

**Routing Diagram for NPDES Stormwater-REV1.1**  
 Prepared by Keystone Consulting Engineers, Printed 11/16/2022  
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**NPDES\_Stormwater-REV1.1**

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**Area Listing (selected nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
4.192	61	>75% Grass cover, Good, HSG B (12S, 34S)
0.792	74	>75% Grass cover, Good, HSG C (17S, 34S)
0.799	58	Meadow, non-grazed, HSG B (12S)
1.312	98	Paved parking & roofs (17S)
<b>7.095</b>	<b>69</b>	<b>TOTAL AREA</b>

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Post BMPs 9-10  
Type II 24-hr 2-Year Rainfall=3.36"

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**Summary for Subcatchment 12S: bio-retention basin #4a (BMP #9)**

Runoff = 0.84 cfs @ 12.23 hrs, Volume= 0.106 af, Depth= 0.47"  
Routed to Pond 13P : bio-retention basin #4a

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Type II 24-hr 2-Year Rainfall=3.36"

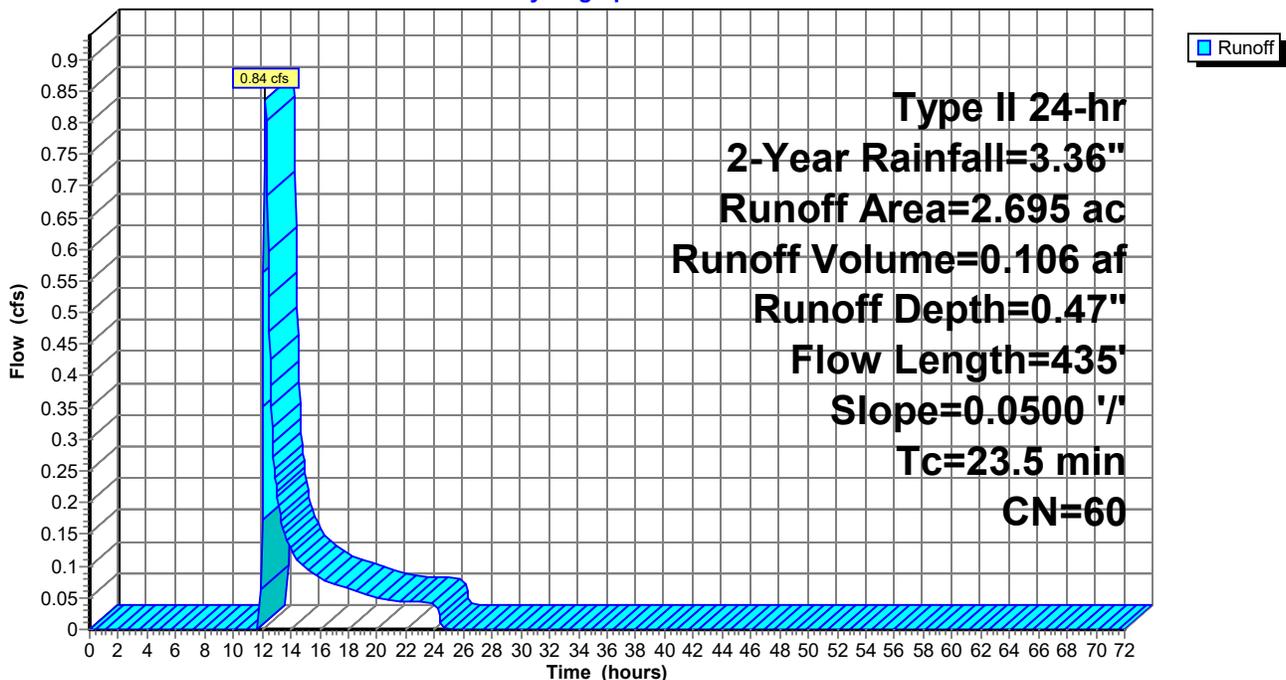
Area (ac)	CN	Description
1.896	61	>75% Grass cover, Good, HSG B
0.799	58	Meadow, non-grazed, HSG B
2.695	60	Weighted Average
2.695		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.5	150	0.0500	0.12		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.23"
3.0	285	0.0500	1.57		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
23.5	435	Total			

**Subcatchment 12S: bio-retention basin #4a (BMP #9)**

Hydrograph



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Post BMPs 9-10

Type II 24-hr 2-Year Rainfall=3.36"

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**Summary for Subcatchment 17S: SEEPAGE BED #4b (BMP #10)**

Runoff = 6.30 cfs @ 11.96 hrs, Volume= 0.340 af, Depth= 2.91"  
 Routed to Pond 15P : seepage pit with chambers #4b

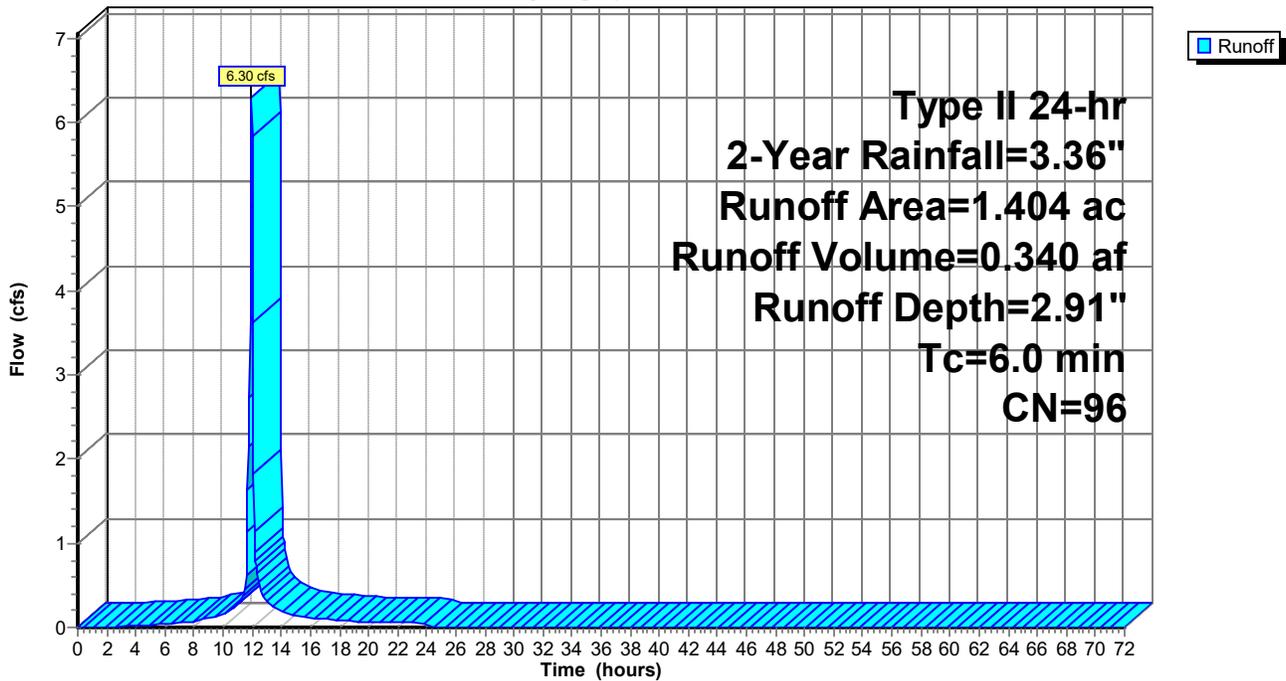
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Type II 24-hr 2-Year Rainfall=3.36"

Area (ac)	CN	Description
1.312	98	Paved parking & roofs
0.092	74	>75% Grass cover, Good, HSG C
1.404	96	Weighted Average
0.092		6.55% Pervious Area
1.312		93.45% Impervious Area

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

**Subcatchment 17S: SEEPAGE BED #4b (BMP #10)**

Hydrograph



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Post BMPs 9-10  
Type II 24-hr 2-Year Rainfall=3.36"

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**Summary for Subcatchment 34S: SWL #4**

Runoff = 2.00 cfs @ 12.10 hrs, Volume= 0.159 af, Depth= 0.64"  
Routed to Reach 23R : SWL-4

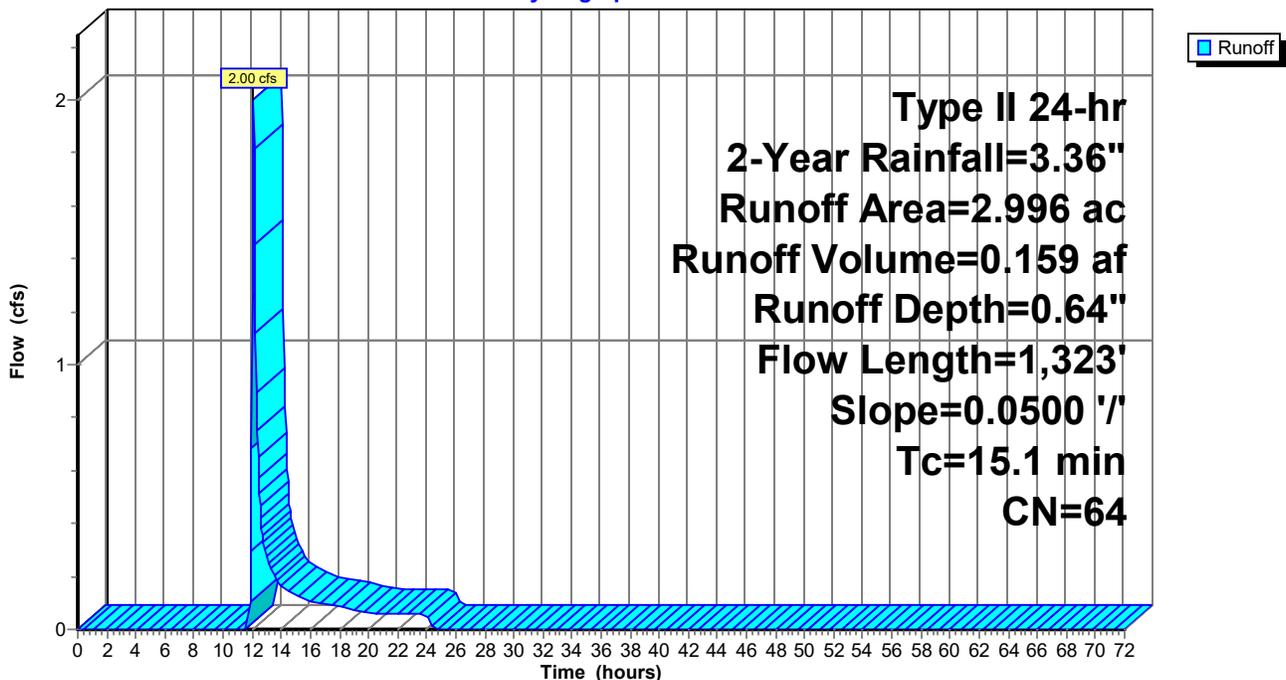
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Type II 24-hr 2-Year Rainfall=3.36"

Area (ac)	CN	Description
2.296	61	>75% Grass cover, Good, HSG B
0.700	74	>75% Grass cover, Good, HSG C
2.996	64	Weighted Average
2.996		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	150	0.0500	0.27		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.23"
5.8	1,173	0.0500	3.35		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
15.1	1,323	Total			

**Subcatchment 34S: SWL #4**

Hydrograph



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Type II 24-hr 2-Year Rainfall=3.36"

