

# Preliminary Drainage Analysis

**6473 Seeds Road**

Grove City, Ohio

Prepared By:



880 King Ave.  
Columbus, Ohio 43212

EP Ferris # 1115.001

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	0.316 CF
1Yr. Post-Developed Storm Runoff Volume	0.414 CF
Volume Increase	31%
Critical Storm	5 Year

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

<b>Storm Event</b>	<b>Pre-Dev. Peak (CFS)</b>	<b>Post-Dev. Peak (CFS)</b>	<b>Allowable Release Rate (CFS)</b>	<b>Release West to East Pond (CFS)</b>	<b>Final Release East (CFS)</b>	<b>West Ponding Elevation</b>	<b>East Ponding Elevation</b>
<b>1 Yr.</b>	<b>4.45</b>	6.11	4.45	0.08	2.61	839.21	837.88
2 Yr.	6.18	8.07	4.45	0.12	3.27	839.75	838.73
<b>5 Yr.</b>	8.84	10.98	<b>4.45</b>	0.61	4.36	840.00	840.58
10 Yr.	11.14	13.42	11.14	1.46	6.22	840.28	841.05
25 Yr.	14.46	16.92	14.46	2.99	8.41	840.69	841.17
50 Yr.	17.30	19.87	17.30	4.37	11.11	841.03	841.28
100 yr.	20.37	23.03	20.37	5.78	14.05	841.37	841.39

**Table 3 – Detention Summary Table**

	<b>West</b>	<b>East</b>	<b>Total</b>
Water Quality Volume Required	7,187 CF	4,900 CF	12,087 CF
Water Quality Volume Provided	7,778 CF	4,062 CF	11,840 CF
Water Quantity Volume Required	15,079 CF	1,949 CF	17,028 CF
Water Quantity Volume Provided	27,713 CF	4,643 CF	32,356 CF

## **INTRODUCTION:**

The above Executive Summary represents the preliminary analysis and proposal of storm water management for 6473 Seeds Road, Grove City, Ohio. Three new buildings and additional gravel parking is being proposed.

Two separate drainage areas were analyzed, one west (2.75 Ac.) and one east (2.25 Ac.), with the west pond draining to the east pond. The total tributary area to the detention facility is approximately 5.00 acres+/-, see Appendix "C" Tributary Map. The area of the property, 5.00 acres, was used to determine the critical storm. The offsite area and un-detained areas were considered to be negligible.

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.

## **PRE-DEVELOPED CONDITIONS:**

The pre-developed condition of the site consists of a developed lot with multiple buildings, retention pond, asphalt parking and gravel yard. The area also has small areas of grass with some trees, found to have a curve number CN=86. The time of concentration was found to be 17.7 minutes using a hydraulic length of 620 feet with a slope of 1.0 %.

Currently the site drains from west to the east towards Seeds Road.

## **POST-DEVELOPED CONDITIONS:**

The post developed condition of the site will consist of 3 additional buildings, a retention pond, asphalt parking, new gravel area and green space. The developed site is determined to have a curve number CN =90. The time of concentration was found to be 16.6 minutes and 15.7 minutes for the west and east facilities with ditches being provided at 0.50% and proposed storm sewers to the final control structure.

The proposed site continues to drain to west to east and Seeds Road.

### **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: 0.316 af  
Post-Development 1-Year Storm Event: 0.414 af  
 $((0.414\text{af} - 0.316\text{af}) / 0.316\text{af}) \times 100\% = 31\%$  (**5 year critical storm**)

### **WATER QUALITY:**

Water quality will be provided in the retention pond as well as in the infiltration ditch using void spaces in the gravel and surface storage of the ditch. See (Appendix “B”).

### **SUMMARY:**

The developed site is controlled by two different detention systems (west and east). The west system uses a 1.5” water quality orifice with along with an internal weir to control flow of less frequent storms. The west pond outlets to a proposed storm sewer system which drains to a final outlet control basin which provide an additional control feature to further provide water quality and quantity for the eastern portion of the site which proposes only one new building. The control at the east detention system uses a 9” orifice plus four 2’ side windows which will flood route to the existing ditch along Seeds Road.

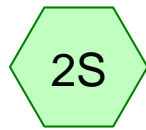
From the above Executive Summary, the detention system’s limits of release rate are found not to exceed the parameters set forth from the above design criteria.

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”.

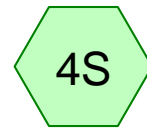
**APPENDIX A**  
(HydroCAD Report)



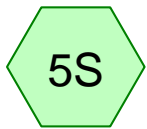
PreDeveloped



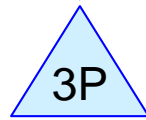
Developed West



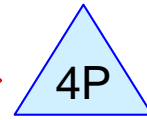
Developed East



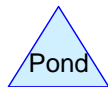
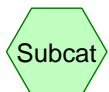
Developed



Detention Pond West



Detention Pond East



**6473 Seeds Road**

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Type II 24-hr 1-Year Rainfall=1.88"

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**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 4.45 cfs @ 12.11 hrs, Volume= 0.316 af, Depth= 0.76"

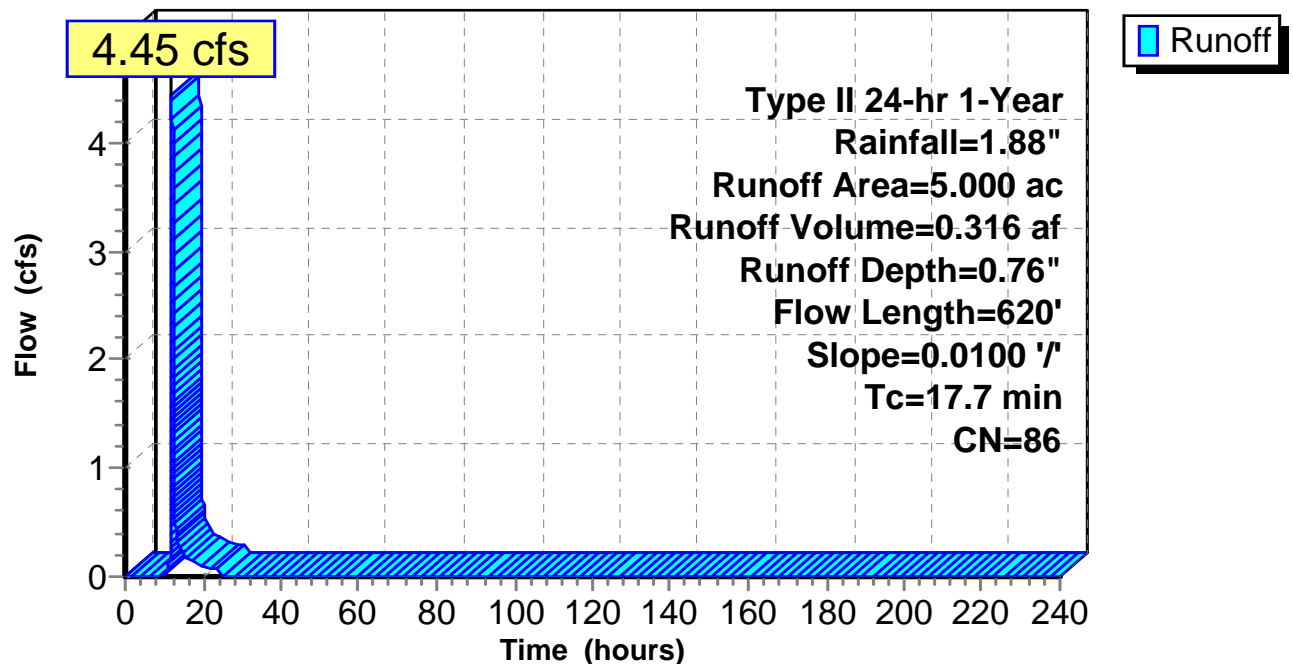
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 1-Year Rainfall=1.88"

Area (ac)	CN	Description
1.947	89	Gravel roads, HSG C
0.758	98	Roofs, HSG C
0.097	98	Water Surface, HSG C
2.198	79	50-75% Grass cover, Fair, HSG C
5.000	86	Weighted Average
4.145		82.90% Pervious Area
0.855		17.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.7	620	0.0100	0.58		Lag/CN Method,

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



**6473 Seeds Road**

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Type II 24-hr 1-Year Rainfall=1.88"

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**Summary for Subcatchment 2S: Developed West**

Runoff = 2.93 cfs @ 12.09 hrs, Volume= 0.199 af, Depth= 0.87"

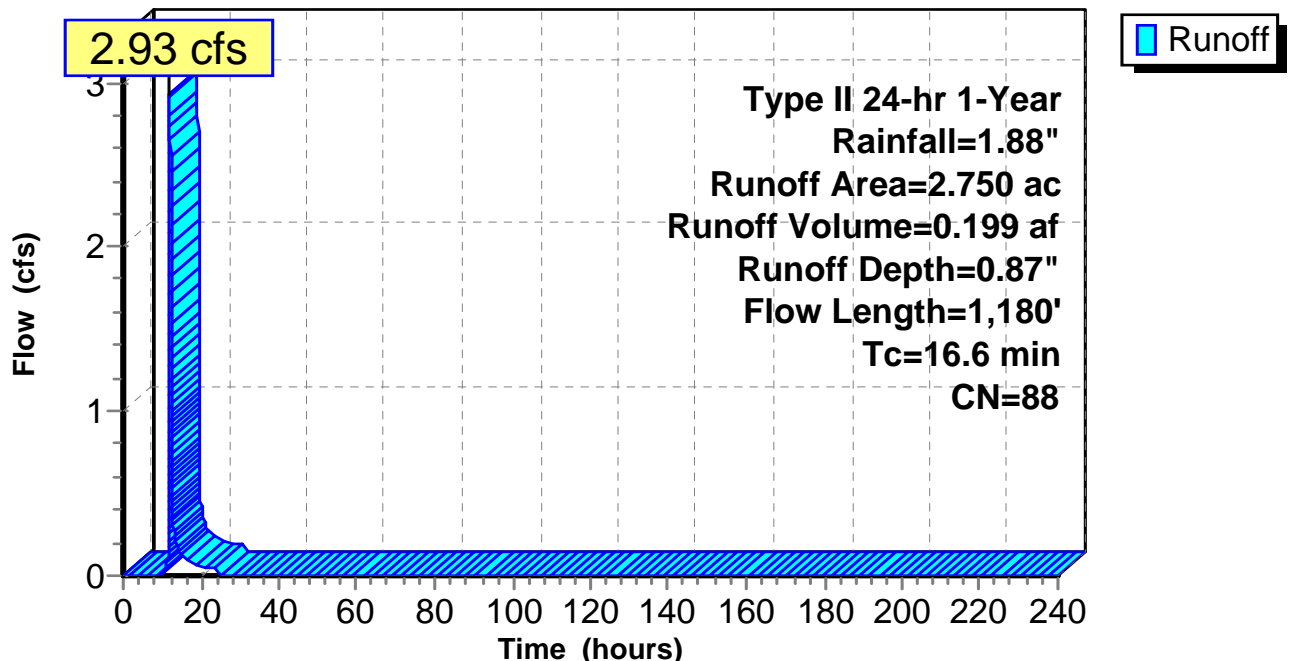
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 1-Year Rainfall=1.88"

Area (ac)	CN	Description
0.760	98	Roofs, HSG C
1.140	89	Gravel roads, HSG C
0.750	74	>75% Grass cover, Good, HSG C
0.100	98	Water Surface, HSG C
2.750	88	Weighted Average
1.890		68.73% Pervious Area
0.860		31.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 2S: Developed West**

**Hydrograph**





**6473 Seeds Road**

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Type II 24-hr 1-Year Rainfall=1.88"

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**Summary for Subcatchment 4S: Developed East**

Runoff = 3.02 cfs @ 12.08 hrs, Volume= 0.199 af, Depth= 1.06"

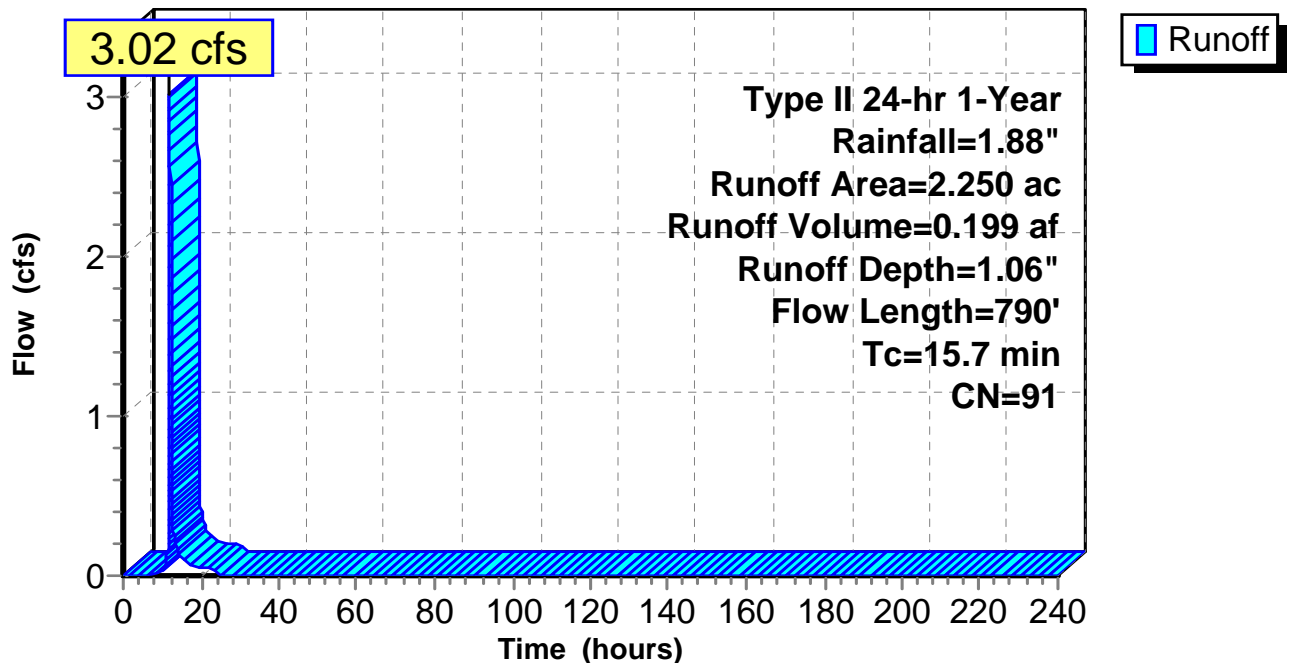
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 1-Year Rainfall=1.88"

Area (ac)	CN	Description
0.510	74	>75% Grass cover, Good, HSG C
0.650	98	Paved parking, HSG C
0.420	89	Gravel roads, HSG C
0.670	98	Roofs, HSG C
2.250	91	Weighted Average
0.930		41.33% Pervious Area
1.320		58.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	20	0.0040	0.05		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.25"
7.7	440	0.0040	0.95		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
1.9	330	0.0030	2.88	3.54	<b>Pipe Channel,</b> 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
15.7	790	Total			

**Subcatchment 4S: Developed East**

**Hydrograph**



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Type II 24-hr 1-Year Rainfall=1.88"

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**Summary for Subcatchment 5S: Developed**

Runoff = 6.11 cfs @ 12.09 hrs, Volume= 0.414 af, Depth= 0.99"

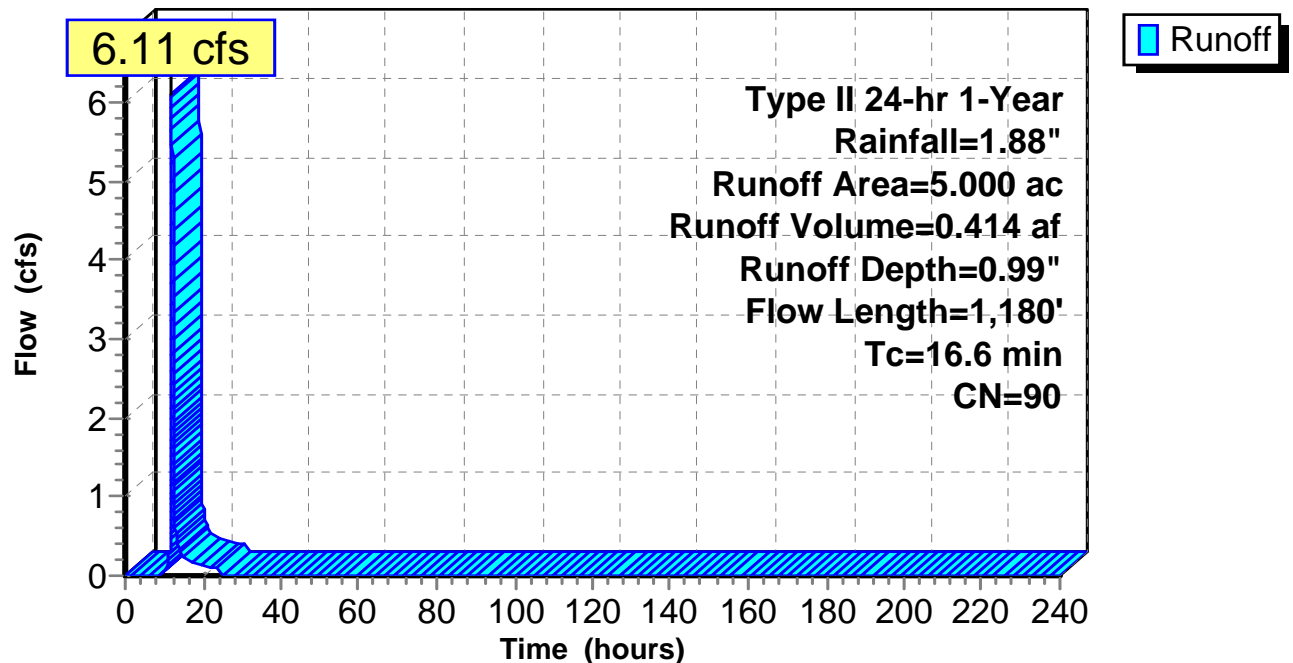
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 1-Year Rainfall=1.88"

Area (ac)	CN	Description
1.663	98	Roofs, HSG C
0.470	98	Paved parking, HSG C
1.326	89	Gravel roads, HSG C
1.444	79	50-75% Grass cover, Fair, HSG C
0.097	98	Water Surface, HSG C
5.000	90	Weighted Average
2.770		55.40% Pervious Area
2.230		44.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 5S: Developed**

**Hydrograph**



**Summary for Pond 3P: Detention Pond West**

Inflow Area = 2.750 ac, 31.27% Impervious, Inflow Depth = 0.87" for 1-Year event  
 Inflow = 2.93 cfs @ 12.09 hrs, Volume= 0.199 af  
 Outflow = 0.08 cfs @ 17.85 hrs, Volume= 0.199 af, Atten= 97%, Lag= 345.5 min  
 Primary = 0.08 cfs @ 17.85 hrs, Volume= 0.199 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 839.21' @ 17.85 hrs Surf.Area= 3,795 sf Storage= 5,847 cf

Plug-Flow detention time= 998.0 min calculated for 0.199 af (100% of inflow)  
 Center-of-Mass det. time= 997.9 min ( 1,843.5 - 845.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	837.50'	27,713 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
837.50	3,000	0	0
838.00	3,300	1,575	1,575
839.00	3,700	3,500	5,075
840.00	4,162	3,931	9,006
841.00	4,532	4,347	13,353
842.00	5,103	4,818	18,171
843.00	13,982	9,543	27,713

Device	Routing	Invert	Outlet Devices
#1	Primary	837.50'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	839.70'	<b>1.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height
#3	Tertiary	842.75'	<b>24.0" x 24.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.08 cfs @ 17.85 hrs HW=839.21' (Free Discharge)

↑**1=Orifice/Grate** (Orifice Controls 0.08 cfs @ 6.17 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=837.50' (Free Discharge)

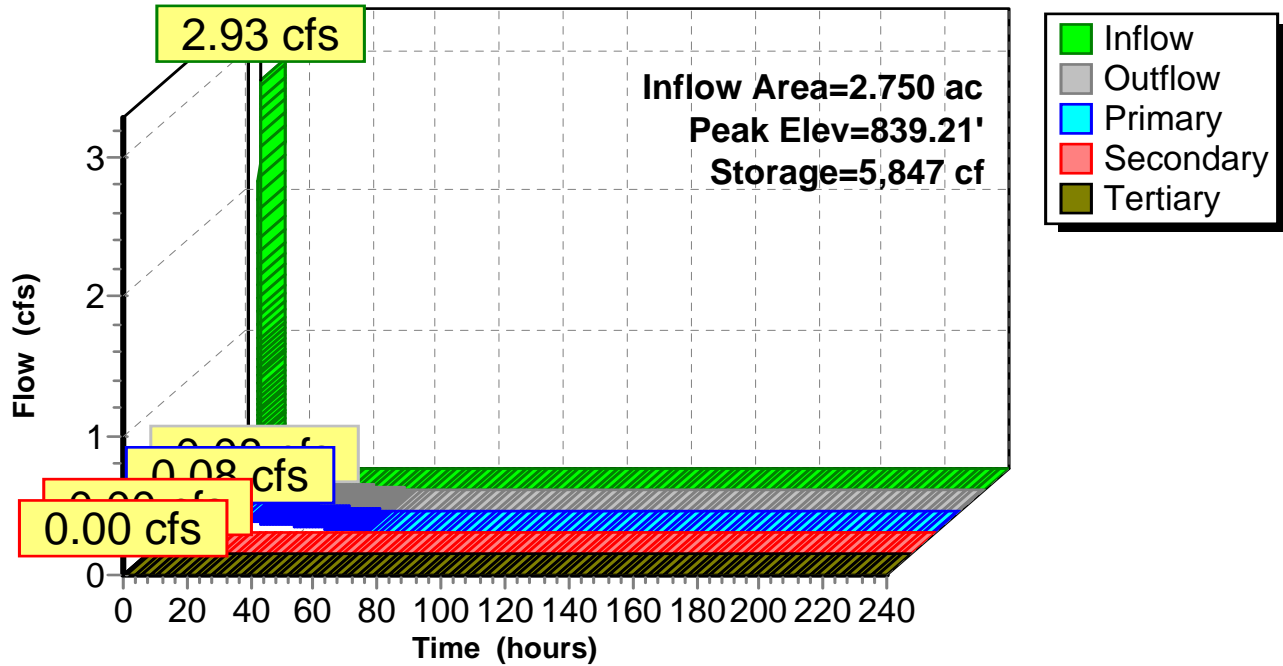
↑**2=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Tertiary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=837.50' (Free Discharge)

↑**3=Orifice/Grate** ( Controls 0.00 cfs)

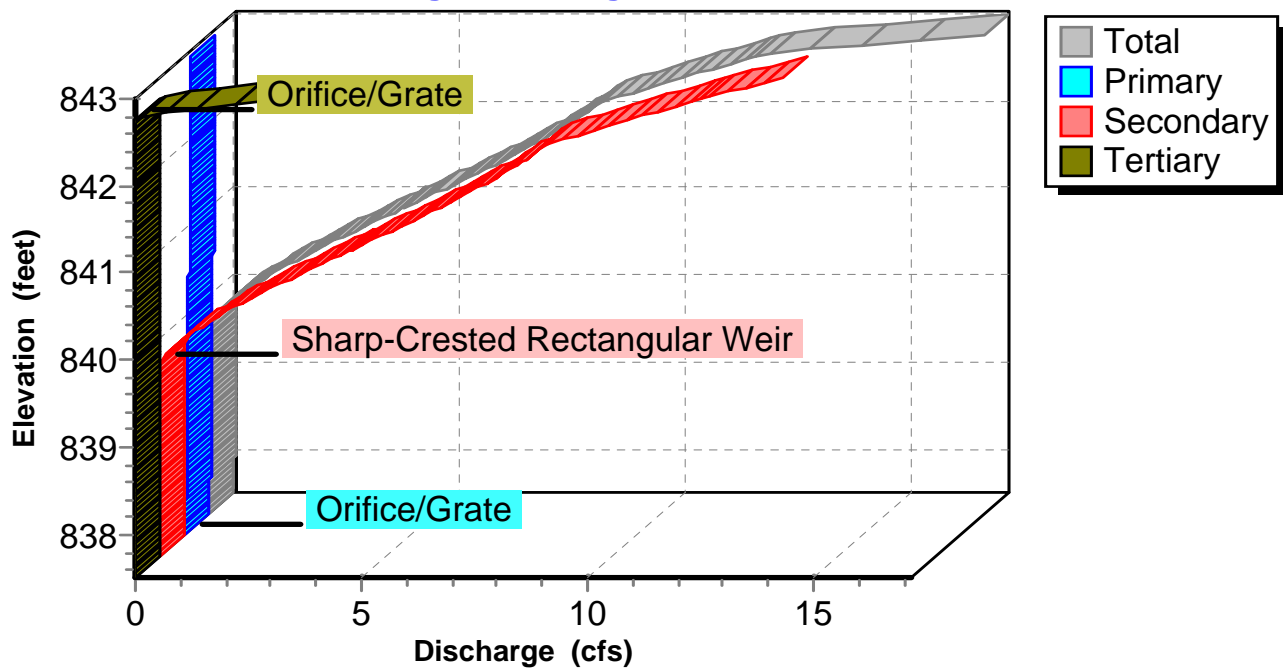
### Pond 3P: Detention Pond West

#### Hydrograph



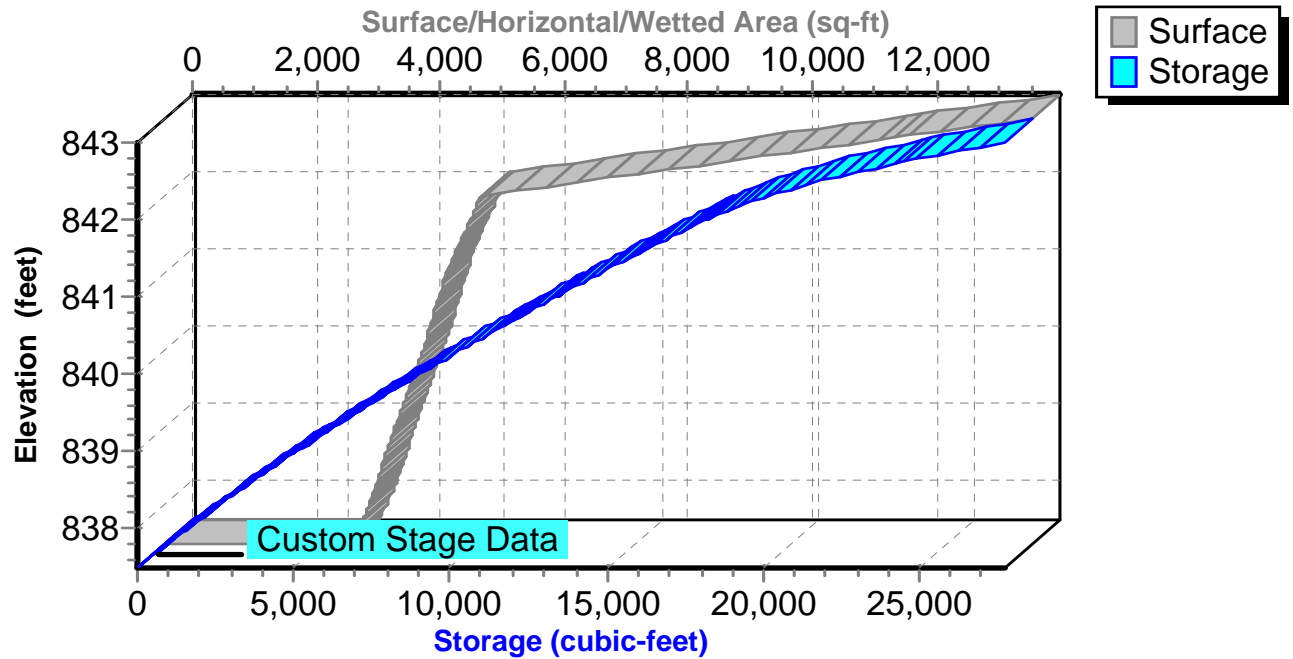
### Pond 3P: Detention Pond West

#### Stage-Discharge



### Pond 3P: Detention Pond West

#### Stage-Area-Storage



**6473 Seeds Road**

Type II 24-hr 1-Year Rainfall=1.88"

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**Summary for Pond 4P: Detention Pond East**

Inflow Area = 5.000 ac, 43.60% Impervious, Inflow Depth = 0.95" for 1-Year event  
 Inflow = 3.06 cfs @ 12.08 hrs, Volume= 0.398 af  
 Outflow = 2.61 cfs @ 12.15 hrs, Volume= 0.398 af, Atten= 15%, Lag= 4.2 min  
 Primary = 2.61 cfs @ 12.15 hrs, Volume= 0.398 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 837.88' @ 12.15 hrs Surf.Area= 437 sf Storage= 380 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 0.3 min ( 1,337.8 - 1,337.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	836.41'	779 cf	<b>15.0" D x 635.0'L 15" Pipe Storage S= 0.0030 'I'</b>
#2	836.90'	35 cf	<b>12.0" D x 45.0'L 12" Pipe Storage S= 0.0045 'I'</b>
#3	838.90'	480 cf	<b>Inf. Trench Stone (Prismatic) Listed below (Recalc)</b>
#4	840.90'	3,348 cf	<b>Ditch Volume (Prismatic) Listed below (Recalc)</b>
		4,643 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
838.90	0	0.0	0	0
840.90	1,200	40.0	480	480

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.90	0	0	0
842.00	6,088	3,348	3,348

Device	Routing	Invert	Outlet Devices
#1	Primary	836.00'	<b>9.0" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	840.90'	<b>8.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height

