ISD #31 Upper Elementary School Stormwater Management Plan

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Project Name: ISD #31 Gene Dillion Upper Elementary School

To: Beltrami County Environmental Services Department

From: Sam Anderson, P.E.

Re: Project Stormwater Management Plan

Date: March 29th, 201616004

Executive Summary

On behalf of Karvakko Engineering, I am pleased to present this stormwater report for the proposed ISD #31 Upper Elementary School, located north of the intersection of Division St. W and Becida Rd SW, Bemidji, Minnesota. The information provided within this report is directed to the Beltrami County Environmental Services Department. This office is located at 701 Minnesota Avenue NW Suite 113, Bemidji, MN. Any questions of the information contained within this report can be directed to Sam Anderson with Karvakko Engineering by phone at (218)-444-8004 or by email at sam.anderson@karvakko.com.

Project Location

Existing Stormwater Flow

The project is located on a 160 acre parcel. Within this parcel there is a variety of land types, uses, and vegetation that all contribute to a unique drainage pattern. Of the entire 160 acre parcel, about 77 acres is outlined as a drainage boundary that will be affected from the proposed project. Within the drainage boundary exists open green space, trees, and building development. The drainage boundary is surrounded with two lakes, a wetland, and surrounding greenspace/foliage and shrubbery.

The existing drainage pattern, within the 77.85 acre drainage boundary can be viewed as four (4) drainage catch basins. These basins are shown on *Exhibit A: Existing Conditions*, included in this report. The catch basins are labeled North Lake, South Wetland, East, and Southeast Existing Development. These areas are described below:

North Lake

This 20.86 acre drainage basin is located directly south of a body of water. The land consists of shoreline, trees/shrubbery, and a pasture, all of which is pervious land. The topography shows most all contours parallel with the shoreline, directing all stormwater into the body of water. A small ponding area is also shown in the far northeast corner of the basin. All stormwater within this drainage basin will stay within the parcel but will not affect the proposed project.

South Wetland

This 32.34 acre drainage basin is located north of Division Street and east of the wetland. The wetland's geometry deviates with the changing seasons causing the west boundary of the drainage basin to shift throughout the years. The topography within this drainage basin slopes to the west into the wetland. The land consists mostly of pasture of which all is pervious. There is a ditch that separates Division Street with the pasture. This ditch catches stormwater and directs it to the far west side of the parcel into the existing wetland.

East

The East drainage basin accounts for 15.03 acres of land, consisting mostly of a field. The topography in this catch basin contains a natural depression with a low elevation of 1382 and increasing to 1390 on the east edge of the parcel. The stormwater in this basin naturally gravitates to this low spot without leaving the parcel.

Southeast Existing Development

This 8.62 acre drainage basin is surrounded by Division Street to the south and the parcel boundary to the east. The topography within this basin ungulates throughout. There are some ponding areas within this basin. Some stormwater will remain on site and pond in the various depressions located about the area and some will spill over into the adjacent parcel. About 2.2 acres of land in this catch basin direct water to flow over into the connecting parcel. This area can be seen in Exhibit A, attached to this report.

Existing Stormwater Calculation Table

Table 1: Existing Stormwater Flows

Drainage Catch Basin Area	Existing Storm Water Flow		
	2-Year	10-Year	100-Year
North Lake	2.13 cfs	7.15 cfs	16.10 cfs
South Wetland	9.06 cfs	31.60 cfs	70.22 cfs
East	0.00 cfs	0.00 cfs	0.00 cfs
Southeast Existing Development	0.86 cfs	2.88 cfs	6.29 cfs

The above table summarizes the existing stormwater cfs (cubic feet per second) flow in a 2-year storm, 10-year storm, and 100-year storm leaving the drainage area. The North Lake catch basin flows enter the lake to the north of the site. The South Wetland catch basin flows enter the wetland to the west of the site. The East catch basin flow is 0 due to all stormwater being contained within its natural ponding characteristics. The Southeast Existing Development catch basin flows spill over the parcel boundary into the adjacent parcel.

Proposed Stormwater Flow

The project is proposed to feature a 85,224 square foot elementary school. Along with the building other developments in the project include a 300 space parking lot, 20 space bus parking lot, surrounding sidewalk, playground, and turf fields. Adding these impervious surfaces to the existing land will change the stormwater drainage pattern and rate of flow off the site.

The proposed drainage boundary, remains within the 77 acre drainage boundary created to examine the existing site. The proposed elements cause the existing drainage catch basins to shift, creating 6 (six) concentrated areas of drainage. These basins are shown on *Exhibit B: Proposed Conditions*, included in this report. The catch basins are labeled North Lake, South Wetland, West Pond, East, East Null, and Southeast Existing Development. These areas are described down below:

North Lake

The North Lake drainage basin remains the same after development at 20.86 acres. The project doesn't impact this area of the parcel. The stormwater will naturally continue to flow to the northwest into the existing body of water. This entire drainage basin will remain pervious. As shown in Table 2 below, the existing and proposed flows remain the same for all three storm events.

South Wetland

The South Wetland basin will be impacted most by the project. This drainage catch basin will be broken down into 3 separate areas when looking at the proposed drainage. The 3 (three) pieces of this basin will be the South Wetland, West Pond, and West Playground and all eventually drain into the existing wetland located west of the drainage boundary.

South Wetland

The South Wetland drainage basin becomes smaller due to the proposed development. The east, north, and south boundary remain the same, however the west perimeter follows the grading limits of the proposed entrance road. This drainage basin becomes 19.39 acres after the project. Stormwater in this drainage basin will naturally flow to the west into the existing wetland. The South Wetland basin will remain pervious. As shown in Table 2, the South Wetland flow rates become smaller due to the area reducing.

West Pond

The stormwater contributing to the West Pond include the impervious building roof (85,224 square feet), paved parking lot (150,694 square feet), surrounding sidewalk (27,795 square feet), and additional pervious green space. Two ponds will be created in this drainage basin to slow down stormwater as it enters the South Wetland and continues west exiting in the wetland. Both ponds are labeled in *Exhibit B: Proposed Conditions*. Pond 1 will intake water from the building roof and parking lot by means of a storm network under the parking lot. Water will then run from Pond 1, under the entrance road through a 24" culvert to Pond 2. Water will naturally fill up on Pond 2 and overflow into the South Wetland and naturally flow west into the existing wetland. Flow rates exiting Pond 2 are shown in the West Pond row in Table 2 below. The flow rates from this area, (West Pond), South Wetland, and West Playground all combine for a total flow into the existing wetland.

West Playground

The stormwater contributing to the West Playground drainage basin include the green space west of the proposed building, entrance road, and additional pervious areas behind the building. This area accounts for 4.19 total acres in the drainage boundary. Stormwater will flow directly west into the South Wetland. The flow rates from this area (West Playground), South Wetland, and West Pond all combine for a total flow leaving the drainage boundary into the existing wetland to the west.

East

The East drainage basin becomes a crucial part of the proposed stormwater management plan. This drainage basin will be broken down into 2 separate areas when looking at the proposed drainage. The 2 (two) areas of this basin will be the East and East Null.

East

This basin increased in size to 16.01 acres. It continues to naturally serve as a pond for stormwater. The proposed bus parking lot and sidewalk impacts this basin, which increases the impervious area to 2.85 acres as opposed to all area being pervious before the project. Stormwater sheet drains off of the sidewalk and bus parking lot and continues to flow naturally to the east. Stormwater naturally sits in this pond and remains on site.

East Null

This area includes a small pond created to hold water from the traffic lane surrounding the parking lot. The total basin accounts for 1.06 acres. Stormwater hitting the road will sheet drain to the east into this shallow basin. Water will leave this area through

infiltration only. This area also includes the right lane of the bus driveway entrance. This water will also sheet drain into the basin and leave through infiltration.

Southeast Existing Development

The Southeast Existing Development drainage basin decreases in size to 6.38 acres due to the addition of the bus entrance road. This basin remains to be surrounded by Division Street to the south and the parcel boundary to the east. The proposed bus entrance road creates a barrier which tips all stormwater landing on this road into the East Null to the west of the bus entrance road. The drainage pattern will remain similar to its existing characteristics. Some stormwater will remain on site and pond in the various depressions located about the area and some will spill over into the adjacent parcel. About 2.2 acres of land in this catch basin direct water to flow over into the connecting parcel. As seen in Table 2 below, the amount of water leaving the site remains the same.

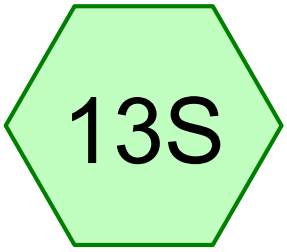
Combined Stormwater Calculation Table

Table 2: Proposed Stormwater Flows

Drainage Catch Basin Area	**Existing Storm Water Flow**			**Proposed Storm Water Flow**		
	2-Year	10-Year	100-Year	2-Year	10-Year	100-Year
North Lake						
North Lake	2.13 cfs	7.15 cfs	16.10 cfs	2.13 cfs	7.15 cfs	16.10 cfs
Basin Total	**2.13 cfs**	**7.15 cfs**	**16.10 cfs**	**2.13 cfs**	**7.15 cfs**	**16.10 cfs**
South Wetland						
South Wetland	9.06 cfs	31.60 cfs	70.22 cfs	3.38 cfs	11.88 cfs	26.81 cfs
West Pond	*Accounted for in South Wetland*			0.35 cfs	10.59 cfs	18.74 cfs
West Playground	*Accounted for in South Wetland*			3.71 cfs	7.88 cfs	14.45 cfs
Basin Total	**9.06 cfs**	**31.60 cfs**	**70.22 cfs**	**7.44 cfs**	**30.35 cfs**	**60.00 cfs**
East						
East	0.00 cfs	0.00 cfs	0.00 cfs	0.00 cfs	0.00 cfs	0.00 cfs
East Null	*Accounted for in East calculations*			0.00 cfs	0.00 cfs	0.00 cfs
Basin Total	**0.00 cfs**	**0.00 cfs**	**0.00 cfs**	**0.00 cfs**	**0.00 cfs**	**0.00 cfs**
Southeast Existing Development						
Southeast Existing Development	0.86 cfs	2.88 cfs	6.29 cfs	0.86 cfs	2.88 cfs	6.29 cfs
Basin Total	**0.86 cfs**	**2.88 cfs**	**6.29 cfs**	**0.86 cfs**	**2.88 cfs**	**6.29 cfs**
Parcel Total	**12.05 cfs**	**41.63 cfs**	**92.61 cfs**	**10.43 cfs**	**40.38 cfs**	**82.39 cfs**

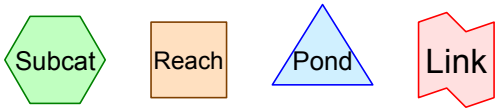
The above table summarizes the existing and proposed stormwater cfs (cubic feet per second) flow for each drainage basin in a 2-year storm, 10-year storm, and 100-year storm.

Of the total 160.45 acre parcel, 9.9 acres are proposed to be impervious and the remaining 150.55 acres are proposed to remain pervious. This changes the parcel to have 6.2% impervious surfaces.



NORTH LAKE

SOUTH WETLAND



Routing Diagram for 16-004 EXISTING STORMWATER

Prepared by HydroCAD SAMPLER 1-800-927-7246 www.hydrocad.net, Printed 3/29/2016
HydroCAD® 10.00-13 Sampler s/n S08193 © 2014 HydroCAD Software Solutions LLC

Summary for Subcatchment 13S: NORTH LAKE

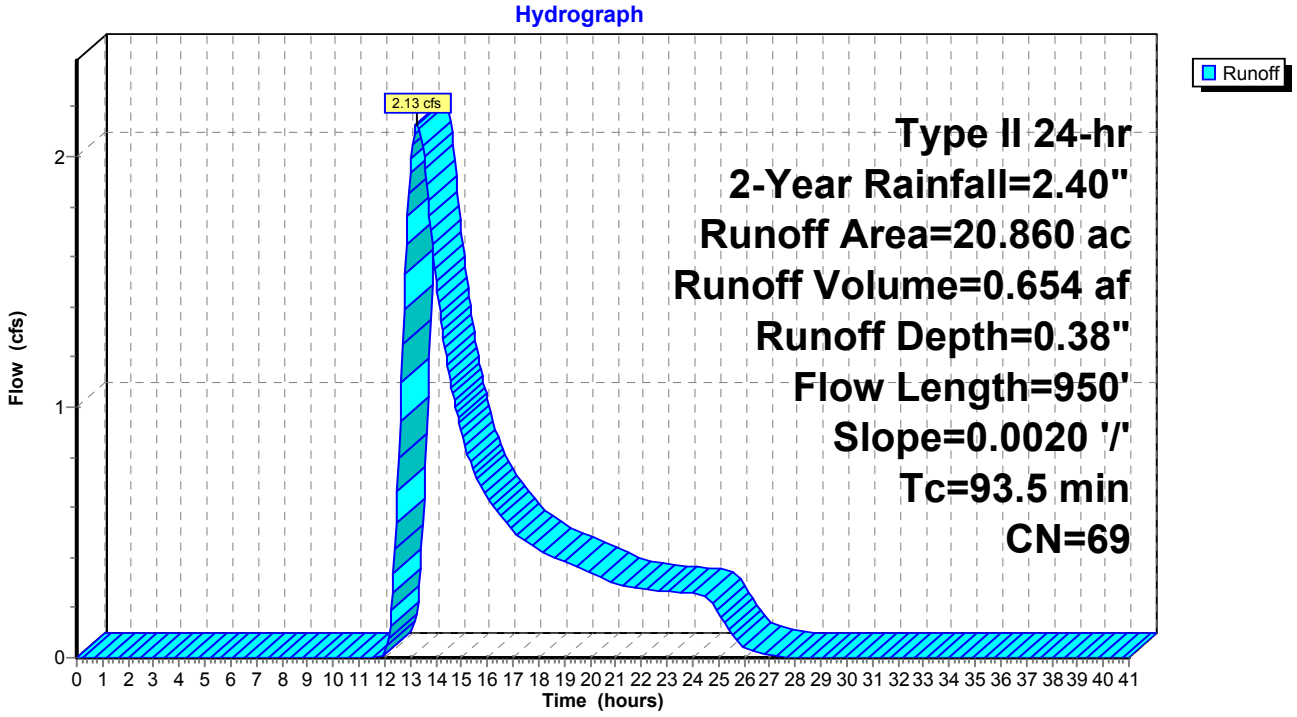
Runoff = 2.13 cfs @ 13.28 hrs, Volume= 0.654 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

Area (ac)	CN	Description
20.860	69	50-75% Grass cover, Fair, HSG B
20.860		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
93.5	950	0.0020	0.17		**Lag/CN Method,**

Subcatchment 13S: NORTH LAKE



Summary for Subcatchment 14S: SOUTH WETLAND

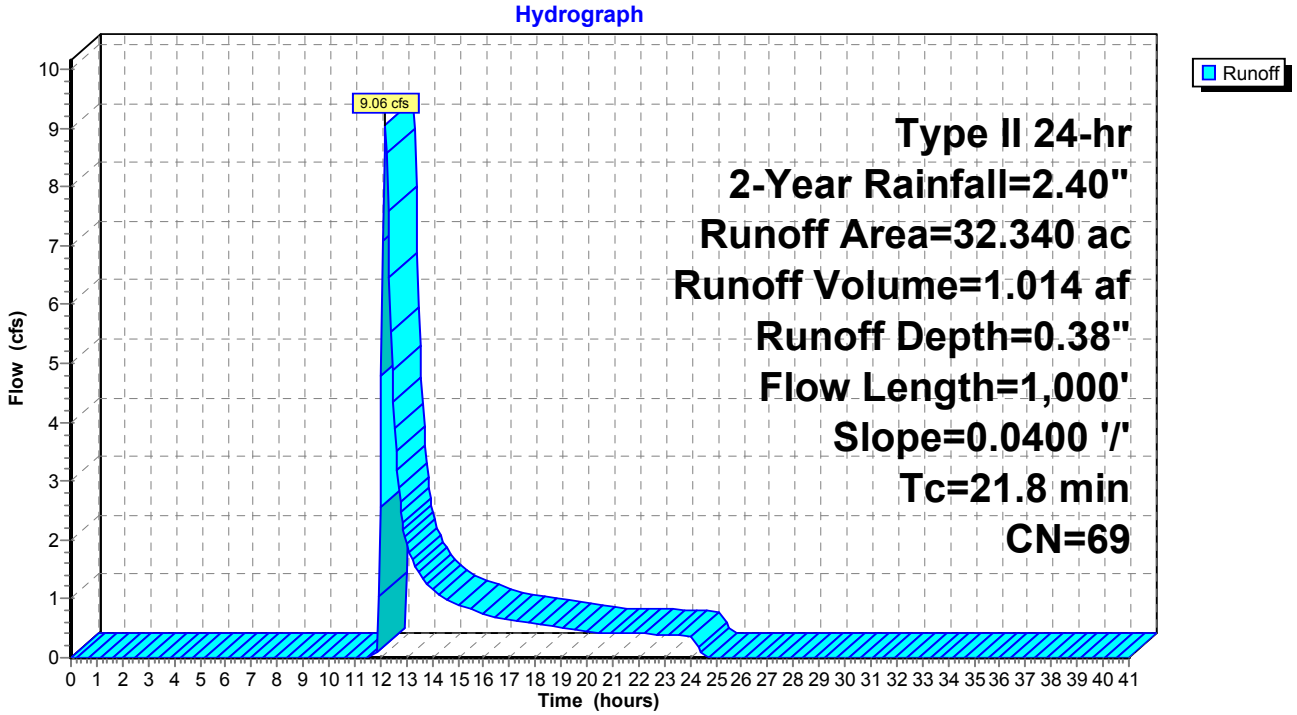
Runoff = 9.06 cfs @ 12.20 hrs, Volume= 1.014 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

Area (ac)	CN	Description
32.340	69	50-75% Grass cover, Fair, HSG B
32.340		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	1,000	0.0400	0.77		**Lag/CN Method,**

Subcatchment 14S: SOUTH WETLAND



Summary for Subcatchment 13S: NORTH LAKE

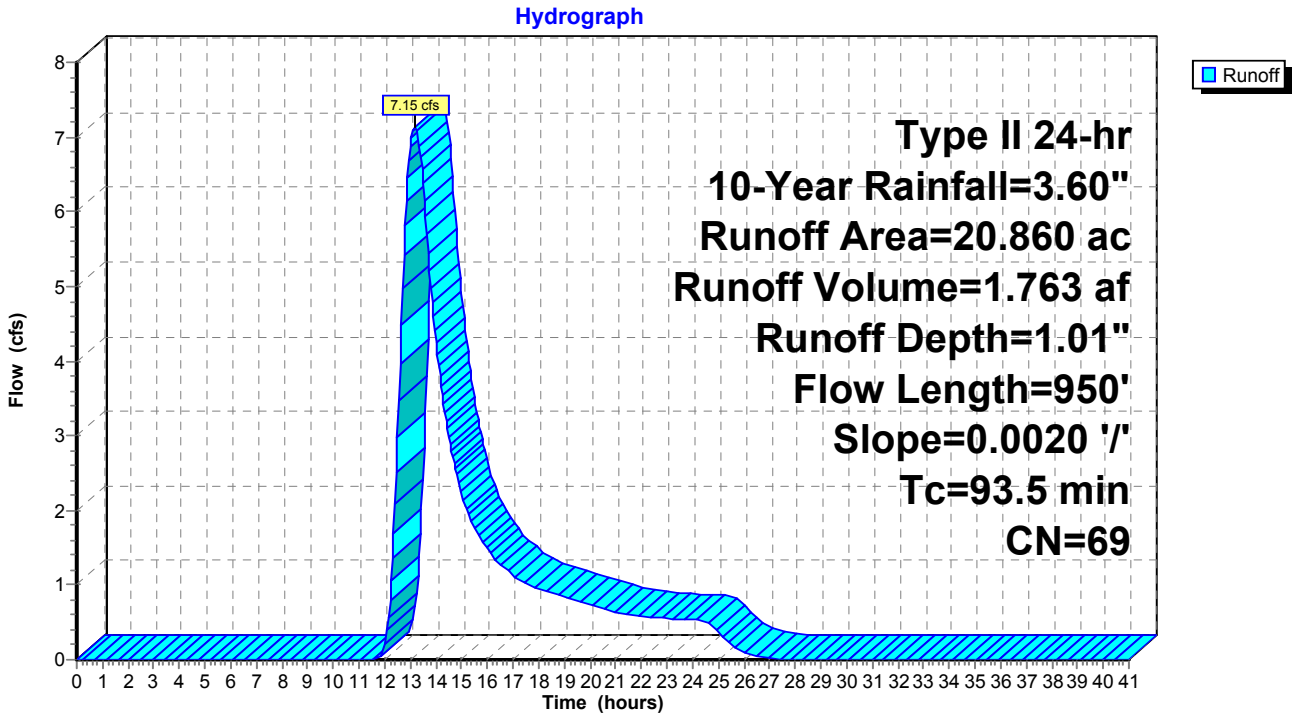
Runoff = 7.15 cfs @ 13.19 hrs, Volume= 1.763 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

Area (ac)	CN	Description
20.860	69	50-75% Grass cover, Fair, HSG B
20.860		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
93.5	950	0.0020	0.17		**Lag/CN Method,**

Subcatchment 13S: NORTH LAKE



Summary for Subcatchment 14S: SOUTH WETLAND

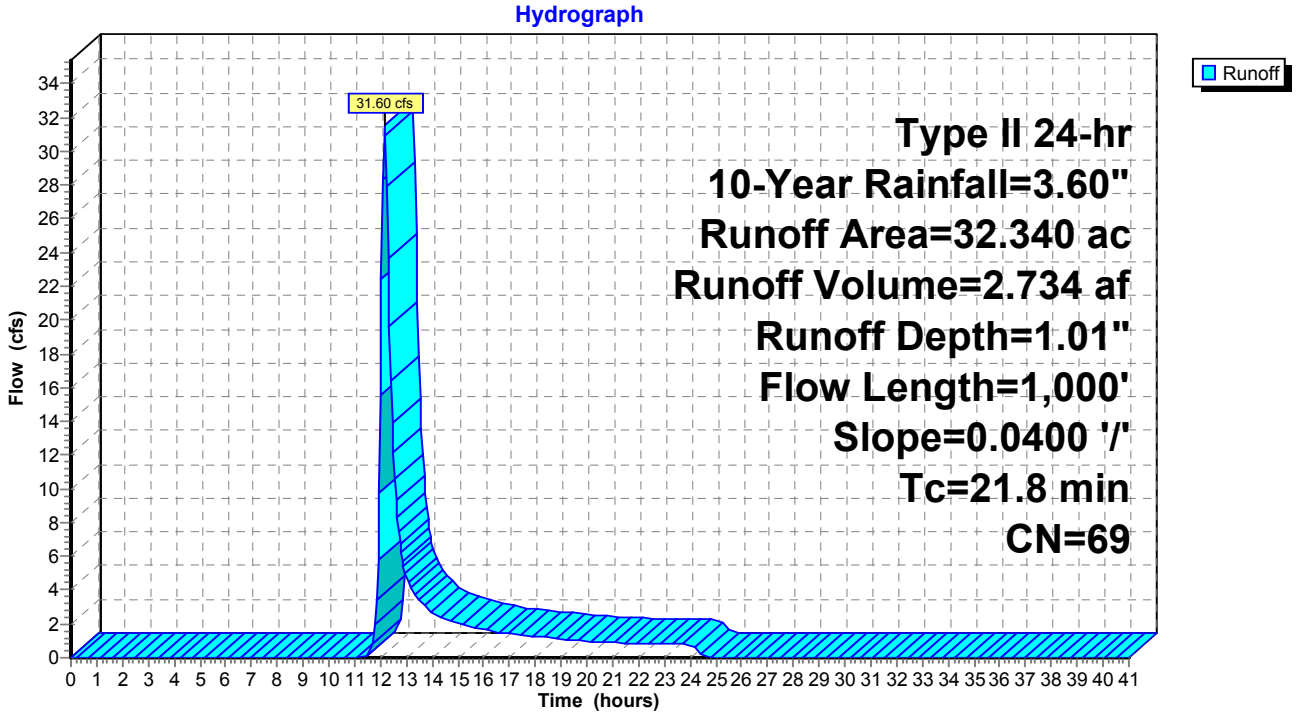
Runoff = 31.60 cfs @ 12.17 hrs, Volume= 2.734 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

Area (ac)	CN	Description
32.340	69	50-75% Grass cover, Fair, HSG B
32.340		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	1,000	0.0400	0.77		**Lag/CN Method,**

Subcatchment 14S: SOUTH WETLAND



Summary for Subcatchment 13S: NORTH LAKE

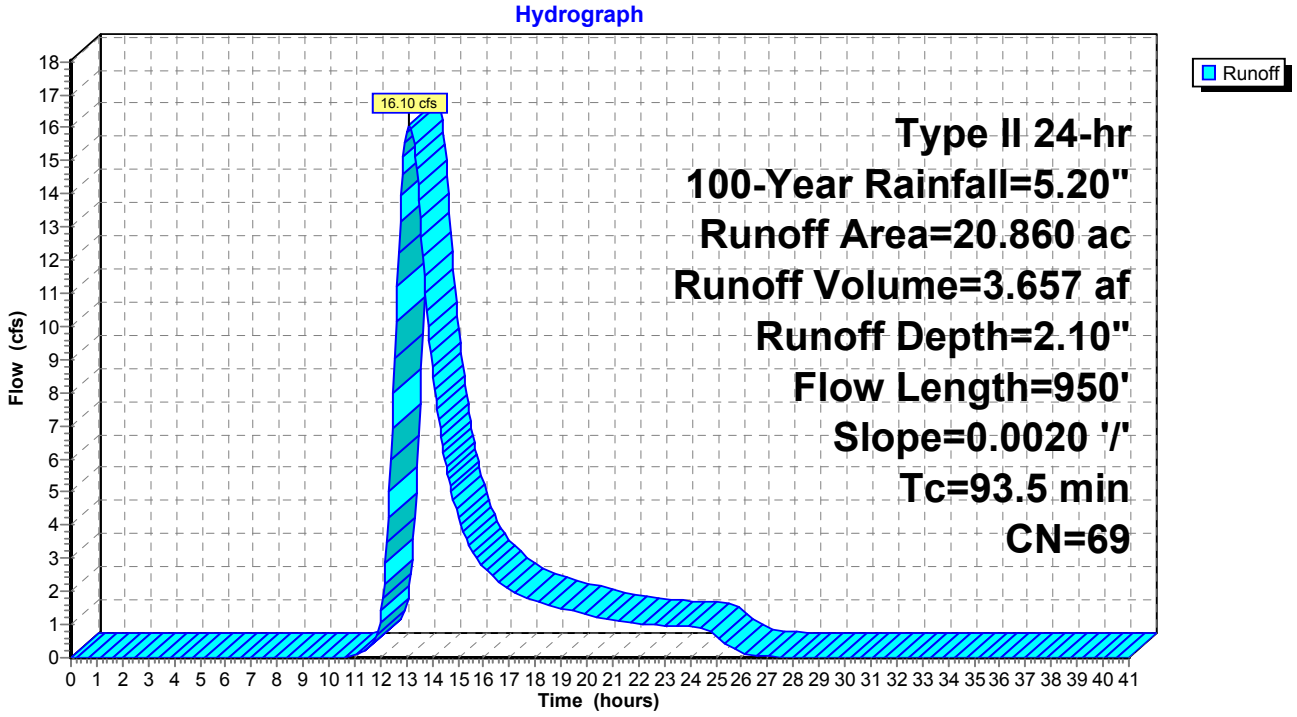
Runoff = 16.10 cfs @ 13.12 hrs, Volume= 3.657 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

Area (ac)	CN	Description
20.860	69	50-75% Grass cover, Fair, HSG B
20.860		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
93.5	950	0.0020	0.17		**Lag/CN Method,**

