MB Engineering Inc.
606 Ryan Drive
Energy, IL 62933

General Stormwater Report for the proposed Car Wash in Lee's Summit Missouri

The proposed Car Wash will be located at 3601 SW Hollywood Dr, Lee's Summit, MO 64082. The existing storm water sheet flows southeast across the site. Sheet C4-01 shows the existing drainage area and the hydraulic calculations are Exhibit A attached below.

The proposed stormwater will follow a similar pattern as shown on sheet C4-01. Area 1 will flow to a proposed underground detention basin which will then be piped to the public storm sewer in Summitcrest Drive.
Area 2 will bypass the proposed detention basin. The hydraulic calculations are Exhibit B attached below.

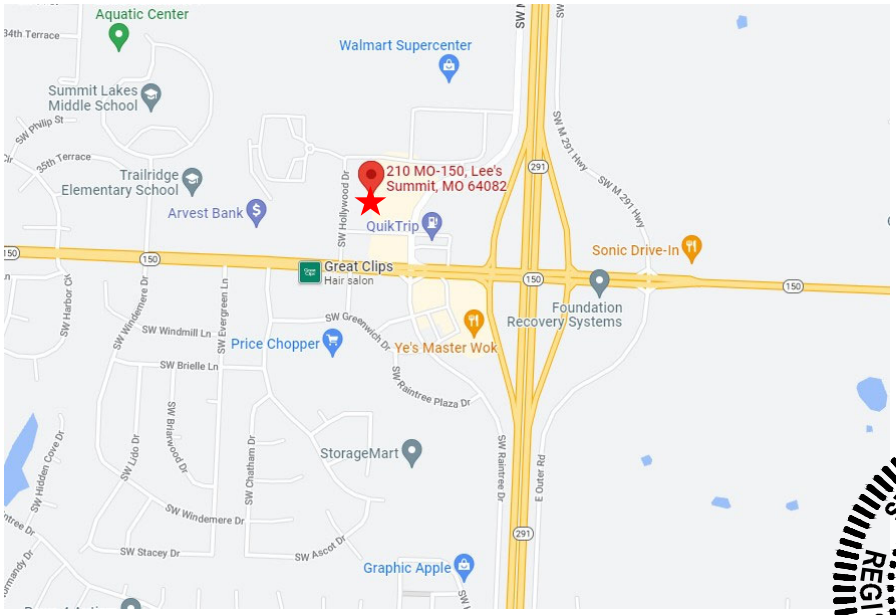
An underground detention basin is being proposed to meet the Comprehensive Control Method.
The post-development peak discharge rates from the site shall not exceed:

2yr = 1.499 acres * 0.5 cfs/acre = 0.75 cfs
10yr = 1.499 acres * 2.0 cfs/acre = 3.00 dfs
100yr = 1.499 acres * 3.0 cfs/acre = 4.50 cfs

The rainfall intensity numbers are taken from "NOAA's National Weather Service Hydrometeorological Design Studies Center Precipitation Frequency Data Server (https://hdsc.nws.noaa.gov/hdcs/pfds/)".

The detention basin has also been evaluated with a low flow blocked scenario. The hydraulic calculations are Exhibit C attached below.

Soil maps are Exhibit D attached below.



Location Map

STATE OF MISSOURI
MICHAEL A. BUESCHER
NUMBER E-2001018714
REGISTERED PROFESSIONAL ENGINEER
7/4/23

Phone 314-368-3040 mbengineeringinc@gmail.com

Exhibit A

Summary for Subcatchment A2: Existing Area

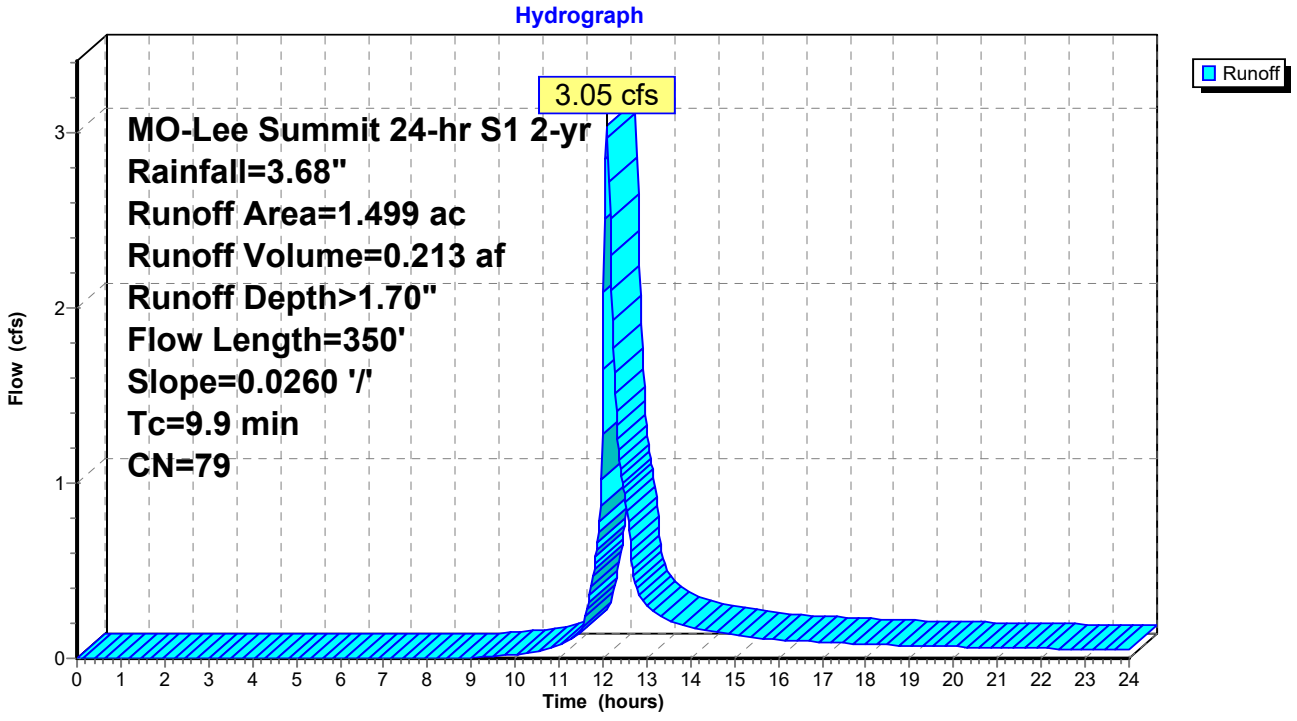
Runoff = 3.05 cfs @ 12.09 hrs, Volume= 0.213 af, Depth> 1.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
MO-Lee Summit 24-hr S1 2-yr Rainfall=3.68"

Area (ac)	CN	Description
1.499	79	50-75% Grass cover, Fair, HSG C
1.499		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0260	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.7	250	0.0260	2.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
9.9	350	Total			

Subcatchment A2: Existing Area



Summary for Subcatchment A2: Existing Area

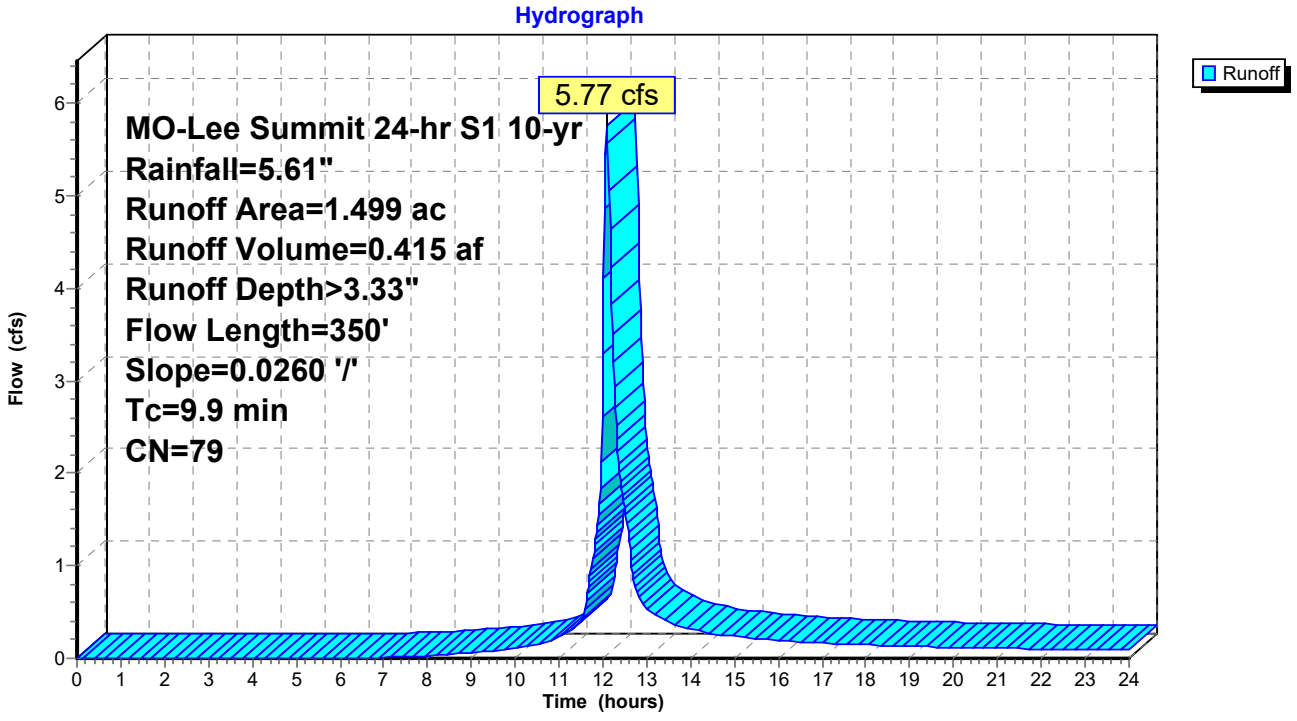
Runoff = 5.77 cfs @ 12.09 hrs, Volume= 0.415 af, Depth> 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
MO-Lee Summit 24-hr S1 10-yr Rainfall=5.61"

Area (ac)	CN	Description
1.499	79	50-75% Grass cover, Fair, HSG C
1.499		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0260	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.7	250	0.0260	2.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
9.9	350	Total			

Subcatchment A2: Existing Area



Summary for Subcatchment A2: Existing Area

Runoff = 10.45 cfs @ 12.09 hrs, Volume= 0.822 af, Depth> 6.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
MO-Lee Summit 24-hr S1 100-yr Rainfall=9.16"

Area (ac)	CN	Description
1.499	79	50-75% Grass cover, Fair, HSG C
1.499		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0260	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.7	250	0.0260	2.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
9.9	350	Total			

