

STORMWATER MANAGEMENT REPORT

for:

100 Prospect Street

Block: 152

Lots: 51.01 & 51.02

Borough of Metuchen

Middlesex County, New Jersey

Prepared By:

Menlo Engineering Associates, Inc

261 Cleveland Avenue

Highland Park, New Jersey 08904

T.: 732.846.8585

F.: 732.846.9439

Under the Immediate Supervision of:



William A. Lane

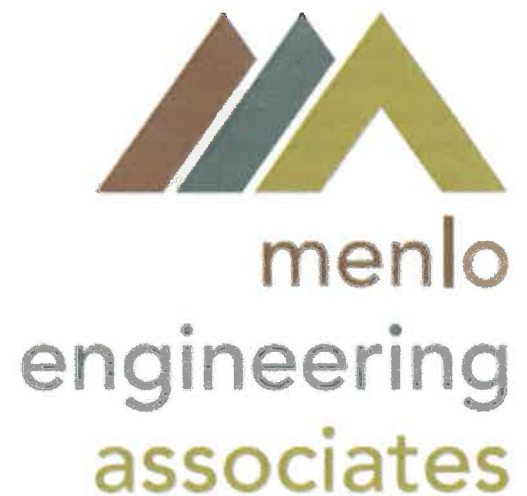
NJPE# 40262

WAL/je

MEA # 2022.004

Dated: 3/29/2023

Revised:



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INTRODUCTION

The following Stormwater Management Report details the design of the stormwater management plan for a proposed building addition located in the Borough of Metuchen, Middlesex County, New Jersey and has been prepared by Menlo Engineering Associates, Inc. in accordance with the standards of the Borough of Metuchen, the County of Middlesex, the New Jersey Soil Conservation Service, and the New Jersey Department of Environmental Protection. This report supplements, and should be reviewed in conjunction with, the project development plans prepared by Menlo Engineering Associates, Inc.

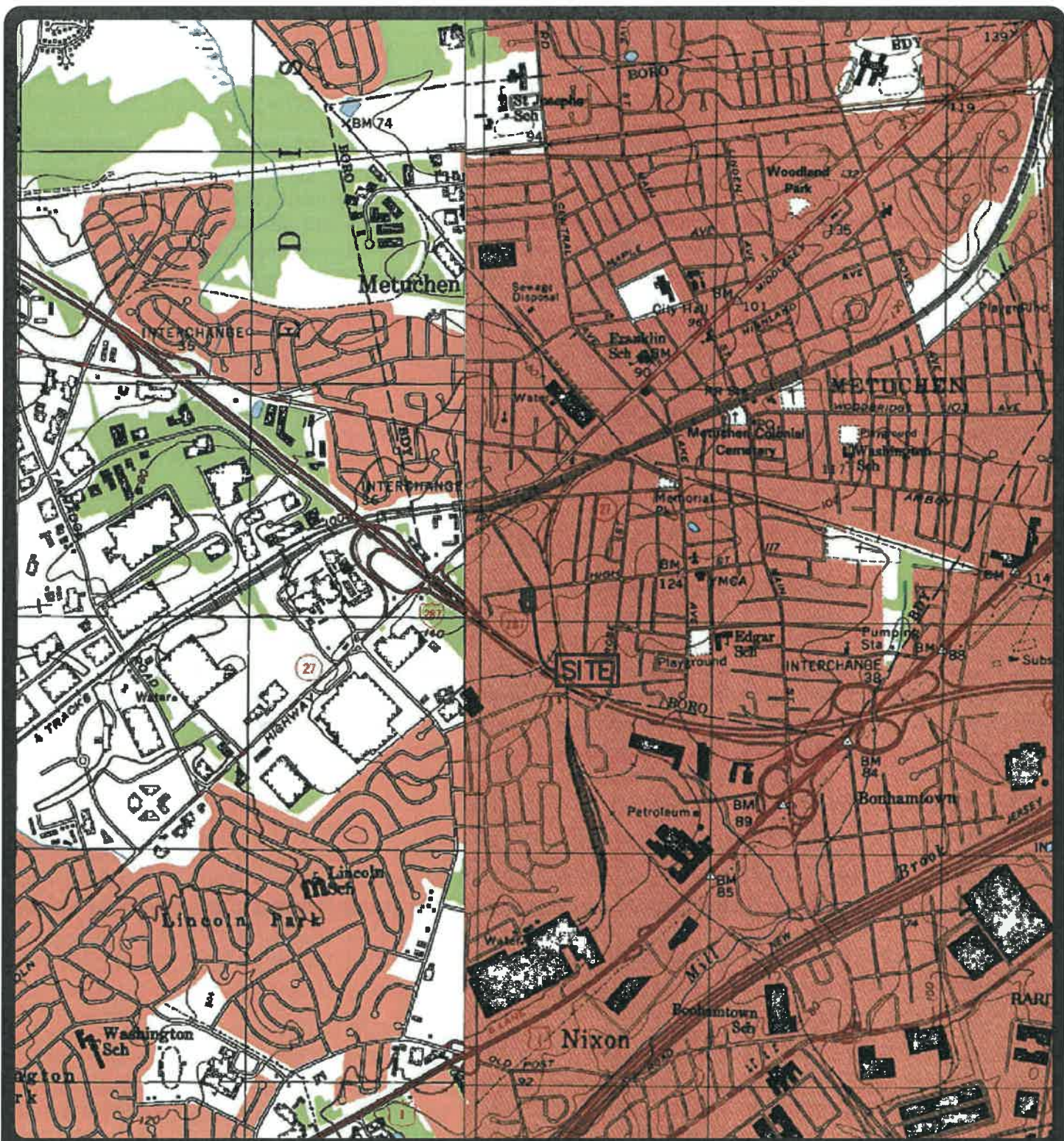
It is the intent of this report to aid and assist Engineers at the Municipal, County, and State levels in evaluating the drainage calculations and considerations incorporated in the design as shown on the plans submitted. This office will readily respond to questions and requests for additional calculations or verification of the proposed design by Municipal, County, or State Engineers, and will be responsive to their suggestions and modifications to the design in conformance to the applicable codes in the interest of land use control consistent with environmental protection.

CRITERIA

In the hydraulic designs involved in this project, the drainage areas have been determined by electronic digitizer from the U.S.G.S. Quadrangle map, topographic survey prepared by Engineering & Land Planning Associates, Inc. and field observations to determine basin limits and off-site and on-site areas. The Soil Conservation Service Soil Survey maps are used for hydrological soil group classification. Existing and proposed conditions are calculated for the 2, 10, 25 and 100-year flows. On-site storm sewer collection systems were sized for the 25-year storm and employed the Rational Method for design calculations.

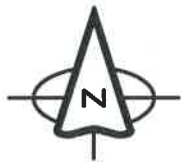
PROJECT LOCATION & DESCRIPTION

This report examines the drainage characteristics and designs for a 0.76-acre tract of land situated in the Borough of Metuchen, Middlesex County, New Jersey. The applicant proposes an 8,400-sf building addition and parking lot. The site is located on the corner of Prospect Street and High Street. The property is currently used for solar energy equipment and as it exists today, contains a 10,000-sf building with a gravel parking lot. Access to the building will be provided by a new parking lot connected to Prospect Street on the southerly portion of the site.



U.S.G.S. MAP

Quad Name: Perth Amboy
 Metuchen Township
 Middlesex County

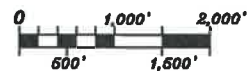


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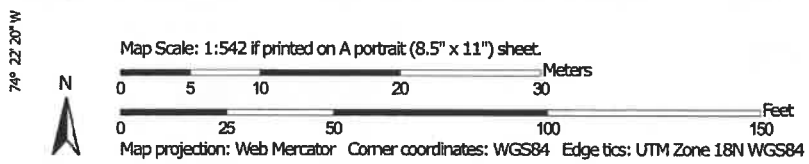
MENLO ENGINEERING ASSOCIATES, INC.
 261 CLEVELAND AVENUE
 HIGHLAND PARK, NJ 08904
 (732) 846-8585

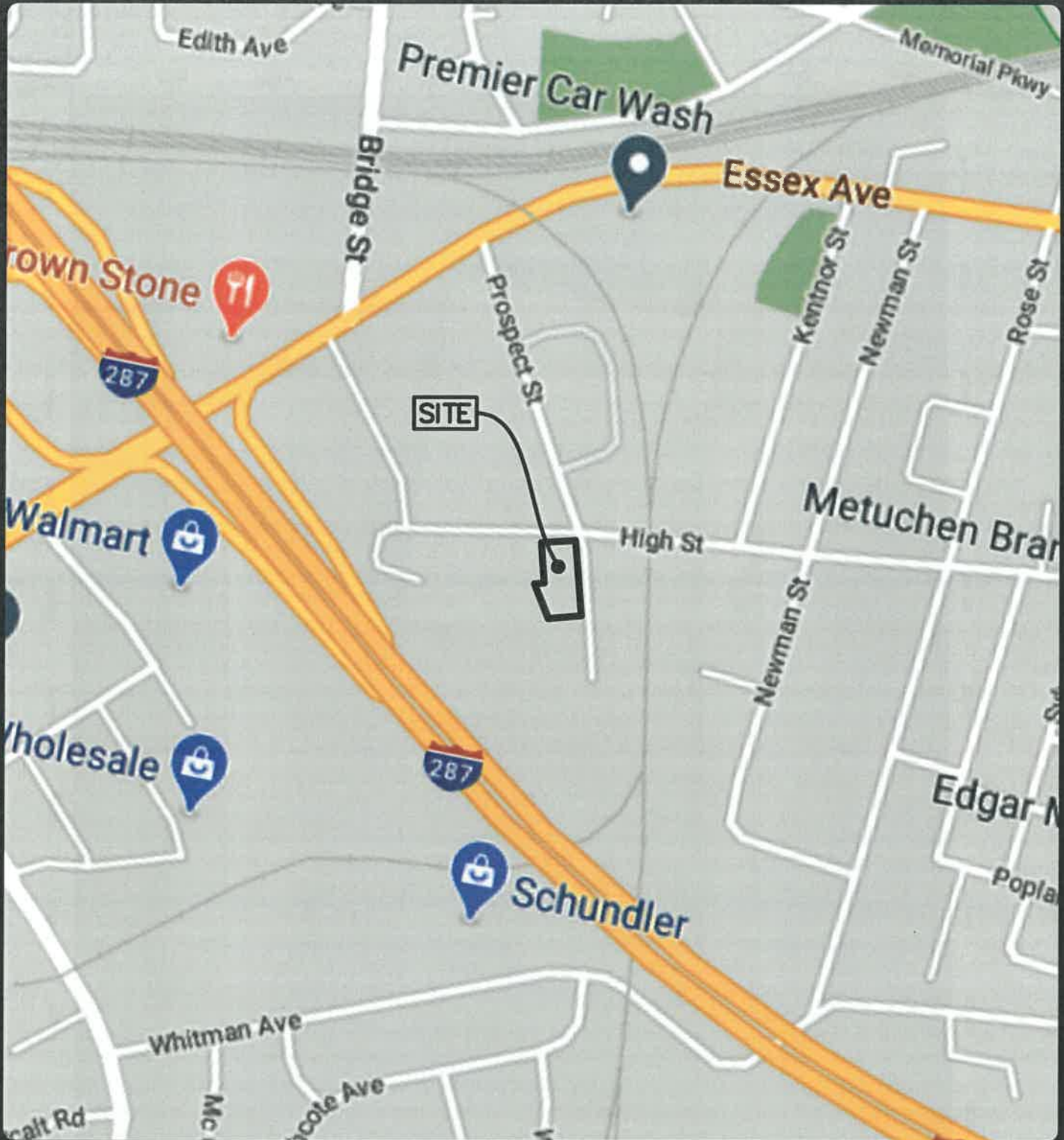
State Plane Coordinates:
 N: 619,043.46 ft.
 E: 527,751.51 ft.



