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Preliminary Drainage Analysis

Balanced Family Academy

Hoover Road
Grove City, Ohio

Prepared By:

E. P. FERRIS AND ASSOCIATES INC
Consulting Civil Engineers and Surveyors

880 King Ave.
Columbus, Ohio 43212

EP Ferris # 1163.002
Date: 9/2/2020

I hereby certify that the calculations contained herein are accurate to the best of my knowledge and belief.

STATE OF OHIO
MICHAEL J. OVERSTREET #E-65572
REGISTERED PROFESSIONAL ENGINEER

By: Michael J. Overstreet, P.E.

9.2.20
Date

EXECUTIVE SUMMARY:

Table 1 – Critical Storm Summary Table

1Yr. Pre-Developed Storm Runoff Volume	0.050 AF
1Yr. Post-Developed Storm Runoff Volume	0.176 AF
Volume Increase	252%
Critical Storm	50 Year

Table 2 – Storm Water Runoff Summary Table

Storm Event	Pre-Dev. Peak (CFS)	Post-Dev. Peak (CFS)	Offsite Peak (CFS)	Ex. Onsite Peak (CFS)	Allowable Release Rate (CFS)	Actual Release (CFS)	Ponding Elevation
1 Yr.	**0.12**	0.40	0.28	2.06	2.46	0.59	807.00
2 Yr.	0.19	0.50	0.36	2.75	3.37	1.16	807.24
5 Yr.	0.30	0.65	0.50	3.80	4.42	2.43	807.42
10 Yr.	0.40	0.78	0.61	4.69	5.42	3.58	807.54
25 Yr.	0.55	0.96	0.77	5.99	6.88	4.94	807.75
50 Yr.	0.62	1.11	0.91	7.10	**8.13**	5.47	808.00
100 yr.	0.84	1.27	1.06	8.29	10.19	7.90	808.15

Table 3 – Detention Summary Table

	Total
Water Quality Volume Required	29,771 CF
Water Quality Volume Provided	30,691 CF
Water Quantity Volume Required	62,926 CF
Water Quantity Volume Provided	91,212 CF

INTRODUCTION:

The above Executive Summary represents the preliminary analysis and proposal of storm water management for Balanced Family Academy, Grove City, Ohio. A new 1.33 acre commercial development with asphalt parking being proposed.

This project will use the critical storm method associated with The City of Grove City Storm Water Manual guidelines to determine allowable release rates and the requirements for storm water management.

The total tributary area to the retention system is approximately 11.16 acres+/-, including this new development, plus a small offsite area, see Appendix "C" Tributary Map. The area not developed with Balanced Family Academy (9.83 Ac.) will be allowed to pass through without detention.

HYDROLOGIC ANALYSIS:

All hydrologic parameters were determined using methodology described in The City of Grove City, Ohio Storm Water Manual Revised May 25, 2016. HydroCAD 10.00 software was used to develop peak flow rates using rainfall distributions from the Huff 2nd quartile, 0-10 square mile, and 12 hr. duration.

PRE-DEVELOPED CONDITIONS:

The pre-developed condition of the site consists of a mostly grass area with some impervious area, yielding a CN= 77 per the Grove City Storm Water Design Manual for >75% grass cover. The time of concentration used was 10 minutes.

POST-DEVELOPED CONDITIONS:

The post developed condition of the site will consist of a commercial area with asphalt parking lots and green space. The developed site was determined to have a curve number CN = 94. The time of concentration was found to be 11 minutes accounting for the time to the proposed storm pipe system and open channel flow in the pipe to the retention system.

The proposed site drains to the proposed retention pond located at the western portion of the site. The outlet release rates were limited to the parameters set forth by the Grove City Drainage Manual.

Critical Storm Calculation:

The critical storm is determined by comparing the increase in runoff volume of the 1-year 24-hour rainfall event using a depth of 2.20 inches from the pre-developed condition to that of the post-developed.

Pre-Development 1-Year Storm Event: 0.050 af
Post-Development 1-Year Storm Event: 0.176 af
((0.176af – 0.050af) / 0.50af) x 100% = 252% **(50-year critical storm)**

WATER QUALITY:

Water quality volume will be provided inside the retention pond. See (Appendix "B") for calculations.

SUMMARY:

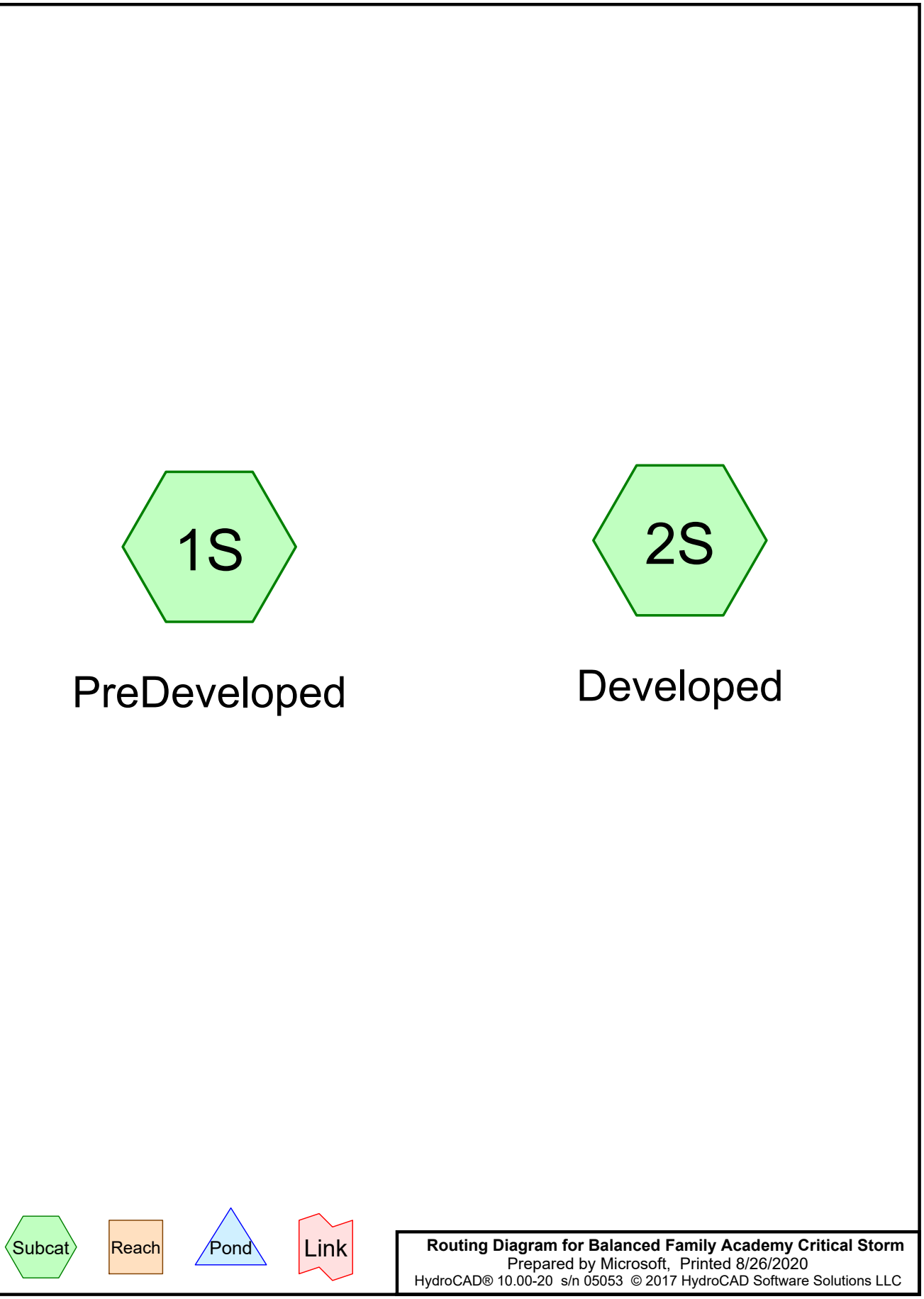
The developed site runoff is controlled by the retention pond and outlet system. The system uses an orifice and weir to control flow. The final outlet drains to an existing storm sewer to the east.

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

HydroCAD calculations can be found in Appendix "A" with the Water Quality Calculations found in Appendix "B" followed by a Tributary Map in Appendix "C".

APPENDIX A

(HydroCAD Report)



Routing Diagram for Balanced Family Academy Critical Storm
Prepared by Microsoft, Printed 8/26/2020
HydroCAD® 10.00-20 s/n 05053 © 2017 HydroCAD Software Solutions LLC

Summary for Subcatchment 1S: PreDeveloped

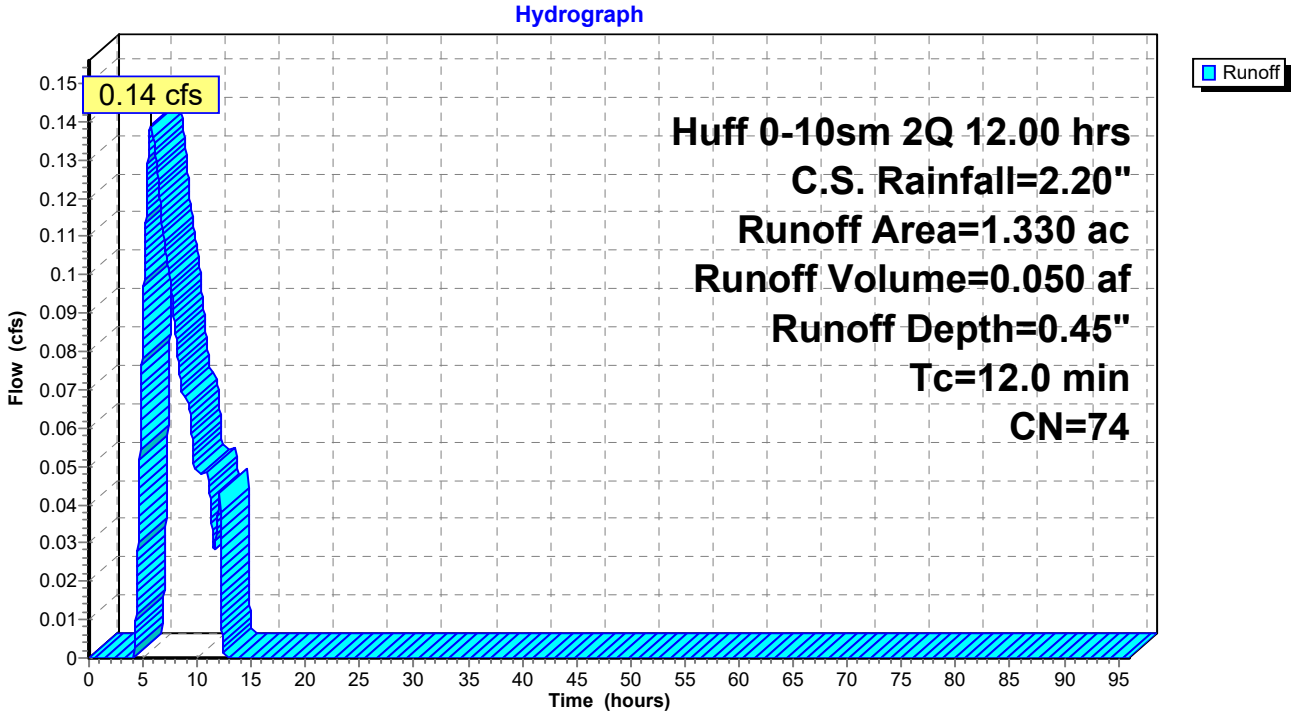
Runoff = 0.14 cfs @ 5.75 hrs, Volume= 0.050 af, Depth= 0.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs C.S. Rainfall=2.20"

Area (ac)	CN	Description
1.330	74	>75% Grass cover, Good, HSG C
1.330		100.00% Pervious Area

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

Subcatchment 1S: PreDeveloped



Summary for Subcatchment 2S: Developed

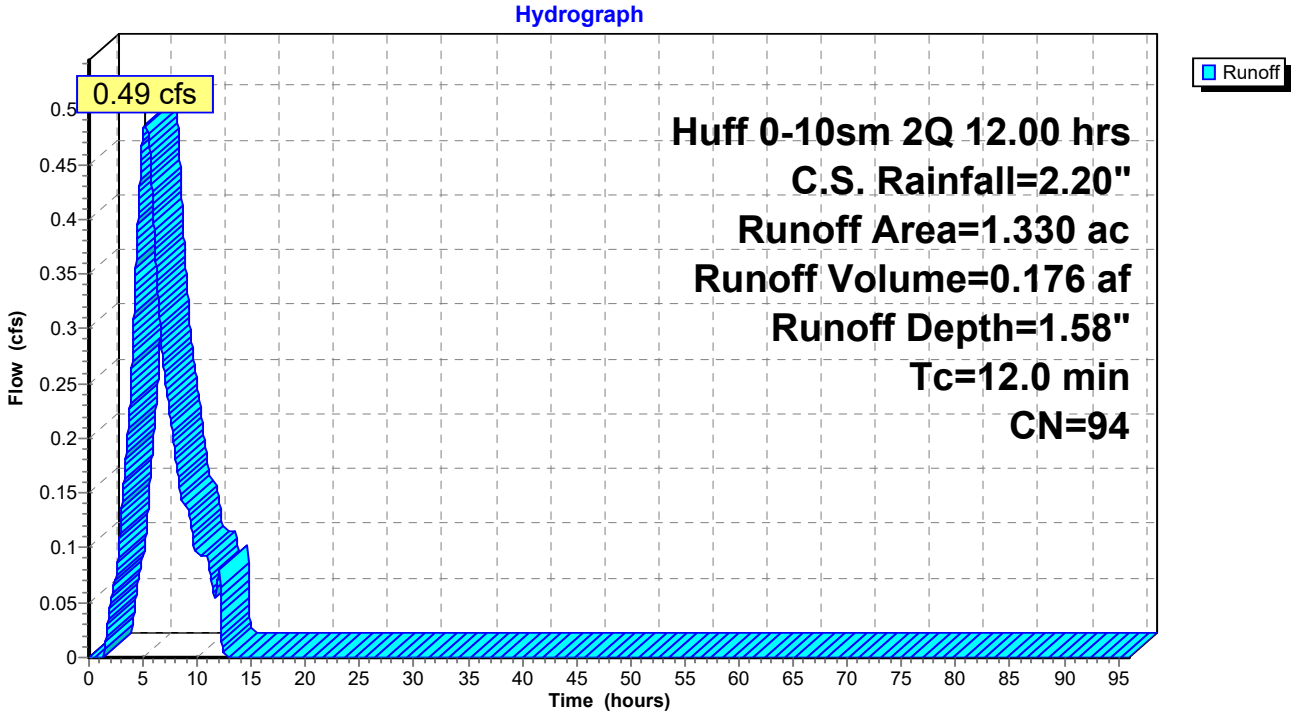
Runoff = 0.49 cfs @ 5.13 hrs, Volume= 0.176 af, Depth= 1.58"

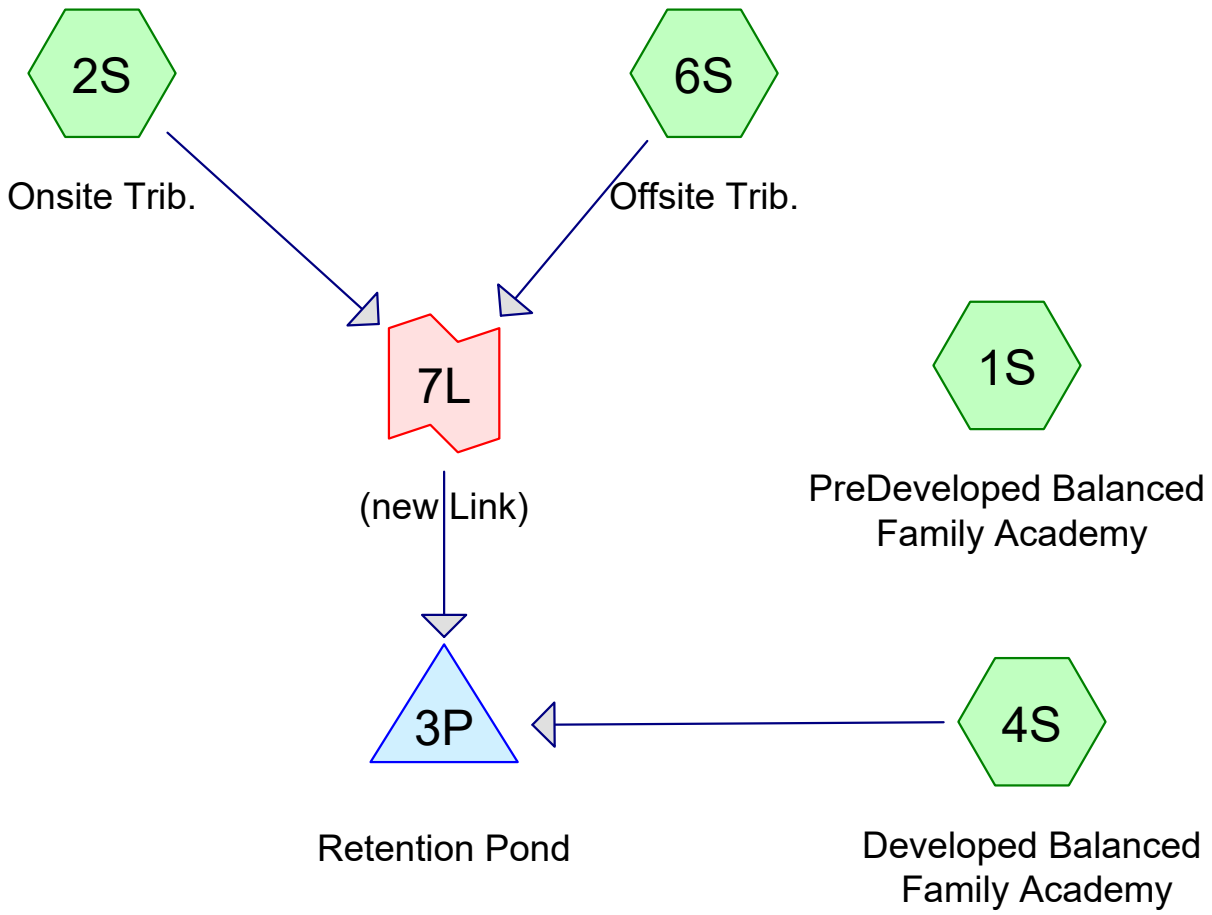
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs C.S. Rainfall=2.20"

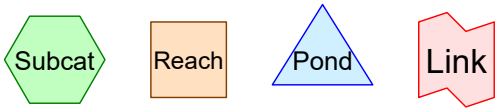
Area (ac)	CN	Description
1.330	94	Urban commercial, 85% imp, HSG C
0.200		15.00% Pervious Area
1.130		85.00% Impervious Area

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

Subcatchment 2S: Developed







Routing Diagram for Balanced Family Academy
Prepared by Microsoft, Printed 8/28/2020
HydroCAD® 10.00-20 s/n 05053 © 2017 HydroCAD Software Solutions LLC

Summary for Subcatchment 1S: PreDeveloped Balanced Family Academy

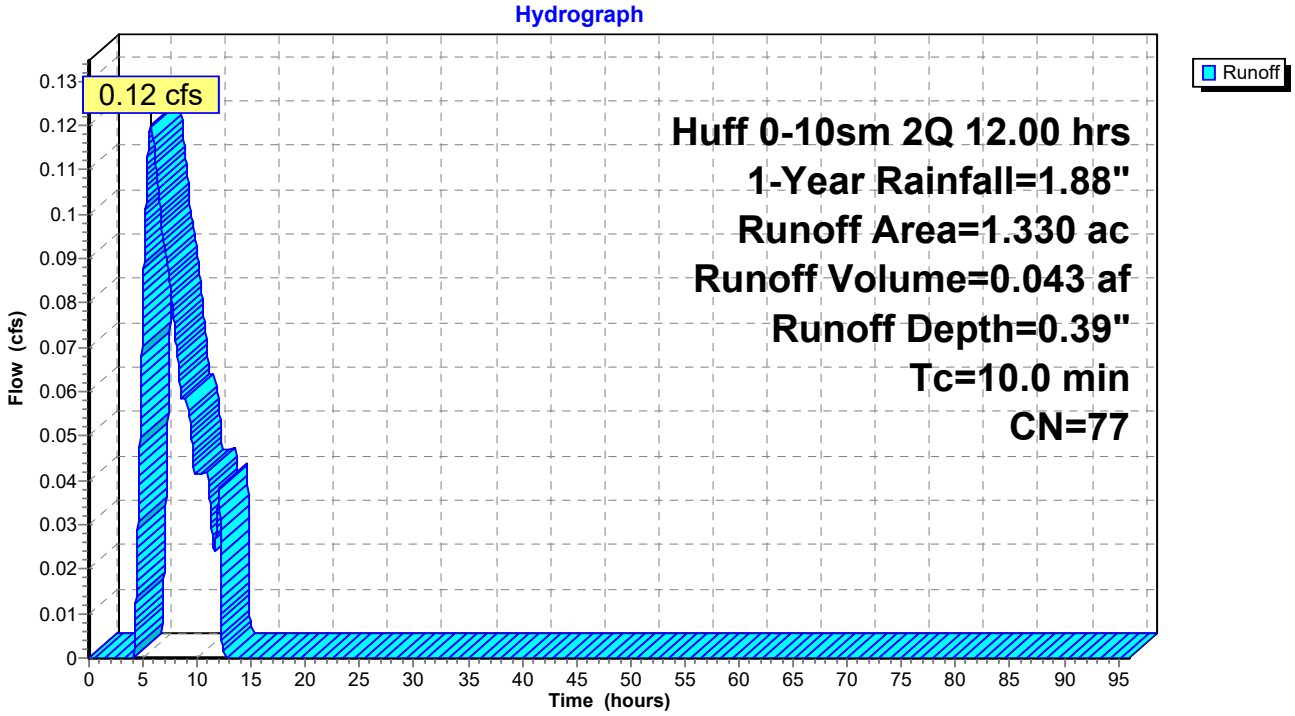
Runoff = 0.12 cfs @ 5.70 hrs, Volume= 0.043 af, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 1-Year Rainfall=1.88"

	Area (ac)	CN	Description
*	1.330	77	>75% Grass cover, Good, HSG C
	1.330		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Start Storm Pipe**

Subcatchment 1S: PreDeveloped Balanced Family Academy



Summary for Subcatchment 2S: Onsite Trib.

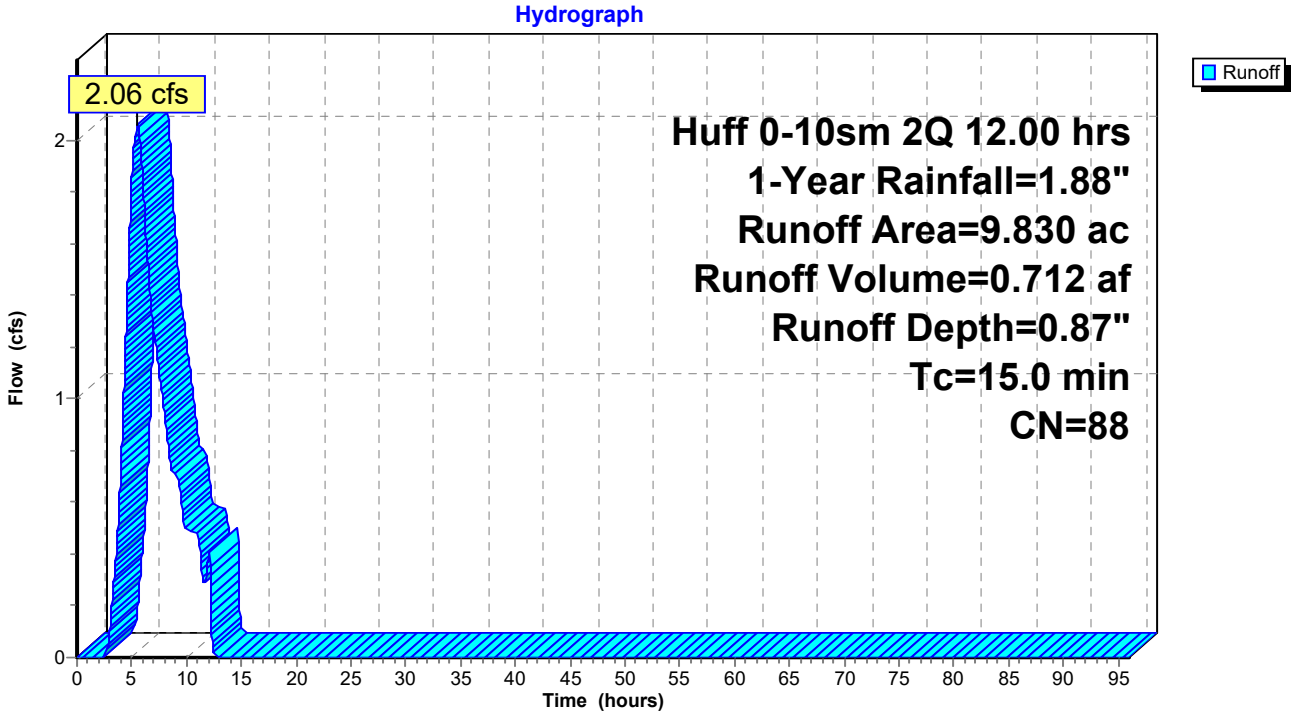
Runoff = 2.06 cfs @ 5.55 hrs, Volume= 0.712 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 1-Year Rainfall=1.88"

	Area (ac)	CN	Description
*	5.760	98	Paved parking, Roofs HSG C
	4.070	74	>75% Grass cover, Good, HSG C
	9.830	88	Weighted Average
	4.070		41.40% Pervious Area
	5.760		58.60% Impervious Area

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

Subcatchment 2S: Onsite Trib.



Summary for Subcatchment 4S: Developed Balanced Family Academy

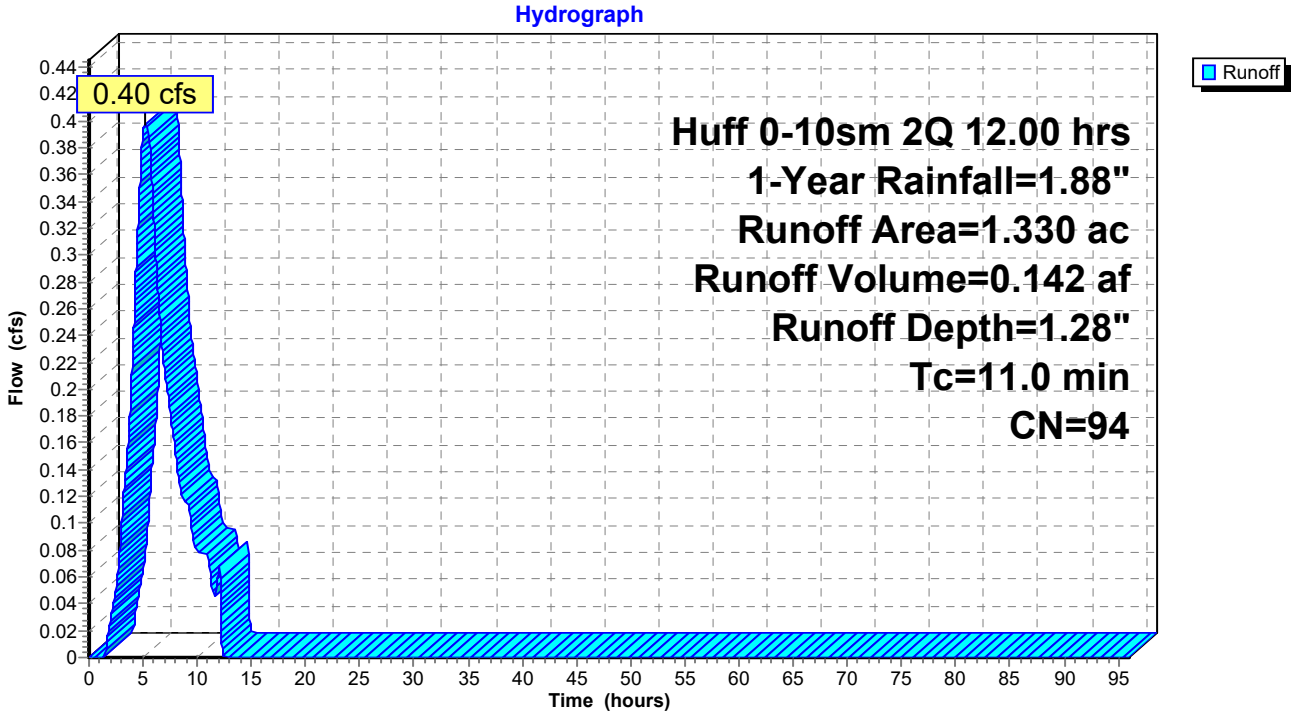
Runoff = 0.40 cfs @ 5.17 hrs, Volume= 0.142 af, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 1-Year Rainfall=1.88"

Area (ac)	CN	Description
1.330	94	Urban commercial, 85% imp, HSG C
0.200		15.00% Pervious Area
1.130		85.00% Impervious Area

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

Subcatchment 4S: Developed Balanced Family Academy



Summary for Subcatchment 6S: Offsite Trib.