Subcatchment A2: Existing Area

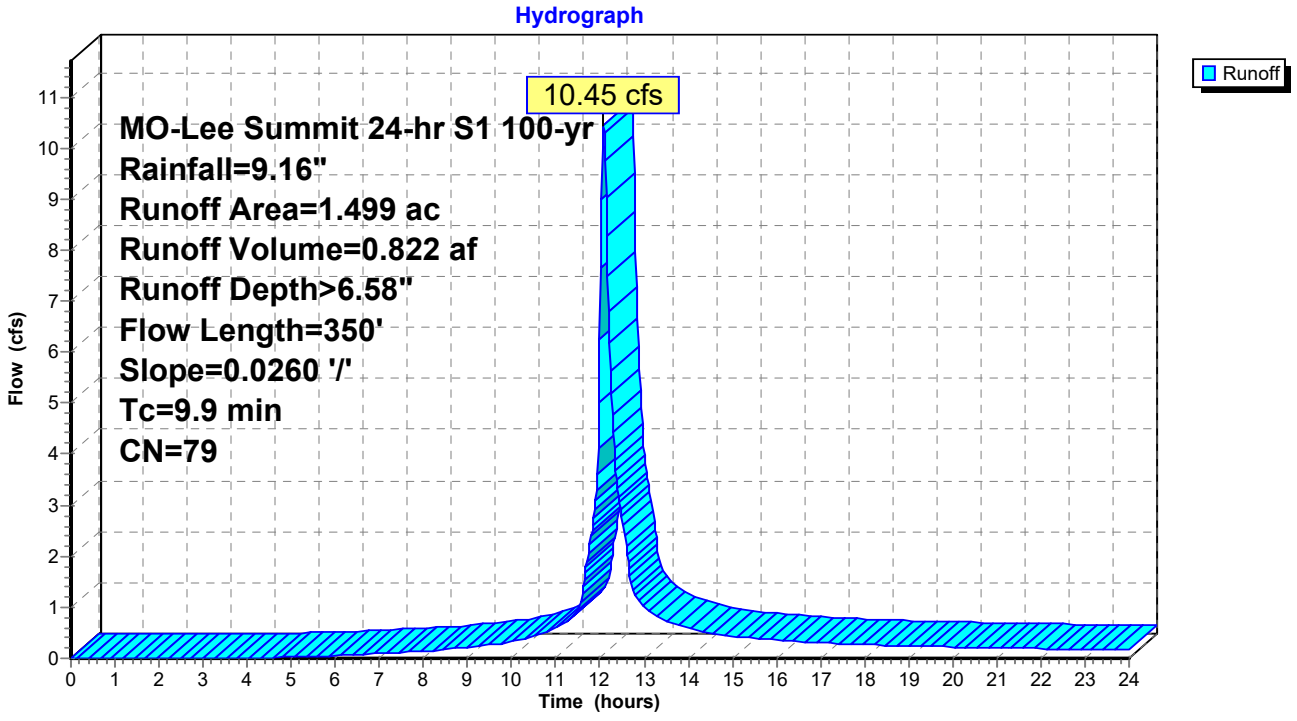


Exhibit B

Summary for Subcatchment A1: Prop Area 1

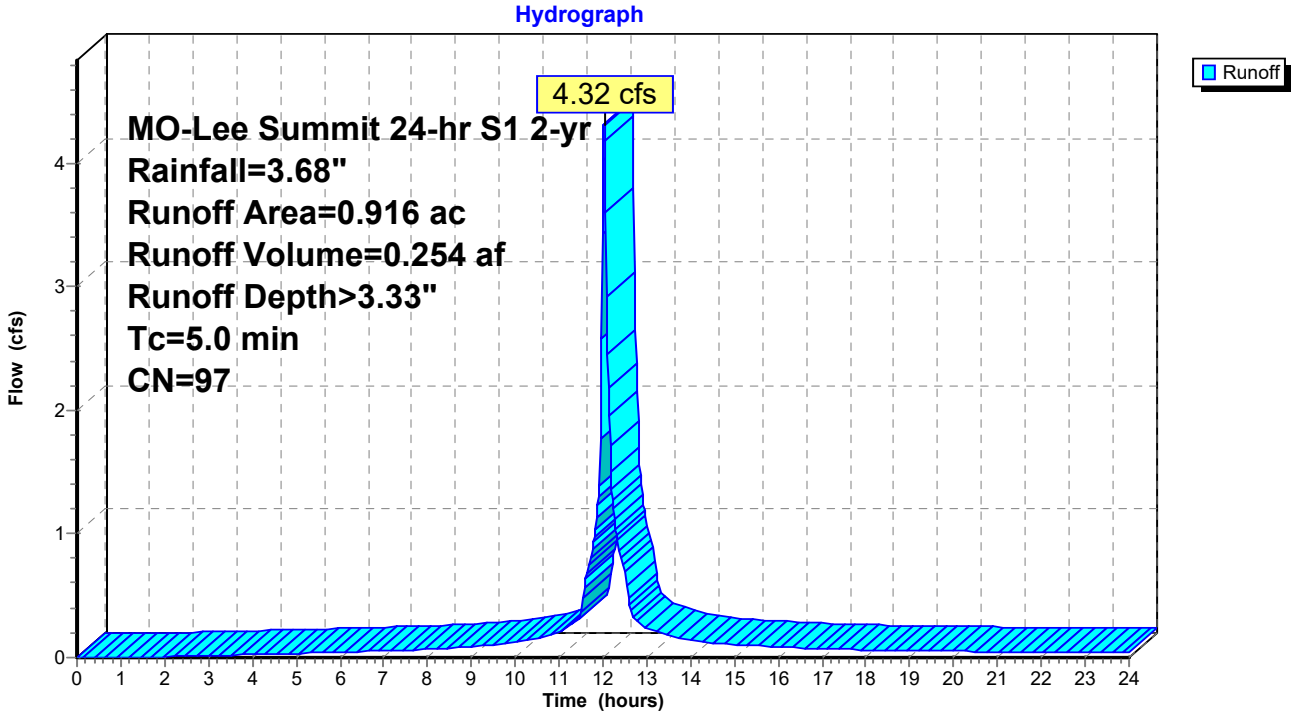
Runoff = 4.32 cfs @ 12.02 hrs, Volume= 0.254 af, Depth> 3.33"
Routed to Pond P4 : Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
MO-Lee Summit 24-hr S1 2-yr Rainfall=3.68"

Area (ac)	CN	Description
0.048	74	>75% Grass cover, Good, HSG C
0.757	98	Paved parking, HSG C
0.111	98	Roofs, HSG C
0.916	97	Weighted Average
0.048		5.24% Pervious Area
0.868		94.76% Impervious Area

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

Subcatchment A1: Prop Area 1



Summary for Subcatchment A1: Prop Area 1

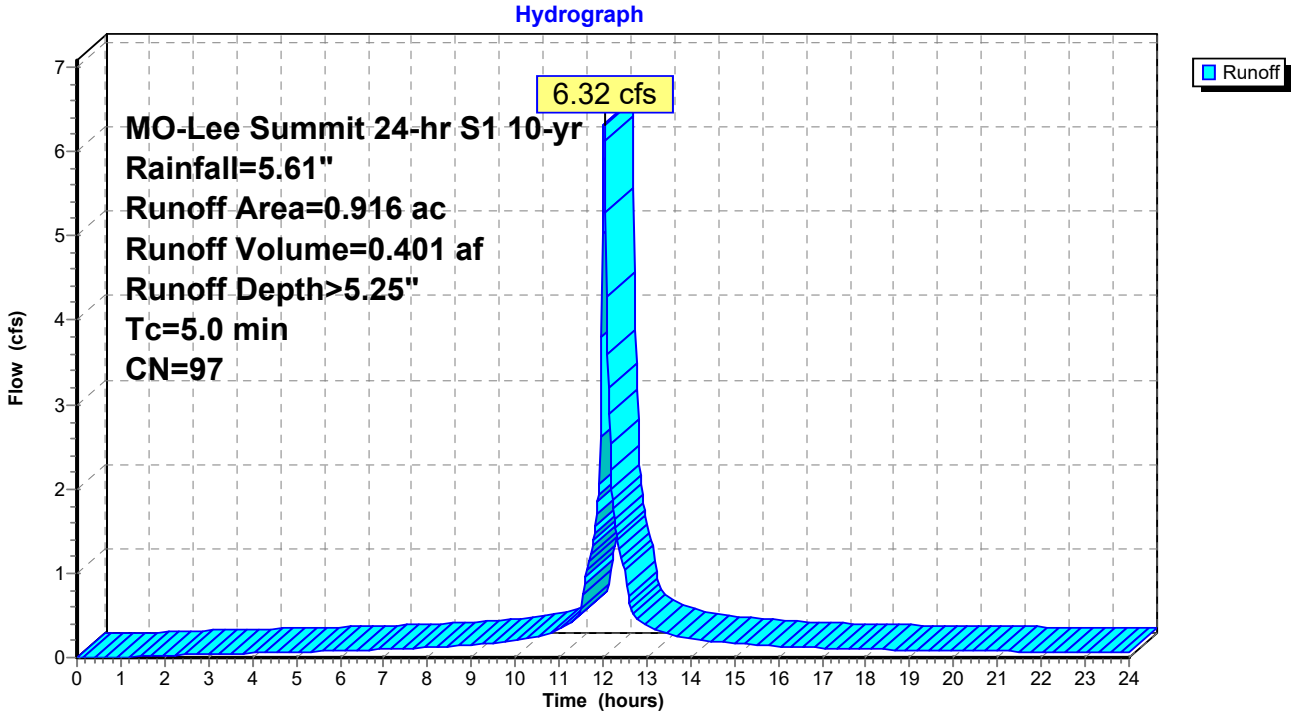
Runoff = 6.32 cfs @ 12.02 hrs, Volume= 0.401 af, Depth> 5.25"
Routed to Pond P4 : Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
MO-Lee Summit 24-hr S1 10-yr Rainfall=5.61"

Area (ac)	CN	Description
0.048	74	>75% Grass cover, Good, HSG C
0.757	98	Paved parking, HSG C
0.111	98	Roofs, HSG C
0.916	97	Weighted Average
0.048		5.24% Pervious Area
0.868		94.76% Impervious Area

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

Subcatchment A1: Prop Area 1



Summary for Subcatchment A1: Prop Area 1

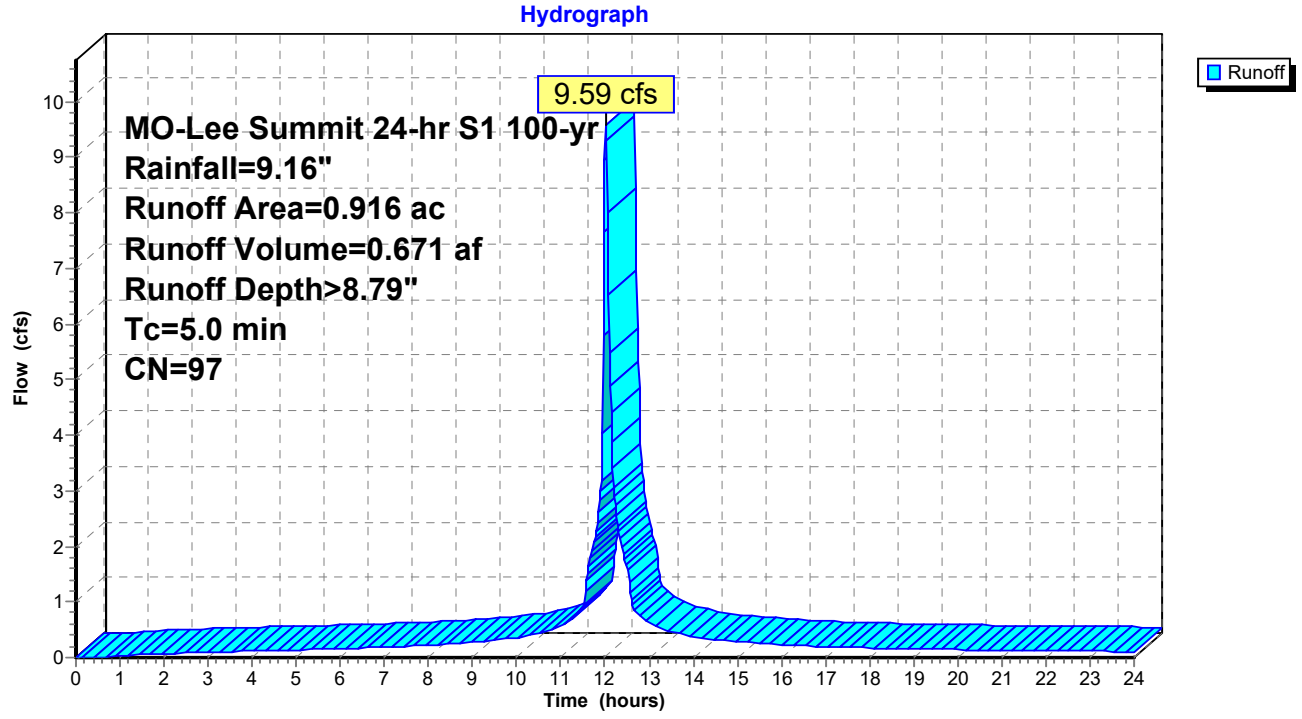
Runoff = 9.59 cfs @ 12.02 hrs, Volume= 0.671 af, Depth> 8.79"
Routed to Pond P4 : Detention Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
MO-Lee Summit 24-hr S1 100-yr Rainfall=9.16"

Area (ac)	CN	Description
0.048	74	>75% Grass cover, Good, HSG C
0.757	98	Paved parking, HSG C
0.111	98	Roofs, HSG C
0.916	97	Weighted Average
0.048		5.24% Pervious Area
0.868		94.76% Impervious Area

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

Subcatchment A1: Prop Area 1



Summary for Subcatchment A3: Prop Area 2

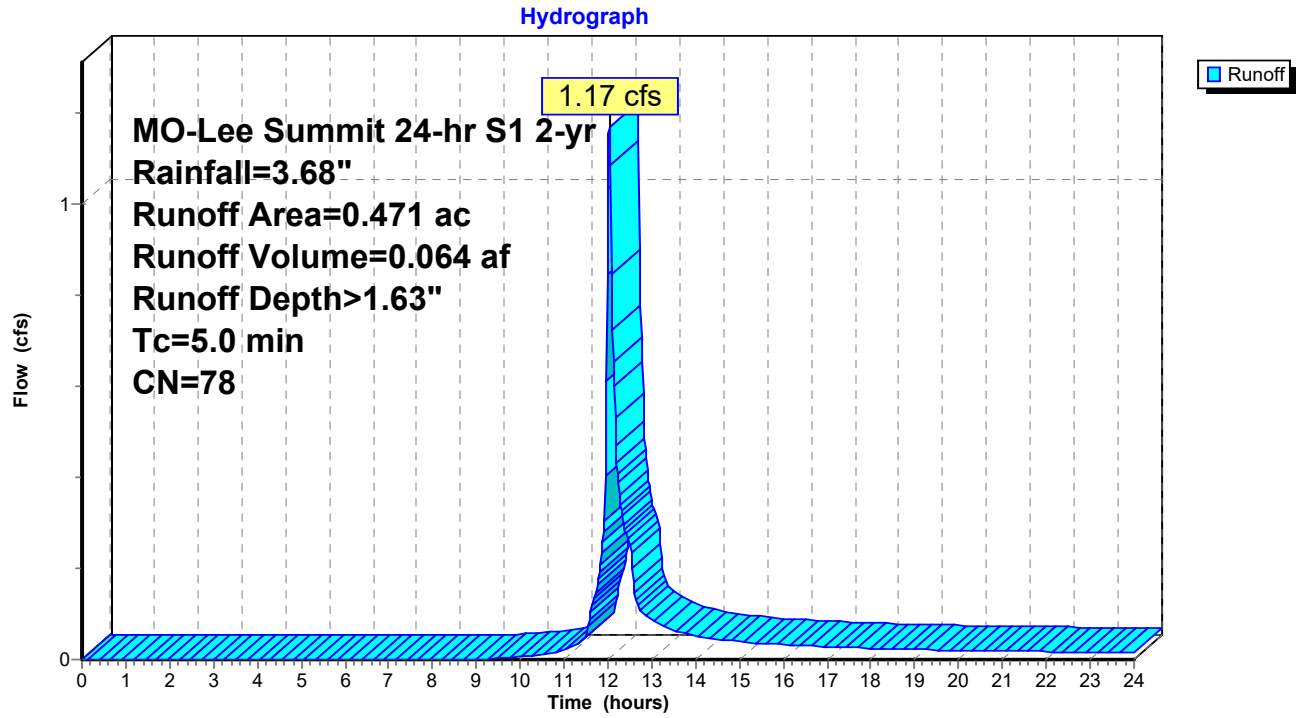
Runoff = 1.17 cfs @ 12.03 hrs, Volume= 0.064 af, Depth> 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
MO-Lee Summit 24-hr S1 2-yr Rainfall=3.68"

