Glade Road Multi-Family Development

STORMWATER MANAGEMENT CONCEPTUAL DESIGN

Located in:

Town of Blacksburg, Virginia

COMMONWEALTH OF VIRGINIA
JOHN T. NEEL
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08/01/19
PROFESSIONAL ENGINEER

Project Number: 1108.7

Date: July 31, 2019

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Glade Road Multi-Family Development

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Glade Road Multi-Family Development

PLAN NARRATIVE

INTRODUCTION

The following Concept Plan was developed to meet the requirements of Sections 18-608, Stormwater Management Concept Plan, of the Code of the Town of Blacksburg Virginia. The concept plan addresses items (a) through (d) of Section 18-608.

PROJECT DESCRIPTION

The site, which is compiled of Tax Parcels 225-(A)-5, 225-(A)-6, and 225-(A)-7, is 2.869 acres and is proposed for Planned Residential District. The proposed land use will be for multi-family residential housing, student housing, club house and associated development to serve residents.

EXISTING SITE CONDITIONS

On Tax Parcel 225-(A)-6, there is currently Heritage Manor, which is a two-story brick apartment building. There is also tree line along the northern and eastern edge of the parcel. Tax Parcel 225-(A)-7 contains a grass field. On Tax Parcel 225-(A)-6, there is currently a 2-story white house that is vacant.

The stormwater on the site currently exits the site to the north into tributaries to Toms Creek. The tributary that the site contributes to is also fed by parts of 460 and Sturbridge apartments. The site and adjacent offsite drainage areas shown in the drainage maps drain to Toms Creek – Poverty Creek in the Upper New River watershed.

The property does not lie within a Special hazard Flood area and is located within unshaded zone X on FEMA flood insurance rate map 51121C0127C, effective date September 25, 2009.

The map section contains a soils map of soil types generated from the USDA Soil Survey website. Detailed descriptions of the soil types indicated for the parcels are located in the soils section of the narrative. The slopes on the site range from 2- 25% and the hydrologic soil group is C.

ADJACENT AREAS

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

OFFSITE AREAS

No off site areas will be impacted by this development.

SOILS

Soils information is contained in the USDA soils report found in the Maps Section.

CRITICAL AREAS

No critical areas have been identified on the site.

STORMWATER RUNOFF CONSIDERATIONS

The pre-developed site was divided into three drainage areas each of them following different ridge lines till they exit the site along the northern and eastern edges with 3 distinct analysis points.

As the site was developed the majority of the site's stormwater was diverted to the middle drainage area (Drainage Area 2). The site will have approximately 58% impervious area. An ADS System will be implemented within Drainage Area 2 to meet Energy Balance. Drainage Areas 1 and 3 will have their stormwater discharge lowered to below pre-development conditions significantly as shown in the enclosed Hydrographs from hydrocad.

Stormwater Quality

To meet the phosphorus removal requirements of the Virginia Runoff Reduction Method, an ADS System has been proposed on-site and Nutrient Credits will be purchased for the remainder of the credits. The ADS System reduces the phosphorus load from 2.82 lb/yr to 1.19 lb/yr and then nutrient credits will be bought to account for the rest. Water Quality calculations have been provided in the appendices.

Channel Protection

To comply with Channel Protection requirements from 9VAC25-870-66-B, option 3a was chosen for DA2. This requires the proposed flow rate for the 1-YR storm to be detained and reduced below the existing 1-YR storm flow rate. The exact requirement accounts for the increase in proposed volume during the 1-YR storm, as well as an improvement factor. Detailed calculations are attached demonstrating what the required flow rate is, and how it is achieved using flow rate reduction via the proposed ADS system. DA1 and DA3 1-year storm flow rates were also significantly reduced to below pre-development. Refer to the Peak Flowrate Summary Table.

Flood Protection

In order to comply with Flood Protection requirements from 9VAC25-870-66-C, option 2b was chosen. This requires the peak flowrate of the 10-YR 24-hour storm post-development to be lower than the predevelopment peak flowrate of the 10-YR event. Downstream stormwater conveyance systems do not require any additional analysis to show compliance with flood protection criteria if this option is utilized. Detailed calculations, including hydrograph

Peak Flowrate Summary

Study Point	*Pre-Dev Area (acre)*	*Post-Dev Area (acre)*	Pre-Development			Post-Development		
			1-Year		10-Year	1-Year		10-Year
			Runoff (cfs)	*Volume (cf)*	*Runoff (cfs)*	*Runoff (cfs)*	*Volume (cf)*	*Runoff (cfs)*
DA 1	1.053	0.266	0.81	1,970	2.94	0.21	462	0.79
DA 2	1.405	2.71	1.18	3,248	3.81	0.21	12,515	3.44
DA 3	0.596	0.019	0.65	1,473	1.99	0.02	33	0.06

STORMWATER FACILITY MAINTENCE CONSIDERATIONS

The ADS System is located east of the club house and beside the parking lot. It can easily be accessed by any service vehicle. Maintenance will be conducted through the ADS clean outs and inspection ports.

MAPS

- Site Location Map
- Soils Map and Soil Unit Summary for Site and Offsite Areas
- Pre-Development Drainage Map
- Post-Development Drainage Map

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LOCATION MAP

GLADE ROAD
MULTI-FAMILY DEVELOPMENT

REVISIONS
1
2

PROJECT TEAM	
PIC	JOHN T. NEEL, P.E
PM	BRYANT H. ALTIZER, P.E L.S
DSGN	ESD

DATE	GNI JN	SHEET
7/31/19	1108.7	1 of 1

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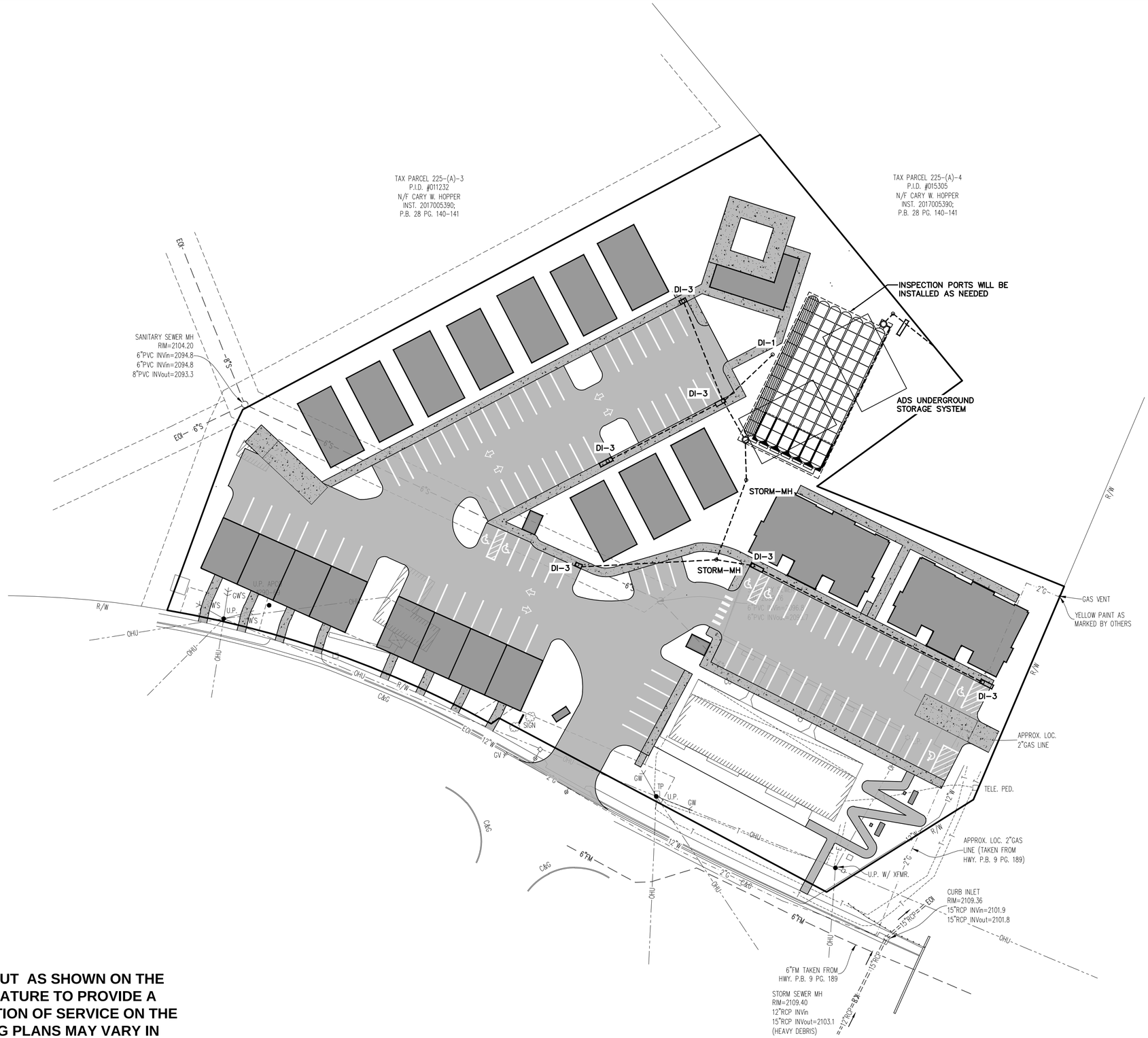

THE STORM DRAIN LAYOUT AS SHOWN ON THE PLAN IS SCHEMATIC IN NATURE TO PROVIDE A GENERAL REPRESENTATION OF SERVICE ON THE SITE. FINAL ENGINEERING PLANS MAY VARY IN COORDINATION WITH TOWN OF BLACKSBURG ENGINEERING.

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GLADE ROAD MULTI-FAMILY DEVELOPMENT LAYOUT

1002 GLADE ROAD

REVISIONS

NO.	COMMENTS	DATE

PROJECT TEAM

PIC	JOHN T. NEEL, P.E
PM	BRYANT H. ALTIZER. P.E , L.S
DESIGN	ESD, BAP

ISSUE DATE

07/31/2019

GNI JOB NO.

1108.7

SHEET TITLE

STORM PLAN LAYOUT

SHEET NUMBER

1 of 1

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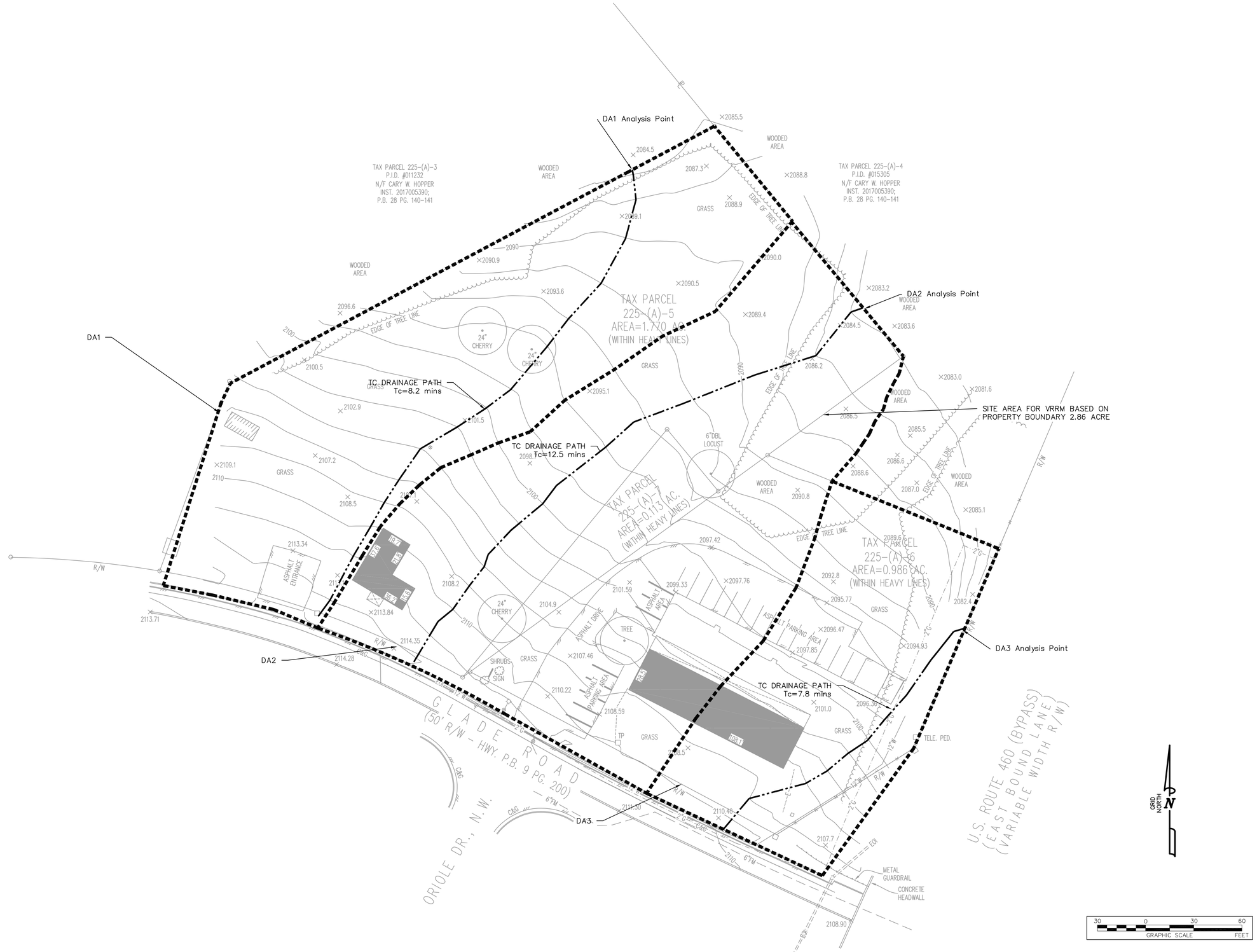

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GLADE ROAD MULTI-FAMILY DEVELOPMENT

BLACKSBURG, VA

REVISIONS

NO.	COMMENTS	DATE

PROJECT TEAM

PIC	JOHN T NEEL, PE
PM	JOSH M MACDONALD, PE
DESIGN	ESD, JMM, BAP

ISSUE DATE

7/31/19

GNI JOB NO.

1108.7

SHEET TITLE

PRE-DEV DRAINAGE AREA

SHEET NUMBER

1 of 1

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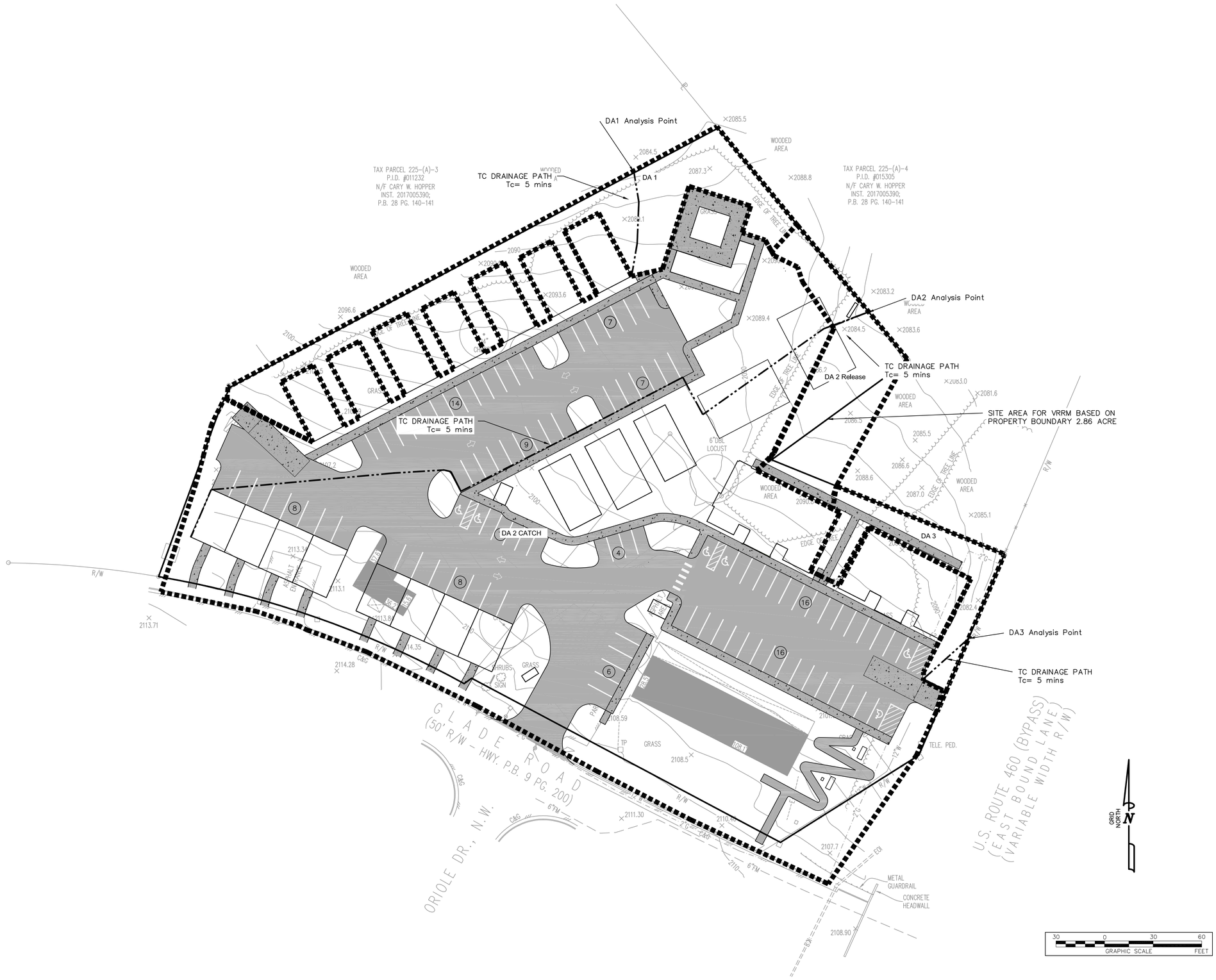

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GLADE ROAD MULTI-FAMILY DEVELOPMENT

BLACKSBURG, VA

REVISIONS		
NO.	COMMENTS	DATE

PROJECT TEAM	
PIC	JOHN T NEEL, PE
PM	BRYANT H. ALTIZER, P.E , L.S
DESIGN	ESD, JMM, BAP

ISSUE DATE: 7/31/19

GNI JOB NO.: 1108.7

SHEET TITLE: POST-DEV. DRAINAGE AREA

SHEET NUMBER: 1 of 1

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CALCULATIONS

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Glade Road Multi-Family Development DA 2

JN: 1108.7
BY: ESD
DATE: 07/31/19

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

Site Area =	1.405	AC	*Limits of Disturbance (see definition in 9VAC25-870*
Improvement Factor (I.F.) =	0.8		*Based on Site Area*
$Q_{Pre\text{-}developed}$ (Qp) =	1.18	cfs	
$RV_{Pre\text{-}developed}$ (RVp) =	2,911	cf	
			Input from Hydrographs
Q_{Forest} (Qf) =	0.73	cfs	
RV_{Forest} (RVf) =	1,528	cf	

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

$RV_{Developed}$ from Hydrograph	12,255	cf	*Input from Hydrographs*
Runoff Reduction from VRRM	-	cf	
$RV_{Developed}$ (RVd) =	12,255	cf	

$Q_{Developed}$ Target = 0.22 cfs

$Q_{Developed}$ (Qd) =	0.21	cfs	*Input from Hydrographs*

Qd	IS LESS THAN	I.F.*(Qp*RVp)/RVd
0.21		0.22

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

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

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

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

Project Name:	Glade Road Multi-Family Development	CLEAR ALL (Ctrl+Shift+R)	data input cells
Date:	7/31/2019		constant values
	Linear Development Project? No		calculation cells
			final results

Site Information

Post-Development Project (Treatment Volume and Loads)

Enter Total Disturbed Area *(acres)* →	2.88	*Check:*	
		BMP Design Specifications List:	2013 Draft Stds & Specs
Maximum reduction required:	20%	*Linear project?*	No
The site's net increase in impervious cover (acres) is:	1.49	*Land cover areas entered correctly?*	✔
Post-Development TP Load Reduction for Site (lb/yr):	2.82	*Total disturbed area entered?*	✔

Pre-ReDevelopment 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			2.67		2.67
Impervious Cover (acres)			0.19		0.19
					2.86

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			1.18		1.18
Impervious Cover (acres)			1.68		1.68
Area Check	OK.	OK.	OK.	OK.	2.86

Constants

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

Runoff Coefficients (Rv)

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

LAND COVER SUMMARY -- PRE-REDEVELOPMENT

Land Cover Summary-Pre		
Pre-ReDevelopment	**Listed**	**Adjusted[1]**
Forest/Open Space Cover (acres)	0.00	0.00
Weighted Rv(forest)	0.00	0.00
% Forest	0%	0%
Managed Turf Cover (acres)	2.67	1.18
Weighted Rv(turf)	0.22	0.22
% Managed Turf	93%	86%
Impervious Cover (acres)	0.19	0.19
Rv(impervious)	0.95	0.95
% Impervious	7%	14%
Total Site Area (acres)	**2.86**	**1.37**
Site Rv	**0.27**	**0.32**

LAND COVER SUMMARY -- POST DEVELOPMENT

Land Cover Summary-Post (Final)	
Post ReDev. & New Impervious	
Forest/Open Space Cover (acres)	0.00
Weighted Rv(forest)	0.00
% Forest	0%
Managed Turf Cover (acres)	1.18
Weighted Rv (turf)	0.22
% Managed Turf	41%
Impervious Cover (acres)	1.68
Rv(impervious)	0.95
% Impervious	59%
Final Site Area (acres)	**2.86**
Final Post Dev Site Rv	**0.65**

Land Cover Summary-Post	
Post-ReDevelopment	
Forest/Open Space Cover (acres)	0.00
Weighted Rv(forest)	0.00
% Forest	0%
Managed Turf Cover (acres)	1.18
Weighted Rv (turf)	0.22
% Managed Turf	86%
ReDev. Impervious Cover (acres)	0.19
Rv(impervious)	0.95
% Impervious	14%
Total ReDev. Site Area (acres)	**1.37**
ReDev Site Rv	**0.32**

Land Cover Summary-Post	
Post-Development New Impervious	
New Impervious Cover (acres)	1.49
Rv(impervious)	0.95

Treatment Volume and Nutrient Load

Pre-ReDevelopment Treatment Volume (acre-ft)	0.0640	0.0367
Pre-ReDevelopment Treatment Volume (cubic feet)	2,787	1,598
Pre-ReDevelopment TP Load (lb/yr)	**1.75**	**1.00**
Pre-ReDevelopment TP Load per acre (lb/acre/yr)	0.61	0.73
Baseline TP Load (lb/yr) (**0.41 lbs/acre/yr** applied to pre-redevelopment area excluding pervious land proposed for new impervious cover)		*0.56*

Treatment Volume and Nutrient Load

Final Post-Development Treatment Volume (acre-ft)	0.1546
Final Post-Development Treatment Volume (cubic feet)	6,736
Final Post-Development TP Load (lb/yr)	**4.23**
Final Post-Development TP Load per acre (lb/acre/yr)	1.48

Post-ReDevelopment Treatment Volume (acre-ft)	0.0367
Post-ReDevelopment Treatment Volume (cubic feet)	1,598
Post-ReDevelopment Load (TP) (lb/yr)*	**1.00**
Post-ReDevelopment TP Load per acre (lb/acre/yr)	0.73
Max. Reduction Required (Below Pre-ReDevelopment Load)	**20%**
TP Load Reduction Required for Redeveloped Area (lb/yr)	**0.20**

Post-Development Treatment Volume (acre-ft)	0.1180
Post-Development Treatment Volume (cubic feet)	5,138
Post-Development TP Load (lb/yr)	**3.23**
TP Load Reduction Required for New Impervious Area (lb/yr)	**2.62**

[1] *Adjusted 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 requriement for new impervious cover (based on new development load limit, 0.41 lbs/acre/year).