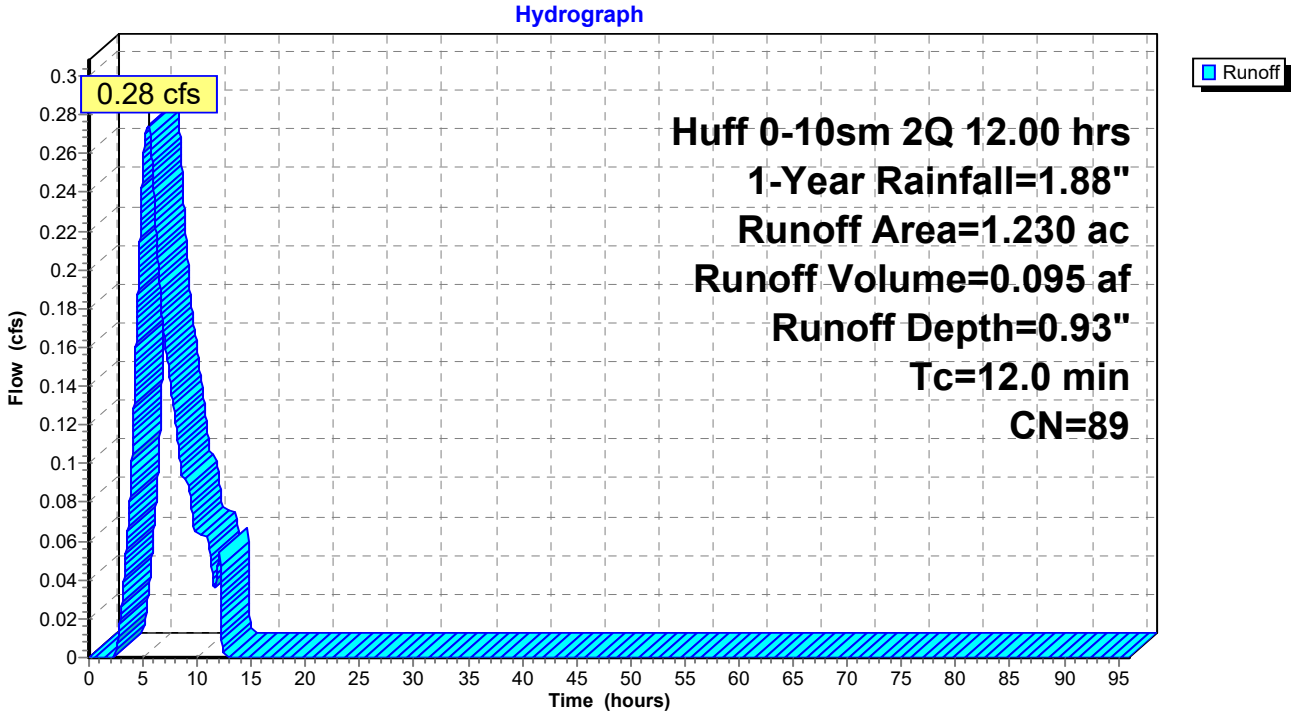
Runoff = 0.28 cfs @ 5.51 hrs, Volume= 0.095 af, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 1-Year Rainfall=1.88"

	Area (ac)	CN	Description
*	0.760	98	Paved parking, Roofs HSG C
	0.470	74	>75% Grass cover, Good, HSG C
	1.230	89	Weighted Average
	0.470		38.21% Pervious Area
	0.760		61.79% Impervious Area

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

Subcatchment 6S: Offsite Trib.



Summary for Pond 3P: Retention Pond

Inflow Area =	12.390 ac, 61.75% Impervious, Inflow Depth = 0.92" for 1-Year event				
Inflow =	2.73 cfs @	5.52 hrs,	Volume=	0.950 af	
Outflow =	0.59 cfs @	11.09 hrs,	Volume=	0.926 af,	Atten= 79%, Lag= 334.2 min
Primary =	0.59 cfs @	11.09 hrs,	Volume=	0.926 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 807.00' @ 11.09 hrs Surf.Area= 28,905 sf Storage= 27,923 cf

Plug-Flow detention time= 726.1 min calculated for 0.926 af (98% of inflow)
Center-of-Mass det. time= 718.7 min (1,124.4 - 405.8)

Volume	Invert	Avail.Storage	Storage Description
#1	806.00'	90,805 cf	**Pond (Prismatic)** Listed below (Recalc)
#2	804.00'	407 cf	**12.0" Round Pipe Storage** L= 518.0' S= 0.0050 '/'
		91,212 cf	Total Available Storage

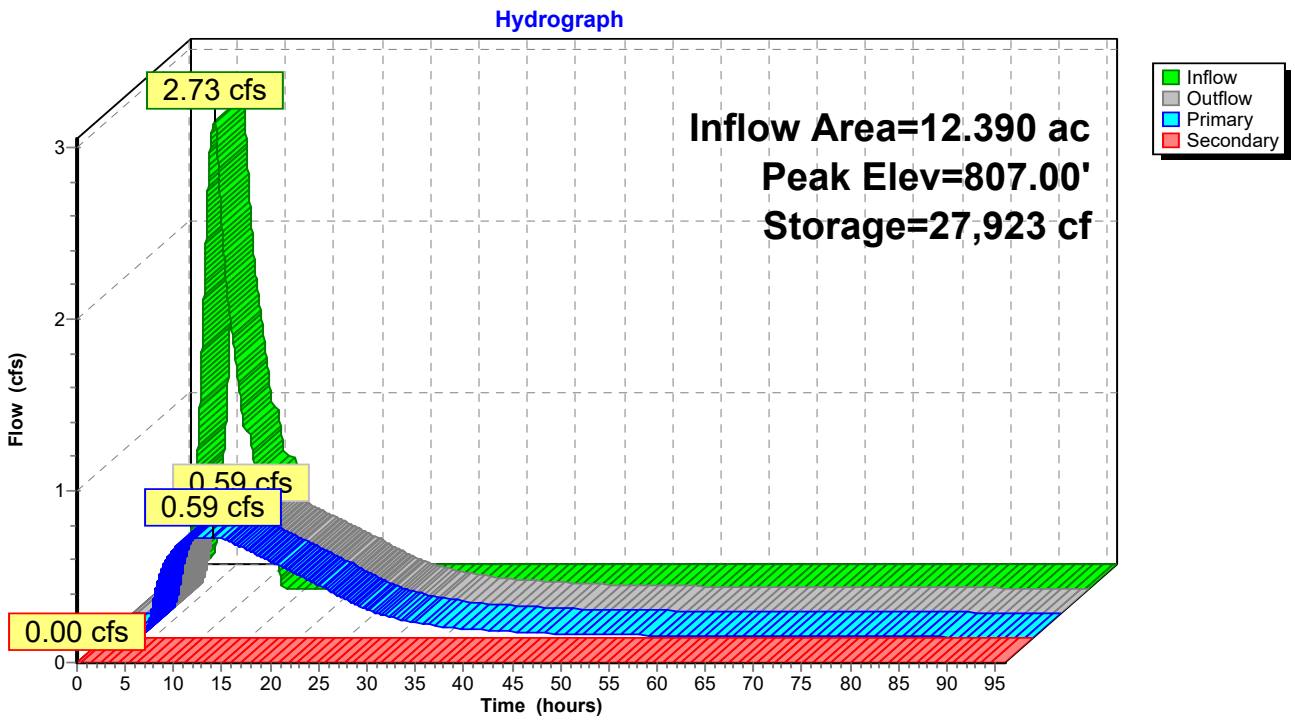
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
806.00	26,017	0	0
807.00	28,796	27,407	27,407
808.00	31,674	30,235	57,642
809.00	34,653	33,164	90,805

Device	Routing	Invert	Outlet Devices
#1	Primary	806.00'	**15.0" Round Culvert** L= 118.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 806.00' / 805.00' S= 0.0085 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	806.00'	**5.0" Vert. Orifice** C= 0.600
#3	Device 1	807.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	808.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

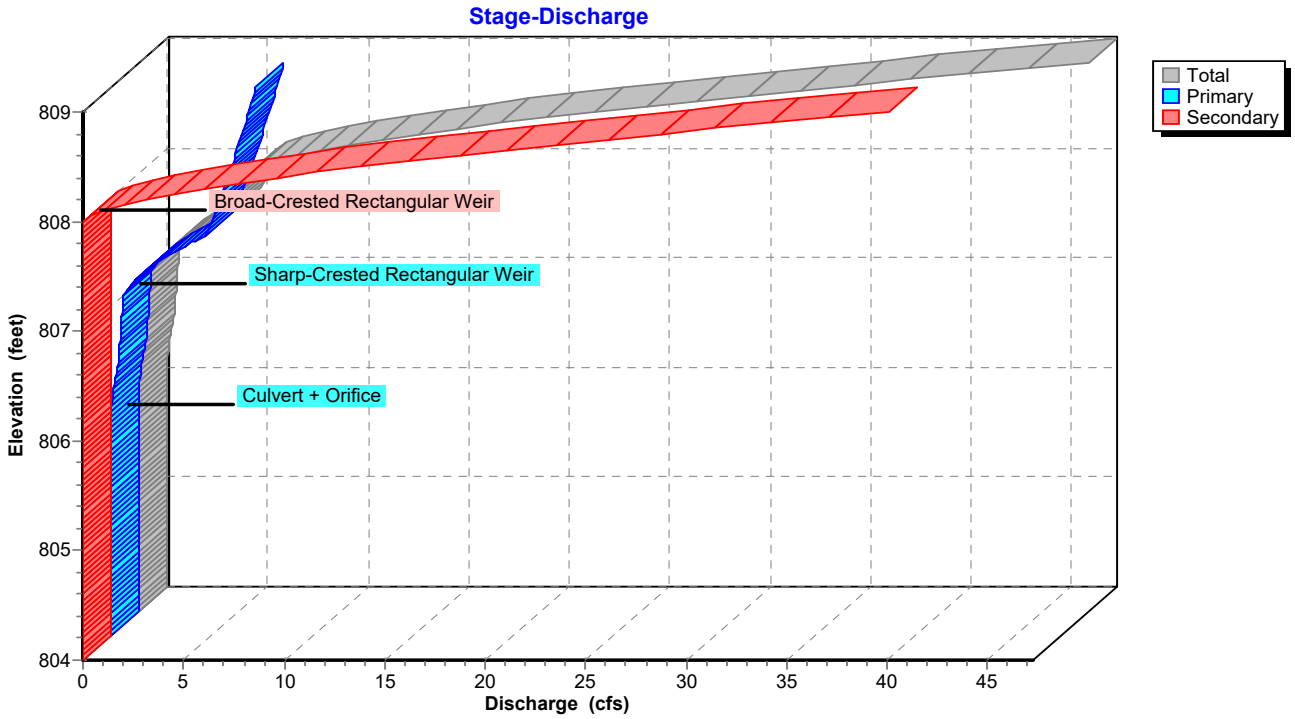
Primary OutFlow Max=0.59 cfs @ 11.09 hrs HW=807.00' (Free Discharge)
└─**1=Culvert** (Passes 0.59 cfs of 2.85 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.59 cfs @ 4.30 fps)
  └─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=804.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

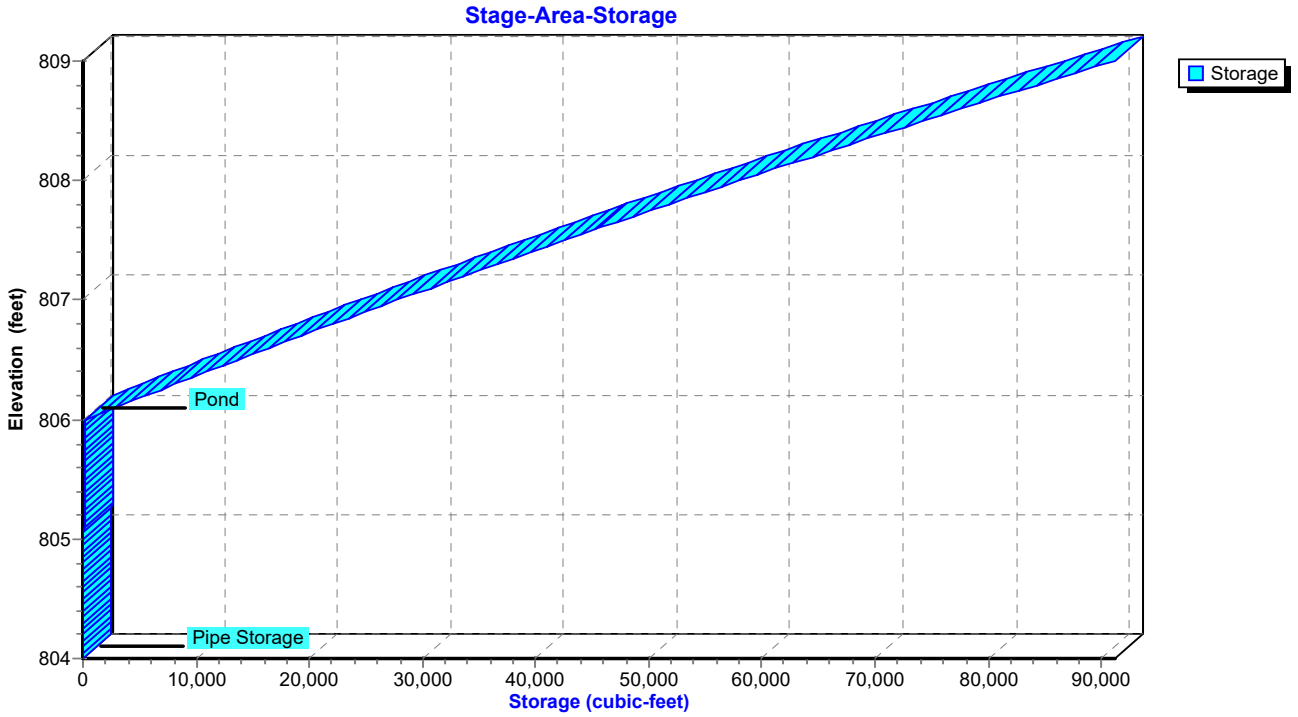
Pond 3P: Retention Pond



Pond 3P: Retention Pond



Pond 3P: Retention Pond

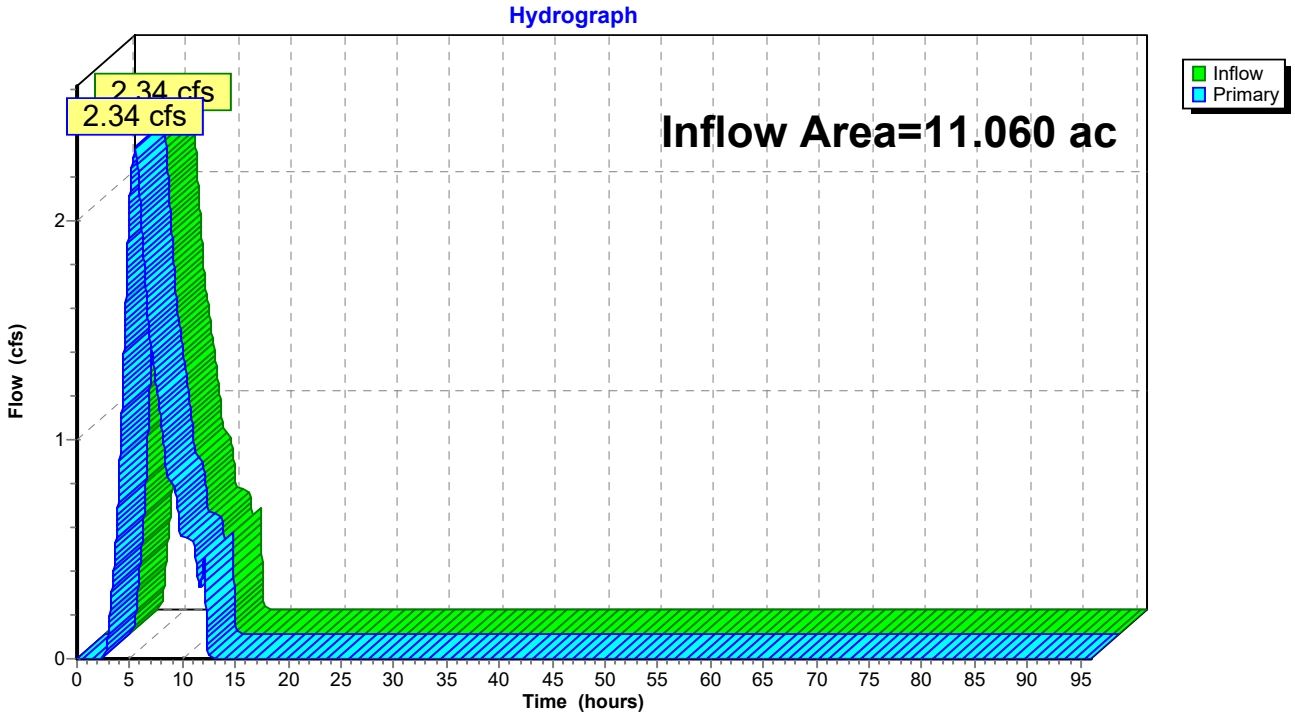


Summary for Link 7L: (new Link)

Inflow Area = 11.060 ac, 58.95% Impervious, Inflow Depth = 0.88" for 1-Year event
Inflow = 2.34 cfs @ 5.55 hrs, Volume= 0.808 af
Primary = 2.34 cfs @ 5.55 hrs, Volume= 0.808 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 7L: (new Link)



Summary for Subcatchment 1S: PreDeveloped Balanced Family Academy

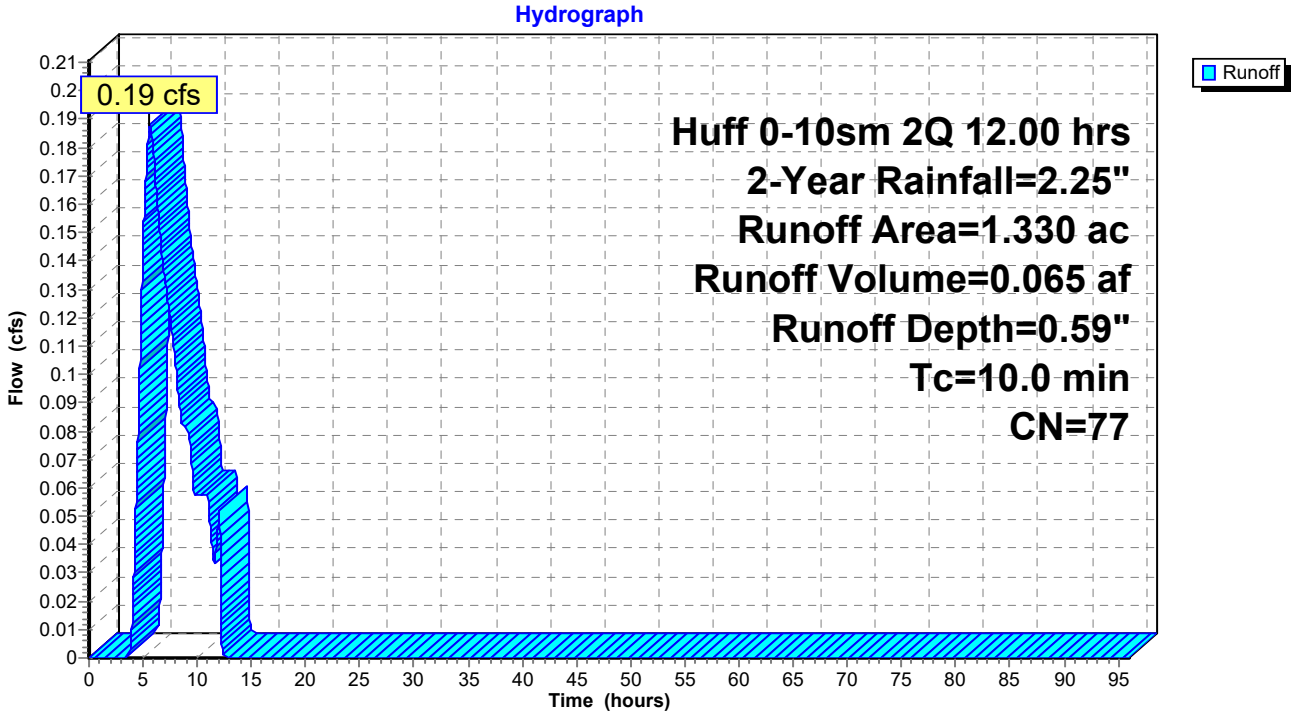
Runoff = 0.19 cfs @ 5.61 hrs, Volume= 0.065 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 2-Year Rainfall=2.25"

	Area (ac)	CN	Description
*	1.330	77	>75% Grass cover, Good, HSG C
	1.330		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Start Storm Pipe**

Subcatchment 1S: PreDeveloped Balanced Family Academy



Summary for Subcatchment 2S: Onsite Trib.

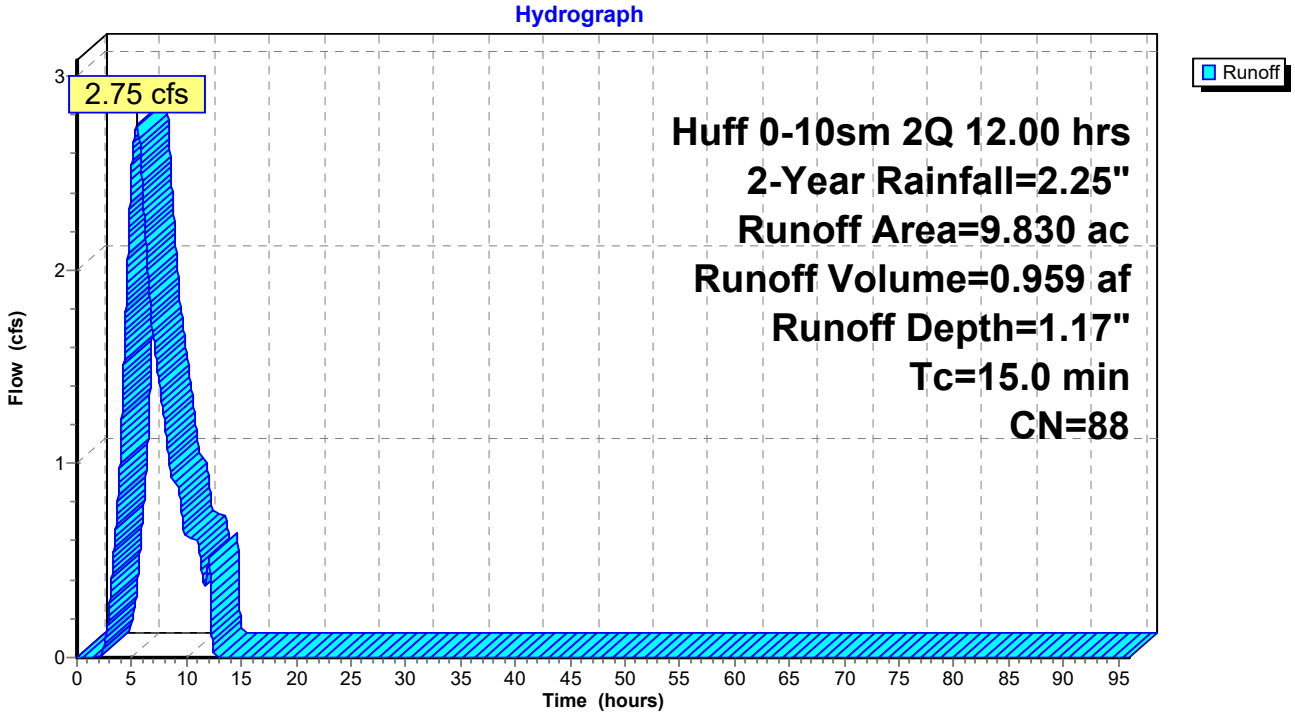
Runoff = 2.75 cfs @ 5.52 hrs, Volume= 0.959 af, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 2-Year Rainfall=2.25"

	Area (ac)	CN	Description
*	5.760	98	Paved parking, Roofs HSG C
	4.070	74	>75% Grass cover, Good, HSG C
	9.830	88	Weighted Average
	4.070		41.40% Pervious Area
	5.760		58.60% Impervious Area

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

Subcatchment 2S: Onsite Trib.



Summary for Subcatchment 4S: Developed Balanced Family Academy

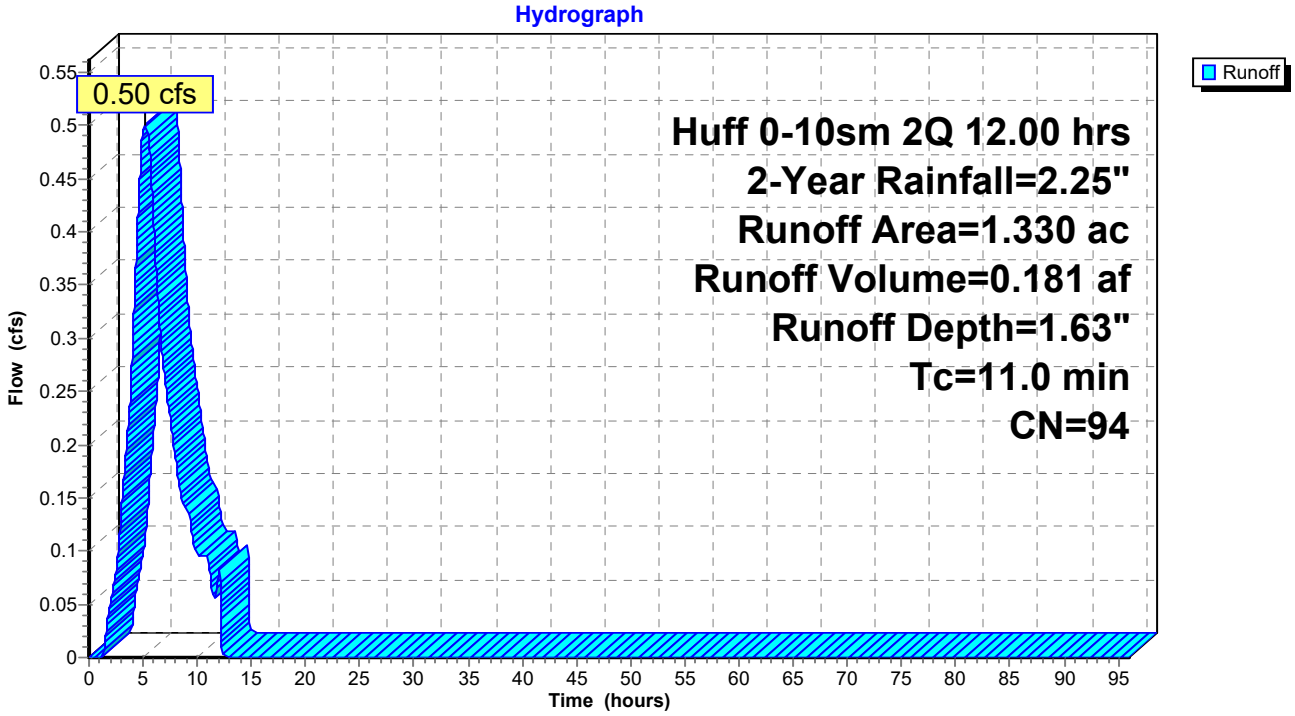
Runoff = 0.50 cfs @ 5.10 hrs, Volume= 0.181 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 2-Year Rainfall=2.25"

Area (ac)	CN	Description
1.330	94	Urban commercial, 85% imp, HSG C
0.200		15.00% Pervious Area
1.130		85.00% Impervious Area

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

Subcatchment 4S: Developed Balanced Family Academy



Summary for Subcatchment 6S: Offsite Trib.