	Area (ac)	CN	Description
	0.387	74	>75% Grass cover, Good, HSG C
*	0.084	98	Impervious
	0.471	78	Weighted Average
	0.387		82.17% Pervious Area
	0.084		17.83% Impervious Area

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

Subcatchment A3: Prop Area 2



Summary for Subcatchment A3: Prop Area 2

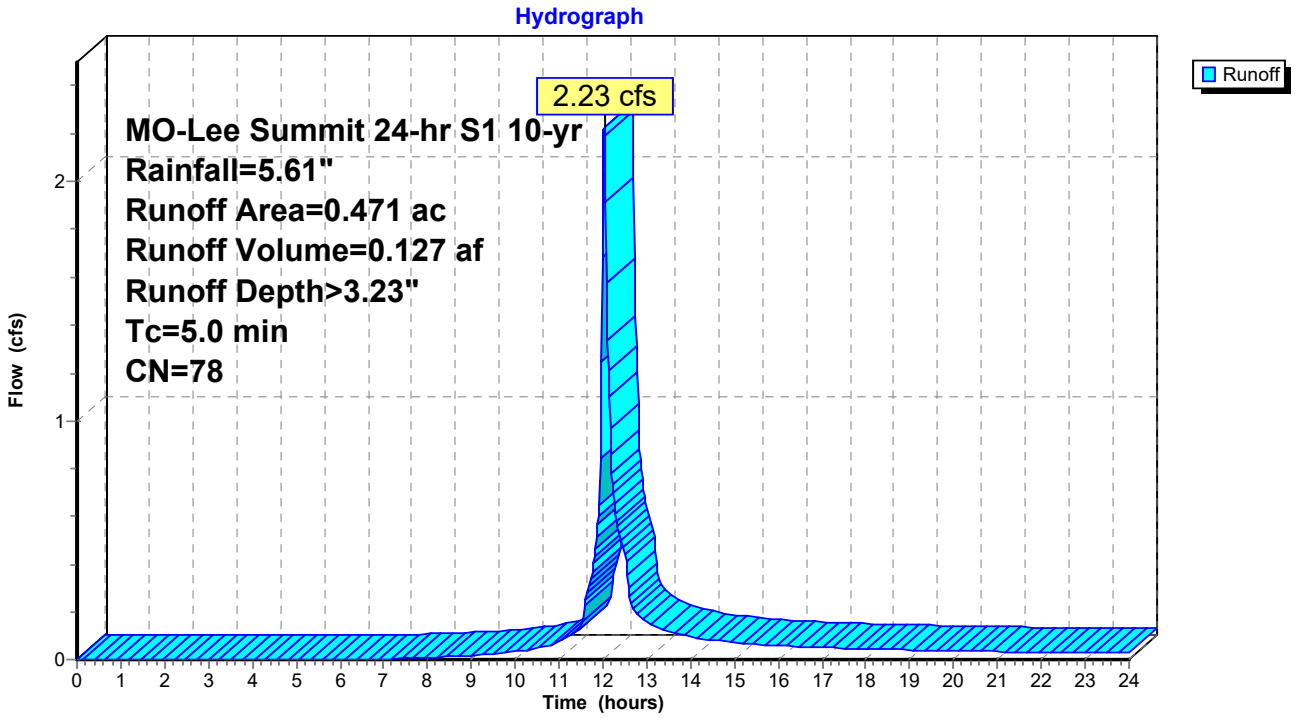
Runoff = 2.23 cfs @ 12.03 hrs, Volume= 0.127 af, Depth> 3.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
MO-Lee Summit 24-hr S1 10-yr Rainfall=5.61"

	Area (ac)	CN	Description
	0.387	74	>75% Grass cover, Good, HSG C
*	0.084	98	Impervious
	0.471	78	Weighted Average
	0.387		82.17% Pervious Area
	0.084		17.83% Impervious Area

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

Subcatchment A3: Prop Area 2



Summary for Subcatchment A3: Prop Area 2

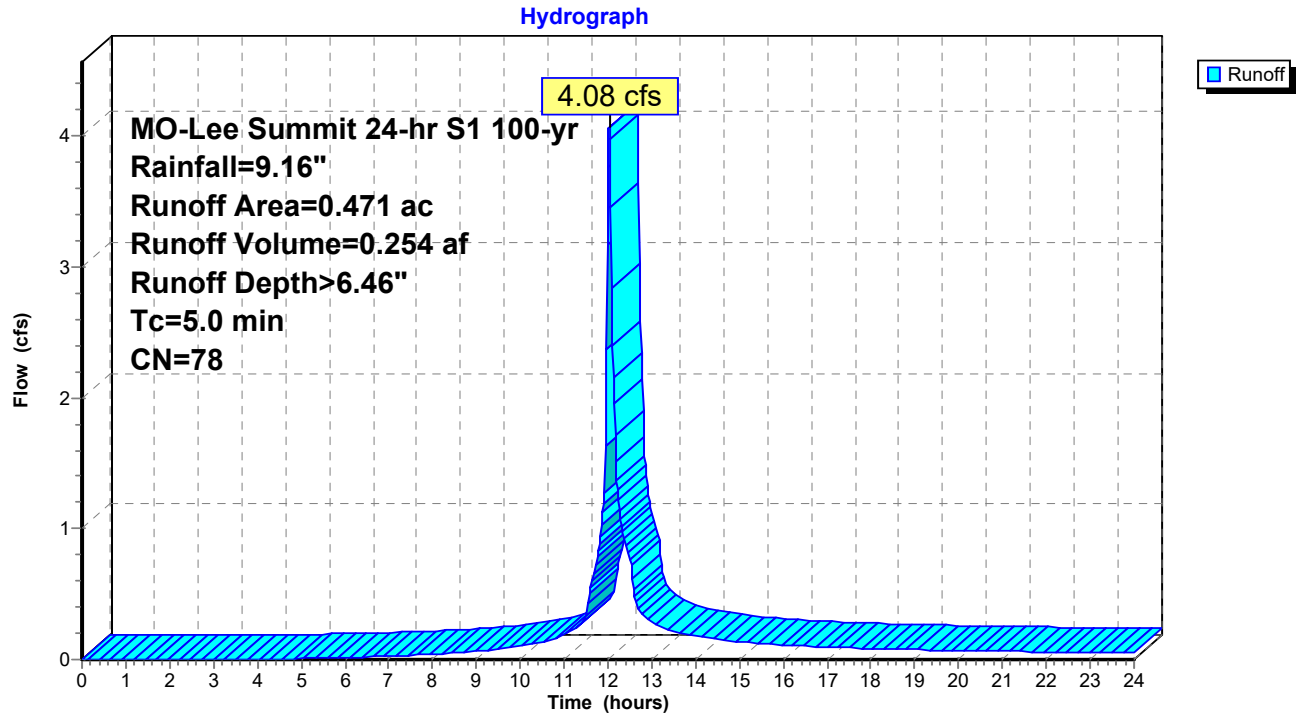
Runoff = 4.08 cfs @ 12.03 hrs, Volume= 0.254 af, Depth> 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
MO-Lee Summit 24-hr S1 100-yr Rainfall=9.16"

	Area (ac)	CN	Description
	0.387	74	>75% Grass cover, Good, HSG C
*	0.084	98	Impervious
	0.471	78	Weighted Average
	0.387		82.17% Pervious Area
	0.084		17.83% Impervious Area

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

Subcatchment A3: Prop Area 2



Summary for Pond P4: Detention Basin

Inflow Area = 0.916 ac, 94.76% Impervious, Inflow Depth > 3.33" for 2-yr event
Inflow = 4.32 cfs @ 12.02 hrs, Volume= 0.254 af
Outflow = 0.71 cfs @ 12.51 hrs, Volume= 0.212 af, Atten= 83%, Lag= 29.1 min
Primary = 0.71 cfs @ 12.51 hrs, Volume= 0.212 af
Routed to Reach 1R : Outlet Pipe

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 1,016.44' @ 12.51 hrs Storage= 5,582 cf

Plug-Flow detention time= 193.8 min calculated for 0.212 af (83% of inflow)
Center-of-Mass det. time= 120.6 min (882.7 - 762.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,014.92'	15,922 cf	**Custom Stage Data** Listed below

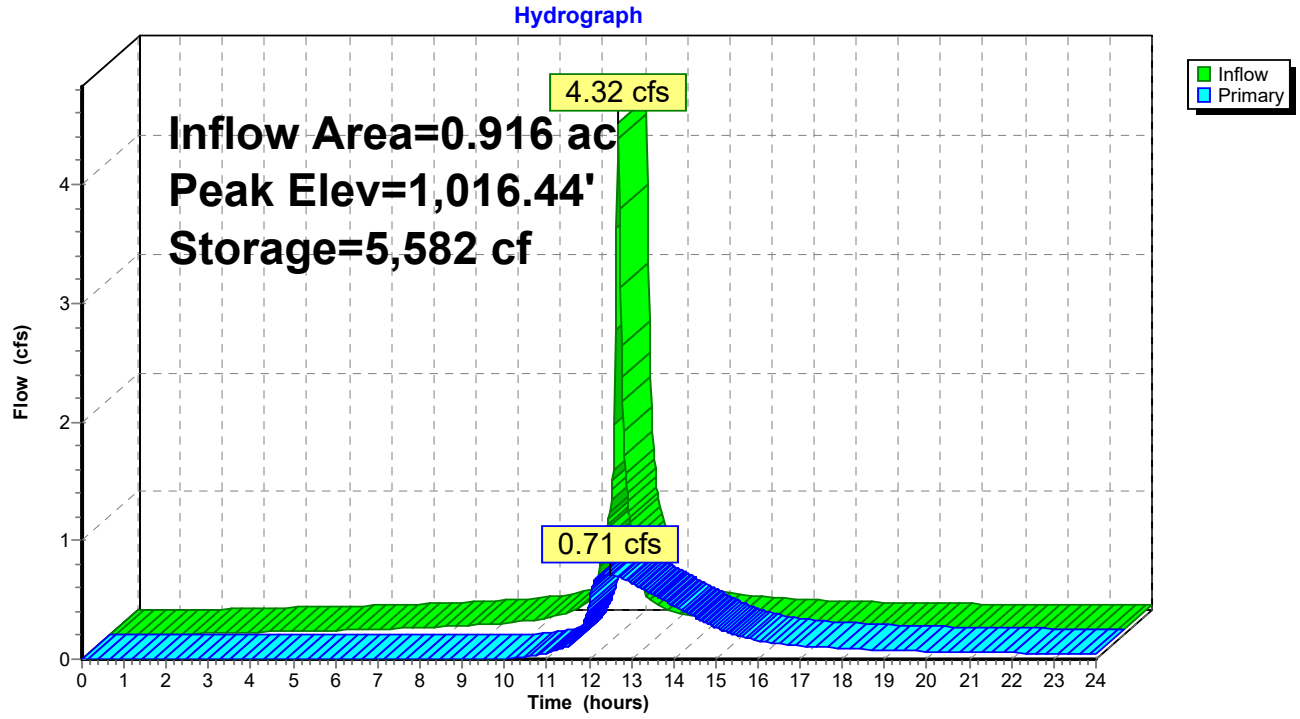
Elevation (feet)	Cum.Store (cubic-feet)
1,014.92	0
1,015.00	147
1,015.09	294
1,015.17	441
1,015.25	587
1,015.34	734
1,015.42	881
1,015.50	1,275
1,015.59	1,666
1,015.67	2,057
1,015.75	2,445
1,015.84	2,833
1,015.92	3,219
1,016.00	3,603
1,016.09	3,986
1,016.17	4,367
1,016.25	4,748
1,016.34	5,126
1,016.42	5,502
1,016.50	5,878
1,016.59	6,251
1,016.67	6,622
1,016.75	6,991
1,016.84	7,357
1,016.92	7,720
1,017.00	8,078
1,017.09	8,434
1,017.17	8,788
1,017.25	9,136
1,017.34	9,479
1,017.42	9,818
1,017.50	10,151
1,017.59	10,477
1,017.67	10,796
1,017.75	11,104
1,017.84	11,405
1,017.92	11,696
1,018.00	11,973
1,018.09	12,236
1,018.17	12,483
1,018.25	12,704
1,018.34	12,896
1,018.42	13,070
1,018.50	13,234
1,018.53	13,278
1,018.61	13,425
1,018.70	13,572
1,018.78	13,719
1,018.86	13,866
1,018.95	14,013
1,019.03	14,160