**Primary OutFlow** Max=2.61 cfs @ 12.15 hrs HW=837.88' (Free Discharge)

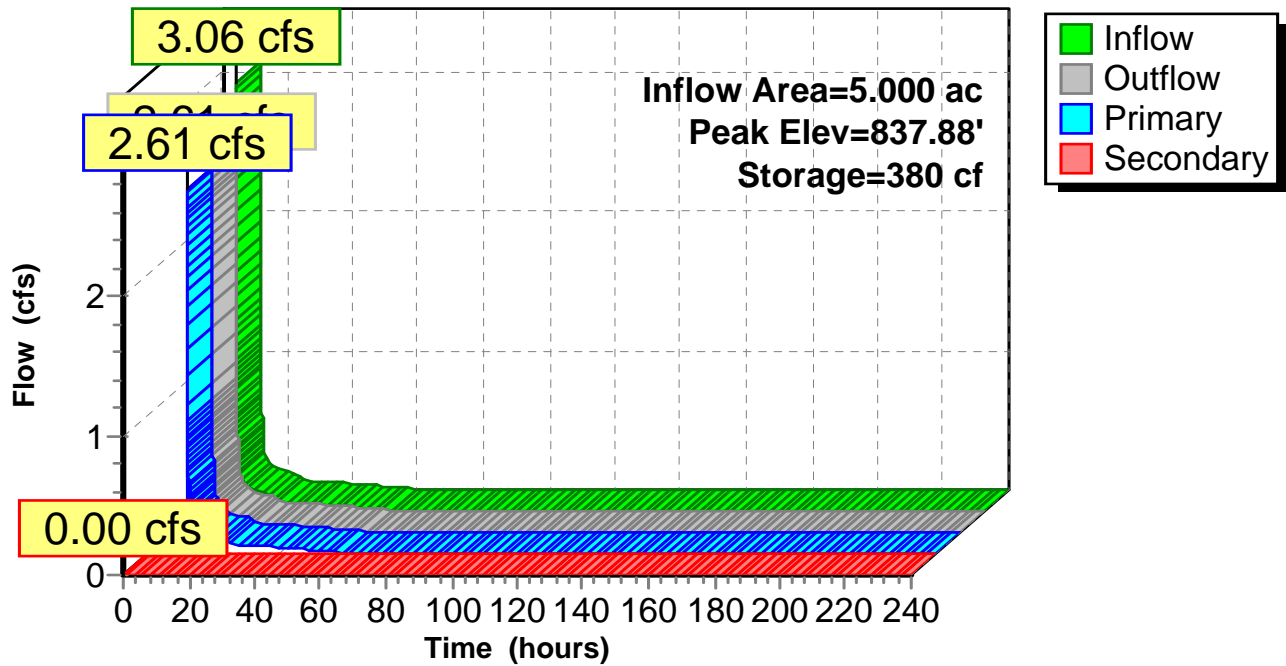
↑**1=Orifice/Grate** (Orifice Controls 2.61 cfs @ 5.92 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=836.41' (Free Discharge)

↑**2=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)

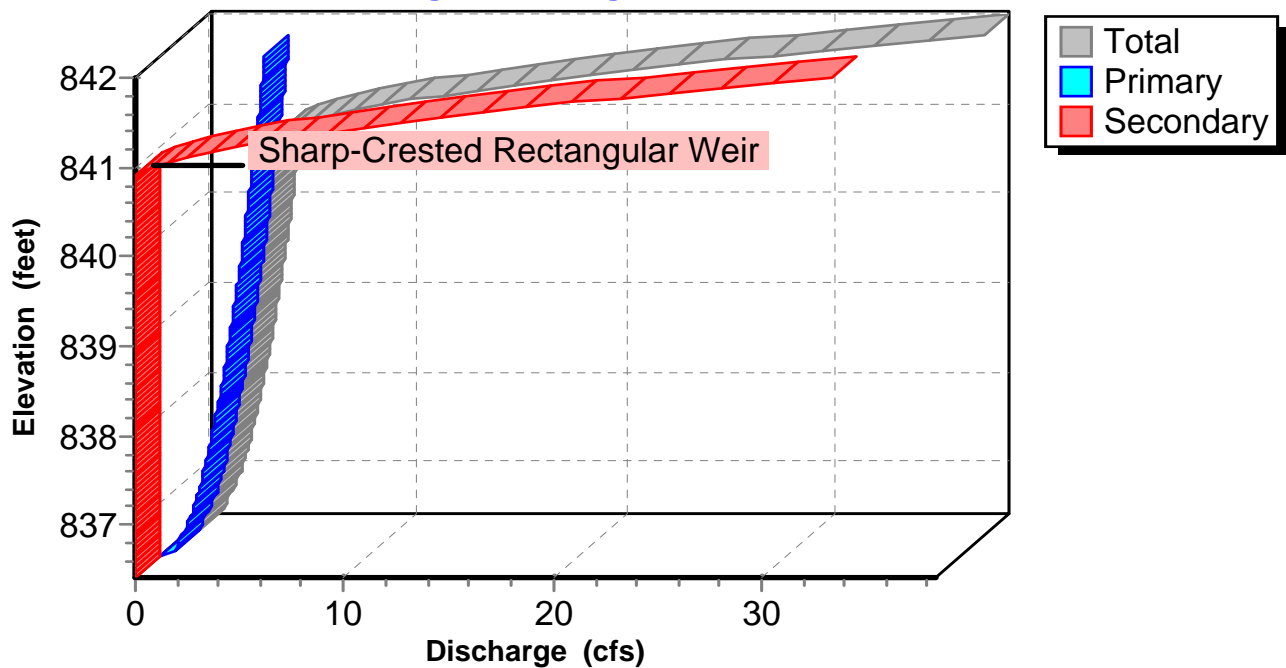
### Pond 4P: Detention Pond East

#### Hydrograph



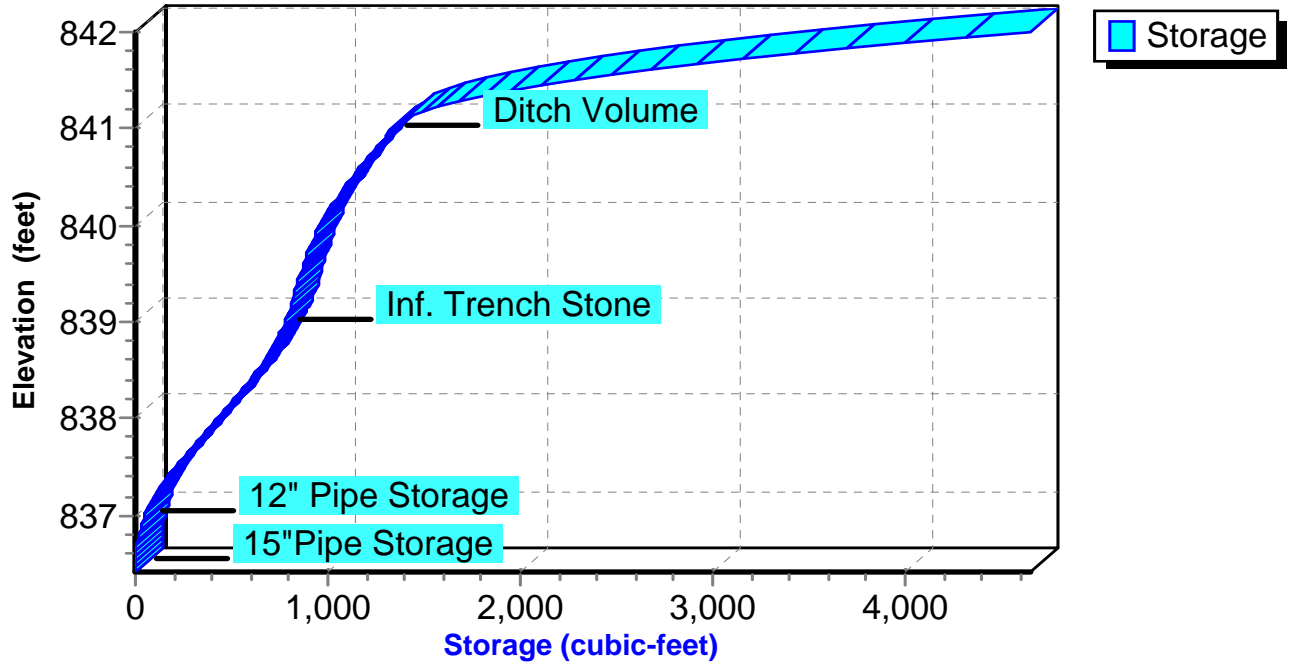
### Pond 4P: Detention Pond East

#### Stage-Discharge



Pond 4P: Detention Pond East

Stage-Area-Storage





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Type II 24-hr 2-Year Rainfall=2.25"

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**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 6.18 cfs @ 12.10 hrs, Volume= 0.434 af, Depth= 1.04"

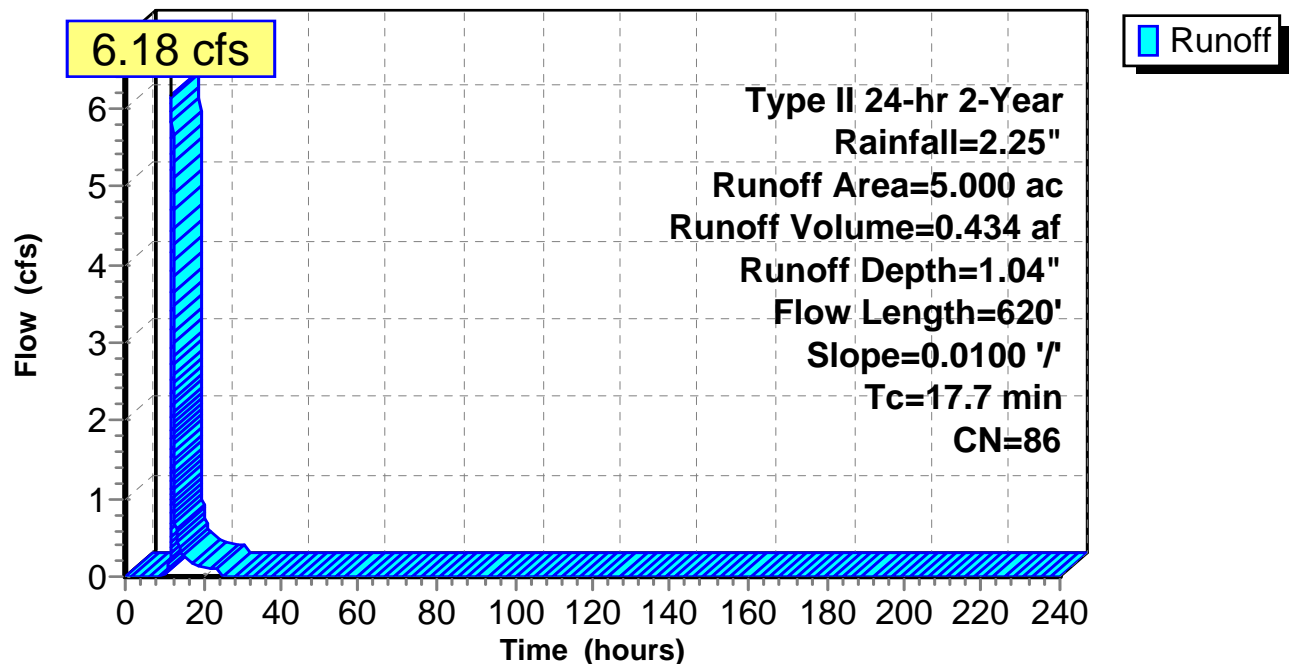
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-Year Rainfall=2.25"

Area (ac)	CN	Description
1.947	89	Gravel roads, HSG C
0.758	98	Roofs, HSG C
0.097	98	Water Surface, HSG C
2.198	79	50-75% Grass cover, Fair, HSG C
5.000	86	Weighted Average
4.145		82.90% Pervious Area
0.855		17.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.7	620	0.0100	0.58		Lag/CN Method,

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



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Type II 24-hr 2-Year Rainfall=2.25"

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**Summary for Subcatchment 2S: Developed West**

Runoff = 3.96 cfs @ 12.09 hrs, Volume= 0.268 af, Depth= 1.17"

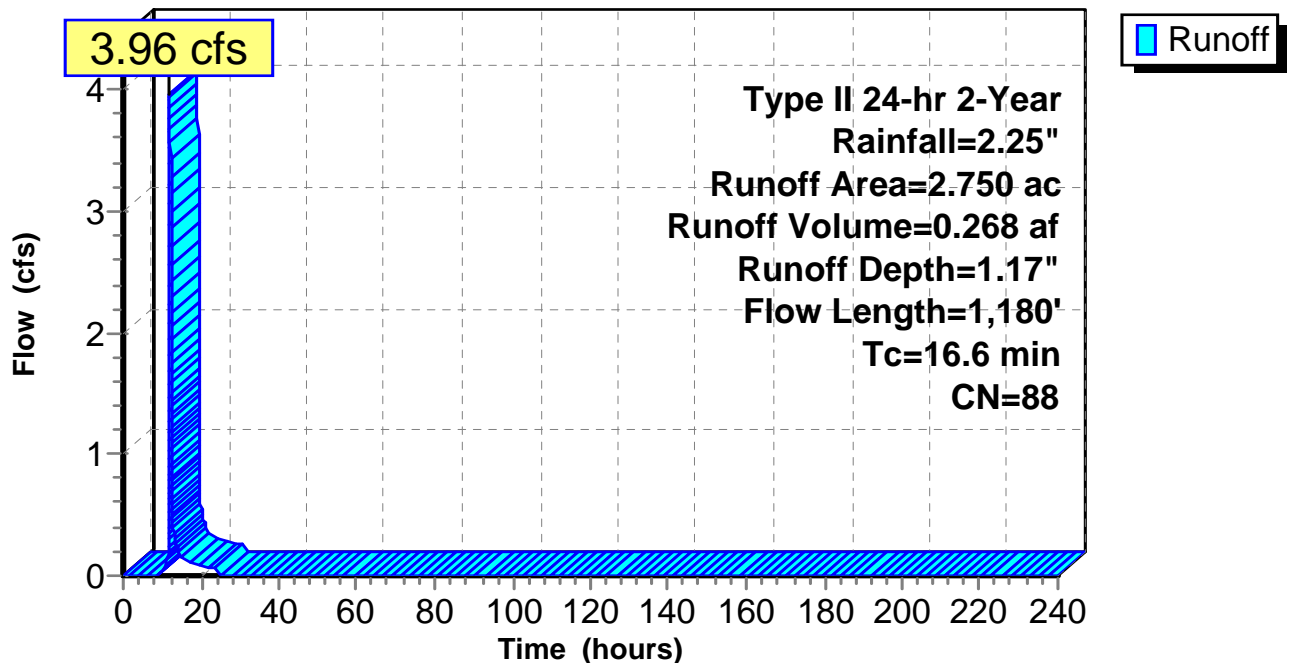
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-Year Rainfall=2.25"

Area (ac)	CN	Description
0.760	98	Roofs, HSG C
1.140	89	Gravel roads, HSG C
0.750	74	>75% Grass cover, Good, HSG C
0.100	98	Water Surface, HSG C
2.750	88	Weighted Average
1.890		68.73% Pervious Area
0.860		31.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 2S: Developed West**

**Hydrograph**



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Type II 24-hr 2-Year Rainfall=2.25"

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**Summary for Subcatchment 4S: Developed East**

Runoff = 3.93 cfs @ 12.08 hrs, Volume= 0.260 af, Depth= 1.38"

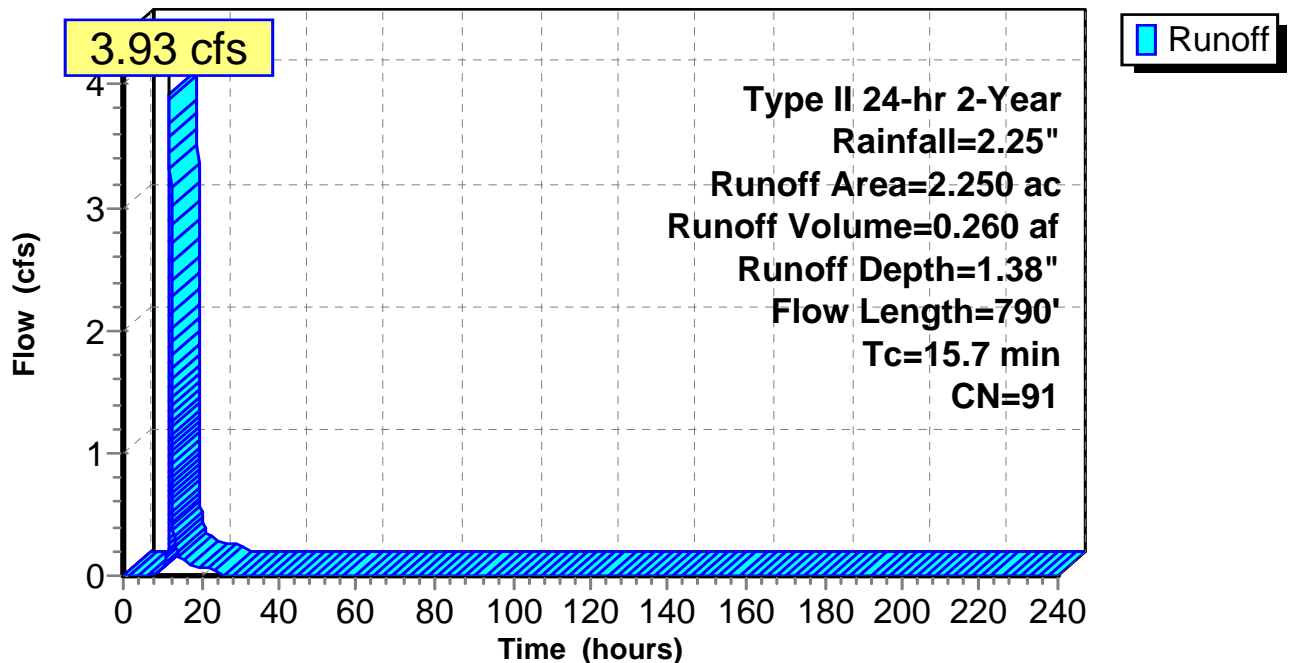
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-Year Rainfall=2.25"

Area (ac)	CN	Description
0.510	74	>75% Grass cover, Good, HSG C
0.650	98	Paved parking, HSG C
0.420	89	Gravel roads, HSG C
0.670	98	Roofs, HSG C
2.250	91	Weighted Average
0.930		41.33% Pervious Area
1.320		58.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	20	0.0040	0.05		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.25"
7.7	440	0.0040	0.95		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
1.9	330	0.0030	2.88	3.54	<b>Pipe Channel,</b> 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
15.7	790	Total			

**Subcatchment 4S: Developed East**

**Hydrograph**



**6473 Seeds Road**

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Type II 24-hr 2-Year Rainfall=2.25"

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**Summary for Subcatchment 5S: Developed**

Runoff = 8.07 cfs @ 12.08 hrs, Volume= 0.546 af, Depth= 1.31"

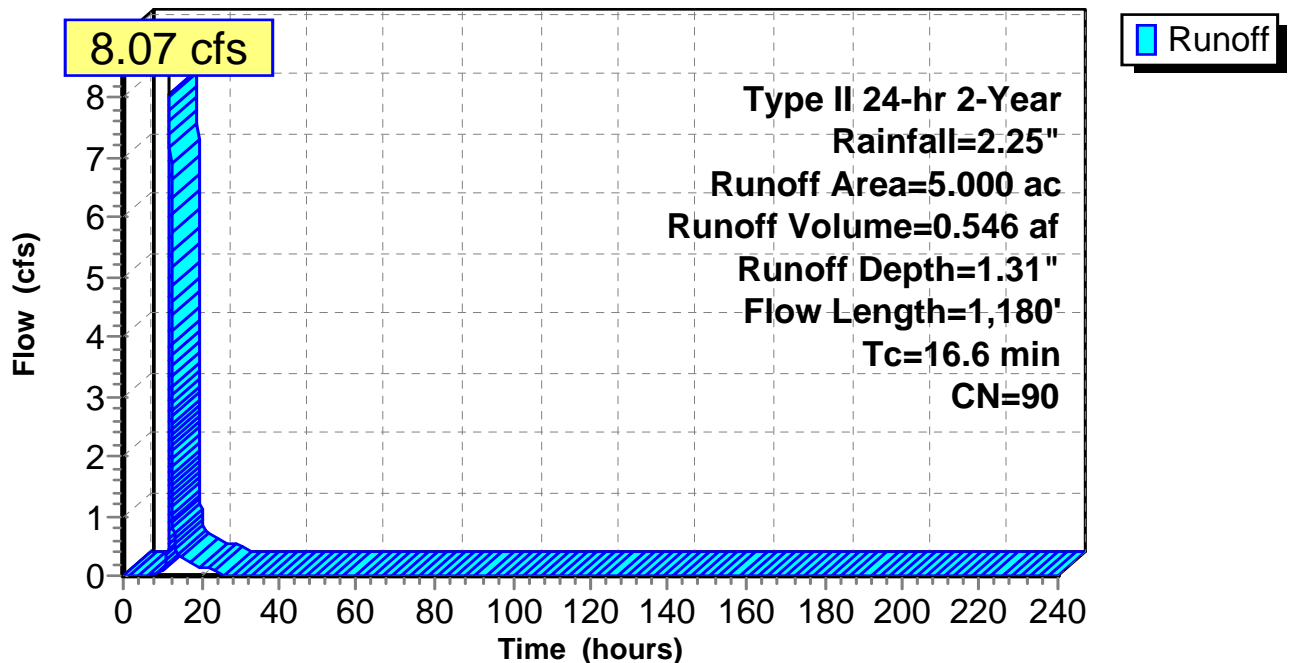
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2-Year Rainfall=2.25"

Area (ac)	CN	Description
1.663	98	Roofs, HSG C
0.470	98	Paved parking, HSG C
1.326	89	Gravel roads, HSG C
1.444	79	50-75% Grass cover, Fair, HSG C
0.097	98	Water Surface, HSG C
5.000	90	Weighted Average
2.770		55.40% Pervious Area
2.230		44.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 5S: Developed**

**Hydrograph**



**6473 Seeds Road**

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Type II 24-hr 2-Year Rainfall=2.25"

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**Summary for Pond 3P: Detention Pond West**

Inflow Area = 2.750 ac, 31.27% Impervious, Inflow Depth = 1.17" for 2-Year event  
 Inflow = 3.96 cfs @ 12.09 hrs, Volume= 0.268 af  
 Outflow = 0.12 cfs @ 16.07 hrs, Volume= 0.268 af, Atten= 97%, Lag= 238.8 min  
 Primary = 0.09 cfs @ 16.07 hrs, Volume= 0.259 af  
 Secondary = 0.03 cfs @ 16.07 hrs, Volume= 0.009 af  
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 839.75' @ 16.07 hrs Surf.Area= 4,044 sf Storage= 7,960 cf

Plug-Flow detention time= 1,107.2 min calculated for 0.268 af (100% of inflow)  
 Center-of-Mass det. time= 1,107.1 min ( 1,944.2 - 837.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	837.50'	27,713 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
837.50	3,000	0	0
838.00	3,300	1,575	1,575
839.00	3,700	3,500	5,075
840.00	4,162	3,931	9,006
841.00	4,532	4,347	13,353
842.00	5,103	4,818	18,171
843.00	13,982	9,543	27,713

Device	Routing	Invert	Outlet Devices
#1	Primary	837.50'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	839.70'	<b>1.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height
#3	Tertiary	842.75'	<b>24.0" x 24.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.09 cfs @ 16.07 hrs HW=839.75' (Free Discharge)

↑**1=Orifice/Grate** (Orifice Controls 0.09 cfs @ 7.11 fps)

**Secondary OutFlow** Max=0.03 cfs @ 16.07 hrs HW=839.75' (Free Discharge)

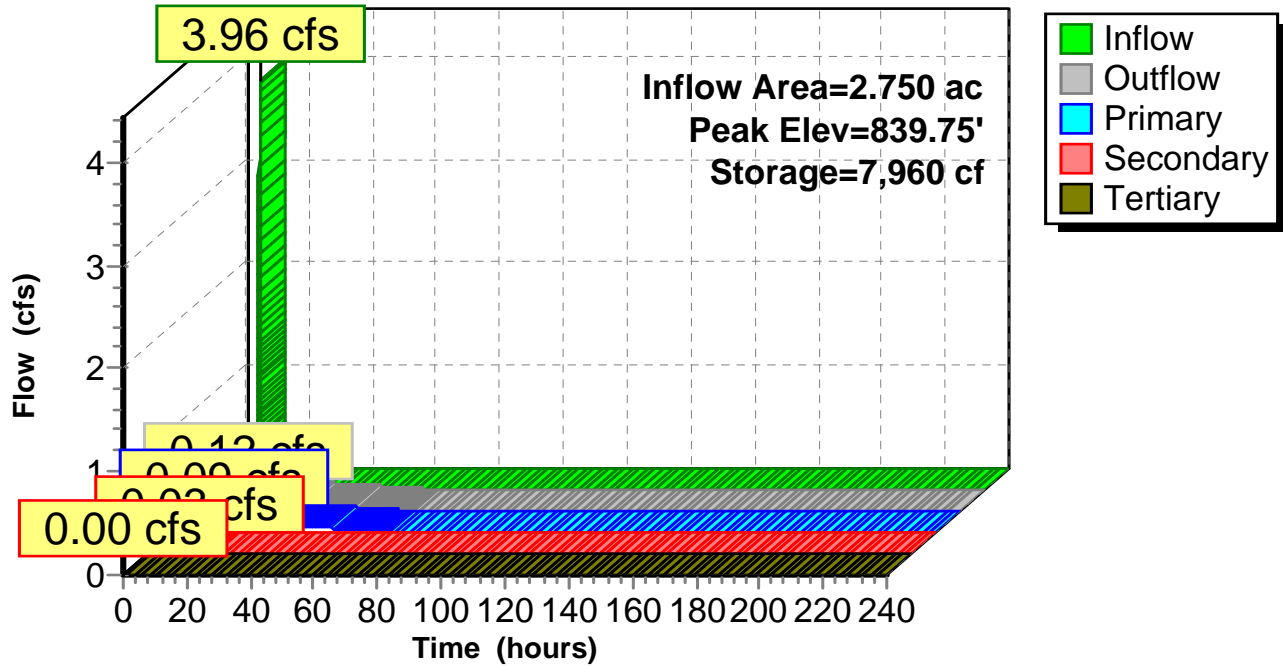
↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.03 cfs @ 0.70 fps)

**Tertiary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=837.50' (Free Discharge)

↑**3=Orifice/Grate** ( Controls 0.00 cfs)

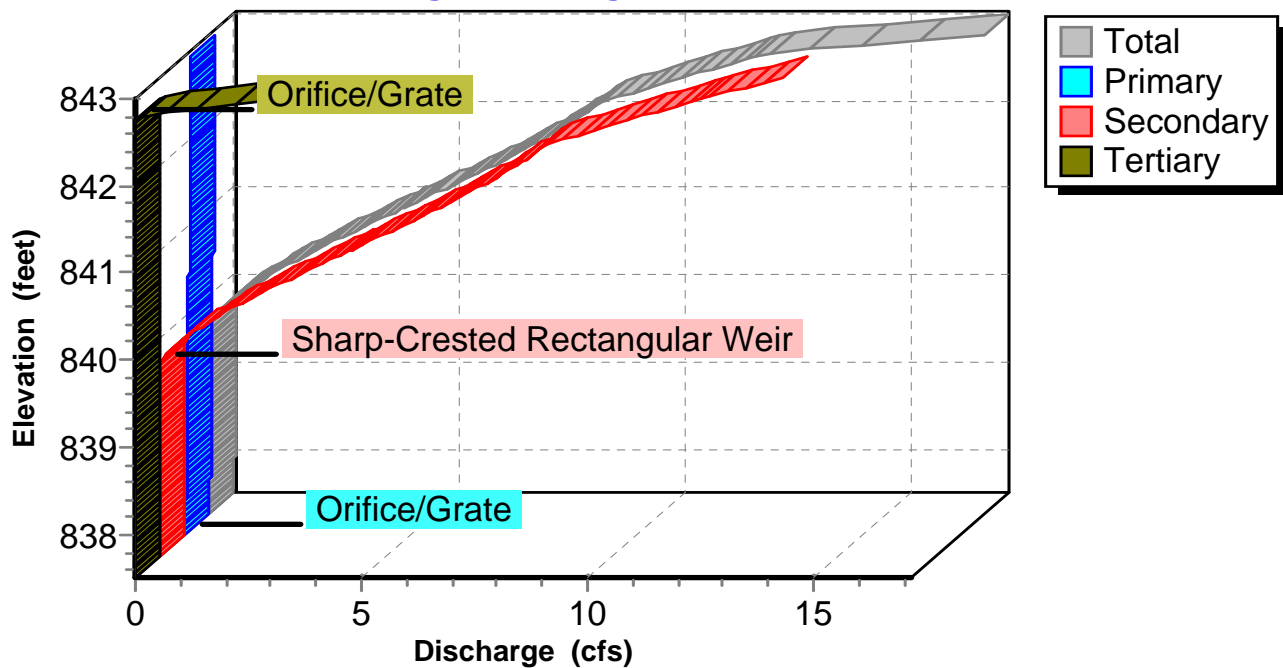
### Pond 3P: Detention Pond West

#### Hydrograph



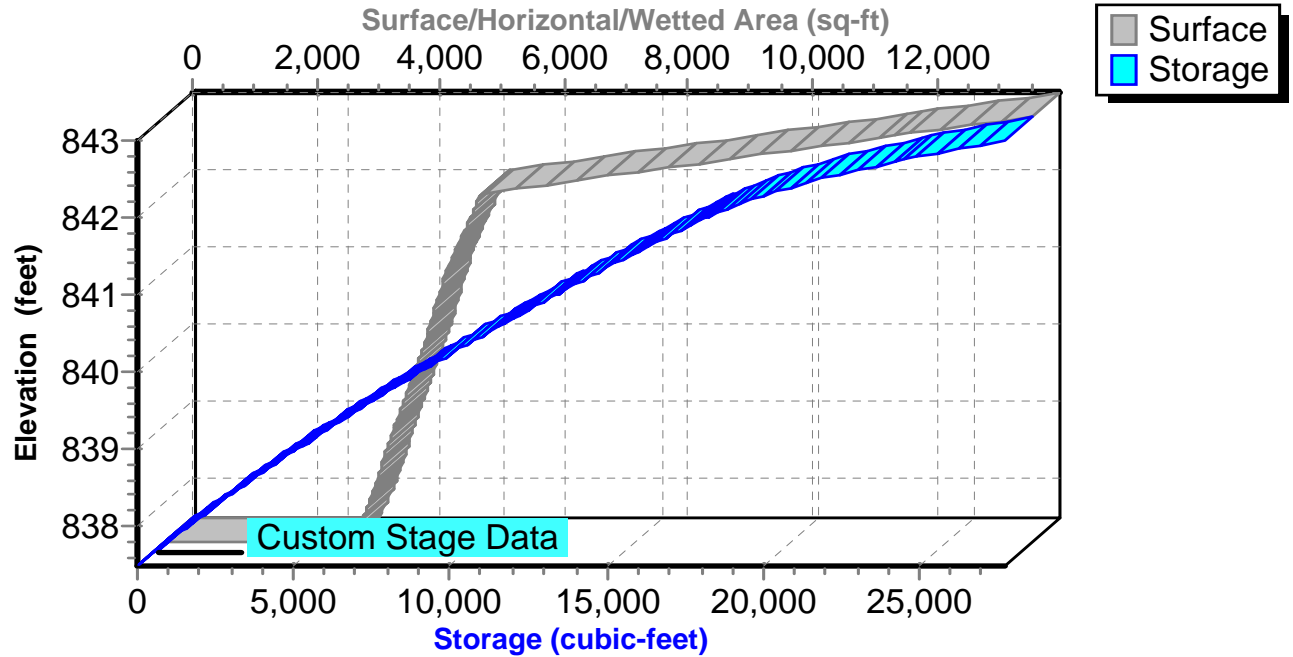
### Pond 3P: Detention Pond West

#### Stage-Discharge



### Pond 3P: Detention Pond West

#### Stage-Area-Storage



**6473 Seeds Road**

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Type II 24-hr 2-Year Rainfall=2.25"

