Stormwater Management Plan for

Sorce Services LLC

Waukesha, Wisconsin

Project No. 138-005-003

September 28, 2020

Stormwater Management Plan for

Sorce Services LLC
220 South Prairie Avenue
City of Waukesha, Wisconsin

Prepared by

Endpoint Solutions
6871 South Lovers Lane
Franklin, Wisconsin 53132

Prepared for

Sorce Services LLC
7619 Nordale Avenue
Franksville, WI 53126

EXECUTIVE SUMMARY

The intent of this document is to present the results of the stormwater management plan for the proposed Sorce Services expansion, on Prairie Avenue, in the City of Waukesha, Waukesha County, WI.

The results of this report provide the water quantity and water quality calculations required by the City of Waukesha and the State of Wisconsin.

- See Table 1 for water quantity summary
- See Table 2 for water quality summary

Table 1 – Water Quantity

	Total	
	E Total (cfs)	P Total (cfs)
1-year, 24-hour Storm	0.25	0.23
2-year, 24-hour Storm	0.43	0.25
10-year, 24-hour Storm	1.44	0.81
100-year, 24-hour Storm	4.68	3.67

Table 2 – Proposed SLAMM Output

	Total Suspended Solids	Percent Reduction
Proposed Site w/o Controls	**1,877.0 lbs.**	
Proposed Site with Controls	**234.1 lbs.**	**87.53%**

INTRODUCTION

Endpoint Solutions has been retained by Sorce Services, LLC to prepare a stormwater management plan for the proposed expansion of their property on Prairie Avenue, in the City of Waukesha, Waukesha County, Wisconsin. The existing property is approximately 2.0 acres and will be adding approximately 2.25 acres from the adjacent property to the southwest. The expansion area was formerly a recreational field that has been allowed to become overgrown over time. Sorce Properties intends to develop this site by expanding their recycling/storage operations into this area. The land will largely be a fenced in gravel storage area, along with some greenspace and a stormwater facility.

Stormwater management for this site is regulated by the City of Waukesha Municipal Code Chapter 32: Stormwater Management and Erosion Control, as well as The Wisconsin Department of Natural Resources NR 151, Wisconsin Administrative Code. The analysis presented in this report addresses water quality and water quantity.

METHOD 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.

The runoff curve number is determined by the soils, vegetation cover and impervious cover to estimate runoff in the SCS Method. Higher curve numbers mean more potential runoff. Composite curve numbers were determined from the existing and proposed land cover types.

The time of concentration is the time required for water to flow from the most remote part of the drainage area to the point of design. The water moves through the watershed or subbasin as sheet flow, shallow concentrated flow, open channel flow or any combination of these aforementioned items.

Table 3 – Design Storm Events
Per City of Waukesha Municipal Code, Chapter 32

Frequency (years)	Duration (hours)	Rainfall Depth (inches)
1	24	2.4
2	24	2.7
10	24	3.81
100	24	6.18

EXISTING SITE CONDITIONS

The site is undeveloped and land cover can be described as densely vegetated cover. The site drains from the north to the south and grades are generally flat with average slopes around 2 percent. No wetland areas were located within the site.

According to the broad NRCS Web Soil Survey, underlying soils within the site contain soils belonging to NRCS Hydrologic Soil Groups B and C (see *Soils Exhibit*). Only a small portion of the site is the C category (approximately 6%) and that area is entirely within proposed pond area. See Table 4 for a brief description of the existing underlying soils according to the NRCS soil survey.

Table 4 – NRCS Soil Survey Summary

NRCS Soil Name	% of Site Area	% slope	NRCS Unit Symbol	Hydrologic Soil Group (HSG)
Warsaw Silt Loam	84.7	0 - 2	WhA	B
Kane Silt Loam	15.3	1 – 3	KeA	C

The existing property is one watershed (see *Existing Hydrology Exhibit*). The drainage pattern is from the northeast corner of the site to the southwest corner and off-site.

Existing conditions assumed "good hydrologic conditions" for appropriate land covers. Runoff Curve Number was determined based on the grassland cover description in the City's Chapter 32 ordinance and the above proportionate areas, resulting in an existing area RCN of 63. Time of Concentration calculations have been determined individually for each watershed.

Design storms for the existing hydrology model include the 1, 2, 10, and 100-year, 24-hour storm events. See Table 5 for an existing hydrology summary. A full summary of results is located in the *Existing Hydrology Calculations* tab of this report.

Table 5 – Existing Hydrology Summary

Watershed ID	Area (acres)	Composite RCN	Tc (minutes)	Peak Discharge (cfs)			
				1-year	2-year	10-year	100-year
E1	2.413	63	30.5	0.25	0.43	1.44	4.68

PROPOSED SITE CONDITIONS

Runoff generated by the developed site is divided into two watersheds (see *Proposed Hydrology Exhibit*). The drainage from the majority of the site discharges to the proposed detention pond along the west edge of the property. The remainder of the site is

undetained areas draining to the west. The ultimate discharge for the entire property drains to the storm sewer immediately south of the property.

WATER QUANTITY AND QUALITY DESIGN

Water quantity requirements (peak discharge rates) are regulated by The Wisconsin Department of Natural Resources NR151, Wisconsin Administrative Code and the City of Waukesha Municipal Code Chapter 32. The City of Waukesha requires post-construction sites reduce peak stormwater discharges rates for the 2, 10 and 100-year, 24-hour design storms to that of pre-developed conditions. The 1-year, 24-hour design storm is also provided.

Runoff curve numbers for all watersheds have been totaled according to the site plan. The watersheds that are virtually all impervious, the times of concentrations were calculated to be less than 6 minutes; therefore, a minimum time of concentration of 6 minutes were assigned to these drainage basins per Technical Release No. 55 recommendation.

See Table 6 for the proposed watersheds and resulting peak discharges which occur prior to detention.

Table 6 – Proposed Peak Discharge Rates (before detention)

Watershed Description	Area (acres)	CN	Tc (minutes)	Peak Discharge			
				1-year	2-year	10-year	100-year
P-1 (Undetained)	0.04	69	6	0.03	0.04	0.08	0.21
P-2	2.37	89	6	6.10	6.99	10.44	18.21
P Total (pre-detention)	2.41	89	6	6.13	7.03	10.52	18.42

A wet detention pond was utilized to provide the required detention as well as water quality. The pond has a single outlet pipe which drains to an adjacent public storm sewer network. The pond outlet restricts the runoff discharge rate within allowable levels of the governing authorities. The pond has an emergency overflow weir which will provide a controlled release point in the event the primary outflow device's capacity is exceeded.

See Tables 7 & 8 for proposed peak discharge rates and routed water surface elevations after detention.

Table 7 – Storm Water Facilities

Detention	Storm Event	Discharge (cfs)	Maximum Elevation	Storage (cu. ft.)
Storm Water Pond (Top EL:20.00) (Spillway EL: 19.20) (NWL EL: 16.00) (Bot EL: 11.00)	1-yr	0.23	17.03	10,039
	2-yr	0.24	17.18	11,588
	10-yr	0.80	17.58	16,152
	100-yr	3.62	18.18	23,362

Table 8 – Discharge Rates Summary (after detention)

TOTAL SITE

Storm Event	Existing	Proposed
1-yr	**0.25**	**0.23**
2-yr	**0.43**	**0.25**
10-yr	**1.44**	**0.81**
100-yr	**4.68**	**3.67**

Water quality requirements are regulated by The Wisconsin Department of Natural Resources NR151, Wisconsin Administrative Code and the City of Waukesha Municipal Code Chapter 32. These codes require best management practices to be designed to reduce the total suspended solids load of new development sites by 80%, based on an average annual rainfall, as compared to no runoff management controls.

An analysis using the approved WINSLAMM model to verify TSS removal rates has been conducted. For detailed calculations, see *WINSLAMM Calculations*.

Table 9 below summarizes the SLAMM output data.

Table 9 – Proposed SLAMM Output

	Total Suspended Solids	Percent Reduction
Proposed Site w/o Controls	**1,877.0 lbs.**	
Proposed Site with Controls	**234.1 lbs.**	**87.53%**

INFILTRATION REQUIREMENTS

Stormwater infiltration requirements are regulated by The Wisconsin Department of Natural Resources NR151, Wisconsin Administrative Code and the City of Waukesha Municipal Code Chapter 32. These codes exempt redevelopments and infill areas from infiltration; therefore, infiltration facilities have not been provided. Soils in the area are typically clays and provide another reason for being exempt.

Appendix A - Soil Data

USGS Web Soil Survey

Map Scale: 1:762 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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 16, Jun 8, 2020

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

Date(s) aerial images were photographed: Aug 1, 2019—Oct 20, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KeA	Kane silt loam, 1 to 3 percent slopes	0.1	5.6%
WhA	Warsaw silt loam, 0 to 2 percent slopes	1.6	94.4%
Totals for Area of Interest		**1.7**	**100.0%**

Milwaukee and Waukesha Counties, Wisconsin

KeA—Kane silt loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: g94g
Elevation: 670 to 1,100 feet
Mean annual precipitation: 28 to 36 inches
Mean annual air temperature: 37 to 55 degrees F
Frost-free period: 135 to 170 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Kane and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kane

Setting

Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over loamy outwash over stratified, calcareous sandy and gravelly outwash

Typical profile

Ap,A,AB - 0 to 14 inches: silt loam
BA,2Bt,2BC - 14 to 36 inches: silty clay loam
3C - 36 to 60 inches: Error

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: None
Frequency of ponding: Rare
Calcium carbonate, maximum content: 40 percent
Available water capacity: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Forage suitability group: High AWC, high water table (G095BY007WI)

Other vegetative classification: High AWC, high water table (G095BY007WI)
Hydric soil rating: No

Minor Components

Sebewa
Percent of map unit: 7 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Warsaw
Percent of map unit: 3 percent
Landform: Rises
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Milwaukee and Waukesha Counties, Wisconsin
Survey Area Data: Version 16, Jun 8, 2020

Milwaukee and Waukesha Counties, Wisconsin

WhA—Warsaw silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2tjx6
Elevation: 750 to 980 feet
Mean annual precipitation: 33 to 37 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 138 to 193 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Warsaw and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Warsaw

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy glaciofluvial deposits over calcareous sandy and gravelly outwash

Typical profile

Ap - 0 to 14 inches: silt loam
Bt1 - 14 to 31 inches: sandy clay loam
2Bt2 - 31 to 36 inches: gravelly sandy clay loam
2C - 36 to 79 inches: stratified sand to gravel

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 35 to 40 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 60 to 79 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: B
Forage suitability group: Mod AWC, adequately drained (G095BY005WI)
Other vegetative classification: Mod AWC, adequately drained (G095BY005WI)
Hydric soil rating: No

Minor Components

Kane

Percent of map unit: 10 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

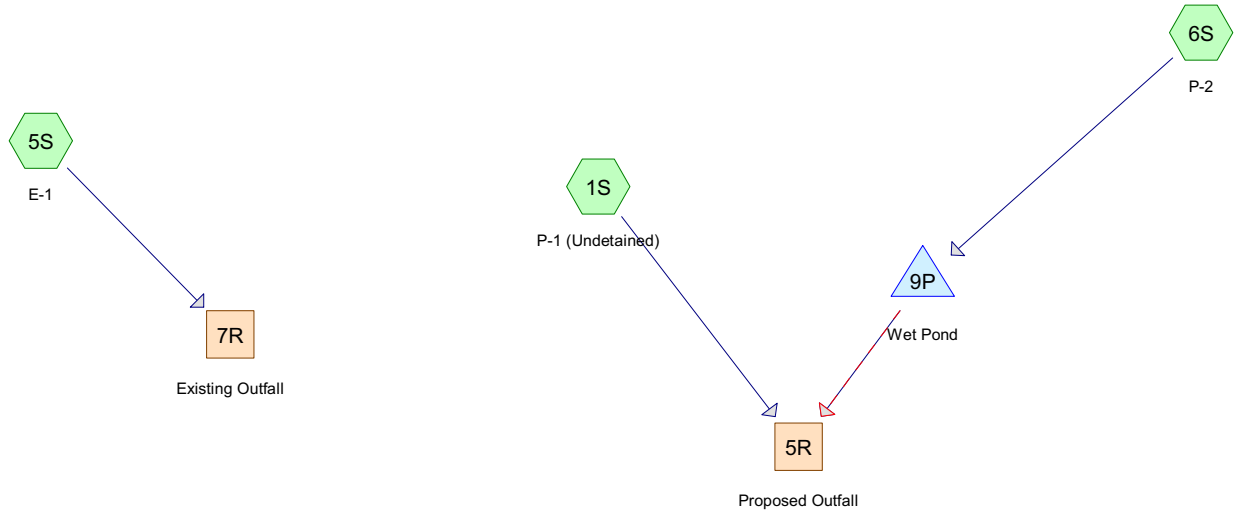
Data Source Information

Soil Survey Area: Milwaukee and Waukesha Counties, Wisconsin
Survey Area Data: Version 16, Jun 8, 2020

Appendix B

Storm Water Quantity Calculations

- HydroCAD Results



Subcat Reach Pond Link

Routing Diagram for 138-005-003_Hydrology
Prepared by Endpoint Solutions, Printed 9/25/2020

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.487	61	>75% Grass cover, Good, HSG B (1S, 6S)
0.175	74	>75% Grass cover, Good, HSG C (1S, 6S)
1.548	98	Paved parking, HSG C (6S)
0.203	98	Water Surface, HSG D (6S)
2.043	61	Woods/grass comb., Fair, HSG B (5S)
0.370	71	Woods/grass comb., Fair, HSG C (5S)
4.825	**76**	**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: P-1 (Undetained) Runoff Area=1,753 sf 0.00% Impervious Runoff Depth=0.41"
Tc=6.0 min CN=WQ Runoff=0.03 cfs 0.001 af

Subcatchment 5S: E-1 Runoff Area=105,100 sf 0.00% Impervious Runoff Depth=0.21"
Flow Length=645' Tc=30.5 min CN=WQ Runoff=0.25 cfs 0.042 af

Subcatchment 6S: P-2 Runoff Area=103,330 sf 73.81% Impervious Runoff Depth=1.67"
Tc=6.0 min CN=WQ Runoff=6.10 cfs 0.330 af