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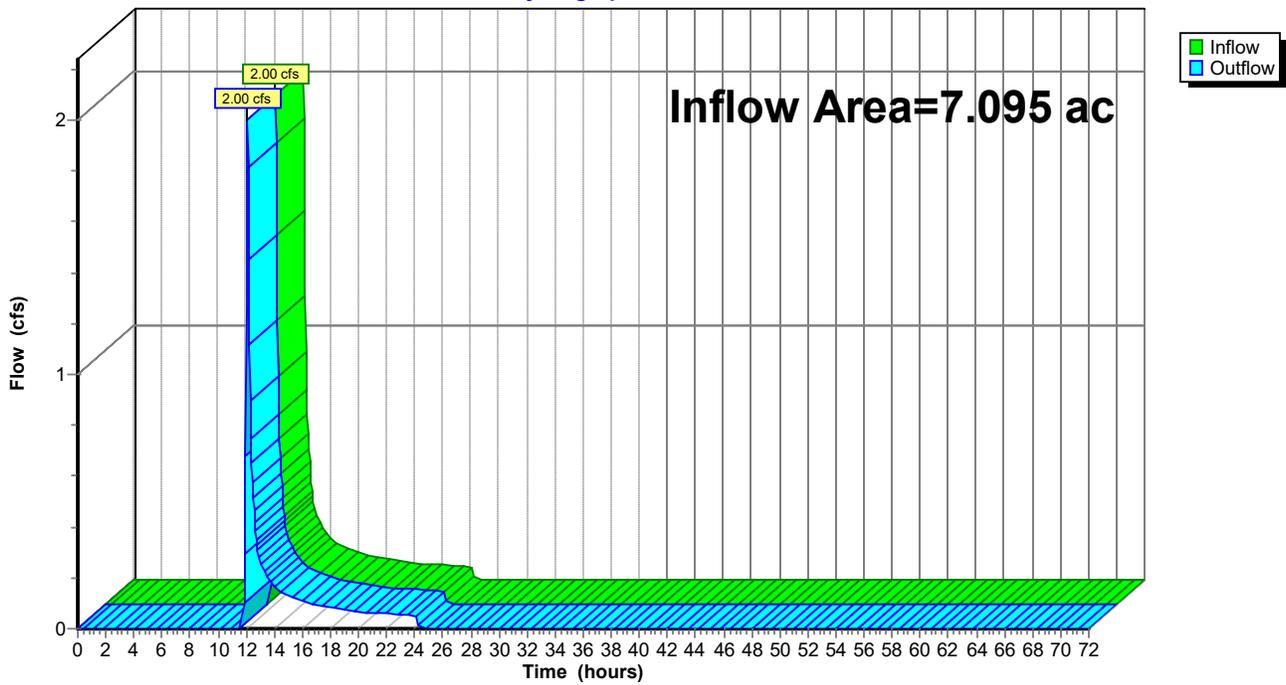
**Summary for Reach 23R: SWL-4**

Inflow Area = 7.095 ac, 18.49% Impervious, Inflow Depth = 0.27" for 2-Year event  
Inflow = 2.00 cfs @ 12.10 hrs, Volume= 0.159 af  
Outflow = 2.00 cfs @ 12.10 hrs, Volume= 0.159 af, Atten= 0%, Lag= 0.0 min  
Routed to Link 37L : Discharge 001

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

**Reach 23R: SWL-4**

Hydrograph



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Post BMPs 9-10  
Type II 24-hr 2-Year Rainfall=3.36"

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**Summary for Pond 13P: bio-retention basin #4a**

Inflow Area = 2.695 ac, 0.00% Impervious, Inflow Depth = 0.47" for 2-Year event  
 Inflow = 0.84 cfs @ 12.23 hrs, Volume= 0.106 af  
 Outflow = 0.11 cfs @ 14.48 hrs, Volume= 0.106 af, Atten= 87%, Lag= 134.8 min  
 Discarded = 0.11 cfs @ 14.48 hrs, Volume= 0.106 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach 23R : SWL-4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1,892.27' @ 14.48 hrs Surf.Area= 5,829 sf Storage= 1,560 cf

Plug-Flow detention time= 158.0 min calculated for 0.106 af (100% of inflow)  
 Center-of-Mass det. time= 157.9 min ( 1,086.6 - 928.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,892.00'	30,734 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,892.00	5,542	0	0
1,894.00	7,636	13,178	13,178
1,896.00	9,920	17,556	30,734

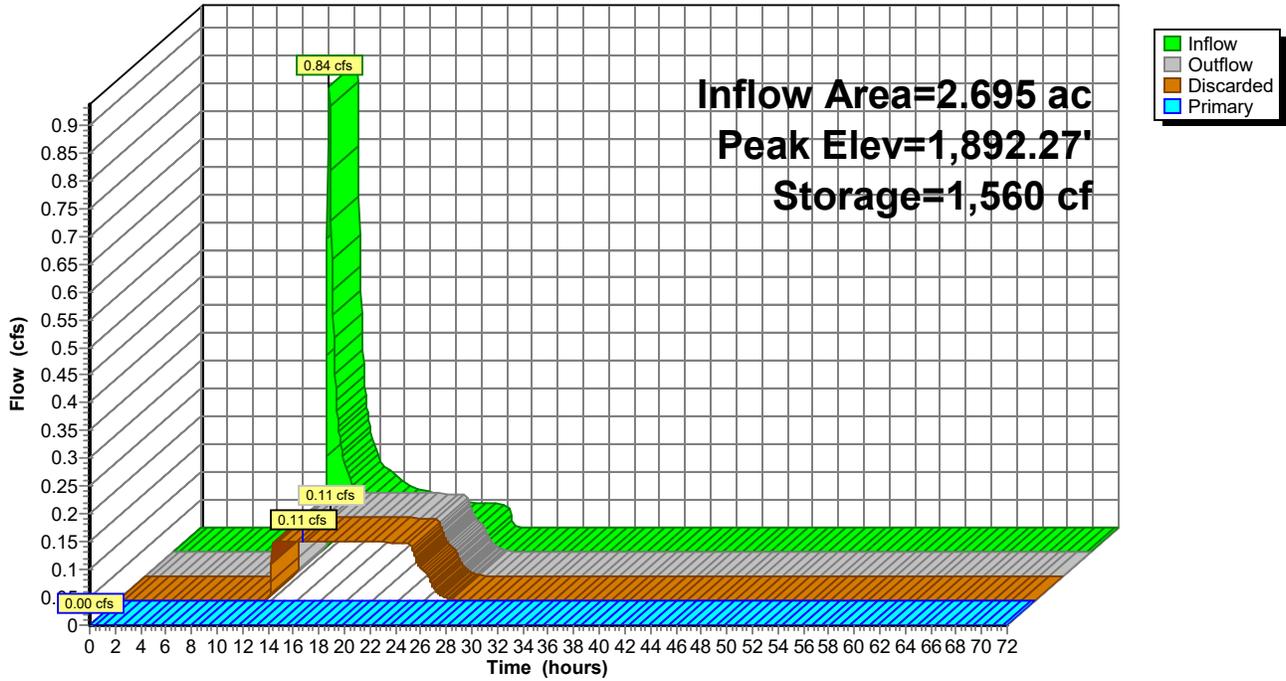
Device	Routing	Invert	Outlet Devices
#1	Discarded	1,892.00'	<b>0.800 in/hr Exfiltration over Surface area</b>
#2	Primary	1,894.00'	<b>20.0' long + 3.0 ' SideZ x 20.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.11 cfs @ 14.48 hrs HW=1,892.27' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.11 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=1,892.00' (Free Discharge)  
 ↑2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

**Pond 13P: bio-retention basin #4a**

Hydrograph



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Post BMPs 9-10

Type II 24-hr 2-Year Rainfall=3.36"

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## Summary for Pond 15P: seepage pit with chambers #4b

Inflow Area = 1.404 ac, 93.45% Impervious, Inflow Depth = 2.91" for 2-Year event  
 Inflow = 6.30 cfs @ 11.96 hrs, Volume= 0.340 af  
 Outflow = 0.22 cfs @ 10.90 hrs, Volume= 0.340 af, Atten= 96%, Lag= 0.0 min  
 Discarded = 0.22 cfs @ 10.90 hrs, Volume= 0.340 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach 23R : SWL-4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1,888.27' @ 13.57 hrs Surf.Area= 12,000 sf Storage= 7,393 cf

Plug-Flow detention time= 290.7 min calculated for 0.340 af (100% of inflow)  
 Center-of-Mass det. time= 290.7 min ( 1,059.8 - 769.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,887.00'	16,609 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 48,000 cf Overall - 6,477 cf Embedded = 41,523 cf x 40.0% Voids
#2	1,887.50'	6,477 cf	<b>Cultec R-360HD</b> x 175 Inside #1 Effective Size= 54.9"W x 36.0"H => 9.99 sf x 3.67'L = 36.6 cf Overall Size= 60.0"W x 36.0"H x 4.17'L with 0.50' Overlap 175 Chambers in 5 Rows Cap Storage= 6.5 cf x 2 x 5 rows = 64.6 cf
		23,086 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,887.00	12,000	0	0
1,891.00	12,000	48,000	48,000

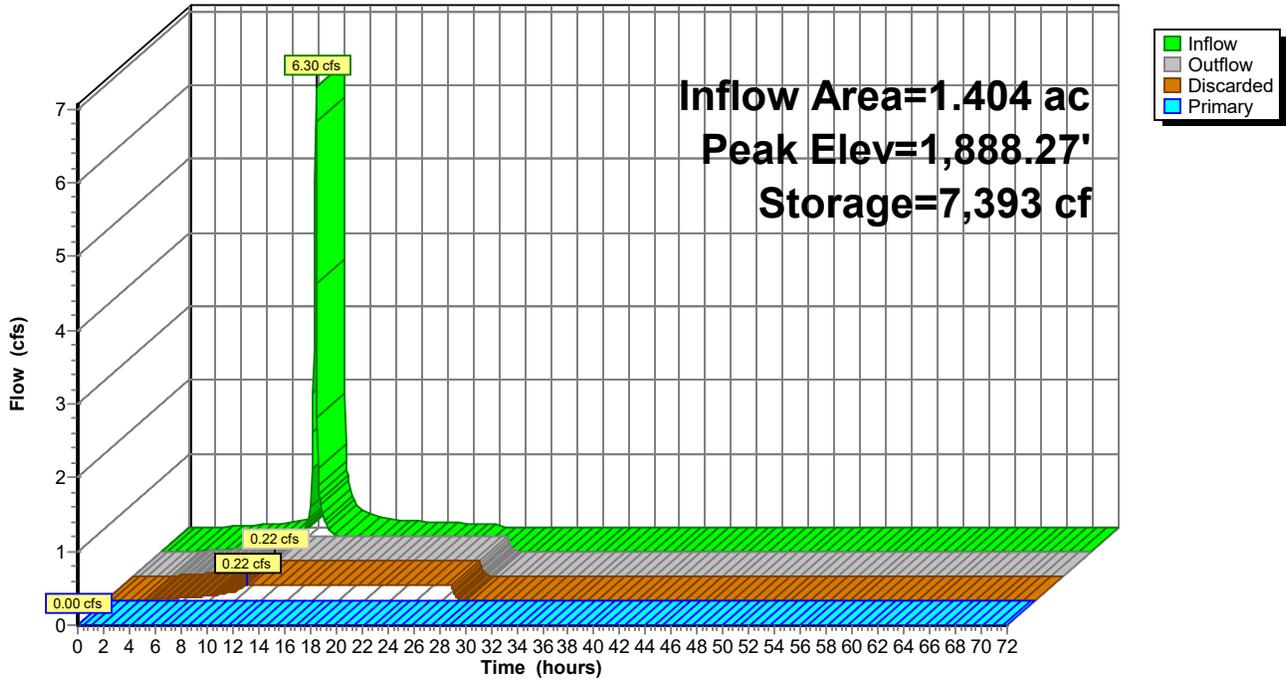
Device	Routing	Invert	Outlet Devices
#1	Primary	1,887.00'	<b>24.0" Round Culvert</b> L= 50.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 1,887.00' / 1,886.00' S= 0.0200 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	1,888.40'	<b>12.0" W x 6.0" H Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Discarded	1,887.00'	<b>0.800 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.22 cfs @ 10.90 hrs HW=1,887.04' (Free Discharge)  
 ↳ **3=Exfiltration** (Exfiltration Controls 0.22 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=1,887.00' (Free Discharge)  
 ↳ **1=Culvert** ( Controls 0.00 cfs)  
 ↳ **2=Orifice/Grate** ( Controls 0.00 cfs)

