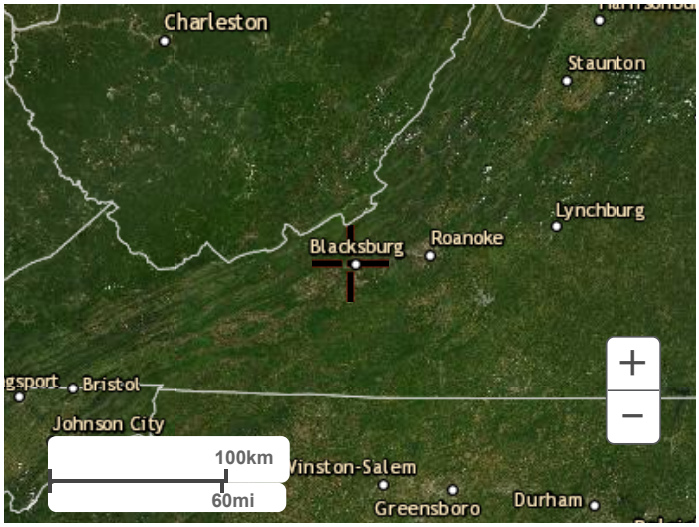
Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
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Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

STORMWATER QUALITY CALCULATIONS

- VRRM Spreadsheet

DEQ Virginia Runoff Reduction Method New Development Compliance Spreadsheet - **Version 3.0**

☐ 2011 BMP Standards and Specifications ☑ 2013 Draft BMP Standards and Specifications

Project Name: 1800 Prices Fork Road
Date: 9/29/2022
BMP Design Specifications List: 2013 Draft Stds & Specs

CLEAR ALL *(Ctrl+Shift+R)*

data input cells
constant values
calculation cells
final results

Site Information

Post-Development Project (Treatment Volume and Loads)

Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed		0.48	0.35		0.83
Impervious Cover (acres)		3.41			3.41
					4.24

Constants

Annual Rainfall (inches)	43
Target Rainfall Event (inches)	1.00
Total Phosphorus (TP) EMC (mg/L)	0.26
Total Nitrogen (TN) EMC (mg/L)	1.86
Target TP Load (lb/acre/yr)	0.41
Pj (unitless correction factor)	0.90

Runoff Coefficients (Rv)

	A Soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

Post-Development Requirement for Site Area

TP Load Reduction Required (lb/yr)	**6.04**

LAND COVER SUMMARY -- POST DEVELOPMENT

Land Cover Summary

Forest/Open Space Cover (acres)	0.00
Weighted Rv (forest)	0.00
% Forest	0%
Managed Turf Cover (acres)	0.83
Weighted Rv (turf)	0.21
% Managed Turf	20%
Impervious Cover (acres)	3.41
Rv (impervious)	0.95
% Impervious	80%
Site Area (acres)	**4.24**
Site Rv	**0.80**

Treatment Volume and Nutrient Loads

Treatment Volume (acre-ft)	0.2844
Treatment Volume (cubic feet)	12,387
TP Load (lb/yr)	7.78
TN Load (lb/yr) (Informational Purposes Only)	55.68

Drainage Area A

Drainage Area A Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals	Land Cover Rv
Forest/Open Space (acres)					0.00	0.00
Managed Turf (acres)		0.40	0.16		0.56	0.21
Impervious Cover (acres)		3.41			3.41	0.95
				Total	3.97	

CLEAR BMP AREAS

Total Phosphorus Available for Removal in D.A. A (lb/yr)	7.65
Post Development Treatment Volume in D.A. A (ft^3)	12,178

Stormwater Best Management Practices (RR = Runoff Reduction)

