raSmith

CREATIVITY BEYOND ENGINEERING

Storm Water Management Report for

Reserve at Waukesha

City of Waukesha, WI

Project No. 3170302

May 10, 2019

TABLE OF CONTENTS

PURPOSE

raSmith has been retained by the Campbell Capital Group to prepare a Stormwater Management Plan for the proposed Reserve at Waukesha project.

The project is located at the southwest corner of E. Saint Paul Avenue and Mary Street, along the Fox River in downtown Waukesha. The entire site is classified by USGS Web Soil Survey as loam soils (hydraulic soil group D). The site is currently developed with mowed grass and pavement for parking. A large portion of the site was previously building per a 2010 aerial photograph. In this analysis, 2010 conditions will be used as existing conditions. The site generally drains north to south and ultimately to the Fox River

The proposed project consists of a multi-level luxury apartment complex with associated parking, sidewalks, and landscaping. To meet stormwater management requirements, an underground detention system has been proposed.

Storm water management for this redevelopment site is regulated by the City of Waukesha Municipal Code Chapter 32 and the Wisconsin Department of Natural Resources NR 151. The analysis presented in this report addresses post-construction water quantity, water quality, and infiltration requirements.

RUNOFF MANAGEMENT REGULATIONS

The total site under investigation is 2.14 acres. Only areas within the property boundaries have been included in the analysis. This project is classified as redevelopment as relating to stormwater management.

Water Quantity: Chapter 32 of the Waukesha code requires that the proposed peak discharge rate for the 1-yr, 2-yr, 10-yr, and 100-yr 24-hr storm events must be no more than the existing peak discharge rate the same storm event

Water Quality: Chapter 32 of the Waukesha code and NR 151.122, total suspended solids (TSS) generated from parking lots and roads must be reduced by 40% as compared with no controls.

Site Infiltration: Per NR 151, redevelopment sites are exempt from infiltration requirements. Per chapter 32 of the Waukesha code, development with more than 40% and up to 80% connected imperviousness shall infiltrate sufficient runoff volume so that the post-development infiltration volume shall be at least 75% of the pre-development infiltration volume, based on an average annual rainfall.

METHODS OF ANALYSIS

Hydrologic analysis included in this report was performed using the HydroCAD hydrologic simulation computer model, version 10.00 by HydroCAD Software Solutions LLC. The discharges were generated using the SCS Dimensionless Unit Hydrograph Method for a 24-hour duration storm. Model parameters include drainage area, SCS runoff curve number, time of concentration and 24-hour precipitation with an MSE Type III distribution.

Table 1 – Design Storm Events
Per Chapter 32.10 Table 3

Frequency (years)	Duration (hours)	Rainfall Depth (inches)
1	24	2.40
2	24	2.70
10	24	3.81
100	24	6.18

WATER QUANTITY DESIGN

The study area is 2.14 acres. Table 2 summarizes the pre-development site parameters and peak discharge rates for the 1-yr, 2-yr, 10-yr, and 100-yr storm events. See the attached hydrographs and existing hydrology exhibit for additional information.

Table 2 – Pre-Development Stormwater Quantity Summary

Watershed ID	**Watershed Characteristics**			**Peak Discharge (cfs)**			
	Area	CN	Tc	1-year	2-year	10-year	100-year
E-1	1.28	95	8.0	3.83	4.39	6.43	10.73
E-2	0.86	98	6.0	3.01	3.40	4.84	7.89
TOTAL	2.14	-	-	**6.76**	**7.70**	**11.14**	**18.42**

The post-developed site increases peak discharge rates due to the increased impervious area. Table 3 summarizes the post-developed site parameters and peak discharge rates generated by the 1-year, 2-year, 10-year, and 100-year storm events prior to detention. Refer to the proposed conditions hydrographs (Before Detention) and proposed hydrology exhibit for more detail.

Table 3 – Post-Developed Peak Discharge Rates (Before Detention)

				Peak Discharge (cfs)			
Watershed	Area (ac)	CN	Tc (min)	1-year	2-year	10-year	100-year
P-1	0.30	96	6.0	1.02	1.16	1.68	2.77
P-2	1.78	97	6.0	6.31	7.16	10.26	16.83
TOTAL	2.05	-	-	**7.33**	**8.31**	**11.93**	**19.60**

A reduction in peak discharge rates will be achieved by routing a portion of the post-developed site (P-1) through the underground detention system. Table 4 summarizes the parameters and peak discharge rates generated by the 1-year, 2-year, 10-year, and 100-year storm events after detention. Refer to the proposed conditions hydrographs (After Detention) and proposed hydrology exhibit for more detail.

Table 4 – Post-Developed Peak Discharge Rates (After Detention)

	Peak Discharge (cfs)				Routed 100-yr Elevation	100-yr Storage (ft^3)
Pond	1-year	2-year	10-year	100-year		
UG Det	0.40	0.39	0.54	1.56	**27.70**	**2,780**
P-2	6.31	7.16	10.26	16.83	**-**	**-**
TOTAL	**6.39**	**7.26**	**10.38**	**17.54**	**-**	**-**

Table 5 – Summary of City of Waukesha Peak Discharge Requirements (cfs)

	1-year	2-year	10-year	100-year
Pre-Development	**6.76**	**7.70**	**11.14**	**18.42**
Post-Development	**6.64**	**7.53**	**10.83**	**18.36**

WATER QUALITY DESIGN

Water quality treatment was obtained through the use of an underground detention system with a normal water level at the midpoint of the pipe. The underground detention basin was designed to reduce the average annual total suspended solids (TSS) load generated for new parking and roads only. Runoff from non-pavement areas such as roofs, sidewalks, and grass has been accounted for while excluding pollutant loading. Storm water quality was evaluated using the Source Loading and Management Model (WinSLAMM). The results are shown in Table 6 with the applicable computer generated information located in the appendix.

Table 6 –Proposed Site TSS Loads With and Without Controls

	TSS Generated (lbs/year)
No Control (Parking Lots & Roads Only)	280.7
No Control (Entire Project Limits)	792.2
With Controls (Entire Project Limits)	652.5

REQUIRED REDUCTION OF TSS
FROM PARKING LOTS AND ROADS = 280.7 x 40% = 112.3 lbs

REDUCTION OF TSS FROM SITE = 792.2-652.5 = 139.7 lbs

(139.7/280.7) = **49.77% TSS REDUCTION**

INFILTRATION DESIGN

The DNR exempts redevelopment sites like this one from stormwater infiltration based on NR 151.124(3)(b)3.

The City of Waukesha promotes infiltration on any site that allows. There are a number of factors on this project that would prohibit infiltration including the following:

- Soils where infiltration is less than 0.6 inches per hour.
- Soils with a high water table.
- Contaminated soils from previous ownership

As such, we have not accounted for infiltration on this project. Further evaluation may be required.

CONSTRUCTION COST ESTIMATE & INSPECTION OF STORMWATER BMP

The underground detention system shall be inspected by City of Waukesha at least once during construction and once after final stabilization of the site. The underground detention system will be checked to verify that the parameters of the system has been constructed as designed.

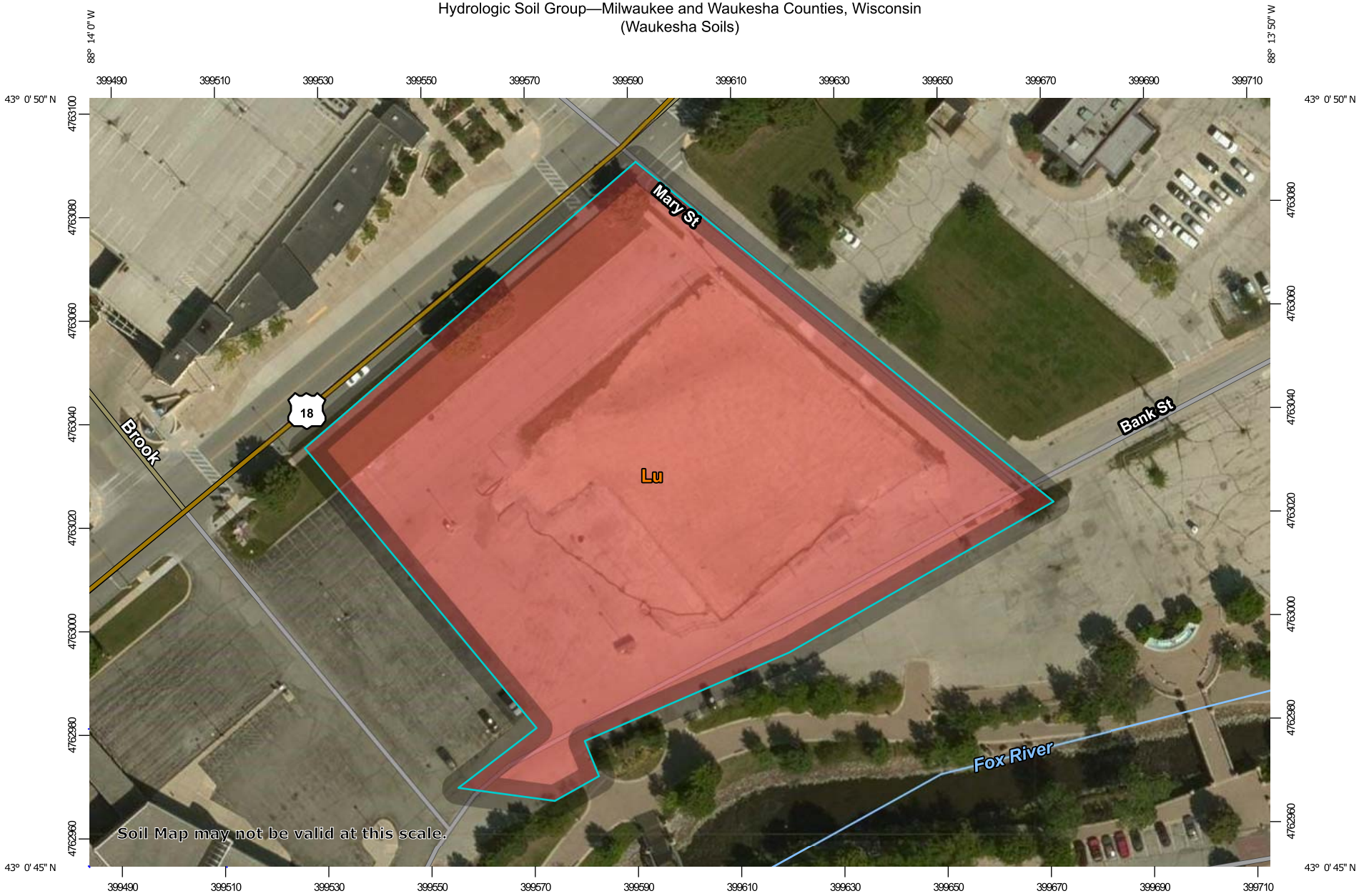
For the purpose of financial assurance per City code section 32.08(c), it is estimated that the underground detention system shall cost $27,000. This includes the 84” diameter pipe, outlet structure, and construction.

SUMMARY

The analysis of the project and the proposed underground detention facility indicates the requirements of the City of Waukesha Chapter 32 and the Wisconsin Department of Natural Resources NR 151 have been satisfied.

Soil & Geotechnical Data

Hydrologic Soil Group—Milwaukee and Waukesha Counties, Wisconsin
(Waukesha Soils)



Map Scale: 1:1,050 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

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

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

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

Soil Survey Area: Milwaukee and Waukesha Counties, Wisconsin
Survey Area Data: Version 14, Sep 12, 2018

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

Date(s) aerial images were photographed: Sep 7, 2014—Sep 22, 2014

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Lu	Loamy land	D	2.2	100.0%
Totals for Area of Interest			**2.2**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

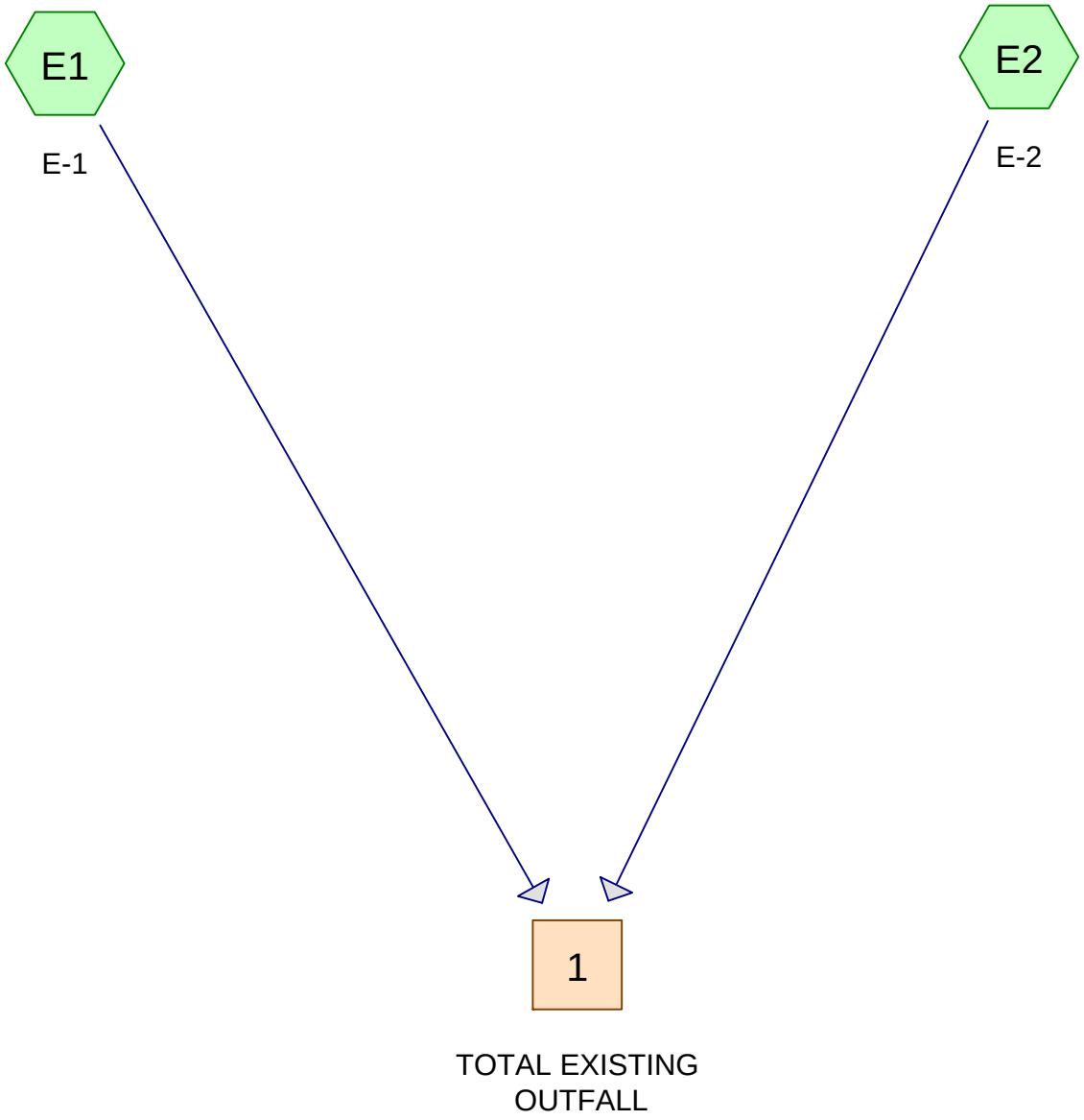
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Storm Water Quantity Calculations - Peak Discharge

Existing Conditions Hydrographs



Subcat Reach Pond Link

Routing Diagram for 3170302 Existing
Prepared by Microsoft, Printed 5/9/2019

Summary for Subcatchment E1: E-1

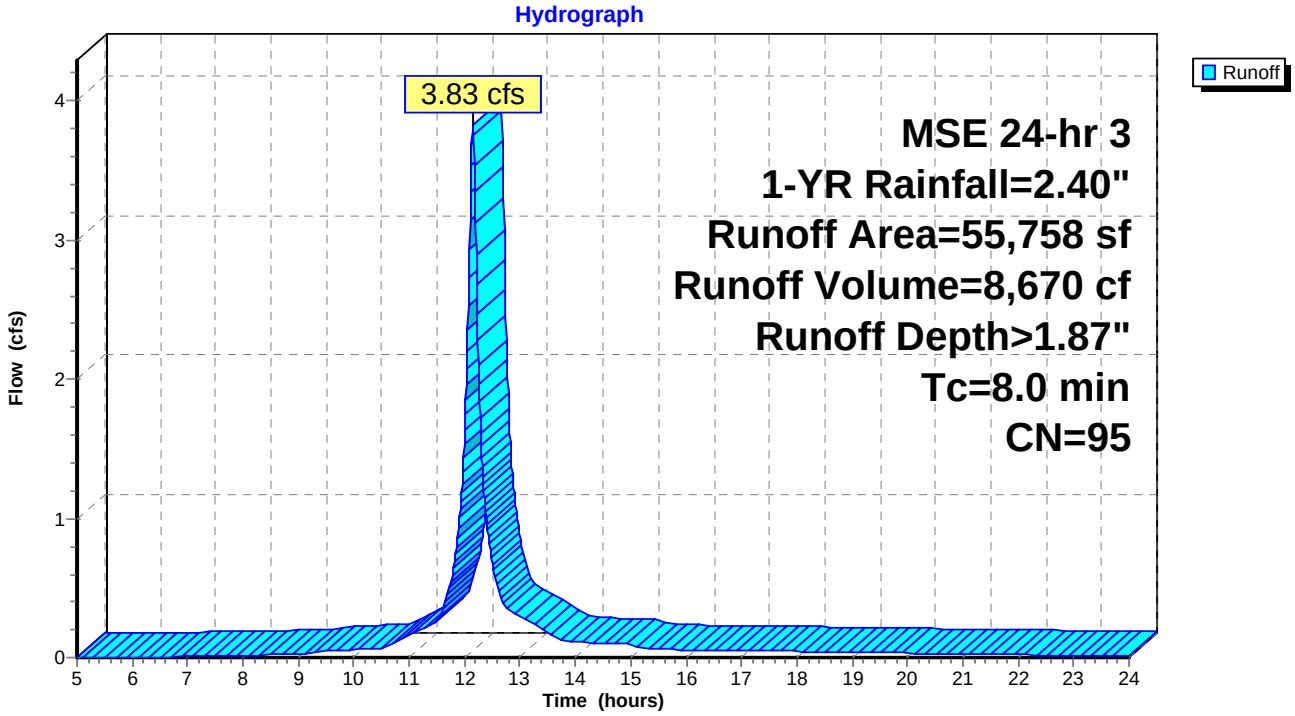
Runoff = 3.83 cfs @ 12.15 hrs, Volume= 8,670 cf, Depth> 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (sf)	CN	Description
8,356	80	>75% Grass cover, Good, HSG D
47,402	98	Paved parking, HSG D
55,758	95	Weighted Average
8,356		14.99% Pervious Area
47,402		85.01% Impervious Area

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

Subcatchment E1: E-1



Summary for Subcatchment E2: E-2

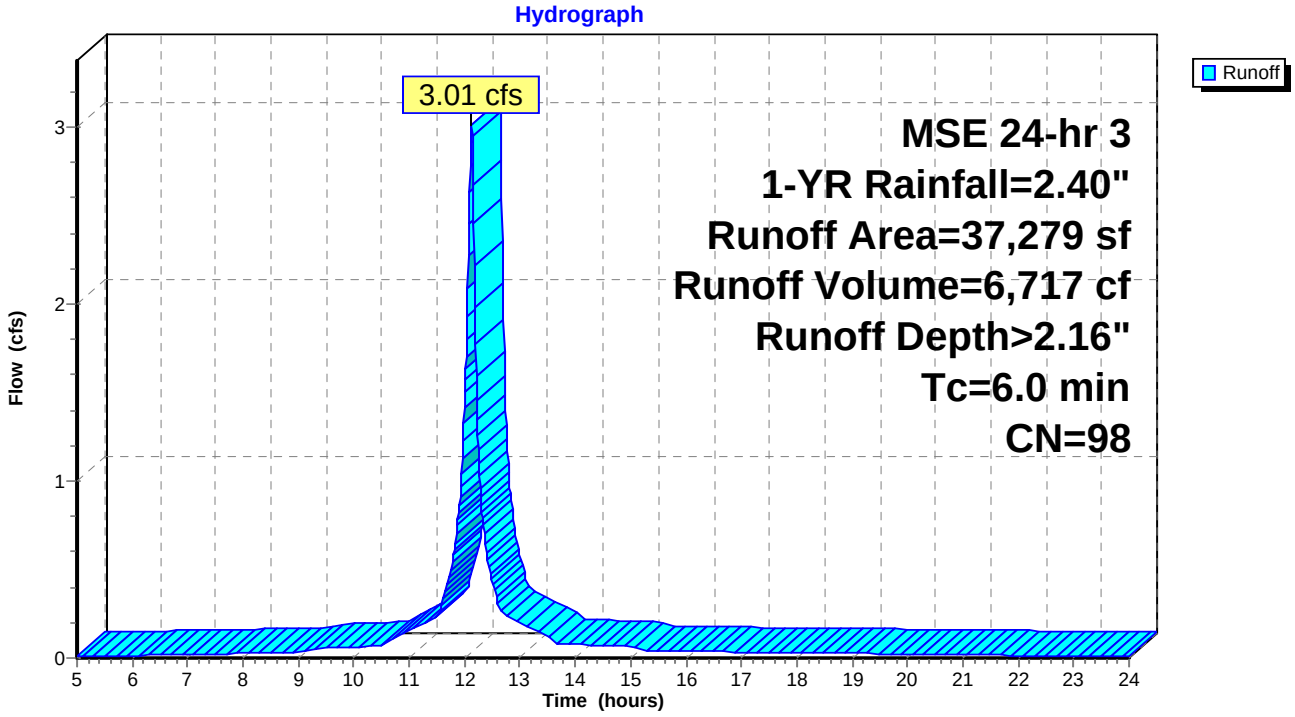
Runoff = 3.01 cfs @ 12.13 hrs, Volume= 6,717 cf, Depth> 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (sf)	CN	Description
13,814	98	Paved parking, HSG D
23,465	98	Roofs, HSG D
37,279	98	Weighted Average
37,279		100.00% Impervious Area

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

Subcatchment E2: E-2

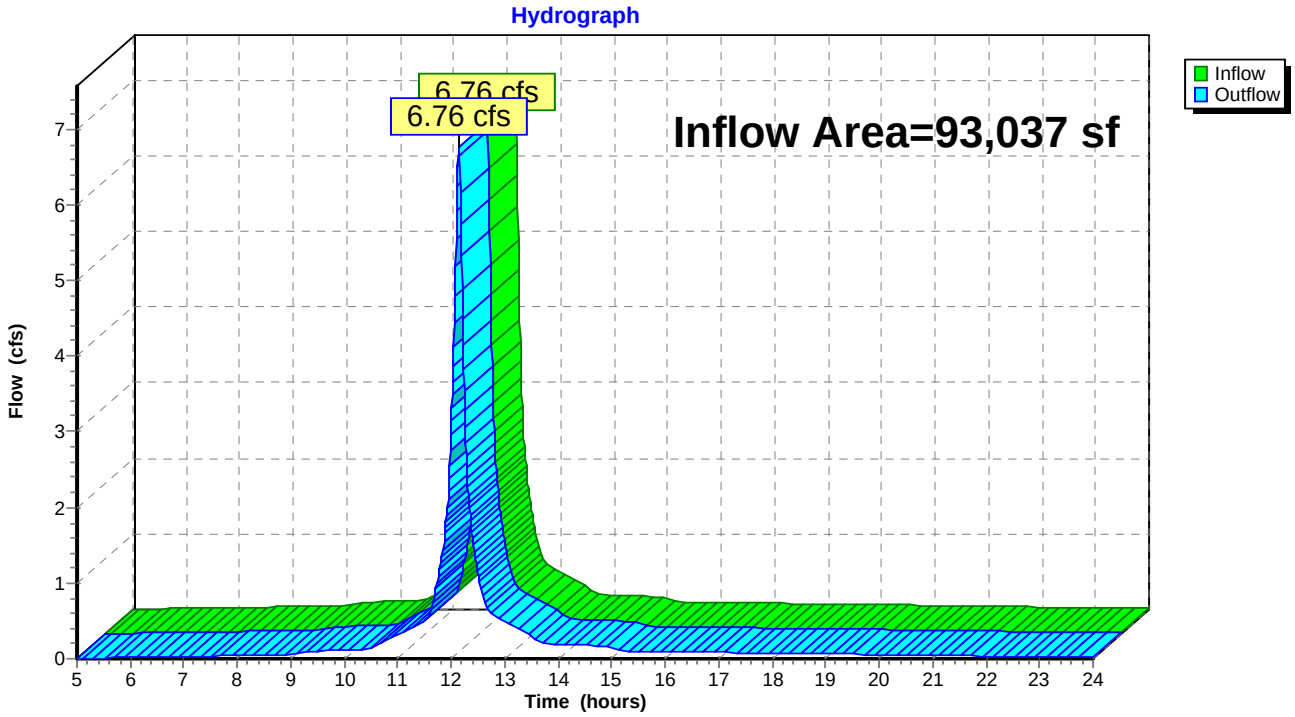


Summary for Reach 1: TOTAL EXISTING OUTFALL

Inflow Area = 93,037 sf, 91.02% Impervious, Inflow Depth > 1.98" for 1-YR event
Inflow = 6.76 cfs @ 12.14 hrs, Volume= 15,387 cf
Outflow = 6.76 cfs @ 12.14 hrs, Volume= 15,387 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs

Reach 1: TOTAL EXISTING OUTFALL



Summary for Subcatchment E1: E-1

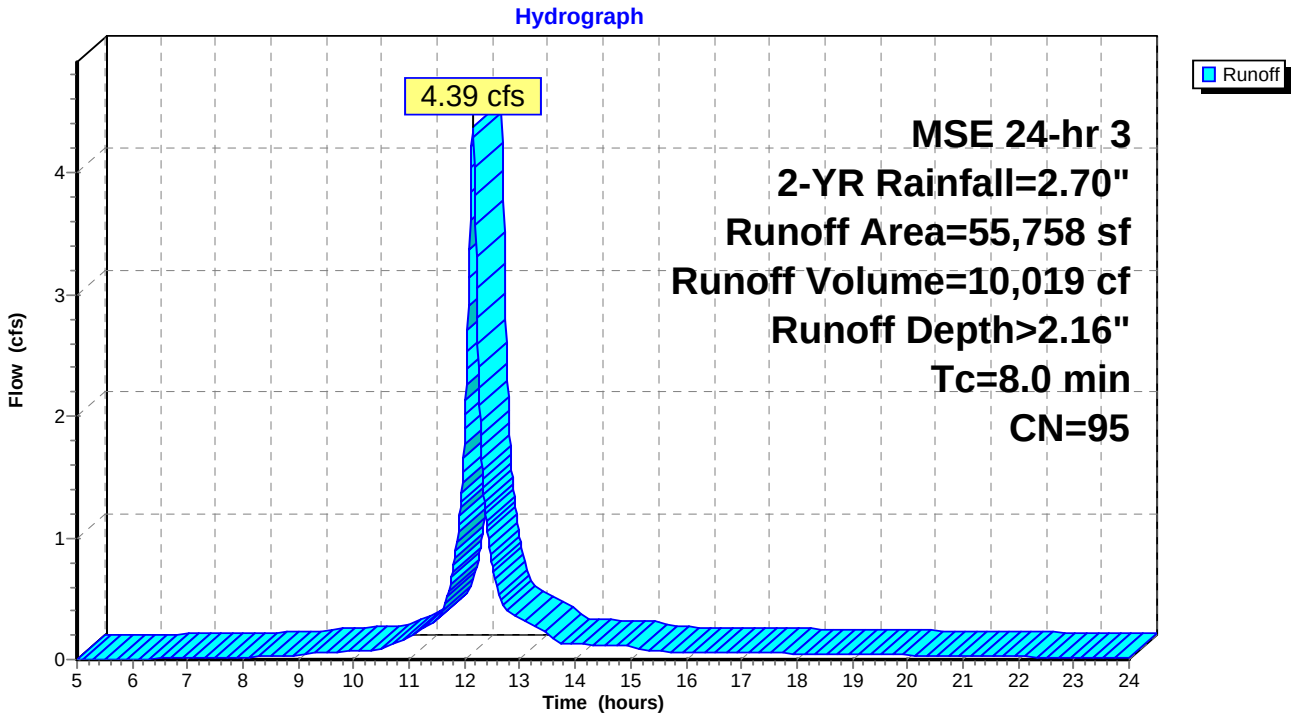
Runoff = 4.39 cfs @ 12.15 hrs, Volume= 10,019 cf, Depth> 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (sf)	CN	Description
8,356	80	>75% Grass cover, Good, HSG D
47,402	98	Paved parking, HSG D
55,758	95	Weighted Average
8,356		14.99% Pervious Area
47,402		85.01% Impervious Area

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

Subcatchment E1: E-1



Summary for Subcatchment E2: E-2

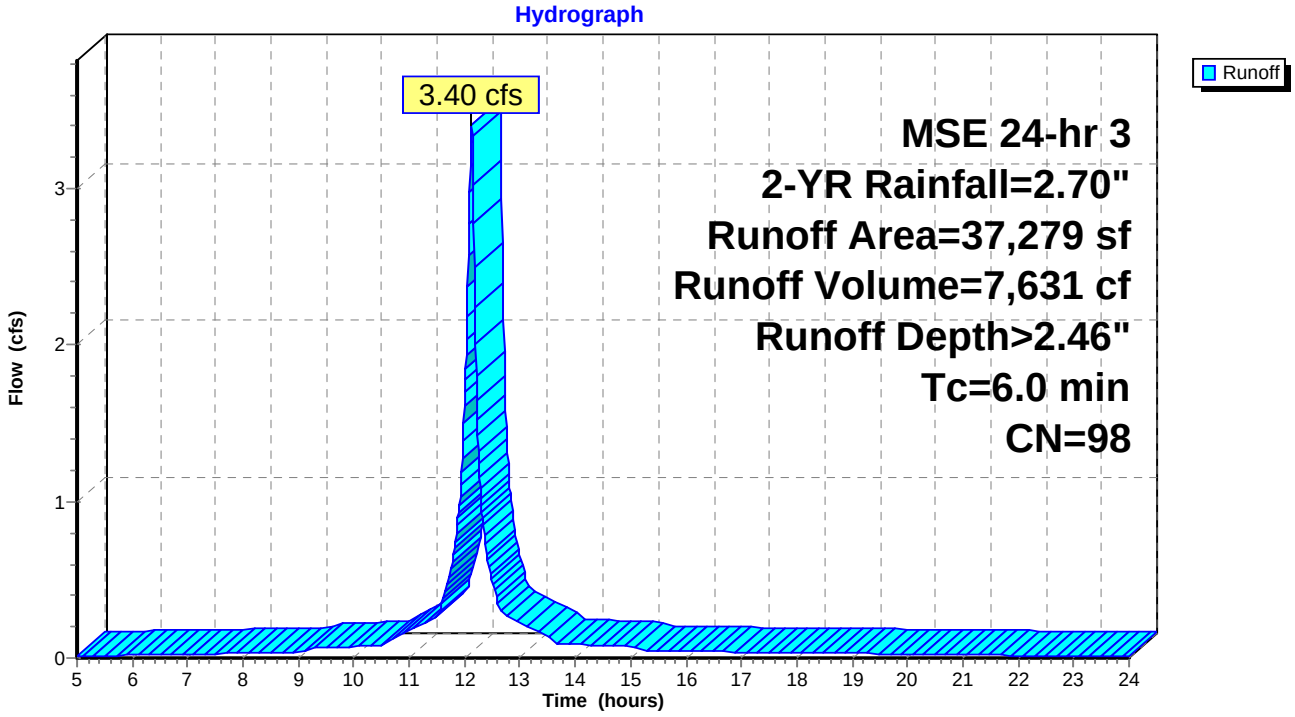
Runoff = 3.40 cfs @ 12.13 hrs, Volume= 7,631 cf, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (sf)	CN	Description
13,814	98	Paved parking, HSG D
23,465	98	Roofs, HSG D
37,279	98	Weighted Average
37,279		100.00% Impervious Area

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

Subcatchment E2: E-2

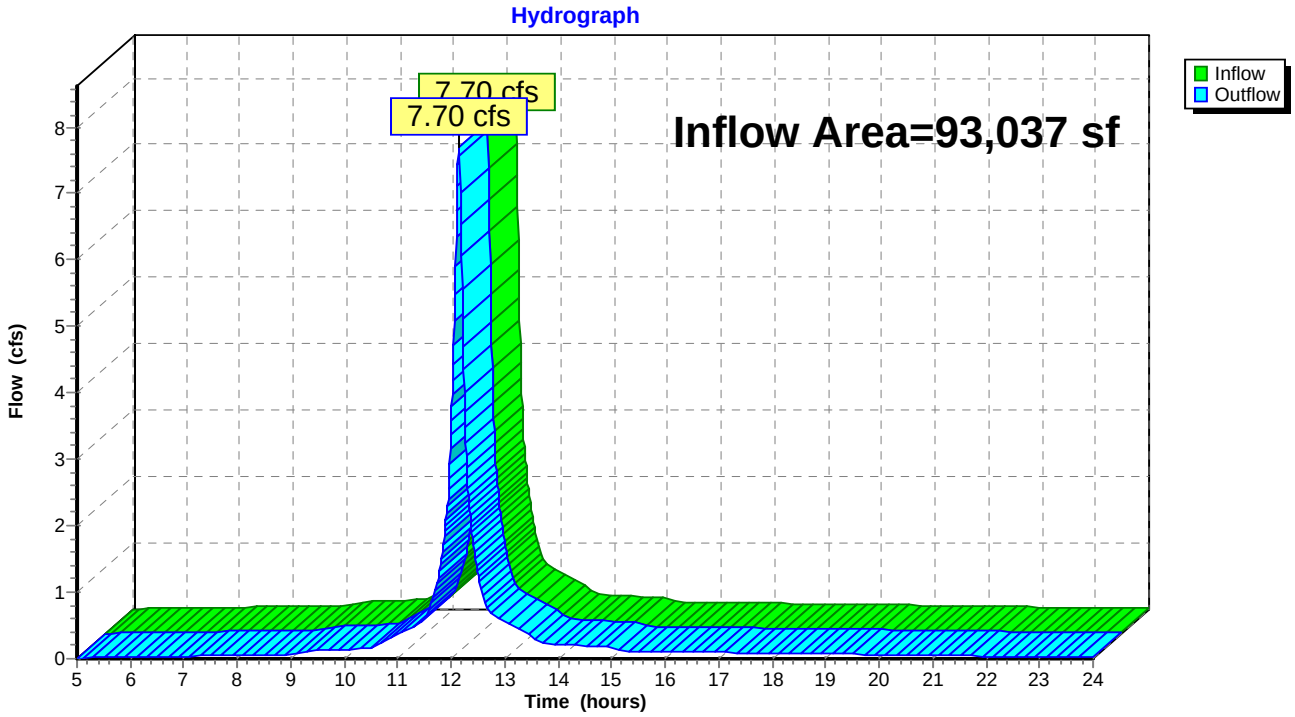


Summary for Reach 1: TOTAL EXISTING OUTFALL

Inflow Area = 93,037 sf, 91.02% Impervious, Inflow Depth > 2.28" for 2-YR event
Inflow = 7.70 cfs @ 12.14 hrs, Volume= 17,651 cf
Outflow = 7.70 cfs @ 12.14 hrs, Volume= 17,651 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs

Reach 1: TOTAL EXISTING OUTFALL



Summary for Subcatchment E1: E-1

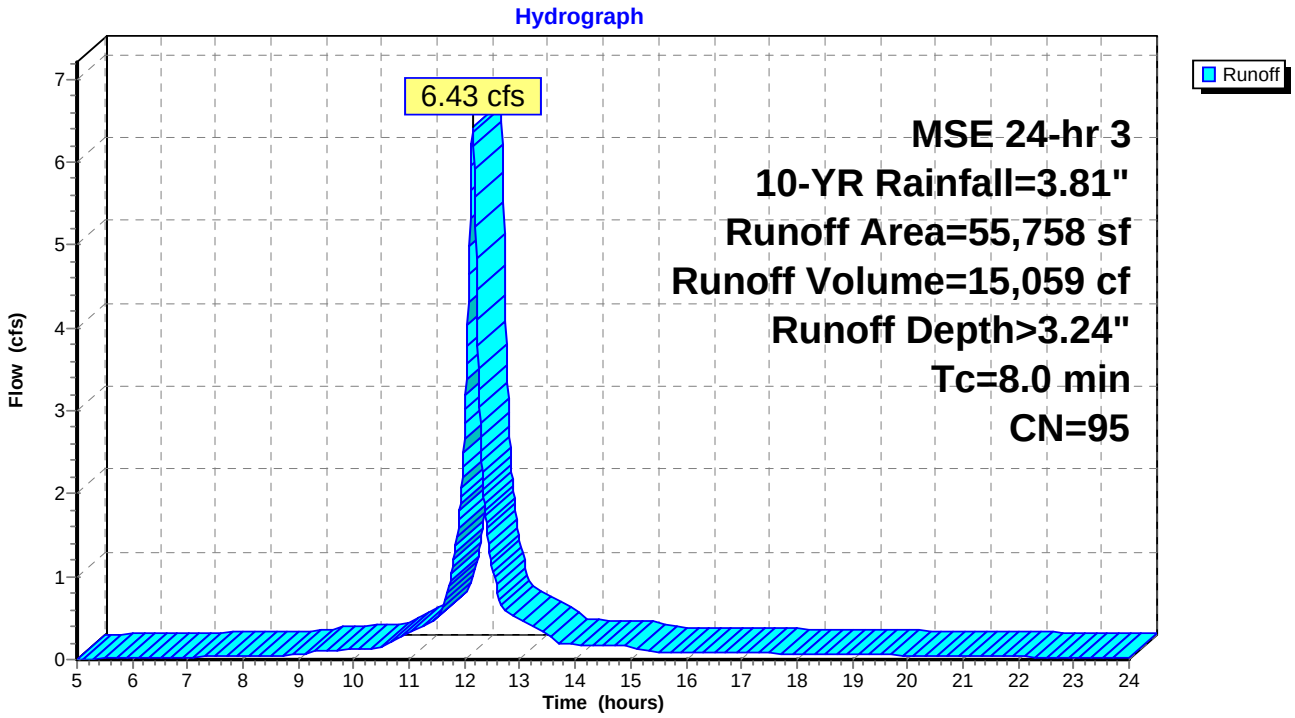
Runoff = 6.43 cfs @ 12.15 hrs, Volume= 15,059 cf, Depth> 3.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (sf)	CN	Description
8,356	80	>75% Grass cover, Good, HSG D
47,402	98	Paved parking, HSG D
55,758	95	Weighted Average
8,356		14.99% Pervious Area
47,402		85.01% Impervious Area

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

Subcatchment E1: E-1



Summary for Subcatchment E2: E-2

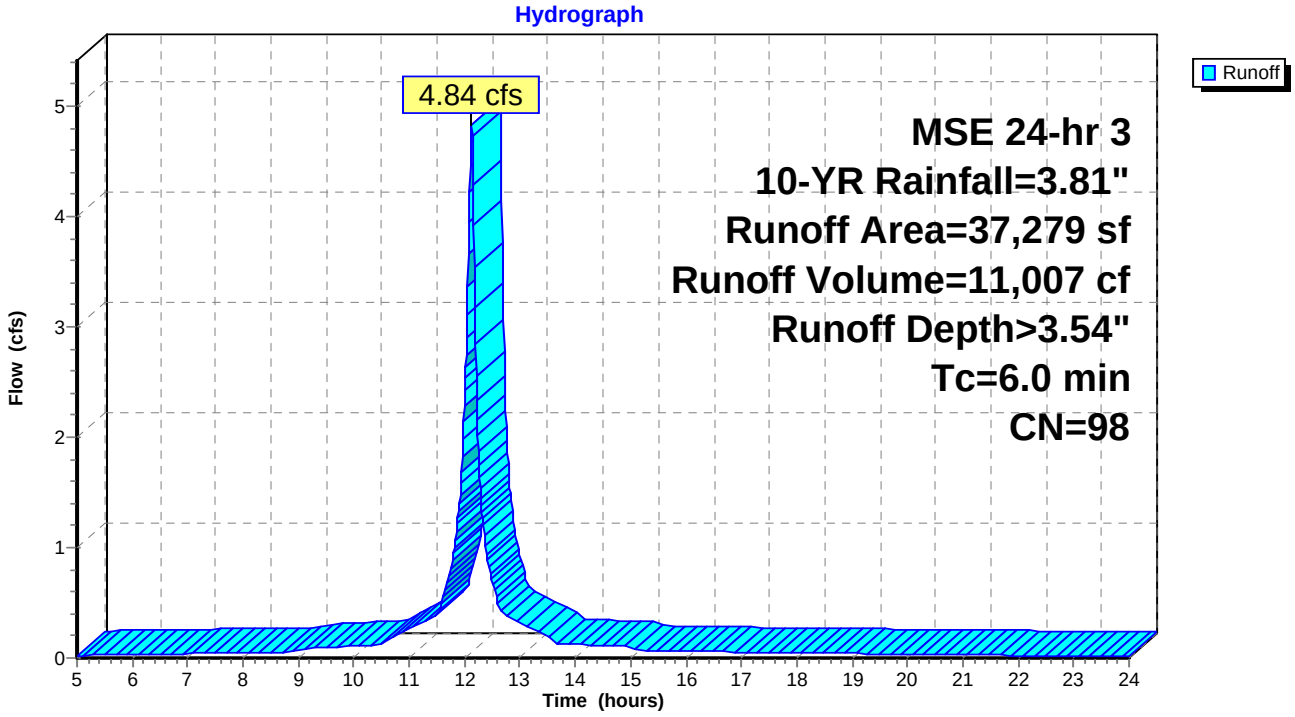
Runoff = 4.84 cfs @ 12.13 hrs, Volume= 11,007 cf, Depth> 3.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (sf)	CN	Description
13,814	98	Paved parking, HSG D
23,465	98	Roofs, HSG D
37,279	98	Weighted Average
37,279		100.00% Impervious Area

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

Subcatchment E2: E-2

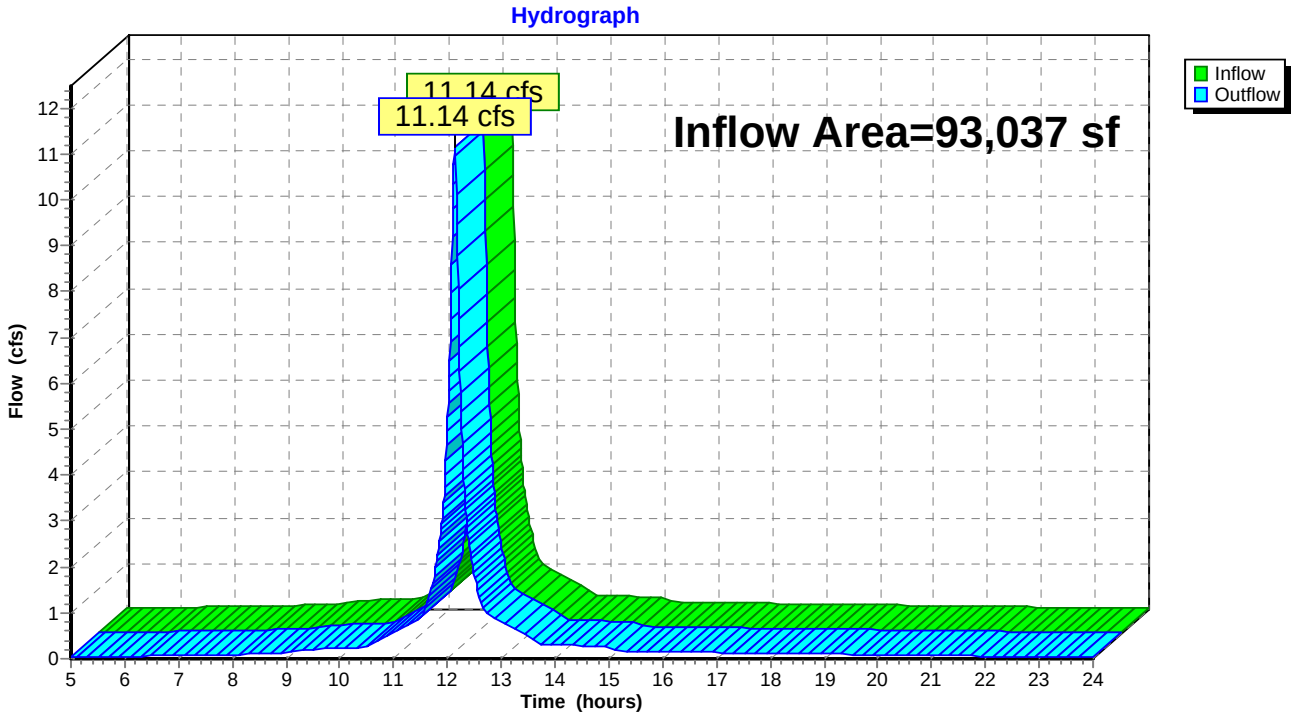


Summary for Reach 1: TOTAL EXISTING OUTFALL

Inflow Area = 93,037 sf, 91.02% Impervious, Inflow Depth > 3.36" for 10-YR event
Inflow = 11.14 cfs @ 12.14 hrs, Volume= 26,066 cf
Outflow = 11.14 cfs @ 12.14 hrs, Volume= 26,066 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs

Reach 1: TOTAL EXISTING OUTFALL



Summary for Subcatchment E1: E-1

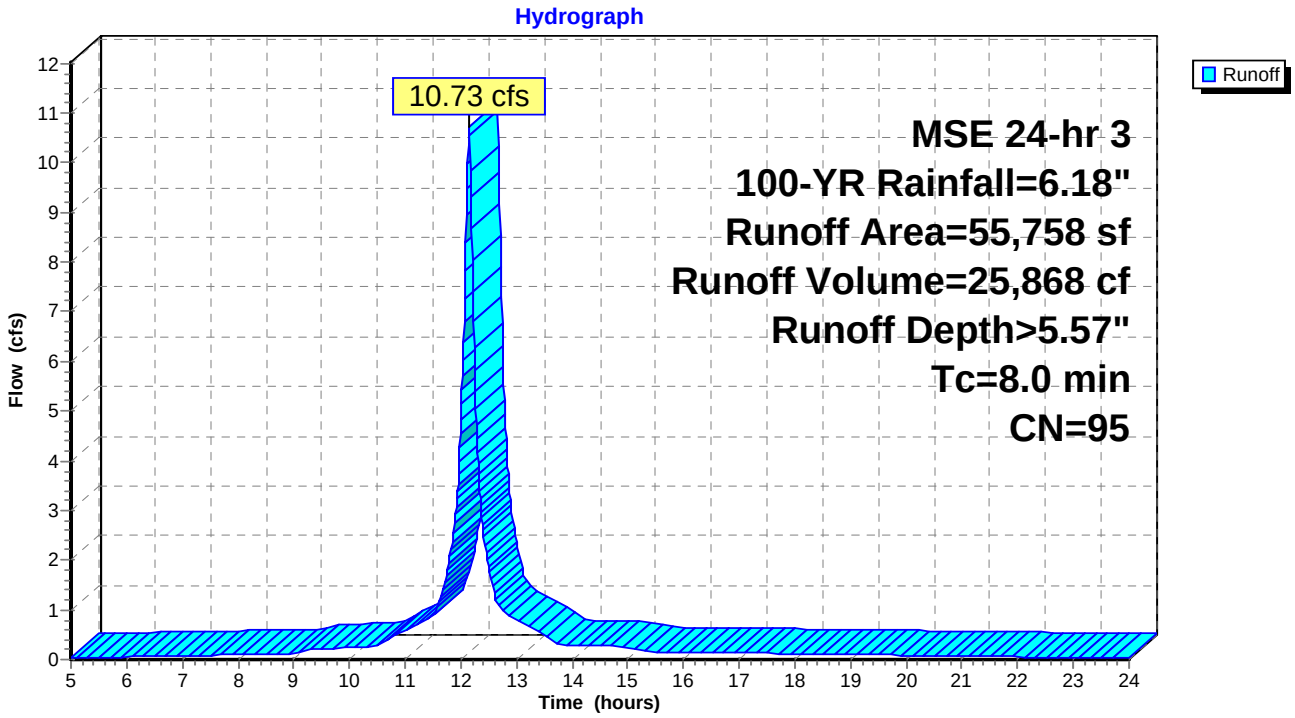
Runoff = 10.73 cfs @ 12.15 hrs, Volume= 25,868 cf, Depth> 5.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (sf)	CN	Description
8,356	80	>75% Grass cover, Good, HSG D
47,402	98	Paved parking, HSG D
55,758	95	Weighted Average
8,356		14.99% Pervious Area
47,402		85.01% Impervious Area

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

Subcatchment E1: E-1



Summary for Subcatchment E2: E-2

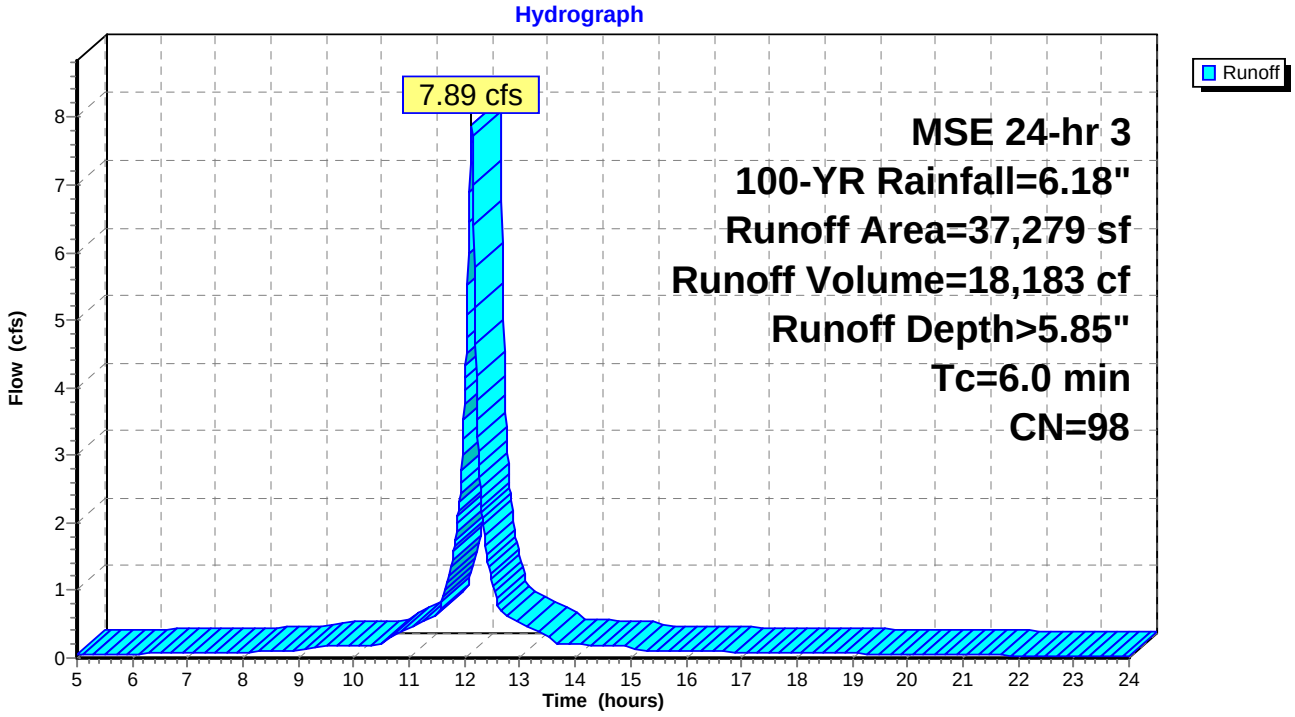
Runoff = 7.89 cfs @ 12.13 hrs, Volume= 18,183 cf, Depth> 5.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (sf)	CN	Description
13,814	98	Paved parking, HSG D
23,465	98	Roofs, HSG D
37,279	98	Weighted Average
37,279		100.00% Impervious Area

