

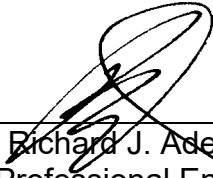
**STORM WATER DRAINAGE
CALCULATIONS**

for

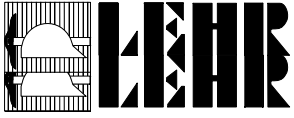
**PROPOSED
RESIDENTIAL DEVELOPMENT
64 NORMA AVENUE
FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY**

September 2021

FRANK H. LEHR ASSOCIATES
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Professional Engineer
NJ License GE035233

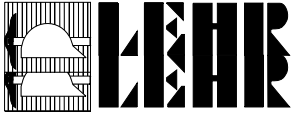


64 Norma Avenue
Franklin, NJ
Stormwater Drainage Calculations

Project # 9270
September 2021
By: RJA

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Description of Site

The Subject property has an area of 73,875 square feet, containing undeveloped land consisting primarily of trees and vegetation.

Grades at the site slope primarily from south to north with approximately 20 feet of grade change across the site.

Description of Proposed Improvements

The proposed construction consists of a high-rise development with 12 residential homes with parking garages. The site would provide an access road to the development along with common parking along the road.

Retaining walls are provided for grade transitions.

Purpose

The objective of the Stormwater Drainage Calculations is to provide supporting computations for the planned development in compliance with New Jersey's Stormwater Management Regulations—NJAC 7:8 and the Franklin Township Land Use Ordinance (Chapters 330: Stormwater Management.)

Drainage - Existing

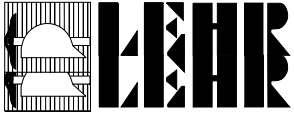
Existing on-site run off generally runs off by sheet flow to the North. The entire site is comprised of trees and vegetation. The soil is classified as Kkoc(Klinesville channery loam). The Hydrologic soil group is group D.

Drainage - Proposed

The post-development proposes to reduce and improve the existing runoff characteristics.

Proposed development consists of 12 residential homes with parking garages and an access road. The access road shall be comprised of approximately 12,000 sf porous pavement. The site also consists of a bioretention/rain garden used to attenuate flows and provide groundwater recharge. The 10 of the proposed residential home's roof leaders are routed to the bioretention basin. The bioretention basin is equipped with an outlet structure to attenuate discharge to the stormwater main along Franklin Boulevard.

The proposed orifice plate has been designed to attenuate flow rates for multiple design storm events.



Time of Concentration

The topology of the site was analyzed, and a critical flow path was determined. Utilizing the SCS methodology, the time of concentration for the existing condition is 10 minutes for the development site.

Methodology

The pre-developed and the post-developed runoff analysis were determined using the Soil Conservation Service Method, utilizing HydroCAD version 10.00-20 stormwater design software and utilizes a type III storm distributions with NCRS rainfall amounts for 64 Norma Avenue. Runoff computations and modeling are based on the site specific 2-, 10-, & 100-year design storm events.

Water Quality

Water quality standards are triggered when a project proposes $\frac{1}{4}$ acre of new impervious surface.

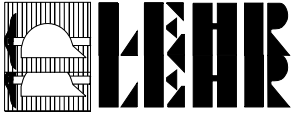
This project utilizes porous pavement and rain gardens to meet water quality standards. The porous pavement collects stormwater from the sidewalk, driveways, and pavement. Building 1-2 roof leaders are routed to the detention below the porous pavement while the rest of the roof leaders are routed to the bioretention basin. Both the bioretention basin and the porous pavement achieve the minimum 80% TSS for water quality measures. This accounts for entirety of the impervious surfaces. The remainder of the site remains landscaped.

Groundwater Recharge

Groundwater recharge requirements are achieved by maintaining 100% of the annual preconstruction groundwater recharge volume for the site or by providing storage volume below the porous pavement to collect 100% of the difference between the site's pre and post-development 2 year run off volume.

The site maintains 100% of the average annual preconstruction groundwater recharge volume for the site. The attached Annual Groundwater Recharge Analysis demonstrates that the 12,000 sq ft detention below our porous pavement is adequate for groundwater recharge.

The site also maintains the difference between the pre and post development 2-year run off volume. The 2 year runoff volume is 9,202 cf. The post development run off volume is 13,490 cf. the difference in volume is 4,288 cf. The volume routed to the porous pavement detention field is 6,129 cf for the 2 year storm. This entire volume is infiltrated into the ground for recharge.

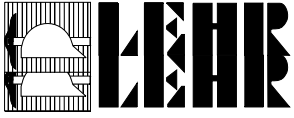


Results

The following table displays a summarized comparison between the existing condition and proposed condition. As shown, the proposed runoff flow connecting to the municipal system has been beneficially reduced. In addition, the proposed drainage system does not adversely affect the existing drainage system.

NOTE: Flow rates computed by SCS Method

| Event | Existing | Factor | Factored Exist | Proposed Outlet Structure (cfs) | |
|-------|----------|--------|----------------|---------------------------------|----|
| 2 | 2.54 | 50% | 1.27 | 1.24 | OK |
| 10 | 5.05 | 75% | 3.79 | 2.51 | OK |
| 100 | 10.24 | 80% | 8.2 | 5.88 | OK |



Design Criteria

Runoff Calculations (Rational Method)

Design Storm Event = 2, 10, 25 100-Year Frequency

Runoff Coefficients:

- Lawns & Green Areas.....0.30
- Pavement.....0.90
- Roof.....0.90

*Runoff Flow: $Q = c*i*A$*

Where c = weighted Runoff Coefficient ratio, no units
 i = intensity, inches per hour
 A = Area in Acres
 Q is given in cubic feet per second

Runoff Calculations (SCS)

24 Hour Precipitation Values for 64 Norma Avenue:

2-year event: 3.32 inches

10-year event: 5.06 inches

100-year event: 8.48 inches

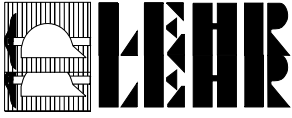
Stormwater Quality Design Storm: 1.25 inches

Curve Number Coefficients for HSG “D” Soils:

- Open Space 80
- Pavement.....98
- Roof.....98

Manning’s “n” values:

- Reinforced Concrete Pipe [RCP].....0.013
- Polyvinyl Chloride Pipe [PVC]0.011
- High Density Polyethylene Pipe [HDPEP].....0.011

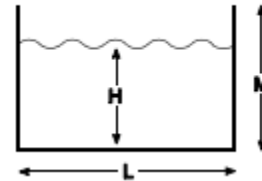


Sharp-Crested Rectangular Weir

The basic equation for a sharp-crested weir is derived in Open Channel Hydraulics p.362.

$$Q = C L_e H^{3/2} \text{ where } C = \frac{2}{3} \sqrt{2g} C_d \quad \text{Eq. 56}$$

C=Weir coefficient
L_e=Effective crest length
H=Head (above crest or invert elevation)
g=Gravitational constant
C_d=Discharge Coefficient

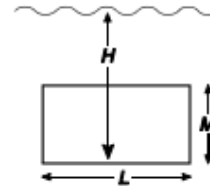


Rectangular Orifice in a Vertical Plane

For a rectangular opening in a vertical plane, the discharge under any head is derived from the discharge through a thin horizontal strip. (See Handbook of Hydraulics p.4-3.)

$$dQ = C_d L \sqrt{2gY} dY \quad \text{Eq. 68}$$

C_d=Discharge coefficient (Default is .60)
L=Strip length (width of orifice)
g=Gravitational constant
Y=Head over center of strip
dY=Height of horizontal strip



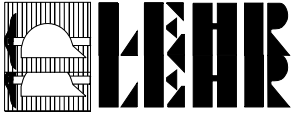
Integrating over the height of the orifice yields:

$$Q = \frac{2}{3} C_d L \sqrt{2g} (H^{3/2} - [H-M]^{3/2}) \quad \text{Eq. 69}$$

H=Head above invert elevation
M=Height of orifice

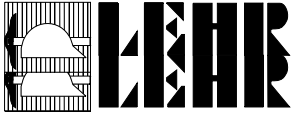
When the orifice is partially submerged (H<M) the term [H-M] becomes zero and this reduces to the rectangular weir equation:

$$Q = \frac{2}{3} C_d L \sqrt{2g} H^{3/2} = C L H^{3/2} \text{ (English units)} \quad \text{Eq. 70}$$



References:

- Design & Construction of Sanitary and Storm Sewers. ASCE Manual on Engineering Practice No. 37. American Society of Civil Engineers. New York. 1969.
- New Jersey Stormwater Best Management Practices Manual
New Jersey Department of Environmental Protection, 2004.
- Urban Hydrology for Small Wetlands, Technical Release 55
- United States Department of Agriculture Soil Conservation Service, 1986.
- Hydrocad Storm Water Modeling System, Owner's Manual, Version 10, 2011



64 Norma Avenue
Franklin, NJ
Stormwater Drainage Calculations

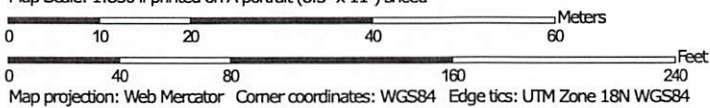
Project # 9270
September 2021
By: RJA

Soil Classification

Soil Map—Somerset County, New Jersey



Map Scale: 1:830 if printed on A portrait (8.5" x 11") sheet.




Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|------------------------------------|---|--------------|----------------|
| KkoC | Klinesville channery loam, 6 to 12 percent slopes | 1.8 | 100.0% |
| Totals for Area of Interest | | 1.8 | 100.0% |

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 1:24,000.

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: Somerset County, New Jersey
 Survey Area Data: Version 18, Jun 1, 2020

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

Date(s) aerial images were photographed: Jun 22, 2019—Jul 13, 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.

Somerset County, New Jersey

KkoC—Klinesville channery loam, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 1jtb9
Elevation: 250 to 1,500 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Farmland of local importance

Map Unit Composition

Klinesville and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Klinesville

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Fine-loamy residuum weathered from shale

Typical profile

Ap - 0 to 9 inches: channery loam
C - 9 to 11 inches: very channery loam
R - 11 to 80 inches: weathered bedrock

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High
(2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Penn, eroded

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Berks, eroded

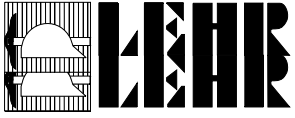
Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Bucks, eroded

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Somerset County, New Jersey
Survey Area Data: Version 18, Jun 1, 2020



64 Norma Avenue
Franklin, NJ
Stormwater Drainage Calculations

Project # 9270
September 2021
By: RJA

Groundwater Recharge

New Jersey
Groundwater
Recharge
Spreadsheet
Version 2.0
November 2003

Annual Groundwater Recharge Analysis (based on GSR-32)

| | | |
|----------------------------|-----------------------|-----------------|
| Select Township ↓ | Average Annual P (in) | Climatic Factor |
| SOMERSET CO., FRANKLIN TWP | 45.7 | 1.48 |

| | |
|----------------|-----------------|
| Project Name: | 64 Norma Avenue |
| Description: | Development |
| Analysis Date: | 07/27/21 |

| Pre-Developed Conditions | | | | | |
|--------------------------|--------------|------------------|-------------|----------------------------|-------------------------------|
| Land Segment | Area (acres) | TR-55 Land Cover | Soil | Annual Recharge (in) | Annual Recharge (cu.ft) |
| 1 | 1.69 | Open space | Klimesville | 14.2 | 87,046 |
| 2 | 0 | | | | |
| 3 | 0 | | | | |
| 4 | 0 | | | | |
| 5 | 0 | | | | |
| 6 | 0 | | | | |
| 7 | 0 | | | | |
| 8 | 0 | | | | |
| 9 | 0 | | | | |
| 10 | 0 | | | | |
| 11 | 0 | | | | |
| 12 | 0 | | | | |
| 13 | 0 | | | | |
| 14 | 0 | | | | |
| 15 | 0 | | | | |
| Total = | 1.7 | | | Total Annual Recharge (in) | Total Annual Recharge (cu-ft) |
| | | | | 14.2 | 87,046 |

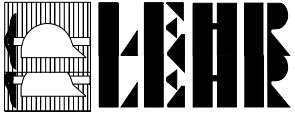
| Post-Developed Conditions | | | | | |
|---------------------------|--------------|------------------|-------------|----------------------------|-------------------------------|
| Land Segment | Area (acres) | TR-55 Land Cover | Soil | Annual Recharge (in) | Annual Recharge (cu.ft) |
| 1 | 0.502 | Impervious areas | Klimesville | 0.0 | - |
| 2 | 0.9 | Open space | Klimesville | 14.2 | 46,356 |
| 3 | 0.288 | Gravel, dirt | Klimesville | 7.9 | 8,240 |
| 4 | 0 | | | | |
| 5 | 0 | | | | |
| 6 | 0 | | | | |
| 7 | 0 | | | | |
| 8 | 0 | | | | |
| 9 | 0 | | | | |
| 10 | 0 | | | | |
| 11 | 0 | | | | |
| 12 | 0 | | | | |
| 13 | 0 | | | | |
| 14 | 0 | | | | |
| 15 | 0 | | | | |
| Total = | 1.7 | | | Total Annual Recharge (in) | Total Annual Recharge (cu.ft) |
| | | | | 8.9 | 54,596 |

Procedure to fill the Pre-Development and Post-Development Conditions Tables

For each land segment, first enter the area, then select TR-55 Land Cover, then select Soil. Start from the top of the table and proceed downward. Don't leave blank rows (with A=0) in between your segment entries. Rows with A=0 will not be displayed or used in calculations. For impervious areas outside of standard lots select "Impervious Areas" as the Land Cover. Soil type for impervious areas are only required if an infiltration facility will be built within these areas.

| | | | | | |
|--|---------------|-------------------------------|------|-------------------------------|--------|
| Annual Recharge Requirements Calculation ↓ | | Total Annual Recharge (in) | 8.9 | Total Annual Recharge (cu.ft) | 54,596 |
| % of Pre-Developed Annual Recharge to Preserve = | 100% | Total Impervious Area (sq.ft) | | | 21,867 |
| Post-Development Annual Recharge Deficit= | 32,451 | (cubic feet) | | | |
| Recharge Efficiency Parameters Calculations (area averages) | | | | | |
| RWC= 1.14 | (in) | DRWC= 0.19 | (in) | | |
| ERWC = 0.30 | (in) | EDRWC= 0.05 | (in) | | |

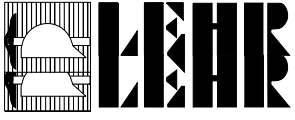
| Project Name | | Description | | Analysis Date | | BMP or LID Type | | | | | |
|--|----------|-------------|----------|--|--------|-----------------|-------------------------------------|---|---------|-------|------|
| 64 Norma Avenue | | Development | | 07/27/21 | | | | | | | |
| Recharge BMP Input Parameters | | | | Root Zone Water capacity Calculated Parameters | | | | Recharge Design Parameters | | | |
| Parameter | Symbol | Value | Unit | Parameter | Symbol | Value | Unit | Parameter | Symbol | Value | Unit |
| BMP Area | ABMP | 12000.0 | sq.ft | Empty Portion of RWC under Post-D Natural Recharge | ERWC | 0.30 | in | Inches of Runoff to capture | Qdesign | 0.37 | in |
| BMP Effective Depth, this is the design variable | dBMP | 0.7 | in | ERWC Modified to consider dEXC | EDRWC | 0.05 | in | Inches of Rainfall to capture | Pdesign | 0.47 | in |
| Upper level of the BMP surface (negative if above ground) | dBMPu | 3.0 | in | Empty Portion of RWC under Infiltr. BMP | RERWC | 0.04 | in | Recharge Provided Avg. over Imp. Area | | 17.8 | in |
| Depth of lower surface of BMP, must be >= dBMPu | dEXC | 27.0 | in | | | | | Runoff Captured Avg. over imp. Area | | 19.5 | in |
| Post-development Land Segment Location of BMP, Input Zero if Location is distributed or undetermined | SegBMP | 0 | unitless | | | | | | | | |
| | | | | BMP Calculated Size Parameters | | | | CALCULATION CHECK MESSAGES | | | |
| | | | | ABMP/Aimp | Aratio | 0.55 | unitless | Volume Balance--> OK | | | |
| | | | | BMP Volume | VBMP | 655 | cu.ft | dBMP Check--> OK | | | |
| | | | | | | | | dEXC Check--> OK | | | |
| Parameters from Annual Recharge Worksheet | | | | System Performance Calculated Parameters | | | | | | | |
| Post-D Deficit Recharge (or desired recharge volume) | Vdef | 32,451 | cu.ft | Annual BMP Recharge Volume | | 32,451 | cu.ft | BMP Location--> Location is selected as distributed or undetermined | | | |
| Post-D Impervious Area (or target Impervious Area) | Aimp | 21,867 | sq.ft | Avg BMP Recharge Efficiency | | 91.4% | Represents % Infiltration Recharged | OTHER NOTES | | | |
| Root Zone Water Capacity | RWC | 1.14 | in | %Rainfall became Runoff | | 77.9% | % | Pdesign is accurate only after BMP dimensions are updated to make rech volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are | | | |
| RWC Modified to consider dEXC | DRWC | 0.19 | in | %Runoff Infiltrated | | 54.7% | % | sensitive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land | | | |
| Climatic Factor | C-factor | 1.48 | no units | %Runoff Recharged | | 50.0% | % | Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by | | | |
| Average Annual P | Pavg | 45.7 | in | %Rainfall Recharged | | 39.0% | % | the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses. | | | |
| Recharge Requirement over Imp. Area | dr | 17.8 | in | | | | | | | | |
| <p>How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "Vdef" and total proposed impervious area "Aimp" from the "Annual Recharge" sheet to "Vdef" and "Aimp" on this page. This allows solution for a single BMP to handle the entire recharge requirement assuming the runoff from entire impervious area is available to the BMP. To solve for a smaller BMP or a LID-IMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration click the "Default Vdef & Aimp" button.</p> | | | | | | | | | | | |



