Engineers Planners Surveyors Landscape Architects Environmental Scientists

MASER CONSULTING

Stormwater Management Report

483 – 485 Elizabeth Ave

Block 507.14, Lots 61 & 62
Franklin Township, Somerset County, NJ

October 2020

Prepared For

Elizabeth Realty Partners, LLC
154 First Ave
Manasquan, NJ 08736

Prepared By

Maser Consulting, Inc.
1000 Waterview Drive, Suite 201
Hamilton, NJ 08691
609.587.8200
N.J. C.O.A. #: 24GA27986500

Julia G. Algeo, PE
License No. GE34313
N.J. Licensed Professional Engineer

MC Project No. 19000649A

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Introduction

On behalf of the applicant, Elizabeth Realty Partners, LLC, Maser Consulting, Inc. is submitting this stormwater management report as part of a major site plan submission. The ±8.40 acre project site (±4.8 acre disturbance area) is located on the northbound side of Elizabeth Ave. The project site is known as Block 507.14, Lots 61 & 62. The proposed development is a warehouse use consisting of an approximate 76,230 SF warehouse including office space. Additional site improvements include, but are not limited to, the construction of loading docks, vehicle parking spaces, site lighting, landscaping, storm sewers, water mains, septic system, and utility laterals. One wet pond and a porous pavement area are proposed for the project. The project includes the demolition of the existing residence on the southeastern side of the site and associated improvements.

To satisfy the current stormwater management regulations, new stormwater management features are proposed. The site has been designed with features that provide stormwater attenuation, address groundwater recharge requirements, and satisfy water quality treatment requirements prior to discharge.

Hydrologic Methodologies

The Soil Conservation Service Unit Hydrograph (Appendix I) was utilized to calculate the stormwater runoff volumes and rates from the project site. Technical Release No. 55 (TR55) was utilized to obtain runoff curve numbers (CNs) for the various land cover types, and to obtain coefficients to calculate the time of concentration (TC) for each drainage area. The hydrologic model was analyzed and designed with the HydroCAD software program v10. The Type C storm was utilized to analyze the 2, 10, 25, and 100-year storm events.

The following parameters were utilized in the design of the stormwater management system:

Water Quantity - NJAC 7:8-5.4(a)3 provides three alternatives for controlling stormwater runoff quantity impacts.

i. Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the two, 10 and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events;

ii. Demonstrate through hydrologic and hydraulic analysis that there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the two, 10 and 100-year storm events and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site. This analysis shall include the analysis of impacts of existing land uses and projected land uses assuming full development under existing zoning and land use ordinances in the drainage area; or

iii. Design stormwater management measures so that the post-construction peak runoff rates for the two, 10 and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed.

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Water Quality - Treat runoff volume generated by the NJDEP 1.25-inch, 2-hour Water Quality Storm by utilizing stormwater management methods that reduce the developed site's average annual total suspended solids (TSS) load by at least 80% for proposed developed drainage areas, per NJAC 7:8-5.5.

Groundwater Recharge - Maintain 100 percent of the existing annual groundwater recharge volume on site under developed conditions, per NJAC 7:8-5.4 and the New Jersey Stormwater BMP Manual, Chapter 6.

Existing Conditions

The site topography has elevations ranging from 62± to 85±. The site is a combination of open space, wooded areas, wooded wetlands, two residential homes & drives, and an unnamed tributary of the Raritan River with crossings.

Based on the NRCS Web Soil Survey for Somerset County, the following soil types are mapped: Norton Loam (HSG C), Penn Silt Loam (HSG C) and Reaville Silt Loam (HSG C).

The existing drainage areas are broken into three areas, EDA 1, 2 and O.S.

EDA 1, the largest tract drains to an existing unnamed tributary of the Raritan River crossing the site. The existing tributary is located on the southwest portion of the site and runs in front of the southern residence and behind the northern residence. The tributary collects all the runoff from the site and Elizabeth Ave. The tributary flows from southwest to northeast and continues offsite and discharges into the Raritan River about two (2) miles northeast.

EDA-2, the northeasterly portion of the site initially drains to the north off-site. The runoff flows towards the tributary but is not collected by the on-site. The stormwater runoff from EDA-2 is collected by the tributary to the north of the site. The area consists of woods and grass.

EDA-O.S. borders the northwest portion of the tract and mainly consists of woods and grass. This area splits into two different routes. The southern portion of the off-site drainage area flows to a swale along the south property line. The northern portion follows the same path as EDA-2.

EDA-1: 4.44 Acres
EDA-2: 0.37 Acres
EDA-O.S.: 0.68 Acres

All three drainage patterns and areas converge into the existing Raritan River Unnamed Tributary.

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Proposed Conditions

The project proposes the construction of a one-story warehouse consisting of an office and warehouse floor space. A driveway, car parking area, truck loading area, and a fire access drive are also proposed. The proposed stormwater management was designed so that the developed flow rates for the 2-year, 10-year and 100-year storms would be reduced to at least 50%, 75% and 80% of the existing flow rates for all of the developed drainage areas (PDA 1, O.S., U.D. A & B).

There are four overall post-developed drainage areas.

PDA 1 & O.S. is captured and detained in a proposed wet pond. The wet pond discharges into the existing tributary via a new driveway crossing and culvert also proposed in this project.

PDA U.D A is located on the west end of the proposed development. This area consists of undetained runoff that could not be routed to the basin due to elevation constraints. The large majority of the undetained area is the proposed driveway. All driveway runoff that could be reasonably captured is collected by two inlets on the high end of the driveway. All other undetained runoff from the drive is collected by additional inlets near Elizabeth Avenue and discharged at the proposed culvert into the tributary.

PDA U.D B. is located on the southeast portion of the site. The area consists of a proposed septic field that will treat wastewater from the warehouse. This area drains into the adjacent wetlands on the southern portion of the site. This wetland area discharges into the swale along the southern property line and into the upstream reach of the on-site tributary. This area follows the same path as EDA O.S.

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Flow Rates & Volumes

The enclosed calculations were performed using the Soil Conservation Service Unit Hydrograph (Appendix I). Below is a comparison of the existing and developed flow rates for the site's drainage areas during a 2-year, 10-year, 25-year, and 100-year storm frequency.

Table 1: Peak Flow Rates for the Existing Drainage Areas (EDAs)

	EDA-1 Peak Flow Rate (cfs)	EDA-2 Peak Flow Rate (cfs)	EDA-O.S. Peak Flow Rate (cfs)
2-year	3.03	0.35	0.99
10-year	6.89	0.82	2.20
25-year	9.90	1.19	3.14
100-year	15.31	1.85	4.81

Table 2: Peak Undetained Flow Rates for the Developed Drainage Areas (PDAs)

	PDA-1 & O.S. (Wet Pond) Peak Flow Rate (cfs)	PDA-1 UD A Peak Flow Rate (cfs)	PDA-1 UD B Peak Flow Rate (cfs)
2-year	0.26	1.05	0.12
10-year	4.12	1.84	0.26
25-year	9.41	2.43	0.37
100-year	10.36	3.45	0.56

Table 3: Permitted Developed Flow Rates (based on NJDEP required reductions)

EDA-1.2 & O.S./PDA-1 & O.S.	2-Year Storm	10-Year Storm	100-Year Storm
EDA-1 & 2 Permitted Discharge Flow Rates	3.38 cfs x 50% = 1.69 cfs	7.71 cfs x 75% = 5.78 cfs	17.16 cfs x 80% = 13.73 cfs
EDA- O.S. Permitted Discharge Flow Rates	0.99 cfs	2.20 cfs	4.81 cfs
Total Permitted Discharge Flow Rates	2.68 cfs	7.98 cfs	18.54 cfs
Basin Discharge, PDA-1, O.S. & PDA-1 UD A&B Combined	0.26 cfs#	4.12 cfs#	10.36 cfs#

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Storage Systems

The proposed stormwater management wet pond is described above in "Proposed Conditions."

Table 5: Peak Rates and Storage Volumes for the Stormwater Management Basins

Wet Pond				
Condition	Peak Inflow Rate (cfs)	Peak Outflow Rate (cfs)	Maximum Storage Volume (cf.)	Maximum Water Surface Elevation
2-year	11.64	0.26	33,090	71.10
10-year	18.35	4.12	40,025	71.60
25-year	23.16	9.41	45,216	71.96
100-year	31.45	10.36	59,183	72.89

Emergency Spillway Calculations

The earthen, broad-crested weir emergency spillway has been designed to safely convey 150% of the 100-year storm if the basin outlet structure orifices, weirs, and grates are blocked.

The emergency spillway is designed as a 50' wide earthen broad-crested weir. The invert of the spillway is 73.00 and the top of the berm is 74.00. At 150% of the 100-year storm, the spillway will convey the stormwater at 46.56 cfs with a maximum elevation of 73.49. The velocity will be 1.91 fps.

Water Quality

The proposed wet pond and porous paving has been designed to provide water quality benefits to meet New Jersey Stormwater Quality Requirements per NJAC 7:8-5.5 and the New Jersey Stormwater BMP Manual, Chapter 9.5.

The total required TSS removal rate for the tract has been calculated below taking into consideration an existing driveway area that will be removed and revegetated as a part of the project (0.11 acres) and an existing gravel driveway that will be removed and replaced.

<u>Required TSS removal rate</u>
Total impervious area to be treated = 1.57 acres
Total paved driveway area to be removed = 0.11 acres
Total gravel driveway area to be removed = 0.01 acres
[(80% x (1.57 acres -0.12 acres)) + (0% x 0.11 acres) + (50% x 0.01 acres)]/1.57 acres = 74.2%
74.2% TSS Removal Rate Required

The Wet Pond utilizes a permanent pool at least three times greater than the water quality storm of the inflow for a 80% TSS removal. The inflow water quality storm volume is 4,051 cf. The permanent pool volume for the wet pond is 28,506 cf which is greater than three times the water quality storm volume. The wet pond also achieves a water quality storm detention time of 46.2 hours and therefore combined with the 3:1 volume achieves a 90% TSS removal rate. See Appendix C.

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The porous paving on a portion of the employee parking area is designed to infiltrate the water quality storm. A minimum of 16" of stone is used throughout the entire porous paving parking lot. A design infiltration rate of 0.5 in/hr was used for exfiltration of the stone. The invert of the stone is 73.85 and the minimum top elevation is 75.19. The water quality storm reaches a peak of 74.64, therefore the stone can detain the water quality storm. Larger storms are collected by an overflow piping system and discharged to the proposed wet pond. Supporting calculations can be found in Appendix C. The porous paving system will provide 80% TSS removal.

A portion of the proposed access driveway cannot be treated in the above systems due to elevation challenges. Since the proposed treatment systems achieve TSS removal rates over the required amount, an average for the project tract has been provided. All area discharge to the downstream side of the proposed culvert within the Raritan River Tributary on-site.

Porous Paver Drainage Area = 80% x 0.23 acres
Wet Pond Drainage Area = 90% x 1.11 acres
Driveway Drainage Area = 0% x 0.23 acres

Provided TSS removal rate
[(0.23 x 80) + (1.11 x 90) + (0.23 x 0)]/1.57 acres = 75.4 %

75.4% TSS Removal Rate Achieved > 74.2% Required

Groundwater Recharge

The proposed groundwater recharge facility (Porous Paving) has been designed to maintain 100 percent of the existing annual groundwater recharge volume, per by NJAC 7:8-5.4 and the New Jersey BMP Manual, Chapter 6. The site was analyzed utilizing the NJ Annual Groundwater Recharge Spreadsheet (based on GSR-32), described in Chapter 6 of the New Jersey Stormwater BMP Manual, along with existing and proposed impervious/pervious coverage information. See Appendix H for supportive documentation that groundwater recharge is achieved. Also refer to the above noted appendices for infiltration design information.

Off-Site Stability

Stability Analysis:

A wet pond has been designed which reduces the peak flow rates to less than 50% of the predevelopment 2-year storm and less than 75% of the predevelopment 10-year storm. A comparison table on page 4 is provided for pre and post development discharges.

Storm Sewer Collection System

The storm sewer system has been designed in accordance with NJAC 5:21-7.2, 7.3 & 7.4. The 25-year frequency storm event was utilized. The Somerset IDF curve, as determined by NOAA Atlas 14 and specified in NJAC 5:21-7.2(c)5, was utilized to determine the storm intensity. A minimum time of concentration of 10 minutes was utilized in the design, per NJAC 5:21-7.2(c)5. See Appendix E for calculation worksheets.

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Nonstructural Strategies

According to the NJDEP Stormwater Management Rules at N.J.A.C. 7:8, the groundwater recharge, stormwater quality, and stormwater quantity standards established by the Rules for major land development projects must be met by incorporating nine specific nonstructural stormwater management strategies into the project's design to the maximum extent practicable.

The site remains compliant with NJAC 7:8-5.3 non-structural management strategies by specifically incorporating the following nonstructural stormwater management strategies as follows:

1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss;

   The footprint of the improvements has been minimized. The existing wetland area disturbance has been minimized and transition area compensated for. Stormwater runoff will be discharged in a similar manor of existing conditions.

2. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces;

   The overall impervious coverage is less than 49% and below the Township ordinance of 60% maximum impervious coverage. Porous paving and curb cuts for drainage have been utilized to disconnect impervious surfaces.

3. Maximize the protection of natural drainage features and vegetation;

   The footprint of the improvements has been minimized to the rear of the site. The clearing of the existing wooded area in the front of the site is minimized. Stormwater runoff will be discharged in a similar manor of existing conditions. Wetland disturbance has been minimized. Soil erosion measures are proposed to be utilized during construction to protect the adjoining properties and wetland area. An existing house and associated impervious improvement will be removed and revegetated.

4. Minimize the decrease in the "time of concentration" from pre-construction to post construction. "Time of concentration" is defined as the time it takes for runoff to travel from the hydraulically most distant point of the drainage area to the point of interest within a watershed;

   Porous paving and curb cuts for drainage have been utilized to disconnect impervious surfaces and increase time of concentration.

5. Minimize land disturbance including clearing and grading;

   The proposed land disturbance has been minimized to 4.77AC which is only 57% of the total tract. Disturbance to wetland and tributary areas have been minimized. Retaining walls are proposed along the parking lot, basin and driveway to reduce expanded grading which reduces the overall disturbance area.

6. Minimize soil compaction;

   Soil compaction has been minimized within the project limits. The site is subject to the decompaction requirements of the from the Soil Erosion & Sediment Control Details for compaction testing details.

7. Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides;

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Landscaping proposed has been chosen for its native and drought tolerant qualities.

8. Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas; and

   The loading area has been designed to discharge through curb cuts to the vegetated basin in lieu of piping.

9. Provide other source controls to prevent or minimize the use or exposure of pollutants at the site to prevent or minimize the release of those pollutants into stormwater runoff. These source controls include, but are not limited to:

   i. Site design features that help to prevent accumulation of trash and debris in drainage systems;

      In existing conditions, the debris washes directly into the existing tributary. In proposed conditions, the stormwater inlets have been specified with "eco J" type curb pieces indicating the text "Dump No Waste, Drains to Waterways" and trash racks are specified for installation at the outlet control structure. In addition, a "Stormwater Management Facilities Operation & Maintenance Manual" has been prepared for use by contractors and the owners that specify that street sweeping must occur on a bi-monthly schedule.

   ii. Site design features that help to prevent discharge of trash and debris from drainage systems;

      In existing conditions, the debris washes directly into the tributary. In proposed conditions, the stormwater inlets have been specified with "eco J" type curb pieces indicating the text "Dump No Waste, Drains to Waterways" and trash racks are specified for installation at the outlet control structure. In addition, a "Stormwater Management Facilities Operation & Maintenance Manual" has been prepared for use by contractors and the owners that specify that street sweeping must occur on a bi-monthly schedule.

   iii. Site design features that help to prevent and/or contain spills or other harmful accumulations of pollutants at industrial or commercial developments; and

      The stormwater management wet pond and porous paving will improve water quality by 80% or more.

   iv. When establishing vegetation after land disturbance, applying fertilizer in accordance with the requirements established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq., and implementing rules.

      The soil erosion and sediment control and landscape plans address the requirement for establishing vegetation.

Preventative source controls include use of ECO inlet curb pieces, storm drain inlets and trash rack on the OFS. Pollution prevention techniques such as water quality treatment thru infiltration and clearing restrictions have been implemented in the design. The soil erosion and sediment control plan addresses, re-stabilizing vegetation and implementing SESC protection measures. Prevention and maintenance is also addressed in the Stormwater Operations and Maintenance Manual prepared for the project.

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Conclusion

The proposed development has been designed in accordance with NJAC 5:21, NJAC 7:8 & the New Jersey Stormwater Best Management Practices Manual.

APPENDIX A

Hydrographs, CN, & Tc Calculations for Existing Conditions

Worksheet 3: Time of Concentration (Tc) or Travel Time (Tt)

Project: Elizabeth Realty Partners LLC

Location: Franklin Township (Somerset) By: MSB Date: 10/12/2020

Circle one: Present Developed Checked: MSY Date:

Circle one: Tc Tt through subarea EDA-1

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (applicable to Tc only)

1.	Surface description (table 3-1)		Grass (Dense)							
2.	Manning's roughness coefficient, n (table 3-1)		0.24							
3.	Flow Length, L (total L ≤ 300 ft)	ft	100							
4.	Two-year 24-hour rainfall, P2	in	3.3							
5.	Land slope, s	ft/ft	0.025							
6.	$Tc = \frac{0.007\ (n\ L)^{0.8}}{(P2)^{0.5}\ s^{0.4}}$	hr	0.21	+	0	+		=	0.21	

Shallow Concentrated Flow

7.	Surface Description (paved or unpaved)		Unpaved							
8.	Flow Length, L	ft	702							
9.	Watercourse slope, s	ft/ft	0.024							
10.	Average Velocity, V (figure 3-1)	ft/sec	0.77							
11.	$Tt = \frac{L}{3600\ V}$	hr	0.25	+	0	+	0	=	0.25	

Channel Flow

12.	Cross sectional flow area, a	sq ft	27.00							
13.	Wetted perimeter, pw	ft	18.00							
14.	Hydraulic radius, r (=a/pw)	ft	1.5000	0		0				
15.	Channel slope, s	ft/ft	0.005							
16.	Manning's roughness coefficient, n		0.03							
17.	$V = \frac{1.49\ r^{(2/3)}\ s^{(1/2)}}{n}$	ft/s	4.60	0		0				
18.	Flow length, L	ft	322							
19.	$Tt = \frac{L}{3600\ V}$	hr	0.02	+	0.00	+	0.00	=	0.02	

20.	Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)	=	0.49	hr
		=	29.1	min

Worksheet 3: Time of Concentration (Tc) or Travel Time (Tt)

Project: Elizabeth Realty Partners LLC

Location: Franklin Township (Somerset) By: MSB Date: 10/12/2020

Circle one: Present Developed Checked: MSY Date:

Circle one: Tc Tt through subarea EDA-2

Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

Sheet Flow (applicable to Tc only)

1.	Surface description (table 3-1)		Grass (Short)							
2.	Manning's roughness coefficient, n (table 3-1)		0.15							
3.	Flow Length, L (total L ≤ 300 ft)	ft	42							
4.	Two-year 24-hour rainfall, P2	in	3.3							
5.	Land slope, s	ft/ft	0.004							
6.	$Tc = \frac{0.007\ (n\ L)^{0.8}}{(P2)^{0.5}\ s^{0.4}}$	hr	0.15	+	0	+		=	0.15	

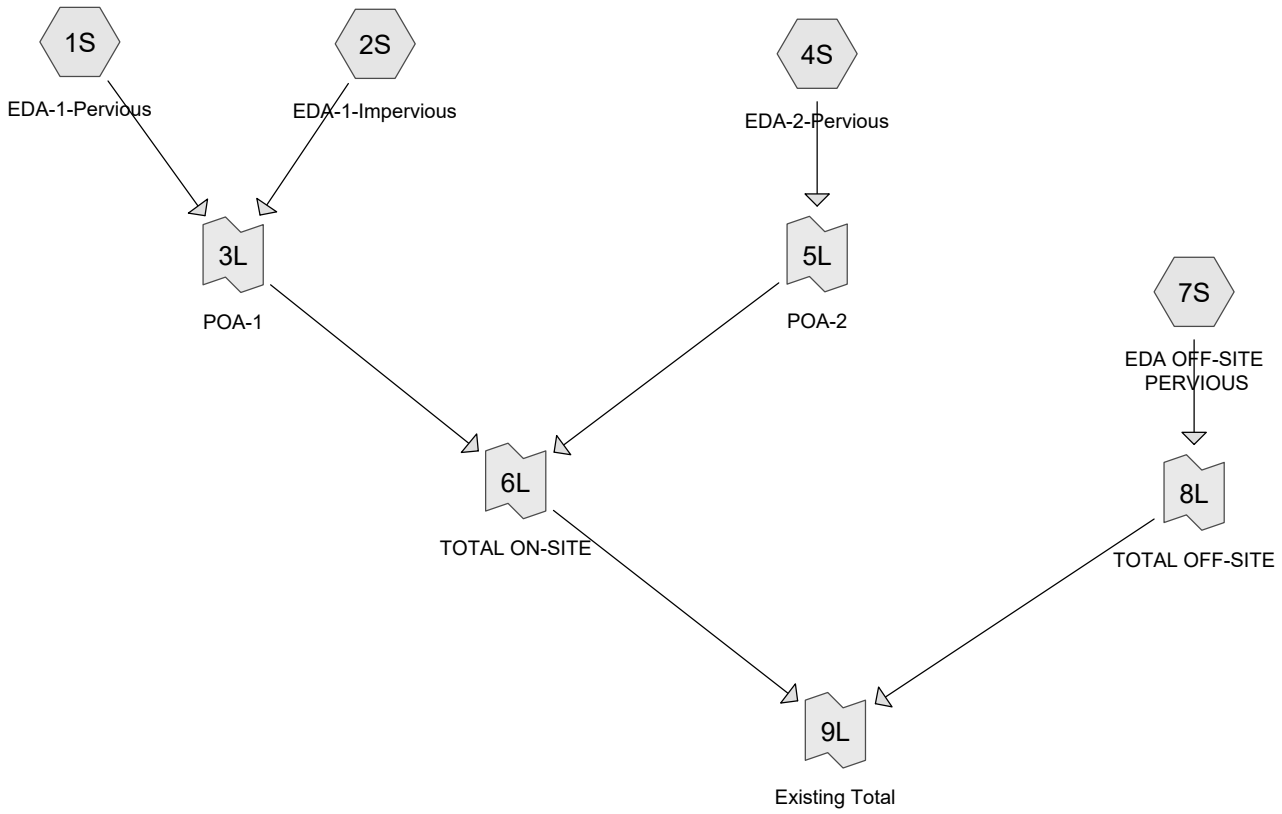
Shallow Concentrated Flow

7.	Surface Description (paved or unpaved)		Grassed	Woodland						
8.	Flow Length, L	ft	20	97						
9.	Watercourse slope, s	ft/ft	0.024	0.021						
10.	Average Velocity, V (figure 3-1)	ft/sec	0.77	0.75						
11.	$Tt = \frac{L}{3600\ V}$	hr	0.01	+	0.04	+	0	=	0.04	

Channel Flow

12.	Cross sectional flow area, a	sq ft								
13.	Wetted perimeter, pw	ft								
14.	Hydraulic radius, r (=a/pw)	ft								
15.	Channel slope, s	ft/ft								
16.	Manning's roughness coefficient, n									
17.	$V = \frac{1.49\ r^{(2/3)}\ s^{(1/2)}}{n}$	ft/s								
18.	Flow length, L	ft								
19.	$Tt = \frac{L}{3600\ V}$	hr						=	0.00	

20.	Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)	=	0.20	hr
		=	11.7	min



Subcat Reach Pond Link

Routing Diagram for Existing
Prepared by Maser Consulting PA, Printed 11/2/2020

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.310	74	>75% Grass cover, Good, HSG C (1S, 4S)
0.060	98	Paved parking, HSG C (2S)
2.440	70	Woods, Good, HSG C (1S, 4S)
0.680	72	Woods/grass comb., Good, HSG C (7S)
5.490	**72**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
5.490	HSG C	1S, 2S, 4S, 7S
0.000	HSG D	
0.000	Other	
5.490		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	2.310	0.000	0.000	2.310	>75% Grass cover, Good	1S, 4S
0.000	0.000	0.060	0.000	0.000	0.060	Paved parking	2S
0.000	0.000	2.440	0.000	0.000	2.440	Woods, Good	1S, 4S
0.000	0.000	0.680	0.000	0.000	0.680	Woods/grass comb., Good	7S
0.000	**0.000**	**5.490**	**0.000**	**0.000**	**5.490**	**TOTAL AREA**	

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

Subcatchment1S: EDA-1-Pervious Runoff Area=4.380 ac 0.00% Impervious Runoff Depth=1.02"
Flow Length=1,124' Tc=29.1 min CN=72 Runoff=2.92 cfs 0.371 af

Subcatchment2S: EDA-1-Impervious Runoff Area=0.060 ac 100.00% Impervious Runoff Depth=3.11"
Flow Length=1,124' Tc=25.4 min CN=98 Runoff=0.13 cfs 0.016 af

Subcatchment4S: EDA-2-Pervious Runoff Area=0.370 ac 0.00% Impervious Runoff Depth=0.96"
Flow Length=159' Tc=11.7 min CN=71 Runoff=0.35 cfs 0.030 af

Subcatchment7S: EDA OFF-SITE PERVIOUS Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=1.02"
Tc=0.0 min CN=72 Runoff=0.99 cfs 0.058 af

Link 3L: POA-1 Inflow=3.03 cfs 0.387 af
Primary=3.03 cfs 0.387 af

Link 5L: POA-2 Inflow=0.35 cfs 0.030 af
Primary=0.35 cfs 0.030 af

Link 6L: TOTAL ON-SITE Inflow=3.20 cfs 0.417 af
Primary=3.20 cfs 0.417 af

Link 8L: TOTAL OFF-SITE Inflow=0.99 cfs 0.058 af
Primary=0.99 cfs 0.058 af

Link 9L: Existing Total Inflow=3.44 cfs 0.474 af
Primary=3.44 cfs 0.474 af

Total Runoff Area = 5.490 ac Runoff Volume = 0.474 af Average Runoff Depth = 1.04"
98.91% Pervious = 5.430 ac 1.09% Impervious = 0.060 ac

Summary for Subcatchment 1S: EDA-1-Pervious

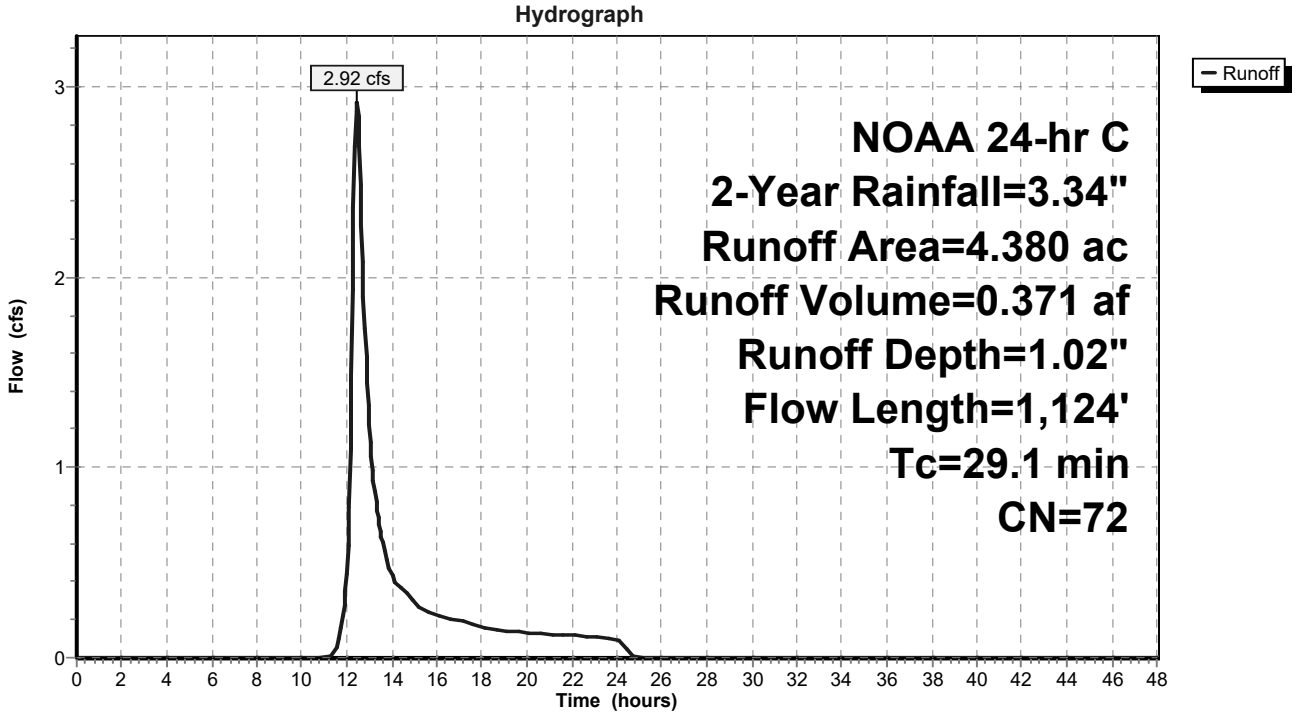
Runoff = 2.92 cfs @ 12.44 hrs, Volume= 0.371 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
2.150	70	Woods, Good, HSG C
2.230	74	>75% Grass cover, Good, HSG C
4.380	72	Weighted Average
4.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	100	0.0252	0.13		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.38"
15.2	702	0.0238	0.77		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
1.2	322	0.0050	4.59	123.92	**Channel Flow, Natural Stream** Area= 27.0 sf Perim= 18.0' r= 1.50' n= 0.030 Stream, clean & straight
29.1	1,124	Total			

Subcatchment 1S: EDA-1-Pervious



Summary for Subcatchment 2S: EDA-1-Impervious

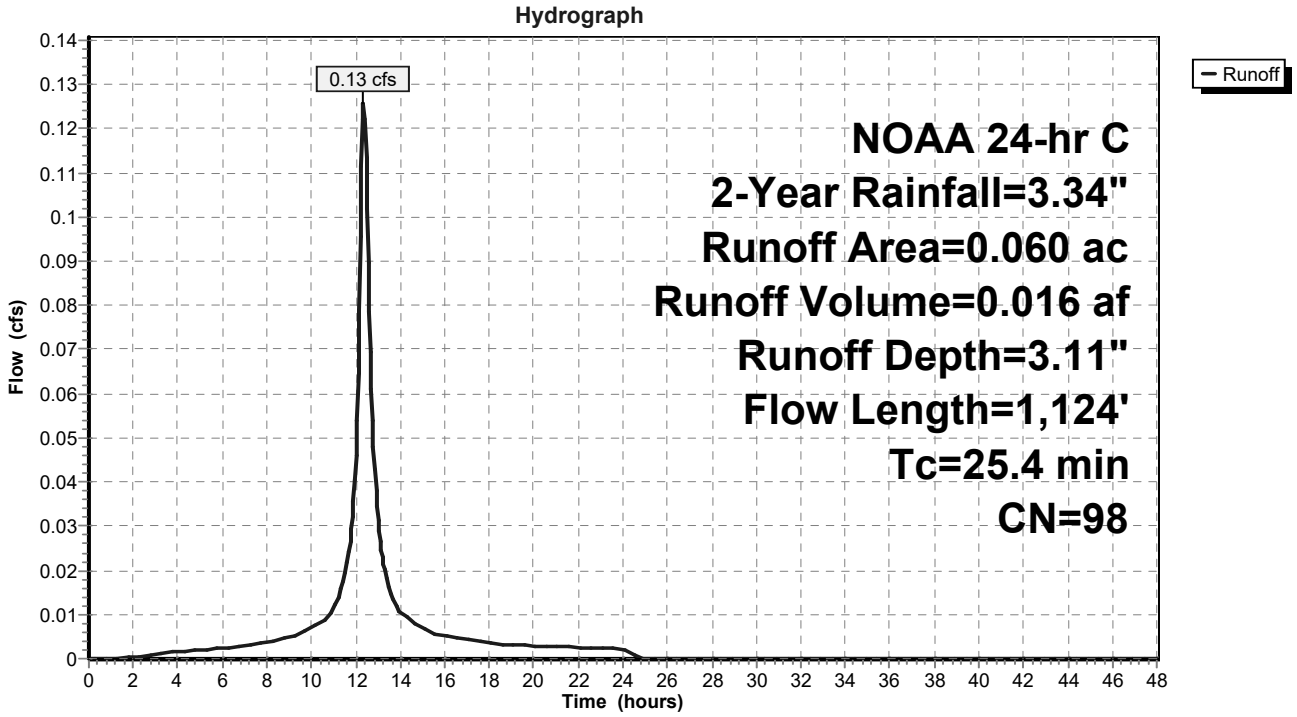
Runoff = 0.13 cfs @ 12.35 hrs, Volume= 0.016 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.060	98	Paved parking, HSG C
0.060		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	108	0.0252	0.19		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.38"
15.0	694	0.0238	0.77		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
1.2	322	0.0050	4.59	123.92	**Channel Flow, Natural Stream** Area= 27.0 sf Perim= 18.0' r= 1.50' n= 0.030 Stream, clean & straight
25.4	1,124	Total			

Subcatchment 2S: EDA-1-Impervious



Summary for Subcatchment 4S: EDA-2-Pervious

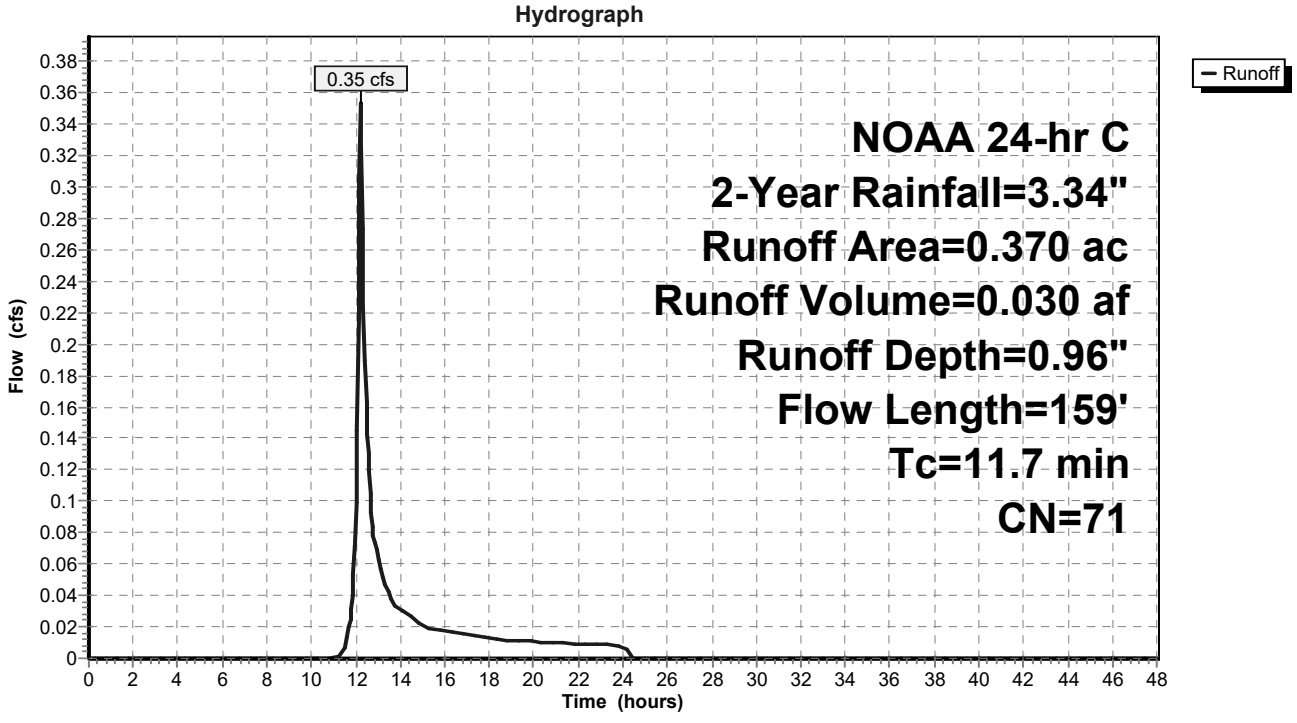
Runoff = 0.35 cfs @ 12.21 hrs, Volume= 0.030 af, Depth= 0.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.290	70	Woods, Good, HSG C
0.080	74	>75% Grass cover, Good, HSG C
0.370	71	Weighted Average
0.370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	42	0.0040	0.08		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.38"
0.4	20	0.0040	0.95		**Shallow Concentrated Flow, Grass Waterway** Grassed Waterway Kv= 15.0 fps
2.2	97	0.0210	0.72		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.7	159	Total			

Subcatchment 4S: EDA-2-Pervious



Summary for Subcatchment 7S: EDA OFF-SITE PERVIOUS

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

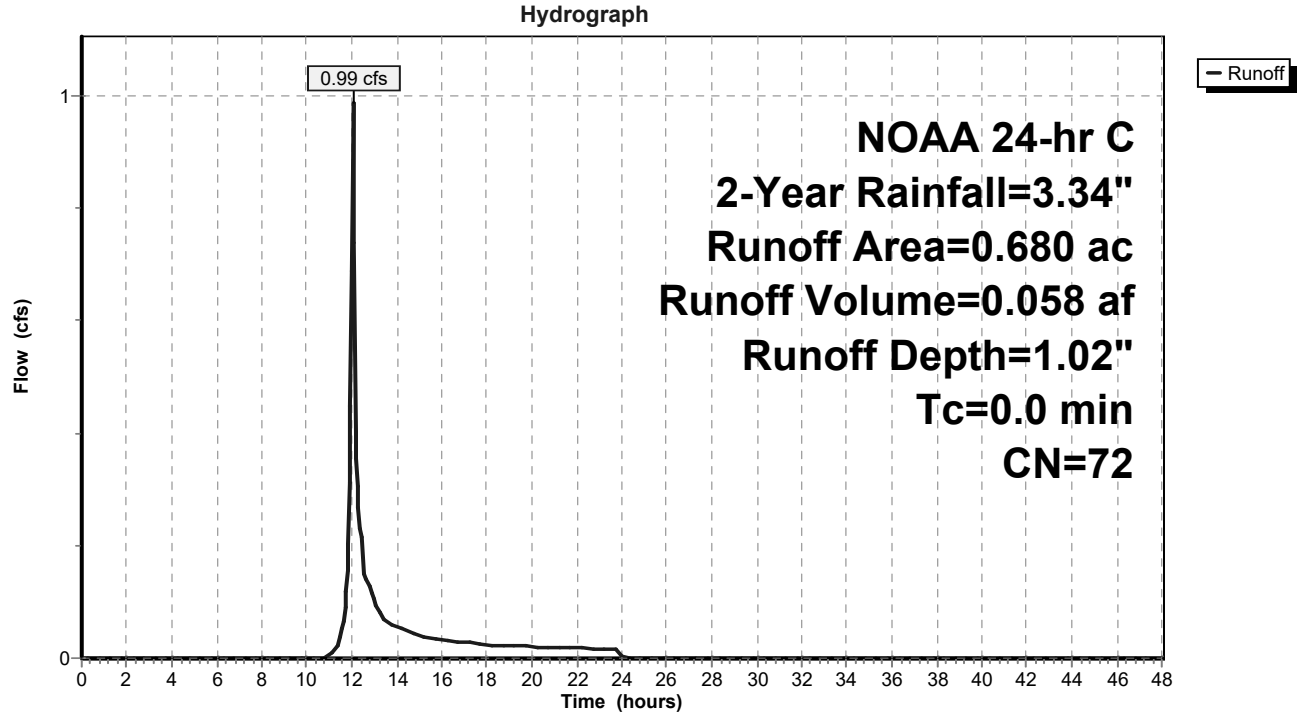
Runoff = 0.99 cfs @ 12.05 hrs, Volume= 0.058 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.680	72	Woods/grass comb., Good, HSG C
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, 10**

Subcatchment 7S: EDA OFF-SITE PERVIOUS

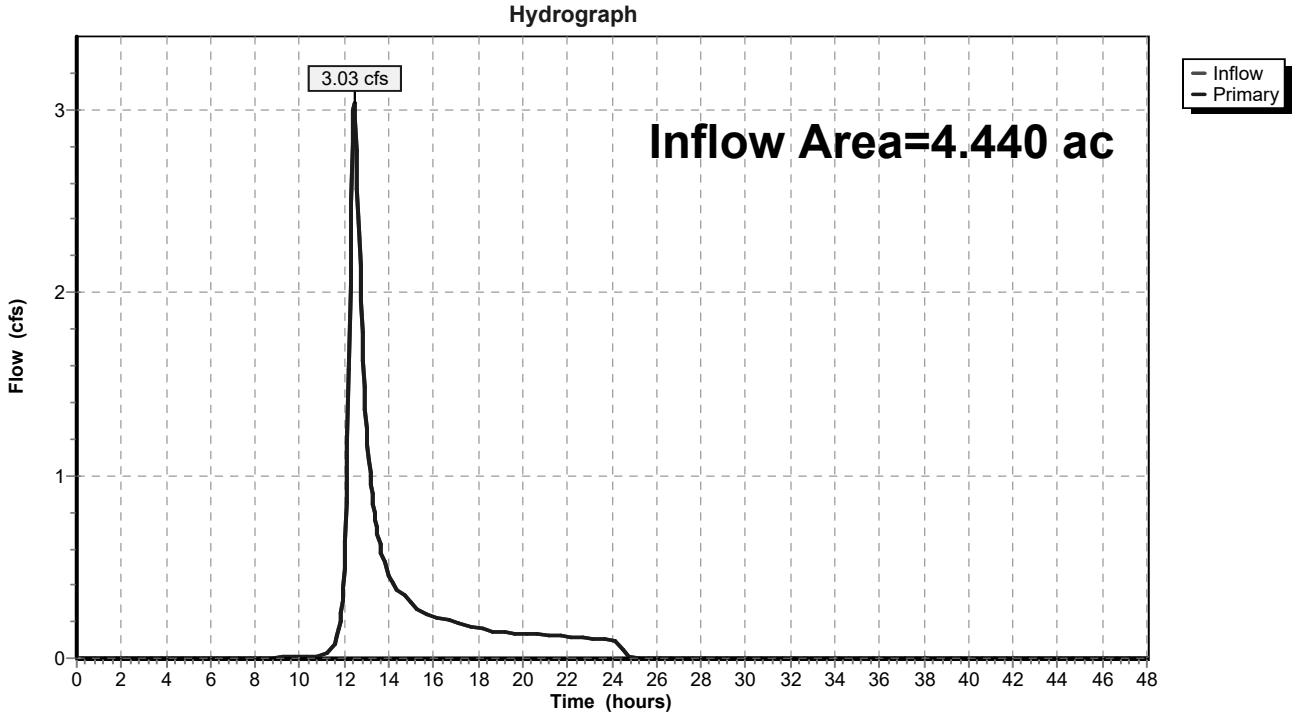


Summary for Link 3L: POA-1

Inflow Area = 4.440 ac, 1.35% Impervious, Inflow Depth = 1.05" for 2-Year event
Inflow = 3.03 cfs @ 12.44 hrs, Volume= 0.387 af
Primary = 3.03 cfs @ 12.44 hrs, Volume= 0.387 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 3L: POA-1

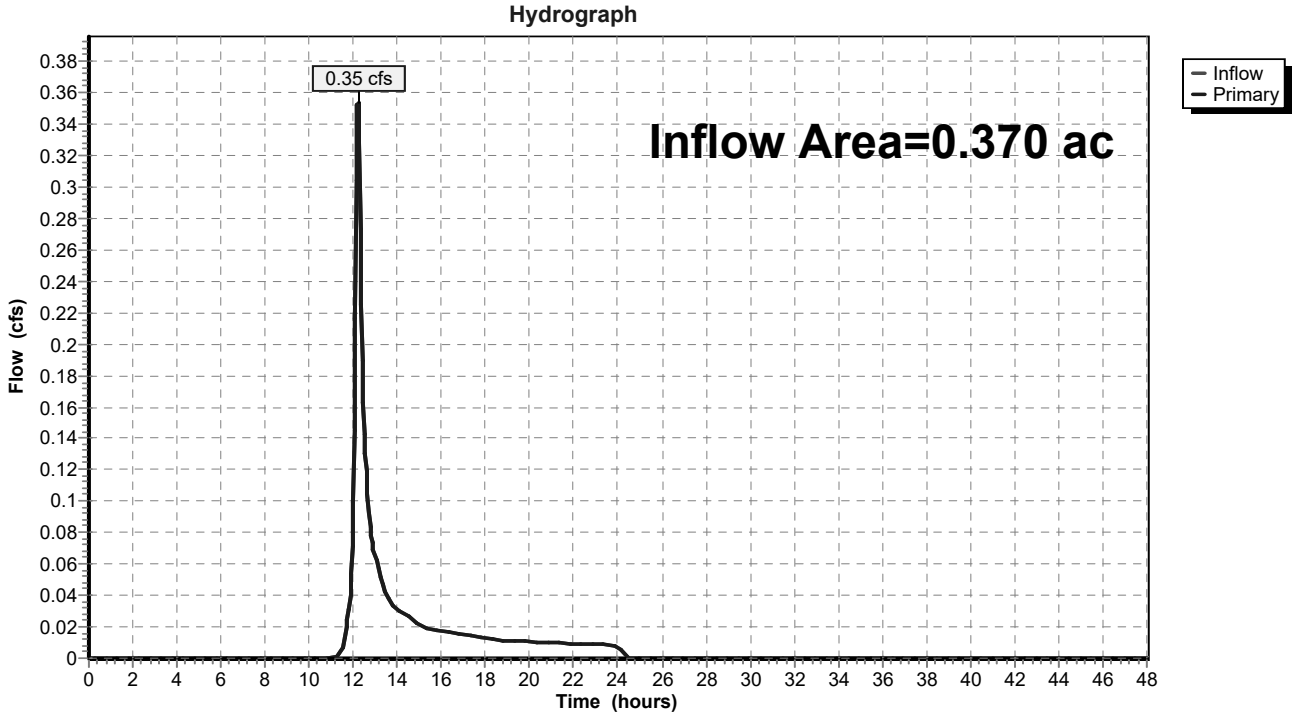


Summary for Link 5L: POA-2

Inflow Area = 0.370 ac, 0.00% Impervious, Inflow Depth = 0.96" for 2-Year event
Inflow = 0.35 cfs @ 12.21 hrs, Volume= 0.030 af
Primary = 0.35 cfs @ 12.21 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 5L: POA-2

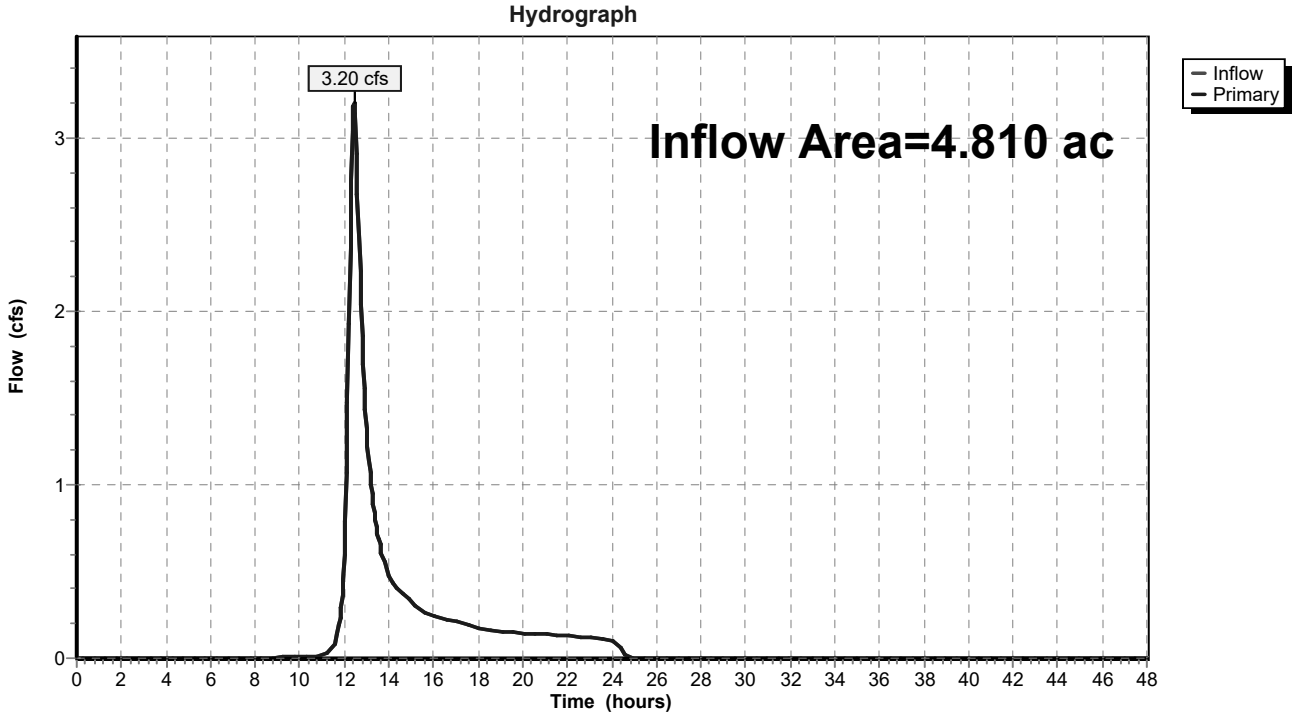


Summary for Link 6L: TOTAL ON-SITE

Inflow Area = 4.810 ac, 1.25% Impervious, Inflow Depth = 1.04" for 2-Year event
Inflow = 3.20 cfs @ 12.43 hrs, Volume= 0.417 af
Primary = 3.20 cfs @ 12.43 hrs, Volume= 0.417 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 6L: TOTAL ON-SITE

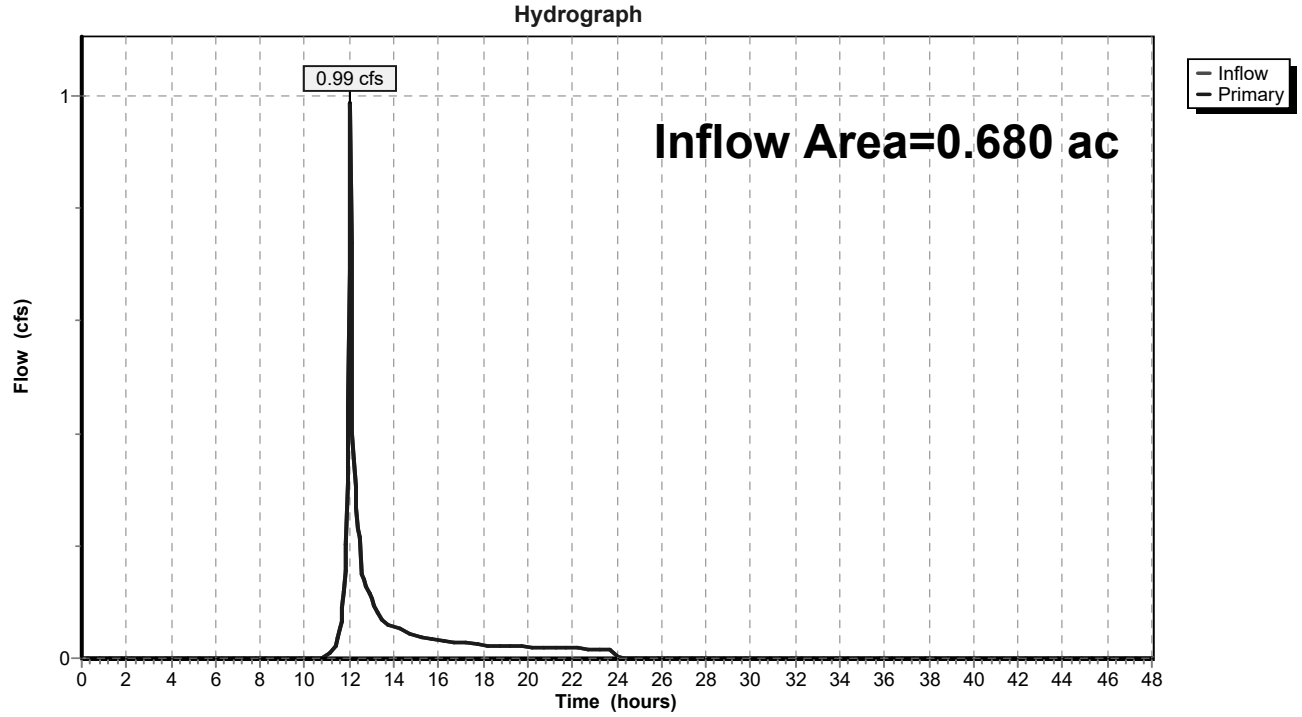


Summary for Link 8L: TOTAL OFF-SITE

Inflow Area = 0.680 ac, 0.00% Impervious, Inflow Depth = 1.02" for 2-Year event
Inflow = 0.99 cfs @ 12.05 hrs, Volume= 0.058 af
Primary = 0.99 cfs @ 12.05 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 8L: TOTAL OFF-SITE

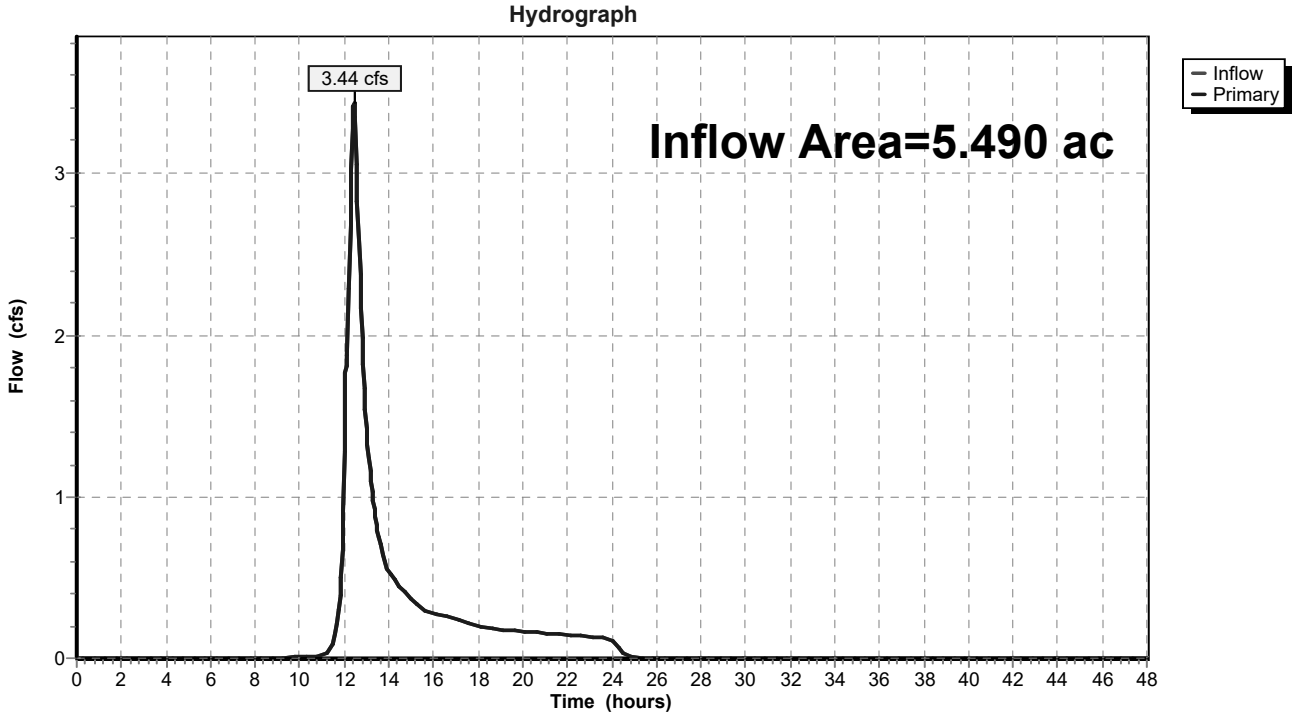


Summary for Link 9L: Existing Total

Inflow Area = 5.490 ac, 1.09% Impervious, Inflow Depth = 1.04" for 2-Year event
Inflow = 3.44 cfs @ 12.43 hrs, Volume= 0.474 af
Primary = 3.44 cfs @ 12.43 hrs, Volume= 0.474 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 9L: Existing Total



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

Subcatchment1S: EDA-1-Pervious Runoff Area=4.380 ac 0.00% Impervious Runoff Depth=2.21"
Flow Length=1,124' Tc=29.1 min CN=72 Runoff=6.71 cfs 0.805 af

Subcatchment2S: EDA-1-Impervious Runoff Area=0.060 ac 100.00% Impervious Runoff Depth=4.77"
Flow Length=1,124' Tc=25.4 min CN=98 Runoff=0.19 cfs 0.024 af

Subcatchment4S: EDA-2-Pervious Runoff Area=0.370 ac 0.00% Impervious Runoff Depth=2.12"
Flow Length=159' Tc=11.7 min CN=71 Runoff=0.82 cfs 0.065 af

Subcatchment7S: EDA OFF-SITE PERVIOUS Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=2.21"
Tc=0.0 min CN=72 Runoff=2.20 cfs 0.125 af

Link 3L: POA-1 Inflow=6.89 cfs 0.829 af
Primary=6.89 cfs 0.829 af

Link 5L: POA-2 Inflow=0.82 cfs 0.065 af
Primary=0.82 cfs 0.065 af

Link 6L: TOTAL ON-SITE Inflow=7.27 cfs 0.894 af
Primary=7.27 cfs 0.894 af

Link 8L: TOTAL OFF-SITE Inflow=2.20 cfs 0.125 af
Primary=2.20 cfs 0.125 af

Link 9L: Existing Total Inflow=7.73 cfs 1.019 af
Primary=7.73 cfs 1.019 af

Total Runoff Area = 5.490 ac Runoff Volume = 1.019 af Average Runoff Depth = 2.23"
98.91% Pervious = 5.430 ac 1.09% Impervious = 0.060 ac

Summary for Subcatchment 1S: EDA-1-Pervious

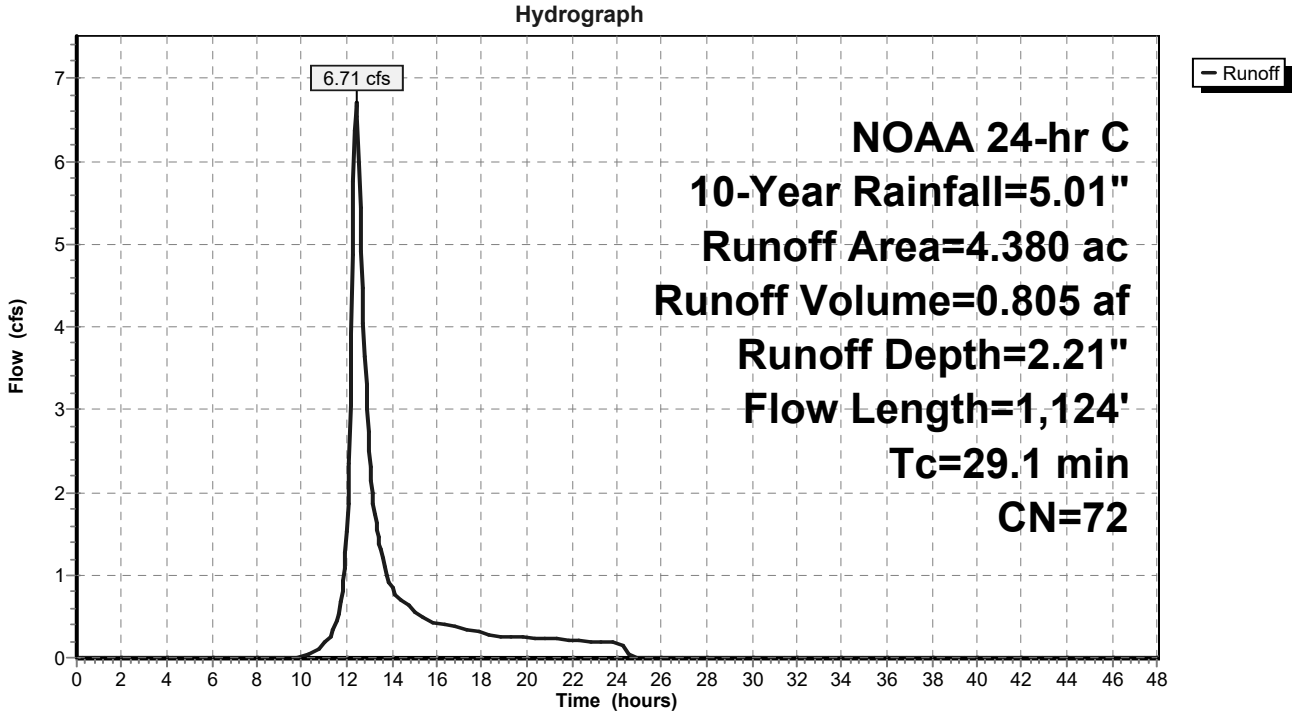
Runoff = 6.71 cfs @ 12.42 hrs, Volume= 0.805 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
2.150	70	Woods, Good, HSG C
2.230	74	>75% Grass cover, Good, HSG C
4.380	72	Weighted Average
4.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	100	0.0252	0.13		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.38"
15.2	702	0.0238	0.77		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
1.2	322	0.0050	4.59	123.92	**Channel Flow, Natural Stream** Area= 27.0 sf Perim= 18.0' r= 1.50' n= 0.030 Stream, clean & straight
29.1	1,124	Total			

Subcatchment 1S: EDA-1-Pervious



Summary for Subcatchment 2S: EDA-1-Impervious

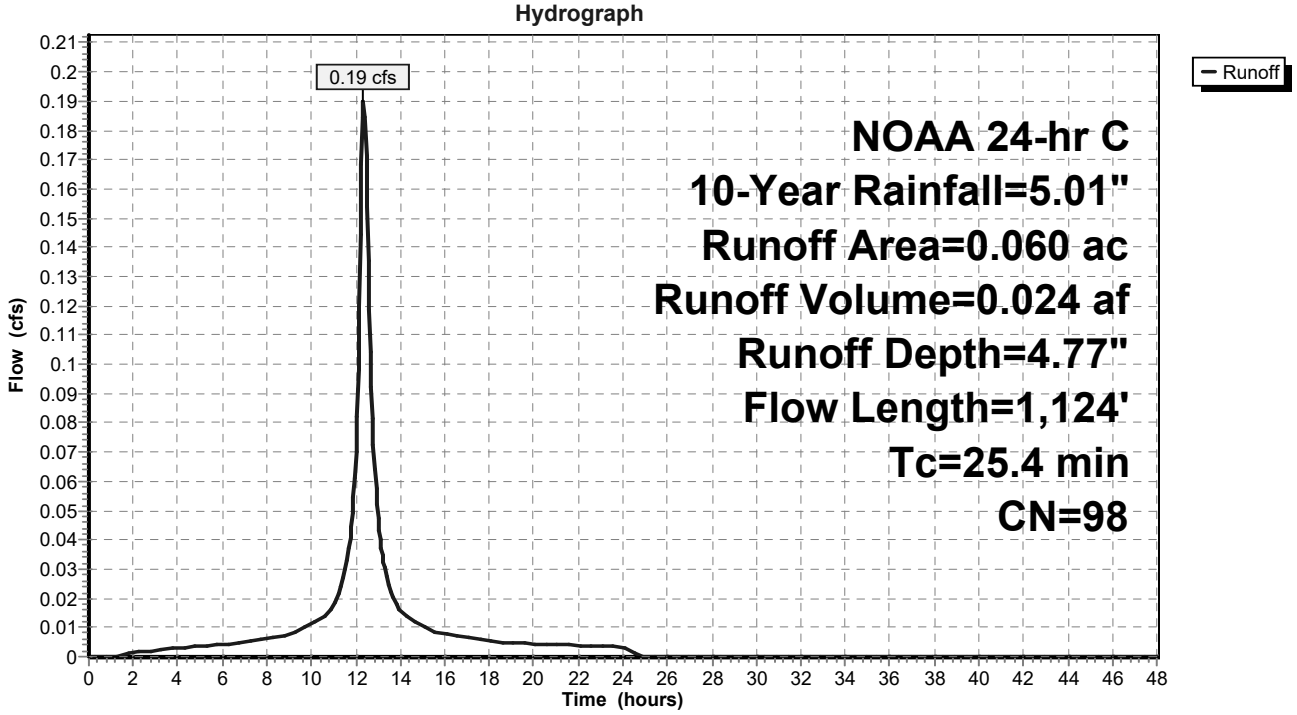
Runoff = 0.19 cfs @ 12.35 hrs, Volume= 0.024 af, Depth= 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.060	98	Paved parking, HSG C
0.060		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	108	0.0252	0.19		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.38"
15.0	694	0.0238	0.77		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
1.2	322	0.0050	4.59	123.92	**Channel Flow, Natural Stream** Area= 27.0 sf Perim= 18.0' r= 1.50' n= 0.030 Stream, clean & straight
25.4	1,124	Total			