**Pond 15P: seepage pit with chambers #4b**

Hydrograph



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Post BMPs 9-10  
 Type II 24-hr 10-Year Rainfall=5.28"  
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**Summary for Subcatchment 12S: bio-retention basin #4a (BMP #9)**

Runoff = 3.61 cfs @ 12.19 hrs, Volume= 0.330 af, Depth= 1.47"  
 Routed to Pond 13P : bio-retention basin #4a

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Type II 24-hr 10-Year Rainfall=5.28"

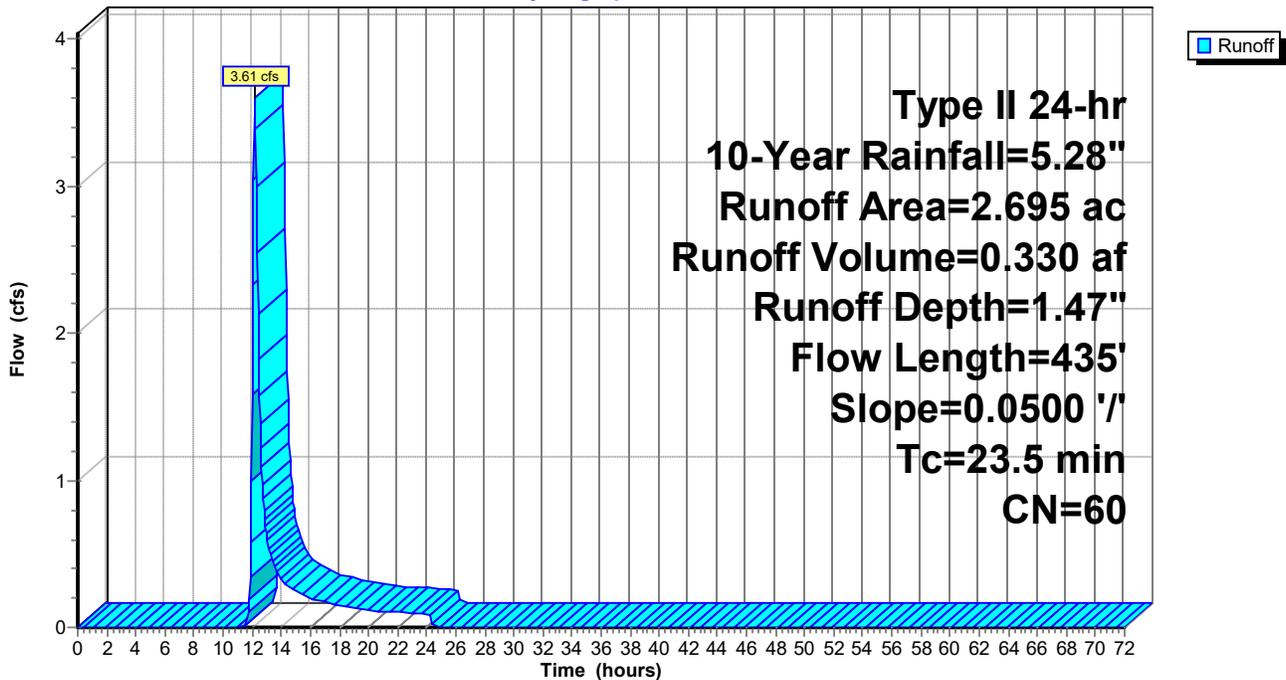
Area (ac)	CN	Description
1.896	61	>75% Grass cover, Good, HSG B
0.799	58	Meadow, non-grazed, HSG B
2.695	60	Weighted Average
2.695		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.5	150	0.0500	0.12		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.23"
3.0	285	0.0500	1.57		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
23.5	435	Total			

**Subcatchment 12S: bio-retention basin #4a (BMP #9)**

Hydrograph



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Post BMPs 9-10

Type II 24-hr 10-Year Rainfall=5.28"

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**Summary for Subcatchment 17S: SEEPAGE BED #4b (BMP #10)**

Runoff = 10.13 cfs @ 11.96 hrs, Volume= 0.563 af, Depth= 4.81"  
 Routed to Pond 15P : seepage pit with chambers #4b

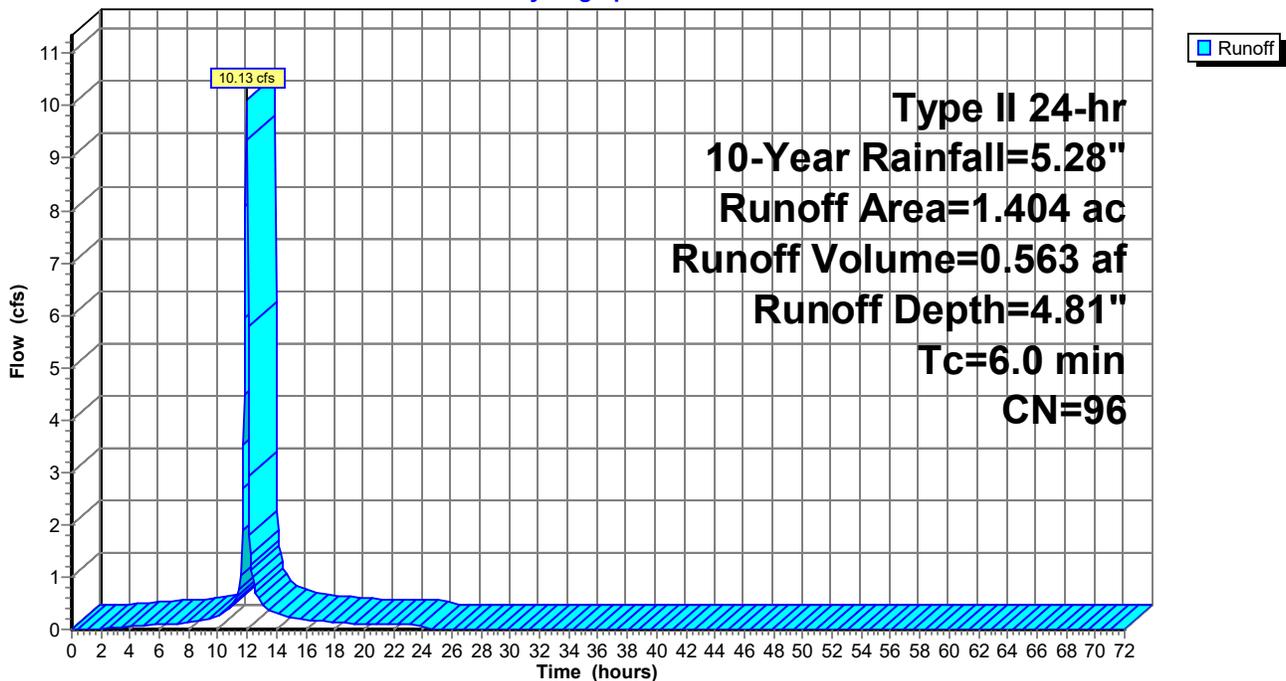
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Type II 24-hr 10-Year Rainfall=5.28"

Area (ac)	CN	Description
1.312	98	Paved parking & roofs
0.092	74	>75% Grass cover, Good, HSG C
1.404	96	Weighted Average
0.092		6.55% Pervious Area
1.312		93.45% Impervious Area

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

**Subcatchment 17S: SEEPAGE BED #4b (BMP #10)**

Hydrograph



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Type II 24-hr 10-Year Rainfall=5.28"

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**Summary for Subcatchment 34S: SWL #4**

Runoff = 6.53 cfs @ 12.08 hrs, Volume= 0.441 af, Depth= 1.77"  
 Routed to Reach 23R : SWL-4

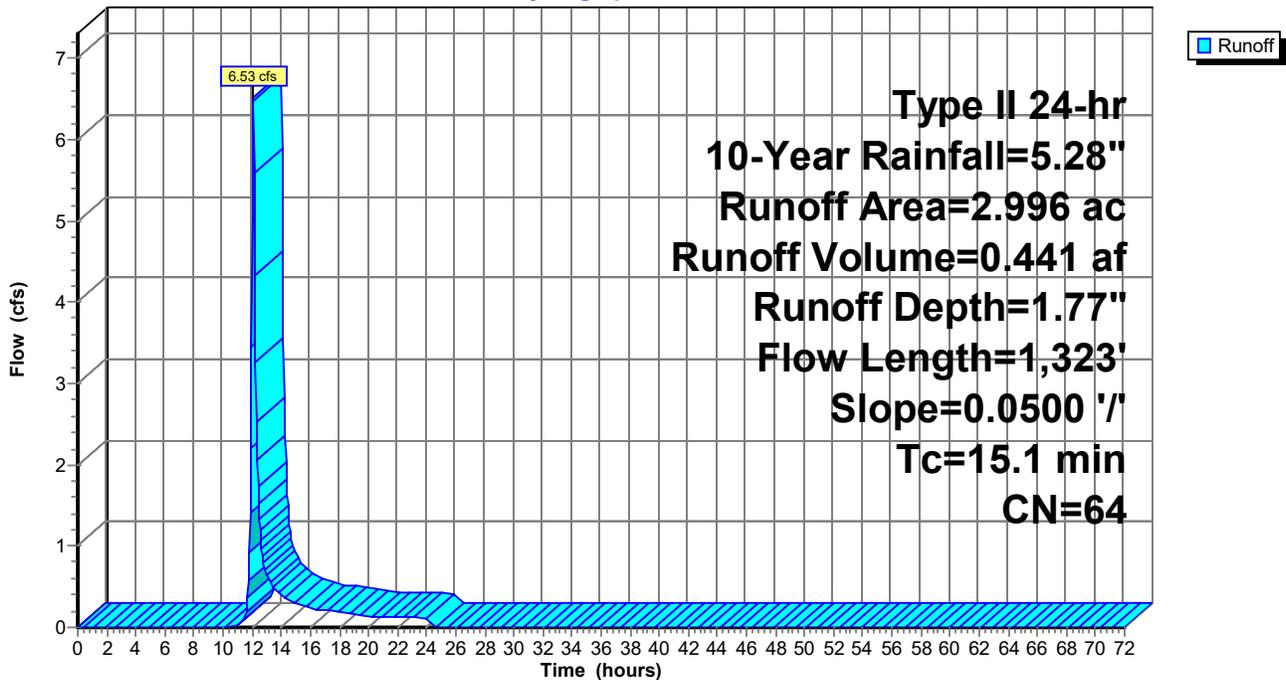
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Type II 24-hr 10-Year Rainfall=5.28"

Area (ac)	CN	Description
2.296	61	>75% Grass cover, Good, HSG B
0.700	74	>75% Grass cover, Good, HSG C
2.996	64	Weighted Average
2.996		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	150	0.0500	0.27		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.23"
5.8	1,173	0.0500	3.35		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
15.1	1,323	Total			