Subcatchment 13S: NORTH LAKE



Summary for Subcatchment 14S: SOUTH WETLAND

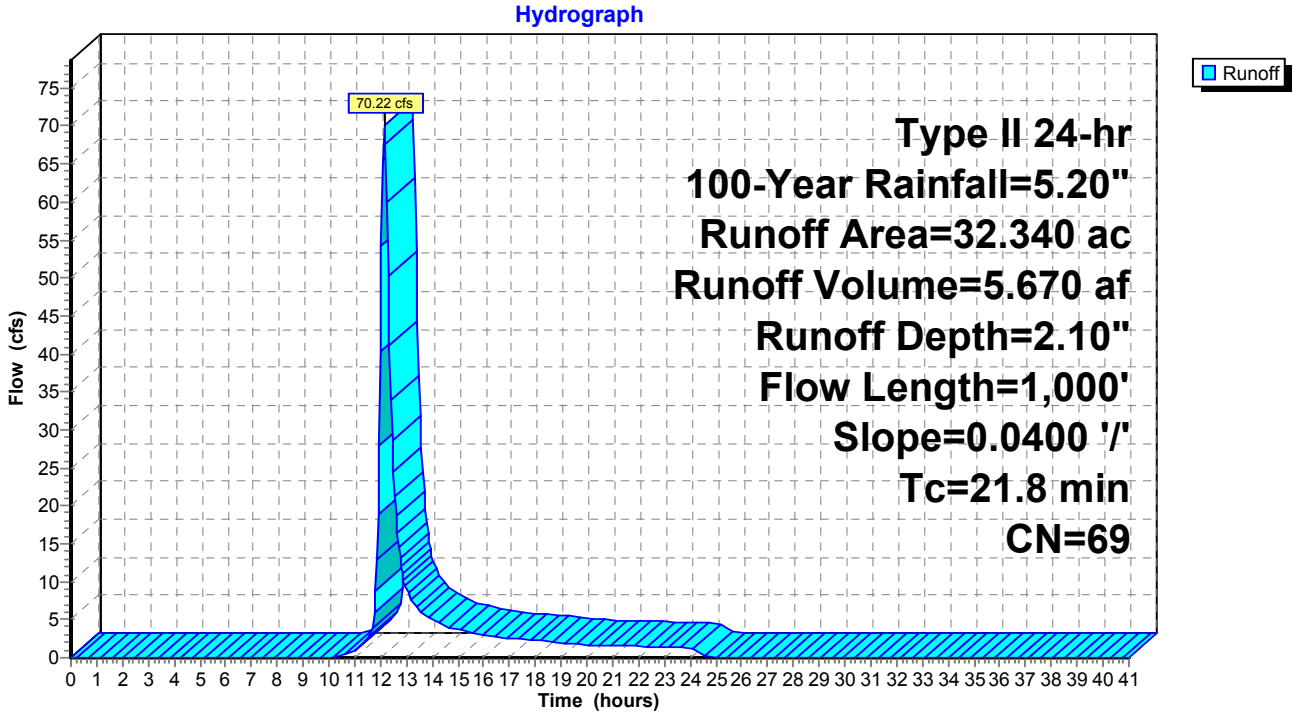
Runoff = 70.22 cfs @ 12.16 hrs, Volume= 5.670 af, Depth= 2.10"

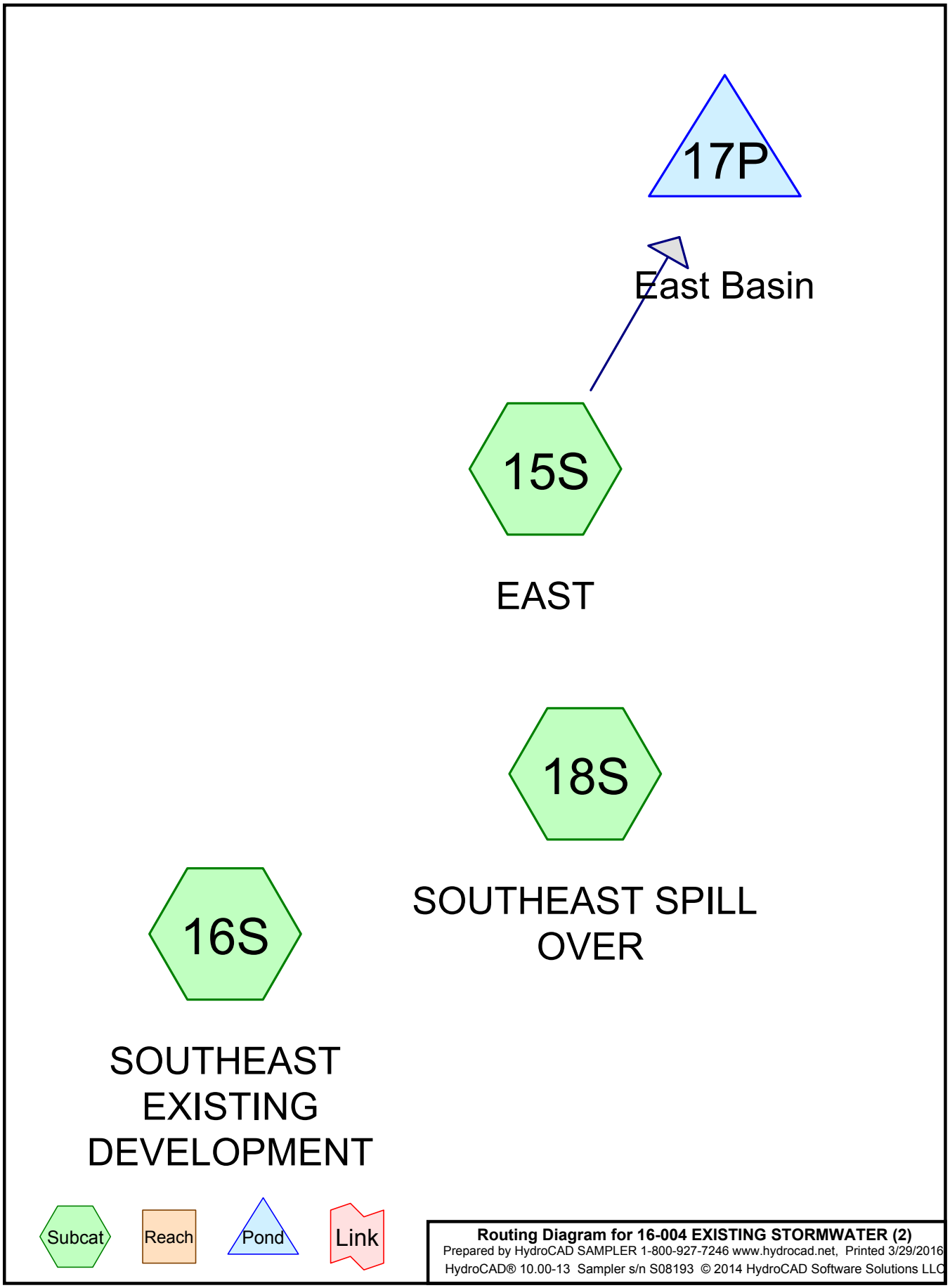
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

Area (ac)	CN	Description
32.340	69	50-75% Grass cover, Fair, HSG B
32.340		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	1,000	0.0400	0.77		**Lag/CN Method,**

Subcatchment 14S: SOUTH WETLAND





Routing Diagram for 16-004 EXISTING STORMWATER (2)

Prepared by HydroCAD SAMPLER 1-800-927-7246 www.hydrocad.net, Printed 3/29/2016

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Summary for Subcatchment 15S: EAST

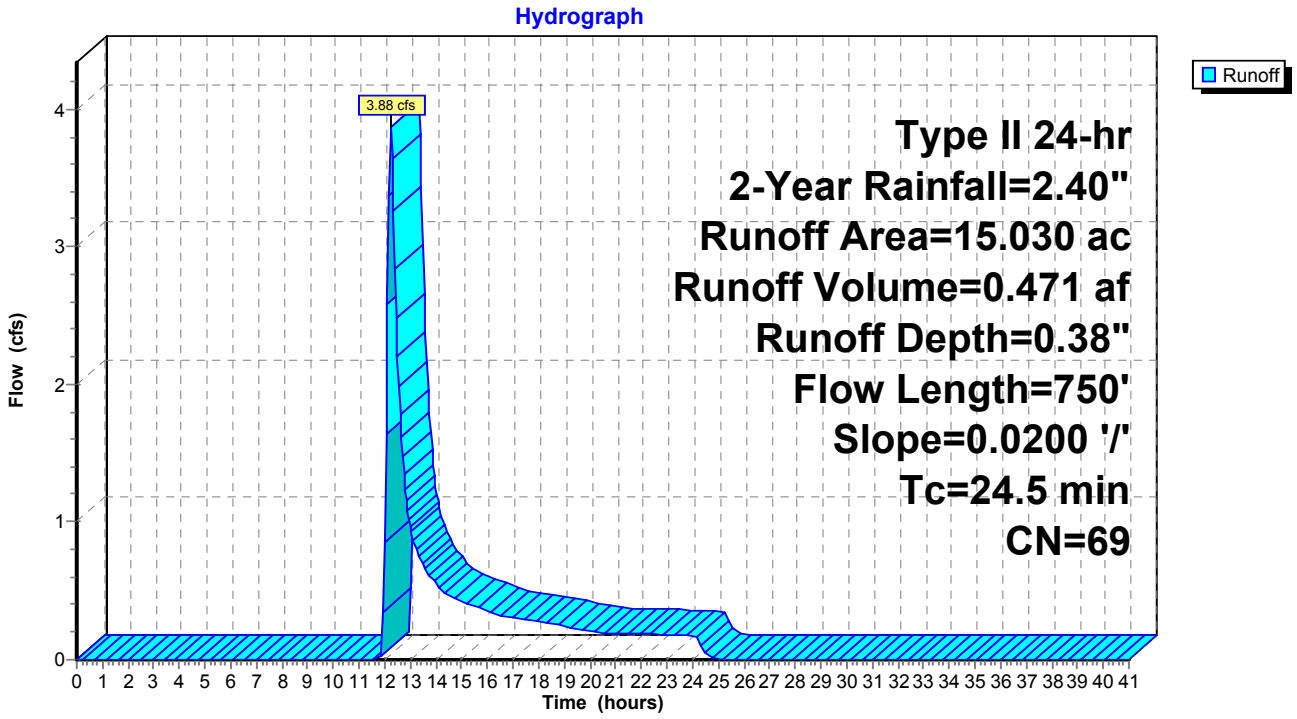
Runoff = 3.88 cfs @ 12.24 hrs, Volume= 0.471 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

Area (ac)	CN	Description
15.030	69	50-75% Grass cover, Fair, HSG B
15.030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	750	0.0200	0.51		**Lag/CN Method,**

Subcatchment 15S: EAST



Summary for Subcatchment 16S: SOUTHEAST EXISTING DEVELOPMENT

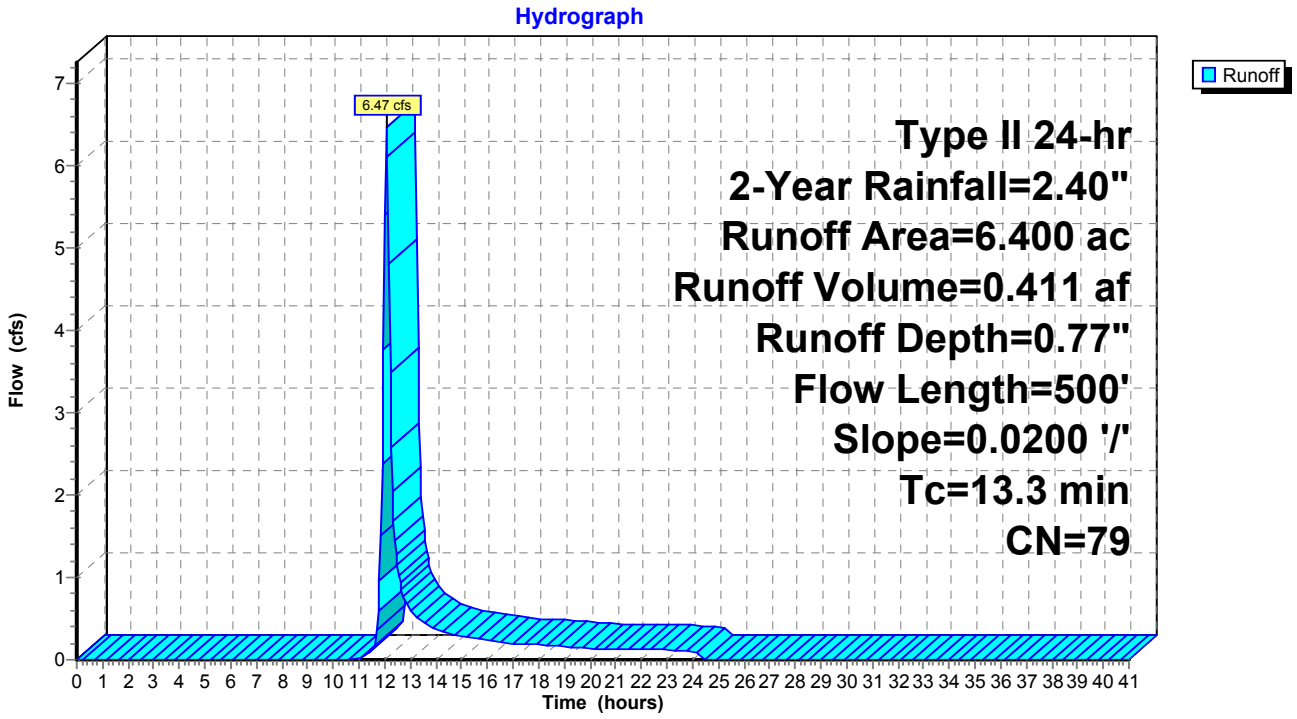
Runoff = 6.47 cfs @ 12.06 hrs, Volume= 0.411 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

Area (ac)	CN	Description
6.400	79	50-75% Grass cover, Fair, HSG C
6.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	500	0.0200	0.63		**Lag/CN Method,**

Subcatchment 16S: SOUTHEAST EXISTING DEVELOPMENT



Summary for Subcatchment 18S: SOUTHEAST SPILL OVER

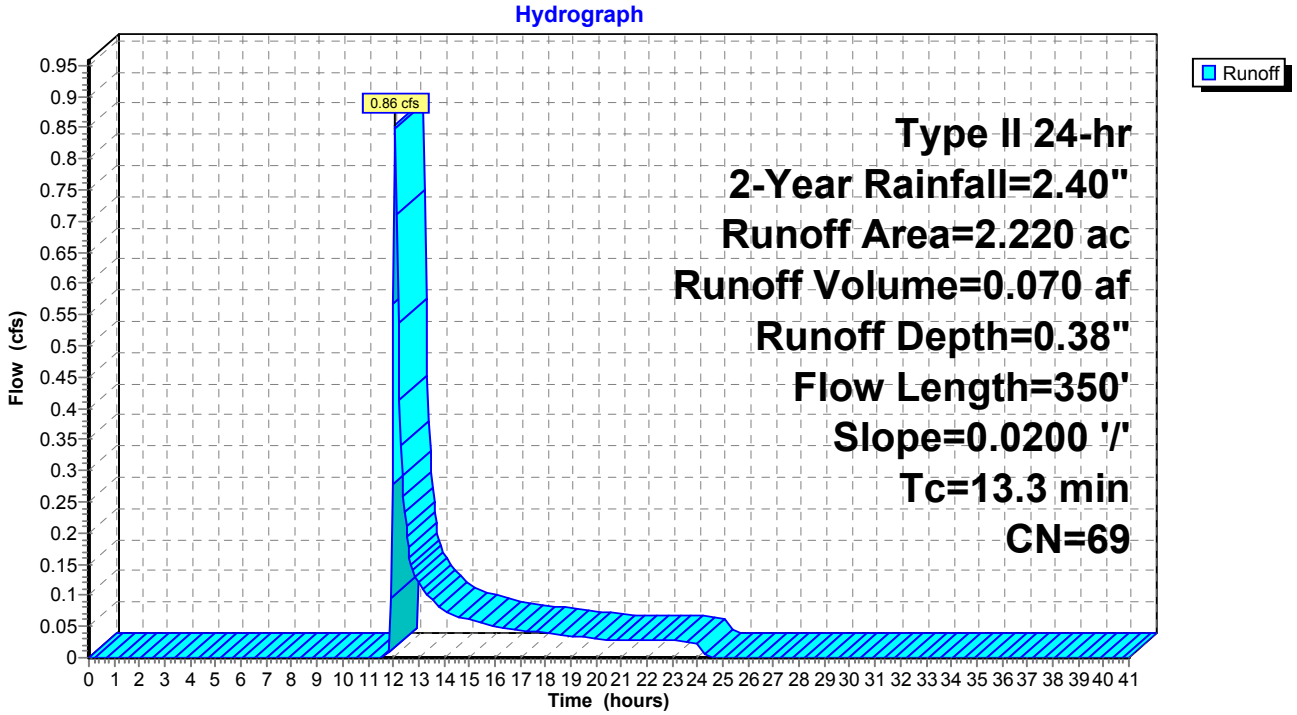
Runoff = 0.86 cfs @ 12.09 hrs, Volume= 0.070 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

Area (ac)	CN	Description
2.220	69	50-75% Grass cover, Fair, HSG B
2.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	350	0.0200	0.44		**Lag/CN Method,**

Subcatchment 18S: SOUTHEAST SPILL OVER



Summary for Pond 17P: East Basin

Inflow Area = 15.030 ac, 0.00% Impervious, Inflow Depth = 0.38" for 2-Year event
Inflow = 3.88 cfs @ 12.24 hrs, Volume= 0.471 af
Outflow = 1.00 cfs @ 12.15 hrs, Volume= 0.471 af, Atten= 74%, Lag= 0.0 min
Discarded = 1.00 cfs @ 12.15 hrs, Volume= 0.471 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,383.34' @ 12.97 hrs Surf.Area= 15,129 sf Storage= 4,494 cf

Plug-Flow detention time= 33.8 min calculated for 0.471 af (100% of inflow)
Center-of-Mass det. time= 33.7 min (955.8 - 922.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,383.00'	218,192 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

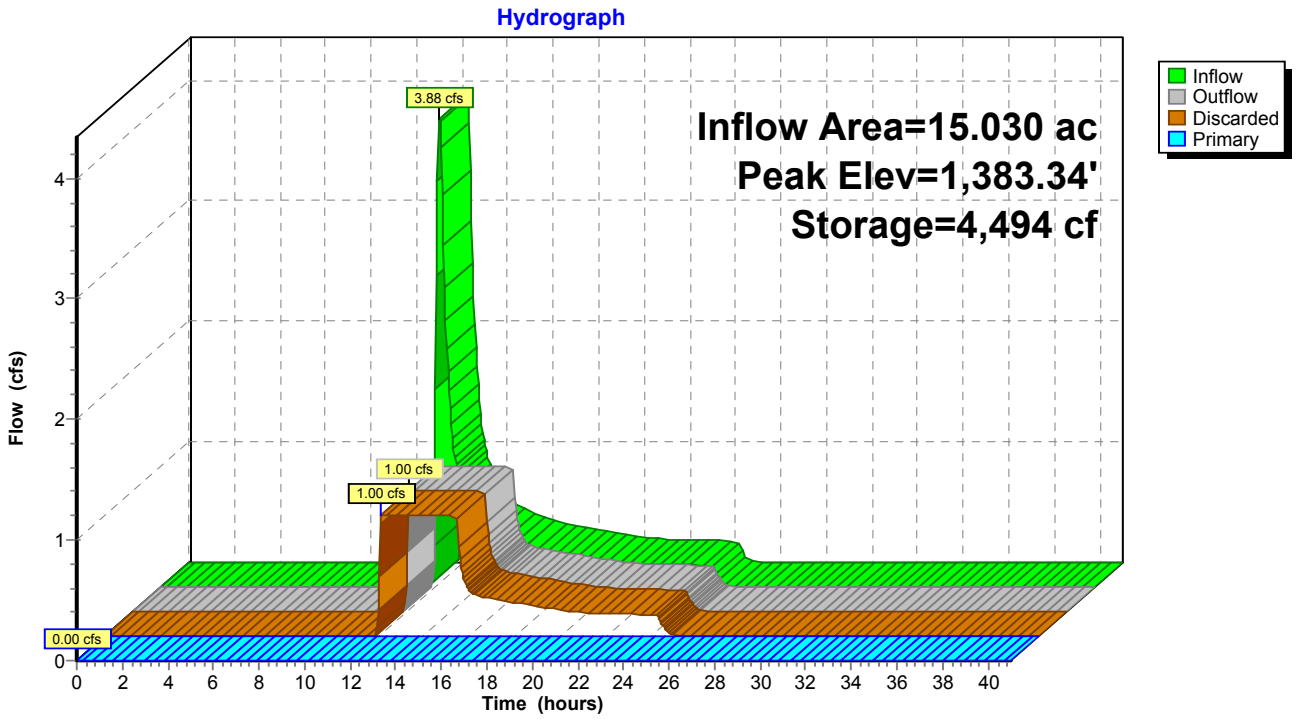
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,383.00	11,240	0	0
1,384.00	22,650	16,945	16,945
1,385.00	34,533	28,592	45,537
1,386.00	47,950	41,242	86,778
1,387.00	64,581	56,266	143,044
1,388.00	85,715	75,148	218,192

Device	Routing	Invert	Outlet Devices
#1	Primary	1,388.00'	**500.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,383.00'	**1.00 cfs Exfiltration when above 1,383.00'**

Discarded OutFlow Max=1.00 cfs @ 12.15 hrs HW=1,383.08' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,383.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 17P: East Basin



Summary for Subcatchment 15S: EAST

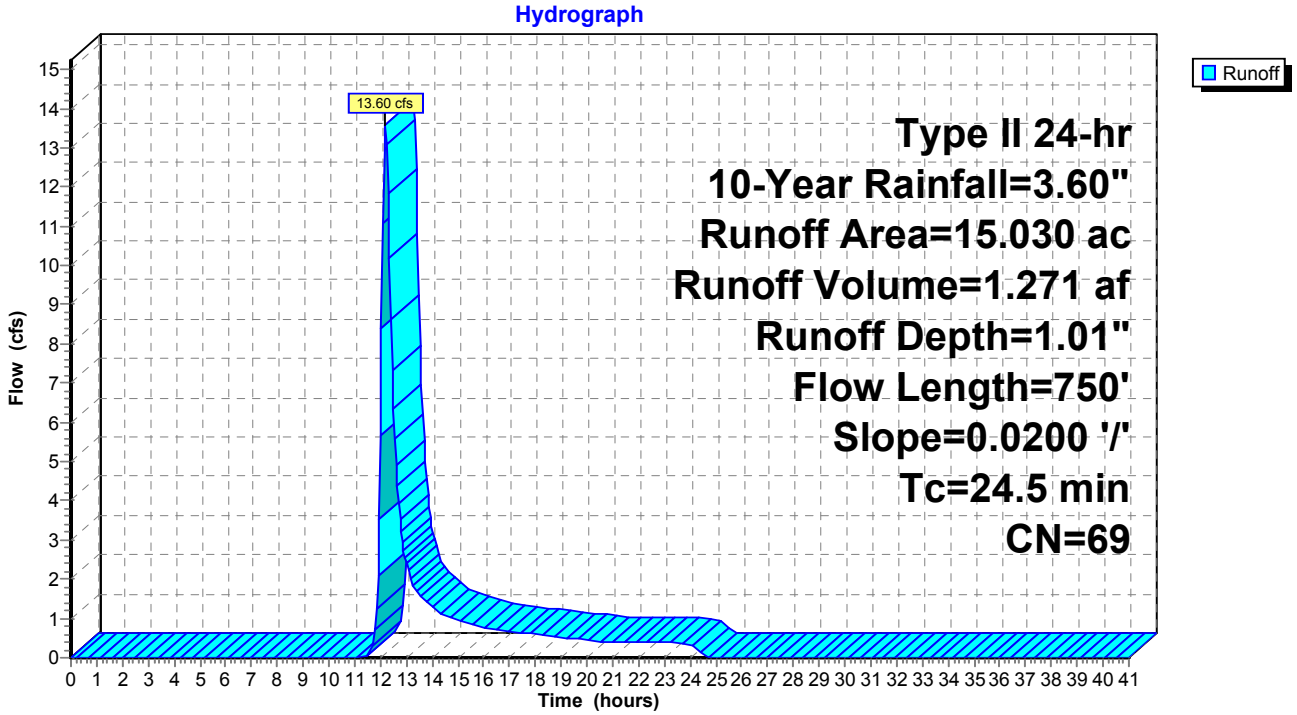
Runoff = 13.60 cfs @ 12.20 hrs, Volume= 1.271 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

Area (ac)	CN	Description
15.030	69	50-75% Grass cover, Fair, HSG B
15.030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	750	0.0200	0.51		**Lag/CN Method,**

Subcatchment 15S: EAST



Summary for Subcatchment 16S: SOUTHEAST EXISTING DEVELOPMENT

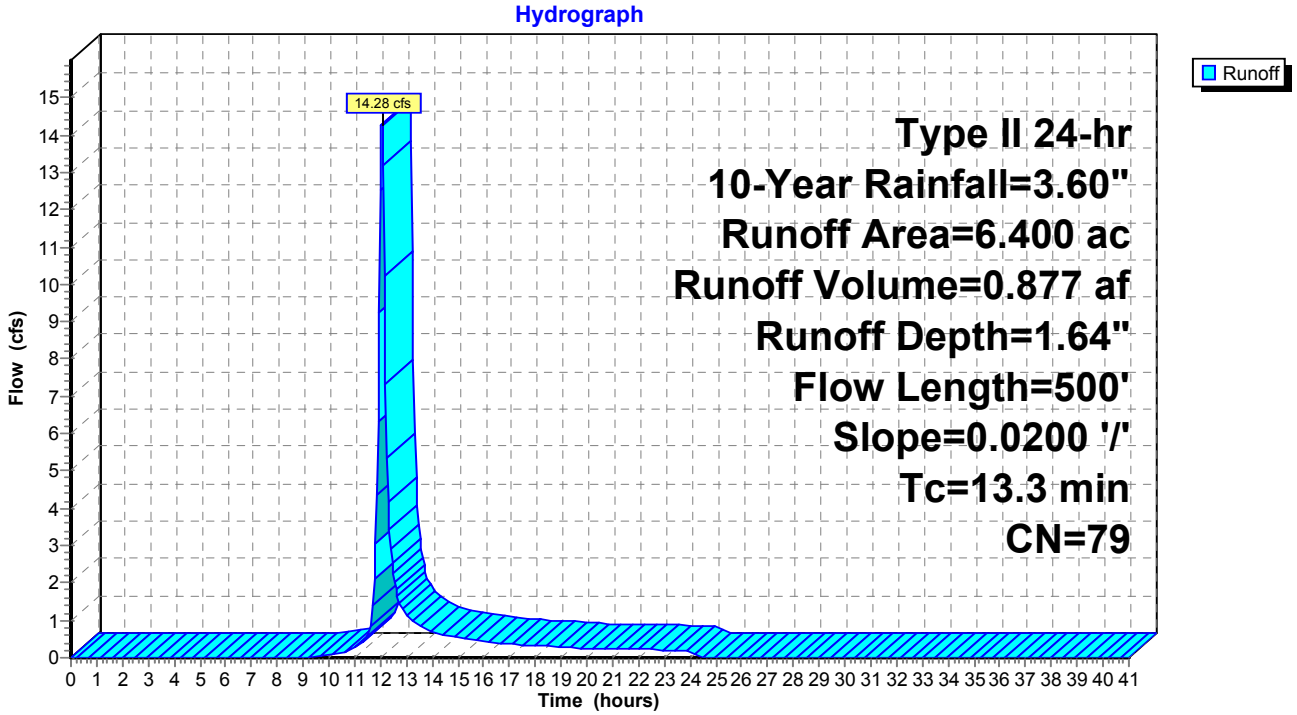
Runoff = 14.28 cfs @ 12.06 hrs, Volume= 0.877 af, Depth= 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

Area (ac)	CN	Description
6.400	79	50-75% Grass cover, Fair, HSG C
6.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	500	0.0200	0.63		**Lag/CN Method,**