Subcatchment 2S: EDA-1-Impervious



Summary for Subcatchment 4S: EDA-2-Pervious

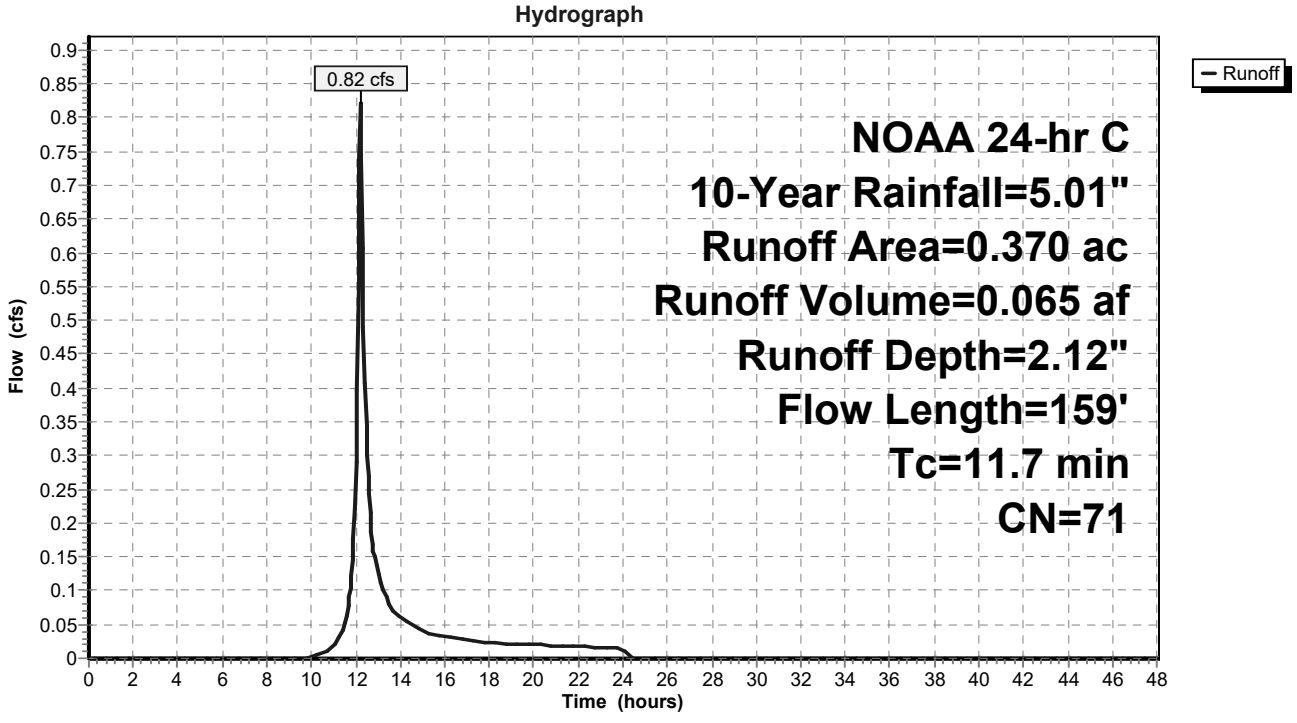
Runoff = 0.82 cfs @ 12.20 hrs, Volume= 0.065 af, Depth= 2.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.290	70	Woods, Good, HSG C
0.080	74	>75% Grass cover, Good, HSG C
0.370	71	Weighted Average
0.370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	42	0.0040	0.08		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.38"
0.4	20	0.0040	0.95		**Shallow Concentrated Flow, Grass Waterway** Grassed Waterway Kv= 15.0 fps
2.2	97	0.0210	0.72		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.7	159	Total			

Subcatchment 4S: EDA-2-Pervious



Summary for Subcatchment 7S: EDA OFF-SITE PERVIOUS

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

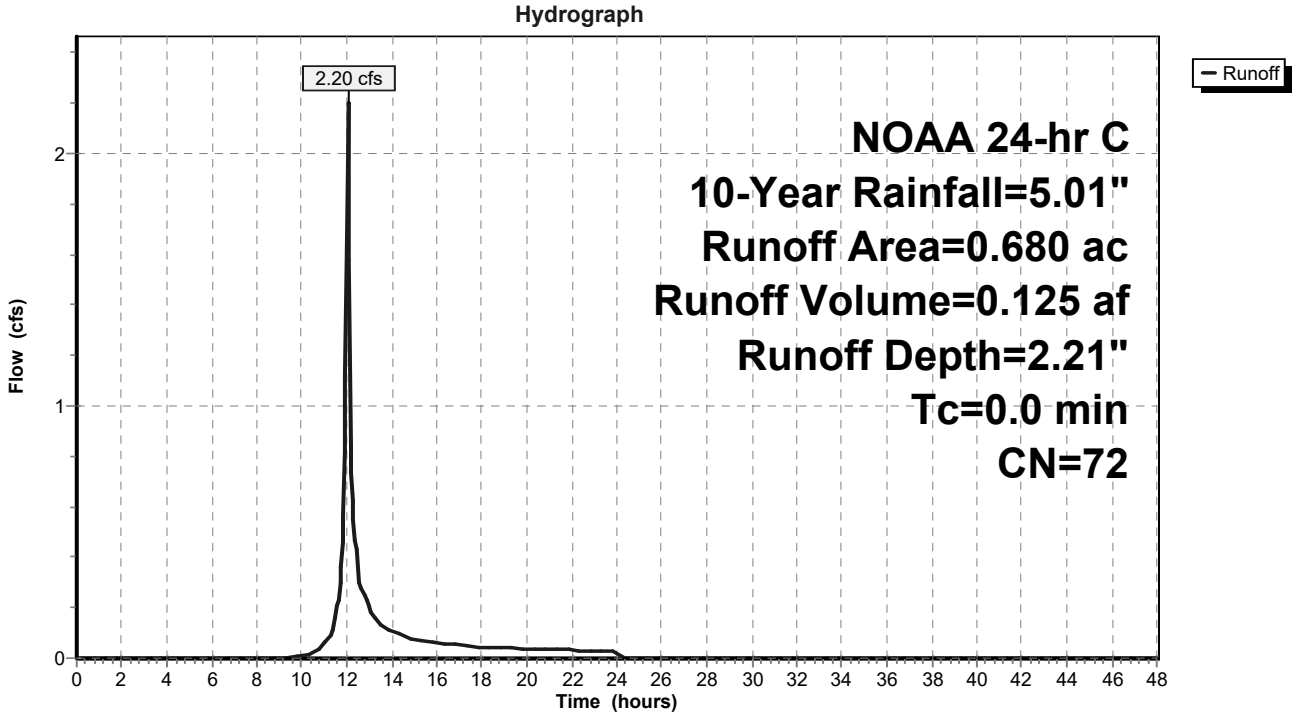
Runoff = 2.20 cfs @ 12.05 hrs, Volume= 0.125 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.680	72	Woods/grass comb., Good, HSG C
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, 10**

Subcatchment 7S: EDA OFF-SITE PERVIOUS

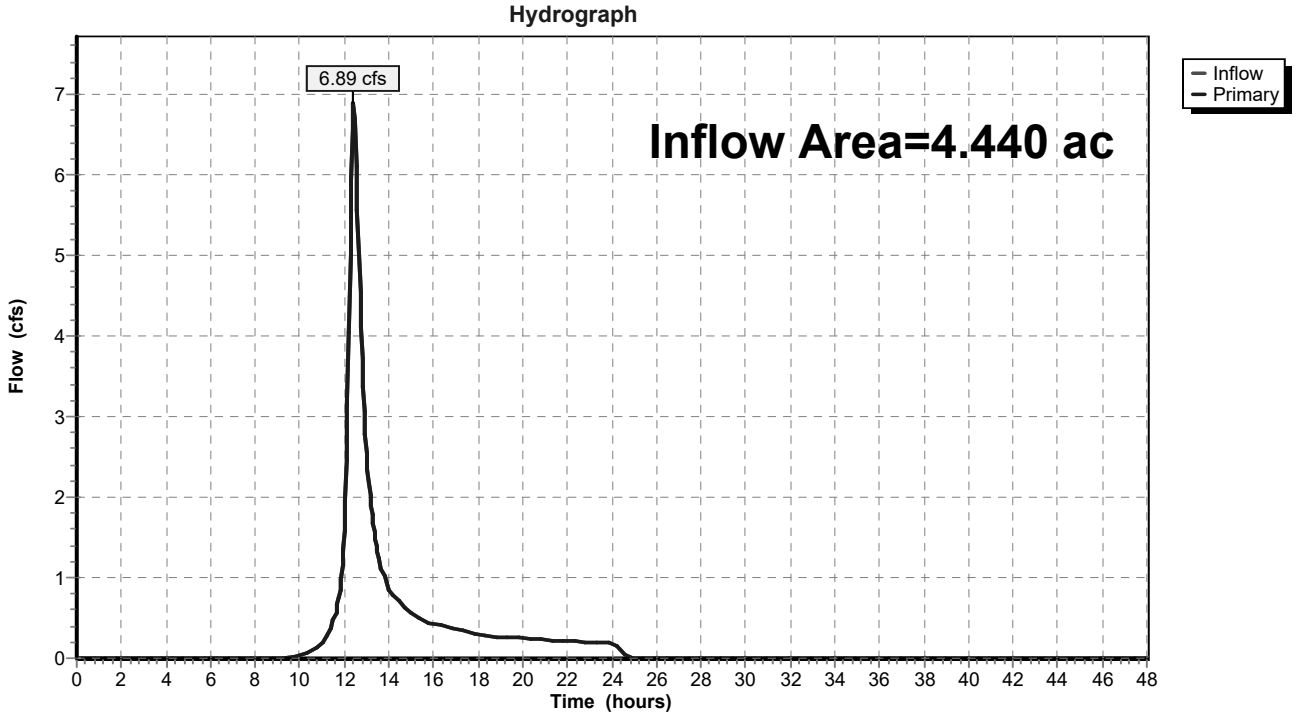


Summary for Link 3L: POA-1

Inflow Area = 4.440 ac, 1.35% Impervious, Inflow Depth = 2.24" for 10-Year event
Inflow = 6.89 cfs @ 12.42 hrs, Volume= 0.829 af
Primary = 6.89 cfs @ 12.42 hrs, Volume= 0.829 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 3L: POA-1

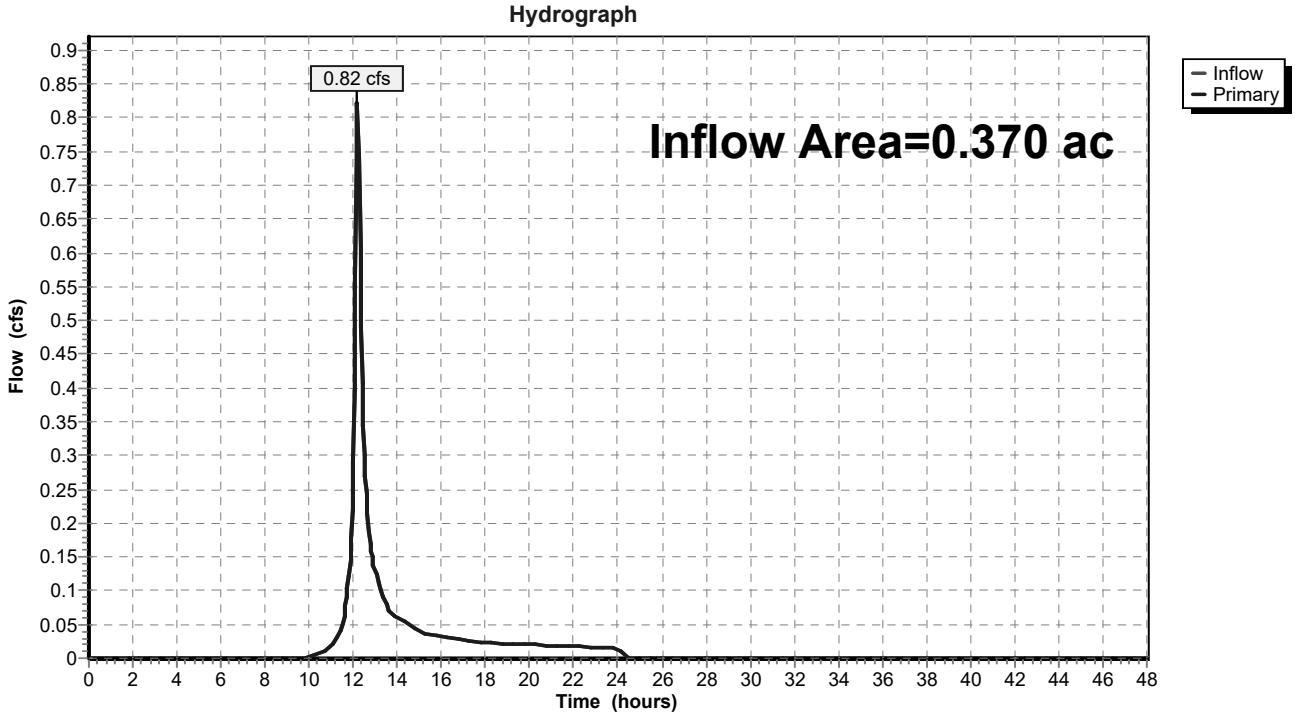


Summary for Link 5L: POA-2

Inflow Area = 0.370 ac, 0.00% Impervious, Inflow Depth = 2.12" for 10-Year event
Inflow = 0.82 cfs @ 12.20 hrs, Volume= 0.065 af
Primary = 0.82 cfs @ 12.20 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 5L: POA-2

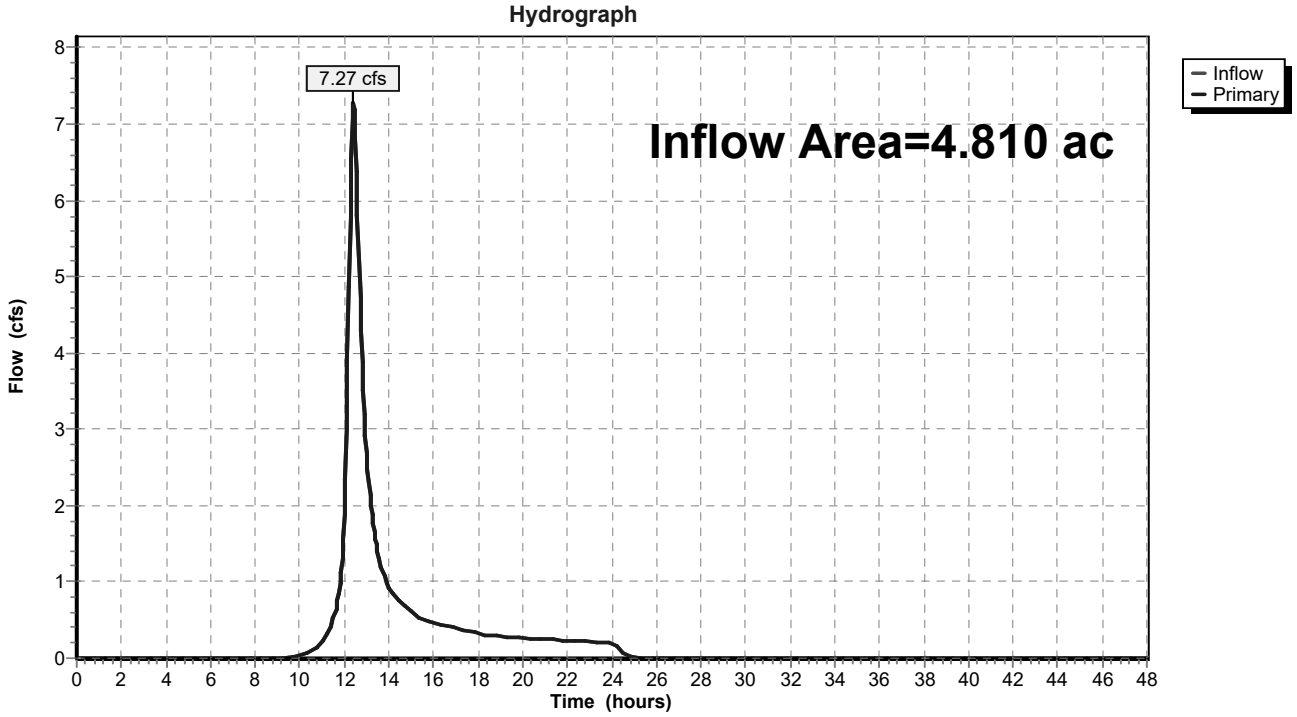


Summary for Link 6L: TOTAL ON-SITE

Inflow Area = 4.810 ac, 1.25% Impervious, Inflow Depth = 2.23" for 10-Year event
Inflow = 7.27 cfs @ 12.41 hrs, Volume= 0.894 af
Primary = 7.27 cfs @ 12.41 hrs, Volume= 0.894 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 6L: TOTAL ON-SITE

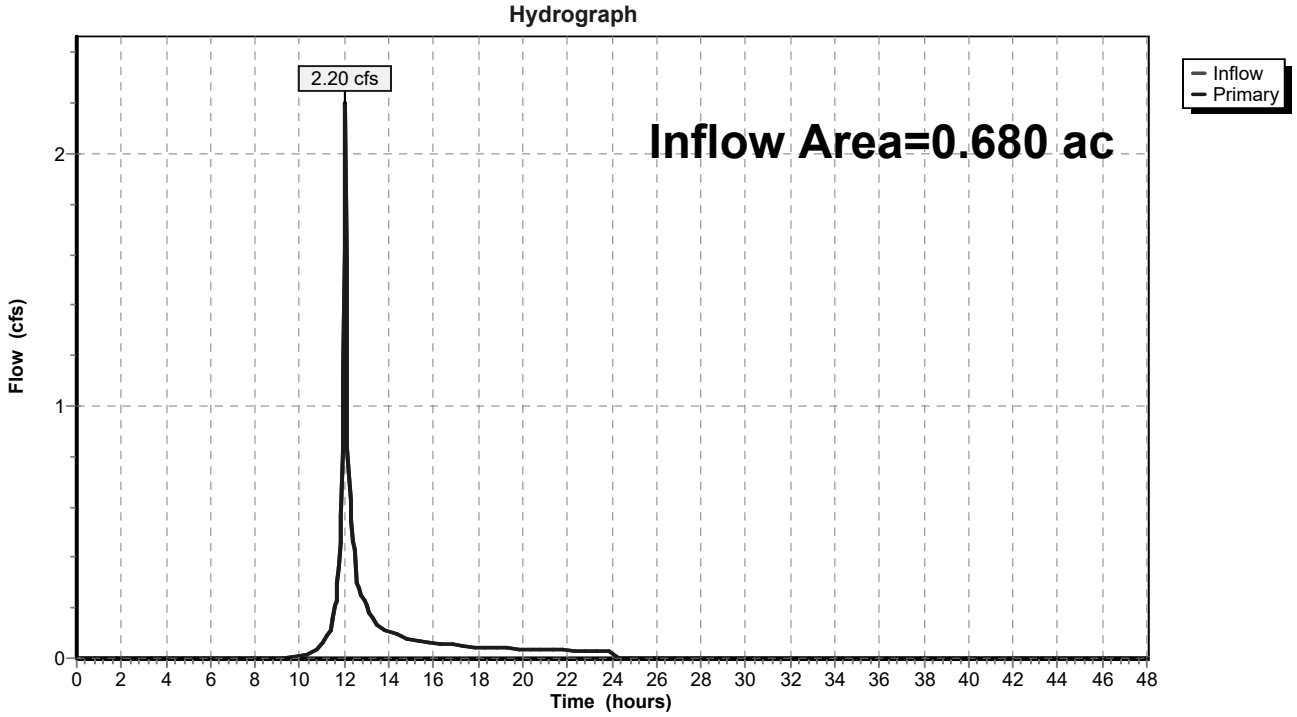


Summary for Link 8L: TOTAL OFF-SITE

Inflow Area = 0.680 ac, 0.00% Impervious, Inflow Depth = 2.21" for 10-Year event
Inflow = 2.20 cfs @ 12.05 hrs, Volume= 0.125 af
Primary = 2.20 cfs @ 12.05 hrs, Volume= 0.125 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 8L: TOTAL OFF-SITE

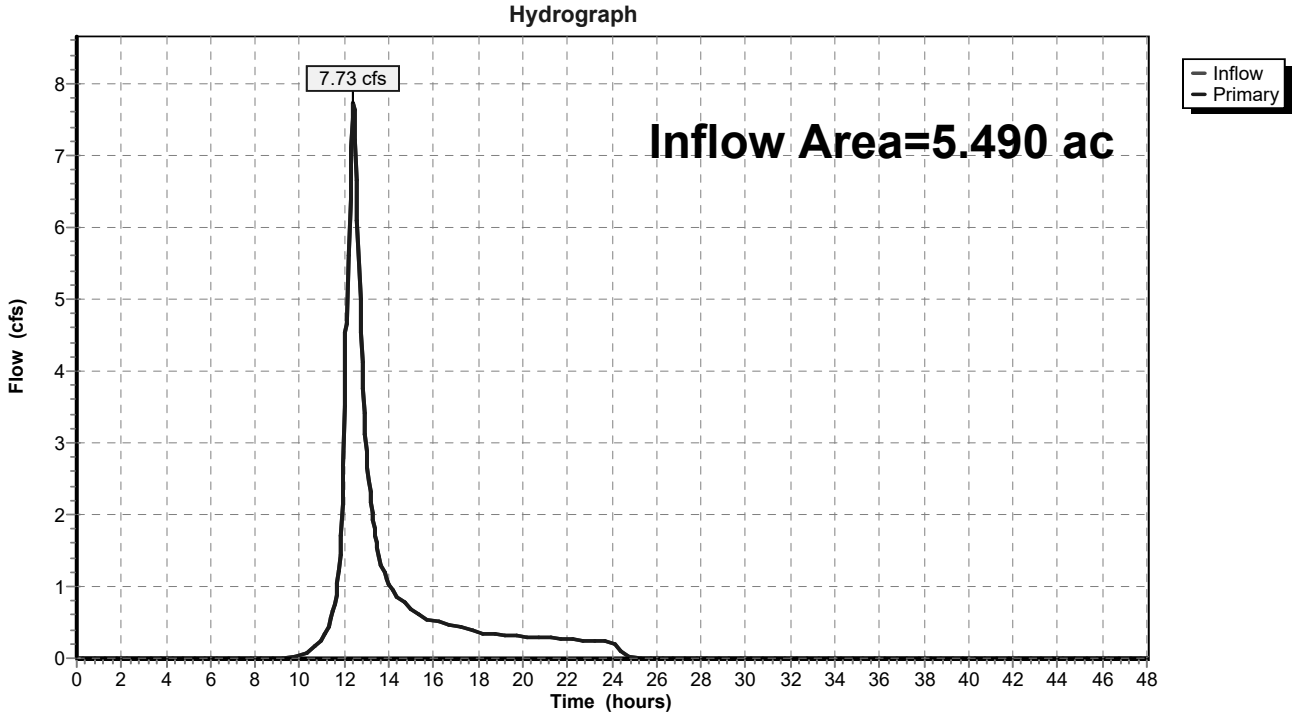


Summary for Link 9L: Existing Total

Inflow Area = 5.490 ac, 1.09% Impervious, Inflow Depth = 2.23" for 10-Year event
Inflow = 7.73 cfs @ 12.41 hrs, Volume= 1.019 af
Primary = 7.73 cfs @ 12.41 hrs, Volume= 1.019 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 9L: Existing Total



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

Subcatchment1S: EDA-1-Pervious Runoff Area=4.380 ac 0.00% Impervious Runoff Depth=3.15"
Flow Length=1,124' Tc=29.1 min CN=72 Runoff=9.67 cfs 1.150 af

Subcatchment2S: EDA-1-Impervious Runoff Area=0.060 ac 100.00% Impervious Runoff Depth=5.95"
Flow Length=1,124' Tc=25.4 min CN=98 Runoff=0.24 cfs 0.030 af

Subcatchment4S: EDA-2-Pervious Runoff Area=0.370 ac 0.00% Impervious Runoff Depth=3.05"
Flow Length=159' Tc=11.7 min CN=71 Runoff=1.19 cfs 0.094 af

Subcatchment7S: EDA OFF-SITE PERVIOUS Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=3.15"
Tc=0.0 min CN=72 Runoff=3.14 cfs 0.178 af

Link 3L: POA-1 Inflow=9.90 cfs 1.179 af
Primary=9.90 cfs 1.179 af

Link 5L: POA-2 Inflow=1.19 cfs 0.094 af
Primary=1.19 cfs 0.094 af

Link 6L: TOTAL ON-SITE Inflow=10.45 cfs 1.273 af
Primary=10.45 cfs 1.273 af

Link 8L: TOTAL OFF-SITE Inflow=3.14 cfs 0.178 af
Primary=3.14 cfs 0.178 af

Link 9L: Existing Total Inflow=11.09 cfs 1.452 af
Primary=11.09 cfs 1.452 af

Total Runoff Area = 5.490 ac Runoff Volume = 1.452 af Average Runoff Depth = 3.17"
98.91% Pervious = 5.430 ac 1.09% Impervious = 0.060 ac

Summary for Subcatchment 1S: EDA-1-Pervious

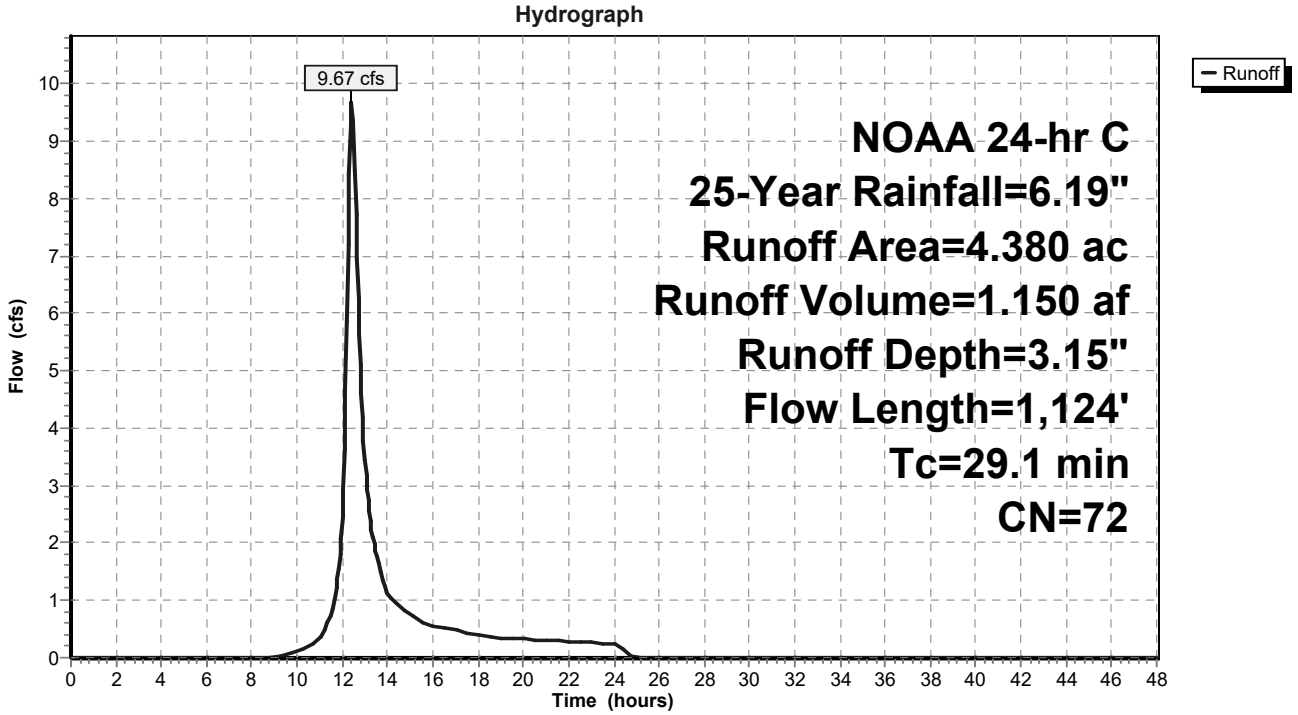
Runoff = 9.67 cfs @ 12.42 hrs, Volume= 1.150 af, Depth= 3.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.19"

Area (ac)	CN	Description
2.150	70	Woods, Good, HSG C
2.230	74	>75% Grass cover, Good, HSG C
4.380	72	Weighted Average
4.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	100	0.0252	0.13		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.38"
15.2	702	0.0238	0.77		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
1.2	322	0.0050	4.59	123.92	**Channel Flow, Natural Stream** Area= 27.0 sf Perim= 18.0' r= 1.50' n= 0.030 Stream, clean & straight
29.1	1,124	Total			

Subcatchment 1S: EDA-1-Pervious



Summary for Subcatchment 2S: EDA-1-Impervious

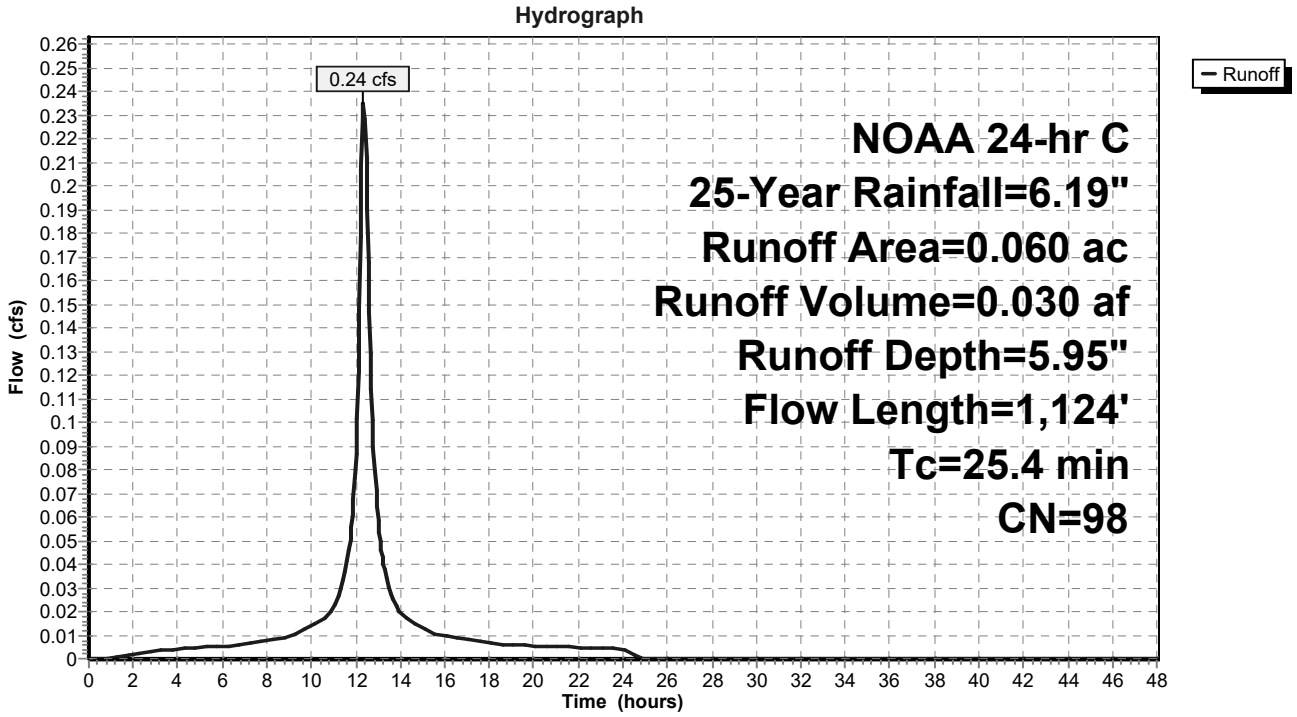
Runoff = 0.24 cfs @ 12.35 hrs, Volume= 0.030 af, Depth= 5.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.19"

Area (ac)	CN	Description
0.060	98	Paved parking, HSG C
0.060		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	108	0.0252	0.19		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.38"
15.0	694	0.0238	0.77		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
1.2	322	0.0050	4.59	123.92	**Channel Flow, Natural Stream** Area= 27.0 sf Perim= 18.0' r= 1.50' n= 0.030 Stream, clean & straight
25.4	1,124	Total			

Subcatchment 2S: EDA-1-Impervious



Summary for Subcatchment 4S: EDA-2-Pervious

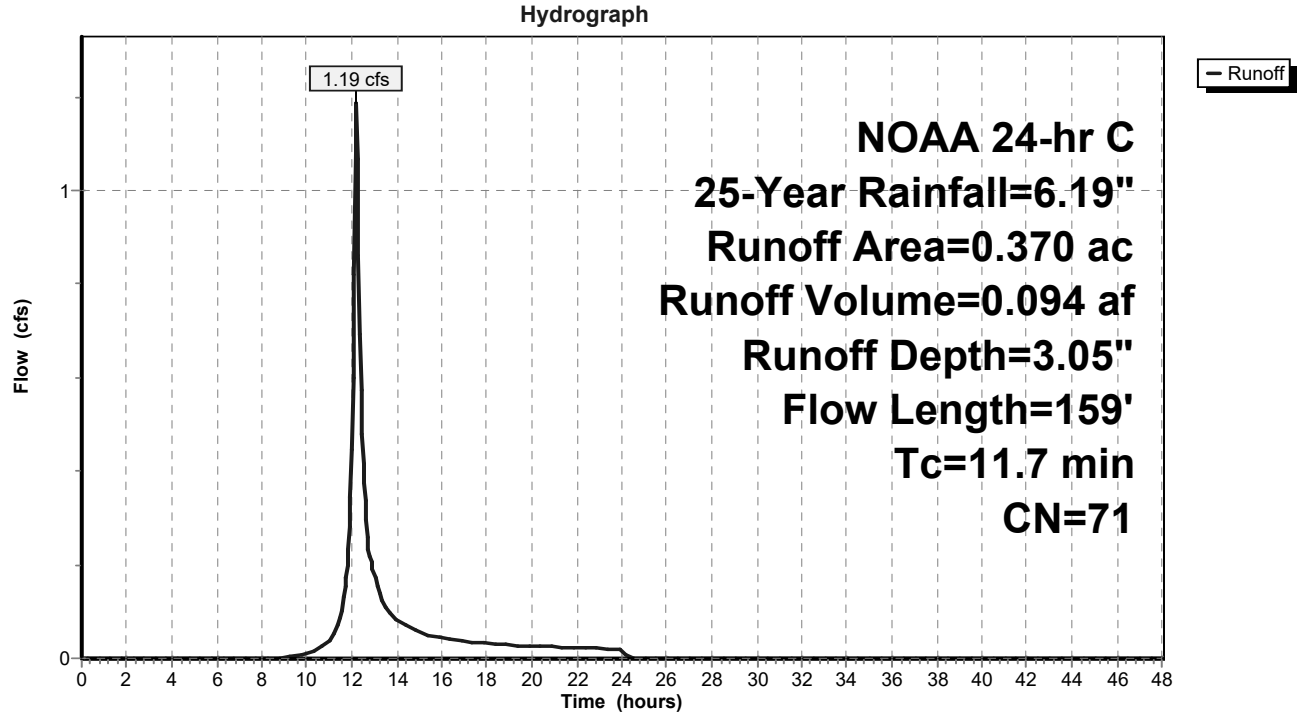
Runoff = 1.19 cfs @ 12.20 hrs, Volume= 0.094 af, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.19"

Area (ac)	CN	Description
0.290	70	Woods, Good, HSG C
0.080	74	>75% Grass cover, Good, HSG C
0.370	71	Weighted Average
0.370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	42	0.0040	0.08		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.38"
0.4	20	0.0040	0.95		**Shallow Concentrated Flow, Grass Waterway** Grassed Waterway Kv= 15.0 fps
2.2	97	0.0210	0.72		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.7	159	Total			

Subcatchment 4S: EDA-2-Pervious



Summary for Subcatchment 7S: EDA OFF-SITE PERVIOUS

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

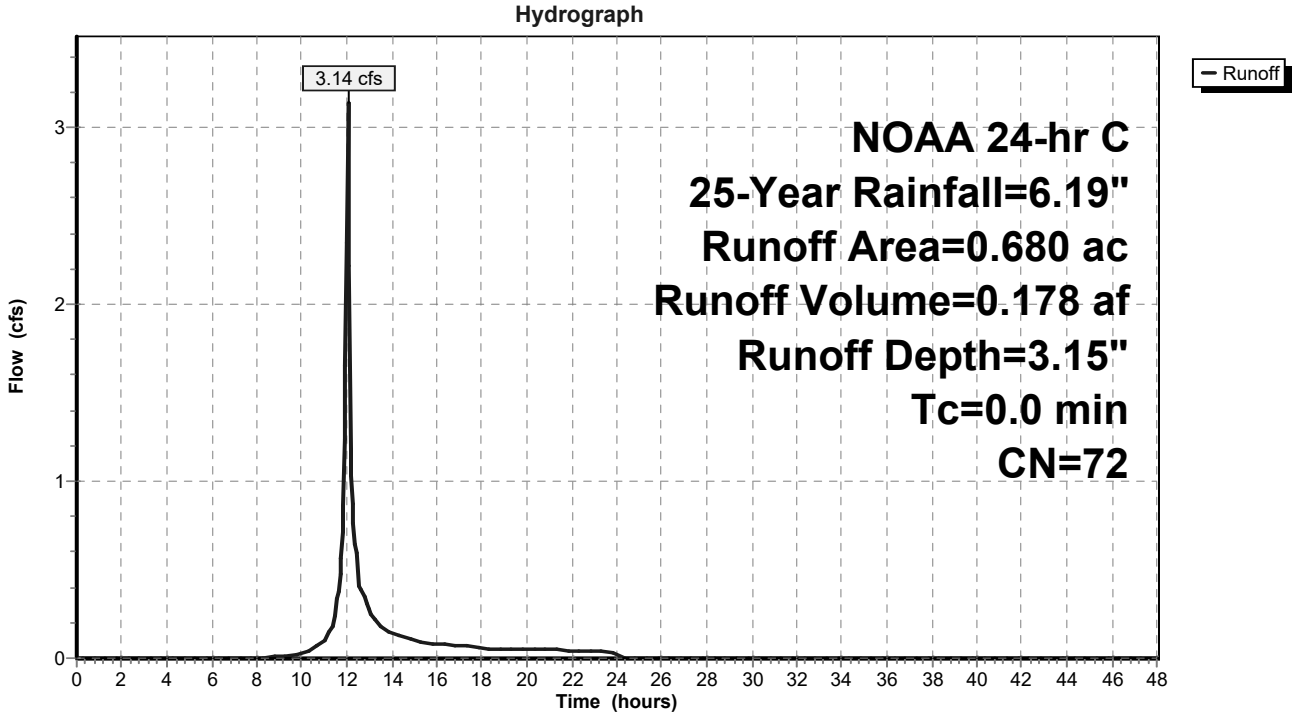
Runoff = 3.14 cfs @ 12.05 hrs, Volume= 0.178 af, Depth= 3.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.19"

Area (ac)	CN	Description
0.680	72	Woods/grass comb., Good, HSG C
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, 10**

Subcatchment 7S: EDA OFF-SITE PERVIOUS

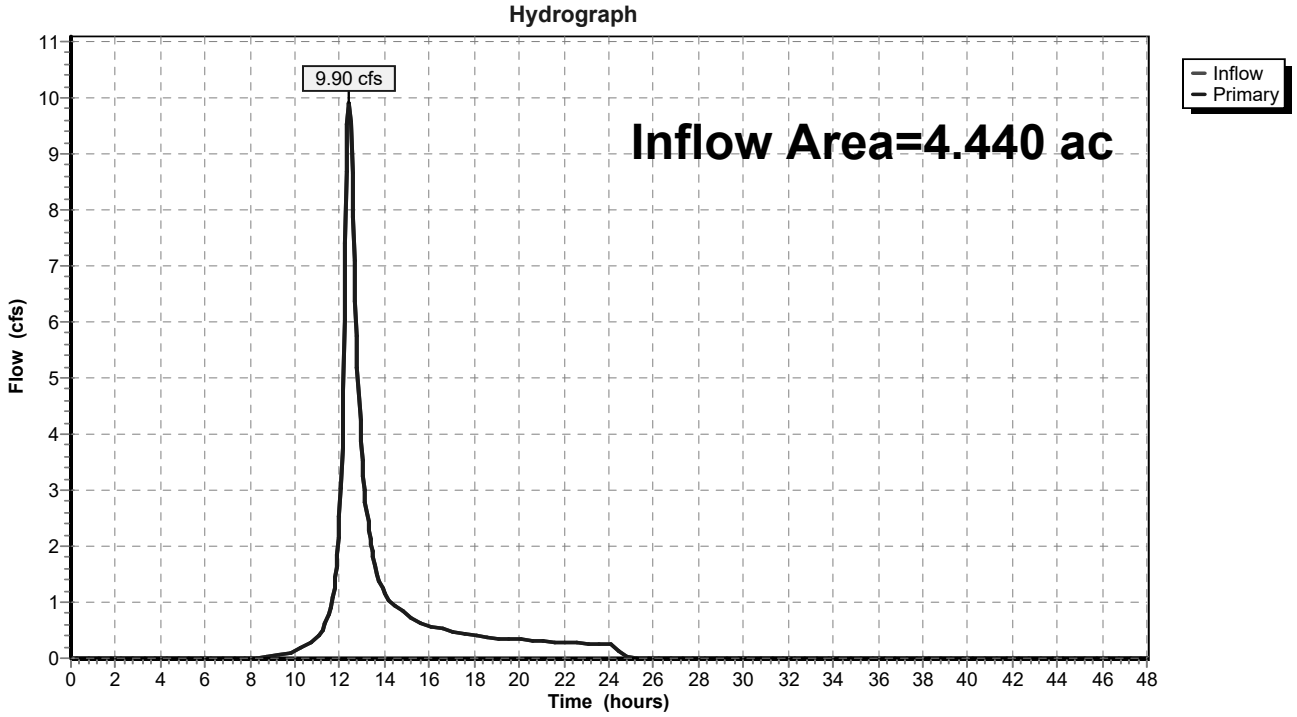


Summary for Link 3L: POA-1

Inflow Area = 4.440 ac, 1.35% Impervious, Inflow Depth = 3.19" for 25-Year event
Inflow = 9.90 cfs @ 12.42 hrs, Volume= 1.179 af
Primary = 9.90 cfs @ 12.42 hrs, Volume= 1.179 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 3L: POA-1

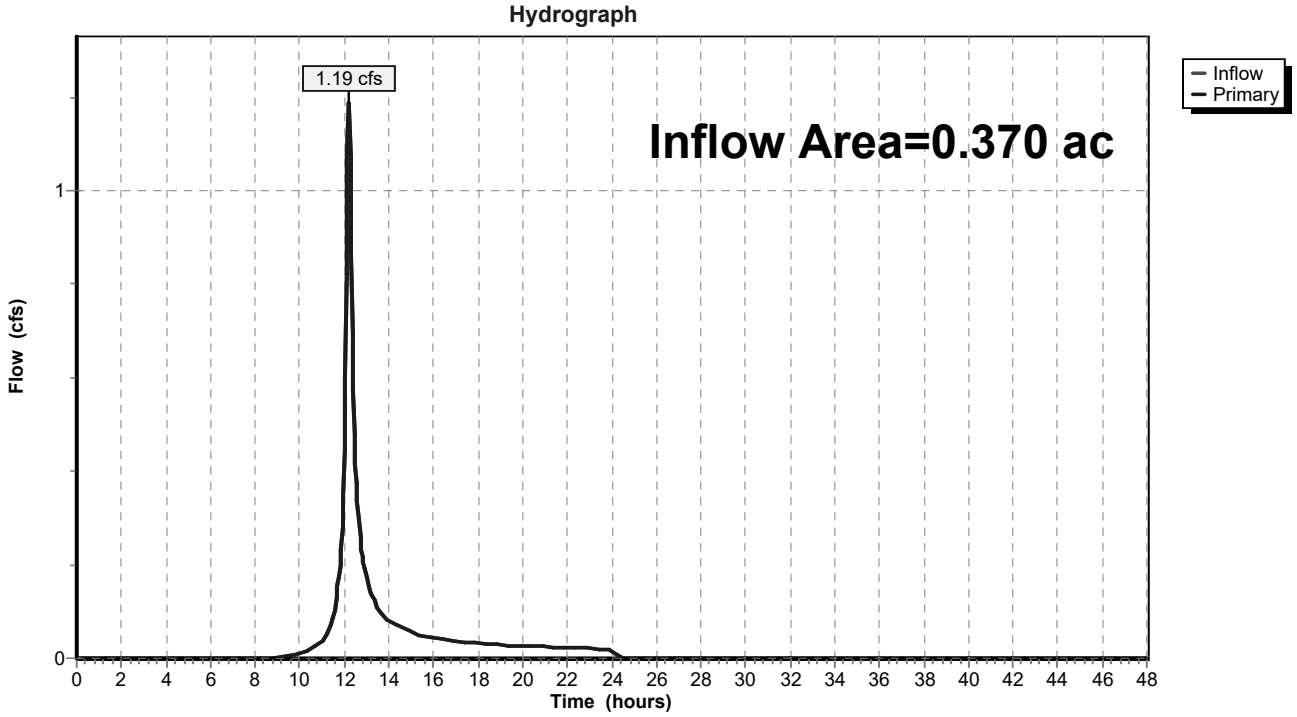


Summary for Link 5L: POA-2

Inflow Area = 0.370 ac, 0.00% Impervious, Inflow Depth = 3.05" for 25-Year event
Inflow = 1.19 cfs @ 12.20 hrs, Volume= 0.094 af
Primary = 1.19 cfs @ 12.20 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 5L: POA-2

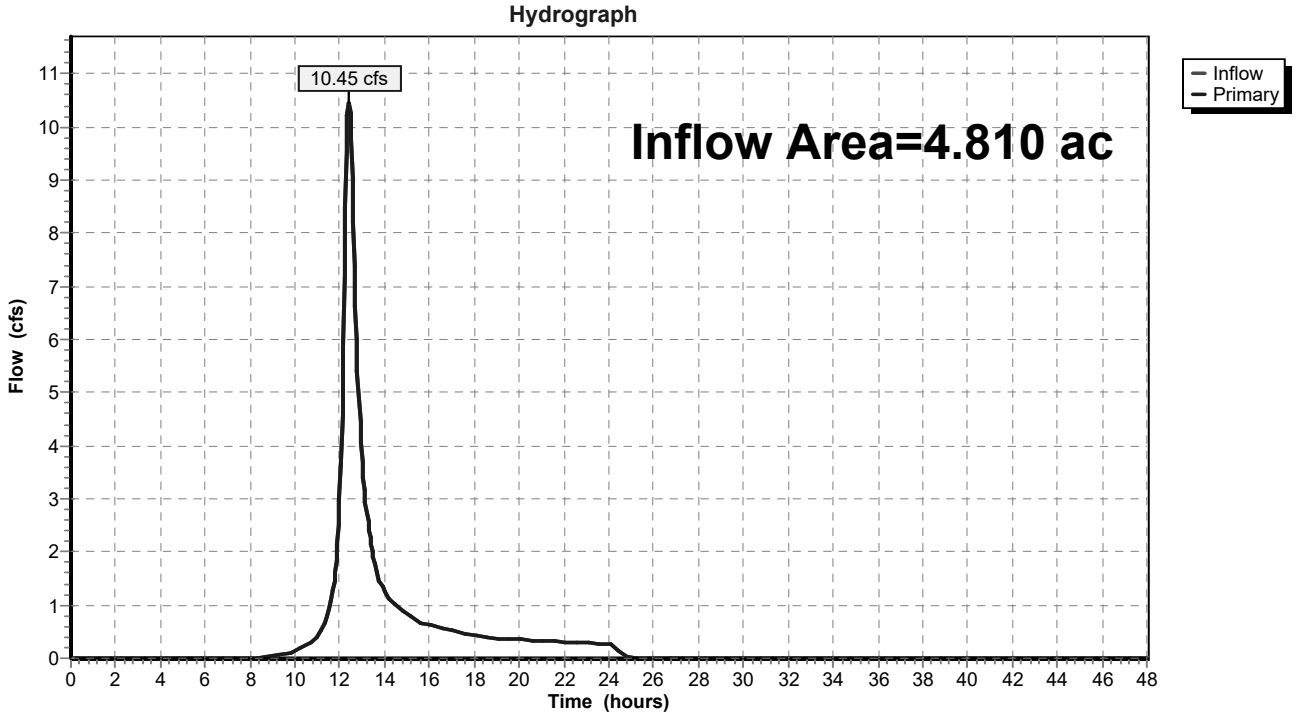


Summary for Link 6L: TOTAL ON-SITE

Inflow Area = 4.810 ac, 1.25% Impervious, Inflow Depth = 3.18" for 25-Year event
Inflow = 10.45 cfs @ 12.40 hrs, Volume= 1.273 af
Primary = 10.45 cfs @ 12.40 hrs, Volume= 1.273 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 6L: TOTAL ON-SITE

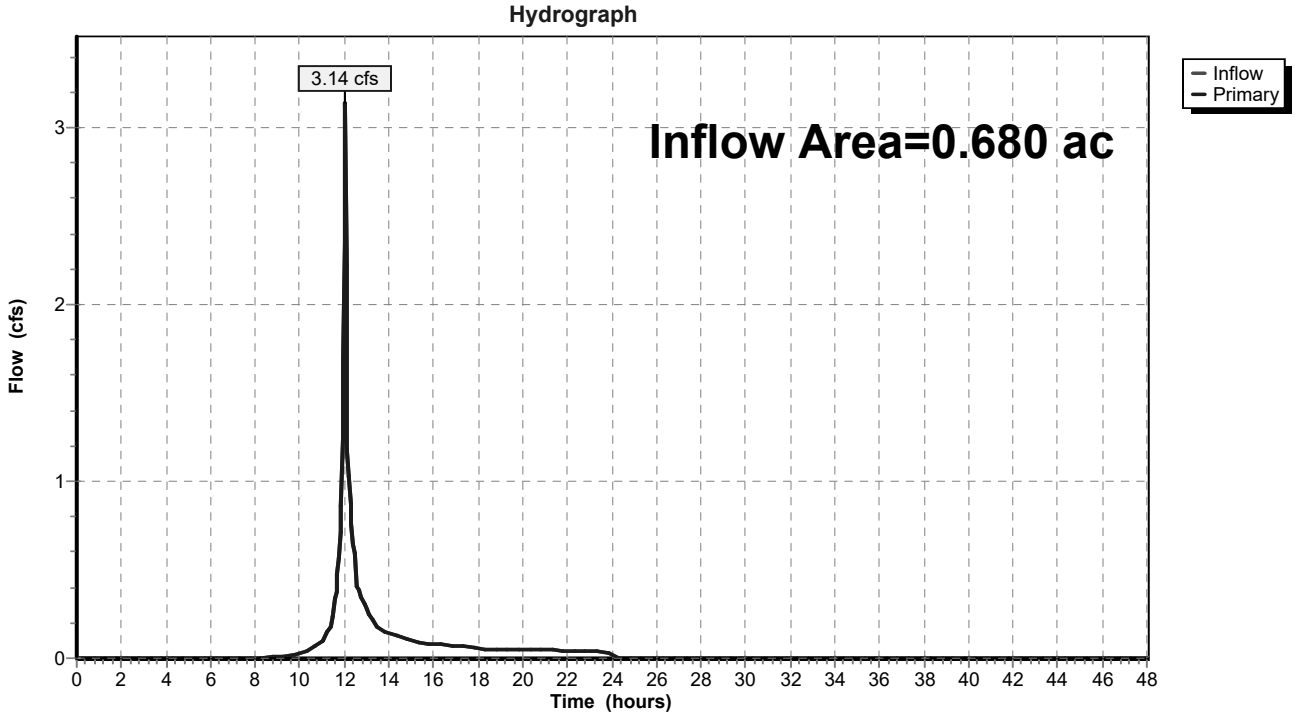


Summary for Link 8L: TOTAL OFF-SITE

Inflow Area = 0.680 ac, 0.00% Impervious, Inflow Depth = 3.15" for 25-Year event
Inflow = 3.14 cfs @ 12.05 hrs, Volume= 0.178 af
Primary = 3.14 cfs @ 12.05 hrs, Volume= 0.178 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 8L: TOTAL OFF-SITE

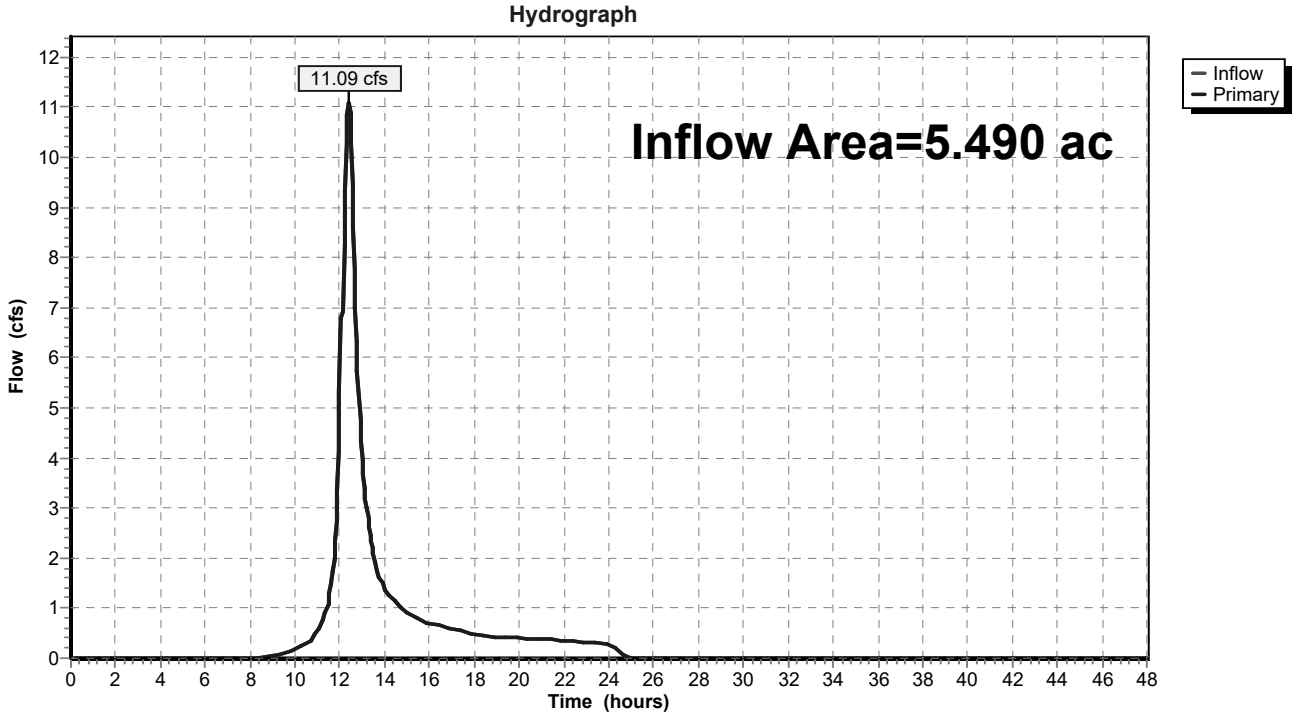


Summary for Link 9L: Existing Total

Inflow Area = 5.490 ac, 1.09% Impervious, Inflow Depth = 3.17" for 25-Year event
Inflow = 11.09 cfs @ 12.40 hrs, Volume= 1.452 af
Primary = 11.09 cfs @ 12.40 hrs, Volume= 1.452 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 9L: Existing Total



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

Subcatchment1S: EDA-1-Pervious Runoff Area=4.380 ac 0.00% Impervious Runoff Depth=4.88"
Flow Length=1,124' Tc=29.1 min CN=72 Runoff=15.01 cfs 1.781 af

Subcatchment2S: EDA-1-Impervious Runoff Area=0.060 ac 100.00% Impervious Runoff Depth=7.97"
Flow Length=1,124' Tc=25.4 min CN=98 Runoff=0.31 cfs 0.040 af

Subcatchment4S: EDA-2-Pervious Runoff Area=0.370 ac 0.00% Impervious Runoff Depth=4.76"
Flow Length=159' Tc=11.7 min CN=71 Runoff=1.85 cfs 0.147 af

Subcatchment7S: EDA OFF-SITE PERVIOUS Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=4.88"
Tc=0.0 min CN=72 Runoff=4.81 cfs 0.276 af

Link 3L: POA-1 Inflow=15.31 cfs 1.821 af
Primary=15.31 cfs 1.821 af

Link 5L: POA-2 Inflow=1.85 cfs 0.147 af
Primary=1.85 cfs 0.147 af

Link 6L: TOTAL ON-SITE Inflow=16.17 cfs 1.968 af
Primary=16.17 cfs 1.968 af

Link 8L: TOTAL OFF-SITE Inflow=4.81 cfs 0.276 af
Primary=4.81 cfs 0.276 af

Link 9L: Existing Total Inflow=17.11 cfs 2.244 af
Primary=17.11 cfs 2.244 af

Total Runoff Area = 5.490 ac Runoff Volume = 2.244 af Average Runoff Depth = 4.91"
98.91% Pervious = 5.430 ac 1.09% Impervious = 0.060 ac

Summary for Subcatchment 1S: EDA-1-Pervious

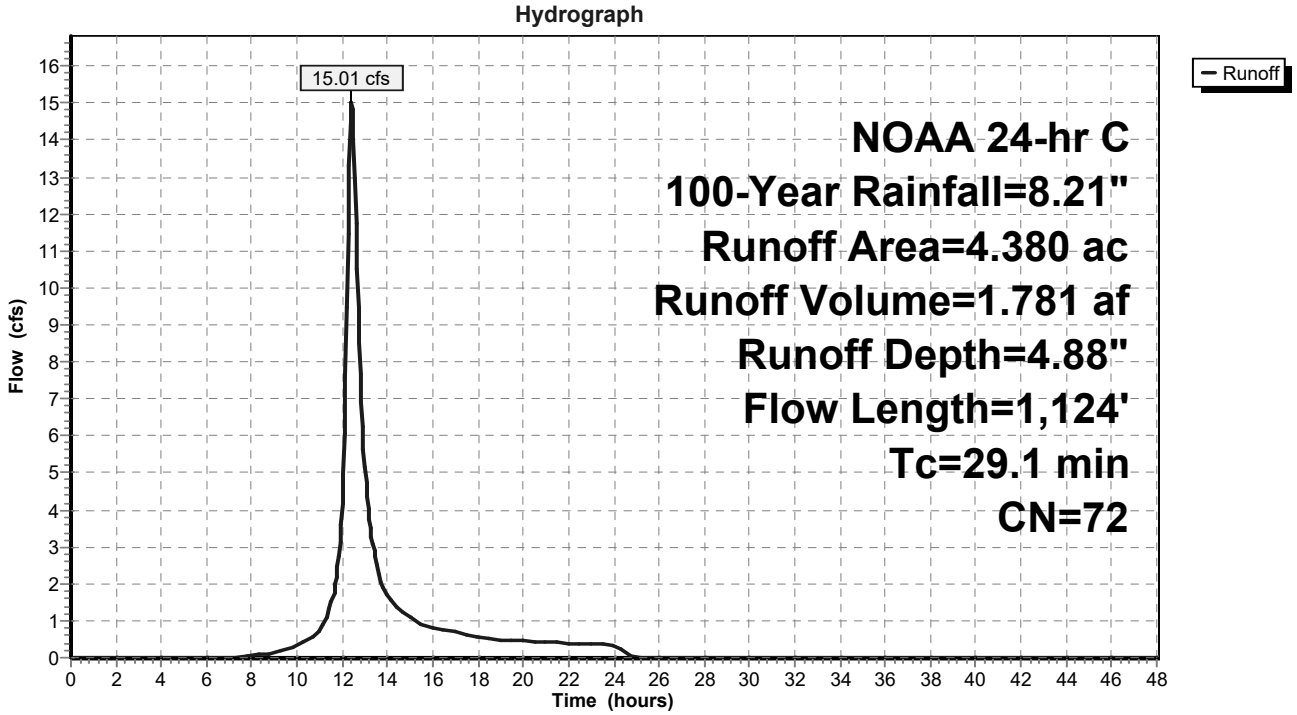
Runoff = 15.01 cfs @ 12.41 hrs, Volume= 1.781 af, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
2.150	70	Woods, Good, HSG C
2.230	74	>75% Grass cover, Good, HSG C
4.380	72	Weighted Average
4.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	100	0.0252	0.13		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.38"
15.2	702	0.0238	0.77		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
1.2	322	0.0050	4.59	123.92	**Channel Flow, Natural Stream** Area= 27.0 sf Perim= 18.0' r= 1.50' n= 0.030 Stream, clean & straight
29.1	1,124	Total			

Subcatchment 1S: EDA-1-Pervious



Summary for Subcatchment 2S: EDA-1-Impervious

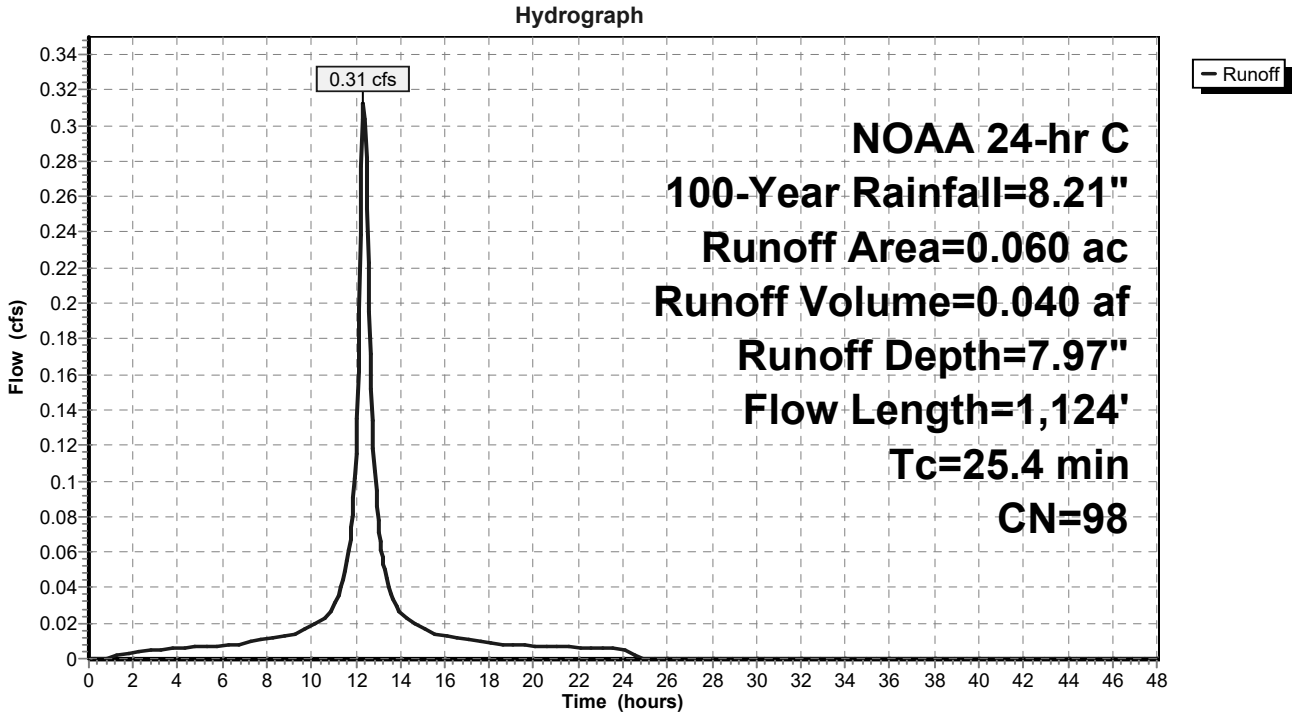
Runoff = 0.31 cfs @ 12.35 hrs, Volume= 0.040 af, Depth= 7.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.060	98	Paved parking, HSG C
0.060		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	108	0.0252	0.19		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.38"
15.0	694	0.0238	0.77		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
1.2	322	0.0050	4.59	123.92	**Channel Flow, Natural Stream** Area= 27.0 sf Perim= 18.0' r= 1.50' n= 0.030 Stream, clean & straight
25.4	1,124	Total			