Reach 5R: Proposed Outfall Inflow=0.23 cfs 0.320 af
Outflow=0.23 cfs 0.320 af

Reach 7R: Existing Outfall Inflow=0.25 cfs 0.042 af
Outflow=0.25 cfs 0.042 af

Pond 9P: Wet Pond Peak Elev=17.03' Storage=10,039 cf Inflow=6.10 cfs 0.330 af
Primary=0.23 cfs 0.318 af Secondary=0.00 cfs 0.000 af Outflow=0.23 cfs 0.318 af

Total Runoff Area = 4.825 ac Runoff Volume = 0.374 af Average Runoff Depth = 0.93"
63.71% Pervious = 3.074 ac 36.29% Impervious = 1.751 ac

Summary for Subcatchment 1S: P-1 (Undetained)

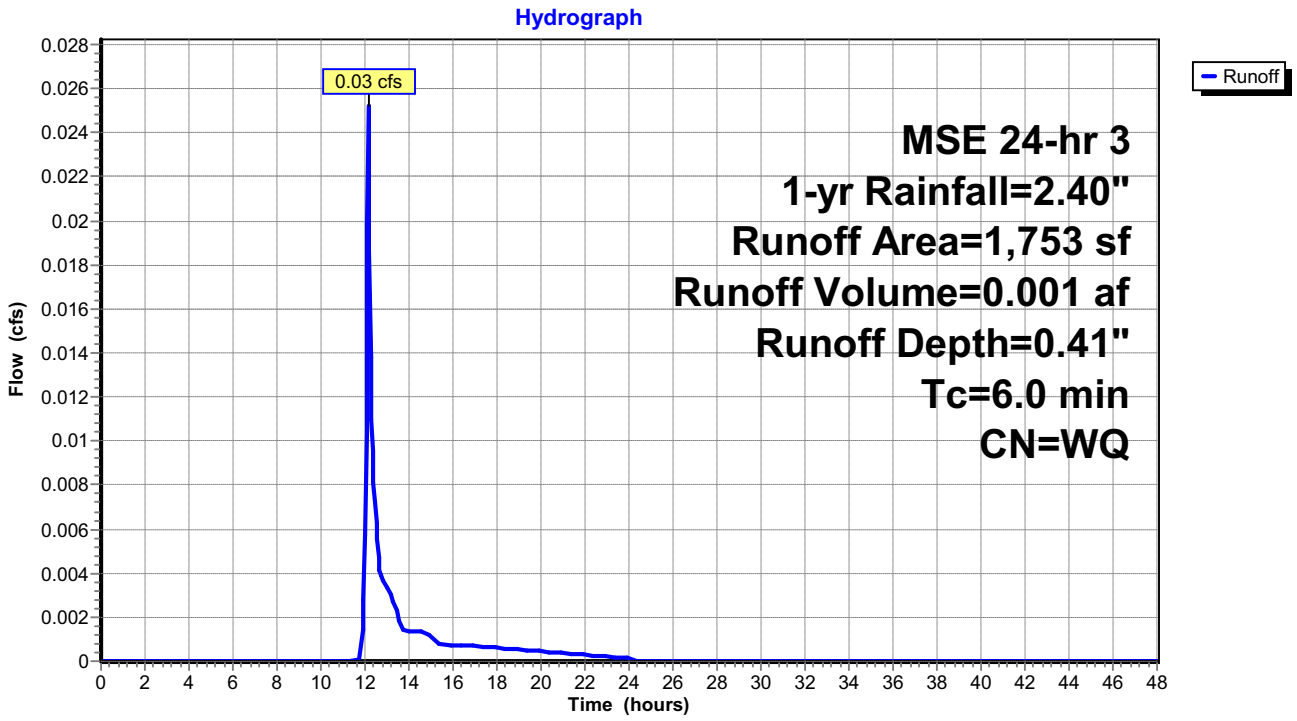
Runoff = 0.03 cfs @ 12.15 hrs, Volume= 0.001 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-yr Rainfall=2.40"

Area (sf)	CN	Description
627	61	>75% Grass cover, Good, HSG B
1,126	74	>75% Grass cover, Good, HSG C
1,753		Weighted Average
1,753		100.00% Pervious Area

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

Subcatchment 1S: P-1 (Undetained)



Summary for Subcatchment 5S: E-1

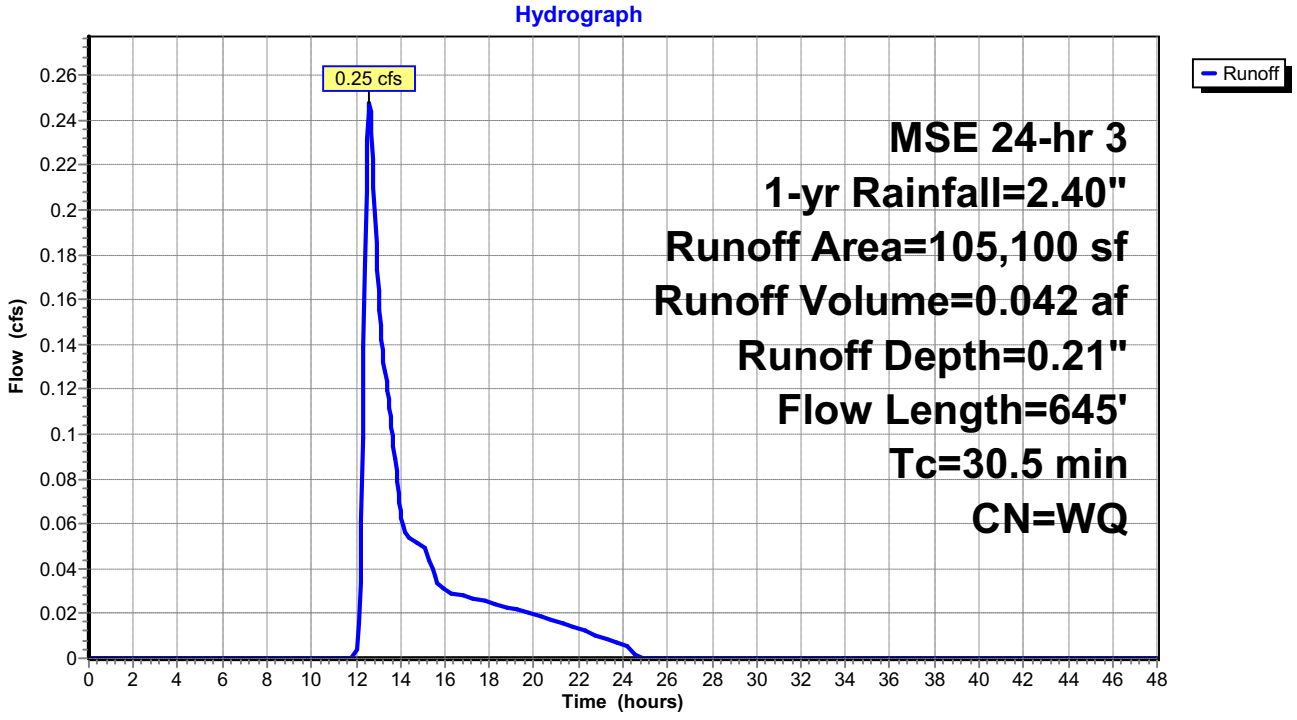
Runoff = 0.25 cfs @ 12.60 hrs, Volume= 0.042 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-yr Rainfall=2.40"

	Area (sf)	CN	Description
*	89,001	61	Woods/grass comb., Fair, HSG B
*	16,099	71	Woods/grass comb., Fair, HSG C
	105,100		Weighted Average
	105,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.1270	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
20.2	495	0.0067	0.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
30.5	645	Total			

Subcatchment 5S: E-1



Summary for Subcatchment 6S: P-2

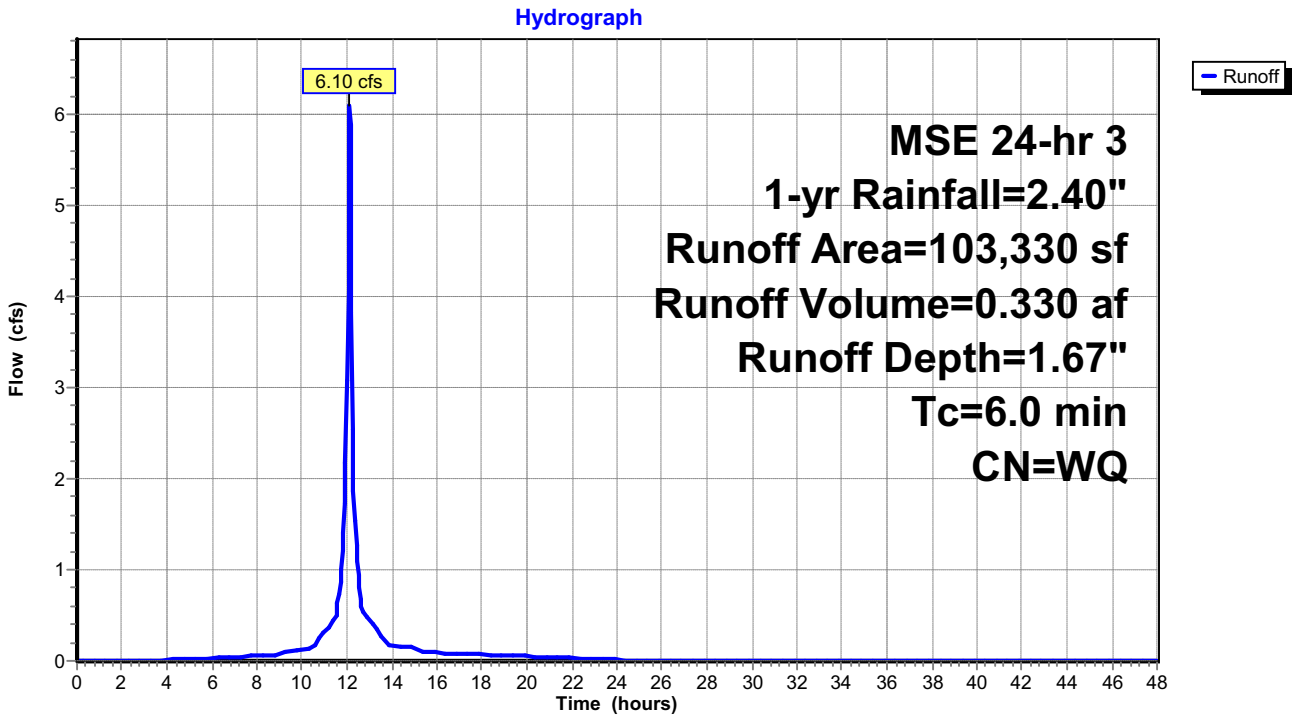
Runoff = 6.10 cfs @ 12.13 hrs, Volume= 0.330 af, Depth= 1.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-yr Rainfall=2.40"

Area (sf)	CN	Description
67,417	98	Paved parking, HSG C
20,584	61	>75% Grass cover, Good, HSG B
8,852	98	Water Surface, HSG D
6,477	74	>75% Grass cover, Good, HSG C
103,330		Weighted Average
27,061		26.19% Pervious Area
76,269		73.81% Impervious Area

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

Subcatchment 6S: P-2



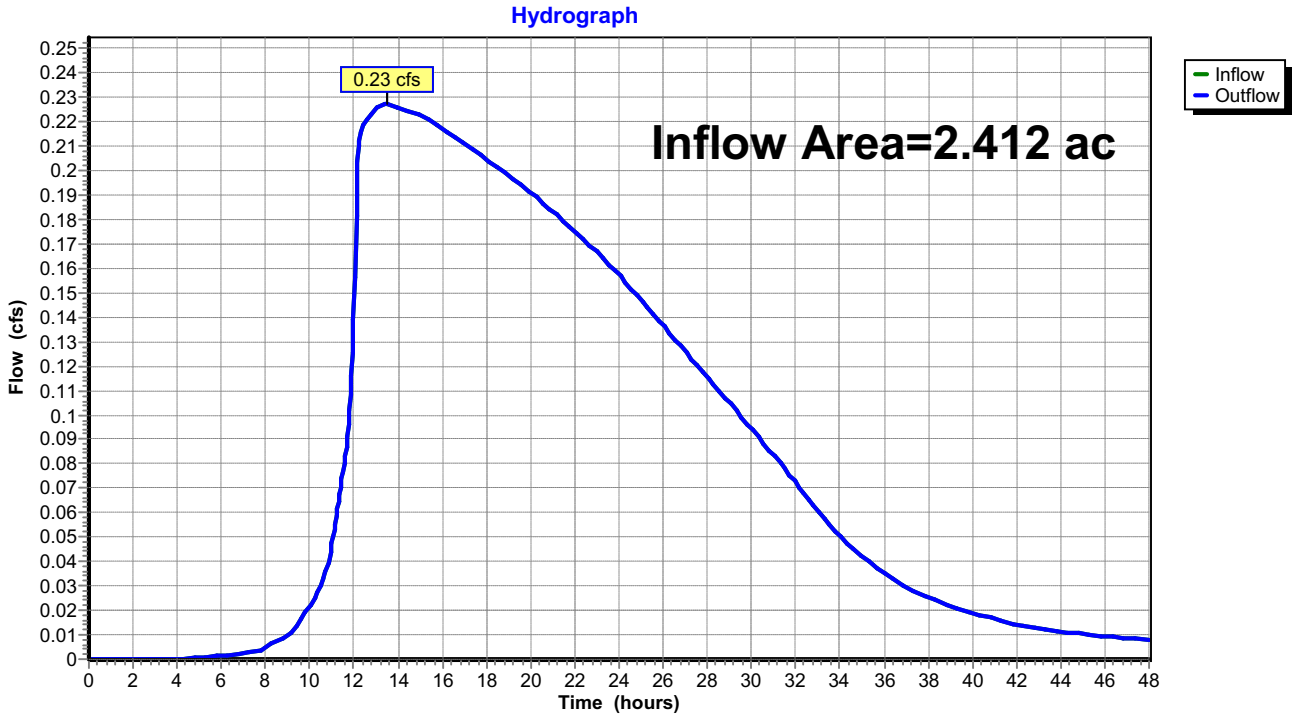
Summary for Reach 5R: Proposed Outfall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.412 ac, 72.58% Impervious, Inflow Depth > 1.59" for 1-yr event
Inflow = 0.23 cfs @ 13.47 hrs, Volume= 0.320 af
Outflow = 0.23 cfs @ 13.47 hrs, Volume= 0.320 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 5R: Proposed Outfall



