



May 1, 2018
Ms. Kafi Howard
Town of Blacksburg, Town Engineer
400 South Main Street
Blacksburg, Virginia 24060

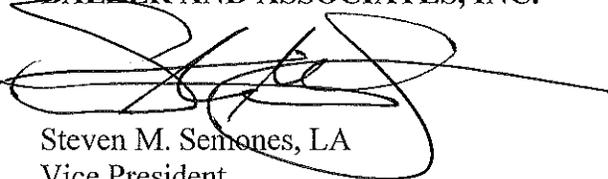
RE: Terrace View Phase I PRD Application
B&A Job #24170107.00

Dear Kafi,

Included in this packet are the Stormwater Management calculations for the proposed Terrace View Phase I PRD application. If you have any questions or comments please feel free to call.

Thank you again for all of your and the staff's assistance with this project.

Sincerely,
BALZER AND ASSOCIATES, INC.



Steven M. Semones, LA
Vice President

STORMWATER MANAGEMENT CALCULATIONS

FOR

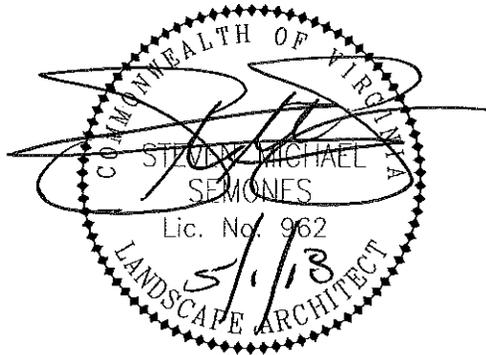
**TERRACE VIEW PHASE I
PRD APPLICATION**

HUNT CLUB ROAD

**PRICES FORK MAGISTERIAL DISTRICT
TOWN OF BLACKSBURG, VA**

B&A Job #24170107.00

MAY 1, 2018



PREPARED BY:

**BALZER AND ASSOCIATES, INC.
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TABLE OF CONTENTS

<u>SECTION I: PROJECT NARRATIVE</u>	4
<u>SECTION II: STORMWATER MANAGEMENT SUMMARY</u>	5
PRE-DEVELOPMENT SUMMARY	6
POST-DEVELOPMENT SUMMARY	9
<u>SECTION III: STORMWATER QUALITY SUMMARY</u>	13
<u>SECTION IV: DOWNSTREAM ANALYSIS</u>	14
<u>SECTION V: STORMWATER MANAGEMENT MAINTENANCE/INSPECTION PLAN</u>	15
<u>APPENDIX A: SOILS MAPS & SOIL DESCRIPTIONS</u>	
<u>APPENDIX B: DRAINAGE MAPS</u>	
<u>APPENDIX C: STORMWATER MANAGEMENT CALCULATIONS</u>	

SECTION I: PROJECT NARRATIVE

Project Description

The purpose of this project is the redevelopment of 14.04 acres of land to a PRD for The Reliant Group. The site is located between Patrick Henry Drive, Tom's Creek Road, and Hunt Club Road in the Town of Blacksburg.

Existing Site Conditions

The site¹ proposed for rezoning is approximately 14.04 acres and encompasses Phases I, II, III, and IX of the Terrace View Development. The proposed project also includes improvements on Hunt Club Road, bringing the total project area to 16.04 acres. The existing site includes multiple apartment buildings, parking lots, sidewalks, amenity areas, and utilities. Also included in the rezoning area is Snyder Lane, a public right of way proposed to be vacated. This existing road connects to Hunt Club Road and serves only the Terrace View community. It does not provide a connection to Patrick Henry Drive. The project proposes to transition Snyder Lane to a private road and provide a connection to Patrick Henry Drive.

The site is bound by Patrick Henry Drive to the north, Terrace View Phase V to the east, Hunt Club Road to the south, and Tom's Creek Road to the west. Existing soil conditions on-site are listed below. There are no wetlands or jurisdictional waters present on site. There are currently no stormwater management BMPs serving the site. Surrounding areas consist of developed urban land primarily consisting of multi-unit residential, with a small amount of commercial and some single family residential.

Existing soil conditions on-site include the following types:

(See attached soils map and plans for specific locations.)

11B - Duffield-Ernest Complex, 2 to 7 percent slopes

K Factor: 0.28

Texture: Silt Loam

Hydrologic Soil Group: B

12C - Frederick and Vertrees Silt Loams, 7 to 15 percent slopes

K-Factor: 0.37

Texture: Silt Loam

Hydrologic Soil Group: B

16B - Groseclose and Poplimento Soils, 2 to 7 percent slopes

K-Factor: 0.32

Texture: Loam

Hydrologic Soil Group: C

¹ For the purposes of the Project Narrative, "site" shall be defined as the area within the subject property boundary, 14.04 acres, Tax Map #'s 225-A-30 and 196-A-8, and the existing Snyder Lane right of way. "Project area" shall be defined as the total disturbed area, encompassing the "site" and the area of proposed improvements on Hunt Club Road.

16C - Groseclose and Poplimento Soils, 7 to 15 percent slopes
K-Factor: 0.32
Texture: Loam
Hydrologic Soil Group: C

Development Plans

The proposed development proposes to remove the existing structures and build two new apartment buildings. Each proposed building will feature a varying roofline, ranging from two to four stories. There will be a parking structure in the courtyard area of each building with a small amount of surface parking in the Building West courtyard and along Snyder Lane. An amenity area will be provided for each building. A total of 1,521 bedrooms is proposed. The proposed site will also include sidewalk connections to all surrounding roads and a stormwater management facility. The site is currently served by Blacksburg Transit with multiple nearby stops.

Adjacent Areas

The only property directly adjacent to the subject parcel is Phase V of Terrace View. All other properties, which consist of multi-unit residential communities and commercial developments, are separated from the project by a public road. Any runoff from the site will be controlled with temporary measures such as a construction entrance, silt fence, inlet protection, sediment traps and/or basins, diversion dikes, seeding, and other measures per Virginia Erosion and Sediment Control Handbook standards.

Permanent Structures to Remain After Construction

In addition to the permanent ESC measures used for permanent stabilization (permanent seeding, blankets and matting, stormwater conveyance channels, and outlet protection), three underground detention systems will remain in place for stormwater quantity and quality. There are two HUC's receiving waters from this site. Most of the site drains to NE59 (New River-Stroubles Creek) while a small piece drains to NE 60 (Toms Creek-Poverty Creek).

SECTION II: STORMWATER MANAGEMENT

SUMMARY

PRE-DEVELOPMENT SUMMARY

Please see sheet SW3 for drainage area map.

In the pre-development condition, a small portion of the project area (approximately 2.88 acres within Drainage Area #1) at the northwest corner drains to storm sewer located in Patrick Henry Drive and Tom's Creek Road. Runoff is then conveyed through a manmade system to flow under US Route 460 to Tom's Creek. Point of Analysis #1 has been set where the runoff from the project site converges with runoff from the storm sewer on the western side of Tom's Creek Road.

The majority of the project area (approximately 13.16 acres within Drainage Area #2) flows to a storm sewer system that drains to multiple culverts under Hunt Club Road. This flow is conveyed through a 54" culvert under Broce Drive and outfalls to a ditch. From this point, runoff flows through a combination of manmade and natural conveyance systems to the Duck Pond. Point of Analysis #2 has been set at the outfall of the culvert under Broce Drive.

There are no existing BMPs on the site or upstream of the development. All flows in this model have been analyzed using the SCS/TR-55, weighted Q method. See HydroCAD report for time of concentration calculations. Where a subwatershed is predominantly impervious, a minimum time of concentration of 6 minutes has been assumed.

Point of Analysis #1

Total Contributing Drainage Area = 7.05 acres

PRE-DEVELOPMENT LAND COVER

DESCRIPTION	AREA (AC)	SOIL TYPE	CN
OPEN SPACE	1.27	C	74
RESIDENTIAL – MULTI-UNIT	0.64	C	90
URBAN COMMERCIAL	0.27	C	94
PAVED ROADS/RIGHT OF WAY	0.15	B	98
PAVED ROADS/RIGHT OF WAY	3.20	C	98
IMPERVIOUS	1.52	C	98

The CN value has been determined based upon soil type information obtained from the NRCS Web Soil Survey. All land covers are assumed to be in good condition and have been estimated from USGS mapping, aerial photography, and Town of Blacksburg GIS maps. All SCS land cover values were taken from Table 4-6a and Table 4-6b of the Virginia Stormwater Management Handbook. Rational “C” coefficients are derived from VSMH Table 4-3 “Rational Equation Runoff Coefficients”.

The peak pre-development runoff flows at Point of Analysis #1 are as follows:
(See HydroCAD report)

1-year 15.83 cfs
2-year 19.80 cfs
10-year 28.59 cfs
100-year 40.30 cfs

Point of Analysis #2

Total Contributing Drainage Area = 47.70 acres

PRE-DEVELOPMENT LAND COVER

DESCRIPTION	AREA (AC)	SOIL TYPE	CN
OPEN SPACE	0.83	B	61
OPEN SPACE	7.08	C	74
RESIDENTIAL – 1/3 AC LOTS	0.35	C	81
RESIDENTIAL – 1/4 AC LOTS	0.20	C	83
RESIDENTIAL – MULTI-UNIT	5.65	B	85
RESIDENTIAL – MULTI-UNIT	23.31	C	90
PAVED ROADS/RIGHT OF WAY	0.49	B	98
PAVED ROADS/RIGHT OF WAY	5.27	C	98
IMPERVIOUS	0.01	B	98
IMPERVIOUS	4.51	C	98

The CN value has been determined based upon soil type information obtained from the NRCS Web Soil Survey. All land covers are assumed to be in good condition and have been estimated from USGS mapping, aerial photography, and Town of Blacksburg GIS maps. All SCS land cover values were taken from Table 4-6a and Table 4-6b of the Virginia Stormwater Management Handbook. Rational “C” coefficients are derived from VSMH Table 4-3 “Rational Equation Runoff Coefficients”.

The peak pre-development runoff flows at Point of Analysis #2 are as follows:
(See HydroCAD report)

1-year 61.94 cfs
2-year 81.64 cfs
10-year 129.91 cfs
100-year 197.57 cfs

POST-DEVELOPMENT SUMMARY

Please see sheet SW4 for drainage area map and sheet SW5 for the stormwater management plan.

Point of Analysis #1

In the post development condition, the overall size of Drainage Area #1 has been reduced by 1.12 acres, resulting in less area and less runoff flowing to Point of Analysis #1. This has reduced the post-development peak flow rates below the pre-development peak flow rates. See below and enclosed HydroCAD calculations.

Total Drainage Area= 5.93 acres

POST-DEVELOPMENT LAND COVER

DESCRIPTION	AREA (AC)	SOIL TYPE	CN
OPEN SPACE	0.67	C	74
RESIDENTIAL – MULTI-UNIT	0.64	C	90
URBAN COMMERCIAL	0.27	C	94
PAVED ROADS/RIGHT OF WAY	3.11	B	98
PAVED ROADS/RIGHT OF WAY	0.15	C	98
IMPERVIOUS	1.09	C	98

The CN value has been determined based upon soil type information obtained from the NRCS Web Soil Survey. All land covers are assumed to be in good condition and have been estimated from USGS mapping, aerial photography, and Town of Blacksburg GIS maps. All SCS land cover values were taken from Table 4-6a and Table 4-6b of the Virginia Stormwater Management Handbook. Rational “C” coefficients are derived from VSMH Table 4-3 “Rational Equation Runoff Coefficients”.

The peak post-development runoff flows at the point of analysis are as follows:
(See HydroCAD report)

1-year 14.17 cfs
2-year 17.60 cfs
10-year 25.05 cfs
100-year 34.79 cfs

As shown above, the post-development flow at the Point of Analysis is less than the pre-development flow for the 1-year, 2-year, and 10-year storms, thus meeting the Town of Blacksburg stormwater management requirements.

In the post development condition, the remaining portion of the site (Drainage Area #2) has been divided into three separate drainage areas, each of which will incorporate an underground stormwater detention system to manage runoff. The proposed site will be graded to capture runoff through a combination of sheet flow, conveyance channels, and curb and gutter. There will be an underground detention system located underneath the driveway leading to the western parking structure (“USWM #1”), a StormTech MC-4500 underground detention/filtration system located below the plaza on the eastern side of Snyder Lane (“USWM #2”), and another underground detention system underneath the pet

park on the eastern side of the project (“USWM #3”). USWM #1 and USWM #2 will outfall to an existing storm drain located on the southern side of Terrace View. USWM #3 will outfall to an existing storm drain located on the south side of Hunt Club Road. Both outfall points are conveyed through the existing development and converge just prior to crossing under Broce Drive to the Point of Analysis. The detention systems have all been designed to manage peak flows and meet all applicable water quantity requirements.

Point of Analysis #2

Total Drainage Area= 48.82 acres

POST-DEVELOPMENT LAND COVER

DESCRIPTION	AREA (AC)	SOIL TYPE	CN
OPEN SPACE	0.73	B	61
OPEN SPACE	4.84	C	74
RESIDENTIAL – 1/3 ACRE LOTS	0.35	C	81
RESIDENTIAL – 1/4 ACRE LOTS	0.20	C	83
RESIDENTIAL – MULTI-UNIT	5.50	B	85
RESIDENTIAL – MULTI-UNIT	23.18	C	90
PAVED ROADS/RIGHT OF WAY	0.02	B	98
PAVED ROADS/RIGHT OF WAY	3.52	C	98
IMPERVIOUS	0.73	B	98
IMPERVIOUS	9.75	C	98

The CN value has been determined based upon soil type information obtained from the NRCS Web Soil Survey. All land covers are assumed to be in good condition and have been estimated from USGS mapping, aerial photography, and Town of Blacksburg GIS maps. All SCS land cover values were taken from Table 4-6a and Table 4-6b of the Virginia Stormwater Management Handbook. Rational “C” coefficients are derived from VSMH Table 4-3 “Rational Equation Runoff Coefficients”.

The peak post-development runoff flows at the point of analysis are as follows:
(See HydroCAD report)

1-year 54.29 cfs
2-year 72.67 cfs
10-year 122.94 cfs
100-year 203.99 cfs

As shown above, the post-development flow at the Point of Analysis is less than the pre-development flow for the 1-year, 2-year, and 10-year storms, thus meeting the Town of Blacksburg stormwater management requirements.

Channel Protection

In accordance with 9VAC25-870-66 (B), concentrated stormwater flows have been discharged directly to a stormwater conveyance system. The portion of the site² that discharges to Point of Analysis #1 outfalls to a manmade conveyance system and travels through a combination of manmade and natural conveyance systems to the 1% analysis point (176 acres). This portion of the site has met the requirements of channel protection per 9VAC25-870-66(B)(3) as shown below:

DA #1 R_v Calculation

Pre-developed = 0.325 acre*ft – See HydroCAD “RV Calculation” Report

Developed = 0.218 acre*ft – See HydroCAD “Channel Protection Volumes” Report

$$Q_{Developed} \leq I.F. \times (Q_{Pre-developed} \times RV_{Pre-Developed}) / RV_{Developed}$$

$$Q_{Developed} \leq 0.8 \times (Q_{Pre-developed} \times 0.325) / 0.218$$

$$Q_{Developed} \leq 1.20 \times Q_{Pre-developed}$$

In the post-development condition, the drainage area flowing to this point of analysis has been reduced, resulting in a post-development runoff volume that is lower than the pre-development runoff volume. As shown above, when this information is entered into the energy balance equation, the equation does not work properly and is not applicable. Therefore, this drainage area has met the requirements of channel protection by reducing the runoff volume and reducing the 1-year peak flow rate.

Pre-development 1-year peak flow rate = 15.83 cfs

Post-development 1-year peak flow rate = 14.17 cfs (a reduction of 10.5%)

The portion of the site² that flows to Point of Analysis #2 discharges to a natural stormwater conveyance system before flowing to the 1% analysis point (1,428 acres) downstream of the Duck Pond and has met the requirements of channel protection per 9VAC25-870-66 (B)(3). At this discharge point, the point of analysis unavoidably includes runoff from adjacent areas not part of the project site. Since the energy balance requirement is to be applied to the development site only, this flow rate reduction has been entered into the pre-development model to obtain a maximum flow rate at the downstream point of analysis, accounting for the energy balance reduction on the development site drainage areas. Per the equations below, the pre-development flows from the site have been multiplied by the prescribed reduction rate in the attached HydroCAD calculations labeled “Channel Protection”.

DA #2 R_v Calculation

Pre-developed = 1.410 acre*ft – See HydroCAD “RV Calculation” Report

Developed = 1.929 acre*ft – See HydroCAD “Channel Protection Volumes” Report

² In the context of channel and flood protection, “site” shall be defined as the land or water area where the land-disturbing activity is physically conducted (the area of land disturbance, approx. 16.04 acres), including the limits of any off-site land disturbance. See Sheets SW3-SW4.

$$Q_{Developed} \leq I.F. \times (Q_{Pre-developed} \times RV_{Pre-Developed}) / RV_{Developed}$$

$$Q_{Developed} \leq 0.8 \times (Q_{Pre-developed} \times 1.410) / 1.929$$

$$Q_{Developed} \leq 0.58 \times Q_{Pre-developed}$$

The resulting maximum allowable peak flow rate for the one-year 24-hour storm at Point of Analysis #2 is 55.23 cfs.

The actual post-development peak flow rate achieved at Point of Analysis #2 is 54.29 cfs.

Flood Protection

In accordance with 9VAC25-870-66 (C), concentrated stormwater flows have been discharged directly to a stormwater conveyance system.

For Drainage Area #1, the flow is discharged to an existing manmade conveyance system on Patrick Henry Drive and carried across US Route 460, and is then discharged to a natural stormwater conveyance system. This system carries flows to a point (confluence with Tom's Creek, 7,740 acres) where the contributing drainage area is less than or equal to 1.0% of the total watershed area as defined in subdivision 3(a) of the regulations (at least 176 acres).

For Drainage Area #2, the flow is discharged to multiple manmade conveyance systems which converge on the northern side of Broce Drive. From there, the flow is conveyed through a culvert under Broce Drive and continues to a point downstream of the Duck Pond (through a combination of manmade and natural conveyance systems), where the contributing drainage area is less than or equal to 1.0% of the total watershed area as defined in subdivision 3(a) of the regulations (at least 1,428 acres).

As shown on the attached HydroCAD calculations, the point of discharge for each drainage area releases a post-development peak flow rate for the 10-year 24-hour storm event that is less than the pre-development peak flow rate from the 10-year 24-hour storm event, satisfying subdivision 2(b). Per subdivision (3), no further analysis of the downstream stormwater conveyance system is required.

SECTION III: STORMWATER QUALITY

SUMMARY

Water Quality:

Water quality compliance has been achieved through use of the Virginia Runoff Reduction Method in accordance with the design criteria set forth in 9VAC25-870-65 and through the purchase of nutrient credits in accordance with the criteria set forth in the Code of Virginia. Per §62.1-44.15:35 (C)(2), the VSMP shall allow the use of nutrient credits when less than five acres of land will be disturbed or the phosphorus water quality reduction requirement is less than 10 pounds per year. The proposed development is within the thresholds for permitted use of credits, with a required phosphorus load reduction of 9.55 lb/yr.

The existing site³ is a developed apartment complex. The pre-development site has an impervious land cover of 8.53 acres (53%). The post development site has an impervious land cover of 11.61 acres (72%), resulting in a composite runoff coefficient (R_v) of 0.75. The prescribed phosphorus pollutant reduction requirement is 9.55 lb/yr. The proposed on-site BMPs remove 4.99 lb/yr and the remaining 4.56 lb/yr removal requirement will be handled by purchasing credits. Please see attached calculation sheets.

³ In the context of water quality compliance, "site" shall be defined as the land or water area where the land-disturbing activity is physically conducted (the area of land disturbance, 16.04 acres), including the limits of any off-site land disturbance. See Sheets SW3-SW4.

SECTION IV: DOWNSTREAM ANALYSIS

Runoff from Drainage Area #1 is discharged directly to a manmade stormwater conveyance system and is then carried through a combination of manmade and natural conveyance systems towards the 1% analysis point. The pre-development peak runoff has been reduced by reducing the overall drainage area flowing towards this point.

Runoff from Drainage Area #2 is discharged directly to a manmade stormwater conveyance system. Runoff is then carried through a combination of manmade and natural conveyance systems through the Virginia Tech campus towards the Duck Pond. The watershed reaches the 1% analysis point (1,428 acres) downstream of the Duck Pond. The post-development peak runoff has been mitigated via various BMPs to prevent adverse impacts to downstream properties in the form of channel erosion, flooding, or increased pollutant loads.

Per 9VAC25-870-66 subsection A, compliance with Minimum Standard 19 of the Virginia Erosion and Sediment Control Regulations has been satisfied by meeting the requirements of the for channel protection and flood protection as shown in the Post Development Summary. No adverse impacts to downstream properties are expected as a result of this development.

SECTION V: STORMWATER MANAGEMENT MAINTENANCE/INSPECTION PLAN

Generally:

1. The owner is responsible for providing or coordinating all facility inspections and any required maintenance that may result from such inspections.
2. Requirements listed here are to be taken as a minimum and do not represent the limit of responsibility.
3. Any standing water pumped during the maintenance operation must be disposed of per the VESCH, 1992 edition and any local requirements.

Required Action:

Sediment Forebays:

1. Sediment shall be removed from the forebay every 3-5 years or when 6-12" has accumulated, whichever comes first. To clean the forebay, draining or pumping and a possible temporary partial drawdown of the pool may be required. Refer to the VESCH, 1992 Edition for proper dewatering methods.
2. All material removed from the sediment forebay must be disposed of off-site in an appropriate manner.

Bioretention Filters:

1. Every (12) twelve months the responsible party shall complete the "Bioretention Practices O&M Checklist" provided in Appendix 9C of the Virginia Stormwater Management Handbook (VSMH) and make any repairs necessary to areas of failure/concern discovered during inspection. Typical maintenance tasks include:
 - 1.1. Check to see if 75% to 90% cover (mulch plus vegetative cover) has been achieved in the bed, and measure the depth of the remaining mulch.
 - 1.2. Check for sediment buildup at curb cuts, gravel diaphragms or pavement edges that prevents flow from getting into the bed, and check for other signs of bypassing.
 - 1.3. Check for any winter- or salt-killed vegetation, and replace it with hardier species.
 - 1.4. Note presence of accumulated sand, sediment and trash in the pre-treatment cell or filter beds, and remove it.
 - 1.5. Inspect bioretention side slopes and grass filter strips for evidence of any rill or gully erosion, and repair it.
 - 1.6. Check the bioretention bed for evidence of mulch flotation, excessive ponding, dead plants or concentrated flows, and take appropriate remedial action.
 - 1.7. Check inflow points for clogging, and remove any sediment.
 - 1.8. Look for any bare soil or sediment sources in the contributing drainage area, and stabilize them immediately.
 - 1.9. Check for clogged or slow-draining soil media, a crust formed on the top layer, inappropriate soil media, or other causes of insufficient filtering time, and restore proper filtration characteristics.

2. Every (6) months and after each major runoff producing storm event, the following maintenance tasks shall be performed:
 - 2.1. Inspect condition of grate inlet riser for evidence of clogging, leakage, debris accumulation, etc. That may compromise the performance of the structure. Such debris or sediments shall be removed immediately.
3. Grassed areas shall be maintained so as to promote soil stabilization of basin side slopes and proper functioning of outfall structures. The basin side slopes shall be mowed a minimum of twice a year to discourage woody growth.

Underground Detention Facilities:

1. Every (6) months and after each major runoff producing storm event, a maintenance visit shall be performed and documented, and any repairs necessary to areas of failure/concern discovered during inspection shall be carried out. Typical maintenance tasks include:
 - a. Cleanout of any debris or sediment accumulated in the structure that reduces the storage volume or otherwise hinders the performance of the facility.
 - b. Visual inspection for structural deterioration, spalling, or cracking of the structural components.
2. The flow control manholes shall be inspected after each runoff producing storm event to check for debris and/or sediment accumulation that may compromise the performance of the structure. Such debris and sediments shall be removed immediately.

Manufactured Treatment Devices (MTDs):

1. The maintenance and inspection of all manufactured treatment devices (MTDs) shall be in accordance with the system manufacturer's guidelines at an interval not to exceed every (12) twelve months. Any repairs necessary to areas of failure/concern discovered during inspection shall be completed promptly by the property owner.
2. Up-to-date maintenance and inspection requirements can be found by contacting the following manufacturers:

- a. StormTech chambers: StormTech, a division of ADS
1-888-892-2694
www.stormtech.com

Per the Town of Blacksburg stormwater ordinance, a formal maintenance agreement shall be provided to the Town for review and ultimately recorded at the Montgomery County Courthouse legally binding the identified party to the maintenance/inspection responsibilities listed above.

APPENDIX A:
SOIL MAPS & SOIL DESCRIPTIONS



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**



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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

Preface	2
How Soil Surveys Are Made	5
Soil Map	8
Soil Map.....	9
Legend.....	10
Map Unit Legend.....	11
Map Unit Descriptions.....	11
Montgomery County, Virginia.....	13
11B—Duffield-Ernest complex, 2 to 7 percent slopes.....	13
12C—Frederick and Vertrees silt loams, 7 to 15 percent slopes.....	14
16B—Groseclose and Poplimento soils, 2 to 7 percent slopes.....	16
16C—Groseclose and Poplimento soils, 7 to 15 percent slopes.....	18
Soil Information for All Uses	20
Soil Properties and Qualities.....	20
Soil Erosion Factors.....	20
K Factor, Rock Free.....	20
Soil Physical Properties.....	23
Surface Texture.....	23
Soil Qualities and Features.....	26
Hydrologic Soil Group.....	26
References	31

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

Custom Soil Resource Report

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

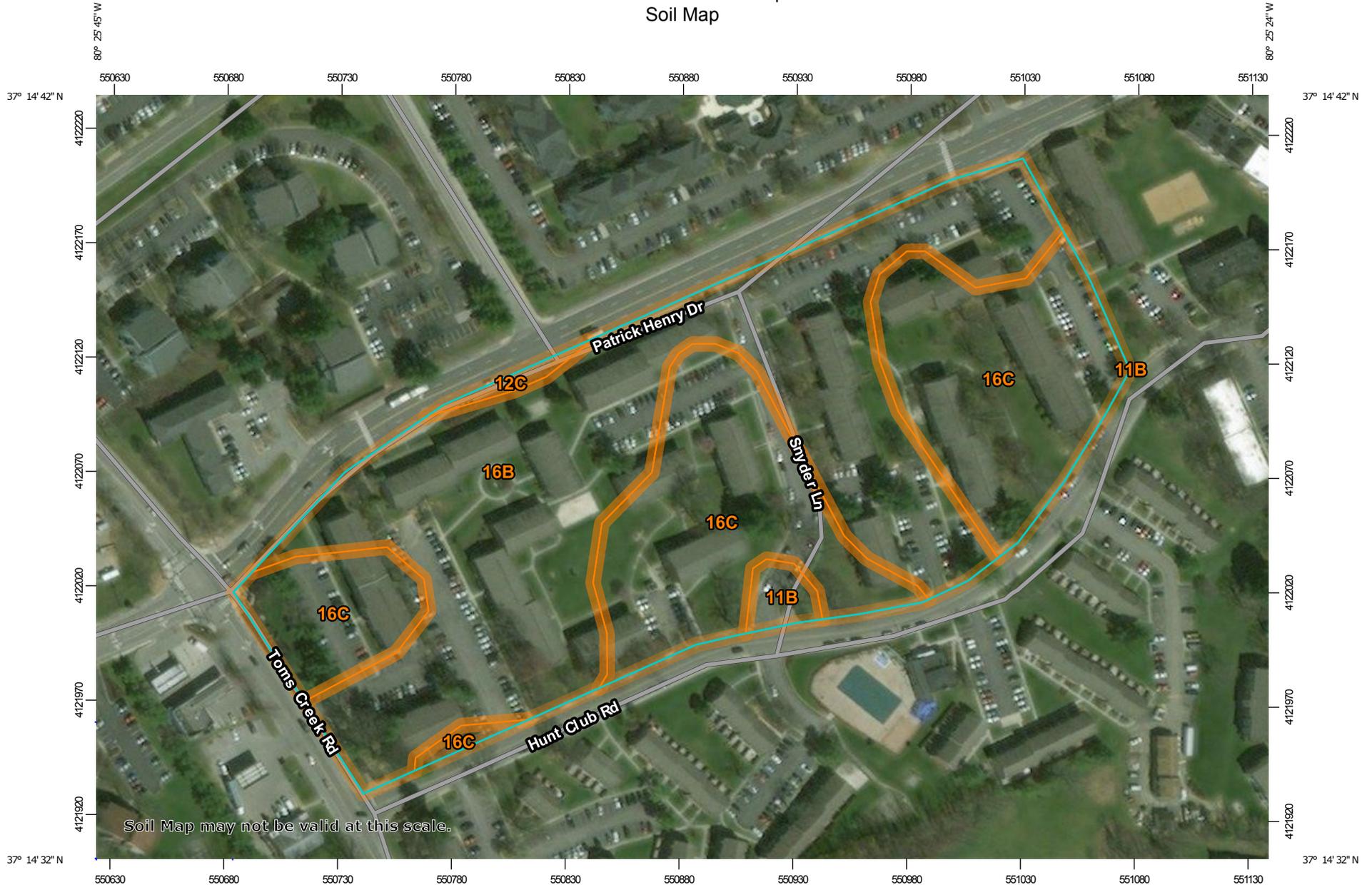
Custom Soil Resource Report

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

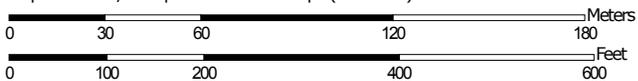
Soil Map

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.

Custom Soil Resource Report Soil Map



Map Scale: 1:2,350 if printed on A landscape (11" x 8.5") sheet.



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 10, Oct 3, 2017

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

Date(s) aerial images were photographed: Oct 22, 2012—Feb 5, 2017

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
11B	Duffield-Ernest complex, 2 to 7 percent slopes	0.2	1.4%
12C	Frederick and Vertrees silt loams, 7 to 15 percent slopes	0.1	0.7%
16B	Groseclose and Poplimento soils, 2 to 7 percent slopes	7.5	54.8%
16C	Groseclose and Poplimento soils, 7 to 15 percent slopes	5.9	43.1%
Totals for Area of Interest		13.6	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.

Custom Soil Resource Report

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

11B—Duffield-Ernest complex, 2 to 7 percent slopes

Map Unit Setting

National map unit symbol: kc1q
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: 2 to 7 percent
Depth to restrictive feature: 48 to 99 inches to lithic bedrock
Natural 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 storage in profile: High (about 10.3 inches)

Interpretive groups

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

Description of Ernest

Setting

Landform: Drainageways

Custom Soil Resource Report

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: 2 to 7 percent
Depth to restrictive feature: 20 to 35 inches to fragipan
Natural 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 storage in profile: Low (about 3.8 inches)

Interpretive groups

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

Minor Components

Purdy

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

12C—Frederick and Vertrees silt loams, 7 to 15 percent slopes

Map Unit Setting

National map unit symbol: kc1t
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

Frederick and similar soils: 40 percent

Vertrees and similar soils: 35 percent

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

Description of Frederick

Setting

Landform: Hills

Landform position (two-dimensional): Backslope, summit

Landform position (three-dimensional): Interfluve, side slope

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Limestone interbedded with siltstone and shale residuum

Typical profile

H1 - 0 to 10 inches: silt loam

H2 - 10 to 22 inches: clay

H3 - 22 to 79 inches: clay

Properties and qualities

Slope: 7 to 15 percent

Depth to restrictive feature: More than 80 inches

Natural 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 storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Other vegetative classification: Moist, Fertile Soils (G128XB001VA)

Hydric soil rating: No

Description of Vertrees

Setting

Landform: Hills

Landform position (two-dimensional): Backslope, summit

Landform position (three-dimensional): Interfluve, side slope

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Limestone, siltstone, and shale residuum

Typical profile

H1 - 0 to 10 inches: silt loam

H2 - 10 to 25 inches: silty clay

H3 - 25 to 50 inches: clay

H4 - 50 to 79 inches: clay

Properties and qualities

Slope: 7 to 15 percent

Custom Soil Resource Report

Depth to restrictive feature: More than 80 inches
Natural 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 storage in profile: Moderate (about 8.9 inches)

Interpretive groups

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

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

Custom Soil Resource Report

Depth to restrictive feature: More than 80 inches
Natural 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 storage in profile: 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
Natural 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 storage in profile: 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): Backslope, summit

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

Natural 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 storage in profile: 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): Backslope, summit

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

Natural 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 storage in profile: 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

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 Erosion Factors

Soil Erosion Factors are soil properties and interpretations used in evaluating the soil for potential erosion. Example soil erosion factors can include K factor for the whole soil or on a rock free basis, T factor, wind erodibility group and wind erodibility index.

K Factor, Rock Free

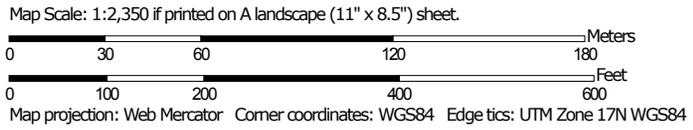
Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

"Erosion factor Kf (rock free)" indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Custom Soil Resource Report Map—K Factor, Rock Free



Soil Map may not be valid at this scale.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

-  .02
-  .05
-  .10
-  .15
-  .17
-  .20
-  .24
-  .28
-  .32
-  .37
-  .43
-  .49
-  .55
-  .64
-  Not rated or not available

Soil Rating Lines

-  .02
-  .05
-  .10
-  .15
-  .17
-  .20

-  .24
-  .28
-  .32
-  .37
-  .43
-  .49
-  .55
-  .64
-  Not rated or not available

Soil Rating Points

-  .02
-  .05
-  .10
-  .15
-  .17
-  .20
-  .24
-  .28
-  .32
-  .37
-  .43
-  .49
-  .55
-  .64
-  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 10, Oct 3, 2017

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

Date(s) aerial images were photographed: Oct 22, 2012—Feb 5, 2017

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

Table—K Factor, Rock Free

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
11B	Duffield-Ernest complex, 2 to 7 percent slopes	.28	0.2	1.4%
12C	Frederick and Vertrees silt loams, 7 to 15 percent slopes	.37	0.1	0.7%
16B	Groseclose and Poplimento soils, 2 to 7 percent slopes	.32	7.5	54.8%
16C	Groseclose and Poplimento soils, 7 to 15 percent slopes	.32	5.9	43.1%
Totals for Area of Interest			13.6	100.0%

Rating Options—K Factor, Rock Free

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Surface Texture

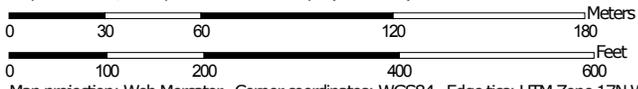
This displays the representative texture class and modifier of the surface horizon.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Custom Soil Resource Report Map—Surface Texture



Map Scale: 1:2,350 if printed on A landscape (11" x 8.5") sheet.



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

 Loam
 Silt loam
 Not rated or not available

Soil Rating Lines

 Loam
 Silt loam
 Not rated or not available

Soil Rating Points

 Loam
 Silt loam
 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 10, Oct 3, 2017

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

Date(s) aerial images were photographed: Oct 22, 2012—Feb 5, 2017

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

Table—Surface Texture

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
11B	Duffield-Ernest complex, 2 to 7 percent slopes	Silt loam	0.2	1.4%
12C	Frederick and Vertrees silt loams, 7 to 15 percent slopes	Silt loam	0.1	0.7%
16B	Groseclose and Poplimento soils, 2 to 7 percent slopes	Loam	7.5	54.8%
16C	Groseclose and Poplimento soils, 7 to 15 percent slopes	Loam	5.9	43.1%
Totals for Area of Interest			13.6	100.0%

Rating Options—Surface Texture

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options (Horizon Aggregation Method): Surface Layer (Not applicable)

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:

Custom Soil Resource Report

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.

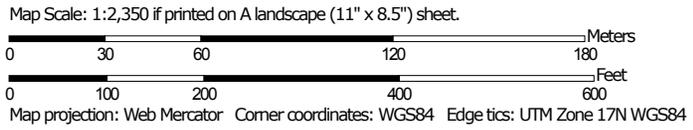
Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over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

Custom Soil Resource Report Map—Hydrologic Soil Group



Soil Map may not be valid at this scale.



MAP LEGEND

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

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

-  A
-  A/D
-  B
-  B/D

Water Features

-  Streams and Canals

Transportation

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

Background

-  Aerial Photography

Soils

-  C
-  C/D
-  D
-  Not rated or not available

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 10, Oct 3, 2017

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

Date(s) aerial images were photographed: Oct 22, 2012—Feb 5, 2017

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
11B	Duffield-Ernest complex, 2 to 7 percent slopes	B	0.2	1.4%
12C	Frederick and Vertrees silt loams, 7 to 15 percent slopes	B	0.1	0.7%
16B	Groseclose and Poplimento soils, 2 to 7 percent slopes	C	7.5	54.8%
16C	Groseclose and Poplimento soils, 7 to 15 percent slopes	C	5.9	43.1%
Totals for Area of Interest			13.6	100.0%

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

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Custom Soil Resource Report

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

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APPENDIX B:
DRAINAGE MAPS



TERRACE VIEW PHASE I PRD
HUNT CLUB ROAD
PRE-DEVELOPMENT DRAINAGE MAP
PRICES FORK MAGISTERIAL DISTRICT
TOWN OF BLACKSBURG, VA

DRAWN BY GLM

DESIGNED BY GLM

CHECKED BY SMS

DATE 5/1/18

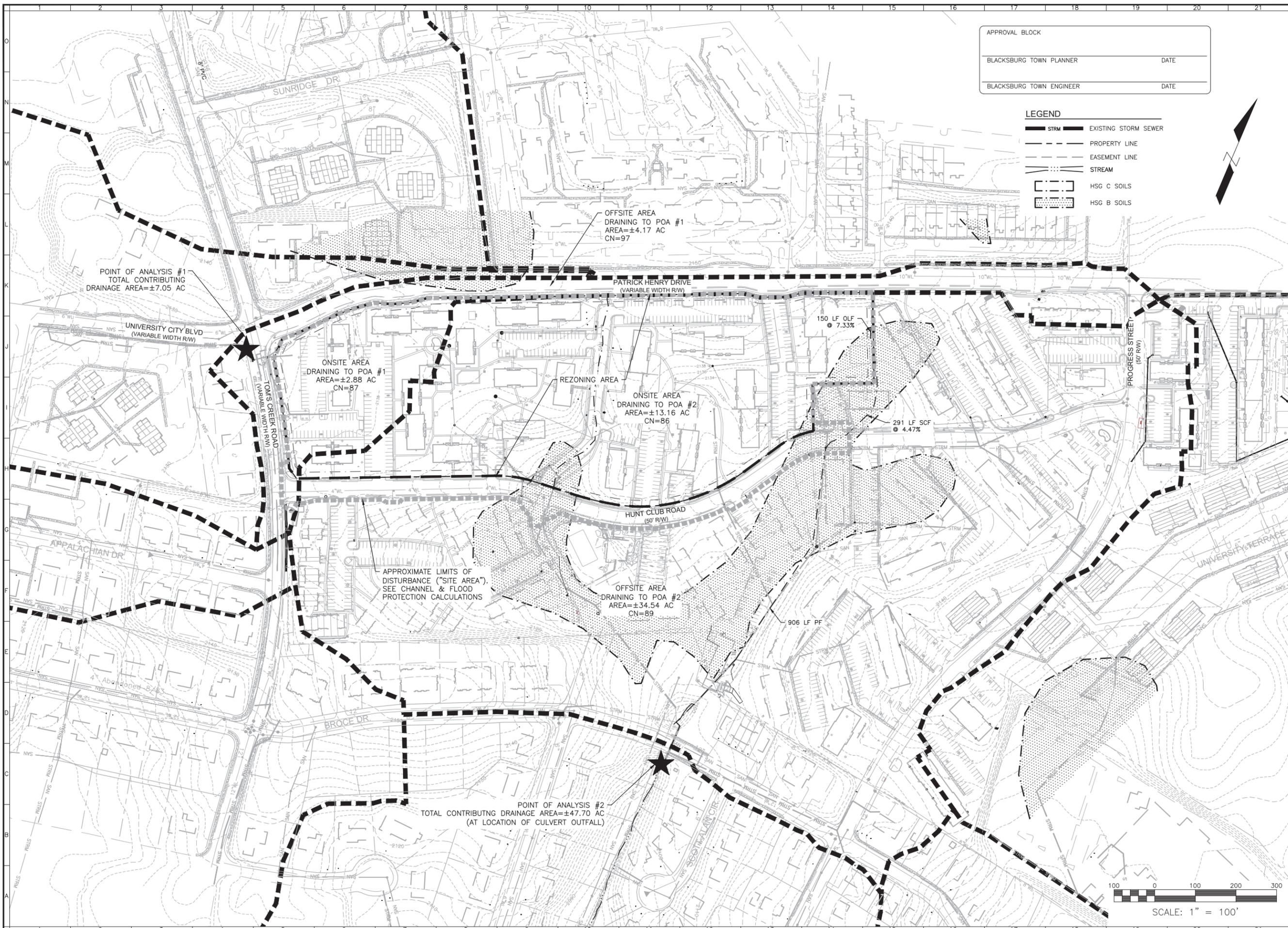
SCALE 1"=100'

REVISIONS:

SHEET NO.

SW3

JOB NO. 24170107.00



APPROVAL BLOCK	
BLACKSBURG TOWN PLANNER	DATE
BLACKSBURG TOWN ENGINEER	DATE

- LEGEND**
- STRM — EXISTING STORM SEWER
 - - - - - PROPERTY LINE
 - - - - - EASEMENT LINE
 - — — — — STREAM
 - HSG C SOILS
 - ▨ HSG B SOILS



POINT OF ANALYSIS #1
TOTAL CONTRIBUTING
DRAINAGE AREA=±7.05 AC

OFFSITE AREA
DRAINING TO POA #1
AREA=±4.17 AC
CN=97

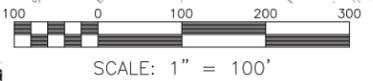
ONSITE AREA
DRAINING TO POA #1
AREA=±2.88 AC
CN=87

ONSITE AREA
DRAINING TO POA #2
AREA=±13.16 AC
CN=86

OFFSITE AREA
DRAINING TO POA #2
AREA=±34.54 AC
CN=89

APPROXIMATE LIMITS OF
DISTURBANCE ("SITE AREA").
SEE CHANNEL & FLOOD
PROTECTION CALCULATIONS

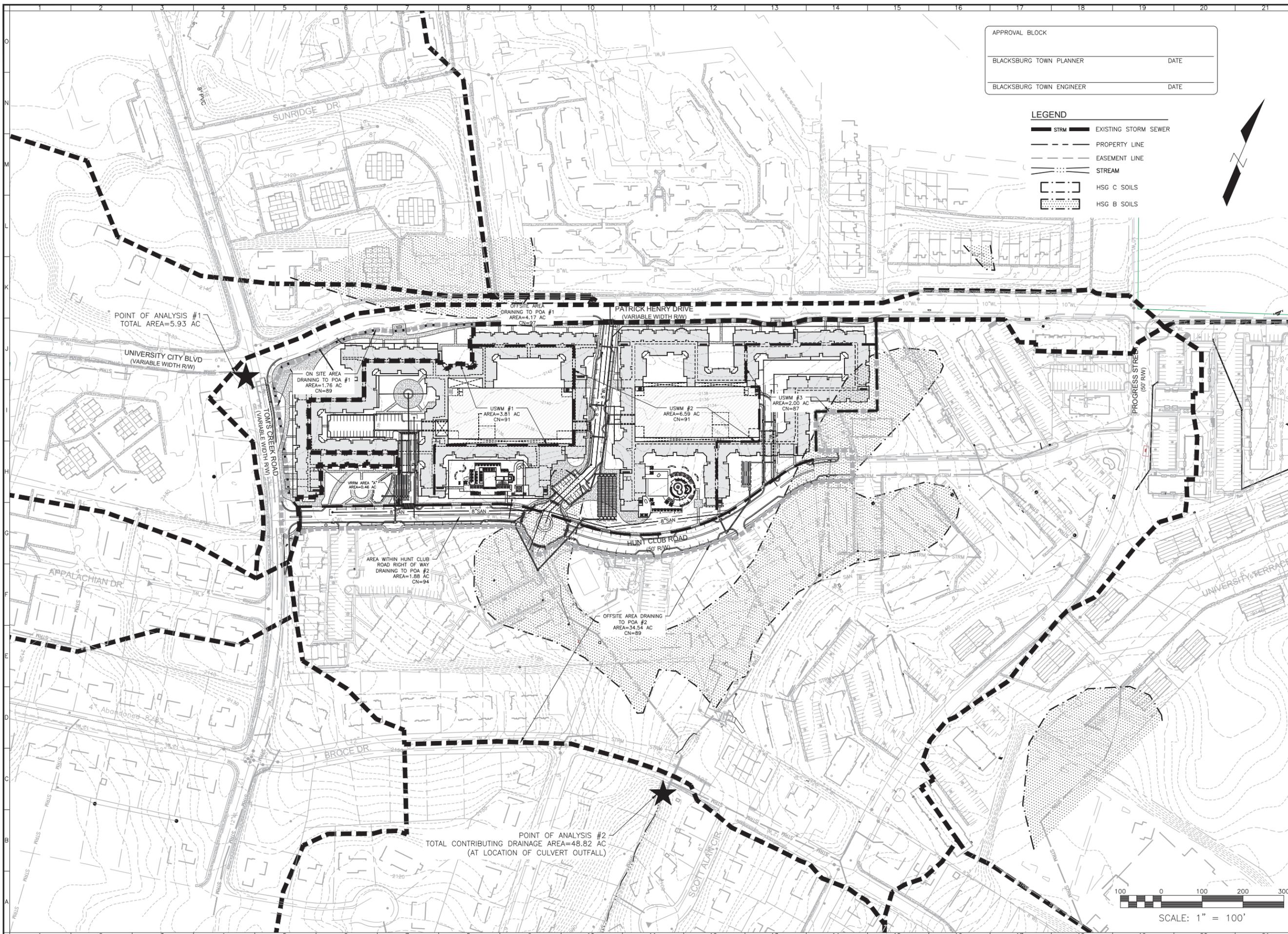
POINT OF ANALYSIS #2
TOTAL CONTRIBUTING DRAINAGE AREA=±47.70 AC
(AT LOCATION OF CULVERT OUTFALL)





APPROVAL BLOCK	
BLACKSBURG TOWN PLANNER	DATE
BLACKSBURG TOWN ENGINEER	DATE

- LEGEND**
- STRM
 - EXISTING STORM SEWER
 - PROPERTY LINE
 - EASEMENT LINE
 - STREAM
 - HSG C SOILS
 - HSG B SOILS

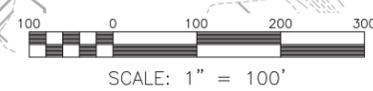


TERRACE VIEW PHASE I PRD
HUNT CLUB ROAD
POST-DEVELOPMENT DRAINAGE MAP
PRICES FORK MAGISTERIAL DISTRICT
TOWN OF BLACKSBURG, VA

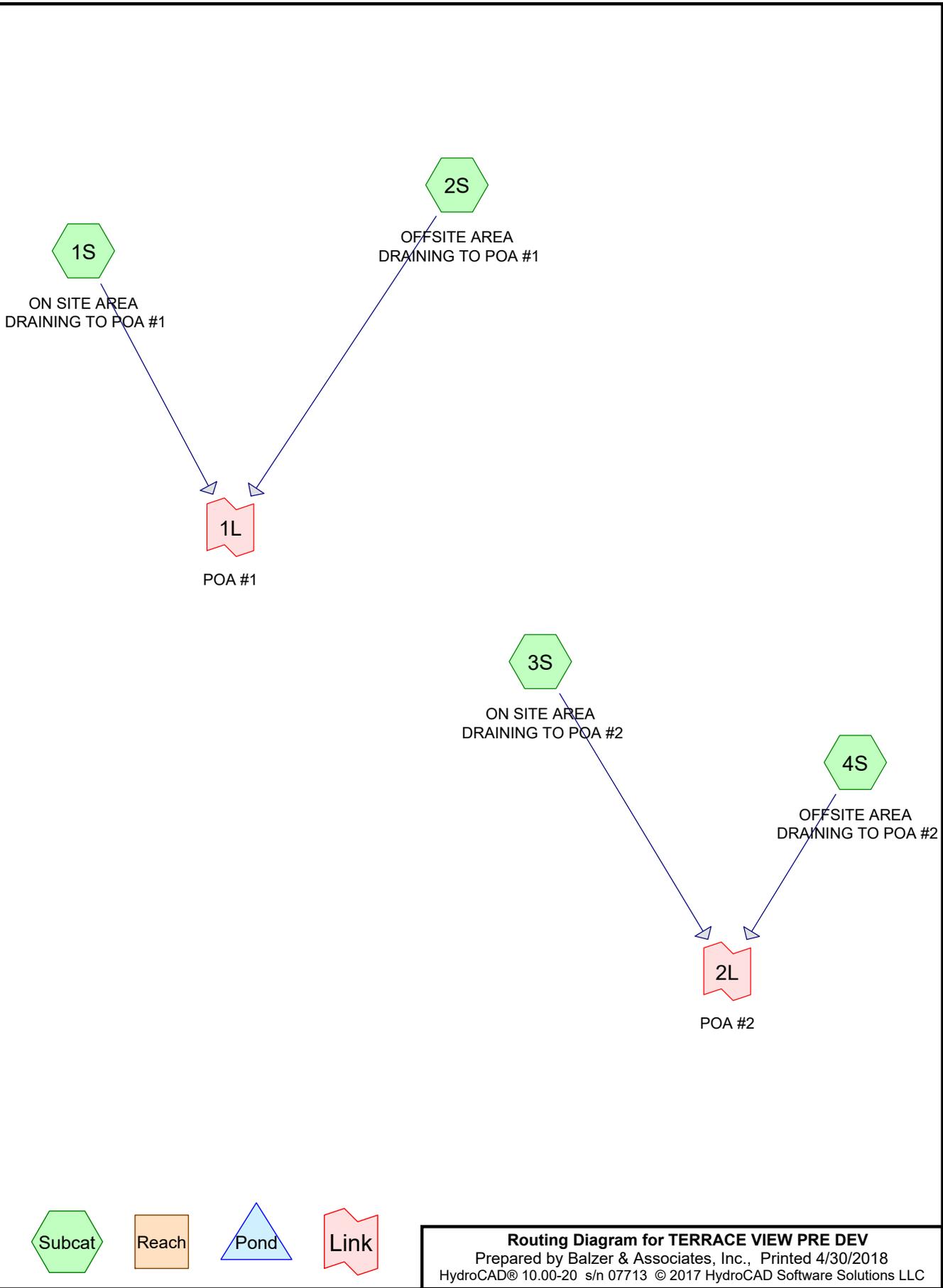
DRAWN BY GLM
DESIGNED BY GLM
CHECKED BY SMS
DATE 5/1/18
SCALE 1"=100'

REVISIONS:

SHEET NO.
SW4
JOB NO. 24170107.00



APPENDIX C:
STORMWATER MANAGEMENT CALCULATIONS



Routing Diagram for TERRACE VIEW PRE DEV
 Prepared by Balzer & Associates, Inc., Printed 4/30/2018
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TERRACE VIEW PRE DEV

Prepared by Balzer & Associates, Inc.

