

# ***DRAINAGE ANALYSIS***

***RANGEWAY EXTENSION  
LEXINGTON, MA***



***AUGUST 7, 2019***

# **Rangeway Extension**

## **Drainage Summary**

### **Introduction**

This report presents analyses of both pre-development and post-development conditions for the subject property. Conditions, which now exist, and those which will result from the development of the property as shown on the attached plan. The report compares existing and proposed conditions at the point of discharge. The Subcatchment analyzed contains 1.88 acres and flows in a southeasterly direction towards Rangeway. Four deep hole observations were performed on site, and were used in the design calculations contained in this analysis (see attached).

### **Existing Conditions**

The existing property is mainly wooded and slopes moderately towards Rangeway.

### **Proposed Conditions**

The project proposes to extend existing Rangeway approximately 150 feet, ending in a “T-type” turnaround. This extension will service one (1) new single family building lot. The existing paved portion of Rangeway from station 0+00 to approximately station 2+60 will be reclaimed and repaved as part of this project. Post-development runoff from the proposed roadway extension and driveway will be directed to two subsurface infiltration systems (infiltration areas 1 & 2). Runoff from the proposed dwelling will be directed to a third infiltration system, however final design will be completed after final architectural plans for the house are complete. This third infiltration system will be adequately designed for the 100 year storm event. By utilizing the proposed infiltration systems the overall rate of stormwater runoff and volume from the site, for the 1, 2, 10 and 100-year storm events will be reduced for post-development conditions.

**Pre-Development vs. Post-Development Drainage Summary Table**

<b>Storm Event</b>	<b>Pre-Development</b>		<b>Post-Development</b>	
	<b>Rate (cfs)</b>	<b>Volume (af)</b>	<b>Rate (cfs)</b>	<b>Volume (af)</b>
<b>1</b>	<b>1.01</b>	<b>0.120</b>	<b>1.01</b>	<b>0.057</b>
<b>2</b>	<b>1.65</b>	<b>0.187</b>	<b>1.65</b>	<b>0.108</b>
<b>10</b>	<b>3.45</b>	<b>0.374</b>	<b>3.24</b>	<b>0.261</b>
<b>100</b>	<b>6.11</b>	<b>0.658</b>	<b>5.39</b>	<b>0.507</b>

### **Analysis of Existing Catch Basin**

The proposed widening along Rangeway between station 1+00 to 1+50 will create approximately 240 sf of additional impervious cover. As a result an analysis was done to determine the impact of this additional pavement on existing flows to the existing catch basin located downstream at station 1+75.

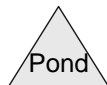
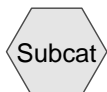
As shown in the table above, the minimal increase in impervious cover will have no impact on flows to the existing catch basin.

**Pre-Development vs. Post-Development Drainage Summary Table**

<b>Storm Event</b>	<b>Pre-Development</b>		<b>Post-Development</b>	
	<b>Rate (cfs)</b>	<b>Volume (af)</b>	<b>Rate (cfs)</b>	<b>Volume (af)</b>
<b>1</b>	<b>1.33</b>	<b>0.102</b>	<b>1.33</b>	<b>0.102</b>
<b>2</b>	<b>2.01</b>	<b>0.150</b>	<b>2.01</b>	<b>0.150</b>
<b>10</b>	<b>3.78</b>	<b>0.280</b>	<b>3.78</b>	<b>0.280</b>
<b>100</b>	<b>6.28</b>	<b>0.469</b>	<b>6.28</b>	<b>0.469</b>



(To be determined)



## Rangeway Ext 08-07-19

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### Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	INF 2	212.00	211.70	30.0	0.0100	0.010	12.0	0.0	0.0

**Rangeway Ext 08-07-19**

Type III 24-hr 1 year storm Rainfall=2.50"

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Time span=0.01-24.00 hrs, dt=0.01 hrs, 2400 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment Drive drain:** Runoff Area=6,800 sf 25.00% Impervious Runoff Depth>0.84"  
 Tc=10.0 min CN=79 Runoff=0.13 cfs 0.011 af

**Subcatchment EX:** Runoff Area=90,600 sf 18.43% Impervious Runoff Depth>0.69"  
 Flow Length=340' Tc=21.4 min CN=76 Runoff=1.01 cfs 0.120 af

**Subcatchment Exist to CB:** Runoff Area=56,500 sf 30.62% Impervious Runoff Depth>0.94"  
 Flow Length=340' Tc=7.2 min CN=81 Runoff=1.33 cfs 0.102 af

**Pond INF 1:** Peak Elev=214.26' Storage=48 cf Inflow=0.13 cfs 0.011 af  
 Discarded=0.07 cfs 0.011 af Secondary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.011 af

**Pond INF 2:** Peak Elev=212.59' Storage=565 cf Inflow=1.15 cfs 0.131 af  
 Discarded=0.10 cfs 0.074 af Secondary=1.01 cfs 0.057 af Outflow=1.11 cfs 0.131 af

**Pond INF 3: (To be determined)** Inflow=0.00 cfs 0.000 af  
 Primary=0.00 cfs 0.000 af

**Reach PR:** Inflow=1.01 cfs 0.057 af  
 Outflow=1.01 cfs 0.057 af

**Subcatchment PR COND:** Runoff Area=82,500 sf 27.15% Impervious Runoff Depth>0.83"  
 Flow Length=340' Tc=21.4 min CN=79 Runoff=1.15 cfs 0.131 af

**Subcatchment Prop to CB:** Runoff Area=56,500 sf 31.04% Impervious Runoff Depth>0.94"  
 Flow Length=340' Tc=7.2 min CN=81 Runoff=1.33 cfs 0.102 af

**Subcatchment Roof:** Runoff=0.00 cfs 0.000 af

**Total Runoff Area = 6.724 ac Runoff Volume = 0.465 af Average Runoff Depth = 0.83"**  
**74.18% Pervious = 4.988 ac 25.82% Impervious = 1.736 ac**

**Summary for Subcatchment Drive drain:**

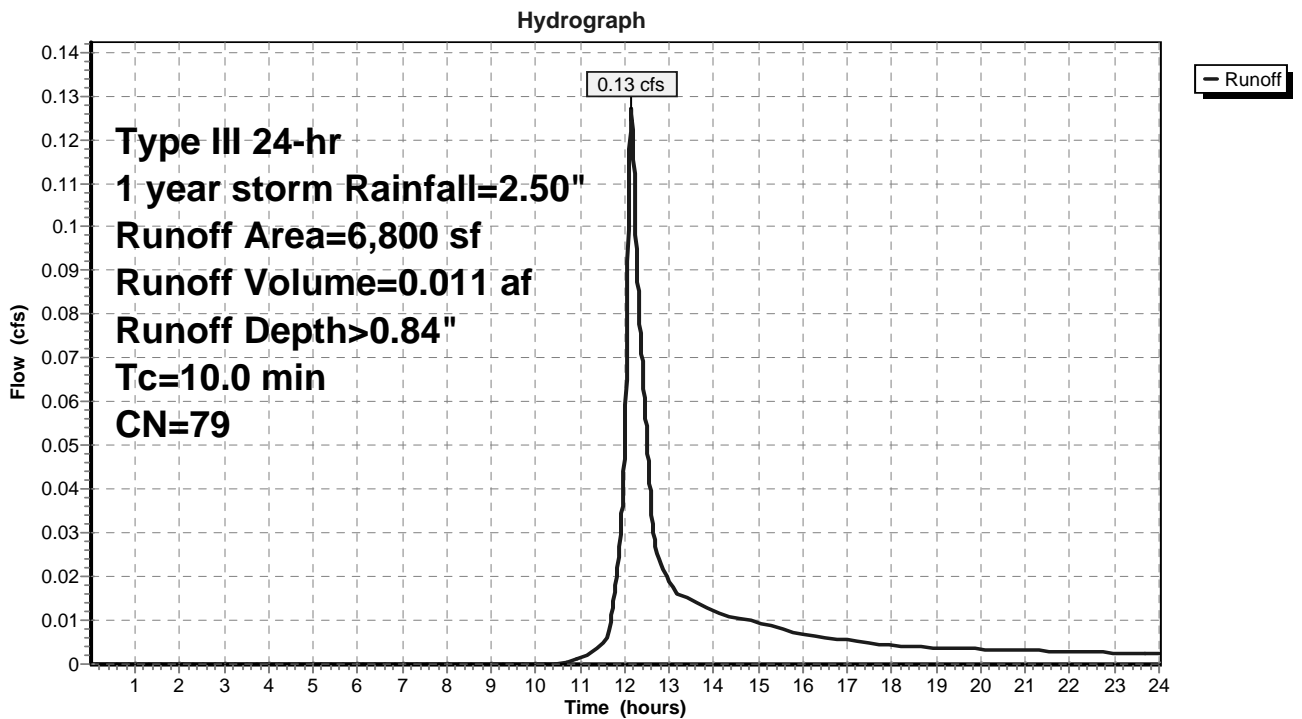
Runoff = 0.13 cfs @ 12.15 hrs, Volume= 0.011 af, Depth> 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 1 year storm Rainfall=2.50"

Area (sf)	CN	Description
1,900	70	Woods, Good, HSG C
1,700	98	Paved parking, HSG C
3,200	74	>75% Grass cover, Good, HSG C
6,800	79	Weighted Average
5,100		75.00% Pervious Area
1,700		25.00% Impervious Area

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

**Subcatchment Drive drain:**



**Summary for Subcatchment EX:**

Runoff = 1.01 cfs @ 12.34 hrs, Volume= 0.120 af, Depth> 0.69"

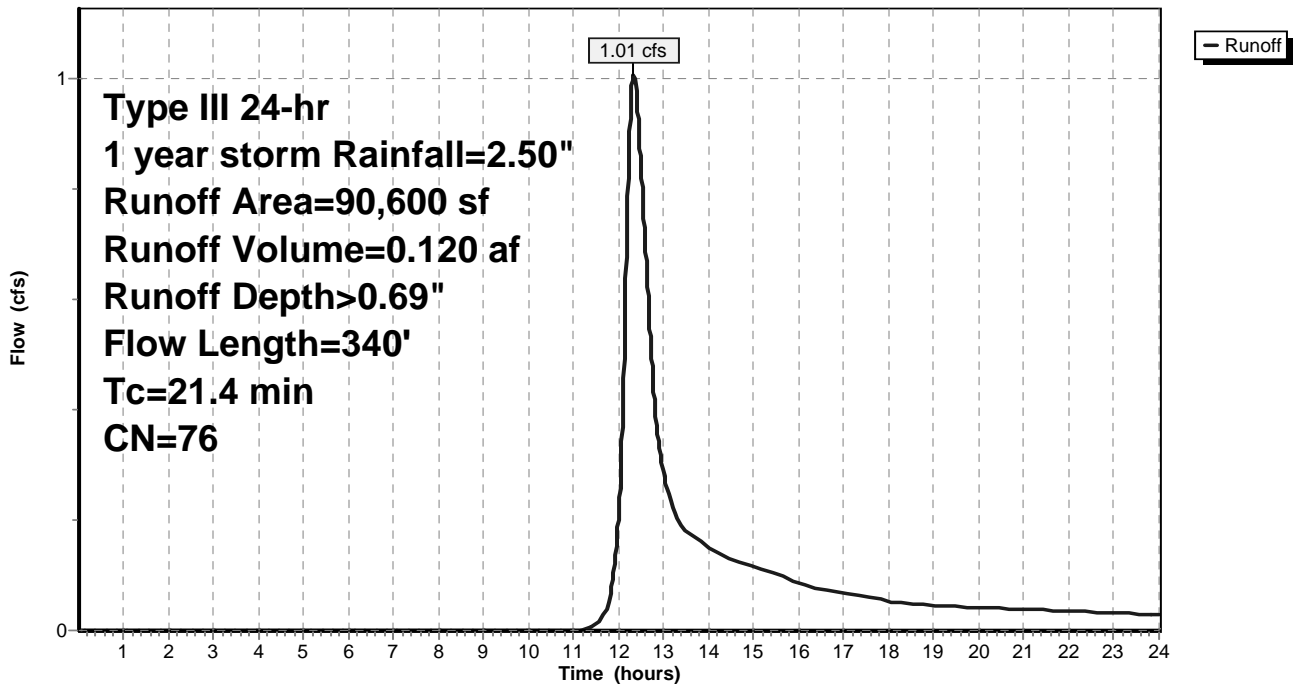
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 1 year storm Rainfall=2.50"

Area (sf)	CN	Description
52,600	70	Woods, Good, HSG C
* 16,700	98	Paved roads, driveways and roofs, HSG C
21,300	74	>75% Grass cover, Good, HSG C
90,600	76	Weighted Average
73,900		81.57% Pervious Area
16,700		18.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	60	0.0330	0.05		<b>Sheet Flow,</b> Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	280	0.1500	6.24		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
21.4	340	Total			

**Subcatchment EX:**

Hydrograph





**Summary for Subcatchment Exist to CB:**

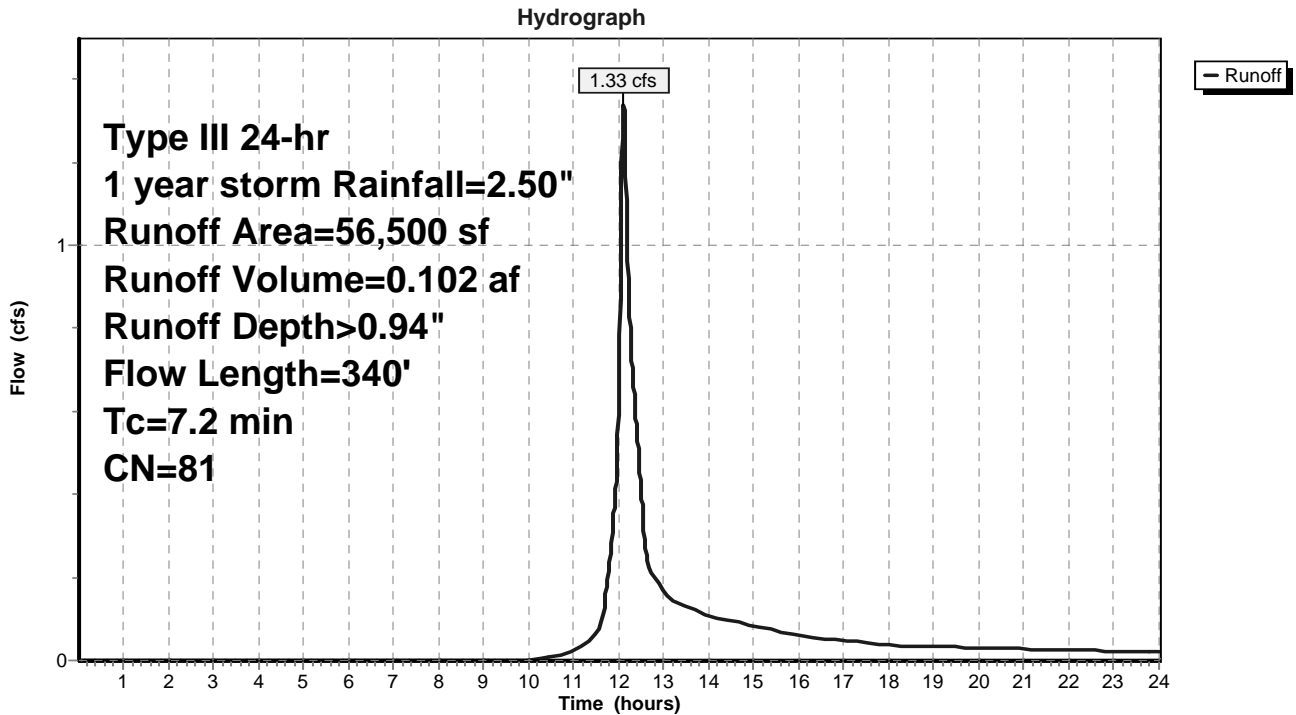
Runoff = 1.33 cfs @ 12.11 hrs, Volume= 0.102 af, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 1 year storm Rainfall=2.50"

Area (sf)	CN	Description
2,100	70	Woods, Good, HSG C
* 17,300	98	Paved roads, driveways & roofs, HSG C
37,100	74	>75% Grass cover, Good, HSG C
56,500	81	Weighted Average
39,200		69.38% Pervious Area
17,300		30.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.10"
0.9	290	0.1200	5.58		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.2	340	Total			

**Subcatchment Exist to CB:**



**Summary for Pond INF 1:**

Inflow Area = 0.156 ac, 25.00% Impervious, Inflow Depth > 0.84" for 1 year storm event  
 Inflow = 0.13 cfs @ 12.15 hrs, Volume= 0.011 af  
 Outflow = 0.07 cfs @ 12.09 hrs, Volume= 0.011 af, Atten= 45%, Lag= 0.0 min  
 Discarded = 0.07 cfs @ 12.09 hrs, Volume= 0.011 af  
 Secondary = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Peak Elev= 214.26' @ 12.38 hrs Surf.Area= 536 sf Storage= 48 cf

Plug-Flow detention time= 5.2 min calculated for 0.011 af (100% of inflow)  
 Center-of-Mass det. time= 4.6 min ( 866.9 - 862.3 )

Volume	Invert	Avail.Storage	Storage Description
#1A	214.00'	436 cf	<b>31.50'W x 17.01'L x 2.83'H Field A</b> 1,518 cf Overall - 274 cf Embedded = 1,245 cf x 35.0% Voids
#2A	215.00'	274 cf	<b>ADS StormTech SC-310 x 18 Inside #1</b> Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 9 rows
		709 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	214.00'	<b>0.07 cfs Exfiltration at all elevations</b>
#2	Secondary	221.40'	<b>12.0" x 144.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.07 cfs @ 12.09 hrs HW=214.08' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.07 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.01 hrs HW=214.00' (Free Discharge)  
 ↑2=Orifice/Grate ( Controls 0.00 cfs)

**Pond INF 1: - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech SC-310 (ADS StormTech® SC-310 without end caps)**

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 2.07 sf x 9 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

2 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 14.68' Row Length +14.0" End Stone x 2 = 17.01' Base Length

9 Rows x 34.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 31.50' Base Width

12.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.83' Field Height

18 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 9 Rows = 273.5 cf Chamber Storage

1,518.3 cf Field - 273.5 cf Chambers = 1,244.8 cf Stone x 35.0% Voids = 435.7 cf Stone Storage

Chamber Storage + Stone Storage = 709.2 cf = 0.016 af

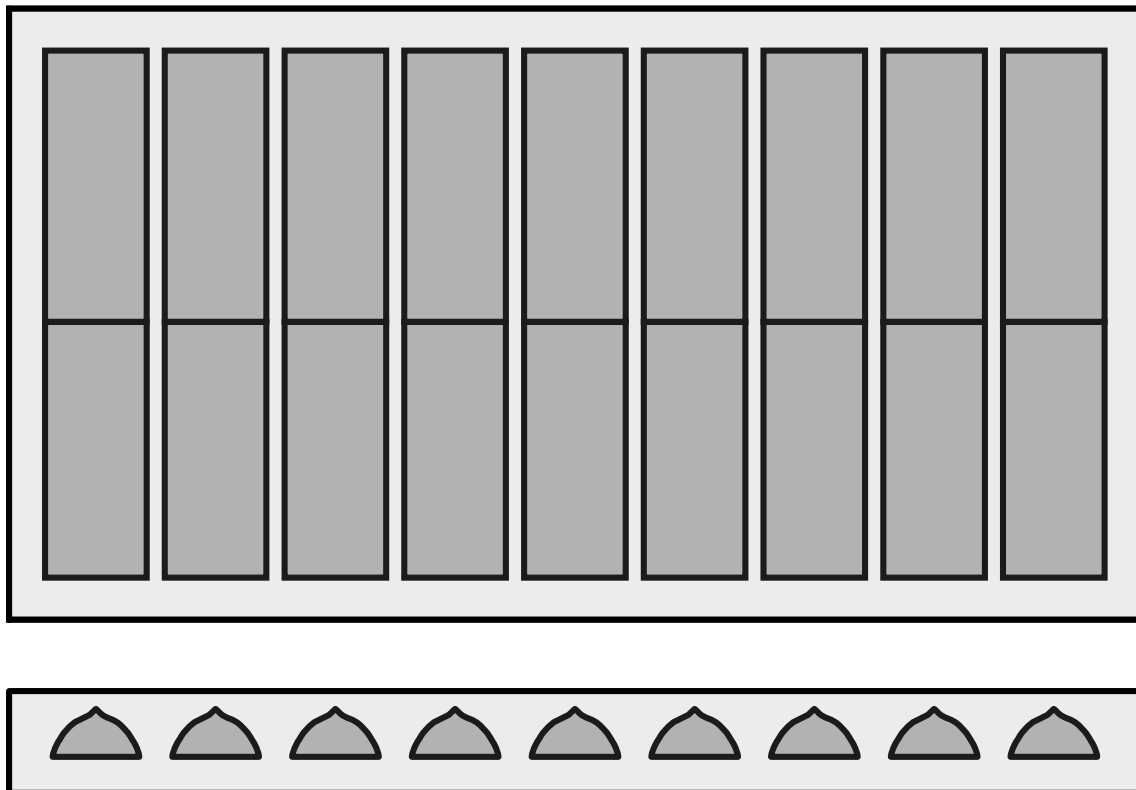
Overall Storage Efficiency = 46.7%

Overall System Size = 17.01' x 31.50' x 2.83'

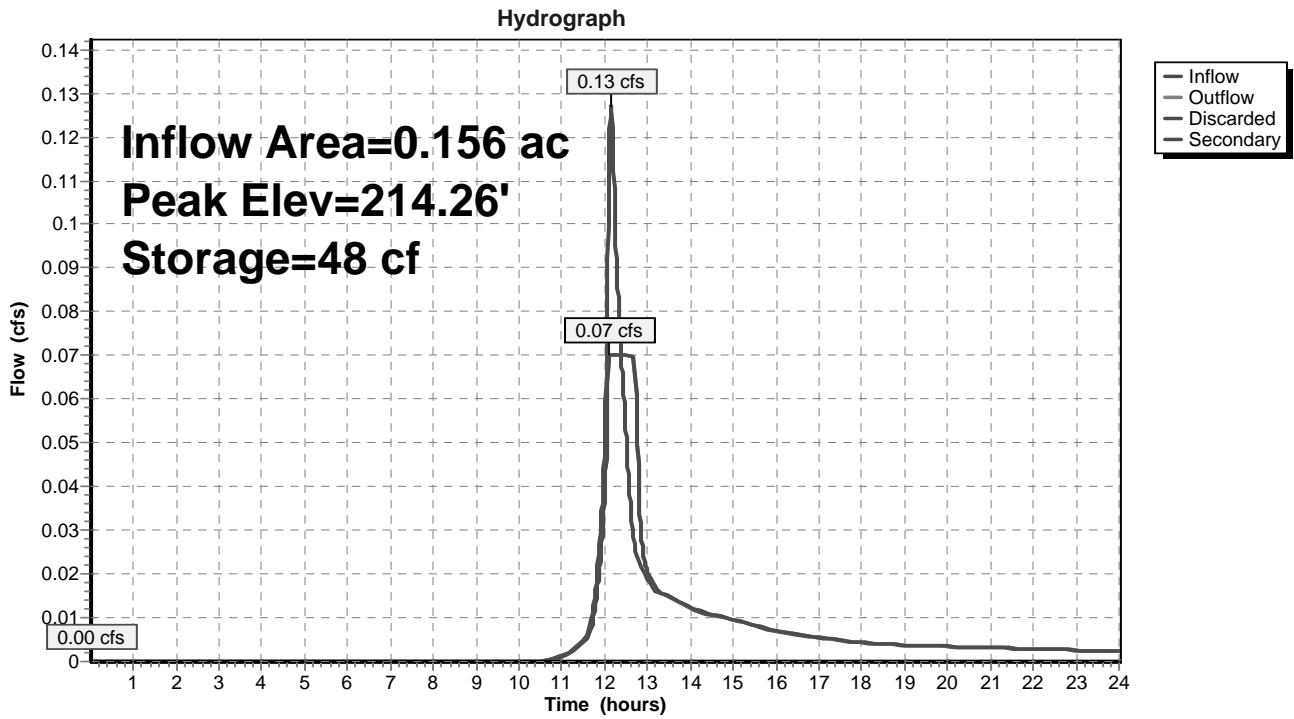
18 Chambers

56.2 cy Field

46.1 cy Stone



**Pond INF 1:**



**Summary for Pond INF 2:**

Inflow Area = 1.894 ac, 27.15% Impervious, Inflow Depth > 0.83" for 1 year storm event  
 Inflow = 1.15 cfs @ 12.32 hrs, Volume= 0.131 af  
 Outflow = 1.11 cfs @ 12.38 hrs, Volume= 0.131 af, Atten= 4%, Lag= 3.9 min  
 Discarded = 0.10 cfs @ 11.81 hrs, Volume= 0.074 af  
 Secondary = 1.01 cfs @ 12.38 hrs, Volume= 0.057 af