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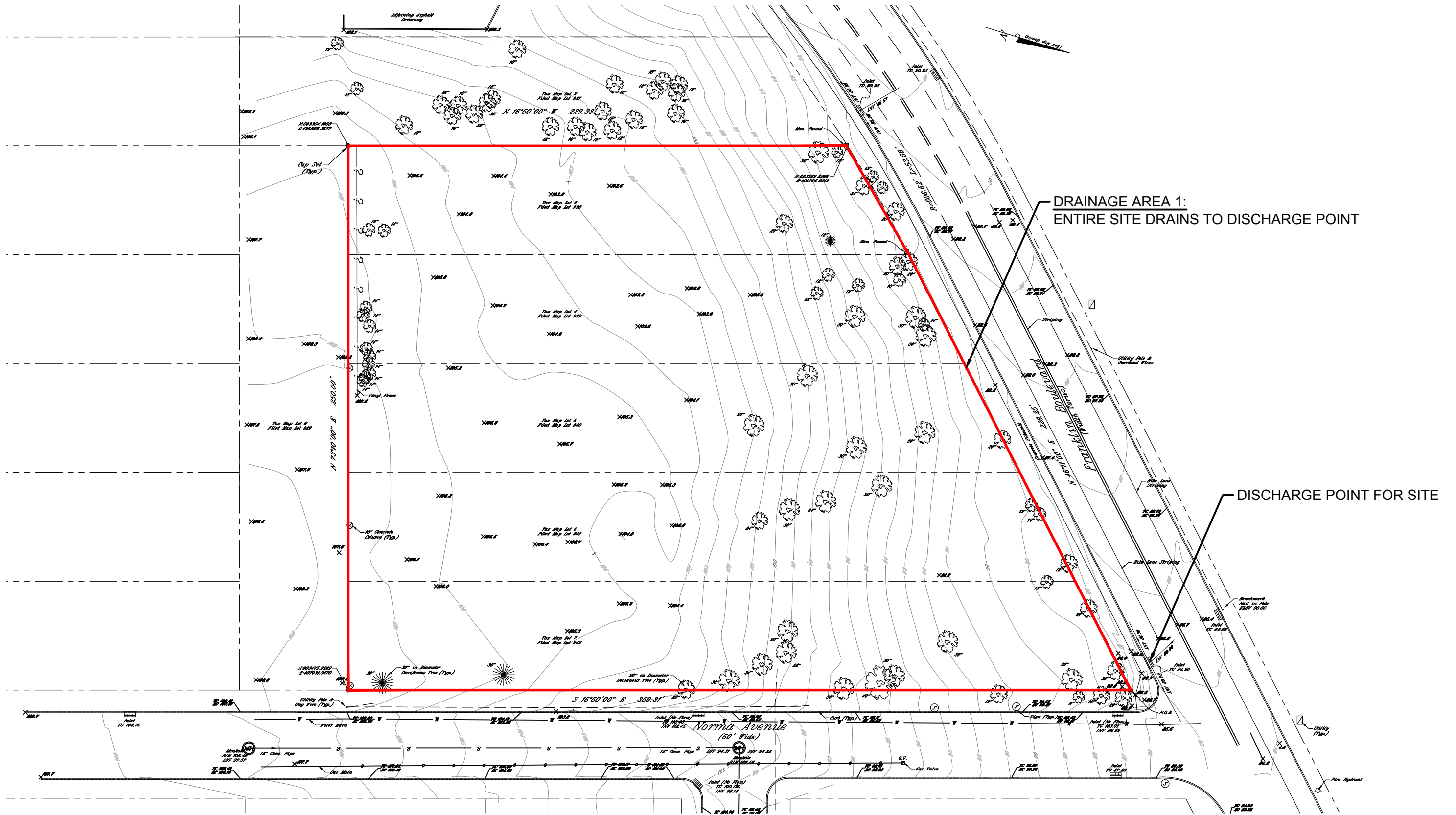
Water Quantity Calculations



64 Norma Avenue
Franklin, NJ
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EXISTING

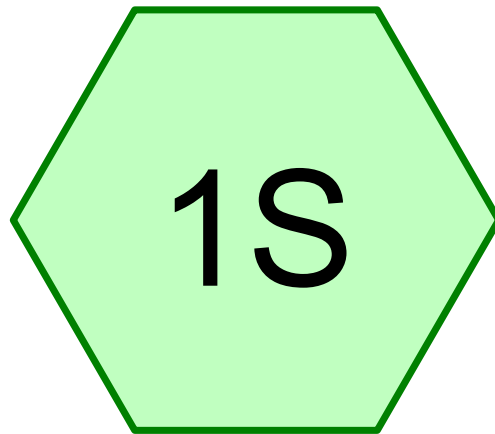


DRAINAGE AREA 1:
ENTIRE SITE DRAINS TO DISCHARGE POINT

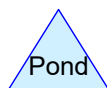
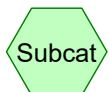
DISCHARGE POINT FOR SITE

EXISTING DRAINAGE AREAS
Scale: N.T.S.

NOTE: ENTIRE SITE IS COMPRISED OF TREES AND VEGETATION



Existing Lot



Routing Diagram for 9270 Existing
Prepared by Frank H. Lehr Associates, Printed 9/20/2021
HydroCAD® 10.10-5a s/n 06491 © 2020 HydroCAD Software Solutions LLC

9270 Existing

Prepared by Frank H. Lehr Associates

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Printed 9/20/2021

Page 2

Rainfall Events Listing (selected events)

| Event# | Event Name | Storm Type | Curve | Mode | Duration (hours) | B/B | Depth (inches) | AMC |
|--------|------------|----------------|-------|---------|------------------|-----|----------------|-----|
| 1 | 2-yr | Type III 24-hr | | Default | 24.00 | 1 | 3.32 | 2 |
| 2 | 10-yr | Type III 24-hr | | Default | 24.00 | 1 | 5.06 | 2 |
| 3 | 100-yr | Type III 24-hr | | Default | 24.00 | 1 | 8.48 | 2 |

9270 Existing

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Page 3

Area Listing (all nodes)

| Area (sq-ft) | CN | Description (subcatchment-numbers) |
|-----------------|-----------|---------------------------------------|
| 73,875 | 80 | >75% Grass cover, Good, HSG D (1S) |
| 73,875 | 80 | TOTAL AREA |

9270 Existing

Prepared by Frank H. Lehr Associates

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Page 4

Soil Listing (all nodes)

| Area (sq-ft) | Soil Group | Subcatchment Numbers |
|-----------------|---------------|-------------------------|
| 0 | HSG A | |
| 0 | HSG B | |
| 0 | HSG C | |
| 73,875 | HSG D | 1S |
| 0 | Other | |
| 73,875 | | TOTAL AREA |

9270 Existing

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Ground Covers (all nodes)

| HSG-A (sq-ft) | HSG-B (sq-ft) | HSG-C (sq-ft) | HSG-D (sq-ft) | Other (sq-ft) | Total (sq-ft) | Ground Cover |
|------------------|------------------|------------------|------------------|------------------|------------------|---------------------------|
| 0 | 0 | 0 | 73,875 | 0 | 73,875 | >75% Grass cover, Good |
| 0 | 0 | 0 | 73,875 | 0 | 73,875 | TOTAL AREA |

Sub
Num

9270 Existing

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Type III 24-hr 2-yr Rainfall=3.32"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Lot

Runoff Area=73,875 sf 0.00% Impervious Runoff Depth=1.49"
Tc=10.0 min CN=80 Runoff=2.54 cfs 9,202 cf

Total Runoff Area = 73,875 sf Runoff Volume = 9,202 cf Average Runoff Depth = 1.49"
100.00% Pervious = 73,875 sf 0.00% Impervious = 0 sf

9270 Existing

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Type III 24-hr 2-yr Rainfall=3.32"

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Summary for Subcatchment 1S: Existing Lot

Runoff = 2.54 cfs @ 12.15 hrs, Volume= 9,202 cf, Depth= 1.49"

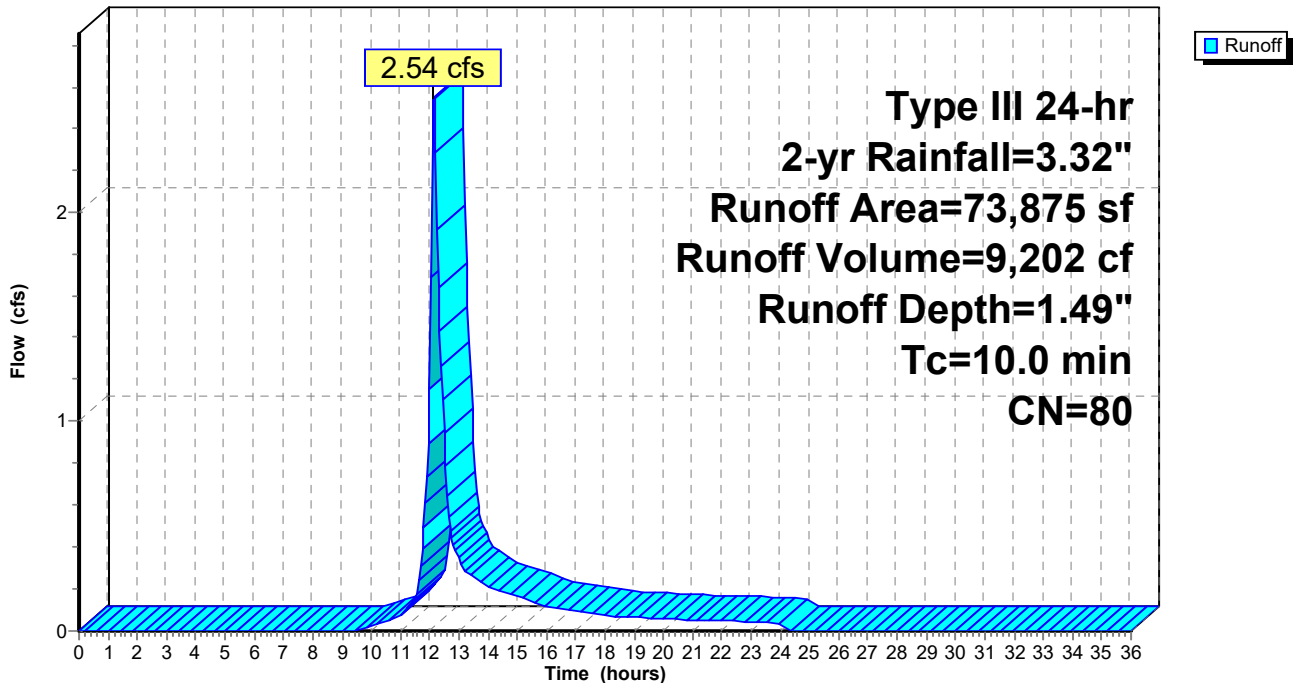
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.32"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 73,875 | 80 | >75% Grass cover, Good, HSG D |
| 73,875 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Subcatchment 1S: Existing Lot

Hydrograph



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Type III 24-hr 10-yr Rainfall=5.06"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Lot

Runoff Area=73,875 sf 0.00% Impervious Runoff Depth=2.95"
Tc=10.0 min CN=80 Runoff=5.05 cfs 18,132 cf

Total Runoff Area = 73,875 sf Runoff Volume = 18,132 cf Average Runoff Depth = 2.95"
100.00% Pervious = 73,875 sf 0.00% Impervious = 0 sf

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Type III 24-hr 10-yr Rainfall=5.06"

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Summary for Subcatchment 1S: Existing Lot

Runoff = 5.05 cfs @ 12.14 hrs, Volume= 18,132 cf, Depth= 2.95"

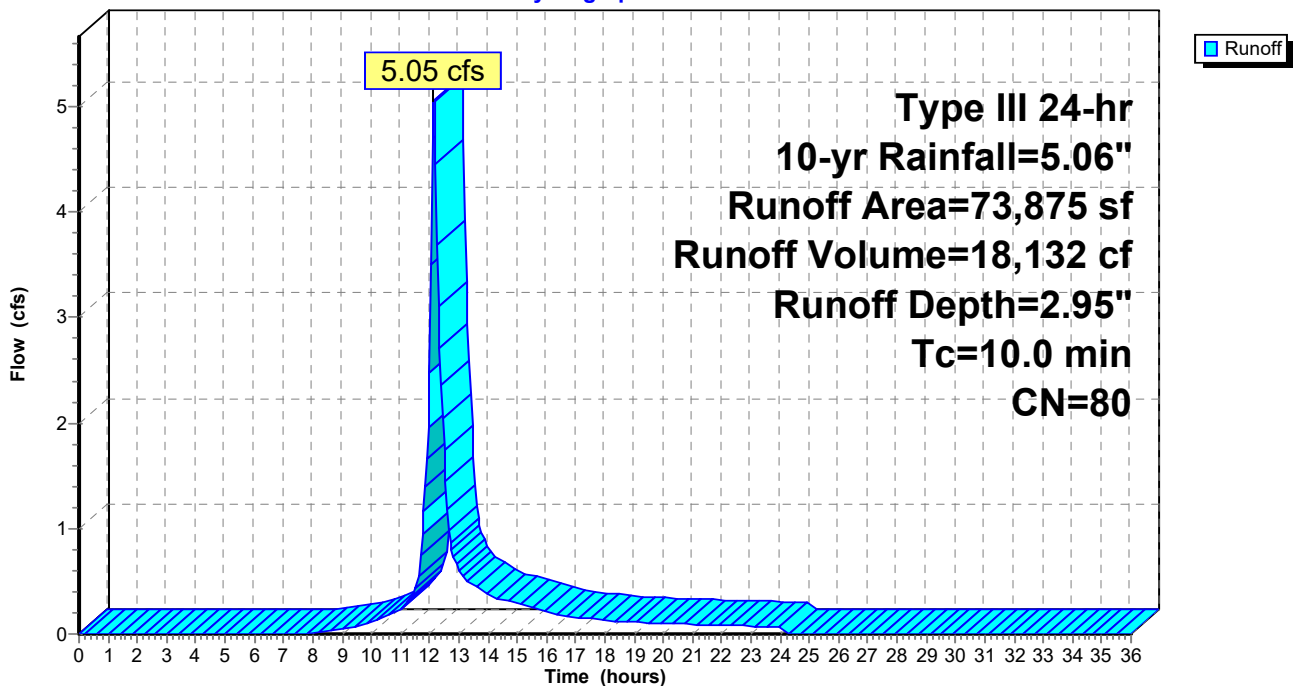
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.06"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 73,875 | 80 | >75% Grass cover, Good, HSG D |
| 73,875 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Subcatchment 1S: Existing Lot

Hydrograph



9270 Existing

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Type III 24-hr 100-yr Rainfall=8.48"

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Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Lot

Runoff Area=73,875 sf 0.00% Impervious Runoff Depth=6.08"
Tc=10.0 min CN=80 Runoff=10.24 cfs 37,408 cf

Total Runoff Area = 73,875 sf Runoff Volume = 37,408 cf Average Runoff Depth = 6.08"
100.00% Pervious = 73,875 sf 0.00% Impervious = 0 sf

9270 Existing

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Type III 24-hr 100-yr Rainfall=8.48"

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Summary for Subcatchment 1S: Existing Lot

Runoff = 10.24 cfs @ 12.14 hrs, Volume= 37,408 cf, Depth= 6.08"

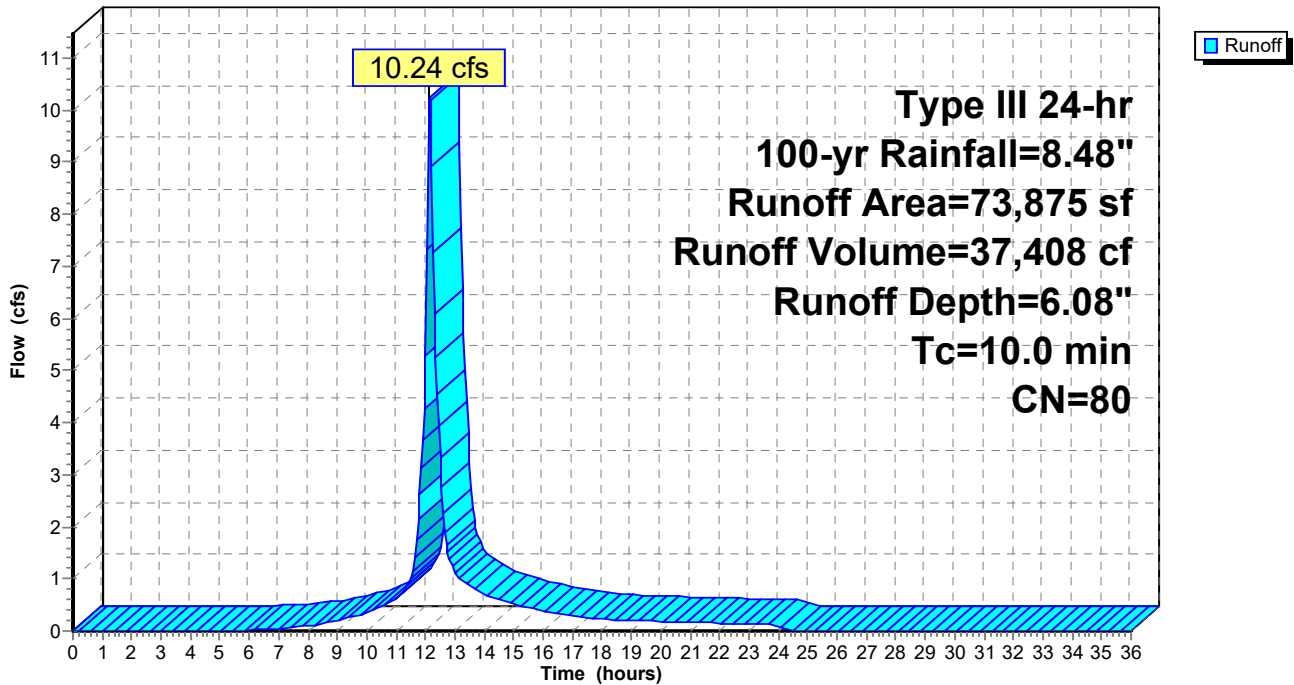
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.48"

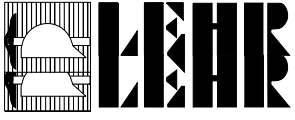
| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 73,875 | 80 | >75% Grass cover, Good, HSG D |
| 73,875 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Subcatchment 1S: Existing Lot