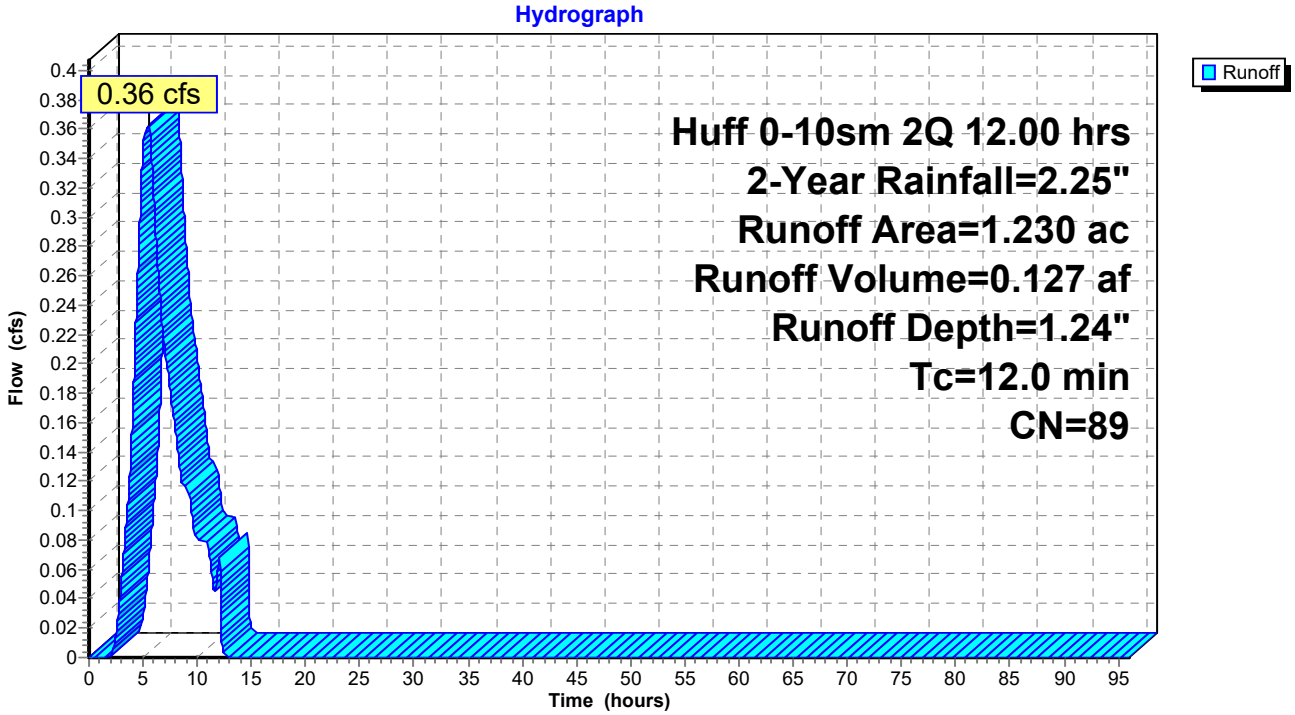
Runoff = 0.36 cfs @ 5.48 hrs, Volume= 0.127 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 2-Year Rainfall=2.25"

	Area (ac)	CN	Description
*	0.760	98	Paved parking, Roofs HSG C
	0.470	74	>75% Grass cover, Good, HSG C
	1.230	89	Weighted Average
	0.470		38.21% Pervious Area
	0.760		61.79% Impervious Area

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

Subcatchment 6S: Offsite Trib.



Summary for Pond 3P: Retention Pond

Inflow Area =	12.390 ac, 61.75% Impervious, Inflow Depth = 1.23" for 2-Year event				
Inflow =	3.61 cfs @	5.48 hrs,	Volume=	1.266 af	
Outflow =	1.16 cfs @	9.19 hrs,	Volume=	1.242 af,	Atten= 68%, Lag= 222.1 min
Primary =	1.16 cfs @	9.19 hrs,	Volume=	1.242 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 807.24' @ 9.19 hrs Surf.Area= 29,524 sf Storage= 34,673 cf

Plug-Flow detention time= 666.3 min calculated for 1.242 af (98% of inflow)
Center-of-Mass det. time= 660.5 min (1,058.9 - 398.4)

Volume	Invert	Avail.Storage	Storage Description
#1	806.00'	90,805 cf	**Pond (Prismatic)** Listed below (Recalc)
#2	804.00'	407 cf	**12.0" Round Pipe Storage** L= 518.0' S= 0.0050 '/'
		91,212 cf	Total Available Storage

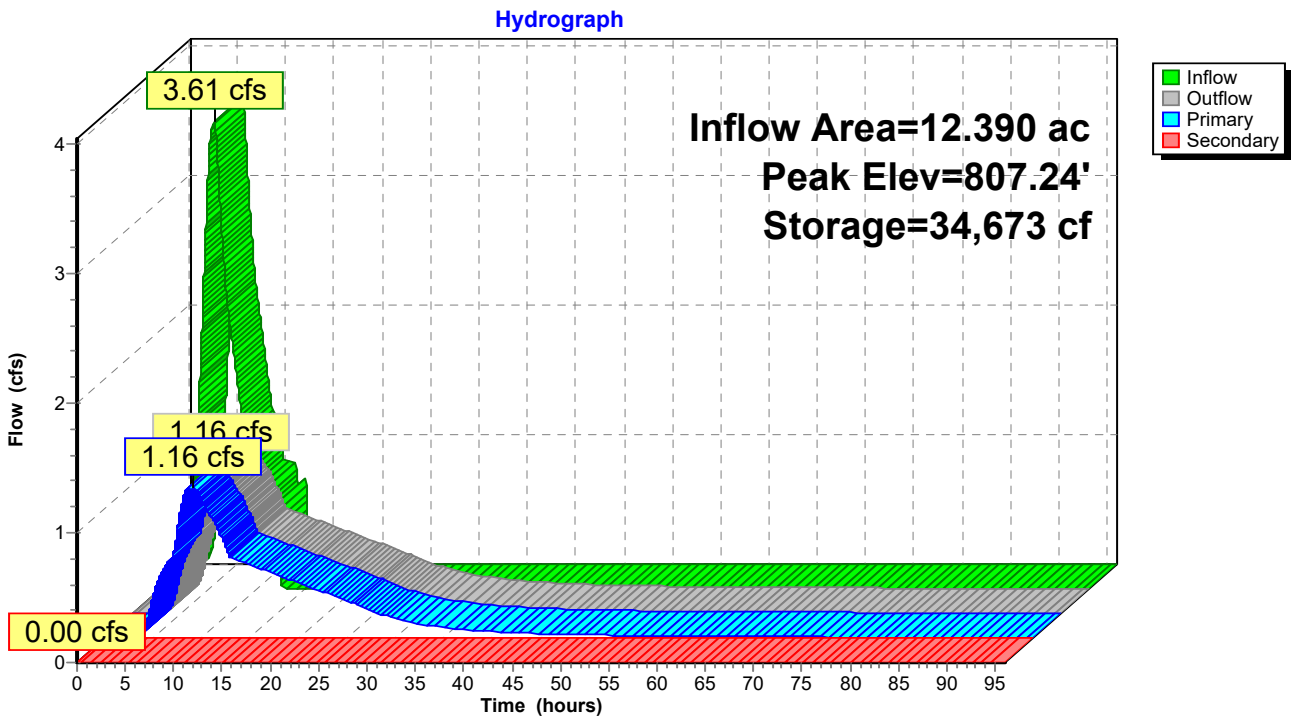
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
806.00	26,017	0	0
807.00	28,796	27,407	27,407
808.00	31,674	30,235	57,642
809.00	34,653	33,164	90,805

Device	Routing	Invert	Outlet Devices
#1	Primary	806.00'	**15.0" Round Culvert** L= 118.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 806.00' / 805.00' S= 0.0085 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	806.00'	**5.0" Vert. Orifice** C= 0.600
#3	Device 1	807.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	808.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

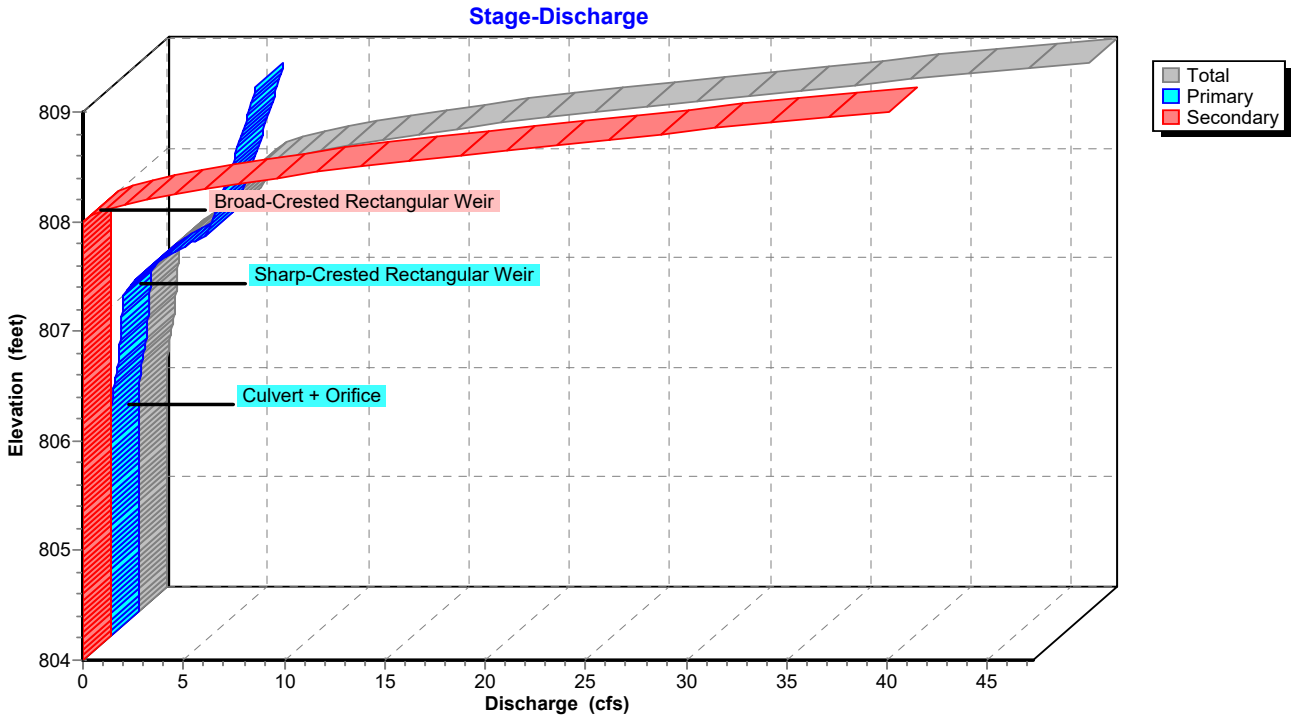
Primary OutFlow Max=1.15 cfs @ 9.19 hrs HW=807.24' (Free Discharge)
└─**1=Culvert** (Passes 1.15 cfs of 3.66 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.67 cfs @ 4.88 fps)
  └─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.49 cfs @ 1.20 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=804.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

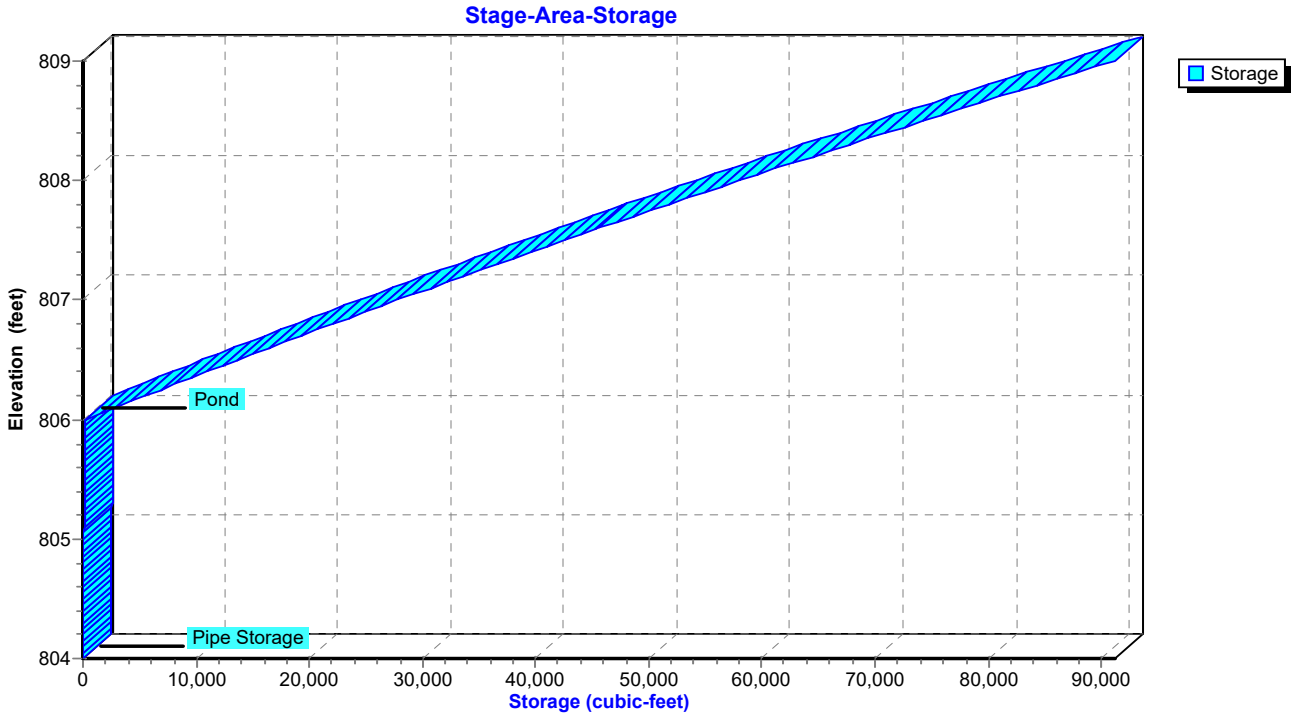
Pond 3P: Retention Pond



Pond 3P: Retention Pond



Pond 3P: Retention Pond

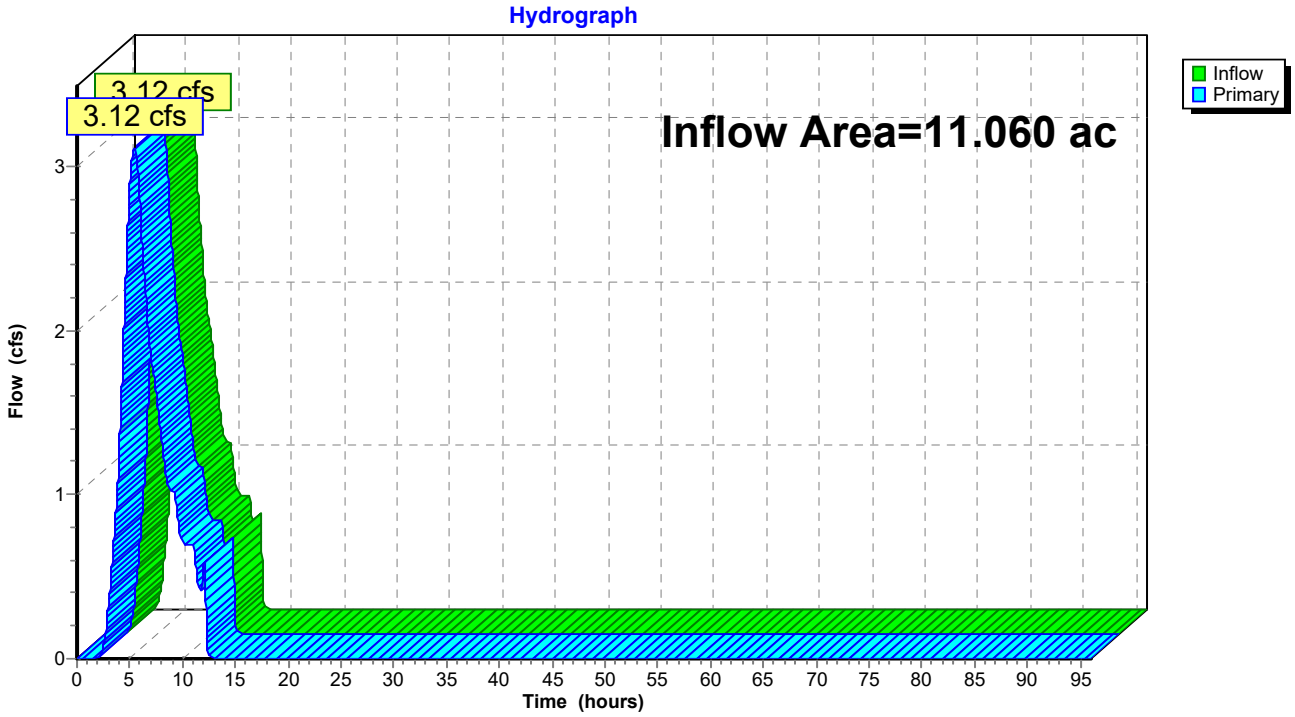


Summary for Link 7L: (new Link)

Inflow Area = 11.060 ac, 58.95% Impervious, Inflow Depth = 1.18" for 2-Year event
Inflow = 3.12 cfs @ 5.52 hrs, Volume= 1.086 af
Primary = 3.12 cfs @ 5.52 hrs, Volume= 1.086 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 7L: (new Link)



Summary for Subcatchment 1S: PreDeveloped Balanced Family Academy

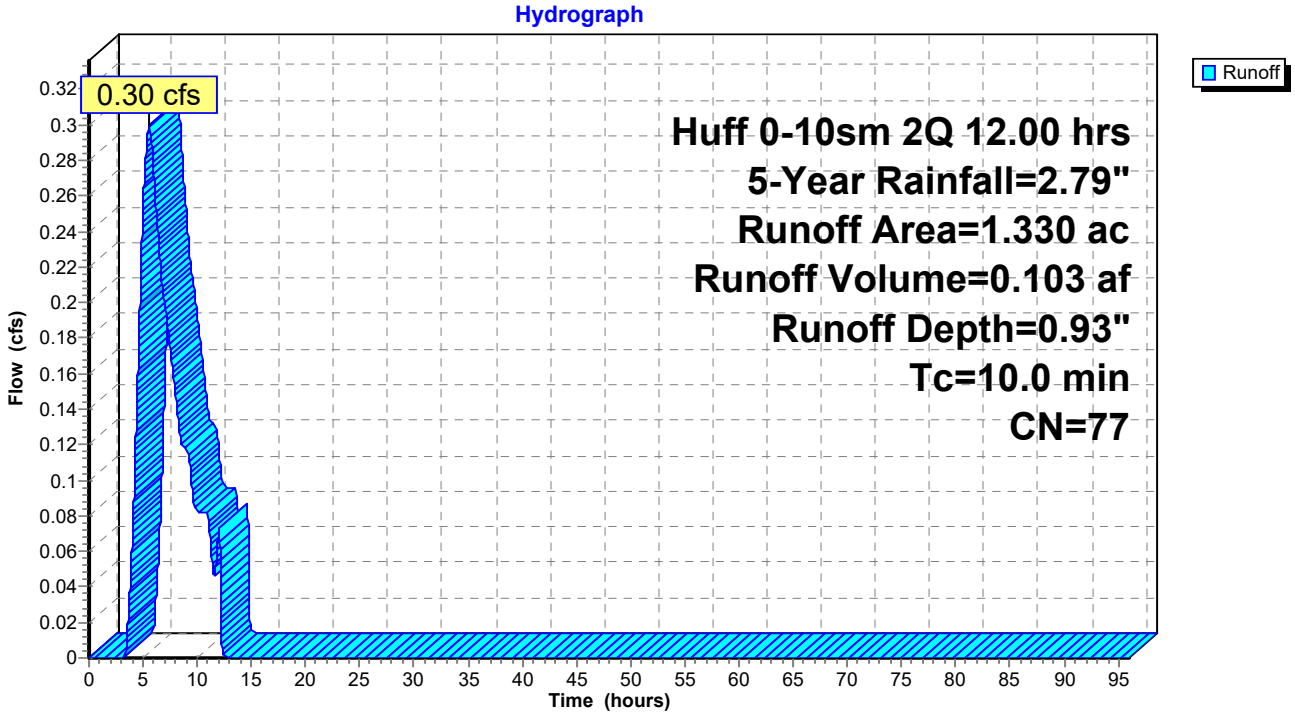
Runoff = 0.30 cfs @ 5.57 hrs, Volume= 0.103 af, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 5-Year Rainfall=2.79"

	Area (ac)	CN	Description
*	1.330	77	>75% Grass cover, Good, HSG C
	1.330		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Start Storm Pipe**

Subcatchment 1S: PreDeveloped Balanced Family Academy



Summary for Subcatchment 2S: Onsite Trib.

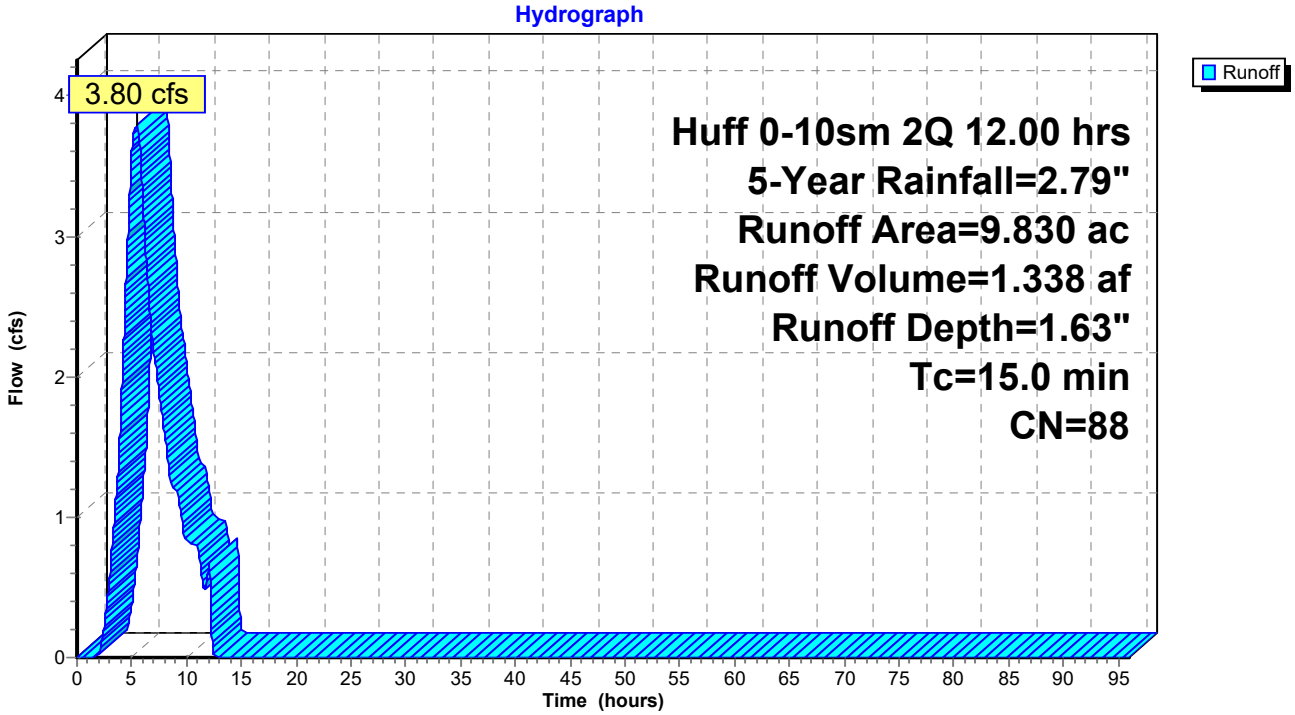
Runoff = 3.80 cfs @ 5.48 hrs, Volume= 1.338 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 5-Year Rainfall=2.79"

	Area (ac)	CN	Description
*	5.760	98	Paved parking, Roofs HSG C
	4.070	74	>75% Grass cover, Good, HSG C
	9.830	88	Weighted Average
	4.070		41.40% Pervious Area
	5.760		58.60% Impervious Area

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

Subcatchment 2S: Onsite Trib.



Summary for Subcatchment 4S: Developed Balanced Family Academy

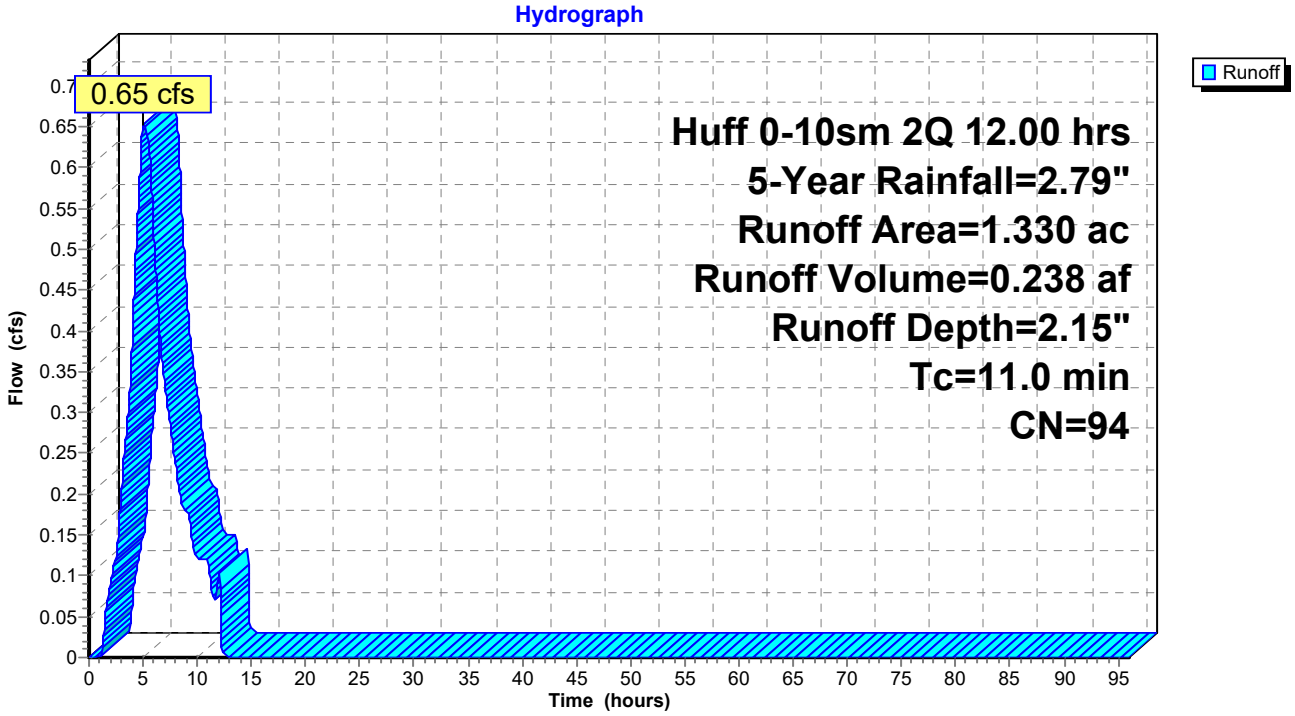
Runoff = 0.65 cfs @ 5.05 hrs, Volume= 0.238 af, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 5-Year Rainfall=2.79"

Area (ac)	CN	Description
1.330	94	Urban commercial, 85% imp, HSG C
0.200		15.00% Pervious Area
1.130		85.00% Impervious Area

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

Subcatchment 4S: Developed Balanced Family Academy



Summary for Subcatchment 6S: Offsite Trib.