Scale: 1"=2,000±ft Job # 2022.004

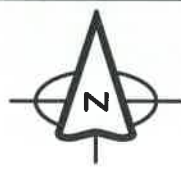
Soil Map—Middlesex County, New Jersey





ROAD MAP

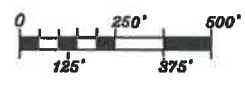
Metuchen Township
Middlesex County



BLOCK
152

LOT
51.01
&
51.02

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261 CLEVELAND AVENUE
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(732) 846-8585



Scale: 1"=500±ft

Job # 2022.004

STORMWATER MANAGEMENT PLAN & DESIGN

The guidelines for hydraulic design, as prepared by the Soil Conservation District, the Borough of Metuchen, Middlesex County and the New Jersey Department of Environmental Protection have been utilized for the drainage design of this project. The purpose of the drainage design is for the post-development peak drainage flow pattern to continue, as it exists today. The proposed location and design of the porous pavement will allow the post-development peak flows from the site to be attenuated to meet all applicable reductions from the pre-development condition.

Summary of the Runoff Analysis:

The existing site drains overland in a Northerly direction into an offsite culvert on the corner of Prospect Street and High Street and continues to flow to the North. The porous pavement is proposed to infiltrate and detain the excess runoff prior to discharging downstream.

In accordance with N.J.A.C. 7:8-5.4(a)3, the stormwater management system for the proposed development has been designed to control stormwater runoff quantity impacts. The post-construction peak runoff rates for the 100, 10 and 2-year storm events are 80, 75 and 50 percent, respectively, of the pre-construction peak runoff rates. 24-hour rainfall rates from NOAA have been used for analysis to calculate durations and intensities through NCRS Method.

Summary Tables:

The following tables summarize the reduction of runoff for the 2, 10, 25, and 100-year storm events:

EXISTING & PROPOSED CONDITIONS

STORM	EXISTING RUNOFF (CFS)	REQUIRED REDUCTION	PROPOSED RUNOFF (CFS)	PERCENT REDUCTION	CONDITION
100	2.52	20%	1.30	51.6%	COMPLIES
25	1.81	-	0.96	53.0%	COMPLIES
10	1.41	25%	0.76	53.9%	COMPLIES
2	0.84	50%	0.41	51.2%	COMPLIES

Summary of the Groundwater Recharge Analysis:

The following tables summarizes the groundwater recharge rates:

<u>Pre-Developed Condition</u>	<u>Post Development Conditions</u>
Total Annual Recharge (cf) = <u>22,064</u>	Annual Recharge Requirements (cf) = <u>10,124</u>
	Annual Recharge Deficit (cf) = <u>11,940</u>

In accordance with N.J.A.C. 7:8-5.4(a)2, the reduction of impervious coverage onsite meets the groundwater recharge requirement (See Appendix D for the spreadsheet).

Summary of the Water Quality Analysis:

The use of porous pavement has an 80% TSS Removal and is in accordance with water quality requirements for all additional vehicular surfaces proposed on site. The maximum ratio of additional inflow drainage area to the pervious paving system is 3:1. Porous pavement has a total surface area of 0.08 acres and the additional inflow drainage area is 0.11 acres, which is a 1.4:1 ratio.

APPENDIX A: EXISTING CONDITIONS



EX UNDETAINED AREA



Summary for Subcatchment 1S: EX UNDETAINED AREA

Runoff = 0.84 cfs @ 12.10 hrs, Volume= 0.055 af, Depth> 2.14"

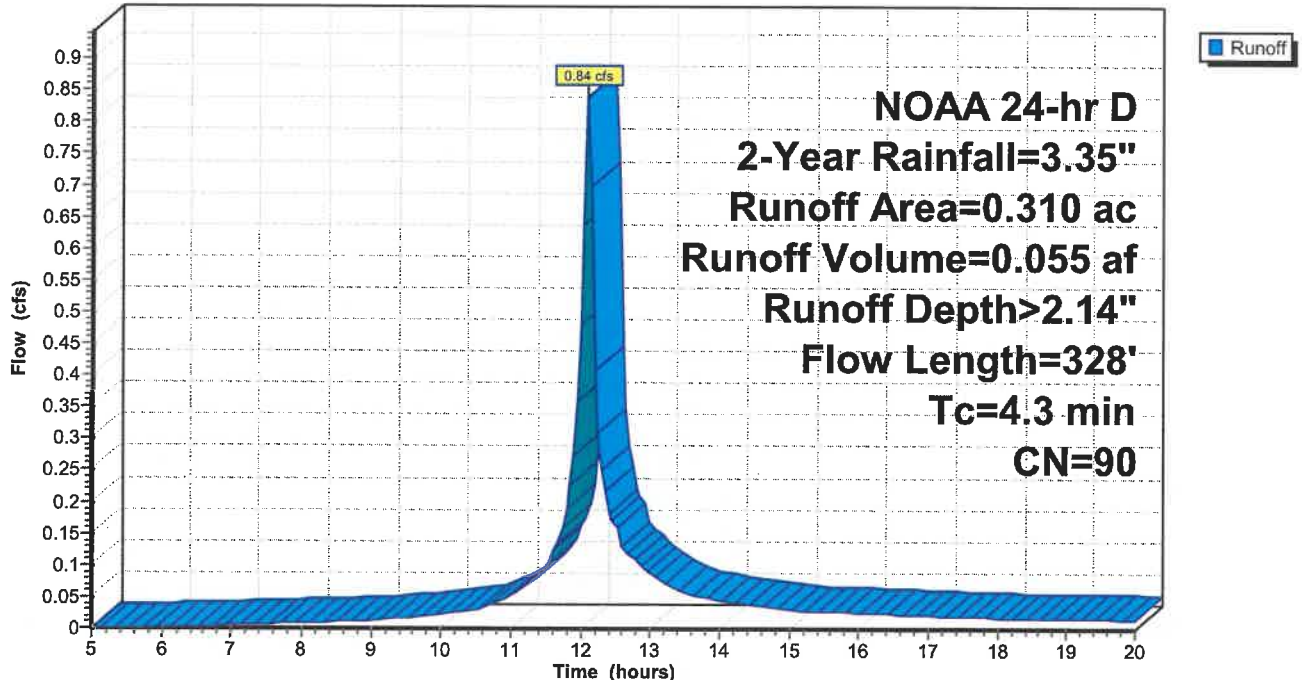
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 2-Year Rainfall=3.35"

Area (ac)	CN	Description
0.230	96	Gravel surface, HSG C
0.030	70	Woods, Good, HSG C
0.050	74	>75% Grass cover, Good, HSG C
0.310	90	Weighted Average
0.310		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	33	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.35"
0.7	131	0.0400	3.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.4	124	0.0556	4.79		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.2	40	0.0050	3.72	4.57	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
4.3	328	Total			

Subcatchment 1S: EX UNDETAINED AREA

Hydrograph



Summary for Subcatchment 1S: EX UNDETAINED AREA

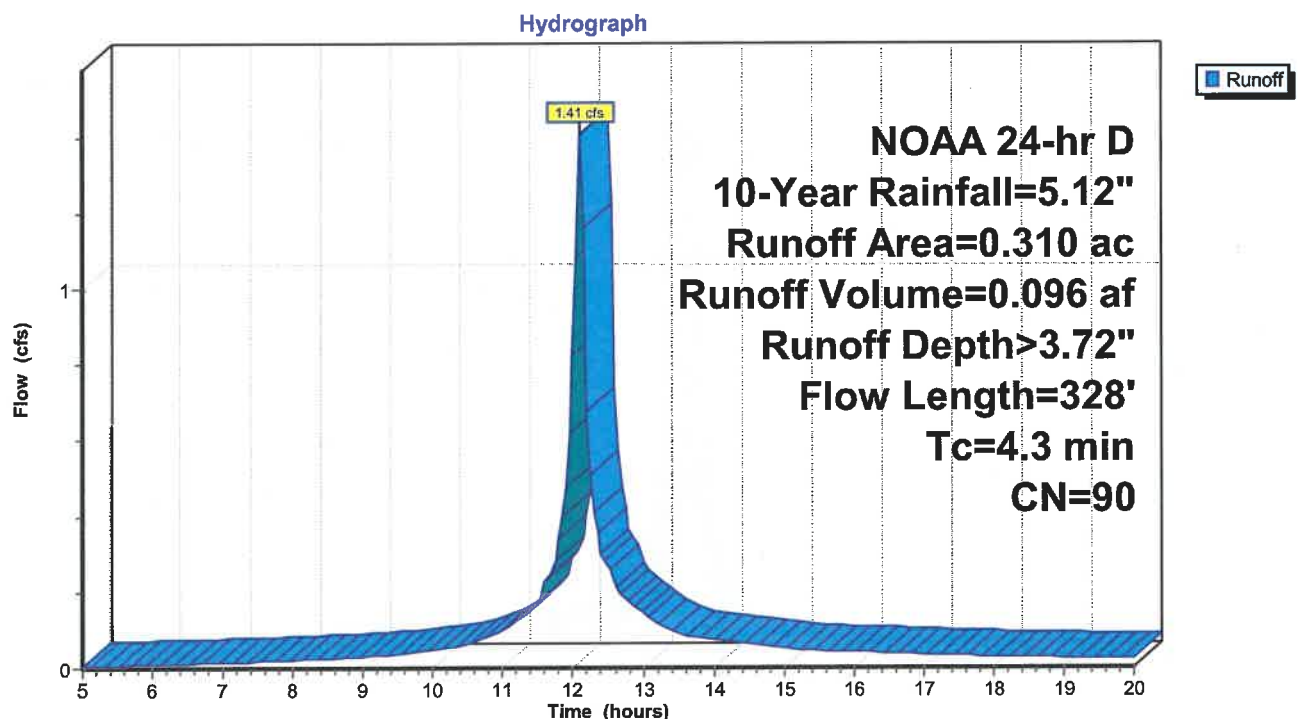
Runoff = 1.41 cfs @ 12.10 hrs, Volume= 0.096 af, Depth> 3.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 10-Year Rainfall=5.12"

Area (ac)	CN	Description
0.230	96	Gravel surface, HSG C
0.030	70	Woods, Good, HSG C
0.050	74	>75% Grass cover, Good, HSG C
0.310	90	Weighted Average
0.310		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	33	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.35"
0.7	131	0.0400	3.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.4	124	0.0556	4.79		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.2	40	0.0050	3.72	4.57	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
4.3	328	Total			

Subcatchment 1S: EX UNDETAINED AREA



Summary for Subcatchment 1S: EX UNDETAINED AREA

Runoff = 1.81 cfs @ 12.10 hrs, Volume= 0.125 af, Depth> 4.84"