Subcatchment 16S: SOUTHEAST EXISTING DEVELOPMENT



Summary for Subcatchment 18S: SOUTHEAST SPILL OVER

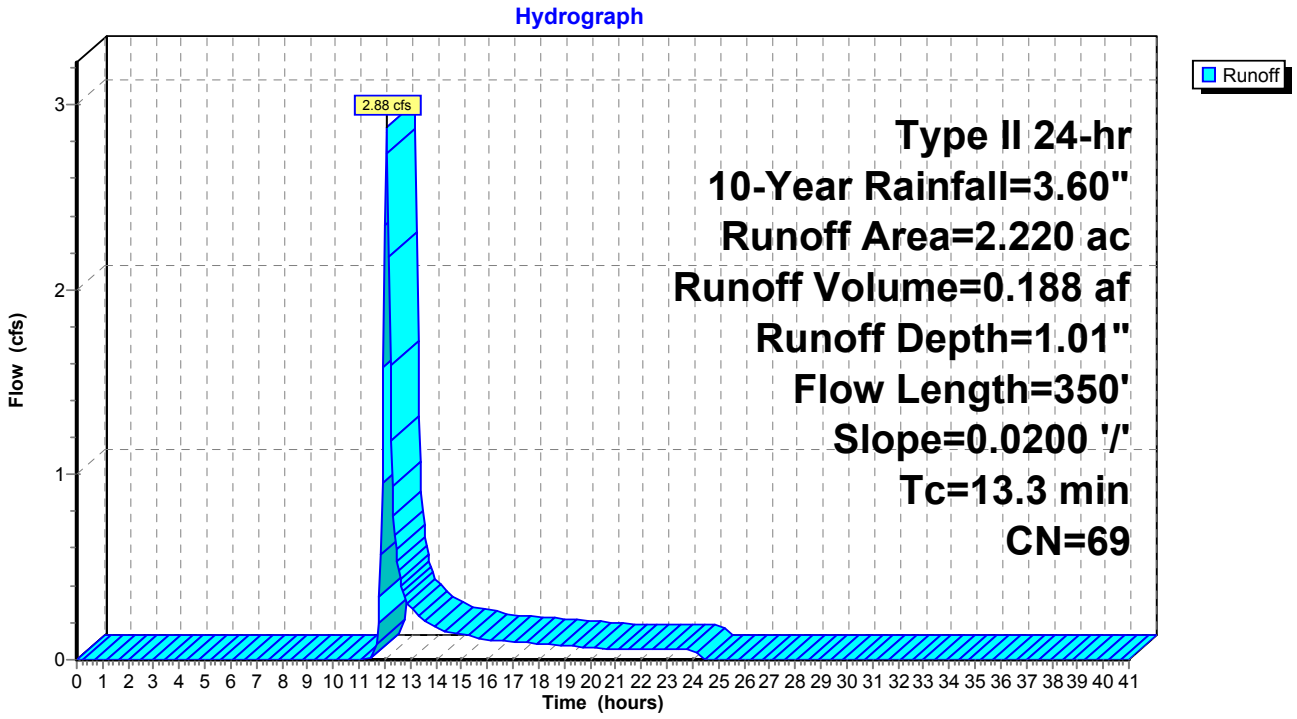
Runoff = 2.88 cfs @ 12.07 hrs, Volume= 0.188 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

Area (ac)	CN	Description
2.220	69	50-75% Grass cover, Fair, HSG B
2.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	350	0.0200	0.44		**Lag/CN Method,**

Subcatchment 18S: SOUTHEAST SPILL OVER



Summary for Pond 17P: East Basin

Inflow Area = 15.030 ac, 0.00% Impervious, Inflow Depth = 1.01" for 10-Year event
Inflow = 13.60 cfs @ 12.20 hrs, Volume= 1.271 af
Outflow = 1.00 cfs @ 11.95 hrs, Volume= 1.271 af, Atten= 93%, Lag= 0.0 min
Discarded = 1.00 cfs @ 11.95 hrs, Volume= 1.271 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,384.37' @ 14.79 hrs Surf.Area= 26,990 sf Storage= 26,009 cf

Plug-Flow detention time= 286.7 min calculated for 1.269 af (100% of inflow)
Center-of-Mass det. time= 286.6 min (1,171.1 - 884.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,383.00'	218,192 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

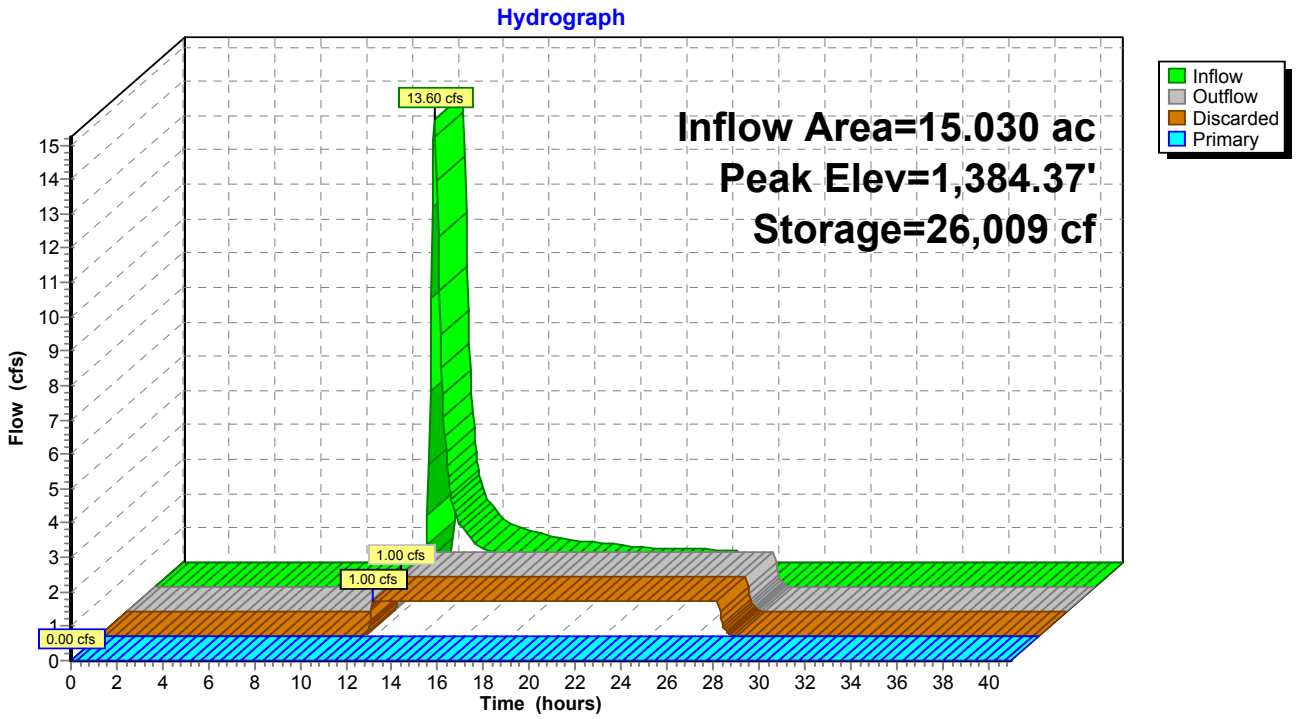
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,383.00	11,240	0	0
1,384.00	22,650	16,945	16,945
1,385.00	34,533	28,592	45,537
1,386.00	47,950	41,242	86,778
1,387.00	64,581	56,266	143,044
1,388.00	85,715	75,148	218,192

Device	Routing	Invert	Outlet Devices
#1	Primary	1,388.00'	**500.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,383.00'	**1.00 cfs Exfiltration when above 1,383.00'**

Discarded OutFlow Max=1.00 cfs @ 11.95 hrs HW=1,383.07' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,383.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 17P: East Basin



Summary for Subcatchment 15S: EAST

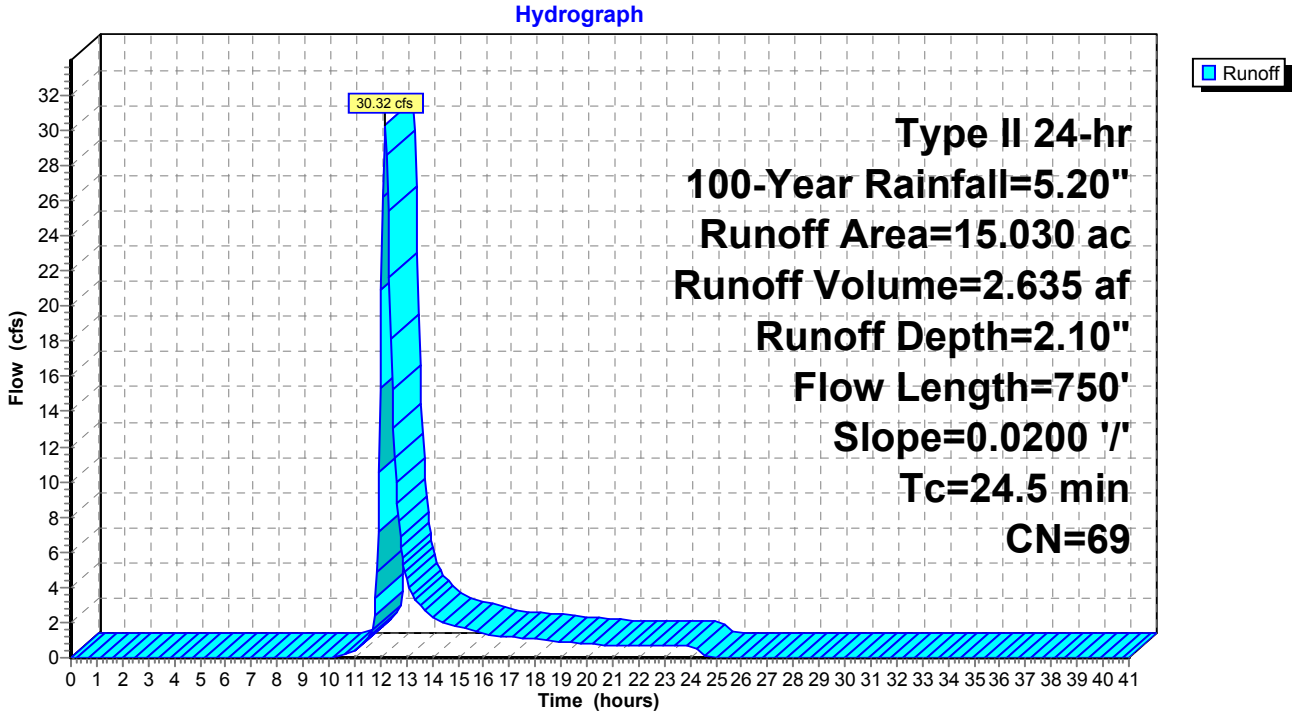
Runoff = 30.32 cfs @ 12.19 hrs, Volume= 2.635 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

Area (ac)	CN	Description
15.030	69	50-75% Grass cover, Fair, HSG B
15.030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	750	0.0200	0.51		**Lag/CN Method,**

Subcatchment 15S: EAST



Summary for Subcatchment 16S: SOUTHEAST EXISTING DEVELOPMENT

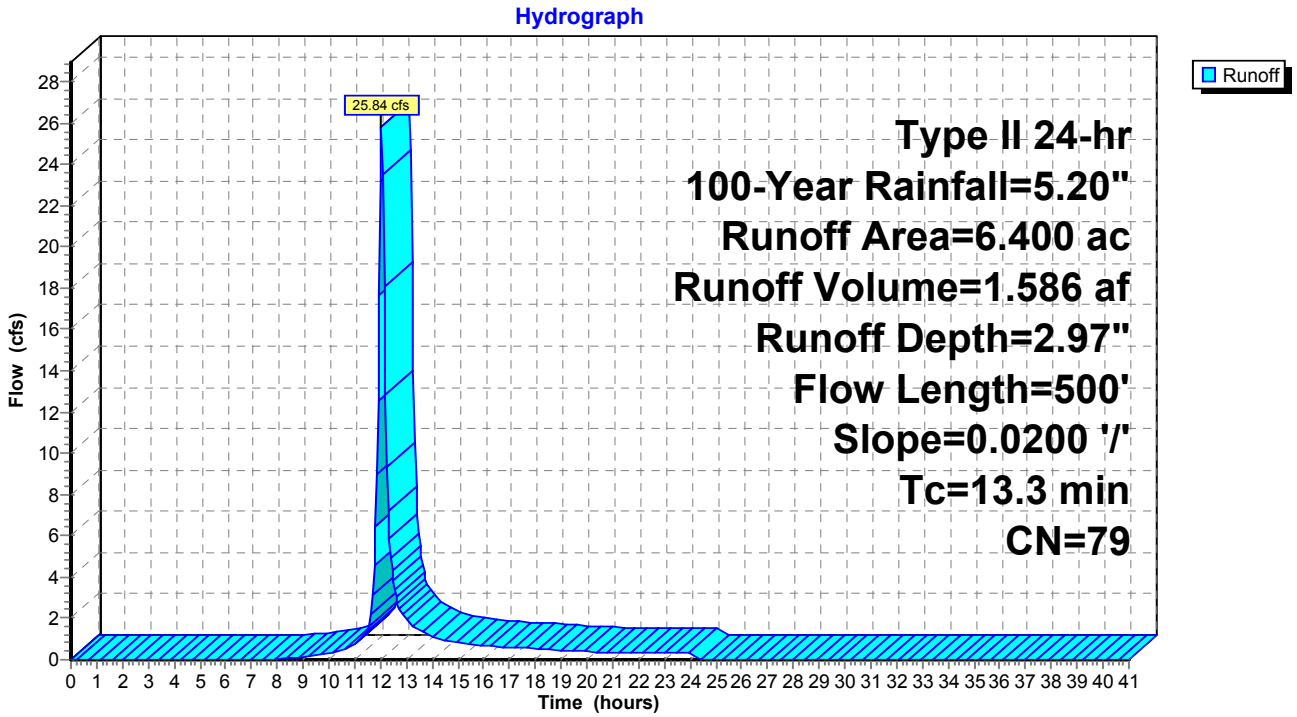
Runoff = 25.84 cfs @ 12.05 hrs, Volume= 1.586 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

Area (ac)	CN	Description
6.400	79	50-75% Grass cover, Fair, HSG C
6.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	500	0.0200	0.63		**Lag/CN Method,**

Subcatchment 16S: SOUTHEAST EXISTING DEVELOPMENT



Summary for Subcatchment 18S: SOUTHEAST SPILL OVER

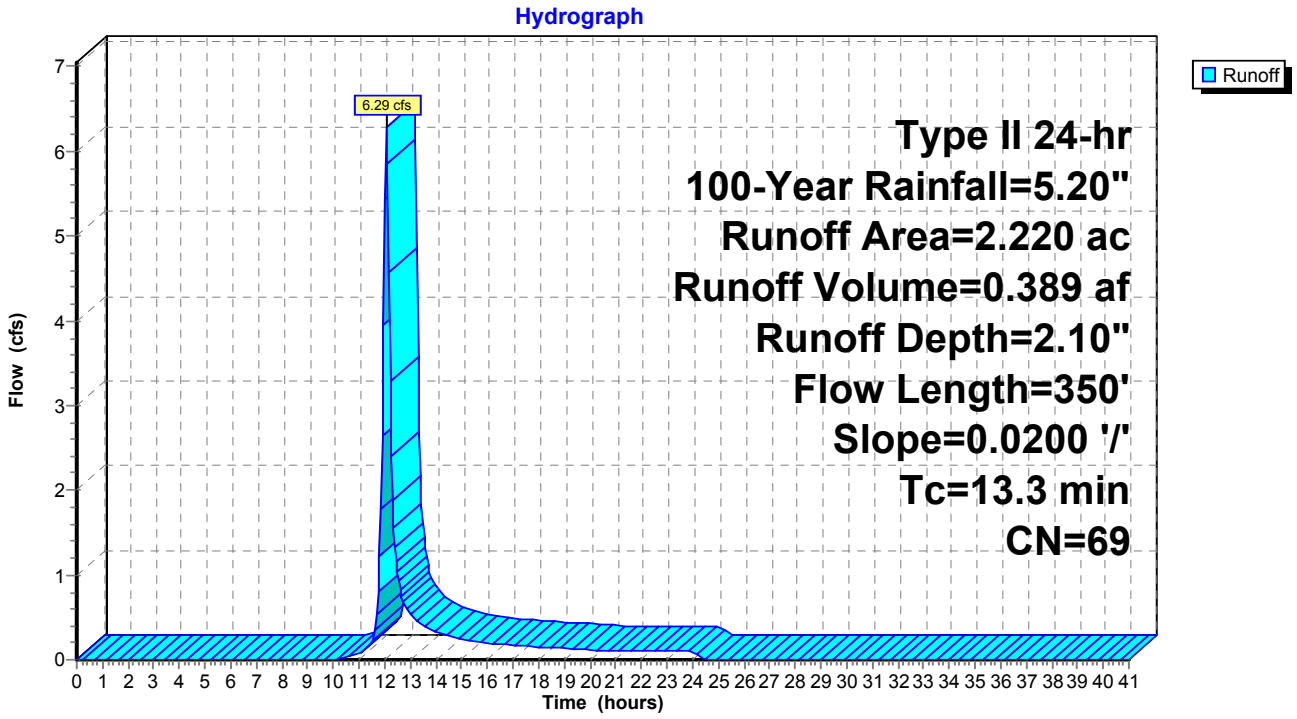
Runoff = 6.29 cfs @ 12.06 hrs, Volume= 0.389 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

Area (ac)	CN	Description
2.220	69	50-75% Grass cover, Fair, HSG B
2.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	350	0.0200	0.44		**Lag/CN Method,**

Subcatchment 18S: SOUTHEAST SPILL OVER



Summary for Pond 17P: East Basin

Inflow Area = 15.030 ac, 0.00% Impervious, Inflow Depth = 2.10" for 100-Year event
Inflow = 30.32 cfs @ 12.19 hrs, Volume= 2.635 af
Outflow = 1.00 cfs @ 11.65 hrs, Volume= 2.467 af, Atten= 97%, Lag= 0.0 min
Discarded = 1.00 cfs @ 11.65 hrs, Volume= 2.467 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,385.69' @ 18.46 hrs Surf.Area= 43,796 sf Storage= 72,576 cf

Plug-Flow detention time= 738.2 min calculated for 2.464 af (93% of inflow)
Center-of-Mass det. time= 704.0 min (1,565.9 - 861.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,383.00'	218,192 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

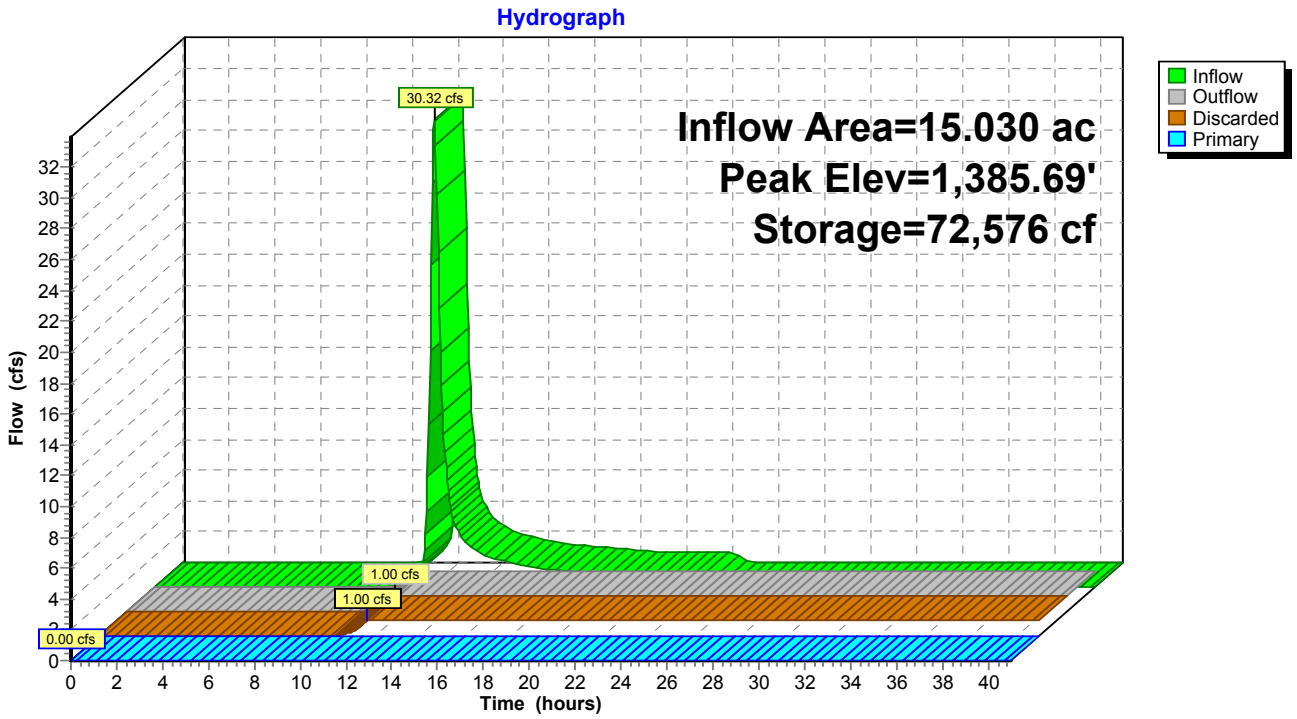
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,383.00	11,240	0	0
1,384.00	22,650	16,945	16,945
1,385.00	34,533	28,592	45,537
1,386.00	47,950	41,242	86,778
1,387.00	64,581	56,266	143,044
1,388.00	85,715	75,148	218,192

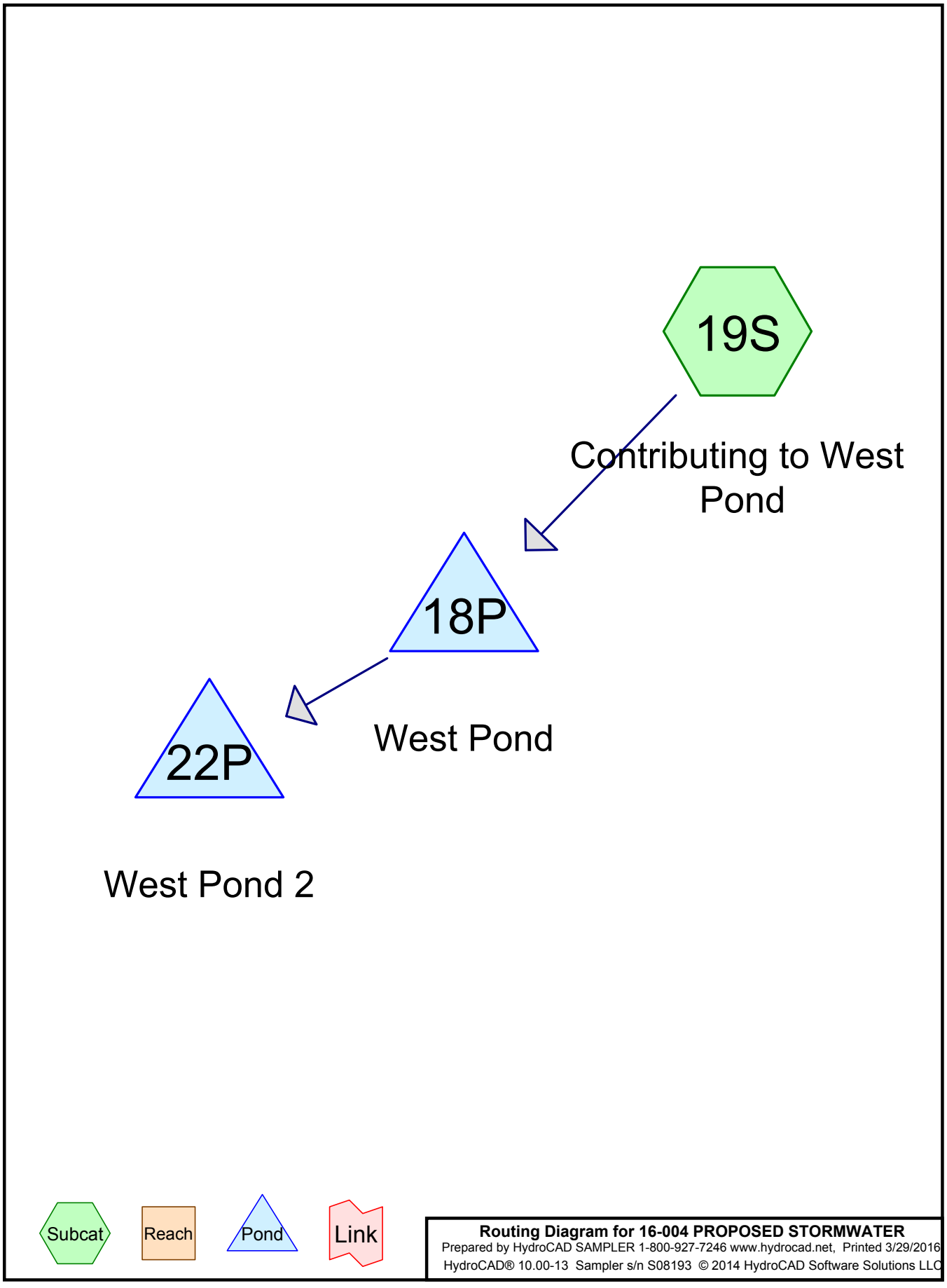
Device	Routing	Invert	Outlet Devices
#1	Primary	1,388.00'	**500.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,383.00'	**1.00 cfs Exfiltration when above 1,383.00'**

Discarded OutFlow Max=1.00 cfs @ 11.65 hrs HW=1,383.05' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,383.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 17P: East Basin





Routing Diagram for 16-004 PROPOSED STORMWATER

Prepared by HydroCAD SAMPLER 1-800-927-7246 www.hydrocad.net, Printed 3/29/2016

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Summary for Subcatchment 19S: Contributing to West Pond

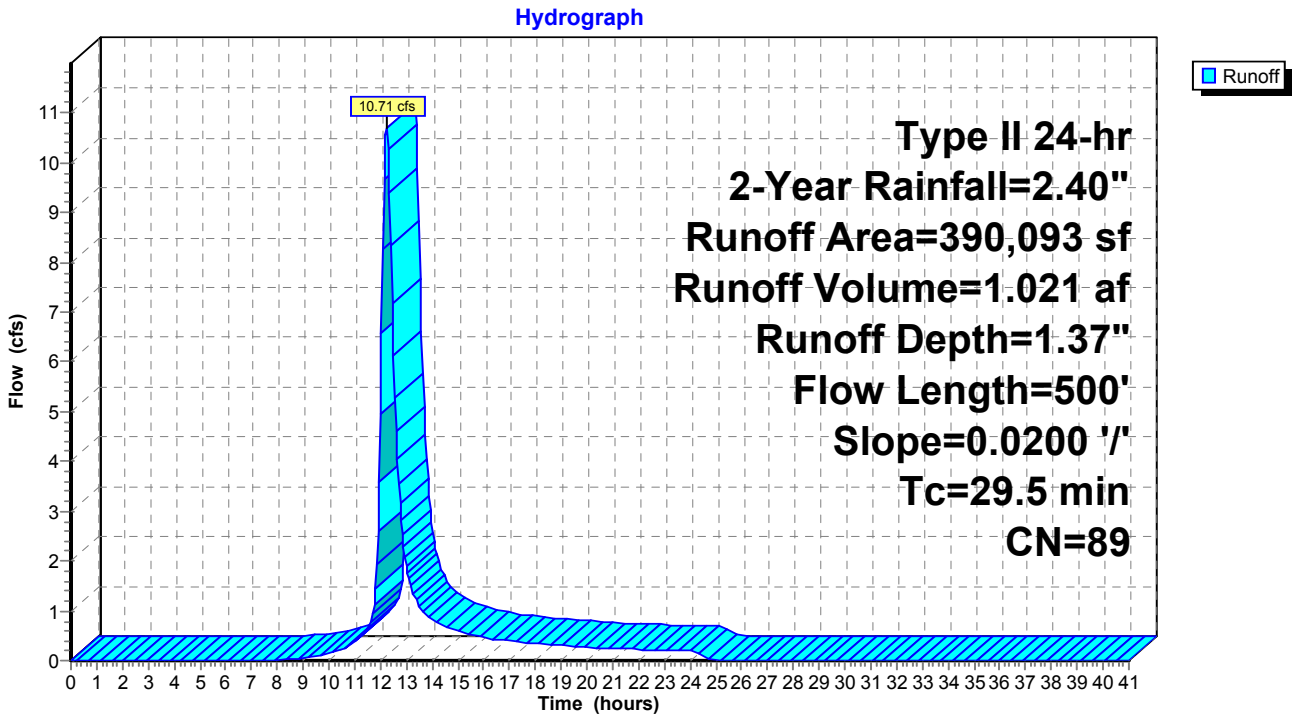
Runoff = 10.71 cfs @ 12.24 hrs, Volume= 1.021 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