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

Subcatchment E2: E-2

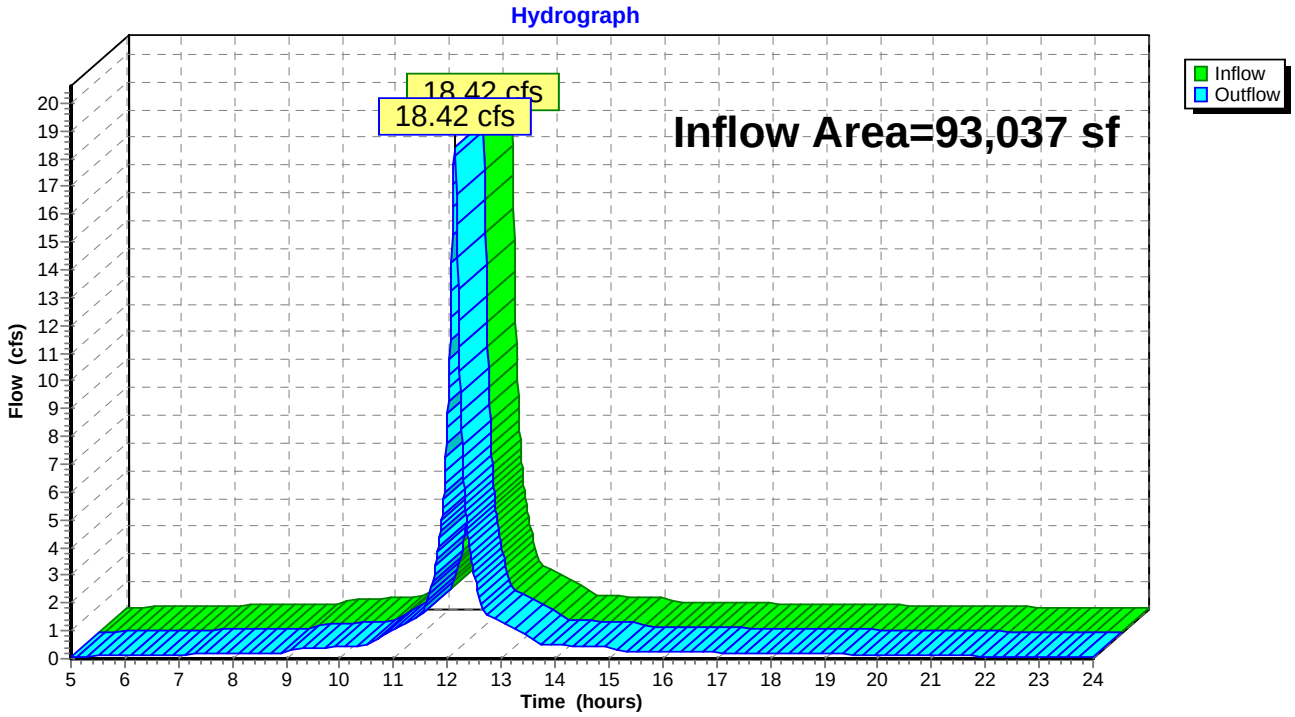


Summary for Reach 1: TOTAL EXISTING OUTFALL

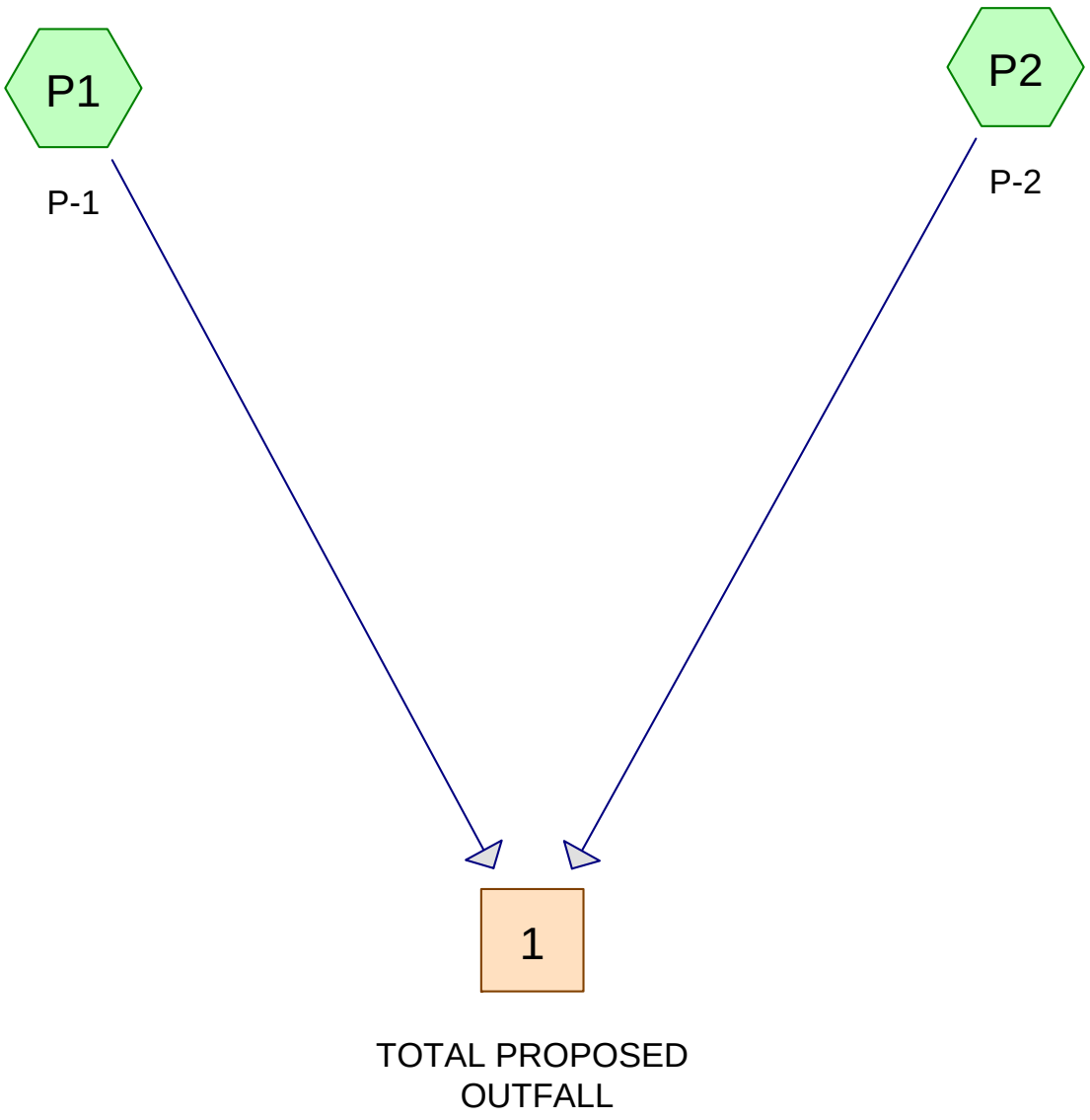
Inflow Area = 93,037 sf, 91.02% Impervious, Inflow Depth > 5.68" for 100-YR event
Inflow = 18.42 cfs @ 12.14 hrs, Volume= 44,051 cf
Outflow = 18.42 cfs @ 12.14 hrs, Volume= 44,051 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs

Reach 1: TOTAL EXISTING OUTFALL



Proposed Conditions Hydrographs
(Before Detention)



Subcat Reach Pond Link

Routing Diagram for 3170302 Proposed No Det
Prepared by Microsoft, Printed 5/9/2019

Summary for Subcatchment P1: P-1

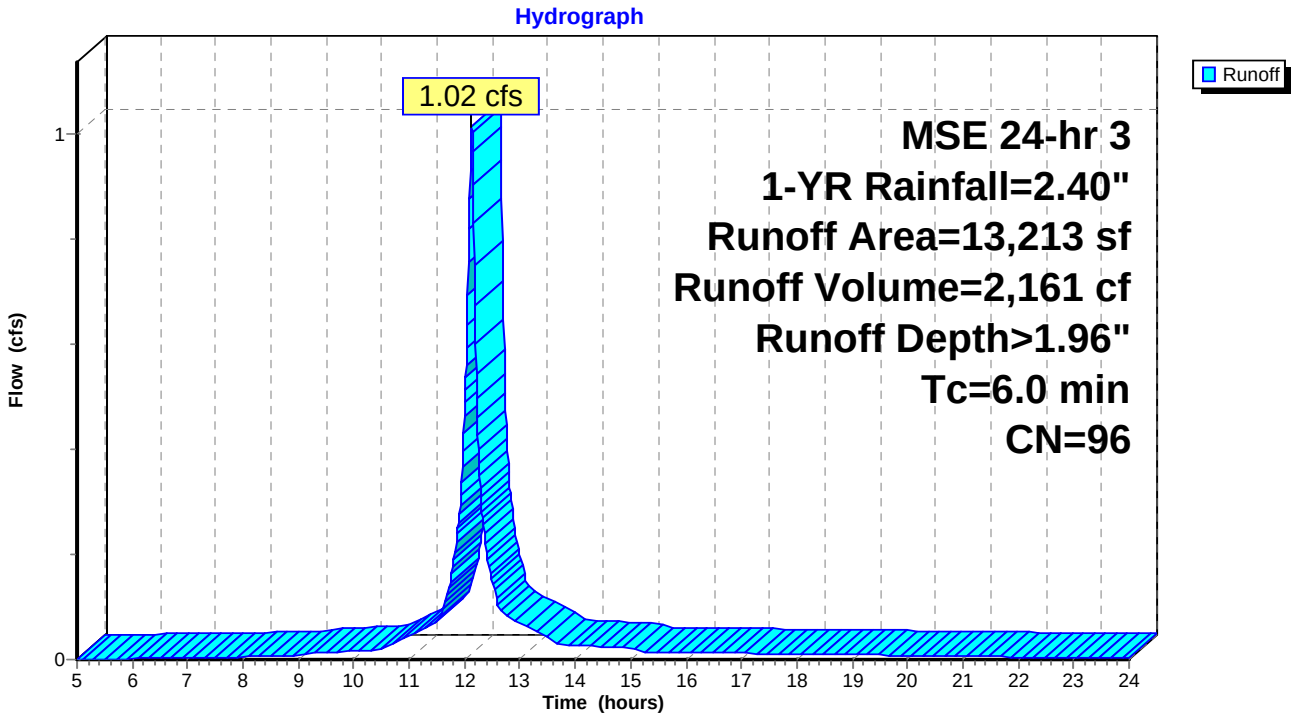
Runoff = 1.02 cfs @ 12.13 hrs, Volume= 2,161 cf, Depth> 1.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (sf)	CN	Description
1,625	80	>75% Grass cover, Good, HSG D
11,588	98	Paved parking, HSG D
13,213	96	Weighted Average
1,625		12.30% Pervious Area
11,588		87.70% Impervious Area

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

Subcatchment P1: P-1



Summary for Subcatchment P2: P-2

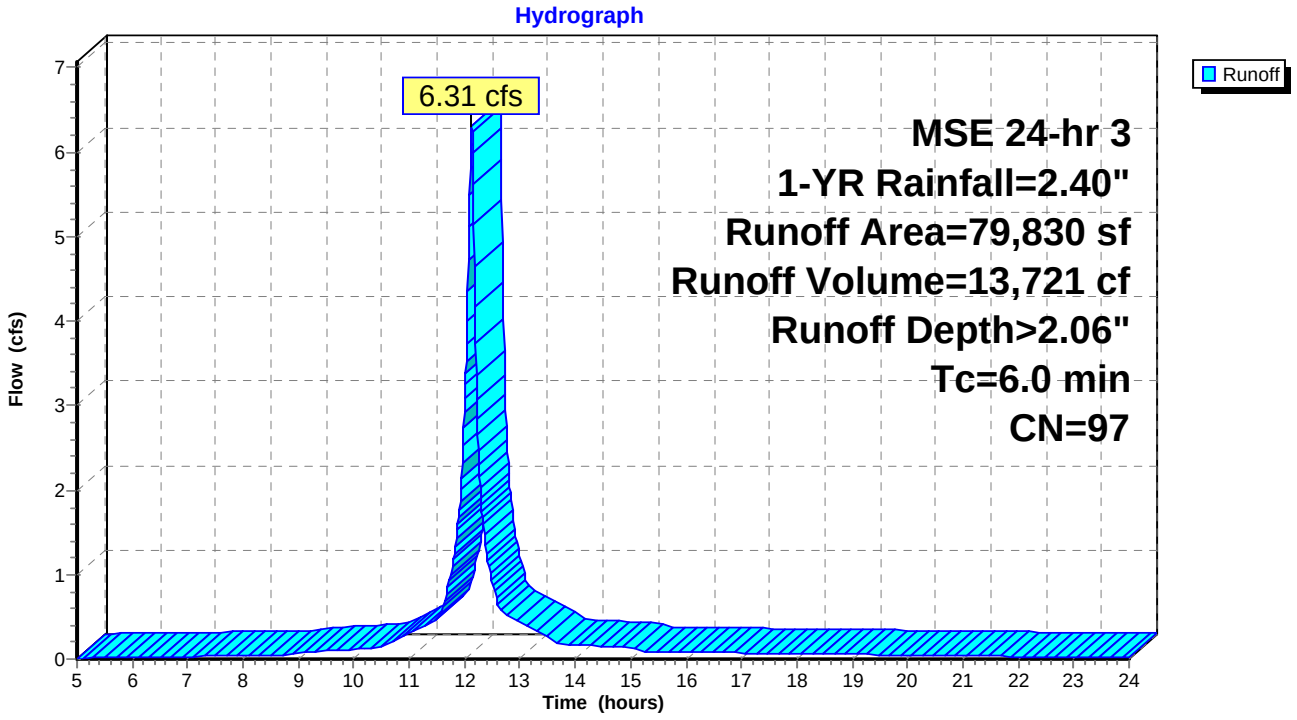
Runoff = 6.31 cfs @ 12.13 hrs, Volume= 13,721 cf, Depth> 2.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (sf)	CN	Description
6,424	80	>75% Grass cover, Good, HSG D
9,476	98	Paved parking, HSG D
63,930	98	Roofs, HSG D
79,830	97	Weighted Average
6,424		8.05% Pervious Area
73,406		91.95% Impervious Area

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

Subcatchment P2: P-2

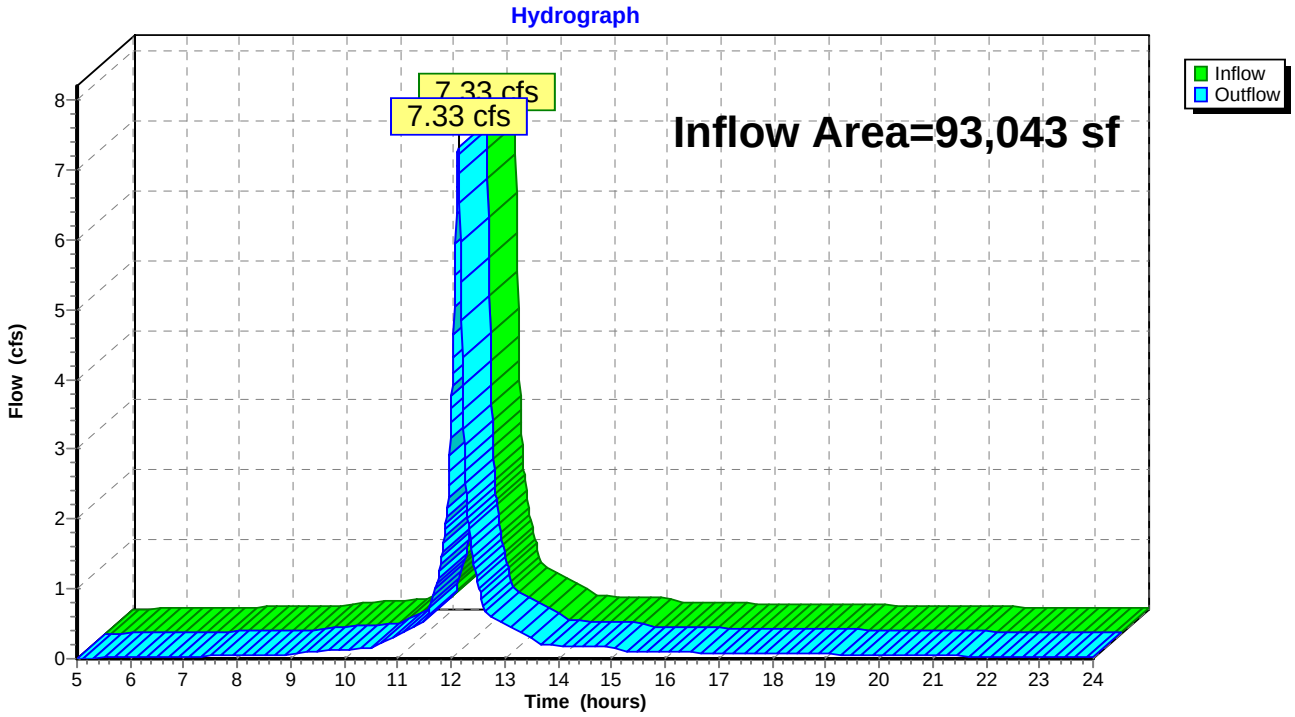


Summary for Reach 1: TOTAL PROPOSED OUTFALL

Inflow Area = 93,043 sf, 91.35% Impervious, Inflow Depth > 2.05" for 1-YR event
Inflow = 7.33 cfs @ 12.13 hrs, Volume= 15,882 cf
Outflow = 7.33 cfs @ 12.13 hrs, Volume= 15,882 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs

Reach 1: TOTAL PROPOSED OUTFALL



Summary for Subcatchment P1: P-1

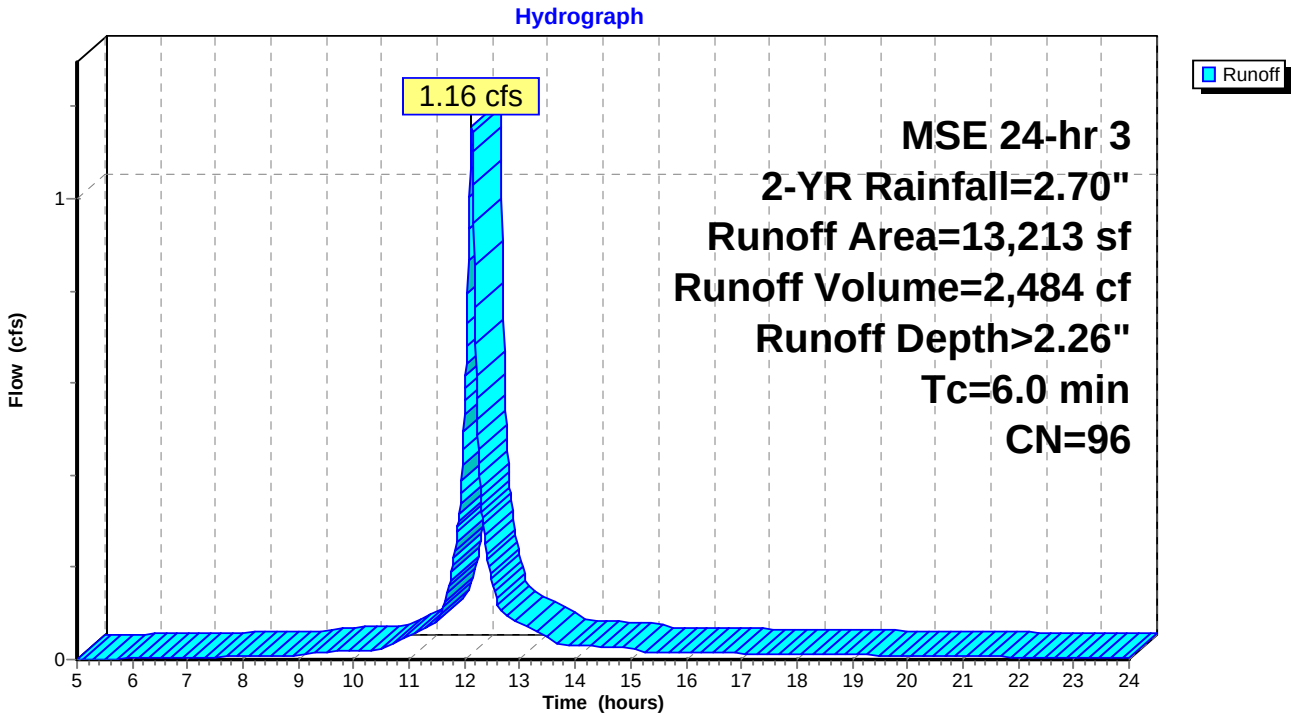
Runoff = 1.16 cfs @ 12.13 hrs, Volume= 2,484 cf, Depth> 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (sf)	CN	Description
1,625	80	>75% Grass cover, Good, HSG D
11,588	98	Paved parking, HSG D
13,213	96	Weighted Average
1,625		12.30% Pervious Area
11,588		87.70% Impervious Area

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

Subcatchment P1: P-1



Summary for Subcatchment P2: P-2

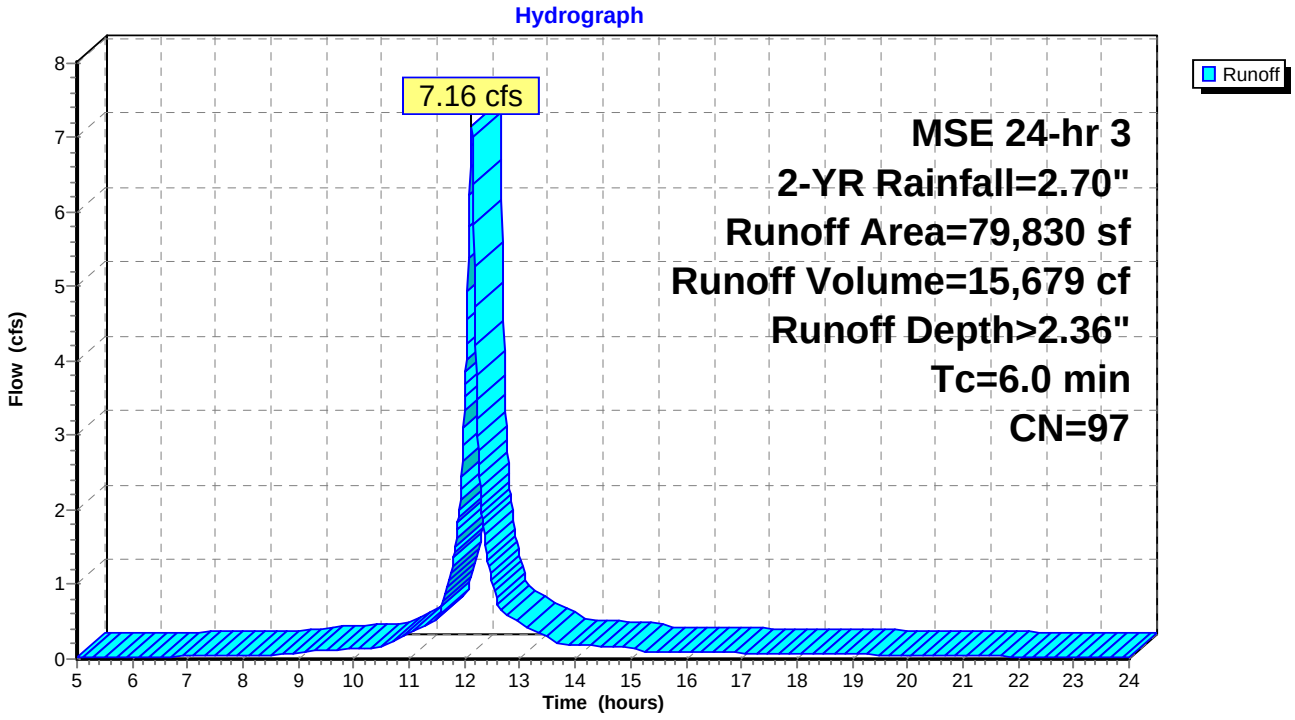
Runoff = 7.16 cfs @ 12.13 hrs, Volume= 15,679 cf, Depth> 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (sf)	CN	Description
6,424	80	>75% Grass cover, Good, HSG D
9,476	98	Paved parking, HSG D
63,930	98	Roofs, HSG D
79,830	97	Weighted Average
6,424		8.05% Pervious Area
73,406		91.95% Impervious Area

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

Subcatchment P2: P-2

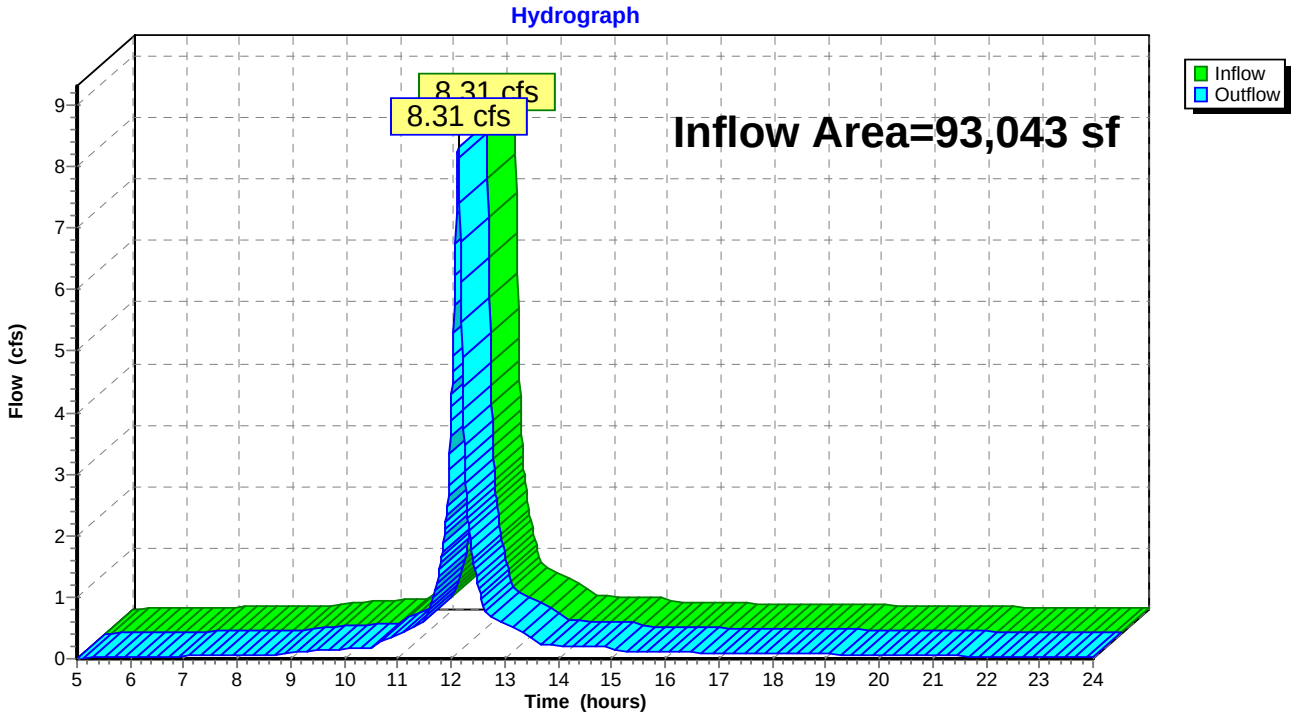


Summary for Reach 1: TOTAL PROPOSED OUTFALL

Inflow Area = 93,043 sf, 91.35% Impervious, Inflow Depth > 2.34" for 2-YR event
Inflow = 8.31 cfs @ 12.13 hrs, Volume= 18,163 cf
Outflow = 8.31 cfs @ 12.13 hrs, Volume= 18,163 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs

Reach 1: TOTAL PROPOSED OUTFALL



Summary for Subcatchment P1: P-1

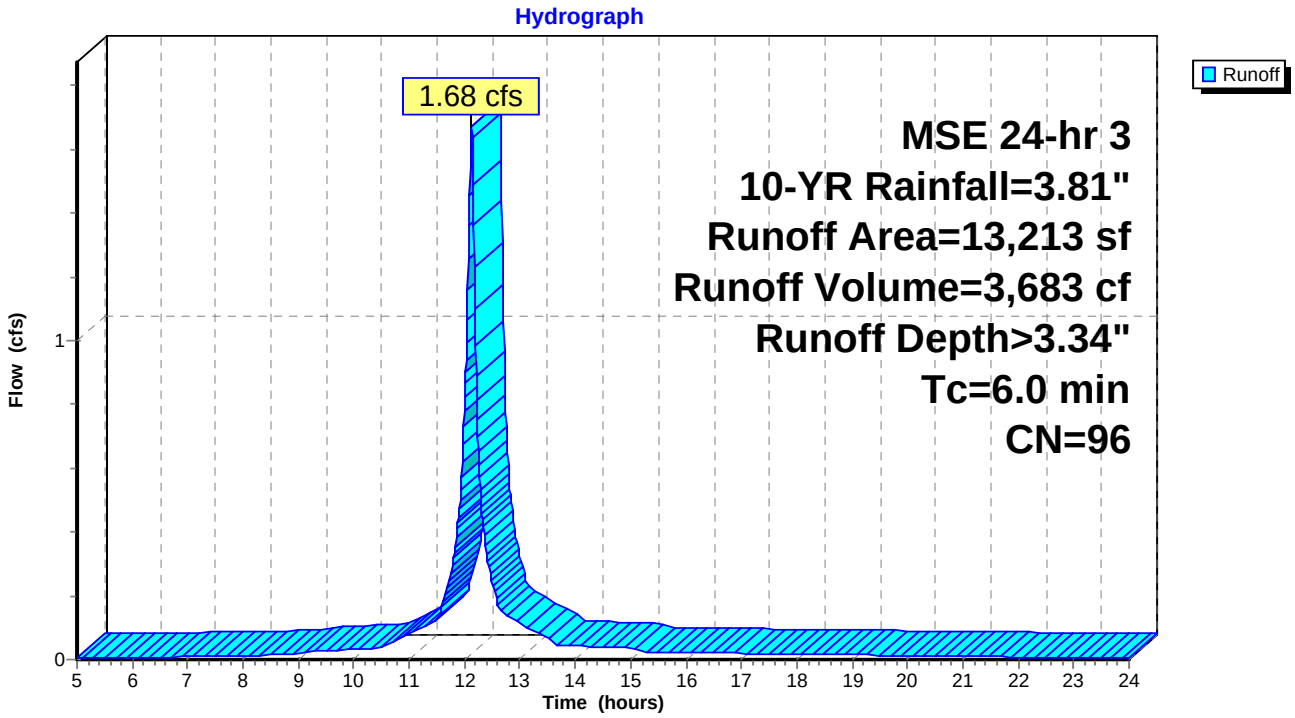
Runoff = 1.68 cfs @ 12.13 hrs, Volume= 3,683 cf, Depth> 3.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (sf)	CN	Description
1,625	80	>75% Grass cover, Good, HSG D
11,588	98	Paved parking, HSG D
13,213	96	Weighted Average
1,625		12.30% Pervious Area
11,588		87.70% Impervious Area

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

Subcatchment P1: P-1



Summary for Subcatchment P2: P-2

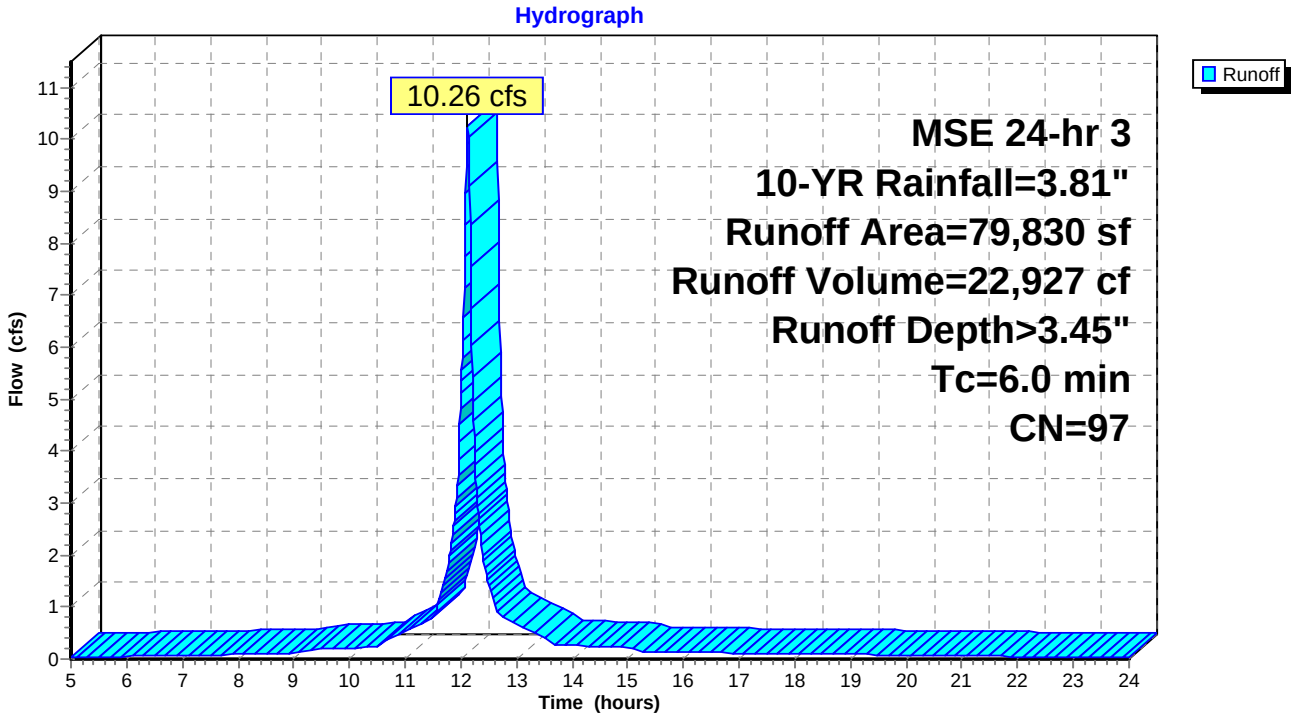
Runoff = 10.26 cfs @ 12.13 hrs, Volume= 22,927 cf, Depth> 3.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (sf)	CN	Description
6,424	80	>75% Grass cover, Good, HSG D
9,476	98	Paved parking, HSG D
63,930	98	Roofs, HSG D
79,830	97	Weighted Average
6,424		8.05% Pervious Area
73,406		91.95% Impervious Area

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

Subcatchment P2: P-2

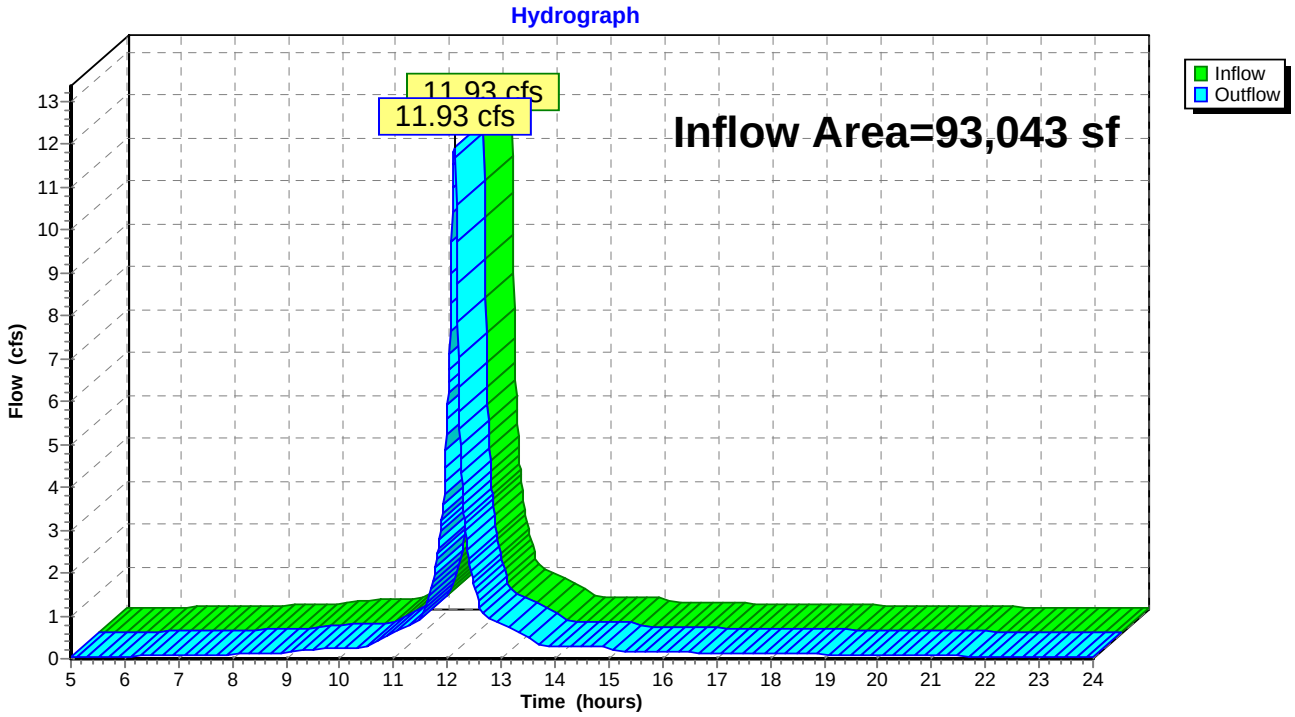


Summary for Reach 1: TOTAL PROPOSED OUTFALL

Inflow Area = 93,043 sf, 91.35% Impervious, Inflow Depth > 3.43" for 10-YR event
Inflow = 11.93 cfs @ 12.13 hrs, Volume= 26,609 cf
Outflow = 11.93 cfs @ 12.13 hrs, Volume= 26,609 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs

Reach 1: TOTAL PROPOSED OUTFALL



Summary for Subcatchment P1: P-1

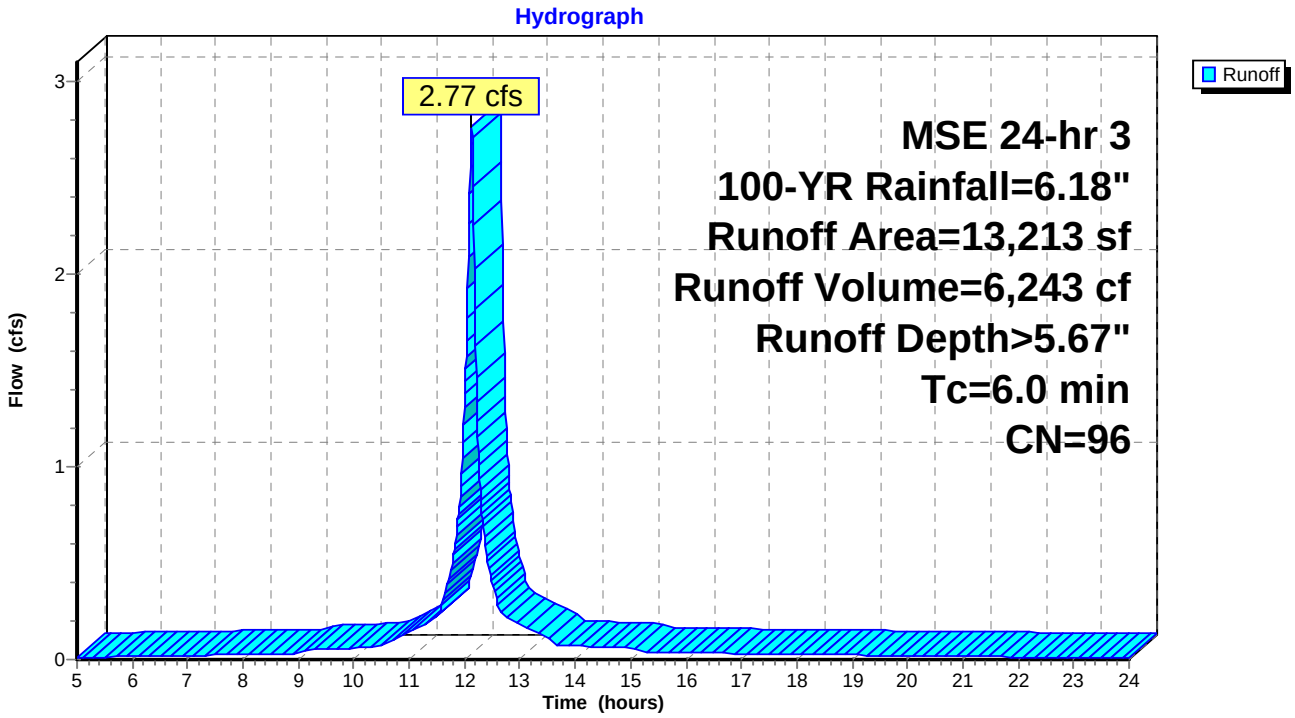
Runoff = 2.77 cfs @ 12.13 hrs, Volume= 6,243 cf, Depth> 5.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (sf)	CN	Description
1,625	80	>75% Grass cover, Good, HSG D
11,588	98	Paved parking, HSG D
13,213	96	Weighted Average
1,625		12.30% Pervious Area
11,588		87.70% Impervious Area

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

Subcatchment P1: P-1



Summary for Subcatchment P2: P-2

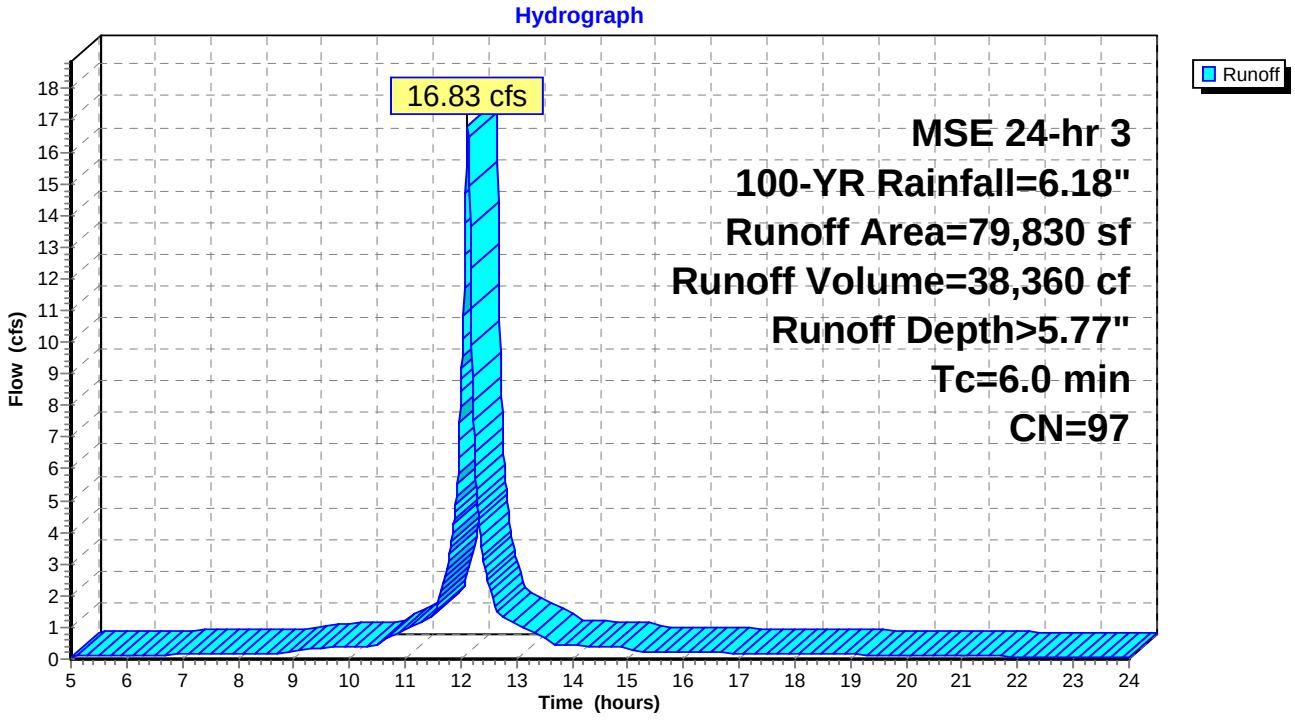
Runoff = 16.83 cfs @ 12.13 hrs, Volume= 38,360 cf, Depth> 5.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (sf)	CN	Description
6,424	80	>75% Grass cover, Good, HSG D
9,476	98	Paved parking, HSG D
63,930	98	Roofs, HSG D
79,830	97	Weighted Average
6,424		8.05% Pervious Area
73,406		91.95% Impervious Area

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

Subcatchment P2: P-2

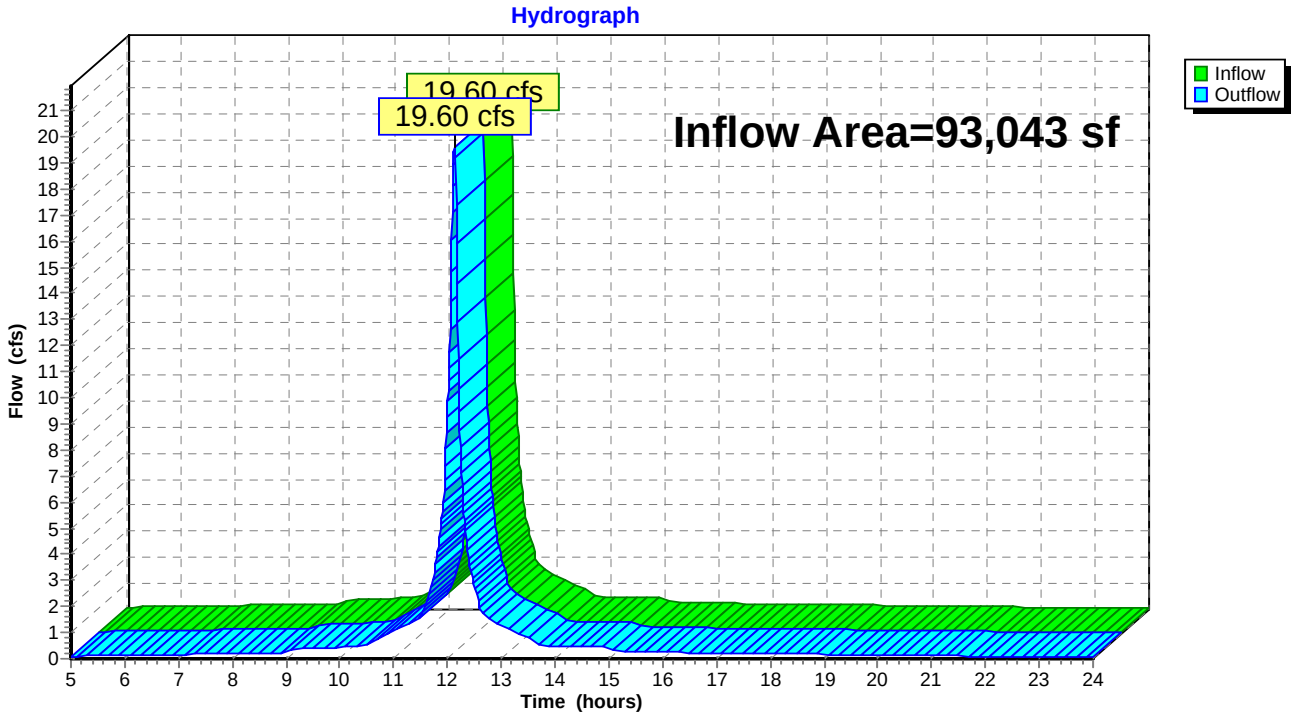


Summary for Reach 1: TOTAL PROPOSED OUTFALL

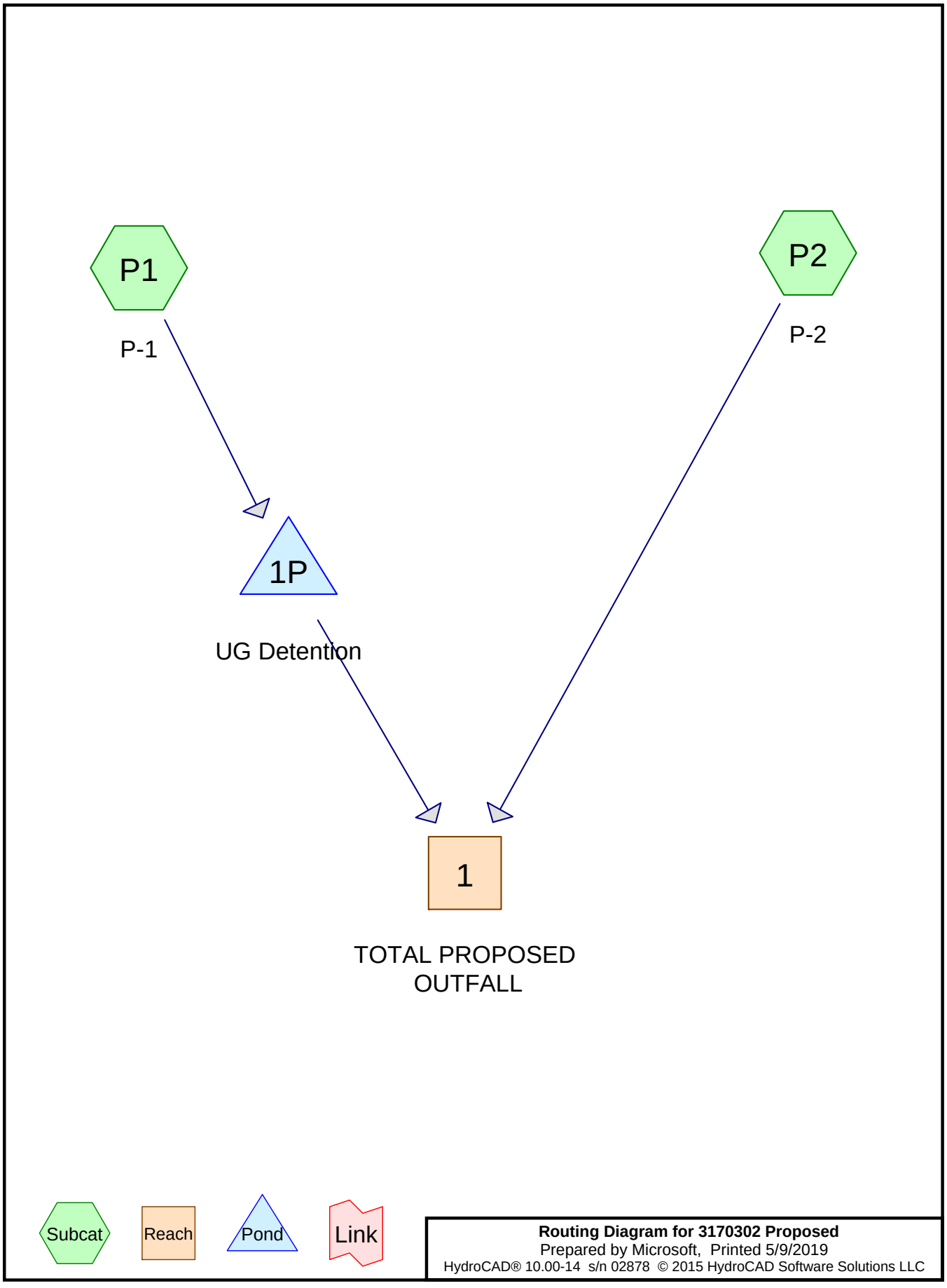
Inflow Area = 93,043 sf, 91.35% Impervious, Inflow Depth > 5.75" for 100-YR event
Inflow = 19.60 cfs @ 12.13 hrs, Volume= 44,602 cf
Outflow = 19.60 cfs @ 12.13 hrs, Volume= 44,602 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs

Reach 1: TOTAL PROPOSED OUTFALL



Proposed Conditions Hydrographs
(After Detention)



Routing Diagram for 3170302 Proposed
Prepared by Microsoft, Printed 5/9/2019

Summary for Subcatchment P1: P-1

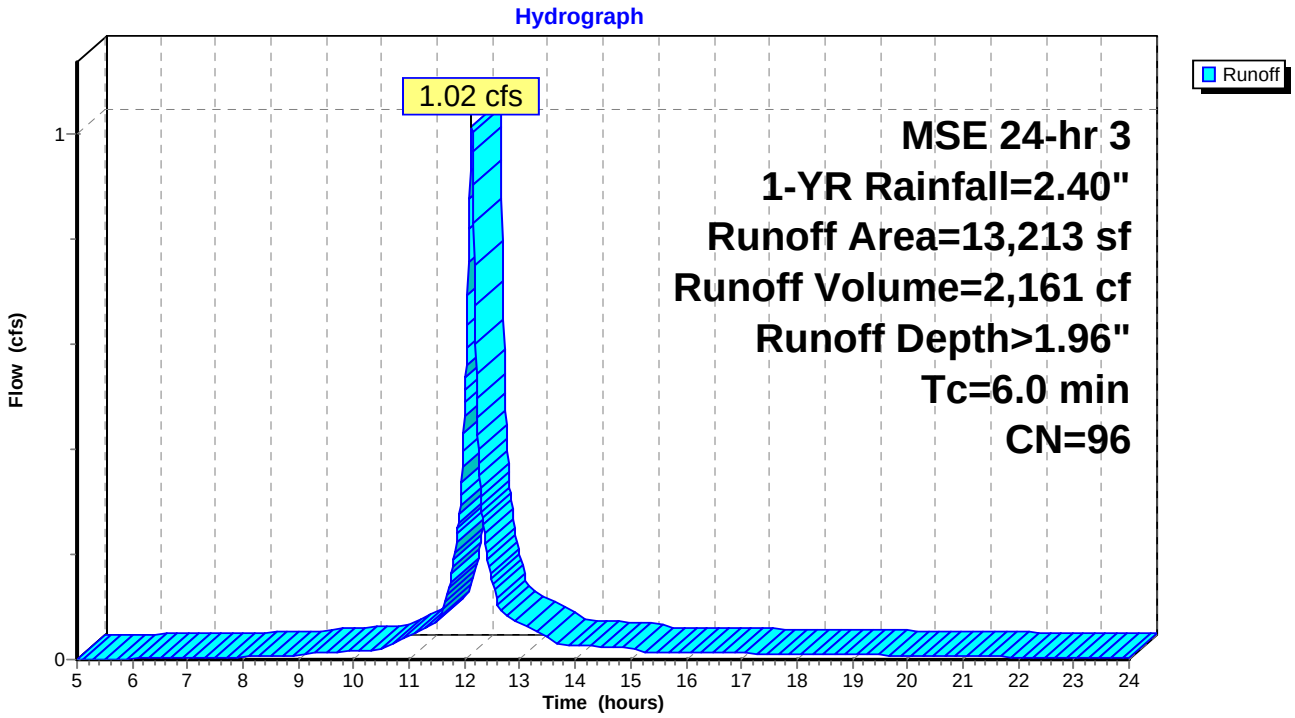
Runoff = 1.02 cfs @ 12.13 hrs, Volume= 2,161 cf, Depth> 1.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (sf)	CN	Description
1,625	80	>75% Grass cover, Good, HSG D
11,588	98	Paved parking, HSG D
13,213	96	Weighted Average
1,625		12.30% Pervious Area
11,588		87.70% Impervious Area