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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.350	81	1/3 acre lots, 30% imp, HSG C (4S)
0.200	83	1/4 acre lots, 38% imp, HSG C (4S)
5.650	85	1/8 acre lots, 65% imp, HSG B (3S, 4S)
23.950	90	1/8 acre lots, 65% imp, HSG C (2S, 3S, 4S)
0.830	61	>75% Grass cover, Good, HSG B (3S, 4S)
8.350	74	>75% Grass cover, Good, HSG C (1S, 3S, 4S)
0.010	98	Paved parking, HSG B (3S)
6.030	98	Paved parking, HSG C (1S, 3S)
0.640	98	Paved roads w/curbs & sewers, HSG B (2S, 3S, 4S)
8.470	98	Paved roads w/curbs & sewers, HSG C (1S, 2S, 3S, 4S)
0.270	94	Urban commercial, 85% imp, HSG C (2S)
54.750	89	TOTAL AREA

TERRACE VIEW PRE DEV

VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Prepared by Balzer & Associates, Inc.

Printed 4/30/2018

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Page 3

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: ON SITE AREA DRAINING TO POA #1 Runoff Area=2.880 ac Runoff Depth=1.35"
Tc=6.0 min CN=WQ Runoff=5.07 cfs 0.325 af

Subcatchment 2S: OFFSITE AREA DRAINING TO POA #1 Runoff Area=4.170 ac Runoff Depth=1.91"
Tc=6.0 min CN=WQ Runoff=10.76 cfs 0.663 af

Subcatchment 3S: ON SITE AREA DRAINING TO POA #2 Runoff Area=13.160 ac Runoff Depth=1.29"
Flow Length=1,347' Tc=13.6 min CN=WQ Runoff=15.98 cfs 1.410 af

Subcatchment 4S: OFFSITE AREA DRAINING TO POA #2 Runoff Area=34.540 ac Runoff Depth=1.29"
Flow Length=1,347' Tc=13.6 min CN=WQ Runoff=45.96 cfs 3.720 af

Link 1L: POA #1 Inflow=15.83 cfs 0.988 af
Primary=15.83 cfs 0.988 af

Link 2L: POA #2 Inflow=61.94 cfs 5.130 af
Primary=61.94 cfs 5.130 af

Total Runoff Area = 54.750 ac Runoff Volume = 6.118 af Average Runoff Depth = 1.34"

Summary for Subcatchment 1S: ON SITE AREA DRAINING TO POA #1

Runoff = 5.07 cfs @ 12.04 hrs, Volume= 0.325 af, Depth= 1.35"

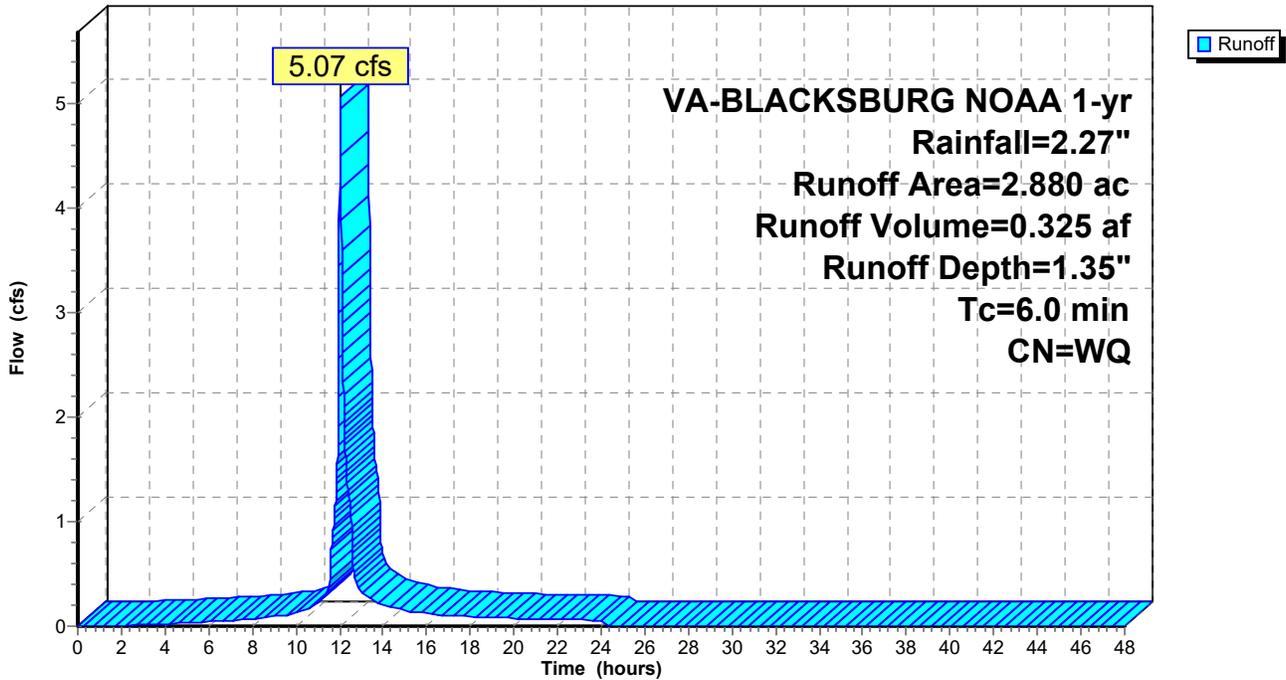
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
1.270	74	>75% Grass cover, Good, HSG C
0.090	98	Paved roads w/curbs & sewers, HSG C
1.520	98	Paved parking, HSG C
2.880		Weighted Average

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

Subcatchment 1S: ON SITE AREA DRAINING TO POA #1

Hydrograph



Summary for Subcatchment 2S: OFFSITE AREA DRAINING TO POA #1

Runoff = 10.76 cfs @ 12.04 hrs, Volume= 0.663 af, Depth= 1.91"

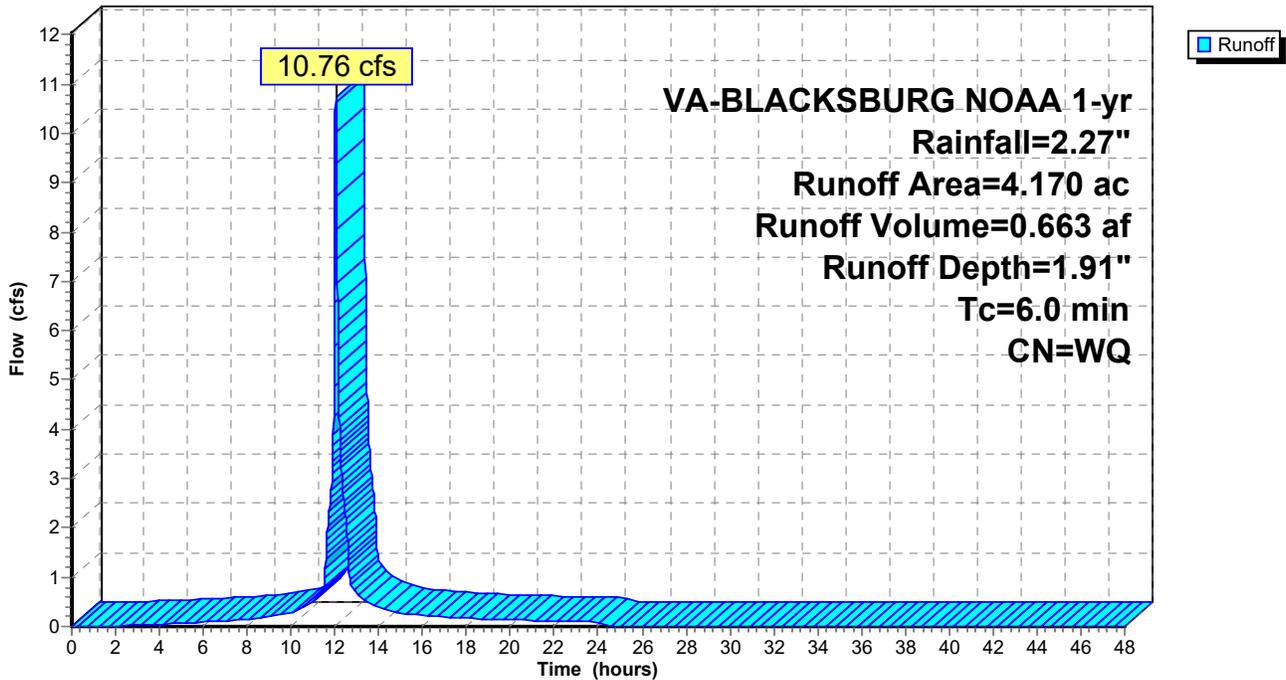
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.640	90	1/8 acre lots, 65% imp, HSG C
0.270	94	Urban commercial, 85% imp, HSG C
0.150	98	Paved roads w/curbs & sewers, HSG B
3.110	98	Paved roads w/curbs & sewers, HSG C
4.170		Weighted Average

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

Subcatchment 2S: OFFSITE AREA DRAINING TO POA #1

Hydrograph



Summary for Subcatchment 3S: ON SITE AREA DRAINING TO POA #2

Runoff = 15.98 cfs @ 12.14 hrs, Volume= 1.410 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.370	61	>75% Grass cover, Good, HSG B
5.770	74	>75% Grass cover, Good, HSG C
0.150	85	1/8 acre lots, 65% imp, HSG B
0.130	90	1/8 acre lots, 65% imp, HSG C
0.470	98	Paved roads w/curbs & sewers, HSG B
1.750	98	Paved roads w/curbs & sewers, HSG C
0.010	98	Paved parking, HSG B
4.510	98	Paved parking, HSG C

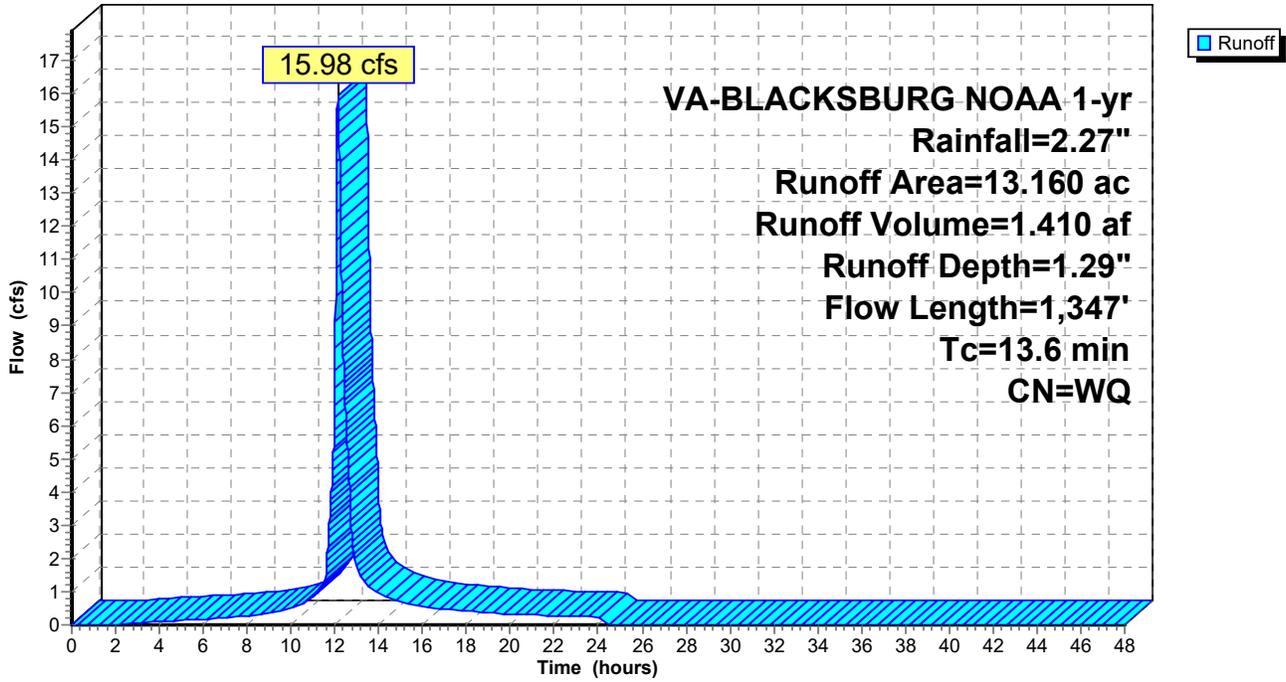
13.160 Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030 Corrugated metal
0.1	101	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013

13.6 1,347 Total

Subcatchment 3S: ON SITE AREA DRAINING TO POA #2

Hydrograph



Summary for Subcatchment 4S: OFFSITE AREA DRAINING TO POA #2

Runoff = 45.96 cfs @ 12.14 hrs, Volume= 3.720 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.460	61	>75% Grass cover, Good, HSG B
1.310	74	>75% Grass cover, Good, HSG C
0.200	83	1/4 acre lots, 38% imp, HSG C
0.350	81	1/3 acre lots, 30% imp, HSG C
5.500	85	1/8 acre lots, 65% imp, HSG B
23.180	90	1/8 acre lots, 65% imp, HSG C
0.020	98	Paved roads w/curbs & sewers, HSG B
3.520	98	Paved roads w/curbs & sewers, HSG C

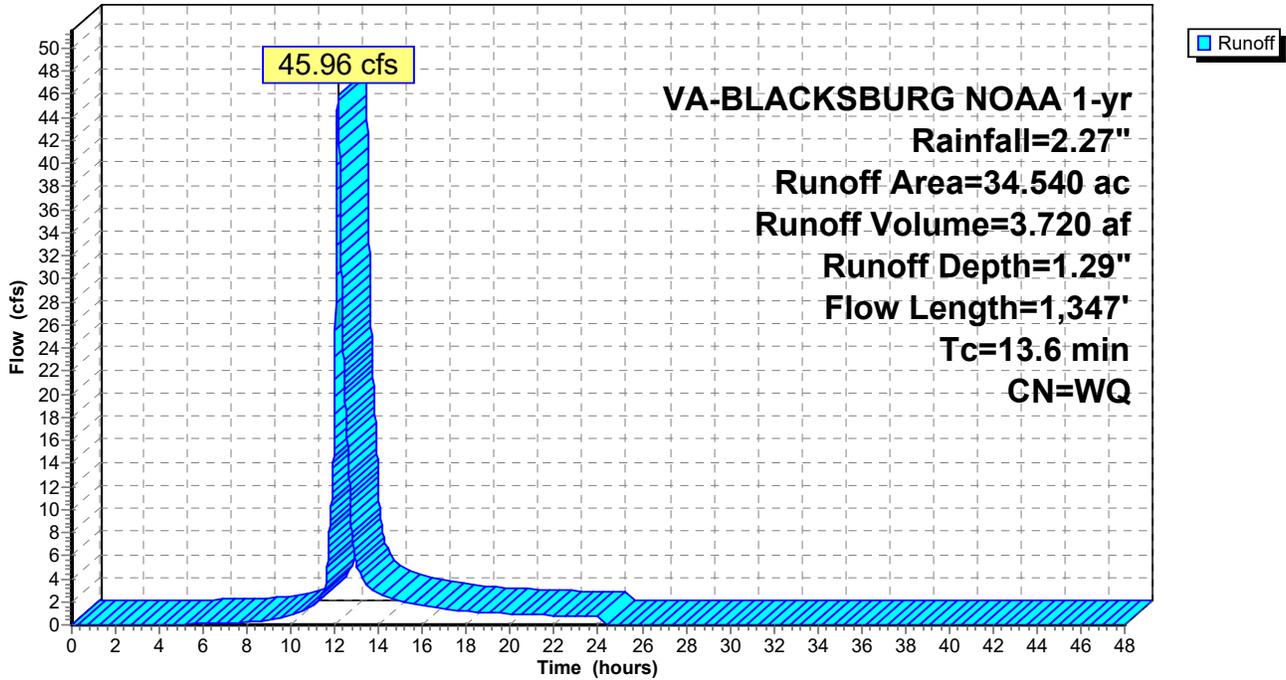
34.540 Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030 Corrugated metal
0.1	101	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013

13.6 1,347 Total

Subcatchment 4S: OFFSITE AREA DRAINING TO POA #2

Hydrograph



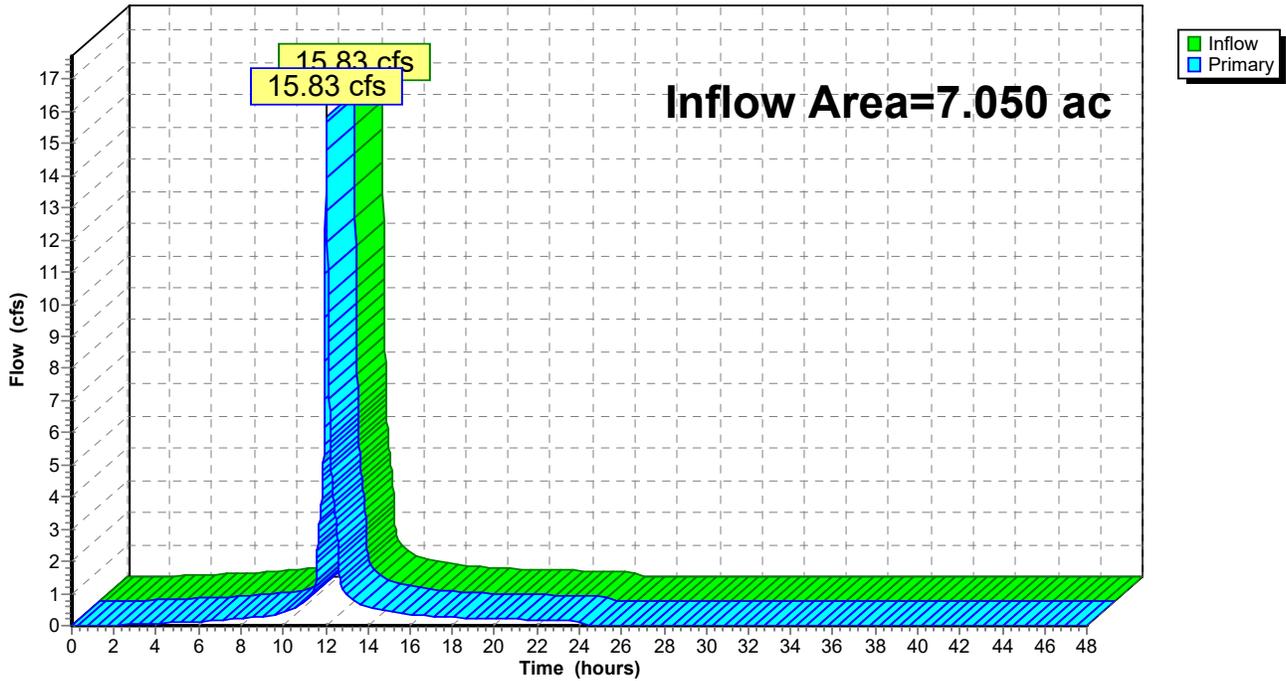
Summary for Link 1L: POA #1

Inflow Area = 7.050 ac, Inflow Depth = 1.68" for 1-yr event
Inflow = 15.83 cfs @ 12.04 hrs, Volume= 0.988 af
Primary = 15.83 cfs @ 12.04 hrs, Volume= 0.988 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: POA #1

Hydrograph



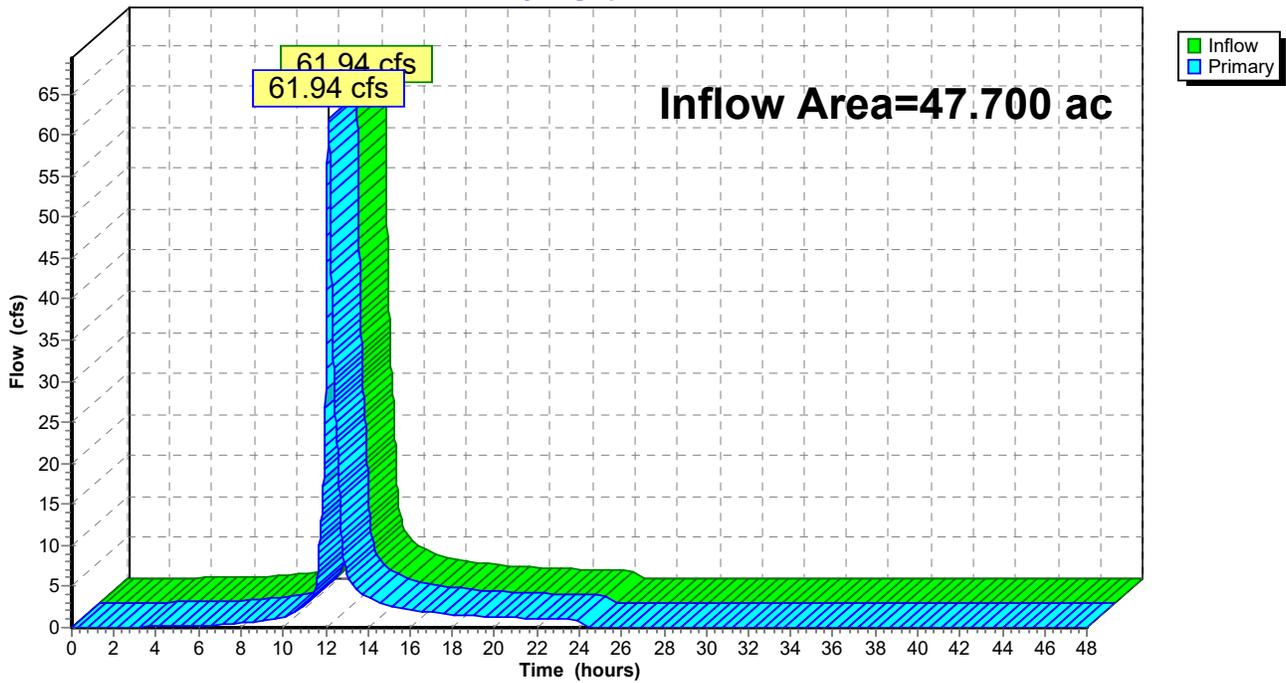
Summary for Link 2L: POA #2

Inflow Area = 47.700 ac, Inflow Depth = 1.29" for 1-yr event
Inflow = 61.94 cfs @ 12.14 hrs, Volume= 5.130 af
Primary = 61.94 cfs @ 12.14 hrs, Volume= 5.130 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 2L: POA #2

Hydrograph



TERRACE VIEW PRE DEV

VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Prepared by Balzer & Associates, Inc.

Printed 4/30/2018

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Page 12

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: ON SITE AREA DRAINING TO POA #1 Runoff Area=2.880 ac Runoff Depth=1.74"
Tc=6.0 min CN=WQ Runoff=6.55 cfs 0.418 af

Subcatchment 2S: OFFSITE AREA DRAINING TO POA #1 Runoff Area=4.170 ac Runoff Depth=2.38"
Tc=6.0 min CN=WQ Runoff=13.25 cfs 0.826 af

Subcatchment 3S: ON SITE AREA DRAINING TO POA #2 Runoff Area=13.160 ac Runoff Depth=1.66"
Flow Length=1,347' Tc=13.6 min CN=WQ Runoff=20.80 cfs 1.822 af

Subcatchment 4S: OFFSITE AREA DRAINING TO POA #2 Runoff Area=34.540 ac Runoff Depth=1.71"
Flow Length=1,347' Tc=13.6 min CN=WQ Runoff=60.83 cfs 4.914 af

Link 1L: POA #1 Inflow=19.80 cfs 1.243 af
Primary=19.80 cfs 1.243 af

Link 2L: POA #2 Inflow=81.64 cfs 6.737 af
Primary=81.64 cfs 6.737 af

Total Runoff Area = 54.750 ac Runoff Volume = 7.980 af Average Runoff Depth = 1.75"

Summary for Subcatchment 1S: ON SITE AREA DRAINING TO POA #1

Runoff = 6.55 cfs @ 12.04 hrs, Volume= 0.418 af, Depth= 1.74"

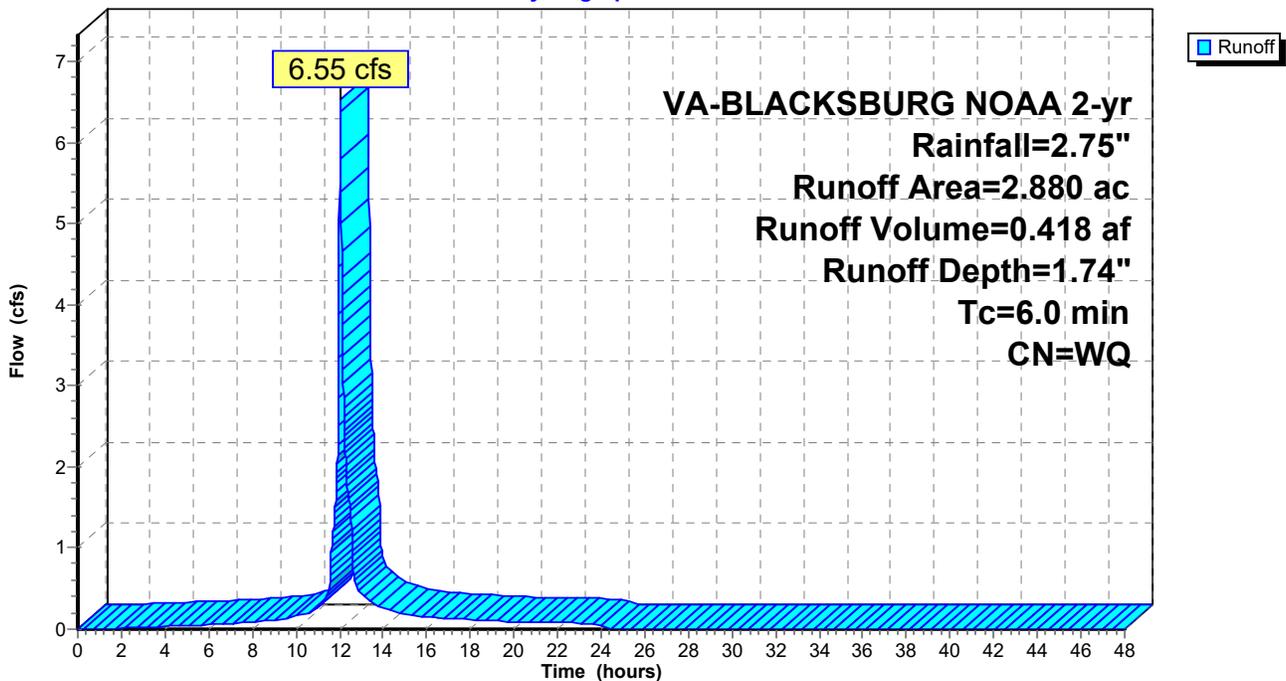
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
1.270	74	>75% Grass cover, Good, HSG C
0.090	98	Paved roads w/curbs & sewers, HSG C
1.520	98	Paved parking, HSG C
2.880		Weighted Average

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

Subcatchment 1S: ON SITE AREA DRAINING TO POA #1

Hydrograph



Summary for Subcatchment 2S: OFFSITE AREA DRAINING TO POA #1

Runoff = 13.25 cfs @ 12.04 hrs, Volume= 0.826 af, Depth= 2.38"

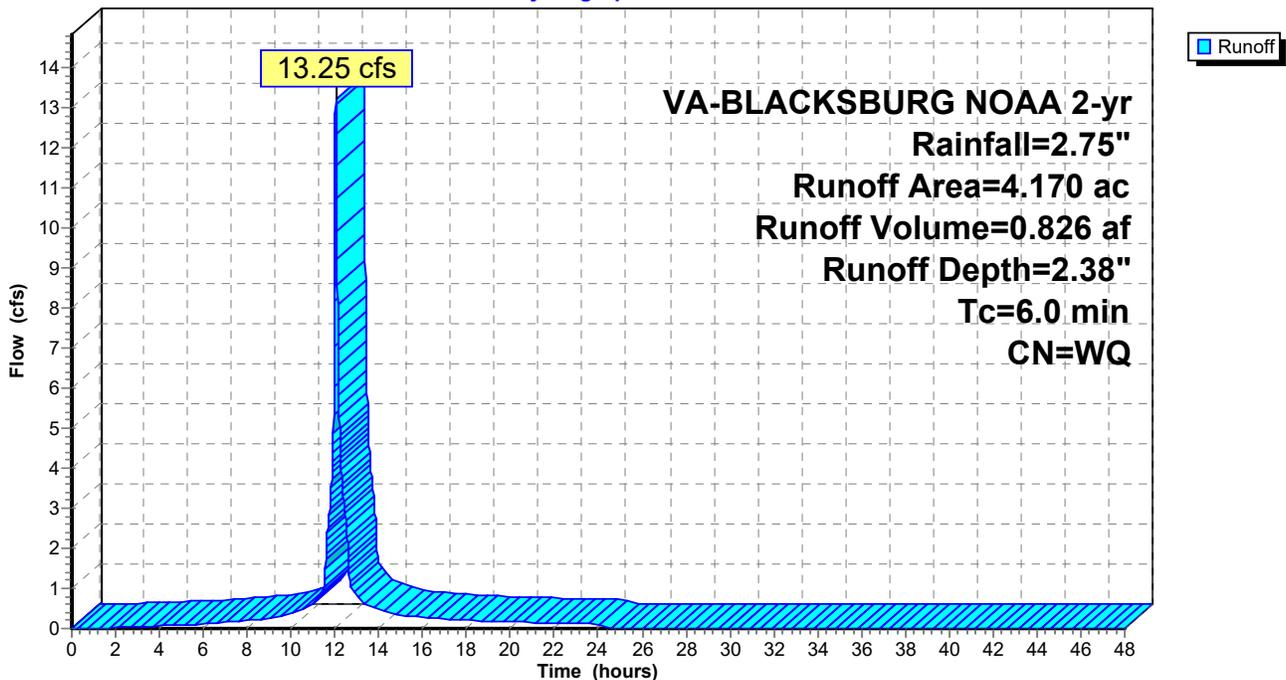
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.640	90	1/8 acre lots, 65% imp, HSG C
0.270	94	Urban commercial, 85% imp, HSG C
0.150	98	Paved roads w/curbs & sewers, HSG B
3.110	98	Paved roads w/curbs & sewers, HSG C
4.170		Weighted Average

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

Subcatchment 2S: OFFSITE AREA DRAINING TO POA #1

Hydrograph



Summary for Subcatchment 3S: ON SITE AREA DRAINING TO POA #2

Runoff = 20.80 cfs @ 12.14 hrs, Volume= 1.822 af, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.370	61	>75% Grass cover, Good, HSG B
5.770	74	>75% Grass cover, Good, HSG C
0.150	85	1/8 acre lots, 65% imp, HSG B
0.130	90	1/8 acre lots, 65% imp, HSG C
0.470	98	Paved roads w/curbs & sewers, HSG B
1.750	98	Paved roads w/curbs & sewers, HSG C
0.010	98	Paved parking, HSG B
4.510	98	Paved parking, HSG C

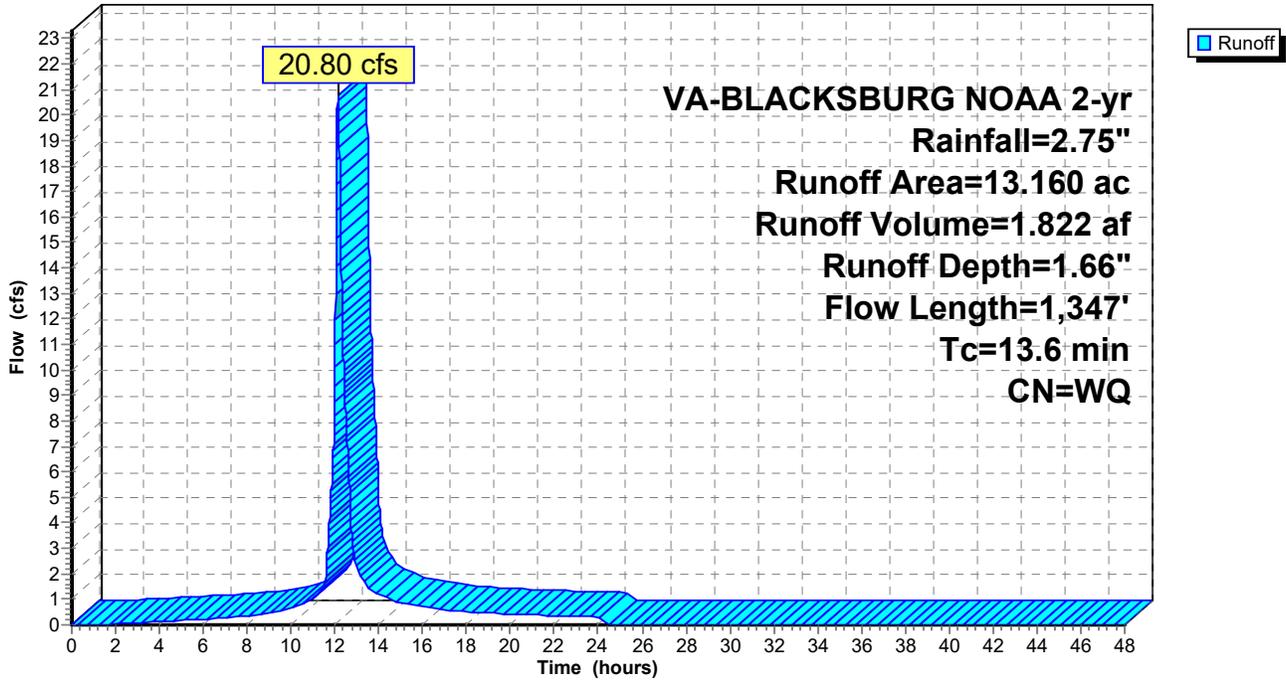
13.160 Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030 Corrugated metal
0.1	101	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013

13.6 1,347 Total

Subcatchment 3S: ON SITE AREA DRAINING TO POA #2

Hydrograph



Summary for Subcatchment 4S: OFFSITE AREA DRAINING TO POA #2

Runoff = 60.83 cfs @ 12.14 hrs, Volume= 4.914 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.460	61	>75% Grass cover, Good, HSG B
1.310	74	>75% Grass cover, Good, HSG C
0.200	83	1/4 acre lots, 38% imp, HSG C
0.350	81	1/3 acre lots, 30% imp, HSG C
5.500	85	1/8 acre lots, 65% imp, HSG B
23.180	90	1/8 acre lots, 65% imp, HSG C
0.020	98	Paved roads w/curbs & sewers, HSG B
3.520	98	Paved roads w/curbs & sewers, HSG C

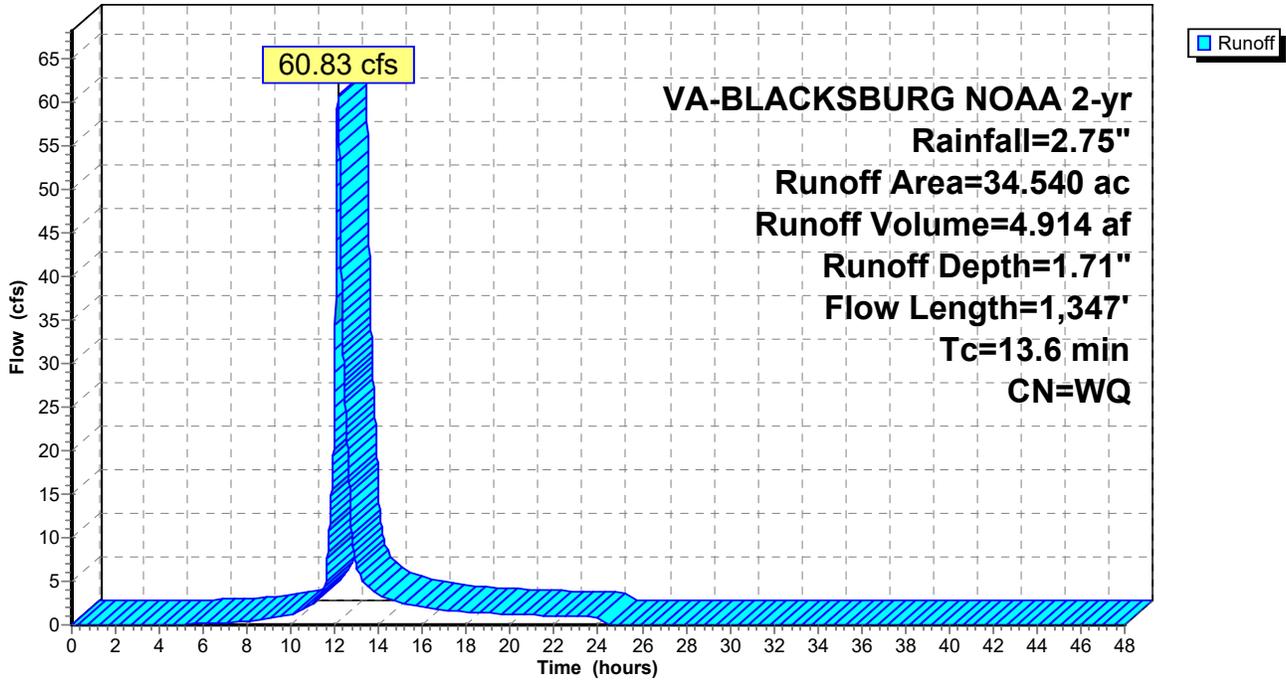
34.540 Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030 Corrugated metal
0.1	101	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013

13.6 1,347 Total

Subcatchment 4S: OFFSITE AREA DRAINING TO POA #2

Hydrograph



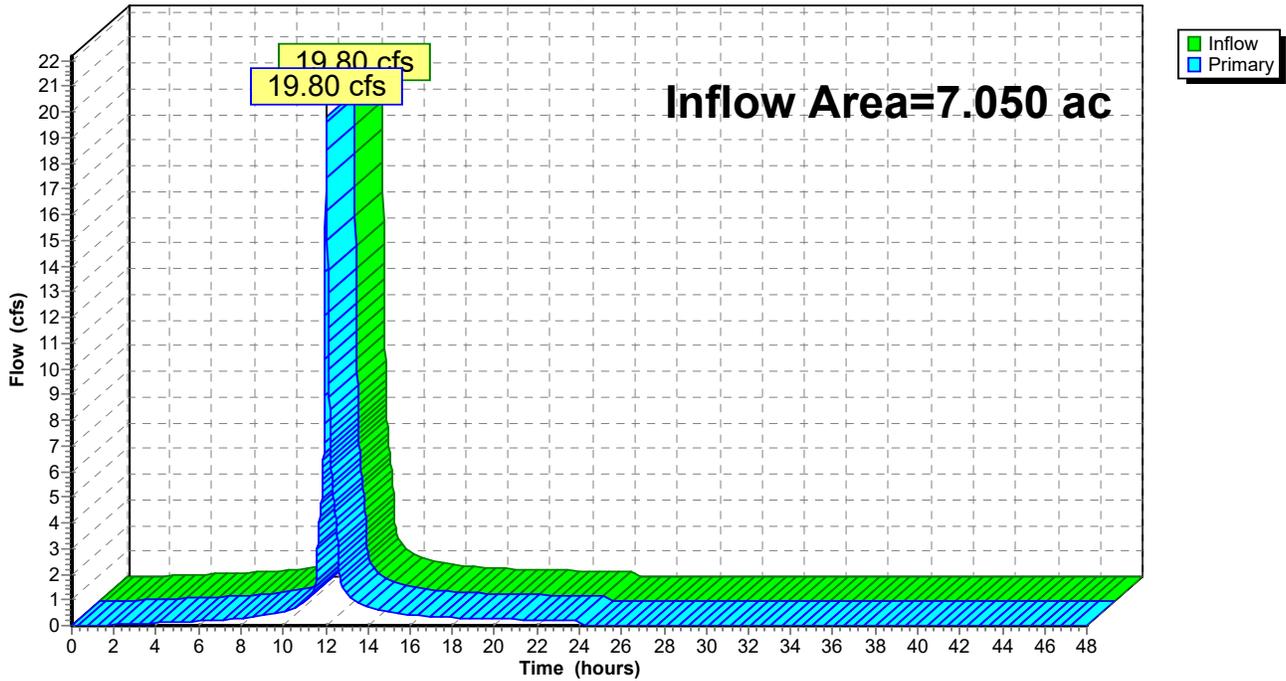
Summary for Link 1L: POA #1

Inflow Area = 7.050 ac, Inflow Depth = 2.12" for 2-yr event
Inflow = 19.80 cfs @ 12.04 hrs, Volume= 1.243 af
Primary = 19.80 cfs @ 12.04 hrs, Volume= 1.243 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: POA #1

Hydrograph



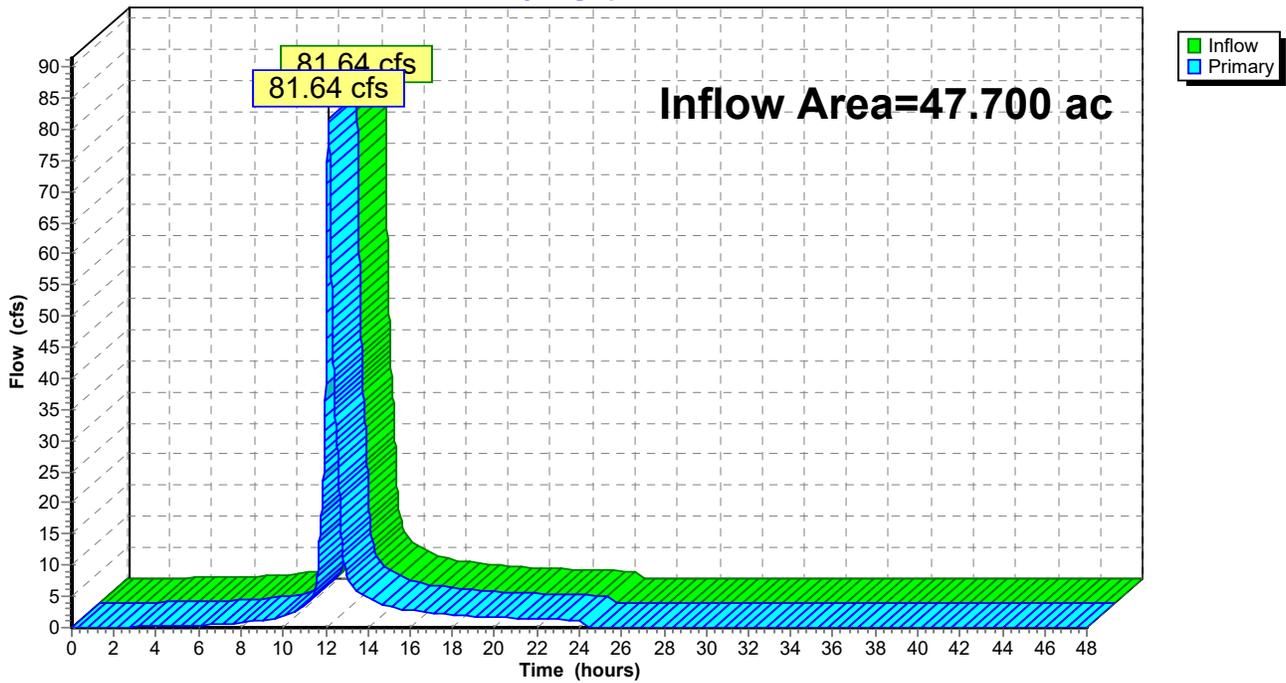
Summary for Link 2L: POA #2

Inflow Area = 47.700 ac, Inflow Depth = 1.69" for 2-yr event
Inflow = 81.64 cfs @ 12.14 hrs, Volume= 6.737 af
Primary = 81.64 cfs @ 12.14 hrs, Volume= 6.737 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 2L: POA #2

Hydrograph



TERRACE VIEW PRE DEV

VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Prepared by Balzer & Associates, Inc.