Subcatchment 2S: EDA-1-Impervious



Summary for Subcatchment 4S: EDA-2-Pervious

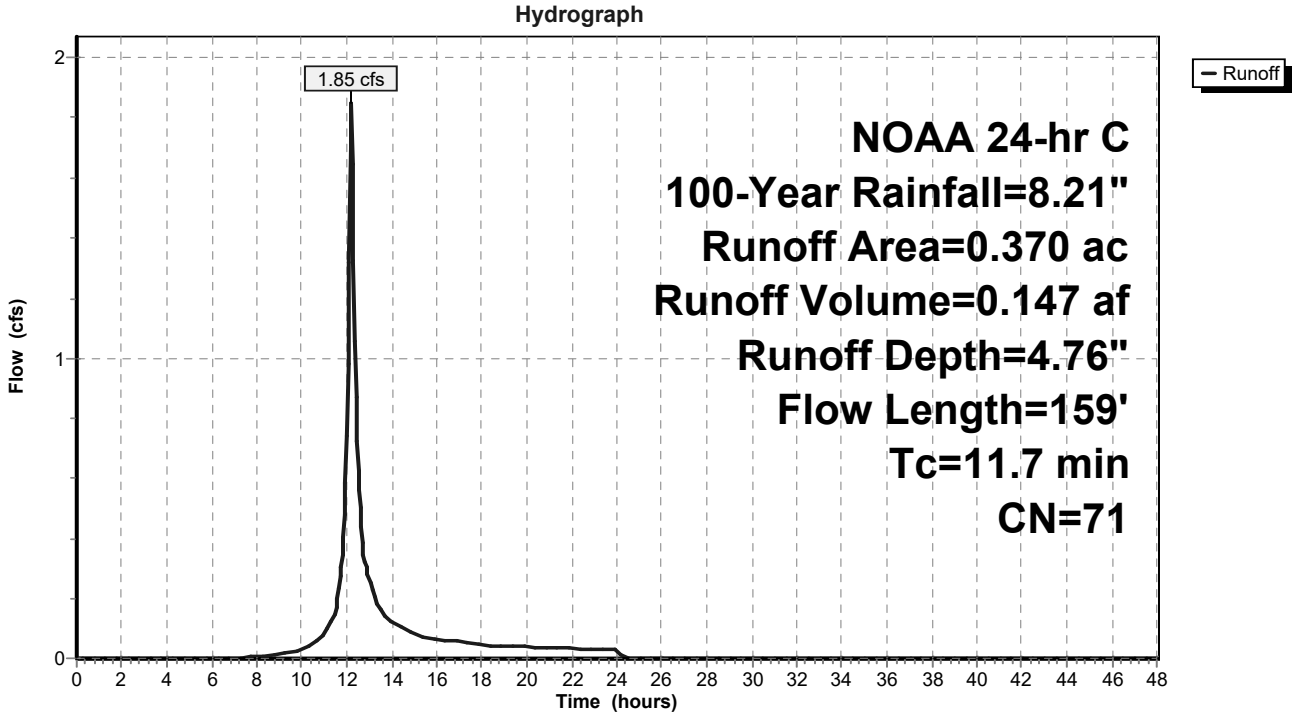
Runoff = 1.85 cfs @ 12.20 hrs, Volume= 0.147 af, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.290	70	Woods, Good, HSG C
0.080	74	>75% Grass cover, Good, HSG C
0.370	71	Weighted Average
0.370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	42	0.0040	0.08		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.38"
0.4	20	0.0040	0.95		**Shallow Concentrated Flow, Grass Waterway** Grassed Waterway Kv= 15.0 fps
2.2	97	0.0210	0.72		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.7	159	Total			

Subcatchment 4S: EDA-2-Pervious



Summary for Subcatchment 7S: EDA OFF-SITE PERVIOUS

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

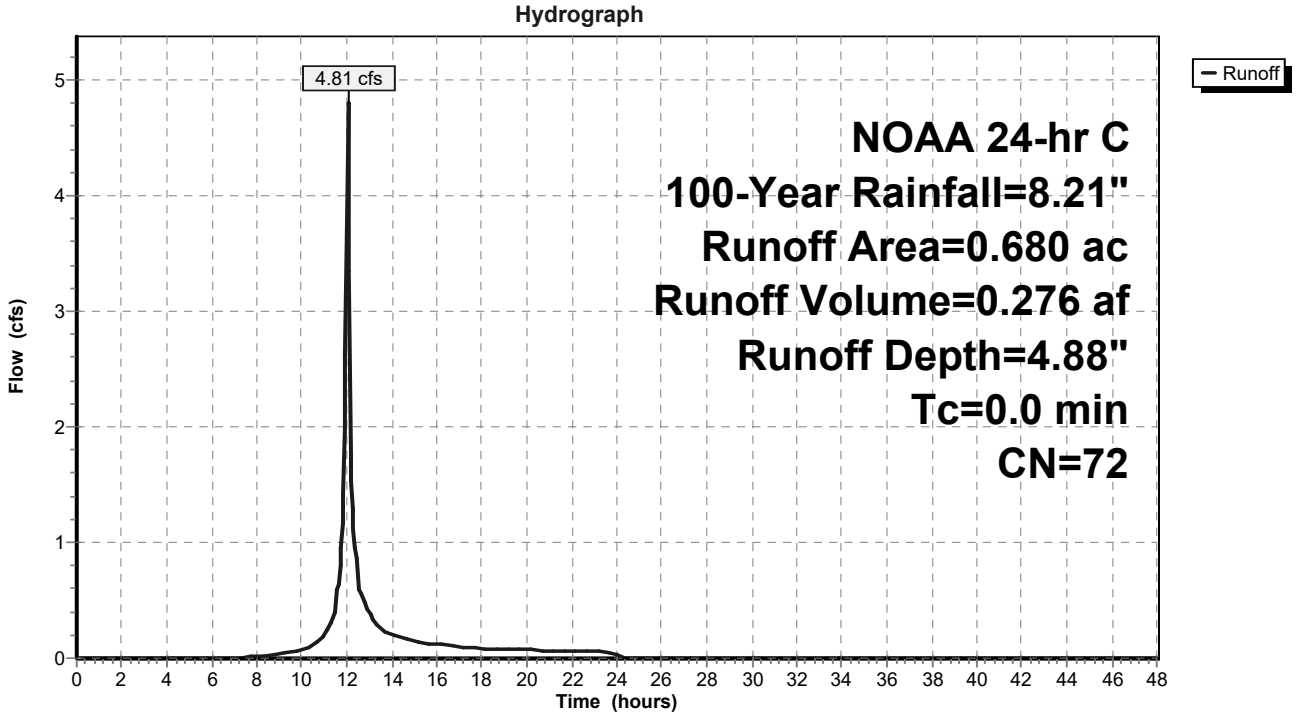
Runoff = 4.81 cfs @ 12.05 hrs, Volume= 0.276 af, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.680	72	Woods/grass comb., Good, HSG C
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, 10**

Subcatchment 7S: EDA OFF-SITE PERVIOUS

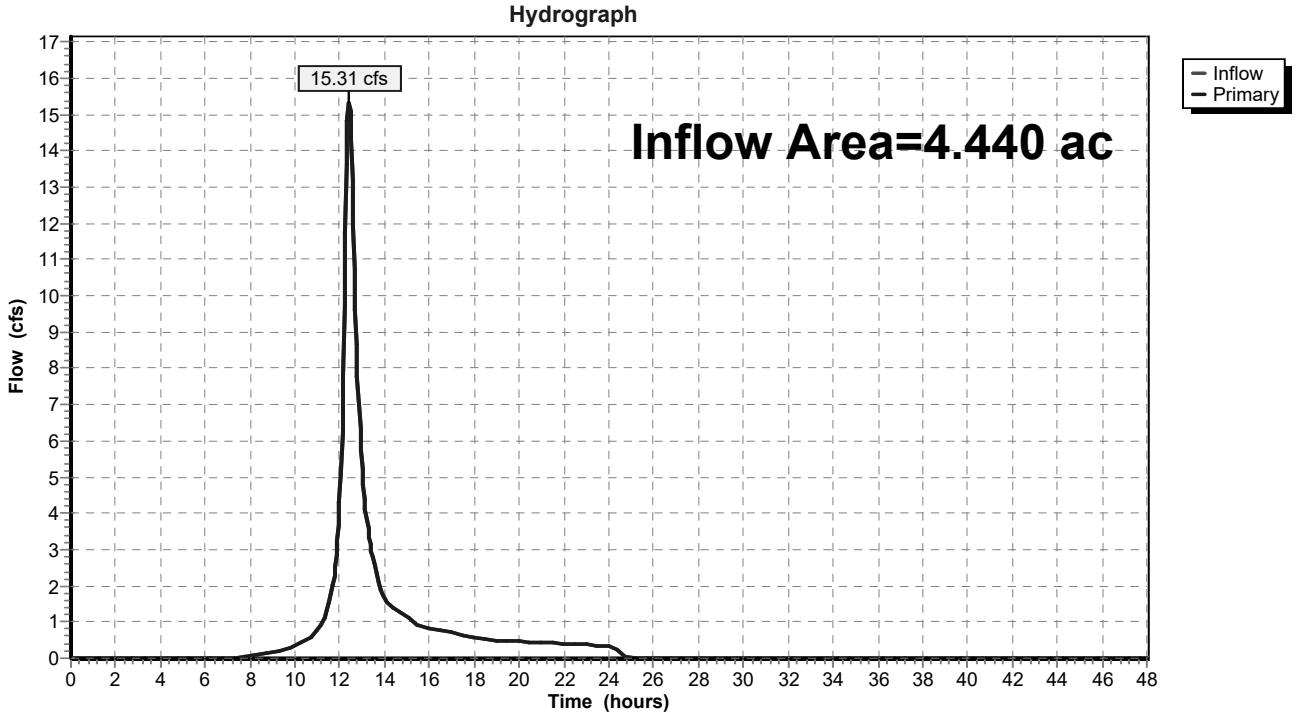


Summary for Link 3L: POA-1

Inflow Area = 4.440 ac, 1.35% Impervious, Inflow Depth = 4.92" for 100-Year event
Inflow = 15.31 cfs @ 12.41 hrs, Volume= 1.821 af
Primary = 15.31 cfs @ 12.41 hrs, Volume= 1.821 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 3L: POA-1

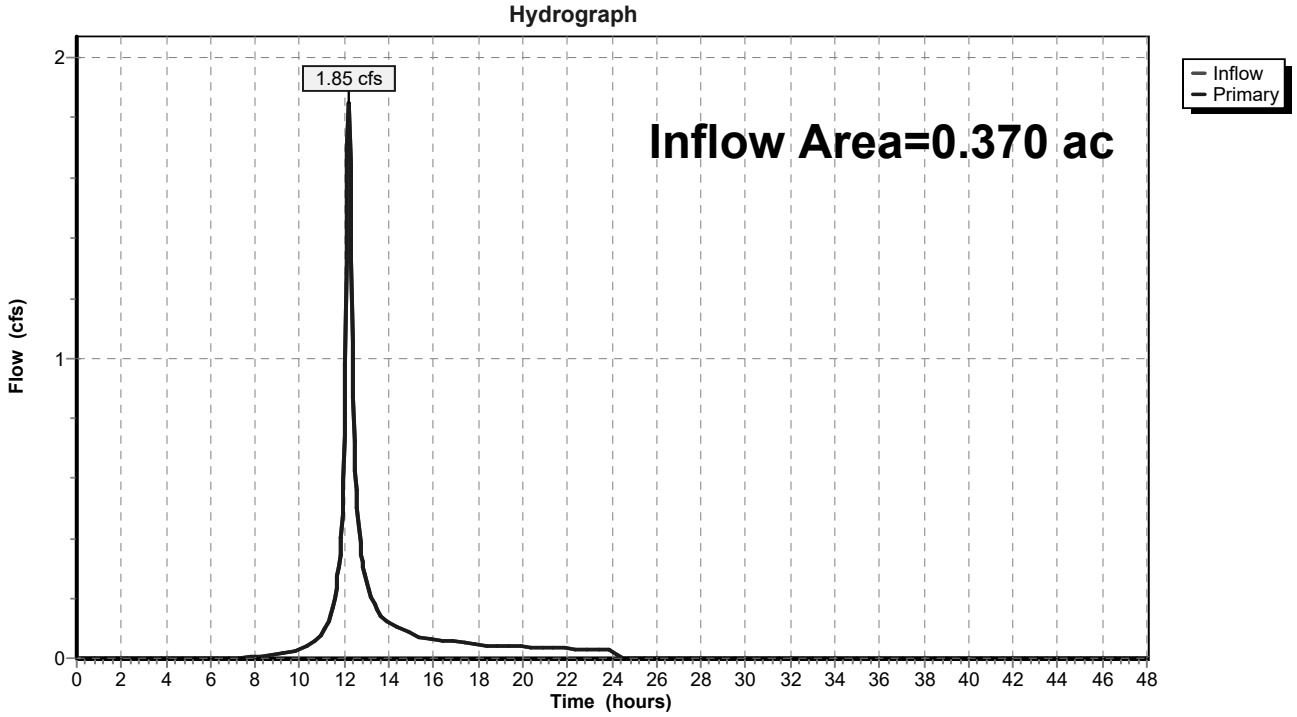


Summary for Link 5L: POA-2

Inflow Area = 0.370 ac, 0.00% Impervious, Inflow Depth = 4.76" for 100-Year event
Inflow = 1.85 cfs @ 12.20 hrs, Volume= 0.147 af
Primary = 1.85 cfs @ 12.20 hrs, Volume= 0.147 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 5L: POA-2

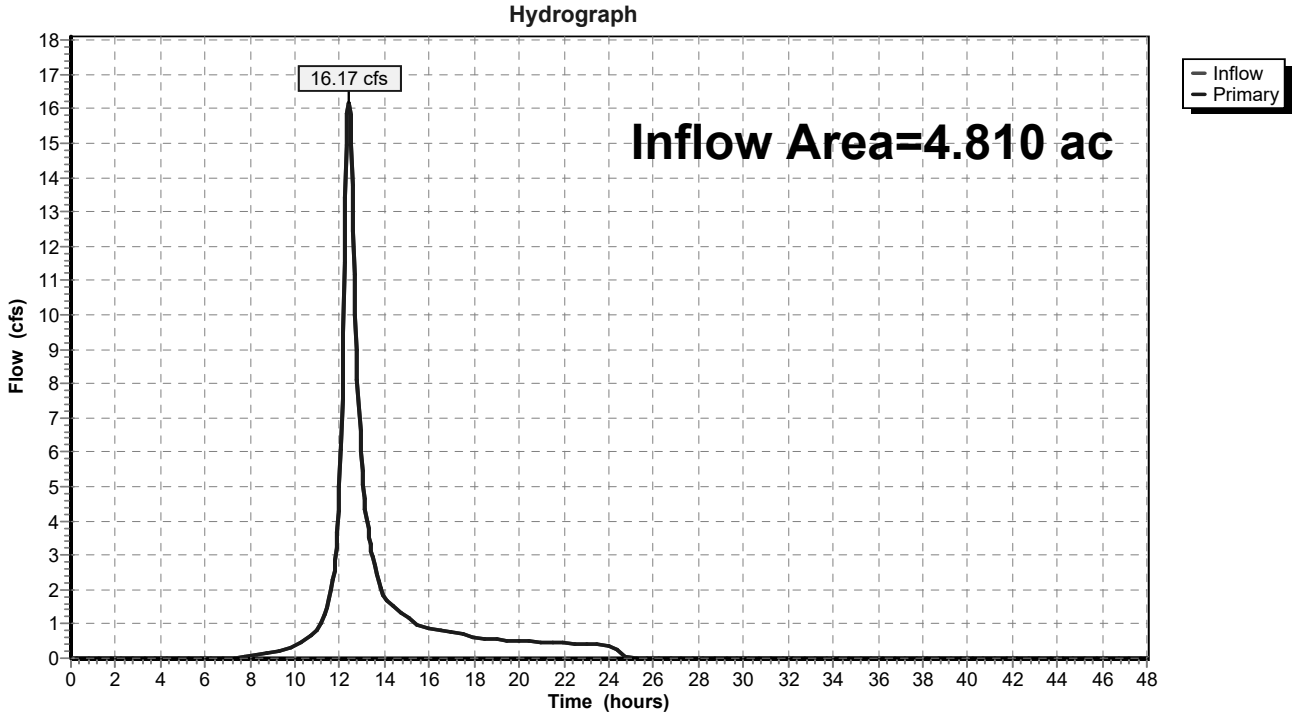


Summary for Link 6L: TOTAL ON-SITE

Inflow Area = 4.810 ac, 1.25% Impervious, Inflow Depth = 4.91" for 100-Year event
Inflow = 16.17 cfs @ 12.40 hrs, Volume= 1.968 af
Primary = 16.17 cfs @ 12.40 hrs, Volume= 1.968 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 6L: TOTAL ON-SITE

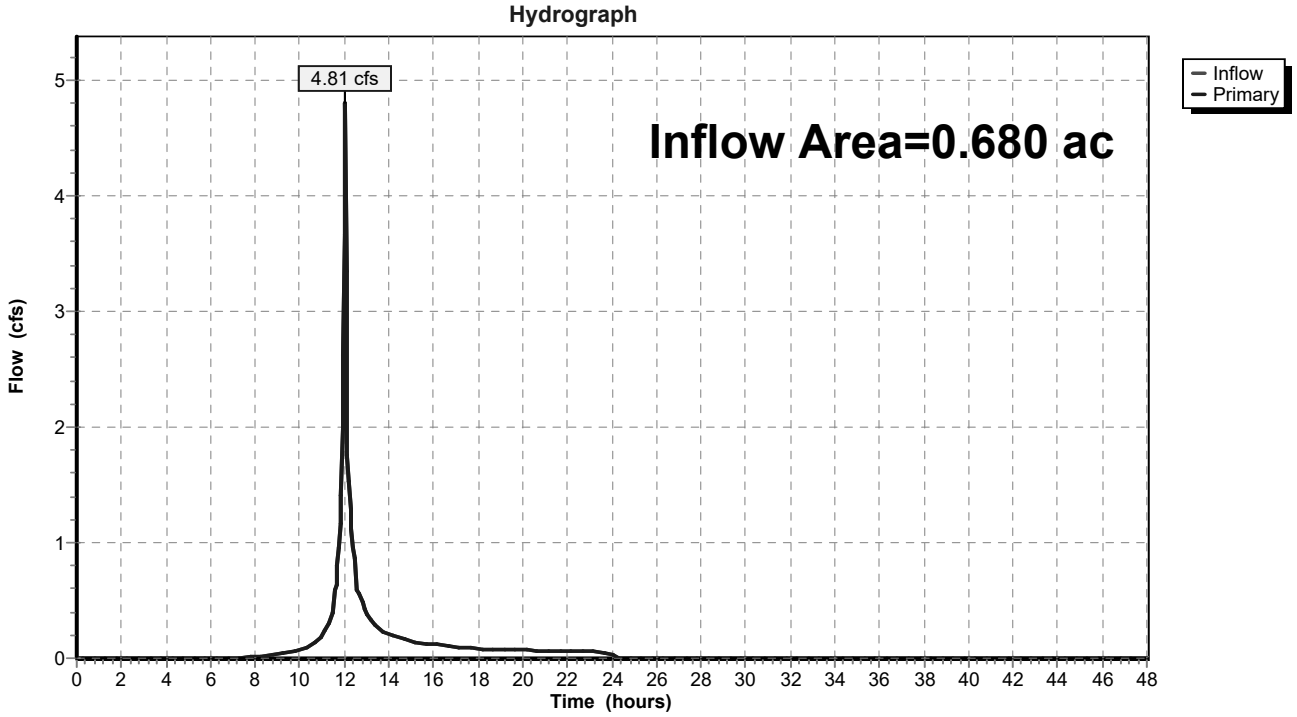


Summary for Link 8L: TOTAL OFF-SITE

Inflow Area = 0.680 ac, 0.00% Impervious, Inflow Depth = 4.88" for 100-Year event
Inflow = 4.81 cfs @ 12.05 hrs, Volume= 0.276 af
Primary = 4.81 cfs @ 12.05 hrs, Volume= 0.276 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 8L: TOTAL OFF-SITE

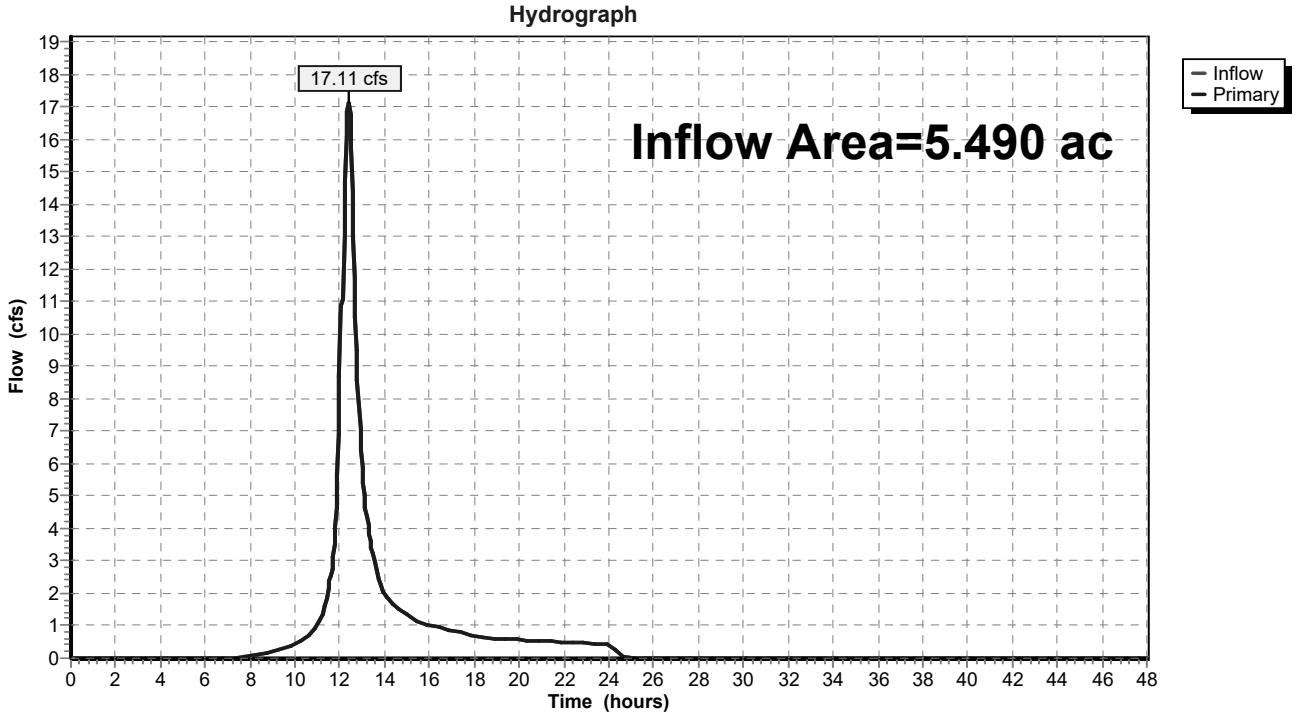


Summary for Link 9L: Existing Total

Inflow Area = 5.490 ac, 1.09% Impervious, Inflow Depth = 4.91" for 100-Year event
Inflow = 17.11 cfs @ 12.40 hrs, Volume= 2.244 af
Primary = 17.11 cfs @ 12.40 hrs, Volume= 2.244 af, Atten= 0%, Lag= 0.0 min

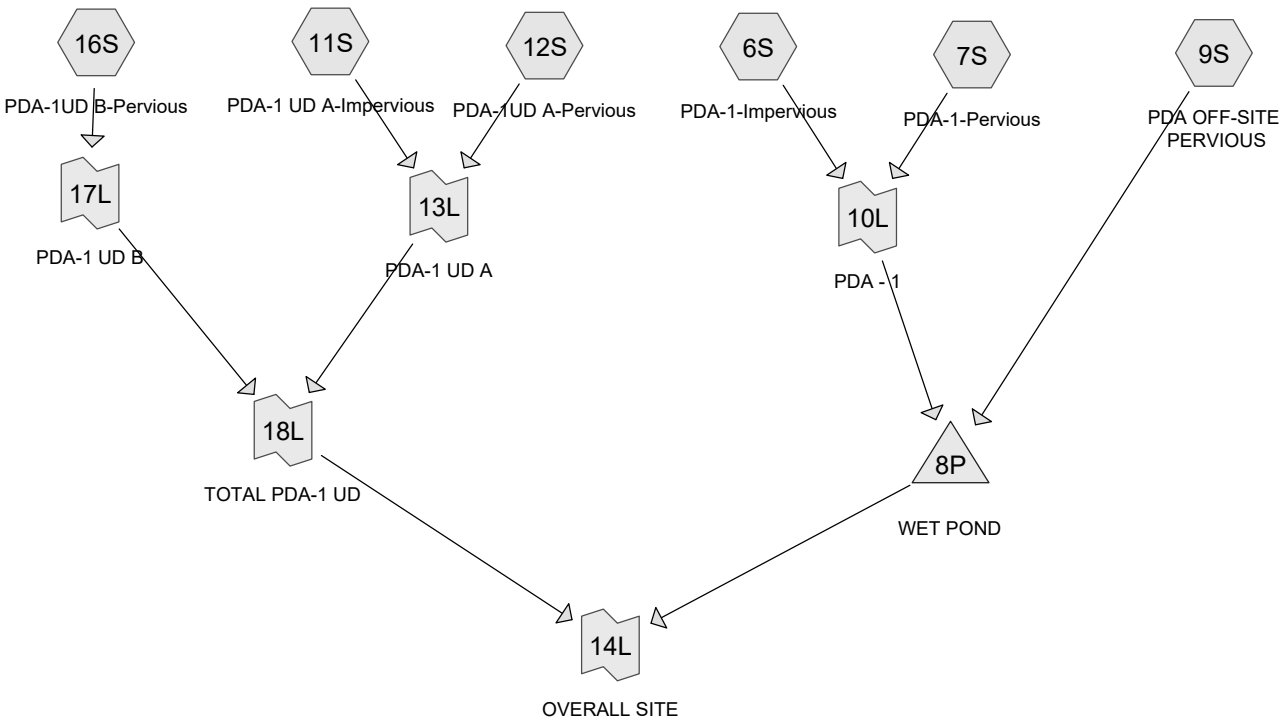
Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 9L: Existing Total



APPENDIX B

Hydrographs, CN, & Tc Calculations for Developed Conditions, Storage Volume and Stage-Storage Calculations for Stormwater Management Basin



Subcat Reach Pond Link

Routing Diagram for Proposed
Prepared by Maser Consulting PA, Printed 11/2/2020

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.140	74	>75% Grass cover, Good, HSG C (7S, 12S, 16S)
3.670	98	Paved parking, HSG C (6S, 11S)
0.680	72	Woods/grass comb., Good, HSG C (9S)
5.490	**90**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
5.490	HSG C	6S, 7S, 9S, 11S, 12S, 16S
0.000	HSG D	
0.000	Other	
5.490		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.140	0.000	0.000	1.140	>75% Grass cover, Good	7S, 12S, 16S
0.000	0.000	3.670	0.000	0.000	3.670	Paved parking	6S, 11S
0.000	0.000	0.680	0.000	0.000	0.680	Woods/grass comb., Good	9S
0.000	**0.000**	**5.490**	**0.000**	**0.000**	**5.490**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	8P	66.50	66.00	100.0	0.0050	0.015	15.0	0.0	0.0

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

Subcatchment6S: PDA-1-Impervious Runoff Area=3.450 ac 100.00% Impervious Runoff Depth=3.11"
Tc=10.0 min CN=98 Runoff=10.42 cfs 0.893 af

Subcatchment7S: PDA-1-Pervious Runoff Area=0.720 ac 0.00% Impervious Runoff Depth=1.13"
Tc=10.0 min CN=74 Runoff=0.88 cfs 0.068 af

Subcatchment9S: PDA OFF-SITE PERVIOUS Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=1.02"
Tc=0.0 min CN=72 Runoff=0.99 cfs 0.058 af

Subcatchment11S: PDA-1 UD Runoff Area=0.220 ac 100.00% Impervious Runoff Depth=3.11"
Tc=10.0 min CN=98 Runoff=0.66 cfs 0.057 af

Subcatchment12S: PDA-1UD A-Pervious Runoff Area=0.320 ac 0.00% Impervious Runoff Depth=1.13"
Tc=10.0 min CN=74 Runoff=0.39 cfs 0.030 af

Subcatchment16S: PDA-1UD B-Pervious Runoff Area=0.100 ac 0.00% Impervious Runoff Depth=1.13"
Tc=10.0 min CN=74 Runoff=0.12 cfs 0.009 af

Pond 8P: WET POND Peak Elev=71.10' Storage=33,090 cf Inflow=11.64 cfs 1.019 af
Outflow=0.26 cfs 0.707 af

Link 10L: PDA - 1 Inflow=11.29 cfs 0.961 af
Primary=11.29 cfs 0.961 af

Link 13L: PDA-1 UD A Inflow=1.05 cfs 0.087 af
Primary=1.05 cfs 0.087 af

Link 14L: OVERALL SITE Inflow=1.36 cfs 0.803 af
Primary=1.36 cfs 0.803 af

Link 17L: PDA-1 UD B Inflow=0.12 cfs 0.009 af
Primary=0.12 cfs 0.009 af

Link 18L: TOTAL PDA-1 UD Inflow=1.17 cfs 0.097 af
Primary=1.17 cfs 0.097 af

Total Runoff Area = 5.490 ac Runoff Volume = 1.115 af Average Runoff Depth = 2.44"
33.15% Pervious = 1.820 ac 66.85% Impervious = 3.670 ac

Summary for Subcatchment 6S: PDA-1-Impervious

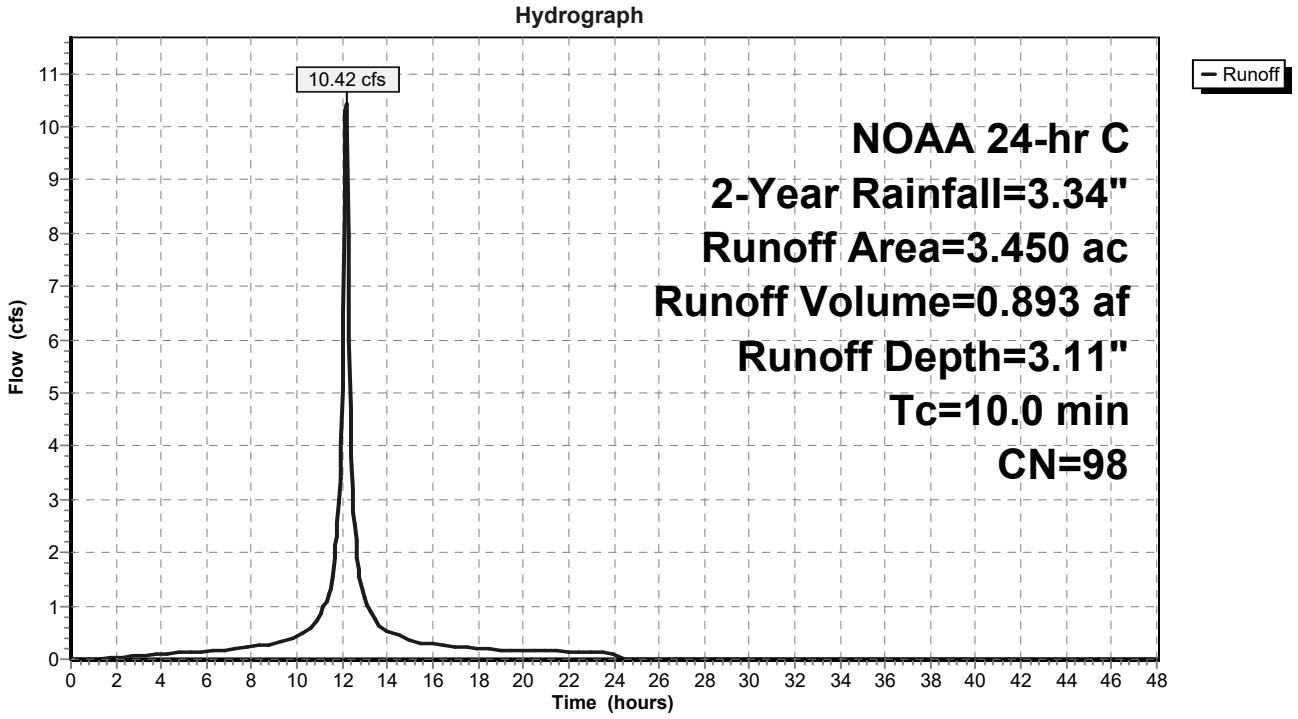
Runoff = 10.42 cfs @ 12.17 hrs, Volume= 0.893 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
3.450	98	Paved parking, HSG C
3.450		100.00% Impervious Area

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

Subcatchment 6S: PDA-1-Impervious



Summary for Subcatchment 7S: PDA-1-Pervious

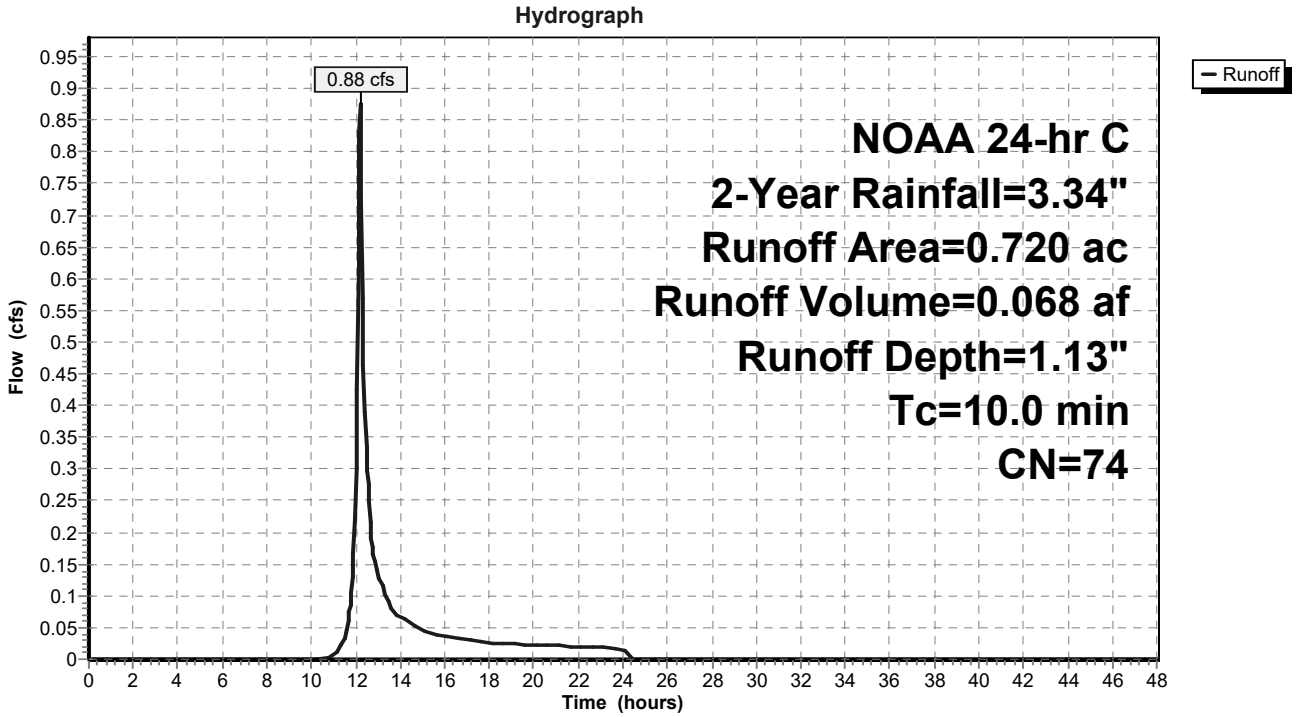
Runoff = 0.88 cfs @ 12.18 hrs, Volume= 0.068 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.720	74	>75% Grass cover, Good, HSG C
0.720		100.00% Pervious Area

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

Subcatchment 7S: PDA-1-Pervious



Summary for Subcatchment 9S: PDA OFF-SITE PERVIOUS

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

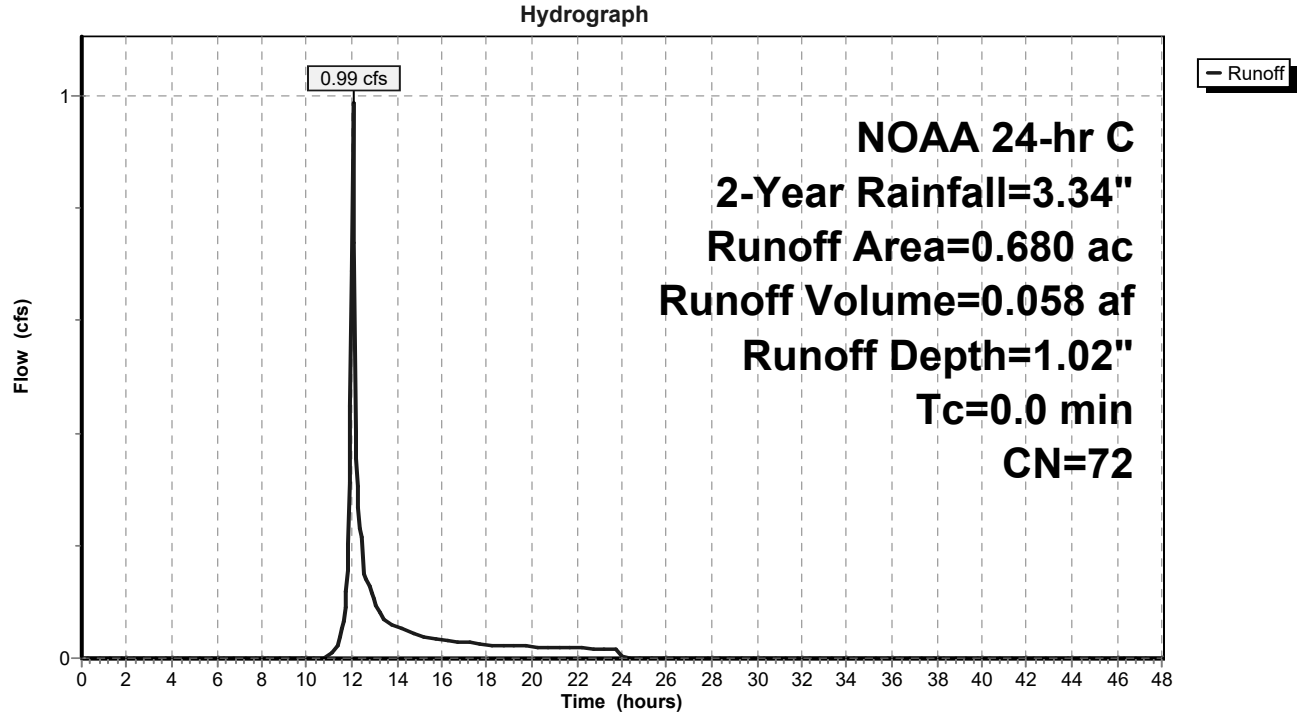
Runoff = 0.99 cfs @ 12.05 hrs, Volume= 0.058 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.680	72	Woods/grass comb., Good, HSG C
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, 10**

Subcatchment 9S: PDA OFF-SITE PERVIOUS



Summary for Subcatchment 11S: PDA-1 UD A-Impervious

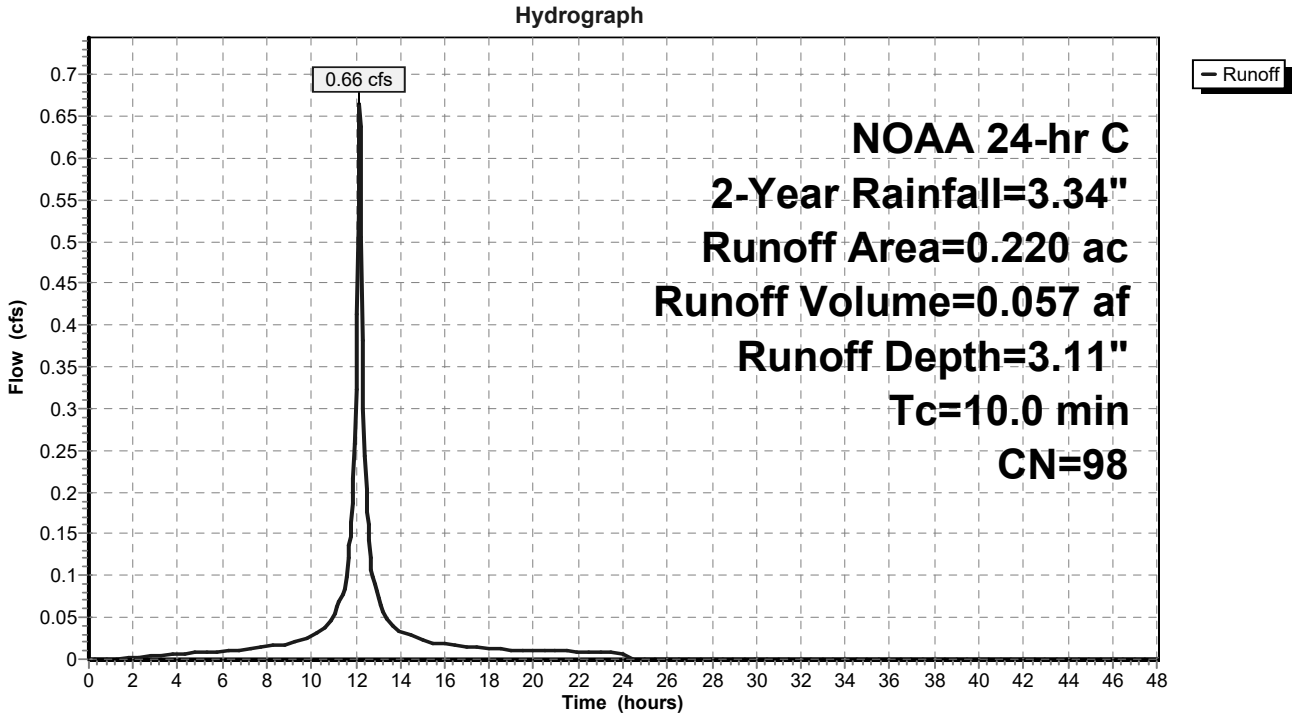
Runoff = 0.66 cfs @ 12.17 hrs, Volume= 0.057 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG C
0.220		100.00% Impervious Area

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

Subcatchment 11S: PDA-1 UD A-Impervious



Summary for Subcatchment 12S: PDA-1UD A-Pervious

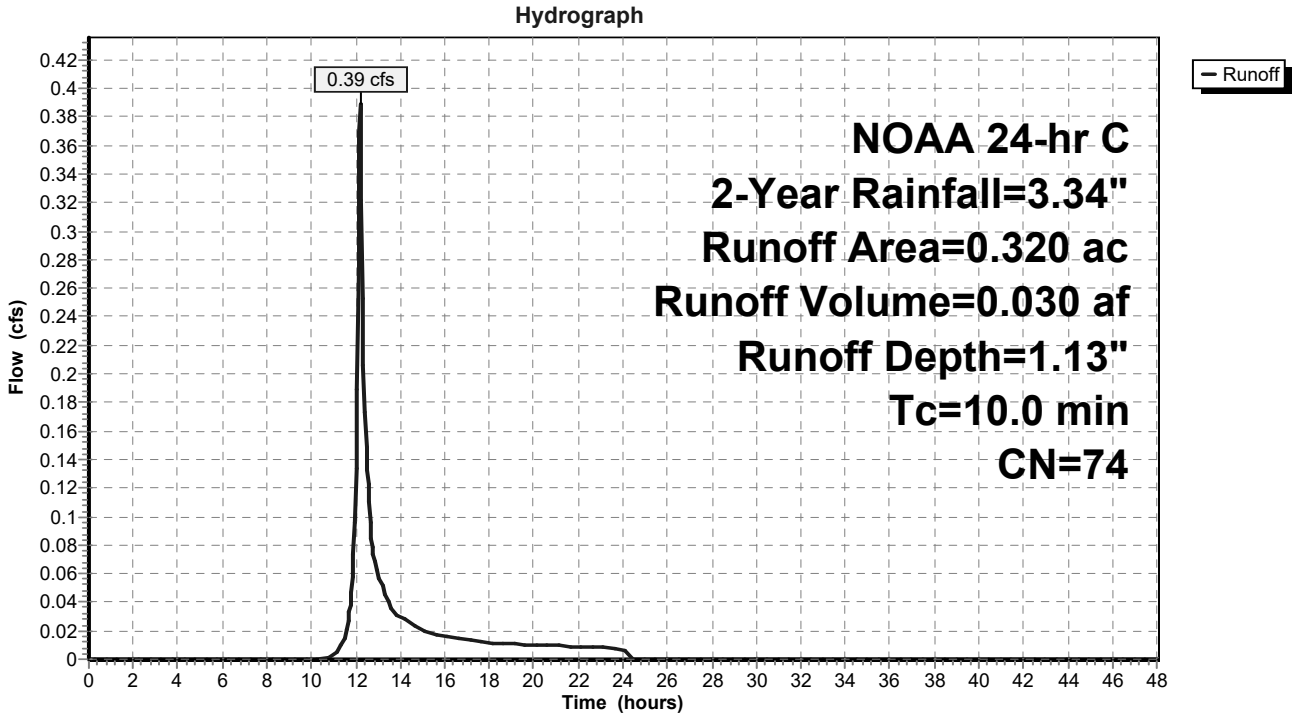
Runoff = 0.39 cfs @ 12.18 hrs, Volume= 0.030 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.320	74	>75% Grass cover, Good, HSG C
0.320		100.00% Pervious Area

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

Subcatchment 12S: PDA-1UD A-Pervious



Summary for Subcatchment 16S: PDA-1UD B-Pervious

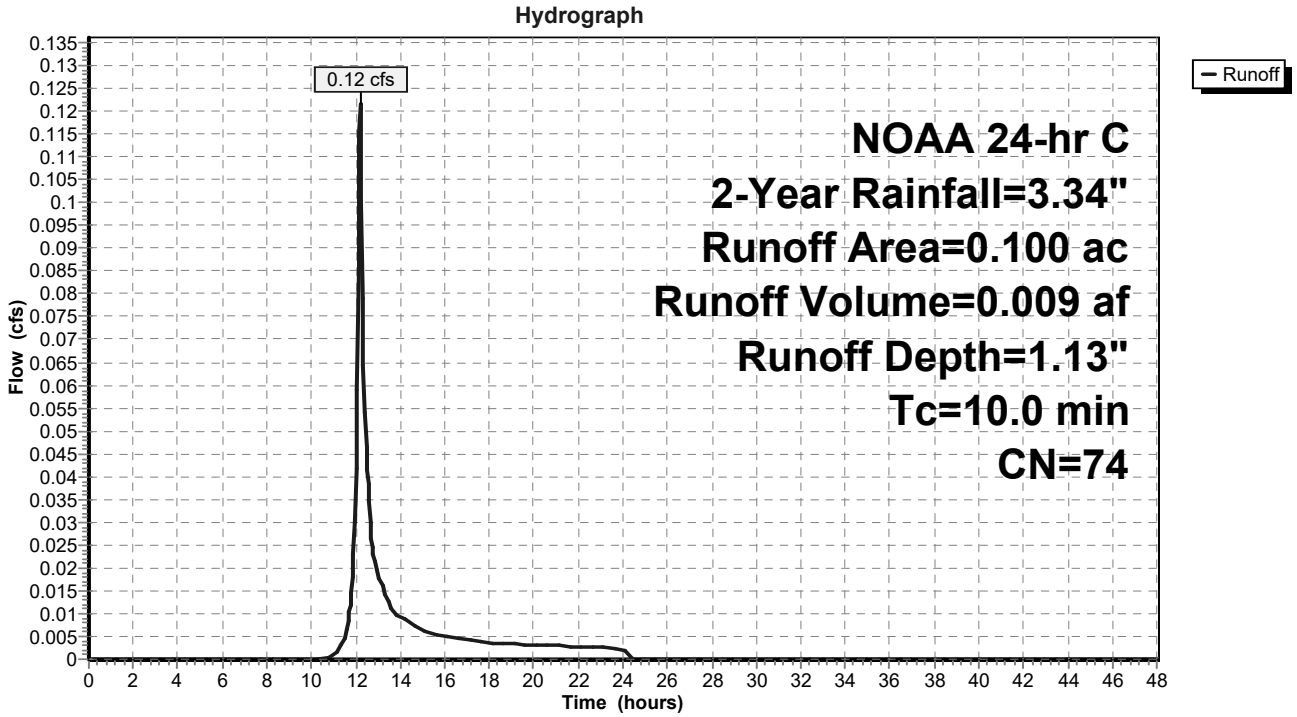
Runoff = 0.12 cfs @ 12.18 hrs, Volume= 0.009 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 2-Year Rainfall=3.34"

Area (ac)	CN	Description
0.100	74	>75% Grass cover, Good, HSG C
0.100		100.00% Pervious Area

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

Subcatchment 16S: PDA-1UD B-Pervious



Summary for Pond 8P: WET POND

Inflow Area = 4.850 ac, 71.13% Impervious, Inflow Depth = 2.52" for 2-Year event
Inflow = 11.64 cfs @ 12.17 hrs, Volume= 1.019 af
Outflow = 0.26 cfs @ 17.74 hrs, Volume= 0.707 af, Atten= 98%, Lag= 334.6 min
Primary = 0.26 cfs @ 17.74 hrs, Volume= 0.707 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 71.10' @ 17.74 hrs Surf.Area= 13,789 sf Storage= 33,090 cf

Plug-Flow detention time= 990.6 min calculated for 0.706 af (69% of inflow)
Center-of-Mass det. time= 891.4 min (1,664.7 - 773.3)

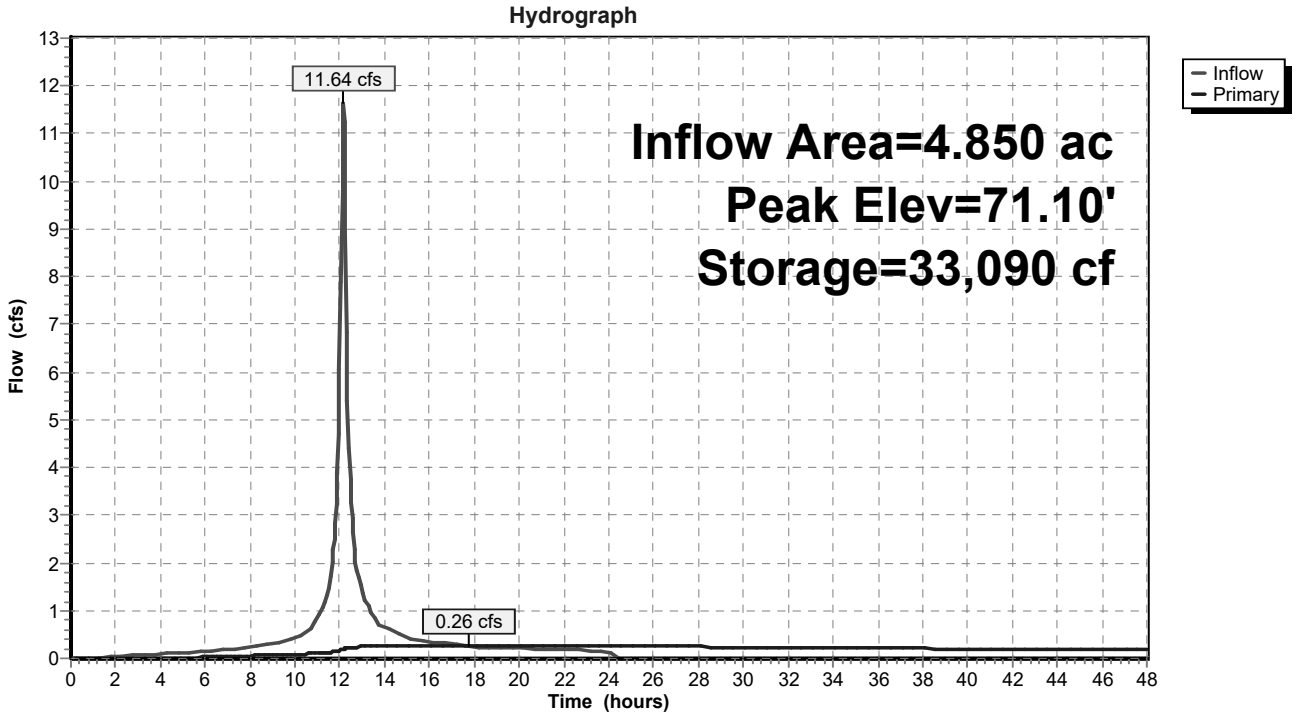
Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	60,825 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	11,408	0	0
69.00	12,104	5,878	5,878
70.00	12,902	12,503	18,381
71.00	13,711	13,307	31,688
72.00	14,475	14,093	45,781
73.00	15,613	15,044	60,825

Device	Routing	Invert	Outlet Devices
#1	Primary	66.50'	**15.0" Round Culvert** L= 100.0' Ke= 1.000 Inlet / Outlet Invert= 66.50' / 66.00' S= 0.0050 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf
#2	Device 1	68.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	71.15'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	72.90'	**48.0" x 42.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.26 cfs @ 17.74 hrs HW=71.10' (Free Discharge)
└**1=Culvert** (Passes 0.26 cfs of 8.55 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 0.26 cfs @ 7.61 fps)
  ├**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**4=Grate** (Controls 0.00 cfs)

Pond 8P: WET POND

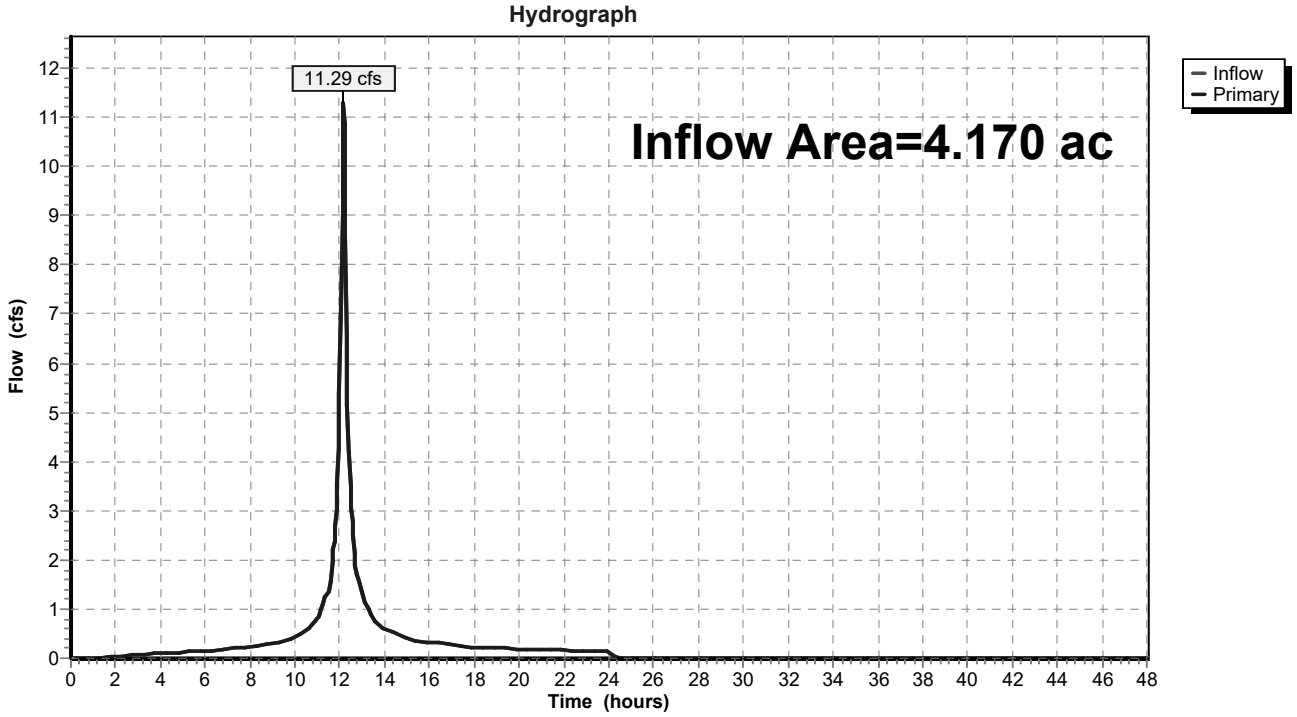


Summary for Link 10L: PDA - 1

Inflow Area = 4.170 ac, 82.73% Impervious, Inflow Depth = 2.77" for 2-Year event
Inflow = 11.29 cfs @ 12.17 hrs, Volume= 0.961 af
Primary = 11.29 cfs @ 12.17 hrs, Volume= 0.961 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 10L: PDA - 1

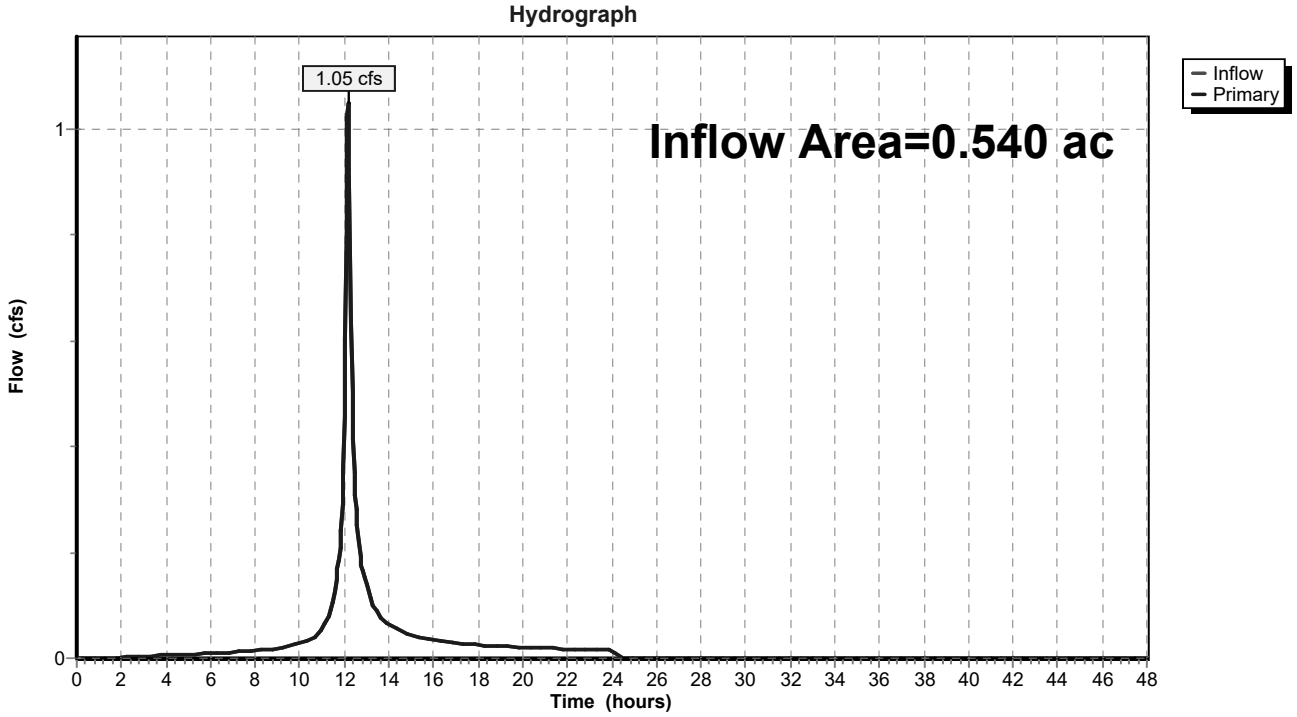


Summary for Link 13L: PDA-1 UD A

Inflow Area = 0.540 ac, 40.74% Impervious, Inflow Depth = 1.94" for 2-Year event
Inflow = 1.05 cfs @ 12.17 hrs, Volume= 0.087 af
Primary = 1.05 cfs @ 12.17 hrs, Volume= 0.087 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 13L: PDA-1 UD A

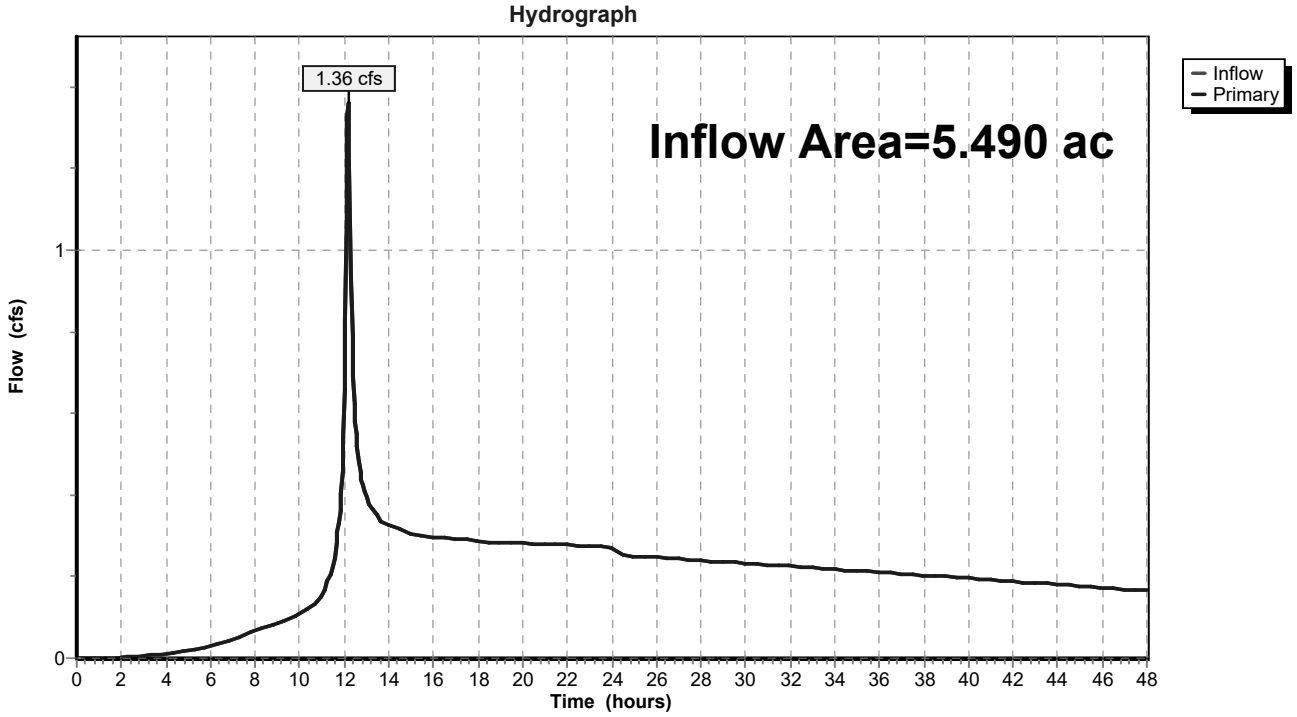


Summary for Link 14L: OVERALL SITE

Inflow Area = 5.490 ac, 66.85% Impervious, Inflow Depth > 1.76" for 2-Year event
Inflow = 1.36 cfs @ 12.18 hrs, Volume= 0.803 af
Primary = 1.36 cfs @ 12.18 hrs, Volume= 0.803 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 14L: OVERALL SITE