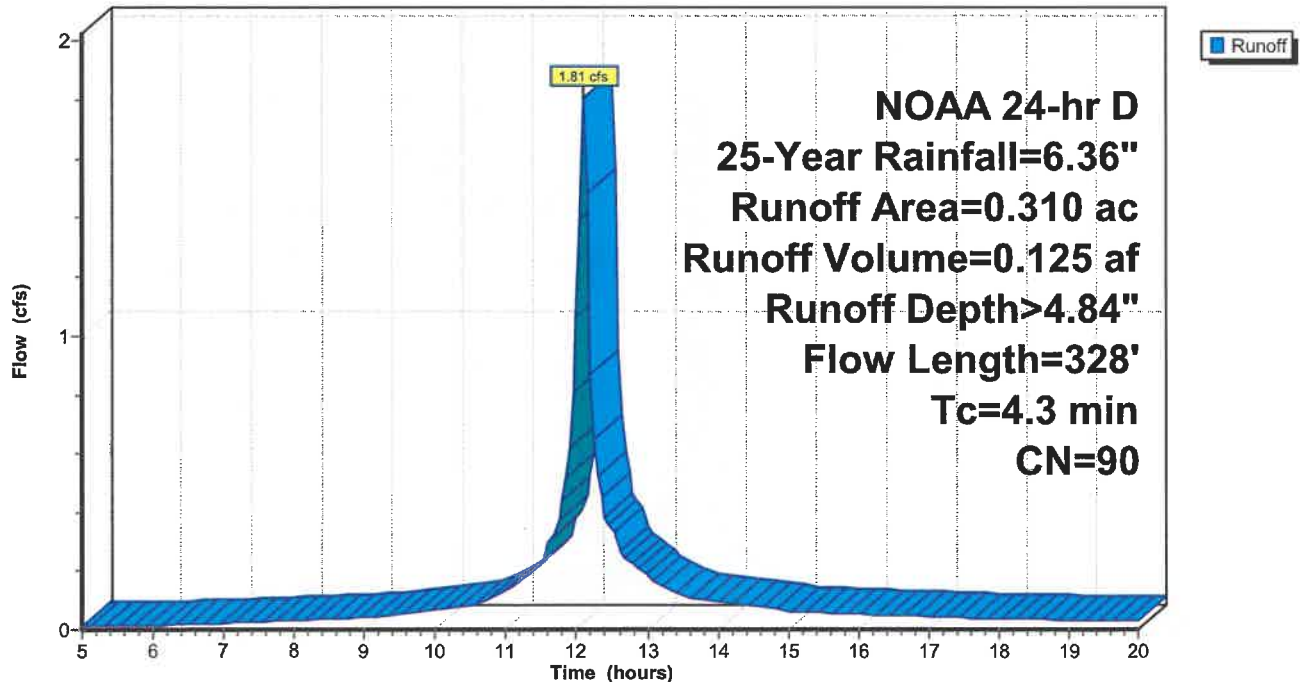
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 25-Year Rainfall=6.36"

Area (ac)	CN	Description
0.230	96	Gravel surface, HSG C
0.030	70	Woods, Good, HSG C
0.050	74	>75% Grass cover, Good, HSG C
0.310	90	Weighted Average
0.310		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	33	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.35"
0.7	131	0.0400	3.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.4	124	0.0556	4.79		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.2	40	0.0050	3.72	4.57	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
4.3	328	Total			

Subcatchment 1S: EX UNDETAINED AREA

Hydrograph



Summary for Subcatchment 1S: EX UNDETAINED AREA

Runoff = 2.52 cfs @ 12.10 hrs, Volume= 0.178 af, Depth> 6.89"

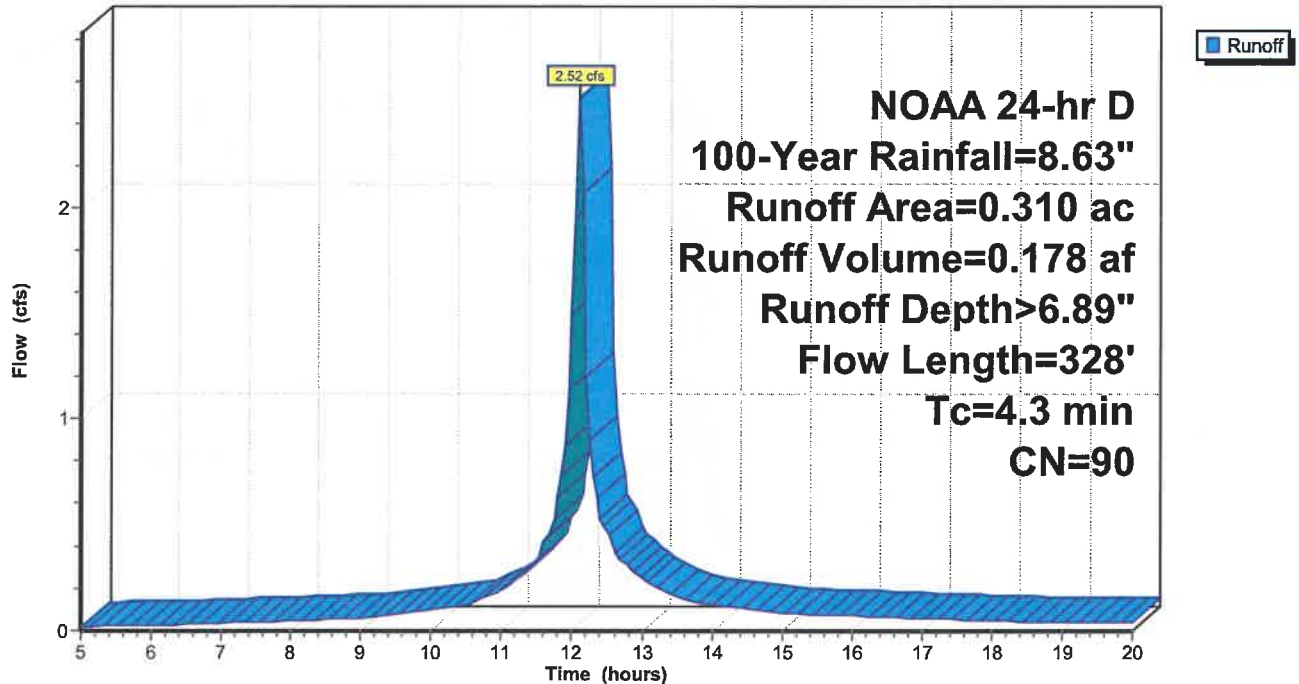
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 100-Year Rainfall=8.63"

Area (ac)	CN	Description
0.230	96	Gravel surface, HSG C
0.030	70	Woods, Good, HSG C
0.050	74	>75% Grass cover, Good, HSG C
0.310	90	Weighted Average
0.310		100.00% Pervious Area

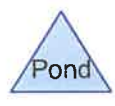
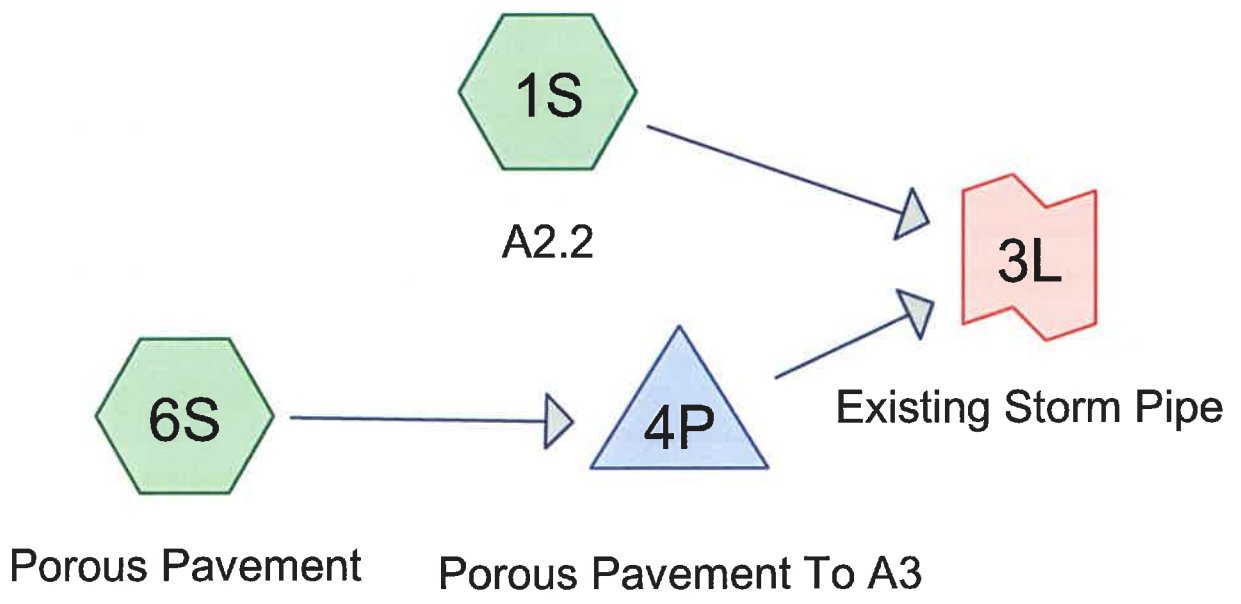
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	33	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.35"
0.7	131	0.0400	3.22		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.4	124	0.0556	4.79		Shallow Concentrated Flow, Paved Kv= 20.3 fps
0.2	40	0.0050	3.72	4.57	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
4.3	328	Total			

Subcatchment 1S: EX UNDETAINED AREA

Hydrograph



APPENDIX B: PROPOSED CONDITIONS



2022.004-PROPOSED

NOAA 24-hr D 2-Year Rainfall=3.35"

Prepared by Menlo Engineering Associates

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Page 2

Summary for Subcatchment 1S: A2.2

Runoff = 0.41 cfs @ 12.09 hrs, Volume= 0.029 af, Depth> 2.94"
 Routed to Link 3L : Existing Storm Pipe

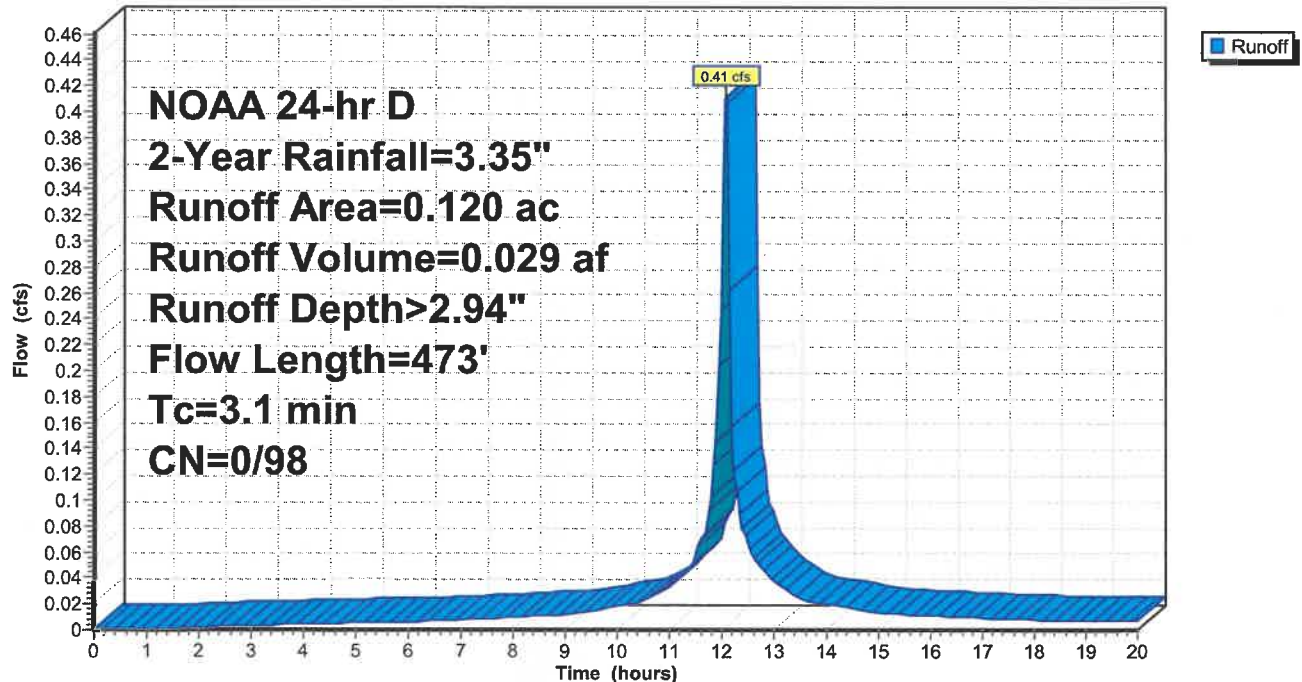
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 2-Year Rainfall=3.35"