1,019.11	14,306
1,019.20	14,453
1,019.28	14,600
1,019.36	14,747
1,019.45	14,894
1,019.53	15,041
1,019.61	15,187
1,019.70	15,334
1,019.78	15,481
1,019.86	15,628
1,019.95	15,775
1,020.03	15,922

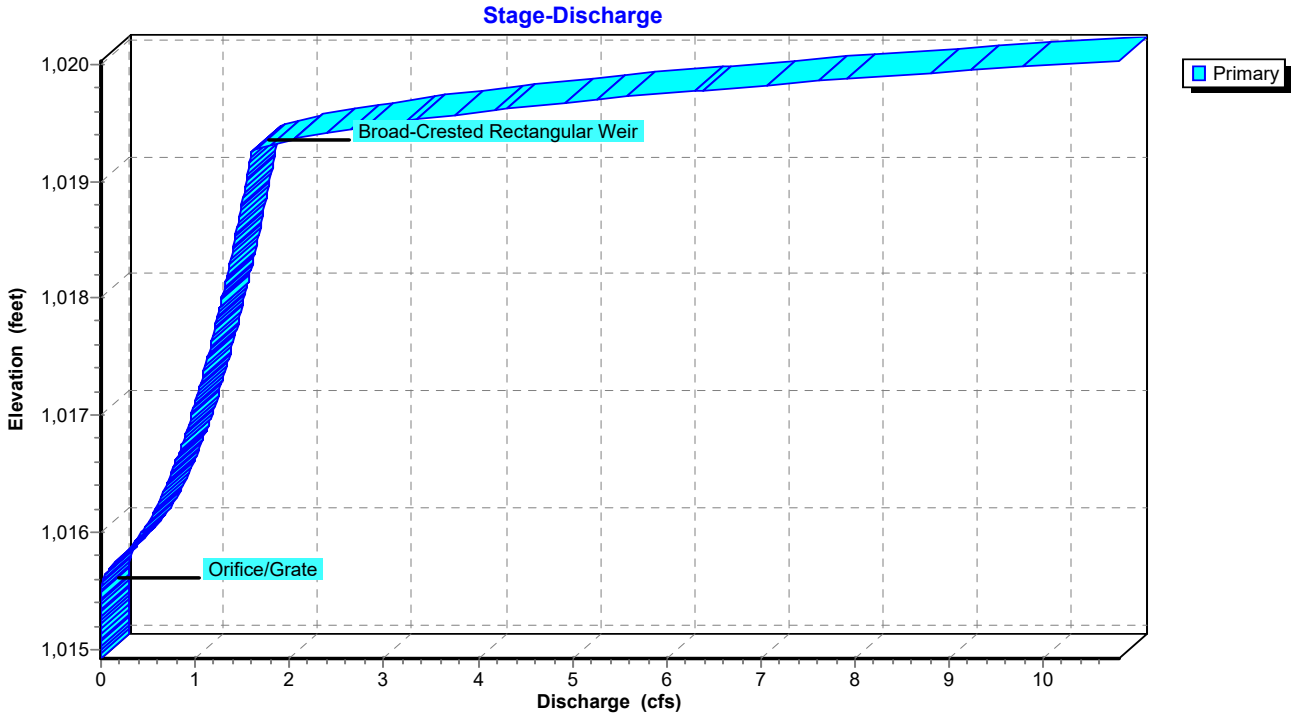
Device	Routing	Invert	Outlet Devices
#1	Primary	1,015.50'	**5.7" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	1,019.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.71 cfs @ 12.51 hrs HW=1,016.44' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.71 cfs @ 4.03 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

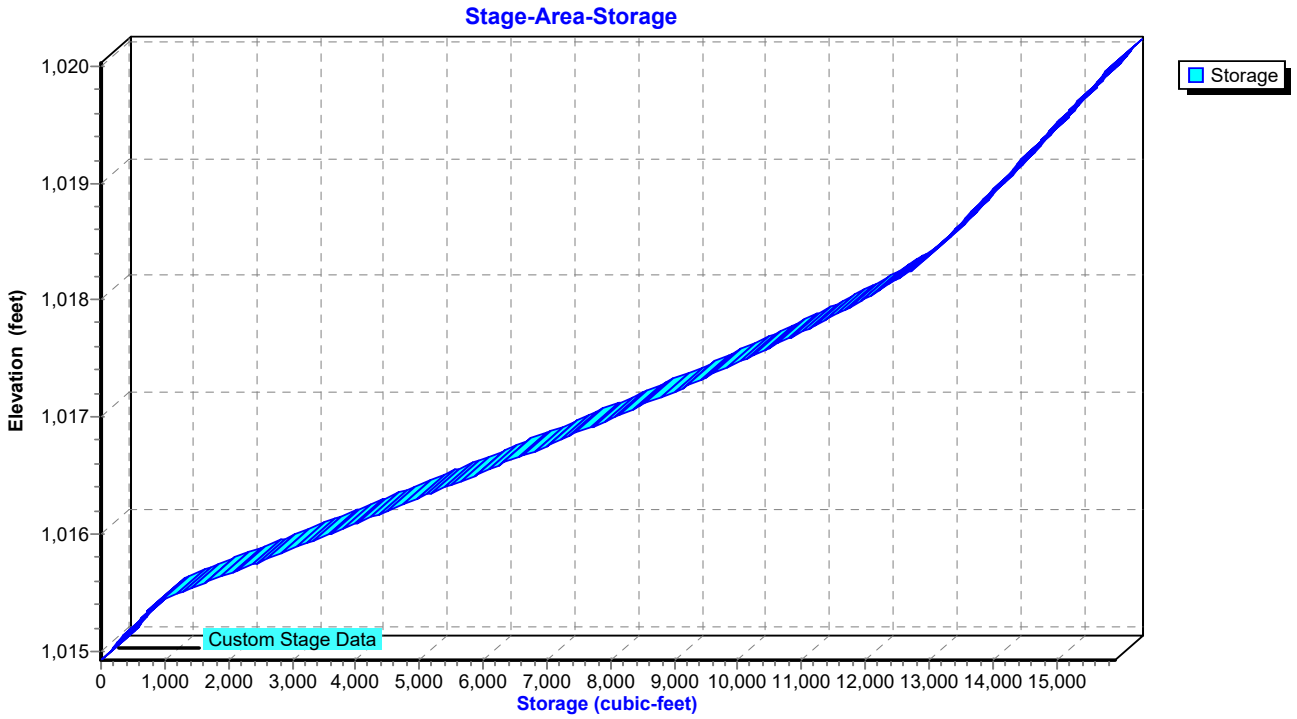
Pond P4: Detention Basin



Pond P4: Detention Basin



Pond P4: Detention Basin



Summary for Pond P4: Detention Basin

Inflow Area = 0.916 ac, 94.76% Impervious, Inflow Depth > 5.25" for 10-yr event
Inflow = 6.32 cfs @ 12.02 hrs, Volume= 0.401 af
Outflow = 0.95 cfs @ 12.54 hrs, Volume= 0.355 af, Atten= 85%, Lag= 31.2 min
Primary = 0.95 cfs @ 12.54 hrs, Volume= 0.355 af
Routed to Reach 1R : Outlet Pipe

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 1,016.97' @ 12.54 hrs Storage= 7,957 cf

Plug-Flow detention time= 176.5 min calculated for 0.355 af (89% of inflow)
Center-of-Mass det. time= 117.6 min (870.3 - 752.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,014.92'	15,922 cf	**Custom Stage Data** Listed below

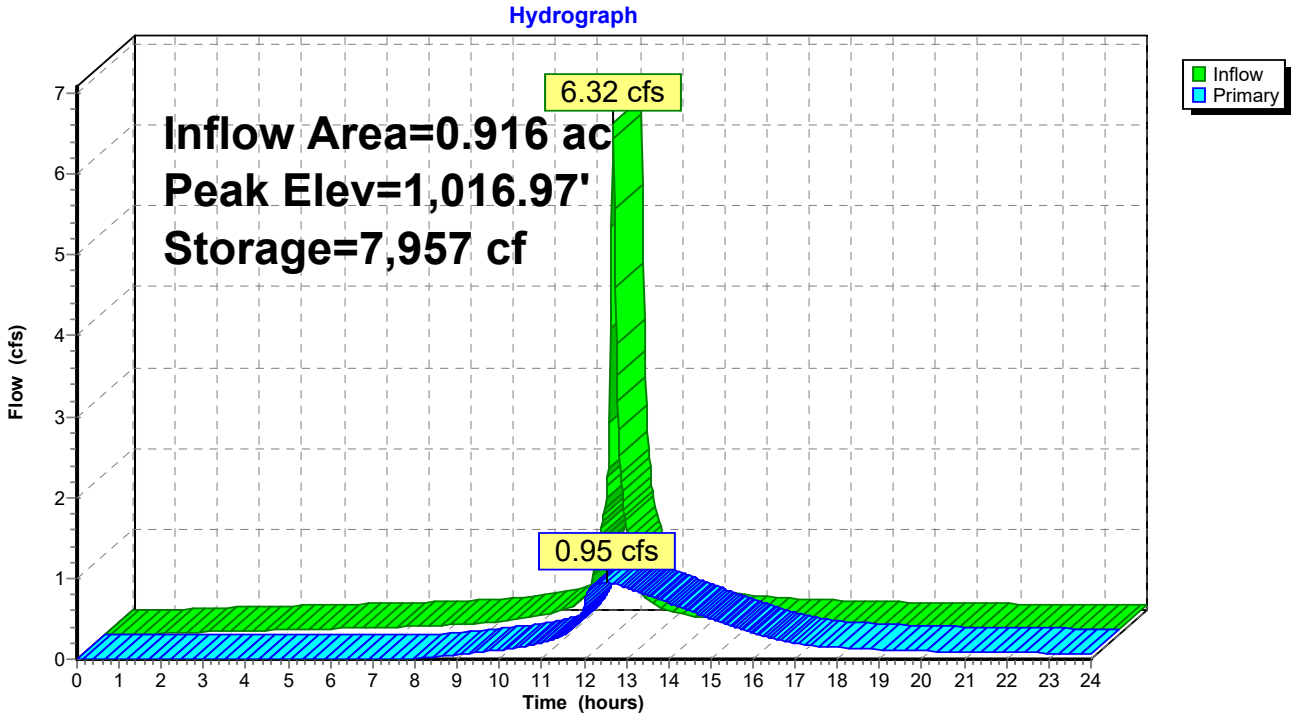
Elevation (feet)	Cum.Store (cubic-feet)
1,014.92	0
1,015.00	147
1,015.09	294
1,015.17	441
1,015.25	587
1,015.34	734
1,015.42	881
1,015.50	1,275
1,015.59	1,666
1,015.67	2,057
1,015.75	2,445
1,015.84	2,833
1,015.92	3,219
1,016.00	3,603
1,016.09	3,986
1,016.17	4,367
1,016.25	4,748
1,016.34	5,126
1,016.42	5,502
1,016.50	5,878
1,016.59	6,251
1,016.67	6,622
1,016.75	6,991
1,016.84	7,357
1,016.92	7,720
1,017.00	8,078
1,017.09	8,434
1,017.17	8,788
1,017.25	9,136
1,017.34	9,479
1,017.42	9,818
1,017.50	10,151
1,017.59	10,477
1,017.67	10,796
1,017.75	11,104
1,017.84	11,405
1,017.92	11,696
1,018.00	11,973
1,018.09	12,236
1,018.17	12,483
1,018.25	12,704
1,018.34	12,896
1,018.42	13,070
1,018.50	13,234
1,018.53	13,278
1,018.61	13,425
1,018.70	13,572
1,018.78	13,719
1,018.86	13,866
1,018.95	14,013
1,019.03	14,160

1,019.11	14,306
1,019.20	14,453
1,019.28	14,600
1,019.36	14,747
1,019.45	14,894
1,019.53	15,041
1,019.61	15,187
1,019.70	15,334
1,019.78	15,481
1,019.86	15,628
1,019.95	15,775
1,020.03	15,922

