ABBY ROAD DEVELOPMENT

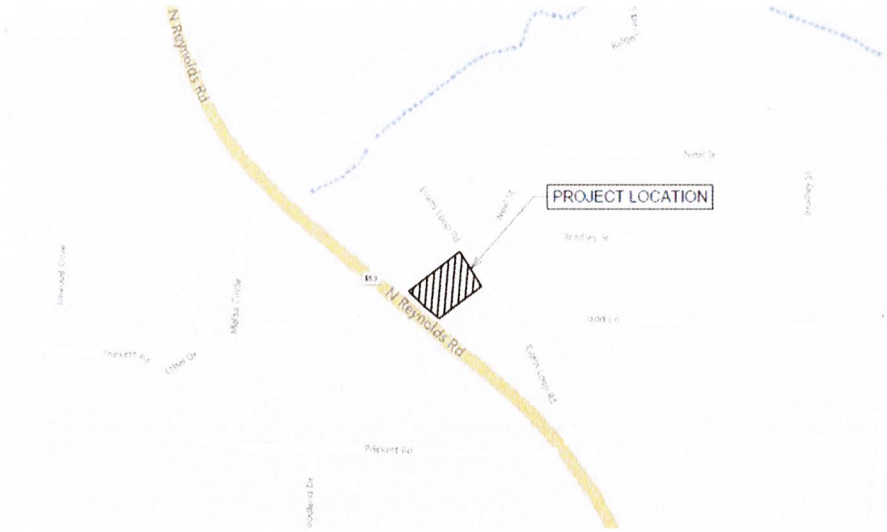
DRAINAGE REPORT

LOCATED IN
BRYANT, ARKANSAS

Prepared by:

PHILLIP LEWIS ENGINEERING
Structural + Civil Consultants
23620 Interstate 30 | Bryant, AR
PH: 501-350-9840

PROJECT LOCATION MAP



Vicinity Map

PROJECT SUMMARY

The proposed project is for the consruction of a new multi-use lease building Bryant, Arkansas.

The proposed development is for a 7,500 sq. ft. building and parking lot that will utilize curb/gutter and concrete/asphalt swales to direct stormwater to the designated detention basin.

The total development area is 34,280 sq. ft. (0.79 acres). A total area of 35,018 sq. ft. will be ultimately captured by the detention basin. Post-Devlopment conditions are split into two subcatchments, North and South. Both subcatchments are directed to and released into the detention basin in two locations.

Subcatchment Areas

	Pre-Development	North Subcatchment (Developed)	South Subcatchment (Developed)
Impervious Surface	16,008 sf	13,214 cf	10,570 sf
Pervious Surface	19,010 sf	3,559 sf	7,675 sf

A stormwater analysis was ran on the development using HydroCAD software. Stormwater calculations were setup and run for the 2, 5, 10, 25, 50, and 100-year storm event using the rational method.

The final release rate of the detention pond is controlled by a single 8" HDPE culvert, conforming to fill at the lowest elevation of the pond, and releasing to the existing storm drainage ditch on the west property line.

The results of the analysis for both pre-development and post-development, including the change in runoff volume and runoff rate, are shown below within the attached report.

Summary for Subcatchment 1S: Pre-Development Subcatchment

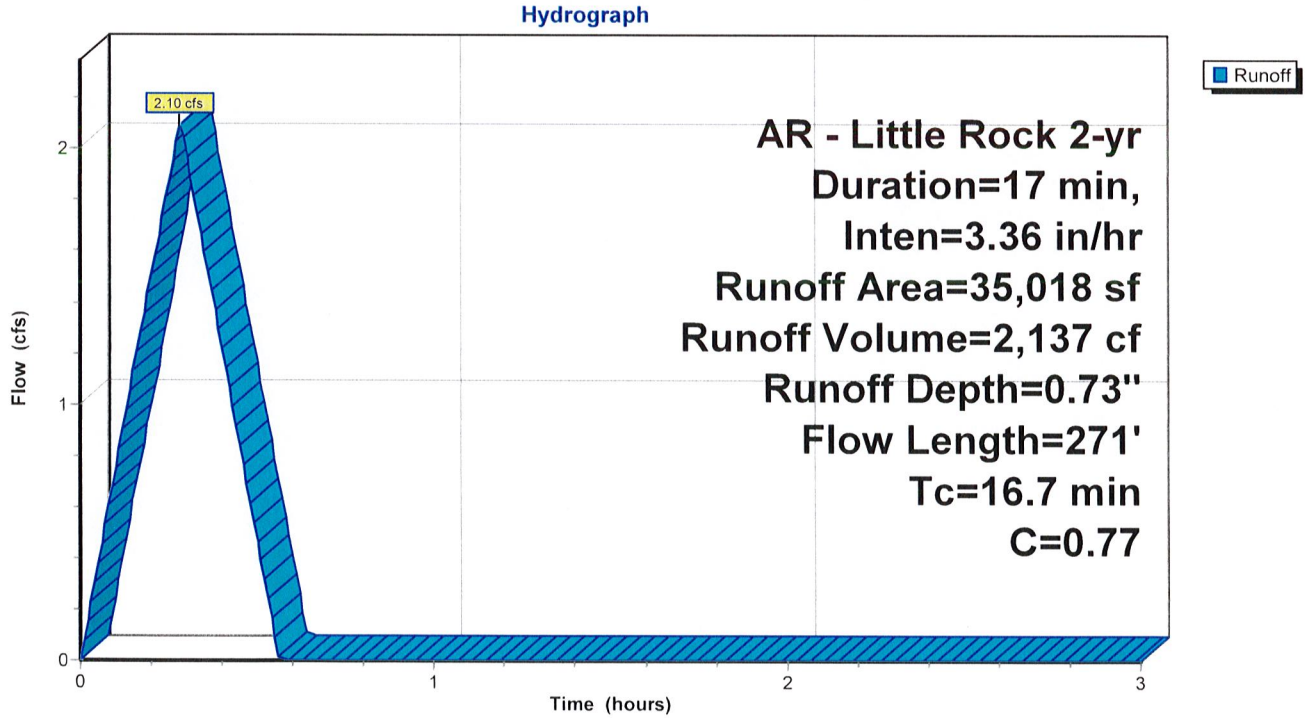
Runoff = 2.10 cfs @ 0.28 hrs, Volume= 2,137 cf, Depth= 0.73"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 2-yr Duration=17 min, Inten=3.36 in/hr

Area (sf)	C	Description
19,010	0.61	>75% Grass cover, Good, HSG B
4,305	0.98	Paved parking, HSG B
11,703	0.96	Gravel surface, HSG B
35,018	0.77	Weighted Average
19,010		54.29% Pervious Area
16,008		45.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	11	0.3400	0.39		**Sheet Flow, Sheet Flow from Adjacent Property** Grass: Short n= 0.150 P2= 4.19"
8.0	140	0.0350	0.29		**Sheet Flow, Sheet Flow across gravel** Range n= 0.130 P2= 4.19"
8.2	120	0.0325	0.25		**Sheet Flow, Sheet Flow across grass** Grass: Short n= 0.150 P2= 4.19"
16.7	271	Total			

Subcatchment 1S: Pre-Development Subcatchment



Summary for Subcatchment 1S: Pre-Development Subcatchment

Runoff = 2.49 cfs @ 0.28 hrs, Volume= 2,540 cf, Depth= 0.87"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 5-yr Duration=17 min, Inten=3.99 in/hr

Area (sf)	C	Description
19,010	0.61	>75% Grass cover, Good, HSG B
4,305	0.98	Paved parking, HSG B
11,703	0.96	Gravel surface, HSG B
35,018	0.77	Weighted Average
19,010		54.29% Pervious Area
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0.5	11	0.3400	0.39		**Sheet Flow, Sheet Flow from Adjacent Property** Grass: Short n= 0.150 P2= 4.19"
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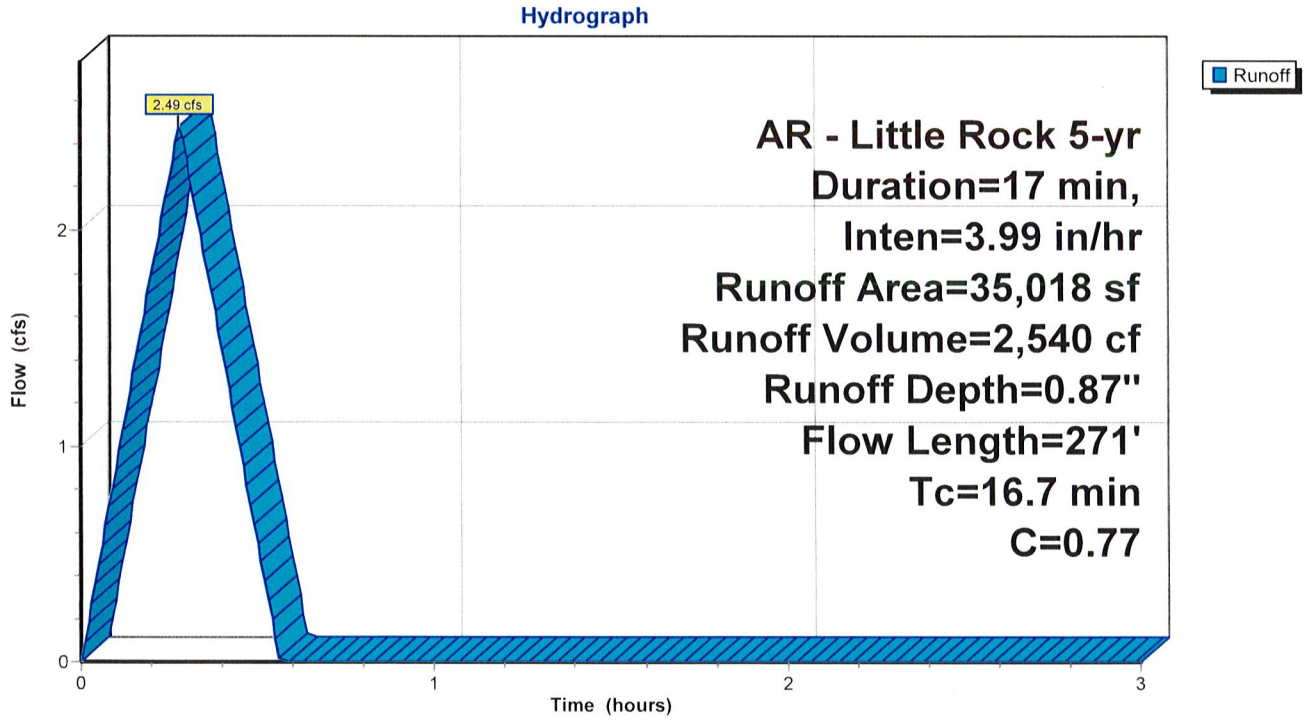
Subcatchment 1S: Pre-Development Subcatchment



Summary for Subcatchment 1S: Pre-Development Subcatchment

Runoff = 2.82 cfs @ 0.28 hrs, Volume= 2,875 cf, Depth= 0.99"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 10-yr Duration=17 min, Inten=4.52 in/hr

Area (sf)	C	Description
19,010	0.61	>75% Grass cover, Good, HSG B
4,305	0.98	Paved parking, HSG B
11,703	0.96	Gravel surface, HSG B
35,018	0.77	Weighted Average
19,010		54.29% Pervious Area
16,008		45.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	11	0.3400	0.39		**Sheet Flow, Sheet Flow from Adjacent Property** Grass: Short n= 0.150 P2= 4.19"
8.0	140	0.0350	0.29		**Sheet Flow, Sheet Flow across gravel** Range n= 0.130 P2= 4.19"
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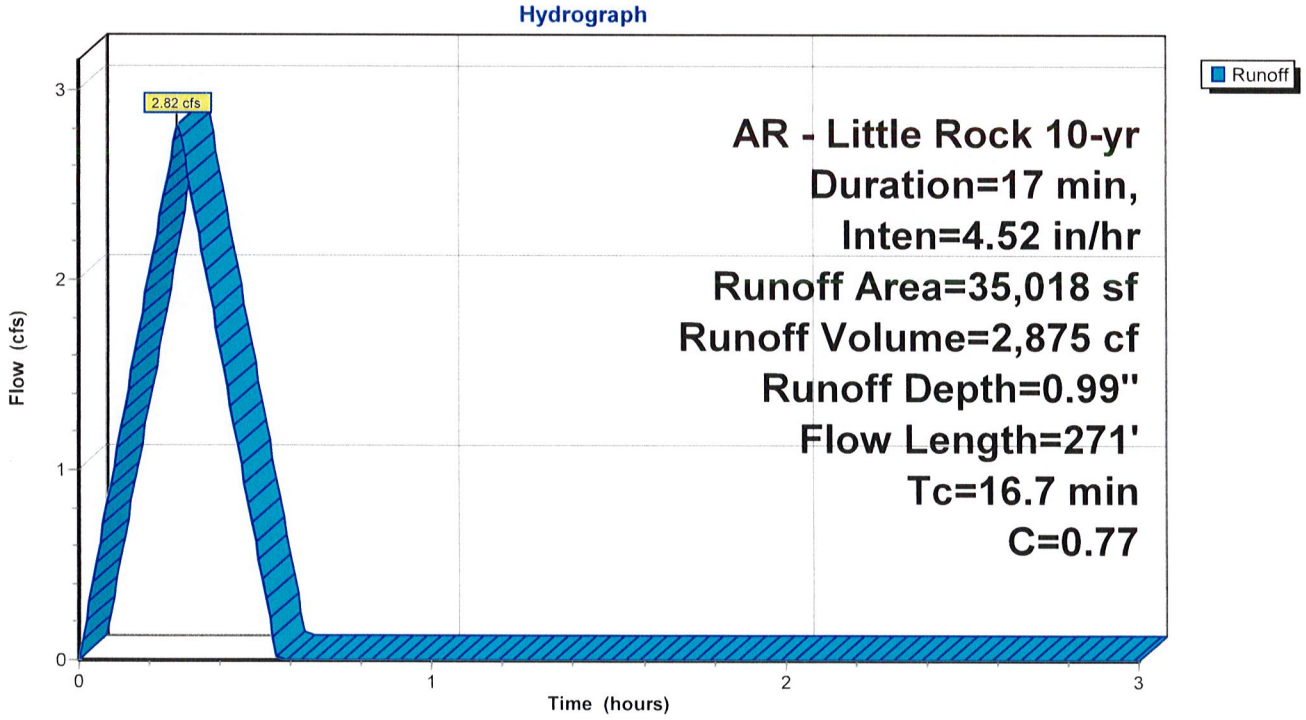
Subcatchment 1S: Pre-Development Subcatchment



Summary for Subcatchment 1S: Pre-Development Subcatchment

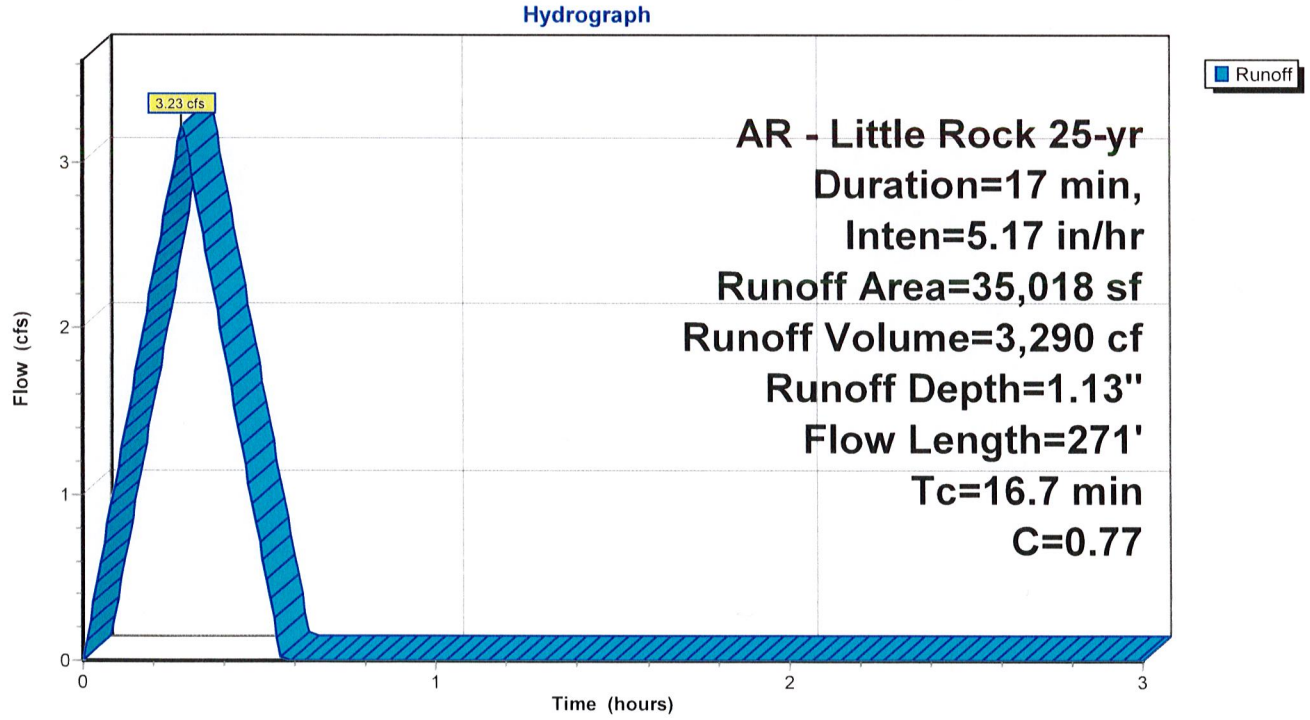
Runoff = 3.23 cfs @ 0.28 hrs, Volume= 3,290 cf, Depth= 1.13"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 25-yr Duration=17 min, Inten=5.17 in/hr