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**Summary for Pond 4P: Detention Pond East**

Inflow Area = 5.000 ac, 43.60% Impervious, Inflow Depth = 1.27" for 2-Year event  
 Inflow = 3.98 cfs @ 12.08 hrs, Volume= 0.528 af  
 Outflow = 3.27 cfs @ 12.16 hrs, Volume= 0.528 af, Atten= 18%, Lag= 4.8 min  
 Primary = 3.27 cfs @ 12.16 hrs, Volume= 0.528 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 838.73' @ 12.16 hrs Surf.Area= 289 sf Storage= 709 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 0.5 min ( 1,392.8 - 1,392.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	836.41'	779 cf	<b>15.0" D x 635.0'L 15" Pipe Storage S= 0.0030 'I'</b>
#2	836.90'	35 cf	<b>12.0" D x 45.0'L 12" Pipe Storage S= 0.0045 'I'</b>
#3	838.90'	480 cf	<b>Inf. Trench Stone (Prismatic) Listed below (Recalc)</b>
#4	840.90'	3,348 cf	<b>Ditch Volume (Prismatic) Listed below (Recalc)</b>
		4,643 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
838.90	0	0.0	0	0
840.90	1,200	40.0	480	480

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.90	0	0	0
842.00	6,088	3,348	3,348

Device	Routing	Invert	Outlet Devices
#1	Primary	836.00'	<b>9.0" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	840.90'	<b>8.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height

**Primary OutFlow** Max=3.27 cfs @ 12.16 hrs HW=838.73' (Free Discharge)

↑**1=Orifice/Grate** (Orifice Controls 3.27 cfs @ 7.39 fps)

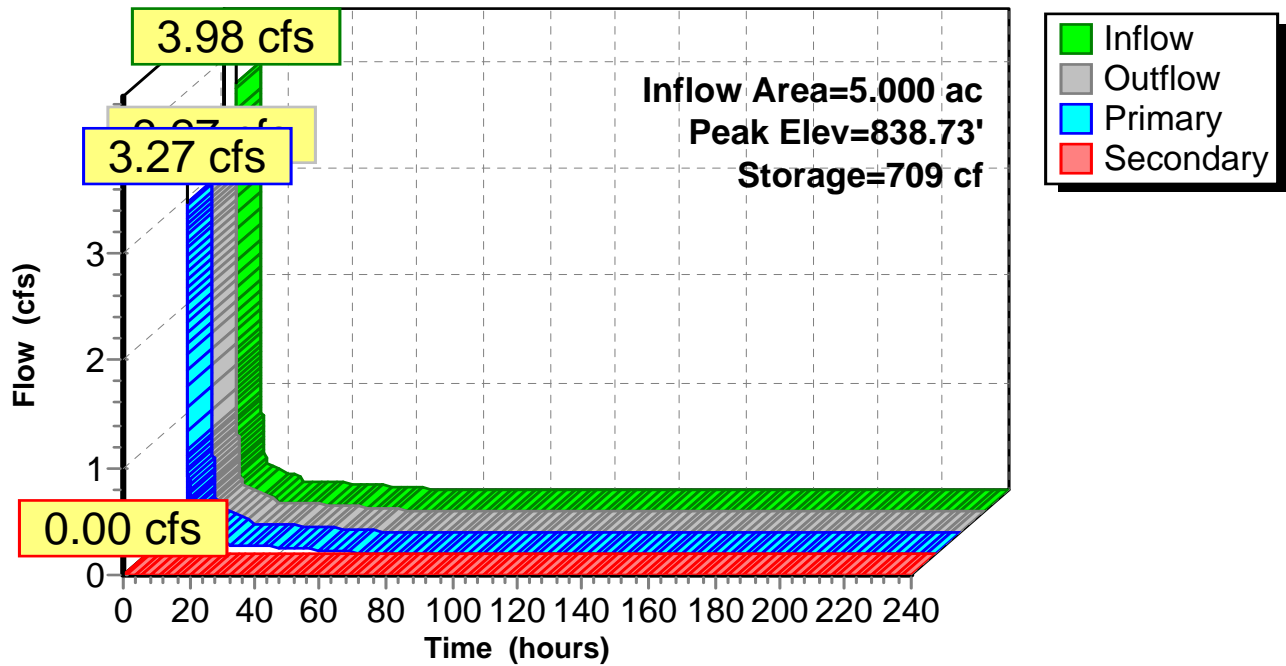
**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=836.41' (Free Discharge)

↑**2=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)



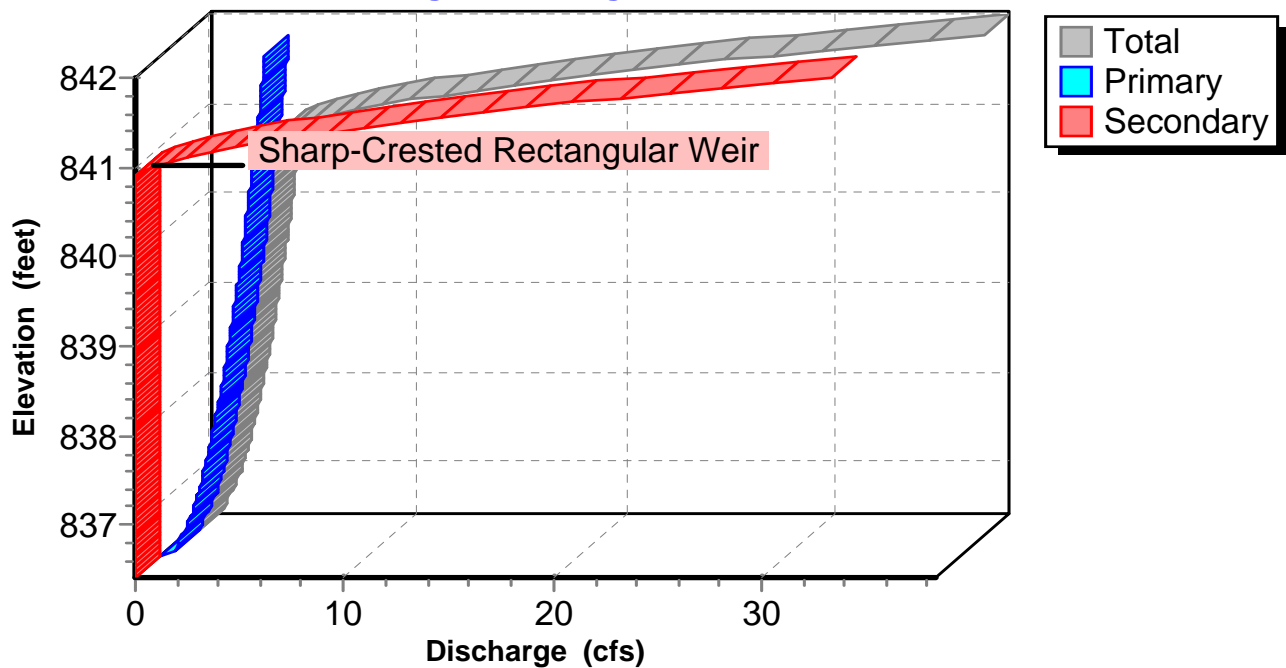
### Pond 4P: Detention Pond East

#### Hydrograph



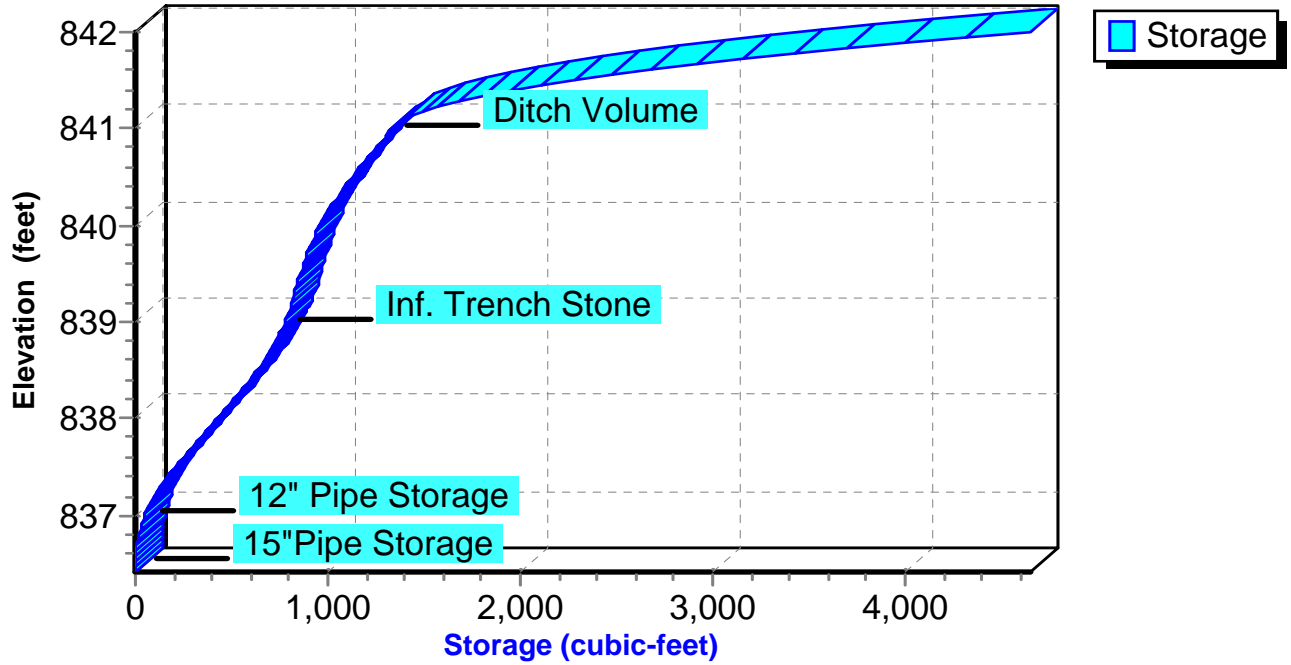
### Pond 4P: Detention Pond East

#### Stage-Discharge



Pond 4P: Detention Pond East

Stage-Area-Storage



**6473 Seeds Road**

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Type II 24-hr 5-Year Rainfall=2.79"

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**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 8.84 cfs @ 12.10 hrs, Volume= 0.618 af, Depth= 1.48"

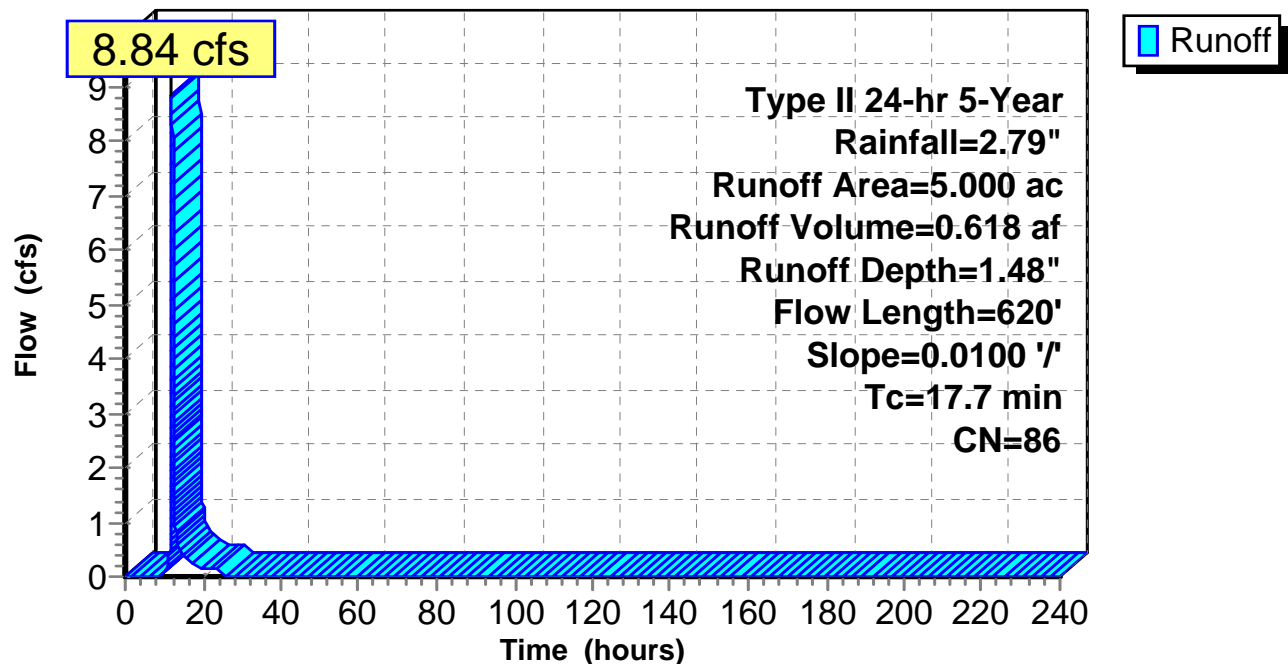
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 5-Year Rainfall=2.79"

Area (ac)	CN	Description
1.947	89	Gravel roads, HSG C
0.758	98	Roofs, HSG C
0.097	98	Water Surface, HSG C
2.198	79	50-75% Grass cover, Fair, HSG C
5.000	86	Weighted Average
4.145		82.90% Pervious Area
0.855		17.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.7	620	0.0100	0.58		Lag/CN Method,

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



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Type II 24-hr 5-Year Rainfall=2.79"

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**Summary for Subcatchment 2S: Developed West**

Runoff = 5.53 cfs @ 12.08 hrs, Volume= 0.374 af, Depth= 1.63"

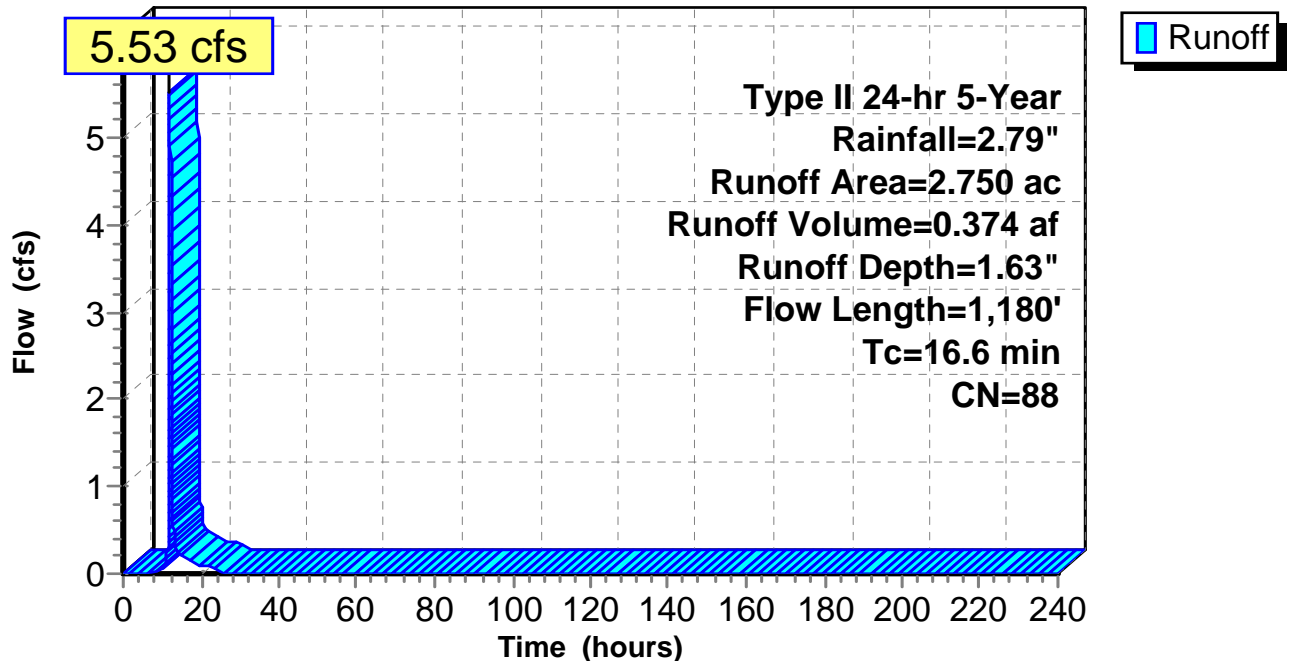
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 5-Year Rainfall=2.79"

Area (ac)	CN	Description
0.760	98	Roofs, HSG C
1.140	89	Gravel roads, HSG C
0.750	74	>75% Grass cover, Good, HSG C
0.100	98	Water Surface, HSG C
2.750	88	Weighted Average
1.890		68.73% Pervious Area
0.860		31.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 2S: Developed West**

**Hydrograph**



**Summary for Subcatchment 4S: Developed East**

Runoff = 5.28 cfs @ 12.07 hrs, Volume= 0.352 af, Depth= 1.88"

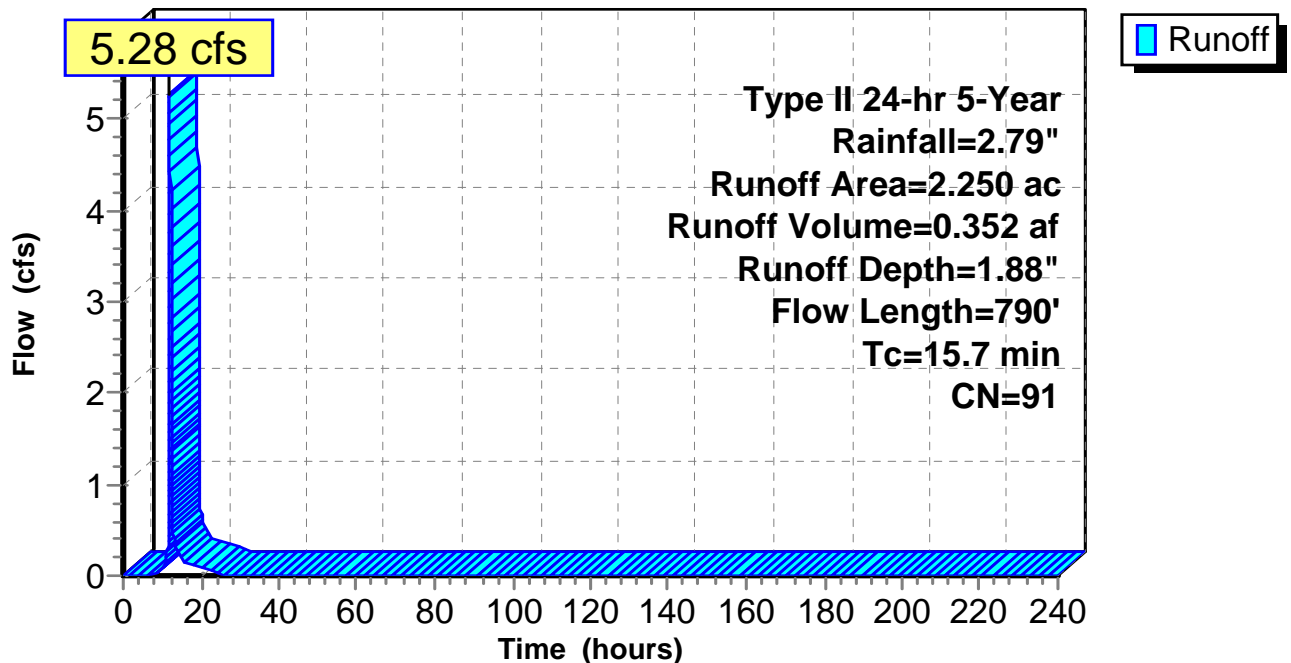
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 5-Year Rainfall=2.79"

Area (ac)	CN	Description
0.510	74	>75% Grass cover, Good, HSG C
0.650	98	Paved parking, HSG C
0.420	89	Gravel roads, HSG C
0.670	98	Roofs, HSG C
2.250	91	Weighted Average
0.930		41.33% Pervious Area
1.320		58.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	20	0.0040	0.05		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.25"
7.7	440	0.0040	0.95		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
1.9	330	0.0030	2.88	3.54	<b>Pipe Channel,</b> 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
15.7	790	Total			

**Subcatchment 4S: Developed East**

**Hydrograph**



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Type II 24-hr 5-Year Rainfall=2.79"

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**Summary for Subcatchment 5S: Developed**

Runoff = 10.98 cfs @ 12.08 hrs, Volume= 0.747 af, Depth= 1.79"

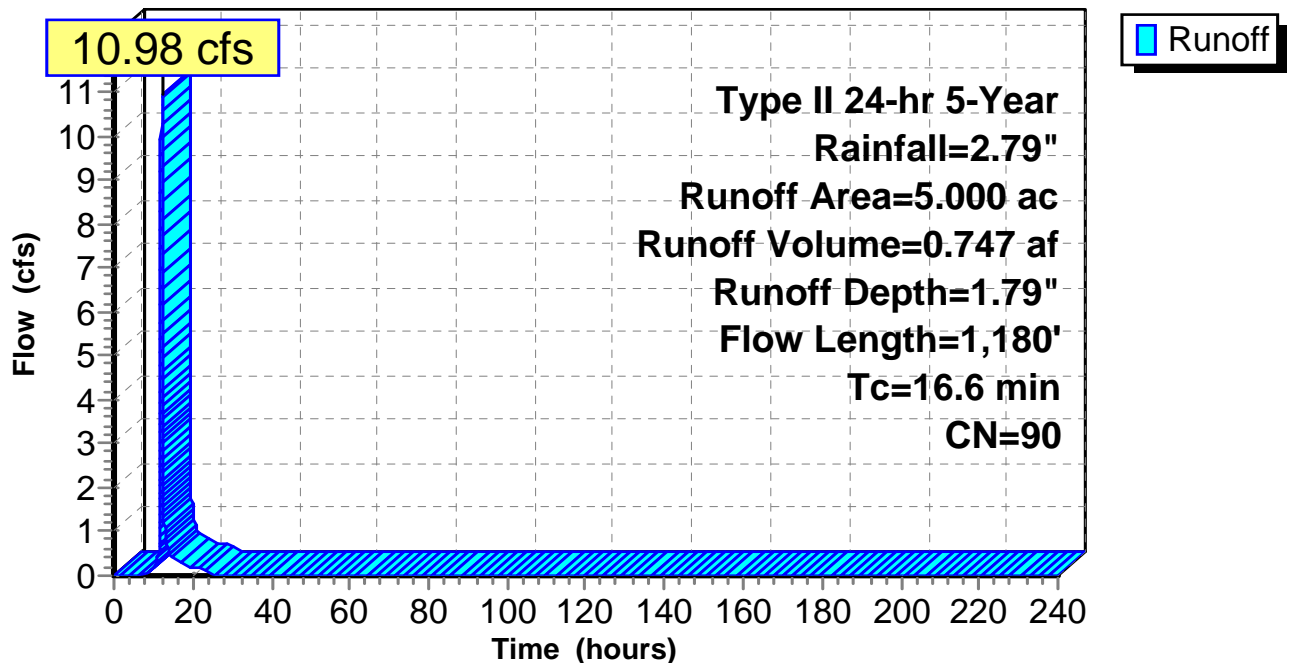
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 5-Year Rainfall=2.79"

Area (ac)	CN	Description
1.663	98	Roofs, HSG C
0.470	98	Paved parking, HSG C
1.326	89	Gravel roads, HSG C
1.444	79	50-75% Grass cover, Fair, HSG C
0.097	98	Water Surface, HSG C
5.000	90	Weighted Average
2.770		55.40% Pervious Area
2.230		44.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 5S: Developed**

**Hydrograph**



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Type II 24-hr 5-Year Rainfall=2.79"

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**Summary for Pond 3P: Detention Pond West**

Inflow Area = 2.750 ac, 31.27% Impervious, Inflow Depth = 1.63" for 5-Year event  
 Inflow = 5.53 cfs @ 12.08 hrs, Volume= 0.374 af  
 Outflow = 0.61 cfs @ 12.76 hrs, Volume= 0.374 af, Atten= 89%, Lag= 40.5 min  
 Primary = 0.09 cfs @ 12.76 hrs, Volume= 0.271 af  
 Secondary = 0.52 cfs @ 12.76 hrs, Volume= 0.104 af  
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 840.00' @ 12.76 hrs Surf.Area= 4,161 sf Storage= 8,997 cf

Plug-Flow detention time= 847.1 min calculated for 0.374 af (100% of inflow)  
 Center-of-Mass det. time= 847.4 min ( 1,674.9 - 827.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	837.50'	27,713 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
837.50	3,000	0	0
838.00	3,300	1,575	1,575
839.00	3,700	3,500	5,075
840.00	4,162	3,931	9,006
841.00	4,532	4,347	13,353
842.00	5,103	4,818	18,171
843.00	13,982	9,543	27,713

Device	Routing	Invert	Outlet Devices
#1	Primary	837.50'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	839.70'	<b>1.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height
#3	Tertiary	842.75'	<b>24.0" x 24.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.09 cfs @ 12.76 hrs HW=840.00' (Free Discharge)

↑**1=Orifice/Grate** (Orifice Controls 0.09 cfs @ 7.51 fps)

**Secondary OutFlow** Max=0.52 cfs @ 12.76 hrs HW=840.00' (Free Discharge)

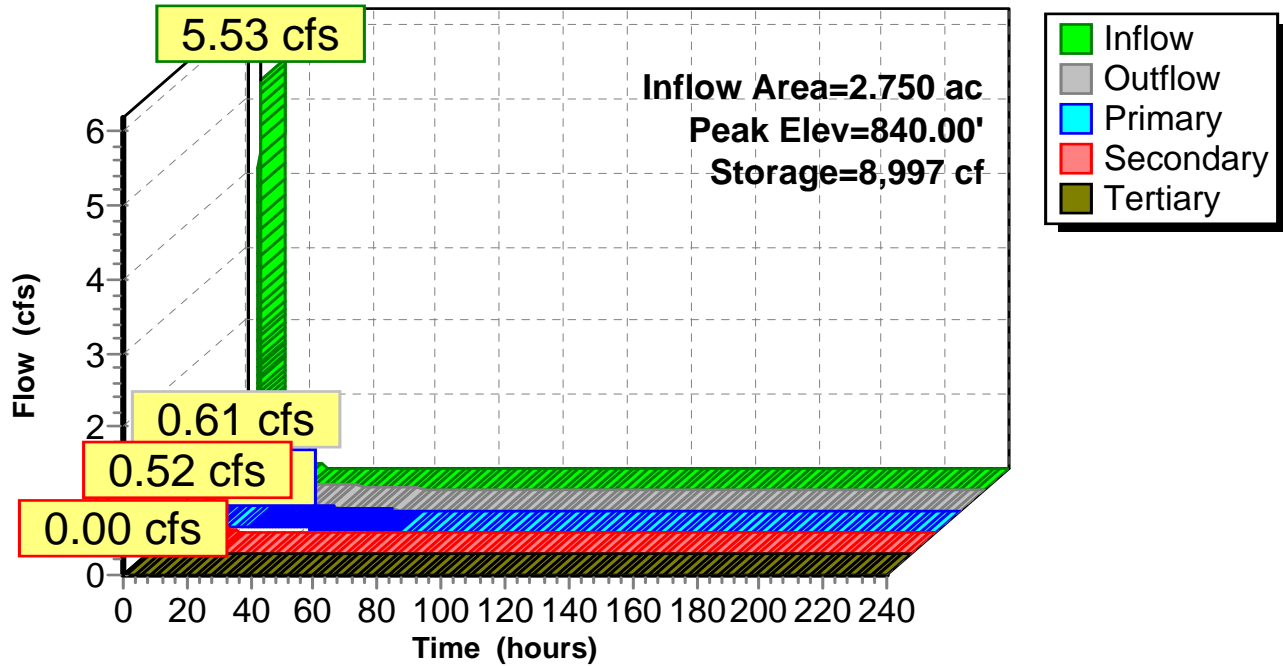
↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.52 cfs @ 1.85 fps)

**Tertiary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=837.50' (Free Discharge)

↑**3=Orifice/Grate** ( Controls 0.00 cfs)