**Subcatchment 34S: SWL #4**

Hydrograph



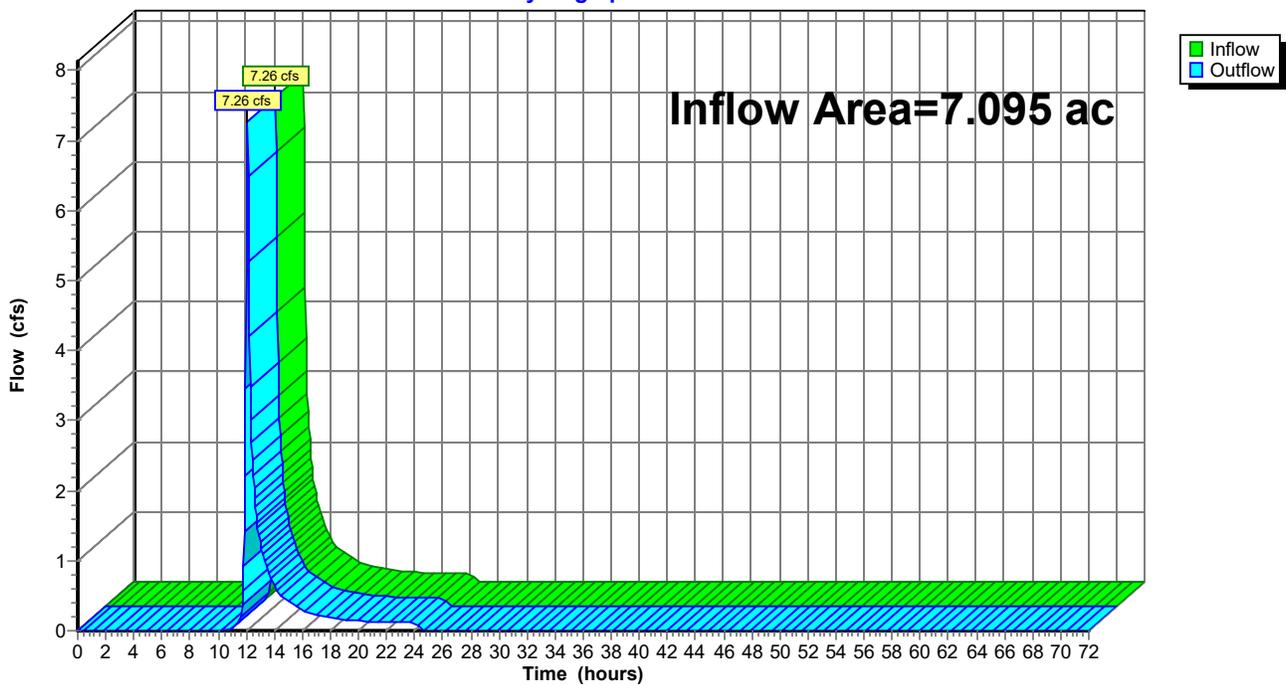
### Summary for Reach 23R: SWL-4

Inflow Area = 7.095 ac, 18.49% Impervious, Inflow Depth = 0.95" for 10-Year event  
Inflow = 7.26 cfs @ 12.09 hrs, Volume= 0.560 af  
Outflow = 7.26 cfs @ 12.09 hrs, Volume= 0.560 af, Atten= 0%, Lag= 0.0 min  
Routed to Link 37L : Discharge 001

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

### Reach 23R: SWL-4

Hydrograph



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Post BMPs 9-10

Type II 24-hr 10-Year Rainfall=5.28"

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## Summary for Pond 13P: bio-retention basin #4a

Inflow Area = 2.695 ac, 0.00% Impervious, Inflow Depth = 1.47" for 10-Year event  
 Inflow = 3.61 cfs @ 12.19 hrs, Volume= 0.330 af  
 Outflow = 0.13 cfs @ 19.29 hrs, Volume= 0.330 af, Atten= 96%, Lag= 425.7 min  
 Discarded = 0.13 cfs @ 19.29 hrs, Volume= 0.330 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach 23R : SWL-4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1,893.43' @ 19.29 hrs Surf.Area= 7,042 sf Storage= 9,017 cf

Plug-Flow detention time= 783.1 min calculated for 0.329 af (100% of inflow)  
 Center-of-Mass det. time= 783.5 min ( 1,667.9 - 884.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,892.00'	30,734 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,892.00	5,542	0	0
1,894.00	7,636	13,178	13,178
1,896.00	9,920	17,556	30,734

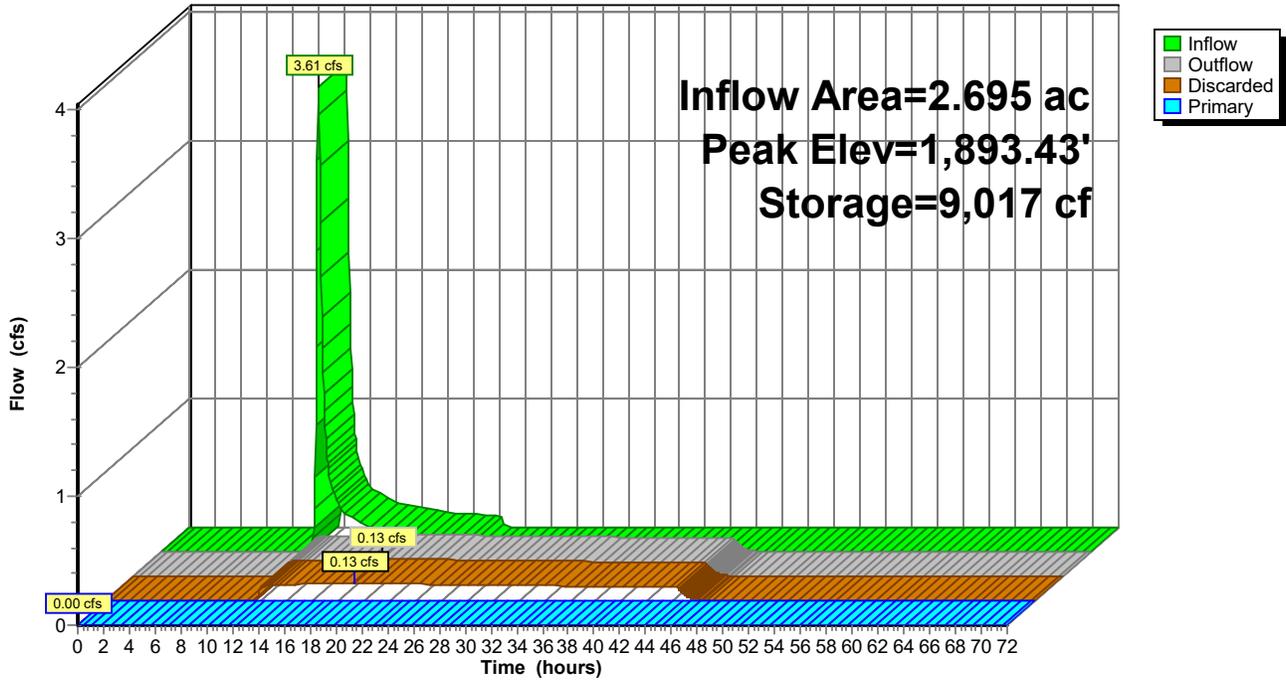
Device	Routing	Invert	Outlet Devices
#1	Discarded	1,892.00'	<b>0.800 in/hr Exfiltration over Surface area</b>
#2	Primary	1,894.00'	<b>20.0' long + 3.0 ' SideZ x 20.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.13 cfs @ 19.29 hrs HW=1,893.43' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.13 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=1,892.00' (Free Discharge)  
 ↑2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

**Pond 13P: bio-retention basin #4a**

Hydrograph



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Post BMPs 9-10

Type II 24-hr 10-Year Rainfall=5.28"

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## Summary for Pond 15P: seepage pit with chambers #4b

Inflow Area = 1.404 ac, 93.45% Impervious, Inflow Depth = 4.81" for 10-Year event  
 Inflow = 10.13 cfs @ 11.96 hrs, Volume= 0.563 af  
 Outflow = 1.18 cfs @ 12.28 hrs, Volume= 0.563 af, Atten= 88%, Lag= 19.3 min  
 Discarded = 0.22 cfs @ 9.90 hrs, Volume= 0.443 af  
 Primary = 0.96 cfs @ 12.28 hrs, Volume= 0.119 af  
 Routed to Reach 23R : SWL-4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1,888.85' @ 12.28 hrs Surf.Area= 12,000 sf Storage= 11,101 cf

Plug-Flow detention time= 287.2 min calculated for 0.562 af (100% of inflow)  
 Center-of-Mass det. time= 287.3 min ( 1,044.6 - 757.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,887.00'	16,609 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 48,000 cf Overall - 6,477 cf Embedded = 41,523 cf x 40.0% Voids
#2	1,887.50'	6,477 cf	<b>Cultec R-360HD</b> x 175 Inside #1 Effective Size= 54.9"W x 36.0"H => 9.99 sf x 3.67'L = 36.6 cf Overall Size= 60.0"W x 36.0"H x 4.17'L with 0.50' Overlap 175 Chambers in 5 Rows Cap Storage= 6.5 cf x 2 x 5 rows = 64.6 cf
		23,086 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,887.00	12,000	0	0
1,891.00	12,000	48,000	48,000

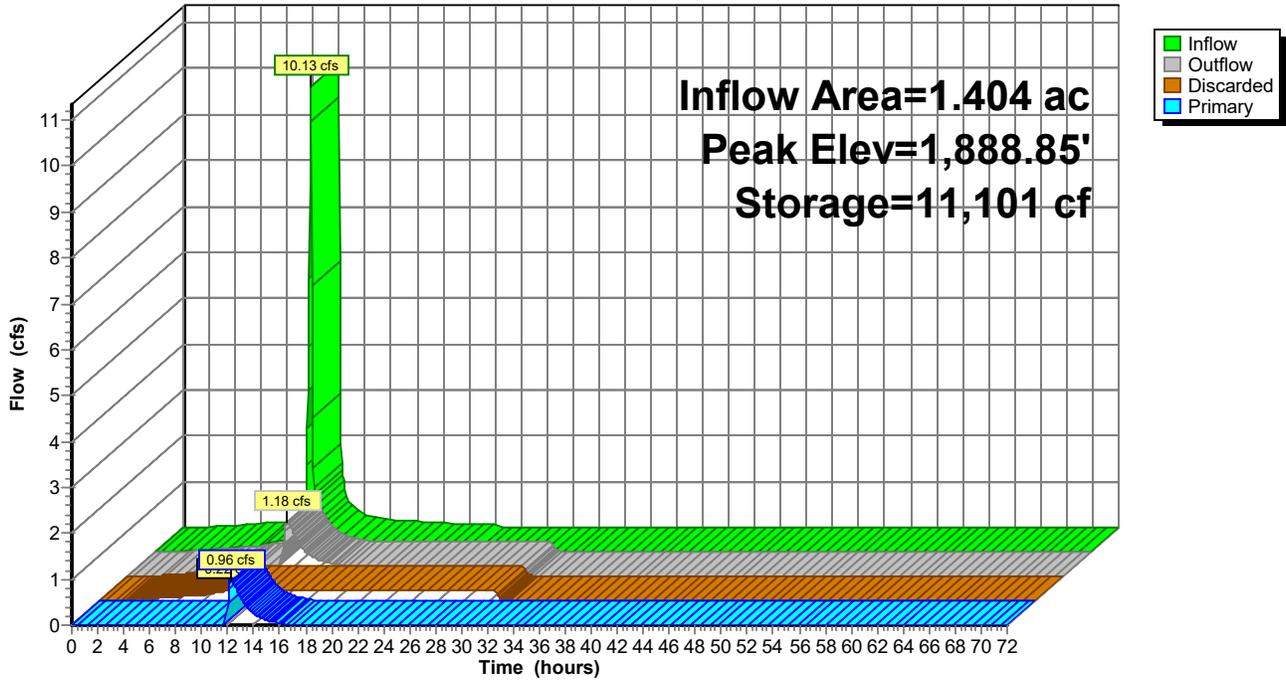
Device	Routing	Invert	Outlet Devices
#1	Primary	1,887.00'	<b>24.0" Round Culvert</b> L= 50.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 1,887.00' / 1,886.00' S= 0.0200 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	1,888.40'	<b>12.0" W x 6.0" H Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Discarded	1,887.00'	<b>0.800 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.22 cfs @ 9.90 hrs HW=1,887.04' (Free Discharge)  
 ↳ **3=Exfiltration** (Exfiltration Controls 0.22 cfs)