--Select from dropdown lists--

Practice	Runoff Reduction Credit (%)	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	Volume from Upstream Practice (ft^3)	Runoff Reduction (ft^3)	Remaining Runoff Volume (ft^3)	Total BMP Treatment Volume (ft^3)	Phosphorus Removal Efficiency (%)	Phosphorus Load from Upstream Practices (lb)	Untreated Phosphorus Load to Practice (lb)	Phosphorus Removed By Practice (lb)	Remaining Phosphorus Load (lb)	Downstream Practice to be Employed
1. Vegetated Roof (RR)													
1.a. Vegetated Roof #1 (Spec #5)	45				0	0	0	0		0.00	0.00	0.00	
1.b. Vegetated Roof #2 (Spec #5)	60				0	0	0	0		0.00	0.00	0.00	
2. Rooftop Disconnection (RR)													
2.a. Simple Disconnection to A/B Soils (Spec #1)	50			0	0	0	0	0	0.00	0.00	0.00	0.00	
2.b. Simple Disconnection to C/D Soils (Spec #1)	25			0	0	0	0	0	0.00	0.00	0.00	0.00	
2.c. To Soil Amended Filter Path as per specifications (existing C/D soils) (Spec #4)	50			0	0	0	0	0	0.00	0.00	0.00	0.00	
2.d. To Dry Well or French Drain #1, Micro-Infilration #1 (Spec #8)	50			0	0	0	0	25	0.00	0.00	0.00	0.00	
2.e. To Dry Well or French Drain #2, Micro-Infiltration #2 (Spec #8)	90			0	0	0	0	25	0.00	0.00	0.00	0.00	
2.f. To Rain Garden #1, Micro-Bioretention #1 (Spec #9)	40			0	0	0	0	25	0.00	0.00	0.00	0.00	
2.g. To Rain Garden #2, Micro-Bioretention #2 (Spec #9)	80			0	0	0	0	50	0.00	0.00	0.00	0.00	
2.h. To Rainwater Harvesting (Spec #6)	0			0	0	0	0	0	0.00	0.00	0.00	0.00	
2.i. To Stormwater Planter, Urban Bioretention (Spec #9, Appendix A)	40			0	0	0	0	25	0.00	0.00	0.00	0.00	
3. Permeable Pavement (RR)													
3.a. Permeable Pavement #1 (Spec #7)	45			0	0	0	0	25	0.00	0.00	0.00	0.00	
3.b. Permeable Pavement #2 (Spec #7)	75				0	0	0	25		0.00	0.00	0.00	
4. Grass Channel (RR)													
4.a. Grass Channel A/B Soils (Spec #3)	20			0	0	0	0	15	0.00	0.00	0.00	0.00	
4.b. Grass Channel C/D Soils (Spec #3)	10			0	0	0	0	15	0.00	0.00	0.00	0.00	
4.c. Grass Channel with Compost Amended Soils as per specs (see Spec #4)	20			0	0	0	0	15	0.00	0.00	0.00	0.00	
5. Dry Swale (RR)													
5.a. Dry Swale #1 (Spec #10)	40			0	0	0	0	20	0.00	0.00	0.00	0.00	
5.b. Dry Swale #2 (Spec #10)	60			0	0	0	0	40	0.00	0.00	0.00	0.00	
6. Bioretention (RR)													
6.a. Bioretention #1 or Micro-Bioretention #1 or Urban Bioretention (Spec #9)	40			0	0	0	0	25	0.00	0.00	0.00	0.00	

Nitrogen Removal Efficiency (%)	Nitrogen Load from Upstream Practices (lbs)	Untreated Nitrogen Load to Practice (lbs)	Nitrogen Removed By Practice (lbs)	Remaining Nitrogen Load (lbs)
1. Vegetated Roof (RR)				
0		0.00	0.00	0.00
0		0.00	0.00	0.00
2. Rooftop Disconnection (RR)				
0	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00
60	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00
3. Permeable Pavement (RR)				
25	0.00	0.00	0.00	0.00
25		0.00	0.00	0.00
4. Grass Channel (RR)				
20	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00
5. Dry Swale (RR)				
25	0.00	0.00	0.00	0.00
35	0.00	0.00	0.00	0.00
6. Bioretention (RR)				
40	0.00	0.00	0.00	0.00