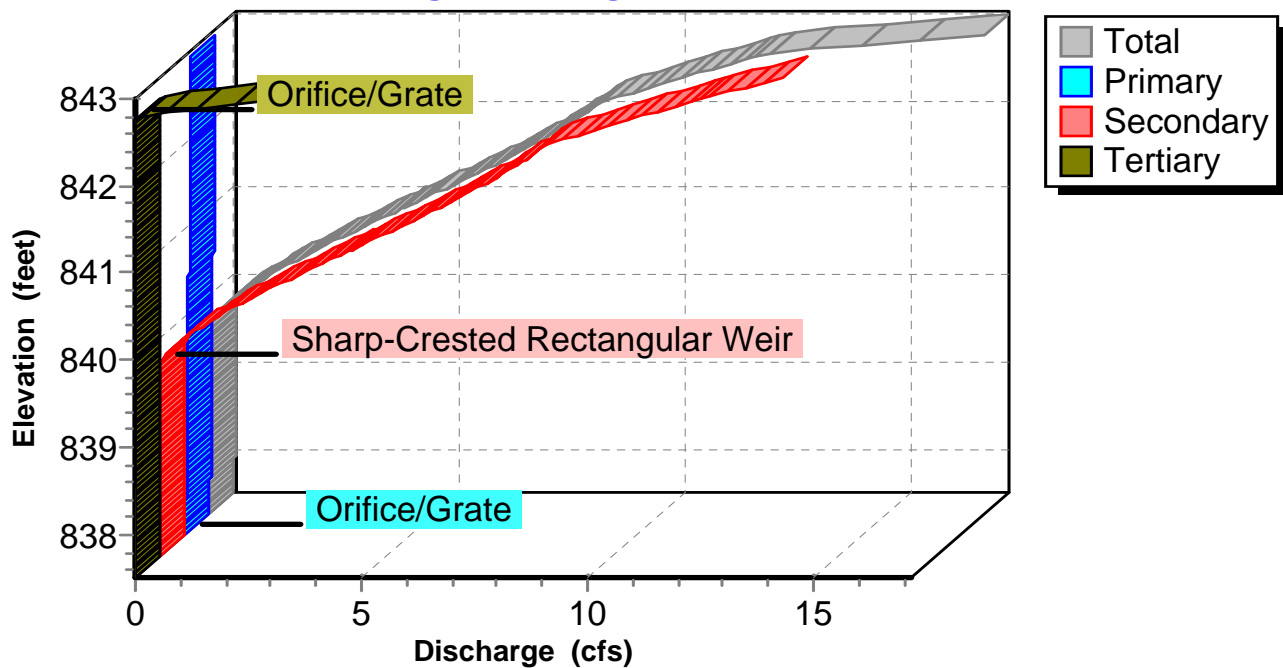
### Pond 3P: Detention Pond West

#### Hydrograph



### Pond 3P: Detention Pond West

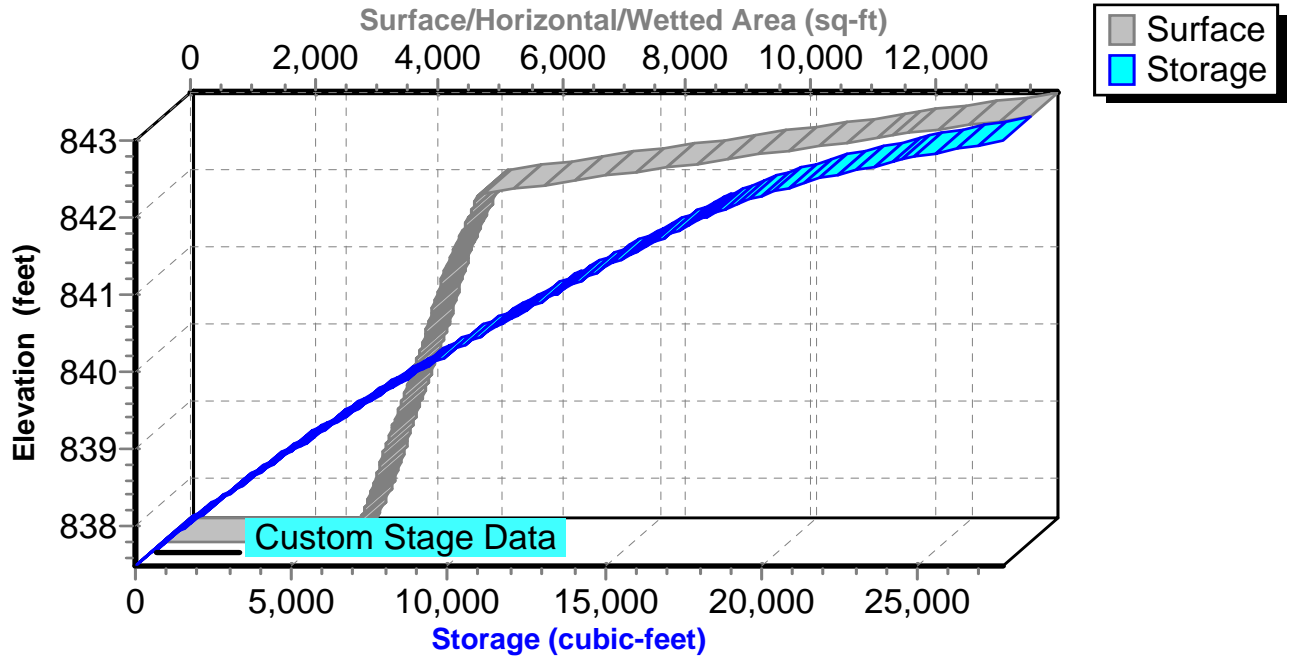
#### Stage-Discharge





### Pond 3P: Detention Pond West

#### Stage-Area-Storage



**6473 Seeds Road**

Type II 24-hr 5-Year Rainfall=2.79"

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**Summary for Pond 4P: Detention Pond East**

Inflow Area = 5.000 ac, 43.60% Impervious, Inflow Depth = 1.74" for 5-Year event  
 Inflow = 5.35 cfs @ 12.07 hrs, Volume= 0.726 af  
 Outflow = 4.36 cfs @ 12.16 hrs, Volume= 0.726 af, Atten= 18%, Lag= 4.9 min  
 Primary = 4.36 cfs @ 12.16 hrs, Volume= 0.726 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 840.58' @ 12.16 hrs Surf.Area= 1,010 sf Storage= 1,155 cf

Plug-Flow detention time= 0.8 min calculated for 0.726 af (100% of inflow)  
 Center-of-Mass det. time= 0.7 min ( 1,258.3 - 1,257.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	836.41'	779 cf	<b>15.0" D x 635.0'L 15" Pipe Storage S= 0.0030 'I'</b>
#2	836.90'	35 cf	<b>12.0" D x 45.0'L 12" Pipe Storage S= 0.0045 'I'</b>
#3	838.90'	480 cf	<b>Inf. Trench Stone (Prismatic) Listed below (Recalc)</b>
#4	840.90'	3,348 cf	<b>Ditch Volume (Prismatic) Listed below (Recalc)</b>
		4,643 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
838.90	0	0.0	0	0
840.90	1,200	40.0	480	480

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.90	0	0	0
842.00	6,088	3,348	3,348

Device	Routing	Invert	Outlet Devices
#1	Primary	836.00'	<b>9.0" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	840.90'	<b>8.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height

**Primary OutFlow** Max=4.36 cfs @ 12.16 hrs HW=840.58' (Free Discharge)

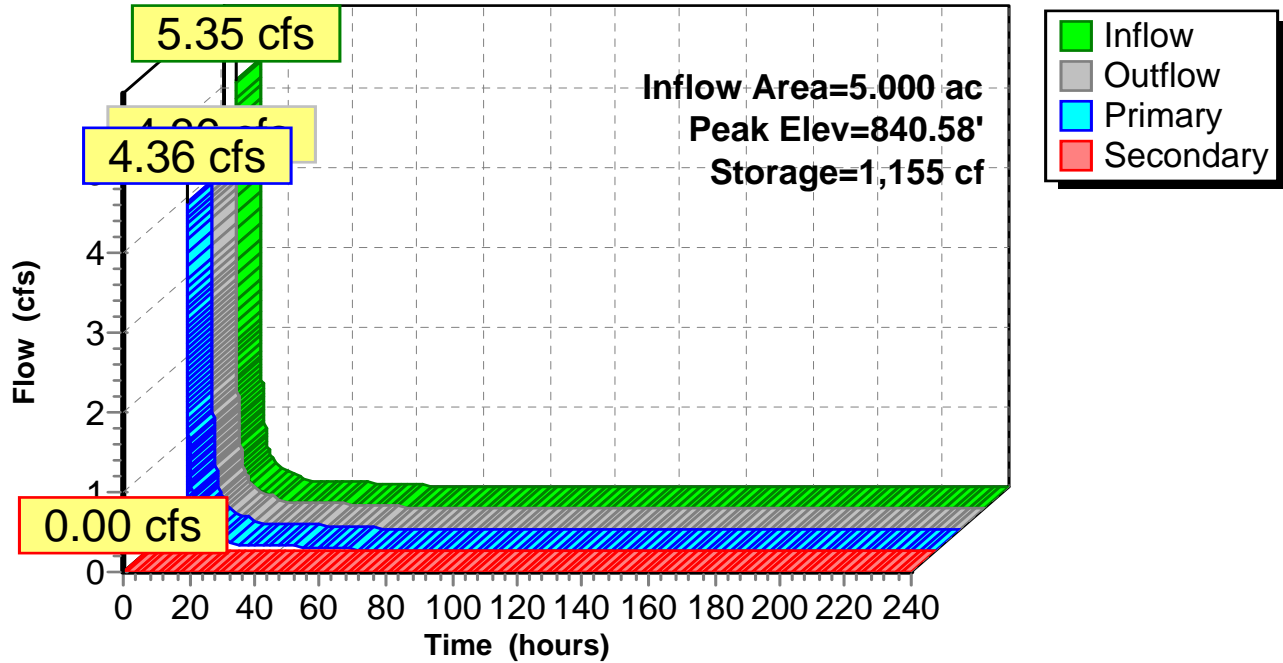
↑**1=Orifice/Grate** (Orifice Controls 4.36 cfs @ 9.88 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=836.41' (Free Discharge)

↑**2=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)

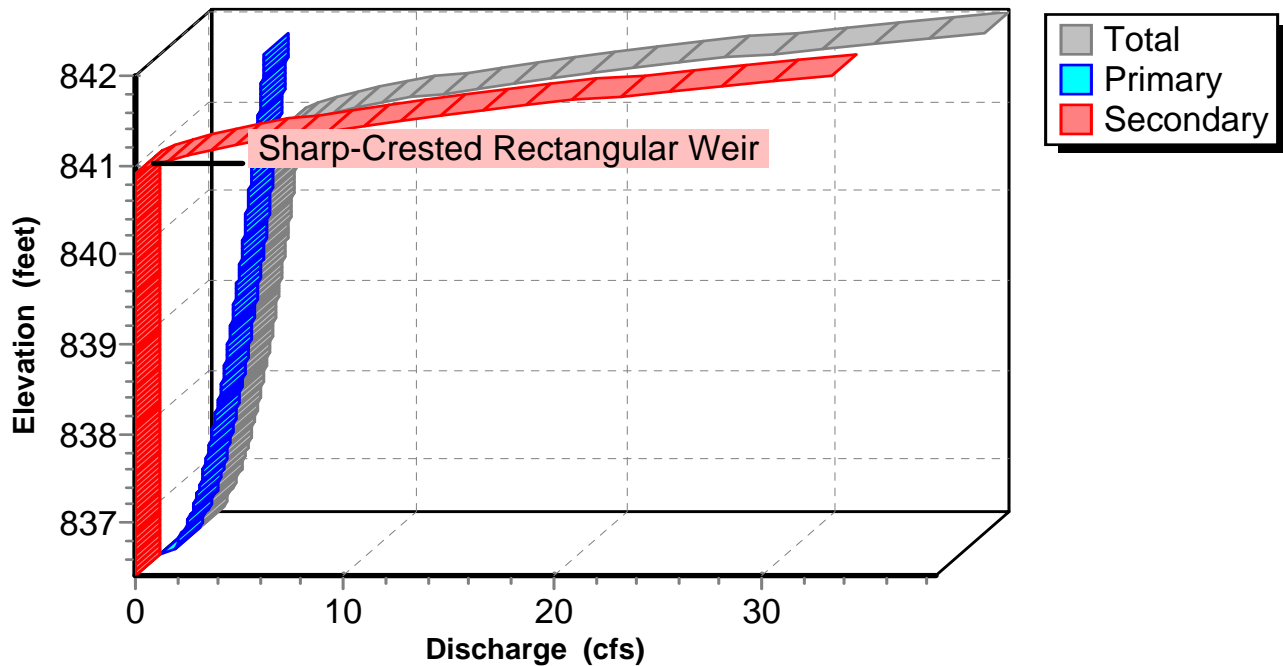
### Pond 4P: Detention Pond East

#### Hydrograph



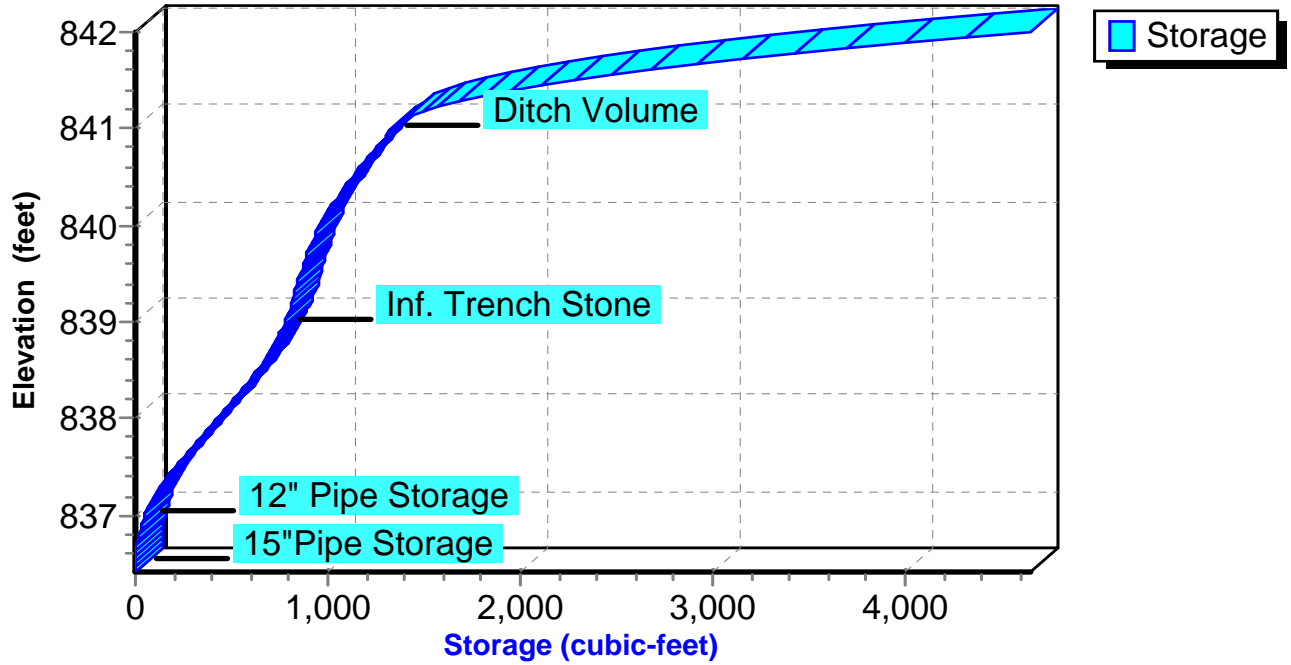
### Pond 4P: Detention Pond East

#### Stage-Discharge



Pond 4P: Detention Pond East

Stage-Area-Storage



**6473 Seeds Road**

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Type II 24-hr 10-Year Rainfall=3.24"

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**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 11.14 cfs @ 12.10 hrs, Volume= 0.779 af, Depth= 1.87"

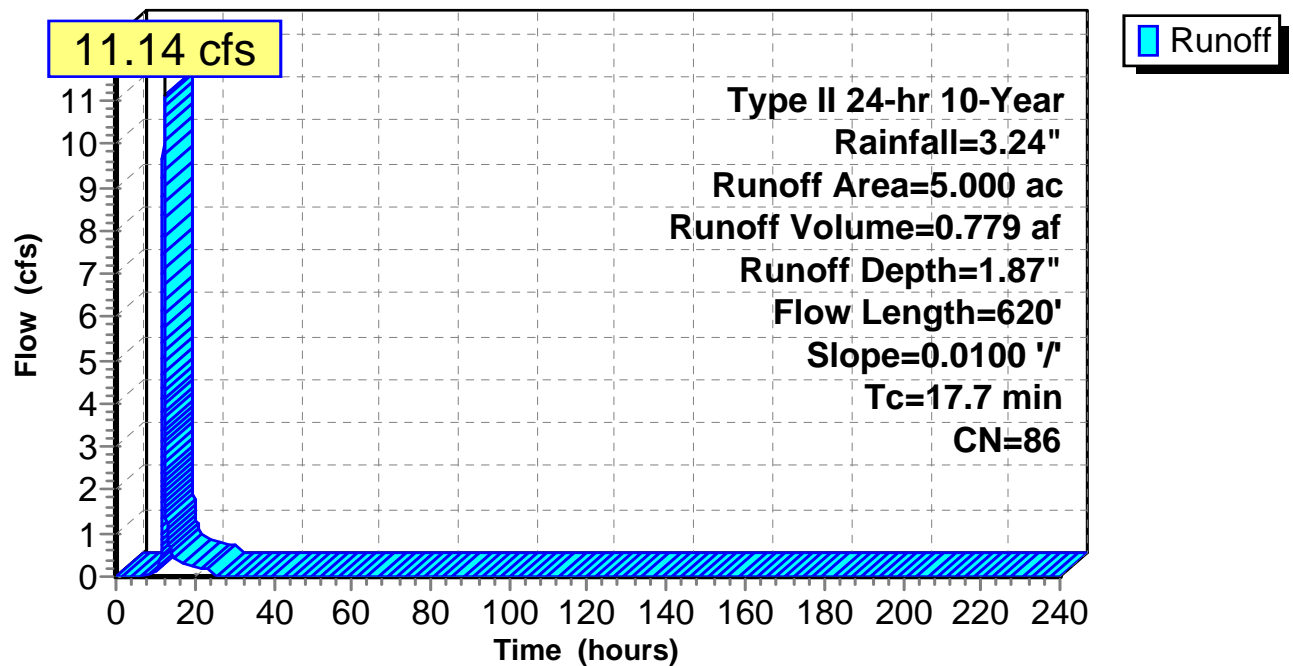
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10-Year Rainfall=3.24"

Area (ac)	CN	Description
1.947	89	Gravel roads, HSG C
0.758	98	Roofs, HSG C
0.097	98	Water Surface, HSG C
2.198	79	50-75% Grass cover, Fair, HSG C
5.000	86	Weighted Average
4.145		82.90% Pervious Area
0.855		17.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.7	620	0.0100	0.58		Lag/CN Method,

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



**6473 Seeds Road**

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Type II 24-hr 10-Year Rainfall=3.24"

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**Summary for Subcatchment 2S: Developed West**

Runoff = 6.86 cfs @ 12.08 hrs, Volume= 0.466 af, Depth= 2.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-Year Rainfall=3.24"

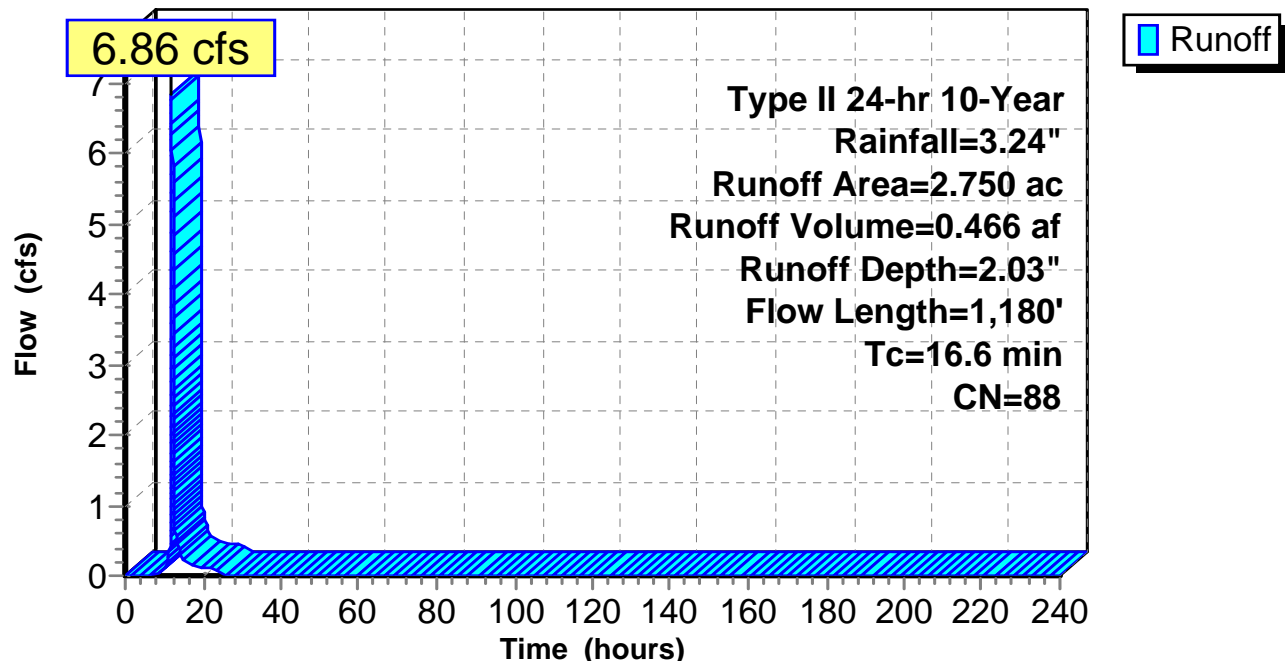
Area (ac)	CN	Description
0.760	98	Roofs, HSG C
1.140	89	Gravel roads, HSG C
0.750	74	>75% Grass cover, Good, HSG C
0.100	98	Water Surface, HSG C
2.750	88	Weighted Average
1.890		68.73% Pervious Area
0.860		31.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 2S: Developed West**

**Hydrograph**



**6473 Seeds Road**

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Type II 24-hr 10-Year Rainfall=3.24"

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**Summary for Subcatchment 4S: Developed East**

Runoff = 6.41 cfs @ 12.07 hrs, Volume= 0.430 af, Depth= 2.30"

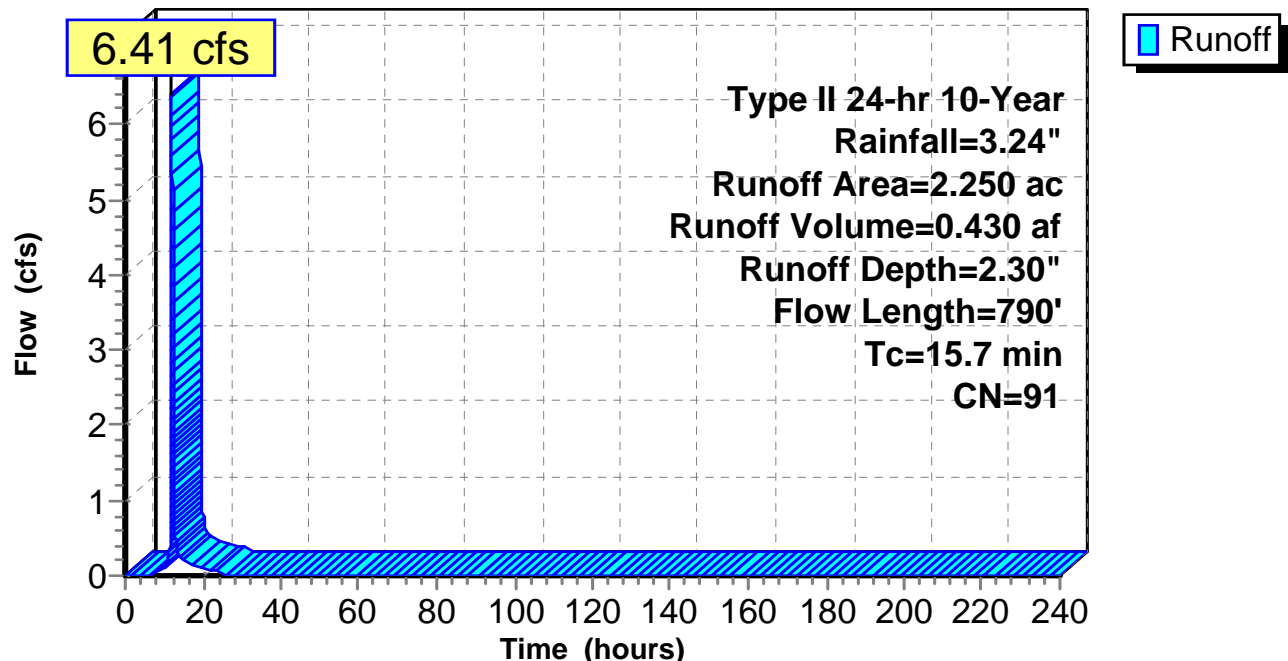
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-Year Rainfall=3.24"

Area (ac)	CN	Description
0.510	74	>75% Grass cover, Good, HSG C
0.650	98	Paved parking, HSG C
0.420	89	Gravel roads, HSG C
0.670	98	Roofs, HSG C
2.250	91	Weighted Average
0.930		41.33% Pervious Area
1.320		58.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	20	0.0040	0.05		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.25"
7.7	440	0.0040	0.95		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
1.9	330	0.0030	2.88	3.54	<b>Pipe Channel,</b> 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
15.7	790	Total			

**Subcatchment 4S: Developed East**

**Hydrograph**



**6473 Seeds Road**

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Type II 24-hr 10-Year Rainfall=3.24"

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**Summary for Subcatchment 5S: Developed**

Runoff = 13.42 cfs @ 12.08 hrs, Volume= 0.919 af, Depth= 2.21"

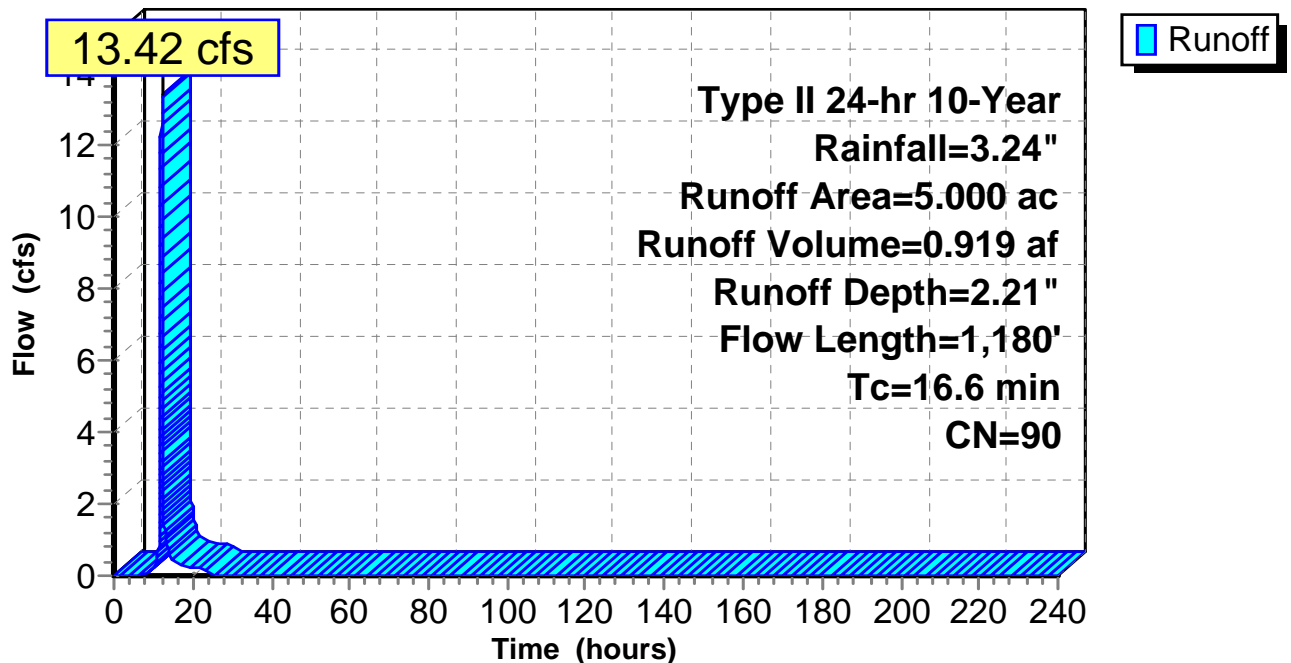
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10-Year Rainfall=3.24"

Area (ac)	CN	Description
1.663	98	Roofs, HSG C
0.470	98	Paved parking, HSG C
1.326	89	Gravel roads, HSG C
1.444	79	50-75% Grass cover, Fair, HSG C
0.097	98	Water Surface, HSG C
5.000	90	Weighted Average
2.770		55.40% Pervious Area
2.230		44.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 5S: Developed**

**Hydrograph**





**6473 Seeds Road**

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Type II 24-hr 10-Year Rainfall=3.24"

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**Summary for Pond 3P: Detention Pond West**

Inflow Area = 2.750 ac, 31.27% Impervious, Inflow Depth = 2.03" for 10-Year event  
 Inflow = 6.86 cfs @ 12.08 hrs, Volume= 0.466 af  
 Outflow = 1.46 cfs @ 12.47 hrs, Volume= 0.466 af, Atten= 79%, Lag= 23.1 min  
 Primary = 0.10 cfs @ 12.47 hrs, Volume= 0.276 af  
 Secondary = 1.36 cfs @ 12.47 hrs, Volume= 0.190 af  
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 840.28' @ 12.47 hrs Surf.Area= 4,265 sf Storage= 10,175 cf

Plug-Flow detention time= 697.5 min calculated for 0.466 af (100% of inflow)  
 Center-of-Mass det. time= 697.8 min ( 1,519.1 - 821.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	837.50'	27,713 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
837.50	3,000	0	0
838.00	3,300	1,575	1,575
839.00	3,700	3,500	5,075
840.00	4,162	3,931	9,006
841.00	4,532	4,347	13,353
842.00	5,103	4,818	18,171
843.00	13,982	9,543	27,713

Device	Routing	Invert	Outlet Devices
#1	Primary	837.50'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	839.70'	<b>1.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height
#3	Tertiary	842.75'	<b>24.0" x 24.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.10 cfs @ 12.47 hrs HW=840.28' (Free Discharge)

↑**1=Orifice/Grate** (Orifice Controls 0.10 cfs @ 7.93 fps)