Routing by Stor-Ind method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 212.59' @ 12.38 hrs Surf.Area= 699 sf Storage= 565 cf

Plug-Flow detention time= 19.4 min calculated for 0.131 af (100% of inflow)  
 Center-of-Mass det. time= 19.2 min ( 890.2 - 871.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	211.20'	610 cf	<b>26.92'W x 25.96'L x 3.50'H Field A</b> 2,446 cf Overall - 703 cf Embedded = 1,743 cf x 35.0% Voids
#2A	211.70'	703 cf	<b>ADS StormTech SC-740 x 15 Inside #1</b> Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 5 rows
		1,313 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	211.20'	<b>0.10 cfs Exfiltration at all elevations</b>
#2	Secondary	212.00'	<b>12.0" Round Culvert</b> L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 212.00' / 211.70' S= 0.0100 1' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.10 cfs @ 11.81 hrs HW=211.24' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.10 cfs)

**Secondary OutFlow** Max=1.01 cfs @ 12.38 hrs HW=212.59' (Free Discharge)  
 ↑2=Culvert (Inlet Controls 1.01 cfs @ 2.07 fps)

**Pond INF 2: - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech SC-740 (ADS StormTech® SC-740 without end caps)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 6.45 sf x 5 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

3 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 21.80' Row Length +25.0" End Stone x 2 = 25.96' Base Length

5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 22.0" Side Stone x 2 = 26.92' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

15 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 5 Rows = 703.2 cf Chamber Storage

2,446.1 cf Field - 703.2 cf Chambers = 1,742.9 cf Stone x 35.0% Voids = 610.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,313.2 cf = 0.030 af

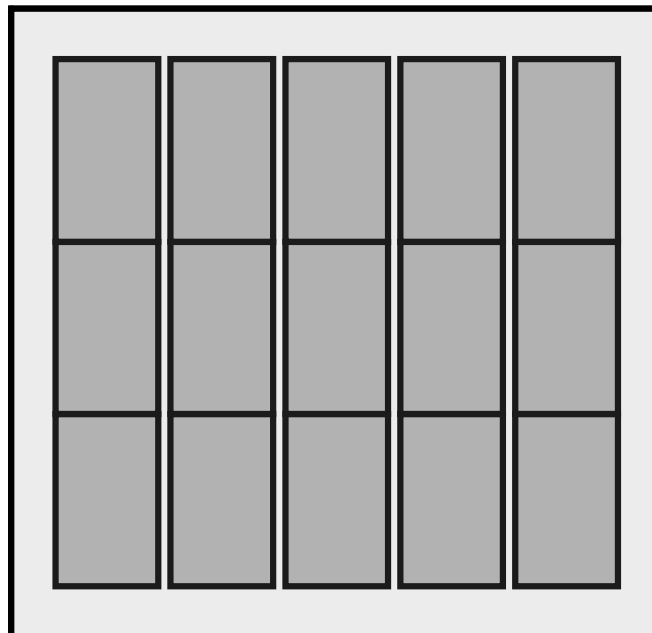
Overall Storage Efficiency = 53.7%

Overall System Size = 25.96' x 26.92' x 3.50'

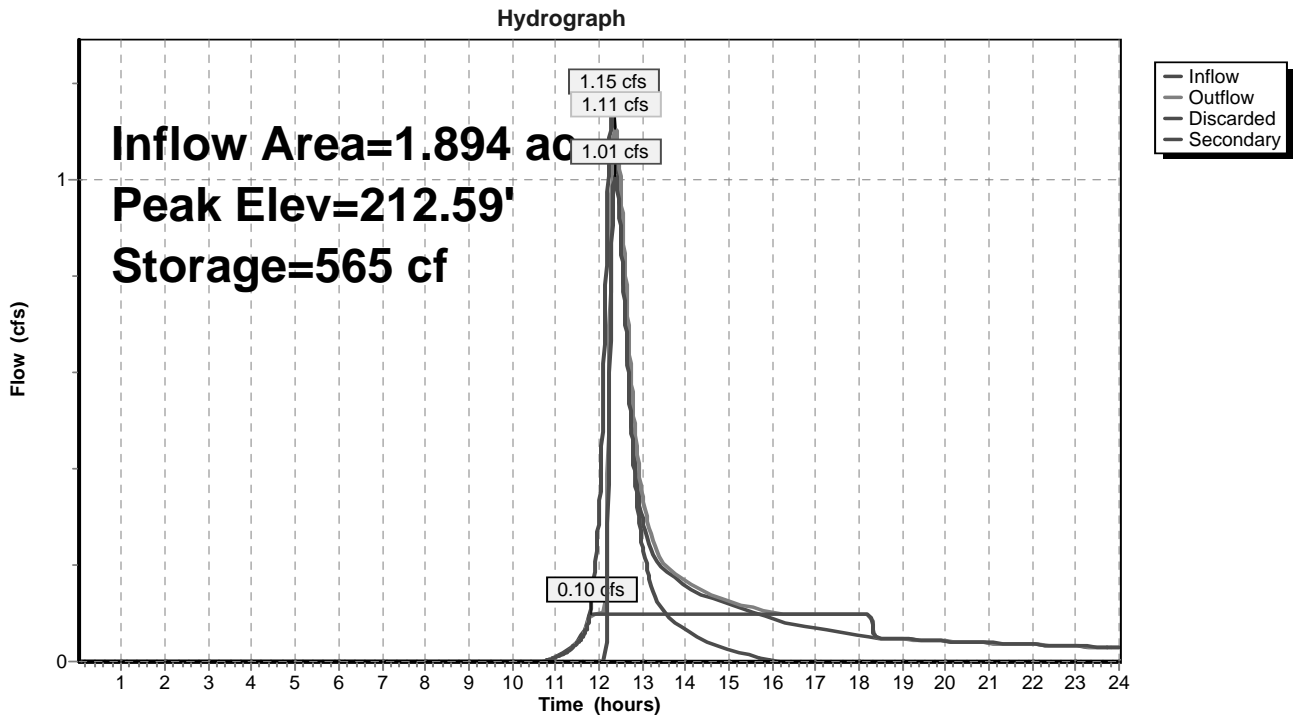
15 Chambers

90.6 cy Field

64.6 cy Stone



**Pond INF 2:**

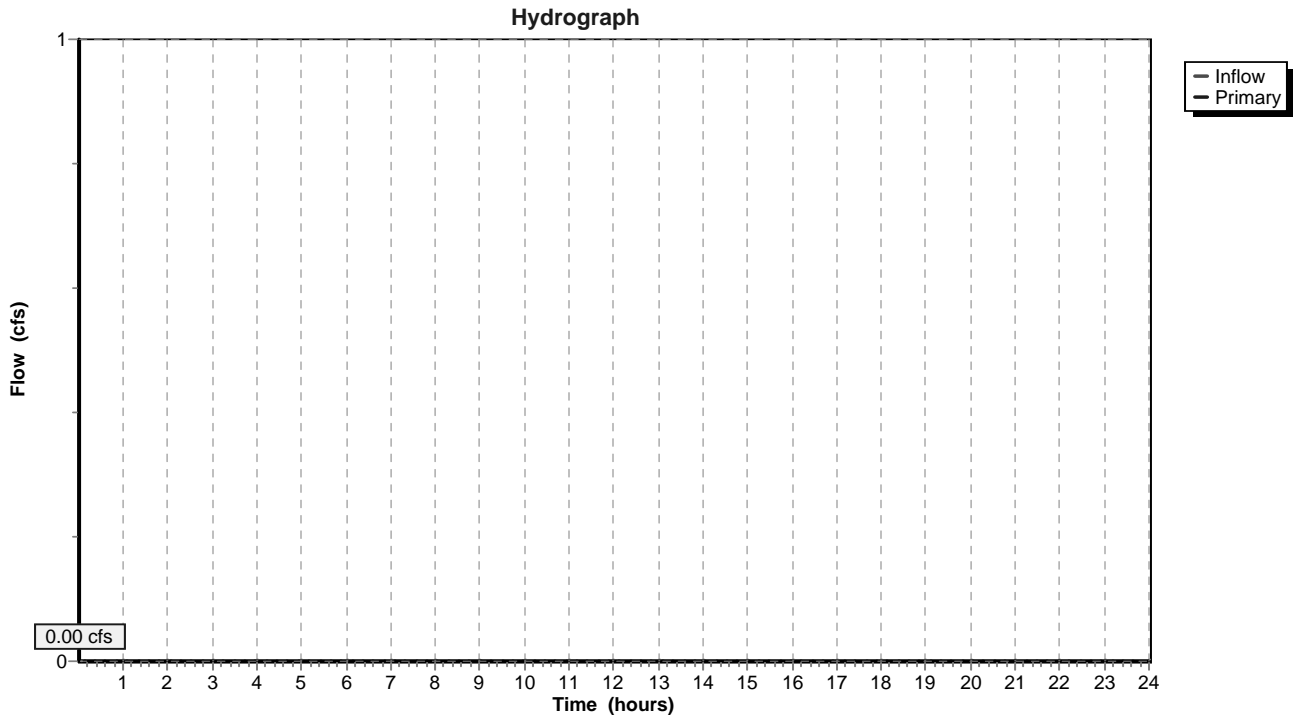


**Summary for Pond INF 3: (To be determined)**

Inflow = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af  
Primary = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs

**Pond INF 3: (To be determined)**





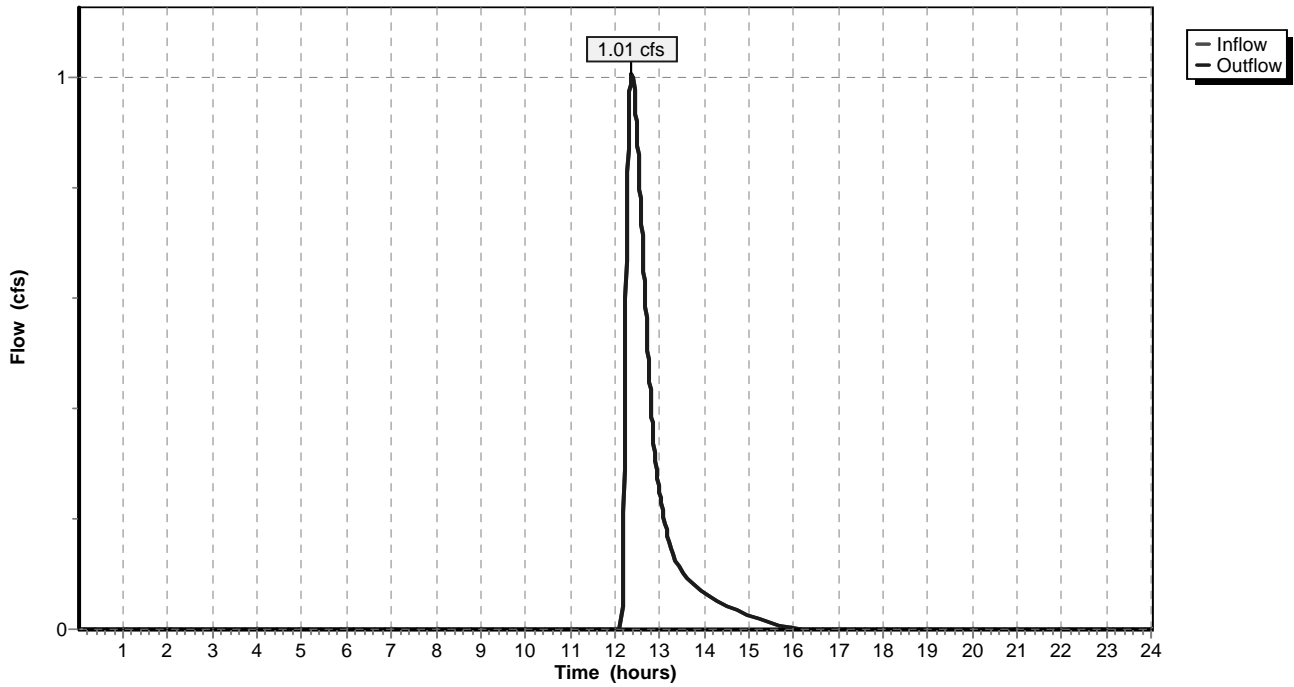
**Summary for Reach PR:**

Inflow = 1.01 cfs @ 12.38 hrs, Volume= 0.057 af  
Outflow = 1.01 cfs @ 12.38 hrs, Volume= 0.057 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs

**Reach PR:**

Hydrograph



**Summary for Subcatchment PR COND:**

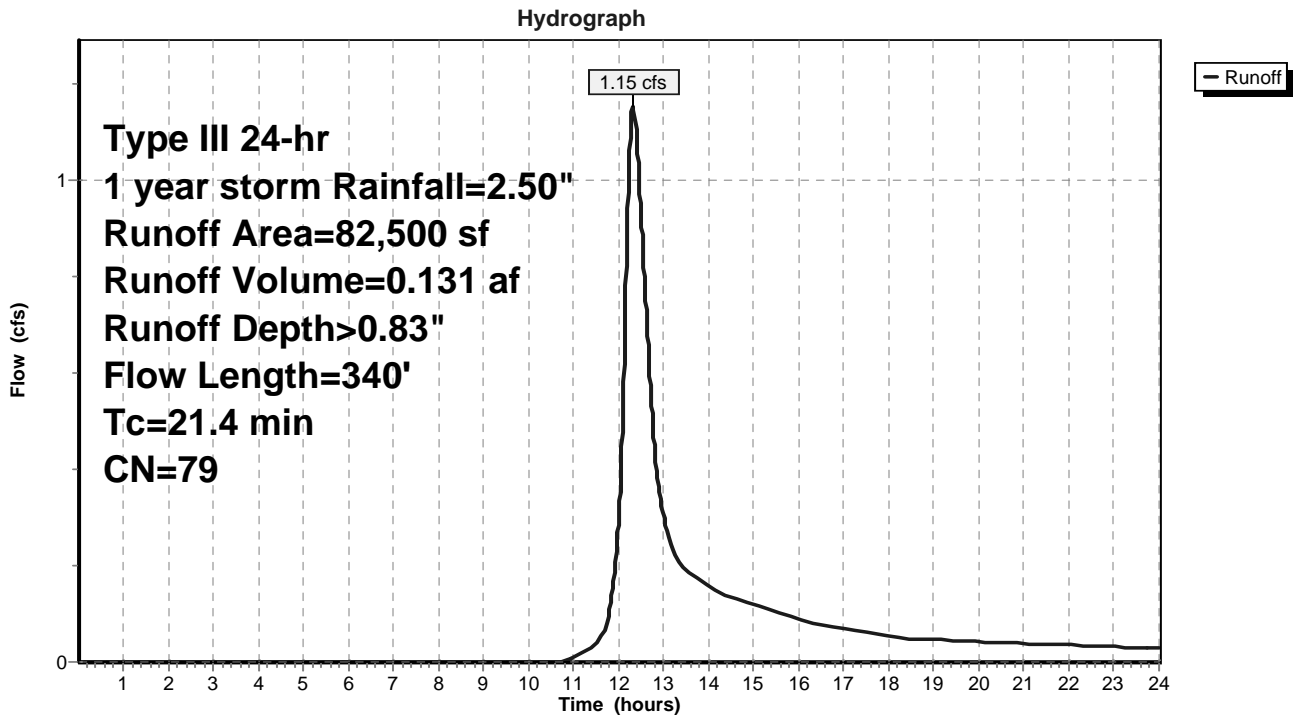
Runoff = 1.15 cfs @ 12.32 hrs, Volume= 0.131 af, Depth> 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 1 year storm Rainfall=2.50"

Area (sf)	CN	Description
37,300	70	Woods, Good, HSG C
* 20,780	98	Paved roads, driveways & roofs, HSG C
* 1,620	98	Reclaimed paved roads, HSG C
22,800	74	>75% Grass cover, Good, HSG C
82,500	79	Weighted Average
60,100		72.85% Pervious Area
22,400		27.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	60	0.0330	0.05		<b>Sheet Flow,</b> Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	280	0.1500	6.24		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
21.4	340	Total			

**Subcatchment PR COND:**



**Rangeway Ext 08-07-19**

Type III 24-hr 1 year storm Rainfall=2.50"

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**Summary for Subcatchment Prop to CB:**

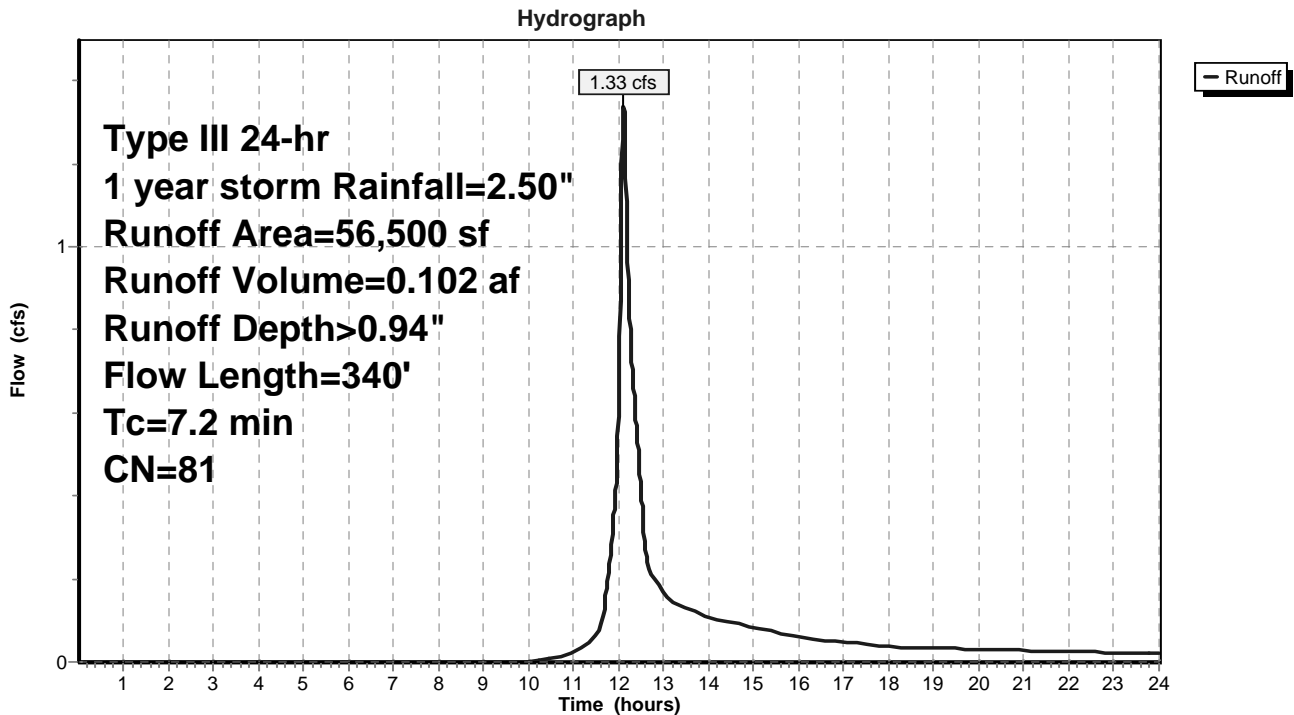
Runoff = 1.33 cfs @ 12.11 hrs, Volume= 0.102 af, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 1 year storm Rainfall=2.50"

Area (sf)	CN	Description
2,100	70	Woods, Good, HSG C
* 15,260	98	Paved roads, driveways & roofs, HSG C
* 2,280	98	Reclaimed paved roads, HSG C
36,860	74	>75% Grass cover, Good, HSG C
56,500	81	Weighted Average
38,960		68.96% Pervious Area
17,540		31.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.10"
0.9	290	0.1200	5.58		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.2	340	Total			

**Subcatchment Prop to CB:**

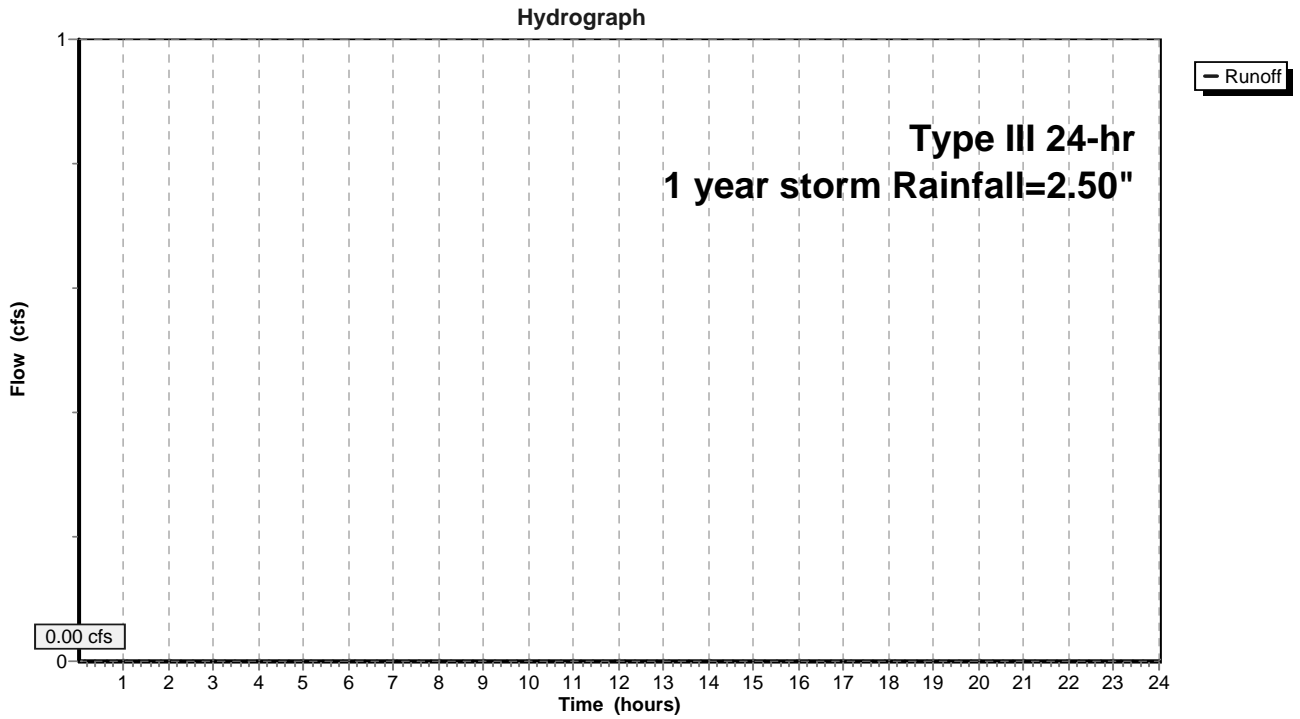


**Summary for Subcatchment Roof:**

Runoff = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 1 year storm Rainfall=2.50"

**Subcatchment Roof:**



**Rangeway Ext 08-07-19**

Type III 24-hr 2 year storm Rainfall=3.10"

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Time span=0.01-24.00 hrs, dt=0.01 hrs, 2400 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment Drive drain:** Runoff Area=6,800 sf 25.00% Impervious Runoff Depth>1.26"  
 Tc=10.0 min CN=79 Runoff=0.20 cfs 0.016 af

**Subcatchment EX:** Runoff Area=90,600 sf 18.43% Impervious Runoff Depth>1.08"  
 Flow Length=340' Tc=21.4 min CN=76 Runoff=1.65 cfs 0.187 af

**Subcatchment Exist to CB:** Runoff Area=56,500 sf 30.62% Impervious Runoff Depth>1.39"  
 Flow Length=340' Tc=7.2 min CN=81 Runoff=2.01 cfs 0.150 af