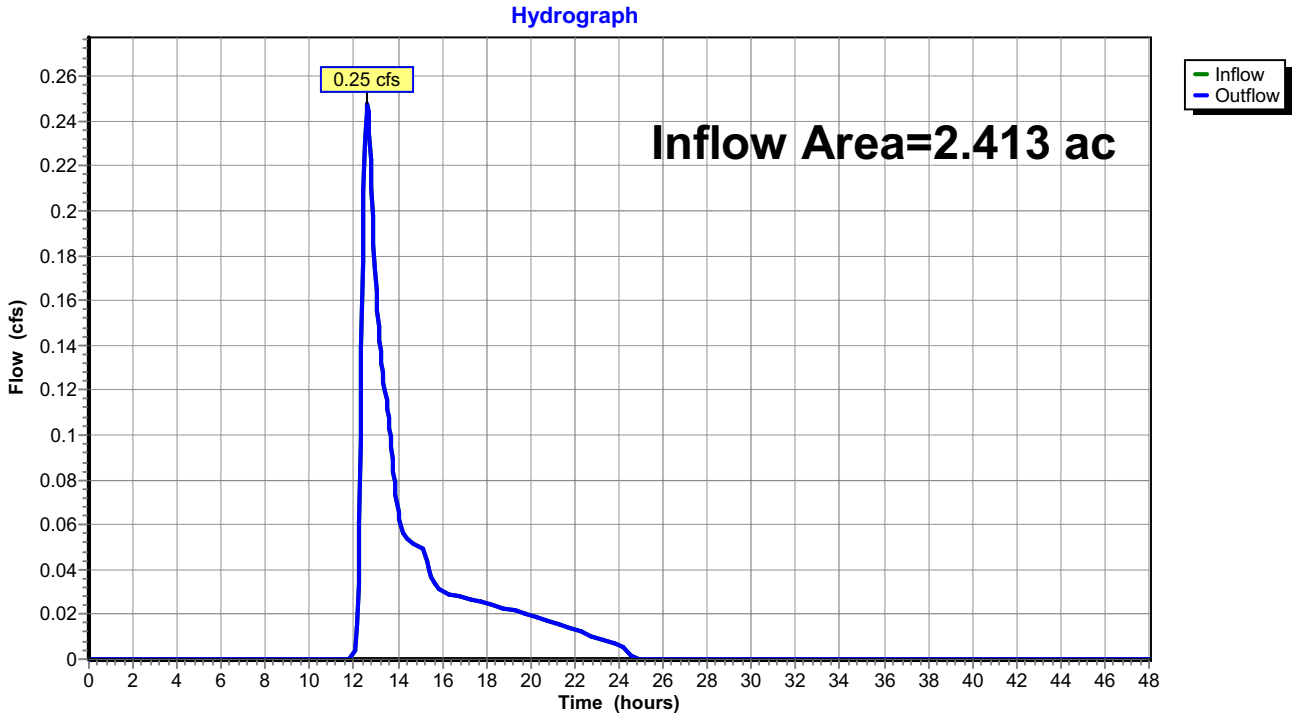
Summary for Reach 7R: Existing Outfall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.413 ac, 0.00% Impervious, Inflow Depth = 0.21" for 1-yr event
Inflow = 0.25 cfs @ 12.60 hrs, Volume= 0.042 af
Outflow = 0.25 cfs @ 12.60 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 7R: Existing Outfall



Summary for Pond 9P: Wet Pond

Inflow Area = 2.372 ac, 73.81% Impervious, Inflow Depth = 1.67" for 1-yr event
Inflow = 6.10 cfs @ 12.13 hrs, Volume= 0.330 af
Outflow = 0.23 cfs @ 13.59 hrs, Volume= 0.318 af, Atten= 96%, Lag= 87.5 min
Primary = 0.23 cfs @ 13.59 hrs, Volume= 0.318 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 17.03' @ 13.59 hrs Surf.Area= 10,595 sf Storage= 10,039 cf

Plug-Flow detention time= 566.7 min calculated for 0.318 af (96% of inflow)
Center-of-Mass det. time= 548.4 min (1,310.1 - 761.7)

Volume	Invert	Avail.Storage	Storage Description
#1	16.00'	49,291 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

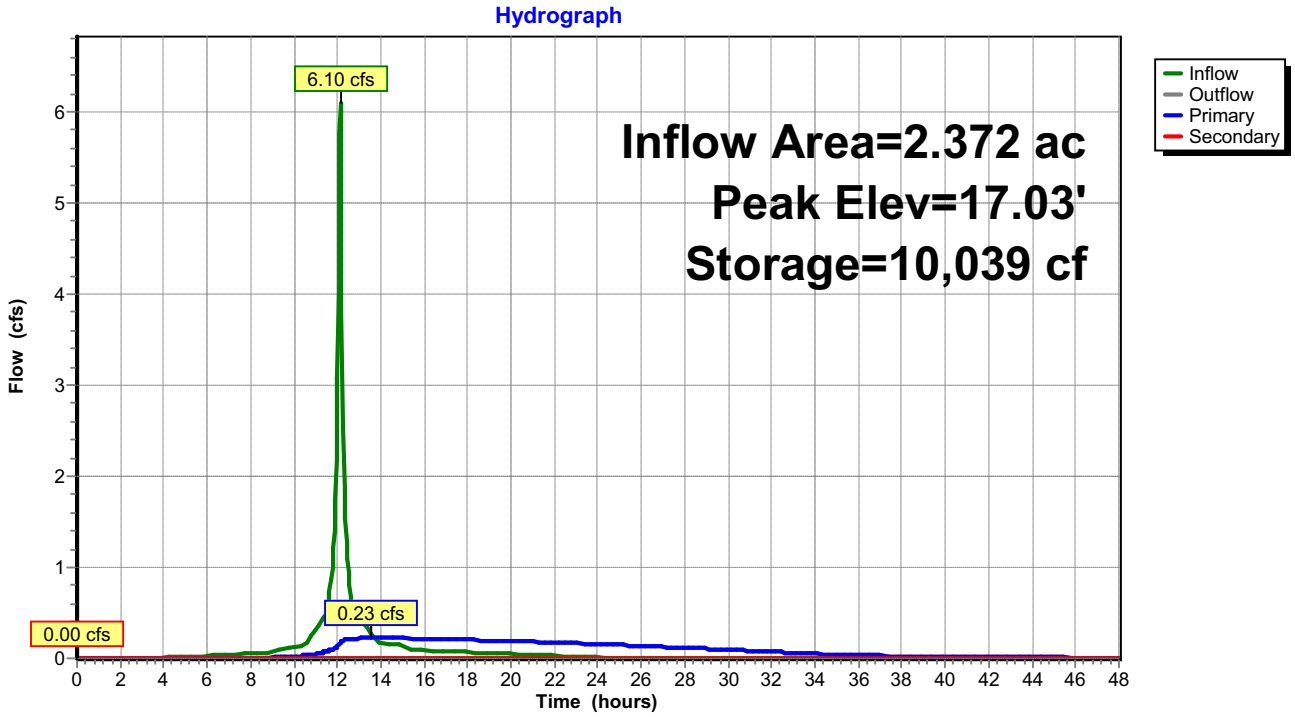
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
16.00	8,852	0	0
17.00	10,538	9,695	9,695
18.00	12,280	11,409	21,104
19.00	14,079	13,180	34,284
20.00	15,935	15,007	49,291

Device	Routing	Invert	Outlet Devices
#1	Primary	16.00'	**12.0" Round Culvert** L= 61.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 16.00' / 15.70' S= 0.0049 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 0.79 sf
#2	Device 1	16.00'	**3.0" Vert. Orifice** C= 0.600
#3	Device 1	17.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	19.20'	**20.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.23 cfs @ 13.59 hrs HW=17.03' (Free Discharge)
└**1=Culvert** (Passes 0.23 cfs of 1.98 cfs potential flow)
  └**2=Orifice** (Orifice Controls 0.23 cfs @ 4.59 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=16.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 9P: Wet Pond



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: P-1 (Undetained) Runoff Area=1,753 sf 0.00% Impervious Runoff Depth=0.56"
Tc=6.0 min CN=WQ Runoff=0.04 cfs 0.002 af

Subcatchment 5S: E-1 Runoff Area=105,100 sf 0.00% Impervious Runoff Depth=0.31"
Flow Length=645' Tc=30.5 min CN=WQ Runoff=0.43 cfs 0.062 af

Subcatchment 6S: P-2 Runoff Area=103,330 sf 73.81% Impervious Runoff Depth=1.92"
Tc=6.0 min CN=WQ Runoff=6.99 cfs 0.379 af

Reach 5R: Proposed Outfall Inflow=0.25 cfs 0.368 af
Outflow=0.25 cfs 0.368 af

Reach 7R: Existing Outfall Inflow=0.43 cfs 0.062 af
Outflow=0.43 cfs 0.062 af

Pond 9P: Wet Pond Peak Elev=17.18' Storage=11,588 cf Inflow=6.99 cfs 0.379 af
Primary=0.24 cfs 0.366 af Secondary=0.00 cfs 0.000 af Outflow=0.24 cfs 0.366 af

Total Runoff Area = 4.825 ac Runoff Volume = 0.444 af Average Runoff Depth = 1.10"
63.71% Pervious = 3.074 ac 36.29% Impervious = 1.751 ac

Summary for Subcatchment 1S: P-1 (Undetained)

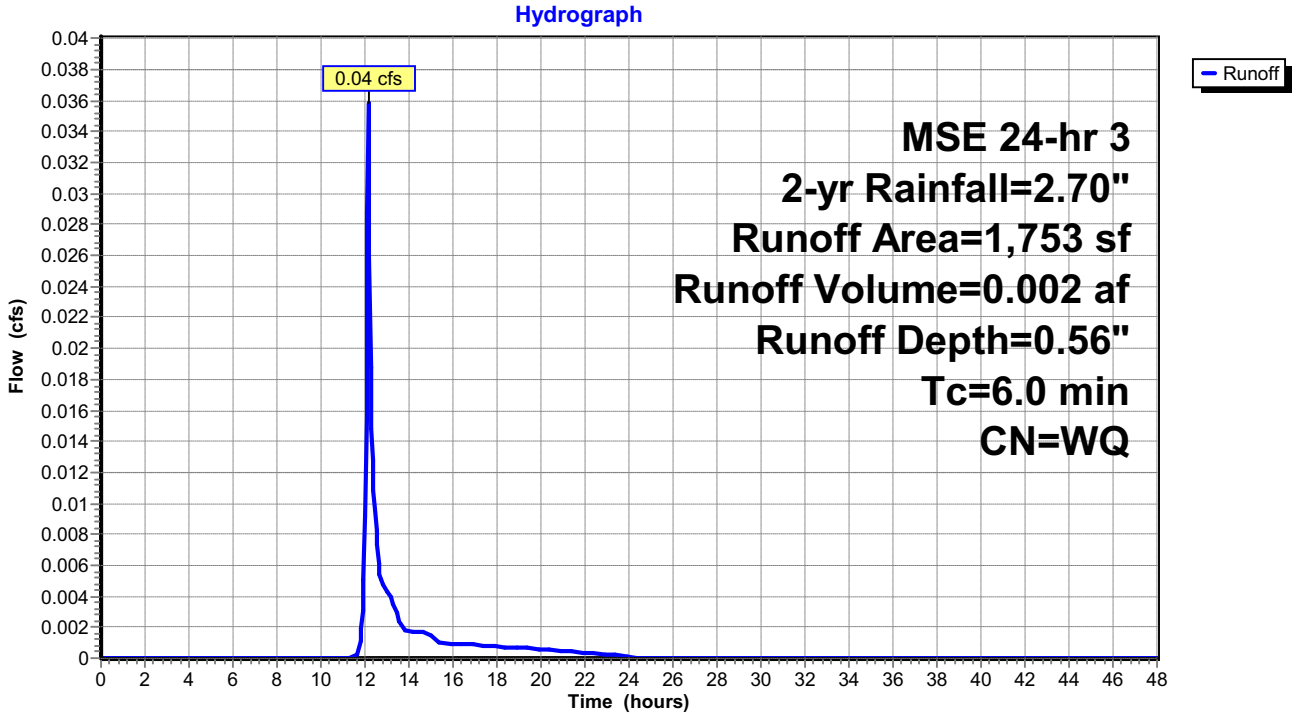
Runoff = 0.04 cfs @ 12.15 hrs, Volume= 0.002 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-yr Rainfall=2.70"

Area (sf)	CN	Description
627	61	>75% Grass cover, Good, HSG B
1,126	74	>75% Grass cover, Good, HSG C
1,753		Weighted Average
1,753		100.00% Pervious Area

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

Subcatchment 1S: P-1 (Undetained)