6.b. Bioretention #2 or Micro-Bioretention #2 (Spec #9)	80			0	0	0	0	50	0.00	0.00	0.00	0.00	
7. Infiltration (RR)													
7.a. Infiltration #1 (Spec #8)	50			0	0	0	0	25	0.00	0.00	0.00	0.00	
7.b. Infiltration #2 (Spec #8)	90			0	0	0	0	25	0.00	0.00	0.00	0.00	
8. Extended Detention Pond (RR)													
8.a. ED #1 (Spec #15)	0			0	0	0	0	15	0.00	0.00	0.00	0.00	
8.b. ED #2 (Spec #15)	15			0	0	0	0	15	0.00	0.00	0.00	0.00	
9. Sheetflow to Filter/Open Space (RR)													
9.a. Sheetflow to Conservation Area, A/B Soils (Spec #2)	75			0	0	0	0	0	0.00	0.00	0.00	0.00	
9.b. Sheetflow to Conservation Area, C/D Soils (Spec #2)	50			0	0	0	0	0	0.00	0.00	0.00	0.00	
9.c. Sheetflow to Vegetated Filter Strip, A Soils or Compost Amended B/C/D Soils (Spec #2 & #4)	50			0	0	0	0	0	0.00	0.00	0.00	0.00	

60	0.00	0.00	0.00	0.00
7. Infiltration (RR)				
15	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00
8. Extended Detention Pond (RR)				
10	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00
9. Sheetflow to Filter/Open Space (RR)				
0	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00

TOTAL IMPERVIOUS COVER TREATED (ac)	0.00	AREA CHECK: OK.
TOTAL MANAGED TURF AREA TREATED (ac)	0.00	AREA CHECK: OK.
TOTAL RUNOFF REDUCTION IN D.A. A (ft^3)	0	
TOTAL PHOSPHORUS AVAILABLE FOR REMOVAL IN D.A. A (lb/yr)	7.65	
TOTAL PHOSPHORUS REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00	
TOTAL PHOSPHORUS REMAINING AFTER APPLYING RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	7.65	

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

TOTAL RUNOFF REDUCTION IN D.A. A (ft^3)	0	
NITROGEN REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00	

SEE WATER QUALITY COMPLIANCE TAB FOR SITE CALCULATIONS (Information Only)

10. Wet Swale (no RR)													
10.a. Wet Swale #1 (Spec #11)	0			0	0	0	0	20	0.00	0.00	0.00	0.00	
10.b. Wet Swale #2 (Spec #11)	0			0	0	0	0	40	0.00	0.00	0.00	0.00	
11. Filtering Practices (no RR)													
11.a.Filtering Practice #1 (Spec #12)	0			0	0	0	0	60	0.00	0.00	0.00	0.00	
11.b. Filtering Practice #2 (Spec #12)	0			0	0	0	0	65	0.00	0.00	0.00	0.00	
12. Constructed Wetland (no RR)													
12.a.Constructed Wetland #1 (Spec #13)	0			0	0	0	0	50	0.00	0.00	0.00	0.00	
12.b. Constructed Wetland #2 (Spec #13)	0			0	0	0	0	75	0.00	0.00	0.00	0.00	
13. Wet Ponds (no RR)													
13.a. Wet Pond #1 (Spec #14)	0			0	0	0	0	50	0.00	0.00	0.00	0.00	
13.b. Wet Pond #1 (Coastal Plain) (Spec #14)	0			0	0	0	0	45	0.00	0.00	0.00	0.00	
13.c. Wet Pond #2 (Spec #14)	0			0	0	0	0	75	0.00	0.00	0.00	0.00	
13.d. Wet Pond #2 (Coastal Plain) (Spec #14)	0			0	0	0	0	65	0.00	0.00	0.00	0.00	