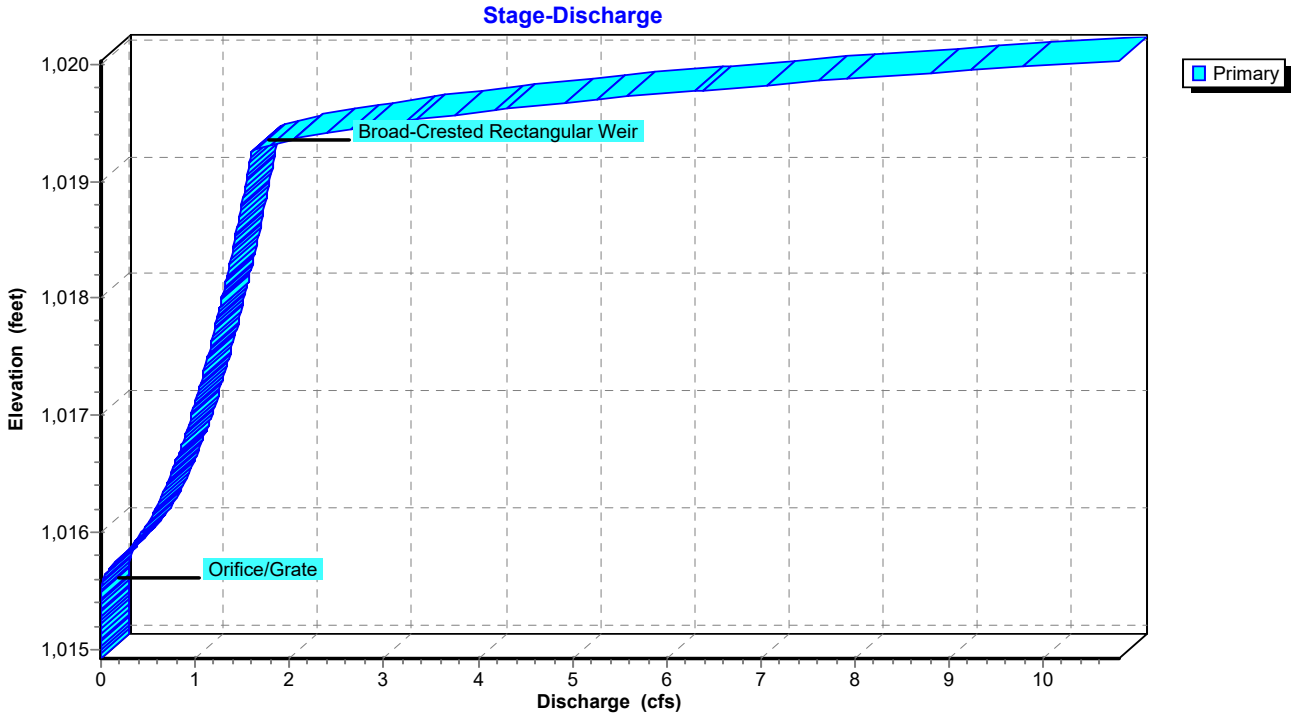
Device	Routing	Invert	Outlet Devices
#1	Primary	1,015.50'	**5.7" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	1,019.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.95 cfs @ 12.54 hrs HW=1,016.97' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 0.95 cfs @ 5.35 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

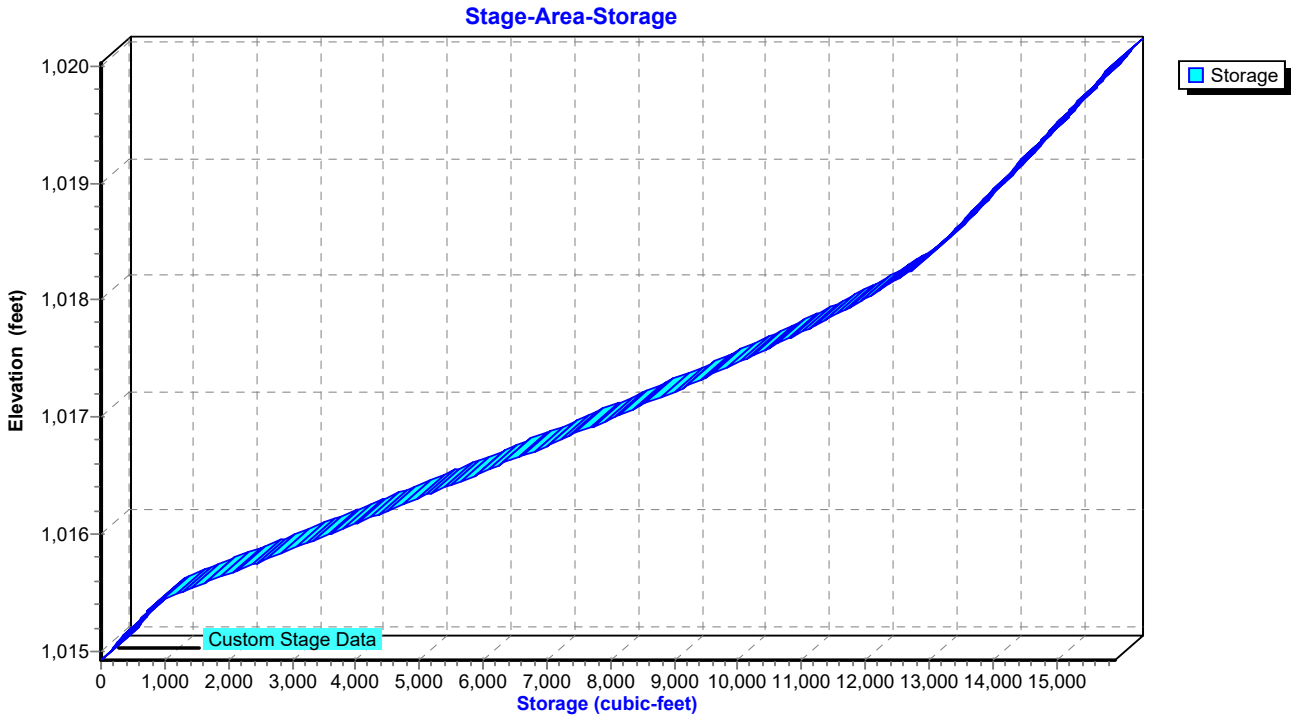
Pond P4: Detention Basin



Pond P4: Detention Basin



Pond P4: Detention Basin



Summary for Pond P4: Detention Basin

Inflow Area = 0.916 ac, 94.76% Impervious, Inflow Depth > 8.79" for 100-yr event
Inflow = 9.59 cfs @ 12.02 hrs, Volume= 0.671 af
Outflow = 1.28 cfs @ 12.57 hrs, Volume= 0.620 af, Atten= 87%, Lag= 32.6 min
Primary = 1.28 cfs @ 12.57 hrs, Volume= 0.620 af
Routed to Reach 1R : Outlet Pipe

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 1,018.00' @ 12.57 hrs Storage= 11,982 cf

Plug-Flow detention time= 160.9 min calculated for 0.620 af (92% of inflow)
Center-of-Mass det. time= 116.0 min (859.8 - 743.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,014.92'	15,922 cf	**Custom Stage Data** Listed below

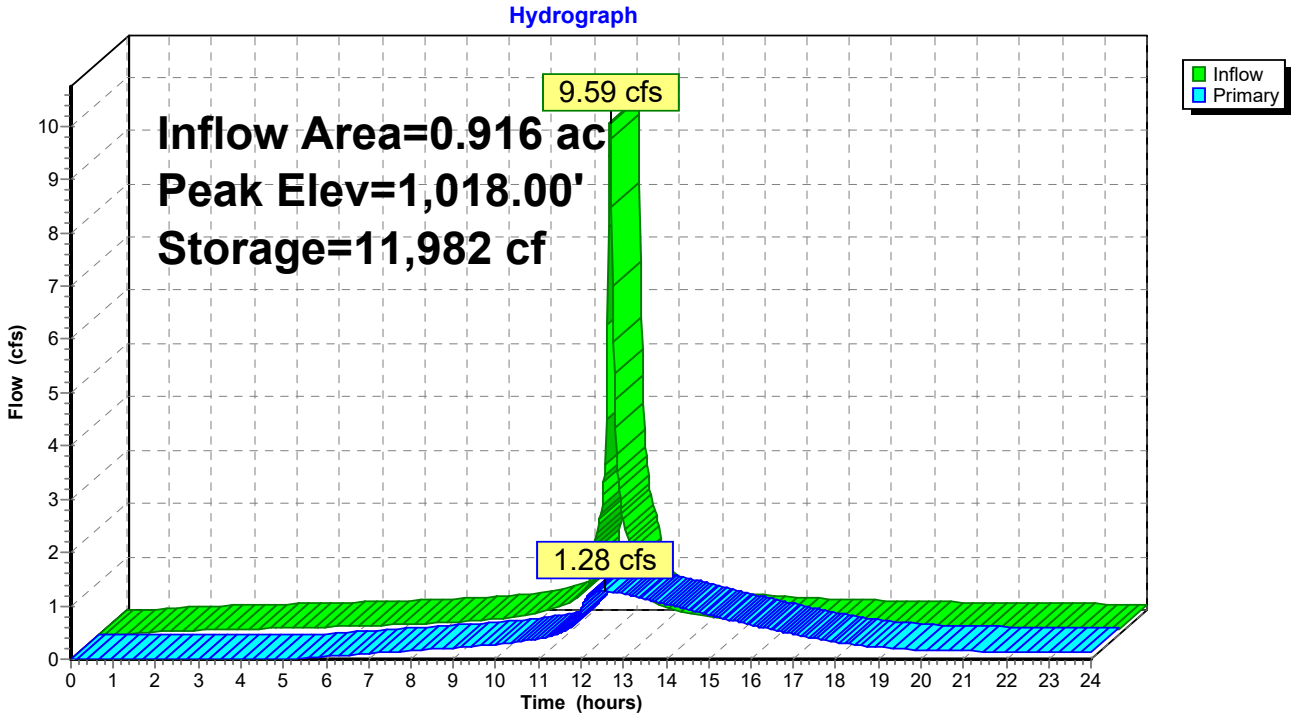
Elevation (feet)	Cum.Store (cubic-feet)
1,014.92	0
1,015.00	147
1,015.09	294
1,015.17	441
1,015.25	587
1,015.34	734
1,015.42	881
1,015.50	1,275
1,015.59	1,666
1,015.67	2,057
1,015.75	2,445
1,015.84	2,833
1,015.92	3,219
1,016.00	3,603
1,016.09	3,986
1,016.17	4,367
1,016.25	4,748
1,016.34	5,126
1,016.42	5,502
1,016.50	5,878
1,016.59	6,251
1,016.67	6,622
1,016.75	6,991
1,016.84	7,357
1,016.92	7,720
1,017.00	8,078
1,017.09	8,434
1,017.17	8,788
1,017.25	9,136
1,017.34	9,479
1,017.42	9,818
1,017.50	10,151
1,017.59	10,477
1,017.67	10,796
1,017.75	11,104
1,017.84	11,405
1,017.92	11,696
1,018.00	11,973
1,018.09	12,236
1,018.17	12,483
1,018.25	12,704
1,018.34	12,896
1,018.42	13,070
1,018.50	13,234
1,018.53	13,278
1,018.61	13,425
1,018.70	13,572
1,018.78	13,719
1,018.86	13,866
1,018.95	14,013
1,019.03	14,160

1,019.11	14,306
1,019.20	14,453
1,019.28	14,600
1,019.36	14,747
1,019.45	14,894
1,019.53	15,041
1,019.61	15,187
1,019.70	15,334
1,019.78	15,481
1,019.86	15,628
1,019.95	15,775
1,020.03	15,922

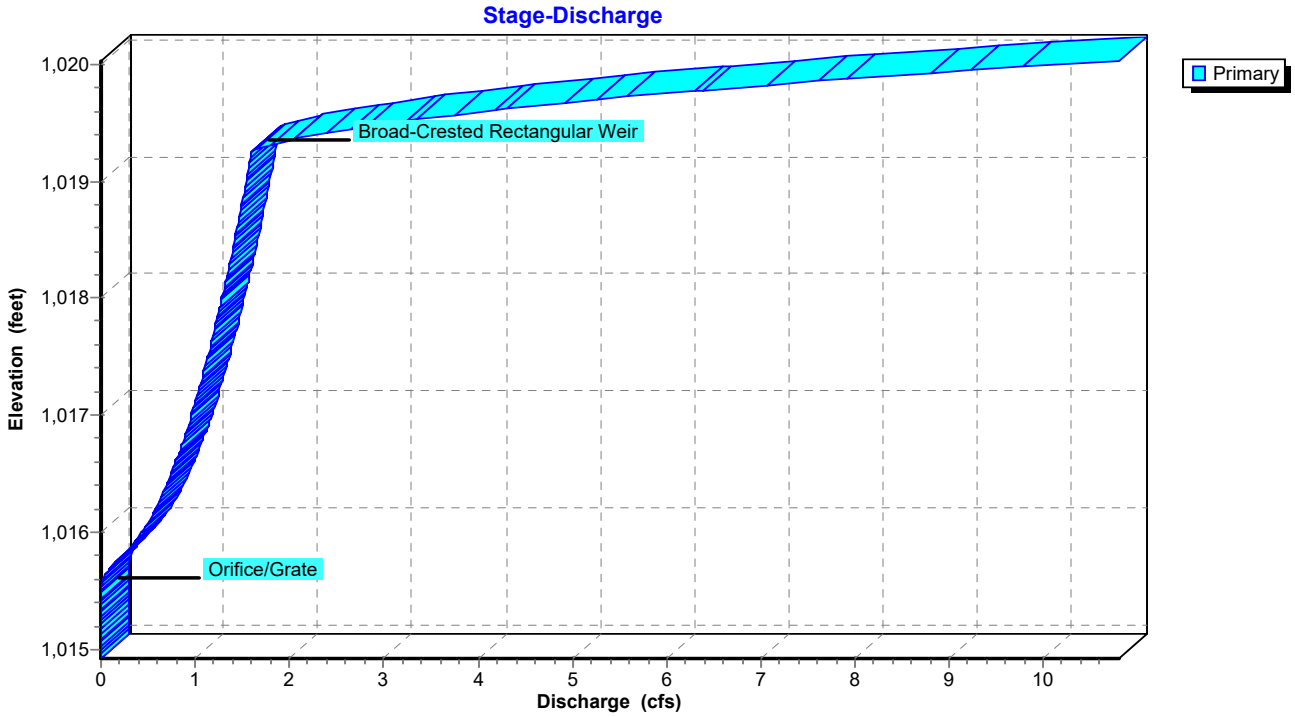
Device	Routing	Invert	Outlet Devices
#1	Primary	1,015.50'	**5.7" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	1,019.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.28 cfs @ 12.57 hrs HW=1,018.00' (Free Discharge)
└─**1=Orifice/Grate** (Orifice Controls 1.28 cfs @ 7.25 fps)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P4: Detention Basin