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

Subcatchment P1: P-1



Summary for Subcatchment P2: P-2

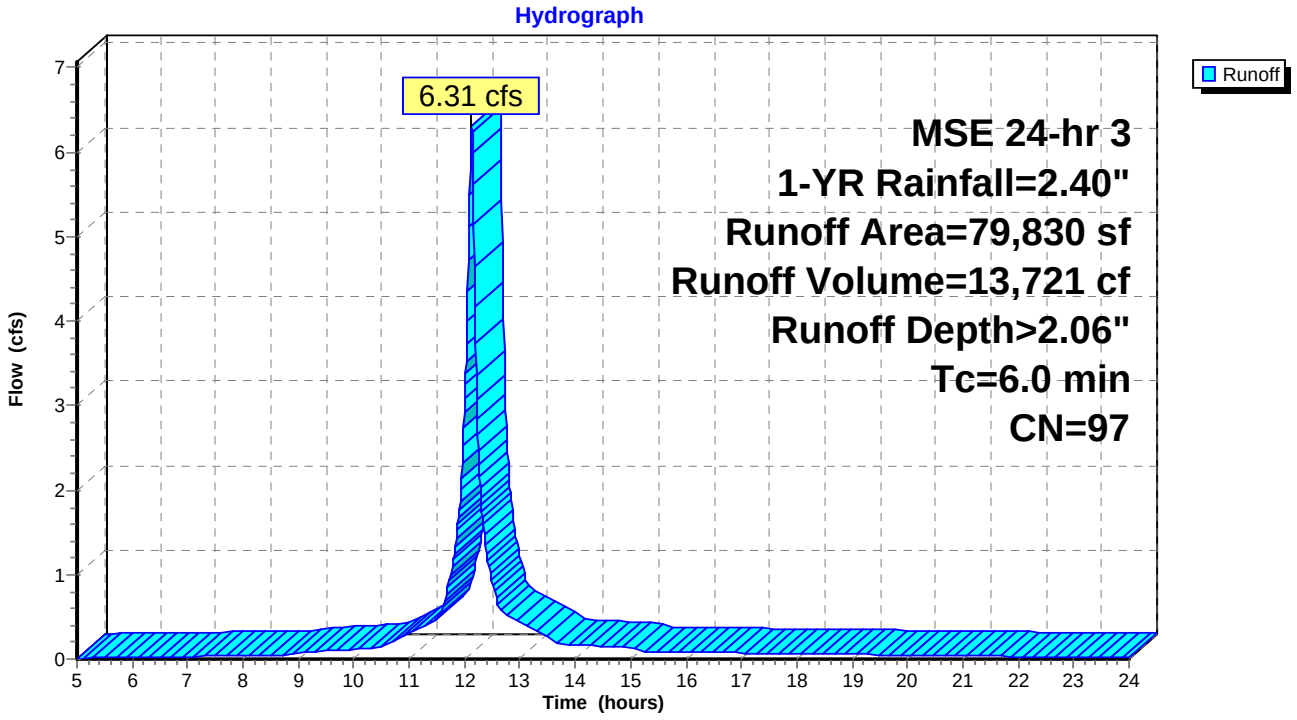
Runoff = 6.31 cfs @ 12.13 hrs, Volume= 13,721 cf, Depth> 2.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 1-YR Rainfall=2.40"

Area (sf)	CN	Description
6,424	80	>75% Grass cover, Good, HSG D
9,476	98	Paved parking, HSG D
63,930	98	Roofs, HSG D
79,830	97	Weighted Average
6,424		8.05% Pervious Area
73,406		91.95% Impervious Area

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

Subcatchment P2: P-2

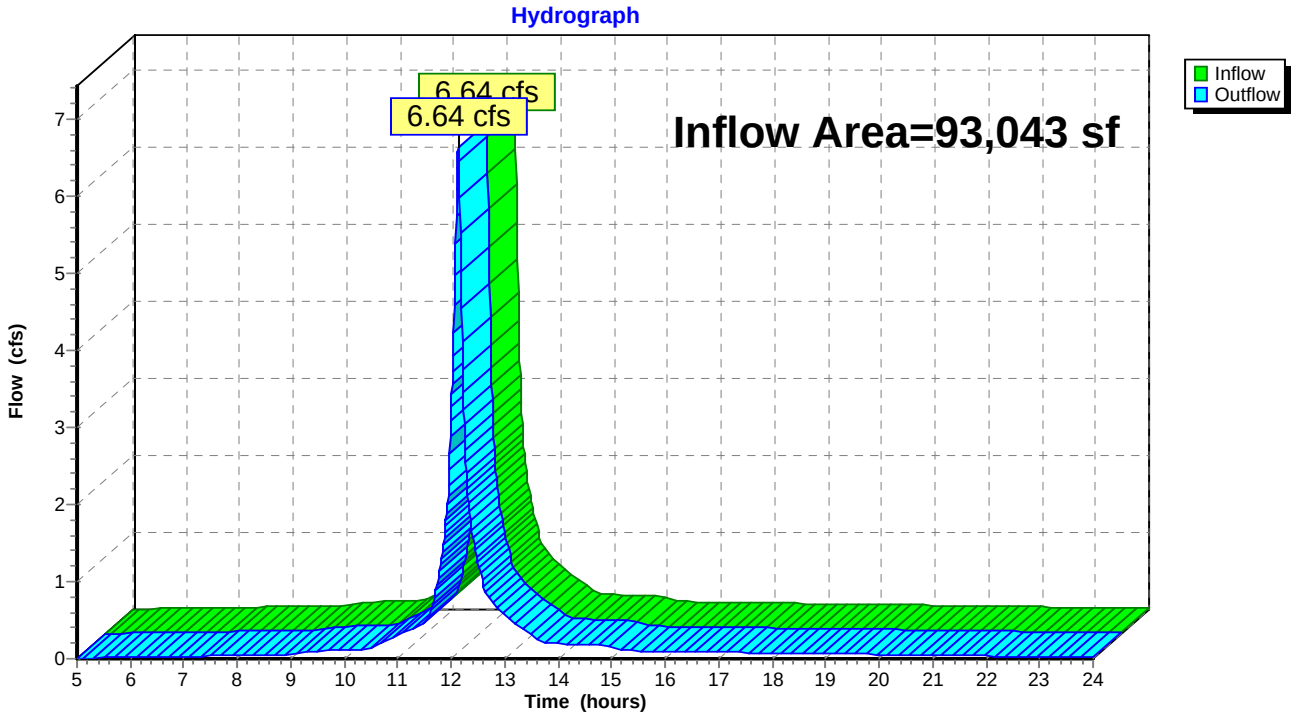


Summary for Reach 1: TOTAL PROPOSED OUTFALL

Inflow Area = 93,043 sf, 91.35% Impervious, Inflow Depth > 2.00" for 1-YR event
Inflow = 6.64 cfs @ 12.13 hrs, Volume= 15,471 cf
Outflow = 6.64 cfs @ 12.13 hrs, Volume= 15,471 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs

Reach 1: TOTAL PROPOSED OUTFALL



Summary for Pond 1P: UG Detention

Inflow Area = 13,213 sf, 87.70% Impervious, Inflow Depth > 1.96" for 1-YR event
Inflow = 1.02 cfs @ 12.13 hrs, Volume= 2,161 cf
Outflow = 0.40 cfs @ 12.25 hrs, Volume= 1,750 cf, Atten= 61%, Lag= 7.3 min
Primary = 0.40 cfs @ 12.25 hrs, Volume= 1,750 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 24.00' Surf.Area= 513 sf Storage= 1,052 cf
Peak Elev= 25.81' @ 12.25 hrs Surf.Area= 500 sf Storage= 1,990 cf (938 cf above start)

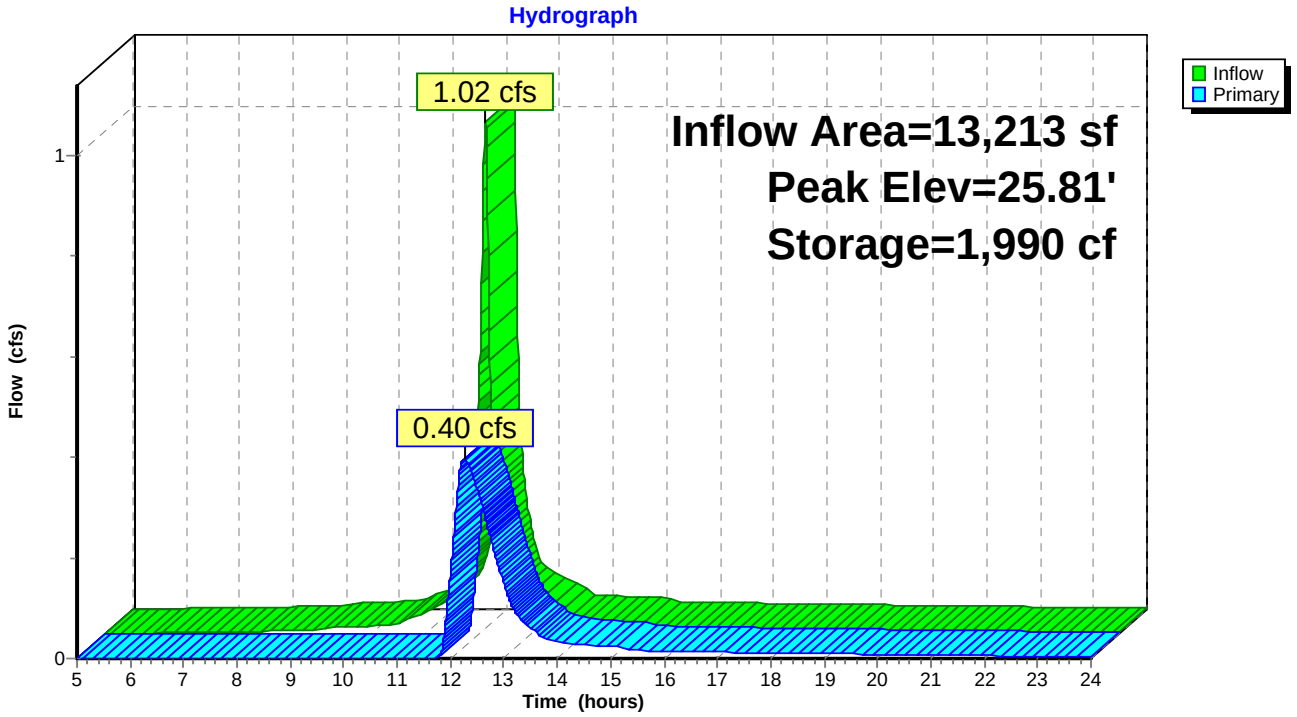
Plug-Flow detention time= 270.6 min calculated for 697 cf (32% of inflow)
Center-of-Mass det. time= 51.2 min (822.7 - 771.5)

Volume	Invert	Avail.Storage	Storage Description
#1	21.25'	2,886 cf	**84.0" Round UG Detenttion** L= 75.0'

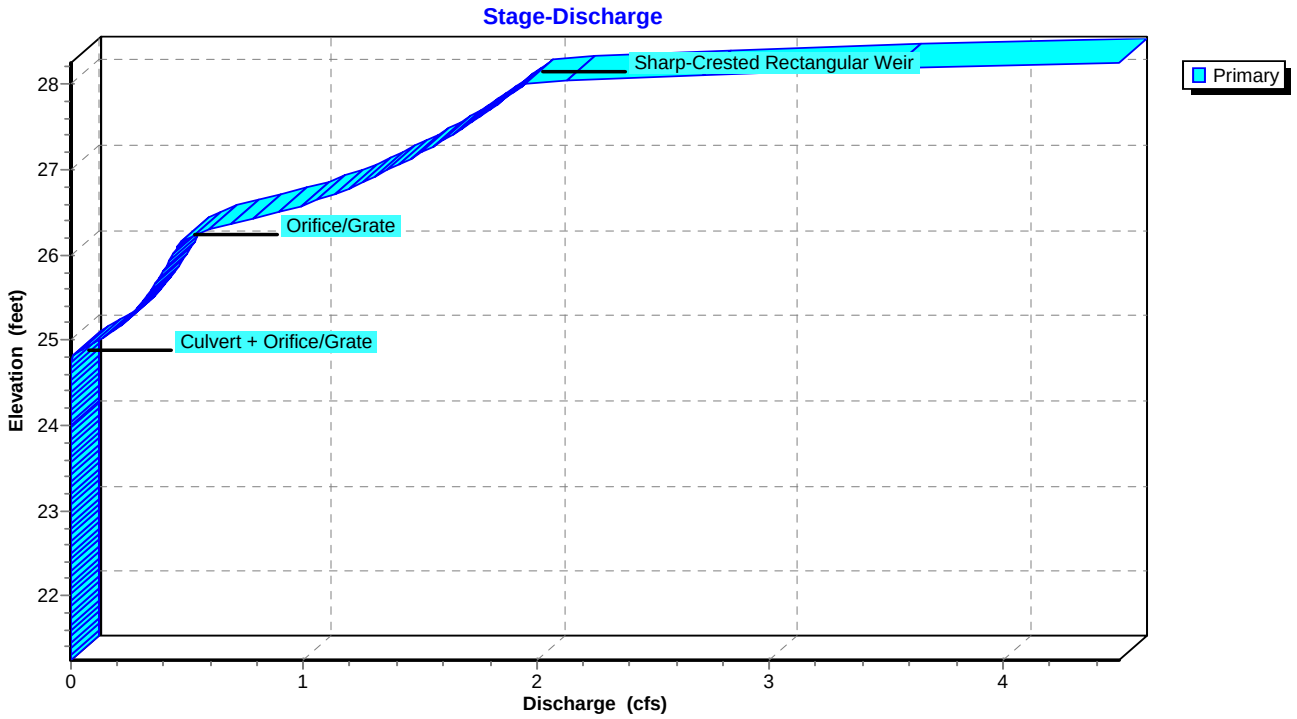
Device	Routing	Invert	Outlet Devices
#1	Primary	24.75'	**15.0" Round Culvert** L= 100.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 24.75' / 24.55' S= 0.0020 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	24.75'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	26.10'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	28.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.40 cfs @ 12.25 hrs HW=25.81' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.40 cfs of 2.70 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.40 cfs @ 4.55 fps)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

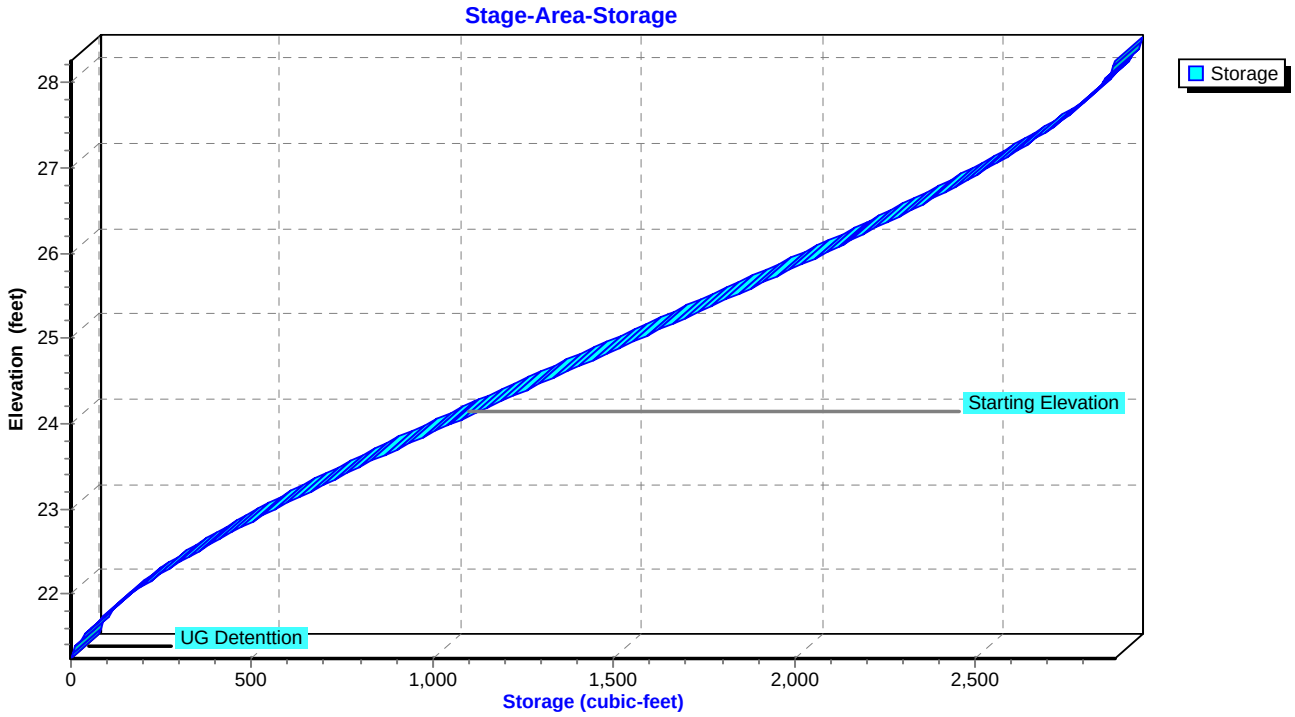
Pond 1P: UG Detention



Pond 1P: UG Detention



Pond 1P: UG Detention



Summary for Subcatchment P1: P-1

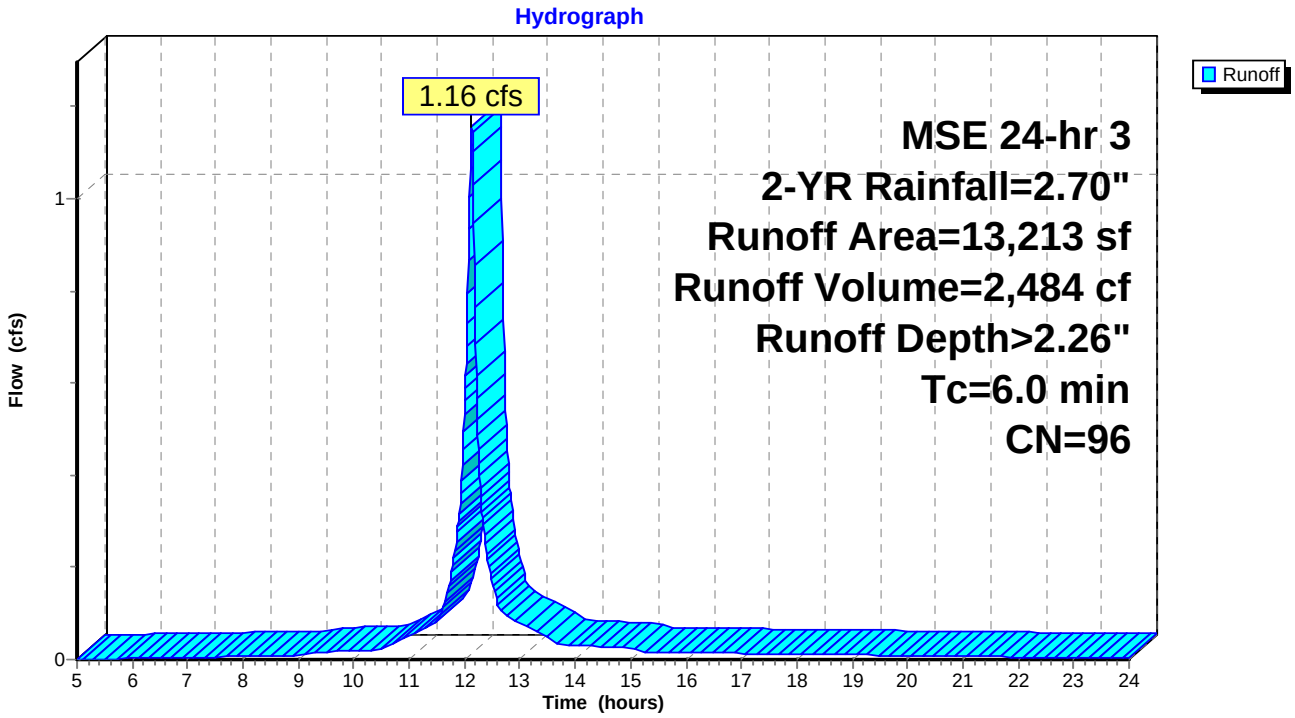
Runoff = 1.16 cfs @ 12.13 hrs, Volume= 2,484 cf, Depth> 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (sf)	CN	Description
1,625	80	>75% Grass cover, Good, HSG D
11,588	98	Paved parking, HSG D
13,213	96	Weighted Average
1,625		12.30% Pervious Area
11,588		87.70% Impervious Area

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

Subcatchment P1: P-1



Summary for Subcatchment P2: P-2

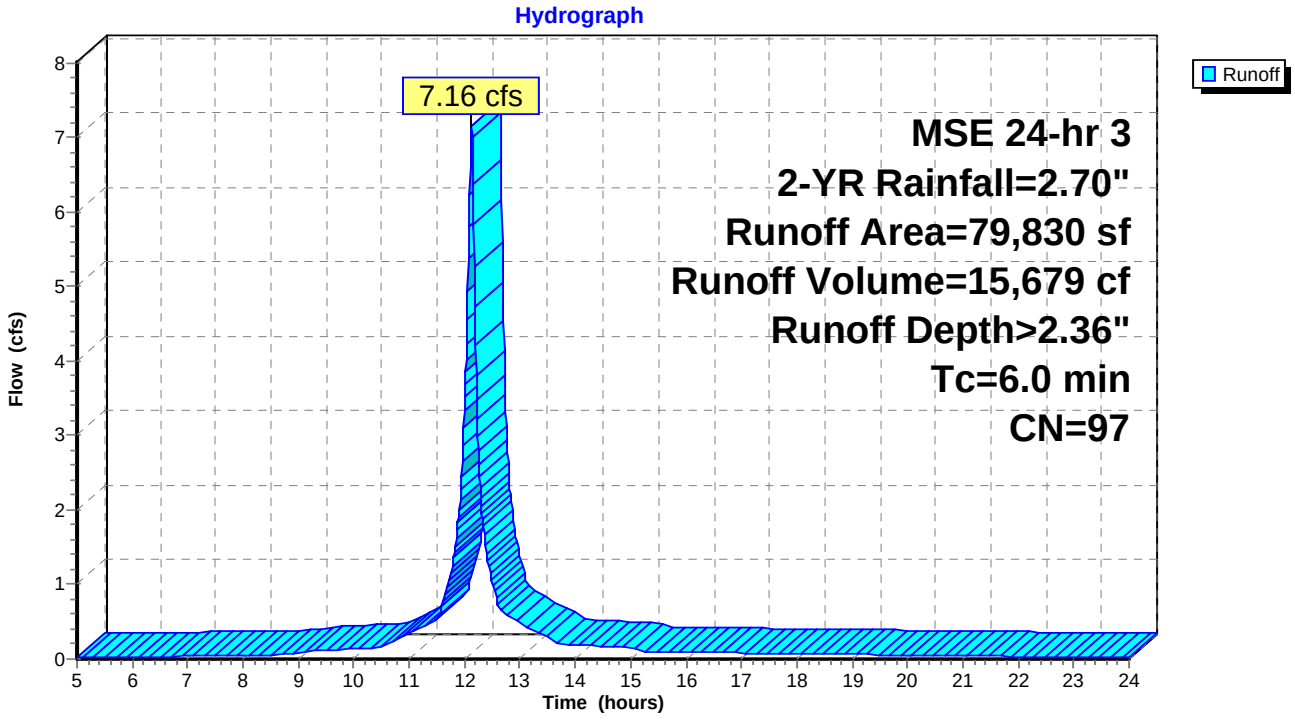
Runoff = 7.16 cfs @ 12.13 hrs, Volume= 15,679 cf, Depth> 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-YR Rainfall=2.70"

Area (sf)	CN	Description
6,424	80	>75% Grass cover, Good, HSG D
9,476	98	Paved parking, HSG D
63,930	98	Roofs, HSG D
79,830	97	Weighted Average
6,424		8.05% Pervious Area
73,406		91.95% Impervious Area

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

Subcatchment P2: P-2

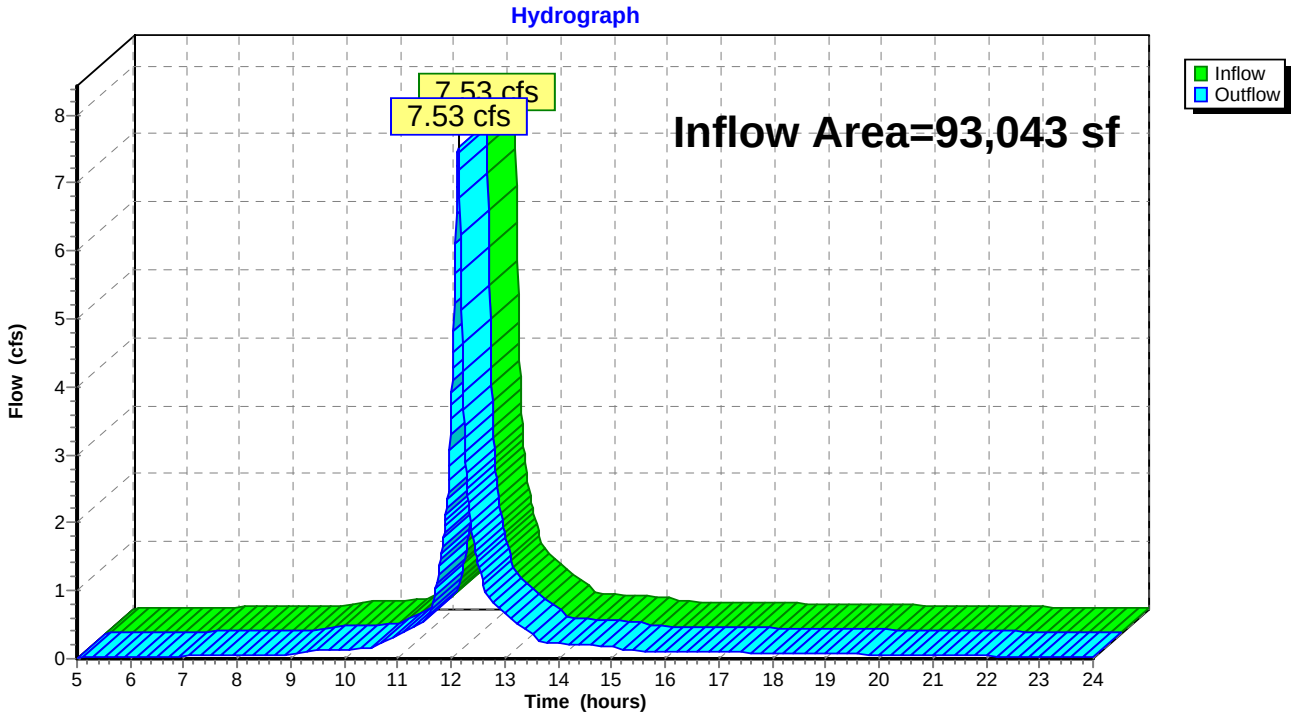


Summary for Reach 1: TOTAL PROPOSED OUTFALL

Inflow Area = 93,043 sf, 91.35% Impervious, Inflow Depth > 2.29" for 2-YR event
Inflow = 7.53 cfs @ 12.13 hrs, Volume= 17,751 cf
Outflow = 7.53 cfs @ 12.13 hrs, Volume= 17,751 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs

Reach 1: TOTAL PROPOSED OUTFALL



Summary for Pond 1P: UG Detention

Inflow Area = 13,213 sf, 87.70% Impervious, Inflow Depth > 2.26" for 2-YR event
Inflow = 1.16 cfs @ 12.13 hrs, Volume= 2,484 cf
Outflow = 0.44 cfs @ 12.25 hrs, Volume= 2,072 cf, Atten= 62%, Lag= 7.5 min
Primary = 0.44 cfs @ 12.25 hrs, Volume= 2,072 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 24.00' Surf.Area= 513 sf Storage= 1,052 cf
Peak Elev= 26.02' @ 12.25 hrs Surf.Area= 489 sf Storage= 2,096 cf (1,043 cf above start)