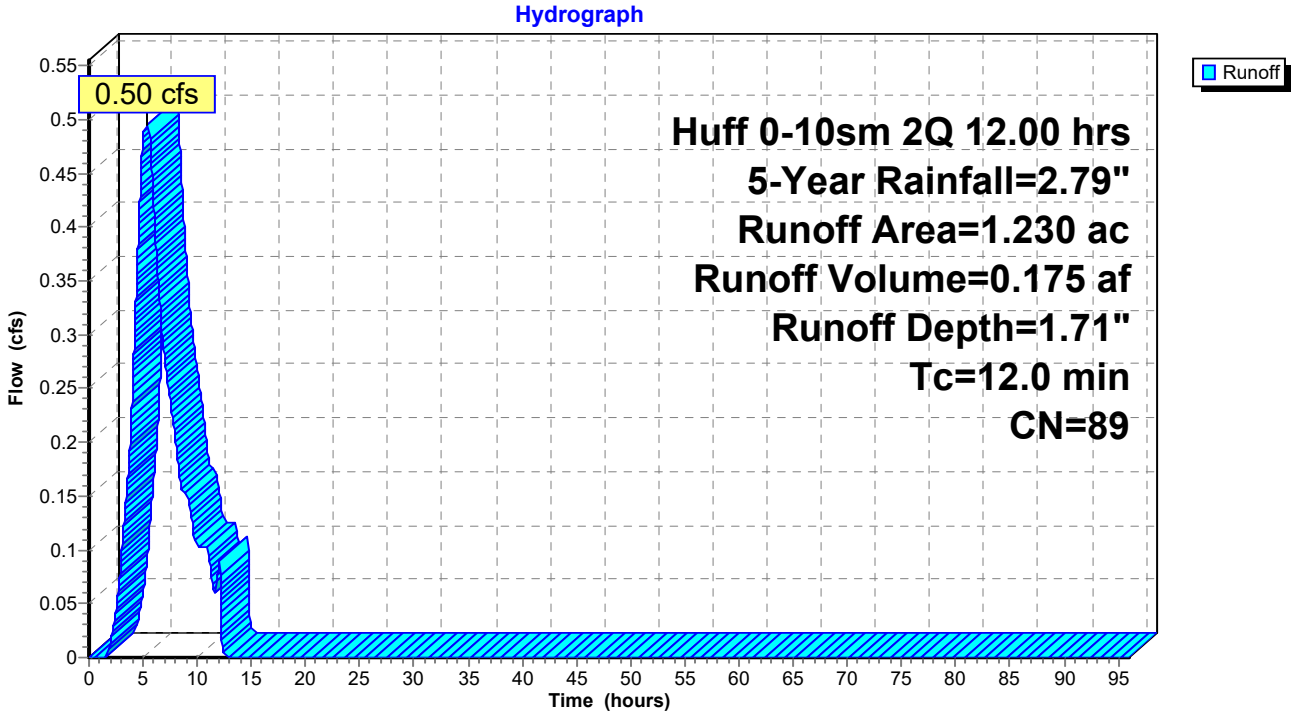
Runoff = 0.50 cfs @ 5.40 hrs, Volume= 0.175 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 5-Year Rainfall=2.79"

	Area (ac)	CN	Description
*	0.760	98	Paved parking, Roofs HSG C
	0.470	74	>75% Grass cover, Good, HSG C
	1.230	89	Weighted Average
	0.470		38.21% Pervious Area
	0.760		61.79% Impervious Area

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

Subcatchment 6S: Offsite Trib.



Summary for Pond 3P: Retention Pond

Inflow Area =	12.390 ac, 61.75% Impervious, Inflow Depth = 1.70" for 5-Year event				
Inflow =	4.93 cfs @	5.45 hrs,	Volume=	1.751 af	
Outflow =	2.43 cfs @	7.48 hrs,	Volume=	1.726 af,	Atten= 51%, Lag= 122.1 min
Primary =	2.43 cfs @	7.48 hrs,	Volume=	1.726 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 807.42' @ 7.48 hrs Surf.Area= 30,010 sf Storage= 40,028 cf

Plug-Flow detention time= 526.2 min calculated for 1.726 af (99% of inflow)
Center-of-Mass det. time= 521.5 min (911.8 - 390.3)

Volume	Invert	Avail.Storage	Storage Description
#1	806.00'	90,805 cf	**Pond (Prismatic)** Listed below (Recalc)
#2	804.00'	407 cf	**12.0" Round Pipe Storage** L= 518.0' S= 0.0050 '/'
		91,212 cf	Total Available Storage

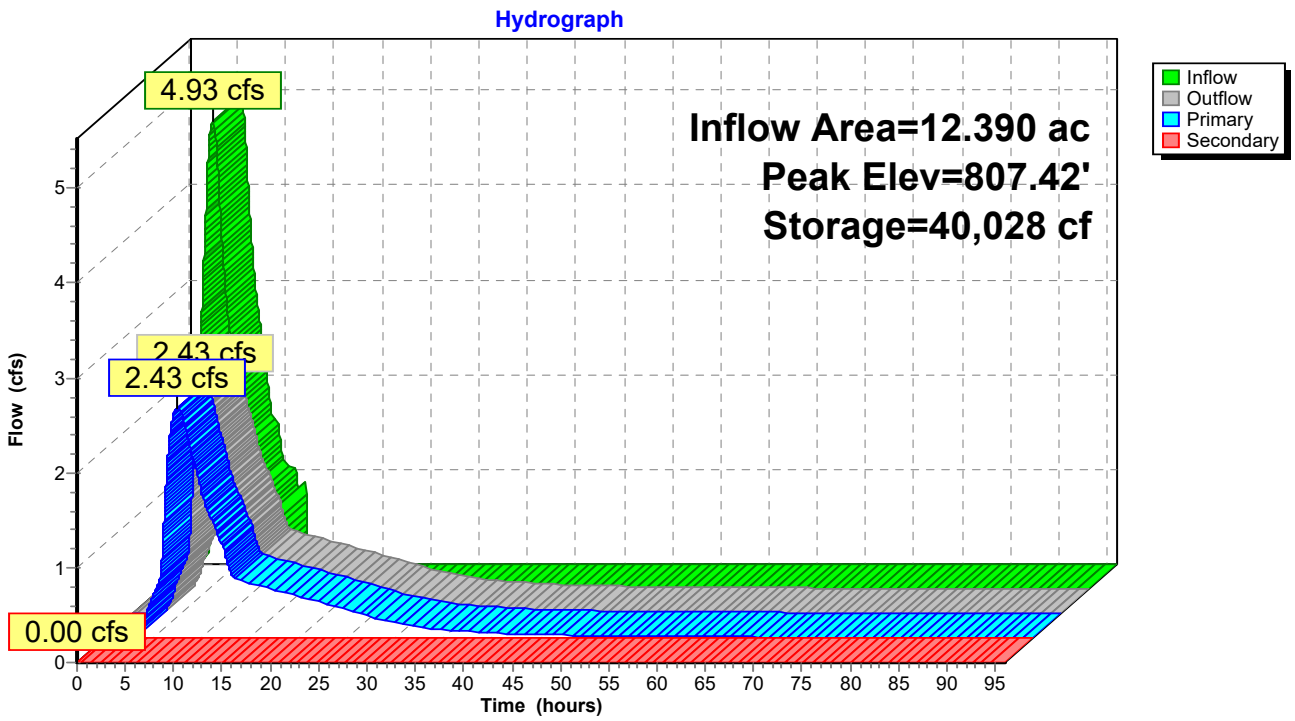
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
806.00	26,017	0	0
807.00	28,796	27,407	27,407
808.00	31,674	30,235	57,642
809.00	34,653	33,164	90,805

Device	Routing	Invert	Outlet Devices
#1	Primary	806.00'	**15.0" Round Culvert** L= 118.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 806.00' / 805.00' S= 0.0085 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	806.00'	**5.0" Vert. Orifice** C= 0.600
#3	Device 1	807.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	808.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

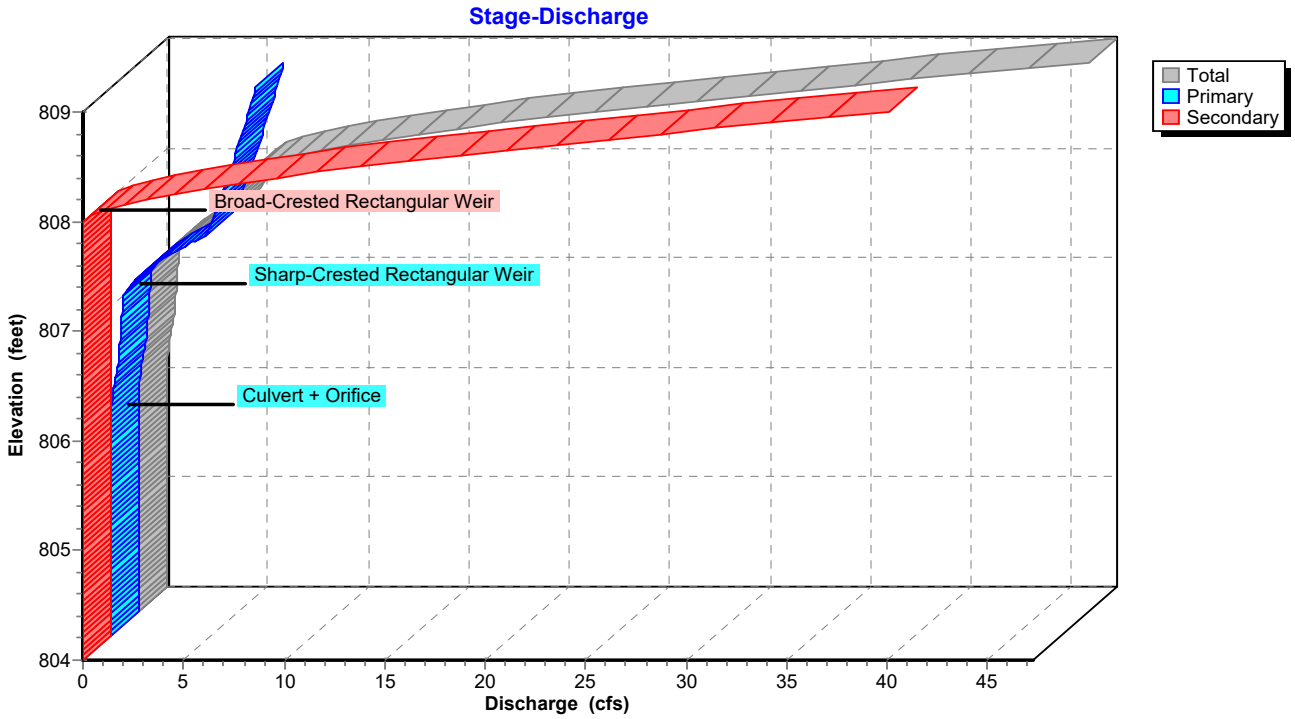
Primary OutFlow Max=2.42 cfs @ 7.48 hrs HW=807.42' (Free Discharge)
└─**1=Culvert** (Passes 2.42 cfs of 4.15 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.72 cfs @ 5.29 fps)
  └─**3=Sharp-Crested Rectangular Weir** (Weir Controls 1.70 cfs @ 1.84 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=804.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

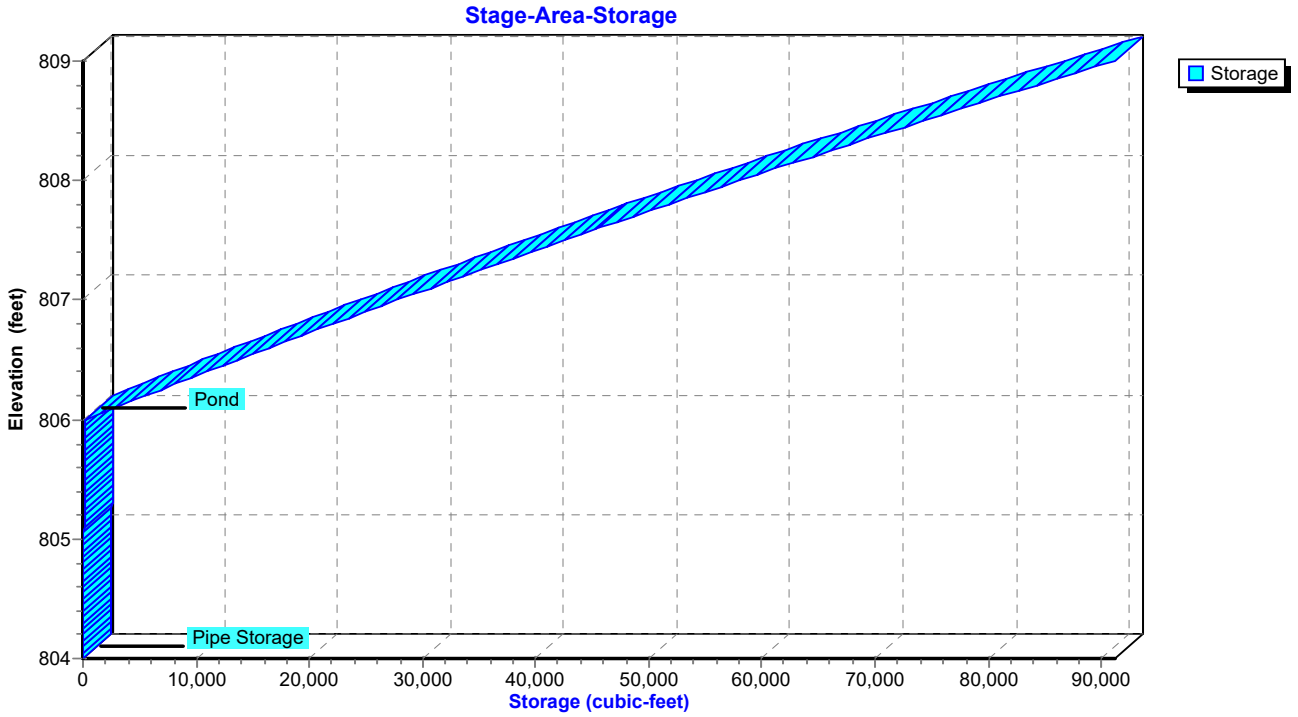
Pond 3P: Retention Pond



Pond 3P: Retention Pond



Pond 3P: Retention Pond

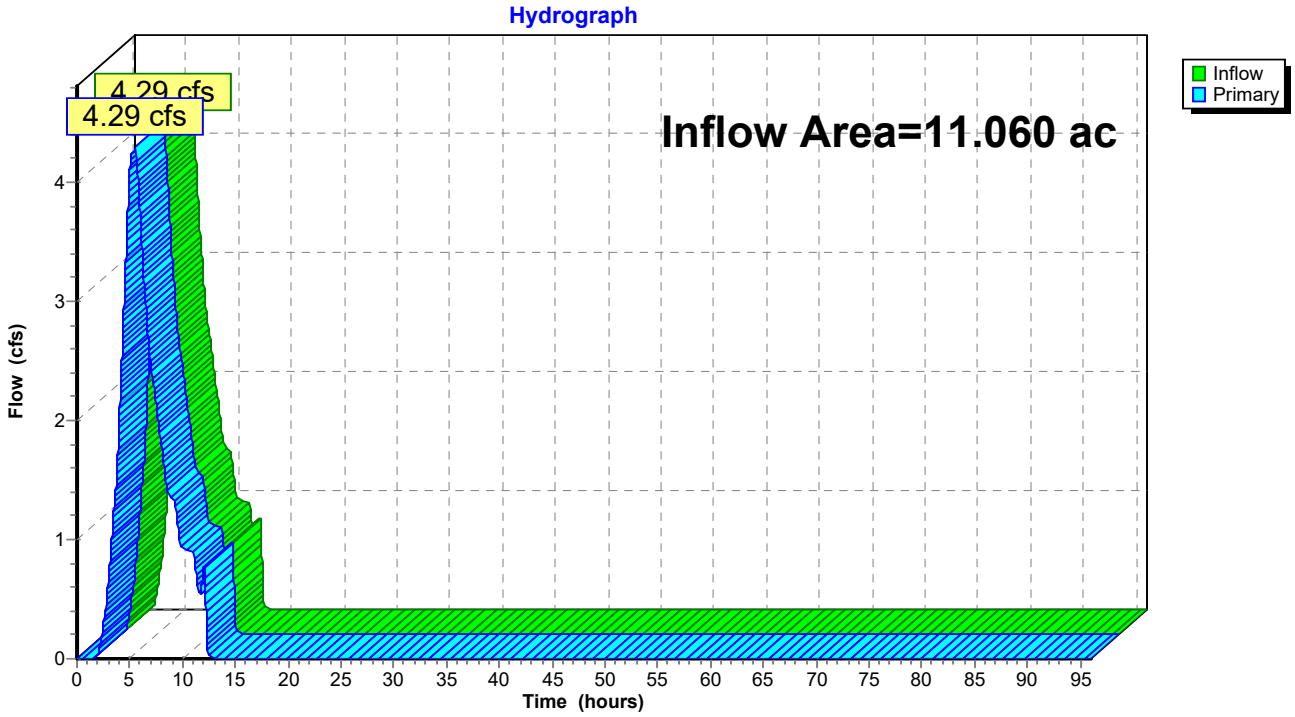


Summary for Link 7L: (new Link)

Inflow Area = 11.060 ac, 58.95% Impervious, Inflow Depth = 1.64" for 5-Year event
Inflow = 4.29 cfs @ 5.45 hrs, Volume= 1.513 af
Primary = 4.29 cfs @ 5.45 hrs, Volume= 1.513 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 7L: (new Link)



Summary for Subcatchment 1S: PreDeveloped Balanced Family Academy

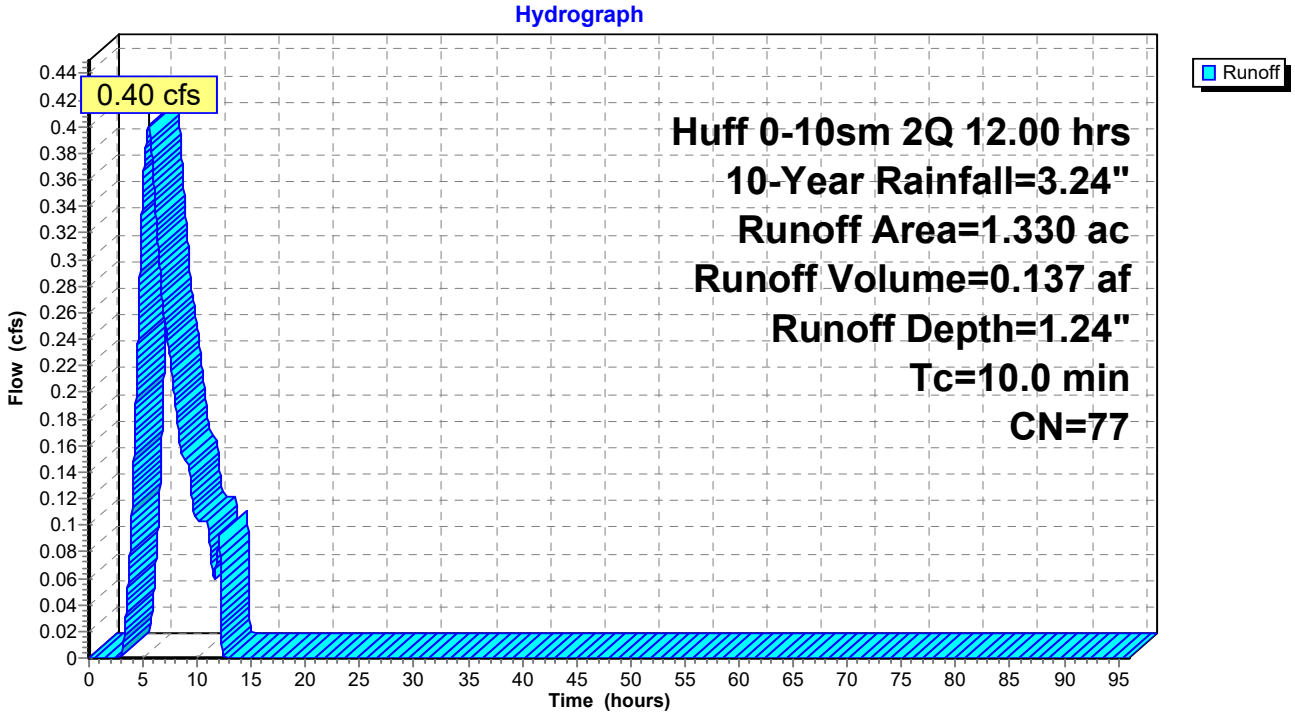
Runoff = 0.40 cfs @ 5.52 hrs, Volume= 0.137 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 10-Year Rainfall=3.24"

	Area (ac)	CN	Description
*	1.330	77	>75% Grass cover, Good, HSG C
	1.330		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Start Storm Pipe**

Subcatchment 1S: PreDeveloped Balanced Family Academy



Summary for Subcatchment 2S: Onsite Trib.

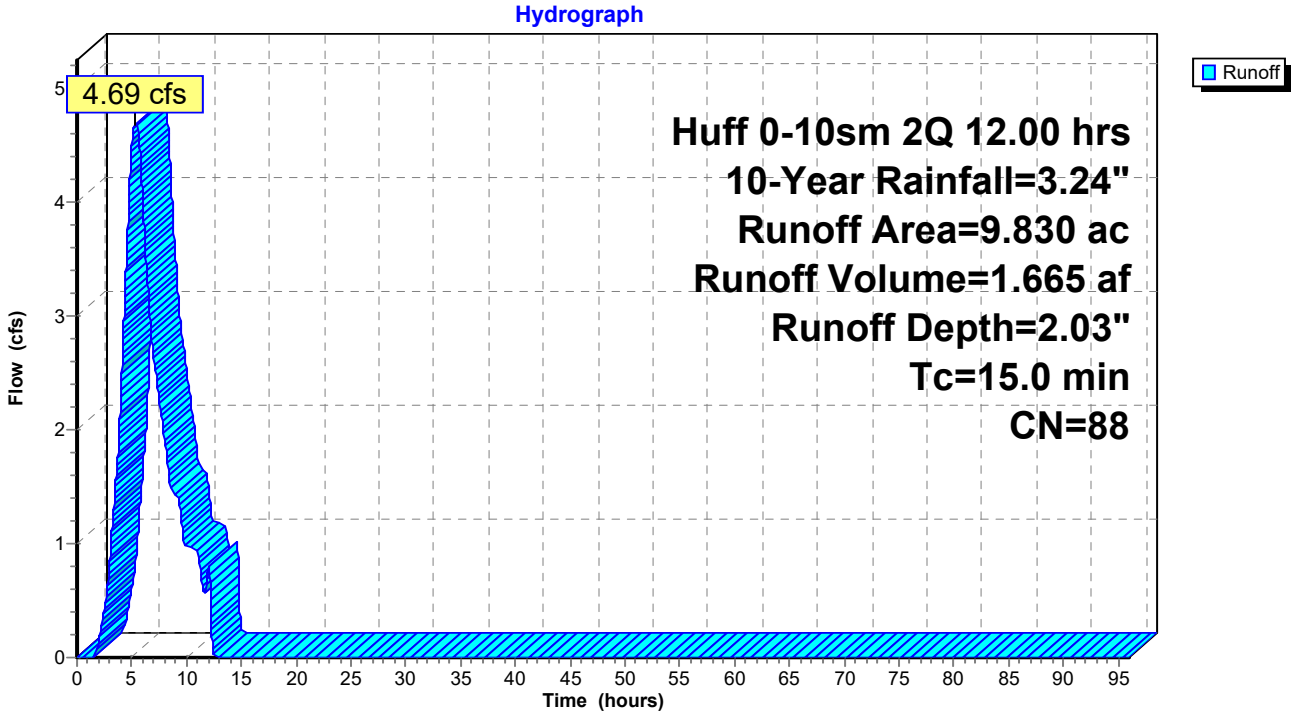
Runoff = 4.69 cfs @ 5.38 hrs, Volume= 1.665 af, Depth= 2.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 10-Year Rainfall=3.24"

	Area (ac)	CN	Description
*	5.760	98	Paved parking, Roofs HSG C
	4.070	74	>75% Grass cover, Good, HSG C
	9.830	88	Weighted Average
	4.070		41.40% Pervious Area
	5.760		58.60% Impervious Area

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

Subcatchment 2S: Onsite Trib.



Summary for Subcatchment 4S: Developed Balanced Family Academy

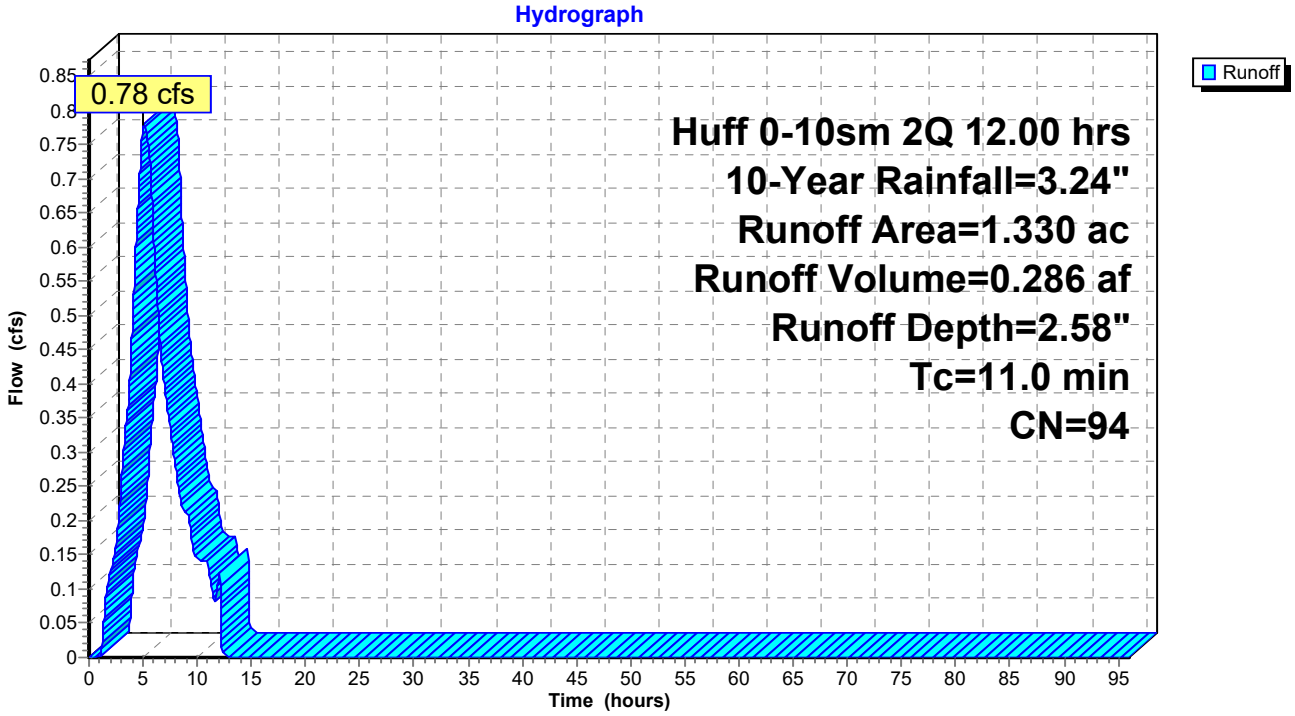
Runoff = 0.78 cfs @ 5.05 hrs, Volume= 0.286 af, Depth= 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 10-Year Rainfall=3.24"

Area (ac)	CN	Description
1.330	94	Urban commercial, 85% imp, HSG C
0.200		15.00% Pervious Area
1.130		85.00% Impervious Area

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

Subcatchment 4S: Developed Balanced Family Academy



Summary for Subcatchment 6S: Offsite Trib.

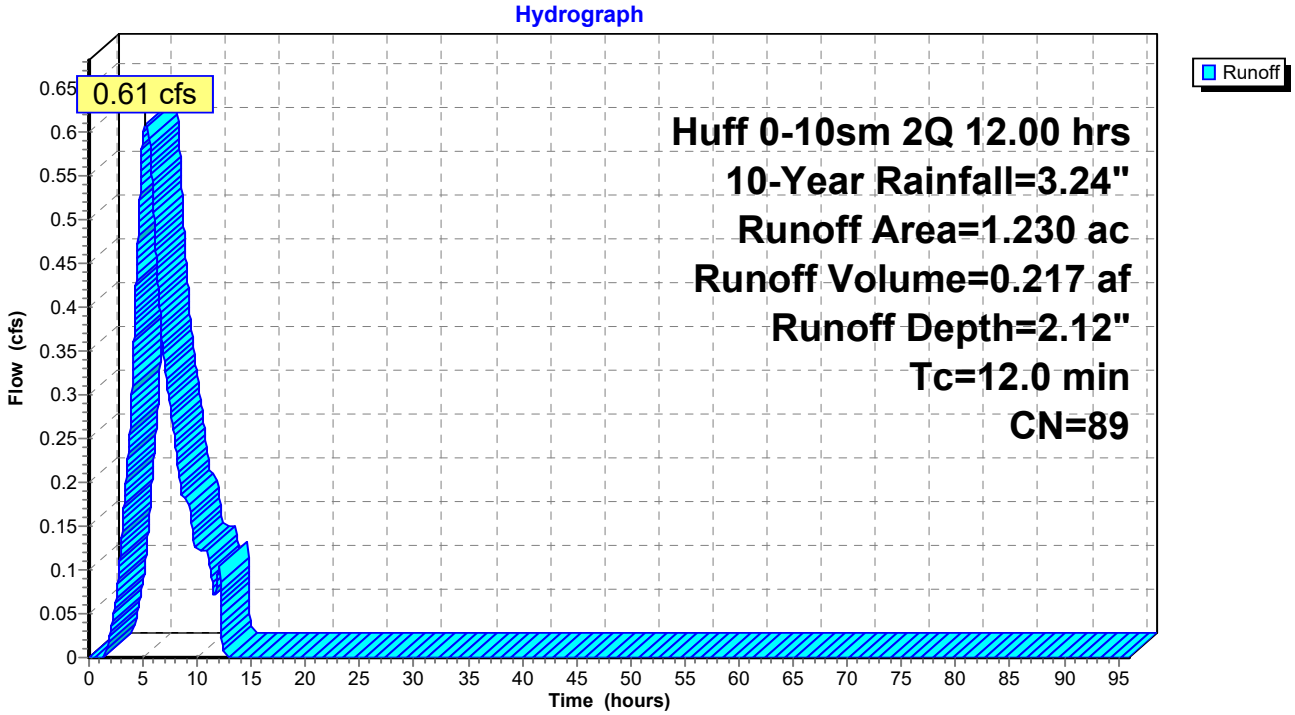
Runoff = 0.61 cfs @ 5.24 hrs, Volume= 0.217 af, Depth= 2.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 10-Year Rainfall=3.24"

	Area (ac)	CN	Description
*	0.760	98	Paved parking, Roofs HSG C
	0.470	74	>75% Grass cover, Good, HSG C
	1.230	89	Weighted Average
	0.470		38.21% Pervious Area
	0.760		61.79% Impervious Area

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

Subcatchment 6S: Offsite Trib.