Area (ac)	CN	Description
0.120	98	Paved parking, HSG C
0.120	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	88	0.0100	1.04		Sheet Flow, Roof Smooth surfaces n= 0.011 P2= 3.35"
1.7	385	0.0050	3.72	4.57	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.1	473	Total			

Subcatchment 1S: A2.2

Hydrograph



Summary for Subcatchment 6S: Porous Pavement

Runoff = 0.61 cfs @ 12.10 hrs, Volume= 0.045 af, Depth> 2.83"
 Routed to Pond 4P : Porous Pavement To A3

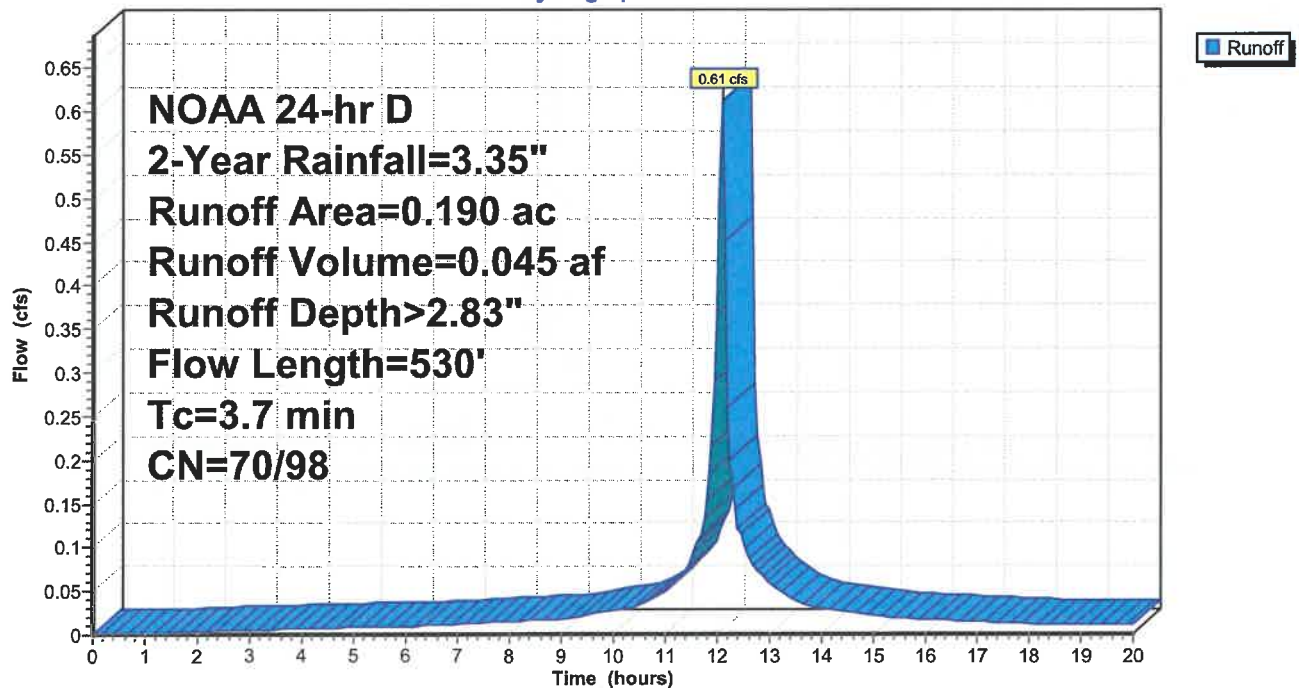
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 2-Year Rainfall=3.35"

Area (ac)	CN	Description
0.180	98	Paved parking, HSG C
0.010	70	Woods, Good, HSG C
0.190	97	Weighted Average
0.010	70	5.26% Pervious Area
0.180	98	94.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.07		Sheet Flow, Roof Smooth surfaces n= 0.011 P2= 3.35"
0.4	50	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.7	380	0.0050	3.72	4.57	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.7	530	Total			

Subcatchment 6S: Porous Pavement

Hydrograph



Summary for Pond 4P: Porous Pavement To A3

Inflow Area = 0.190 ac, 94.74% Impervious, Inflow Depth > 2.83" for 2-Year event
 Inflow = 0.61 cfs @ 12.10 hrs, Volume= 0.045 af
 Outflow = 0.06 cfs @ 12.93 hrs, Volume= 0.017 af, Atten= 90%, Lag= 50.0 min
 Primary = 0.06 cfs @ 12.93 hrs, Volume= 0.017 af
 Routed to Link 3L : Existing Storm Pipe

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 117.20' @ 12.93 hrs Surf.Area= 3,375 sf Storage= 1,334 cf

Plug-Flow detention time= 314.4 min calculated for 0.017 af (39% of inflow)
 Center-of-Mass det. time= 172.1 min (895.2 - 723.1)

Volume	Invert	Avail.Storage	Storage Description
#1	116.00'	3,341 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 10,125 cf Overall x 33.0% Voids

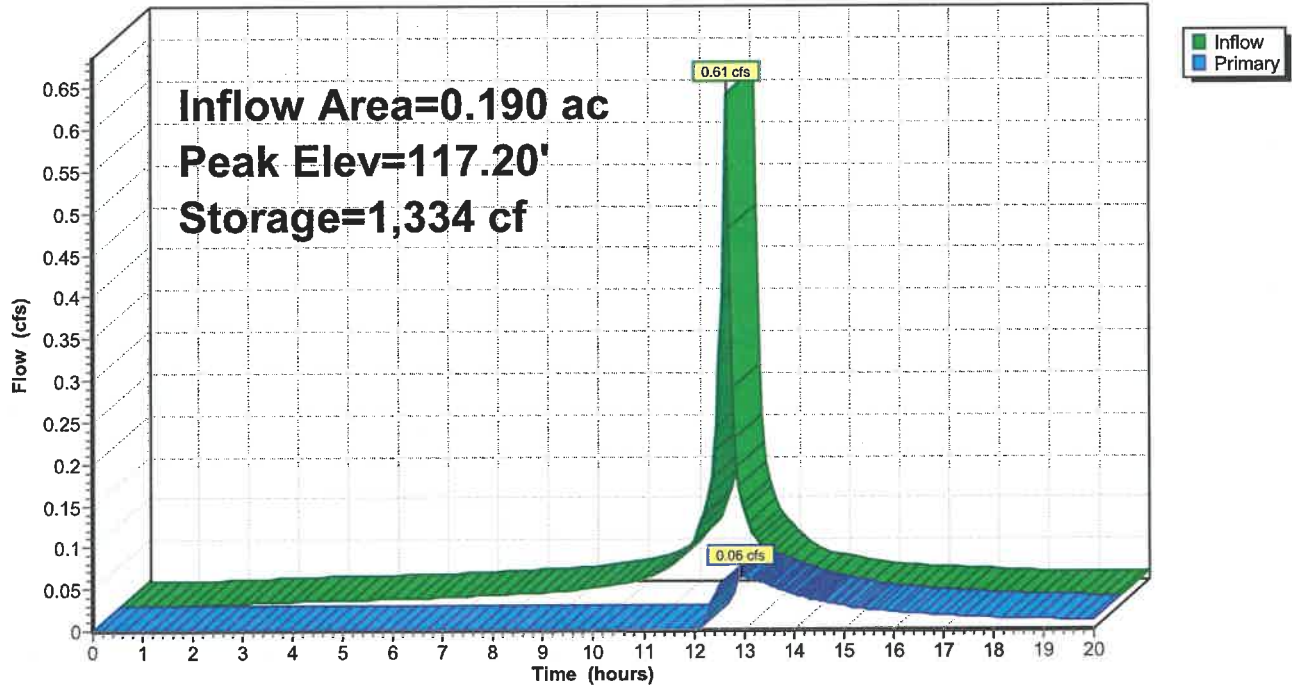
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
116.00	3,375	0	0
119.00	3,375	10,125	10,125

Device	Routing	Invert	Outlet Devices
#1	Primary	117.00'	3.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.06 cfs @ 12.93 hrs HW=117.20' (Free Discharge)
 1=Orifice/Grate (Orifice Controls 0.06 cfs @ 1.51 fps)

Pond 4P: Porous Pavement To A3

Hydrograph



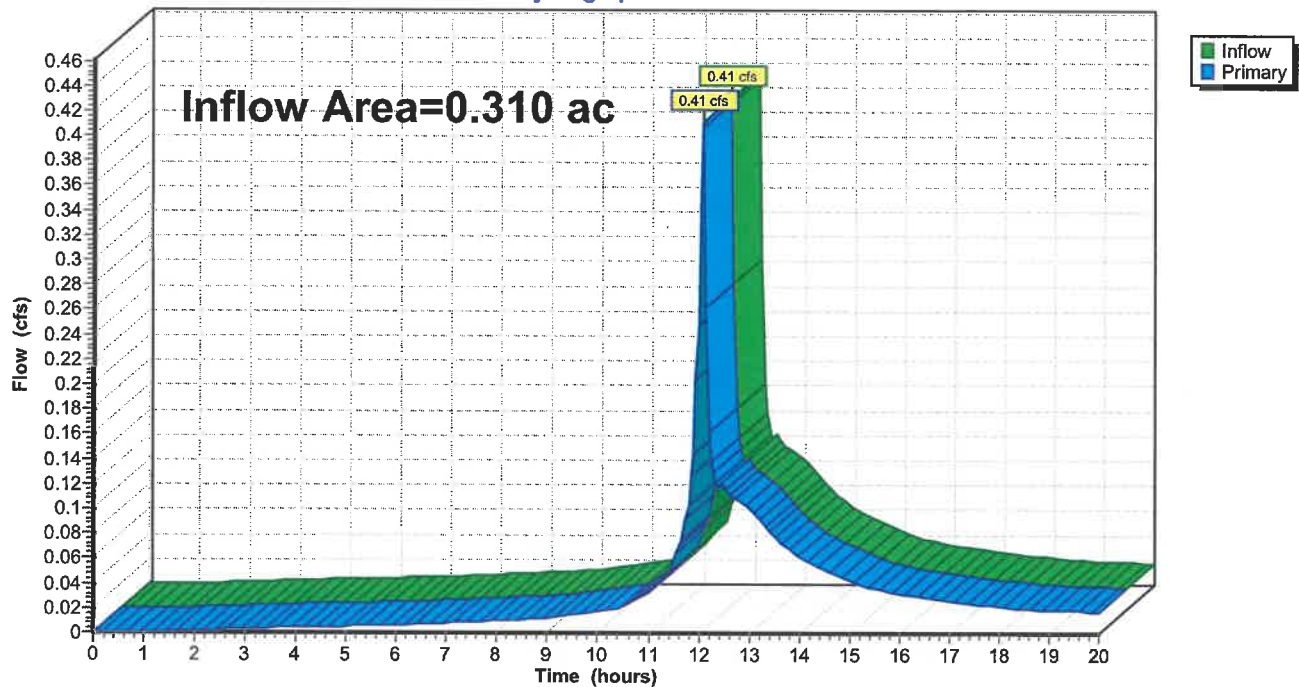
Summary for Link 3L: Existing Storm Pipe