Area (sf)	C	Description
19,010	0.61	>75% Grass cover, Good, HSG B
4,305	0.98	Paved parking, HSG B
11,703	0.96	Gravel surface, HSG B
35,018	0.77	Weighted Average
19,010		54.29% Pervious Area
16,008		45.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	11	0.3400	0.39		**Sheet Flow, Sheet Flow from Adjacent Property** Grass: Short n= 0.150 P2= 4.19"
8.0	140	0.0350	0.29		**Sheet Flow, Sheet Flow across gravel** Range n= 0.130 P2= 4.19"
8.2	120	0.0325	0.25		**Sheet Flow, Sheet Flow across grass** Grass: Short n= 0.150 P2= 4.19"
16.7	271	Total			

Subcatchment 1S: Pre-Development Subcatchment



Summary for Subcatchment 1S: Pre-Development Subcatchment

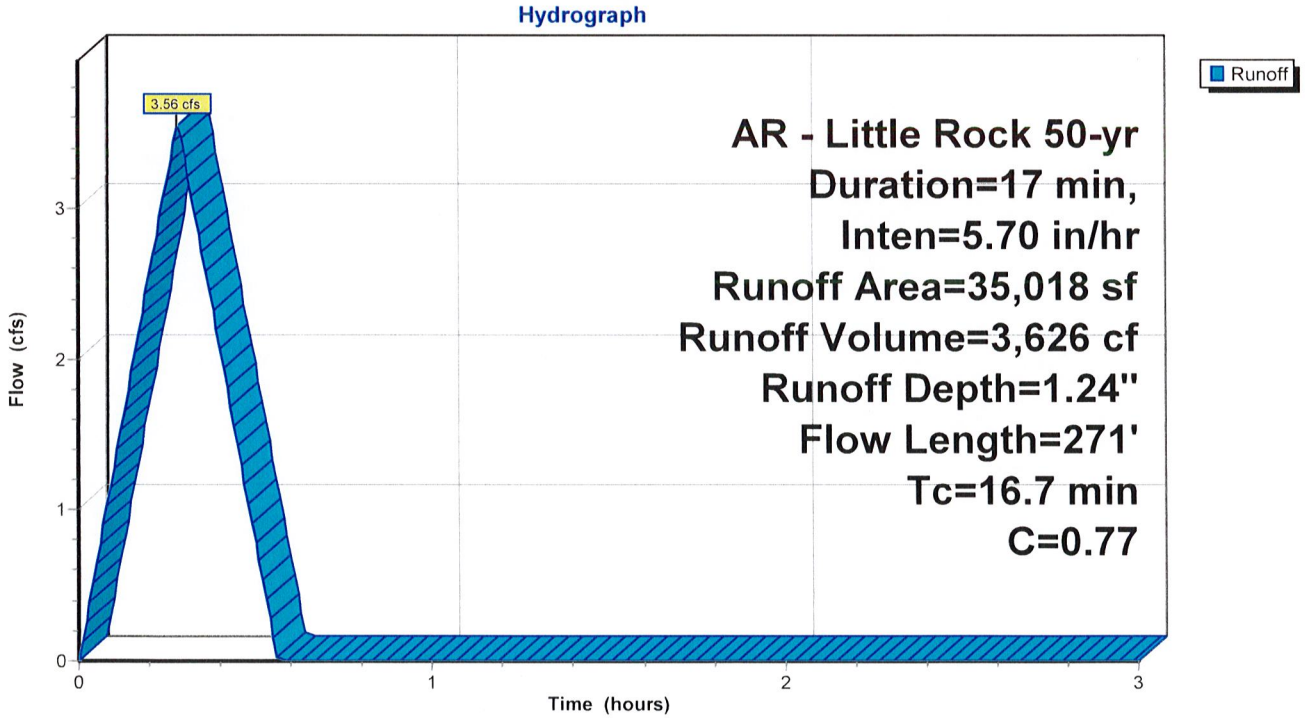
Runoff = 3.56 cfs @ 0.28 hrs, Volume= 3,626 cf, Depth= 1.24"

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 50-yr Duration=17 min, Inten=5.70 in/hr

Area (sf)	C	Description
19,010	0.61	>75% Grass cover, Good, HSG B
4,305	0.98	Paved parking, HSG B
11,703	0.96	Gravel surface, HSG B
35,018	0.77	Weighted Average
19,010		54.29% Pervious Area
16,008		45.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	11	0.3400	0.39		**Sheet Flow, Sheet Flow from Adjacent Property** Grass: Short n= 0.150 P2= 4.19"
8.0	140	0.0350	0.29		**Sheet Flow, Sheet Flow across gravel** Range n= 0.130 P2= 4.19"
8.2	120	0.0325	0.25		**Sheet Flow, Sheet Flow across grass** Grass: Short n= 0.150 P2= 4.19"
16.7	271	Total			

Subcatchment 1S: Pre-Development Subcatchment



Summary for Subcatchment 1S: Pre-Development Subcatchment

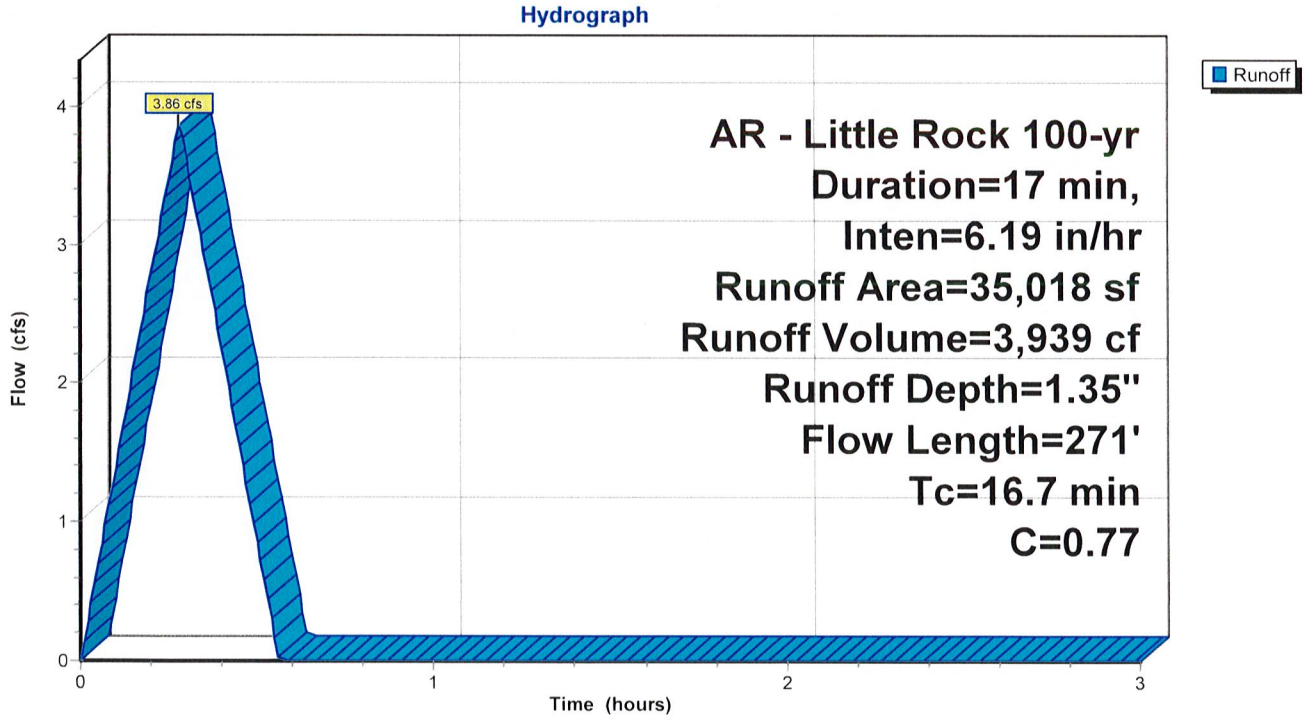
Runoff = 3.86 cfs @ 0.28 hrs, Volume= 3,939 cf, Depth= 1.35"

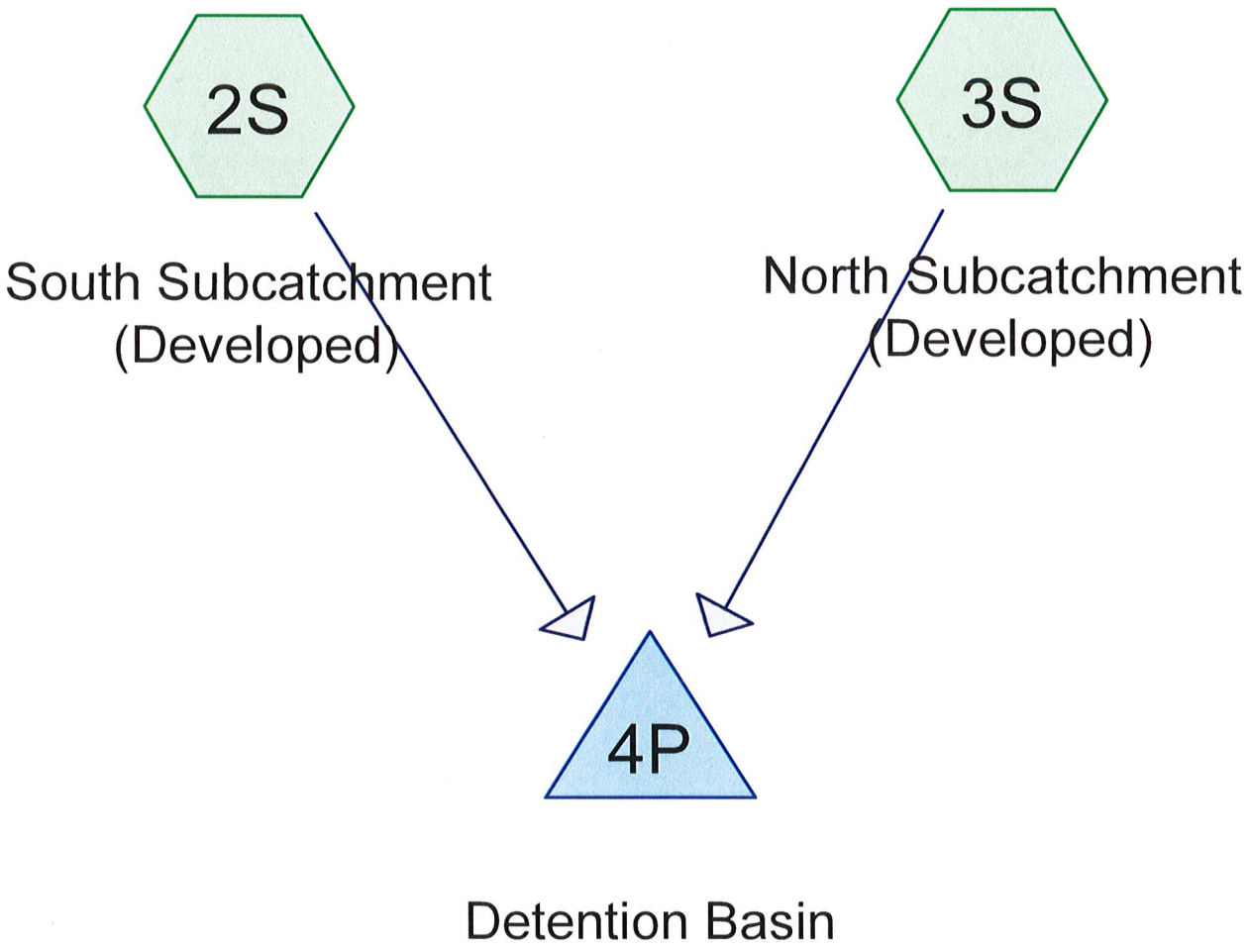
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 100-yr Duration=17 min, Inten=6.19 in/hr

Area (sf)	C	Description
19,010	0.61	>75% Grass cover, Good, HSG B
4,305	0.98	Paved parking, HSG B
11,703	0.96	Gravel surface, HSG B
35,018	0.77	Weighted Average
19,010		54.29% Pervious Area
16,008		45.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	11	0.3400	0.39		**Sheet Flow, Sheet Flow from Adjacent Property** Grass: Short n= 0.150 P2= 4.19"
8.0	140	0.0350	0.29		**Sheet Flow, Sheet Flow across gravel** Range n= 0.130 P2= 4.19"
8.2	120	0.0325	0.25		**Sheet Flow, Sheet Flow across grass** Grass: Short n= 0.150 P2= 4.19"
16.7	271	Total			

Subcatchment 1S: Pre-Development Subcatchment





Subcat Reach Pond Link

Routing Diagram for Abby Road
Prepared by Phillip Lewis Engineering, Printed 7/20/2022
HydroCAD® 10.20-2d s/n 12520 © 2021 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	C	Description (subcatchment-numbers)
11,234	0.61	>75% Grass cover, Good, HSG B (2S, 3S)
16,284	0.98	Paved parking, HSG B (2S, 3S)
7,500	0.98	Roofs, HSG B (3S)
35,018	**0.86**	**TOTAL AREA**

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: South Subcatchment Runoff Area=18,245 sf 57.93% Impervious Runoff Depth=0.78"
Flow Length=224' Tc=3.4 min C=0.82 Runoff=1.16 cfs 1,184 cf

Subcatchment 3S: North Subcatchment Runoff Area=16,773 sf 78.78% Impervious Runoff Depth=0.86"
Flow Length=249' Tc=3.6 min C=0.90 Runoff=1.17 cfs 1,197 cf

Pond 4P: Detention Basin Peak Elev=395.09' Storage=978 cf Inflow=2.34 cfs 2,381 cf
8.0" Round Culvert n=0.012 L=23.0' S=0.0287 '/' Outflow=1.76 cfs 2,350 cf

Total Runoff Area = 35,018 sf Runoff Volume = 2,381 cf Average Runoff Depth = 0.82"
32.08% Pervious = 11,234 sf 67.92% Impervious = 23,784 sf

Summary for Subcatchment 2S: South Subcatchment (Developed)