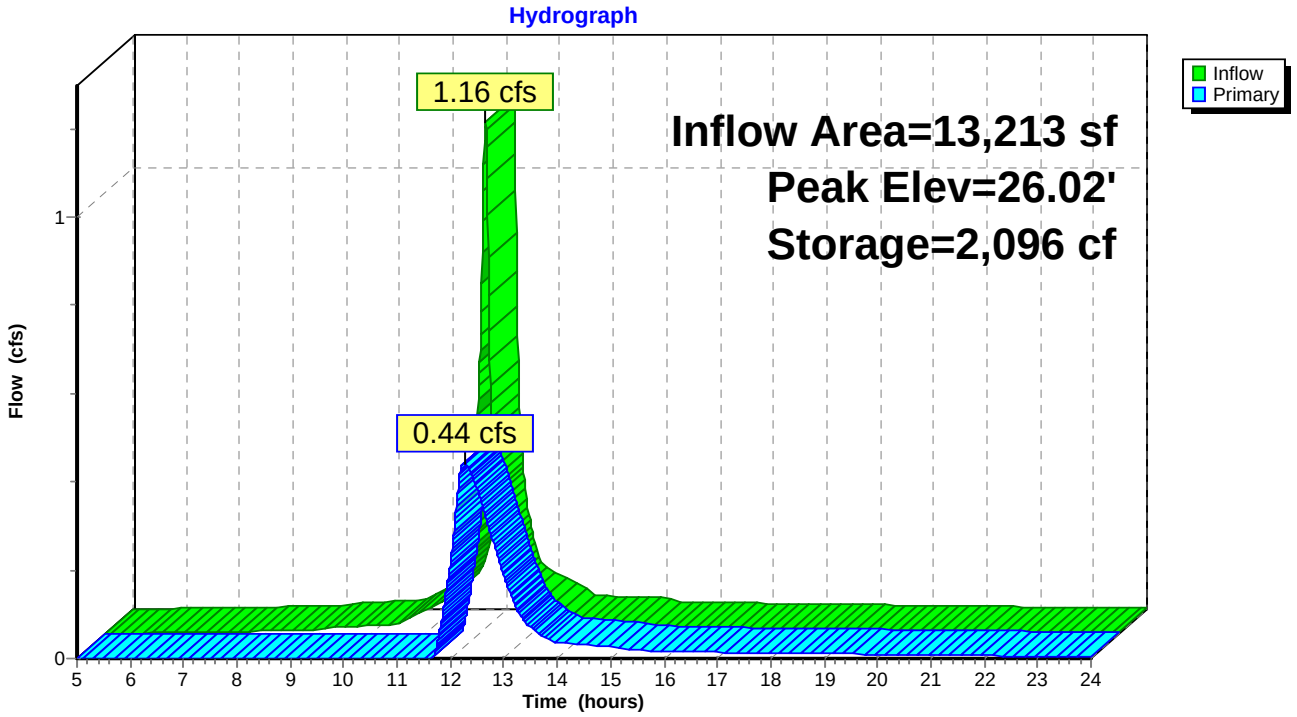
Plug-Flow detention time= 223.6 min calculated for 1,019 cf (41% of inflow)
Center-of-Mass det. time= 49.7 min (818.6 - 768.9)

Volume	Invert	Avail.Storage	Storage Description
#1	21.25'	2,886 cf	**84.0" Round UG Detenttion** L= 75.0'

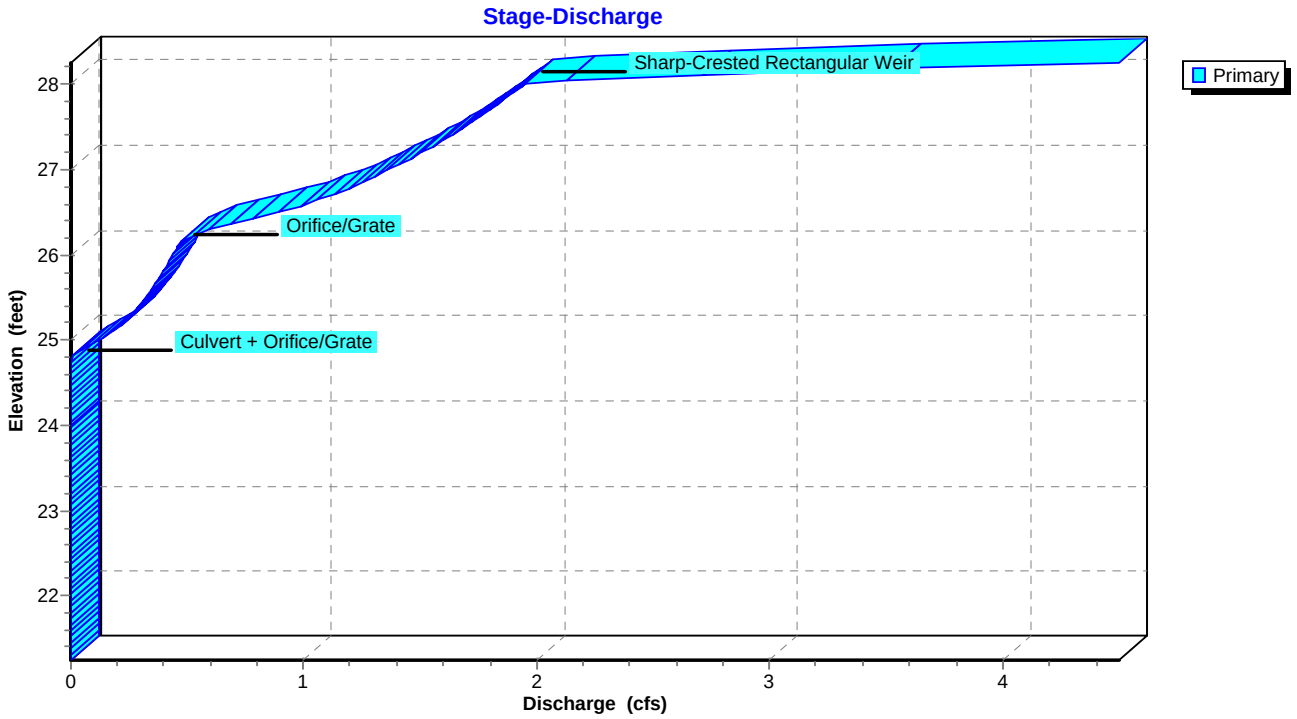
Device	Routing	Invert	Outlet Devices
#1	Primary	24.75'	**15.0" Round Culvert** L= 100.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 24.75' / 24.55' S= 0.0020 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	24.75'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	26.10'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	28.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.44 cfs @ 12.25 hrs HW=26.02' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.44 cfs of 3.57 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.44 cfs @ 5.06 fps)
  ├─**3=Orifice/Grate** (Controls 0.00 cfs)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

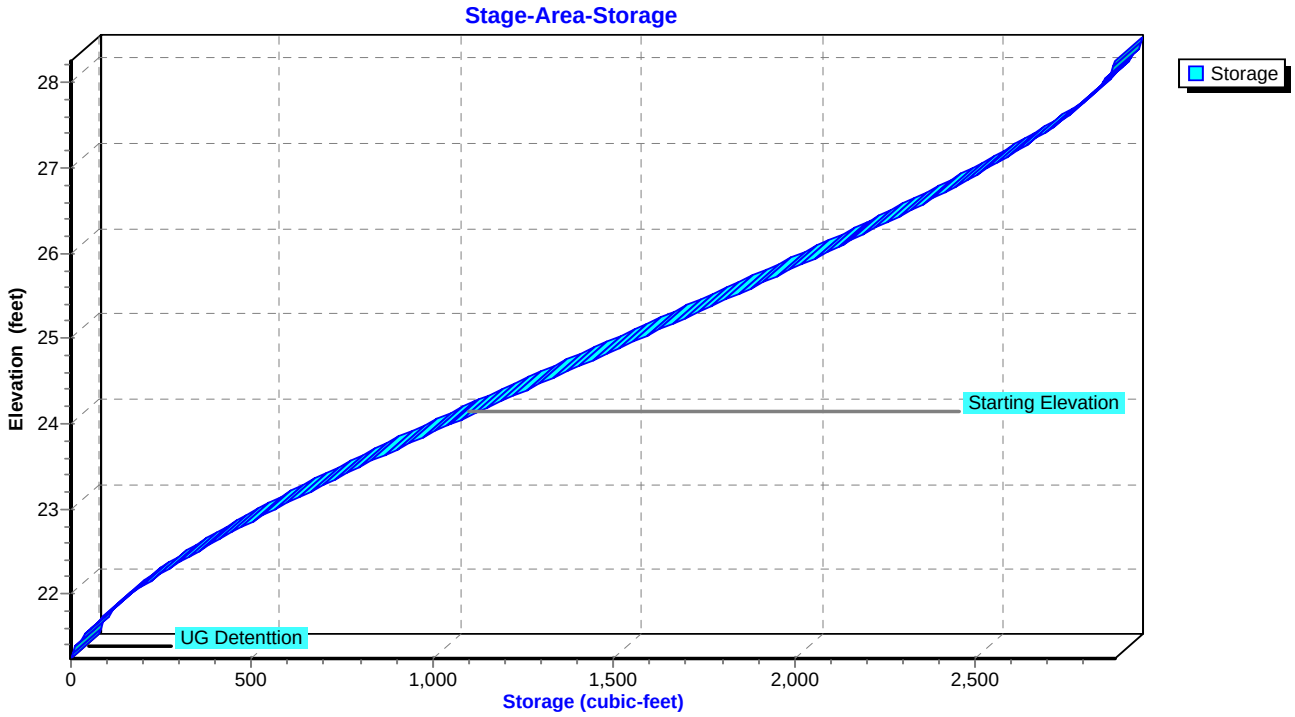
Pond 1P: UG Detention



Pond 1P: UG Detention



Pond 1P: UG Detention



Summary for Subcatchment P1: P-1

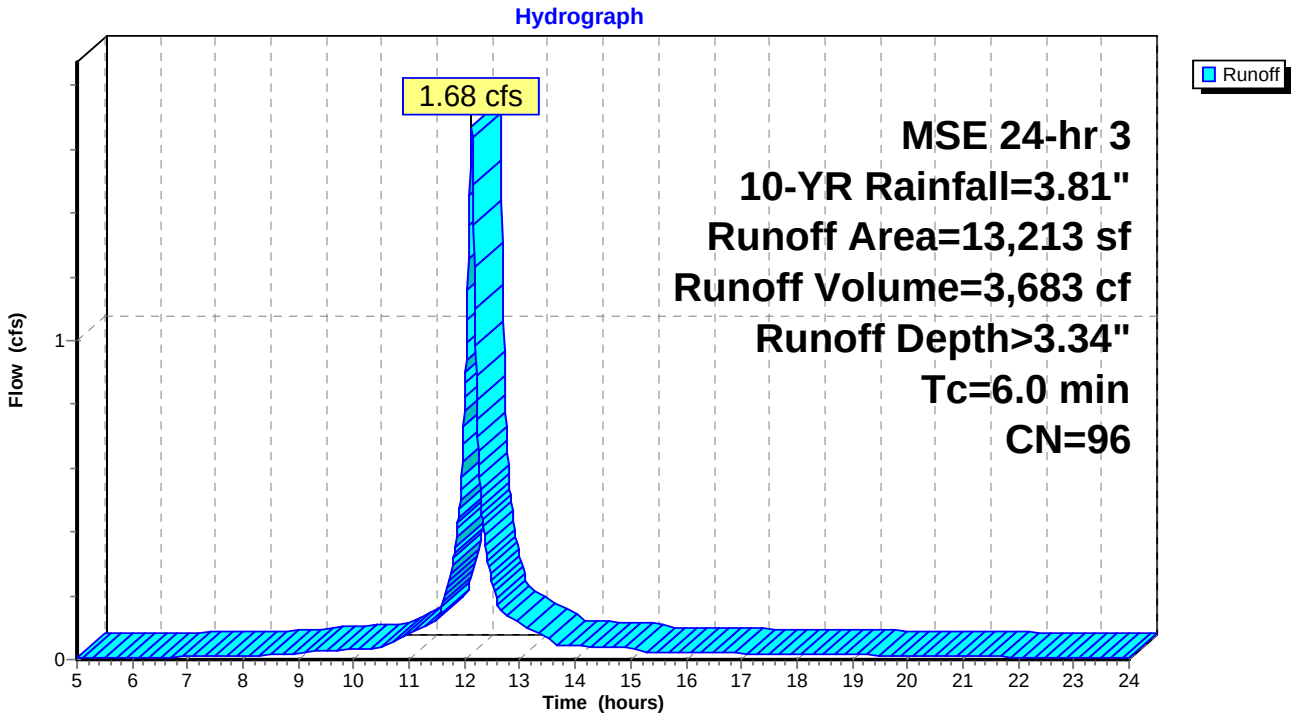
Runoff = 1.68 cfs @ 12.13 hrs, Volume= 3,683 cf, Depth> 3.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (sf)	CN	Description
1,625	80	>75% Grass cover, Good, HSG D
11,588	98	Paved parking, HSG D
13,213	96	Weighted Average
1,625		12.30% Pervious Area
11,588		87.70% Impervious Area

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

Subcatchment P1: P-1



Summary for Subcatchment P2: P-2

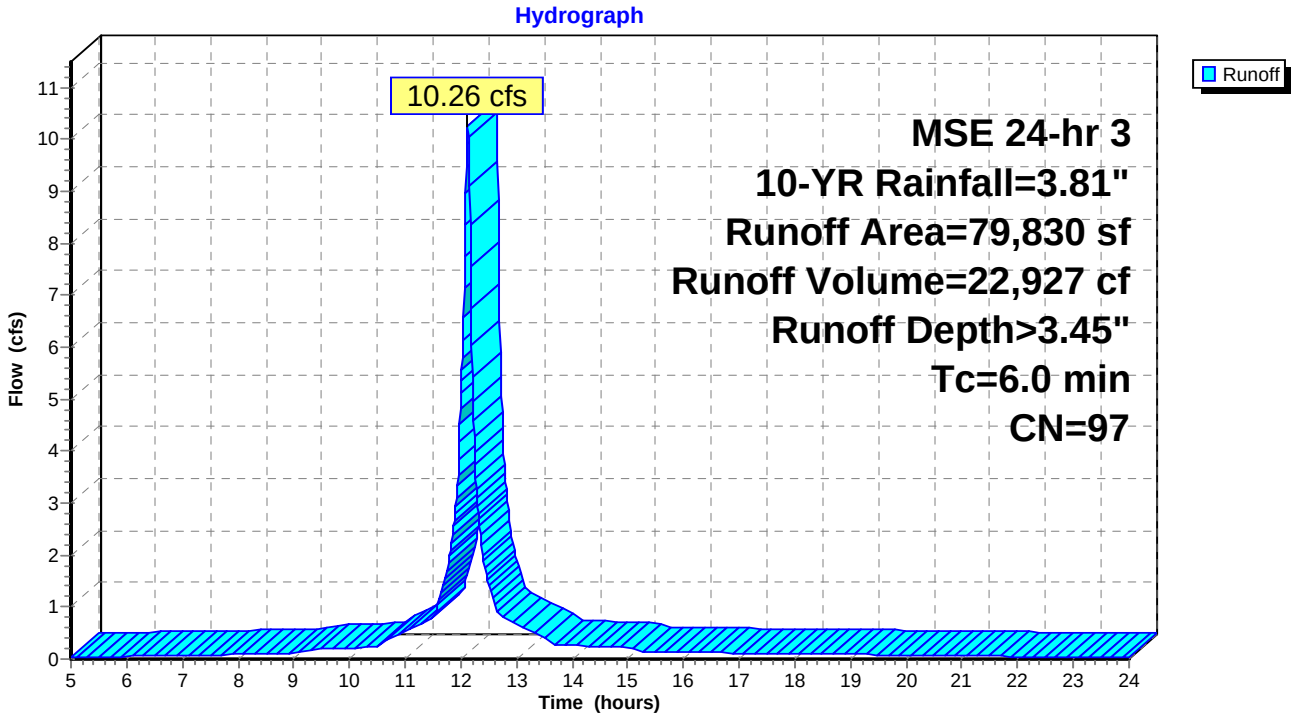
Runoff = 10.26 cfs @ 12.13 hrs, Volume= 22,927 cf, Depth> 3.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-YR Rainfall=3.81"

Area (sf)	CN	Description
6,424	80	>75% Grass cover, Good, HSG D
9,476	98	Paved parking, HSG D
63,930	98	Roofs, HSG D
79,830	97	Weighted Average
6,424		8.05% Pervious Area
73,406		91.95% Impervious Area

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

Subcatchment P2: P-2

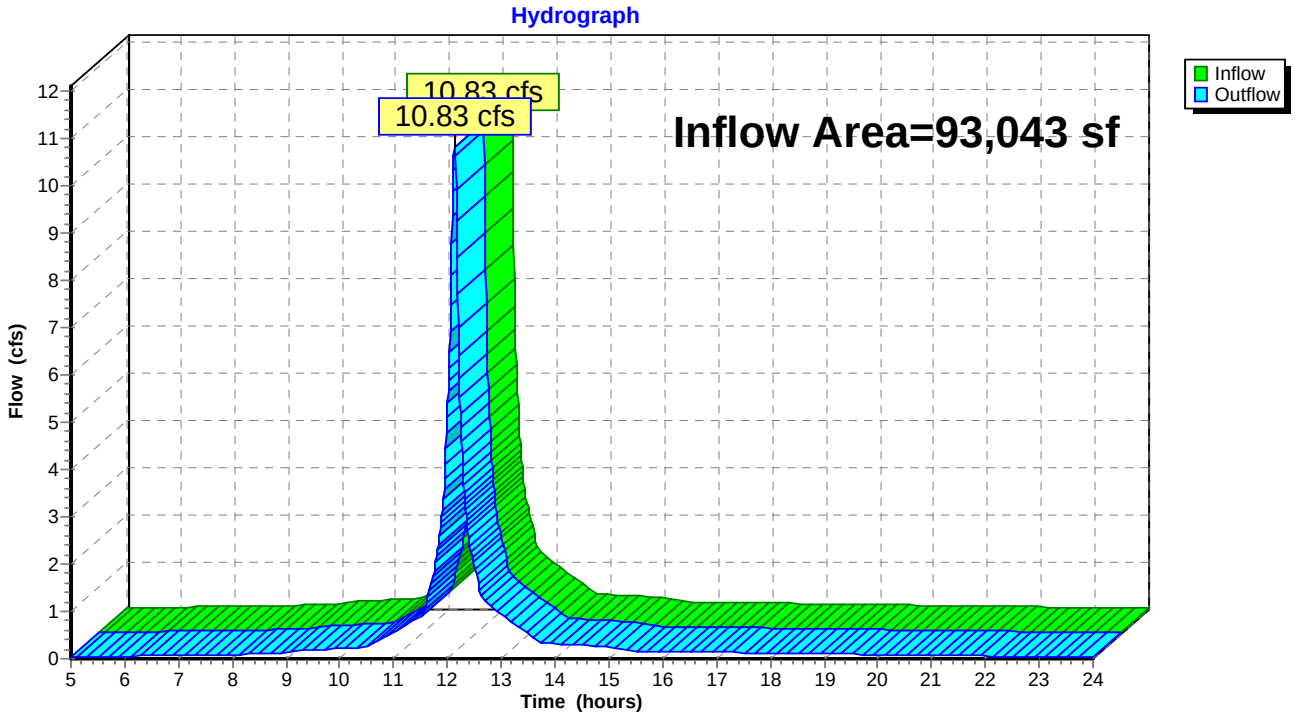


Summary for Reach 1: TOTAL PROPOSED OUTFALL

Inflow Area = 93,043 sf, 91.35% Impervious, Inflow Depth > 3.38" for 10-YR event
Inflow = 10.83 cfs @ 12.13 hrs, Volume= 26,194 cf
Outflow = 10.83 cfs @ 12.13 hrs, Volume= 26,194 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs

Reach 1: TOTAL PROPOSED OUTFALL



Summary for Pond 1P: UG Detention

Inflow Area = 13,213 sf, 87.70% Impervious, Inflow Depth > 3.34" for 10-YR event
Inflow = 1.68 cfs @ 12.13 hrs, Volume= 3,683 cf
Outflow = 0.98 cfs @ 12.20 hrs, Volume= 3,267 cf, Atten= 42%, Lag= 4.3 min
Primary = 0.98 cfs @ 12.20 hrs, Volume= 3,267 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 24.00' Surf.Area= 513 sf Storage= 1,052 cf
Peak Elev= 26.56' @ 12.20 hrs Surf.Area= 449 sf Storage= 2,351 cf (1,299 cf above start)

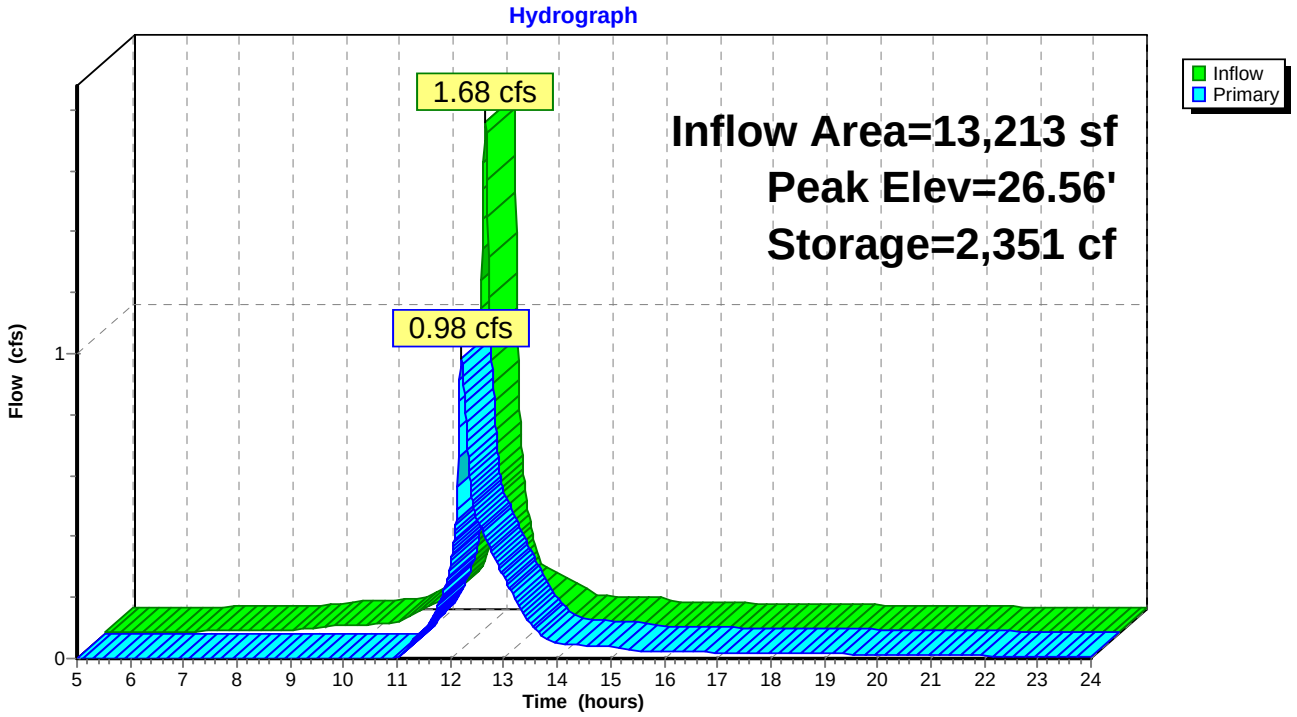
Plug-Flow detention time= 160.5 min calculated for 2,215 cf (60% of inflow)
Center-of-Mass det. time= 44.1 min (806.6 - 762.5)

Volume	Invert	Avail.Storage	Storage Description
#1	21.25'	2,886 cf	**84.0" Round UG Detenttion** L= 75.0'

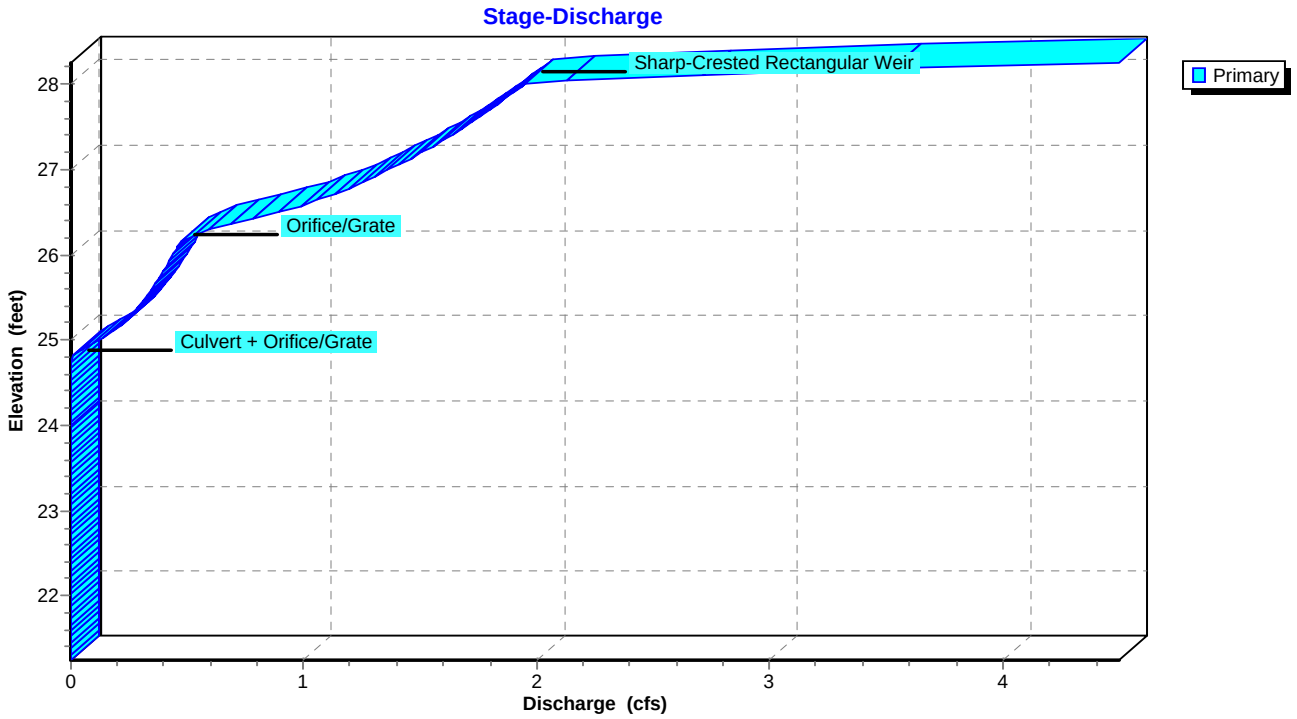
Device	Routing	Invert	Outlet Devices
#1	Primary	24.75'	**15.0" Round Culvert** L= 100.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 24.75' / 24.55' S= 0.0020 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	24.75'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	26.10'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	28.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.98 cfs @ 12.20 hrs HW=26.56' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.98 cfs of 4.90 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.54 cfs @ 6.18 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.44 cfs @ 2.32 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

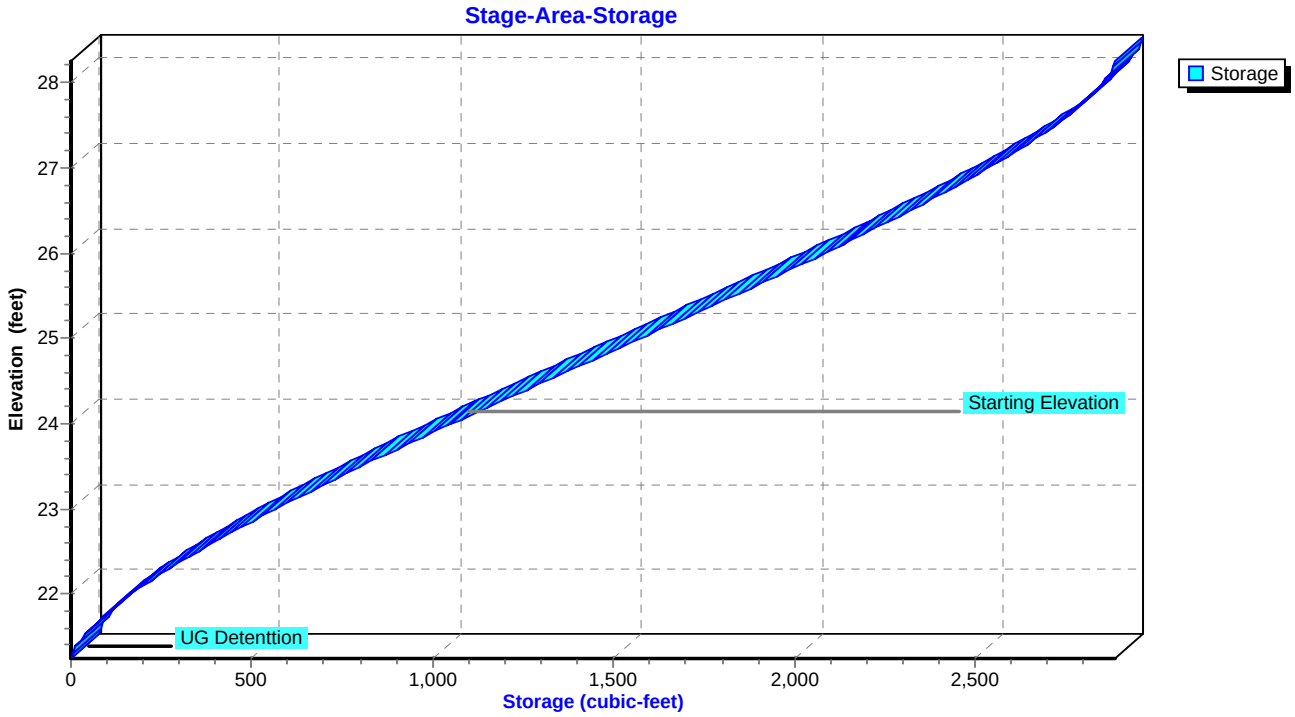
Pond 1P: UG Detention



Pond 1P: UG Detention



Pond 1P: UG Detention



Summary for Subcatchment P1: P-1

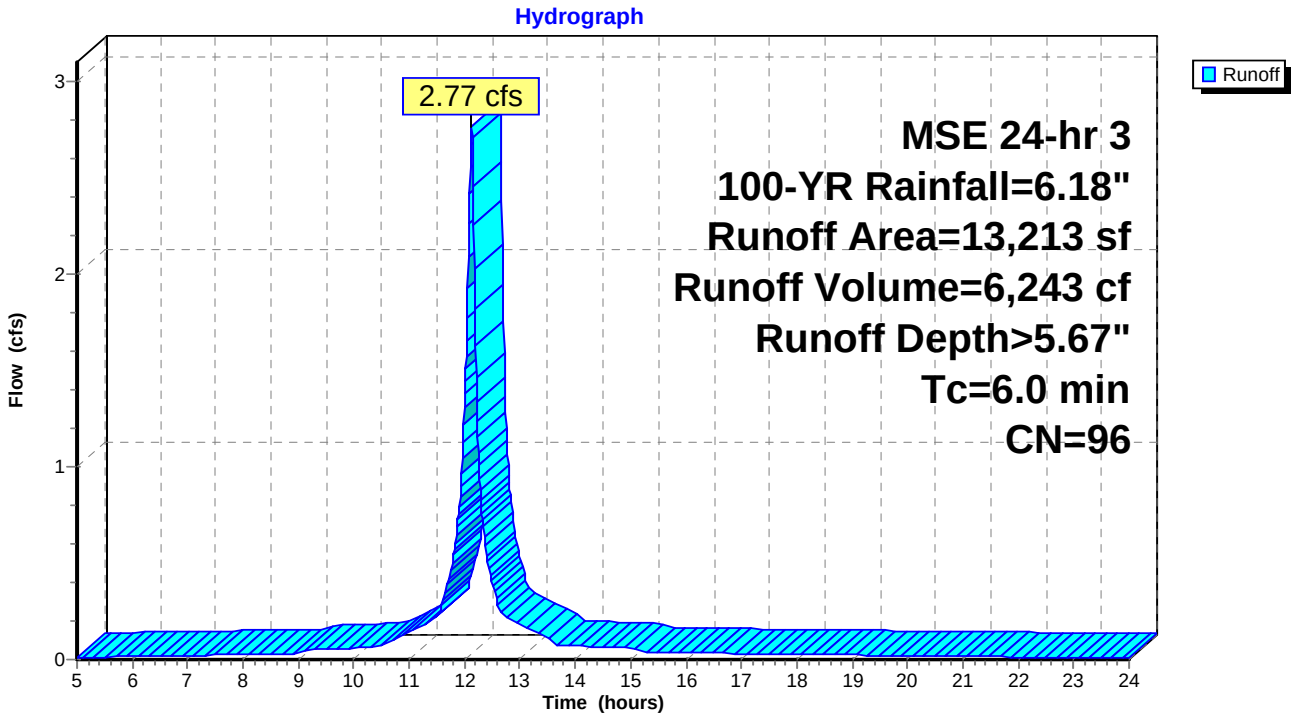
Runoff = 2.77 cfs @ 12.13 hrs, Volume= 6,243 cf, Depth> 5.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (sf)	CN	Description
1,625	80	>75% Grass cover, Good, HSG D
11,588	98	Paved parking, HSG D
13,213	96	Weighted Average
1,625		12.30% Pervious Area
11,588		87.70% Impervious Area

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

Subcatchment P1: P-1



Summary for Subcatchment P2: P-2

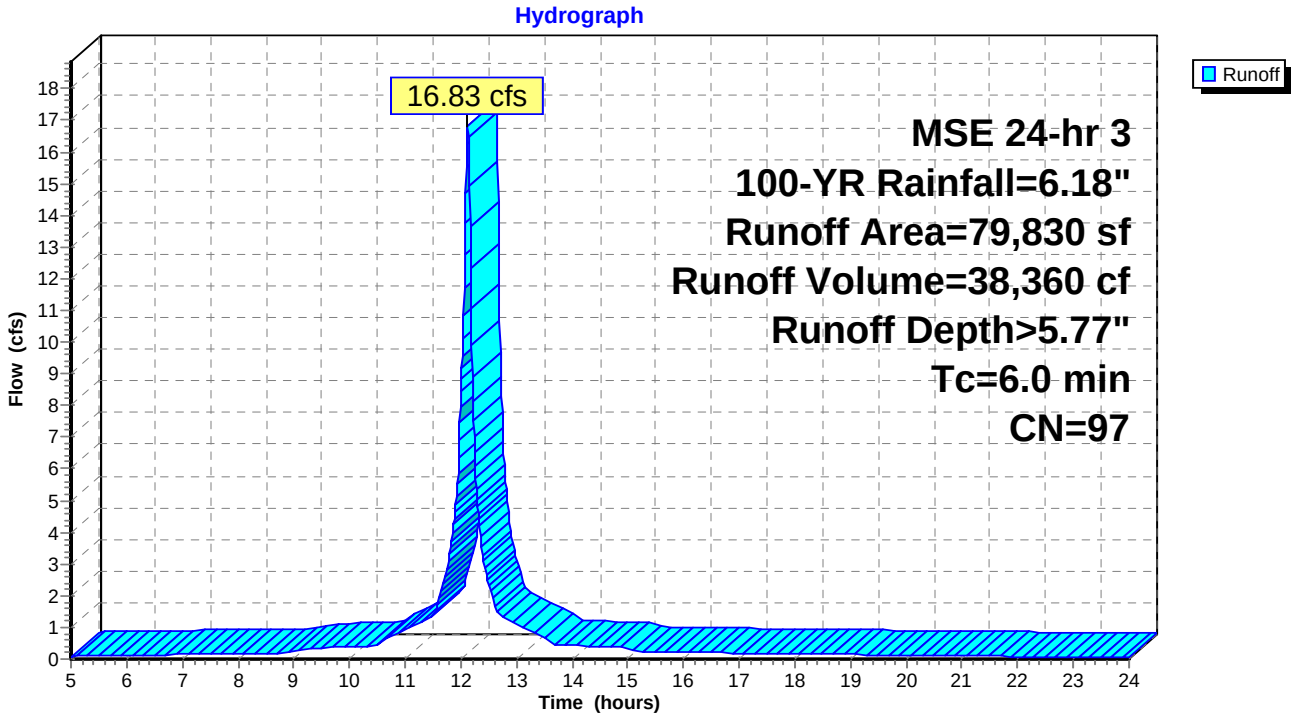
Runoff = 16.83 cfs @ 12.13 hrs, Volume= 38,360 cf, Depth> 5.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-YR Rainfall=6.18"

Area (sf)	CN	Description
6,424	80	>75% Grass cover, Good, HSG D
9,476	98	Paved parking, HSG D
63,930	98	Roofs, HSG D
79,830	97	Weighted Average
6,424		8.05% Pervious Area
73,406		91.95% Impervious Area

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

Subcatchment P2: P-2

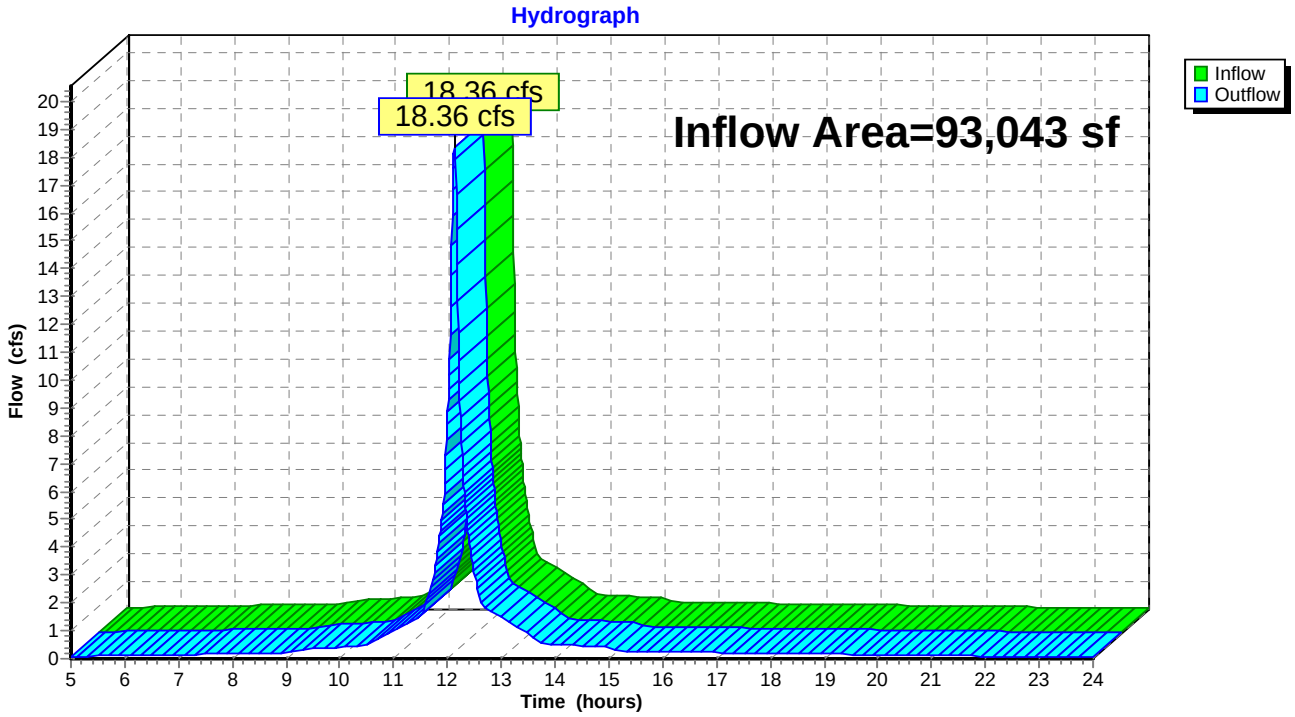


Summary for Reach 1: TOTAL PROPOSED OUTFALL

Inflow Area = 93,043 sf, 91.35% Impervious, Inflow Depth > 5.70" for 100-YR event
Inflow = 18.36 cfs @ 12.13 hrs, Volume= 44,181 cf
Outflow = 18.36 cfs @ 12.13 hrs, Volume= 44,181 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs

Reach 1: TOTAL PROPOSED OUTFALL



Summary for Pond 1P: UG Detention

Inflow Area = 13,213 sf, 87.70% Impervious, Inflow Depth > 5.67" for 100-YR event
Inflow = 2.77 cfs @ 12.13 hrs, Volume= 6,243 cf
Outflow = 1.80 cfs @ 12.19 hrs, Volume= 5,821 cf, Atten= 35%, Lag= 3.7 min
Primary = 1.80 cfs @ 12.19 hrs, Volume= 5,821 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-24.00 hrs, dt= 0.01 hrs
Starting Elev= 24.00' Surf.Area= 513 sf Storage= 1,052 cf
Peak Elev= 27.70' @ 12.19 hrs Surf.Area= 283 sf Storage= 2,780 cf (1,728 cf above start)

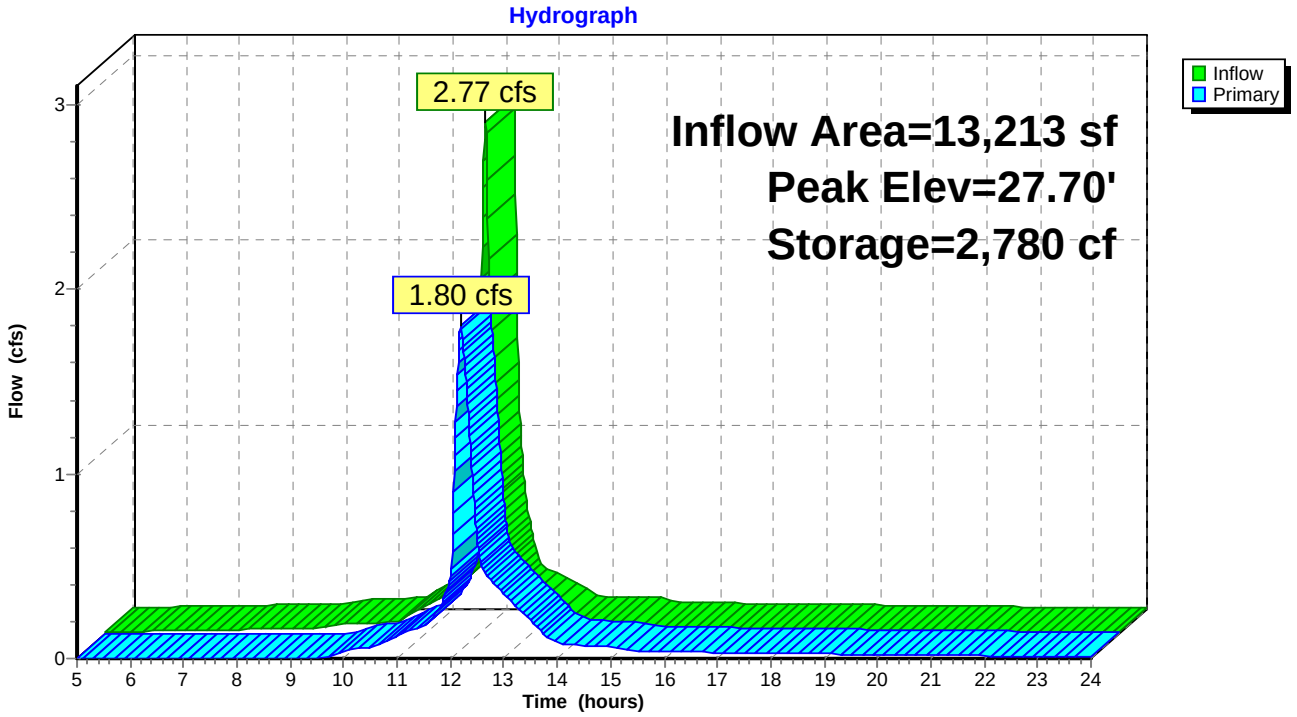
Plug-Flow detention time= 123.0 min calculated for 4,769 cf (76% of inflow)
Center-of-Mass det. time= 36.2 min (791.9 - 755.7)

Volume	Invert	Avail.Storage	Storage Description
#1	21.25'	2,886 cf	**84.0" Round UG Detenttion** L= 75.0'

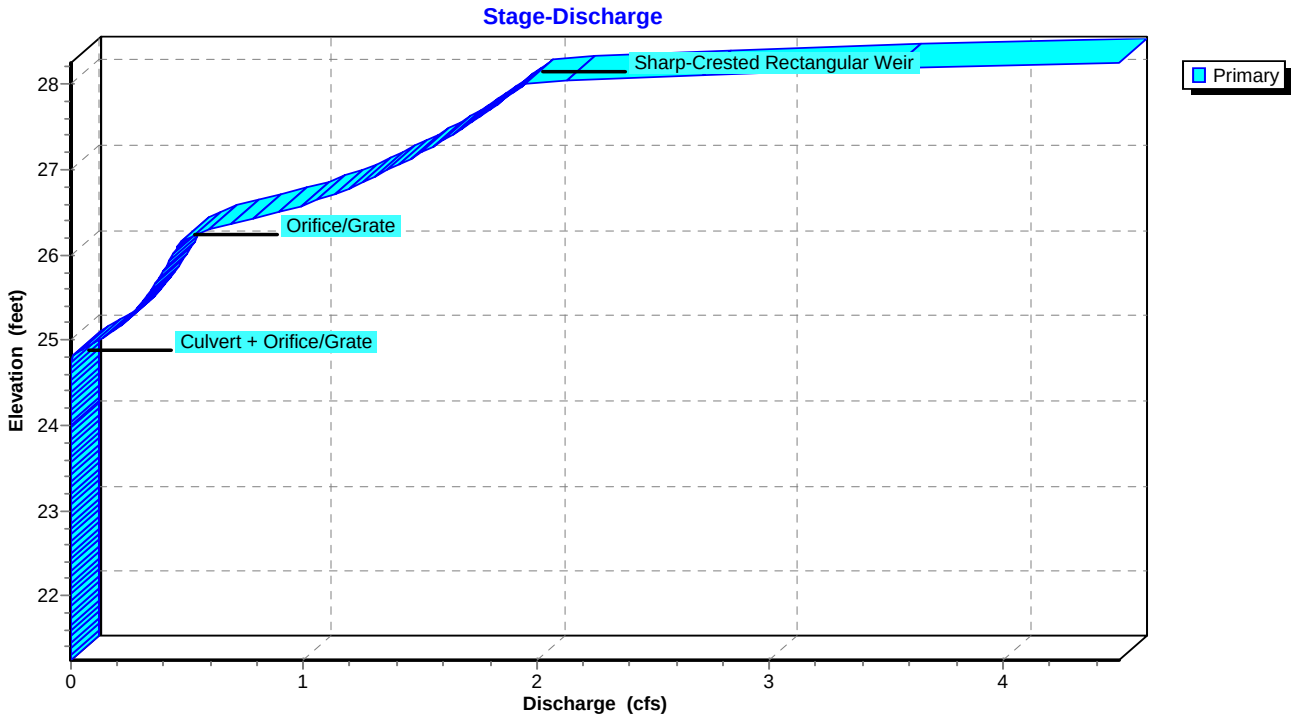
Device	Routing	Invert	Outlet Devices
#1	Primary	24.75'	**15.0" Round Culvert** L= 100.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 24.75' / 24.55' S= 0.0020 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	24.75'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	26.10'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	28.00'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.80 cfs @ 12.19 hrs HW=27.70' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.80 cfs of 7.72 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.70 cfs @ 8.03 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 1.10 cfs @ 5.59 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

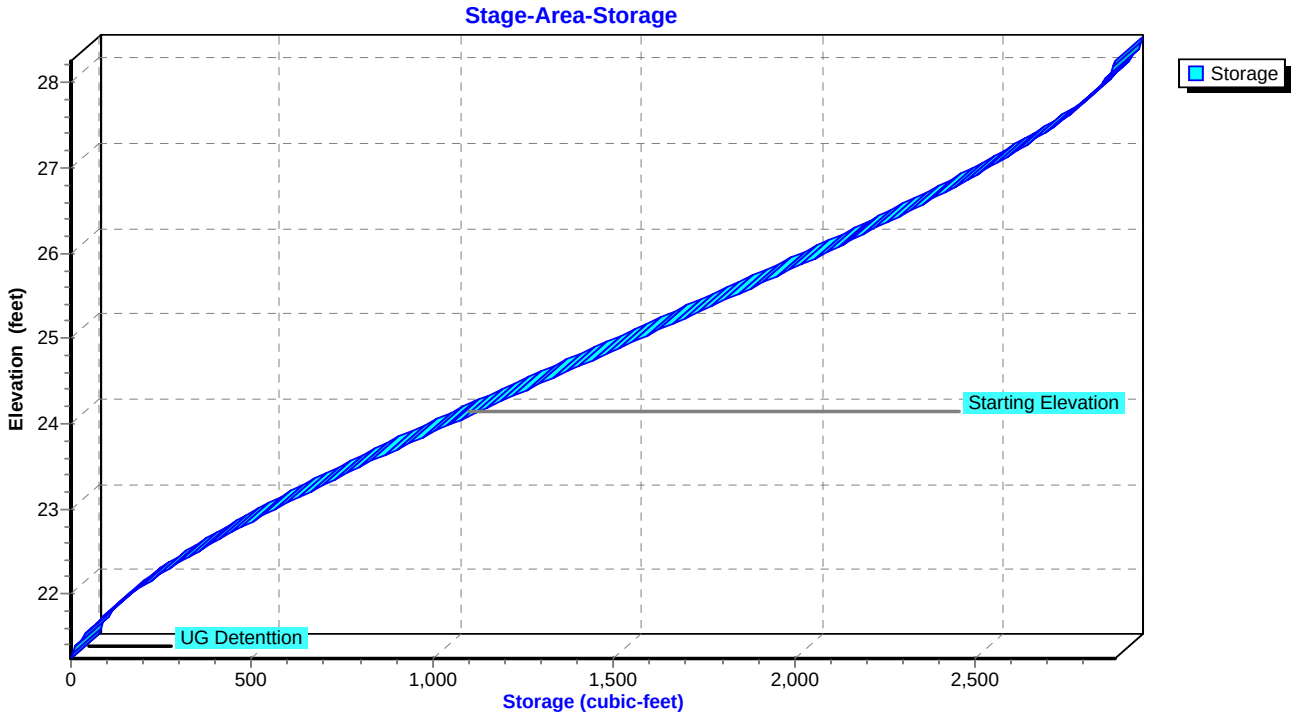
Pond 1P: UG Detention



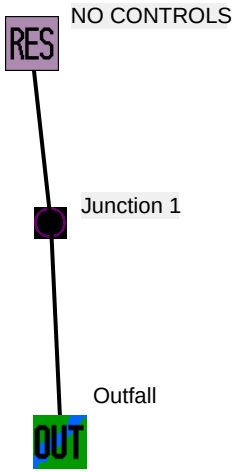
Pond 1P: UG Detention



Pond 1P: UG Detention



Storm Water Quality Calculations - WINSLAMM


NO CONTROLS
RES
Junction 1
Outfall
OUT

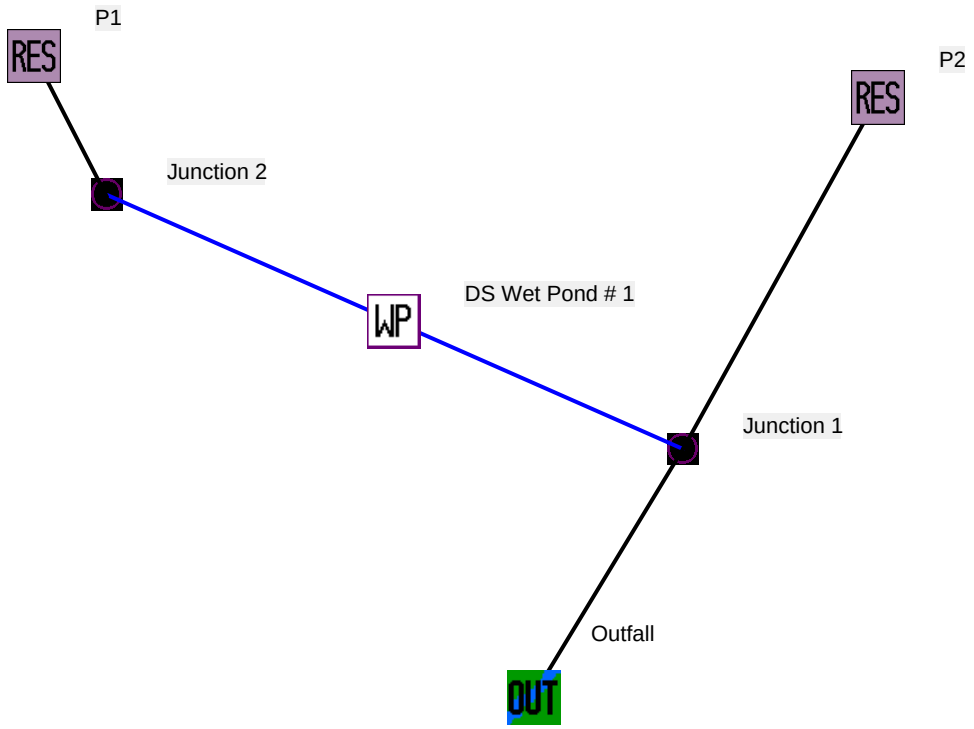
Data file name: P:\3170302\Eng Data\Hydrology\SLAMM\NO CONTROLS.mdb
WinSLAMM Version 10.4.1
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Milwaukee WI 1969.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv
Cost Data file name:
If Other Device Pollutant Load Reduction Values = 1, Off-site Pollutant Loads are Removed from Pollutant Load % Reduction calculations
Seed for random number generator: -42
Study period starting date: 01/01/69 Study period ending date: 12/31/69
Start of Winter Season: 12/06 End of Winter Season: 03/28
Date: 05-09-2019 Time: 16:27:40
Site information: 3170302 Reserve at Waukesha

LU# 1 - Residential: NO CONTROLS Total area (ac): 0.380
    25 - Driveways 1: 0.380 ac. Connected PSD File: C:\WinSLAMM Files\NURP.cpz

SLAMM for Windows Version 10.4.1

Data file name: P:\3170302\Eng Data\Hydrology\SLAMM\NO CONTROLS.mdb
WinSLAMM Version 10.4.1
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Milwaukee WI 1969.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False
Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv
Cost Data file name:
If Other Device Pollutant Load Reduction Values = 1, Off-site Pollutant Loads are Removed from Pollutant Load % Reduction calculations
Seed for random number generator: -42
Study period starting date: 01/01/69 Study period ending date: 12/31/69
Start of Winter Season: 12/06 End of Winter Season: 03/28
Model Run Start Date: 01/01/69 Model Run End Date: 12/31/69
Date of run: 05-09-2019 Time of run: 16:28:51
Total Area Modeled (acres): 0.380
Years in Model Run: 0.99