**Pond INF 1:** Peak Elev=214.68' Storage=128 cf Inflow=0.20 cfs 0.016 af  
 Discarded=0.07 cfs 0.016 af Secondary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.016 af

**Pond INF 2:** Peak Elev=212.81' Storage=666 cf Inflow=1.80 cfs 0.198 af  
 Discarded=0.10 cfs 0.090 af Secondary=1.65 cfs 0.108 af Outflow=1.75 cfs 0.198 af

**Pond INF 3: (To be determined)** Inflow=0.00 cfs 0.000 af  
 Primary=0.00 cfs 0.000 af

**Reach PR:** Inflow=1.65 cfs 0.108 af  
 Outflow=1.65 cfs 0.108 af

**Subcatchment PR COND:** Runoff Area=82,500 sf 27.15% Impervious Runoff Depth>1.26"  
 Flow Length=340' Tc=21.4 min CN=79 Runoff=1.80 cfs 0.198 af

**Subcatchment Prop to CB:** Runoff Area=56,500 sf 31.04% Impervious Runoff Depth>1.39"  
 Flow Length=340' Tc=7.2 min CN=81 Runoff=2.01 cfs 0.150 af

**Subcatchment Roof:** Runoff=0.00 cfs 0.000 af

**Total Runoff Area = 6.724 ac Runoff Volume = 0.701 af Average Runoff Depth = 1.25"**  
**74.18% Pervious = 4.988 ac 25.82% Impervious = 1.736 ac**

**Summary for Subcatchment Drive drain:**

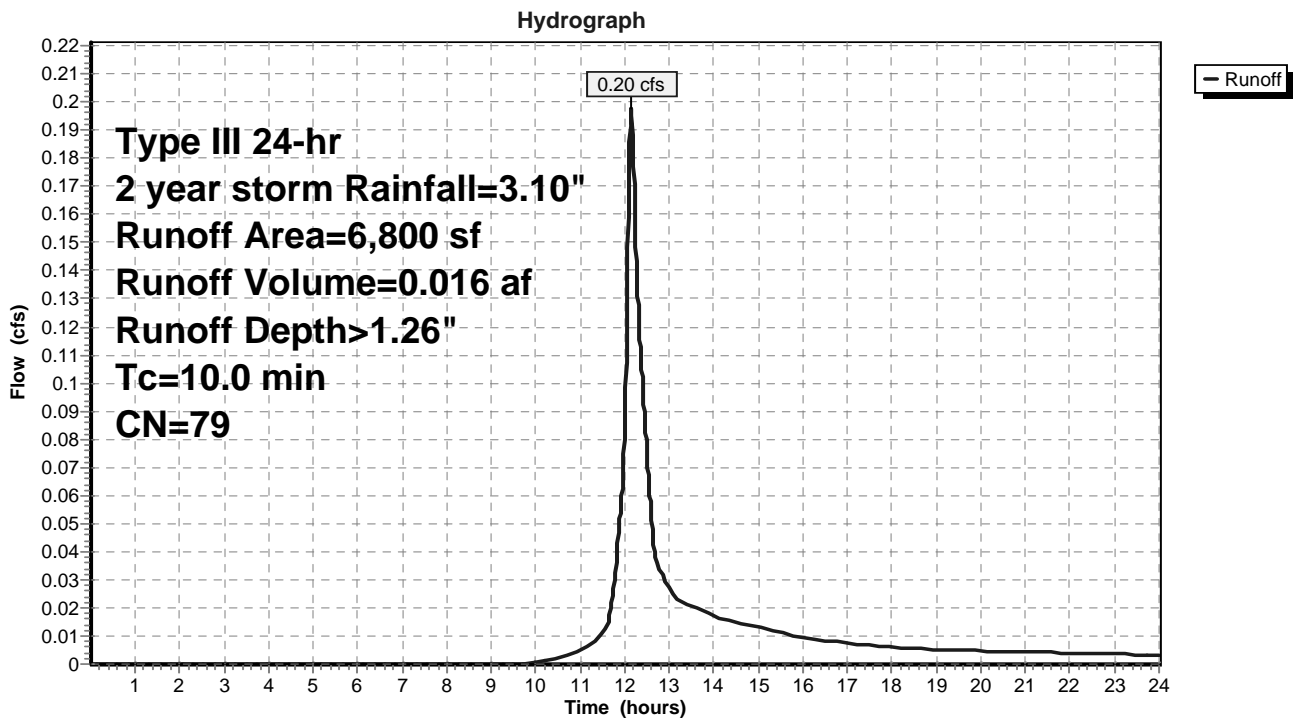
Runoff = 0.20 cfs @ 12.15 hrs, Volume= 0.016 af, Depth> 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2 year storm Rainfall=3.10"

Area (sf)	CN	Description
1,900	70	Woods, Good, HSG C
1,700	98	Paved parking, HSG C
3,200	74	>75% Grass cover, Good, HSG C
6,800	79	Weighted Average
5,100		75.00% Pervious Area
1,700		25.00% Impervious Area

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

**Subcatchment Drive drain:**



**Summary for Subcatchment EX:**

Runoff = 1.65 cfs @ 12.32 hrs, Volume= 0.187 af, Depth> 1.08"

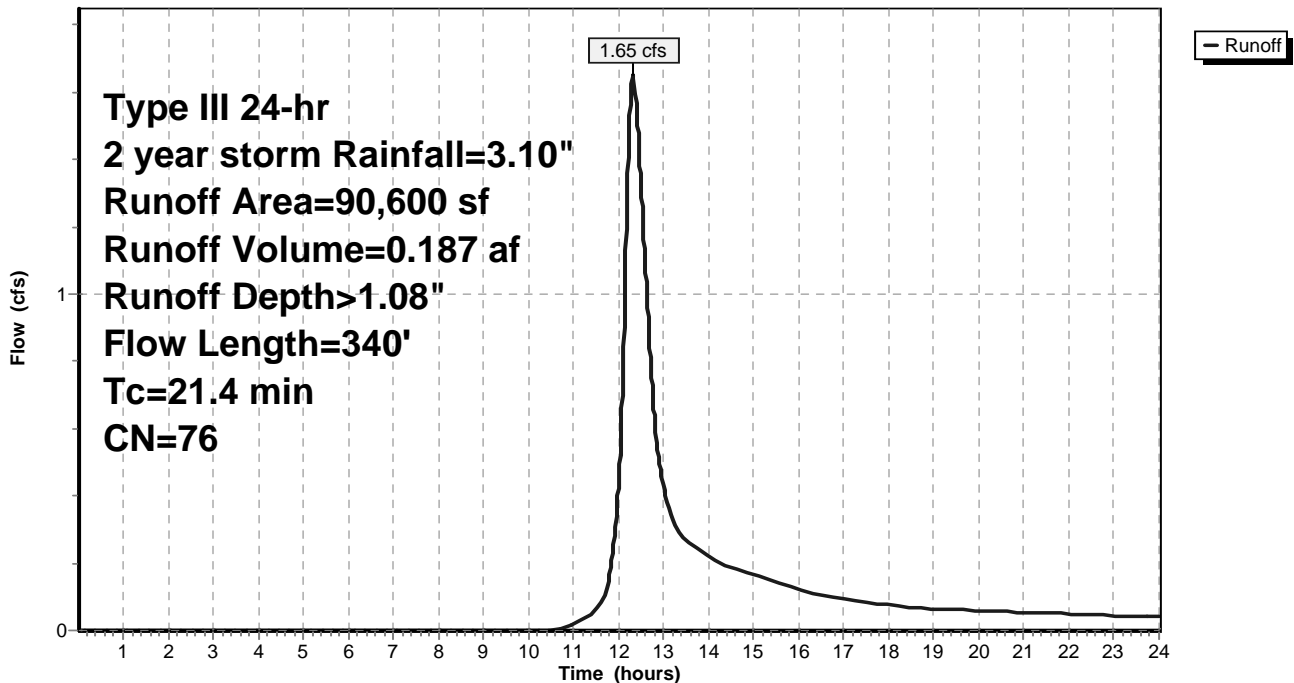
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2 year storm Rainfall=3.10"

Area (sf)	CN	Description
52,600	70	Woods, Good, HSG C
* 16,700	98	Paved roads, driveways and roofs, HSG C
21,300	74	>75% Grass cover, Good, HSG C
90,600	76	Weighted Average
73,900		81.57% Pervious Area
16,700		18.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	60	0.0330	0.05		<b>Sheet Flow,</b> Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	280	0.1500	6.24		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
21.4	340	Total			

**Subcatchment EX:**

Hydrograph



**Summary for Subcatchment Exist to CB:**

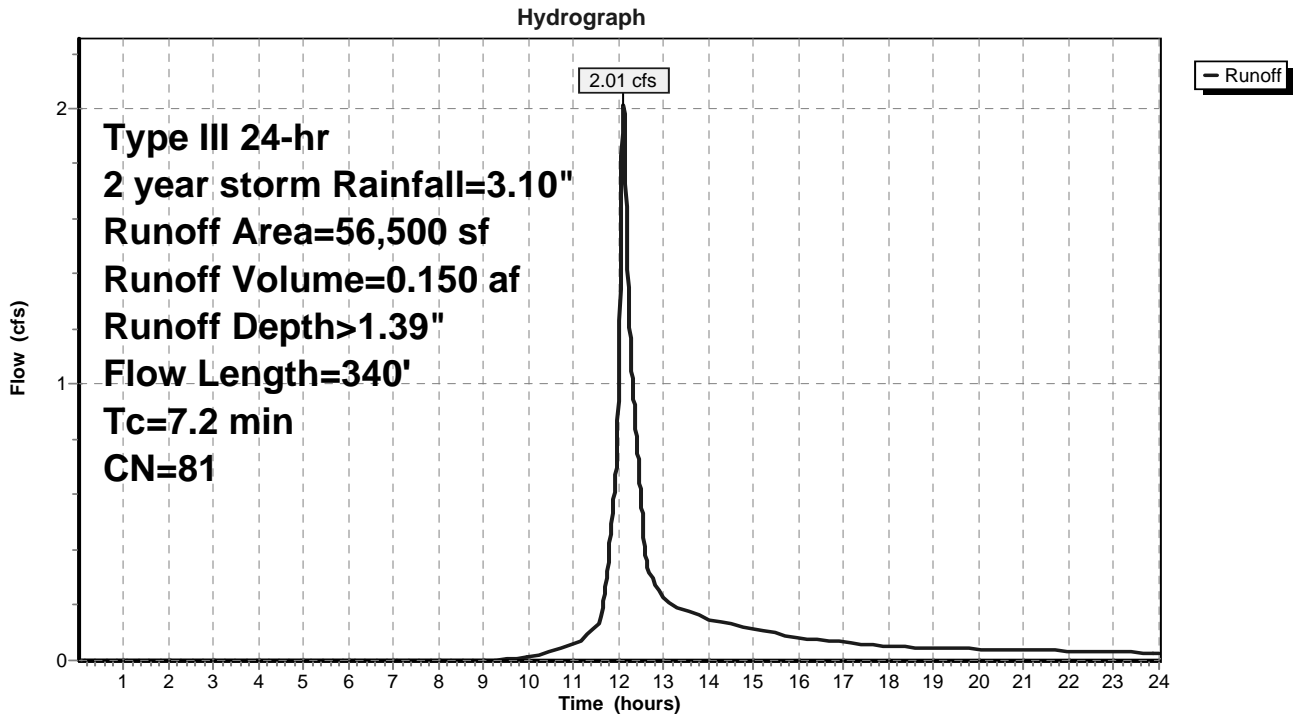
Runoff = 2.01 cfs @ 12.11 hrs, Volume= 0.150 af, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2 year storm Rainfall=3.10"

Area (sf)	CN	Description
2,100	70	Woods, Good, HSG C
* 17,300	98	Paved roads, driveways & roofs, HSG C
37,100	74	>75% Grass cover, Good, HSG C
56,500	81	Weighted Average
39,200		69.38% Pervious Area
17,300		30.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.10"
0.9	290	0.1200	5.58		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.2	340	Total			

**Subcatchment Exist to CB:**





**Summary for Pond INF 1:**

Inflow Area = 0.156 ac, 25.00% Impervious, Inflow Depth > 1.26" for 2 year storm event  
 Inflow = 0.20 cfs @ 12.15 hrs, Volume= 0.016 af  
 Outflow = 0.07 cfs @ 12.01 hrs, Volume= 0.016 af, Atten= 65%, Lag= 0.0 min  
 Discarded = 0.07 cfs @ 12.01 hrs, Volume= 0.016 af  
 Secondary = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Peak Elev= 214.68' @ 12.52 hrs Surf.Area= 536 sf Storage= 128 cf

Plug-Flow detention time= 11.1 min calculated for 0.016 af (100% of inflow)  
 Center-of-Mass det. time= 10.5 min ( 860.5 - 850.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	214.00'	436 cf	<b>31.50'W x 17.01'L x 2.83'H Field A</b> 1,518 cf Overall - 274 cf Embedded = 1,245 cf x 35.0% Voids
#2A	215.00'	274 cf	<b>ADS StormTech SC-310 x 18 Inside #1</b> Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 9 rows
		709 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	214.00'	<b>0.07 cfs Exfiltration at all elevations</b>
#2	Secondary	221.40'	<b>12.0" x 144.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.07 cfs @ 12.01 hrs HW=214.07' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.07 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.01 hrs HW=214.00' (Free Discharge)  
 ↑2=Orifice/Grate ( Controls 0.00 cfs)

**Pond INF 1: - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech SC-310 (ADS StormTech® SC-310 without end caps)**

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 2.07 sf x 9 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

2 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 14.68' Row Length +14.0" End Stone x 2 = 17.01' Base Length

9 Rows x 34.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 31.50' Base Width

12.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.83' Field Height

18 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 9 Rows = 273.5 cf Chamber Storage

1,518.3 cf Field - 273.5 cf Chambers = 1,244.8 cf Stone x 35.0% Voids = 435.7 cf Stone Storage

Chamber Storage + Stone Storage = 709.2 cf = 0.016 af

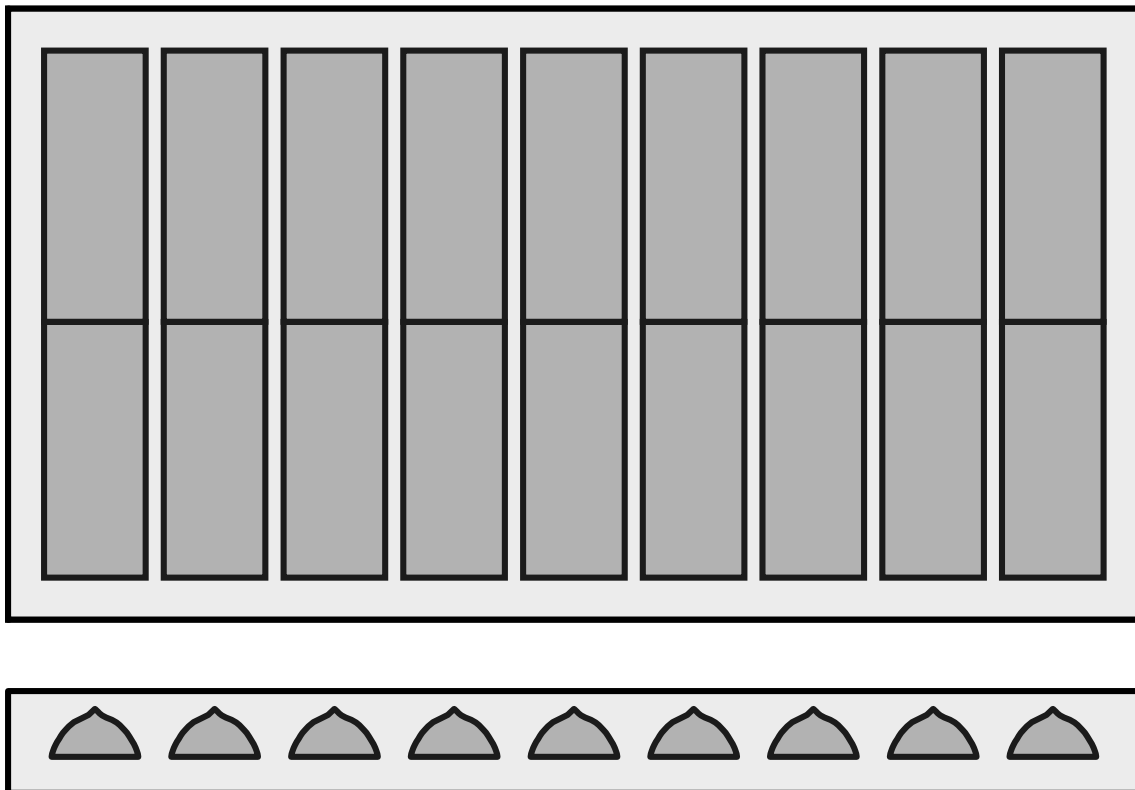
Overall Storage Efficiency = 46.7%

Overall System Size = 17.01' x 31.50' x 2.83'

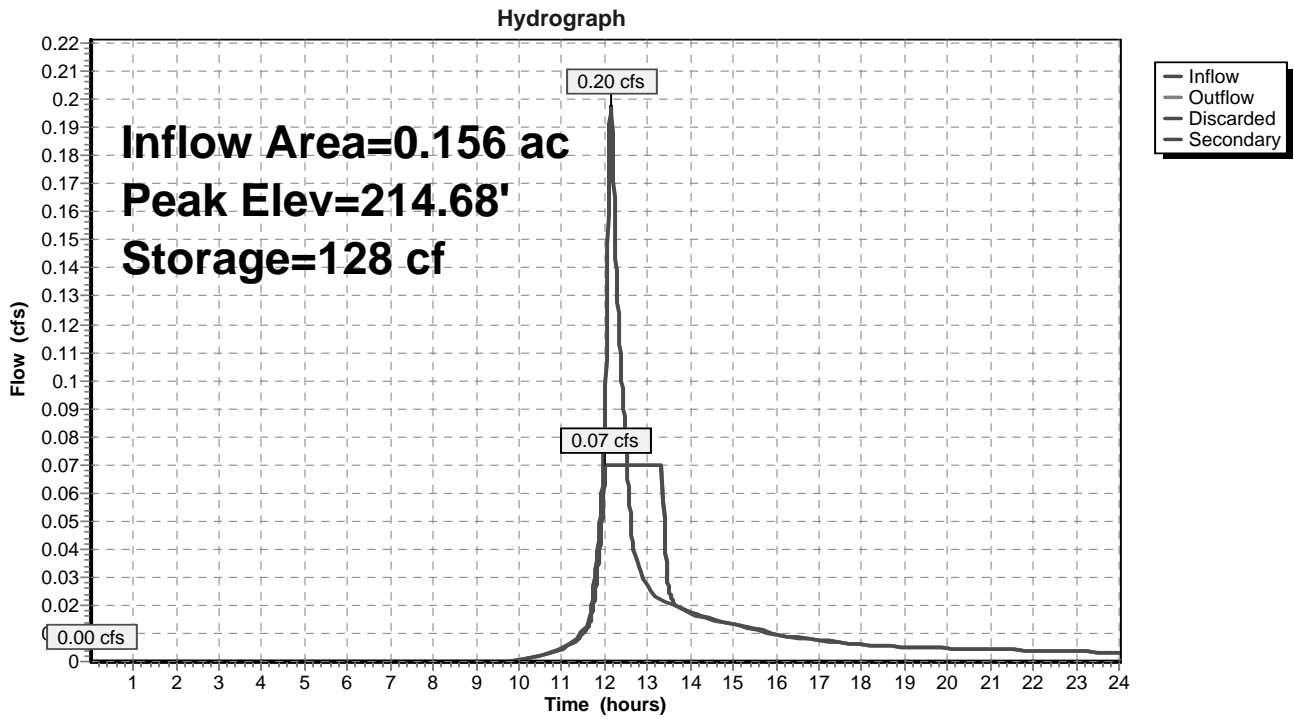
18 Chambers

56.2 cy Field

46.1 cy Stone



### Pond INF 1:



**Summary for Pond INF 2:**

Inflow Area = 1.894 ac, 27.15% Impervious, Inflow Depth > 1.26" for 2 year storm event  
 Inflow = 1.80 cfs @ 12.30 hrs, Volume= 0.198 af  
 Outflow = 1.75 cfs @ 12.36 hrs, Volume= 0.198 af, Atten= 2%, Lag= 3.1 min  
 Discarded = 0.10 cfs @ 11.53 hrs, Volume= 0.090 af  
 Secondary = 1.65 cfs @ 12.36 hrs, Volume= 0.108 af

Routing by Stor-Ind method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 212.81' @ 12.36 hrs Surf.Area= 699 sf Storage= 666 cf

Plug-Flow detention time= 17.3 min calculated for 0.198 af (100% of inflow)  
 Center-of-Mass det. time= 17.1 min ( 876.0 - 858.9 )

Volume	Invert	Avail.Storage	Storage Description
#1A	211.20'	610 cf	<b>26.92'W x 25.96'L x 3.50'H Field A</b> 2,446 cf Overall - 703 cf Embedded = 1,743 cf x 35.0% Voids
#2A	211.70'	703 cf	<b>ADS StormTech SC-740 x 15 Inside #1</b> Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 5 rows
		1,313 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	211.20'	<b>0.10 cfs Exfiltration at all elevations</b>
#2	Secondary	212.00'	<b>12.0" Round Culvert</b> L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 212.00' / 211.70' S= 0.0100 1' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.10 cfs @ 11.53 hrs HW=211.24' (Free Discharge)  
 ↑**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

**Secondary OutFlow** Max=1.65 cfs @ 12.36 hrs HW=212.81' (Free Discharge)  
 ↑**2=Culvert** (Inlet Controls 1.65 cfs @ 2.42 fps)

**Pond INF 2: - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech SC-740 (ADS StormTech® SC-740 without end caps)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 6.45 sf x 5 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

3 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 21.80' Row Length +25.0" End Stone x 2 = 25.96' Base Length

5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 22.0" Side Stone x 2 = 26.92' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

15 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 5 Rows = 703.2 cf Chamber Storage

2,446.1 cf Field - 703.2 cf Chambers = 1,742.9 cf Stone x 35.0% Voids = 610.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,313.2 cf = 0.030 af

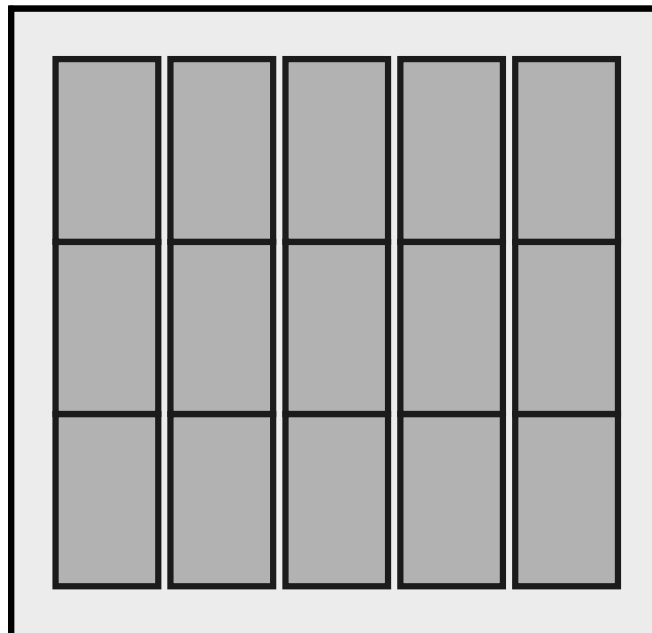
Overall Storage Efficiency = 53.7%

Overall System Size = 25.96' x 26.92' x 3.50'