	Area (sf)	CN	Description
	150,694	98	Paved parking, HSG B
	85,450	98	Unconnected roofs, HSG B
	126,154	69	50-75% Grass cover, Fair, HSG B
*	27,795	98	Sidewalk
	390,093	89	Weighted Average
	126,154		32.34% Pervious Area
	263,939		67.66% Impervious Area
	85,450		32.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.1	300	0.0200	0.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 0.04"
3.4	200	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
29.5	500	Total			

Subcatchment 19S: Contributing to West Pond



Summary for Pond 18P: West Pond

Inflow Area = 8.955 ac, 67.66% Impervious, Inflow Depth = 1.37" for 2-Year event
Inflow = 10.71 cfs @ 12.24 hrs, Volume= 1.021 af
Outflow = 5.28 cfs @ 12.55 hrs, Volume= 0.942 af, Atten= 51%, Lag= 19.0 min
Discarded = 0.01 cfs @ 9.45 hrs, Volume= 0.027 af
Primary = 5.27 cfs @ 12.55 hrs, Volume= 0.916 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,387.69' @ 12.55 hrs Surf.Area= 12,767 sf Storage= 15,643 cf

Plug-Flow detention time= 132.8 min calculated for 0.942 af (92% of inflow)
Center-of-Mass det. time= 91.5 min (933.2 - 841.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,386.00'	63,137 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,386.00	6,051	0	0
1,387.00	9,694	7,873	7,873
1,388.00	14,136	11,915	19,788
1,389.00	21,597	17,867	37,654
1,390.00	29,369	25,483	63,137

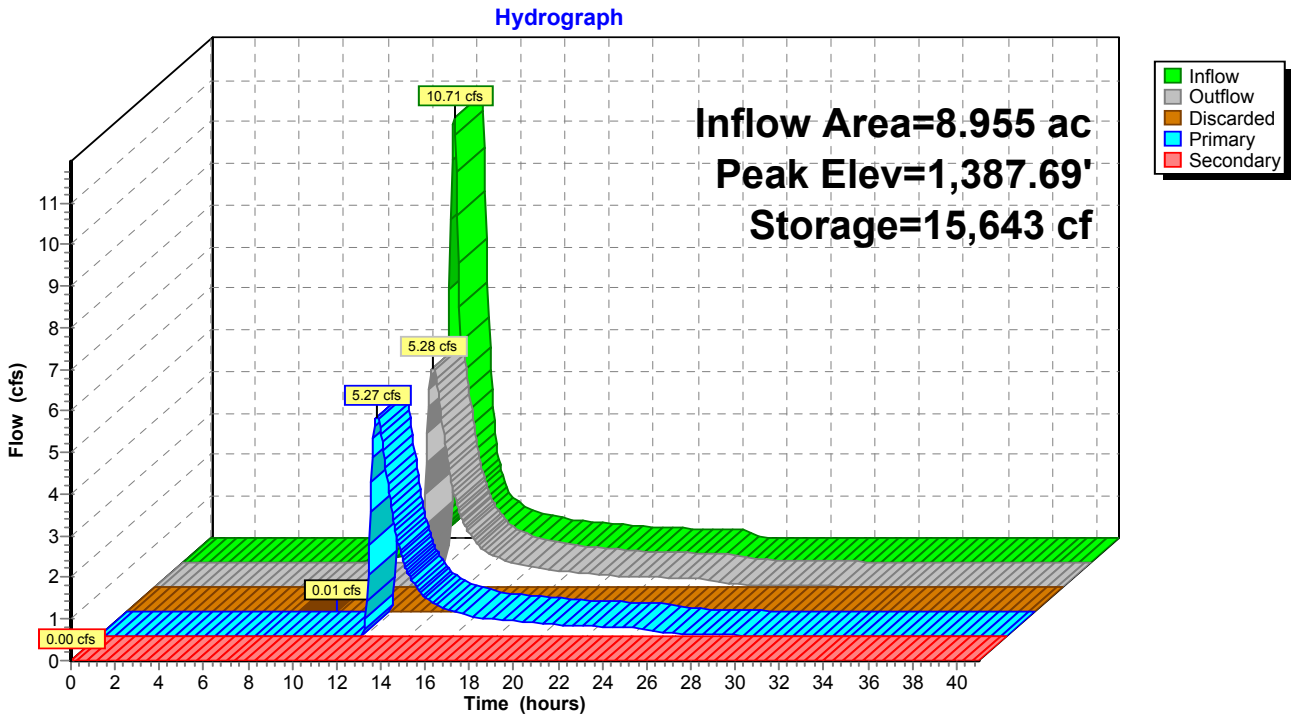
Device	Routing	Invert	Outlet Devices
#1	Secondary	1,390.00'	**100.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,386.00'	**0.01 cfs Exfiltration when above 1,386.00'**
#3	Primary	1,386.50'	**24.0" Round CMP_Round 24"** L= 110.0' Ke= 0.900 Inlet / Outlet Invert= 1,386.50' / 1,386.00' S= 0.0045 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=0.01 cfs @ 9.45 hrs HW=1,386.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=5.27 cfs @ 12.55 hrs HW=1,387.69' (Free Discharge)
↑—**3=CMP_Round 24"** (Barrel Controls 5.27 cfs @ 3.88 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,386.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 18P: West Pond



Summary for Pond 22P: West Pond 2

[93] Warning: Storage range exceeded by 0.01'
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=79)
[79] Warning: Submerged Pond 18P Primary device # 3 OUTLET by 0.01'

Inflow Area = 8.955 ac, 67.66% Impervious, Inflow Depth = 1.23" for 2-Year event
Inflow = 5.27 cfs @ 12.55 hrs, Volume= 0.916 af
Outflow = 0.36 cfs @ 22.40 hrs, Volume= 0.083 af, Atten= 93%, Lag= 590.7 min
Discarded = 0.01 cfs @ 12.10 hrs, Volume= 0.024 af
Primary = 0.35 cfs @ 22.40 hrs, Volume= 0.059 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,386.01' @ 22.40 hrs Surf.Area= 19,379 sf Storage= 36,545 cf

Plug-Flow detention time= 759.0 min calculated for 0.083 af (9% of inflow)
Center-of-Mass det. time= 580.2 min (1,497.1 - 916.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,383.00'	36,545 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

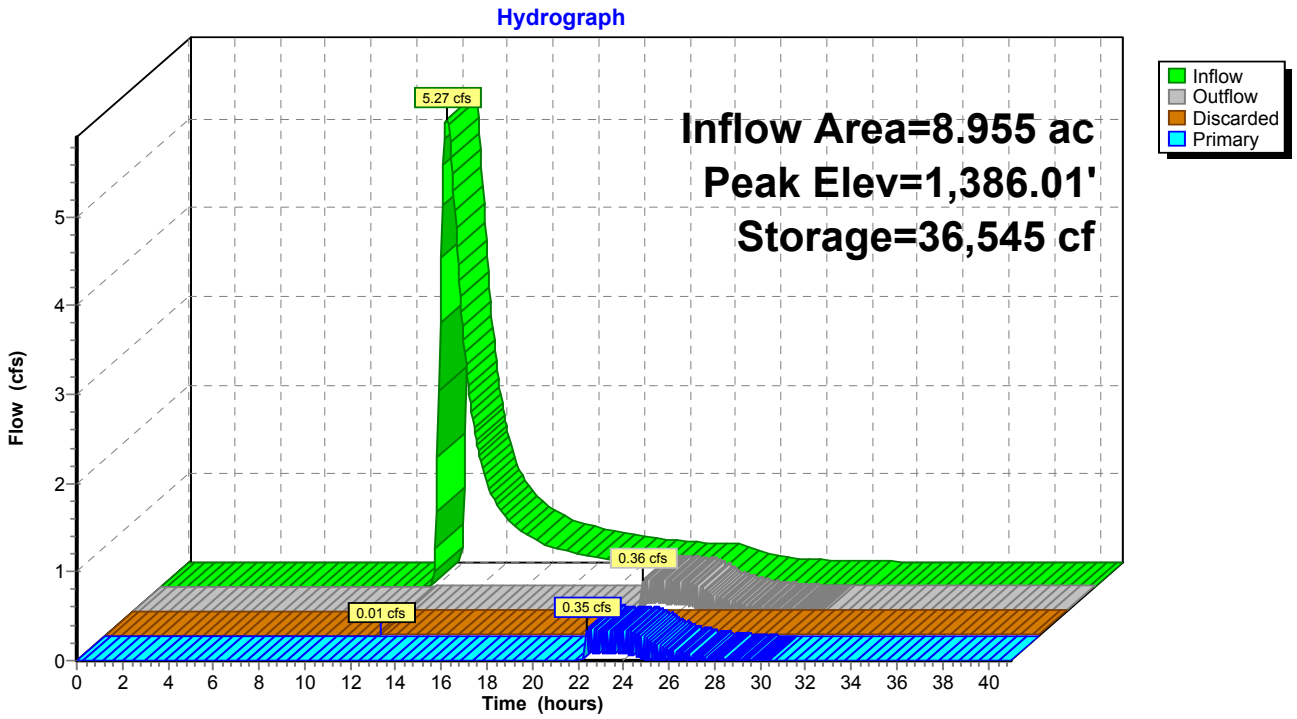
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,383.00	6,051	0	0
1,384.00	9,694	7,873	7,873
1,385.00	14,136	11,915	19,788
1,386.00	19,379	16,758	36,545

Device	Routing	Invert	Outlet Devices
#1	Primary	1,386.00'	**100.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,383.00'	**0.01 cfs Exfiltration when above 1,383.00'**

Discarded OutFlow Max=0.01 cfs @ 12.10 hrs HW=1,383.03' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.18 cfs @ 22.40 hrs HW=1,386.01' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.18 cfs @ 0.23 fps)

Pond 22P: West Pond 2



Summary for Subcatchment 19S: Contributing to West Pond

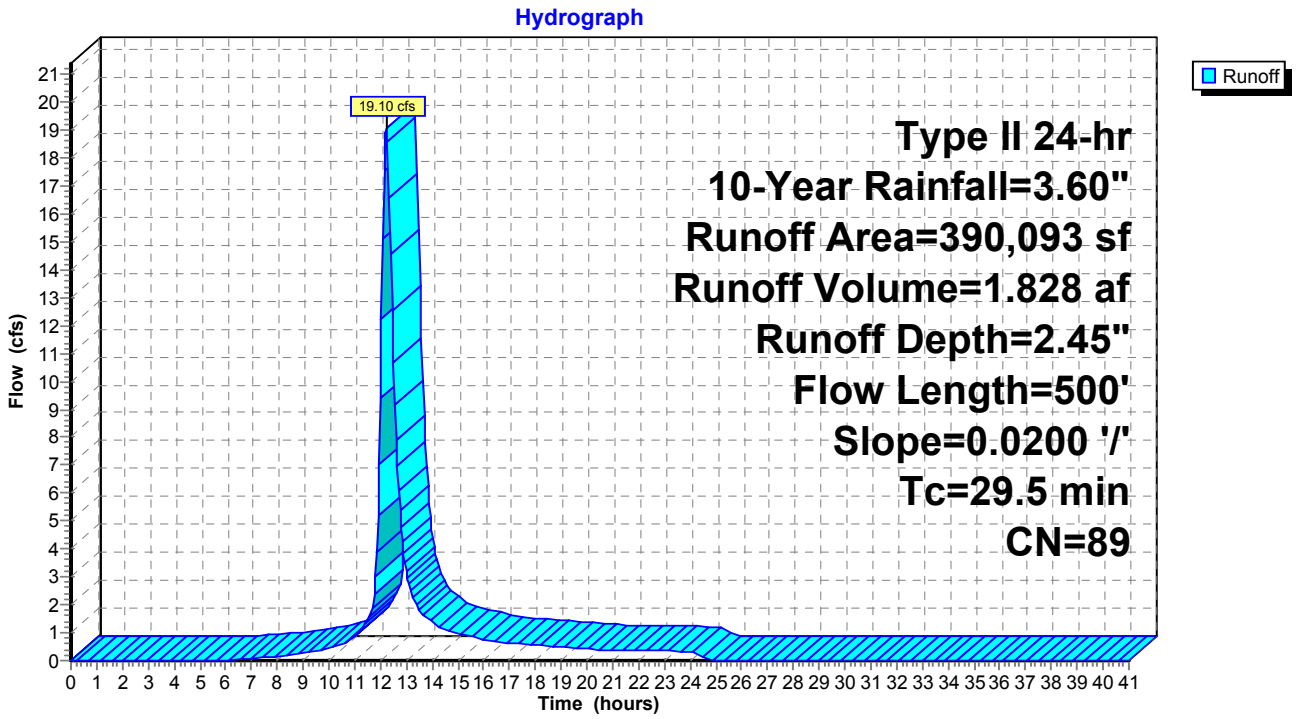
Runoff = 19.10 cfs @ 12.23 hrs, Volume= 1.828 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

	Area (sf)	CN	Description
	150,694	98	Paved parking, HSG B
	85,450	98	Unconnected roofs, HSG B
	126,154	69	50-75% Grass cover, Fair, HSG B
*	27,795	98	Sidewalk
	390,093	89	Weighted Average
	126,154		32.34% Pervious Area
	263,939		67.66% Impervious Area
	85,450		32.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.1	300	0.0200	0.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 0.04"
3.4	200	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
29.5	500	Total			

Subcatchment 19S: Contributing to West Pond



Summary for Pond 18P: West Pond

Inflow Area = 8.955 ac, 67.66% Impervious, Inflow Depth = 2.45" for 10-Year event
Inflow = 19.10 cfs @ 12.23 hrs, Volume= 1.828 af
Outflow = 10.57 cfs @ 12.51 hrs, Volume= 1.749 af, Atten= 45%, Lag= 16.5 min
Discarded = 0.01 cfs @ 7.40 hrs, Volume= 0.028 af
Primary = 10.56 cfs @ 12.51 hrs, Volume= 1.721 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,388.35' @ 12.51 hrs Surf.Area= 16,733 sf Storage= 25,161 cf

Plug-Flow detention time= 96.3 min calculated for 1.749 af (96% of inflow)
Center-of-Mass det. time= 71.1 min (896.2 - 825.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,386.00'	63,137 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,386.00	6,051	0	0
1,387.00	9,694	7,873	7,873
1,388.00	14,136	11,915	19,788
1,389.00	21,597	17,867	37,654
1,390.00	29,369	25,483	63,137

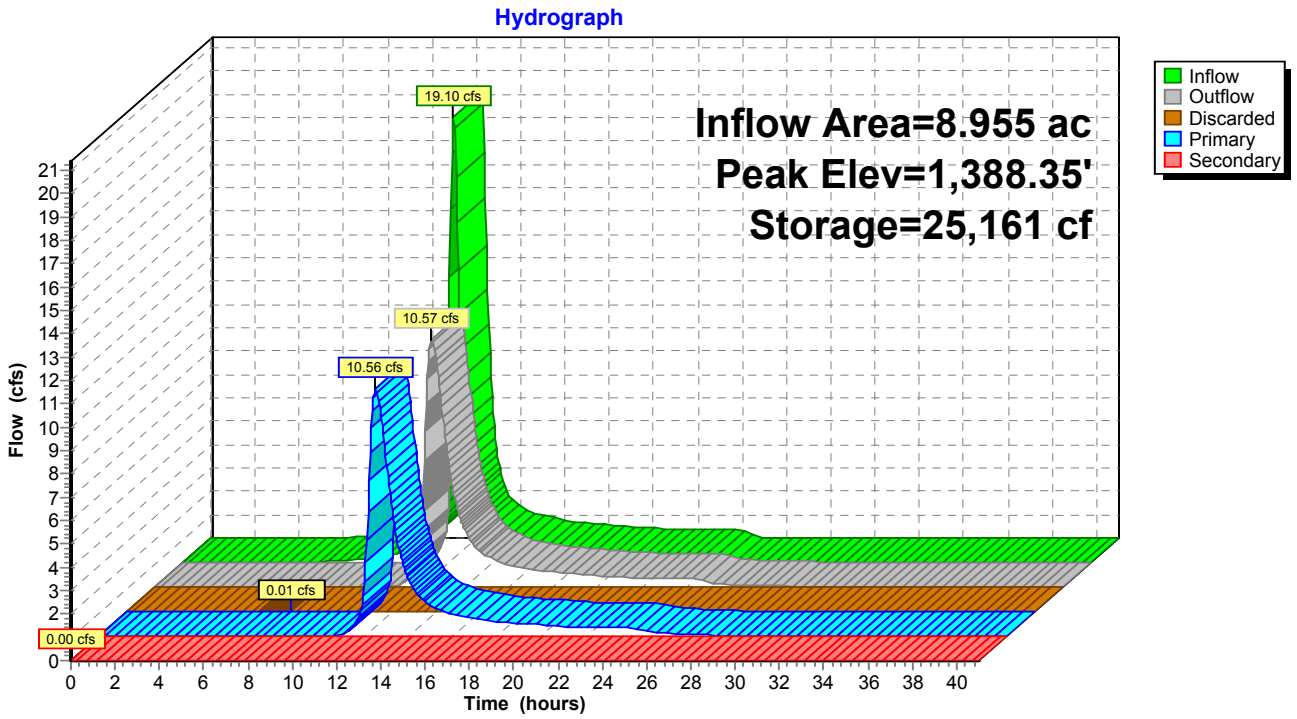
Device	Routing	Invert	Outlet Devices
#1	Secondary	1,390.00'	**100.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,386.00'	**0.01 cfs Exfiltration when above 1,386.00'**
#3	Primary	1,386.50'	**24.0" Round CMP_Round 24"** L= 110.0' Ke= 0.900 Inlet / Outlet Invert= 1,386.50' / 1,386.00' S= 0.0045 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=0.01 cfs @ 7.40 hrs HW=1,386.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=10.55 cfs @ 12.51 hrs HW=1,388.35' (Free Discharge)
↑—**3=CMP_Round 24"** (Barrel Controls 10.55 cfs @ 4.54 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,386.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 18P: West Pond



Summary for Pond 22P: West Pond 2

[93] Warning: Storage range exceeded by 0.12'
[88] Warning: Qout>Qin may require smaller dt or Finer Routing
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=144)
[79] Warning: Submerged Pond 18P Primary device # 3 OUTLET by 0.12'

Inflow Area = 8.955 ac, 67.66% Impervious, Inflow Depth = 2.31" for 10-Year event
Inflow = 10.56 cfs @ 12.51 hrs, Volume= 1.721 af
Outflow = 10.60 cfs @ 13.25 hrs, Volume= 0.888 af, Atten= 0%, Lag= 44.6 min
Discarded = 0.01 cfs @ 11.35 hrs, Volume= 0.025 af
Primary = 10.59 cfs @ 13.25 hrs, Volume= 0.863 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,386.12' @ 13.25 hrs Surf.Area= 19,379 sf Storage= 36,545 cf

Plug-Flow detention time= 266.0 min calculated for 0.888 af (52% of inflow)
Center-of-Mass det. time= 134.8 min (1,022.2 - 887.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,383.00'	36,545 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

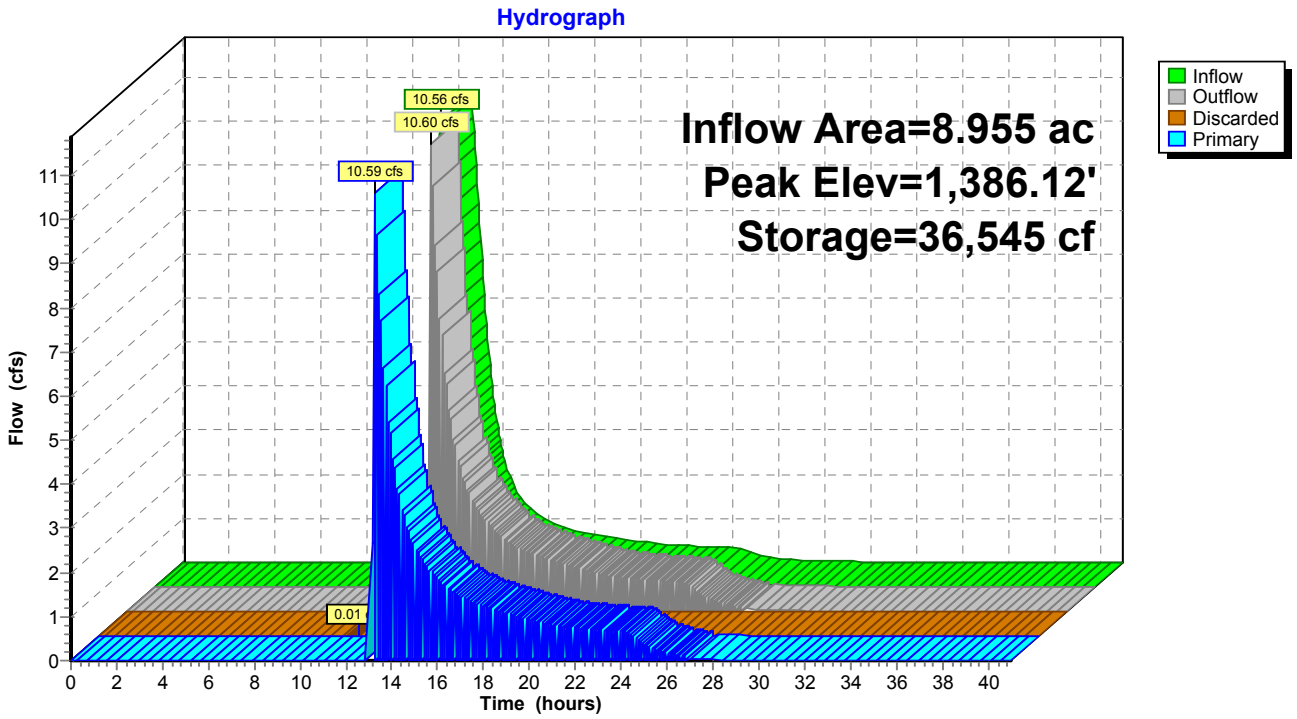
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,383.00	6,051	0	0
1,384.00	9,694	7,873	7,873
1,385.00	14,136	11,915	19,788
1,386.00	19,379	16,758	36,545

Device	Routing	Invert	Outlet Devices
#1	Primary	1,386.00'	**100.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,383.00'	**0.01 cfs Exfiltration when above 1,383.00'**

Discarded OutFlow Max=0.01 cfs @ 11.35 hrs HW=1,383.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=10.55 cfs @ 13.25 hrs HW=1,386.12' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 10.55 cfs @ 0.91 fps)

Pond 22P: West Pond 2



Summary for Subcatchment 19S: Contributing to West Pond

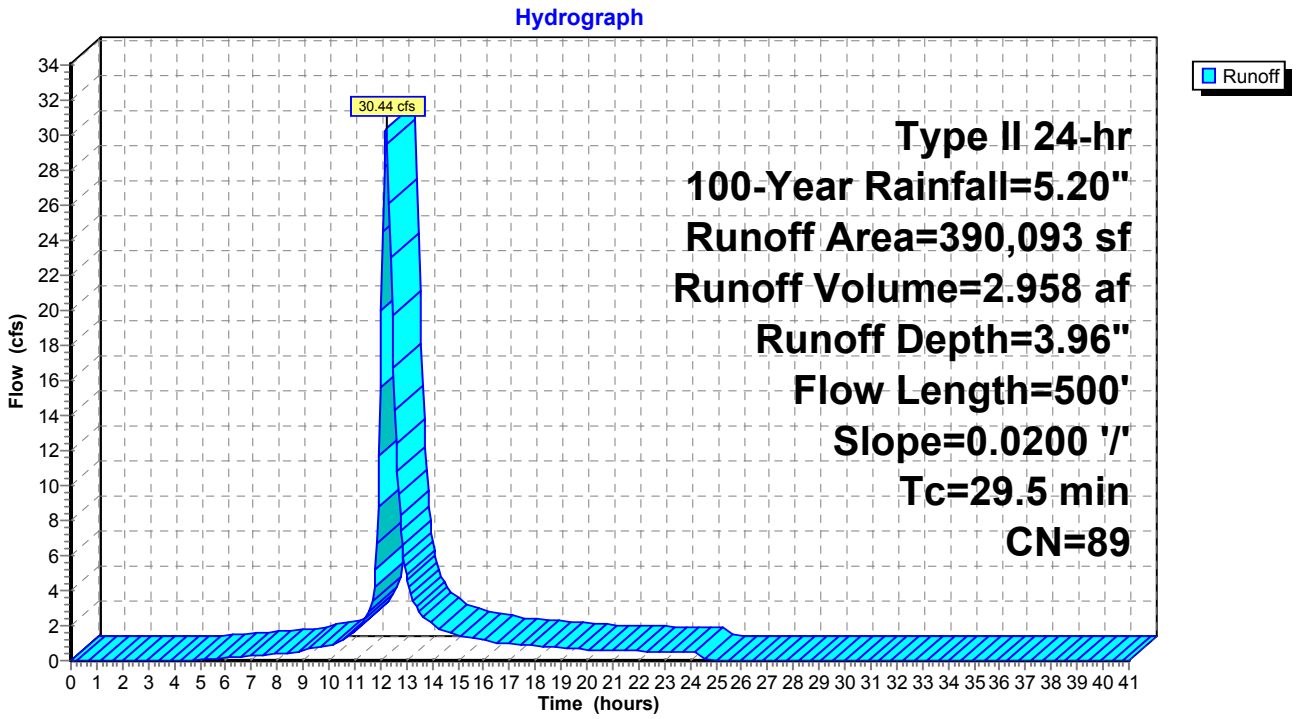
Runoff = 30.44 cfs @ 12.23 hrs, Volume= 2.958 af, Depth= 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

	Area (sf)	CN	Description
	150,694	98	Paved parking, HSG B
	85,450	98	Unconnected roofs, HSG B
	126,154	69	50-75% Grass cover, Fair, HSG B
*	27,795	98	Sidewalk
	390,093	89	Weighted Average
	126,154		32.34% Pervious Area
	263,939		67.66% Impervious Area
	85,450		32.37% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.1	300	0.0200	0.19		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 0.04"
3.4	200	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
29.5	500	Total			

Subcatchment 19S: Contributing to West Pond



Summary for Pond 18P: West Pond

Inflow Area = 8.955 ac, 67.66% Impervious, Inflow Depth = 3.96" for 100-Year event
Inflow = 30.44 cfs @ 12.23 hrs, Volume= 2.958 af
Outflow = 14.94 cfs @ 12.54 hrs, Volume= 2.879 af, Atten= 51%, Lag= 18.7 min
Discarded = 0.01 cfs @ 5.75 hrs, Volume= 0.030 af
Primary = 14.93 cfs @ 12.54 hrs, Volume= 2.849 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,389.06' @ 12.54 hrs Surf.Area= 22,080 sf Storage= 39,012 cf

Plug-Flow detention time= 78.8 min calculated for 2.879 af (97% of inflow)
Center-of-Mass det. time= 62.2 min (873.9 - 811.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,386.00'	63,137 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,386.00	6,051	0	0
1,387.00	9,694	7,873	7,873
1,388.00	14,136	11,915	19,788
1,389.00	21,597	17,867	37,654
1,390.00	29,369	25,483	63,137