Post-Development Requirement for Site Area

				TP Load Reduction Required (lb/yr)		2.82						
	Nitrogen Loads (Informational Purposes Only)											
	Pre-ReDevelopment TN Load (lb/yr)		12.53			Final Post-Development TN Load (Post-ReDevelopment & New Impervious) (lb/yr)		30.28				

Drainage Area A

Drainage Area A Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals	Land Cover Rv
Forest/Open Space (acres)					0.00	0.00
Managed Turf (acres)			1.18		1.18	0.22
Impervious Cover (acres)			1.68		1.68	0.95
				Total	2.86	

CLEAR BMP AREAS

Total Phosphorus Available for Removal in D.A. A (lb/yr)	4.23
Post Development Treatment Volume in D.A. A (ft^3)	6,736

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-Bioretention #1 (Spec #9)	40			0	0	0	0	25	0.00	0.00	0.00	0.00	
2.g. To Rain Garden #2, Micro-Bioretention #2 (Spec #9)	80			0	0	0	0	50	0.00	0.00	0.00	0.00	
2.h. To Rainwater Harvesting (Spec #6)	0			0	0	0	0	0	0.00	0.00	0.00	0.00	
2.i. To Stormwater Planter, Urban Bioretention (Spec #9, Appendix A)	40			0	0	0	0	25	0.00	0.00	0.00	0.00	
3. Permeable Pavement (RR)													
3.a. Permeable Pavement #1 (Spec #7)	45			0	0	0	0	25	0.00	0.00	0.00	0.00	
3.b. Permeable Pavement #2 (Spec #7)	75				0	0	0	25		0.00	0.00	0.00	
4. Grass Channel (RR)													
4.a. Grass Channel A/B Soils (Spec #3)	20			0	0	0	0	15	0.00	0.00	0.00	0.00	
4.b. Grass Channel C/D Soils (Spec #3)	10			0	0	0	0	15	0.00	0.00	0.00	0.00	
4.c. Grass Channel with Compost Amended Soils as per specs (see Spec #4)	20			0	0	0	0	15	0.00	0.00	0.00	0.00	
5. Dry Swale (RR)													
5.a. Dry Swale #1 (Spec #10)	40			0	0	0	0	20	0.00	0.00	0.00	0.00	
5.b. Dry Swale #2 (Spec #10)	60			0	0	0	0	40	0.00	0.00	0.00	0.00	
6. Bioretention (RR)													
6.a. Bioretention #1 or Micro-Bioretention #1 or Urban Bioretention (Spec #9)	40			0	0	0	0	25	0.00	0.00	0.00	0.00	
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	

Practice	Nitrogen Removal Efficiency (%)	Nitrogen Load from Upstream Practices (lbs)	Untreated Nitrogen Load to Practice (lbs)	Nitrogen Removed By Practice (lbs)	Remaining Nitrogen Load (lbs)
1. Vegetated Roof (RR)					
1.a. Vegetated Roof #1 (Spec #5)	0		0.00	0.00	0.00
1.b. Vegetated Roof #2 (Spec #5)	0		0.00	0.00	0.00
2. Rooftop Disconnection (RR)					
2.a. Simple Disconnection to A/B Soils (Spec #1)	0	0.00	0.00	0.00	0.00
2.b. Simple Disconnection to C/D Soils (Spec #1)	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)	0	0.00	0.00	0.00	0.00
2.d. To Dry Well or French Drain #1, Micro-Infiltration #1 (Spec #8)	15	0.00	0.00	0.00	0.00
2.e. To Dry Well or French Drain #2, Micro-Infiltration #2 (Spec #8)	15	0.00	0.00	0.00	0.00
2.f. To Rain Garden #1, Micro-Bioretention #1 (Spec #9)	40	0.00	0.00	0.00	0.00
2.g. To Rain Garden #2, Micro-Bioretention #2 (Spec #9)	60	0.00	0.00	0.00	0.00
2.h. To Rainwater Harvesting (Spec #6)	0	0.00	0.00	0.00	0.00
2.i. To Stormwater Planter, Urban Bioretention (Spec #9, Appendix A)	40	0.00	0.00	0.00	0.00
3. Permeable Pavement (RR)					
3.a. Permeable Pavement #1 (Spec #7)	25	0.00	0.00	0.00	0.00
3.b. Permeable Pavement #2 (Spec #7)	25		0.00	0.00	0.00
4. Grass Channel (RR)					
4.a. Grass Channel A/B Soils (Spec #3)	20	0.00	0.00	0.00	0.00
4.b. Grass Channel C/D Soils (Spec #3)	20	0.00	0.00	0.00	0.00
4.c. Grass Channel with Compost Amended Soils as per specs (see Spec #4)	20	0.00	0.00	0.00	0.00
5. Dry Swale (RR)					
5.a. Dry Swale #1 (Spec #10)	25	0.00	0.00	0.00	0.00
5.b. Dry Swale #2 (Spec #10)	35	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	0.00	0.00	0.00	0.00
6.b. Bioretention #2 or Micro-Bioretention #2 (Spec #9)	60	0.00	0.00	0.00	0.00
7. Infiltration (RR)					
7.a. Infiltration #1 (Spec #8)	15	0.00	0.00	0.00	0.00
7.b. Infiltration #2 (Spec #8)	15	0.00	0.00	0.00	0.00
8. Extended Detention Pond (RR)					
8.a. ED #1 (Spec #15)	10	0.00	0.00	0.00	0.00
8.b. ED #2 (Spec #15)	10	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)	0	0.00	0.00	0.00	0.00
9.b. Sheetflow to Conservation Area, C/D Soils (Spec #2)	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)	0	0.00	0.00	0.00	0.00

TOTAL IMPERVIOUS COVER TREATED (ac)	0.00	AREA CHECK: OK.
TOTAL MANAGED TURF AREA TREATED (ac)	0.00	AREA CHECK: OK.
TOTAL RUNOFF REDUCTION IN D.A. A (ft^3)	0	

TOTAL PHOSPHORUS AVAILABLE FOR REMOVAL IN D.A. A (lb/yr)	4.23
TOTAL PHOSPHORUS REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00
TOTAL PHOSPHORUS REMAINING AFTER APPLYING RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	4.23

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

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

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

10. Wet Swale (no RR)														**10. Wet Swale (Coastal Plain) (no RR)**				
10.a. Wet Swale #1 (Spec #11)	0			0	0	0	0	20	0.00	0.00	0.00	0.00		25	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		35	0.00	0.00	0.00	0.00
11. Filtering Practices (no RR)														**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		30	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		45	0.00	0.00	0.00	0.00
12. Constructed Wetland (no RR)														**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		25	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		55	0.00	0.00	0.00	0.00
13. Wet Ponds (no RR)														**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		30	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		20	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		40	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		30	0.00	0.00	0.00	0.00
14. Manufactured Treatment Devices (no RR)														**14. Manufactured BMP (no RR)**				
14.a. Manufactured Treatment Device-Hydrodynamic	0			0	0	0	0	40	0.00	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00
14.b. Manufactured Treatment Device-Filtering	0	0.88	1.68	0	0	6,496	6,496	40	0.00	4.08	1.63	2.45		0	0.00	29.17	0.00	29.17
14.c. Manufactured Treatment Device-Generic	0			0	0	0	0	40	0.00	0.00	0.00	0.00		0	0.00	0.00	0.00	0.00

TOTAL IMPERVIOUS COVER TREATED (ac)	1.68	AREA CHECK: OK.
TOTAL MANAGED TURF AREA TREATED (ac)	0.88	AREA CHECK: OK.
TOTAL PHOSPHORUS REMOVAL REQUIRED ON SITE (lb/yr)	2.82	
TOTAL PHOSPHORUS AVAILABLE FOR REMOVAL IN D.A. A (lb/yr)	4.23	
TOTAL PHOSPHORUS REMOVED WITHOUT RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	1.63	
TOTAL PHOSPHORUS REMOVED WITH RUNOFF REDUCTION PRACTICES IN D.A. A (lb/yr)	0.00	
TOTAL PHOSPHORUS LOAD REDUCTION ACHIEVED IN D.A. A (lb/yr)	1.63	
TOTAL PHOSPHORUS REMAINING AFTER APPLYING BMP LOAD REDUCTIONS IN D.A. A (lb/yr)	2.60	

SEE WATER QUALITY COMPLIANCE TAB FOR SITE COMPLIANCE CALCULATIONS

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

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)	1.68	0.00	0.00	0.00	0.00	OK.
IMPERVIOUS COVER TREATED (ac)	1.68	0.00	0.00	0.00	0.00	OK.
MANAGED TURF AREA (ac)	1.18	0.00	0.00	0.00	0.00	OK.
MANAGED TURF AREA TREATED (ac)	0.88	0.00	0.00	0.00	0.00	OK.
AREA CHECK	OK.	OK.	OK.	OK.	OK.	

Site Treatment Volume (ft^3)	6,736

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)	0	0	0	0	0	0
TP LOAD AVAILABLE FOR REMOVAL (lb/yr)	4.23	0.00	0.00	0.00	0.00	4.23
TP LOAD REDUCTION ACHIEVED (lb/yr)	1.63	0.00	0.00	0.00	0.00	1.63
TP LOAD REMAINING (lb/yr)	2.60	0.00	0.00	0.00	0.00	2.60
NITROGEN LOAD REDUCTION ACHIEVED (lb/yr)	0.00	0.00	0.00	0.00	0.00	0.00

Total Phosphorus

FINAL POST-DEVELOPMENT TP LOAD (lb/yr)	4.23
TP LOAD REDUCTION REQUIRED (lb/yr)	2.82
TP LOAD REDUCTION ACHIEVED (lb/yr)	1.63
TP LOAD REMAINING (lb/yr):	2.60
REMAINING TP LOAD REDUCTION REQUIRED (lb/yr):	1.19

Total Nitrogen (For Information Purposes)

POST-DEVELOPMENT LOAD (lb/yr)	30.28
NITROGEN LOAD REDUCTION ACHIEVED (lb/yr)	0.00
REMAINING POST-DEVELOPMENT NITROGEN LOAD (lb/yr)	30.28

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

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

Site Summary

Total Rainfall (in):	**43**
Total Disturbed Acreage:	**2.88**

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	0.00	2.67	0.00	2.67	93
Impervious Cover (acres)	0.00	0.00	0.19	0.00	0.19	7
					2.86	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	0.00	1.18	0.00	1.18	41
Impervious Cover (acres)	0.00	0.00	1.68	0.00	1.68	59
					2.86	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	0.65	0.32	0.95	0.32
Treatment Volume (ft^3)	6,736	1,598	5,138	1,598
TP Load (lb/yr)	4.23	1.00	3.23	1.00

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)
0.73	**1.48**	**0.73**

Total TP Load Reduction Required (lb/yr)	**2.82**	0.20	2.62

	Final Post-Development Load (Post-ReDevelopment & New Impervious)	Pre-ReDevelopment
TN Load (lb/yr)	30.28	12.53

Site Compliance Summary

Maximum % Reduction Required Below Pre-ReDevelopment Load	20%

Total Runoff Volume Reduction (ft^3)	0
Total TP Load Reduction Achieved (lb/yr)	1.63
Total TN Load Reduction Achieved (lb/yr)	0.00
Remaining Post Development TP Load (lb/yr)	2.60
Remaining TP Load Reduction (lb/yr) Required	**1.19**

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)	1.18	0.00	0.00	0.00	0.00	1.18
Impervious Cover (acres)	1.68	0.00	0.00	0.00	0.00	1.68
Total Area (acres)	**2.86**	**0.00**	**0.00**	**0.00**	**0.00**	**2.86**

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)	1.63	0.00	0.00	0.00	0.00	1.63
TN Load Reduced (lb/yr)	0.00	0.00	0.00	0.00	0.00	0.00

Drainage Area A Summary

Land Cover Summary

	A Soils	B Soils	C Soils	D Soils	Total	% of Total
Forest/Open (acres)	0.00	0.00	0.00	0.00	0.00	0
Managed Turf (acres)	0.00	0.00	1.18	0.00	1.18	41
Impervious Cover (acres)	0.00	0.00	1.68	0.00	1.68	59
					2.86	

BMP Selections

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

Total Impervious Cover Treated (acres)	1.68
Total Turf Area Treated (acres)	0.88
Total TP Load Reduction Achieved in D.A. (lb/yr)	1.63
Total TN Load Reduction Achieved in D.A. (lb/yr)	0.00

Drainage Area B Summary

Land Cover Summary

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

BMP Selections

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

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

Drainage Area C Summary

Land Cover Summary

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

BMP Selections

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

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

Drainage Area D Summary

Land Cover Summary

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

BMP Selections

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

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

Drainage Area E Summary

Land Cover Summary

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

BMP Selections

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

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

Runoff Volume and CN Calculations

	1-year storm	2-year storm	10-year storm
Target Rainfall Event (in)	0.00	0.00	0.00

Drainage Areas	RV & CN	Drainage Area A	Drainage Area B	Drainage Area C	Drainage Area D	Drainage Area E
CN		88	0	0	0	0
RR (ft^3)		0	0	0	0	0
1-year return period	RV wo RR (ws-in)	0.00	0.00	0.00	0.00	0.00
	RV w RR (ws-in)	0.00	0.00	0.00	0.00	0.00
	CN adjusted	100	0	0	0	0
2-year return period	RV wo RR (ws-in)	0.00	0.00	0.00	0.00	0.00
	RV w RR (ws-in)	0.00	0.00	0.00	0.00	0.00
	CN adjusted	100	0	0	0	0
10-year return period	RV wo RR (ws-in)	0.00	0.00	0.00	0.00	0.00
	RV w RR (ws-in)	0.00	0.00	0.00	0.00	0.00
	CN adjusted	100	0	0	0	0

Version 2.8 - June 2014 - 2011 BMP Stds & Specs

1 Fixed summary sheet - totals /percentage column fixed
2 Corrected nitrogen efficiency percentages
3 Corrected the Rv value in column J for managed turf
4 Checked and revised runoff reduction credit values assigned

Version 3.0 - 2011 and draft 2013 BMP Stds & Specs

General

1 Added error checks and user prompts to Site tab, DA tabs, and Runoff Volume and CN tab for data input errors.
2 Various format changes thoughout the spreadsheet.
3 Combined 2011 and 2013 BMP spreadsheets into one spreadsheet with a user selection option included in Site tab.
4 User input cell color changed from cyan blue to green; calculation cells changed from mid-grey to light grey; and added final result cell in indigo.

Site tab

5 Locked annual rainfall of 43 inches for use throughout Virginia since regulatory site based TP load limit is based on this value.
6 Corrected error in formula for total phosporus load reduction requirement. Previous formula was inconsistent with 9VAC25-870-63 A.2 and under certain circumstances provided erroneous TP load reduction requirement for development on prior developed lands.
7 Added button and shortcut (Ctrl+Shift+R) to clear user inputs from all worksheets.
8 Added shortcut (Ctrl+Shift+D) to clear land cover data from Site tab.
9 Added TP Baseline Load for adjusted pre-redevelopement portion (cell C58).
10 Added note (triggered to appear when applicable) below "Land Cover Summary for Redevelopment" - indicating that reduction below baseline TP load (<0.41 lbs/acre) not required as per 9VAC25-870-63.
11 Added error messages when data input areas incomplete or not entered correctly.
12 Conditional formatting (Summary sections grayed out) when input information incomplete or incorrect.
13 Added Pre-redevelopment and Post-development load in lbs/acre/yr (row 57) for additional comparison purposes
14 Corrected error in excel formula for new impervious cover Rv.
15 Corrected errors in excel formula for total site area and Rv's in redevelopment portion: error appeared when soil types change between pre-redevelopment and post-development with no net increases in impervious increase.
16 Added section for Final Post-Development to Land Cover Summaries to show combination of redevelopment portion and new net impervious cover portion.
17 Added informational section in blue (columns B to F, rows 12-14) and input/error guide (columns H to K, rows 12-14) to indicate to users upfront when new net impervious cover is being triggered, when 10 or 20% reductions are being utilized, and when data entry is completed correctly.
18 Added data entry instruction when user inputs blank (row 8).
19 Added option for linear development projects (row 6, and cells D64-G64)

D.A. tabs

20 Added MTDs: Hydrodynamic, Filtering, Generic.
21 Added "Total BMP Treatment Volume (ft^3)" column.
22 Rearranged previous Turf and Impervious input rows to adjacent cells in same row so each practice now located on 1 row only.
23 Consolidated BMP Practice heading and added (RR or no RR label) to each practice to identify those with and without Runoff Reduction.
24 Added " Total Phosphorus Available for Removal in D.A. _ (lbs)".
25 Added button to clear BMP credit areas entered for each practice.
26 Added user prompts to assist with user-input Rainwater Harvesting runoff reduction credit, and MTDs.
27 Renamed Credit and Phosphorus/Nitrogen Efficiency column headers to Runoff Removal Credit and Phosphorus/Nitrogen Removal Efficiency for clarity.
28 Removed "RR" from Column headings referring to runoff volume and TP load from upstream practices (which may be RR or non-RR practices).
29 Renamed "10. Wet Swale (Coastal Plain)" to "10. Wet Swale" in BMP heading in order to improve clarity. The practice is well suited for but not limited to the Coastal Plain.
30 Renamed "14. Manufactured BMPs" section heading to "14. Manufactured Treatment Device"s for consistency with Virginia BMP Clearinghouse.
31 Added "Micro-Bioretention #1" and "Micro-Bioretention #2" to Bioretention headings (6.a and 6.b on tab, respectively) from Spec 9.
32 Replaced zero values from all data entry cells with blank cells, blocked out calculation and data entry cells where input or calculations are not applicable.

Water Quality Compliance tab

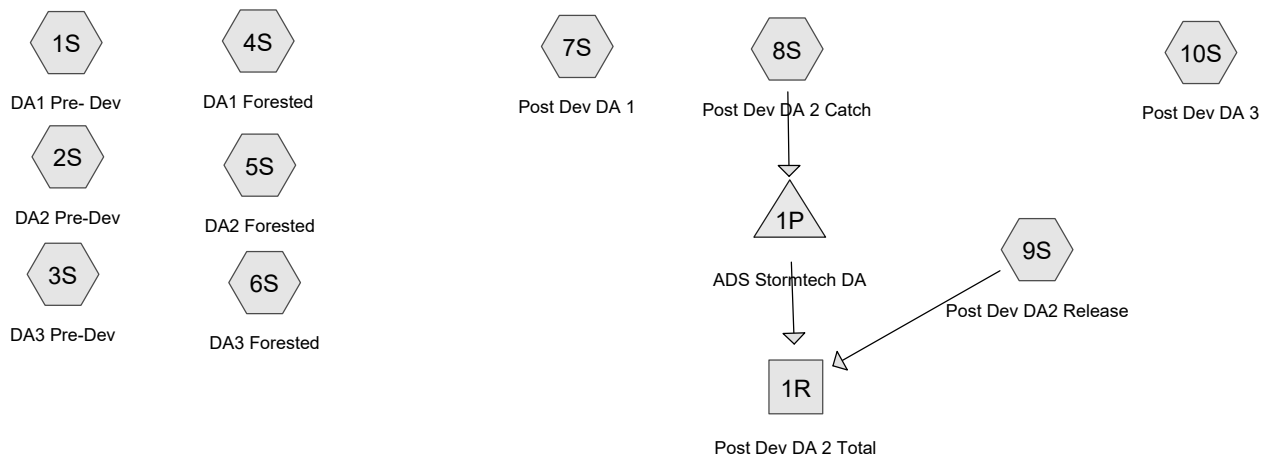
33 Optimized and reorganized for improved information output.
34 Added "Runoff Reduction Volume and TP By Drainage Area".
35 Added section for linear development projects (rows 21-26)

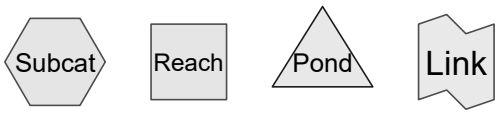
Runoff Volume and CN tab

36 Reorganized and renamed Channel and Flood Protection tab to Runoff Volume and CN to more accurately reflect information provided.
37 Added user notes regarding limitations of Runoff Volume and CN tab for water quantity calculations.
38 Renamed $CN_{weighted}$ to $CN_{(D.A.\ X)}$ for the CNs based on soils and land cover types for each drainage area

Summary tab

39 Added "Print Preview" button.
40 Fixed runtime error in Summary tab update macro.
41 Added "BMP Treatment Volume", "TP Load from Upstream practice", "TP Removed" and "TP remaining" columns to Summary tab.
42 Optimized macro efficiency and eliminated screen updating/flashing during macros.
43 Corrected Summary tab macro -Turf missing routine missing "<>".
44 Added additional pre and post site data onto Summary tab.
45 Added Error Summary Table to Summary tab (appears only if errors on Site tab or Drainage Area tabs are present)
46 Expanded and improved Runoff Coefficient and CN calculation section.
47 Added summary information for linear projects, only populates if applicable.





Routing Diagram for 1108.7_Glade Road Multi-Family Development__7-31-19
Prepared by Hewlett-Packard Company, Printed 7/31/2019
HydroCAD® 10.00-21 s/n 09081 © 2018 HydroCAD Software Solutions LLC

Summary for Subcatchment 1S: DA1 Pre- Dev

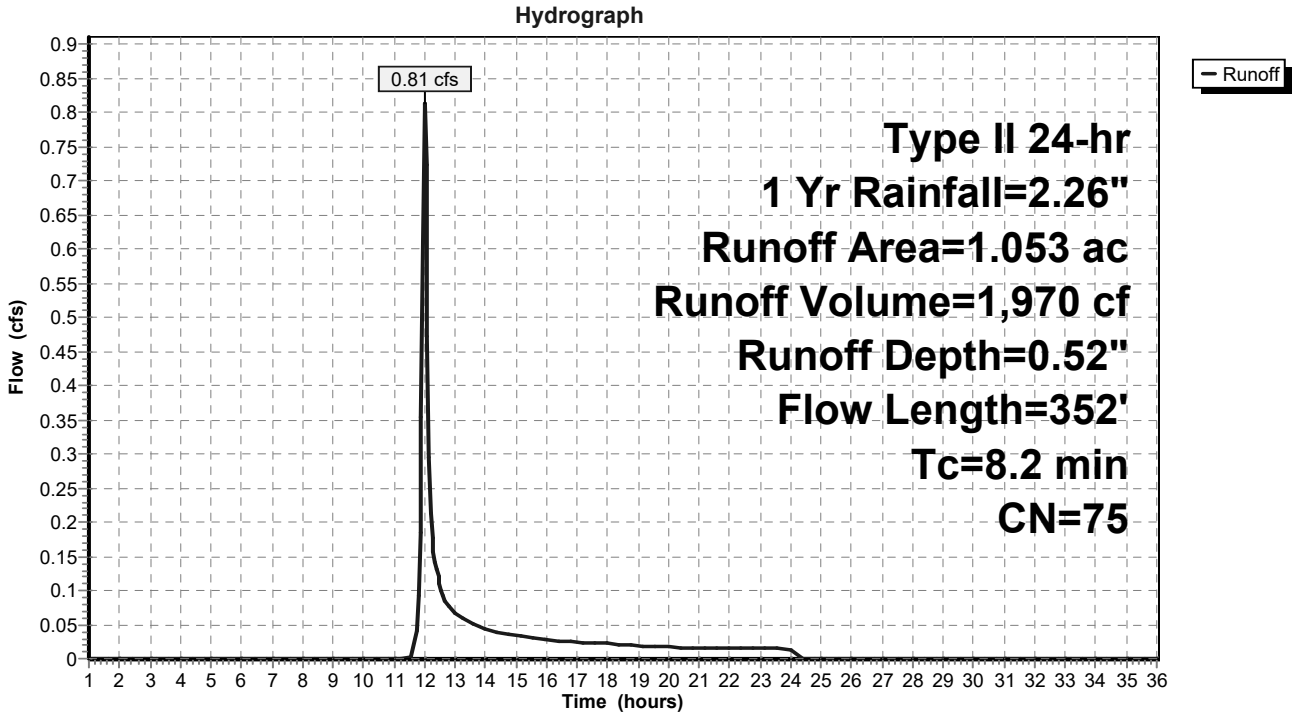
Runoff = 0.81 cfs @ 12.01 hrs, Volume= 1,970 cf, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.26"

Area (ac)	CN	Description
1.014	74	>75% Grass cover, Good, HSG C
0.039	98	Paved parking, HSG C
1.053	75	Weighted Average
1.014		96.30% Pervious Area
0.039		3.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	100	0.0800	0.27		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.73"
2.1	252	0.0790	1.97		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.2	352	Total			

Subcatchment 1S: DA1 Pre- Dev



Summary for Subcatchment 2S: DA2 Pre-Dev

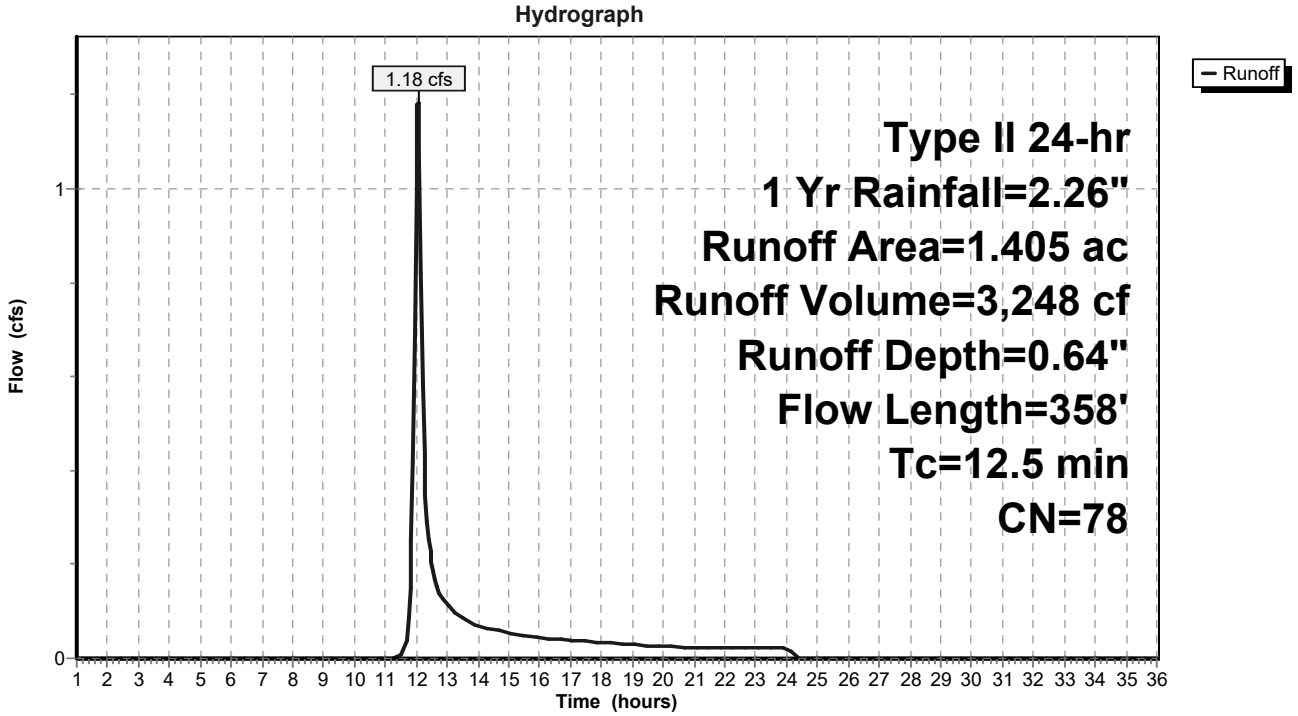
Runoff = 1.18 cfs @ 12.06 hrs, Volume= 3,248 cf, Depth= 0.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.26"