Printed 4/30/2018

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Page 21

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: ON SITE AREA DRAINING TO POA #1 Runoff Area=2.880 ac Runoff Depth=2.89"
Tc=6.0 min CN=WQ Runoff=10.04 cfs 0.693 af

Subcatchment 2S: OFFSITE AREA DRAINING TO POA #1 Runoff Area=4.170 ac Runoff Depth=3.70"
Tc=6.0 min CN=WQ Runoff=18.55 cfs 1.284 af

Subcatchment 3S: ON SITE AREA DRAINING TO POA #2 Runoff Area=13.160 ac Runoff Depth=2.79"
Flow Length=1,347' Tc=13.6 min CN=WQ Runoff=33.04 cfs 3.055 af

Subcatchment 4S: OFFSITE AREA DRAINING TO POA #2 Runoff Area=34.540 ac Runoff Depth=2.93"
Flow Length=1,347' Tc=13.6 min CN=WQ Runoff=96.87 cfs 8.422 af

Link 1L: POA #1 Inflow=28.59 cfs 1.977 af
Primary=28.59 cfs 1.977 af

Link 2L: POA #2 Inflow=129.91 cfs 11.478 af
Primary=129.91 cfs 11.478 af

Total Runoff Area = 54.750 ac Runoff Volume = 13.455 af Average Runoff Depth = 2.95"

Summary for Subcatchment 1S: ON SITE AREA DRAINING TO POA #1

Runoff = 10.04 cfs @ 12.04 hrs, Volume= 0.693 af, Depth= 2.89"

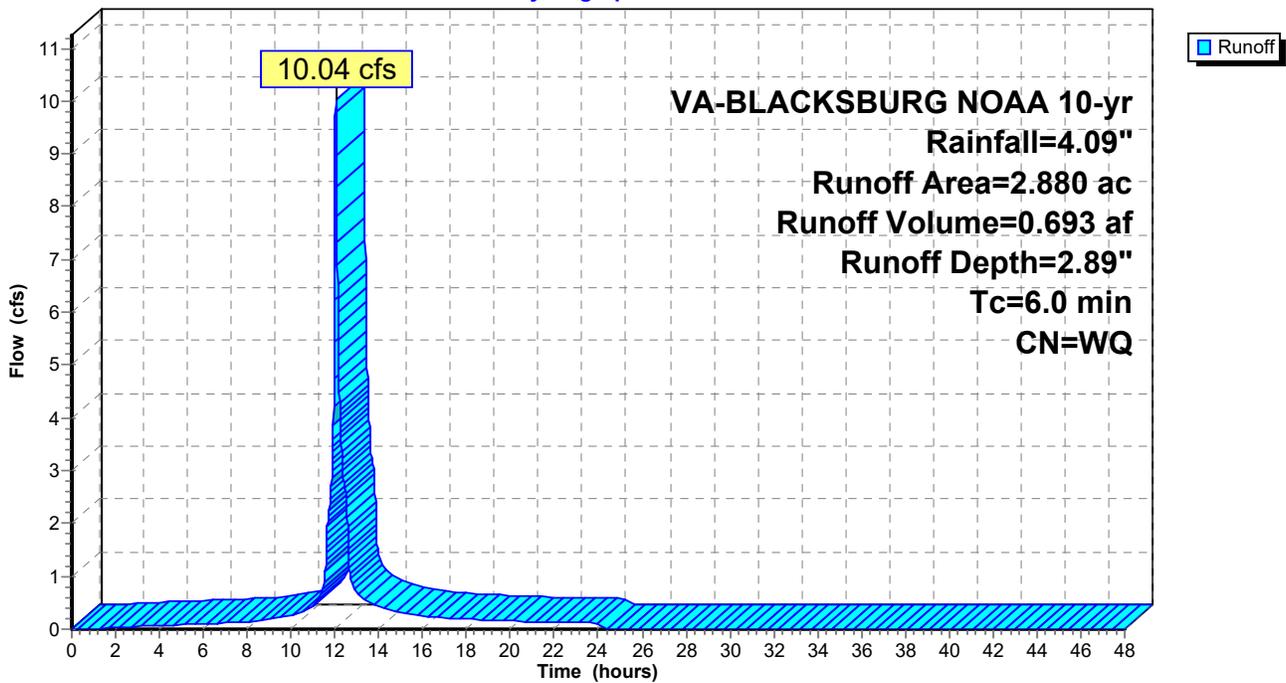
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
1.270	74	>75% Grass cover, Good, HSG C
0.090	98	Paved roads w/curbs & sewers, HSG C
1.520	98	Paved parking, HSG C
2.880		Weighted Average

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

Subcatchment 1S: ON SITE AREA DRAINING TO POA #1

Hydrograph



Summary for Subcatchment 2S: OFFSITE AREA DRAINING TO POA #1

Runoff = 18.55 cfs @ 12.04 hrs, Volume= 1.284 af, Depth= 3.70"

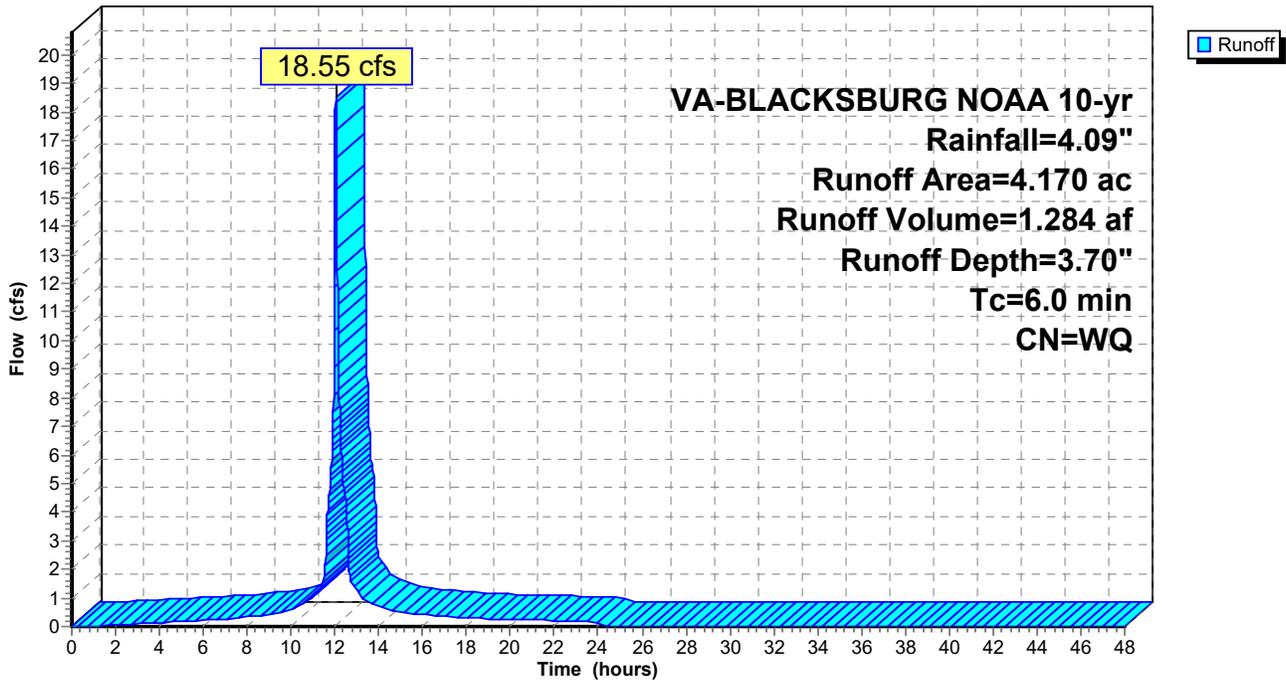
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.640	90	1/8 acre lots, 65% imp, HSG C
0.270	94	Urban commercial, 85% imp, HSG C
0.150	98	Paved roads w/curbs & sewers, HSG B
3.110	98	Paved roads w/curbs & sewers, HSG C
4.170		Weighted Average

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

Subcatchment 2S: OFFSITE AREA DRAINING TO POA #1

Hydrograph



Summary for Subcatchment 3S: ON SITE AREA DRAINING TO POA #2

Runoff = 33.04 cfs @ 12.14 hrs, Volume= 3.055 af, Depth= 2.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.370	61	>75% Grass cover, Good, HSG B
5.770	74	>75% Grass cover, Good, HSG C
0.150	85	1/8 acre lots, 65% imp, HSG B
0.130	90	1/8 acre lots, 65% imp, HSG C
0.470	98	Paved roads w/curbs & sewers, HSG B
1.750	98	Paved roads w/curbs & sewers, HSG C
0.010	98	Paved parking, HSG B
4.510	98	Paved parking, HSG C

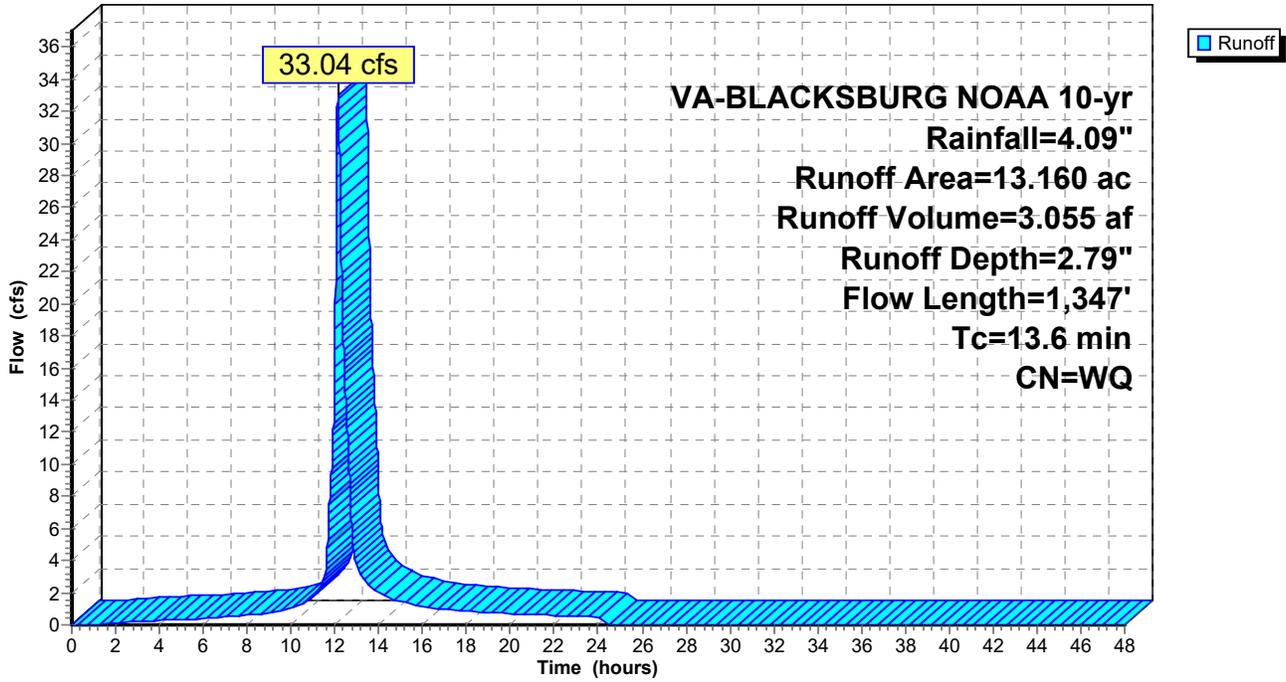
13.160 Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030 Corrugated metal
0.1	101	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013

13.6 1,347 Total

Subcatchment 3S: ON SITE AREA DRAINING TO POA #2

Hydrograph



Summary for Subcatchment 4S: OFFSITE AREA DRAINING TO POA #2

Runoff = 96.87 cfs @ 12.14 hrs, Volume= 8.422 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.460	61	>75% Grass cover, Good, HSG B
1.310	74	>75% Grass cover, Good, HSG C
0.200	83	1/4 acre lots, 38% imp, HSG C
0.350	81	1/3 acre lots, 30% imp, HSG C
5.500	85	1/8 acre lots, 65% imp, HSG B
23.180	90	1/8 acre lots, 65% imp, HSG C
0.020	98	Paved roads w/curbs & sewers, HSG B
3.520	98	Paved roads w/curbs & sewers, HSG C

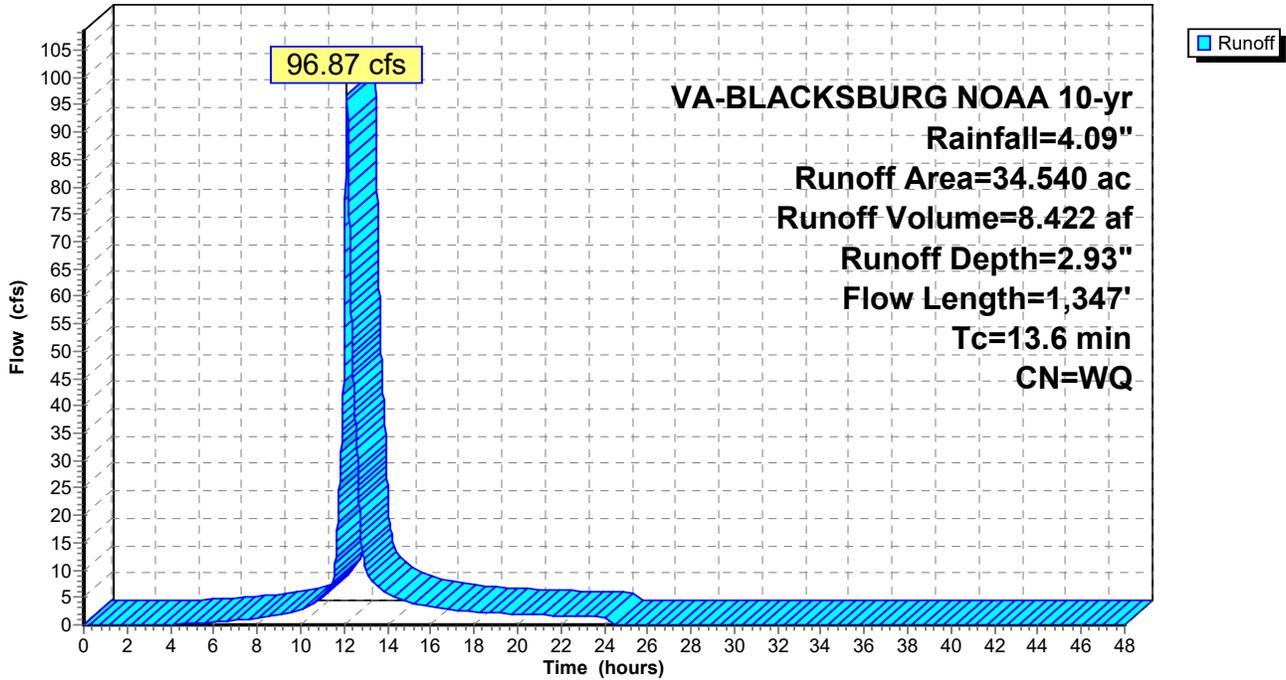
34.540 Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030 Corrugated metal
0.1	101	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013

13.6 1,347 Total

Subcatchment 4S: OFFSITE AREA DRAINING TO POA #2

Hydrograph



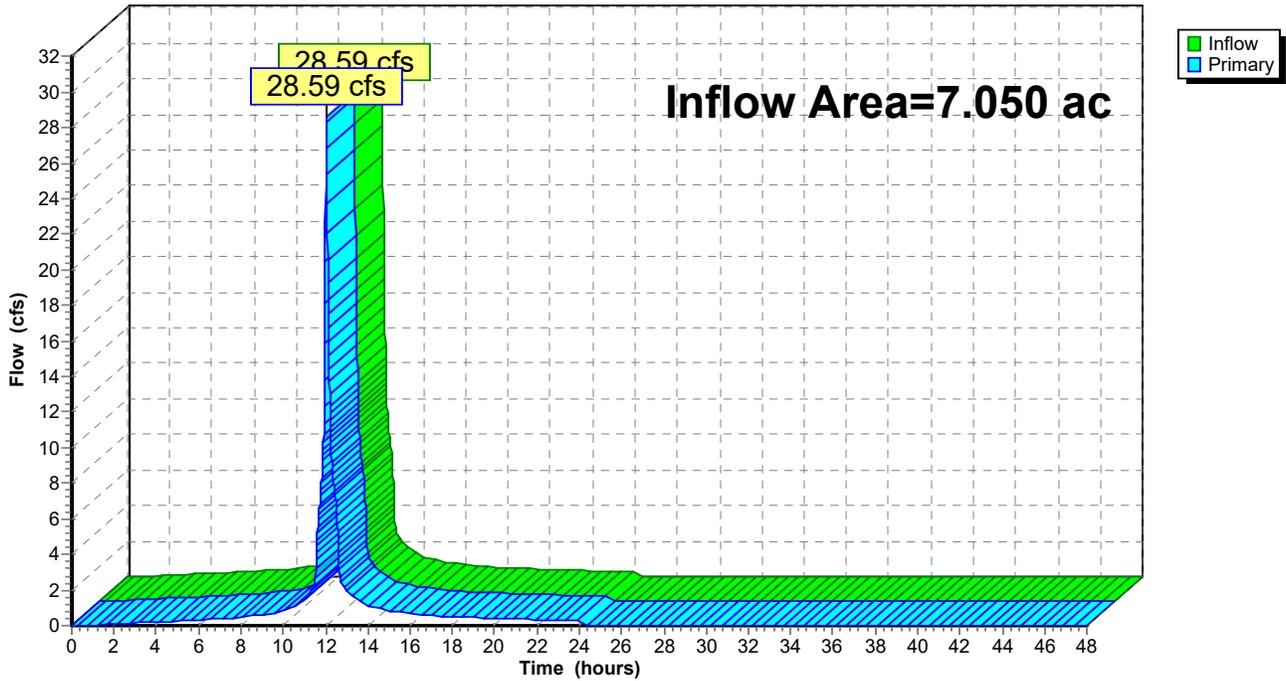
Summary for Link 1L: POA #1

Inflow Area = 7.050 ac, Inflow Depth = 3.37" for 10-yr event
Inflow = 28.59 cfs @ 12.04 hrs, Volume= 1.977 af
Primary = 28.59 cfs @ 12.04 hrs, Volume= 1.977 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: POA #1

Hydrograph



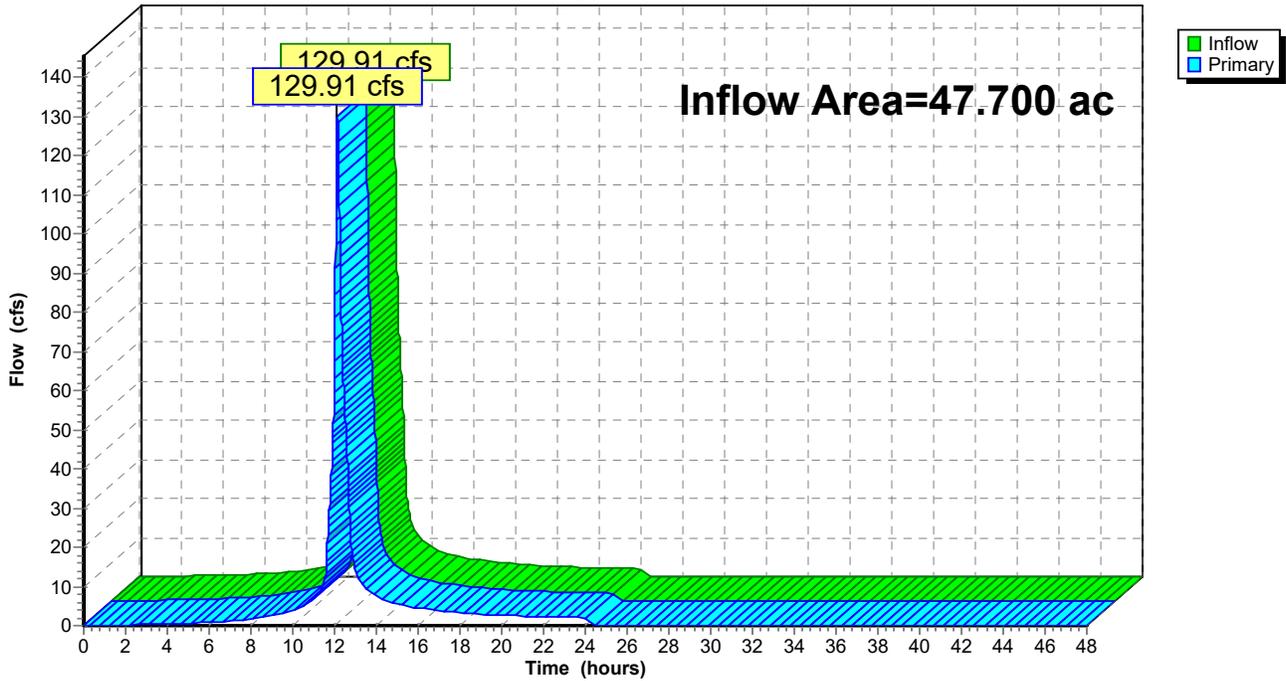
Summary for Link 2L: POA #2

Inflow Area = 47.700 ac, Inflow Depth = 2.89" for 10-yr event
Inflow = 129.91 cfs @ 12.14 hrs, Volume= 11.478 af
Primary = 129.91 cfs @ 12.14 hrs, Volume= 11.478 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 2L: POA #2

Hydrograph



TERRACE VIEW PRE DEV

VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Prepared by Balzer & Associates, Inc.

Printed 4/30/2018

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Page 30

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: ON SITE AREA DRAINING TO POA #1 Runoff Area=2.880 ac Runoff Depth=5.07"
Tc=6.0 min CN=WQ Runoff=14.99 cfs 1.218 af

Subcatchment 2S: OFFSITE AREA DRAINING TO POA #1 Runoff Area=4.170 ac Runoff Depth=6.07"
Tc=6.0 min CN=WQ Runoff=25.31 cfs 2.109 af

Subcatchment 3S: ON SITE AREA DRAINING TO POA #2 Runoff Area=13.160 ac Runoff Depth=4.94"
Flow Length=1,347' Tc=13.6 min CN=WQ Runoff=51.16 cfs 5.422 af

Subcatchment 4S: OFFSITE AREA DRAINING TO POA #2 Runoff Area=34.540 ac Runoff Depth=5.20"
Flow Length=1,347' Tc=13.6 min CN=WQ Runoff=146.42 cfs 14.970 af

Link 1L: POA #1 Inflow=40.30 cfs 3.326 af
Primary=40.30 cfs 3.326 af

Link 2L: POA #2 Inflow=197.57 cfs 20.392 af
Primary=197.57 cfs 20.392 af

Total Runoff Area = 54.750 ac Runoff Volume = 23.719 af Average Runoff Depth = 5.20"

Summary for Subcatchment 1S: ON SITE AREA DRAINING TO POA #1

Runoff = 14.99 cfs @ 12.04 hrs, Volume= 1.218 af, Depth= 5.07"

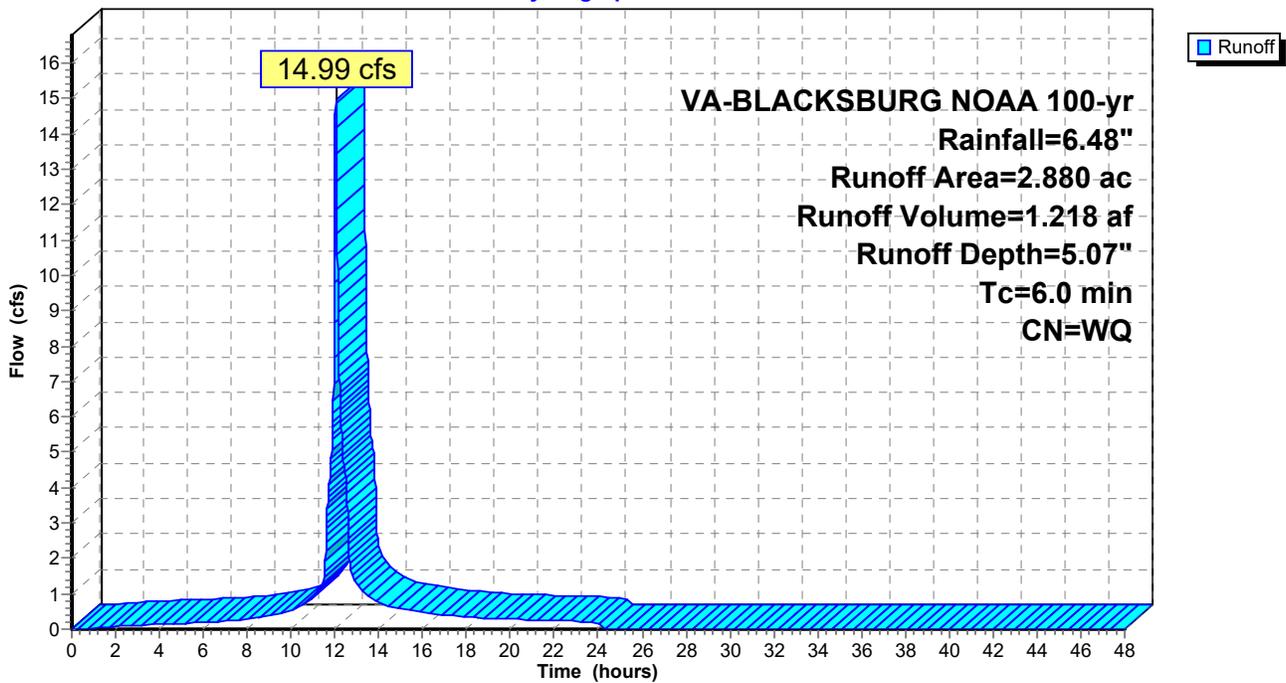
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
1.270	74	>75% Grass cover, Good, HSG C
0.090	98	Paved roads w/curbs & sewers, HSG C
1.520	98	Paved parking, HSG C
2.880		Weighted Average

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

Subcatchment 1S: ON SITE AREA DRAINING TO POA #1

Hydrograph



Summary for Subcatchment 2S: OFFSITE AREA DRAINING TO POA #1

Runoff = 25.31 cfs @ 12.04 hrs, Volume= 2.109 af, Depth= 6.07"

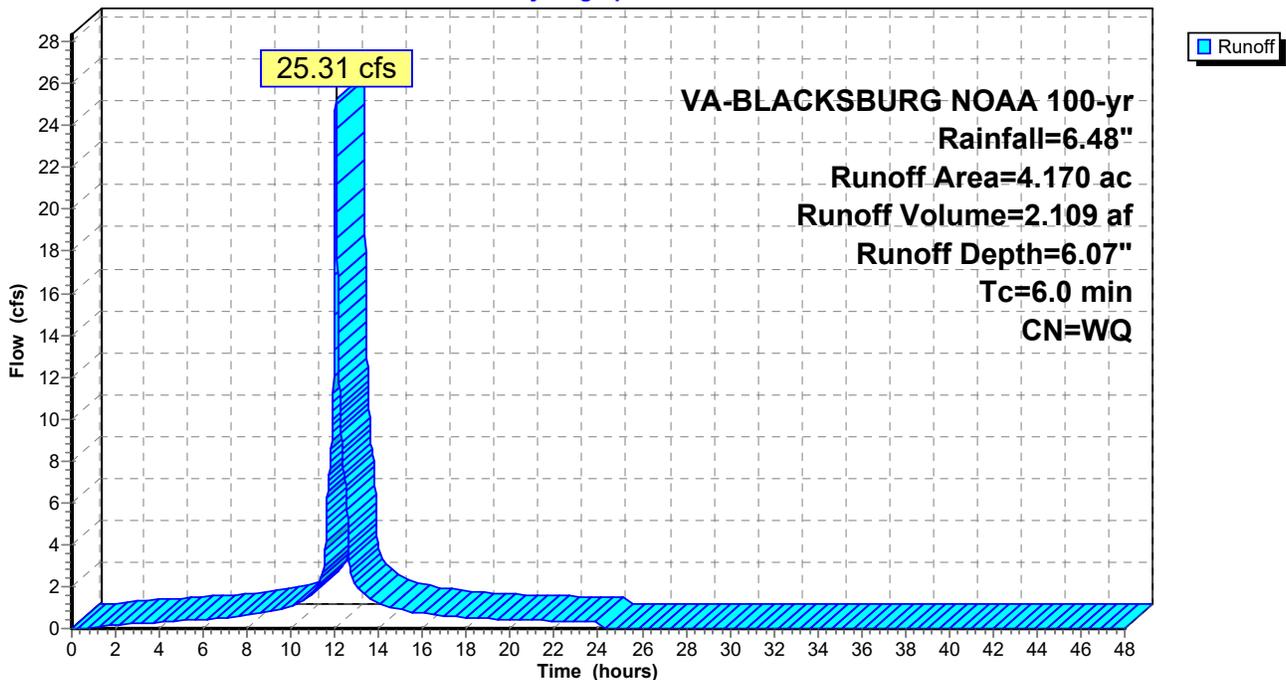
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.640	90	1/8 acre lots, 65% imp, HSG C
0.270	94	Urban commercial, 85% imp, HSG C
0.150	98	Paved roads w/curbs & sewers, HSG B
3.110	98	Paved roads w/curbs & sewers, HSG C
4.170		Weighted Average

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

Subcatchment 2S: OFFSITE AREA DRAINING TO POA #1

Hydrograph



Summary for Subcatchment 3S: ON SITE AREA DRAINING TO POA #2

Runoff = 51.16 cfs @ 12.14 hrs, Volume= 5.422 af, Depth= 4.94"

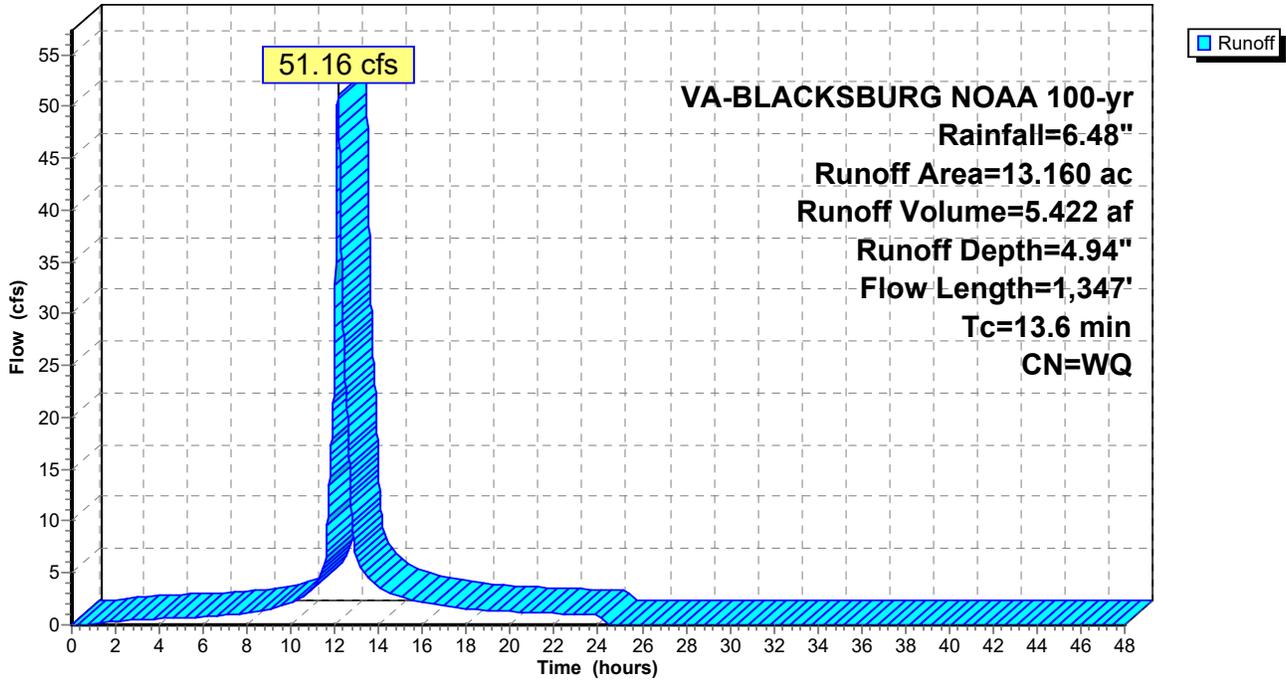
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.370	61	>75% Grass cover, Good, HSG B
5.770	74	>75% Grass cover, Good, HSG C
0.150	85	1/8 acre lots, 65% imp, HSG B
0.130	90	1/8 acre lots, 65% imp, HSG C
0.470	98	Paved roads w/curbs & sewers, HSG B
1.750	98	Paved roads w/curbs & sewers, HSG C
0.010	98	Paved parking, HSG B
4.510	98	Paved parking, HSG C
13.160		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030 Corrugated metal
0.1	101	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013
13.6	1,347	Total			

Subcatchment 3S: ON SITE AREA DRAINING TO POA #2

Hydrograph



Summary for Subcatchment 4S: OFFSITE AREA DRAINING TO POA #2

Runoff = 146.42 cfs @ 12.14 hrs, Volume= 14.970 af, Depth= 5.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.460	61	>75% Grass cover, Good, HSG B
1.310	74	>75% Grass cover, Good, HSG C
0.200	83	1/4 acre lots, 38% imp, HSG C
0.350	81	1/3 acre lots, 30% imp, HSG C
5.500	85	1/8 acre lots, 65% imp, HSG B
23.180	90	1/8 acre lots, 65% imp, HSG C
0.020	98	Paved roads w/curbs & sewers, HSG B
3.520	98	Paved roads w/curbs & sewers, HSG C

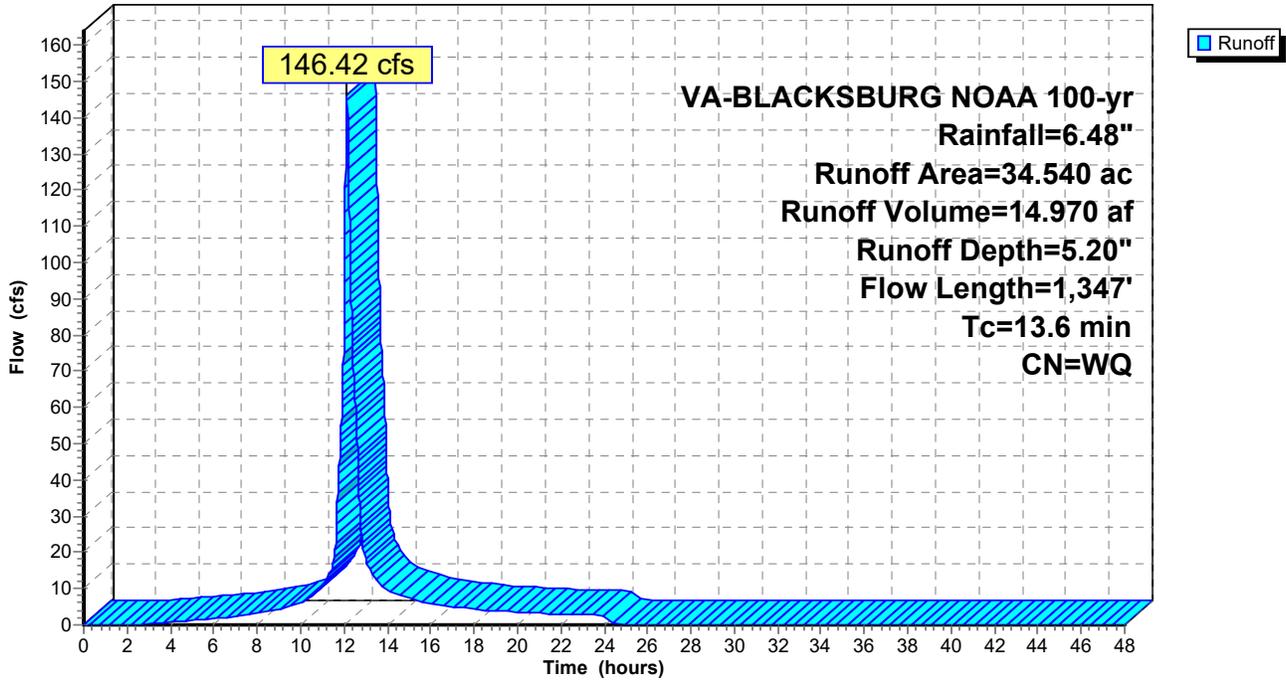
34.540 Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030 Corrugated metal
0.1	101	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013

13.6 1,347 Total

Subcatchment 4S: OFFSITE AREA DRAINING TO POA #2

Hydrograph



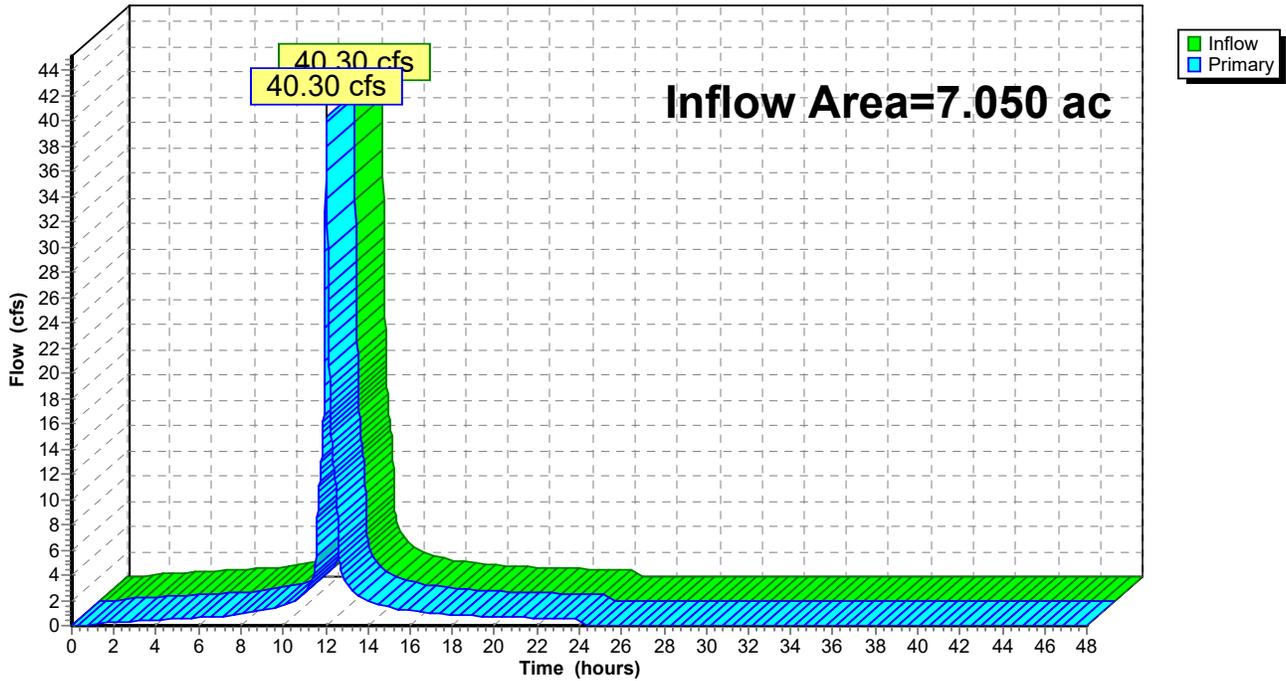
Summary for Link 1L: POA #1

Inflow Area = 7.050 ac, Inflow Depth = 5.66" for 100-yr event
Inflow = 40.30 cfs @ 12.04 hrs, Volume= 3.326 af
Primary = 40.30 cfs @ 12.04 hrs, Volume= 3.326 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: POA #1

Hydrograph



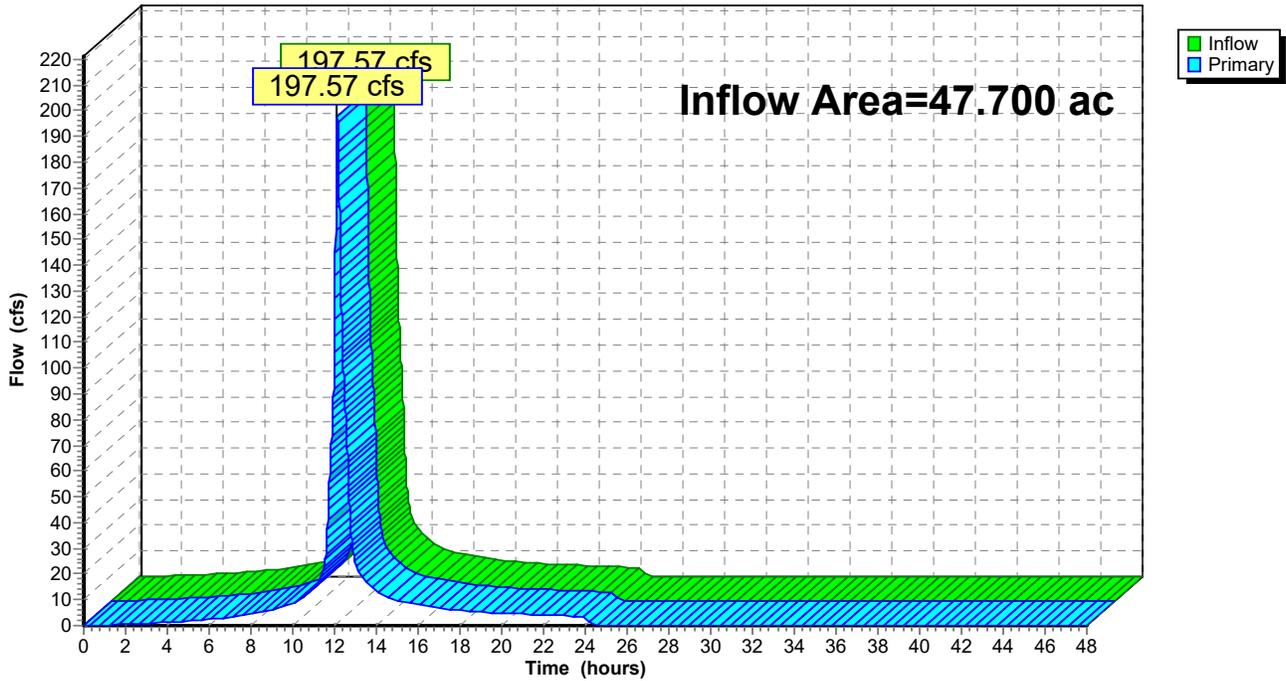
Summary for Link 2L: POA #2

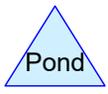
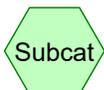
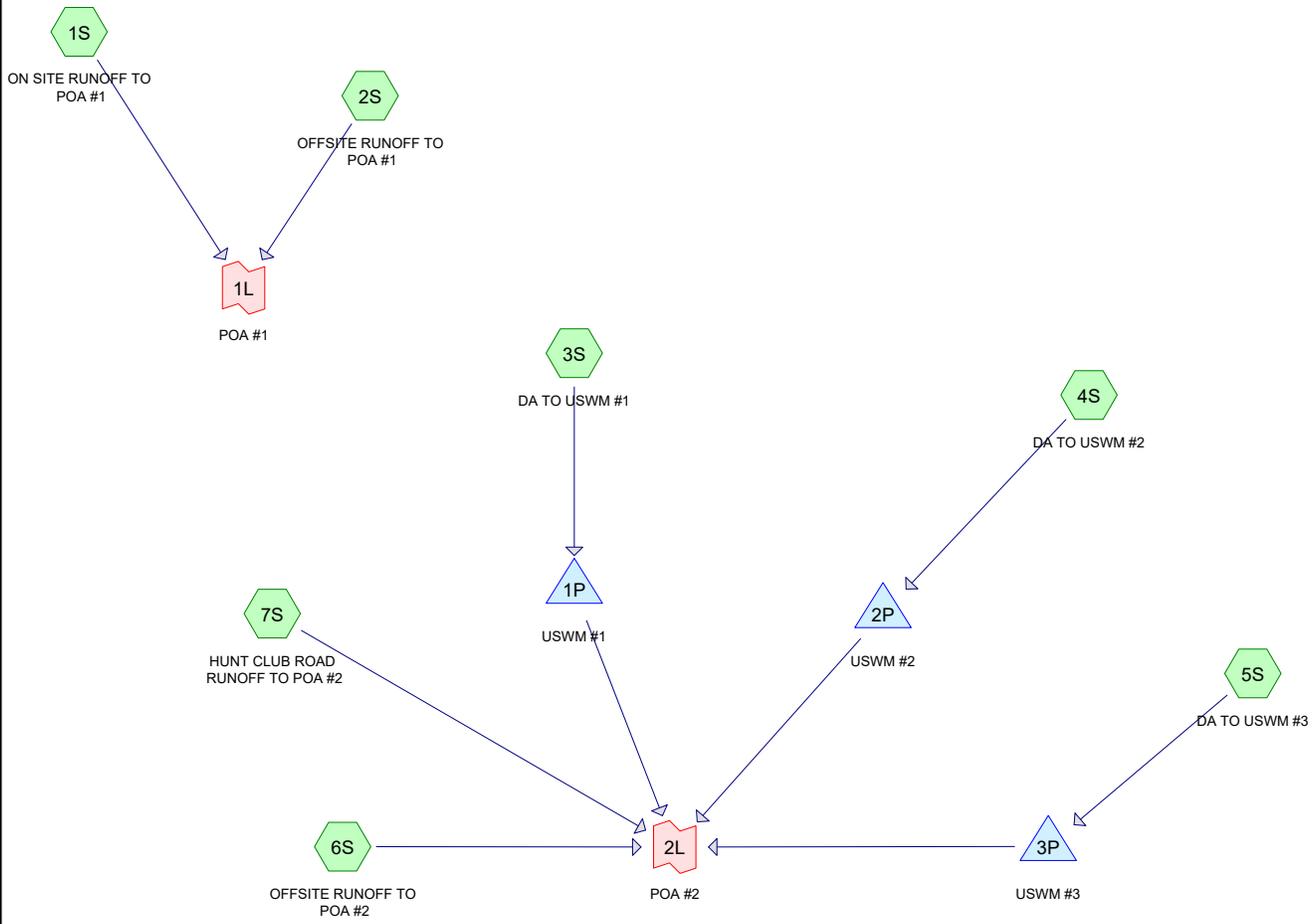
Inflow Area = 47.700 ac, Inflow Depth = 5.13" for 100-yr event
Inflow = 197.57 cfs @ 12.14 hrs, Volume= 20.392 af
Primary = 197.57 cfs @ 12.14 hrs, Volume= 20.392 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 2L: POA #2

Hydrograph





Routing Diagram for TERRACE VIEW POST DEV - 1 YR
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TERRACE VIEW POST DEV - 1 YR

Prepared by Balzer & Associates, Inc.

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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.350	81	1/3 acre lots, 30% imp, HSG C (6S)
0.200	83	1/4 acre lots, 38% imp, HSG C (6S)
5.500	85	1/8 acre lots, 65% imp, HSG B (6S)
23.820	90	1/8 acre lots, 65% imp, HSG C (2S, 6S)
0.724	61	>75% Grass cover, Good, HSG B (4S, 5S, 6S, 7S)
5.194	74	>75% Grass cover, Good, HSG C (1S, 3S, 4S, 5S, 6S, 7S)
0.730	98	Paved parking, HSG B (4S, 5S, 7S)
10.698	98	Paved parking, HSG C (1S, 3S, 4S, 5S, 7S)
3.130	98	Paved roads w/curbs & sewers, HSG B (2S, 6S)
3.670	98	Paved roads w/curbs & sewers, HSG C (2S, 6S)
0.270	94	Urban commercial, 85% imp, HSG C (2S)
0.462	75	VRRM Area A Adjusted CN (3S)
54.748	90	TOTAL AREA

TERRACE VIEW POST DEV - 1 YR

VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Prepared by Balzer & Associates, Inc.

