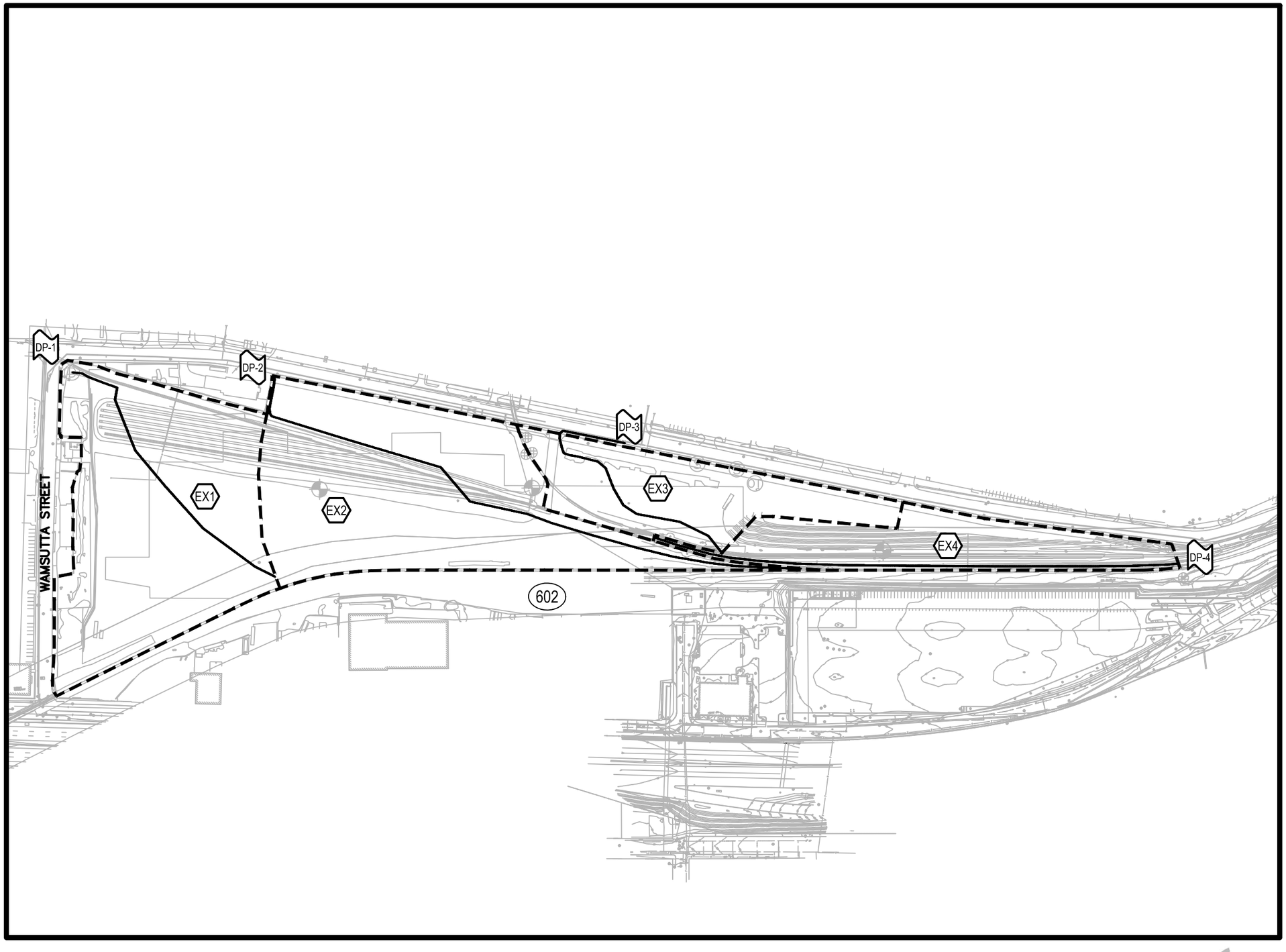
Attachment A

HydroCAD Report



Legend

SYMBOLS

DP-1 — DESIGN POINT

EX2 — DRAINAGE AREA DESIGNATION

LINETYPES

DRAINAGE AREA BOUNDARY

TIME OF CONCENTRATION FLOW LINE

SCS SOIL CLASSIFICATIONS

602 — URBAN LAND

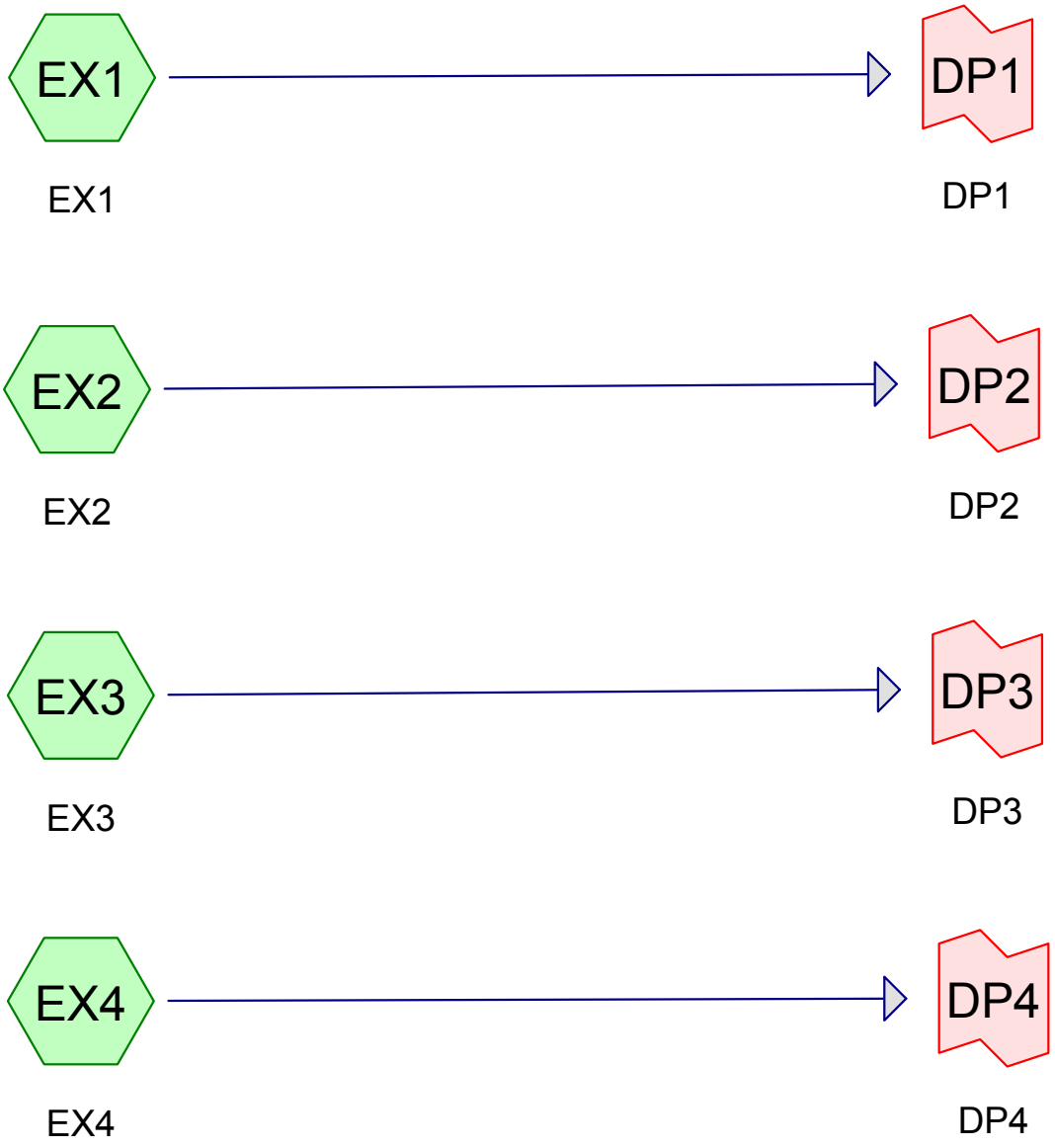
0 125 250 Feet

Existing Drainage Areas

Wamsutta Layover
New Bedford, MA

Figure 3

11/15/2017



Subcat Reach Pond Link

Routing Diagram for Wamsutta-EX
Prepared by VHB, Printed 11/14/2017

Summary for Subcatchment EX1: EX1

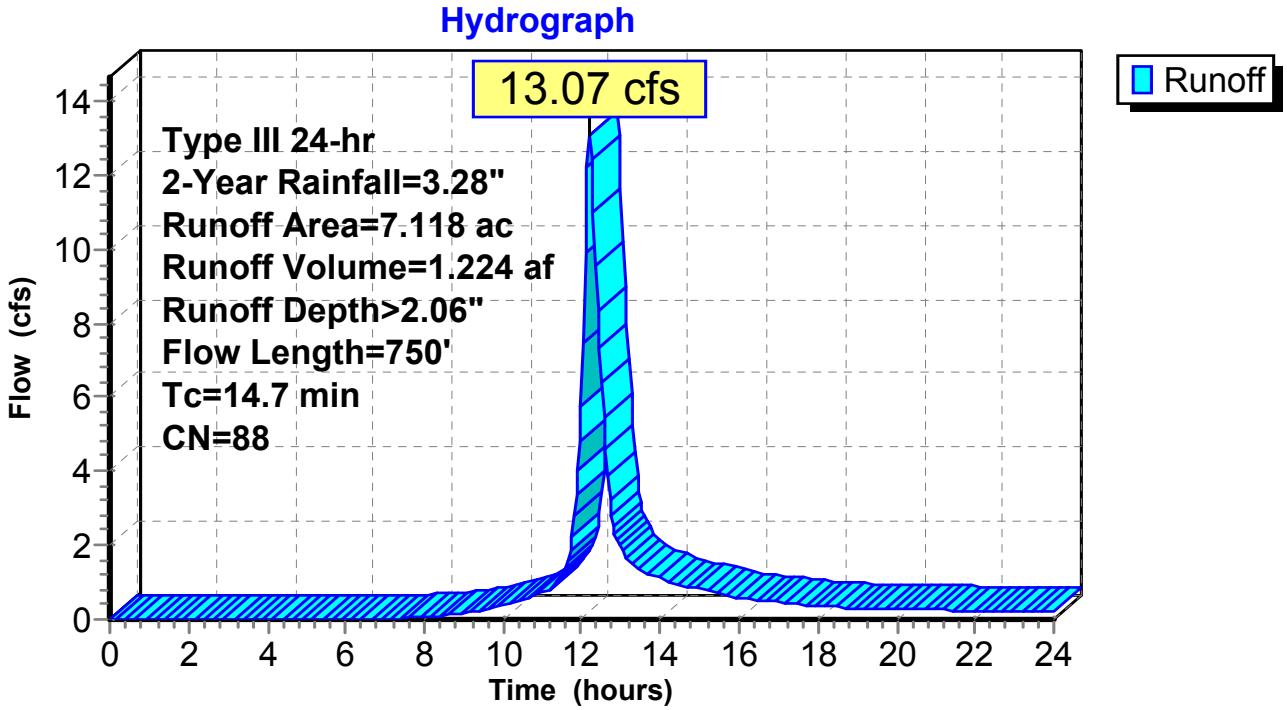
Runoff = 13.07 cfs @ 12.20 hrs, Volume= 1.224 af, Depth> 2.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.28"

	Area (ac)	CN	Description
	3.715	94	Fallow, bare soil, HSG D
	0.765	84	50-75% Grass cover, Fair, HSG D
*	1.512	84	Freight Yard Ballast HSG D
	1.126	77	Brush, Fair, HSG D
	7.118	88	Weighted Average
	7.118		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
7.2	700	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.7	750	Total			

Subcatchment EX1: EX1



Summary for Subcatchment EX2: EX2

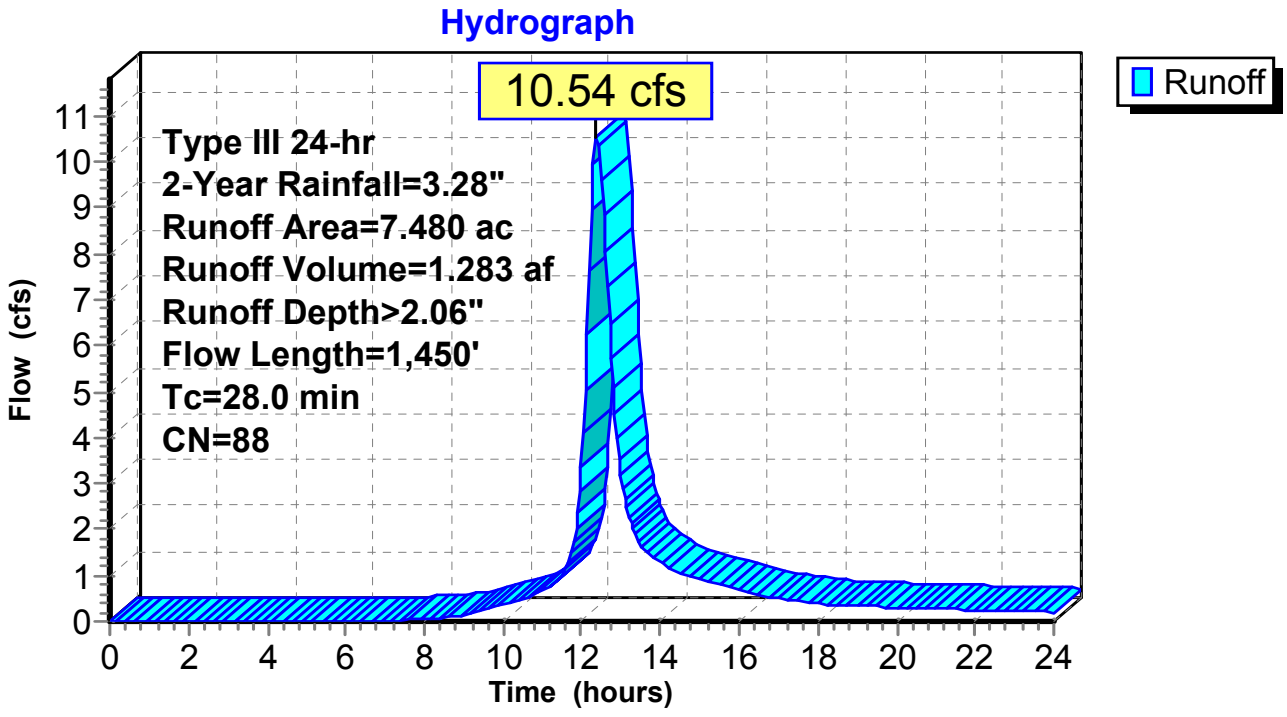
Runoff = 10.54 cfs @ 12.38 hrs, Volume= 1.283 af, Depth> 2.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.28"

	Area (ac)	CN	Description
	2.917	94	Fallow, bare soil, HSG D
	3.231	84	50-75% Grass cover, Fair, HSG D
*	1.332	84	Freigth Yard Ballast, HSG D
	7.480	88	Weighted Average
	7.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
20.5	1,400	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
28.0	1,450	Total			

Subcatchment EX2: EX2



Summary for Subcatchment EX3: EX3

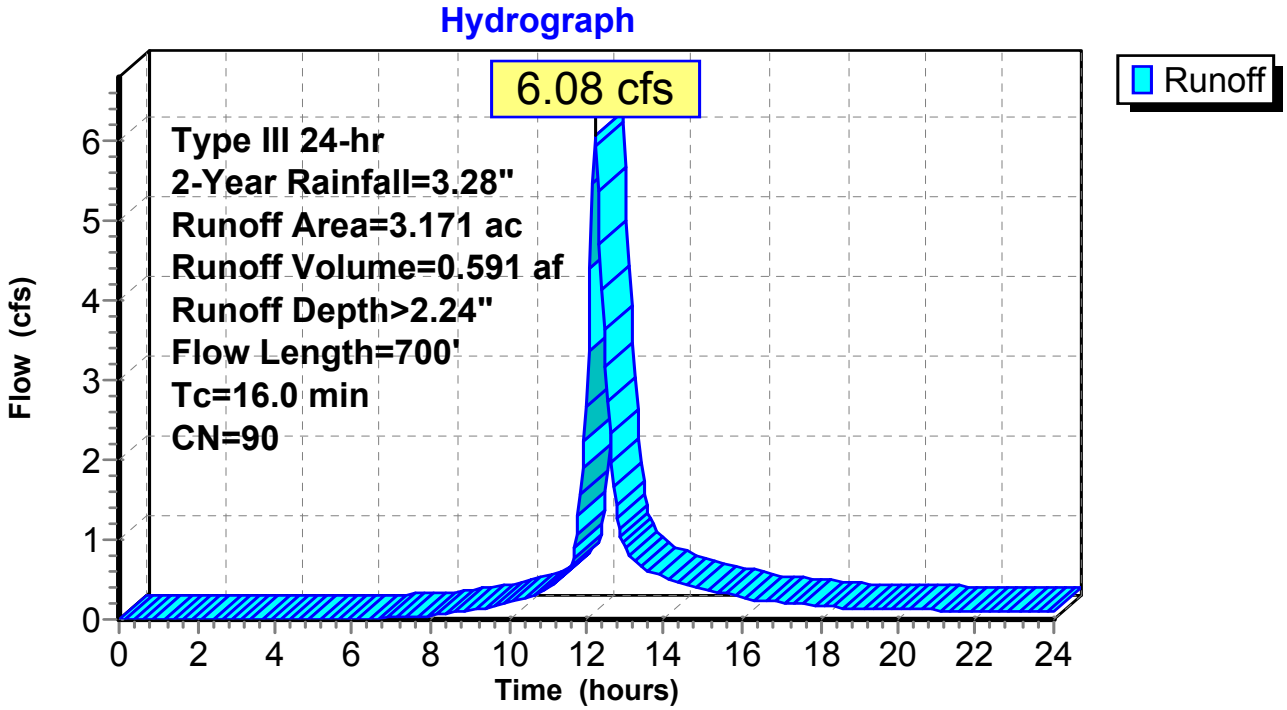
Runoff = 6.08 cfs @ 12.22 hrs, Volume= 0.591 af, Depth> 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.28"

Area (ac)	CN	Description
1.907	94	Fallow, bare soil, HSG D
1.264	84	50-75% Grass cover, Fair, HSG D
3.171	90	Weighted Average
3.171		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
7.3	500	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	700	Total			

Subcatchment EX3: EX3



Summary for Subcatchment EX4: EX4

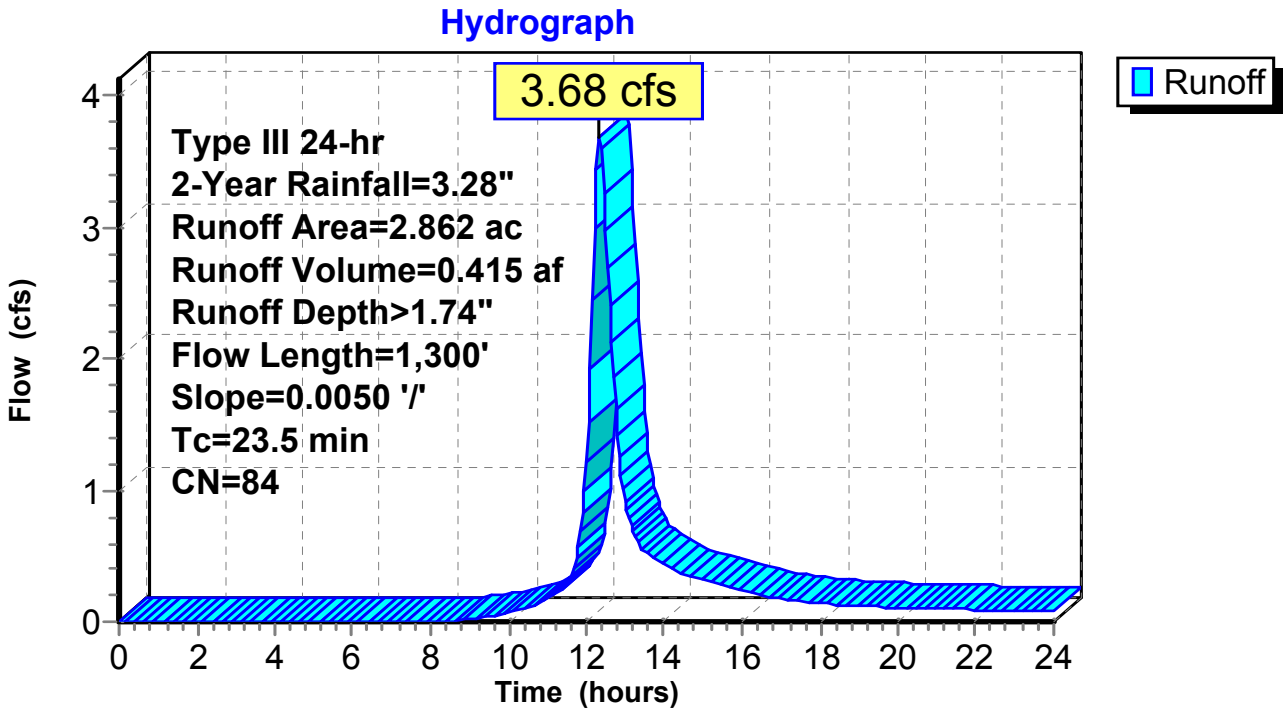
Runoff = 3.68 cfs @ 12.33 hrs, Volume= 0.415 af, Depth> 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.28"

	Area (ac)	CN	Description
*	1.321	84	Rail Ballast, HSG D
	1.541	84	50-75% Grass cover, Fair, HSG D
	2.862	84	Weighted Average
	2.862		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0050	0.21		**Sheet Flow, sheet flow on the track base** Fallow n= 0.050 P2= 3.40"
19.6	1,250	0.0050	1.06		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.5	1,300	Total			

Subcatchment EX4: EX4

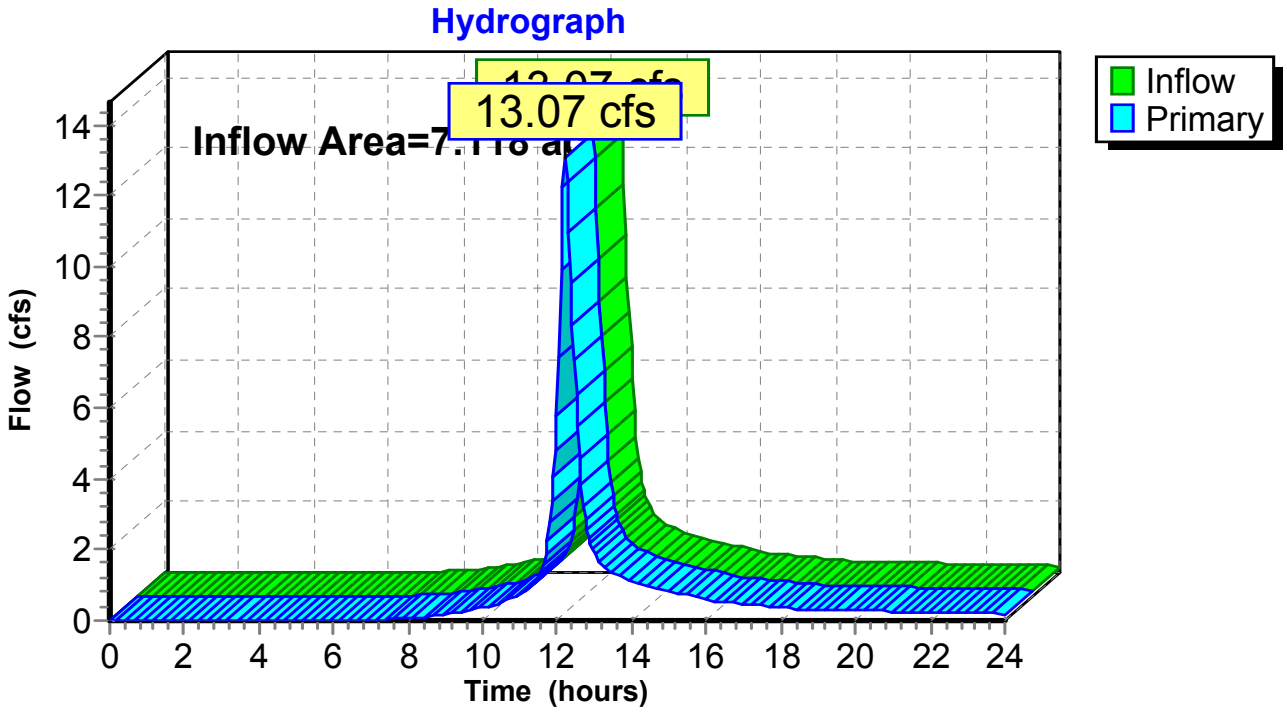


Summary for Link DP1: DP1

Inflow Area = 7.118 ac, 0.00% Impervious, Inflow Depth > 2.06" for 2-Year event
Inflow = 13.07 cfs @ 12.20 hrs, Volume= 1.224 af
Primary = 13.07 cfs @ 12.20 hrs, Volume= 1.224 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP1: DP1

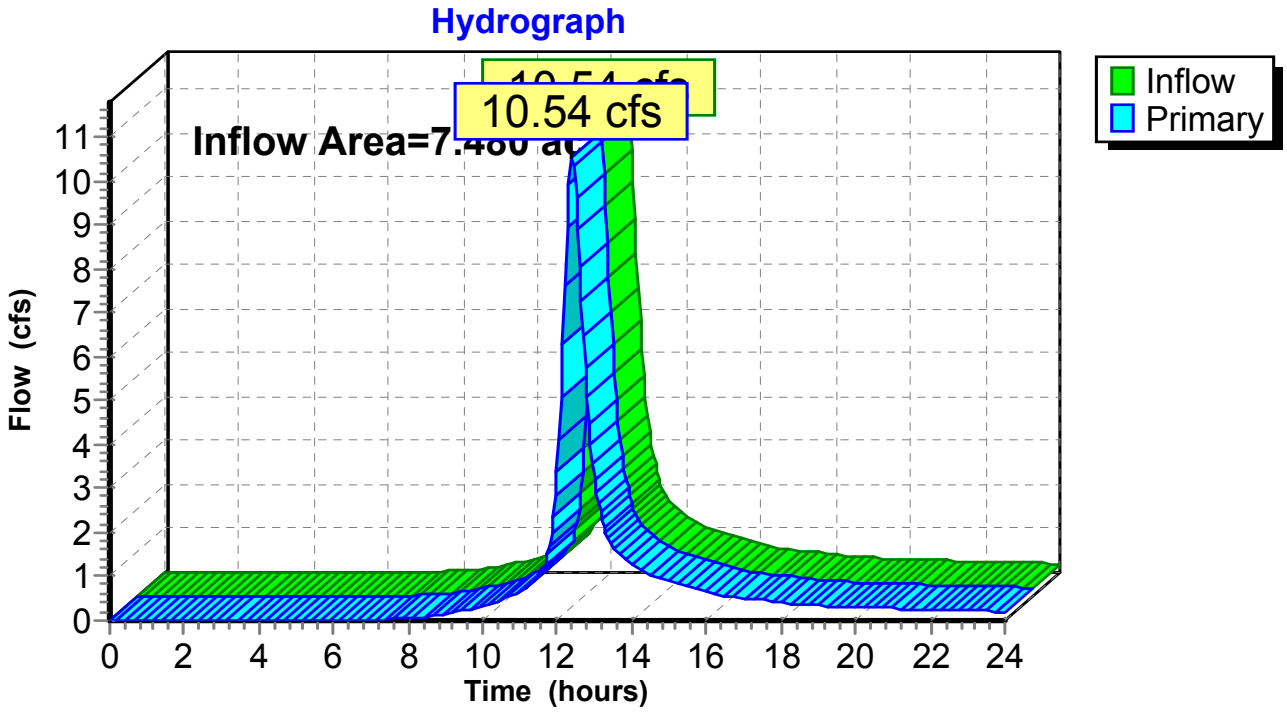


Summary for Link DP2: DP2

Inflow Area = 7.480 ac, 0.00% Impervious, Inflow Depth > 2.06" for 2-Year event
Inflow = 10.54 cfs @ 12.38 hrs, Volume= 1.283 af
Primary = 10.54 cfs @ 12.38 hrs, Volume= 1.283 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

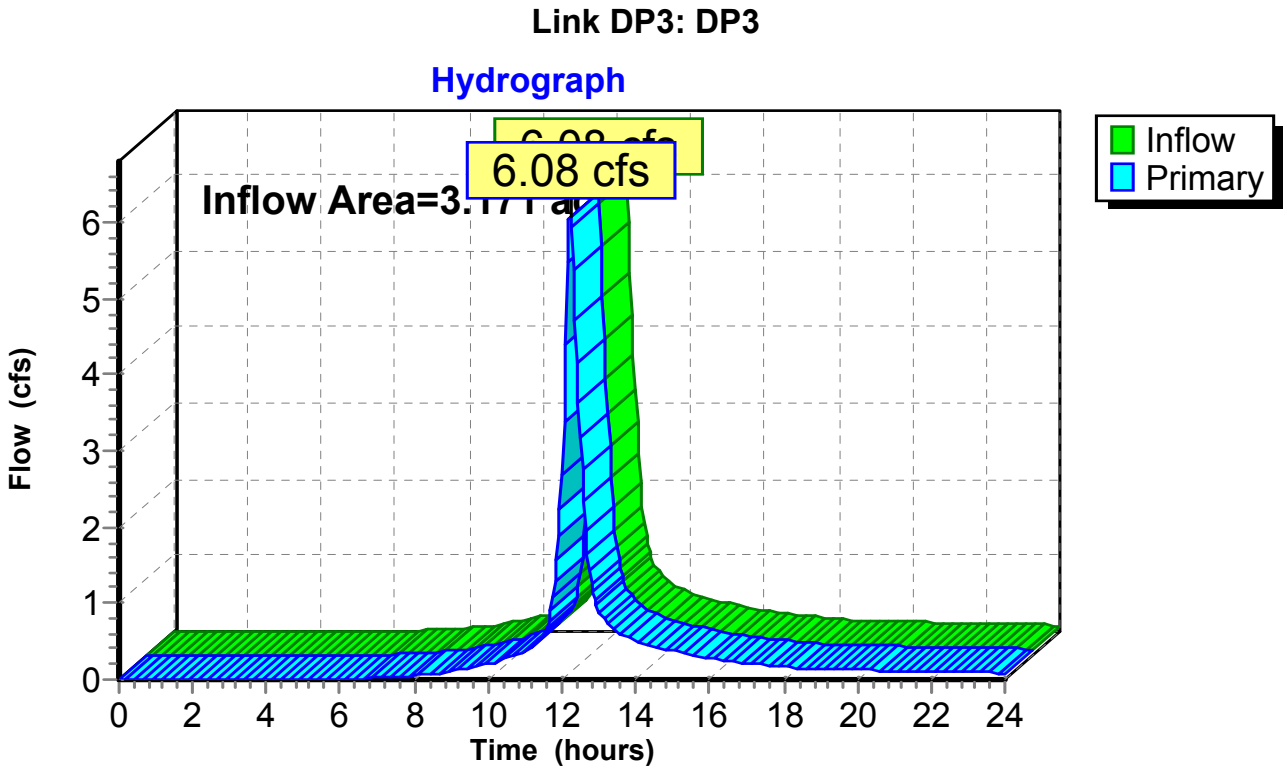
Link DP2: DP2



Summary for Link DP3: DP3

Inflow Area = 3.171 ac, 0.00% Impervious, Inflow Depth > 2.24" for 2-Year event
Inflow = 6.08 cfs @ 12.22 hrs, Volume= 0.591 af
Primary = 6.08 cfs @ 12.22 hrs, Volume= 0.591 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

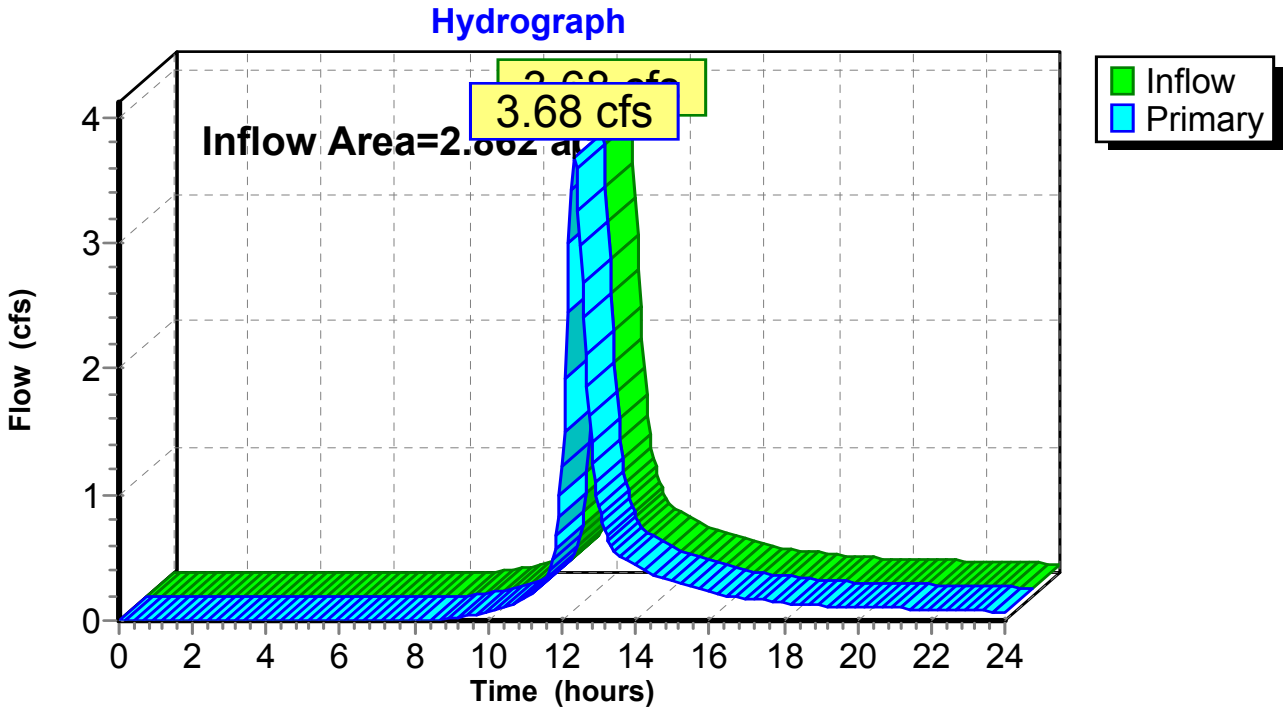


Summary for Link DP4: DP4

Inflow Area = 2.862 ac, 0.00% Impervious, Inflow Depth > 1.74" for 2-Year event
Inflow = 3.68 cfs @ 12.33 hrs, Volume= 0.415 af
Primary = 3.68 cfs @ 12.33 hrs, Volume= 0.415 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP4: DP4