[70] Warning: Tc<8dt requires smaller dt

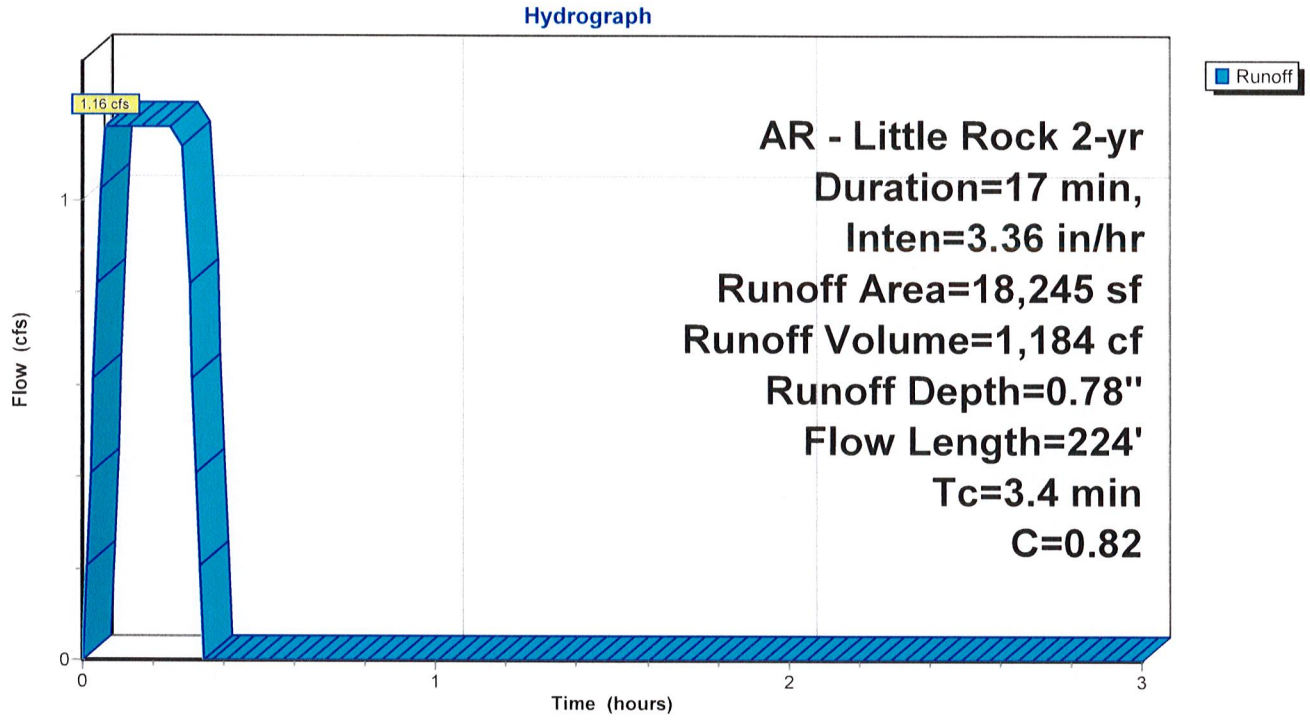
Runoff = 1.16 cfs @ 0.06 hrs, Volume= 1,184 cf, Depth= 0.78"
Routed to Pond 4P : Detention Basin

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 2-yr Duration=17 min, Inten=3.36 in/hr

Area (sf)	C	Description
7,675	0.61	>75% Grass cover, Good, HSG B
10,570	0.98	Paved parking, HSG B
18,245	0.82	Weighted Average
7,675		42.07% Pervious Area
10,570		57.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	25	0.2200	0.38		**Sheet Flow, Sheet Flow from adjacent property** Grass: Short n= 0.150 P2= 4.19"
0.9	42	0.0060	0.82		**Sheet Flow, Sheet Flow to Gutter** Smooth surfaces n= 0.011 P2= 4.19"
0.3	25	0.0060	1.57		**Shallow Concentrated Flow, Gutter Flow Building to South Parl** Paved Kv= 20.3 fps
0.2	23	0.0100	2.03		**Shallow Concentrated Flow, Gutter to Swale in South Parking a** Paved Kv= 20.3 fps
0.9	109	0.0090	1.93		**Shallow Concentrated Flow, South Parking Swale** Paved Kv= 20.3 fps
3.4	224	Total			

Subcatchment 2S: South Subcatchment (Developed)



Summary for Subcatchment 3S: North Subcatchment (Developed)

[70] Warning: Tc<8dt requires smaller dt

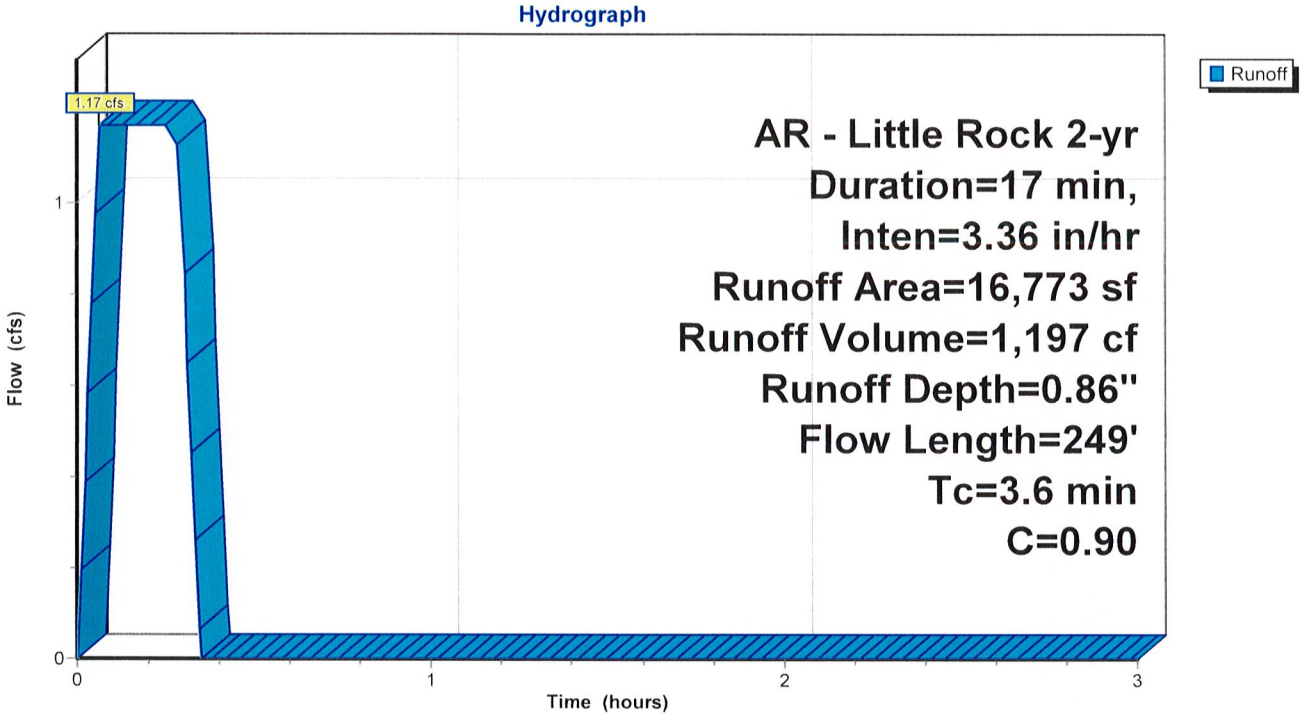
Runoff = 1.17 cfs @ 0.06 hrs, Volume= 1,197 cf, Depth= 0.86"
Routed to Pond 4P : Detention Basin

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 2-yr Duration=17 min, Inten=3.36 in/hr

Area (sf)	C	Description
3,559	0.61	>75% Grass cover, Good, HSG B
5,714	0.98	Paved parking, HSG B
7,500	0.98	Roofs, HSG B
16,773	0.90	Weighted Average
3,559		21.22% Pervious Area
13,214		78.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	25	0.2200	0.38		**Sheet Flow, Sheet Flow from adjacent property** Grass: Short n= 0.150 P2= 4.19"
1.0	42	0.0040	0.70		**Sheet Flow, Sheet Flow to Gutter** Smooth surfaces n= 0.011 P2= 4.19"
0.3	30	0.0050	1.44		**Shallow Concentrated Flow, Gutter From Building to North Parl** Paved Kv= 20.3 fps
0.7	84	0.0110	2.13		**Shallow Concentrated Flow, North Parking Swale** Paved Kv= 20.3 fps
0.5	68	0.0110	2.13		**Shallow Concentrated Flow, Concrete Flume From North Parkir** Paved Kv= 20.3 fps
3.6	249	Total			

Subcatchment 3S: North Subcatchment (Developed)



Summary for Pond 4P: Detention Basin

Inflow Area = 35,018 sf, 67.92% Impervious, Inflow Depth = 0.82" for 2-yr event
Inflow = 2.34 cfs @ 0.06 hrs, Volume= 2,381 cf
Outflow = 1.76 cfs @ 0.30 hrs, Volume= 2,350 cf, Atten= 25%, Lag= 14.3 min
Primary = 1.76 cfs @ 0.30 hrs, Volume= 2,350 cf

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 395.09' @ 0.30 hrs Storage= 978 cf

Plug-Flow detention time= 7.2 min calculated for 2,342 cf (98% of inflow)
Center-of-Mass det. time= 7.3 min (17.5 - 10.3)

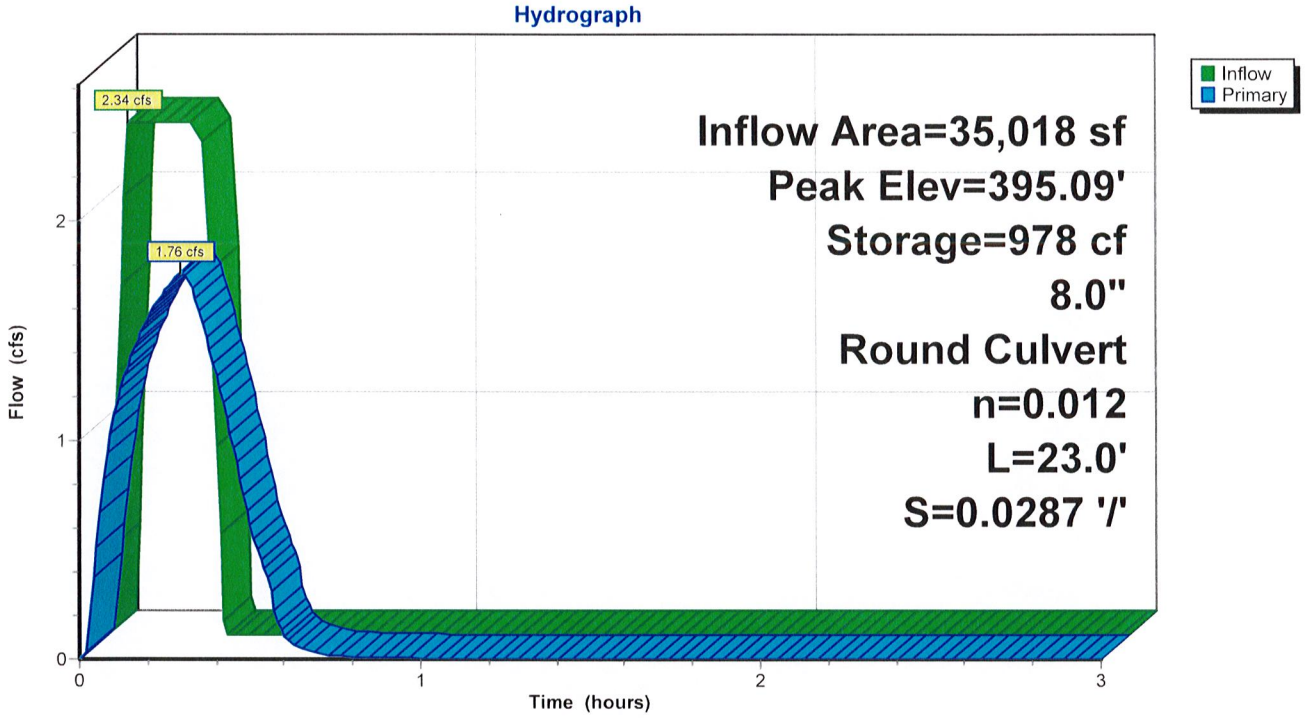
Volume	Invert	Avail.Storage	Storage Description
#1	393.50'	2,553 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
393.50	0
394.00	96
394.50	462
395.00	890
395.50	1,381
396.00	1,935
396.50	2,553

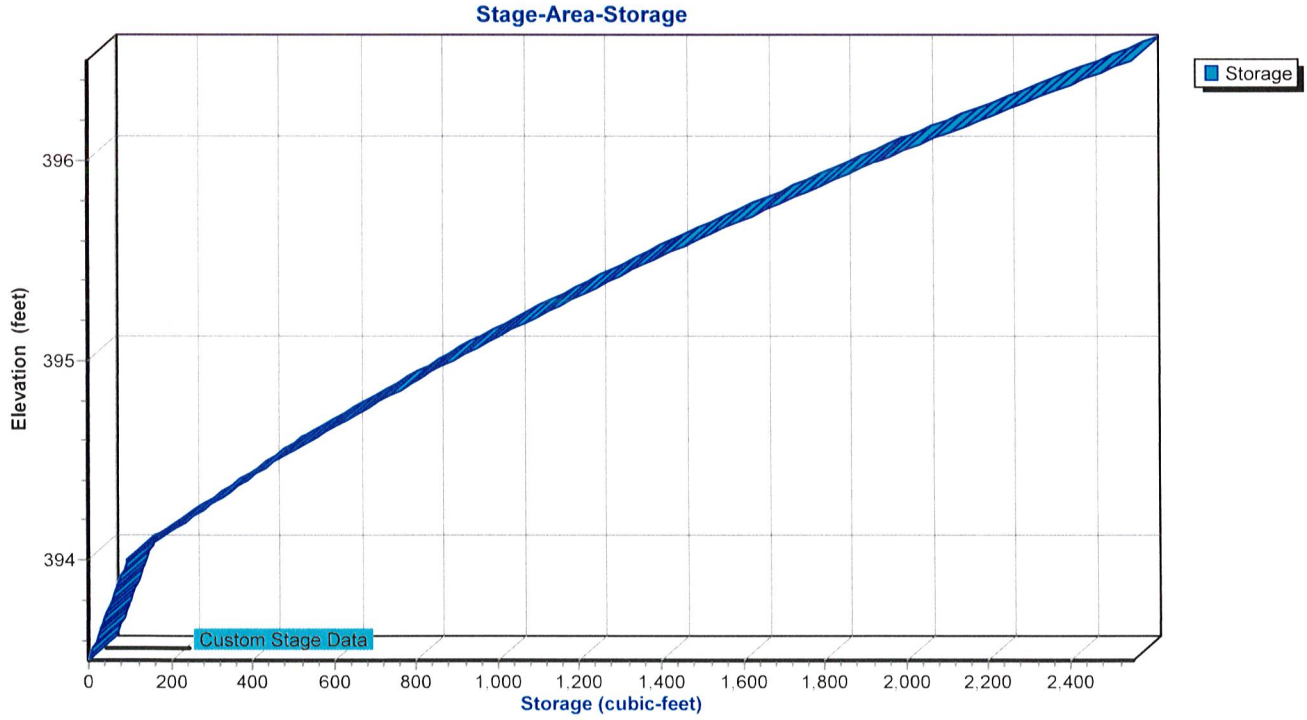
Device	Routing	Invert	Outlet Devices
#1	Primary	393.66'	**8.0" Round Culvert** L= 23.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 393.66' / 393.00' S= 0.0287 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=1.76 cfs @ 0.30 hrs HW=395.09' (Free Discharge)
↑**1=Culvert** (Inlet Controls 1.76 cfs @ 5.04 fps)

Pond 4P: Detention Basin



Pond 4P: Detention Basin



Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: South Subcatchment Runoff Area=18,245 sf 57.93% Impervious Runoff Depth=0.93"
Flow Length=224' Tc=3.4 min C=0.82 Runoff=1.38 cfs 1,407 cf

Subcatchment 3S: North Subcatchment Runoff Area=16,773 sf 78.78% Impervious Runoff Depth=1.02"
Flow Length=249' Tc=3.6 min C=0.90 Runoff=1.39 cfs 1,422 cf

Pond 4P: Detention Basin Peak Elev=395.37' Storage=1,251 cf Inflow=2.78 cfs 2,829 cf
8.0" Round Culvert n=0.012 L=23.0' S=0.0287 '/' Outflow=1.97 cfs 2,798 cf

Total Runoff Area = 35,018 sf Runoff Volume = 2,829 cf Average Runoff Depth = 0.97"
32.08% Pervious = 11,234 sf 67.92% Impervious = 23,784 sf

Summary for Subcatchment 2S: South Subcatchment (Developed)