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Page 3

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: ON SITE RUNOFF TO POA #1

Runoff Area=1.760 ac Runoff Depth=1.48"
 Tc=6.0 min CN=WQ Runoff=3.42 cfs 0.218 af

Subcatchment 2S: OFFSITE RUNOFF TO POA #1

Runoff Area=4.170 ac Runoff Depth=1.91"
 Tc=6.0 min CN=WQ Runoff=10.76 cfs 0.663 af

Subcatchment 3S: DA TO USWM #1

Runoff Area=3.810 ac Runoff Depth=1.60"
 Tc=6.0 min CN=WQ Runoff=8.05 cfs 0.509 af

Subcatchment 4S: DA TO USWM #2

Runoff Area=6.588 ac Runoff Depth=1.62"
 Tc=6.0 min CN=WQ Runoff=14.02 cfs 0.888 af

Subcatchment 5S: DA TO USWM #3

Runoff Area=2.000 ac Runoff Depth=1.36"
 Tc=6.0 min CN=WQ Runoff=3.54 cfs 0.227 af

Subcatchment 6S: OFFSITE RUNOFF TO POA #2

Runoff Area=34.540 ac Runoff Depth=1.29"
 Flow Length=1,347' Tc=13.6 min CN=WQ Runoff=45.96 cfs 3.720 af

Subcatchment 7S: HUNT CLUB ROAD RUNOFF TO POA #2

Runoff Area=1.880 ac Runoff Depth=1.80"
 Tc=6.0 min CN=WQ Runoff=4.49 cfs 0.283 af

Pond 1P: USWM #1

Peak Elev=2,129.02' Storage=0.128 af Inflow=8.05 cfs 0.509 af
 Outflow=1.99 cfs 0.509 af

Pond 2P: USWM #2

Peak Elev=2,118.35' Storage=0.249 af Inflow=14.02 cfs 0.888 af
 Outflow=3.01 cfs 0.888 af

Pond 3P: USWM #3

Peak Elev=2,121.23' Storage=0.042 af Inflow=3.54 cfs 0.227 af
 Outflow=1.21 cfs 0.227 af

Link 1L: POA #1

Inflow=14.17 cfs 0.880 af
 Primary=14.17 cfs 0.880 af

Link 2L: POA #2

Inflow=54.29 cfs 5.626 af
 Primary=54.29 cfs 5.626 af

Total Runoff Area = 54.748 ac Runoff Volume = 6.507 af Average Runoff Depth = 1.43"

Summary for Subcatchment 1S: ON SITE RUNOFF TO POA #1

Runoff = 3.42 cfs @ 12.04 hrs, Volume= 0.218 af, Depth= 1.48"

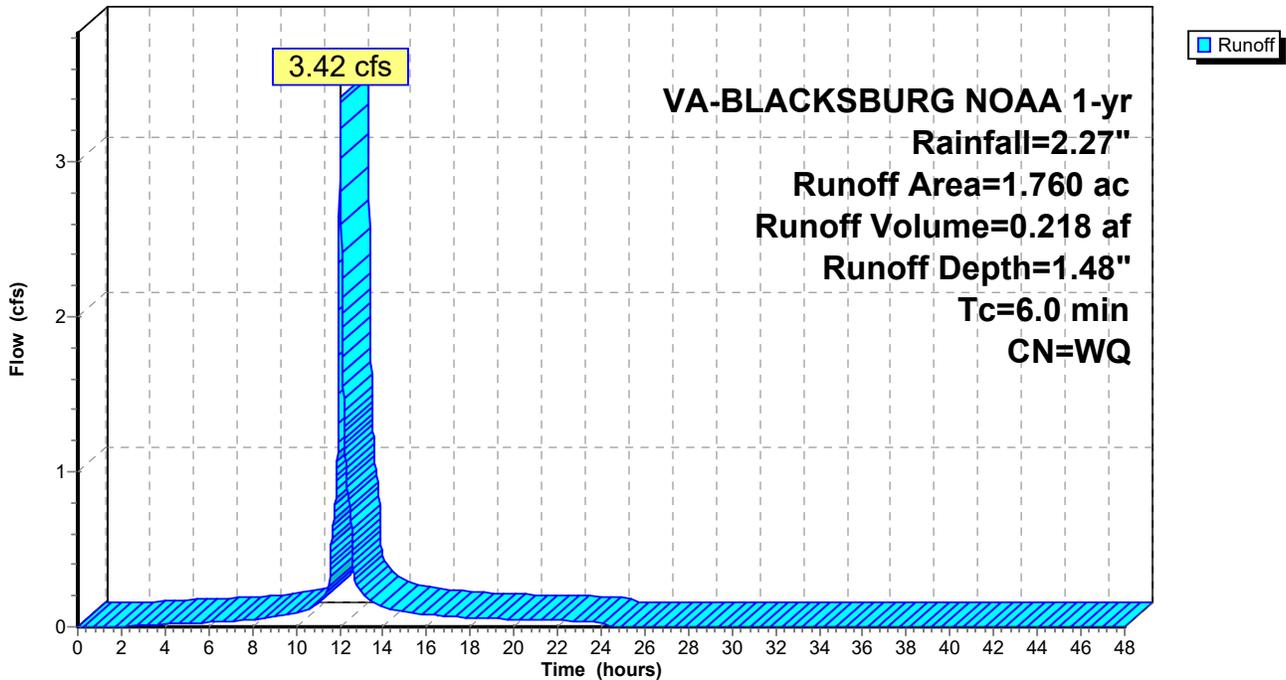
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.630	74	>75% Grass cover, Good, HSG C
1.130	98	Paved parking, HSG C
1.760		Weighted Average

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

Subcatchment 1S: ON SITE RUNOFF TO POA #1

Hydrograph



Summary for Subcatchment 2S: OFFSITE RUNOFF TO POA #1

Runoff = 10.76 cfs @ 12.04 hrs, Volume= 0.663 af, Depth= 1.91"

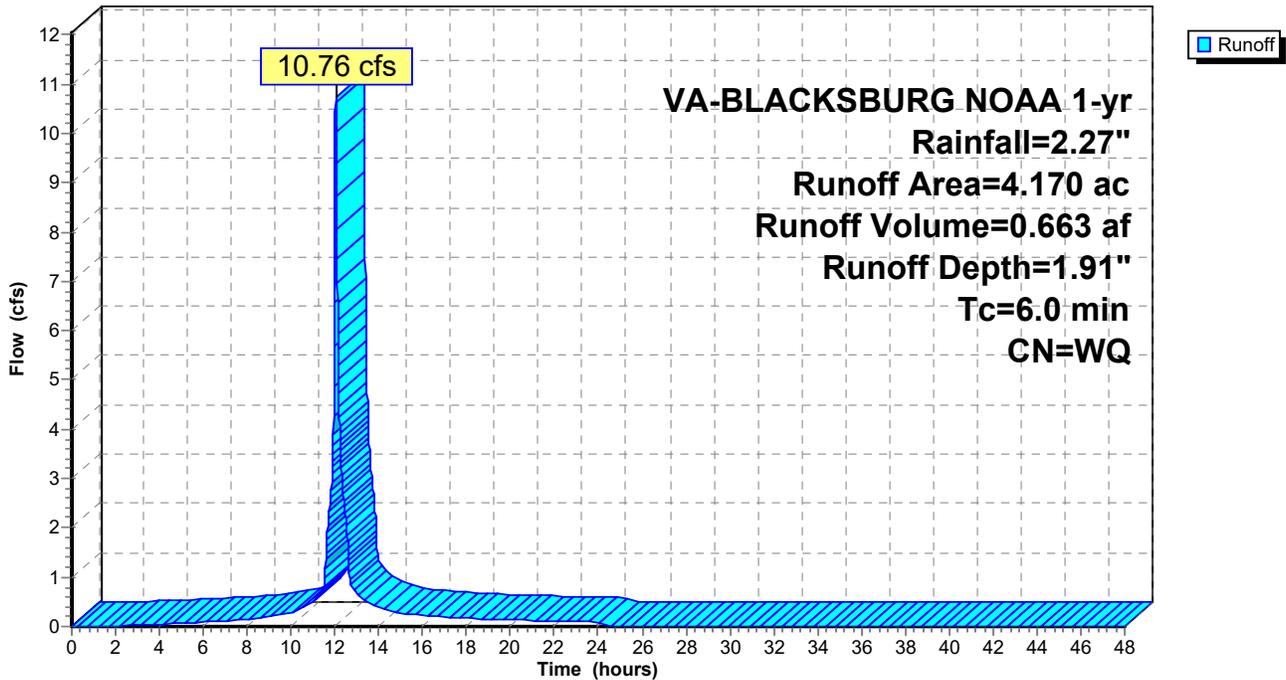
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.640	90	1/8 acre lots, 65% imp, HSG C
0.270	94	Urban commercial, 85% imp, HSG C
3.110	98	Paved roads w/curbs & sewers, HSG B
0.150	98	Paved roads w/curbs & sewers, HSG C
4.170		Weighted Average

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

Subcatchment 2S: OFFSITE RUNOFF TO POA #1

Hydrograph



Summary for Subcatchment 3S: DA TO USWM #1

Runoff = 8.05 cfs @ 12.04 hrs, Volume= 0.509 af, Depth= 1.60"

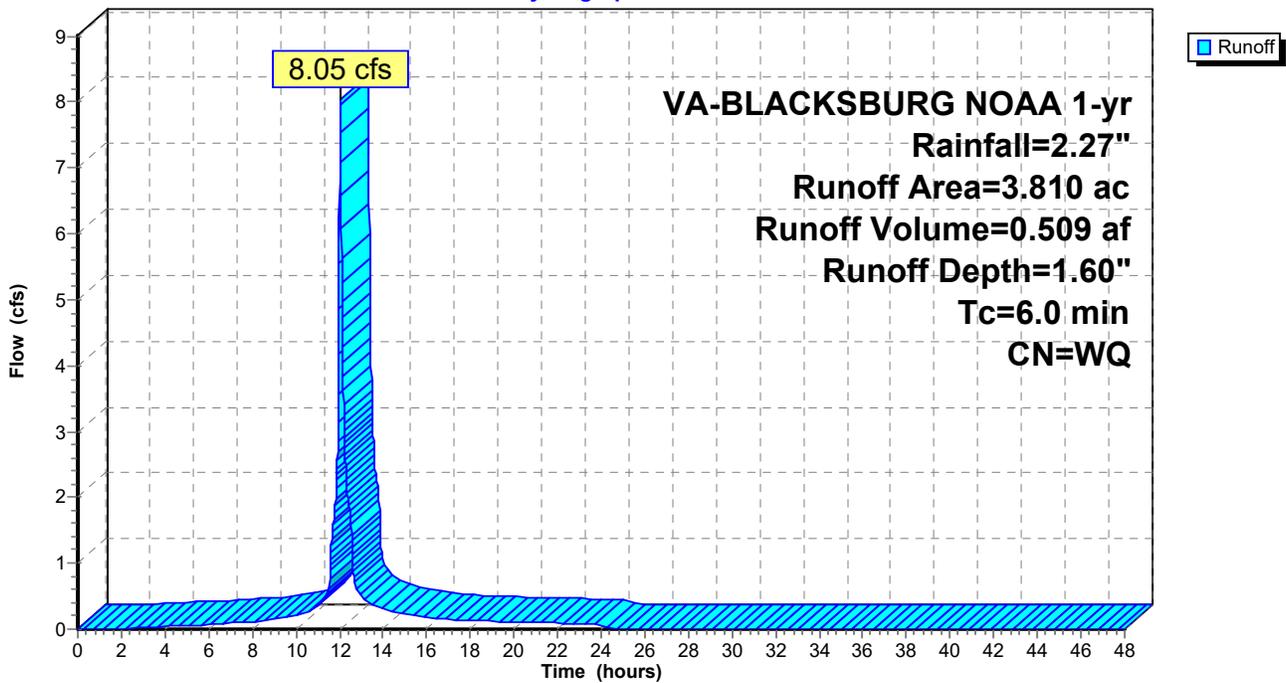
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.620	74	>75% Grass cover, Good, HSG C
2.728	98	Paved parking, HSG C
* 0.462	75	VRRM Area A Adjusted CN
3.810		Weighted Average

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

Subcatchment 3S: DA TO USWM #1

Hydrograph



Summary for Subcatchment 4S: DA TO USWM #2

Runoff = 14.02 cfs @ 12.04 hrs, Volume= 0.888 af, Depth= 1.62"

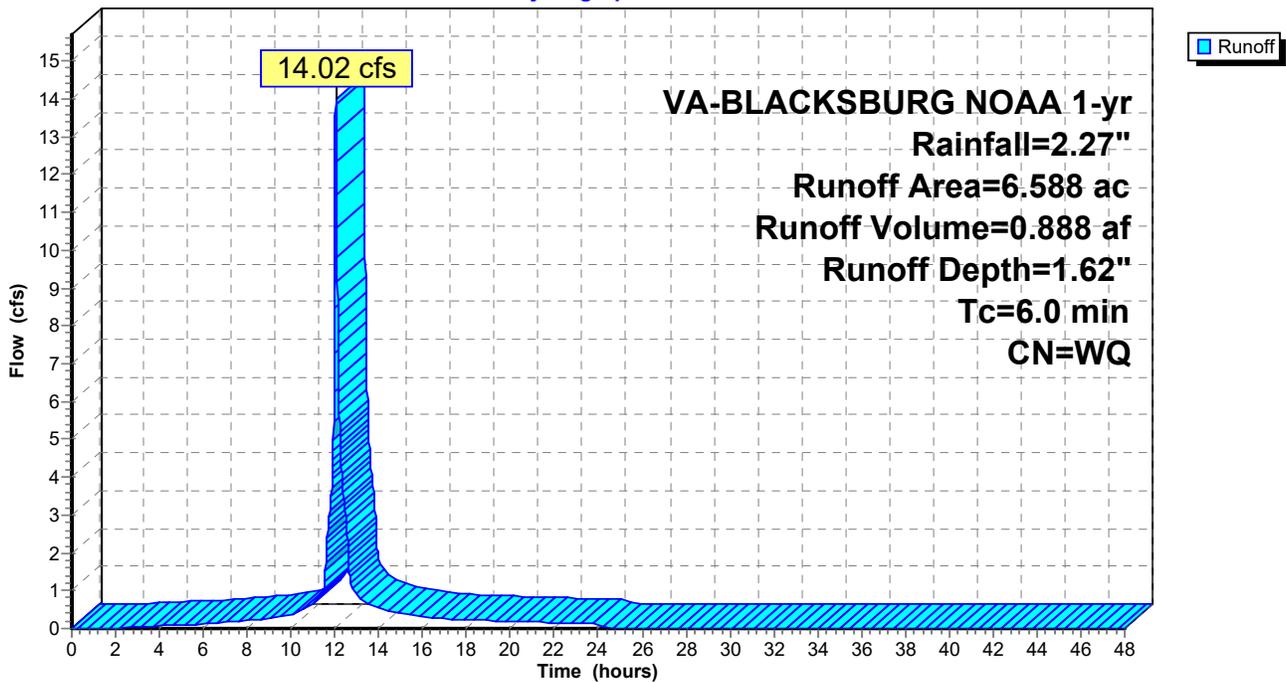
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.044	61	>75% Grass cover, Good, HSG B
1.744	74	>75% Grass cover, Good, HSG C
0.200	98	Paved parking, HSG B
4.600	98	Paved parking, HSG C
6.588		Weighted Average

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

Subcatchment 4S: DA TO USWM #2

Hydrograph



Summary for Subcatchment 5S: DA TO USWM #3

Runoff = 3.54 cfs @ 12.04 hrs, Volume= 0.227 af, Depth= 1.36"

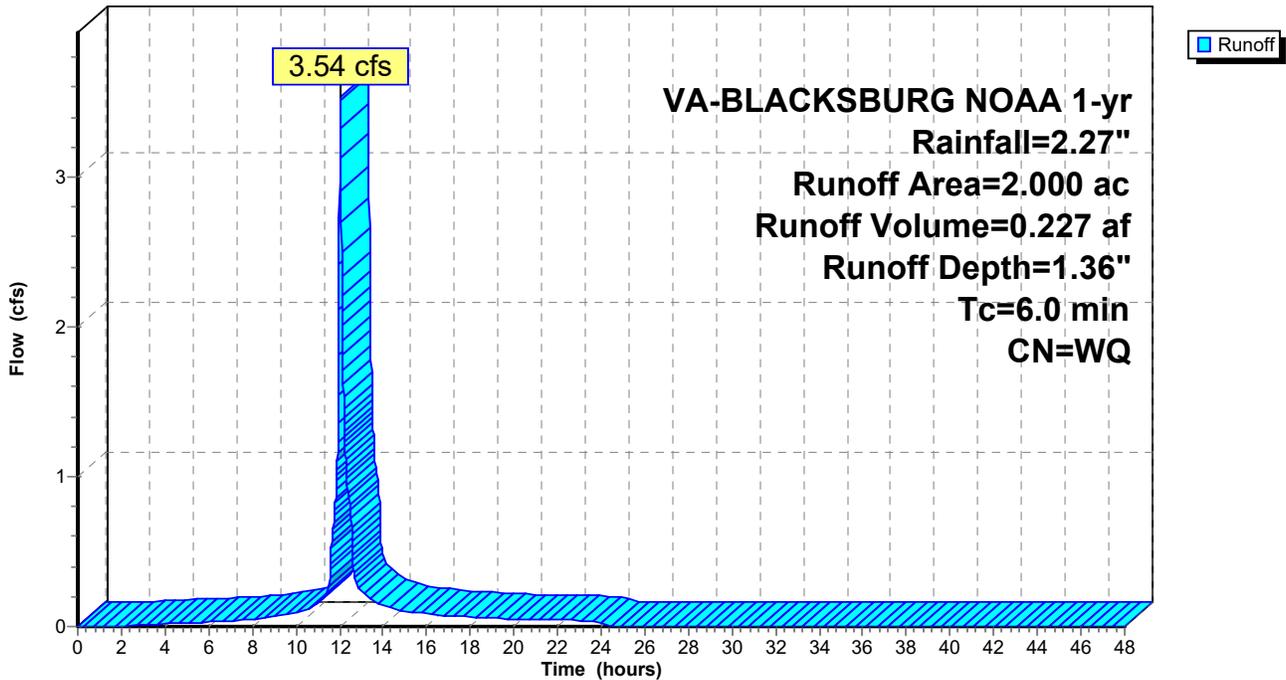
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.140	61	>75% Grass cover, Good, HSG B
0.700	74	>75% Grass cover, Good, HSG C
0.130	98	Paved parking, HSG B
1.030	98	Paved parking, HSG C
2.000		Weighted Average

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

Subcatchment 5S: DA TO USWM #3

Hydrograph



Summary for Subcatchment 6S: OFFSITE RUNOFF TO POA #2

Runoff = 45.96 cfs @ 12.14 hrs, Volume= 3.720 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.460	61	>75% Grass cover, Good, HSG B
1.310	74	>75% Grass cover, Good, HSG C
0.200	83	1/4 acre lots, 38% imp, HSG C
0.350	81	1/3 acre lots, 30% imp, HSG C
5.500	85	1/8 acre lots, 65% imp, HSG B
23.180	90	1/8 acre lots, 65% imp, HSG C
0.020	98	Paved roads w/curbs & sewers, HSG B
3.520	98	Paved roads w/curbs & sewers, HSG C

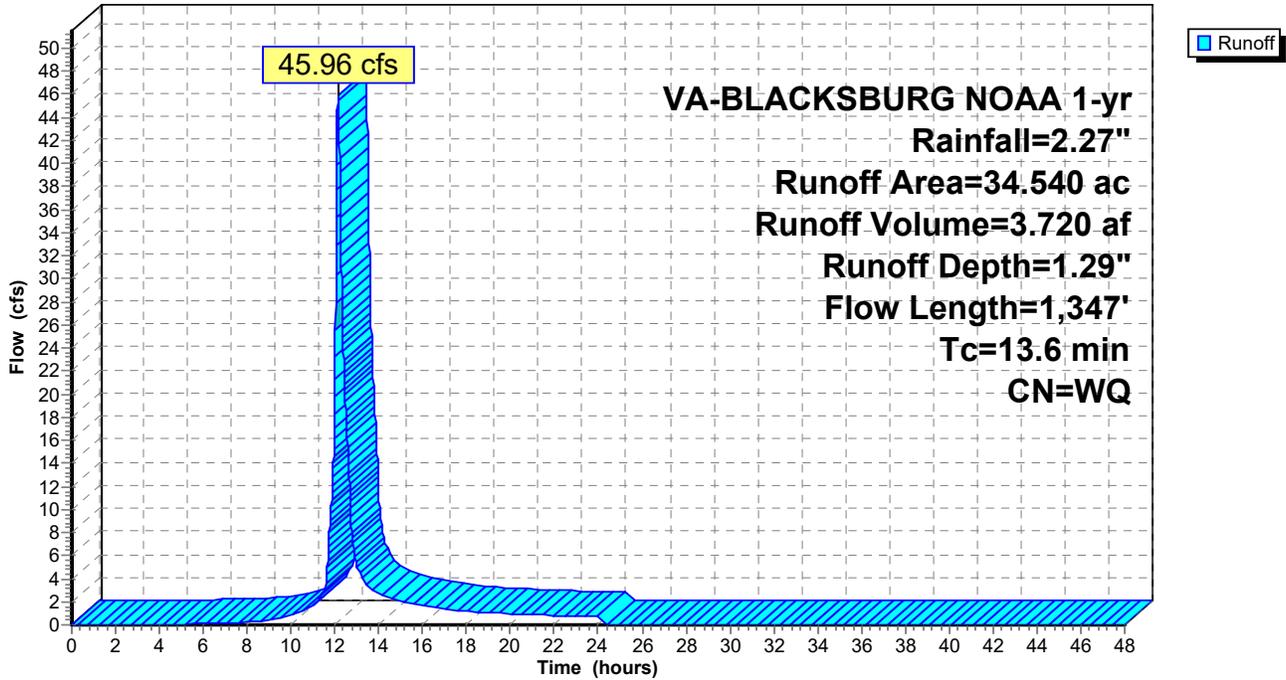
34.540 Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030 Corrugated metal
0.1	101	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013

13.6 1,347 Total

Subcatchment 6S: OFFSITE RUNOFF TO POA #2

Hydrograph



Summary for Subcatchment 7S: HUNT CLUB ROAD RUNOFF TO POA #2

Runoff = 4.49 cfs @ 12.04 hrs, Volume= 0.283 af, Depth= 1.80"

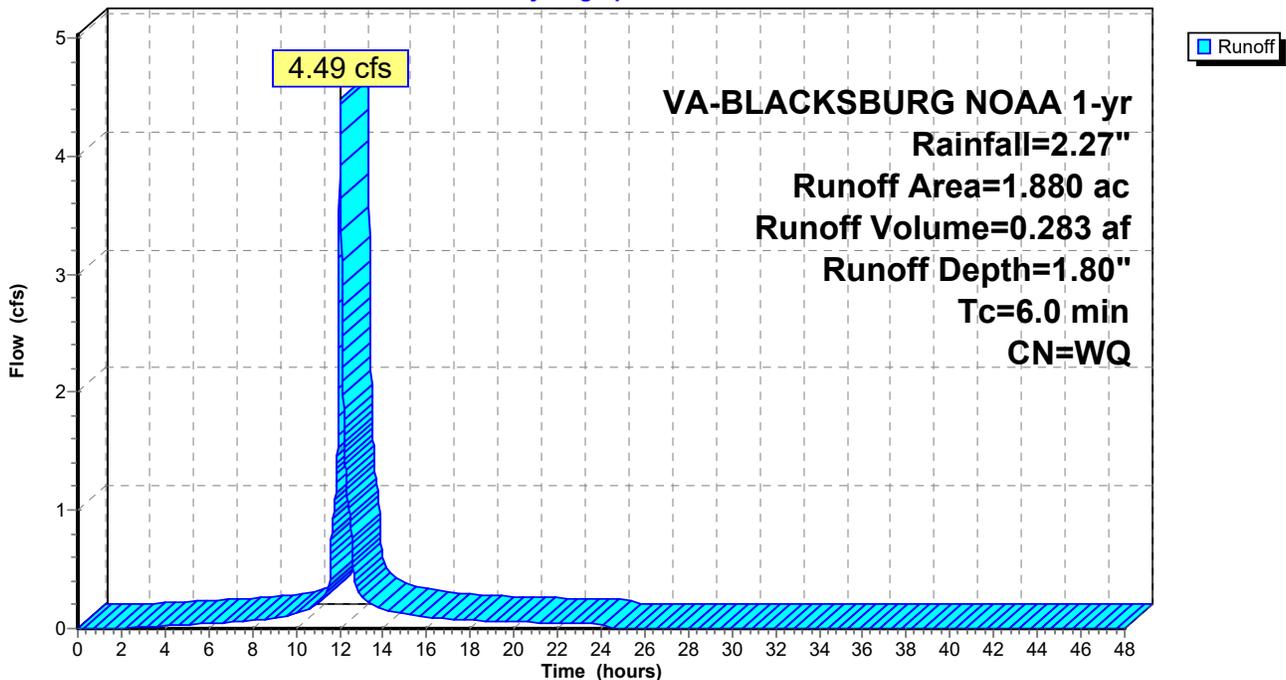
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.080	61	>75% Grass cover, Good, HSG B
0.190	74	>75% Grass cover, Good, HSG C
0.400	98	Paved parking, HSG B
1.210	98	Paved parking, HSG C
1.880		Weighted Average

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

Subcatchment 7S: HUNT CLUB ROAD RUNOFF TO POA #2

Hydrograph



Summary for Pond 1P: USWM #1

Inflow Area = 3.810 ac, Inflow Depth = 1.60" for 1-yr event
 Inflow = 8.05 cfs @ 12.04 hrs, Volume= 0.509 af
 Outflow = 1.99 cfs @ 12.39 hrs, Volume= 0.509 af, Atten= 75%, Lag= 20.9 min
 Primary = 1.99 cfs @ 12.39 hrs, Volume= 0.509 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 2,129.02' @ 12.39 hrs Surf.Area= 0.054 ac Storage= 0.128 af

Plug-Flow detention time= 22.8 min calculated for 0.509 af (100% of inflow)
 Center-of-Mass det. time= 22.8 min (798.4 - 775.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,125.50'	0.076 af	38.00'W x 62.00'L x 5.50'H Field A 0.297 af Overall - 0.107 af Embedded = 0.191 af x 40.0% Voids
#2A	2,126.00'	0.107 af	CMP Round 48 x 18 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf Overall Size= 48.0"W x 48.0"H x 20.00'L Row Length Adjustment= -4.00' x 12.57 sf x 6 rows 34.00' Header x 12.57 sf x 1 = 427.3 cf Inside
		0.183 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,125.30'	24.0" Round 24" CULVERT L= 423.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,125.30' / 2,110.00' S= 0.0361 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	2,125.40'	8.0" W x 4.0" H Vert. Orifice/Grate C= 0.600
#3	Device 1	2,129.20'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.99 cfs @ 12.39 hrs HW=2,129.02' (Free Discharge)

- 1=24" CULVERT (Passes 1.99 cfs of 24.97 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 1.99 cfs @ 8.95 fps)
- 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 1P: USWM #1 - Chamber Wizard Field A

Chamber Model = CMP Round 48 (Round Corrugated Metal Pipe)

Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf

Overall Size= 48.0"W x 48.0"H x 20.00'L

Row Length Adjustment= -4.00' x 12.57 sf x 6 rows

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

3 Chambers/Row x 20.00' Long -4.00' Row Adjustment +4.00' Header x 1 = 60.00' Row Length +12.0"

End Stone x 2 = 62.00' Base Length

6 Rows x 48.0" Wide + 24.0" Spacing x 5 + 24.0" Side Stone x 2 = 38.00' Base Width

6.0" Base + 48.0" Chamber Height + 12.0" Cover = 5.50' Field Height

18 Chambers x 251.3 cf -4.00' Row Adjustment x 12.57 sf x 6 Rows + 34.00' Header x 12.57 sf =
4,649.6 cf Chamber Storage

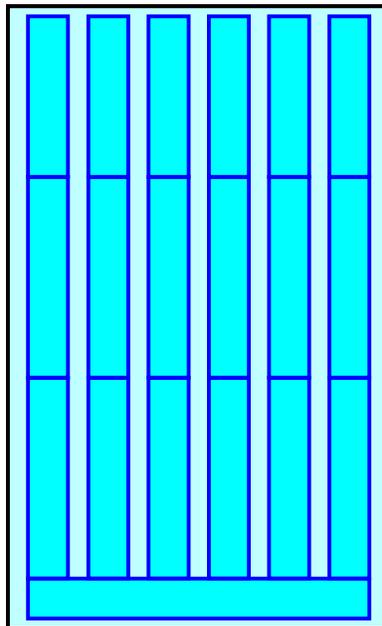
12,958.0 cf Field - 4,649.6 cf Chambers = 8,308.4 cf Stone x 40.0% Voids = 3,323.4 cf Stone Storage

Chamber Storage + Stone Storage = 7,972.9 cf = 0.183 af

Overall Storage Efficiency = 61.5%

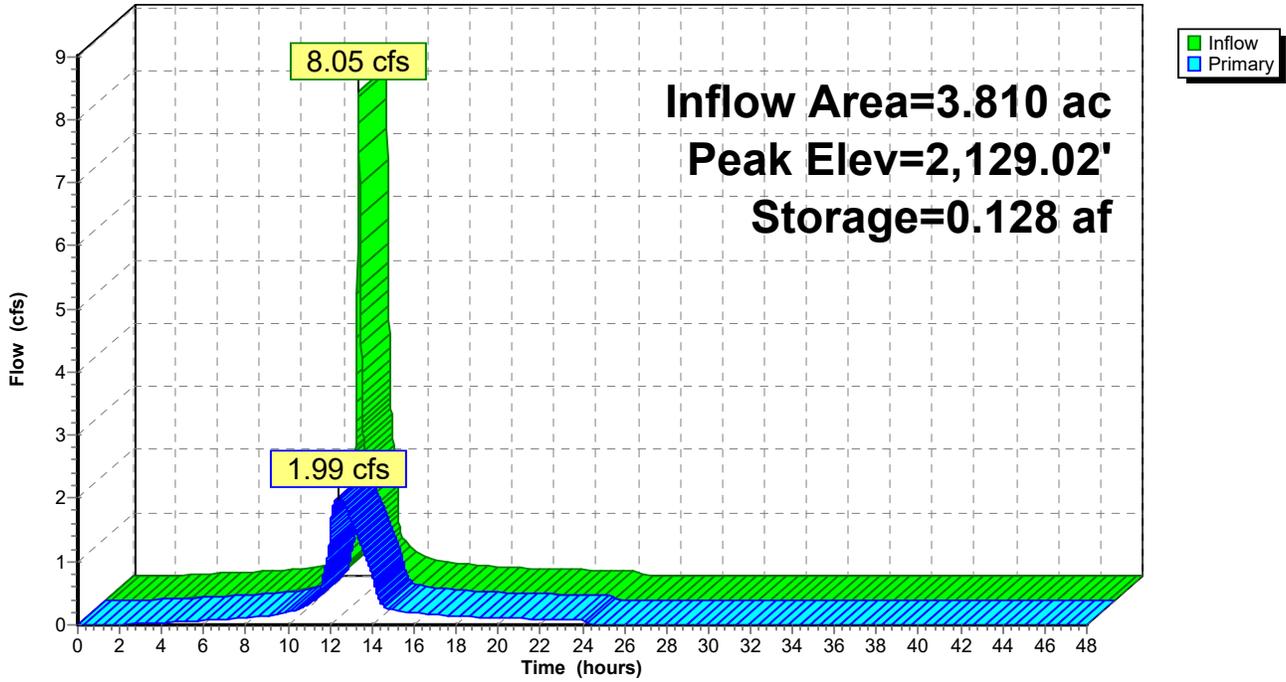
Overall System Size = 62.00' x 38.00' x 5.50'

18 Chambers
479.9 cy Field
307.7 cy Stone



Pond 1P: USWM #1

Hydrograph



Summary for Pond 2P: USWM #2

Inflow Area = 6.588 ac, Inflow Depth = 1.62" for 1-yr event
 Inflow = 14.02 cfs @ 12.04 hrs, Volume= 0.888 af
 Outflow = 3.01 cfs @ 12.49 hrs, Volume= 0.888 af, Atten= 79%, Lag= 27.0 min
 Primary = 3.01 cfs @ 12.49 hrs, Volume= 0.888 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 2,118.35' @ 12.49 hrs Surf.Area= 0.116 ac Storage= 0.249 af

Plug-Flow detention time= 31.2 min calculated for 0.887 af (100% of inflow)
 Center-of-Mass det. time= 31.2 min (805.9 - 774.7)

Volume	Invert	Avail.Storage	Storage Description
#1	2,115.00'	0.224 af	46.67'W x 108.00'L x 7.50'H Stone Storage 0.868 af Overall - 0.307 af Embedded = 0.561 af x 40.0% Voids
#2	2,116.50'	0.003 af	24.0" Round Inlet Manifold Inside #1 L= 38.5'
#3	2,116.50'	0.060 af	ADS_StormTech MC-4500 +Cap x 24 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf
#4	2,116.50'	0.241 af	ADS_StormTech MC-4500 +Cap x 96 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 4 Rows of 24 Chambers Cap Storage= +35.7 cf x 2 x 4 rows = 285.6 cf
#5	2,115.00'	0.003 af	24.0" Round Outlet Manifold Inside #1 L= 38.0'
		0.531 af	Total Available Storage

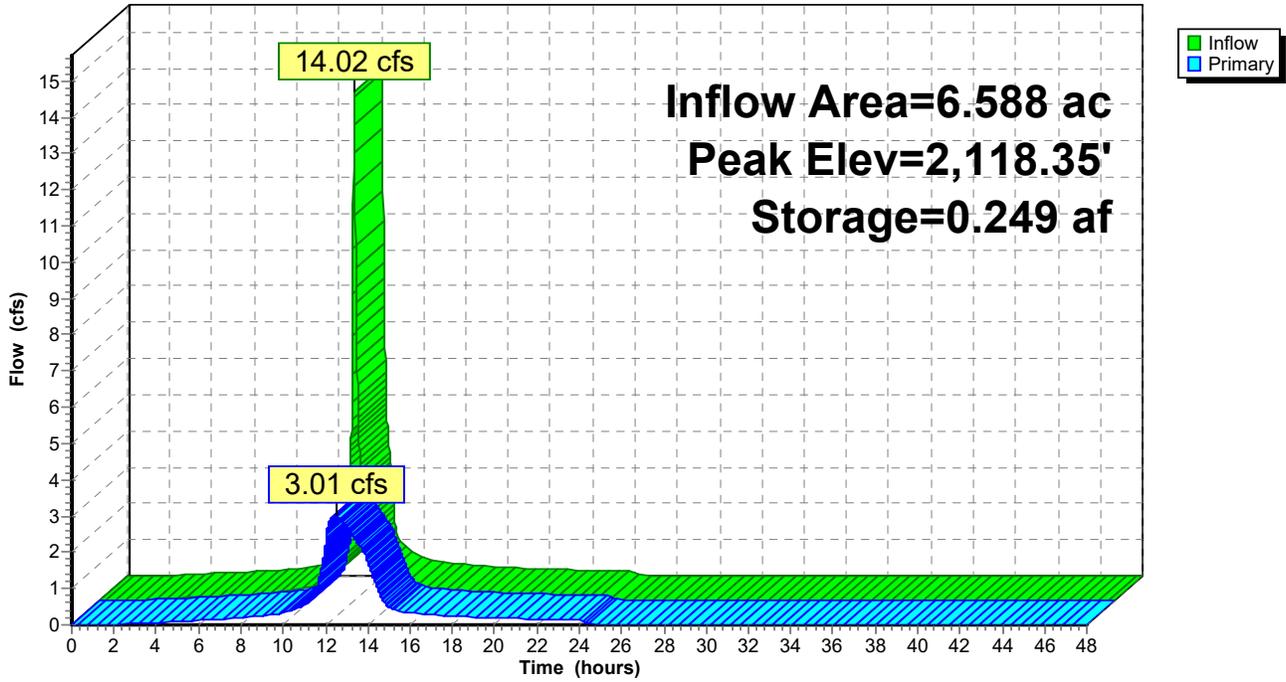
Device	Routing	Invert	Outlet Devices
#1	Primary	2,114.80'	24.0" Round 24" Culvert L= 165.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,114.80' / 2,110.00' S= 0.0290 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	2,114.90'	10.0" W x 5.0" H Vert. Orifice/Grate C= 0.600
#3	Device 1	2,120.50'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=3.01 cfs @ 12.49 hrs HW=2,118.35' (Free Discharge)

- 1=24" Culvert (Passes 3.01 cfs of 24.17 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 3.01 cfs @ 8.67 fps)
- 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 2P: USWM #2

Hydrograph



Summary for Pond 3P: USWM #3

Inflow Area = 2.000 ac, Inflow Depth = 1.36" for 1-yr event
 Inflow = 3.54 cfs @ 12.04 hrs, Volume= 0.227 af
 Outflow = 1.21 cfs @ 12.26 hrs, Volume= 0.227 af, Atten= 66%, Lag= 13.1 min
 Primary = 1.21 cfs @ 12.26 hrs, Volume= 0.227 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 2,121.23' @ 12.26 hrs Surf.Area= 0.034 ac Storage= 0.042 af

Plug-Flow detention time= 11.4 min calculated for 0.227 af (100% of inflow)
 Center-of-Mass det. time= 11.4 min (793.1 - 781.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,119.20'	0.047 af	24.00'W x 62.50'L x 5.00'H Field A 0.172 af Overall - 0.055 af Embedded = 0.117 af x 40.0% Voids
#2A	2,119.70'	0.055 af	CMP Round 42 x 12 Inside #1 Effective Size= 42.0"W x 42.0"H => 9.62 sf x 20.00'L = 192.4 cf Overall Size= 42.0"W x 42.0"H x 20.00'L Row Length Adjustment= -3.00' x 9.62 sf x 4 rows 20.00' Header x 9.62 sf x 1 = 192.4 cf Inside
		0.102 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,119.00'	24.0" Round 24" CULVERT L= 117.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,119.00' / 2,117.00' S= 0.0171 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	2,119.10'	8.5" W x 3.0" H Vert. Orifice/Grate C= 0.600
#3	Device 1	2,122.80'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.21 cfs @ 12.26 hrs HW=2,121.23' (Free Discharge)

- 1=24" CULVERT (Passes 1.21 cfs of 16.80 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 1.21 cfs @ 6.82 fps)
- 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 3P: USWM #3 - Chamber Wizard Field A

Chamber Model = CMP Round 42 (Round Corrugated Metal Pipe)

Effective Size= 42.0"W x 42.0"H => 9.62 sf x 20.00'L = 192.4 cf

Overall Size= 42.0"W x 42.0"H x 20.00'L

Row Length Adjustment= -3.00' x 9.62 sf x 4 rows

42.0" Wide + 24.0" Spacing = 66.0" C-C Row Spacing

3 Chambers/Row x 20.00' Long -3.00' Row Adjustment +3.50' Header x 1 = 60.50' Row Length +12.0" End Stone x 2 = 62.50' Base Length

4 Rows x 42.0" Wide + 24.0" Spacing x 3 + 24.0" Side Stone x 2 = 24.00' Base Width

6.0" Base + 42.0" Chamber Height + 12.0" Cover = 5.00' Field Height

12 Chambers x 192.4 cf -3.00' Row Adjustment x 9.62 sf x 4 Rows + 20.00' Header x 9.62 sf = 2,386.0 cf Chamber Storage

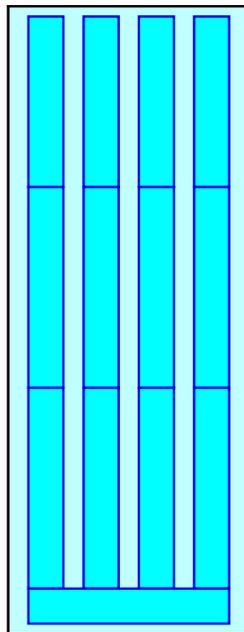
7,500.0 cf Field - 2,386.0 cf Chambers = 5,114.0 cf Stone x 40.0% Voids = 2,045.6 cf Stone Storage

Chamber Storage + Stone Storage = 4,431.6 cf = 0.102 af

Overall Storage Efficiency = 59.1%

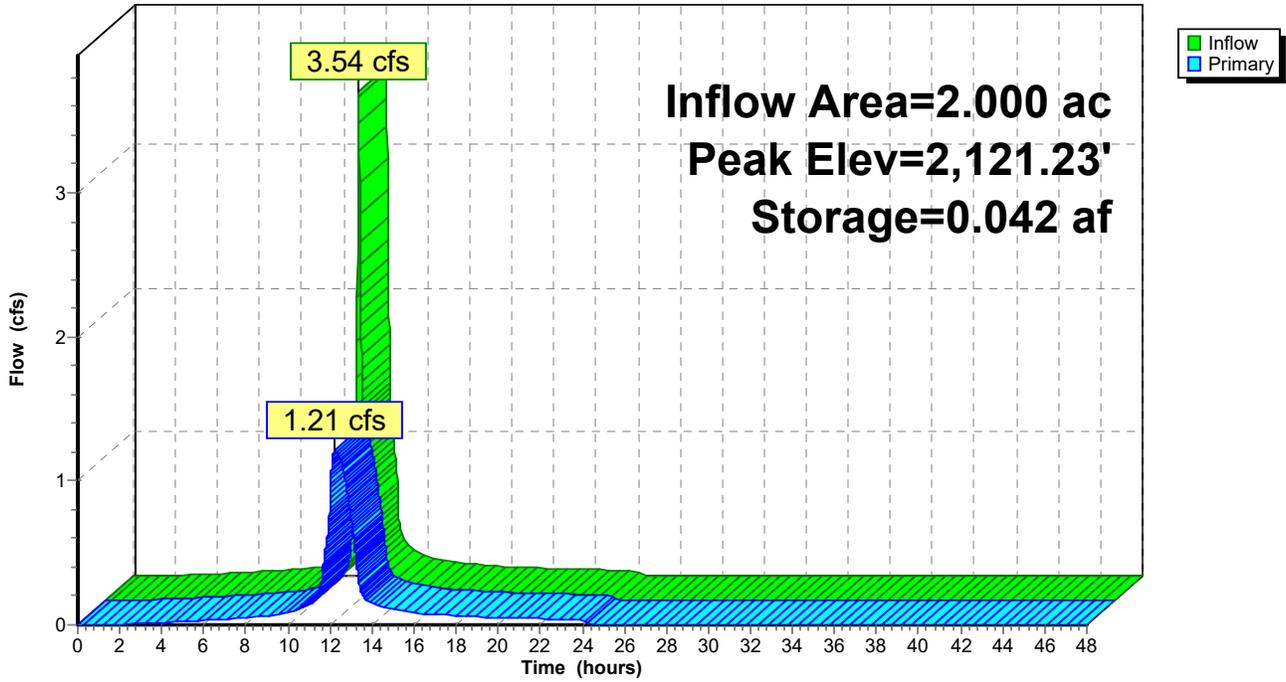
Overall System Size = 62.50' x 24.00' x 5.00'

12 Chambers
277.8 cy Field
189.4 cy Stone



Pond 3P: USWM #3

Hydrograph



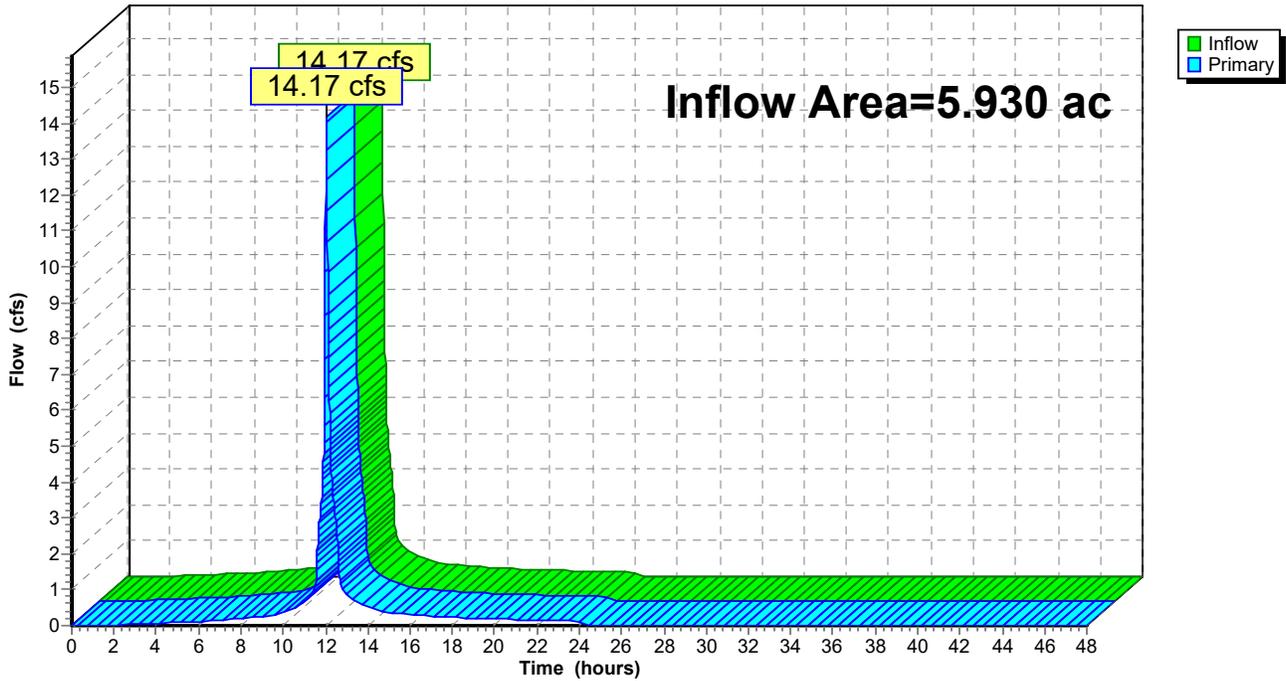
Summary for Link 1L: POA #1

Inflow Area = 5.930 ac, Inflow Depth = 1.78" for 1-yr event
Inflow = 14.17 cfs @ 12.04 hrs, Volume= 0.880 af
Primary = 14.17 cfs @ 12.04 hrs, Volume= 0.880 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: POA #1

Hydrograph



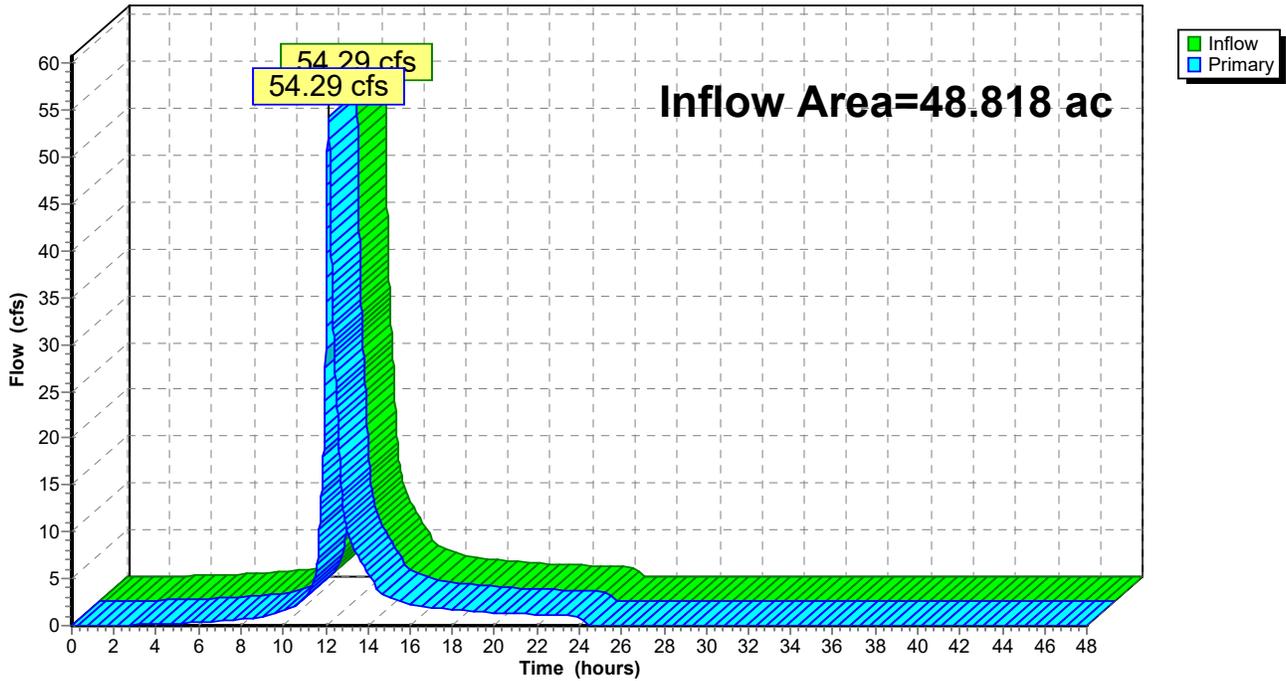
Summary for Link 2L: POA #2

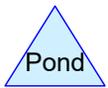
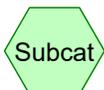
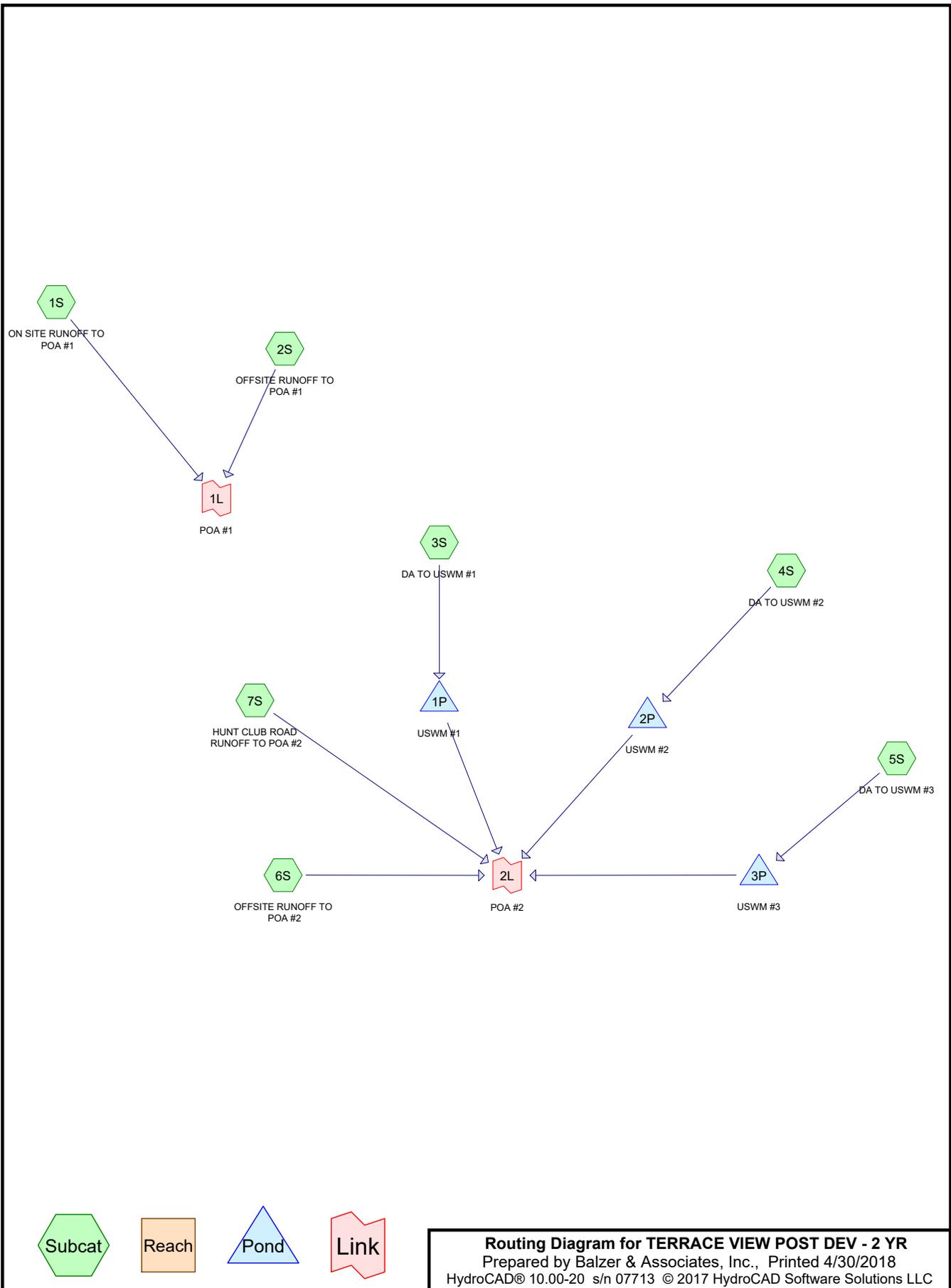
Inflow Area = 48.818 ac, Inflow Depth = 1.38" for 1-yr event
Inflow = 54.29 cfs @ 12.14 hrs, Volume= 5.626 af
Primary = 54.29 cfs @ 12.14 hrs, Volume= 5.626 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 2L: POA #2

Hydrograph





Routing Diagram for TERRACE VIEW POST DEV - 2 YR
 Prepared by Balzer & Associates, Inc., Printed 4/30/2018
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TERRACE VIEW POST DEV - 2 YR

Prepared by Balzer & Associates, Inc.

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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.350	81	1/3 acre lots, 30% imp, HSG C (6S)
0.200	83	1/4 acre lots, 38% imp, HSG C (6S)
5.500	85	1/8 acre lots, 65% imp, HSG B (6S)
23.820	90	1/8 acre lots, 65% imp, HSG C (2S, 6S)
0.724	61	>75% Grass cover, Good, HSG B (4S, 5S, 6S, 7S)
5.194	74	>75% Grass cover, Good, HSG C (1S, 3S, 4S, 5S, 6S, 7S)
0.730	98	Paved parking, HSG B (4S, 5S, 7S)
10.698	98	Paved parking, HSG C (1S, 3S, 4S, 5S, 7S)
3.130	98	Paved roads w/curbs & sewers, HSG B (2S, 6S)
3.670	98	Paved roads w/curbs & sewers, HSG C (2S, 6S)
0.270	94	Urban commercial, 85% imp, HSG C (2S)
0.462	77	VRRM Area A Adjusted CN (3S)
54.748	90	TOTAL AREA

TERRACE VIEW POST DEV - 2 YR

VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Prepared by Balzer & Associates, Inc.