**Primary OutFlow** Max=0.96 cfs @ 12.28 hrs HW=1,888.85' (Free Discharge)  
 ↳ **1=Culvert** (Passes 0.96 cfs of 12.37 cfs potential flow)  
 ↳ **2=Orifice/Grate** (Orifice Controls 0.96 cfs @ 2.14 fps)

**Pond 15P: seepage pit with chambers #4b**

Hydrograph



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Post BMPs 9-10

Type II 24-hr 50-Year Rainfall=7.20"

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**Summary for Subcatchment 12S: bio-retention basin #4a (BMP #9)**

Runoff = 7.21 cfs @ 12.18 hrs, Volume= 0.617 af, Depth= 2.75"  
 Routed to Pond 13P : bio-retention basin #4a

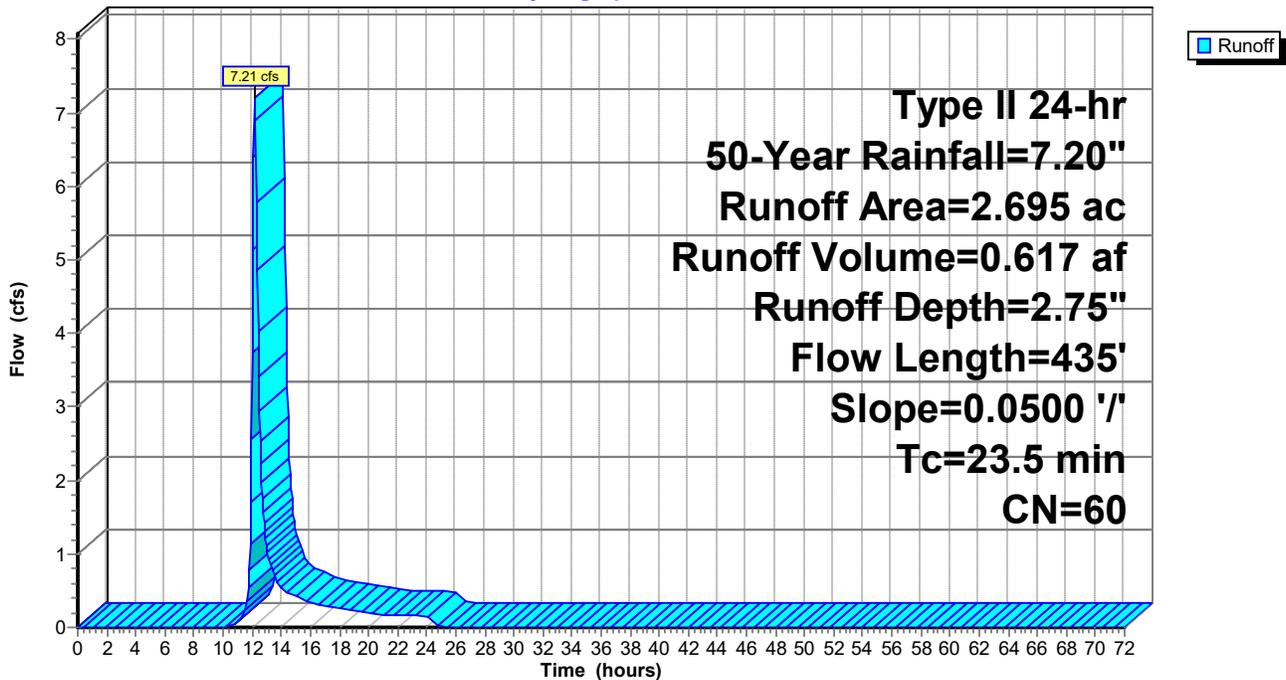
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Type II 24-hr 50-Year Rainfall=7.20"

Area (ac)	CN	Description
1.896	61	>75% Grass cover, Good, HSG B
0.799	58	Meadow, non-grazed, HSG B
2.695	60	Weighted Average
2.695		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.5	150	0.0500	0.12		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.23"
3.0	285	0.0500	1.57		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
23.5	435	Total			

**Subcatchment 12S: bio-retention basin #4a (BMP #9)**

Hydrograph



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Type II 24-hr 50-Year Rainfall=7.20"

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**Summary for Subcatchment 17S: SEEPAGE BED #4b (BMP #10)**

Runoff = 13.92 cfs @ 11.96 hrs, Volume= 0.787 af, Depth= 6.72"  
 Routed to Pond 15P : seepage pit with chambers #4b

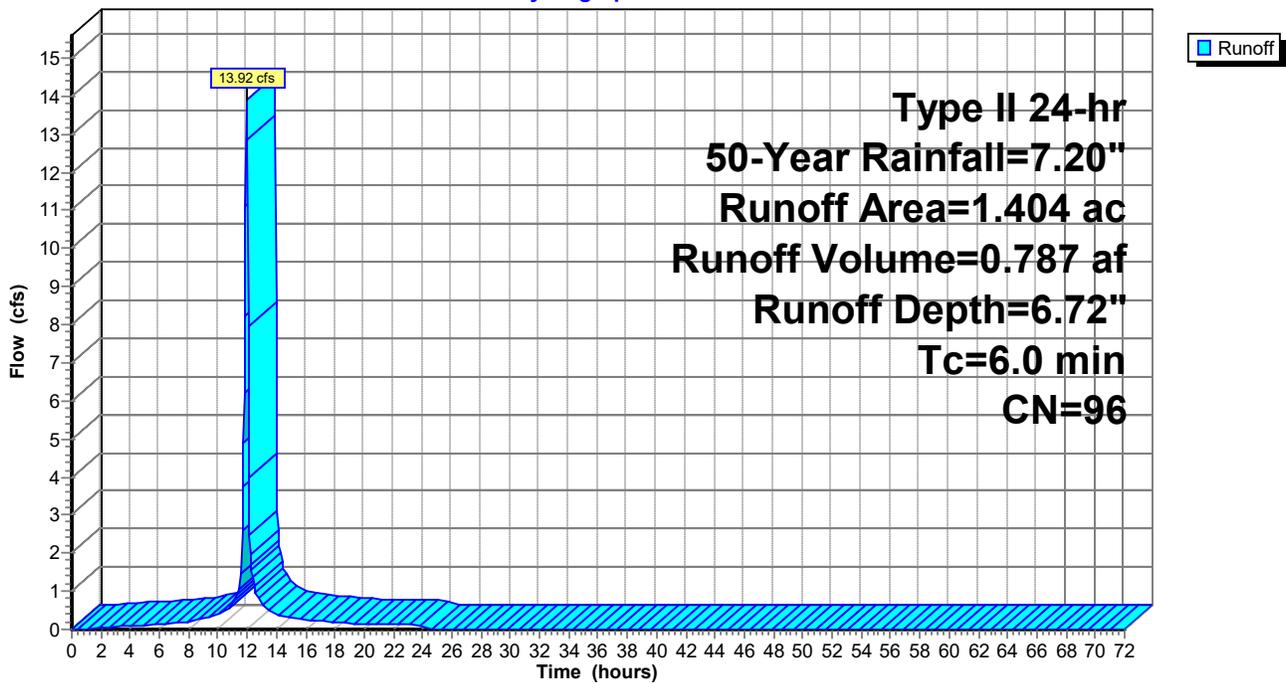
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Type II 24-hr 50-Year Rainfall=7.20"

Area (ac)	CN	Description
1.312	98	Paved parking & roofs
0.092	74	>75% Grass cover, Good, HSG C
1.404	96	Weighted Average
0.092		6.55% Pervious Area
1.312		93.45% Impervious Area

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

**Subcatchment 17S: SEEPAGE BED #4b (BMP #10)**

Hydrograph



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Type II 24-hr 50-Year Rainfall=7.20"

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**Summary for Subcatchment 34S: SWL #4**

Runoff = 12.00 cfs @ 12.08 hrs, Volume= 0.788 af, Depth= 3.15"  
 Routed to Reach 23R : SWL-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Type II 24-hr 50-Year Rainfall=7.20"

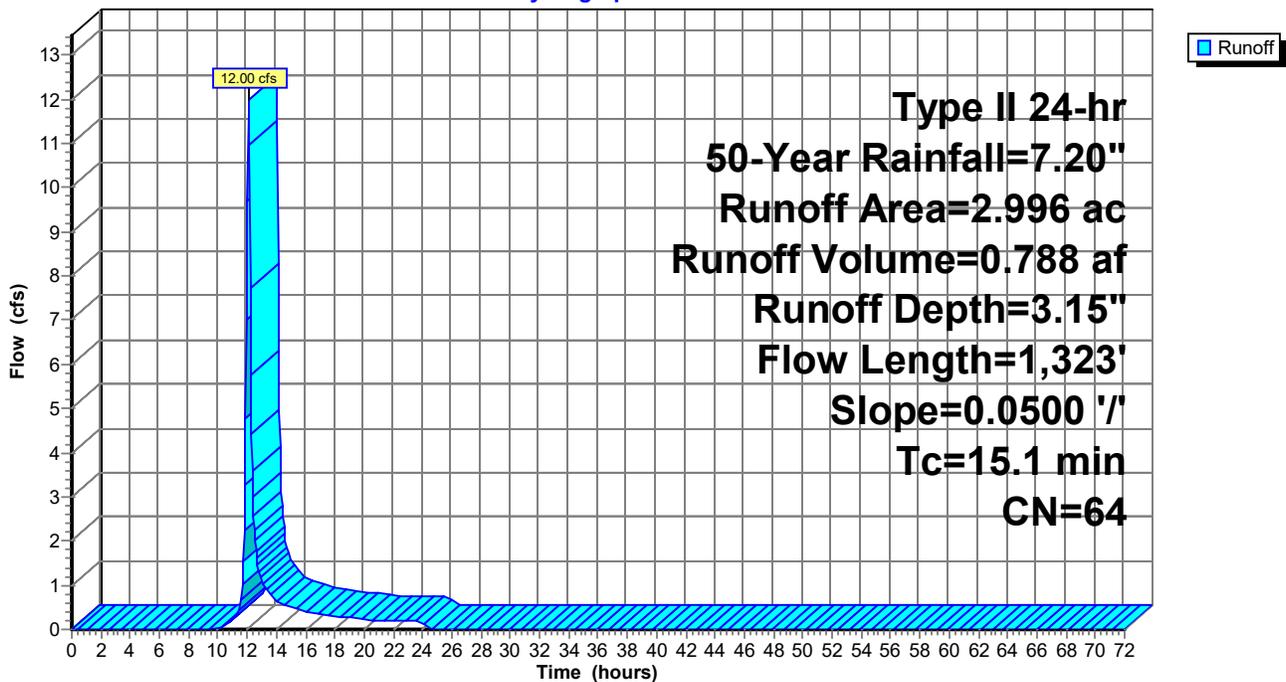
Area (ac)	CN	Description
2.296	61	>75% Grass cover, Good, HSG B
0.700	74	>75% Grass cover, Good, HSG C
2.996	64	Weighted Average
2.996		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	150	0.0500	0.27		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.23"
5.8	1,173	0.0500	3.35		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
15.1	1,323	Total			