Hydrograph

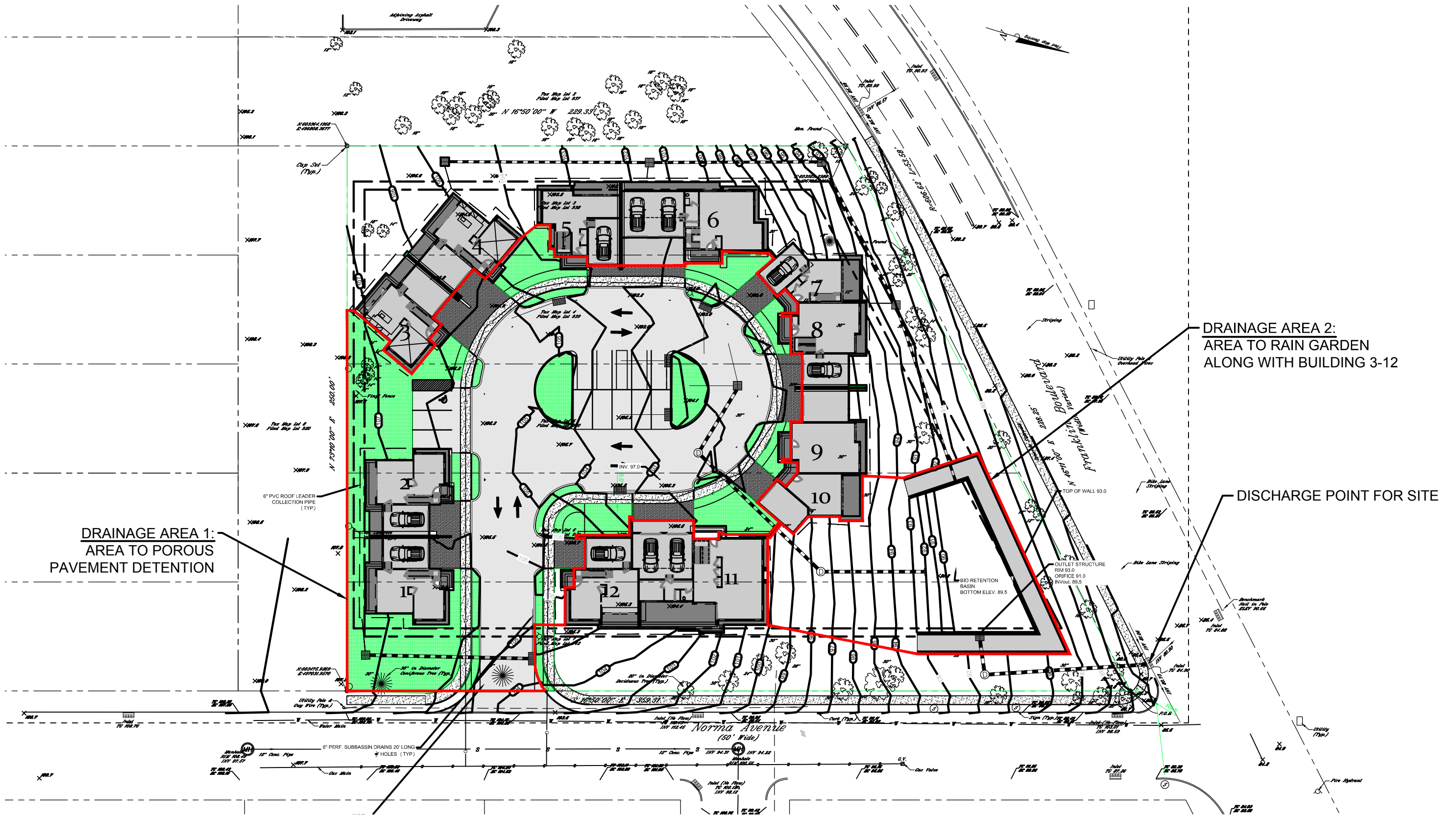




64 Norma Avenue
Franklin, NJ
Stormwater Drainage Calculations

Project # 9270
September 2021
By: RJA

PROPOSED



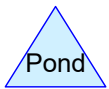
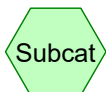
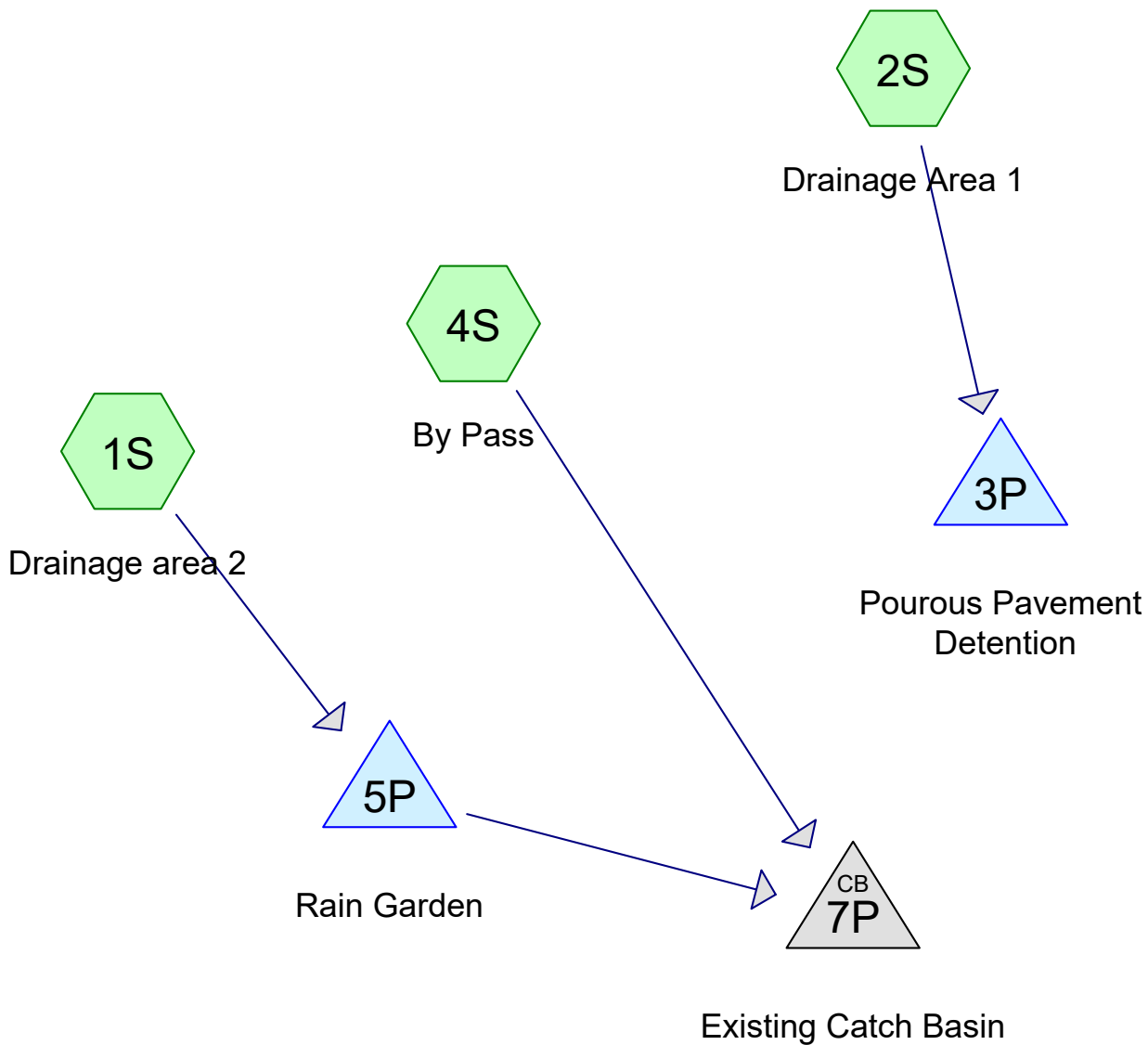
DRAINAGE AREA 1:
AREA TO POROUS
PAVEMENT DETENTION

DRAINAGE AREA 2:
AREA TO RAIN GARDEN
ALONG WITH BUILDING 3-12

DISCHARGE POINT FOR SITE

PROPOSED DRAINAGE AREAS
Scale: N.T.S.

**NOTE: PARTIAL LANDSCAPED AREAS BYPASS
COLLECTION AND COLLECT AT EXISTING INLET**



Routing Diagram for 9270 Proposed
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Project Notes

Defined 4 rainfall events from 64 Norma Street IDF

Defined 4 rainfall events from 64 Norma Street IDF

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Rainfall Events Listing (selected events)

| Event# | Event Name | Storm Type | Curve | Mode | Duration (hours) | B/B | Depth (inches) | AMC |
|--------|------------|----------------|-------|---------|------------------|-----|----------------|-----|
| 1 | 2-yr | Type III 24-hr | | Default | 24.00 | 1 | 3.32 | 2 |
| 2 | 10-yr | Type III 24-hr | | Default | 24.00 | 1 | 5.06 | 2 |
| 3 | 100-yr | Type III 24-hr | | Default | 24.00 | 1 | 8.48 | 2 |

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Area Listing (all nodes)

| Area (sq-ft) | CN | Description (subcatchment-numbers) |
|-----------------|-----------|---------------------------------------|
| 597 | 98 | 3 car parking spot pavement (2S) |
| 9,740 | 80 | >75% Grass cover, Good, HSG D (2S) |
| 2,602 | 98 | Building 1-2 Roof (2S) |
| 11,240 | 98 | Buildings 3-12 roof (1S) |
| 2,311 | 98 | Driveways (2S) |
| 29,999 | 80 | Landscaping HSG D (4S) |
| 2,797 | 98 | Patios (4S) |
| 11,690 | 98 | Pavement (2S) |
| 2,899 | 98 | Sidewalk (2S) |
| 73,875 | 88 | TOTAL AREA |

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Soil Listing (all nodes)

| Area (sq-ft) | Soil Group | Subcatchment Numbers |
|-----------------|---------------|-------------------------|
| 0 | HSG A | |
| 0 | HSG B | |
| 0 | HSG C | |
| 39,739 | HSG D | 2S, 4S |
| 34,136 | Other | 1S, 2S, 4S |
| 73,875 | | TOTAL AREA |

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Ground Covers (all nodes)

| HSG-A (sq-ft) | HSG-B (sq-ft) | HSG-C (sq-ft) | HSG-D (sq-ft) | Other (sq-ft) | Total (sq-ft) | Ground Cover |
|------------------|------------------|------------------|------------------|------------------|------------------|--------------------------------|
| 0 | 0 | 0 | 0 | 597 | 597 | 3 car parking spot pavement |
| 0 | 0 | 0 | 9,740 | 0 | 9,740 | >75% Grass cover, Good |
| 0 | 0 | 0 | 0 | 2,602 | 2,602 | Building 1-2 Roof |
| 0 | 0 | 0 | 0 | 11,240 | 11,240 | Buildings 3-12 roof |
| 0 | 0 | 0 | 0 | 2,311 | 2,311 | Driveways |
| 0 | 0 | 0 | 29,999 | 0 | 29,999 | Landscaping |
| 0 | 0 | 0 | 0 | 2,797 | 2,797 | Patios |
| 0 | 0 | 0 | 0 | 11,690 | 11,690 | Pavement |
| 0 | 0 | 0 | 0 | 2,899 | 2,899 | Sidewalk |
| 0 | 0 | 0 | 39,739 | 34,136 | 73,875 | TOTAL AREA |

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Pipe Listing (all nodes)

| Line# | Node Number | In-Invert (feet) | Out-Invert (feet) | Length (feet) | Slope (ft/ft) | n | Width (inches) | Diam/Height (inches) | Inside-Fill (inches) |
|-------|----------------|---------------------|----------------------|------------------|------------------|-------|-------------------|-------------------------|-------------------------|
| 1 | 5P | 91.00 | 90.50 | 50.0 | 0.0100 | 0.011 | 0.0 | 15.0 | 0.0 |
| 2 | 7P | 80.73 | 78.73 | 100.0 | 0.0200 | 0.012 | 0.0 | 15.0 | 0.0 |

9270 Proposed

Type III 24-hr 2-yr Rainfall=3.32"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Drainage area 2 Runoff Area=11,240 sf 100.00% Impervious Runoff Depth=3.09"
Tc=10.0 min CN=98 Runoff=0.72 cfs 2,892 cf

Subcatchment 2S: Drainage Area 1 Runoff Area=29,839 sf 67.36% Impervious Runoff Depth=2.46"
Tc=10.0 min CN=92 Runoff=1.67 cfs 6,129 cf

Subcatchment 4S: By Pass Runoff Area=32,796 sf 8.53% Impervious Runoff Depth=1.64"
Tc=10.0 min CN=82 Runoff=1.24 cfs 4,469 cf

Pond 3P: Poured Pavement Detention Peak Elev=97.40' Storage=2,001 cf Inflow=1.67 cfs 6,129 cf
Outflow=0.23 cfs 6,131 cf

Pond 5P: Rain Garden Peak Elev=91.12' Storage=2,022 cf Inflow=0.72 cfs 2,892 cf
Discarded=0.00 cfs 0 cf Primary=0.06 cfs 1,083 cf Outflow=0.06 cfs 1,083 cf

Pond 7P: Existing Catch Basin Peak Elev=81.34' Inflow=1.24 cfs 5,551 cf
15.0" Round Culvert n=0.012 L=100.0' S=0.0200 '/' Outflow=1.24 cfs 5,551 cf

Total Runoff Area = 73,875 sf Runoff Volume = 13,489 cf Average Runoff Depth = 2.19"
53.79% Pervious = 39,739 sf 46.21% Impervious = 34,136 sf

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Type III 24-hr 2-yr Rainfall=3.32"

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Summary for Subcatchment 1S: Drainage area 2

Runoff = 0.72 cfs @ 12.14 hrs, Volume= 2,892 cf, Depth= 3.09"

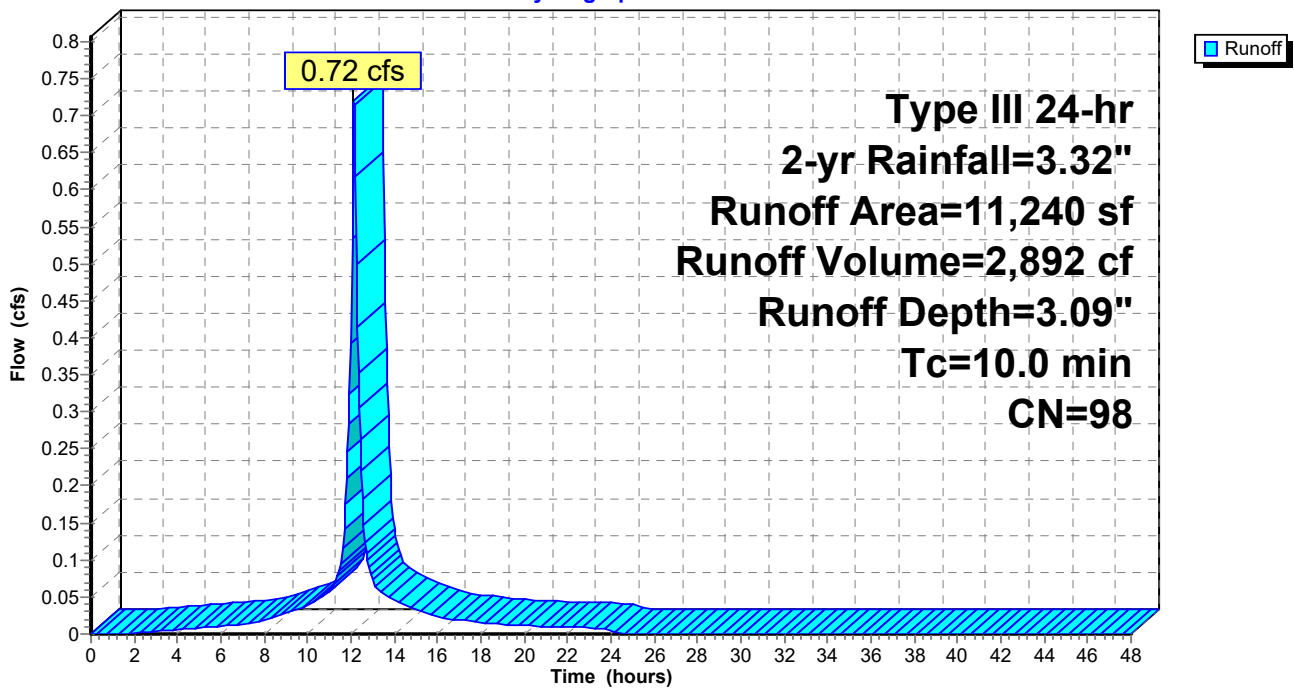
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.32"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| * 11,240 | 98 | Buildings 3-12 roof |
| 11,240 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Subcatchment 1S: Drainage area 2

Hydrograph



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Type III 24-hr 2-yr Rainfall=3.32"

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Summary for Subcatchment 2S: Drainage Area 1

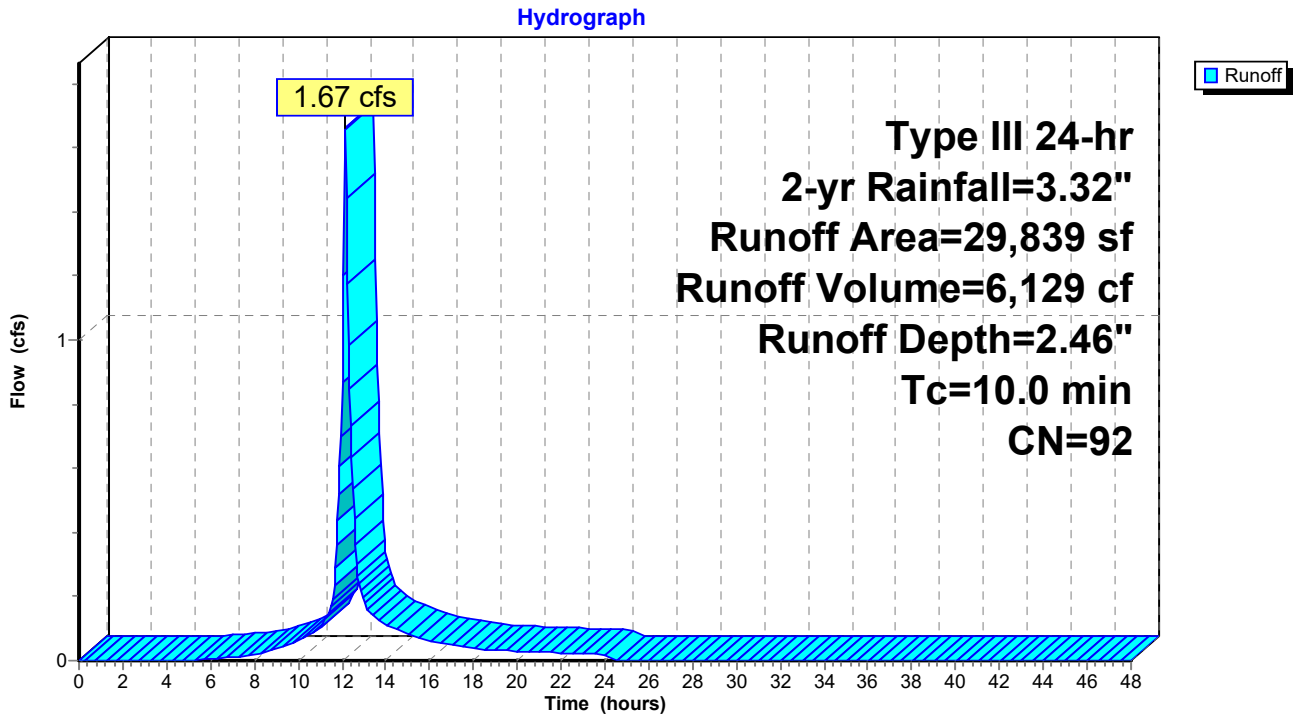
Runoff = 1.67 cfs @ 12.14 hrs, Volume= 6,129 cf, Depth= 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.32"

| | Area (sf) | CN | Description |
|---|-----------|----|-------------------------------|
| * | 11,690 | 98 | Pavement |
| * | 2,311 | 98 | Driveways |
| * | 2,899 | 98 | Sidewalk |
| | 9,740 | 80 | >75% Grass cover, Good, HSG D |
| * | 2,602 | 98 | Building 1-2 Roof |
| * | 597 | 98 | 3 car parking spot pavement |
| | 29,839 | 92 | Weighted Average |
| | 9,740 | | 32.64% Pervious Area |
| | 20,099 | | 67.36% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Subcatchment 2S: Drainage Area 1