Printed 4/30/2018

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Page 3

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: ON SITE RUNOFF TO POA #1

Runoff Area=1.760 ac Runoff Depth=1.89"
 Tc=6.0 min CN=WQ Runoff=4.35 cfs 0.277 af

Subcatchment 2S: OFFSITE RUNOFF TO POA #1

Runoff Area=4.170 ac Runoff Depth=2.38"
 Tc=6.0 min CN=WQ Runoff=13.25 cfs 0.826 af

Subcatchment 3S: DA TO USWM #1

Runoff Area=3.810 ac Runoff Depth=2.04"
 Tc=6.0 min CN=WQ Runoff=10.20 cfs 0.646 af

Subcatchment 4S: DA TO USWM #2

Runoff Area=6.588 ac Runoff Depth=2.04"
 Tc=6.0 min CN=WQ Runoff=17.59 cfs 1.118 af

Subcatchment 5S: DA TO USWM #3

Runoff Area=2.000 ac Runoff Depth=1.74"
 Tc=6.0 min CN=WQ Runoff=4.53 cfs 0.291 af

Subcatchment 6S: OFFSITE RUNOFF TO POA #2

Runoff Area=34.540 ac Runoff Depth=1.71"
 Flow Length=1,347' Tc=13.6 min CN=WQ Runoff=60.83 cfs 4.914 af

Subcatchment 7S: HUNT CLUB ROAD RUNOFF TO POA #2

Runoff Area=1.880 ac Runoff Depth=2.25"
 Tc=6.0 min CN=WQ Runoff=5.53 cfs 0.352 af

Pond 1P: USWM #1

Peak Elev=2,129.53' Storage=0.147 af Inflow=10.20 cfs 0.646 af
 Outflow=4.85 cfs 0.646 af

Pond 2P: USWM #2

Peak Elev=2,119.36' Storage=0.338 af Inflow=17.59 cfs 1.118 af
 Outflow=3.45 cfs 1.118 af

Pond 3P: USWM #3

Peak Elev=2,121.92' Storage=0.060 af Inflow=4.53 cfs 0.291 af
 Outflow=1.40 cfs 0.291 af

Link 1L: POA #1

Inflow=17.60 cfs 1.102 af
 Primary=17.60 cfs 1.102 af

Link 2L: POA #2

Inflow=72.67 cfs 7.322 af
 Primary=72.67 cfs 7.322 af

Total Runoff Area = 54.748 ac Runoff Volume = 8.424 af Average Runoff Depth = 1.85"

Summary for Subcatchment 1S: ON SITE RUNOFF TO POA #1

Runoff = 4.35 cfs @ 12.04 hrs, Volume= 0.277 af, Depth= 1.89"

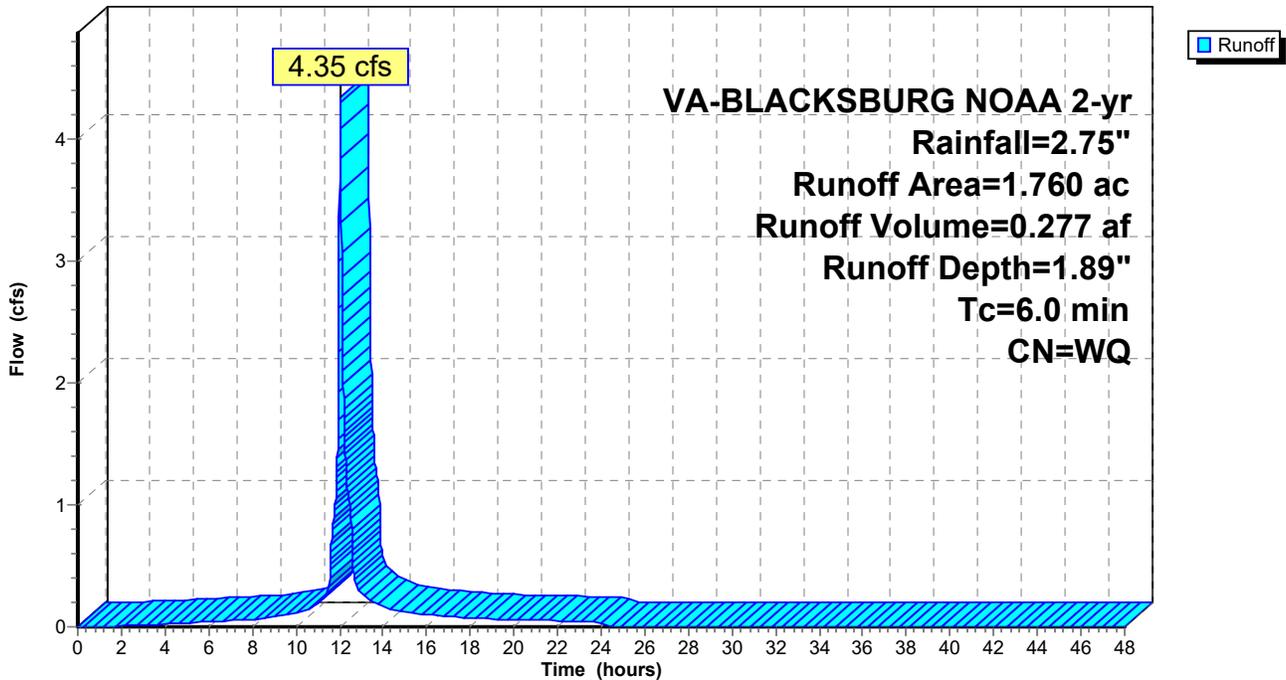
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.630	74	>75% Grass cover, Good, HSG C
1.130	98	Paved parking, HSG C
1.760		Weighted Average

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

Subcatchment 1S: ON SITE RUNOFF TO POA #1

Hydrograph



Summary for Subcatchment 2S: OFFSITE RUNOFF TO POA #1

Runoff = 13.25 cfs @ 12.04 hrs, Volume= 0.826 af, Depth= 2.38"

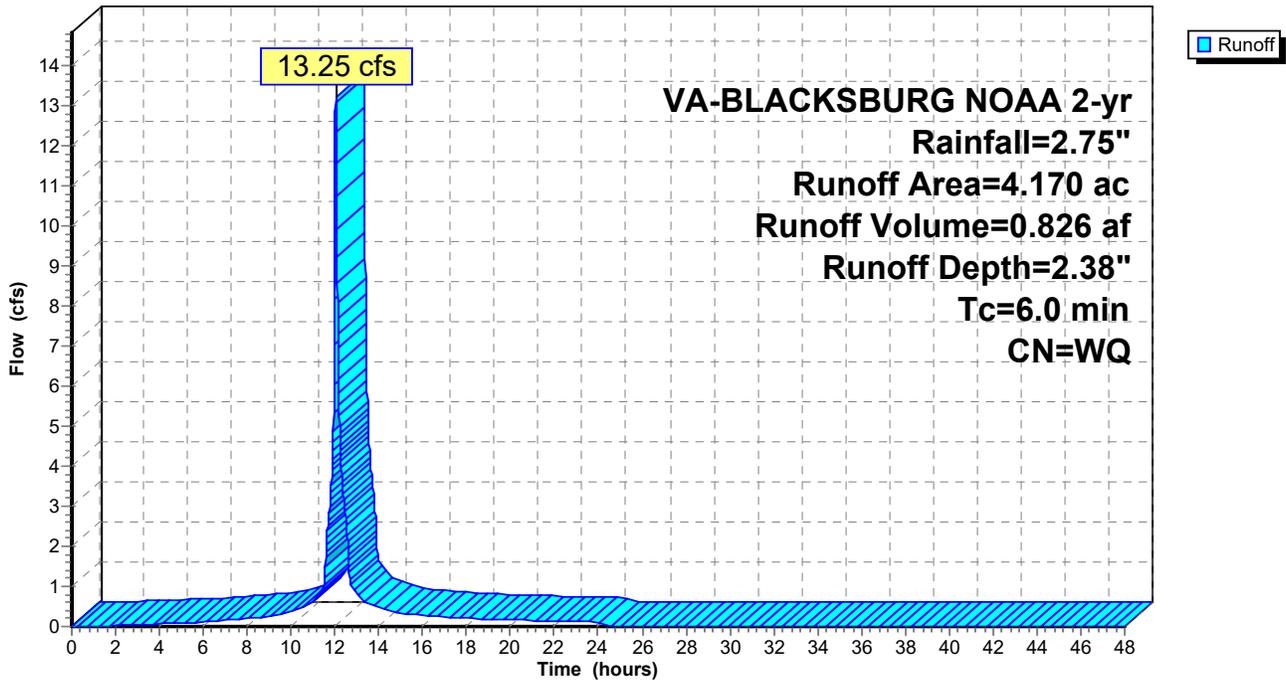
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.640	90	1/8 acre lots, 65% imp, HSG C
0.270	94	Urban commercial, 85% imp, HSG C
3.110	98	Paved roads w/curbs & sewers, HSG B
0.150	98	Paved roads w/curbs & sewers, HSG C
4.170		Weighted Average

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

Subcatchment 2S: OFFSITE RUNOFF TO POA #1

Hydrograph



Summary for Subcatchment 3S: DA TO USWM #1

Runoff = 10.20 cfs @ 12.04 hrs, Volume= 0.646 af, Depth= 2.04"

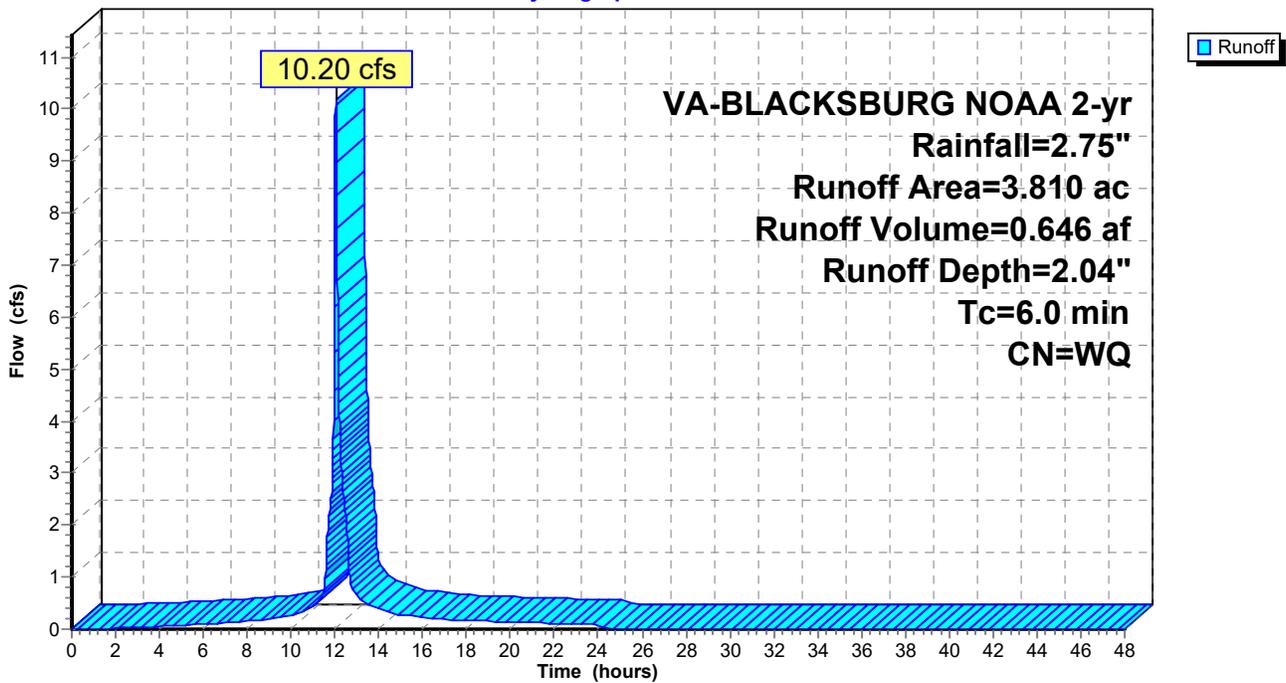
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.620	74	>75% Grass cover, Good, HSG C
2.728	98	Paved parking, HSG C
* 0.462	77	VRRM Area A Adjusted CN
3.810		Weighted Average

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

Subcatchment 3S: DA TO USWM #1

Hydrograph



Summary for Subcatchment 4S: DA TO USWM #2

Runoff = 17.59 cfs @ 12.04 hrs, Volume= 1.118 af, Depth= 2.04"

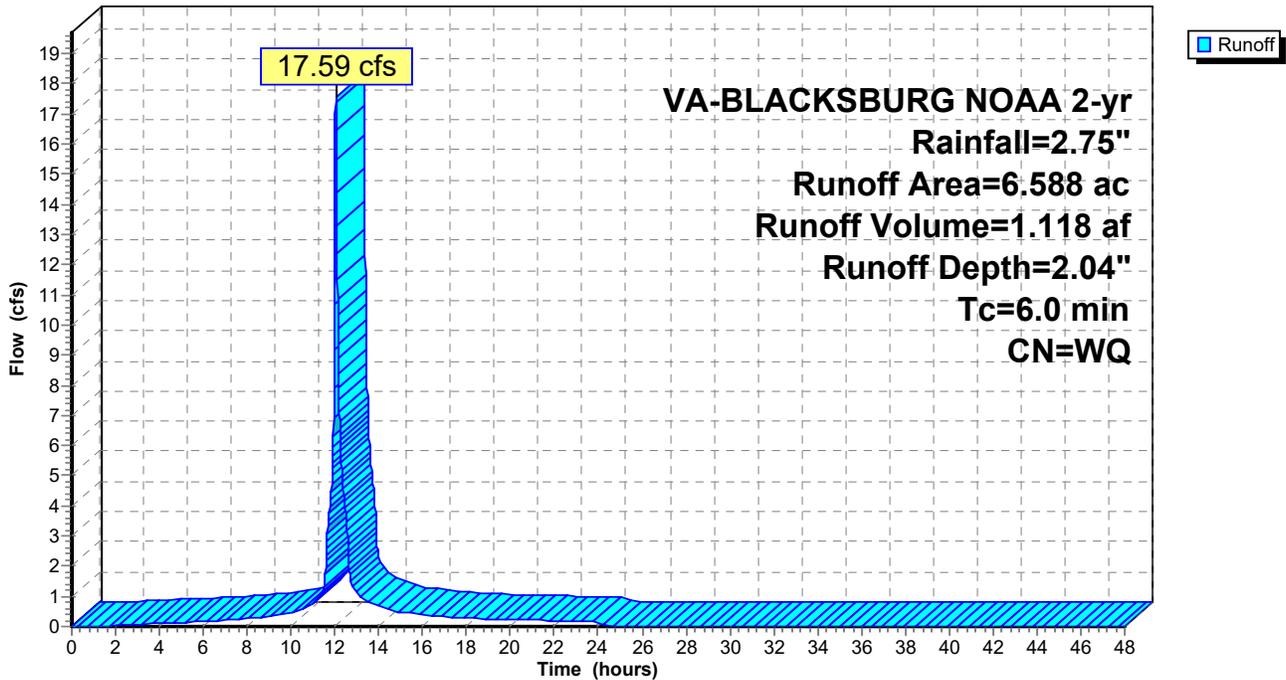
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.044	61	>75% Grass cover, Good, HSG B
1.744	74	>75% Grass cover, Good, HSG C
0.200	98	Paved parking, HSG B
* 4.600	98	Paved parking, HSG C
6.588		Weighted Average

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

Subcatchment 4S: DA TO USWM #2

Hydrograph



Summary for Subcatchment 5S: DA TO USWM #3

Runoff = 4.53 cfs @ 12.04 hrs, Volume= 0.291 af, Depth= 1.74"

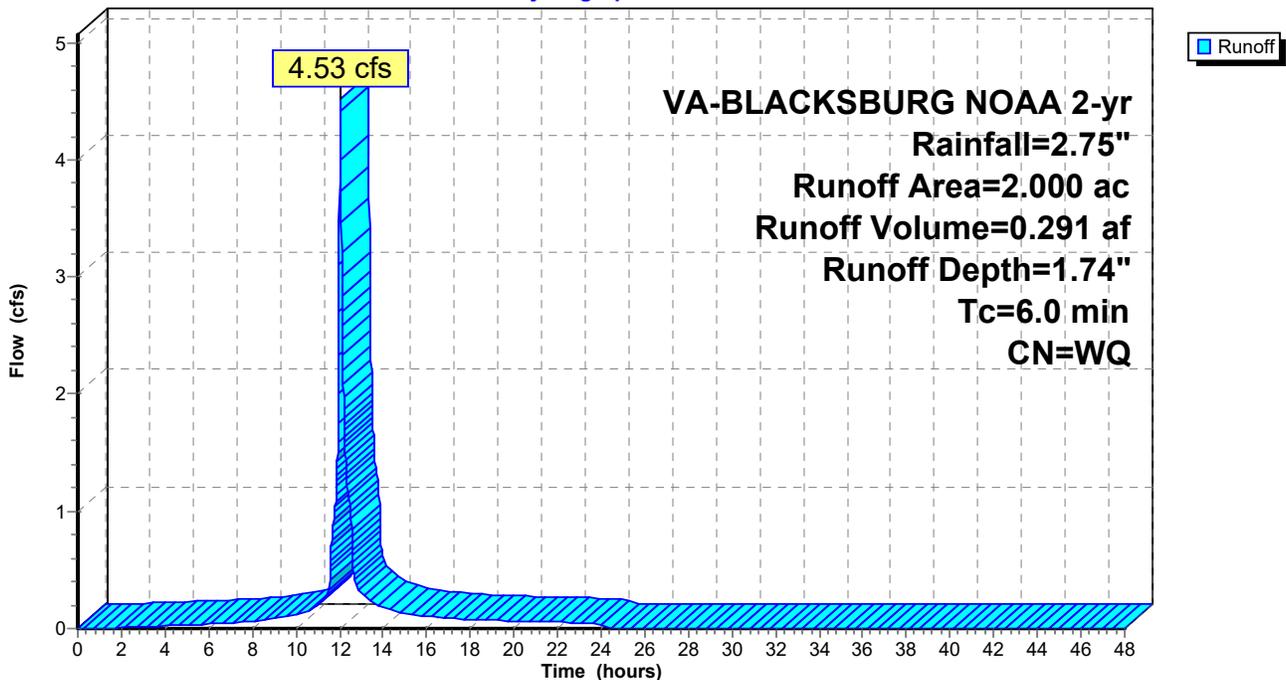
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.140	61	>75% Grass cover, Good, HSG B
0.700	74	>75% Grass cover, Good, HSG C
0.130	98	Paved parking, HSG B
1.030	98	Paved parking, HSG C
2.000		Weighted Average

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

Subcatchment 5S: DA TO USWM #3

Hydrograph



Summary for Subcatchment 6S: OFFSITE RUNOFF TO POA #2

Runoff = 60.83 cfs @ 12.14 hrs, Volume= 4.914 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.460	61	>75% Grass cover, Good, HSG B
1.310	74	>75% Grass cover, Good, HSG C
0.200	83	1/4 acre lots, 38% imp, HSG C
0.350	81	1/3 acre lots, 30% imp, HSG C
5.500	85	1/8 acre lots, 65% imp, HSG B
23.180	90	1/8 acre lots, 65% imp, HSG C
0.020	98	Paved roads w/curbs & sewers, HSG B
3.520	98	Paved roads w/curbs & sewers, HSG C

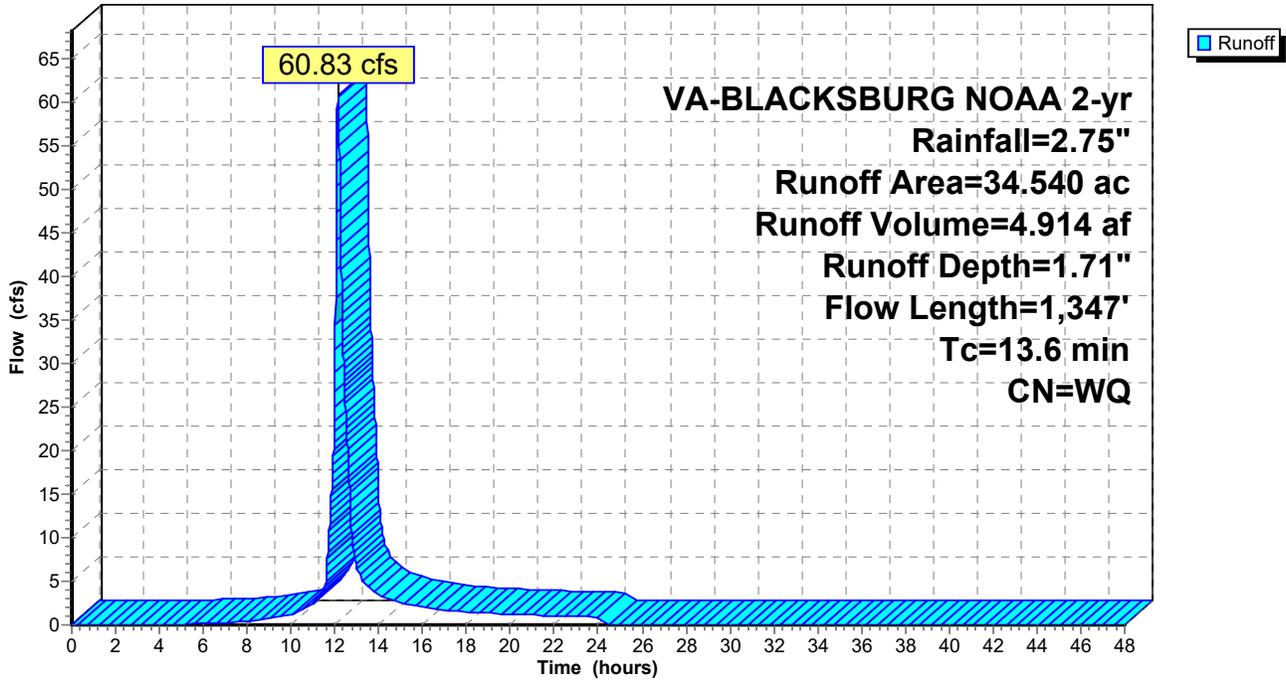
34.540 Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030 Corrugated metal
0.1	101	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013

13.6 1,347 Total

Subcatchment 6S: OFFSITE RUNOFF TO POA #2

Hydrograph



Summary for Subcatchment 7S: HUNT CLUB ROAD RUNOFF TO POA #2

Runoff = 5.53 cfs @ 12.04 hrs, Volume= 0.352 af, Depth= 2.25"

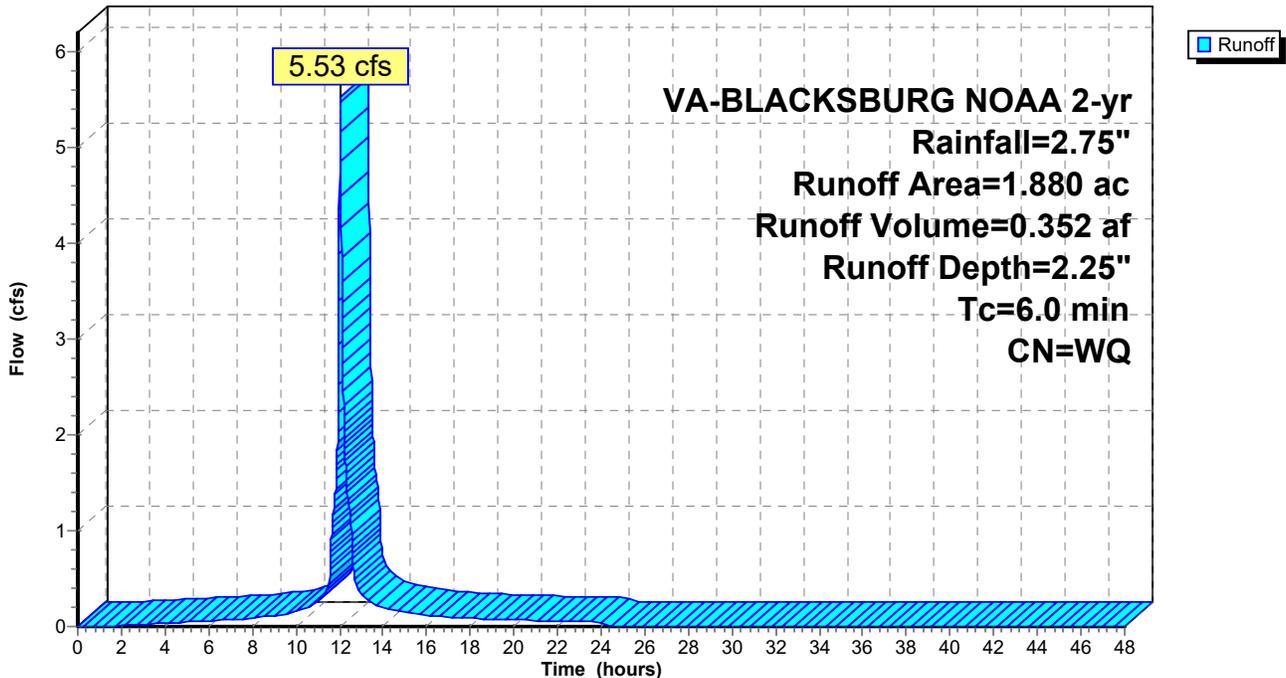
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 2-yr Rainfall=2.75"

Area (ac)	CN	Description
0.080	61	>75% Grass cover, Good, HSG B
0.190	74	>75% Grass cover, Good, HSG C
0.400	98	Paved parking, HSG B
1.210	98	Paved parking, HSG C
1.880		Weighted Average

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

Subcatchment 7S: HUNT CLUB ROAD RUNOFF TO POA #2

Hydrograph



Summary for Pond 1P: USWM #1

Inflow Area = 3.810 ac, Inflow Depth = 2.04" for 2-yr event
 Inflow = 10.20 cfs @ 12.04 hrs, Volume= 0.646 af
 Outflow = 4.85 cfs @ 12.17 hrs, Volume= 0.646 af, Atten= 52%, Lag= 8.1 min
 Primary = 4.85 cfs @ 12.17 hrs, Volume= 0.646 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 2,129.53' @ 12.17 hrs Surf.Area= 0.054 ac Storage= 0.147 af

Plug-Flow detention time= 22.2 min calculated for 0.646 af (100% of inflow)
 Center-of-Mass det. time= 22.2 min (794.5 - 772.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,125.50'	0.076 af	38.00'W x 62.00'L x 5.50'H Field A 0.297 af Overall - 0.107 af Embedded = 0.191 af x 40.0% Voids
#2A	2,126.00'	0.107 af	CMP Round 48 x 18 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf Overall Size= 48.0"W x 48.0"H x 20.00'L Row Length Adjustment= -4.00' x 12.57 sf x 6 rows 34.00' Header x 12.57 sf x 1 = 427.3 cf Inside
		0.183 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,125.30'	24.0" Round 24" CULVERT L= 423.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,125.30' / 2,110.00' S= 0.0361 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	2,125.40'	8.0" W x 4.0" H Vert. Orifice/Grate C= 0.600
#3	Device 1	2,129.20'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.84 cfs @ 12.17 hrs HW=2,129.53' (Free Discharge)

- 1=24" CULVERT (Passes 4.84 cfs of 27.18 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 2.13 cfs @ 9.58 fps)
- 3=Broad-Crested Rectangular Weir (Weir Controls 2.71 cfs @ 1.65 fps)

Pond 1P: USWM #1 - Chamber Wizard Field A

Chamber Model = CMP Round 48 (Round Corrugated Metal Pipe)

Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf

Overall Size= 48.0"W x 48.0"H x 20.00'L

Row Length Adjustment= -4.00' x 12.57 sf x 6 rows

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

3 Chambers/Row x 20.00' Long -4.00' Row Adjustment +4.00' Header x 1 = 60.00' Row Length +12.0" End Stone x 2 = 62.00' Base Length

6 Rows x 48.0" Wide + 24.0" Spacing x 5 + 24.0" Side Stone x 2 = 38.00' Base Width

6.0" Base + 48.0" Chamber Height + 12.0" Cover = 5.50' Field Height

18 Chambers x 251.3 cf -4.00' Row Adjustment x 12.57 sf x 6 Rows + 34.00' Header x 12.57 sf = 4,649.6 cf Chamber Storage

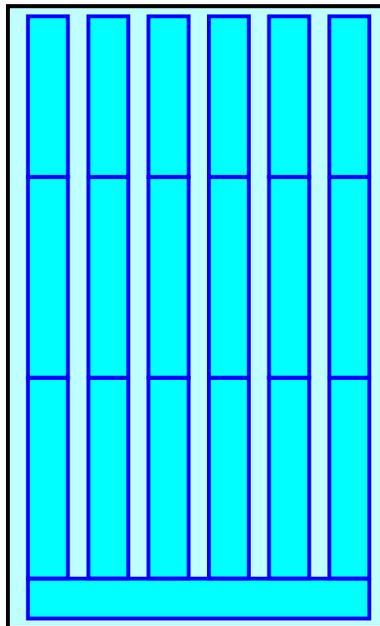
12,958.0 cf Field - 4,649.6 cf Chambers = 8,308.4 cf Stone x 40.0% Voids = 3,323.4 cf Stone Storage

Chamber Storage + Stone Storage = 7,972.9 cf = 0.183 af

Overall Storage Efficiency = 61.5%

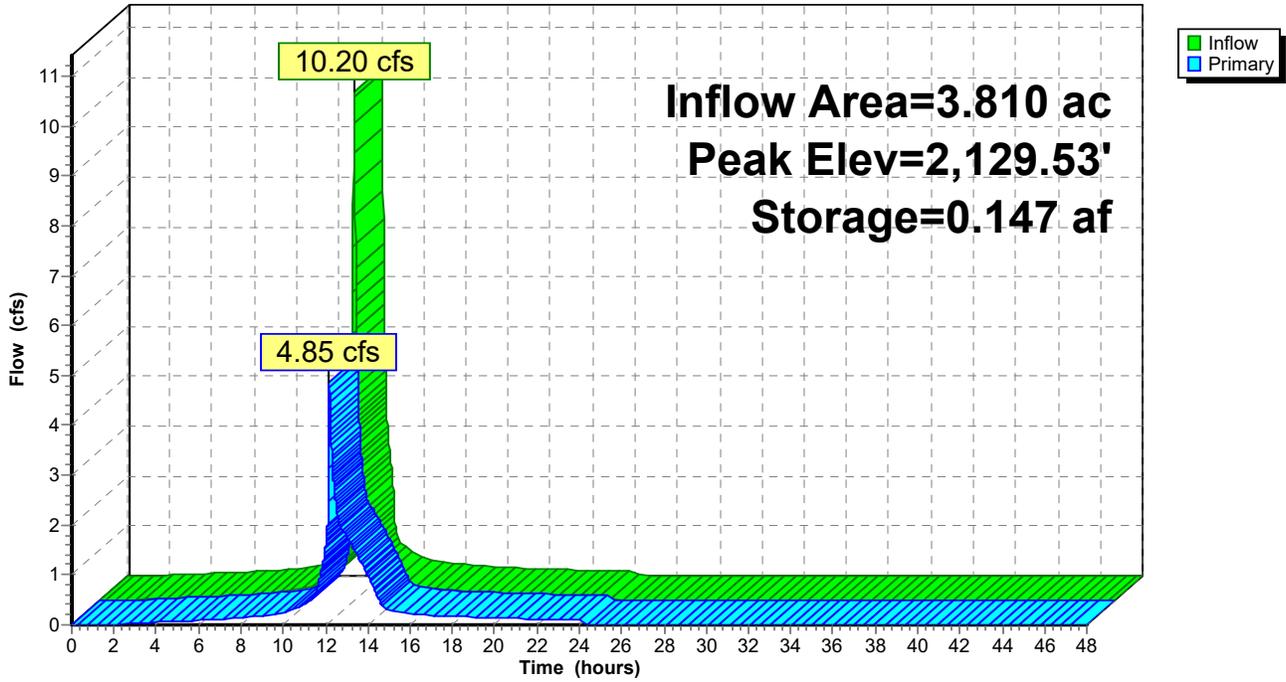
Overall System Size = 62.00' x 38.00' x 5.50'

18 Chambers
479.9 cy Field
307.7 cy Stone



Pond 1P: USWM #1

Hydrograph



Summary for Pond 2P: USWM #2

Inflow Area = 6.588 ac, Inflow Depth = 2.04" for 2-yr event
 Inflow = 17.59 cfs @ 12.04 hrs, Volume= 1.118 af
 Outflow = 3.45 cfs @ 12.54 hrs, Volume= 1.118 af, Atten= 80%, Lag= 30.4 min
 Primary = 3.45 cfs @ 12.54 hrs, Volume= 1.118 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 2,119.36' @ 12.54 hrs Surf.Area= 0.116 ac Storage= 0.338 af

Plug-Flow detention time= 36.7 min calculated for 1.118 af (100% of inflow)
 Center-of-Mass det. time= 36.7 min (807.9 - 771.2)

Volume	Invert	Avail.Storage	Storage Description
#1	2,115.00'	0.224 af	46.67'W x 108.00'L x 7.50'H Stone Storage 0.868 af Overall - 0.307 af Embedded = 0.561 af x 40.0% Voids
#2	2,116.50'	0.003 af	24.0" Round Inlet Manifold Inside #1 L= 38.5'
#3	2,116.50'	0.060 af	ADS_StormTech MC-4500 +Cap x 24 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf
#4	2,116.50'	0.241 af	ADS_StormTech MC-4500 +Cap x 96 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 4 Rows of 24 Chambers Cap Storage= +35.7 cf x 2 x 4 rows = 285.6 cf
#5	2,115.00'	0.003 af	24.0" Round Outlet Manifold Inside #1 L= 38.0'
		0.531 af	Total Available Storage

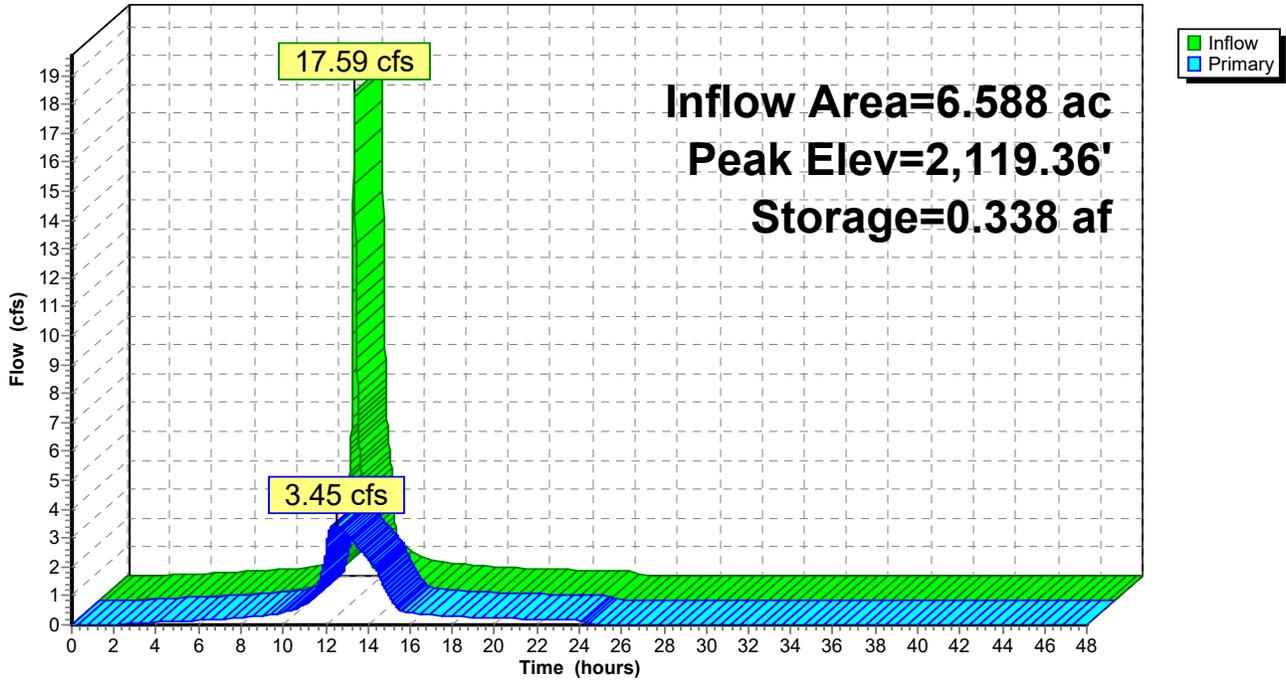
Device	Routing	Invert	Outlet Devices
#1	Primary	2,114.80'	24.0" Round 24" Culvert L= 165.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,114.80' / 2,110.00' S= 0.0290 1' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	2,114.90'	10.0" W x 5.0" H Vert. Orifice/Grate C= 0.600
#3	Device 1	2,120.50'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=3.45 cfs @ 12.54 hrs HW=2,119.36' (Free Discharge)

- 1=24" Culvert (Passes 3.45 cfs of 28.54 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 3.45 cfs @ 9.93 fps)
- 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 2P: USWM #2

Hydrograph



Summary for Pond 3P: USWM #3

Inflow Area = 2.000 ac, Inflow Depth = 1.74" for 2-yr event
 Inflow = 4.53 cfs @ 12.04 hrs, Volume= 0.291 af
 Outflow = 1.40 cfs @ 12.29 hrs, Volume= 0.291 af, Atten= 69%, Lag= 15.1 min
 Primary = 1.40 cfs @ 12.29 hrs, Volume= 0.291 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 2,121.92' @ 12.29 hrs Surf.Area= 0.034 ac Storage= 0.060 af

Plug-Flow detention time= 14.0 min calculated for 0.291 af (100% of inflow)
 Center-of-Mass det. time= 13.9 min (793.1 - 779.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,119.20'	0.047 af	24.00'W x 62.50'L x 5.00'H Field A 0.172 af Overall - 0.055 af Embedded = 0.117 af x 40.0% Voids
#2A	2,119.70'	0.055 af	CMP Round 42 x 12 Inside #1 Effective Size= 42.0"W x 42.0"H => 9.62 sf x 20.00'L = 192.4 cf Overall Size= 42.0"W x 42.0"H x 20.00'L Row Length Adjustment= -3.00' x 9.62 sf x 4 rows 20.00' Header x 9.62 sf x 1 = 192.4 cf Inside
		0.102 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,119.00'	24.0" Round 24" CULVERT L= 117.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,119.00' / 2,117.00' S= 0.0171 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	2,119.10'	8.5" W x 3.0" H Vert. Orifice/Grate C= 0.600
#3	Device 1	2,122.80'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.40 cfs @ 12.29 hrs HW=2,121.92' (Free Discharge)

- 1=24" CULVERT (Passes 1.40 cfs of 20.98 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 1.40 cfs @ 7.91 fps)
- 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 3P: USWM #3 - Chamber Wizard Field A

Chamber Model = CMP Round 42 (Round Corrugated Metal Pipe)

Effective Size= 42.0"W x 42.0"H => 9.62 sf x 20.00'L = 192.4 cf

Overall Size= 42.0"W x 42.0"H x 20.00'L

Row Length Adjustment= -3.00' x 9.62 sf x 4 rows

42.0" Wide + 24.0" Spacing = 66.0" C-C Row Spacing

3 Chambers/Row x 20.00' Long -3.00' Row Adjustment +3.50' Header x 1 = 60.50' Row Length +12.0" End Stone x 2 = 62.50' Base Length

4 Rows x 42.0" Wide + 24.0" Spacing x 3 + 24.0" Side Stone x 2 = 24.00' Base Width

6.0" Base + 42.0" Chamber Height + 12.0" Cover = 5.00' Field Height

12 Chambers x 192.4 cf -3.00' Row Adjustment x 9.62 sf x 4 Rows + 20.00' Header x 9.62 sf = 2,386.0 cf Chamber Storage

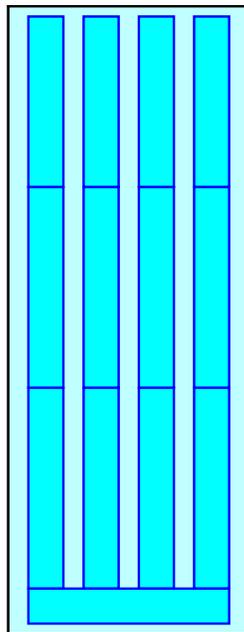
7,500.0 cf Field - 2,386.0 cf Chambers = 5,114.0 cf Stone x 40.0% Voids = 2,045.6 cf Stone Storage

Chamber Storage + Stone Storage = 4,431.6 cf = 0.102 af

Overall Storage Efficiency = 59.1%

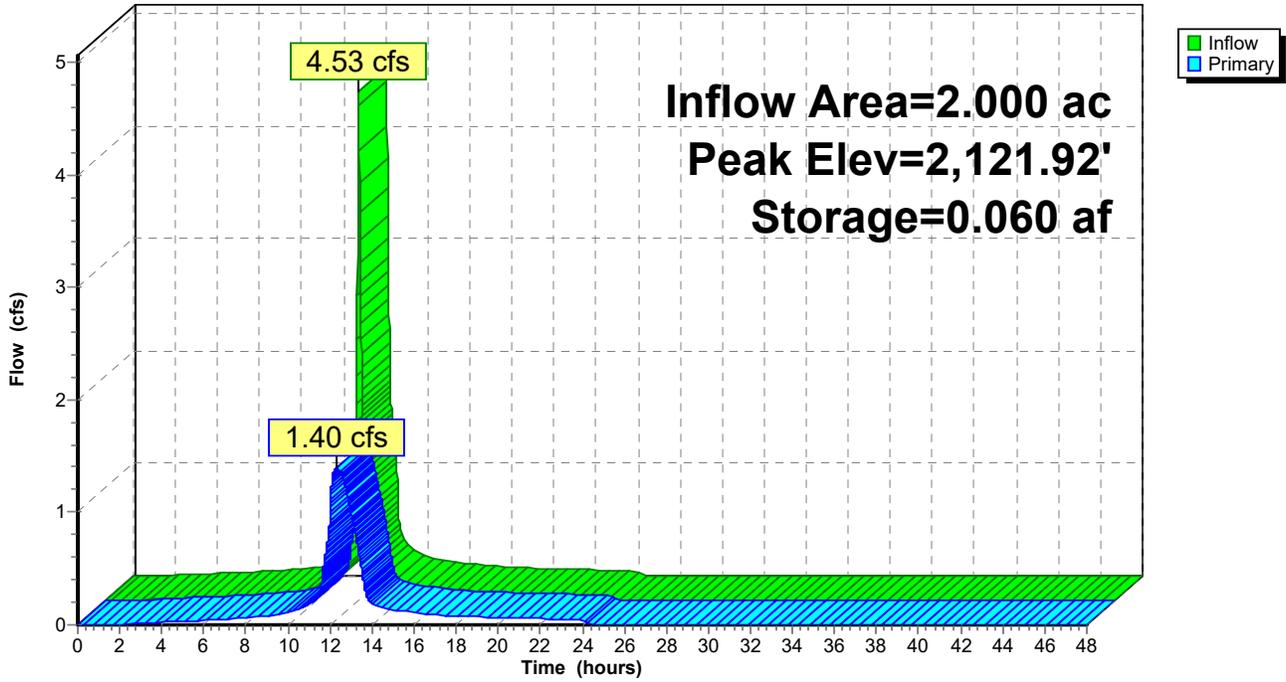
Overall System Size = 62.50' x 24.00' x 5.00'

12 Chambers
277.8 cy Field
189.4 cy Stone



Pond 3P: USWM #3

Hydrograph



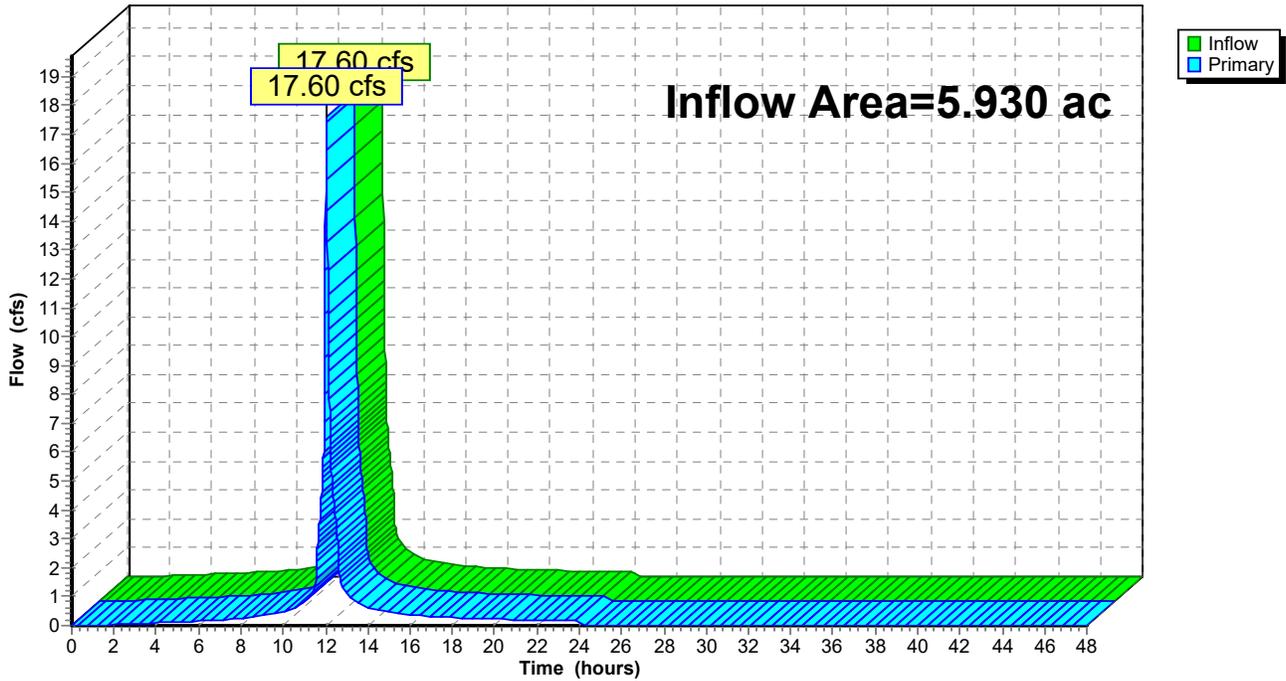
Summary for Link 1L: POA #1

Inflow Area = 5.930 ac, Inflow Depth = 2.23" for 2-yr event
Inflow = 17.60 cfs @ 12.04 hrs, Volume= 1.102 af
Primary = 17.60 cfs @ 12.04 hrs, Volume= 1.102 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: POA #1

Hydrograph



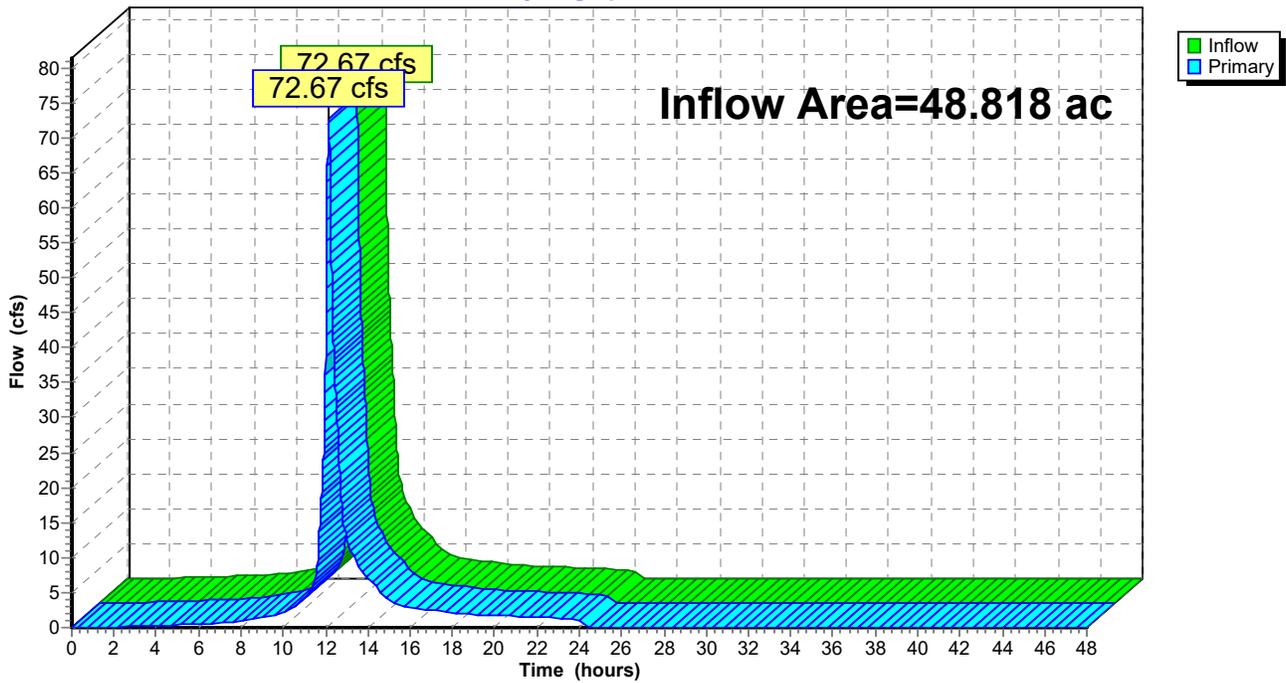
Summary for Link 2L: POA #2

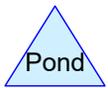
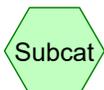
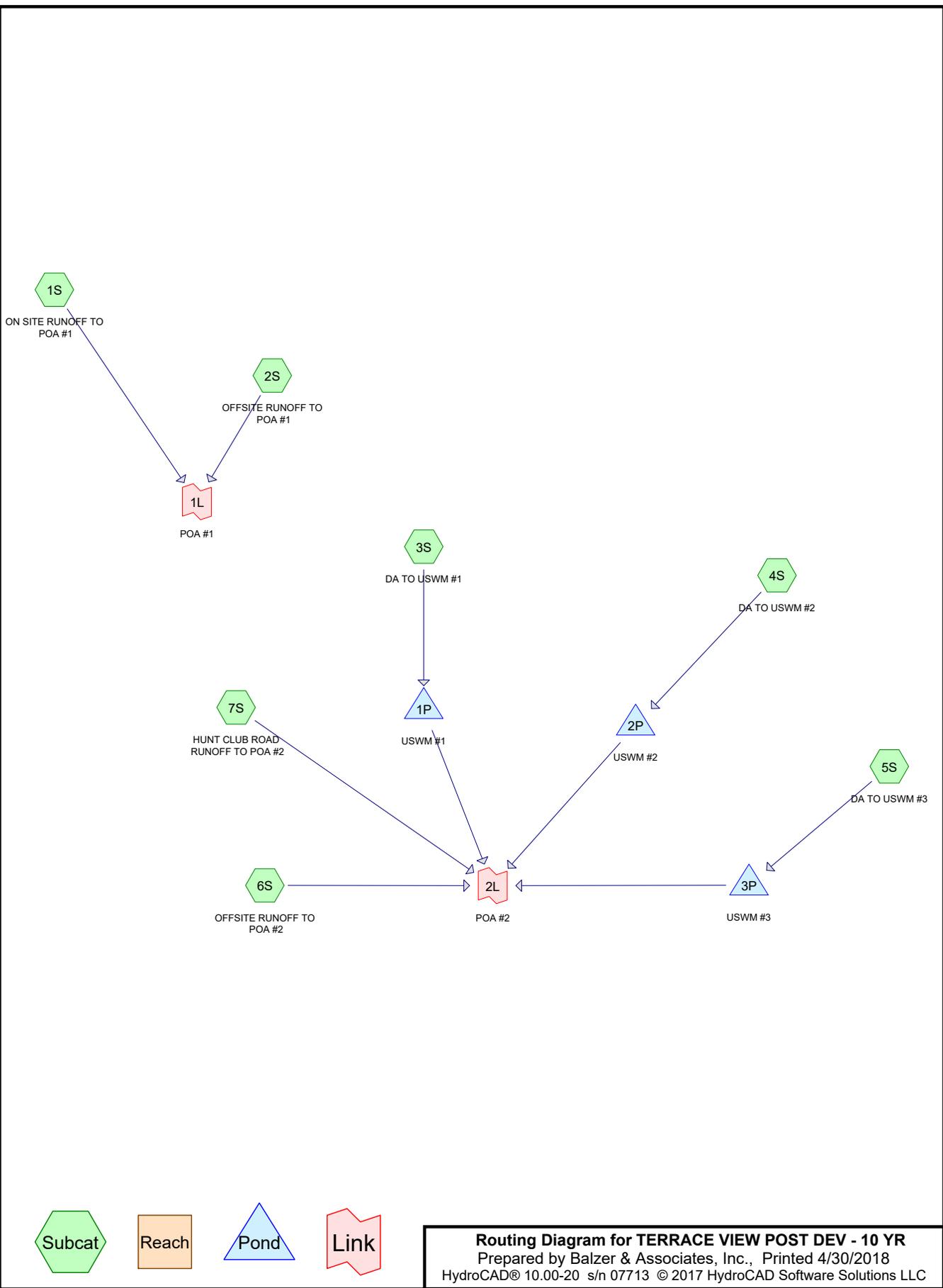
Inflow Area = 48.818 ac, Inflow Depth = 1.80" for 2-yr event
Inflow = 72.67 cfs @ 12.14 hrs, Volume= 7.322 af
Primary = 72.67 cfs @ 12.14 hrs, Volume= 7.322 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 2L: POA #2

Hydrograph





Routing Diagram for TERRACE VIEW POST DEV - 10 YR
 Prepared by Balzer & Associates, Inc., Printed 4/30/2018
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TERRACE VIEW POST DEV - 10 YR

Prepared by Balzer & Associates, Inc.