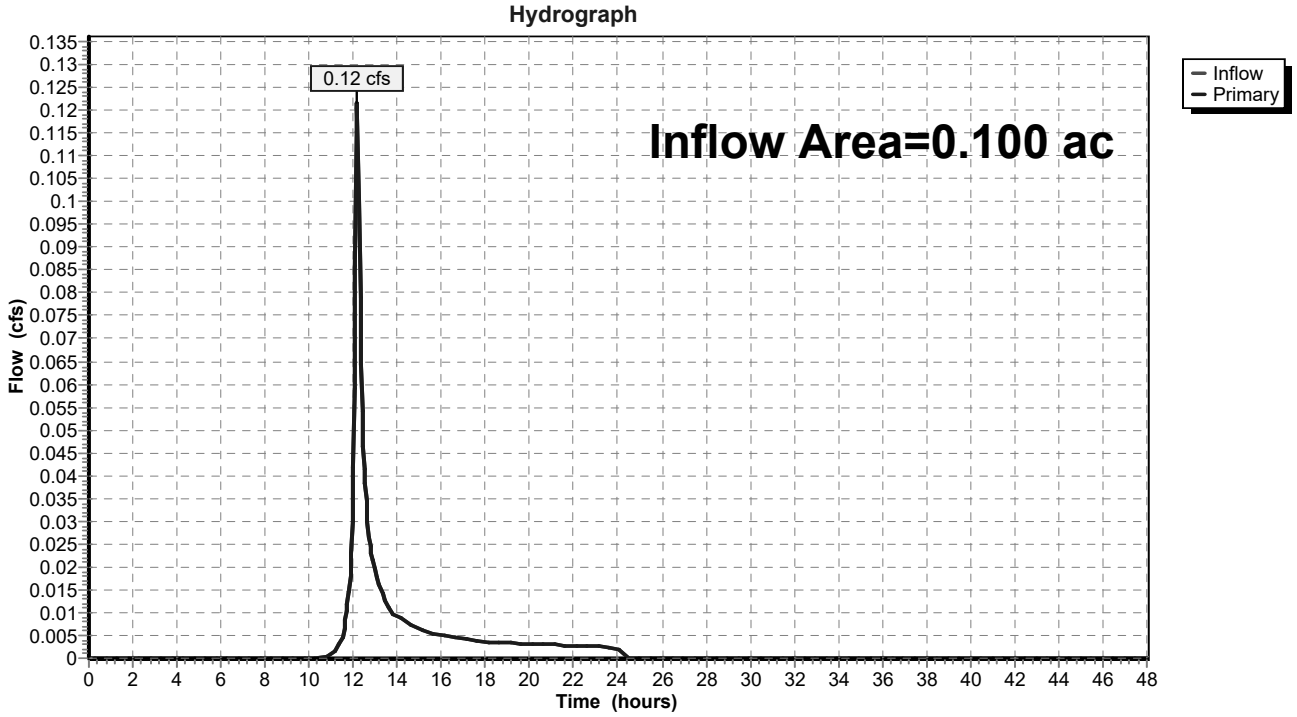


Summary for Link 17L: PDA-1 UD B

Inflow Area = 0.100 ac, 0.00% Impervious, Inflow Depth = 1.13" for 2-Year event
Inflow = 0.12 cfs @ 12.18 hrs, Volume= 0.009 af
Primary = 0.12 cfs @ 12.18 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 17L: PDA-1 UD B

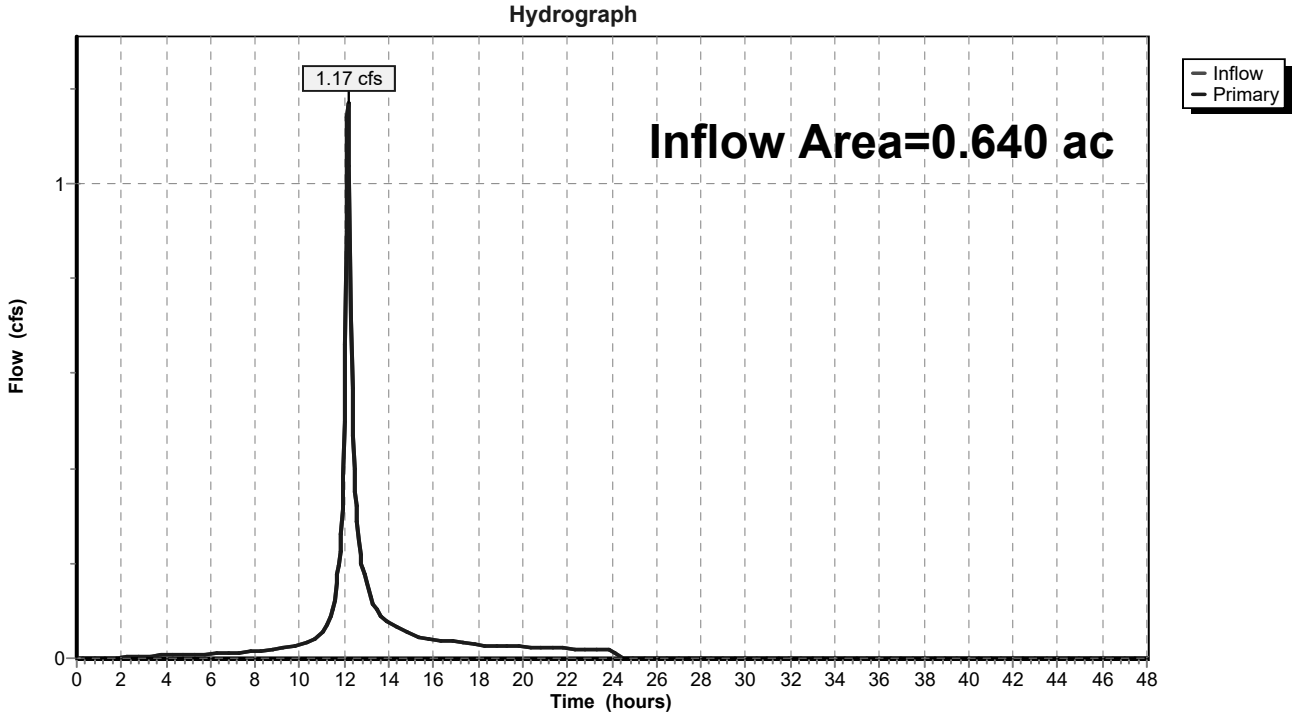


Summary for Link 18L: TOTAL PDA-1 UD

Inflow Area = 0.640 ac, 34.38% Impervious, Inflow Depth = 1.81" for 2-Year event
Inflow = 1.17 cfs @ 12.18 hrs, Volume= 0.097 af
Primary = 1.17 cfs @ 12.18 hrs, Volume= 0.097 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 18L: TOTAL PDA-1 UD



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

Subcatchment6S: PDA-1-Impervious Runoff Area=3.450 ac 100.00% Impervious Runoff Depth=4.77"
Tc=10.0 min CN=98 Runoff=15.74 cfs 1.372 af

Subcatchment7S: PDA-1-Pervious Runoff Area=0.720 ac 0.00% Impervious Runoff Depth=2.37"
Tc=10.0 min CN=74 Runoff=1.89 cfs 0.142 af

Subcatchment9S: PDA OFF-SITE PERVIOUS Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=2.21"
Tc=0.0 min CN=72 Runoff=2.20 cfs 0.125 af

Subcatchment11S: PDA-1 UD Runoff Area=0.220 ac 100.00% Impervious Runoff Depth=4.77"
Tc=10.0 min CN=98 Runoff=1.00 cfs 0.088 af

Subcatchment12S: PDA-1UD A-Pervious Runoff Area=0.320 ac 0.00% Impervious Runoff Depth=2.37"
Tc=10.0 min CN=74 Runoff=0.84 cfs 0.063 af

Subcatchment16S: PDA-1UD B-Pervious Runoff Area=0.100 ac 0.00% Impervious Runoff Depth=2.37"
Tc=10.0 min CN=74 Runoff=0.26 cfs 0.020 af

Pond 8P: WET POND Peak Elev=71.60' Storage=40,025 cf Inflow=18.35 cfs 1.640 af
Outflow=4.12 cfs 1.296 af

Link 10L: PDA - 1 Inflow=17.62 cfs 1.515 af
Primary=17.62 cfs 1.515 af

Link 13L: PDA-1 UD A Inflow=1.84 cfs 0.151 af
Primary=1.84 cfs 0.151 af

Link 14L: OVERALL SITE Inflow=4.64 cfs 1.466 af
Primary=4.64 cfs 1.466 af

Link 17L: PDA-1 UD B Inflow=0.26 cfs 0.020 af
Primary=0.26 cfs 0.020 af

Link 18L: TOTAL PDA-1 UD Inflow=2.10 cfs 0.171 af
Primary=2.10 cfs 0.171 af

Total Runoff Area = 5.490 ac Runoff Volume = 1.810 af Average Runoff Depth = 3.96"
33.15% Pervious = 1.820 ac 66.85% Impervious = 3.670 ac

Summary for Subcatchment 6S: PDA-1-Impervious

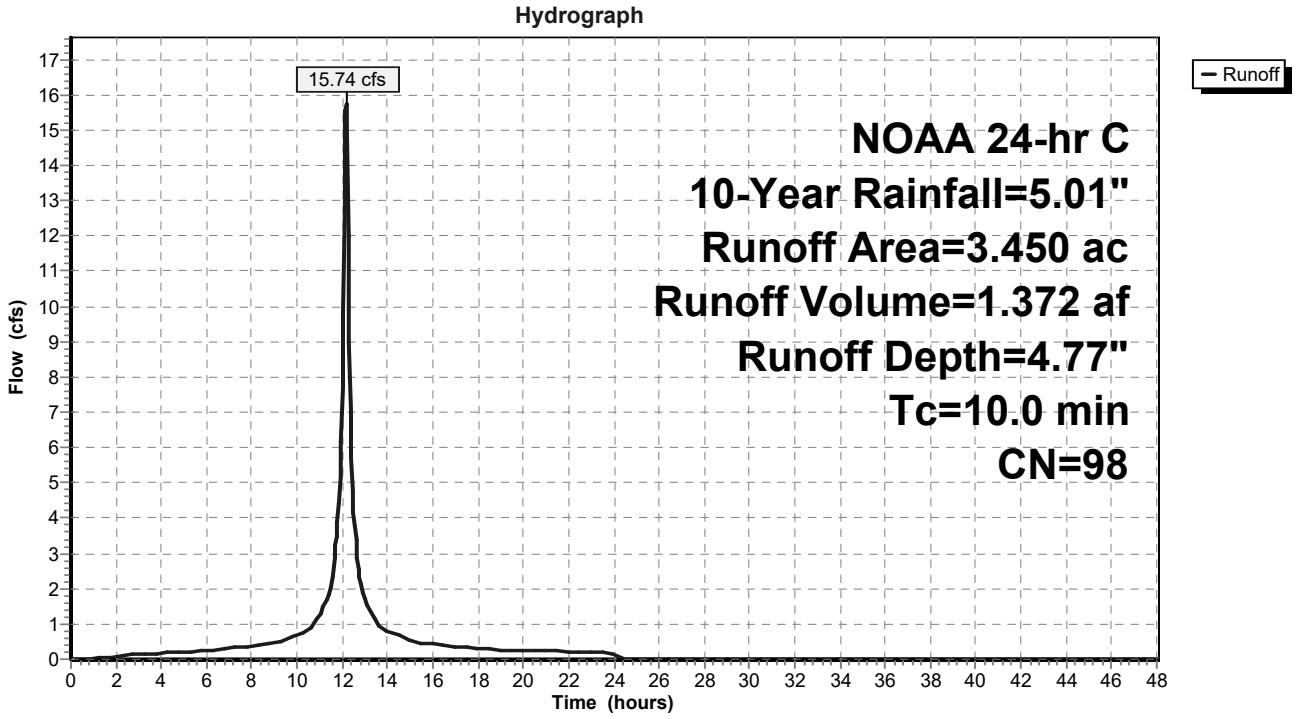
Runoff = 15.74 cfs @ 12.17 hrs, Volume= 1.372 af, Depth= 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
3.450	98	Paved parking, HSG C
3.450		100.00% Impervious Area

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

Subcatchment 6S: PDA-1-Impervious



Summary for Subcatchment 7S: PDA-1-Pervious

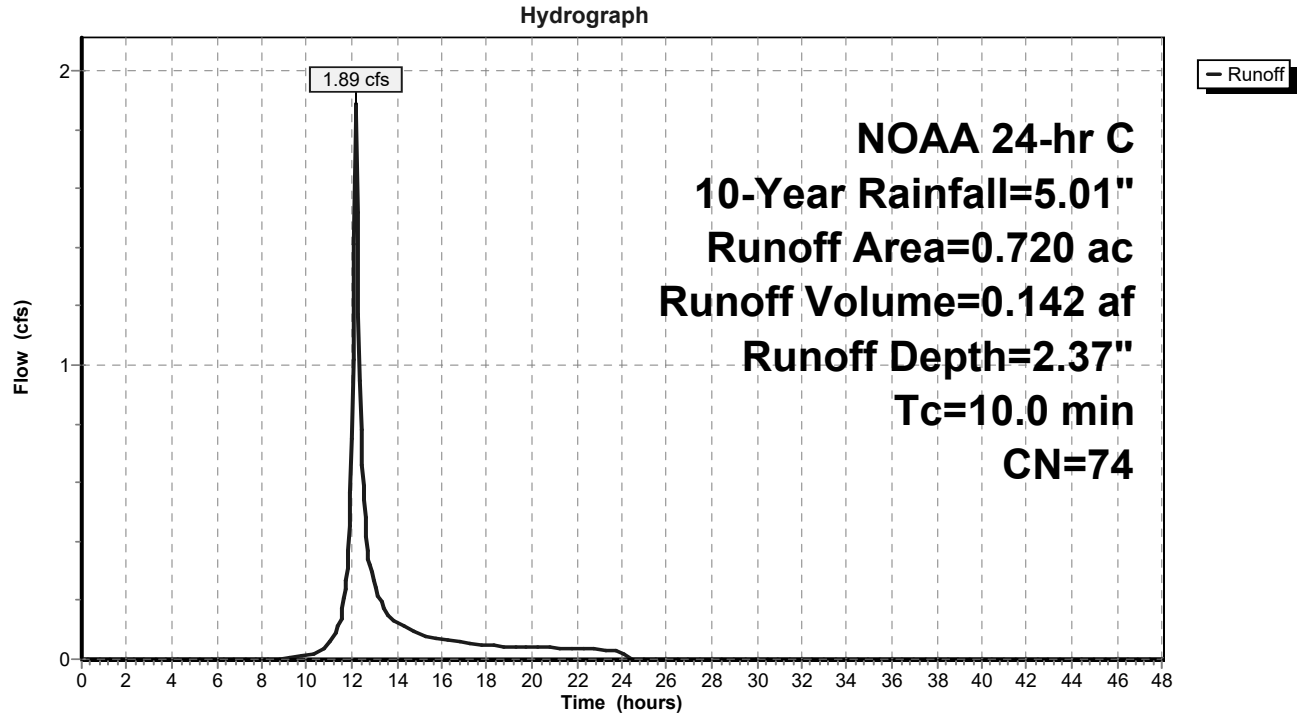
Runoff = 1.89 cfs @ 12.18 hrs, Volume= 0.142 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.720	74	>75% Grass cover, Good, HSG C
0.720		100.00% Pervious Area

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

Subcatchment 7S: PDA-1-Pervious



Summary for Subcatchment 9S: PDA OFF-SITE PERVIOUS

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

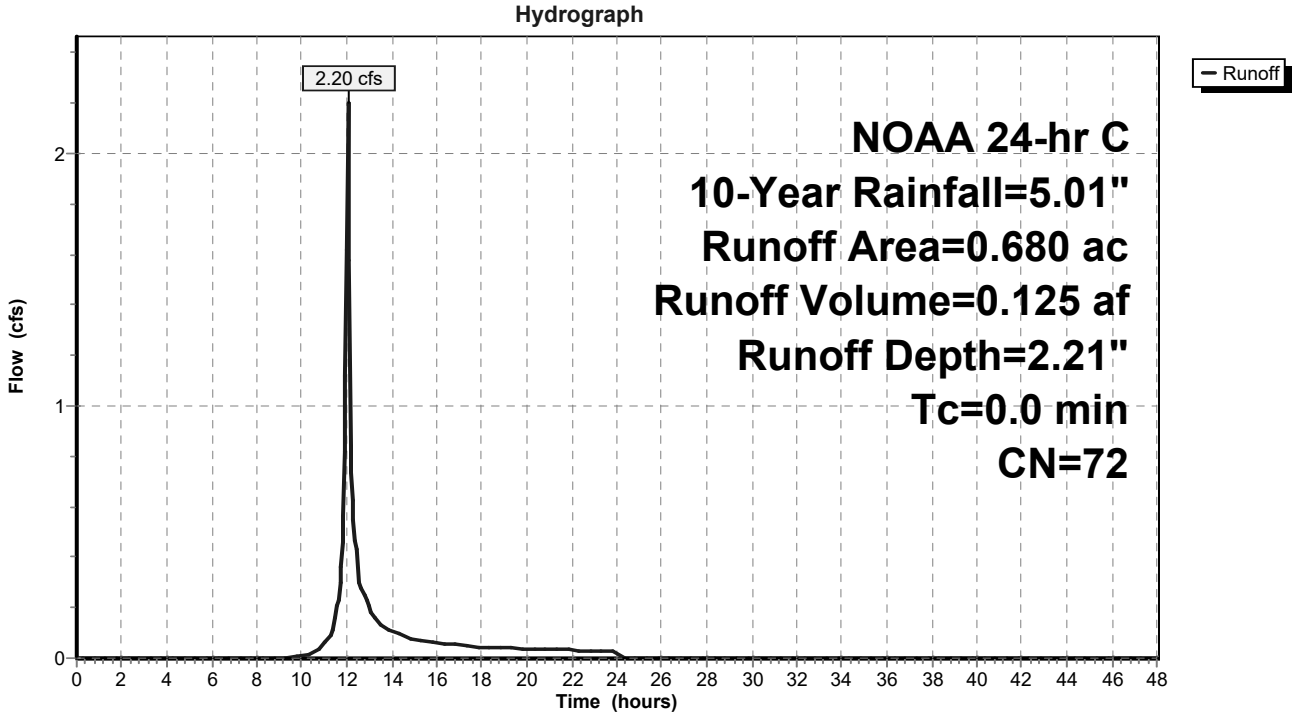
Runoff = 2.20 cfs @ 12.05 hrs, Volume= 0.125 af, Depth= 2.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.680	72	Woods/grass comb., Good, HSG C
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, 10**

Subcatchment 9S: PDA OFF-SITE PERVIOUS



Summary for Subcatchment 11S: PDA-1 UD A-Impervious

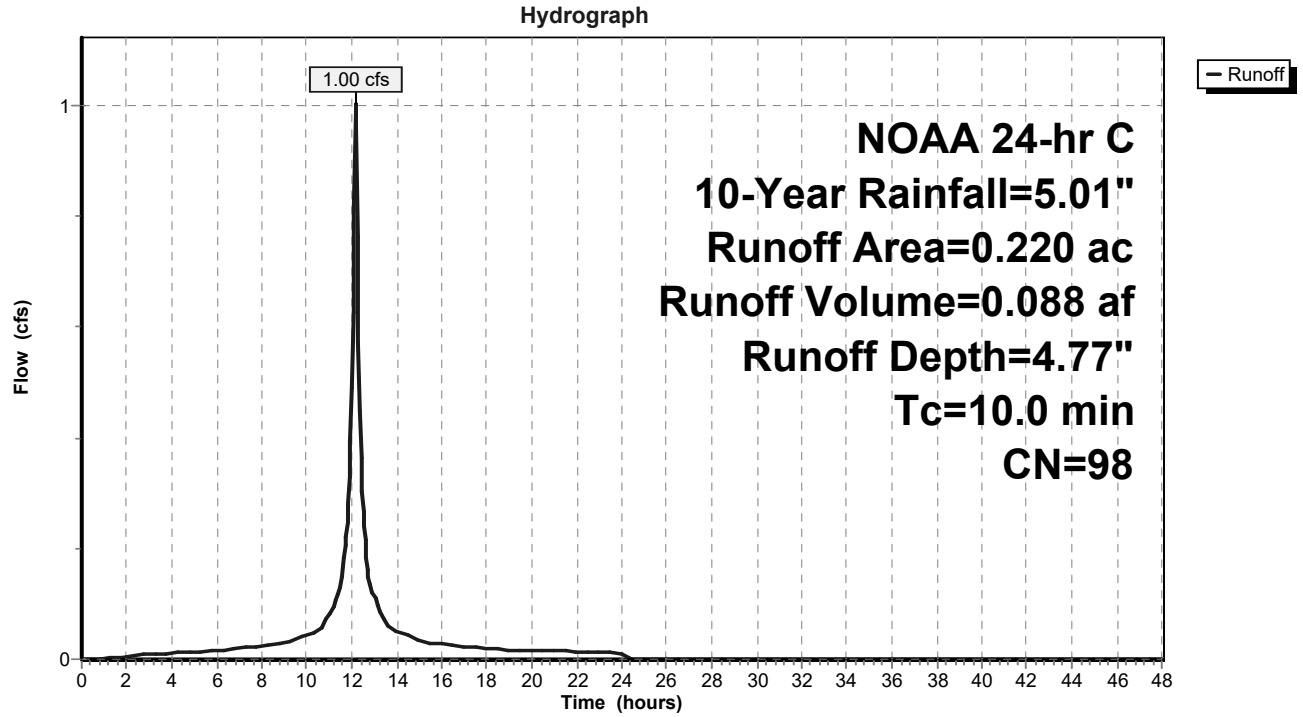
Runoff = 1.00 cfs @ 12.17 hrs, Volume= 0.088 af, Depth= 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG C
0.220		100.00% Impervious Area

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

Subcatchment 11S: PDA-1 UD A-Impervious



Summary for Subcatchment 12S: PDA-1UD A-Pervious

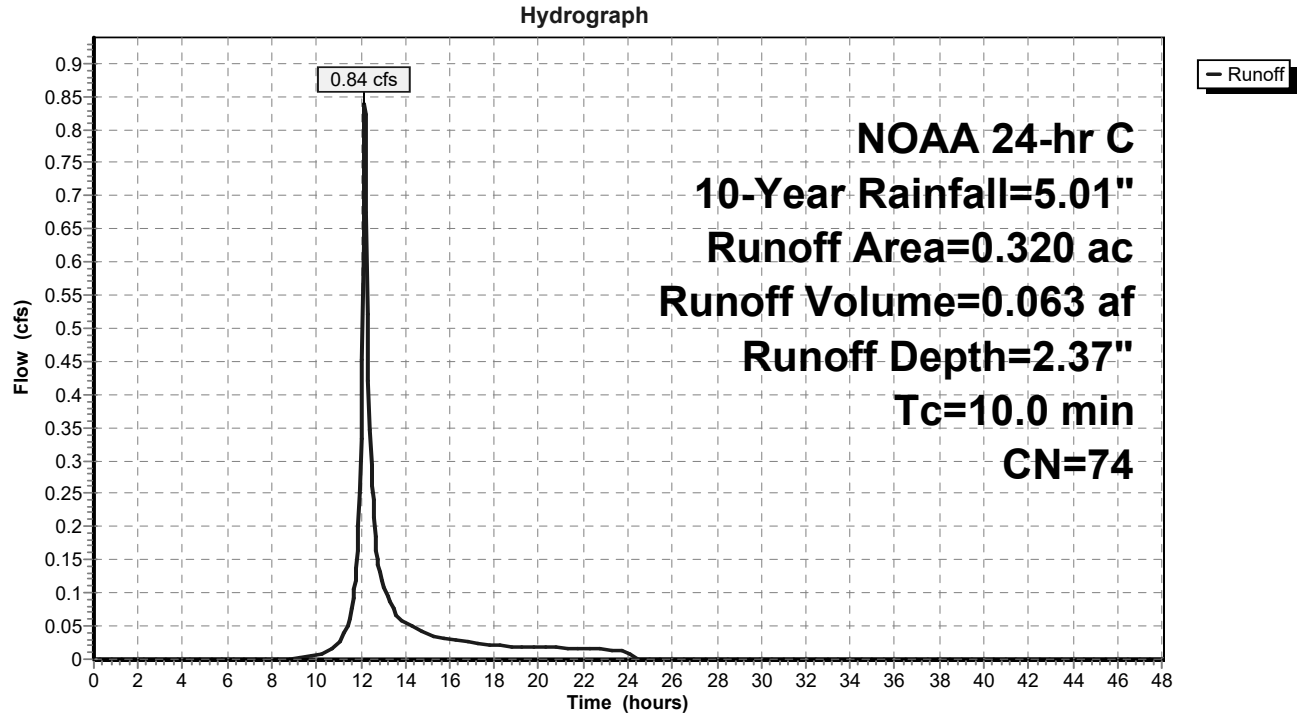
Runoff = 0.84 cfs @ 12.18 hrs, Volume= 0.063 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.320	74	>75% Grass cover, Good, HSG C
0.320		100.00% Pervious Area

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

Subcatchment 12S: PDA-1UD A-Pervious



Summary for Subcatchment 16S: PDA-1UD B-Pervious

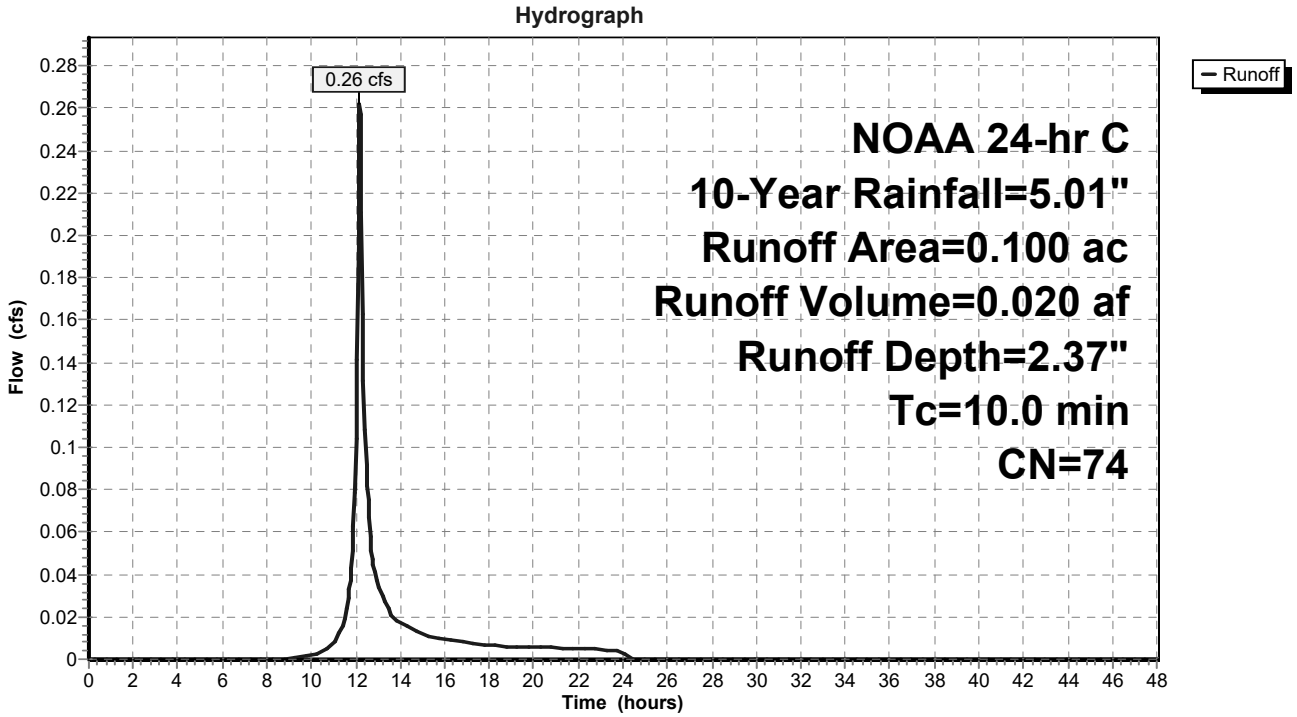
Runoff = 0.26 cfs @ 12.18 hrs, Volume= 0.020 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-Year Rainfall=5.01"

Area (ac)	CN	Description
0.100	74	>75% Grass cover, Good, HSG C
0.100		100.00% Pervious Area

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

Subcatchment 16S: PDA-1UD B-Pervious



Summary for Pond 8P: WET POND

Inflow Area = 4.850 ac, 71.13% Impervious, Inflow Depth = 4.06" for 10-Year event
Inflow = 18.35 cfs @ 12.17 hrs, Volume= 1.640 af
Outflow = 4.12 cfs @ 12.60 hrs, Volume= 1.296 af, Atten= 78%, Lag= 26.1 min
Primary = 4.12 cfs @ 12.60 hrs, Volume= 1.296 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 71.60' @ 12.60 hrs Surf.Area= 14,168 sf Storage= 40,025 cf

Plug-Flow detention time= 623.6 min calculated for 1.296 af (79% of inflow)
Center-of-Mass det. time= 539.8 min (1,307.0 - 767.2)

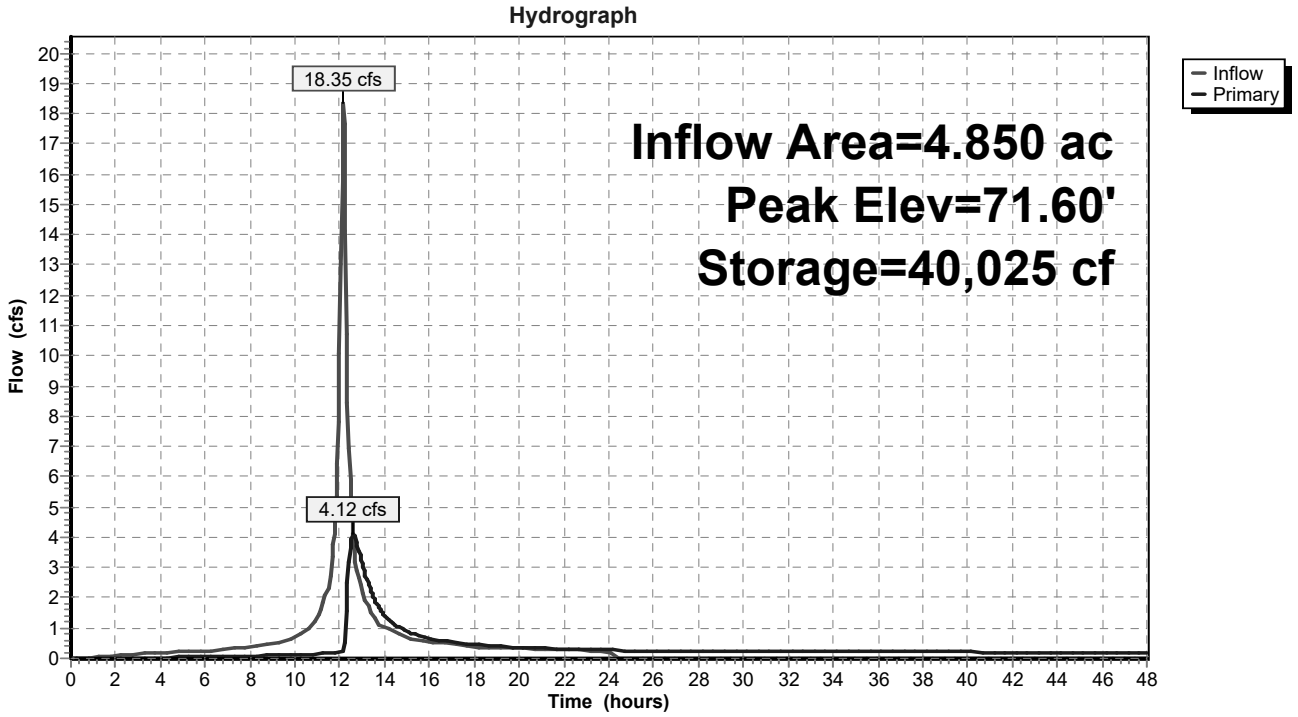
Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	60,825 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	11,408	0	0
69.00	12,104	5,878	5,878
70.00	12,902	12,503	18,381
71.00	13,711	13,307	31,688
72.00	14,475	14,093	45,781
73.00	15,613	15,044	60,825

Device	Routing	Invert	Outlet Devices
#1	Primary	66.50'	**15.0" Round Culvert** L= 100.0' Ke= 1.000 Inlet / Outlet Invert= 66.50' / 66.00' S= 0.0050 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf
#2	Device 1	68.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	71.15'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	72.90'	**48.0" x 42.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.12 cfs @ 12.60 hrs HW=71.60' (Free Discharge)
└**1=Culvert** (Passes 4.12 cfs of 9.09 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 0.28 cfs @ 8.33 fps)
  ├**3=Sharp-Crested Rectangular Weir** (Weir Controls 3.83 cfs @ 2.19 fps)
  └**4=Grate** (Controls 0.00 cfs)

Pond 8P: WET POND

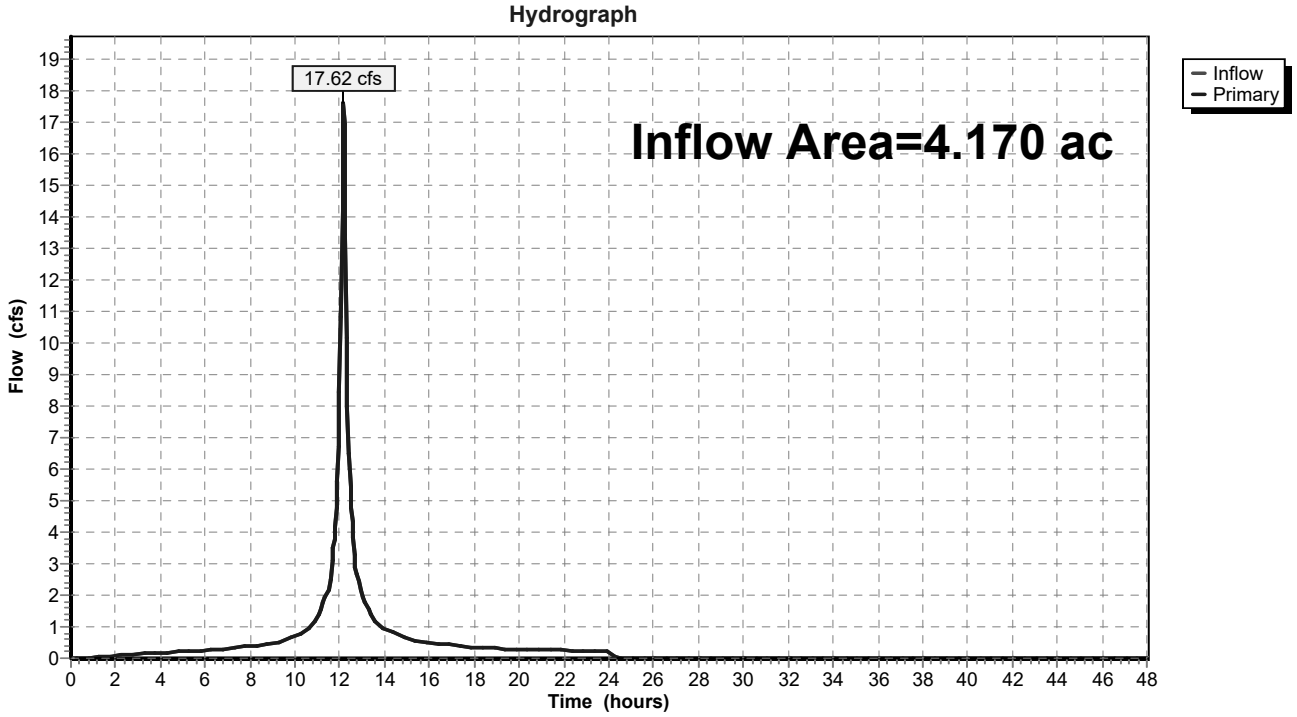


Summary for Link 10L: PDA - 1

Inflow Area = 4.170 ac, 82.73% Impervious, Inflow Depth = 4.36" for 10-Year event
Inflow = 17.62 cfs @ 12.17 hrs, Volume= 1.515 af
Primary = 17.62 cfs @ 12.17 hrs, Volume= 1.515 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 10L: PDA - 1

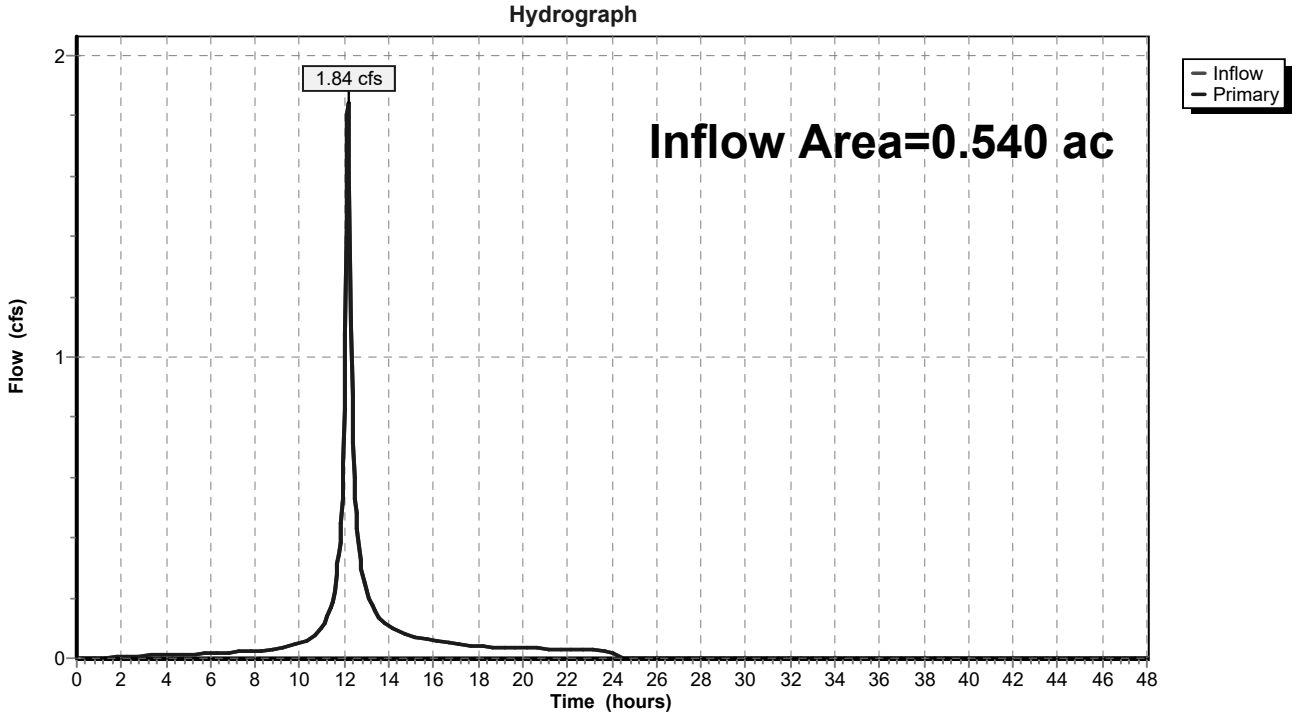


Summary for Link 13L: PDA-1 UD A

Inflow Area = 0.540 ac, 40.74% Impervious, Inflow Depth = 3.35" for 10-Year event
Inflow = 1.84 cfs @ 12.17 hrs, Volume= 0.151 af
Primary = 1.84 cfs @ 12.17 hrs, Volume= 0.151 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 13L: PDA-1 UD A

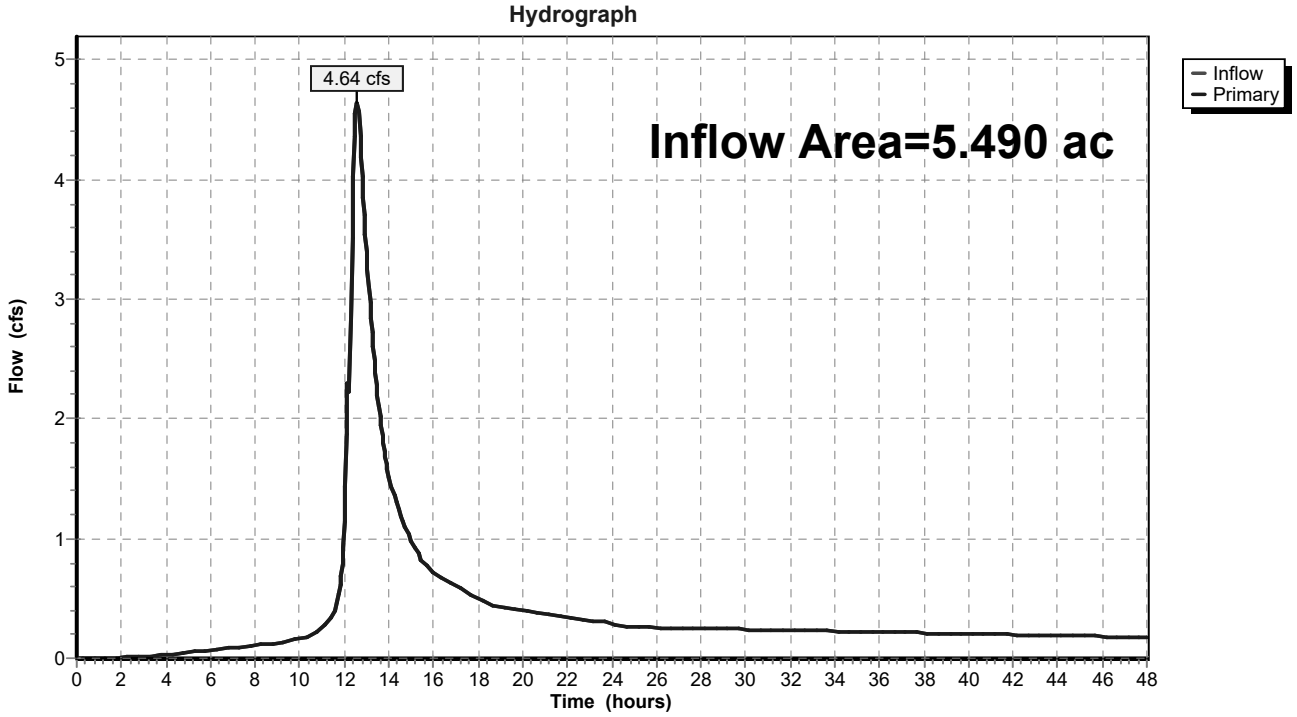


Summary for Link 14L: OVERALL SITE

Inflow Area = 5.490 ac, 66.85% Impervious, Inflow Depth > 3.20" for 10-Year event
Inflow = 4.64 cfs @ 12.57 hrs, Volume= 1.466 af
Primary = 4.64 cfs @ 12.57 hrs, Volume= 1.466 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 14L: OVERALL SITE

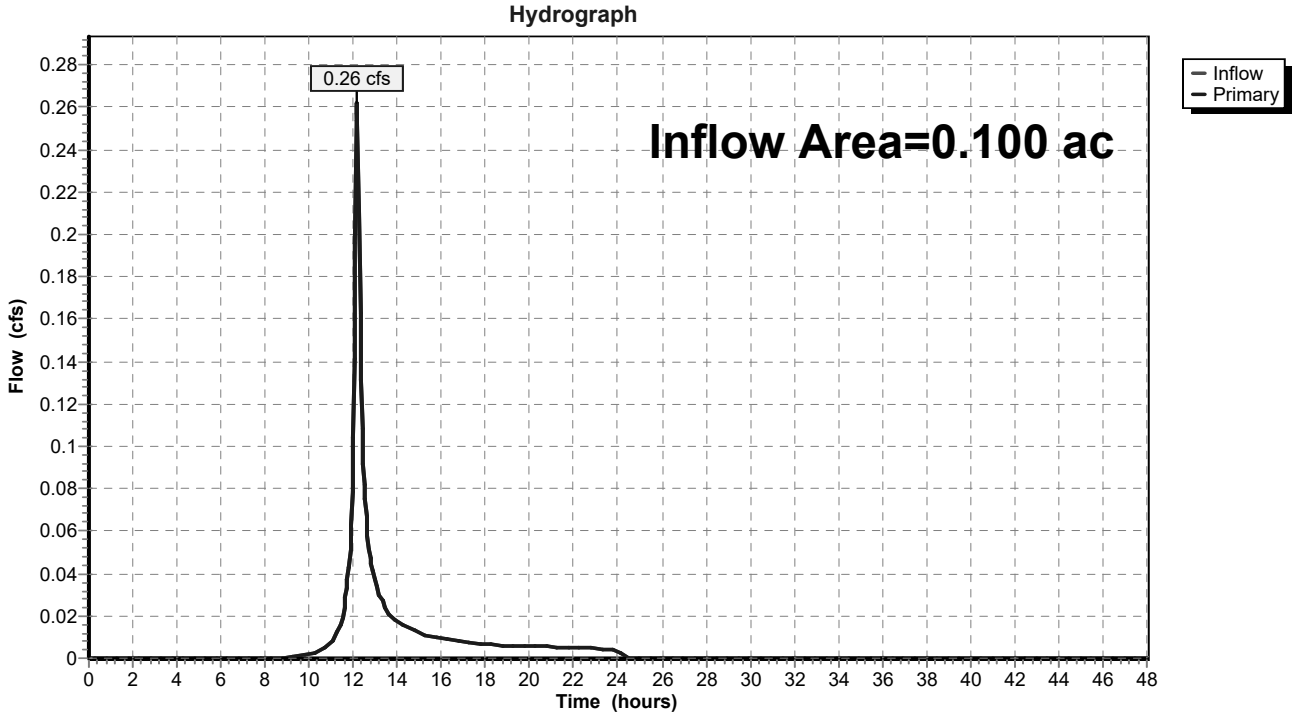


Summary for Link 17L: PDA-1 UD B

Inflow Area = 0.100 ac, 0.00% Impervious, Inflow Depth = 2.37" for 10-Year event
Inflow = 0.26 cfs @ 12.18 hrs, Volume= 0.020 af
Primary = 0.26 cfs @ 12.18 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 17L: PDA-1 UD B

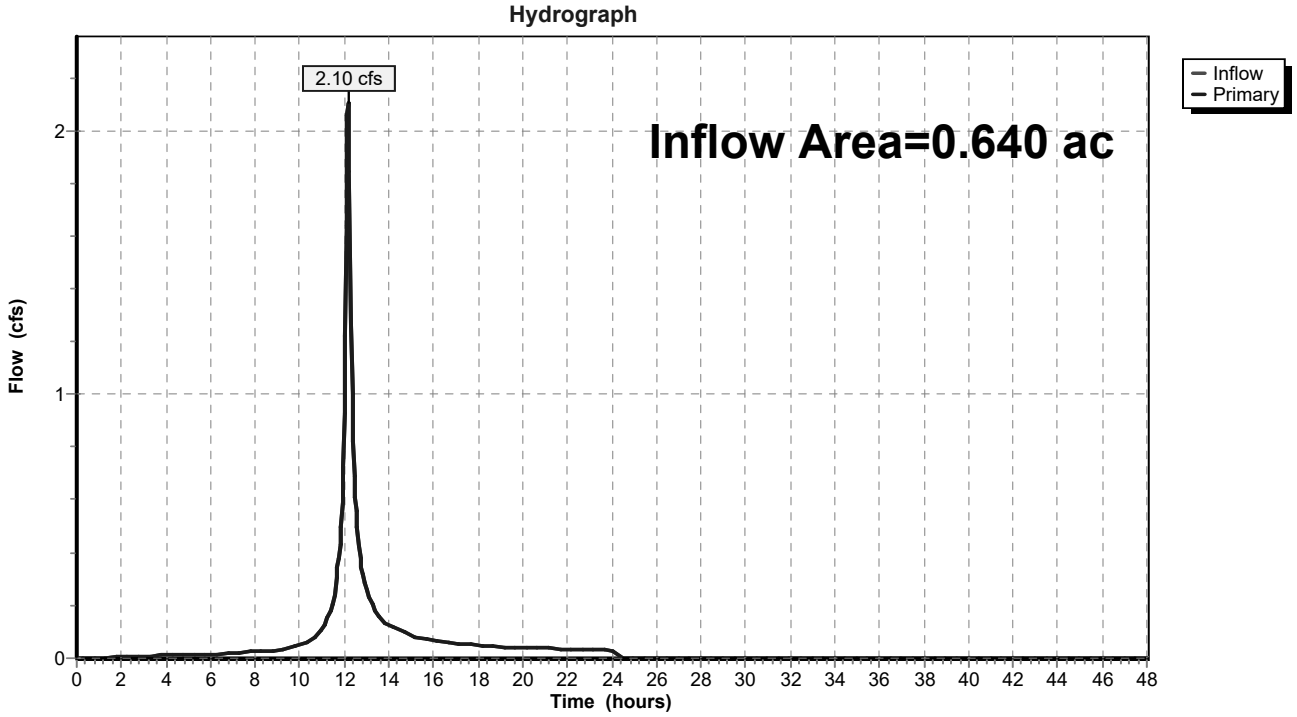


Summary for Link 18L: TOTAL PDA-1 UD

Inflow Area = 0.640 ac, 34.38% Impervious, Inflow Depth = 3.20" for 10-Year event
Inflow = 2.10 cfs @ 12.17 hrs, Volume= 0.171 af
Primary = 2.10 cfs @ 12.17 hrs, Volume= 0.171 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 18L: TOTAL PDA-1 UD



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

Subcatchment6S: PDA-1-Impervious Runoff Area=3.450 ac 100.00% Impervious Runoff Depth=5.95"
Tc=10.0 min CN=98 Runoff=19.48 cfs 1.711 af

Subcatchment7S: PDA-1-Pervious Runoff Area=0.720 ac 0.00% Impervious Runoff Depth=3.35"
Tc=10.0 min CN=74 Runoff=2.66 cfs 0.201 af

Subcatchment9S: PDA OFF-SITE PERVIOUS Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=3.15"
Tc=0.0 min CN=72 Runoff=3.14 cfs 0.178 af

Subcatchment11S: PDA-1 UD Runoff Area=0.220 ac 100.00% Impervious Runoff Depth=5.95"
Tc=10.0 min CN=98 Runoff=1.24 cfs 0.109 af

Subcatchment12S: PDA-1UD A-Pervious Runoff Area=0.320 ac 0.00% Impervious Runoff Depth=3.35"
Tc=10.0 min CN=74 Runoff=1.18 cfs 0.089 af

Subcatchment16S: PDA-1UD B-Pervious Runoff Area=0.100 ac 0.00% Impervious Runoff Depth=3.35"
Tc=10.0 min CN=74 Runoff=0.37 cfs 0.028 af

Pond 8P: WET POND Peak Elev=71.96' Storage=45,216 cf Inflow=23.16 cfs 2.090 af
Outflow=9.41 cfs 1.742 af

Link 10L: PDA - 1 Inflow=22.14 cfs 1.912 af
Primary=22.14 cfs 1.912 af

Link 13L: PDA-1 UD A Inflow=2.43 cfs 0.198 af
Primary=2.43 cfs 0.198 af

Link 14L: OVERALL SITE Inflow=10.64 cfs 1.968 af
Primary=10.64 cfs 1.968 af

Link 17L: PDA-1 UD B Inflow=0.37 cfs 0.028 af
Primary=0.37 cfs 0.028 af

Link 18L: TOTAL PDA-1 UD Inflow=2.80 cfs 0.226 af
Primary=2.80 cfs 0.226 af

Total Runoff Area = 5.490 ac Runoff Volume = 2.316 af Average Runoff Depth = 5.06"
33.15% Pervious = 1.820 ac 66.85% Impervious = 3.670 ac

Summary for Subcatchment 6S: PDA-1-Impervious

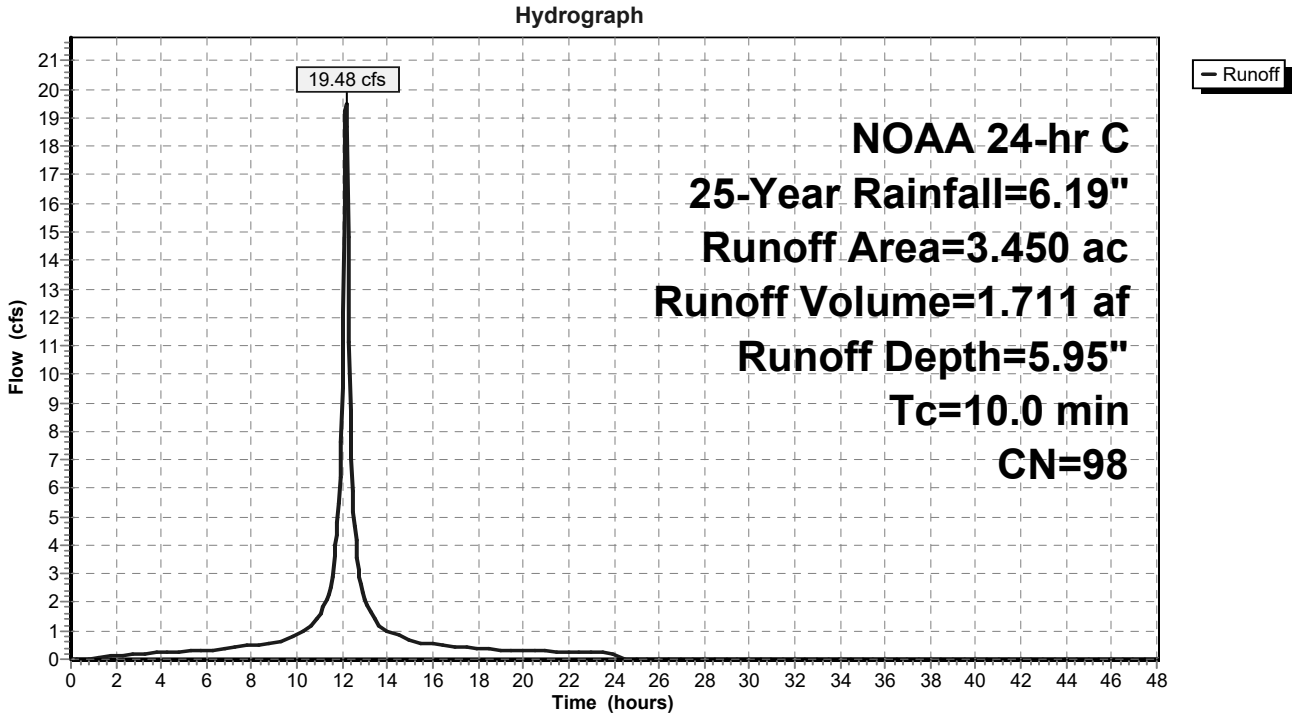
Runoff = 19.48 cfs @ 12.17 hrs, Volume= 1.711 af, Depth= 5.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.19"

Area (ac)	CN	Description
3.450	98	Paved parking, HSG C
3.450		100.00% Impervious Area

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

Subcatchment 6S: PDA-1-Impervious



Summary for Subcatchment 7S: PDA-1-Pervious

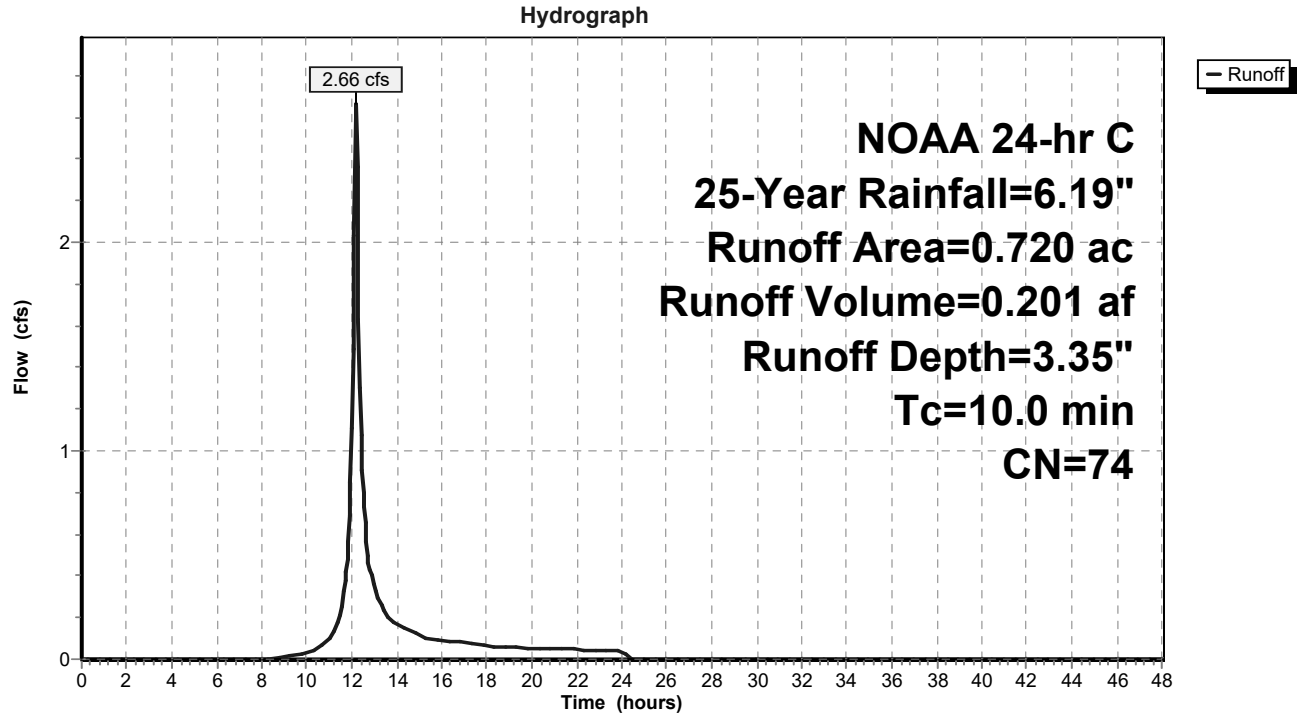
Runoff = 2.66 cfs @ 12.18 hrs, Volume= 0.201 af, Depth= 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.19"

Area (ac)	CN	Description
0.720	74	>75% Grass cover, Good, HSG C
0.720		100.00% Pervious Area

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

Subcatchment 7S: PDA-1-Pervious



Summary for Subcatchment 9S: PDA OFF-SITE PERVIOUS

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

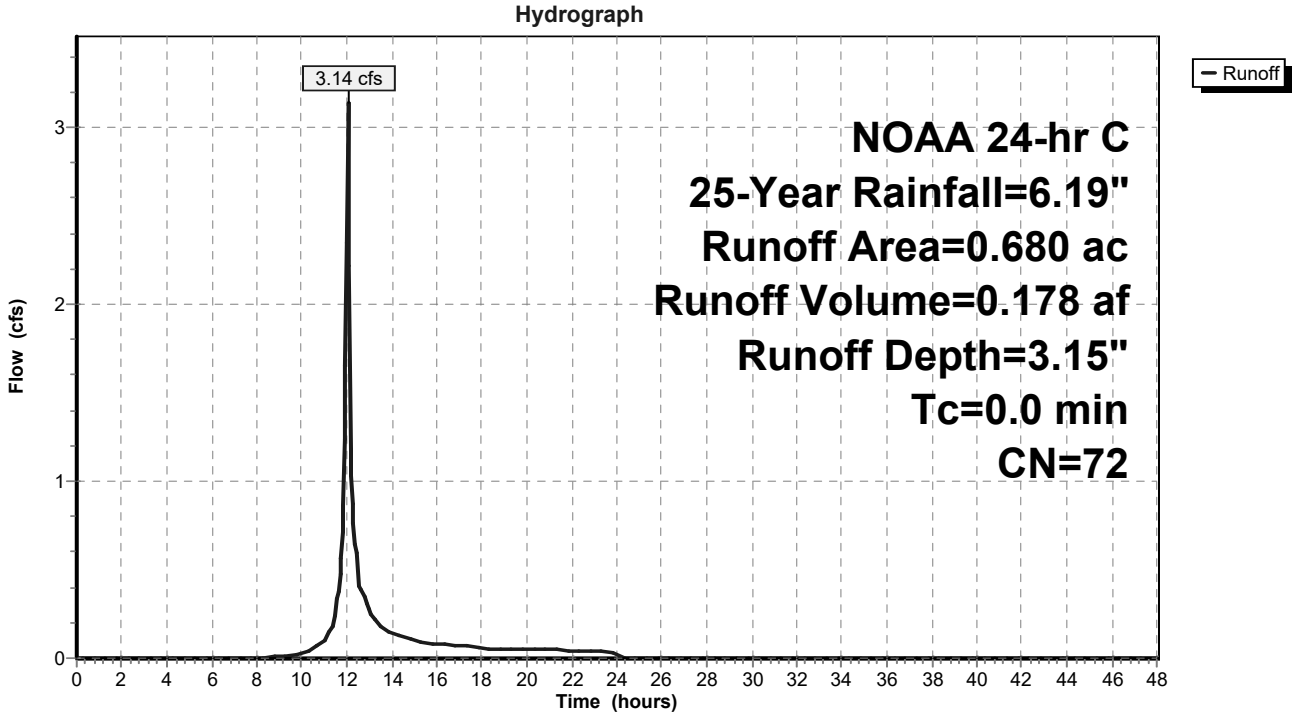
Runoff = 3.14 cfs @ 12.05 hrs, Volume= 0.178 af, Depth= 3.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.19"

Area (ac)	CN	Description
0.680	72	Woods/grass comb., Good, HSG C
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, 10**