Inflow Area = 0.310 ac, 96.77% Impervious, Inflow Depth > 1.81" for 2-Year event
Inflow = 0.41 cfs @ 12.09 hrs, Volume= 0.047 af
Primary = 0.41 cfs @ 12.09 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link 3L: Existing Storm Pipe

Hydrograph



Summary for Subcatchment 1S: A2.2

Runoff = 0.63 cfs @ 12.09 hrs, Volume= 0.046 af, Depth> 4.61"
 Routed to Link 3L : Existing Storm Pipe

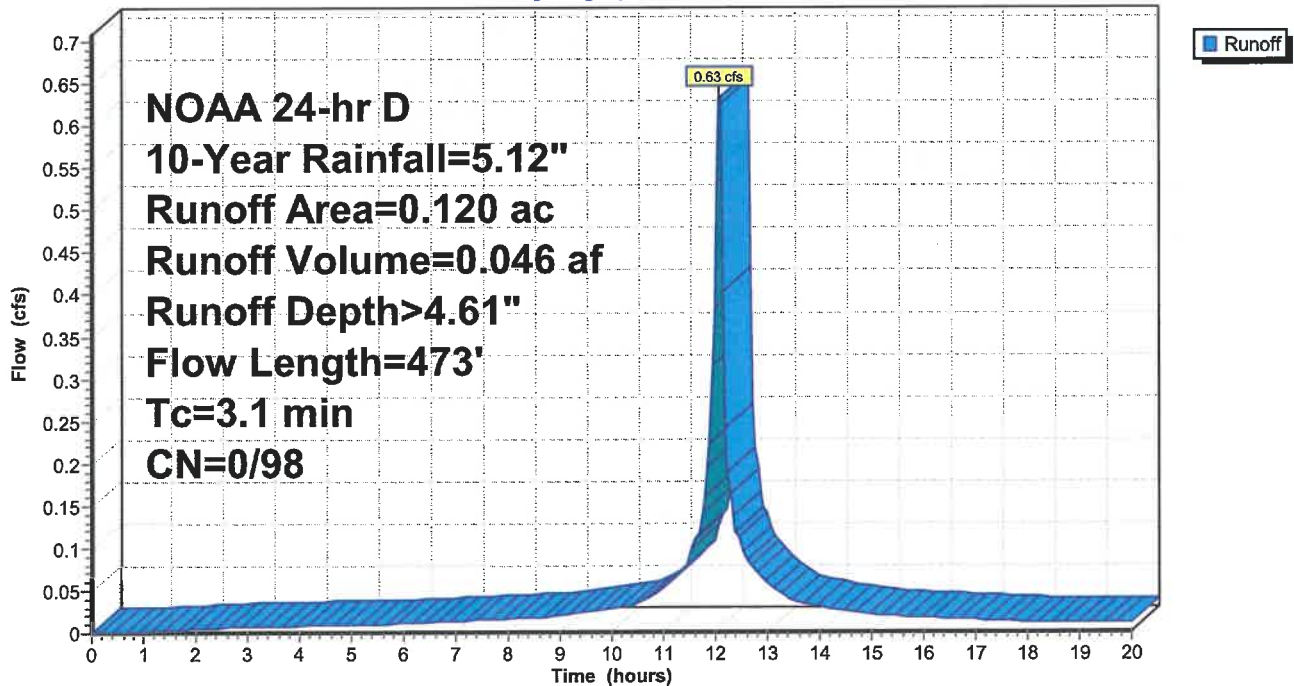
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 10-Year Rainfall=5.12"

Area (ac)	CN	Description
0.120	98	Paved parking, HSG C
0.120	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	88	0.0100	1.04		Sheet Flow, Roof Smooth surfaces n= 0.011 P2= 3.35"
1.7	385	0.0050	3.72	4.57	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.1	473	Total			

Subcatchment 1S: A2.2

Hydrograph



Summary for Subcatchment 6S: Porous Pavement

Runoff = 0.95 cfs @ 12.10 hrs, Volume= 0.071 af, Depth> 4.47"
 Routed to Pond 4P : Porous Pavement To A3

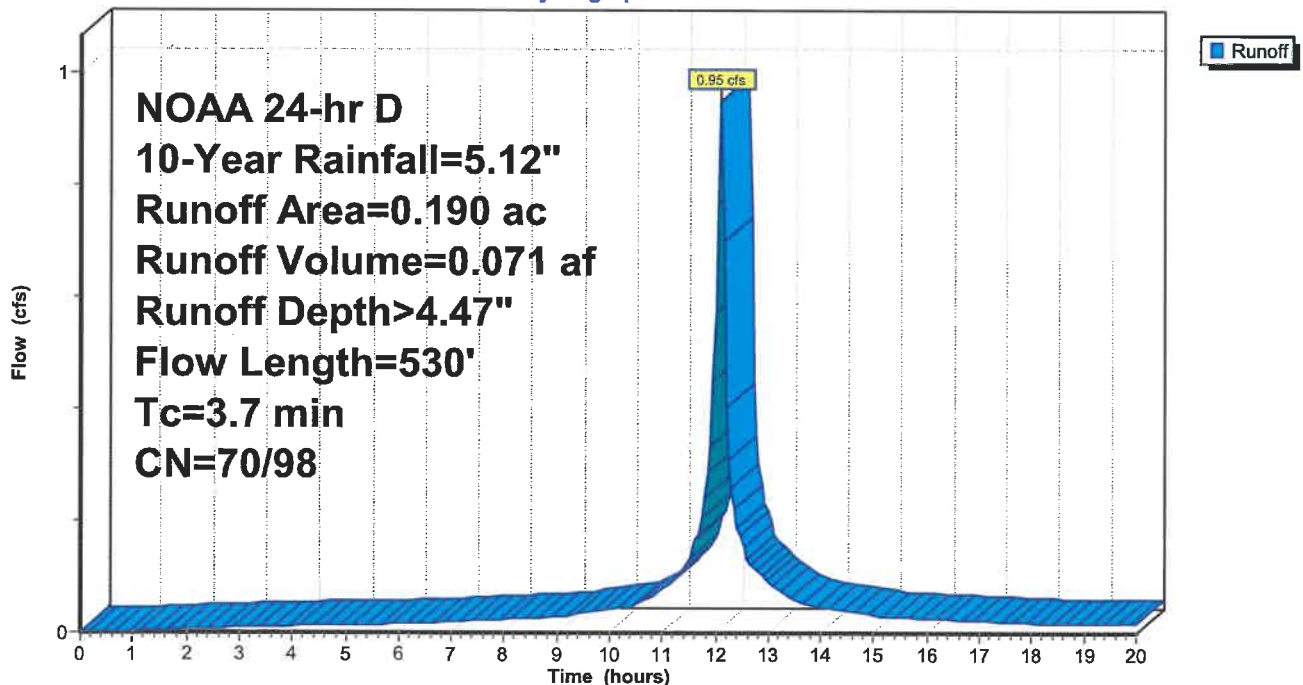
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 10-Year Rainfall=5.12"

Area (ac)	CN	Description
0.180	98	Paved parking, HSG C
0.010	70	Woods, Good, HSG C
0.190	97	Weighted Average
0.010	70	5.26% Pervious Area
0.180	98	94.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.07		Sheet Flow, Roof Smooth surfaces n= 0.011 P2= 3.35"
0.4	50	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.7	380	0.0050	3.72	4.57	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.7	530	Total			

Subcatchment 6S: Porous Pavement

Hydrograph



Summary for Pond 4P: Porous Pavement To A3

Inflow Area = 0.190 ac, 94.74% Impervious, Inflow Depth > 4.47" for 10-Year event
 Inflow = 0.95 cfs @ 12.10 hrs, Volume= 0.071 af
 Outflow = 0.17 cfs @ 12.49 hrs, Volume= 0.043 af, Atten= 82%, Lag= 23.6 min
 Primary = 0.17 cfs @ 12.49 hrs, Volume= 0.043 af
 Routed to Link 3L : Existing Storm Pipe

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 117.66' @ 12.49 hrs Surf.Area= 3,375 sf Storage= 1,849 cf

Plug-Flow detention time= 232.2 min calculated for 0.043 af (61% of inflow)
 Center-of-Mass det. time= 139.5 min (855.0 - 715.5)

Volume	Invert	Avail.Storage	Storage Description
#1	116.00'	3,341 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 10,125 cf Overall x 33.0% Voids

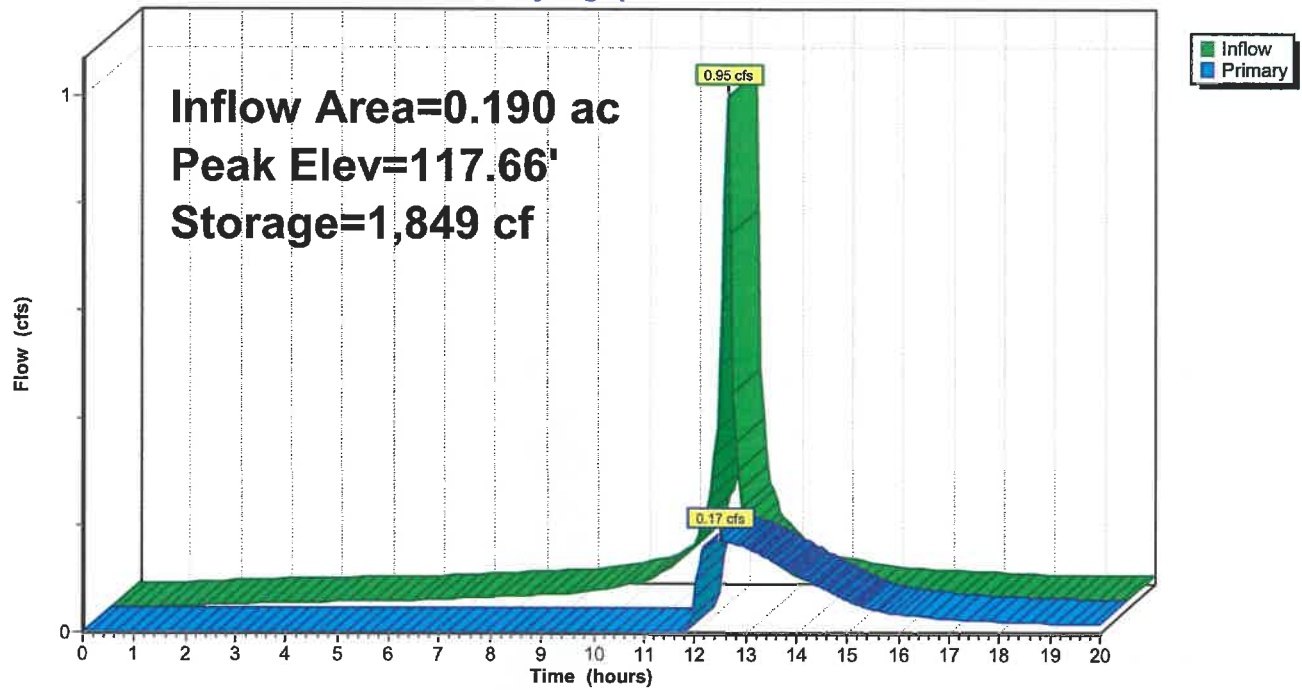
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
116.00	3,375	0	0
119.00	3,375	10,125	10,125