Summary for Subcatchment 5S: E-1

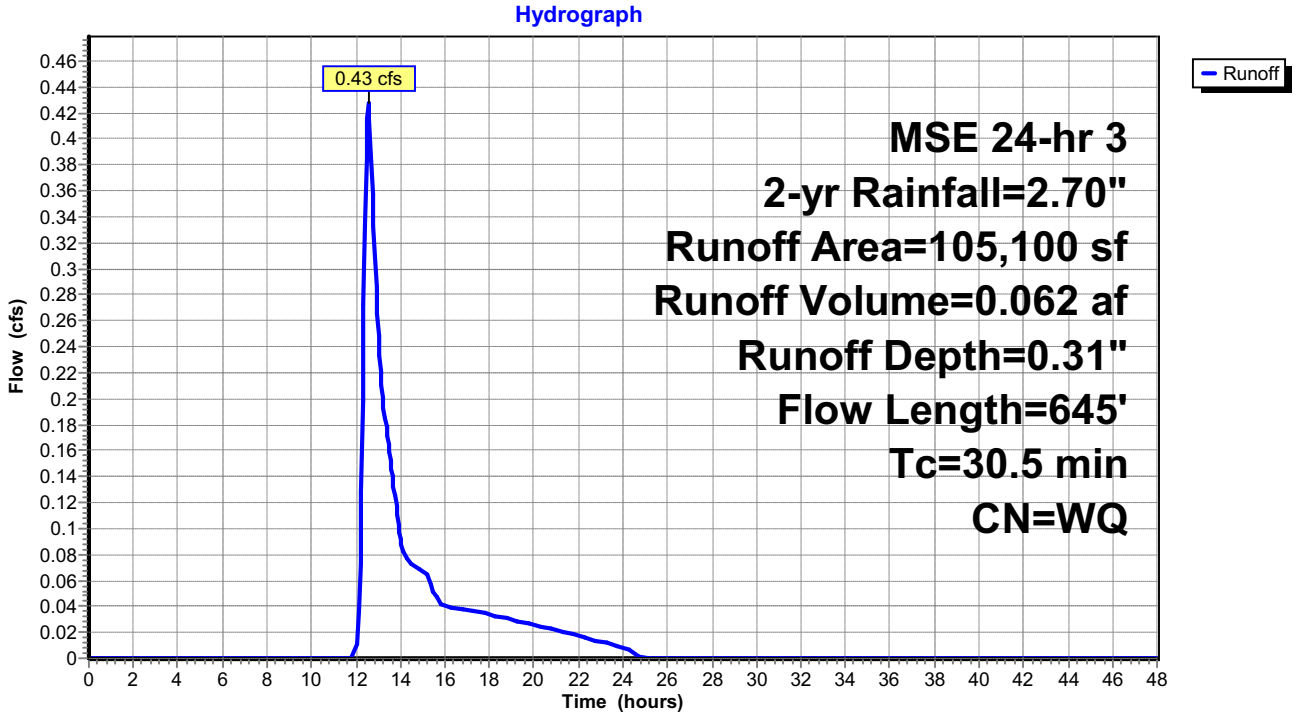
Runoff = 0.43 cfs @ 12.56 hrs, Volume= 0.062 af, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-yr Rainfall=2.70"

	Area (sf)	CN	Description
*	89,001	61	Woods/grass comb., Fair, HSG B
*	16,099	71	Woods/grass comb., Fair, HSG C
	105,100		Weighted Average
	105,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.1270	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
20.2	495	0.0067	0.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
30.5	645	Total			

Subcatchment 5S: E-1



Summary for Subcatchment 6S: P-2

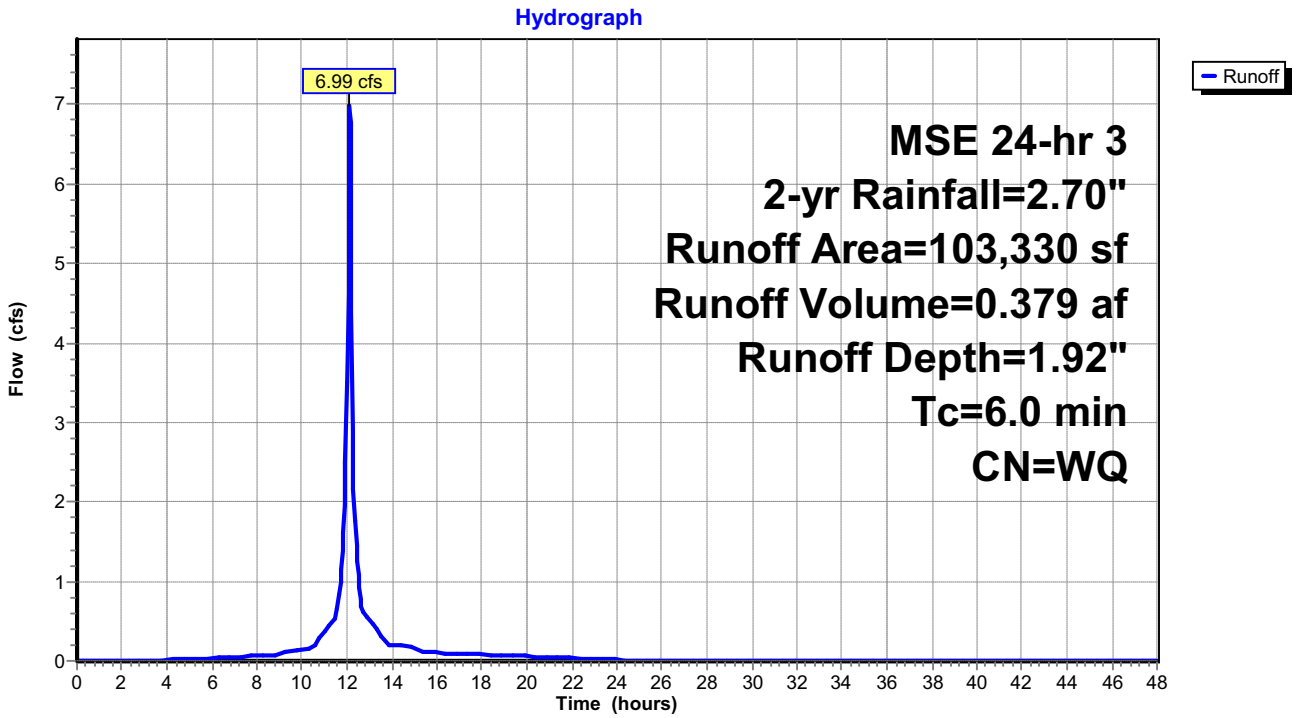
Runoff = 6.99 cfs @ 12.13 hrs, Volume= 0.379 af, Depth= 1.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-yr Rainfall=2.70"

Area (sf)	CN	Description
67,417	98	Paved parking, HSG C
20,584	61	>75% Grass cover, Good, HSG B
8,852	98	Water Surface, HSG D
6,477	74	>75% Grass cover, Good, HSG C
103,330		Weighted Average
27,061		26.19% Pervious Area
76,269		73.81% Impervious Area

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

Subcatchment 6S: P-2



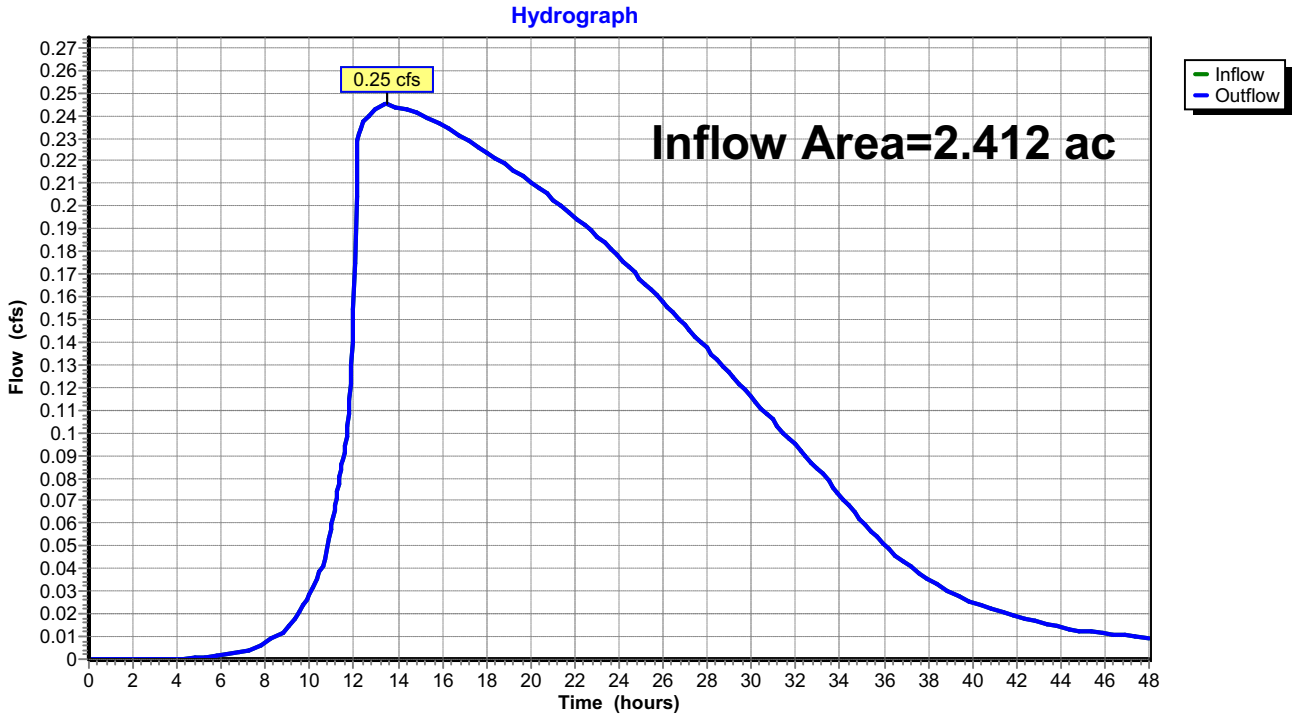
Summary for Reach 5R: Proposed Outfall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.412 ac, 72.58% Impervious, Inflow Depth > 1.83" for 2-yr event
Inflow = 0.25 cfs @ 13.46 hrs, Volume= 0.368 af
Outflow = 0.25 cfs @ 13.46 hrs, Volume= 0.368 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 5R: Proposed Outfall



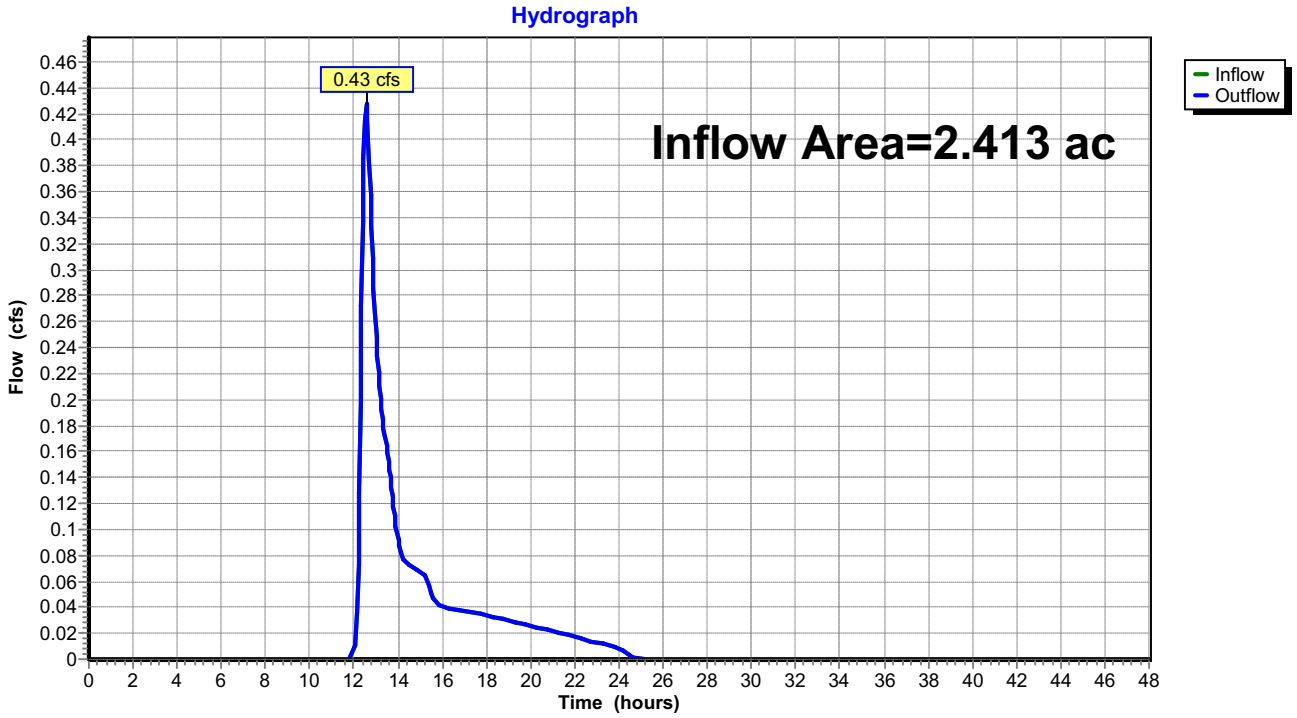
Summary for Reach 7R: Existing Outfall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.413 ac, 0.00% Impervious, Inflow Depth = 0.31" for 2-yr event
Inflow = 0.43 cfs @ 12.56 hrs, Volume= 0.062 af
Outflow = 0.43 cfs @ 12.56 hrs, Volume= 0.062 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 7R: Existing Outfall



Summary for Pond 9P: Wet Pond

Inflow Area = 2.372 ac, 73.81% Impervious, Inflow Depth = 1.92" for 2-yr event
Inflow = 6.99 cfs @ 12.13 hrs, Volume= 0.379 af
Outflow = 0.24 cfs @ 13.61 hrs, Volume= 0.366 af, Atten= 97%, Lag= 88.7 min
Primary = 0.24 cfs @ 13.61 hrs, Volume= 0.366 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 17.18' @ 13.61 hrs Surf.Area= 10,846 sf Storage= 11,588 cf

Plug-Flow detention time= 597.1 min calculated for 0.366 af (97% of inflow)
Center-of-Mass det. time= 578.0 min (1,338.3 - 760.3)

Volume	Invert	Avail.Storage	Storage Description
#1	16.00'	49,291 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