Area (ac)	CN	Description
0.977	74	>75% Grass cover, Good, HSG C
0.240	98	Paved parking, HSG C
0.188	70	Woods, Good, HSG C
1.405	78	Weighted Average
1.165		82.92% Pervious Area
0.240		17.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0200	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.73"
1.9	258	0.1100	2.32		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.5	358	Total			

Subcatchment 2S: DA2 Pre-Dev



Summary for Subcatchment 3S: DA3 Pre-Dev

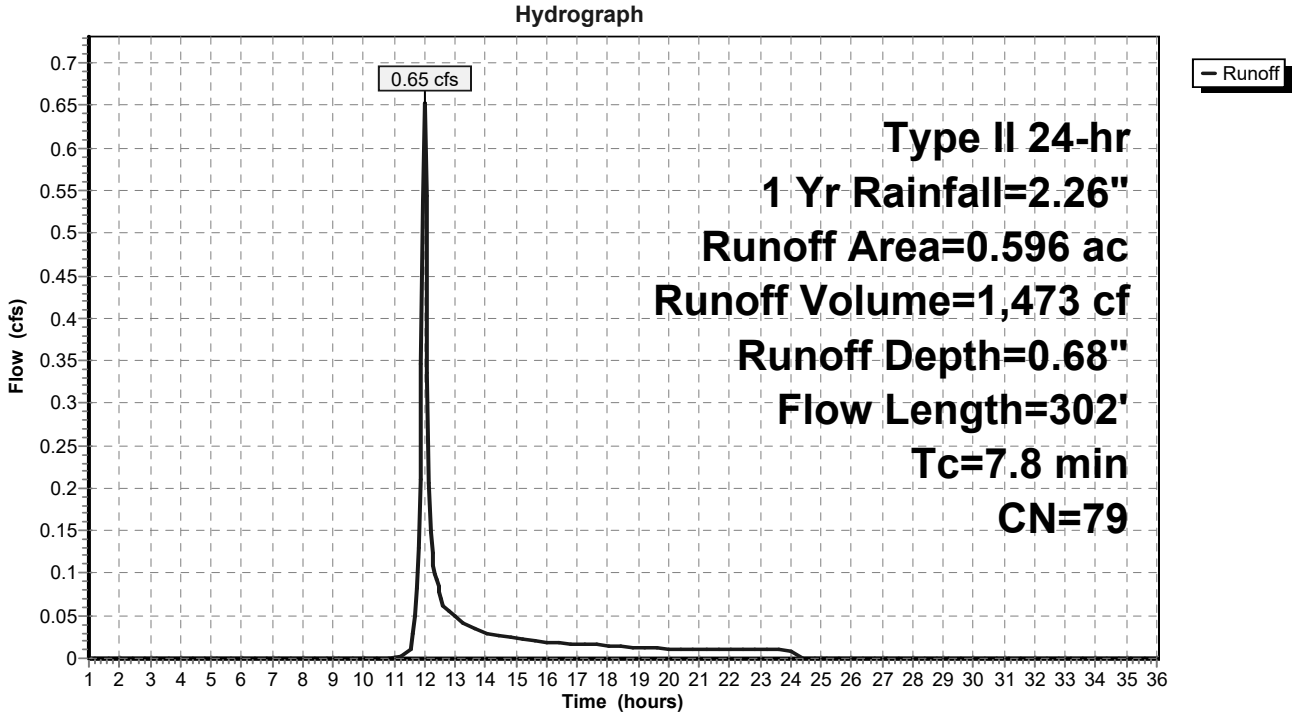
Runoff = 0.65 cfs @ 12.00 hrs, Volume= 1,473 cf, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.26"

Area (ac)	CN	Description
0.465	74	>75% Grass cover, Good, HSG C
0.121	98	Paved parking, HSG C
0.010	70	Woods, Good, HSG C
0.596	79	Weighted Average
0.475		79.70% Pervious Area
0.121		20.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	100	0.1000	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.73"
2.2	202	0.0490	1.55		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.8	302	Total			

Subcatchment 3S: DA3 Pre-Dev



Summary for Subcatchment 4S: DA1 Forested

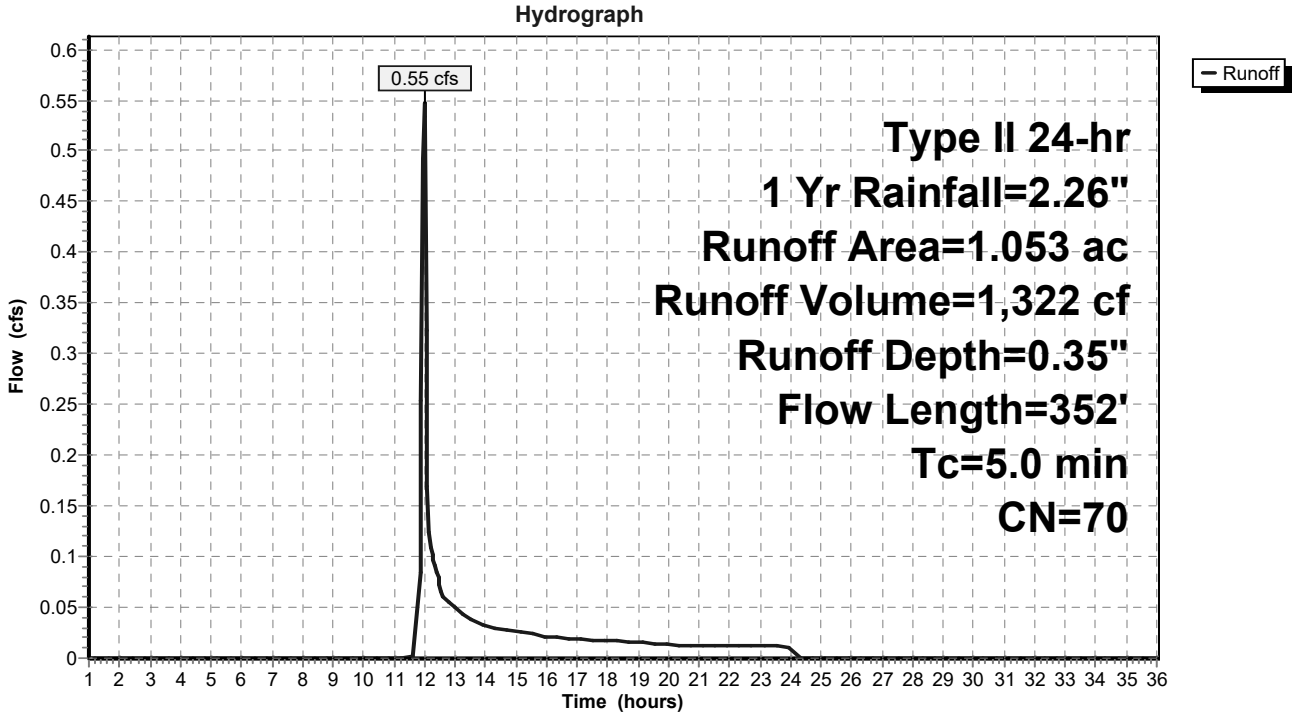
Runoff = 0.55 cfs @ 11.98 hrs, Volume= 1,322 cf, Depth= 0.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.26"

Area (ac)	CN	Description
1.014	70	Woods, Good, HSG C
0.039	70	Woods, Good, HSG C
1.053	70	Weighted Average
1.053		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	352		1.17		**Direct Entry,**

Subcatchment 4S: DA1 Forested



Summary for Subcatchment 5S: DA2 Forested

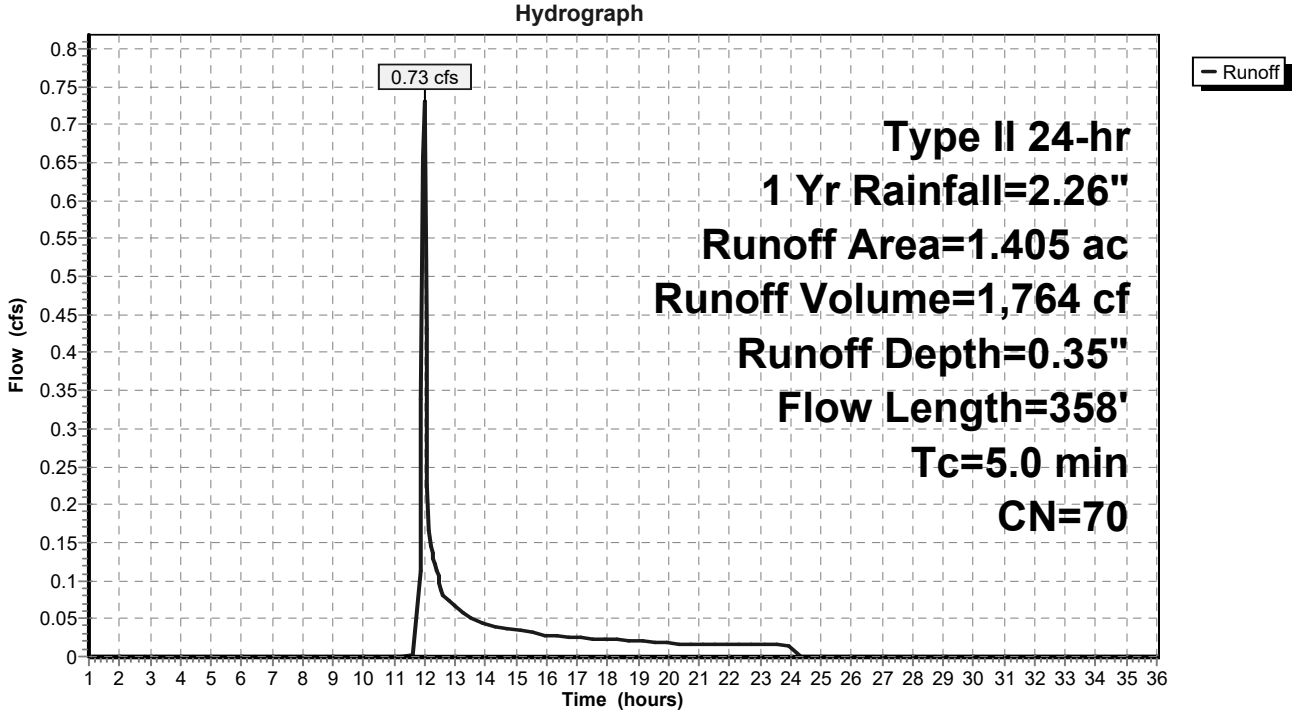
Runoff = 0.73 cfs @ 11.98 hrs, Volume= 1,764 cf, Depth= 0.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.26"

Area (ac)	CN	Description
0.977	70	Woods, Good, HSG C
0.240	70	Woods, Good, HSG C
0.188	70	Woods, Good, HSG C
1.405	70	Weighted Average
1.405		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	358		1.19		**Direct Entry,**

Subcatchment 5S: DA2 Forested



Summary for Subcatchment 6S: DA3 Forested

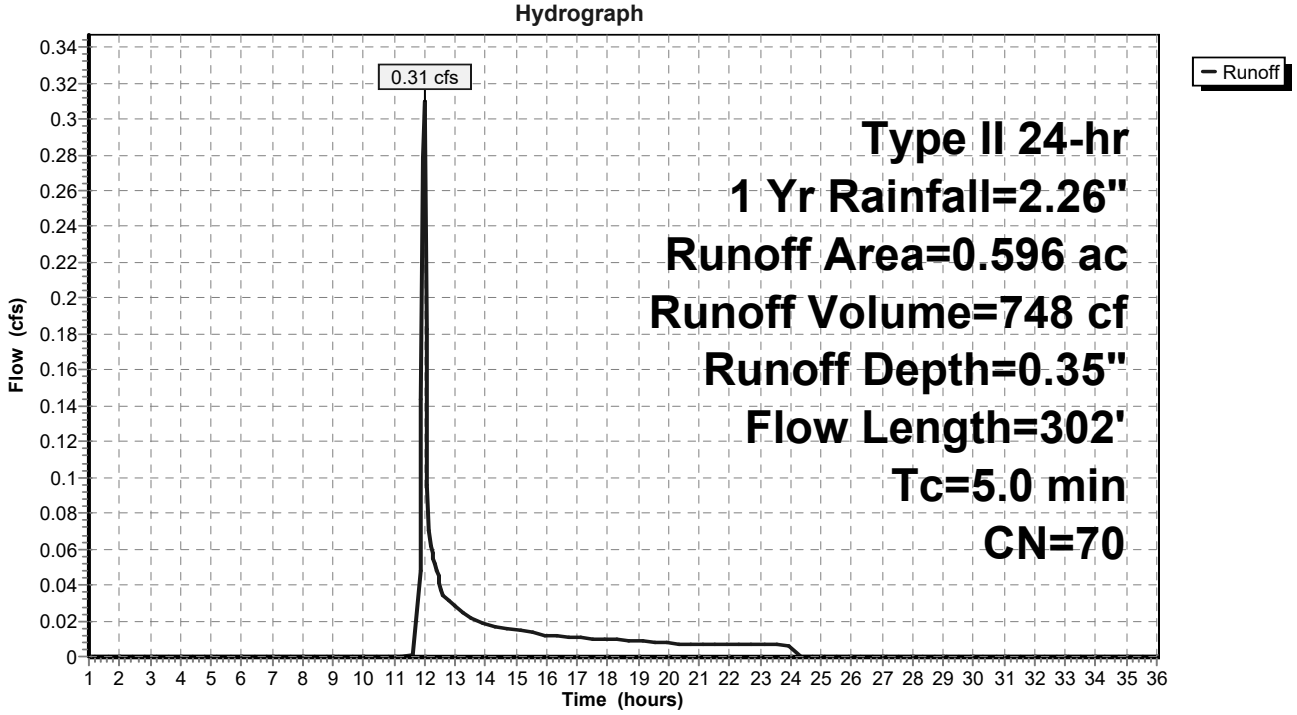
Runoff = 0.31 cfs @ 11.98 hrs, Volume= 748 cf, Depth= 0.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.26"

Area (ac)	CN	Description
0.465	70	Woods, Good, HSG C
0.121	70	Woods, Good, HSG C
0.010	70	Woods, Good, HSG C
0.596	70	Weighted Average
0.596		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	302		1.01		**Direct Entry,**

Subcatchment 6S: DA3 Forested



Summary for Subcatchment 7S: Post Dev DA 1

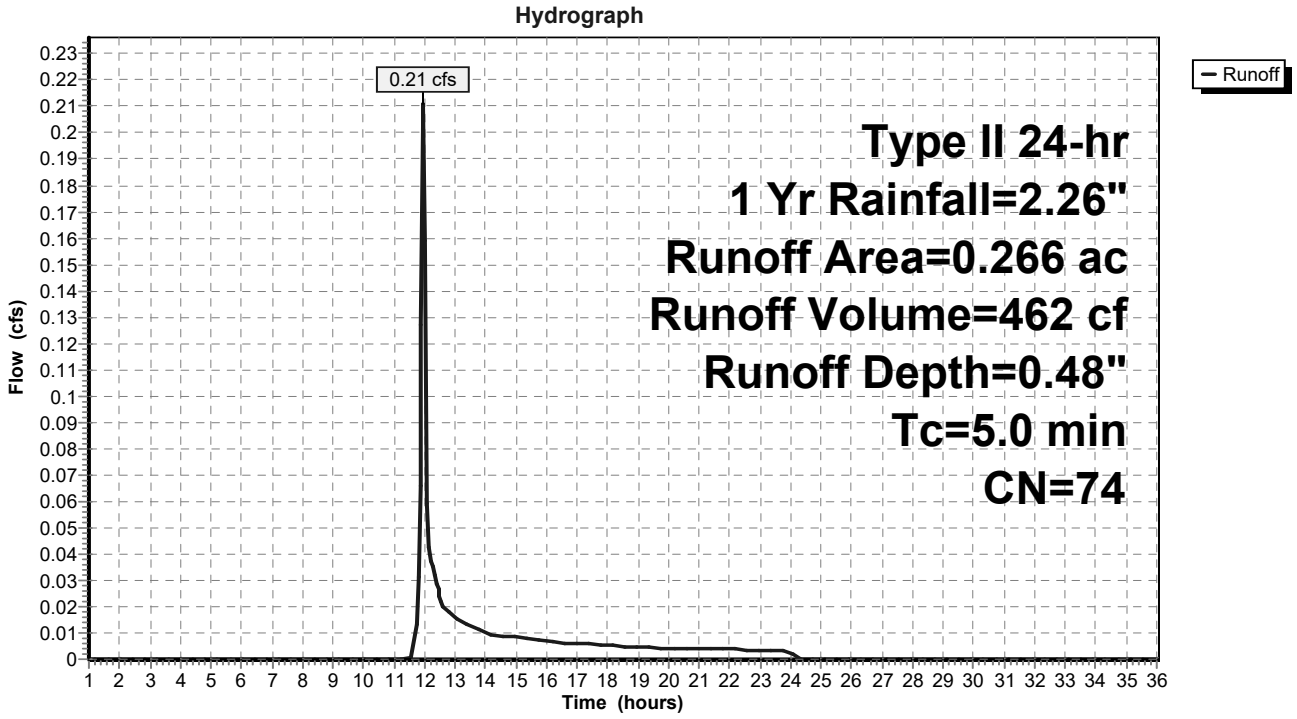
Runoff = 0.21 cfs @ 11.97 hrs, Volume= 462 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.26"

Area (ac)	CN	Description
0.266	74	>75% Grass cover, Good, HSG C
0.266		100.00% Pervious Area

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

Subcatchment 7S: Post Dev DA 1



Summary for Subcatchment 8S: Post Dev DA 2 Catch

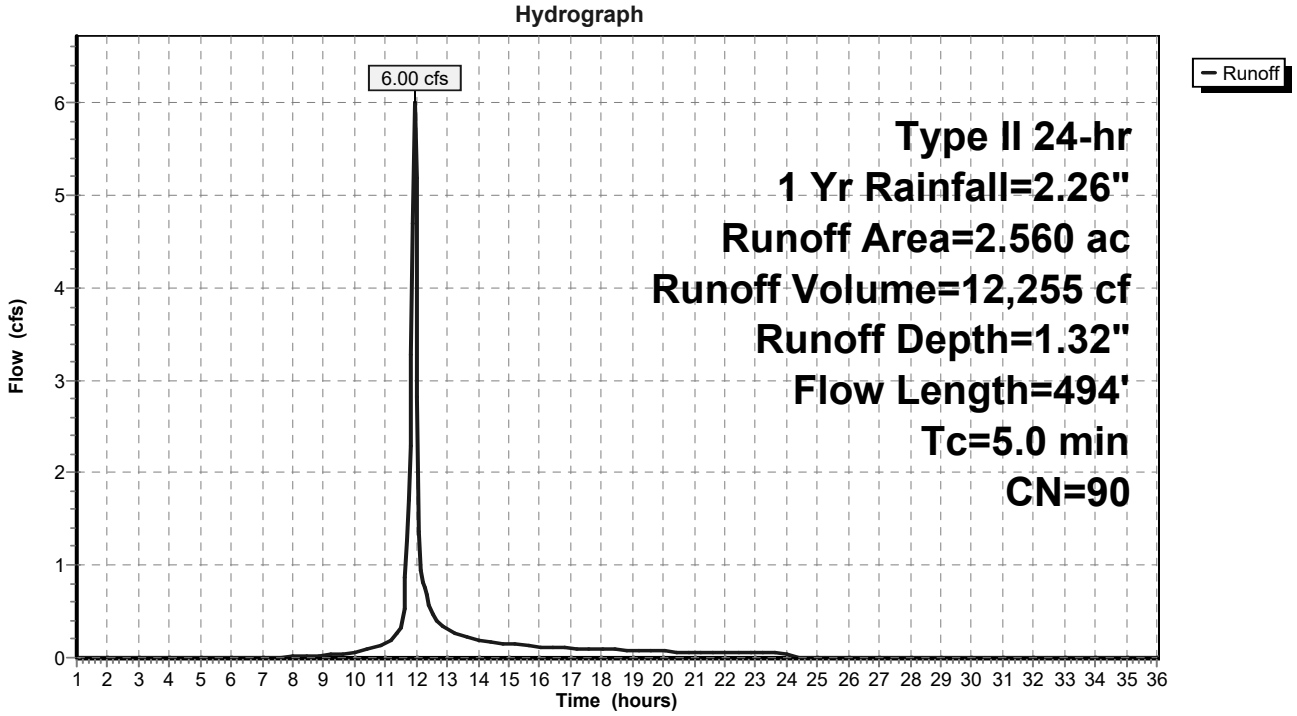
Runoff = 6.00 cfs @ 11.96 hrs, Volume= 12,255 cf, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.26"

Area (ac)	CN	Description
1.680	98	Paved parking, HSG C
0.880	74	>75% Grass cover, Good, HSG C
2.560	90	Weighted Average
0.880		34.38% Pervious Area
1.680		65.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	274	0.0320	3.63		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	220	0.0600	8.38	10.29	**Pipe Channel, CMP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.020 Corrugated PE, corrugated interior
3.3					**Direct Entry, To make it 5**
5.0	494	Total			

Subcatchment 8S: Post Dev DA 2 Catch



Summary for Subcatchment 9S: Post Dev DA2 Release

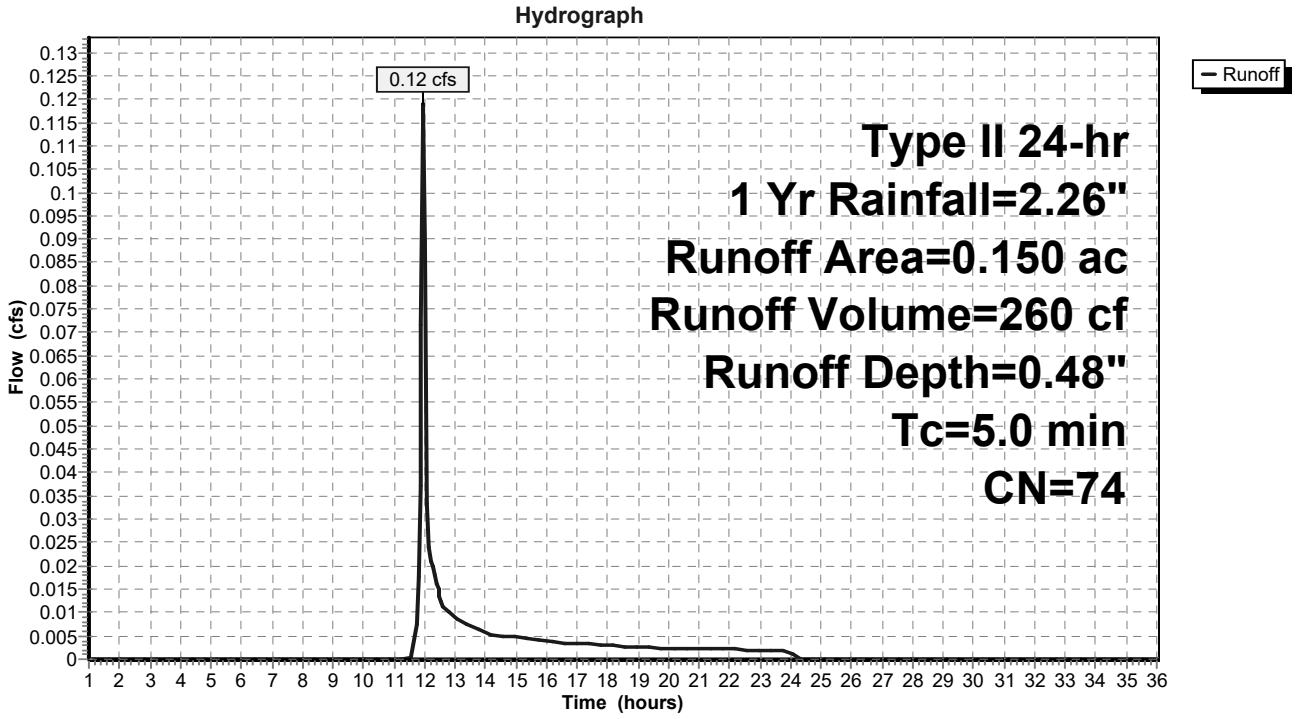
Runoff = 0.12 cfs @ 11.97 hrs, Volume= 260 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.26"