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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.350	81	1/3 acre lots, 30% imp, HSG C (6S)
0.200	83	1/4 acre lots, 38% imp, HSG C (6S)
5.500	85	1/8 acre lots, 65% imp, HSG B (6S)
23.820	90	1/8 acre lots, 65% imp, HSG C (2S, 6S)
0.724	61	>75% Grass cover, Good, HSG B (4S, 5S, 6S, 7S)
5.194	74	>75% Grass cover, Good, HSG C (1S, 3S, 4S, 5S, 6S, 7S)
0.730	98	Paved parking, HSG B (4S, 5S, 7S)
10.698	98	Paved parking, HSG C (1S, 3S, 4S, 5S, 7S)
3.130	98	Paved roads w/curbs & sewers, HSG B (2S, 6S)
3.670	98	Paved roads w/curbs & sewers, HSG C (2S, 6S)
0.270	94	Urban commercial, 85% imp, HSG C (2S)
0.462	79	VRRM Area A Adjusted CN (3S)
54.748	90	TOTAL AREA

TERRACE VIEW POST DEV - 10 YR

VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Prepared by Balzer & Associates, Inc.

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Page 3

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: ON SITE RUNOFF TO POA #1

Runoff Area=1.760 ac Runoff Depth=3.07"
 Tc=6.0 min CN=WQ Runoff=6.49 cfs 0.450 af

Subcatchment 2S: OFFSITE RUNOFF TO POA #1

Runoff Area=4.170 ac Runoff Depth=3.70"
 Tc=6.0 min CN=WQ Runoff=18.55 cfs 1.284 af

Subcatchment 3S: DA TO USWM #1

Runoff Area=3.810 ac Runoff Depth=3.28"
 Tc=6.0 min CN=WQ Runoff=15.00 cfs 1.041 af

Subcatchment 4S: DA TO USWM #2

Runoff Area=6.588 ac Runoff Depth=3.25"
 Tc=6.0 min CN=WQ Runoff=25.65 cfs 1.787 af

Subcatchment 5S: DA TO USWM #3

Runoff Area=2.000 ac Runoff Depth=2.88"
 Tc=6.0 min CN=WQ Runoff=6.90 cfs 0.480 af

Subcatchment 6S: OFFSITE RUNOFF TO POA #2

Runoff Area=34.540 ac Runoff Depth=2.93"
 Flow Length=1,347' Tc=13.6 min CN=WQ Runoff=96.87 cfs 8.422 af

Subcatchment 7S: HUNT CLUB ROAD RUNOFF TO POA #2

Runoff Area=1.880 ac Runoff Depth=3.51"
 Tc=6.0 min CN=WQ Runoff=7.82 cfs 0.549 af

Pond 1P: USWM #1

Peak Elev=2,130.01' Storage=0.162 af Inflow=15.00 cfs 1.041 af
 Outflow=14.21 cfs 1.041 af

Pond 2P: USWM #2

Peak Elev=2,121.11' Storage=0.466 af Inflow=25.65 cfs 1.787 af
 Outflow=11.57 cfs 1.787 af

Pond 3P: USWM #3

Peak Elev=2,123.13' Storage=0.087 af Inflow=6.90 cfs 0.480 af
 Outflow=4.43 cfs 0.480 af

Link 1L: POA #1

Inflow=25.05 cfs 1.735 af
 Primary=25.05 cfs 1.735 af

Link 2L: POA #2

Inflow=122.94 cfs 12.279 af
 Primary=122.94 cfs 12.279 af

Total Runoff Area = 54.748 ac Runoff Volume = 14.013 af Average Runoff Depth = 3.07"

Summary for Subcatchment 1S: ON SITE RUNOFF TO POA #1

Runoff = 6.49 cfs @ 12.04 hrs, Volume= 0.450 af, Depth= 3.07"

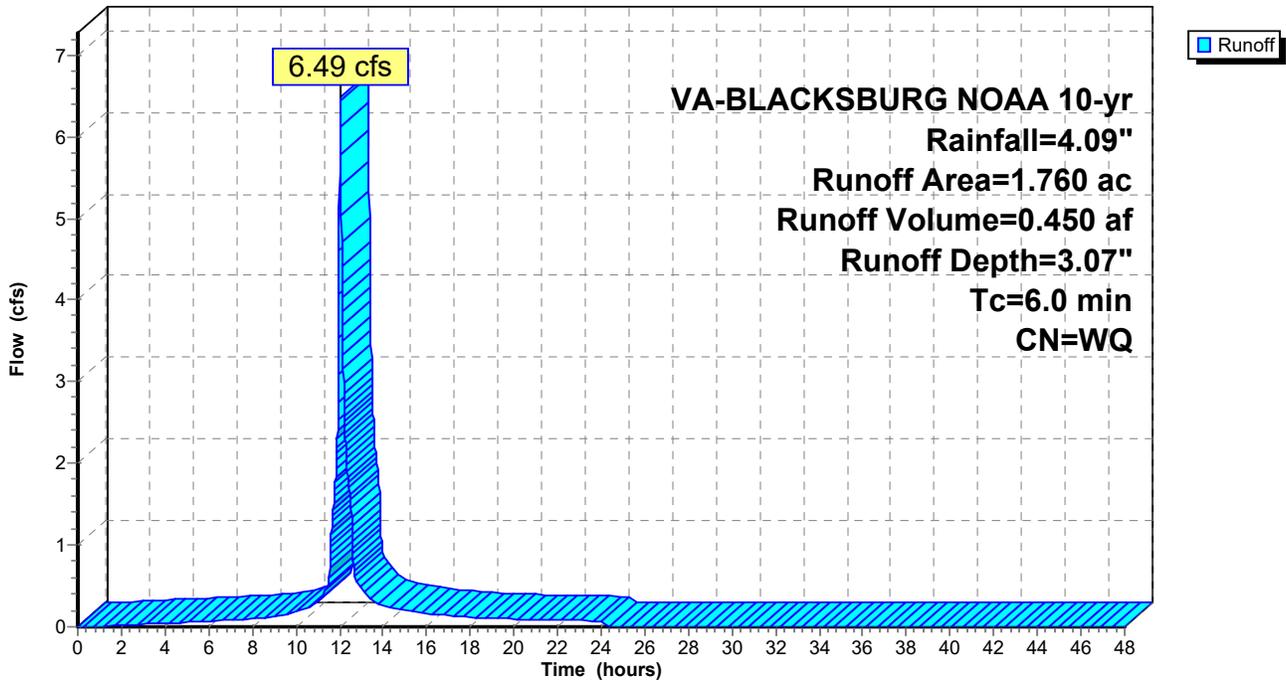
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.630	74	>75% Grass cover, Good, HSG C
1.130	98	Paved parking, HSG C
1.760		Weighted Average

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

Subcatchment 1S: ON SITE RUNOFF TO POA #1

Hydrograph



Summary for Subcatchment 2S: OFFSITE RUNOFF TO POA #1

Runoff = 18.55 cfs @ 12.04 hrs, Volume= 1.284 af, Depth= 3.70"

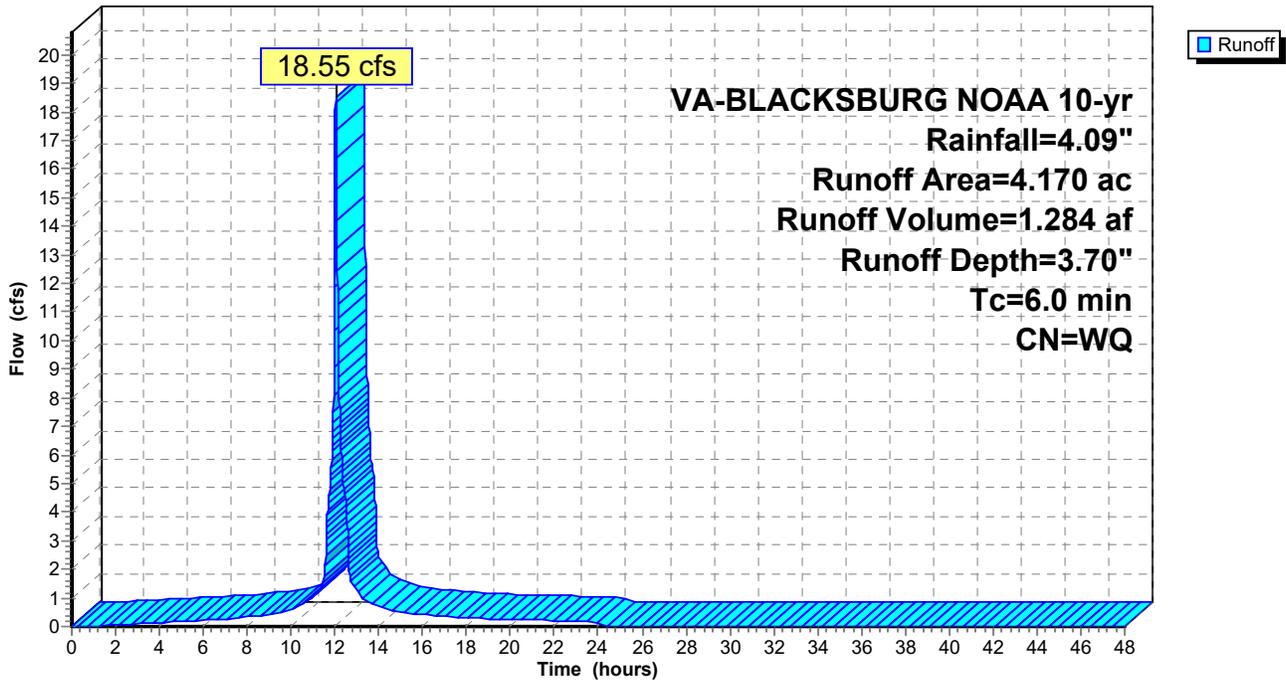
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.640	90	1/8 acre lots, 65% imp, HSG C
0.270	94	Urban commercial, 85% imp, HSG C
3.110	98	Paved roads w/curbs & sewers, HSG B
0.150	98	Paved roads w/curbs & sewers, HSG C
4.170		Weighted Average

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

Subcatchment 2S: OFFSITE RUNOFF TO POA #1

Hydrograph



Summary for Subcatchment 3S: DA TO USWM #1

Runoff = 15.00 cfs @ 12.04 hrs, Volume= 1.041 af, Depth= 3.28"

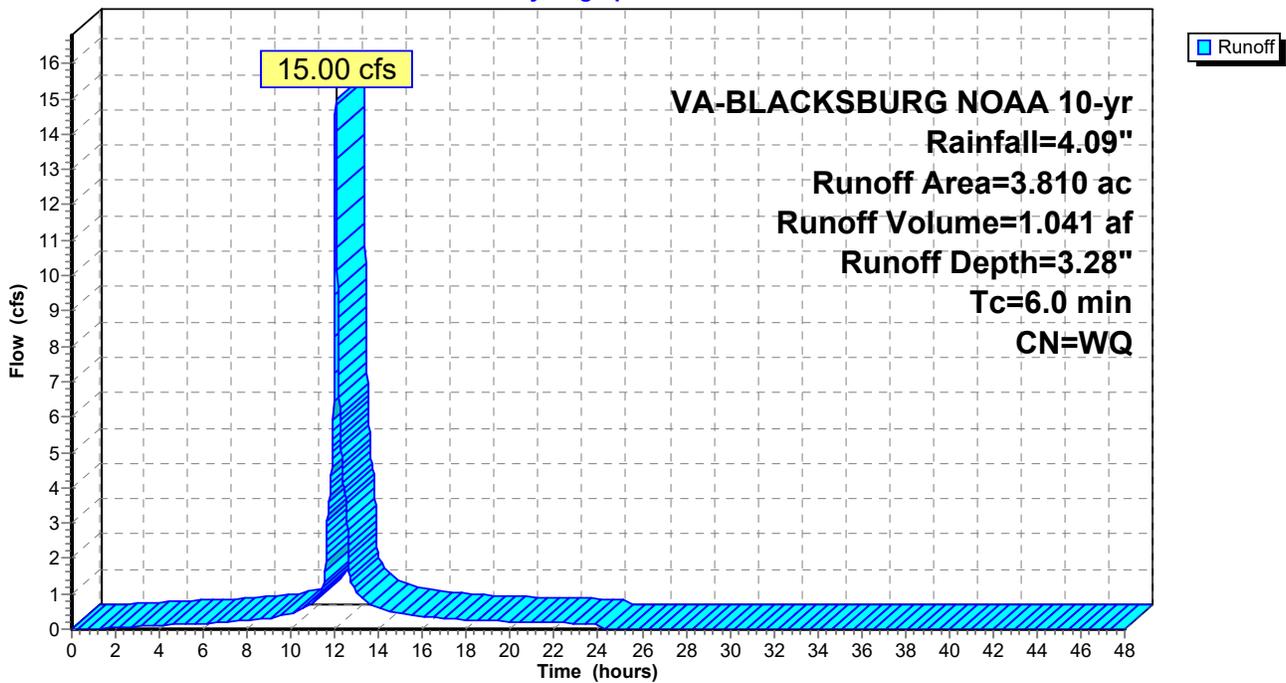
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.620	74	>75% Grass cover, Good, HSG C
2.728	98	Paved parking, HSG C
* 0.462	79	VRRM Area A Adjusted CN
3.810		Weighted Average

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

Subcatchment 3S: DA TO USWM #1

Hydrograph



Summary for Subcatchment 4S: DA TO USWM #2

Runoff = 25.65 cfs @ 12.04 hrs, Volume= 1.787 af, Depth= 3.25"

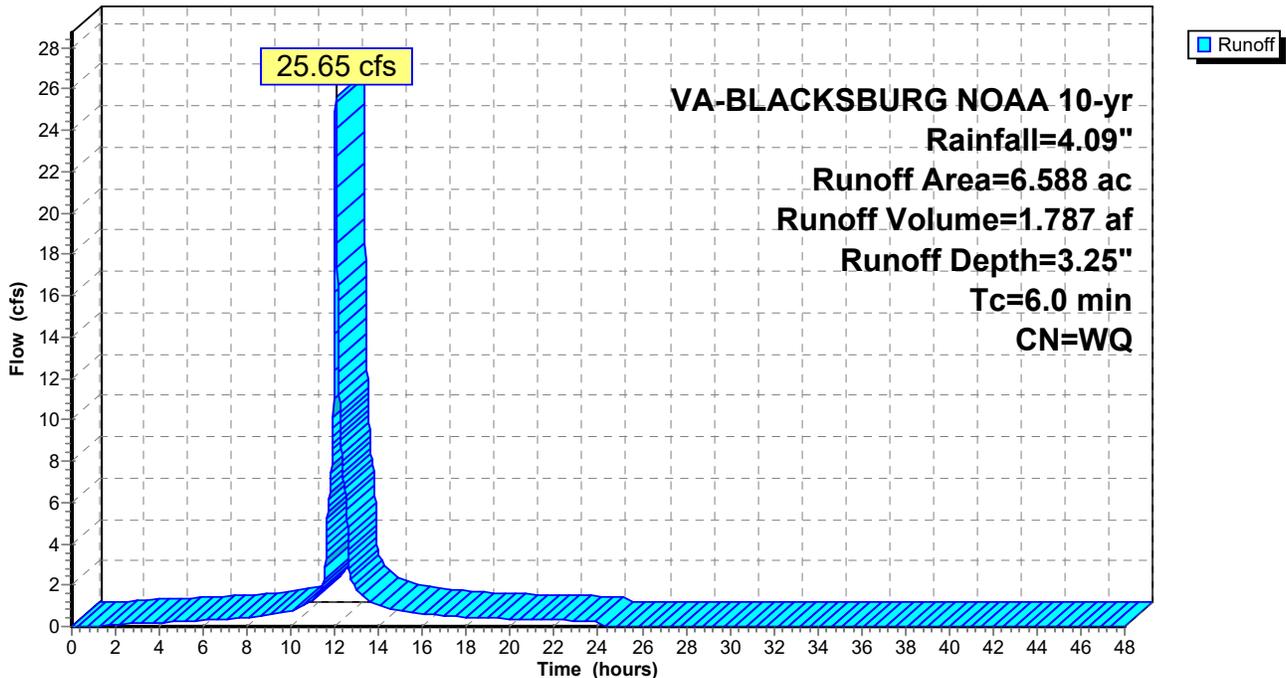
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.044	61	>75% Grass cover, Good, HSG B
1.744	74	>75% Grass cover, Good, HSG C
0.200	98	Paved parking, HSG B
4.600	98	Paved parking, HSG C
6.588		Weighted Average

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

Subcatchment 4S: DA TO USWM #2

Hydrograph



Summary for Subcatchment 5S: DA TO USWM #3

Runoff = 6.90 cfs @ 12.04 hrs, Volume= 0.480 af, Depth= 2.88"

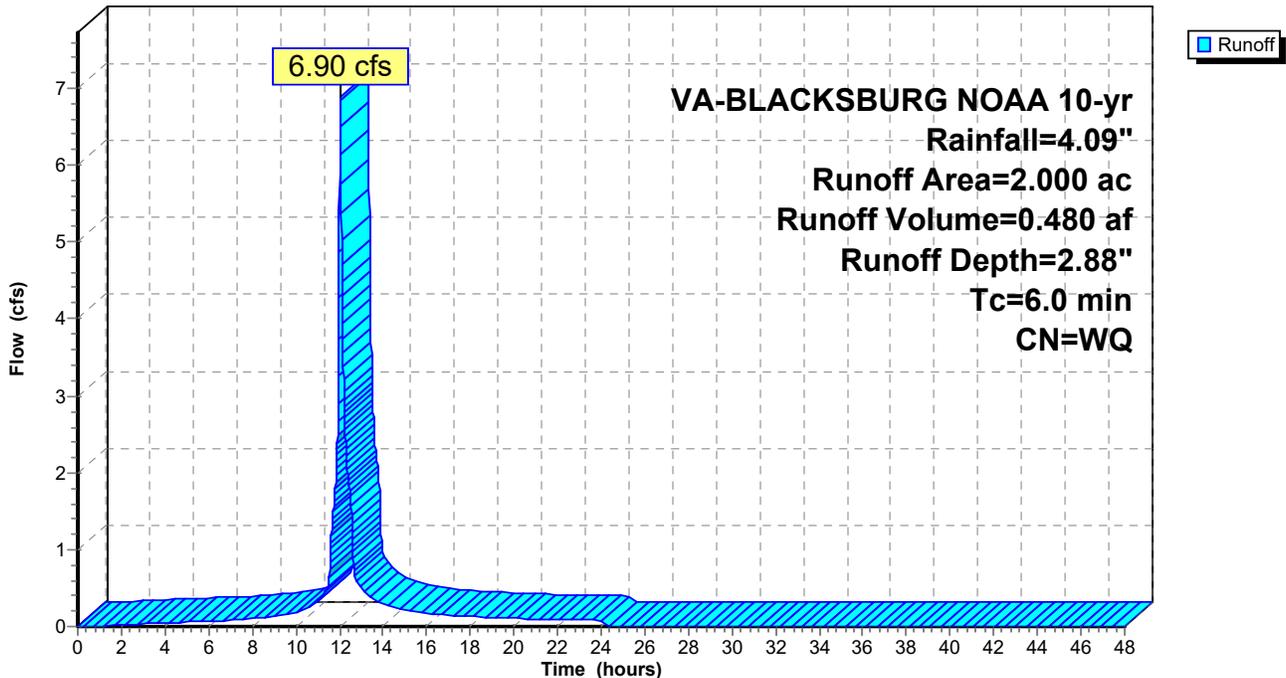
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.140	61	>75% Grass cover, Good, HSG B
0.700	74	>75% Grass cover, Good, HSG C
0.130	98	Paved parking, HSG B
1.030	98	Paved parking, HSG C
2.000		Weighted Average

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

Subcatchment 5S: DA TO USWM #3

Hydrograph



Summary for Subcatchment 6S: OFFSITE RUNOFF TO POA #2

Runoff = 96.87 cfs @ 12.14 hrs, Volume= 8.422 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

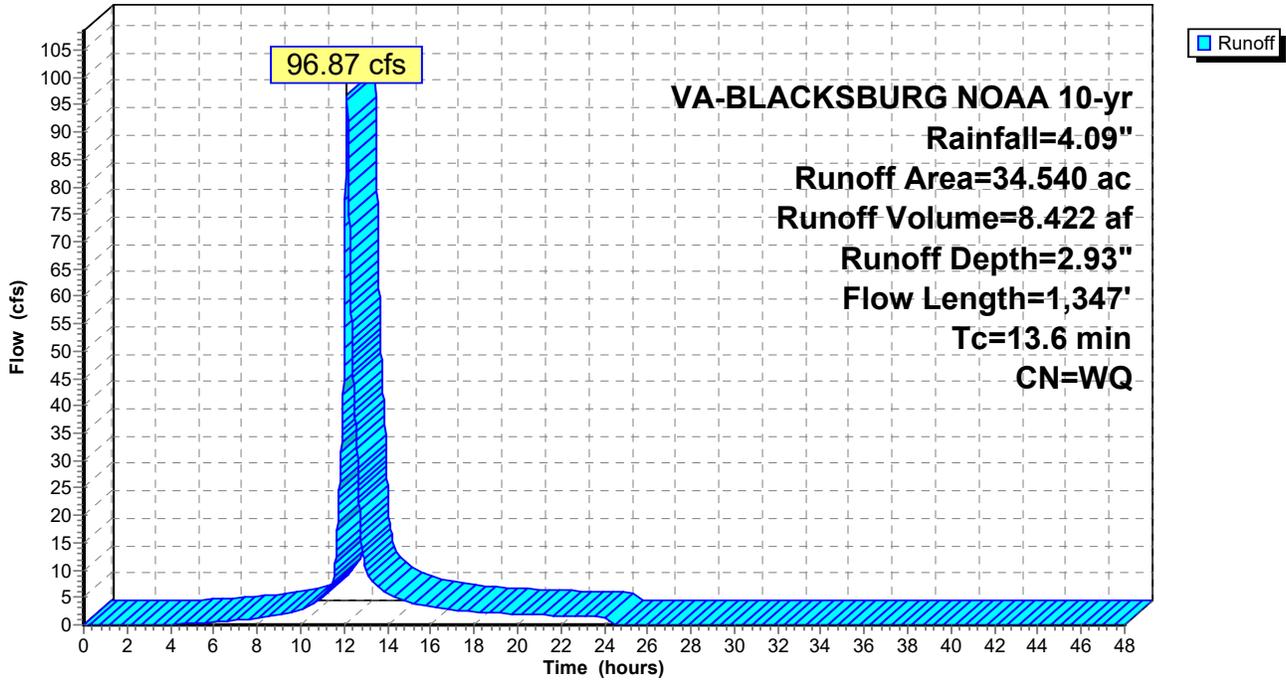
Area (ac)	CN	Description
0.460	61	>75% Grass cover, Good, HSG B
1.310	74	>75% Grass cover, Good, HSG C
0.200	83	1/4 acre lots, 38% imp, HSG C
0.350	81	1/3 acre lots, 30% imp, HSG C
5.500	85	1/8 acre lots, 65% imp, HSG B
23.180	90	1/8 acre lots, 65% imp, HSG C
0.020	98	Paved roads w/curbs & sewers, HSG B
3.520	98	Paved roads w/curbs & sewers, HSG C

34.540 Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030 Corrugated metal
0.1	101	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013
13.6	1,347	Total			

Subcatchment 6S: OFFSITE RUNOFF TO POA #2

Hydrograph



Summary for Subcatchment 7S: HUNT CLUB ROAD RUNOFF TO POA #2

Runoff = 7.82 cfs @ 12.04 hrs, Volume= 0.549 af, Depth= 3.51"

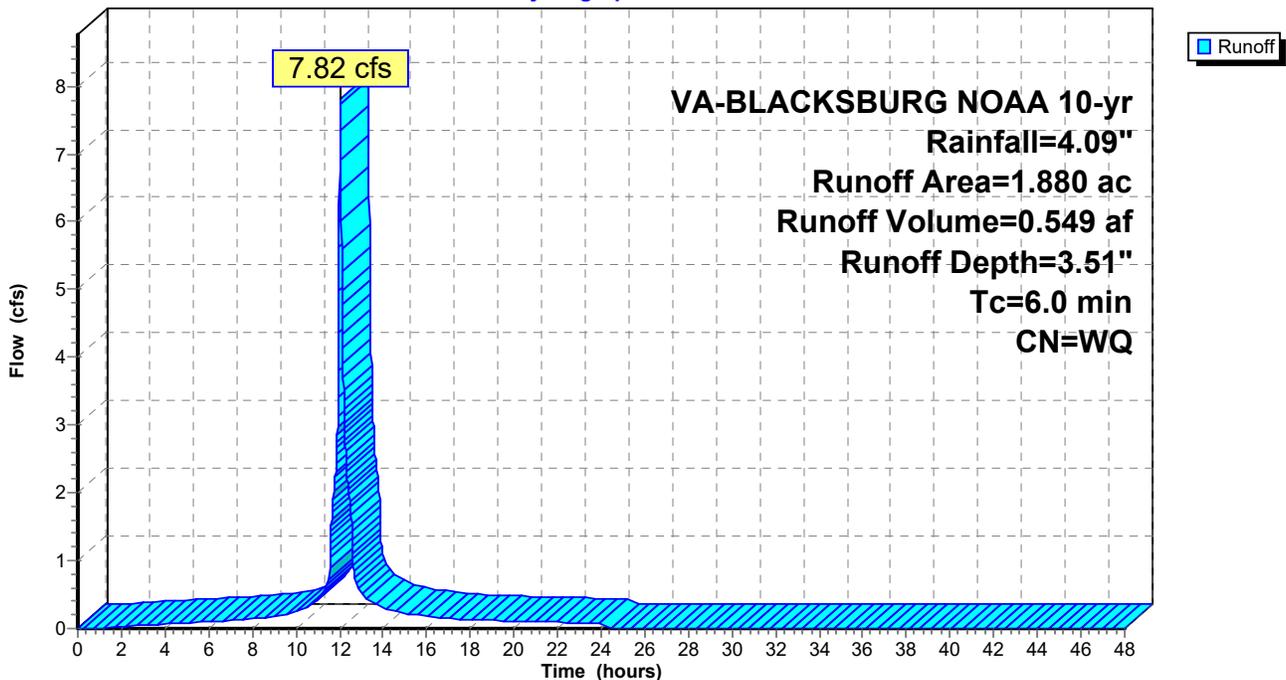
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 10-yr Rainfall=4.09"

Area (ac)	CN	Description
0.080	61	>75% Grass cover, Good, HSG B
0.190	74	>75% Grass cover, Good, HSG C
0.400	98	Paved parking, HSG B
1.210	98	Paved parking, HSG C
1.880		Weighted Average

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

Subcatchment 7S: HUNT CLUB ROAD RUNOFF TO POA #2

Hydrograph



Summary for Pond 1P: USWM #1

Inflow Area = 3.810 ac, Inflow Depth = 3.28" for 10-yr event
 Inflow = 15.00 cfs @ 12.04 hrs, Volume= 1.041 af
 Outflow = 14.21 cfs @ 12.06 hrs, Volume= 1.041 af, Atten= 5%, Lag= 1.4 min
 Primary = 14.21 cfs @ 12.06 hrs, Volume= 1.041 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 2,130.01' @ 12.06 hrs Surf.Area= 0.054 ac Storage= 0.162 af

Plug-Flow detention time= 19.0 min calculated for 1.040 af (100% of inflow)
 Center-of-Mass det. time= 19.0 min (785.2 - 766.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,125.50'	0.076 af	38.00'W x 62.00'L x 5.50'H Field A 0.297 af Overall - 0.107 af Embedded = 0.191 af x 40.0% Voids
#2A	2,126.00'	0.107 af	CMP Round 48 x 18 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf Overall Size= 48.0"W x 48.0"H x 20.00'L Row Length Adjustment= -4.00' x 12.57 sf x 6 rows 34.00' Header x 12.57 sf x 1 = 427.3 cf Inside
		0.183 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,125.30'	24.0" Round 24" CULVERT L= 423.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,125.30' / 2,110.00' S= 0.0361 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	2,125.40'	8.0" W x 4.0" H Vert. Orifice/Grate C= 0.600
#3	Device 1	2,129.20'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=14.21 cfs @ 12.06 hrs HW=2,130.01' (Free Discharge)

- 1=24" CULVERT (Passes 14.21 cfs of 29.12 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 2.25 cfs @ 10.15 fps)
- 3=Broad-Crested Rectangular Weir (Weir Controls 11.95 cfs @ 2.96 fps)

Pond 1P: USWM #1 - Chamber Wizard Field A

Chamber Model = CMP Round 48 (Round Corrugated Metal Pipe)

Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf

Overall Size= 48.0"W x 48.0"H x 20.00'L

Row Length Adjustment= -4.00' x 12.57 sf x 6 rows

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

3 Chambers/Row x 20.00' Long -4.00' Row Adjustment +4.00' Header x 1 = 60.00' Row Length +12.0" End Stone x 2 = 62.00' Base Length

6 Rows x 48.0" Wide + 24.0" Spacing x 5 + 24.0" Side Stone x 2 = 38.00' Base Width

6.0" Base + 48.0" Chamber Height + 12.0" Cover = 5.50' Field Height

18 Chambers x 251.3 cf -4.00' Row Adjustment x 12.57 sf x 6 Rows + 34.00' Header x 12.57 sf = 4,649.6 cf Chamber Storage

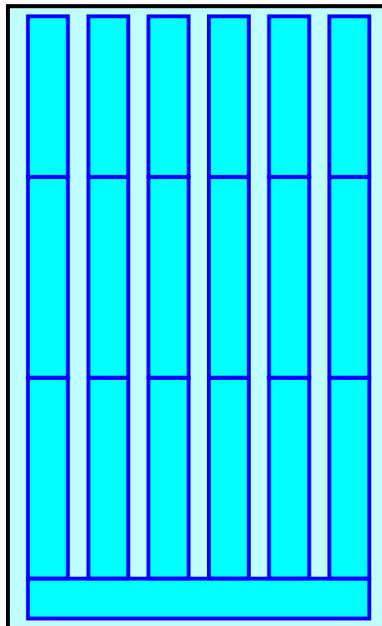
12,958.0 cf Field - 4,649.6 cf Chambers = 8,308.4 cf Stone x 40.0% Voids = 3,323.4 cf Stone Storage

Chamber Storage + Stone Storage = 7,972.9 cf = 0.183 af

Overall Storage Efficiency = 61.5%

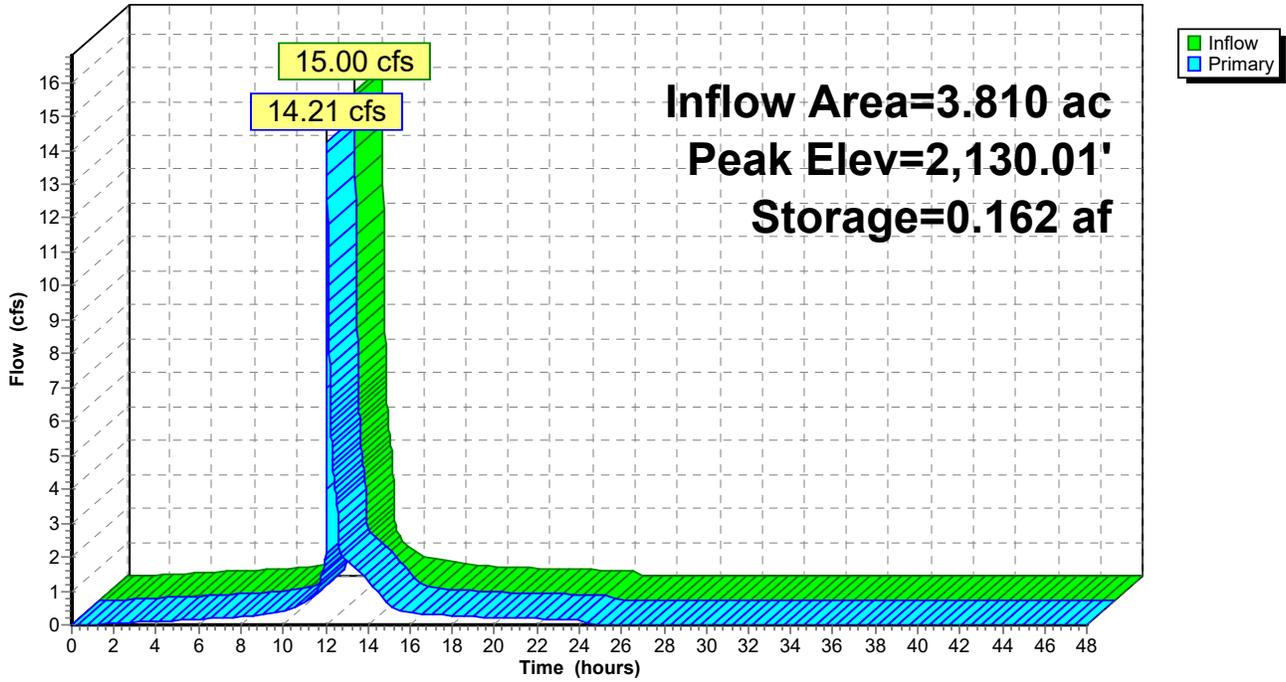
Overall System Size = 62.00' x 38.00' x 5.50'

18 Chambers
479.9 cy Field
307.7 cy Stone



Pond 1P: USWM #1

Hydrograph



Summary for Pond 2P: USWM #2

Inflow Area = 6.588 ac, Inflow Depth = 3.25" for 10-yr event
 Inflow = 25.65 cfs @ 12.04 hrs, Volume= 1.787 af
 Outflow = 11.57 cfs @ 12.19 hrs, Volume= 1.787 af, Atten= 55%, Lag= 9.4 min
 Primary = 11.57 cfs @ 12.19 hrs, Volume= 1.787 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 2,121.11' @ 12.19 hrs Surf.Area= 0.116 ac Storage= 0.466 af

Plug-Flow detention time= 38.2 min calculated for 1.787 af (100% of inflow)
 Center-of-Mass det. time= 38.2 min (803.5 - 765.3)

Volume	Invert	Avail.Storage	Storage Description
#1	2,115.00'	0.224 af	46.67'W x 108.00'L x 7.50'H Stone Storage 0.868 af Overall - 0.307 af Embedded = 0.561 af x 40.0% Voids
#2	2,116.50'	0.003 af	24.0" Round Inlet Manifold Inside #1 L= 38.5'
#3	2,116.50'	0.060 af	ADS_StormTech MC-4500 +Cap x 24 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf
#4	2,116.50'	0.241 af	ADS_StormTech MC-4500 +Cap x 96 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 4 Rows of 24 Chambers Cap Storage= +35.7 cf x 2 x 4 rows = 285.6 cf
#5	2,115.00'	0.003 af	24.0" Round Outlet Manifold Inside #1 L= 38.0'
		0.531 af	Total Available Storage

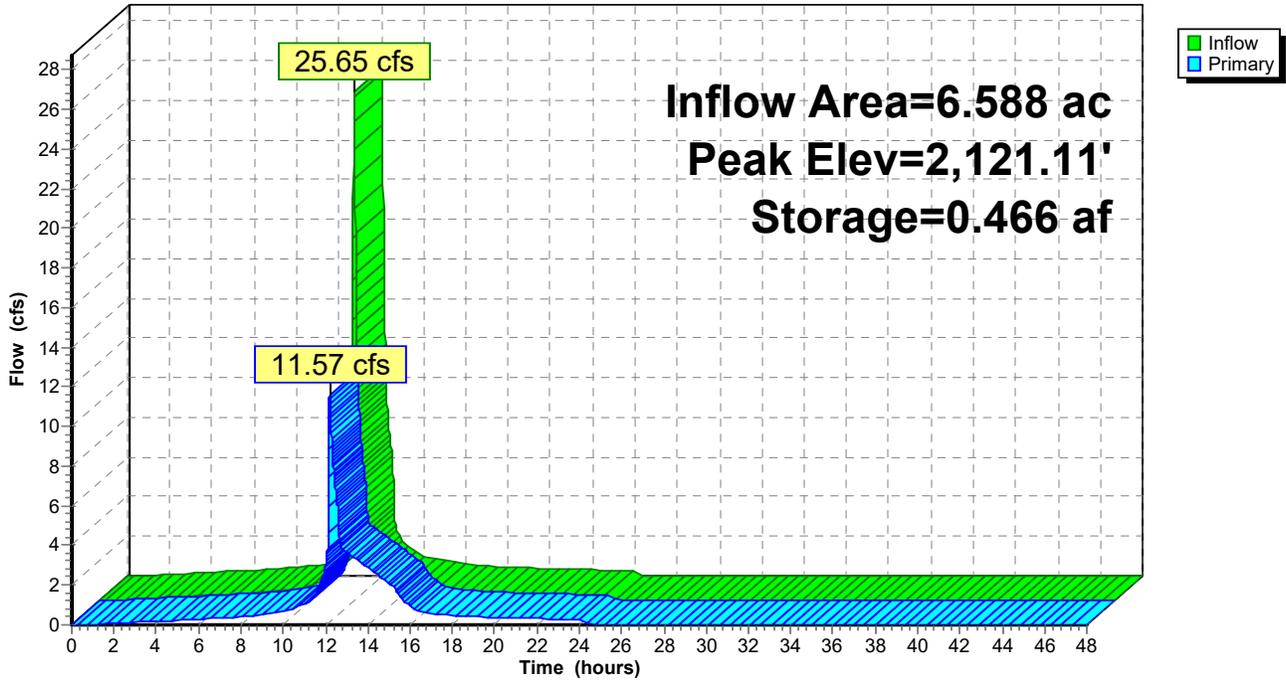
Device	Routing	Invert	Outlet Devices
#1	Primary	2,114.80'	24.0" Round 24" Culvert L= 165.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,114.80' / 2,110.00' S= 0.0290 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	2,114.90'	10.0" W x 5.0" H Vert. Orifice/Grate C= 0.600
#3	Device 1	2,120.50'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=11.53 cfs @ 12.19 hrs HW=2,121.11' (Free Discharge)

- 1=24" Culvert (Passes 11.53 cfs of 34.87 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 4.10 cfs @ 11.80 fps)
- 3=Broad-Crested Rectangular Weir (Weir Controls 7.43 cfs @ 2.42 fps)

Pond 2P: USWM #2

Hydrograph



Summary for Pond 3P: USWM #3

Inflow Area = 2.000 ac, Inflow Depth = 2.88" for 10-yr event
 Inflow = 6.90 cfs @ 12.04 hrs, Volume= 0.480 af
 Outflow = 4.43 cfs @ 12.12 hrs, Volume= 0.480 af, Atten= 36%, Lag= 5.2 min
 Primary = 4.43 cfs @ 12.12 hrs, Volume= 0.480 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 2,123.13' @ 12.12 hrs Surf.Area= 0.034 ac Storage= 0.087 af

Plug-Flow detention time= 15.4 min calculated for 0.480 af (100% of inflow)
 Center-of-Mass det. time= 15.4 min (790.1 - 774.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,119.20'	0.047 af	24.00'W x 62.50'L x 5.00'H Field A 0.172 af Overall - 0.055 af Embedded = 0.117 af x 40.0% Voids
#2A	2,119.70'	0.055 af	CMP Round 42 x 12 Inside #1 Effective Size= 42.0"W x 42.0"H => 9.62 sf x 20.00'L = 192.4 cf Overall Size= 42.0"W x 42.0"H x 20.00'L Row Length Adjustment= -3.00' x 9.62 sf x 4 rows 20.00' Header x 9.62 sf x 1 = 192.4 cf Inside
		0.102 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,119.00'	24.0" Round 24" CULVERT L= 117.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,119.00' / 2,117.00' S= 0.0171 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	2,119.10'	8.5" W x 3.0" H Vert. Orifice/Grate C= 0.600
#3	Device 1	2,122.80'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.40 cfs @ 12.12 hrs HW=2,123.13' (Free Discharge)

- 1=24" CULVERT (Passes 4.40 cfs of 26.76 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 1.68 cfs @ 9.51 fps)
- 3=Broad-Crested Rectangular Weir (Weir Controls 2.72 cfs @ 1.65 fps)

Pond 3P: USWM #3 - Chamber Wizard Field A

Chamber Model = CMP Round 42 (Round Corrugated Metal Pipe)

Effective Size= 42.0"W x 42.0"H => 9.62 sf x 20.00'L = 192.4 cf

Overall Size= 42.0"W x 42.0"H x 20.00'L

Row Length Adjustment= -3.00' x 9.62 sf x 4 rows

42.0" Wide + 24.0" Spacing = 66.0" C-C Row Spacing

3 Chambers/Row x 20.00' Long -3.00' Row Adjustment +3.50' Header x 1 = 60.50' Row Length +12.0" End Stone x 2 = 62.50' Base Length

4 Rows x 42.0" Wide + 24.0" Spacing x 3 + 24.0" Side Stone x 2 = 24.00' Base Width

6.0" Base + 42.0" Chamber Height + 12.0" Cover = 5.00' Field Height

12 Chambers x 192.4 cf -3.00' Row Adjustment x 9.62 sf x 4 Rows + 20.00' Header x 9.62 sf = 2,386.0 cf Chamber Storage

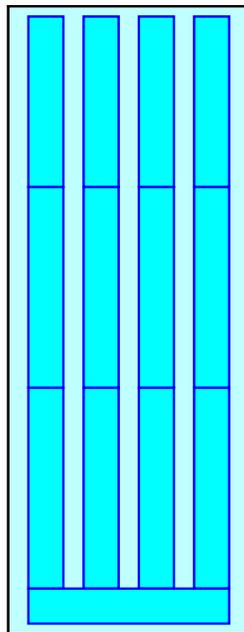
7,500.0 cf Field - 2,386.0 cf Chambers = 5,114.0 cf Stone x 40.0% Voids = 2,045.6 cf Stone Storage

Chamber Storage + Stone Storage = 4,431.6 cf = 0.102 af

Overall Storage Efficiency = 59.1%

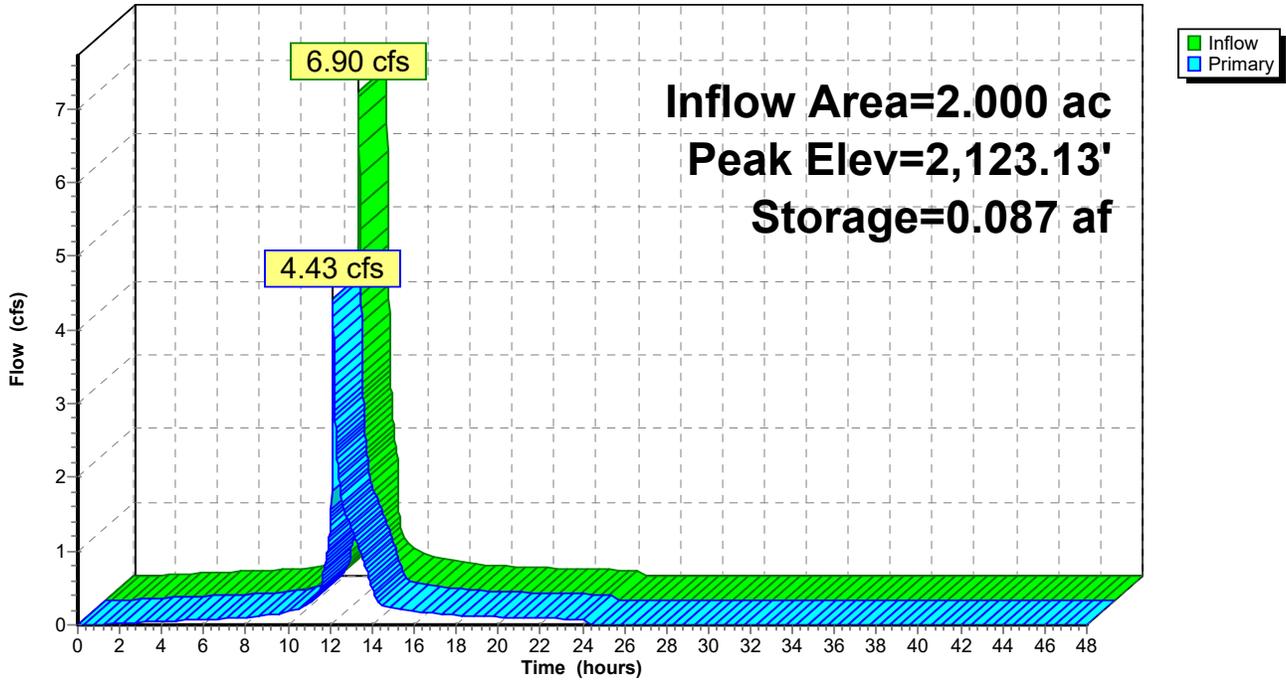
Overall System Size = 62.50' x 24.00' x 5.00'