Summary for Subcatchment EX1: EX1

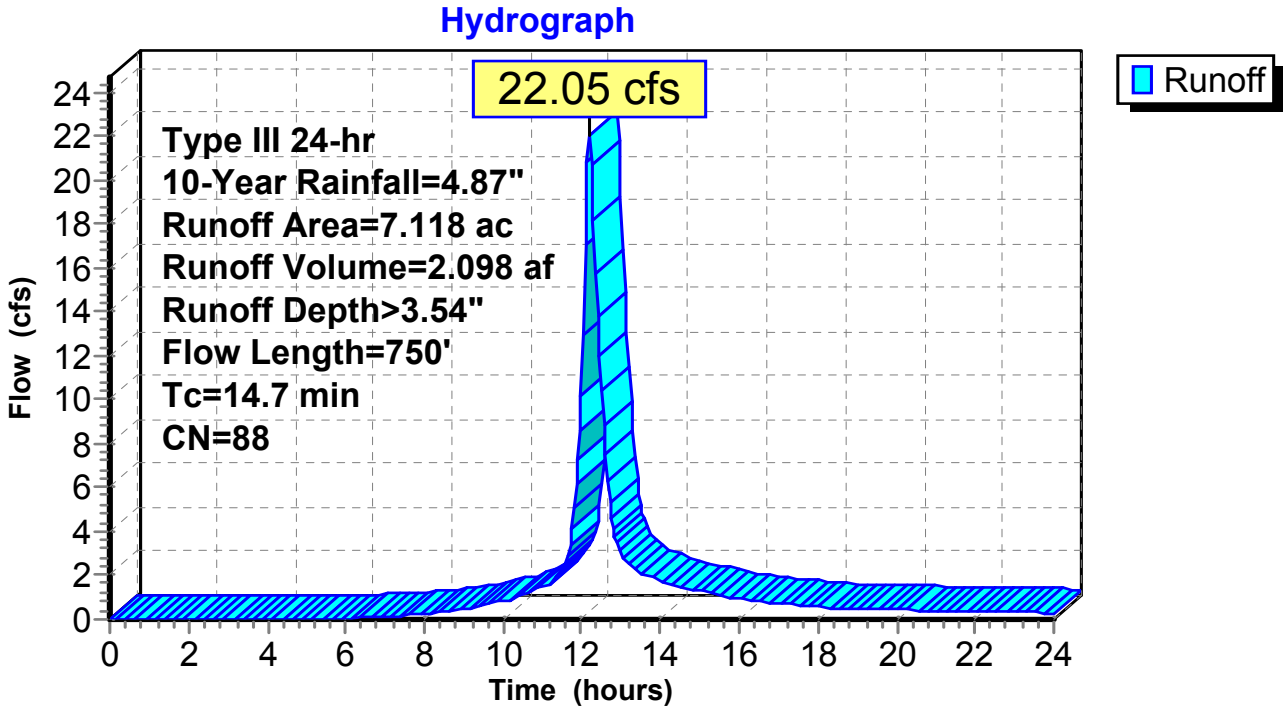
Runoff = 22.05 cfs @ 12.20 hrs, Volume= 2.098 af, Depth> 3.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.87"

	Area (ac)	CN	Description
	3.715	94	Fallow, bare soil, HSG D
	0.765	84	50-75% Grass cover, Fair, HSG D
*	1.512	84	Freight Yard Ballast HSG D
	1.126	77	Brush, Fair, HSG D
	7.118	88	Weighted Average
	7.118		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
7.2	700	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.7	750	Total			

Subcatchment EX1: EX1



Summary for Subcatchment EX2: EX2

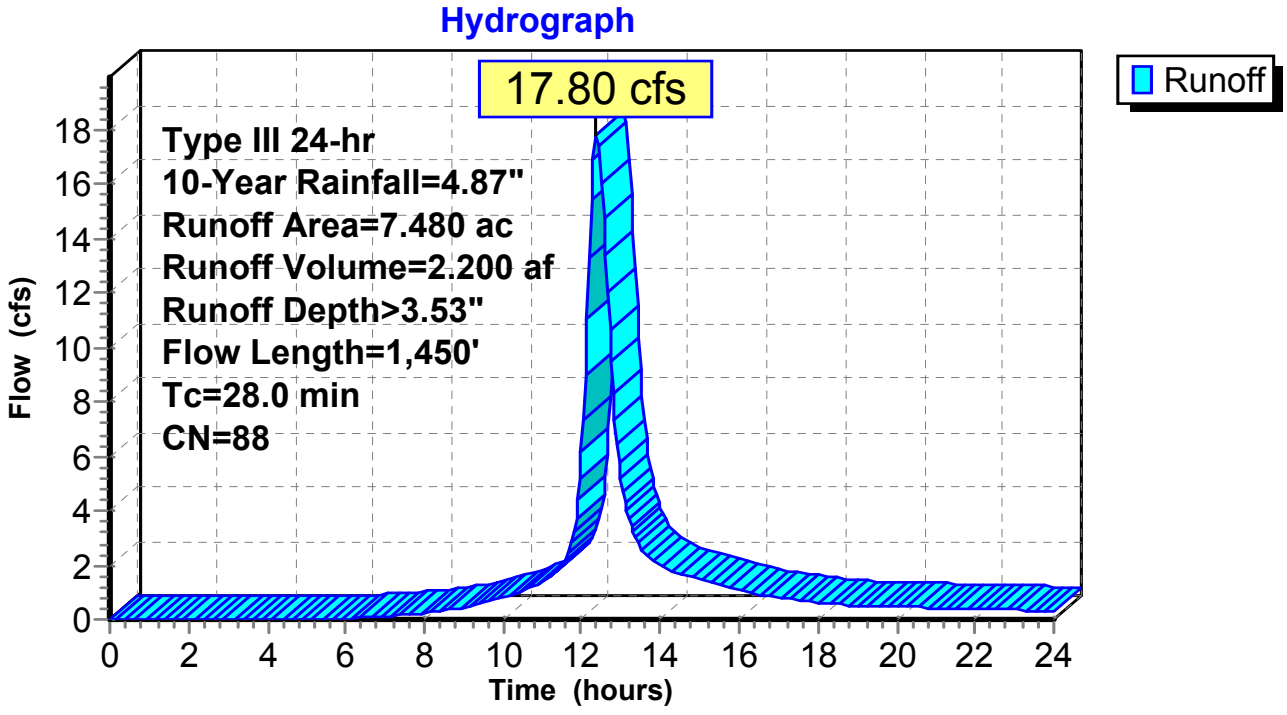
Runoff = 17.80 cfs @ 12.38 hrs, Volume= 2.200 af, Depth> 3.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.87"

	Area (ac)	CN	Description
	2.917	94	Fallow, bare soil, HSG D
	3.231	84	50-75% Grass cover, Fair, HSG D
*	1.332	84	Freigth Yard Ballast, HSG D
	7.480	88	Weighted Average
	7.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
20.5	1,400	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
28.0	1,450	Total			

Subcatchment EX2: EX2



Summary for Subcatchment EX3: EX3

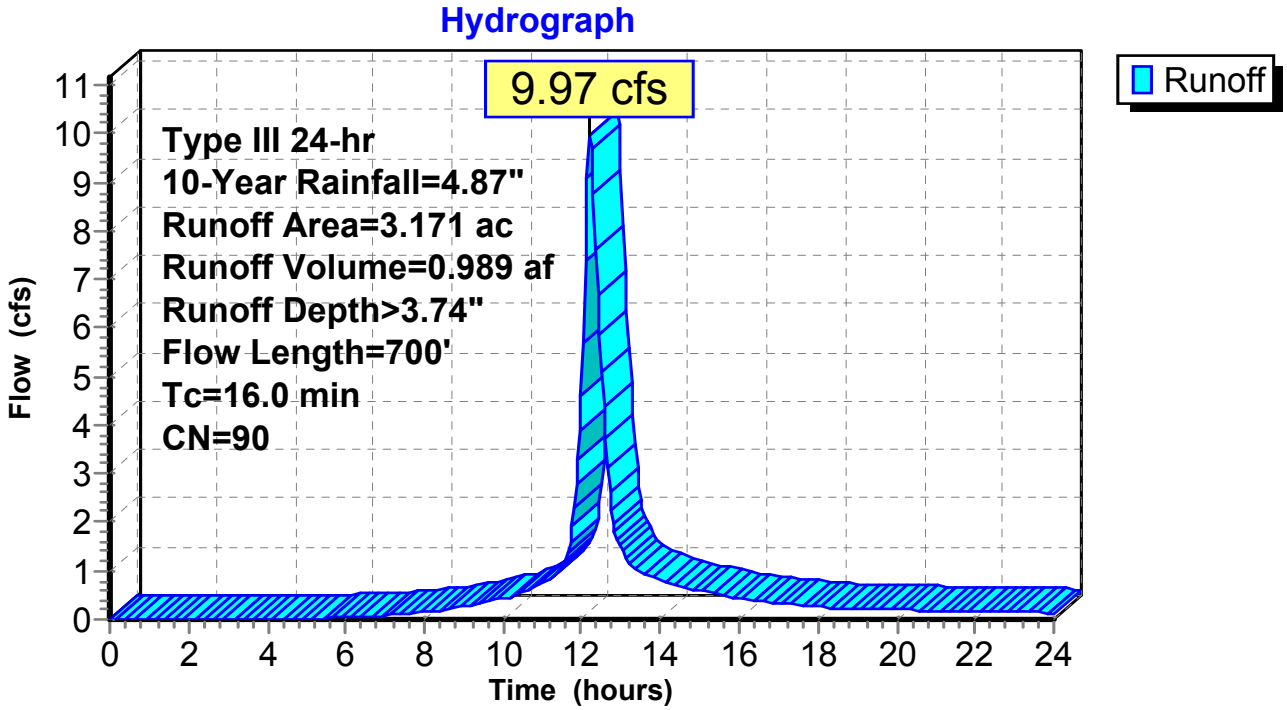
Runoff = 9.97 cfs @ 12.21 hrs, Volume= 0.989 af, Depth> 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.87"

Area (ac)	CN	Description
1.907	94	Fallow, bare soil, HSG D
1.264	84	50-75% Grass cover, Fair, HSG D
3.171	90	Weighted Average
3.171		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
7.3	500	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	700	Total			

Subcatchment EX3: EX3



Summary for Subcatchment EX4: EX4

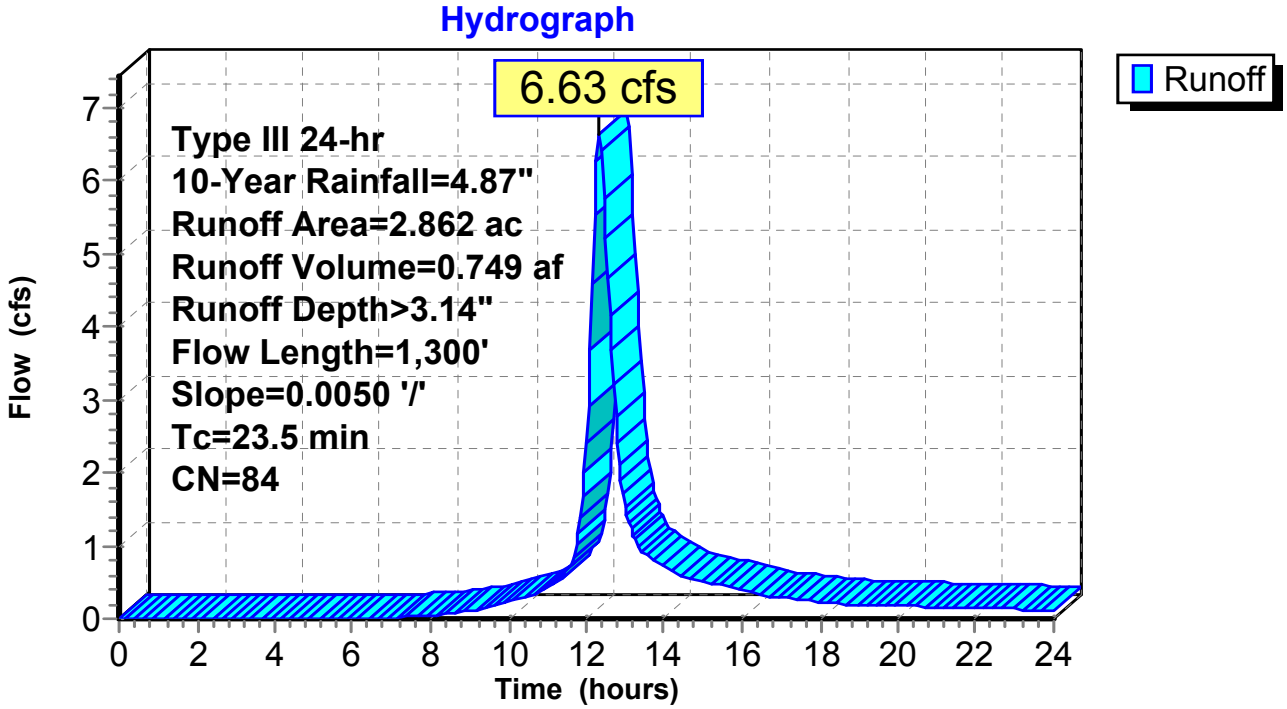
Runoff = 6.63 cfs @ 12.32 hrs, Volume= 0.749 af, Depth> 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.87"

	Area (ac)	CN	Description
*	1.321	84	Rail Ballast, HSG D
	1.541	84	50-75% Grass cover, Fair, HSG D
	2.862	84	Weighted Average
	2.862		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0050	0.21		**Sheet Flow, sheet flow on the track base** Fallow n= 0.050 P2= 3.40"
19.6	1,250	0.0050	1.06		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.5	1,300	Total			

Subcatchment EX4: EX4

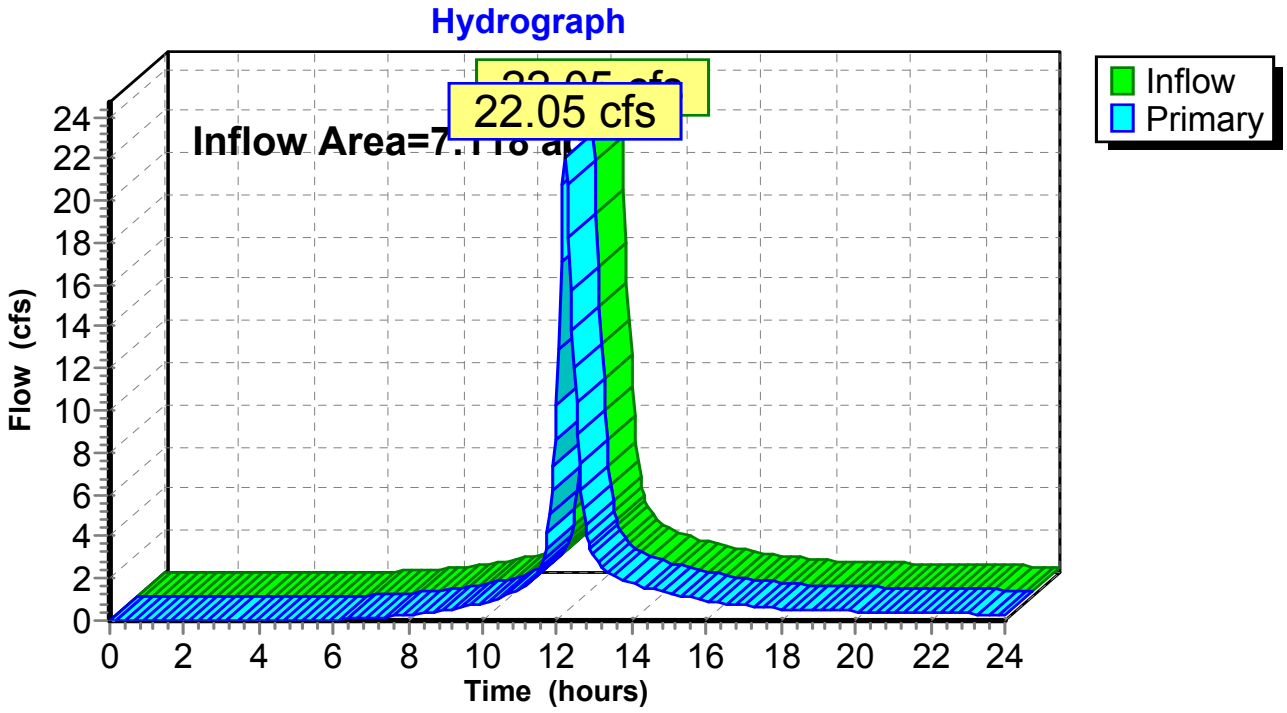


Summary for Link DP1: DP1

Inflow Area = 7.118 ac, 0.00% Impervious, Inflow Depth > 3.54" for 10-Year event
Inflow = 22.05 cfs @ 12.20 hrs, Volume= 2.098 af
Primary = 22.05 cfs @ 12.20 hrs, Volume= 2.098 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP1: DP1

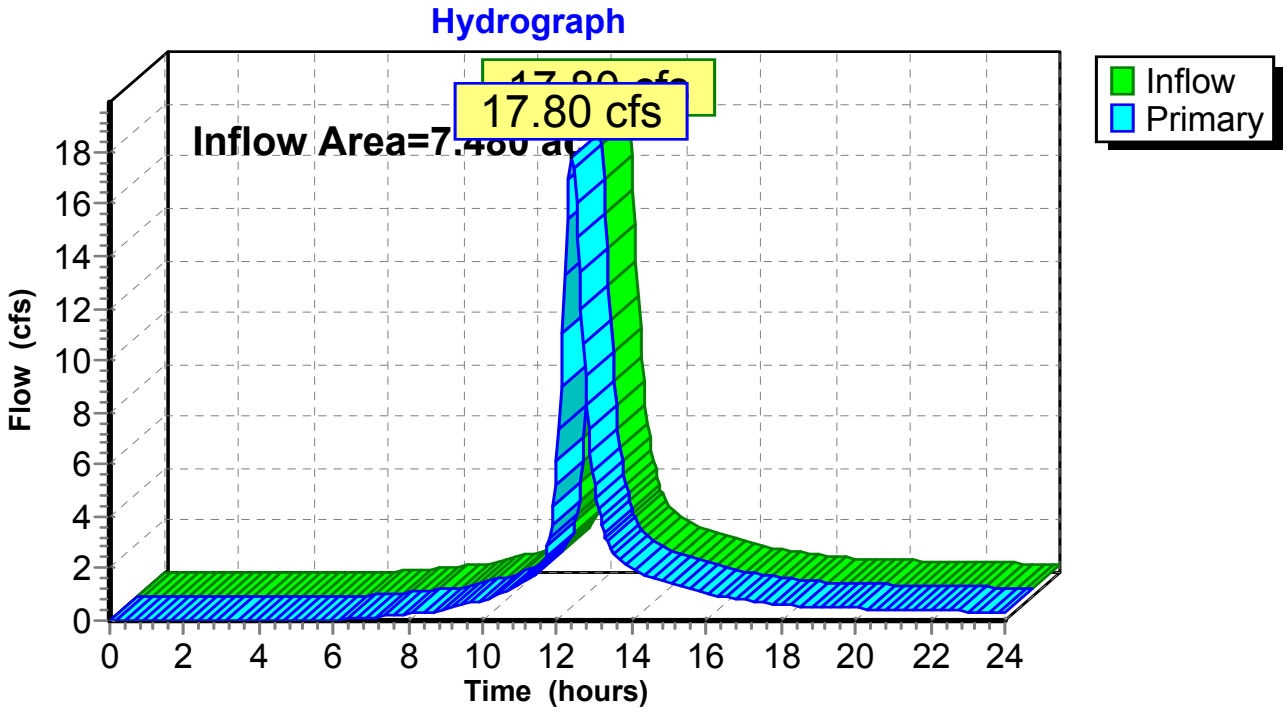


Summary for Link DP2: DP2

Inflow Area = 7.480 ac, 0.00% Impervious, Inflow Depth > 3.53" for 10-Year event
Inflow = 17.80 cfs @ 12.38 hrs, Volume= 2.200 af
Primary = 17.80 cfs @ 12.38 hrs, Volume= 2.200 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP2: DP2

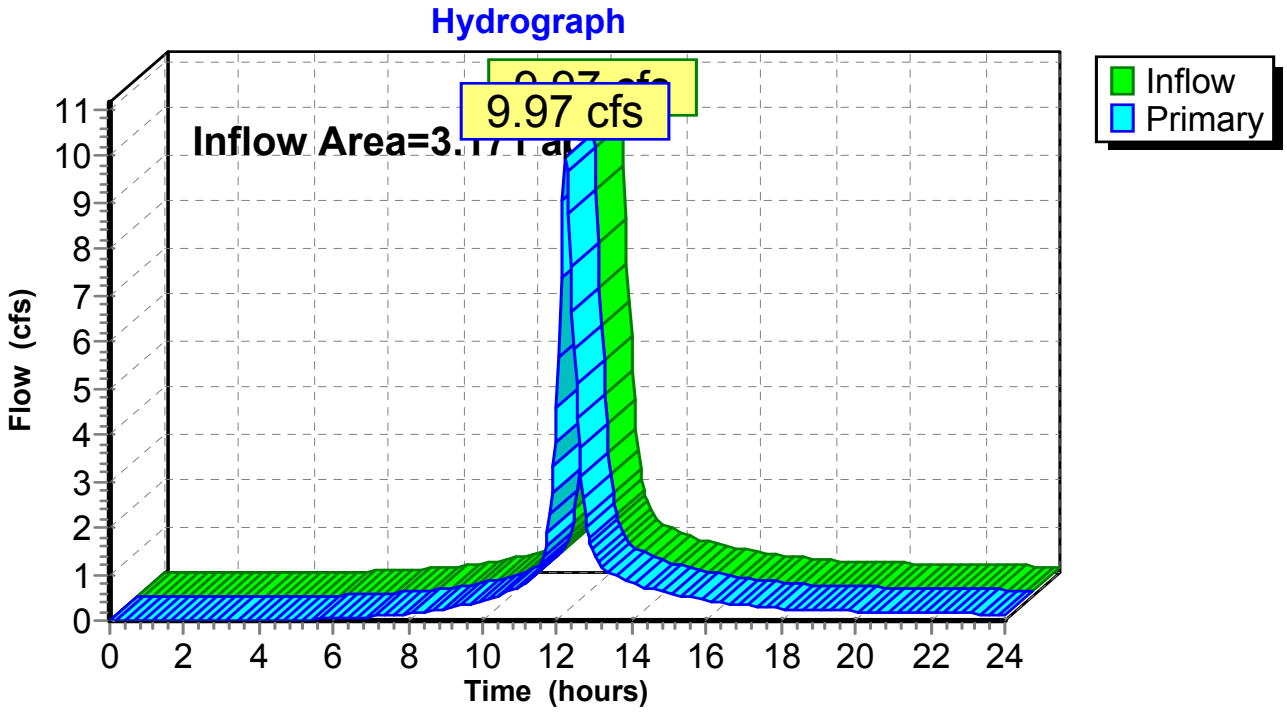


Summary for Link DP3: DP3

Inflow Area = 3.171 ac, 0.00% Impervious, Inflow Depth > 3.74" for 10-Year event
Inflow = 9.97 cfs @ 12.21 hrs, Volume= 0.989 af
Primary = 9.97 cfs @ 12.21 hrs, Volume= 0.989 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP3: DP3

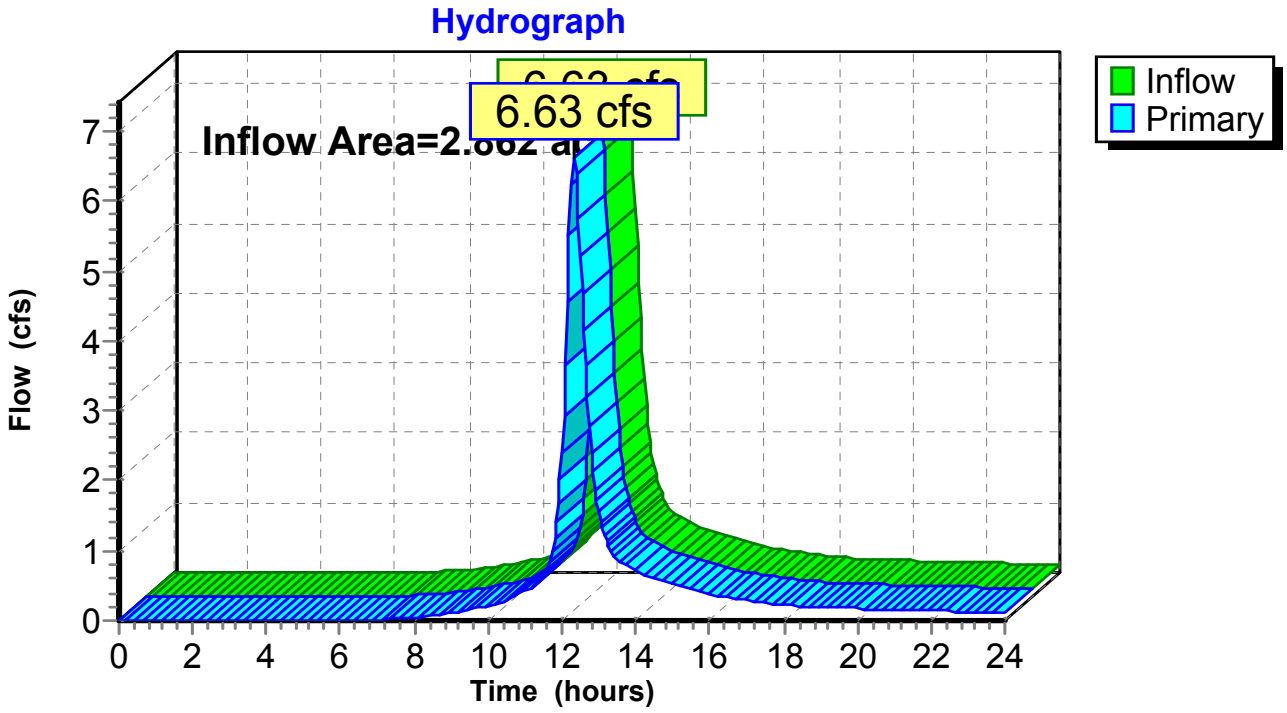


Summary for Link DP4: DP4

Inflow Area = 2.862 ac, 0.00% Impervious, Inflow Depth > 3.14" for 10-Year event
Inflow = 6.63 cfs @ 12.32 hrs, Volume= 0.749 af
Primary = 6.63 cfs @ 12.32 hrs, Volume= 0.749 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP4: DP4



Summary for Subcatchment EX1: EX1

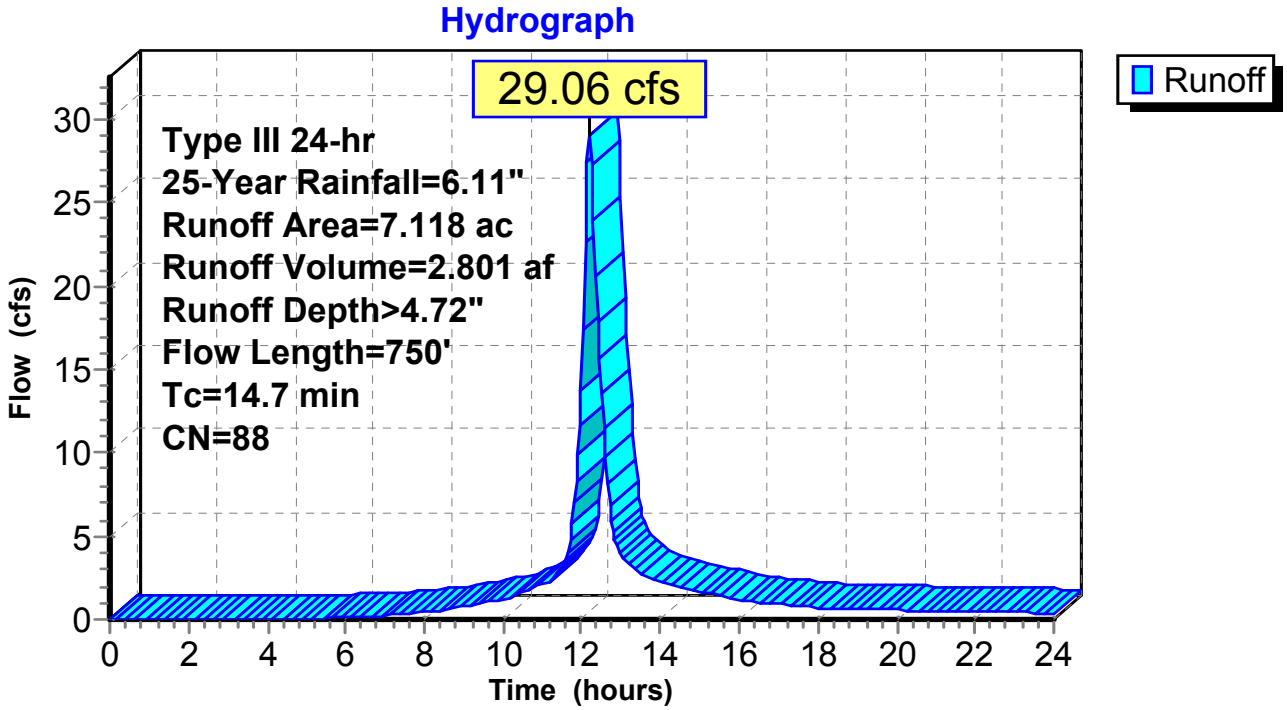
Runoff = 29.06 cfs @ 12.20 hrs, Volume= 2.801 af, Depth> 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.11"

	Area (ac)	CN	Description
	3.715	94	Fallow, bare soil, HSG D
	0.765	84	50-75% Grass cover, Fair, HSG D
*	1.512	84	Freight Yard Ballast HSG D
	1.126	77	Brush, Fair, HSG D
	7.118	88	Weighted Average
	7.118		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
7.2	700	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.7	750	Total			

Subcatchment EX1: EX1



Summary for Subcatchment EX2: EX2

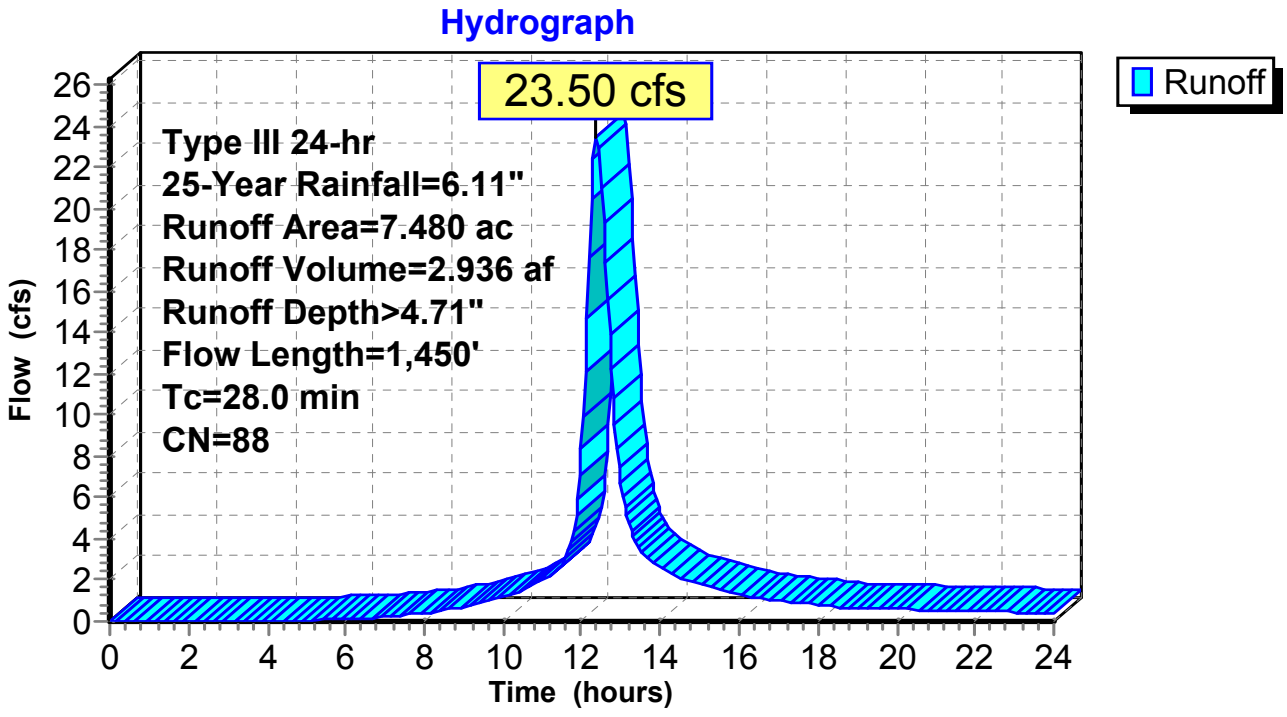
Runoff = 23.50 cfs @ 12.37 hrs, Volume= 2.936 af, Depth> 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.11"