**Secondary OutFlow** Max=1.36 cfs @ 12.47 hrs HW=840.28' (Free Discharge)

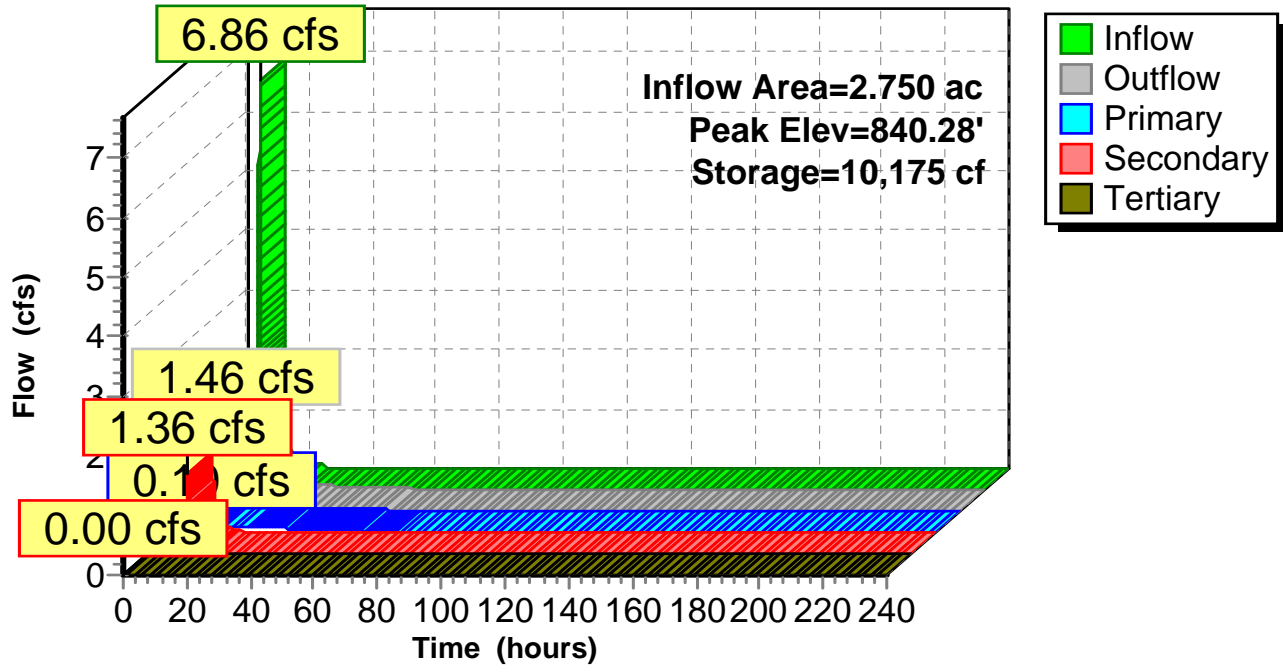
↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 1.36 cfs @ 2.66 fps)

**Tertiary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=837.50' (Free Discharge)

↑**3=Orifice/Grate** ( Controls 0.00 cfs)

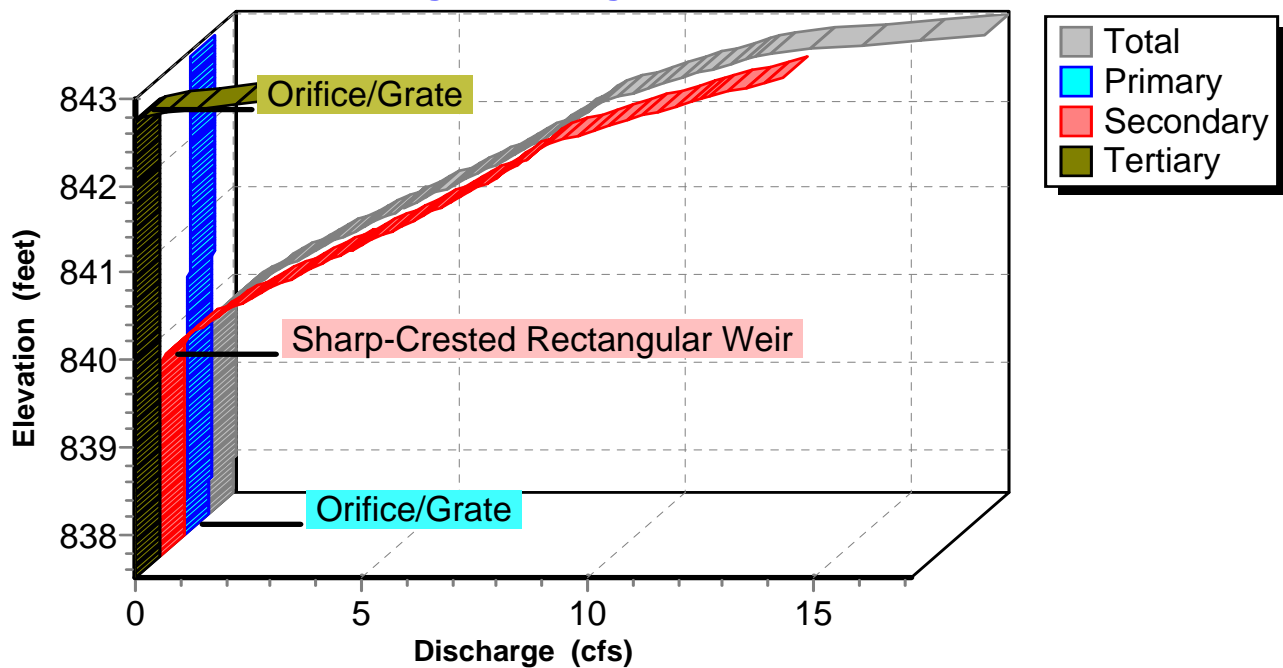
### Pond 3P: Detention Pond West

#### Hydrograph



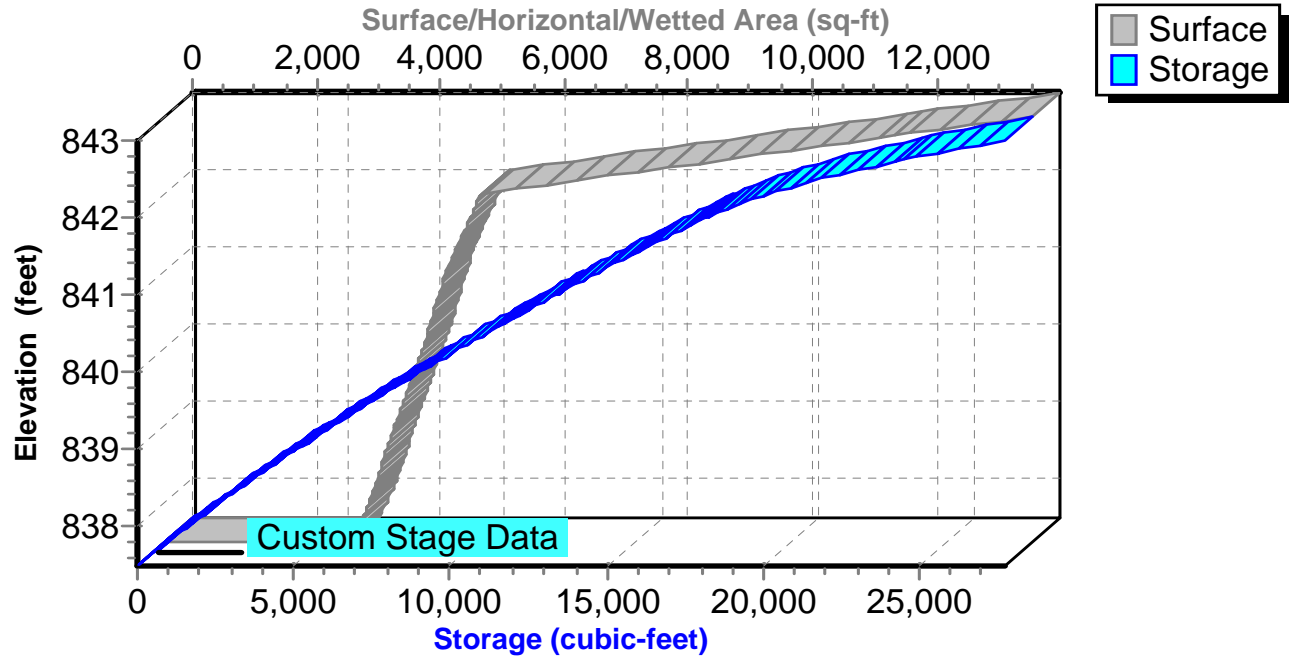
### Pond 3P: Detention Pond West

#### Stage-Discharge



### Pond 3P: Detention Pond West

#### Stage-Area-Storage



**6473 Seeds Road**

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Type II 24-hr 10-Year Rainfall=3.24"

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**Summary for Pond 4P: Detention Pond East**

Inflow Area = 5.000 ac, 43.60% Impervious, Inflow Depth = 2.15" for 10-Year event  
 Inflow = 6.49 cfs @ 12.07 hrs, Volume= 0.896 af  
 Outflow = 6.22 cfs @ 12.11 hrs, Volume= 0.896 af, Atten= 4%, Lag= 2.2 min  
 Primary = 4.60 cfs @ 12.11 hrs, Volume= 0.885 af  
 Secondary = 1.61 cfs @ 12.11 hrs, Volume= 0.011 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 841.05' @ 12.11 hrs Surf.Area= 2,054 sf Storage= 1,360 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 1.0 min ( 1,178.6 - 1,177.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	836.41'	779 cf	<b>15.0" D x 635.0'L 15" Pipe Storage S= 0.0030 'I'</b>
#2	836.90'	35 cf	<b>12.0" D x 45.0'L 12" Pipe Storage S= 0.0045 'I'</b>
#3	838.90'	480 cf	<b>Inf. Trench Stone (Prismatic) Listed below (Recalc)</b>
#4	840.90'	3,348 cf	<b>Ditch Volume (Prismatic) Listed below (Recalc)</b>
		4,643 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
838.90	0	0.0	0	0
840.90	1,200	40.0	480	480

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.90	0	0	0
842.00	6,088	3,348	3,348

Device	Routing	Invert	Outlet Devices
#1	Primary	836.00'	<b>9.0" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	840.90'	<b>8.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height

**Primary OutFlow** Max=4.60 cfs @ 12.11 hrs HW=841.05' (Free Discharge)

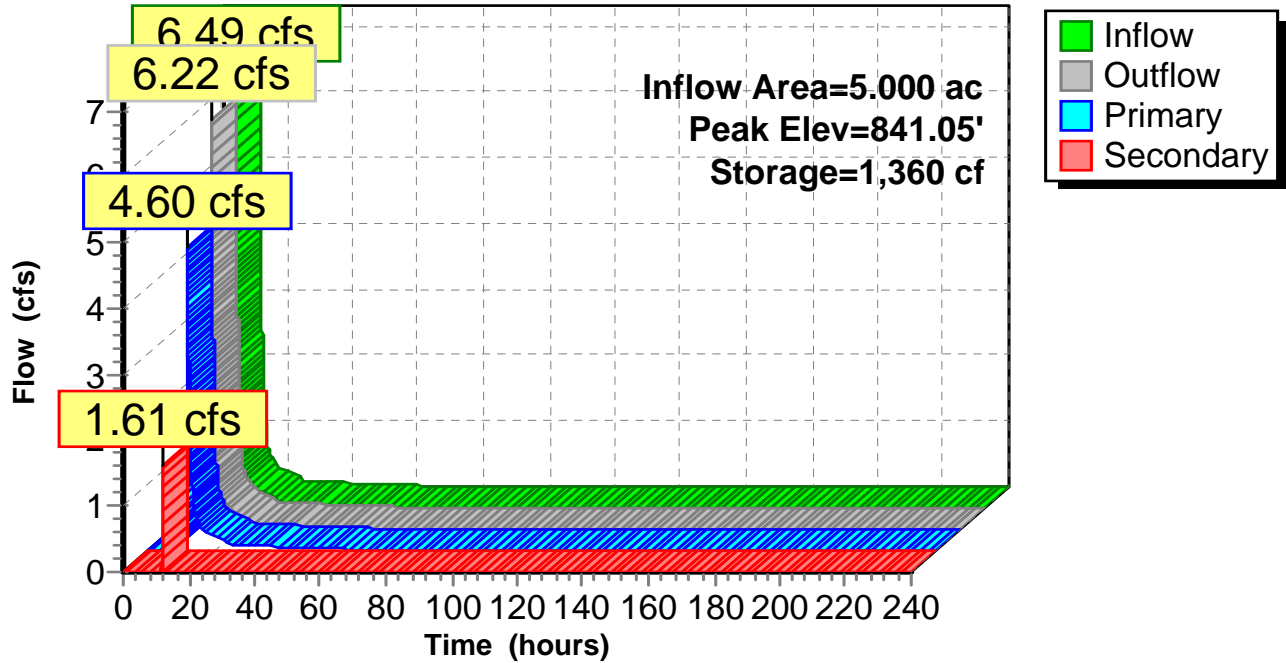
↑**1=Orifice/Grate** (Orifice Controls 4.60 cfs @ 10.42 fps)

**Secondary OutFlow** Max=1.61 cfs @ 12.11 hrs HW=841.05' (Free Discharge)

↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 1.61 cfs @ 1.31 fps)

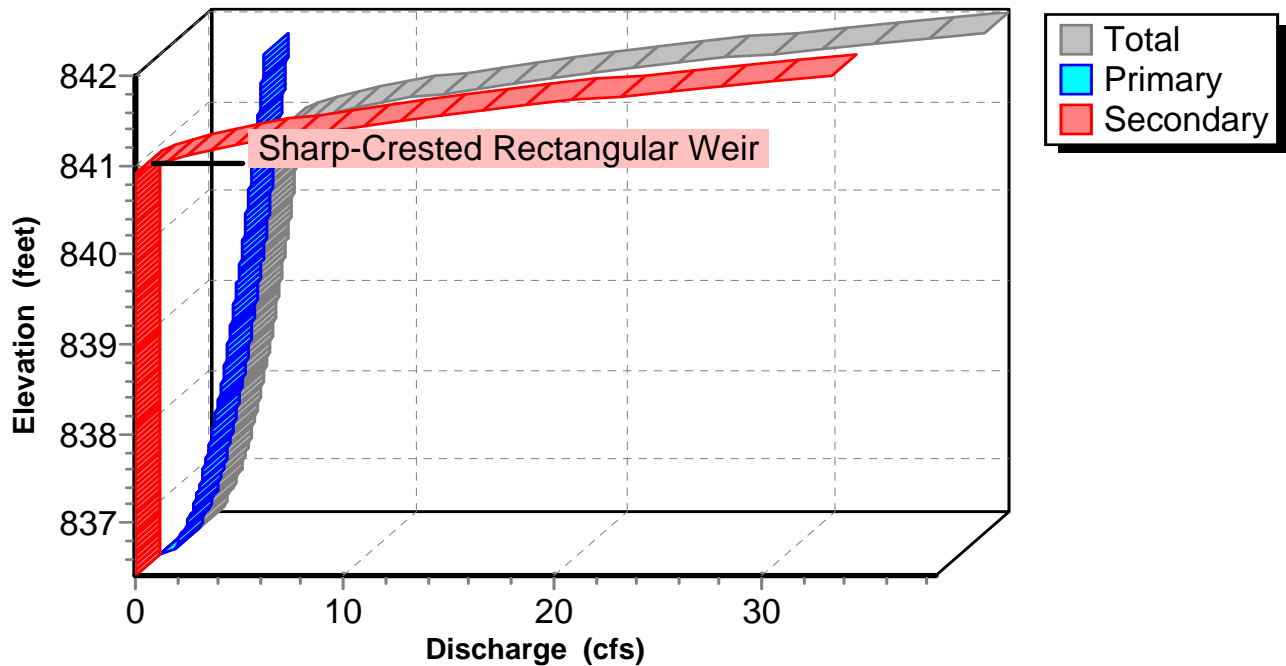
Pond 4P: Detention Pond East

Hydrograph



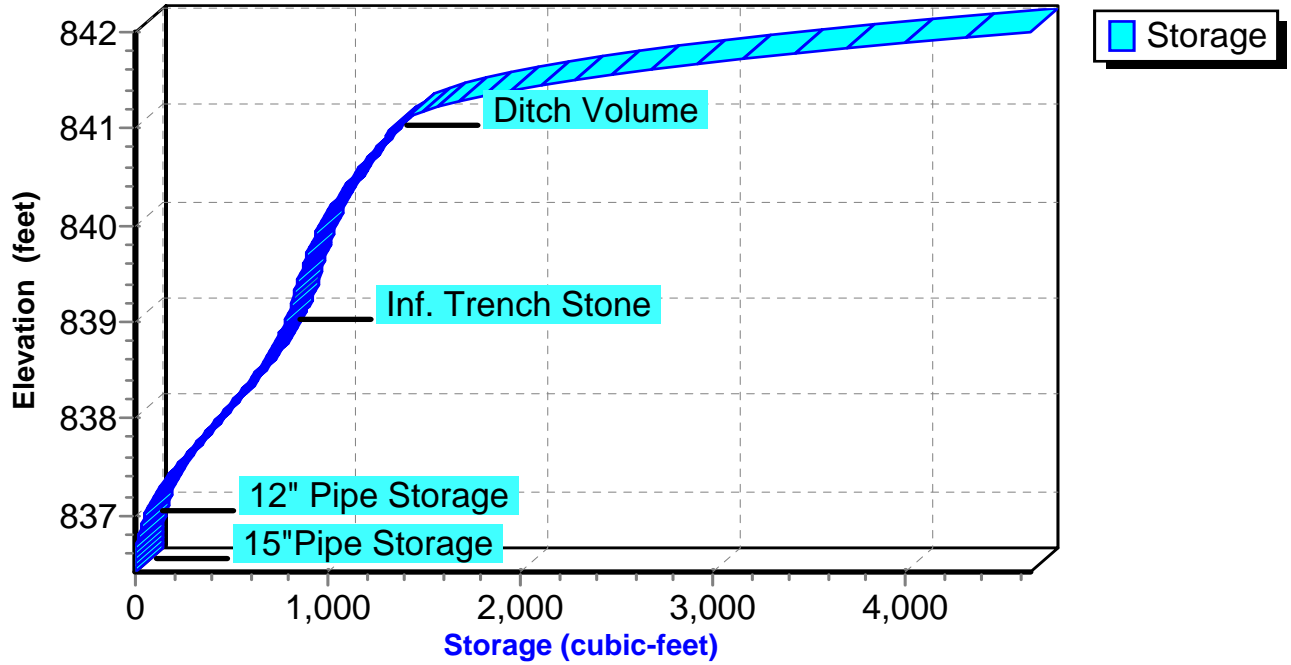
Pond 4P: Detention Pond East

Stage-Discharge



Pond 4P: Detention Pond East

Stage-Area-Storage



**6473 Seeds Road**

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Type II 24-hr 25-Year Rainfall=3.88"

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**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 14.46 cfs @ 12.10 hrs, Volume= 1.016 af, Depth= 2.44"

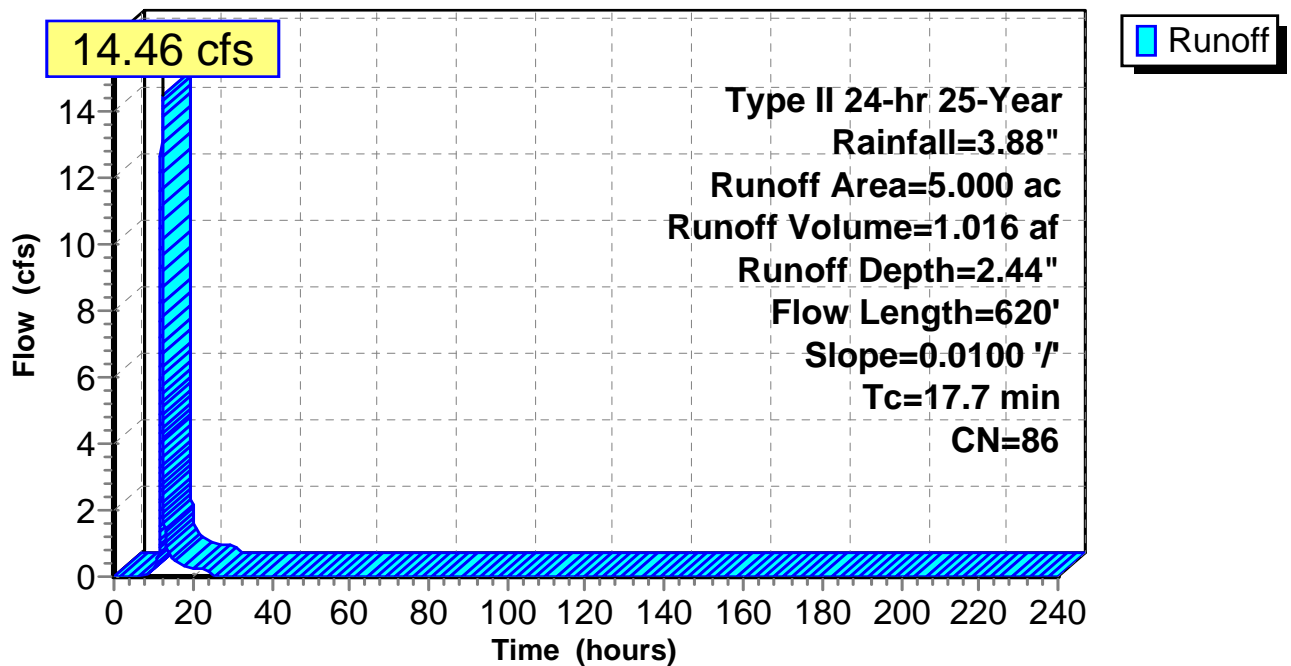
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 25-Year Rainfall=3.88"

Area (ac)	CN	Description
1.947	89	Gravel roads, HSG C
0.758	98	Roofs, HSG C
0.097	98	Water Surface, HSG C
2.198	79	50-75% Grass cover, Fair, HSG C
5.000	86	Weighted Average
4.145		82.90% Pervious Area
0.855		17.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.7	620	0.0100	0.58		Lag/CN Method,

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



**6473 Seeds Road**

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Type II 24-hr 25-Year Rainfall=3.88"

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**Summary for Subcatchment 2S: Developed West**

Runoff = 8.77 cfs @ 12.08 hrs, Volume= 0.600 af, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 25-Year Rainfall=3.88"

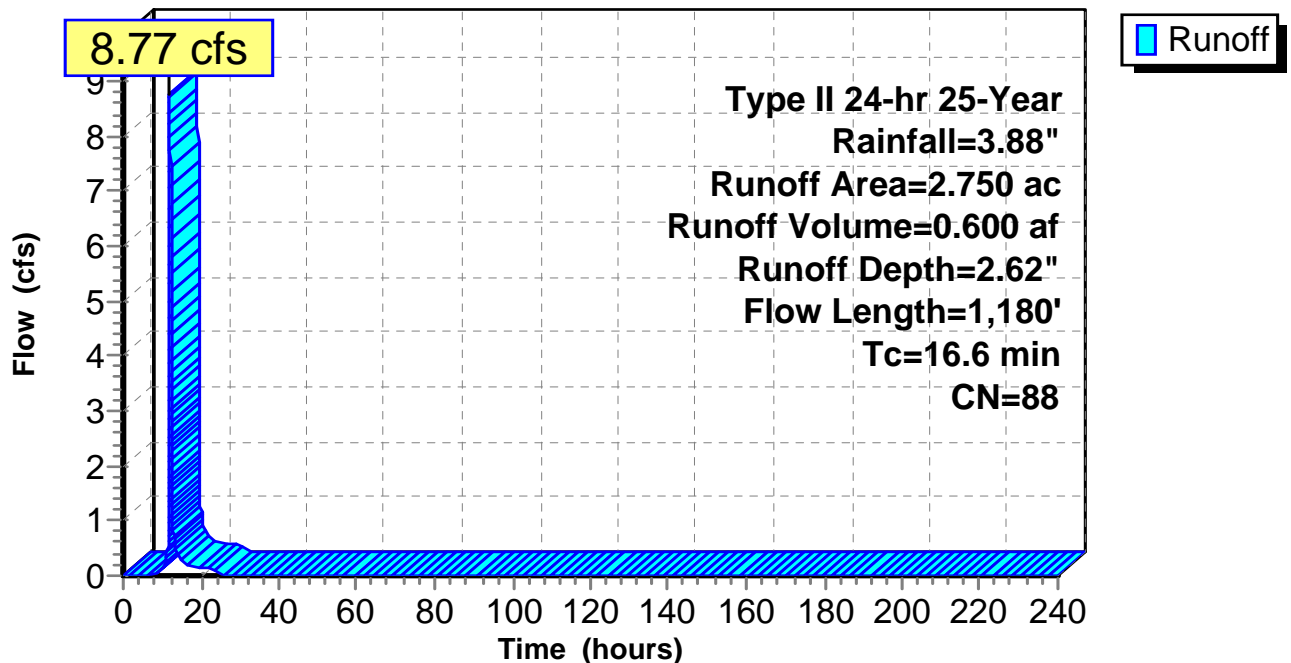
Area (ac)	CN	Description
0.760	98	Roofs, HSG C
1.140	89	Gravel roads, HSG C
0.750	74	>75% Grass cover, Good, HSG C
0.100	98	Water Surface, HSG C
2.750	88	Weighted Average
1.890		68.73% Pervious Area
0.860		31.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 2S: Developed West**

**Hydrograph**





**6473 Seeds Road**

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Type II 24-hr 25-Year Rainfall=3.88"

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**Summary for Subcatchment 4S: Developed East**

Runoff = 8.02 cfs @ 12.07 hrs, Volume= 0.544 af, Depth= 2.90"

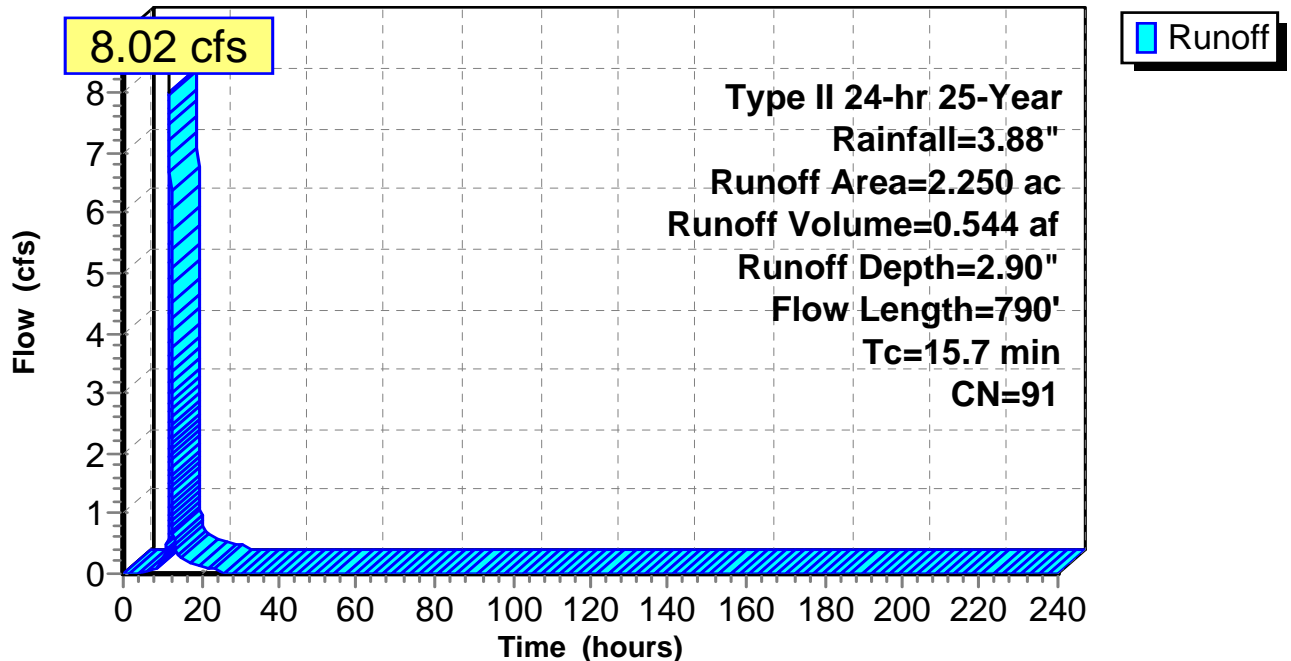
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 25-Year Rainfall=3.88"

Area (ac)	CN	Description
0.510	74	>75% Grass cover, Good, HSG C
0.650	98	Paved parking, HSG C
0.420	89	Gravel roads, HSG C
0.670	98	Roofs, HSG C
2.250	91	Weighted Average
0.930		41.33% Pervious Area
1.320		58.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	20	0.0040	0.05		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.25"
7.7	440	0.0040	0.95		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
1.9	330	0.0030	2.88	3.54	<b>Pipe Channel,</b> 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
15.7	790	Total			

**Subcatchment 4S: Developed East**

**Hydrograph**



**6473 Seeds Road**

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Type II 24-hr 25-Year Rainfall=3.88"

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**Summary for Subcatchment 5S: Developed**

Runoff = 16.92 cfs @ 12.08 hrs, Volume= 1.169 af, Depth= 2.81"

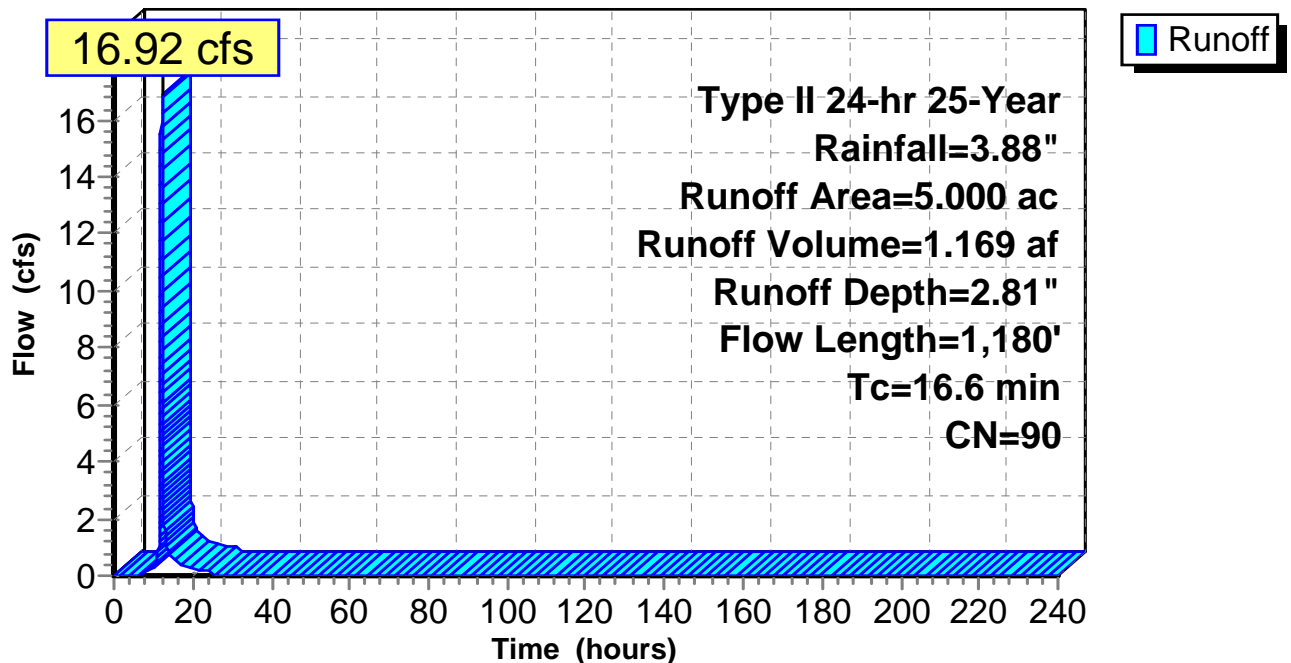
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 25-Year Rainfall=3.88"