10. Wet Swale (Coastal Plain) (no RR)				
25	0.00	0.00	0.00	0.00
35	0.00	0.00	0.00	0.00
11. Filtering Practices (no RR)				
30	0.00	0.00	0.00	0.00
45	0.00	0.00	0.00	0.00
12. Constructed Wetland (no RR)				
25	0.00	0.00	0.00	0.00
55	0.00	0.00	0.00	0.00
13. Wet Ponds (no RR)				
30	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00

14. Manufactured Treatment Devices (no RR)													
14.a. Manufactured Treatment Device-Hydrodynamic	0			0	0	0	0	20	0.00	0.00	0.00	0.00	
14.b. Manufactured Treatment Device-Filtering	0	0.56	3.41	0	0	12,178	12,178	40	0.00	7.64	3.06	4.59	
14.c. Manufactured Treatment Device-Generic	0			0	0	0	0	20	0.00	0.00	0.00	0.00	

14. Manufactured BMP (no RR)				
0	0.00	0.00	0.00	0.00
0	0.00	54.67	0.00	54.67
0	0.00	0.00	0.00	0.00

TOTAL IMPERVIOUS COVER TREATED (ac)	3.41	AREA CHECK: OK.
TOTAL MANAGED TURF AREA TREATED (ac)	0.56	AREA CHECK: OK.
TOTAL PHOSPHORUS REMOVAL REQUIRED ON SITE (lb/yr)	6.04	
TOTAL PHOSPHORUS AVAILABLE FOR REMOVAL IN D.A. A (lb/yr)	7.65	
TOTAL PHOSPHORUS REMOVED WITHOUT RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	3.06	
TOTAL PHOSPHORUS REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00	
TOTAL PHOSPHORUS LOAD REDUCTION ACHIEVED IN D.A. A (lb/yr)	3.06	
TOTAL PHOSPHORUS REMAINING AFTER APPLYING BMP LOAD REDUCTIONS IN D.A. A (lb/yr)	4.59	

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

NITROGEN REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00
NITROGEN REMOVED WITHOUT RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00
TOTAL NITROGEN REMOVED IN D.A. A (lb/yr)	0.00

DEQ Virginia Runoff Reduction Method New Development Compliance Spreadsheet - Version 3.0

BMP Design Specifications List: **2013 Draft Stds & Specs**

Site Summary

Project Title: 1800 Prices Fork Road

Date: 44833

Total Rainfall = 43 inches

Site Land Cover Summary

	A soils	B Soils	C Soils	D Soils	Totals	% of Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0
Managed Turf (acres)	0.00	0.48	0.35	0.00	0.83	20
Impervious Cover (acres)	0.00	3.41	0.00	0.00	3.41	80
					4.24	100

Site Tv and Land Cover Nutrient Loads

Site Rv	0.80
Treatment Volume (ft^3)	12,387
TP Load (lb/yr)	7.78
TN Load (lb/yr)	55.68

Total TP Load Reduction Required (lb/yr)	6.04

Site Compliance Summary

Total Runoff Volume Reduction (ft^3)	0
Total TP Load Reduction Achieved (lb/yr)	3.06
Total TN Load Reduction Achieved (lb/yr)	0.00
Remaining Post Development TP Load (lb/yr)	4.73
Remaining TP Load Reduction (lb/yr) Required	2.99

Drainage Area Summary

	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0.00
Managed Turf (acres)	0.56	0.00	0.00	0.00	0.00	0.56
Impervious Cover (acres)	3.41	0.00	0.00	0.00	0.00	3.41
Total Area (acres)	**3.97**	**0.00**	**0.00**	**0.00**	**0.00**	**3.97**

Drainage Area Compliance Summary

	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	Total
TP Load Reduced (lb/yr)	3.06	0.00	0.00	0.00	0.00	3.06