Summary for Pond 3P: Retention Pond

Inflow Area =	12.390 ac, 61.75% Impervious, Inflow Depth = 2.10" for 10-Year event				
Inflow =	6.06 cfs @	5.32 hrs,	Volume=	2.169 af	
Outflow =	3.58 cfs @	6.80 hrs,	Volume=	2.144 af,	Atten= 41%, Lag= 88.7 min
Primary =	3.58 cfs @	6.80 hrs,	Volume=	2.144 af	
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 807.54' @ 6.80 hrs Surf.Area= 30,366 sf Storage= 43,925 cf

Plug-Flow detention time= 447.0 min calculated for 2.144 af (99% of inflow)
Center-of-Mass det. time= 443.1 min (828.1 - 385.1)

Volume	Invert	Avail.Storage	Storage Description
#1	806.00'	90,805 cf	**Pond (Prismatic)** Listed below (Recalc)
#2	804.00'	407 cf	**12.0" Round Pipe Storage** L= 518.0' S= 0.0050 '/'
		91,212 cf	Total Available Storage

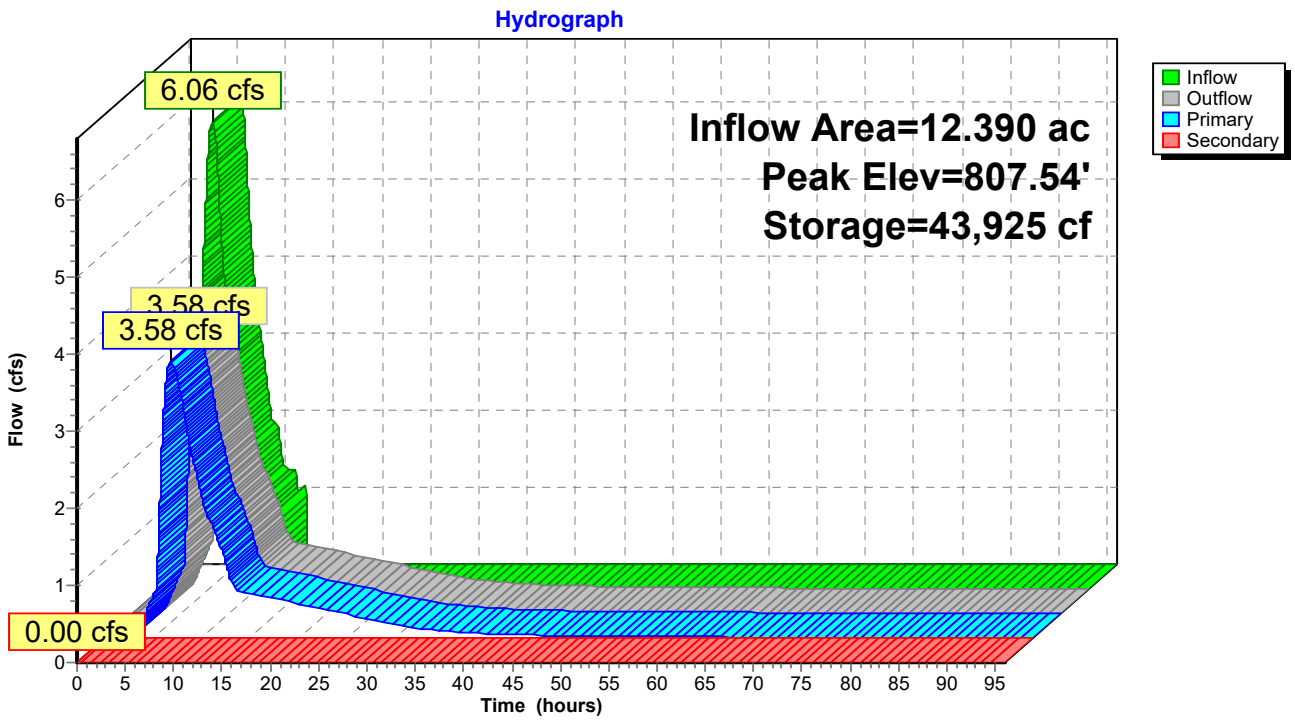
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
806.00	26,017	0	0
807.00	28,796	27,407	27,407
808.00	31,674	30,235	57,642
809.00	34,653	33,164	90,805

Device	Routing	Invert	Outlet Devices
#1	Primary	806.00'	**15.0" Round Culvert** L= 118.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 806.00' / 805.00' S= 0.0085 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	806.00'	**5.0" Vert. Orifice** C= 0.600
#3	Device 1	807.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	808.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

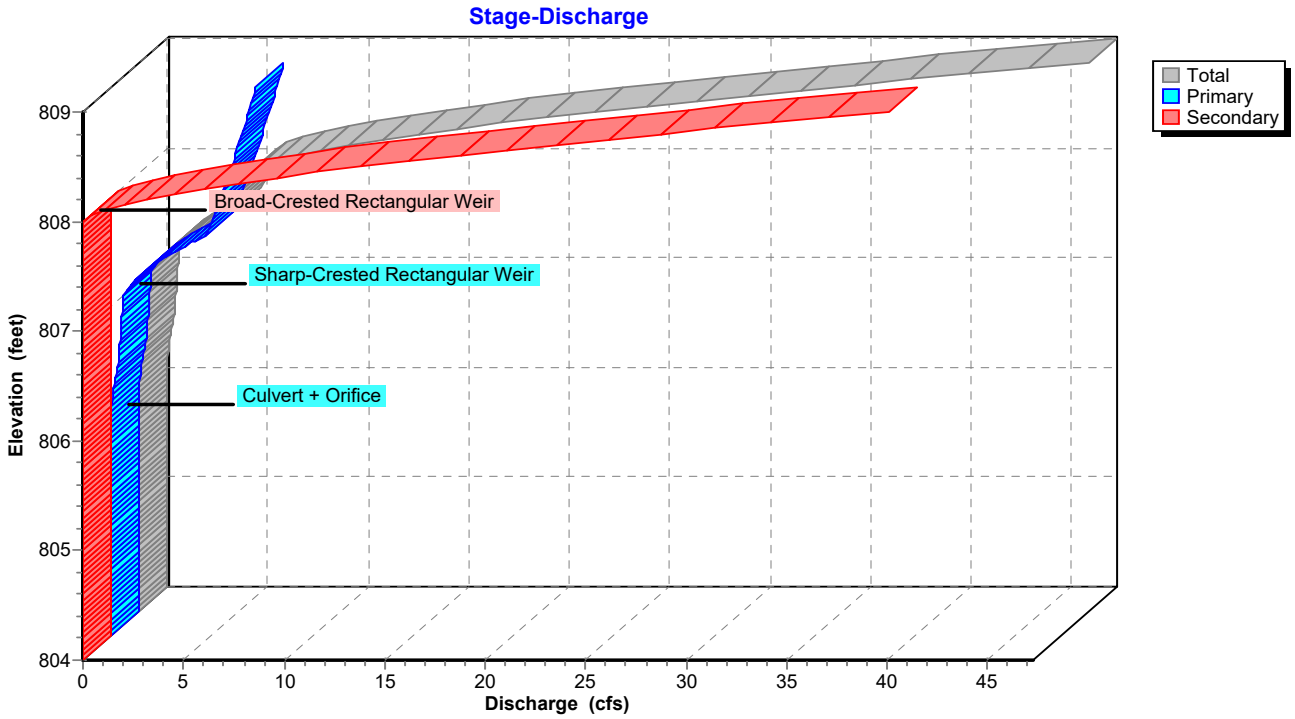
Primary OutFlow Max=3.58 cfs @ 6.80 hrs HW=807.54' (Free Discharge)
└─**1=Culvert** (Passes 3.58 cfs of 4.47 cfs potential flow)
  ├─**2=Orifice** (Orifice Controls 0.76 cfs @ 5.57 fps)
  └─**3=Sharp-Crested Rectangular Weir** (Weir Controls 2.82 cfs @ 2.18 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=804.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

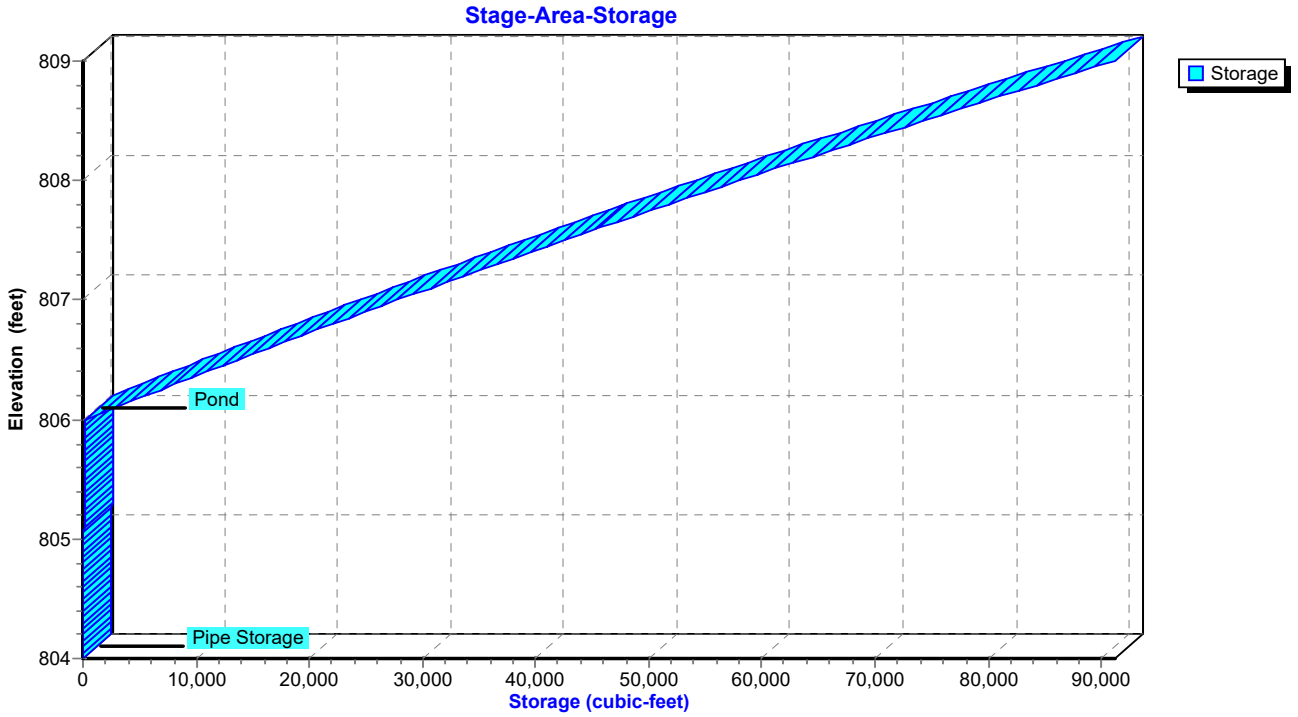
Pond 3P: Retention Pond



Pond 3P: Retention Pond



Pond 3P: Retention Pond

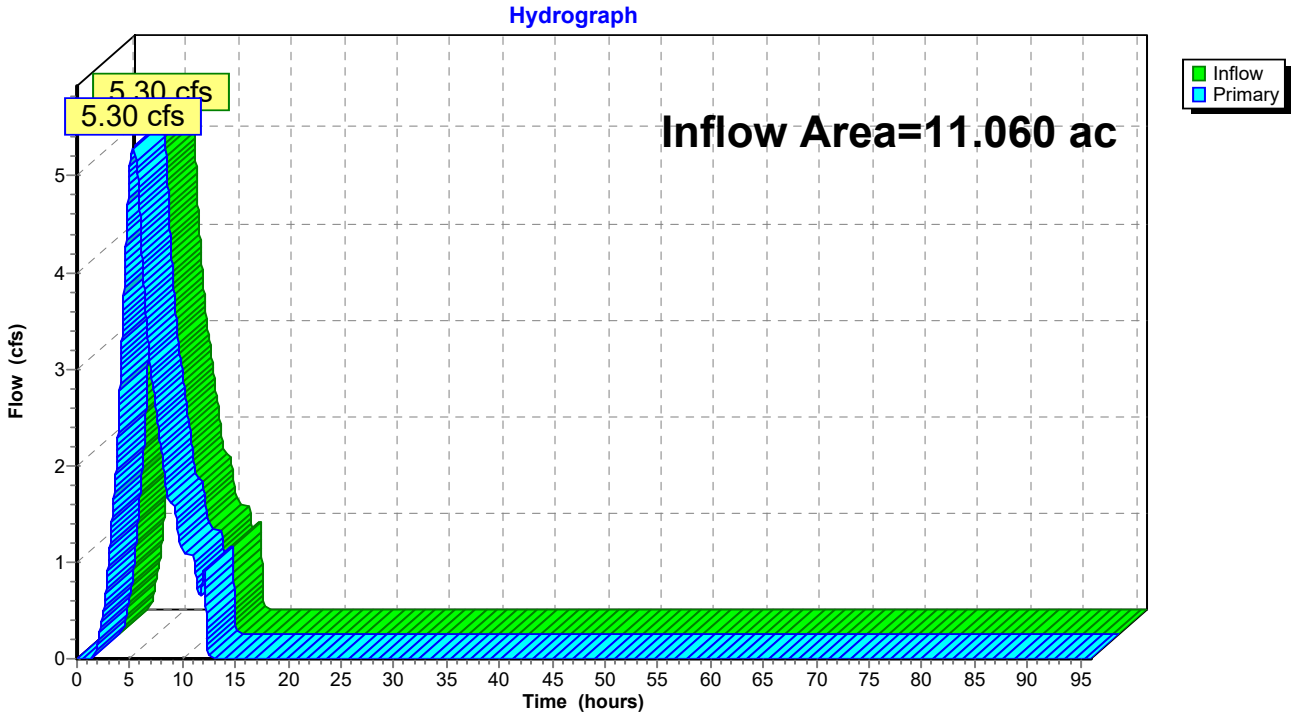


Summary for Link 7L: (new Link)

Inflow Area = 11.060 ac, 58.95% Impervious, Inflow Depth = 2.04" for 10-Year event
Inflow = 5.30 cfs @ 5.35 hrs, Volume= 1.882 af
Primary = 5.30 cfs @ 5.35 hrs, Volume= 1.882 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 7L: (new Link)



Summary for Subcatchment 1S: PreDeveloped Balanced Family Academy

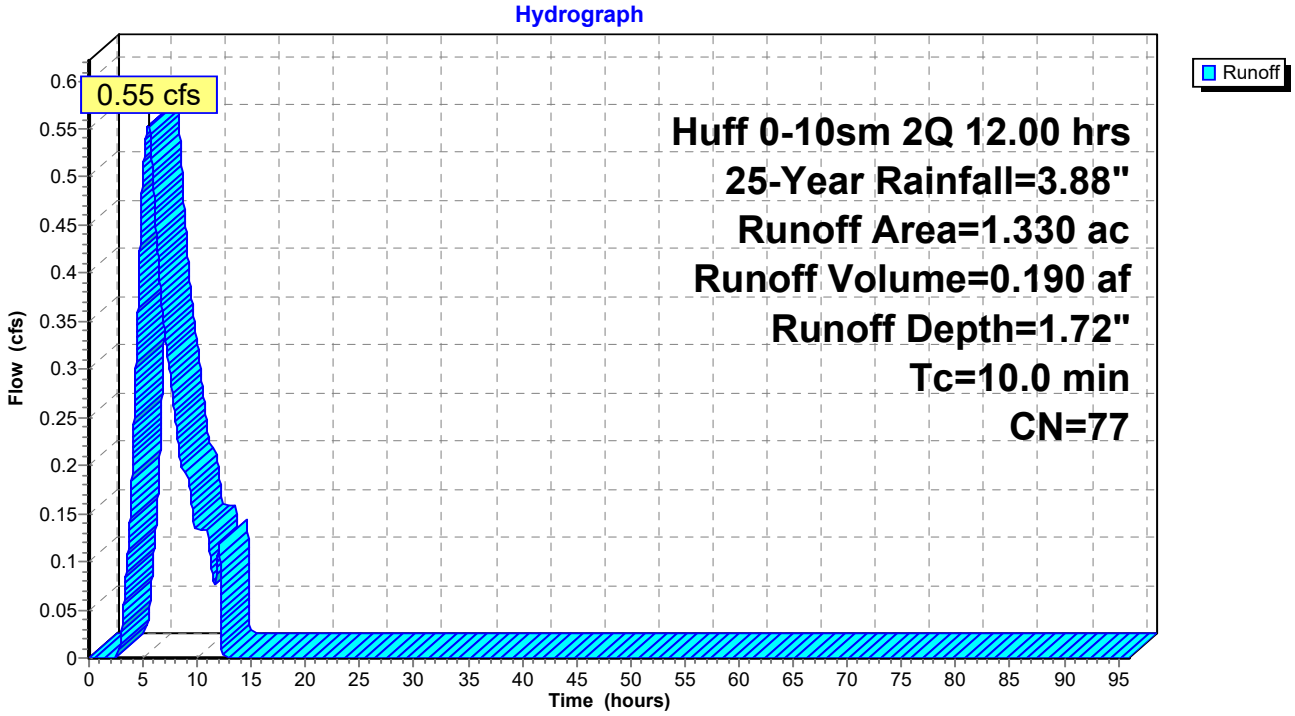
Runoff = 0.55 cfs @ 5.50 hrs, Volume= 0.190 af, Depth= 1.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 25-Year Rainfall=3.88"

	Area (ac)	CN	Description
*	1.330	77	>75% Grass cover, Good, HSG C
	1.330		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Start Storm Pipe**

Subcatchment 1S: PreDeveloped Balanced Family Academy



Summary for Subcatchment 2S: Onsite Trib.

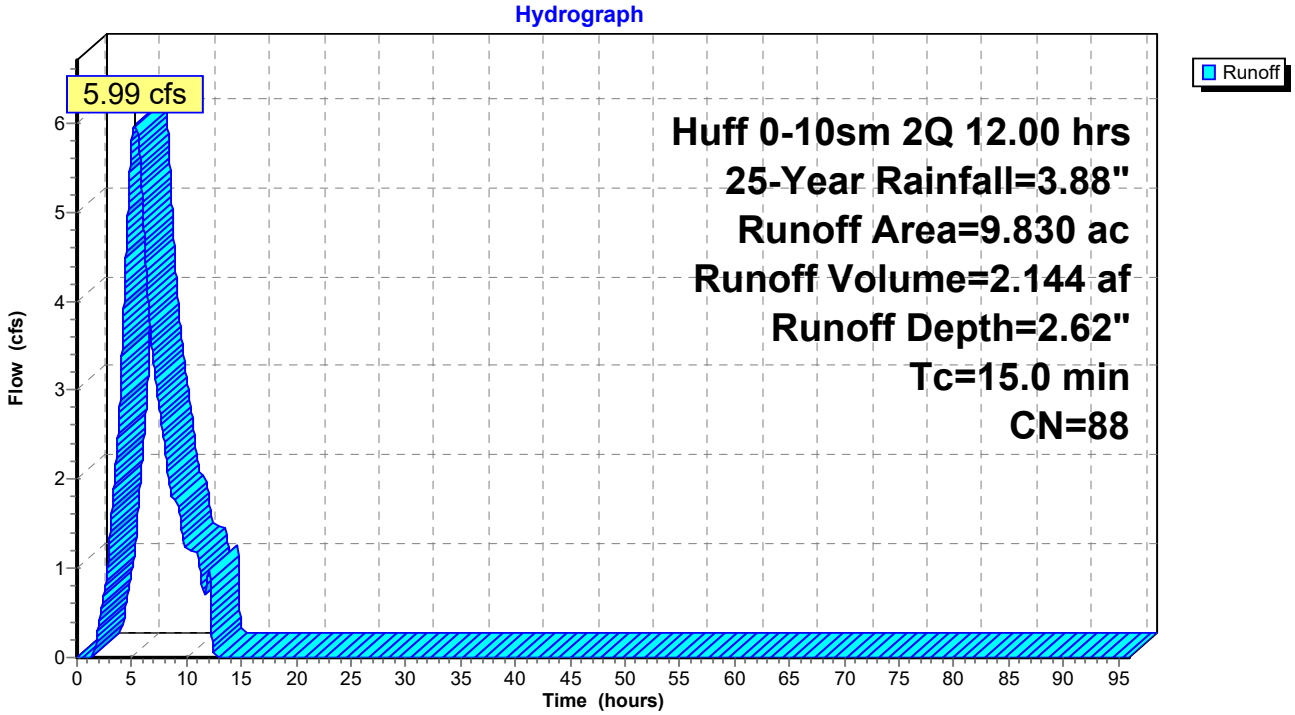
Runoff = 5.99 cfs @ 5.25 hrs, Volume= 2.144 af, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 25-Year Rainfall=3.88"

	Area (ac)	CN	Description
*	5.760	98	Paved parking, Roofs HSG C
	4.070	74	>75% Grass cover, Good, HSG C
	9.830	88	Weighted Average
	4.070		41.40% Pervious Area
	5.760		58.60% Impervious Area

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

Subcatchment 2S: Onsite Trib.



Summary for Subcatchment 4S: Developed Balanced Family Academy

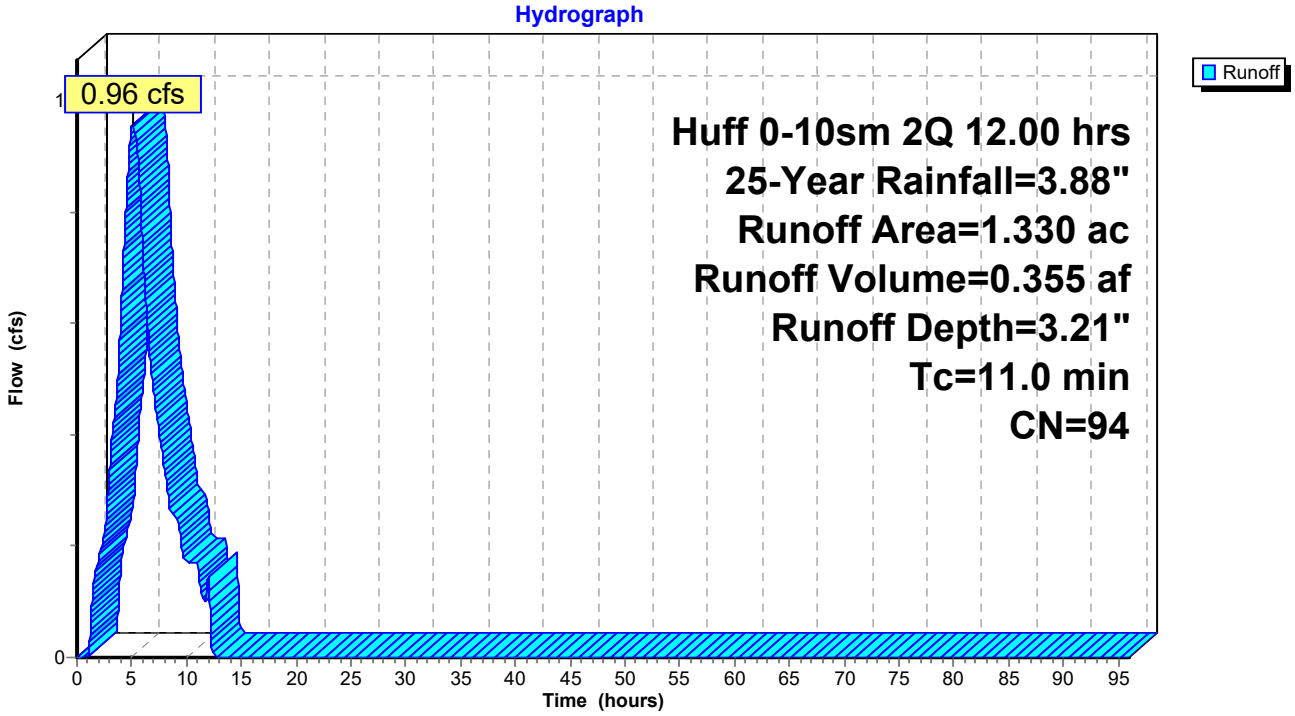
Runoff = 0.96 cfs @ 5.02 hrs, Volume= 0.355 af, Depth= 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 25-Year Rainfall=3.88"

Area (ac)	CN	Description
1.330	94	Urban commercial, 85% imp, HSG C
0.200		15.00% Pervious Area
1.130		85.00% Impervious Area

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

Subcatchment 4S: Developed Balanced Family Academy



Summary for Subcatchment 6S: Offsite Trib.

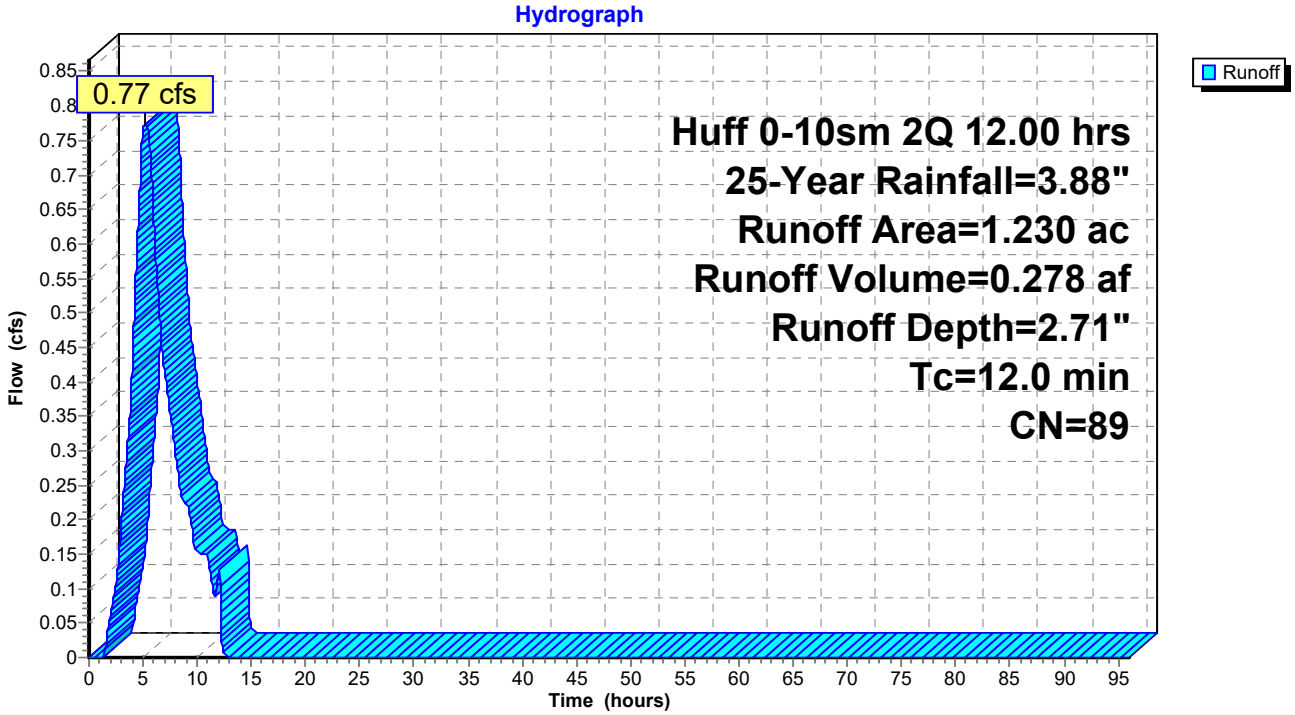
Runoff = 0.77 cfs @ 5.16 hrs, Volume= 0.278 af, Depth= 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 25-Year Rainfall=3.88"

	Area (ac)	CN	Description
*	0.760	98	Paved parking, Roofs HSG C
	0.470	74	>75% Grass cover, Good, HSG C
	1.230	89	Weighted Average
	0.470		38.21% Pervious Area
	0.760		61.79% Impervious Area

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

Subcatchment 6S: Offsite Trib.