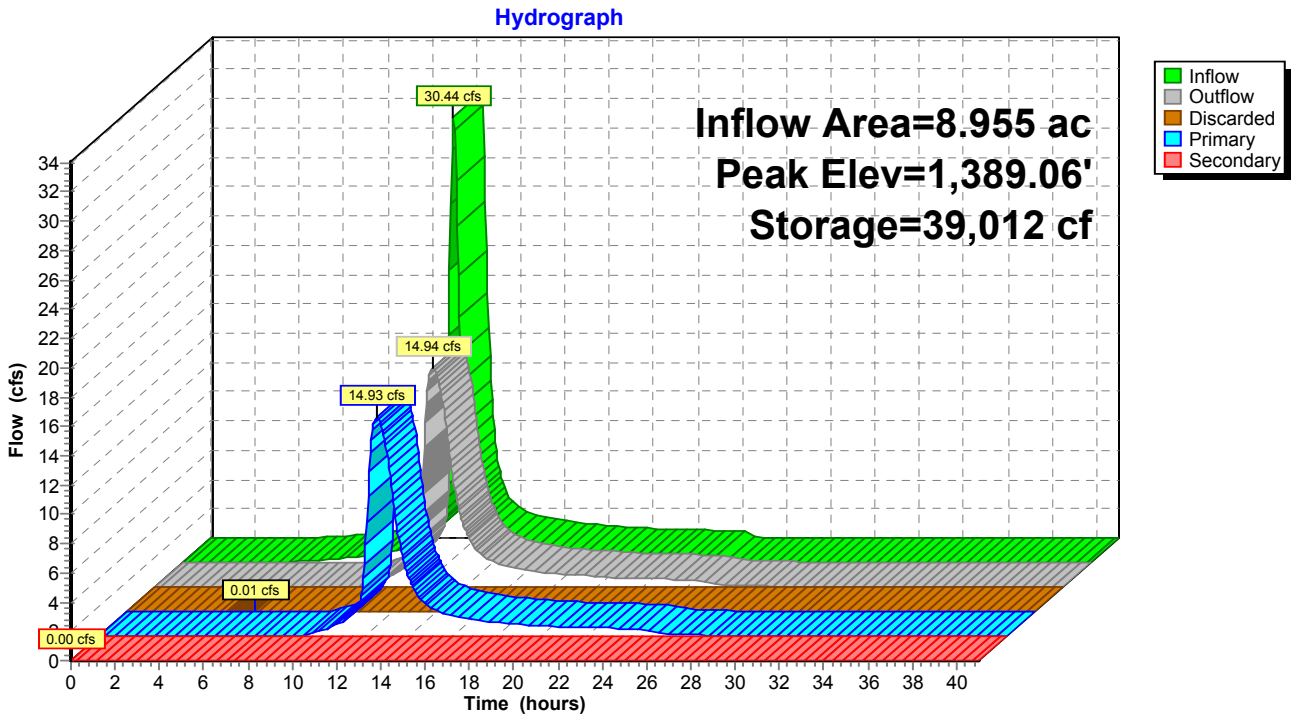
Device	Routing	Invert	Outlet Devices
#1	Secondary	1,390.00'	**100.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,386.00'	**0.01 cfs Exfiltration when above 1,386.00'**
#3	Primary	1,386.50'	**24.0" Round CMP_Round 24"** L= 110.0' Ke= 0.900 Inlet / Outlet Invert= 1,386.50' / 1,386.00' S= 0.0045 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=0.01 cfs @ 5.75 hrs HW=1,386.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=14.92 cfs @ 12.54 hrs HW=1,389.06' (Free Discharge)
↑—**3=CMP_Round 24"** (Inlet Controls 14.92 cfs @ 4.75 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,386.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 18P: West Pond



Summary for Pond 22P: West Pond 2

[93] Warning: Storage range exceeded by 0.17'
[88] Warning: Qout>Qin may require smaller dt or Finer Routing
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=145)
[79] Warning: Submerged Pond 18P Primary device # 3 OUTLET by 0.17'

Inflow Area = 8.955 ac, 67.66% Impervious, Inflow Depth = 3.82" for 100-Year event
Inflow = 14.93 cfs @ 12.54 hrs, Volume= 2.849 af
Outflow = 18.75 cfs @ 12.65 hrs, Volume= 2.016 af, Atten= 0%, Lag= 6.7 min
Discarded = 0.01 cfs @ 9.70 hrs, Volume= 0.026 af
Primary = 18.74 cfs @ 12.65 hrs, Volume= 1.990 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,386.17' @ 12.65 hrs Surf.Area= 19,379 sf Storage= 36,545 cf

Plug-Flow detention time= 165.4 min calculated for 2.013 af (71% of inflow)
Center-of-Mass det. time= 63.9 min (932.5 - 868.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,383.00'	36,545 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

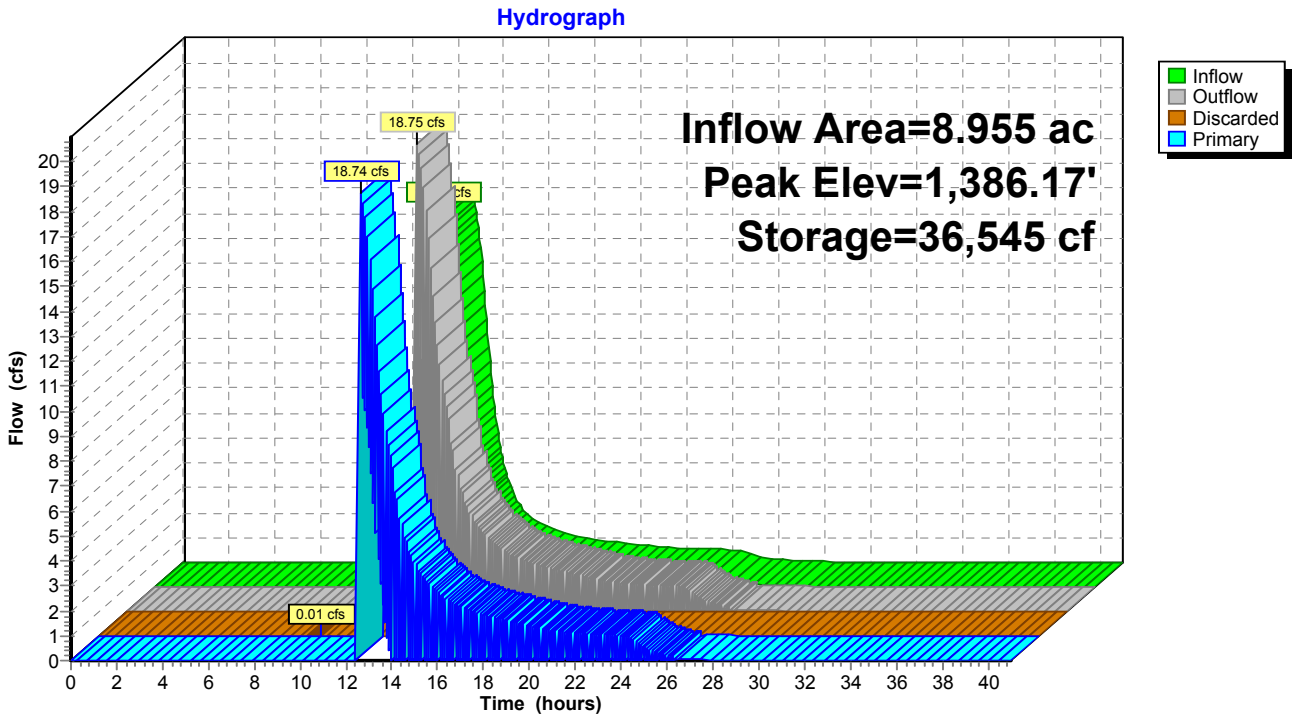
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,383.00	6,051	0	0
1,384.00	9,694	7,873	7,873
1,385.00	14,136	11,915	19,788
1,386.00	19,379	16,758	36,545

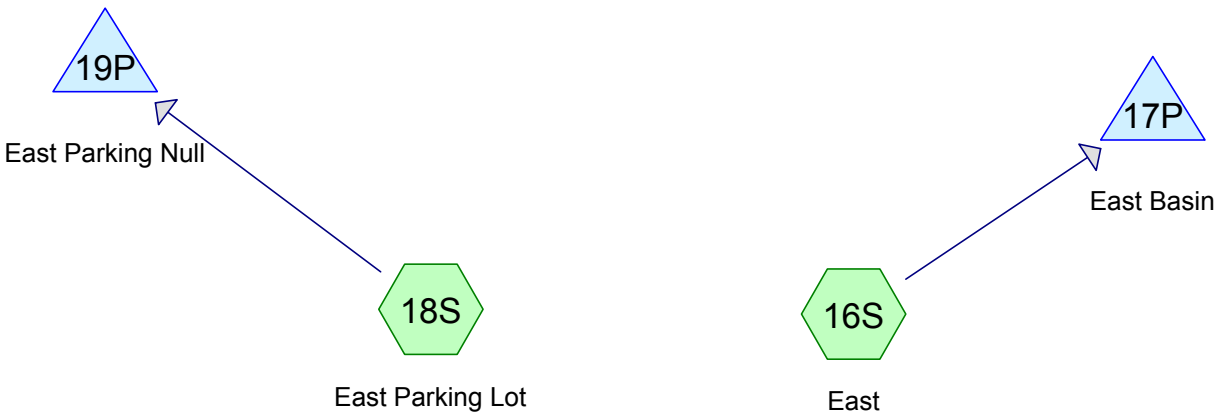
Device	Routing	Invert	Outlet Devices
#1	Primary	1,386.00'	**100.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,383.00'	**0.01 cfs Exfiltration when above 1,383.00'**

Discarded OutFlow Max=0.01 cfs @ 9.70 hrs HW=1,383.03' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=18.69 cfs @ 12.65 hrs HW=1,386.17' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 18.69 cfs @ 1.11 fps)

Pond 22P: West Pond 2





Subcat Reach Pond Link

Routing Diagram for 16-004 PROPOSED STORMWATER (2)

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Summary for Subcatchment 16S: East

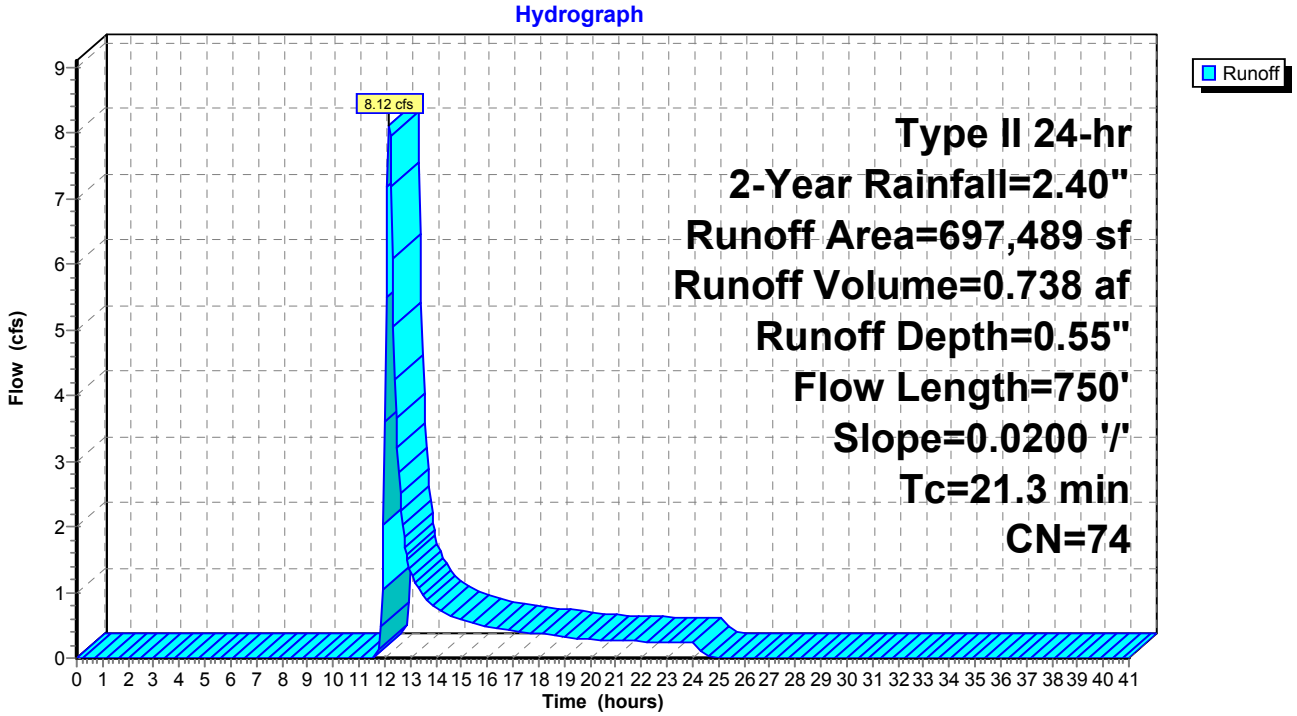
Runoff = 8.12 cfs @ 12.17 hrs, Volume= 0.738 af, Depth= 0.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

Area (sf)	CN	Description
572,991	69	50-75% Grass cover, Fair, HSG B
124,498	98	Paved parking, HSG A
697,489	74	Weighted Average
572,991		82.15% Pervious Area
124,498		17.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	750	0.0200	0.59		**Lag/CN Method,**

Subcatchment 16S: East



Summary for Subcatchment 18S: East Parking Lot

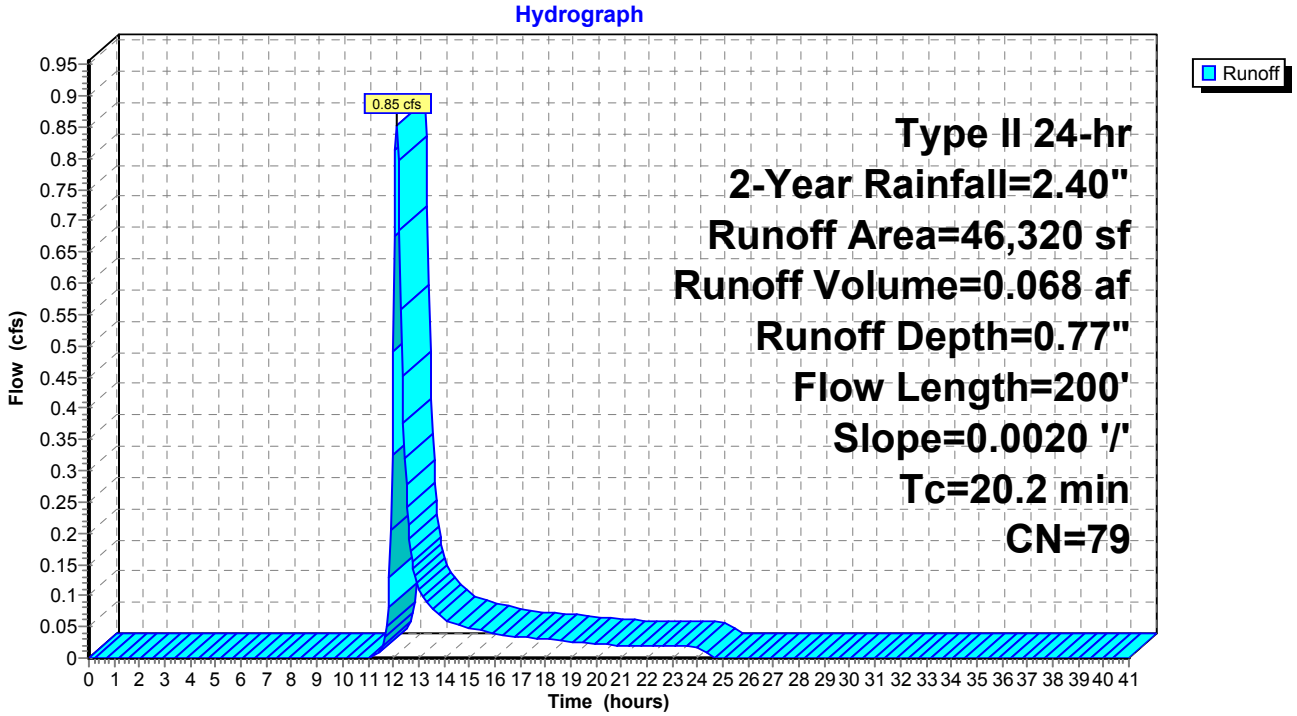
Runoff = 0.85 cfs @ 12.15 hrs, Volume= 0.068 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

Area (sf)	CN	Description
15,233	98	Water Surface, HSG C
31,087	69	50-75% Grass cover, Fair, HSG B
46,320	79	Weighted Average
31,087		67.11% Pervious Area
15,233		32.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	200	0.0020	0.16		**Lag/CN Method,**

Subcatchment 18S: East Parking Lot



Summary for Pond 17P: East Basin

Inflow Area = 16.012 ac, 17.85% Impervious, Inflow Depth = 0.55" for 2-Year event
Inflow = 8.12 cfs @ 12.17 hrs, Volume= 0.738 af
Outflow = 1.00 cfs @ 12.00 hrs, Volume= 0.738 af, Atten= 88%, Lag= 0.0 min
Discarded = 1.00 cfs @ 12.00 hrs, Volume= 0.738 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,383.74' @ 13.42 hrs Surf.Area= 19,649 sf Storage= 11,382 cf

Plug-Flow detention time= 103.6 min calculated for 0.737 af (100% of inflow)
Center-of-Mass det. time= 103.5 min (997.6 - 894.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,383.00'	218,192 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

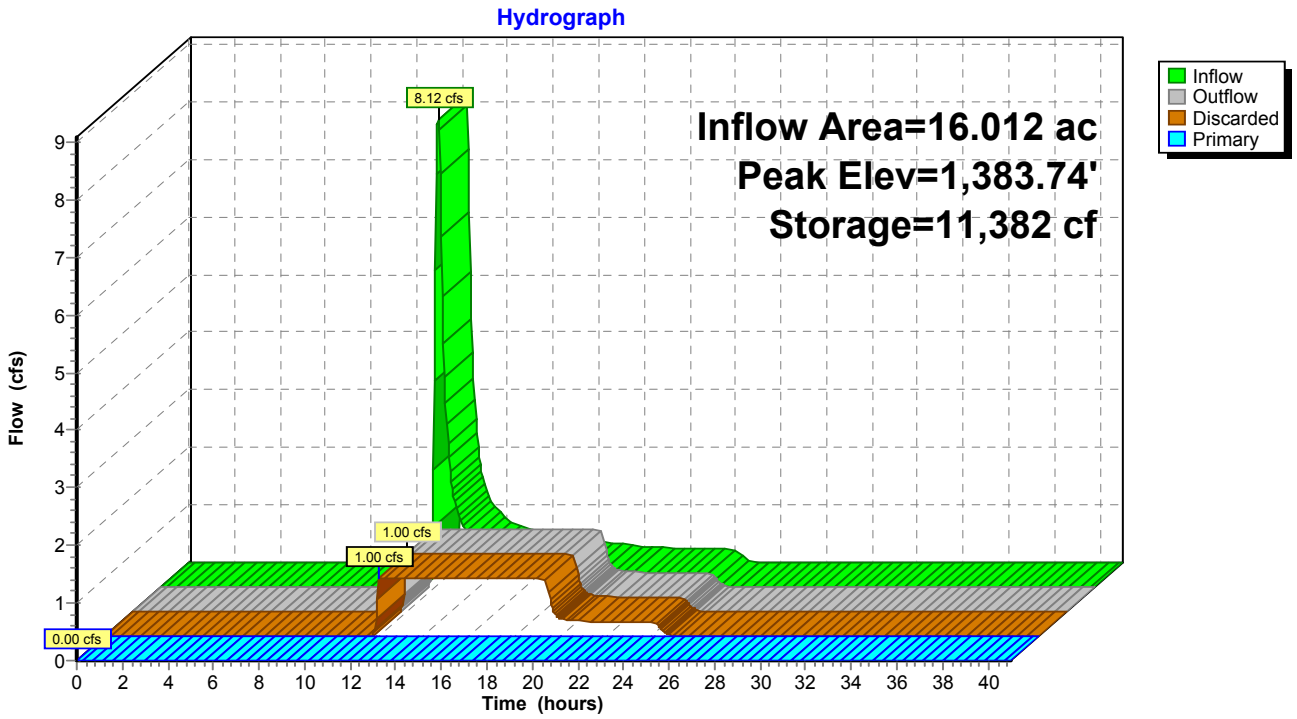
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,383.00	11,240	0	0
1,384.00	22,650	16,945	16,945
1,385.00	34,533	28,592	45,537
1,386.00	47,950	41,242	86,778
1,387.00	64,581	56,266	143,044
1,388.00	85,715	75,148	218,192

Device	Routing	Invert	Outlet Devices
#1	Primary	1,388.00'	**500.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,383.00'	**1.00 cfs Exfiltration when above 1,383.00'**

Discarded OutFlow Max=1.00 cfs @ 12.00 hrs HW=1,383.06' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,383.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 17P: East Basin



Summary for Pond 19P: East Parking Null

Inflow Area = 1.063 ac, 32.89% Impervious, Inflow Depth = 0.77" for 2-Year event
Inflow = 0.85 cfs @ 12.15 hrs, Volume= 0.068 af
Outflow = 0.01 cfs @ 12.10 hrs, Volume= 0.024 af, Atten= 99%, Lag= 0.0 min
Discarded = 0.01 cfs @ 12.10 hrs, Volume= 0.024 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,398.12' @ 24.27 hrs Surf.Area= 21,361 sf Storage= 2,528 cf

Plug-Flow detention time= 863.4 min calculated for 0.024 af (35% of inflow)
Center-of-Mass det. time= 717.0 min (1,589.5 - 872.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,398.00'	48,297 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

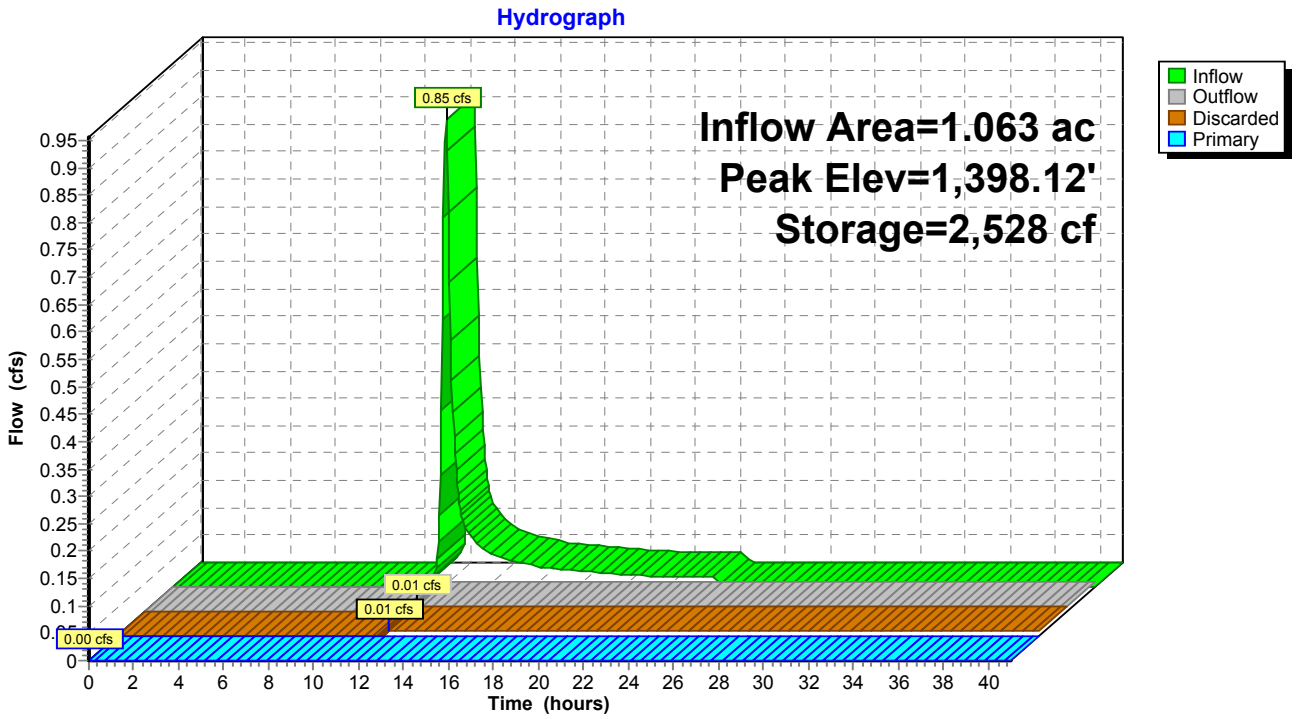
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,398.00	21,037	0	0
1,399.00	23,757	22,397	22,397
1,400.00	28,043	25,900	48,297

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,398.00'	**0.01 cfs Exfiltration when above 1,398.00'**
#2	Primary	1,400.00'	**100.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.01 cfs @ 12.10 hrs HW=1,398.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,398.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 19P: East Parking Null



Summary for Subcatchment 16S: East

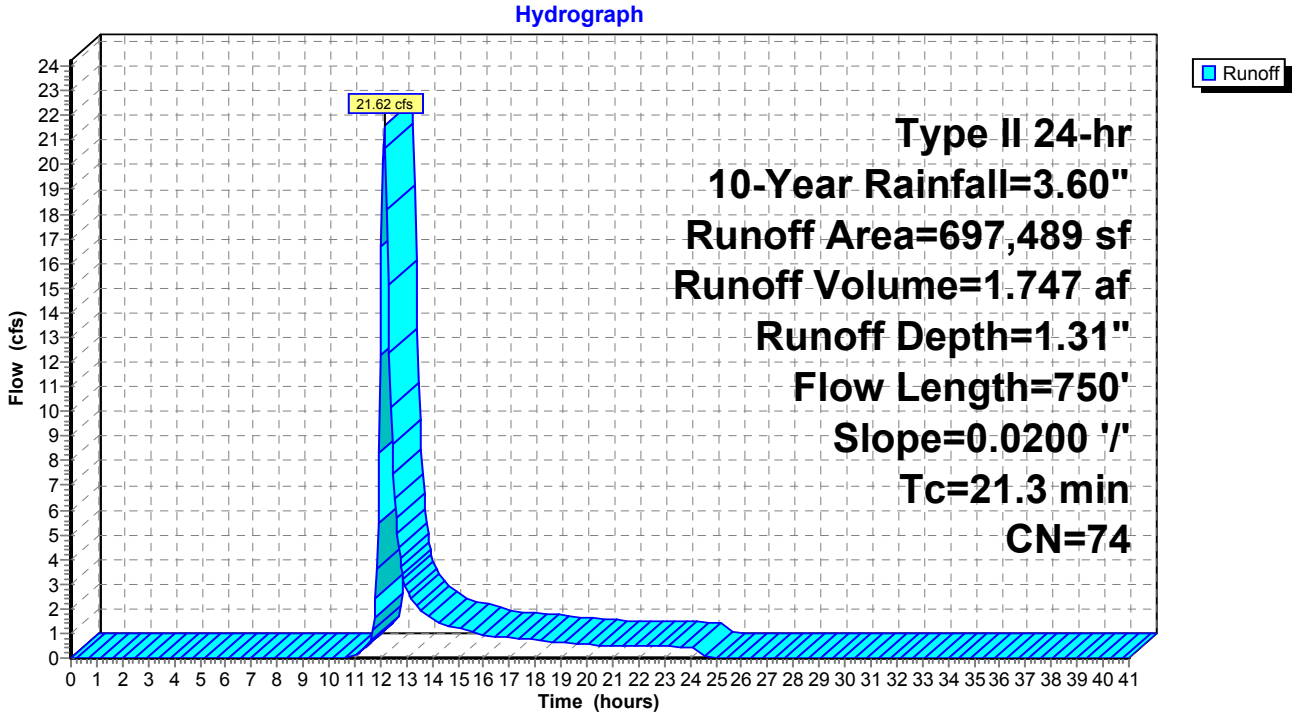
Runoff = 21.62 cfs @ 12.15 hrs, Volume= 1.747 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

Area (sf)	CN	Description
572,991	69	50-75% Grass cover, Fair, HSG B
124,498	98	Paved parking, HSG A
697,489	74	Weighted Average
572,991		82.15% Pervious Area
124,498		17.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	750	0.0200	0.59		**Lag/CN Method,**