Pond P4: Detention Basin



Pond P4: Detention Basin

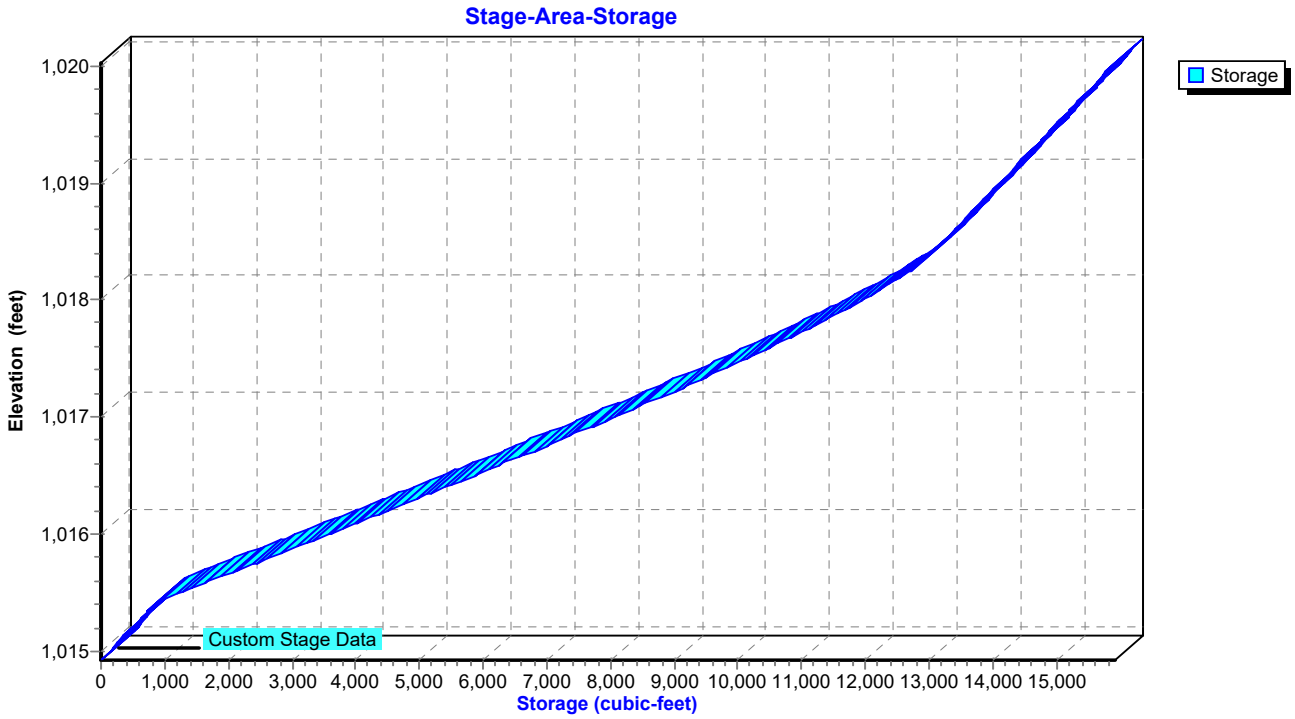


Exhibit C

Summary for Pond P4: Detention Basin

Inflow Area = 0.916 ac, 94.76% Impervious, Inflow Depth > 3.33" for 2-yr event
Inflow = 4.32 cfs @ 12.02 hrs, Volume= 0.254 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 1R : Outlet Pipe

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 1,017.74' @ 24.00 hrs Storage= 11,073 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	1,014.92'	15,922 cf	**Custom Stage Data** Listed below

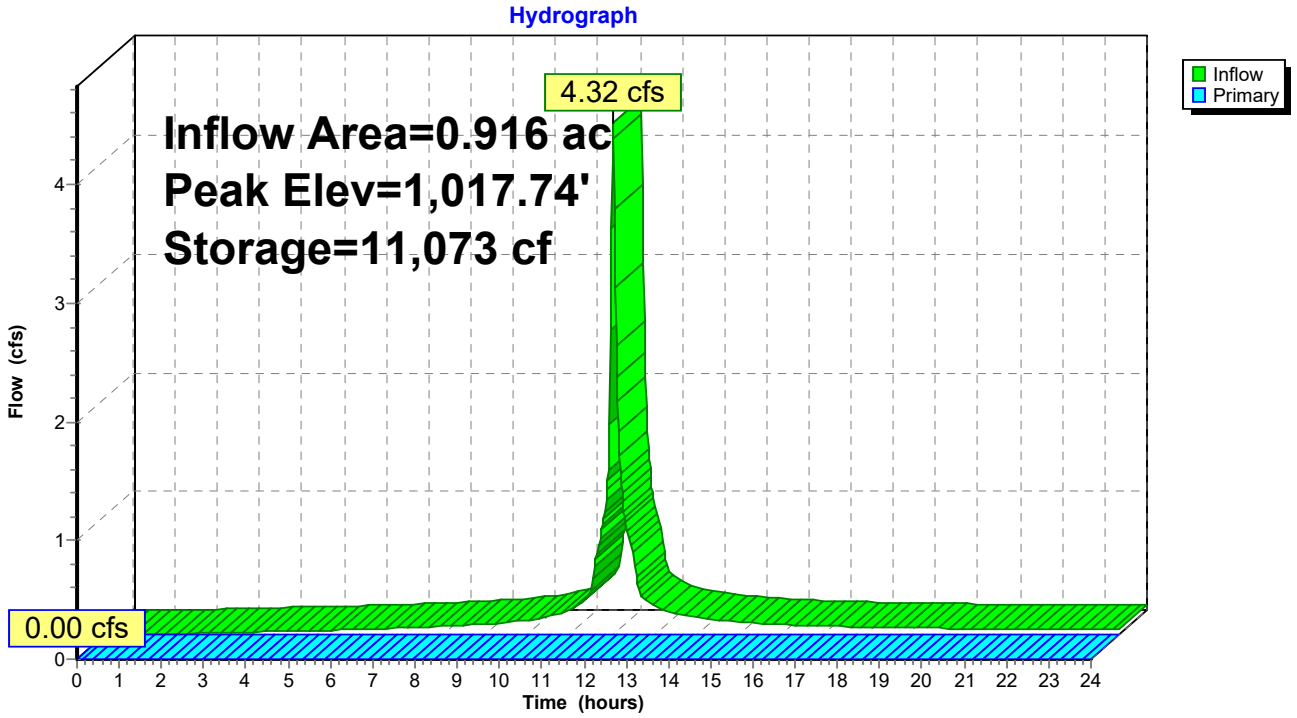
Elevation (feet)	Cum.Store (cubic-feet)
1,014.92	0
1,015.00	147
1,015.09	294
1,015.17	441
1,015.25	587
1,015.34	734
1,015.42	881
1,015.50	1,275
1,015.59	1,666
1,015.67	2,057
1,015.75	2,445
1,015.84	2,833
1,015.92	3,219
1,016.00	3,603
1,016.09	3,986
1,016.17	4,367
1,016.25	4,748
1,016.34	5,126
1,016.42	5,502
1,016.50	5,878
1,016.59	6,251
1,016.67	6,622
1,016.75	6,991
1,016.84	7,357
1,016.92	7,720
1,017.00	8,078
1,017.09	8,434
1,017.17	8,788
1,017.25	9,136
1,017.34	9,479
1,017.42	9,818
1,017.50	10,151
1,017.59	10,477
1,017.67	10,796
1,017.75	11,104
1,017.84	11,405
1,017.92	11,696
1,018.00	11,973
1,018.09	12,236
1,018.17	12,483
1,018.25	12,704
1,018.34	12,896
1,018.42	13,070
1,018.50	13,234
1,018.53	13,278
1,018.61	13,425
1,018.70	13,572
1,018.78	13,719
1,018.86	13,866
1,018.95	14,013
1,019.03	14,160

1,019.11	14,306
1,019.20	14,453
1,019.28	14,600
1,019.36	14,747
1,019.45	14,894
1,019.53	15,041
1,019.61	15,187
1,019.70	15,334
1,019.78	15,481
1,019.86	15,628
1,019.95	15,775
1,020.03	15,922

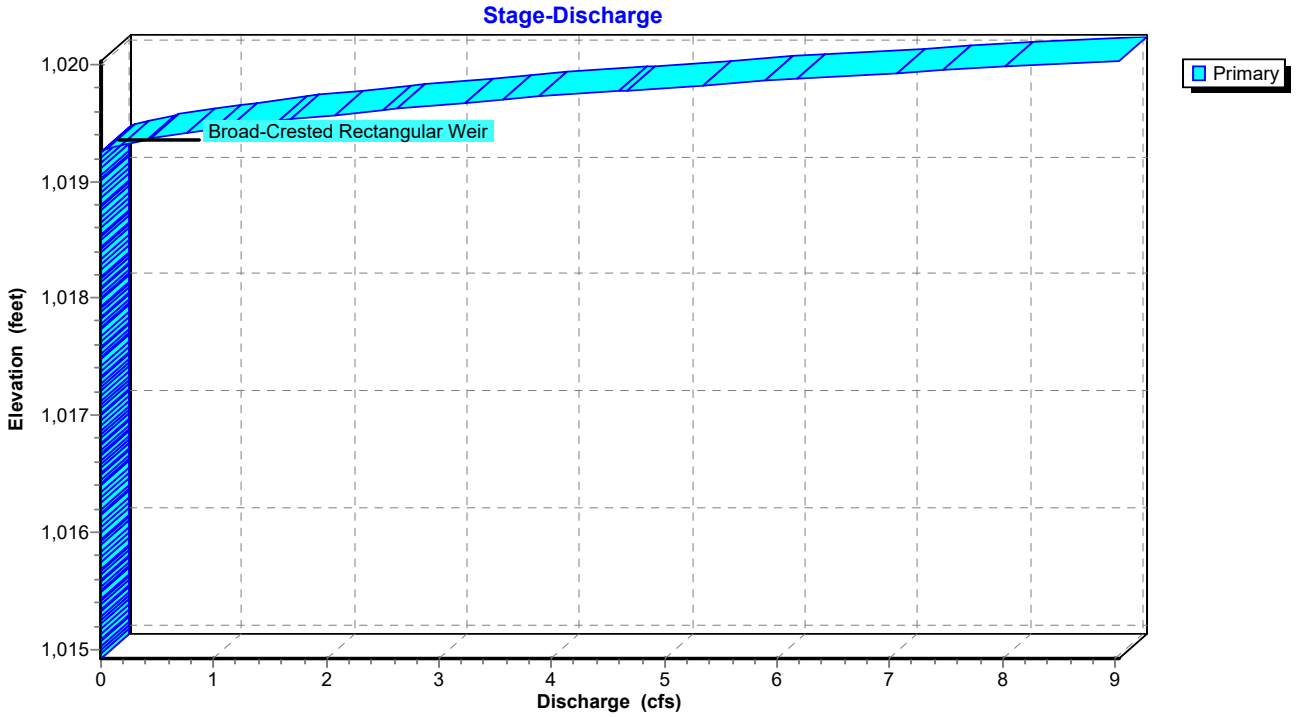
Device	Routing	Invert	Outlet Devices
#1	Primary	1,019.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,014.92' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