12 Chambers
277.8 cy Field
189.4 cy Stone



Pond 3P: USWM #3

Hydrograph



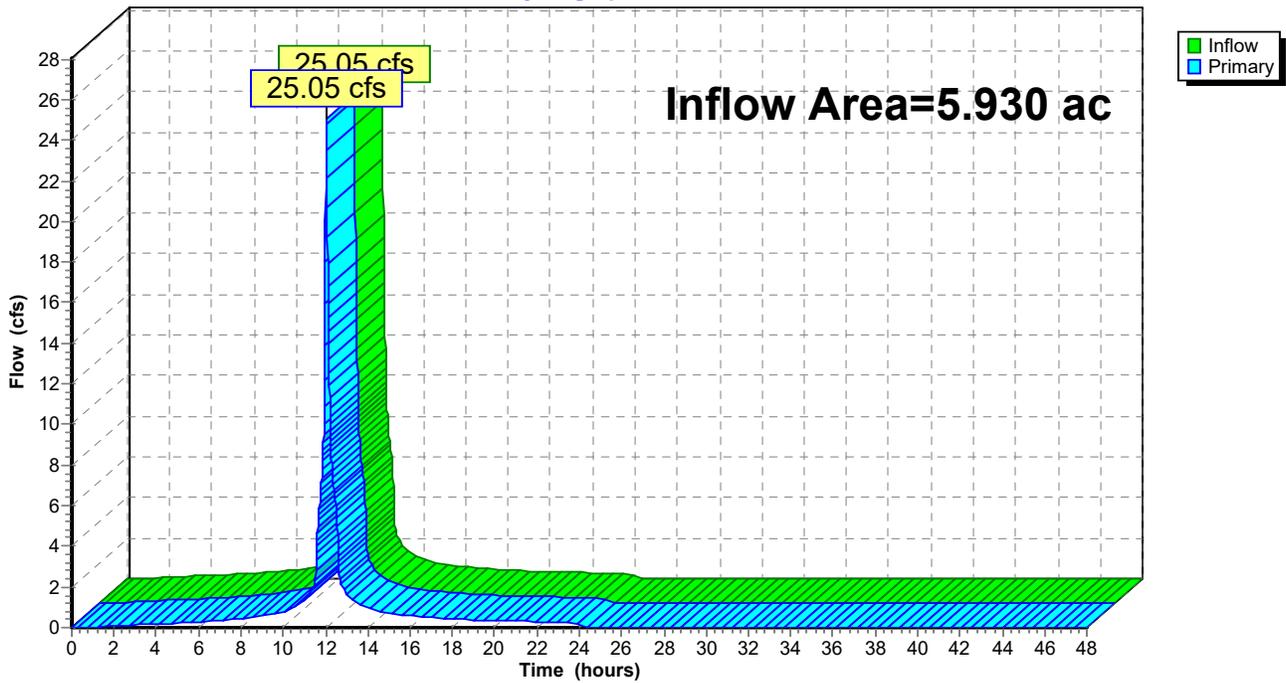
Summary for Link 1L: POA #1

Inflow Area = 5.930 ac, Inflow Depth = 3.51" for 10-yr event
Inflow = 25.05 cfs @ 12.04 hrs, Volume= 1.735 af
Primary = 25.05 cfs @ 12.04 hrs, Volume= 1.735 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: POA #1

Hydrograph



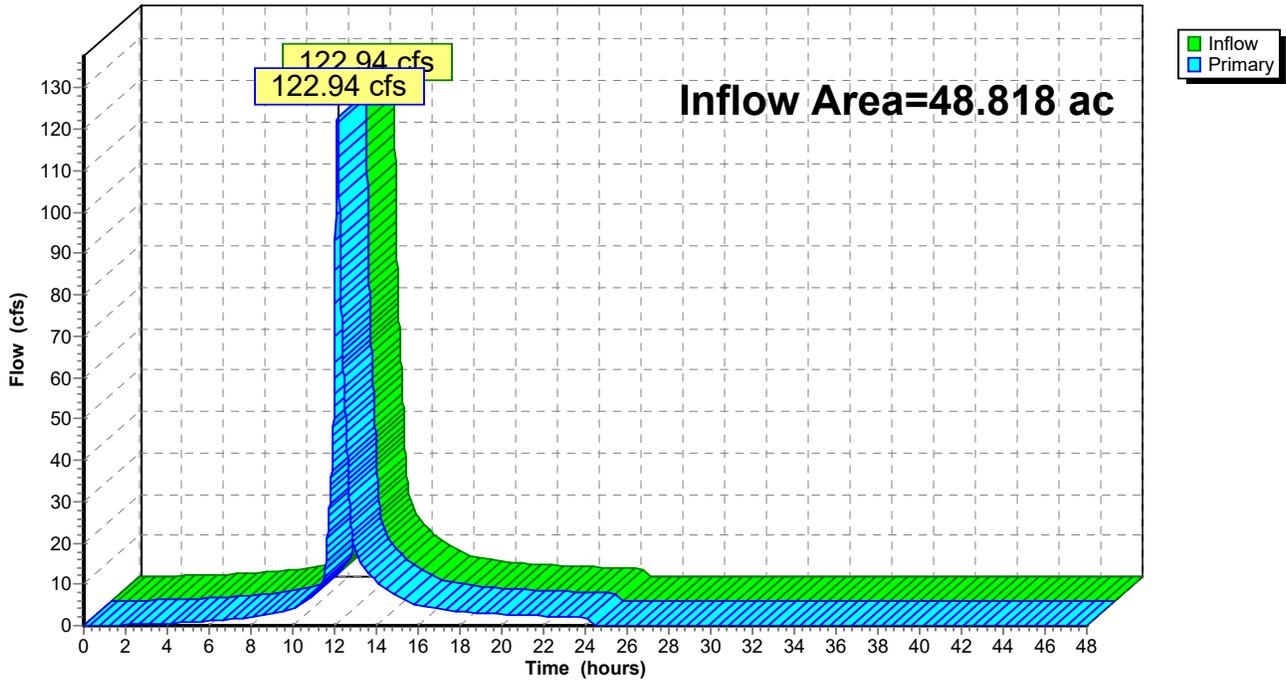
Summary for Link 2L: POA #2

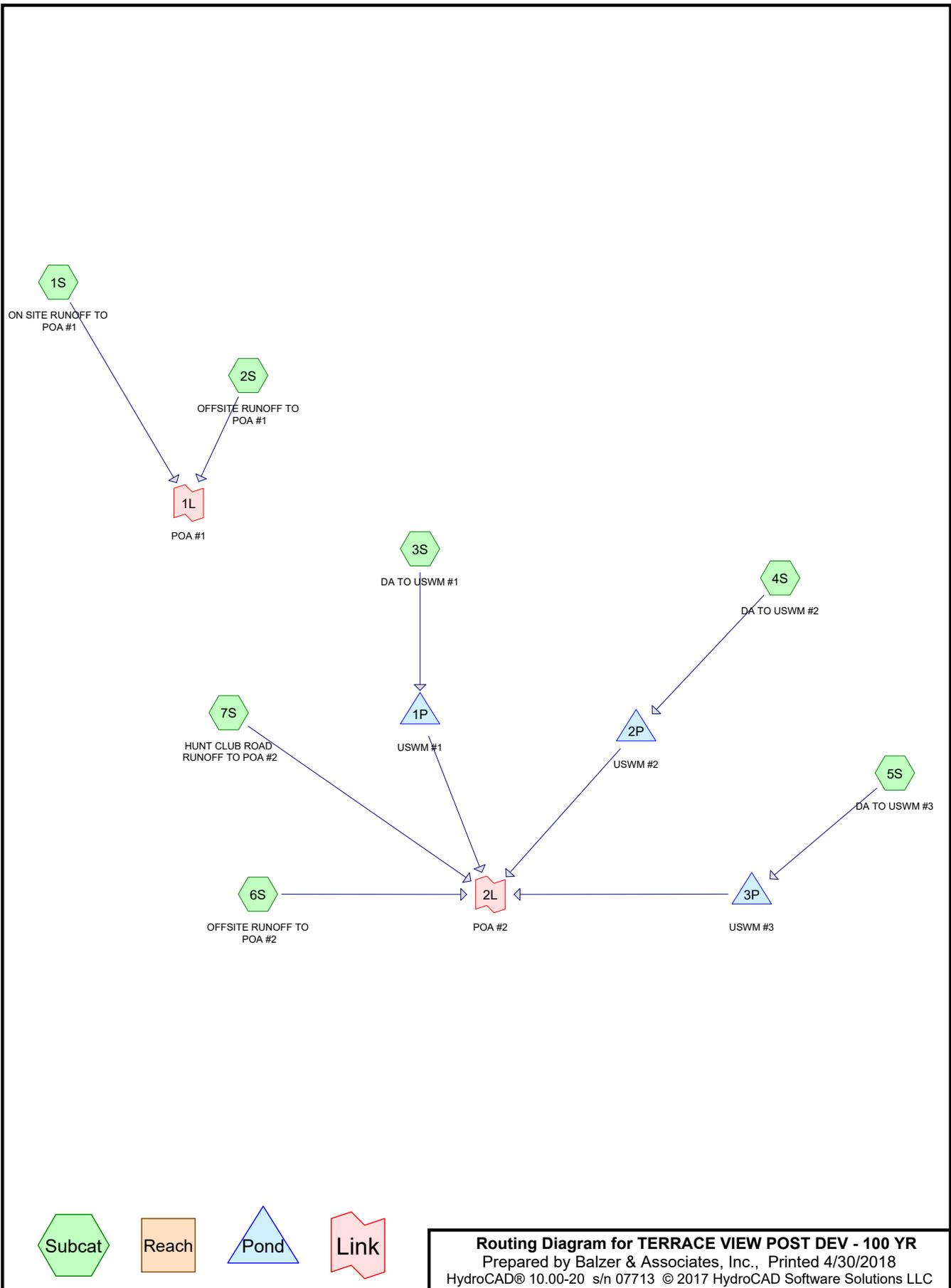
Inflow Area = 48.818 ac, Inflow Depth = 3.02" for 10-yr event
Inflow = 122.94 cfs @ 12.15 hrs, Volume= 12.279 af
Primary = 122.94 cfs @ 12.15 hrs, Volume= 12.279 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 2L: POA #2

Hydrograph





1S

ON SITE RUNOFF TO
POA #1

2S

OFFSITE RUNOFF TO
POA #1

1L

POA #1

3S

DA TO USWM #1

4S

DA TO USWM #2

7S

HUNT CLUB ROAD
RUNOFF TO POA #2

1P

USWM #1

2P

USWM #2

5S

DA TO USWM #3

6S

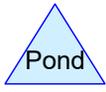
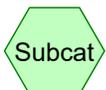
OFFSITE RUNOFF TO
POA #2

2L

POA #2

3P

USWM #3



TERRACE VIEW POST DEV - 100 YR

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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.350	81	1/3 acre lots, 30% imp, HSG C (6S)
0.200	83	1/4 acre lots, 38% imp, HSG C (6S)
5.500	85	1/8 acre lots, 65% imp, HSG B (6S)
23.820	90	1/8 acre lots, 65% imp, HSG C (2S, 6S)
0.724	61	>75% Grass cover, Good, HSG B (4S, 5S, 6S, 7S)
5.474	74	>75% Grass cover, Good, HSG C (1S, 3S, 4S, 5S, 6S, 7S)
0.730	98	Paved parking, HSG B (4S, 5S, 7S)
10.880	98	Paved parking, HSG C (1S, 3S, 4S, 5S, 7S)
3.130	98	Paved roads w/curbs & sewers, HSG B (2S, 6S)
3.670	98	Paved roads w/curbs & sewers, HSG C (2S, 6S)
0.270	94	Urban commercial, 85% imp, HSG C (2S)
54.748	90	TOTAL AREA

TERRACE VIEW POST DEV - 100 YR

VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

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Page 3

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 1S: ON SITE RUNOFF TO POA #1

Runoff Area=1.760 ac Runoff Depth=5.29"
 Tc=6.0 min CN=WQ Runoff=9.48 cfs 0.776 af

Subcatchment 2S: OFFSITE RUNOFF TO POA #1

Runoff Area=4.170 ac Runoff Depth=6.07"
 Tc=6.0 min CN=WQ Runoff=25.31 cfs 2.109 af

Subcatchment 3S: DA TO USWM #1

Runoff Area=3.810 ac Runoff Depth=5.62"
 Tc=6.0 min CN=WQ Runoff=21.50 cfs 1.783 af

Subcatchment 4S: DA TO USWM #2

Runoff Area=6.588 ac Runoff Depth=5.51"
 Tc=6.0 min CN=WQ Runoff=36.62 cfs 3.027 af

Subcatchment 5S: DA TO USWM #3

Runoff Area=2.000 ac Runoff Depth=5.04"
 Tc=6.0 min CN=WQ Runoff=10.28 cfs 0.840 af

Subcatchment 6S: OFFSITE RUNOFF TO POA #2

Runoff Area=34.540 ac Runoff Depth=5.20"
 Flow Length=1,347' Tc=13.6 min CN=WQ Runoff=146.42 cfs 14.970 af

Subcatchment 7S: HUNT CLUB ROAD RUNOFF TO POA #2

Runoff Area=1.880 ac Runoff Depth=5.81"
 Tc=6.0 min CN=WQ Runoff=10.86 cfs 0.910 af

Pond 1P: USWM #1

Peak Elev=2,130.29' Storage=0.168 af Inflow=21.50 cfs 1.783 af
 Outflow=21.28 cfs 1.783 af

Pond 2P: USWM #2

Peak Elev=2,121.98' Storage=0.507 af Inflow=36.62 cfs 3.027 af
 Outflow=34.21 cfs 3.027 af

Pond 3P: USWM #3

Peak Elev=2,123.46' Storage=0.092 af Inflow=10.28 cfs 0.840 af
 Outflow=10.22 cfs 0.840 af

Link 1L: POA #1

Inflow=34.79 cfs 2.885 af
 Primary=34.79 cfs 2.885 af

Link 2L: POA #2

Inflow=203.99 cfs 21.530 af
 Primary=203.99 cfs 21.530 af

Total Runoff Area = 54.748 ac Runoff Volume = 24.415 af Average Runoff Depth = 5.35"

Summary for Subcatchment 1S: ON SITE RUNOFF TO POA #1

Runoff = 9.48 cfs @ 12.04 hrs, Volume= 0.776 af, Depth= 5.29"

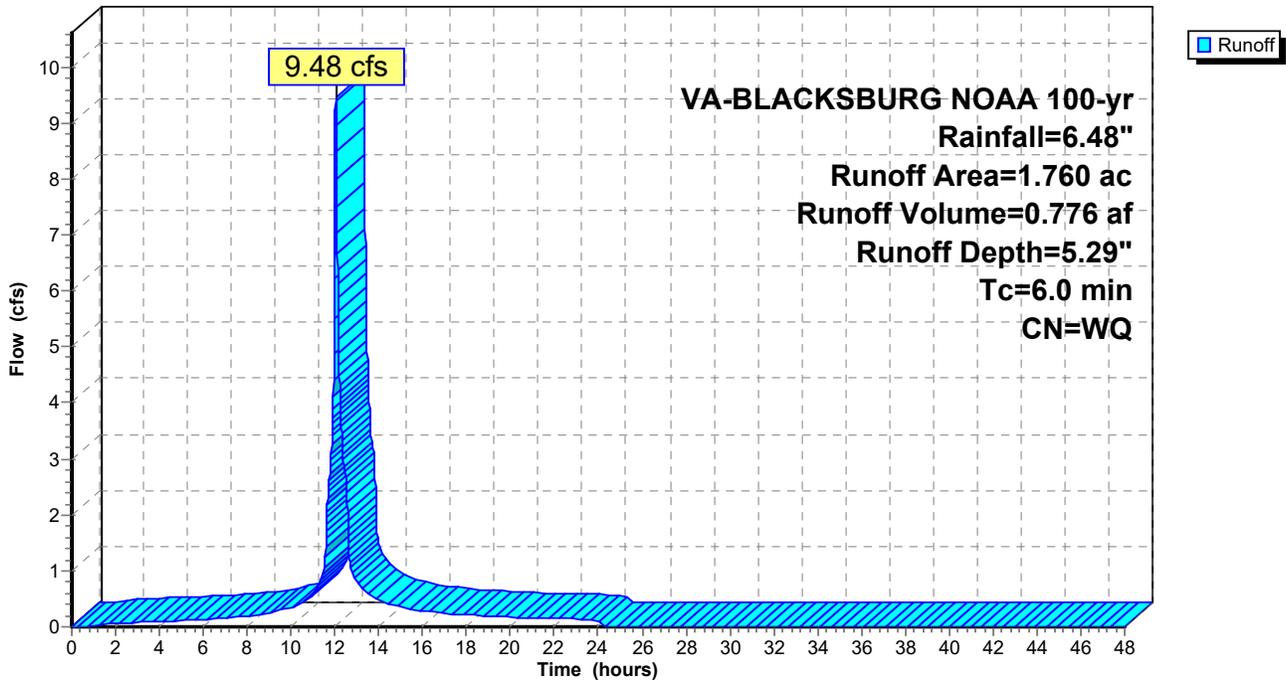
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.630	74	>75% Grass cover, Good, HSG C
1.130	98	Paved parking, HSG C
1.760		Weighted Average

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

Subcatchment 1S: ON SITE RUNOFF TO POA #1

Hydrograph



Summary for Subcatchment 2S: OFFSITE RUNOFF TO POA #1

Runoff = 25.31 cfs @ 12.04 hrs, Volume= 2.109 af, Depth= 6.07"

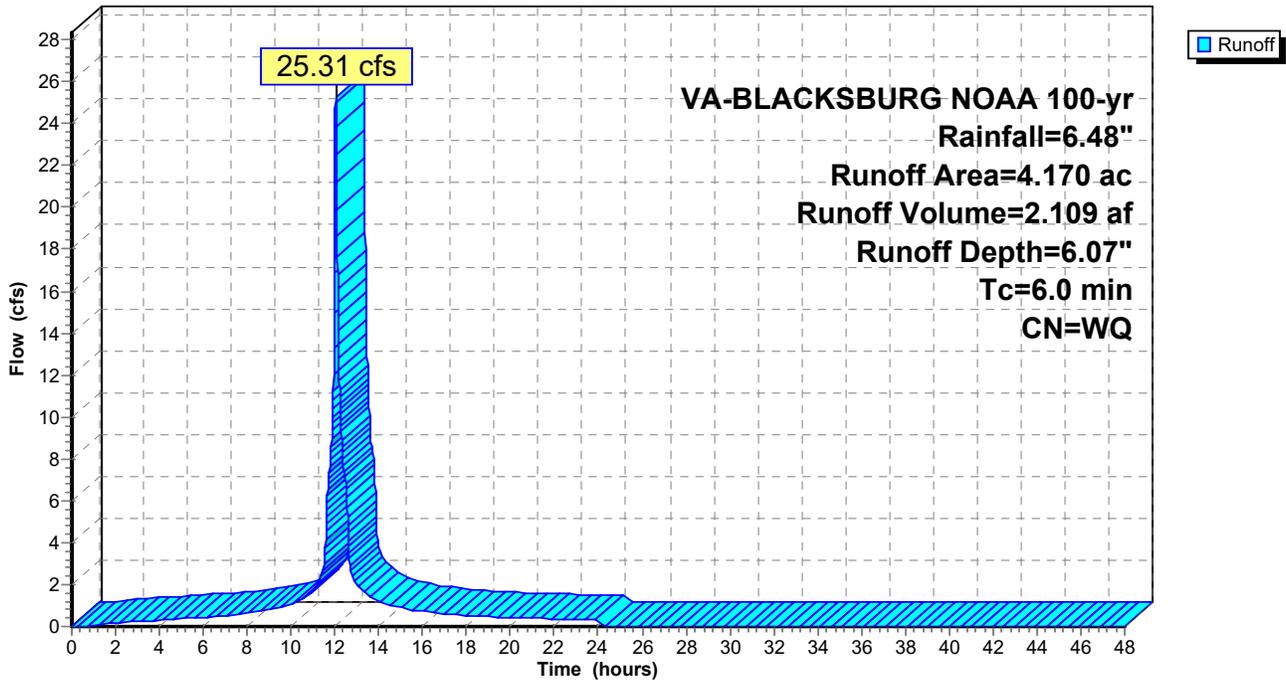
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.640	90	1/8 acre lots, 65% imp, HSG C
0.270	94	Urban commercial, 85% imp, HSG C
3.110	98	Paved roads w/curbs & sewers, HSG B
0.150	98	Paved roads w/curbs & sewers, HSG C
4.170		Weighted Average

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

Subcatchment 2S: OFFSITE RUNOFF TO POA #1

Hydrograph



Summary for Subcatchment 3S: DA TO USWM #1

Runoff = 21.50 cfs @ 12.04 hrs, Volume= 1.783 af, Depth= 5.62"

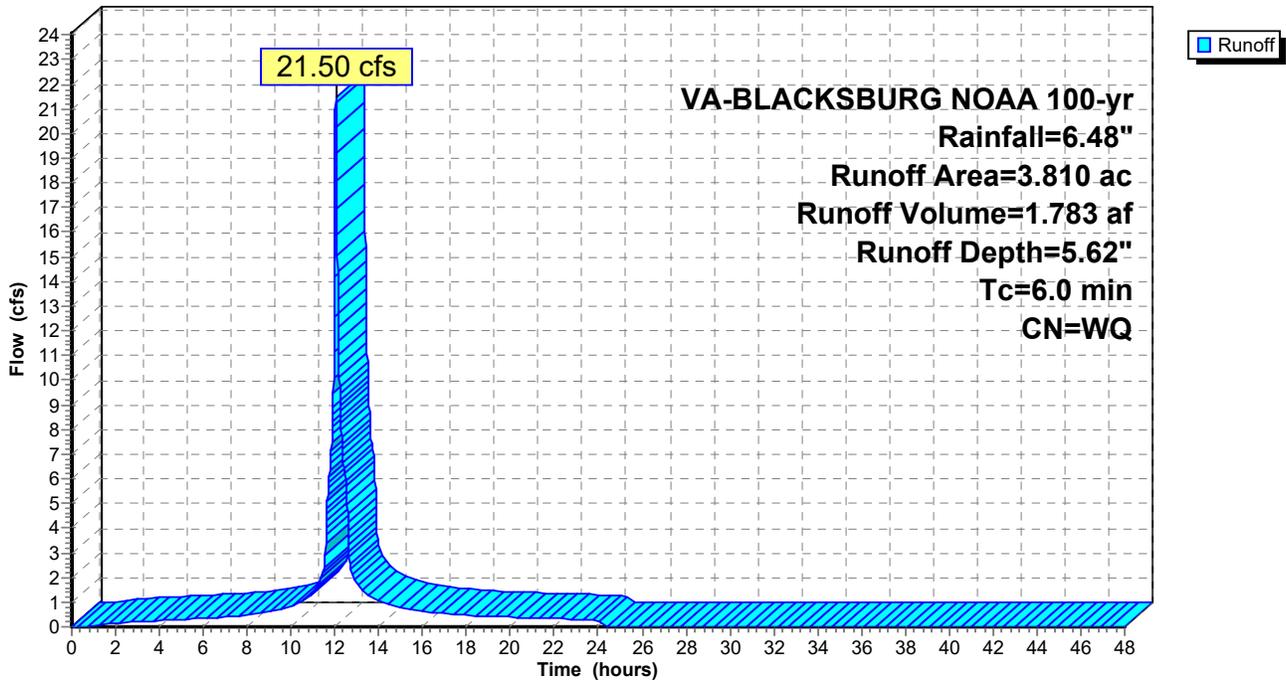
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.900	74	>75% Grass cover, Good, HSG C
2.910	98	Paved parking, HSG C
3.810		Weighted Average

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

Subcatchment 3S: DA TO USWM #1

Hydrograph



Summary for Subcatchment 4S: DA TO USWM #2

Runoff = 36.62 cfs @ 12.04 hrs, Volume= 3.027 af, Depth= 5.51"

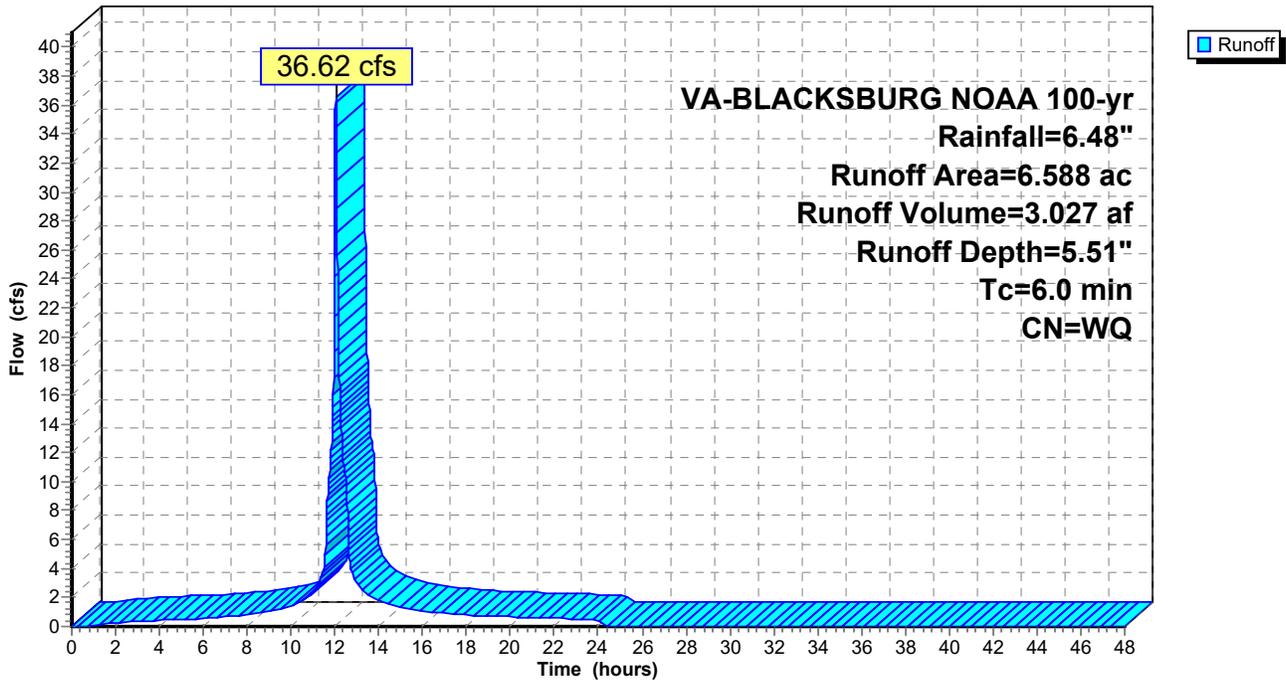
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.044	61	>75% Grass cover, Good, HSG B
1.744	74	>75% Grass cover, Good, HSG C
0.200	98	Paved parking, HSG B
4.600	98	Paved parking, HSG C
6.588		Weighted Average

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

Subcatchment 4S: DA TO USWM #2

Hydrograph



Summary for Subcatchment 5S: DA TO USWM #3

Runoff = 10.28 cfs @ 12.04 hrs, Volume= 0.840 af, Depth= 5.04"

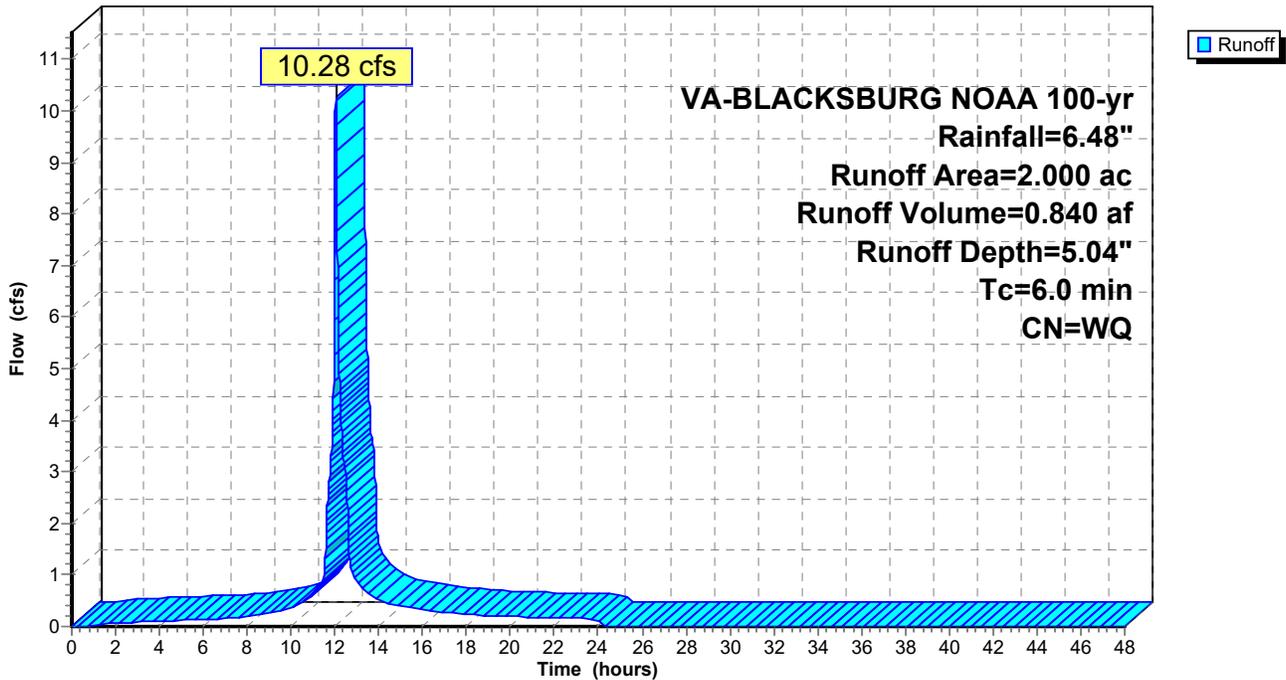
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.140	61	>75% Grass cover, Good, HSG B
0.700	74	>75% Grass cover, Good, HSG C
0.130	98	Paved parking, HSG B
1.030	98	Paved parking, HSG C
2.000		Weighted Average

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

Subcatchment 5S: DA TO USWM #3

Hydrograph



Summary for Subcatchment 6S: OFFSITE RUNOFF TO POA #2

Runoff = 146.42 cfs @ 12.14 hrs, Volume= 14.970 af, Depth= 5.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.460	61	>75% Grass cover, Good, HSG B
1.310	74	>75% Grass cover, Good, HSG C
0.200	83	1/4 acre lots, 38% imp, HSG C
0.350	81	1/3 acre lots, 30% imp, HSG C
5.500	85	1/8 acre lots, 65% imp, HSG B
23.180	90	1/8 acre lots, 65% imp, HSG C
0.020	98	Paved roads w/curbs & sewers, HSG B
3.520	98	Paved roads w/curbs & sewers, HSG C

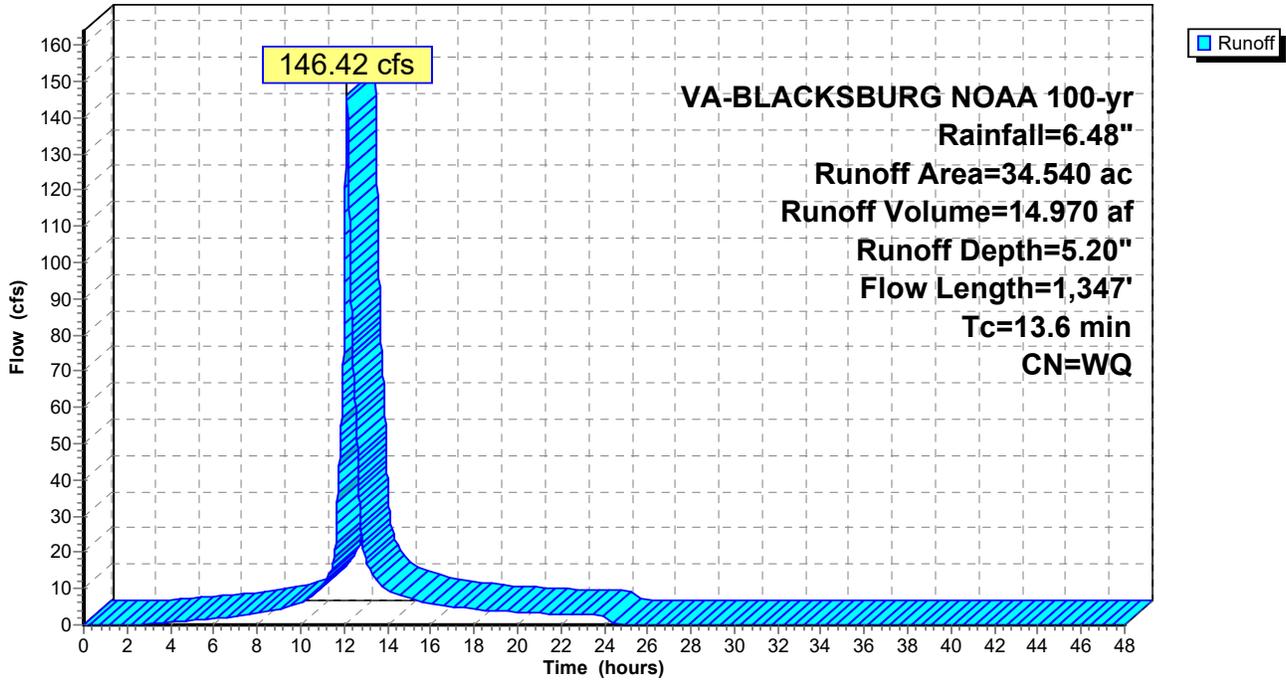
34.540 Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Concrete pipe, straight & clean
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030 Corrugated metal
0.1	101	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013

13.6 1,347 Total

Subcatchment 6S: OFFSITE RUNOFF TO POA #2

Hydrograph



Summary for Subcatchment 7S: HUNT CLUB ROAD RUNOFF TO POA #2

Runoff = 10.86 cfs @ 12.04 hrs, Volume= 0.910 af, Depth= 5.81"

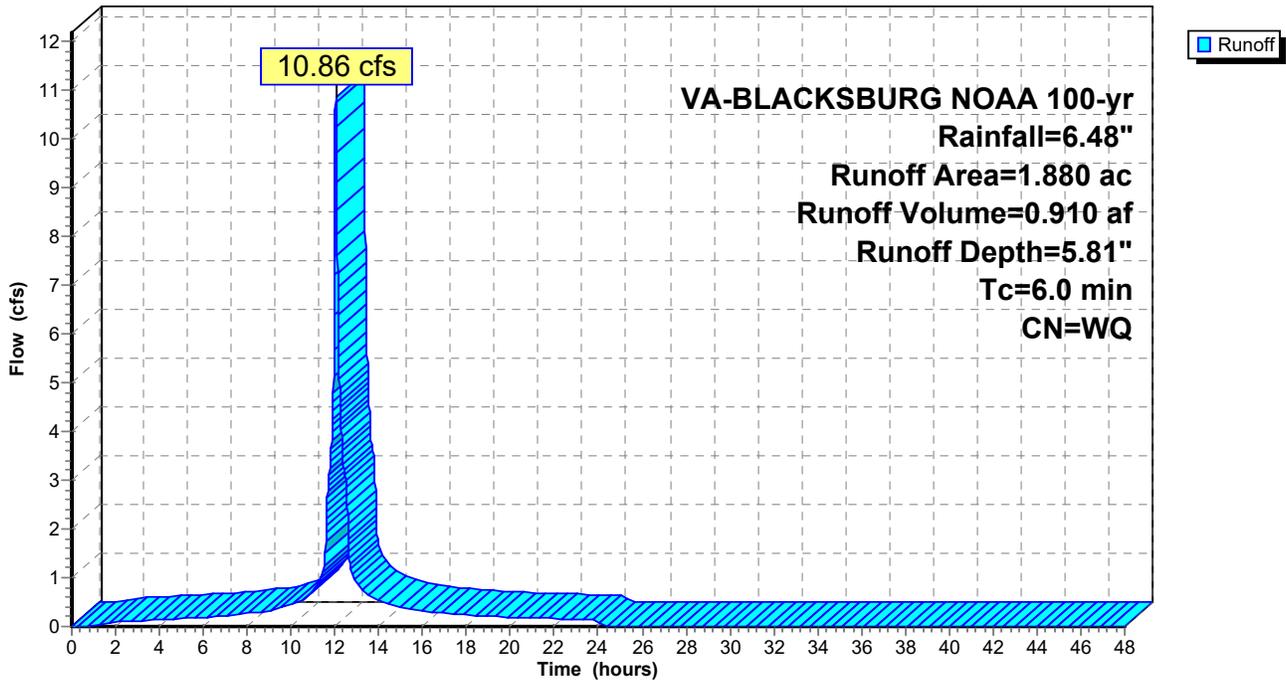
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 VA-BLACKSBURG NOAA 100-yr Rainfall=6.48"

Area (ac)	CN	Description
0.080	61	>75% Grass cover, Good, HSG B
0.190	74	>75% Grass cover, Good, HSG C
0.400	98	Paved parking, HSG B
1.210	98	Paved parking, HSG C
1.880		Weighted Average

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

Subcatchment 7S: HUNT CLUB ROAD RUNOFF TO POA #2

Hydrograph



Summary for Pond 1P: USWM #1

Inflow Area = 3.810 ac, Inflow Depth = 5.62" for 100-yr event
 Inflow = 21.50 cfs @ 12.04 hrs, Volume= 1.783 af
 Outflow = 21.28 cfs @ 12.05 hrs, Volume= 1.783 af, Atten= 1%, Lag= 0.6 min
 Primary = 21.28 cfs @ 12.05 hrs, Volume= 1.783 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 2,130.29' @ 12.05 hrs Surf.Area= 0.054 ac Storage= 0.168 af

Plug-Flow detention time= 17.7 min calculated for 1.783 af (100% of inflow)
 Center-of-Mass det. time= 17.7 min (775.7 - 758.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,125.50'	0.076 af	38.00'W x 62.00'L x 5.50'H Field A 0.297 af Overall - 0.107 af Embedded = 0.191 af x 40.0% Voids
#2A	2,126.00'	0.107 af	CMP Round 48 x 18 Inside #1 Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf Overall Size= 48.0"W x 48.0"H x 20.00'L Row Length Adjustment= -4.00' x 12.57 sf x 6 rows 34.00' Header x 12.57 sf x 1 = 427.3 cf Inside
		0.183 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,125.30'	24.0" Round 24" Culvert L= 423.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,125.30' / 2,110.00' S= 0.0361 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	2,125.40'	8.0" W x 4.0" H Vert. Orifice/Grate C= 0.600
#3	Device 1	2,129.20'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=21.23 cfs @ 12.05 hrs HW=2,130.29' (Free Discharge)
 1=24" Culvert (Passes 21.23 cfs of 30.22 cfs potential flow)
 2=Orifice/Grate (Orifice Controls 2.33 cfs @ 10.46 fps)
 3=Broad-Crested Rectangular Weir (Weir Controls 18.91 cfs @ 3.47 fps)

Pond 1P: USWM #1 - Chamber Wizard Field A

Chamber Model = CMP Round 48 (Round Corrugated Metal Pipe)

Effective Size= 48.0"W x 48.0"H => 12.57 sf x 20.00'L = 251.3 cf

Overall Size= 48.0"W x 48.0"H x 20.00'L

Row Length Adjustment= -4.00' x 12.57 sf x 6 rows

48.0" Wide + 24.0" Spacing = 72.0" C-C Row Spacing

3 Chambers/Row x 20.00' Long -4.00' Row Adjustment +4.00' Header x 1 = 60.00' Row Length +12.0" End Stone x 2 = 62.00' Base Length

6 Rows x 48.0" Wide + 24.0" Spacing x 5 + 24.0" Side Stone x 2 = 38.00' Base Width

6.0" Base + 48.0" Chamber Height + 12.0" Cover = 5.50' Field Height

18 Chambers x 251.3 cf -4.00' Row Adjustment x 12.57 sf x 6 Rows + 34.00' Header x 12.57 sf = 4,649.6 cf Chamber Storage

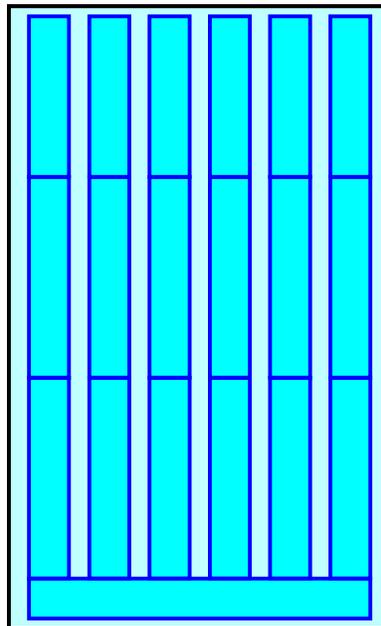
12,958.0 cf Field - 4,649.6 cf Chambers = 8,308.4 cf Stone x 40.0% Voids = 3,323.4 cf Stone Storage

Chamber Storage + Stone Storage = 7,972.9 cf = 0.183 af

Overall Storage Efficiency = 61.5%

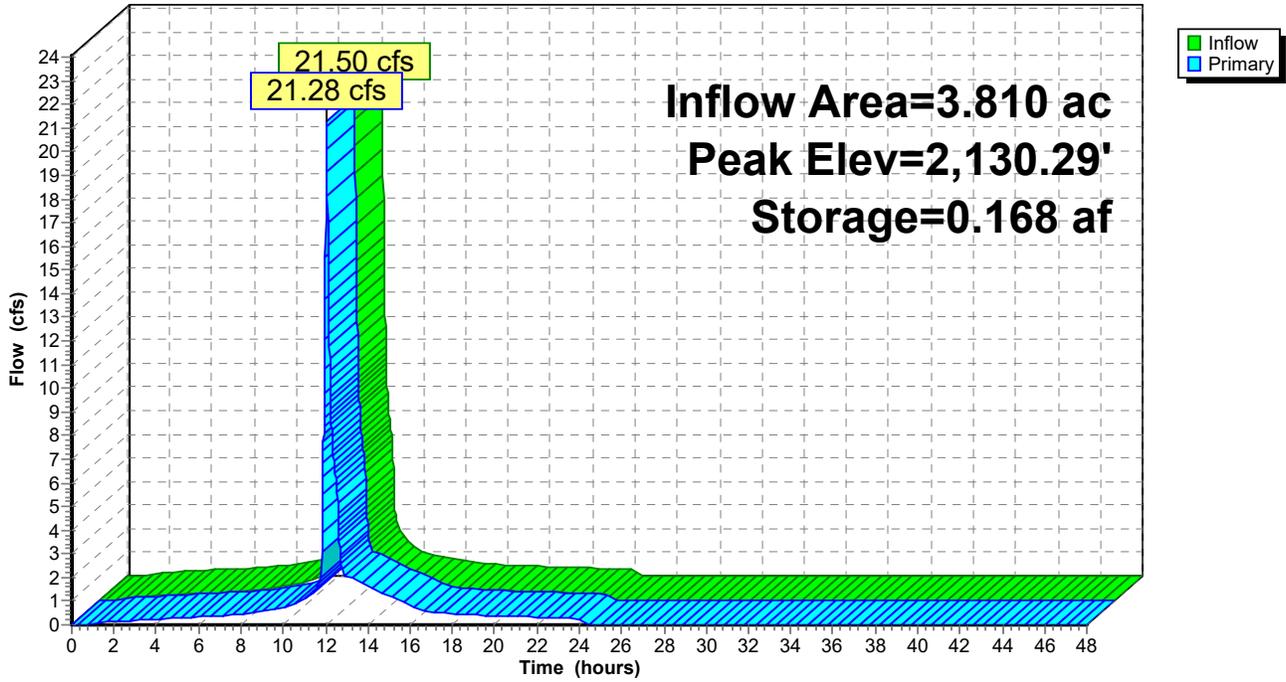
Overall System Size = 62.00' x 38.00' x 5.50'

18 Chambers
479.9 cy Field
307.7 cy Stone



Pond 1P: USWM #1

Hydrograph



Summary for Pond 2P: USWM #2

Inflow Area = 6.588 ac, Inflow Depth = 5.51" for 100-yr event
 Inflow = 36.62 cfs @ 12.04 hrs, Volume= 3.027 af
 Outflow = 34.21 cfs @ 12.06 hrs, Volume= 3.027 af, Atten= 7%, Lag= 1.6 min
 Primary = 34.21 cfs @ 12.06 hrs, Volume= 3.027 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 2,121.98' @ 12.06 hrs Surf.Area= 0.116 ac Storage= 0.507 af

Plug-Flow detention time= 33.2 min calculated for 3.027 af (100% of inflow)
 Center-of-Mass det. time= 33.2 min (793.5 - 760.3)

Volume	Invert	Avail.Storage	Storage Description
#1	2,115.00'	0.224 af	46.67'W x 108.00'L x 7.50'H Stone Storage 0.868 af Overall - 0.307 af Embedded = 0.561 af x 40.0% Voids
#2	2,116.50'	0.003 af	24.0" Round Inlet Manifold Inside #1 L= 38.5'
#3	2,116.50'	0.060 af	ADS_StormTech MC-4500 +Cap x 24 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf
#4	2,116.50'	0.241 af	ADS_StormTech MC-4500 +Cap x 96 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 4 Rows of 24 Chambers Cap Storage= +35.7 cf x 2 x 4 rows = 285.6 cf
#5	2,115.00'	0.003 af	24.0" Round Outlet Manifold Inside #1 L= 38.0'
		0.531 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	2,114.80'	24.0" Round 24" Culvert L= 165.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,114.80' / 2,110.00' S= 0.0290 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	2,114.90'	10.0" W x 5.0" H Vert. Orifice/Grate C= 0.600
#3	Device 1	2,120.50'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=34.10 cfs @ 12.06 hrs HW=2,121.97' (Free Discharge)

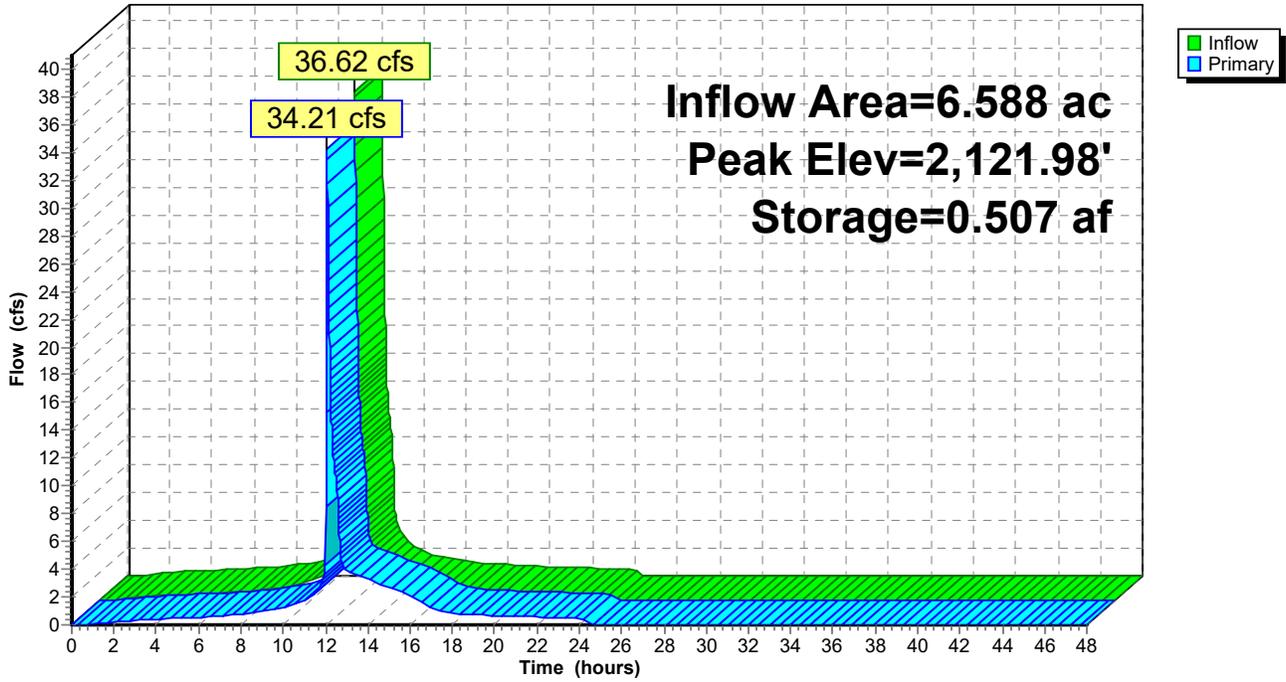
1=24" Culvert (Passes 34.10 cfs of 37.59 cfs potential flow)

2=Orifice/Grate (Orifice Controls 4.38 cfs @ 12.62 fps)

3=Broad-Crested Rectangular Weir (Weir Controls 29.72 cfs @ 4.03 fps)

Pond 2P: USWM #2

Hydrograph



Summary for Pond 3P: USWM #3

Inflow Area = 2.000 ac, Inflow Depth = 5.04" for 100-yr event
 Inflow = 10.28 cfs @ 12.04 hrs, Volume= 0.840 af
 Outflow = 10.22 cfs @ 12.04 hrs, Volume= 0.840 af, Atten= 1%, Lag= 0.4 min
 Primary = 10.22 cfs @ 12.04 hrs, Volume= 0.840 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 2,123.46' @ 12.04 hrs Surf.Area= 0.034 ac Storage= 0.092 af

Plug-Flow detention time= 13.2 min calculated for 0.840 af (100% of inflow)
 Center-of-Mass det. time= 13.2 min (784.2 - 771.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,119.20'	0.047 af	24.00'W x 62.50'L x 5.00'H Field A 0.172 af Overall - 0.055 af Embedded = 0.117 af x 40.0% Voids
#2A	2,119.70'	0.055 af	CMP Round 42 x 12 Inside #1 Effective Size= 42.0"W x 42.0"H => 9.62 sf x 20.00'L = 192.4 cf Overall Size= 42.0"W x 42.0"H x 20.00'L Row Length Adjustment= -3.00' x 9.62 sf x 4 rows 20.00' Header x 9.62 sf x 1 = 192.4 cf Inside
		0.102 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,119.00'	24.0" Round 24" Culvert L= 117.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2,119.00' / 2,117.00' S= 0.0171 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	2,119.10'	8.5" W x 3.0" H Vert. Orifice/Grate C= 0.600
#3	Device 1	2,122.80'	5.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=10.19 cfs @ 12.04 hrs HW=2,123.46' (Free Discharge)