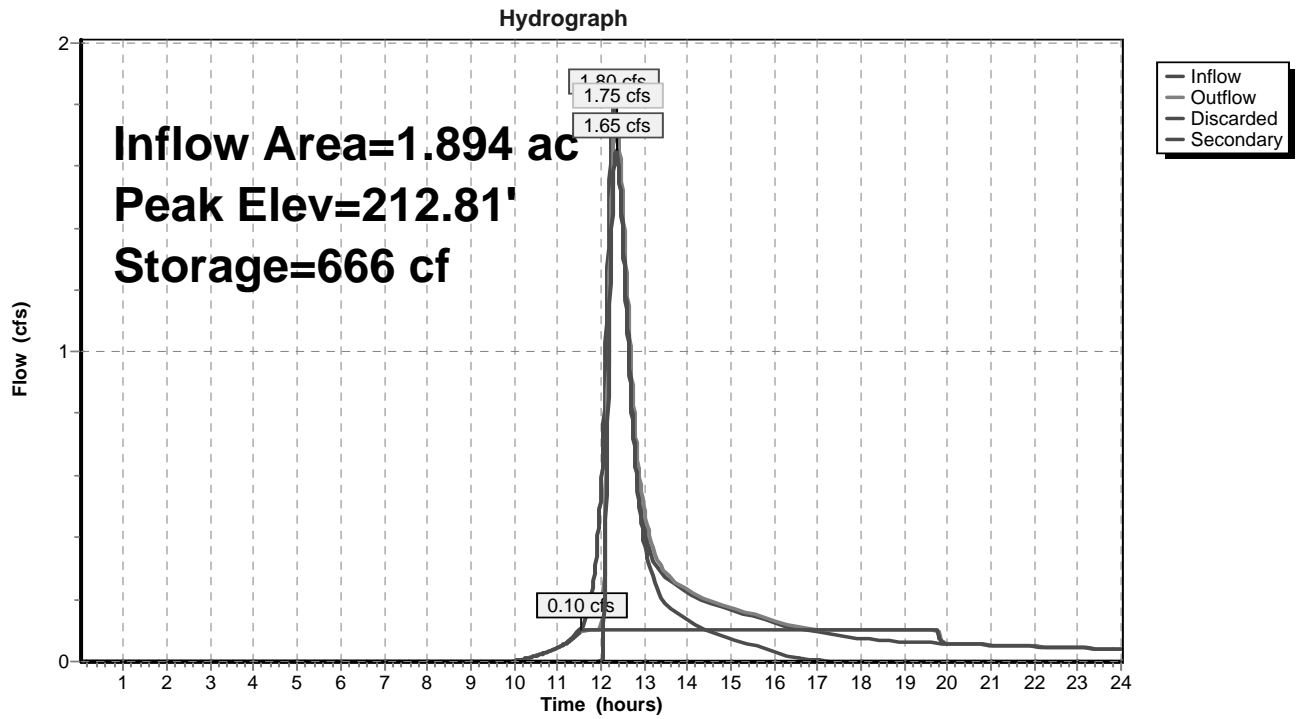
15 Chambers

90.6 cy Field

64.6 cy Stone



### Pond INF 2:

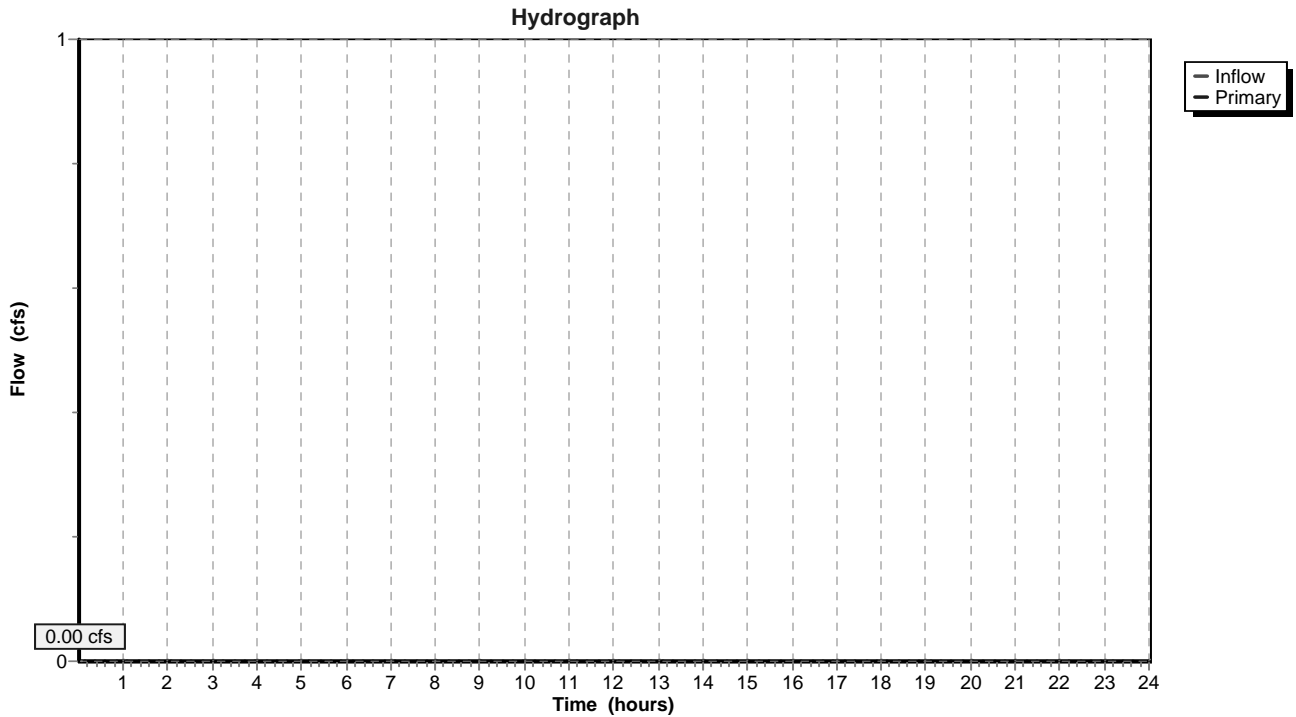


**Summary for Pond INF 3: (To be determined)**

Inflow = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af  
Primary = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs

**Pond INF 3: (To be determined)**



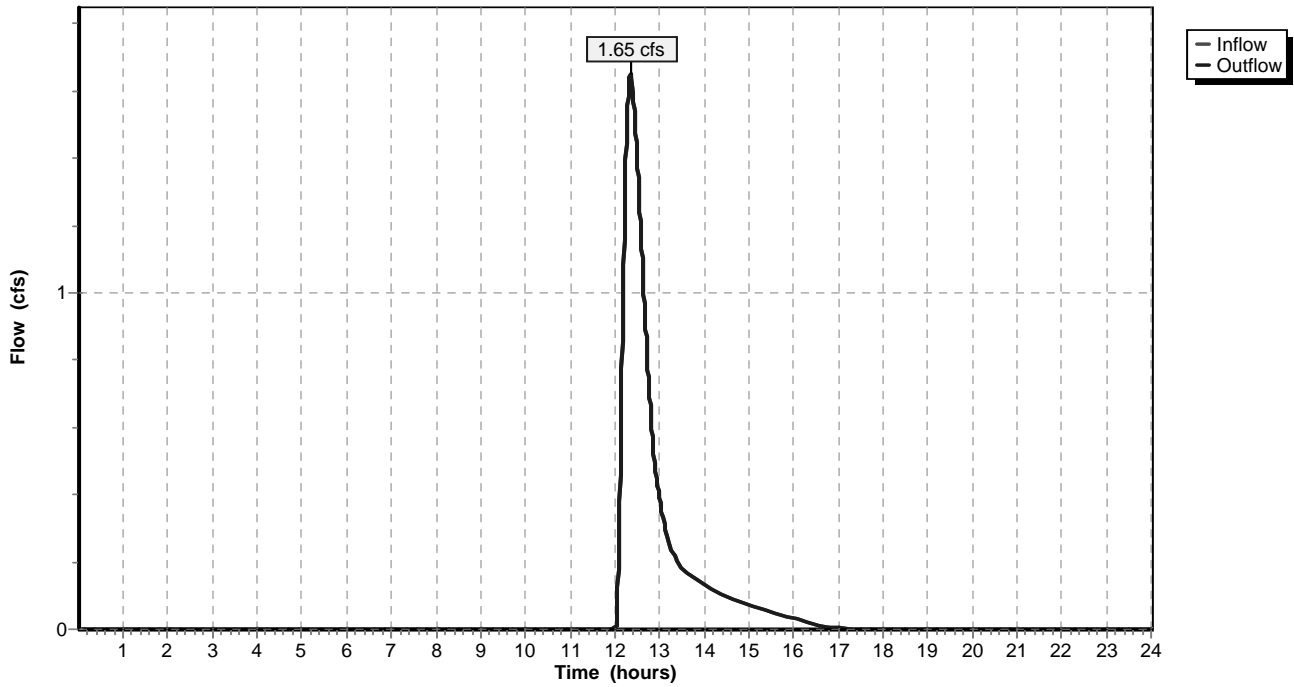
**Summary for Reach PR:**

Inflow = 1.65 cfs @ 12.36 hrs, Volume= 0.108 af  
Outflow = 1.65 cfs @ 12.36 hrs, Volume= 0.108 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs

**Reach PR:**

Hydrograph





**Rangeway Ext 08-07-19**

Type III 24-hr 2 year storm Rainfall=3.10"

Prepared by Frederick W. Russell, PE

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**Summary for Subcatchment PR COND:**

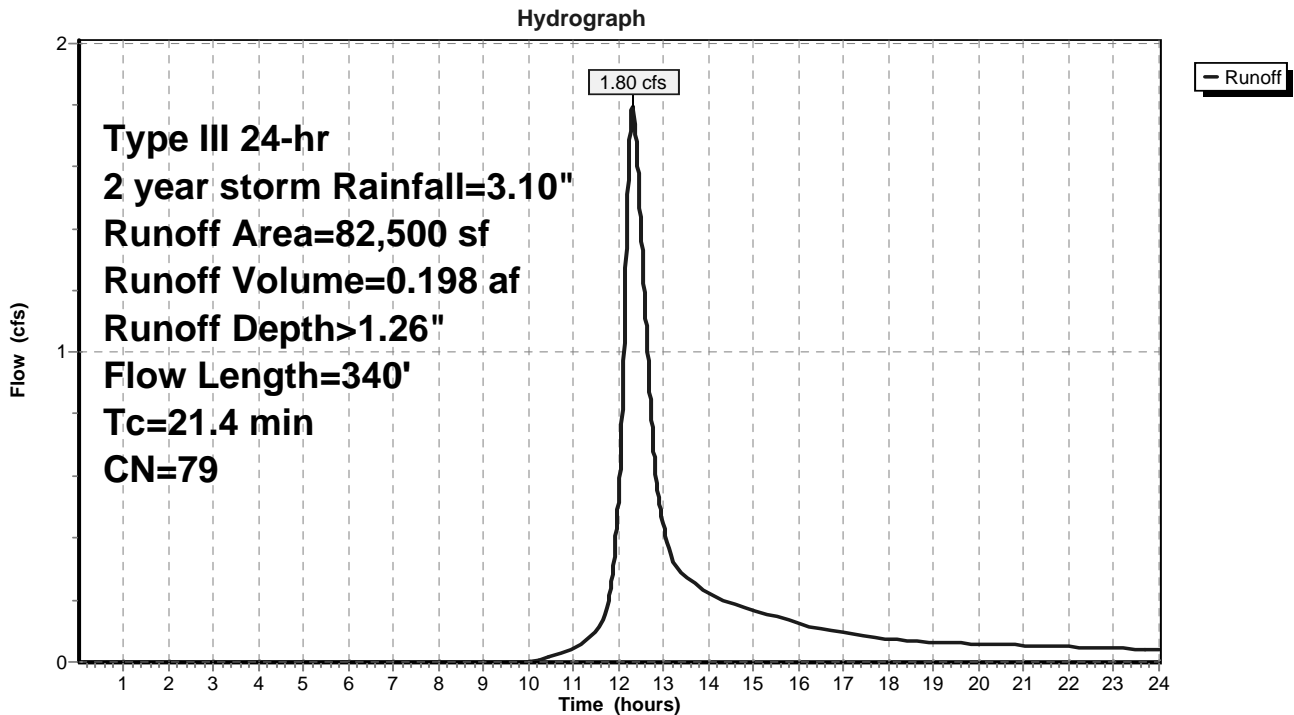
Runoff = 1.80 cfs @ 12.30 hrs, Volume= 0.198 af, Depth> 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2 year storm Rainfall=3.10"

Area (sf)	CN	Description
37,300	70	Woods, Good, HSG C
* 20,780	98	Paved roads, driveways & roofs, HSG C
* 1,620	98	Reclaimed paved roads, HSG C
22,800	74	>75% Grass cover, Good, HSG C
82,500	79	Weighted Average
60,100		72.85% Pervious Area
22,400		27.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	60	0.0330	0.05		<b>Sheet Flow,</b> Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	280	0.1500	6.24		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
21.4	340	Total			

**Subcatchment PR COND:**



**Rangeway Ext 08-07-19**

Type III 24-hr 2 year storm Rainfall=3.10"

Prepared by Frederick W. Russell, PE

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**Summary for Subcatchment Prop to CB:**

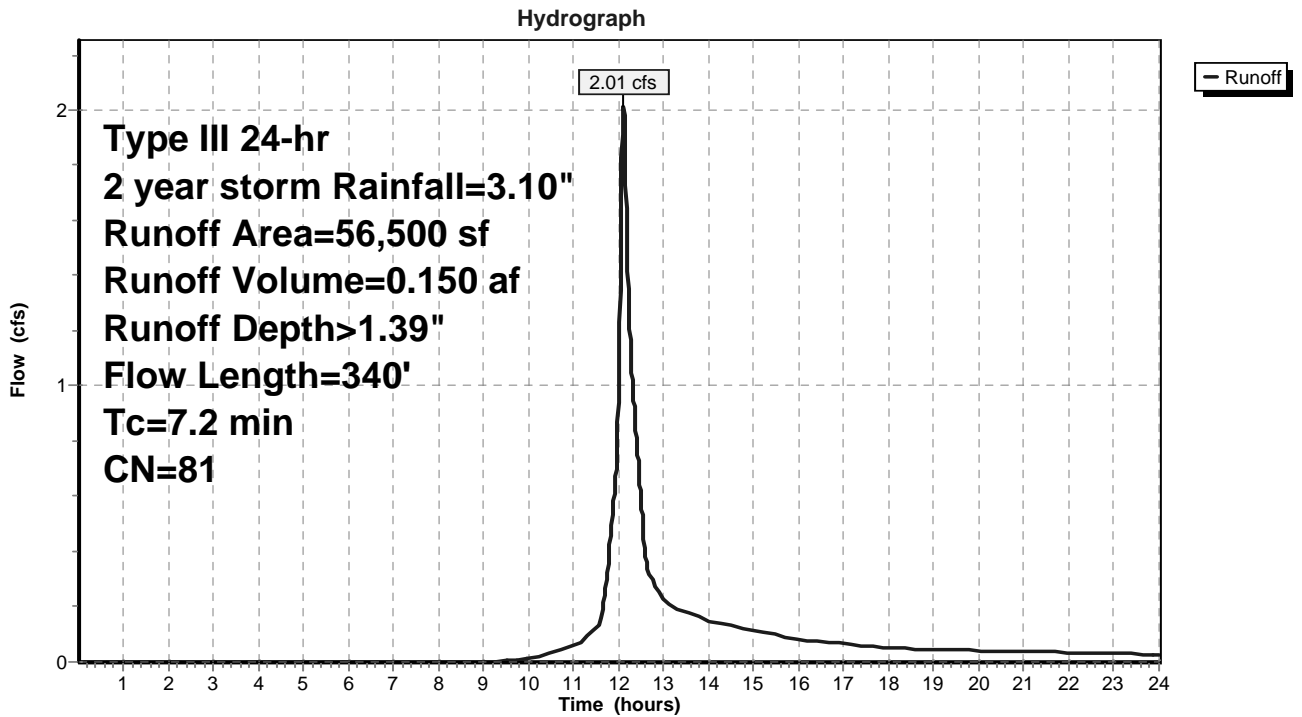
Runoff = 2.01 cfs @ 12.11 hrs, Volume= 0.150 af, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2 year storm Rainfall=3.10"

Area (sf)	CN	Description
2,100	70	Woods, Good, HSG C
* 15,260	98	Paved roads, driveways & roofs, HSG C
* 2,280	98	Reclaimed paved roads, HSG C
36,860	74	>75% Grass cover, Good, HSG C
56,500	81	Weighted Average
38,960		68.96% Pervious Area
17,540		31.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.10"
0.9	290	0.1200	5.58		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.2	340	Total			

**Subcatchment Prop to CB:**

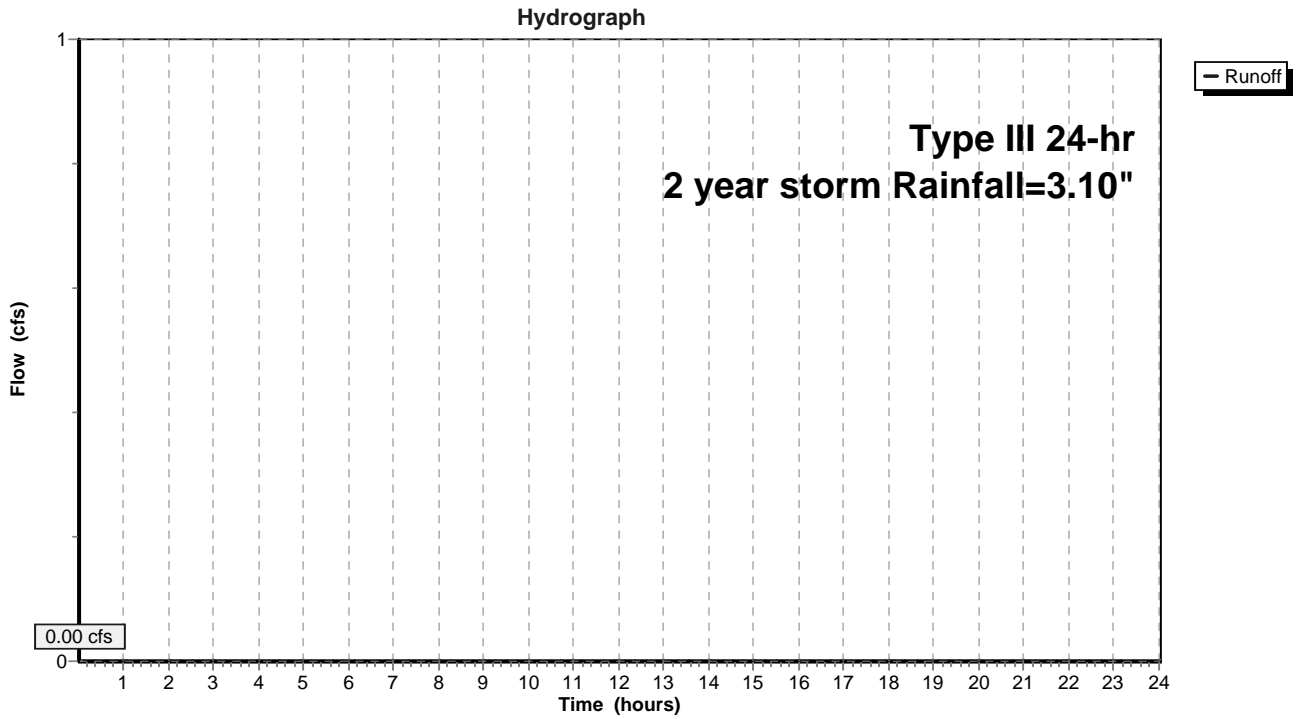


**Summary for Subcatchment Roof:**

Runoff = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2 year storm Rainfall=3.10"

**Subcatchment Roof:**



**Rangeway Ext 08-07-19**

Type III 24-hr 10 year storm Rainfall=4.55"

Prepared by Frederick W. Russell, PE

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Time span=0.01-24.00 hrs, dt=0.01 hrs, 2400 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment Drive drain:** Runoff Area=6,800 sf 25.00% Impervious Runoff Depth>2.41"  
 Tc=10.0 min CN=79 Runoff=0.39 cfs 0.031 af

**Subcatchment EX:** Runoff Area=90,600 sf 18.43% Impervious Runoff Depth>2.16"  
 Flow Length=340' Tc=21.4 min CN=76 Runoff=3.45 cfs 0.374 af

**Subcatchment Exist to CB:** Runoff Area=56,500 sf 30.62% Impervious Runoff Depth>2.59"  
 Flow Length=340' Tc=7.2 min CN=81 Runoff=3.78 cfs 0.280 af

**Pond INF 1:** Peak Elev=215.58' Storage=406 cf Inflow=0.39 cfs 0.031 af  
 Discarded=0.07 cfs 0.031 af Secondary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.031 af

**Pond INF 2:** Peak Elev=213.68' Storage=1,031 cf Inflow=3.52 cfs 0.380 af  
 Discarded=0.10 cfs 0.119 af Secondary=3.24 cfs 0.261 af Outflow=3.34 cfs 0.380 af

**Pond INF 3: (To be determined)** Inflow=0.00 cfs 0.000 af  
 Primary=0.00 cfs 0.000 af

**Reach PR:** Inflow=3.24 cfs 0.261 af  
 Outflow=3.24 cfs 0.261 af

**Subcatchment PR COND:** Runoff Area=82,500 sf 27.15% Impervious Runoff Depth>2.41"  
 Flow Length=340' Tc=21.4 min CN=79 Runoff=3.52 cfs 0.380 af

**Subcatchment Prop to CB:** Runoff Area=56,500 sf 31.04% Impervious Runoff Depth>2.59"  
 Flow Length=340' Tc=7.2 min CN=81 Runoff=3.78 cfs 0.280 af

**Subcatchment Roof:** Runoff=0.00 cfs 0.000 af

**Total Runoff Area = 6.724 ac Runoff Volume = 1.345 af Average Runoff Depth = 2.40"**  
**74.18% Pervious = 4.988 ac 25.82% Impervious = 1.736 ac**

**Summary for Subcatchment Drive drain:**

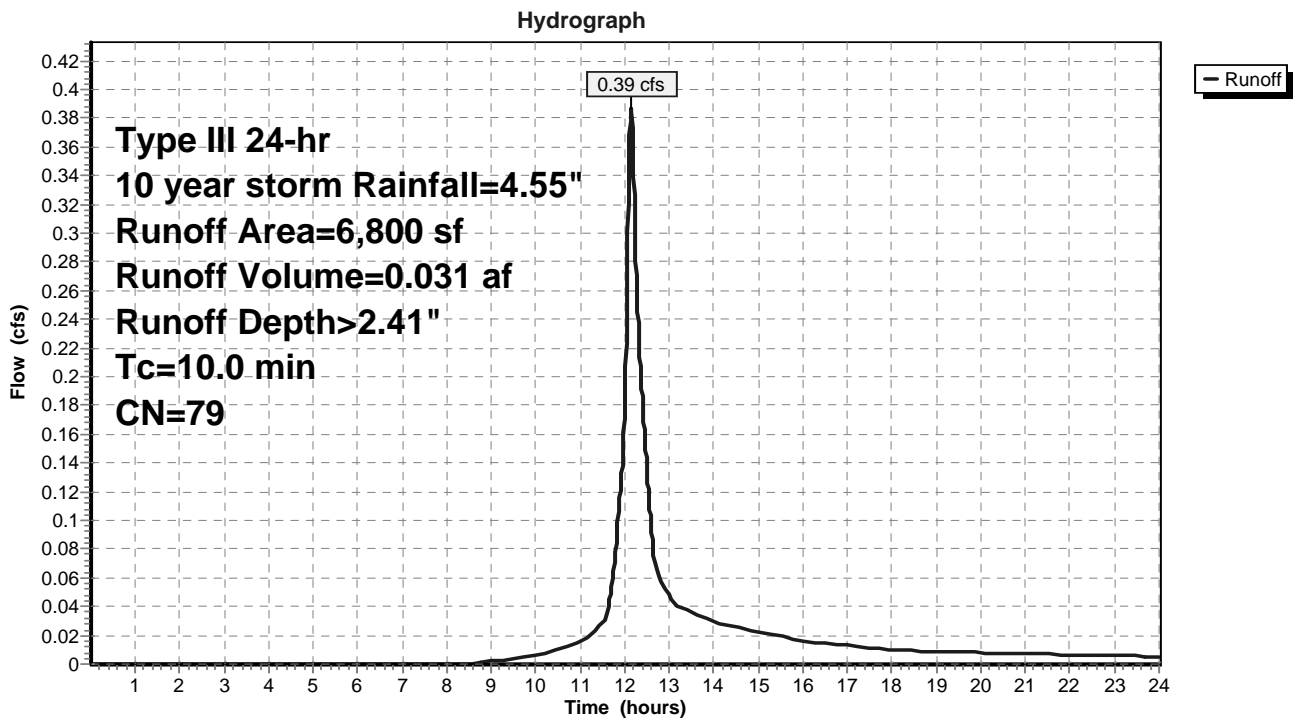
Runoff = 0.39 cfs @ 12.14 hrs, Volume= 0.031 af, Depth> 2.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10 year storm Rainfall=4.55"