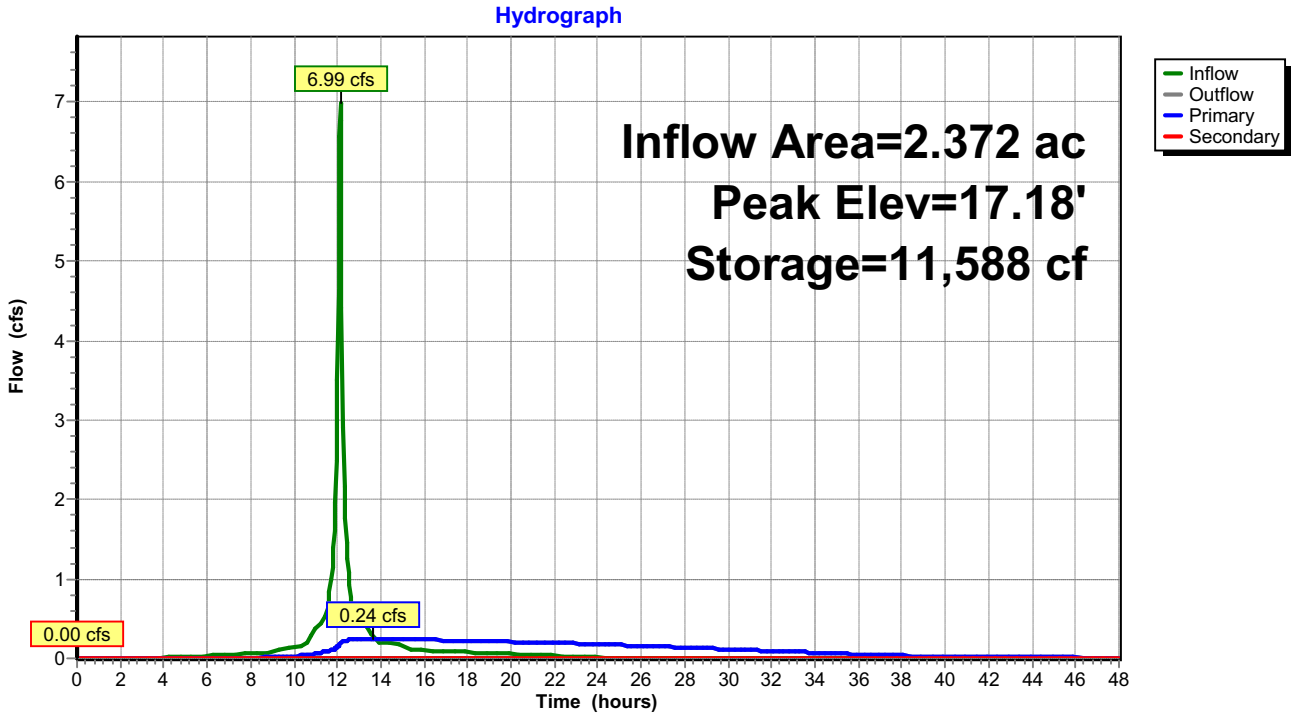
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
16.00	8,852	0	0
17.00	10,538	9,695	9,695
18.00	12,280	11,409	21,104
19.00	14,079	13,180	34,284
20.00	15,935	15,007	49,291

Device	Routing	Invert	Outlet Devices
#1	Primary	16.00'	**12.0" Round Culvert** L= 61.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 16.00' / 15.70' S= 0.0049 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 0.79 sf
#2	Device 1	16.00'	**3.0" Vert. Orifice** C= 0.600
#3	Device 1	17.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	19.20'	**20.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.24 cfs @ 13.61 hrs HW=17.18' (Free Discharge)
└**1=Culvert** (Passes 0.24 cfs of 2.29 cfs potential flow)
└**2=Orifice** (Orifice Controls 0.24 cfs @ 4.94 fps)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=16.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 9P: Wet Pond



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: P-1 (Undetained) Runoff Area=1,753 sf 0.00% Impervious Runoff Depth=1.19"
Tc=6.0 min CN=WQ Runoff=0.08 cfs 0.004 af

Subcatchment 5S: E-1 Runoff Area=105,100 sf 0.00% Impervious Runoff Depth=0.80"
Flow Length=645' Tc=30.5 min CN=WQ Runoff=1.44 cfs 0.161 af

Subcatchment 6S: P-2 Runoff Area=103,330 sf 73.81% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=WQ Runoff=10.44 cfs 0.568 af

Reach 5R: Proposed Outfall Inflow=0.81 cfs 0.554 af
Outflow=0.81 cfs 0.554 af

Reach 7R: Existing Outfall Inflow=1.44 cfs 0.161 af
Outflow=1.44 cfs 0.161 af

Pond 9P: Wet Pond Peak Elev=17.58' Storage=16,152 cf Inflow=10.44 cfs 0.568 af
Primary=0.80 cfs 0.550 af Secondary=0.00 cfs 0.000 af Outflow=0.80 cfs 0.550 af

Total Runoff Area = 4.825 ac Runoff Volume = 0.733 af Average Runoff Depth = 1.82"
63.71% Pervious = 3.074 ac 36.29% Impervious = 1.751 ac

Summary for Subcatchment 1S: P-1 (Undetained)

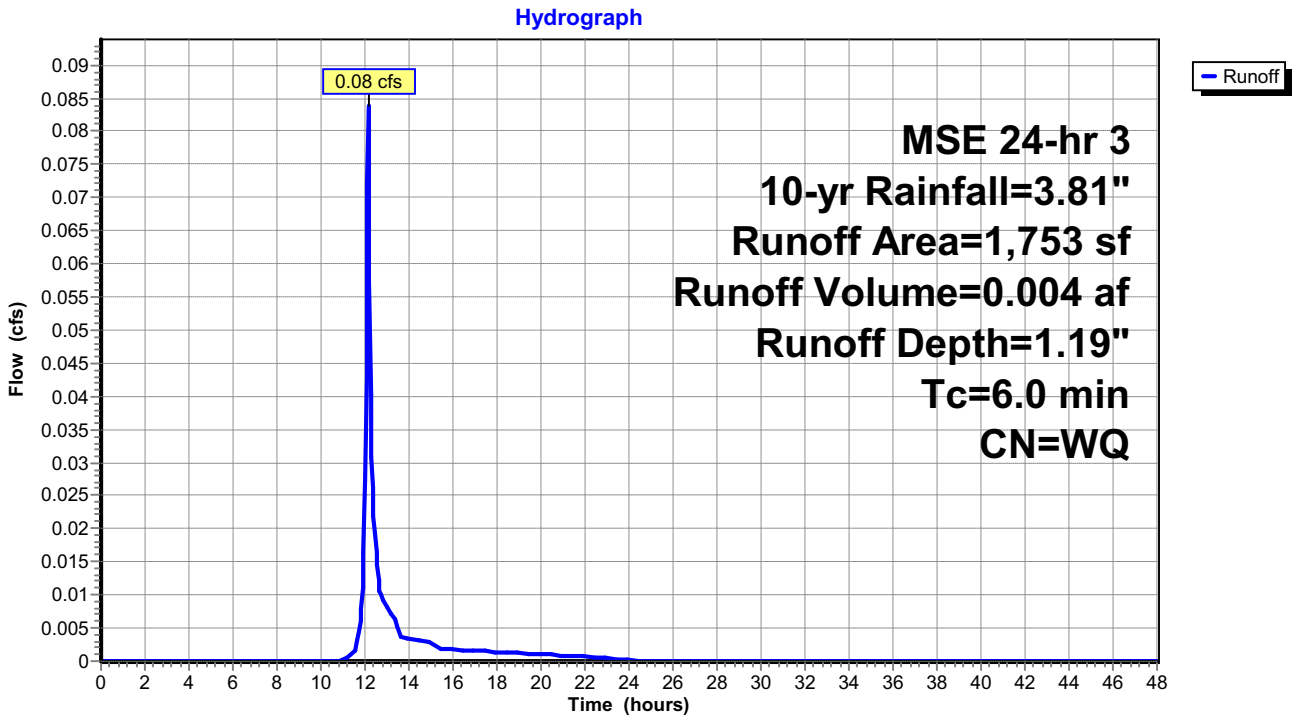
Runoff = 0.08 cfs @ 12.14 hrs, Volume= 0.004 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-yr Rainfall=3.81"

Area (sf)	CN	Description
627	61	>75% Grass cover, Good, HSG B
1,126	74	>75% Grass cover, Good, HSG C
1,753		Weighted Average
1,753		100.00% Pervious Area

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

Subcatchment 1S: P-1 (Undetained)



Summary for Subcatchment 5S: E-1

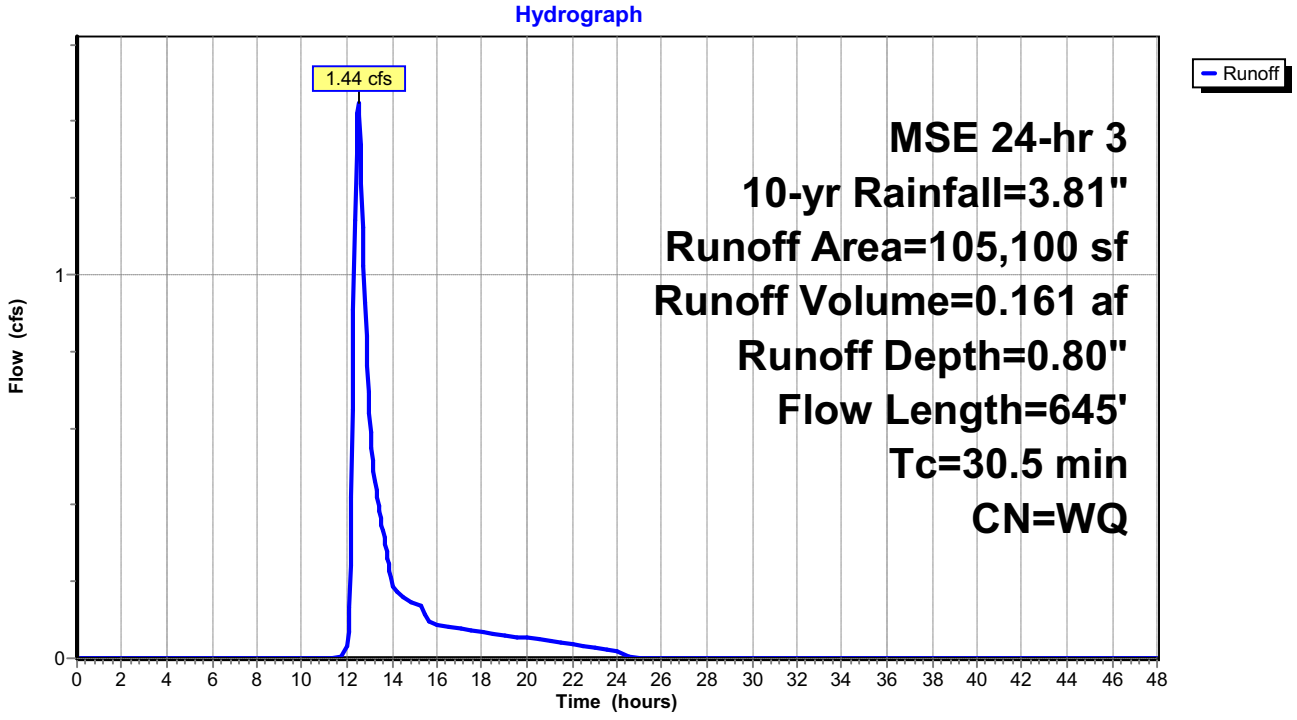
Runoff = 1.44 cfs @ 12.50 hrs, Volume= 0.161 af, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-yr Rainfall=3.81"

	Area (sf)	CN	Description
*	89,001	61	Woods/grass comb., Fair, HSG B
*	16,099	71	Woods/grass comb., Fair, HSG C
	105,100		Weighted Average
	105,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.1270	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
20.2	495	0.0067	0.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
30.5	645	Total			

Subcatchment 5S: E-1



Summary for Subcatchment 6S: P-2

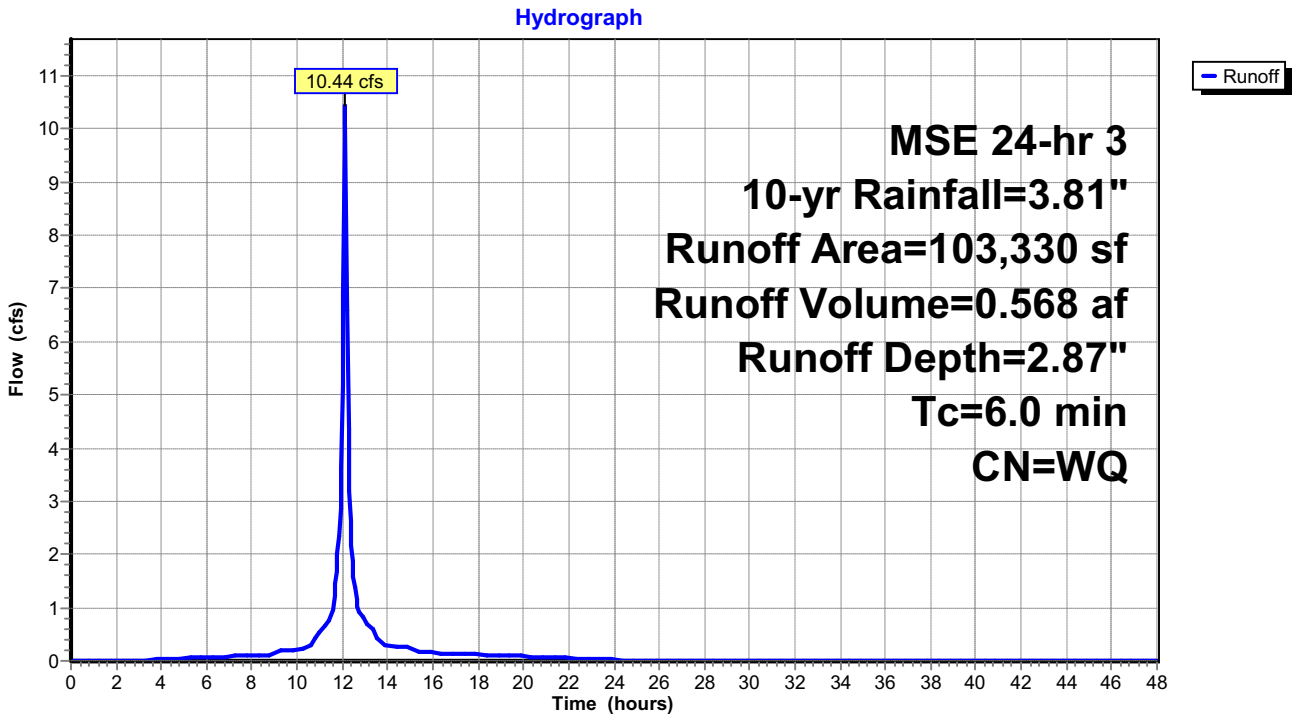
Runoff = 10.44 cfs @ 12.13 hrs, Volume= 0.568 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-yr Rainfall=3.81"