	Area (ac)	CN	Description
	2.917	94	Fallow, bare soil, HSG D
	3.231	84	50-75% Grass cover, Fair, HSG D
*	1.332	84	Freigth Yard Ballast, HSG D
	7.480	88	Weighted Average
	7.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
20.5	1,400	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
28.0	1,450	Total			

Subcatchment EX2: EX2



Summary for Subcatchment EX3: EX3

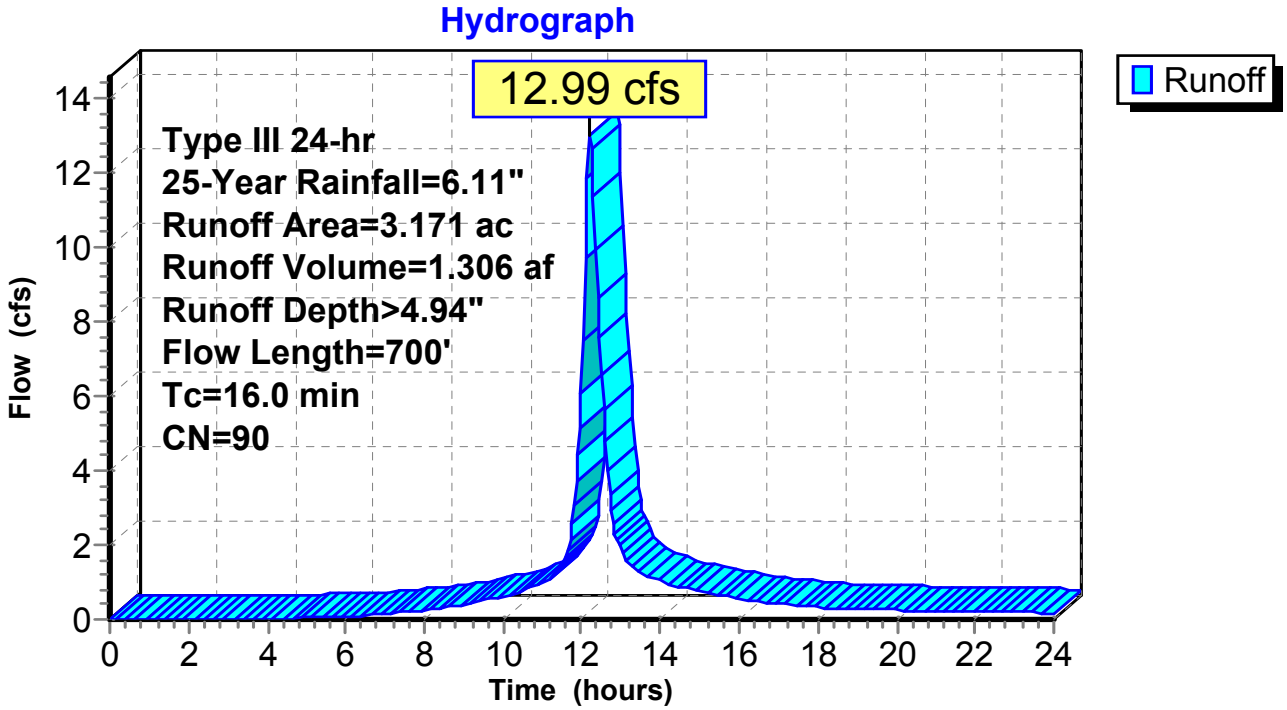
Runoff = 12.99 cfs @ 12.21 hrs, Volume= 1.306 af, Depth> 4.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.11"

Area (ac)	CN	Description
1.907	94	Fallow, bare soil, HSG D
1.264	84	50-75% Grass cover, Fair, HSG D
3.171	90	Weighted Average
3.171		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
7.3	500	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	700	Total			

Subcatchment EX3: EX3



Summary for Subcatchment EX4: EX4

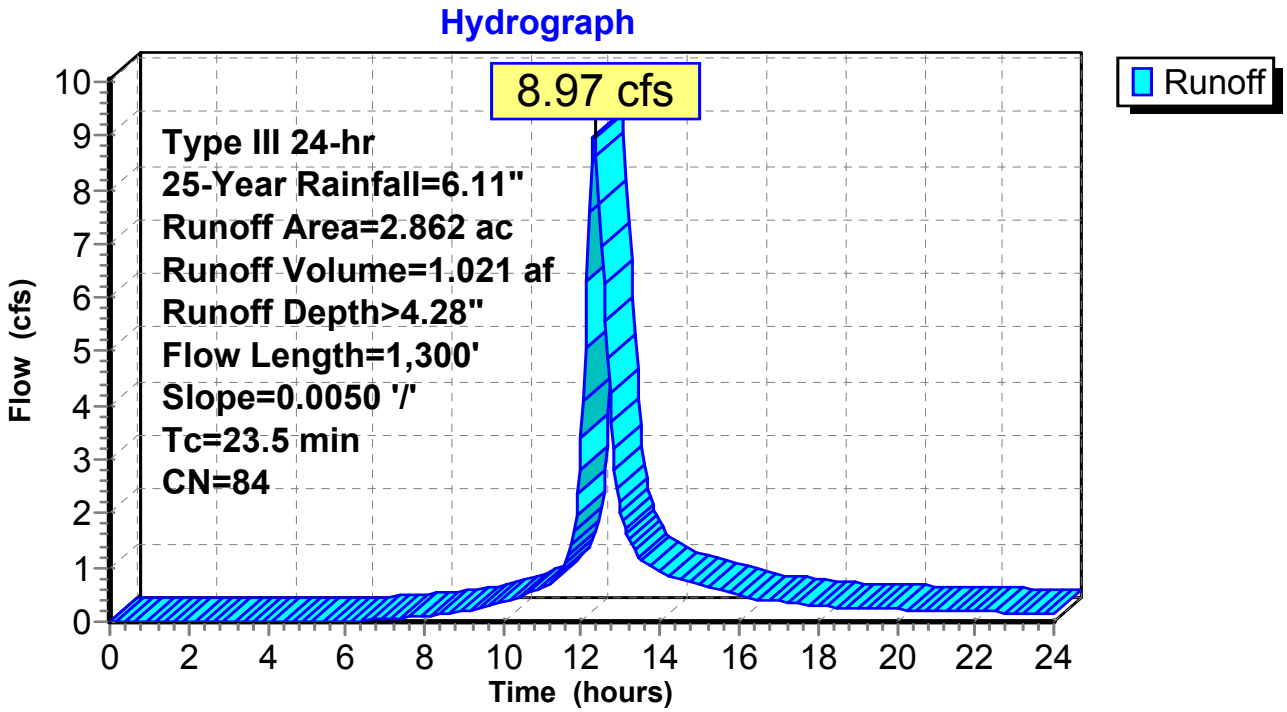
Runoff = 8.97 cfs @ 12.32 hrs, Volume= 1.021 af, Depth> 4.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.11"

	Area (ac)	CN	Description
*	1.321	84	Rail Ballast, HSG D
	1.541	84	50-75% Grass cover, Fair, HSG D
	2.862	84	Weighted Average
	2.862		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0050	0.21		**Sheet Flow, sheet flow on the track base** Fallow n= 0.050 P2= 3.40"
19.6	1,250	0.0050	1.06		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.5	1,300	Total			

Subcatchment EX4: EX4

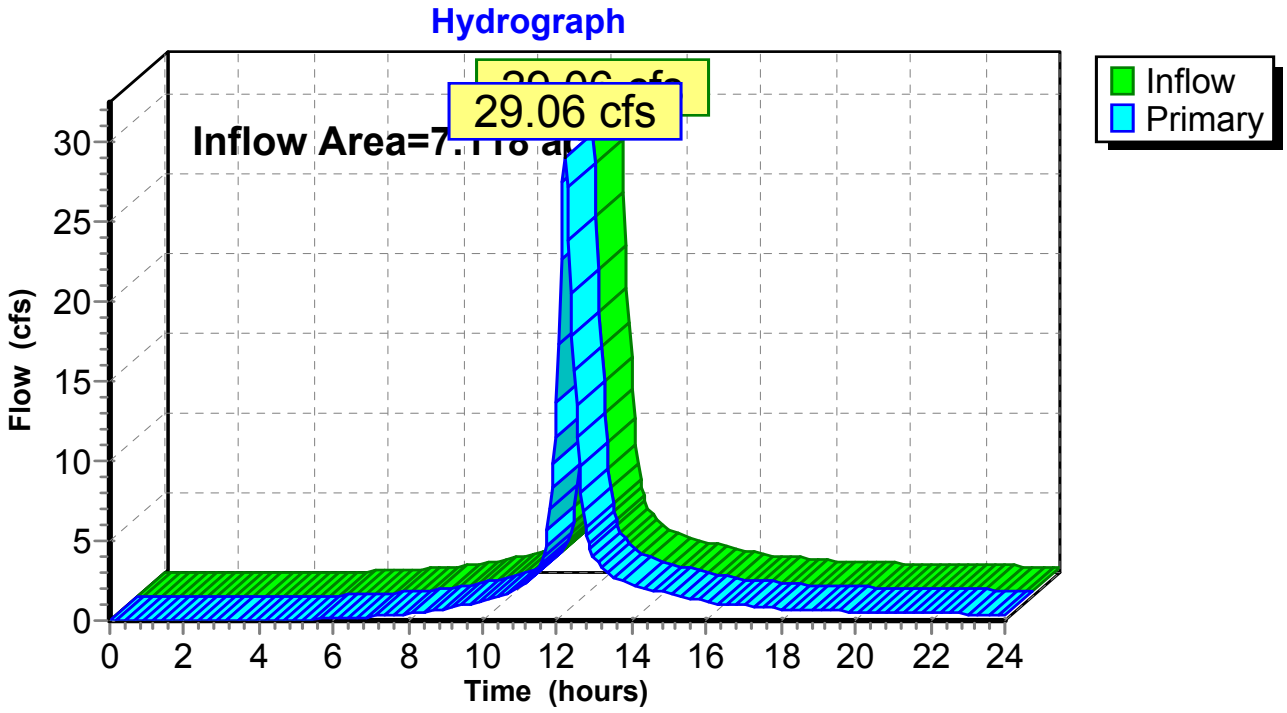


Summary for Link DP1: DP1

Inflow Area = 7.118 ac, 0.00% Impervious, Inflow Depth > 4.72" for 25-Year event
Inflow = 29.06 cfs @ 12.20 hrs, Volume= 2.801 af
Primary = 29.06 cfs @ 12.20 hrs, Volume= 2.801 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP1: DP1

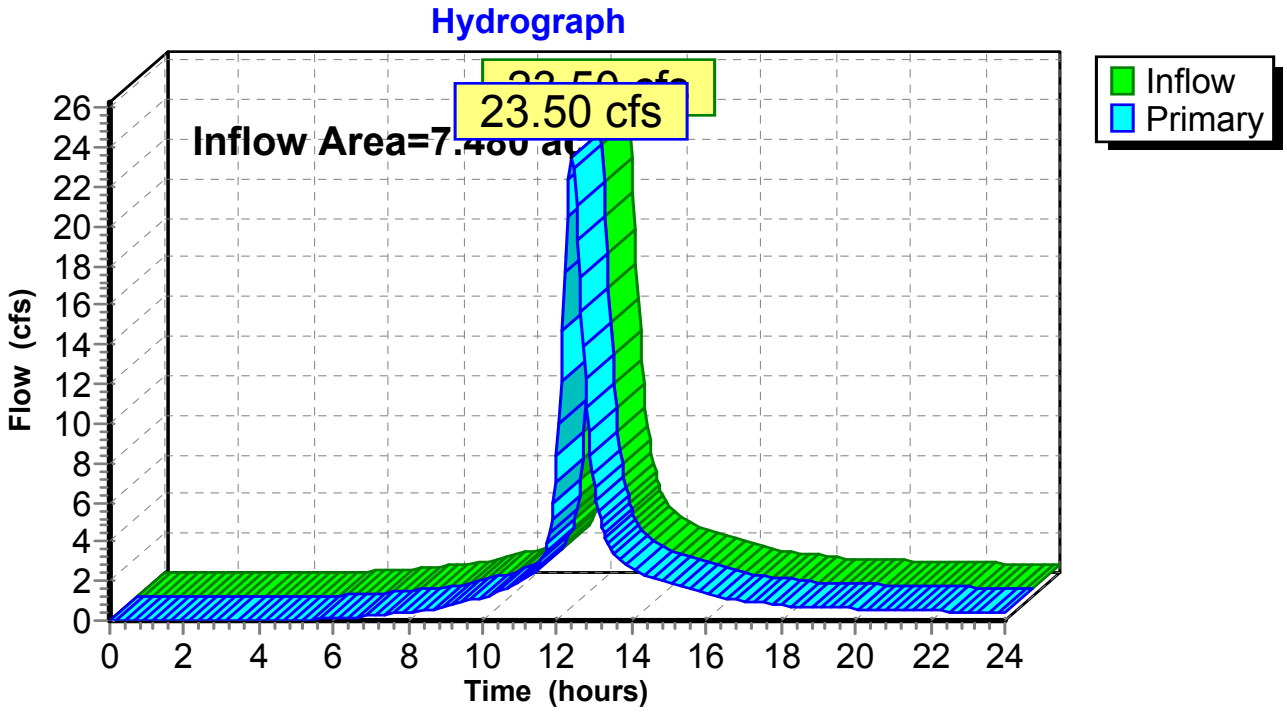


Summary for Link DP2: DP2

Inflow Area = 7.480 ac, 0.00% Impervious, Inflow Depth > 4.71" for 25-Year event
Inflow = 23.50 cfs @ 12.37 hrs, Volume= 2.936 af
Primary = 23.50 cfs @ 12.37 hrs, Volume= 2.936 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP2: DP2

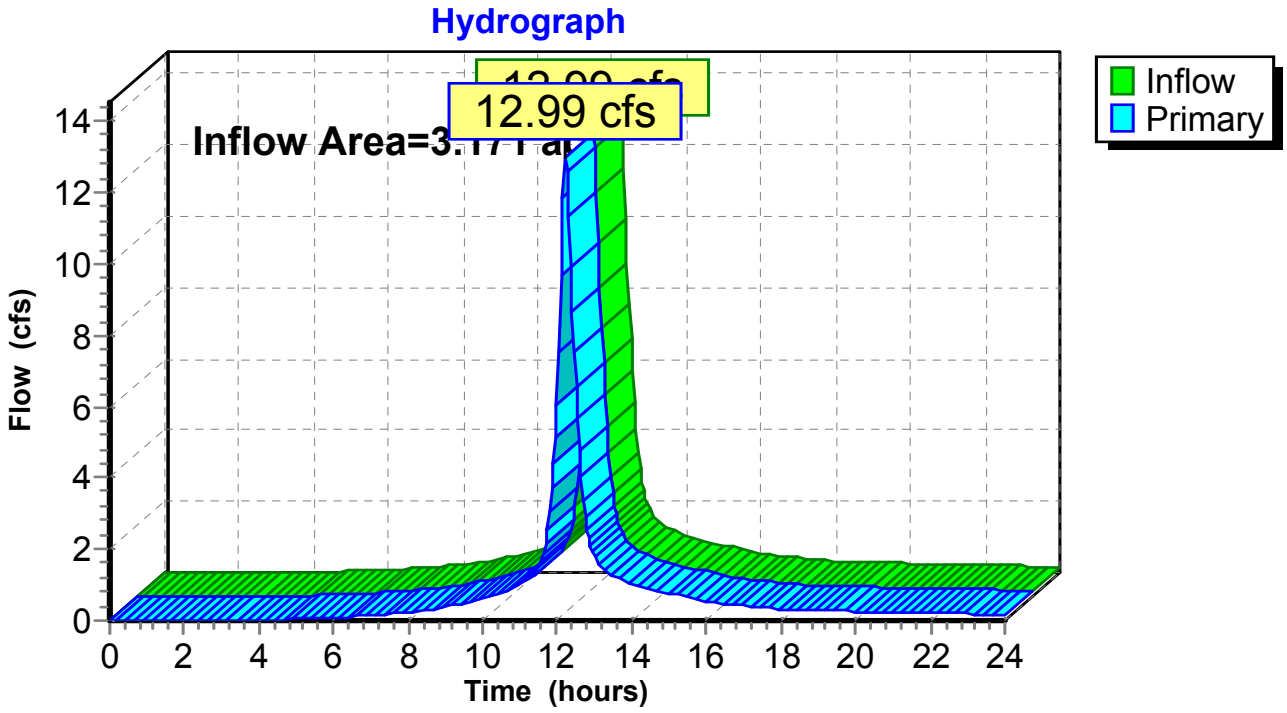


Summary for Link DP3: DP3

Inflow Area = 3.171 ac, 0.00% Impervious, Inflow Depth > 4.94" for 25-Year event
Inflow = 12.99 cfs @ 12.21 hrs, Volume= 1.306 af
Primary = 12.99 cfs @ 12.21 hrs, Volume= 1.306 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP3: DP3

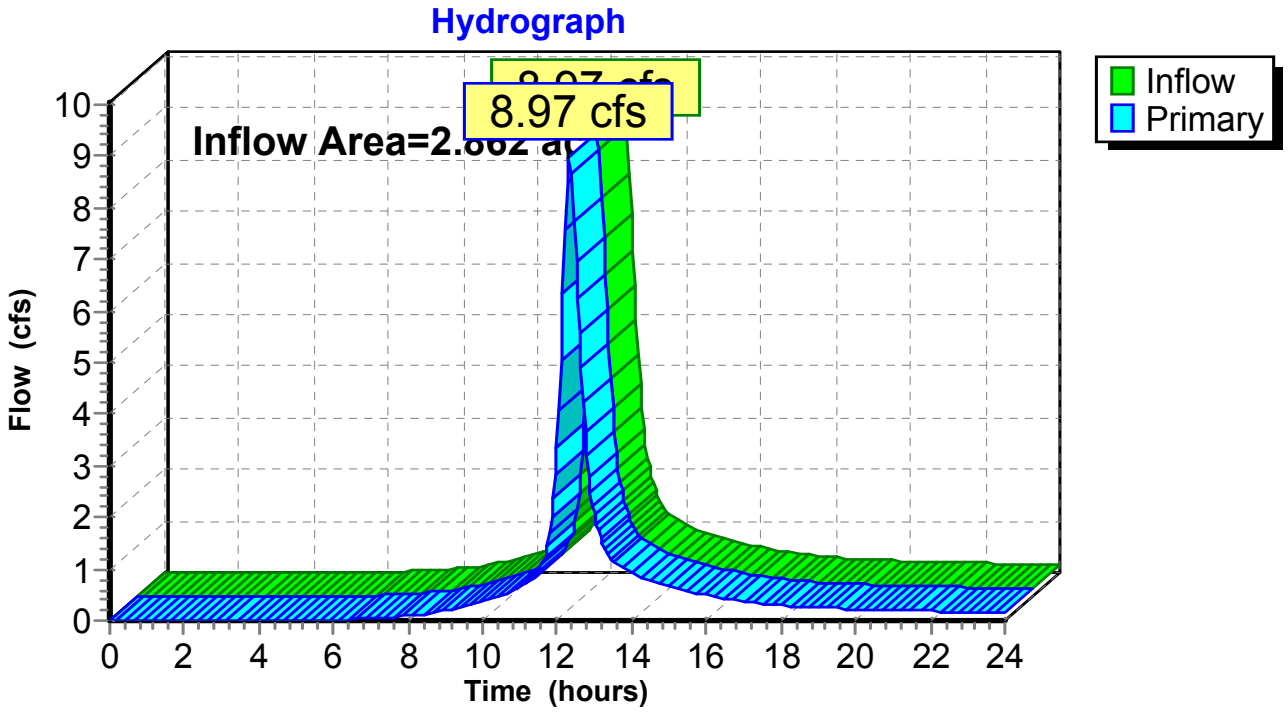


Summary for Link DP4: DP4

Inflow Area = 2.862 ac, 0.00% Impervious, Inflow Depth > 4.28" for 25-Year event
Inflow = 8.97 cfs @ 12.32 hrs, Volume= 1.021 af
Primary = 8.97 cfs @ 12.32 hrs, Volume= 1.021 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP4: DP4



Summary for Subcatchment EX1: EX1

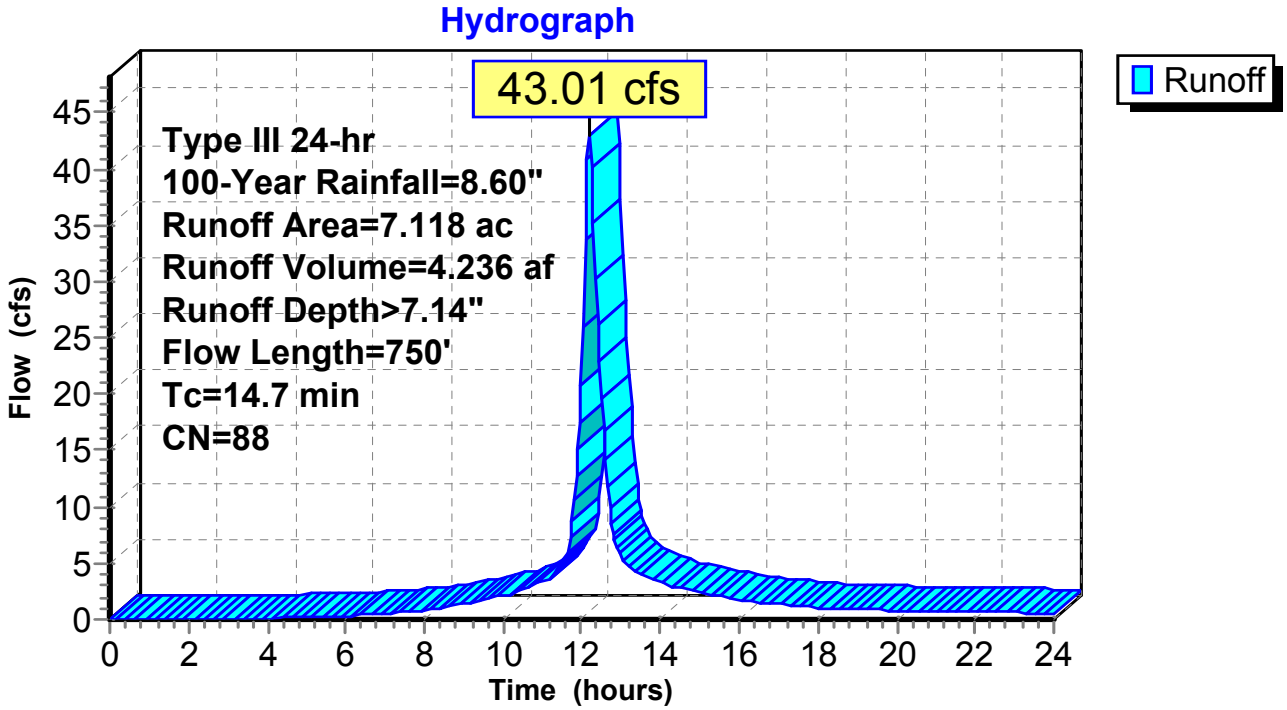
Runoff = 43.01 cfs @ 12.20 hrs, Volume= 4.236 af, Depth> 7.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

	Area (ac)	CN	Description
	3.715	94	Fallow, bare soil, HSG D
	0.765	84	50-75% Grass cover, Fair, HSG D
*	1.512	84	Freight Yard Ballast HSG D
	1.126	77	Brush, Fair, HSG D
	7.118	88	Weighted Average
	7.118		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
7.2	700	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.7	750	Total			

Subcatchment EX1: EX1



Summary for Subcatchment EX2: EX2

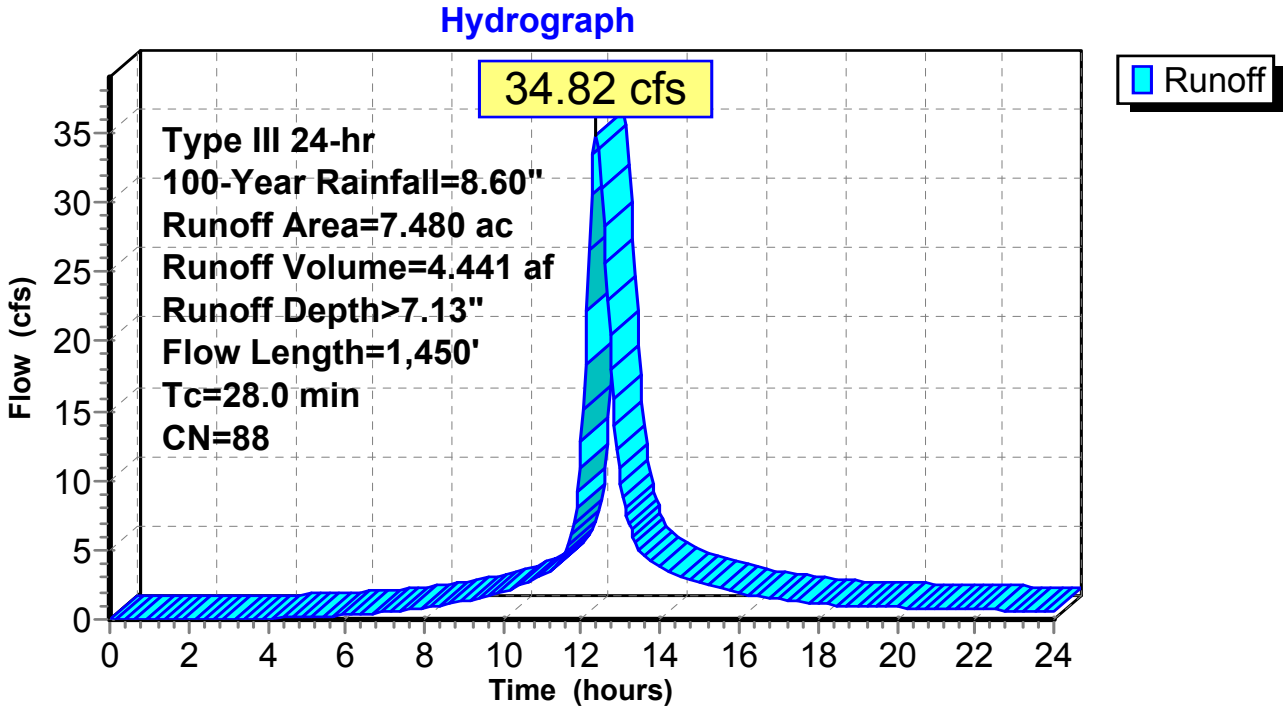
Runoff = 34.82 cfs @ 12.37 hrs, Volume= 4.441 af, Depth> 7.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

	Area (ac)	CN	Description
	2.917	94	Fallow, bare soil, HSG D
	3.231	84	50-75% Grass cover, Fair, HSG D
*	1.332	84	Freigth Yard Ballast, HSG D
	7.480	88	Weighted Average
	7.480		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
20.5	1,400	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
28.0	1,450	Total			

Subcatchment EX2: EX2



Summary for Subcatchment EX3: EX3

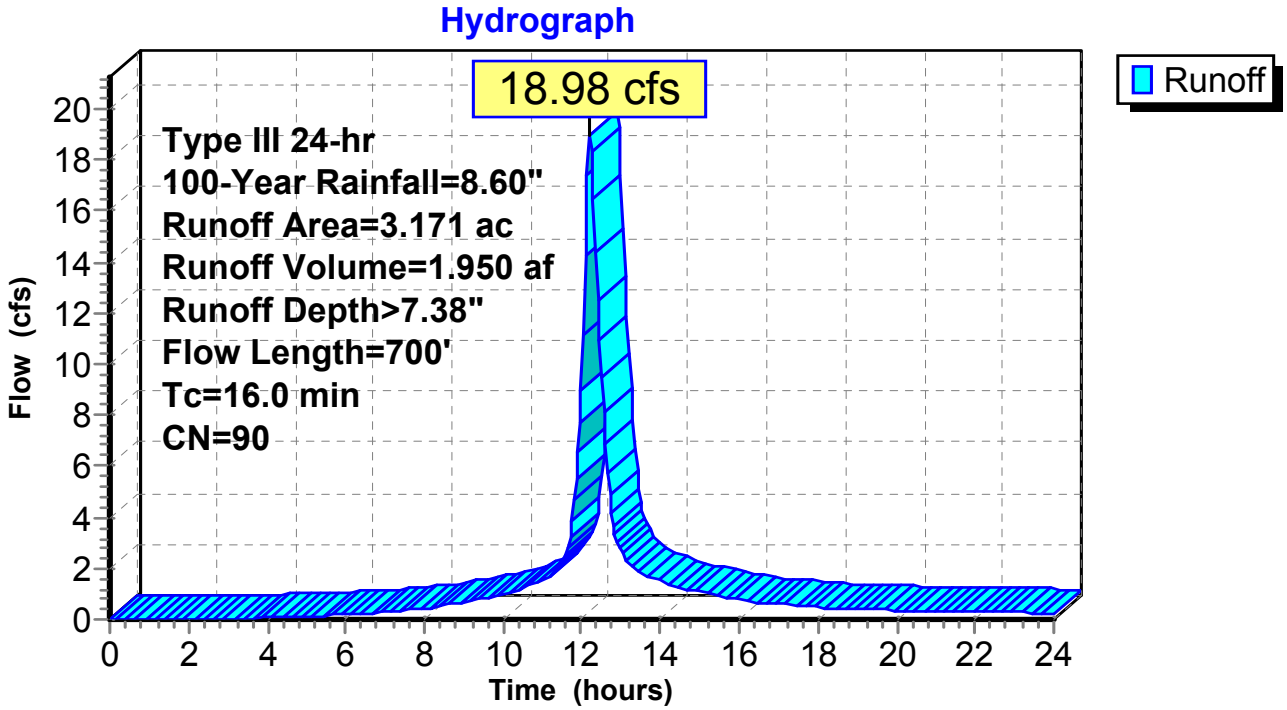
Runoff = 18.98 cfs @ 12.21 hrs, Volume= 1.950 af, Depth> 7.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (ac)	CN	Description
1.907	94	Fallow, bare soil, HSG D
1.264	84	50-75% Grass cover, Fair, HSG D
3.171	90	Weighted Average
3.171		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
7.3	500	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	700	Total			

Subcatchment EX3: EX3



Summary for Subcatchment EX4: EX4

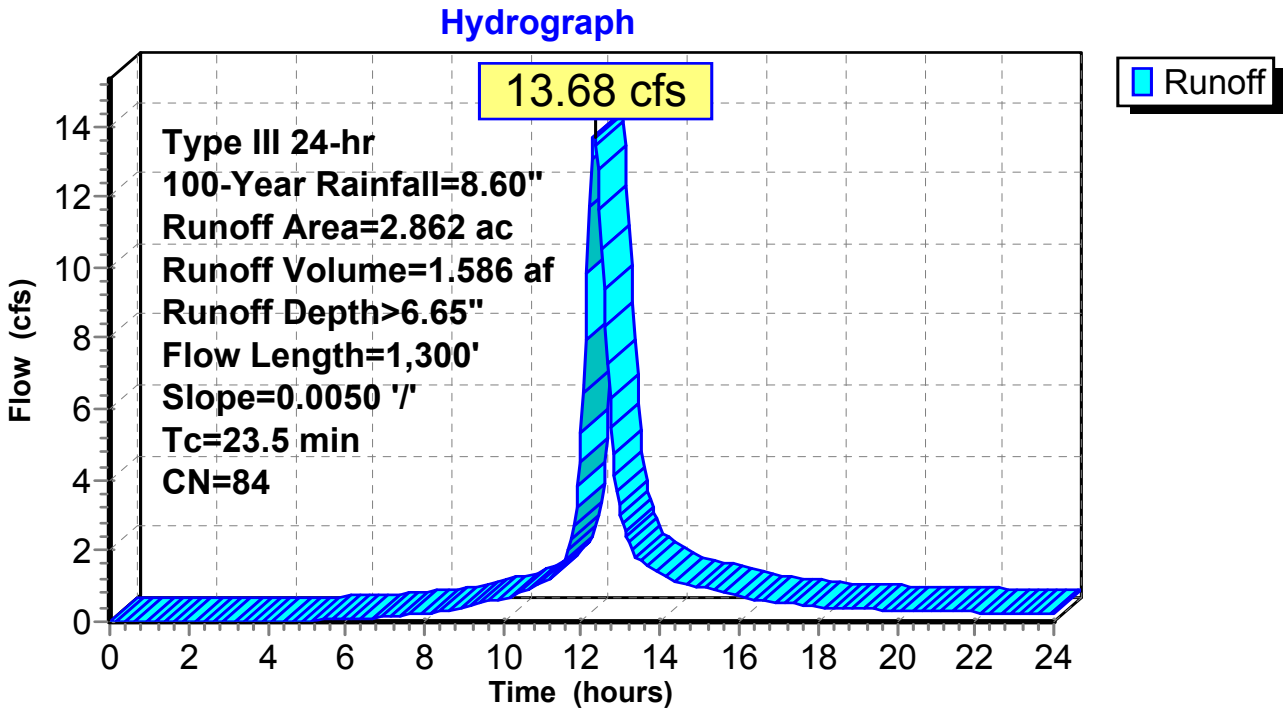
Runoff = 13.68 cfs @ 12.31 hrs, Volume= 1.586 af, Depth> 6.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

	Area (ac)	CN	Description
*	1.321	84	Rail Ballast, HSG D
	1.541	84	50-75% Grass cover, Fair, HSG D
	2.862	84	Weighted Average
	2.862		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0050	0.21		**Sheet Flow, sheet flow on the track base** Fallow n= 0.050 P2= 3.40"
19.6	1,250	0.0050	1.06		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.5	1,300	Total			