Area (ac)	CN	Description
1.663	98	Roofs, HSG C
0.470	98	Paved parking, HSG C
1.326	89	Gravel roads, HSG C
1.444	79	50-75% Grass cover, Fair, HSG C
0.097	98	Water Surface, HSG C
5.000	90	Weighted Average
2.770		55.40% Pervious Area
2.230		44.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 5S: Developed**

**Hydrograph**



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Type II 24-hr 25-Year Rainfall=3.88"

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**Summary for Pond 3P: Detention Pond West**

Inflow Area = 2.750 ac, 31.27% Impervious, Inflow Depth = 2.62" for 25-Year event  
 Inflow = 8.77 cfs @ 12.08 hrs, Volume= 0.600 af  
 Outflow = 2.99 cfs @ 12.34 hrs, Volume= 0.600 af, Atten= 66%, Lag= 15.2 min  
 Primary = 0.10 cfs @ 12.34 hrs, Volume= 0.282 af  
 Secondary = 2.89 cfs @ 12.34 hrs, Volume= 0.318 af  
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 840.69' @ 12.34 hrs Surf.Area= 4,417 sf Storage= 11,957 cf

Plug-Flow detention time= 557.9 min calculated for 0.600 af (100% of inflow)  
 Center-of-Mass det. time= 557.7 min ( 1,371.9 - 814.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	837.50'	27,713 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
837.50	3,000	0	0
838.00	3,300	1,575	1,575
839.00	3,700	3,500	5,075
840.00	4,162	3,931	9,006
841.00	4,532	4,347	13,353
842.00	5,103	4,818	18,171
843.00	13,982	9,543	27,713

Device	Routing	Invert	Outlet Devices
#1	Primary	837.50'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	839.70'	<b>1.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height
#3	Tertiary	842.75'	<b>24.0" x 24.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.10 cfs @ 12.34 hrs HW=840.69' (Free Discharge)

↑**1=Orifice/Grate** (Orifice Controls 0.10 cfs @ 8.51 fps)

**Secondary OutFlow** Max=2.89 cfs @ 12.34 hrs HW=840.69' (Free Discharge)

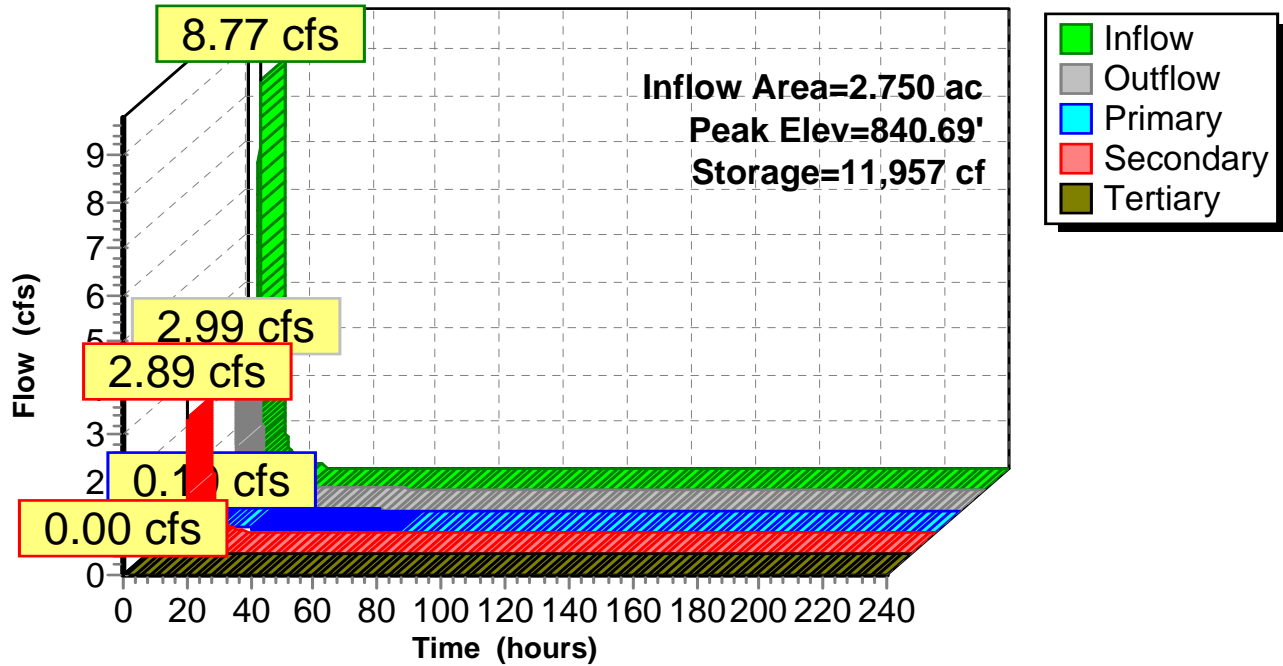
↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 2.89 cfs @ 3.64 fps)

**Tertiary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=837.50' (Free Discharge)

↑**3=Orifice/Grate** ( Controls 0.00 cfs)

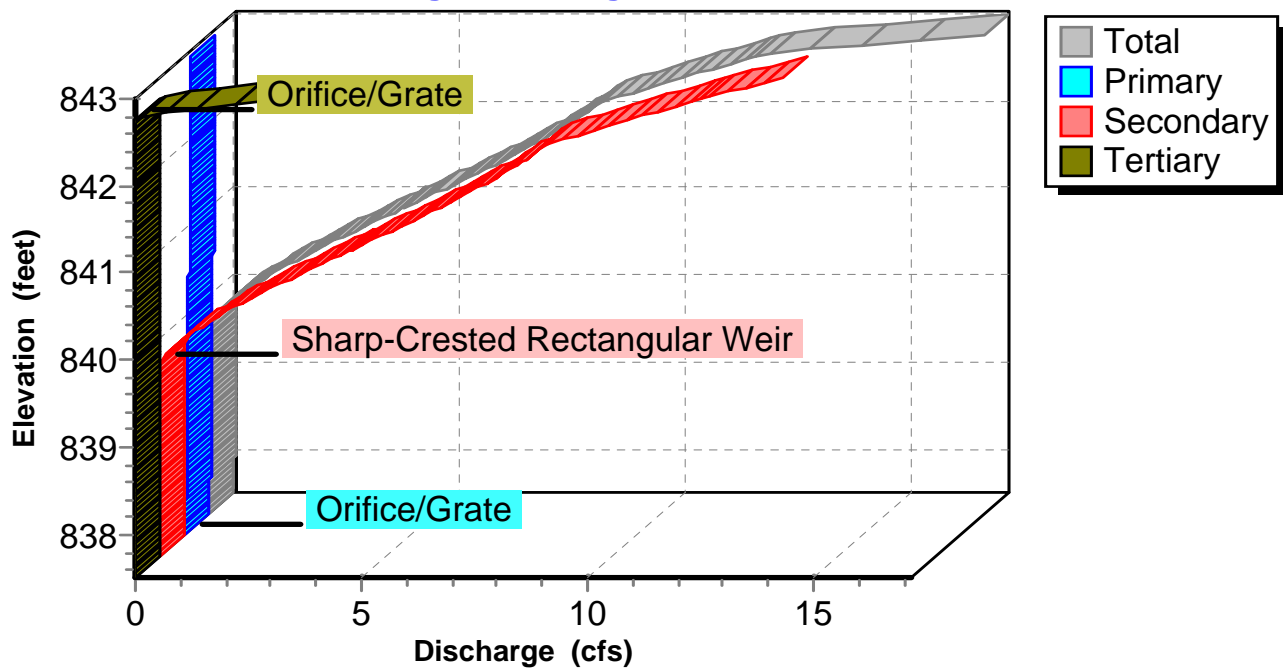
### Pond 3P: Detention Pond West

#### Hydrograph



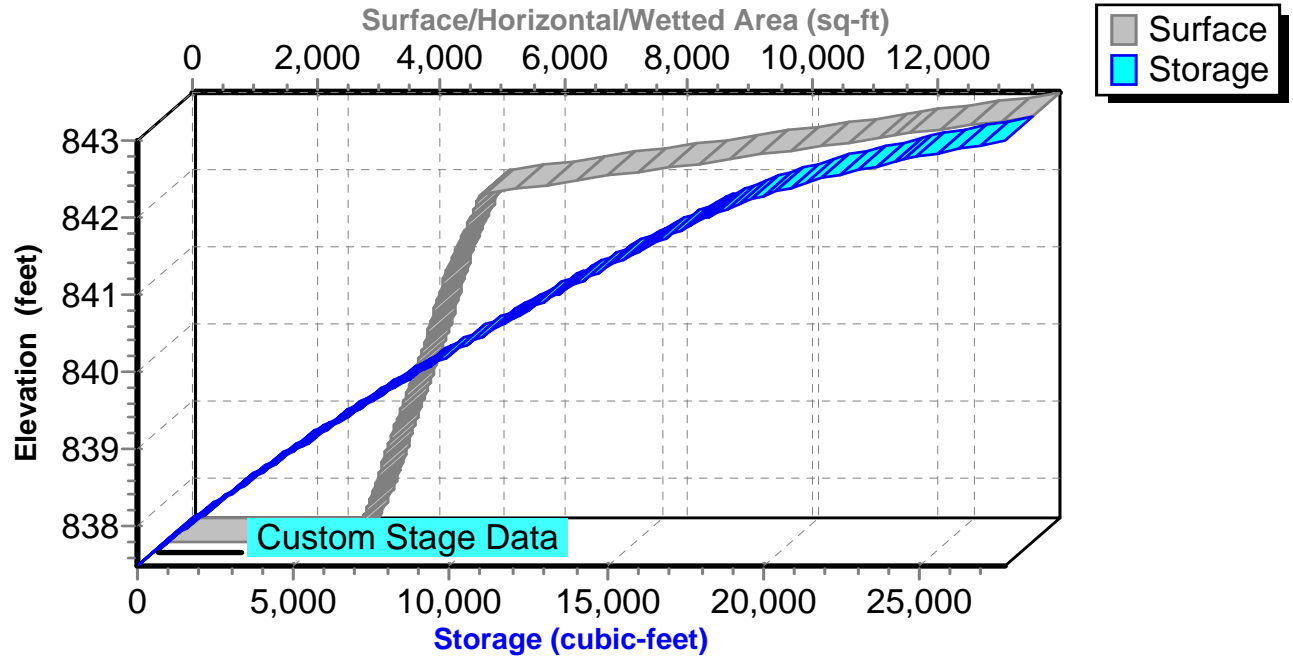
### Pond 3P: Detention Pond West

#### Stage-Discharge



### Pond 3P: Detention Pond West

#### Stage-Area-Storage



**6473 Seeds Road**

Type II 24-hr 25-Year Rainfall=3.88"

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**Summary for Pond 4P: Detention Pond East**

Inflow Area = 5.000 ac, 43.60% Impervious, Inflow Depth = 2.75" for 25-Year event  
 Inflow = 8.47 cfs @ 12.11 hrs, Volume= 1.144 af  
 Outflow = 8.41 cfs @ 12.13 hrs, Volume= 1.144 af, Atten= 1%, Lag= 1.0 min  
 Primary = 4.66 cfs @ 12.13 hrs, Volume= 1.071 af  
 Secondary = 3.76 cfs @ 12.13 hrs, Volume= 0.073 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 841.17' @ 12.13 hrs Surf.Area= 2,690 sf Storage= 1,495 cf

Plug-Flow detention time= 2.0 min calculated for 1.144 af (100% of inflow)  
 Center-of-Mass det. time= 1.4 min ( 1,101.9 - 1,100.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	836.41'	779 cf	<b>15.0" D x 635.0'L 15" Pipe Storage S= 0.0030 'I'</b>
#2	836.90'	35 cf	<b>12.0" D x 45.0'L 12" Pipe Storage S= 0.0045 'I'</b>
#3	838.90'	480 cf	<b>Inf. Trench Stone (Prismatic) Listed below (Recalc)</b>
#4	840.90'	3,348 cf	<b>Ditch Volume (Prismatic) Listed below (Recalc)</b>
		4,643 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
838.90	0	0.0	0	0
840.90	1,200	40.0	480	480

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.90	0	0	0
842.00	6,088	3,348	3,348

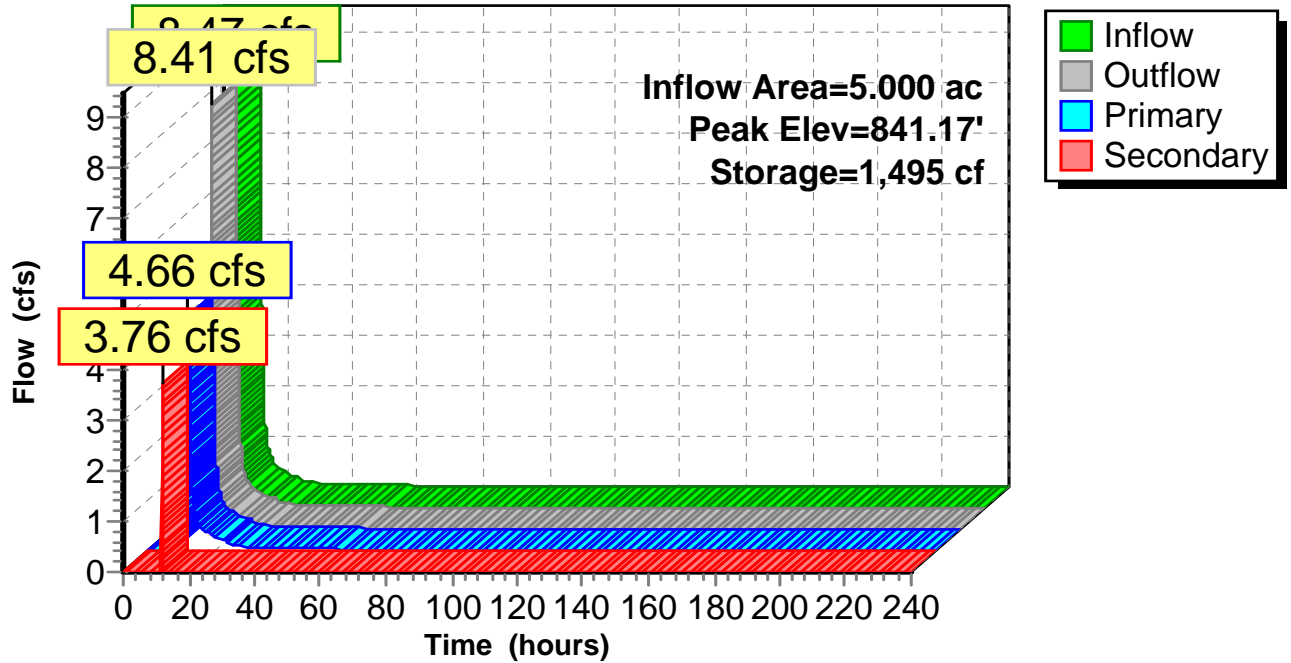
Device	Routing	Invert	Outlet Devices
#1	Primary	836.00'	<b>9.0" Vert. Orifice/Grate C= 0.600</b>
#2	Secondary	840.90'	<b>8.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)</b> 1.0' Crest Height

**Primary OutFlow** Max=4.66 cfs @ 12.13 hrs HW=841.17' (Free Discharge)  
 ↑1=Orifice/Grate (Orifice Controls 4.66 cfs @ 10.54 fps)

**Secondary OutFlow** Max=3.75 cfs @ 12.13 hrs HW=841.17' (Free Discharge)  
 ↑2=Sharp-Crested Rectangular Weir (Weir Controls 3.75 cfs @ 1.75 fps)

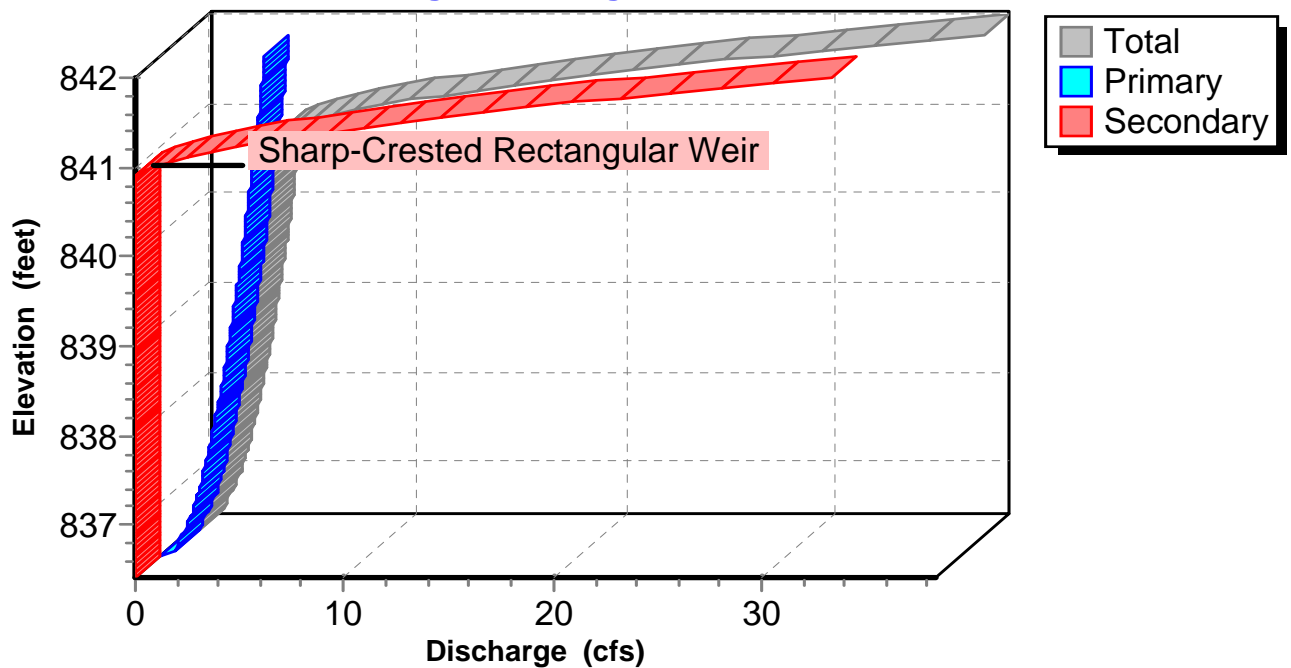
### Pond 4P: Detention Pond East

#### Hydrograph



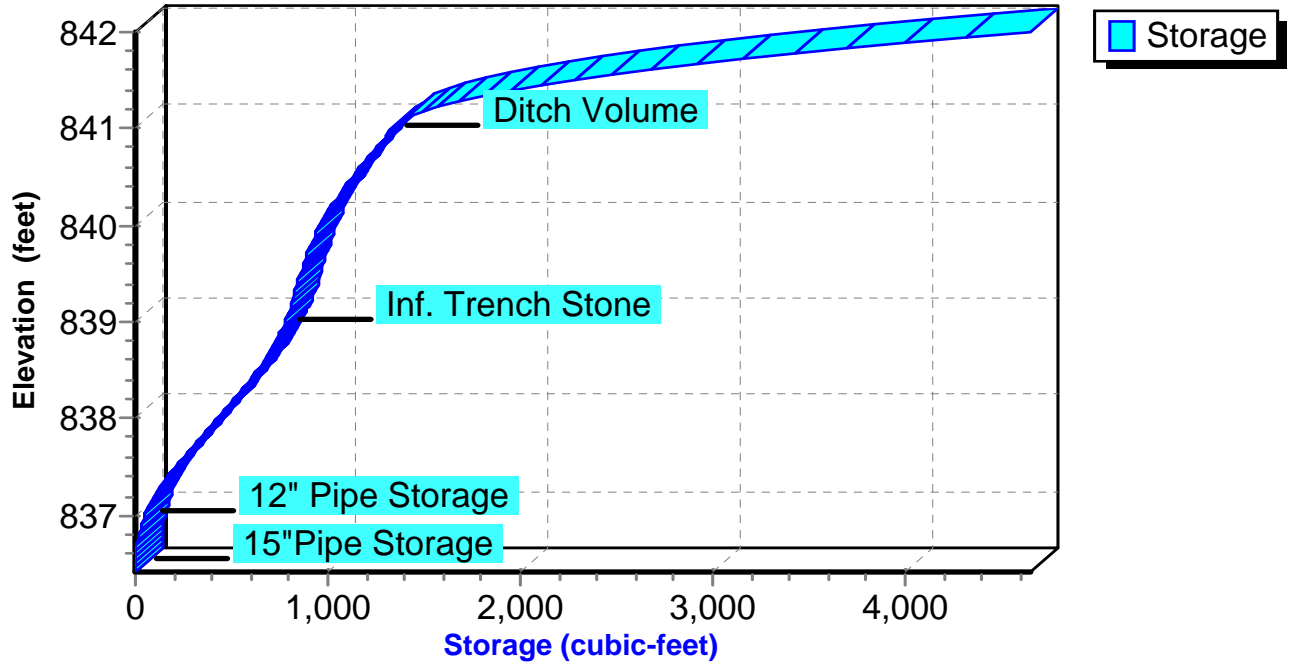
### Pond 4P: Detention Pond East

#### Stage-Discharge



Pond 4P: Detention Pond East

Stage-Area-Storage





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Type II 24-hr 50-Year Rainfall=4.42"

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**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 17.30 cfs @ 12.10 hrs, Volume= 1.221 af, Depth= 2.93"

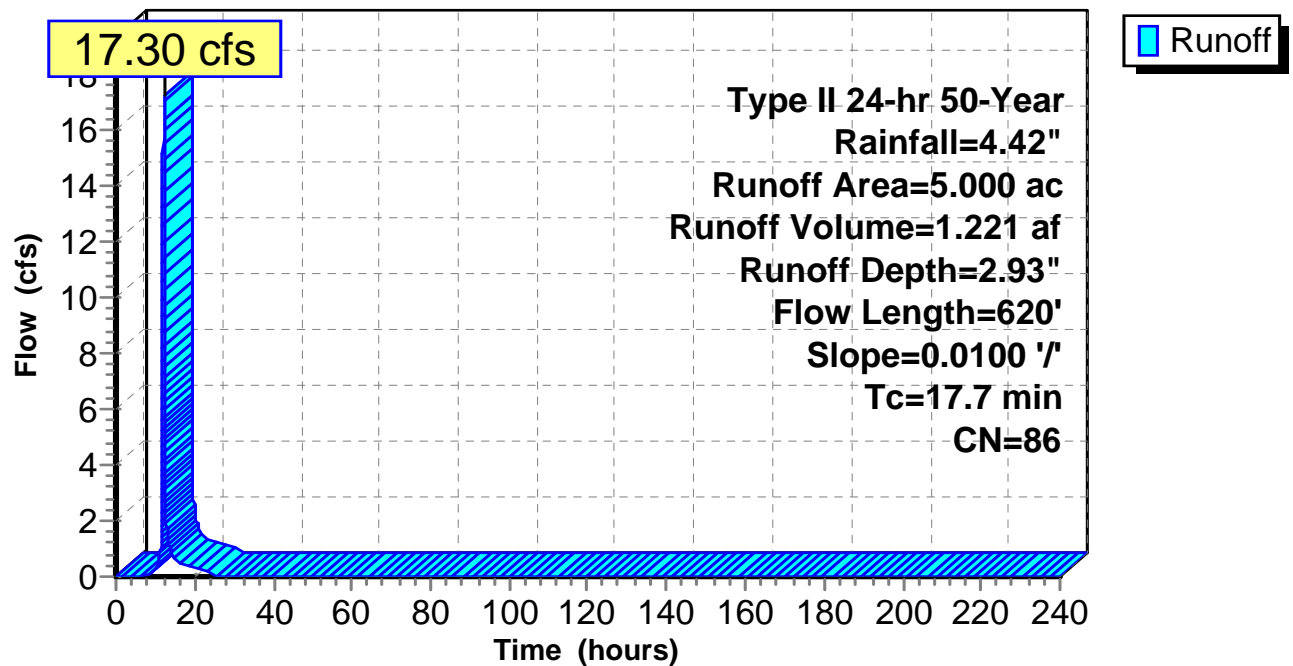
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 50-Year Rainfall=4.42"

Area (ac)	CN	Description
1.947	89	Gravel roads, HSG C
0.758	98	Roofs, HSG C
0.097	98	Water Surface, HSG C
2.198	79	50-75% Grass cover, Fair, HSG C
5.000	86	Weighted Average
4.145		82.90% Pervious Area
0.855		17.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.7	620	0.0100	0.58		Lag/CN Method,

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



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Type II 24-hr 50-Year Rainfall=4.42"

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**Summary for Subcatchment 2S: Developed West**

Runoff = 10.39 cfs @ 12.08 hrs, Volume= 0.715 af, Depth= 3.12"

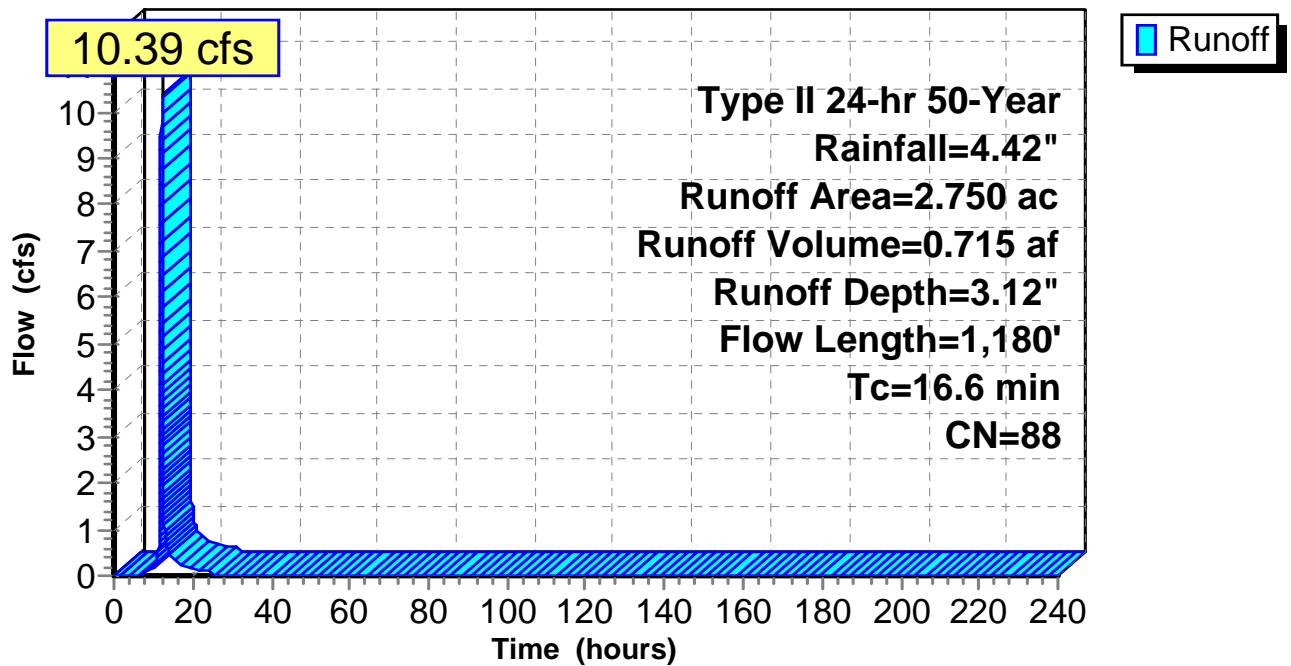
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 50-Year Rainfall=4.42"

Area (ac)	CN	Description
0.760	98	Roofs, HSG C
1.140	89	Gravel roads, HSG C
0.750	74	>75% Grass cover, Good, HSG C
0.100	98	Water Surface, HSG C
2.750	88	Weighted Average
1.890		68.73% Pervious Area
0.860		31.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 2S: Developed West**

**Hydrograph**



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Type II 24-hr 50-Year Rainfall=4.42"

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**Summary for Subcatchment 4S: Developed East**

Runoff = 9.37 cfs @ 12.07 hrs, Volume= 0.641 af, Depth= 3.42"

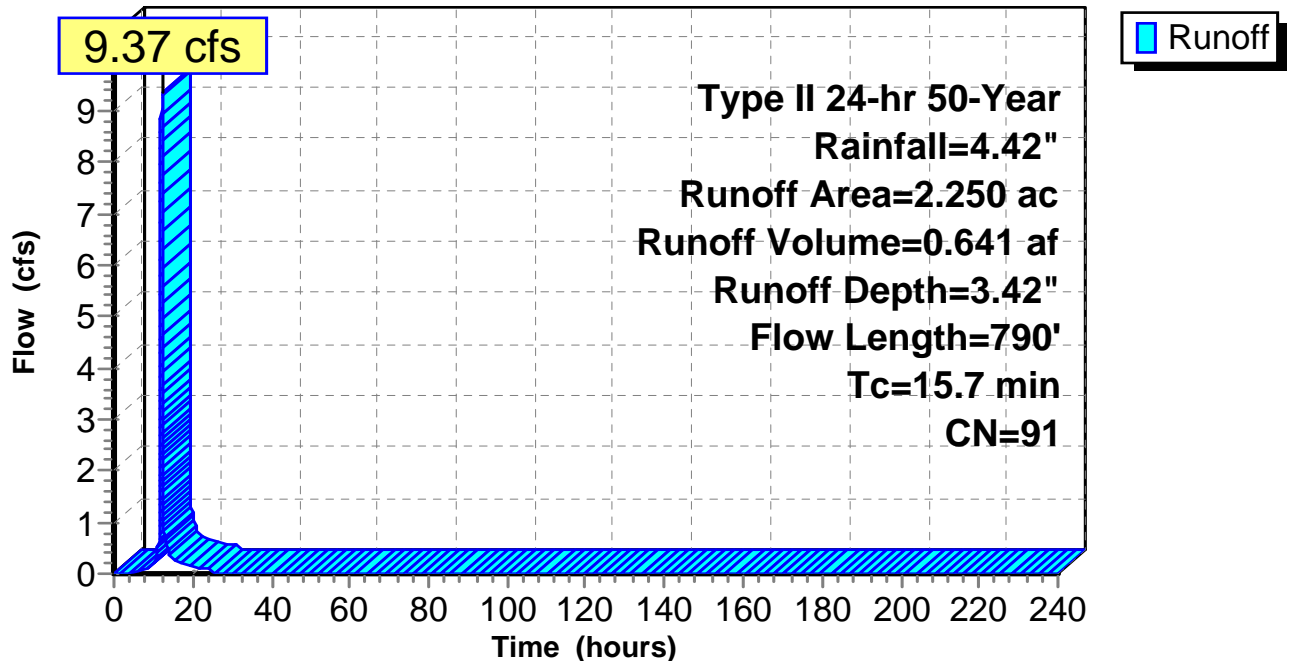
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 50-Year Rainfall=4.42"