Subcatchment 9S: PDA OFF-SITE PERVIOUS



Summary for Subcatchment 11S: PDA-1 UD A-Impervious

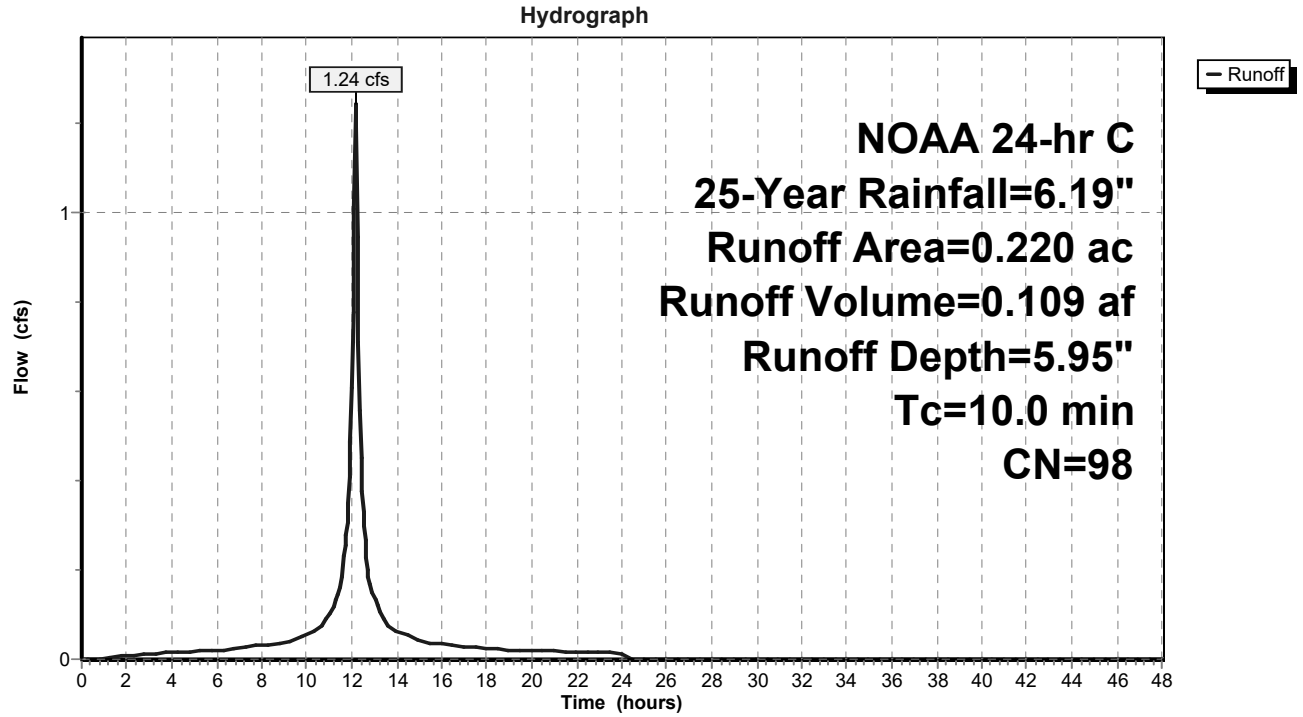
Runoff = 1.24 cfs @ 12.17 hrs, Volume= 0.109 af, Depth= 5.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.19"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG C
0.220		100.00% Impervious Area

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

Subcatchment 11S: PDA-1 UD A-Impervious



Summary for Subcatchment 12S: PDA-1UD A-Pervious

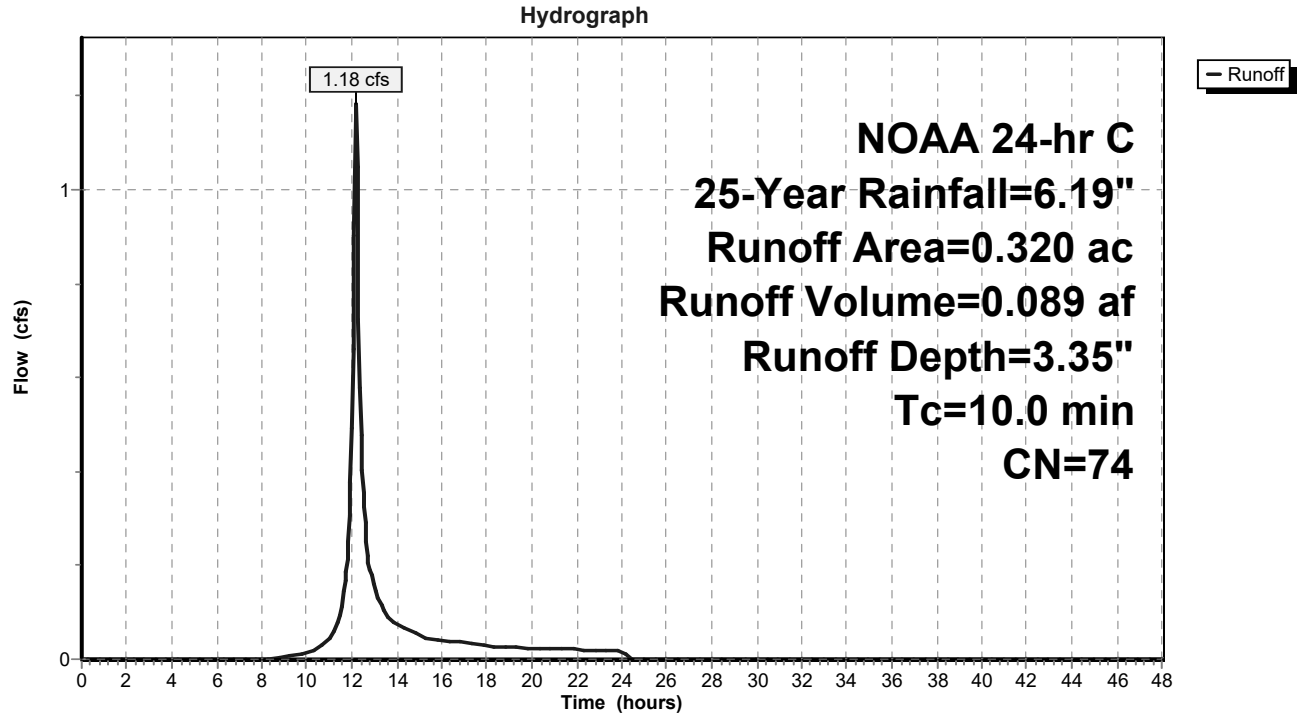
Runoff = 1.18 cfs @ 12.18 hrs, Volume= 0.089 af, Depth= 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.19"

Area (ac)	CN	Description
0.320	74	>75% Grass cover, Good, HSG C
0.320		100.00% Pervious Area

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

Subcatchment 12S: PDA-1UD A-Pervious



Summary for Subcatchment 16S: PDA-1UD B-Pervious

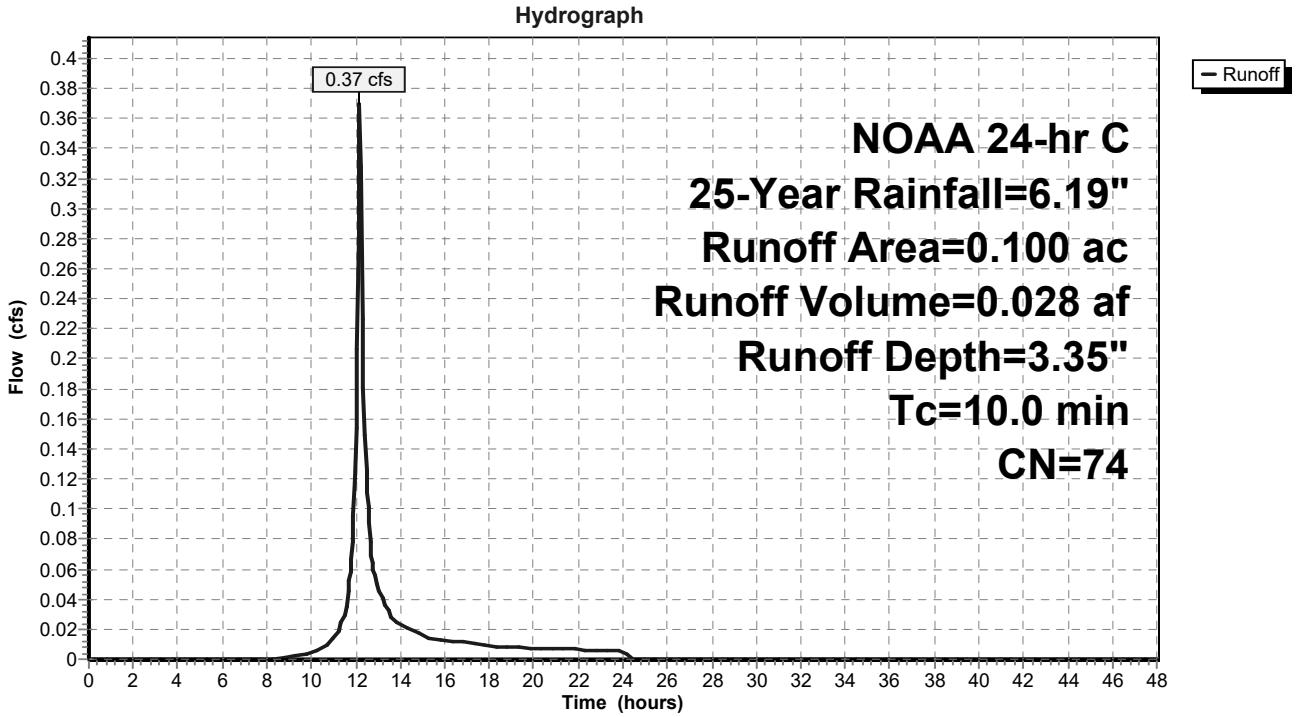
Runoff = 0.37 cfs @ 12.18 hrs, Volume= 0.028 af, Depth= 3.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-Year Rainfall=6.19"

Area (ac)	CN	Description
0.100	74	>75% Grass cover, Good, HSG C
0.100		100.00% Pervious Area

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

Subcatchment 16S: PDA-1UD B-Pervious



Summary for Pond 8P: WET POND

Inflow Area = 4.850 ac, 71.13% Impervious, Inflow Depth = 5.17" for 25-Year event
Inflow = 23.16 cfs @ 12.17 hrs, Volume= 2.090 af
Outflow = 9.41 cfs @ 12.39 hrs, Volume= 1.742 af, Atten= 59%, Lag= 13.3 min
Primary = 9.41 cfs @ 12.39 hrs, Volume= 1.742 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 71.96' @ 12.39 hrs Surf.Area= 14,445 sf Storage= 45,216 cf

Plug-Flow detention time= 492.4 min calculated for 1.742 af (83% of inflow)
Center-of-Mass det. time= 418.8 min (1,183.0 - 764.2)

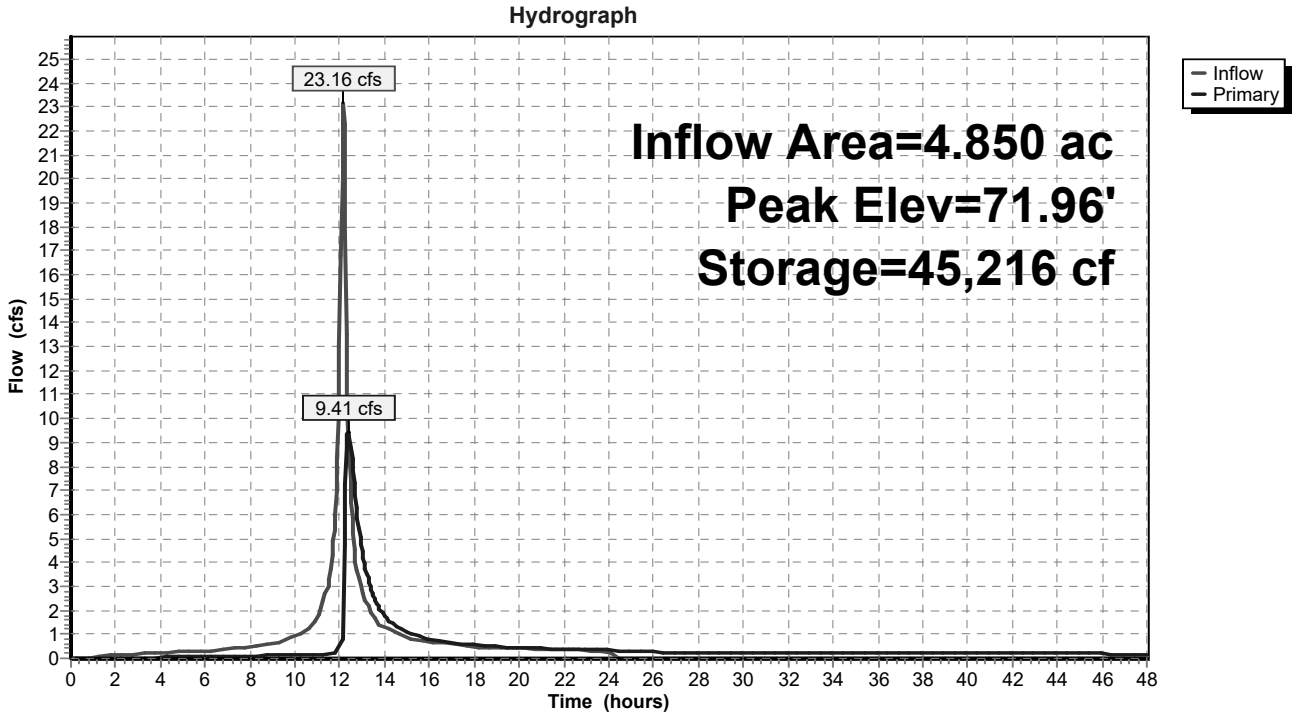
Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	60,825 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	11,408	0	0
69.00	12,104	5,878	5,878
70.00	12,902	12,503	18,381
71.00	13,711	13,307	31,688
72.00	14,475	14,093	45,781
73.00	15,613	15,044	60,825

Device	Routing	Invert	Outlet Devices
#1	Primary	66.50'	**15.0" Round Culvert** L= 100.0' Ke= 1.000 Inlet / Outlet Invert= 66.50' / 66.00' S= 0.0050 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf
#2	Device 1	68.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	71.15'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	72.90'	**48.0" x 42.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=9.44 cfs @ 12.39 hrs HW=71.96' (Free Discharge)
└**1=Culvert** (Passes 9.44 cfs of 9.46 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 0.30 cfs @ 8.82 fps)
  ├**3=Sharp-Crested Rectangular Weir** (Weir Controls 9.14 cfs @ 2.94 fps)
  └**4=Grate** (Controls 0.00 cfs)

Pond 8P: WET POND

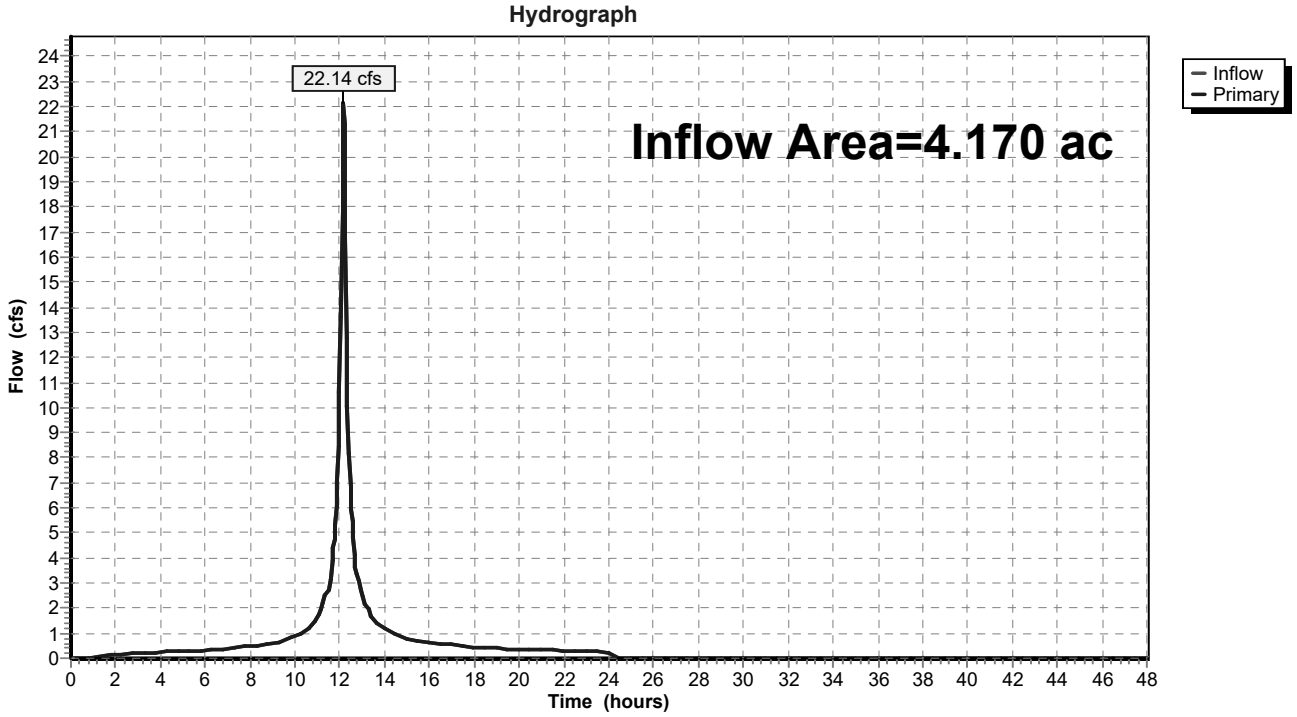


Summary for Link 10L: PDA - 1

Inflow Area = 4.170 ac, 82.73% Impervious, Inflow Depth = 5.50" for 25-Year event
Inflow = 22.14 cfs @ 12.17 hrs, Volume= 1.912 af
Primary = 22.14 cfs @ 12.17 hrs, Volume= 1.912 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 10L: PDA - 1

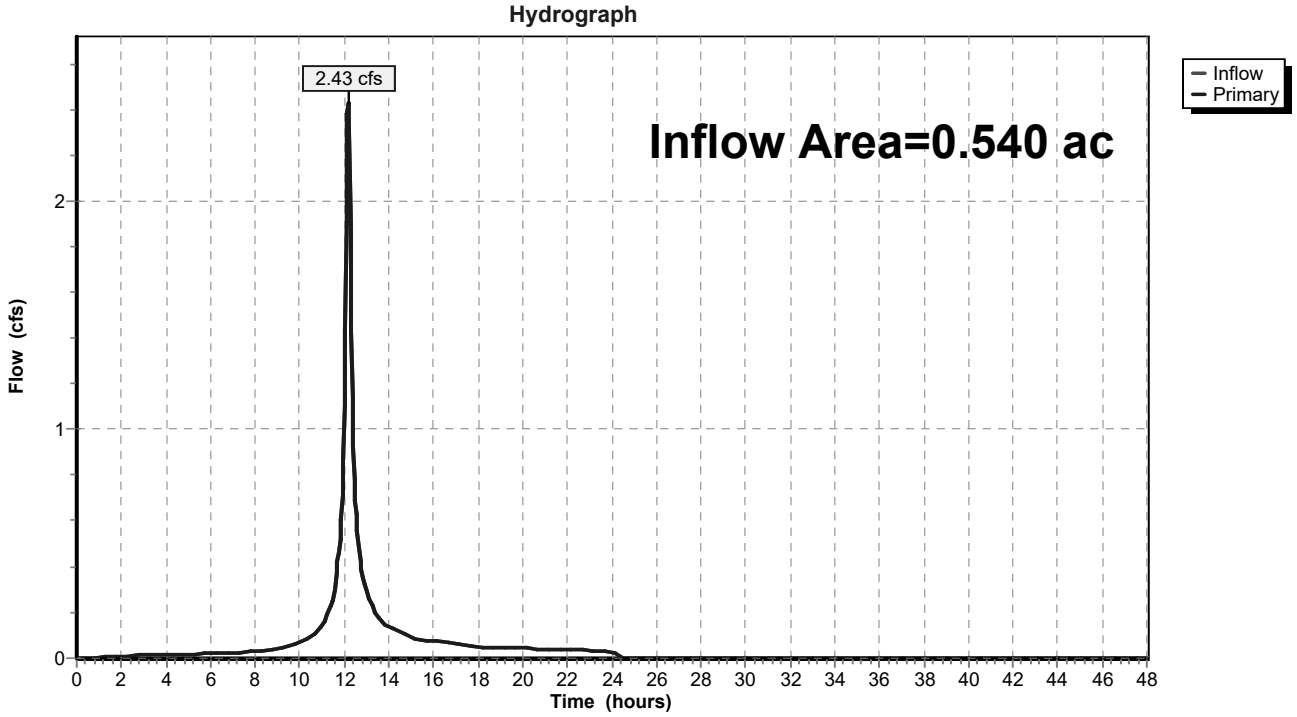


Summary for Link 13L: PDA-1 UD A

Inflow Area = 0.540 ac, 40.74% Impervious, Inflow Depth = 4.41" for 25-Year event
Inflow = 2.43 cfs @ 12.17 hrs, Volume= 0.198 af
Primary = 2.43 cfs @ 12.17 hrs, Volume= 0.198 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 13L: PDA-1 UD A

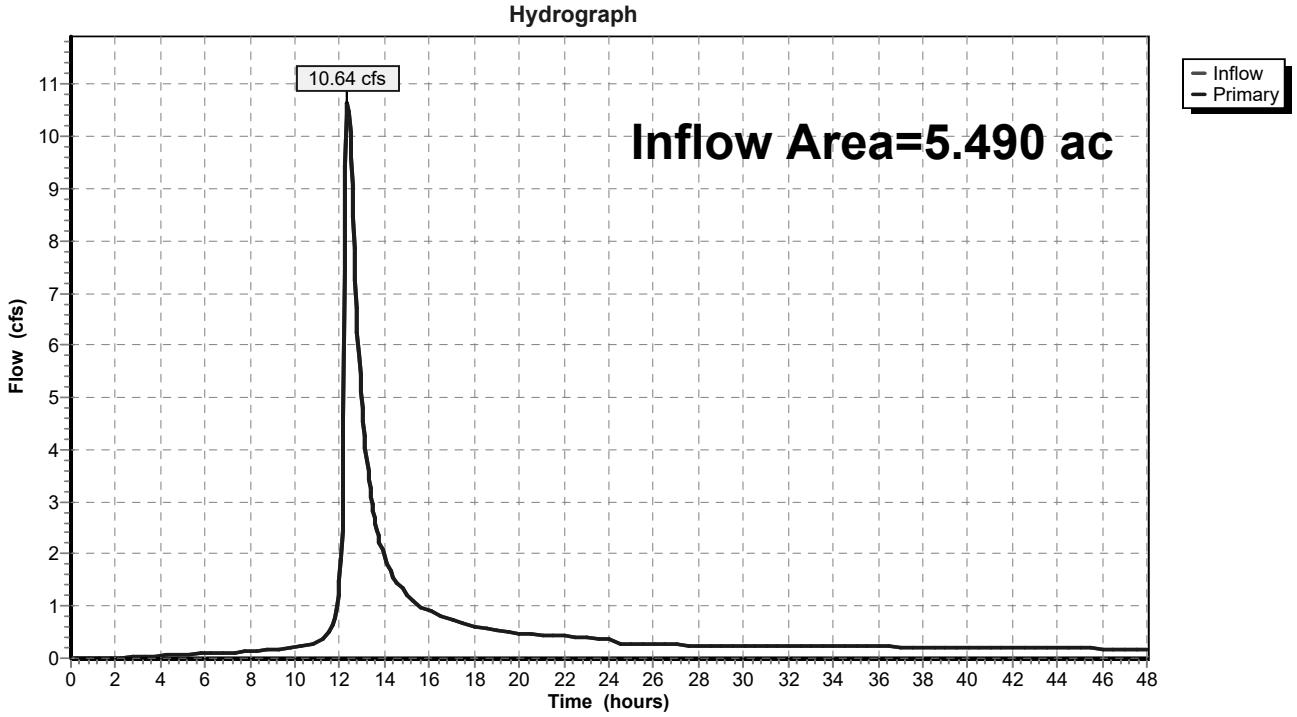


Summary for Link 14L: OVERALL SITE

Inflow Area = 5.490 ac, 66.85% Impervious, Inflow Depth > 4.30" for 25-Year event
Inflow = 10.64 cfs @ 12.35 hrs, Volume= 1.968 af
Primary = 10.64 cfs @ 12.35 hrs, Volume= 1.968 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 14L: OVERALL SITE

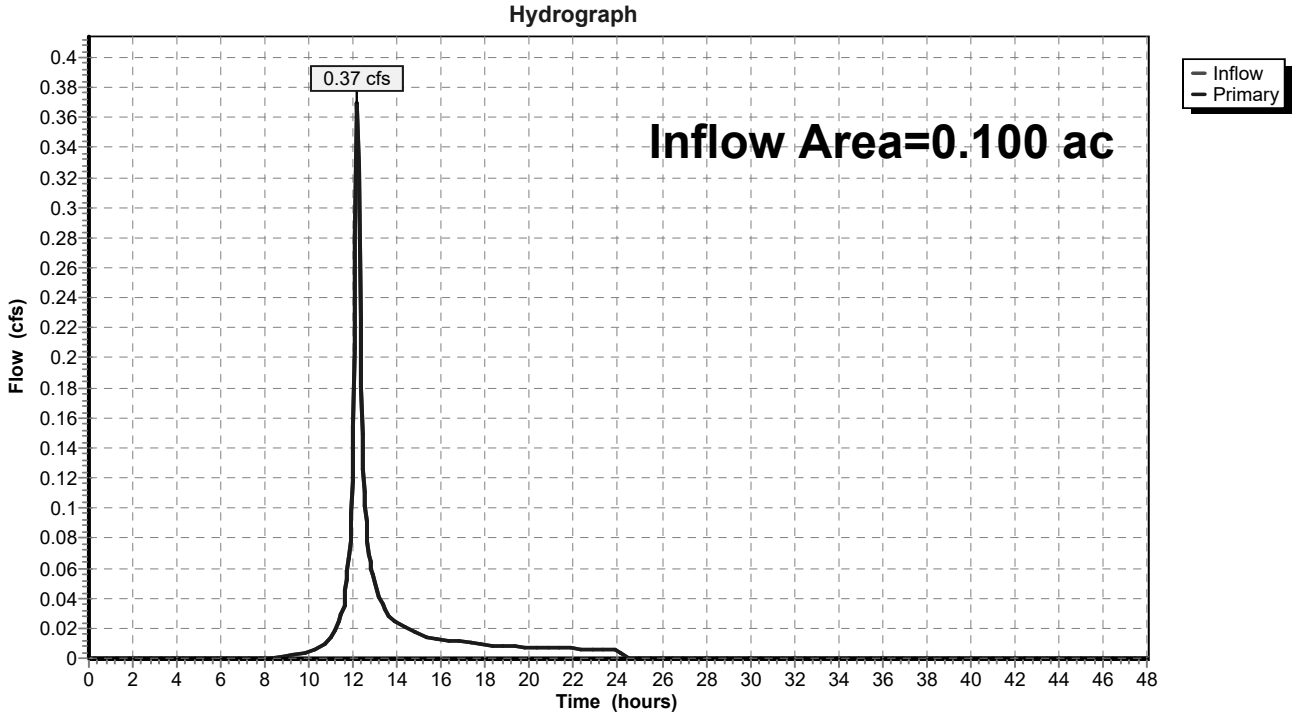


Summary for Link 17L: PDA-1 UD B

Inflow Area = 0.100 ac, 0.00% Impervious, Inflow Depth = 3.35" for 25-Year event
Inflow = 0.37 cfs @ 12.18 hrs, Volume= 0.028 af
Primary = 0.37 cfs @ 12.18 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 17L: PDA-1 UD B

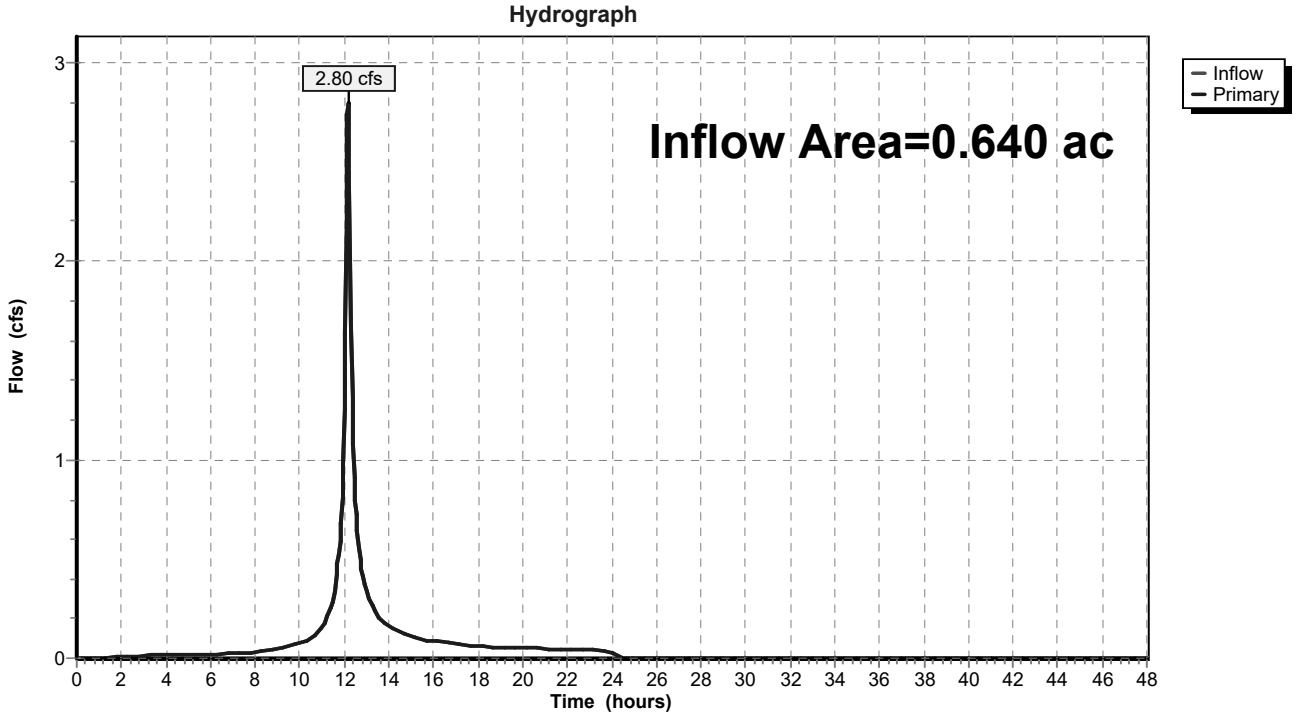


Summary for Link 18L: TOTAL PDA-1 UD

Inflow Area = 0.640 ac, 34.38% Impervious, Inflow Depth = 4.24" for 25-Year event
Inflow = 2.80 cfs @ 12.17 hrs, Volume= 0.226 af
Primary = 2.80 cfs @ 12.17 hrs, Volume= 0.226 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 18L: TOTAL PDA-1 UD



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

Subcatchment6S: PDA-1-Impervious Runoff Area=3.450 ac 100.00% Impervious Runoff Depth=7.97"
Tc=10.0 min CN=98 Runoff=25.88 cfs 2.291 af

Subcatchment7S: PDA-1-Pervious Runoff Area=0.720 ac 0.00% Impervious Runoff Depth=5.11"
Tc=10.0 min CN=74 Runoff=4.04 cfs 0.307 af

Subcatchment9S: PDA OFF-SITE PERVIOUS Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=4.88"
Tc=0.0 min CN=72 Runoff=4.81 cfs 0.276 af

Subcatchment11S: PDA-1 UD Runoff Area=0.220 ac 100.00% Impervious Runoff Depth=7.97"
Tc=10.0 min CN=98 Runoff=1.65 cfs 0.146 af

Subcatchment12S: PDA-1UD A-Pervious Runoff Area=0.320 ac 0.00% Impervious Runoff Depth=5.11"
Tc=10.0 min CN=74 Runoff=1.80 cfs 0.136 af

Subcatchment16S: PDA-1UD B-Pervious Runoff Area=0.100 ac 0.00% Impervious Runoff Depth=5.11"
Tc=10.0 min CN=74 Runoff=0.56 cfs 0.043 af

Pond 8P: WET POND Peak Elev=72.89' Storage=59,183 cf Inflow=31.45 cfs 2.875 af
Outflow=10.36 cfs 2.522 af

Link 10L: PDA - 1 Inflow=29.92 cfs 2.598 af
Primary=29.92 cfs 2.598 af

Link 13L: PDA-1 UD A Inflow=3.45 cfs 0.282 af
Primary=3.45 cfs 0.282 af

Link 14L: OVERALL SITE Inflow=13.84 cfs 2.847 af
Primary=13.84 cfs 2.847 af

Link 17L: PDA-1 UD B Inflow=0.56 cfs 0.043 af
Primary=0.56 cfs 0.043 af

Link 18L: TOTAL PDA-1 UD Inflow=4.01 cfs 0.325 af
Primary=4.01 cfs 0.325 af

Total Runoff Area = 5.490 ac Runoff Volume = 3.200 af Average Runoff Depth = 6.99"
33.15% Pervious = 1.820 ac 66.85% Impervious = 3.670 ac

Summary for Subcatchment 6S: PDA-1-Impervious

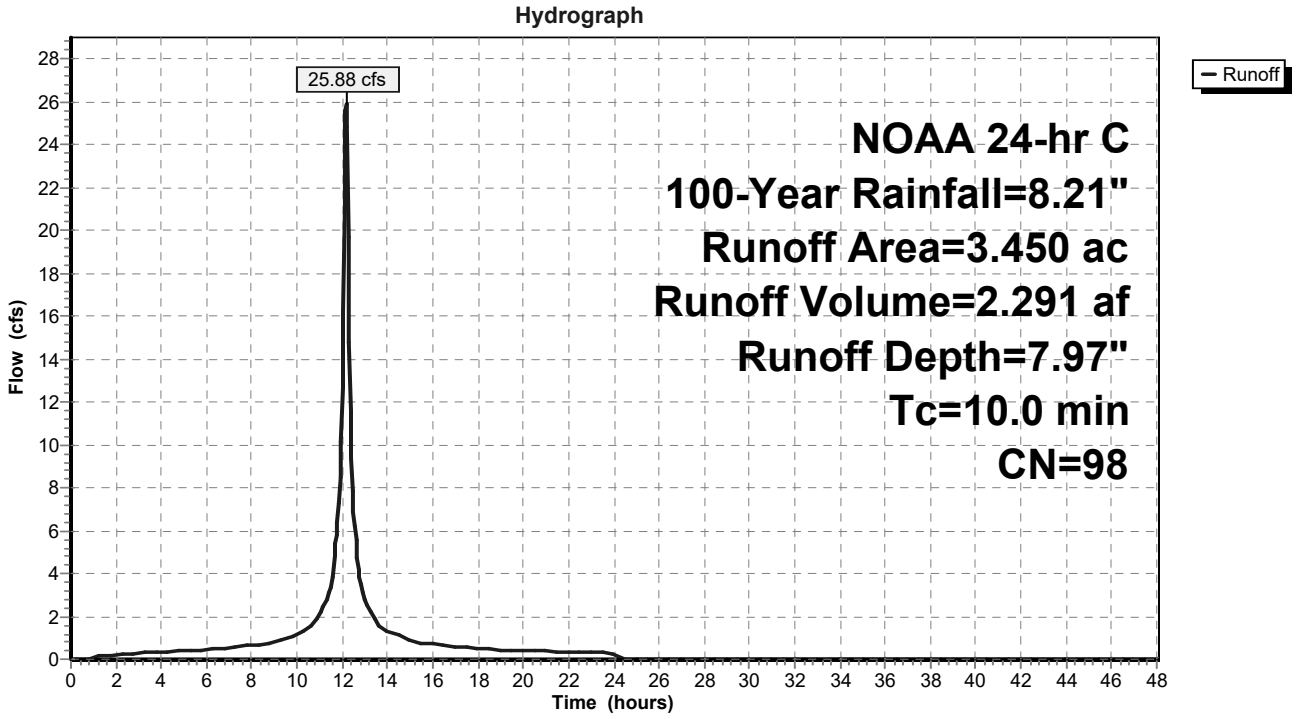
Runoff = 25.88 cfs @ 12.17 hrs, Volume= 2.291 af, Depth= 7.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
3.450	98	Paved parking, HSG C
3.450		100.00% Impervious Area

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

Subcatchment 6S: PDA-1-Impervious



Summary for Subcatchment 7S: PDA-1-Pervious

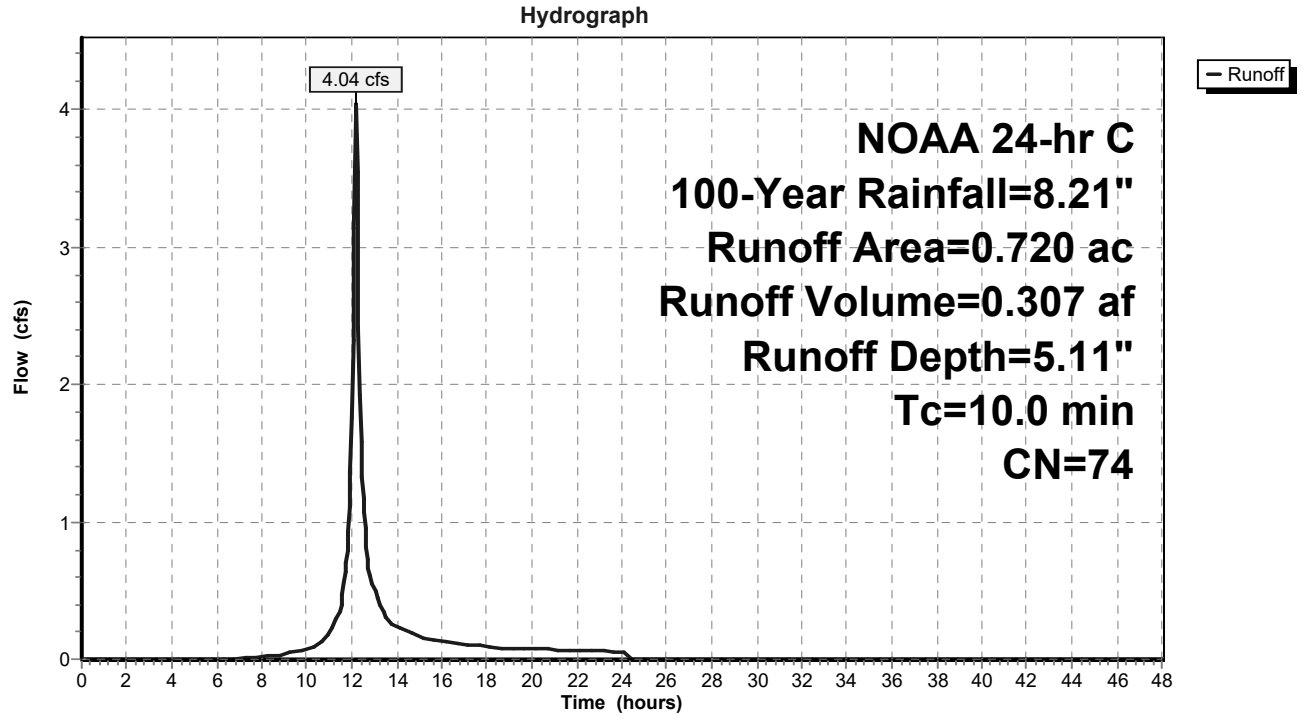
Runoff = 4.04 cfs @ 12.17 hrs, Volume= 0.307 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.720	74	>75% Grass cover, Good, HSG C
0.720		100.00% Pervious Area

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

Subcatchment 7S: PDA-1-Pervious



Summary for Subcatchment 9S: PDA OFF-SITE PERVIOUS

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

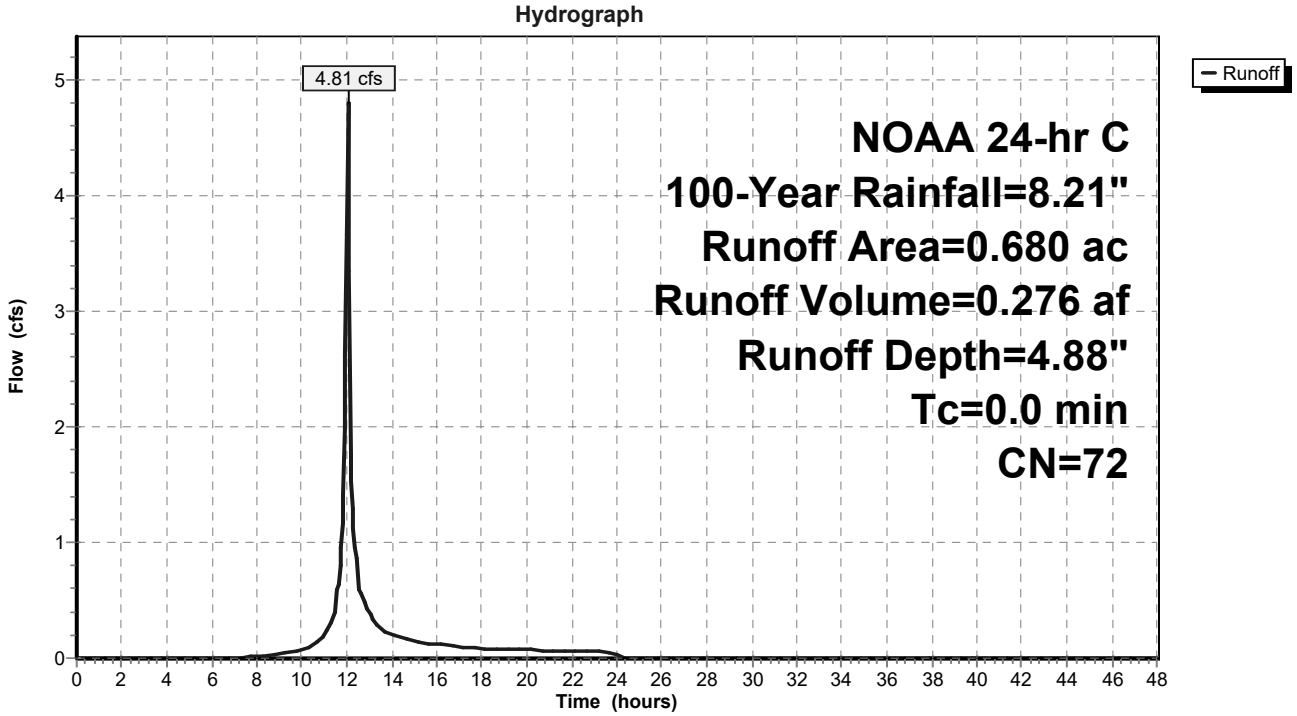
Runoff = 4.81 cfs @ 12.05 hrs, Volume= 0.276 af, Depth= 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.680	72	Woods/grass comb., Good, HSG C
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, 10**

Subcatchment 9S: PDA OFF-SITE PERVIOUS



Summary for Subcatchment 11S: PDA-1 UD A-Impervious

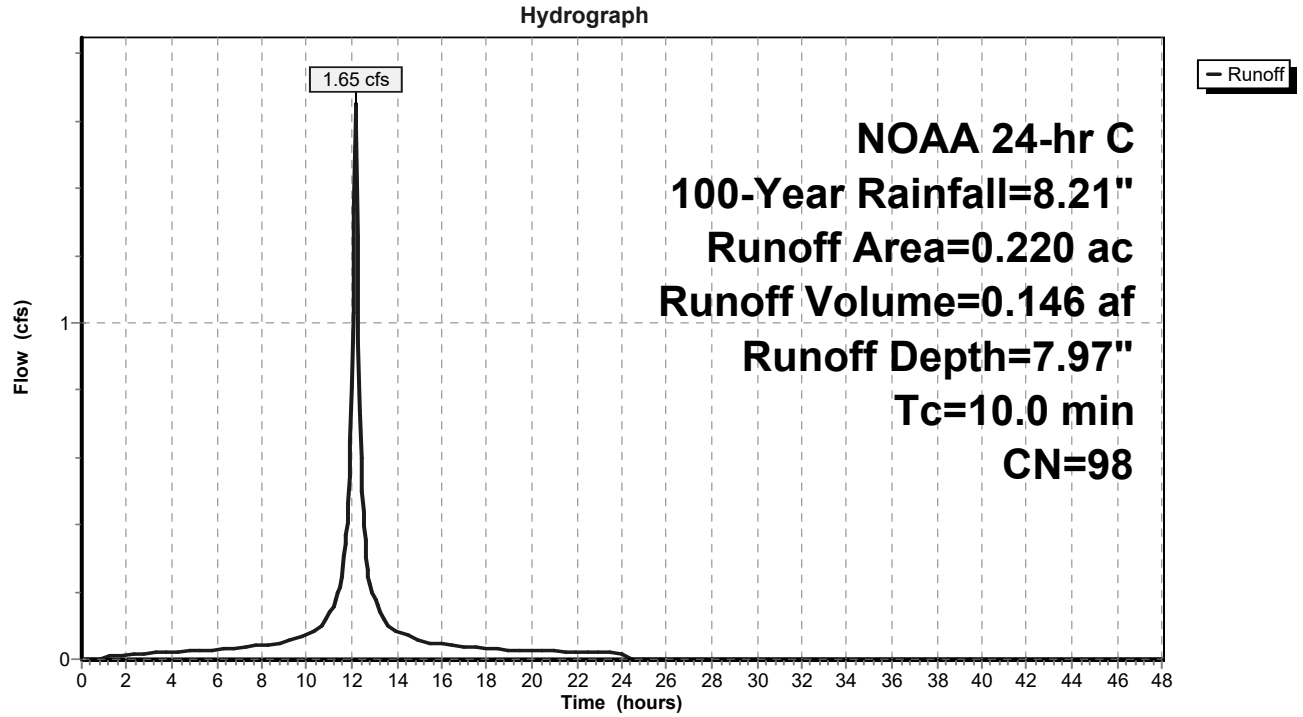
Runoff = 1.65 cfs @ 12.17 hrs, Volume= 0.146 af, Depth= 7.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.220	98	Paved parking, HSG C
0.220		100.00% Impervious Area

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

Subcatchment 11S: PDA-1 UD A-Impervious



Summary for Subcatchment 12S: PDA-1UD A-Pervious

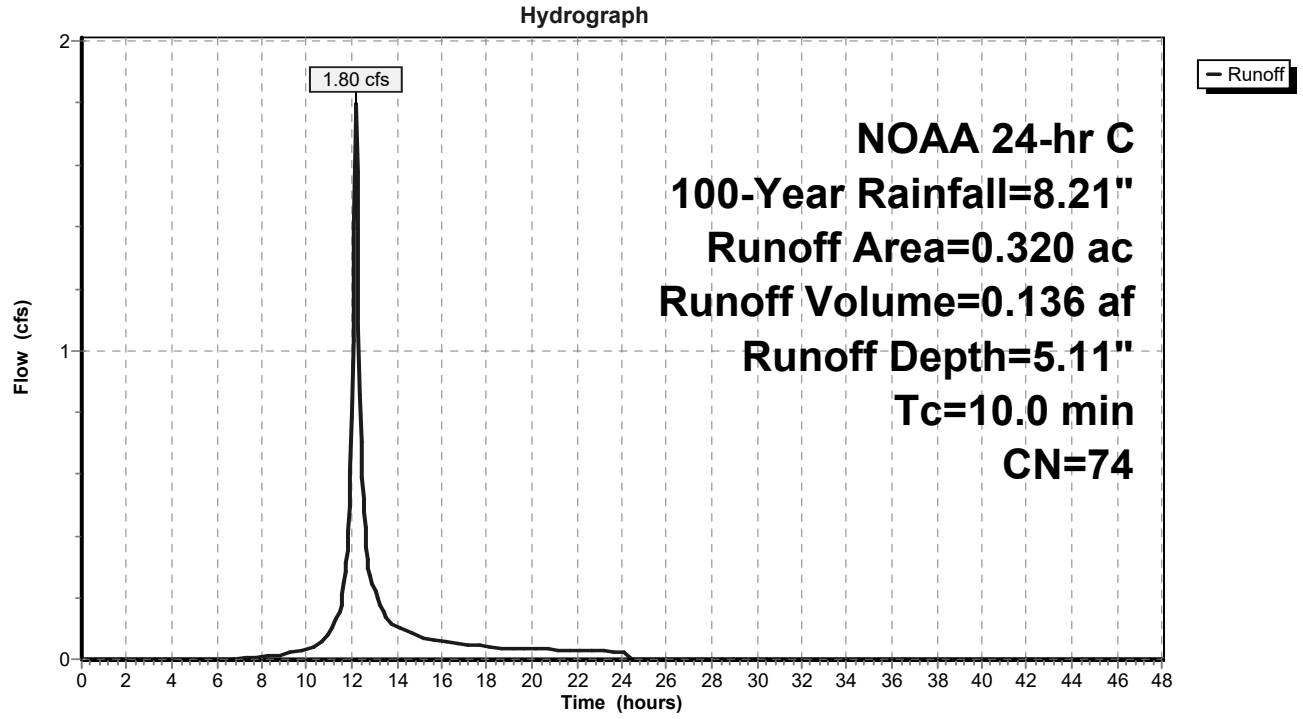
Runoff = 1.80 cfs @ 12.17 hrs, Volume= 0.136 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.320	74	>75% Grass cover, Good, HSG C
0.320		100.00% Pervious Area

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

Subcatchment 12S: PDA-1UD A-Pervious



Summary for Subcatchment 16S: PDA-1UD B-Pervious

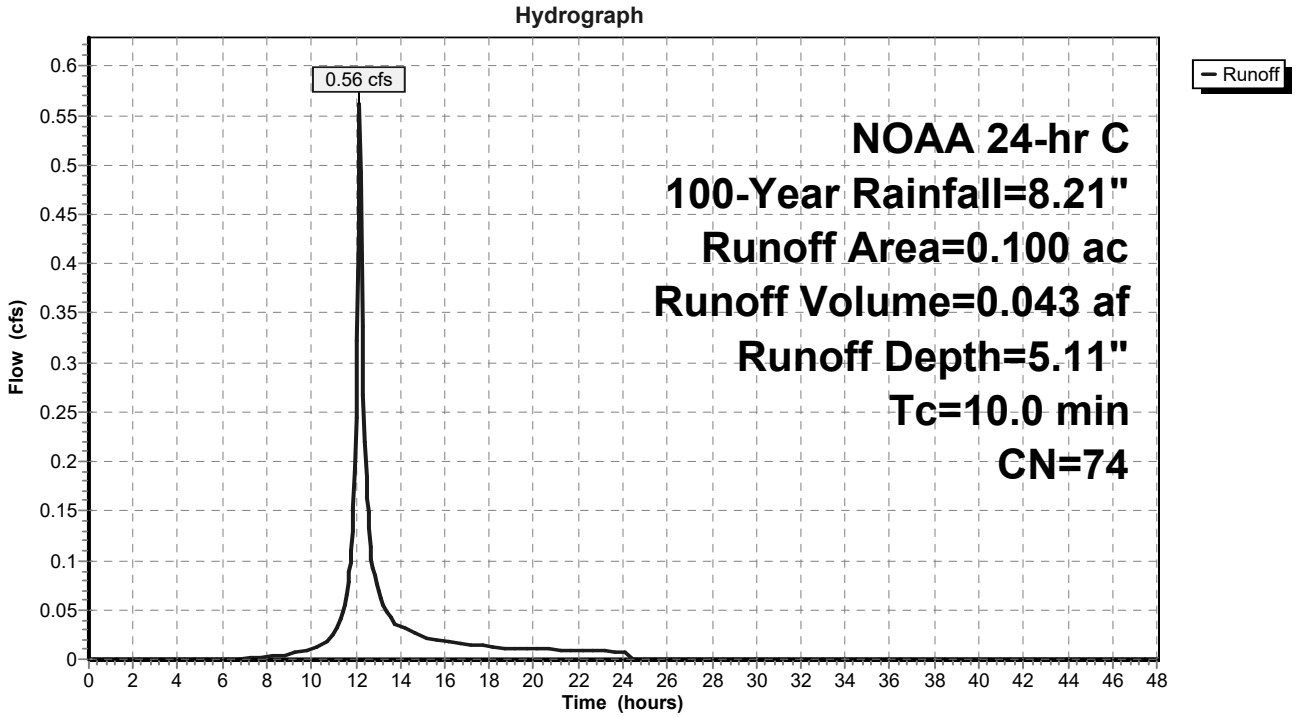
Runoff = 0.56 cfs @ 12.17 hrs, Volume= 0.043 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year Rainfall=8.21"

Area (ac)	CN	Description
0.100	74	>75% Grass cover, Good, HSG C
0.100		100.00% Pervious Area

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

Subcatchment 16S: PDA-1UD B-Pervious



Summary for Pond 8P: WET POND

Inflow Area = 4.850 ac, 71.13% Impervious, Inflow Depth = 7.11" for 100-Year event
Inflow = 31.45 cfs @ 12.16 hrs, Volume= 2.875 af
Outflow = 10.36 cfs @ 12.45 hrs, Volume= 2.522 af, Atten= 67%, Lag= 16.9 min
Primary = 10.36 cfs @ 12.45 hrs, Volume= 2.522 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 72.89' @ 12.45 hrs Surf.Area= 15,493 sf Storage= 59,183 cf

Plug-Flow detention time= 373.6 min calculated for 2.520 af (88% of inflow)
Center-of-Mass det. time= 314.5 min (1,074.8 - 760.3)

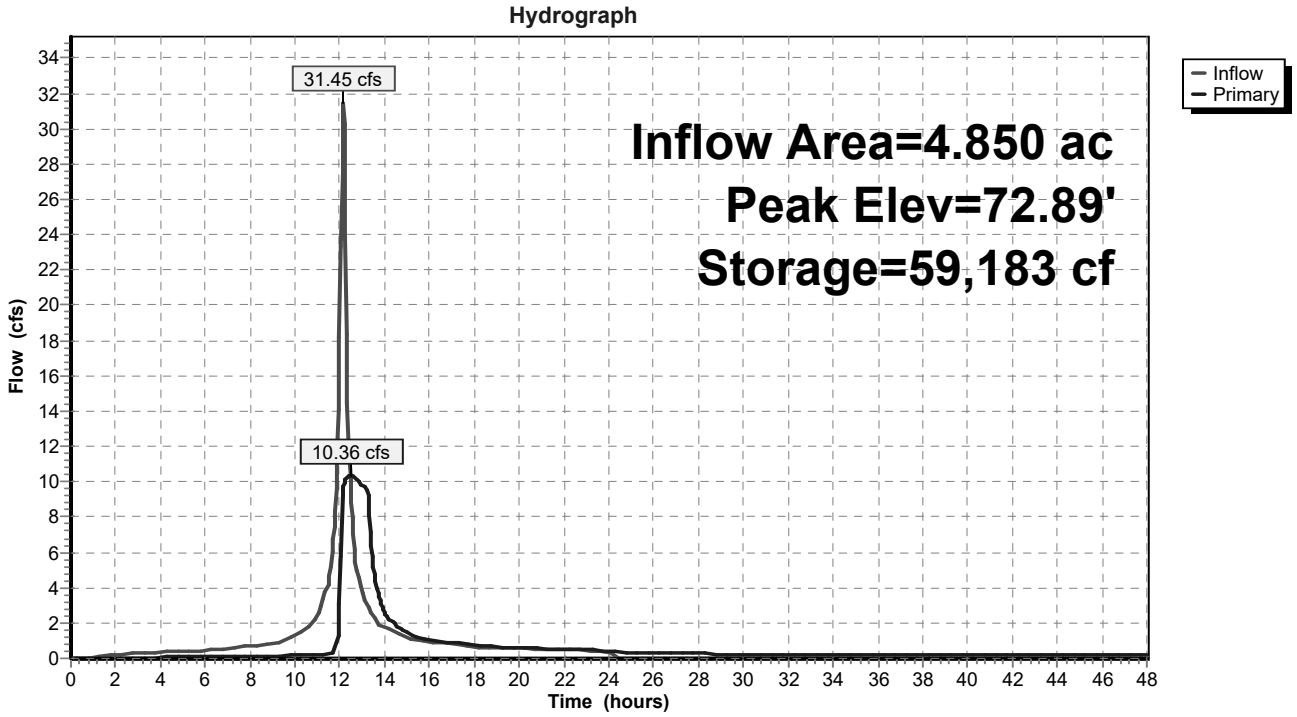
Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	60,825 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	11,408	0	0
69.00	12,104	5,878	5,878
70.00	12,902	12,503	18,381
71.00	13,711	13,307	31,688
72.00	14,475	14,093	45,781
73.00	15,613	15,044	60,825

Device	Routing	Invert	Outlet Devices
#1	Primary	66.50'	**15.0" Round Culvert** L= 100.0' Ke= 1.000 Inlet / Outlet Invert= 66.50' / 66.00' S= 0.0050 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf
#2	Device 1	68.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	71.15'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	72.90'	**48.0" x 42.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=10.36 cfs @ 12.45 hrs HW=72.89' (Free Discharge)
└**1=Culvert** (Barrel Controls 10.36 cfs @ 8.44 fps)
  ├**2=Orifice** (Passes < 0.34 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Passes < 27.49 cfs potential flow)
  └**4=Grate** (Controls 0.00 cfs)

Pond 8P: WET POND

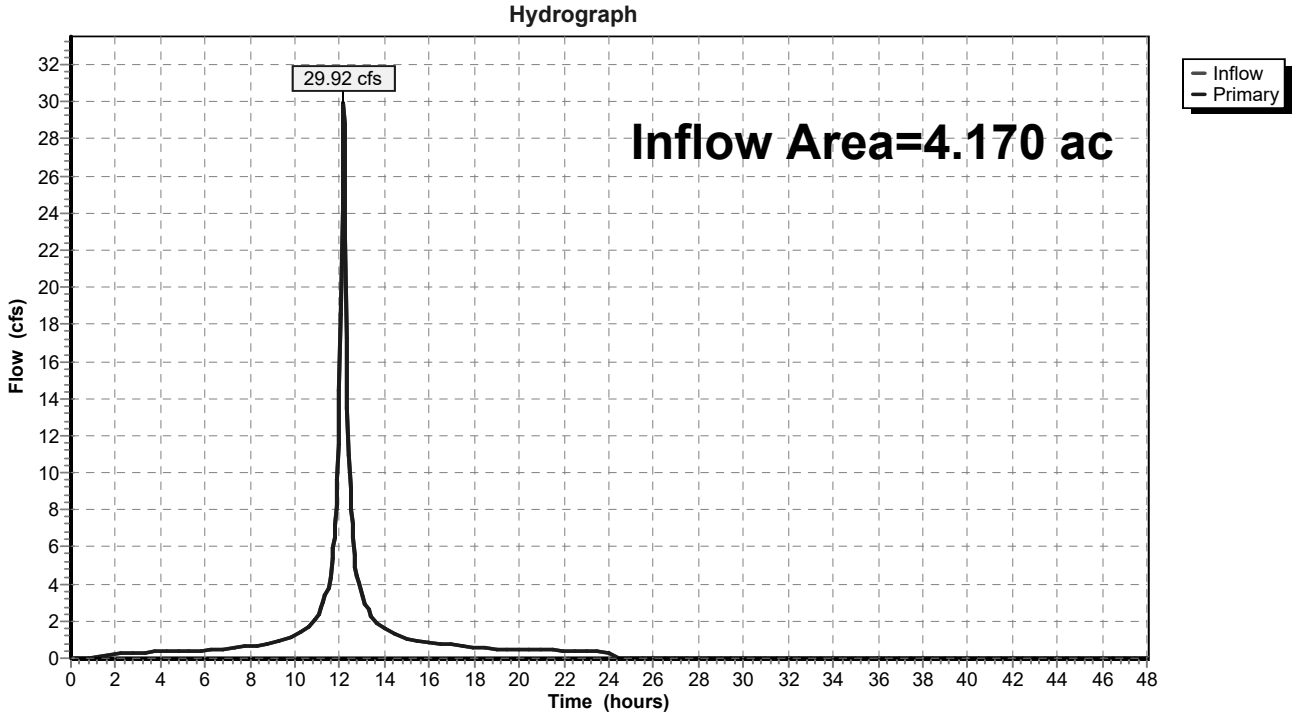


Summary for Link 10L: PDA - 1

Inflow Area = 4.170 ac, 82.73% Impervious, Inflow Depth = 7.48" for 100-Year event
Inflow = 29.92 cfs @ 12.17 hrs, Volume= 2.598 af
Primary = 29.92 cfs @ 12.17 hrs, Volume= 2.598 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 10L: PDA - 1

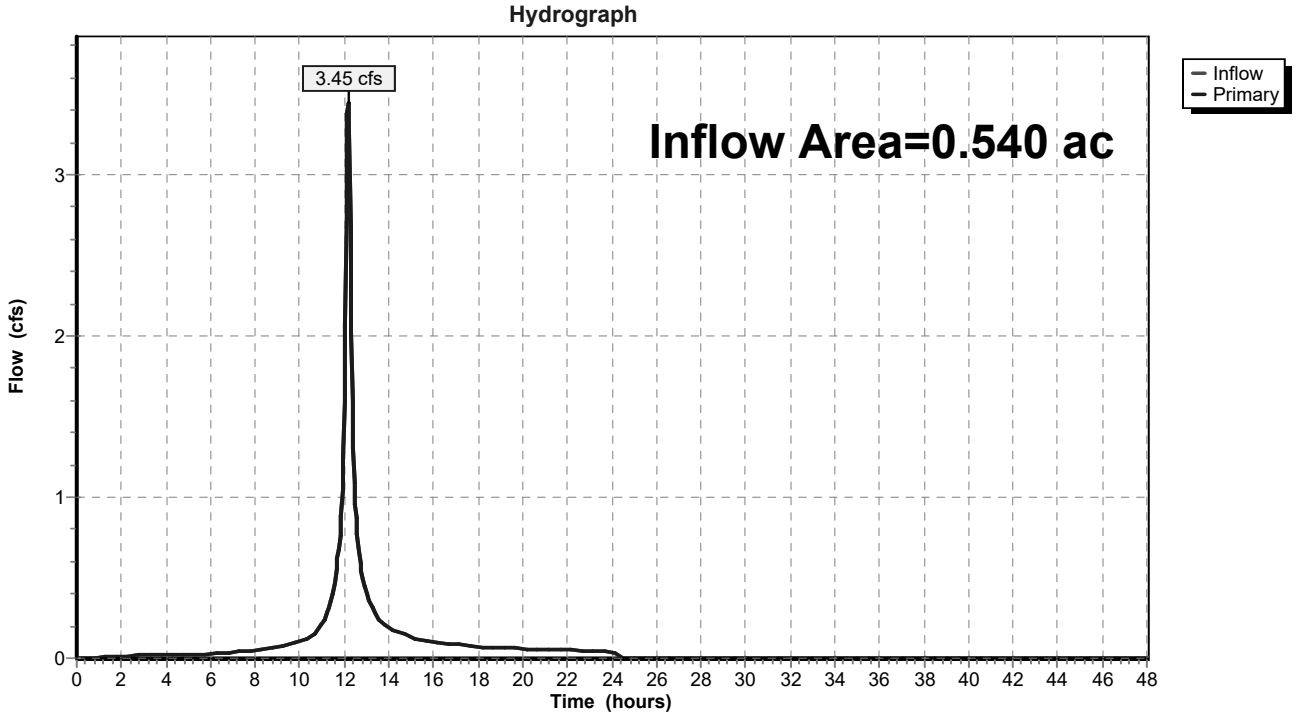


Summary for Link 13L: PDA-1 UD A

Inflow Area = 0.540 ac, 40.74% Impervious, Inflow Depth = 6.28" for 100-Year event
Inflow = 3.45 cfs @ 12.17 hrs, Volume= 0.282 af
Primary = 3.45 cfs @ 12.17 hrs, Volume= 0.282 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 13L: PDA-1 UD A

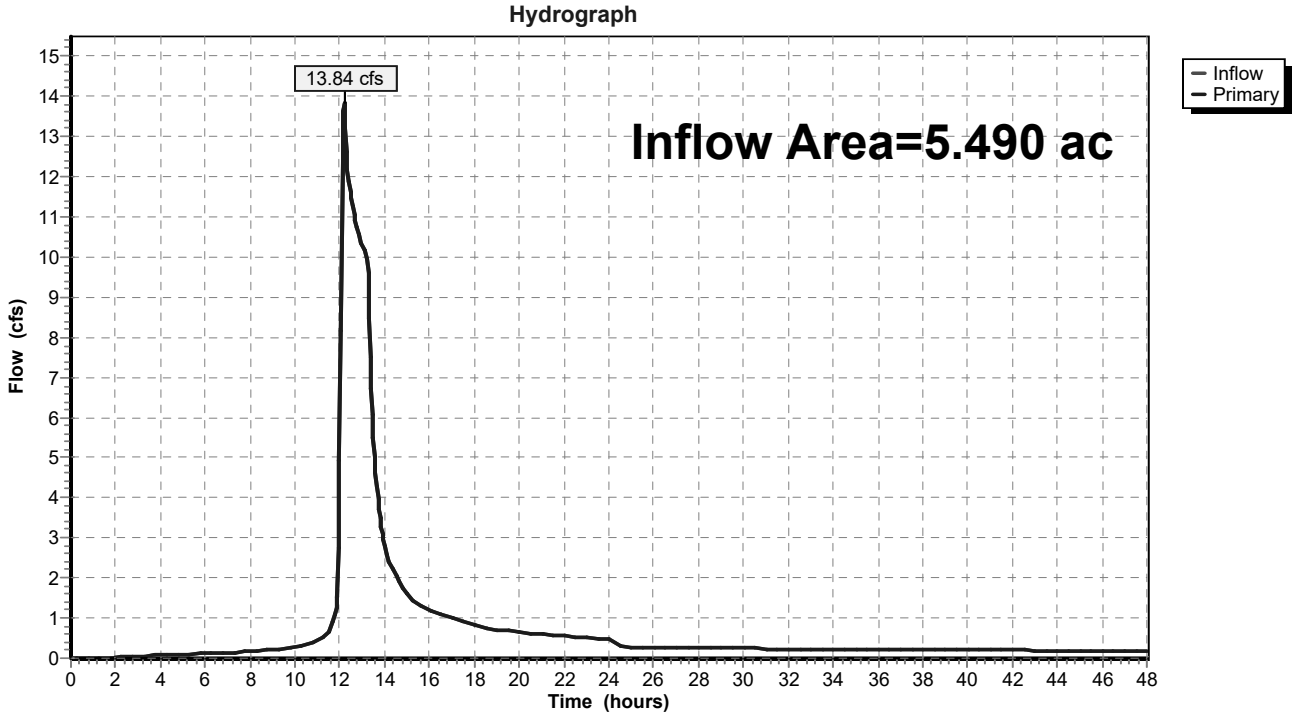


Summary for Link 14L: OVERALL SITE

Inflow Area = 5.490 ac, 66.85% Impervious, Inflow Depth > 6.22" for 100-Year event
Inflow = 13.84 cfs @ 12.19 hrs, Volume= 2.847 af
Primary = 13.84 cfs @ 12.19 hrs, Volume= 2.847 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 14L: OVERALL SITE

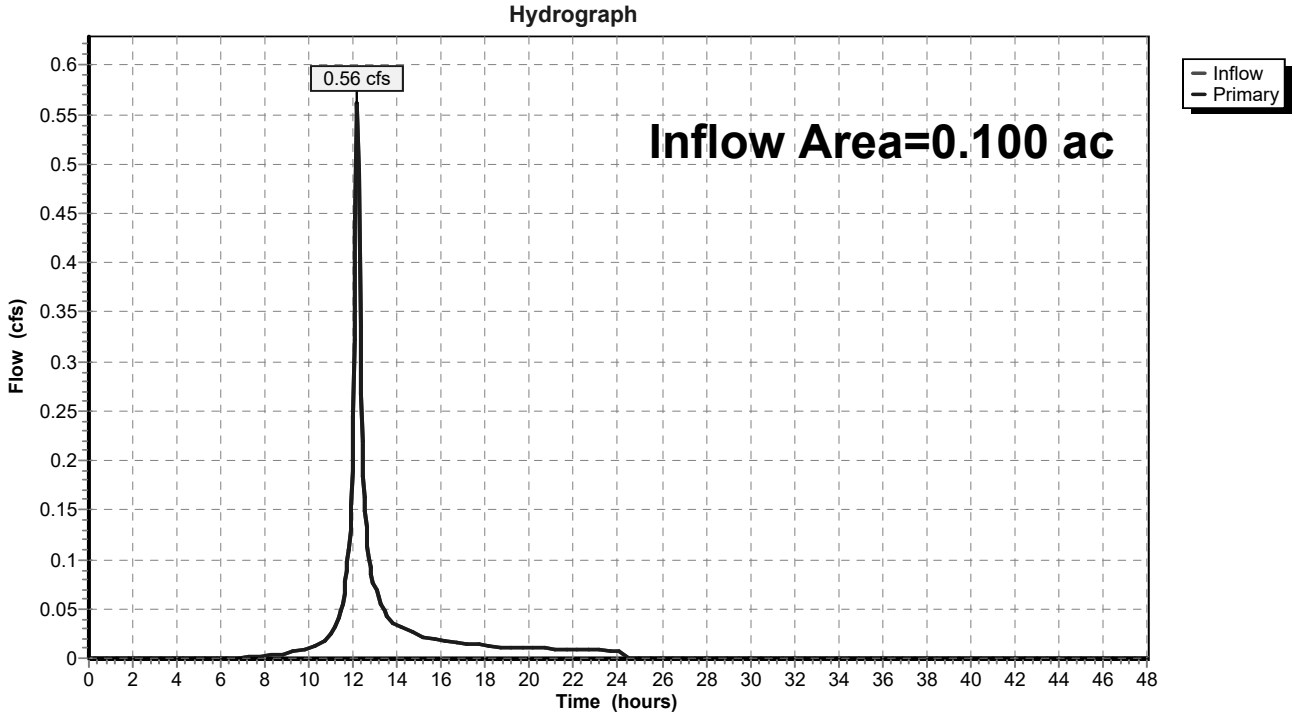


Summary for Link 17L: PDA-1 UD B

Inflow Area = 0.100 ac, 0.00% Impervious, Inflow Depth = 5.11" for 100-Year event
Inflow = 0.56 cfs @ 12.17 hrs, Volume= 0.043 af
Primary = 0.56 cfs @ 12.17 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 17L: PDA-1 UD B

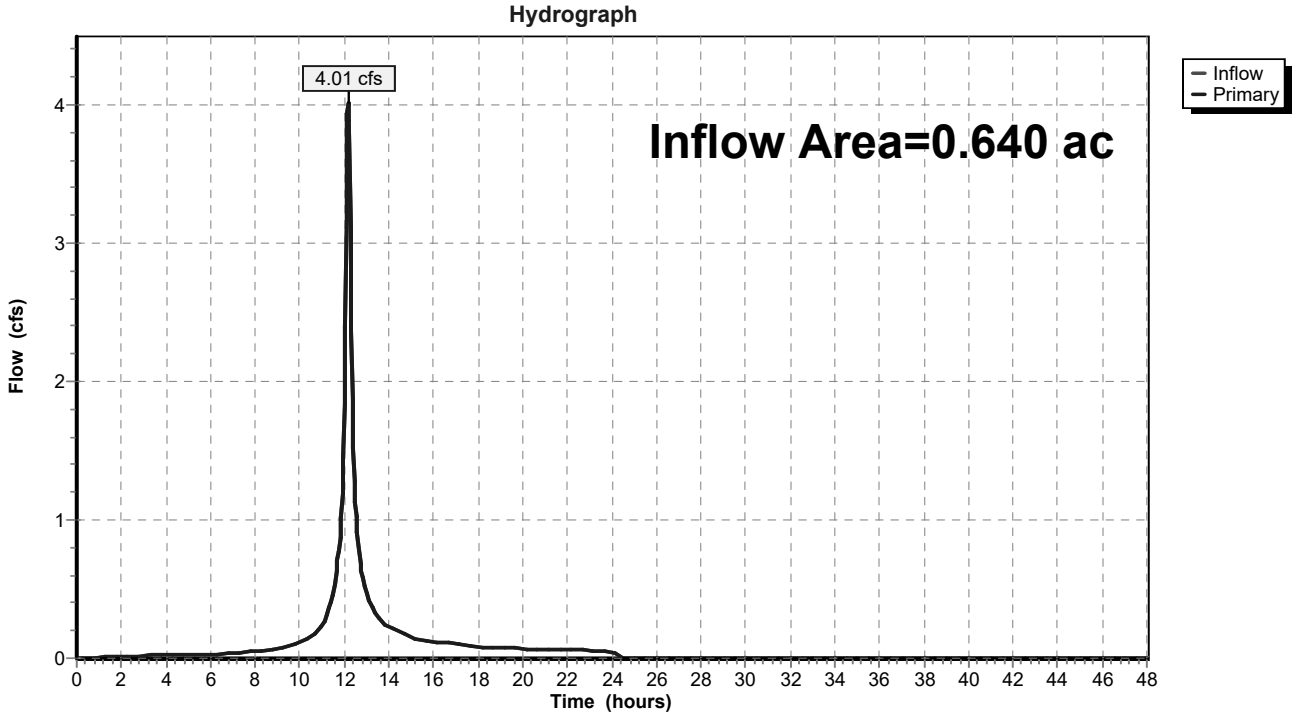


Summary for Link 18L: TOTAL PDA-1 UD

Inflow Area = 0.640 ac, 34.38% Impervious, Inflow Depth = 6.10" for 100-Year event
Inflow = 4.01 cfs @ 12.17 hrs, Volume= 0.325 af
Primary = 4.01 cfs @ 12.17 hrs, Volume= 0.325 af, Atten= 0%, Lag= 0.0 min

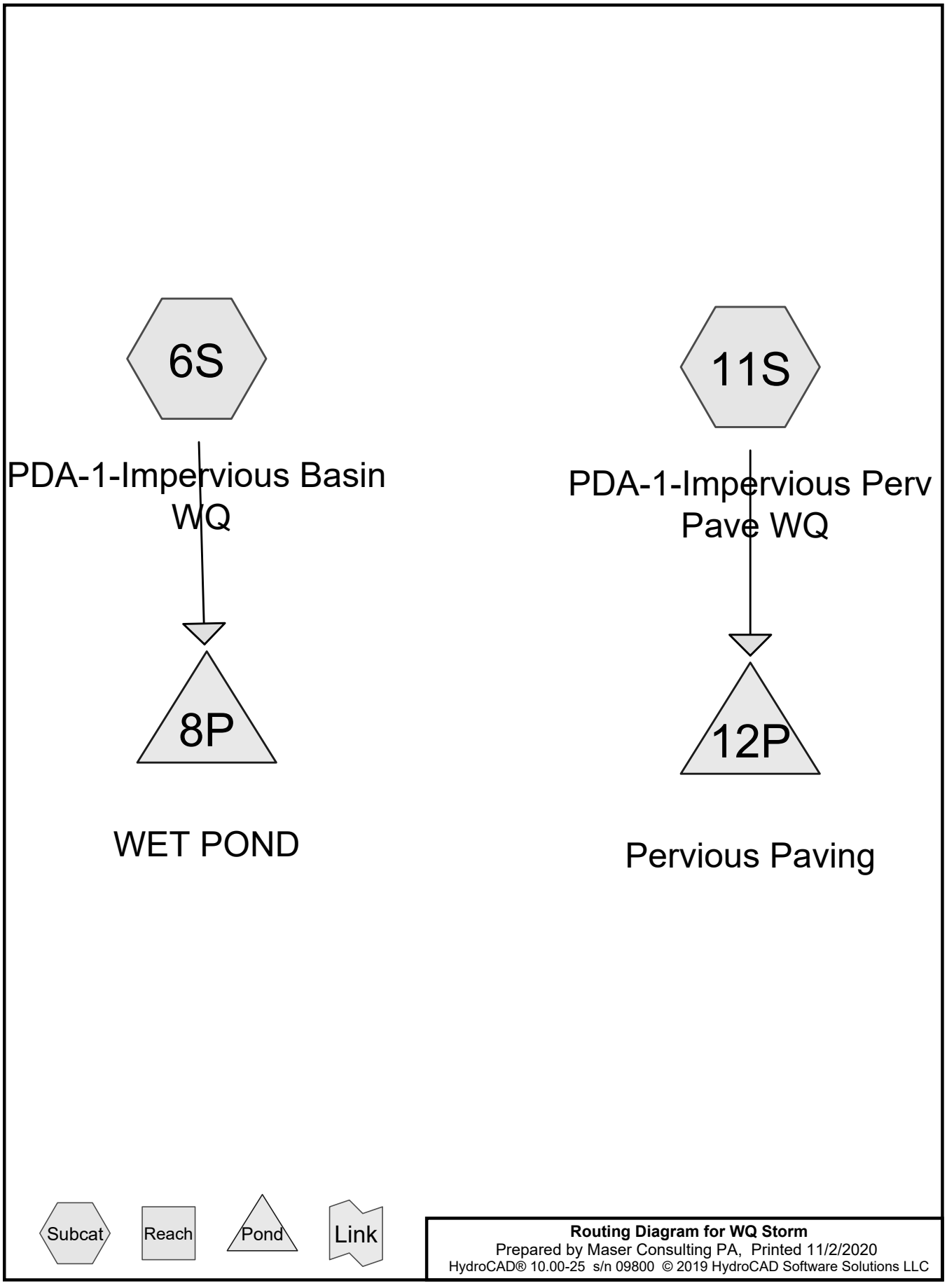
Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 18L: TOTAL PDA-1 UD



APPENDIX C

NJDEP Water Quality Storm Routing, Calculations, Dewatering & Water Budget



Routing Diagram for WQ Storm
Prepared by Maser Consulting PA, Printed 11/2/2020

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.390	98	Paved parking, HSG C (6S, 11S)
1.390	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.390	HSG C	6S, 11S
0.000	HSG D	
0.000	Other	
1.390		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.390	0.000	0.000	1.390	Paved parking	6S, 11S
0.000	**0.000**	**1.390**	**0.000**	**0.000**	**1.390**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	8P	66.50	66.00	100.0	0.0050	0.015	15.0	0.0	0.0

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

Subcatchment6S: PDA-1-Impervious Runoff Area=1.110 ac 100.00% Impervious Runoff Depth=1.03"
Tc=10.0 min CN=98 Runoff=2.86 cfs 0.096 af

Subcatchment11S: PDA-1-Impervious Runoff Area=0.280 ac 100.00% Impervious Runoff Depth=1.03"
Tc=10.0 min CN=98 Runoff=0.72 cfs 0.024 af

Pond 8P: WET POND Peak Elev=68.83' Storage=3,889 cf Inflow=2.86 cfs 0.096 af
Outflow=0.08 cfs 0.086 af

Pond 12P: Pervious Paving Peak Elev=73.98' Storage=571 cf Inflow=0.72 cfs 0.024 af
Outflow=0.14 cfs 0.024 af

Total Runoff Area = 1.390 ac Runoff Volume = 0.120 af Average Runoff Depth = 1.03"
0.00% Pervious = 0.000 ac 100.00% Impervious = 1.390 ac

Summary for Subcatchment 6S: PDA-1-Impervious Basin WQ

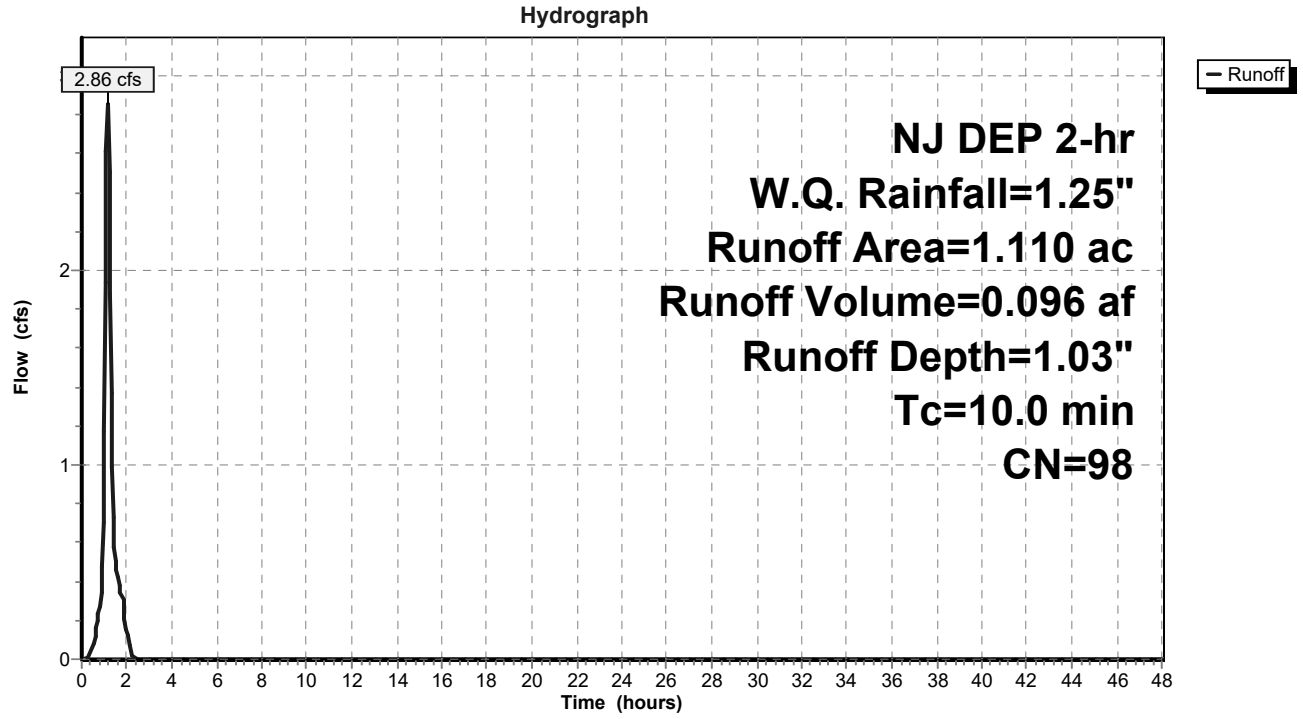
Runoff = 2.86 cfs @ 1.15 hrs, Volume= 0.096 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr W.Q. Rainfall=1.25"

Area (ac)	CN	Description
1.110	98	Paved parking, HSG C
1.110		100.00% Impervious Area

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

Subcatchment 6S: PDA-1-Impervious Basin WQ



Summary for Subcatchment 11S: PDA-1-Impervious Perv Pave WQ

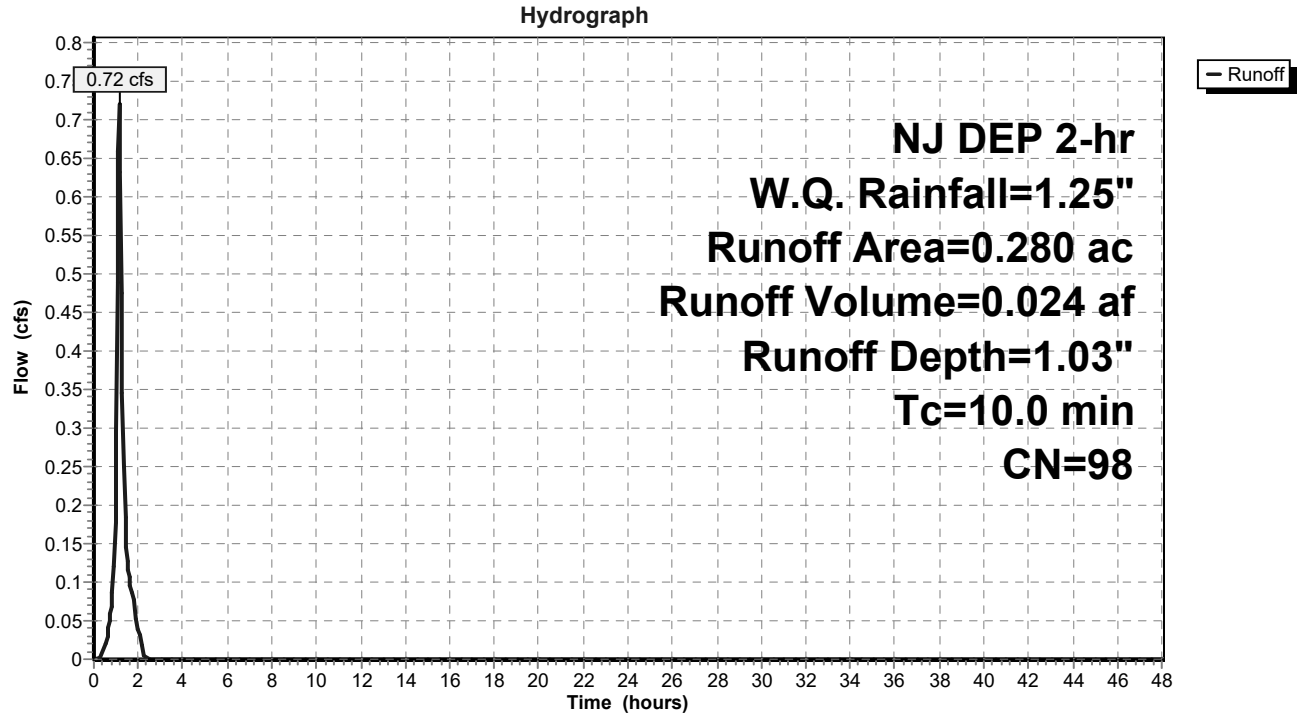
Runoff = 0.72 cfs @ 1.15 hrs, Volume= 0.024 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr W.Q. Rainfall=1.25"

Area (ac)	CN	Description
0.280	98	Paved parking, HSG C
0.280		100.00% Impervious Area

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

Subcatchment 11S: PDA-1-Impervious Perv Pave WQ



Summary for Pond 8P: WET POND

Inflow Area = 1.110 ac,100.00% Impervious, Inflow Depth = 1.03" for W.Q. event
Inflow = 2.86 cfs @ 1.15 hrs, Volume= 0.096 af
Outflow = 0.08 cfs @ 2.11 hrs, Volume= 0.086 af, Atten= 97%, Lag= 58.0 min
Primary = 0.08 cfs @ 2.11 hrs, Volume= 0.086 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 68.83' @ 2.11 hrs Surf.Area= 11,873 sf Storage= 3,889 cf

Plug-Flow detention time= 663.2 min calculated for 0.086 af (90% of inflow)
Center-of-Mass det. time= 659.3 min (733.3 - 74.0)

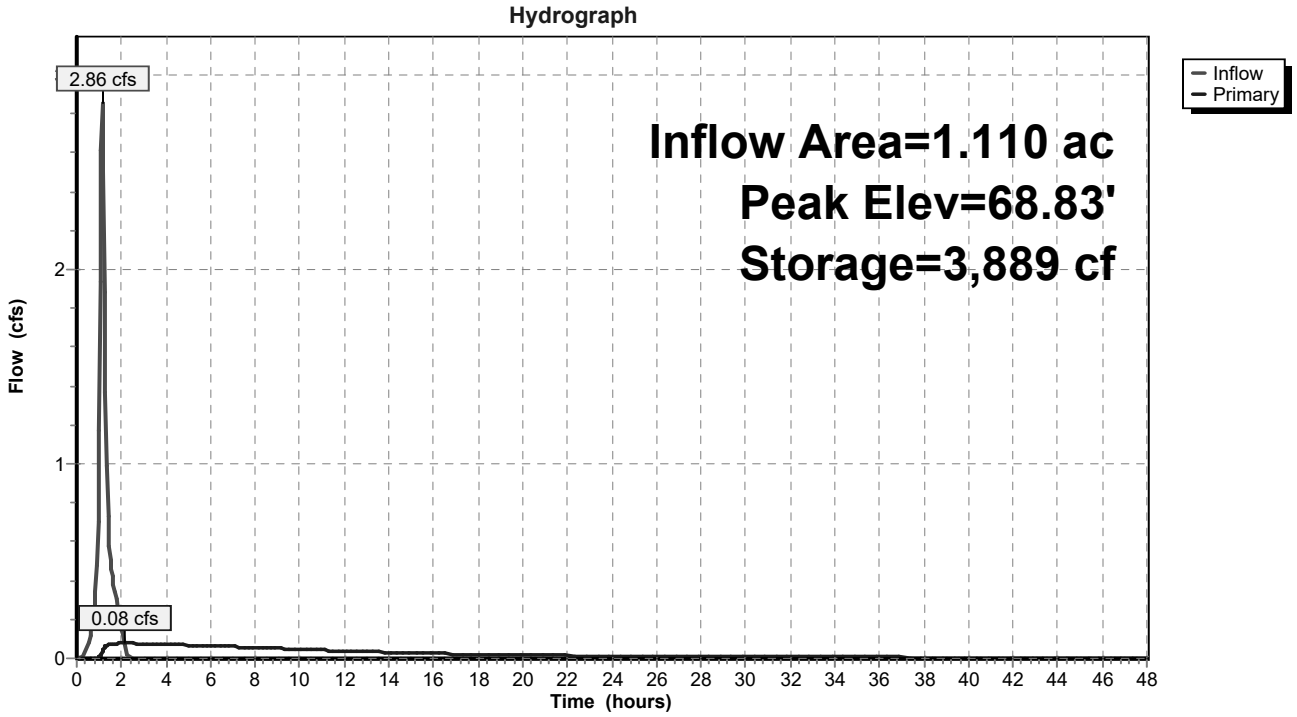
Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	60,825 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	11,408	0	0
69.00	12,104	5,878	5,878
70.00	12,902	12,503	18,381
71.00	13,711	13,307	31,688
72.00	14,475	14,093	45,781
73.00	15,613	15,044	60,825

Device	Routing	Invert	Outlet Devices
#1	Primary	66.50'	**15.0" Round Culvert** L= 100.0' Ke= 1.000 Inlet / Outlet Invert= 66.50' / 66.00' S= 0.0050 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf
#2	Device 1	68.50'	**2.5" Vert. Orifice** C= 0.600
#3	Device 1	71.15'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	72.90'	**48.0" x 42.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.08 cfs @ 2.11 hrs HW=68.83' (Free Discharge)
└**1=Culvert** (Passes 0.08 cfs of 5.49 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 0.08 cfs @ 2.31 fps)
  ├**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**4=Grate** (Controls 0.00 cfs)

Pond 8P: WET POND



Summary for Pond 12P: Pervious Paving

Inflow Area = 0.280 ac,100.00% Impervious, Inflow Depth = 1.03" for W.Q. event
Inflow = 0.72 cfs @ 1.15 hrs, Volume= 0.024 af
Outflow = 0.14 cfs @ 1.48 hrs, Volume= 0.024 af, Atten= 81%, Lag= 20.0 min
Primary = 0.14 cfs @ 1.48 hrs, Volume= 0.024 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 73.98' @ 1.48 hrs Surf.Area= 10,747 sf Storage= 571 cf

Plug-Flow detention time= 42.1 min calculated for 0.024 af (100% of inflow)
Center-of-Mass det. time= 42.1 min (116.1 - 74.0)

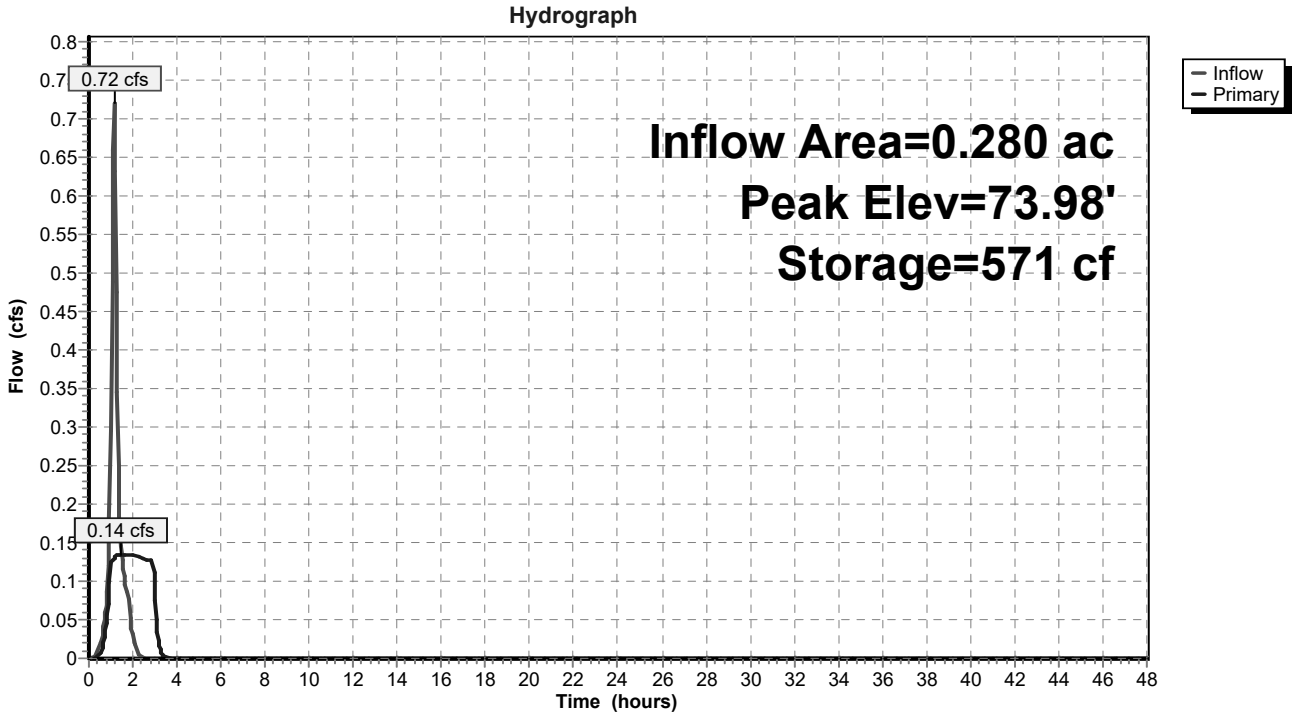
Volume	Invert	Avail.Storage	Storage Description
#1	73.85'	5,760 cf	**Stone Storage (Prismatic)** Listed below (Recalc) 14,401 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
73.85	10,747	0	0
75.19	10,747	14,401	14,401

Device	Routing	Invert	Outlet Devices
#1	Primary	73.85'	**0.500 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 72.30'

Primary OutFlow Max=0.14 cfs @ 1.48 hrs HW=73.98' (Free Discharge)
↑**1=Exfiltration** (Controls 0.14 cfs)

Pond 12P: Pervious Paving



MASER CONSULTING P.A.

Project: Elizabeth Ave

Project#: Sheet#: of Scale:

Calculated By: MB Date: Checked By: Date: 10/7/24

Office Submitted By: Date:

Engineers | Planners | Surveyors | Landscape Architects | Environmental Scientists

Pervious Paving Capacity

Area of Perv Pave: 1Ø27Ø SF (.24AC)

Total Area draining to Perv Pave

ØØ.32AC

- .24 Pavement
- .Ø3 Conc
- .Ø5 Grass

WQ Runoff = Ø.ØØ24af = 1Ø45 cf

1Ø45 cf → Runoff volume

1Ø27Ø SF → Pave(Perv) Area

= Ø.1Ø ft = 1.22" / Ø.4Ø voids = **3.05" stone needed for WQ**

GW Recharge requires 6.5" of stone

WATER BUDGET **JOB DESCRIPTION:** Elizabeth Ave Warehouse **DATE:** 10/23/2020 **Sheet 1**
MC#: 19000694A **BASIN NAME:** Wet Pond 1 **DESIGN BY:** LMB

Volume = Initial Volume + Rainfall - Evapotranspiration - Infiltration
V = Vi + R -PET - I

Drainage Area to Basin: 4.85 acres
211266 square feet
Initial Permanent Pool Volume: 18,978 cubic feet
Normal Water Surface Area: 11,408 square feet

Monthly Evapotranspiration Rate: (See Sheet 2)

Infiltration Rate: 0.02 inches / hour

Rainfall "R" Somerset County - ONJSC monthly rainfall data - 1965 (Dry Year)

	January	February	March	April	May	June	July	August	September	October	November	December	
Monthly Rainfall (1965)	2.72	2.77	3.2	2.47	1.39	1.27	3.13	3.79	2.94	2.61	1.67	1.88	29.84
	0.227	0.231	0.267	0.206	0.116	0.106	0.261	0.316	0.245	0.218	0.139	0.157	feet / month
"R" Total	**47887**	**48767**	**56338**	**43486**	**24472**	**22359**	**55105**	**66725**	**51760**	**45950**	**29401**	**33098**	**cubic feet / month**

Evapotranspiration "PET"

	January	February	March	April	May	June	July	August	September	October	November	December	
Monthly PET	0.00	0.01	0.59	1.70	3.33	4.88	5.65	5.01	3.51	1.94	0.80	0.12	inches / month
	0.000	0.001	0.049	0.142	0.278	0.407	0.471	0.418	0.293	0.162	0.067	0.010	feet / month
"PET" Total	**0**	**9**	**564**	**1618**	**3167**	**4643**	**5373**	**4765**	**3338**	**1846**	**764**	**115**	**cubic feet / month**

Infiltration "I"

	January	February	March	April	May	June	July	August	September	October	November	December	
Infiltration Rate	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	inches / hour
	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	feet / hour
	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	feet / day
	1.24	1.12	1.24	1.20	1.24	1.20	1.24	1.24	1.20	1.24	1.20	1.24	feet / month
"I" Total	**14145.92**	**12776.96**	**14145.92**	**13689.6**	**14145.92**	**13689.6**	**14145.92**	**14145.92**	**13689.6**	**14145.92**	**13689.6**	**14145.92**	**cubic feet / month**

Net Gain / (Loss)

	January	February	March	April	May	June	July	August	September	October	November	December	
	33741	35982	41628	28178	7159	4027	35586	47814	34733	29958	14947	18837	cubic feet / month
Permanent Pool Volume **18978**		54960	60606	47156	26137	23005	54564	66792	53711	48936	33925	37815	cubic feet
	18978	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**cubic feet**

Note: If permanent pool volume exceeds initial permanent pool volume at the end of the month, then permanent pool volume resets to initial permanent pool volume. This accounts for the loss of rainfall volume through the outlet structure.

RESULT: There are not any times where there are three consecutive months of drying. Therefore, the basin meets the NJDEP BMP Guidelines of not having a drying period longer than two consecutive months. (Page 9.2-10 of NJDEP BMP Manual)

Formulas:

"R" Total (cubic feet / month) = Avg. Montly Rainfall (feet / month) x Drainage Area to Basin (square feet)

"PET" Total (cubic feet / month) = Monthly Evapotranspiration Rate (feet / month) x Normal Water Surface Area (square feet)

"I" Total (cubic feet / month) = Infiltration Rate (feet / month) x Normal Water Surface Area (square feet)

WATER BUDGET **JOB DESCRIPTION:** Elizabeth Ave Warehouse **DATE:** 10/23/2020 **Sheet 1**
MC#: 19000694A **BASIN NAME:** Wet Pond 1 **DESIGN BY:** LMB

Volume = Initial Volume + Rainfall - Evapotranspiration - Infiltration
V = Vi + R -PET - I

Drainage Area to Basin: 4.85 acres
211266 square feet
Initial Permanent Pool Volume: 18,978 cubic feet
Normal Water Surface Area: 11,408 square feet

Monthly Evapotranspiration Rate: (See Sheet 2)

Infiltration Rate: 0.02 inches / hour

Rainfall "R" Somerset County - ONJSC monthly rainfall data - 1987 (Median Year)

	January	February	March	April	May	June	July	August	September	October	November	December	
Monthly Rainfall (1987)	4.91	1.13	2.66	5.72	2.05	4.39	7.37	4.86	4.49	4.37	3.42	1.79	
	0.409	0.094	0.222	0.477	0.171	0.366	0.614	0.405	0.374	0.364	0.285	0.149	feet / month
"R" Total	**86443**	**19894**	**46831**	**100703**	**36091**	**77288**	**129753**	**85563**	**79049**	**76936**	**60211**	**31514**	**cubic feet / month**

Evapotranspiration "PET"

	January	February	March	April	May	June	July	August	September	October	November	December	
Monthly PET	0.00	0.01	0.59	1.70	3.33	4.88	5.65	5.01	3.51	1.94	0.80	0.12	inches / month
	0.000	0.001	0.049	0.142	0.278	0.407	0.471	0.418	0.293	0.162	0.067	0.010	feet / month
"PET" Total	**0**	**9**	**564**	**1618**	**3167**	**4643**	**5373**	**4765**	**3338**	**1846**	**764**	**115**	**cubic feet / month**

Infiltration "I"

	January	February	March	April	May	June	July	August	September	October	November	December	
Infiltration Rate	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	inches / hour
	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	feet / hour
	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	feet / day
	1.24	1.12	1.24	1.20	1.24	1.20	1.24	1.24	1.20	1.24	1.20	1.24	feet / month
"I" Total	**14145.92**	**12776.96**	**14145.92**	**13689.6**	**14145.92**	**13689.6**	**14145.92**	**14145.92**	**13689.6**	**14145.92**	**13689.6**	**14145.92**	**cubic feet / month**

Net Gain / (Loss)

	January	February	March	April	May	June	July	August	September	October	November	December	
	72297	7109	32121	85396	18778	58956	110233	66652	62022	60944	45757	17253	cubic feet / month
Permanent Pool Volume **18978**		26087	51099	104374	37756	77934	129211	85630	81000	79922	64735	36231	cubic feet
	18978	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**cubic feet**

Note: If permanent pool volume exceeds initial permanent pool volume at the end of the month, then permanent pool volume resets to initial permanent pool volume. This accounts for the loss of rainfall volume through the outlet structure.

RESULT: There are not any times where there are three consecutive months of drying. Therefore, the basin meets the NJDEP BMP Guidelines of not having a drying period longer than two consecutive months. (Page 9.2-10 of NJDEP BMP Manual)

Formulas:

"R" Total (cubic feet / month) = Avg. Montly Rainfall (feet / month) x Drainage Area to Basin (square feet)

"PET" Total (cubic feet / month) = Monthly Evapotranspiration Rate (feet / month) x Normal Water Surface Area (square feet)

"I" Total (cubic feet / month) = Infiltration Rate (feet / month) x Normal Water Surface Area (square feet)

WATER BUDGET **JOB DESCRIPTION:** Elizabeth Ave Warehouse **DATE:** 10/23/2020 **Sheet 1**
MC#: 19000694A **BASIN NAME:** Wet Pond 1 **DESIGN BY:** LMB

Volume = Initial Volume + Rainfall - Evapotranspiration - Infiltration
V = Vi + R -PET - I

Drainage Area to Basin: 4.85 acres
211266 square feet
Initial Permanent Pool Volume: 18,978 cubic feet
Normal Water Surface Area: 11,408 square feet

Monthly Evapotranspiration Rate: (See Sheet 2)

Infiltration Rate: 0.02 inches / hour

Rainfall "R" Somerset County - ONJSC monthly rainfall data - 2011 (Wet Year)

	January	February	March	April	May	June	July	August	September	October	November	December	
Monthly Rainfall (2011)	3.38	2.97	6.4	6.86	4.65	3.5	3.43	16.83	8.77	4.49	3.73	4.3	
	0.282	0.248	0.533	0.572	0.388	0.292	0.286	1.403	0.731	0.374	0.311	0.358	feet / month
"R" Total	**59507**	**52288**	**112675**	**120774**	**81866**	**61619**	**60387**	**296301**	**154400**	**79049**	**65669**	**75704**	**cubic feet / month**

Evapotranspiration "PET"

	January	February	March	April	May	June	July	August	September	October	November	December	
Monthly PET	0.00	0.01	0.59	1.70	3.33	4.88	5.65	5.01	3.51	1.94	0.80	0.12	inches / month
	0.000	0.001	0.049	0.142	0.278	0.407	0.471	0.418	0.293	0.162	0.067	0.010	feet / month
"PET" Total	**0**	**9**	**564**	**1618**	**3167**	**4643**	**5373**	**4765**	**3338**	**1846**	**764**	**115**	**cubic feet / month**

Infiltration "I"

	January	February	March	April	May	June	July	August	September	October	November	December	
Infiltration Rate	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	inches / hour
	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	0.0017	feet / hour
	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	feet / day
	1.24	1.12	1.24	1.20	1.24	1.20	1.24	1.24	1.20	1.24	1.20	1.24	feet / month
"I" Total	**14145.92**	**12776.96**	**14145.92**	**13689.6**	**14145.92**	**13689.6**	**14145.92**	**14145.92**	**13689.6**	**14145.92**	**13689.6**	**14145.92**	**cubic feet / month**

Net Gain / (Loss)

	January	February	March	April	May	June	July	August	September	October	November	December	
	45361	39503	97965	105466	64553	43287	40868	277390	137373	63057	51214	61443	cubic feet / month
Permanent Pool Volume **18978**		58481	116943	124444	83531	62265	59846	296368	156351	82035	70192	80421	cubic feet
	18978	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**18978**	**cubic feet**

Note: If permanent pool volume exceeds initial permanent pool volume at the end of the month, then permanent pool volume resets to initial permanent pool volume. This accounts for the loss of rainfall volume through the outlet structure.

RESULT: There are not any times where there are three consecutive months of drying. Therefore, the basin meets the NJDEP BMP Guidelines of not having a drying period longer than two consecutive months. (Page 9.2-10 of NJDEP BMP Manual)

Formulas:

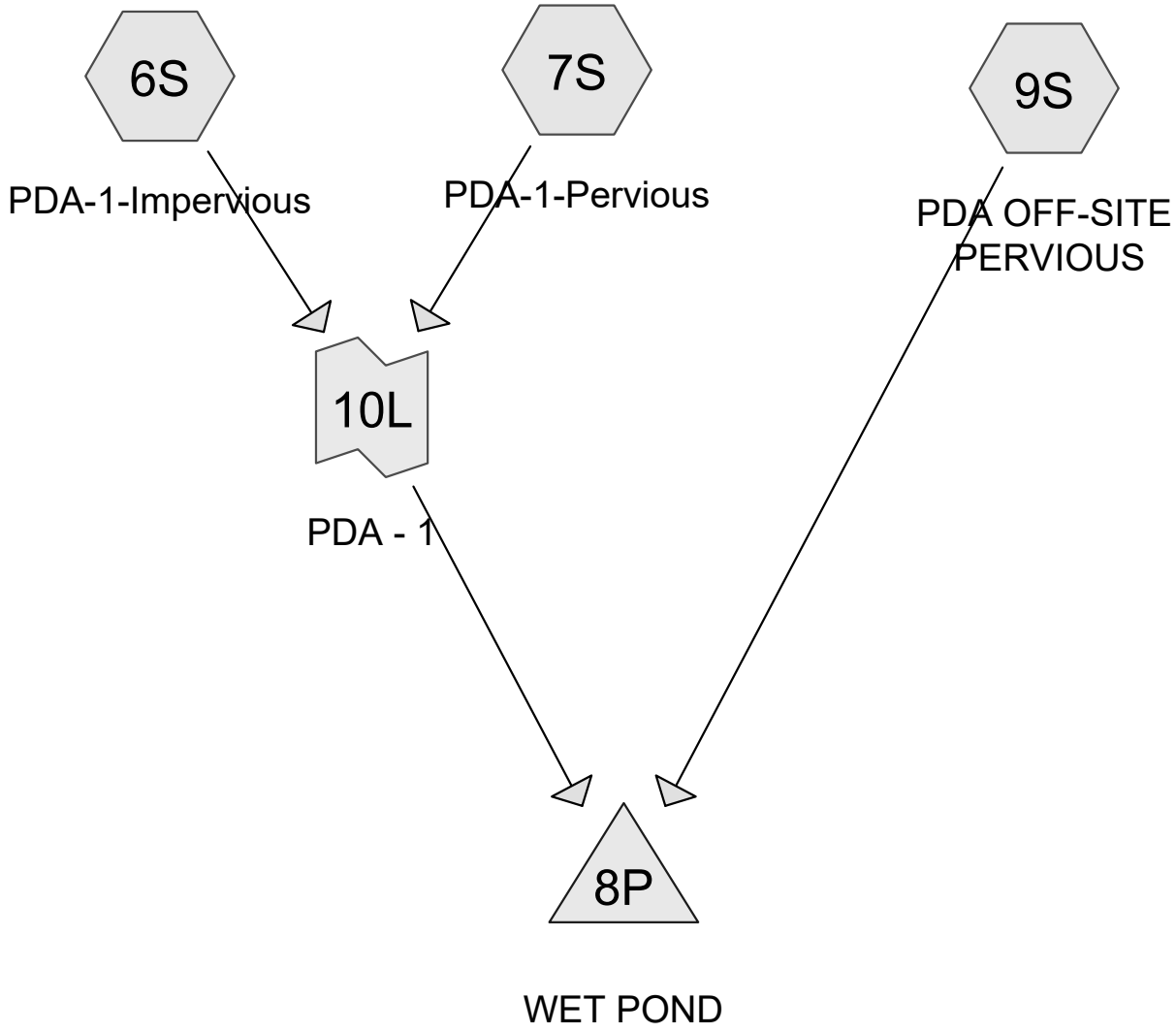
"R" Total (cubic feet / month) = Avg. Montly Rainfall (feet / month) x Drainage Area to Basin (square feet)

"PET" Total (cubic feet / month) = Monthly Evapotranspiration Rate (feet / month) x Normal Water Surface Area (square feet)

"I" Total (cubic feet / month) = Infiltration Rate (feet / month) x Normal Water Surface Area (square feet)

APPENDIX D

Emergency Spillway Calculations (150% of 100 Year Storm Routing)



Subcat Reach Pond Link

Routing Diagram for Emergency Spillway
Prepared by Maser Consulting PA, Printed 11/2/2020

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.720	74	>75% Grass cover, Good, HSG C (7S)
3.450	98	Paved parking, HSG C (6S)
0.680	72	Woods/grass comb., Good, HSG C (9S)
4.850	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
4.850	HSG C	6S, 7S, 9S
0.000	HSG D	
0.000	Other	
4.850		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.720	0.000	0.000	0.720	>75% Grass cover, Good	7S
0.000	0.000	3.450	0.000	0.000	3.450	Paved parking	6S
0.000	0.000	0.680	0.000	0.000	0.680	Woods/grass comb., Good	9S
0.000	**0.000**	**4.850**	**0.000**	**0.000**	**4.850**	**TOTAL AREA**	

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

Subcatchment6S: PDA-1-Impervious Runoff Area=3.450 ac 100.00% Impervious Runoff Depth=12.08"
Tc=10.0 min CN=98 Runoff=38.89 cfs 3.473 af

Subcatchment7S: PDA-1-Pervious Runoff Area=0.720 ac 0.00% Impervious Runoff Depth=8.92"
Tc=10.0 min CN=74 Runoff=6.90 cfs 0.535 af

Subcatchment9S: PDA OFF-SITE PERVIOUS Runoff Area=0.680 ac 0.00% Impervious Runoff Depth=8.63"
Tc=0.0 min CN=72 Runoff=8.29 cfs 0.489 af

Pond 8P: WET POND Peak Elev=73.49' Storage=68,687 cf Inflow=48.37 cfs 4.497 af
Outflow=47.05 cfs 3.101 af

Link 10L: PDA - 1 Inflow=45.79 cfs 4.008 af
Primary=45.79 cfs 4.008 af

Total Runoff Area = 4.850 ac Runoff Volume = 4.497 af Average Runoff Depth = 11.13"
28.87% Pervious = 1.400 ac 71.13% Impervious = 3.450 ac

Summary for Subcatchment 6S: PDA-1-Impervious

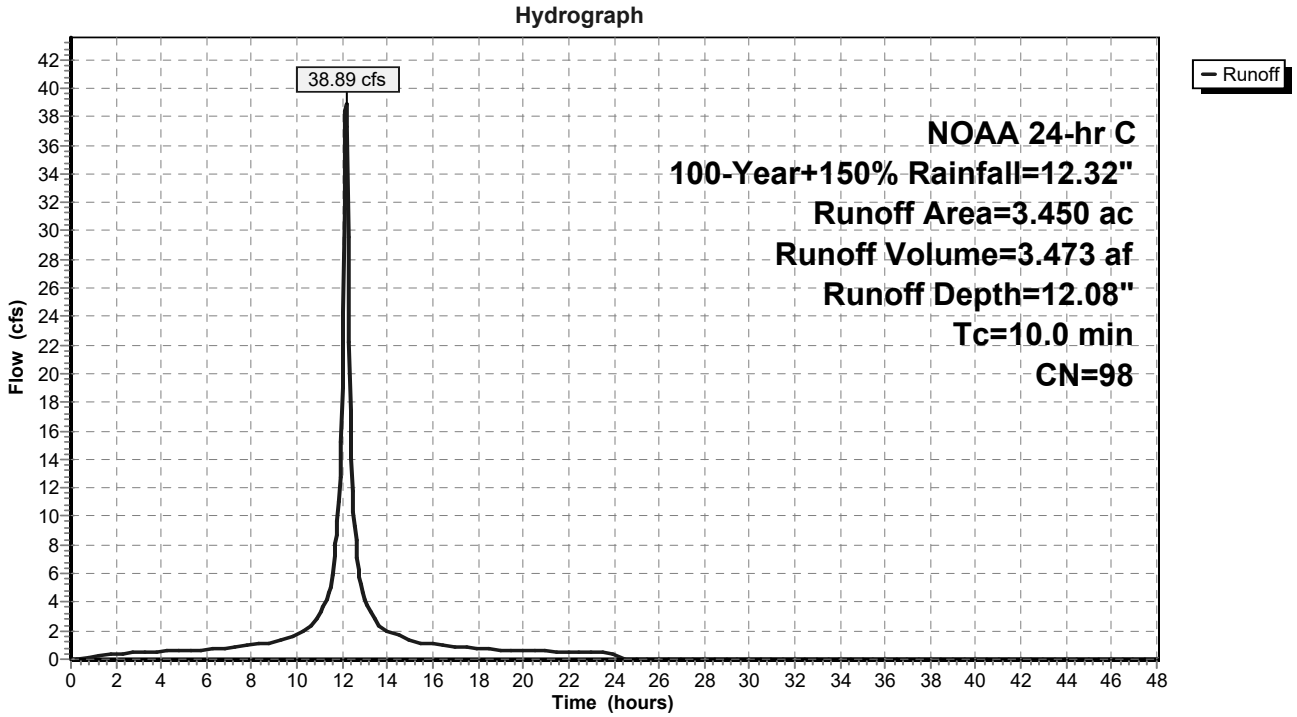
Runoff = 38.89 cfs @ 12.17 hrs, Volume= 3.473 af, Depth=12.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year+150% Rainfall=12.32"

Area (ac)	CN	Description
3.450	98	Paved parking, HSG C
3.450		100.00% Impervious Area

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

Subcatchment 6S: PDA-1-Impervious



Summary for Subcatchment 7S: PDA-1-Pervious

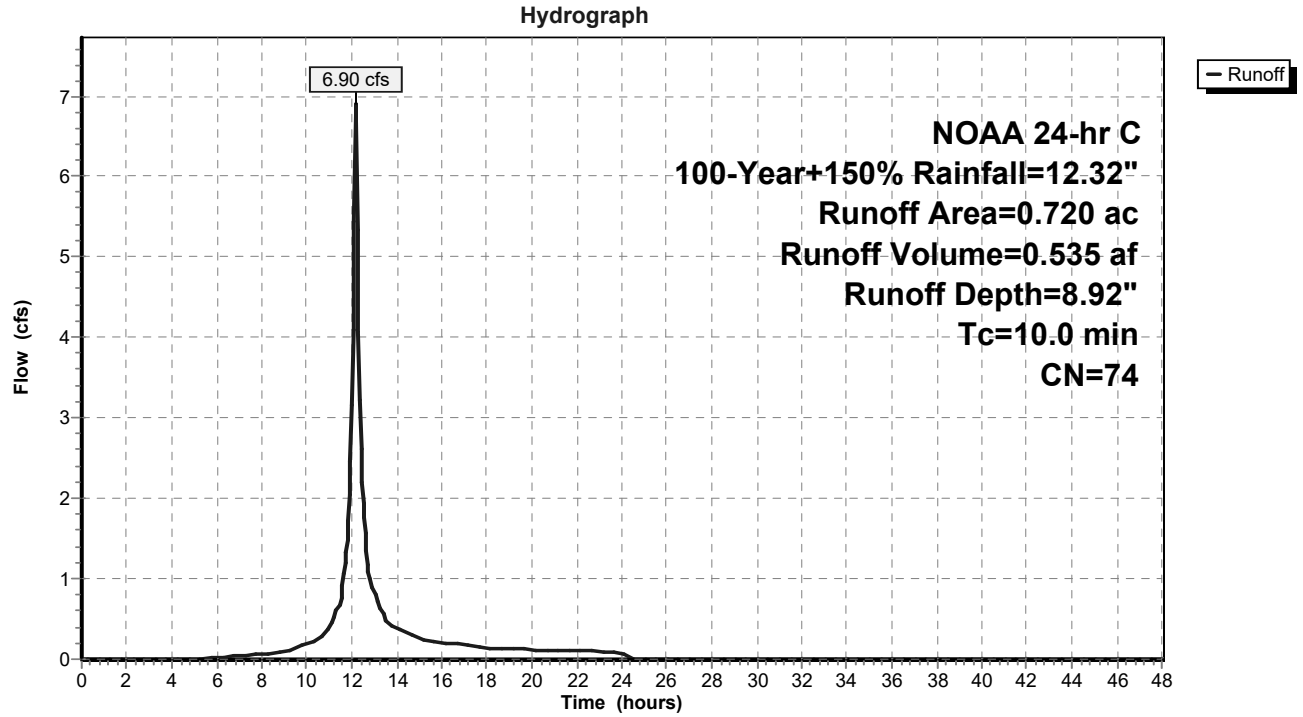
Runoff = 6.90 cfs @ 12.17 hrs, Volume= 0.535 af, Depth= 8.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year+150% Rainfall=12.32"

Area (ac)	CN	Description
0.720	74	>75% Grass cover, Good, HSG C
0.720		100.00% Pervious Area

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

Subcatchment 7S: PDA-1-Pervious



Summary for Subcatchment 9S: PDA OFF-SITE PERVIOUS

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

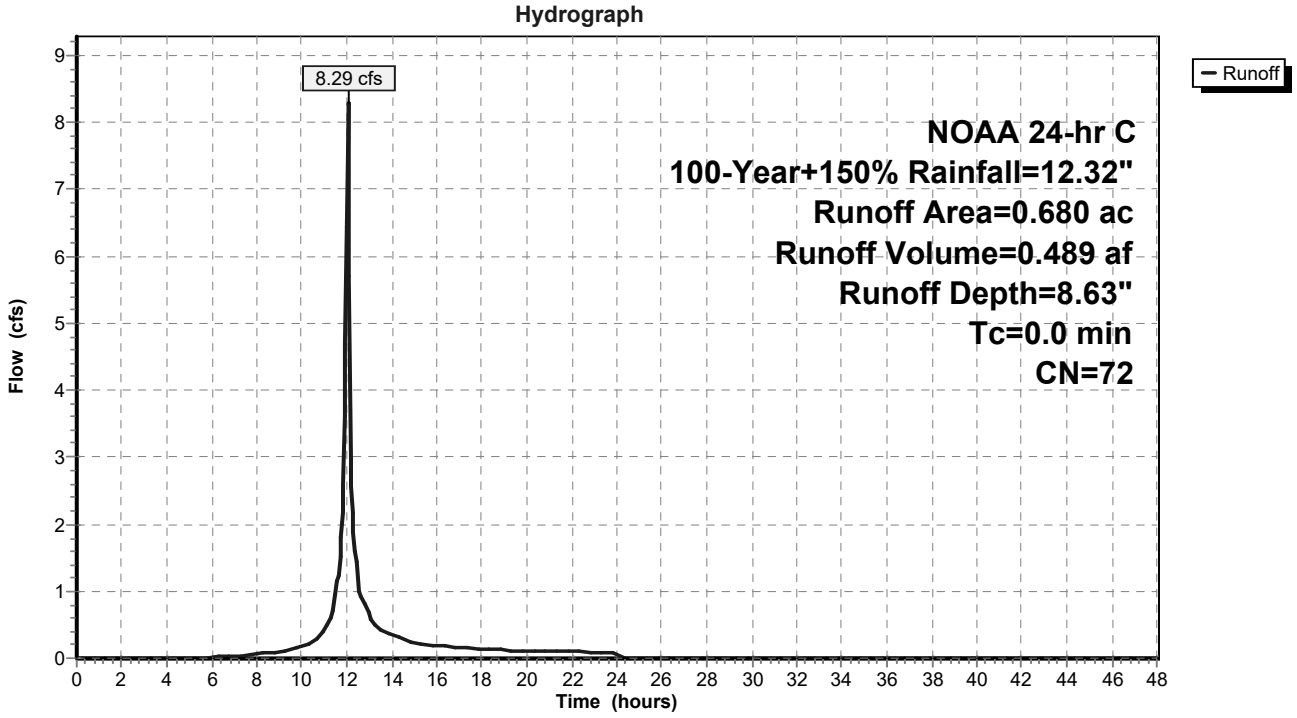
Runoff = 8.29 cfs @ 12.05 hrs, Volume= 0.489 af, Depth= 8.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 100-Year+150% Rainfall=12.32"

Area (ac)	CN	Description
0.680	72	Woods/grass comb., Good, HSG C
0.680		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0					**Direct Entry, 10**

Subcatchment 9S: PDA OFF-SITE PERVIOUS



Summary for Pond 8P: WET POND

Inflow Area = 4.850 ac, 71.13% Impervious, Inflow Depth = 11.13" for 100-Year+150% event
Inflow = 48.37 cfs @ 12.16 hrs, Volume= 4.497 af
Outflow = 47.05 cfs @ 12.19 hrs, Volume= 3.101 af, Atten= 3%, Lag= 1.7 min
Primary = 47.05 cfs @ 12.19 hrs, Volume= 3.101 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 73.49' @ 12.19 hrs Surf.Area= 16,420 sf Storage= 68,687 cf

Plug-Flow detention time= 194.2 min calculated for 3.097 af (69% of inflow)
Center-of-Mass det. time= 94.2 min (849.1 - 755.0)

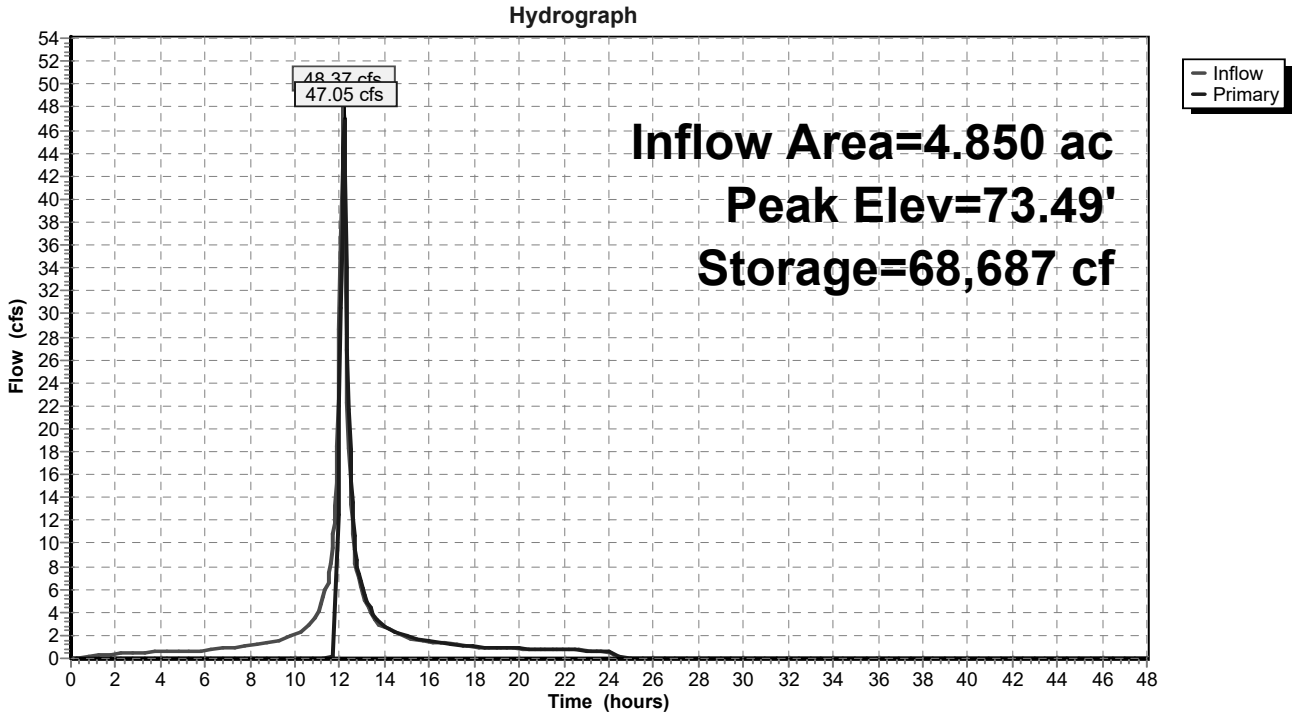
Volume	Invert	Avail.Storage	Storage Description
#1	68.50'	77,260 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
68.50	11,408	0	0
69.00	12,104	5,878	5,878
70.00	12,902	12,503	18,381
71.00	13,711	13,307	31,688
72.00	14,475	14,093	45,781
73.00	15,613	15,044	60,825
74.00	17,258	16,436	77,260

Device	Routing	Invert	Outlet Devices
#1	Primary	73.00'	**50.0' long x 1.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=46.56 cfs @ 12.19 hrs HW=73.49' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 46.56 cfs @ 1.91 fps)

Pond 8P: WET POND

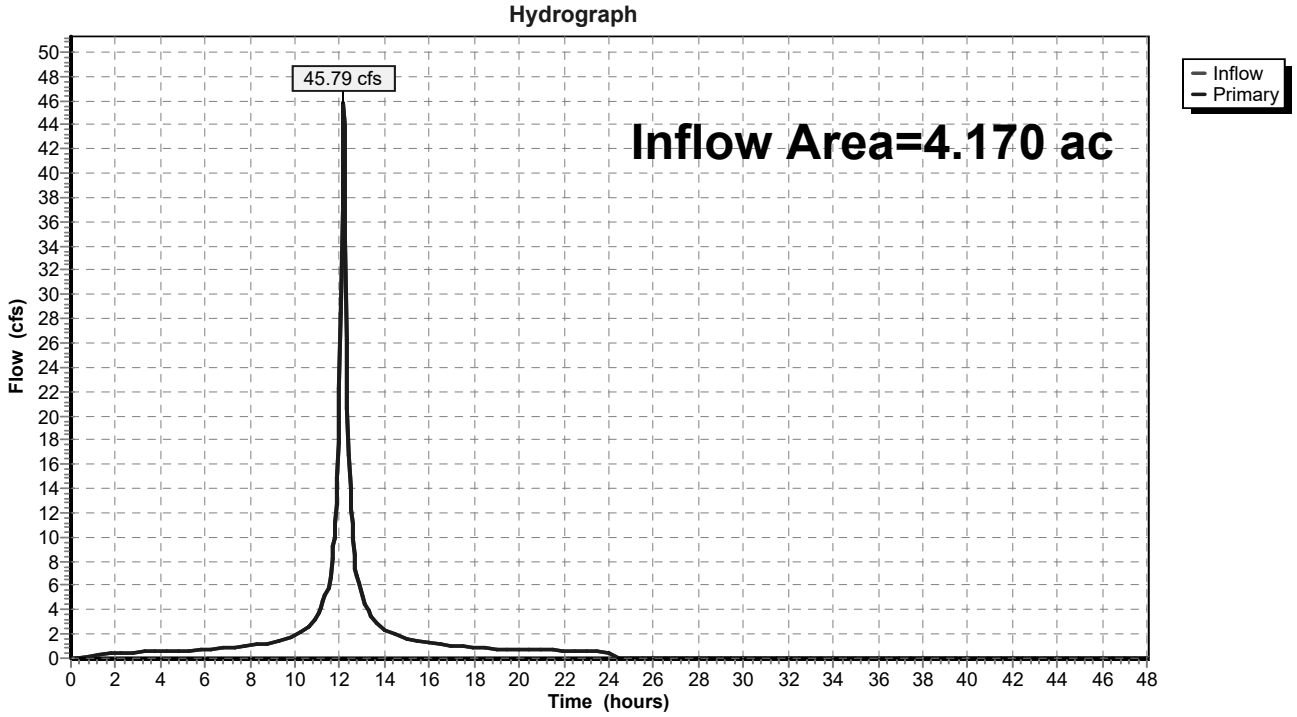


Summary for Link 10L: PDA - 1

Inflow Area = 4.170 ac, 82.73% Impervious, Inflow Depth = 11.53" for 100-Year+150% event
Inflow = 45.79 cfs @ 12.17 hrs, Volume= 4.008 af
Primary = 45.79 cfs @ 12.17 hrs, Volume= 4.008 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 10L: PDA - 1



APPENDIX E

Pipe Calculations for Stormwater Conveyance System & HGL Profiles

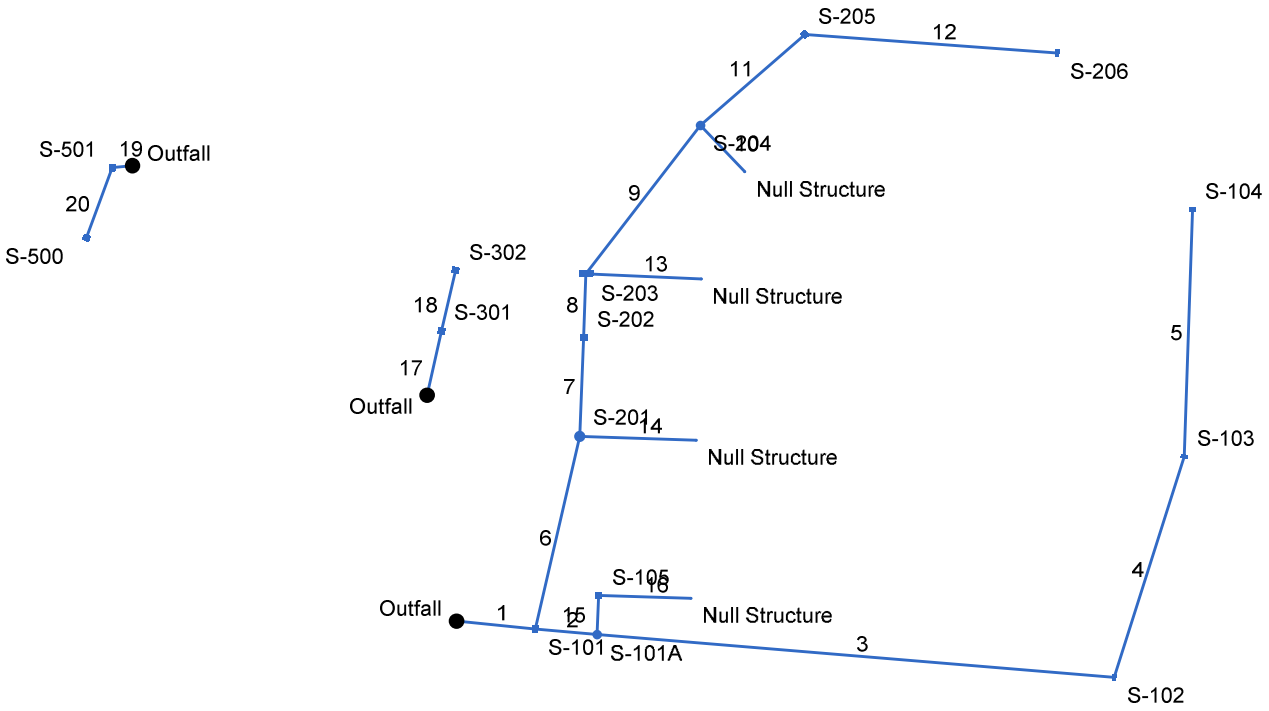
Elizabeth Realty Partners LLC
Block 507.14, Lot 61
Township of Franklin
Job No. 19000649A

10/26/20

INLET DRAINAGE AREA
COMPOSITE "C" CALCULATIONS

DESCRIPTION	TOTAL	IMP. AREA (SF)	HSG C (LAWN)	HSG C (WOODS)	COMPOSITE	CHECK	
(Inlet or Manhole #)	AREA (SF)	0.99	0.51	0.45	"C"	SUM	CHECK?
WET POND							OK
IDA-104	0.48	0.07	0.11	0.30	0.54	0.48	OK
IDA-103	0.60	0.10	0.13	0.37	0.55	0.60	OK
IDA-102	0.20	0.07	0.13		0.68	0.20	OK
IDA-105	0.21	0.12	0.09		0.78	0.21	OK
IDA-101	0.03	0.03	0.00		0.99	0.03	OK
IDA-206	0.12	0.06	0.06		0.75	0.12	OK
IDA-205	0.22	0.19	0.03		0.92	0.22	OK
IDA-203	0.16	0.14	0.02		0.93	0.16	OK
IDA-202	0.02	0.01	0.01		0.75	0.02	OK
IDA-302	0.05	0.05			0.99	0.05	OK
IDA-301	0.02	0.02			0.99	0.02	OK
IDA-500	0.11	0.10	0.01		0.95	0.11	OK
IDA-501	0.10	0.09	0.01		0.94	0.10	OK
IDA-RR-1	0.30	0.30			0.99	0.30	OK
IDA-RR-2	0.60	0.60			0.99	0.60	OK
IDA-RR-3	0.60	0.60			0.99	0.60	OK
IDA-RR-4	0.26	0.26			0.99	0.26	OK
CC-1	0.21	0.21			0.99	0.21	OK
CC-2	0.36	0.34	0.02		0.96	0.36	OK

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: 201102_Proposed Storm.stm	Number of lines: 20	Date: 11/2/2020

MC RPRT_A

Line No.	Line ID	Inlet ID	Drng Area (ac)	Runoff Coeff (C)	Tc (min)	i Sys (in/hr)	Q Capt (cfs)	Total Runoff (cfs)	Capac Full (cfs)	Vel Ave (ft/s)	Line Type	n-val Pipe	Line Size (in)	Line Slope (%)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)
1	P-101	S-101	0.03	0.99	14.1	5.05	0.17	15.73	22.67	5.01	Cir	0.013	24	1.00	48	68.98	68.50	74.47	71.25
2	P-101A	S-101A	0.00	0.00	13.1	5.19	....	6.16	10.50	5.40	Cir	0.013	18	1.00	38	71.23	70.85	75.18	74.47
3	P-102	S-102	0.20	0.68	11.9	5.40	0.78	3.92	4.57	4.19	Cir	0.013	15	0.50	314	73.05	71.48	77.20	75.18
4	P-103	S-103	0.60	0.55	11.1	5.54	1.90	3.27	4.56	3.00	Cir	0.013	15	0.50	141	73.75	73.05	77.50	77.20
5	P-104	S-104	0.48	0.54	10.0	5.75	1.49	1.49	4.57	2.28	Cir	0.013	15	0.50	150	74.50	73.75	77.80	77.50
6	P-201	S-201	0.00	0.00	13.6	5.11	....	9.72	15.99	4.46	Cir	0.013	24	0.50	120	70.96	70.36	74.76	74.47
7	P-202	S-202	0.02	0.75	13.4	5.14	0.09	6.73	8.13	5.11	Cir	0.013	18	0.60	60	71.82	71.46	75.58	74.76
8	P-203	S-203	0.16	0.93	13.3	5.17	0.86	6.68	8.08	4.49	Cir	0.013	18	0.59	39	72.05	71.82	76.48	75.58
9	P-204	S-204	0.00	0.00	12.3	5.33	....	2.93	7.43	1.84	Cir	0.013	18	0.50	114	72.62	72.05	78.48	76.48
10	P-209	Null Structure	0.26	0.99	10.0	5.75	....	1.48	2.41	4.65	Cir	0.012	10	1.04	39	74.00	73.60	0.00	78.48
11	P-205	S-205	0.22	0.92	11.6	5.45	1.16	1.59	4.57	2.14	Cir	0.013	15	0.50	84	73.29	72.87	76.99	78.48
12	P-206	S-206	0.12	0.75	10.0	5.75	0.52	0.52	4.55	1.59	Cir	0.013	15	0.50	153	74.05	73.29	77.32	76.99
13	P-208	Null Structure	0.60	0.99	10.0	5.75	....	3.42	3.94	5.65	Cir	0.012	12	1.04	70	74.00	73.27	0.00	76.48
14	P-207A	Null Structure	0.60	0.99	10.0	5.75	....	3.42	3.93	5.63	Cir	0.012	12	1.04	70	74.00	73.27	0.00	74.76
15	P-105	S-105	0.21	0.78	10.2	5.71	0.94	2.63	4.96	4.10	Cir	0.012	15	0.50	24	71.75	71.63	74.70	75.18
16	P-106	Null Structure	0.30	0.99	10.0	5.75	....	1.71	2.42	4.80	Cir	0.012	10	1.04	56	72.75	72.17	0.00	74.70
17	P-301	S-301	0.02	0.99	12.7	5.26	0.11	0.36	4.56	0.30	Cir	0.013	15	0.50	40	68.70	68.50	74.99	70.44
18	P-302	S-302	0.05	0.99	10.0	5.75	0.28	0.28	4.58	0.23	Cir	0.013	15	0.50	38	68.89	68.70	74.39	74.99
19	P-501	S-501	0.10	0.94	10.3	5.69	0.54	1.13	7.32	3.00	Cir	0.013	18	0.49	12	62.51	62.45	69.77	64.16
20	P-500	S-500	0.11	0.95	10.0	5.75	0.60	0.60	7.47	2.52	Cir	0.013	18	0.51	45	66.14	65.91	69.09	69.77

Project File: New.stm | Number of lines: 20 | Date: 11/2/2020

NOTES: Intensity = 54.48 / (Inlet time + 11.00) ^ 0.74 -- Return period = 25 Yrs. ; ** Critical depth

MC-RPRT_B

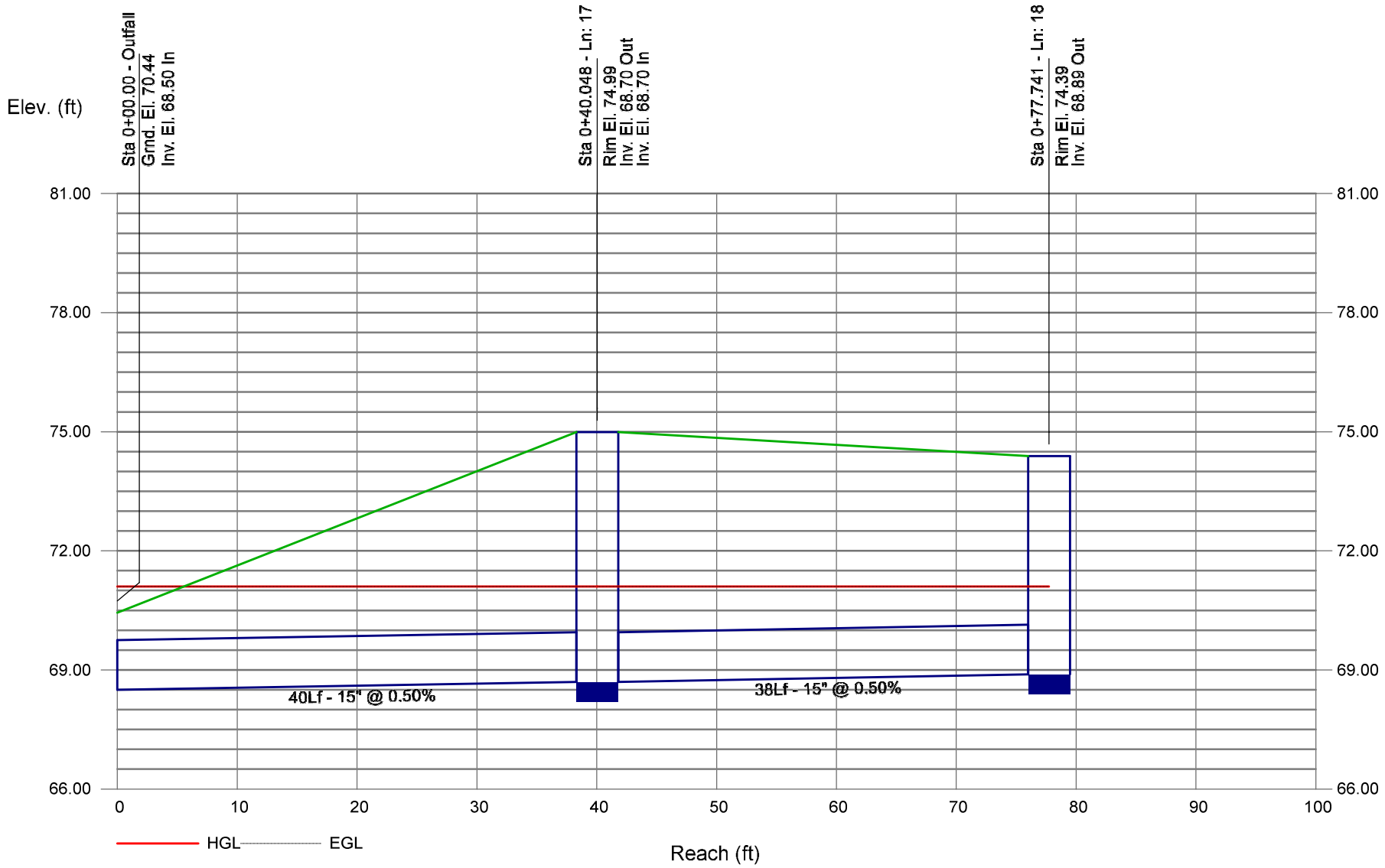
Line No.	Line ID	Inlet ID	Total Runoff (cfs)	Capac Full (cfs)	Vel Up (ft/s)	Vel Dn (ft/s)	Line Size (in)	Line Slope (%)	Line Length (ft)	Invert Up (ft)	Invert Dn (ft)	Gnd/Rim El Up (ft)	Gnd/Rim El Dn (ft)	HGL Up (ft)	HGL Dn (ft)	Cover Up (ft)	Cover Dn (ft)	
1	P-101	S-101	15.73	22.67	5.01	5.01	24	1.00	48	68.98	68.50	74.47	71.25	71.33	71.10	3.49	0.75	
2	P-101A	S-101A	6.16	10.50	6.18	4.62	18	1.00	38	71.23	70.85	75.18	74.47	72.06 j	71.91	2.45	2.12	
3	P-102	S-102	3.92	4.57	4.19	4.18	15	0.50	314	73.05	71.48	77.20	75.18	73.94	72.37	2.90	2.45	
4	P-103	S-103	3.27	4.56	3.34	2.66	15	0.50	141	73.75	73.05	77.50	77.20	74.68	74.34	2.50	2.90	
5	P-104	S-104	1.49	4.57	3.16	1.40	15	0.50	150	74.50	73.75	77.80	77.50	75.01	74.77	2.05	2.50	
6	P-201	S-201	9.72	15.99	5.21	3.72	24	0.50	120	70.96	70.36	74.76	74.47	72.11	71.91	1.80	2.11	
7	P-202	S-202	6.73	8.13	5.20	5.03	18	0.60	60	71.82	71.46	75.58	74.76	72.85	72.52	2.26	1.80	
8	P-203	S-203	6.68	8.08	4.71	4.27	18	0.59	39	72.05	71.82	76.48	75.58	73.17	73.06	2.93	2.26	
9	P-204	S-204	2.93	7.43	2.03	1.66	18	0.50	114	72.62	72.05	78.48	76.48	73.76	73.69	4.36	2.93	
10	P-209	Null Structure	1.48	2.41	4.65	4.65	10	1.04	39	74.00	73.60	0.00	78.48	74.47	74.07	n/a	4.04	
11	P-205	S-205	1.59	4.57	2.70	1.58	15	0.50	84	73.29	72.87	76.99	78.48	73.90	73.83	2.45	4.36	
12	P-206	S-206	0.52	4.55	2.49	0.69	15	0.50	153	74.05	73.29	77.32	76.99	74.33	74.02	2.02	2.45	
13	P-208	Null Structure	3.42	3.94	5.65	5.65	12	1.04	70	74.00	73.27	0.00	76.48	74.72	73.99	n/a	2.21	
14	P-207A	Null Structure	3.42	3.93	5.63	5.63	12	1.04	70	74.00	73.27	0.00	74.76	74.72	73.99	n/a	0.49	
15	P-105	S-105	2.63	4.96	4.10	4.10	15	0.50	24	71.75	71.63	74.70	75.18	72.40	72.28	1.70	2.30	
16	P-106	Null Structure	1.71	2.42	4.80	4.80	10	1.04	56	72.75	72.17	0.00	74.70	73.27	72.69	n/a	1.70	
17	P-301	S-301	0.36	4.56	0.30	0.30	15	0.50	40	68.70	68.50	74.99	70.44	71.10	71.10	5.04	0.69	
18	P-302	S-302	0.28	4.58	0.23	0.23	15	0.50	38	68.89	68.70	74.39	74.99	71.10	71.10	4.25	5.04	
19	P-501	S-501	1.13	7.32	2.99	3.02	18	0.49	12	62.51	62.45	69.77	64.16	62.91	62.85	5.76	0.21	
20	P-500	S-500	0.60	7.47	2.50	2.53	18	0.51	45	66.14	65.91	69.09	69.77	66.43	66.20	1.45	2.36	

Project File: New.stm | Number of lines: 20 | Date: 11/2/2020

NOTES: ** Critical depth

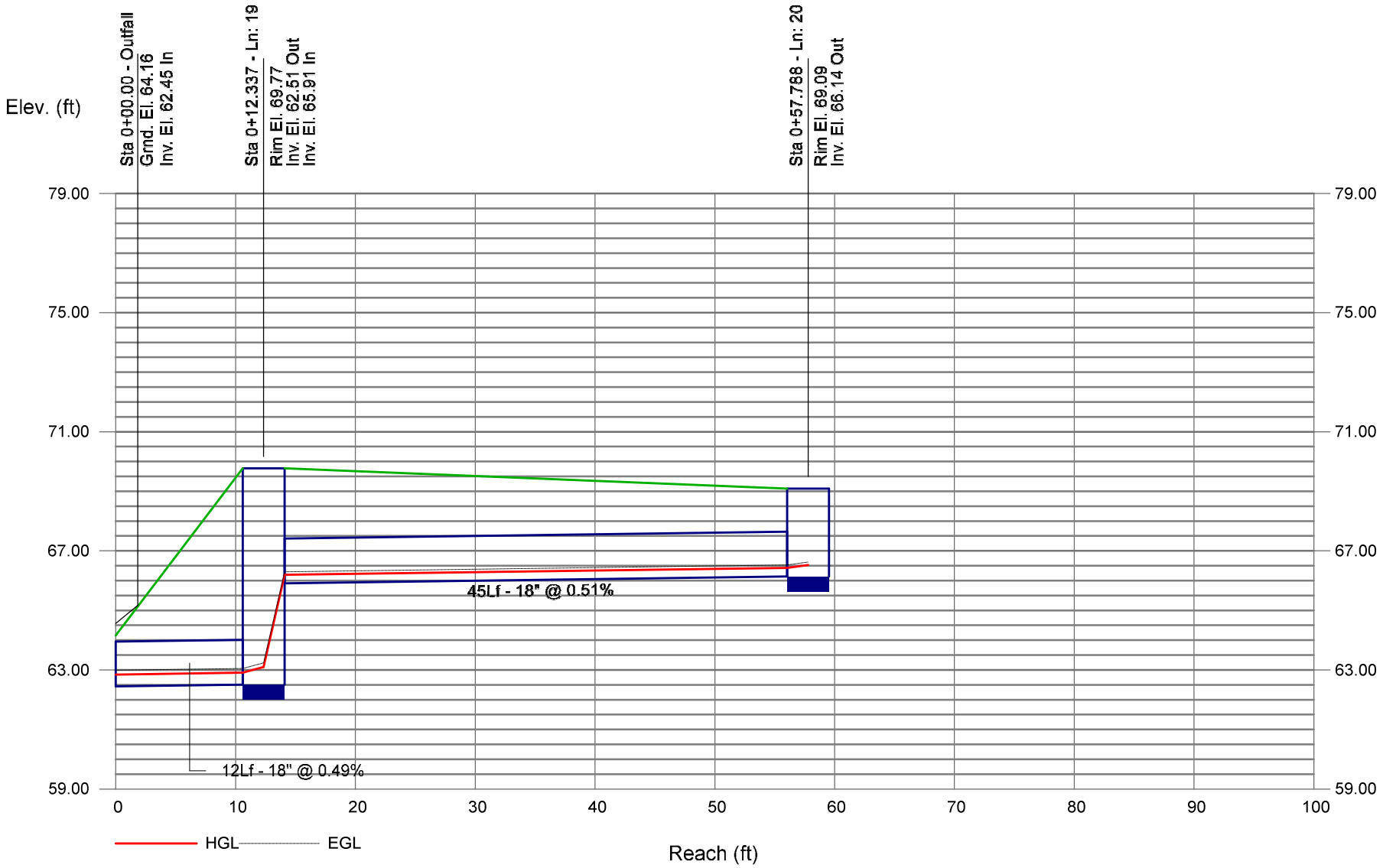
Storm Sewer Profile

Proj. file: New.stm



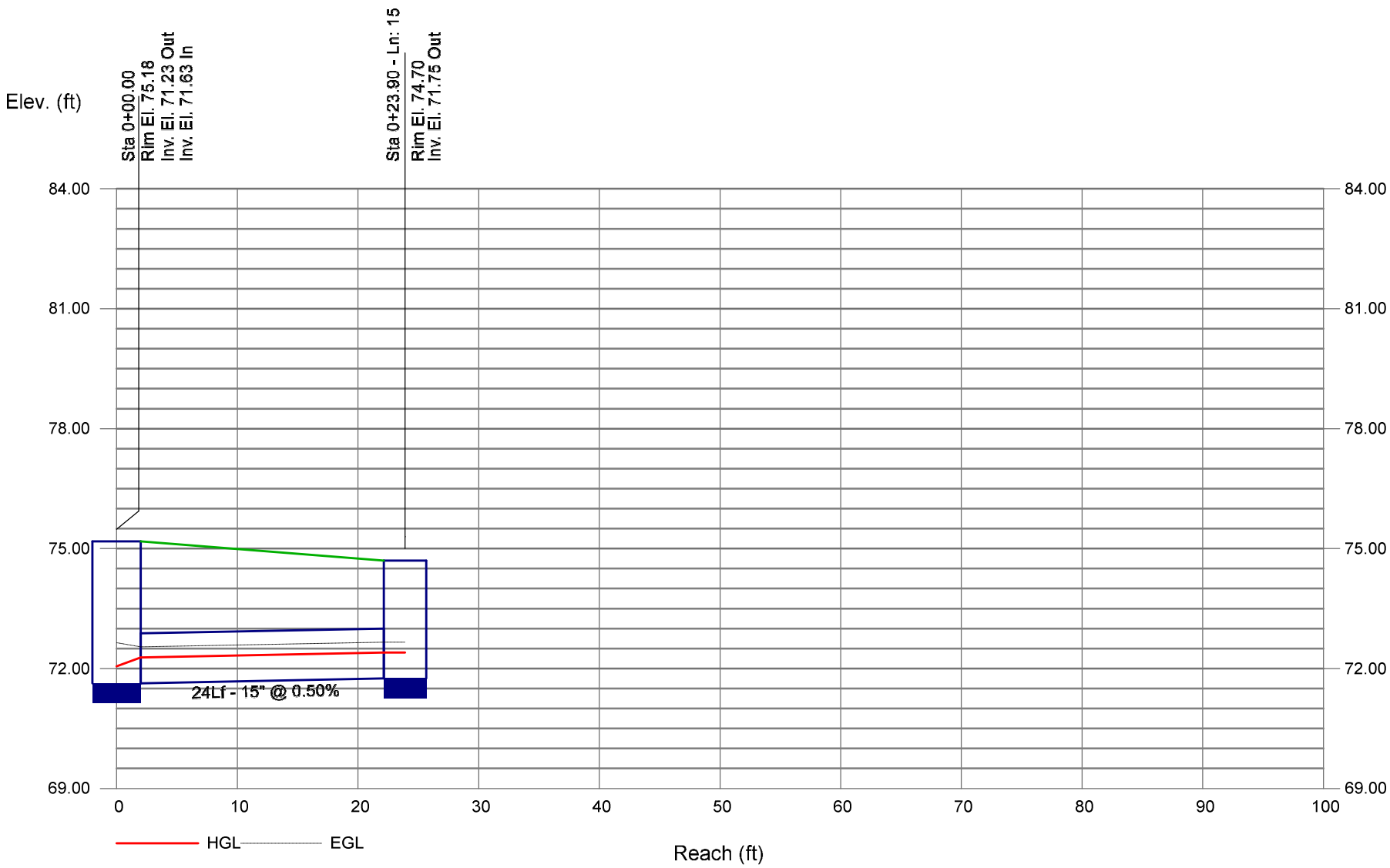
Storm Sewer Profile

Proj. file: New.stm



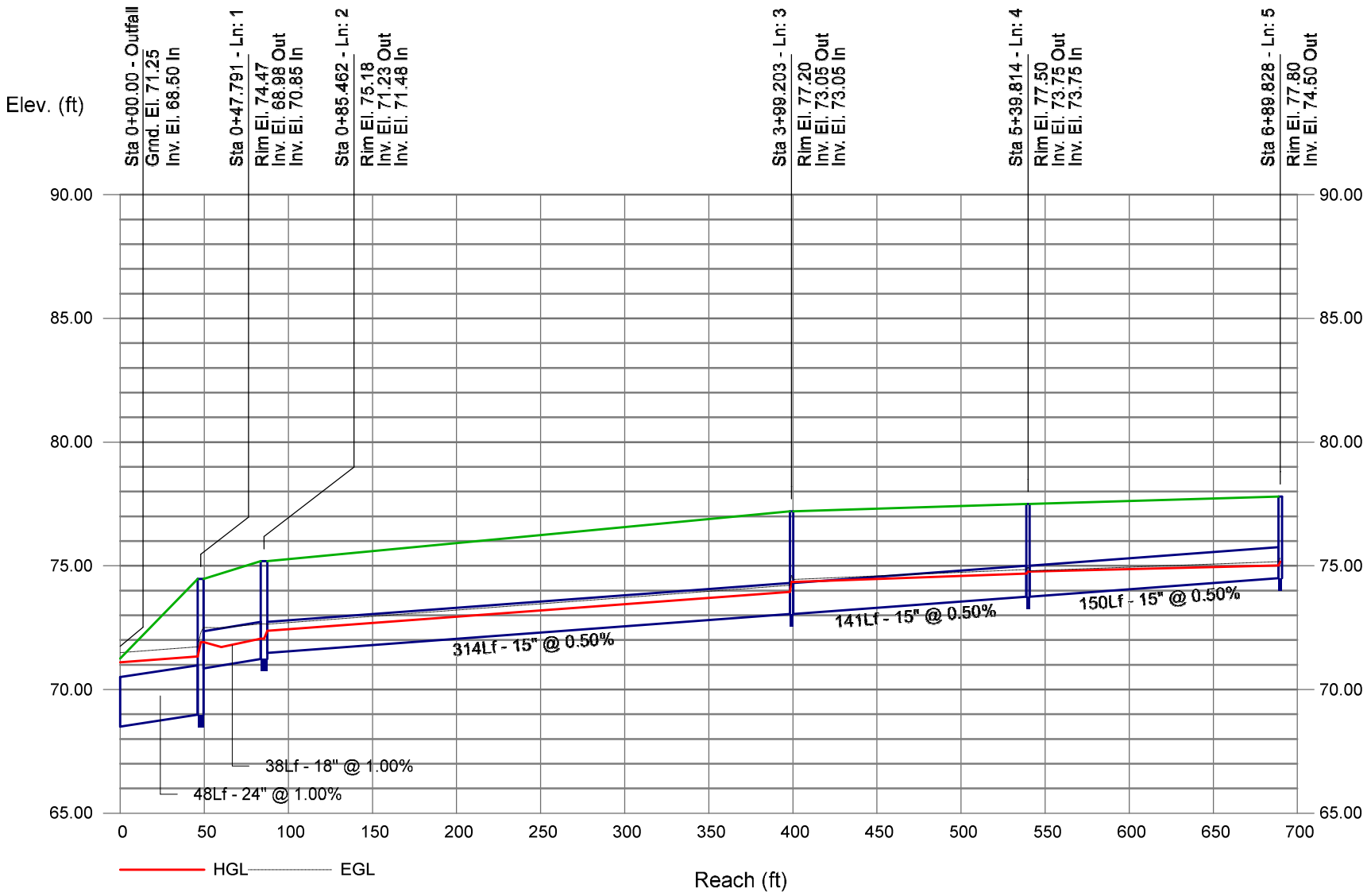
Storm Sewer Profile

Proj. file: New.stm



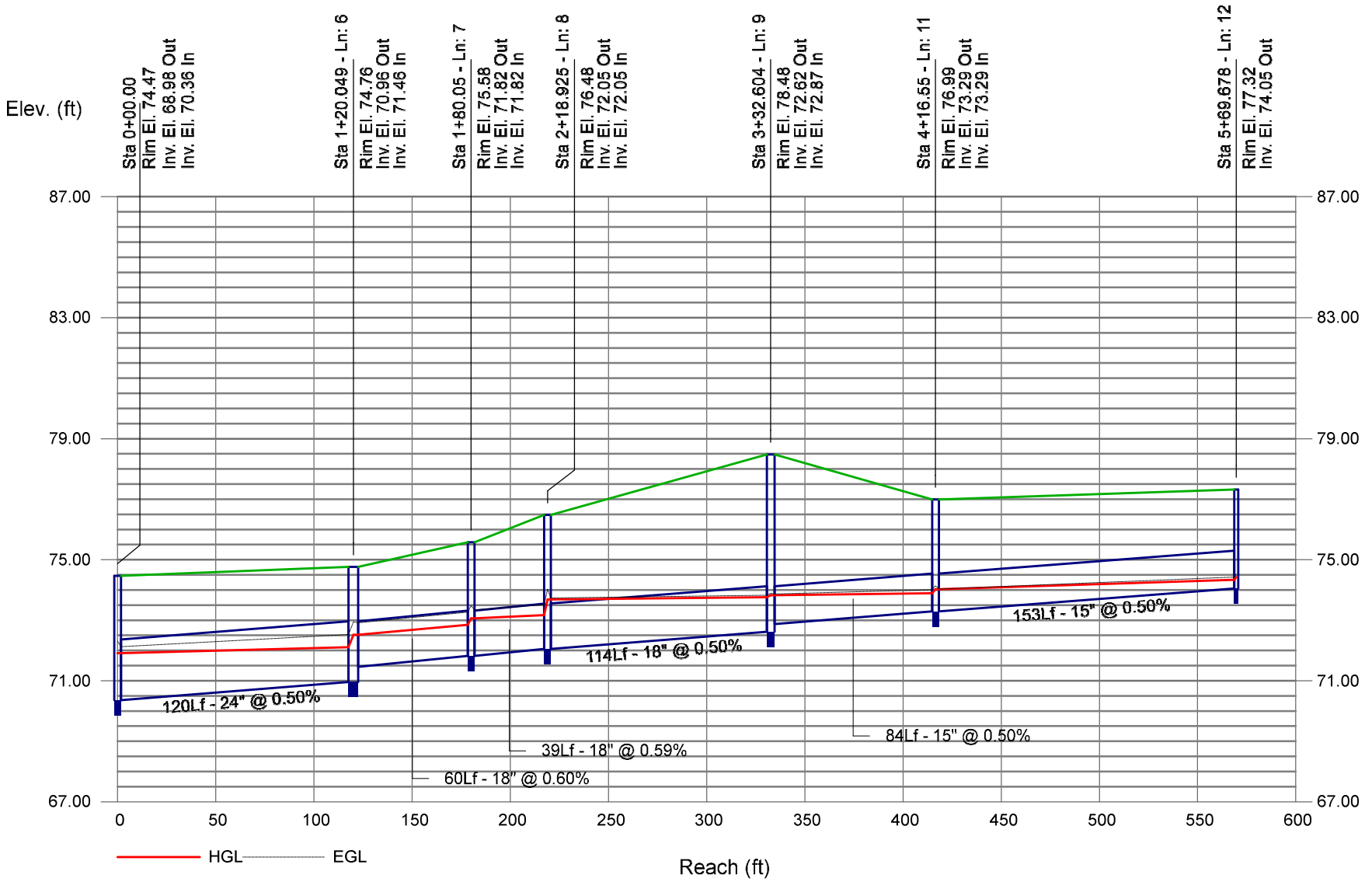
Storm Sewer Profile

Proj. file: New.stm



Storm Sewer Profile

Proj. file: New.stm



APPENDIX F

Conduit Outlet Protection & Curb Cut Calculaitons

CONDUIT OUTLET PROTECTION

Project: Elizabeth Realty Partners LLC Calc. By: MSB Date: 10/26/2020

Location: Franklin Township (Somerset) Checked By: MSY Date:

Outlet #	Do, Outlet Dia. (ft)	Q (cfs)	TW (ft)	q=Q/Do	La (ft)	Width at outlet (3xDo) (ft)	W, Width at end (ft)	d50 (in)	COMMENTS
HW - S-100	2	15.73	2.59	7.87	17	6	12.8	3	THICKNESS = 6"
	q=15.73/2 =7.87	La=3(7.87)/2^0.5 =16.69 use 17'				W= 3(2)+0.4(17)=12.8'		D50 =0.016(7.77^1.33)/2.59 =.094'=1.13" Use 3"	
HW - S-300	1.25	0.36	2.59	0.29	4	3.75	5.4	3	THICKNESS = 6"
	q=0.36/1.25 =0.29	La=3(0.29)/1.25^0.5 =0.83 use 4'				W= 3(1.5)+0.4(4)=5.4		D50 =0.016(0.29^1.33)/2.59 =0.001'=0.02" Use 3"	

DESIGN IN ACCORDANCE WITH STANDARD FOR SOIL EROSION AND SEDIMENT CONTROL IN NEW JERSEY.

FOR TW<0.5 Do (FT):

La = (1.8 x q)/(Do^0.5)+7(Do)

W=3Do+La

FOR TW≥1/2 Do(FT):

La = (3 x q)/(Do^0.5)

W=3Do+0.4La

RIPRAP (FT):

$d50=(0.016/TW)(q)^{\wedge 1.33}$

Do-DIAMETER OF OUTLET, FT.

Q-DESIGN STORM DISCHARGE, CFS

q=Q/Do

La-LENGTH OF APRON, FT.

W-WIDTH OF APRON, FT.

d50-MEDIAN STONE SIZE, FT.

TW-TAILWATER DEPTH, FT

TAILWATER MEASUREMENTS:

TW=0.2Do FOR DISCHARGE ABOVE FLOOD ELEVATION.

TW=(2 yr FLOOD ELEV.)-(INVERT ELEV.)

DRAINAGE CALCULATIONS

MADE BY: MSB DATE: 10/30/20

REV. BY: _____ DATE: _____

PROJECT Elizabeth Ave

PROJ. NO. 19000649A

Scour Hole Conduit Outlet Protection Computation

Scour Hole Location	D_o (ft)	W_o (ft)	Q (cfs)	TW (ft)	Y (ft)	D_{50} (in)	3Do (ft)	2Wo (ft)	L (ft)	W (ft)	Stone Thickness
HW S-502	1.50	1.50	1.13	0.30	0.75	.3 inch	4.5	3.0	9.0	7.5	.7 inch
HW S-403	1.50	1.50	9.41	0.30	0.75	5.7 inch	4.5	3.0	9.0	7.5	11.5 inch

MASER CONSULTING P.A.
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PROJECT- ELIZABETH REALTY PARTNERS LLC
NUMBER- 19000649A
BY- MSB
DATE- 10/12/2020
REVISED-

Rip Rap Slope Protection Calculations - Rip Rap Slope Protection for Curb Cut #1

1. Peak Runoff Calculations

Runoff Coefficient, C=	0.99	
Rainfall Intensity, i=	5.01	inches/hour
Drainage Area, A=	0.21	Acres
10 Year Runoff, $Q_{(10)}$=	1.04	CFS

2. Riprap Calculations

Bottom Width, b=	5	ft
Bed Slope, S=	0.33	ft/ft
Unit Discharge, q=	0.21	CFS/ft

$D_{50}=[q(s)^{0.58}/3.93(10)^{-2}]^{1/1.89}$

Riprap Size, D_{50}=	1.7	inches

$n=0.047(D_{50}S)^{0.147}$

Mannings, n=	0.043	

$z=[n(q)/1.486(S)^{0.50}]^{3/5}$

Flow depth, z=	0.07	ft

3. Riprap Slope Protection Dimensions

Bottom Width, W=	5	ft
D50=	3	inches
Thickness, T=	6	inches
Channel Depth, Z=	0.5	ft

See Rip Rap Slope Protection Detail on Construction Details sheet.
See Inlet Area Map for contributory drainage area.

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PROJECT- ELIZABETH REALTY PARTNERS LLC
NUMBER- 19000649A
BY- MSB
DATE- 10/12/2020
REVISED-

Rip Rap Slope Protection Calculations - Rip Rap Slope Protection for Curb Cut #1

1. Peak Runoff Calculations

Runoff Coefficient, C=	0.99	
Rainfall Intensity, i=	5.01	inches/hour
Drainage Area, A=	0.36	Acres
10 Year Runoff, $Q_{(10)}$=	1.79	CFS

2. Riprap Calculations

Bottom Width, b=	5	ft
Bed Slope, S=	0.33	ft/ft
Unit Discharge, q=	0.36	CFS/ft

$D_{50}=[q(s)^{0.58}/3.93(10)^{-2}]^{1/1.89}$

Riprap Size, D_{50}=	2.3	inches

$n=0.047(D_{50}S)^{0.147}$

Mannings, n=	0.045	

$z=[n(q)/1.486(S)^{0.50}]^{3/5}$

Flow depth, z=	0.09	ft

3. Riprap Slope Protection Dimensions

Bottom Width, W=	5	ft
D50=	3	inches
Thickness, T=	6	inches
Channel Depth, Z=	0.5	ft

See Rip Rap Slope Protection Detail on Construction Details sheet.
See Inlet Area Map for contributory drainage area.

APPENDIX G

Soil Test Pit Logs and Permeability Results

MASER CONSULTING P.A.
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Project: **483 & 485 ELIZABETH AVENUE**
Location: **FRANKLIN TOWNSHIP, SOMERSET COUNTY, NJ**
Number: **19000649A**

TEST PIT TP-1

Date Started: **8/17/20**
Date Completed: **8/17/20**
Contractor: **Bob Viersma & Sons**
Operator: **Kevin Viersma**
Equipment: **Trackhoe**

Ground Surface Elevation (ft.): **73.2**
Datum: **TOPO**

Groundwater:	Depth (ft.)	Date
First Encountered ▽		
At Completion (0 Hrs.) ▼	**5**	**8/17/2020**
After Completion (≥ 24 Hrs.) ▼		

GRAPHIC LOG	MATERIAL DESCRIPTION		DEPTH (ft.)	ELEVATION (ft.)	REMARKS
		0.0	0.0	73.2	
	5YR 3/4 Silt Loam, 5% Gravel, Granular, Very Friable	0.58			
	2.5YR 4/4 Silt Loam, 40% Gravel, Subangular Blocky, Friable	1.75			
	5YR 4/3 Silt Loam, Subangular Blocky, Friable	2.5	2.5	70.7	
	2.5YR 4/4 Silty Clay Loam, 10% Gravel, Subangular Blocky, Friable	3.25			
	2.5YR 4/4 Silt Loam 90% Cobble, Massive, Firm with Many/Fine/Distinct 7.5YR 5/6 Redox (Densic)	5	5.0 ▼	68.2	
	2.5YR 4/4 Fractured Platy Rock Fragments with soil fillings (Paralithic)				
			7.5	65.7	
		8			
	Bottom of Test Pit at 8.0 Ft.				

Logged By: AY Checked By: MC

Notes: ESHWT: 39 inches

TEST PIT TP-1
PAGE 1 OF 1

MASER CONSULTING P.A.
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Project: **483 & 485 ELIZABETH AVENUE**
Location: **FRANKLIN TOWNSHIP, SOMERSET COUNTY, NJ**
Number: **19000649A**

TEST PIT TP-2

Date Started: **8/17/20**
Date Completed: **8/17/20**

Contractor: **Bob Viersma & Sons**
Operator: **Kevin Viersma**
Equipment: **Trackhoe**

Ground Surface Elevation (ft.): **73.5**
Datum: **TOPO**

Groundwater:	Depth (ft.)	Date
First Encountered ▽		
At Completion (0 Hrs.) ▼	**5**	**8/17/2020**
After Completion (≥ 24 Hrs.) ▼		

GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft.)	ELEVATION (ft.)	REMARKS
	5YR 3/3 Silt Loam, Granular, Very Friable	0.0	73.5	
		0.5		
	5YR 4/4 Silty Clay Loam, 5% Gravel, Subangular Blocky, Friable			
		1.25		
	2.5YR 4/4 Silt Loam 45% Gravel, Massive, Friable			
		1.83		
	2.5YR 4/4 Fractured Platy Rock Fragments with soil fillings (Paralithic)	2.5	71.0	
		5.0 ▼	68.5	
		7		

Bottom of Test Pit at 7.0 Ft.

Logged By: AY Checked By: MC

Notes:

TEST PIT TP-2
PAGE 1 OF 1

MASER CONSULTING P.A.
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Project: **483 & 485 ELIZABETH AVENUE**
Location: **FRANKLIN TOWNSHIP, SOMERSET COUNTY, NJ**
Number: **19000649A**

TEST PIT TP-3

Date Started: **8/17/20**
Date Completed: **8/17/20**

Contractor: **Bob Viersma & Sons**
Operator: **Kevin Viersma**
Equipment: **Trackhoe**

Ground Surface Elevation (ft.): **76.1**
Datum: **TOPO**

Groundwater:	Depth (ft.)	Date
First Encountered ▽		
At Completion (0 Hrs.) ▼	**7.5**	**8/17/2020**
After Completion (≥ 24 Hrs.) ▼		

GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft.)	ELEVATION (ft.)	REMARKS
		0.0	76.1	
	2.5YR 3/3 Silt Loam, Granular, Very Friable			
		0.5		
	2.5YR 4/4 Silt Loam, Subangular Blocky, Friable			
		1.5		
	5YR 5/4 Silt Loam, 5% Gravel, Subangular Blocky, Friable with Many/Fine/Distinct 7.5YR 5/6 Redox			
		2		
	2.5YR 3/4 Loam, 30% Gravel, Massive Very Firm (Densic)	2.5	73.6	
		3		
	2.5YR 4/4 Fractured Platy Rock Fragments with soil fillings (Paralithic)	5.0	71.1	
		7.5 ▼	68.6	
		8		
	Bottom of Test Pit at 8.0 Ft.			

Logged By: AY Checked By: MC

Notes: ESHWT: 20 inches

TEST PIT TP-3
PAGE 1 OF 1

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Project: **483 & 485 ELIZABETH AVENUE**
Location: **FRANKLIN TOWNSHIP, SOMERSET COUNTY, NJ**
Number: **19000649A**

TEST PIT TP-4

Date Started: **8/17/20**
Date Completed: **8/17/20**

Contractor: **Bob Viersma & Sons**
Operator: **Kevin Viersma**
Equipment: **Trackhoe**

Ground Surface Elevation (ft.): **74.3**
Datum: **TOPO**

Groundwater:	Depth (ft.)	Date
First Encountered ▽		
At Completion (0 Hrs.) ▼	**4.1**	**8/17/2020**
After Completion (≥ 24 Hrs.) ▼		

GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft.)	ELEVATION (ft.)	REMARKS
		0.0	74.3	
	2.5YR 4/4 Silt Loam, 10% Gravel, Granular, Very Friable	0.5		
	2.5YR 3/4 Silt Loam, 40% Gravel, Subangular Blocky, Friable	1.5		
	5YR 4/3 Silt Loam, 5% Gravel, Subangular Blocky,Friable	2		
	5YR 4/4 Silty Clay Loam 5% Gravel, Subangular Blocky, Friable with Many/Fine/Faint 7.5YR 5/6 Redox	2.5	71.8	
	2.5YR 4/4 Fractured Platy Rock Fragments with soil fillings (Paralithic)	3		
		5.0	69.3	
		7.5	66.8	
		8		

Bottom of Test Pit at 8.0 Ft.

Logged By: AY Checked By: MC

Notes: ESHWT: 24 inches

TEST PIT TP-4
PAGE 1 OF 1

TEST PIT TP-5

MASER CONSULTING P.A.
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Project: **483 & 485 ELIZABETH AVENUE**
Location: **FRANKLIN TOWNSHIP, SOMERSET COUNTY, NJ**
Number: **19000649A**

Date Started: **8/17/20**
Date Completed: **8/17/20**

Contractor: **Bob Viersma & Sons**
Operator: **Kevin Viersma**
Equipment: **Trackhoe**

Ground Surface Elevation (ft.): **81**
Datum: **TOPO**

Groundwater:	Depth (ft.)	Date
First Encountered ▽		
At Completion (0 Hrs.) ▼	**7.7**	**8/17/2020**
After Completion (≥ 24 Hrs.) ▼		

GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft.)	ELEVATION (ft.)	REMARKS
		0.0	81.0	
	5YR 2.5/1 Silt Loam, Granular, Very Friable	0.5		
	7.5YR 5/4 Silt Loam 5% Gravel, Subangular Blocky, Friable	1.58		
	5YR 5/4 Fractured Platy Shale with 2% Soil Fillings	2.5	78.5	
		5.0	76.0	
		7.5	73.5	
		10	10.0	71.0

Bottom of Test Pit at 10.0 Ft.

Logged By: AY Checked By: MC

Notes:

TEST PIT TP-5
PAGE 1 OF 1

TEST PIT TP-6

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Project: **483 & 485 ELIZABETH AVENUE**
Location: **FRANKLIN TOWNSHIP, SOMERSET COUNTY, NJ**
Number: **19000649A**

Date Started: **8/17/20**
Date Completed: **8/17/20**

Contractor: **Bob Viersma & Sons**
Operator: **Kevin Viersma**
Equipment: **Trackhoe**

Ground Surface Elevation (ft.): **81**
Datum: **TOPO**

Groundwater:	Depth (ft.)	Date
First Encountered ▽		
At Completion (0 Hrs.) ▼	**6.2**	**8/17/2020**
After Completion (≥ 24 Hrs.) ▼		

GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft.)	ELEVATION (ft.)	REMARKS
	5YR 2.5/1 Silt Loam, Granular, Very Friable	0.0	81.0	
	5YR 5/4 Silt Loam, 10% Gravel, Subangular Blocky, Friable	0.5		
	5YR 4/3 Silty Clay Loam, 10% Gravel, Subangular Blocky, Firm	2.5	78.5	
	5YR 5/4 Fractured Platy Shale with 2% Soil Fillings	5.0	76.0	
		6		
		7.5	73.5	
		10	10.0	71.0

Bottom of Test Pit at 10.0 Ft.

Logged By: AY Checked By: MC

Notes:

TEST PIT TP-6
PAGE 1 OF 1

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Project: **483 & 485 ELIZABETH AVENUE**
Location: **FRANKLIN TOWNSHIP, SOMERSET COUNTY, NJ**
Number: **19000649A**

TEST PIT TP-7

Date Started: **8/17/20**
Date Completed: **8/17/20**

Contractor: **Bob Viersma & Sons**
Operator: **Kevin Viersma**
Equipment: **Trackhoe**

Ground Surface Elevation (ft.): **78.3**
Datum: **TOPO**

Groundwater:	Depth (ft.)	Date
First Encountered ▽		
At Completion (0 Hrs.) ▼	**NE**	**8/17/2020**
After Completion (≥ 24 Hrs.) ▼		

GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft.)	ELEVATION (ft.)	REMARKS
	5YR 3/4 Silt Loam, Granular, Very Friable	0.0	78.3	
	0.5			
	5YR 4/4 Silty Clay Loam, 20% Gravel, 5% Cobble, Subangular Blocky, Friable			
	2			
	5YR 4/3 Loam, 20% Gravel, Subangular Blocky, Very Friable	2.5	75.8	
	5	5.0	73.3	
	2.5YR 4/4 Fractured Platy Rock Fragments with soil fillings (Paralithic)			
	6			

Bottom of Test Pit at 6.0 Ft.

Logged By: AY Checked By: MC

Notes:

TEST PIT TP-7
PAGE 1 OF 1

MASER CONSULTING P.A.
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Project: **483 & 485 ELIZABETH AVENUE**
Location: **FRANKLIN TOWNSHIP, SOMERSET COUNTY, NJ**
Number: **19000649A**

TEST PIT TP-8

Date Started: **8/17/20**
Date Completed: **8/17/20**

Contractor: **Bob Viersma & Sons**
Operator: **Kevin Viersma**
Equipment: **Trackhoe**

Ground Surface Elevation (ft.): **75.4**
Datum: **TOPO**

Groundwater:	Depth (ft.)	Date
First Encountered ▽		
At Completion (0 Hrs.) ▼	**NE**	**8/17/2020**
After Completion (≥ 24 Hrs.) ▼		

GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft.)	ELEVATION (ft.)	REMARKS
		0.0	75.4	
	5YR 4/4 Silt Loam, Granular, Very Friable	0.5		
	5YR 5/4 Silty Clay Loam, 10% Gravel, Subangular Blocky, Firm	2		
	2.5YR 4/4 Silt Loam, 50% Gravel, Massive, Friable	2.5	72.9	
		3		
	2.5YR 4/4 Fractured Platy Rock Fragments with soil fillings (Paralithic)	5.0	70.4	
		7.5	67.9	
		8		
	Bottom of Test Pit at 8.0 Ft.			

Logged By: AY Checked By: MC

Notes:

TEST PIT TP-8
PAGE 1 OF 1

MASER CONSULTING P.A.
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Project: **483 & 485 ELIZABETH AVENUE**
Location: **FRANKLIN TOWNSHIP, SOMERSET COUNTY, NJ**
Number: **19000649A**

TEST PIT TP-9

Date Started: **8/17/20**
Date Completed: **8/17/20**

Contractor: **Bob Viersma & Sons**
Operator: **Kevin Viersma**
Equipment: **Trackhoe**

Ground Surface Elevation (ft.): **78.3**
Datum: **TOPO**

Groundwater:	Depth (ft.)	Date
First Encountered ▽		
At Completion (0 Hrs.) ▼	**NE**	**8/17/2020**
After Completion (≥ 24 Hrs.) ▼		

GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft.)	ELEVATION (ft.)	REMARKS
		0.0	78.3	
	5YR 4/4 Silt Loam, Granular, Very Friable			
	0.42			
	2.5YR 4/4 Silty Clay Loam, 10% Gravel, Subangular Blocky, Friable			
	1.25			
	2.5YR 3/4 Loam, 50% Gravel, 20 % Cobble, Massive, Firm (Densic)	2.5	75.8	
		5.0	73.3	
	6			
	2.5YR 4/4 Fractured Platy Rock Fragments with soil fillings (Paralithic)			
	6.5			

Bottom of Test Pit at 6.5 Ft.

Logged By: AY Checked By: MC

Notes:

TEST PIT TP-9
PAGE 1 OF 1

TEST PIT TP-10

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Project: **483 & 485 ELIZABETH AVENUE**
Location: **FRANKLIN TOWNSHIP, SOMERSET COUNTY, NJ**
Number: **19000649A**

Date Started: **8/17/20**
Date Completed: **8/17/20**

Contractor: **Bob Viersma & Sons**
Operator: **Kevin Viersma**
Equipment: **Trackhoe**

Ground Surface Elevation (ft.): **79.8**
Datum: **TOPO**

Groundwater:	Depth (ft.)	Date
First Encountered ▽		
At Completion (0 Hrs.) ▼	**NE**	**8/17/2020**
After Completion (≥ 24 Hrs.) ▼		

GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft.)	ELEVATION (ft.)	REMARKS
		0.0	79.8	
	5YR 3/3 Silt Loam, 5% Gravel, Granular, Very Friable	0.42		
	5YR 5/4 Silt Loam, 5% Gravel, Platy, Friable	1		
	2.5YR 4/4 Silty Clay Loam, 20% Gravel, 5% Cobble, Subangular Blocky, Friable	1.67		
	2.5YR 3/4 Silt Loam, 90% Cobble, Massive, Very Firm (Densic)	2.5	77.3	
		5.0	74.8	
		6		

Bottom of Test Pit at 6.0 Ft.

Logged By: AY Checked By: MC

Notes:

TEST PIT TP-10
PAGE 1 OF 1

TEST PIT TP-11

MASER CONSULTING P.A.
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Project: **483 & 485 ELIZABETH AVENUE**
Location: **FRANKLIN TOWNSHIP, SOMERSET COUNTY, NJ**
Number: **19000649A**

Date Started: **8/17/20**
Date Completed: **8/17/20**

Contractor: **Bob Viersma & Sons**
Operator: **Kevin Viersma**
Equipment: **Trackhoe**

Ground Surface Elevation (ft.): **80.8**
Datum: **TOPO**

Groundwater:	Depth (ft.)	Date
First Encountered ▽		
At Completion (0 Hrs.) ▼	**NE**	**8/17/2020**
After Completion (≥ 24 Hrs.) ▼		

GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft.)	ELEVATION (ft.)	REMARKS
		0.0	80.8	
	7.5YR 3/4 Silt Loam, 5% Gravel, Granular, Very Friable			
	0.42			
	5YR 4/4 Silty Clay Loam, 5% Gravel, Subangular Blocky, Friable			
	1			
	2.5YR 4/4 Silt Loam, 40% Gravel, 5% Cobble, Subangular Blocky, Friable			
	1.67			
	2.5YR 4/4 Fractured Platy Rock Fragments with soil fillings (Paralithic)			
		2.5	78.3	
		5.0	75.8	
	6			
	Bottom of Test Pit at 6.0 Ft.			

Logged By: AY Checked By: MC

Notes:

TEST PIT TP-11
PAGE 1 OF 1

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Project: **483 & 485 ELIZABETH AVENUE**
Location: **FRANKLIN TOWNSHIP, SOMERSET COUNTY, NJ**
Number: **19000649A**

TEST PIT TP-12

Date Started: **8/17/20**
Date Completed: **8/17/20**

Contractor: **Bob Viersma & Sons**
Operator: **Kevin Viersma**
Equipment: **Trackhoe**

Ground Surface Elevation (ft.): **85.3**
Datum: **TOPO**

Groundwater:	Depth (ft.)	Date
First Encountered ▽		
At Completion (0 Hrs.) ▼	**NE**	**8/17/2020**
After Completion (≥ 24 Hrs.) ▼		

GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (ft.)	ELEVATION (ft.)	REMARKS
	7.5YR 3/3 Silt Loam, 5% Gravel, Granular, Very Friable	0.0	85.3	
		0.5		
	5YR 5/6 Silt Loam, 20% Gravel, Subangular Blocky, Friable			
		1.67		
	2.5YR 4/4 Fractured Platy Rock Fragments with soil fillings (Paralithic)	2.5	82.8	
		5	5.0	80.3
	Bottom of Test Pit at 5.0 Ft.			

Logged By: AY Checked By: MC

Notes:

TEST PIT TP-12
PAGE 1 OF 1

APPENDIX B

TUBE PERMEAMETER TEST RESULTS

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-1A **Depth:** 7"

Visual Description of Soil (USCS): Brown red silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
14.7	4.96	2.875	121.7	106.1

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	128.5	2.142	19.0	0.78	1.025	0.80
2	90.0	80.0	10.0	125.1	2.086	19.0	0.80	1.025	0.82
3	90.0	80.0	10.0	129.8	2.163	19.0	0.77	1.025	0.79
4	80.0	70.0	10.0	191.6	3.194	19.0	0.59	1.025	0.61
5	80.0	70.0	10.0	194.6	3.243	19.0	0.58	1.025	0.60
6	80.0	70.0	10.0	192.7	3.212	19.0	0.59	1.025	0.61
7	70.0	60.0	10.0	293.8	4.897	18.4	0.45	1.041	0.47
8	70.0	60.0	10.0	295.7	4.928	18.4	0.44	1.041	0.46
9	70.0	60.0	10.0	299.7	4.995	18.4	0.44	1.041	0.46
10	60.0	50.0	10.0	383.5	6.391	18.0	0.40	1.051	0.43
11	60.0	50.0	10.0	388.9	6.481	18.0	0.40	1.051	0.42
12	60.0	50.0	10.0	383.9	6.398	18.0	0.40	1.051	0.43
13	50.0	40.0	10.0	553.6	9.226	18.0	0.34	1.051	0.36
14	50.0	40.0	10.0	558.4	9.306	18.0	0.34	1.051	0.36
15	50.0	40.0	10.0	557.5	9.291	18.0	0.34	1.051	0.36

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr):	**0.53**
SOIL PERMEABILITY CLASS:	**K1**

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

- Some localized gaps in soil due to gravel pieces and organic matter

Plate No.: TP-1

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-1B **Depth:** 7"

Visual Description of Soil (USCS): Brown red silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
14.7	4.48	2.875	118.2	103.1

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	21.7	0.362	19.0	4.18	1.025	4.29
2	90.0	80.0	10.0	21.6	0.361	19.0	4.19	1.025	4.30
3	90.0	80.0	10.0	21.6	0.360	19.0	4.20	1.025	4.31
4	80.0	70.0	10.0	35.9	0.598	19.0	2.87	1.025	2.94
5	80.0	70.0	10.0	35.6	0.593	19.0	2.89	1.025	2.96
6	80.0	70.0	10.0	35.7	0.595	19.0	2.88	1.025	2.95
7	70.0	60.0	10.0	45.5	0.758	19.0	2.61	1.025	2.68
8	70.0	60.0	10.0	45.5	0.758	19.0	2.61	1.025	2.68
9	70.0	60.0	10.0	45.6	0.759	19.0	2.61	1.025	2.67
10	60.0	50.0	10.0	52.8	0.879	19.0	2.66	1.025	2.73
11	60.0	50.0	10.0	52.9	0.882	19.0	2.66	1.025	2.72
12	60.0	50.0	10.0	52.8	0.879	19.0	2.66	1.025	2.73
13	50.0	40.0	10.0	64.1	1.068	19.0	2.68	1.025	2.75
14	50.0	40.0	10.0	64.2	1.070	19.0	2.68	1.025	2.75
15	50.0	40.0	10.0	64.2	1.070	19.0	2.68	1.025	2.75

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr):	**3.08**
SOIL PERMEABILITY CLASS:	**K3**

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

- Some localized gaps in soil due to gravel pieces and organic matter

Plate No.: TP-2

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-1A **Depth:** 30"

Visual Description of Soil (USCS): Brown red silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
22.7	4.83	2.875	123.5	100.6

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	4.2	0.069	19.7	23.52	1.008	23.70
2	90.0	80.0	10.0	4.3	0.071	19.7	23.03	1.008	23.20
3	90.0	80.0	10.0	4.3	0.071	19.7	22.92	1.008	23.09
4	80.0	70.0	10.0	5.8	0.096	19.7	19.30	1.008	19.44
5	80.0	70.0	10.0	5.9	0.098	19.7	18.93	1.008	19.08
6	80.0	70.0	10.0	5.8	0.097	19.7	19.16	1.008	19.31
7	70.0	60.0	10.0	7.8	0.130	19.7	16.46	1.008	16.59
8	70.0	60.0	10.0	8.0	0.133	19.7	16.01	1.008	16.13
9	70.0	60.0	10.0	8.2	0.136	19.7	15.66	1.008	15.78
10	60.0	50.0	10.0	10.0	0.167	19.7	15.15	1.008	15.26
11	60.0	50.0	10.0	10.3	0.172	19.7	14.65	1.008	14.76
12	60.0	50.0	10.0	10.2	0.171	19.7	14.81	1.008	14.92
13	50.0	40.0	10.0	14.3	0.239	19.7	12.96	1.008	13.05
14	50.0	40.0	10.0	14.1	0.235	19.7	13.16	1.008	13.26
15	50.0	40.0	10.0	14.7	0.245	19.7	12.60	1.008	12.69

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr):	**17.35**
SOIL PERMEABILITY CLASS:	**K4**

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

- Localized void along sample wall but did not extend full length of sample.

Plate No.: TP-3

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-1B **Depth:** 30"

Visual Description of Soil (USCS): Brown red silty/clayey SAND with gravel

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
25.5	5.04	2.875	125.0	99.6

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	16.1	0.268	19.6	6.34	1.010	6.40
2	90.0	80.0	10.0	16.2	0.271	19.6	6.28	1.010	6.34
3	90.0	80.0	10.0	16.3	0.271	19.6	6.26	1.010	6.32
4	80.0	70.0	10.0	21.4	0.357	19.4	5.39	1.015	5.47
5	80.0	70.0	10.0	21.4	0.356	19.4	5.41	1.015	5.49
6	80.0	70.0	10.0	21.4	0.357	19.4	5.39	1.015	5.47
7	70.0	60.0	10.0	26.4	0.441	19.4	5.05	1.015	5.12
8	70.0	60.0	10.0	26.5	0.441	19.4	5.04	1.015	5.12
9	70.0	60.0	10.0	26.5	0.442	19.4	5.03	1.015	5.11
10	60.0	50.0	10.0	31.4	0.523	19.3	5.03	1.018	5.12
11	60.0	50.0	10.0	31.2	0.520	19.3	5.05	1.018	5.14
12	60.0	50.0	10.0	31.3	0.521	19.3	5.05	1.018	5.13
13	50.0	40.0	10.0	39.4	0.656	19.2	4.91	1.020	5.00
14	50.0	40.0	10.0	39.2	0.654	19.2	4.92	1.020	5.02
15	50.0	40.0	10.0	39.4	0.656	19.2	4.91	1.020	5.00

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr):	**5.42**
SOIL PERMEABILITY CLASS:	**K3**

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

- Localized void along sample wall but did not extend full length of sample.