Area (sf)	CN	Description
67,417	98	Paved parking, HSG C
20,584	61	>75% Grass cover, Good, HSG B
8,852	98	Water Surface, HSG D
6,477	74	>75% Grass cover, Good, HSG C
103,330		Weighted Average
27,061		26.19% Pervious Area
76,269		73.81% Impervious Area

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

Subcatchment 6S: P-2



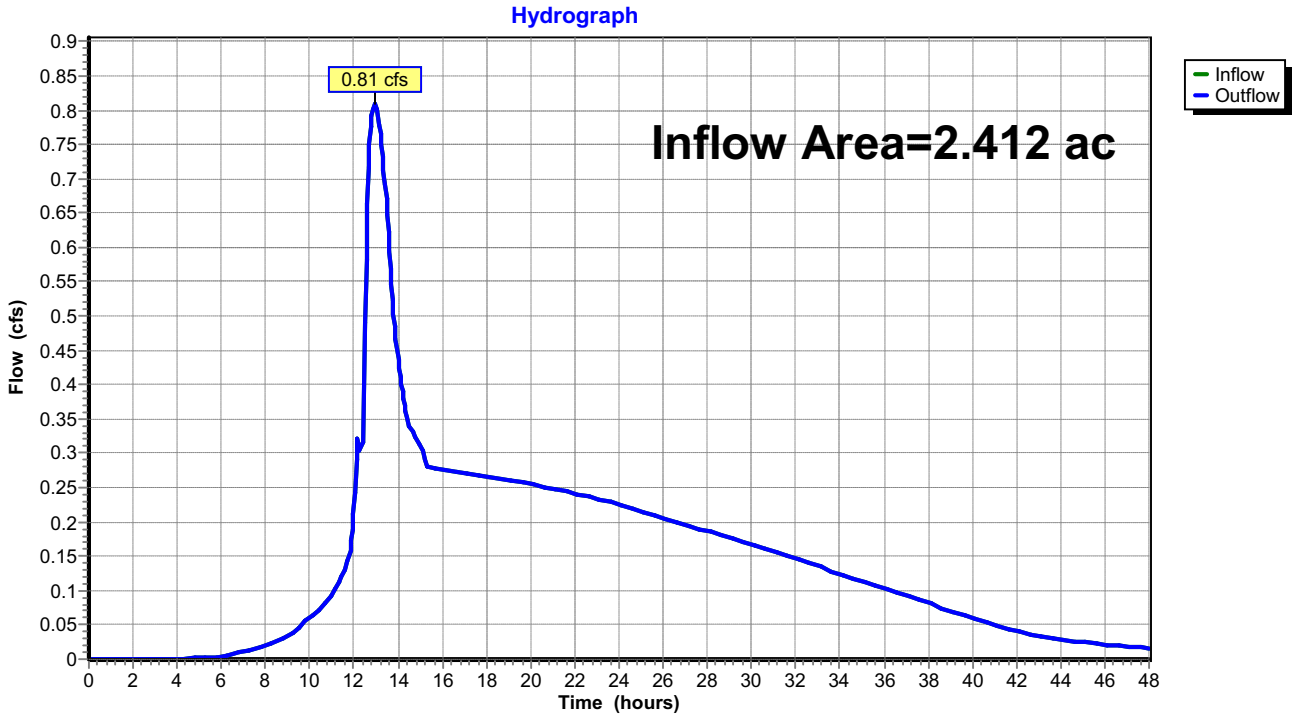
Summary for Reach 5R: Proposed Outfall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.412 ac, 72.58% Impervious, Inflow Depth > 2.76" for 10-yr event
Inflow = 0.81 cfs @ 12.94 hrs, Volume= 0.554 af
Outflow = 0.81 cfs @ 12.94 hrs, Volume= 0.554 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 5R: Proposed Outfall



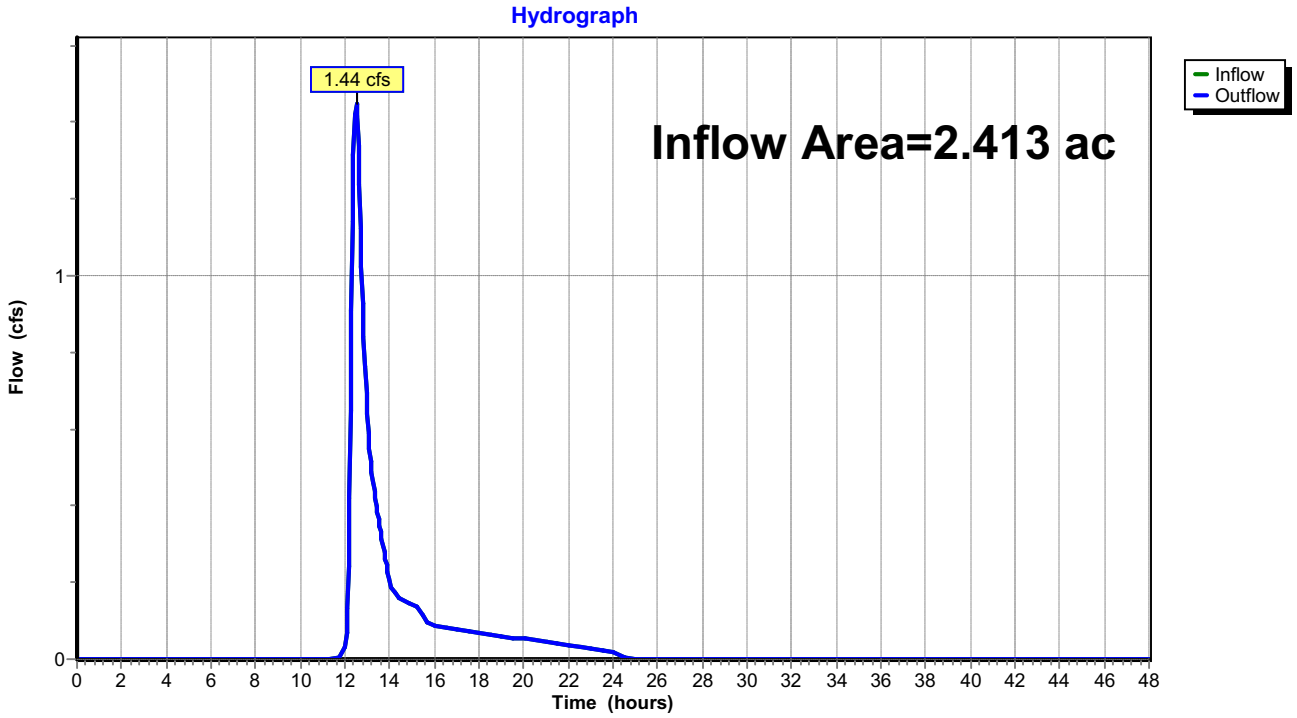
Summary for Reach 7R: Existing Outfall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.413 ac, 0.00% Impervious, Inflow Depth = 0.80" for 10-yr event
Inflow = 1.44 cfs @ 12.50 hrs, Volume= 0.161 af
Outflow = 1.44 cfs @ 12.50 hrs, Volume= 0.161 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 7R: Existing Outfall



Summary for Pond 9P: Wet Pond

Inflow Area = 2.372 ac, 73.81% Impervious, Inflow Depth = 2.87" for 10-yr event
Inflow = 10.44 cfs @ 12.13 hrs, Volume= 0.568 af
Outflow = 0.80 cfs @ 12.94 hrs, Volume= 0.550 af, Atten= 92%, Lag= 48.8 min
Primary = 0.80 cfs @ 12.94 hrs, Volume= 0.550 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 17.58' @ 12.94 hrs Surf.Area= 11,556 sf Storage= 16,152 cf

Plug-Flow detention time= 604.5 min calculated for 0.549 af (97% of inflow)
Center-of-Mass det. time= 587.9 min (1,344.4 - 756.6)

Volume	Invert	Avail.Storage	Storage Description
#1	16.00'	49,291 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

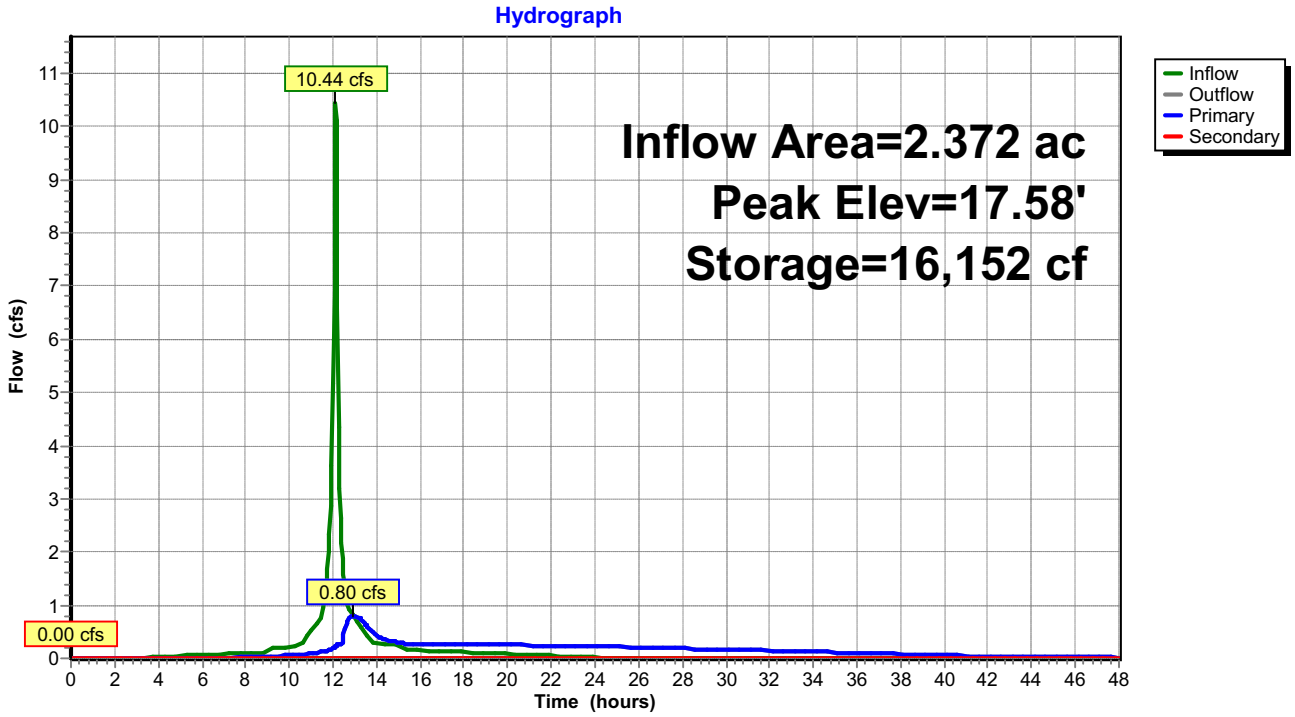
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
16.00	8,852	0	0
17.00	10,538	9,695	9,695
18.00	12,280	11,409	21,104
19.00	14,079	13,180	34,284
20.00	15,935	15,007	49,291

Device	Routing	Invert	Outlet Devices
#1	Primary	16.00'	**12.0" Round Culvert** L= 61.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 16.00' / 15.70' S= 0.0049 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 0.79 sf
#2	Device 1	16.00'	**3.0" Vert. Orifice** C= 0.600
#3	Device 1	17.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	19.20'	**20.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.79 cfs @ 12.94 hrs HW=17.58' (Free Discharge)
└**1=Culvert** (Passes 0.79 cfs of 2.80 cfs potential flow)
  └**2=Orifice** (Orifice Controls 0.29 cfs @ 5.82 fps)
  └**3=Orifice/Grate** (Weir Controls 0.50 cfs @ 0.95 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=16.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 9P: Wet Pond



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: P-1 (Undetained) Runoff Area=1,753 sf 0.00% Impervious Runoff Depth=2.90"
Tc=6.0 min CN=WQ Runoff=0.21 cfs 0.010 af

Subcatchment 5S: E-1 Runoff Area=105,100 sf 0.00% Impervious Runoff Depth=2.27"
Flow Length=645' Tc=30.5 min CN=WQ Runoff=4.68 cfs 0.456 af

Subcatchment 6S: P-2 Runoff Area=103,330 sf 73.81% Impervious Runoff Depth=5.02"
Tc=6.0 min CN=WQ Runoff=18.21 cfs 0.992 af

Reach 5R: Proposed Outfall Inflow=3.67 cfs 0.980 af
Outflow=3.67 cfs 0.980 af

Reach 7R: Existing Outfall Inflow=4.68 cfs 0.456 af
Outflow=4.68 cfs 0.456 af

Pond 9P: Wet Pond Peak Elev=18.18' Storage=23,362 cf Inflow=18.21 cfs 0.992 af
Primary=3.62 cfs 0.971 af Secondary=0.00 cfs 0.000 af Outflow=3.62 cfs 0.971 af

Total Runoff Area = 4.825 ac Runoff Volume = 1.458 af Average Runoff Depth = 3.63"
63.71% Pervious = 3.074 ac 36.29% Impervious = 1.751 ac

Summary for Subcatchment 1S: P-1 (Undetained)