Area (ac)	CN	Description
0.510	74	>75% Grass cover, Good, HSG C
0.650	98	Paved parking, HSG C
0.420	89	Gravel roads, HSG C
0.670	98	Roofs, HSG C
2.250	91	Weighted Average
0.930		41.33% Pervious Area
1.320		58.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	20	0.0040	0.05		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.25"
7.7	440	0.0040	0.95		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
1.9	330	0.0030	2.88	3.54	<b>Pipe Channel,</b> 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
15.7	790	Total			

**Subcatchment 4S: Developed East**

**Hydrograph**



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Type II 24-hr 50-Year Rainfall=4.42"

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**Summary for Subcatchment 5S: Developed**

Runoff = 19.87 cfs @ 12.08 hrs, Volume= 1.383 af, Depth= 3.32"

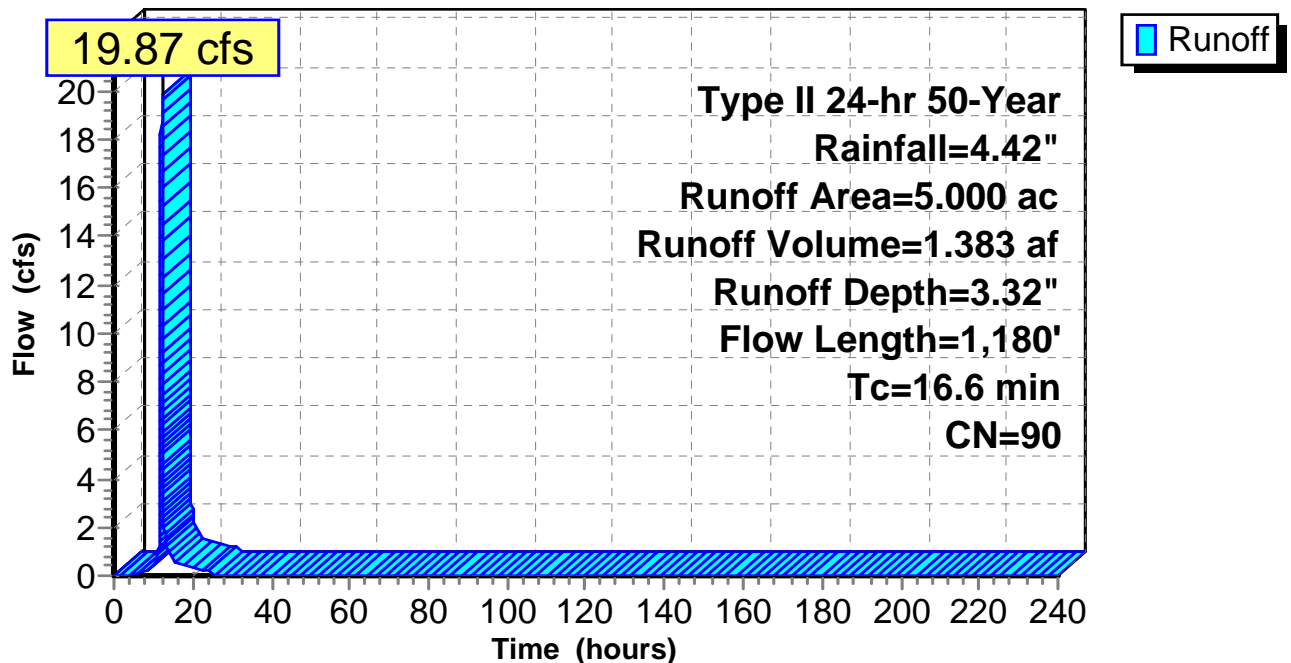
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 50-Year Rainfall=4.42"

Area (ac)	CN	Description
1.663	98	Roofs, HSG C
0.470	98	Paved parking, HSG C
1.326	89	Gravel roads, HSG C
1.444	79	50-75% Grass cover, Fair, HSG C
0.097	98	Water Surface, HSG C
5.000	90	Weighted Average
2.770		55.40% Pervious Area
2.230		44.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 5S: Developed**

**Hydrograph**



**6473 Seeds Road**

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Type II 24-hr 50-Year Rainfall=4.42"

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**Summary for Pond 3P: Detention Pond West**

Inflow Area = 2.750 ac, 31.27% Impervious, Inflow Depth = 3.12" for 50-Year event  
 Inflow = 10.39 cfs @ 12.08 hrs, Volume= 0.715 af  
 Outflow = 4.37 cfs @ 12.29 hrs, Volume= 0.715 af, Atten= 58%, Lag= 12.5 min  
 Primary = 0.11 cfs @ 12.29 hrs, Volume= 0.287 af  
 Secondary = 4.26 cfs @ 12.29 hrs, Volume= 0.429 af  
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 841.03' @ 12.29 hrs Surf.Area= 4,547 sf Storage= 13,469 cf

Plug-Flow detention time= 477.5 min calculated for 0.715 af (100% of inflow)  
 Center-of-Mass det. time= 477.8 min ( 1,286.9 - 809.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	837.50'	27,713 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
837.50	3,000	0	0
838.00	3,300	1,575	1,575
839.00	3,700	3,500	5,075
840.00	4,162	3,931	9,006
841.00	4,532	4,347	13,353
842.00	5,103	4,818	18,171
843.00	13,982	9,543	27,713

Device	Routing	Invert	Outlet Devices
#1	Primary	837.50'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	839.70'	<b>1.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height
#3	Tertiary	842.75'	<b>24.0" x 24.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.11 cfs @ 12.29 hrs HW=841.03' (Free Discharge)

↑**1=Orifice/Grate** (Orifice Controls 0.11 cfs @ 8.96 fps)

**Secondary OutFlow** Max=4.26 cfs @ 12.29 hrs HW=841.03' (Free Discharge)

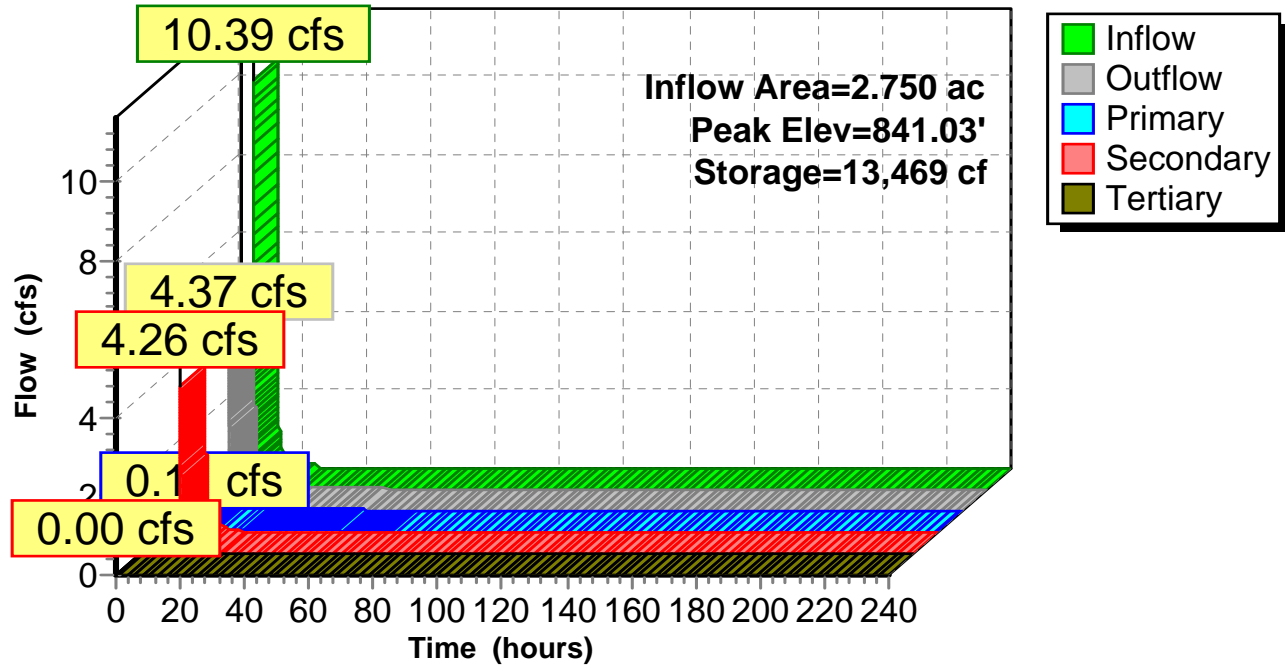
↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 4.26 cfs @ 4.38 fps)

**Tertiary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=837.50' (Free Discharge)

↑**3=Orifice/Grate** ( Controls 0.00 cfs)

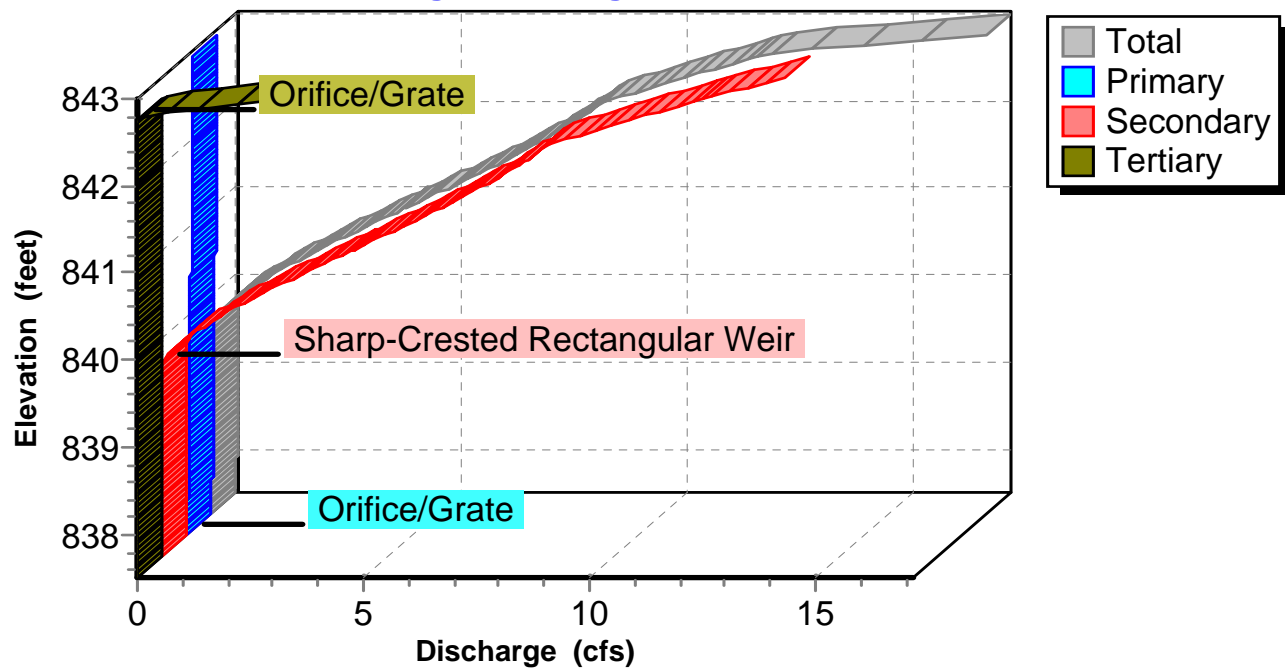
Pond 3P: Detention Pond West

Hydrograph



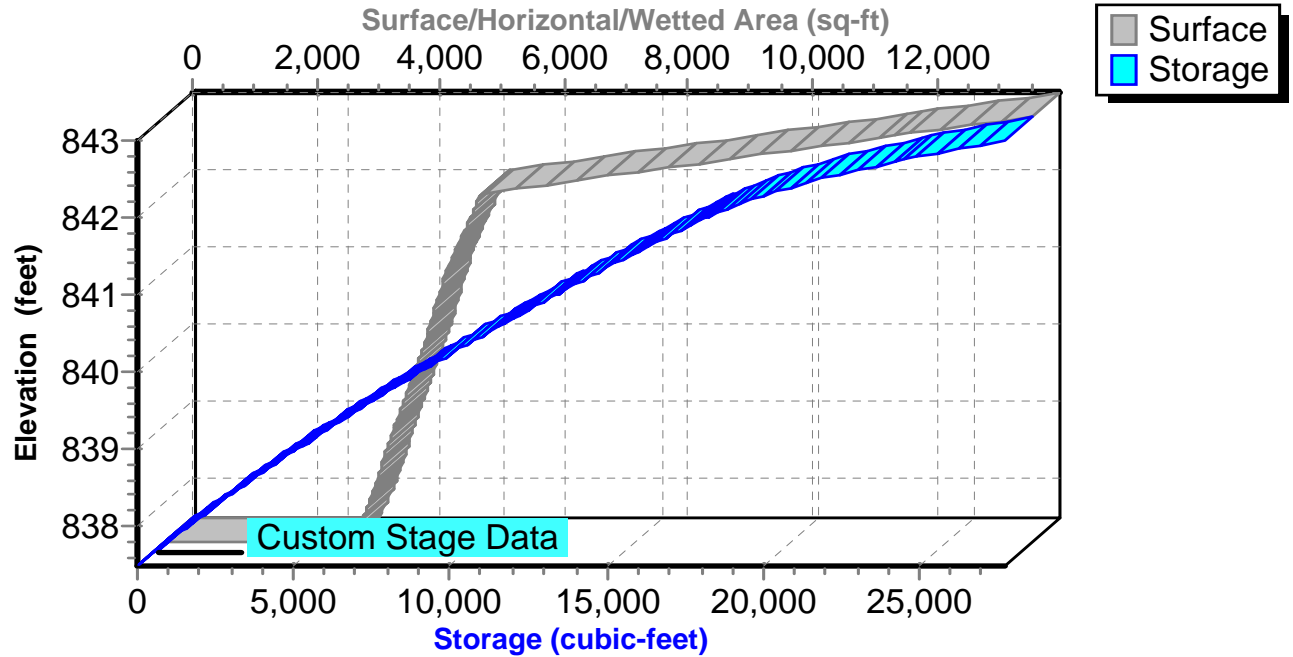
Pond 3P: Detention Pond West

Stage-Discharge



### Pond 3P: Detention Pond West

#### Stage-Area-Storage



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Type II 24-hr 50-Year Rainfall=4.42"

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**Summary for Pond 4P: Detention Pond East**

Inflow Area = 5.000 ac, 43.60% Impervious, Inflow Depth = 3.26" for 50-Year event  
 Inflow = 11.25 cfs @ 12.12 hrs, Volume= 1.357 af  
 Outflow = 11.11 cfs @ 12.14 hrs, Volume= 1.357 af, Atten= 1%, Lag= 1.2 min  
 Primary = 4.71 cfs @ 12.14 hrs, Volume= 1.198 af  
 Secondary = 6.40 cfs @ 12.14 hrs, Volume= 0.159 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 841.28' @ 12.14 hrs Surf.Area= 3,312 sf Storage= 1,698 cf

Plug-Flow detention time= 2.2 min calculated for 1.357 af (100% of inflow)  
 Center-of-Mass det. time= 1.5 min ( 1,056.7 - 1,055.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	836.41'	779 cf	<b>15.0" D x 635.0'L 15" Pipe Storage S= 0.0030 'I'</b>
#2	836.90'	35 cf	<b>12.0" D x 45.0'L 12" Pipe Storage S= 0.0045 'I'</b>
#3	838.90'	480 cf	<b>Inf. Trench Stone (Prismatic)</b> Listed below (Recalc)
#4	840.90'	3,348 cf	<b>Ditch Volume (Prismatic)</b> Listed below (Recalc)
		4,643 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
838.90	0	0.0	0	0
840.90	1,200	40.0	480	480

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.90	0	0	0
842.00	6,088	3,348	3,348

Device	Routing	Invert	Outlet Devices
#1	Primary	836.00'	<b>9.0" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	840.90'	<b>8.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height

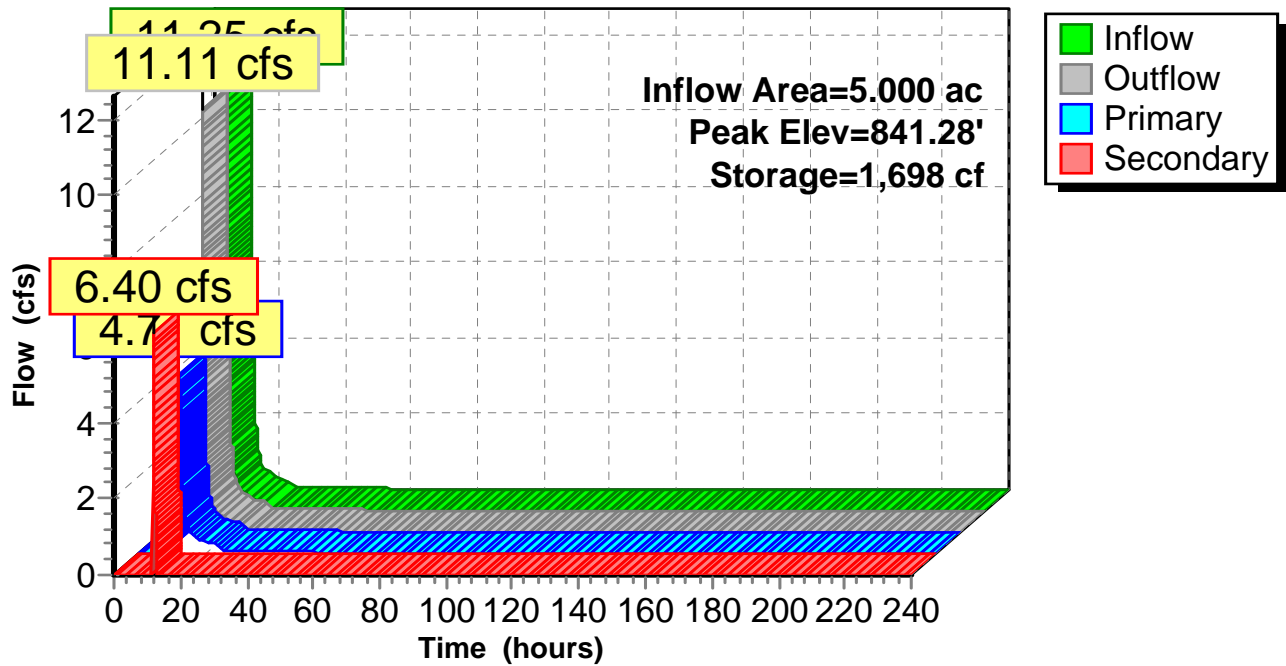
**Primary OutFlow** Max=4.71 cfs @ 12.14 hrs HW=841.28' (Free Discharge)  
 ↑1=Orifice/Grate (Orifice Controls 4.71 cfs @ 10.67 fps)

**Secondary OutFlow** Max=6.39 cfs @ 12.14 hrs HW=841.28' (Free Discharge)  
 ↑2=Sharp-Crested Rectangular Weir (Weir Controls 6.39 cfs @ 2.11 fps)



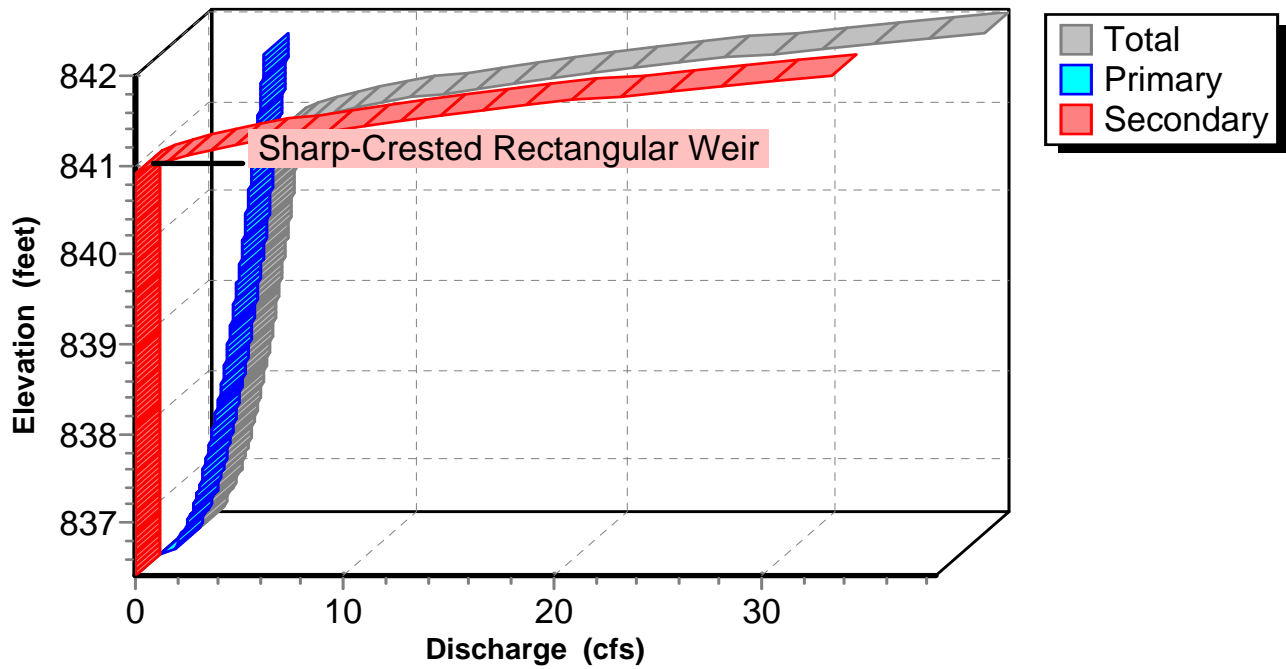
### Pond 4P: Detention Pond East

#### Hydrograph



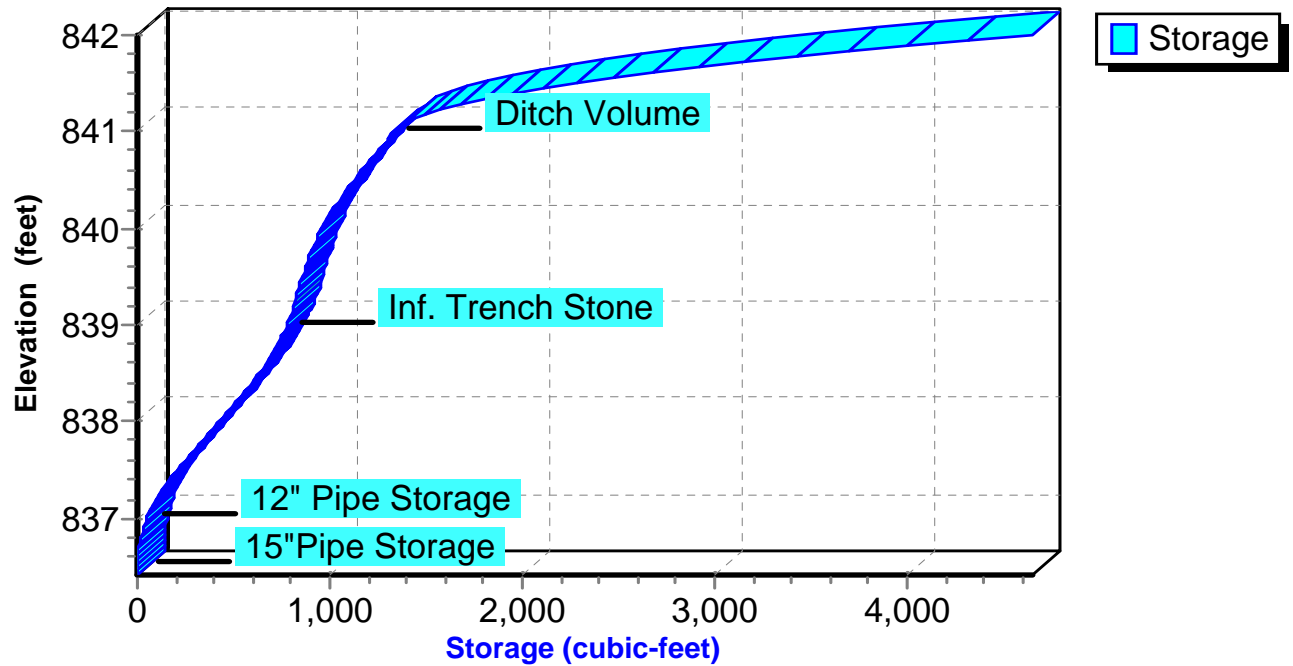
### Pond 4P: Detention Pond East

#### Stage-Discharge



### Pond 4P: Detention Pond East

#### Stage-Area-Storage



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Type II 24-hr 100-Year Rainfall=5.00"

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**Summary for Subcatchment 1S: PreDeveloped**

Runoff = 20.37 cfs @ 12.10 hrs, Volume= 1.445 af, Depth= 3.47"

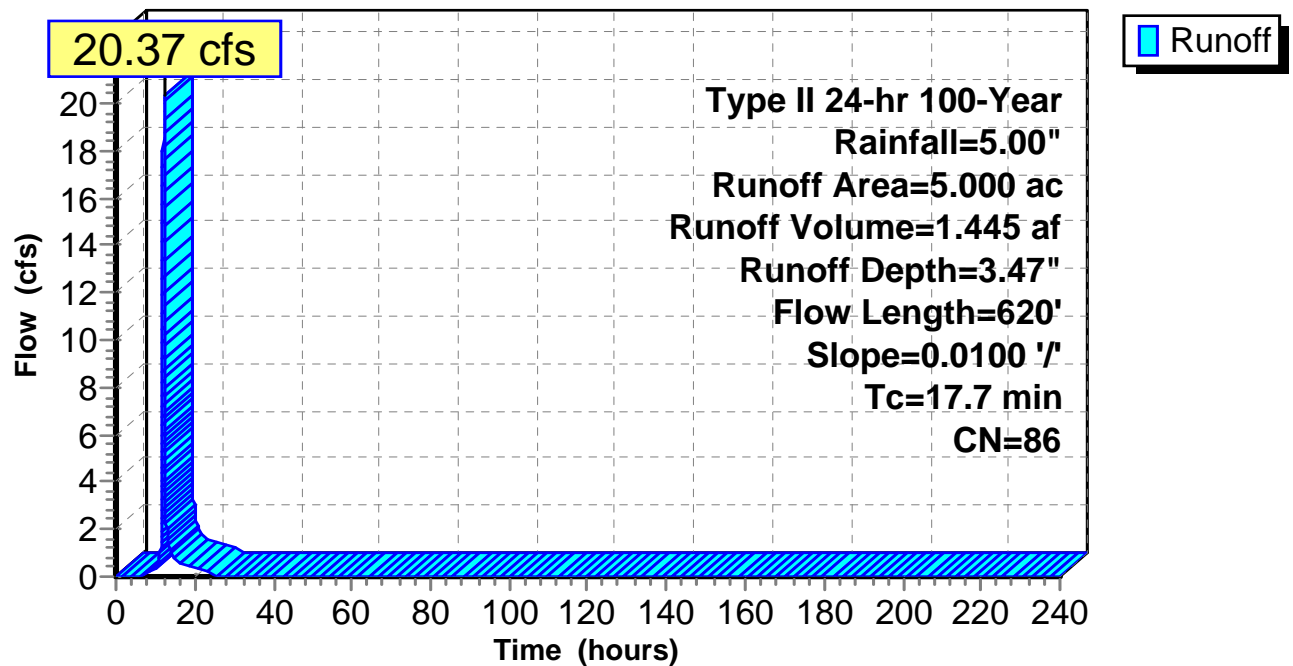
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-Year Rainfall=5.00"

Area (ac)	CN	Description
1.947	89	Gravel roads, HSG C
0.758	98	Roofs, HSG C
0.097	98	Water Surface, HSG C
2.198	79	50-75% Grass cover, Fair, HSG C
5.000	86	Weighted Average
4.145		82.90% Pervious Area
0.855		17.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.7	620	0.0100	0.58		Lag/CN Method,

**Subcatchment 1S: PreDeveloped**

**Hydrograph**



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Type II 24-hr 100-Year Rainfall=5.00"

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**Summary for Subcatchment 2S: Developed West**

Runoff = 12.14 cfs @ 12.08 hrs, Volume= 0.841 af, Depth= 3.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-Year Rainfall=5.00"