Area (ac)	CN	Description
0.150	74	>75% Grass cover, Good, HSG C
0.150		100.00% Pervious Area

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

Subcatchment 9S: Post Dev DA2 Release



Summary for Subcatchment 10S: Post Dev DA 3

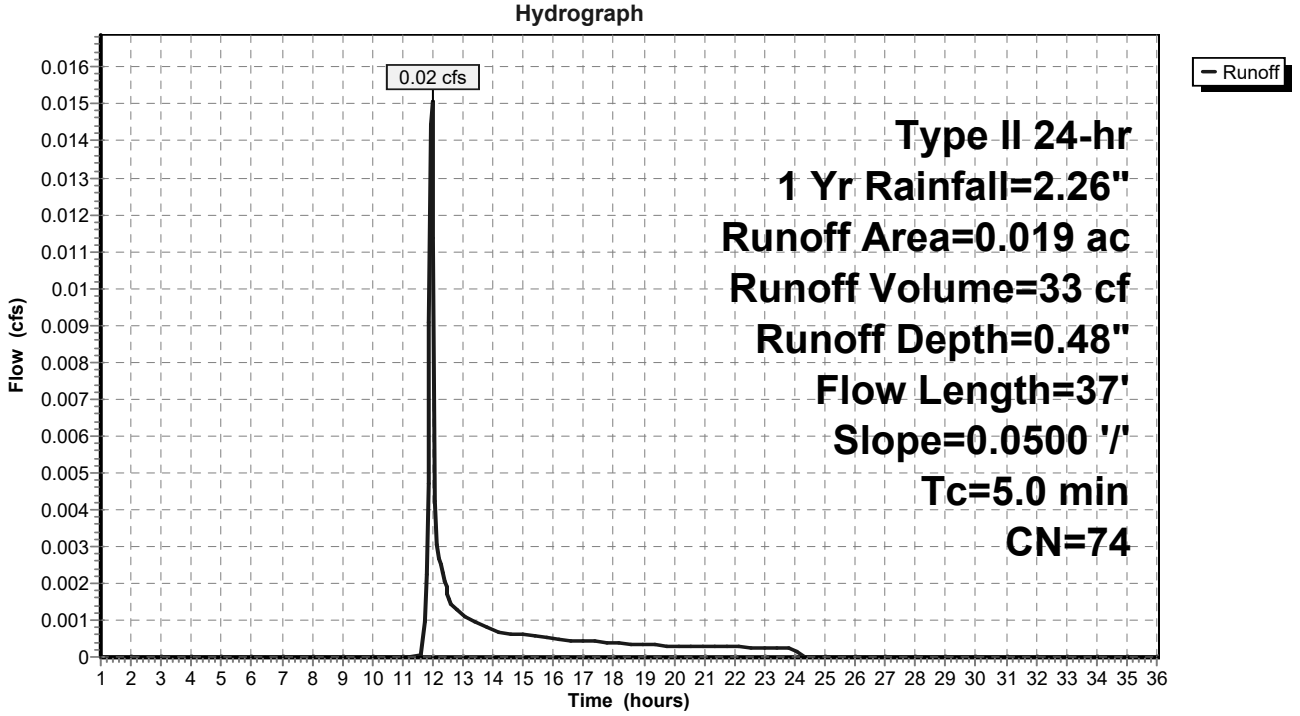
Runoff = 0.02 cfs @ 11.97 hrs, Volume= 33 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 Yr Rainfall=2.26"

Area (ac)	CN	Description
0.019	74	>75% Grass cover, Good, HSG C
0.019		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	37	0.0500	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.73"
1.7					**Direct Entry, To make 5 mins**
5.0	37	Total			

Subcatchment 10S: Post Dev DA 3

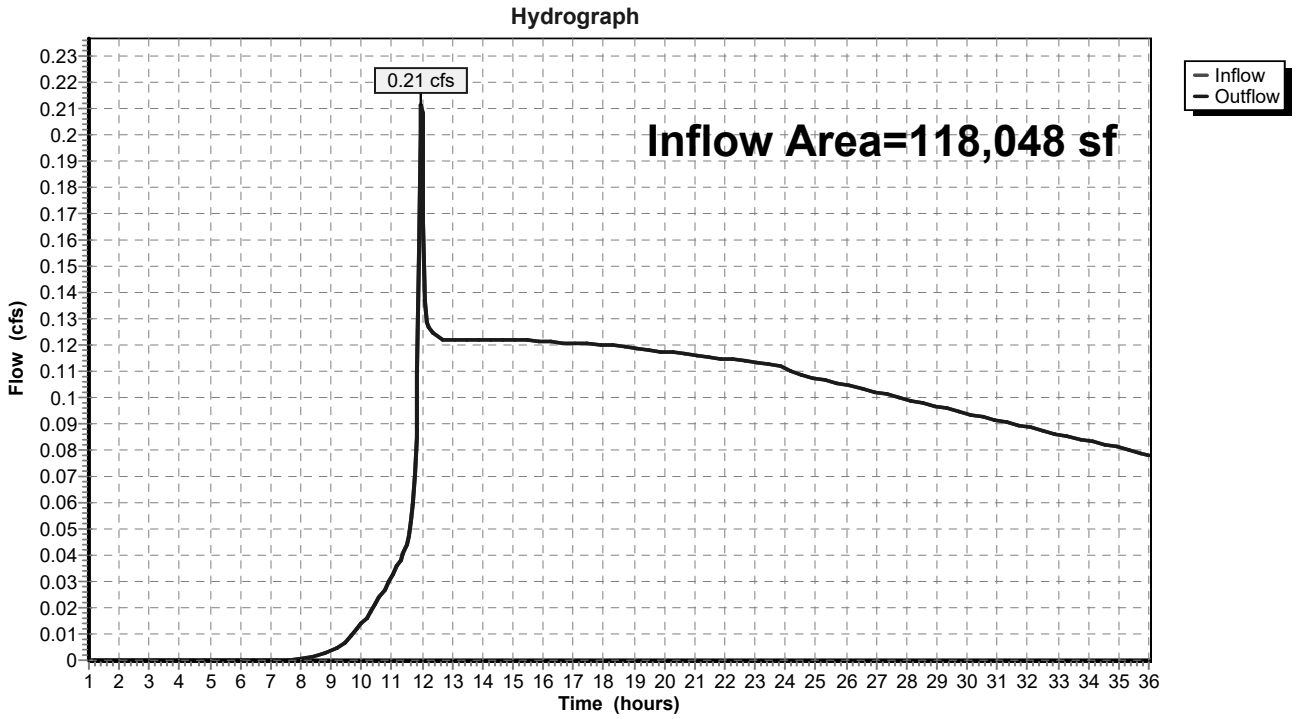


Summary for Reach 1R: Post Dev DA 2 Total

Inflow Area = 118,048 sf, 61.99% Impervious, Inflow Depth > 0.97" for 1 Yr event
Inflow = 0.21 cfs @ 11.98 hrs, Volume= 9,571 cf
Outflow = 0.21 cfs @ 11.98 hrs, Volume= 9,571 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Reach 1R: Post Dev DA 2 Total



Summary for Pond 1P: ADS Stormtech DA

Inflow Area = 111,514 sf, 65.63% Impervious, Inflow Depth = 1.32" for 1 Yr event
Inflow = 6.00 cfs @ 11.96 hrs, Volume= 12,255 cf
Outflow = 0.12 cfs @ 15.98 hrs, Volume= 9,310 cf, Atten= 98%, Lag= 241.4 min
Primary = 0.12 cfs @ 15.98 hrs, Volume= 9,310 cf

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,086.47' @ 15.98 hrs Surf.Area= 4,717 sf Storage= 8,102 cf

Plug-Flow detention time= 646.5 min calculated for 9,310 cf (76% of inflow)
Center-of-Mass det. time= 554.9 min (1,372.0 - 817.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,084.00'	6,599 cf	**51.42'W x 91.74'L x 5.50'H Field A** 25,943 cf Overall - 9,445 cf Embedded = 16,499 cf x 40.0% Voids
#2A	2,084.75'	9,445 cf	**ADS_StormTech MC-3500 d +Cap**x 84 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 7 Rows of 12 Chambers Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf
		16,044 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,084.00'	**15.0" Round Outfall Pipe** L= 60.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 2,084.00' / 2,083.50' S= 0.0083 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	2,084.00'	**1.7" Vert. 1 Year Storm** C= 0.600
#3	Device 1	2,087.75'	**12.0" Horiz. 10 Year Riser** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.12 cfs @ 15.98 hrs HW=2,086.47' (Free Discharge)
└─**1=Outfall Pipe** (Passes 0.12 cfs of 7.08 cfs potential flow)
  ├─**2=1 Year Storm** (Orifice Controls 0.12 cfs @ 7.46 fps)
  └─**3=10 Year Riser** (Controls 0.00 cfs)

Pond 1P: ADS Stormtech DA - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-3500 d +Cap (ADS StormTech®MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

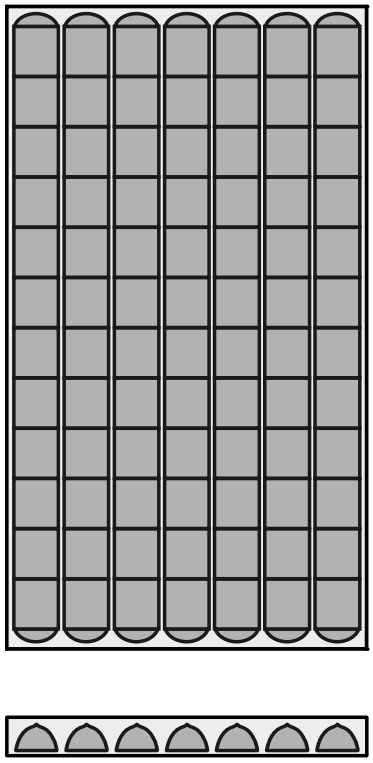
12 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 89.74' Row Length +12.0" End Stone x 2 = 91.74' Base Length
7 Rows x 77.0" Wide + 9.0" Spacing x 6 + 12.0" Side Stone x 2 = 51.42' Base Width
9.0" Base + 45.0" Chamber Height + 12.0" Cover = 5.50' Field Height

84 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 7 Rows = 9,444.6 cf Chamber Storage

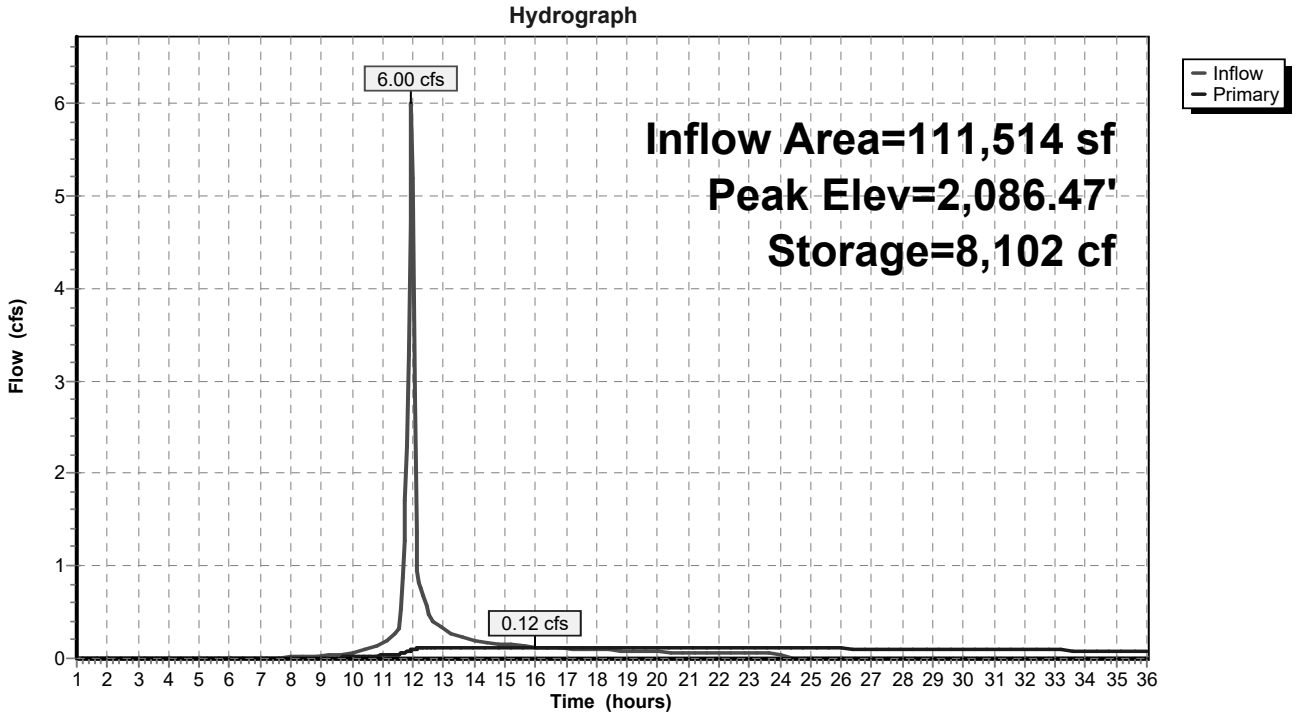
25,943.3 cf Field - 9,444.6 cf Chambers = 16,498.7 cf Stone x 40.0% Voids = 6,599.5 cf Stone Storage

Chamber Storage + Stone Storage = 16,044.1 cf = 0.368 af
Overall Storage Efficiency = 61.8%
Overall System Size = 91.74' x 51.42' x 5.50'

84 Chambers
960.9 cy Field
611.1 cy Stone



Pond 1P: ADS Stormtech DA



Summary for Subcatchment 1S: DA1 Pre- Dev

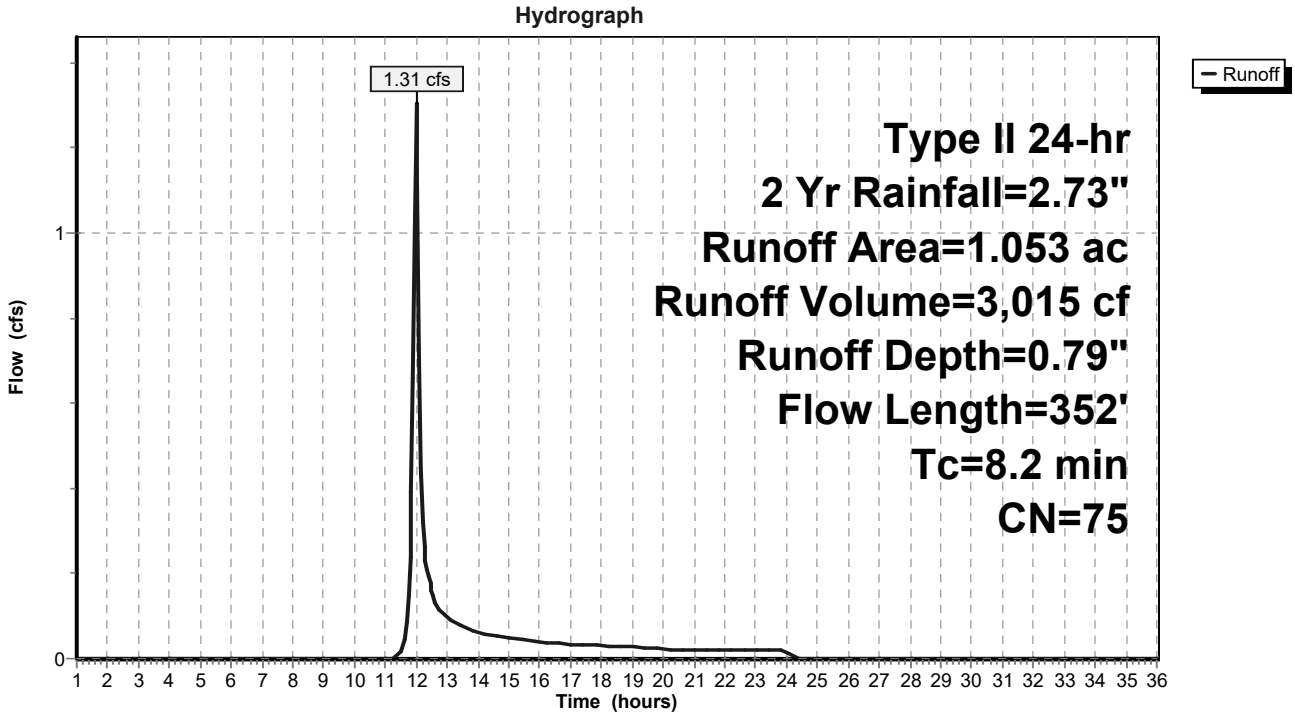
Runoff = 1.31 cfs @ 12.01 hrs, Volume= 3,015 cf, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Yr Rainfall=2.73"

Area (ac)	CN	Description
1.014	74	>75% Grass cover, Good, HSG C
0.039	98	Paved parking, HSG C
1.053	75	Weighted Average
1.014		96.30% Pervious Area
0.039		3.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	100	0.0800	0.27		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.73"
2.1	252	0.0790	1.97		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.2	352	Total			

Subcatchment 1S: DA1 Pre- Dev



Summary for Subcatchment 2S: DA2 Pre-Dev

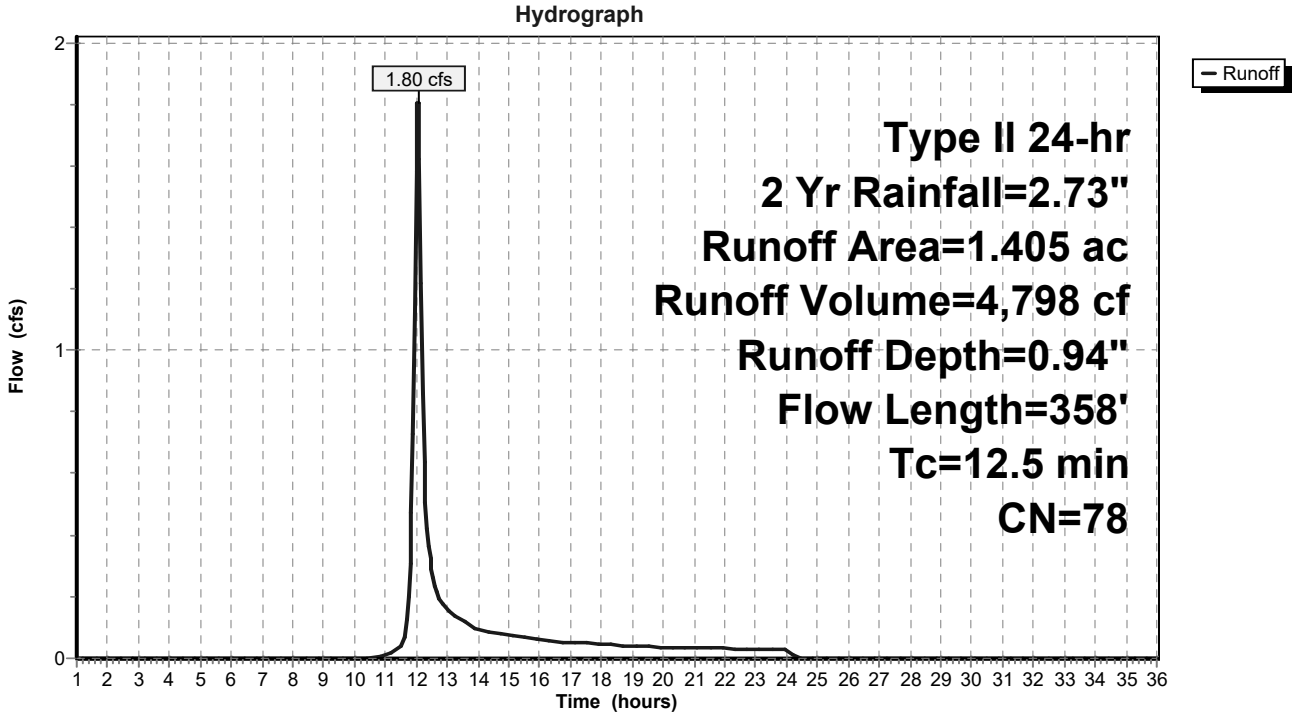
Runoff = 1.80 cfs @ 12.05 hrs, Volume= 4,798 cf, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Yr Rainfall=2.73"

Area (ac)	CN	Description
0.977	74	>75% Grass cover, Good, HSG C
0.240	98	Paved parking, HSG C
0.188	70	Woods, Good, HSG C
1.405	78	Weighted Average
1.165		82.92% Pervious Area
0.240		17.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0200	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.73"
1.9	258	0.1100	2.32		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.5	358	Total			

Subcatchment 2S: DA2 Pre-Dev



Summary for Subcatchment 3S: DA3 Pre-Dev

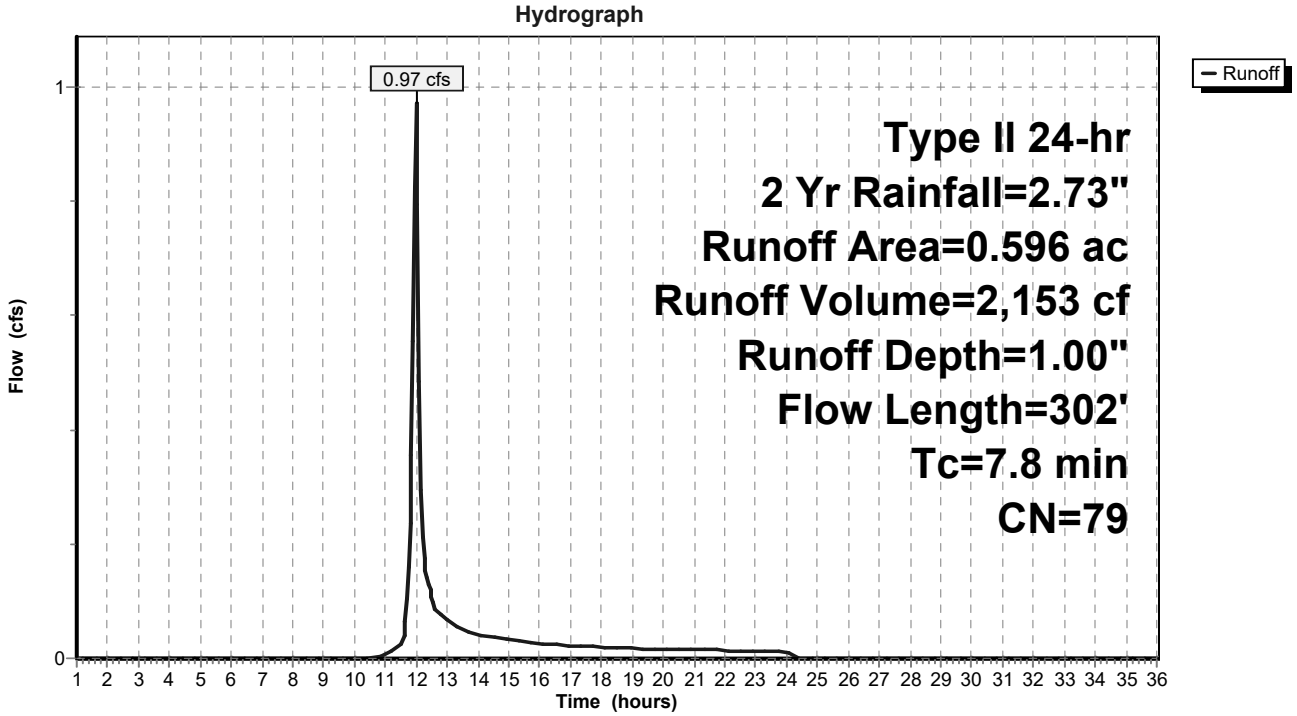
Runoff = 0.97 cfs @ 12.00 hrs, Volume= 2,153 cf, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Yr Rainfall=2.73"

Area (ac)	CN	Description
0.465	74	>75% Grass cover, Good, HSG C
0.121	98	Paved parking, HSG C
0.010	70	Woods, Good, HSG C
0.596	79	Weighted Average
0.475		79.70% Pervious Area
0.121		20.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	100	0.1000	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.73"
2.2	202	0.0490	1.55		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.8	302	Total			