**Subcatchment 34S: SWL #4**

Hydrograph



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Type II 24-hr 50-Year Rainfall=7.20"

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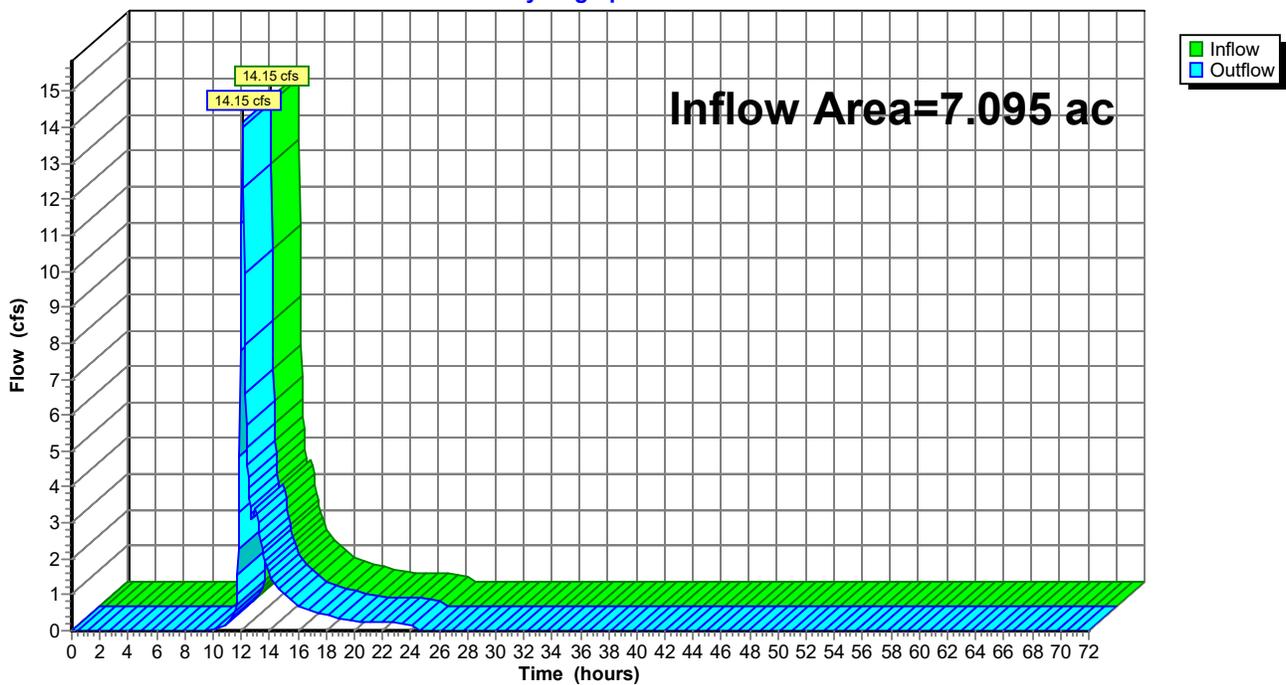
## Summary for Reach 23R: SWL-4

Inflow Area = 7.095 ac, 18.49% Impervious, Inflow Depth = 2.10" for 50-Year event  
Inflow = 14.15 cfs @ 12.08 hrs, Volume= 1.239 af  
Outflow = 14.15 cfs @ 12.08 hrs, Volume= 1.239 af, Atten= 0%, Lag= 0.0 min  
Routed to Link 37L : Discharge 001

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

### Reach 23R: SWL-4

Hydrograph



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Type II 24-hr 50-Year Rainfall=7.20"

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## Summary for Pond 13P: bio-retention basin #4a

Inflow Area = 2.695 ac, 0.00% Impervious, Inflow Depth = 2.75" for 50-Year event  
 Inflow = 7.21 cfs @ 12.18 hrs, Volume= 0.617 af  
 Outflow = 1.00 cfs @ 13.06 hrs, Volume= 0.617 af, Atten= 86%, Lag= 52.6 min  
 Discarded = 0.14 cfs @ 13.06 hrs, Volume= 0.454 af  
 Primary = 0.86 cfs @ 13.06 hrs, Volume= 0.163 af  
 Routed to Reach 23R : SWL-4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1,894.06' @ 13.06 hrs Surf.Area= 7,706 sf Storage= 13,651 cf

Plug-Flow detention time= 778.6 min calculated for 0.616 af (100% of inflow)  
 Center-of-Mass det. time= 779.4 min ( 1,644.2 - 864.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,892.00'	30,734 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,892.00	5,542	0	0
1,894.00	7,636	13,178	13,178
1,896.00	9,920	17,556	30,734

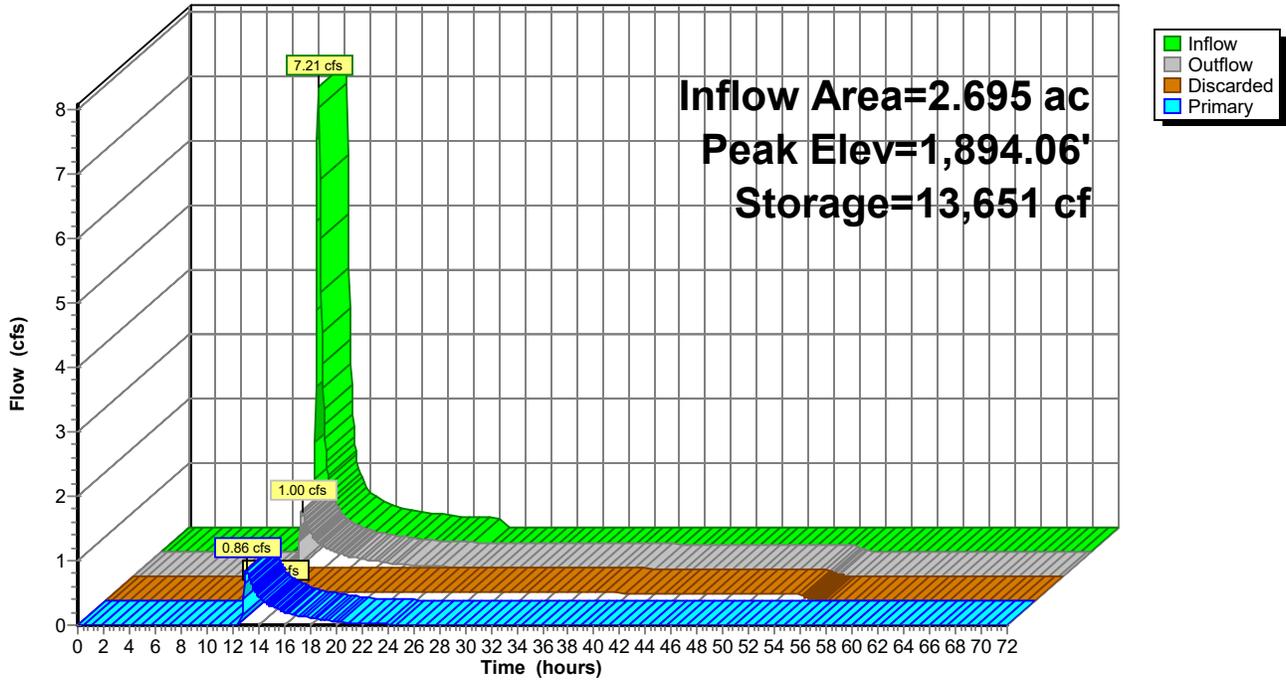
Device	Routing	Invert	Outlet Devices
#1	Discarded	1,892.00'	<b>0.800 in/hr Exfiltration over Surface area</b>
#2	Primary	1,894.00'	<b>20.0' long + 3.0 ' SideZ x 20.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.14 cfs @ 13.06 hrs HW=1,894.06' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.14 cfs)

**Primary OutFlow** Max=0.82 cfs @ 13.06 hrs HW=1,894.06' (Free Discharge)  
 ↑2=Broad-Crested Rectangular Weir (Weir Controls 0.82 cfs @ 0.66 fps)

**Pond 13P: bio-retention basin #4a**

Hydrograph



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Type II 24-hr 50-Year Rainfall=7.20"

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**Summary for Pond 15P: seepage pit with chambers #4b**

Inflow Area = 1.404 ac, 93.45% Impervious, Inflow Depth = 6.72" for 50-Year event  
 Inflow = 13.92 cfs @ 11.96 hrs, Volume= 0.787 af  
 Outflow = 2.45 cfs @ 12.16 hrs, Volume= 0.787 af, Atten= 82%, Lag= 12.1 min  
 Discarded = 0.22 cfs @ 8.60 hrs, Volume= 0.498 af  
 Primary = 2.23 cfs @ 12.16 hrs, Volume= 0.288 af  
 Routed to Reach 23R : SWL-4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1,889.51' @ 12.16 hrs Surf.Area= 12,000 sf Storage= 15,212 cf

Plug-Flow detention time= 244.7 min calculated for 0.786 af (100% of inflow)  
 Center-of-Mass det. time= 244.9 min ( 995.3 - 750.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,887.00'	16,609 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 48,000 cf Overall - 6,477 cf Embedded = 41,523 cf x 40.0% Voids
#2	1,887.50'	6,477 cf	<b>Cultec R-360HD</b> x 175 Inside #1 Effective Size= 54.9"W x 36.0"H => 9.99 sf x 3.67'L = 36.6 cf Overall Size= 60.0"W x 36.0"H x 4.17'L with 0.50' Overlap 175 Chambers in 5 Rows Cap Storage= 6.5 cf x 2 x 5 rows = 64.6 cf
		23,086 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,887.00	12,000	0	0
1,891.00	12,000	48,000	48,000

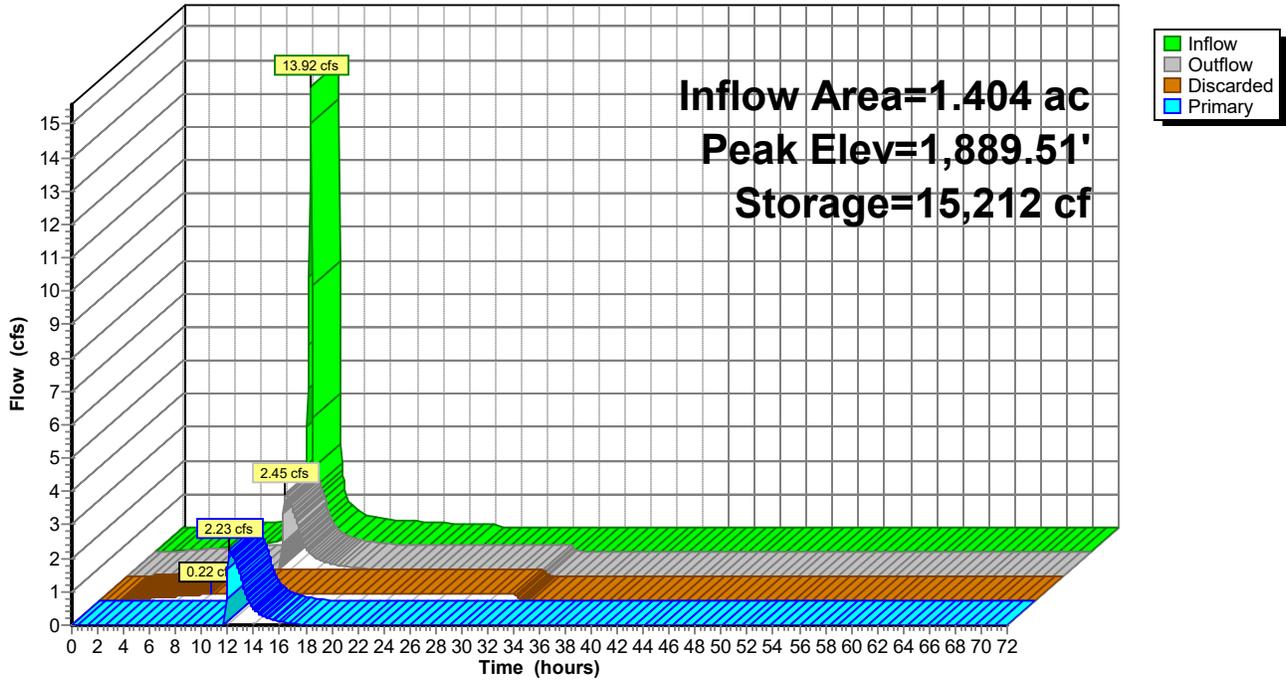
Device	Routing	Invert	Outlet Devices
#1	Primary	1,887.00'	<b>24.0" Round Culvert</b> L= 50.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 1,887.00' / 1,886.00' S= 0.0200 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	1,888.40'	<b>12.0" W x 6.0" H Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Discarded	1,887.00'	<b>0.800 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.22 cfs @ 8.60 hrs HW=1,887.04' (Free Discharge)  
 ↳ **3=Exfiltration** (Exfiltration Controls 0.22 cfs)