Plate No.: TP-4

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-2A **Depth:** 6"

Visual Description of Soil (USCS): Brown silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type: Undisturbed ☑ Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
27.5	5.02	2.875	110.6	86.8

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	12.8	0.213	18.7	7.97	1.033	8.23
2	90.0	80.0	10.0	12.8	0.213	18.7	7.97	1.033	8.23
3	90.0	80.0	10.0	12.8	0.214	18.7	7.93	1.033	8.19
4	80.0	70.0	10.0	16.1	0.268	18.7	7.18	1.033	7.41
5	80.0	70.0	10.0	16.2	0.269	18.7	7.13	1.033	7.37
6	80.0	70.0	10.0	16.2	0.269	18.7	7.14	1.033	7.37
7	70.0	60.0	10.0	19.4	0.323	18.9	6.87	1.028	7.06
8	70.0	60.0	10.0	19.4	0.323	18.9	6.87	1.028	7.06
9	70.0	60.0	10.0	19.4	0.324	18.9	6.85	1.028	7.04
10	60.0	50.0	10.0	23.2	0.387	18.9	6.78	1.028	6.96
11	60.0	50.0	10.0	23.3	0.388	18.9	6.76	1.028	6.95
12	60.0	50.0	10.0	23.3	0.389	18.9	6.75	1.028	6.94
13	50.0	40.0	10.0	30.6	0.510	19.0	6.30	1.025	6.45
14	50.0	40.0	10.0	30.6	0.509	19.0	6.30	1.025	6.46
15	50.0	40.0	10.0	30.6	0.510	19.0	6.30	1.025	6.46

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr):	**7.21**
SOIL PERMEABILITY CLASS:	**K4**

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

Plate No.: TP-5

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-2B **Depth:** 6"

Visual Description of Soil (USCS): Brown silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type: Undisturbed ☑ Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
30.9	4.90	2.875	111.6	85.3

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	29.0	0.484	18.7	3.41	1.033	3.52
2	90.0	80.0	10.0	29.9	0.498	18.7	3.32	1.033	3.43
3	90.0	80.0	10.0	29.8	0.497	18.7	3.32	1.033	3.43
4	80.0	70.0	10.0	37.2	0.620	18.9	3.02	1.028	3.10
5	80.0	70.0	10.0	37.2	0.621	18.9	3.02	1.028	3.10
6	80.0	70.0	10.0	37.3	0.622	18.9	3.01	1.028	3.10
7	70.0	60.0	10.0	54.6	0.909	18.6	2.38	1.036	2.46
8	70.0	60.0	10.0	54.6	0.910	18.6	2.38	1.036	2.46
9	70.0	60.0	10.0	54.6	0.909	18.6	2.38	1.036	2.46
10	60.0	50.0	10.0	64.4	1.074	18.5	2.38	1.038	2.47
11	60.0	50.0	10.0	64.5	1.075	18.5	2.38	1.038	2.47
12	60.0	50.0	10.0	64.5	1.076	18.5	2.38	1.038	2.47
13	50.0	40.0	10.0	93.9	1.565	18.4	2.00	1.041	2.08
14	50.0	40.0	10.0	93.9	1.565	18.4	2.00	1.041	2.08
15	50.0	40.0	10.0	94.0	1.566	18.4	2.00	1.041	2.08

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr): 2.71

SOIL PERMEABILITY CLASS: K3

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

Plate No.: TP-6

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-3A **Depth:** 5"

Visual Description of Soil (USCS): Brown red silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
17.9	4.81	2.875	107.1	90.9

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	62.7	1.045	19.0	1.55	1.025	1.59
2	90.0	80.0	10.0	61.8	1.029	19.0	1.58	1.025	1.62
3	90.0	80.0	10.0	62.8	1.046	19.0	1.55	1.025	1.59
4	80.0	70.0	10.0	84.3	1.404	18.9	1.31	1.028	1.35
5	80.0	70.0	10.0	82.1	1.369	18.9	1.34	1.028	1.38
6	80.0	70.0	10.0	83.4	1.390	18.9	1.32	1.028	1.36
7	70.0	60.0	10.0	88.7	1.478	18.8	1.44	1.030	1.48
8	70.0	60.0	10.0	79.2	1.320	18.8	1.61	1.030	1.66
9	70.0	60.0	10.0	79.4	1.324	18.8	1.60	1.030	1.65
10	60.0	50.0	10.0	93.9	1.565	18.7	1.61	1.033	1.66
11	60.0	50.0	10.0	93.3	1.555	18.7	1.62	1.033	1.67
12	60.0	50.0	10.0	92.5	1.541	18.7	1.63	1.033	1.68
13	50.0	40.0	10.0	118.6	1.977	18.6	1.56	1.036	1.61
14	50.0	40.0	10.0	116.1	1.935	18.6	1.59	1.036	1.65
15	50.0	40.0	10.0	117.5	1.959	18.6	1.57	1.036	1.63

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr):	**1.57**
SOIL PERMEABILITY CLASS:	**K2**

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-3B **Depth:** 5"

Visual Description of Soil (USCS): Brown red silty/clayey SAND with gravel and trace organics

Technician: K. Perry

Proctor Data:

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
18.7	4.85	2.875	108.4	91.3

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	2.2	0.037	19.6	44.86	1.010	45.31
2	90.0	80.0	10.0	2.2	0.036	19.6	45.48	1.010	45.94
3	90.0	80.0	10.0	2.2	0.037	19.6	44.26	1.010	44.70
4	80.0	70.0	10.0	2.5	0.041	19.5	45.09	1.013	45.66
5	80.0	70.0	10.0	2.4	0.039	19.5	47.40	1.013	47.99
6	80.0	70.0	10.0	2.4	0.040	19.5	46.22	1.013	46.80
7	70.0	60.0	10.0	2.9	0.049	19.4	44.19	1.015	44.85
8	70.0	60.0	10.0	2.8	0.047	19.4	45.28	1.015	45.96
9	70.0	60.0	10.0	2.9	0.048	19.4	44.80	1.015	45.48
10	60.0	50.0	10.0	3.2	0.053	19.0	48.28	1.025	49.50
11	60.0	50.0	10.0	3.1	0.052	19.0	48.59	1.025	49.81
12	60.0	50.0	10.0	3.2	0.053	19.0	47.67	1.025	48.88
13	50.0	40.0	10.0	3.7	0.062	19.0	50.04	1.025	51.30
14	50.0	40.0	10.0	3.7	0.062	19.0	50.31	1.025	51.57
15	50.0	40.0	10.0	3.7	0.061	19.0	50.58	1.025	51.85

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr): 47.7

SOIL PERMEABILITY CLASS: K5

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

- Localized void along sample wall but did not extend full length of sample.
- Sample was very loose inside of the tube. Sample able to slide up and down within the tube during preparation.

Plate No.: TP-8

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-4A **Depth:** 6"

Visual Description of Soil (USCS): Brown red silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
17.0	4.37	2.875	127.2	108.7

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	4.6	0.076	19.0	19.38	1.025	19.86
2	90.0	80.0	10.0	4.7	0.078	19.0	19.00	1.025	19.48
3	90.0	80.0	10.0	4.7	0.079	19.0	18.76	1.025	19.23
4	80.0	70.0	10.0	8.2	0.137	19.0	12.23	1.025	12.54
5	80.0	70.0	10.0	8.2	0.137	19.0	12.26	1.025	12.57
6	80.0	70.0	10.0	8.3	0.138	19.0	12.17	1.025	12.48
7	70.0	60.0	10.0	9.2	0.153	18.9	12.67	1.028	13.02
8	70.0	60.0	10.0	9.2	0.154	18.9	12.56	1.028	12.90
9	70.0	60.0	10.0	9.2	0.153	18.9	12.62	1.028	12.97
10	60.0	50.0	10.0	10.2	0.169	18.9	13.50	1.028	13.88
11	60.0	50.0	10.0	10.2	0.170	18.9	13.48	1.028	13.85
12	60.0	50.0	10.0	10.1	0.168	18.9	13.57	1.028	13.95
13	50.0	40.0	10.0	12.9	0.216	18.9	12.97	1.028	13.33
14	50.0	40.0	10.0	13.0	0.216	18.9	12.92	1.028	13.28
15	50.0	40.0	10.0	12.9	0.215	18.9	12.98	1.028	13.34

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr): 14.45

SOIL PERMEABILITY CLASS: K4

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

- Large stone at top of sample.

Plate No.: TP-9

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-4A **Depth:** 24"

Visual Description of Soil (USCS): Red brown silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
21.7	4.50	2.875	117.2	96.3

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	7.8	0.129	19.6	11.75	1.010	11.87
2	90.0	80.0	10.0	7.7	0.128	19.6	11.86	1.010	11.98
3	90.0	80.0	10.0	7.7	0.129	19.6	11.80	1.010	11.92
4	80.0	70.0	10.0	8.6	0.144	19.5	11.97	1.013	12.12
5	80.0	70.0	10.0	8.6	0.144	19.5	12.00	1.013	12.15
6	80.0	70.0	10.0	8.6	0.144	19.5	11.97	1.013	12.12
7	70.0	60.0	10.0	9.9	0.165	19.3	12.08	1.018	12.29
8	70.0	60.0	10.0	9.8	0.164	19.3	12.15	1.018	12.37
9	70.0	60.0	10.0	9.9	0.165	19.3	12.06	1.018	12.27
10	60.0	50.0	10.0	11.2	0.186	19.2	12.64	1.020	12.89
11	60.0	50.0	10.0	11.2	0.187	19.2	12.60	1.020	12.86
12	60.0	50.0	10.0	11.1	0.186	19.2	12.67	1.020	12.93
13	50.0	40.0	10.0	13.3	0.222	19.1	12.94	1.023	13.23
14	50.0	40.0	10.0	13.4	0.224	19.1	12.84	1.023	13.13
15	50.0	40.0	10.0	13.4	0.223	19.1	12.89	1.023	13.18

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr): 12.49

SOIL PERMEABILITY CLASS: K4

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

Plate No.: TP-10

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-7A **Depth:** 6"

Visual Description of Soil (USCS): Red brown silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
20.1	5.01	2.875	106.7	88.8

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	9.5	0.159	19.0	10.65	1.025	10.92
2	90.0	80.0	10.0	9.6	0.160	19.0	10.60	1.025	10.86
3	90.0	80.0	10.0	9.6	0.159	19.0	10.61	1.025	10.87
4	80.0	70.0	10.0	12.7	0.212	19.0	9.04	1.025	9.27
5	80.0	70.0	10.0	12.8	0.213	19.0	9.02	1.025	9.24
6	80.0	70.0	10.0	12.8	0.214	19.0	8.97	1.025	9.20
7	70.0	60.0	10.0	16.6	0.277	19.0	7.99	1.025	8.20
8	70.0	60.0	10.0	16.8	0.280	19.0	7.89	1.025	8.09
9	70.0	60.0	10.0	16.8	0.281	19.0	7.88	1.025	8.08
10	60.0	50.0	10.0	18.3	0.305	18.9	8.57	1.028	8.81
11	60.0	50.0	10.0	18.3	0.306	18.9	8.56	1.028	8.80
12	60.0	50.0	10.0	18.4	0.307	18.9	8.54	1.028	8.77
13	50.0	40.0	10.0	21.2	0.353	18.9	9.07	1.028	9.32
14	50.0	40.0	10.0	21.2	0.354	18.9	9.06	1.028	9.31
15	50.0	40.0	10.0	21.2	0.353	18.9	9.08	1.028	9.33

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr): 9.27

SOIL PERMEABILITY CLASS: K4

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

Plate No.: TP-11

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-7B **Depth:** 6"

Visual Description of Soil (USCS): Red brown silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
20.9	4.87	2.875	114.7	94.9

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	10.6	0.177	18.6	9.29	1.036	9.62
2	90.0	80.0	10.0	10.6	0.177	18.6	9.30	1.036	9.64
3	90.0	80.0	10.0	10.8	0.179	18.6	9.17	1.036	9.50
4	80.0	70.0	10.0	13.2	0.219	18.5	8.50	1.038	8.82
5	80.0	70.0	10.0	13.2	0.219	18.5	8.50	1.038	8.83
6	80.0	70.0	10.0	13.2	0.220	18.5	8.49	1.038	8.81
7	70.0	60.0	10.0	15.3	0.254	18.4	8.46	1.041	8.81
8	70.0	60.0	10.0	15.2	0.253	18.4	8.51	1.041	8.86
9	70.0	60.0	10.0	15.3	0.255	18.4	8.43	1.041	8.77
10	60.0	50.0	10.0	18.8	0.314	18.4	8.12	1.041	8.45
11	60.0	50.0	10.0	18.8	0.314	18.4	8.11	1.041	8.44
12	60.0	50.0	10.0	18.9	0.314	18.4	8.10	1.041	8.43
13	50.0	40.0	10.0	20.0	0.333	18.4	9.36	1.041	9.74
14	50.0	40.0	10.0	20.0	0.333	18.4	9.37	1.041	9.75
15	50.0	40.0	10.0	20.0	0.333	18.4	9.35	1.041	9.73

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr):	**9.08**
SOIL PERMEABILITY CLASS:	**K4**

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-9A **Depth:** 5"

Visual Description of Soil (USCS): Brown red silty/clayey SAND with gravel

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
23.6	4.88	2.875	118.3	95.7

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	15.9	0.265	19.0	6.22	1.025	6.38
2	90.0	80.0	10.0	15.7	0.262	19.0	6.28	1.025	6.44
3	90.0	80.0	10.0	15.9	0.265	19.0	6.22	1.025	6.38
4	80.0	70.0	10.0	18.8	0.313	19.0	5.97	1.025	6.12
5	80.0	70.0	10.0	18.8	0.313	19.0	5.95	1.025	6.10
6	80.0	70.0	10.0	18.8	0.314	19.0	5.95	1.025	6.10
7	70.0	60.0	10.0	21.2	0.353	18.9	6.11	1.028	6.28
8	70.0	60.0	10.0	21.4	0.357	18.9	6.04	1.028	6.21
9	70.0	60.0	10.0	21.3	0.355	18.9	6.06	1.028	6.23
10	60.0	50.0	10.0	28.6	0.477	18.8	5.34	1.030	5.51
11	60.0	50.0	10.0	28.6	0.476	18.8	5.35	1.030	5.51
12	60.0	50.0	10.0	28.5	0.475	18.8	5.36	1.030	5.52
13	50.0	40.0	10.0	31.5	0.525	18.7	5.94	1.033	6.13
14	50.0	40.0	10.0	31.4	0.524	18.7	5.95	1.033	6.15
15	50.0	40.0	10.0	31.6	0.526	18.7	5.92	1.033	6.12

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr):	**6.08**
SOIL PERMEABILITY CLASS:	**K4**

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

- Large stone at bottom of sample.

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-9B **Depth:** 5"

Visual Description of Soil (USCS): Red brown silty/clayey SAND

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
23.0	4.87	2.875	114.4	93.0

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	84.9	1.415	19.2	1.16	1.020	1.18
2	90.0	80.0	10.0	84.8	1.413	19.2	1.16	1.020	1.19
3	90.0	80.0	10.0	84.9	1.415	19.2	1.16	1.020	1.19
4	80.0	70.0	10.0	139.0	2.317	19.1	0.80	1.023	0.82
5	80.0	70.0	10.0	138.9	2.315	19.1	0.80	1.023	0.82
6	80.0	70.0	10.0	139.2	2.321	19.1	0.80	1.023	0.82
7	70.0	60.0	10.0	167.5	2.792	19.0	0.77	1.025	0.79
8	70.0	60.0	10.0	167.6	2.793	19.0	0.77	1.025	0.79
9	70.0	60.0	10.0	167.6	2.793	19.0	0.77	1.025	0.79
10	60.0	50.0	10.0	232.2	3.870	18.7	0.66	1.033	0.68
11	60.0	50.0	10.0	232.3	3.871	18.7	0.66	1.033	0.68
12	60.0	50.0	10.0	232.3	3.871	18.7	0.66	1.033	0.68
13	50.0	40.0	10.0	310.3	5.172	18.7	0.60	1.033	0.62
14	50.0	40.0	10.0	310.5	5.174	18.7	0.60	1.033	0.62
15	50.0	40.0	10.0	310.4	5.174	18.7	0.60	1.033	0.62

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr):	**0.82**
SOIL PERMEABILITY CLASS:	**K2**

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

Plate No.: TP-14

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-10A **Depth:** 15"

Visual Description of Soil (USCS): Red brown silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
22.7	4.97	2.875	108.8	88.7

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	771.7	12.861	20.1	0.13	0.998	0.13
2	90.0	80.0	10.0	773.8	12.896	20.1	0.13	0.998	0.13
3	90.0	80.0	10.0	772.5	12.875	20.1	0.13	0.998	0.13
4	80.0	71.0	9.0	900.0	15.000	20.0	0.11	1.000	0.11
5	70.0	62.5	7.5	900.0	15.000	19.8	0.11	1.005	0.11
6	60.0	55.0	5.0	900.0	15.000	19.7	0.08	1.008	0.08
7	50.0	46.3	3.7	900.0	15.000	19.5	0.07	1.013	0.07

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr):	**0.11**
SOIL PERMEABILITY CLASS:	**K0**

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

Plate No.: TP-15

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-10B **Depth:** 15"

Visual Description of Soil (USCS): Red brown silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
18.2	5.07	2.875	111.6	94.4

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	21.6	0.360	19.0	4.76	1.025	4.88
2	90.0	80.0	10.0	21.4	0.357	19.0	4.80	1.025	4.92
3	90.0	80.0	10.0	21.5	0.358	19.0	4.78	1.025	4.90
4	80.0	70.0	10.0	25.9	0.432	18.7	4.50	1.033	4.64
5	80.0	70.0	10.0	25.9	0.432	18.7	4.49	1.033	4.64
6	80.0	70.0	10.0	25.7	0.428	18.7	4.53	1.033	4.68
7	70.0	60.0	10.0	30.7	0.512	18.6	4.37	1.036	4.53
8	70.0	60.0	10.0	30.9	0.515	18.6	4.35	1.036	4.51
9	70.0	60.0	10.0	30.8	0.514	18.6	4.36	1.036	4.51
10	60.0	50.0	10.0	41.5	0.692	18.6	3.83	1.036	3.97
11	60.0	50.0	10.0	41.6	0.693	18.6	3.82	1.036	3.96
12	60.0	50.0	10.0	41.5	0.691	18.6	3.83	1.036	3.97
13	50.0	40.0	10.0	58.7	0.978	18.4	3.32	1.041	3.45
14	50.0	40.0	10.0	58.7	0.978	18.4	3.31	1.041	3.45
15	50.0	40.0	10.0	58.7	0.979	18.4	3.31	1.041	3.45

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr):	**4.30**
SOIL PERMEABILITY CLASS:	**K3**

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

- Large localized voids along inner tube wall but did not extend full length of sample.

Plate No.: TP-16

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-11A **Depth:** 8"

Visual Description of Soil (USCS): Red brown silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
21.0	4.71	2.875	115.9	95.8

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	4.9	0.082	19.2	19.47	1.020	19.86
2	90.0	80.0	10.0	4.9	0.082	19.2	19.39	1.020	19.78
3	90.0	80.0	10.0	5.0	0.083	19.2	19.20	1.020	19.58
4	80.0	70.0	10.0	5.2	0.086	19.1	20.96	1.023	21.44
5	80.0	70.0	10.0	5.2	0.087	19.1	20.80	1.023	21.27
6	80.0	70.0	10.0	5.1	0.086	19.1	21.09	1.023	21.56
7	70.0	60.0	10.0	6.1	0.102	19.1	20.37	1.023	20.83
8	70.0	60.0	10.0	6.6	0.109	19.1	19.06	1.023	19.50
9	70.0	60.0	10.0	6.6	0.110	19.1	18.95	1.023	19.38
10	60.0	50.0	10.0	6.9	0.115	19.0	21.40	1.025	21.94
11	60.0	50.0	10.0	6.9	0.116	19.0	21.31	1.025	21.85
12	60.0	50.0	10.0	7.0	0.116	19.0	21.19	1.025	21.72
13	50.0	40.0	10.0	8.2	0.136	19.0	22.15	1.025	22.71
14	50.0	40.0	10.0	8.3	0.138	19.0	21.86	1.025	22.41
15	50.0	40.0	10.0	8.2	0.137	19.0	21.96	1.025	22.52

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr): 21.09

SOIL PERMEABILITY CLASS: K5

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

- Localized void along sample wall but did not extend full length of sample.
- Sample was very loose inside of the tube. Sample able to slide up and down within the tube during preparation.

Plate No.: TP-17

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TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-11B **Depth:** 8"

Visual Description of Soil (USCS): Red brown silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
22.5	4.72	2.875	109.9	89.7

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	8.6	0.144	19.6	11.06	1.010	11.17
2	90.0	80.0	10.0	8.6	0.143	19.6	11.10	1.010	11.21
3	90.0	80.0	10.0	8.7	0.146	19.6	10.94	1.010	11.05
4	80.0	70.0	10.0	9.7	0.161	19.4	11.22	1.015	11.39
5	80.0	70.0	10.0	9.7	0.161	19.4	11.22	1.015	11.39
6	80.0	70.0	10.0	9.6	0.160	19.4	11.25	1.015	11.42
7	70.0	60.0	10.0	11.2	0.187	19.3	11.14	1.018	11.33
8	70.0	60.0	10.0	11.4	0.189	19.3	11.00	1.018	11.19
9	70.0	60.0	10.0	11.3	0.188	19.3	11.09	1.018	11.28
10	60.0	50.0	10.0	12.9	0.216	19.2	11.43	1.020	11.66
11	60.0	50.0	10.0	13.0	0.216	19.2	11.39	1.020	11.61
12	60.0	50.0	10.0	13.0	0.216	19.2	11.39	1.020	11.62
13	50.0	40.0	10.0	13.3	0.222	19.2	13.56	1.020	13.83
14	50.0	40.0	10.0	13.2	0.221	19.2	13.67	1.020	13.95
15	50.0	40.0	10.0	13.3	0.221	19.2	13.65	1.020	13.93

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr): 11.87

SOIL PERMEABILITY CLASS: K4

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

Plate No.: TP-18

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5439 Harding Highway
Mays Landing, NJ 08330
T: 800.258.3787
T: 609.625.1700
F: 609.625.1798
www.maserconsulting.com

TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-12A **Depth:** 12"

Visual Description of Soil (USCS): Brown red silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
12.0	4.66	2.875	75.4	67.3

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	5.2	0.087	19.1	18.06	1.023	18.47
2	90.0	80.0	10.0	5.3	0.088	19.1	17.96	1.023	18.37
3	90.0	80.0	10.0	5.3	0.088	19.1	17.89	1.023	18.30
4	80.0	70.0	10.0	6.7	0.112	19.0	15.98	1.025	16.38
5	80.0	70.0	10.0	6.7	0.112	19.0	15.91	1.025	16.31
6	80.0	70.0	10.0	6.8	0.113	19.0	15.74	1.025	16.14
7	70.0	60.0	10.0	8.4	0.140	19.0	14.71	1.025	15.08
8	70.0	60.0	10.0	8.4	0.139	19.0	14.78	1.025	15.15
9	70.0	60.0	10.0	8.4	0.141	19.0	14.62	1.025	14.99
10	60.0	50.0	10.0	9.5	0.158	18.9	15.40	1.028	15.83
11	60.0	50.0	10.0	9.4	0.157	18.9	15.48	1.028	15.91
12	60.0	50.0	10.0	9.5	0.158	18.9	15.41	1.028	15.84
13	50.0	40.0	10.0	12.9	0.215	18.9	13.88	1.028	14.27
14	50.0	40.0	10.0	12.9	0.215	18.9	13.86	1.028	14.24
15	50.0	40.0	10.0	12.8	0.213	18.9	13.98	1.028	14.37

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr): 15.98

SOIL PERMEABILITY CLASS: K4

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

- Sample was very loose inside of the tube. Sample able to slide up and down within the tube during preparation.

Plate No.: TP-19

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Engineers
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Surveyors
Landscape Architects
Environmental Scientists

5439 Harding Highway
Mays Landing, NJ 08330
T: 800.258.3787
T: 609.625.1700
F: 609.625.1798
www.maserconsulting.com

TUBE PERMEAMETER TEST

(N.J.A.C. 7:9A - Standards for Individual Subsurface Sewage Disposal Systems; Subchapter 6, Section 6.2, page 39, Modified)

Client: John Kainer **MC #:** 19000649A

Project: 483 and 485 Elizabeth Avenue, Franklin Township, NJ **Date:** September 11, 2020

Boring/Sample # or Descrip./Location: TP-12B **Depth:** 12"

Visual Description of Soil (USCS): Brown red silty/clayey SAND with gravel and trace organics

Technician: K. Perry **Proctor Data:**

Max Dry Density (pcf)	% of Max Dry Density	Opt. Moisture (%)
-	-	-

Initial Specimen Data:

Sample Type:
Undisturbed ☑
Re-Compacted ☐

Water Content (%)	Length, L (in)	Diameter (in)	Wet Density (pcf)	Dry Density (pcf)
11.1	5.02	2.875	84.0	75.6

Radius of Burette, r: 0.3141 in **Radius of Soil Specimen, R:** 1.4375 in

TEST DATA

1	2	3	4	5		6	7	8	9
Trial No.	Burette Readings		Head, h (cm)	Time, t		Temp, T (^oC)	Permeability at T^oC, k_T	Temp Correc.	Permeability at 20^oC, k_{20}
	h_1 (cm)	h_2 (cm)		Sec	Min				
1	90.0	80.0	10.0	33.0	0.550	19.1	3.08	1.023	3.15
2	90.0	80.0	10.0	35.3	0.589	19.1	2.88	1.023	2.94
3	90.0	80.0	10.0	34.2	0.570	19.1	2.97	1.023	3.04
4	80.0	70.0	10.0	43.8	0.731	19.0	2.63	1.025	2.69
5	80.0	70.0	10.0	43.5	0.724	19.0	2.65	1.025	2.72
6	80.0	70.0	10.0	43.8	0.730	19.0	2.63	1.025	2.70
7	70.0	60.0	10.0	57.6	0.959	19.0	2.31	1.025	2.37
8	70.0	60.0	10.0	56.8	0.947	19.0	2.34	1.025	2.40
9	70.0	60.0	10.0	58.2	0.969	19.0	2.29	1.025	2.34
10	60.0	50.0	10.0	69.3	1.155	18.8	2.27	1.030	2.34
11	60.0	50.0	10.0	69.7	1.162	18.8	2.26	1.030	2.33
12	60.0	50.0	10.0	69.7	1.162	18.8	2.26	1.030	2.33
13	50.0	40.0	10.0	87.3	1.455	18.7	2.20	1.033	2.28
14	50.0	40.0	10.0	89.1	1.485	18.7	2.16	1.033	2.23
15	50.0	40.0	10.0	89.3	1.488	18.7	2.16	1.033	2.23

Perm, k_T (7) = 60 * L/t * r^2/R^2* ln(h1/h2) = 60* L/(5) * r^2/R^2 * ln((2)/(3))

Head, h (4) = (2) - (3); **Perm, k_{20}** (9) = (7)*(8)

AVERAGE k_{20} (in/hr): 2.54

SOIL PERMEABILITY CLASS: K3

Soil Permeability Classes

> 20 inches per hour (in/hr)	K5
6 - 20 in/hr	K4
2 - 6 in/hr	K3
0.6 - 2 in/hr	K2
0.2 - 0.6 in/hr	K1
< 0.2 in/hr	K0

Remarks

- Sample was very loose inside of the tube. Sample able to slide up and down within the tube during preparation.

Plate No.: TP-20

APPENDIX H

Groundwater Recharge Worksheet

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:	483 & 485 Elizabeth Avenue
Description:	19000649A
Analysis Date:	10/7/2020

Pre-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	0.33	Impervious areas	Norton	0.0	-
2	3.69	Woods	Norton	12.5	166,898
3	2.73	Meadow, Pasture, Grassland or range	Norton	12.5	123,874
4	0.43	Woods	Reaville	12.9	20,079
5	0.04	Impervious areas	Reaville	0.0	-
6	1.04	Meadow, Pasture, Grassland or range	Reaville	12.6	47,524
7	0.03	Woods	Penn	12.9	1,400
8	0.03	Impervious areas	Penn	0.0	-
9	0.08	Meadow, Pasture, Grassland or range	Penn	12.6	3,654
10					
11					
12					
13					
14					
15					
Total =	8.4			Total Annual Recharge (in)	Total Annual Recharge (cu-ft)
				11.9	363,429

Post-Developed Conditions

Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu.ft)
1	3.6	Impervious Areas	Norton	0.0	-
2	1.05	Woods	Norton	12.5	47,491
3	2.1	Open space	Norton	12.5	95,498
4	0.41	Woods	Reaville	12.9	19,145
5	0.18	Impervious Areas	Reaville	0.0	-
6	0.92	Open space	Reaville	12.3	41,120
7	0.03	Woods	Penn	12.9	1,400
8	0.03	Impervious Areas	Penn	0.0	-
9	0.08	Open space	Penn	12.3	3,574
10					
11					
12					
13					
14					
15					
Total =	8.4			Total Annual Recharge (in)	Total Annual Recharge (cu.ft)
				6.8	208,229

Annual Recharge Requirements Calculation ↓

% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq.ft)
		165,964
Post-Development Annual Recharge Deficit=	*155,200*	(cubic feet)

Recharge Efficiency Parameters Calculations (area averages)

RWC=	#N/A	(in)	DRWC=	#N/A	(in)
ERWC =	#N/A	(in)	EDRWC=	#N/A	(in)

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.

Project Name	Description	Analysis Date	BMP or LID Type
483 & 485 Elizabeth Avenu	19000649A	10/07/20	Pervious Paving

Recharge BMP Input Parameters

Parameter	Symbol	Value	Unit
BMP Area	ABMP	10270.0	sq.ft
BMP Effective Depth, this is the design variable	dBMP	2.7	in
Upper level of the BMP surface (negative if above ground)	dBMPu	7.0	in
Depth of lower surface of BMP, must be>=dBMPu	dEXC	23.0	in
Post-development Land Segment Location of BMP , Input Zero if Location is distributed or undetermined	SegBMP	1	unitless

Root Zone Water capacity Calculated Parameters

Parameter	Symbol	Value	Unit
Empty Portion of RWC under Post-D Natural Recharge	ERWC	0.73	in
ERWC Modified to consider dEXC	EDRWC	0.00	in
Empty Portion of RWC under Infilt. BMP	RERWC	0.00	in

Recharge Design Parameters

Parameter	Symbol	Value	Unit
Inches of Runoff to capture	Qdesign	0.17	in
Inches of Rainfall to capture	Pdesign	0.23	in
Recharge Provided Avg. over Imp. Area		11.2	in
Runoff Captured Avg. over imp. Area		11.2	in

BMP Calculated Size Parameters

ABMP/Aimp	Aratio	0.06	unitless
BMP Volume	VBMP	2,278	cu.ft

CALCULATION CHECK MESSAGES

Volume Balance-> OK
dBMP Check---> OK
dEXC Check---> OK
BMP Location---> OK

Parameters from Annual Recharge Worksheet

Post-D Deficit Recharge (or desired recharge volume)	Vdef	155,200	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	165,964	sq.ft
Root Zone Water Capacity	RWC	2.82	in
RWC Modified to consider dEXC	DRWC	0.00	in
Climatic Factor	C-factor	1.48	no units
Average Annual P	Pavg	45.7	in
Recharge Requirement over Imp. Area	dr	11.2	in

System Performance Calculated Parameters

Annual BMP Recharge Volume		155,200	cu.ft
Avg BMP Recharge Efficiency		100.0%	Represents % Infiltration Recharged
%Rainfall became Runoff		77.9%	%
%Runoff Infiltrated		31.5%	%
%Runoff Recharged		31.5%	%
%Rainfall Recharged		24.6%	%

OTHER NOTES

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 sensetive to dBMP, make sure dBMP selected is small enough for BMP to empty in less than 3 days. For land Segment Location of BMP if you select "impervious areas" RWC will be minimal but not zero as determined by the soil type and a shallow root zone for this Land Cover allowing consideration of lateral flow and other losses.

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 clik the "Default Vdef & Aimp" button.

APPENDIX I

References

This simplification is based on the following assumptions:

- shallow steady uniform flow
- constant rainfall excess intensity (that part of a rain available for runoff) both temporally and spatially
- 2-year, 24-hour rainfall assuming standard NRCS rainfall intensity-duration relations apply (Types I, II, and III)
- minor effect of infiltration on travel time

For sheet flow, the roughness coefficient includes the effects of roughness and the effects of raindrop impact including drag over the surface; obstacles such as litter, crop ridges, and rocks; and erosion and transport of sediment. These n values are only applicable for flow depths of approximately 0.1 foot or less, where sheet flow occurs. Table 15–1 gives roughness coefficient values for sheet flow for various surface conditions.

Kibler and Aron (1982) and others indicated the maximum sheet flow length is less than 100 feet. To support the sheet flow limit of 100 feet, Merkel (2001) reviewed a number of technical papers on sheet flow. McCuen and Spiess (1995) indicated that use of flow length as the limiting variable in the equation 15–8 could lead to less accurate designs, and proposed that the limitation should instead be based on:

$$\ell = \frac{100\sqrt{S}}{n} \qquad \text{(eq. 15–9)}$$

Table 15–2 Maximum sheet flow lengths using the McCuen-Spiess limitation criterion

Cover type	*n* values	Slope (ft/ft)	Length (ft)
Range	0.13	0.01	77
Grass	0.41	0.01	24
Woods	0.80	0.01	12.5
Range	0.13	0.05	172
Grass	0.41	0.05	55
Woods	0.80	0.05	28

where:
n = Manning's roughness coefficient
ℓ = limiting length of flow, ft
S = slope, ft/ft

Table 15–2 provides maximum sheet flow lengths based on the McCuen-Spiess limiting criteria for various cover type—n value—slope combinations.

Shallow concentrated flow—After approximately 100 feet, sheet flow usually becomes shallow concentrated flow collecting in swales, small rills, and gullies. Shallow concentrated flow is assumed not to have a well-defined channel and has flow depths of 0.1 to 0.5 feet. It is assumed that shallow concentrated flow can be represented by one of seven flow types. The curves in figure 15–4 were used to develop the information in table 15–3.

To estimate shallow concentrated flow travel time, velocities are developed using figure 15–4, in which average velocity is a function of watercourse slope and type of channel (Kent 1964). For slopes less than 0.005 foot per foot, the equations in table 15–3 may be used.

After estimating average velocity using figure 15–4, use equation 15–1 to estimate travel time for the shallow concentrated flow segment.

Open channel flow— Shallow concentrated flow is assumed to occur after sheet flow ends at shallow depths of 0.1 to 0.5 feet. Beyond that channel flow is assumed to occur. Open channels are assumed to begin where surveyed cross-sectional information has been obtained, where channels are visible on aerial photographs, or where bluelines (indicating streams) appear on U.S. Geological Survey (USGS) quadrangle sheets.

Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for the bankfull elevation.

Manning's equation is:

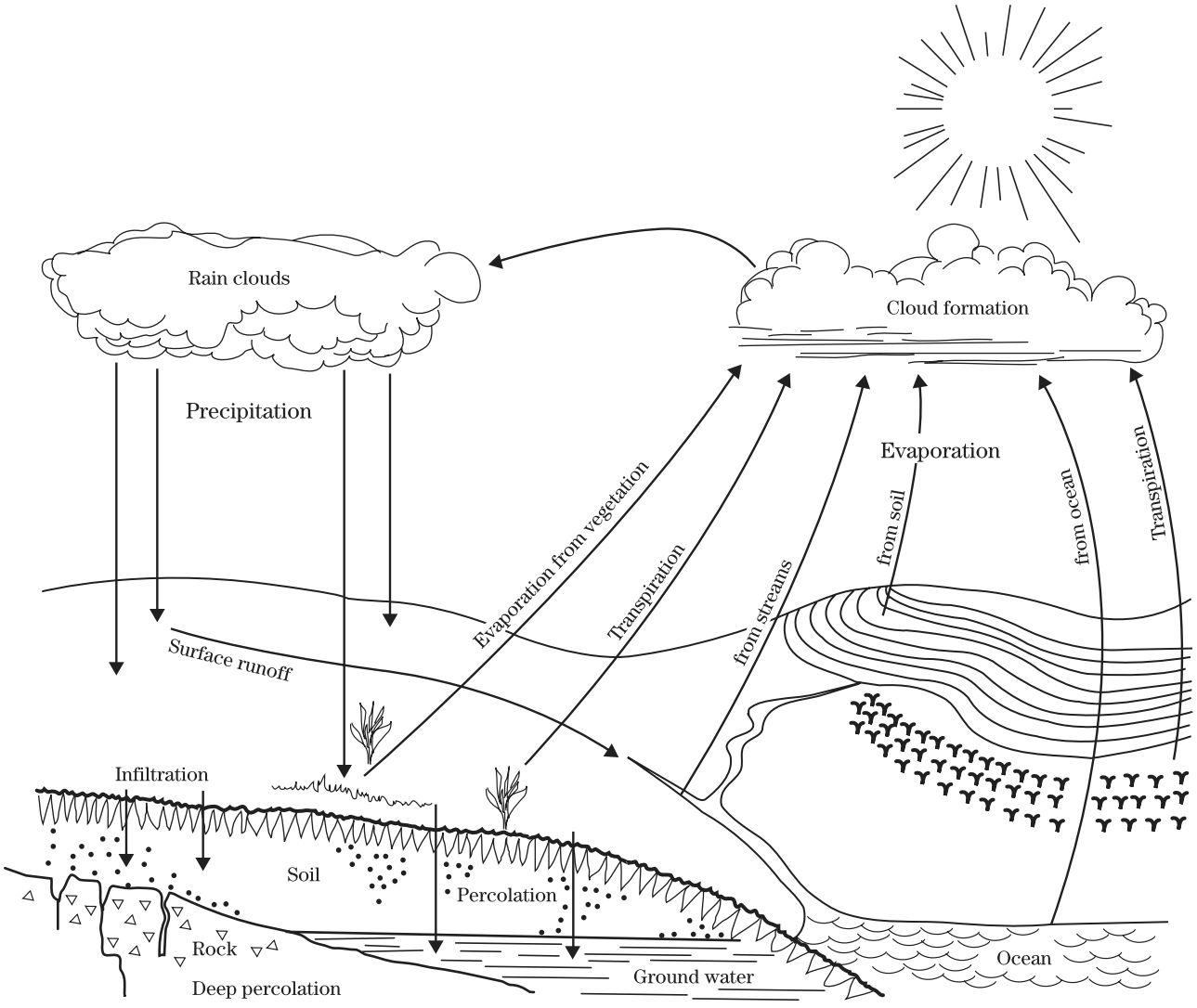
$$V = \frac{1.49 r^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \qquad \text{(eq. 15–10)}$$

United States
Department of
Agriculture

**Natural
Resources
Conservation
Service**

Part 630 Hydrology
National Engineering Handbook

Chapter 15 Time of Concentration



NOAA Atlas 14, Volume 2, Version 3
Location name: Somerset, New Jersey, USA*
Latitude: 40.5257°, Longitude: -74.5433°
Elevation: 79.56 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**3.98** (3.61-4.40)	**4.74** (4.30-5.24)	**5.63** (5.08-6.22)	**6.26** (5.65-6.91)	**7.04** (6.32-7.76)	**7.60** (6.78-8.35)	**8.14** (7.24-8.96)	**8.62** (7.63-9.52)	**9.23** (8.09-10.2)	**9.67** (8.44-10.7)
10-min	**3.18** (2.88-3.52)	**3.80** (3.43-4.19)	**4.50** (4.07-4.97)	**5.01** (4.52-5.53)	**5.61** (5.03-6.19)	**6.04** (5.40-6.65)	**6.46** (5.75-7.12)	**6.83** (6.05-7.54)	**7.30** (6.40-8.07)	**7.62** (6.64-8.45)
15-min	**2.65** (2.40-2.93)	**3.18** (2.88-3.52)	**3.80** (3.43-4.20)	**4.22** (3.81-4.66)	**4.74** (4.26-5.23)	**5.10** (4.56-5.62)	**5.44** (4.84-6.00)	**5.75** (5.08-6.34)	**6.12** (5.37-6.77)	**6.38** (5.56-7.07)
30-min	**1.82** (1.65-2.01)	**2.20** (1.99-2.43)	**2.70** (2.44-2.98)	**3.06** (2.76-3.38)	**3.51** (3.15-3.87)	**3.84** (3.43-4.23)	**4.17** (3.71-4.60)	**4.47** (3.96-4.94)	**4.87** (4.27-5.39)	**5.16** (4.50-5.72)
60-min	**1.13** (1.03-1.25)	**1.38** (1.25-1.52)	**1.73** (1.56-1.91)	**1.99** (1.80-2.20)	**2.34** (2.10-2.58)	**2.60** (2.33-2.87)	**2.87** (2.55-3.17)	**3.14** (2.78-3.46)	**3.50** (3.07-3.87)	**3.77** (3.28-4.18)
2-hr	**0.692** (0.622-0.770)	**0.843** (0.759-0.936)	**1.07** (0.962-1.19)	**1.25** (1.12-1.38)	**1.49** (1.33-1.65)	**1.69** (1.50-1.87)	**1.89** (1.67-2.10)	**2.11** (1.85-2.33)	**2.40** (2.08-2.67)	**2.64** (2.26-2.94)
3-hr	**0.513** (0.462-0.572)	**0.624** (0.563-0.697)	**0.794** (0.715-0.885)	**0.925** (0.831-1.03)	**1.11** (0.989-1.23)	**1.26** (1.12-1.40)	**1.41** (1.24-1.57)	**1.57** (1.38-1.75)	**1.80** (1.55-2.00)	**1.97** (1.69-2.20)
6-hr	**0.329** (0.296-0.368)	**0.399** (0.360-0.446)	**0.507** (0.455-0.563)	**0.594** (0.531-0.659)	**0.719** (0.637-0.796)	**0.824** (0.726-0.910)	**0.936** (0.817-1.03)	**1.06** (0.913-1.17)	**1.23** (1.05-1.36)	**1.38** (1.16-1.52)
12-hr	**0.199** (0.178-0.223)	**0.241** (0.216-0.270)	**0.307** (0.274-0.344)	**0.363** (0.323-0.405)	**0.446** (0.394-0.496)	**0.518** (0.454-0.575)	**0.596** (0.517-0.661)	**0.683** (0.584-0.758)	**0.811** (0.682-0.901)	**0.921** (0.762-1.02)
24-hr	**0.113** (0.105-0.123)	**0.137** (0.127-0.149)	**0.175** (0.162-0.191)	**0.208** (0.192-0.226)	**0.257** (0.236-0.279)	**0.300** (0.272-0.325)	**0.347** (0.313-0.376)	**0.399** (0.356-0.434)	**0.477** (0.419-0.520)	**0.545** (0.470-0.595)
2-day	**0.066** (0.060-0.072)	**0.079** (0.073-0.087)	**0.101** (0.093-0.112)	**0.120** (0.109-0.131)	**0.146** (0.132-0.161)	**0.169** (0.152-0.185)	**0.194** (0.173-0.213)	**0.221** (0.195-0.243)	**0.260** (0.226-0.287)	**0.293** (0.252-0.325)
3-day	**0.046** (0.043-0.051)	**0.056** (0.052-0.062)	**0.071** (0.065-0.078)	**0.084** (0.076-0.092)	**0.102** (0.093-0.112)	**0.118** (0.106-0.129)	**0.134** (0.120-0.147)	**0.152** (0.135-0.167)	**0.178** (0.155-0.196)	**0.200** (0.172-0.221)
4-day	**0.037** (0.034-0.040)	**0.045** (0.041-0.049)	**0.056** (0.052-0.062)	**0.066** (0.060-0.072)	**0.080** (0.073-0.088)	**0.092** (0.083-0.100)	**0.104** (0.093-0.114)	**0.118** (0.105-0.129)	**0.137** (0.120-0.151)	**0.153** (0.132-0.169)
7-day	**0.025** (0.023-0.027)	**0.030** (0.027-0.032)	**0.037** (0.034-0.040)	**0.043** (0.039-0.046)	**0.051** (0.047-0.056)	**0.058** (0.053-0.063)	**0.066** (0.059-0.071)	**0.074** (0.066-0.080)	**0.085** (0.075-0.093)	**0.094** (0.082-0.104)
10-day	**0.020** (0.018-0.021)	**0.023** (0.022-0.025)	**0.029** (0.027-0.031)	**0.033** (0.031-0.036)	**0.039** (0.036-0.042)	**0.044** (0.040-0.048)	**0.049** (0.045-0.053)	**0.055** (0.049-0.059)	**0.062** (0.056-0.068)	**0.068** (0.060-0.075)
20-day	**0.013** (0.012-0.014)	**0.016** (0.015-0.017)	**0.019** (0.018-0.020)	**0.021** (0.020-0.023)	**0.024** (0.023-0.026)	**0.027** (0.025-0.029)	**0.029** (0.027-0.031)	**0.032** (0.030-0.034)	**0.035** (0.032-0.038)	**0.038** (0.035-0.041)
30-day	**0.011** (0.010-0.012)	**0.013** (0.012-0.014)	**0.015** (0.014-0.016)	**0.017** (0.016-0.018)	**0.019** (0.018-0.020)	**0.021** (0.019-0.022)	**0.022** (0.021-0.024)	**0.024** (0.022-0.025)	**0.026** (0.024-0.028)	**0.027** (0.025-0.029)
45-day	**0.009** (0.009-0.010)	**0.011** (0.010-0.012)	**0.013** (0.012-0.013)	**0.014** (0.013-0.015)	**0.016** (0.015-0.016)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)	**0.019** (0.018-0.020)	**0.020** (0.019-0.022)	**0.021** (0.020-0.023)
60-day	**0.008** (0.008-0.009)	**0.010** (0.009-0.010)	**0.011** (0.011-0.012)	**0.012** (0.012-0.013)	**0.014** (0.013-0.014)	**0.015** (0.014-0.015)	**0.015** (0.015-0.016)	**0.016** (0.015-0.017)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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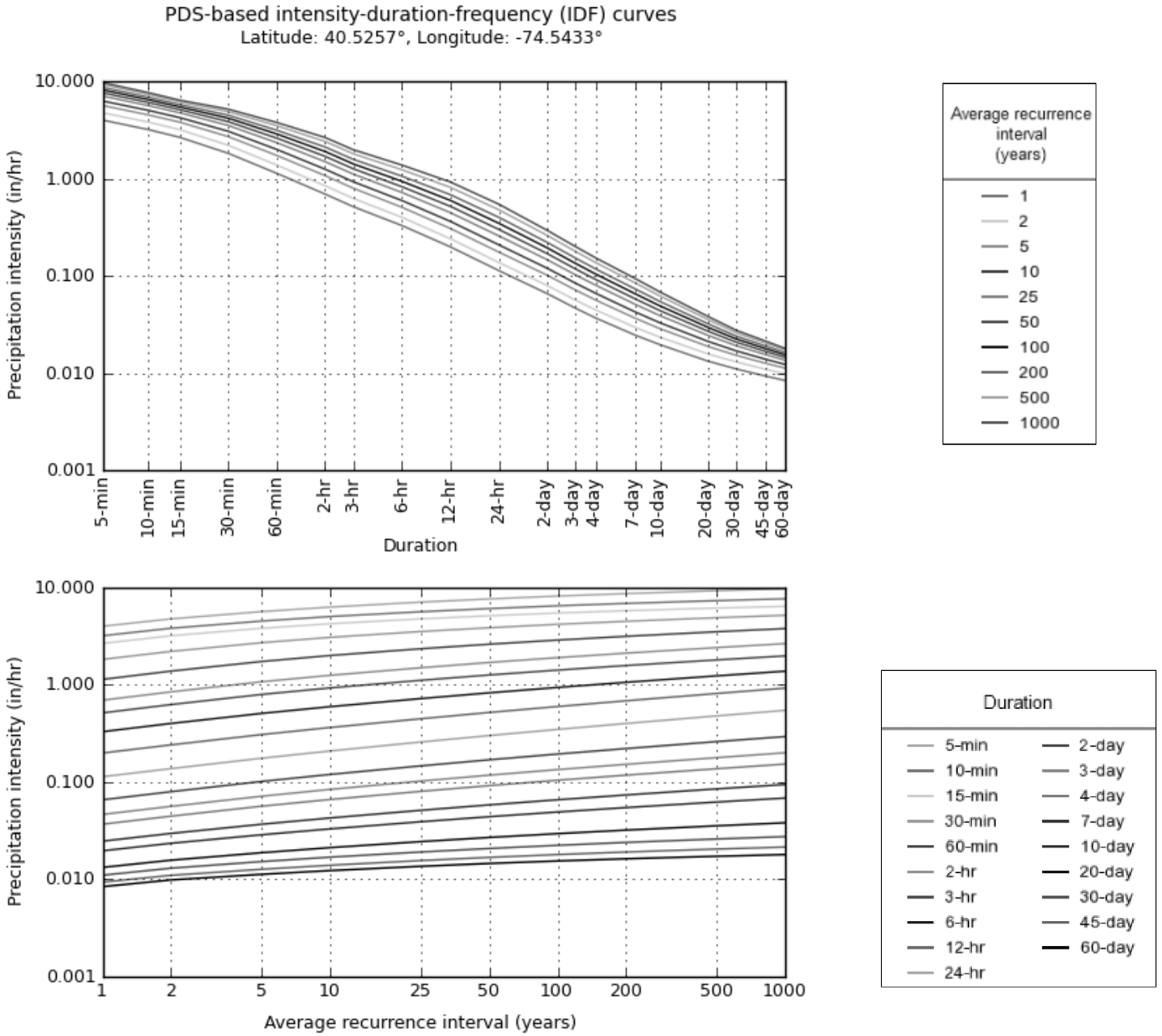
PF graphical



NOAA Atlas 14, Volume 2, Version 3

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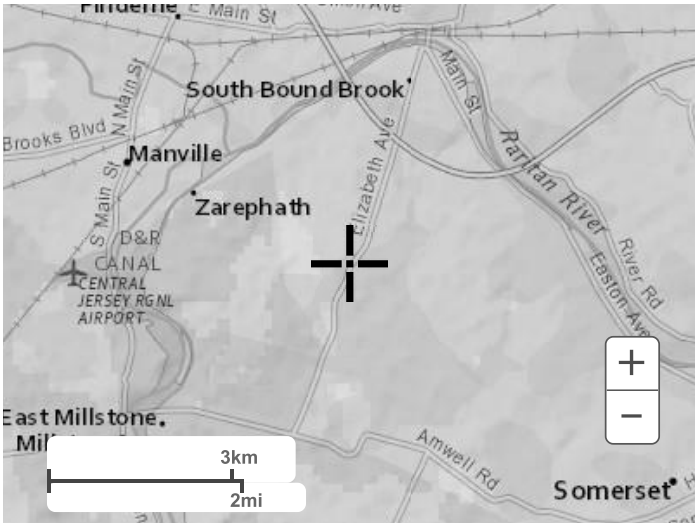
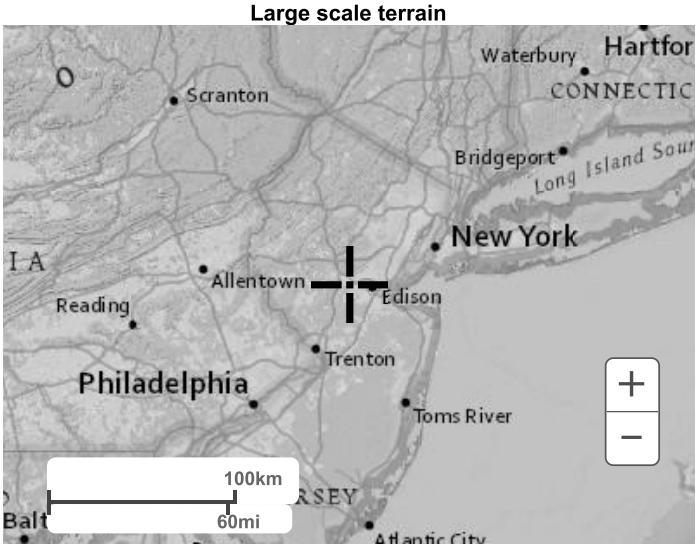
Maps & aerials

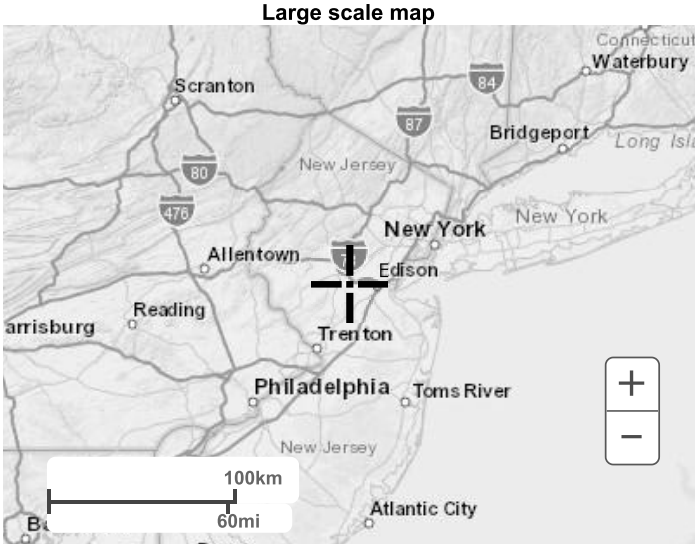
Small scale terrain



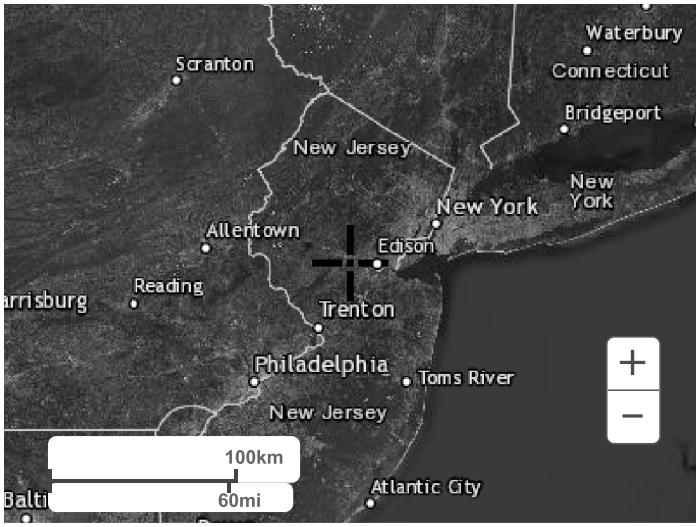
Large scale terrain



Large scale map



Large scale aerial



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National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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MAPS

Aerial Map
Source: NJ 2015 Orthophotography
Elizabeth Realty Partners, LLC
Block 507.14, Lots 61 & 62
Franklin Township, Somerset County, New Jersey
MC Project No. 19000649A

0 45 90 180 Feet

N

Approximate Site Boundary

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Hamilton, NJ 08691
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Fax: 609-587-8260

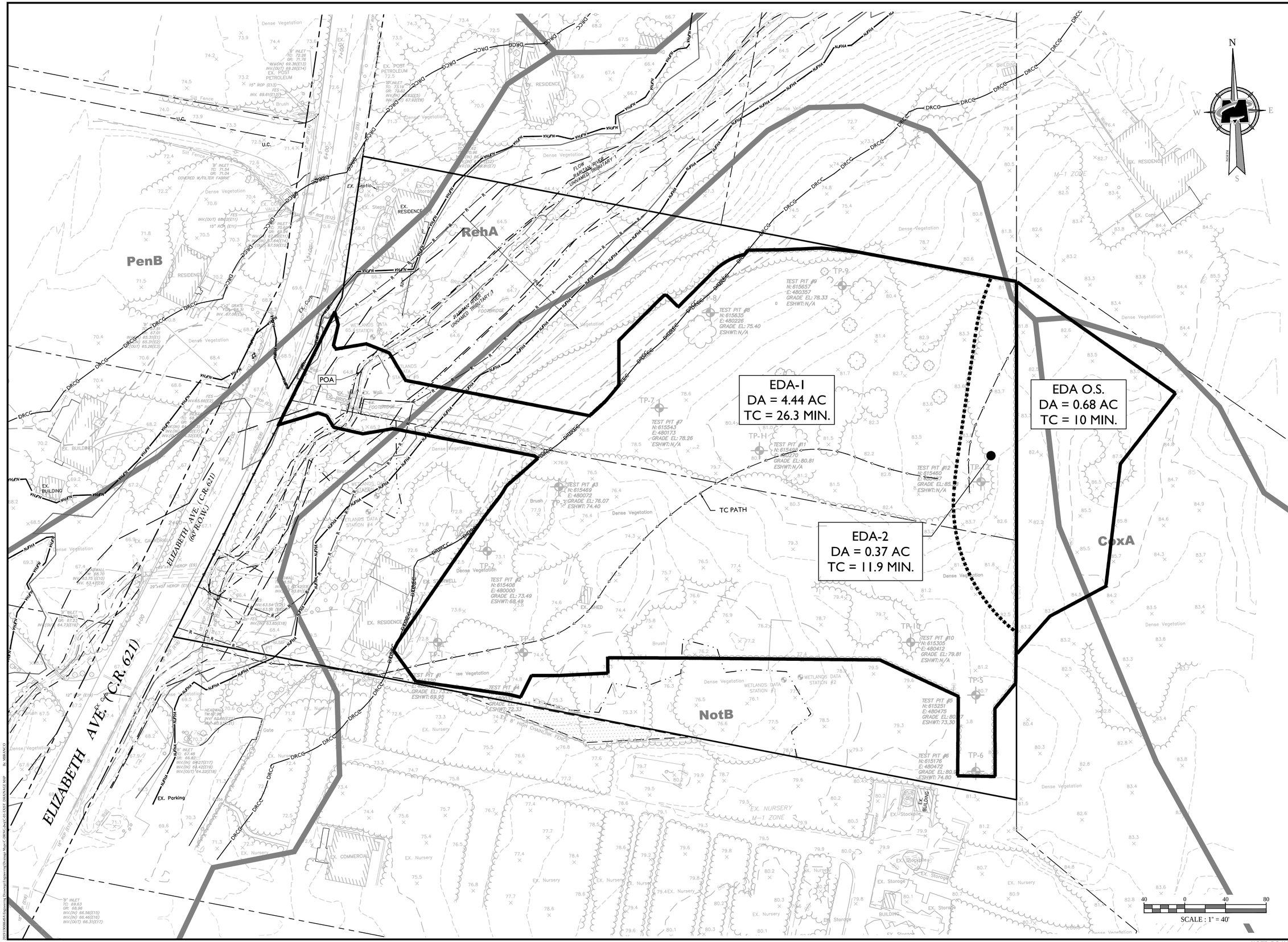
Soils Map
Source: NJDEP Geographical Information Systems
Elizabeth Realty Partners, LLC
Block 507.14, Lots 61 & 62
Franklin Township, Somerset County, New Jersey
MC Project No. 19000649A

0 45 90 180 Feet

N

Approximate Site Boundary

Soil Boundary



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1 of 3

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2019\19000649A\Engineering Drainage\Engineering Drainage Maps\C-DRNG.dwg\C-01-EXST. DRAINAGE MAP

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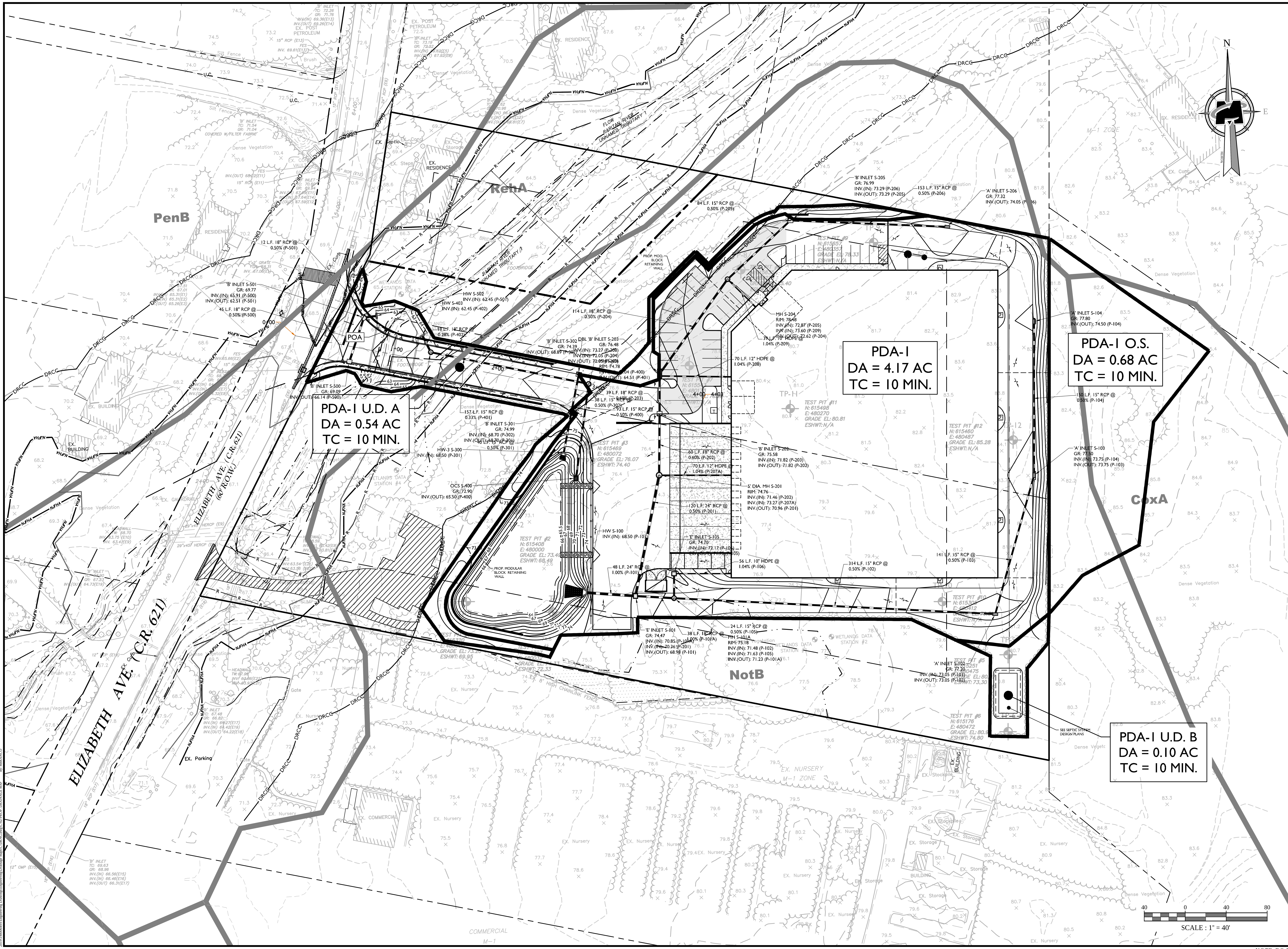

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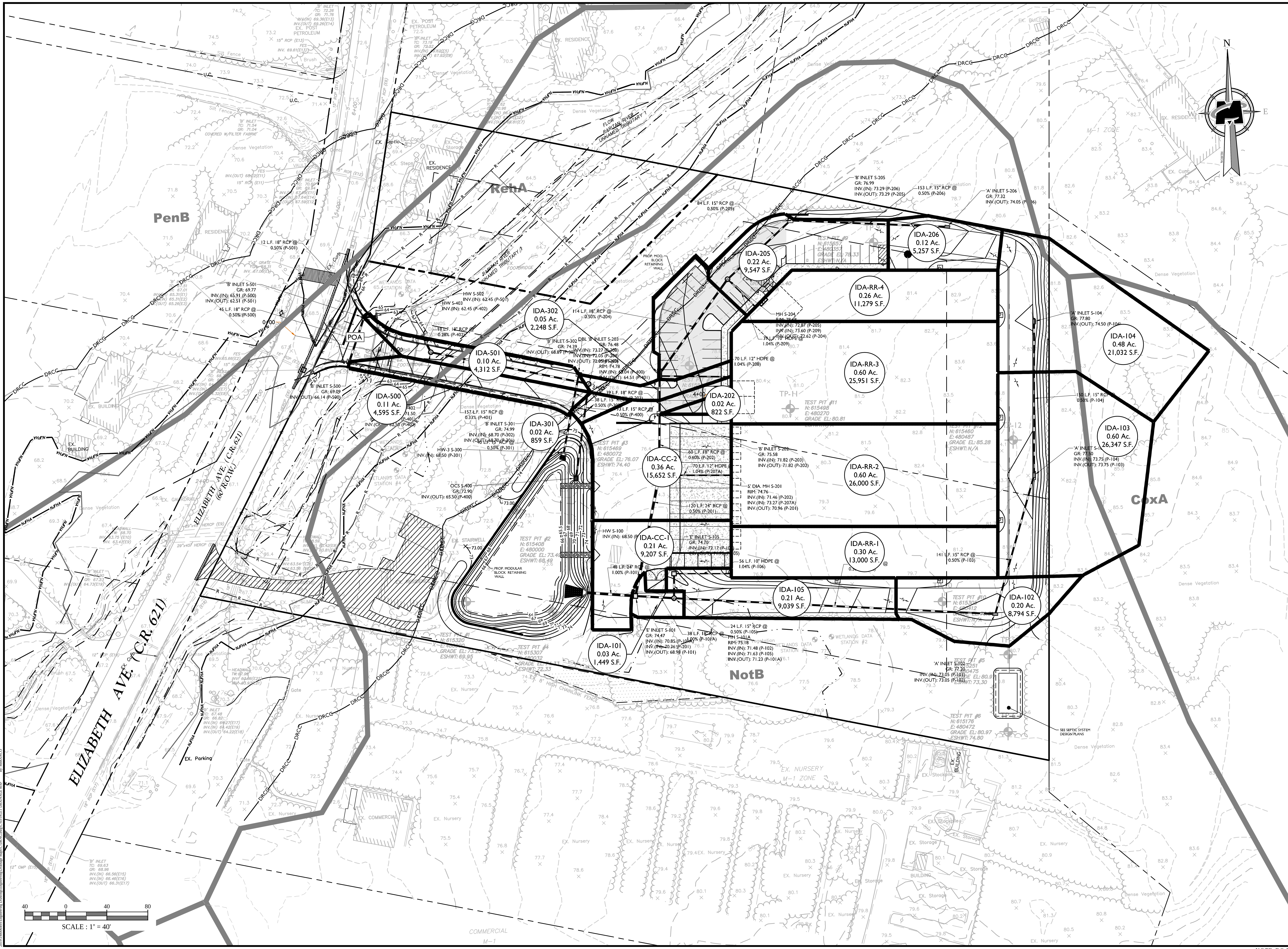
2019\19000649A\Engineering Drawings\Engineering\Drainage Maps\C-DRNG.dwg\C-02-PROP. DRAINAGE MAP By: MBRANCO



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