- 1=24" Culvert (Passes 10.19 cfs of 28.14 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 1.75 cfs @ 9.91 fps)
- 3=Broad-Crested Rectangular Weir (Weir Controls 8.44 cfs @ 2.56 fps)

Pond 3P: USWM #3 - Chamber Wizard Field A

Chamber Model = CMP Round 42 (Round Corrugated Metal Pipe)

Effective Size= 42.0"W x 42.0"H => 9.62 sf x 20.00'L = 192.4 cf

Overall Size= 42.0"W x 42.0"H x 20.00'L

Row Length Adjustment= -3.00' x 9.62 sf x 4 rows

42.0" Wide + 24.0" Spacing = 66.0" C-C Row Spacing

3 Chambers/Row x 20.00' Long -3.00' Row Adjustment +3.50' Header x 1 = 60.50' Row Length +12.0" End Stone x 2 = 62.50' Base Length

4 Rows x 42.0" Wide + 24.0" Spacing x 3 + 24.0" Side Stone x 2 = 24.00' Base Width

6.0" Base + 42.0" Chamber Height + 12.0" Cover = 5.00' Field Height

12 Chambers x 192.4 cf -3.00' Row Adjustment x 9.62 sf x 4 Rows + 20.00' Header x 9.62 sf = 2,386.0 cf Chamber Storage

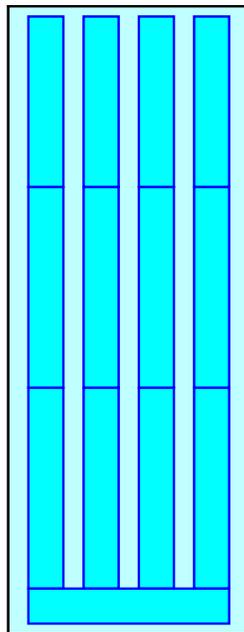
7,500.0 cf Field - 2,386.0 cf Chambers = 5,114.0 cf Stone x 40.0% Voids = 2,045.6 cf Stone Storage

Chamber Storage + Stone Storage = 4,431.6 cf = 0.102 af

Overall Storage Efficiency = 59.1%

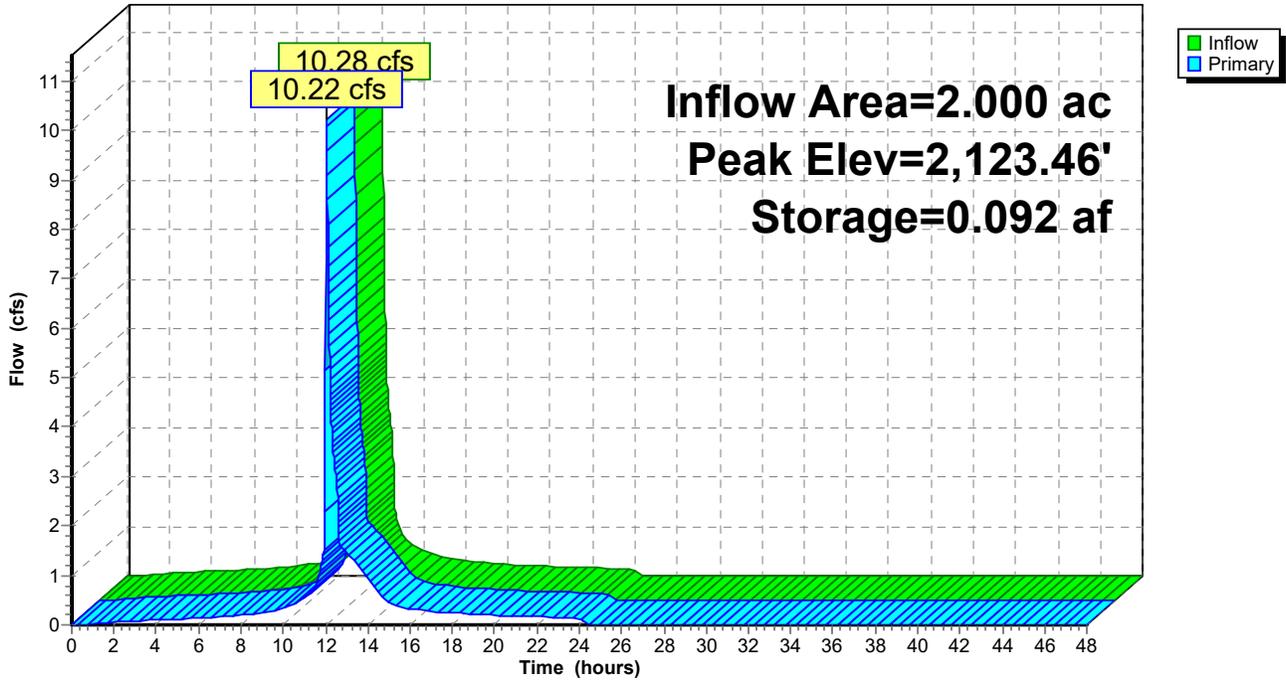
Overall System Size = 62.50' x 24.00' x 5.00'

12 Chambers
277.8 cy Field
189.4 cy Stone



Pond 3P: USWM #3

Hydrograph



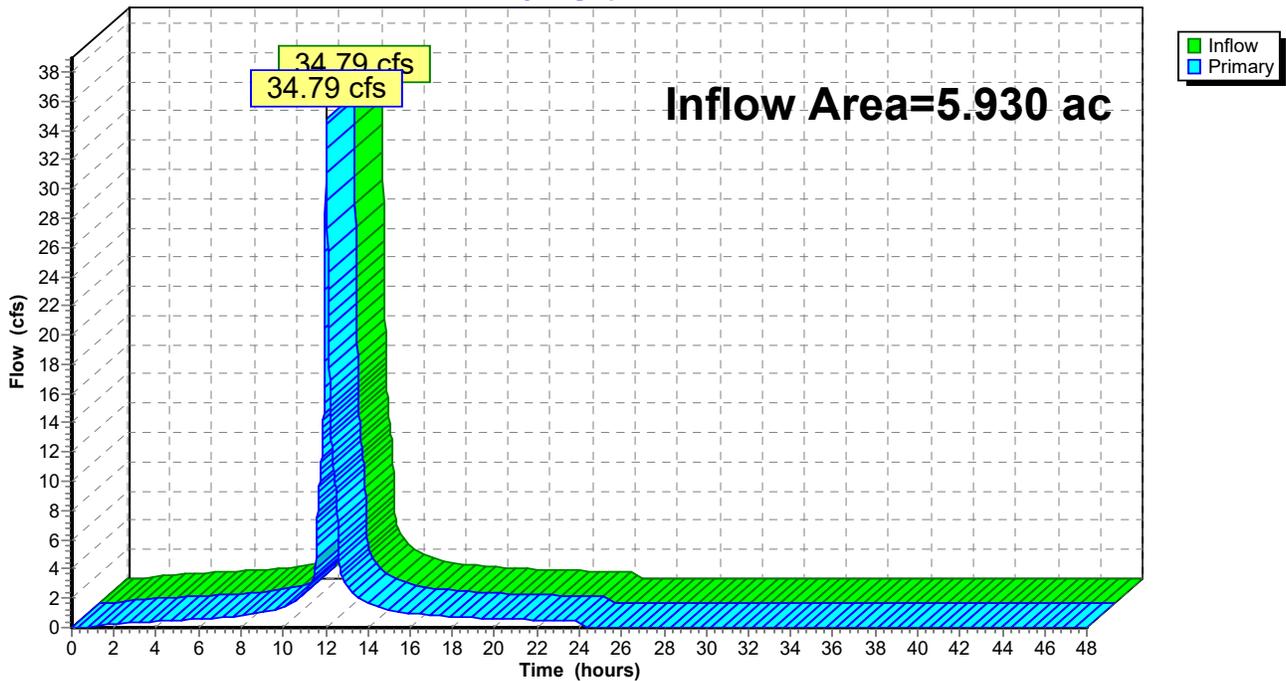
Summary for Link 1L: POA #1

Inflow Area = 5.930 ac, Inflow Depth = 5.84" for 100-yr event
Inflow = 34.79 cfs @ 12.04 hrs, Volume= 2.885 af
Primary = 34.79 cfs @ 12.04 hrs, Volume= 2.885 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: POA #1

Hydrograph



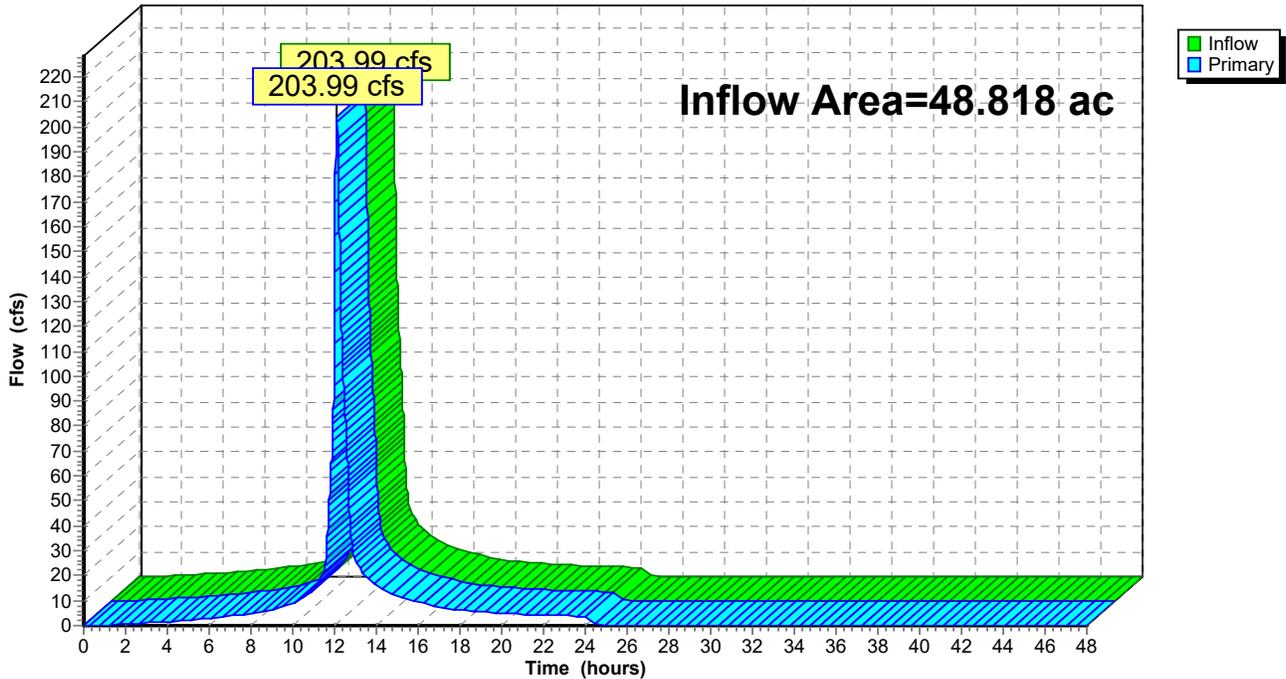
Summary for Link 2L: POA #2

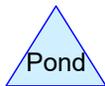
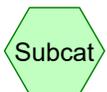
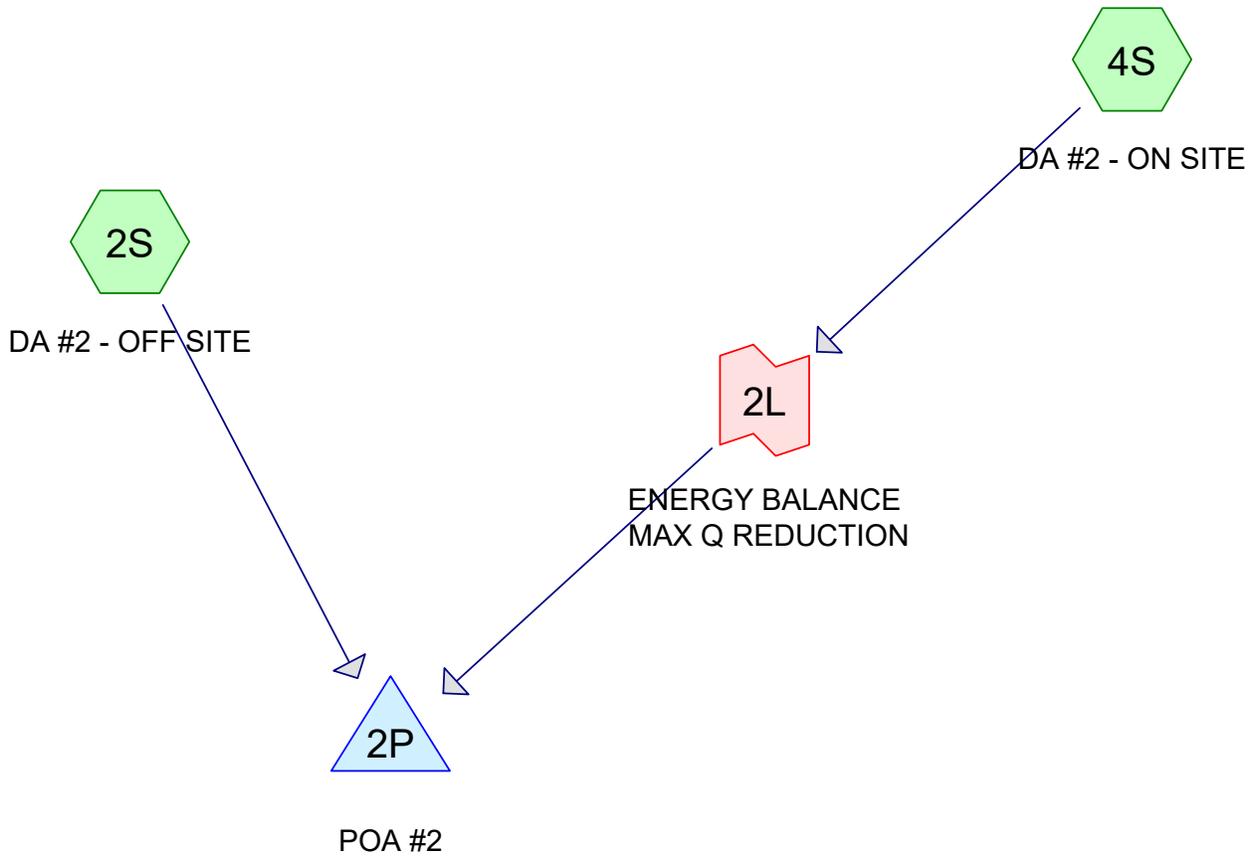
Inflow Area = 48.818 ac, Inflow Depth = 5.29" for 100-yr event
Inflow = 203.99 cfs @ 12.10 hrs, Volume= 21.530 af
Primary = 203.99 cfs @ 12.10 hrs, Volume= 21.530 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 2L: POA #2

Hydrograph





Routing Diagram for CHANNEL PROTECTION
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CHANNEL PROTECTION

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Page 2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.350	81	1/3 acre lots, 30% imp, HSG C (2S)
0.200	83	1/4 acre lots, 38% imp, HSG C (2S)
5.650	85	1/8 acre lots, 65% imp, HSG B (2S, 4S)
23.310	90	1/8 acre lots, 65% imp, HSG C (2S, 4S)
0.830	61	>75% Grass cover, Good, HSG B (2S, 4S)
7.080	74	>75% Grass cover, Good, HSG C (2S, 4S)
0.010	98	Paved parking, HSG B (4S)
4.510	98	Paved parking, HSG C (4S)
0.490	98	Paved roads w/curbs & sewers, HSG B (2S, 4S)
5.270	98	Paved roads w/curbs & sewers, HSG C (2S, 4S)
47.700	88	TOTAL AREA

CHANNEL PROTECTION

VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

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Page 3

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment2S: DA #2 - OFF SITE

Runoff Area=34.540 ac Runoff Depth=1.29"
Flow Length=1,349' Tc=13.6 min CN=WQ Runoff=45.96 cfs 3.720 af

Subcatchment4S: DA #2 - ON SITE

Runoff Area=13.160 ac Runoff Depth=1.29"
Flow Length=1,349' Tc=13.6 min CN=WQ Runoff=15.98 cfs 1.410 af

Pond 2P: POA #2

Inflow=55.23 cfs 4.538 af
Primary=55.23 cfs 4.538 af

Link 2L: ENERGY BALANCE MAX Q REDUCTION

x 0.58 Inflow=15.98 cfs 1.410 af
Primary=9.27 cfs 0.818 af Secondary=6.71 cfs 0.592 af

Total Runoff Area = 47.700 ac Runoff Volume = 5.130 af Average Runoff Depth = 1.29"

CHANNEL PROTECTION

VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

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Page 4

Summary for Subcatchment 2S: DA #2 - OFF SITE

Runoff = 45.96 cfs @ 12.14 hrs, Volume= 3.720 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.460	61	>75% Grass cover, Good, HSG B
1.310	74	>75% Grass cover, Good, HSG C
0.200	83	1/4 acre lots, 38% imp, HSG C
0.350	81	1/3 acre lots, 30% imp, HSG C
5.500	85	1/8 acre lots, 65% imp, HSG B
23.180	90	1/8 acre lots, 65% imp, HSG C
0.020	98	Paved roads w/curbs & sewers, HSG B
3.520	98	Paved roads w/curbs & sewers, HSG C
34.540		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030
0.1	103	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013
13.6	1,349	Total			

CHANNEL PROTECTION

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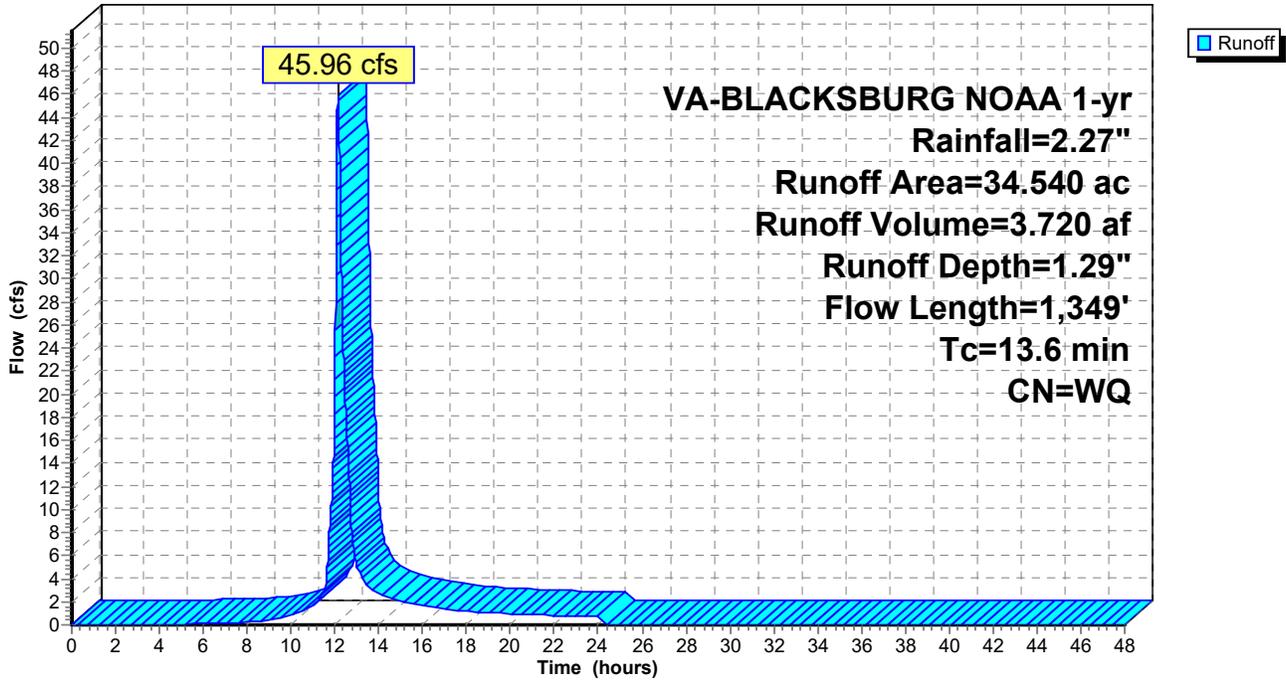
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

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Page 5

Subcatchment 2S: DA #2 - OFF SITE

Hydrograph



CHANNEL PROTECTION

VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

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Page 6

Summary for Subcatchment 4S: DA #2 - ON SITE

Runoff = 15.98 cfs @ 12.14 hrs, Volume= 1.410 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

Area (ac)	CN	Description
0.370	61	>75% Grass cover, Good, HSG B
5.770	74	>75% Grass cover, Good, HSG C
0.150	85	1/8 acre lots, 65% imp, HSG B
0.130	90	1/8 acre lots, 65% imp, HSG C
0.470	98	Paved roads w/curbs & sewers, HSG B
1.750	98	Paved roads w/curbs & sewers, HSG C
0.010	98	Paved parking, HSG B
4.510	98	Paved parking, HSG C
13.160		Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	150	0.0733	0.29		Sheet Flow, OLF Grass: Short n= 0.150 P2= 2.76"
3.3	291	0.0447	1.48		Shallow Concentrated Flow, SCF Short Grass Pasture Kv= 7.0 fps
0.9	580	0.0200	10.18	31.99	Pipe Channel, 24" PIPE 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.6	225	0.0200	5.78	40.87	Pipe Channel, 36" PIPE 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.030
0.1	103	0.0220	18.34	291.68	Pipe Channel, 54" PIPE 54.0" Round Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.013
13.6	1,349	Total			

CHANNEL PROTECTION

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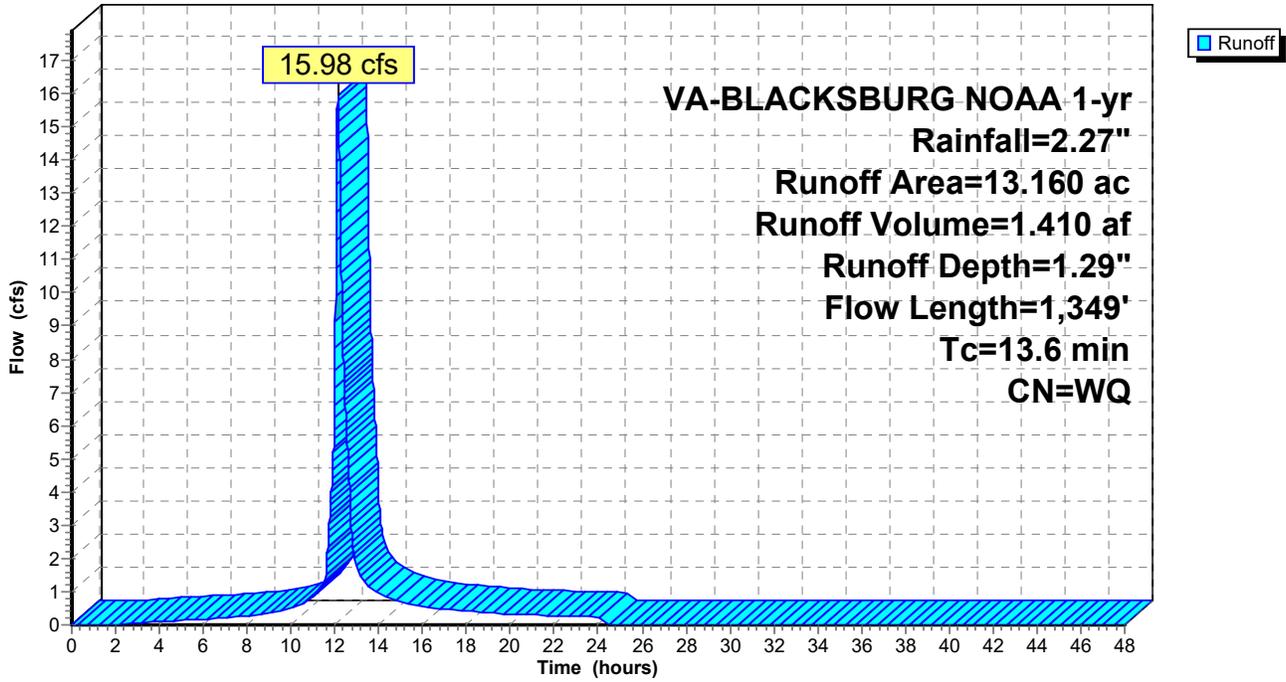
VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

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Page 7

Subcatchment 4S: DA #2 - ON SITE

Hydrograph



CHANNEL PROTECTION

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VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

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Page 8

Summary for Pond 2P: POA #2

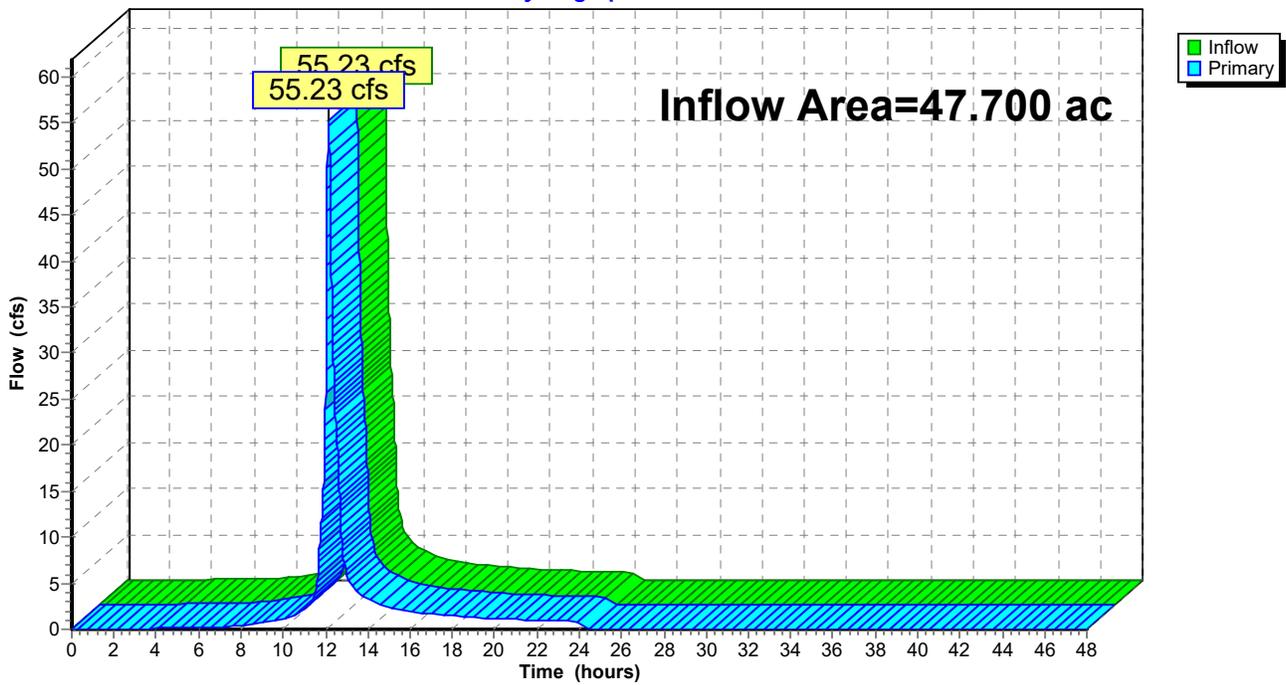
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 47.700 ac, Inflow Depth = 1.14" for 1-yr event
Inflow = 55.23 cfs @ 12.14 hrs, Volume= 4.538 af
Primary = 55.23 cfs @ 12.14 hrs, Volume= 4.538 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 2P: POA #2

Hydrograph



CHANNEL PROTECTION

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VA-BLACKSBURG NOAA 1-yr Rainfall=2.27"

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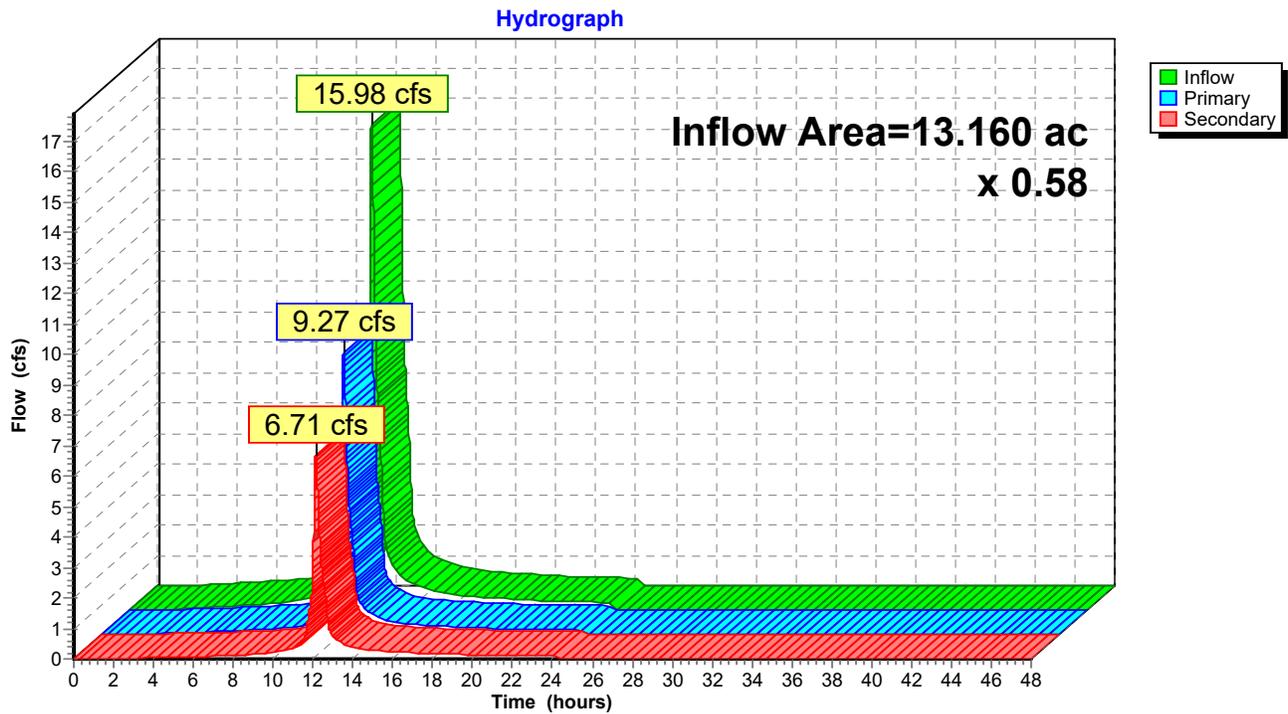
Page 9

Summary for Link 2L: ENERGY BALANCE MAX Q REDUCTION

Inflow Area = 13.160 ac, Inflow Depth = 1.29" for 1-yr event
Inflow = 15.98 cfs @ 12.14 hrs, Volume= 1.410 af
Primary = 9.27 cfs @ 12.14 hrs, Volume= 0.818 af, Atten= 42%, Lag= 0.0 min
Secondary = 6.71 cfs @ 12.14 hrs, Volume= 0.592 af

Primary outflow = Inflow x 0.58, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 2L: ENERGY BALANCE MAX Q REDUCTION



WATER QUALITY

Project Name:	Terrace View Phase I PRD	CLEAR ALL	data input cells
Date:	4/2/2018		constant values
Linear Development Project?	No		calculation cells
			final results

Site Information

Post-Development Project (Treatment Volume and Loads)

Enter Total Disturbed Area (acres) → 16.04

Check: 2011 Stds & Specs

BMP Design Specifications List: Linear project? No

Land cover areas entered correctly? ✓

Total disturbed area entered? ✓

Maximum reduction required: 20%

The site's net increase in impervious cover (acres) is: 3.08

Post-Development TP Load Reduction for Site (lb/yr): 9.55

Pre-ReDevelopment Land Cover (acres)					
	A Soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed forest/open space					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed		0.42	7.09		7.51
Impervious Cover (acres)		0.58	7.95		8.53
					16.04

Post-Development 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		0.27	4.16		4.43
Impervious Cover (acres)		0.73	10.88		11.61
Area Check	OK.	OK.	OK.	OK.	16.04

Constants		Runoff Coefficients (Rv)				
Annual Rainfall (inches)	43		A Soils	B Soils	C Soils	D Soils
Target Rainfall Event (inches)	1.00	Forest/Open Space	0.02	0.03	0.04	0.05
Total Phosphorus (TP) EMC (mg/L)	0.26	Managed Turf	0.15	0.20	0.22	0.25
Total Nitrogen (TN) EMC (mg/L)	1.86	Impervious Cover	0.95	0.95	0.95	0.95
Target TP Load (lb/acre/yr)	0.41					
Pj (unitless correction factor)	0.90					

LAND COVER SUMMARY -- PRE-REDEVELOPMENT		
Land Cover Summary-Pre		
Pre-ReDevelopment	Listed	Adjusted ^a
Forest/Open Space Cover (acres)	0.00	0.00
Weighted Rv(forest)	0.00	0.00
% Forest	0%	0%
Managed Turf Cover (acres)	7.51	4.43
Weighted Rv(turf)	0.22	0.22
% Managed Turf	47%	34%
Impervious Cover (acres)	8.53	8.53
Rv(impervious)	0.95	0.95
% Impervious	53%	66%
Total Site Area (acres)	16.04	12.96
Site Rv	0.61	0.70

LAND COVER SUMMARY -- POST DEVELOPMENT			
Land Cover Summary-Post (Final)		Land Cover Summary-Post	
Post ReDev. & New Impervious	Post-Development	Post-Development	Post-Development New Impervious
Forest/Open Space Cover (acres)	0.00	0.00	
Weighted Rv(forest)	0.00	0.00	
% Forest	0%	0%	
Managed Turf Cover (acres)	4.43	4.43	
Weighted Rv (turf)	0.22	0.22	
% Managed Turf	28%	34%	
Impervious Cover (acres)	11.61	8.53	New Impervious Cover (acres) 3.08
Rv(impervious)	0.95	0.95	Rv(impervious) 0.95
% Impervious	72%	66%	
Final Site Area (acres)	16.04	Total ReDev. Site Area (acres) 12.96	
Final Post Dev Site Rv	0.75	ReDev Site Rv 0.70	

Treatment Volume and Nutrient Load		
Pre-ReDevelopment Treatment Volume (acre-ft)	0.8123	0.7561
Pre-ReDevelopment Treatment Volume (cubic feet)	35,383	32,934
Pre-ReDevelopment TP Load (lb/yr)	22.23	20.69
Pre-ReDevelopment TP Load per acre (lb/acre/yr)	1.39	1.60
Baseline TP Load (lb/yr) (0.41 lbs/acre/yr applied to pre-redevelopment area excluding pervious land proposed for new impervious cover)		5.31

Treatment Volume and Nutrient Load			
Final Post-Development Treatment Volume (acre-ft)	0.9999	Post-ReDevelopment Treatment Volume (acre-ft) 0.7561	Post-Development Treatment Volume (acre-ft) 0.2438
Final Post-Development Treatment Volume (cubic feet)	43,555	Post-ReDevelopment Treatment Volume (cubic feet) 32,934	Post-Development Treatment Volume (cubic feet) 10,621
Final Post-Development TP Load (lb/yr)	27.37	Post-ReDevelopment Load (TP) (lb/yr)* 20.69	Post-Development TP Load (lb/yr) 6.67
Final Post-Development TP Load per acre (lb/acre/yr)	1.71	Post-ReDevelopment TP Load per acre (lb/acre/yr) 1.60	
		Max. Reduction Required (Below Pre-ReDevelopment Load) 20%	
		TP Load Reduction Required for Redeveloped Area (lb/yr) 4.14	TP Load Reduction Required for New Impervious Area (lb/yr) 5.41

^aAdjusted Land Cover Summary:
Pre-ReDevelopment land cover minus pervious land cover (forest/open space or managed turf) acreage proposed for new impervious cover.

Adjusted total acreage is consistent with Post-ReDevelopment acreage (minus acreage of new impervious cover).

Column I shows load reduction requirement for new impervious cover (based on new development load limit, 0.41 lbs/acre/yr).

Post-Development Requirement for Site Area	
TP Load Reduction Required (lb/yr)	9.55

Nitrogen Loads (Informational Purposes Only)			
Pre-ReDevelopment TN Load (lb/yr)	159.04	Final Post-Development TN Load (Post-ReDevelopment & New Impervious) (lb/yr)	195.77

Drainage Area A

CLEAR BMP AREAS

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)			0.28		0.28	0.22
Impervious Cover (acres)			0.18		0.18	0.95
Total					0.46	

Total Phosphorus Available for Removal in D.A. A (lb/yr)	0.54
Post Development Treatment Volume in D.A. A (ft ³)	857

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-Infiltration #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-Bioretenion #1 (Spec #9)	40			0	0	0	0	25	0.00	0.00	0.00	0.00	
2.g. To Rain Garden #2, Micro-Bioretenion #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)	30			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	
6.b. Bioretention #2 or Micro-Bioretention #2 (Spec #9)	80	0.28	0.18	0	674	169	843	50	0.00	0.53	0.48	0.05	
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	

TOTAL IMPERVIOUS COVER TREATED (ac)	0.18	AREA CHECK: OK.
TOTAL MANAGED TURF AREA TREATED (ac)	0.28	AREA CHECK: OK.
TOTAL RUNOFF REDUCTION IN D.A. A (ft ³)	674	
TOTAL PHOSPHORUS AVAILABLE FOR REMOVAL IN D.A. A (lb/yr)	0.54	
TOTAL PHOSPHORUS REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.48	
TOTAL PHOSPHORUS REMAINING AFTER APPLYING RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.06	

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

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	

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	0	0	0	20	0.00	0.00	0.00	0.00	
14.c. Manufactured Treatment Device-Generic	0			0	0	0	0	20	0.00	0.00	0.00	0.00	

TOTAL IMPERVIOUS COVER TREATED (ac)	0.18	AREA CHECK: OK.
TOTAL MANAGED TURF AREA TREATED (ac)	0.28	AREA CHECK: OK.
TOTAL PHOSPHORUS REMOVAL REQUIRED ON SITE (lb/yr)	9.55	
TOTAL PHOSPHORUS AVAILABLE FOR REMOVAL IN D.A. A (lb/yr)	0.54	
TOTAL PHOSPHORUS REMOVED WITHOUT RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00	
TOTAL PHOSPHORUS REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.48	
TOTAL PHOSPHORUS LOAD REDUCTION ACHIEVED IN D.A. A (lb/yr)	0.48	
TOTAL PHOSPHORUS REMAINING AFTER APPLYING BMP LOAD REDUCTIONS IN D.A. A (lb/yr)	0.06	
SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS		
NITROGEN REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	3.48	
NITROGEN REMOVED WITHOUT RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00	
TOTAL NITROGEN REMOVED IN D.A. A (lb/yr)	3.48	

Drainage Area B

CLEAR BMP AREAS

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)		0.04	1.74		1.79	0.22
Impervious Cover (acres)		0.20	4.60		4.80	0.95
Total					6.59	

Total Phosphorus Available for Removal in D.A. B (lb/yr)	11.30
Post Development Treatment Volume in D.A. B (ft³)	17,978

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-Infiltration #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-Bioretenion #1 (Spec #9)	40			0	0	0	0	25	0.00	0.00	0.00	0.00	
2.g. To Rain Garden #2, Micro-Bioretenion #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)	30			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	
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	

TOTAL IMPERVIOUS COVER TREATED (ac)	0.00	AREA CHECK: OK.
TOTAL TURF AREA TREATED (ac)	0.00	AREA CHECK: OK.
TOTAL RUNOFF REDUCTION IN D.A. B (ft ³)	0	
TOTAL PHOSPHORUS AVAILABLE FOR REMOVAL IN D.A. B (lb/yr)	11.30	
TOTAL PHOSPHORUS REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. B (lb/yr)	0.00	
TOTAL PHOSPHORUS REMAINING AFTER APPLYING RUNOFF REDUCTION PRACTICES IN D.A. B (lb/yr)	11.30	

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

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	
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	0	0	0	20	0.00	0.00	0.00	0.00	
14.c. Manufactured Treatment Device-Generic	0	1.79	4.80	0	0	17,978	17,978	40	0.00	11.28	4.51	6.77	

TOTAL IMPERVIOUS COVER TREATED (ac)	4.80	AREA CHECK: OK.
TOTAL MANAGED TURF AREA TREATED (ac)	1.79	AREA CHECK: OK.
TOTAL PHOSPHORUS REMOVAL REQUIRED ON SITE (lb/yr)	9.55	
TOTAL PHOSPHORUS AVAILABLE FOR REMOVAL IN D.A. B (lb/yr)	11.30	
TOTAL PHOSPHORUS REMOVED WITHOUT RUNOFF REDUCTION PRACTICES IN D.A. B (lb/yr)	4.51	
TOTAL PHOSPHORUS REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. B (lb/yr)	0.00	
TOTAL PHOSPHORUS LOAD REDUCTION ACHIEVED IN D.A. B (lb/yr)	4.51	
TOTAL PHOSPHORUS REMAINING AFTER APPLYING BMP LOAD REDUCTIONS IN D.A. B (lb/yr)	6.78	
SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS		
NITROGEN REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. B (lb/yr)	0.00	
NITROGEN REMOVED WITHOUT RUNOFF REDUCTION PRACTICES IN D.A. B (lb/yr)	0.00	
TOTAL NITROGEN REMOVED IN D.A. B (lb/yr)	0.00	

Site Results (Water Quality Compliance)

Area Checks	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	AREA CHECK
FOREST/OPEN SPACE (ac)	0.00	0.00	0.00	0.00	0.00	OK.
IMPERVIOUS COVER (ac)	0.18	4.80	0.00	0.00	0.00	OK.
IMPERVIOUS COVER TREATED (ac)	0.18	4.80	0.00	0.00	0.00	OK.
MANAGED TURF AREA (ac)	0.28	1.79	0.00	0.00	0.00	OK.
MANAGED TURF AREA TREATED (ac)	0.28	1.79	0.00	0.00	0.00	OK.
AREA CHECK	OK.	OK.	OK.	OK.	OK.	
Site Treatment Volume (ft³)	43,555					
Runoff Reduction Volume and TP By Drainage Area						
	D.A. A	D.A. B	D.A. C	D.A. D	D.A. E	TOTAL
RUNOFF REDUCTION VOLUME ACHIEVED (ft ³)	674	0	0	0	0	674
TP LOAD AVAILABLE FOR REMOVAL (lb/yr)	0.54	11.30	0.00	0.00	0.00	11.83
TP LOAD REDUCTION ACHIEVED (lb/yr)	0.48	4.51	0.00	0.00	0.00	4.99
TP LOAD REMAINING (lb/yr)	0.06	6.78	0.00	0.00	0.00	6.84
NITROGEN LOAD REDUCTION ACHIEVED (lb/yr)	3.48	0.00	0.00	0.00	0.00	3.48
Total Phosphorus						
FINAL POST-DEVELOPMENT TP LOAD (lb/yr)	27.37					
TP LOAD REDUCTION REQUIRED (lb/yr)	9.55					
TP LOAD REDUCTION ACHIEVED (lb/yr)	4.99					
TP LOAD REMAINING (lb/yr):	22.38					
REMAINING TP LOAD REDUCTION REQUIRED (lb/yr):	4.56					
Total Nitrogen (For Information Purposes)						
POST-DEVELOPMENT LOAD (lb/yr)	195.77					
NITROGEN LOAD REDUCTION ACHIEVED (lb/yr)	3.48					
REMAINING POST-DEVELOPMENT NITROGEN LOAD (lb/yr)	192.29					

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

BMP Design Specifications List: 2011 Stds & Specs

Site Summary

Project Title: Terrace View Phase I PRD
Date: 43192

Total Rainfall (in):	43
Total Disturbed Acreage:	16.04

Site Land Cover Summary

Pre-ReDevelopment Land Cover (acres)

	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	0.42	7.09	0.00	7.51	47
Impervious Cover (acres)	0.00	0.58	7.95	0.00	8.53	53
					16.04	100

Post-ReDevelopment Land Cover (acres)

	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	0.27	4.16	0.00	4.43	28
Impervious Cover (acres)	0.00	0.73	10.88	0.00	11.61	72
					16.04	100

Site Tv and Land Cover Nutrient Loads

	Final Post-Development (Post-ReDevelopment & New Impervious)	Post- ReDevelopment	Post- Development (New Impervious)	Adjusted Pre- ReDevelopment
Site Rv	0.75	0.70	0.95	0.70
Treatment Volume (ft ³)	43,555	32,934	10,621	32,934
TP Load (lb/yr)	27.37	20.69	6.67	20.69

Pre- ReDevelopment TP Load per acre (lb/acre/yr)	Final Post-Development TP Load per acre (lb/acre/yr)	Post-ReDevelopment TP Load per acre (lb/acre/yr)
1.60	1.71	1.60

Total TP Load Reduction Required (lb/yr)	9.55	4.14	5.41
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	Final Post-Development Load (Post-ReDevelopment & New Impervious)	Pre- ReDevelopment
TN Load (lb/yr)	195.77	159.04

Site Compliance Summary

Maximum % Reduction Required Below Pre-ReDevelopment Load	20%
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Total Runoff Volume Reduction (ft ³)	674
Total TP Load Reduction Achieved (lb/yr)	4.99
Total TN Load Reduction Achieved (lb/yr)	3.48
Remaining Post Development TP Load (lb/yr)	22.38
Remaining TP Load Reduction (lb/yr) Required	4.56

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)	0.28	1.79	0.00	0.00	0.00	2.07
Impervious Cover (acres)	0.18	4.80	0.00	0.00	0.00	4.98
Total Area (acres)	0.46	6.59	0.00	0.00	0.00	7.05

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)	0.48	4.51	0.00	0.00	0.00	4.99
TN Load Reduced (lb/yr)	3.48	0.00	0.00	0.00	0.00	3.48

Runoff Volume and CN Calculations

	1-year storm	2-year storm	10-year storm
Target Rainfall Event (in)	2.28	2.76	4.11

Drainage Areas	RV & CN	Drainage Area A	Drainage Area B	Drainage Area C	Drainage Area D	Drainage Area E
CN		84	91	0	0	0
RR (ft ³)		674	0	0	0	0
1-year return period	RV wo RR (ws-in)	0.95	1.41	0.00	0.00	0.00
	RV w RR (ws-in)	0.55	1.41	0.00	0.00	0.00
	CN adjusted	75	91	0	0	0
2-year return period	RV wo RR (ws-in)	1.32	1.85	0.00	0.00	0.00
	RV w RR (ws-in)	0.92	1.85	0.00	0.00	0.00
	CN adjusted	77	91	0	0	0
10-year return period	RV wo RR (ws-in)	2.47	3.12	0.00	0.00	0.00
	RV w RR (ws-in)	2.07	3.12	0.00	0.00	0.00
	CN adjusted	79	91	0	0	0

WATER QUANTITY

Manufactured Treatment Device Calculations

Per the manufacturers, StormTech Isolator Rows shall be sized based on the regulatory agency specified treatment flow rate (q_{pTv}), anticipated sediment mass load, and required pollutant storage capacities in order to achieve the target Total Phosphorus (TP) removal efficiency of 40% and 20%, respectively. Sizing criteria has been calculated using the total area draining to the system, including offsite runoff that is not included in the credit area from the Virginia Runoff Reduction Method worksheets.

StormTech Filter

Flow rate sizing (per VSMH Section 11.5.3):

Derivation of adjusted CN for contributing drainage area

$$\begin{aligned} T_v &= 17,983 \text{ cf} && \text{(treatment volume from BMP Tv worksheet)} \\ P &= 1.0" \text{ (inches)} \\ Q_a &= \frac{17,983 \text{ ft}^3}{287,027 \text{ ft}^2} \times \frac{12 \text{ in}}{\text{ft}} = 0.75 \text{ watershed inches} \\ CN &= \frac{1000}{[10+5P+10Q_a-10(Q_a^2+1.25Q_aP)^{0.5}]} = 98 \quad \text{(VSMH Eq. 11.11)} \end{aligned}$$

Calculation of Water Quality Treatment Volume peak discharge (q_{pTv})

$$\begin{aligned} q_u &= 1050 \text{ cfs/mi}^2/\text{in} \quad \text{(from TR-55 Graphical Peak Discharge Method, Exhibit 4-II)} \\ A &= 0.01029 \text{ mi}^2 \\ Q_a &= 0.75 \text{ watershed inches} \end{aligned}$$

$$q_{pTv} = 1050 \frac{\text{csm}}{\text{in}} \times 0.01027 \text{ mi}^2 \times 0.75 \text{ in} = 8.11 \text{ cfs} \quad \text{(VSMH Eq. 11.12)}$$

StormTech Isolator Row Sizing

The StormTech Isolator Row shall be sized to treat a peak runoff rate of 8.11 cfs from the site. Per the manufacturer, the Isolator Row shall be of a sufficient length to pass the water quality treatment rate through the filtering mechanism. MC-4500 systems have a specified treatment rate per chamber of 0.35 cfs per chamber, therefore at least 24 Isolator Row chambers will be required. The proposed design incorporates a total of 24 Isolator Row chambers.