[70] Warning: Tc<8dt requires smaller dt

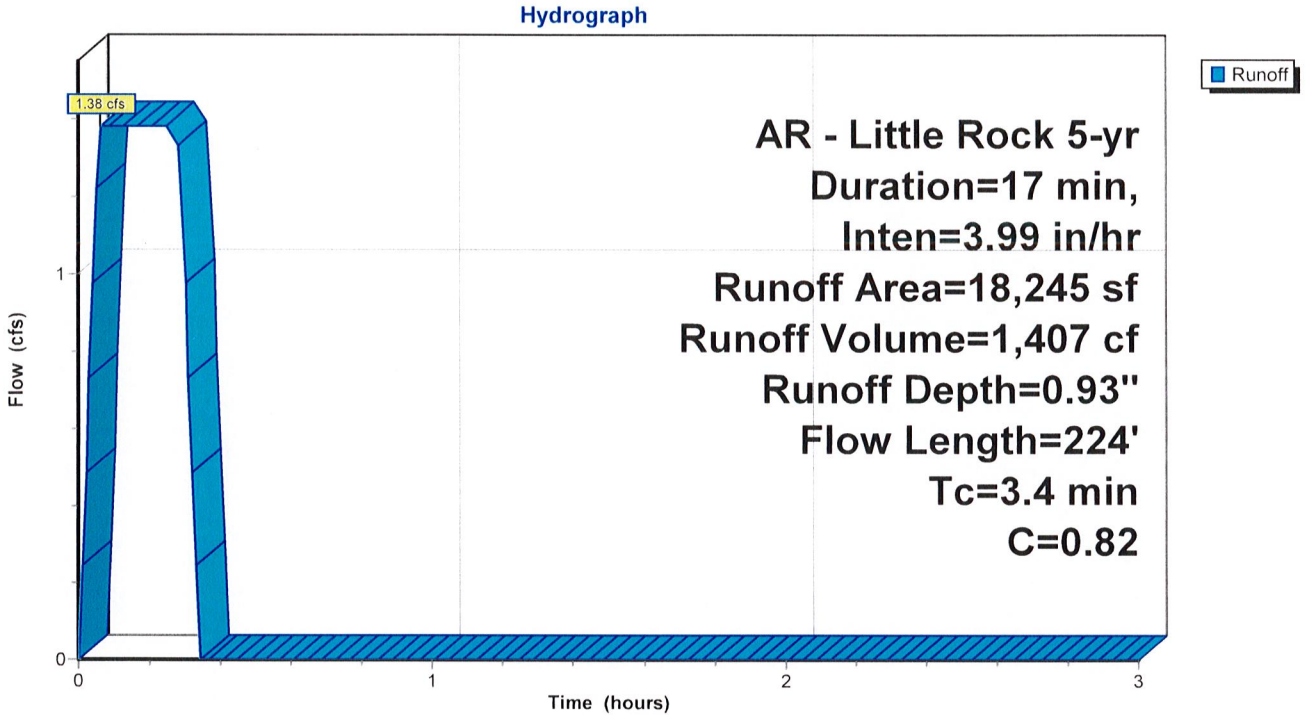
Runoff = 1.38 cfs @ 0.06 hrs, Volume= 1,407 cf, Depth= 0.93"
Routed to Pond 4P : Detention Basin

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 5-yr Duration=17 min, Inten=3.99 in/hr

Area (sf)	C	Description
7,675	0.61	>75% Grass cover, Good, HSG B
10,570	0.98	Paved parking, HSG B
18,245	0.82	Weighted Average
7,675		42.07% Pervious Area
10,570		57.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	25	0.2200	0.38		**Sheet Flow, Sheet Flow from adjacent property** Grass: Short n= 0.150 P2= 4.19"
0.9	42	0.0060	0.82		**Sheet Flow, Sheet Flow to Gutter** Smooth surfaces n= 0.011 P2= 4.19"
0.3	25	0.0060	1.57		**Shallow Concentrated Flow, Gutter Flow Building to South Parl** Paved Kv= 20.3 fps
0.2	23	0.0100	2.03		**Shallow Concentrated Flow, Gutter to Swale in South Parking a** Paved Kv= 20.3 fps
0.9	109	0.0090	1.93		**Shallow Concentrated Flow, South Parking Swale** Paved Kv= 20.3 fps
3.4	224	Total			

Subcatchment 2S: South Subcatchment (Developed)



Summary for Subcatchment 3S: North Subcatchment (Developed)

[70] Warning: Tc<8dt requires smaller dt

Runoff = 1.39 cfs @ 0.06 hrs, Volume= 1,422 cf, Depth= 1.02"
Routed to Pond 4P : Detention Basin

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 5-yr Duration=17 min, Inten=3.99 in/hr

Area (sf)	C	Description
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5,714	0.98	Paved parking, HSG B
7,500	0.98	Roofs, HSG B
16,773	0.90	Weighted Average
3,559		21.22% Pervious Area
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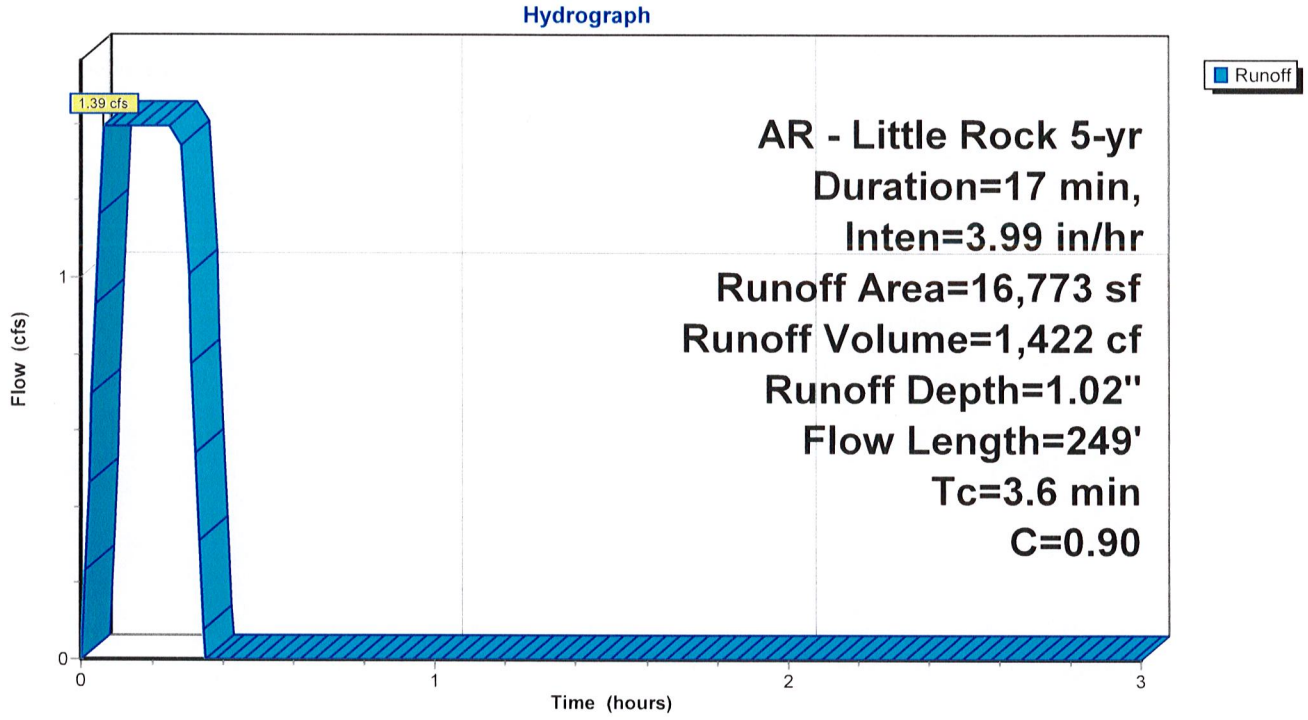
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	25	0.2200	0.38		**Sheet Flow, Sheet Flow from adjacent property** Grass: Short n= 0.150 P2= 4.19"
1.0	42	0.0040	0.70		**Sheet Flow, Sheet Flow to Gutter** Smooth surfaces n= 0.011 P2= 4.19"
0.3	30	0.0050	1.44		**Shallow Concentrated Flow, Gutter From Building to North Parl** Paved Kv= 20.3 fps
0.7	84	0.0110	2.13		**Shallow Concentrated Flow, North Parking Swale** Paved Kv= 20.3 fps
0.5	68	0.0110	2.13		**Shallow Concentrated Flow, Concrete Flume From North Parkii** Paved Kv= 20.3 fps
3.6	249	Total			

Subcatchment 3S: North Subcatchment (Developed)



Summary for Pond 4P: Detention Basin

Inflow Area = 35,018 sf, 67.92% Impervious, Inflow Depth = 0.97" for 5-yr event
Inflow = 2.78 cfs @ 0.06 hrs, Volume= 2,829 cf
Outflow = 1.97 cfs @ 0.30 hrs, Volume= 2,798 cf, Atten= 29%, Lag= 14.4 min
Primary = 1.97 cfs @ 0.30 hrs, Volume= 2,798 cf

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 395.37' @ 0.30 hrs Storage= 1,251 cf

Plug-Flow detention time= 8.0 min calculated for 2,789 cf (99% of inflow)
Center-of-Mass det. time= 8.1 min (18.3 - 10.3)

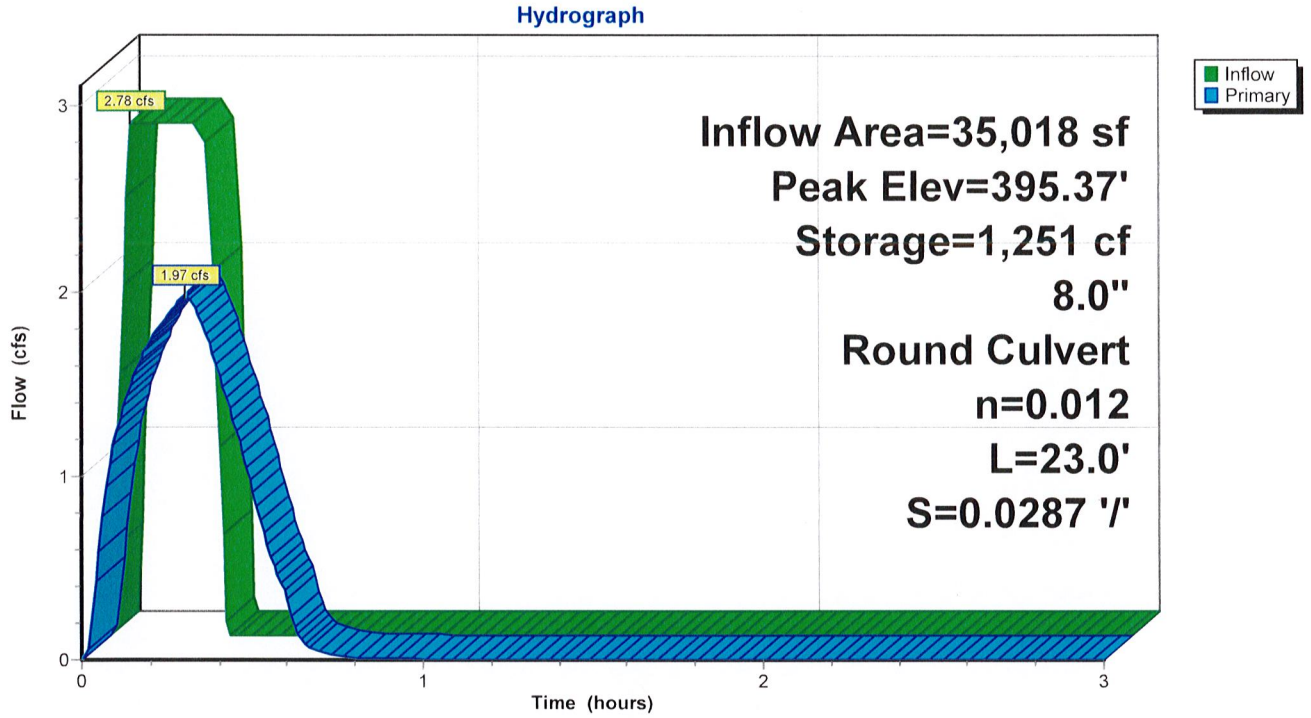
Volume	Invert	Avail.Storage	Storage Description
#1	393.50'	2,553 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
393.50	0
394.00	96
394.50	462
395.00	890
395.50	1,381
396.00	1,935
396.50	2,553

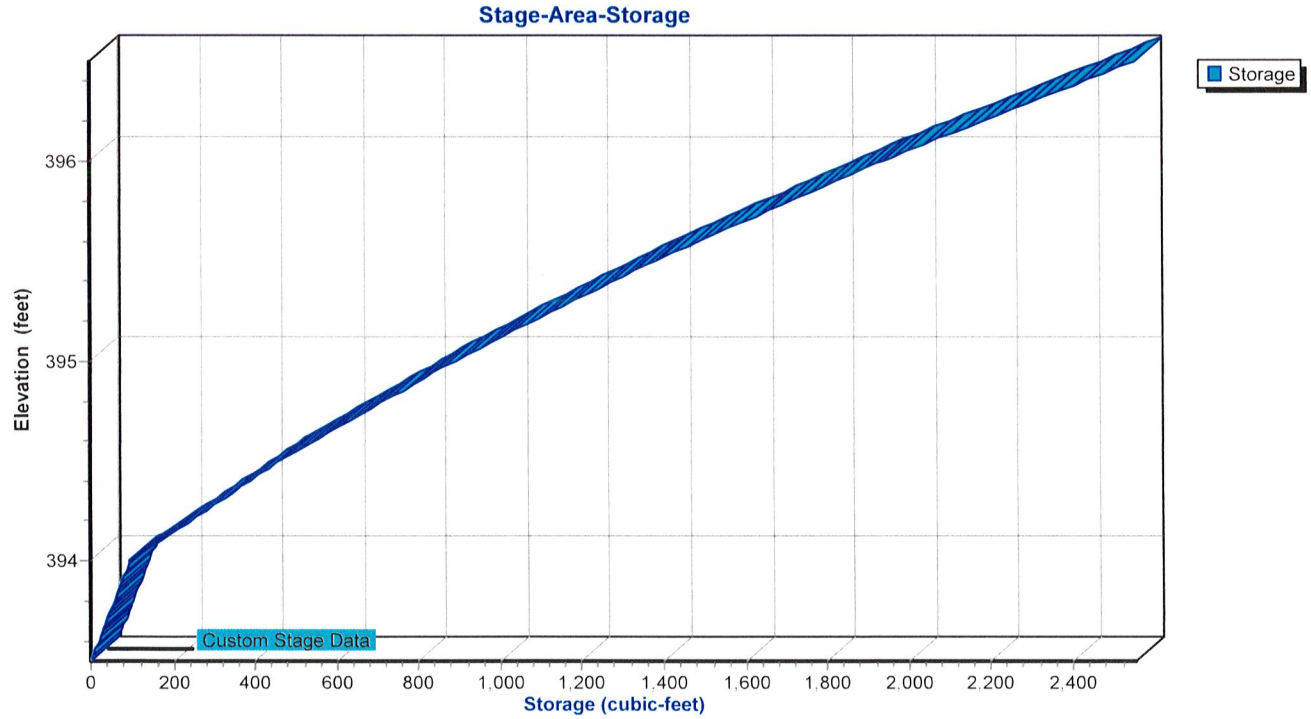
Device	Routing	Invert	Outlet Devices
#1	Primary	393.66'	**8.0" Round Culvert** L= 23.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 393.66' / 393.00' S= 0.0287 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=1.97 cfs @ 0.30 hrs HW=395.37' (Free Discharge)
1=Culvert (Inlet Controls 1.97 cfs @ 5.64 fps)

Pond 4P: Detention Basin



Pond 4P: Detention Basin



Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: South Subcatchment Runoff Area=18,245 sf 57.93% Impervious Runoff Depth=1.05"
Flow Length=224' Tc=3.4 min C=0.82 Runoff=1.56 cfs 1,593 cf

Subcatchment 3S: North Subcatchment Runoff Area=16,773 sf 78.78% Impervious Runoff Depth=1.15"
Flow Length=249' Tc=3.6 min C=0.90 Runoff=1.58 cfs 1,610 cf

Pond 4P: Detention Basin Peak Elev=395.60' Storage=1,489 cf Inflow=3.14 cfs 3,203 cf
8.0" Round Culvert n=0.012 L=23.0' S=0.0287 '/' Outflow=2.13 cfs 3,172 cf

Total Runoff Area = 35,018 sf Runoff Volume = 3,203 cf Average Runoff Depth = 1.10"
32.08% Pervious = 11,234 sf 67.92% Impervious = 23,784 sf

Summary for Subcatchment 2S: South Subcatchment (Developed)