Subcatchment 3S: DA3 Pre-Dev



Summary for Subcatchment 4S: DA1 Forested

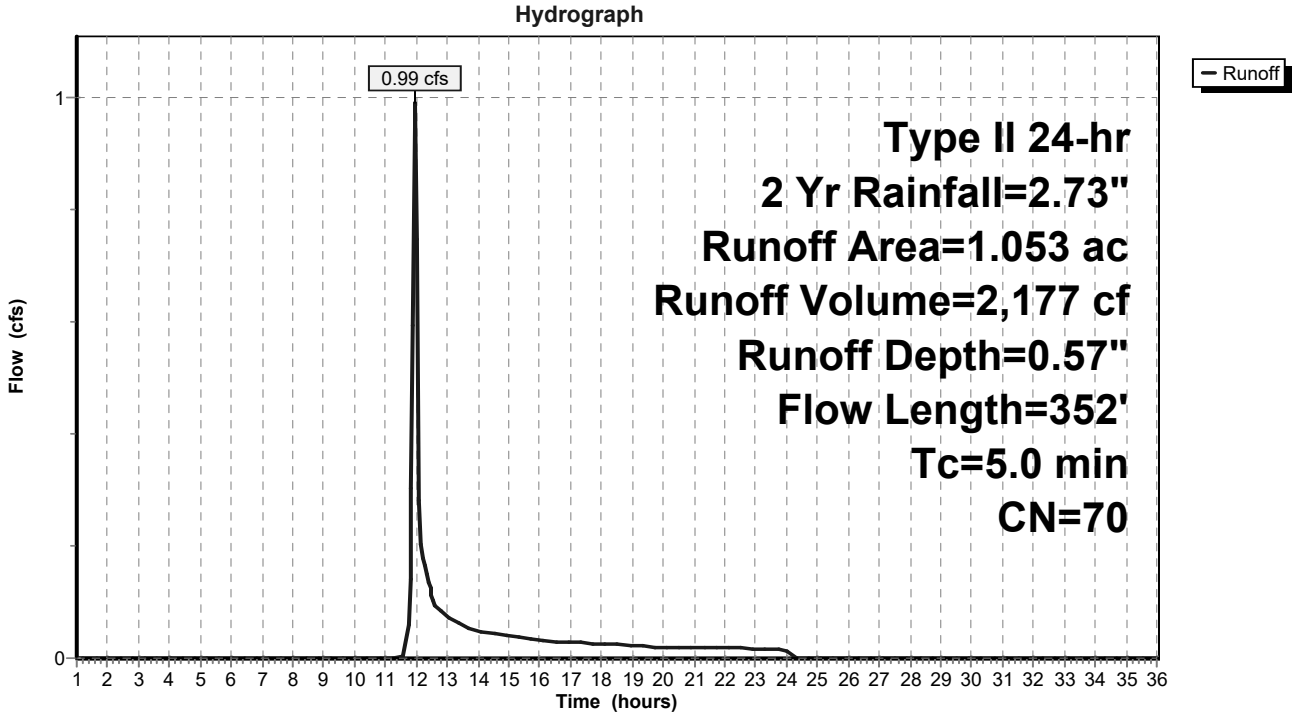
Runoff = 0.99 cfs @ 11.97 hrs, Volume= 2,177 cf, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Yr Rainfall=2.73"

Area (ac)	CN	Description
1.014	70	Woods, Good, HSG C
0.039	70	Woods, Good, HSG C
1.053	70	Weighted Average
1.053		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	352		1.17		**Direct Entry,**

Subcatchment 4S: DA1 Forested



Summary for Subcatchment 5S: DA2 Forested

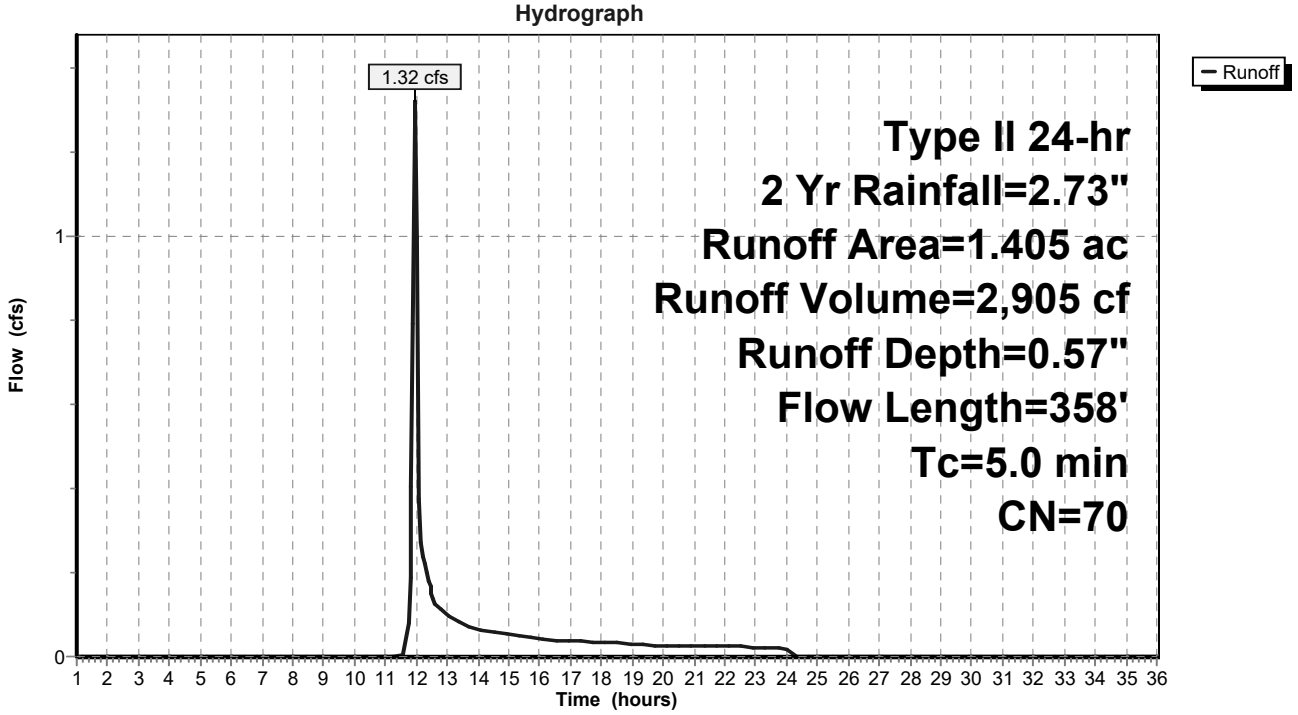
Runoff = 1.32 cfs @ 11.97 hrs, Volume= 2,905 cf, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Yr Rainfall=2.73"

Area (ac)	CN	Description
0.977	70	Woods, Good, HSG C
0.240	70	Woods, Good, HSG C
0.188	70	Woods, Good, HSG C
1.405	70	Weighted Average
1.405		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	358		1.19		**Direct Entry,**

Subcatchment 5S: DA2 Forested



Summary for Subcatchment 6S: DA3 Forested

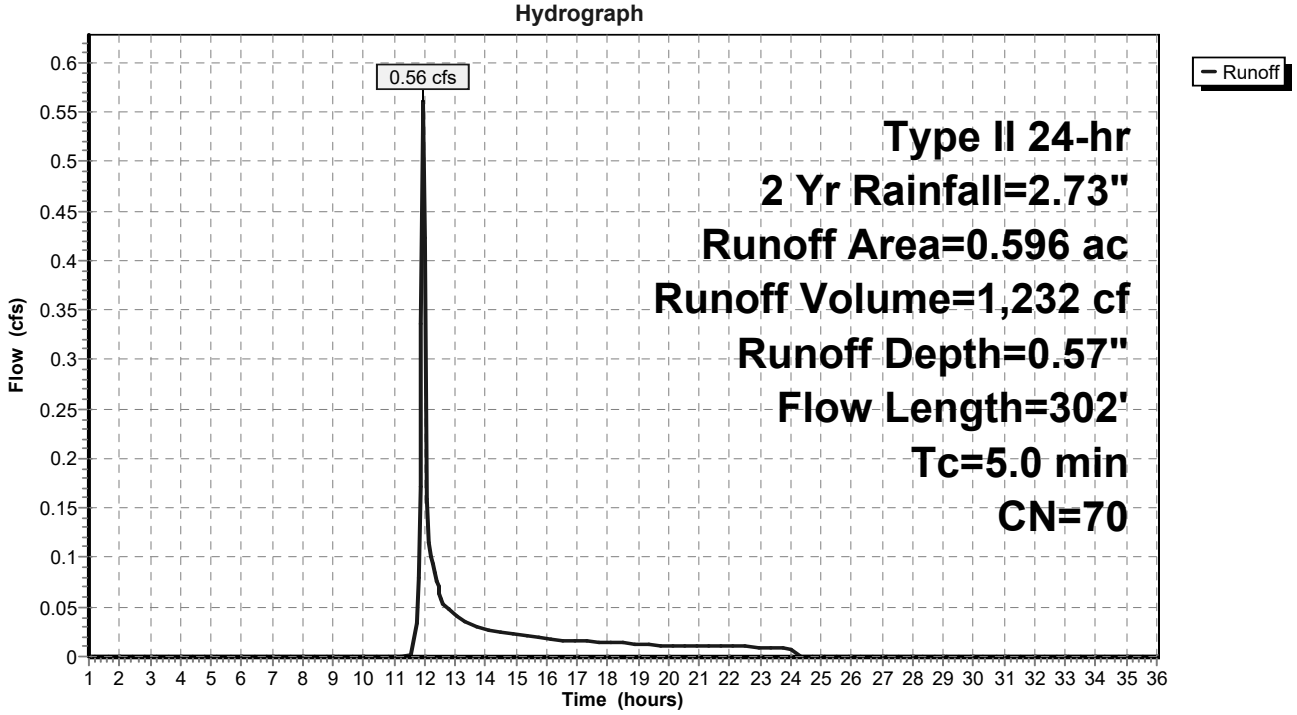
Runoff = 0.56 cfs @ 11.97 hrs, Volume= 1,232 cf, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Yr Rainfall=2.73"

Area (ac)	CN	Description
0.465	70	Woods, Good, HSG C
0.121	70	Woods, Good, HSG C
0.010	70	Woods, Good, HSG C
0.596	70	Weighted Average
0.596		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	302		1.01		**Direct Entry,**

Subcatchment 6S: DA3 Forested



Summary for Subcatchment 7S: Post Dev DA 1

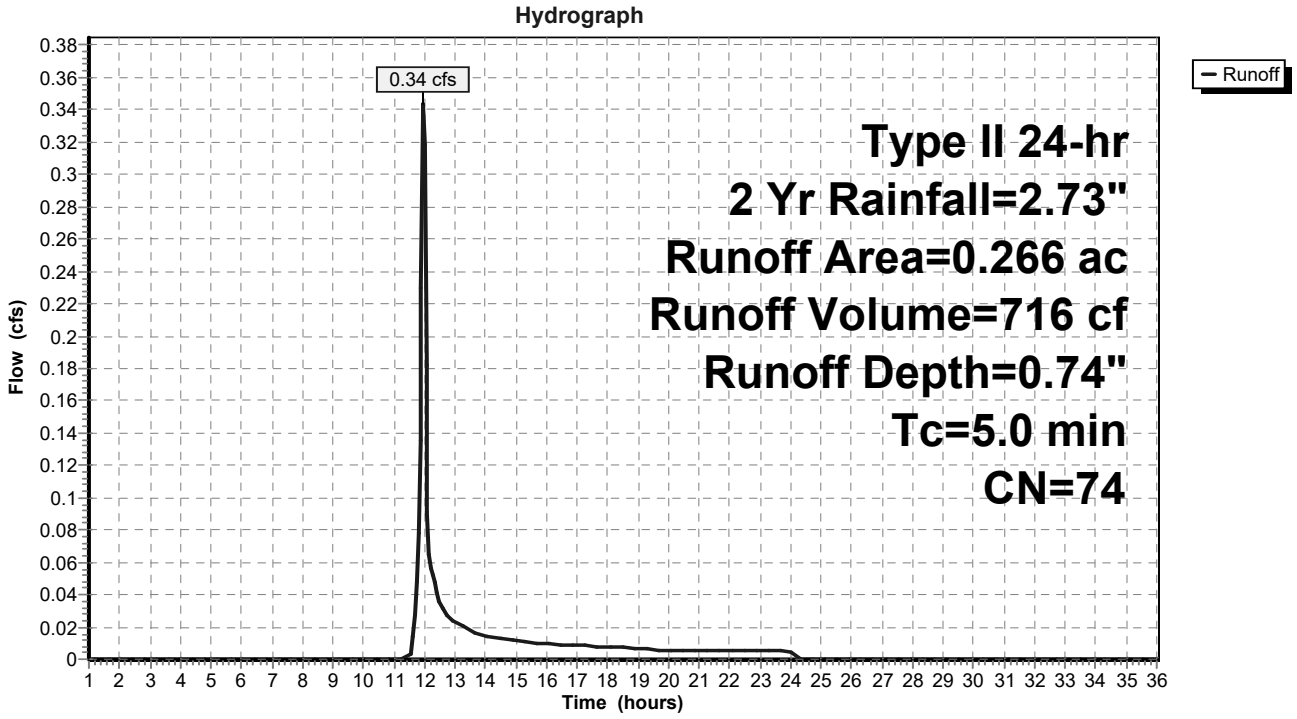
Runoff = 0.34 cfs @ 11.97 hrs, Volume= 716 cf, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Yr Rainfall=2.73"

Area (ac)	CN	Description
0.266	74	>75% Grass cover, Good, HSG C
0.266		100.00% Pervious Area

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

Subcatchment 7S: Post Dev DA 1



Summary for Subcatchment 8S: Post Dev DA 2 Catch

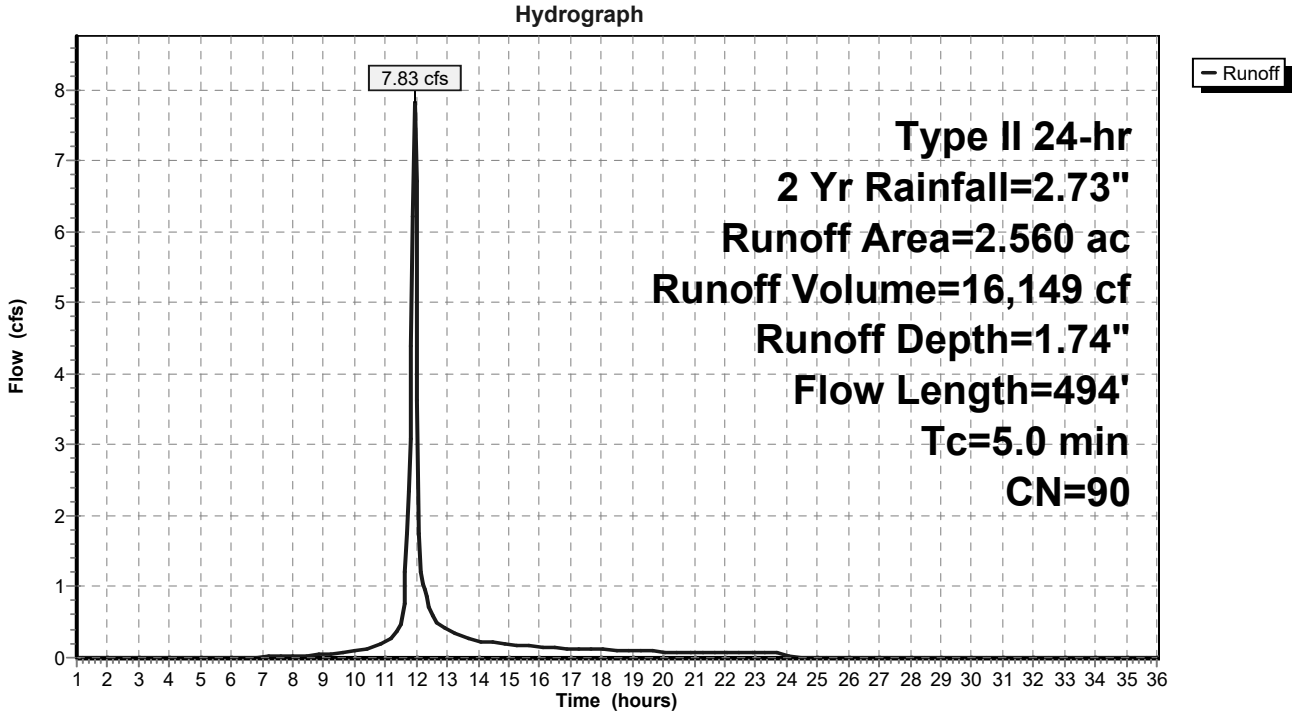
Runoff = 7.83 cfs @ 11.95 hrs, Volume= 16,149 cf, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Yr Rainfall=2.73"

Area (ac)	CN	Description
1.680	98	Paved parking, HSG C
0.880	74	>75% Grass cover, Good, HSG C
2.560	90	Weighted Average
0.880		34.38% Pervious Area
1.680		65.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	274	0.0320	3.63		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	220	0.0600	8.38	10.29	**Pipe Channel, CMP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.020 Corrugated PE, corrugated interior
3.3					**Direct Entry, To make it 5**
5.0	494	Total			

Subcatchment 8S: Post Dev DA 2 Catch



Summary for Subcatchment 9S: Post Dev DA2 Release

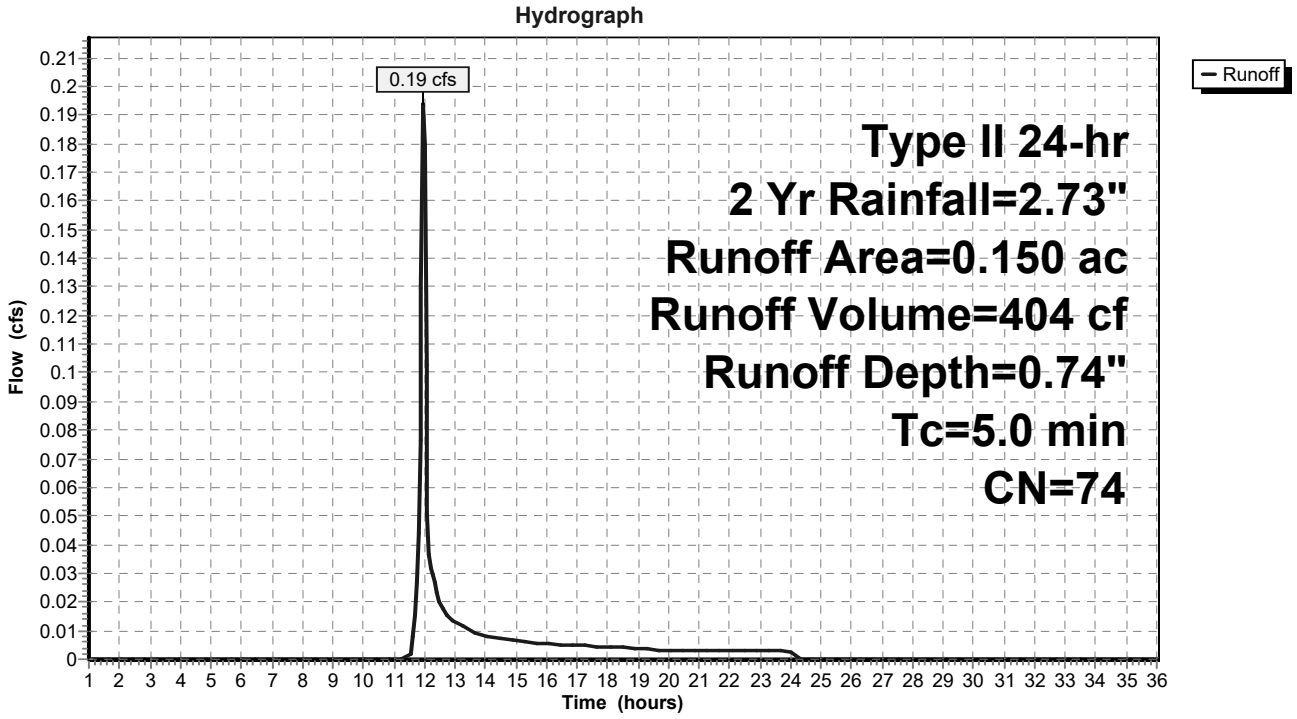
Runoff = 0.19 cfs @ 11.97 hrs, Volume= 404 cf, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Yr Rainfall=2.73"

Area (ac)	CN	Description
0.150	74	>75% Grass cover, Good, HSG C
0.150		100.00% Pervious Area

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

Subcatchment 9S: Post Dev DA2 Release



Summary for Subcatchment 10S: Post Dev DA 3

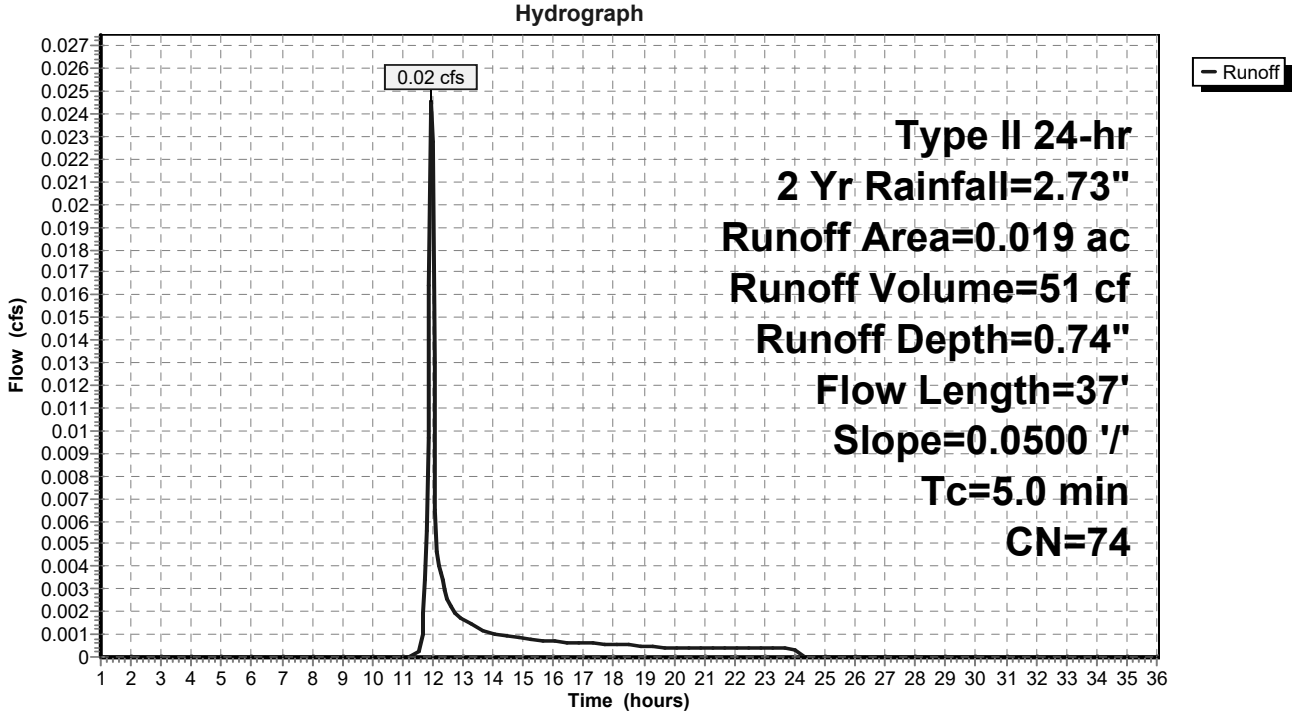
Runoff = 0.02 cfs @ 11.97 hrs, Volume= 51 cf, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 Yr Rainfall=2.73"

Area (ac)	CN	Description
0.019	74	>75% Grass cover, Good, HSG C
0.019		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	37	0.0500	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.73"
1.7					**Direct Entry, To make 5 mins**
5.0	37	Total			