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Type III 24-hr 2-yr Rainfall=3.32"

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Summary for Subcatchment 4S: By Pass

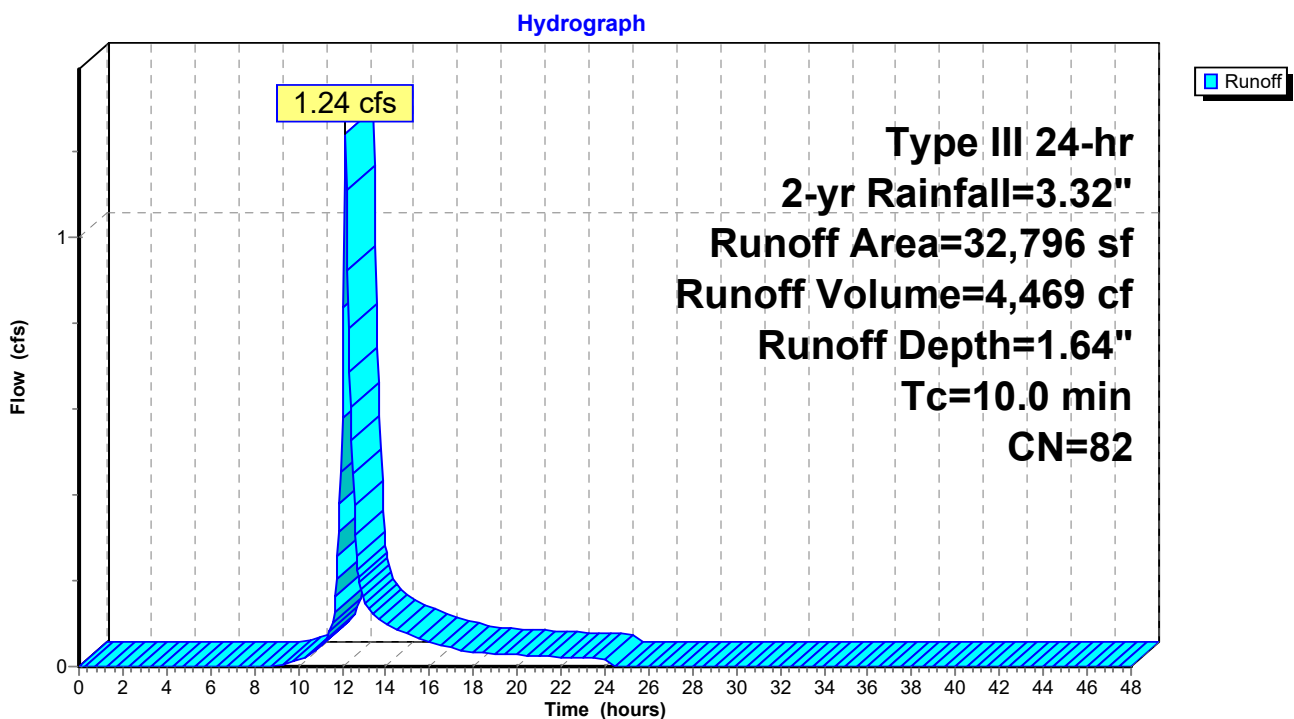
Runoff = 1.24 cfs @ 12.15 hrs, Volume= 4,469 cf, Depth= 1.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.32"

| | Area (sf) | CN | Description |
|---|-----------|----|-----------------------|
| * | 29,999 | 80 | Landscaping HSG D |
| * | 2,797 | 98 | Patios |
| | 32,796 | 82 | Weighted Average |
| | 29,999 | | 91.47% Pervious Area |
| | 2,797 | | 8.53% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Subcatchment 4S: By Pass



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Type III 24-hr 2-yr Rainfall=3.32"

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Summary for Pond 3P: Poured Pavement Detention

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=72)

Inflow Area = 29,839 sf, 67.36% Impervious, Inflow Depth = 2.46" for 2-yr event
 Inflow = 1.67 cfs @ 12.14 hrs, Volume= 6,129 cf
 Outflow = 0.23 cfs @ 11.90 hrs, Volume= 6,131 cf, Atten= 86%, Lag= 0.0 min
 Discarded = 0.23 cfs @ 11.90 hrs, Volume= 6,131 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 97.40' @ 12.79 hrs Surf.Area= 10,000 sf Storage= 2,001 cf

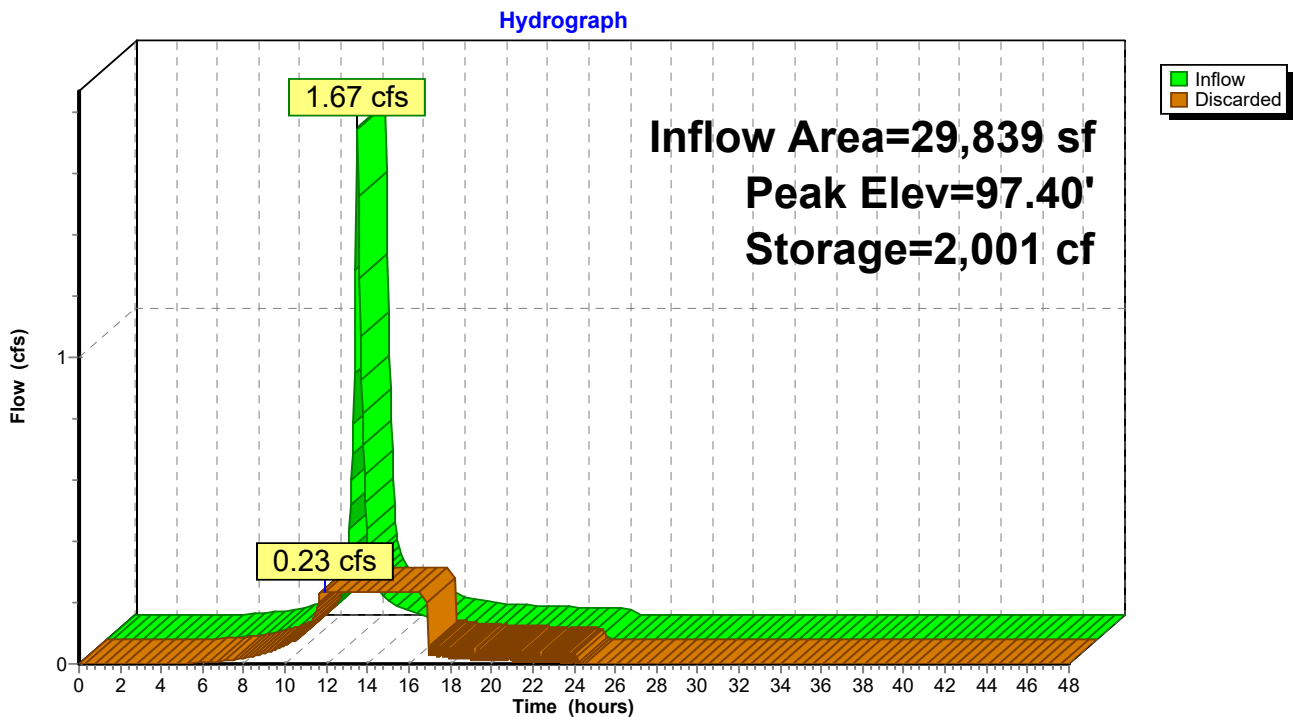
Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 59.6 min (859.8 - 800.1)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 97.00' | 10,000 cf | 100.00'W x 100.00'L x 2.00'H Prismatic 20,000 cf Overall x 50.0% Voids |

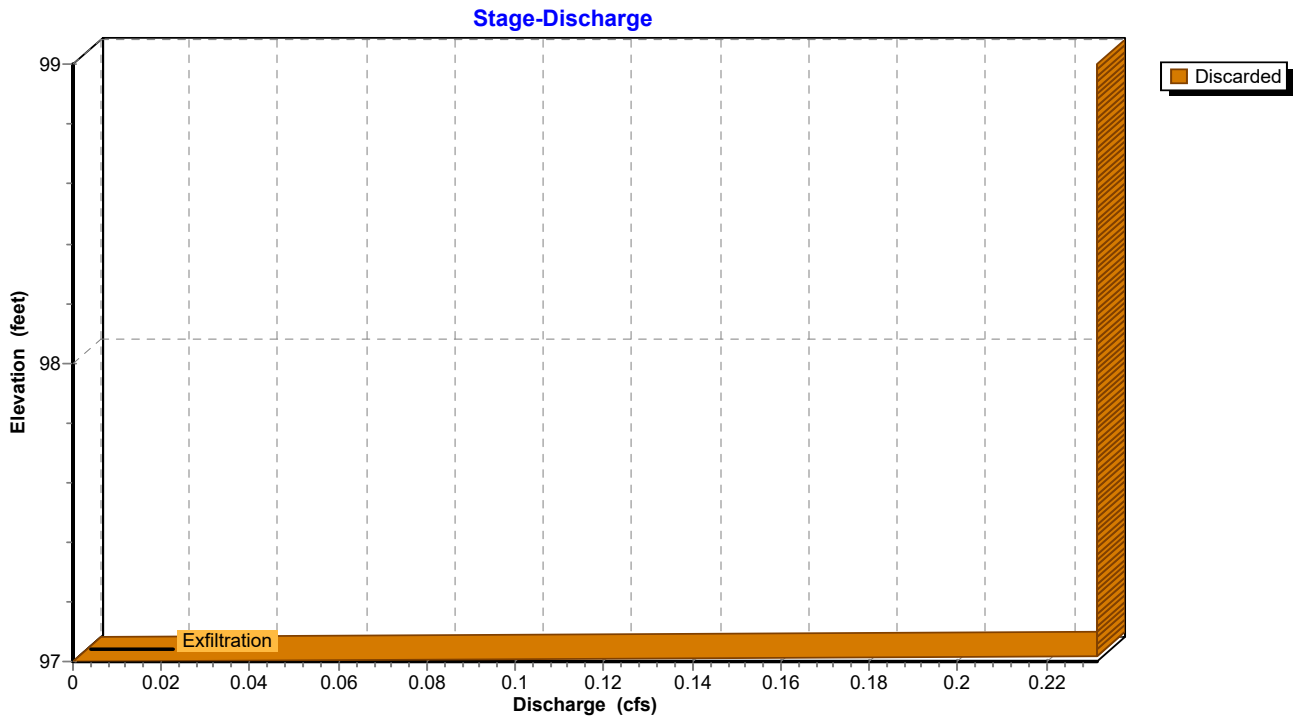
| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Discarded | 97.00' | 1.000 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=0.23 cfs @ 11.90 hrs HW=97.03' (Free Discharge)
 ↳ 1=Exfiltration (Exfiltration Controls 0.23 cfs)

Pond 3P: Poured Pavement Detention



Pond 3P: Porous Pavement Detention



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Type III 24-hr 2-yr Rainfall=3.32"

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Summary for Pond 5P: Rain Garden

Inflow Area = 11,240 sf, 100.00% Impervious, Inflow Depth = 3.09" for 2-yr event
 Inflow = 0.72 cfs @ 12.14 hrs, Volume= 2,892 cf
 Outflow = 0.06 cfs @ 13.34 hrs, Volume= 1,083 cf, Atten= 92%, Lag= 71.9 min
 Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Primary = 0.06 cfs @ 13.34 hrs, Volume= 1,083 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 91.12' @ 13.34 hrs Surf.Area= 1,800 sf Storage= 2,022 cf

Plug-Flow detention time= 427.6 min calculated for 1,081 cf (37% of inflow)
 Center-of-Mass det. time= 272.8 min (1,032.2 - 759.3)

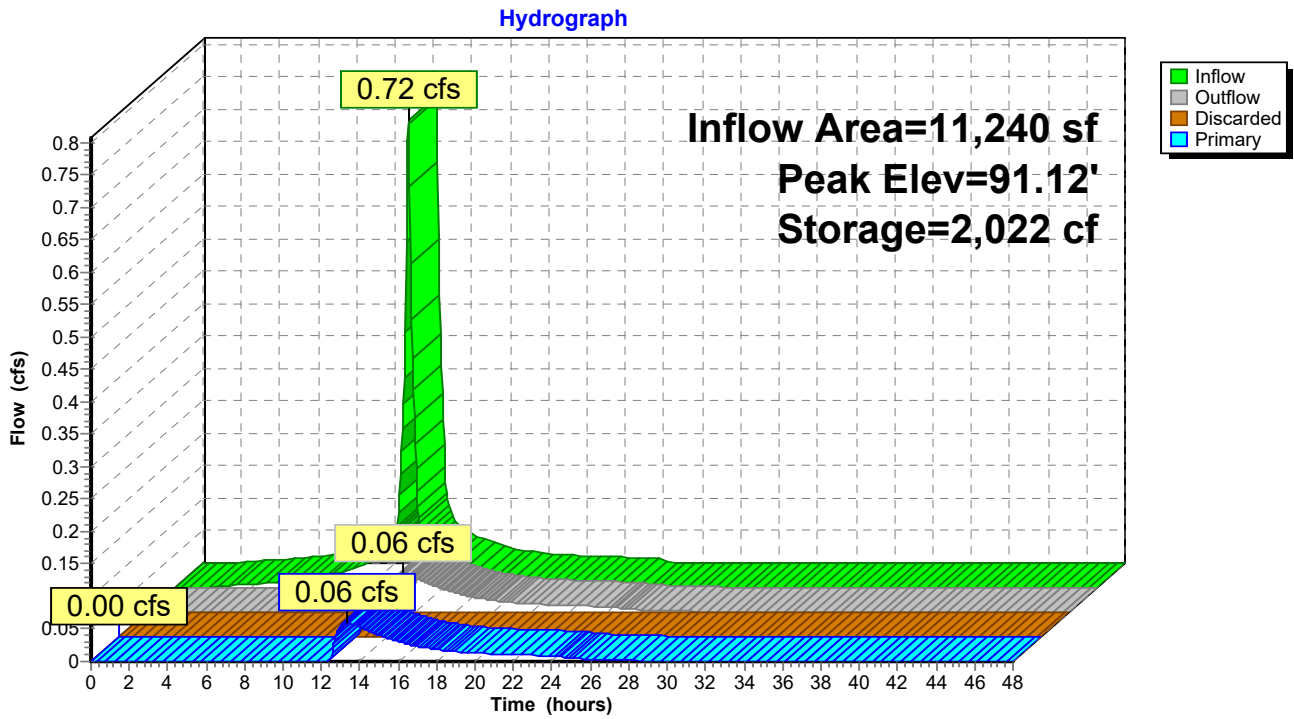
| Volume | Invert | Avail.Storage | Storage Description |
|---------------------|----------------------|---------------------------|--|
| #1 | 90.00' | 3,600 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 90.00 | 1,800 | 0 | 0 |
| 91.00 | 1,800 | 1,800 | 1,800 |
| 92.00 | 1,800 | 1,800 | 3,600 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Discarded | 90.00' | 1.000 in/hr Exfiltration over Surface area above 90.00' Excluded Surface area = 1,800 sf |
| #2 | Primary | 91.00' | 15.0" Round Culvert L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 91.00' / 90.50' S= 0.0100 ' S= 0.0100 ' Cc= 0.900 n= 0.011, Flow Area= 1.23 sf |

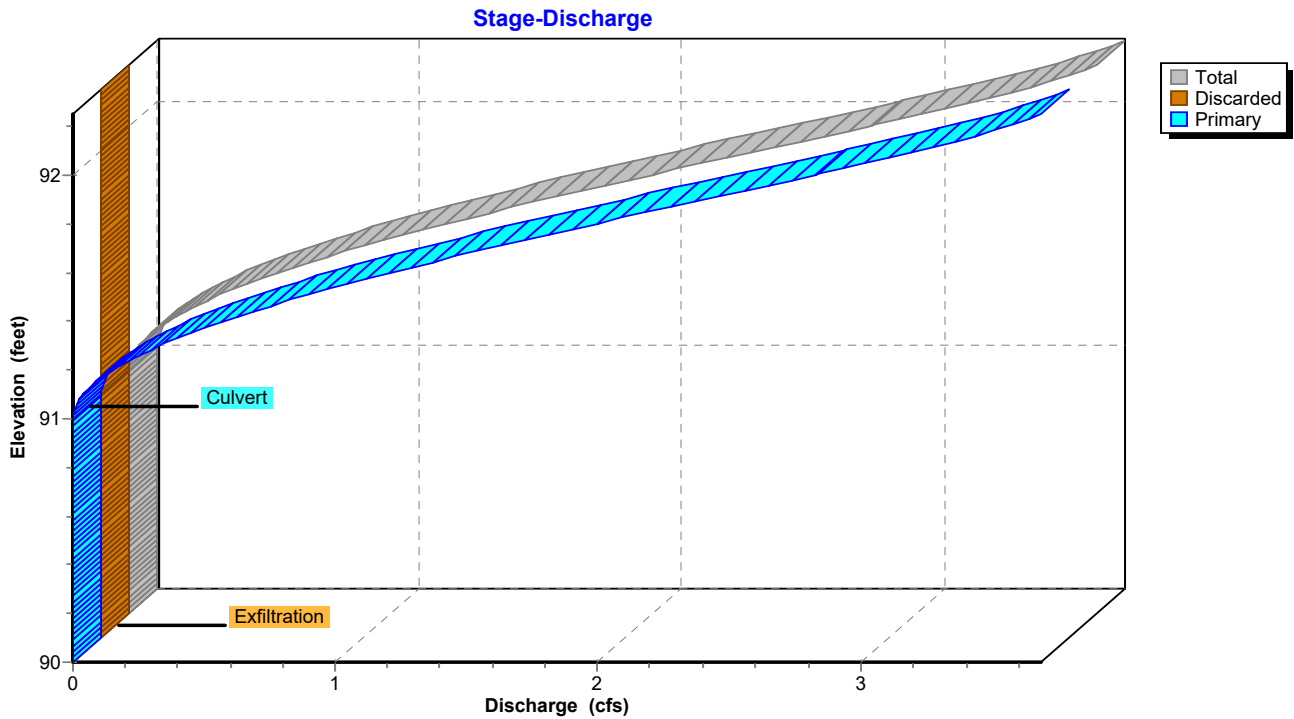
Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=90.00' (Free Discharge)
 ↑1=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=0.06 cfs @ 13.34 hrs HW=91.12' TW=80.95' (Dynamic Tailwater)
 ↑2=Culvert (Inlet Controls 0.06 cfs @ 0.94 fps)