TN Load Reduced (lb/yr)	0.00	0.00	0.00	0.00	0.00	0.00

Drainage Area A Summary

Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0
Managed Turf (acres)	0.00	0.40	0.16	0.00	0.56	14
Impervious Cover (acres)	0.00	3.41	0.00	0.00	3.41	86
					3.97	

BMP Selections

Practice	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	BMP Treatment Volume (ft^3)	TP Load from Upstream Practices (lbs)	Untreated TP Load to Practice (lbs)	TP Removed (lb/yr)	TP Remaining (lb/yr)	Downstream Treatment to be Employed

Total Impervious Cover Treated (acres)	3.41
Total Turf Area Treated (acres)	0.56
Total TP Load Reduction Achieved in D.A. (lb/yr)	3.06
Total TN Load Reduction Achieved in D.A. (lb/yr)	0.00

Drainage Area B Summary

Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0
Managed Turf (acres)	0.00	0.00	0.00	0.00	0.00	0
Impervious Cover (acres)	0.00	0.00	0.00	0.00	0.00	0
					0.00	

BMP Selections

Practice	Managed Turf Credit Area (acres)	Impervious Cover Credit Area (acres)	BMP Treatment Volume (ft^3)	TP Load from Upstream Practices (lbs)	Untreated TP Load to Practice (lbs)	TP Removed (lb/yr)	TP Remaining (lb/yr)	Downstream Treatment to be Employed

Total Impervious Cover Treated (acres)	0.00
Total Turf Area Treated (acres)	0.00
Total TP Load Reduction Achieved in D.A. (lb/yr)	0.00
Total TN Load Reduction Achieved in D.A. (lb/yr)	0.00

APPENDIX

- NRCS Soils Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Montgomery County, Virginia

May 25, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:2,090 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

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
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Montgomery County, Virginia
Survey Area Data: Version 14, Sep 14, 2021

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

Date(s) aerial images were photographed: Sep 29, 2019—Oct 4, 2019

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 Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2B	Berks-Groseclose complex, 2 to 7 percent slopes	2.1	14.4%
2C	Berks-Groseclose complex, 7 to 15 percent slopes	1.5	10.5%
3D	Berks-Lowell-Rayne complex, 15 to 25 percent slopes	2.4	16.4%
3E	Berks-Lowell-Rayne complex, 25 to 65 percent slopes	0.6	3.9%
11C	Duffield-Ernest complex, 7 to 15 percent slopes	4.0	27.6%
16B	Groseclose and Poplimento soils, 2 to 7 percent slopes	0.0	0.1%
16C	Groseclose and Poplimento soils, 7 to 15 percent slopes	3.9	26.7%
16D	Groseclose and Poplimento soils, 15 to 25 percent slopes	0.1	0.5%
Totals for Area of Interest		**14.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas

are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Montgomery County, Virginia

2B—Berks-Groseclose complex, 2 to 7 percent slopes

Map Unit Setting

National map unit symbol: kc2s
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Berks and similar soils: 40 percent
Groseclose and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Berks

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 7 inches: channery silt loam
H2 - 7 to 23 inches: very channery silt loam
H3 - 23 to 33 inches: extremely channery silt loam
H4 - 33 to 79 inches: bedrock

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Forage suitability group: Droughty Soils (G128XB012VA)
Other vegetative classification: Droughty Soils (G128XB012VA)
Hydric soil rating: No

Description of Groseclose

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 28 inches: clay
H3 - 28 to 39 inches: clay
H4 - 39 to 51 inches: clay
H5 - 51 to 79 inches: clay loam

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Forage suitability group: Moist, Fertile Soils (G128XB001VA)
Other vegetative classification: Moist, Fertile Soils (G128XB001VA)
Hydric soil rating: No

2C—Berks-Groseclose complex, 7 to 15 percent slopes

Map Unit Setting

National map unit symbol: kc2t
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Berks and similar soils: 40 percent
Groseclose and similar soils: 35 percent

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

Description of Berks

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 7 inches: channery silt loam
H2 - 7 to 23 inches: very channery silt loam
H3 - 23 to 33 inches: extremely channery silt loam
H4 - 33 to 79 inches: bedrock