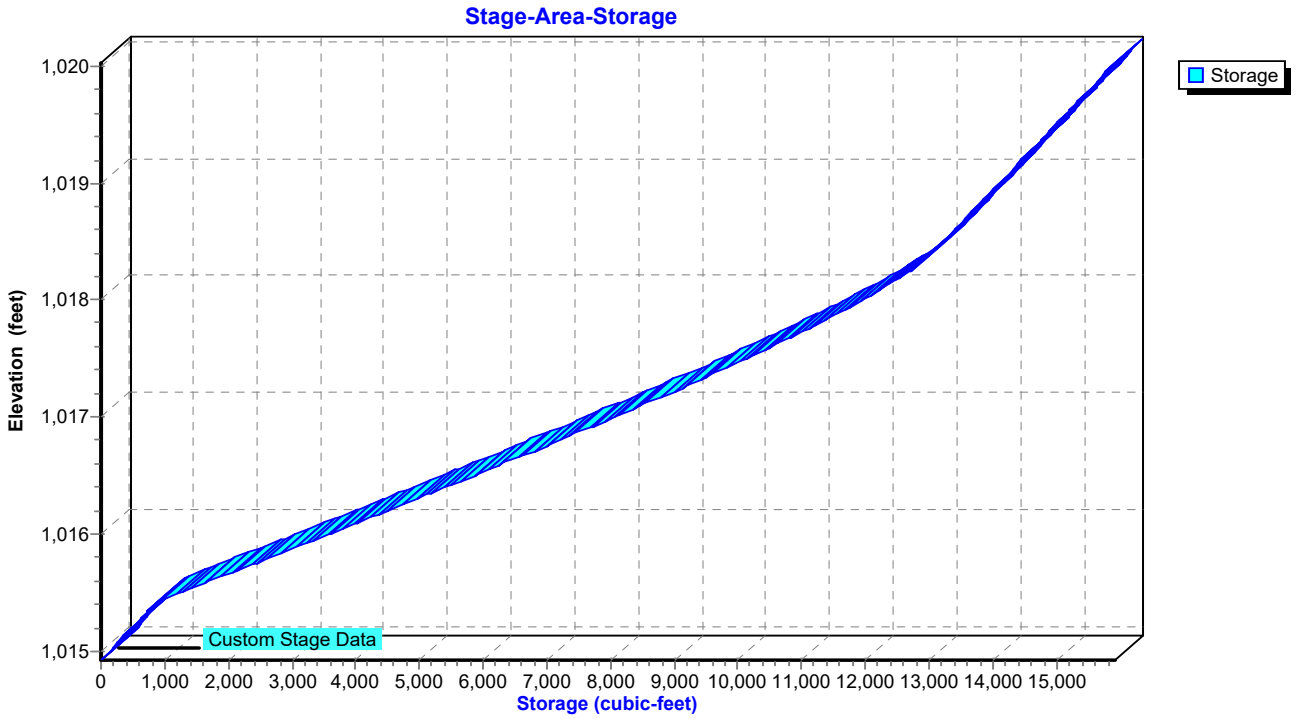
Pond P4: Detention Basin



Pond P4: Detention Basin



Pond P4: Detention Basin



Summary for Pond P4: Detention Basin

Inflow Area = 0.916 ac, 94.76% Impervious, Inflow Depth > 5.25" for 10-yr event
Inflow = 6.32 cfs @ 12.02 hrs, Volume= 0.401 af
Outflow = 0.14 cfs @ 15.76 hrs, Volume= 0.066 af, Atten= 98%, Lag= 224.5 min
Primary = 0.14 cfs @ 15.76 hrs, Volume= 0.066 af
Routed to Reach 1R : Outlet Pipe

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 1,019.30' @ 15.76 hrs Storage= 14,642 cf

Plug-Flow detention time= 707.7 min calculated for 0.066 af (16% of inflow)
Center-of-Mass det. time= 389.7 min (1,142.4 - 752.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,014.92'	15,922 cf	**Custom Stage Data** Listed below

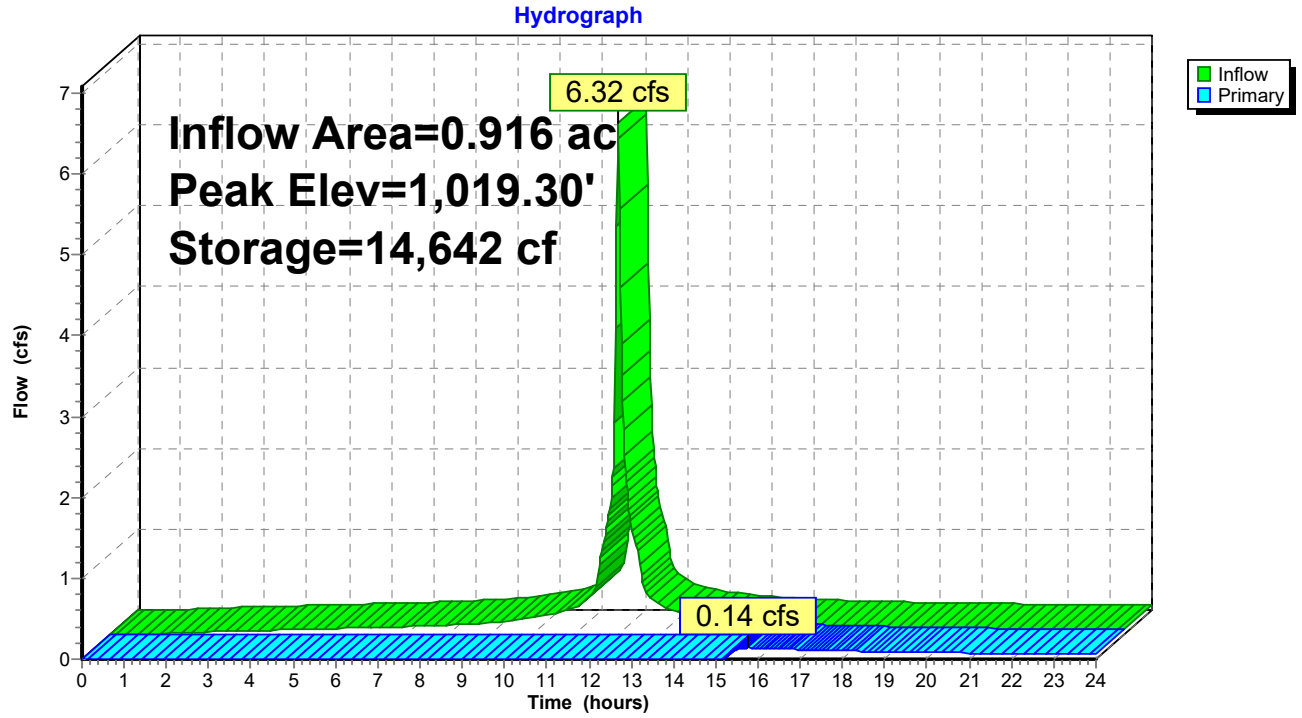
Elevation (feet)	Cum.Store (cubic-feet)
1,014.92	0
1,015.00	147
1,015.09	294
1,015.17	441
1,015.25	587
1,015.34	734
1,015.42	881
1,015.50	1,275
1,015.59	1,666
1,015.67	2,057
1,015.75	2,445
1,015.84	2,833
1,015.92	3,219
1,016.00	3,603
1,016.09	3,986
1,016.17	4,367
1,016.25	4,748
1,016.34	5,126
1,016.42	5,502
1,016.50	5,878
1,016.59	6,251
1,016.67	6,622
1,016.75	6,991
1,016.84	7,357
1,016.92	7,720
1,017.00	8,078
1,017.09	8,434
1,017.17	8,788
1,017.25	9,136
1,017.34	9,479
1,017.42	9,818
1,017.50	10,151
1,017.59	10,477
1,017.67	10,796
1,017.75	11,104
1,017.84	11,405
1,017.92	11,696
1,018.00	11,973
1,018.09	12,236
1,018.17	12,483
1,018.25	12,704
1,018.34	12,896
1,018.42	13,070
1,018.50	13,234
1,018.53	13,278
1,018.61	13,425
1,018.70	13,572
1,018.78	13,719
1,018.86	13,866
1,018.95	14,013
1,019.03	14,160

1,019.11	14,306
1,019.20	14,453
1,019.28	14,600
1,019.36	14,747
1,019.45	14,894
1,019.53	15,041
1,019.61	15,187
1,019.70	15,334
1,019.78	15,481
1,019.86	15,628
1,019.95	15,775
1,020.03	15,922

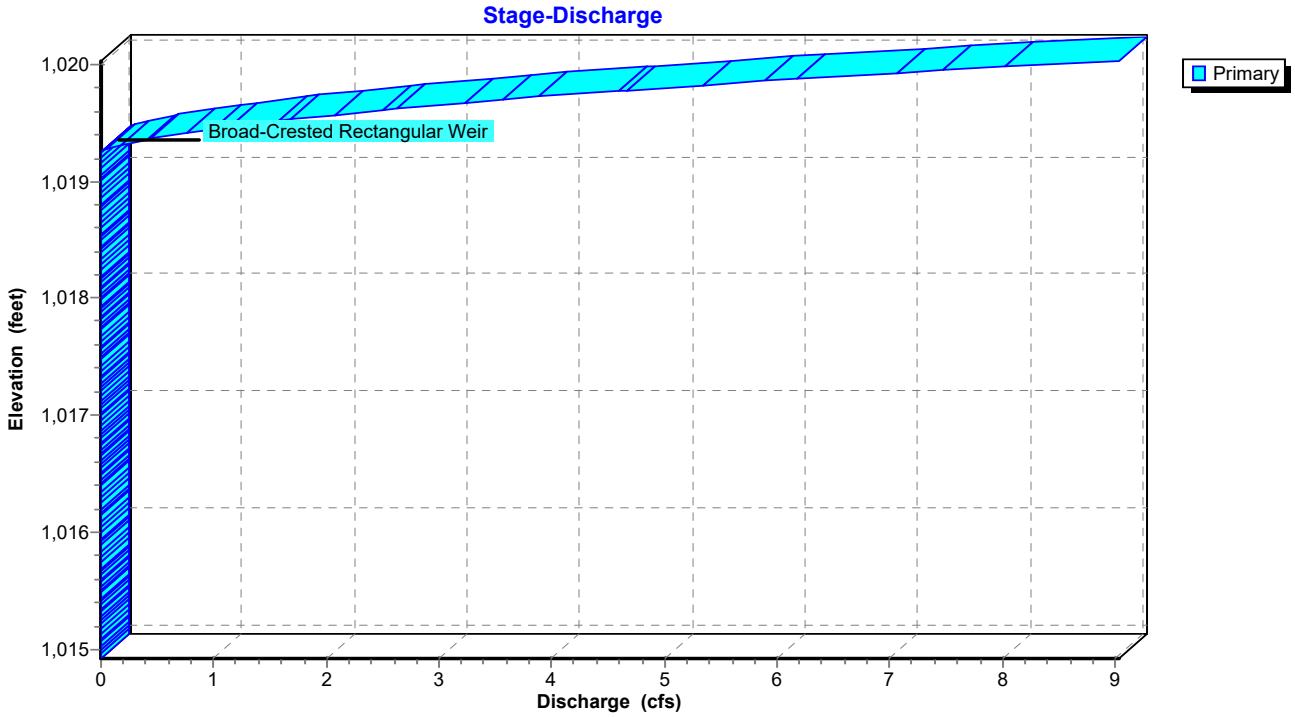
Device	Routing	Invert	Outlet Devices
#1	Primary	1,019.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.14 cfs @ 15.76 hrs HW=1,019.30' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 0.14 cfs @ 0.64 fps)

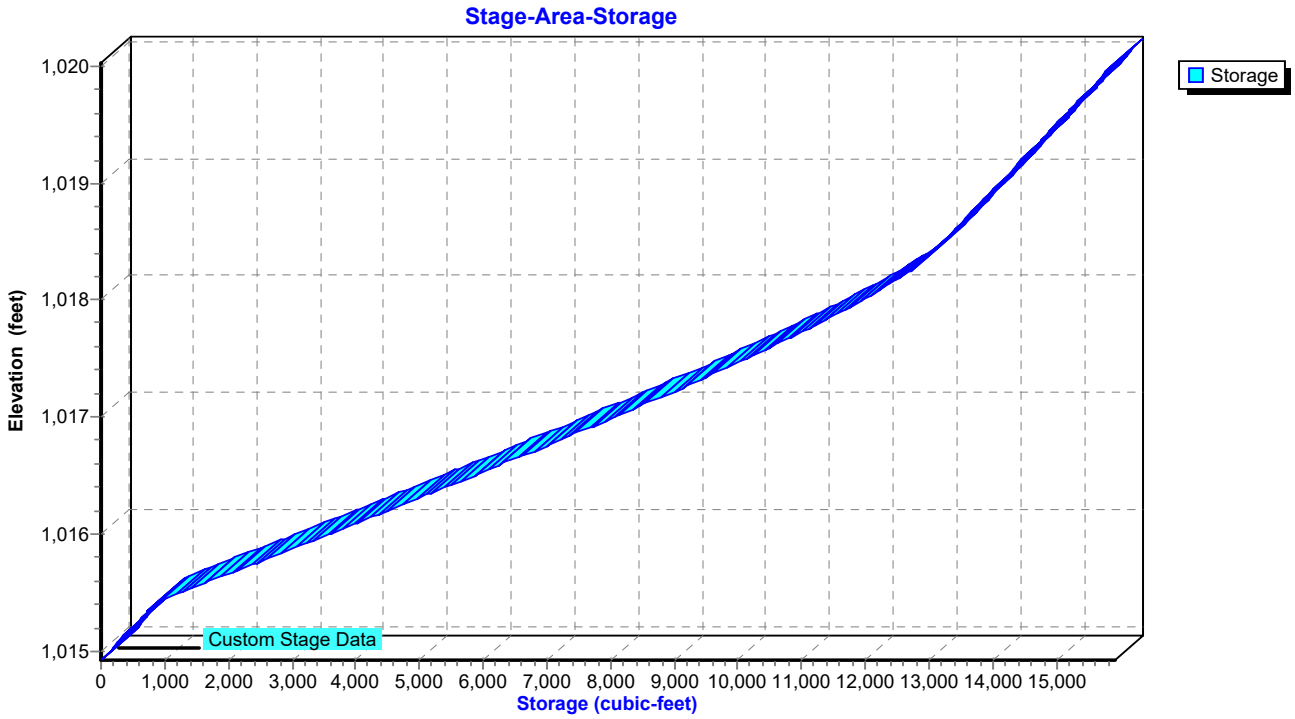
Pond P4: Detention Basin



Pond P4: Detention Basin



Pond P4: Detention Basin



Summary for Pond P4: Detention Basin

Inflow Area = 0.916 ac, 94.76% Impervious, Inflow Depth > 8.79" for 100-yr event
Inflow = 9.59 cfs @ 12.02 hrs, Volume= 0.671 af
Outflow = 4.45 cfs @ 12.14 hrs, Volume= 0.335 af, Atten= 54%, Lag= 7.0 min
Primary = 4.45 cfs @ 12.14 hrs, Volume= 0.335 af
Routed to Reach 1R : Outlet Pipe