**Primary OutFlow** Max=2.22 cfs @ 12.16 hrs HW=1,889.51' (Free Discharge)  
 ↳ **1=Culvert** (Passes 2.22 cfs of 16.40 cfs potential flow)  
 ↳ **2=Orifice/Grate** (Orifice Controls 2.22 cfs @ 4.45 fps)

**Pond 15P: seepage pit with chambers #4b**

Hydrograph



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Post BMPs 9-10  
Type II 24-hr 100-Year Rainfall=8.40"

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**Summary for Subcatchment 12S: bio-retention basin #4a (BMP #9)**

Runoff = 9.73 cfs @ 12.17 hrs, Volume= 0.817 af, Depth= 3.64"  
Routed to Pond 13P : bio-retention basin #4a

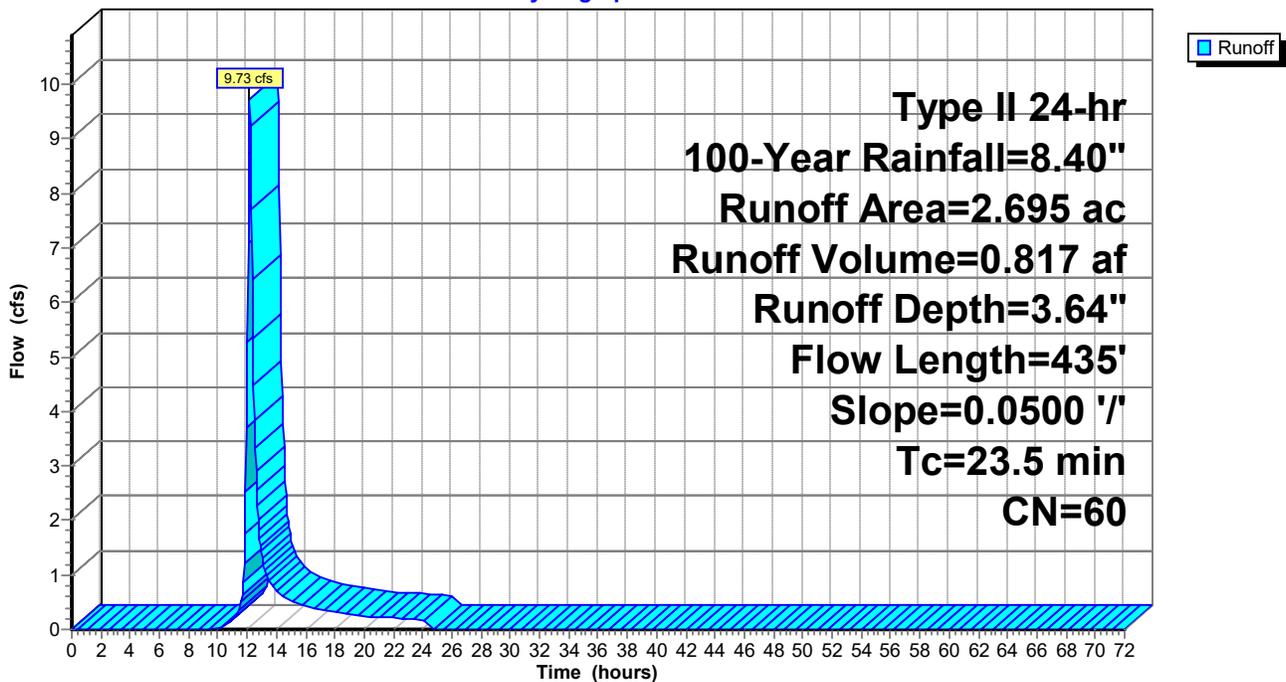
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Type II 24-hr 100-Year Rainfall=8.40"

Area (ac)	CN	Description
1.896	61	>75% Grass cover, Good, HSG B
0.799	58	Meadow, non-grazed, HSG B
2.695	60	Weighted Average
2.695		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.5	150	0.0500	0.12		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 3.23"
3.0	285	0.0500	1.57		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
23.5	435	Total			

**Subcatchment 12S: bio-retention basin #4a (BMP #9)**

Hydrograph



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Post BMPs 9-10

Type II 24-hr 100-Year Rainfall=8.40"

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**Summary for Subcatchment 17S: SEEPAGE BED #4b (BMP #10)**

Runoff = 16.29 cfs @ 11.96 hrs, Volume= 0.927 af, Depth= 7.92"  
 Routed to Pond 15P : seepage pit with chambers #4b

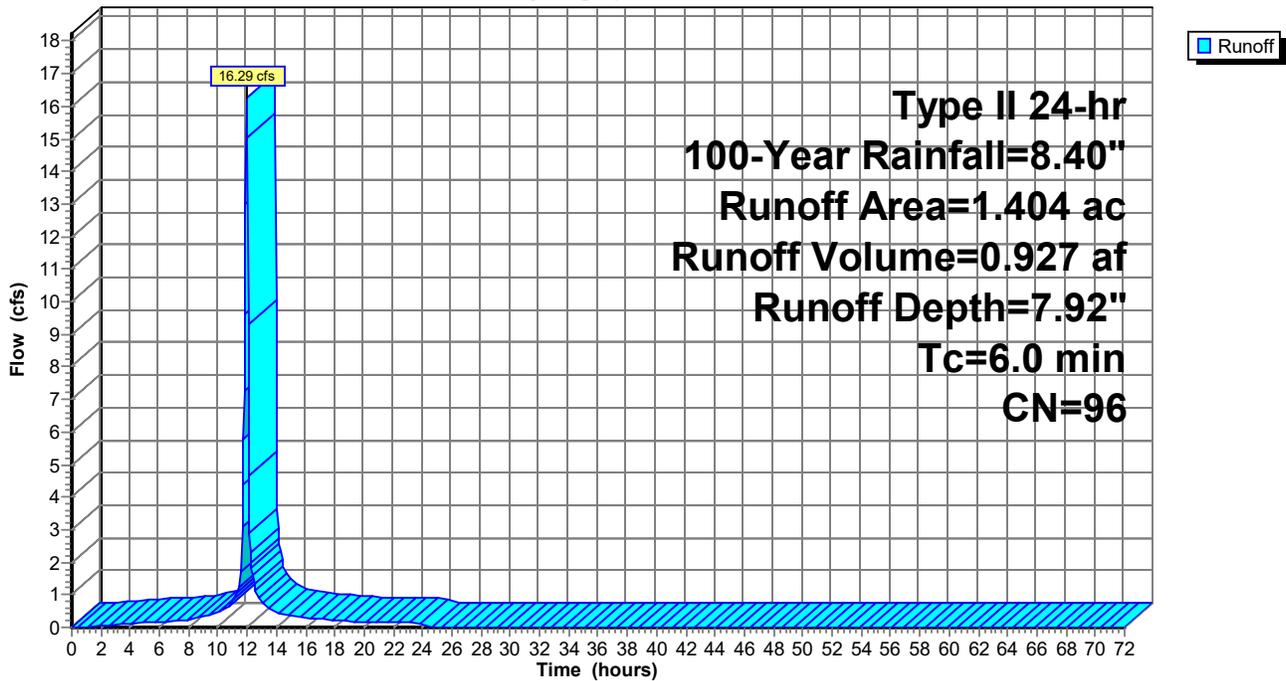
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Type II 24-hr 100-Year Rainfall=8.40"

Area (ac)	CN	Description
1.312	98	Paved parking & roofs
0.092	74	>75% Grass cover, Good, HSG C
1.404	96	Weighted Average
0.092		6.55% Pervious Area
1.312		93.45% Impervious Area

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

**Subcatchment 17S: SEEPAGE BED #4b (BMP #10)**

Hydrograph



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Type II 24-hr 100-Year Rainfall=8.40"

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**Summary for Subcatchment 34S: SWL #4**

Runoff = 15.72 cfs @ 12.07 hrs, Volume= 1.024 af, Depth= 4.10"  
 Routed to Reach 23R : SWL-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Type II 24-hr 100-Year Rainfall=8.40"

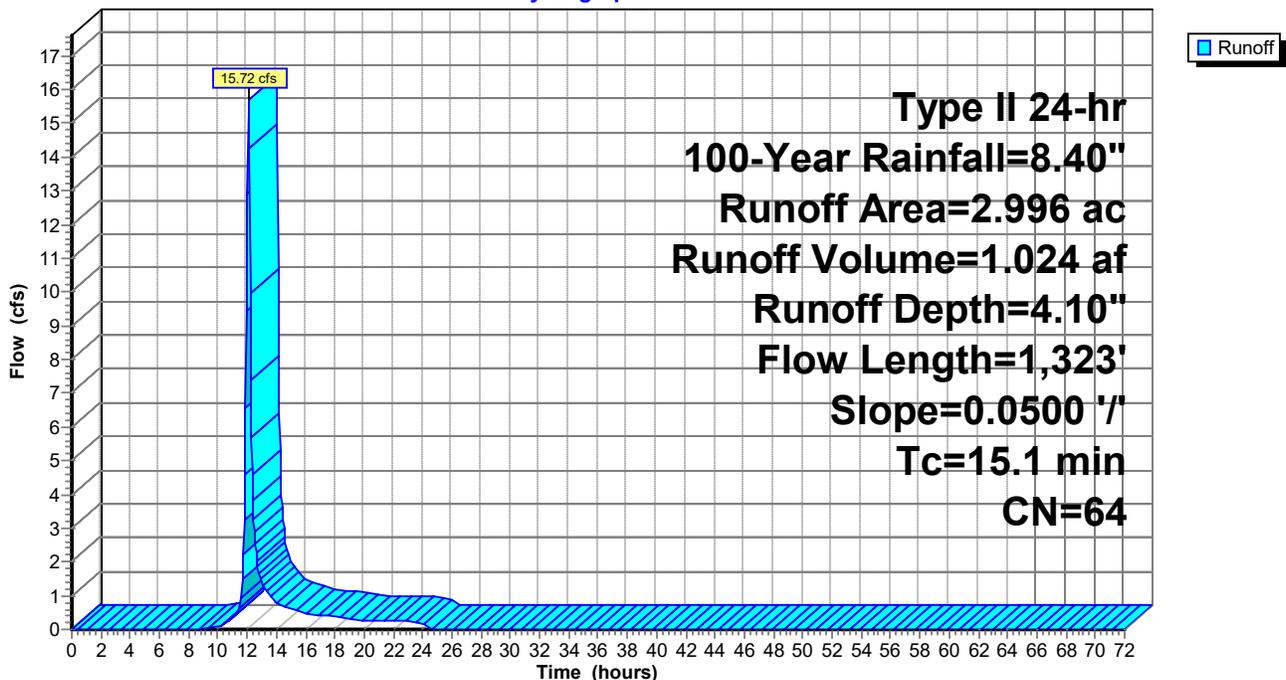
Area (ac)	CN	Description
2.296	61	>75% Grass cover, Good, HSG B
0.700	74	>75% Grass cover, Good, HSG C
2.996	64	Weighted Average
2.996		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	150	0.0500	0.27		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 3.23"
5.8	1,173	0.0500	3.35		<b>Shallow Concentrated Flow,</b> Grassed Waterway Kv= 15.0 fps
15.1	1,323	Total			