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Forage suitability group: Droughty Soils (G128XB012VA)
Other vegetative classification: Droughty Soils (G128XB012VA)
Hydric soil rating: No

Description of Groseclose

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 28 inches: clay
H3 - 28 to 39 inches: clay
H4 - 39 to 51 inches: clay
H5 - 51 to 79 inches: clay loam

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Forage suitability group: Moist, Fertile Soils (G128XB001VA)
Other vegetative classification: Moist, Fertile Soils (G128XB001VA)
Hydric soil rating: No

3D—Berks-Lowell-Rayne complex, 15 to 25 percent slopes

Map Unit Setting
National map unit symbol: kc34
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Berks and similar soils: 35 percent
Lowell and similar soils: 30 percent
Rayne and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Berks

Setting
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Shale, siltstone, and sandstone residuum

Typical profile
H1 - 0 to 7 inches: channery silt loam
H2 - 7 to 23 inches: very channery silt loam
H3 - 23 to 33 inches: extremely channery silt loam
H4 - 33 to 79 inches: bedrock

Properties and qualities
Slope: 15 to 25 percent

Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Forage suitability group: Droughty Soils (G128XB012VA)
Other vegetative classification: Droughty Soils (G128XB012VA)
Hydric soil rating: No

Description of Lowell

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Limestone and calcareous shale residuum

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 15 inches: silty clay
H3 - 15 to 32 inches: silty clay
H4 - 32 to 50 inches: very channery clay
H5 - 50 to 79 inches: bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 40 to 80 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very 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 supply, 0 to 60 inches: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Forage suitability group: Acid Soils (G128XM004VA)
Other vegetative classification: Acid Soils (G128XM004VA)
Hydric soil rating: No

Description of Rayne

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 7 inches: channery loam
H2 - 7 to 24 inches: channery silty clay loam
H3 - 24 to 39 inches: very channery silty clay loam
H4 - 39 to 53 inches: channery silty clay loam
H5 - 53 to 79 inches: very channery silty clay loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 40 to 72 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
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 supply, 0 to 60 inches: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Forage suitability group: Acid Soils (G128XM004VA)
Other vegetative classification: Acid Soils (G128XM004VA)
Hydric soil rating: No

3E—Berks-Lowell-Rayne complex, 25 to 65 percent slopes

Map Unit Setting

National map unit symbol: kc35
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Berks and similar soils: 35 percent

Lowell and similar soils: 30 percent
Rayne and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Berks

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 7 inches: channery silt loam
H2 - 7 to 23 inches: very channery silt loam
H3 - 23 to 33 inches: extremely channery silt loam
H4 - 33 to 79 inches: bedrock

Properties and qualities

Slope: 25 to 65 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Forage suitability group: Steep, Droughty Soils (G128XB013VA)
Other vegetative classification: Steep, Droughty Soils (G128XB013VA)
Hydric soil rating: No

Description of Lowell

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Limestone and calcareous shale residuum

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 15 inches: silty clay
H3 - 15 to 32 inches: silty clay
H4 - 32 to 50 inches: very channery clay
H5 - 50 to 79 inches: bedrock

Properties and qualities

Slope: 25 to 65 percent
Depth to restrictive feature: 40 to 80 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very 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 supply, 0 to 60 inches: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Forage suitability group: Acid Soils (G128XM004VA)
Other vegetative classification: Acid Soils (G128XM004VA)
Hydric soil rating: No

Description of Rayne

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 7 inches: channery loam
H2 - 7 to 24 inches: channery silty clay loam
H3 - 24 to 39 inches: very channery silty clay loam
H4 - 39 to 53 inches: channery silty clay loam
H5 - 53 to 79 inches: very channery silty clay loam