Device	Routing	Invert	Outlet Devices
#1	Primary	117.00'	3.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.17 cfs @ 12.49 hrs HW=117.66' (Free Discharge)
 ←**1=Orifice/Grate** (Orifice Controls 0.17 cfs @ 3.52 fps)

Pond 4P: Porous Pavement To A3

Hydrograph



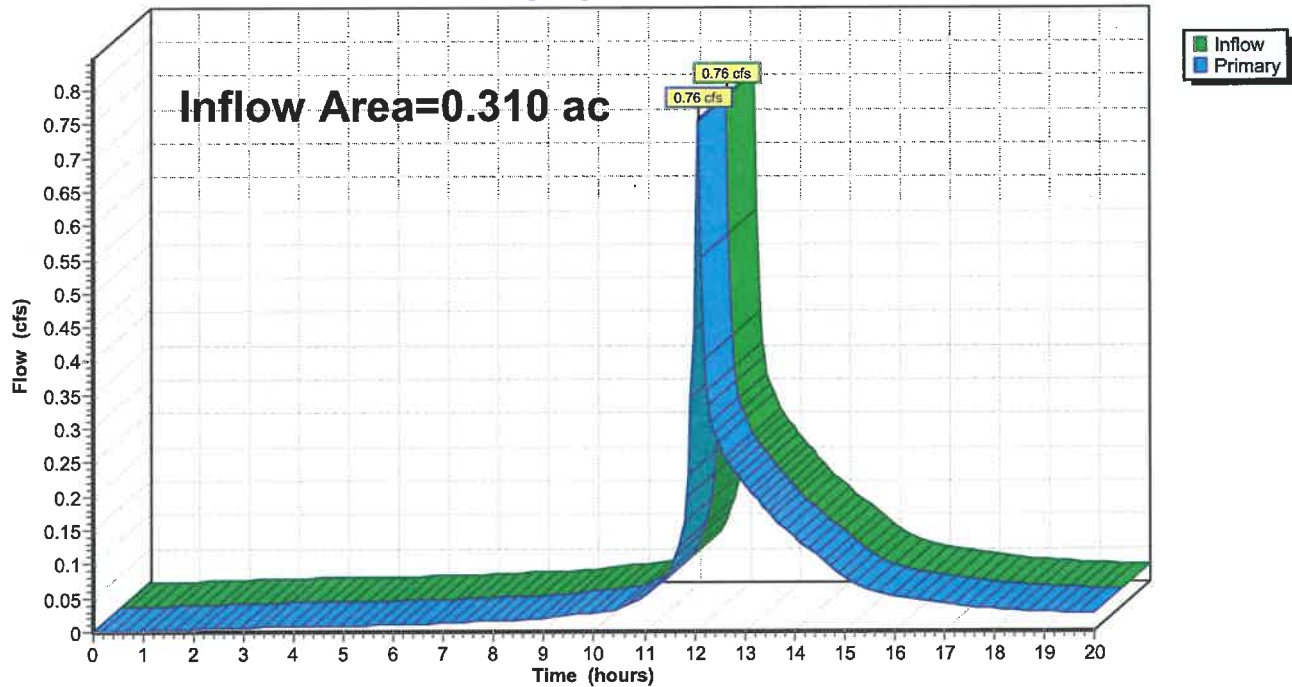
Summary for Link 3L: Existing Storm Pipe

Inflow Area = 0.310 ac, 96.77% Impervious, Inflow Depth > 3.45" for 10-Year event
Inflow = 0.76 cfs @ 12.09 hrs, Volume= 0.089 af
Primary = 0.76 cfs @ 12.09 hrs, Volume= 0.089 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link 3L: Existing Storm Pipe

Hydrograph



Summary for Subcatchment 1S: A2.2

Runoff = 0.79 cfs @ 12.09 hrs, Volume= 0.058 af, Depth> 5.79"
 Routed to Link 3L : Existing Storm Pipe

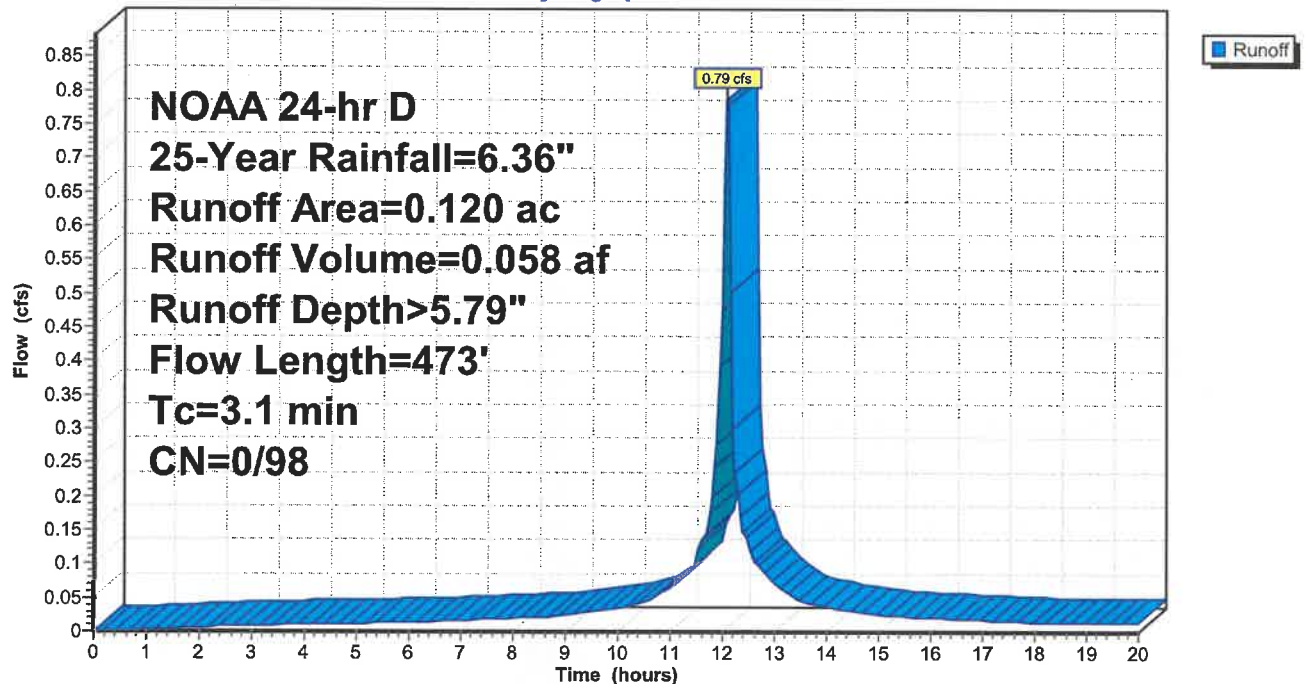
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 25-Year Rainfall=6.36"

Area (ac)	CN	Description
0.120	98	Paved parking, HSG C
0.120	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	88	0.0100	1.04		Sheet Flow, Roof Smooth surfaces n= 0.011 P2= 3.35"
1.7	385	0.0050	3.72	4.57	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.1	473	Total			

Subcatchment 1S: A2.2

Hydrograph



Summary for Subcatchment 6S: Porous Pavement

Runoff = 1.19 cfs @ 12.10 hrs, Volume= 0.089 af, Depth> 5.63"
 Routed to Pond 4P : Porous Pavement To A3

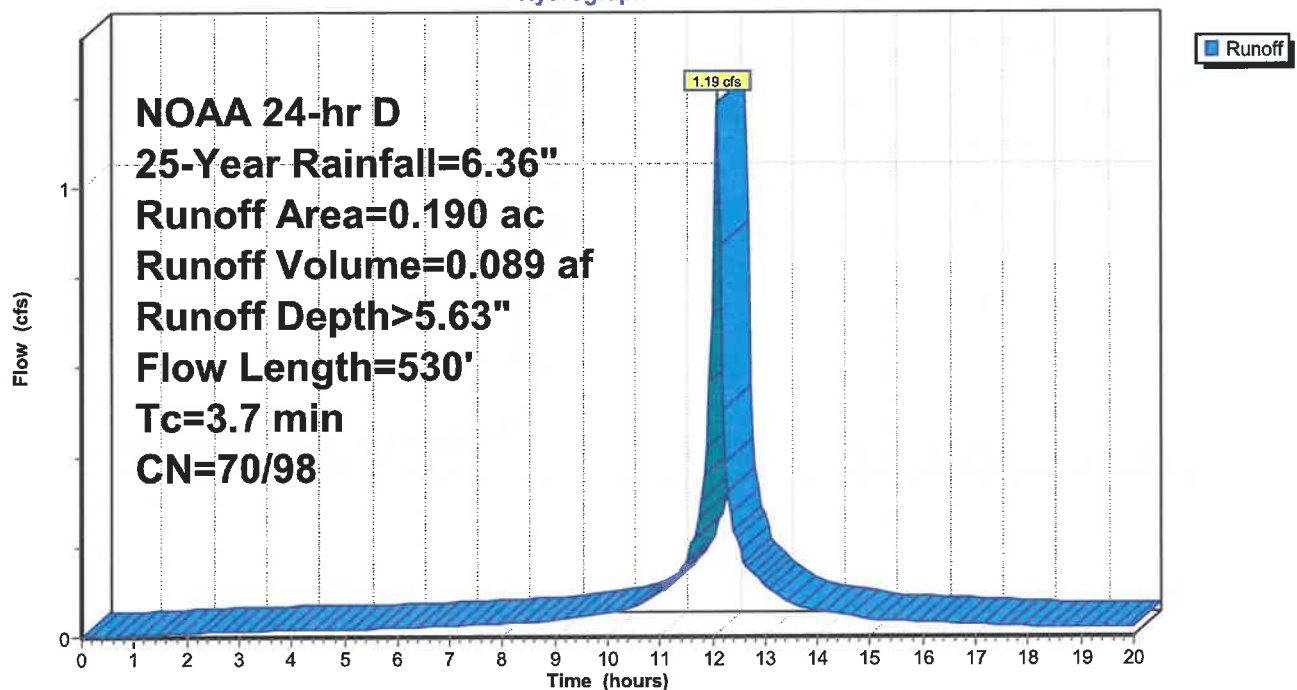
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 25-Year Rainfall=6.36"

Area (ac)	CN	Description
0.180	98	Paved parking, HSG C
0.010	70	Woods, Good, HSG C
0.190	97	Weighted Average
0.010	70	5.26% Pervious Area
0.180	98	94.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.07		Sheet Flow, Roof Smooth surfaces n= 0.011 P2= 3.35"
0.4	50	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.7	380	0.0050	3.72	4.57	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.7	530	Total			

Subcatchment 6S: Porous Pavement

Hydrograph



Summary for Pond 4P: Porous Pavement To A3

Inflow Area = 0.190 ac, 94.74% Impervious, Inflow Depth > 5.63" for 25-Year event
 Inflow = 1.19 cfs @ 12.10 hrs, Volume= 0.089 af
 Outflow = 0.22 cfs @ 12.47 hrs, Volume= 0.061 af, Atten= 81%, Lag= 22.5 min
 Primary = 0.22 cfs @ 12.47 hrs, Volume= 0.061 af
 Routed to Link 3L : Existing Storm Pipe