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 1,019.76' @ 12.14 hrs Storage= 15,452 cf

Plug-Flow detention time= 311.8 min calculated for 0.335 af (50% of inflow)
Center-of-Mass det. time= 158.0 min (901.9 - 743.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,014.92'	15,922 cf	**Custom Stage Data** Listed below

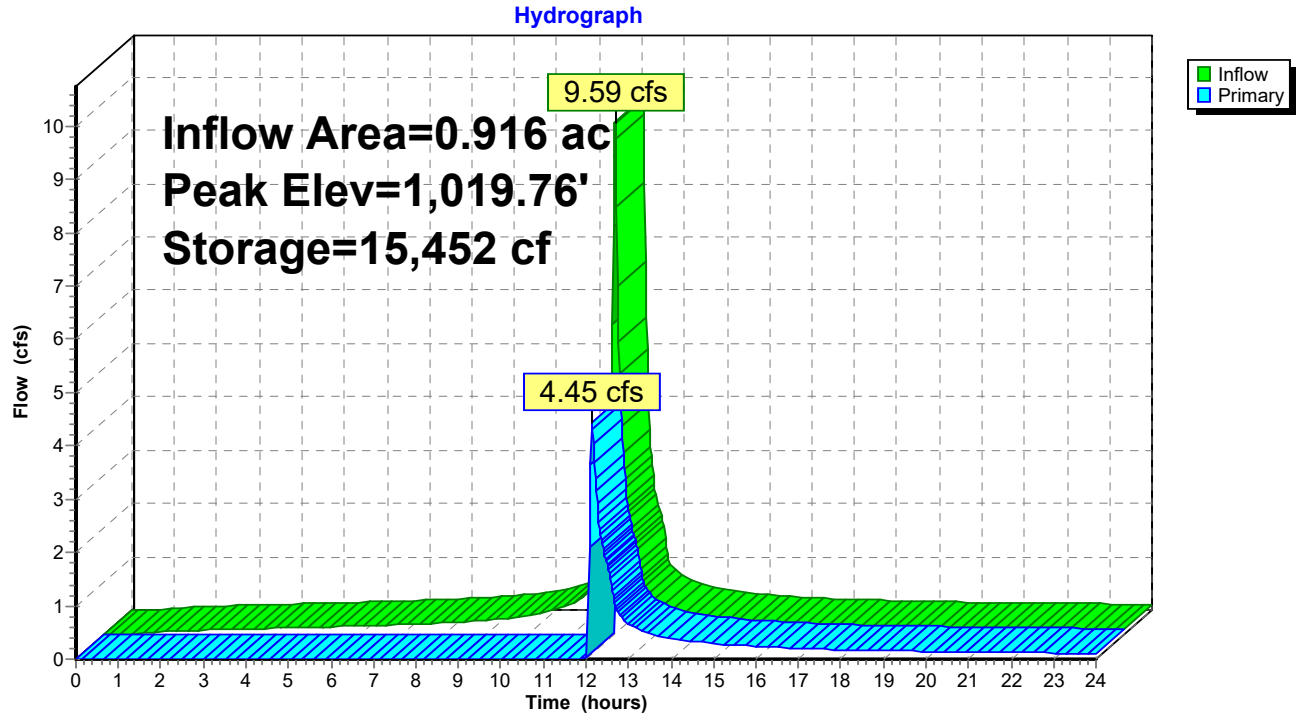
Elevation (feet)	Cum.Store (cubic-feet)
1,014.92	0
1,015.00	147
1,015.09	294
1,015.17	441
1,015.25	587
1,015.34	734
1,015.42	881
1,015.50	1,275
1,015.59	1,666
1,015.67	2,057
1,015.75	2,445
1,015.84	2,833
1,015.92	3,219
1,016.00	3,603
1,016.09	3,986
1,016.17	4,367
1,016.25	4,748
1,016.34	5,126
1,016.42	5,502
1,016.50	5,878
1,016.59	6,251
1,016.67	6,622
1,016.75	6,991
1,016.84	7,357
1,016.92	7,720
1,017.00	8,078
1,017.09	8,434
1,017.17	8,788
1,017.25	9,136
1,017.34	9,479
1,017.42	9,818
1,017.50	10,151
1,017.59	10,477
1,017.67	10,796
1,017.75	11,104
1,017.84	11,405
1,017.92	11,696
1,018.00	11,973
1,018.09	12,236
1,018.17	12,483
1,018.25	12,704
1,018.34	12,896
1,018.42	13,070
1,018.50	13,234
1,018.53	13,278
1,018.61	13,425
1,018.70	13,572
1,018.78	13,719
1,018.86	13,866
1,018.95	14,013
1,019.03	14,160

1,019.11	14,306
1,019.20	14,453
1,019.28	14,600
1,019.36	14,747
1,019.45	14,894
1,019.53	15,041
1,019.61	15,187
1,019.70	15,334
1,019.78	15,481
1,019.86	15,628
1,019.95	15,775
1,020.03	15,922

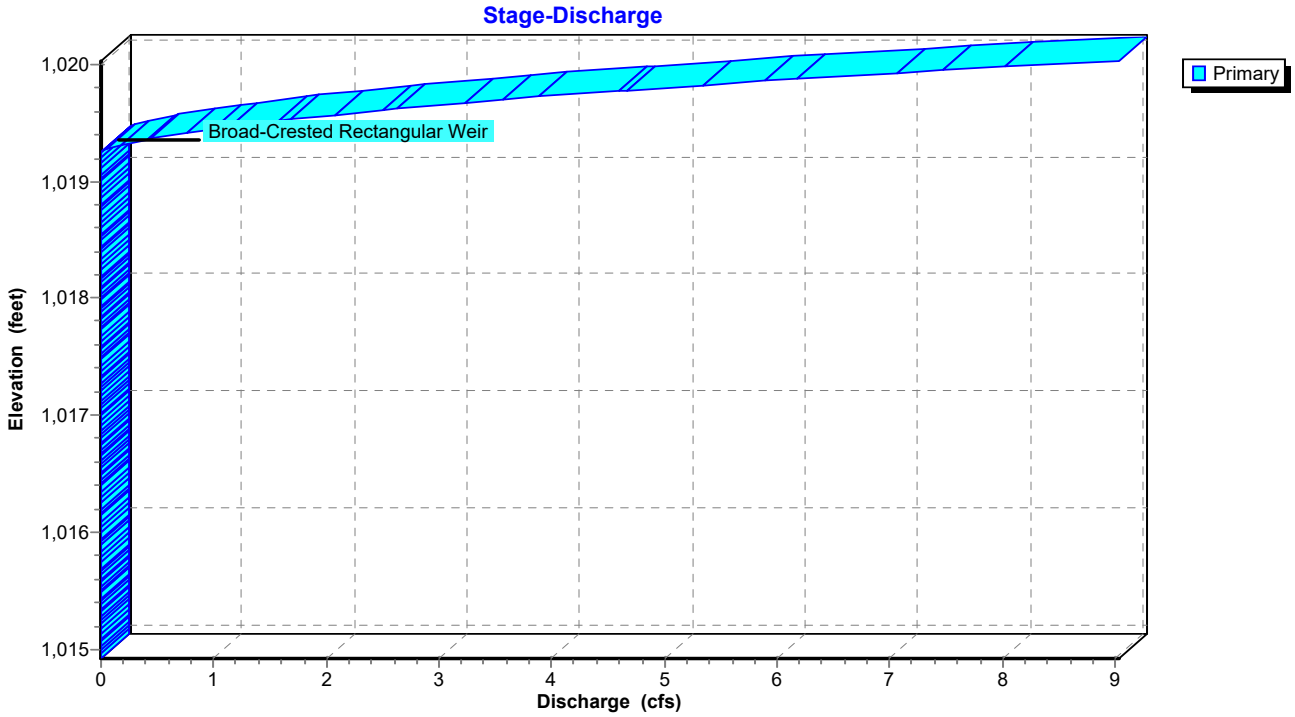
Device	Routing	Invert	Outlet Devices
#1	Primary	1,019.25'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=4.44 cfs @ 12.14 hrs HW=1,019.76' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 4.44 cfs @ 2.16 fps)

Pond P4: Detention Basin



Pond P4: Detention Basin



Pond P4: Detention Basin

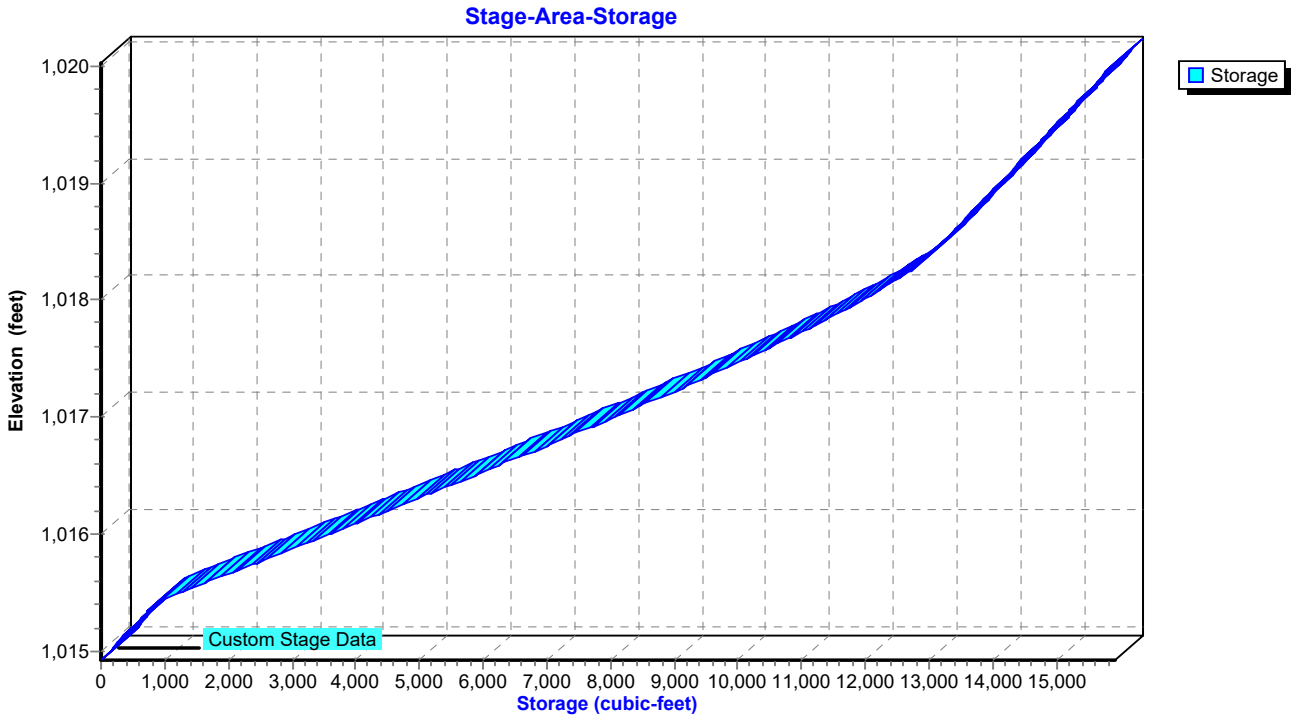


Exhibit D

Soil Map—Jackson County, Missouri
(Lee Summit, MO)

Map Scale: 1:697 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 30 60 120 180

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 24, Aug 31, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 6, 2019—Nov 16, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10082	Arisburg-Urban land complex, 1 to 5 percent slopes	2.0	100.0%
Totals for Area of Interest		**2.0**	**100.0%**