[70] Warning: Tc<8dt requires smaller dt

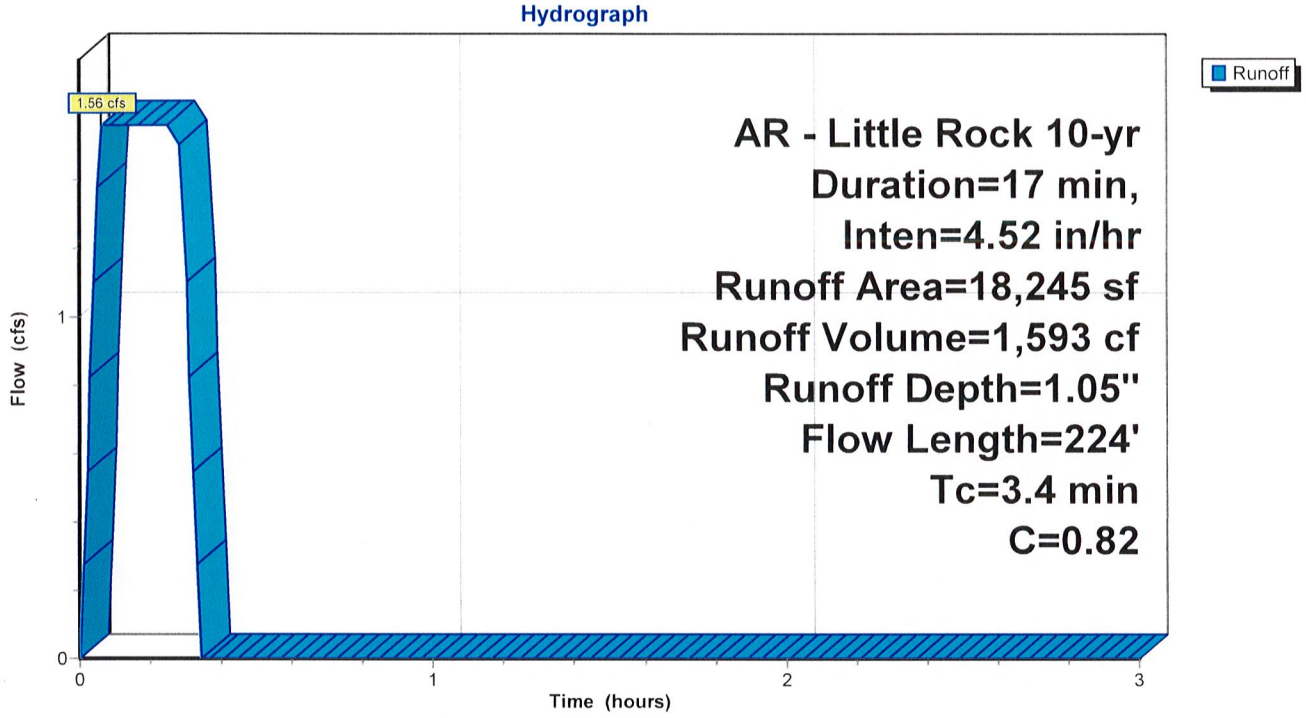
Runoff = 1.56 cfs @ 0.06 hrs, Volume= 1,593 cf, Depth= 1.05"
Routed to Pond 4P : Detention Basin

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 10-yr Duration=17 min, Inten=4.52 in/hr

Area (sf)	C	Description
7,675	0.61	>75% Grass cover, Good, HSG B
10,570	0.98	Paved parking, HSG B
18,245	0.82	Weighted Average
7,675		42.07% Pervious Area
10,570		57.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	25	0.2200	0.38		**Sheet Flow, Sheet Flow from adjacent property** Grass: Short n= 0.150 P2= 4.19"
0.9	42	0.0060	0.82		**Sheet Flow, Sheet Flow to Gutter** Smooth surfaces n= 0.011 P2= 4.19"
0.3	25	0.0060	1.57		**Shallow Concentrated Flow, Gutter Flow Building to South Parl** Paved Kv= 20.3 fps
0.2	23	0.0100	2.03		**Shallow Concentrated Flow, Gutter to Swale in South Parking a** Paved Kv= 20.3 fps
0.9	109	0.0090	1.93		**Shallow Concentrated Flow, South Parking Swale** Paved Kv= 20.3 fps
3.4	224	Total			

Subcatchment 2S: South Subcatchment (Developed)



Summary for Subcatchment 3S: North Subcatchment (Developed)

[70] Warning: Tc<8dt requires smaller dt

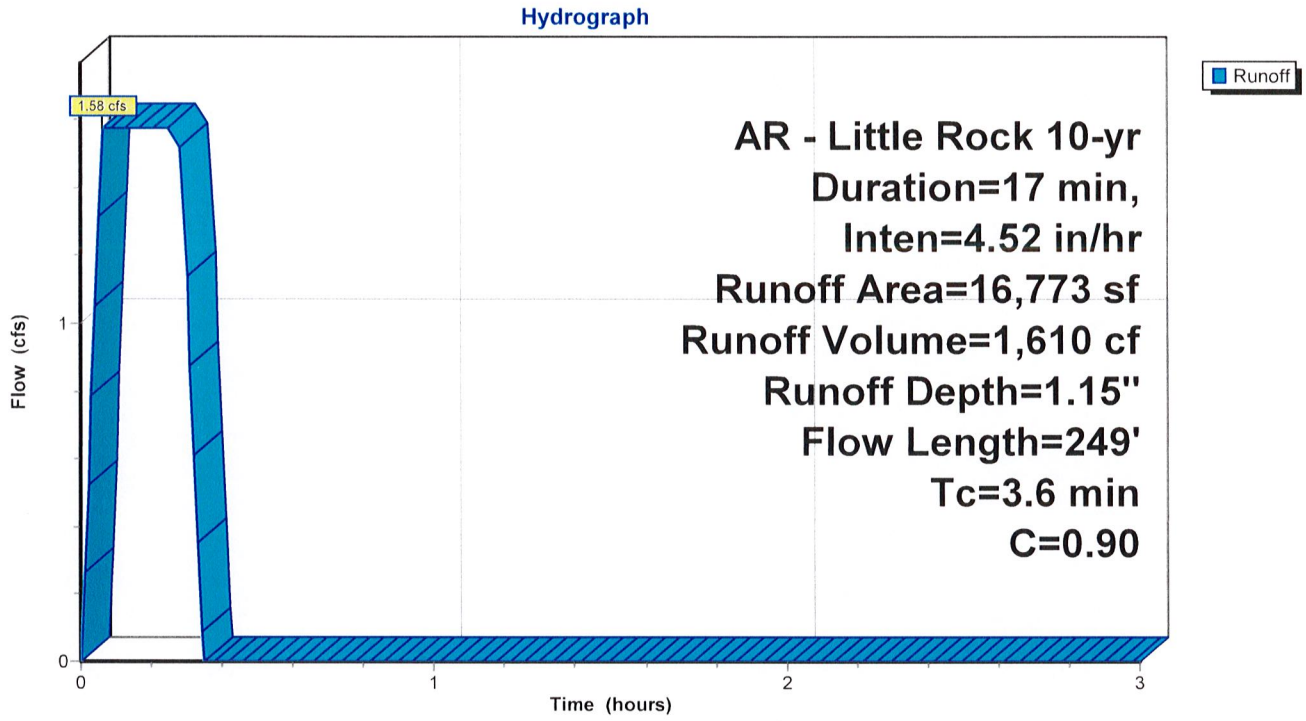
Runoff = 1.58 cfs @ 0.06 hrs, Volume= 1,610 cf, Depth= 1.15"
Routed to Pond 4P : Detention Basin

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 10-yr Duration=17 min, Inten=4.52 in/hr

Area (sf)	C	Description
3,559	0.61	>75% Grass cover, Good, HSG B
5,714	0.98	Paved parking, HSG B
7,500	0.98	Roofs, HSG B
16,773	0.90	Weighted Average
3,559		21.22% Pervious Area
13,214		78.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	25	0.2200	0.38		**Sheet Flow, Sheet Flow from adjacent property** Grass: Short n= 0.150 P2= 4.19"
1.0	42	0.0040	0.70		**Sheet Flow, Sheet Flow to Gutter** Smooth surfaces n= 0.011 P2= 4.19"
0.3	30	0.0050	1.44		**Shallow Concentrated Flow, Gutter From Building to North Parl** Paved Kv= 20.3 fps
0.7	84	0.0110	2.13		**Shallow Concentrated Flow, North Parking Swale** Paved Kv= 20.3 fps
0.5	68	0.0110	2.13		**Shallow Concentrated Flow, Concrete Flume From North Parkir** Paved Kv= 20.3 fps
3.6	249	Total			

Subcatchment 3S: North Subcatchment (Developed)



Summary for Pond 4P: Detention Basin

Inflow Area = 35,018 sf, 67.92% Impervious, Inflow Depth = 1.10" for 10-yr event
Inflow = 3.14 cfs @ 0.06 hrs, Volume= 3,203 cf
Outflow = 2.13 cfs @ 0.30 hrs, Volume= 3,172 cf, Atten= 32%, Lag= 14.5 min
Primary = 2.13 cfs @ 0.30 hrs, Volume= 3,172 cf

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 395.60' @ 0.30 hrs Storage= 1,489 cf

Plug-Flow detention time= 8.6 min calculated for 3,162 cf (99% of inflow)
Center-of-Mass det. time= 8.7 min (19.0 - 10.3)

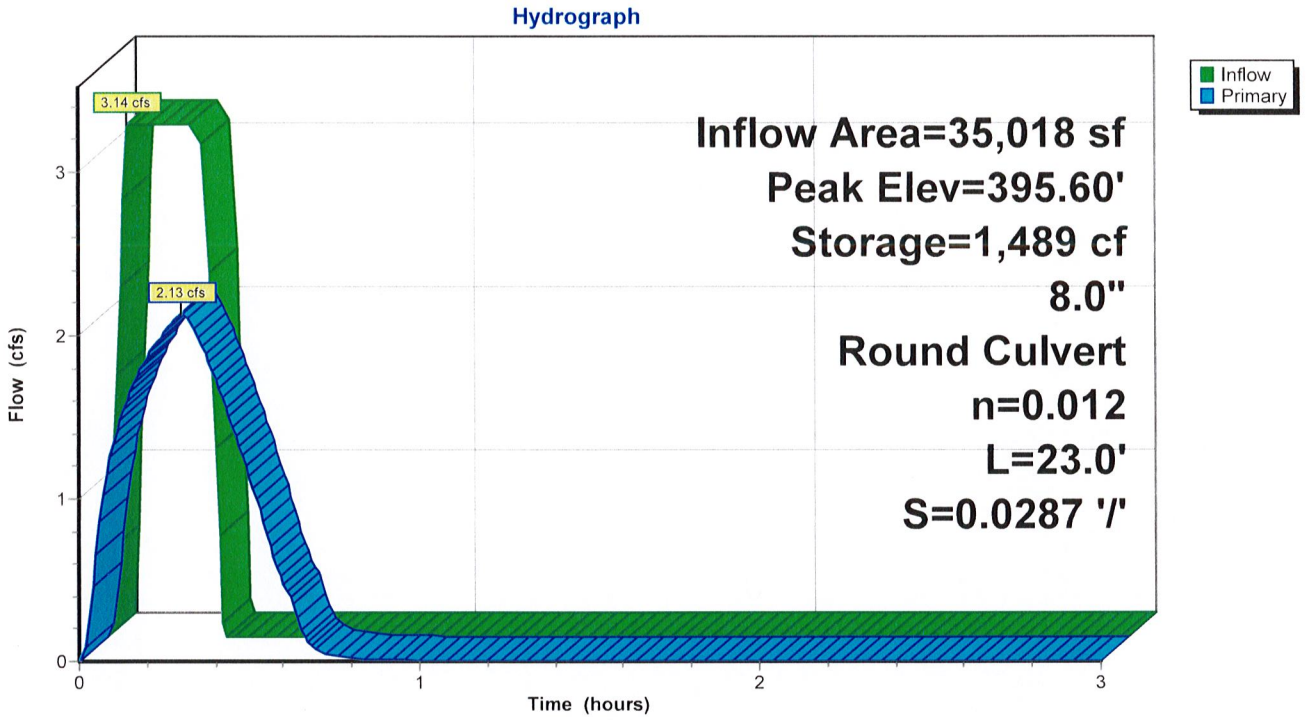
Volume	Invert	Avail.Storage	Storage Description
#1	393.50'	2,553 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
393.50	0
394.00	96
394.50	462
395.00	890
395.50	1,381
396.00	1,935
396.50	2,553

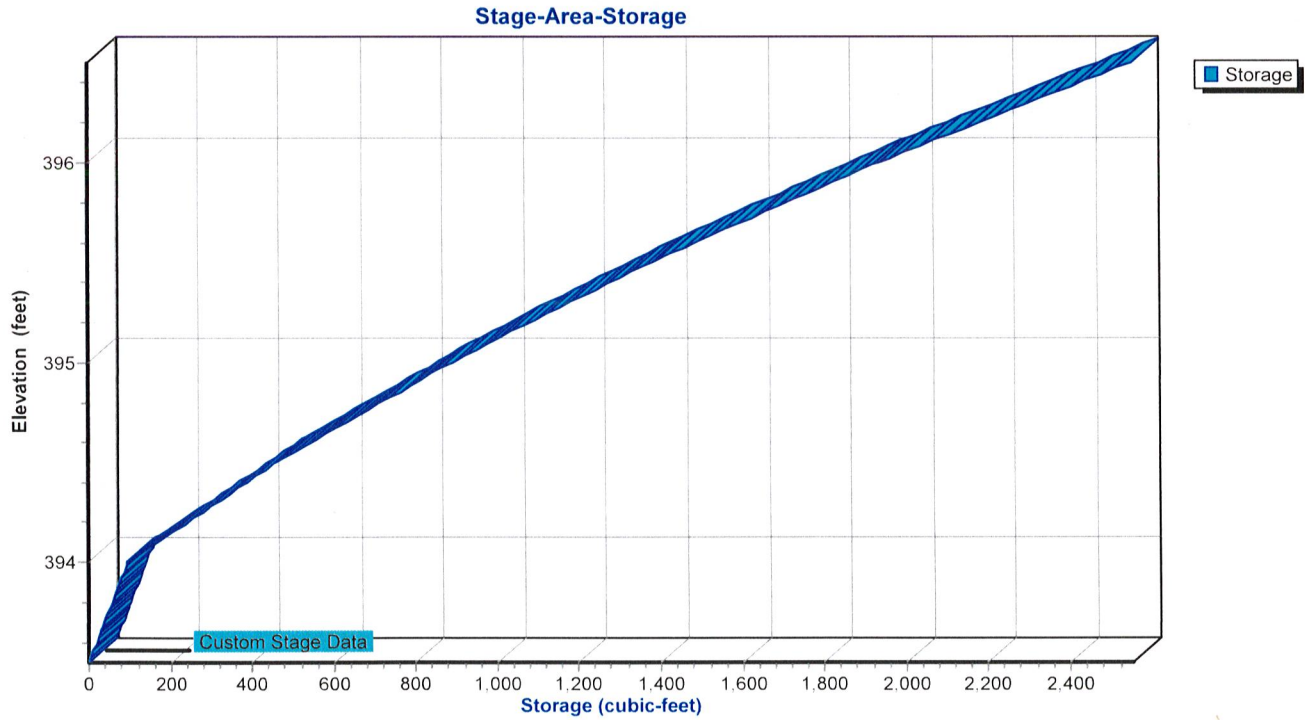
Device	Routing	Invert	Outlet Devices
#1	Primary	393.66'	**8.0" Round Culvert** L= 23.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 393.66' / 393.00' S= 0.0287 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=2.13 cfs @ 0.30 hrs HW=395.60' (Free Discharge)
↑**1=Culvert** (Inlet Controls 2.13 cfs @ 6.10 fps)

Pond 4P: Detention Basin



Pond 4P: Detention Basin



Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: South Subcatchment Runoff Area=18,245 sf 57.93% Impervious Runoff Depth=1.20"
Flow Length=224' Tc=3.4 min C=0.82 Runoff=1.79 cfs 1,823 cf

Subcatchment 3S: North Subcatchment Runoff Area=16,773 sf 78.78% Impervious Runoff Depth=1.32"
Flow Length=249' Tc=3.6 min C=0.90 Runoff=1.81 cfs 1,842 cf

Pond 4P: Detention Basin Peak Elev=395.88' Storage=1,799 cf Inflow=3.60 cfs 3,666 cf
8.0" Round Culvert n=0.012 L=23.0' S=0.0287 '/' Outflow=2.31 cfs 3,635 cf

Total Runoff Area = 35,018 sf Runoff Volume = 3,666 cf Average Runoff Depth = 1.26"
32.08% Pervious = 11,234 sf 67.92% Impervious = 23,784 sf

Summary for Subcatchment 2S: South Subcatchment (Developed)