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 118.00' @ 12.47 hrs Surf.Area= 3,375 sf Storage= 2,228 cf

Plug-Flow detention time= 219.4 min calculated for 0.061 af (68% of inflow)
 Center-of-Mass det. time= 138.5 min (850.7 - 712.2)

Volume	Invert	Avail.Storage	Storage Description
#1	116.00'	3,341 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 10,125 cf Overall x 33.0% Voids

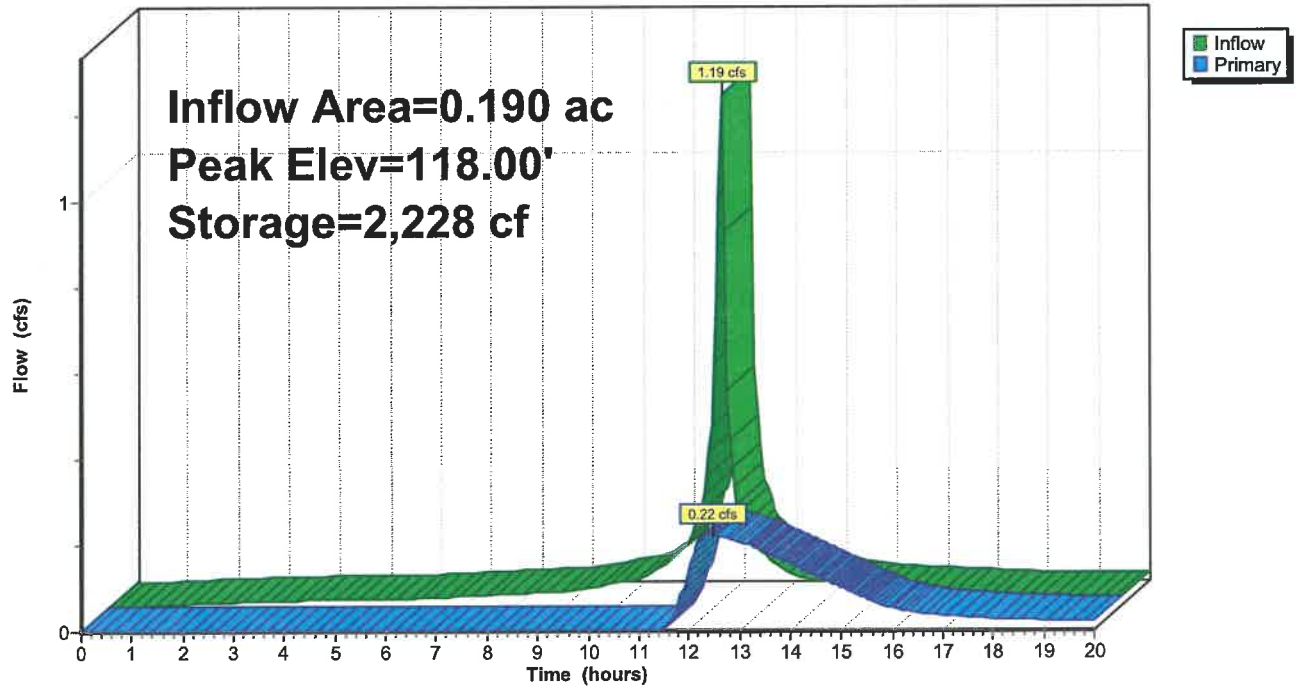
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
116.00	3,375	0	0
119.00	3,375	10,125	10,125

Device	Routing	Invert	Outlet Devices
#1	Primary	117.00'	3.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.22 cfs @ 12.47 hrs HW=118.00' (Free Discharge)
 ↖ **1=Orifice/Grate** (Orifice Controls 0.22 cfs @ 4.51 fps)

Pond 4P: Porous Pavement To A3

Hydrograph

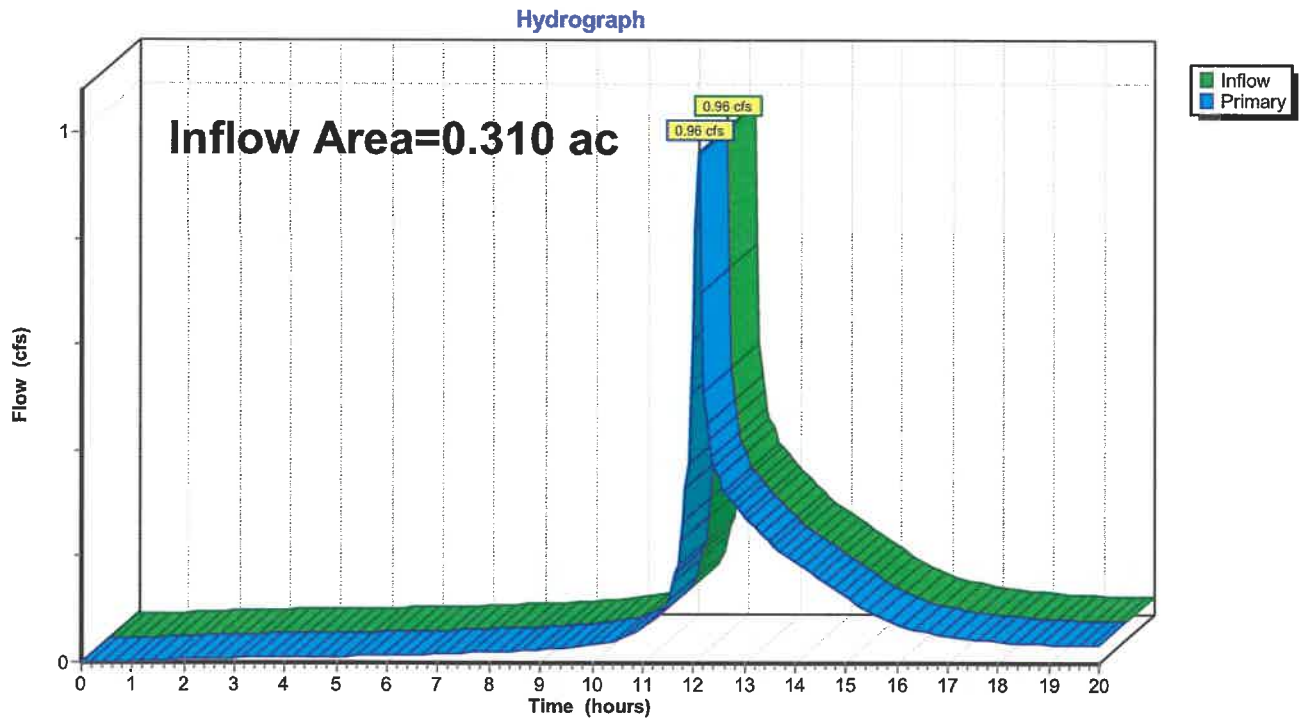


Summary for Link 3L: Existing Storm Pipe

Inflow Area = 0.310 ac, 96.77% Impervious, Inflow Depth > 4.60" for 25-Year event
Inflow = 0.96 cfs @ 12.09 hrs, Volume= 0.119 af
Primary = 0.96 cfs @ 12.09 hrs, Volume= 0.119 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link 3L: Existing Storm Pipe



Summary for Subcatchment 1S: A2.2

Runoff = 1.07 cfs @ 12.09 hrs, Volume= 0.079 af, Depth> 7.93"
 Routed to Link 3L : Existing Storm Pipe

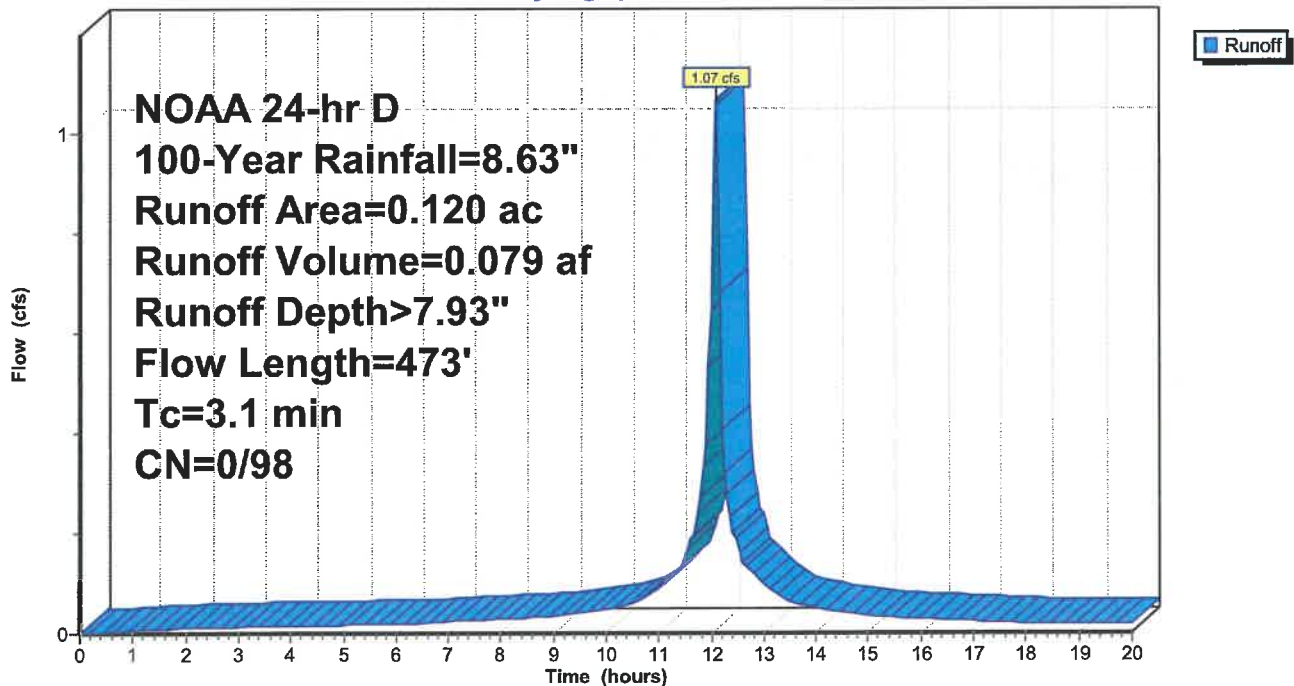
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 100-Year Rainfall=8.63"

Area (ac)	CN	Description
0.120	98	Paved parking, HSG C
0.120	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	88	0.0100	1.04		Sheet Flow, Roof Smooth surfaces n= 0.011 P2= 3.35"
1.7	385	0.0050	3.72	4.57	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.1	473	Total			

Subcatchment 1S: A2.2

Hydrograph



Summary for Subcatchment 6S: Porous Pavement

Runoff = 1.63 cfs @ 12.10 hrs, Volume= 0.123 af, Depth> 7.76"
 Routed to Pond 4P : Porous Pavement To A3