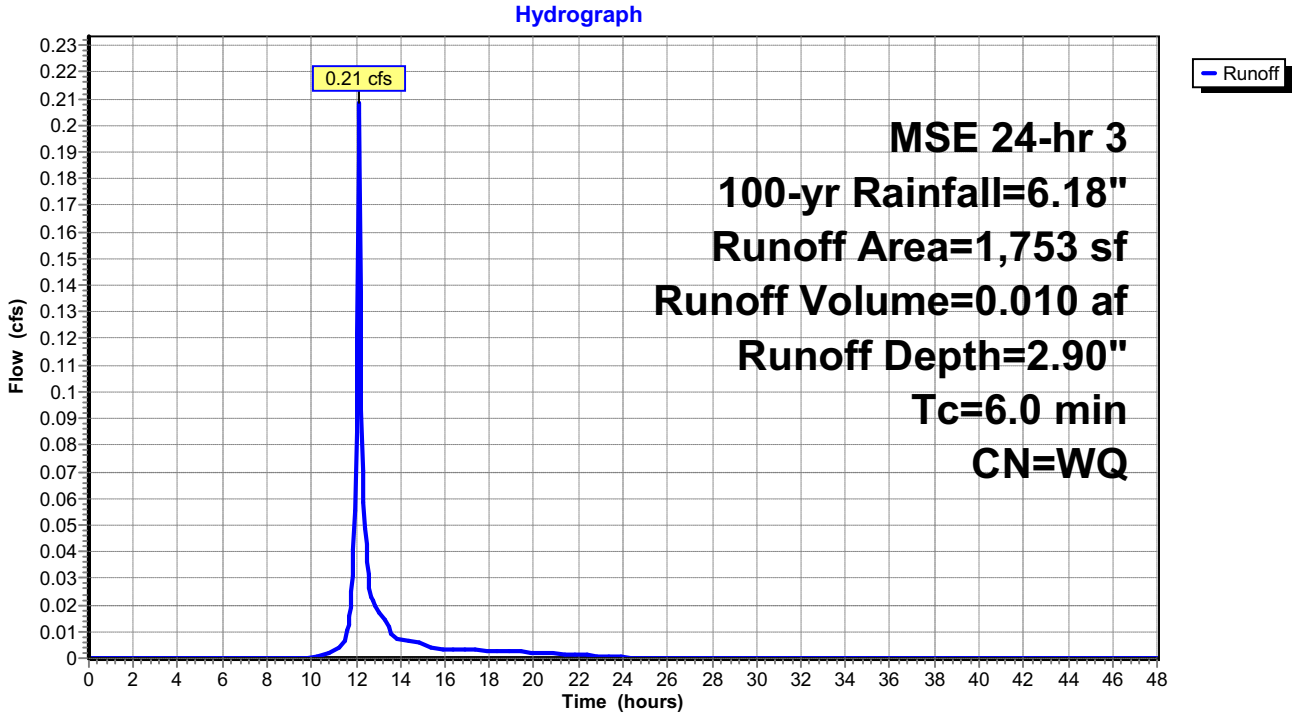
Runoff = 0.21 cfs @ 12.13 hrs, Volume= 0.010 af, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-yr Rainfall=6.18"

Area (sf)	CN	Description
627	61	>75% Grass cover, Good, HSG B
1,126	74	>75% Grass cover, Good, HSG C
1,753		Weighted Average
1,753		100.00% Pervious Area

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

Subcatchment 1S: P-1 (Undetained)



Summary for Subcatchment 5S: E-1

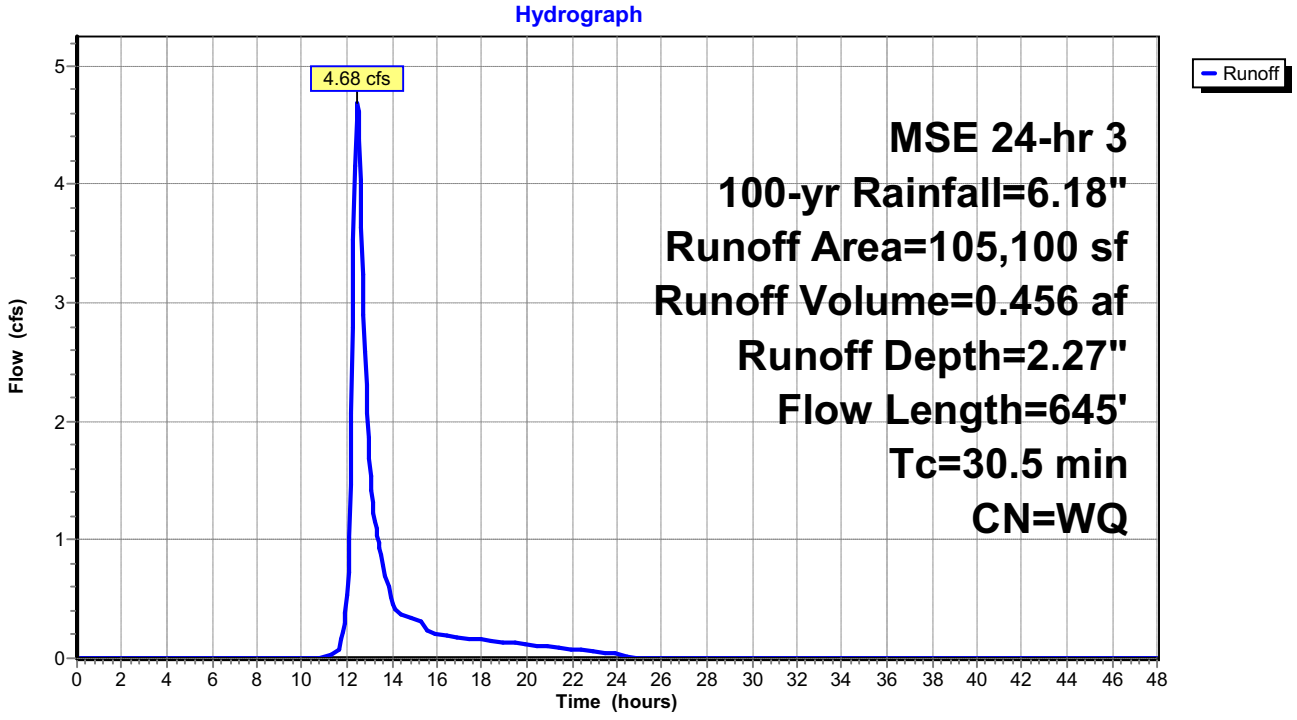
Runoff = 4.68 cfs @ 12.46 hrs, Volume= 0.456 af, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-yr Rainfall=6.18"

	Area (sf)	CN	Description
*	89,001	61	Woods/grass comb., Fair, HSG B
*	16,099	71	Woods/grass comb., Fair, HSG C
	105,100		Weighted Average
	105,100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.3	150	0.1270	0.24		**Sheet Flow,** Grass: Dense n= 0.240 P2= 2.70"
20.2	495	0.0067	0.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
30.5	645	Total			

Subcatchment 5S: E-1



Summary for Subcatchment 6S: P-2

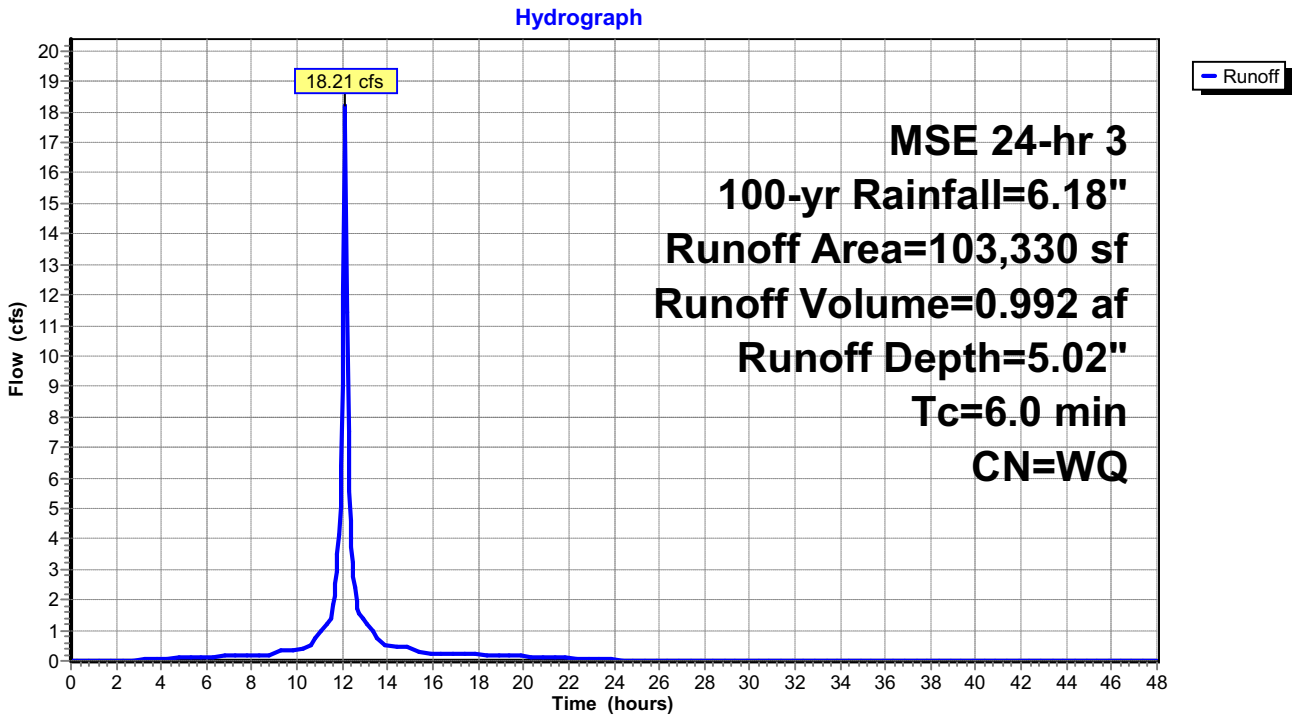
Runoff = 18.21 cfs @ 12.13 hrs, Volume= 0.992 af, Depth= 5.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 100-yr Rainfall=6.18"

Area (sf)	CN	Description
67,417	98	Paved parking, HSG C
20,584	61	>75% Grass cover, Good, HSG B
8,852	98	Water Surface, HSG D
6,477	74	>75% Grass cover, Good, HSG C
103,330		Weighted Average
27,061		26.19% Pervious Area
76,269		73.81% Impervious Area

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

Subcatchment 6S: P-2



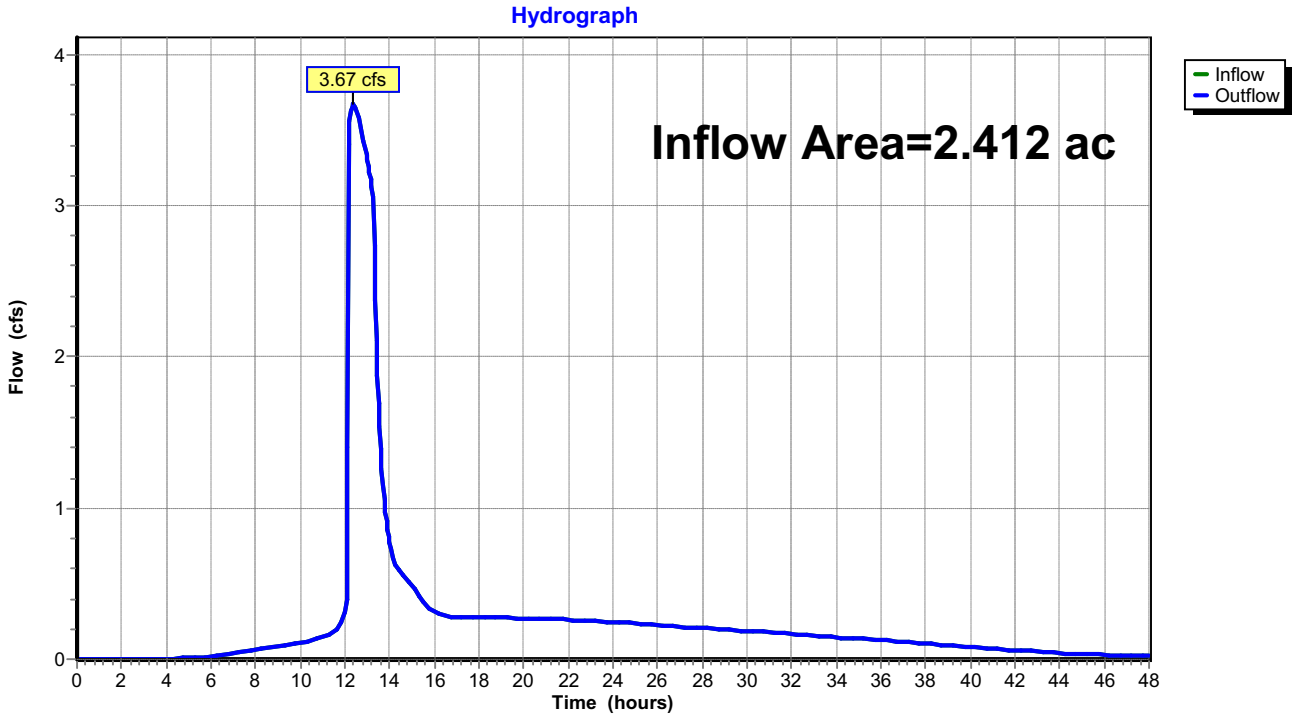
Summary for Reach 5R: Proposed Outfall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.412 ac, 72.58% Impervious, Inflow Depth > 4.88" for 100-yr event
Inflow = 3.67 cfs @ 12.37 hrs, Volume= 0.980 af
Outflow = 3.67 cfs @ 12.37 hrs, Volume= 0.980 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 5R: Proposed Outfall