Subcatchment EX4: EX4

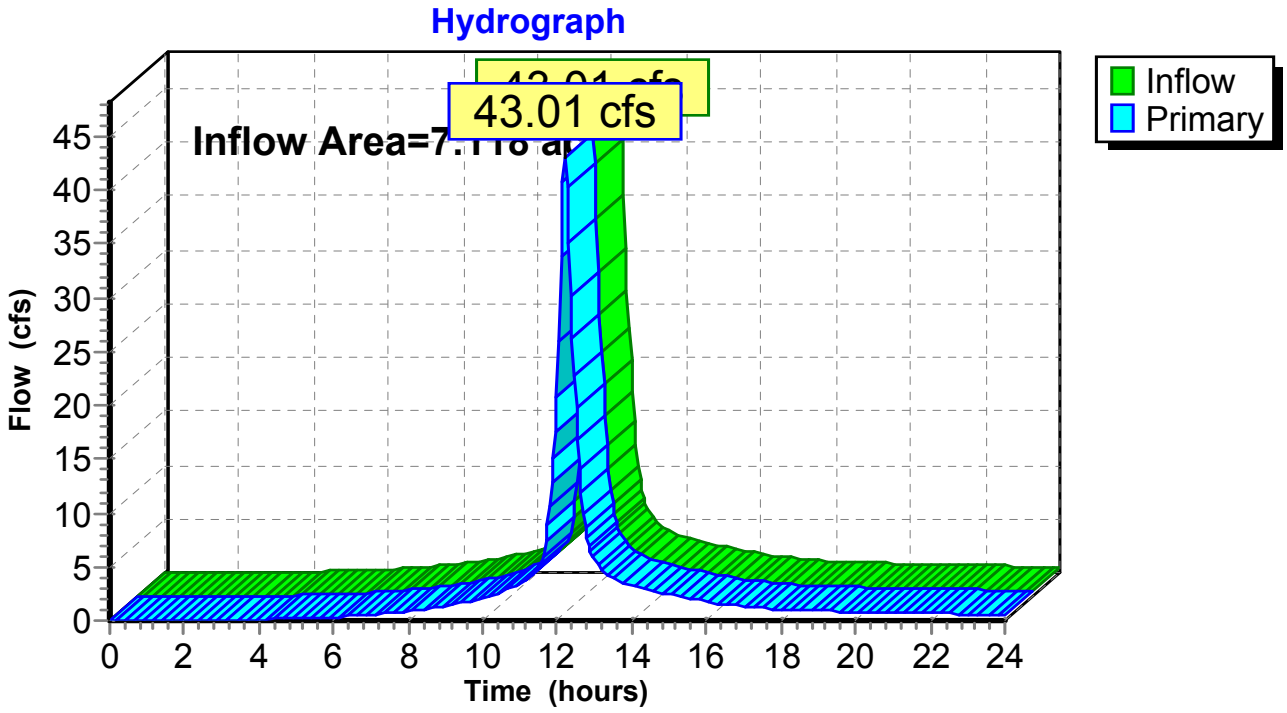


Summary for Link DP1: DP1

Inflow Area = 7.118 ac, 0.00% Impervious, Inflow Depth > 7.14" for 100-Year event
Inflow = 43.01 cfs @ 12.20 hrs, Volume= 4.236 af
Primary = 43.01 cfs @ 12.20 hrs, Volume= 4.236 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP1: DP1

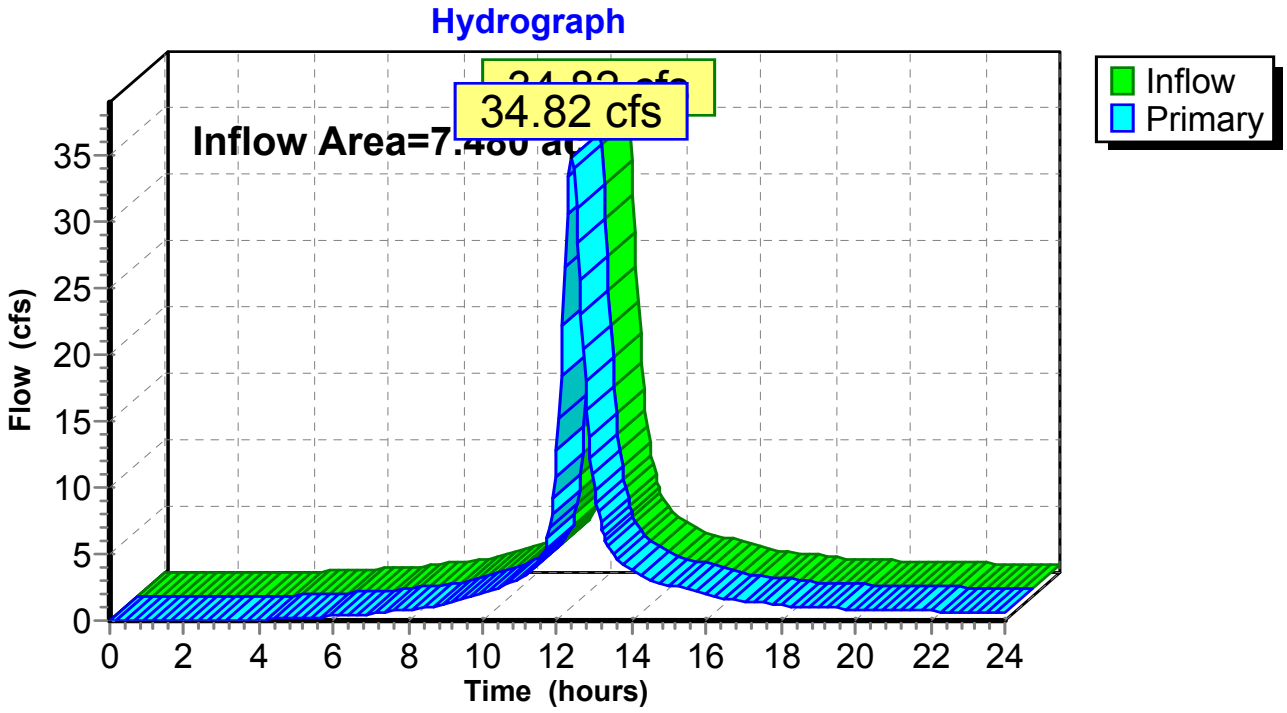


Summary for Link DP2: DP2

Inflow Area = 7.480 ac, 0.00% Impervious, Inflow Depth > 7.13" for 100-Year event
Inflow = 34.82 cfs @ 12.37 hrs, Volume= 4.441 af
Primary = 34.82 cfs @ 12.37 hrs, Volume= 4.441 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP2: DP2

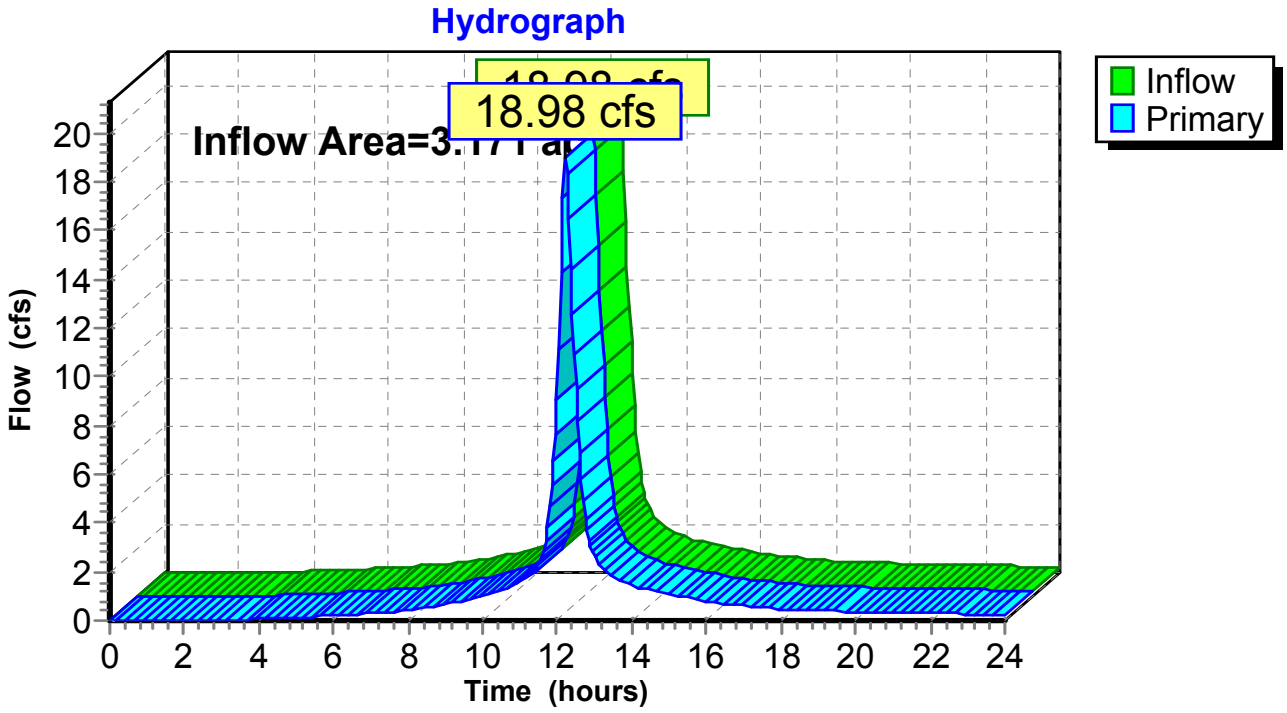


Summary for Link DP3: DP3

Inflow Area = 3.171 ac, 0.00% Impervious, Inflow Depth > 7.38" for 100-Year event
Inflow = 18.98 cfs @ 12.21 hrs, Volume= 1.950 af
Primary = 18.98 cfs @ 12.21 hrs, Volume= 1.950 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

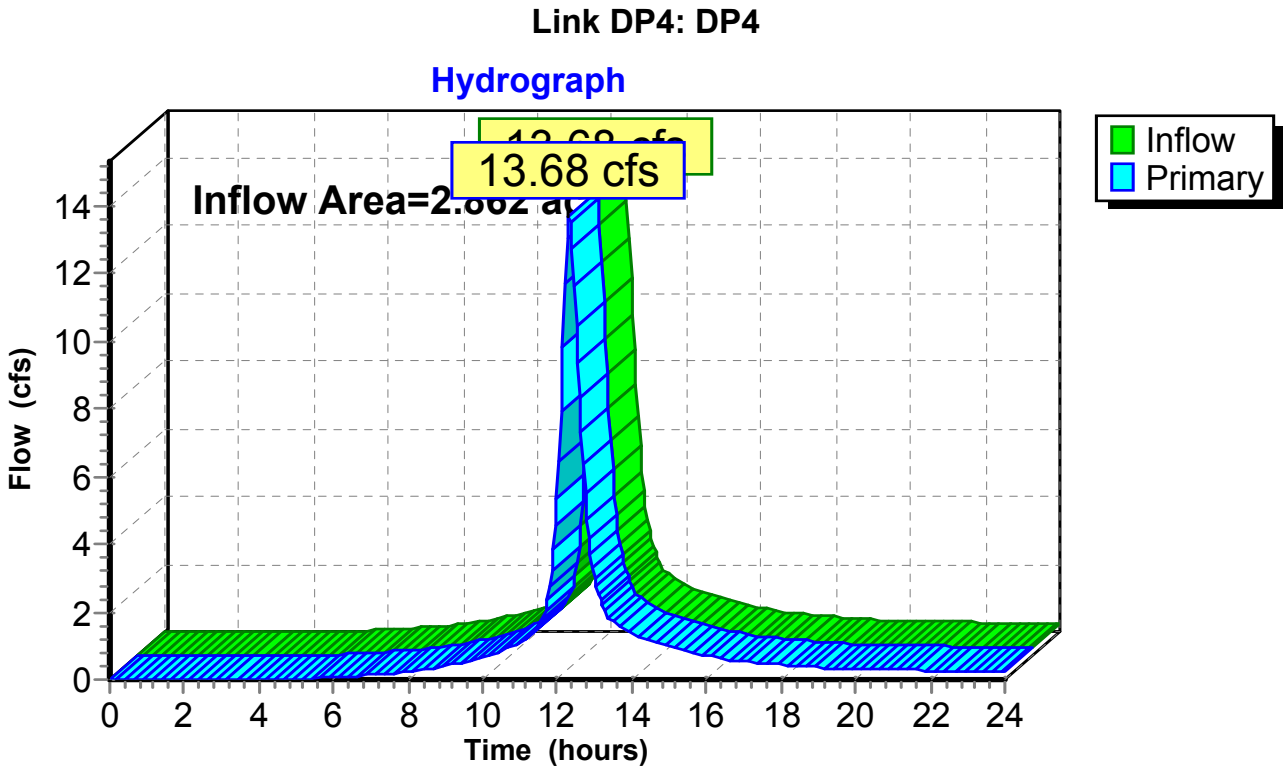
Link DP3: DP3

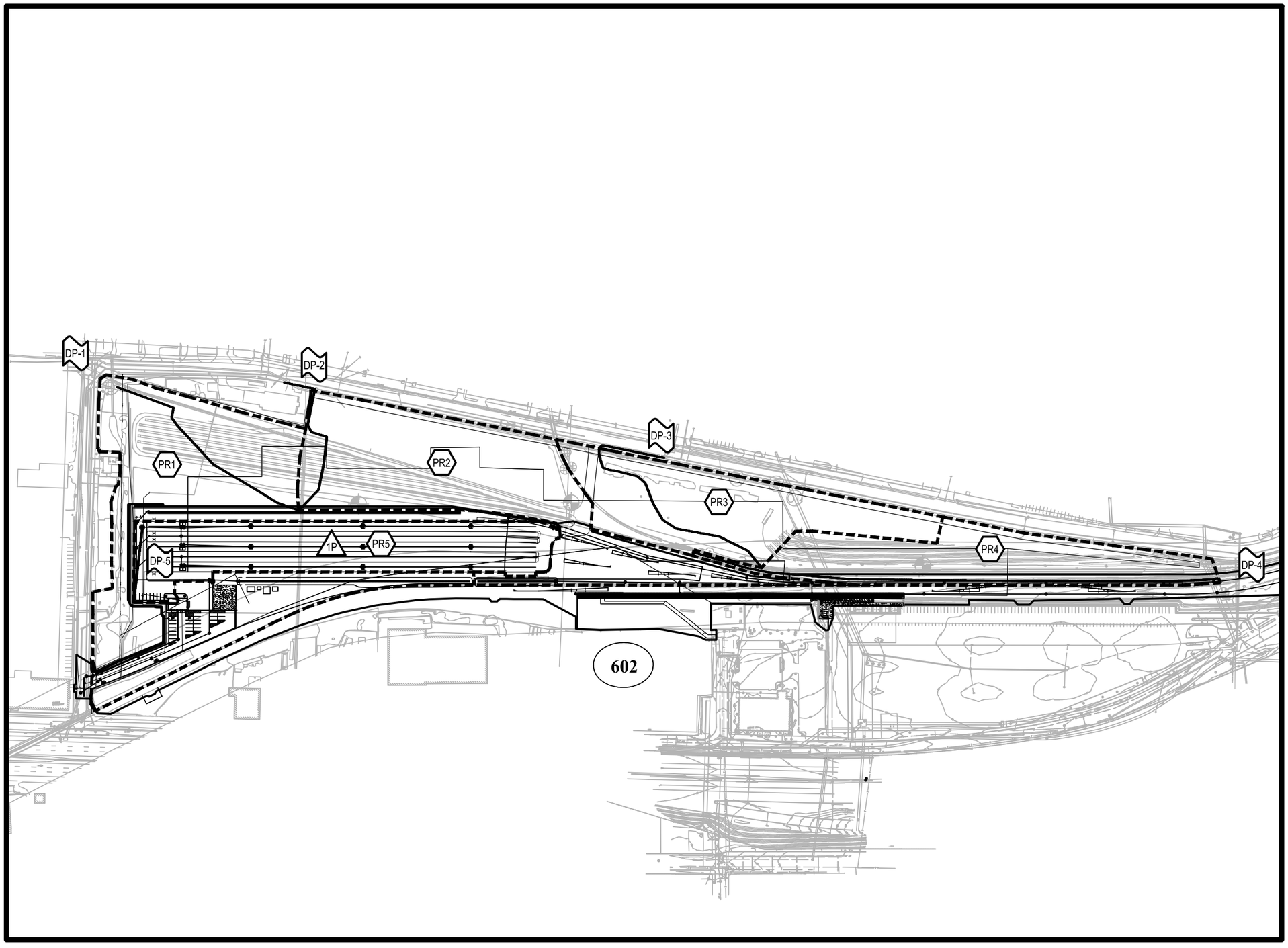


Summary for Link DP4: DP4

Inflow Area = 2.862 ac, 0.00% Impervious, Inflow Depth > 6.65" for 100-Year event
Inflow = 13.68 cfs @ 12.31 hrs, Volume= 1.586 af
Primary = 13.68 cfs @ 12.31 hrs, Volume= 1.586 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs





Legend

SYMBOLS

DP-1 — DESIGN POINT

PR2 — DRAINAGE AREA DESIGNATION

1P — POND

LINETYPES

DRAINAGE AREA BOUNDARY

TIME OF CONCENTRATION FLOW LINE

SCS SOIL CLASSIFICATIONS

602 — URBAN LAND

0 125 250 Feet

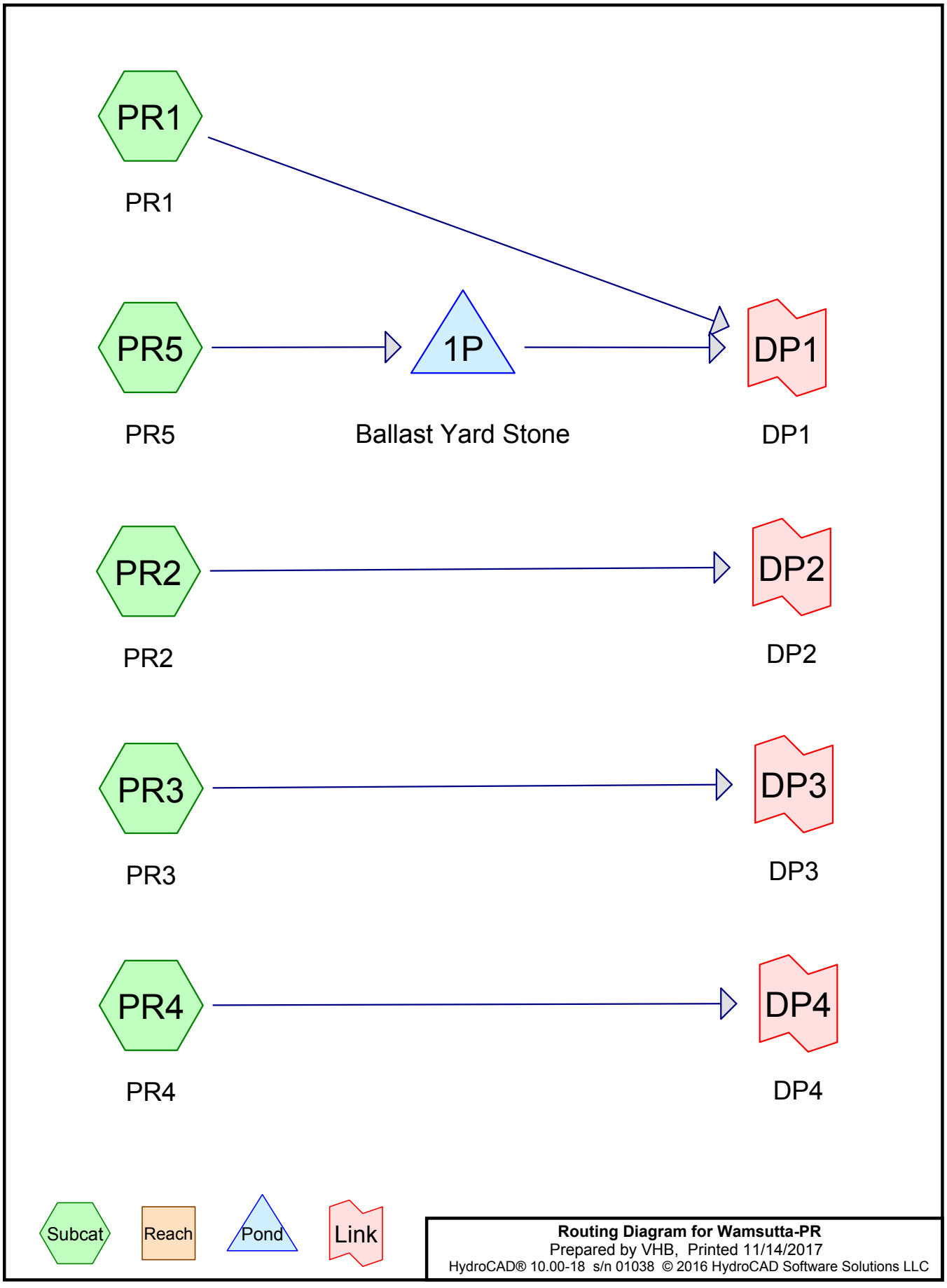
vhb

Proposed Drainage Areas

Figure 4

Wamsutta Layover
New Bedford, MA

11/15/2017



Routing Diagram for Wamsutta-PR
Prepared by VHB, Printed 11/14/2017

Summary for Subcatchment PR1: PR1

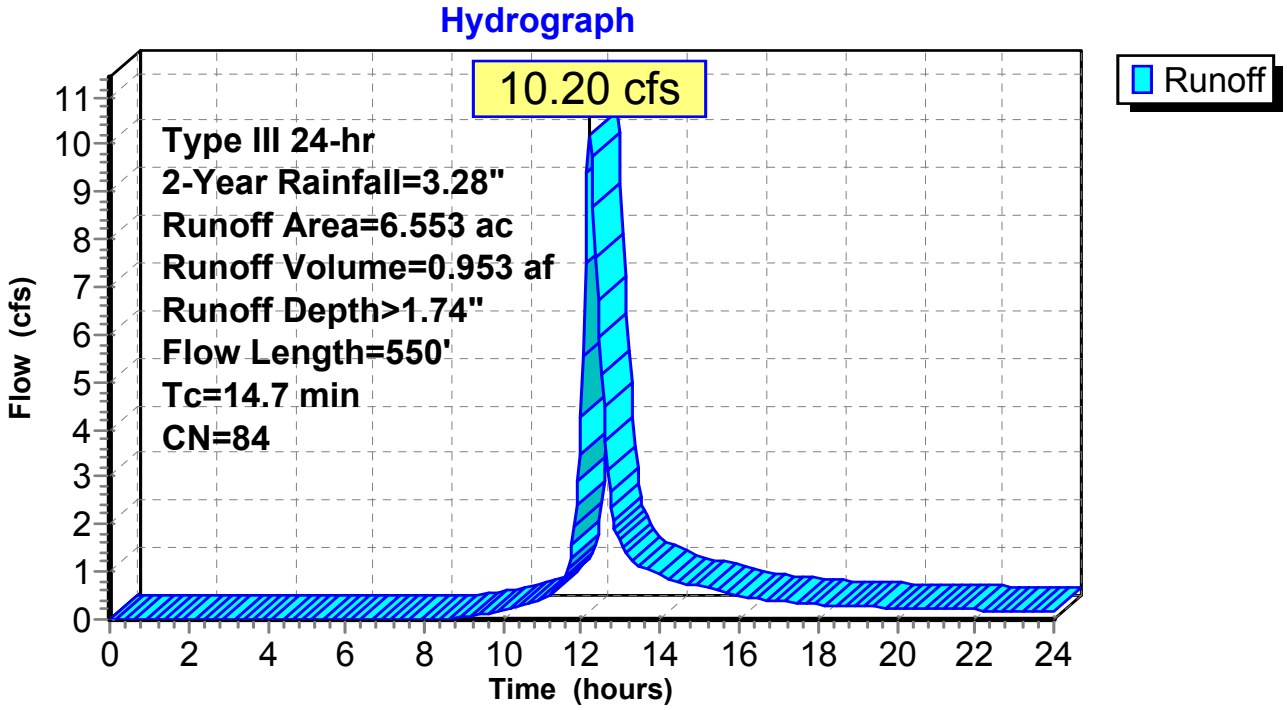
Runoff = 10.20 cfs @ 12.21 hrs, Volume= 0.953 af, Depth> 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.28"

	Area (ac)	CN	Description
	0.661	98	Paved parking, HSG D
	3.345	84	50-75% Grass cover, Fair, HSG D
*	1.512	84	Freight Yard Ballast HSG D
	1.035	77	Brush, Fair, HSG D
	6.553	84	Weighted Average
	5.892		89.91% Pervious Area
	0.661		10.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
5.2	500	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.7	550	Total			

Subcatchment PR1: PR1



Summary for Subcatchment PR2: PR2

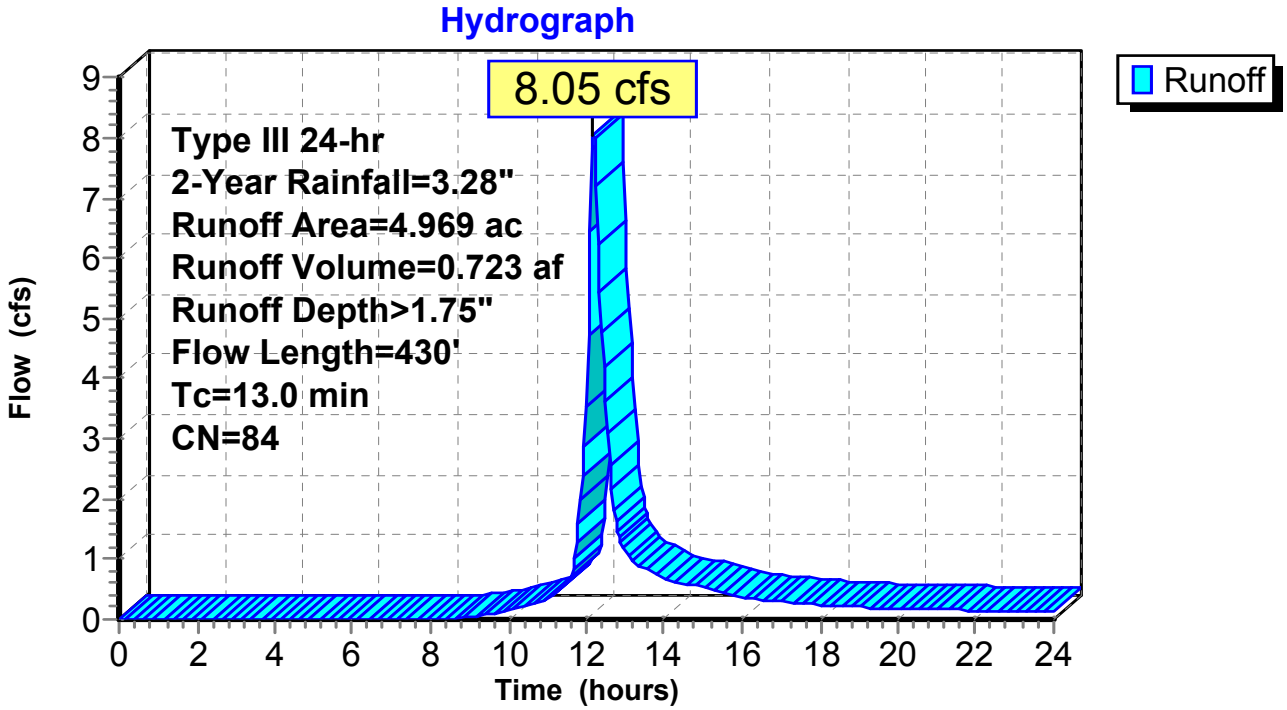
Runoff = 8.05 cfs @ 12.18 hrs, Volume= 0.723 af, Depth> 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.28"

	Area (ac)	CN	Description
	2.569	84	50-75% Grass cover, Fair, HSG D
*	2.381	84	Freigth Yard Ballast, HSG D
	0.019	98	Paved parking, HSG D
	4.969	84	Weighted Average
	4.950		99.62% Pervious Area
	0.019		0.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
3.5	380	0.0130	1.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	430	Total			

Subcatchment PR2: PR2



Summary for Subcatchment PR3: PR3

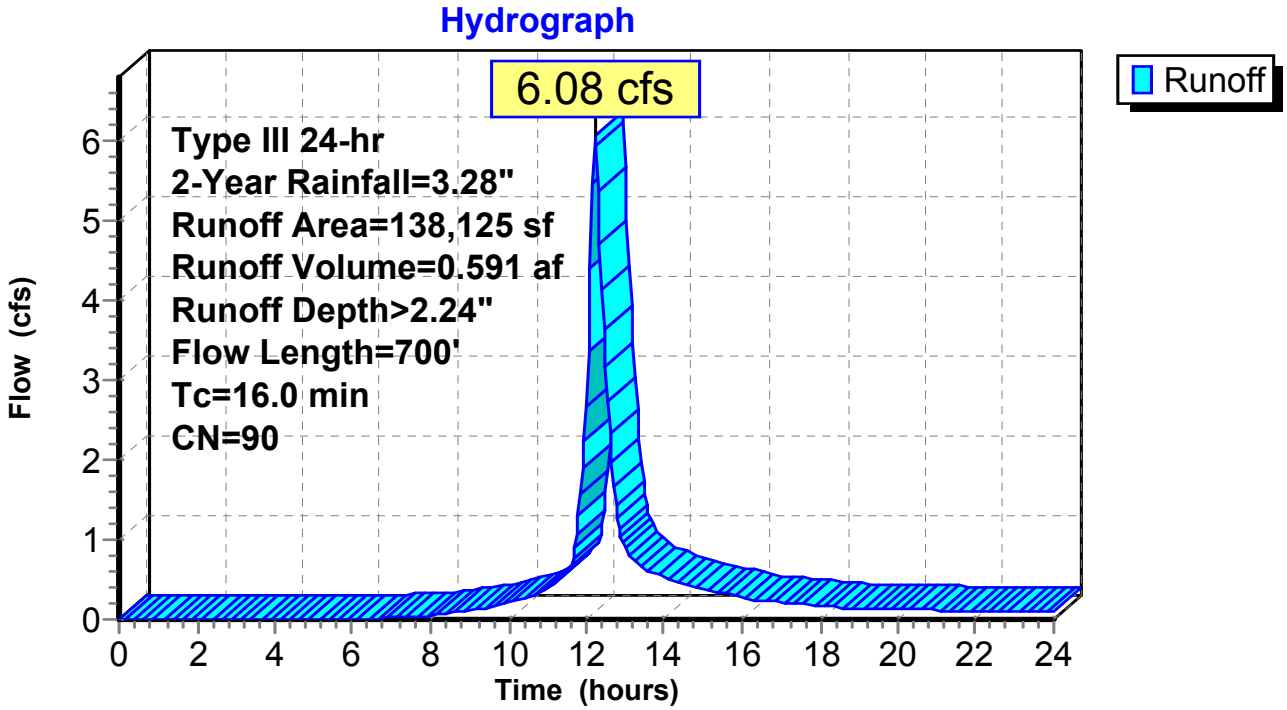
Runoff = 6.08 cfs @ 12.22 hrs, Volume= 0.591 af, Depth> 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.28"

Area (sf)	CN	Description
83,051	94	Fallow, bare soil, HSG D
55,074	84	50-75% Grass cover, Fair, HSG D
138,125	90	Weighted Average
138,125		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
7.3	500	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	700	Total			

Subcatchment PR3: PR3



Summary for Subcatchment PR4: PR4

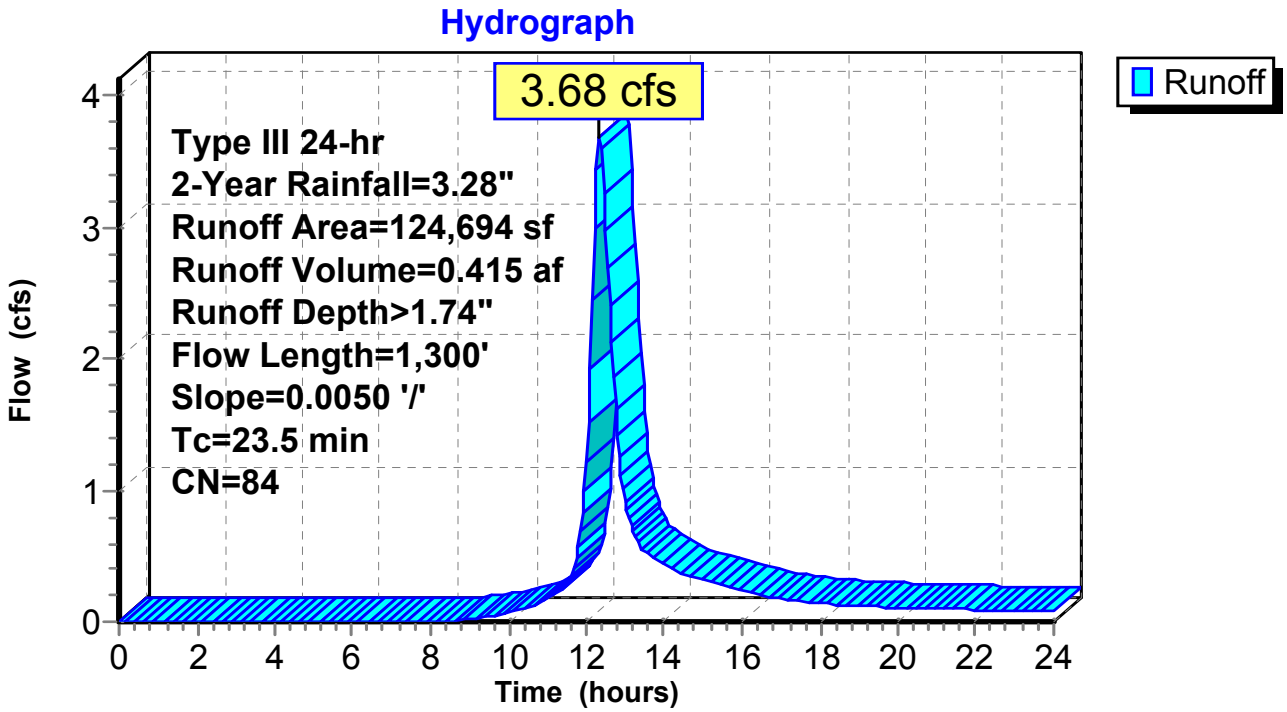
Runoff = 3.68 cfs @ 12.33 hrs, Volume= 0.415 af, Depth> 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.28"