Subcatchment 10S: Post Dev DA 3

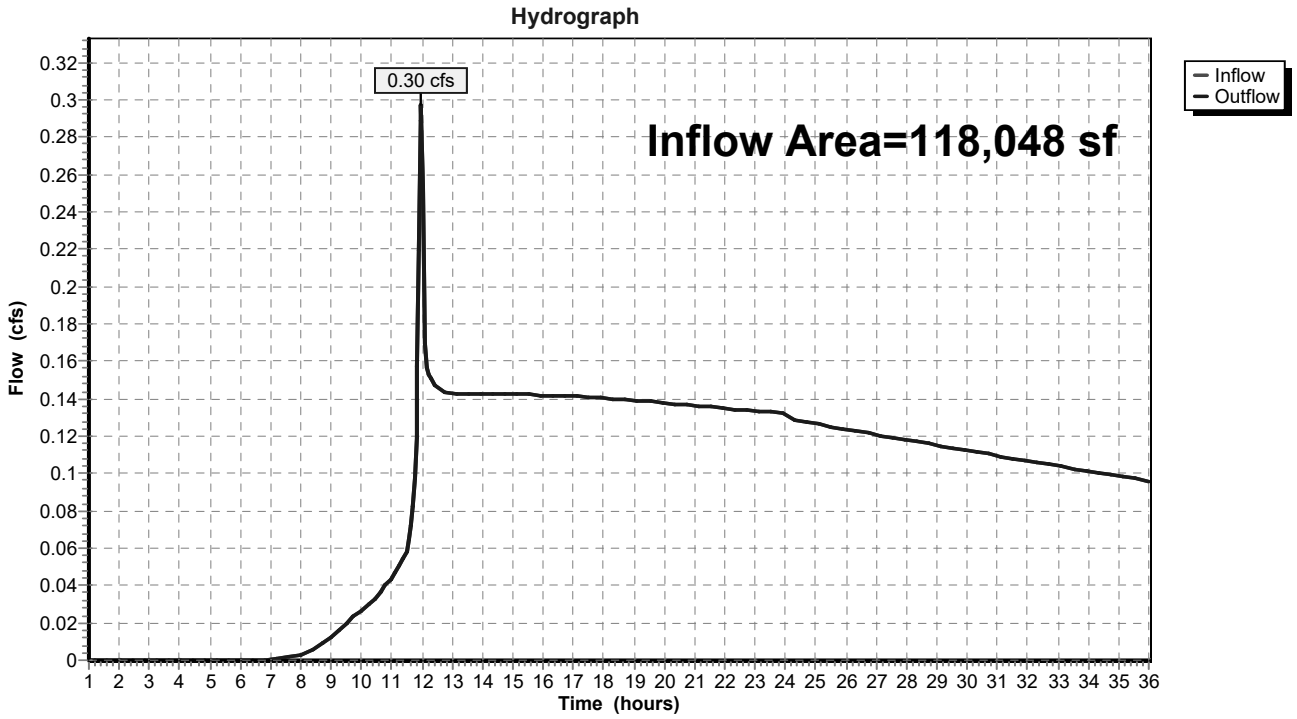


Summary for Reach 1R: Post Dev DA 2 Total

Inflow Area = 118,048 sf, 61.99% Impervious, Inflow Depth > 1.17" for 2 Yr event
Inflow = 0.30 cfs @ 11.97 hrs, Volume= 11,484 cf
Outflow = 0.30 cfs @ 11.97 hrs, Volume= 11,484 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Reach 1R: Post Dev DA 2 Total



Summary for Pond 1P: ADS Stormtech DA

Inflow Area = 111,514 sf, 65.63% Impervious, Inflow Depth = 1.74" for 2 Yr event
Inflow = 7.83 cfs @ 11.95 hrs, Volume= 16,149 cf
Outflow = 0.14 cfs @ 16.54 hrs, Volume= 11,081 cf, Atten= 98%, Lag= 275.3 min
Primary = 0.14 cfs @ 16.54 hrs, Volume= 11,081 cf

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,087.31' @ 16.54 hrs Surf.Area= 4,717 sf Storage= 11,032 cf

Plug-Flow detention time= 662.8 min calculated for 11,081 cf (69% of inflow)
Center-of-Mass det. time= 561.8 min (1,370.9 - 809.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,084.00'	6,599 cf	**51.42'W x 91.74'L x 5.50'H Field A** 25,943 cf Overall - 9,445 cf Embedded = 16,499 cf x 40.0% Voids
#2A	2,084.75'	9,445 cf	**ADS_StormTech MC-3500 d +Cap**x 84 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 7 Rows of 12 Chambers Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf
		16,044 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,084.00'	**15.0" Round Outfall Pipe** L= 60.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 2,084.00' / 2,083.50' S= 0.0083 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	2,084.00'	**1.7" Vert. 1 Year Storm** C= 0.600
#3	Device 1	2,087.75'	**12.0" Horiz. 10 Year Riser** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.14 cfs @ 16.54 hrs HW=2,087.31' (Free Discharge)
└─**1=Outfall Pipe** (Passes 0.14 cfs of 8.55 cfs potential flow)
  ├─**2=1 Year Storm** (Orifice Controls 0.14 cfs @ 8.67 fps)
  └─**3=10 Year Riser** (Controls 0.00 cfs)

Pond 1P: ADS Stormtech DA - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-3500 d +Cap (ADS StormTech®MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

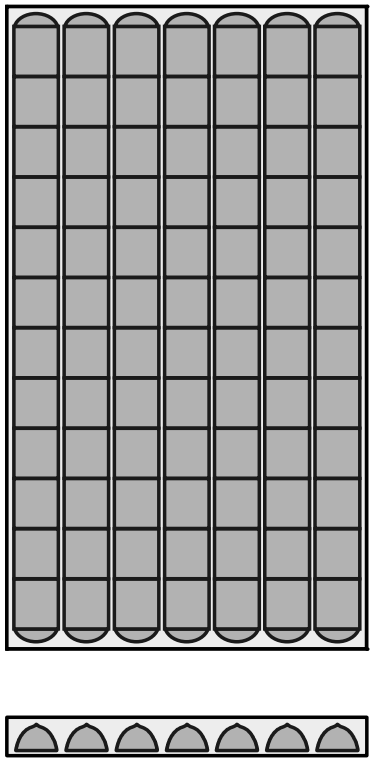
12 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 89.74' Row Length +12.0" End Stone x 2 = 91.74' Base Length
7 Rows x 77.0" Wide + 9.0" Spacing x 6 + 12.0" Side Stone x 2 = 51.42' Base Width
9.0" Base + 45.0" Chamber Height + 12.0" Cover = 5.50' Field Height

84 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 7 Rows = 9,444.6 cf Chamber Storage

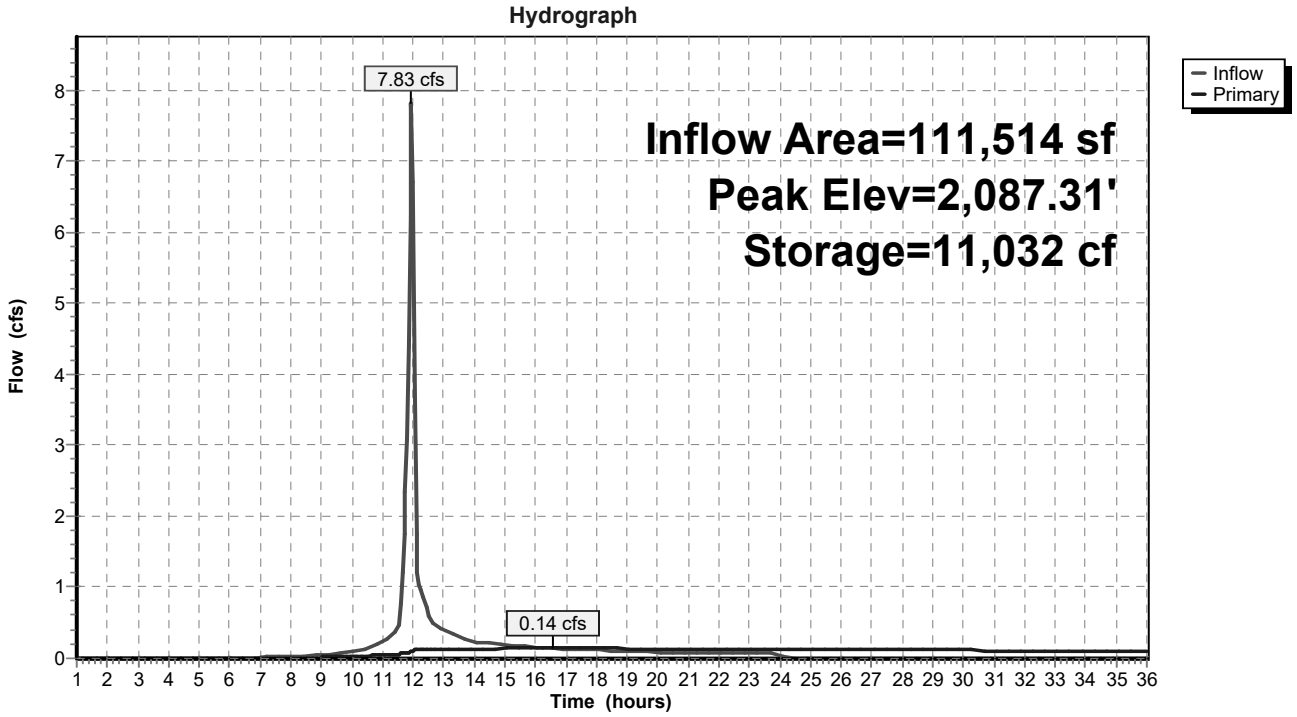
25,943.3 cf Field - 9,444.6 cf Chambers = 16,498.7 cf Stone x 40.0% Voids = 6,599.5 cf Stone Storage

Chamber Storage + Stone Storage = 16,044.1 cf = 0.368 af
Overall Storage Efficiency = 61.8%
Overall System Size = 91.74' x 51.42' x 5.50'

84 Chambers
960.9 cy Field
611.1 cy Stone



Pond 1P: ADS Stormtech DA



Summary for Subcatchment 1S: DA1 Pre- Dev

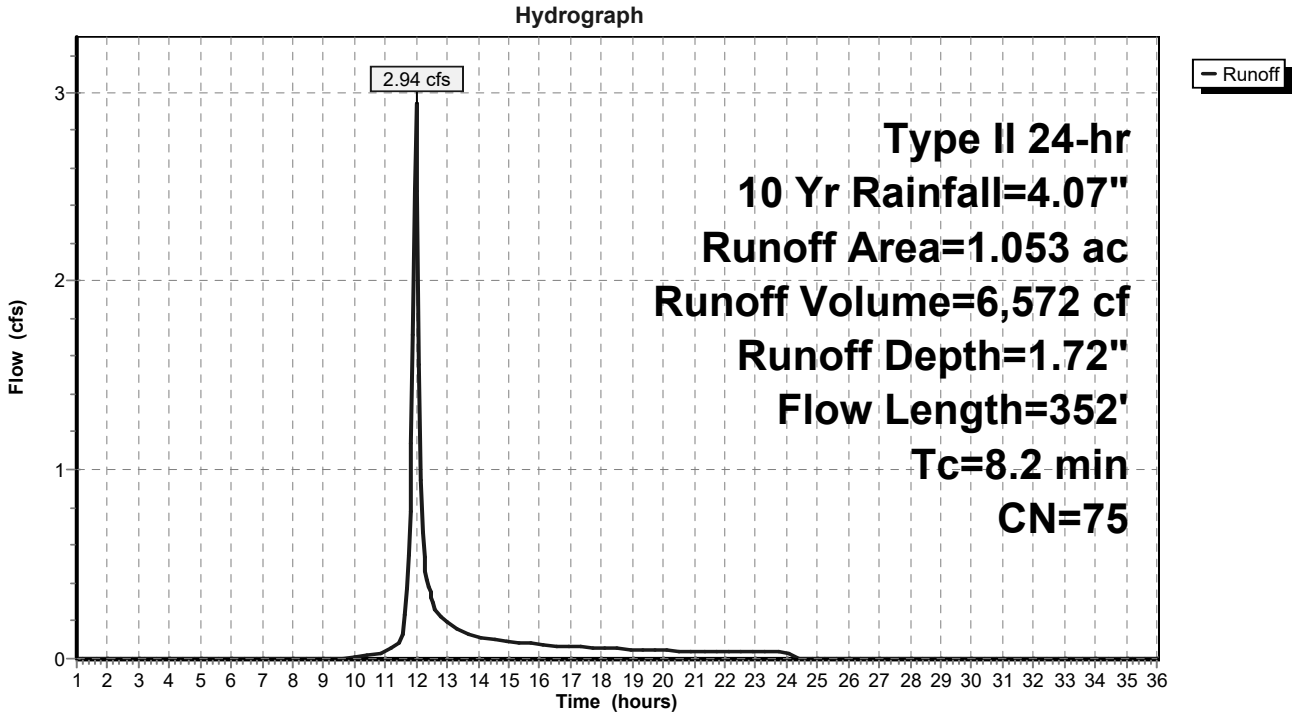
Runoff = 2.94 cfs @ 12.00 hrs, Volume= 6,572 cf, Depth= 1.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.07"

Area (ac)	CN	Description
1.014	74	>75% Grass cover, Good, HSG C
0.039	98	Paved parking, HSG C
1.053	75	Weighted Average
1.014		96.30% Pervious Area
0.039		3.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	100	0.0800	0.27		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.73"
2.1	252	0.0790	1.97		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
8.2	352	Total			

Subcatchment 1S: DA1 Pre- Dev



Summary for Subcatchment 2S: DA2 Pre-Dev

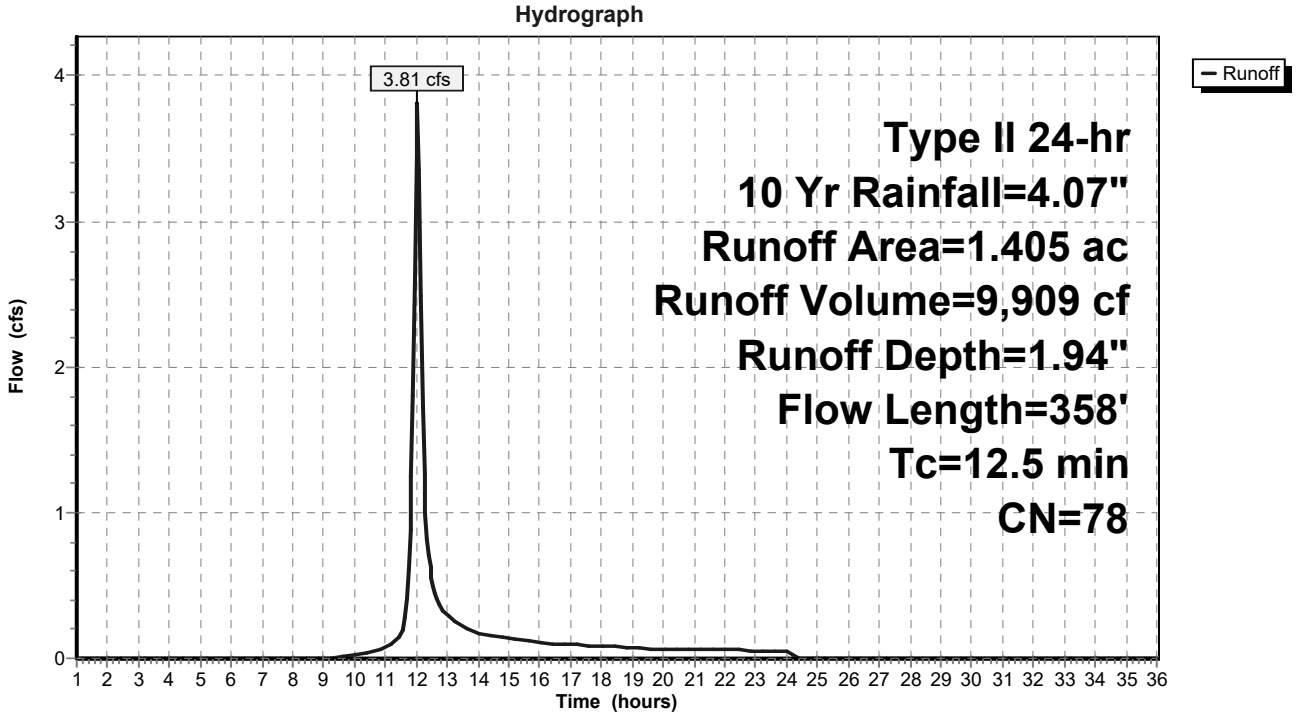
Runoff = 3.81 cfs @ 12.05 hrs, Volume= 9,909 cf, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.07"

Area (ac)	CN	Description
0.977	74	>75% Grass cover, Good, HSG C
0.240	98	Paved parking, HSG C
0.188	70	Woods, Good, HSG C
1.405	78	Weighted Average
1.165		82.92% Pervious Area
0.240		17.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.0200	0.16		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.73"
1.9	258	0.1100	2.32		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.5	358	Total			

Subcatchment 2S: DA2 Pre-Dev



Summary for Subcatchment 3S: DA3 Pre-Dev

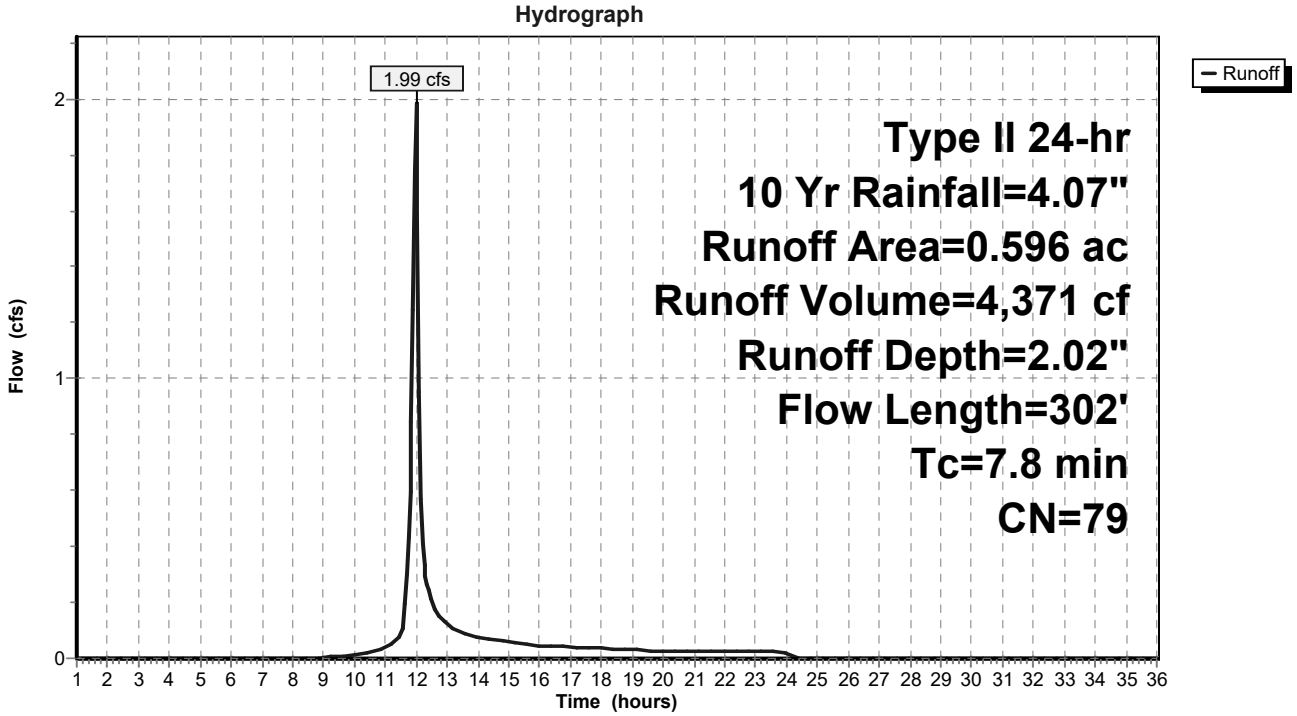
Runoff = 1.99 cfs @ 11.99 hrs, Volume= 4,371 cf, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.07"

Area (ac)	CN	Description
0.465	74	>75% Grass cover, Good, HSG C
0.121	98	Paved parking, HSG C
0.010	70	Woods, Good, HSG C
0.596	79	Weighted Average
0.475		79.70% Pervious Area
0.121		20.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	100	0.1000	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.73"
2.2	202	0.0490	1.55		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
7.8	302	Total			

Subcatchment 3S: DA3 Pre-Dev



Summary for Subcatchment 4S: DA1 Forested

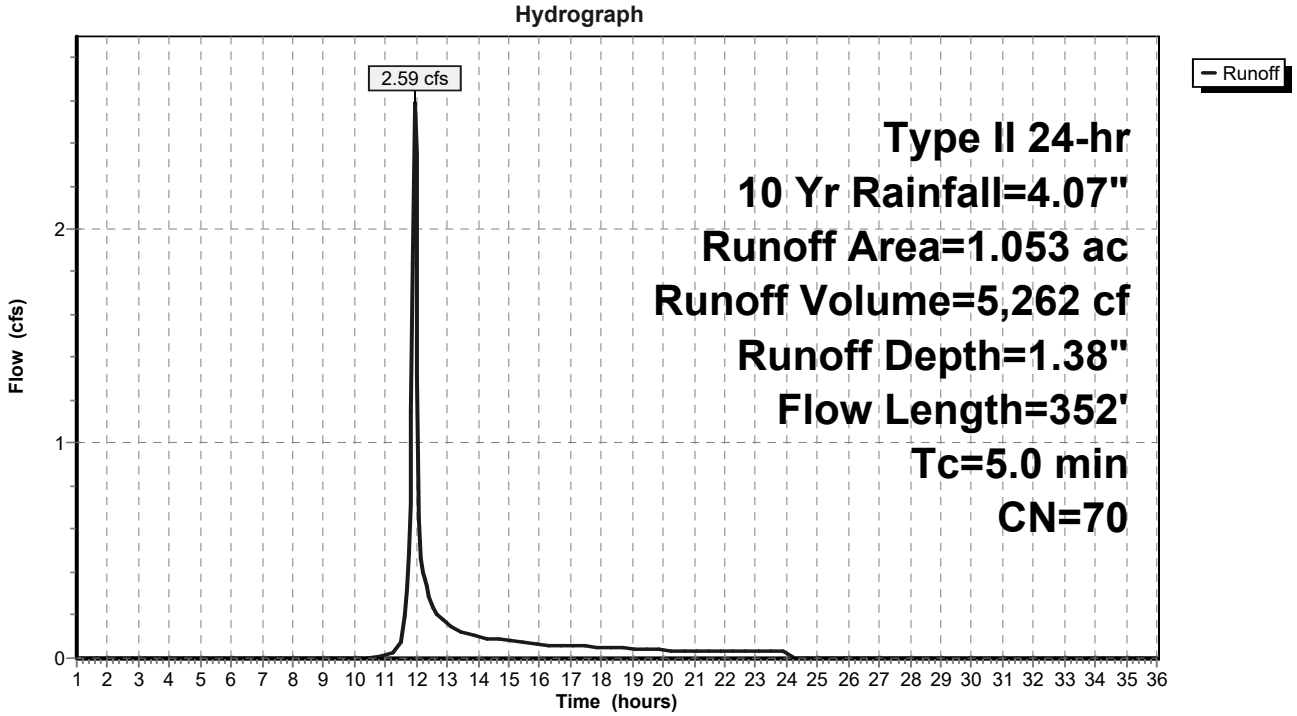
Runoff = 2.59 cfs @ 11.96 hrs, Volume= 5,262 cf, Depth= 1.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.07"

Area (ac)	CN	Description
1.014	70	Woods, Good, HSG C
0.039	70	Woods, Good, HSG C
1.053	70	Weighted Average
1.053		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	352		1.17		**Direct Entry,**

Subcatchment 4S: DA1 Forested



Summary for Subcatchment 5S: DA2 Forested

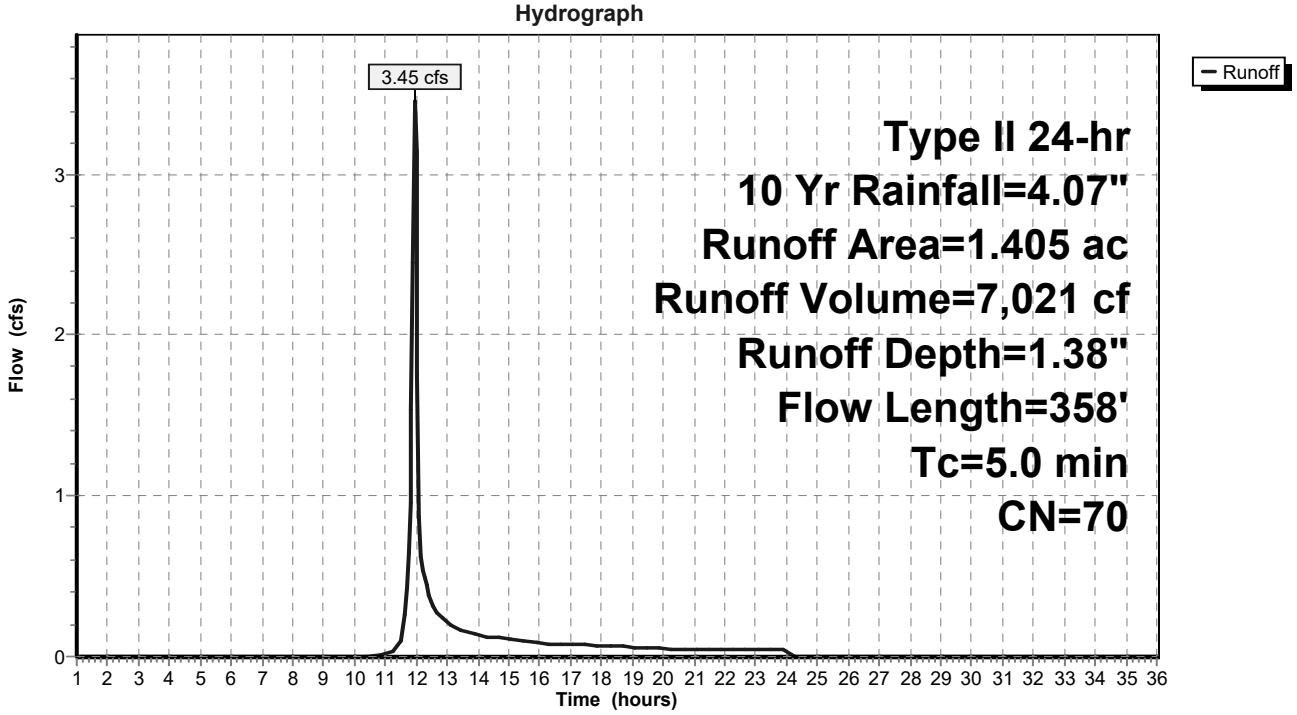
Runoff = 3.45 cfs @ 11.96 hrs, Volume= 7,021 cf, Depth= 1.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.07"