Pond 5P: Rain Garden



Pond 5P: Rain Garden



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Type III 24-hr 2-yr Rainfall=3.32"

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Summary for Pond 7P: Existing Catch Basin

[57] Hint: Peaked at 81.34' (Flood elevation advised)

Inflow Area = 44,036 sf, 31.88% Impervious, Inflow Depth = 1.51" for 2-yr event
 Inflow = 1.24 cfs @ 12.15 hrs, Volume= 5,551 cf
 Outflow = 1.24 cfs @ 12.15 hrs, Volume= 5,551 cf, Atten= 0%, Lag= 0.0 min
 Primary = 1.24 cfs @ 12.15 hrs, Volume= 5,551 cf

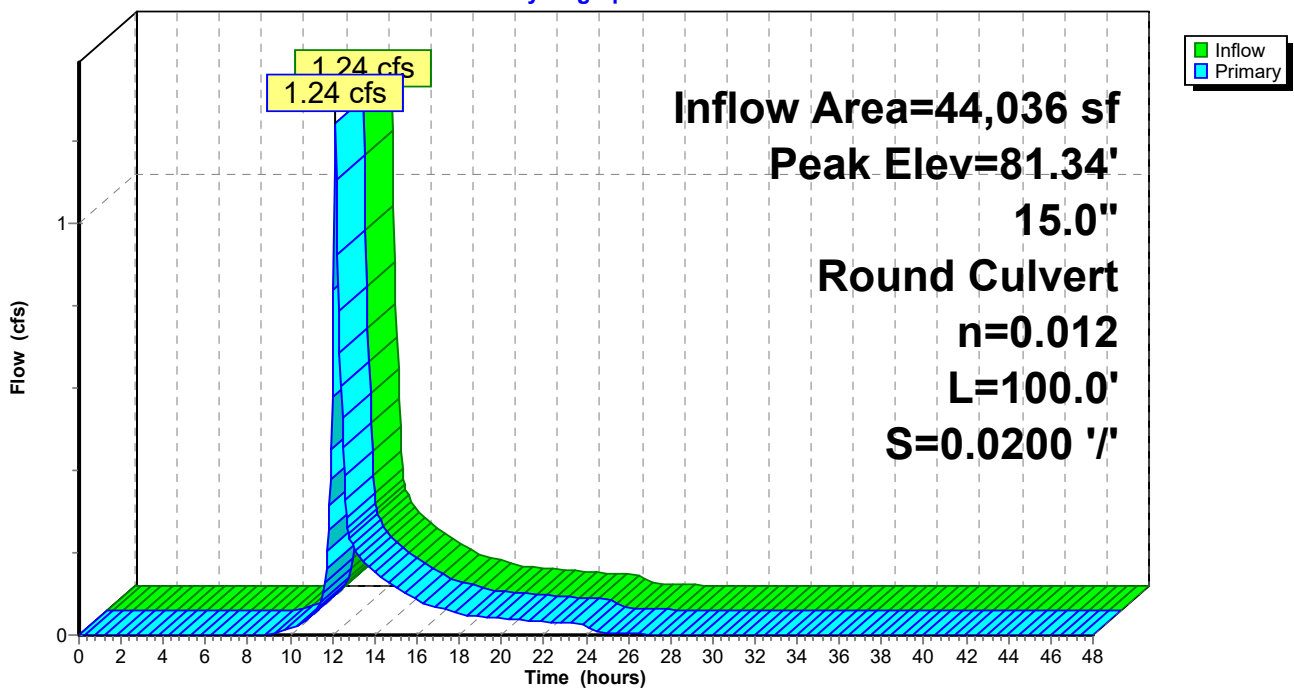
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 81.34' @ 12.15 hrs

| Device | Routing | Invert | Outlet Devices |
|--------|---------|--------|---|
| #1 | Primary | 80.73' | 15.0" Round Culvert L= 100.0' Ke= 0.900 Inlet / Outlet Invert= 80.73' / 78.73' S= 0.0200 '/ Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

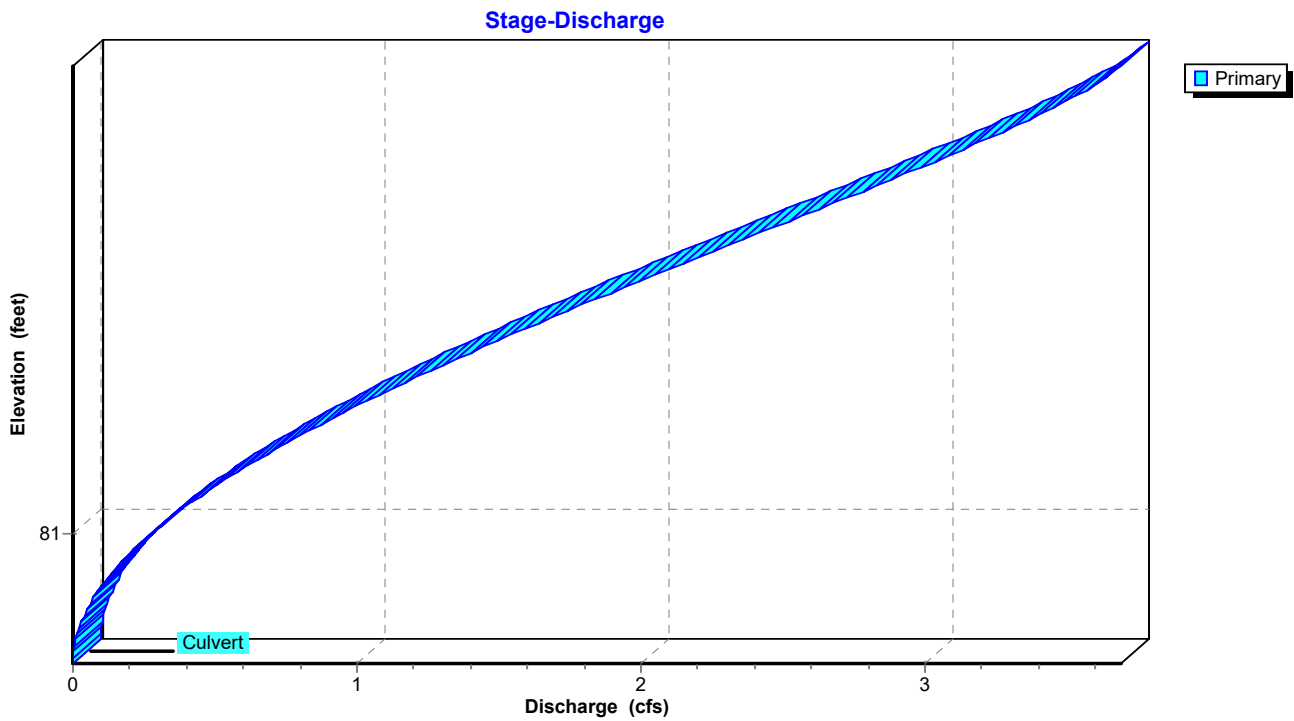
Primary OutFlow Max=1.23 cfs @ 12.15 hrs HW=81.34' (Free Discharge)
 ←1=Culvert (Inlet Controls 1.23 cfs @ 2.09 fps)

Pond 7P: Existing Catch Basin

Hydrograph



Pond 7P: Existing Catch Basin



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Type III 24-hr 10-yr Rainfall=5.06"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Drainage area 2 Runoff Area=11,240 sf 100.00% Impervious Runoff Depth=4.82"
Tc=10.0 min CN=98 Runoff=1.11 cfs 4,518 cf

Subcatchment 2S: Drainage Area 1 Runoff Area=29,839 sf 67.36% Impervious Runoff Depth=4.15"
Tc=10.0 min CN=92 Runoff=2.73 cfs 10,314 cf

Subcatchment 4S: By Pass Runoff Area=32,796 sf 8.53% Impervious Runoff Depth=3.13"
Tc=10.0 min CN=82 Runoff=2.38 cfs 8,562 cf

Pond 3P: Pourous Pavement Detention Peak Elev=97.82' Storage=4,091 cf Inflow=2.73 cfs 10,314 cf
Outflow=0.23 cfs 10,329 cf

Pond 5P: Rain Garden Peak Elev=91.36' Storage=2,457 cf Inflow=1.11 cfs 4,518 cf
Discarded=0.00 cfs 0 cf Primary=0.48 cfs 2,708 cf Outflow=0.48 cfs 2,708 cf

Pond 7P: Existing Catch Basin Peak Elev=81.65' Inflow=2.51 cfs 11,270 cf
15.0" Round Culvert n=0.012 L=100.0' S=0.0200 '/' Outflow=2.51 cfs 11,270 cf

Total Runoff Area = 73,875 sf Runoff Volume = 23,394 cf Average Runoff Depth = 3.80"
53.79% Pervious = 39,739 sf 46.21% Impervious = 34,136 sf

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Type III 24-hr 10-yr Rainfall=5.06"

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Summary for Subcatchment 1S: Drainage area 2

Runoff = 1.11 cfs @ 12.14 hrs, Volume= 4,518 cf, Depth= 4.82"

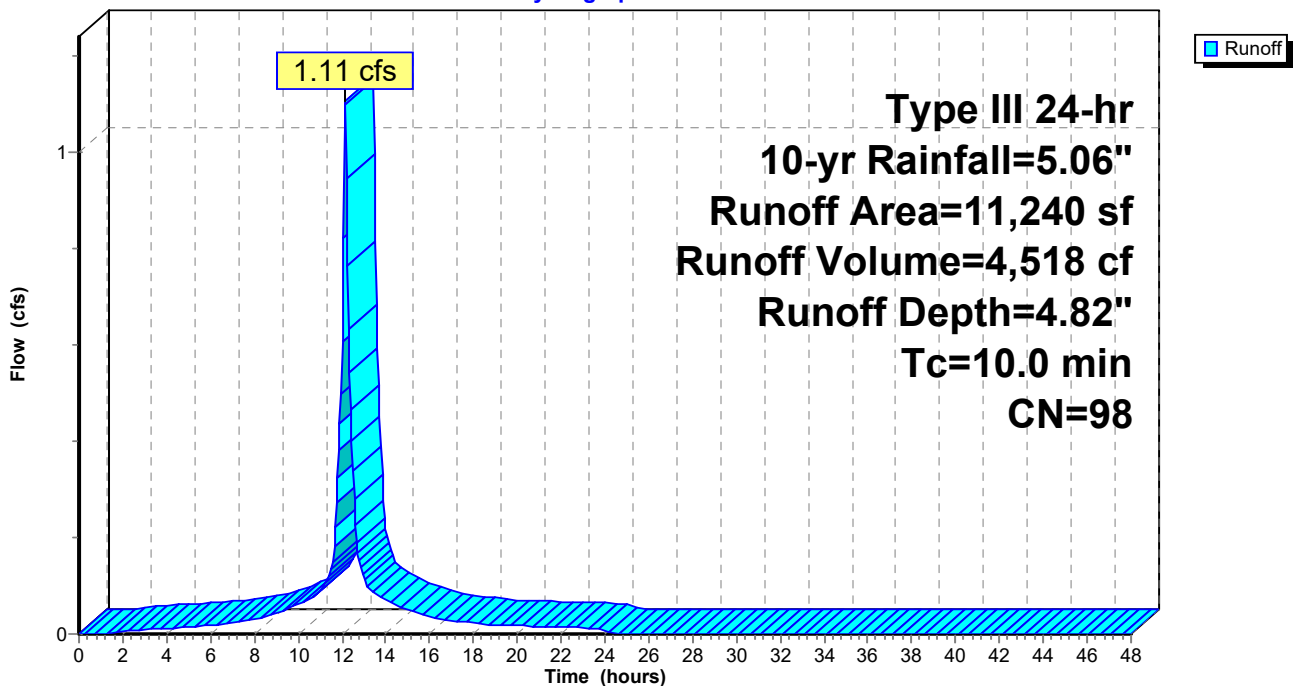
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.06"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| * 11,240 | 98 | Buildings 3-12 roof |
| 11,240 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Subcatchment 1S: Drainage area 2

Hydrograph



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Type III 24-hr 10-yr Rainfall=5.06"

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Summary for Subcatchment 2S: Drainage Area 1

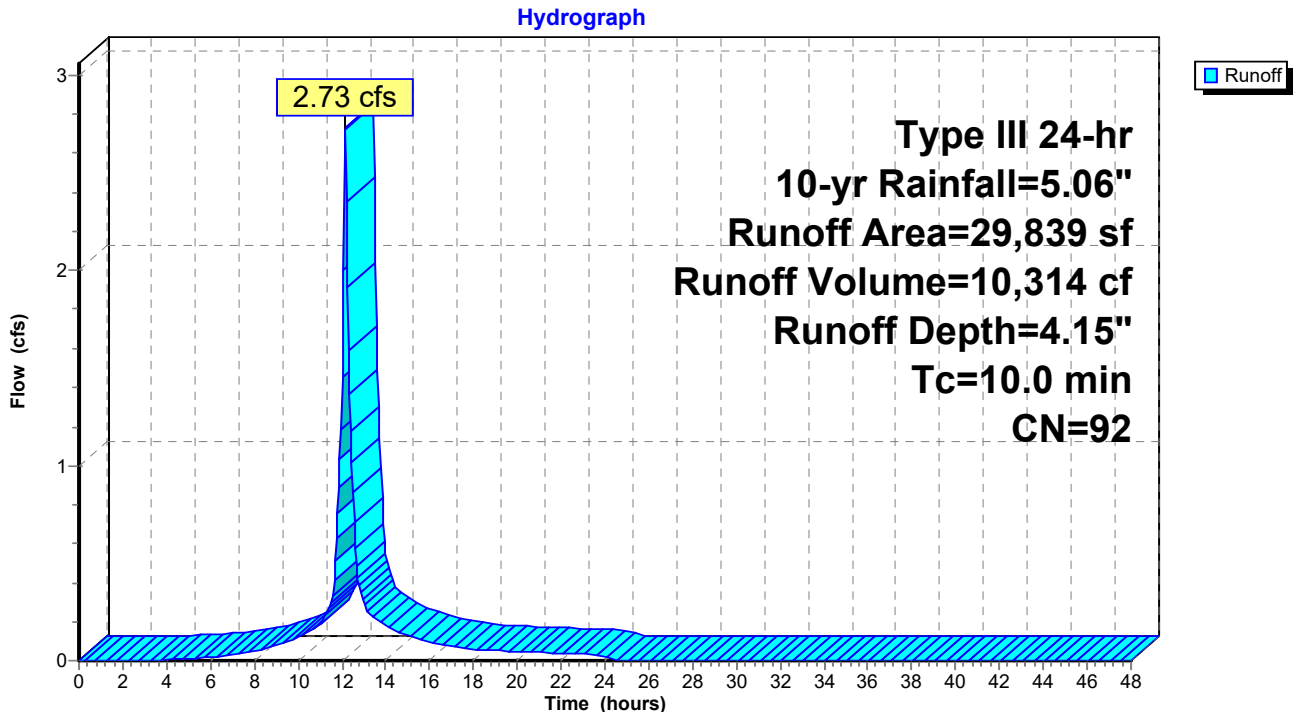
Runoff = 2.73 cfs @ 12.14 hrs, Volume= 10,314 cf, Depth= 4.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.06"

| | Area (sf) | CN | Description |
|---|-----------|----|-------------------------------|
| * | 11,690 | 98 | Pavement |
| * | 2,311 | 98 | Driveways |
| * | 2,899 | 98 | Sidewalk |
| | 9,740 | 80 | >75% Grass cover, Good, HSG D |
| * | 2,602 | 98 | Building 1-2 Roof |
| * | 597 | 98 | 3 car parking spot pavement |
| | 29,839 | 92 | Weighted Average |
| | 9,740 | | 32.64% Pervious Area |
| | 20,099 | | 67.36% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Subcatchment 2S: Drainage Area 1



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Type III 24-hr 10-yr Rainfall=5.06"

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Summary for Subcatchment 4S: By Pass

Runoff = 2.38 cfs @ 12.14 hrs, Volume= 8,562 cf, Depth= 3.13"