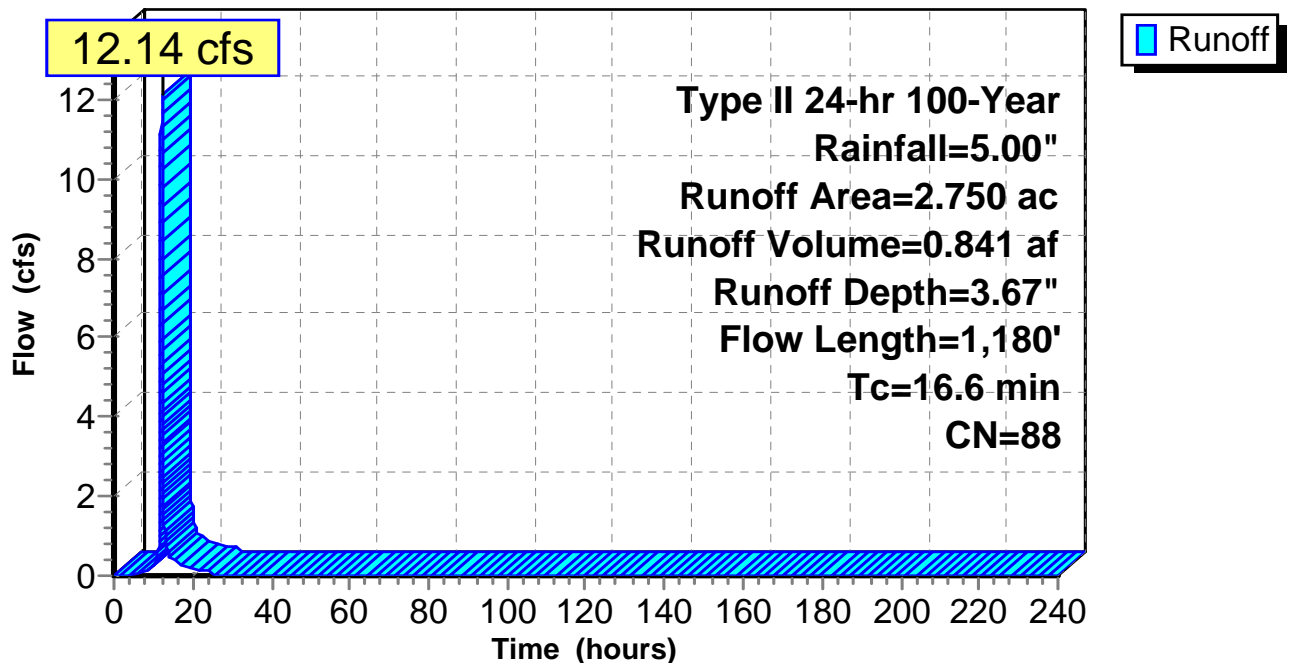
Area (ac)	CN	Description
0.760	98	Roofs, HSG C
1.140	89	Gravel roads, HSG C
0.750	74	>75% Grass cover, Good, HSG C
0.100	98	Water Surface, HSG C
2.750	88	Weighted Average
1.890		68.73% Pervious Area
0.860		31.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 2S: Developed West**

**Hydrograph**



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Type II 24-hr 100-Year Rainfall=5.00"

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**Summary for Subcatchment 4S: Developed East**

Runoff = 10.82 cfs @ 12.07 hrs, Volume= 0.747 af, Depth= 3.98"

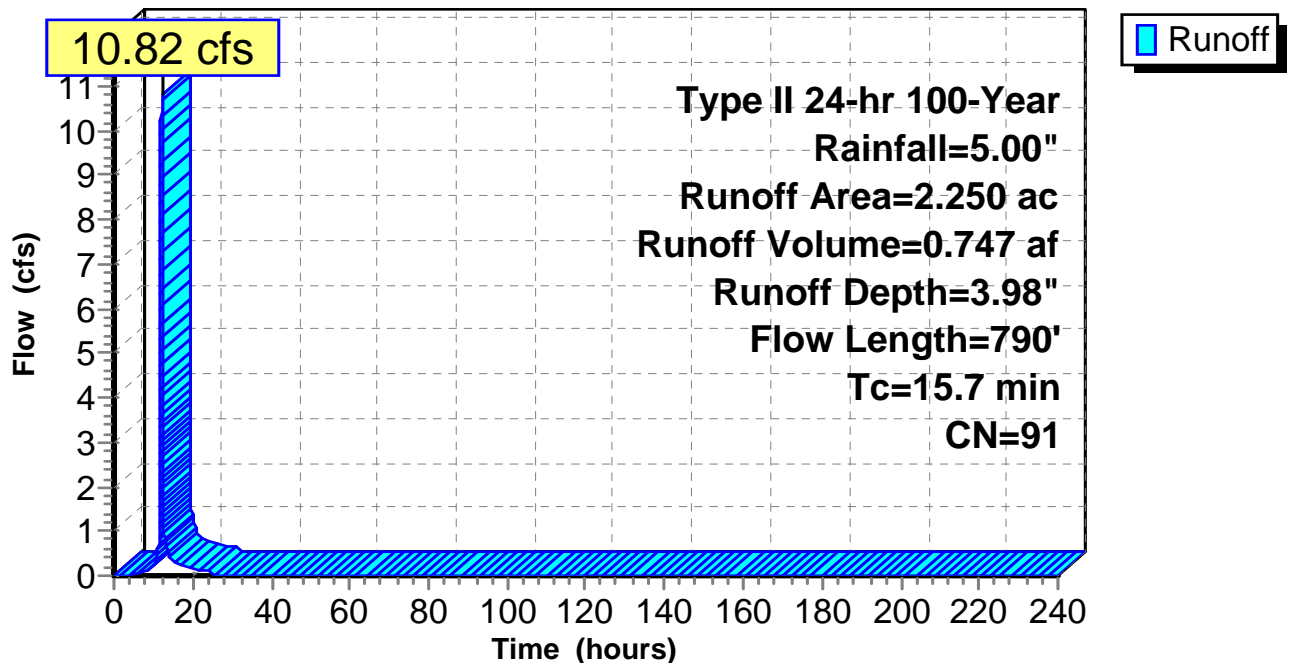
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-Year Rainfall=5.00"

Area (ac)	CN	Description
0.510	74	>75% Grass cover, Good, HSG C
0.650	98	Paved parking, HSG C
0.420	89	Gravel roads, HSG C
0.670	98	Roofs, HSG C
2.250	91	Weighted Average
0.930		41.33% Pervious Area
1.320		58.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	20	0.0040	0.05		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.25"
7.7	440	0.0040	0.95		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
1.9	330	0.0030	2.88	3.54	<b>Pipe Channel,</b> 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Concrete pipe, bends & connections
15.7	790	Total			

**Subcatchment 4S: Developed East**

**Hydrograph**



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Type II 24-hr 100-Year Rainfall=5.00"

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**Summary for Subcatchment 5S: Developed**

Runoff = 23.03 cfs @ 12.08 hrs, Volume= 1.615 af, Depth= 3.88"

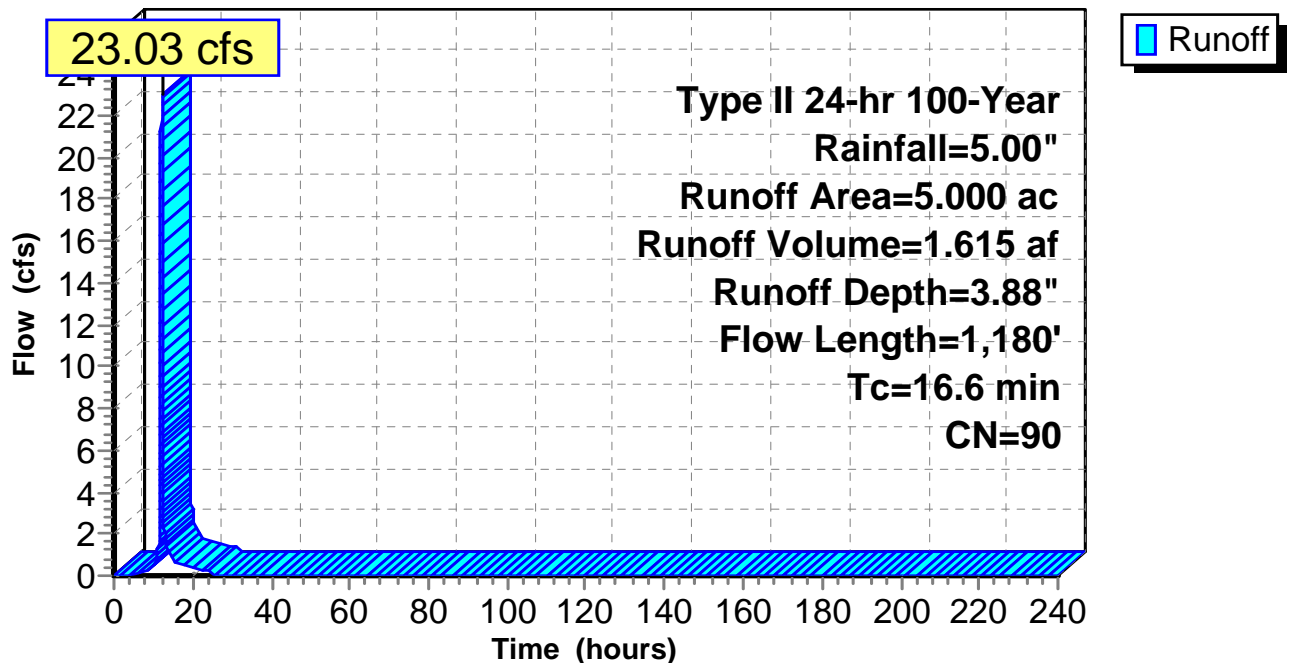
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100-Year Rainfall=5.00"

Area (ac)	CN	Description
1.663	98	Roofs, HSG C
0.470	98	Paved parking, HSG C
1.326	89	Gravel roads, HSG C
1.444	79	50-75% Grass cover, Fair, HSG C
0.097	98	Water Surface, HSG C
5.000	90	Weighted Average
2.770		55.40% Pervious Area
2.230		44.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	20	0.0050	0.06		<b>Sheet Flow, Sheet flow</b> Grass: Short n= 0.150 P2= 2.25"
8.2	560	0.0050	1.14		<b>Shallow Concentrated Flow, Ditch flow</b> Unpaved Kv= 16.1 fps
2.8	600	0.0045	3.59	2.87	<b>Channel Flow, Pipe flow</b> Area= 0.8 sf Perim= 2.5' r= 0.32' n= 0.013
16.6	1,180	Total			

**Subcatchment 5S: Developed**

**Hydrograph**



**6473 Seeds Road**

Type II 24-hr 100-Year Rainfall=5.00"

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**Summary for Pond 3P: Detention Pond West**

Inflow Area = 2.750 ac, 31.27% Impervious, Inflow Depth = 3.67" for 100-Year event  
 Inflow = 12.14 cfs @ 12.08 hrs, Volume= 0.841 af  
 Outflow = 5.78 cfs @ 12.27 hrs, Volume= 0.841 af, Atten= 52%, Lag= 11.1 min  
 Primary = 0.12 cfs @ 12.27 hrs, Volume= 0.291 af  
 Secondary = 5.67 cfs @ 12.27 hrs, Volume= 0.550 af  
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 841.37' @ 12.27 hrs Surf.Area= 4,744 sf Storage= 15,079 cf

Plug-Flow detention time= 414.7 min calculated for 0.841 af (100% of inflow)  
 Center-of-Mass det. time= 414.9 min ( 1,219.5 - 804.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	837.50'	27,713 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
837.50	3,000	0	0
838.00	3,300	1,575	1,575
839.00	3,700	3,500	5,075
840.00	4,162	3,931	9,006
841.00	4,532	4,347	13,353
842.00	5,103	4,818	18,171
843.00	13,982	9,543	27,713

Device	Routing	Invert	Outlet Devices
#1	Primary	837.50'	<b>1.5" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	839.70'	<b>1.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height
#3	Tertiary	842.75'	<b>24.0" x 24.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.12 cfs @ 12.27 hrs HW=841.37' (Free Discharge)

↑**1=Orifice/Grate** (Orifice Controls 0.12 cfs @ 9.40 fps)

**Secondary OutFlow** Max=5.67 cfs @ 12.27 hrs HW=841.37' (Free Discharge)

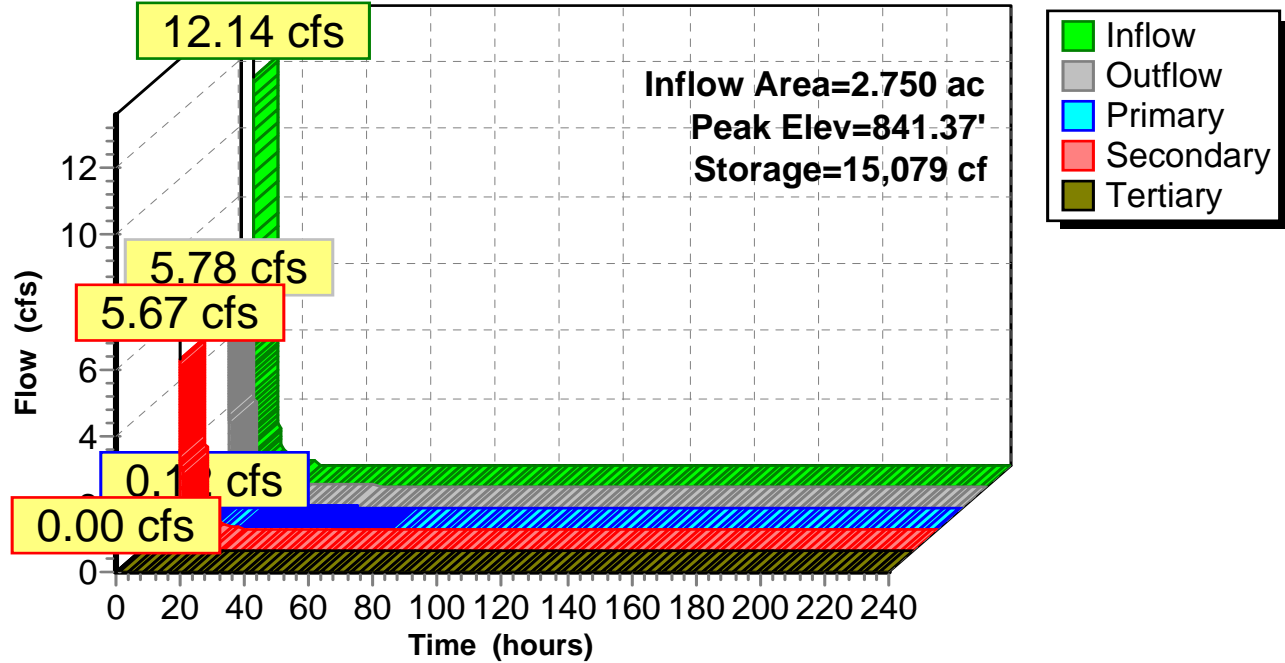
↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 5.67 cfs @ 5.09 fps)

**Tertiary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=837.50' (Free Discharge)

↑**3=Orifice/Grate** ( Controls 0.00 cfs)

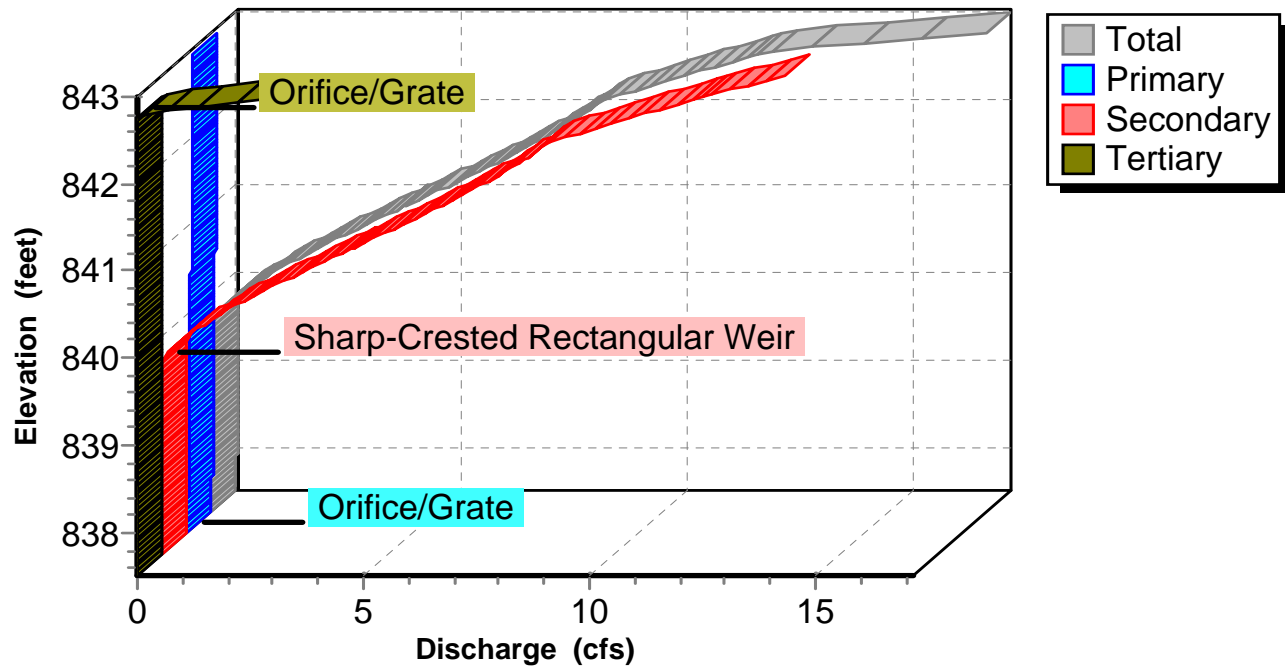
Pond 3P: Detention Pond West

Hydrograph



Pond 3P: Detention Pond West

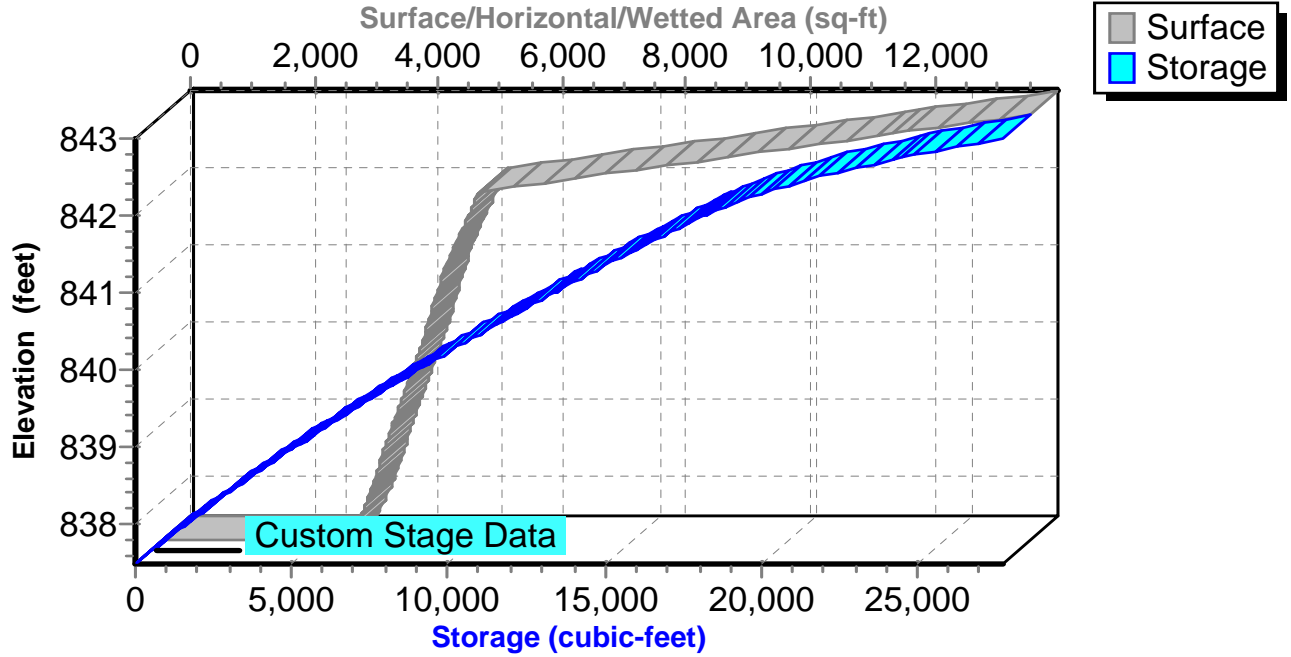
Stage-Discharge





### Pond 3P: Detention Pond West

#### Stage-Area-Storage



**6473 Seeds Road**

Type II 24-hr 100-Year Rainfall=5.00"

Prepared by E.P. Ferris &amp; Associates

Printed 5/24/2017

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**Summary for Pond 4P: Detention Pond East**

Inflow Area = 5.000 ac, 43.60% Impervious, Inflow Depth = 3.81" for 100-Year event  
 Inflow = 14.25 cfs @ 12.11 hrs, Volume= 1.587 af  
 Outflow = 14.05 cfs @ 12.14 hrs, Volume= 1.588 af, Atten= 1%, Lag= 1.4 min  
 Primary = 4.76 cfs @ 12.14 hrs, Volume= 1.322 af  
 Secondary = 9.28 cfs @ 12.14 hrs, Volume= 0.265 af

Routing by Stor-Ind method, Time Span= 0.00-240.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 841.39' @ 12.14 hrs Surf.Area= 3,891 sf Storage= 1,949 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 1.5 min ( 1,020.2 - 1,018.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	836.41'	779 cf	<b>15.0" D x 635.0'L 15" Pipe Storage S= 0.0030 'I'</b>
#2	836.90'	35 cf	<b>12.0" D x 45.0'L 12" Pipe Storage S= 0.0045 'I'</b>
#3	838.90'	480 cf	<b>Inf. Trench Stone (Prismatic)</b> Listed below (Recalc)
#4	840.90'	3,348 cf	<b>Ditch Volume (Prismatic)</b> Listed below (Recalc)
		4,643 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
838.90	0	0.0	0	0
840.90	1,200	40.0	480	480

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
840.90	0	0	0
842.00	6,088	3,348	3,348

Device	Routing	Invert	Outlet Devices
#1	Primary	836.00'	<b>9.0" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	840.90'	<b>8.0' long Sharp-Crested Rectangular Weir</b> 2 End Contraction(s) 1.0' Crest Height

**Primary OutFlow** Max=4.76 cfs @ 12.14 hrs HW=841.39' (Free Discharge)

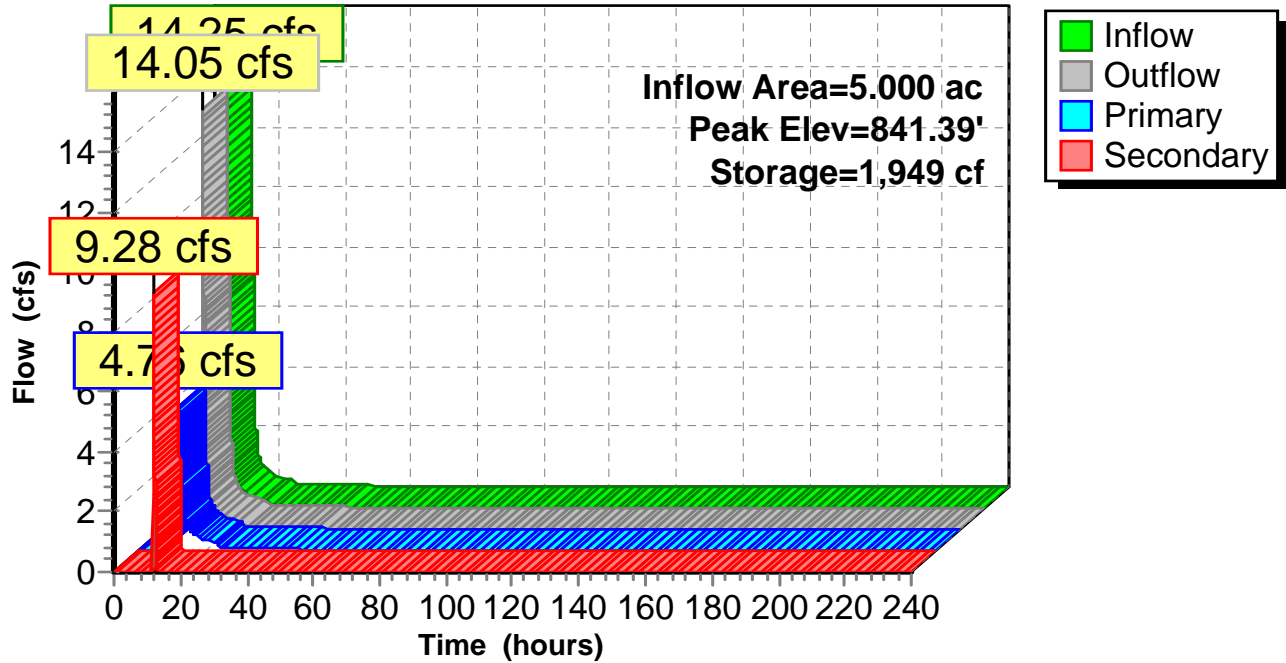
↑**1=Orifice/Grate** (Orifice Controls 4.76 cfs @ 10.78 fps)

**Secondary OutFlow** Max=9.28 cfs @ 12.14 hrs HW=841.39' (Free Discharge)

↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 9.28 cfs @ 2.42 fps)

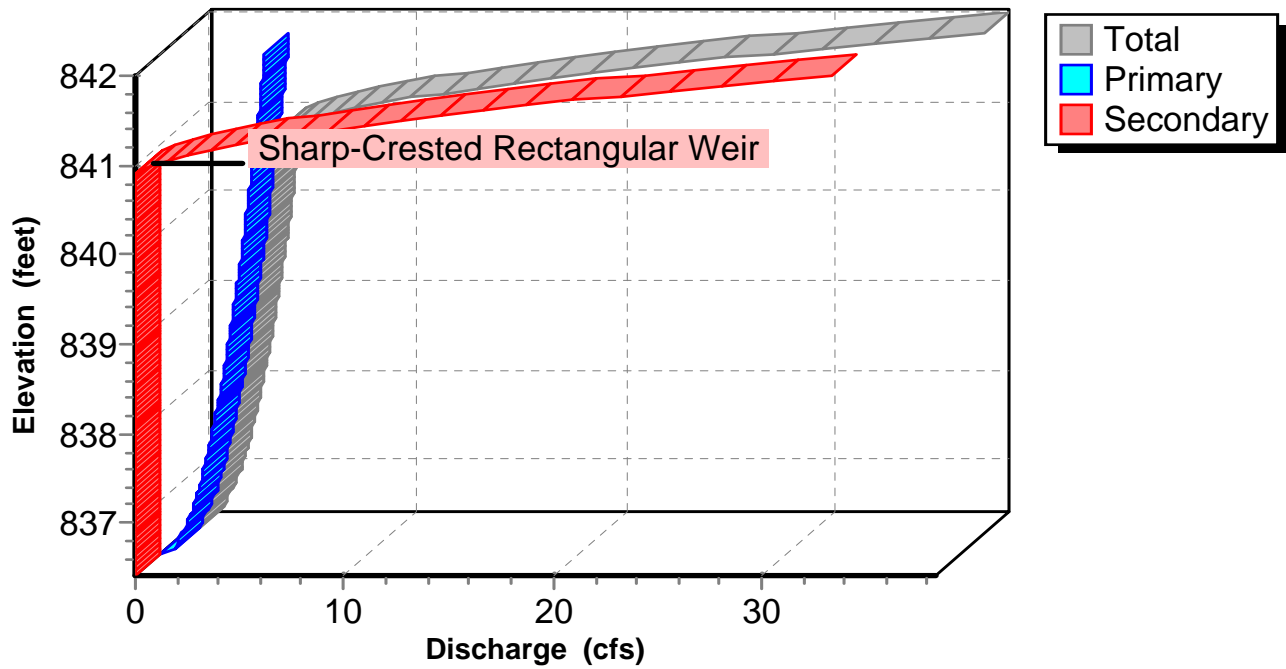
### Pond 4P: Detention Pond East

#### Hydrograph



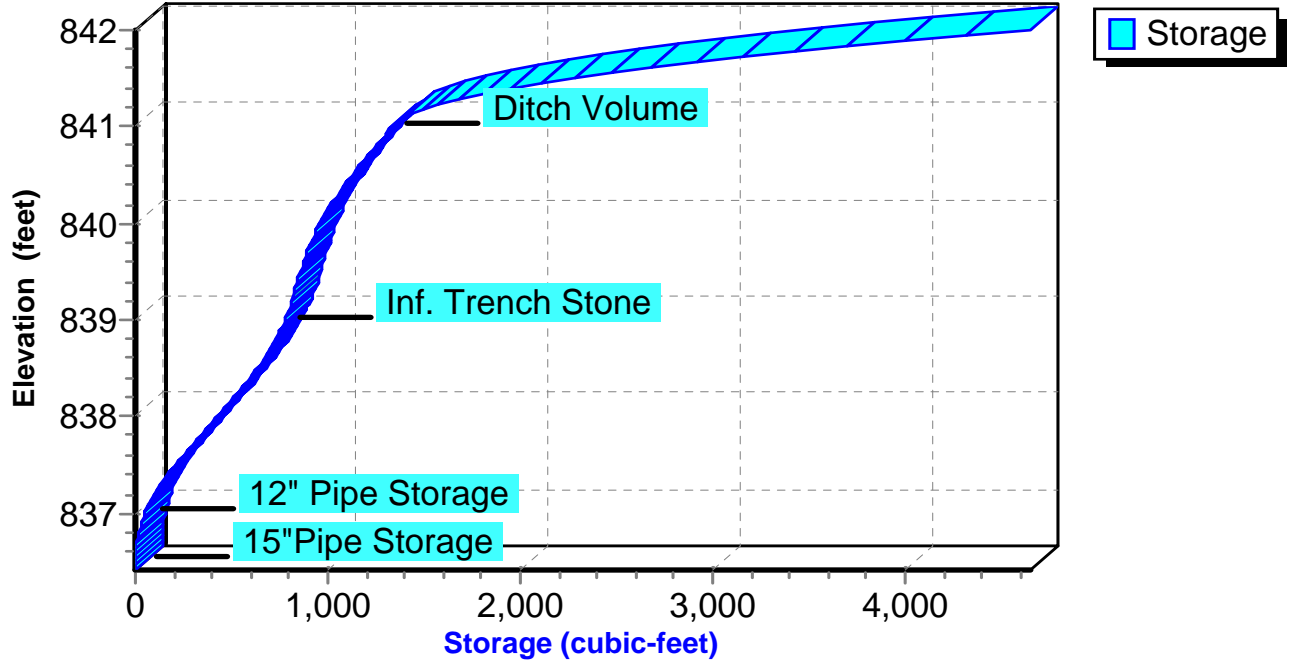
### Pond 4P: Detention Pond East

#### Stage-Discharge



Pond 4P: Detention Pond East

Stage-Area-Storage



**APPENDIX B**  
(Water Quality Calculations)

# 6473 Seeds Road

Grove City, Ohio

## Water Quality Orifice Calculation

-Volume provided for water quality:

**7,778 C.F.**

-Use 24 hours drawdown time:

From  $Q = 0.6A (gh^2)^{1/2}$

Where;

$$Q = 7,778 \text{ cf} / 86,400\text{s} = 0.090 \text{ cfs}$$

$$h = 839.70 - 837.50 = 2.20 \text{ ft.}$$

$$g = 32.2 \text{ ft/(s)}^2$$

**A** = Area in (sq.ft.)

$$A = 0.0126 \text{ sq.ft.}$$

$$D = 0.126 \text{ ft.} = 1.52 \text{ inches}$$

**Use 1.5" Diameter Orifice**

**APPENDIX C**  
(Tributary Map)