	Area (sf)	CN	Description
*	57,552	84	Rail Ballast, HSG D
	67,142	84	50-75% Grass cover, Fair, HSG D
	124,694	84	Weighted Average
	124,694		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0050	0.21		**Sheet Flow, sheet flow on the track base** Fallow n= 0.050 P2= 3.40"
19.6	1,250	0.0050	1.06		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.5	1,300	Total			

Subcatchment PR4: PR4



Summary for Subcatchment PR5: PR5

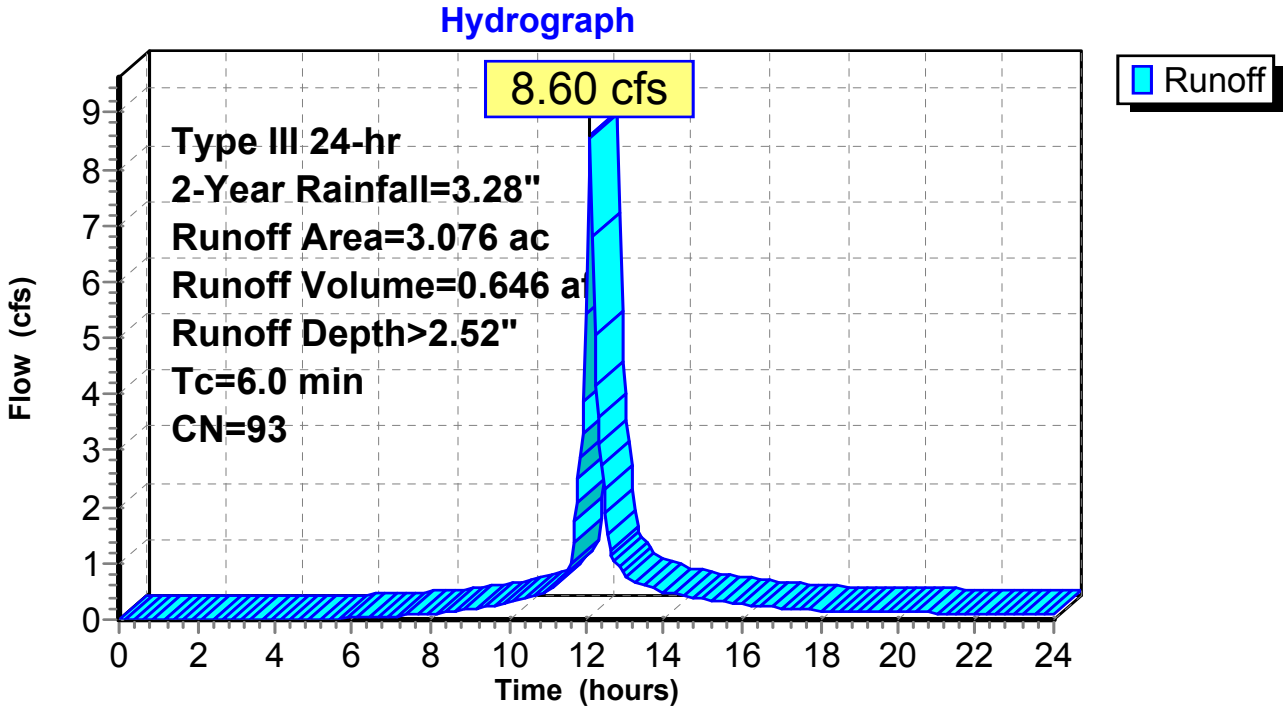
Runoff = 8.60 cfs @ 12.09 hrs, Volume= 0.646 af, Depth> 2.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.28"

	Area (ac)	CN	Description
	1.905	98	Paved parking, HSG D
*	1.171	84	Ballast, HSG D
	3.076	93	Weighted Average
	1.171		38.07% Pervious Area
	1.905		61.93% Impervious Area

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

Subcatchment PR5: PR5



Summary for Pond 1P: Ballast Yard Stone

Inflow Area = 3.076 ac, 61.93% Impervious, Inflow Depth > 2.52" for 2-Year event
Inflow = 8.60 cfs @ 12.09 hrs, Volume= 0.646 af
Outflow = 3.59 cfs @ 12.30 hrs, Volume= 0.581 af, Atten= 58%, Lag= 12.8 min
Discarded = 0.53 cfs @ 12.05 hrs, Volume= 0.065 af
Primary = 3.06 cfs @ 12.30 hrs, Volume= 0.516 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 11.35' @ 12.30 hrs Surf.Area= 3.075 ac Storage= 0.164 af

Plug-Flow detention time= 83.2 min calculated for 0.580 af (90% of inflow)
Center-of-Mass det. time= 35.2 min (826.6 - 791.3)

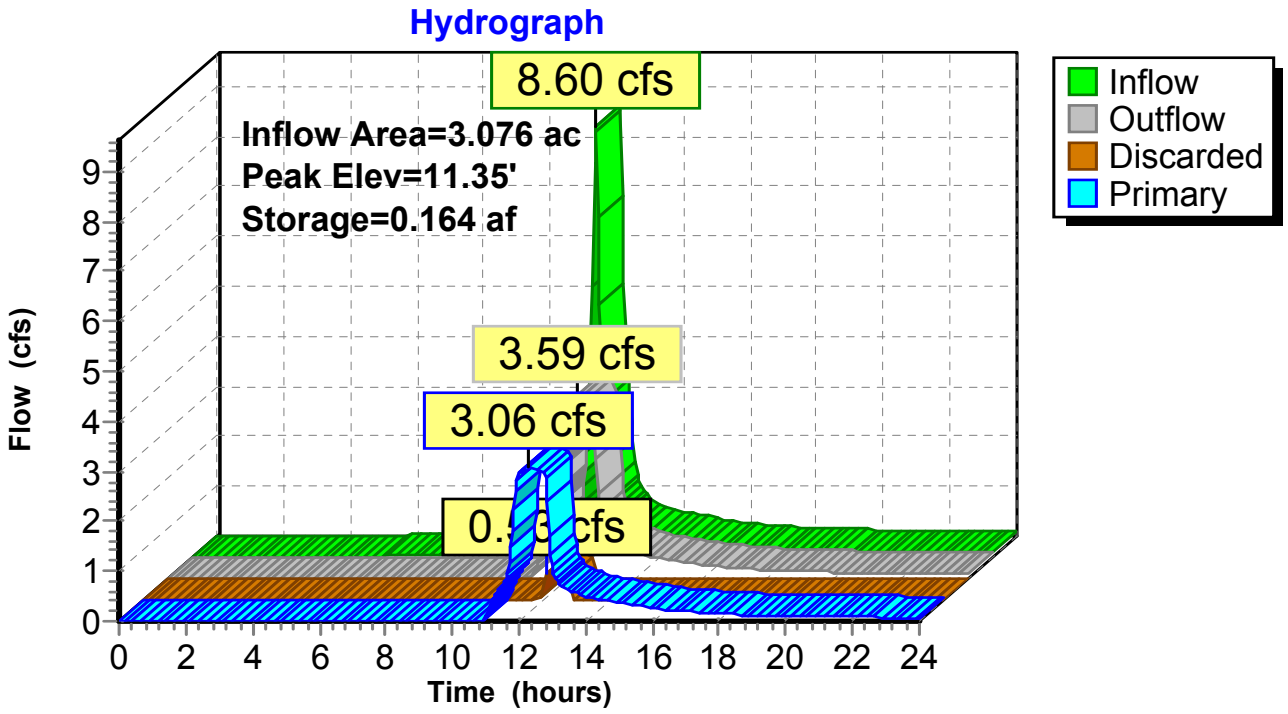
Volume	Invert	Avail.Storage	Storage Description
#1	9.80'	0.110 af	**3.00'W x 950.00'L x 2.50'H Prismatoid** x 2 0.327 af Overall - 0.051 af Embedded = 0.276 af x 40.0% Voids
#2	9.80'	0.051 af	**12.0" Round Pipe Storage** x 3 Inside #1 L= 950.0' S= 0.0015 '/'
#3	11.30'	1.178 af	**135.00'W x 950.00'L x 1.00'H Prismatoid** 2.944 af Overall x 40.0% Voids
		1.339 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.80'	**0.170 in/hr Exfiltration over Surface area**
#2	Primary	9.80'	**12.0" Round Culvert** L= 32.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 9.80' / 8.90' S= 0.0281 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	10.80'	**4.0' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Discarded OutFlow Max=0.53 cfs @ 12.05 hrs HW=11.31' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.53 cfs)

Primary OutFlow Max=3.06 cfs @ 12.30 hrs HW=11.35' (Free Discharge)
↑**2=Culvert** (Inlet Controls 3.06 cfs @ 3.90 fps)
↑**3=Sharp-Crested Rectangular Weir** (Passes 3.06 cfs of 5.55 cfs potential flow)

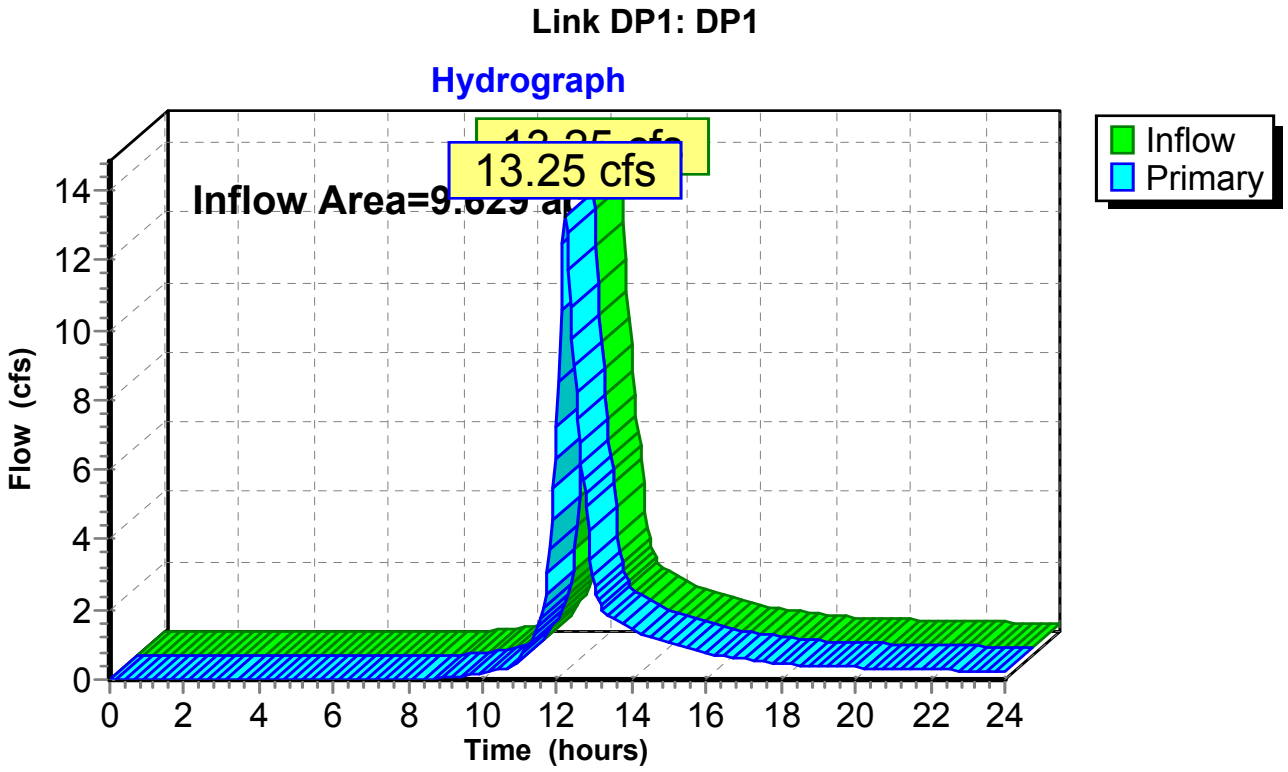
Pond 1P: Ballast Yard Stone



Summary for Link DP1: DP1

Inflow Area = 9.629 ac, 26.65% Impervious, Inflow Depth > 1.83" for 2-Year event
Inflow = 13.25 cfs @ 12.21 hrs, Volume= 1.468 af
Primary = 13.25 cfs @ 12.21 hrs, Volume= 1.468 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

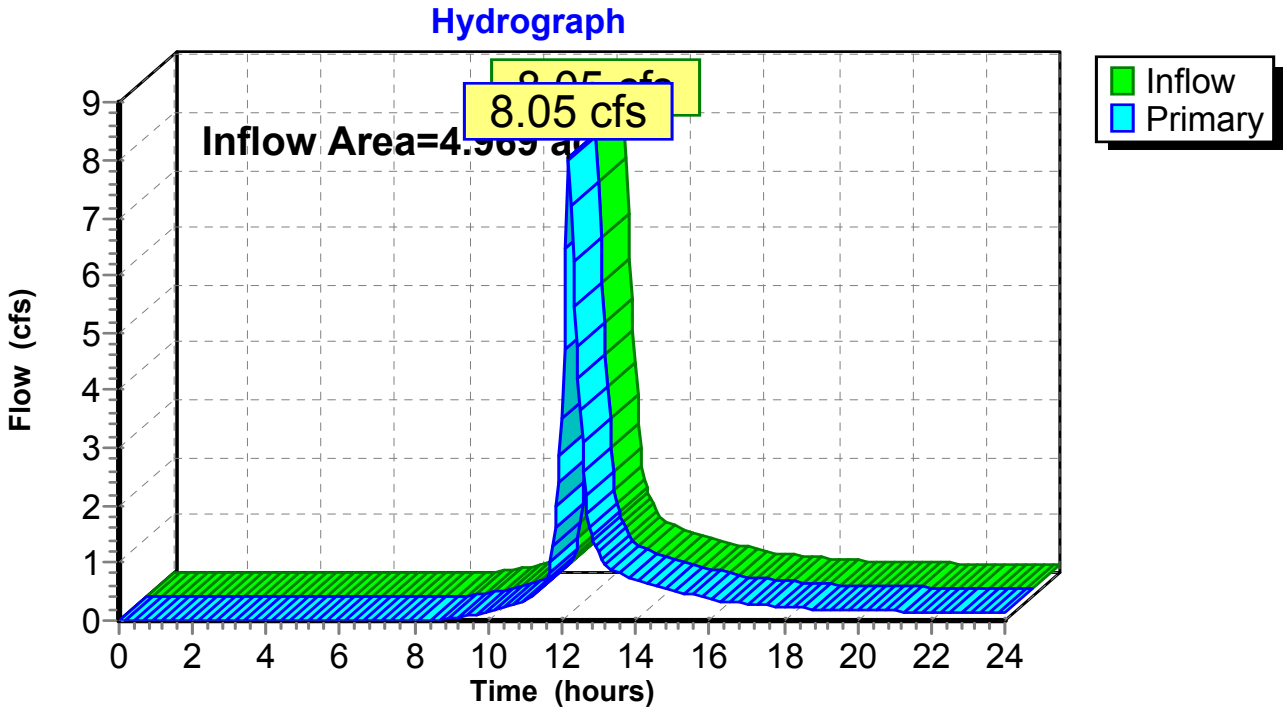


Summary for Link DP2: DP2

Inflow Area = 4.969 ac, 0.38% Impervious, Inflow Depth > 1.75" for 2-Year event
Inflow = 8.05 cfs @ 12.18 hrs, Volume= 0.723 af
Primary = 8.05 cfs @ 12.18 hrs, Volume= 0.723 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

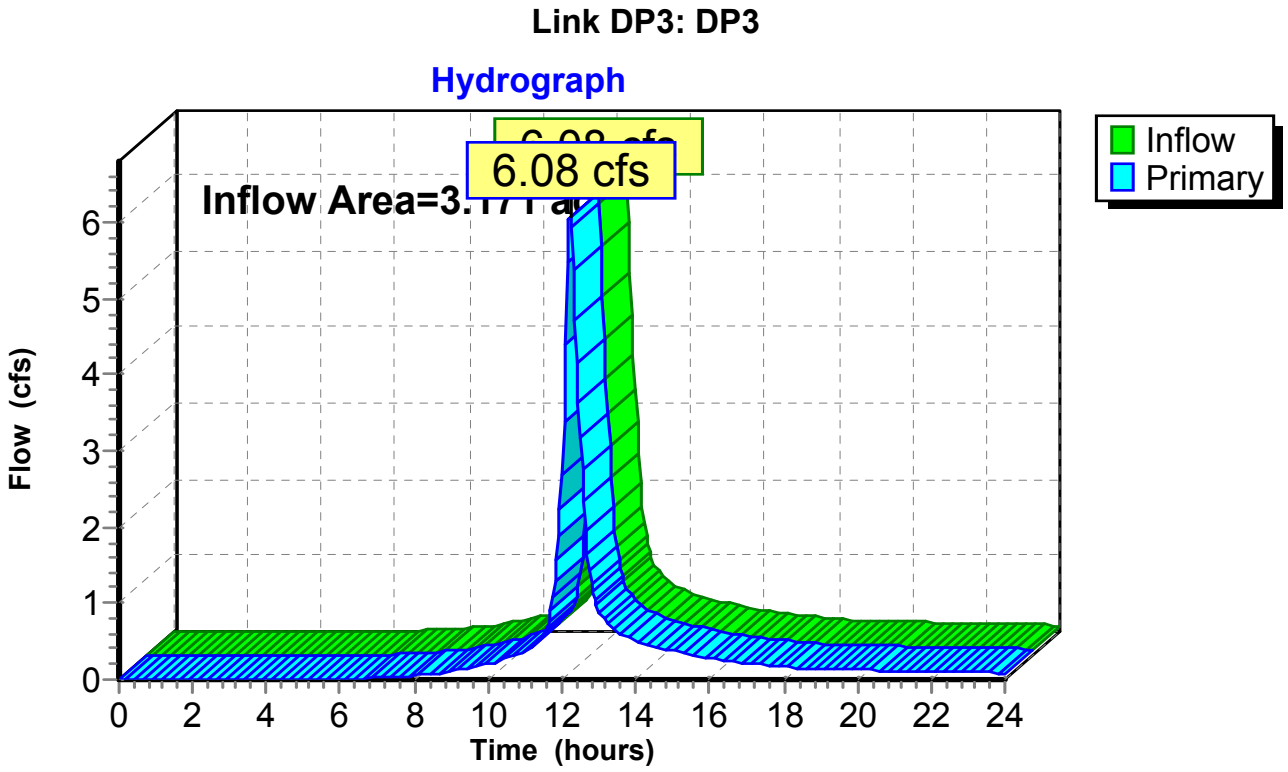
Link DP2: DP2



Summary for Link DP3: DP3

Inflow Area = 3.171 ac, 0.00% Impervious, Inflow Depth > 2.24" for 2-Year event
Inflow = 6.08 cfs @ 12.22 hrs, Volume= 0.591 af
Primary = 6.08 cfs @ 12.22 hrs, Volume= 0.591 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

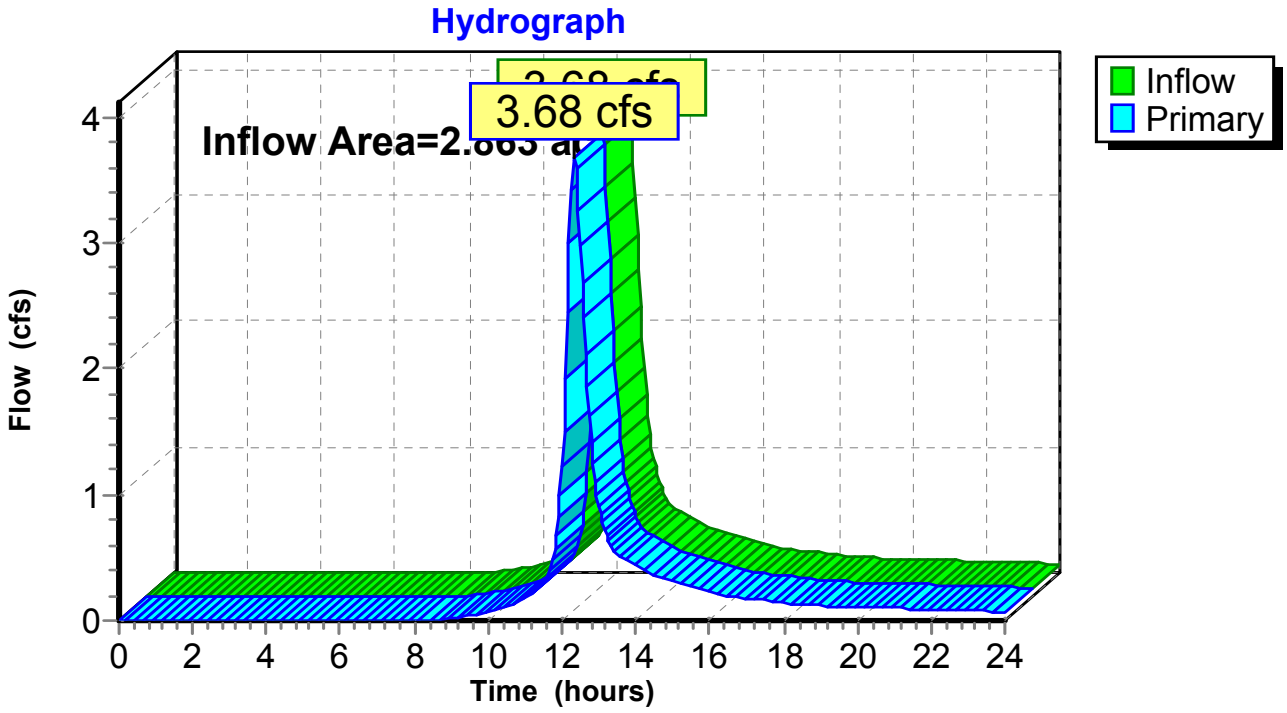


Summary for Link DP4: DP4

Inflow Area = 2.863 ac, 0.00% Impervious, Inflow Depth > 1.74" for 2-Year event
Inflow = 3.68 cfs @ 12.33 hrs, Volume= 0.415 af
Primary = 3.68 cfs @ 12.33 hrs, Volume= 0.415 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP4: DP4



Summary for Subcatchment PR1: PR1

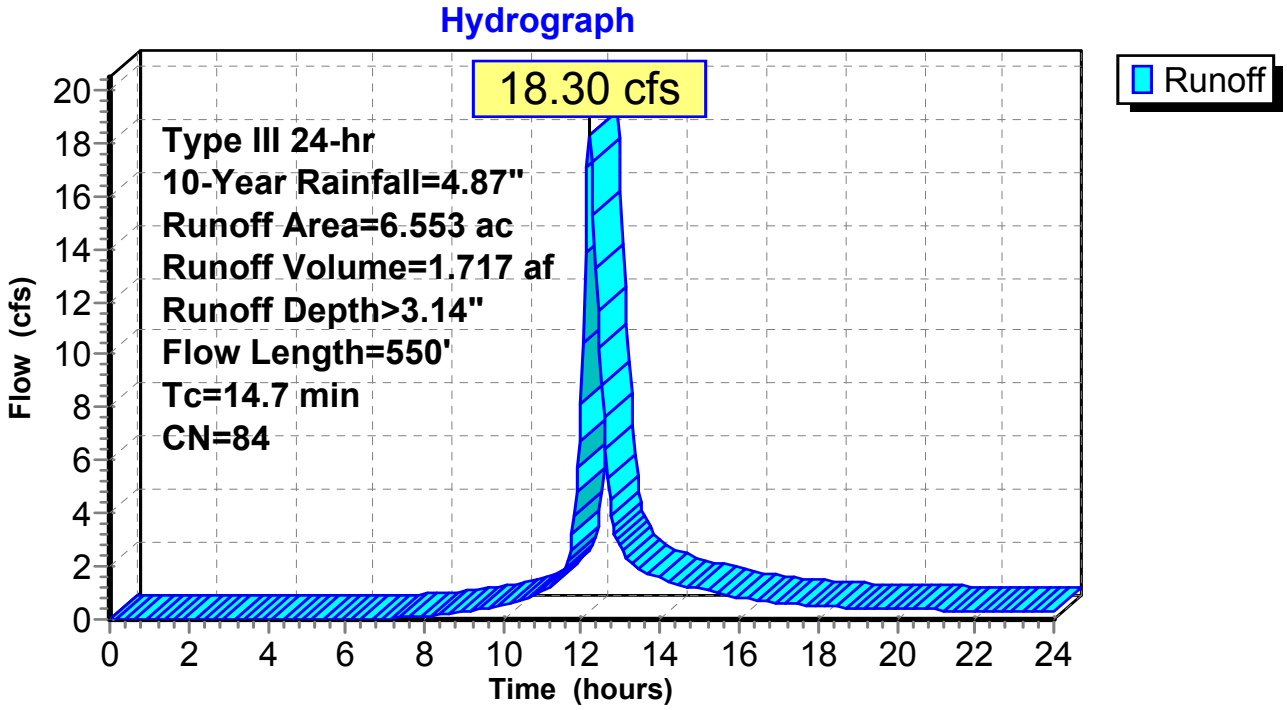
Runoff = 18.30 cfs @ 12.20 hrs, Volume= 1.717 af, Depth> 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.87"

	Area (ac)	CN	Description
	0.661	98	Paved parking, HSG D
	3.345	84	50-75% Grass cover, Fair, HSG D
*	1.512	84	Freight Yard Ballast HSG D
	1.035	77	Brush, Fair, HSG D
	6.553	84	Weighted Average
	5.892		89.91% Pervious Area
	0.661		10.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
5.2	500	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.7	550	Total			

Subcatchment PR1: PR1



Summary for Subcatchment PR2: PR2

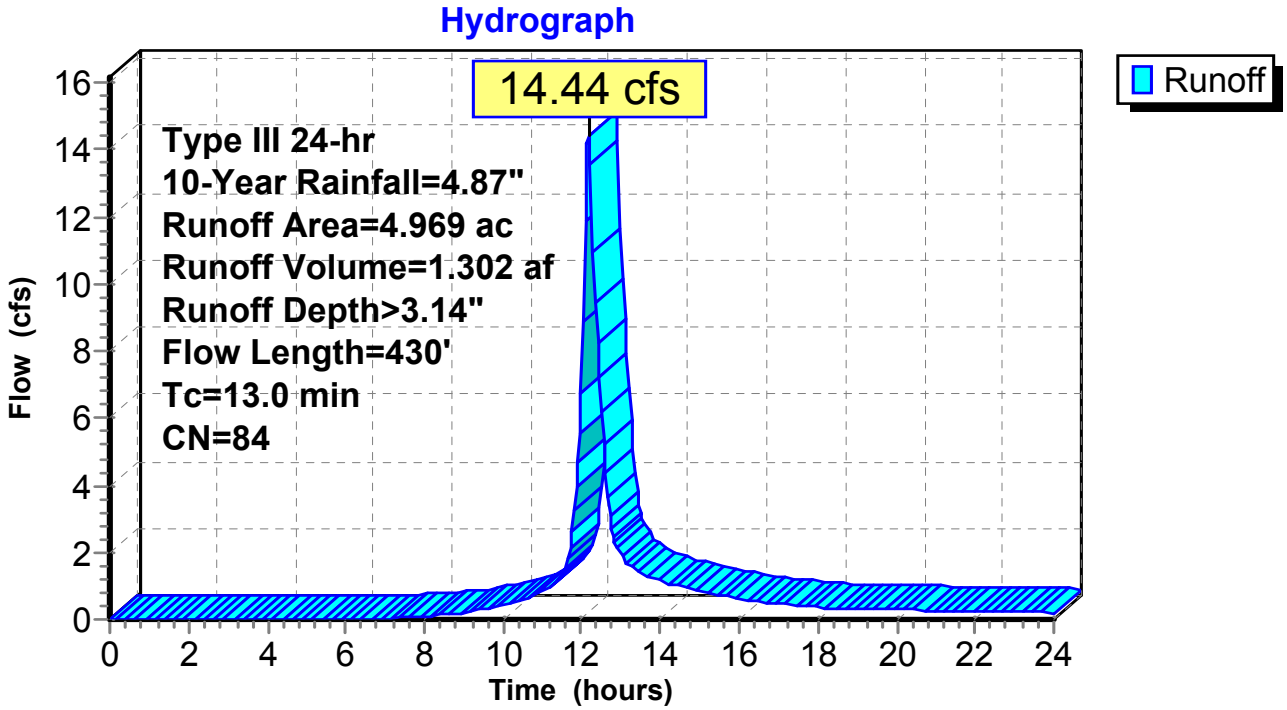
Runoff = 14.44 cfs @ 12.18 hrs, Volume= 1.302 af, Depth> 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.87"

	Area (ac)	CN	Description
	2.569	84	50-75% Grass cover, Fair, HSG D
*	2.381	84	Freigth Yard Ballast, HSG D
	0.019	98	Paved parking, HSG D
	4.969	84	Weighted Average
	4.950		99.62% Pervious Area
	0.019		0.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
3.5	380	0.0130	1.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	430	Total			

Subcatchment PR2: PR2



Summary for Subcatchment PR3: PR3

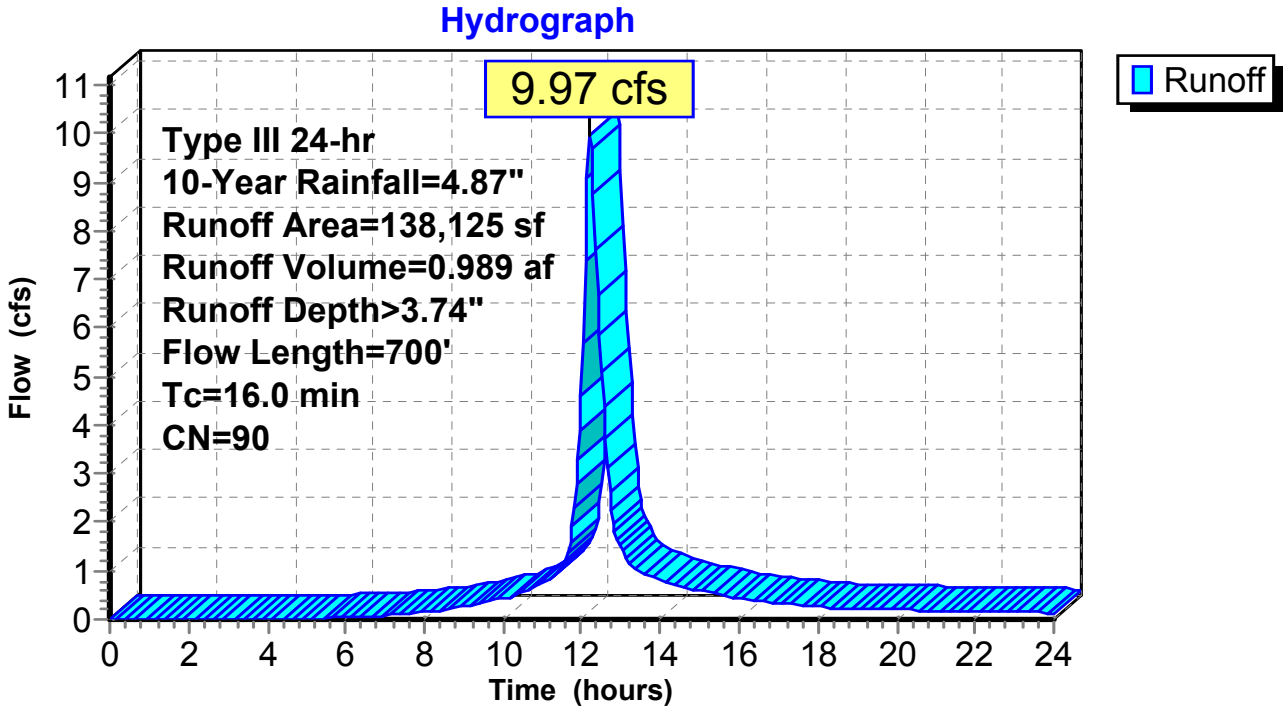
Runoff = 9.97 cfs @ 12.21 hrs, Volume= 0.989 af, Depth> 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.87"

Area (sf)	CN	Description
83,051	94	Fallow, bare soil, HSG D
55,074	84	50-75% Grass cover, Fair, HSG D
138,125	90	Weighted Average
138,125		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
7.3	500	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	700	Total			