Summary for Pond 3P: Retention Pond

Inflow Area =	12.390 ac, 61.75% Impervious, Inflow Depth = 2.69" for 25-Year event				
Inflow =	7.70 cfs @	5.22 hrs, Volume=	2.778 af		
Outflow =	4.94 cfs @	6.57 hrs, Volume=	2.753 af, Atten= 36%, Lag= 81.1 min		
Primary =	4.94 cfs @	6.57 hrs, Volume=	2.753 af		
Secondary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af		

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 807.75' @ 6.57 hrs Surf.Area= 30,942 sf Storage= 50,090 cf

Plug-Flow detention time= 371.3 min calculated for 2.753 af (99% of inflow)
Center-of-Mass det. time= 368.2 min (747.4 - 379.2)

Volume	Invert	Avail.Storage	Storage Description
#1	806.00'	90,805 cf	**Pond (Prismatic)** Listed below (Recalc)
#2	804.00'	407 cf	**12.0" Round Pipe Storage** L= 518.0' S= 0.0050 '/'
		91,212 cf	Total Available Storage

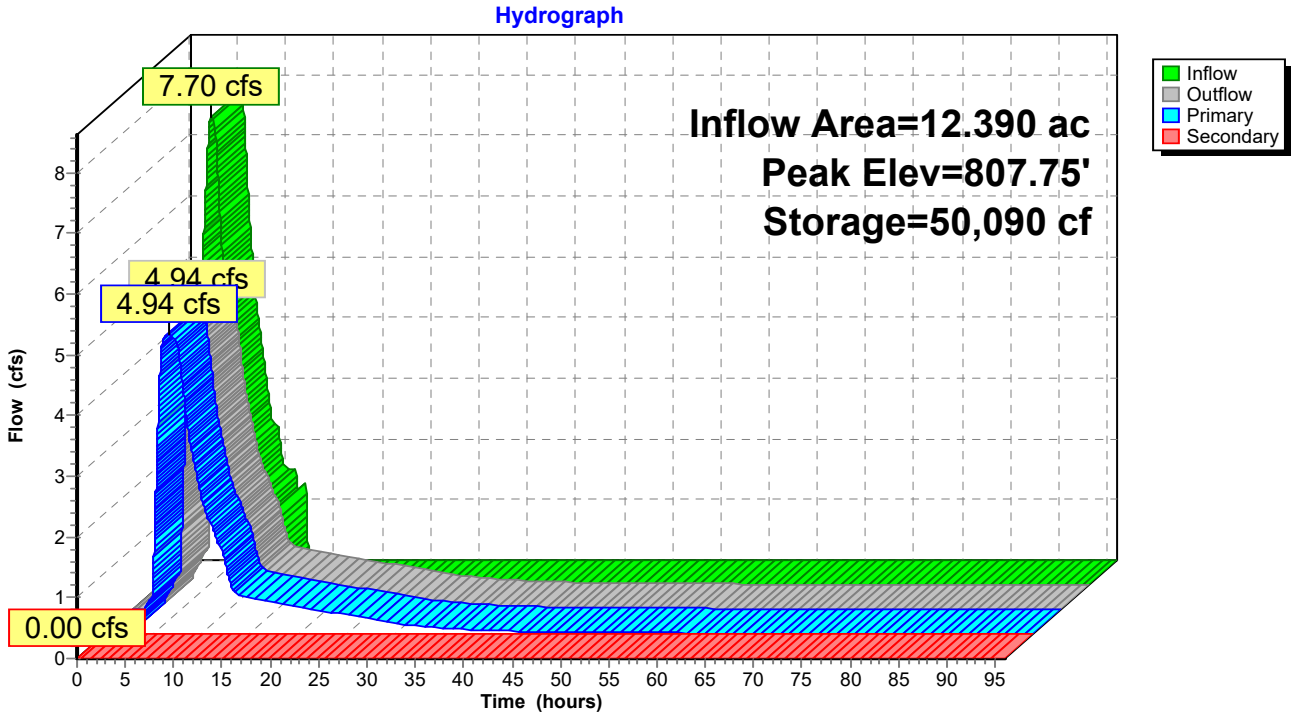
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
806.00	26,017	0	0
807.00	28,796	27,407	27,407
808.00	31,674	30,235	57,642
809.00	34,653	33,164	90,805

Device	Routing	Invert	Outlet Devices
#1	Primary	806.00'	**15.0" Round Culvert** L= 118.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 806.00' / 805.00' S= 0.0085 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	806.00'	**5.0" Vert. Orifice** C= 0.600
#3	Device 1	807.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	808.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

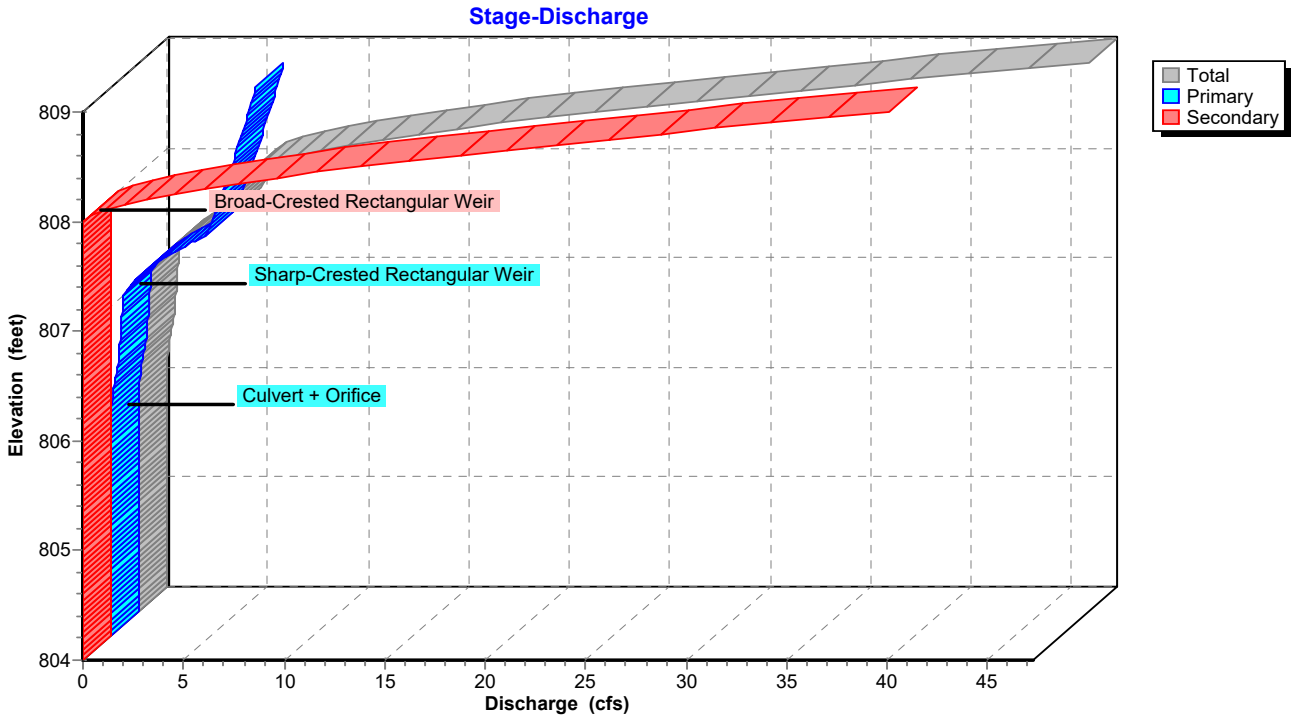
Primary OutFlow Max=4.94 cfs @ 6.57 hrs HW=807.75' (Free Discharge)
└─**1=Culvert** (Inlet Controls 4.94 cfs @ 4.02 fps)
  ├─**2=Orifice** (Passes < 0.81 cfs potential flow)
  └─**3=Sharp-Crested Rectangular Weir** (Passes < 4.87 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=804.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

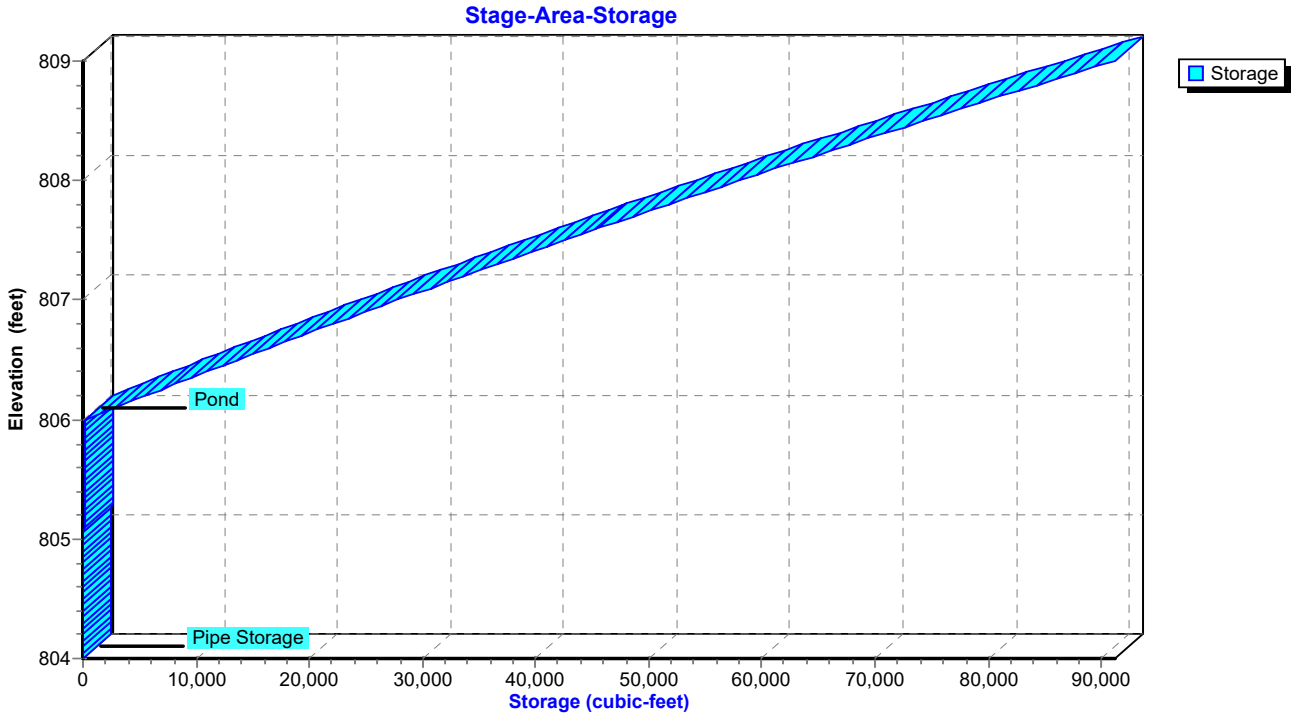
Pond 3P: Retention Pond



Pond 3P: Retention Pond



Pond 3P: Retention Pond

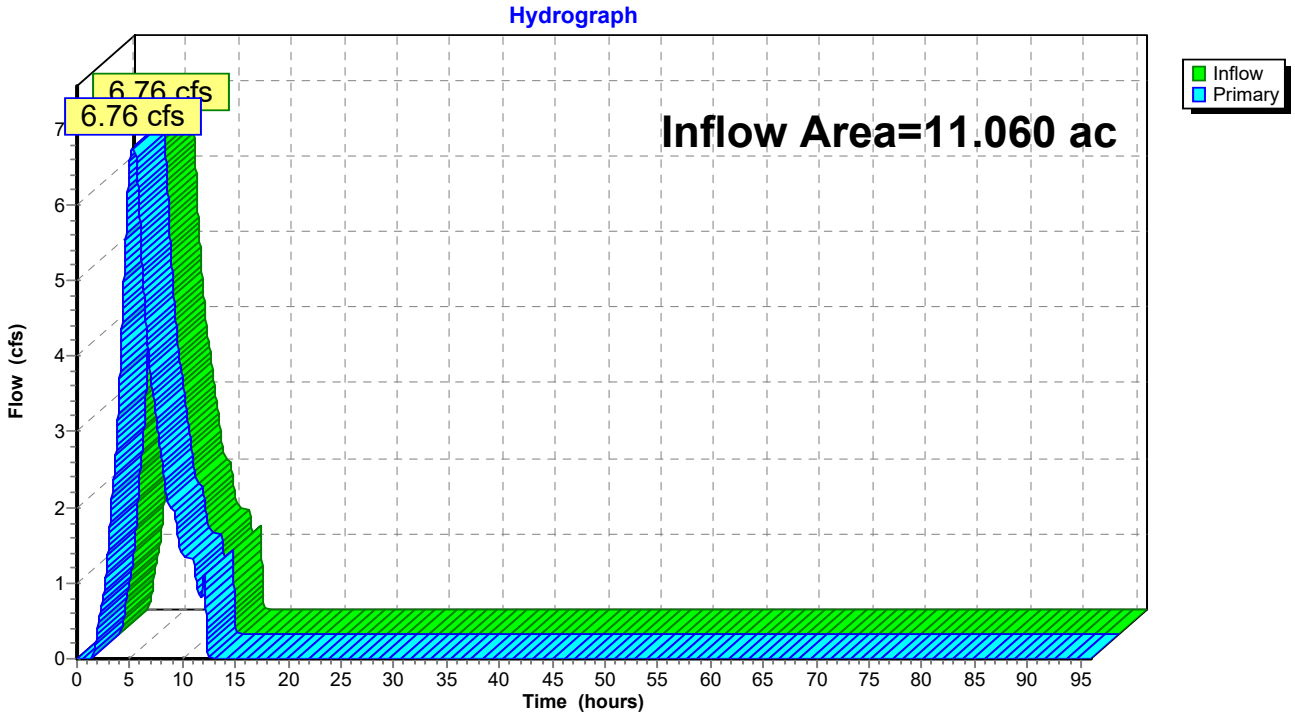


Summary for Link 7L: (new Link)

Inflow Area = 11.060 ac, 58.95% Impervious, Inflow Depth = 2.63" for 25-Year event
Inflow = 6.76 cfs @ 5.25 hrs, Volume= 2.422 af
Primary = 6.76 cfs @ 5.25 hrs, Volume= 2.422 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 7L: (new Link)



Summary for Subcatchment 1S: PreDeveloped Balanced Family Academy

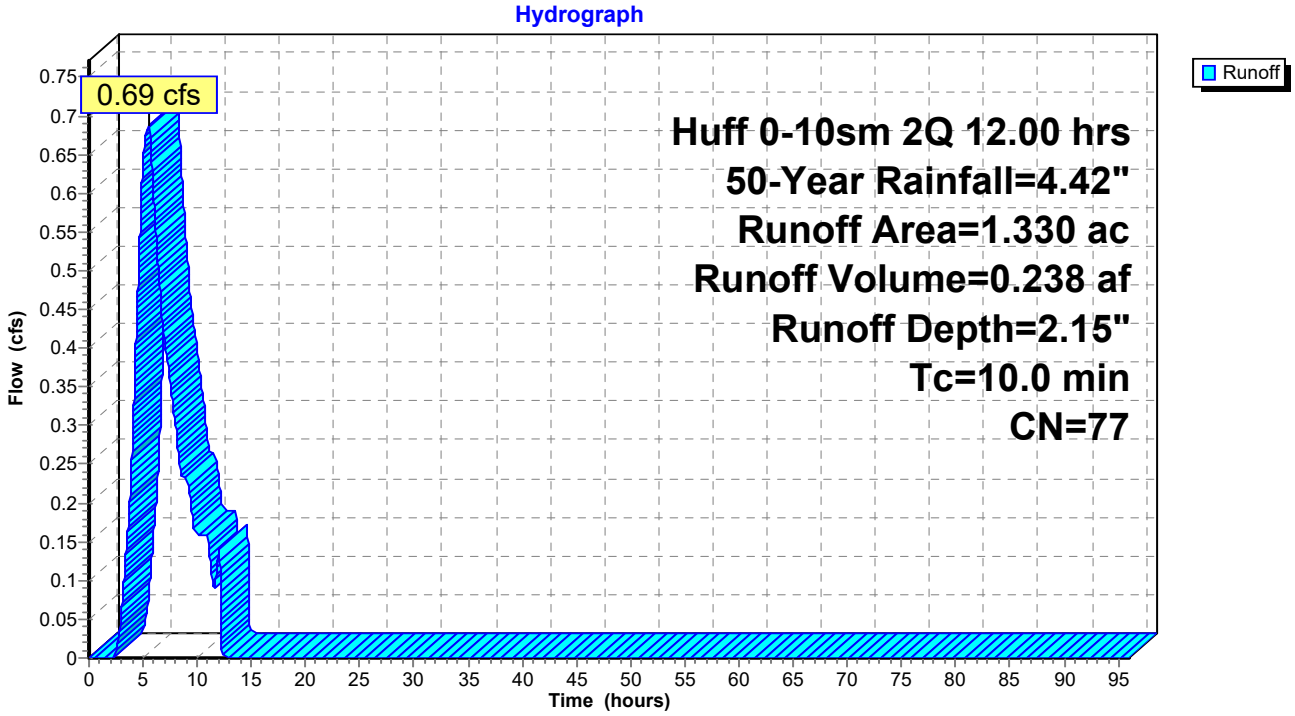
Runoff = 0.69 cfs @ 5.50 hrs, Volume= 0.238 af, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 50-Year Rainfall=4.42"

	Area (ac)	CN	Description
*	1.330	77	>75% Grass cover, Good, HSG C
	1.330		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Start Storm Pipe**

Subcatchment 1S: PreDeveloped Balanced Family Academy



Summary for Subcatchment 2S: Onsite Trib.

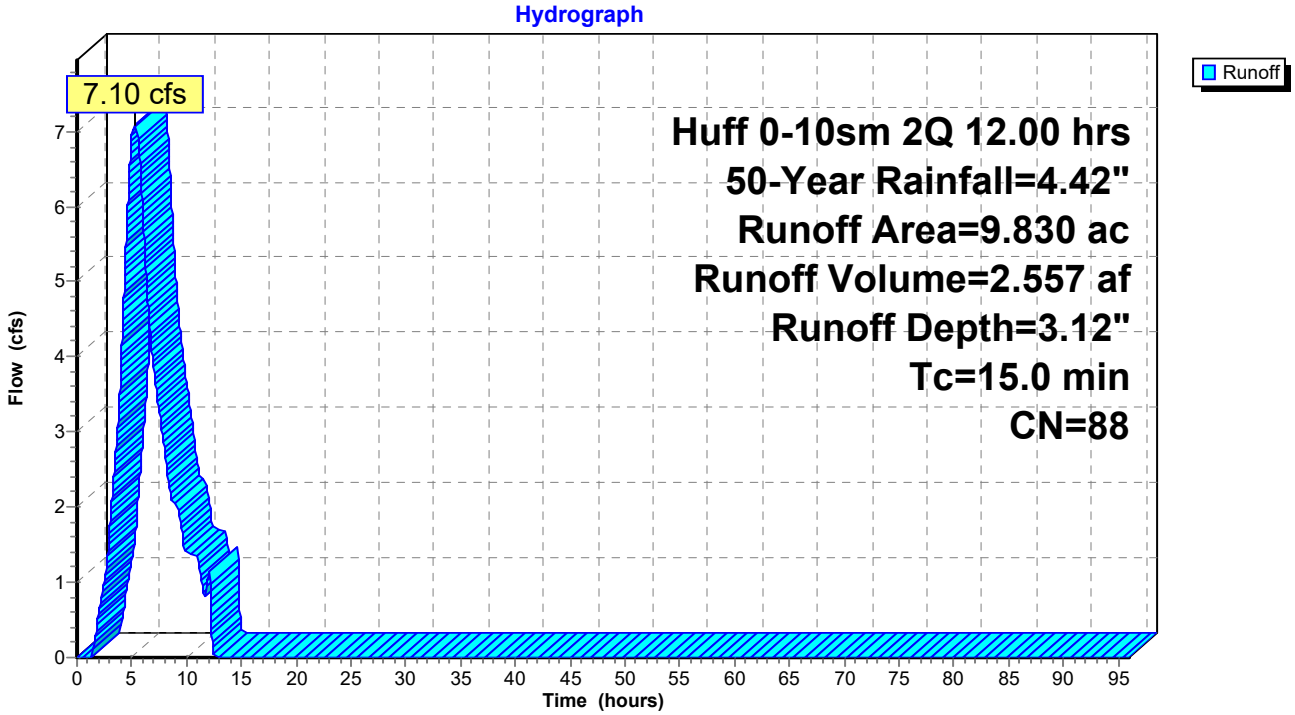
Runoff = 7.10 cfs @ 5.22 hrs, Volume= 2.557 af, Depth= 3.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 50-Year Rainfall=4.42"

	Area (ac)	CN	Description
*	5.760	98	Paved parking, Roofs HSG C
	4.070	74	>75% Grass cover, Good, HSG C
	9.830	88	Weighted Average
	4.070		41.40% Pervious Area
	5.760		58.60% Impervious Area

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

Subcatchment 2S: Onsite Trib.



Summary for Subcatchment 4S: Developed Balanced Family Academy

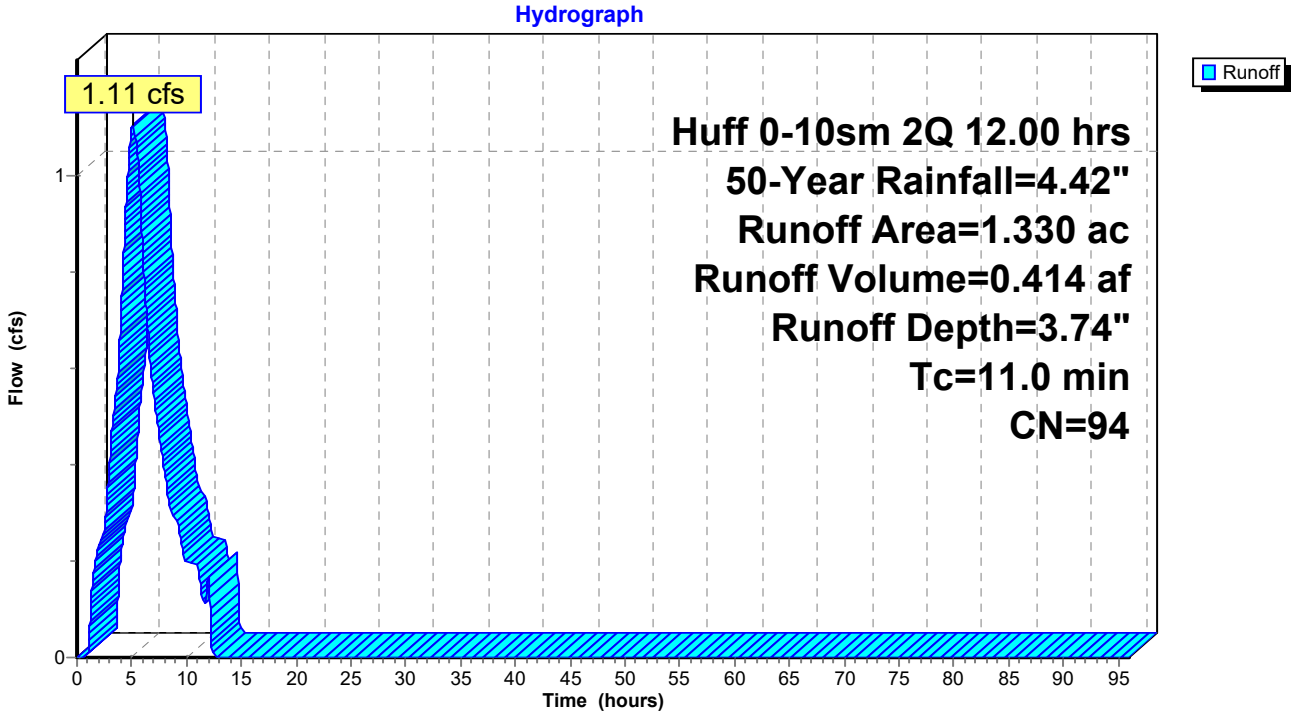
Runoff = 1.11 cfs @ 5.02 hrs, Volume= 0.414 af, Depth= 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 50-Year Rainfall=4.42"

Area (ac)	CN	Description
1.330	94	Urban commercial, 85% imp, HSG C
0.200		15.00% Pervious Area
1.130		85.00% Impervious Area

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

Subcatchment 4S: Developed Balanced Family Academy



Summary for Subcatchment 6S: Offsite Trib.

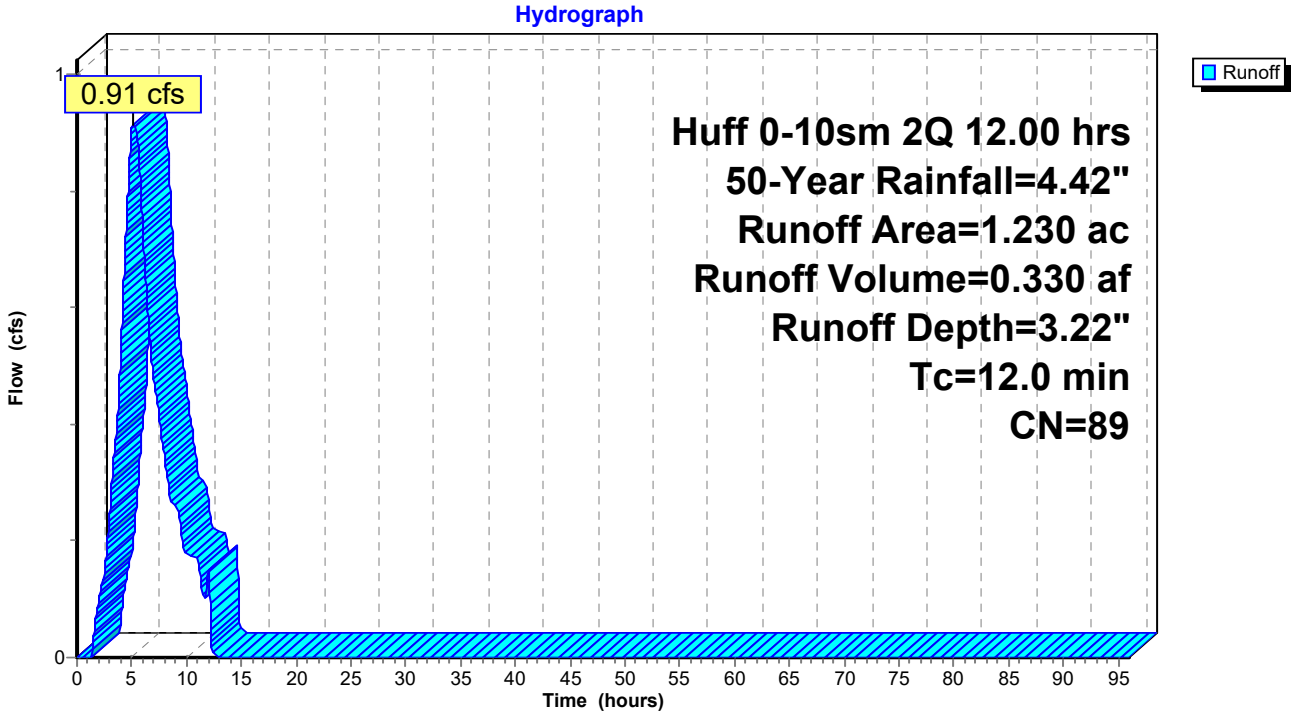
Runoff = 0.91 cfs @ 5.11 hrs, Volume= 0.330 af, Depth= 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 50-Year Rainfall=4.42"

	Area (ac)	CN	Description
*	0.760	98	Paved parking, Roofs HSG C
	0.470	74	>75% Grass cover, Good, HSG C
	1.230	89	Weighted Average
	0.470		38.21% Pervious Area
	0.760		61.79% Impervious Area

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

Subcatchment 6S: Offsite Trib.