Subcatchment 16S: East



Summary for Subcatchment 18S: East Parking Lot

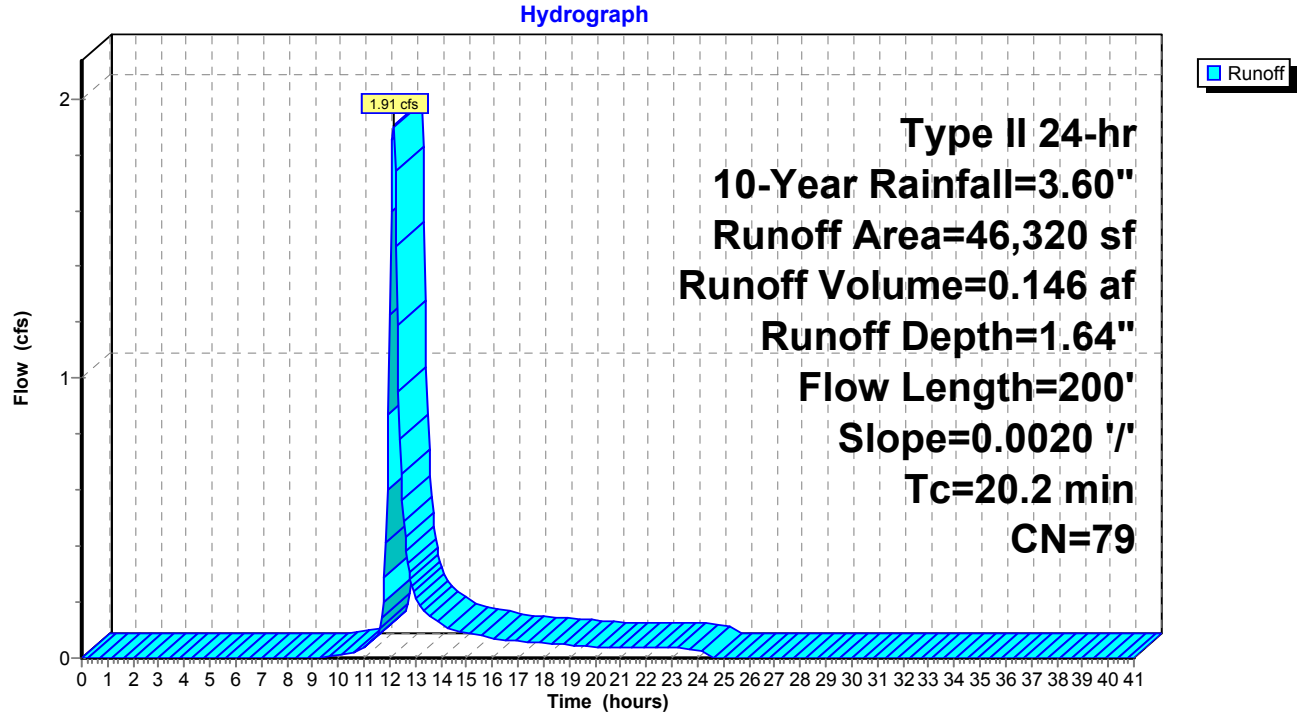
Runoff = 1.91 cfs @ 12.14 hrs, Volume= 0.146 af, Depth= 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

Area (sf)	CN	Description
15,233	98	Water Surface, HSG C
31,087	69	50-75% Grass cover, Fair, HSG B
46,320	79	Weighted Average
31,087		67.11% Pervious Area
15,233		32.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	200	0.0020	0.16		**Lag/CN Method,**

Subcatchment 18S: East Parking Lot



Summary for Pond 17P: East Basin

Inflow Area = 16.012 ac, 17.85% Impervious, Inflow Depth = 1.31" for 10-Year event
Inflow = 21.62 cfs @ 12.15 hrs, Volume= 1.747 af
Outflow = 1.00 cfs @ 11.80 hrs, Volume= 1.747 af, Atten= 95%, Lag= 0.0 min
Discarded = 1.00 cfs @ 11.80 hrs, Volume= 1.747 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,384.89' @ 15.83 hrs Surf.Area= 33,217 sf Storage= 41,784 cf

Plug-Flow detention time= 458.1 min calculated for 1.745 af (100% of inflow)
Center-of-Mass det. time= 458.2 min (1,323.9 - 865.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,383.00'	218,192 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

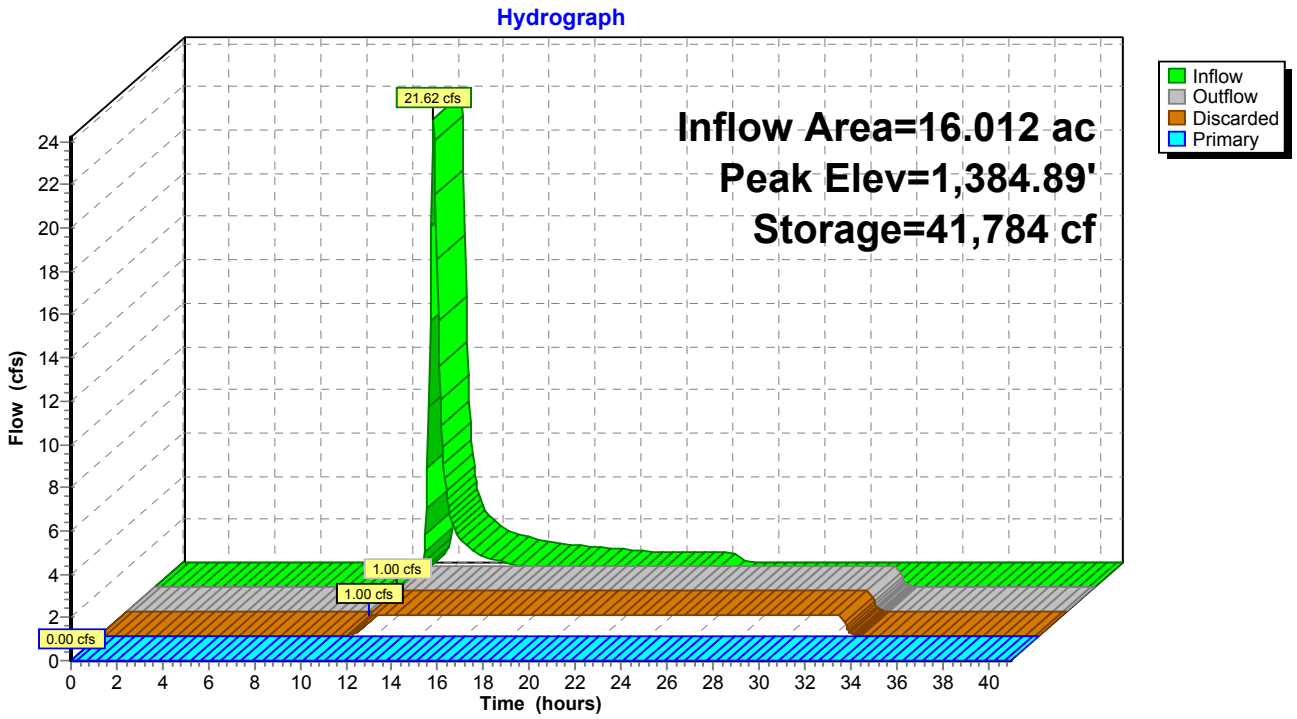
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,383.00	11,240	0	0
1,384.00	22,650	16,945	16,945
1,385.00	34,533	28,592	45,537
1,386.00	47,950	41,242	86,778
1,387.00	64,581	56,266	143,044
1,388.00	85,715	75,148	218,192

Device	Routing	Invert	Outlet Devices
#1	Primary	1,388.00'	**500.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,383.00'	**1.00 cfs Exfiltration when above 1,383.00'**

Discarded OutFlow Max=1.00 cfs @ 11.80 hrs HW=1,383.06' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,383.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 17P: East Basin



Summary for Pond 19P: East Parking Null

Inflow Area = 1.063 ac, 32.89% Impervious, Inflow Depth = 1.64" for 10-Year event
Inflow = 1.91 cfs @ 12.14 hrs, Volume= 0.146 af
Outflow = 0.01 cfs @ 11.90 hrs, Volume= 0.024 af, Atten= 99%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.90 hrs, Volume= 0.024 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,398.27' @ 24.36 hrs Surf.Area= 21,783 sf Storage= 5,875 cf

Plug-Flow detention time= 868.1 min calculated for 0.024 af (17% of inflow)
Center-of-Mass det. time= 723.4 min (1,573.2 - 849.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,398.00'	48,297 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

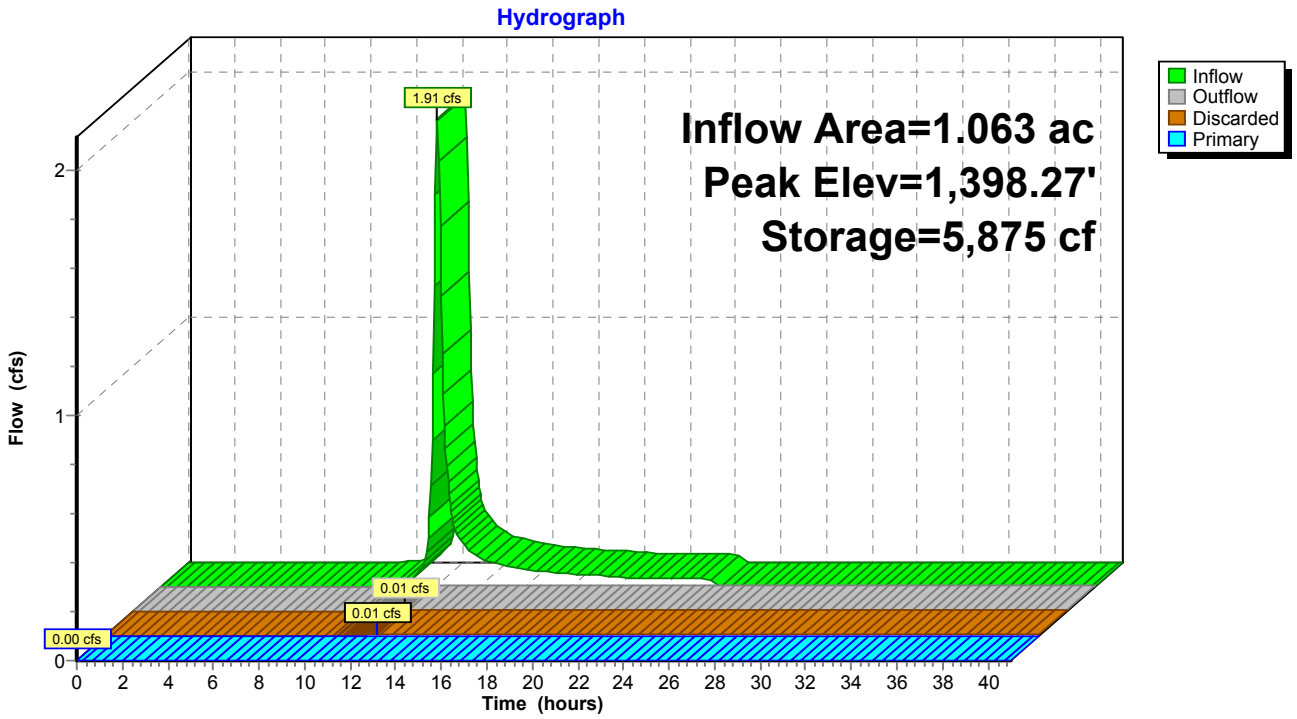
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,398.00	21,037	0	0
1,399.00	23,757	22,397	22,397
1,400.00	28,043	25,900	48,297

Device	Routing	Invert	Outlet Devices
#1	Discarded	1,398.00'	**0.01 cfs Exfiltration when above 1,398.00'**
#2	Primary	1,400.00'	**100.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.01 cfs @ 11.90 hrs HW=1,398.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,398.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 19P: East Parking Null



Summary for Subcatchment 16S: East

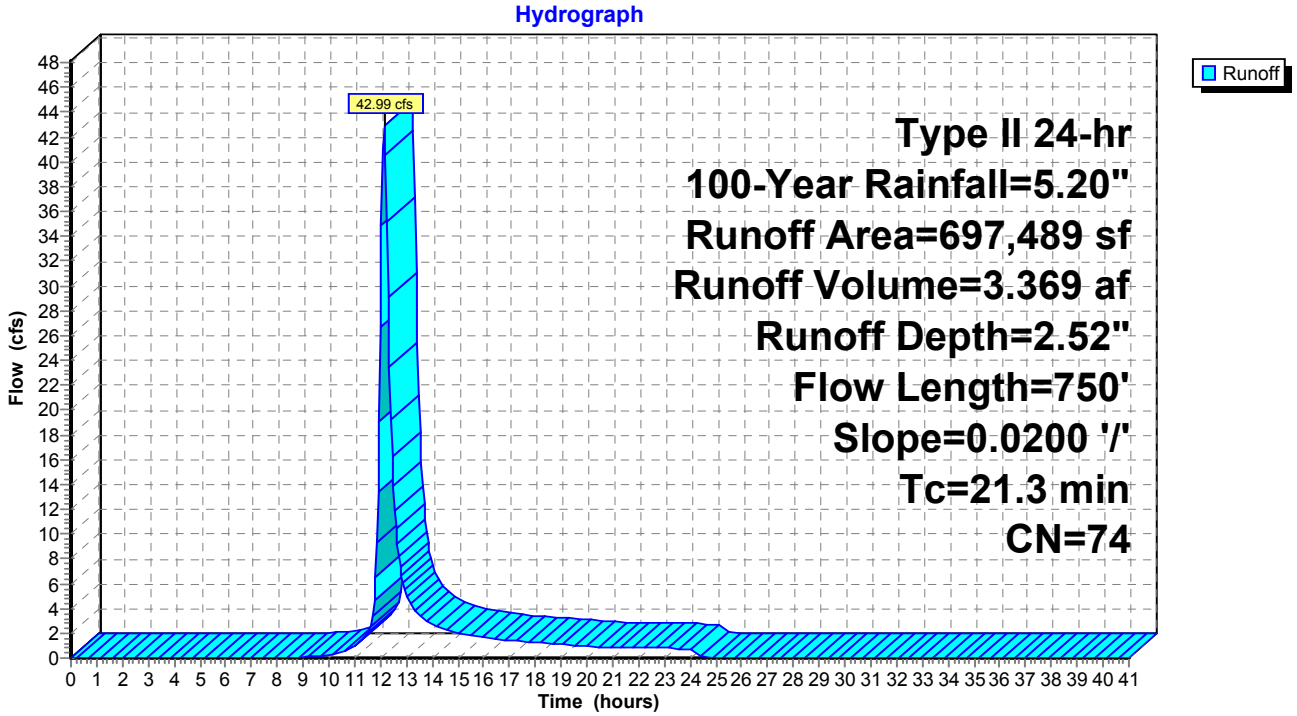
Runoff = 42.99 cfs @ 12.15 hrs, Volume= 3.369 af, Depth= 2.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

Area (sf)	CN	Description
572,991	69	50-75% Grass cover, Fair, HSG B
124,498	98	Paved parking, HSG A
697,489	74	Weighted Average
572,991		82.15% Pervious Area
124,498		17.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.3	750	0.0200	0.59		**Lag/CN Method,**

Subcatchment 16S: East



Summary for Subcatchment 18S: East Parking Lot

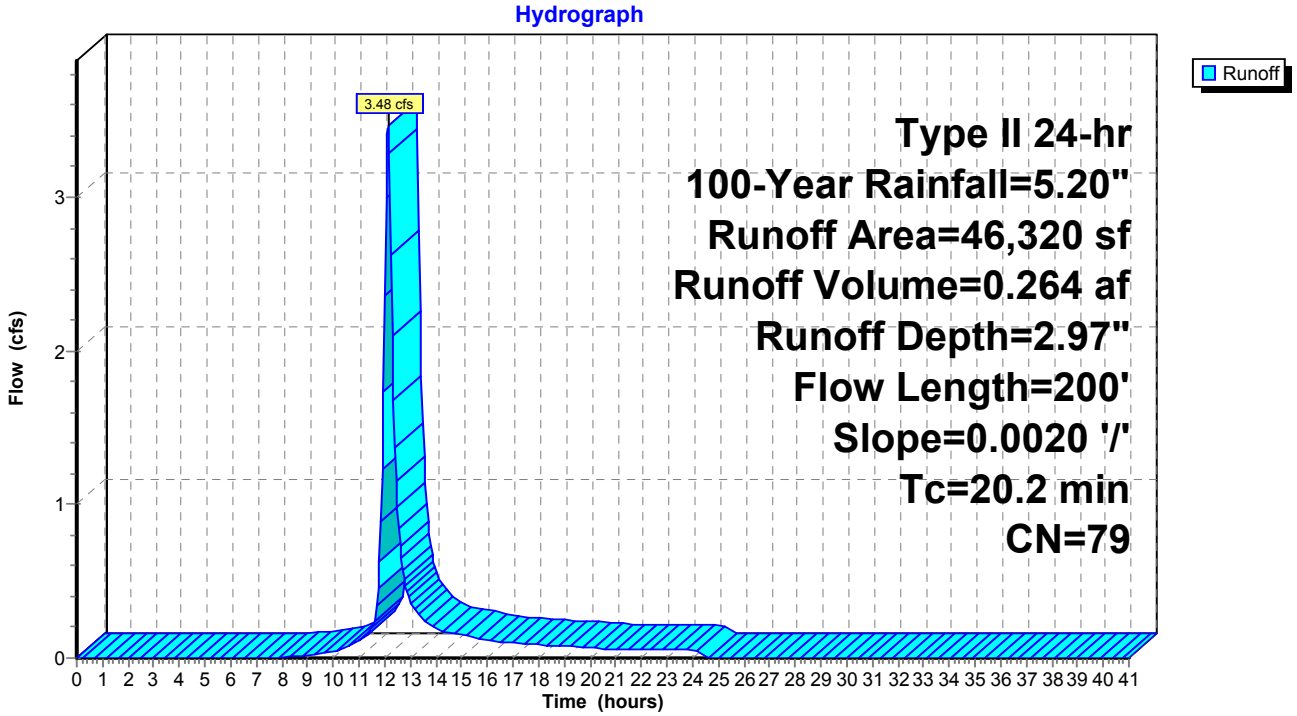
Runoff = 3.48 cfs @ 12.13 hrs, Volume= 0.264 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

Area (sf)	CN	Description
15,233	98	Water Surface, HSG C
31,087	69	50-75% Grass cover, Fair, HSG B
46,320	79	Weighted Average
31,087		67.11% Pervious Area
15,233		32.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.2	200	0.0020	0.16		**Lag/CN Method,**

Subcatchment 18S: East Parking Lot



Summary for Pond 17P: East Basin

Inflow Area = 16.012 ac, 17.85% Impervious, Inflow Depth = 2.52" for 100-Year event
Inflow = 42.99 cfs @ 12.15 hrs, Volume= 3.369 af
Outflow = 1.00 cfs @ 11.20 hrs, Volume= 2.527 af, Atten= 98%, Lag= 0.0 min
Discarded = 1.00 cfs @ 11.20 hrs, Volume= 2.527 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,386.26' @ 19.51 hrs Surf.Area= 52,251 sf Storage= 99,734 cf

Plug-Flow detention time= 793.6 min calculated for 2.527 af (75% of inflow)
Center-of-Mass det. time= 697.3 min (1,543.8 - 846.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,383.00'	218,192 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

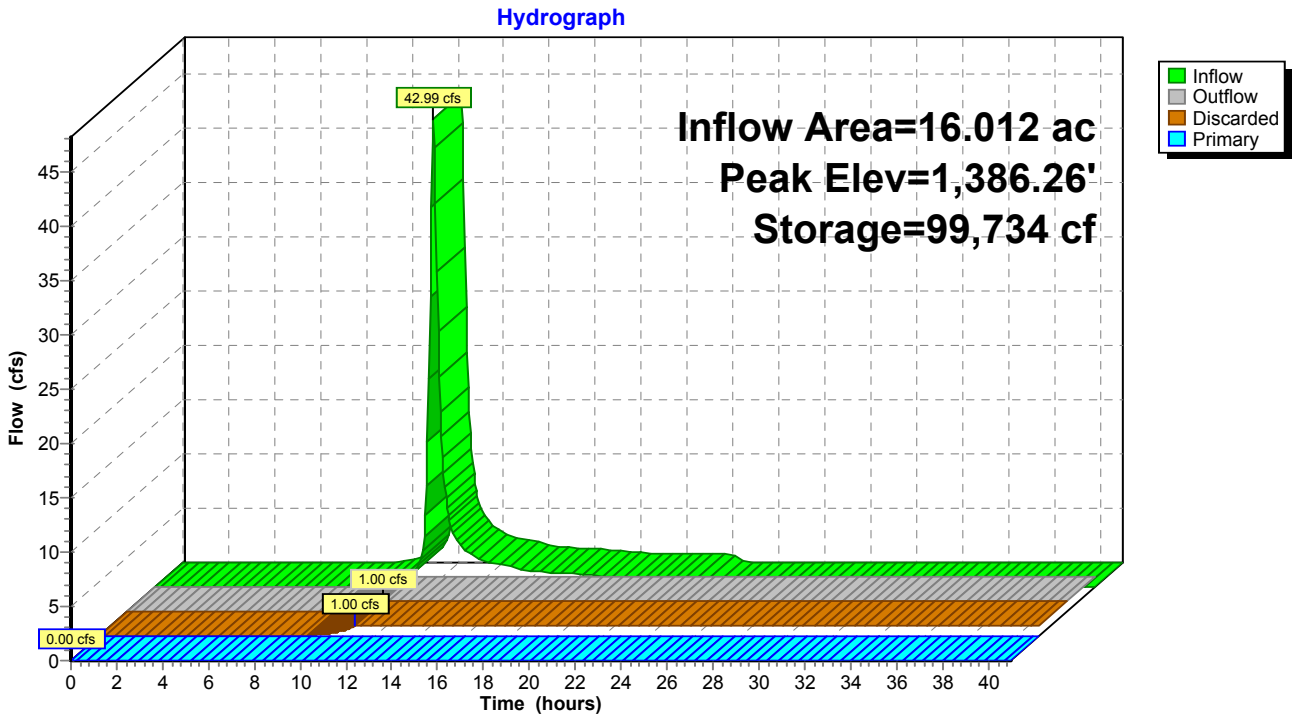
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,383.00	11,240	0	0
1,384.00	22,650	16,945	16,945
1,385.00	34,533	28,592	45,537
1,386.00	47,950	41,242	86,778
1,387.00	64,581	56,266	143,044
1,388.00	85,715	75,148	218,192

Device	Routing	Invert	Outlet Devices
#1	Primary	1,388.00'	**500.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Discarded	1,383.00'	**1.00 cfs Exfiltration when above 1,383.00'**

Discarded OutFlow Max=1.00 cfs @ 11.20 hrs HW=1,383.05' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,383.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 17P: East Basin



Summary for Pond 19P: East Parking Null

Inflow Area = 1.063 ac, 32.89% Impervious, Inflow Depth = 2.97" for 100-Year event
Inflow = 3.48 cfs @ 12.13 hrs, Volume= 0.264 af
Outflow = 0.01 cfs @ 11.15 hrs, Volume= 0.026 af, Atten= 100%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.15 hrs, Volume= 0.026 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Peak Elev= 1,398.50' @ 24.43 hrs Surf.Area= 22,410 sf Storage= 10,963 cf

Plug-Flow detention time= 874.9 min calculated for 0.026 af (10% of inflow)
Center-of-Mass det. time= 702.0 min (1,534.8 - 832.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,398.00'	48,297 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

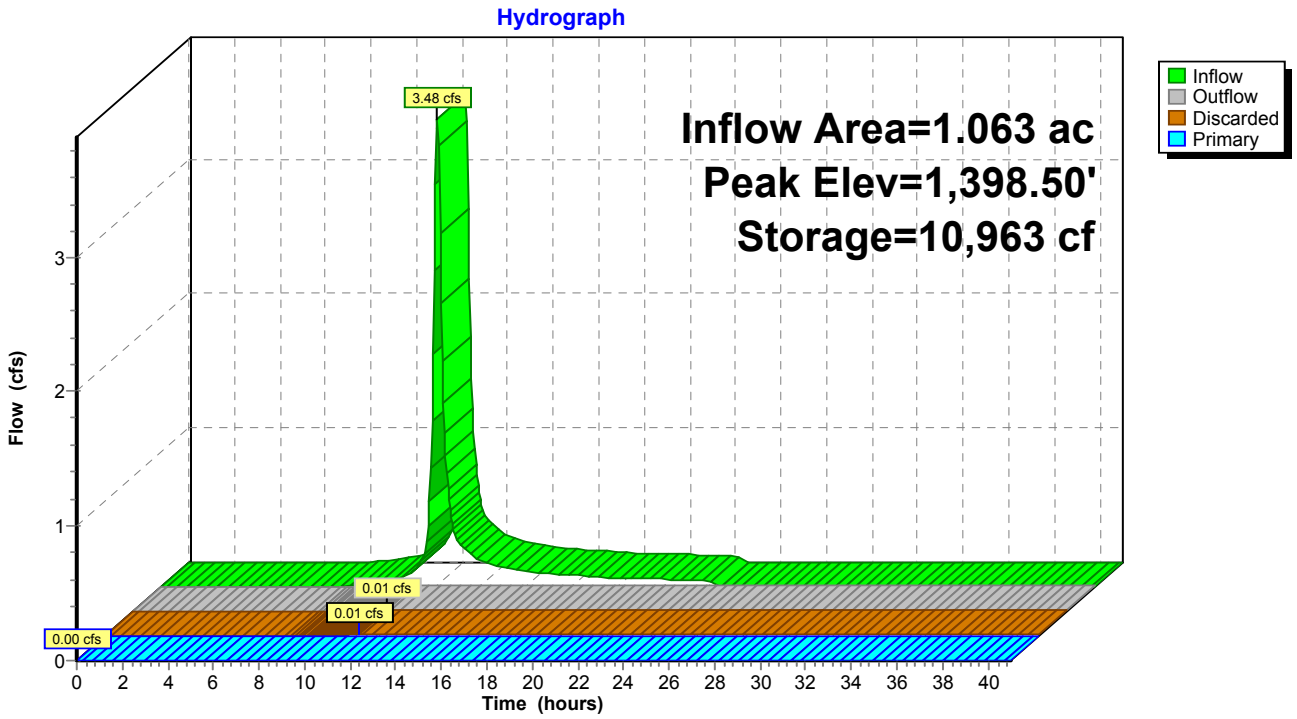
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,398.00	21,037	0	0
1,399.00	23,757	22,397	22,397
1,400.00	28,043	25,900	48,297

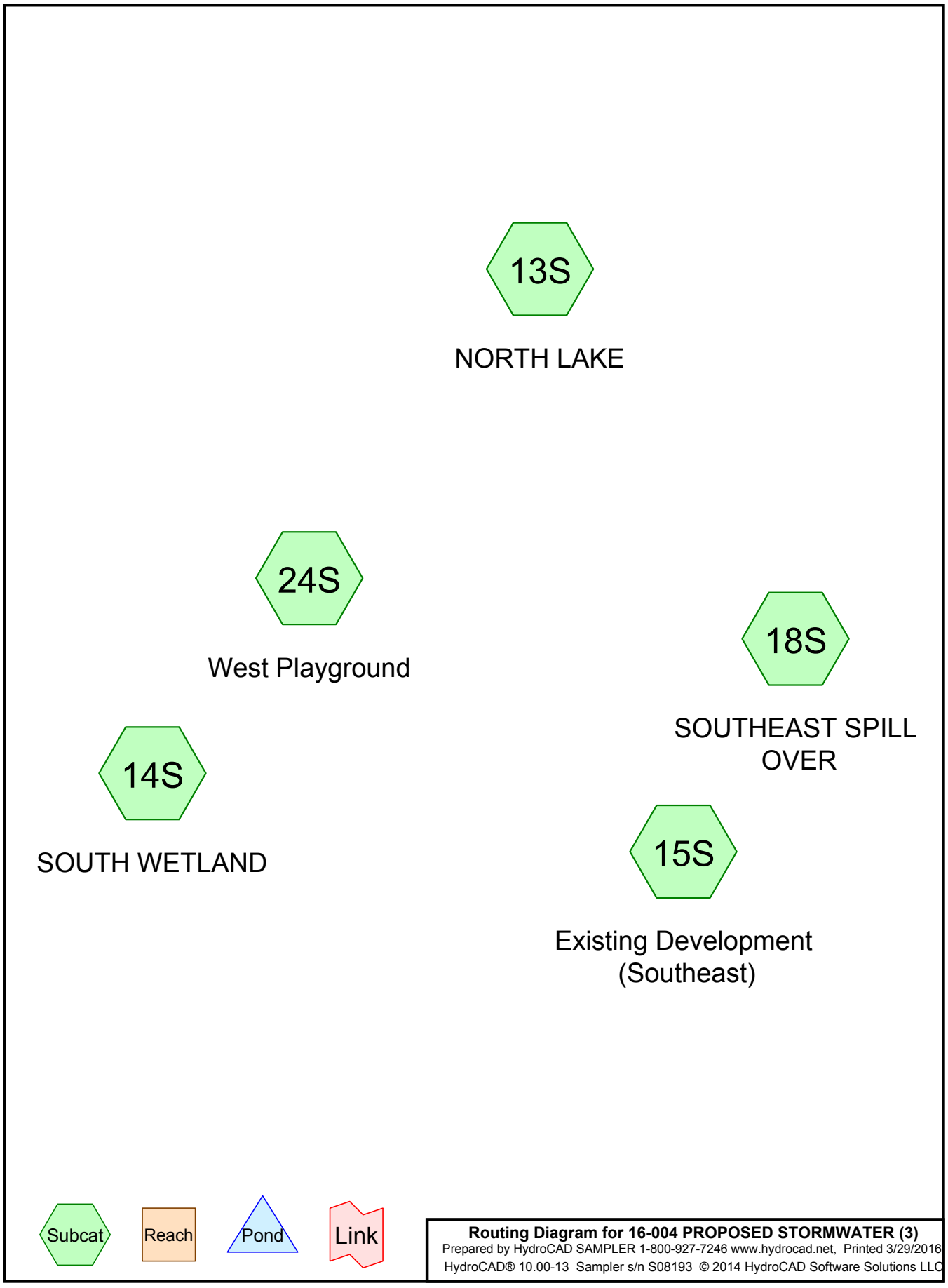
Device	Routing	Invert	Outlet Devices
#1	Discarded	1,398.00'	**0.01 cfs Exfiltration when above 1,398.00'**
#2	Primary	1,400.00'	**100.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.01 cfs @ 11.15 hrs HW=1,398.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,398.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 19P: East Parking Null