Subcatchment PR3: PR3



Summary for Subcatchment PR4: PR4

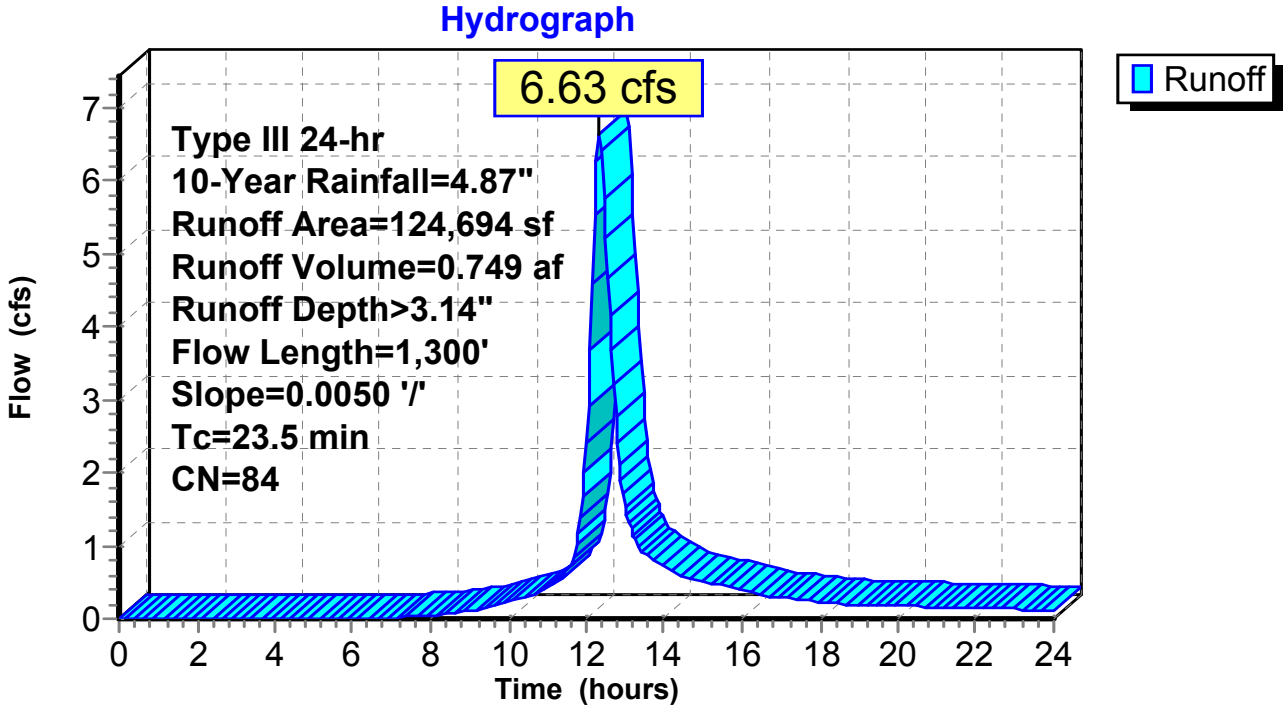
Runoff = 6.63 cfs @ 12.32 hrs, Volume= 0.749 af, Depth> 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.87"

	Area (sf)	CN	Description
*	57,552	84	Rail Ballast, HSG D
	67,142	84	50-75% Grass cover, Fair, HSG D
	124,694	84	Weighted Average
	124,694		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0050	0.21		**Sheet Flow, sheet flow on the track base** Fallow n= 0.050 P2= 3.40"
19.6	1,250	0.0050	1.06		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.5	1,300	Total			

Subcatchment PR4: PR4



Summary for Subcatchment PR5: PR5

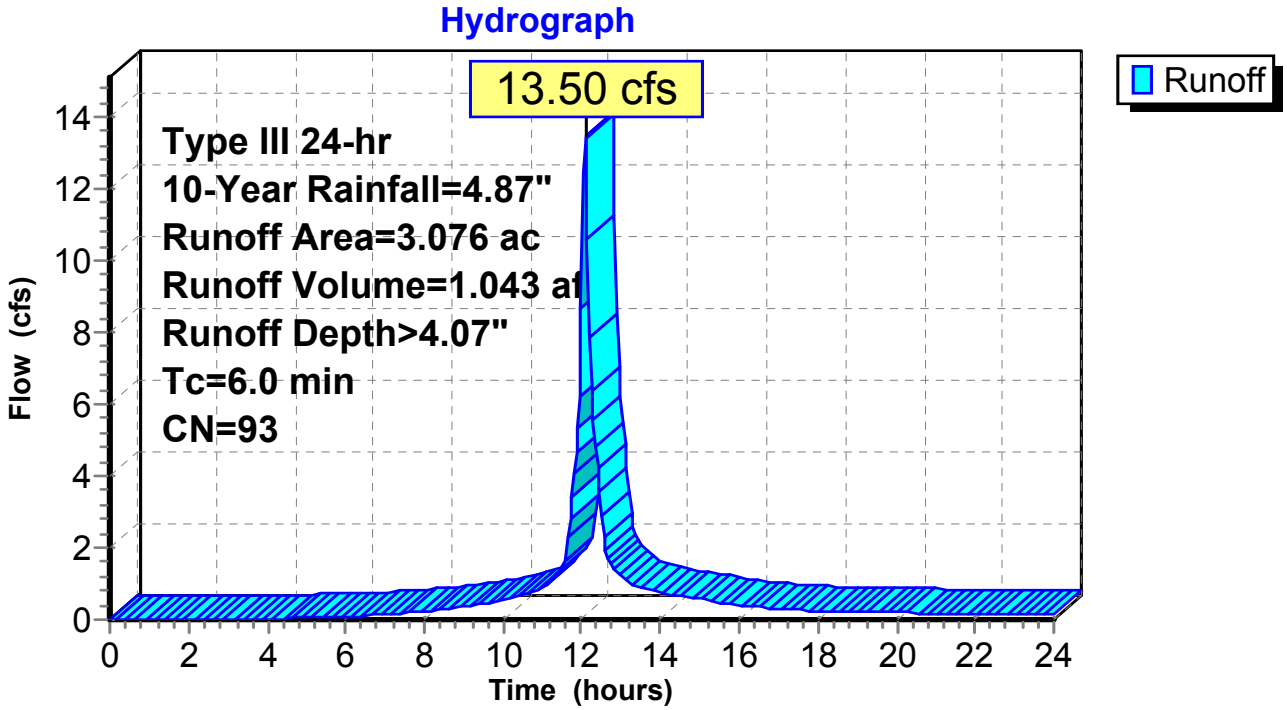
Runoff = 13.50 cfs @ 12.09 hrs, Volume= 1.043 af, Depth> 4.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.87"

	Area (ac)	CN	Description
	1.905	98	Paved parking, HSG D
*	1.171	84	Ballast, HSG D
	3.076	93	Weighted Average
	1.171		38.07% Pervious Area
	1.905		61.93% Impervious Area

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

Subcatchment PR5: PR5



Summary for Pond 1P: Ballast Yard Stone

Inflow Area = 3.076 ac, 61.93% Impervious, Inflow Depth > 4.07" for 10-Year event
Inflow = 13.50 cfs @ 12.09 hrs, Volume= 1.043 af
Outflow = 3.73 cfs @ 12.44 hrs, Volume= 0.976 af, Atten= 72%, Lag= 20.9 min
Discarded = 0.53 cfs @ 11.90 hrs, Volume= 0.104 af
Primary = 3.20 cfs @ 12.44 hrs, Volume= 0.873 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 11.45' @ 12.44 hrs Surf.Area= 3.075 ac Storage= 0.289 af

Plug-Flow detention time= 72.0 min calculated for 0.976 af (94% of inflow)
Center-of-Mass det. time= 37.7 min (816.3 - 778.6)

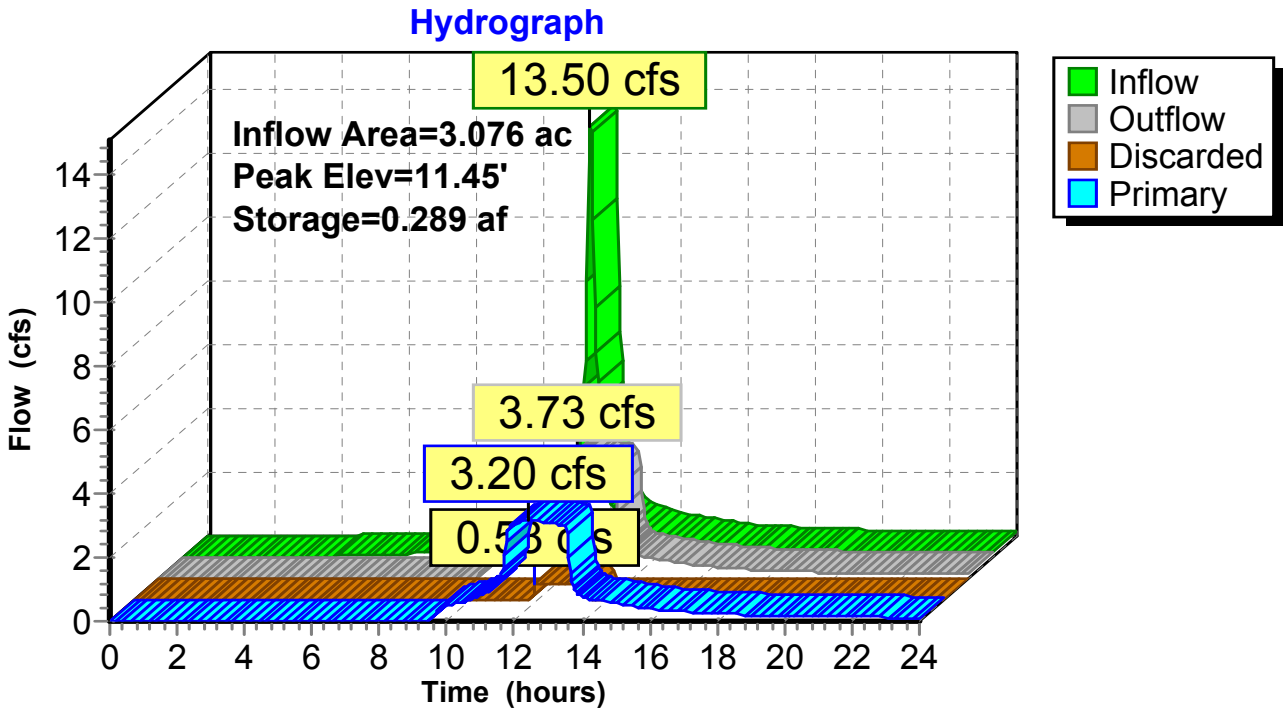
Volume	Invert	Avail.Storage	Storage Description
#1	9.80'	0.110 af	**3.00'W x 950.00'L x 2.50'H Prismatoid** x 2 0.327 af Overall - 0.051 af Embedded = 0.276 af x 40.0% Voids
#2	9.80'	0.051 af	**12.0" Round Pipe Storage** x 3 Inside #1 L= 950.0' S= 0.0015 '/'
#3	11.30'	1.178 af	**135.00'W x 950.00'L x 1.00'H Prismatoid** 2.944 af Overall x 40.0% Voids
		1.339 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.80'	**0.170 in/hr Exfiltration over Surface area**
#2	Primary	9.80'	**12.0" Round Culvert** L= 32.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 9.80' / 8.90' S= 0.0281 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	10.80'	**4.0' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Discarded OutFlow Max=0.53 cfs @ 11.90 hrs HW=11.30' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.53 cfs)

Primary OutFlow Max=3.20 cfs @ 12.44 hrs HW=11.45' (Free Discharge)
└**2=Culvert** (Inlet Controls 3.20 cfs @ 4.08 fps)
└**3=Sharp-Crested Rectangular Weir** (Passes 3.20 cfs of 7.18 cfs potential flow)

Pond 1P: Ballast Yard Stone

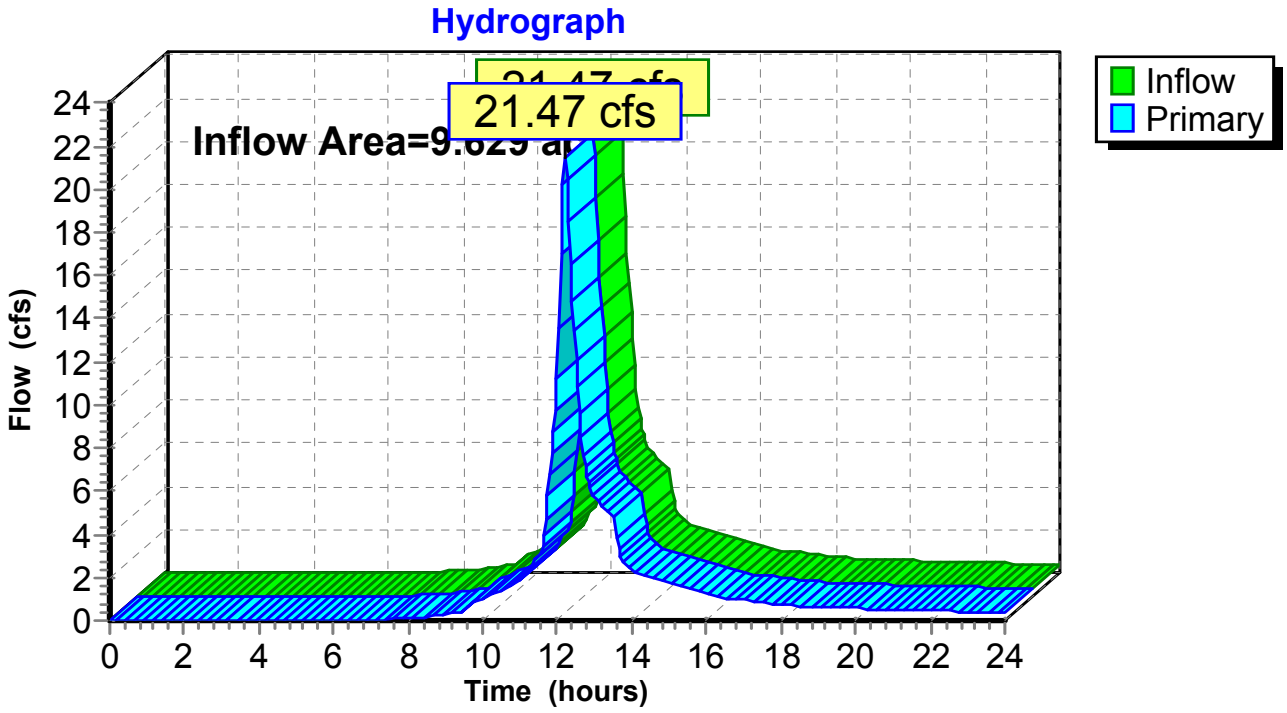


Summary for Link DP1: DP1

Inflow Area = 9.629 ac, 26.65% Impervious, Inflow Depth > 3.23" for 10-Year event
Inflow = 21.47 cfs @ 12.20 hrs, Volume= 2.590 af
Primary = 21.47 cfs @ 12.20 hrs, Volume= 2.590 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP1: DP1

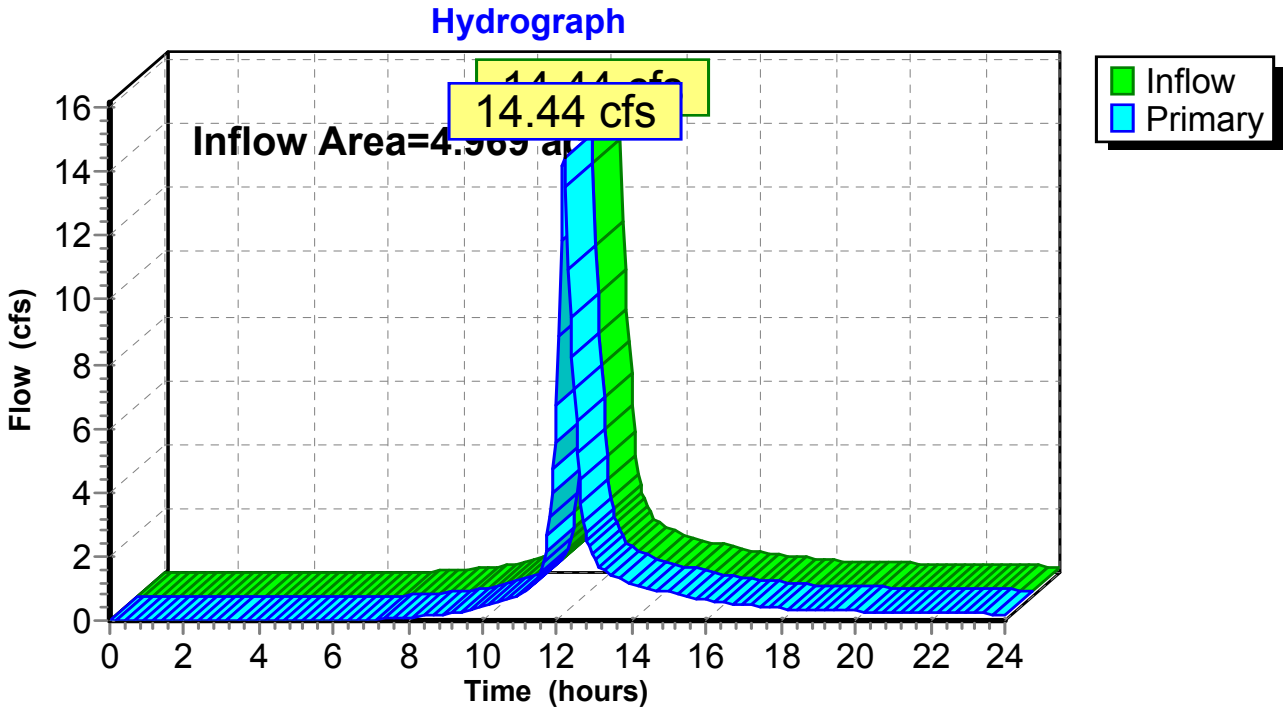


Summary for Link DP2: DP2

Inflow Area = 4.969 ac, 0.38% Impervious, Inflow Depth > 3.14" for 10-Year event
Inflow = 14.44 cfs @ 12.18 hrs, Volume= 1.302 af
Primary = 14.44 cfs @ 12.18 hrs, Volume= 1.302 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

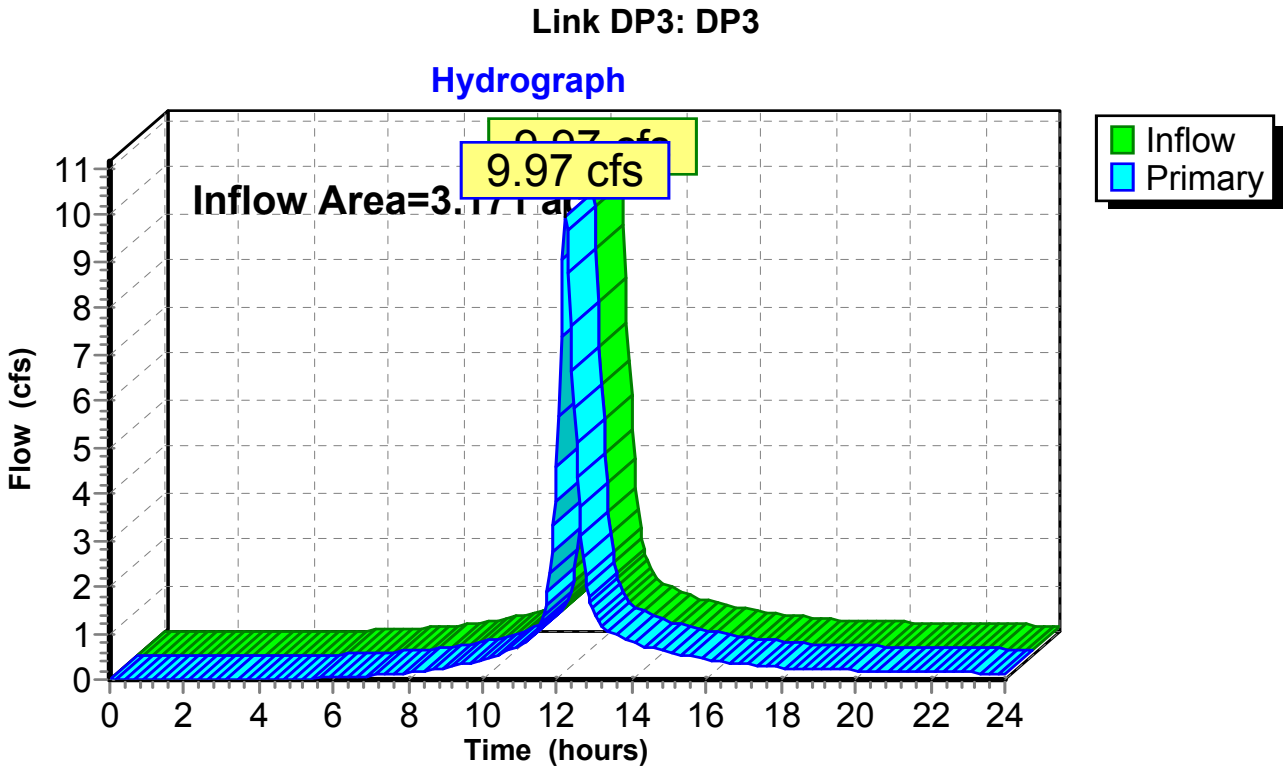
Link DP2: DP2



Summary for Link DP3: DP3

Inflow Area = 3.171 ac, 0.00% Impervious, Inflow Depth > 3.74" for 10-Year event
Inflow = 9.97 cfs @ 12.21 hrs, Volume= 0.989 af
Primary = 9.97 cfs @ 12.21 hrs, Volume= 0.989 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

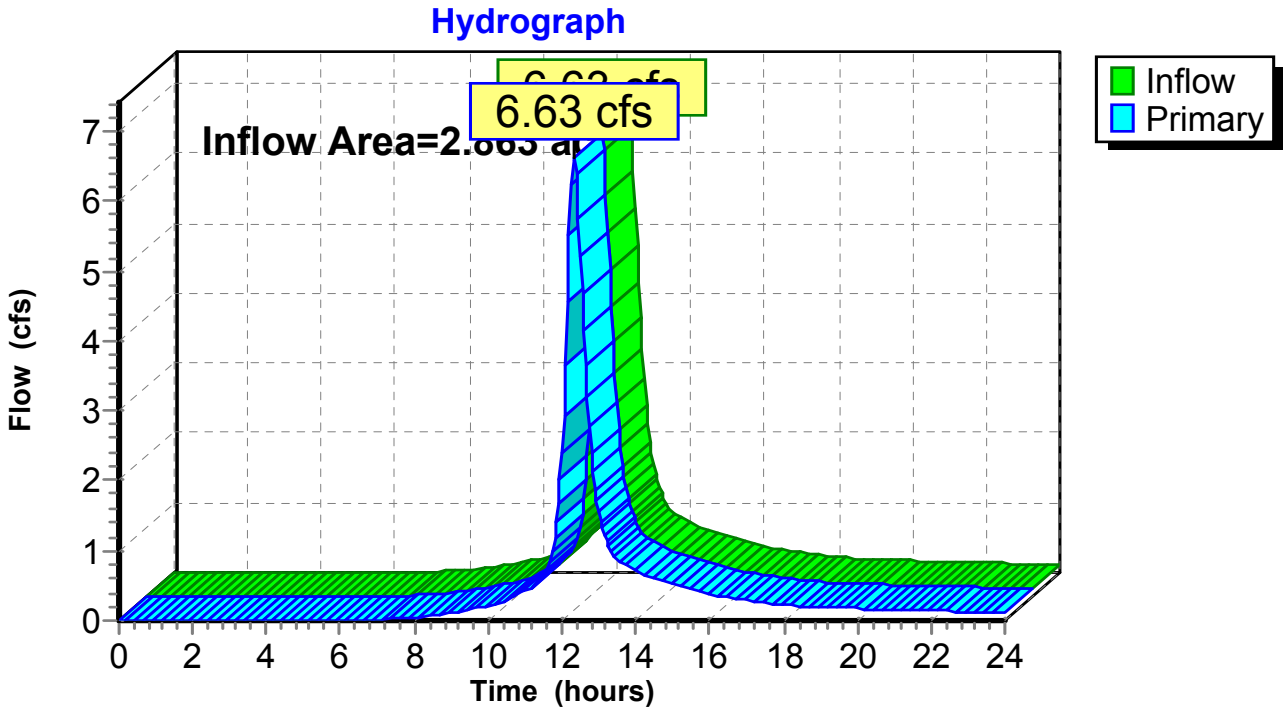


Summary for Link DP4: DP4

Inflow Area = 2.863 ac, 0.00% Impervious, Inflow Depth > 3.14" for 10-Year event
Inflow = 6.63 cfs @ 12.32 hrs, Volume= 0.749 af
Primary = 6.63 cfs @ 12.32 hrs, Volume= 0.749 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP4: DP4



Summary for Subcatchment PR1: PR1

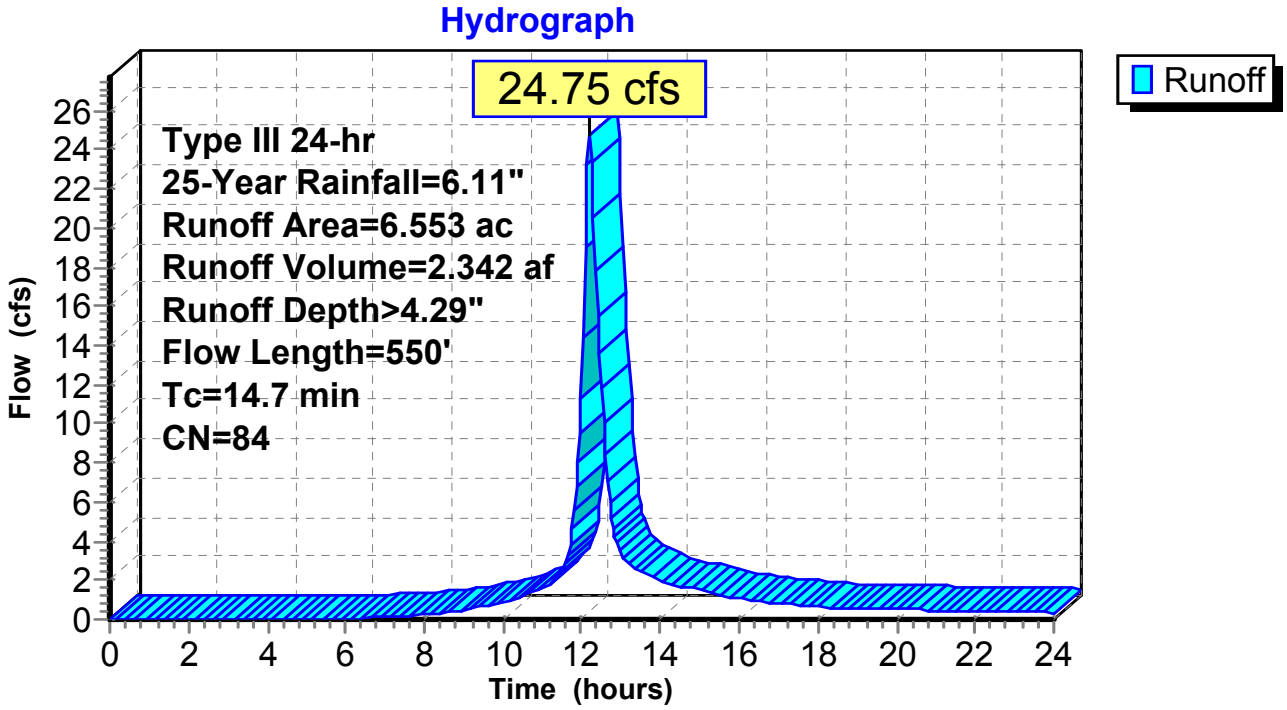
Runoff = 24.75 cfs @ 12.20 hrs, Volume= 2.342 af, Depth> 4.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.11"

	Area (ac)	CN	Description
	0.661	98	Paved parking, HSG D
	3.345	84	50-75% Grass cover, Fair, HSG D
*	1.512	84	Freight Yard Ballast HSG D
	1.035	77	Brush, Fair, HSG D
	6.553	84	Weighted Average
	5.892		89.91% Pervious Area
	0.661		10.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
5.2	500	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.7	550	Total			

Subcatchment PR1: PR1



Summary for Subcatchment PR2: PR2

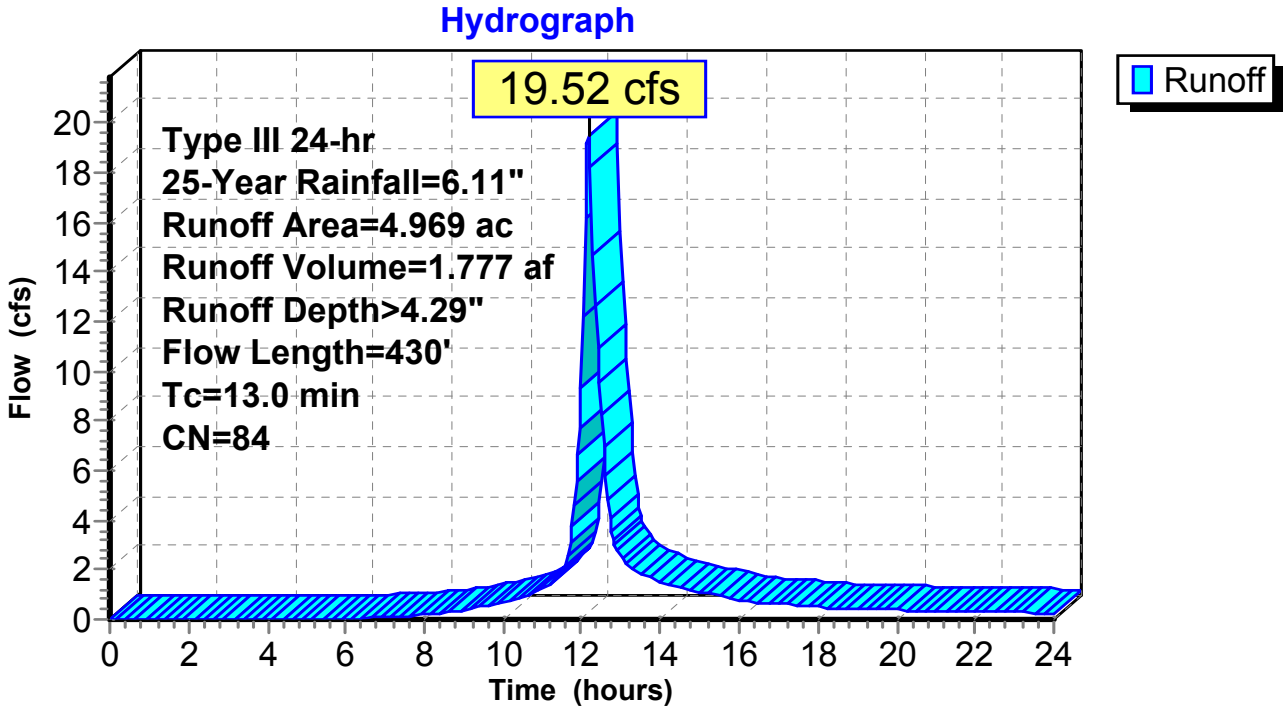
Runoff = 19.52 cfs @ 12.18 hrs, Volume= 1.777 af, Depth> 4.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.11"

	Area (ac)	CN	Description
	2.569	84	50-75% Grass cover, Fair, HSG D
*	2.381	84	Freigth Yard Ballast, HSG D
	0.019	98	Paved parking, HSG D
	4.969	84	Weighted Average
	4.950		99.62% Pervious Area
	0.019		0.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
3.5	380	0.0130	1.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	430	Total			

Subcatchment PR2: PR2



Summary for Subcatchment PR3: PR3

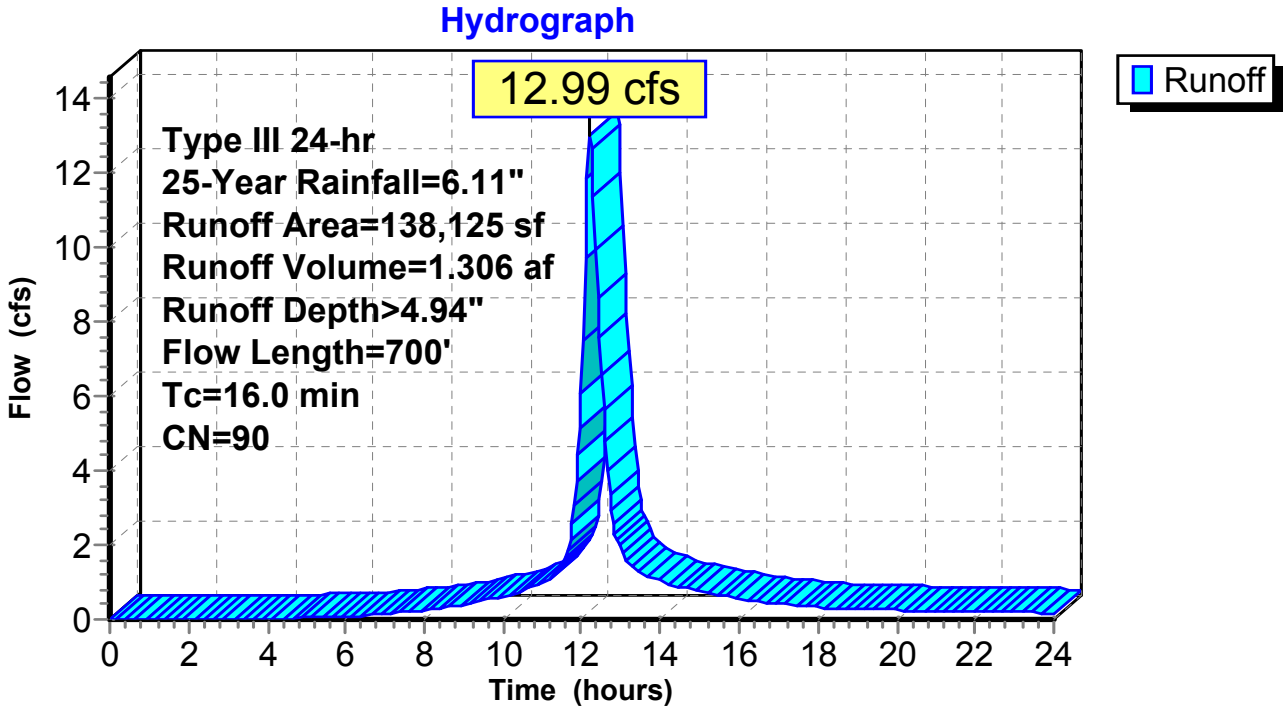
Runoff = 12.99 cfs @ 12.21 hrs, Volume= 1.306 af, Depth> 4.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.11"

Area (sf)	CN	Description
83,051	94	Fallow, bare soil, HSG D
55,074	84	50-75% Grass cover, Fair, HSG D
138,125	90	Weighted Average
138,125		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
7.3	500	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	700	Total			