Summary for Pond 3P: Retention Pond

Inflow Area =	12.390 ac, 61.75% Impervious, Inflow Depth = 3.20" for 50-Year event				
Inflow =	9.10 cfs @	5.18 hrs, Volume=	3.301 af		
Outflow =	5.47 cfs @	6.67 hrs, Volume=	3.276 af, Atten= 40%, Lag= 89.5 min		
Primary =	5.47 cfs @	6.67 hrs, Volume=	3.276 af		
Secondary =	0.00 cfs @	6.67 hrs, Volume=	0.000 af		

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 808.00' @ 6.67 hrs Surf.Area= 31,674 sf Storage= 58,049 cf

Plug-Flow detention time= 333.5 min calculated for 3.276 af (99% of inflow)
Center-of-Mass det. time= 330.8 min (706.0 - 375.2)

Volume	Invert	Avail.Storage	Storage Description
#1	806.00'	90,805 cf	**Pond (Prismatic)** Listed below (Recalc)
#2	804.00'	407 cf	**12.0" Round Pipe Storage** L= 518.0' S= 0.0050 '/'
		91,212 cf	Total Available Storage

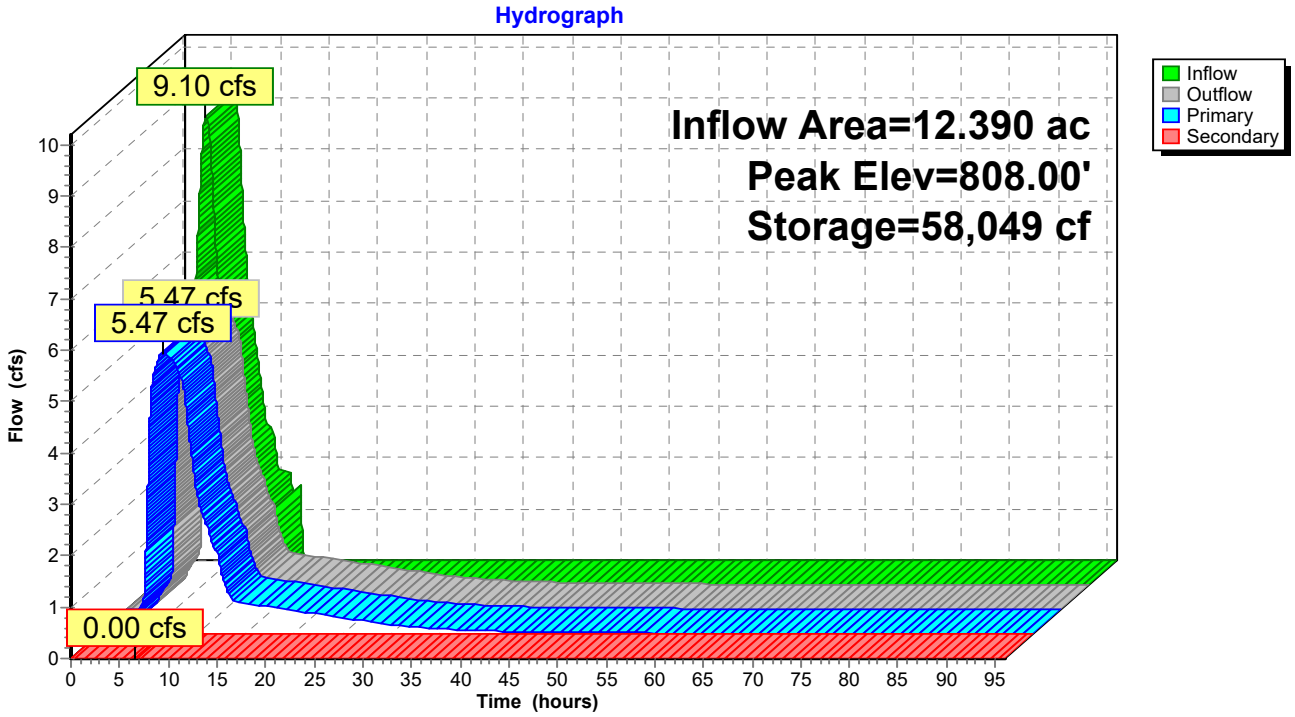
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
806.00	26,017	0	0
807.00	28,796	27,407	27,407
808.00	31,674	30,235	57,642
809.00	34,653	33,164	90,805

Device	Routing	Invert	Outlet Devices
#1	Primary	806.00'	**15.0" Round Culvert** L= 118.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 806.00' / 805.00' S= 0.0085 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	806.00'	**5.0" Vert. Orifice** C= 0.600
#3	Device 1	807.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	808.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

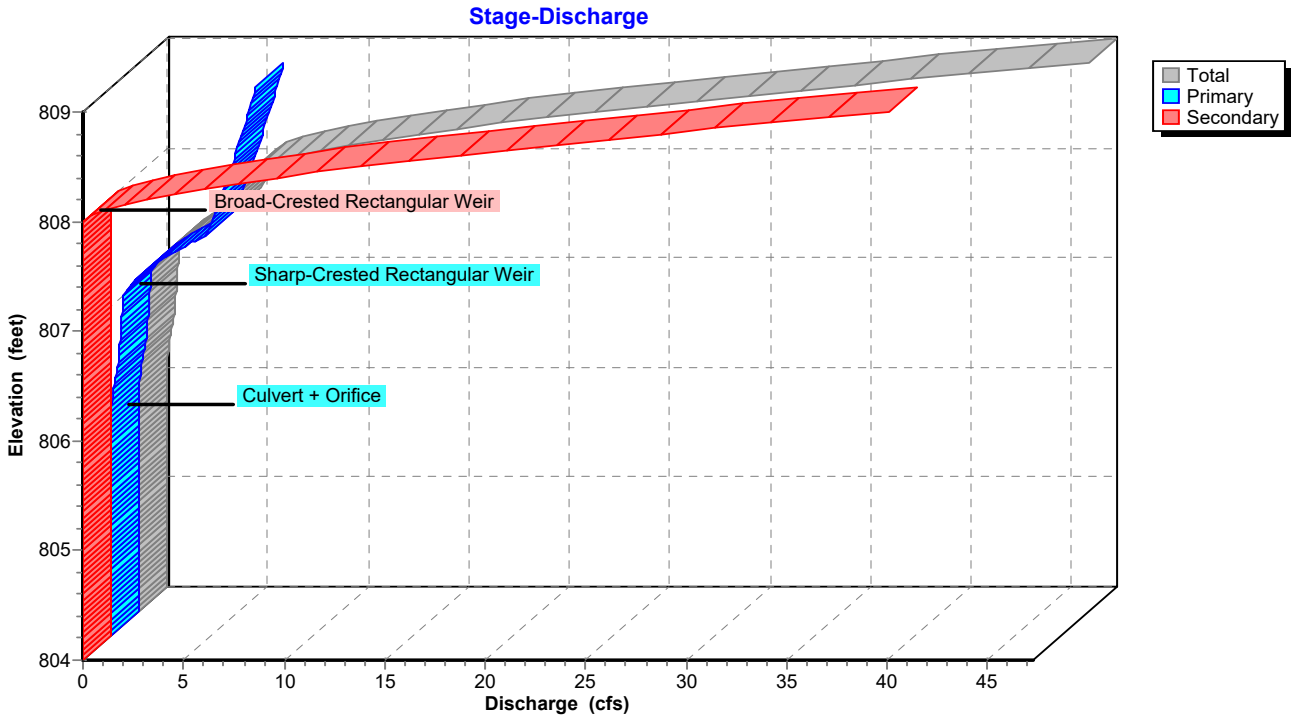
Primary OutFlow Max=5.47 cfs @ 6.67 hrs HW=808.00' (Free Discharge)
└─**1=Culvert** (Inlet Controls 5.47 cfs @ 4.46 fps)
  ├─**2=Orifice** (Passes < 0.88 cfs potential flow)
  └─**3=Sharp-Crested Rectangular Weir** (Passes < 7.87 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 6.67 hrs HW=808.00' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 0.00 cfs)

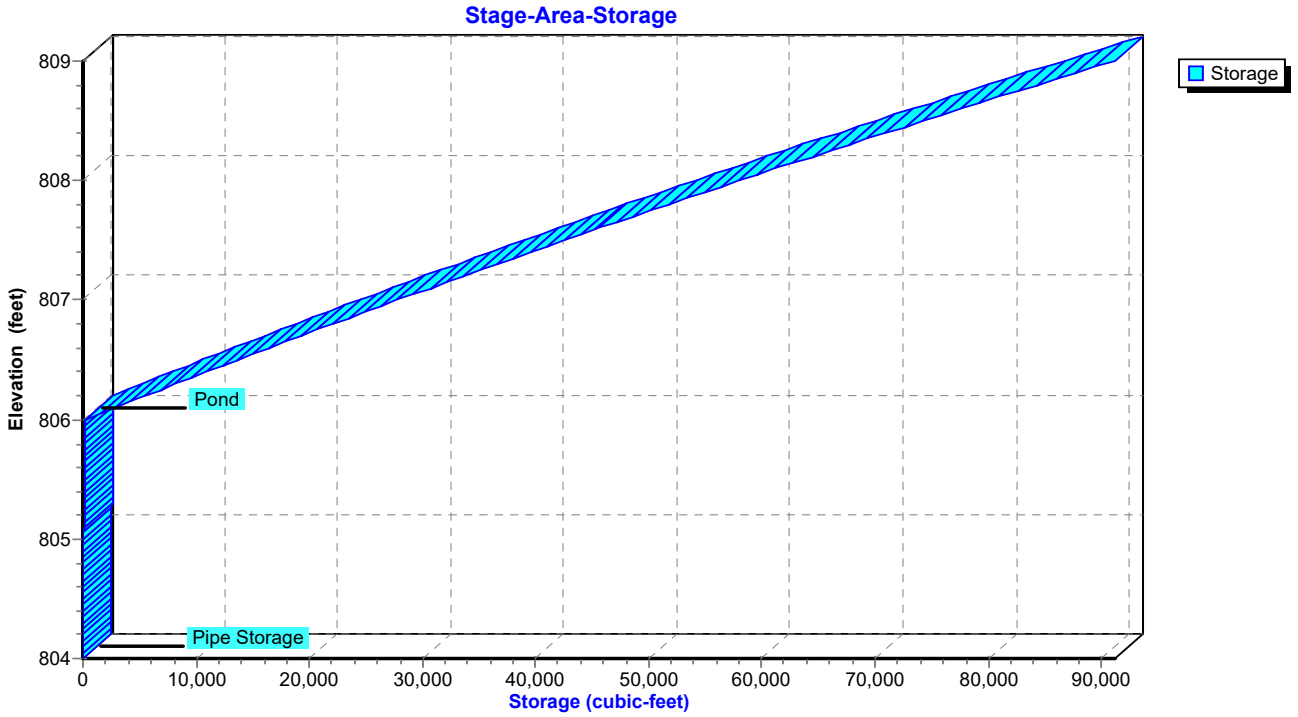
Pond 3P: Retention Pond



Pond 3P: Retention Pond



Pond 3P: Retention Pond

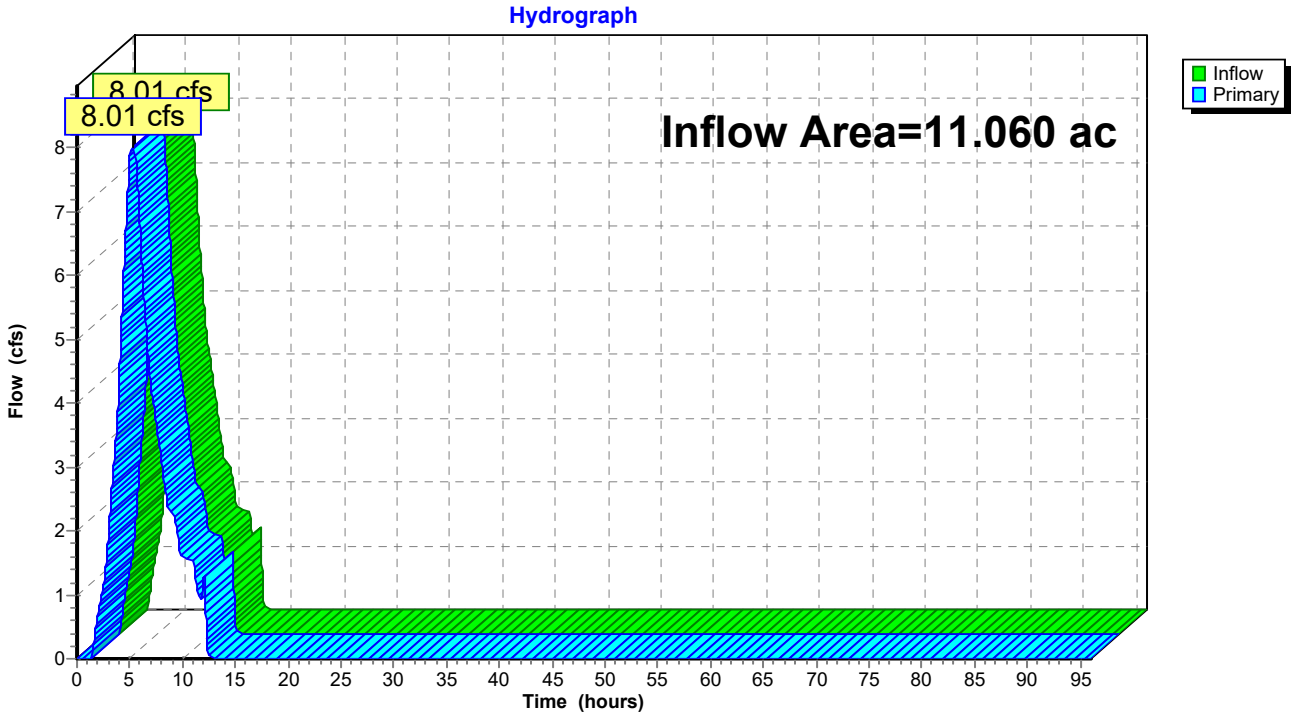


Summary for Link 7L: (new Link)

Inflow Area = 11.060 ac, 58.95% Impervious, Inflow Depth = 3.13" for 50-Year event
Inflow = 8.01 cfs @ 5.22 hrs, Volume= 2.887 af
Primary = 8.01 cfs @ 5.22 hrs, Volume= 2.887 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 7L: (new Link)



Summary for Subcatchment 1S: PreDeveloped Balanced Family Academy

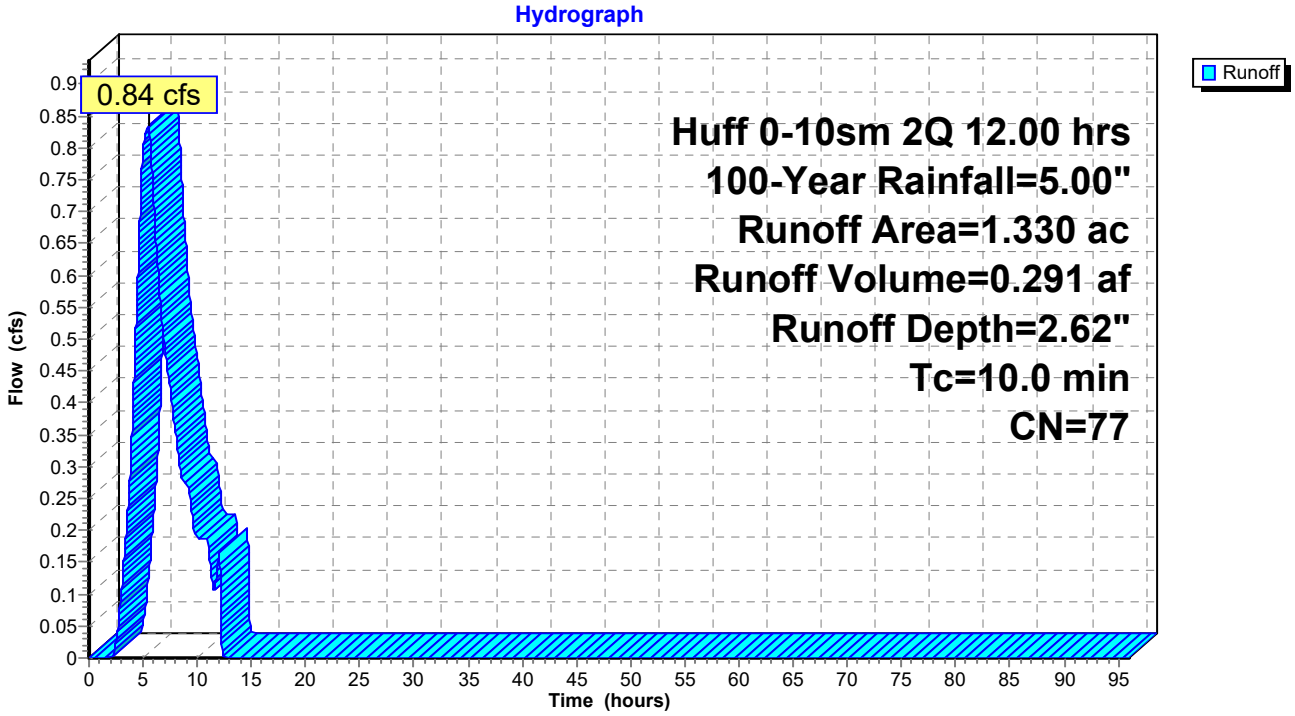
Runoff = 0.84 cfs @ 5.48 hrs, Volume= 0.291 af, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 100-Year Rainfall=5.00"

	Area (ac)	CN	Description
*	1.330	77	>75% Grass cover, Good, HSG C
	1.330		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Start Storm Pipe**

Subcatchment 1S: PreDeveloped Balanced Family Academy



Summary for Subcatchment 2S: Onsite Trib.

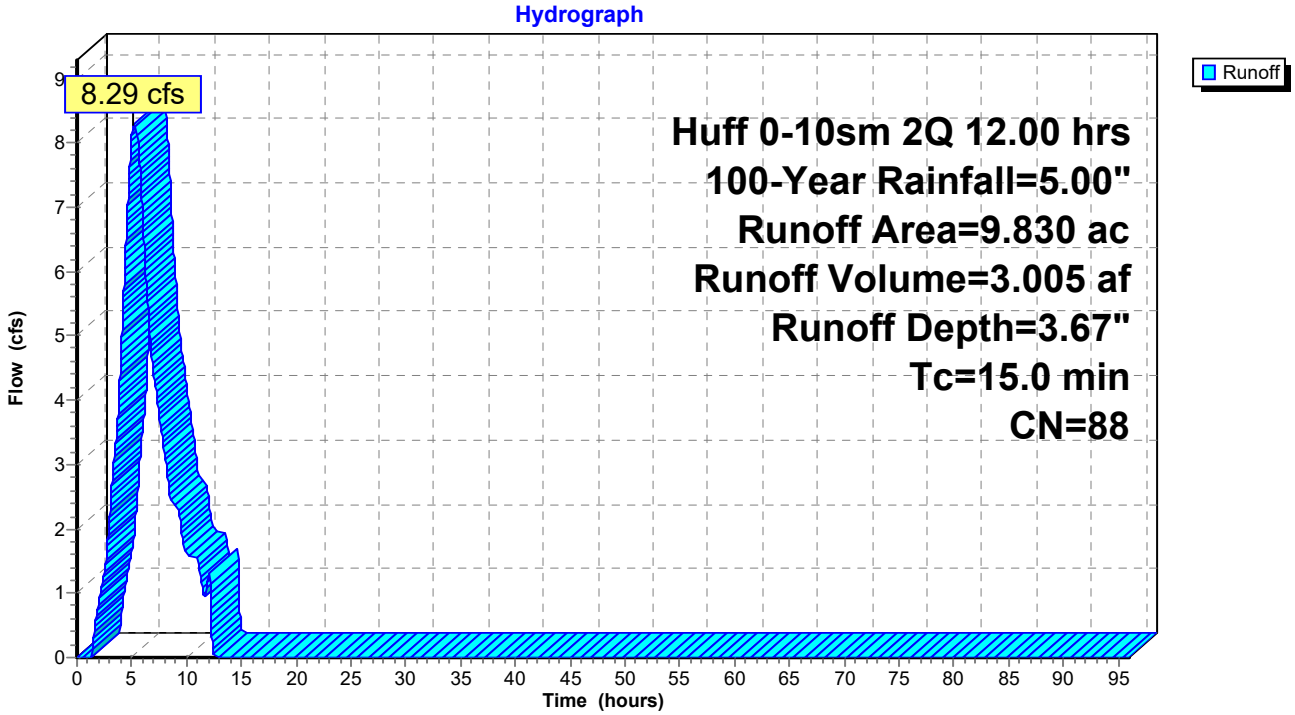
Runoff = 8.29 cfs @ 5.18 hrs, Volume= 3.005 af, Depth= 3.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 100-Year Rainfall=5.00"

	Area (ac)	CN	Description
*	5.760	98	Paved parking, Roofs HSG C
	4.070	74	>75% Grass cover, Good, HSG C
	9.830	88	Weighted Average
	4.070		41.40% Pervious Area
	5.760		58.60% Impervious Area

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

Subcatchment 2S: Onsite Trib.



Summary for Subcatchment 4S: Developed Balanced Family Academy

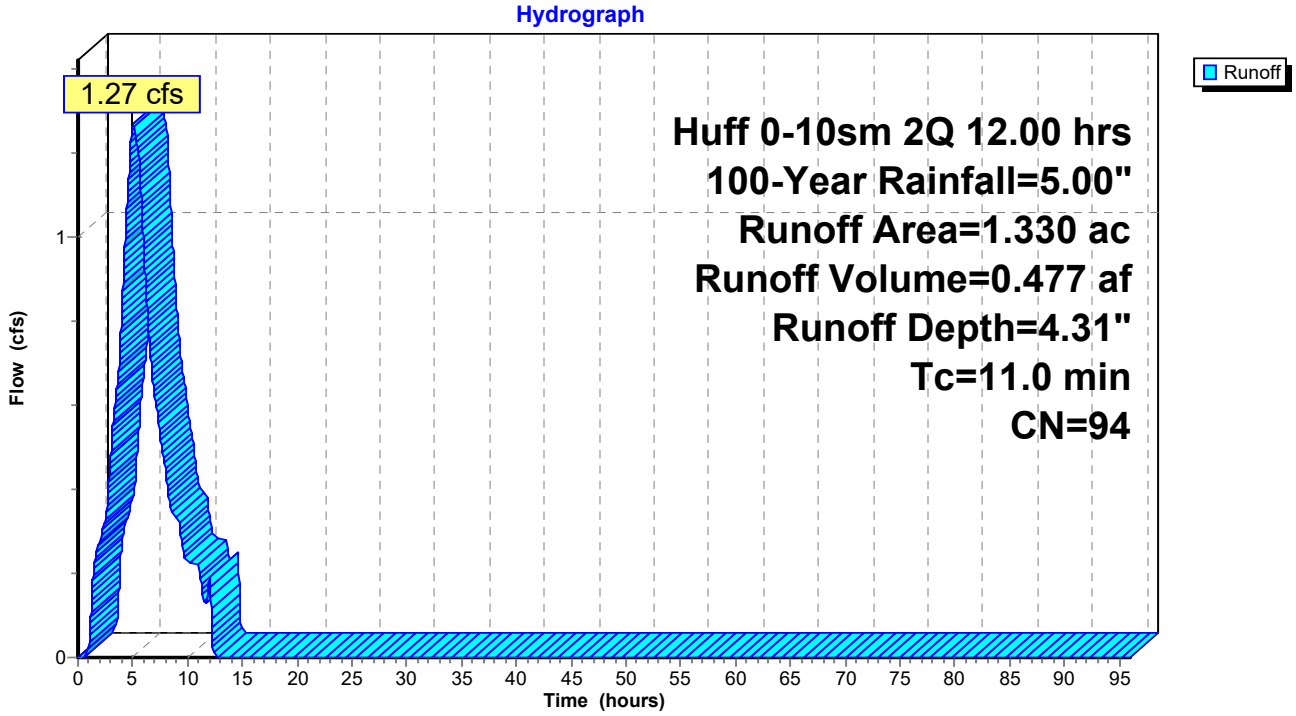
Runoff = 1.27 cfs @ 5.00 hrs, Volume= 0.477 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 100-Year Rainfall=5.00"

Area (ac)	CN	Description
1.330	94	Urban commercial, 85% imp, HSG C
0.200		15.00% Pervious Area
1.130		85.00% Impervious Area

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

Subcatchment 4S: Developed Balanced Family Academy



Summary for Subcatchment 6S: Offsite Trib.

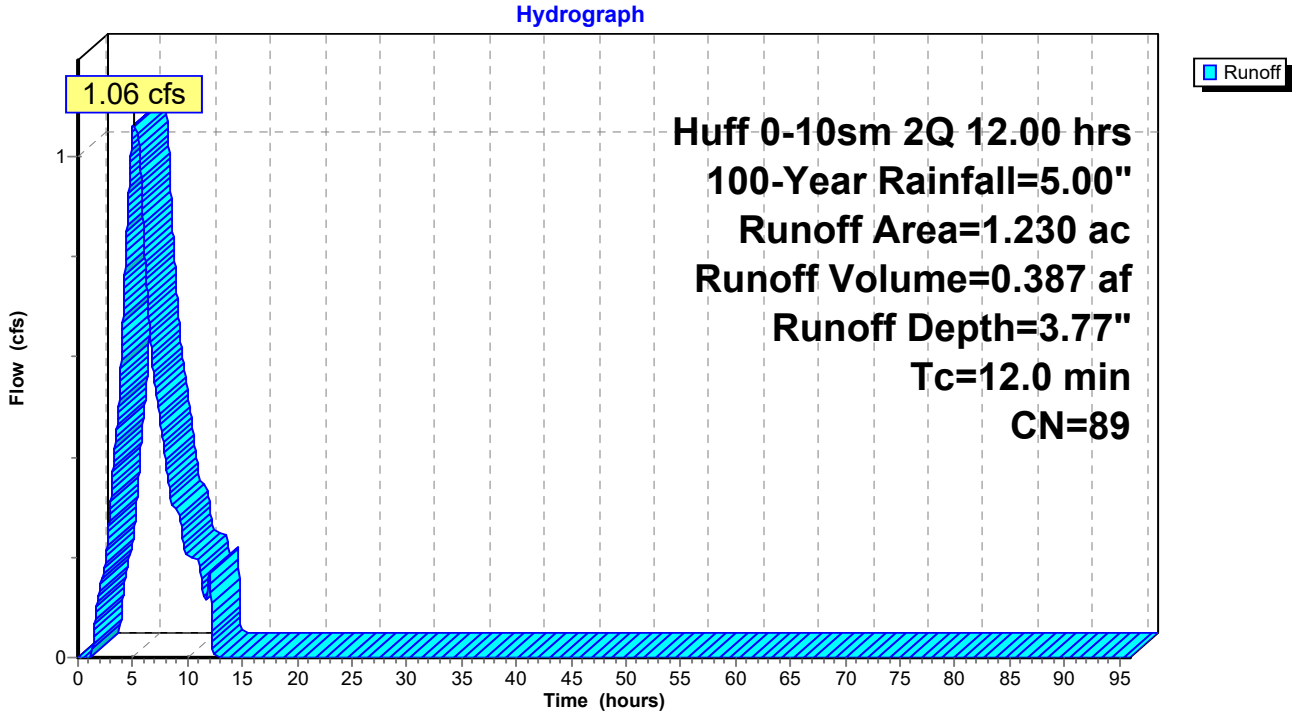
Runoff = 1.06 cfs @ 5.08 hrs, Volume= 0.387 af, Depth= 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs
Huff 0-10sm 2Q 12.00 hrs 100-Year Rainfall=5.00"

	Area (ac)	CN	Description
*	0.760	98	Paved parking, Roofs HSG C
	0.470	74	>75% Grass cover, Good, HSG C
	1.230	89	Weighted Average
	0.470		38.21% Pervious Area
	0.760		61.79% Impervious Area

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

Subcatchment 6S: Offsite Trib.