[70] Warning: Tc<8dt requires smaller dt

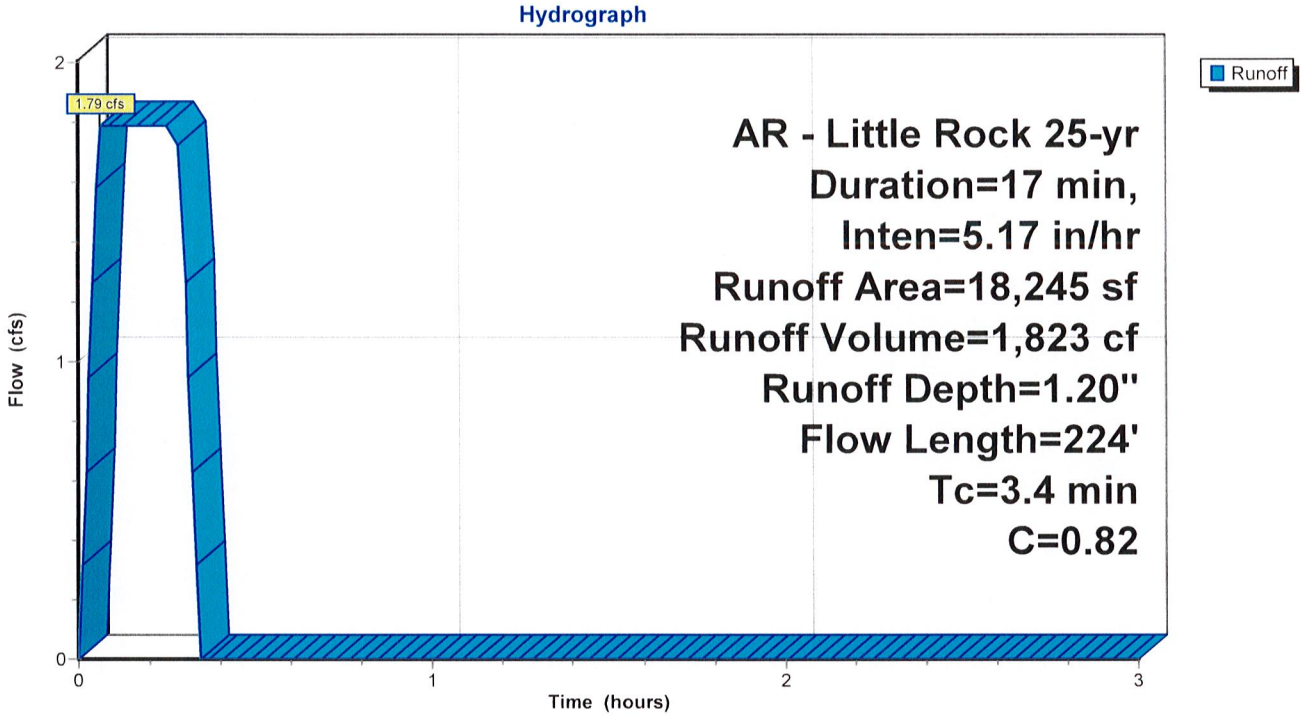
Runoff = 1.79 cfs @ 0.06 hrs, Volume= 1,823 cf, Depth= 1.20"
Routed to Pond 4P : Detention Basin

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 25-yr Duration=17 min, Inten=5.17 in/hr

Area (sf)	C	Description
7,675	0.61	>75% Grass cover, Good, HSG B
10,570	0.98	Paved parking, HSG B
18,245	0.82	Weighted Average
7,675		42.07% Pervious Area
10,570		57.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	25	0.2200	0.38		**Sheet Flow, Sheet Flow from adjacent property** Grass: Short n= 0.150 P2= 4.19"
0.9	42	0.0060	0.82		**Sheet Flow, Sheet Flow to Gutter** Smooth surfaces n= 0.011 P2= 4.19"
0.3	25	0.0060	1.57		**Shallow Concentrated Flow, Gutter Flow Building to South Parl** Paved Kv= 20.3 fps
0.2	23	0.0100	2.03		**Shallow Concentrated Flow, Gutter to Swale in South Parking a** Paved Kv= 20.3 fps
0.9	109	0.0090	1.93		**Shallow Concentrated Flow, South Parking Swale** Paved Kv= 20.3 fps
3.4	224	Total			

Subcatchment 2S: South Subcatchment (Developed)



Summary for Subcatchment 3S: North Subcatchment (Developed)

[70] Warning: Tc<8dt requires smaller dt

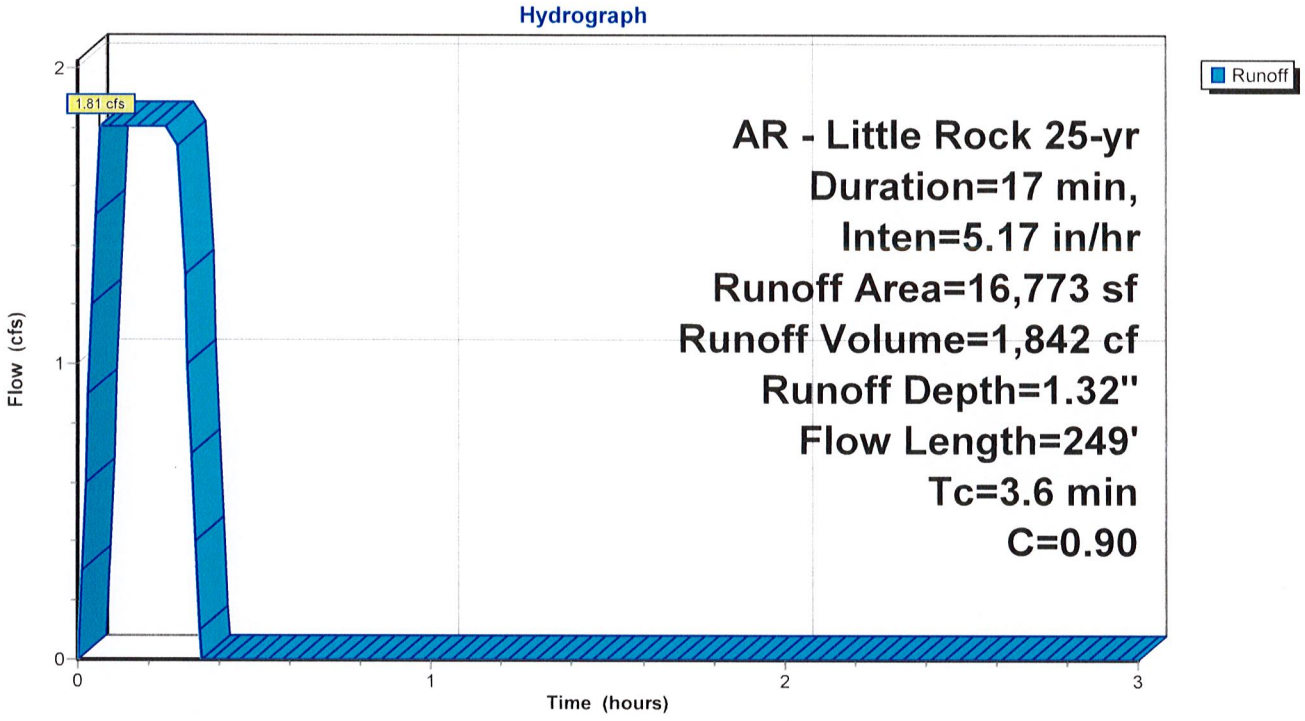
Runoff = 1.81 cfs @ 0.06 hrs, Volume= 1,842 cf, Depth= 1.32"
Routed to Pond 4P : Detention Basin

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 25-yr Duration=17 min, Inten=5.17 in/hr

Area (sf)	C	Description
3,559	0.61	>75% Grass cover, Good, HSG B
5,714	0.98	Paved parking, HSG B
7,500	0.98	Roofs, HSG B
16,773	0.90	Weighted Average
3,559		21.22% Pervious Area
13,214		78.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	25	0.2200	0.38		**Sheet Flow, Sheet Flow from adjacent property** Grass: Short n= 0.150 P2= 4.19"
1.0	42	0.0040	0.70		**Sheet Flow, Sheet Flow to Gutter** Smooth surfaces n= 0.011 P2= 4.19"
0.3	30	0.0050	1.44		**Shallow Concentrated Flow, Gutter From Building to North Parl** Paved Kv= 20.3 fps
0.7	84	0.0110	2.13		**Shallow Concentrated Flow, North Parking Swale** Paved Kv= 20.3 fps
0.5	68	0.0110	2.13		**Shallow Concentrated Flow, Concrete Flume From North Parkii** Paved Kv= 20.3 fps
3.6	249	Total			

Subcatchment 3S: North Subcatchment (Developed)



Summary for Pond 4P: Detention Basin

Inflow Area = 35,018 sf, 67.92% Impervious, Inflow Depth = 1.26" for 25-yr event
Inflow = 3.60 cfs @ 0.06 hrs, Volume= 3,666 cf
Outflow = 2.31 cfs @ 0.30 hrs, Volume= 3,635 cf, Atten= 36%, Lag= 14.7 min
Primary = 2.31 cfs @ 0.30 hrs, Volume= 3,635 cf

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 395.88' @ 0.30 hrs Storage= 1,799 cf

Plug-Flow detention time= 9.7 min calculated for 3,635 cf (99% of inflow)
Center-of-Mass det. time= 9.5 min (19.8 - 10.3)

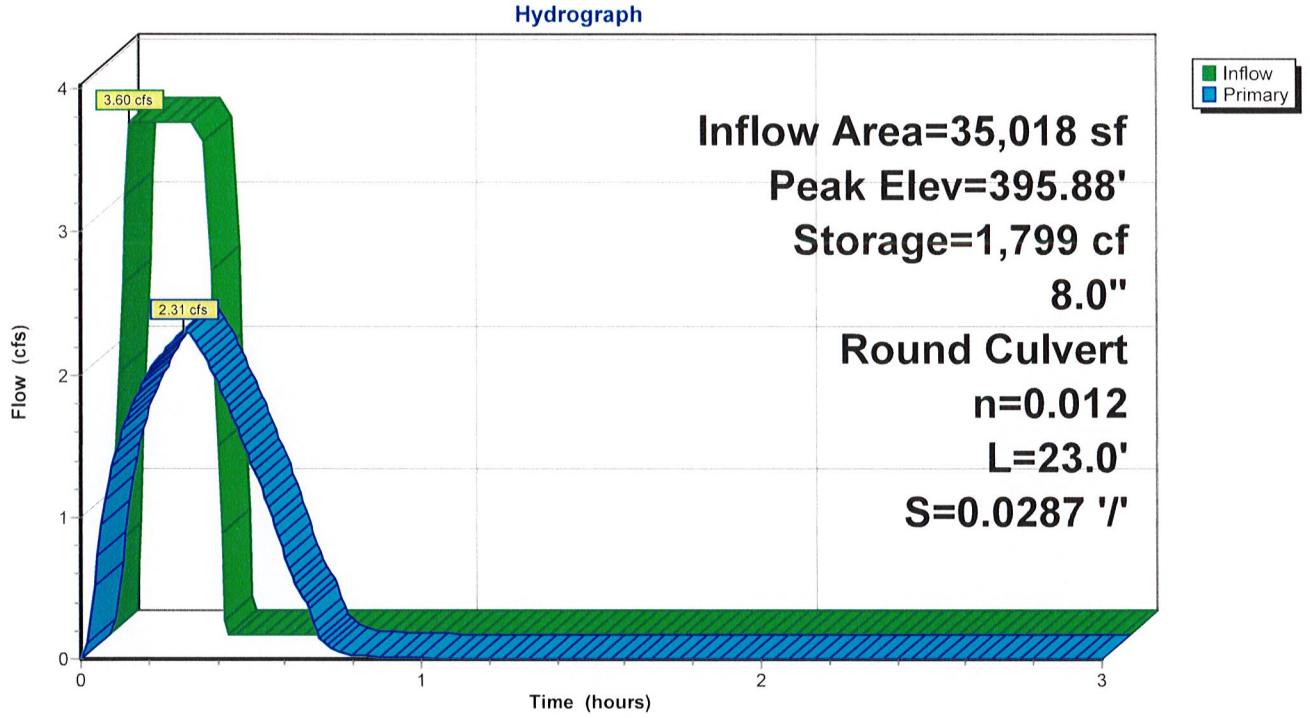
Volume	Invert	Avail.Storage	Storage Description
#1	393.50'	2,553 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
393.50	0
394.00	96
394.50	462
395.00	890
395.50	1,381
396.00	1,935
396.50	2,553

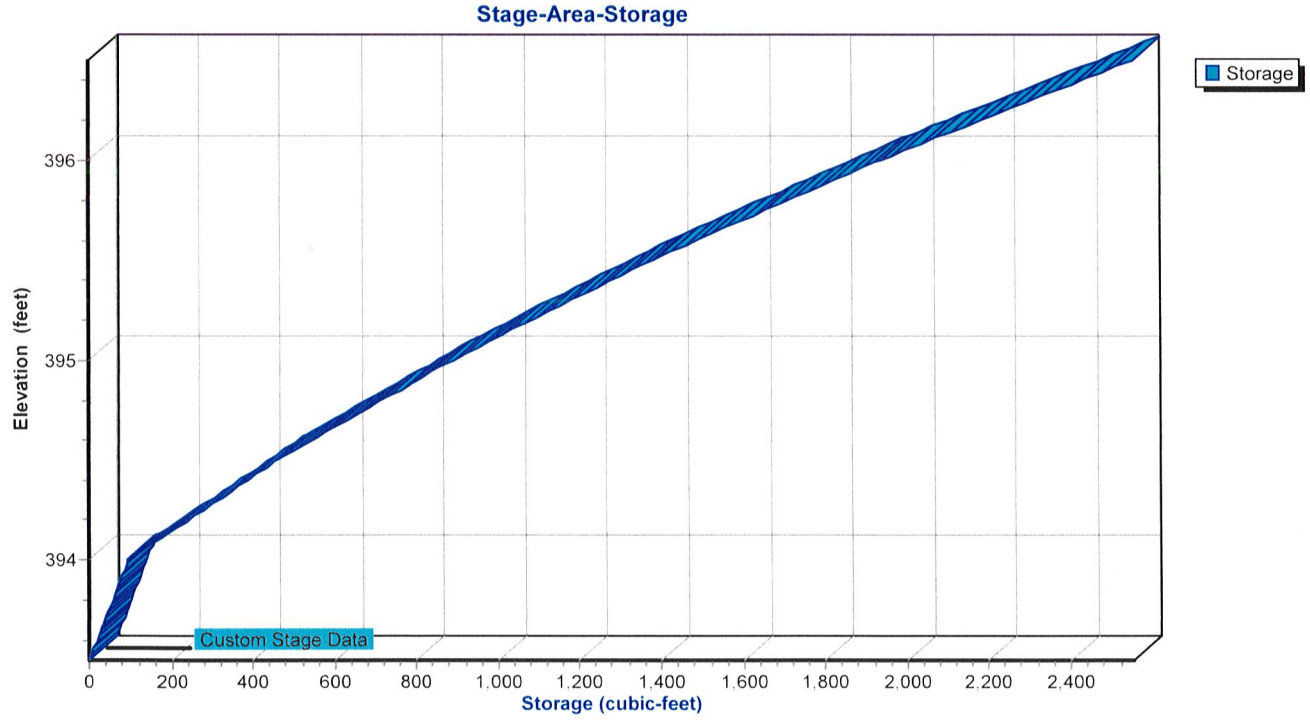
Device	Routing	Invert	Outlet Devices
#1	Primary	393.66'	**8.0" Round Culvert** L= 23.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 393.66' / 393.00' S= 0.0287 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=2.31 cfs @ 0.30 hrs HW=395.87' (Free Discharge)
↑**1=Culvert** (Inlet Controls 2.31 cfs @ 6.60 fps)

Pond 4P: Detention Basin



Pond 4P: Detention Basin



Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: South Subcatchment Runoff Area=18,245 sf 57.93% Impervious Runoff Depth=1.32"
Flow Length=224' Tc=3.4 min C=0.82 Runoff=1.97 cfs 2,009 cf

Subcatchment 3S: North Subcatchment Runoff Area=16,773 sf 78.78% Impervious Runoff Depth=1.45"
Flow Length=249' Tc=3.6 min C=0.90 Runoff=1.99 cfs 2,030 cf

Pond 4P: Detention Basin Peak Elev=396.10' Storage=2,057 cf Inflow=3.96 cfs 4,040 cf
8.0" Round Culvert n=0.012 L=23.0' S=0.0287 '/' Outflow=2.44 cfs 4,009 cf