	Runoff Volume (cu ft)	Percent Runoff Volume Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total of all Land Uses without Controls:	29194	-	154.0	280.7	-
Outfall Total with Controls:	29194	0.00%	154.0	280.7	0.00%
Annualized Total After Outfall Controls:	29600			284.6	


P1
RES
P2
RES
Junction 2
DS Wet Pond # 1
WP
Junction 1
Outfall
OUT

Data file name: P:\3170302\Eng Data\Hydrology\SLAMM\WITH CONTROLS.mdb
WinSLAMM Version 10.4.1
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Milwaukee WI 1969.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv
Cost Data file name:
If Other Device Pollutant Load Reduction Values = 1, Off-site Pollutant Loads are Removed from Pollutant Load % Reduction calculations
Seed for random number generator: -42
Study period starting date: 01/01/69 Study period ending date: 12/31/69
Start of Winter Season: 12/06 End of Winter Season: 03/28
Date: 05-09-2019 Time: 16:31:39
Site information: 3170302 Reserve at Waukesha

LU# 1 - Residential: P2 Total area (ac): 1.830
1 - Roofs 1: 1.470 ac. Flat Connected PSD File: C:\WinSLAMM Files\NURP.cpz
25 - Driveways 1: 0.140 ac. Connected PSD File: C:\WinSLAMM Files\NURP.cpz
31 - Sidewalks 1: 0.070 ac. Connected PSD File: C:\WinSLAMM Files\NURP.cpz
45 - Large Landscaped Areas 1: 0.150 ac. Moderately Compacted Silty PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 2 - Residential: P1 Total area (ac): 0.300
25 - Driveways 1: 0.240 ac. Connected PSD File: C:\WinSLAMM Files\NURP.cpz
31 - Sidewalks 1: 0.020 ac. Connected PSD File: C:\WinSLAMM Files\NURP.cpz
45 - Large Landscaped Areas 1: 0.040 ac. Moderately Compacted Silty PSD File: C:\WinSLAMM Files\NURP.cpz

Control Practice 1: Wet Detention Pond CP# 1 (DS) - DS Wet Pond # 1
Particle Size Distribution file name: Not needed - calculated by program
Initial stage elevation (ft): 3.5
Peak to Average Flow Ratio: 3.8
Maximum flow allowed into pond (cfs): No maximum value entered
Outlet Characteristics:
Outlet type: Sharp Crested Weir
1. Sharp crested weir length (ft): 6
2. Sharp crested weir height from invert: 0.25
3. Sharp crested weir invert elevation above datum (ft): 6.75
Outlet type: Orifice 1
1. Orifice diameter (ft): 0.33
2. Number of orifices: 1
3. Invert elevation above datum (ft): 3.5
Outlet type: Orifice 2
1. Orifice diameter (ft): 0.5
2. Number of orifices: 1
3. Invert elevation above datum (ft): 4.85
Outlet type: Broad Crested Weir
1. Weir crest length (ft): 6
2. Weir crest width (ft): 0.5
3. Height from datum to bottom of weir opening: 6.99
Pond stage and surface area

Entry Number	Stage (ft)	Pond Area (acres)	Natural Seepage (in/hr)	Other Outflow (cfs)
0	0.00	0.0000	0.00	0.00
1	1.00	0.0095	0.00	0.00
2	2.00	0.0095	0.00	0.00
3	3.00	0.0095	0.00	0.00
4	4.00	0.0095	0.00	0.00
5	5.00	0.0095	0.00	0.00
6	6.00	0.0095	0.00	0.00
7	7.00	0.0095	0.00	0.00

SLAMM for Windows Version 10.4.1

Data file name: P:\3170302\Eng Data\Hydrology\SLAMM\WITH CONTROLS.mdb
WinSLAMM Version 10.4.1
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Milwaukee WI 1969.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False
Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv
Cost Data file name:
If Other Device Pollutant Load Reduction Values = 1, Off-site Pollutant Loads are Removed from Pollutant Load % Reduction calculations
Seed for random number generator: -42
Study period starting date: 01/01/69 Study period ending date: 12/31/69
Start of Winter Season: 12/06 End of Winter Season: 03/28
Model Run Start Date: 01/01/69 Model Run End Date: 12/31/69
Date of run: 05-09-2019 Time of run: 16:33:02
Total Area Modeled (acres): 2.130
Years in Model Run: 0.99

	Runoff Volume (cu ft)	Percent Runoff Volume Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total of all Land Uses without Controls:	170130	-	74.59	792.2	-
Outfall Total with Controls:	170155	-0.01%	61.43	652.5	17.63%
Annualized Total After Outfall Controls:	172518			661.6	

Hydrology Exhibits

Pre-Developed Site Conditions

EXISTING SITE DATA

PROPERTY AREA =	93,043 SF	2.14 AC	
OVERALL GREEN SPACE =	8,356 SF	0.19 AC	8.98%
OVERALL IMPERVIOUS =	84,687 SF	1.95 AC	91.02%

N

GRAPHIC SCALE
15 0 15 30 60
(IN FEET)

LEGEND

- PERVIOUS AREA
- WATERSHED BREAK LINE
- WATERSHED LIMIT

*2010 AERIAL FROM WAUKESHA COUNTY GIS

811 Know what's **below.** **Call** before you dig.

R.A.SMITH, INC. ASSUMES NO RESPONSIBILITY FOR DAMAGES, LIABILITY OR COSTS RESULTING FROM CHANGES OR ALTERATIONS MADE TO THIS PLAN WITHOUT THE EXPRESSED WRITTEN CONSENT OF R.A.SMITH, INC.

DATE	DESCRIPTION
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raSmith
CREATIVITY BEYOND ENGINEERING
16745 W. Bluemound Road
Brookfield, WI 53005-5938
(262) 781-1000
rasmith.com
Brookfield, WI | Milwaukee, WI | Appleton, WI | Madison, WI | Cedarburg, WI
Mount Pleasant, WI | Naperville, IL | Pittsburgh, PA | Irvine, CA

RESERVE AT WAUKESHA
CITY OF WAUKESHA, WI

PRE-DEVELOPMENT GREENSPACE EXHIBIT

DATE: 04/11/2019
SCALE: 1" = 30'
JOB NO. 3170302
PROJECT MANAGER: MATT P. KOCOUREK, P.E.
DESIGNED BY: CDC
CHECKED BY: RJY

SHEET NUMBER
HX 1

P:\3170302\Eng Data\Hydrology\Figures\HX01.dwg, Plan Sheet 36x24, 5/9/2019 1:39:29 PM, rjy

Post-Developed Site Conditions

PROPERTY LINE

N

GRAPHIC SCALE

15 0 15 30 60

(IN FEET)

LEGEND

PROPOSED GREENSPACE

WATERSHED LIMIT

PROPOSED SITE DATA

PROPERTY AREA =		93,043 SF	2.14 AC
OVERALL GREEN SPACE =	8,049 SF	0.19 AC	8.65%
OVERALL IMPERVIOUS =	84,994 SF	1.95 AC	91.35%

Know what's below. Call before you dig.

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DATE	DESCRIPTION
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RESERVE AT WAUKESHA
CITY OF WAUKESHA, WI

POST-DEVELOPMENT GREENSPACE EXHIBIT

DATE: 04/11/2019

SCALE: 1" = 30'

JOB NO. 3170302

PROJECT MANAGER: MATT P. KOCOUREK, P.E.

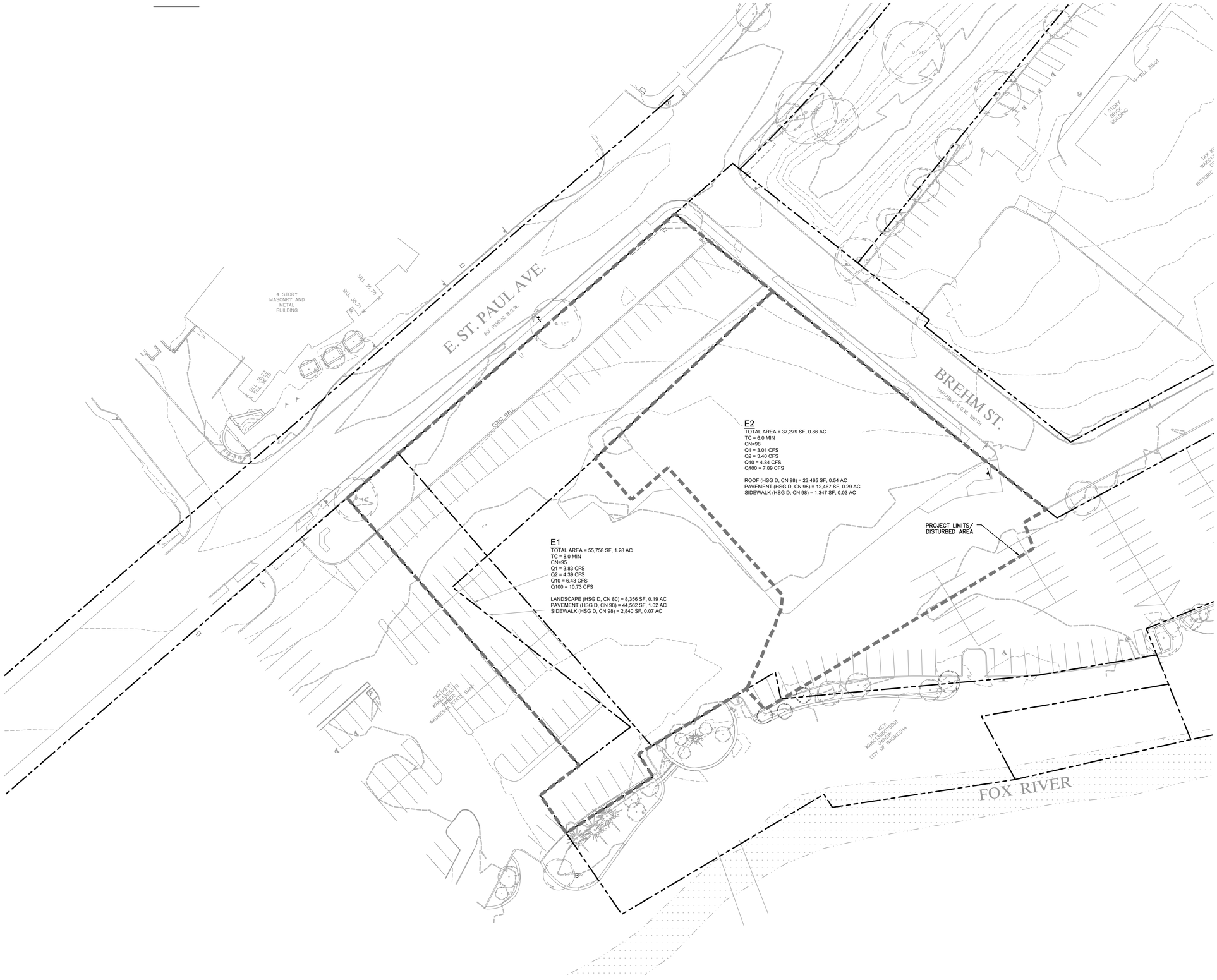
DESIGNED BY: CDC

CHECKED BY: RJY

SHEET NUMBER

HX 2

Pre-Developed Hydrology



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RESERVE AT WAUKESHA
CITY OF WAUKESHA, WI

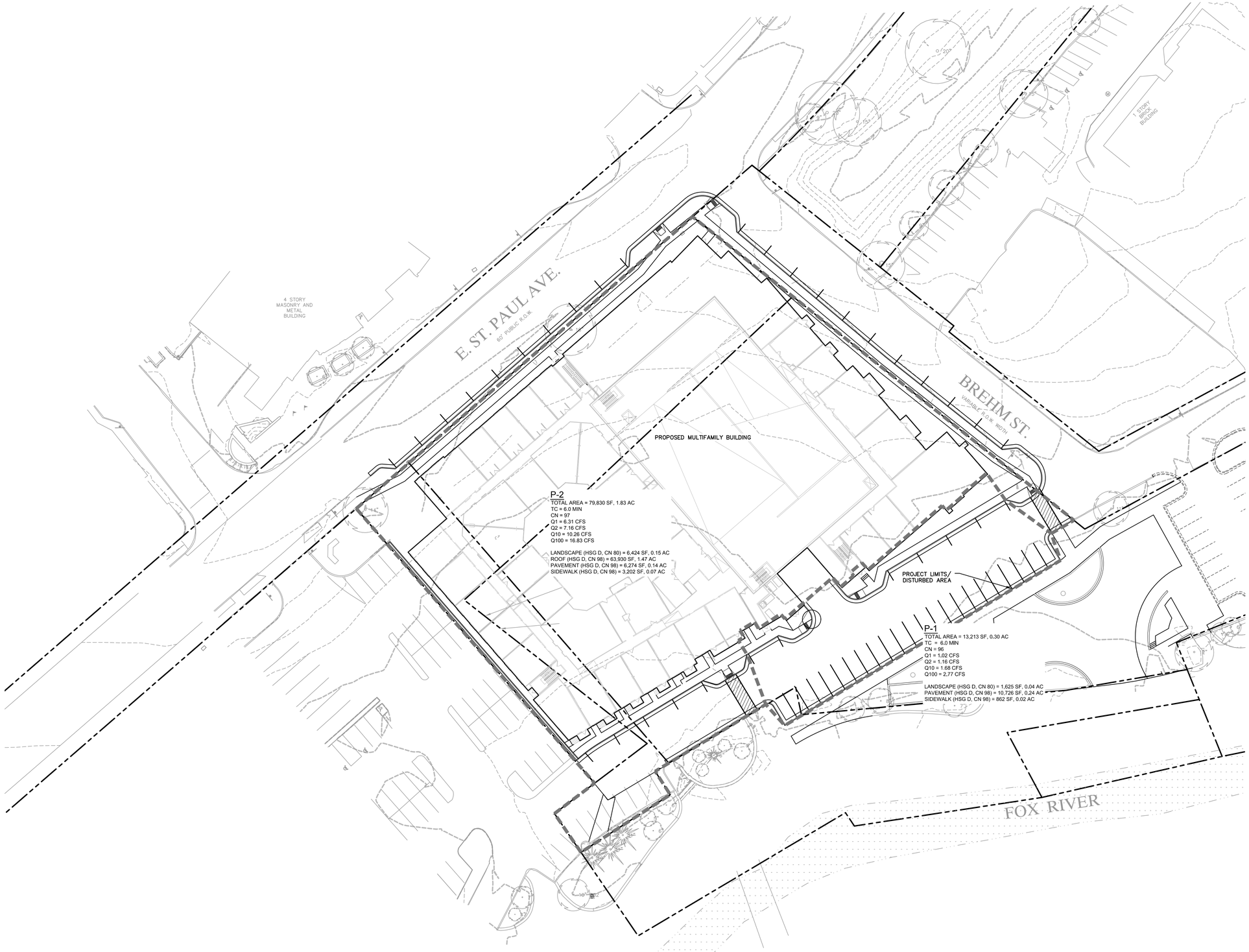
PRE-DEVELOPMENT HYDROLOGY EXHIBIT

Know what's below. Call before you dig.

DATE: 04/11/2019
SCALE: 1" = 30'
JOB NO. 3170302
PROJECT MANAGER: MATT P. KOCOUREK, P.E.
DESIGNED BY: CDC
CHECKED BY: RJY

SHEET NUMBER
HX 3

Post-Developed Hydrology



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RESERVE AT WAUKESHA
CITY OF WAUKESHA, WI

POST-DEVELOPMENT HYDROLOGY EXHIBIT

Know what's **below.** **Call** before you dig.

DATE: 04/11/2019
SCALE: 1" = 30'
JOB NO. 3170302
PROJECT MANAGER: MATT P. KOCOUREK, P.E.
DESIGNED BY: CDC
CHECKED BY: RJY

SHEET NUMBER
HX 4

Maintenance Agreement

Document Number

Storm Water Management Practice Maintenance Agreement

Michael Campbell, Campbell Capital Group, LLC, as "Owner" of the property described below, in accordance with Chapter 32 City of Waukesha Storm Water Management and Erosion Control, agrees to install and maintain storm water management practice(s) on the subject property in accordance with approved plans and Storm Water Management Plan conditions. The owner further agrees to the terms stated in this document to ensure that the storm water management practice(s) continues serving the intended functions in perpetuity. This Agreement includes the following exhibits:

Exhibit A: Legal Description of the real estate for which this Agreement applies ("Property").
Exhibit B: Location Map(s) – shows an accurate location of each storm water management practice affected by this Agreement.
Exhibit C: Maintenance Plan – prescribes those activities that must be carried out to maintain compliance with this Agreement.

Note: After construction verification has been accepted by the City of Waukesha, for all planned storm water management practices, an addendum(s) to this agreement shall be recorded by the Owner showing design and construction details. The addendum(s) may contain several additional exhibits, including certification by City of Waukesha of Storm Water and Erosion Control Permit termination, as described below.

Name and Return Address

City of Waukesha
130 Delafield Street
Waukesha, WI 53188

Parcel Identification Number(s) – (PIN)

Through this Agreement, the Owner hereby subjects the Property to the following covenants, conditions and restrictions:

1. The Owner shall be responsible for the routine and extraordinary maintenance and repair of the storm water management practice(s) and drainage easements identified in Exhibit B until Storm Water and Erosion Control Permit termination by the City of Waukesha in accordance with Chapter 32 of the City Code of Ordinances.
2. After Storm Water and Erosion Control Permit termination under 1., the current Owner(s) shall be solely responsible for maintenance and repair of the storm water management practices and drainage easements in accordance with the maintenance plan contained in Exhibit C.
3. The Owner(s) shall, at their own cost, complete inspections of the storm water management practices at the time intervals listed in Exhibit C, and conduct the inspections by a qualified professional, file the reports with the City of Waukesha after each inspection and complete any maintenance or repair work recommended in the report. The Owner(s) shall be liable for the failure to undertake any maintenance or repairs. After the work is completed by the Contractor, the qualified professional shall verify that the work was properly completed and submit the follow-up report to the City within 30 days.
4. In addition, and independent of the requirements under paragraph 3 above, the City of Waukesha, or its designee, is authorized to access the property as necessary to conduct inspections of the storm water management practices or drainage easements to ascertain compliance with the intent of this Agreement and the activities prescribed in Exhibit C. The City of Waukesha may require work to be done which differs from the report described in paragraph 3 above, if the City of Waukesha reasonably concludes that such work is necessary and consistent with the intent of this agreement. Upon notification by the City of Waukesha of required maintenance or repairs, the Owner(s) shall complete the specified maintenance or repairs within a reasonable time frame determined by the City of Waukesha.
5. If the Owner(s) do not complete an inspection under 3. above or required maintenance or repairs under 4. above within the specified time period, the City of Waukesha is authorized, but not required, to perform the specified inspections, maintenance or repairs. In the case of an emergency situation, as determined by the City of Waukesha, no notice shall be required prior to the City of Waukesha performing emergency maintenance or repairs. The City of Waukesha may levy the costs and expenses of such inspections, maintenance or repair related actions as a special charge against the Property and collected as such in accordance with the procedures under s. 66.0627 Wis. Stats. or subch. VII of ch. 66 Wis. Stats.

6. This Agreement shall run with the Property and be binding upon all heirs, successors and assigns. After the Owner records the addendum noted above, the City of Waukesha shall have the sole authority to modify this agreement upon a 30-day notice to the current Owner(s).

Dated this ___ day of _____, 2019.

Owner:

_____
(Owners Signature)

_____
(Owners Typed Name)

Acknowledgements

State of Wisconsin:
County of Waukesha

Personally came before me this ____ day of _____, 2019, the above named Michael Campbell to me known to be the person who executed the foregoing instrument and acknowledged the same.

_____.
[Name]
Notary Public, Waukesha County, WI
My commission expires:_____.

This document was drafted by:

Jeff Yersin, PE
RA Smith Inc.
16745 W. Bluemound Rd
Brookfield, WI 53005

For Certification Stamp

City of Waukesha Common Council Approval

Dated this ___ day of _____, 2019.

_____

Shawn N. Reilly, Mayor

_____

Gina Kozlik, City Clerk

Acknowledgements

State of Wisconsin:
County of Waukesha

Personally came before me this ____ day of _____, 2019, the above named _____ to me known to be the person who executed the foregoing instrument and acknowledged the same.

_____.
[Name]
Notary Public, Waukesha County, WI
My commission expires:_____.

Exhibit A – Legal Description

The following description and reduced copy map identifies the land parcel(s) affected by this Agreement. For a larger scale view of the referenced document, contact the Waukesha County Register of Deeds office.

Project Identifier: **The Reserve at Waukesha** Acres**: TBD**
Date of Recording: **TBD**
Map Produced By: **RASmith Inc, 16745 W. Bluemound Rd, Brookfield, WI 53005**
Legal Description: **TBD**

Exhibit B - Location Map
Storm Water Management Practices Covered by this Agreement

The storm water management practices covered by this Agreement are depicted in the reduced copy of a portion of the construction plans, as shown below. The practices include an underground detention system with Outlet Structure for storm water quantity and quality.

Subdivision Name:	**The Reserve at Waukesha**
Storm water Practices:	**Underground Detention**
Location of Practices:	**Private Drive SW of Brehm St and Bank St intersection**
Owners of Storm water BMP:	**Campbell Capital Group, LLC**

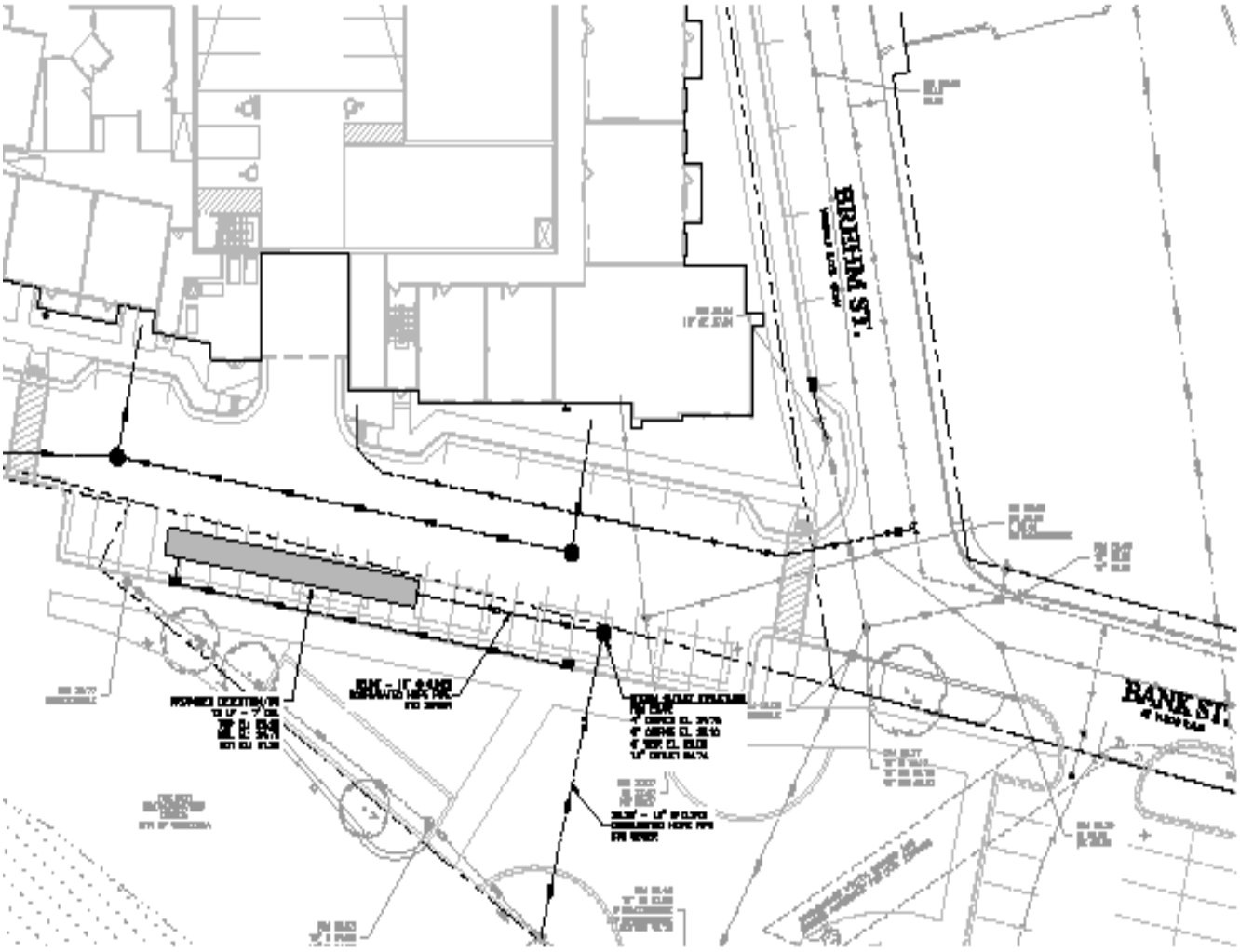

Exhibit C
Storm Water Practice Maintenance Plan

This exhibit explains the basic function of each of the storm water practices listed in Exhibit B and prescribes the minimum maintenance requirements to remain compliant with this Agreement. The maintenance activities listed below are aimed to ensure these practices continue serving their intended functions in perpetuity. The list of activities is not all inclusive, but rather indicates the minimum type of maintenance that can be expected for this particular site. Access to the stormwater practices for maintenance vehicles is shown in Exhibit B. Any failure of a storm water practice that is caused by a lack of maintenance will subject the Owner(s) to enforcement of the provisions listed on page 1 of this Agreement by the City of Waukesha.

System Description:
The 75' – 84" diameter underground detention basin is designed to trap 40% of total suspended solids of newly created roads and parking lots only as compared to no controls. Additionally, proposed runoff shall be maintain pre-development downstream peak flows for the 1-yr, 2-yr, 10-yr, and 100-yr, 24 hour storms. The underground basin has an outlet control structure that regulates flows. The detention system has a permanent pool depth of 3.5'.

Minimum Maintenance Requirements:
To ensure the proper long-term function of the storm water management practices described above, the following activities must be completed:

1. All outlet pipes must be checked semi-annually to ensure there is no blockage from floating debris or ice, especially the 4 and 6 inch orifices in the Outlet Structure. Any blockage must be removed immediately.
2. When sediment in the underground detention system has accumulated to an elevation of three feet below the outlet elevation, it must be removed (see Exhibit D). All removed sediment must be placed in an appropriate upland disposal site and stabilized (grass cover) to prevent sediment from washing back into the basin.
3. Any other repair or maintenance needed to ensure the continued function of the storm water practices or as ordered by the City of Waukesha under the provisions listed on page 1 of this Agreement.
4. The titleholder(s) or their designee must document all inspections as specified above. Documentation shall include as a minimum: (a) Inspectors Name, Address and Telephone Number, (b) Date of Inspections, (c) Condition Report of the Storm Water Management Practice, (d) Corrective Actions to be Taken and Time Frame for Completion, (e) Follow-up Documentation after Completion of the Maintenance Activities. All documentation is to be delivered to the attention of the City Engineer at the City of Waukesha Engineering Department on January 10th and July 10th each year.