Subcatchment PR3: PR3



Summary for Subcatchment PR4: PR4

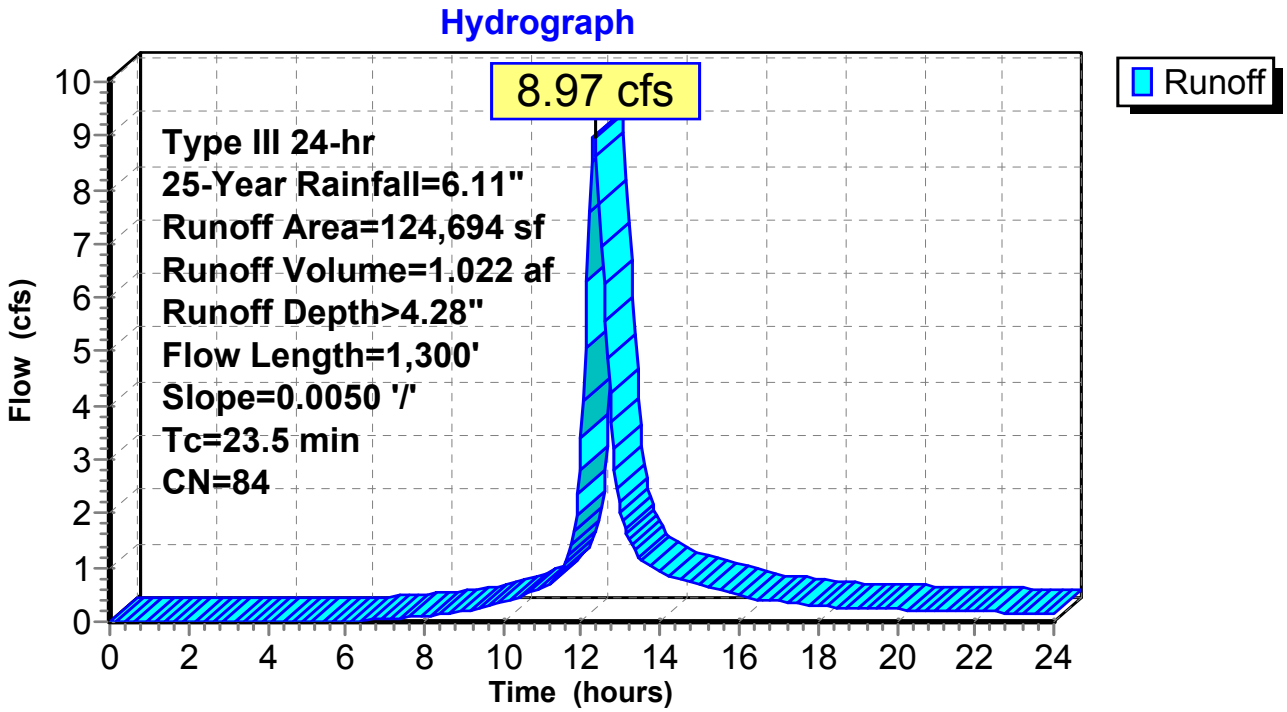
Runoff = 8.97 cfs @ 12.32 hrs, Volume= 1.022 af, Depth> 4.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.11"

	Area (sf)	CN	Description
*	57,552	84	Rail Ballast, HSG D
	67,142	84	50-75% Grass cover, Fair, HSG D
	124,694	84	Weighted Average
	124,694		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0050	0.21		**Sheet Flow, sheet flow on the track base** Fallow n= 0.050 P2= 3.40"
19.6	1,250	0.0050	1.06		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.5	1,300	Total			

Subcatchment PR4: PR4



Summary for Subcatchment PR5: PR5

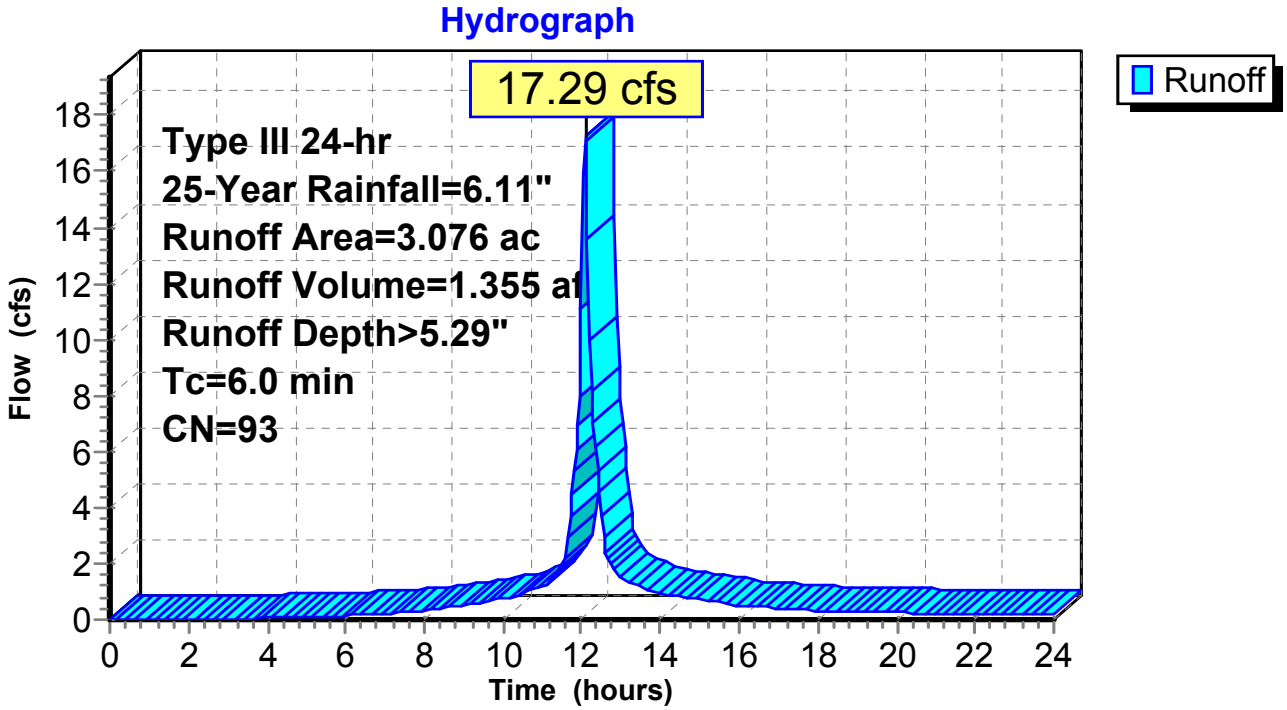
Runoff = 17.29 cfs @ 12.09 hrs, Volume= 1.355 af, Depth> 5.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.11"

	Area (ac)	CN	Description
	1.905	98	Paved parking, HSG D
*	1.171	84	Ballast, HSG D
	3.076	93	Weighted Average
	1.171		38.07% Pervious Area
	1.905		61.93% Impervious Area

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

Subcatchment PR5: PR5



Summary for Pond 1P: Ballast Yard Stone

Inflow Area = 3.076 ac, 61.93% Impervious, Inflow Depth > 5.29" for 25-Year event
Inflow = 17.29 cfs @ 12.09 hrs, Volume= 1.355 af
Outflow = 3.85 cfs @ 12.49 hrs, Volume= 1.289 af, Atten= 78%, Lag= 24.3 min
Discarded = 0.53 cfs @ 11.80 hrs, Volume= 0.136 af
Primary = 3.33 cfs @ 12.49 hrs, Volume= 1.153 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 11.54' @ 12.49 hrs Surf.Area= 3.075 ac Storage= 0.401 af

Plug-Flow detention time= 70.1 min calculated for 1.286 af (95% of inflow)
Center-of-Mass det. time= 42.4 min (814.5 - 772.0)

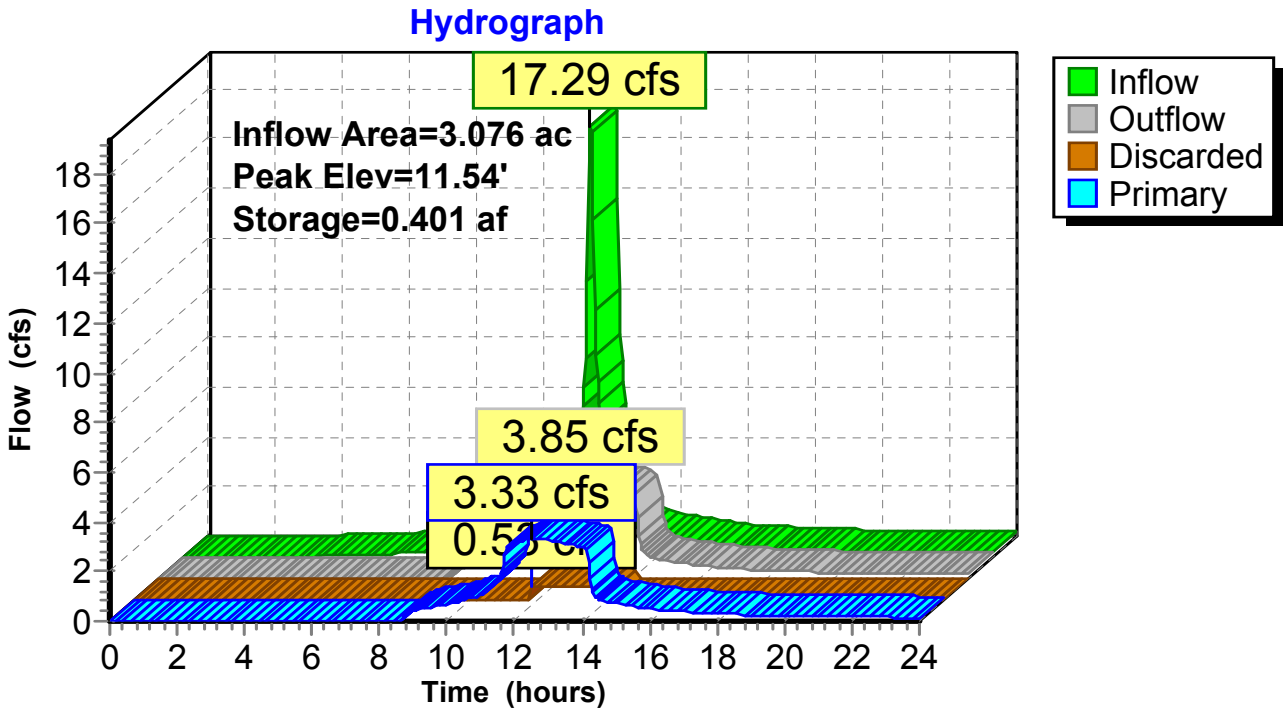
Volume	Invert	Avail.Storage	Storage Description
#1	9.80'	0.110 af	**3.00'W x 950.00'L x 2.50'H Prismatoid** x 2 0.327 af Overall - 0.051 af Embedded = 0.276 af x 40.0% Voids
#2	9.80'	0.051 af	**12.0" Round Pipe Storage** x 3 Inside #1 L= 950.0' S= 0.0015 '/'
#3	11.30'	1.178 af	**135.00'W x 950.00'L x 1.00'H Prismatoid** 2.944 af Overall x 40.0% Voids
		1.339 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.80'	**0.170 in/hr Exfiltration over Surface area**
#2	Primary	9.80'	**12.0" Round Culvert** L= 32.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 9.80' / 8.90' S= 0.0281 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	10.80'	**4.0' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Discarded OutFlow Max=0.53 cfs @ 11.80 hrs HW=11.30' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.53 cfs)

Primary OutFlow Max=3.33 cfs @ 12.49 hrs HW=11.54' (Free Discharge)
└**2=Culvert** (Inlet Controls 3.33 cfs @ 4.23 fps)
└**3=Sharp-Crested Rectangular Weir** (Passes 3.33 cfs of 8.76 cfs potential flow)

Pond 1P: Ballast Yard Stone

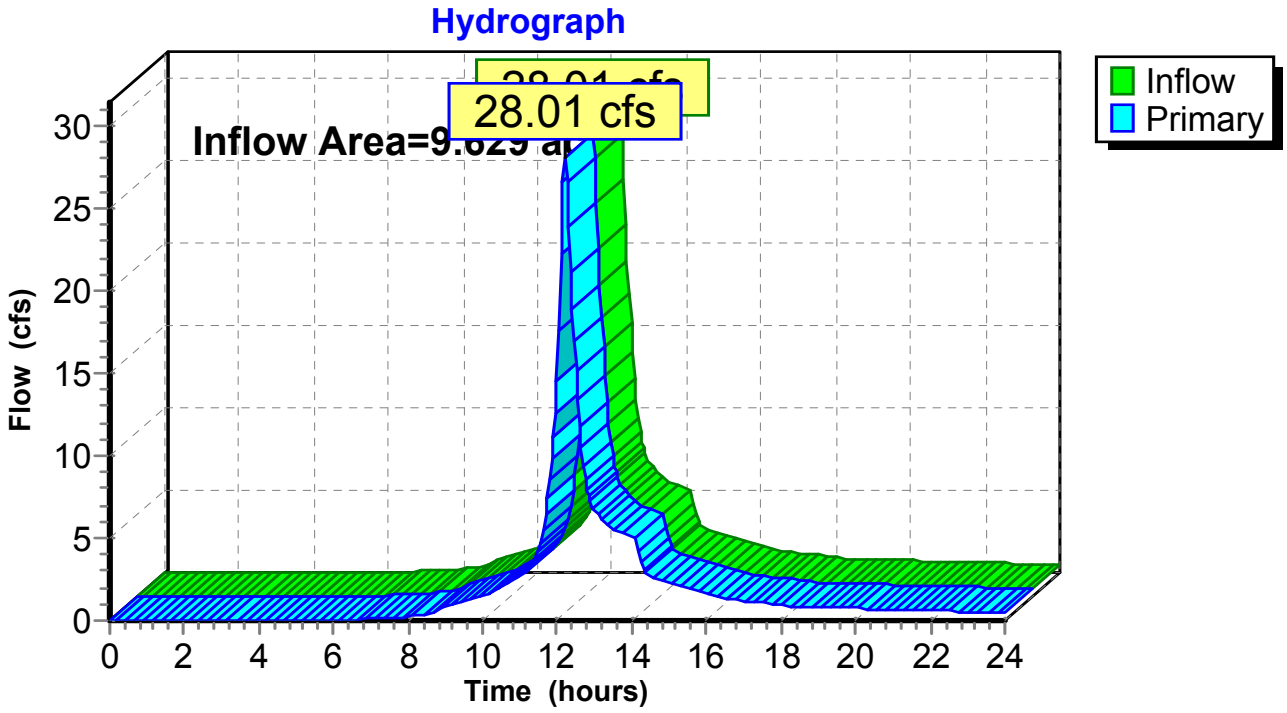


Summary for Link DP1: DP1

Inflow Area = 9.629 ac, 26.65% Impervious, Inflow Depth > 4.36" for 25-Year event
Inflow = 28.01 cfs @ 12.20 hrs, Volume= 3.495 af
Primary = 28.01 cfs @ 12.20 hrs, Volume= 3.495 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP1: DP1

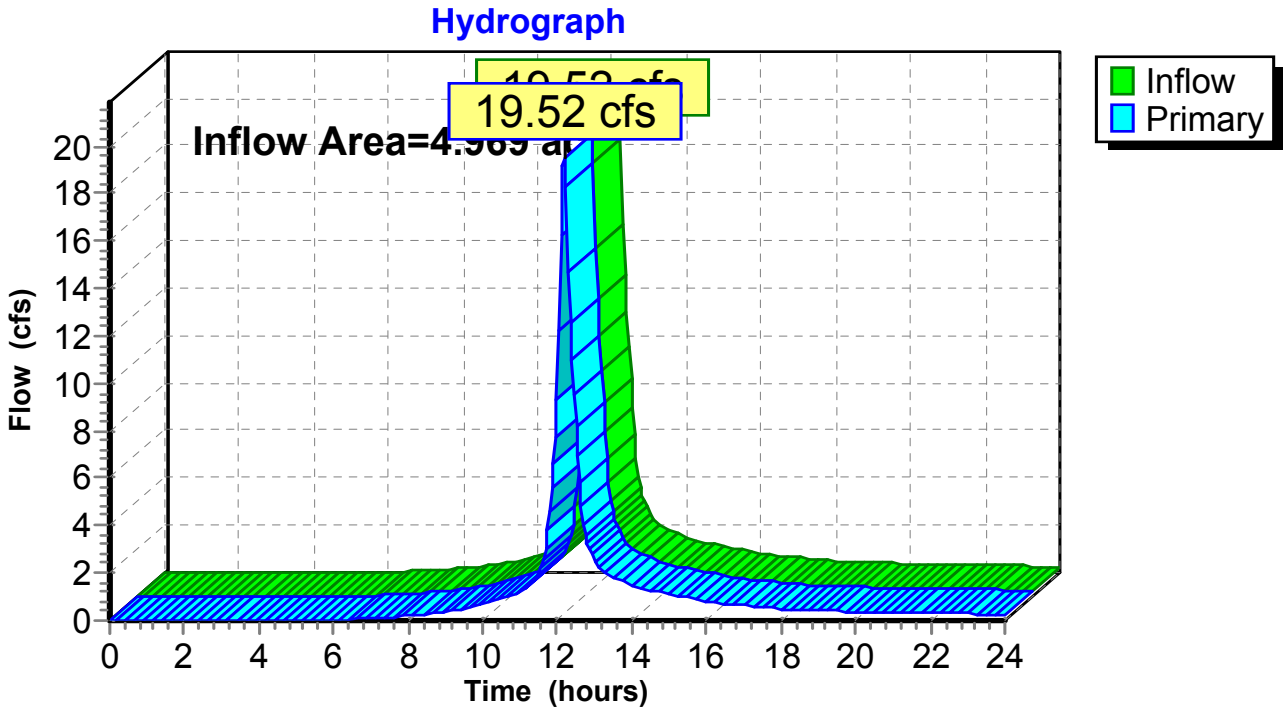


Summary for Link DP2: DP2

Inflow Area = 4.969 ac, 0.38% Impervious, Inflow Depth > 4.29" for 25-Year event
Inflow = 19.52 cfs @ 12.18 hrs, Volume= 1.777 af
Primary = 19.52 cfs @ 12.18 hrs, Volume= 1.777 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP2: DP2

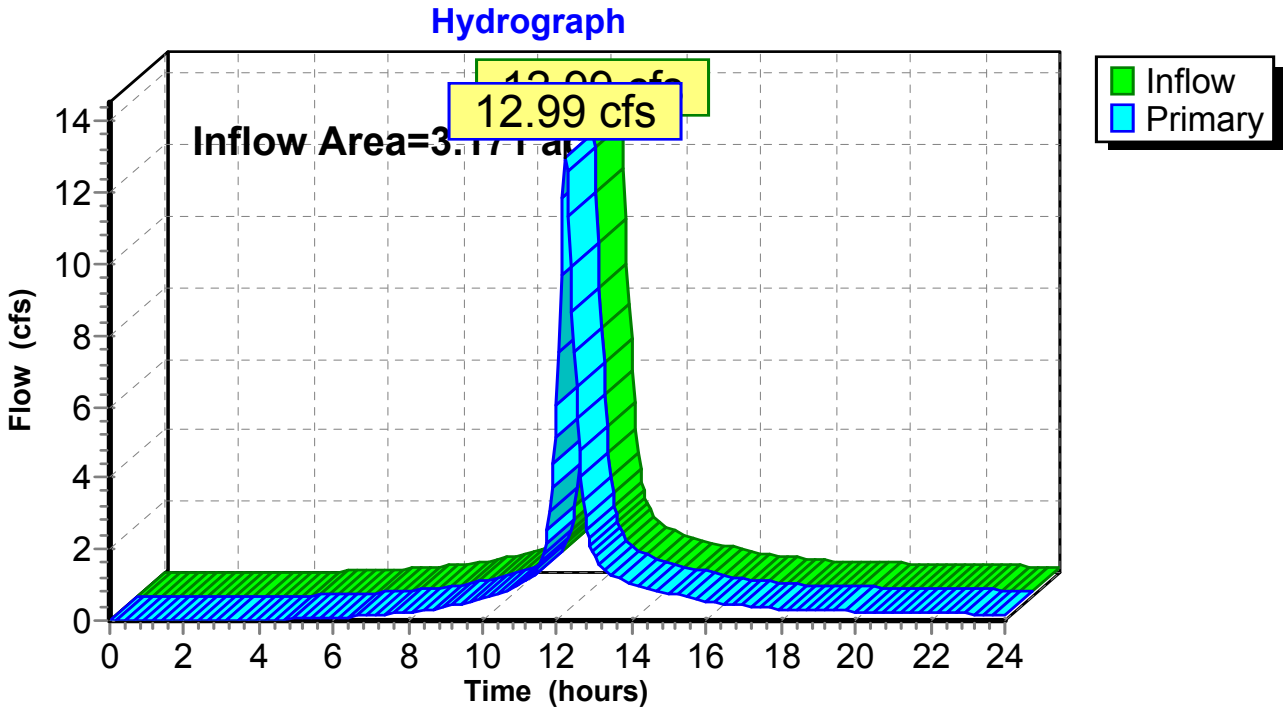


Summary for Link DP3: DP3

Inflow Area = 3.171 ac, 0.00% Impervious, Inflow Depth > 4.94" for 25-Year event
Inflow = 12.99 cfs @ 12.21 hrs, Volume= 1.306 af
Primary = 12.99 cfs @ 12.21 hrs, Volume= 1.306 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP3: DP3

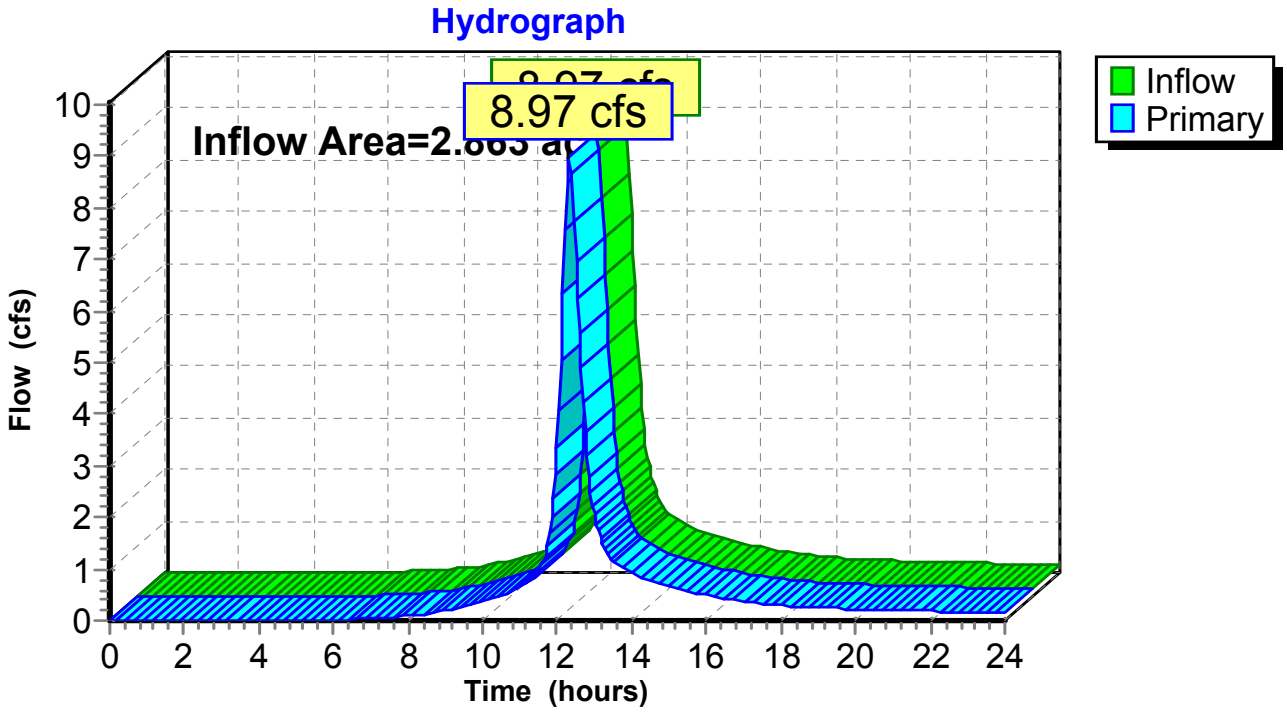


Summary for Link DP4: DP4

Inflow Area = 2.863 ac, 0.00% Impervious, Inflow Depth > 4.28" for 25-Year event
Inflow = 8.97 cfs @ 12.32 hrs, Volume= 1.022 af
Primary = 8.97 cfs @ 12.32 hrs, Volume= 1.022 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP4: DP4



Summary for Subcatchment PR1: PR1

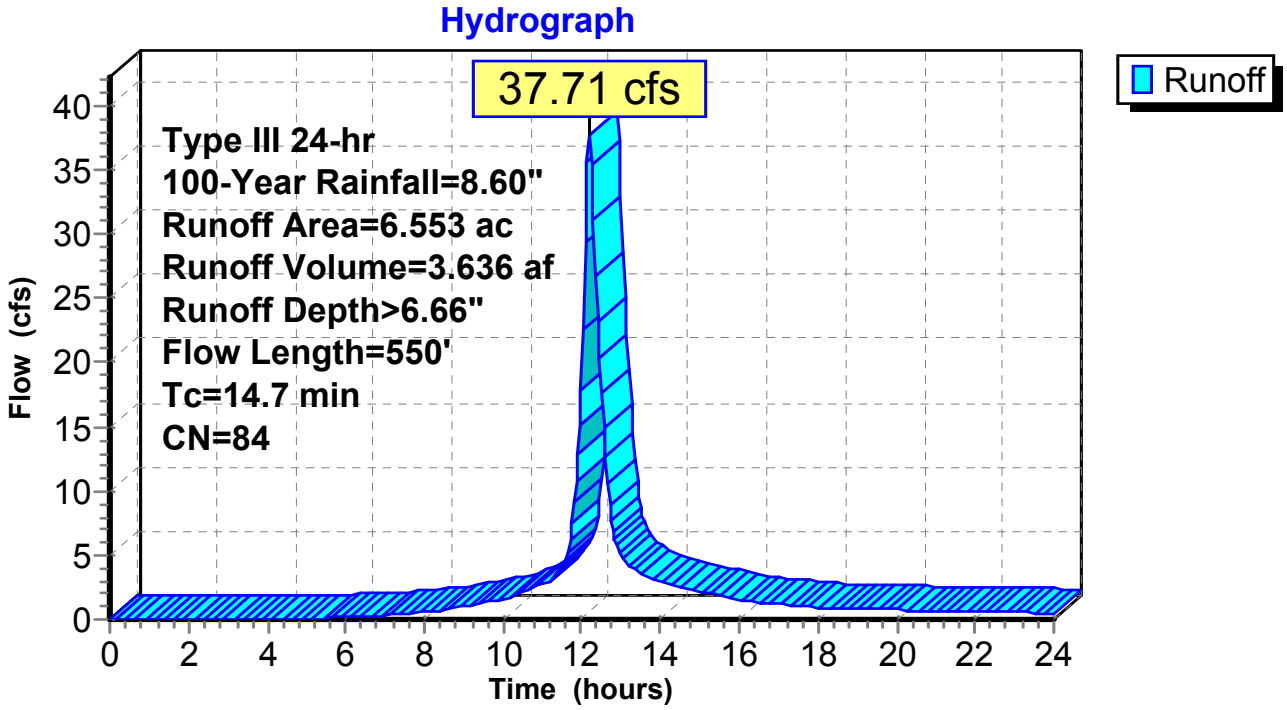
Runoff = 37.71 cfs @ 12.20 hrs, Volume= 3.636 af, Depth> 6.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

	Area (ac)	CN	Description
	0.661	98	Paved parking, HSG D
	3.345	84	50-75% Grass cover, Fair, HSG D
*	1.512	84	Freight Yard Ballast HSG D
	1.035	77	Brush, Fair, HSG D
	6.553	84	Weighted Average
	5.892		89.91% Pervious Area
	0.661		10.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
5.2	500	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
14.7	550	Total			

Subcatchment PR1: PR1



Summary for Subcatchment PR2: PR2

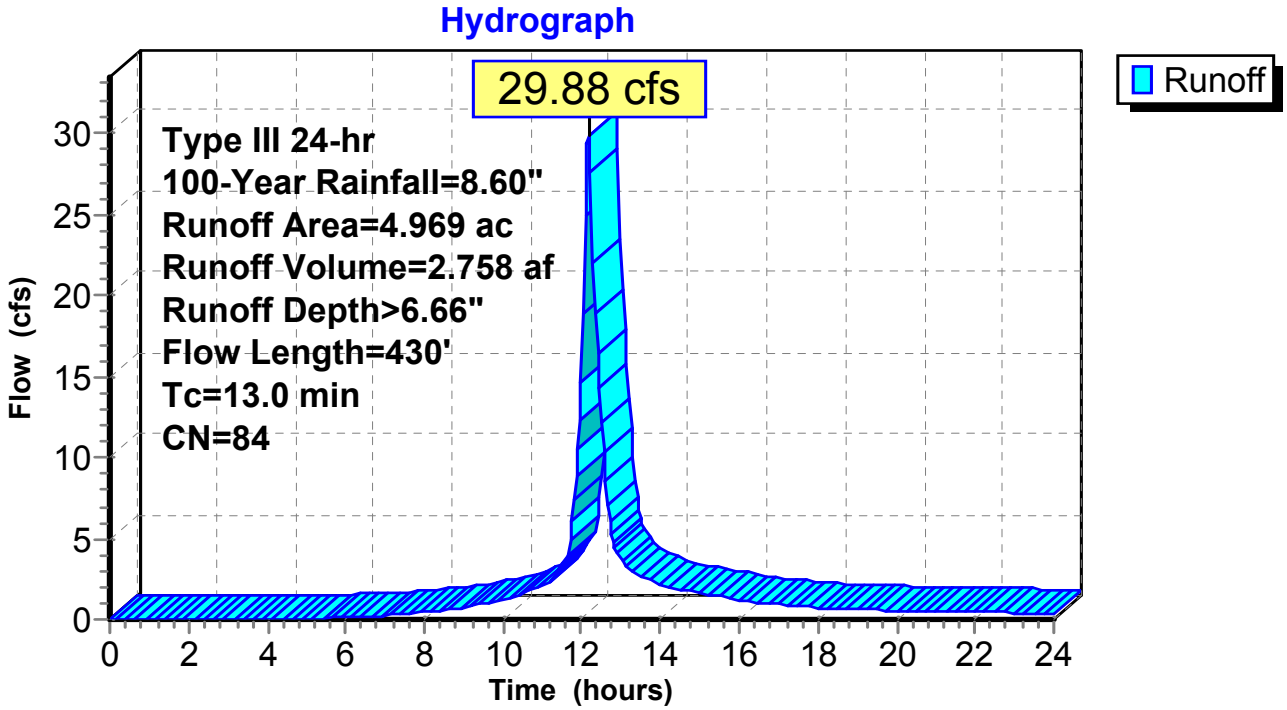
Runoff = 29.88 cfs @ 12.17 hrs, Volume= 2.758 af, Depth> 6.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

	Area (ac)	CN	Description
	2.569	84	50-75% Grass cover, Fair, HSG D
*	2.381	84	Freigth Yard Ballast, HSG D
	0.019	98	Paved parking, HSG D
	4.969	84	Weighted Average
	4.950		99.62% Pervious Area
	0.019		0.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0050	0.09		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.40"
3.5	380	0.0130	1.84		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
13.0	430	Total			

Subcatchment PR2: PR2



Summary for Subcatchment PR3: PR3

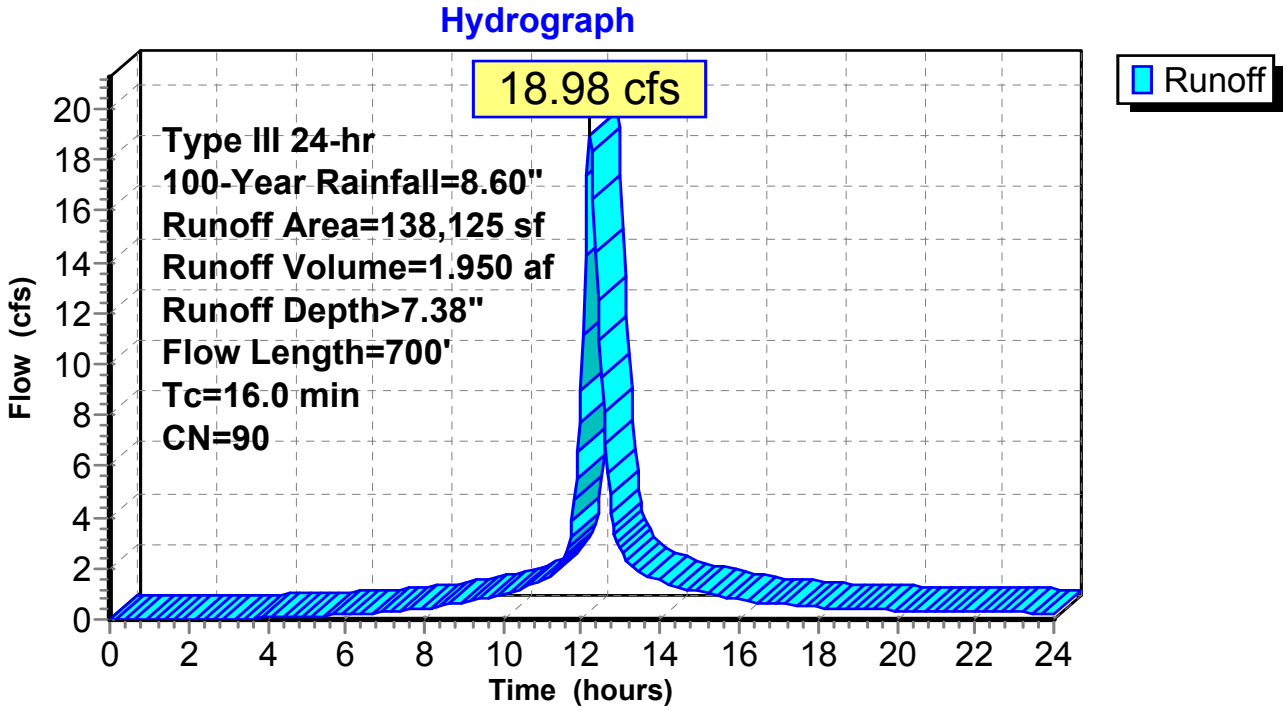
Runoff = 18.98 cfs @ 12.21 hrs, Volume= 1.950 af, Depth> 7.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

Area (sf)	CN	Description
83,051	94	Fallow, bare soil, HSG D
55,074	84	50-75% Grass cover, Fair, HSG D
138,125	90	Weighted Average
138,125		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0010	0.11		**Sheet Flow,** Fallow n= 0.050 P2= 3.40"
7.3	500	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	150	0.0100	2.03		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.0	700	Total			

Subcatchment PR3: PR3



Summary for Subcatchment PR4: PR4

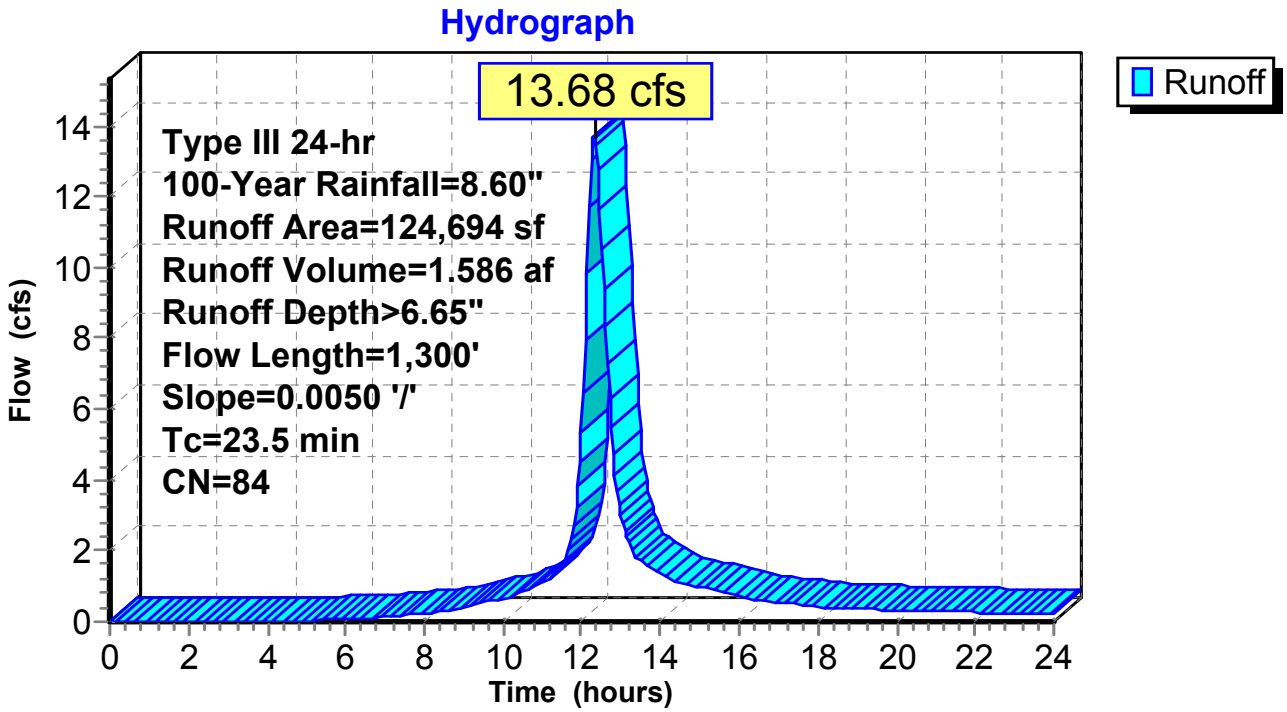
Runoff = 13.68 cfs @ 12.31 hrs, Volume= 1.586 af, Depth> 6.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

	Area (sf)	CN	Description
*	57,552	84	Rail Ballast, HSG D
	67,142	84	50-75% Grass cover, Fair, HSG D
	124,694	84	Weighted Average
	124,694		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0050	0.21		**Sheet Flow, sheet flow on the track base** Fallow n= 0.050 P2= 3.40"
19.6	1,250	0.0050	1.06		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.5	1,300	Total			

Subcatchment PR4: PR4



Summary for Subcatchment PR5: PR5

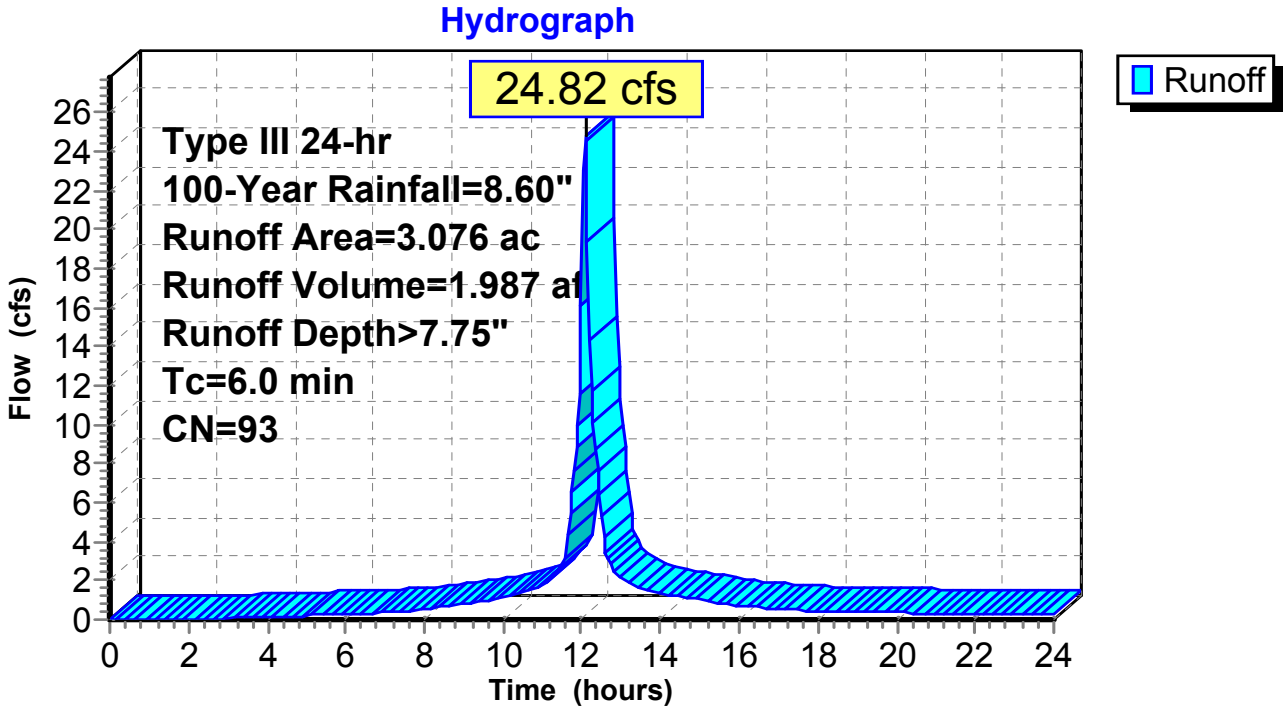
Runoff = 24.82 cfs @ 12.09 hrs, Volume= 1.987 af, Depth> 7.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.60"

	Area (ac)	CN	Description
	1.905	98	Paved parking, HSG D
*	1.171	84	Ballast, HSG D
	3.076	93	Weighted Average
	1.171		38.07% Pervious Area
	1.905		61.93% Impervious Area

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

Subcatchment PR5: PR5



Summary for Pond 1P: Ballast Yard Stone

Inflow Area = 3.076 ac, 61.93% Impervious, Inflow Depth > 7.75" for 100-Year event
Inflow = 24.82 cfs @ 12.09 hrs, Volume= 1.987 af
Outflow = 4.11 cfs @ 12.56 hrs, Volume= 1.920 af, Atten= 83%, Lag= 28.3 min
Discarded = 0.53 cfs @ 11.70 hrs, Volume= 0.196 af
Primary = 3.58 cfs @ 12.56 hrs, Volume= 1.723 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 11.74' @ 12.56 hrs Surf.Area= 3.075 ac Storage= 0.644 af

Plug-Flow detention time= 76.0 min calculated for 1.916 af (96% of inflow)
Center-of-Mass det. time= 55.7 min (818.8 - 763.1)

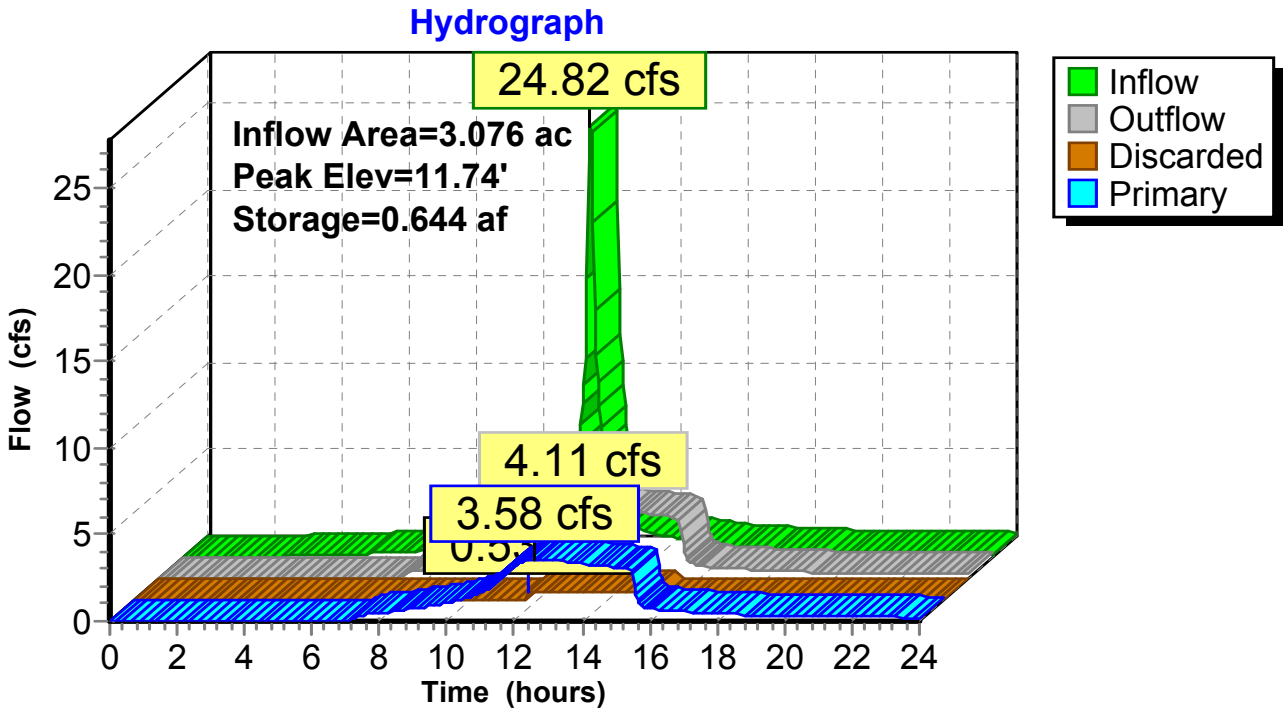
Volume	Invert	Avail.Storage	Storage Description
#1	9.80'	0.110 af	**3.00'W x 950.00'L x 2.50'H Prismatoid** x 2 0.327 af Overall - 0.051 af Embedded = 0.276 af x 40.0% Voids
#2	9.80'	0.051 af	**12.0" Round Pipe Storage** x 3 Inside #1 L= 950.0' S= 0.0015 '/'
#3	11.30'	1.178 af	**135.00'W x 950.00'L x 1.00'H Prismatoid** 2.944 af Overall x 40.0% Voids
		1.339 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	9.80'	**0.170 in/hr Exfiltration over Surface area**
#2	Primary	9.80'	**12.0" Round Culvert** L= 32.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 9.80' / 8.90' S= 0.0281 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#3	Device 2	10.80'	**4.0' long x 3.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Discarded OutFlow Max=0.53 cfs @ 11.70 hrs HW=11.30' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.53 cfs)

Primary OutFlow Max=3.58 cfs @ 12.56 hrs HW=11.74' (Free Discharge)
└**2=Culvert** (Inlet Controls 3.58 cfs @ 4.56 fps)
└**3=Sharp-Crested Rectangular Weir** (Passes 3.58 cfs of 12.59 cfs potential flow)

Pond 1P: Ballast Yard Stone

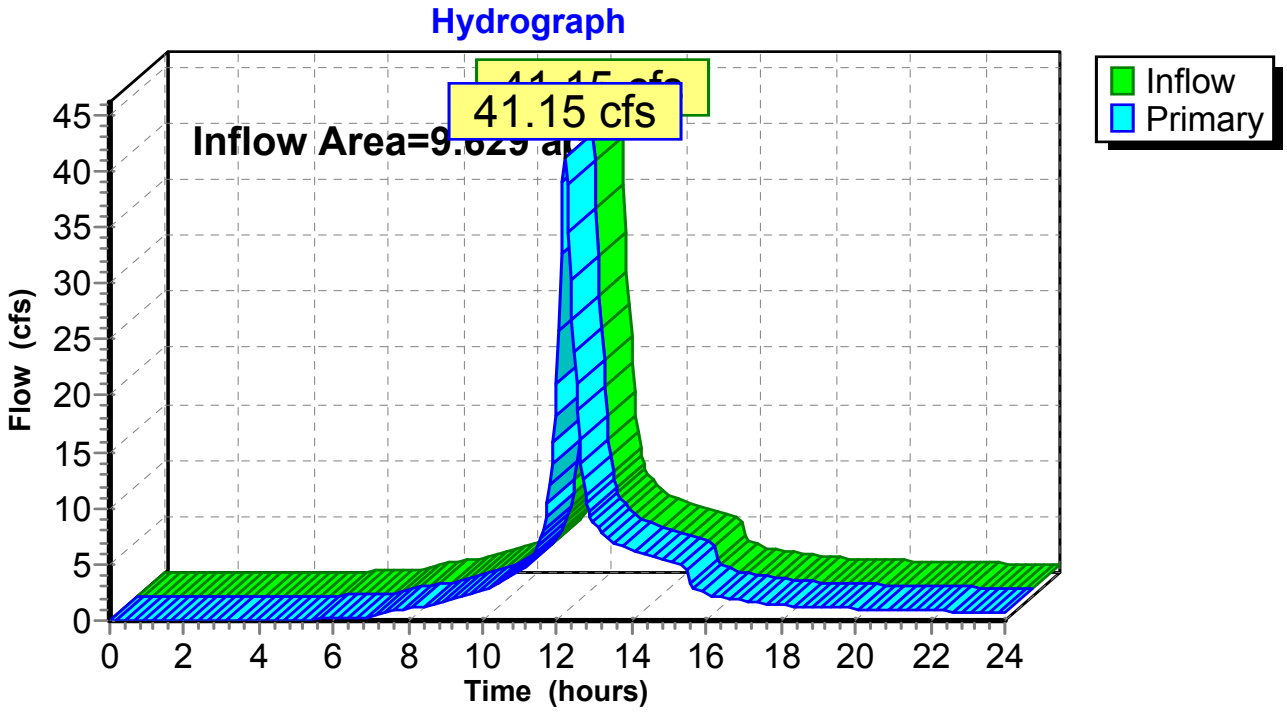


Summary for Link DP1: DP1

Inflow Area = 9.629 ac, 26.65% Impervious, Inflow Depth > 6.68" for 100-Year event
Inflow = 41.15 cfs @ 12.20 hrs, Volume= 5.359 af
Primary = 41.15 cfs @ 12.20 hrs, Volume= 5.359 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP1: DP1

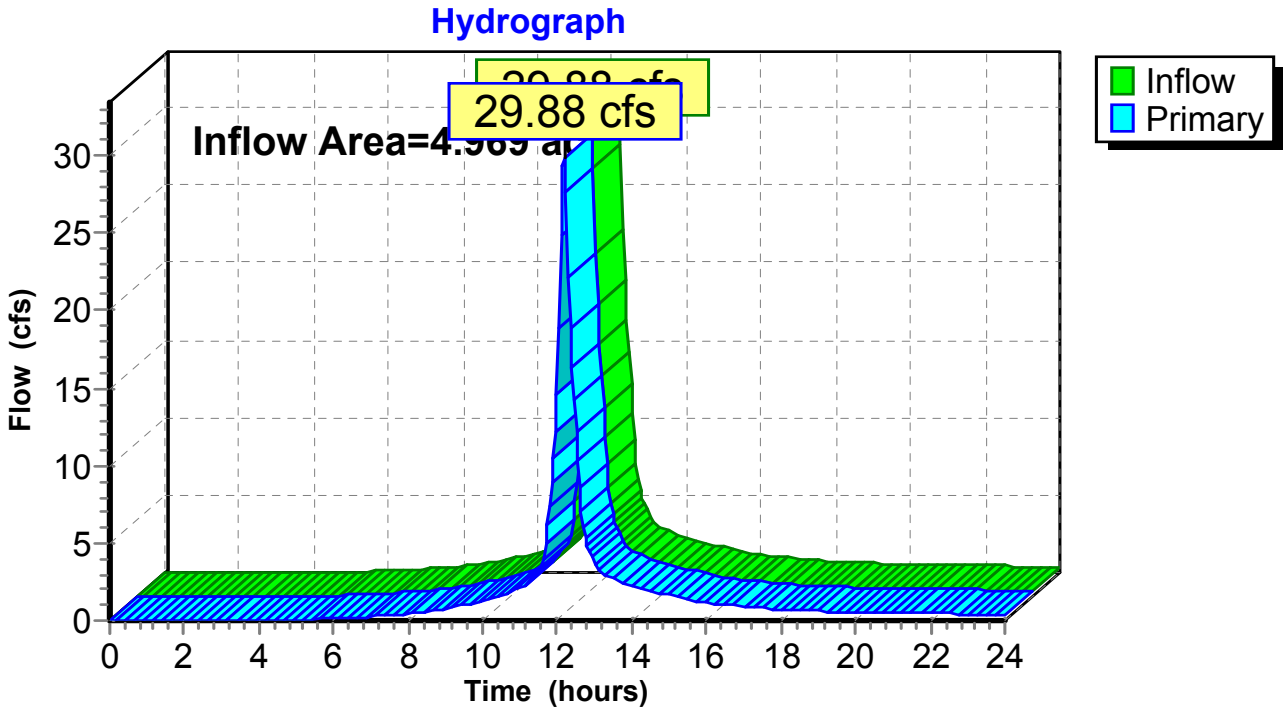


Summary for Link DP2: DP2

Inflow Area = 4.969 ac, 0.38% Impervious, Inflow Depth > 6.66" for 100-Year event
Inflow = 29.88 cfs @ 12.17 hrs, Volume= 2.758 af
Primary = 29.88 cfs @ 12.17 hrs, Volume= 2.758 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP2: DP2

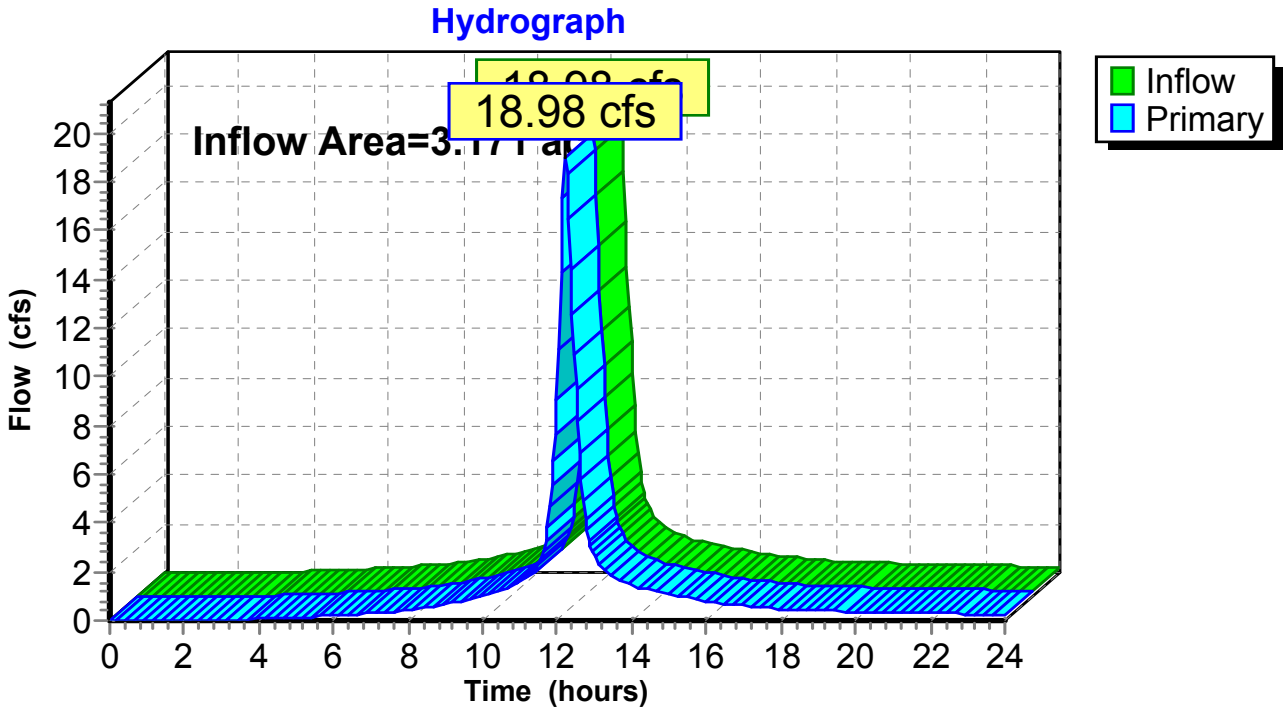


Summary for Link DP3: DP3

Inflow Area = 3.171 ac, 0.00% Impervious, Inflow Depth > 7.38" for 100-Year event
Inflow = 18.98 cfs @ 12.21 hrs, Volume= 1.950 af
Primary = 18.98 cfs @ 12.21 hrs, Volume= 1.950 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP3: DP3

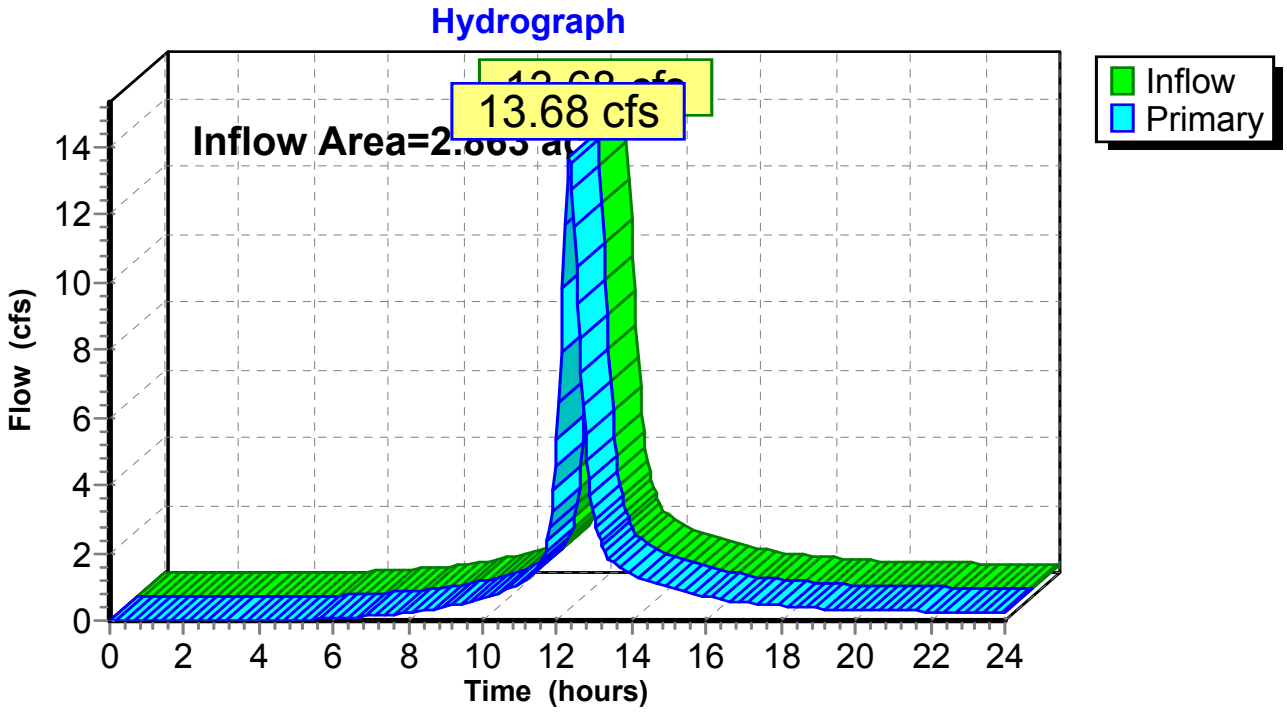


Summary for Link DP4: DP4

Inflow Area = 2.863 ac, 0.00% Impervious, Inflow Depth > 6.65" for 100-Year event
Inflow = 13.68 cfs @ 12.31 hrs, Volume= 1.586 af
Primary = 13.68 cfs @ 12.31 hrs, Volume= 1.586 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link DP4: DP4



Attachment B

Recharge Calculations

Recharge Calculations

Project Name:	South Coast Rail	**Proj. No.:**	12815.00
	Wamsutta Layover	**Date:**	11/14/2017
Project Location:	New Bedford, MA	**Calculated by:**	RLG

Proposed Impervious Surface Summary

Net Proposed Impervious Areas by Hydrologic Soil Group (HSG) in acres

Subcatchment	HSG A	HSG B	HSG C	HSG D	Total Area
1	0.00			2.57	2.57
TOTAL	**0.00**	**0.00**	**0.00**	**2.57**	**2.57**

Required Recharge Volume (Cubic Feet)

HSG	Area (acres)	Recharge Depth* (in.)	Volume (c.f.)
A	0.0	0.60	0
B	0.0	0.35	0
C	0.0	0.25	0
D	2.6	0.10	931
TOTAL			**931**

Assumptions:

* Massachusetts DEP Infiltration requirement: HSG A = 0.60 in; HSG B = 0.35 in; HSG C = 0.25 in; HSG D = 0.10 in.

Capture Area Adjustment

Required Recharge Volume	931	c.f.
Total Site Impervious Area	2.57	acres
Total Site Impervious Area Draining to Recharge Facilities	1.91	acres
Capture Area Adjustment Factor	1.35	-
Adjusted Required Recharge Volume:	**1,255**	**c.f.**

Provided Recharge Volume (Cubic Feet) and Drawdown Times

DRAINAGE AREA 1

Ballast Yard Stone/Pipe System (Recharge Volume and Drawdown Time)

Infiltration Volumes Provided in BMP below Overflow Weir at elevation 10.8

Basin Volume Below Overflow Weir

Elevation	Area (s.f.)	Cumulative Volume (c.f.)	Drawdown (hours)
9.35	5,700	0	
10.35	5,700	3,613	44.7
TOTAL		**3,613**	**44.7**

Note: Cumulative volume below lowest outlet consists of 1900 lf of 3'W x 1'H crushed stone trench embedded with 1900 lf of perforated pipe.

Assumptions:

Recharge Rate: 0.17 in/hr* *Approximate Infiltration Rate, based on the slowest allowable by Stormwater Reg's (area requires geotech)

Total Drawdown Time: 44.7 hours

Total Recharge Volume: 3,613 c.f.

Attachment C

TSS Removal

TSS Removal Calculation Worksheet

VHB, Inc..
101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Wamsutta Layover Facility**	Sheet:	**1 of 2**
Project Number:	**12815.00**	Date:	**14-Nov-2017**
Location:	**New Bedford**	Computed by:	**RLG**
Discharge Point:	**1**	Checked by:	**HF**
Drainage Area(s):	**PR5**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D E)
Water Quality Inlet Tank	**25%**	**1.00**	**0.25**	**0.75**
Subsurface Infiltration Structure	**80%**	**0.75**	**0.60**	**0.15**
	0%	**0.15**	**0.00**	**0.15**
	0%	**0.15**	**0.00**	**0.15**
	0%	**0.15**	**0.00**	**0.15**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1.
Removal rates for proprietary devices are from approved studies and/or manufacturer data (attach study or data source, or remove this sentence if not applicable).
** Equals remaining load from previous BMP (E)
*** Stormceptor sizing calculation gives a TSS removal rate of 87%. To be conservative, 80% removal is used for this calculation (Change name of device and the claimed removal rate shown on the calc. sheet. Remove this sentence if not applicable.

Treatment Train TSS Removal = **85%**

TSS Removal Calculation Worksheet

VHB, Inc..
101 Walnut Street
Post Office Box 9151
Watertown, MA 02471
P 617.924.1770

Project Name:	**Wamsutta Layover Facility**	Sheet:	**2 of 2**
Project Number:	**12815.00**	Date:	**14-Nov-2017**
Location:	**New Bedford**	Computed by:	**RLG**
Discharge Point:	**2**	Checked by:	**HF**
Drainage Area(s):	**PR1**		

A	B	C	D	E
BMP*	TSS Removal Rate*	Starting TSS Load**	Amount Removed (C*D)	Remaining Load (D E)
StormCeptor	**80%**	**1.00**	**0.80**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**
	0%	**0.20**	**0.00**	**0.20**

* BMP and TSS Removal Rate Values from the MassDEP Stormwater Handbook Vol. 1. Removal rates for proprietary devices are from approved studies and/or manufacturer data (attach study or data source, or remove this sentence if not applicable).

** Equals remaining load from previous BMP (E)

*** Stormceptor sizing calculation gives a TSS removal rate of 87%. To be conservative, 80% removal is used for this calculation (Change name of device and the claimed removal rate shown on the calc. sheet. Remove this sentence if not applicable.

Treatment Train TSS Removal = **80%**

Attachment D

Pipe Calculation

[redacted]

Project: South Coast Rail - Wamustta | **Project #:** 12815.00
Location: New Bedford, MA | **Sheet:** 1 of 1
Calculated By: RLG/SJH | **Date:** 11/15/2017
Title: Pipe Sizing Calculations 25-Year Storm

Start Node	Stop Node	Upstream Invert (ft)	Downstream Invert (ft)	Slope (ft/ft)	Manning's n	Diameter (in)	Length (ft)	System Intensity (in/hr)	Upstream Inlet Area (sf)	Upstream Inlet C (acres)	Flow (cfs)	Capacity (cfs)	Average Velocity (ft/s)	Elevation Ground Start (ft)	Cover Start (ft)	Elevation Ground Stop (ft)	Cover Stop (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
Grass Channel	DMH-11	10.2	9.6	0.009	0.012	12	67.1	7.084	35,349	0.3	1.7	3.7	4.6	0.0	0.0	12.9	2.3	10.8	10.1
DMH-6	DMH-11	8.9	7.8	0.006	0.012	18	179.4	7.440	(N/A)	(N/A)	3.3	8.9	4.2	13.3	2.9	12.9	3.6	10.4	9.1
DMH-4	DMH-60	5.6	4.0	0.012	0.012	18	134.8	6.718	(N/A)	(N/A)	8.5	12.4	7.6	12.2	5.1	8.3	2.8	6.7	5.4
DMH-11	DMH-5	7.8	7.0	0.006	0.012	18	130.5	6.997	(N/A)	(N/A)	7.3	8.9	5.6	12.9	3.6	15.3	6.8	8.8	8.3
DMH-5	DMH-4	7.0	5.6	0.009	0.012	18	155.6	6.860	(N/A)	(N/A)	7.2	10.8	6.5	15.3	6.8	12.2	5.1	8.0	6.9
DMH-60	WQS-1	4.0	3.9	0.012	0.012	18	8.1	6.612	(N/A)	(N/A)	9.1	12.6	7.8	8.3	2.8	8.0	2.6	5.2	5.1
WQS-1	IP-1	3.8	3.0	0.019	0.012	18	42.8	6.606	(N/A)	(N/A)	9.1	15.7	8.6	8.0	2.7	7.7	3.2	5.0	3.9
CB-3	DMH-11	10.0	9.9	0.013	0.012	12	7.9	7.084	15,974	0.86	2.3	4.3	5.6	12.9	1.9	12.9	2.0	10.6	10.5
CB-1	DMH-4	8.0	7.6	0.026	0.012	12	15.3	7.084	12,797	0.686	1.4	6.2	6.5	12.2	3.2	12.2	3.6	8.5	8.0
CB-16	DMH-60	4.3	4.0	0.023	0.012	12	13.0	7.084	8,855	0.54	0.8	5.9	1.0	8.3	3.0	8.3	3.3	5.4	5.4
IP-1	IP-2	2.29	2.05	0.002	0.013	60x24	126.3	6.571	(N/A)	(N/A)	24.9	39.8	5.3	7.7	3.4	5.0	1.0	3.7	3.2
IP-2	HEADWALL	2.05	1.92	0.002	0.013	60x24	84.7	(N/A)	(N/A)	(N/A)	(N/A)	35.8	(N/A)	5.0	1.0	3.8	0.0	(N/A)	(N/A)

NOTE: This pipe sizing analysis is for the closed piping system downstream of the proposed rail layover yard piping system which which consists of perforated pipe within crushed stone trenches and a crushed stone bed/ballast above. A HydroCAD analysis has been performed (attached hereto) for this pipe/stone system which effectively acts as an infiltration best management practice (BMP). To retain runoff from the layover yard on-site and thus reduce flows to the Wamsutta Street drainage system, a control weir has been added within DMH-6. Note that the outflow from DMH-6 and the BMP for the 25-year storm HydroCAD analysis (6.30 cfs) has been input into the pipe-sizing calculation above.