Routing Diagram for 16-004 PROPOSED STORMWATER (3)

Prepared by HydroCAD SAMPLER 1-800-927-7246 www.hydrocad.net, Printed 3/29/2016

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Summary for Subcatchment 13S: NORTH LAKE

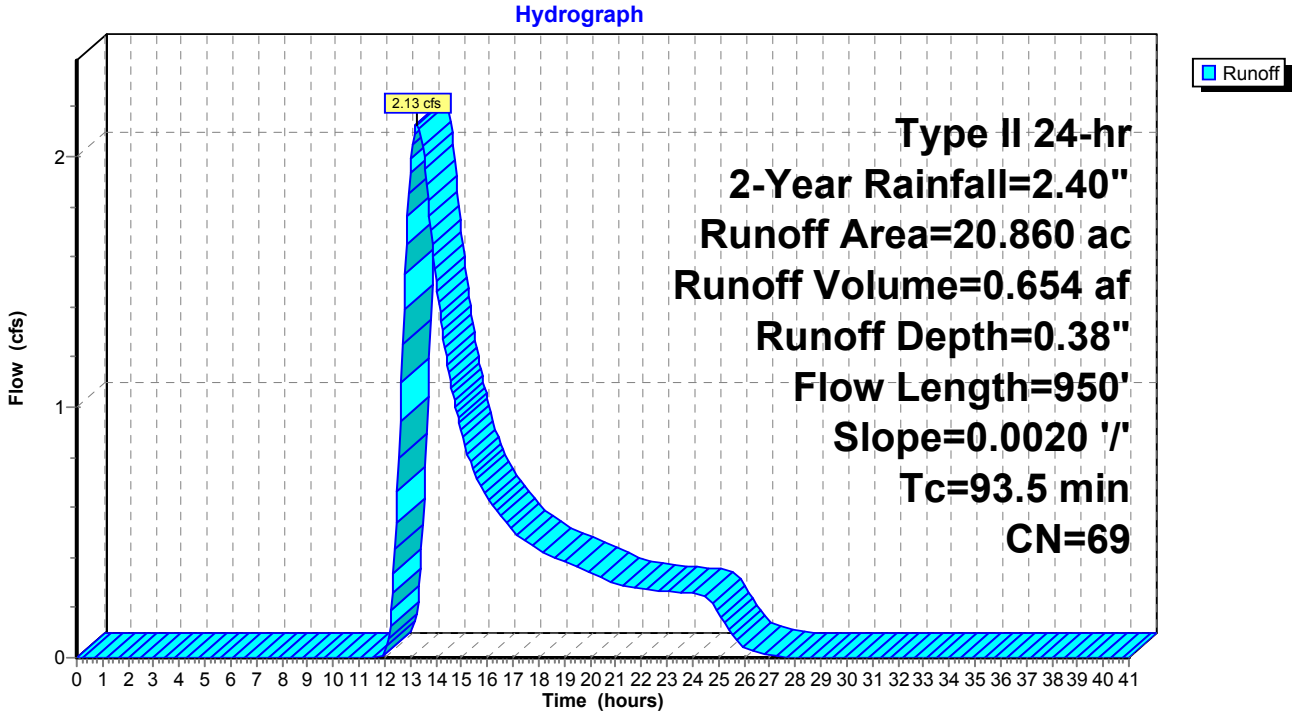
Runoff = 2.13 cfs @ 13.28 hrs, Volume= 0.654 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

Area (ac)	CN	Description
20.860	69	50-75% Grass cover, Fair, HSG B
20.860		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
93.5	950	0.0020	0.17		**Lag/CN Method,**

Subcatchment 13S: NORTH LAKE



Summary for Subcatchment 14S: SOUTH WETLAND

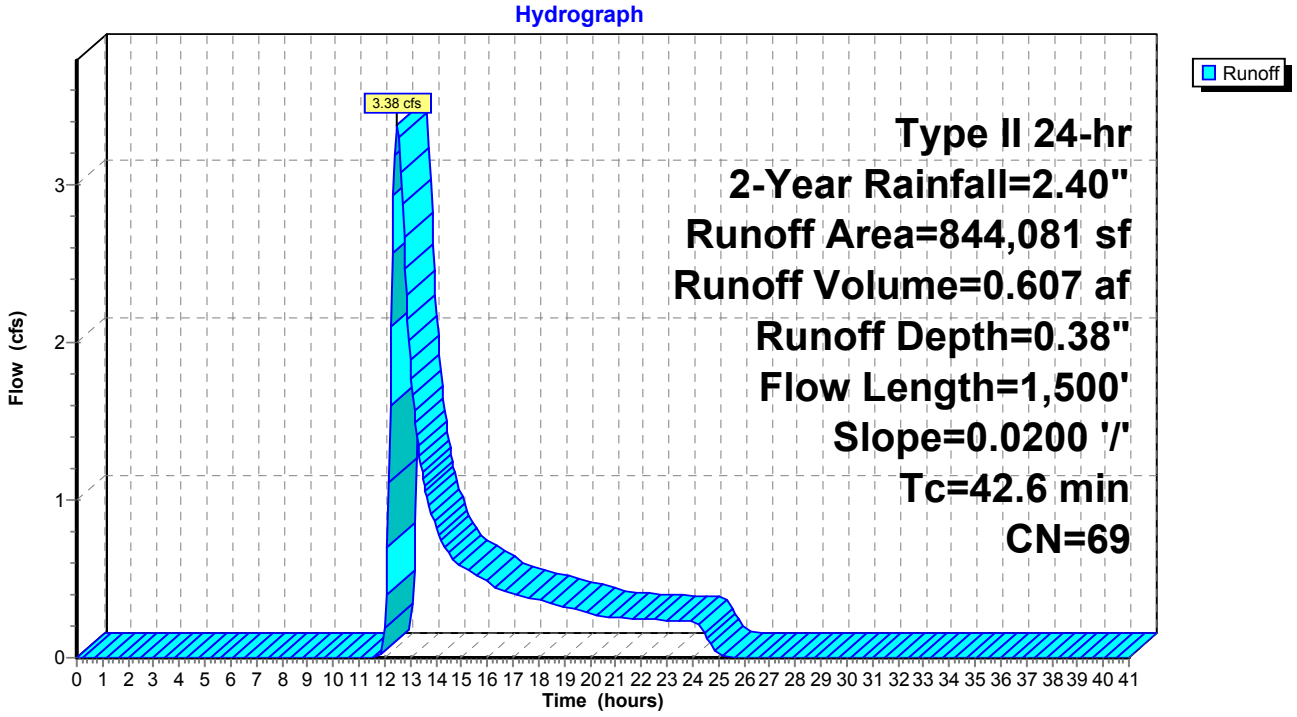
Runoff = 3.38 cfs @ 12.50 hrs, Volume= 0.607 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

Area (sf)	CN	Description
844,081	69	50-75% Grass cover, Fair, HSG B
844,081		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
42.6	1,500	0.0200	0.59		**Lag/CN Method,**

Subcatchment 14S: SOUTH WETLAND



Summary for Subcatchment 15S: Existing Development (Southeast)

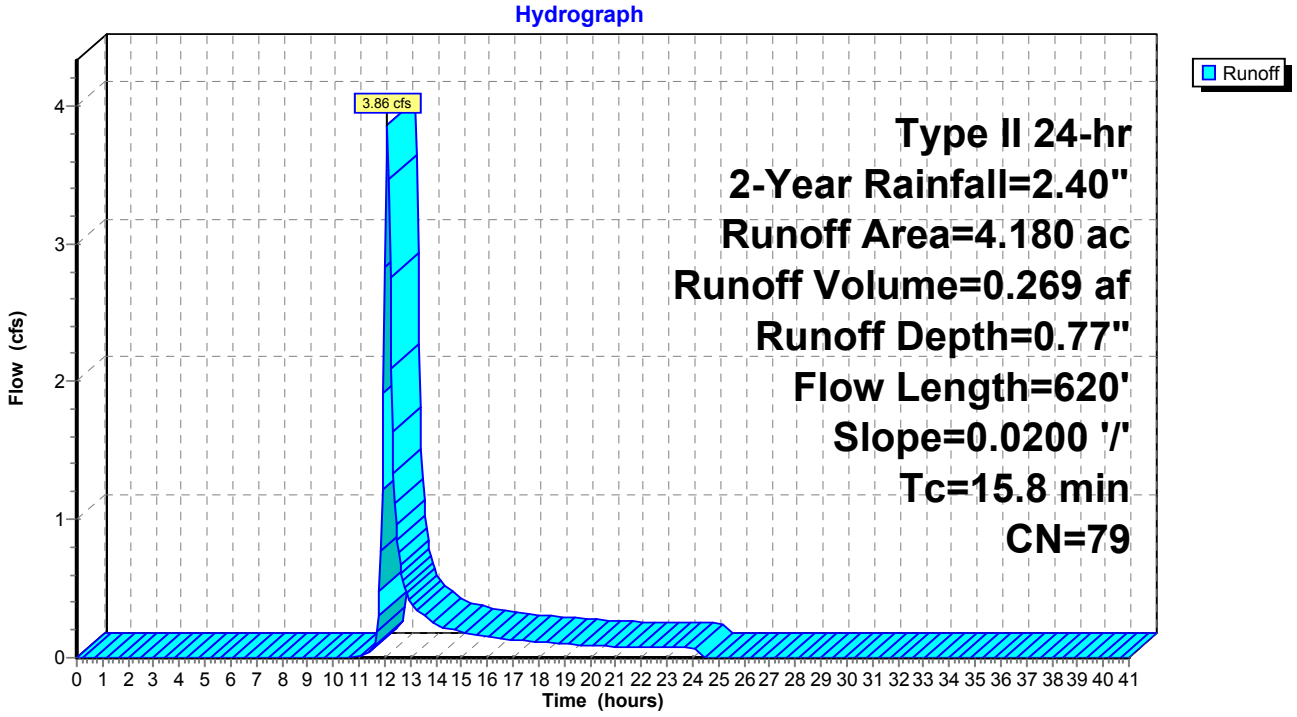
Runoff = 3.86 cfs @ 12.09 hrs, Volume= 0.269 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

Area (ac)	CN	Description
4.180	79	50-75% Grass cover, Fair, HSG C
4.180		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	620	0.0200	0.65		**Lag/CN Method,**

Subcatchment 15S: Existing Development (Southeast)



Summary for Subcatchment 18S: SOUTHEAST SPILL OVER

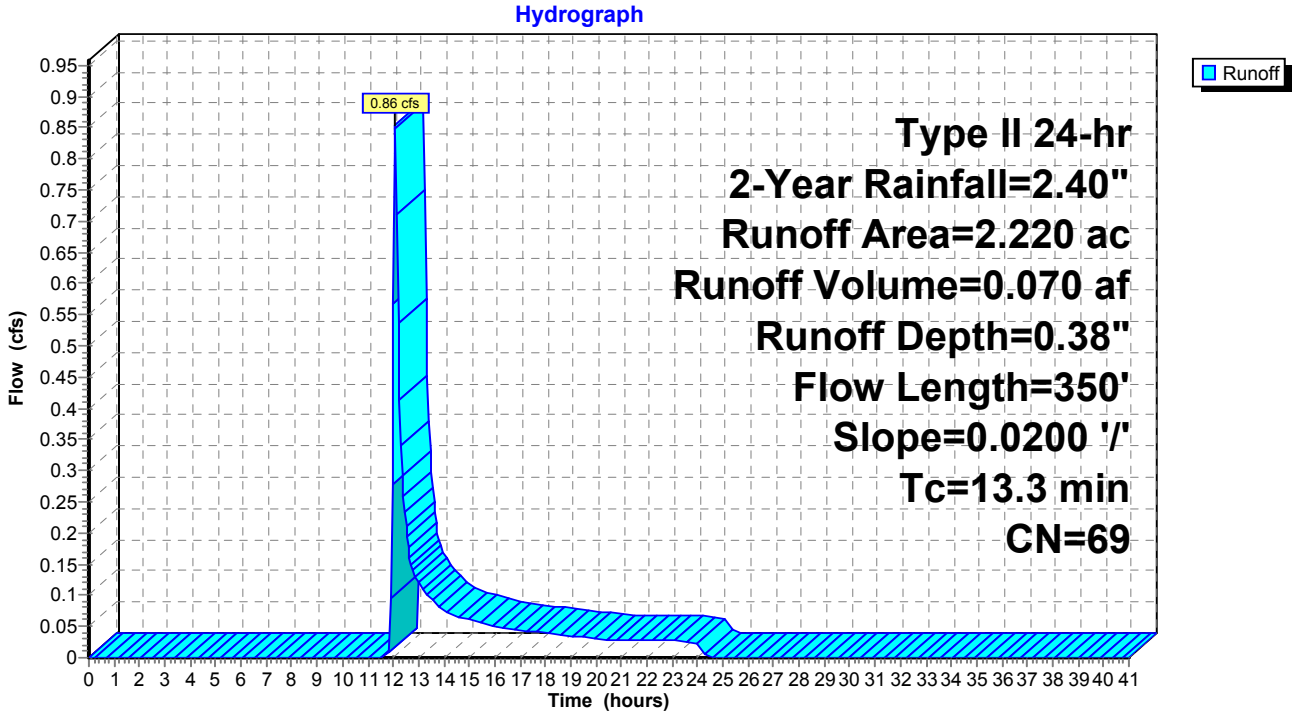
Runoff = 0.86 cfs @ 12.09 hrs, Volume= 0.070 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

Area (ac)	CN	Description
2.220	69	50-75% Grass cover, Fair, HSG B
2.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	350	0.0200	0.44		**Lag/CN Method,**

Subcatchment 18S: SOUTHEAST SPILL OVER



Summary for Subcatchment 24S: West Playground

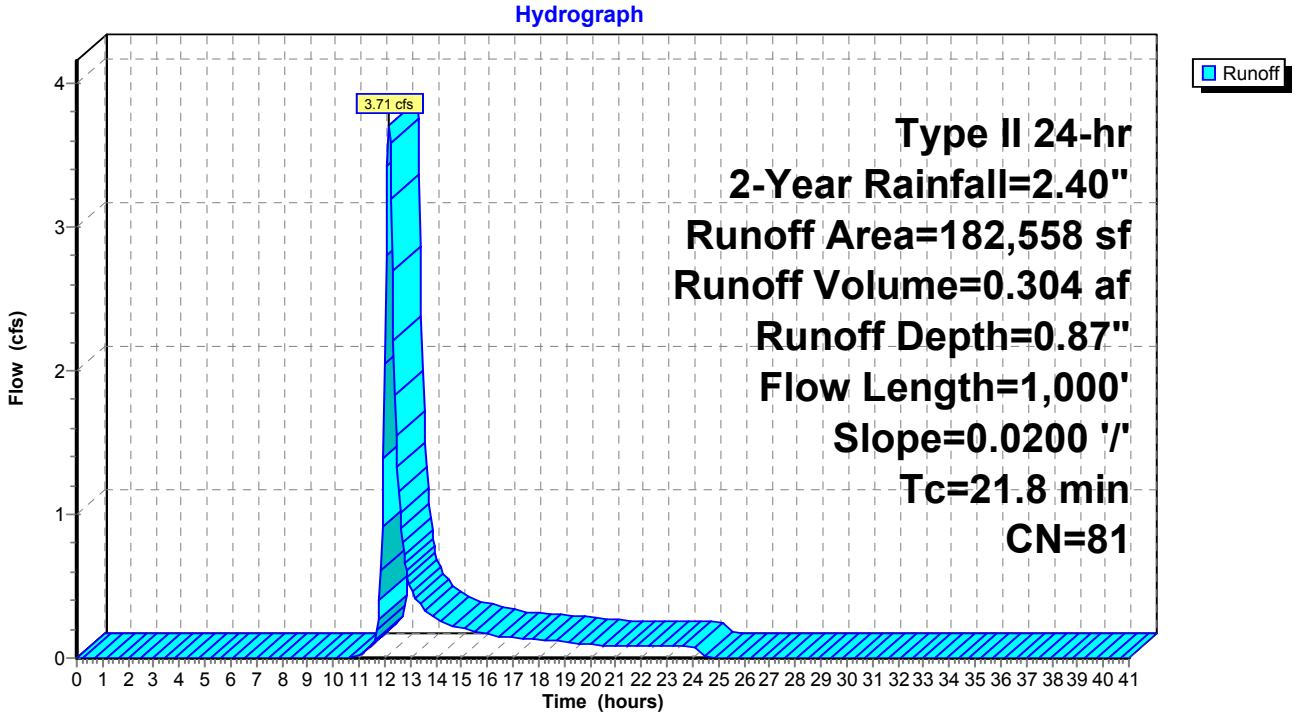
Runoff = 3.71 cfs @ 12.16 hrs, Volume= 0.304 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.40"

Area (sf)	CN	Description
106,488	69	50-75% Grass cover, Fair, HSG B
76,070	98	Paved parking, HSG C
182,558	81	Weighted Average
106,488		58.33% Pervious Area
76,070		41.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	1,000	0.0200	0.77		**Lag/CN Method,**

Subcatchment 24S: West Playground



Summary for Subcatchment 13S: NORTH LAKE

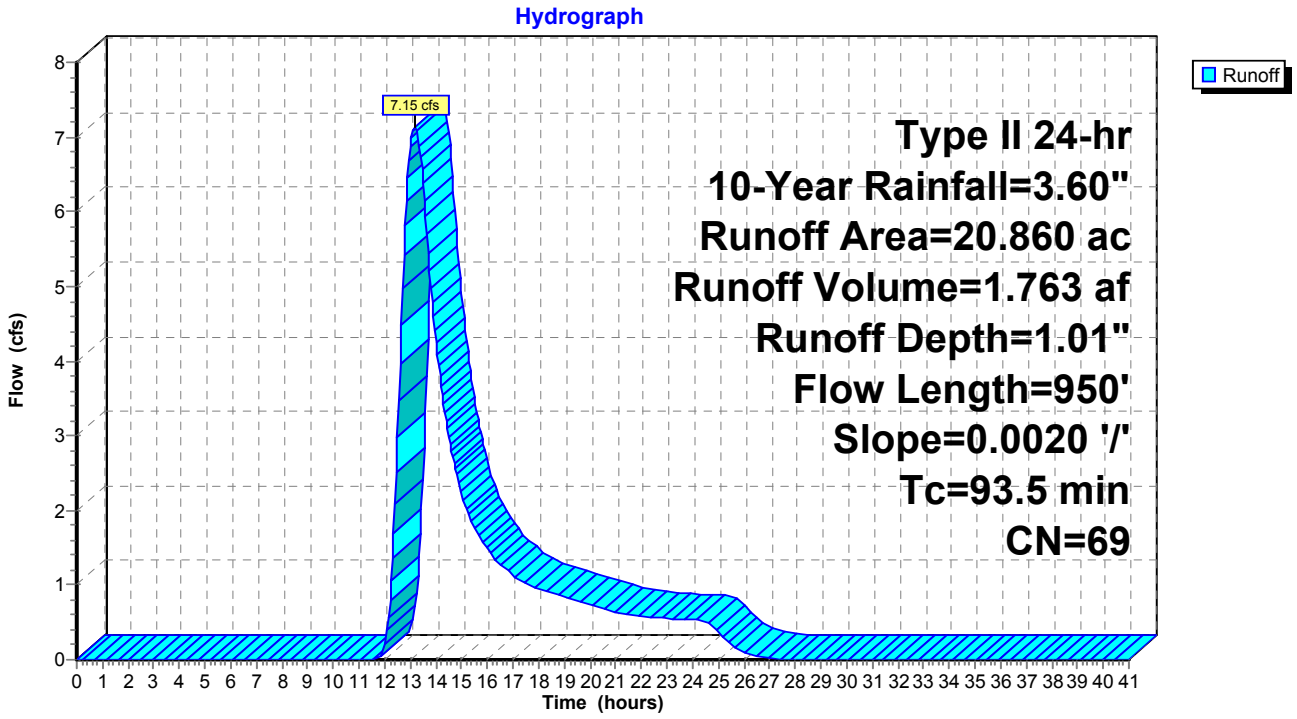
Runoff = 7.15 cfs @ 13.19 hrs, Volume= 1.763 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

Area (ac)	CN	Description
20.860	69	50-75% Grass cover, Fair, HSG B
20.860		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
93.5	950	0.0020	0.17		**Lag/CN Method,**

Subcatchment 13S: NORTH LAKE



Summary for Subcatchment 14S: SOUTH WETLAND

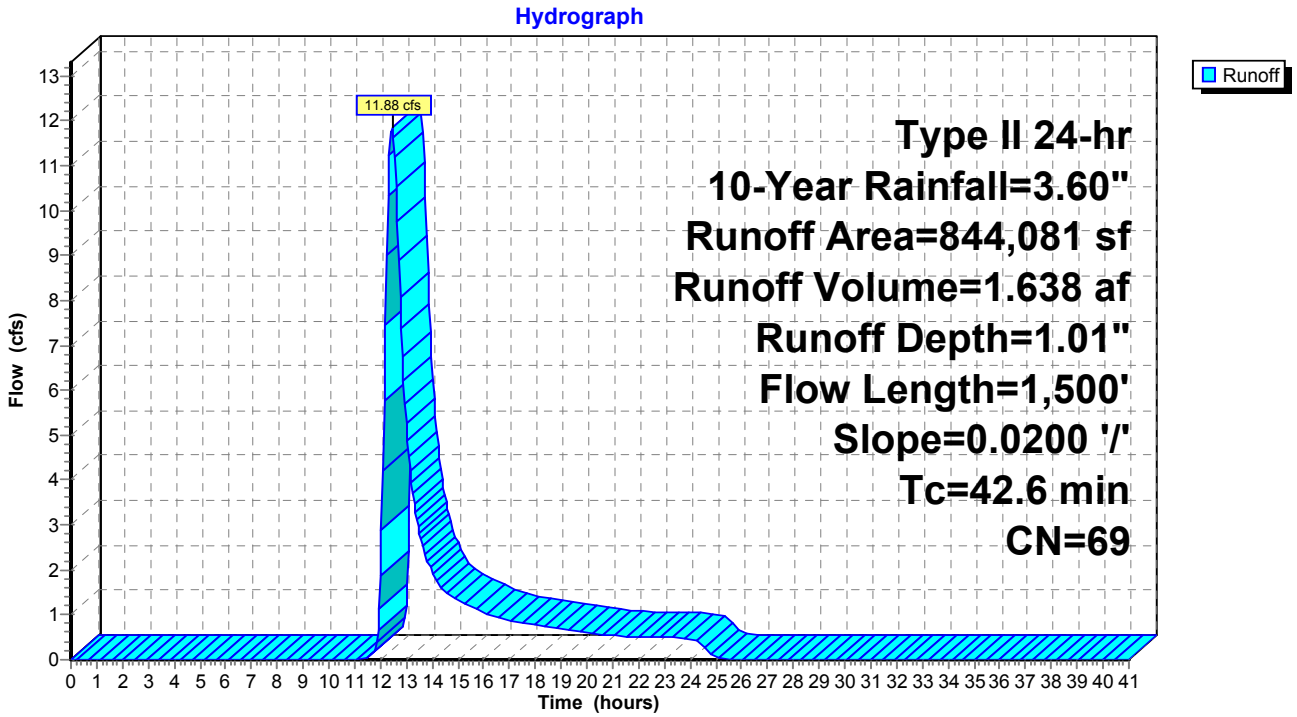
Runoff = 11.88 cfs @ 12.44 hrs, Volume= 1.638 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

Area (sf)	CN	Description
844,081	69	50-75% Grass cover, Fair, HSG B
844,081		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
42.6	1,500	0.0200	0.59		**Lag/CN Method,**

Subcatchment 14S: SOUTH WETLAND



Summary for Subcatchment 15S: Existing Development (Southeast)

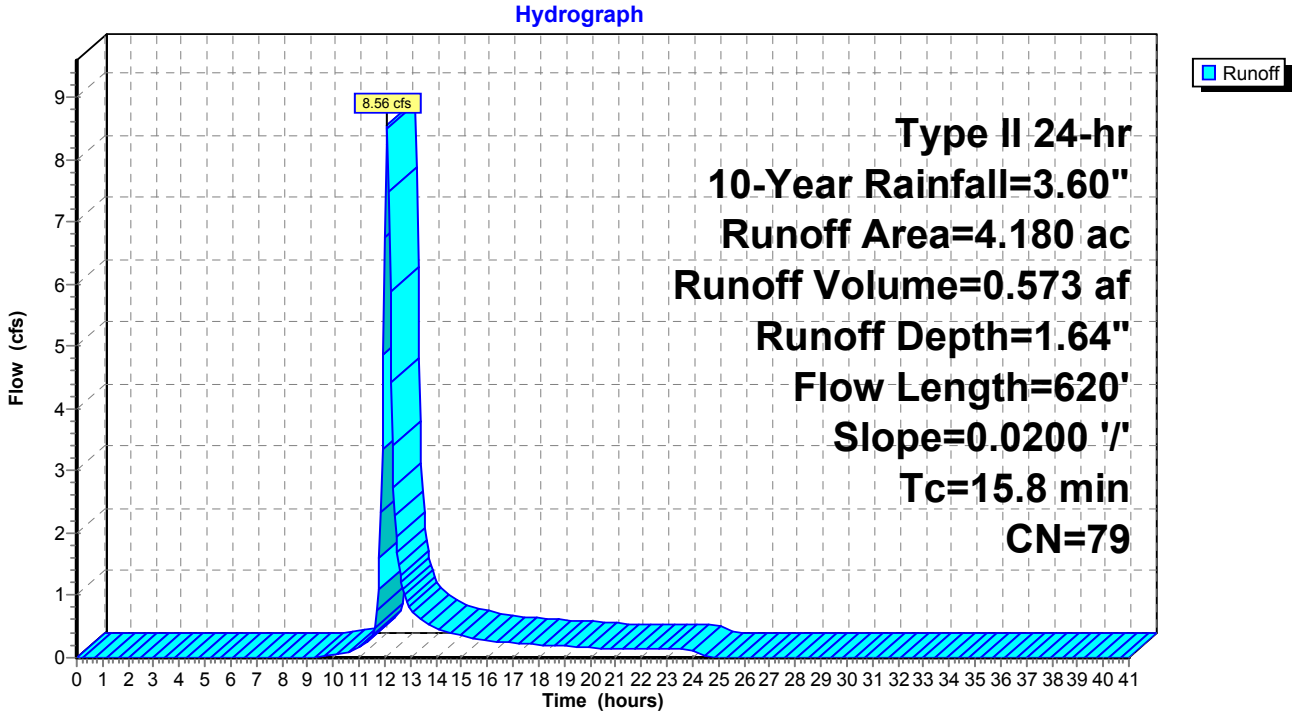
Runoff = 8.56 cfs @ 12.08 hrs, Volume= 0.573 af, Depth= 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

Area (ac)	CN	Description
4.180	79	50-75% Grass cover, Fair, HSG C
4.180		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	620	0.0200	0.65		**Lag/CN Method,**

Subcatchment 15S: Existing Development (Southeast)