Properties and qualities

Slope: 25 to 65 percent
Depth to restrictive feature: 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
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 supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Forage suitability group: Acid Soils (G128XM004VA)
Other vegetative classification: Acid Soils (G128XM004VA)
Hydric soil rating: No

11C—Duffield-Ernest complex, 7 to 15 percent slopes

Map Unit Setting

National map unit symbol: kc1r
Elevation: 1,300 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Duffield and similar soils: 45 percent
Ernest and similar soils: 35 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duffield

Setting

Landform: Drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Loamy colluvial, alluvial, eolian sediments underlain by loamy and clayey residuum of limestone and shale

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 37 inches: silty clay loam
H3 - 37 to 79 inches: clay

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: 48 to 99 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
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 supply, 0 to 60 inches: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Ernest

Setting

Landform: Drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Interbedded limestone and shale residuum

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 26 inches: silty clay loam
H3 - 26 to 50 inches: silty clay loam
H4 - 50 to 79 inches: silty clay loam

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: 20 to 35 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Purdy

Percent of map unit: 3 percent
Landform: Stream terraces, depressions
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

16B—Groseclose and Poplimento soils, 2 to 7 percent slopes

Map Unit Setting

National map unit symbol: kc22
Elevation: 1,700 to 3,000 feet

Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Groseclose and similar soils: 45 percent
Poplimento and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Groseclose

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 10 inches: loam
H2 - 10 to 28 inches: clay
H3 - 28 to 39 inches: clay
H4 - 39 to 51 inches: clay
H5 - 51 to 79 inches: clay loam

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Poplimento

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 12 inches: silt loam

H2 - 12 to 35 inches: clay
H3 - 35 to 55 inches: clay
H4 - 55 to 79 inches: channery silty clay loam

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Hydric soil rating: No

16C—Groseclose and Poplimento soils, 7 to 15 percent slopes

Map Unit Setting

National map unit symbol: kc23
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Groseclose and similar soils: 45 percent
Poplimento and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Groseclose

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 10 inches: loam
H2 - 10 to 28 inches: clay
H3 - 28 to 39 inches: clay

H4 - 39 to 51 inches: clay
H5 - 51 to 79 inches: clay loam

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Poplimento

Setting

Landform: Hills
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 12 inches: silt loam
H2 - 12 to 35 inches: clay
H3 - 35 to 55 inches: clay
H4 - 55 to 79 inches: channery silty clay loam

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

16D—Groseclose and Poplimento soils, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: kc24
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Groseclose and similar soils: 45 percent
Poplimento and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Groseclose

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 10 inches: loam
H2 - 10 to 28 inches: clay
H3 - 28 to 39 inches: clay
H4 - 39 to 51 inches: clay
H5 - 51 to 79 inches: clay loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Poplimento

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Limestone, shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 12 inches: silt loam
H2 - 12 to 35 inches: clay
H3 - 35 to 55 inches: clay
H4 - 55 to 79 inches: channery silty clay loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