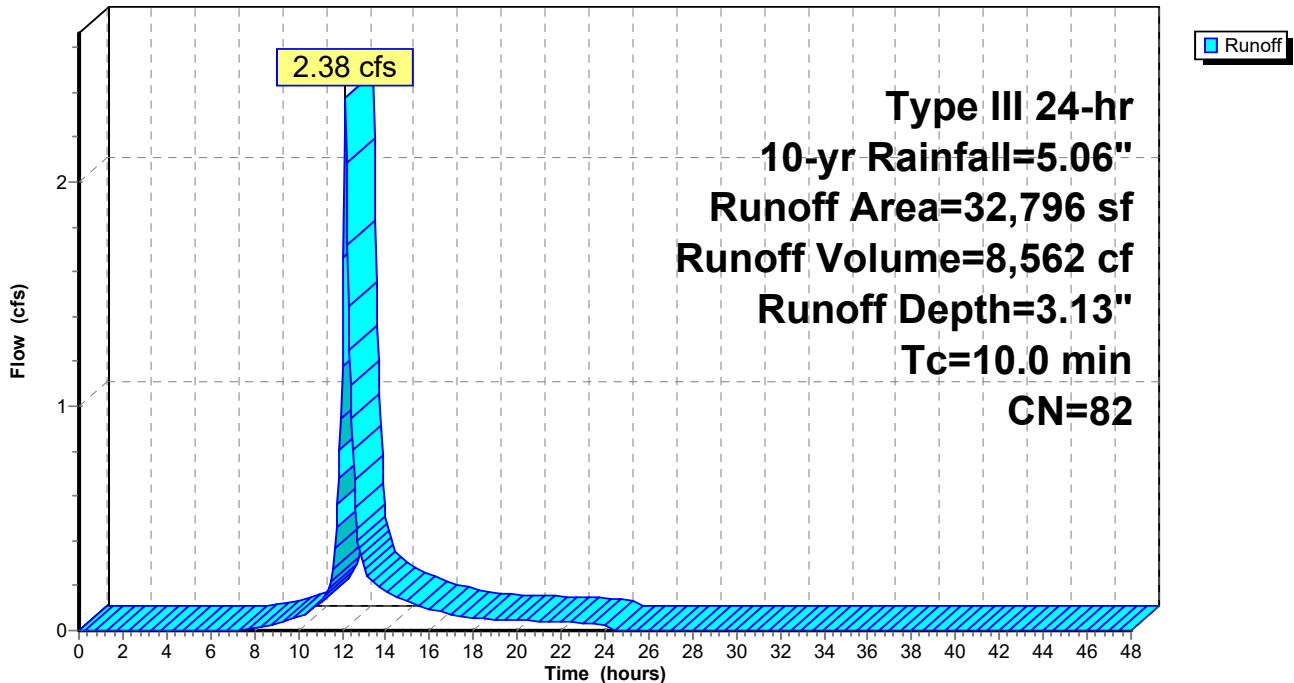
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.06"

| | Area (sf) | CN | Description |
|---|-----------|----|-----------------------|
| * | 29,999 | 80 | Landscaping HSG D |
| * | 2,797 | 98 | Patios |
| | 32,796 | 82 | Weighted Average |
| | 29,999 | | 91.47% Pervious Area |
| | 2,797 | | 8.53% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Subcatchment 4S: By Pass

Hydrograph



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Type III 24-hr 10-yr Rainfall=5.06"

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Summary for Pond 3P: Porous Pavement Detention

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=28)

Inflow Area = 29,839 sf, 67.36% Impervious, Inflow Depth = 4.15" for 10-yr event
 Inflow = 2.73 cfs @ 12.14 hrs, Volume= 10,314 cf
 Outflow = 0.23 cfs @ 11.70 hrs, Volume= 10,329 cf, Atten= 92%, Lag= 0.0 min
 Discarded = 0.23 cfs @ 11.70 hrs, Volume= 10,329 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 97.82' @ 13.34 hrs Surf.Area= 10,000 sf Storage= 4,091 cf

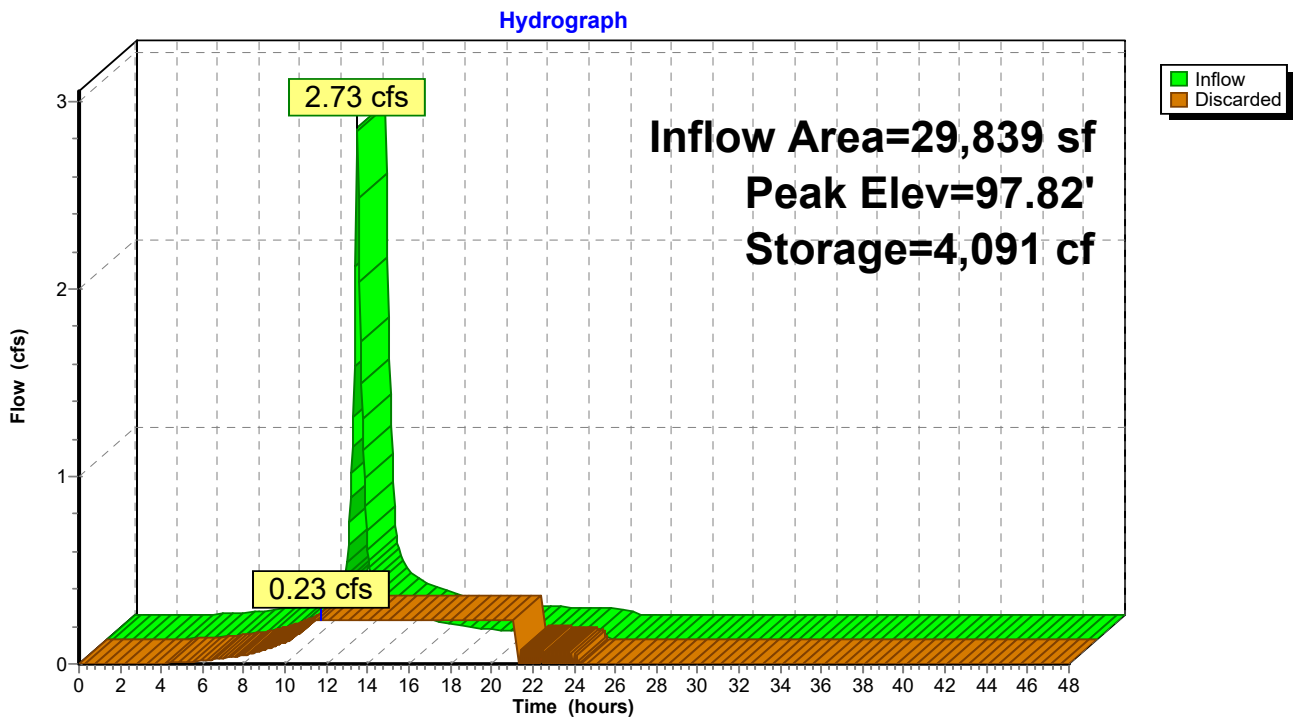
Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 140.7 min (926.8 - 786.0)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 97.00' | 10,000 cf | 100.00'W x 100.00'L x 2.00'H Prismatic 20,000 cf Overall x 50.0% Voids |

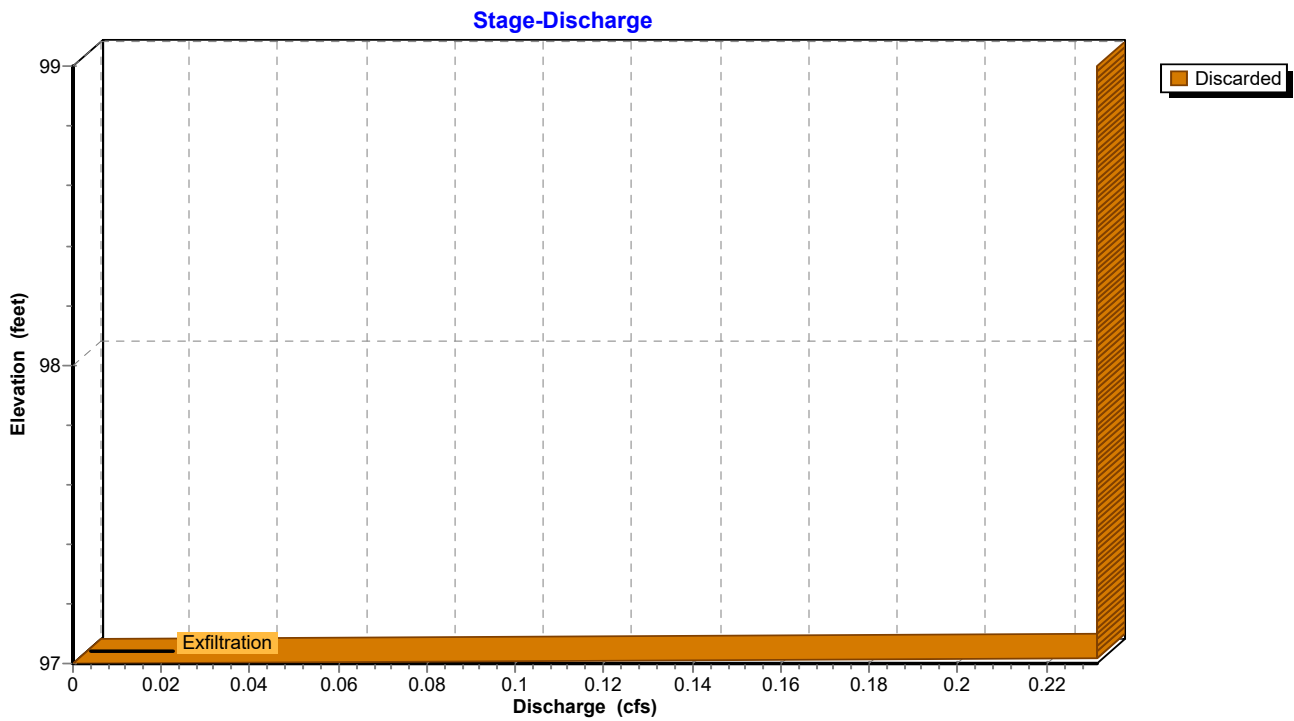
| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Discarded | 97.00' | 1.000 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=0.23 cfs @ 11.70 hrs HW=97.03' (Free Discharge)
 ↳ 1=Exfiltration (Exfiltration Controls 0.23 cfs)

Pond 3P: Porous Pavement Detention



Pond 3P: Porous Pavement Detention



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Type III 24-hr 10-yr Rainfall=5.06"

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Summary for Pond 5P: Rain Garden

Inflow Area = 11,240 sf, 100.00% Impervious, Inflow Depth = 4.82" for 10-yr event
 Inflow = 1.11 cfs @ 12.14 hrs, Volume= 4,518 cf
 Outflow = 0.48 cfs @ 12.39 hrs, Volume= 2,708 cf, Atten= 56%, Lag= 15.3 min
 Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Primary = 0.48 cfs @ 12.39 hrs, Volume= 2,708 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 91.36' @ 12.39 hrs Surf.Area= 1,800 sf Storage= 2,457 cf

Plug-Flow detention time= 272.1 min calculated for 2,708 cf (60% of inflow)
 Center-of-Mass det. time= 161.3 min (912.8 - 751.5)

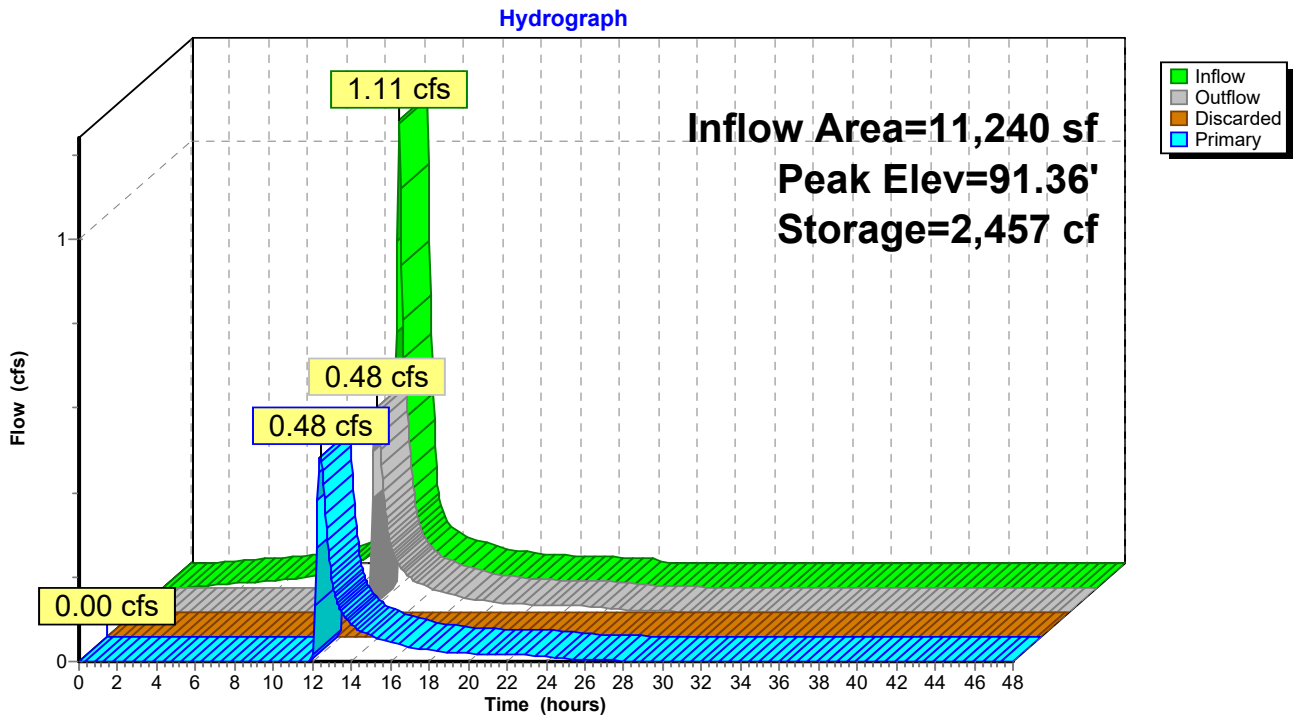
| Volume | Invert | Avail.Storage | Storage Description |
|---------------------|----------------------|---------------------------|--|
| #1 | 90.00' | 3,600 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 90.00 | 1,800 | 0 | 0 |
| 91.00 | 1,800 | 1,800 | 1,800 |
| 92.00 | 1,800 | 1,800 | 3,600 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Discarded | 90.00' | 1.000 in/hr Exfiltration over Surface area above 90.00' Excluded Surface area = 1,800 sf |
| #2 | Primary | 91.00' | 15.0" Round Culvert L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 91.00' / 90.50' S= 0.0100 ' S= 0.0100 ' Cc= 0.900 n= 0.011, Flow Area= 1.23 sf |

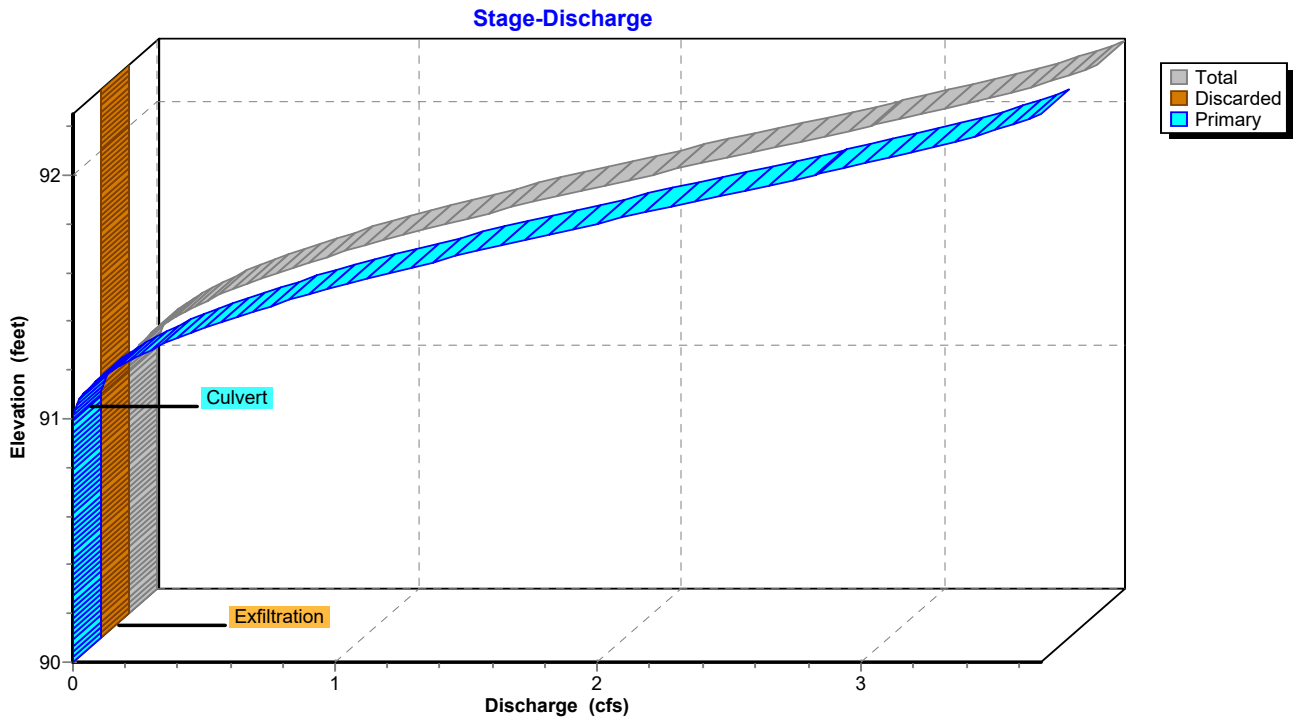
Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=90.00' (Free Discharge)
 ↑1=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=0.48 cfs @ 12.39 hrs HW=91.36' TW=81.43' (Dynamic Tailwater)
 ↑2=Culvert (Inlet Controls 0.48 cfs @ 1.62 fps)

Pond 5P: Rain Garden



Pond 5P: Rain Garden



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Type III 24-hr 10-yr Rainfall=5.06"

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Summary for Pond 7P: Existing Catch Basin

[57] Hint: Peaked at 81.65' (Flood elevation advised)

Inflow Area = 44,036 sf, 31.88% Impervious, Inflow Depth = 3.07" for 10-yr event
 Inflow = 2.51 cfs @ 12.16 hrs, Volume= 11,270 cf
 Outflow = 2.51 cfs @ 12.16 hrs, Volume= 11,270 cf, Atten= 0%, Lag= 0.0 min
 Primary = 2.51 cfs @ 12.16 hrs, Volume= 11,270 cf

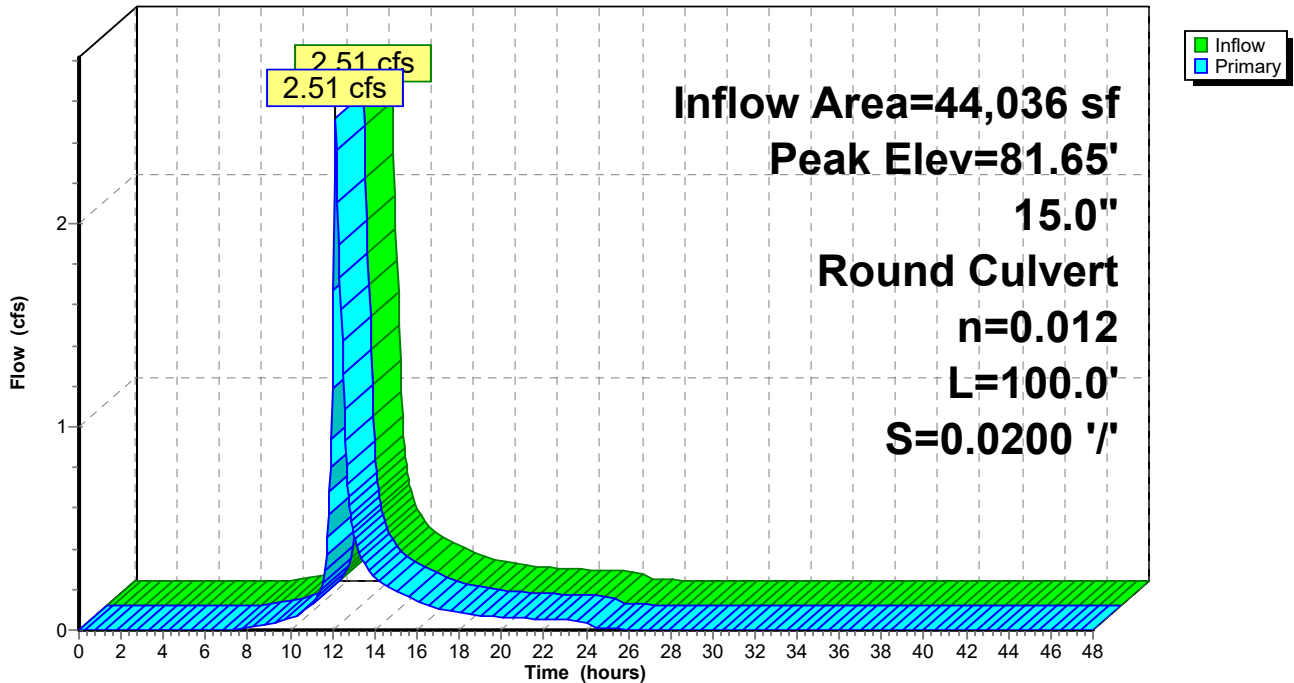
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 81.65' @ 12.16 hrs

| Device | Routing | Invert | Outlet Devices |
|--------|---------|--------|---|
| #1 | Primary | 80.73' | 15.0" Round Culvert L= 100.0' Ke= 0.900 Inlet / Outlet Invert= 80.73' / 78.73' S= 0.0200 '/ Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

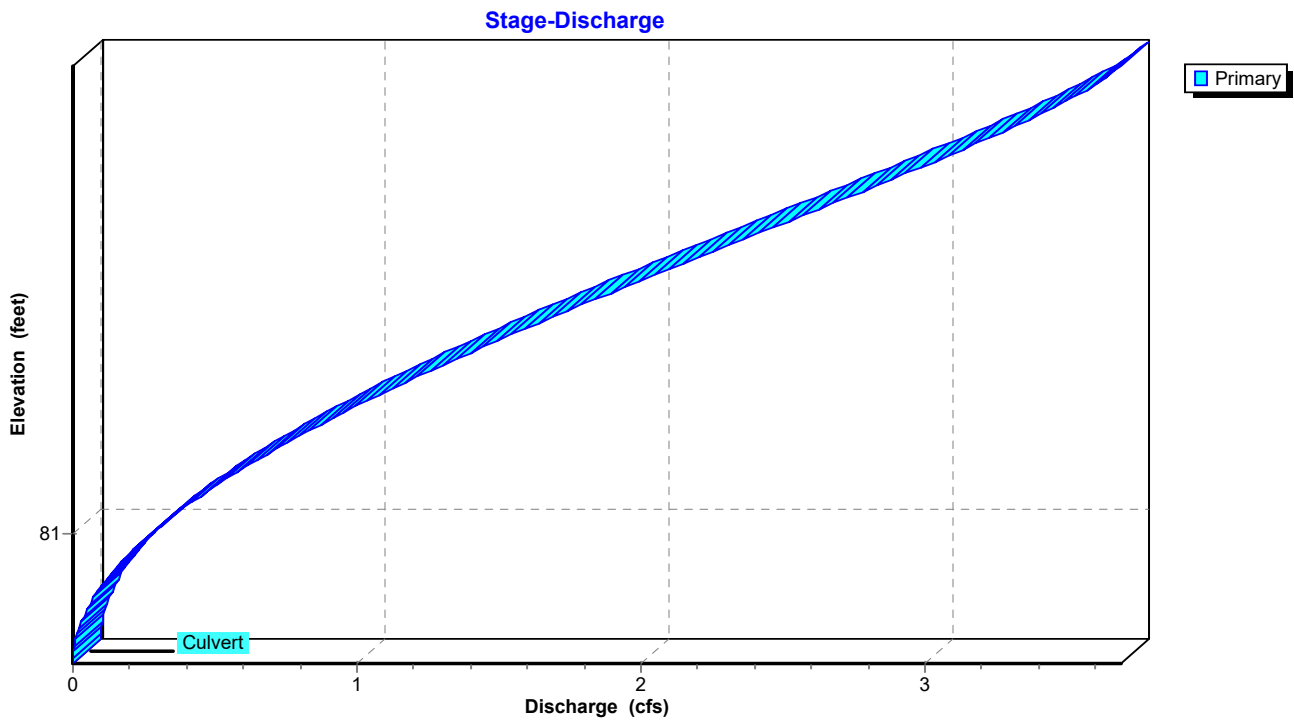
Primary OutFlow Max=2.49 cfs @ 12.16 hrs HW=81.65' (Free Discharge)
 ←1=Culvert (Inlet Controls 2.49 cfs @ 2.58 fps)

Pond 7P: Existing Catch Basin

Hydrograph



Pond 7P: Existing Catch Basin



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Type III 24-hr 100-yr Rainfall=8.48"

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Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Drainage area 2 Runoff Area=11,240 sf 100.00% Impervious Runoff Depth=8.24"
Tc=10.0 min CN=98 Runoff=1.86 cfs 7,718 cf

Subcatchment 2S: Drainage Area 1 Runoff Area=29,839 sf 67.36% Impervious Runoff Depth=7.52"
Tc=10.0 min CN=92 Runoff=4.79 cfs 18,696 cf

Subcatchment 4S: By Pass Runoff Area=32,796 sf 8.53% Impervious Runoff Depth=6.32"
Tc=10.0 min CN=82 Runoff=4.69 cfs 17,263 cf

Pond 3P: Pourous Pavement Detention Peak Elev=98.86' Storage=9,291 cf Inflow=4.79 cfs 18,696 cf
Outflow=0.23 cfs 18,715 cf

Pond 5P: Rain Garden Peak Elev=91.65' Storage=2,967 cf Inflow=1.86 cfs 7,718 cf
Discarded=0.00 cfs 0 cf Primary=1.39 cfs 5,909 cf Outflow=1.39 cfs 5,909 cf

Pond 7P: Existing Catch Basin Peak Elev=82.94' Inflow=5.88 cfs 23,172 cf
15.0" Round Culvert n=0.012 L=100.0' S=0.0200 '/' Outflow=5.88 cfs 23,172 cf

Total Runoff Area = 73,875 sf Runoff Volume = 43,678 cf Average Runoff Depth = 7.09"
53.79% Pervious = 39,739 sf 46.21% Impervious = 34,136 sf

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Type III 24-hr 100-yr Rainfall=8.48"

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Summary for Subcatchment 1S: Drainage area 2

Runoff = 1.86 cfs @ 12.14 hrs, Volume= 7,718 cf, Depth= 8.24"

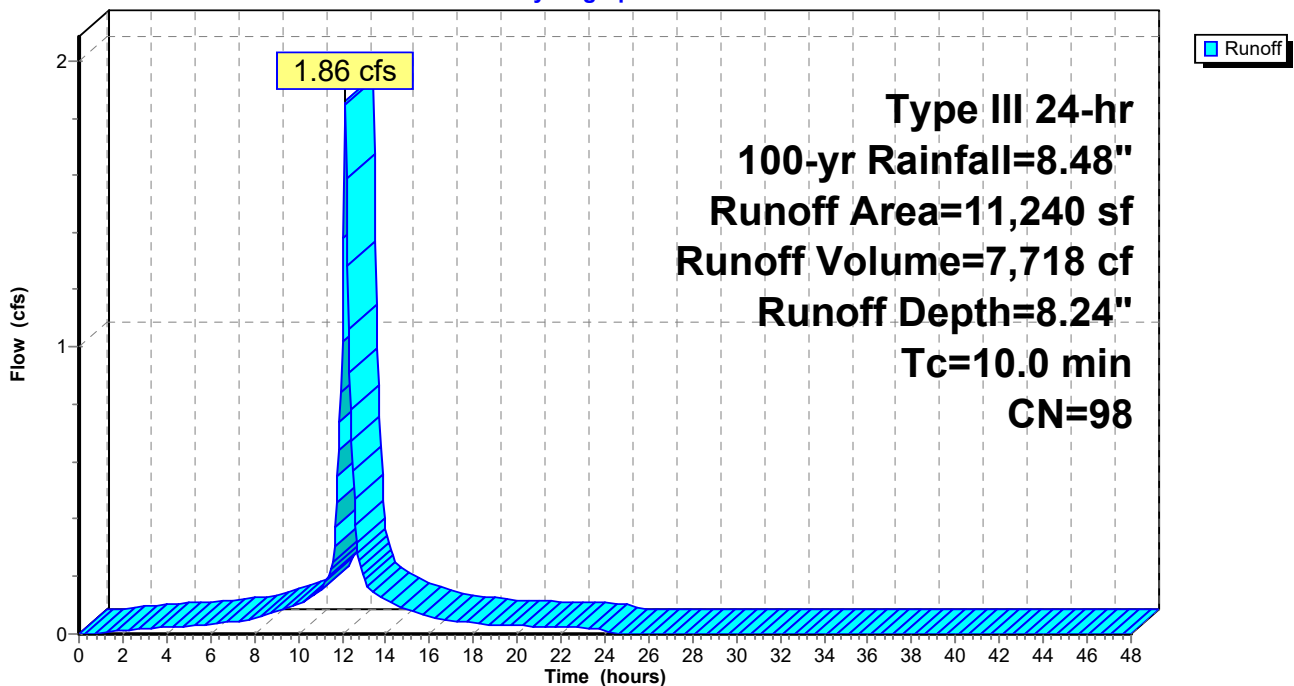
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.48"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| * 11,240 | 98 | Buildings 3-12 roof |
| 11,240 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Subcatchment 1S: Drainage area 2

Hydrograph



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Type III 24-hr 100-yr Rainfall=8.48"

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Summary for Subcatchment 2S: Drainage Area 1

Runoff = 4.79 cfs @ 12.14 hrs, Volume= 18,696 cf, Depth= 7.52"

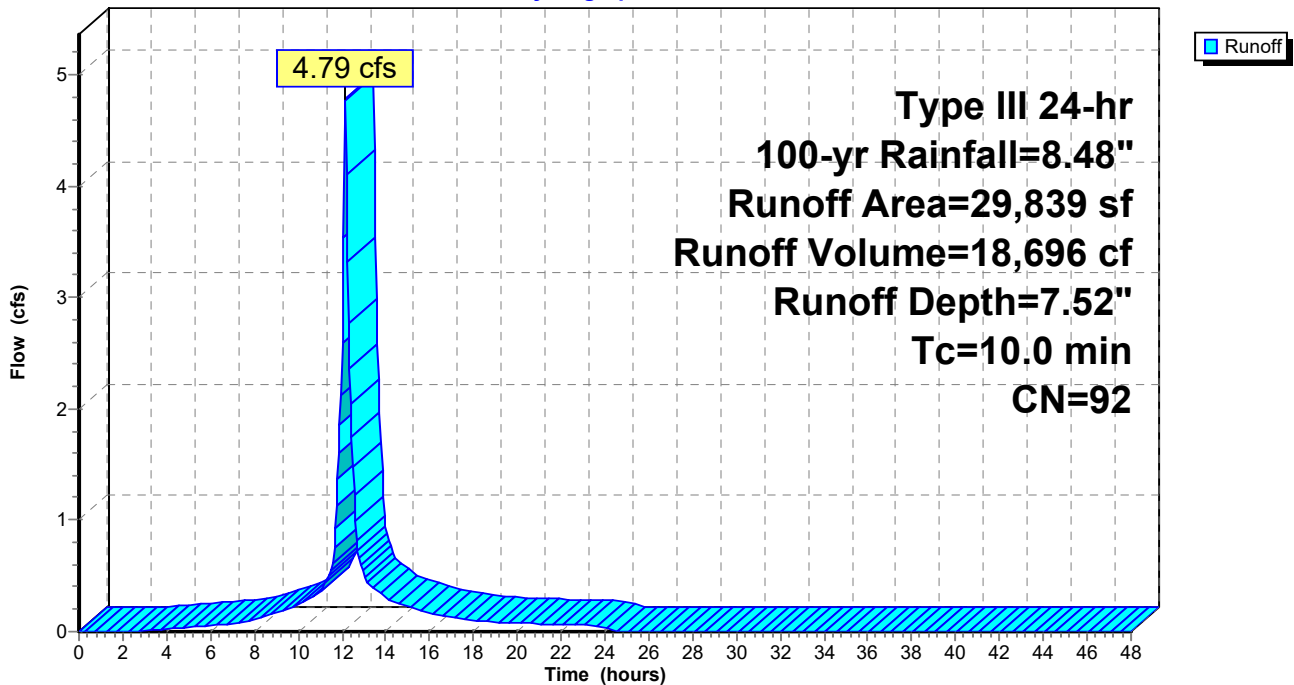
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.48"

| | Area (sf) | CN | Description |
|---|-----------|----|-------------------------------|
| * | 11,690 | 98 | Pavement |
| * | 2,311 | 98 | Driveways |
| * | 2,899 | 98 | Sidewalk |
| | 9,740 | 80 | >75% Grass cover, Good, HSG D |
| * | 2,602 | 98 | Building 1-2 Roof |
| * | 597 | 98 | 3 car parking spot pavement |
| | 29,839 | 92 | Weighted Average |
| | 9,740 | | 32.64% Pervious Area |
| | 20,099 | | 67.36% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Subcatchment 2S: Drainage Area 1

Hydrograph



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Type III 24-hr 100-yr Rainfall=8.48"

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Summary for Subcatchment 4S: By Pass

Runoff = 4.69 cfs @ 12.14 hrs, Volume= 17,263 cf, Depth= 6.32"

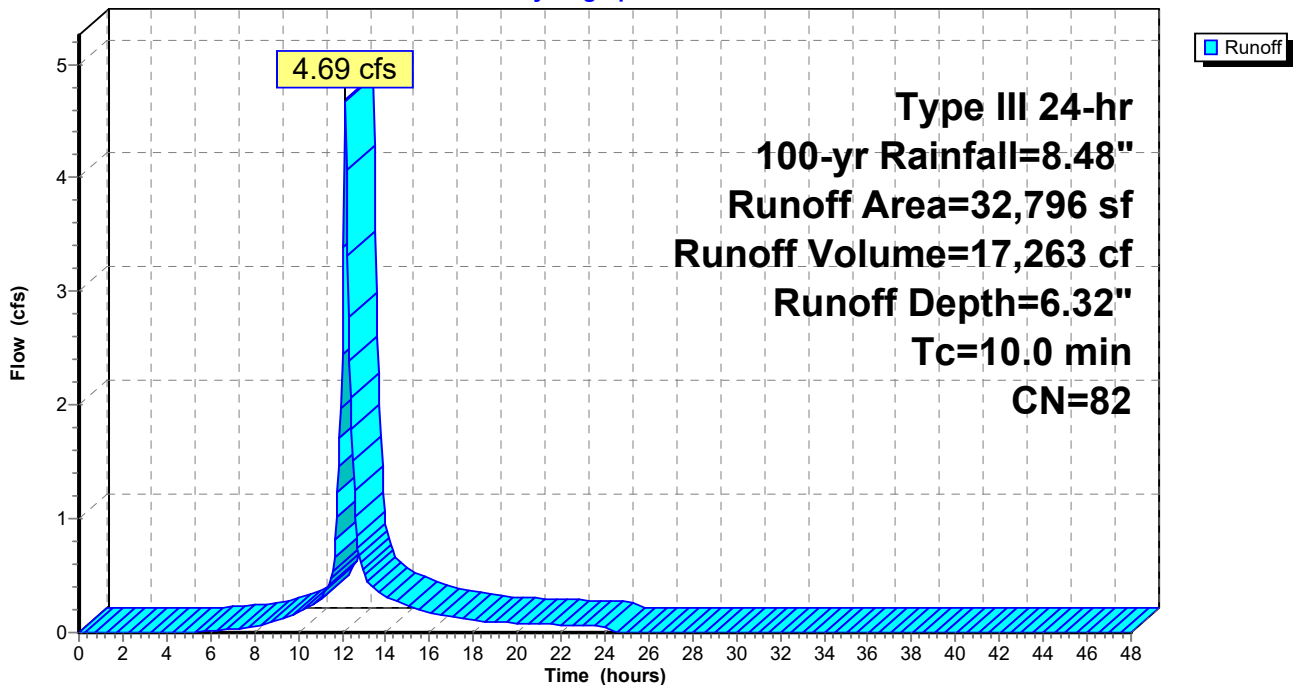
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.48"

| | Area (sf) | CN | Description |
|---|-----------|----|-----------------------|
| * | 29,999 | 80 | Landscaping HSG D |
| * | 2,797 | 98 | Patios |
| | 32,796 | 82 | Weighted Average |
| | 29,999 | | 91.47% Pervious Area |
| | 2,797 | | 8.53% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 10.0 | | | | | Direct Entry, |

Subcatchment 4S: By Pass

Hydrograph



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Type III 24-hr 100-yr Rainfall=8.48"

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Summary for Pond 3P: Poured Pavement Detention

Inflow Area = 29,839 sf, 67.36% Impervious, Inflow Depth = 7.52" for 100-yr event
 Inflow = 4.79 cfs @ 12.14 hrs, Volume= 18,696 cf
 Outflow = 0.23 cfs @ 10.70 hrs, Volume= 18,715 cf, Atten= 95%, Lag= 0.0 min
 Discarded = 0.23 cfs @ 10.70 hrs, Volume= 18,715 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 98.86' @ 14.94 hrs Surf.Area= 10,000 sf Storage= 9,291 cf

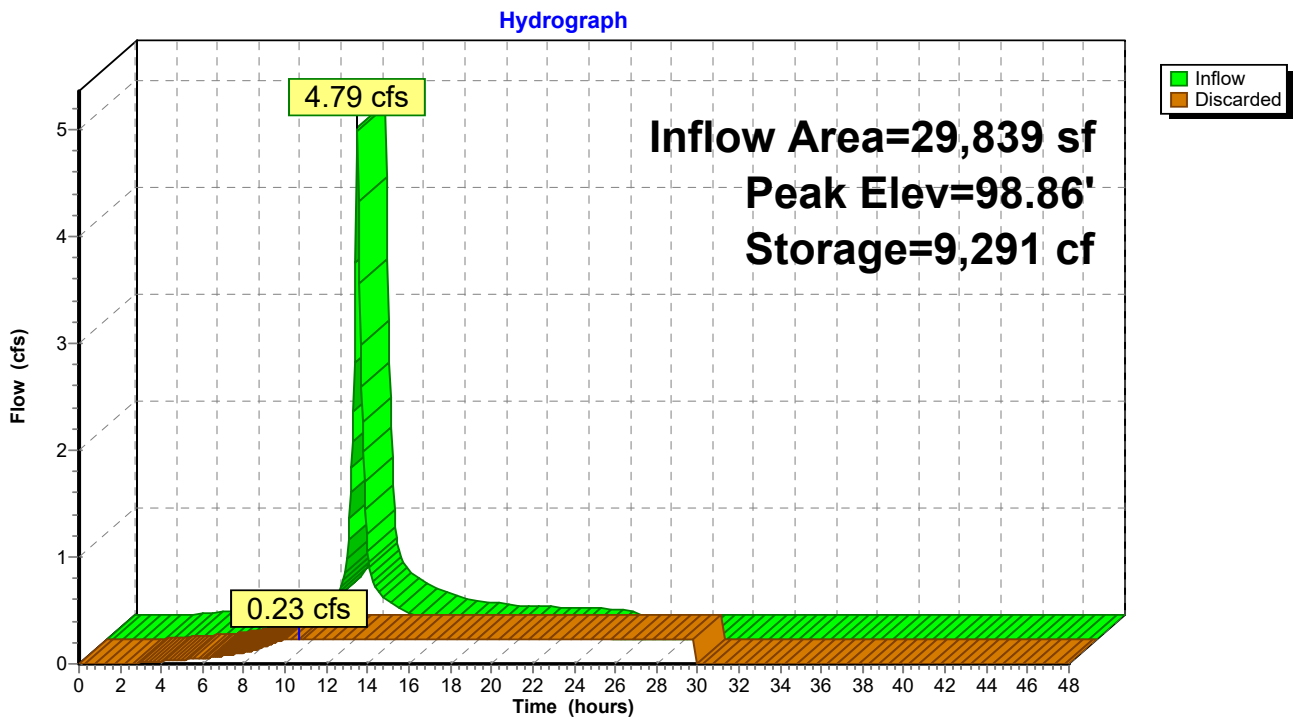
Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 347.5 min (1,118.7 - 771.3)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 97.00' | 10,000 cf | 100.00'W x 100.00'L x 2.00'H Prismaoid 20,000 cf Overall x 50.0% Voids |

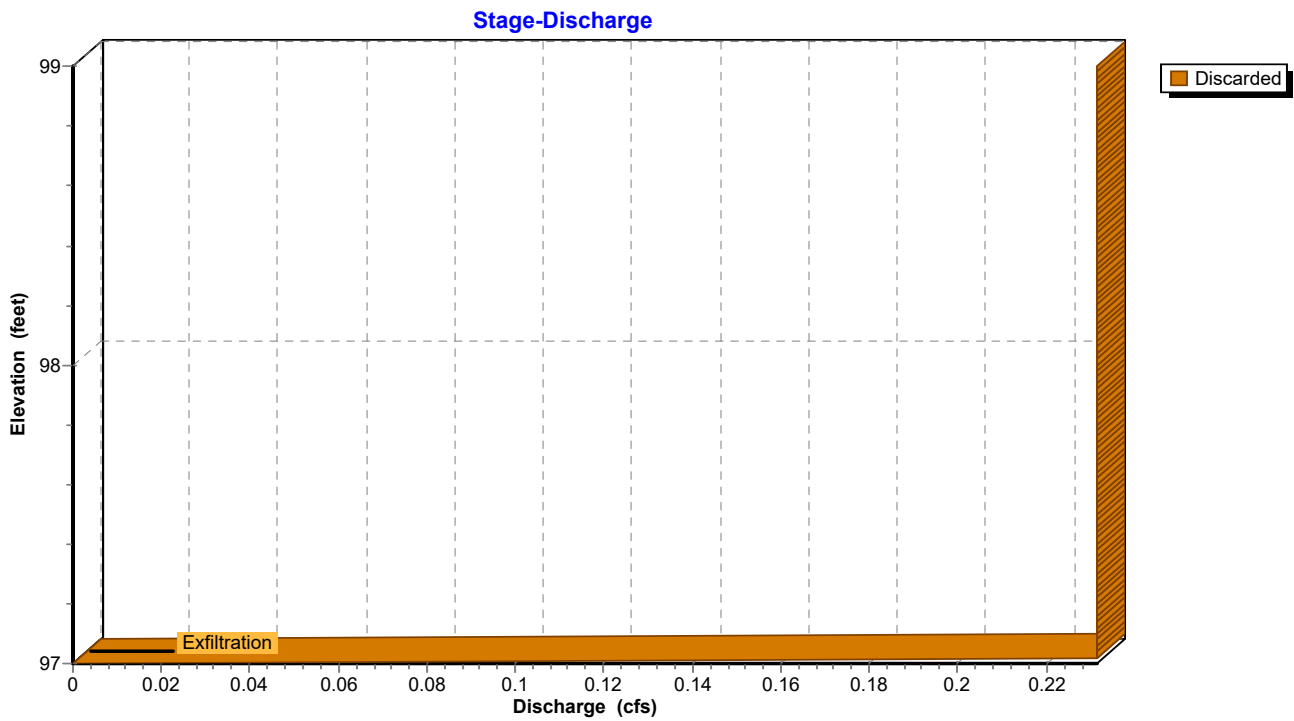
| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Discarded | 97.00' | 1.000 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=0.23 cfs @ 10.70 hrs HW=97.02' (Free Discharge)
 ↳1=Exfiltration (Exfiltration Controls 0.23 cfs)

Pond 3P: Poured Pavement Detention



Pond 3P: Porous Pavement Detention



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Type III 24-hr 100-yr Rainfall=8.48"

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Summary for Pond 5P: Rain Garden

Inflow Area = 11,240 sf, 100.00% Impervious, Inflow Depth = 8.24" for 100-yr event
 Inflow = 1.86 cfs @ 12.14 hrs, Volume= 7,718 cf
 Outflow = 1.39 cfs @ 12.24 hrs, Volume= 5,909 cf, Atten= 25%, Lag= 6.1 min
 Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Primary = 1.39 cfs @ 12.24 hrs, Volume= 5,909 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
 Peak Elev= 91.65' @ 12.24 hrs Surf.Area= 1,800 sf Storage= 2,967 cf

Plug-Flow detention time= 198.4 min calculated for 5,903 cf (76% of inflow)
 Center-of-Mass det. time= 115.1 min (859.3 - 744.2)

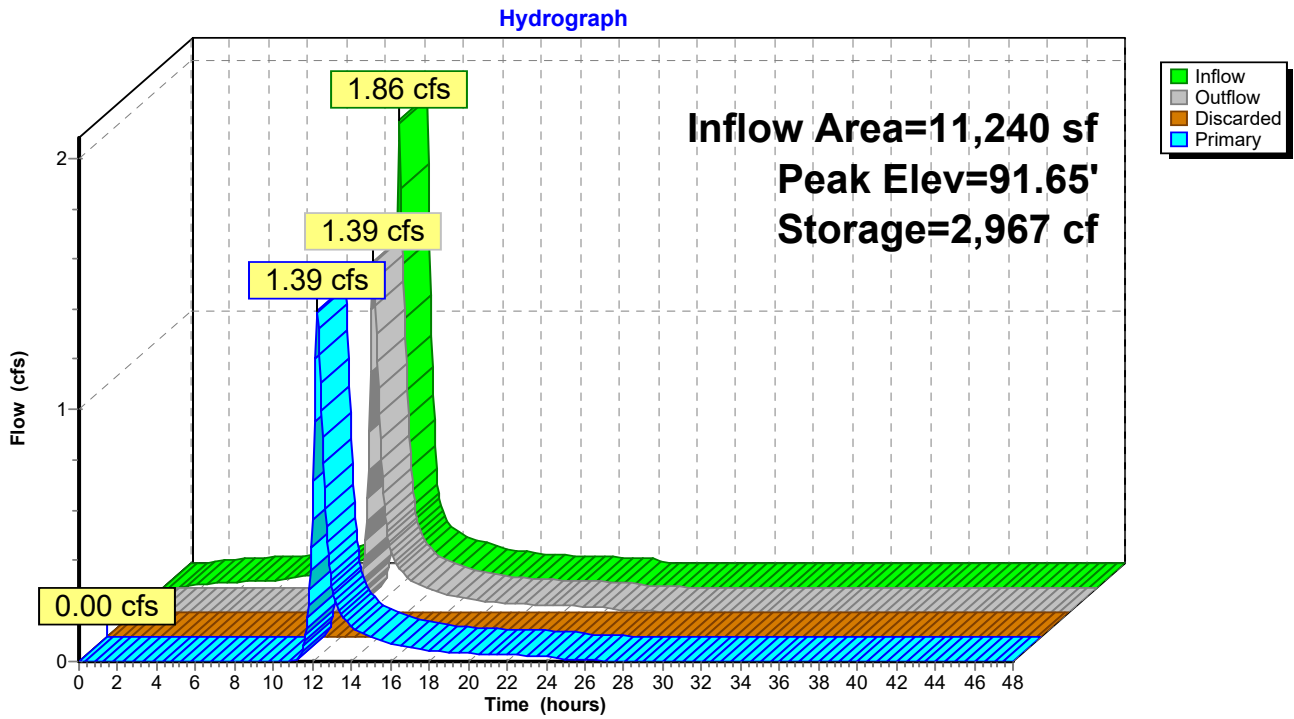
| Volume | Invert | Avail.Storage | Storage Description |
|---------------------|----------------------|---------------------------|--|
| #1 | 90.00' | 3,600 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 90.00 | 1,800 | 0 | 0 |
| 91.00 | 1,800 | 1,800 | 1,800 |
| 92.00 | 1,800 | 1,800 | 3,600 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Discarded | 90.00' | 1.000 in/hr Exfiltration over Surface area above 90.00' Excluded Surface area = 1,800 sf |
| #2 | Primary | 91.00' | 15.0" Round Culvert L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 91.00' / 90.50' S= 0.0100 ' S= 0.0100 ' Cc= 0.900 n= 0.011, Flow Area= 1.23 sf |

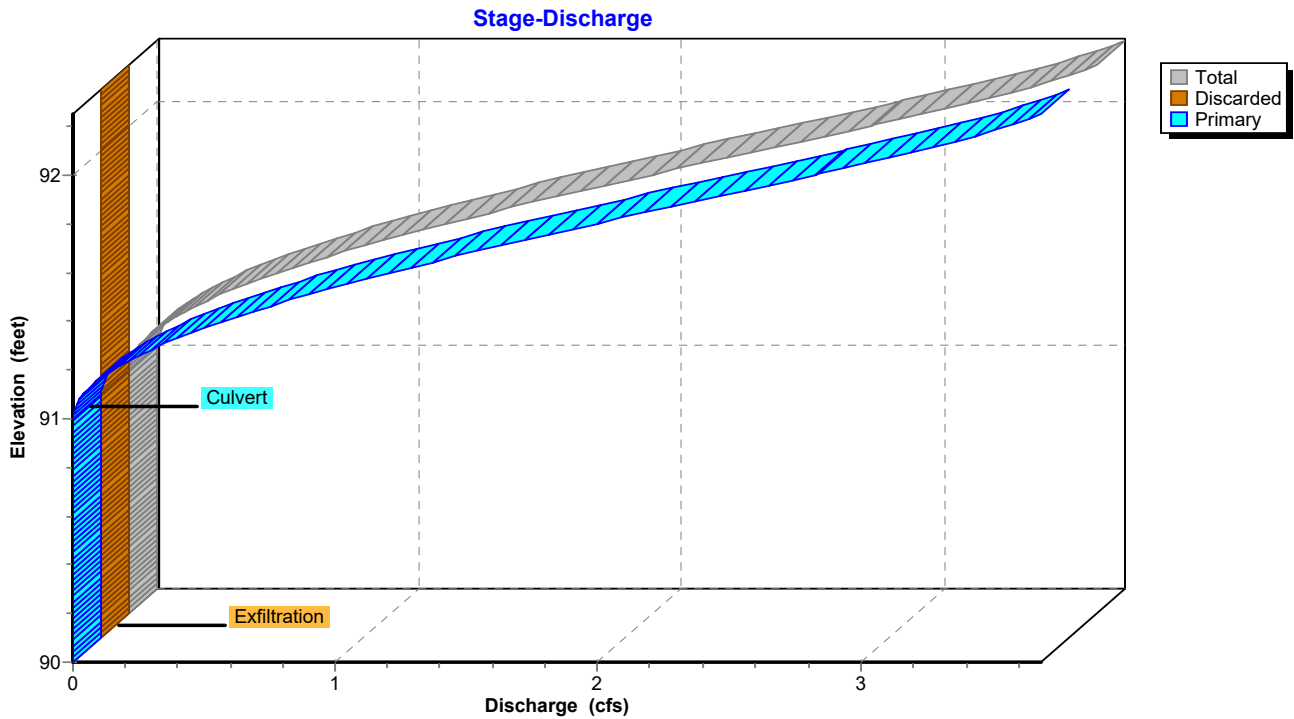
Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=90.00' (Free Discharge)
 ↑1=Exfiltration (Controls 0.00 cfs)

Primary OutFlow Max=1.38 cfs @ 12.24 hrs HW=91.65' TW=82.46' (Dynamic Tailwater)
 ↑2=Culvert (Inlet Controls 1.38 cfs @ 2.16 fps)

Pond 5P: Rain Garden



Pond 5P: Rain Garden



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Type III 24-hr 100-yr Rainfall=8.48"

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Summary for Pond 7P: Existing Catch Basin

[57] Hint: Peaked at 82.94' (Flood elevation advised)

Inflow Area = 44,036 sf, 31.88% Impervious, Inflow Depth = 6.31" for 100-yr event
Inflow = 5.88 cfs @ 12.15 hrs, Volume= 23,172 cf
Outflow = 5.88 cfs @ 12.15 hrs, Volume= 23,172 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.88 cfs @ 12.15 hrs, Volume= 23,172 cf

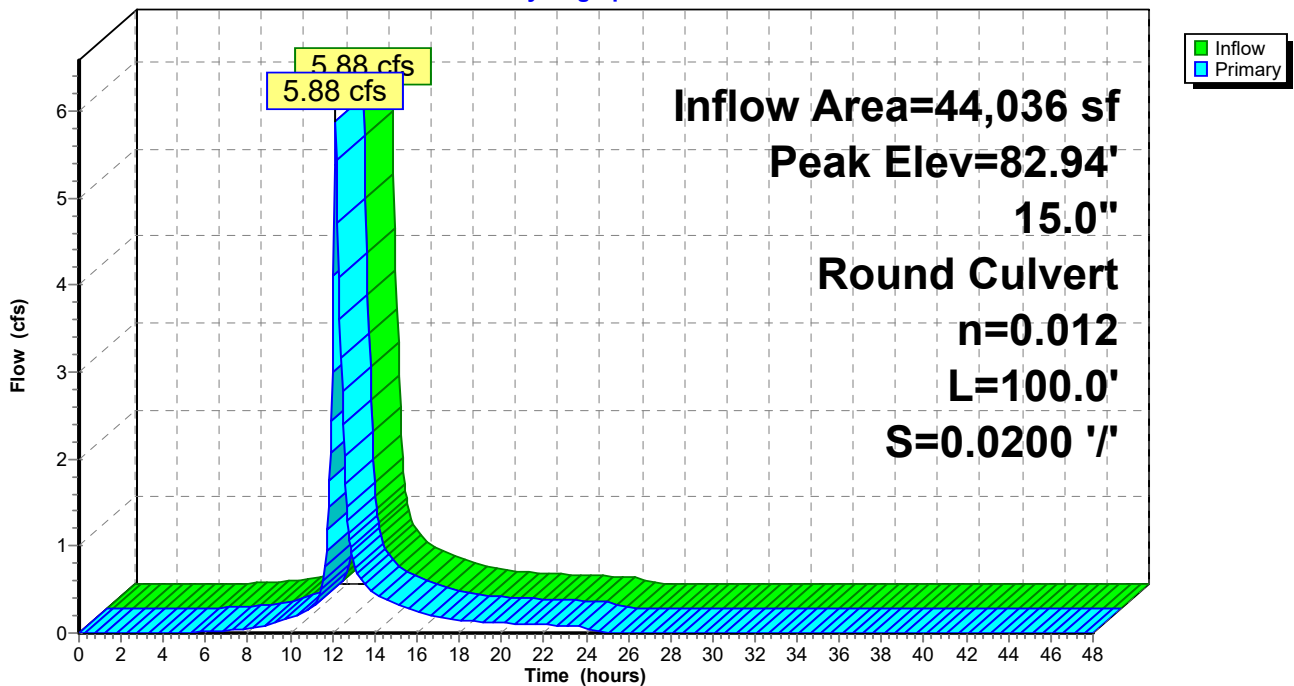
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 82.94' @ 12.15 hrs

| Device | Routing | Invert | Outlet Devices |
|--------|---------|--------|---|
| #1 | Primary | 80.73' | 15.0" Round Culvert L= 100.0' Ke= 0.900 Inlet / Outlet Invert= 80.73' / 78.73' S= 0.0200 '/ Cc= 0.900 n= 0.012, Flow Area= 1.23 sf |

Primary OutFlow Max=5.87 cfs @ 12.15 hrs HW=82.94' (Free Discharge)
↑=Culvert (Inlet Controls 5.87 cfs @ 4.78 fps)

Pond 7P: Existing Catch Basin

Hydrograph



Pond 7P: Existing Catch Basin