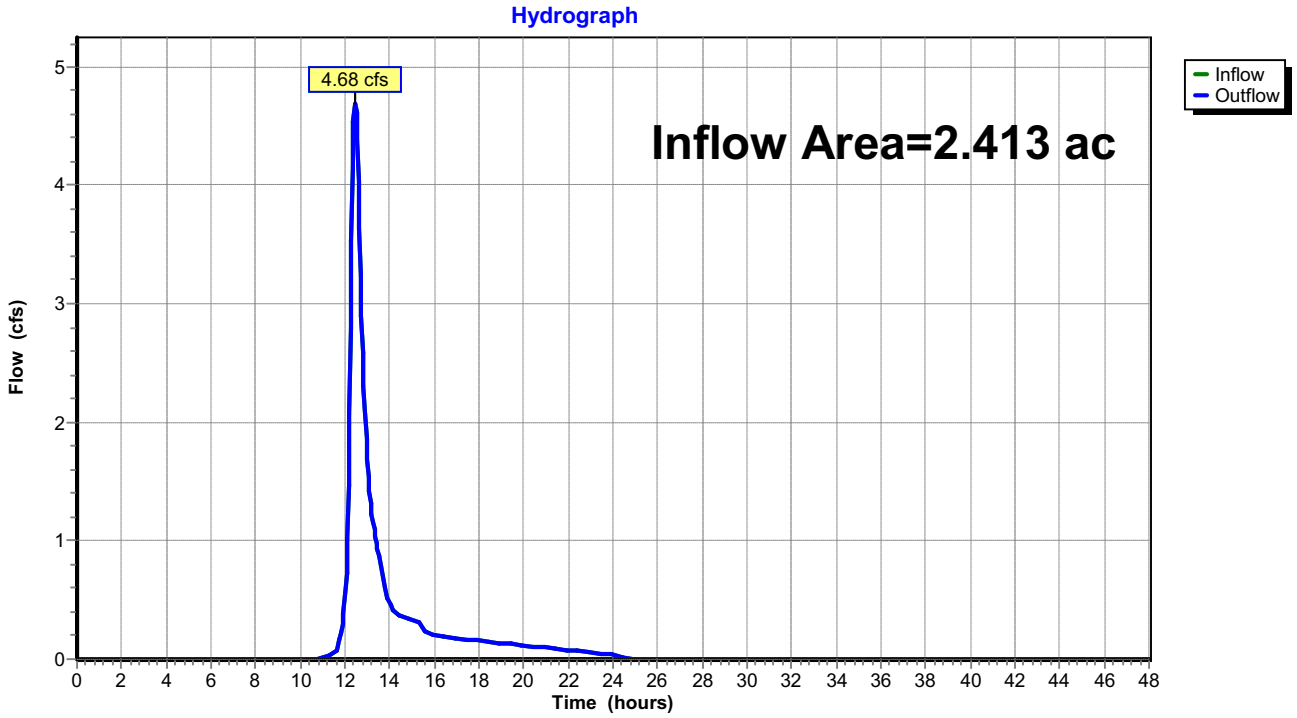
Summary for Reach 7R: Existing Outfall

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 2.413 ac, 0.00% Impervious, Inflow Depth = 2.27" for 100-yr event
Inflow = 4.68 cfs @ 12.46 hrs, Volume= 0.456 af
Outflow = 4.68 cfs @ 12.46 hrs, Volume= 0.456 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Reach 7R: Existing Outfall



Summary for Pond 9P: Wet Pond

Inflow Area = 2.372 ac, 73.81% Impervious, Inflow Depth = 5.02" for 100-yr event
Inflow = 18.21 cfs @ 12.13 hrs, Volume= 0.992 af
Outflow = 3.62 cfs @ 12.42 hrs, Volume= 0.971 af, Atten= 80%, Lag= 17.2 min
Primary = 3.62 cfs @ 12.42 hrs, Volume= 0.971 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 18.18' @ 12.42 hrs Surf.Area= 12,606 sf Storage= 23,362 cf

Plug-Flow detention time= 407.6 min calculated for 0.970 af (98% of inflow)
Center-of-Mass det. time= 396.2 min (1,148.2 - 752.1)

Volume	Invert	Avail.Storage	Storage Description
#1	16.00'	49,291 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

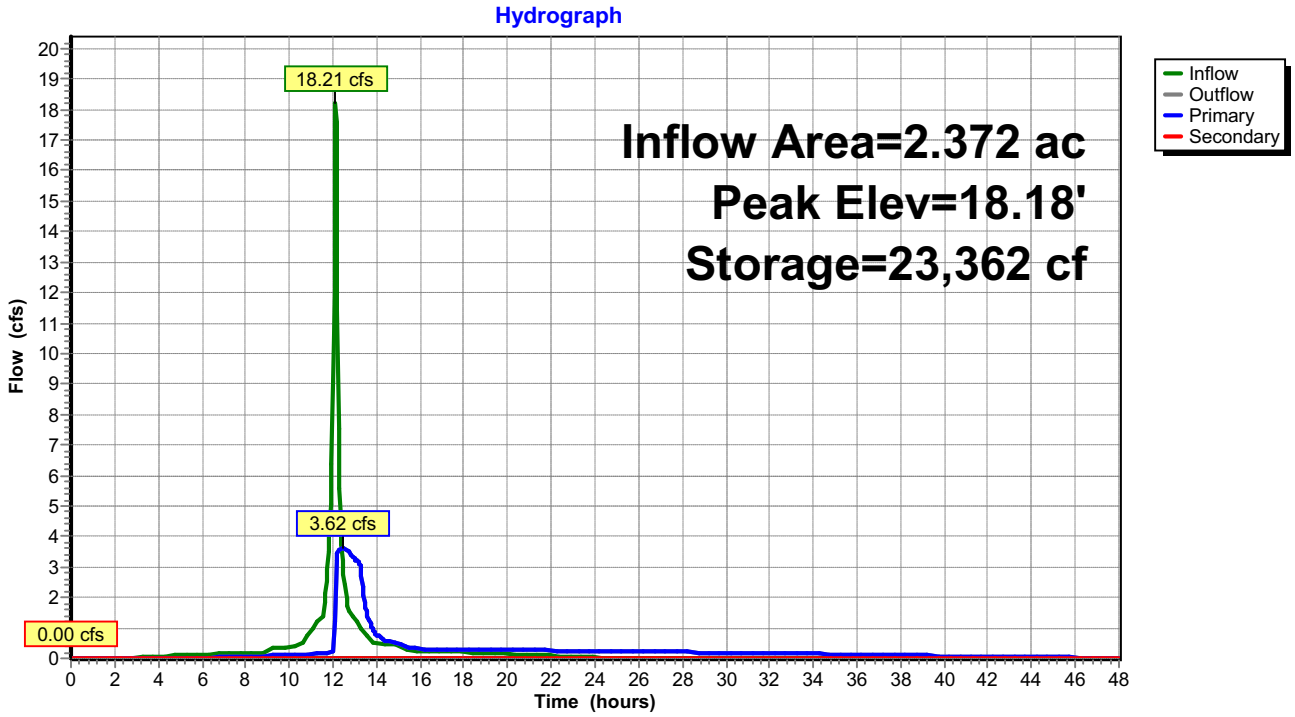
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
16.00	8,852	0	0
17.00	10,538	9,695	9,695
18.00	12,280	11,409	21,104
19.00	14,079	13,180	34,284
20.00	15,935	15,007	49,291

Device	Routing	Invert	Outlet Devices
#1	Primary	16.00'	**12.0" Round Culvert** L= 61.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 16.00' / 15.70' S= 0.0049 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 0.79 sf
#2	Device 1	16.00'	**3.0" Vert. Orifice** C= 0.600
#3	Device 1	17.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	19.20'	**20.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=3.62 cfs @ 12.42 hrs HW=18.18' (Free Discharge)
└**1=Culvert** (Barrel Controls 3.62 cfs @ 4.61 fps)
  └**2=Orifice** (Passes < 0.34 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 11.53 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=16.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 9P: Wet Pond



Appendix C

Storm Water Quality Calculations

- WinSLAMM

Data file name: P:\Sorce - 138\005 - 809 Phillip Drive\003 - Civil Design & Permitting\Hydrology\138-005-003_Slamm.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_Com Inst Indust Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust 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\Freeway 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:
Seed for random number generator: -42
Study period starting date: 01/05/69 Study period ending date: 12/31/69
Date: 09-25-2020 Time: 13:33:14
Site information:

LU# 1 - Commercial: P-1 Total area (ac): 2.412
13 - Paved Parking 1: 1.548 ac. Connected PSD File: C:\WinSLAMM Files\NURP.cpz
45 - Large Landscaped Areas 1: 0.661 ac. Moderately Compacted Clayey PSD File: C:\WinSLAMM Files\NURP.cpz
70 - Water Body Areas: 0.203 ac. PSD File:

Control Practice 1: Wet Detention Pond CP# 1 (DS) - DS Wet Pond # 2
Particle Size Distribution file name: Not needed - calculated by program
Initial stage elevation (ft): 5
Peak to Average Flow Ratio: 3.8
Maximum flow allowed into pond (cfs): No maximum value entered
Outlet Characteristics:
Outlet type: Orifice 1
1. Orifice diameter (ft): 0.25
2. Number of orifices: 1
3. Invert elevation above datum (ft): 5
Outlet type: Broad Crested Weir
1. Weir crest length (ft): 20
2. Weir crest width (ft): 3
3. Height from datum to bottom of weir opening: 8.2
Outlet type: Vertical Stand Pipe
1. Stand pipe diameter (ft): 2
2. Stand pipe height above datum (ft): 6.5
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	0.0400	0.00	0.00
2	2.00	0.0614	0.00	0.00
3	3.00	0.0836	0.00	0.00
4	4.00	0.1064	0.00	0.00
5	5.00	0.2032	0.00	0.00
6	6.00	0.2419	0.00	0.00
7	7.00	0.2819	0.00	0.00
8	8.00	0.3232	0.00	0.00
9	9.00	0.3658	0.00	0.00

SLAMM for Windows Version 10.4.1

Data file name: P:\Sorce - 138\005 - 809 Phillip Drive\003 - Civil Design & Permitting\Hydrology\138-005-003_Slamm.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_Com Inst Indust Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust 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\Freeway 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:
Seed for random number generator: -42
Study period starting date: 01/05/69 Study period ending date: 12/31/69
Model Run Start Date: 01/05/69 Model Run End Date: 12/31/69
Date of run: 09-25-2020 Time of run: 13:32:37
Total Area Modeled (acres): 2.412
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:	213397	-	140.9	1877	-
Outfall Total with Controls:	213623	-0.11%	17.55	234.1	87.53%
Annualized Total After Outfall Controls:	216590			237.3	

Appendix D

Hydrology Exhibits

EXISTING SORCE PROPERTY

UNPLATTED LANDS
OWNER: ONE SORCE PROPERTIES LLC

UNPLATTED LANDS
OWNER: PRAIRIE AVENUE WAUKESHA LLC

ADJACENT PAVEMENT

PROPOSED PROPERTY LINE

PARCEL B
C.S.M. NO. 3857

WATERSHED E-1 AREA:
105,100 SF (2.41 AC)
RCN: 63
Tc: 30.5 MIN.

NRCS SOIL CHANGE LINE

EXISTING TIME OF CONCENTRATION

N89°35'45"E 58.00'

N13°14'36"E 162.37'

N89°35'45"E 270.00'

S00°24'15"E 355.03' (N01°36'30"E)

N00°24'15"W 310.00' (N01°36'30"E)

S72°29'40"W 383.24' (S74°30'25"W 383.456')

SET 1" IRON PIPE

FOUND 1" IRON PIPE

FENCE 0.5' EAST
ASPHALT 3.2' W

ASPHALT 1.0' E

ASPHALT 2.5' N

ASPHALT 0.6' N

S.F.
2.1827 Acres

N

0 30' 60'

BASEMAP/TOPO PROVIDED BY CHAPUT LAND SURVEYORS DRAWING NO. 20200922POST3586-far, ON SEPTEMBER 23, 2020.

REV	DATE
6	.
5	.
4	.
3	.
2	.
1	.
0	.

Endpoint Solutions
6871 S. LOVERS LANE
FRANKLIN, WI 53132
PHONE: (414) 427-1200

SORCE SERVICES - PROPERTY EXPANSION

EXISTING HYDROLOGY EXHIBIT

220 SOUTH PRAIRIE AVENUE
WAUKESHA, WI

DRAWN BY:	JAH	DATE: 09/28/2020
CHECKED BY:	NWD	DATE: 09/28/2020
APPROVED BY:	JAH	DATE: 09/28/2020

PROJECT NO.
138-005-003

SHEET NO.
EX 1

Sep 25, 2020 2:20pm PLOTTED BY: jhelnonen SAVED BY: jhelnonen
P:\Sorce – 138\cadd\005–003 Waukesha Redevelopment\Exhibits\SHT EX1_Sorce Waukesha – Existing Hydrology.dwg Layout1
IMAGES: T:\Template Forms\CADD\Logos\Endpoint\Endpoint Solutions HI-Res.jpg;
XREFS: ..\base map from chaput.dwg; ..\sorce waukesha – proposed layout.dwg; ..\endpoint border-sorce waukesha.dwg; ..\Sorce Waukesha – E

EXISTING SORCE PROPERTY

UNPLATTED LANDS
OWNER: ONE SORCE PROPERTIES LLC

UNPLATTED LANDS
OWNER: PRAIRIE AVENUE WAUKESHA LLC

ADJACENT PAVEMENT

PROPOSED PROPERTY LINE

WATERSHED P-2 AREA:
103,330 SF (2.37 AC)
RCN: 89
Tc: 6 MIN.

AREA
95,080 S.F.
2.1827 acres

NRCS SOIL CHANGE LINE

WATERSHED P-1 AREA:
1,753 SF (0.04 AC)
RCN: 69
Tc: 6 MIN.

PARCEL B
C.S.M. NO. 3857

PARCEL B
C.S.M. NO. 3857

N89°35'45"E 270.00'

N89°35'45"E 58.00'

S00°24'15"E 355.03' ((N01°36'30"E)

N00°24'15"W 310.00' ((N01°36'30"E)

S72°29'40"W 383.24' (S74°30'25"W 383.456')

SET 1" IRON PIPE

FOUND 1" IRON PIPE

FENCE 0.5' EAST
ASPHALT 3.2' W

ASPHALT 1.0' E

bldg. line 38.50

bldg. cor. 30.57

0 30' 60'

N

BASEMAP/TOPO PROVIDED BY CHAPUT LAND SURVEYORS DRAWING NO. 20200922POST3586-far, ON SEPTEMBER 23, 2020.

REV	DATE
6	
5	
4	
3	
2	
1	
0	

Endpoint Solutions
6871 S. LOVERS LANE
FRANKLIN, WI 53132
PHONE: (414) 427-1200

SORCE SERVICES - PROPERTY EXPANSION

PROPOSED HYDROLOGY EXHIBIT

220 SOUTH PRAIRIE AVENUE
WAUKESHA, WI

DRAWN BY:	JAH	DATE:	09/28/2020
CHECKED BY:	NWD	DATE:	09/28/2020
APPROVED BY:	JAH	DATE:	09/28/2020

PROJECT NO.
138-005-003

SHEET NO.
EX 2

Sep 25, 2020 2:21pm PLOTTED BY: jhelnonen SAVED BY: jhelnonen
P:\Sorce - 138\cadd\005-003 Waukesha Redevelopment\Exhibits\SHT EX2_Sorce Waukesha - Proposed Hydrology.dwg Layout1
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XREFS: ..\base map from chaput.dwg; ..\sorce waukesha - proposed layout.dwg; ..\endpoint border-sorce waukesha.dwg