**Subcatchment 34S: SWL #4**

Hydrograph



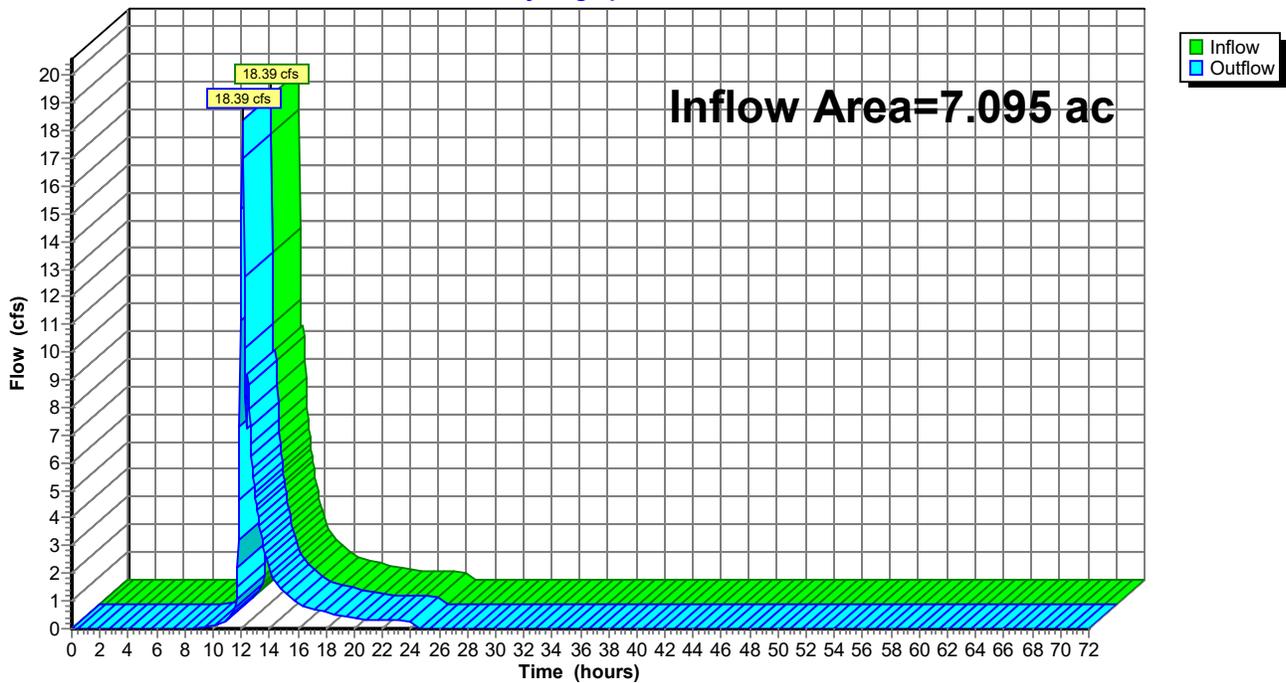
### Summary for Reach 23R: SWL-4

Inflow Area = 7.095 ac, 18.49% Impervious, Inflow Depth = 3.01" for 100-Year event  
Inflow = 18.39 cfs @ 12.08 hrs, Volume= 1.782 af  
Outflow = 18.39 cfs @ 12.08 hrs, Volume= 1.782 af, Atten= 0%, Lag= 0.0 min  
Routed to Link 37L : Discharge 001

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

### Reach 23R: SWL-4

Hydrograph



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Type II 24-hr 100-Year Rainfall=8.40"

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**Summary for Pond 13P: bio-retention basin #4a**

Inflow Area = 2.695 ac, 0.00% Impervious, Inflow Depth = 3.64" for 100-Year event  
 Inflow = 9.73 cfs @ 12.17 hrs, Volume= 0.817 af  
 Outflow = 3.87 cfs @ 12.51 hrs, Volume= 0.817 af, Atten= 60%, Lag= 20.1 min  
 Discarded = 0.14 cfs @ 12.51 hrs, Volume= 0.459 af  
 Primary = 3.73 cfs @ 12.51 hrs, Volume= 0.357 af  
 Routed to Reach 23R : SWL-4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1,894.17' @ 12.51 hrs Surf.Area= 7,826 sf Storage= 14,466 cf

Plug-Flow detention time= 595.4 min calculated for 0.817 af (100% of inflow)  
 Center-of-Mass det. time= 595.1 min ( 1,451.6 - 856.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,892.00'	30,734 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,892.00	5,542	0	0
1,894.00	7,636	13,178	13,178
1,896.00	9,920	17,556	30,734

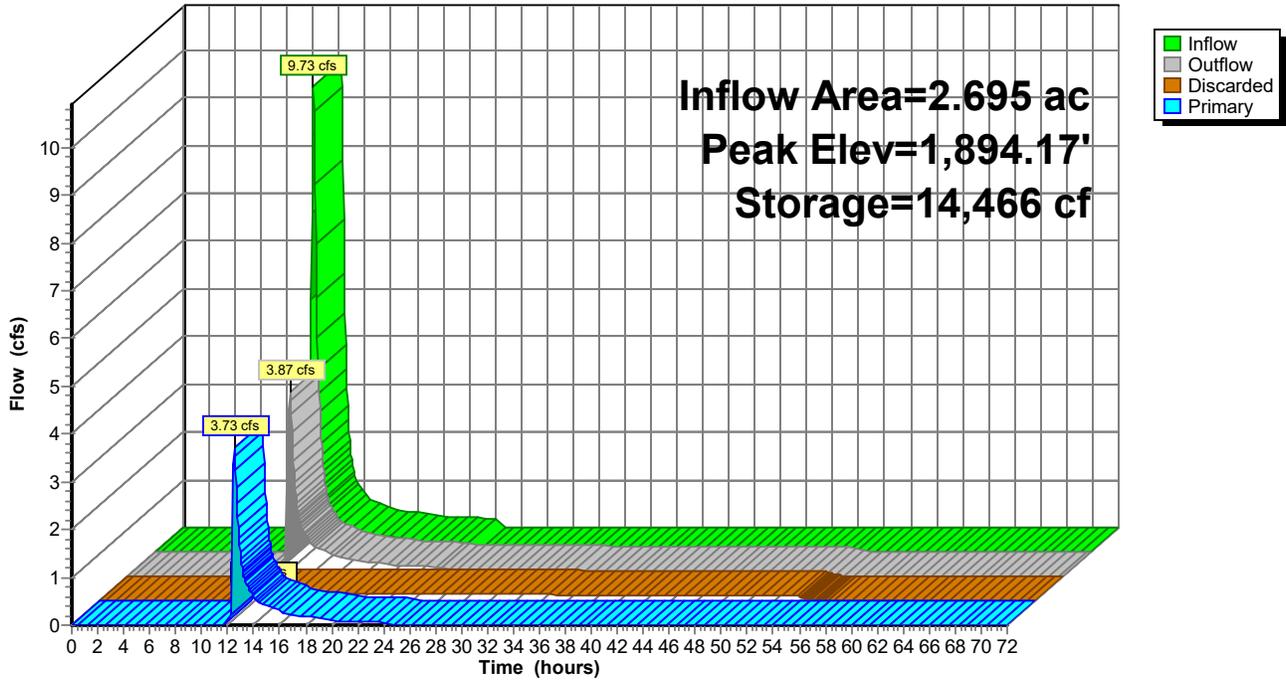
Device	Routing	Invert	Outlet Devices
#1	Discarded	1,892.00'	<b>0.800 in/hr Exfiltration over Surface area</b>
#2	Primary	1,894.00'	<b>20.0' long + 3.0 ' SideZ x 20.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Discarded OutFlow** Max=0.14 cfs @ 12.51 hrs HW=1,894.17' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.14 cfs)

**Primary OutFlow** Max=3.67 cfs @ 12.51 hrs HW=1,894.17' (Free Discharge)  
 ↑2=Broad-Crested Rectangular Weir (Weir Controls 3.67 cfs @ 1.08 fps)

**Pond 13P: bio-retention basin #4a**

Hydrograph



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Type II 24-hr 100-Year Rainfall=8.40"

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## Summary for Pond 15P: seepage pit with chambers #4b

Inflow Area = 1.404 ac, 93.45% Impervious, Inflow Depth = 7.92" for 100-Year event  
 Inflow = 16.29 cfs @ 11.96 hrs, Volume= 0.927 af  
 Outflow = 3.00 cfs @ 12.16 hrs, Volume= 0.927 af, Atten= 82%, Lag= 11.8 min  
 Discarded = 0.22 cfs @ 7.85 hrs, Volume= 0.526 af  
 Primary = 2.78 cfs @ 12.16 hrs, Volume= 0.400 af  
 Routed to Reach 23R : SWL-4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 1,889.99' @ 12.16 hrs Surf.Area= 12,000 sf Storage= 17,989 cf

Plug-Flow detention time= 227.6 min calculated for 0.926 af (100% of inflow)  
 Center-of-Mass det. time= 227.8 min ( 975.3 - 747.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	1,887.00'	16,609 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc) 48,000 cf Overall - 6,477 cf Embedded = 41,523 cf x 40.0% Voids
#2	1,887.50'	6,477 cf	<b>Cultec R-360HD</b> x 175 Inside #1 Effective Size= 54.9"W x 36.0"H => 9.99 sf x 3.67'L = 36.6 cf Overall Size= 60.0"W x 36.0"H x 4.17'L with 0.50' Overlap 175 Chambers in 5 Rows Cap Storage= 6.5 cf x 2 x 5 rows = 64.6 cf
		23,086 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,887.00	12,000	0	0
1,891.00	12,000	48,000	48,000

Device	Routing	Invert	Outlet Devices
#1	Primary	1,887.00'	<b>24.0" Round Culvert</b> L= 50.0' CPP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 1,887.00' / 1,886.00' S= 0.0200 ' / Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	1,888.40'	<b>12.0" W x 6.0" H Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Discarded	1,887.00'	<b>0.800 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.22 cfs @ 7.85 hrs HW=1,887.04' (Free Discharge)  
 ↳ **3=Exfiltration** (Exfiltration Controls 0.22 cfs)

**Primary OutFlow** Max=2.78 cfs @ 12.16 hrs HW=1,889.98' (Free Discharge)  
 ↳ **1=Culvert** (Passes 2.78 cfs of 18.80 cfs potential flow)  
 ↳ **2=Orifice/Grate** (Orifice Controls 2.78 cfs @ 5.55 fps)

**Pond 15P: seepage pit with chambers #4b**

Hydrograph