Area (sf)	CN	Description
1,900	70	Woods, Good, HSG C
1,700	98	Paved parking, HSG C
3,200	74	>75% Grass cover, Good, HSG C
6,800	79	Weighted Average
5,100		75.00% Pervious Area
1,700		25.00% Impervious Area

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

**Subcatchment Drive drain:**



**Summary for Subcatchment EX:**

Runoff = 3.45 cfs @ 12.30 hrs, Volume= 0.374 af, Depth> 2.16"

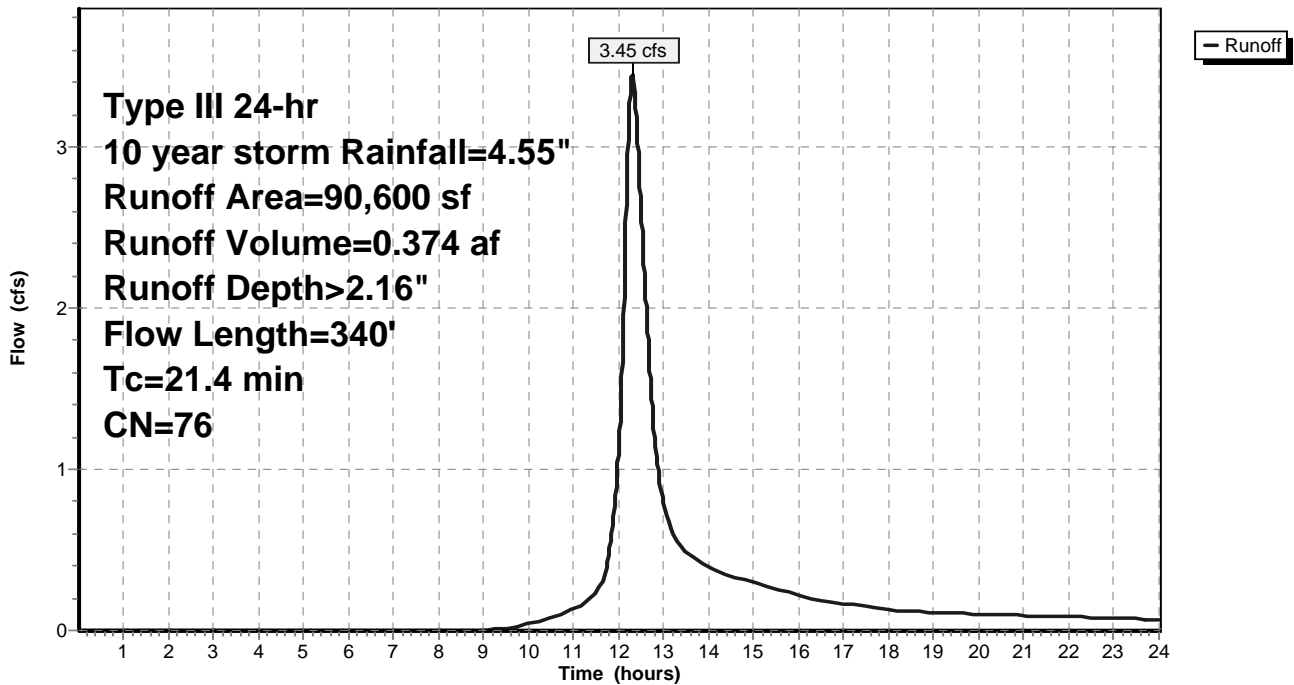
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10 year storm Rainfall=4.55"

Area (sf)	CN	Description
52,600	70	Woods, Good, HSG C
* 16,700	98	Paved roads, driveways and roofs, HSG C
21,300	74	>75% Grass cover, Good, HSG C
90,600	76	Weighted Average
73,900		81.57% Pervious Area
16,700		18.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	60	0.0330	0.05		<b>Sheet Flow,</b> Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	280	0.1500	6.24		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
21.4	340	Total			

**Subcatchment EX:**

Hydrograph



**Summary for Subcatchment Exist to CB:**

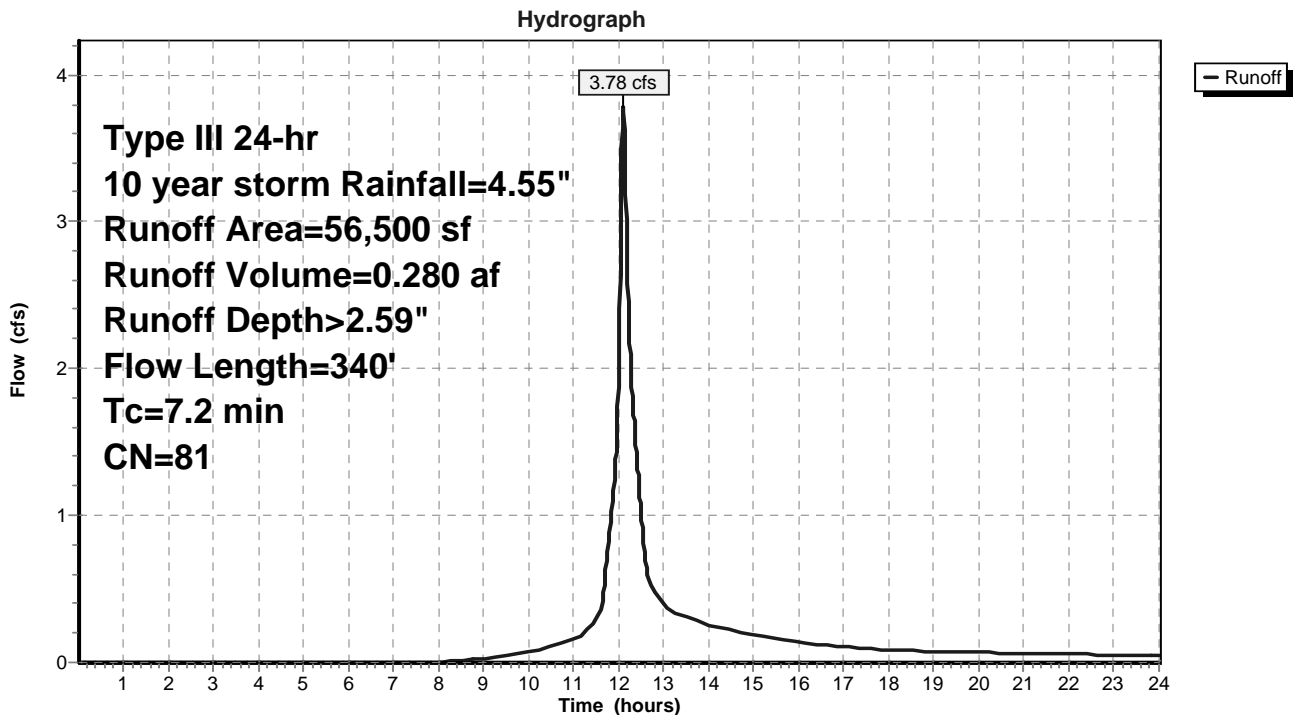
Runoff = 3.78 cfs @ 12.10 hrs, Volume= 0.280 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10 year storm Rainfall=4.55"

Area (sf)	CN	Description
2,100	70	Woods, Good, HSG C
* 17,300	98	Paved roads, driveways & roofs, HSG C
37,100	74	>75% Grass cover, Good, HSG C
56,500	81	Weighted Average
39,200		69.38% Pervious Area
17,300		30.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.10"
0.9	290	0.1200	5.58		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.2	340	Total			

**Subcatchment Exist to CB:**



**Summary for Pond INF 1:**

Inflow Area = 0.156 ac, 25.00% Impervious, Inflow Depth > 2.41" for 10 year storm event  
 Inflow = 0.39 cfs @ 12.14 hrs, Volume= 0.031 af  
 Outflow = 0.07 cfs @ 11.82 hrs, Volume= 0.031 af, Atten= 82%, Lag= 0.0 min  
 Discarded = 0.07 cfs @ 11.82 hrs, Volume= 0.031 af  
 Secondary = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Peak Elev= 215.58' @ 12.68 hrs Surf.Area= 536 sf Storage= 406 cf

Plug-Flow detention time= 40.2 min calculated for 0.031 af (100% of inflow)  
 Center-of-Mass det. time= 39.8 min ( 870.9 - 831.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	214.00'	436 cf	<b>31.50'W x 17.01'L x 2.83'H Field A</b> 1,518 cf Overall - 274 cf Embedded = 1,245 cf x 35.0% Voids
#2A	215.00'	274 cf	<b>ADS StormTech SC-310 x 18 Inside #1</b> Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 9 rows
		709 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	214.00'	<b>0.07 cfs Exfiltration at all elevations</b>
#2	Secondary	221.40'	<b>12.0" x 144.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.07 cfs @ 11.82 hrs HW=214.08' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.07 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.01 hrs HW=214.00' (Free Discharge)  
 ↑2=Orifice/Grate ( Controls 0.00 cfs)



**Pond INF 1: - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech SC-310 (ADS StormTech® SC-310 without end caps)**

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 2.07 sf x 9 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

2 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 14.68' Row Length +14.0" End Stone x 2 = 17.01' Base Length

9 Rows x 34.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 31.50' Base Width

12.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.83' Field Height

18 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 9 Rows = 273.5 cf Chamber Storage

1,518.3 cf Field - 273.5 cf Chambers = 1,244.8 cf Stone x 35.0% Voids = 435.7 cf Stone Storage

Chamber Storage + Stone Storage = 709.2 cf = 0.016 af

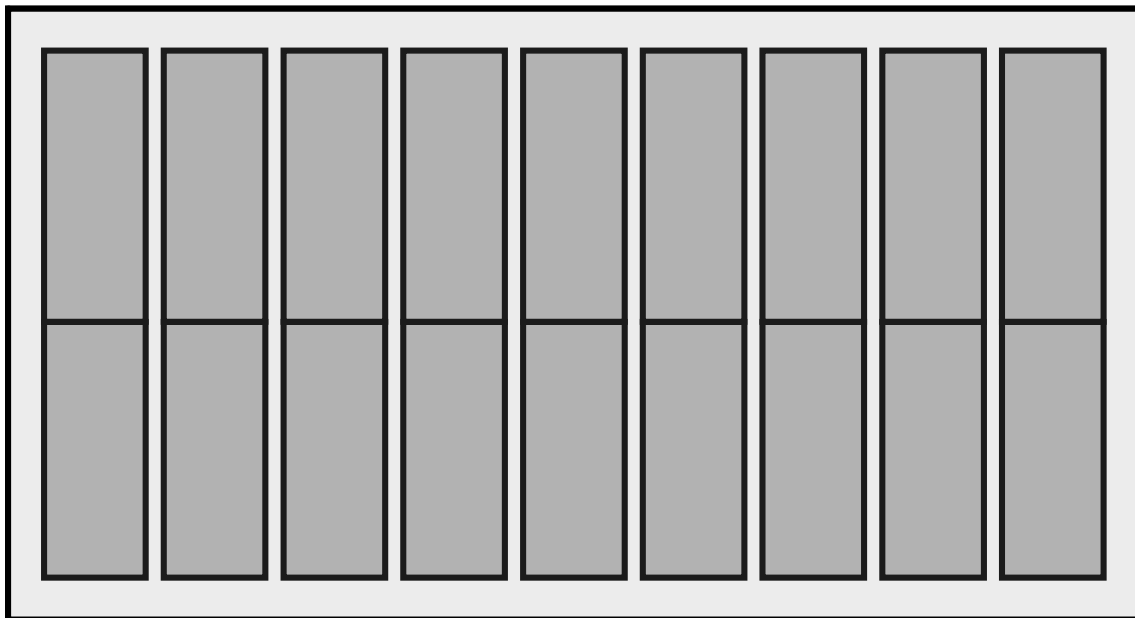
Overall Storage Efficiency = 46.7%

Overall System Size = 17.01' x 31.50' x 2.83'

18 Chambers

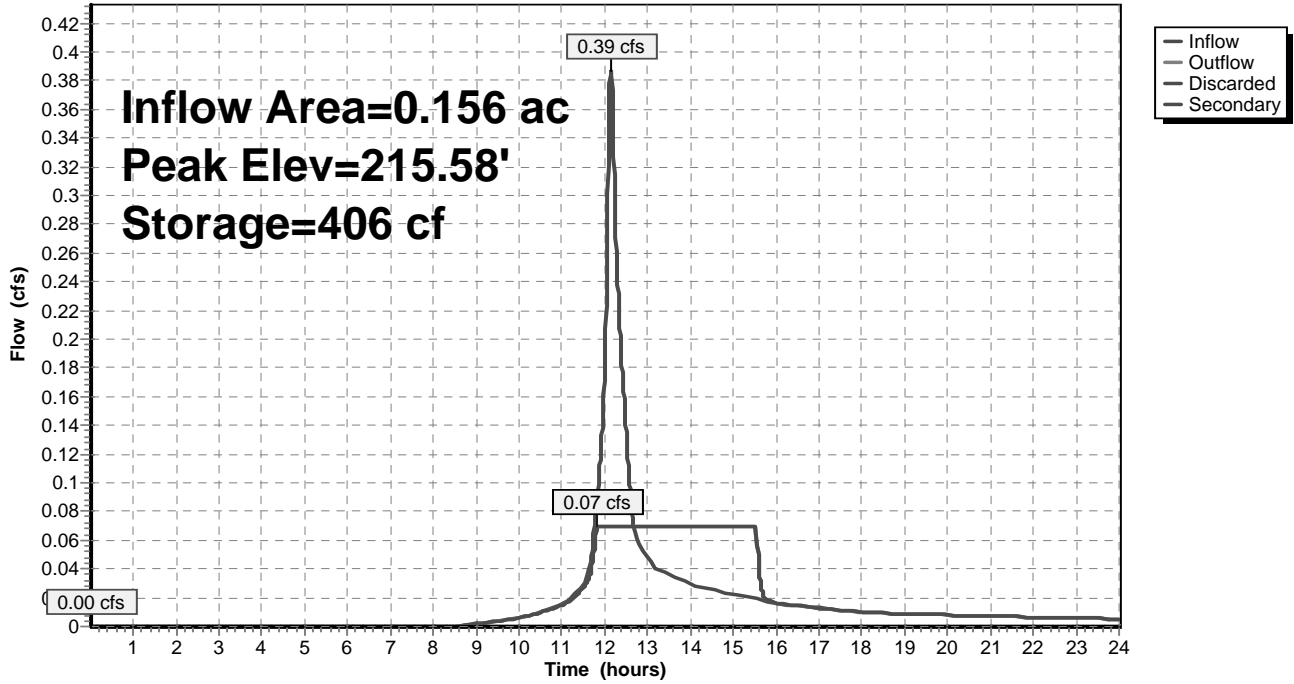
56.2 cy Field

46.1 cy Stone



**Pond INF 1:**

Hydrograph



**Summary for Pond INF 2:**

Inflow Area = 1.894 ac, 27.15% Impervious, Inflow Depth > 2.41" for 10 year storm event  
 Inflow = 3.52 cfs @ 12.29 hrs, Volume= 0.380 af  
 Outflow = 3.34 cfs @ 12.37 hrs, Volume= 0.380 af, Atten= 5%, Lag= 4.4 min  
 Discarded = 0.10 cfs @ 10.46 hrs, Volume= 0.119 af  
 Secondary = 3.24 cfs @ 12.37 hrs, Volume= 0.261 af

Routing by Stor-Ind method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 213.68' @ 12.37 hrs Surf.Area= 699 sf Storage= 1,031 cf

Plug-Flow detention time= 15.7 min calculated for 0.380 af (100% of inflow)  
 Center-of-Mass det. time= 15.5 min ( 855.7 - 840.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	211.20'	610 cf	<b>26.92'W x 25.96'L x 3.50'H Field A</b> 2,446 cf Overall - 703 cf Embedded = 1,743 cf x 35.0% Voids
#2A	211.70'	703 cf	<b>ADS StormTech SC-740 x 15 Inside #1</b> Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 5 rows
		1,313 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	211.20'	<b>0.10 cfs Exfiltration at all elevations</b>
#2	Secondary	212.00'	<b>12.0" Round Culvert</b> L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 212.00' / 211.70' S= 0.0100 1' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.10 cfs @ 10.46 hrs HW=211.24' (Free Discharge)  
 ↑**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

**Secondary OutFlow** Max=3.24 cfs @ 12.37 hrs HW=213.67' (Free Discharge)  
 ↑**2=Culvert** (Inlet Controls 3.24 cfs @ 4.12 fps)

**Pond INF 2: - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech SC-740 (ADS StormTech® SC-740 without end caps)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 6.45 sf x 5 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

3 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 21.80' Row Length +25.0" End Stone x 2 = 25.96' Base Length

5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 22.0" Side Stone x 2 = 26.92' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

15 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 5 Rows = 703.2 cf Chamber Storage

2,446.1 cf Field - 703.2 cf Chambers = 1,742.9 cf Stone x 35.0% Voids = 610.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,313.2 cf = 0.030 af

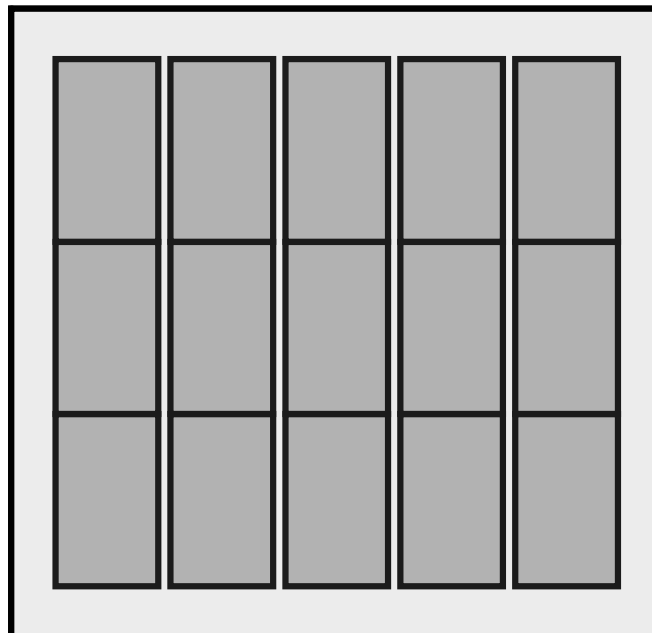
Overall Storage Efficiency = 53.7%

Overall System Size = 25.96' x 26.92' x 3.50'

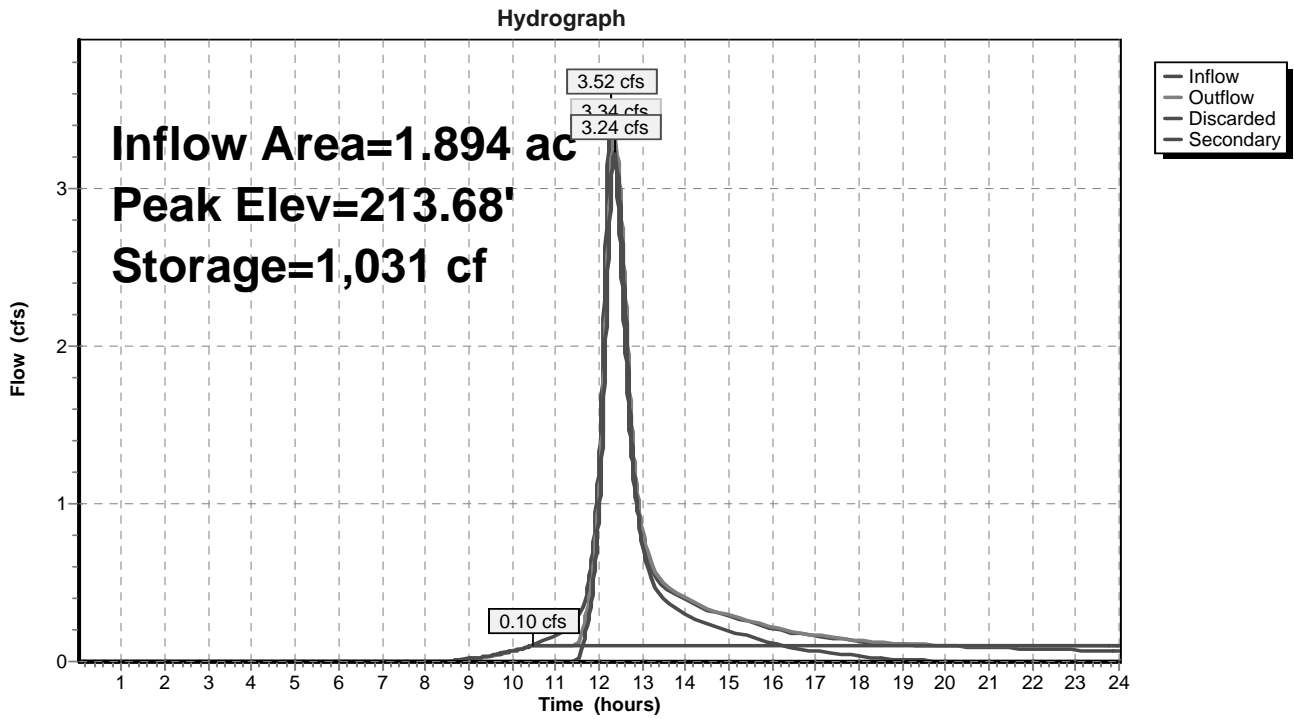
15 Chambers

90.6 cy Field

64.6 cy Stone



**Pond INF 2:**

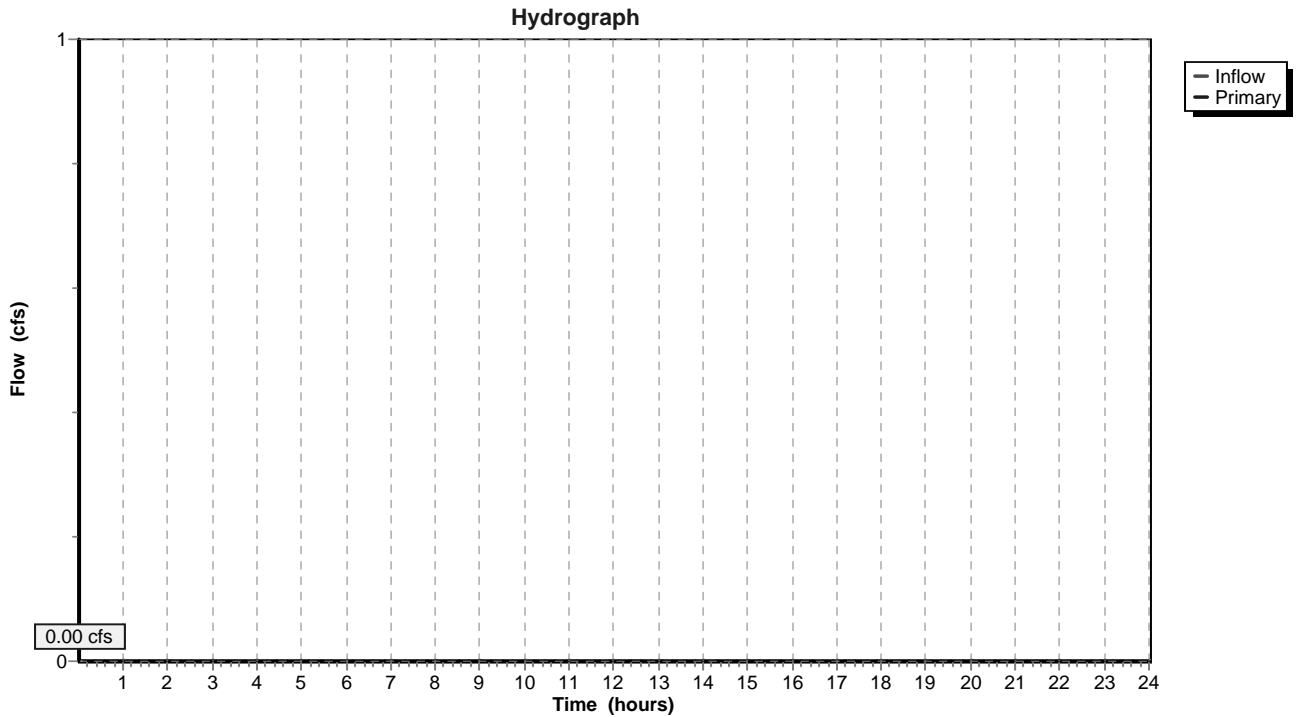


**Summary for Pond INF 3: (To be determined)**

Inflow = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af  
Primary = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs

**Pond INF 3: (To be determined)**



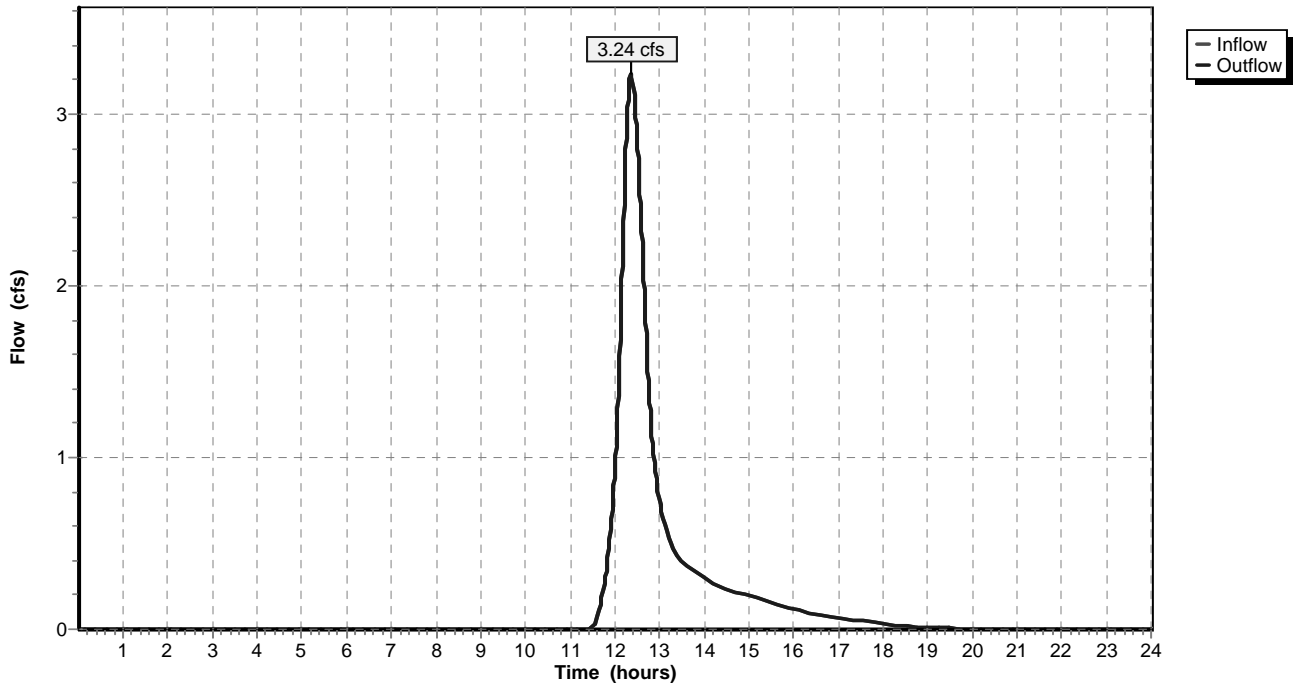
**Summary for Reach PR:**

Inflow = 3.24 cfs @ 12.37 hrs, Volume= 0.261 af  
Outflow = 3.24 cfs @ 12.37 hrs, Volume= 0.261 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs

**Reach PR:**

Hydrograph



**Summary for Subcatchment PR COND:**

Runoff = 3.52 cfs @ 12.29 hrs, Volume= 0.380 af, Depth> 2.41"

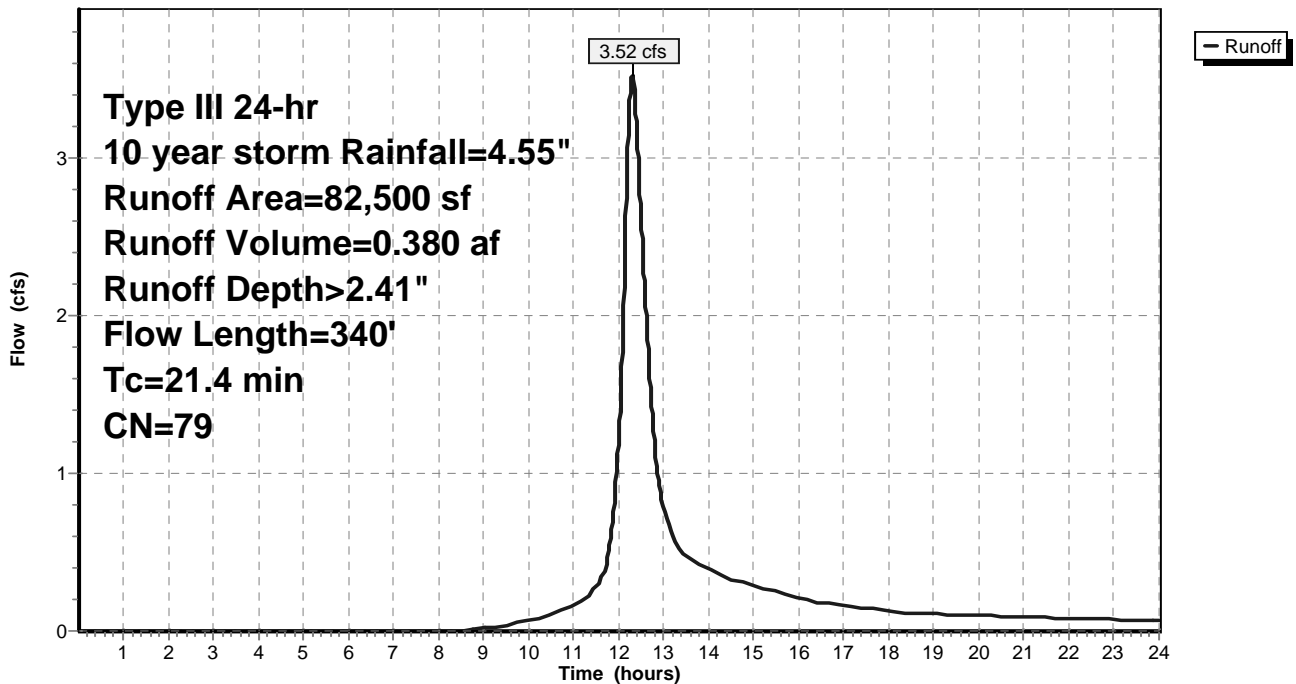
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10 year storm Rainfall=4.55"

Area (sf)	CN	Description
37,300	70	Woods, Good, HSG C
* 20,780	98	Paved roads, driveways & roofs, HSG C
* 1,620	98	Reclaimed paved roads, HSG C
22,800	74	>75% Grass cover, Good, HSG C
82,500	79	Weighted Average
60,100		72.85% Pervious Area
22,400		27.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	60	0.0330	0.05		<b>Sheet Flow,</b> Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	280	0.1500	6.24		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
21.4	340	Total			

**Subcatchment PR COND:**

Hydrograph





**Rangeway Ext 08-07-19**

Type III 24-hr 10 year storm Rainfall=4.55"

Prepared by Frederick W. Russell, PE

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**Summary for Subcatchment Prop to CB:**

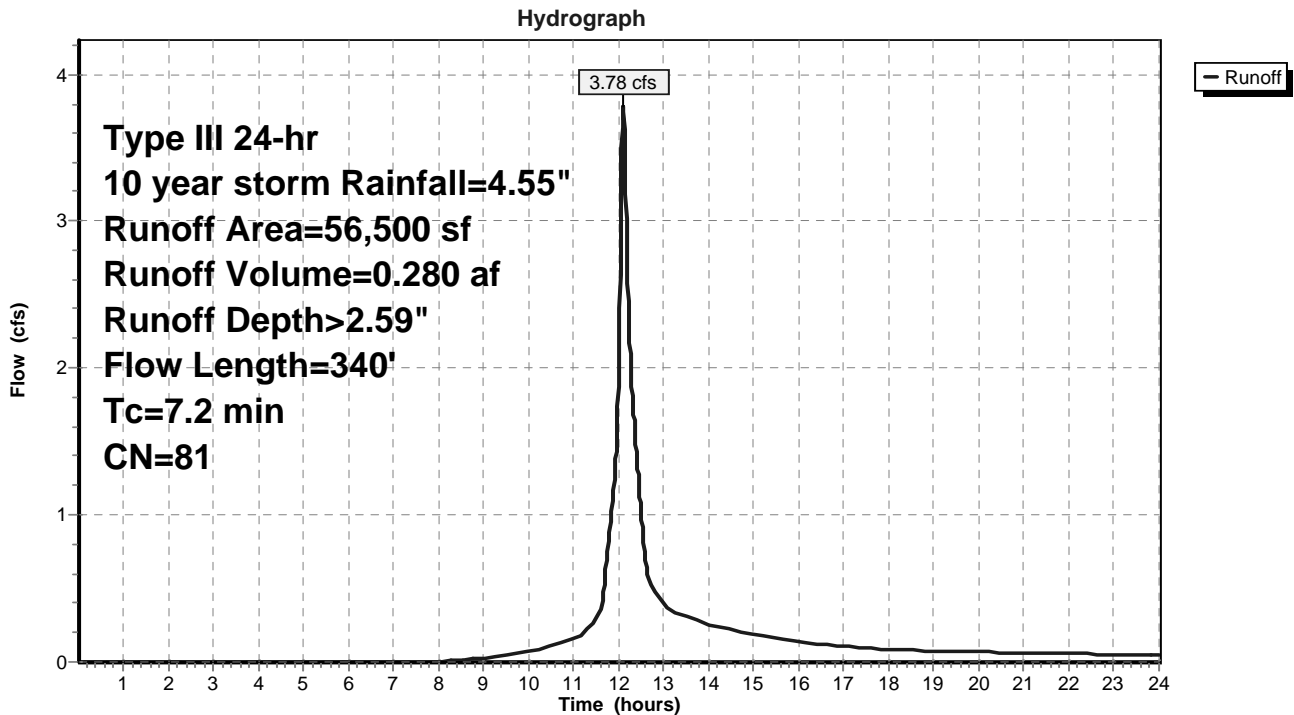
Runoff = 3.78 cfs @ 12.10 hrs, Volume= 0.280 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10 year storm Rainfall=4.55"

Area (sf)	CN	Description
2,100	70	Woods, Good, HSG C
* 15,260	98	Paved roads, driveways & roofs, HSG C
* 2,280	98	Reclaimed paved roads, HSG C
36,860	74	>75% Grass cover, Good, HSG C
56,500	81	Weighted Average
38,960		68.96% Pervious Area
17,540		31.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.10"
0.9	290	0.1200	5.58		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.2	340	Total			

**Subcatchment Prop to CB:**

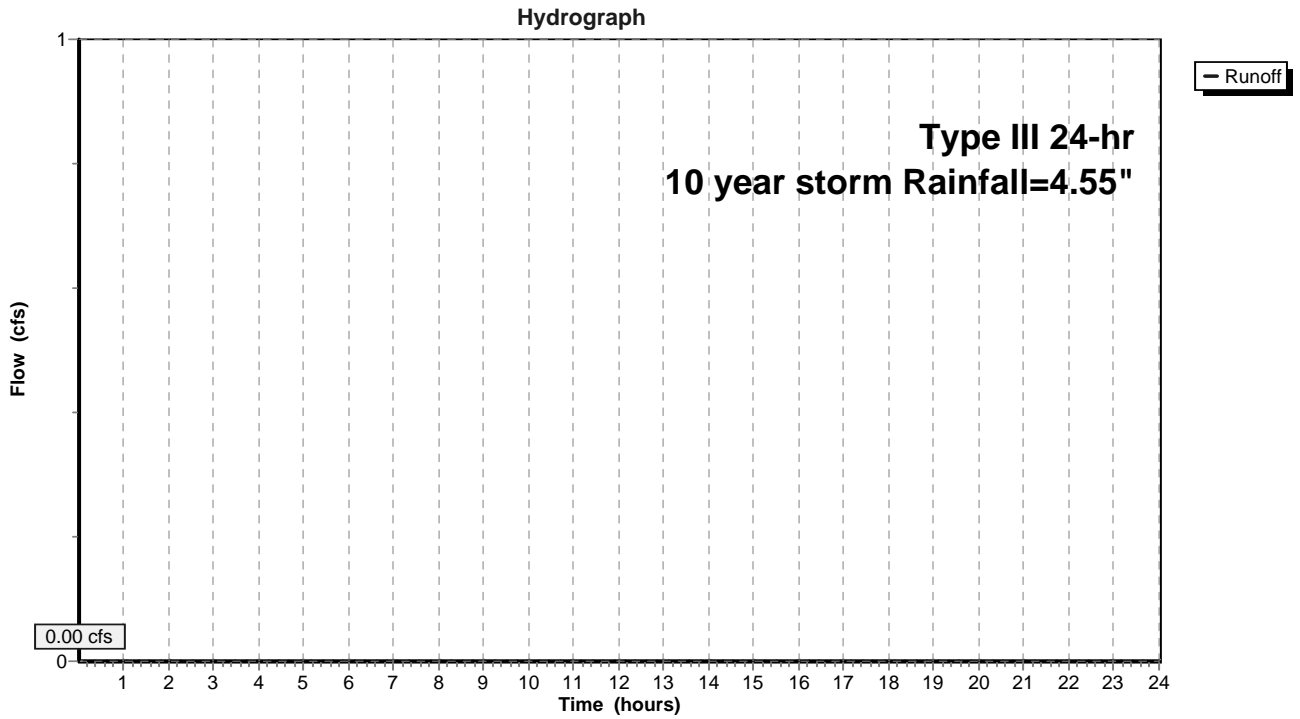


**Summary for Subcatchment Roof:**

Runoff = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10 year storm Rainfall=4.55"

**Subcatchment Roof:**



**Rangeway Ext 08-07-19**

Type III 24-hr 100 year storm Rainfall=6.50"

Prepared by Frederick W. Russell, PE

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Time span=0.01-24.00 hrs, dt=0.01 hrs, 2400 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment Drive drain:** Runoff Area=6,800 sf 25.00% Impervious Runoff Depth>4.12"  
 Tc=10.0 min CN=79 Runoff=0.66 cfs 0.054 af

**Subcatchment EX:** Runoff Area=90,600 sf 18.43% Impervious Runoff Depth>3.80"  
 Flow Length=340' Tc=21.4 min CN=76 Runoff=6.11 cfs 0.658 af

**Subcatchment Exist to CB:** Runoff Area=56,500 sf 30.62% Impervious Runoff Depth>4.34"  
 Flow Length=340' Tc=7.2 min CN=81 Runoff=6.28 cfs 0.469 af

**Pond INF 1:** Peak Elev=221.42' Storage=709 cf Inflow=0.66 cfs 0.054 af  
 Discarded=0.07 cfs 0.050 af Secondary=0.44 cfs 0.004 af Outflow=0.51 cfs 0.054 af

**Pond INF 2:** Peak Elev=215.76' Storage=1,313 cf Inflow=6.00 cfs 0.649 af  
 Discarded=0.10 cfs 0.130 af Secondary=5.39 cfs 0.503 af Outflow=5.49 cfs 0.633 af

**Pond INF 3: (To be determined)** Inflow=0.00 cfs 0.000 af  
 Primary=0.00 cfs 0.000 af

**Reach PR:** Inflow=5.39 cfs 0.507 af  
 Outflow=5.39 cfs 0.507 af

**Subcatchment PR COND:** Runoff Area=82,500 sf 27.15% Impervious Runoff Depth>4.11"  
 Flow Length=340' Tc=21.4 min CN=79 Runoff=6.00 cfs 0.649 af

**Subcatchment Prop to CB:** Runoff Area=56,500 sf 31.04% Impervious Runoff Depth>4.34"  
 Flow Length=340' Tc=7.2 min CN=81 Runoff=6.28 cfs 0.469 af

**Subcatchment Roof:** Runoff=0.00 cfs 0.000 af

**Total Runoff Area = 6.724 ac Runoff Volume = 2.299 af Average Runoff Depth = 4.10"**  
**74.18% Pervious = 4.988 ac 25.82% Impervious = 1.736 ac**

**Summary for Subcatchment Drive drain:**

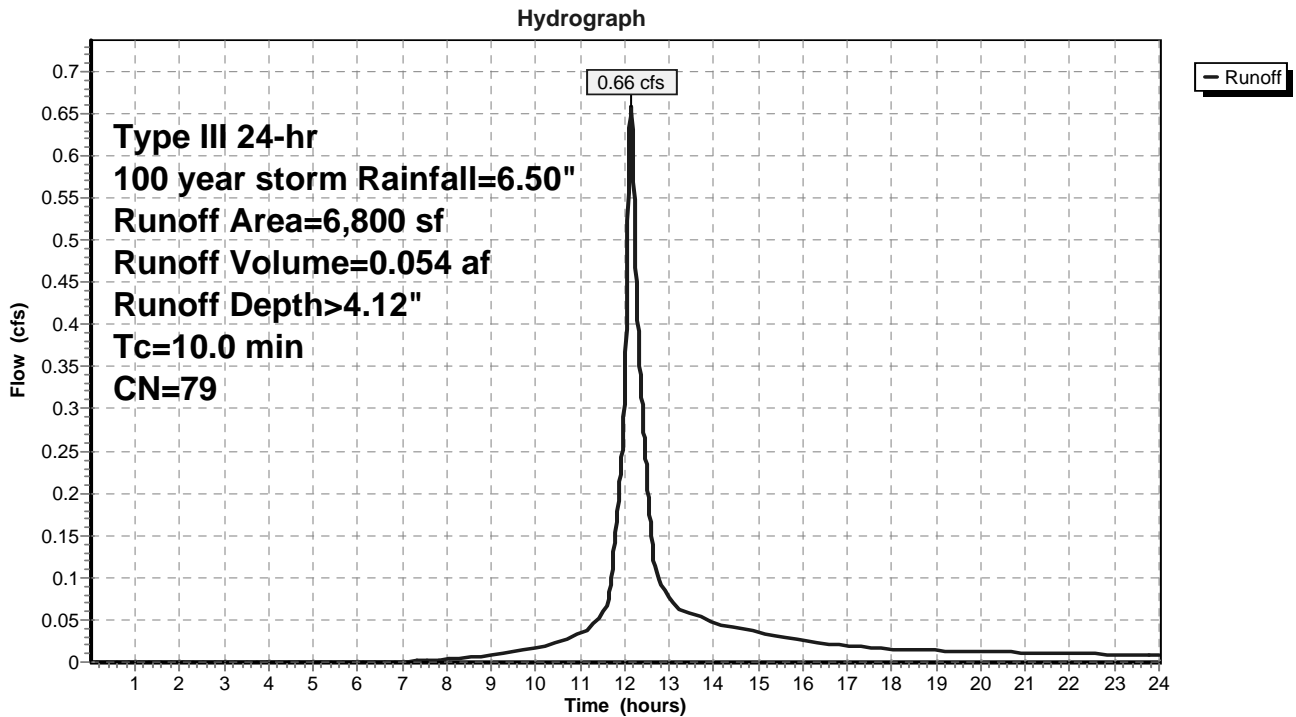
Runoff = 0.66 cfs @ 12.14 hrs, Volume= 0.054 af, Depth> 4.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100 year storm Rainfall=6.50"

Area (sf)	CN	Description
1,900	70	Woods, Good, HSG C
1,700	98	Paved parking, HSG C
3,200	74	>75% Grass cover, Good, HSG C
6,800	79	Weighted Average
5,100		75.00% Pervious Area
1,700		25.00% Impervious Area

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

**Subcatchment Drive drain:**



**Summary for Subcatchment EX:**

Runoff = 6.11 cfs @ 12.29 hrs, Volume= 0.658 af, Depth> 3.80"

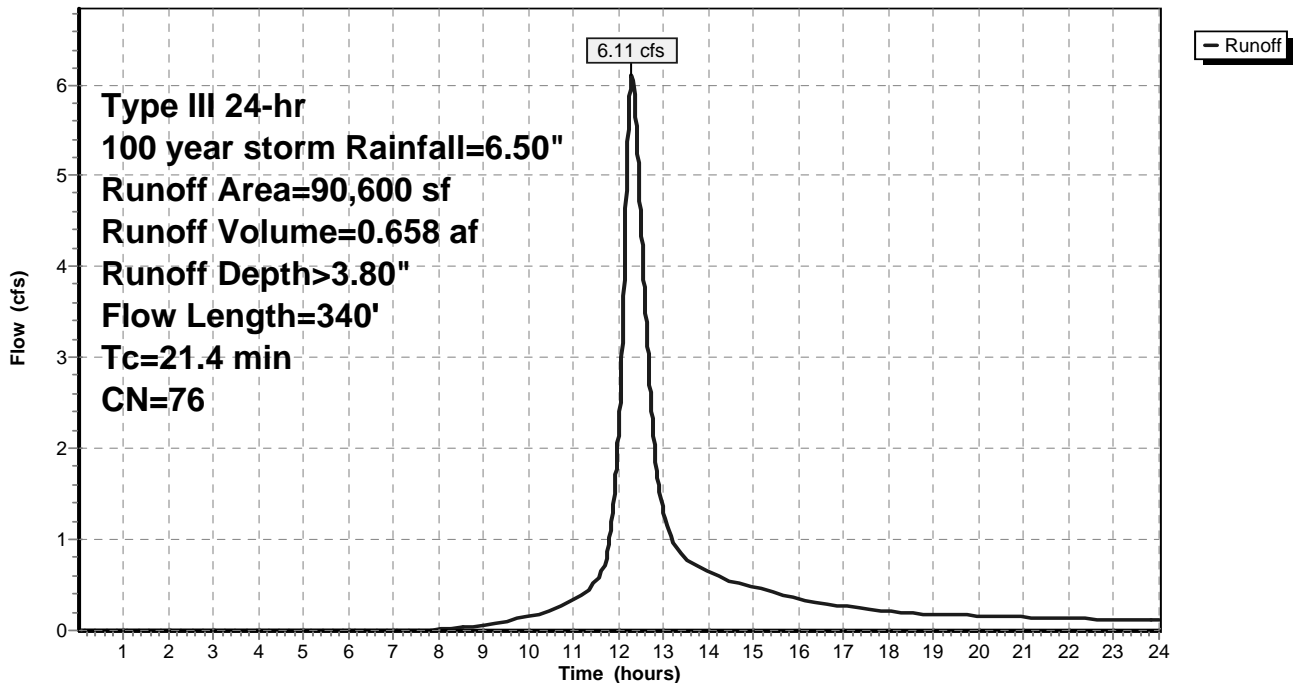
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100 year storm Rainfall=6.50"

Area (sf)	CN	Description
52,600	70	Woods, Good, HSG C
* 16,700	98	Paved roads, driveways and roofs, HSG C
21,300	74	>75% Grass cover, Good, HSG C
90,600	76	Weighted Average
73,900		81.57% Pervious Area
16,700		18.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	60	0.0330	0.05		<b>Sheet Flow,</b> Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	280	0.1500	6.24		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
21.4	340	Total			