Total Runoff Area = 35,018 sf Runoff Volume = 4,040 cf Average Runoff Depth = 1.38"
32.08% Pervious = 11,234 sf 67.92% Impervious = 23,784 sf

Summary for Subcatchment 2S: South Subcatchment (Developed)

[70] Warning: Tc<8dt requires smaller dt

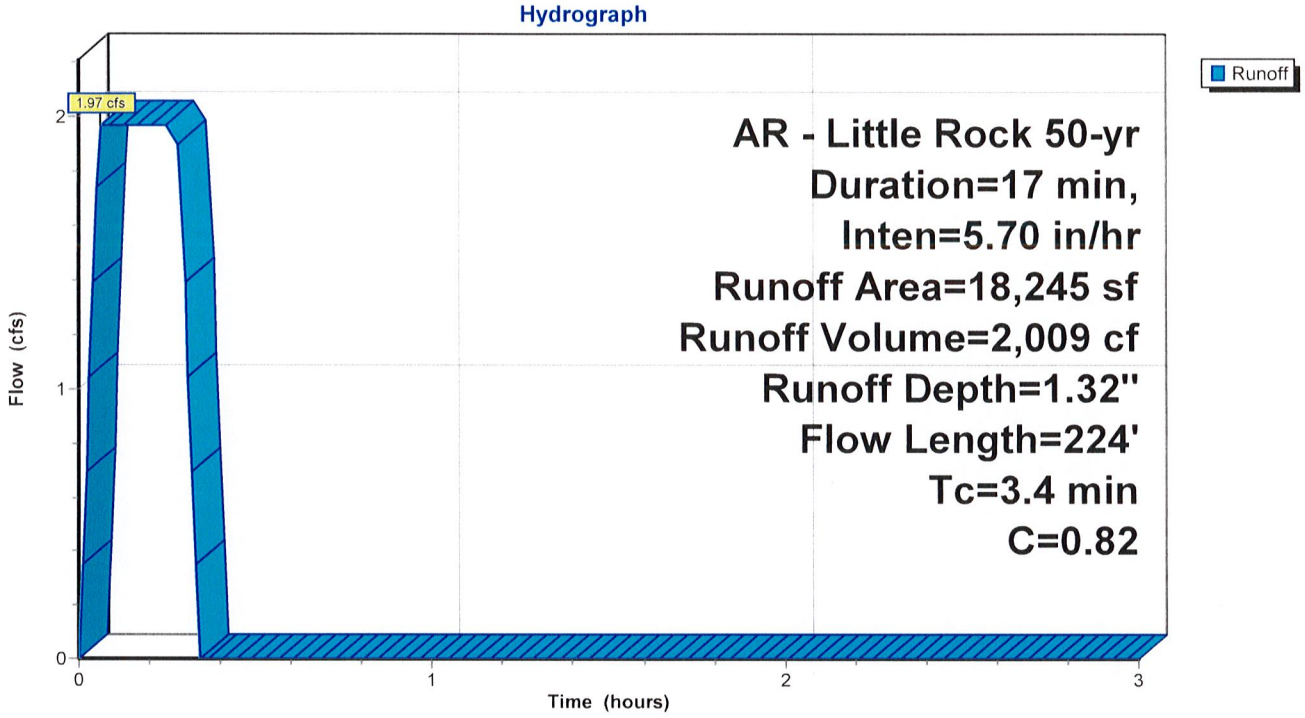
Runoff = 1.97 cfs @ 0.06 hrs, Volume= 2,009 cf, Depth= 1.32"
Routed to Pond 4P : Detention Basin

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 50-yr Duration=17 min, Inten=5.70 in/hr

Area (sf)	C	Description
7,675	0.61	>75% Grass cover, Good, HSG B
10,570	0.98	Paved parking, HSG B
18,245	0.82	Weighted Average
7,675		42.07% Pervious Area
10,570		57.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	25	0.2200	0.38		**Sheet Flow, Sheet Flow from adjacent property** Grass: Short n= 0.150 P2= 4.19"
0.9	42	0.0060	0.82		**Sheet Flow, Sheet Flow to Gutter** Smooth surfaces n= 0.011 P2= 4.19"
0.3	25	0.0060	1.57		**Shallow Concentrated Flow, Gutter Flow Building to South Parl** Paved Kv= 20.3 fps
0.2	23	0.0100	2.03		**Shallow Concentrated Flow, Gutter to Swale in South Parking a** Paved Kv= 20.3 fps
0.9	109	0.0090	1.93		**Shallow Concentrated Flow, South Parking Swale** Paved Kv= 20.3 fps
3.4	224	Total			

Subcatchment 2S: South Subcatchment (Developed)



Summary for Subcatchment 3S: North Subcatchment (Developed)

[70] Warning: Tc<8dt requires smaller dt

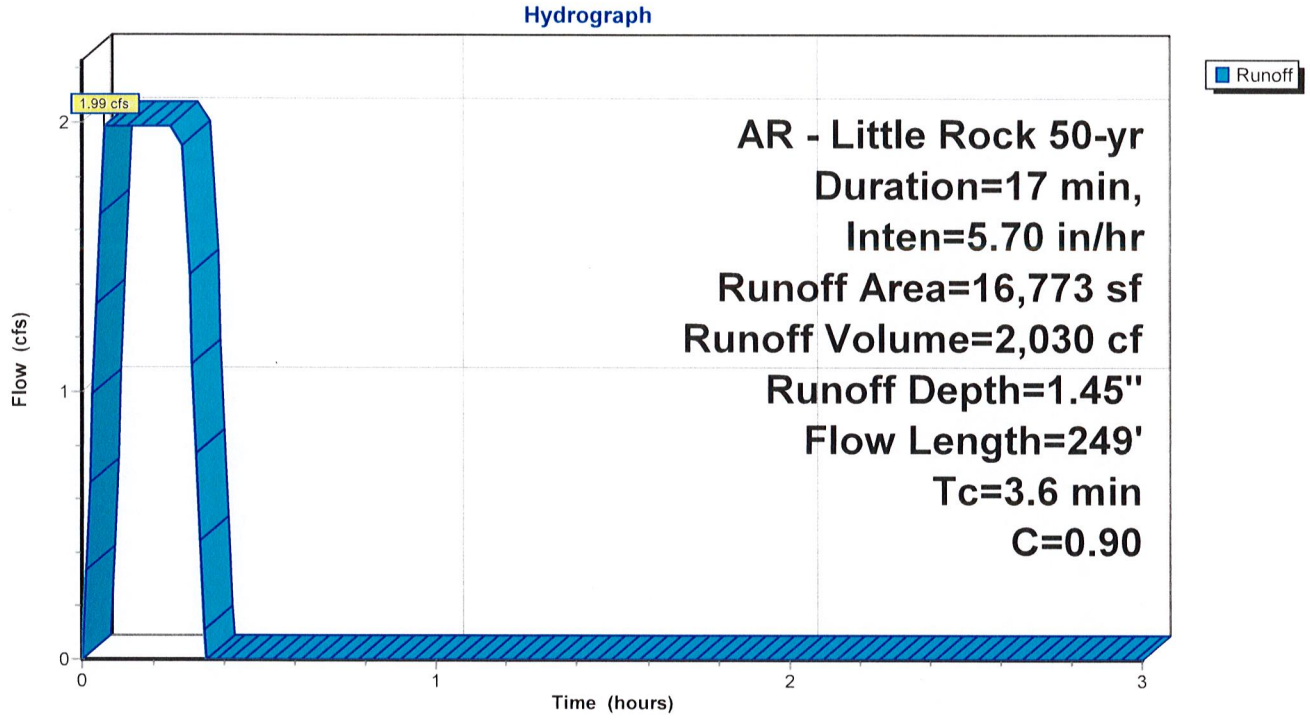
Runoff = 1.99 cfs @ 0.06 hrs, Volume= 2,030 cf, Depth= 1.45"
Routed to Pond 4P : Detention Basin

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 50-yr Duration=17 min, Inten=5.70 in/hr

Area (sf)	C	Description
3,559	0.61	>75% Grass cover, Good, HSG B
5,714	0.98	Paved parking, HSG B
7,500	0.98	Roofs, HSG B
16,773	0.90	Weighted Average
3,559		21.22% Pervious Area
13,214		78.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	25	0.2200	0.38		**Sheet Flow, Sheet Flow from adjacent property** Grass: Short n= 0.150 P2= 4.19"
1.0	42	0.0040	0.70		**Sheet Flow, Sheet Flow to Gutter** Smooth surfaces n= 0.011 P2= 4.19"
0.3	30	0.0050	1.44		**Shallow Concentrated Flow, Gutter From Building to North Parl** Paved Kv= 20.3 fps
0.7	84	0.0110	2.13		**Shallow Concentrated Flow, North Parking Swale** Paved Kv= 20.3 fps
0.5	68	0.0110	2.13		**Shallow Concentrated Flow, Concrete Flume From North Parki** Paved Kv= 20.3 fps
3.6	249	Total			

Subcatchment 3S: North Subcatchment (Developed)



Summary for Pond 4P: Detention Basin

Inflow Area = 35,018 sf, 67.92% Impervious, Inflow Depth = 1.38" for 50-yr event
Inflow = 3.96 cfs @ 0.06 hrs, Volume= 4,040 cf
Outflow = 2.44 cfs @ 0.31 hrs, Volume= 4,009 cf, Atten= 38%, Lag= 14.7 min
Primary = 2.44 cfs @ 0.31 hrs, Volume= 4,009 cf

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 396.10' @ 0.31 hrs Storage= 2,057 cf

Plug-Flow detention time= 10.1 min calculated for 3,995 cf (99% of inflow)
Center-of-Mass det. time= 10.1 min (20.4 - 10.3)

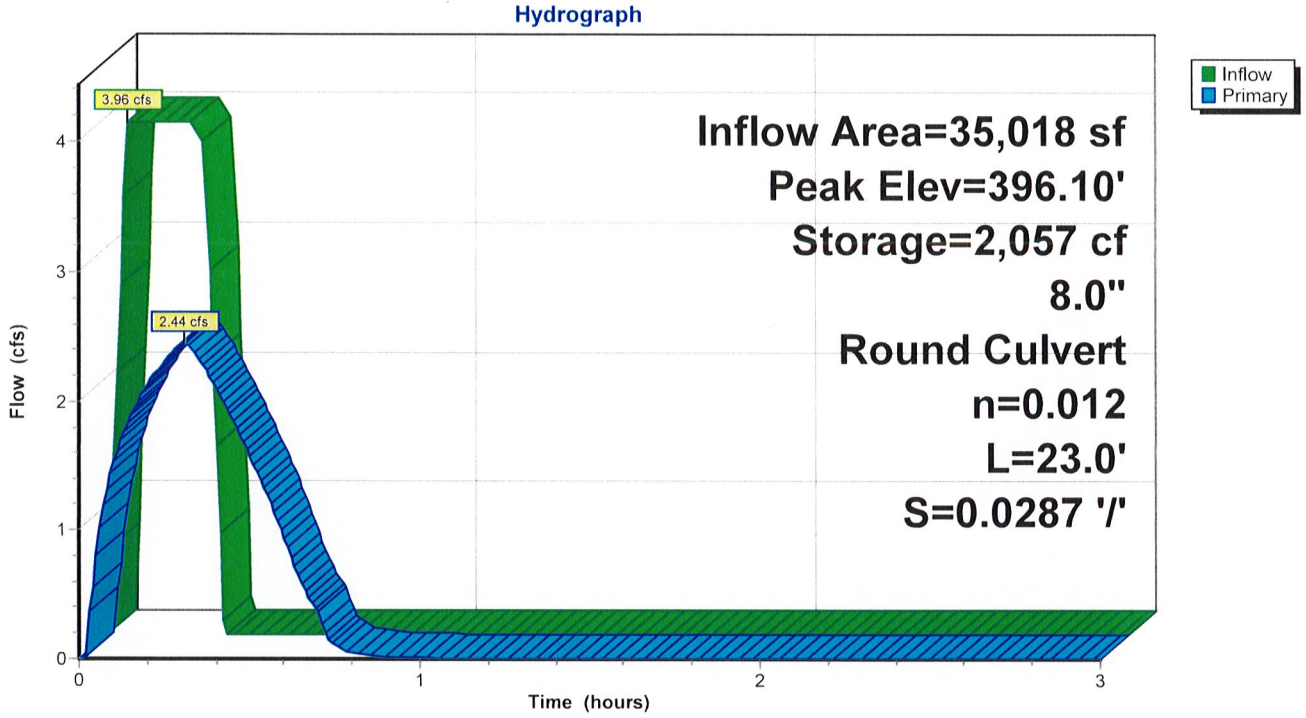
Volume	Invert	Avail.Storage	Storage Description
#1	393.50'	2,553 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
393.50	0
394.00	96
394.50	462
395.00	890
395.50	1,381
396.00	1,935
396.50	2,553

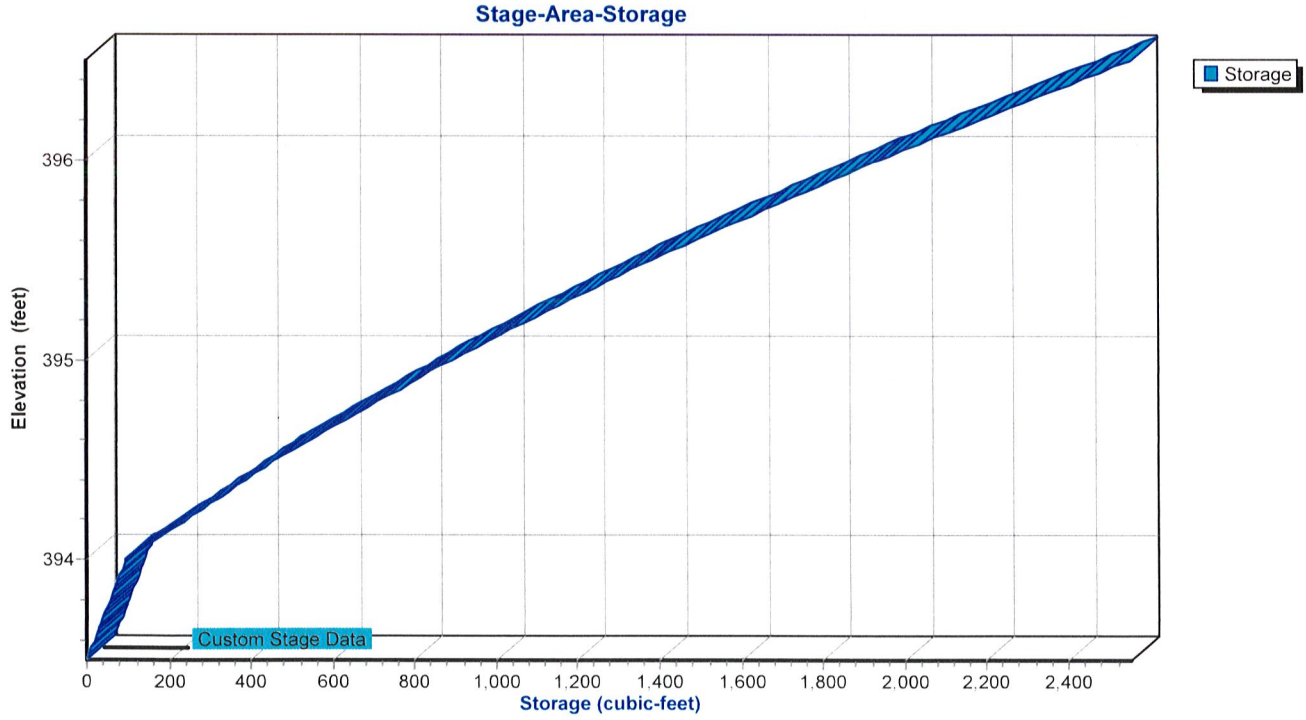
Device	Routing	Invert	Outlet Devices
#1	Primary	393.66'	**8.0" Round Culvert** L= 23.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 393.66' / 393.00' S= 0.0287 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=2.44 cfs @ 0.31 hrs HW=396.10' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 2.44 cfs @ 6.98 fps)

Pond 4P: Detention Basin



Pond 4P: Detention Basin



Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 2S: South Subcatchment Runoff Area=18,245 sf 57.93% Impervious Runoff Depth=1.44"
Flow Length=224' Tc=3.4 min C=0.82 Runoff=2.14 cfs 2,183 cf

Subcatchment 3S: North Subcatchment Runoff Area=16,773 sf 78.78% Impervious Runoff Depth=1.58"
Flow Length=249' Tc=3.6 min C=0.90 Runoff=2.16 cfs 2,205 cf