Area (ac)	CN	Description
0.977	70	Woods, Good, HSG C
0.240	70	Woods, Good, HSG C
0.188	70	Woods, Good, HSG C
1.405	70	Weighted Average
1.405		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	358		1.19		**Direct Entry,**

Subcatchment 5S: DA2 Forested



Summary for Subcatchment 6S: DA3 Forested

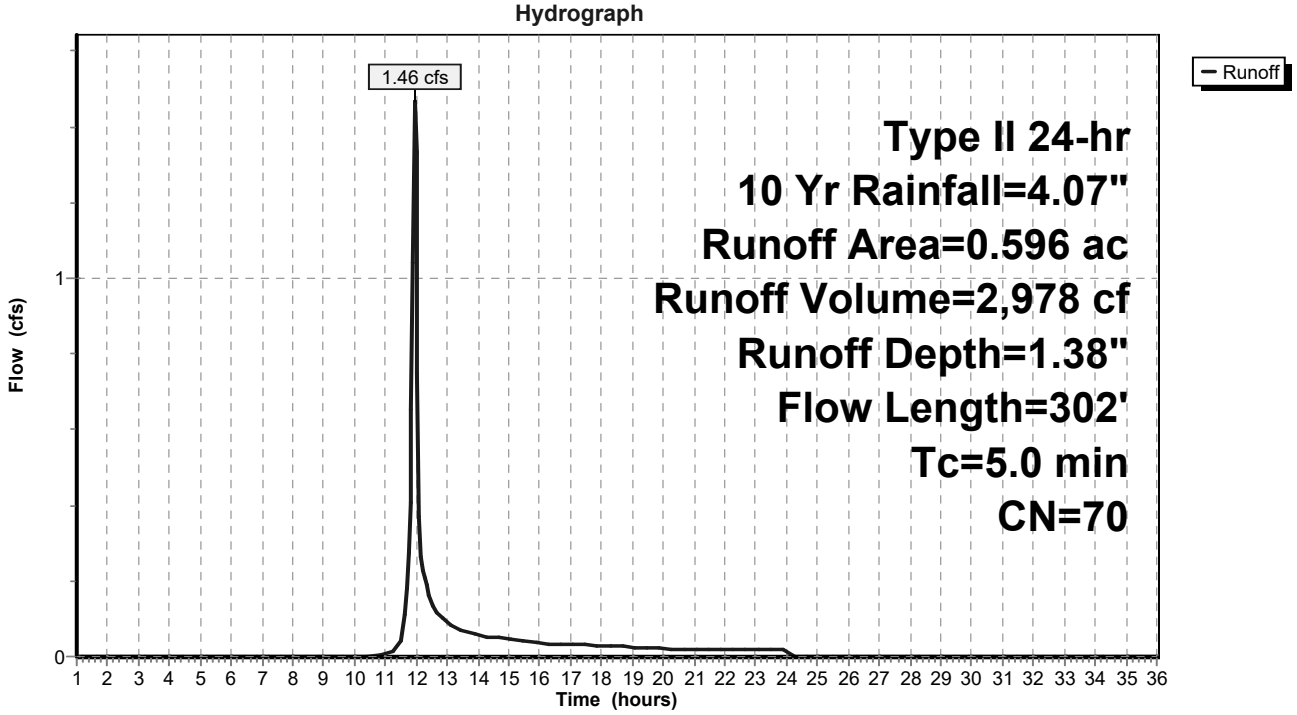
Runoff = 1.46 cfs @ 11.96 hrs, Volume= 2,978 cf, Depth= 1.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.07"

Area (ac)	CN	Description
0.465	70	Woods, Good, HSG C
0.121	70	Woods, Good, HSG C
0.010	70	Woods, Good, HSG C
0.596	70	Weighted Average
0.596		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	302		1.01		**Direct Entry,**

Subcatchment 6S: DA3 Forested



Summary for Subcatchment 7S: Post Dev DA 1

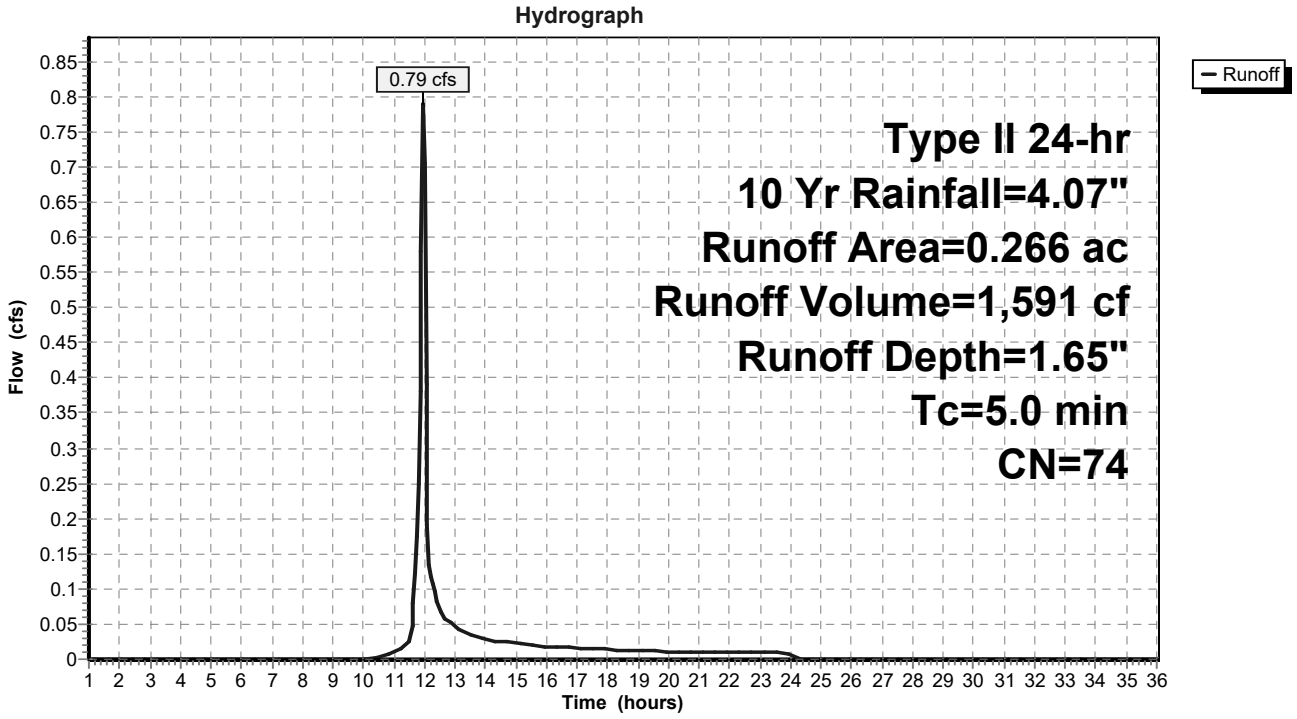
Runoff = 0.79 cfs @ 11.96 hrs, Volume= 1,591 cf, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.07"

Area (ac)	CN	Description
0.266	74	>75% Grass cover, Good, HSG C
0.266		100.00% Pervious Area

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

Subcatchment 7S: Post Dev DA 1



Summary for Subcatchment 8S: Post Dev DA 2 Catch

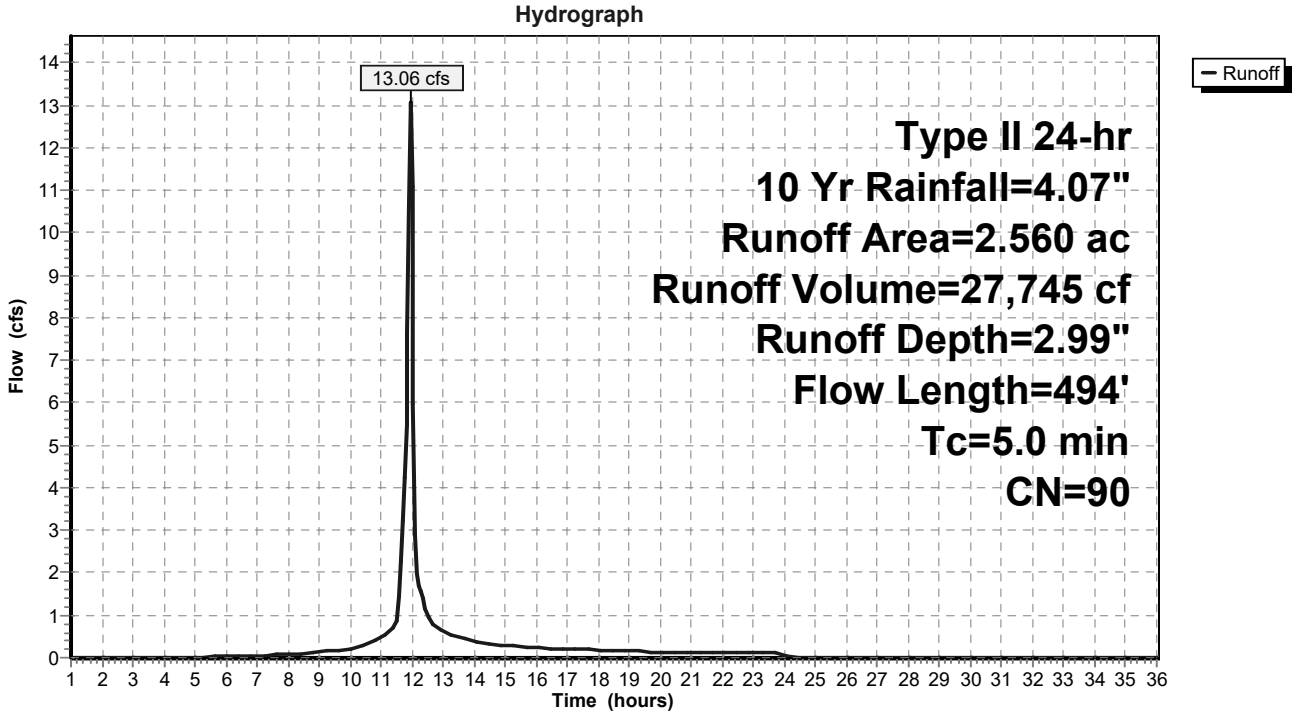
Runoff = 13.06 cfs @ 11.95 hrs, Volume= 27,745 cf, Depth= 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.07"

Area (ac)	CN	Description
1.680	98	Paved parking, HSG C
0.880	74	>75% Grass cover, Good, HSG C
2.560	90	Weighted Average
0.880		34.38% Pervious Area
1.680		65.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	274	0.0320	3.63		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	220	0.0600	8.38	10.29	**Pipe Channel, CMP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.020 Corrugated PE, corrugated interior
3.3					**Direct Entry, To make it 5**
5.0	494	Total			

Subcatchment 8S: Post Dev DA 2 Catch



Summary for Subcatchment 9S: Post Dev DA2 Release

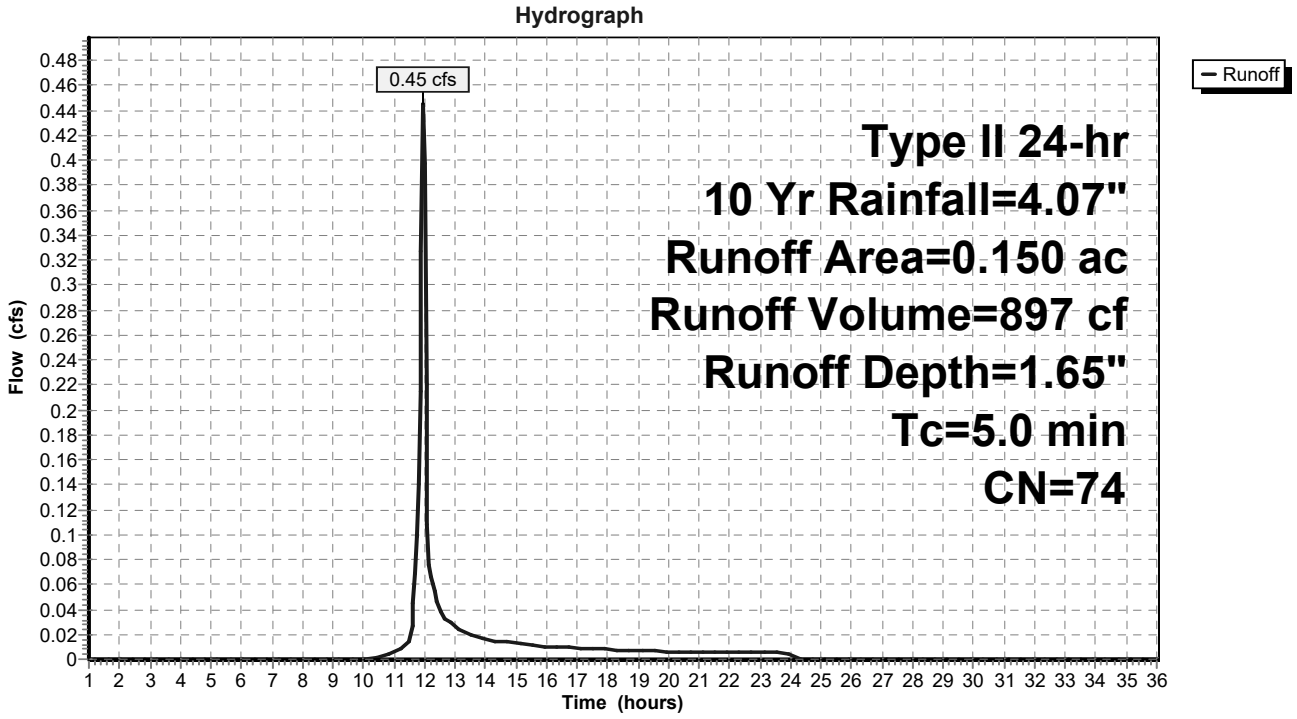
Runoff = 0.45 cfs @ 11.96 hrs, Volume= 897 cf, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.07"

Area (ac)	CN	Description
0.150	74	>75% Grass cover, Good, HSG C
0.150		100.00% Pervious Area

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

Subcatchment 9S: Post Dev DA2 Release



Summary for Subcatchment 10S: Post Dev DA 3

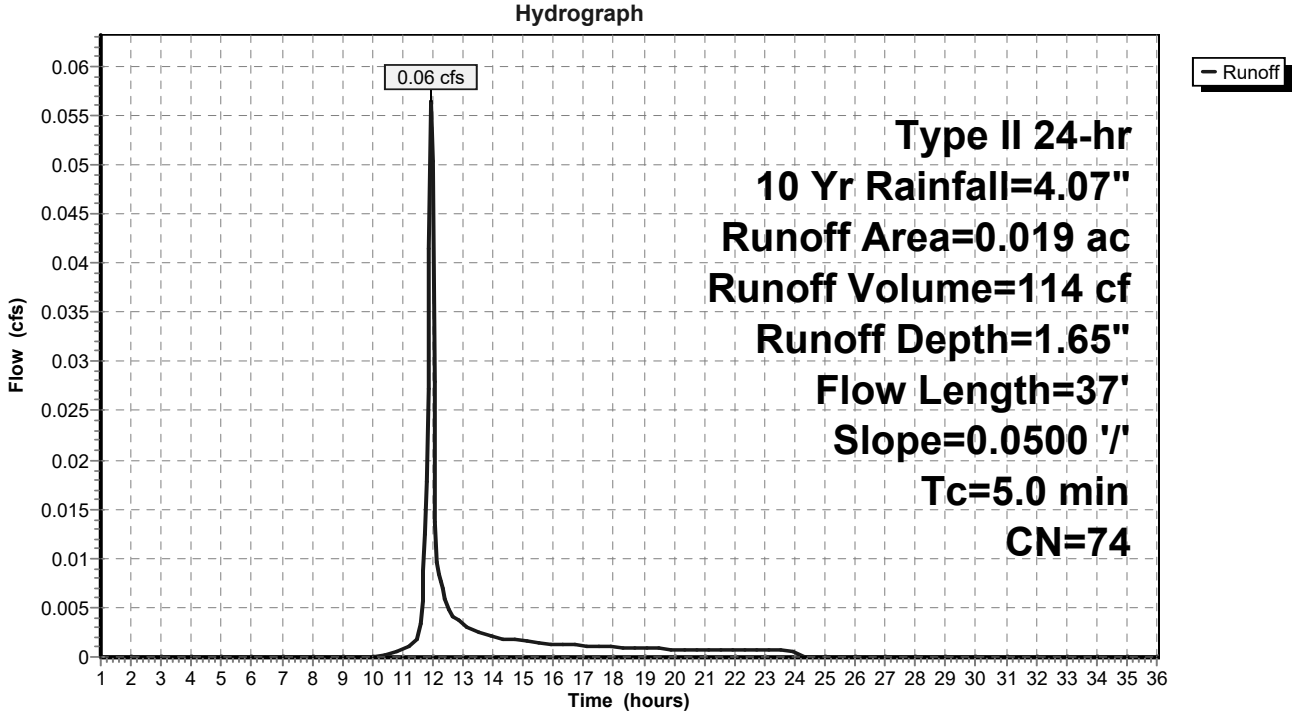
Runoff = 0.06 cfs @ 11.96 hrs, Volume= 114 cf, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 Yr Rainfall=4.07"

Area (ac)	CN	Description
0.019	74	>75% Grass cover, Good, HSG C
0.019		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	37	0.0500	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 2.73"
1.7					**Direct Entry, To make 5 mins**
5.0	37	Total			

Subcatchment 10S: Post Dev DA 3

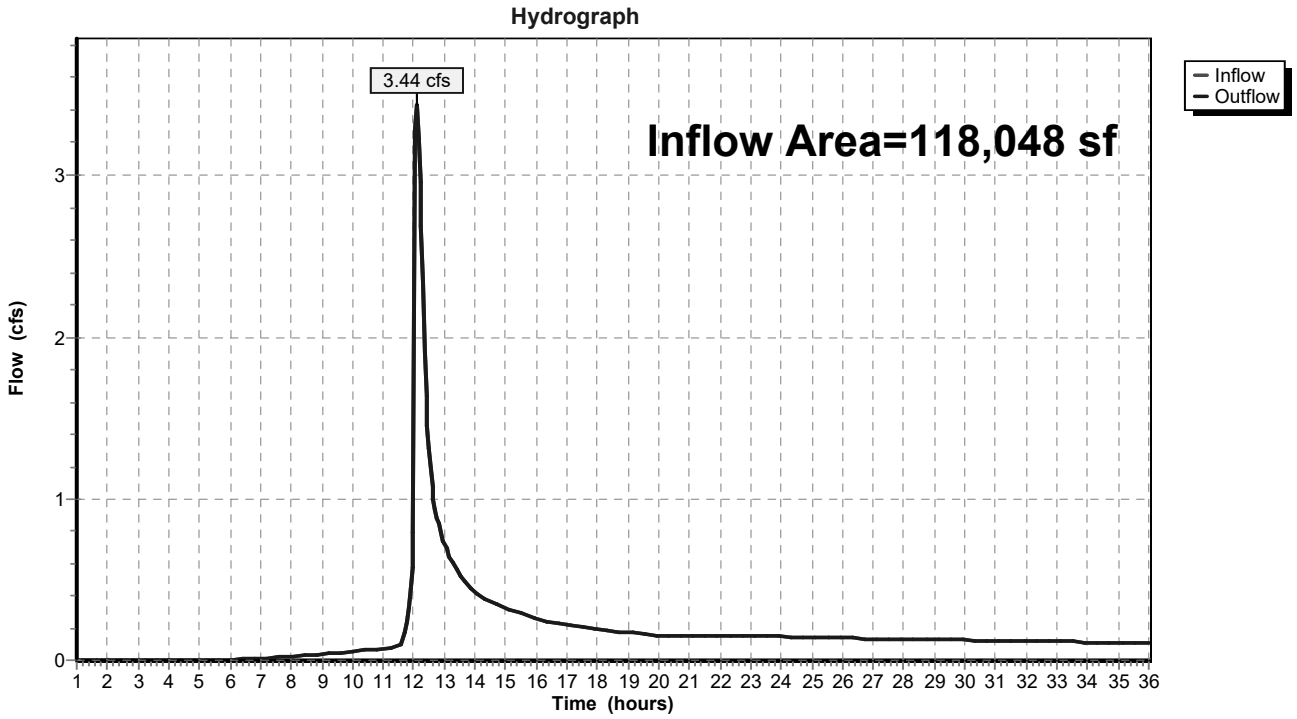


Summary for Reach 1R: Post Dev DA 2 Total

Inflow Area = 118,048 sf, 61.99% Impervious, Inflow Depth > 2.24" for 10 Yr event
Inflow = 3.44 cfs @ 12.10 hrs, Volume= 21,991 cf
Outflow = 3.44 cfs @ 12.10 hrs, Volume= 21,991 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs

Reach 1R: Post Dev DA 2 Total



Summary for Pond 1P: ADS Stormtech DA

Inflow Area = 111,514 sf, 65.63% Impervious, Inflow Depth = 2.99" for 10 Yr event
Inflow = 13.06 cfs @ 11.95 hrs, Volume= 27,745 cf
Outflow = 3.33 cfs @ 12.10 hrs, Volume= 21,094 cf, Atten= 75%, Lag= 9.1 min
Primary = 3.33 cfs @ 12.10 hrs, Volume= 21,094 cf

Routing by Stor-Ind method, Time Span= 1.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,088.45' @ 12.10 hrs Surf.Area= 4,717 sf Storage= 14,068 cf

Plug-Flow detention time= 417.7 min calculated for 21,064 cf (76% of inflow)
Center-of-Mass det. time= 330.7 min (1,124.6 - 793.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	2,084.00'	6,599 cf	**51.42'W x 91.74'L x 5.50'H Field A** 25,943 cf Overall - 9,445 cf Embedded = 16,499 cf x 40.0% Voids
#2A	2,084.75'	9,445 cf	**ADS_StormTech MC-3500 d +Cap**x 84 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 7 Rows of 12 Chambers Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf
		16,044 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	2,084.00'	**15.0" Round Outfall Pipe** L= 60.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 2,084.00' / 2,083.50' S= 0.0083 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	2,084.00'	**1.7" Vert. 1 Year Storm** C= 0.600
#3	Device 1	2,087.75'	**12.0" Horiz. 10 Year Riser** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.31 cfs @ 12.10 hrs HW=2,088.44' (Free Discharge)
└─**1=Outfall Pipe** (Passes 3.31 cfs of 10.19 cfs potential flow)
  ├─**2=1 Year Storm** (Orifice Controls 0.16 cfs @ 10.07 fps)
  └─**3=10 Year Riser** (Orifice Controls 3.15 cfs @ 4.01 fps)

Pond 1P: ADS Stormtech DA - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-3500 d +Cap (ADS StormTech®MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 7 rows = 208.6 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

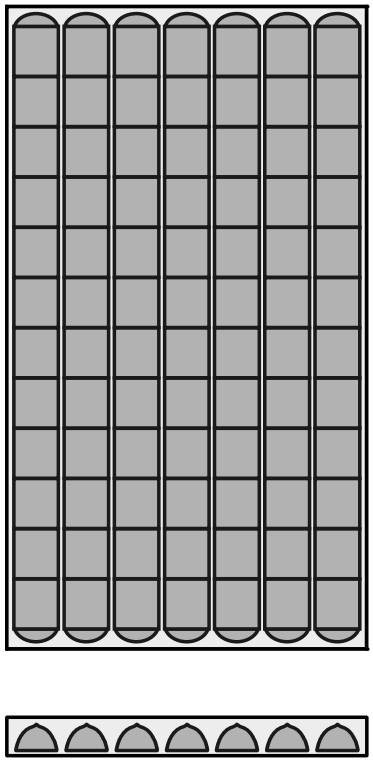
12 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 89.74' Row Length +12.0" End Stone x 2 = 91.74' Base Length
7 Rows x 77.0" Wide + 9.0" Spacing x 6 + 12.0" Side Stone x 2 = 51.42' Base Width
9.0" Base + 45.0" Chamber Height + 12.0" Cover = 5.50' Field Height

84 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 7 Rows = 9,444.6 cf Chamber Storage

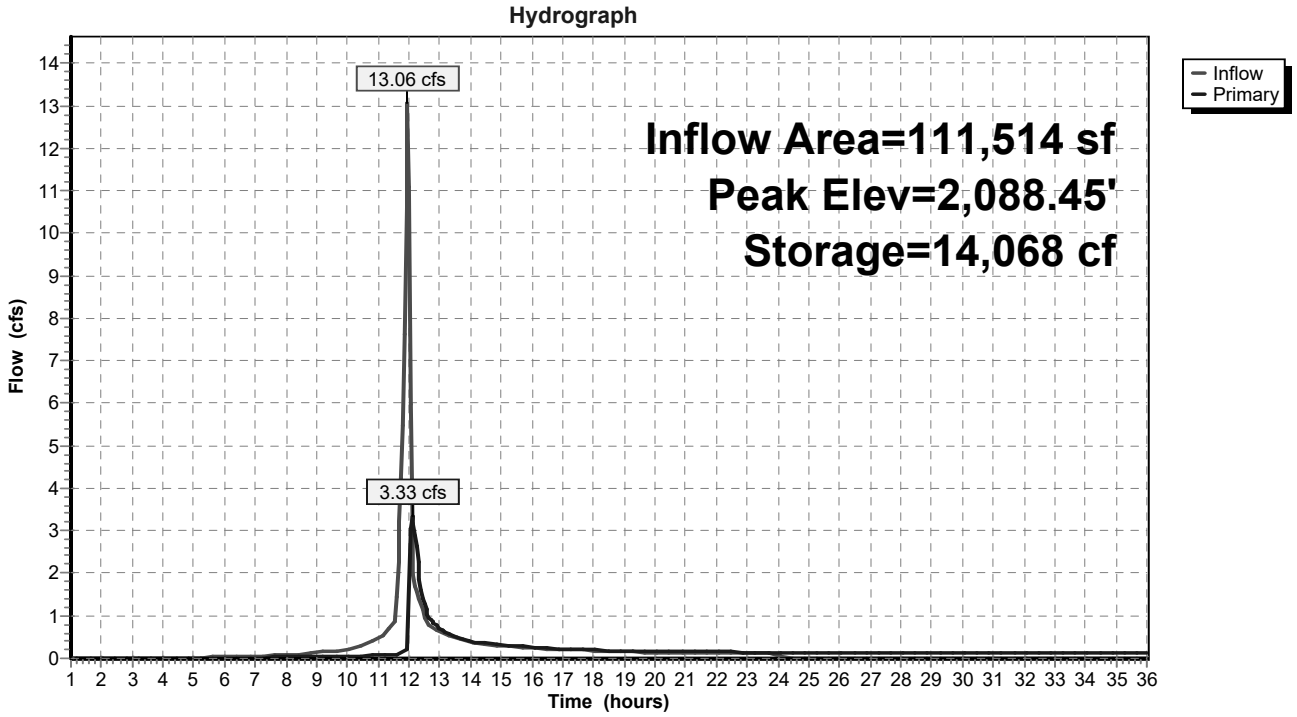
25,943.3 cf Field - 9,444.6 cf Chambers = 16,498.7 cf Stone x 40.0% Voids = 6,599.5 cf Stone Storage

Chamber Storage + Stone Storage = 16,044.1 cf = 0.368 af
Overall Storage Efficiency = 61.8%
Overall System Size = 91.74' x 51.42' x 5.50'

84 Chambers
960.9 cy Field
611.1 cy Stone



Pond 1P: ADS Stormtech DA



ADVANCED DRAINAGE SYSTEMS, INC.