Summary for Pond 3P: Retention Pond

Inflow Area = 12.390 ac, 61.75% Impervious, Inflow Depth = 3.75" for 100-Year event
Inflow = 10.61 cfs @ 5.15 hrs, Volume= 3.870 af
Outflow = 7.90 cfs @ 6.18 hrs, Volume= 3.845 af, Atten= 26%, Lag= 61.7 min
Primary = 5.77 cfs @ 6.18 hrs, Volume= 3.639 af
Secondary = 2.14 cfs @ 6.18 hrs, Volume= 0.205 af

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 808.15' @ 6.18 hrs Surf.Area= 32,129 sf Storage= 62,926 cf

Plug-Flow detention time= 298.9 min calculated for 3.845 af (99% of inflow)
Center-of-Mass det. time= 296.6 min (668.1 - 371.6)

Volume	Invert	Avail.Storage	Storage Description
#1	806.00'	90,805 cf	**Pond (Prismatic)** Listed below (Recalc)
#2	804.00'	407 cf	**12.0" Round Pipe Storage** L= 518.0' S= 0.0050 '/'
		91,212 cf	Total Available Storage

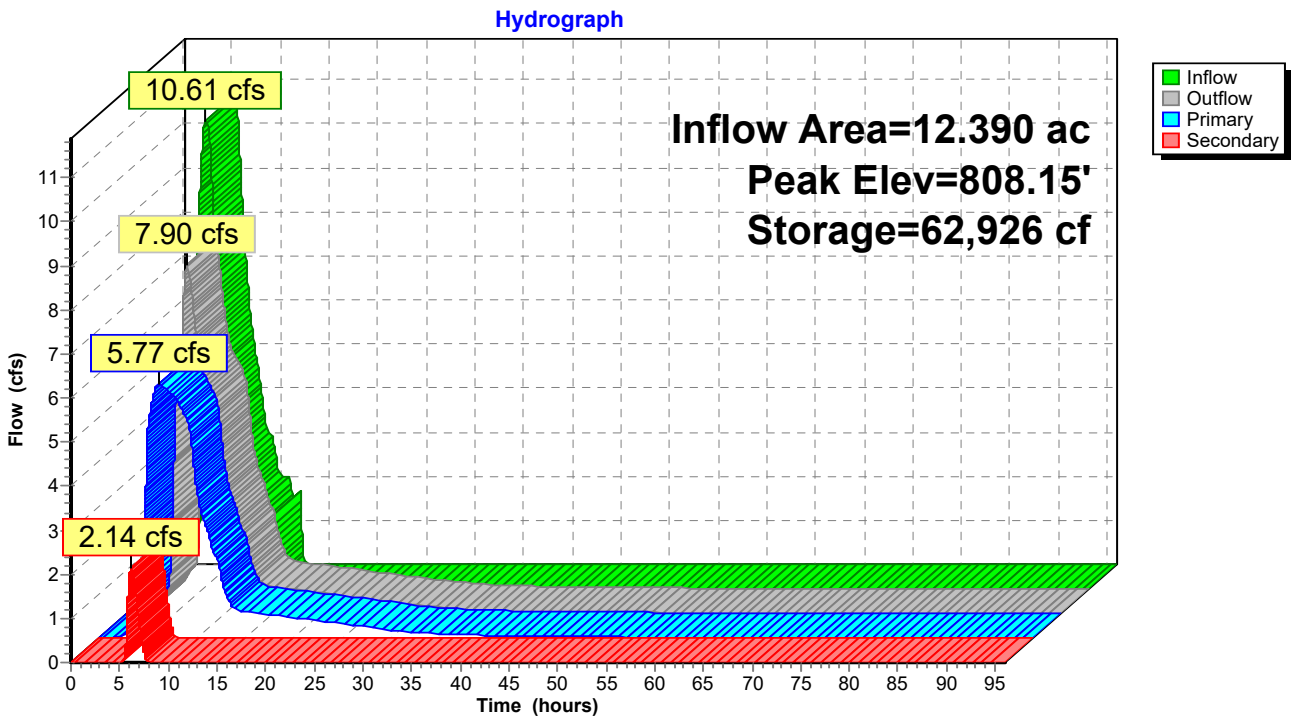
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
806.00	26,017	0	0
807.00	28,796	27,407	27,407
808.00	31,674	30,235	57,642
809.00	34,653	33,164	90,805

Device	Routing	Invert	Outlet Devices
#1	Primary	806.00'	**15.0" Round Culvert** L= 118.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 806.00' / 805.00' S= 0.0085 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	806.00'	**5.0" Vert. Orifice** C= 0.600
#3	Device 1	807.10'	**3.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Secondary	808.00'	**15.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

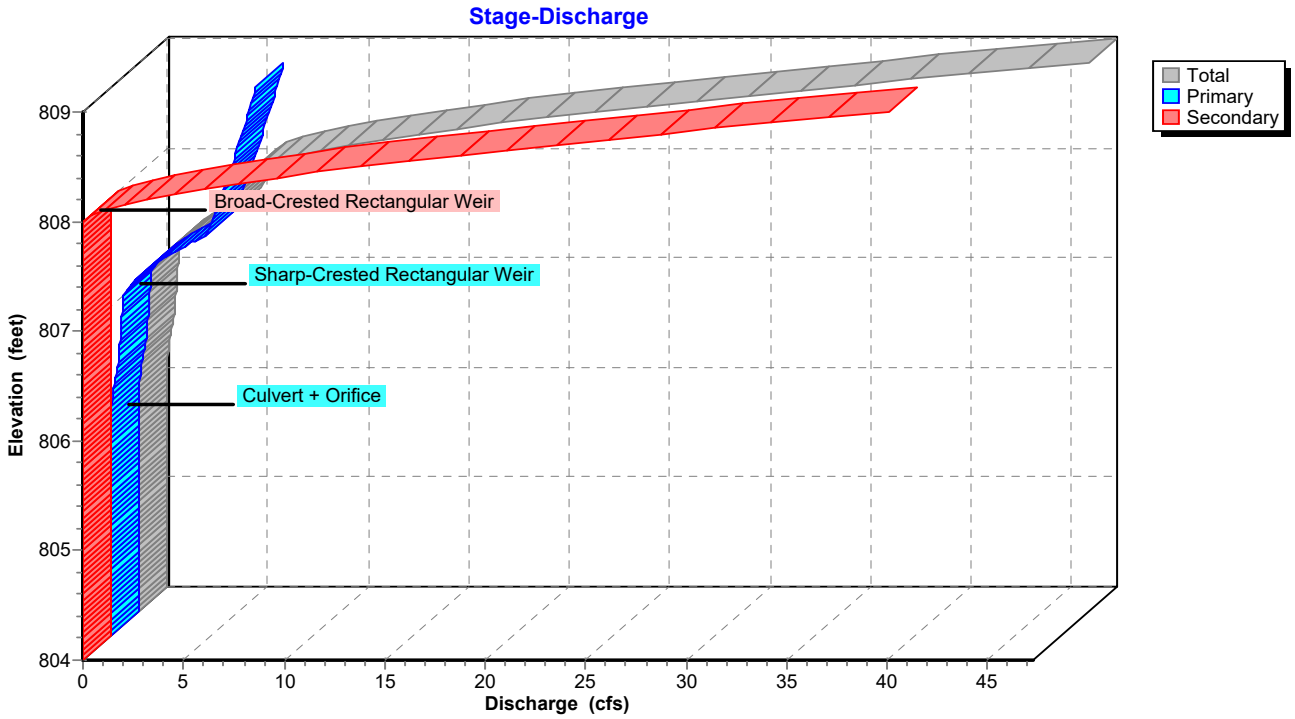
Primary OutFlow Max=5.77 cfs @ 6.18 hrs HW=808.15' (Free Discharge)
└─**1=Culvert** (Inlet Controls 5.77 cfs @ 4.70 fps)
  ├─**2=Orifice** (Passes < 0.92 cfs potential flow)
  └─**3=Sharp-Crested Rectangular Weir** (Passes < 9.85 cfs potential flow)

Secondary OutFlow Max=2.13 cfs @ 6.18 hrs HW=808.15' (Free Discharge)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 2.13 cfs @ 0.93 fps)

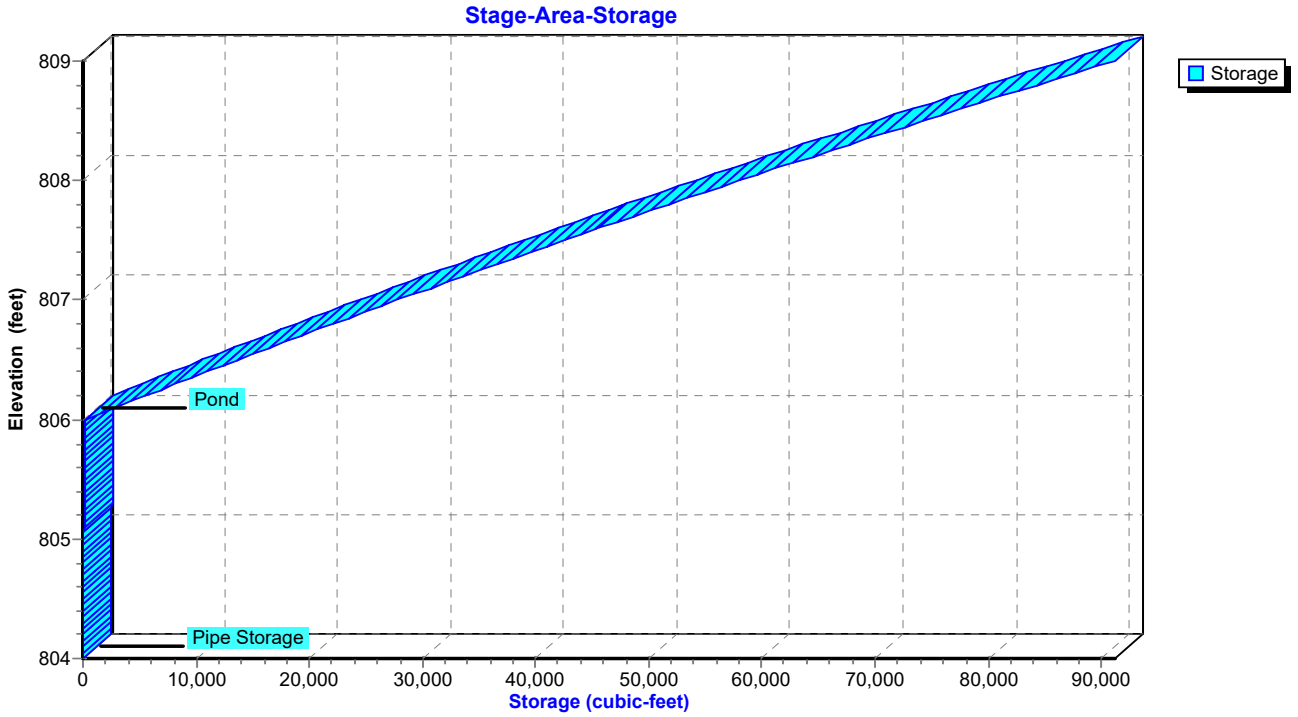
Pond 3P: Retention Pond



Pond 3P: Retention Pond



Pond 3P: Retention Pond

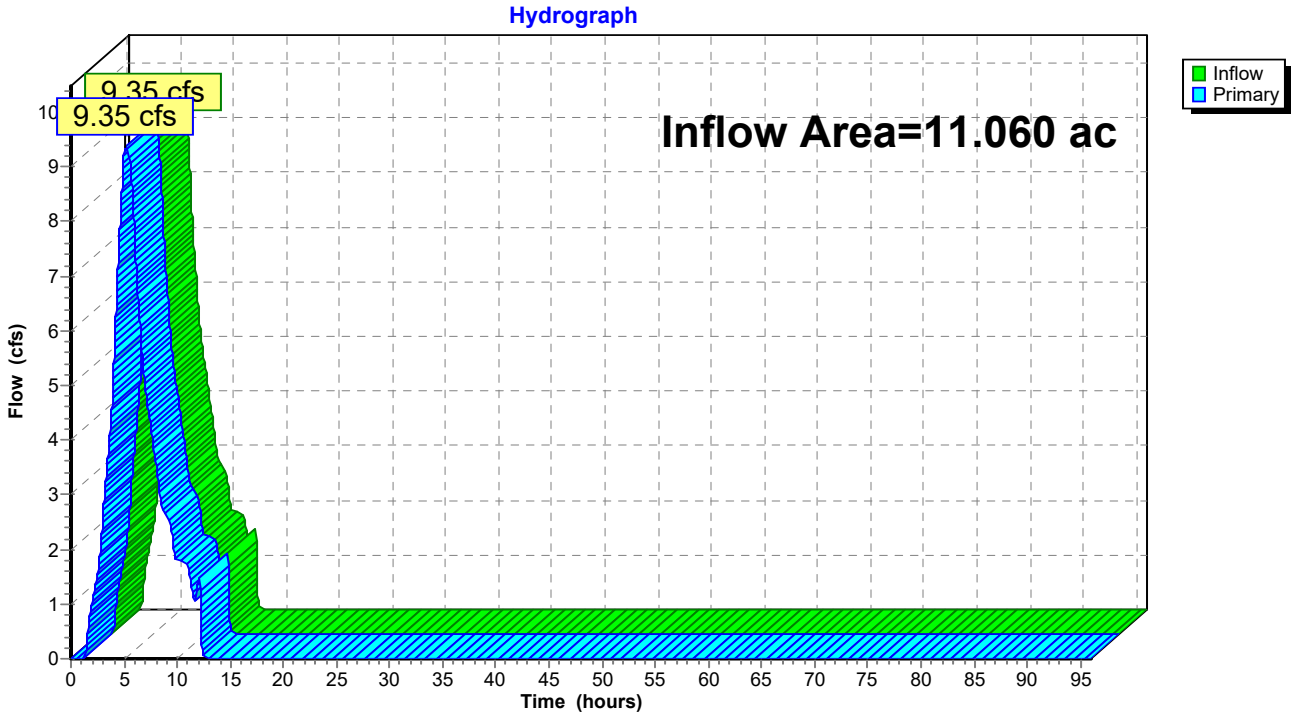


Summary for Link 7L: (new Link)

Inflow Area = 11.060 ac, 58.95% Impervious, Inflow Depth = 3.68" for 100-Year event
Inflow = 9.35 cfs @ 5.15 hrs, Volume= 3.392 af
Primary = 9.35 cfs @ 5.15 hrs, Volume= 3.392 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.01 hrs

Link 7L: (new Link)



APPENDIX B

(Water Quality Calculations)

WATER QUALITY CALCULATIONS

E. P. FERRIS and ASSOCIATES INC.
880 King Avenue
Columbus, Ohio 43212
614-299-2999
614-299-2992 (Fax)

Balanced Academy
Grove City, Ohio

Prepared I MJO
Checked: CLL

Date: 8/24/2020

Project: 1163.002

Water Quality Calculation - Per Ohio EPA requirements

WQv = Rv x P x A

Rv - Volumetric Runoff Coefficient
P - precepitation depth (usually 0.90 inches)
A - Area draining to Pervious Pavers (acres)

Rv:	0.608	
P:	0.9	0.90 inches is EPA
A:	12.49	Acres
	544064	Sq-Ft
i:	0.62	

Table 1 C Values:

Industrial/Commercial	0.8
High Density residential (>8dw/ac)	0.5
Medium Density res. (4 to 8 dw/ac)	0.4
Low Density res (<4 dw/ac)	0.3
Open Space and Recreation Area	0.2

Formula:
Rv=0.9i +0.05
i - watershed imperviousness ratio, the percent inperviouness divided by 100

Rv = 0.608

WQv:	6.834528	acre-inches	(units for pourous pavement calcs)
	24809	cubic feet	REQUIRED for treatment of disturbed area
	0.569544	*acre-feet*	
	4962	cubic feet of sediment volume (not required for pervious pavement)	

WQv
Total: 29771
Note: Impervious = 1.33Ac @0.8 + 11.16Ac @ 0.6 = 0.62

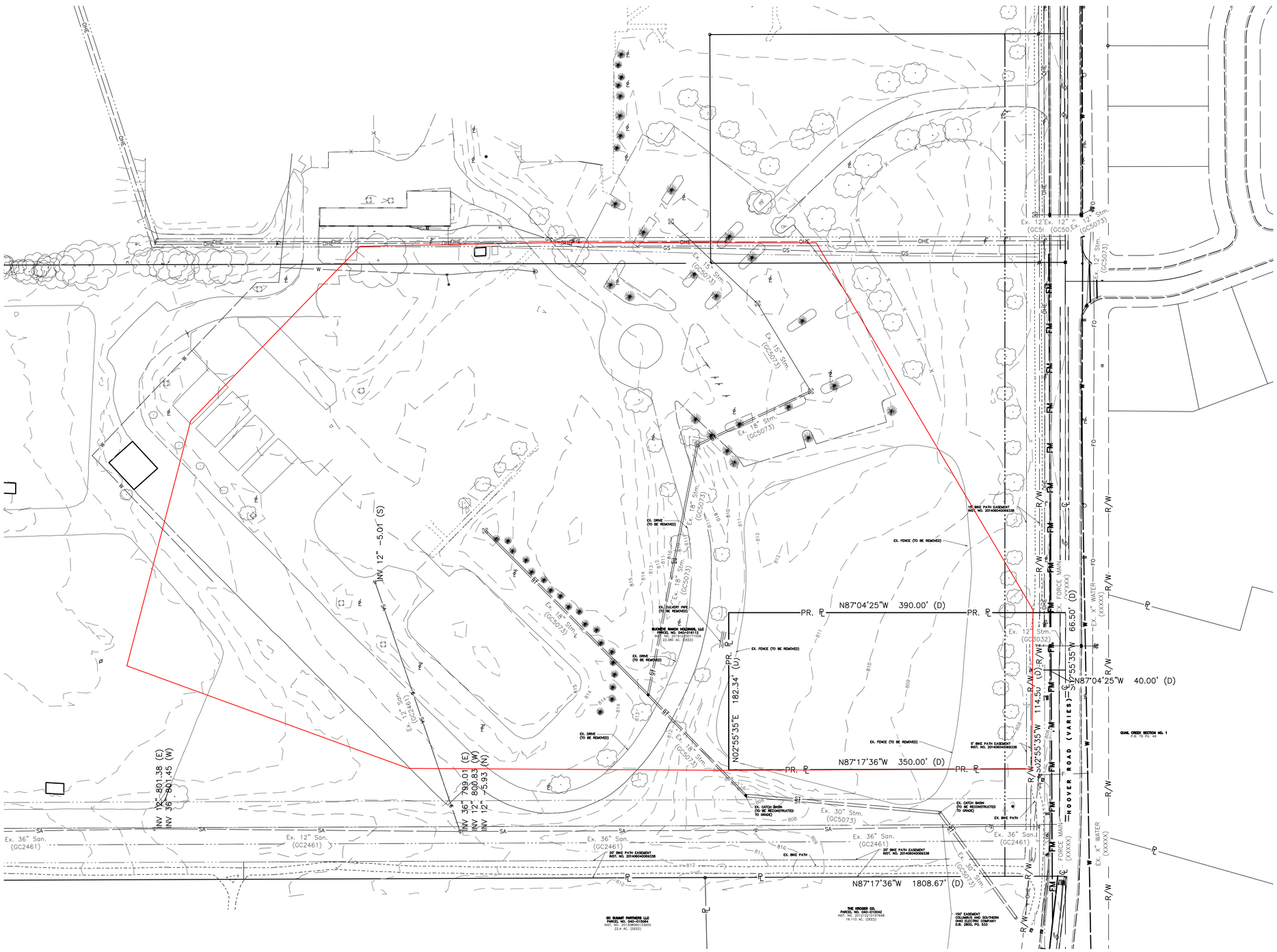
INPUT
OUPUT

Hydrograph for Pond 8P: WQv

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	**0.00**	**30,691**	**807.10**	**0.62**
2.00	0.00	26,421	806.95	0.57
4.00	0.00	22,538	806.82	0.51
6.00	0.00	19,049	806.69	0.46
8.00	0.00	15,957	806.58	0.40
10.00	0.00	13,268	806.49	0.35
12.00	0.00	10,981	806.40	0.29
14.00	0.00	9,109	806.33	0.23
16.00	0.00	7,661	806.28	0.18
18.00	0.00	6,554	806.24	0.13
20.00	0.00	5,698	806.21	0.10
22.00	0.00	5,026	806.18	0.08
24.00	0.00	4,487	806.16	0.07
26.00	0.00	4,051	806.14	0.05
28.00	0.00	3,687	806.13	0.05
30.00	0.00	3,380	806.12	0.04
32.00	0.00	3,121	806.11	0.03
34.00	0.00	2,902	806.10	0.03
36.00	0.00	2,713	806.09	0.02
38.00	0.00	2,544	806.09	0.02
40.00	0.00	2,393	806.08	0.02
42.00	0.00	2,257	806.08	0.02
44.00	0.00	2,136	806.07	0.02
46.00	0.00	2,027	806.07	0.01
48.00	0.00	1,929	806.06	0.01
50.00	0.00	1,841	806.06	0.01
52.00	0.00	1,763	806.06	0.01
54.00	0.00	1,692	806.06	0.01
56.00	0.00	1,629	806.05	0.01
58.00	0.00	1,573	806.05	0.01
60.00	0.00	1,521	806.05	0.01
62.00	0.00	1,473	806.05	0.01
64.00	0.00	1,426	806.05	0.01
66.00	0.00	1,380	806.04	0.01
68.00	0.00	1,337	806.04	0.01
70.00	0.00	1,295	806.04	0.01
72.00	0.00	1,255	806.04	0.01
74.00	0.00	1,216	806.04	0.01
76.00	0.00	1,179	806.04	0.01
78.00	0.00	1,143	806.03	0.00
80.00	0.00	1,109	806.03	0.00
82.00	0.00	1,076	806.03	0.00
84.00	0.00	1,044	806.03	0.00
86.00	0.00	1,013	806.03	0.00
88.00	0.00	983	806.03	0.00
90.00	0.00	955	806.03	0.00
92.00	0.00	928	806.03	0.00
94.00	0.00	901	806.03	0.00
96.00	0.00	876	806.02	0.00

APPENDIX C

(Tributary Maps)



LEGEND

- EX. FIRE HYDRANT
- EX. PULL BOX
- EX. TREE
- EX. CATCH BASIN
- EX. SANITARY MANHOLE
- EX. STORM MANHOLE
- EX. STORM CURB INLET
- EX. UTILITY POLE
- EX. LIGHT POLE
- EX. SIGNAL POLE
- EX. TELEPHONE POLE
- EX. TELEPHONE POWER POLE
- EX. MONUMENT
- EX. GAS SERVICE VALVE
- EX. UNDERGROUND TELEPHONE PEDESTAL
- EX. WATER SERVICE VALVE
- EX. SIGN
- X — EX. FENCE
- W — EX. WATER LINE
- WS — EX. WATER SERVICE
- UGT — EX. UNDERGROUND TELEPHONE
- G — EX. GAS MAIN
- ST — EX. STORM SEWER MAIN
- SA — EX. SANITARY SEWER MAIN
- UGE — EX. UNDERGROUND ELECTRIC LINE
- OHE — EX. OVERHEAD ELECTRIC LINE
- EX. 100 YEAR FLOODPLAIN (APPROX.)
- (TBR) TO BE REMOVED
- SCPZ STREAM CORRIDOR PROTECTION ZONE

NOTES

1. EXISTING STORM (GC5073) IS DRAWN PER PLAN AND SHALL BE FIELD VERIFIED.

0 30 60
SCALE IN FEET

REVISIONS	DATE	BY	CHK.

E. P. FERRIS AND ASSOCIATES INC
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880 KING AVENUE
COLUMBUS, OHIO 43212
(614) 299-2999
(614) 299-2992 (Fax)
www.EPFERRIS.com

GROVE CITY, OHIO

BALANCED FAMILY ACADEMY

BBR VENTURES, LLC

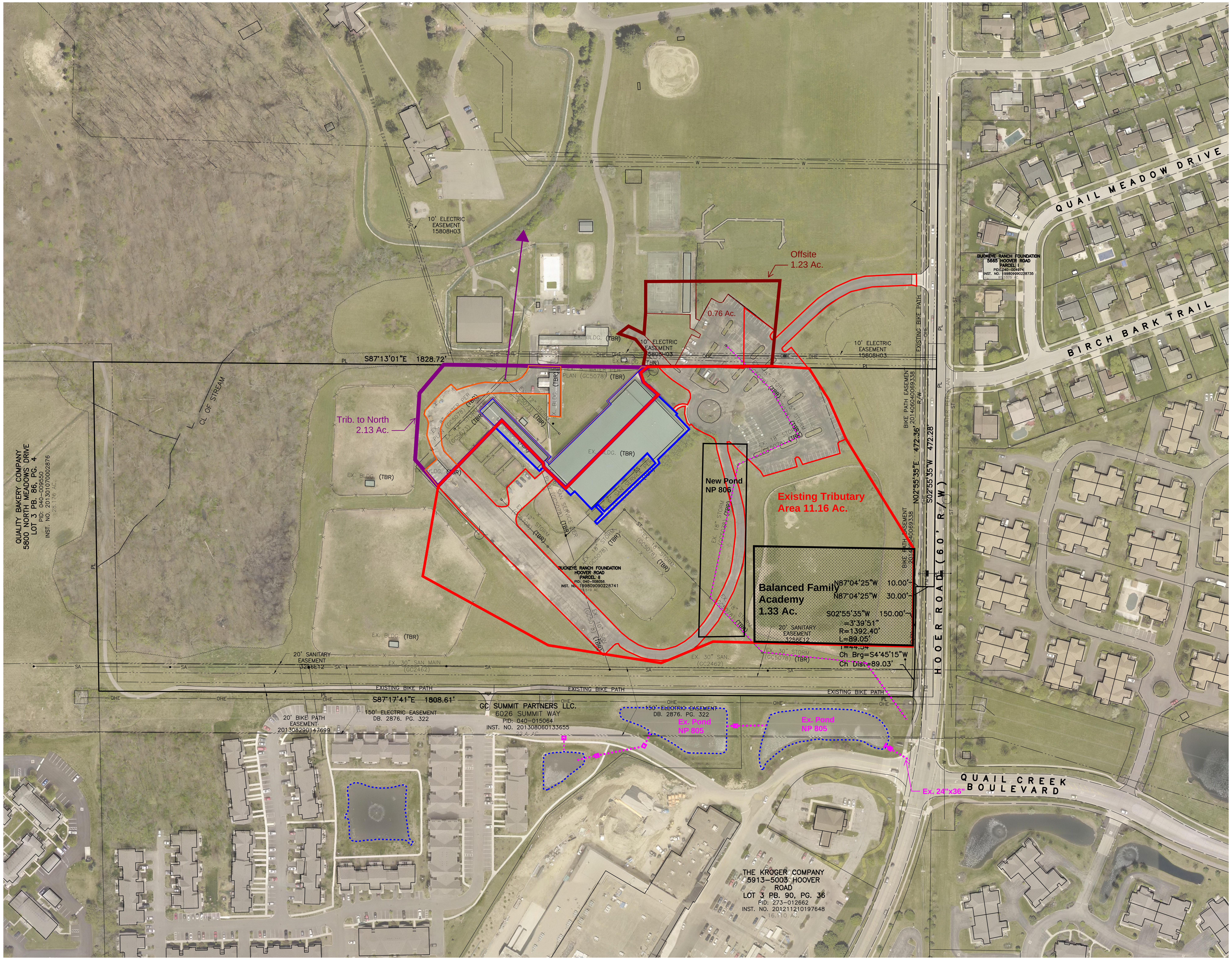
JOB NO.	1163.002
DESIGNED BY:	JLC
DRAWN BY:	JLC
CHECKED BY:	CJB
APPROVED BY:	____
DATE:	8/12/2020

EXISTING CONDITIONS PLAN

SCALE: 1" = 30'

SHEET NO. 2 OF 6

M:\1163002_BalancedFamilyAcademy\DWG\Production Drawings\Final Development Plan\1163002_FDP_Existing Conditions.dwg <EXISTING CONDITIONS PLAN LAST EDITED BYMOVERSTREET ON 8/21/20



LEGEND

PL	PROPERTY LINE
R/W	EX. RIGHT-OF-WAY
PR. R/W	PR. RIGHT-OF-WAY
LL	LOT LINE
	ROADWAY CENTERLINE
	EDGE OF PAVEMENT/BACK OF CURB
	EDGE OF DRIVEWAYS
	MISC. EASEMENTS
	EX. FIRE HYDRANT
	EX. WATER SERVICE VALVE
	EX. PULL BOX
	EX. TREE
	EX. SANITARY MANHOLE
	EX. CATCH BASIN
	EX. STORM MANHOLE
	EX. STORM CURB INLET
	EX. UTILITY POLE
	EX. LIGHT POLE
	EX. UNDERGROUND TELEPHONE PEDESTAL
	EX. MAILBOX
	EX. SIGN
X	EX. FENCE
W	EX. WATER LINE
WS	EX. WATER SERVICE
WS (PLAN)	EX. WATER SERVICE (LOCATION PER RECORD PLAN)
UGT	EX. UNDERGROUND TELEPHONE
G	EX. GAS
ST	EX. STORM
SA	EX SANITARY
CMS	EX COMBINED SEWER
UGE	EX. UNDERGROUND ELECTRIC
OHE	EX. OVERHEAD ELECTRIC
OHL	EX. OVERHEAD STREET LIGHTING
L	EX. UNDERGROUND STREET LIGHTING
FO	EX. FIBER OPTIC
FM	EX. SANITARY FORCE MAIN
TBR	TO BE REMOVED
TBA	TO BE ABANDONED
TBRL	TO BE RELOCATED
DND	DO NOT DISTURB
AB	ABANDONED

0 50 100 200

REVISIONS	DATE	BY	CHK.

E. P. FERRIS AND ASSOCIATES INC
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(614) 299-2999
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www.EPFERRIS.com

CITY OF GROVE CITY, OHIO

BALANCED FAMILY ACADEMY

JOB NO.	1163.002
DESIGNED BY:	DAS
DRAWN BY:	JAR
CHECKED BY:	CLP
APPROVED BY:	___
DATE:	05/29/19

EXISTING CONDITIONS PLAN

SCALE: 1" = 100'

SHEET NO. 2 OF 6

M:\1163001_BuckeyeRanch\DWG\Production Drawings\Preliminary Development Plan\Existing Conditions Plan.dwg -Existing Conditions Plan LAST EDITED BY DSHREMSHOCK ON 5/28/19

E.P. FERRIS & ASSOCIATES INC