**Subcatchment EX:**

Hydrograph



**Summary for Subcatchment Exist to CB:**

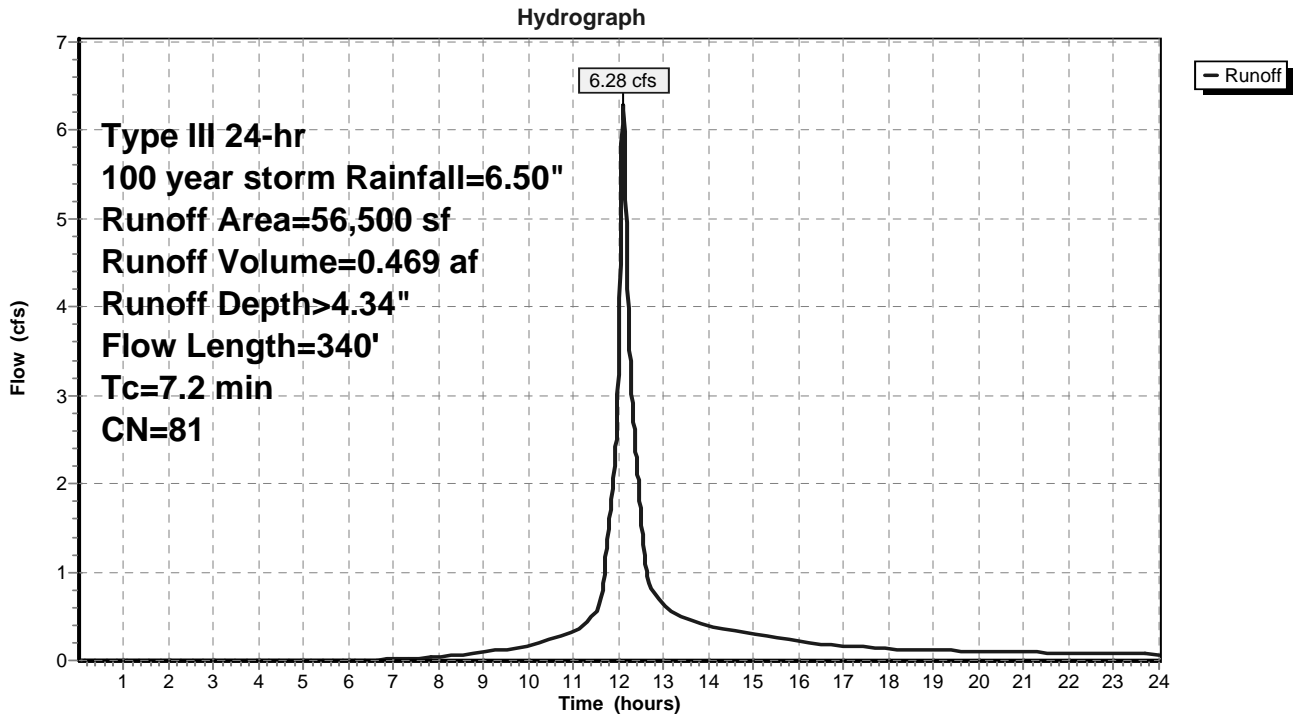
Runoff = 6.28 cfs @ 12.10 hrs, Volume= 0.469 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100 year storm Rainfall=6.50"

Area (sf)	CN	Description
2,100	70	Woods, Good, HSG C
* 17,300	98	Paved roads, driveways & roofs, HSG C
37,100	74	>75% Grass cover, Good, HSG C
56,500	81	Weighted Average
39,200		69.38% Pervious Area
17,300		30.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.10"
0.9	290	0.1200	5.58		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.2	340	Total			

**Subcatchment Exist to CB:**



**Summary for Pond INF 1:**

Inflow Area = 0.156 ac, 25.00% Impervious, Inflow Depth > 4.12" for 100 year storm event  
 Inflow = 0.66 cfs @ 12.14 hrs, Volume= 0.054 af  
 Outflow = 0.51 cfs @ 12.38 hrs, Volume= 0.054 af, Atten= 22%, Lag= 14.5 min  
 Discarded = 0.07 cfs @ 11.65 hrs, Volume= 0.050 af  
 Secondary = 0.44 cfs @ 12.38 hrs, Volume= 0.004 af

Routing by Stor-Ind method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Peak Elev= 221.42' @ 12.38 hrs Surf.Area= 536 sf Storage= 709 cf

Plug-Flow detention time= 75.7 min calculated for 0.054 af (100% of inflow)  
 Center-of-Mass det. time= 75.3 min ( 891.2 - 815.9 )

Volume	Invert	Avail.Storage	Storage Description
#1A	214.00'	436 cf	<b>31.50'W x 17.01'L x 2.83'H Field A</b> 1,518 cf Overall - 274 cf Embedded = 1,245 cf x 35.0% Voids
#2A	215.00'	274 cf	<b>ADS StormTech SC-310 x 18 Inside #1</b> Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 9 rows
		709 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	214.00'	<b>0.07 cfs Exfiltration at all elevations</b>
#2	Secondary	221.40'	<b>12.0" x 144.0" Horiz. Orifice/Grate C= 0.600</b> Limited to weir flow at low heads

**Discarded OutFlow** Max=0.07 cfs @ 11.65 hrs HW=214.07' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.07 cfs)

**Secondary OutFlow** Max=0.22 cfs @ 12.38 hrs HW=221.42' (Free Discharge)  
 ↑2=Orifice/Grate (Weir Controls 0.22 cfs @ 0.45 fps)

**Pond INF 1: - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech SC-310 (ADS StormTech® SC-310 without end caps)**

Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf

Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 2.07 sf x 9 rows

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

2 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 14.68' Row Length +14.0" End Stone x 2 = 17.01' Base Length

9 Rows x 34.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 31.50' Base Width

12.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.83' Field Height

18 Chambers x 14.7 cf +0.44' Row Adjustment x 2.07 sf x 9 Rows = 273.5 cf Chamber Storage

1,518.3 cf Field - 273.5 cf Chambers = 1,244.8 cf Stone x 35.0% Voids = 435.7 cf Stone Storage

Chamber Storage + Stone Storage = 709.2 cf = 0.016 af

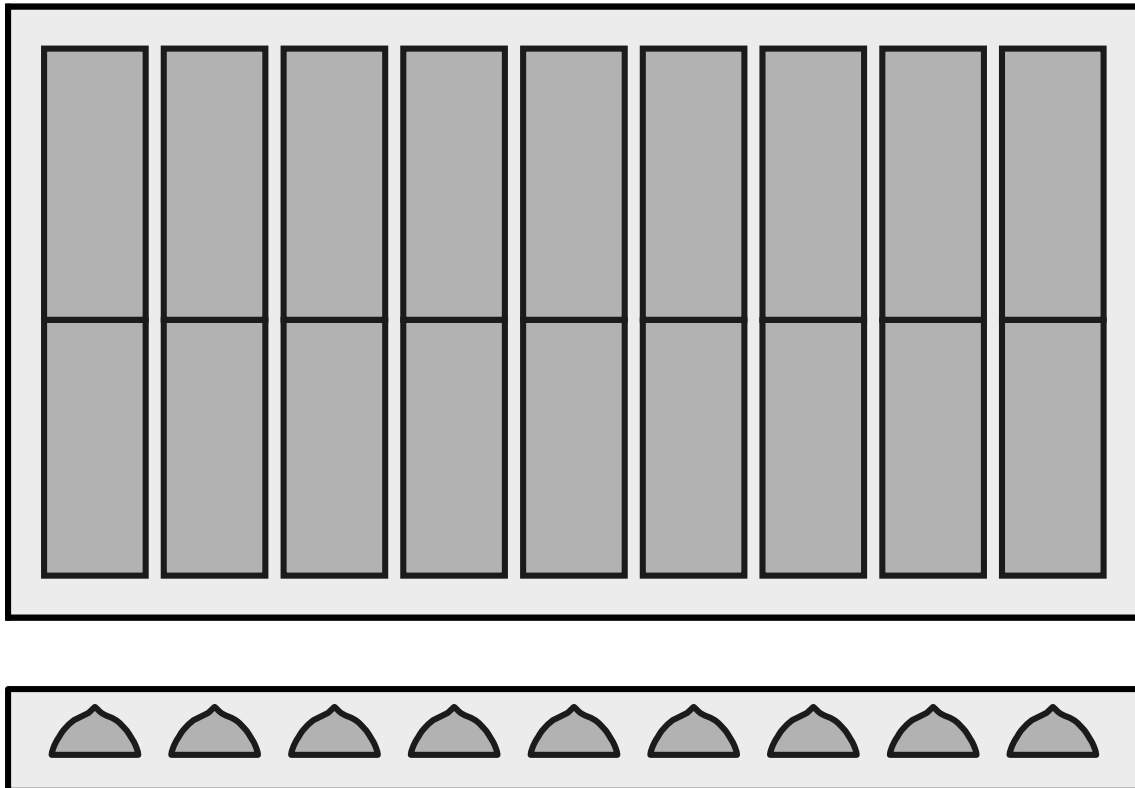
Overall Storage Efficiency = 46.7%

Overall System Size = 17.01' x 31.50' x 2.83'

18 Chambers

56.2 cy Field

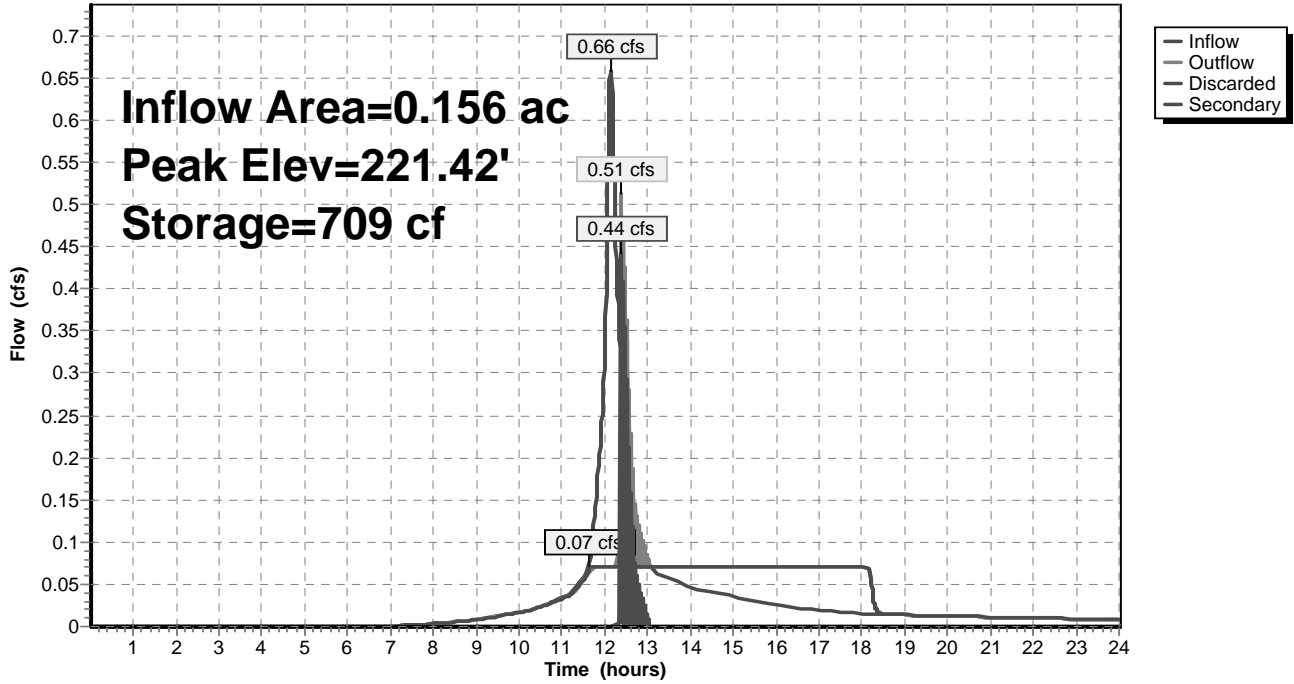
46.1 cy Stone





**Pond INF 1:**

Hydrograph



**Summary for Pond INF 2:**

Inflow Area = 1.894 ac, 27.15% Impervious, Inflow Depth > 4.11" for 100 year storm event  
 Inflow = 6.00 cfs @ 12.29 hrs, Volume= 0.649 af  
 Outflow = 5.49 cfs @ 12.29 hrs, Volume= 0.633 af, Atten= 9%, Lag= 0.0 min  
 Discarded = 0.10 cfs @ 9.15 hrs, Volume= 0.130 af  
 Secondary = 5.39 cfs @ 12.29 hrs, Volume= 0.503 af

Routing by Stor-Ind method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 215.76' @ 12.29 hrs Surf.Area= 699 sf Storage= 1,313 cf

Plug-Flow detention time= 22.3 min calculated for 0.632 af (97% of inflow)  
 Center-of-Mass det. time= 7.8 min ( 833.0 - 825.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	211.20'	610 cf	<b>26.92'W x 25.96'L x 3.50'H Field A</b> 2,446 cf Overall - 703 cf Embedded = 1,743 cf x 35.0% Voids
#2A	211.70'	703 cf	<b>ADS StormTech SC-740 x 15 Inside #1</b> Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 6.45 sf x 5 rows
		1,313 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	211.20'	<b>0.10 cfs Exfiltration at all elevations</b>
#2	Secondary	212.00'	<b>12.0" Round Culvert</b> L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 212.00' / 211.70' S= 0.0100 1' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.10 cfs @ 9.15 hrs HW=211.24' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.10 cfs)

**Secondary OutFlow** Max=5.39 cfs @ 12.29 hrs HW=215.76' (Free Discharge)  
 ↑2=Culvert (Inlet Controls 5.39 cfs @ 6.86 fps)

**Pond INF 2: - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech SC-740 (ADS StormTech® SC-740 without end caps)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

Row Length Adjustment= +0.44' x 6.45 sf x 5 rows

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

3 Chambers/Row x 7.12' Long +0.44' Row Adjustment = 21.80' Row Length +25.0" End Stone x 2 = 25.96' Base Length

5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 22.0" Side Stone x 2 = 26.92' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

15 Chambers x 45.9 cf +0.44' Row Adjustment x 6.45 sf x 5 Rows = 703.2 cf Chamber Storage

2,446.1 cf Field - 703.2 cf Chambers = 1,742.9 cf Stone x 35.0% Voids = 610.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,313.2 cf = 0.030 af

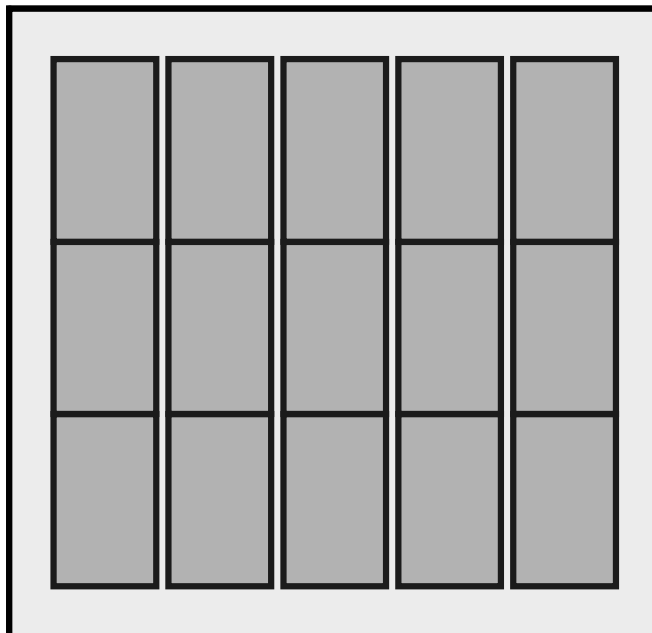
Overall Storage Efficiency = 53.7%

Overall System Size = 25.96' x 26.92' x 3.50'

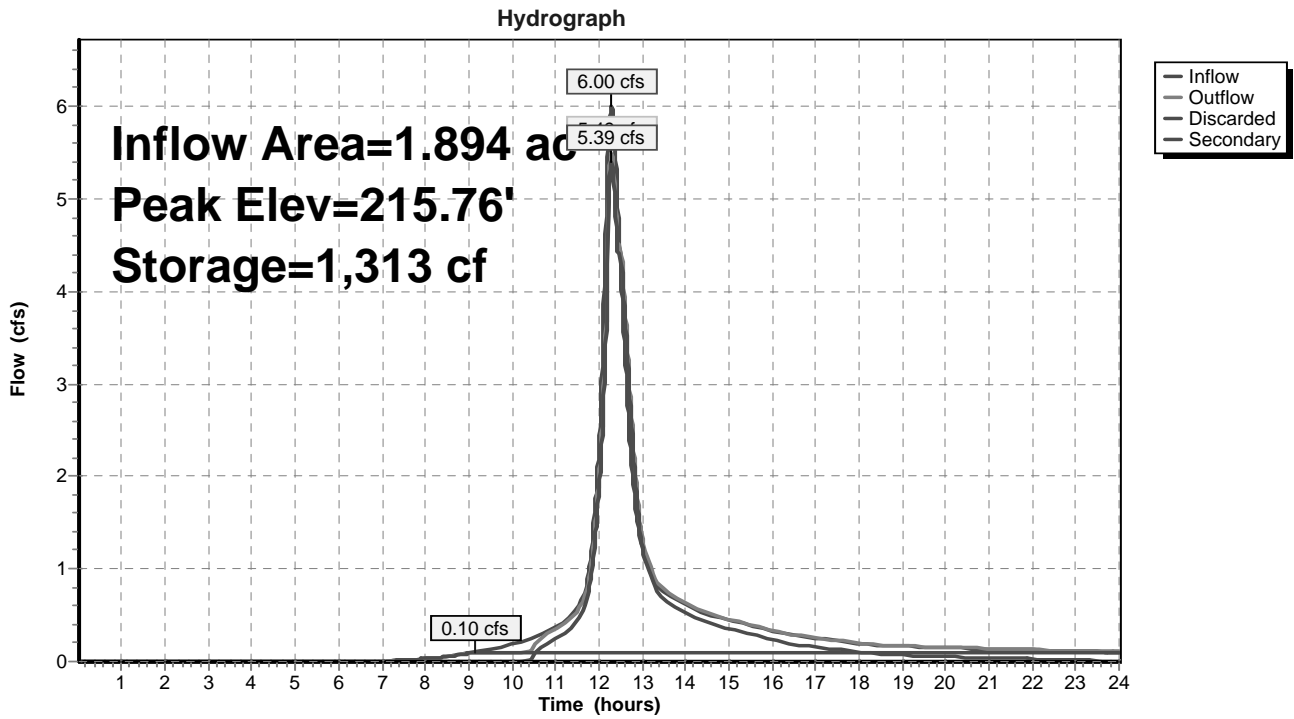
15 Chambers

90.6 cy Field

64.6 cy Stone



**Pond INF 2:**

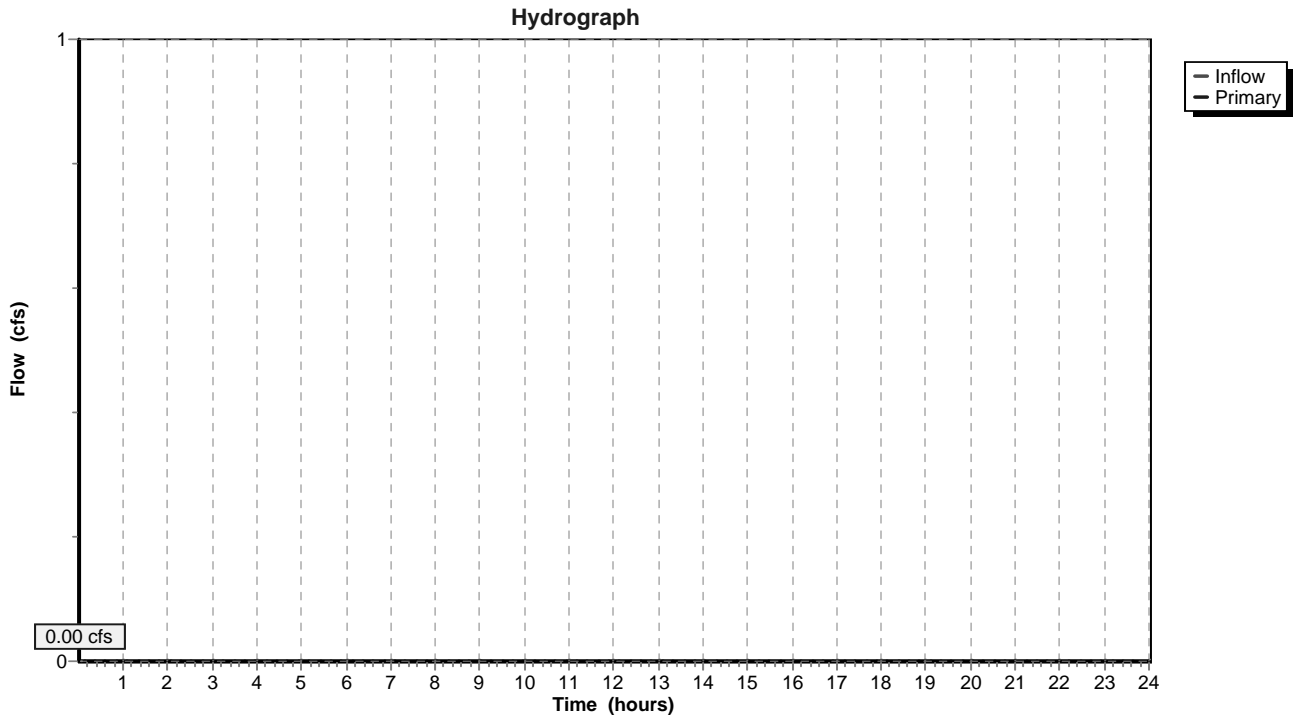


**Summary for Pond INF 3: (To be determined)**

Inflow = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af  
Primary = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs

**Pond INF 3: (To be determined)**

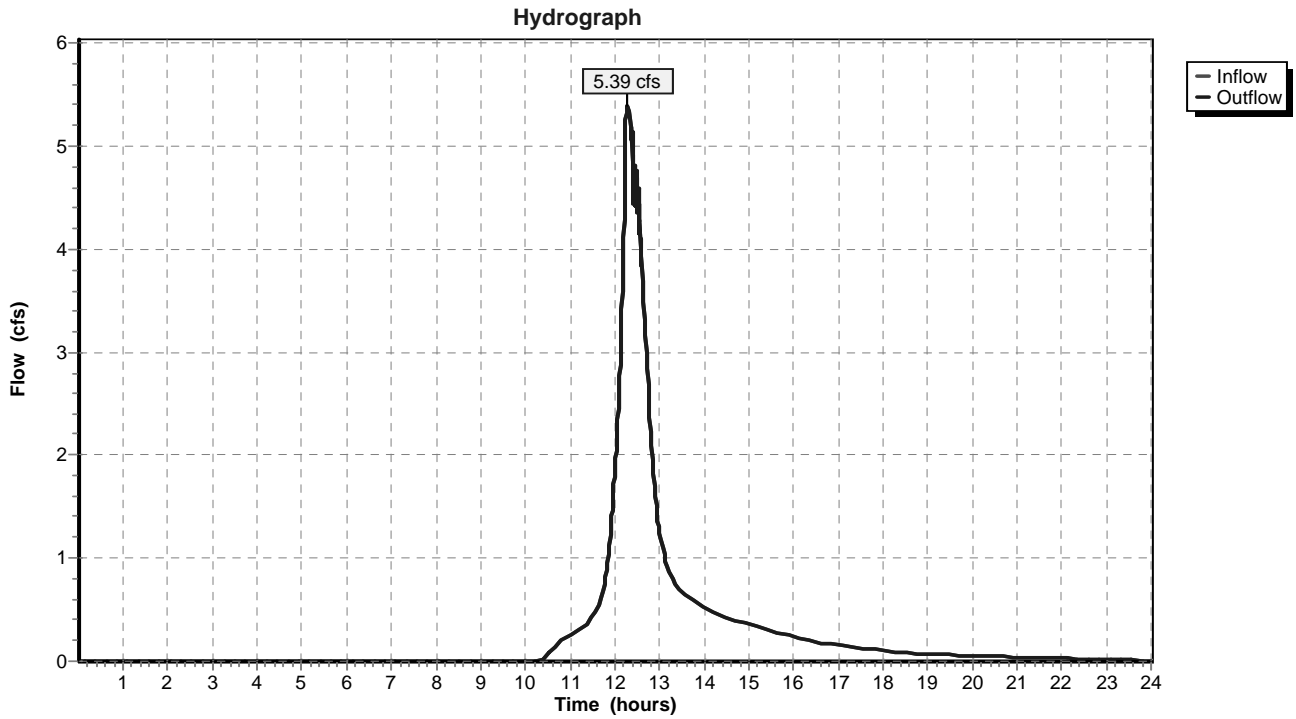


**Summary for Reach PR:**

Inflow = 5.39 cfs @ 12.29 hrs, Volume= 0.507 af  
Outflow = 5.39 cfs @ 12.29 hrs, Volume= 0.507 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs

**Reach PR:**



**Summary for Subcatchment PR COND:**

Runoff = 6.00 cfs @ 12.29 hrs, Volume= 0.649 af, Depth> 4.11"

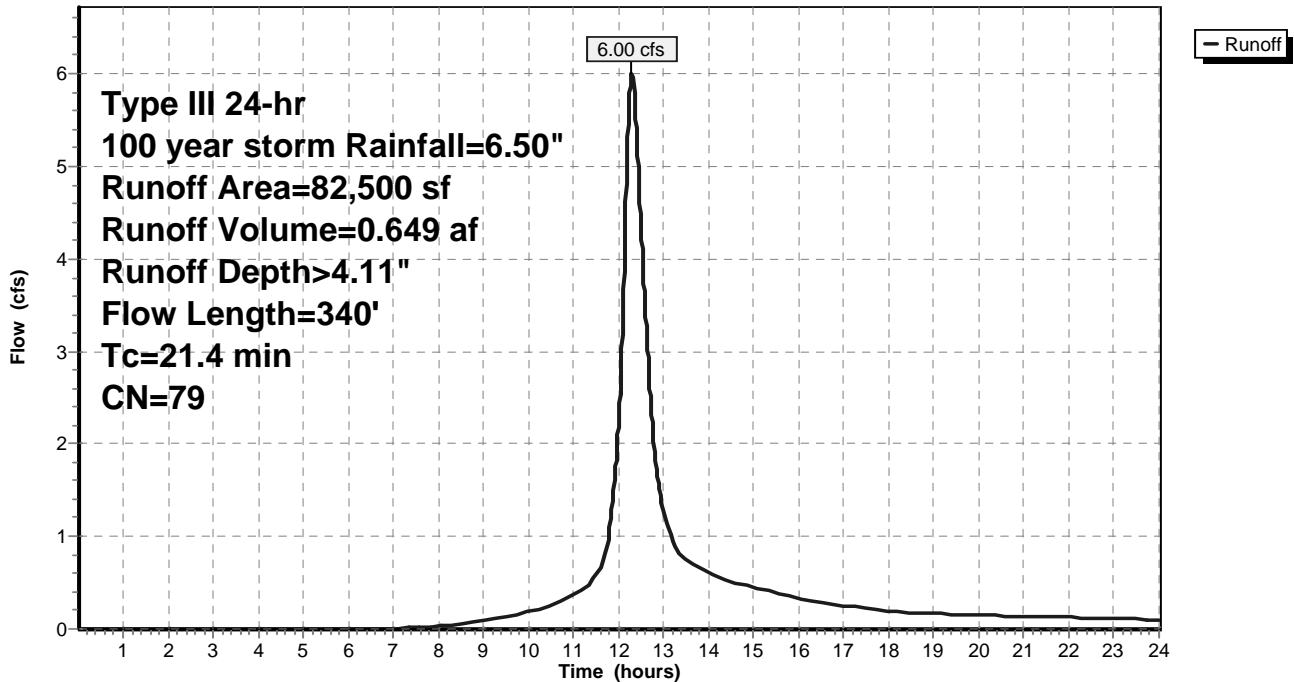
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100 year storm Rainfall=6.50"

Area (sf)	CN	Description
37,300	70	Woods, Good, HSG C
* 20,780	98	Paved roads, driveways & roofs, HSG C
* 1,620	98	Reclaimed paved roads, HSG C
22,800	74	>75% Grass cover, Good, HSG C
82,500	79	Weighted Average
60,100		72.85% Pervious Area
22,400		27.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	60	0.0330	0.05		<b>Sheet Flow,</b> Woods: Dense underbrush n= 0.800 P2= 3.10"
0.7	280	0.1500	6.24		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
21.4	340	Total			

**Subcatchment PR COND:**

Hydrograph



**Rangeway Ext 08-07-19**

Type III 24-hr 100 year storm Rainfall=6.50"

Prepared by Frederick W. Russell, PE

HydroCAD® 10.00-24 s/n 04321 © 2018 HydroCAD Software Solutions LLC

**Summary for Subcatchment Prop to CB:**

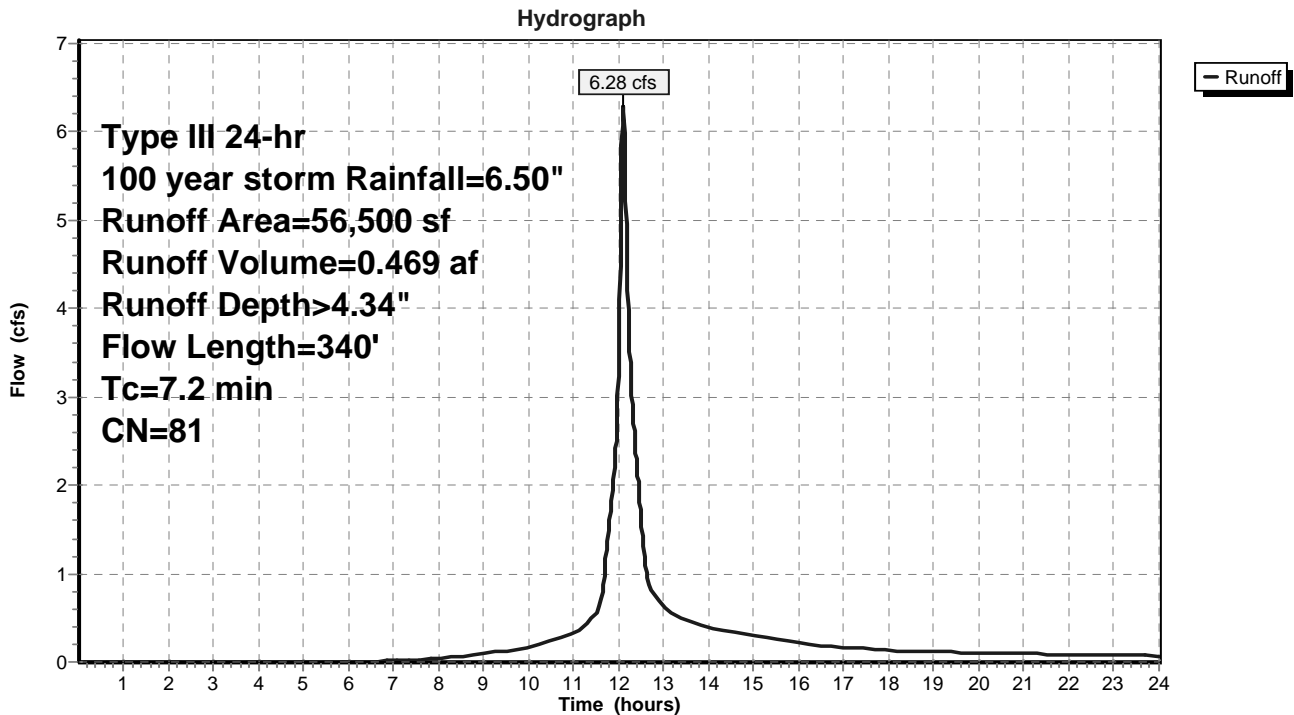
Runoff = 6.28 cfs @ 12.10 hrs, Volume= 0.469 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100 year storm Rainfall=6.50"

Area (sf)	CN	Description
2,100	70	Woods, Good, HSG C
* 15,260	98	Paved roads, driveways & roofs, HSG C
* 2,280	98	Reclaimed paved roads, HSG C
36,860	74	>75% Grass cover, Good, HSG C
56,500	81	Weighted Average
38,960		68.96% Pervious Area
17,540		31.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 3.10"
0.9	290	0.1200	5.58		<b>Shallow Concentrated Flow,</b> Unpaved Kv= 16.1 fps
7.2	340	Total			

**Subcatchment Prop to CB:**



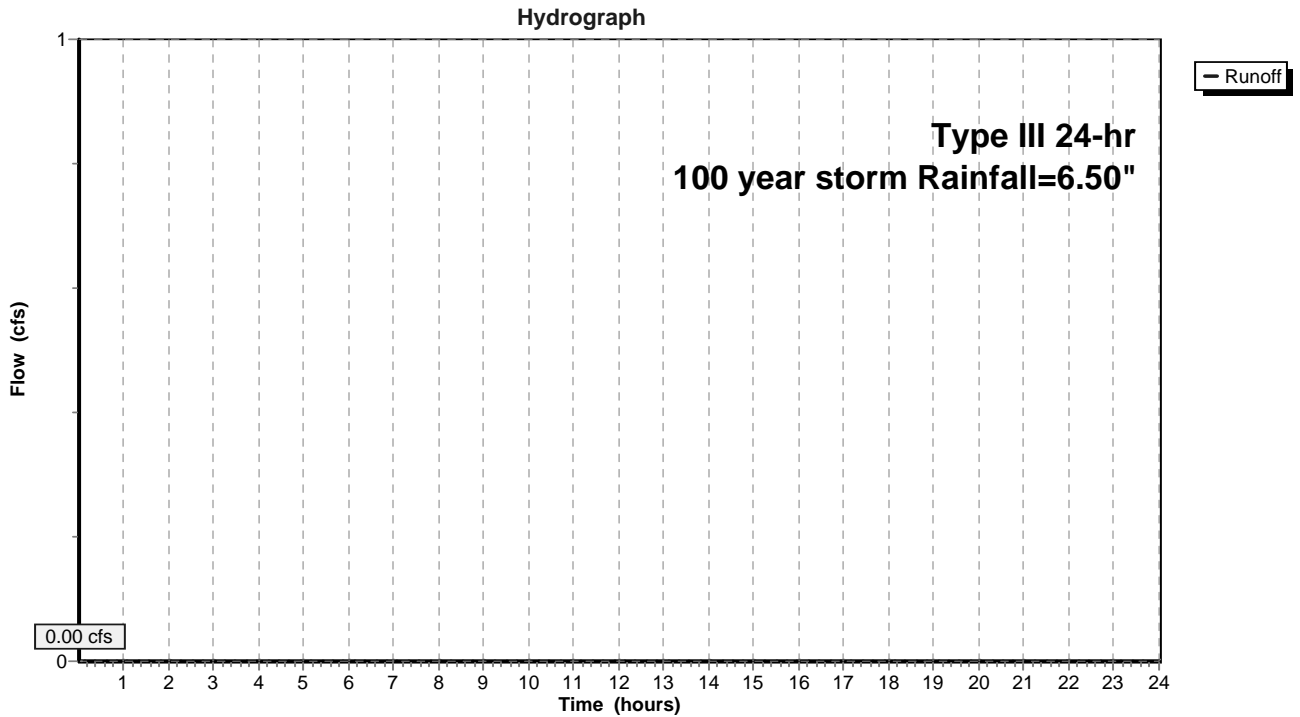


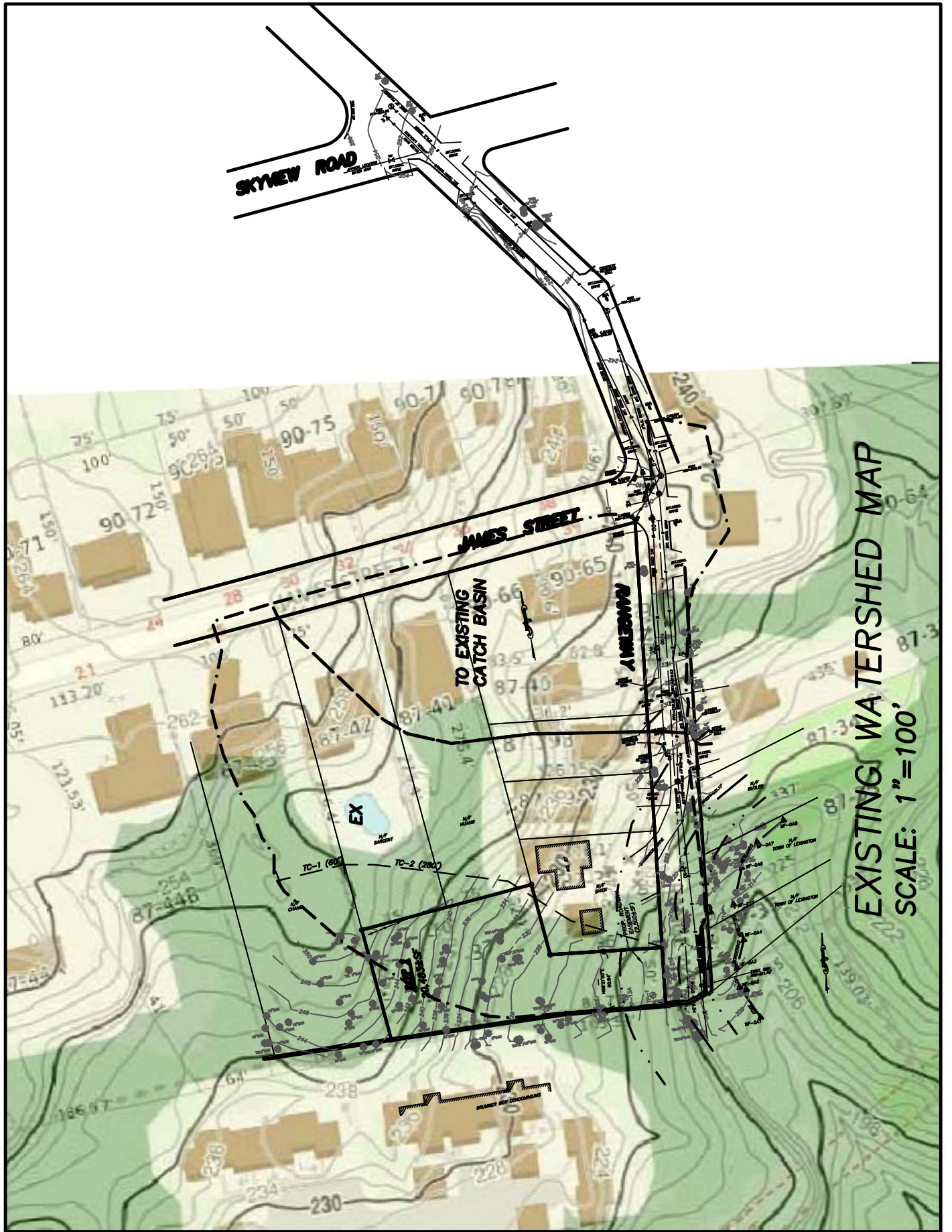
**Summary for Subcatchment Roof:**

Runoff = 0.00 cfs @ 0.01 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.01-24.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100 year storm Rainfall=6.50"

**Subcatchment Roof:**





**SKYNEW ROAD**

**JAMES STREET**

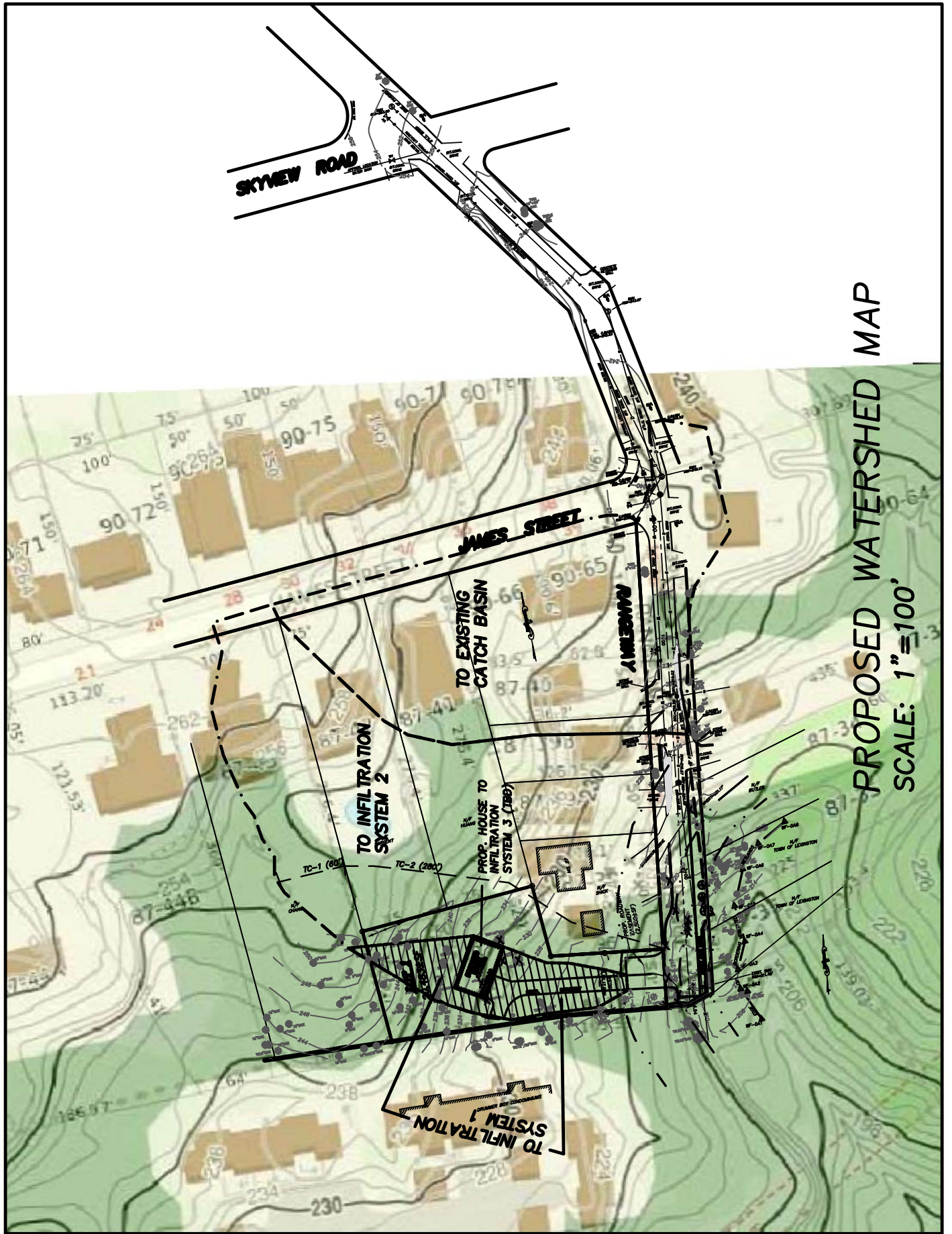
**TO EXISTING CATCH BASIN**

TC-1 (600) TC-2 (200)

**EX**

**DRAINER BOX**

**EXISTING WATERSHED MAP**  
**SCALE: 1"=100'**



PROPOSED WATERSHED MAP  
SCALE: 1" = 100'

*Frederick W. Russell, PE  
154 Aldrich Road  
Wilmington, MA 01887  
978-604-6590*

**Stormwater Operation &  
Maintenance Plan**

**Rangeway Extension**

**In  
Lexington, MA**

**February 3, 2019**

**Project Name: Rangeway Extension  
Lexington, MA**

**Owner Name: Doris L. Duff  
15 Ponds View Lane  
Laconia, NH 03246-4065**

**Party Responsible for Maintenance until transfer:** Doris L. Duff  
15 Ponds View Lane  
Laconia, NH 03246-4065

**General Information:**

The following on-site maintenance program for the stormwater management system is proposed in order to keep the stormwater management systems functioning properly. Operation and maintenance of these systems will be the responsibility of the developer, and his contractor initially, and the proposed homeowners association upon transfer of ownership. The responsibilities outlined in this Operation and Maintenance Plan shall be made part of the Lexington Conservation Commission's Order of Conditions and will "run" with the property as ownership is transferred.

**Planned Erosion and Sedimentation Control Measures during construction Activities**

**Dewatering**

Dewatering may be required during roadway construction and utility installation. Should the need for dewatering arise, groundwater will be pumped directly into a temporary settling basin or frac tank dewatering box, which will act as a sediment trap during construction. All temporary settling basins or tanks will be located within close proximity of daily work activities. Prior to discharge, all groundwater will be treated by means of the settling basin through a series of stone check dams or acceptable substitute. Discharges from sediment basins will be free of visible floating, suspended and settleable solids that would impair the functions of a wetland or degrade the chemical composition of the wetland resource area receiving ground or surface water flows and will be to the combined system.

**Storm Drain Inlet Protection**

A temporary storm inlet protection filter will be placed around all catch basin units. The purpose of the filter is to prevent the inflow of sediments into the closed drainage system. The filter shall remain in place until a permanent vegetative cover is established and the transport of sediment is no longer visibly apparent. The filter shall be inspected and maintained on a weekly basis.

The performance of the catch basins and water quality units shall be checked weekly and after every major storm event during construction.

### **Surface Stabilization**

The surface of all disturbed areas shall be stabilized during and after construction. Temporary measures shall be taken during construction to prevent erosion and siltation. No construction sediment shall be allowed to enter the infiltration system. All disturbed slopes will be stabilized with a permanent vegetative cover. Some or all of the following measures will be utilized on this project as conditions may warrant.

- a. Temporary Seeding
- b. Temporary Mulching
- c. Permanent Seeding
- d. Placement of Sod
- e. Hydroseeding
- f. Placement of Hay
- g. Placement of Jute Netting

### **Subsurface Infiltration Systems**

Erosion controls (such as haybales or silt fencing) and temporary swales should be installed around the perimeter of the excavation to collect and/or divert runoff containing fines and sediments from entering the systems. The existing subgrade under the system bed areas shall not be compacted or subject to excessive construction equipment traffic. Once the site is stabilized and [mal grade over the systems is established, ensure that proper signs and/or barricades around the systems are installed to avoid compaction or vehicular traffic over the system. During construction, the Proposed Subsurface Infiltration Systems should be inspected weekly and after every major storm event. Ponded water inside the system (as visible from the observation wells) after several days often indicates that the bottom of the system is clogged. If the systems are found to be clogged, flushing and vacuuming of the systems will be required.

### **Long-Term Inspection and Maintenance Measures After Construction**

#### **Erosion Control**

Eroded sediments can adversely affect the performance of the stormwater management system. Eroding or barren areas should be immediately re-vegetated.

## **Debris and Litter Removal**

Trash may collect in the BMP's, potentially causing clogging of the facilities. All debris and litter shall be removed when necessary, and after each storm event. Sediment and debris collected from vacuuming sweeping should be disposed at a permitted waste disposal facility. Avoid disposing of this material on site, where it could be washed into the infiltration systems or rain garden.

## **Subsurface Infiltration Systems**

The subsurface infiltration systems should be inspected after the first several rainfall events or few months after construction, after all major storms (>2-year), and on regular biannual scheduled dates. Pooled water inside the system (as visible from the observation wells) after several days often indicates that the bottom of the system is clogged. If the systems are found to be clogged, flushing and vacuuming of the systems will be required.

## **Deep Sump Catch Basins**

The catch basins shall be inspected two (2) times per year, and if necessary, any maintenance shall be performed so that it functions as designed. The catch basins shall be cleaned twice per year, and when sediment in the bottom of the sump reaches within 12 inches below the bottom of the outlet. Inlet and outlet pipes should be checked for clogging. At a minimum, inspection of the catch basin shall be performed during the last week of April and the first week of October each year.

## **Stormceptor® Unit**

The manufacturer recommends quarterly inspections during the first year of installation to accurately establish a maintenance schedule. At a minimum the manufacturer recommends annual maintenance be performed or when the sediment volume in the unit reaches 15 percent of the Stormceptor® total storage. In the event of any hazardous spill, it is recommended that maintenance be performed immediately. Maintenance should be performed by a licensed liquid waste hauler.

Oil is removed through the 6" inspection/oil port and sediment is removed through the 24" diameter outlet riser pipe. Alternatively, oil could be removed from the 24" opening if water is removed from the lower chamber, lowering the oil level below the drop pipe. For the STC 900 maintenance is performed through the 12" inlet drop pipe. The inlet drop pipe has a tapered insert connected to a handle. After removing the handle, remove oil and sediment from the 12-inch diameter inlet drop pipe.

## **Snow disposal and plowing**

Snow shall be plowed and stored on gravel, grass, or other permeable surface to allow filtration to occur; such locations shall be selected so that all melted snow will flow into the formal drainage system. Once snow melts all sand salt and debris shall be extracted from surface and properly disposed of. Avoid disposing snow on top of storm drain catch basins.

The amount of road salt applied should be regulated to prevent over salting and increasing runoff concentrations. Alternative materials, such as sand or gravel, should be used in especially sensitive areas.

### **Roadway sweeping schedule**

Pavement sweeping shall be conducted at a frequency of not less than once per year. Removal of any accumulated sand, grit, and debris from roadway after the snow melts shall be complete shortly after snow melts for the season.