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Glade Road

Blacksburg

STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500 OR APPROVED EQUAL.
2. CHAMBERS SHALL BE MADE FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORT PANELS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
4. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
5. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
6. CHAMBERS SHALL BE DESIGNED AND ALLOWABLE LOADS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
7. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. THE CHAMBER MANUFACTURER SHALL SUBMIT THE FOLLOWING UPON REQUEST TO THE SITE DESIGN ENGINEER FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE:
   a. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY AASHTO FOR THERMOPLASTIC PIPE.
   b. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET. THE 50 YEAR CREEP MODULUS DATA SPECIFIED IN ASTM F2418 MUST BE USED AS PART OF THE AASHTO STRUCTURAL EVALUATION TO VERIFY LONG-TERM PERFORMANCE.
   c. STRUCTURAL CROSS SECTION DETAIL ON WHICH THE STRUCTURAL EVALUATION IS BASED.
8. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS.

   STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 3/4-2" (20-50 mm) MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING..
10. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

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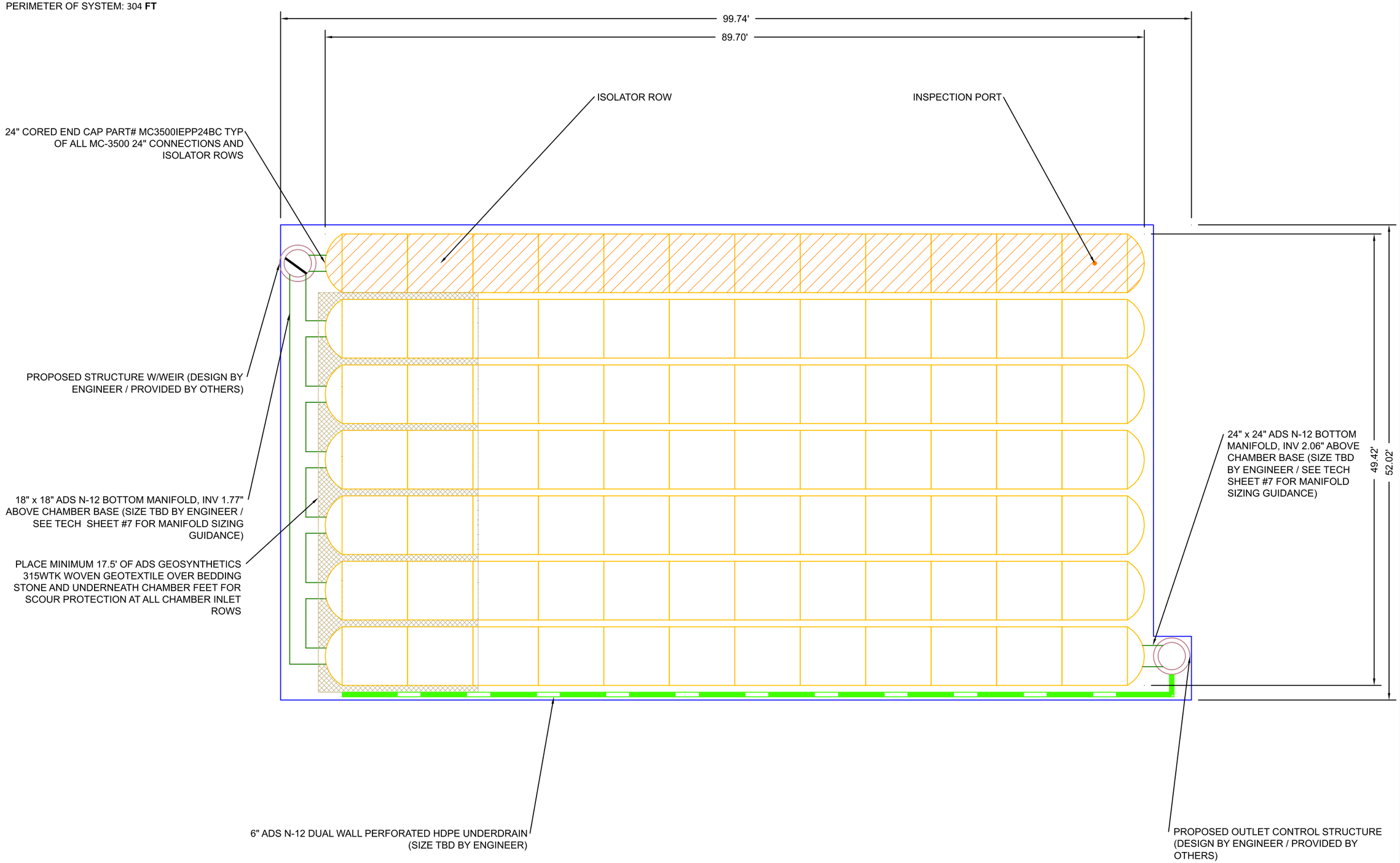
CONCEPTUAL LAYOUT

(84) STORMTECH MC-3500 CHAMBERS
(14) STORMTECH MC-3500 END CAPS
INSTALLED WITH 12 " COVER STONE, 9 " BASE STONE, 40% STONE VOID
INSTALLED SYSTEM VOLUME: 16669 CF
AREA OF SYSTEM: 5001 **FT²**
PERIMETER OF SYSTEM: 304 **FT**

COMPUTER GENERATED CONCEPTUAL LAYOUT - NOT FOR CONSTRUCTION



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REV	DRW	CHK	DESCRIPTION

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NOT TO SCALE

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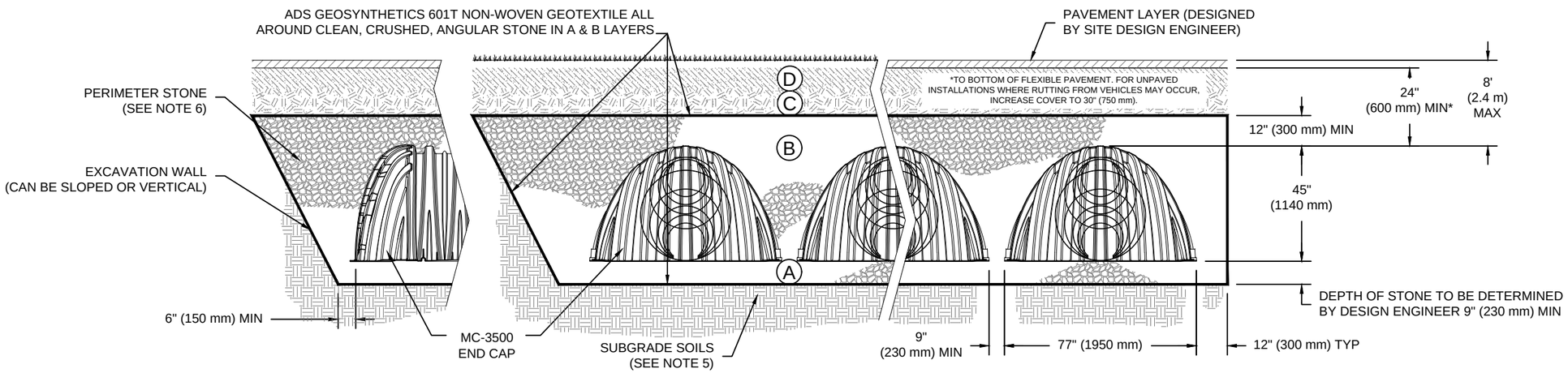
ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE, NOMINAL SIZE DISTRIBUTION BETWEEN 3/4-2 INCH (20-50 mm)	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE. [2] [3]

PLEASE NOTE:

1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.



NOTES:

1. MC-3500 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS.
4. THE "SITE DESIGN ENGINEER" REFERS TO THE ENGINEER RESPONSIBLE FOR THE DESIGN AND LAYOUT OF THE STORMTECH CHAMBERS FOR THIS PROJECT.
5. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
6. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
7. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.

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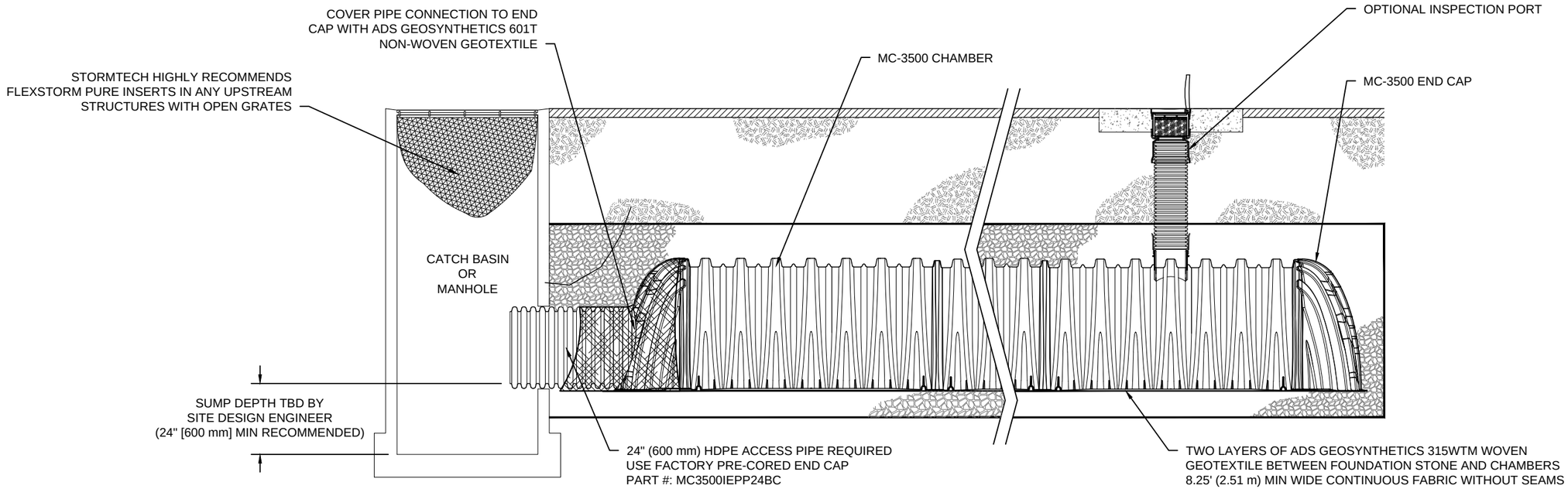


MC-3500 ISOLATOR ROW DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

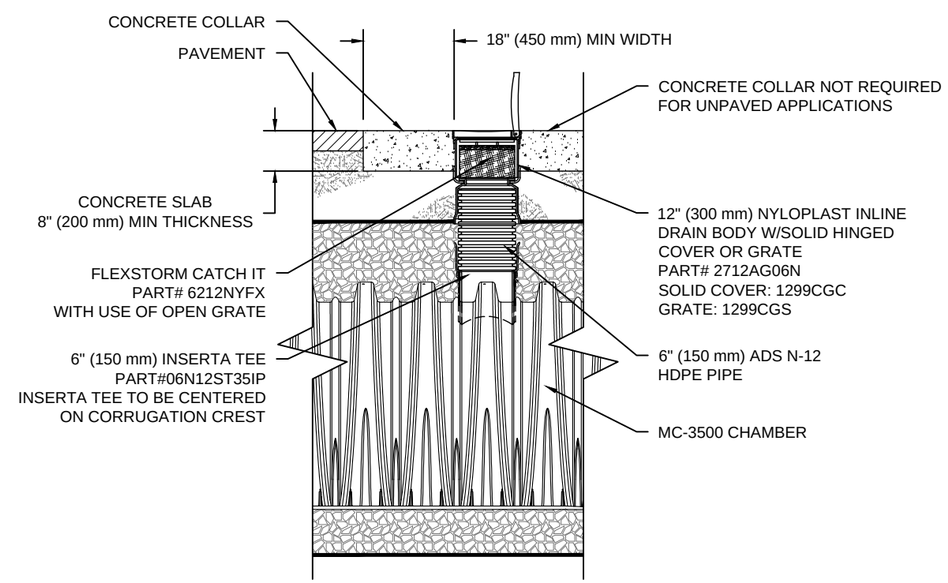
STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



MC-3500 6" INSPECTION PORT DETAIL

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REV	DRW	CHK	DESCRIPTION

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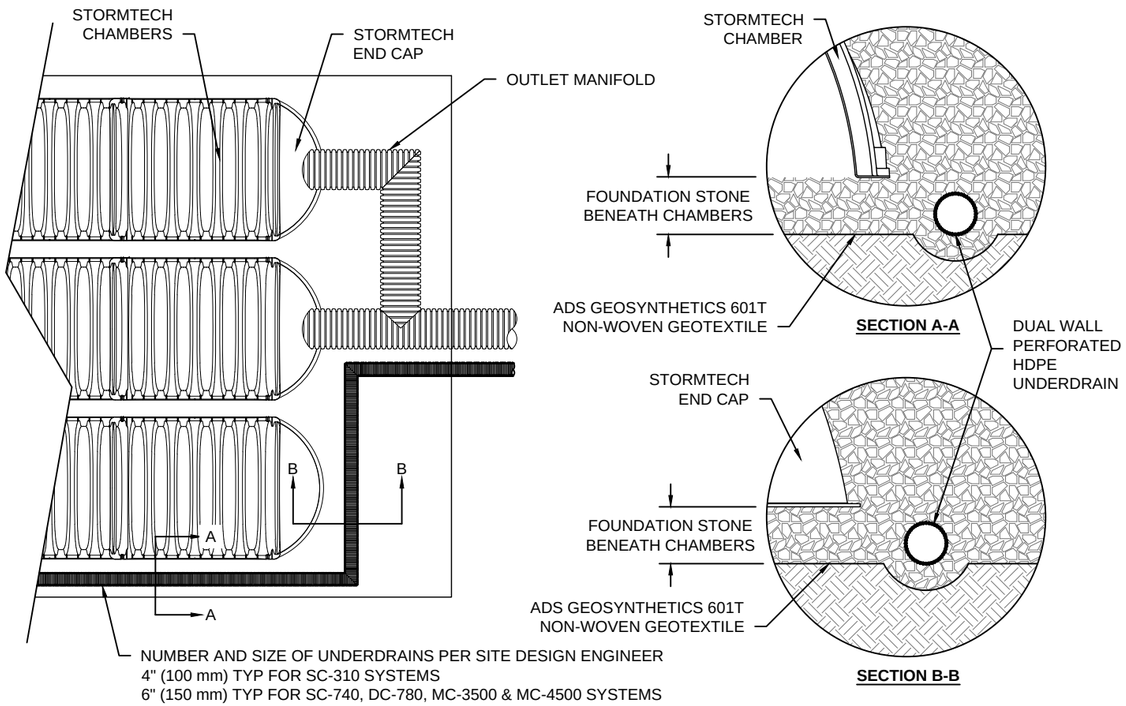
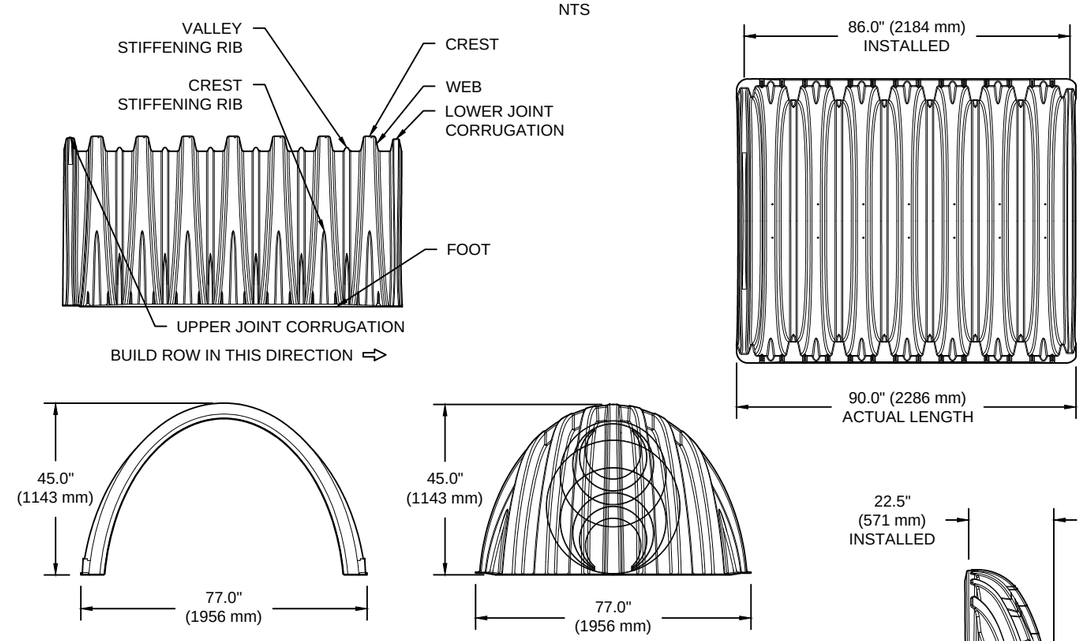
UNDERDRAIN DETAIL

NTS



MC-3500 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	178.9 CUBIC FEET	(5.06 m³)
WEIGHT	135.0 lbs.	(61.2 kg)

NOMINAL END CAP SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 22.5"	(1956 mm X 1143 mm X 571 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	46.0 CUBIC FEET	(1.30 m³)
WEIGHT	50.0 lbs.	(22.7 kg)

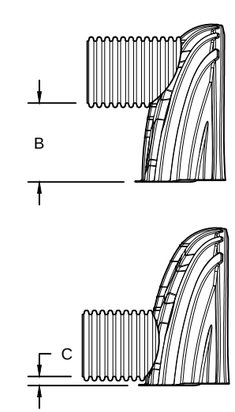
*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP30BC	30" (750 mm)	---	

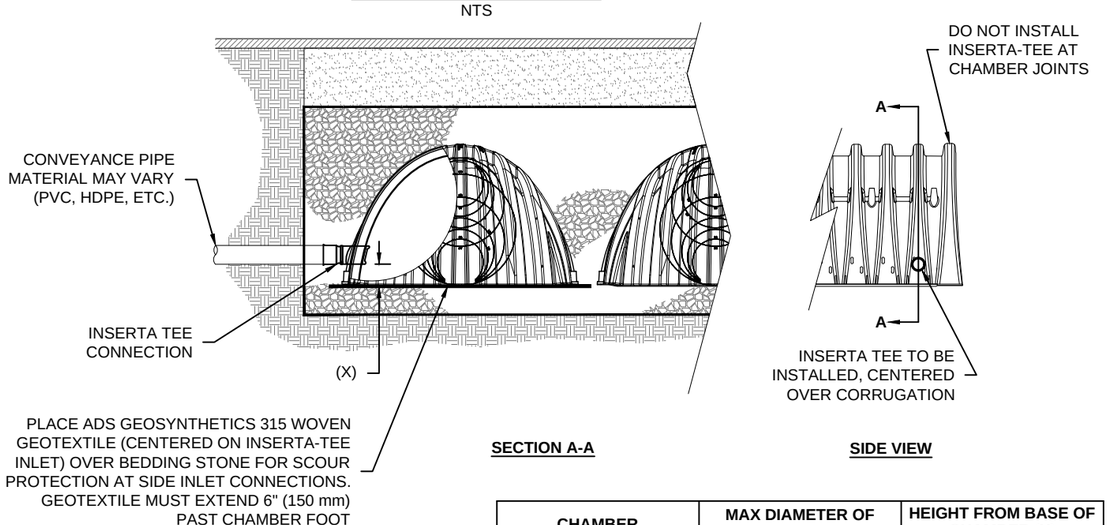
NOTE: ALL DIMENSIONS ARE NOMINAL

CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS.
CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm)
THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHTEST POSSIBLE FOR THE PIPE SIZE.



INSERTA TEE DETAIL

NTS



CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
MC-3500	12" (300 mm)	6" (150 mm)
MC-4500	12" (300 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

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PROJECT #: Tool | CHECKED: ---

REV	DRW	CHK	DESCRIPTION

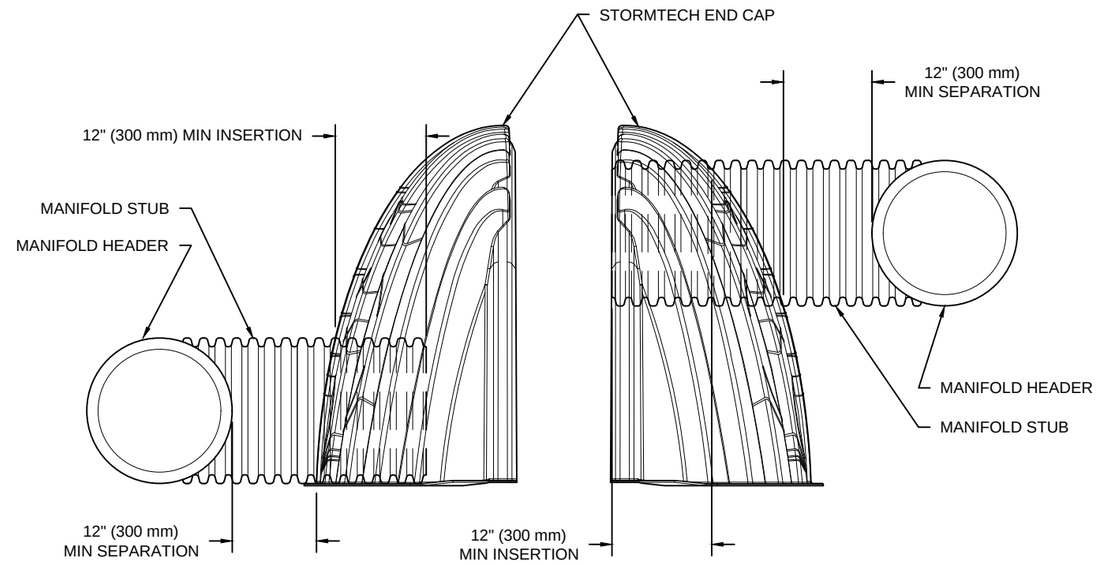
StormTech® Detention•Retention•Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS® ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

MC-SERIES END CAP INSERTION DETAIL

NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

Glade Road
Blacksburg

DATE: 07/26/2019 | DRAWN: ED
PROJECT #: Tool | CHECKED: ---

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