Summary for Subcatchment 18S: SOUTHEAST SPILL OVER

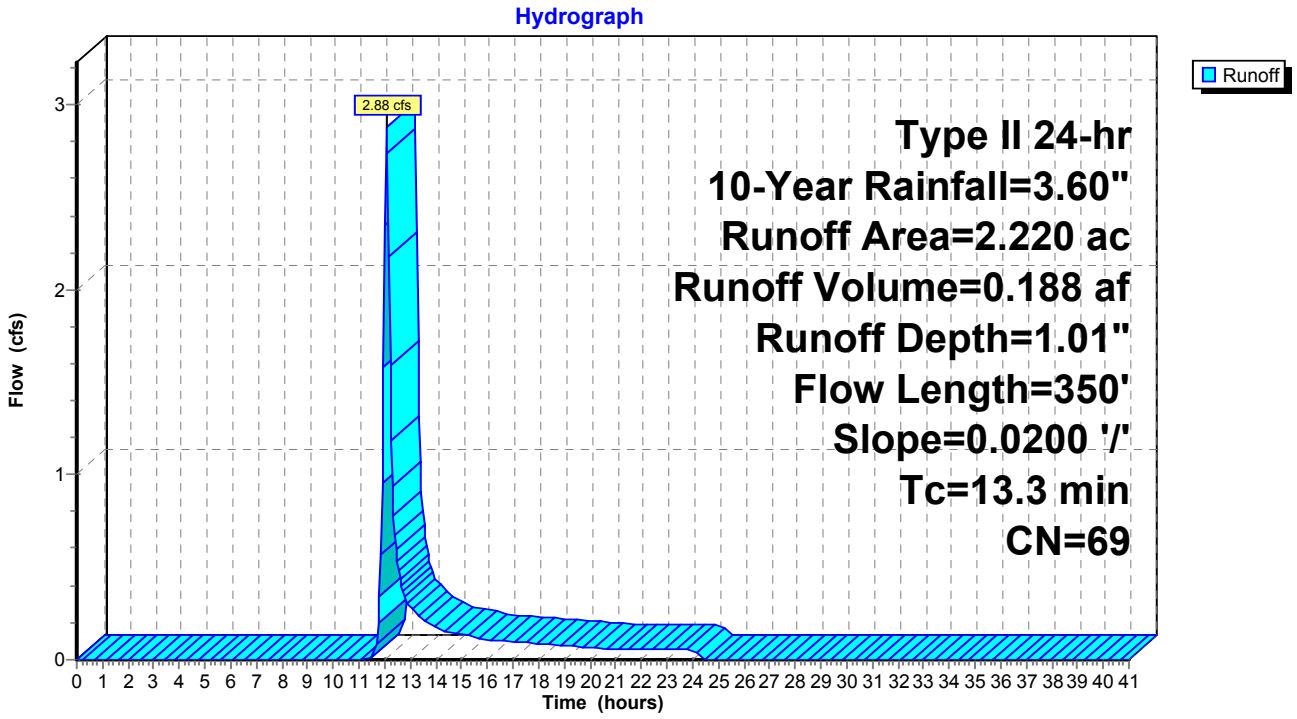
Runoff = 2.88 cfs @ 12.07 hrs, Volume= 0.188 af, Depth= 1.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

Area (ac)	CN	Description
2.220	69	50-75% Grass cover, Fair, HSG B
2.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	350	0.0200	0.44		**Lag/CN Method,**

Subcatchment 18S: SOUTHEAST SPILL OVER



Summary for Subcatchment 24S: West Playground

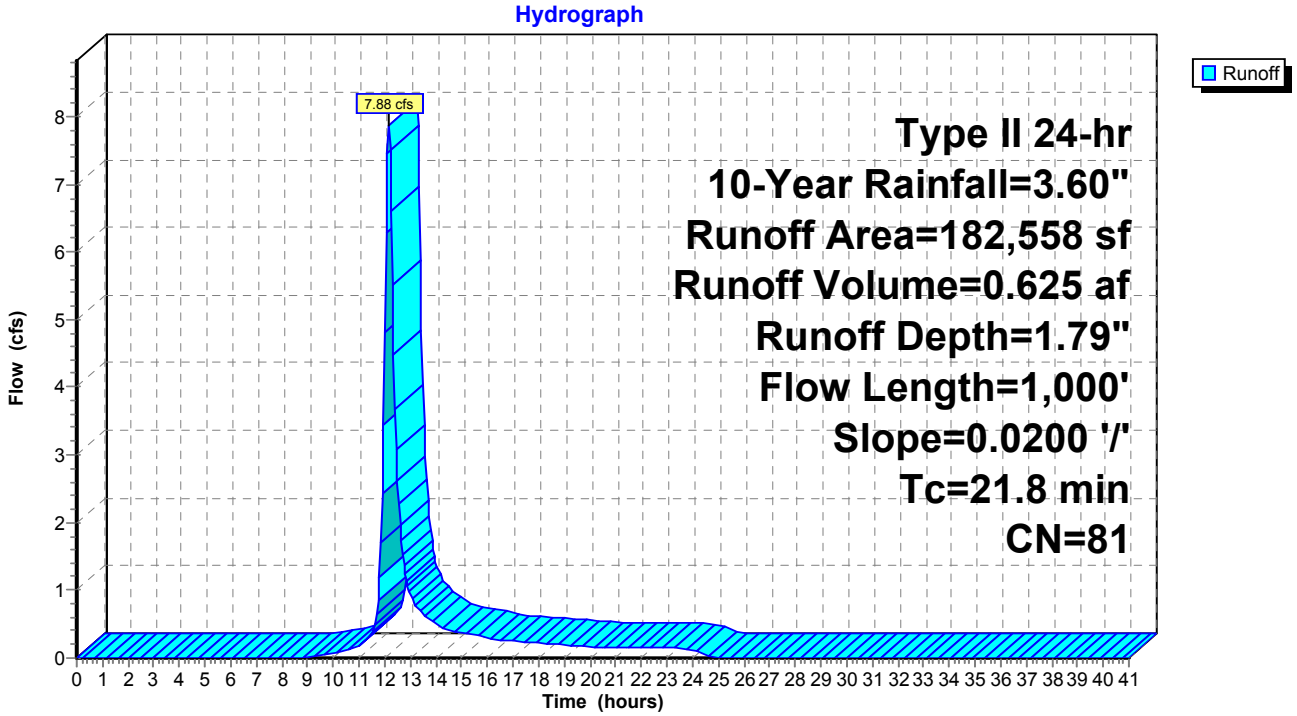
Runoff = 7.88 cfs @ 12.15 hrs, Volume= 0.625 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=3.60"

Area (sf)	CN	Description
106,488	69	50-75% Grass cover, Fair, HSG B
76,070	98	Paved parking, HSG C
182,558	81	Weighted Average
106,488		58.33% Pervious Area
76,070		41.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	1,000	0.0200	0.77		**Lag/CN Method,**

Subcatchment 24S: West Playground



Summary for Subcatchment 13S: NORTH LAKE

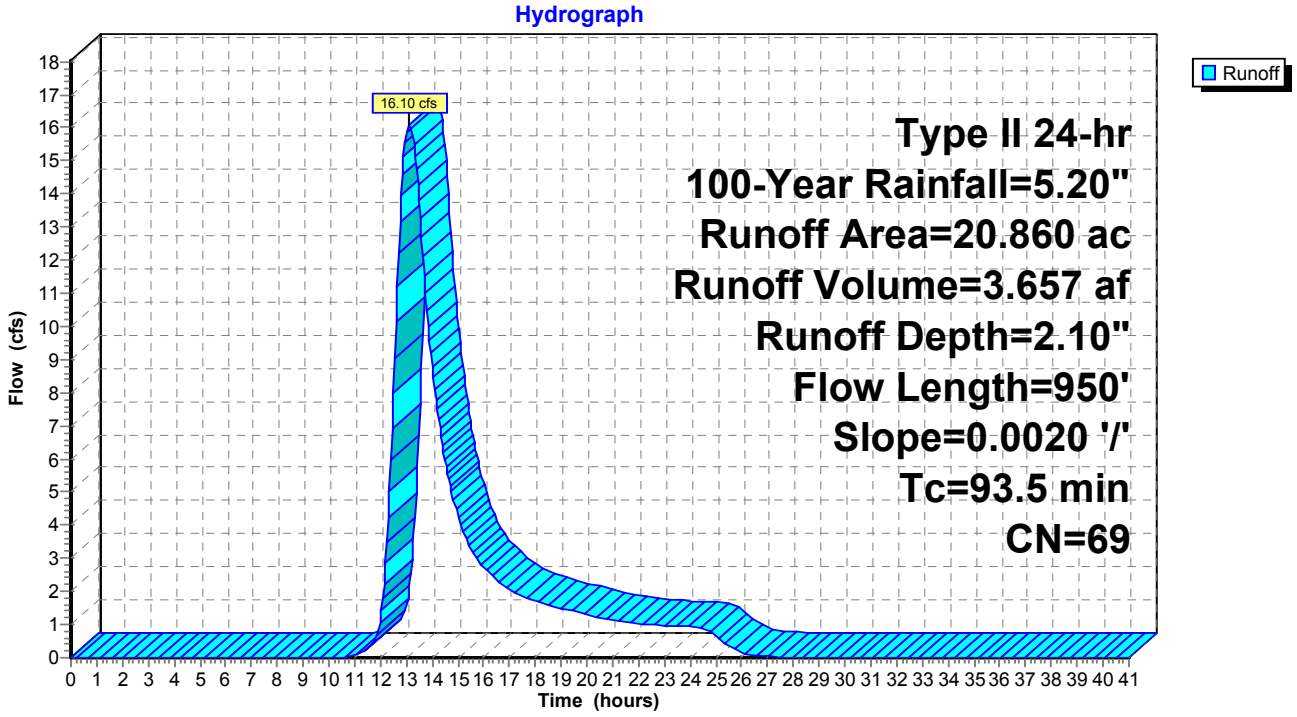
Runoff = 16.10 cfs @ 13.12 hrs, Volume= 3.657 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

Area (ac)	CN	Description
20.860	69	50-75% Grass cover, Fair, HSG B
20.860		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
93.5	950	0.0020	0.17		**Lag/CN Method,**

Subcatchment 13S: NORTH LAKE



Summary for Subcatchment 14S: SOUTH WETLAND

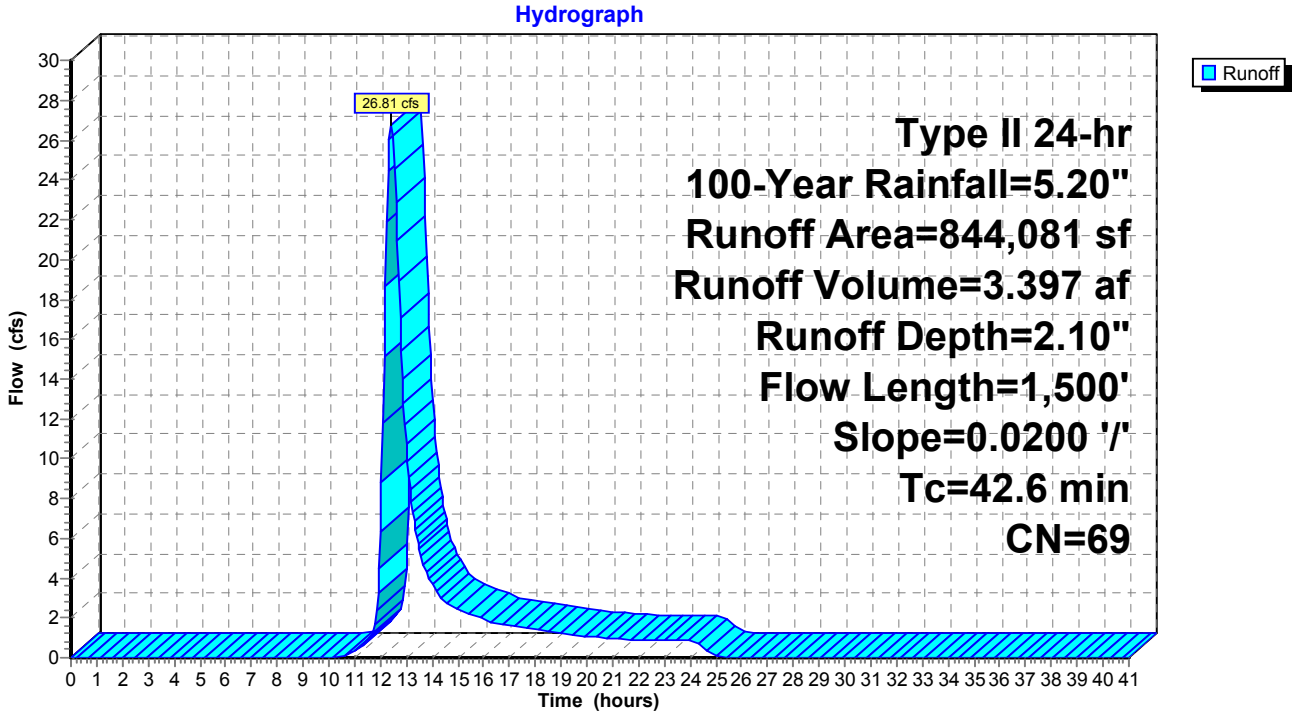
Runoff = 26.81 cfs @ 12.42 hrs, Volume= 3.397 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

Area (sf)	CN	Description
844,081	69	50-75% Grass cover, Fair, HSG B
844,081		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
42.6	1,500	0.0200	0.59		**Lag/CN Method,**

Subcatchment 14S: SOUTH WETLAND



Summary for Subcatchment 15S: Existing Development (Southeast)

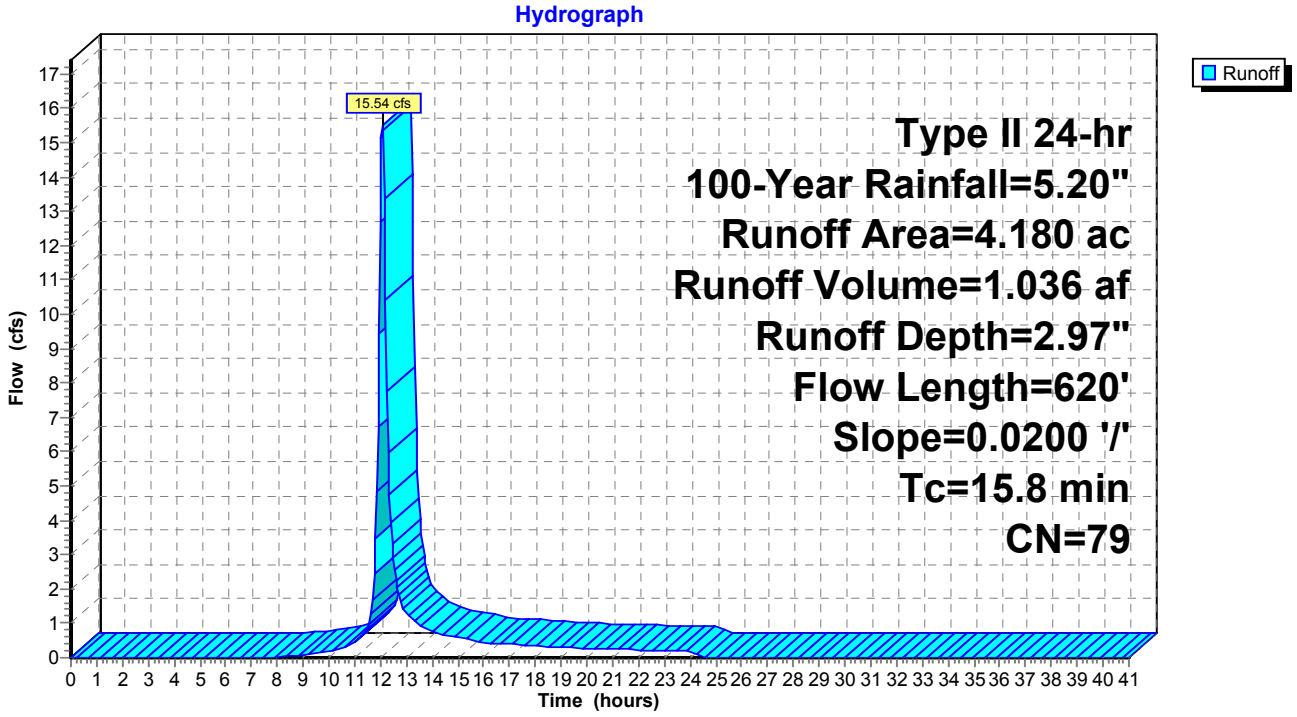
Runoff = 15.54 cfs @ 12.08 hrs, Volume= 1.036 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

Area (ac)	CN	Description
4.180	79	50-75% Grass cover, Fair, HSG C
4.180		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	620	0.0200	0.65		**Lag/CN Method,**

Subcatchment 15S: Existing Development (Southeast)



Summary for Subcatchment 18S: SOUTHEAST SPILL OVER

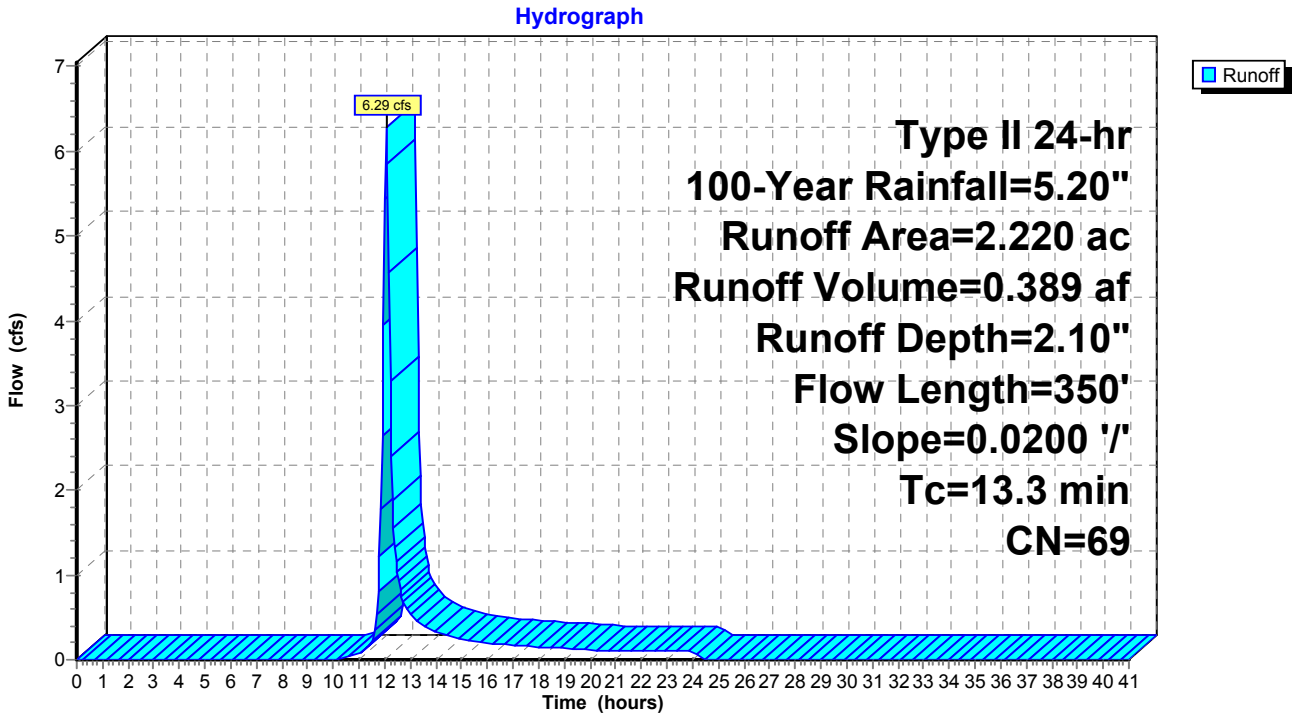
Runoff = 6.29 cfs @ 12.06 hrs, Volume= 0.389 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

Area (ac)	CN	Description
2.220	69	50-75% Grass cover, Fair, HSG B
2.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.3	350	0.0200	0.44		**Lag/CN Method,**

Subcatchment 18S: SOUTHEAST SPILL OVER



Summary for Subcatchment 24S: West Playground

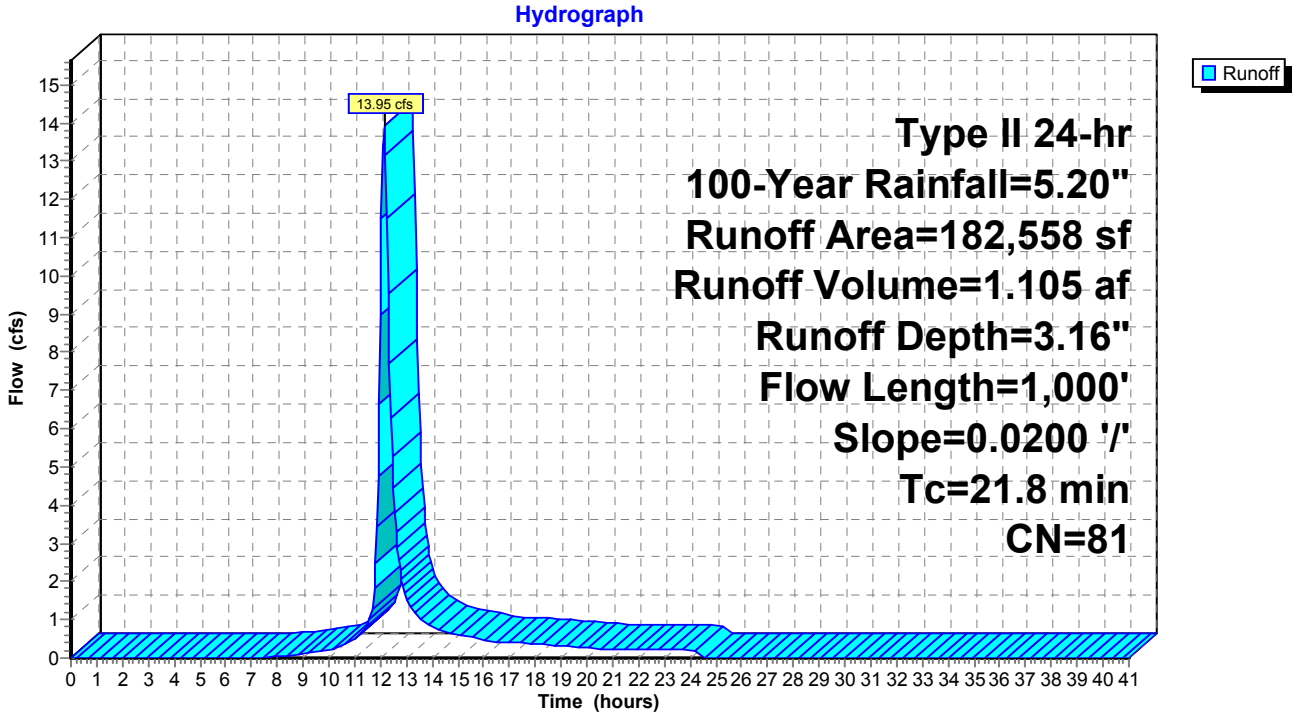
Runoff = 13.95 cfs @ 12.15 hrs, Volume= 1.105 af, Depth= 3.16"

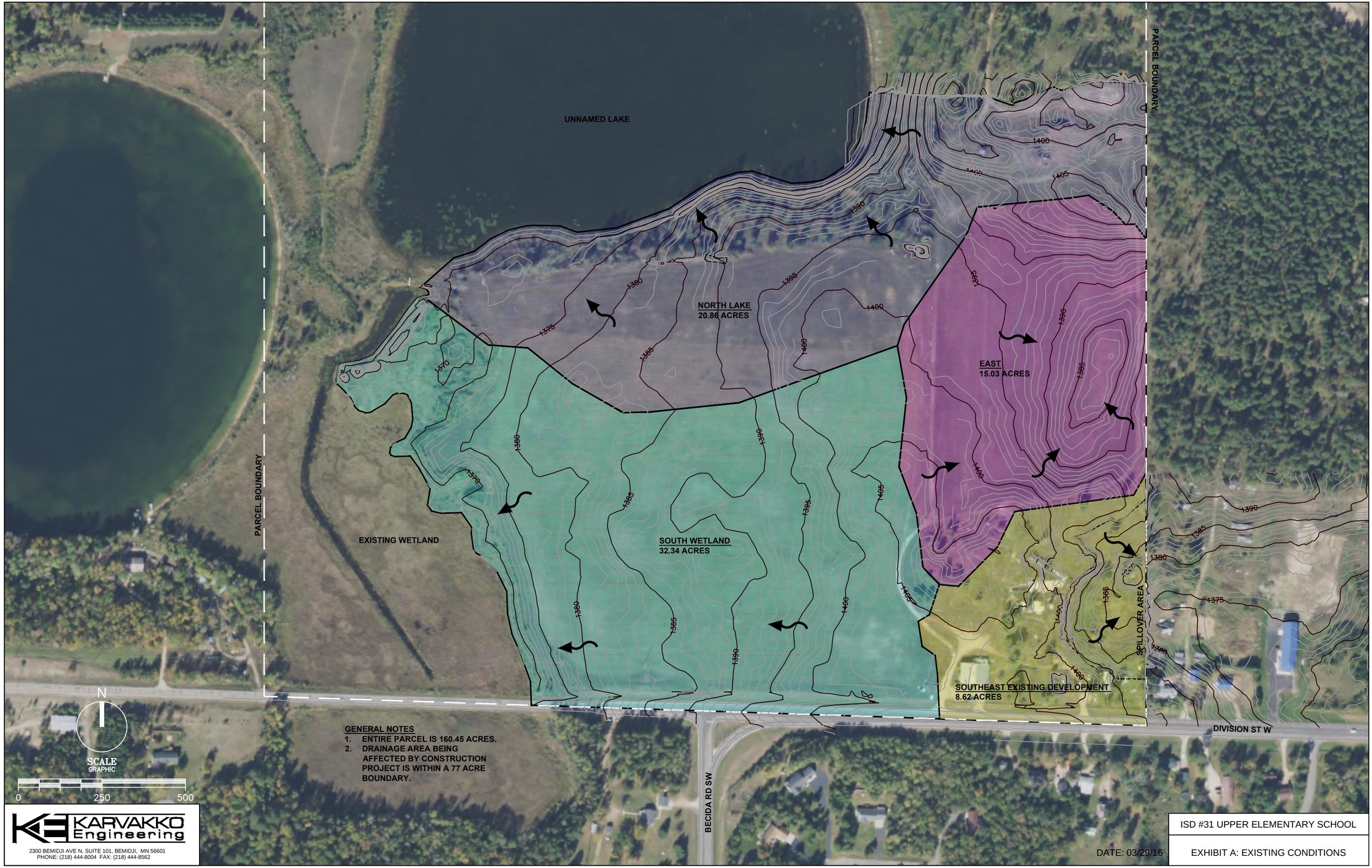
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-41.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-Year Rainfall=5.20"

Area (sf)	CN	Description
106,488	69	50-75% Grass cover, Fair, HSG B
76,070	98	Paved parking, HSG C
182,558	81	Weighted Average
106,488		58.33% Pervious Area
76,070		41.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	1,000	0.0200	0.77		**Lag/CN Method,**

Subcatchment 24S: West Playground





GENERAL NOTES

1. ENTIRE PARCEL IS 160.45 ACRES.
2. DRAINAGE AREA BEING AFFECTED BY CONSTRUCTION PROJECT IS WITHIN A 77 ACRE BOUNDARY.

KARVAKKO Engineering
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ISD #31 UPPER ELEMENTARY SCHOOL

EXHIBIT A: EXISTING CONDITIONS

DATE: 03/29/16

UNNAMED LAKE

NORTH LAKE
20.86 ACRES

EAST
16.01 ACRES

WEST PLAYGROUND
4.19 ACRES

UPPER
ELEMENTARY
SCHOOL

WEST POND
8.96 ACRES

SOUTH WETLAND
19.39 ACRES

EXISTING WETLAND

EAST NULL
1.06 ACRES

SOUTHEAST EXISTING DEVELOPMENT
6.38 ACRES

ENTRANCE ROAD

BUS DROP OFF / PICKUP (20 SPACES)

BUS ENTRANCE ROAD

SPILLOVER AREA

DIVISION ST W

BECIDA RD SW

1400
1395
1390
1385
1380
1375
1370

N

SCALE
GRAPHIC

0 250 500

GENERAL NOTES

1. ENTIRE PARCEL IS 160.45 ACRES.
2. DRAINAGE AREA BEING AFFECTED BY CONSTRUCTION PROJECT IS WITHIN A 77 ACRE BOUNDARY.

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ISD #31 UPPER ELEMENTARY SCHOOL

EXHIBIT B: PROPOSED CONDITIONS

DATE: 03/29/16

KARVAKKO Engineering