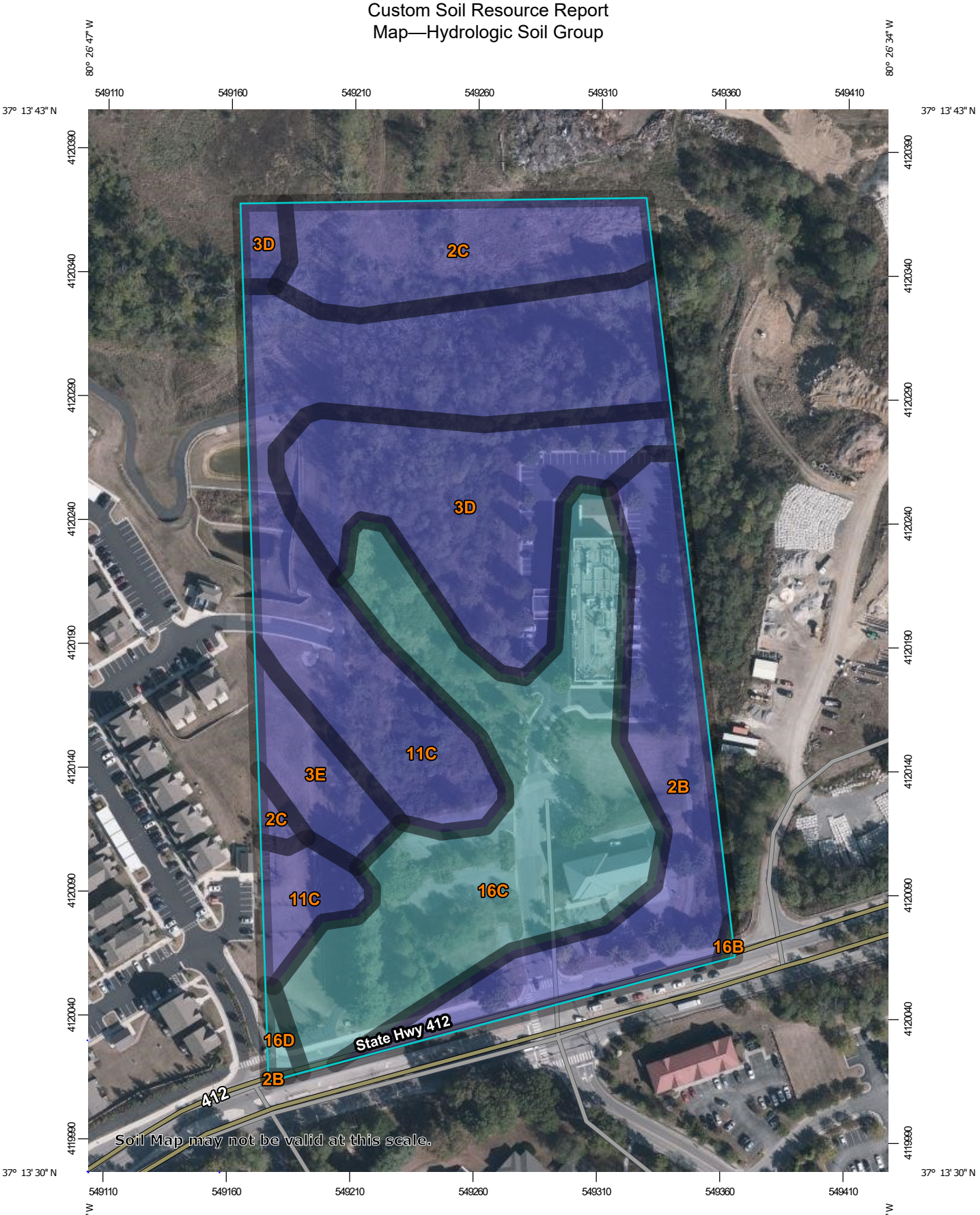
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.



Map Scale: 1:2,090 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Montgomery County, Virginia
Survey Area Data: Version 14, Sep 14, 2021

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

Date(s) aerial images were photographed: Sep 29, 2019—Oct 4, 2019

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
2B	Berks-Groseclose complex, 2 to 7 percent slopes	B	2.1	14.4%
2C	Berks-Groseclose complex, 7 to 15 percent slopes	B	1.5	10.5%
3D	Berks-Lowell-Rayne complex, 15 to 25 percent slopes	B	2.4	16.4%
3E	Berks-Lowell-Rayne complex, 25 to 65 percent slopes	B	0.6	3.9%
11C	Duffield-Ernest complex, 7 to 15 percent slopes	B	4.0	27.6%
16B	Groseclose and Poplimento soils, 2 to 7 percent slopes	C	0.0	0.1%
16C	Groseclose and Poplimento soils, 7 to 15 percent slopes	C	3.9	26.7%
16D	Groseclose and Poplimento soils, 15 to 25 percent slopes	C	0.1	0.5%
Totals for Area of Interest			**14.6**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf