

# Drainage Analysis

For  
**Fairway Realty**

2834 Stringtown Road  
Grove City, Ohio

Prepared By:



880 King Ave.  
Columbus, Ohio 43212

EP Ferris # 1054.005  
Date: 12/18/2017

I hereby certify that the calculations contained herein are accurate to the best of my knowledge and belief.

By: \_\_\_\_\_

Date \_\_\_\_\_

**EXECUTIVE SUMMARY:**

**Table 1 – Critical Storm Summary Table**

1Yr. Pre-Developed Storm Runoff Volume	0.477 AF
1Yr. Post-Developed Storm Runoff Volume	0.544 AF
Volume Increase	14%
Critical Storm	2 Year

**Table 2 – Storm Water Runoff Summary Table**

Storm Event	Pre-Dev. Peak (CFS)	Post-Dev. Peak (North) (CFS)	Post-Dev. Peak (South) (CFS)	Un-Detained Peak (CFS)	Allowable Release Rate (CFS)	Final Release (CFS)	Ponding Elevation (North)	Ponding Elevation (South)
1 Yr.	<b>1.38</b>	0.48	0.58	0.07	1.38	1.13	795.25	795.38
<b>2 Yr.</b>	1.84	0.57	0.69	0.12	<b>1.38</b>	1.38	795.69	795.87
5 Yr.	2.54	0.70	0.85	0.20	2.54	1.75	796.46	796.72
10 Yr.	3.14	0.81	1.00	0.28	3.14	2.09	797.21	797.55
25 Yr.	4.00	1.33	1.82	0.39	4.00	3.54	797.86	798.04
50 Yr.	4.74	1.73	2.38	0.50	4.74	4.61	798.06	798.32
100 yr.	5.54	2.05	2.87	0.61	5.54	5.53	798.22	798.57

**Table 3 – Detention Summary Table**

	<b>Total</b>
Water Quality Volume Required	N/A
Water Quality Volume Provided	N/A
Water Quantity Volume Required	16,753 CF
Water Quantity Volume Provided	18,038 CF

## **INTRODUCTION:**

The above Executive Summary represents the preliminary analysis and proposal of storm water management for a new apartment complex for Fairway Realty at 2834 Stringtown Road, Grove City, Ohio.

The total tributary area to the detention facility is approximately 6.58 acres+/-, see Appendix "C" Tributary Map. This area was used to determine the critical storm. The storm water facilities were divided into 2 parts (North and South). The offsite area was considered to be negligible; however a small area, approximately 1.067 ac. was determined to escape without detention. This area was added to the allowable release rate in the table above.

This project will use the critical storm method associated with The City of Grove City Storm Water Manual guidelines to determine allowable release rates and the requirements for storm water management.

## **HYDROLOGIC ANALYSIS:**

All hydrologic parameters were determined using methodology described in The City of Grove City, Ohio Storm Water Manual Revised May, 25, 2016. HydroCAD 9.10 software was used to develop peak flow rates using rainfall distributions from the Huff 2<sup>nd</sup> quartile, 0-10 square mile, and 12 hr. duration.

## **PRE-DEVELOPED CONDITIONS:**

The pre-developed condition of the site consists of a mostly developed lot approximately 3.548 acres of existing grass, yielding a CN=79. The remaining area 3.032 acres is impervious, found to have a curve number CN=98. The combined CN=88. The time of concentration was found to be 17.9 minutes using a sheet flow and shallow concentrated flow of 150 feet with a slope of 2.0 %.

Currently the site drains to the east and to existing ditch.

## **POST-DEVELOPED CONDITIONS:**

The post developed condition of the site will consist of an apartment complex, asphalt parking lot and green space. The developed site was determined to have a curve number CN =90. The time of concentration was found to be 17.9 minutes using sheet flow to an outlet to the existing ditch.

### **Critical Storm Calculation:**

The critical storm is determined by comparing the increase in runoff volume of the 1-year 24-hour rainfall event from the pre-developed condition to that of the post-developed.

Pre-Development 1-Year Storm Event:      0.477 af  
Post-Development 1-Year Storm Event:      0.544 af  
 $((0.544\text{af} - 0.477\text{af}) / 0.477\text{af}) \times 100\% = 14\%$  **(2 year critical storm)**

## **WATER QUALITY:**

Water quality will be provided in the Storm Tech chambers using isolator rows of MC 3500 chambers for treatment and additional chambers for storage. See (Appendix “B”).

## **SUMMARY:**

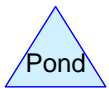
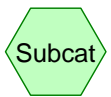
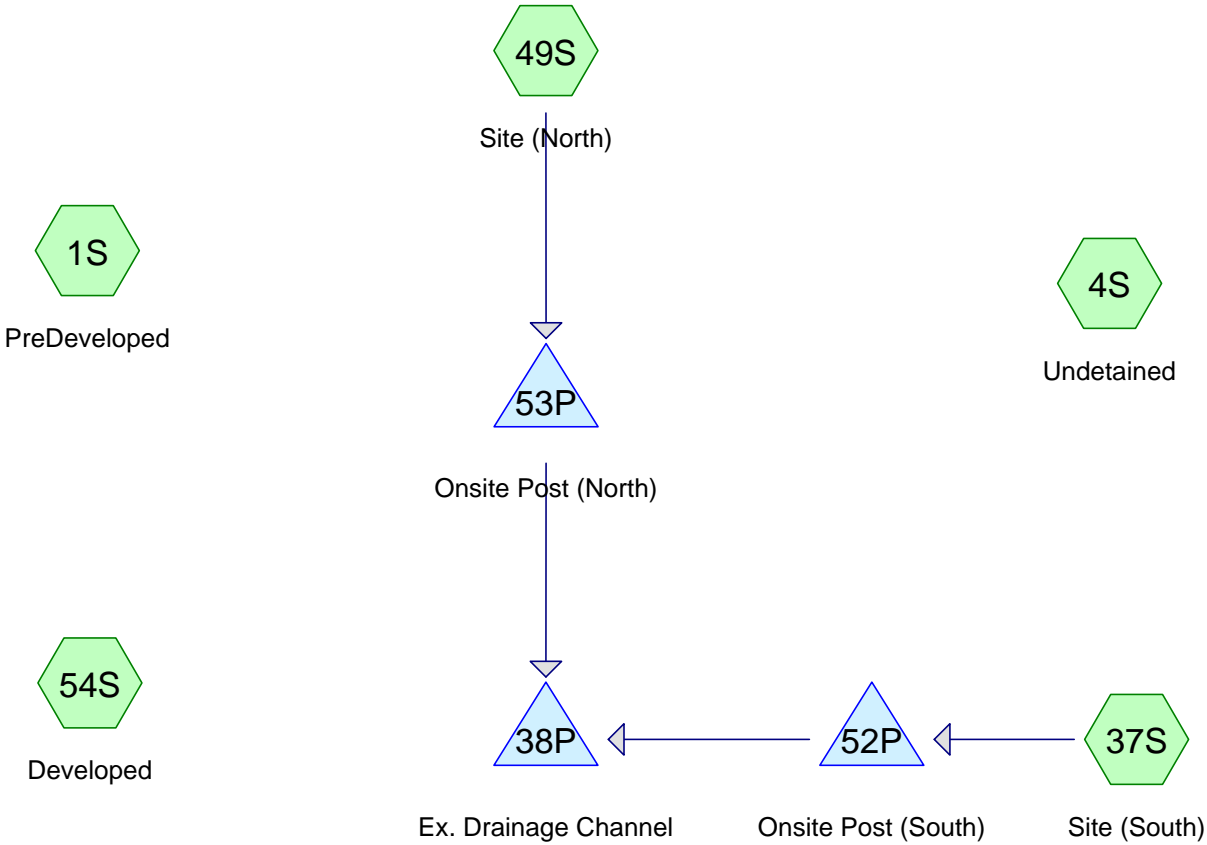
The developed site runoff is controlled by an underground detention system. The system uses an orifice and weir to control flow. The final outlet drains to an existing ditch that runs along the eastern portion of the site.

From the above Executive Summary, the detention system’s limits of release rate are found not to exceed the parameters set forth from the above design criteria.

HydroCAD calculations can be found in Appendix “A” with the Water Quality Calculations found in Appendix “B” followed by a Tributary Map in Appendix “C”.

# **APPENDIX A**

(HydroCAD Report)



# Stringtown

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Page 2

## Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.012	74	>75% Grass cover, Good, HSG C (4S, 49S, 54S)
5.628	79	50-75% Grass cover, Fair, HSG C (1S, 37S, 54S)
7.968	98	Paved parking, HSG C (1S, 37S, 49S, 54S)
3.132	98	Roofs, HSG C (1S, 37S, 49S, 54S)
<b>19.740</b>		<b>TOTAL AREA</b>

# Stringtown

## Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
<b>19.740</b>	HSG C	1S, 4S, 37S, 49S, 54S
0.000	HSG D	
0.000	Other	
19.740		<b>TOTAL AREA</b>



**Stringtown**

Huff 0-10sm 2Q 12.00 hrs 1-Year Rainfall=1.88"

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Page 4

Time span=0.00-100.00 hrs, dt=0.01 hrs, 10001 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: PreDeveloped** Runoff Area=6.580 ac 46.08% Impervious Runoff Depth=0.87"  
Flow Length=250' Slope=0.0200 '/' Tc=17.9 min CN=88 Runoff=1.38 cfs 0.477 af

**Subcatchment 4S: Undetained** Runoff Area=1.067 ac 0.00% Impervious Runoff Depth=0.30"  
Tc=10.0 min CN=74 Runoff=0.07 cfs 0.026 af

**Subcatchment 37S: Site (South)** Runoff Area=3.255 ac 68.05% Impervious Runoff Depth=1.13"  
Flow Length=250' Slope=0.0200 '/' Tc=11.0 min CN=92 Runoff=0.87 cfs 0.307 af

**Subcatchment 49S: Site (North)** Runoff Area=2.258 ac 80.56% Impervious Runoff Depth=1.21"  
Flow Length=300' Slope=0.0200 '/' Tc=18.2 min CN=93 Runoff=0.64 cfs 0.227 af

**Subcatchment 54S: Developed** Runoff Area=6.580 ac 61.31% Impervious Runoff Depth=0.99"  
Flow Length=250' Slope=0.0200 '/' Tc=17.9 min CN=90 Runoff=1.56 cfs 0.544 af

**Pond 38P: Ex. Drainage Channel** Peak Elev=791.61' Storage=23,229 cf Inflow=1.06 cfs 0.533 af  
Outflow=0.00 cfs 0.000 af

**Pond 52P: Onsite Post (South)** Peak Elev=795.38' Storage=2,848 cf Inflow=0.87 cfs 0.307 af  
Primary=0.58 cfs 0.307 af Secondary=0.00 cfs 0.000 af Outflow=0.58 cfs 0.307 af

**Pond 53P: Onsite Post (North)** Peak Elev=795.25' Storage=1,570 cf Inflow=0.64 cfs 0.227 af  
Primary=0.48 cfs 0.227 af Secondary=0.00 cfs 0.000 af Outflow=0.48 cfs 0.227 af

**Total Runoff Area = 19.740 ac Runoff Volume = 1.581 af Average Runoff Depth = 0.96"**  
**43.77% Pervious = 8.640 ac 56.23% Impervious = 11.100 ac**

**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 1.38 cfs @ 5.59 hrs, Volume= 0.477 af, Depth= 0.87"

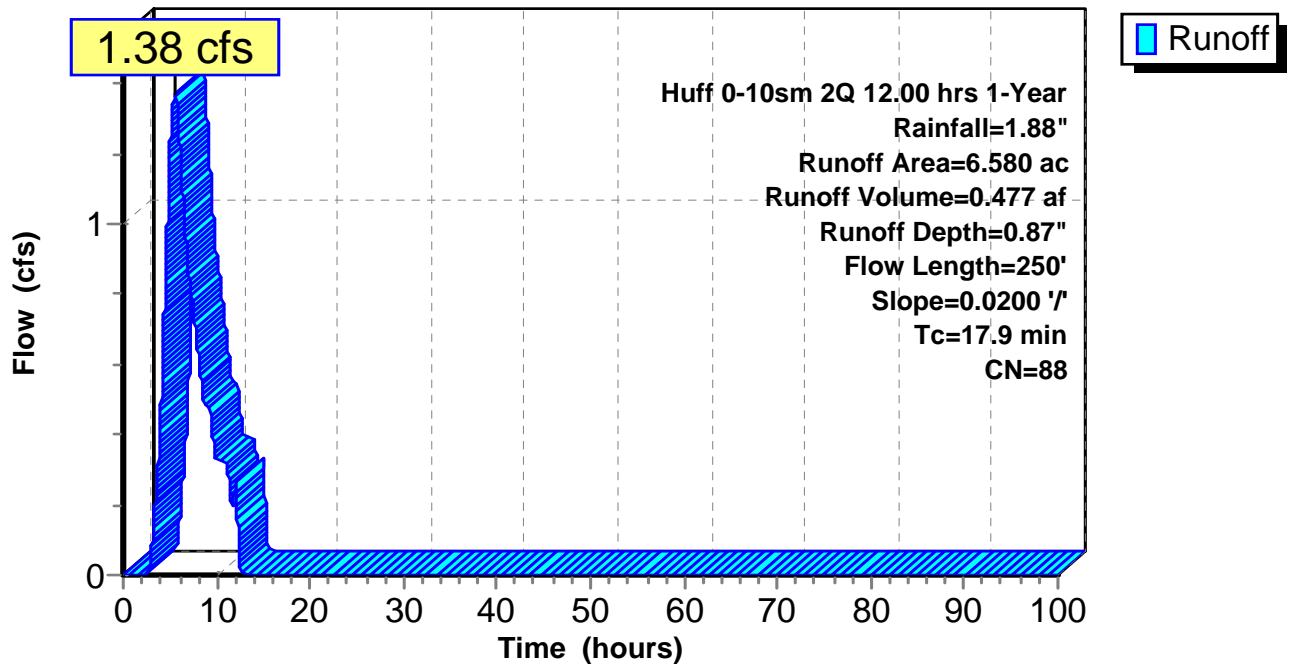
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 1-Year Rainfall=1.88"

Area (ac)	CN	Description
2.432	98	Paved parking, HSG C
0.600	98	Roofs, HSG C
3.548	79	50-75% Grass cover, Fair, HSG C
6.580	88	Weighted Average
3.548		53.92% Pervious Area
3.032		46.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



**Summary for Subcatchment 4S: Undetained**

Runoff = 0.07 cfs @ 5.88 hrs, Volume= 0.026 af, Depth= 0.30"

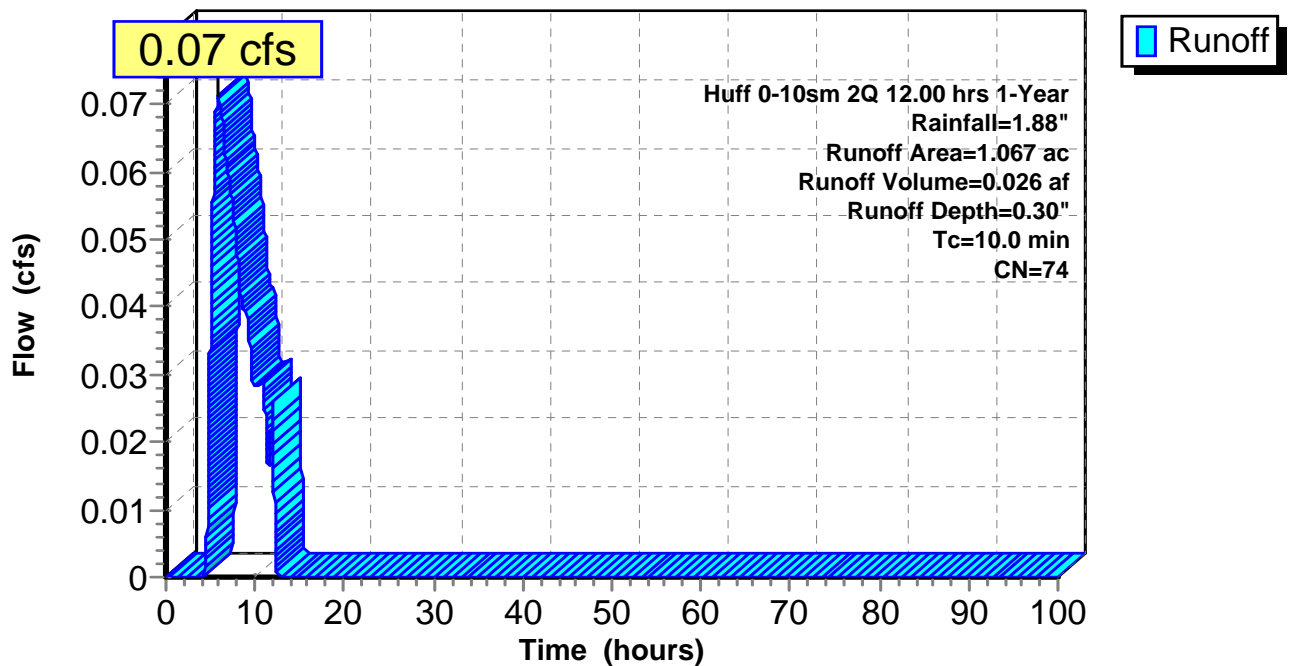
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 1-Year Rainfall=1.88"

Area (ac)	CN	Description
1.067	74	>75% Grass cover, Good, HSG C
1.067		100.00% Pervious Area

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

**Subcatchment 4S: Undetained**

**Hydrograph**



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Huff 0-10sm 2Q 12.00 hrs 1-Year Rainfall=1.88"

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Page 7

## Summary for Subcatchment 37S: Site (South)

Runoff = 0.87 cfs @ 5.39 hrs, Volume= 0.307 af, Depth= 1.13"

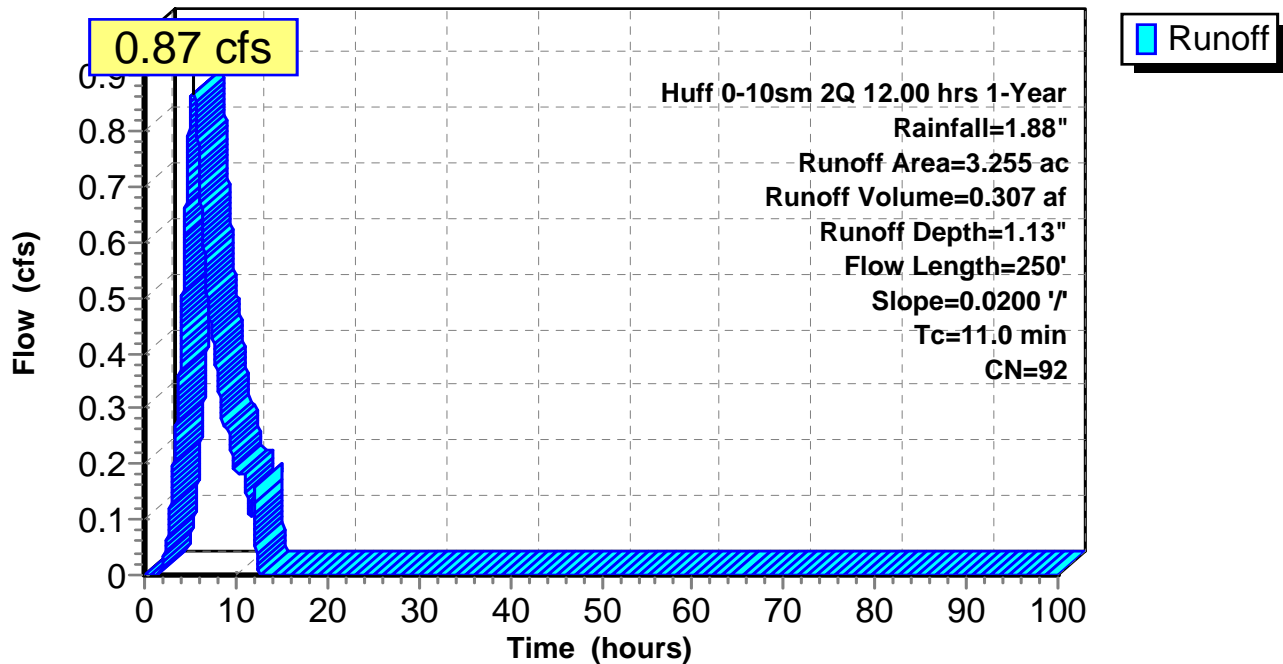
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
Huff 0-10sm 2Q 12.00 hrs 1-Year Rainfall=1.88"

Area (ac)	CN	Description
0.727	98	Roofs, HSG C
1.488	98	Paved parking, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
3.255	92	Weighted Average
1.040		31.95% Pervious Area
2.215		68.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0200	0.09		Sheet Flow, Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		Shallow Concentrated Flow, Paved Kv= 20.3 fps
11.0	250	Total			

## Subcatchment 37S: Site (South)

### Hydrograph



**Summary for Subcatchment 49S: Site (North)**

Runoff = 0.64 cfs @ 5.40 hrs, Volume= 0.227 af, Depth= 1.21"

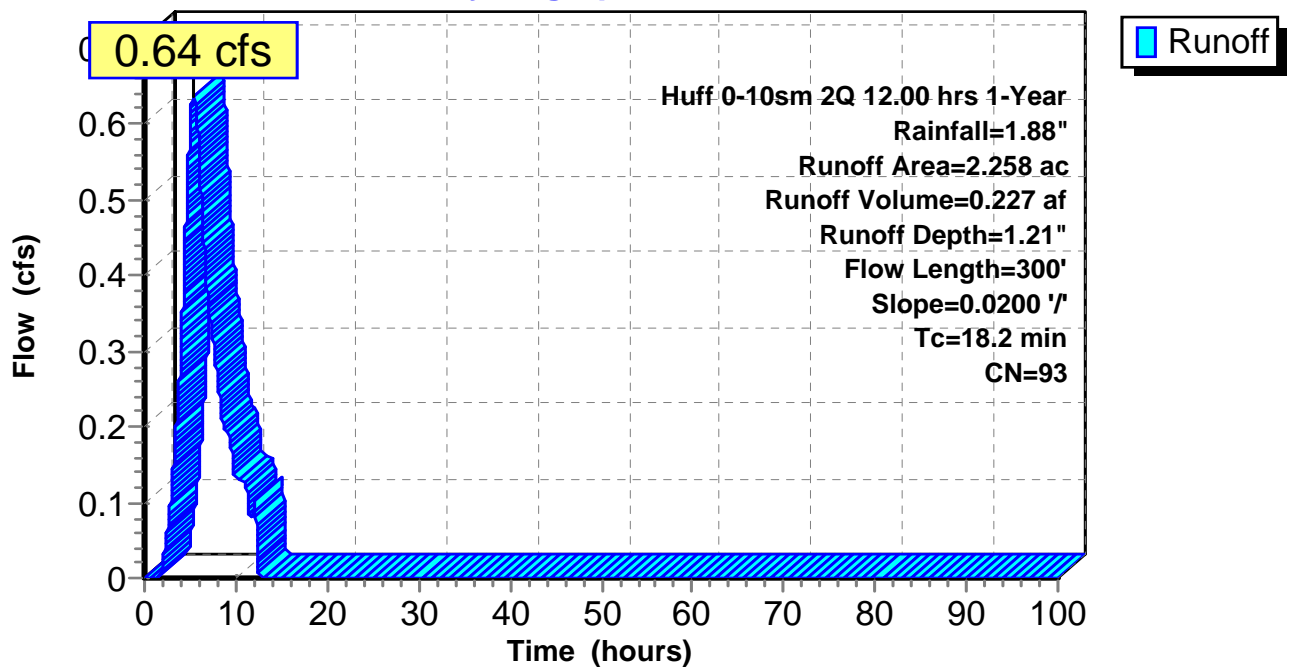
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 1-Year Rainfall=1.88"

Area (ac)	CN	Description
0.539	98	Roofs, HSG C
1.280	98	Paved parking, HSG C
0.439	74	>75% Grass cover, Good, HSG C
2.258	93	Weighted Average
0.439		19.44% Pervious Area
1.819		80.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
18.2	300	Total			

**Subcatchment 49S: Site (North)**

**Hydrograph**



**Summary for Subcatchment 54S: Developed**

Runoff = 1.56 cfs @ 5.55 hrs, Volume= 0.544 af, Depth= 0.99"

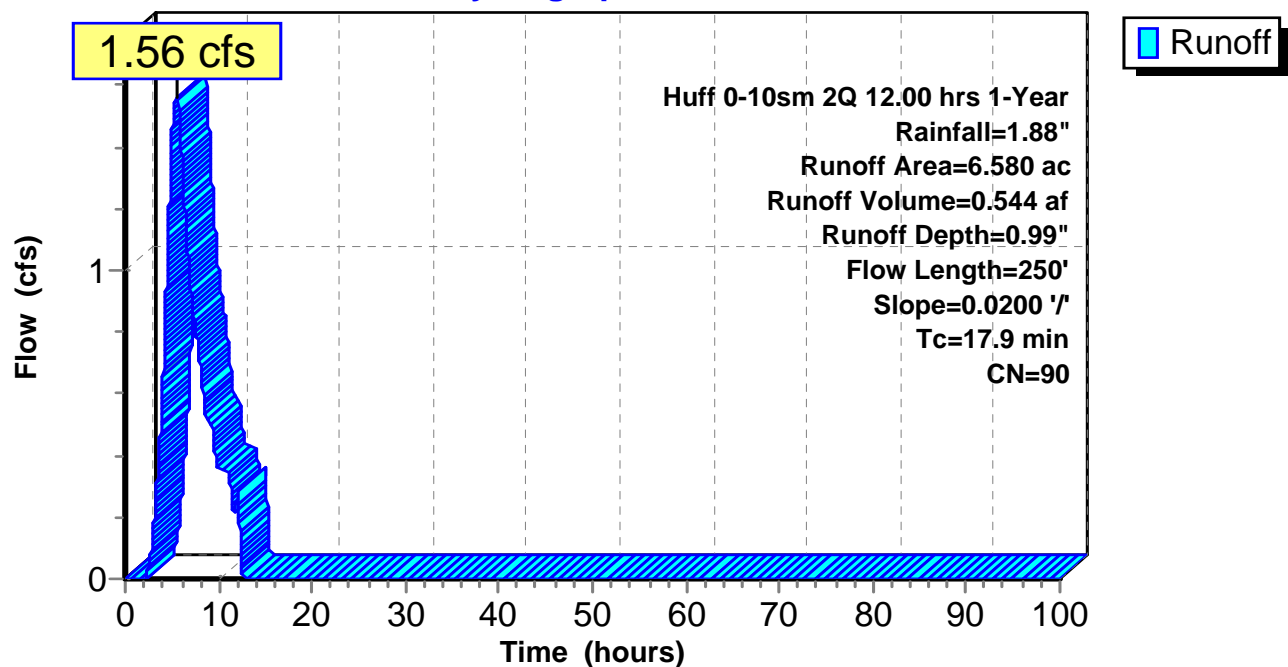
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 1-Year Rainfall=1.88"

Area (ac)	CN	Description
2.768	98	Paved parking, HSG C
1.266	98	Roofs, HSG C
0.439	74	>75% Grass cover, Good, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
1.067	74	>75% Grass cover, Good, HSG C
6.580	90	Weighted Average
2.546		38.69% Pervious Area
4.034		61.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 54S: Developed**

**Hydrograph**



**Summary for Pond 38P: Ex. Drainage Channel**

Inflow Area = 5.513 ac, 73.17% Impervious, Inflow Depth = 1.16" for 1-Year event  
 Inflow = 1.06 cfs @ 6.41 hrs, Volume= 0.533 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

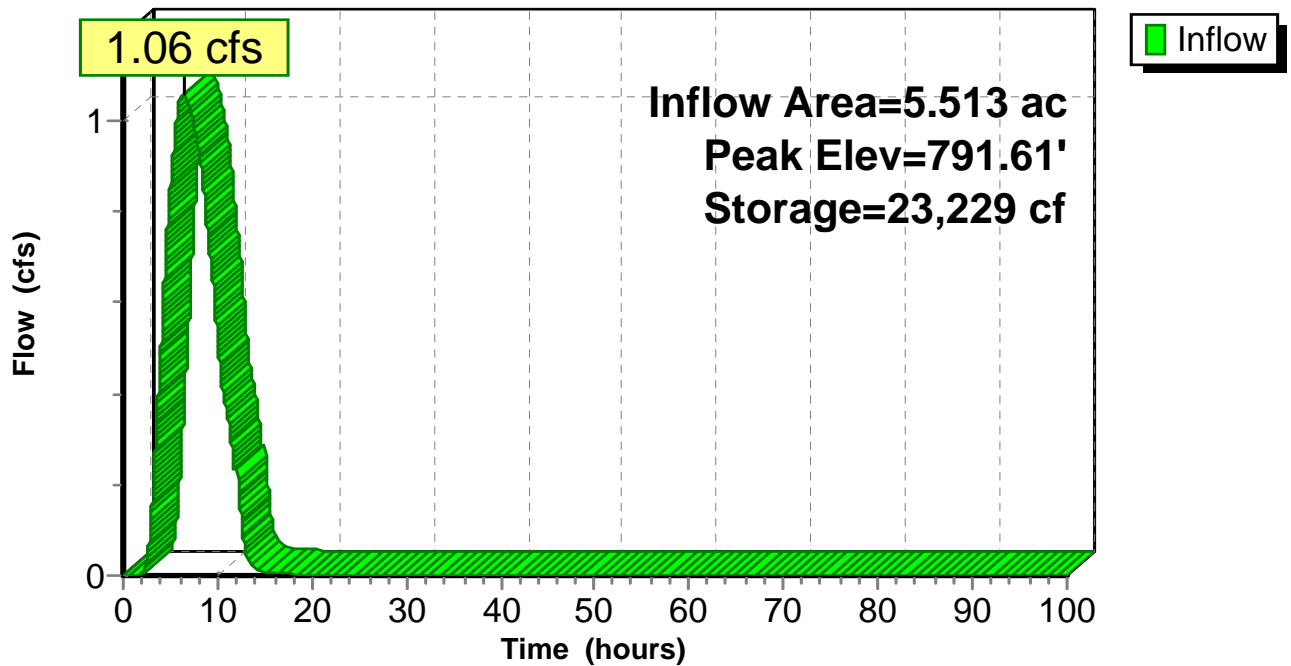
Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 791.61' @ 84.39 hrs Surf.Area= 17,711 sf Storage= 23,229 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	790.00'	319,013 cf	12.50'W x 898.00'L x 10.00'H Prismatic Z=2.2

**Pond 38P: Ex. Drainage Channel**

**Hydrograph**



**Summary for Pond 52P: Onsite Post (South)**

Inflow Area = 3.255 ac, 68.05% Impervious, Inflow Depth = 1.13" for 1-Year event  
 Inflow = 0.87 cfs @ 5.39 hrs, Volume= 0.307 af  
 Outflow = 0.58 cfs @ 6.52 hrs, Volume= 0.307 af, Atten= 33%, Lag= 67.7 min  
 Primary = 0.58 cfs @ 6.52 hrs, Volume= 0.307 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 795.38' @ 6.52 hrs Surf.Area= 3,405 sf Storage= 2,848 cf

Plug-Flow detention time= 62.5 min calculated for 0.307 af (100% of inflow)  
 Center-of-Mass det. time= 62.3 min ( 451.3 - 389.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	3,993 cf	<b>28.50'W x 119.49'L x 5.00'H Field A</b> 17,027 cf Overall - 7,045 cf Embedded = 9,982 cf x 40.0% Voids
#2A	794.75'	7,045 cf	<b>StormTech MC-3500</b> x 64 Inside #1 Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		11,038 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=0.58 cfs @ 6.52 hrs HW=795.38' (Free Discharge)  
 ↑1=Orifice/Grate (Orifice Controls 0.58 cfs @ 5.25 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=794.00' (Free Discharge)  
 ↑2=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)



**Pond 52P: Onsite Post (South) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

16 Chambers/Row x 7.17' Long = 114.72' + 28.6" End Stone x 2 = 119.49' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

64 Chambers x 110.1 cf = 7,044.6 cf Chamber Storage

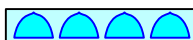
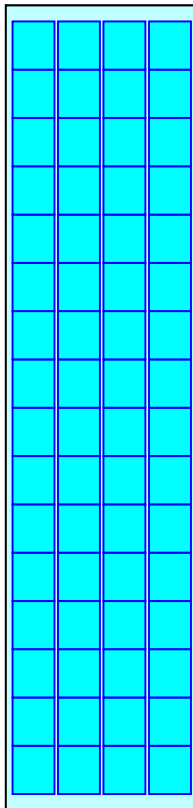
17,026.9 cf Field - 7,044.6 cf Chambers = 9,982.2 cf Stone x 40.0% Voids = 3,992.9 cf Stone Storage

Stone + Chamber Storage = 11,037.5 cf = 0.253 af

64 Chambers

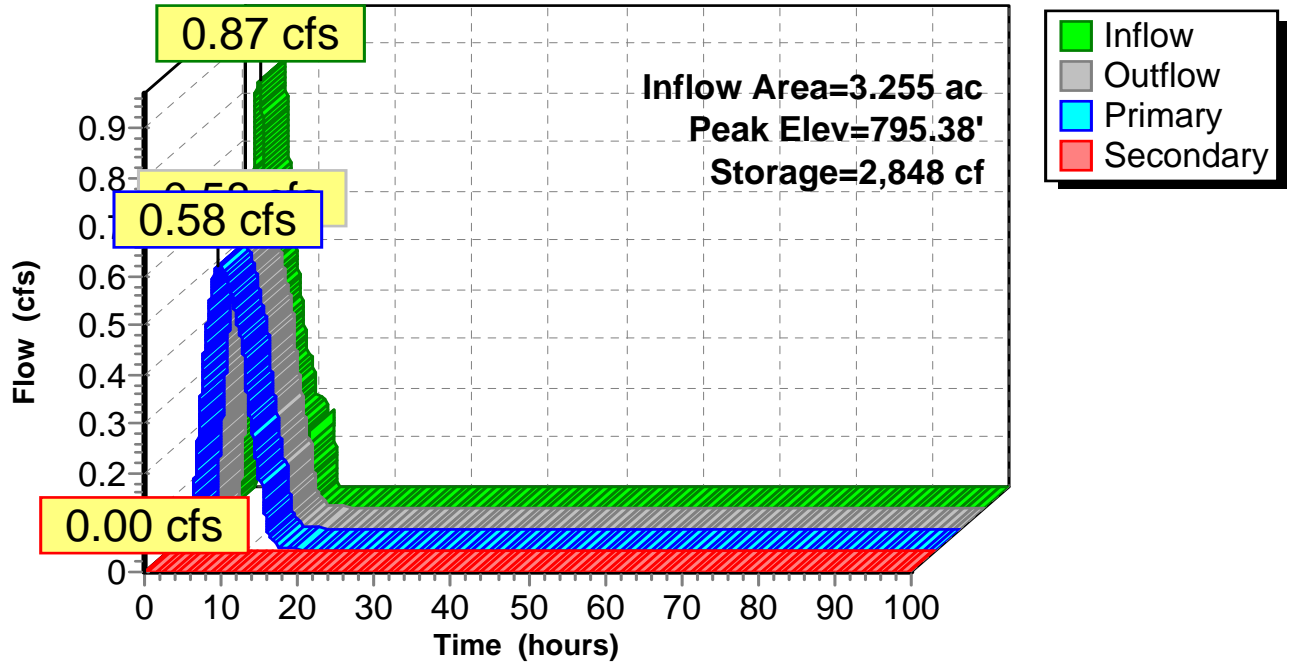
630.6 cy Field

369.7 cy Stone



Pond 52P: Onsite Post (South)

Hydrograph



**Summary for Pond 53P: Onsite Post (North)**

Inflow Area = 2.258 ac, 80.56% Impervious, Inflow Depth = 1.21" for 1-Year event  
 Inflow = 0.64 cfs @ 5.40 hrs, Volume= 0.227 af  
 Outflow = 0.48 cfs @ 6.31 hrs, Volume= 0.227 af, Atten= 25%, Lag= 54.7 min  
 Primary = 0.48 cfs @ 6.31 hrs, Volume= 0.227 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 795.25' @ 6.31 hrs Surf.Area= 2,179 sf Storage= 1,570 cf

Plug-Flow detention time= 40.6 min calculated for 0.227 af (100% of inflow)  
 Center-of-Mass det. time= 40.6 min ( 431.1 - 390.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	2,597 cf	<b>28.50'W x 76.47'L x 5.00'H Field A</b> 10,897 cf Overall - 4,403 cf Embedded = 6,494 cf x 40.0% Voids
#2A	794.75'	4,403 cf	<b>StormTech MC-3500 x 40 Inside #1</b> Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		7,000 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.2" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=0.48 cfs @ 6.31 hrs HW=795.25' (Free Discharge)  
 ↑1=**Orifice/Grate** (Orifice Controls 0.48 cfs @ 4.98 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=794.00' (Free Discharge)  
 ↑2=**Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Pond 53P: Onsite Post (North) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

10 Chambers/Row x 7.17' Long = 71.70' + 28.6" End Stone x 2 = 76.47' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

40 Chambers x 110.1 cf = 4,402.9 cf Chamber Storage

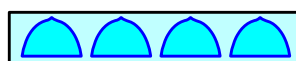
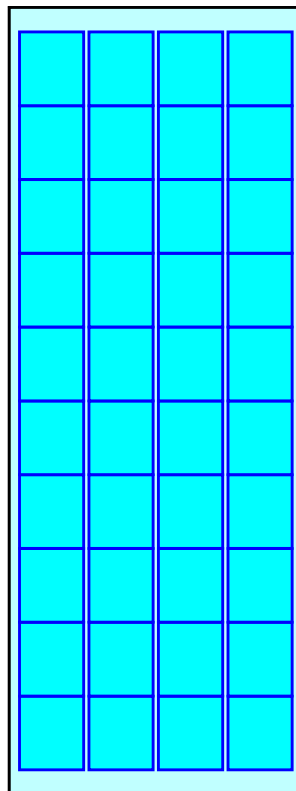
10,896.5 cf Field - 4,402.9 cf Chambers = 6,493.6 cf Stone x 40.0% Voids = 2,597.4 cf Stone Storage

Stone + Chamber Storage = 7,000.3 cf = 0.161 af

40 Chambers

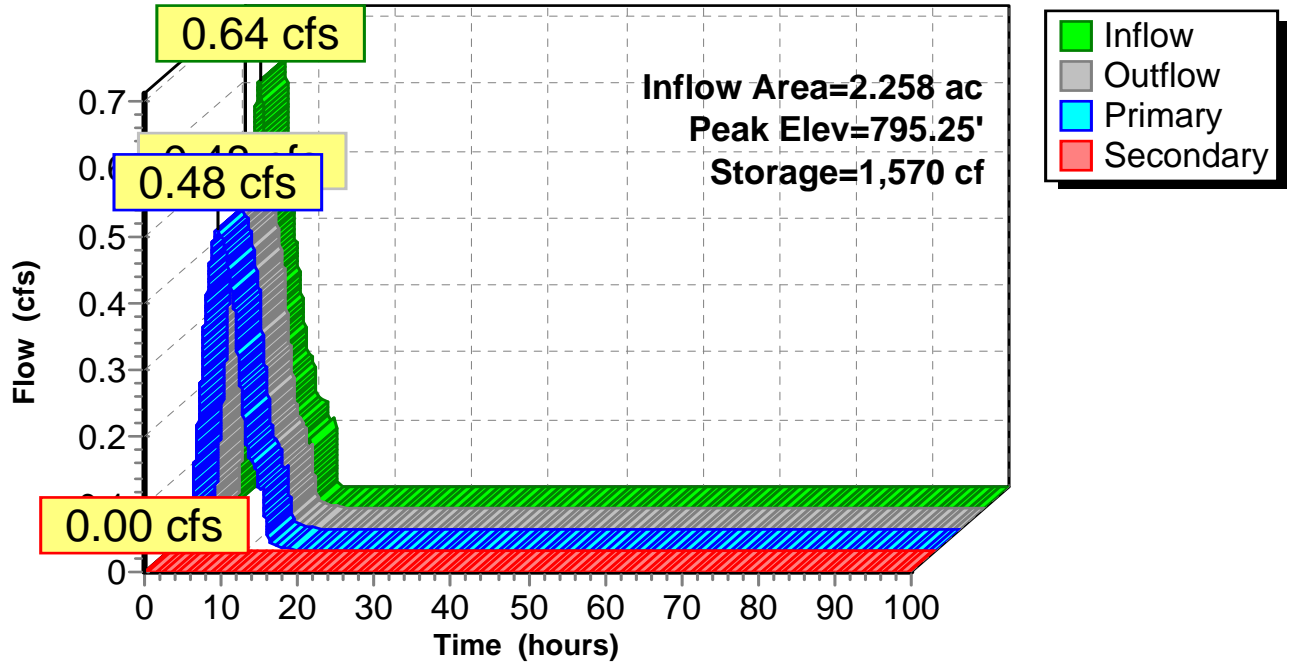
403.6 cy Field

240.5 cy Stone



Pond 53P: Onsite Post (North)

Hydrograph



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Huff 0-10sm 2Q 12.00 hrs 2-Year Rainfall=2.25"

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Page 17

Time span=0.00-100.00 hrs, dt=0.01 hrs, 10001 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: PreDeveloped** Runoff Area=6.580 ac 46.08% Impervious Runoff Depth=1.17"  
Flow Length=250' Slope=0.0200 '/' Tc=17.9 min CN=88 Runoff=1.84 cfs 0.642 af

**Subcatchment 4S: Undetained** Runoff Area=1.067 ac 0.00% Impervious Runoff Depth=0.47"  
Tc=10.0 min CN=74 Runoff=0.12 cfs 0.042 af

**Subcatchment 37S: Site (South)** Runoff Area=3.255 ac 68.05% Impervious Runoff Depth=1.46"  
Flow Length=250' Slope=0.0200 '/' Tc=11.0 min CN=92 Runoff=1.11 cfs 0.397 af

**Subcatchment 49S: Site (North)** Runoff Area=2.258 ac 80.56% Impervious Runoff Depth=1.55"  
Flow Length=300' Slope=0.0200 '/' Tc=18.2 min CN=93 Runoff=0.81 cfs 0.291 af

**Subcatchment 54S: Developed** Runoff Area=6.580 ac 61.31% Impervious Runoff Depth=1.31"  
Flow Length=250' Slope=0.0200 '/' Tc=17.9 min CN=90 Runoff=2.04 cfs 0.718 af

**Pond 38P: Ex. Drainage Channel** Peak Elev=791.97' Storage=29,952 cf Inflow=1.26 cfs 0.688 af  
Outflow=0.00 cfs 0.000 af

**Pond 52P: Onsite Post (South)** Peak Elev=795.87' Storage=4,253 cf Inflow=1.11 cfs 0.397 af  
Primary=0.69 cfs 0.397 af Secondary=0.00 cfs 0.000 af Outflow=0.69 cfs 0.397 af

**Pond 53P: Onsite Post (North)** Peak Elev=795.69' Storage=2,380 cf Inflow=0.81 cfs 0.291 af  
Primary=0.57 cfs 0.291 af Secondary=0.00 cfs 0.000 af Outflow=0.57 cfs 0.291 af

**Total Runoff Area = 19.740 ac Runoff Volume = 2.090 af Average Runoff Depth = 1.27"**  
**43.77% Pervious = 8.640 ac 56.23% Impervious = 11.100 ac**

**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 1.84 cfs @ 5.55 hrs, Volume= 0.642 af, Depth= 1.17"

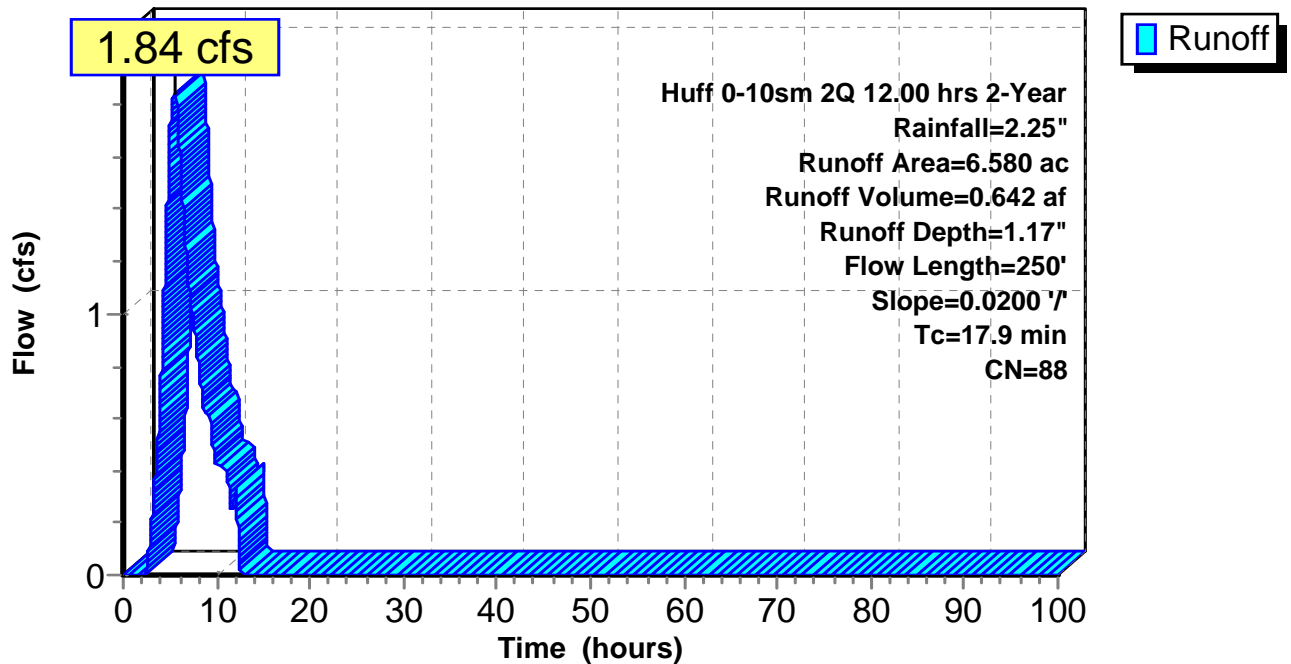
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 2-Year Rainfall=2.25"

Area (ac)	CN	Description
2.432	98	Paved parking, HSG C
0.600	98	Roofs, HSG C
3.548	79	50-75% Grass cover, Fair, HSG C
6.580	88	Weighted Average
3.548		53.92% Pervious Area
3.032		46.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



**Summary for Subcatchment 4S: Undetained**

Runoff = 0.12 cfs @ 5.70 hrs, Volume= 0.042 af, Depth= 0.47"

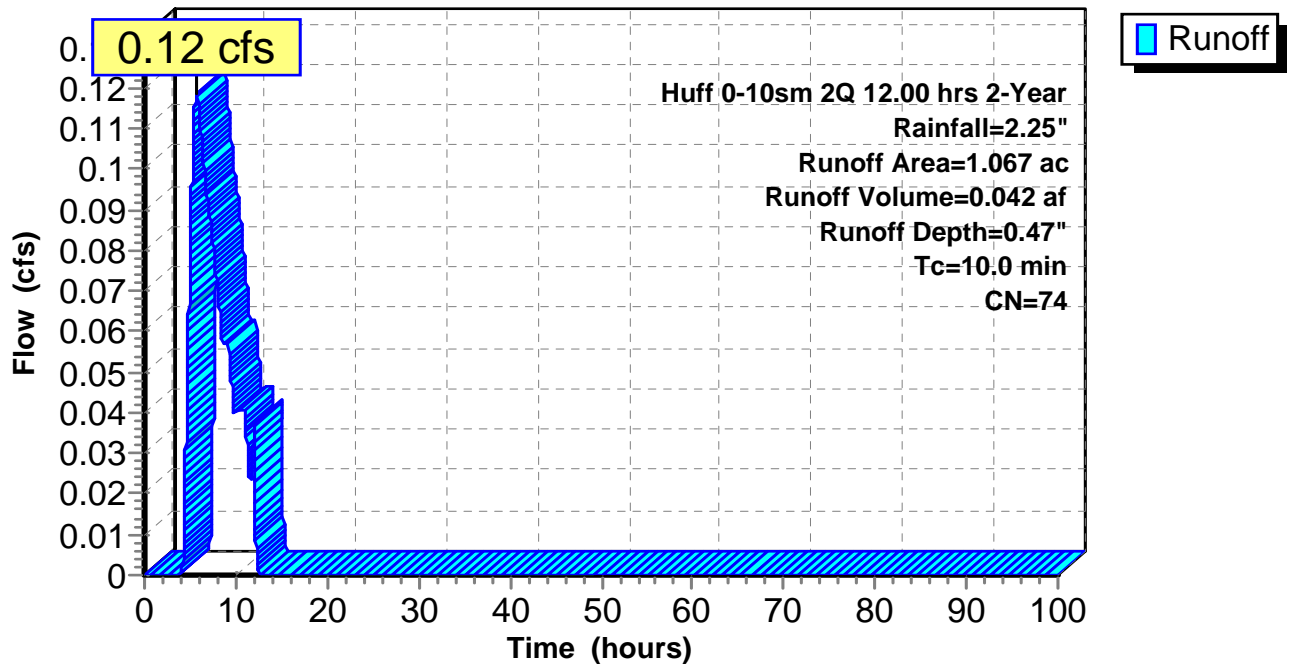
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 2-Year Rainfall=2.25"

Area (ac)	CN	Description
1.067	74	>75% Grass cover, Good, HSG C
1.067		100.00% Pervious Area

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

**Subcatchment 4S: Undetained**

**Hydrograph**





**Summary for Subcatchment 37S: Site (South)**

Runoff = 1.11 cfs @ 5.22 hrs, Volume= 0.397 af, Depth= 1.46"

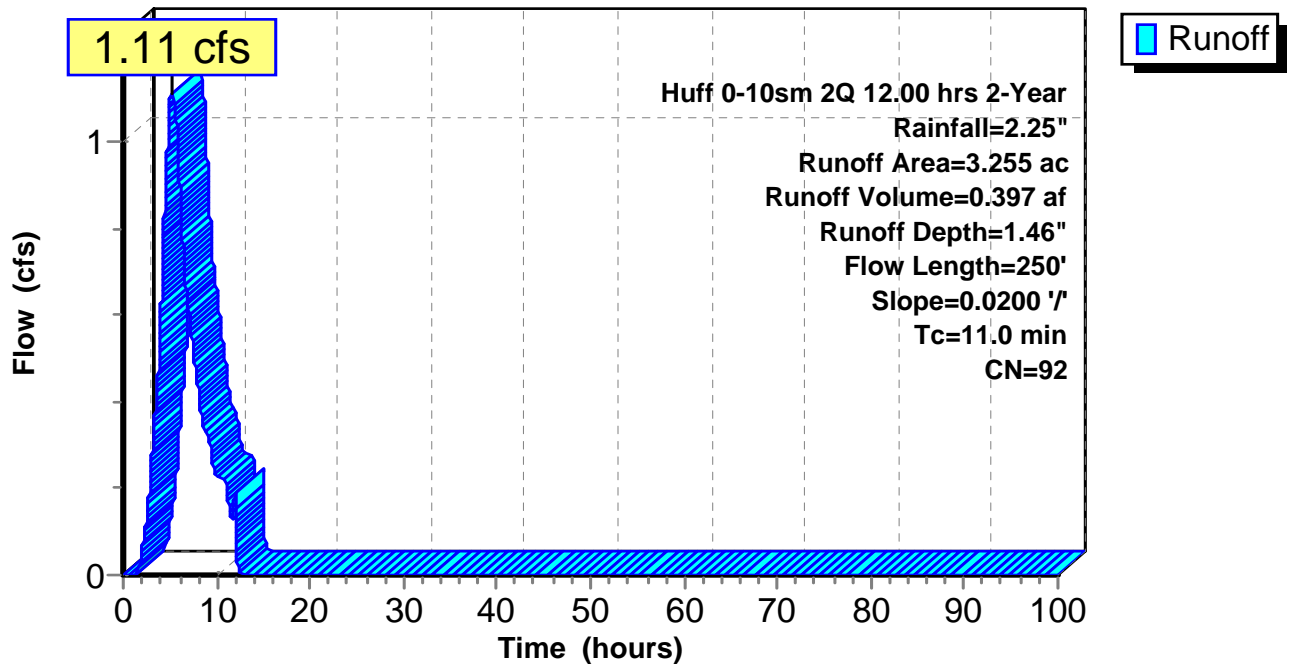
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 2-Year Rainfall=2.25"

Area (ac)	CN	Description
0.727	98	Roofs, HSG C
1.488	98	Paved parking, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
3.255	92	Weighted Average
1.040		31.95% Pervious Area
2.215		68.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0200	0.09		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
11.0	250	Total			

**Subcatchment 37S: Site (South)**

**Hydrograph**



**Stringtown**

Prepared by E.P. Ferris & Associates

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Huff 0-10sm 2Q 12.00 hrs 2-Year Rainfall=2.25"

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Page 21

**Summary for Subcatchment 49S: Site (North)**

Runoff = 0.81 cfs @ 5.32 hrs, Volume= 0.291 af, Depth= 1.55"

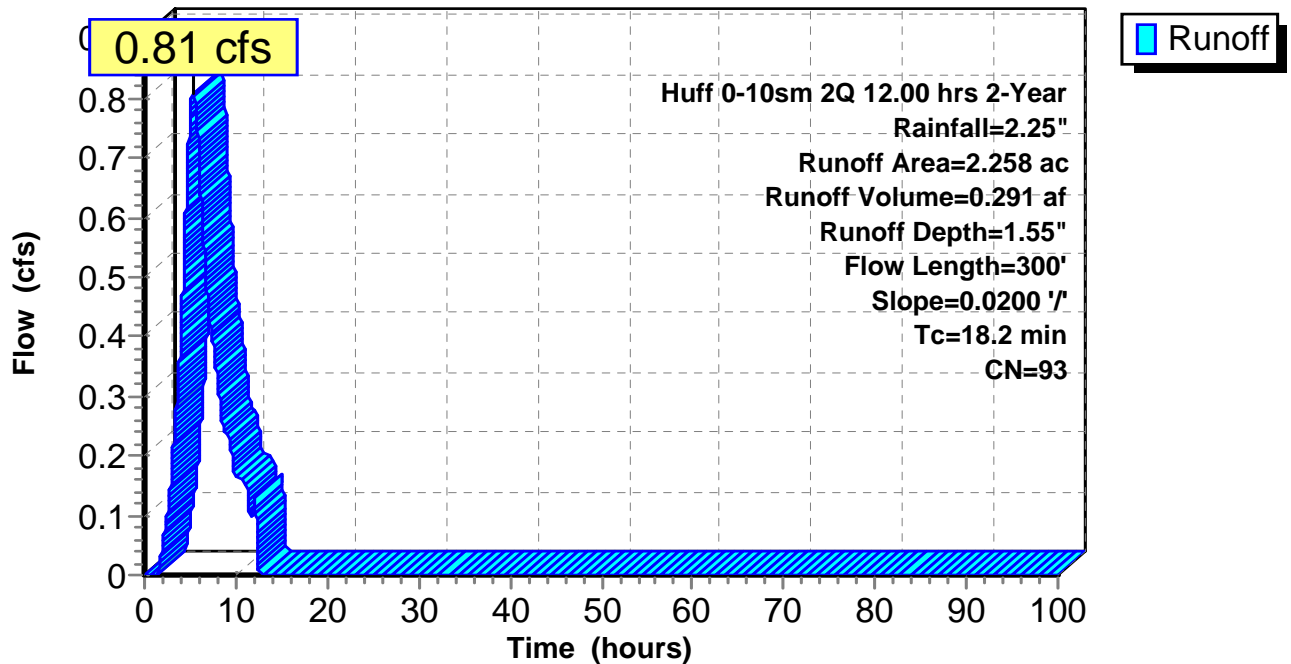
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 2-Year Rainfall=2.25"

Area (ac)	CN	Description
0.539	98	Roofs, HSG C
1.280	98	Paved parking, HSG C
0.439	74	>75% Grass cover, Good, HSG C
2.258	93	Weighted Average
0.439		19.44% Pervious Area
1.819		80.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
18.2	300	Total			

**Subcatchment 49S: Site (North)**

**Hydrograph**



**Summary for Subcatchment 54S: Developed**

Runoff = 2.04 cfs @ 5.51 hrs, Volume= 0.718 af, Depth= 1.31"

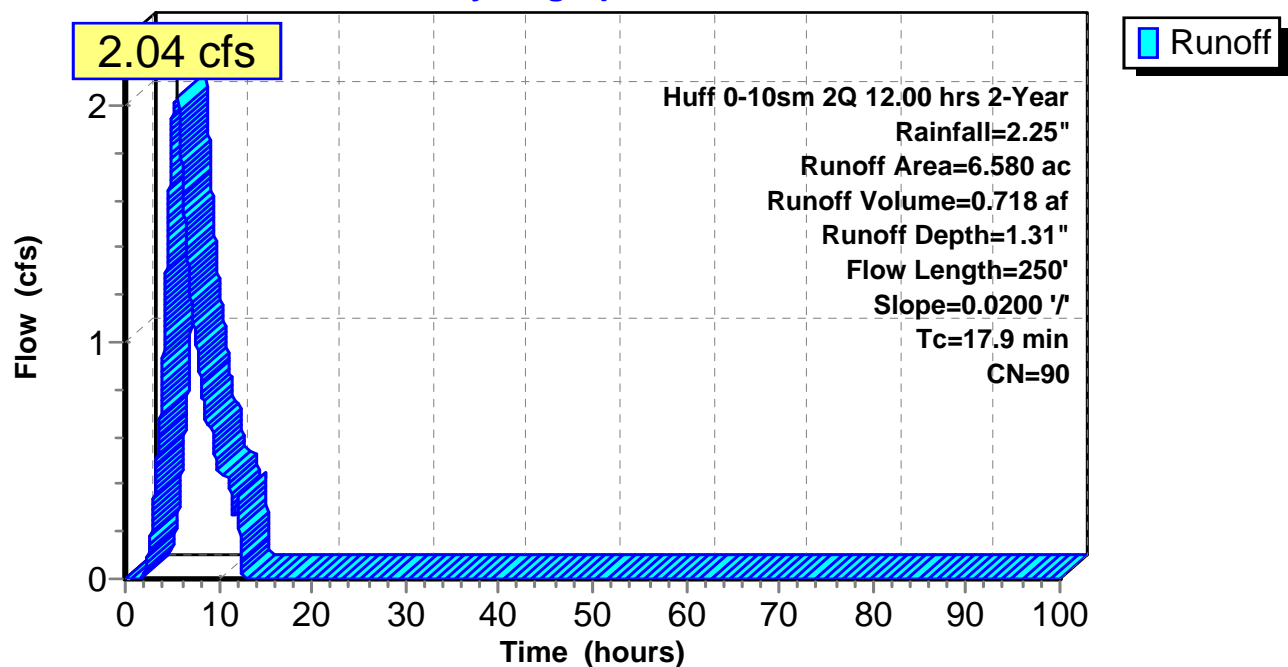
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 2-Year Rainfall=2.25"

Area (ac)	CN	Description
2.768	98	Paved parking, HSG C
1.266	98	Roofs, HSG C
0.439	74	>75% Grass cover, Good, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
1.067	74	>75% Grass cover, Good, HSG C
6.580	90	Weighted Average
2.546		38.69% Pervious Area
4.034		61.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 54S: Developed**

**Hydrograph**



### Summary for Pond 38P: Ex. Drainage Channel

Inflow Area = 5.513 ac, 73.17% Impervious, Inflow Depth = 1.50" for 2-Year event  
Inflow = 1.26 cfs @ 6.53 hrs, Volume= 0.688 af  
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

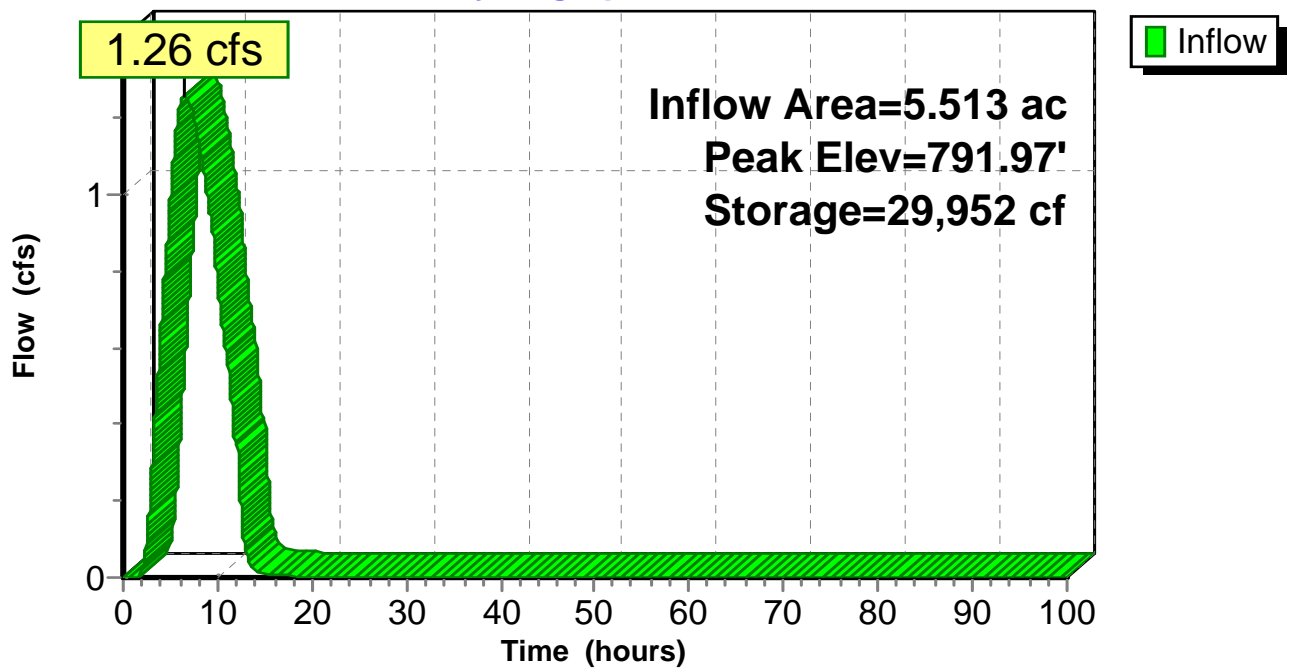
Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
Peak Elev= 791.97' @ 83.94 hrs Surf.Area= 19,196 sf Storage= 29,952 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	790.00'	319,013 cf	12.50'W x 898.00'L x 10.00'H Prismatic Z=2.2

### Pond 38P: Ex. Drainage Channel

#### Hydrograph



**Summary for Pond 52P: Onsite Post (South)**

Inflow Area = 3.255 ac, 68.05% Impervious, Inflow Depth = 1.46" for 2-Year event  
 Inflow = 1.11 cfs @ 5.22 hrs, Volume= 0.397 af  
 Outflow = 0.69 cfs @ 6.63 hrs, Volume= 0.397 af, Atten= 38%, Lag= 84.8 min  
 Primary = 0.69 cfs @ 6.63 hrs, Volume= 0.397 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 795.87' @ 6.63 hrs Surf.Area= 3,405 sf Storage= 4,253 cf

Plug-Flow detention time= 76.8 min calculated for 0.397 af (100% of inflow)  
 Center-of-Mass det. time= 76.9 min ( 459.4 - 382.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	3,993 cf	<b>28.50'W x 119.49'L x 5.00'H Field A</b> 17,027 cf Overall - 7,045 cf Embedded = 9,982 cf x 40.0% Voids
#2A	794.75'	7,045 cf	<b>StormTech MC-3500</b> x 64 Inside #1 Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		11,038 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=0.69 cfs @ 6.63 hrs HW=795.87' (Free Discharge)  
 ↑1=**Orifice/Grate** (Orifice Controls 0.69 cfs @ 6.25 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=794.00' (Free Discharge)  
 ↑2=**Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Pond 52P: Onsite Post (South) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

16 Chambers/Row x 7.17' Long = 114.72' + 28.6" End Stone x 2 = 119.49' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

64 Chambers x 110.1 cf = 7,044.6 cf Chamber Storage

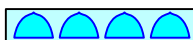
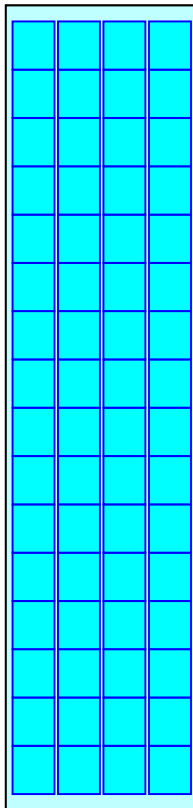
17,026.9 cf Field - 7,044.6 cf Chambers = 9,982.2 cf Stone x 40.0% Voids = 3,992.9 cf Stone Storage

Stone + Chamber Storage = 11,037.5 cf = 0.253 af

64 Chambers

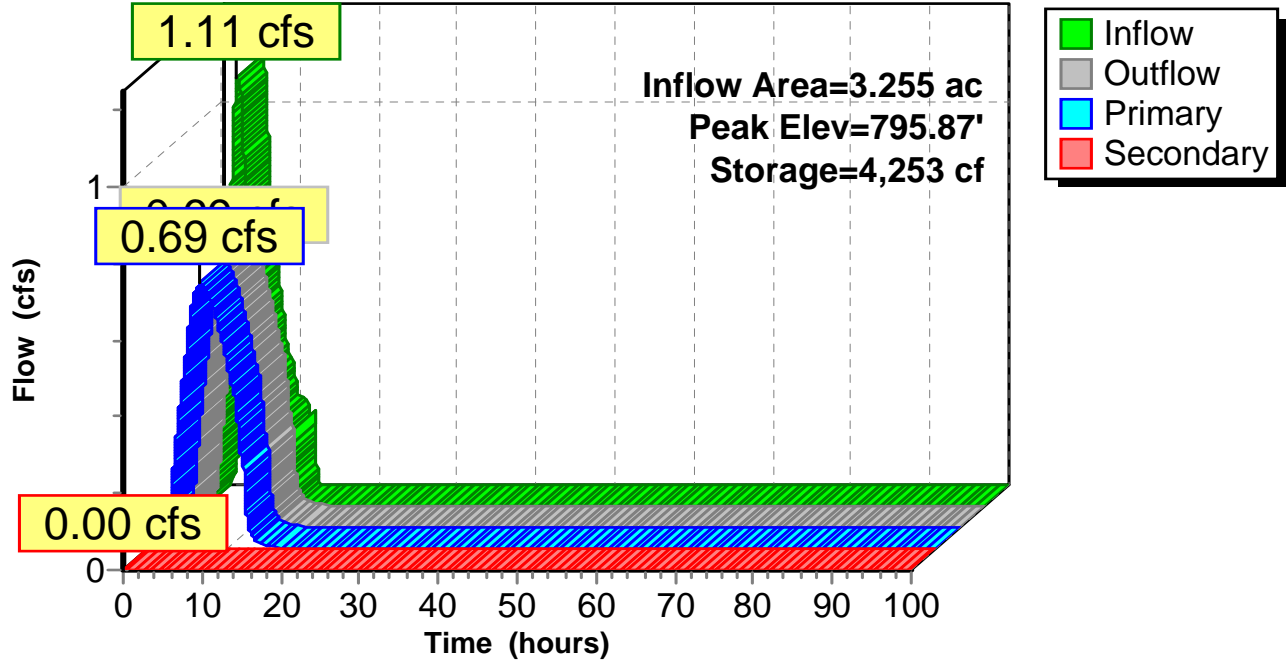
630.6 cy Field

369.7 cy Stone



### Pond 52P: Onsite Post (South)

#### Hydrograph



**Summary for Pond 53P: Onsite Post (North)**

Inflow Area = 2.258 ac, 80.56% Impervious, Inflow Depth = 1.55" for 2-Year event  
 Inflow = 0.81 cfs @ 5.32 hrs, Volume= 0.291 af  
 Outflow = 0.57 cfs @ 6.42 hrs, Volume= 0.291 af, Atten= 29%, Lag= 66.2 min  
 Primary = 0.57 cfs @ 6.42 hrs, Volume= 0.291 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 795.69' @ 6.42 hrs Surf.Area= 2,179 sf Storage= 2,380 cf

Plug-Flow detention time= 49.9 min calculated for 0.291 af (100% of inflow)  
 Center-of-Mass det. time= 49.9 min ( 434.3 - 384.3 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	2,597 cf	<b>28.50'W x 76.47'L x 5.00'H Field A</b> 10,897 cf Overall - 4,403 cf Embedded = 6,494 cf x 40.0% Voids
#2A	794.75'	4,403 cf	<b>StormTech MC-3500</b> x 40 Inside #1 Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		7,000 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.2" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=0.57 cfs @ 6.42 hrs HW=795.69' (Free Discharge)  
 ↑1=Orifice/Grate (Orifice Controls 0.57 cfs @ 5.93 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=794.00' (Free Discharge)  
 ↑2=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)



**Pond 53P: Onsite Post (North) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

10 Chambers/Row x 7.17' Long = 71.70' + 28.6" End Stone x 2 = 76.47' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

40 Chambers x 110.1 cf = 4,402.9 cf Chamber Storage

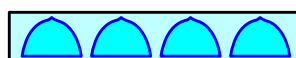
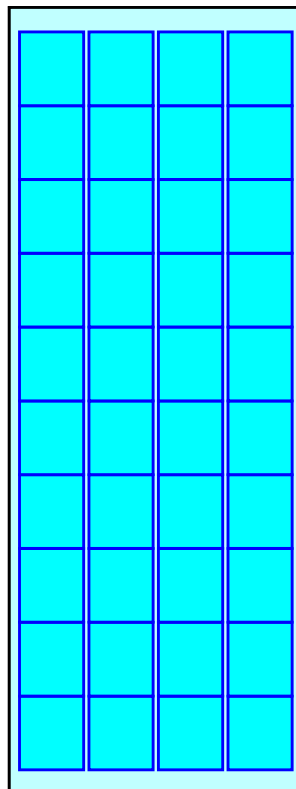
10,896.5 cf Field - 4,402.9 cf Chambers = 6,493.6 cf Stone x 40.0% Voids = 2,597.4 cf Stone Storage

Stone + Chamber Storage = 7,000.3 cf = 0.161 af

40 Chambers

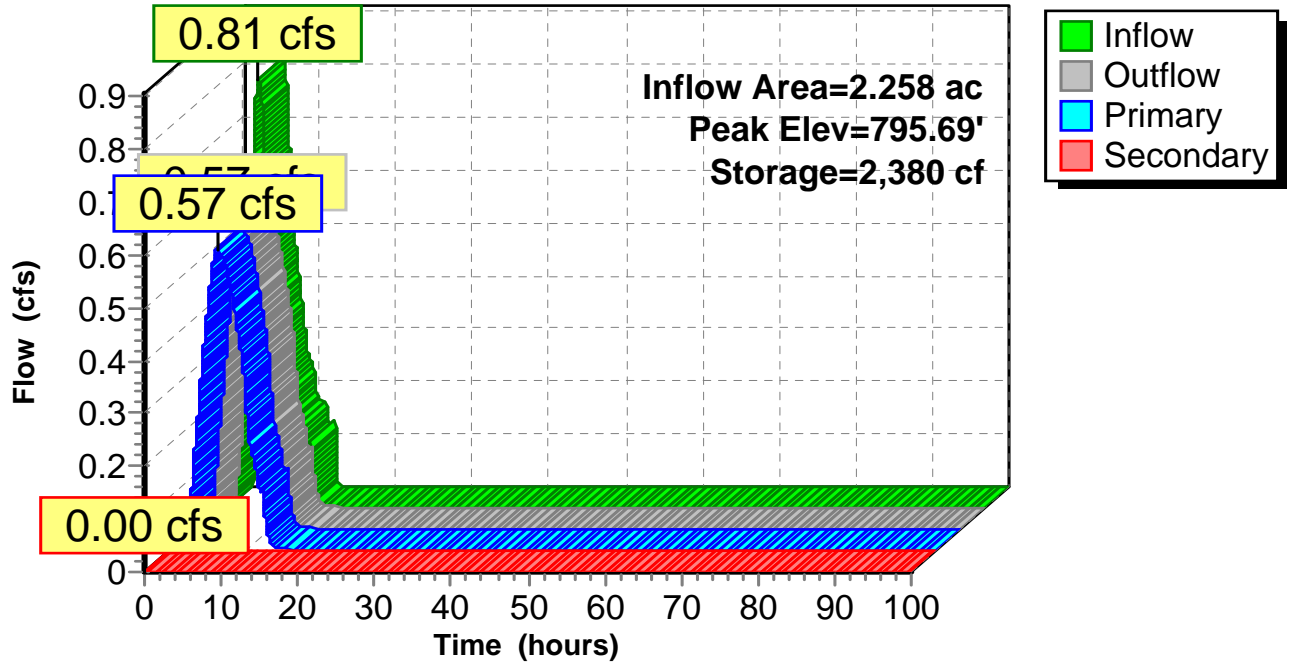
403.6 cy Field

240.5 cy Stone



Pond 53P: Onsite Post (North)

Hydrograph



**Stringtown**

Huff 0-10sm 2Q 12.00 hrs 5-Year Rainfall=2.79"

Prepared by E.P. Ferris &amp; Associates

Printed 12/18/2017

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Page 30

Time span=0.00-100.00 hrs, dt=0.01 hrs, 10001 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: PreDeveloped** Runoff Area=6.580 ac 46.08% Impervious Runoff Depth=1.63"  
Flow Length=250' Slope=0.0200 '/' Tc=17.9 min CN=88 Runoff=2.54 cfs 0.895 af

**Subcatchment 4S: Undetained** Runoff Area=1.067 ac 0.00% Impervious Runoff Depth=0.78"  
Tc=10.0 min CN=74 Runoff=0.20 cfs 0.069 af

**Subcatchment 37S: Site (South)** Runoff Area=3.255 ac 68.05% Impervious Runoff Depth=1.96"  
Flow Length=250' Slope=0.0200 '/' Tc=11.0 min CN=92 Runoff=1.48 cfs 0.533 af

**Subcatchment 49S: Site (North)** Runoff Area=2.258 ac 80.56% Impervious Runoff Depth=2.05"  
Flow Length=300' Slope=0.0200 '/' Tc=18.2 min CN=93 Runoff=1.06 cfs 0.386 af

**Subcatchment 54S: Developed** Runoff Area=6.580 ac 61.31% Impervious Runoff Depth=1.79"  
Flow Length=250' Slope=0.0200 '/' Tc=17.9 min CN=90 Runoff=2.76 cfs 0.983 af

**Pond 38P: Ex. Drainage Channel** Peak Elev=792.47' Storage=40,029 cf Inflow=1.55 cfs 0.919 af  
Outflow=0.00 cfs 0.000 af

**Pond 52P: Onsite Post (South)** Peak Elev=796.72' Storage=6,553 cf Inflow=1.48 cfs 0.533 af  
Primary=0.85 cfs 0.533 af Secondary=0.00 cfs 0.000 af Outflow=0.85 cfs 0.533 af

**Pond 53P: Onsite Post (North)** Peak Elev=796.46' Storage=3,720 cf Inflow=1.06 cfs 0.386 af  
Primary=0.70 cfs 0.386 af Secondary=0.00 cfs 0.000 af Outflow=0.70 cfs 0.386 af

**Total Runoff Area = 19.740 ac Runoff Volume = 2.866 af Average Runoff Depth = 1.74"**  
**43.77% Pervious = 8.640 ac 56.23% Impervious = 11.100 ac**

**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 2.54 cfs @ 5.51 hrs, Volume= 0.895 af, Depth= 1.63"

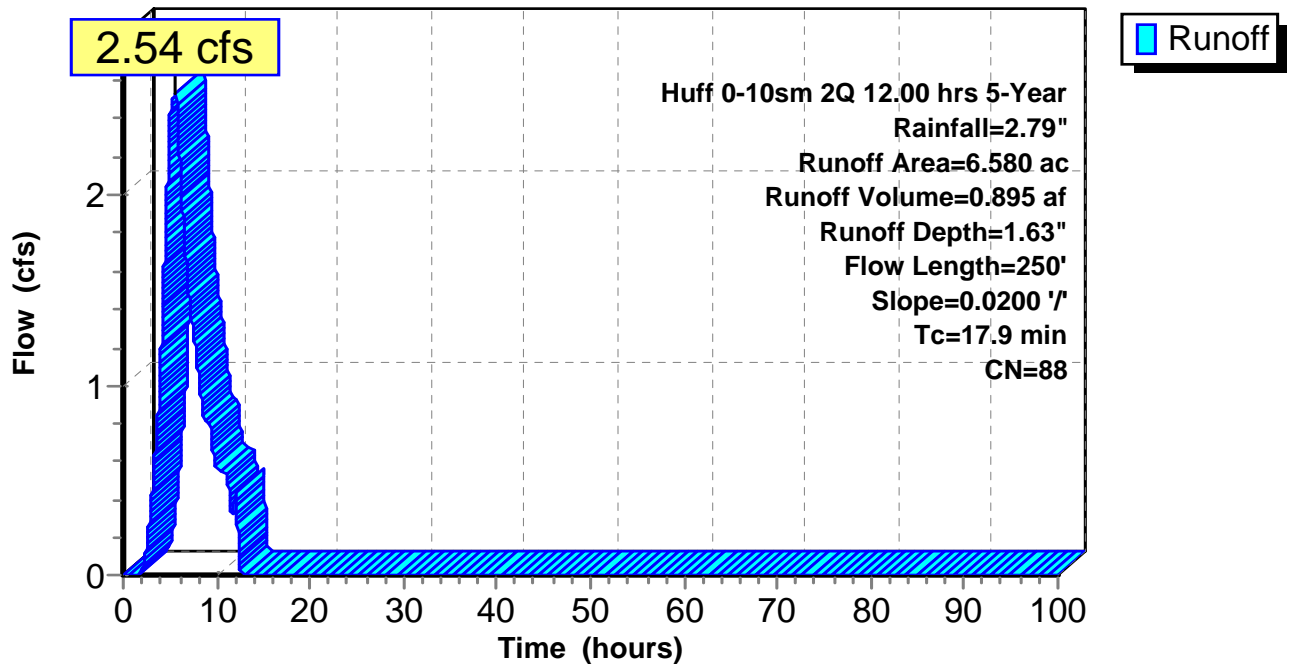
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 5-Year Rainfall=2.79"

Area (ac)	CN	Description
2.432	98	Paved parking, HSG C
0.600	98	Roofs, HSG C
3.548	79	50-75% Grass cover, Fair, HSG C
6.580	88	Weighted Average
3.548		53.92% Pervious Area
3.032		46.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



**Summary for Subcatchment 4S: Undetained**

Runoff = 0.20 cfs @ 5.59 hrs, Volume= 0.069 af, Depth= 0.78"

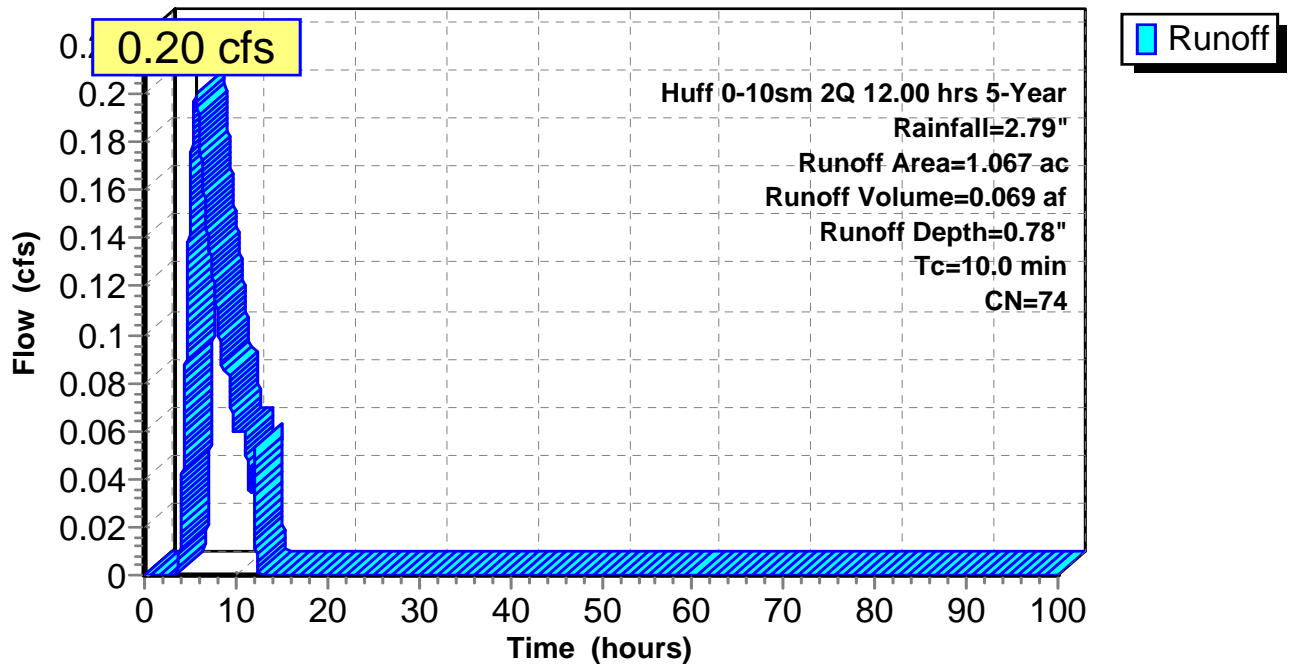
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 5-Year Rainfall=2.79"

Area (ac)	CN	Description
1.067	74	>75% Grass cover, Good, HSG C
1.067		100.00% Pervious Area

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

**Subcatchment 4S: Undetained**

**Hydrograph**



**Summary for Subcatchment 37S: Site (South)**

Runoff = 1.48 cfs @ 5.12 hrs, Volume= 0.533 af, Depth= 1.96"

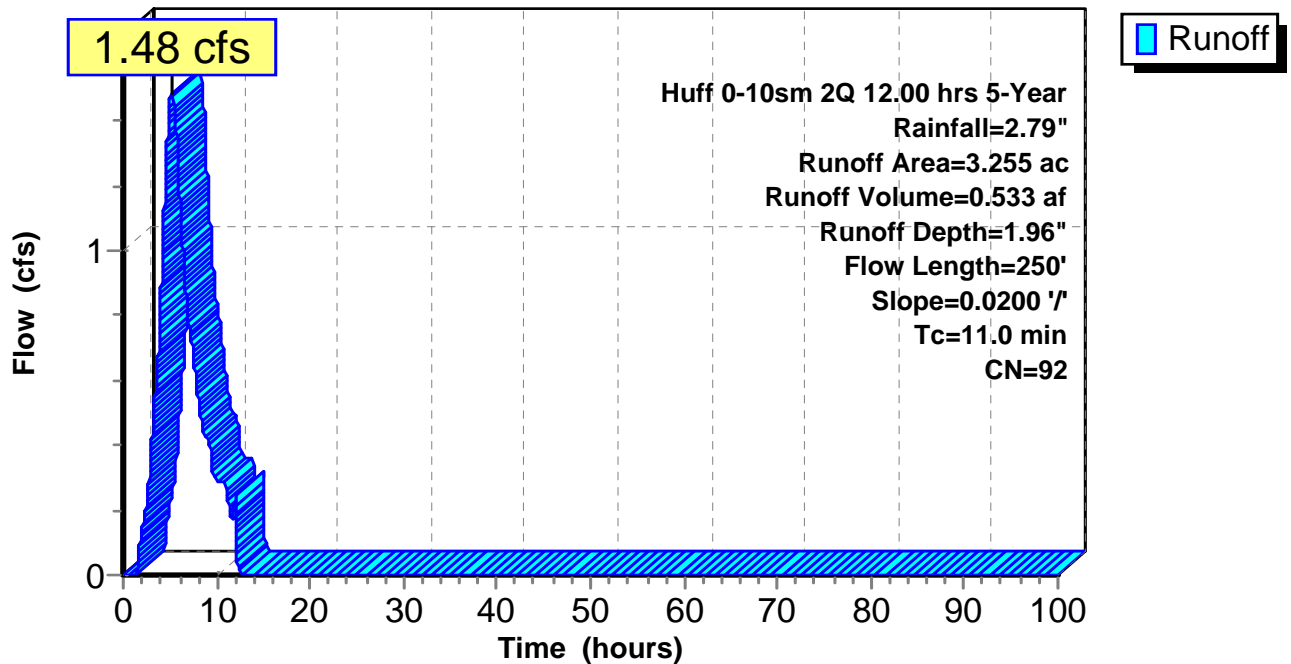
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 5-Year Rainfall=2.79"

Area (ac)	CN	Description
0.727	98	Roofs, HSG C
1.488	98	Paved parking, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
3.255	92	Weighted Average
1.040		31.95% Pervious Area
2.215		68.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0200	0.09		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
11.0	250	Total			

**Subcatchment 37S: Site (South)**

**Hydrograph**



**Summary for Subcatchment 49S: Site (North)**

Runoff = 1.06 cfs @ 5.24 hrs, Volume= 0.386 af, Depth= 2.05"

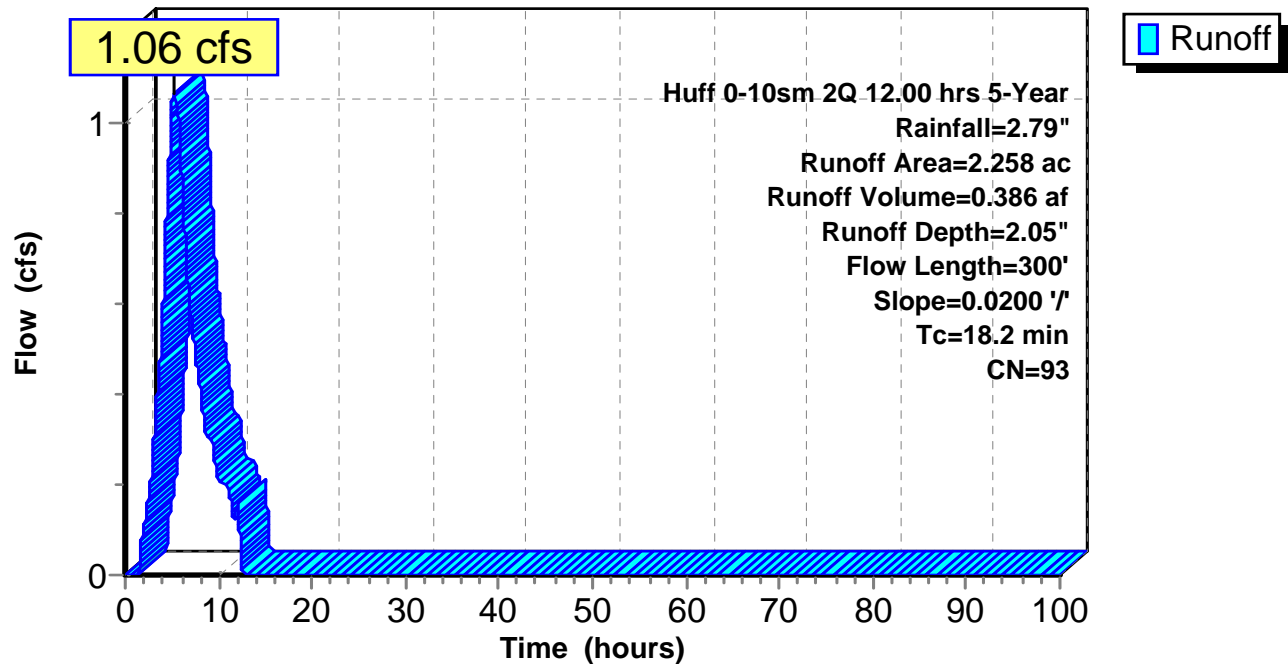
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 5-Year Rainfall=2.79"

Area (ac)	CN	Description
0.539	98	Roofs, HSG C
1.280	98	Paved parking, HSG C
0.439	74	>75% Grass cover, Good, HSG C
2.258	93	Weighted Average
0.439		19.44% Pervious Area
1.819		80.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
18.2	300	Total			

**Subcatchment 49S: Site (North)**

**Hydrograph**



**Summary for Subcatchment 54S: Developed**

Runoff = 2.76 cfs @ 5.39 hrs, Volume= 0.983 af, Depth= 1.79"

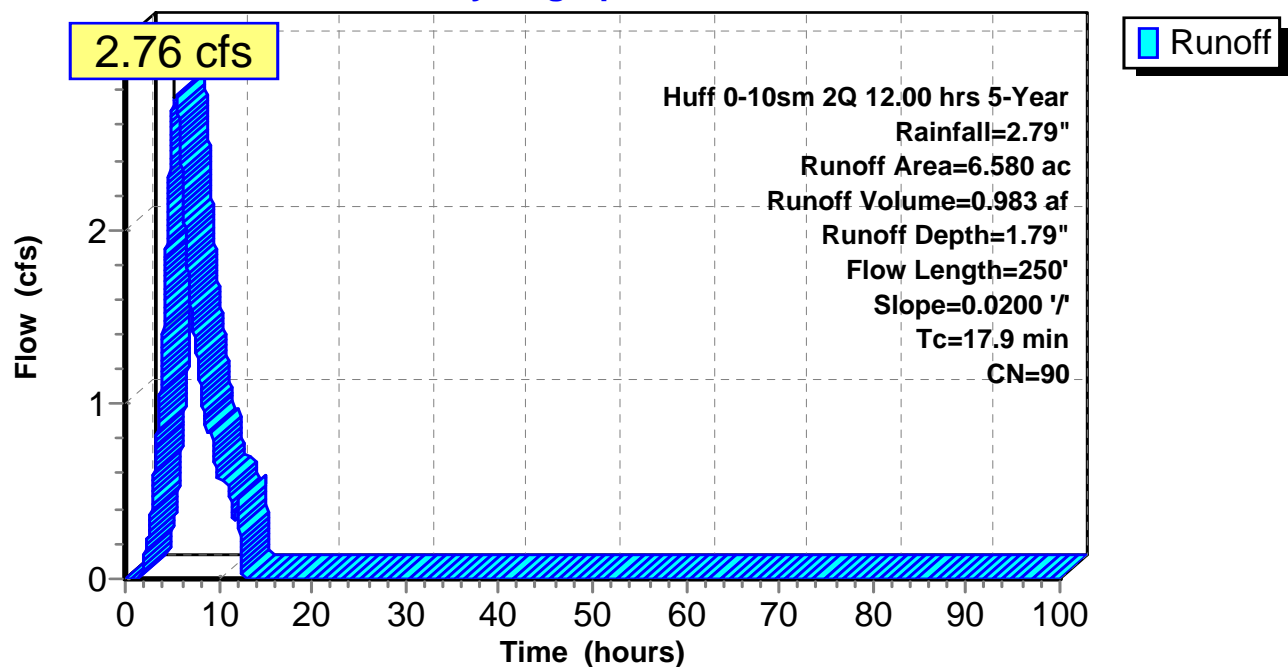
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 5-Year Rainfall=2.79"

Area (ac)	CN	Description
2.768	98	Paved parking, HSG C
1.266	98	Roofs, HSG C
0.439	74	>75% Grass cover, Good, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
1.067	74	>75% Grass cover, Good, HSG C
6.580	90	Weighted Average
2.546		38.69% Pervious Area
4.034		61.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 54S: Developed**

**Hydrograph**





### Summary for Pond 38P: Ex. Drainage Channel

Inflow Area = 5.513 ac, 73.17% Impervious, Inflow Depth = 2.00" for 5-Year event  
 Inflow = 1.55 cfs @ 6.64 hrs, Volume= 0.919 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

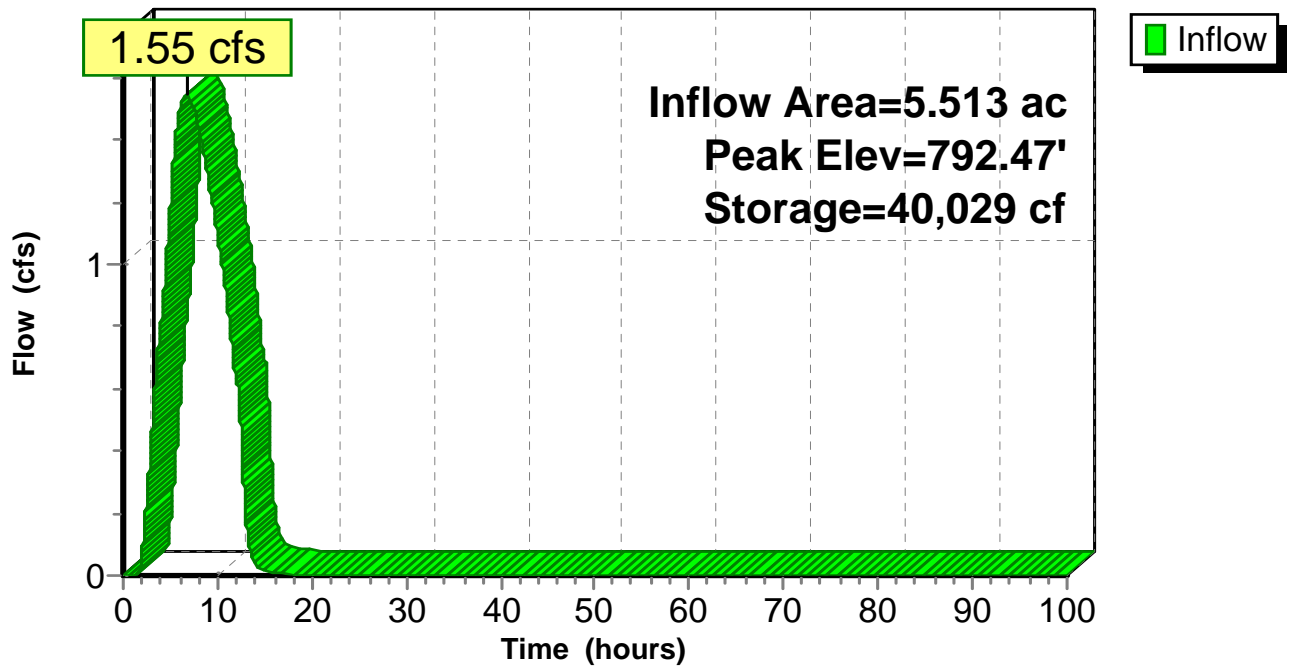
Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 792.47' @ 83.24 hrs Surf.Area= 21,236 sf Storage= 40,029 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	790.00'	319,013 cf	12.50'W x 898.00'L x 10.00'H Prismatic Z=2.2

### Pond 38P: Ex. Drainage Channel

#### Hydrograph



**Summary for Pond 52P: Onsite Post (South)**

Inflow Area = 3.255 ac, 68.05% Impervious, Inflow Depth = 1.96" for 5-Year event  
 Inflow = 1.48 cfs @ 5.12 hrs, Volume= 0.533 af  
 Outflow = 0.85 cfs @ 6.75 hrs, Volume= 0.533 af, Atten= 43%, Lag= 97.8 min  
 Primary = 0.85 cfs @ 6.75 hrs, Volume= 0.533 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 796.72' @ 6.75 hrs Surf.Area= 3,405 sf Storage= 6,553 cf

Plug-Flow detention time= 97.4 min calculated for 0.533 af (100% of inflow)  
 Center-of-Mass det. time= 97.3 min ( 472.6 - 375.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	3,993 cf	<b>28.50'W x 119.49'L x 5.00'H Field A</b> 17,027 cf Overall - 7,045 cf Embedded = 9,982 cf x 40.0% Voids
#2A	794.75'	7,045 cf	<b>StormTech MC-3500</b> x 64 Inside #1 Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		11,038 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=0.85 cfs @ 6.75 hrs HW=796.72' (Free Discharge)  
 ↑1=**Orifice/Grate** (Orifice Controls 0.85 cfs @ 7.66 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=794.00' (Free Discharge)  
 ↑2=**Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Pond 52P: Onsite Post (South) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

16 Chambers/Row x 7.17' Long = 114.72' + 28.6" End Stone x 2 = 119.49' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

64 Chambers x 110.1 cf = 7,044.6 cf Chamber Storage

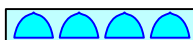
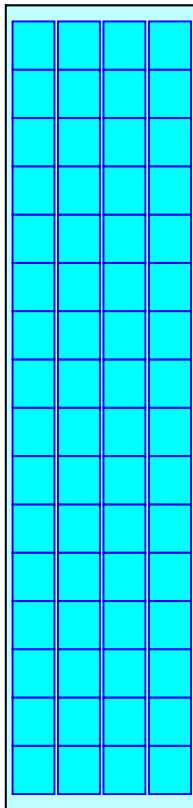
17,026.9 cf Field - 7,044.6 cf Chambers = 9,982.2 cf Stone x 40.0% Voids = 3,992.9 cf Stone Storage

Stone + Chamber Storage = 11,037.5 cf = 0.253 af

64 Chambers

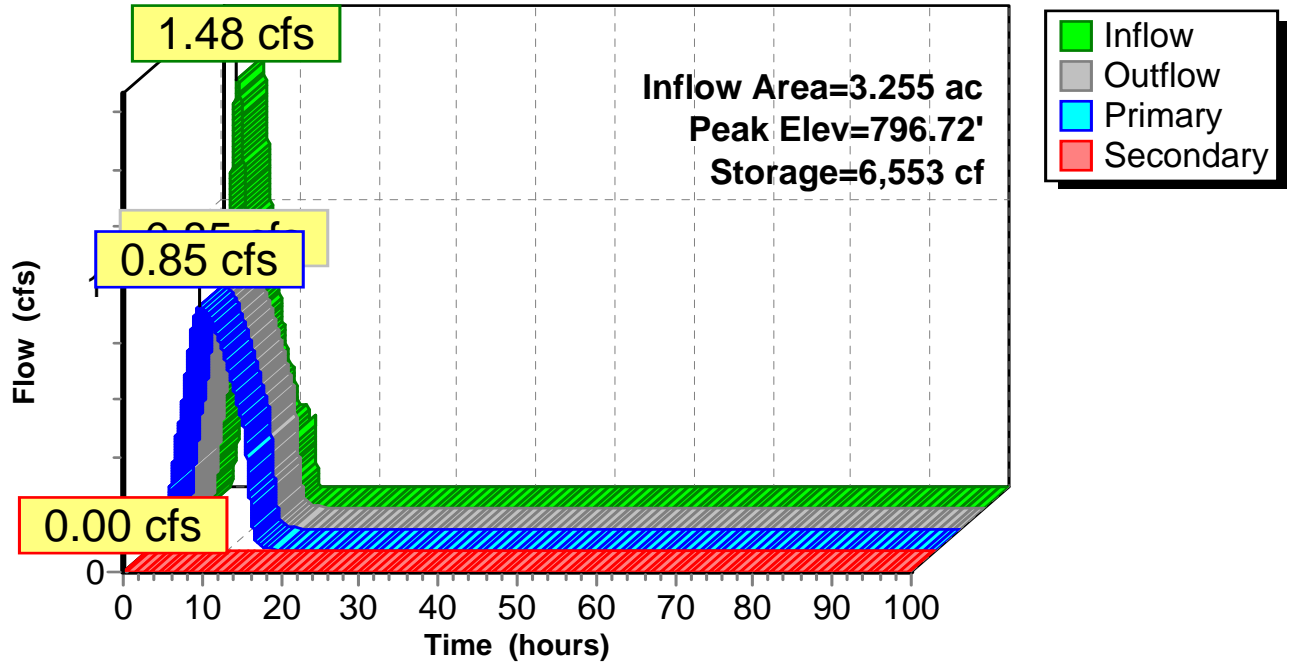
630.6 cy Field

369.7 cy Stone



### Pond 52P: Onsite Post (South)

#### Hydrograph



**Summary for Pond 53P: Onsite Post (North)**

Inflow Area = 2.258 ac, 80.56% Impervious, Inflow Depth = 2.05" for 5-Year event  
 Inflow = 1.06 cfs @ 5.24 hrs, Volume= 0.386 af  
 Outflow = 0.70 cfs @ 6.53 hrs, Volume= 0.386 af, Atten= 34%, Lag= 77.6 min  
 Primary = 0.70 cfs @ 6.53 hrs, Volume= 0.386 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 796.46' @ 6.53 hrs Surf.Area= 2,179 sf Storage= 3,720 cf

Plug-Flow detention time= 63.5 min calculated for 0.386 af (100% of inflow)  
 Center-of-Mass det. time= 63.6 min ( 441.1 - 377.6 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	2,597 cf	<b>28.50'W x 76.47'L x 5.00'H Field A</b> 10,897 cf Overall - 4,403 cf Embedded = 6,494 cf x 40.0% Voids
#2A	794.75'	4,403 cf	<b>StormTech MC-3500 x 40 Inside #1</b> Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		7,000 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.2" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=0.70 cfs @ 6.53 hrs HW=796.46' (Free Discharge)  
 ↑1=**Orifice/Grate** (Orifice Controls 0.70 cfs @ 7.28 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=794.00' (Free Discharge)  
 ↑2=**Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Pond 53P: Onsite Post (North) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

10 Chambers/Row x 7.17' Long = 71.70' + 28.6" End Stone x 2 = 76.47' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

40 Chambers x 110.1 cf = 4,402.9 cf Chamber Storage

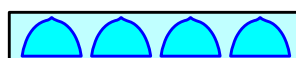
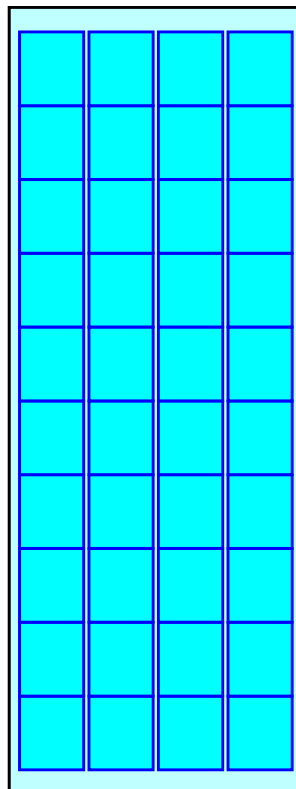
10,896.5 cf Field - 4,402.9 cf Chambers = 6,493.6 cf Stone x 40.0% Voids = 2,597.4 cf Stone Storage

Stone + Chamber Storage = 7,000.3 cf = 0.161 af

40 Chambers

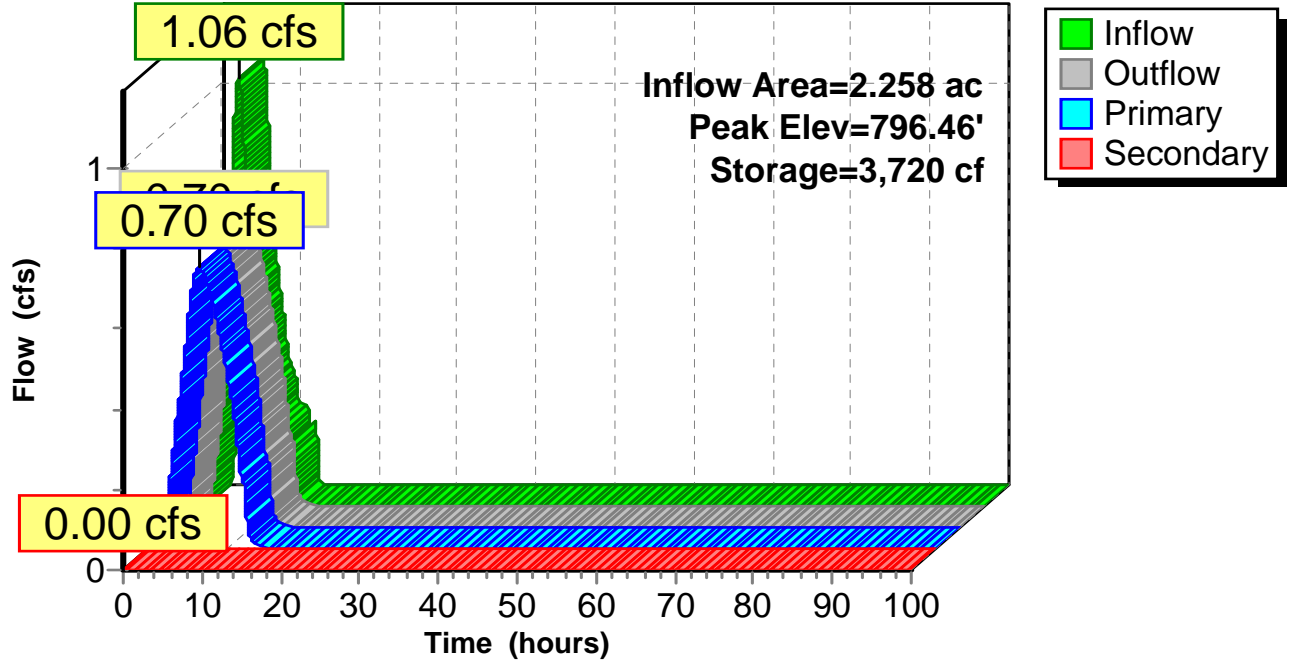
403.6 cy Field

240.5 cy Stone



Pond 53P: Onsite Post (North)

Hydrograph



**Stringtown**

Prepared by E.P. Ferris &amp; Associates

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Huff 0-10sm 2Q 12.00 hrs 10-Year Rainfall=3.24"

Printed 12/18/2017

Page 43

Time span=0.00-100.00 hrs, dt=0.01 hrs, 10001 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: PreDeveloped** Runoff Area=6.580 ac 46.08% Impervious Runoff Depth=2.03"  
Flow Length=250' Slope=0.0200 '/' Tc=17.9 min CN=88 Runoff=3.14 cfs 1.115 af

**Subcatchment 4S: Undetained** Runoff Area=1.067 ac 0.00% Impervious Runoff Depth=1.06"  
Tc=10.0 min CN=74 Runoff=0.28 cfs 0.095 af

**Subcatchment 37S: Site (South)** Runoff Area=3.255 ac 68.05% Impervious Runoff Depth=2.39"  
Flow Length=250' Slope=0.0200 '/' Tc=11.0 min CN=92 Runoff=1.79 cfs 0.648 af

**Subcatchment 49S: Site (North)** Runoff Area=2.258 ac 80.56% Impervious Runoff Depth=2.48"  
Flow Length=300' Slope=0.0200 '/' Tc=18.2 min CN=93 Runoff=1.28 cfs 0.467 af

**Subcatchment 54S: Developed** Runoff Area=6.580 ac 61.31% Impervious Runoff Depth=2.21"  
Flow Length=250' Slope=0.0200 '/' Tc=17.9 min CN=90 Runoff=3.37 cfs 1.209 af

**Pond 38P: Ex. Drainage Channel** Peak Elev=792.86' Storage=48,526 cf Inflow=1.78 cfs 1.114 af  
Outflow=0.00 cfs 0.000 af

**Pond 52P: Onsite Post (South)** Peak Elev=797.55' Storage=8,595 cf Inflow=1.79 cfs 0.648 af  
Primary=0.98 cfs 0.647 af Secondary=0.03 cfs 0.001 af Outflow=1.00 cfs 0.648 af

**Pond 53P: Onsite Post (North)** Peak Elev=797.21' Storage=4,937 cf Inflow=1.28 cfs 0.467 af  
Primary=0.81 cfs 0.467 af Secondary=0.00 cfs 0.000 af Outflow=0.81 cfs 0.467 af

**Total Runoff Area = 19.740 ac Runoff Volume = 3.534 af Average Runoff Depth = 2.15"**  
**43.77% Pervious = 8.640 ac 56.23% Impervious = 11.100 ac**



**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 3.14 cfs @ 5.43 hrs, Volume= 1.115 af, Depth= 2.03"

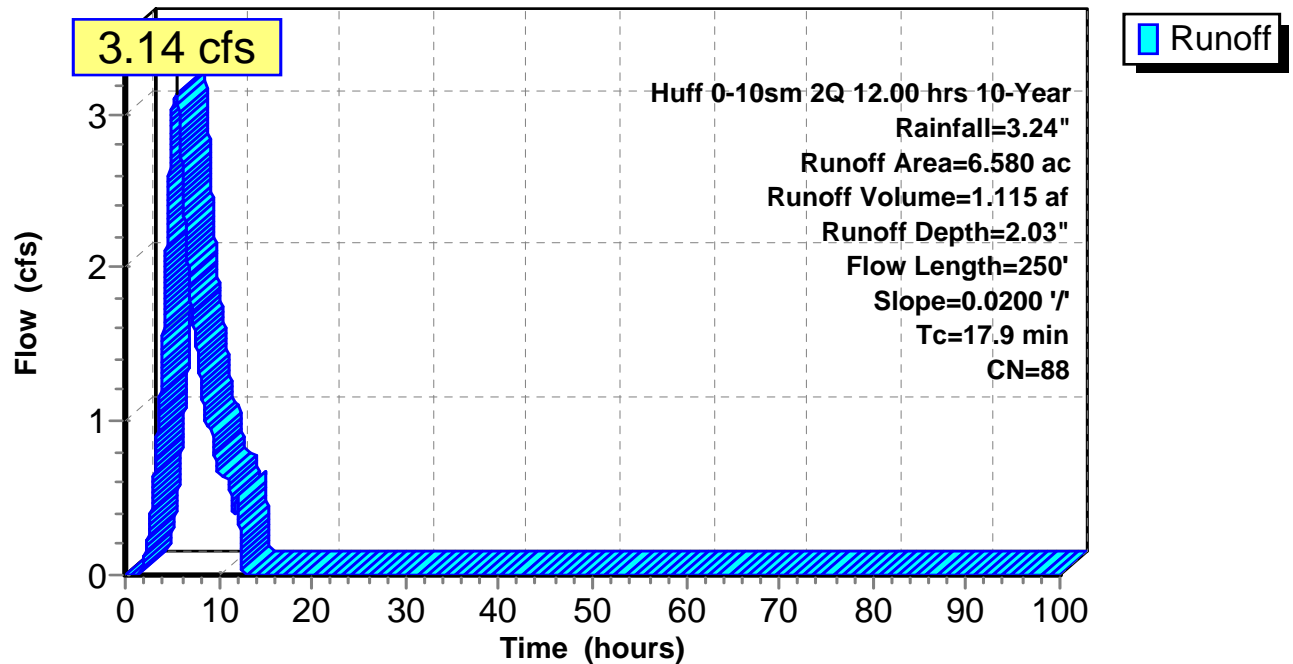
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 10-Year Rainfall=3.24"

Area (ac)	CN	Description
2.432	98	Paved parking, HSG C
0.600	98	Roofs, HSG C
3.548	79	50-75% Grass cover, Fair, HSG C
6.580	88	Weighted Average
3.548		53.92% Pervious Area
3.032		46.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



**Summary for Subcatchment 4S: Undetained**

Runoff = 0.28 cfs @ 5.57 hrs, Volume= 0.095 af, Depth= 1.06"

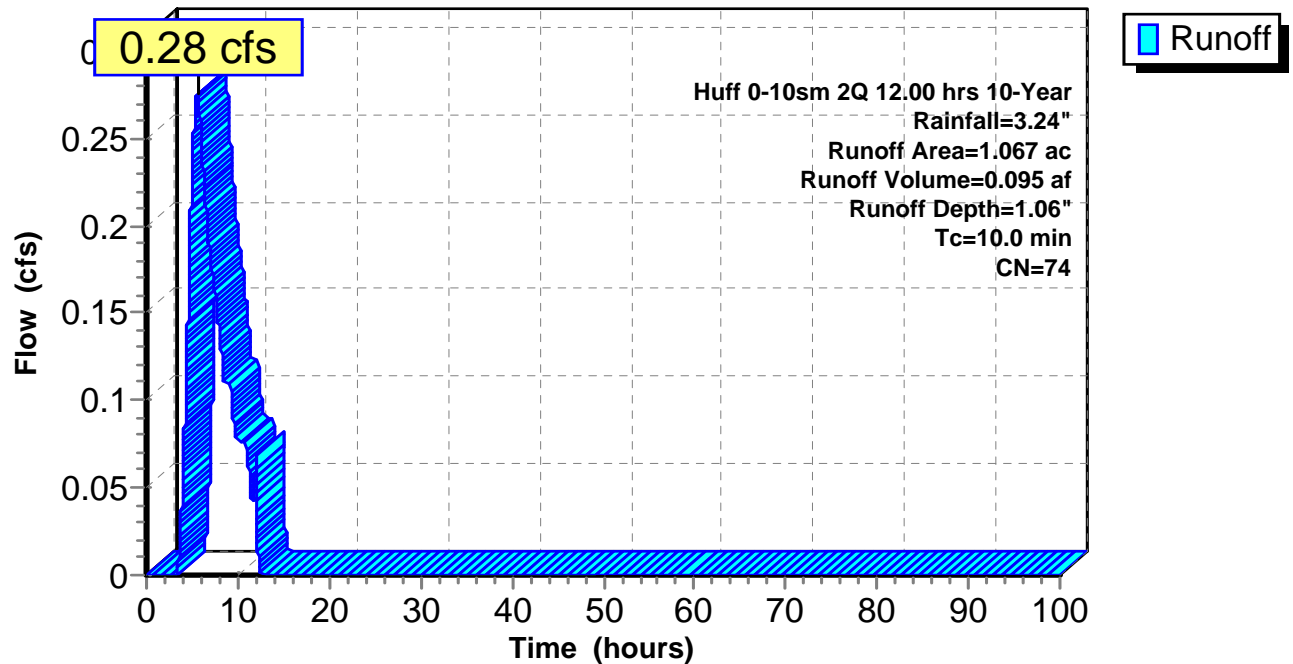
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 10-Year Rainfall=3.24"

Area (ac)	CN	Description
1.067	74	>75% Grass cover, Good, HSG C
1.067		100.00% Pervious Area

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

**Subcatchment 4S: Undetained**

**Hydrograph**



**Summary for Subcatchment 37S: Site (South)**

Runoff = 1.79 cfs @ 5.07 hrs, Volume= 0.648 af, Depth= 2.39"

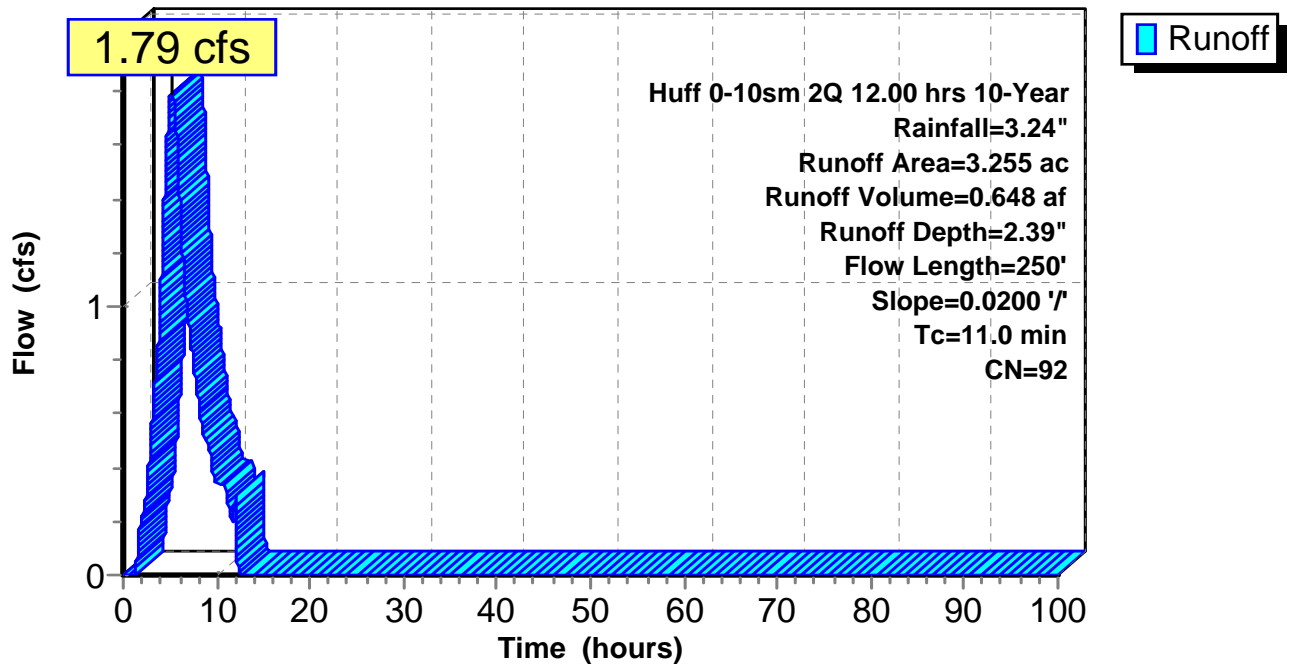
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 10-Year Rainfall=3.24"

Area (ac)	CN	Description
0.727	98	Roofs, HSG C
1.488	98	Paved parking, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
3.255	92	Weighted Average
1.040		31.95% Pervious Area
2.215		68.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0200	0.09		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
11.0	250	Total			

**Subcatchment 37S: Site (South)**

**Hydrograph**



**Summary for Subcatchment 49S: Site (North)**

Runoff = 1.28 cfs @ 5.20 hrs, Volume= 0.467 af, Depth= 2.48"

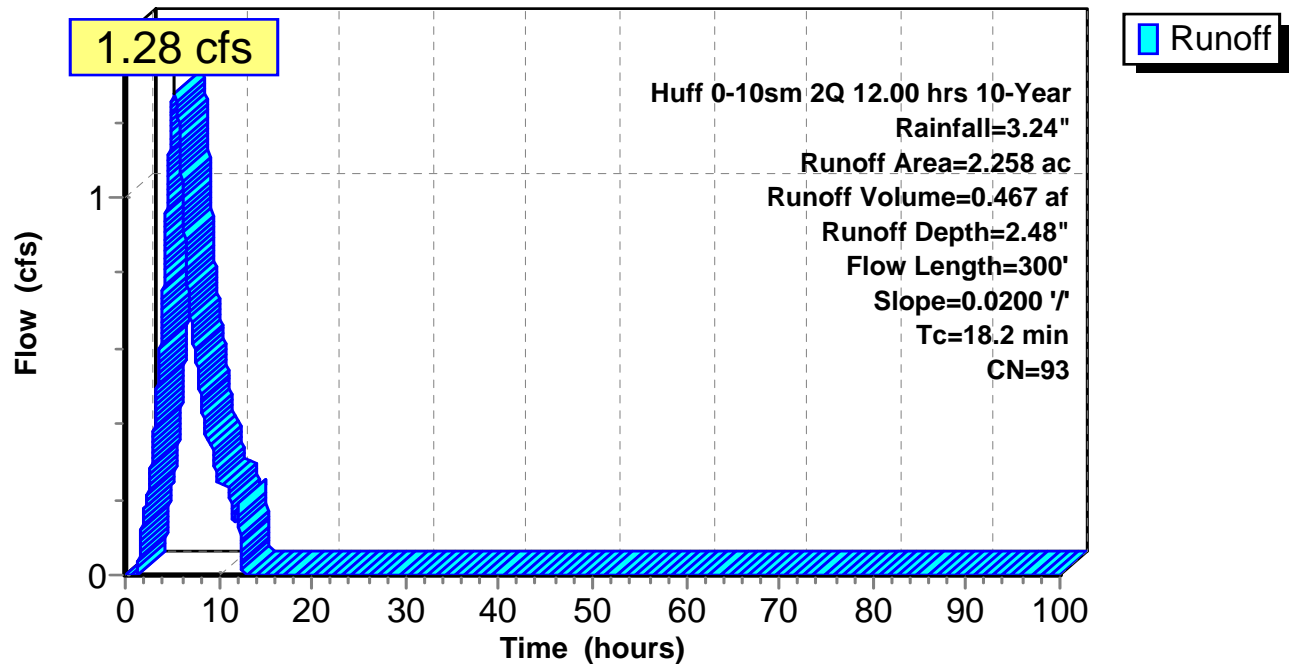
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 10-Year Rainfall=3.24"

Area (ac)	CN	Description
0.539	98	Roofs, HSG C
1.280	98	Paved parking, HSG C
0.439	74	>75% Grass cover, Good, HSG C
2.258	93	Weighted Average
0.439		19.44% Pervious Area
1.819		80.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
18.2	300	Total			

**Subcatchment 49S: Site (North)**

**Hydrograph**



**Summary for Subcatchment 54S: Developed**

Runoff = 3.37 cfs @ 5.31 hrs, Volume= 1.209 af, Depth= 2.21"

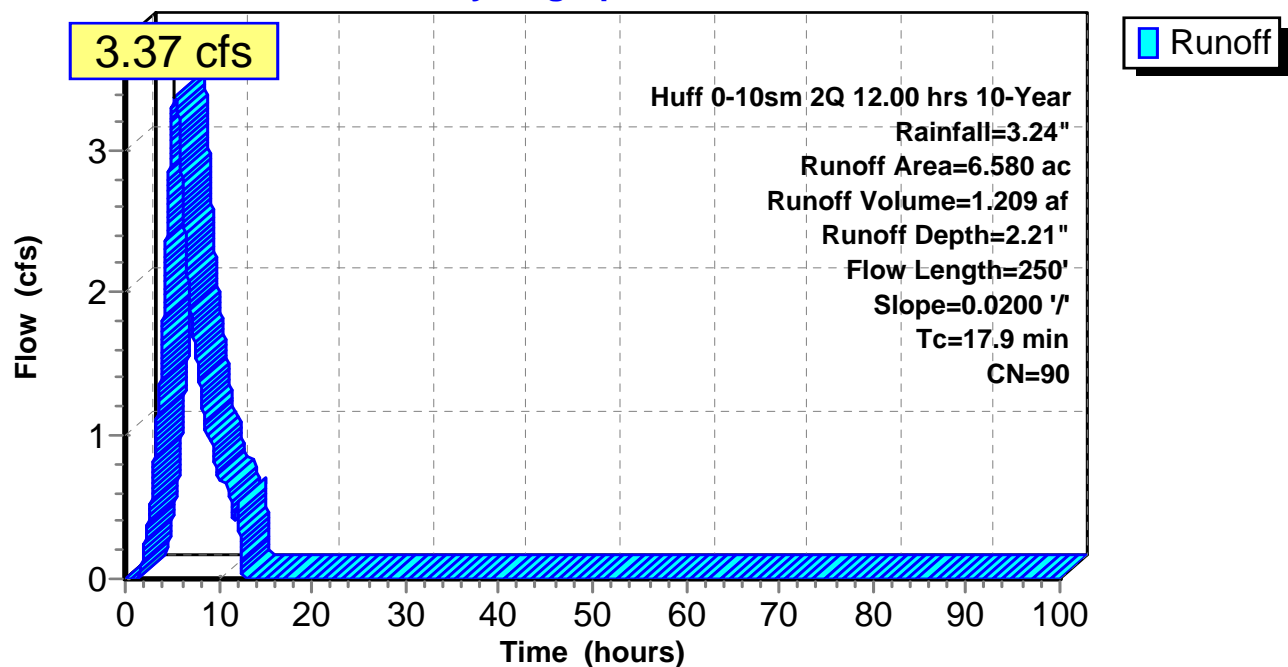
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 10-Year Rainfall=3.24"

Area (ac)	CN	Description
2.768	98	Paved parking, HSG C
1.266	98	Roofs, HSG C
0.439	74	>75% Grass cover, Good, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
1.067	74	>75% Grass cover, Good, HSG C
6.580	90	Weighted Average
2.546		38.69% Pervious Area
4.034		61.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 54S: Developed**

**Hydrograph**



### Summary for Pond 38P: Ex. Drainage Channel

Inflow Area = 5.513 ac, 73.17% Impervious, Inflow Depth = 2.43" for 10-Year event  
 Inflow = 1.78 cfs @ 6.67 hrs, Volume= 1.114 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

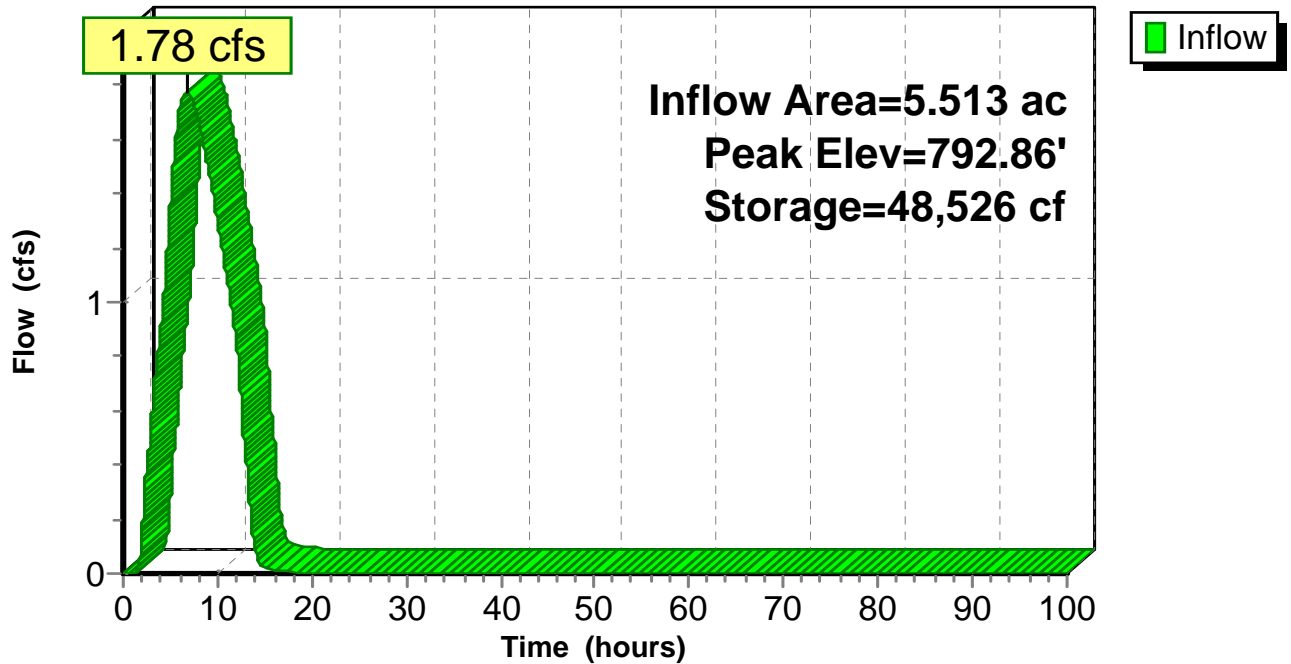
Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 792.86' @ 84.59 hrs Surf.Area= 22,821 sf Storage= 48,526 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	790.00'	319,013 cf	12.50'W x 898.00'L x 10.00'H Prismatic Z=2.2

### Pond 38P: Ex. Drainage Channel

#### Hydrograph



**Summary for Pond 52P: Onsite Post (South)**

Inflow Area = 3.255 ac, 68.05% Impervious, Inflow Depth = 2.39" for 10-Year event  
 Inflow = 1.79 cfs @ 5.07 hrs, Volume= 0.648 af  
 Outflow = 1.00 cfs @ 6.76 hrs, Volume= 0.648 af, Atten= 44%, Lag= 101.1 min  
 Primary = 0.98 cfs @ 6.76 hrs, Volume= 0.647 af  
 Secondary = 0.03 cfs @ 6.76 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 797.55' @ 6.76 hrs Surf.Area= 3,405 sf Storage= 8,595 cf

Plug-Flow detention time= 111.8 min calculated for 0.648 af (100% of inflow)  
 Center-of-Mass det. time= 111.7 min ( 482.4 - 370.8 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	3,993 cf	<b>28.50'W x 119.49'L x 5.00'H Field A</b> 17,027 cf Overall - 7,045 cf Embedded = 9,982 cf x 40.0% Voids
#2A	794.75'	7,045 cf	<b>StormTech MC-3500</b> x 64 Inside #1 Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		11,038 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=0.98 cfs @ 6.76 hrs HW=797.55' (Free Discharge)  
 ↑1=**Orifice/Grate** (Orifice Controls 0.98 cfs @ 8.83 fps)

**Secondary OutFlow** Max=0.03 cfs @ 6.76 hrs HW=797.55' (Free Discharge)  
 ↑2=**Sharp-Crested Rectangular Weir** (Weir Controls 0.03 cfs @ 0.75 fps)

**Pond 52P: Onsite Post (South) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

16 Chambers/Row x 7.17' Long = 114.72' + 28.6" End Stone x 2 = 119.49' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

64 Chambers x 110.1 cf = 7,044.6 cf Chamber Storage

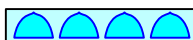
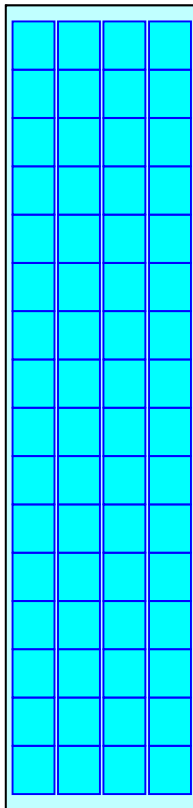
17,026.9 cf Field - 7,044.6 cf Chambers = 9,982.2 cf Stone x 40.0% Voids = 3,992.9 cf Stone Storage

Stone + Chamber Storage = 11,037.5 cf = 0.253 af

64 Chambers

630.6 cy Field

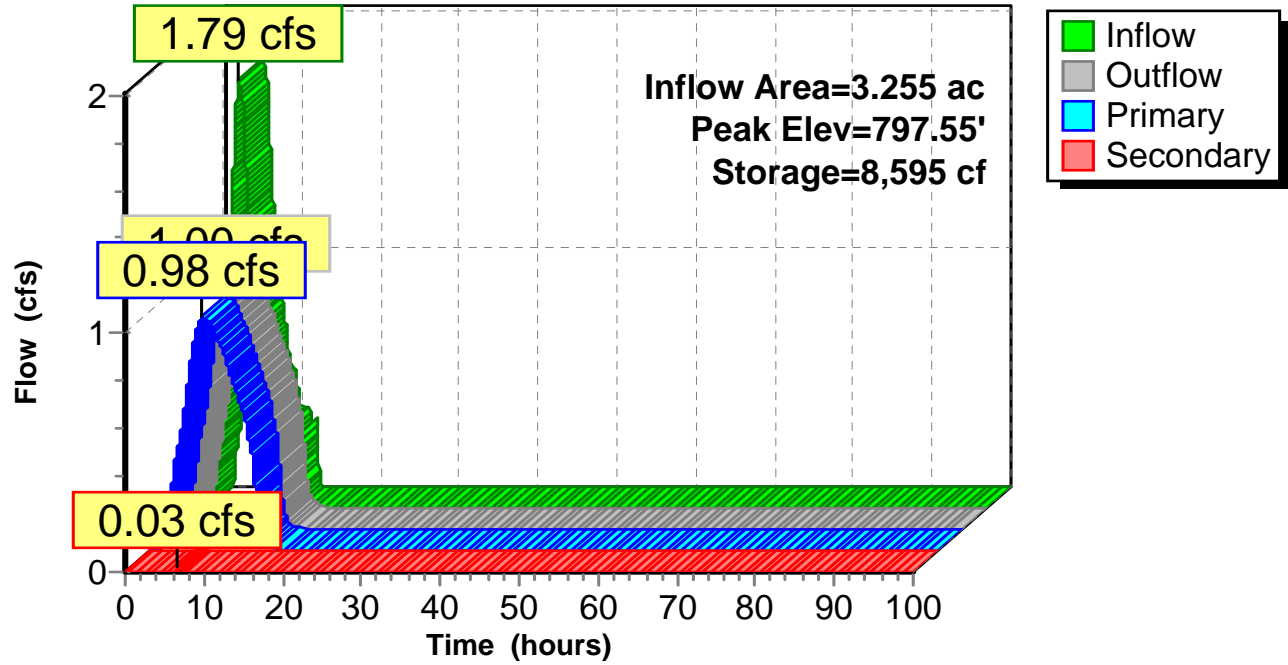
369.7 cy Stone





Pond 52P: Onsite Post (South)

Hydrograph



**Summary for Pond 53P: Onsite Post (North)**

Inflow Area = 2.258 ac, 80.56% Impervious, Inflow Depth = 2.48" for 10-Year event  
 Inflow = 1.28 cfs @ 5.20 hrs, Volume= 0.467 af  
 Outflow = 0.81 cfs @ 6.59 hrs, Volume= 0.467 af, Atten= 37%, Lag= 83.4 min  
 Primary = 0.81 cfs @ 6.59 hrs, Volume= 0.467 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 797.21' @ 6.59 hrs Surf.Area= 2,179 sf Storage= 4,937 cf

Plug-Flow detention time= 74.4 min calculated for 0.467 af (100% of inflow)  
 Center-of-Mass det. time= 74.3 min ( 447.5 - 373.3 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	2,597 cf	<b>28.50'W x 76.47'L x 5.00'H Field A</b> 10,897 cf Overall - 4,403 cf Embedded = 6,494 cf x 40.0% Voids
#2A	794.75'	4,403 cf	<b>StormTech MC-3500 x 40 Inside #1</b> Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		7,000 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.2" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=0.81 cfs @ 6.59 hrs HW=797.21' (Free Discharge)  
 ↑1=Orifice/Grate (Orifice Controls 0.81 cfs @ 8.39 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=794.00' (Free Discharge)  
 ↑2=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)

**Pond 53P: Onsite Post (North) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

10 Chambers/Row x 7.17' Long = 71.70' + 28.6" End Stone x 2 = 76.47' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

40 Chambers x 110.1 cf = 4,402.9 cf Chamber Storage

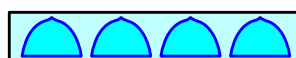
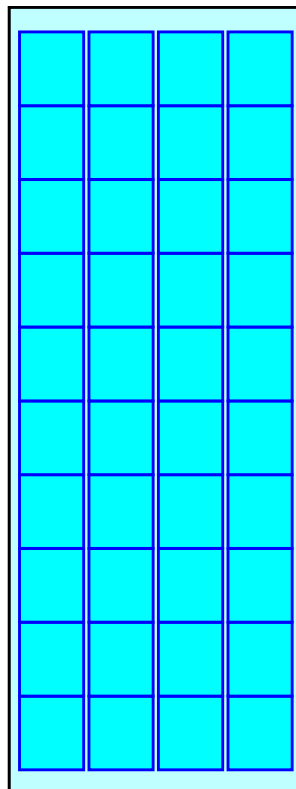
10,896.5 cf Field - 4,402.9 cf Chambers = 6,493.6 cf Stone x 40.0% Voids = 2,597.4 cf Stone Storage

Stone + Chamber Storage = 7,000.3 cf = 0.161 af

40 Chambers

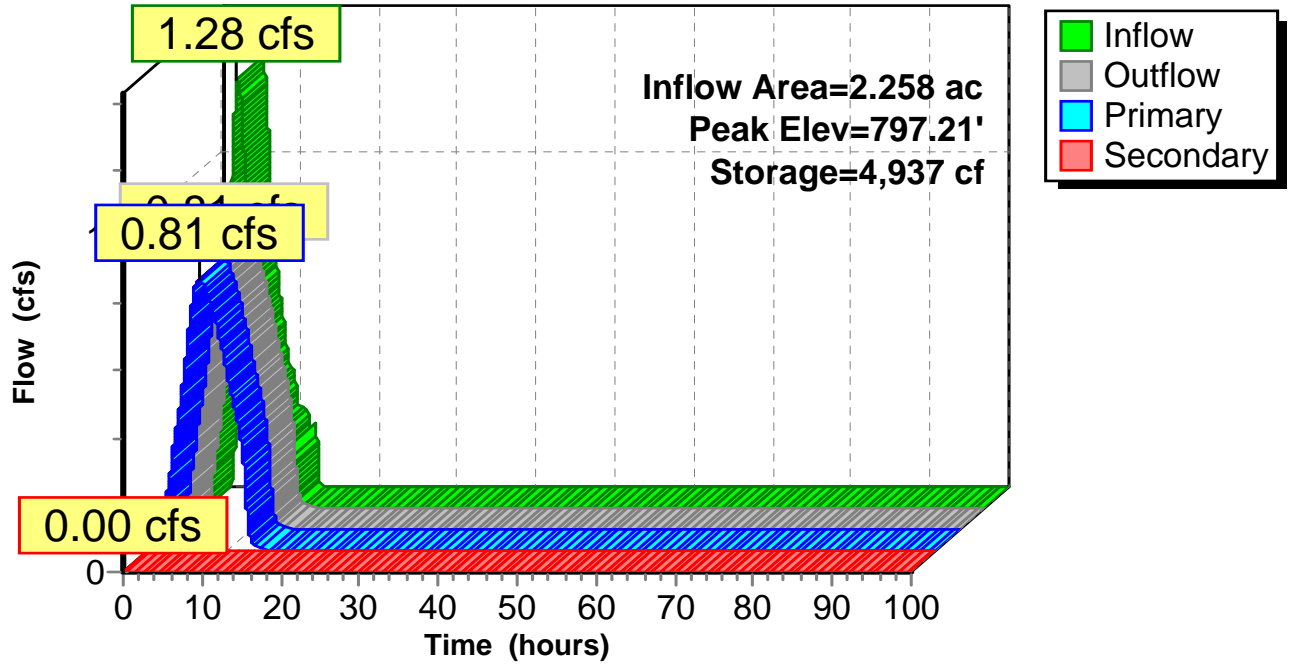
403.6 cy Field

240.5 cy Stone



Pond 53P: Onsite Post (North)

Hydrograph



**Stringtown**

Huff 0-10sm 2Q 12.00 hrs 25-Year Rainfall=3.88"

Prepared by E.P. Ferris &amp; Associates

Printed 12/18/2017

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Page 56

Time span=0.00-100.00 hrs, dt=0.01 hrs, 10001 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: PreDeveloped** Runoff Area=6.580 ac 46.08% Impervious Runoff Depth=2.62"  
Flow Length=250' Slope=0.0200 '/' Tc=17.9 min CN=88 Runoff=4.00 cfs 1.435 af

**Subcatchment 4S: Undetained** Runoff Area=1.067 ac 0.00% Impervious Runoff Depth=1.51"  
Tc=10.0 min CN=74 Runoff=0.39 cfs 0.134 af

**Subcatchment 37S: Site (South)** Runoff Area=3.255 ac 68.05% Impervious Runoff Depth=3.00"  
Flow Length=250' Slope=0.0200 '/' Tc=11.0 min CN=92 Runoff=2.23 cfs 0.814 af

**Subcatchment 49S: Site (North)** Runoff Area=2.258 ac 80.56% Impervious Runoff Depth=3.10"  
Flow Length=300' Slope=0.0200 '/' Tc=18.2 min CN=93 Runoff=1.58 cfs 0.584 af

**Subcatchment 54S: Developed** Runoff Area=6.580 ac 61.31% Impervious Runoff Depth=2.81"  
Flow Length=250' Slope=0.0200 '/' Tc=17.9 min CN=90 Runoff=4.25 cfs 1.538 af

**Pond 38P: Ex. Drainage Channel** Peak Elev=793.16' Storage=55,785 cf Inflow=1.93 cfs 1.281 af  
Outflow=0.00 cfs 0.000 af

**Pond 52P: Onsite Post (South)** Peak Elev=798.04' Storage=9,627 cf Inflow=2.23 cfs 0.814 af  
Primary=1.04 cfs 0.731 af Secondary=0.77 cfs 0.083 af Outflow=1.82 cfs 0.814 af

**Pond 53P: Onsite Post (North)** Peak Elev=797.86' Storage=5,866 cf Inflow=1.58 cfs 0.584 af  
Primary=0.89 cfs 0.549 af Secondary=0.44 cfs 0.034 af Outflow=1.33 cfs 0.584 af

**Total Runoff Area = 19.740 ac Runoff Volume = 4.506 af Average Runoff Depth = 2.74"**  
**43.77% Pervious = 8.640 ac 56.23% Impervious = 11.100 ac**

**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 4.00 cfs @ 5.35 hrs, Volume= 1.435 af, Depth= 2.62"

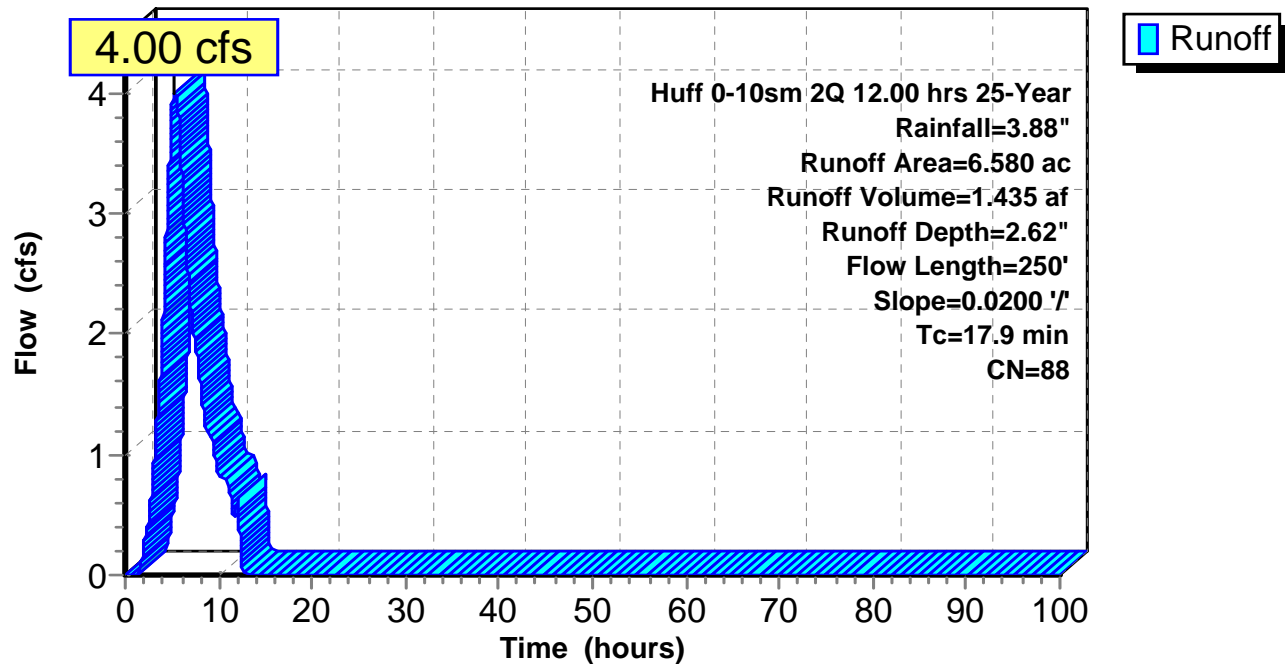
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 25-Year Rainfall=3.88"

Area (ac)	CN	Description
2.432	98	Paved parking, HSG C
0.600	98	Roofs, HSG C
3.548	79	50-75% Grass cover, Fair, HSG C
6.580	88	Weighted Average
3.548		53.92% Pervious Area
3.032		46.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



**Summary for Subcatchment 4S: Undetained**

Runoff = 0.39 cfs @ 5.52 hrs, Volume= 0.134 af, Depth= 1.51"

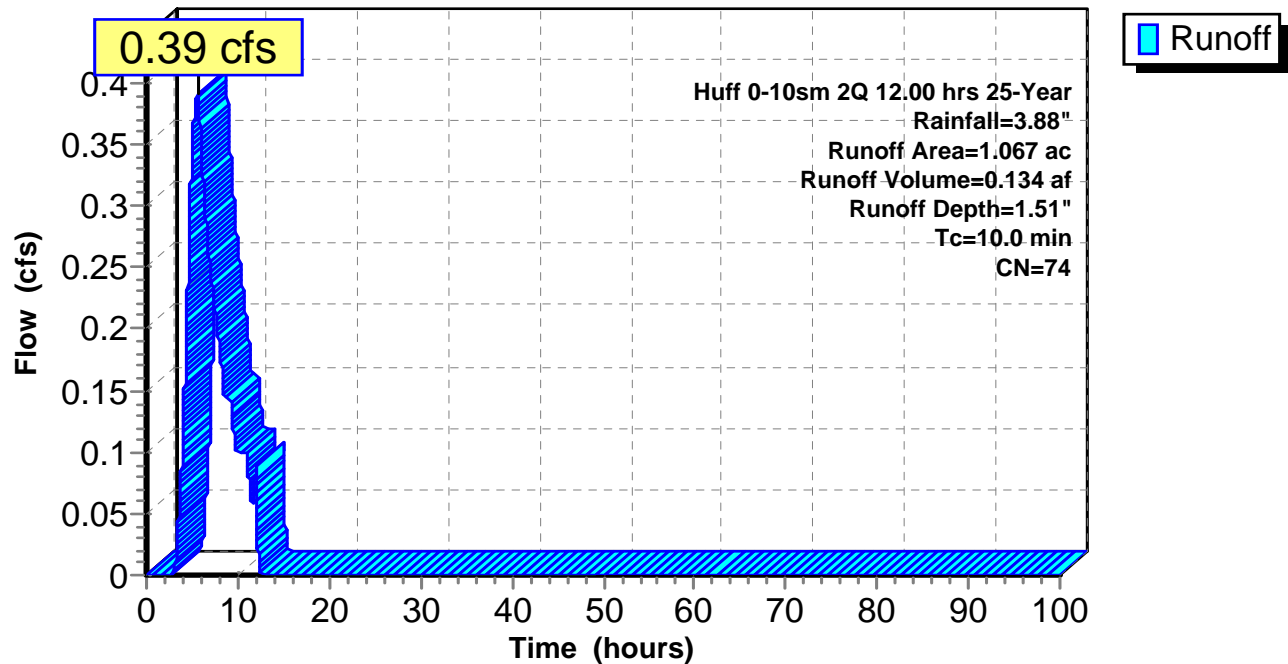
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 25-Year Rainfall=3.88"

Area (ac)	CN	Description
1.067	74	>75% Grass cover, Good, HSG C
1.067		100.00% Pervious Area

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

**Subcatchment 4S: Undetained**

**Hydrograph**



**Summary for Subcatchment 37S: Site (South)**

Runoff = 2.23 cfs @ 5.05 hrs, Volume= 0.814 af, Depth= 3.00"

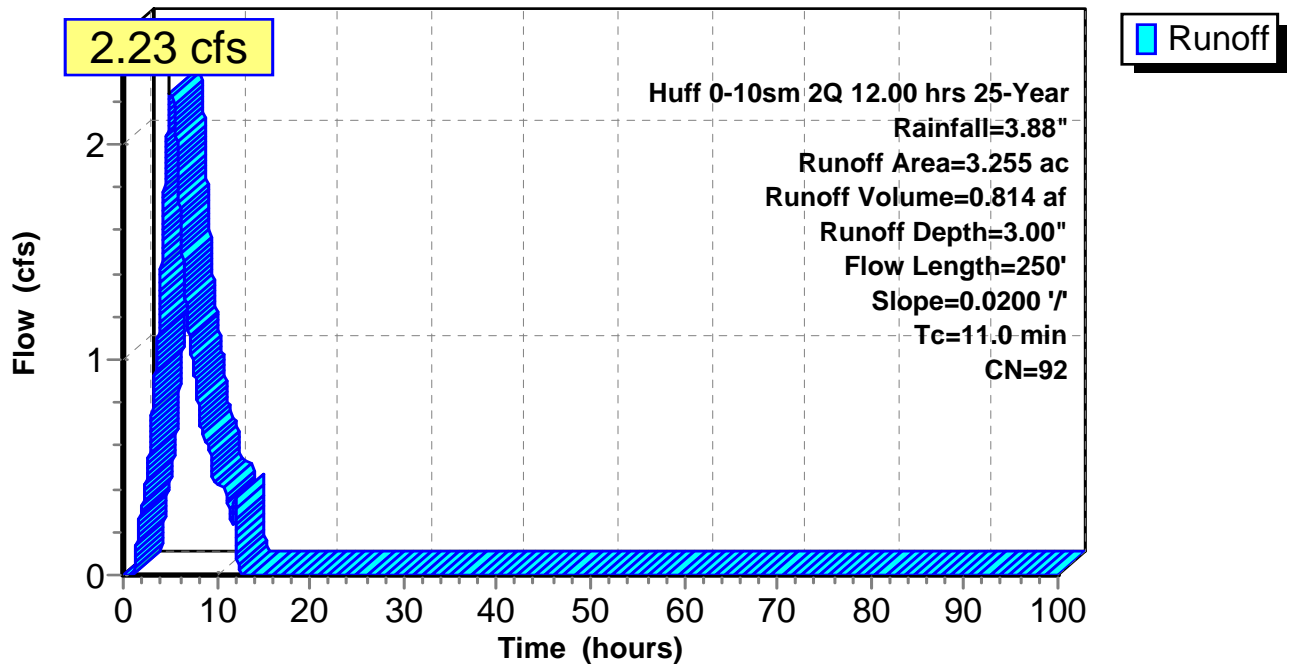
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 25-Year Rainfall=3.88"

Area (ac)	CN	Description
0.727	98	Roofs, HSG C
1.488	98	Paved parking, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
3.255	92	Weighted Average
1.040		31.95% Pervious Area
2.215		68.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0200	0.09		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
11.0	250	Total			

**Subcatchment 37S: Site (South)**

**Hydrograph**





**Summary for Subcatchment 49S: Site (North)**

Runoff = 1.58 cfs @ 5.20 hrs, Volume= 0.584 af, Depth= 3.10"

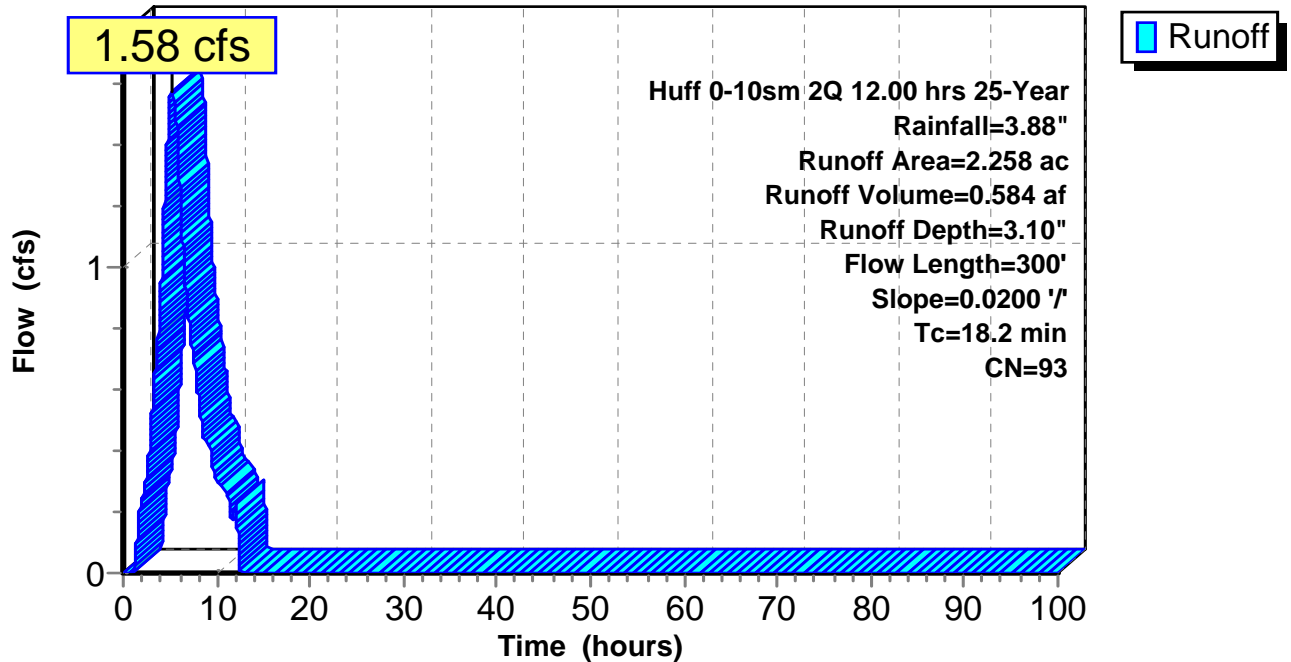
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 25-Year Rainfall=3.88"

Area (ac)	CN	Description
0.539	98	Roofs, HSG C
1.280	98	Paved parking, HSG C
0.439	74	>75% Grass cover, Good, HSG C
2.258	93	Weighted Average
0.439		19.44% Pervious Area
1.819		80.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
18.2	300	Total			

**Subcatchment 49S: Site (North)**

**Hydrograph**



**Summary for Subcatchment 54S: Developed**

Runoff = 4.25 cfs @ 5.27 hrs, Volume= 1.538 af, Depth= 2.81"

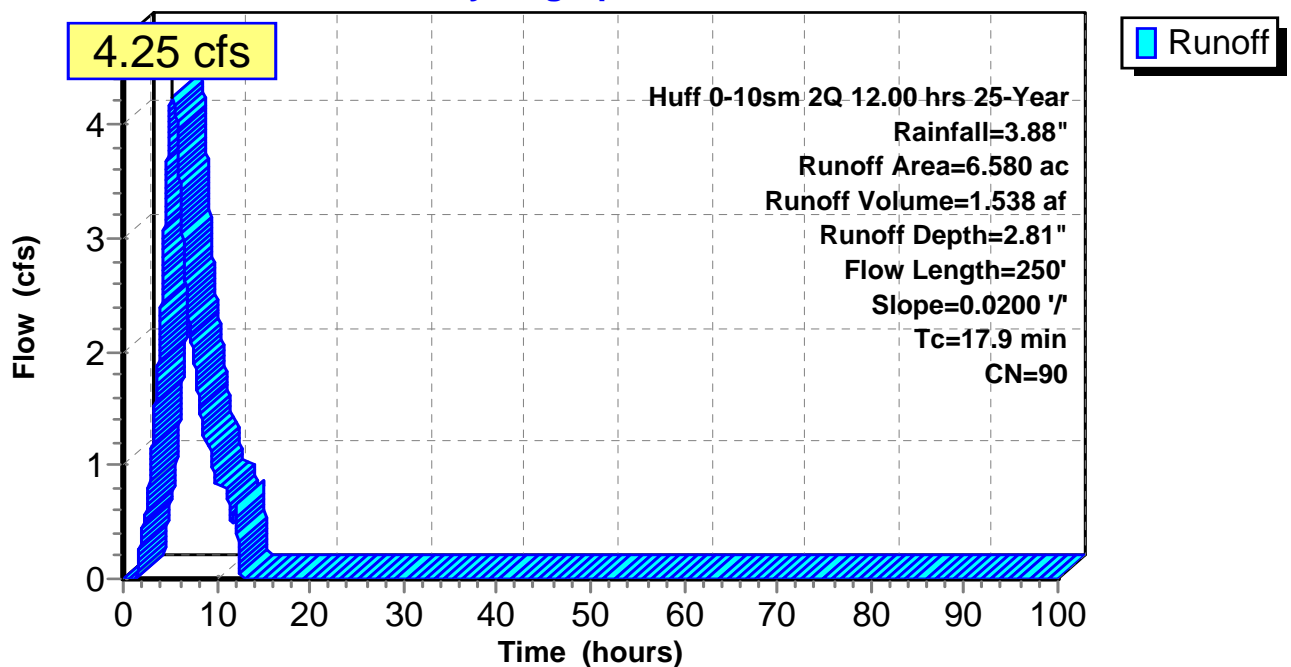
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 25-Year Rainfall=3.88"

Area (ac)	CN	Description
2.768	98	Paved parking, HSG C
1.266	98	Roofs, HSG C
0.439	74	>75% Grass cover, Good, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
1.067	74	>75% Grass cover, Good, HSG C
6.580	90	Weighted Average
2.546		38.69% Pervious Area
4.034		61.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 54S: Developed**

**Hydrograph**



### Summary for Pond 38P: Ex. Drainage Channel

Inflow Area = 5.513 ac, 73.17% Impervious, Inflow Depth = 2.79" for 25-Year event  
 Inflow = 1.93 cfs @ 5.95 hrs, Volume= 1.281 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

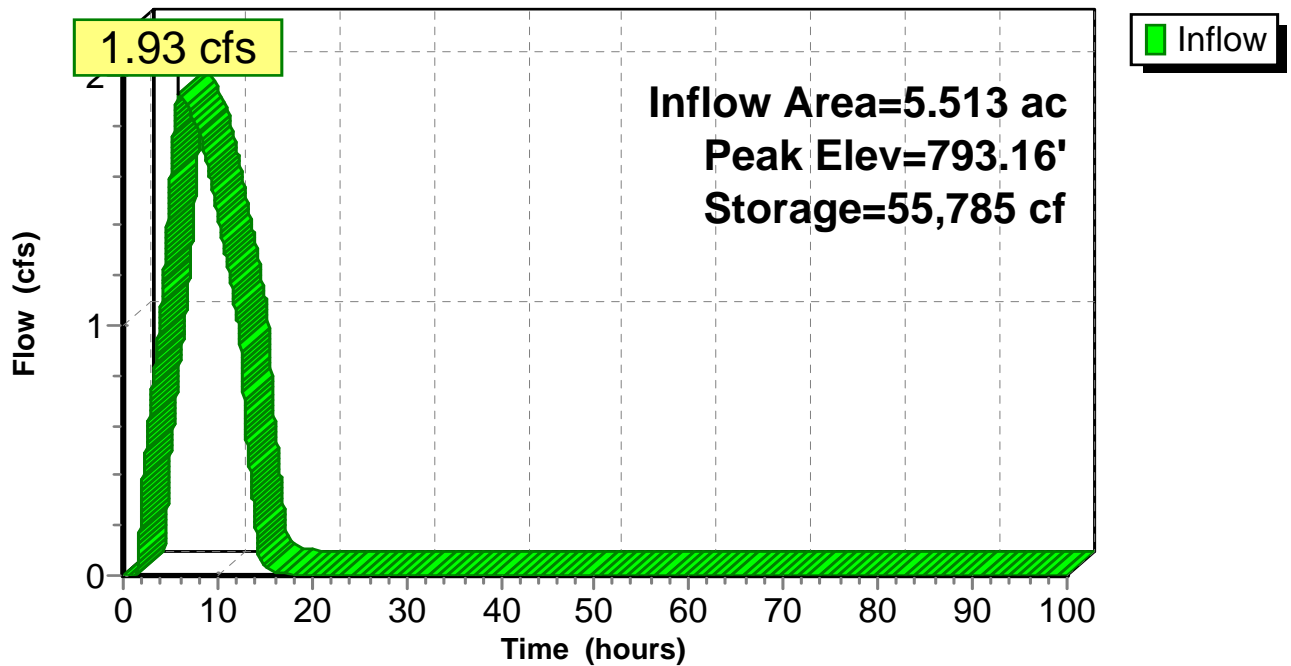
Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 793.16' @ 84.54 hrs Surf.Area= 24,097 sf Storage= 55,785 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	790.00'	319,013 cf	12.50'W x 898.00'L x 10.00'H Prismatic Z=2.2

### Pond 38P: Ex. Drainage Channel

#### Hydrograph



**Summary for Pond 52P: Onsite Post (South)**

Inflow Area = 3.255 ac, 68.05% Impervious, Inflow Depth = 3.00" for 25-Year event  
 Inflow = 2.23 cfs @ 5.05 hrs, Volume= 0.814 af  
 Outflow = 1.82 cfs @ 5.94 hrs, Volume= 0.814 af, Atten= 19%, Lag= 53.1 min  
 Primary = 1.04 cfs @ 5.94 hrs, Volume= 0.731 af  
 Secondary = 0.77 cfs @ 5.94 hrs, Volume= 0.083 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 798.04' @ 5.94 hrs Surf.Area= 3,405 sf Storage= 9,627 cf

Plug-Flow detention time= 107.1 min calculated for 0.814 af (100% of inflow)  
 Center-of-Mass det. time= 106.9 min ( 472.5 - 365.6 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	3,993 cf	<b>28.50'W x 119.49'L x 5.00'H Field A</b> 17,027 cf Overall - 7,045 cf Embedded = 9,982 cf x 40.0% Voids
#2A	794.75'	7,045 cf	<b>StormTech MC-3500</b> x 64 Inside #1 Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		11,038 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=1.04 cfs @ 5.94 hrs HW=798.04' (Free Discharge)  
 ↑1=**Orifice/Grate** (Orifice Controls 1.04 cfs @ 9.45 fps)

**Secondary OutFlow** Max=0.77 cfs @ 5.94 hrs HW=798.04' (Free Discharge)  
 ↑2=**Sharp-Crested Rectangular Weir** (Weir Controls 0.77 cfs @ 2.41 fps)

**Pond 52P: Onsite Post (South) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

16 Chambers/Row x 7.17' Long = 114.72' + 28.6" End Stone x 2 = 119.49' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

64 Chambers x 110.1 cf = 7,044.6 cf Chamber Storage

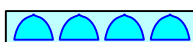
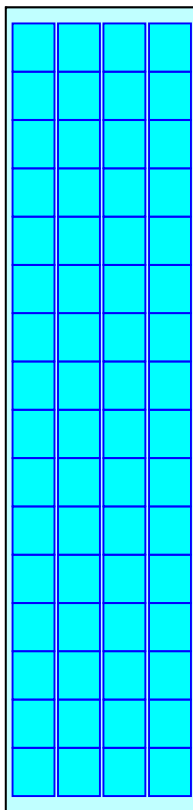
17,026.9 cf Field - 7,044.6 cf Chambers = 9,982.2 cf Stone x 40.0% Voids = 3,992.9 cf Stone Storage

Stone + Chamber Storage = 11,037.5 cf = 0.253 af

64 Chambers

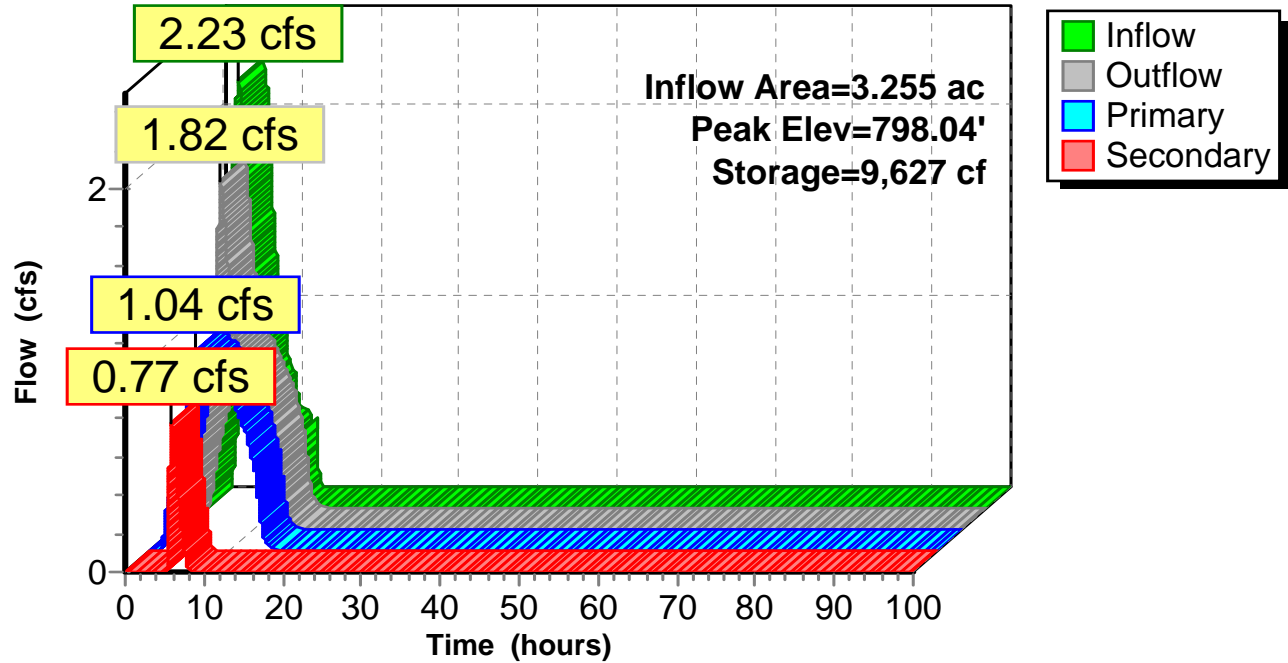
630.6 cy Field

369.7 cy Stone



**Pond 52P: Onsite Post (South)**

**Hydrograph**



**Summary for Pond 53P: Onsite Post (North)**

Inflow Area = 2.258 ac, 80.56% Impervious, Inflow Depth = 3.10" for 25-Year event  
 Inflow = 1.58 cfs @ 5.20 hrs, Volume= 0.584 af  
 Outflow = 1.33 cfs @ 5.97 hrs, Volume= 0.584 af, Atten= 16%, Lag= 46.4 min  
 Primary = 0.89 cfs @ 5.97 hrs, Volume= 0.549 af  
 Secondary = 0.44 cfs @ 5.97 hrs, Volume= 0.034 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 797.86' @ 5.97 hrs Surf.Area= 2,179 sf Storage= 5,866 cf

Plug-Flow detention time= 77.6 min calculated for 0.584 af (100% of inflow)  
 Center-of-Mass det. time= 77.6 min ( 446.1 - 368.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	2,597 cf	<b>28.50'W x 76.47'L x 5.00'H Field A</b> 10,897 cf Overall - 4,403 cf Embedded = 6,494 cf x 40.0% Voids
#2A	794.75'	4,403 cf	<b>StormTech MC-3500 x 40 Inside #1</b> Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		7,000 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.2" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=0.89 cfs @ 5.97 hrs HW=797.86' (Free Discharge)  
 ↑1=Orifice/Grate (Orifice Controls 0.89 cfs @ 9.24 fps)

**Secondary OutFlow** Max=0.44 cfs @ 5.97 hrs HW=797.86' (Free Discharge)  
 ↑2=Sharp-Crested Rectangular Weir (Weir Controls 0.44 cfs @ 1.96 fps)

**Pond 53P: Onsite Post (North) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

10 Chambers/Row x 7.17' Long = 71.70' + 28.6" End Stone x 2 = 76.47' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

40 Chambers x 110.1 cf = 4,402.9 cf Chamber Storage

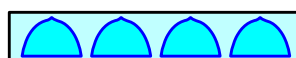
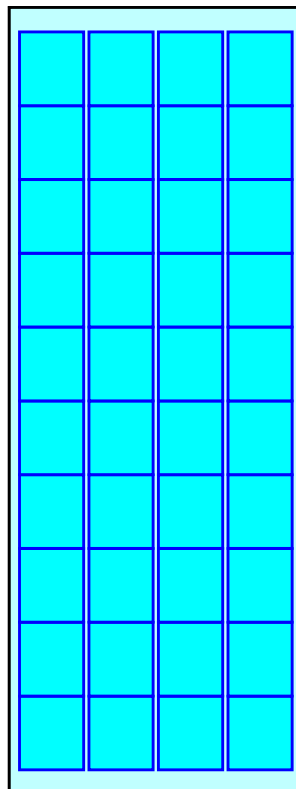
10,896.5 cf Field - 4,402.9 cf Chambers = 6,493.6 cf Stone x 40.0% Voids = 2,597.4 cf Stone Storage

Stone + Chamber Storage = 7,000.3 cf = 0.161 af

40 Chambers

403.6 cy Field

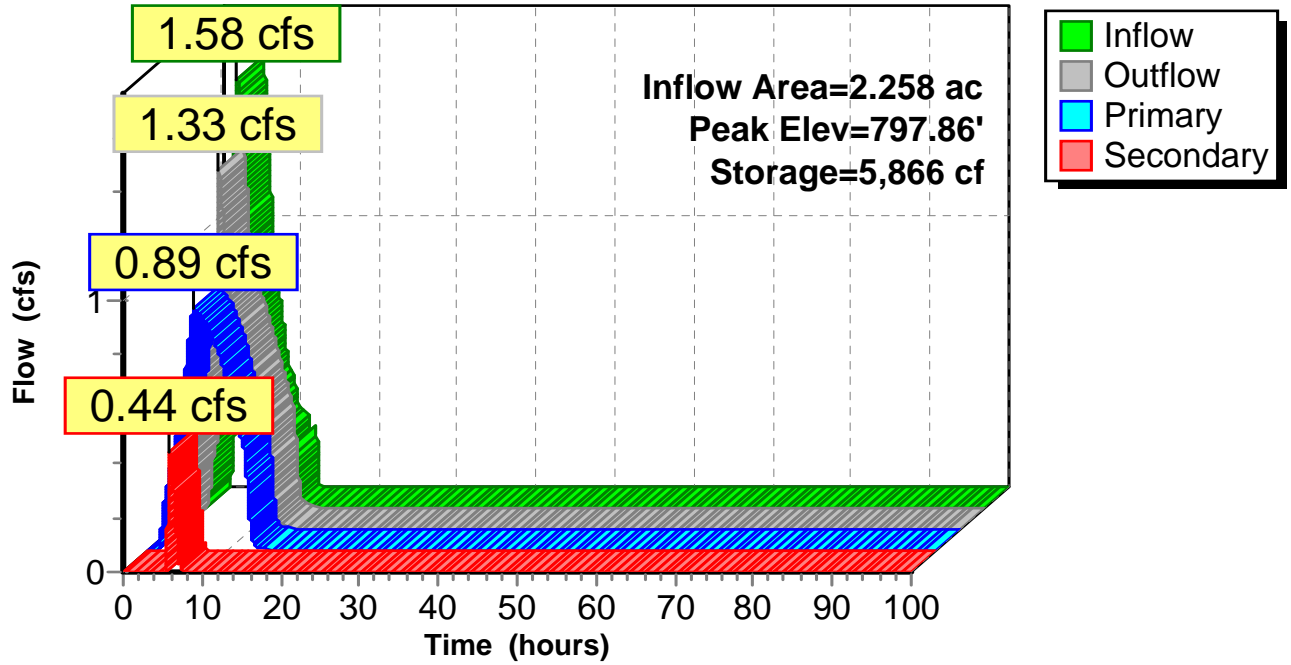
240.5 cy Stone





**Pond 53P: Onsite Post (North)**

**Hydrograph**



**Stringtown**

Huff 0-10sm 2Q 12.00 hrs 50-Year Rainfall=4.42"

Prepared by E.P. Ferris &amp; Associates

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Page 69

Time span=0.00-100.00 hrs, dt=0.01 hrs, 10001 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: PreDeveloped** Runoff Area=6.580 ac 46.08% Impervious Runoff Depth=3.12"  
Flow Length=250' Slope=0.0200 '/' Tc=17.9 min CN=88 Runoff=4.74 cfs 1.711 af

**Subcatchment 4S: Undetained** Runoff Area=1.067 ac 0.00% Impervious Runoff Depth=1.91"  
Tc=10.0 min CN=74 Runoff=0.50 cfs 0.170 af

**Subcatchment 37S: Site (South)** Runoff Area=3.255 ac 68.05% Impervious Runoff Depth=3.52"  
Flow Length=250' Slope=0.0200 '/' Tc=11.0 min CN=92 Runoff=2.60 cfs 0.956 af

**Subcatchment 49S: Site (North)** Runoff Area=2.258 ac 80.56% Impervious Runoff Depth=3.63"  
Flow Length=300' Slope=0.0200 '/' Tc=18.2 min CN=93 Runoff=1.83 cfs 0.683 af

**Subcatchment 54S: Developed** Runoff Area=6.580 ac 61.31% Impervious Runoff Depth=3.32"  
Flow Length=250' Slope=0.0200 '/' Tc=17.9 min CN=90 Runoff=4.99 cfs 1.820 af

**Pond 38P: Ex. Drainage Channel** Peak Elev=793.35' Storage=60,317 cf Inflow=1.99 cfs 1.385 af  
Outflow=0.00 cfs 0.000 af

**Pond 52P: Onsite Post (South)** Peak Elev=798.32' Storage=10,099 cf Inflow=2.60 cfs 0.956 af  
Primary=1.08 cfs 0.788 af Secondary=1.30 cfs 0.168 af Outflow=2.38 cfs 0.956 af

**Pond 53P: Onsite Post (North)** Peak Elev=798.06' Storage=6,122 cf Inflow=1.83 cfs 0.683 af  
Primary=0.91 cfs 0.597 af Secondary=0.81 cfs 0.086 af Outflow=1.72 cfs 0.683 af

**Total Runoff Area = 19.740 ac Runoff Volume = 5.340 af Average Runoff Depth = 3.25"**  
**43.77% Pervious = 8.640 ac 56.23% Impervious = 11.100 ac**

**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 4.74 cfs @ 5.27 hrs, Volume= 1.711 af, Depth= 3.12"

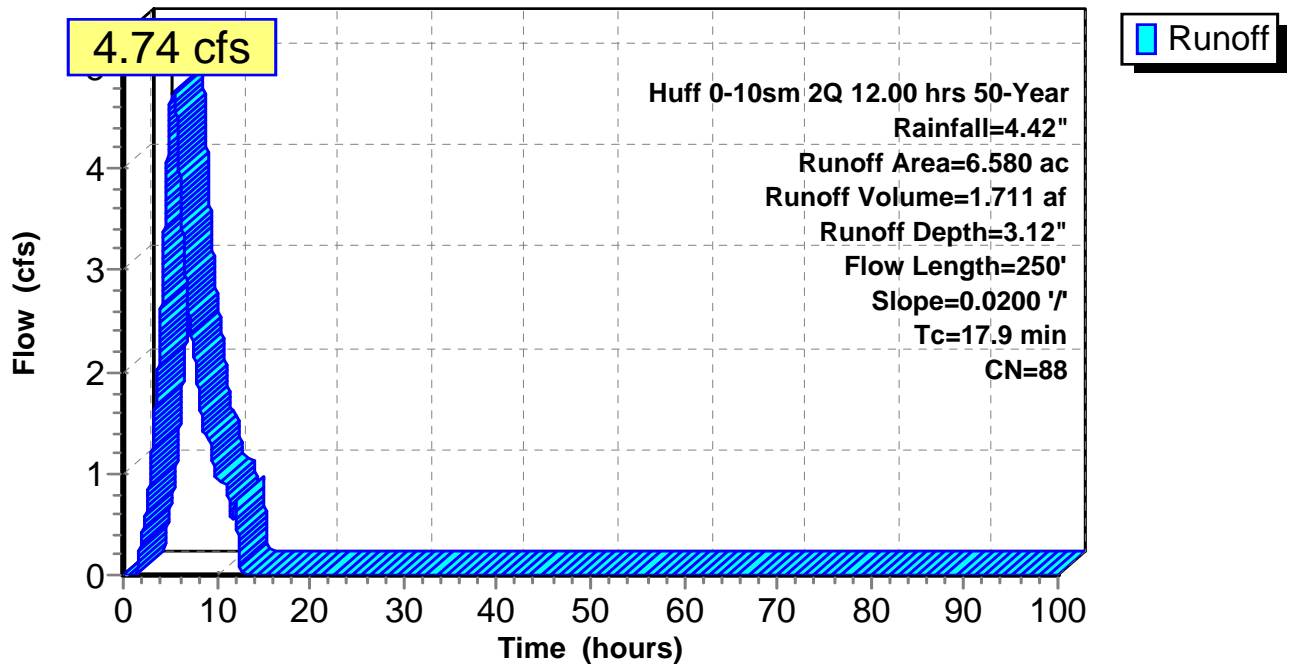
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 50-Year Rainfall=4.42"

Area (ac)	CN	Description
2.432	98	Paved parking, HSG C
0.600	98	Roofs, HSG C
3.548	79	50-75% Grass cover, Fair, HSG C
6.580	88	Weighted Average
3.548		53.92% Pervious Area
3.032		46.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



**Summary for Subcatchment 4S: Undetained**

Runoff = 0.50 cfs @ 5.50 hrs, Volume= 0.170 af, Depth= 1.91"

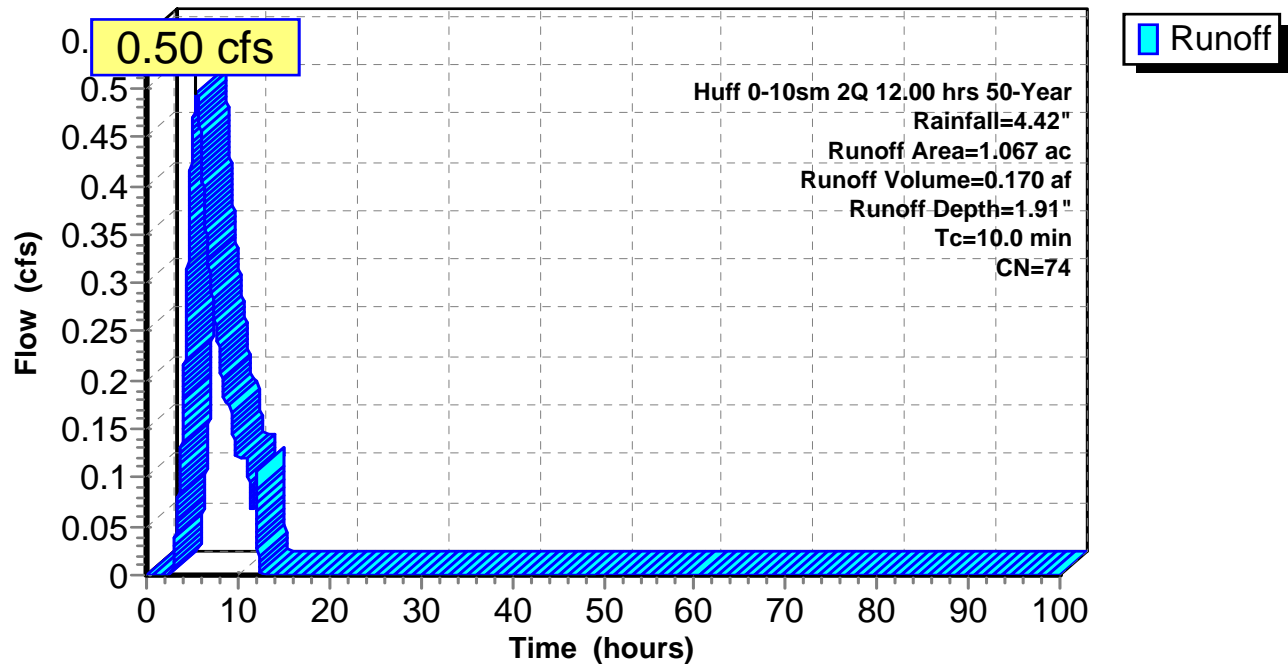
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 50-Year Rainfall=4.42"

Area (ac)	CN	Description
1.067	74	>75% Grass cover, Good, HSG C
1.067		100.00% Pervious Area

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

**Subcatchment 4S: Undetained**

**Hydrograph**



**Summary for Subcatchment 37S: Site (South)**

Runoff = 2.60 cfs @ 5.05 hrs, Volume= 0.956 af, Depth= 3.52"

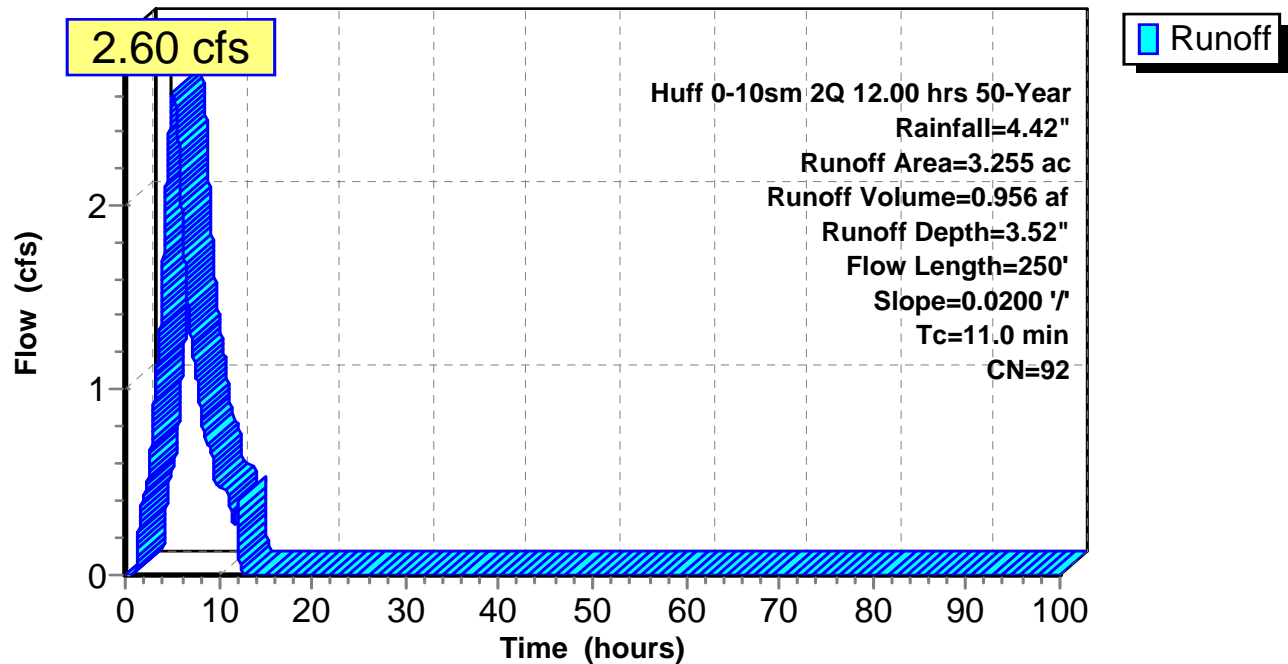
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 50-Year Rainfall=4.42"

Area (ac)	CN	Description
0.727	98	Roofs, HSG C
1.488	98	Paved parking, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
3.255	92	Weighted Average
1.040		31.95% Pervious Area
2.215		68.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0200	0.09		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
11.0	250	Total			

**Subcatchment 37S: Site (South)**

**Hydrograph**



**Summary for Subcatchment 49S: Site (North)**

Runoff = 1.83 cfs @ 5.16 hrs, Volume= 0.683 af, Depth= 3.63"

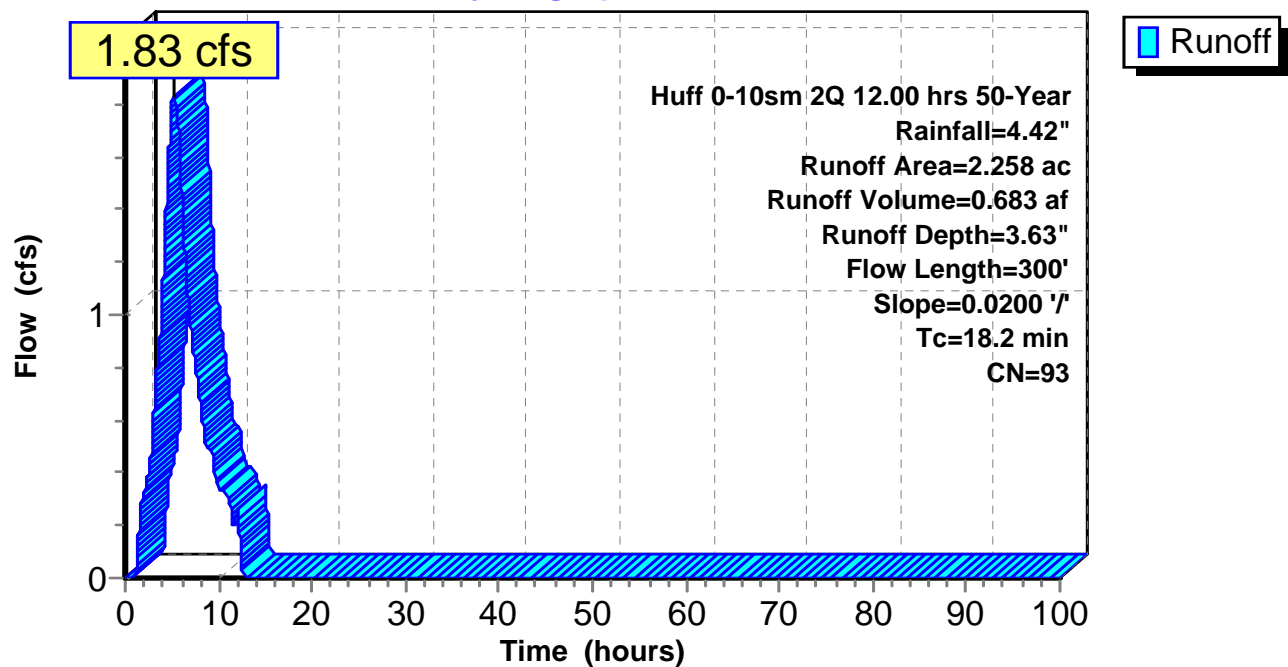
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 50-Year Rainfall=4.42"

Area (ac)	CN	Description
0.539	98	Roofs, HSG C
1.280	98	Paved parking, HSG C
0.439	74	>75% Grass cover, Good, HSG C
2.258	93	Weighted Average
0.439		19.44% Pervious Area
1.819		80.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
18.2	300	Total			

**Subcatchment 49S: Site (North)**

**Hydrograph**



**Summary for Subcatchment 54S: Developed**

Runoff = 4.99 cfs @ 5.23 hrs, Volume= 1.820 af, Depth= 3.32"

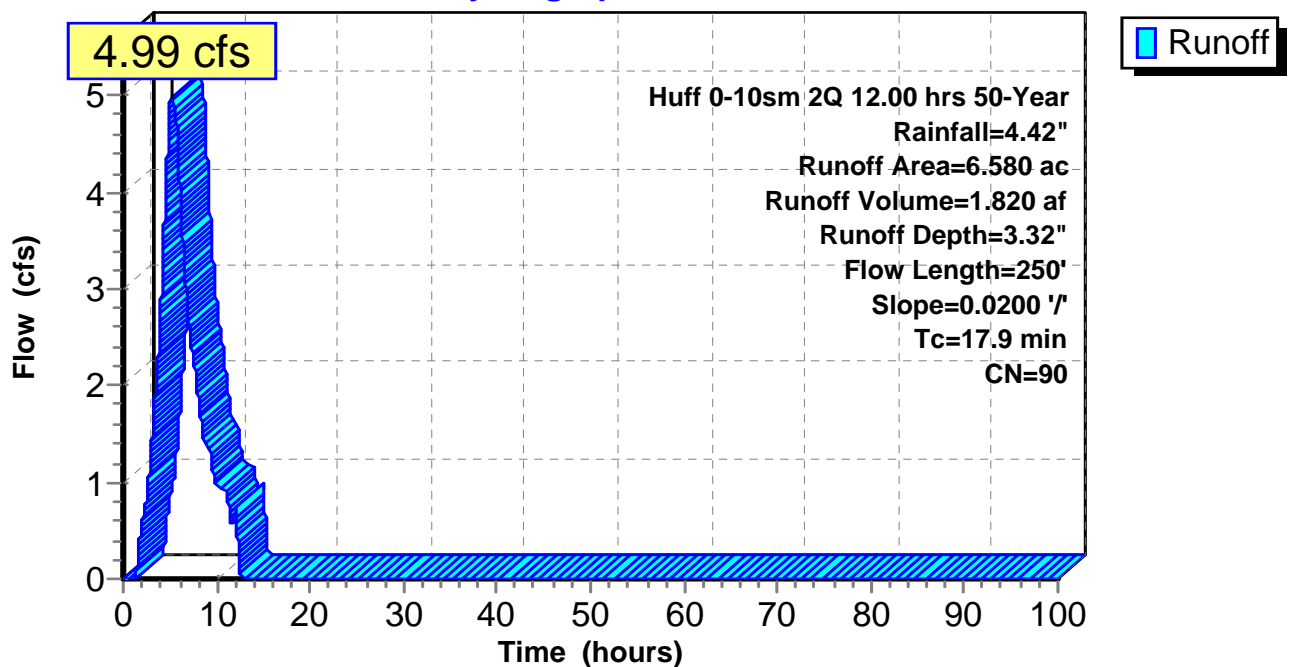
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 50-Year Rainfall=4.42"

Area (ac)	CN	Description
2.768	98	Paved parking, HSG C
1.266	98	Roofs, HSG C
0.439	74	>75% Grass cover, Good, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
1.067	74	>75% Grass cover, Good, HSG C
6.580	90	Weighted Average
2.546		38.69% Pervious Area
4.034		61.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 54S: Developed**

**Hydrograph**



### Summary for Pond 38P: Ex. Drainage Channel

Inflow Area = 5.513 ac, 73.17% Impervious, Inflow Depth = 3.01" for 50-Year event  
Inflow = 1.99 cfs @ 5.68 hrs, Volume= 1.385 af  
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

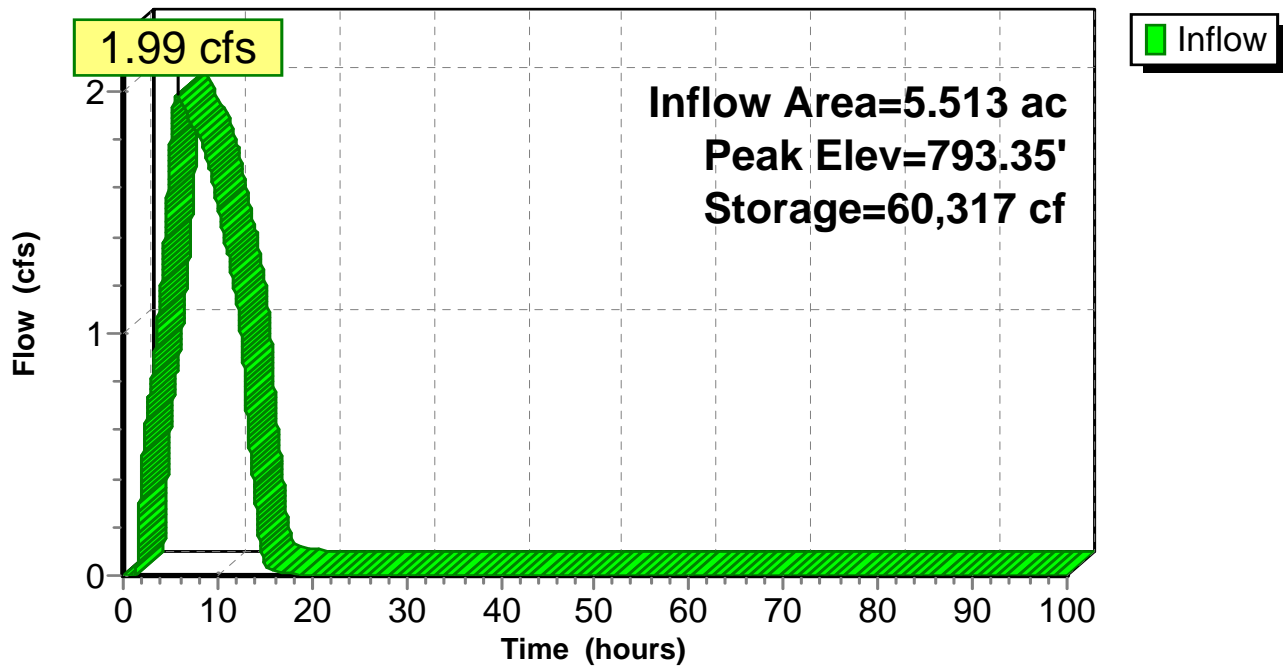
Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
Peak Elev= 793.35' @ 87.15 hrs Surf.Area= 24,862 sf Storage= 60,317 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	790.00'	319,013 cf	12.50'W x 898.00'L x 10.00'H Prismatic Z=2.2

### Pond 38P: Ex. Drainage Channel

#### Hydrograph





**Summary for Pond 52P: Onsite Post (South)**

Inflow Area = 3.255 ac, 68.05% Impervious, Inflow Depth = 3.52" for 50-Year event  
 Inflow = 2.60 cfs @ 5.05 hrs, Volume= 0.956 af  
 Outflow = 2.38 cfs @ 5.67 hrs, Volume= 0.956 af, Atten= 9%, Lag= 37.2 min  
 Primary = 1.08 cfs @ 5.67 hrs, Volume= 0.788 af  
 Secondary = 1.30 cfs @ 5.67 hrs, Volume= 0.168 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 798.32' @ 5.67 hrs Surf.Area= 3,405 sf Storage= 10,099 cf

Plug-Flow detention time= 101.3 min calculated for 0.956 af (100% of inflow)  
 Center-of-Mass det. time= 101.1 min ( 463.3 - 362.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	3,993 cf	<b>28.50'W x 119.49'L x 5.00'H Field A</b> 17,027 cf Overall - 7,045 cf Embedded = 9,982 cf x 40.0% Voids
#2A	794.75'	7,045 cf	<b>StormTech MC-3500</b> x 64 Inside #1 Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		11,038 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=1.08 cfs @ 5.67 hrs HW=798.32' (Free Discharge)  
 ↑1=**Orifice/Grate** (Orifice Controls 1.08 cfs @ 9.79 fps)

**Secondary OutFlow** Max=1.30 cfs @ 5.67 hrs HW=798.32' (Free Discharge)  
 ↑2=**Sharp-Crested Rectangular Weir** (Weir Controls 1.30 cfs @ 2.96 fps)

**Pond 52P: Onsite Post (South) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

16 Chambers/Row x 7.17' Long = 114.72' + 28.6" End Stone x 2 = 119.49' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

64 Chambers x 110.1 cf = 7,044.6 cf Chamber Storage

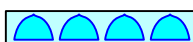
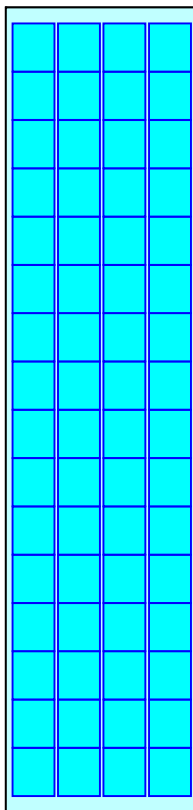
17,026.9 cf Field - 7,044.6 cf Chambers = 9,982.2 cf Stone x 40.0% Voids = 3,992.9 cf Stone Storage

Stone + Chamber Storage = 11,037.5 cf = 0.253 af

64 Chambers

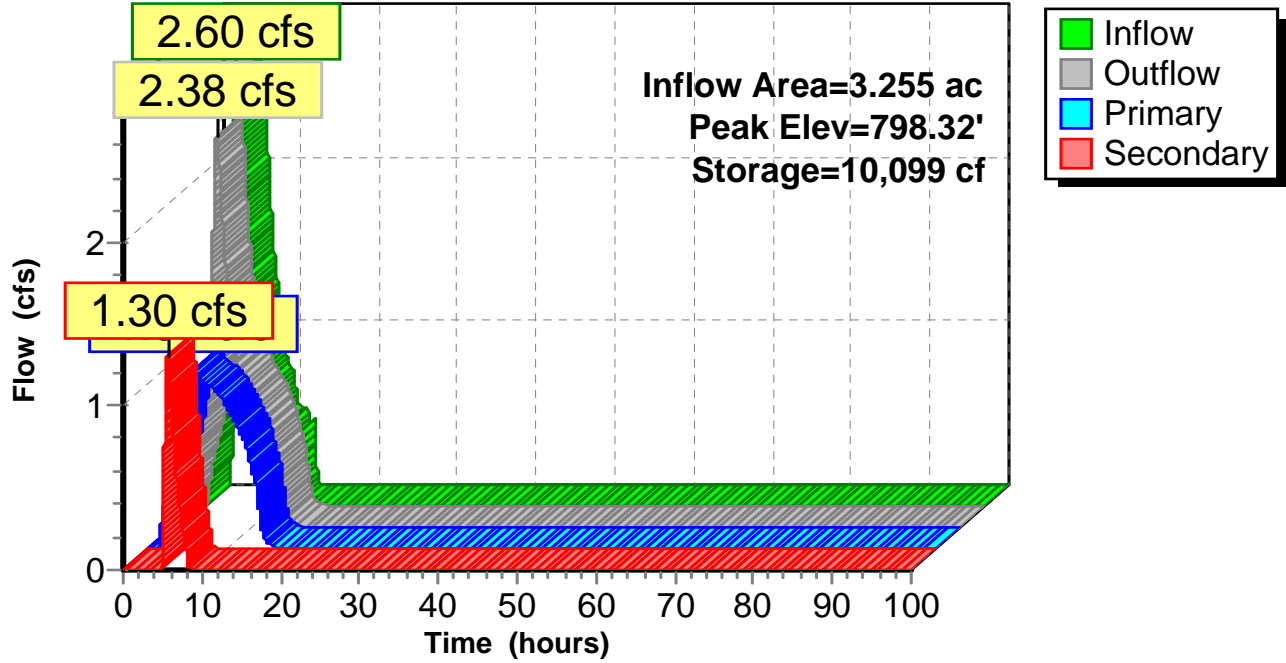
630.6 cy Field

369.7 cy Stone



**Pond 52P: Onsite Post (South)**

**Hydrograph**



**Summary for Pond 53P: Onsite Post (North)**

Inflow Area = 2.258 ac, 80.56% Impervious, Inflow Depth = 3.63" for 50-Year event  
 Inflow = 1.83 cfs @ 5.16 hrs, Volume= 0.683 af  
 Outflow = 1.72 cfs @ 5.69 hrs, Volume= 0.683 af, Atten= 6%, Lag= 32.0 min  
 Primary = 0.91 cfs @ 5.69 hrs, Volume= 0.597 af  
 Secondary = 0.81 cfs @ 5.69 hrs, Volume= 0.086 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 798.06' @ 5.69 hrs Surf.Area= 2,179 sf Storage= 6,122 cf

Plug-Flow detention time= 75.2 min calculated for 0.683 af (100% of inflow)  
 Center-of-Mass det. time= 75.0 min ( 440.3 - 365.3 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	2,597 cf	<b>28.50'W x 76.47'L x 5.00'H Field A</b> 10,897 cf Overall - 4,403 cf Embedded = 6,494 cf x 40.0% Voids
#2A	794.75'	4,403 cf	<b>StormTech MC-3500 x 40 Inside #1</b> Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		7,000 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.2" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=0.91 cfs @ 5.69 hrs HW=798.06' (Free Discharge)  
 ↑1=**Orifice/Grate** (Orifice Controls 0.91 cfs @ 9.49 fps)

**Secondary OutFlow** Max=0.81 cfs @ 5.69 hrs HW=798.06' (Free Discharge)  
 ↑2=**Sharp-Crested Rectangular Weir** (Weir Controls 0.81 cfs @ 2.45 fps)

**Pond 53P: Onsite Post (North) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

10 Chambers/Row x 7.17' Long = 71.70' + 28.6" End Stone x 2 = 76.47' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

40 Chambers x 110.1 cf = 4,402.9 cf Chamber Storage

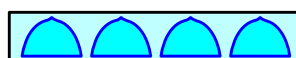
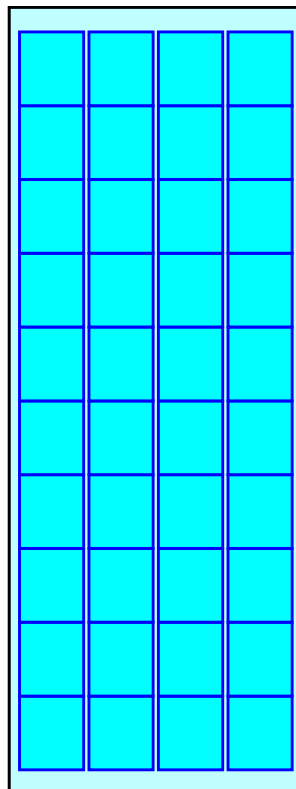
10,896.5 cf Field - 4,402.9 cf Chambers = 6,493.6 cf Stone x 40.0% Voids = 2,597.4 cf Stone Storage

Stone + Chamber Storage = 7,000.3 cf = 0.161 af

40 Chambers

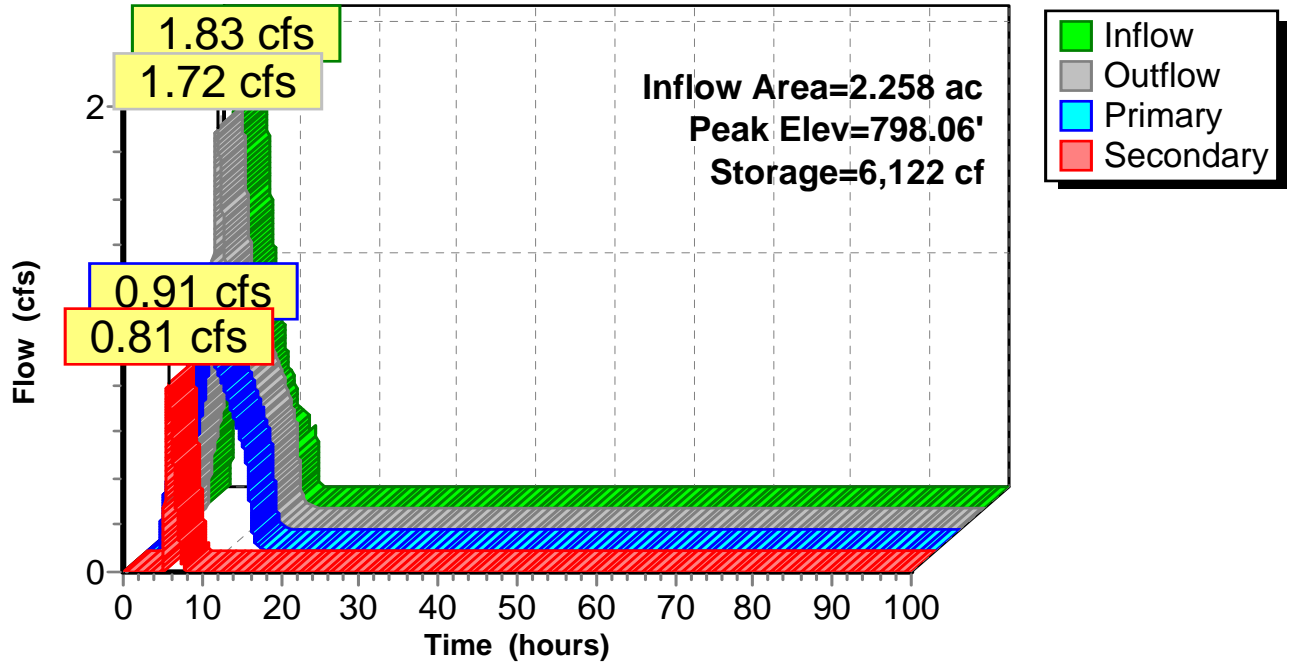
403.6 cy Field

240.5 cy Stone



Pond 53P: Onsite Post (North)

Hydrograph



**Stringtown***Huff 0-10sm 2Q 12.00 hrs 100-Year Rainfall=5.00"*

Prepared by E.P. Ferris &amp; Associates

Printed 12/18/2017

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Page 82

Time span=0.00-100.00 hrs, dt=0.01 hrs, 10001 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: PreDeveloped** Runoff Area=6.580 ac 46.08% Impervious Runoff Depth=3.67"  
Flow Length=250' Slope=0.0200 '/ Tc=17.9 min CN=88 Runoff=5.54 cfs 2.012 af

**Subcatchment 4S: Undetained** Runoff Area=1.067 ac 0.00% Impervious Runoff Depth=2.36"  
Tc=10.0 min CN=74 Runoff=0.61 cfs 0.210 af

**Subcatchment 37S: Site (South)** Runoff Area=3.255 ac 68.05% Impervious Runoff Depth=4.09"  
Flow Length=250' Slope=0.0200 '/ Tc=11.0 min CN=92 Runoff=3.00 cfs 1.109 af

**Subcatchment 49S: Site (North)** Runoff Area=2.258 ac 80.56% Impervious Runoff Depth=4.20"  
Flow Length=300' Slope=0.0200 '/ Tc=18.2 min CN=93 Runoff=2.10 cfs 0.790 af

**Subcatchment 54S: Developed** Runoff Area=6.580 ac 61.31% Impervious Runoff Depth=3.88"  
Flow Length=250' Slope=0.0200 '/ Tc=17.9 min CN=90 Runoff=5.79 cfs 2.126 af

**Pond 38P: Ex. Drainage Channel** Peak Elev=793.52' Storage=64,557 cf Inflow=2.05 cfs 1.482 af  
Outflow=0.00 cfs 0.000 af

**Pond 52P: Onsite Post (South)** Peak Elev=798.57' Storage=10,448 cf Inflow=3.00 cfs 1.109 af  
Primary=1.11 cfs 0.841 af Secondary=1.75 cfs 0.269 af Outflow=2.87 cfs 1.109 af

**Pond 53P: Onsite Post (North)** Peak Elev=798.22' Storage=6,305 cf Inflow=2.10 cfs 0.790 af  
Primary=0.93 cfs 0.641 af Secondary=1.12 cfs 0.148 af Outflow=2.05 cfs 0.790 af

**Total Runoff Area = 19.740 ac Runoff Volume = 6.247 af Average Runoff Depth = 3.80"**  
**43.77% Pervious = 8.640 ac 56.23% Impervious = 11.100 ac**

**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 5.54 cfs @ 5.23 hrs, Volume= 2.012 af, Depth= 3.67"

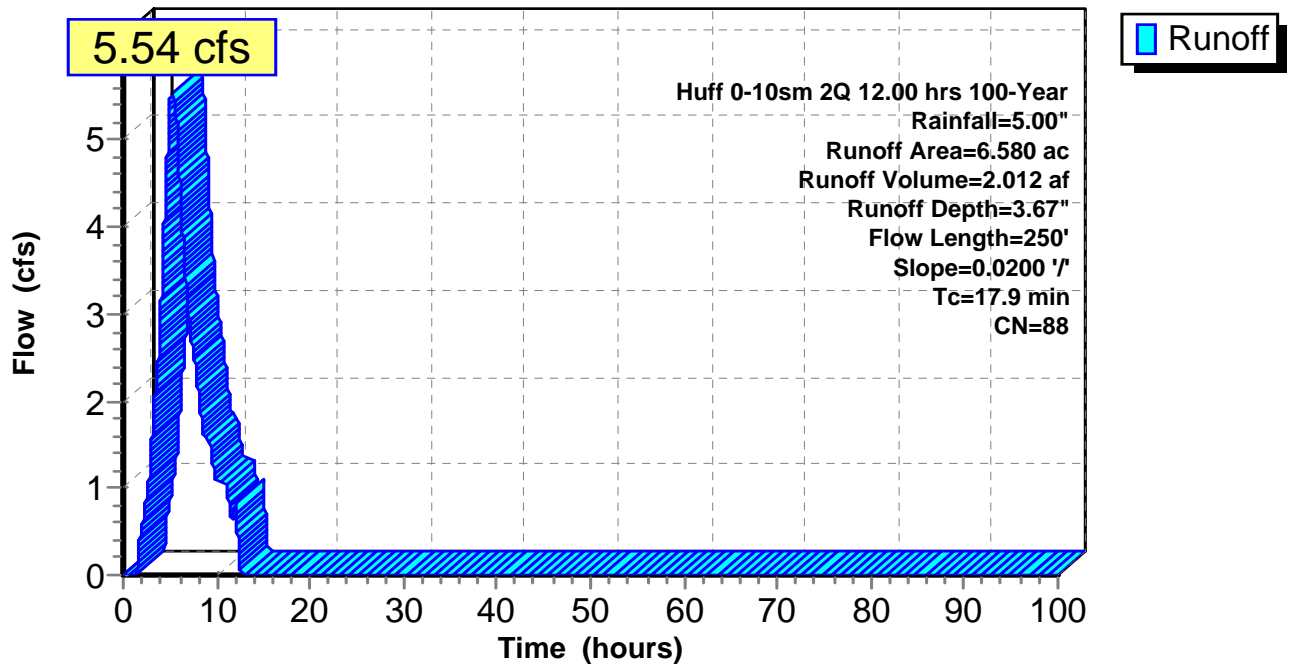
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 100-Year Rainfall=5.00"

Area (ac)	CN	Description
2.432	98	Paved parking, HSG C
0.600	98	Roofs, HSG C
3.548	79	50-75% Grass cover, Fair, HSG C
6.580	88	Weighted Average
3.548		53.92% Pervious Area
3.032		46.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 1S: PreDeveloped**

**Hydrograph**





**Summary for Subcatchment 4S: Undetained**

Runoff = 0.61 cfs @ 5.50 hrs, Volume= 0.210 af, Depth= 2.36"

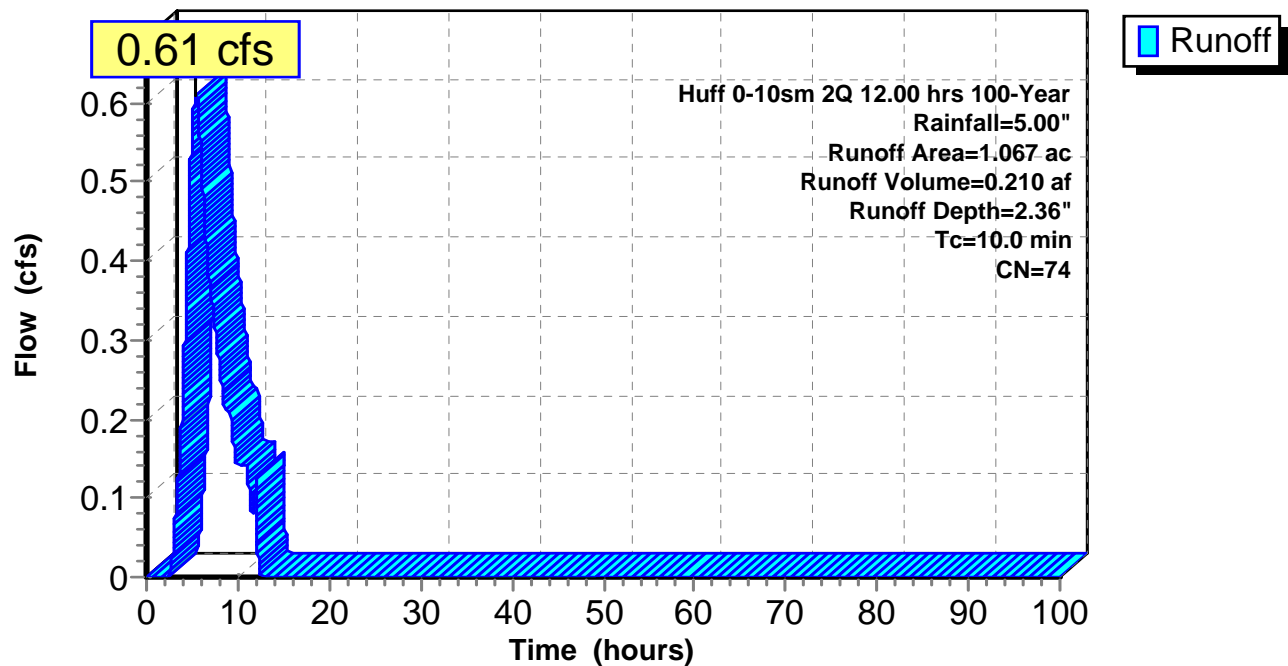
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 100-Year Rainfall=5.00"

Area (ac)	CN	Description
1.067	74	>75% Grass cover, Good, HSG C
1.067		100.00% Pervious Area

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

**Subcatchment 4S: Undetained**

**Hydrograph**



**Summary for Subcatchment 37S: Site (South)**

Runoff = 3.00 cfs @ 5.02 hrs, Volume= 1.109 af, Depth= 4.09"

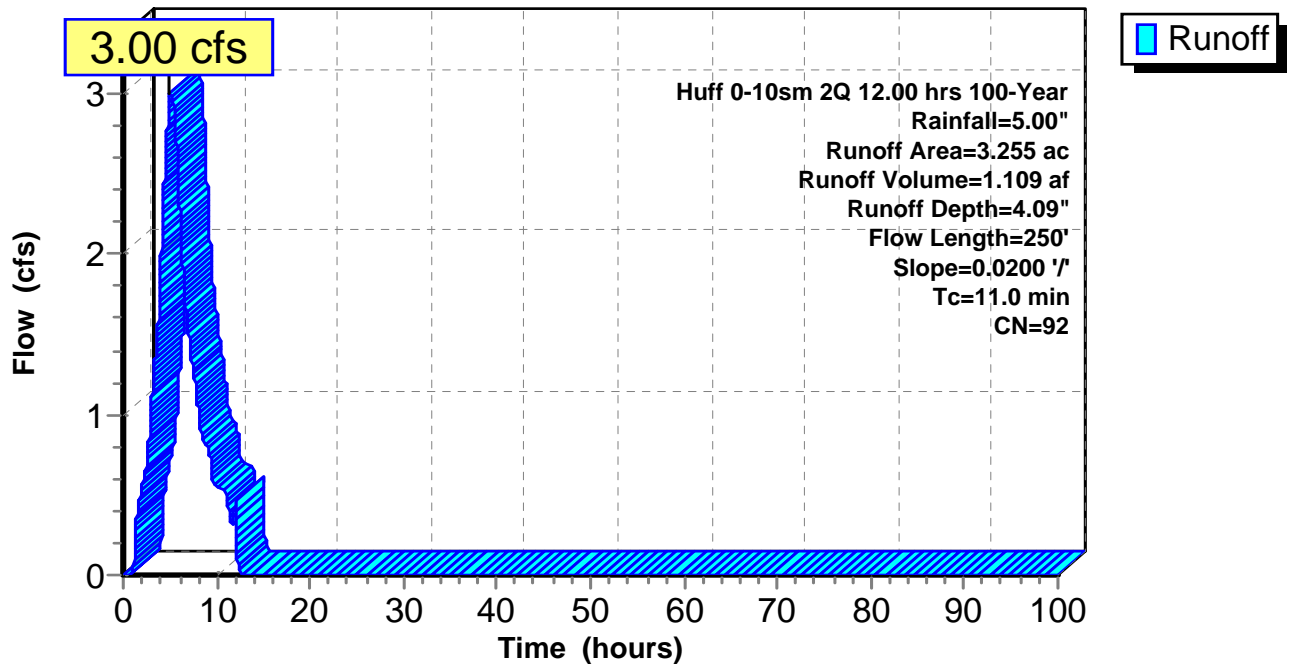
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 100-Year Rainfall=5.00"

Area (ac)	CN	Description
0.727	98	Roofs, HSG C
1.488	98	Paved parking, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
3.255	92	Weighted Average
1.040		31.95% Pervious Area
2.215		68.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0200	0.09		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
11.0	250	Total			

**Subcatchment 37S: Site (South)**

**Hydrograph**



**Summary for Subcatchment 49S: Site (North)**

Runoff = 2.10 cfs @ 5.16 hrs, Volume= 0.790 af, Depth= 4.20"

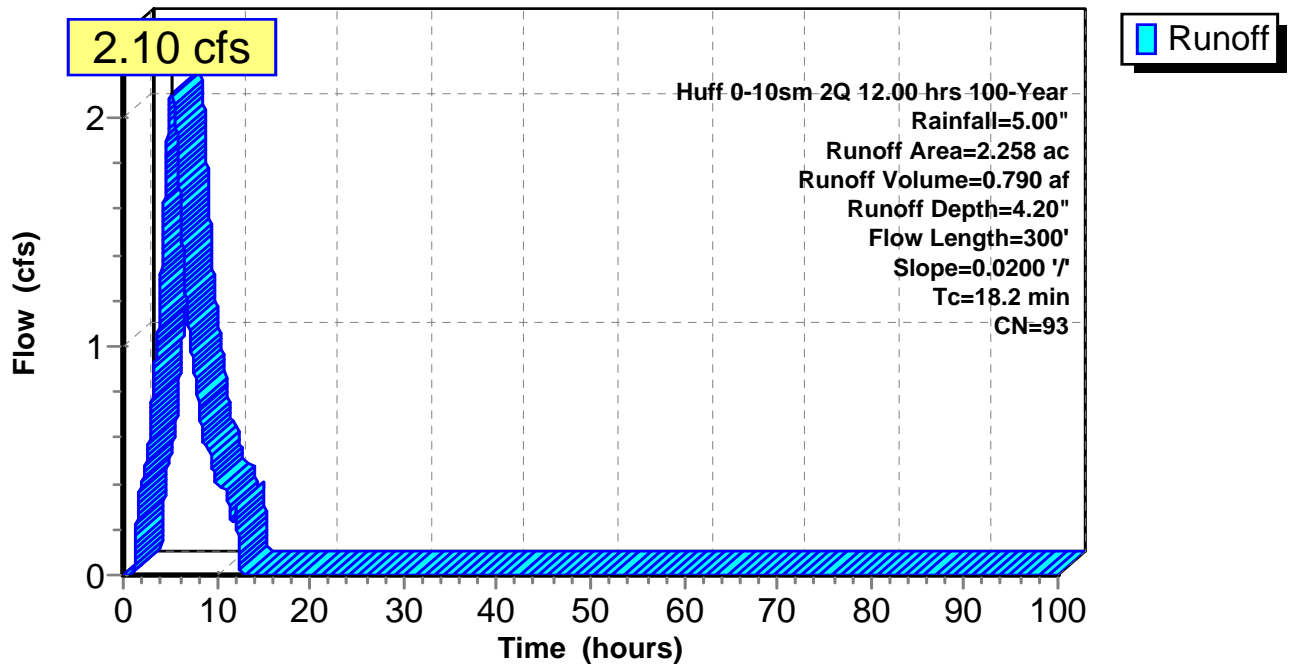
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 100-Year Rainfall=5.00"

Area (ac)	CN	Description
0.539	98	Roofs, HSG C
1.280	98	Paved parking, HSG C
0.439	74	>75% Grass cover, Good, HSG C
2.258	93	Weighted Average
0.439		19.44% Pervious Area
1.819		80.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
1.2	200	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
18.2	300	Total			

**Subcatchment 49S: Site (North)**

**Hydrograph**



**Summary for Subcatchment 54S: Developed**

Runoff = 5.79 cfs @ 5.19 hrs, Volume= 2.126 af, Depth= 3.88"

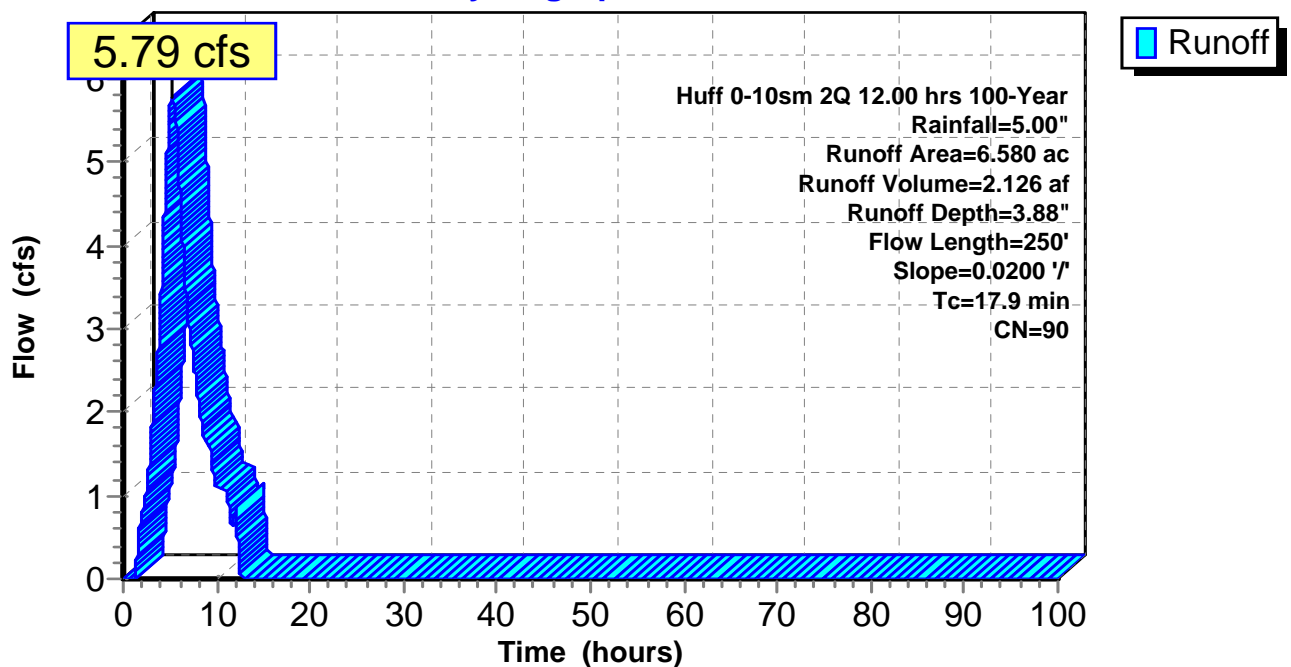
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Huff 0-10sm 2Q 12.00 hrs 100-Year Rainfall=5.00"

Area (ac)	CN	Description
2.768	98	Paved parking, HSG C
1.266	98	Roofs, HSG C
0.439	74	>75% Grass cover, Good, HSG C
1.040	79	50-75% Grass cover, Fair, HSG C
1.067	74	>75% Grass cover, Good, HSG C
6.580	90	Weighted Average
2.546		38.69% Pervious Area
4.034		61.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	100	0.0200	0.10		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 2.25"
0.9	150	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
17.9	250	Total			

**Subcatchment 54S: Developed**

**Hydrograph**



### Summary for Pond 38P: Ex. Drainage Channel

Inflow Area = 5.513 ac, 73.17% Impervious, Inflow Depth = 3.23" for 100-Year event  
Inflow = 2.05 cfs @ 5.51 hrs, Volume= 1.482 af  
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

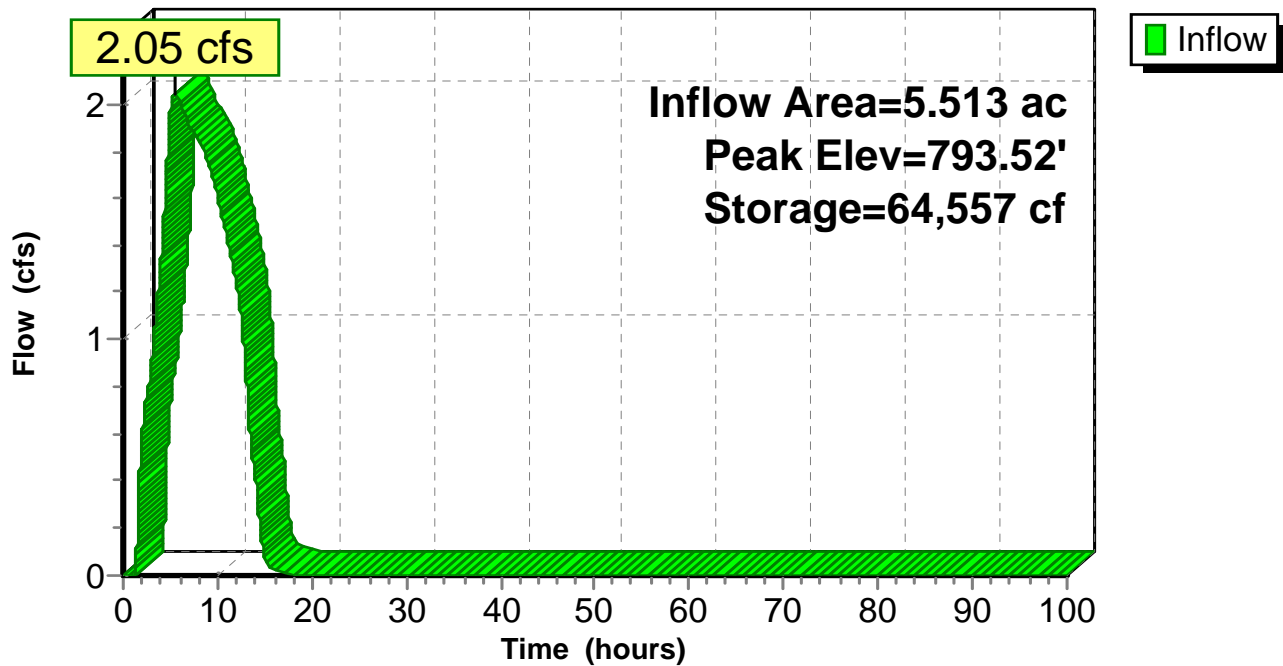
Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
Peak Elev= 793.52' @ 85.98 hrs Surf.Area= 25,558 sf Storage= 64,557 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	790.00'	319,013 cf	12.50'W x 898.00'L x 10.00'H Prismatoid Z=2.2

### Pond 38P: Ex. Drainage Channel

#### Hydrograph



**Summary for Pond 52P: Onsite Post (South)**

Inflow Area = 3.255 ac, 68.05% Impervious, Inflow Depth = 4.09" for 100-Year event  
 Inflow = 3.00 cfs @ 5.02 hrs, Volume= 1.109 af  
 Outflow = 2.87 cfs @ 5.52 hrs, Volume= 1.109 af, Atten= 4%, Lag= 29.7 min  
 Primary = 1.11 cfs @ 5.52 hrs, Volume= 0.841 af  
 Secondary = 1.75 cfs @ 5.52 hrs, Volume= 0.269 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 798.57' @ 5.52 hrs Surf.Area= 3,405 sf Storage= 10,448 cf

Plug-Flow detention time= 95.3 min calculated for 1.109 af (100% of inflow)  
 Center-of-Mass det. time= 95.4 min ( 454.5 - 359.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	3,993 cf	<b>28.50'W x 119.49'L x 5.00'H Field A</b> 17,027 cf Overall - 7,045 cf Embedded = 9,982 cf x 40.0% Voids
#2A	794.75'	7,045 cf	<b>StormTech MC-3500</b> x 64 Inside #1 Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		11,038 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=1.11 cfs @ 5.52 hrs HW=798.57' (Free Discharge)  
 ↑1=**Orifice/Grate** (Orifice Controls 1.11 cfs @ 10.08 fps)

**Secondary OutFlow** Max=1.75 cfs @ 5.52 hrs HW=798.57' (Free Discharge)  
 ↑2=**Sharp-Crested Rectangular Weir** (Weir Controls 1.75 cfs @ 3.38 fps)

**Pond 52P: Onsite Post (South) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

16 Chambers/Row x 7.17' Long = 114.72' + 28.6" End Stone x 2 = 119.49' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

64 Chambers x 110.1 cf = 7,044.6 cf Chamber Storage

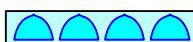
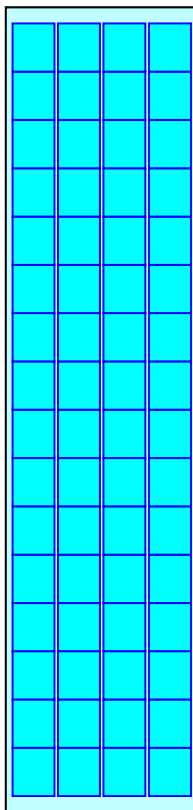
17,026.9 cf Field - 7,044.6 cf Chambers = 9,982.2 cf Stone x 40.0% Voids = 3,992.9 cf Stone Storage

Stone + Chamber Storage = 11,037.5 cf = 0.253 af

64 Chambers

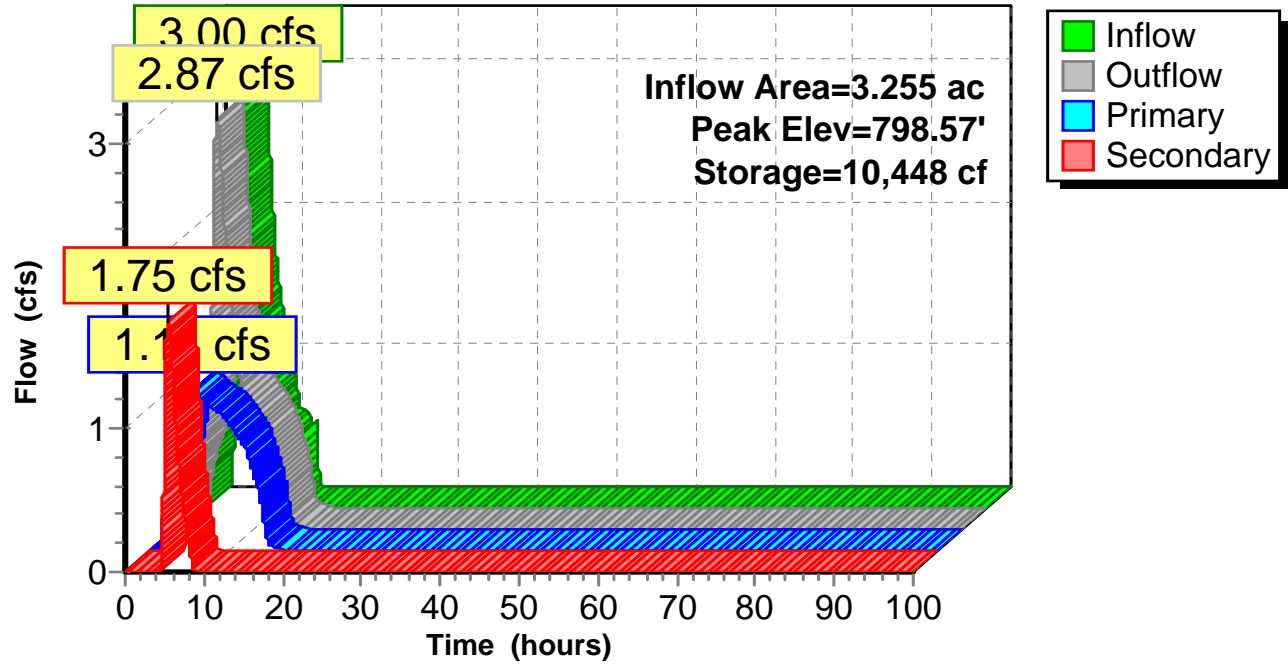
630.6 cy Field

369.7 cy Stone



Pond 52P: Onsite Post (South)

Hydrograph





**Summary for Pond 53P: Onsite Post (North)**

Inflow Area = 2.258 ac, 80.56% Impervious, Inflow Depth = 4.20" for 100-Year event  
 Inflow = 2.10 cfs @ 5.16 hrs, Volume= 0.790 af  
 Outflow = 2.05 cfs @ 5.50 hrs, Volume= 0.790 af, Atten= 3%, Lag= 20.4 min  
 Primary = 0.93 cfs @ 5.50 hrs, Volume= 0.641 af  
 Secondary = 1.12 cfs @ 5.50 hrs, Volume= 0.148 af

Routing by Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs  
 Peak Elev= 798.22' @ 5.50 hrs Surf.Area= 2,179 sf Storage= 6,305 cf

Plug-Flow detention time= 71.9 min calculated for 0.790 af (100% of inflow)  
 Center-of-Mass det. time= 72.0 min ( 434.4 - 362.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	794.00'	2,597 cf	<b>28.50'W x 76.47'L x 5.00'H Field A</b> 10,897 cf Overall - 4,403 cf Embedded = 6,494 cf x 40.0% Voids
#2A	794.75'	4,403 cf	<b>StormTech MC-3500 x 40 Inside #1</b> Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap
		7,000 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	794.00'	<b>4.2" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	797.50'	<b>0.7' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s)

**Primary OutFlow** Max=0.93 cfs @ 5.50 hrs HW=798.22' (Free Discharge)  
 ↑1=**Orifice/Grate** (Orifice Controls 0.93 cfs @ 9.69 fps)

**Secondary OutFlow** Max=1.12 cfs @ 5.50 hrs HW=798.22' (Free Discharge)  
 ↑2=**Sharp-Crested Rectangular Weir** (Weir Controls 1.12 cfs @ 2.78 fps)

**Pond 53P: Onsite Post (North) - Chamber Wizard Field A**

**Chamber Model = StormTech MC-3500**

Effective Size= 69.0"W x 45.0"H => 15.35 sf x 7.17'L = 110.1 cf

Overall Size= 75.0"W x 45.0"H x 7.50'L with 0.33' Overlap

75.0" Wide + 6.0" Spacing = 81.0" C-C

10 Chambers/Row x 7.17' Long = 71.70' + 28.6" End Stone x 2 = 76.47' Base Length

4 Rows x 75.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 28.50' Base Width

9.0" Base + 45.0" Chamber Height + 6.0" Cover = 5.00' Field Height

40 Chambers x 110.1 cf = 4,402.9 cf Chamber Storage

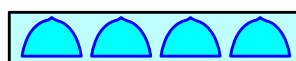
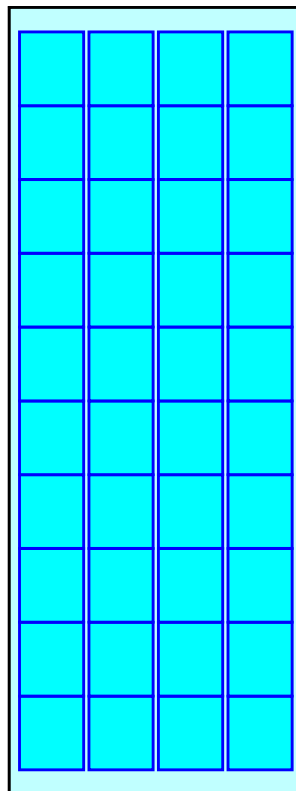
10,896.5 cf Field - 4,402.9 cf Chambers = 6,493.6 cf Stone x 40.0% Voids = 2,597.4 cf Stone Storage

Stone + Chamber Storage = 7,000.3 cf = 0.161 af

40 Chambers

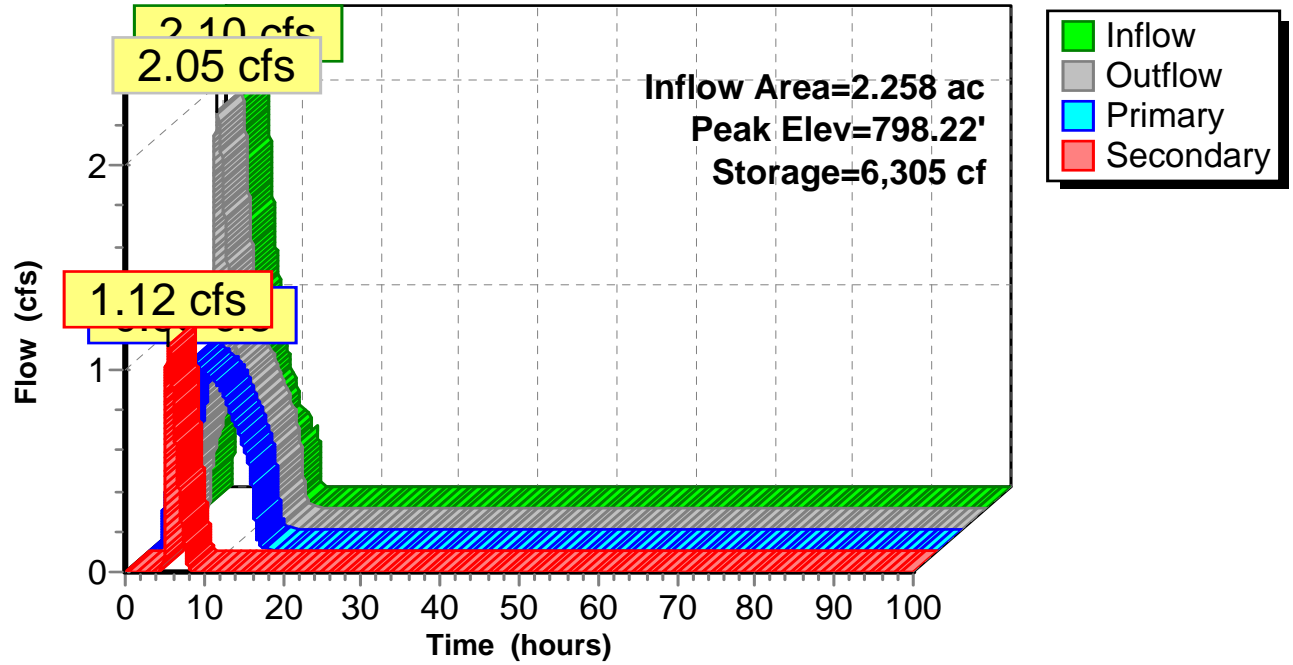
403.6 cy Field

240.5 cy Stone



Pond 53P: Onsite Post (North)

Hydrograph



**APPENDIX B**  
(Water Quality Calculations)

## Water Quality Volume & Peak Flow Calculations (NORTH)

Per Ohio EPA General Permit

Project Name	Tru Home2 Suites
Physical Address	2384 Stringtown Road
City/County	Grove City, Ohio Franklin County
Governing Municipality	Grove City, Ohio
Developer	Indus Hotels
Engineer	EP Ferris & Associates
Designed by	MJO
Date	December 18, 2017

### Input Requirements

Impervious Area (acres)	1.819	impervious area
Total Area (acres)	2.258	total drainage area
P, Rainfall Depth (inches)	0.75	Rainfall Depth - per <b>Ohio EPA General Permit</b>

### Water Quality Volume Calculation

I (%)	81	percent of impervious cover
I	0.81	Imperviousness Ratio
C	0.61	Volumetric runoff coefficient - per <b>Ohio EPA</b>
WQv (acre-feet)	0.102606374	Water quality volume in acre feet
WQv (cubic-feet)	4469.533634	Water quality volume in cubic feet
Qwv (in)	0.454412638	Water quality volume in inches

### Water Quality Volume Peak Flow Calculation

CN	97	SCS Runoff Curve Number
Tc (hours)	0.25	Time of concentration
S (in)	0.31	Potential maximum soil retention
Ia (in)	0.062	Initial abstraction from total rainfall
Ia/P	0.082	
qu (cfs/mi <sup>2</sup> /in)	1000	unit peak discharge - SEE TAB BELOW
Qwq (cfs)	1.6	Water quality peak flow

The treatment flow capacity of the Isolator Row is based on 2.5 gpm/sf and an open surface area of each chamber.

Chamber	Open Area	Flow Rate (per chamber)
SC-310	17.7 sf	0.1 cfs
SC-740	27.8 sf	0.15 cfs
MC-3500	43.2 sf	0.24 cfs
MC-4500	30.1 sf	0.16 cfs

**(7) MC-3500 Chamber \* 0.24 CFS = 1.68 CFS TREATMENT FLOWRATE PROVIDED**

## Water Quality Volume & Peak Flow Calculations (SOUTH)

Per Ohio EPA General Permit

Project Name	Tru Home2 Suites
Physical Address	2384 Stringtown Road
City/County	Grove City, Ohio Franklin County
Governing Municipality	Grove City, Ohio
Developer	Indus Hotels
Engineer	EP Ferris & Associates
Designed by	ERM
Date	December 18, 2017

### Input Requirements

Impervious Area (acres)	2.215	impervious area
Total Area (acres)	3.255	total drainage area
P, Rainfall Depth (inches)	0.75	Rainfall Depth - per <b>Ohio EPA General Permit</b>

### Water Quality Volume Calculation

I (%)	68	percent of impervious cover
I	0.68	Imperviousness Ratio
C	0.48	Volumetric runoff coefficient - per <b>Ohio EPA</b>
WQv (acre-feet)	0.116172976	Water quality volume in acre feet
WQv (cubic-feet)	5060.494846	Water quality volume in cubic feet
Qwv (in)	0.356906225	Water quality volume in inches

### Water Quality Volume Peak Flow Calculation

CN	95	SCS Runoff Curve Number
Tc (hours)	0.25	Time of concentration
S (in)	0.53	Potential maximum soil retention
Ia (in)	0.105	Initial abstraction from total rainfall
Ia/P	0.140	
qu (cfs/mi <sup>2</sup> /in)	1000	unit peak discharge - SEE TAB BELOW
Qwq (cfs)	1.8	Water quality peak flow

The treatment flow capacity of the Isolator Row is based on 2.5 gpm/sf and an open surface area of each chamber.

Chamber	Open Area	Flow Rate (per chamber)
SC-310	17.7 sf	0.1 cfs
SC-740	27.8 sf	0.15 cfs
MC-3500	43.2 sf	0.24 cfs
MC-4500	30.1 sf	0.16 cfs

**(8) MC-3500 Chamber \* 0.24 CFS = 1.92 CFS TREATMENT FLOWRATE PROVIDED**

**APPENDIX C**  
(Tributary Maps)