Pond 4P: Detention Basin Peak Elev=396.30' Storage=2,306 cf Inflow=4.31 cfs 4,388 cf
8.0" Round Culvert n=0.012 L=23.0' S=0.0287 '/' Outflow=2.55 cfs 4,357 cf

Total Runoff Area = 35,018 sf Runoff Volume = 4,388 cf Average Runoff Depth = 1.50"
32.08% Pervious = 11,234 sf 67.92% Impervious = 23,784 sf

Summary for Subcatchment 2S: South Subcatchment (Developed)

[70] Warning: Tc<8dt requires smaller dt

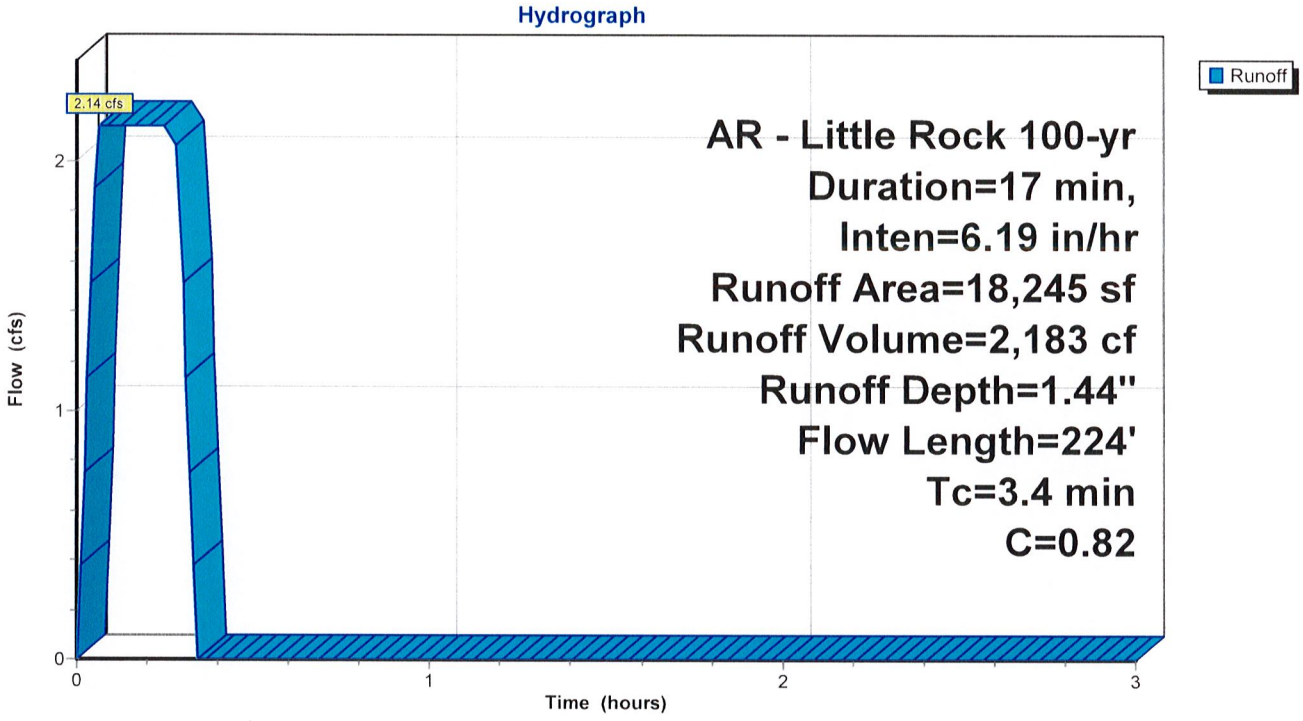
Runoff = 2.14 cfs @ 0.06 hrs, Volume= 2,183 cf, Depth= 1.44"
Routed to Pond 4P : Detention Basin

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 100-yr Duration=17 min, Inten=6.19 in/hr

Area (sf)	C	Description
7,675	0.61	>75% Grass cover, Good, HSG B
10,570	0.98	Paved parking, HSG B
18,245	0.82	Weighted Average
7,675		42.07% Pervious Area
10,570		57.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	25	0.2200	0.38		**Sheet Flow, Sheet Flow from adjacent property** Grass: Short n= 0.150 P2= 4.19"
0.9	42	0.0060	0.82		**Sheet Flow, Sheet Flow to Gutter** Smooth surfaces n= 0.011 P2= 4.19"
0.3	25	0.0060	1.57		**Shallow Concentrated Flow, Gutter Flow Building to South Parl** Paved Kv= 20.3 fps
0.2	23	0.0100	2.03		**Shallow Concentrated Flow, Gutter to Swale in South Parking a** Paved Kv= 20.3 fps
0.9	109	0.0090	1.93		**Shallow Concentrated Flow, South Parking Swale** Paved Kv= 20.3 fps
3.4	224	Total			

Subcatchment 2S: South Subcatchment (Developed)



Summary for Subcatchment 3S: North Subcatchment (Developed)

[70] Warning: Tc<8dt requires smaller dt

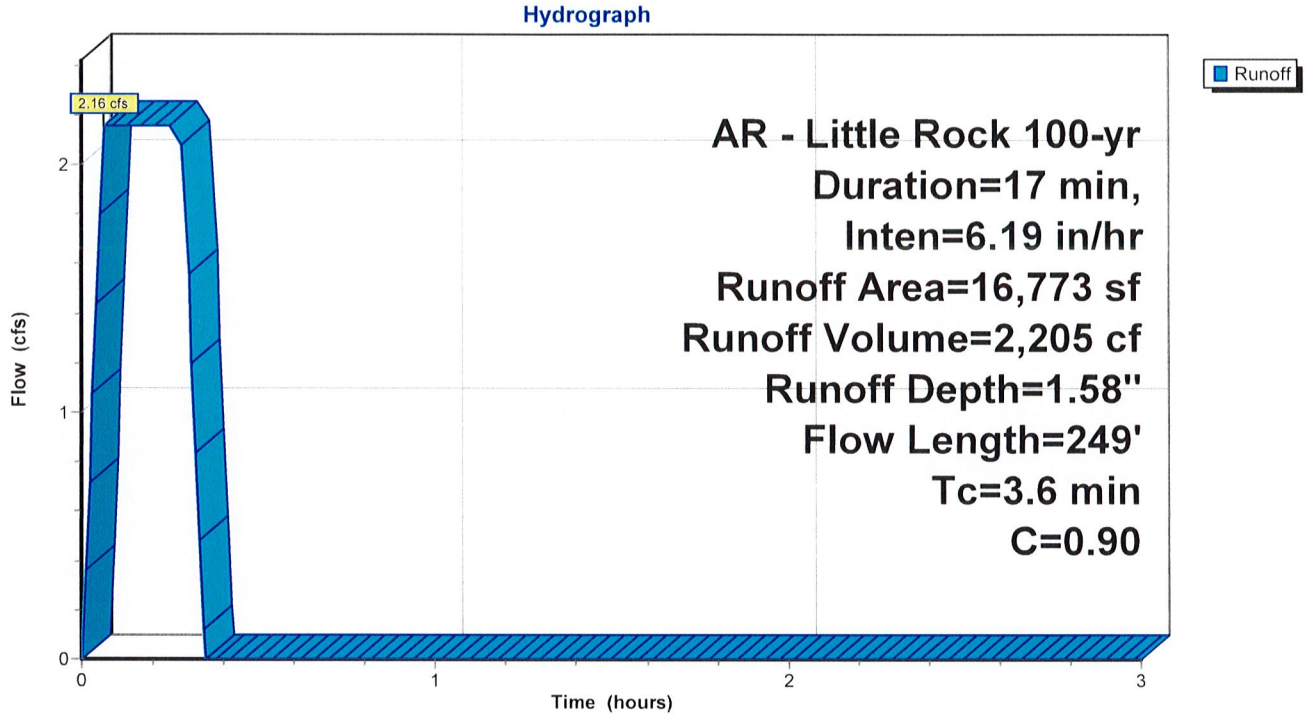
Runoff = 2.16 cfs @ 0.06 hrs, Volume= 2,205 cf, Depth= 1.58"
Routed to Pond 4P : Detention Basin

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
AR - Little Rock 100-yr Duration=17 min, Inten=6.19 in/hr

Area (sf)	C	Description
3,559	0.61	>75% Grass cover, Good, HSG B
5,714	0.98	Paved parking, HSG B
7,500	0.98	Roofs, HSG B
16,773	0.90	Weighted Average
3,559		21.22% Pervious Area
13,214		78.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	25	0.2200	0.38		**Sheet Flow, Sheet Flow from adjacent property** Grass: Short n= 0.150 P2= 4.19"
1.0	42	0.0040	0.70		**Sheet Flow, Sheet Flow to Gutter** Smooth surfaces n= 0.011 P2= 4.19"
0.3	30	0.0050	1.44		**Shallow Concentrated Flow, Gutter From Building to North Parl** Paved Kv= 20.3 fps
0.7	84	0.0110	2.13		**Shallow Concentrated Flow, North Parking Swale** Paved Kv= 20.3 fps
0.5	68	0.0110	2.13		**Shallow Concentrated Flow, Concrete Flume From North Parkii** Paved Kv= 20.3 fps
3.6	249	Total			

Subcatchment 3S: North Subcatchment (Developed)



Summary for Pond 4P: Detention Basin

Inflow Area = 35,018 sf, 67.92% Impervious, Inflow Depth = 1.50" for 100-yr event
Inflow = 4.31 cfs @ 0.06 hrs, Volume= 4,388 cf
Outflow = 2.55 cfs @ 0.31 hrs, Volume= 4,357 cf, Atten= 41%, Lag= 14.8 min
Primary = 2.55 cfs @ 0.31 hrs, Volume= 4,357 cf

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 396.30' @ 0.31 hrs Storage= 2,306 cf

Plug-Flow detention time= 11.0 min calculated for 4,357 cf (99% of inflow)
Center-of-Mass det. time= 10.7 min (21.0 - 10.3)

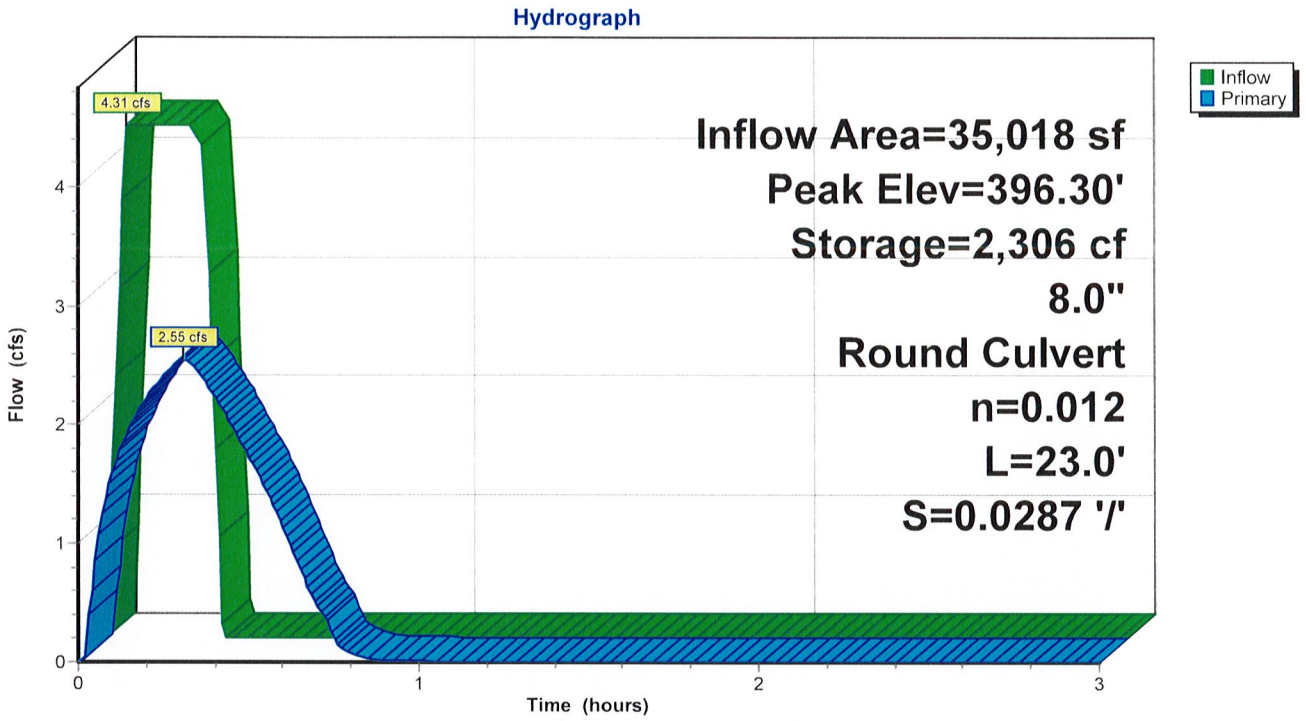
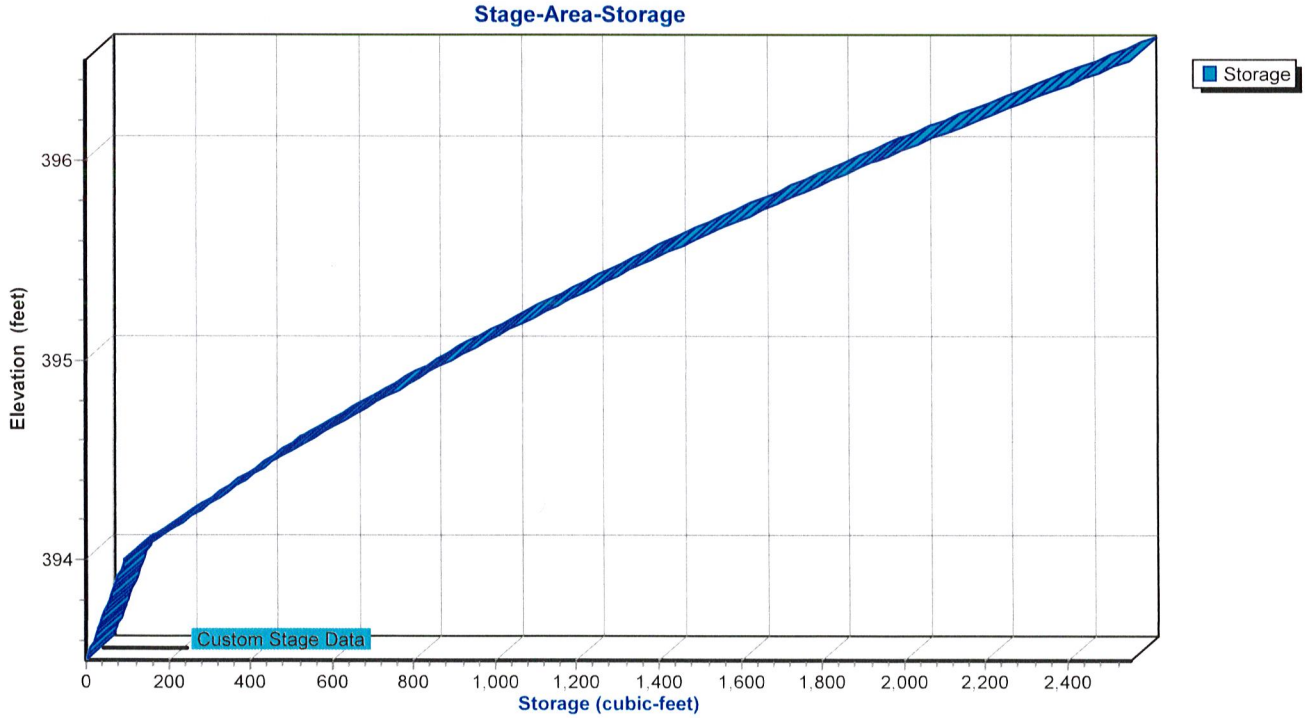
Volume	Invert	Avail.Storage	Storage Description
#1	393.50'	2,553 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
393.50	0
394.00	96
394.50	462
395.00	890
395.50	1,381
396.00	1,935
396.50	2,553

Device	Routing	Invert	Outlet Devices
#1	Primary	393.66'	**8.0" Round Culvert** L= 23.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 393.66' / 393.00' S= 0.0287 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=2.55 cfs @ 0.31 hrs HW=396.30' (Free Discharge)
↑**1=Culvert** (Inlet Controls 2.55 cfs @ 7.31 fps)

Pond 4P: Detention Basin



Pond 4P: Detention Basin