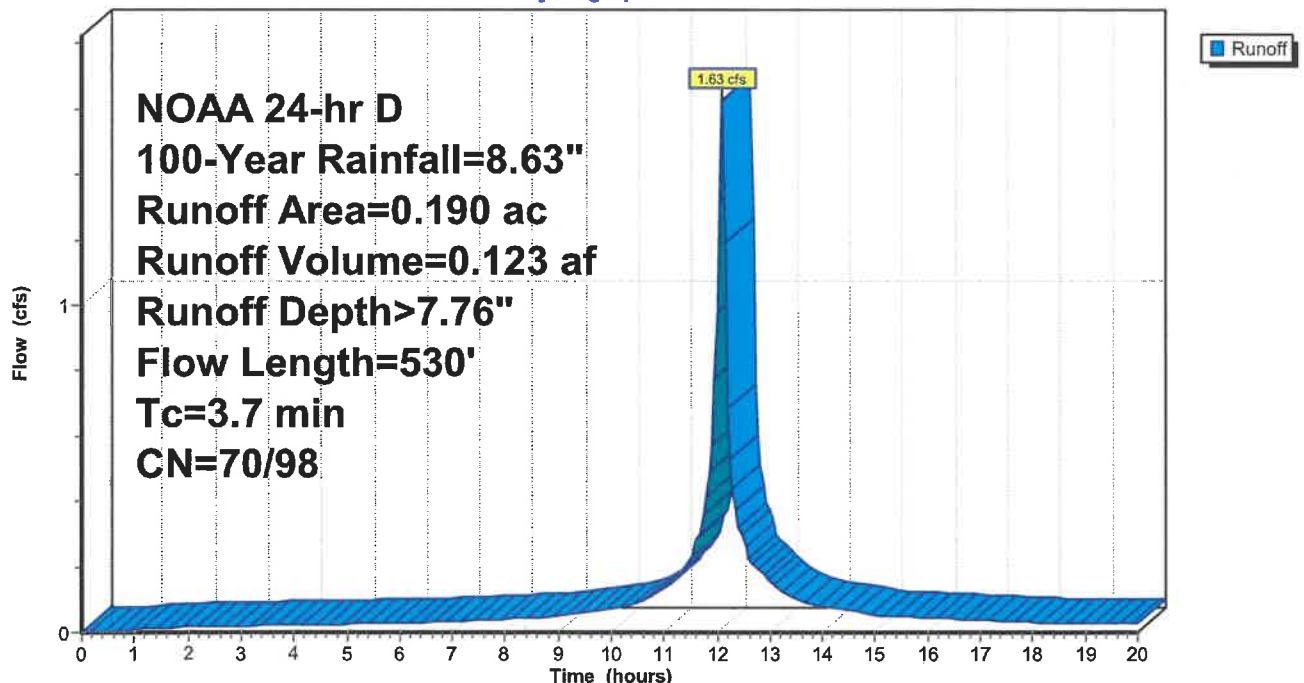
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 100-Year Rainfall=8.63"

Area (ac)	CN	Description
0.180	98	Paved parking, HSG C
0.010	70	Woods, Good, HSG C
0.190	97	Weighted Average
0.010	70	5.26% Pervious Area
0.180	98	94.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0100	1.07		Sheet Flow, Roof Smooth surfaces n= 0.011 P2= 3.35"
0.4	50	0.0100	2.03		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.7	380	0.0050	3.72	4.57	Pipe Channel, RCP_Round 15" 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
3.7	530	Total			

Subcatchment 6S: Porous Pavement

Hydrograph



Summary for Pond 4P: Porous Pavement To A3

Inflow Area = 0.190 ac, 94.74% Impervious, Inflow Depth > 7.76" for 100-Year event
 Inflow = 1.63 cfs @ 12.10 hrs, Volume= 0.123 af
 Outflow = 0.28 cfs @ 12.51 hrs, Volume= 0.094 af, Atten= 83%, Lag= 25.1 min
 Primary = 0.28 cfs @ 12.51 hrs, Volume= 0.094 af
 Routed to Link 3L : Existing Storm Pipe

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 118.57' @ 12.51 hrs Surf.Area= 3,375 sf Storage= 2,858 cf

Plug-Flow detention time= 206.4 min calculated for 0.094 af (77% of inflow)
 Center-of-Mass det. time= 139.6 min (847.8 - 708.2)

Volume	Invert	Avail.Storage	Storage Description
#1	116.00'	3,341 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 10,125 cf Overall x 33.0% Voids

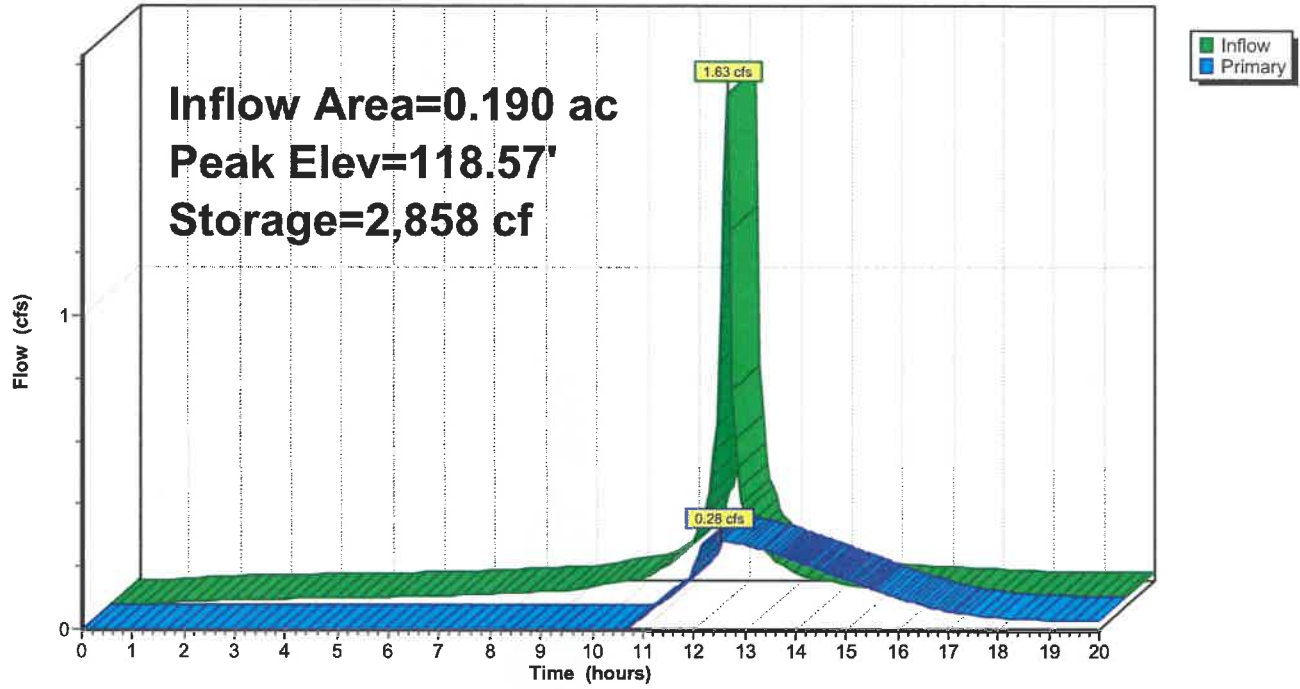
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
116.00	3,375	0	0
119.00	3,375	10,125	10,125

Device	Routing	Invert	Outlet Devices
#1	Primary	117.00'	3.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.28 cfs @ 12.51 hrs HW=118.57' (Free Discharge)
 ↳ **1=Orifice/Grate** (Orifice Controls 0.28 cfs @ 5.78 fps)

Pond 4P: Porous Pavement To A3

Hydrograph

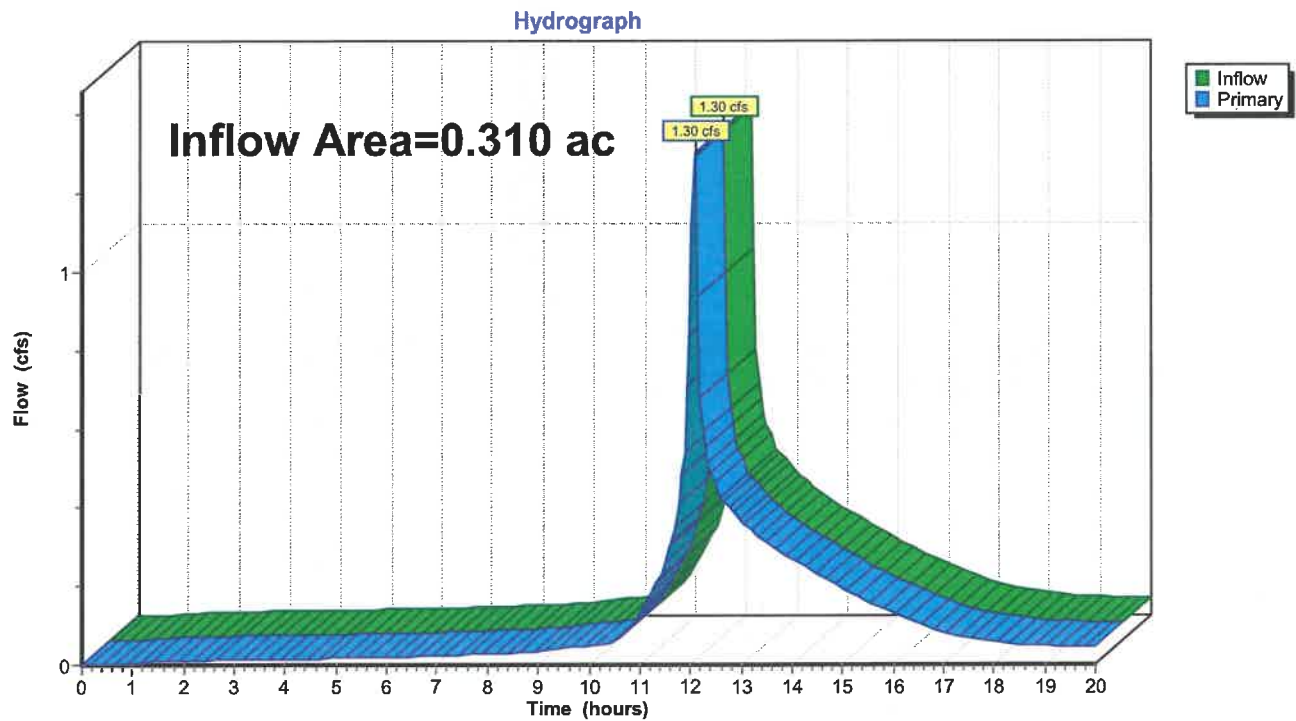


Summary for Link 3L: Existing Storm Pipe

Inflow Area = 0.310 ac, 96.77% Impervious, Inflow Depth > 6.72" for 100-Year event
Inflow = 1.30 cfs @ 12.09 hrs, Volume= 0.174 af
Primary = 1.30 cfs @ 12.09 hrs, Volume= 0.174 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link 3L: Existing Storm Pipe



APPENDIX C: PIPE CALCULATIONS

Pipe Calc

Line No.	Inlet ID	Line ID	Gnd/Rim El Up (ft)	Line Length (ft)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	i Inlet (in/hr)	Incr Q (cfs)	Total Area (ac)	Tc (min)	i Sys (in/hr)	Total Runoff (cfs)	Known Q (cfs)	Flow Rate (cfs)	Capac Full (cfs)	Line Size (in)	Line Slope (%)	Vel Ave (ft/s)	Invert Up (ft)	Invert Dn (ft)	n-val Pipe
1	A2	P8	119.25	43	0.00	0.00	0.0	0.00	0.00	0.31	5.6	8.52	2.57	0.00	2.57	4.40	15	0.46	3.80	112.90	112.70	0.013
2	A2.1	P6	118.90	19	0.00	0.00	0.0	0.00	0.00	0.12	4.1	8.84	1.05	0.00	1.05	4.67	15	0.52	1.17	113.00	112.90	0.013
3	A2.2	P5	115.75	51	0.12	0.99	3.1	8.84	1.05	0.12	3.1	8.84	1.05	0.00	1.05	4.51	15	0.49	1.51	113.25	113.00	0.013
4	A3	P7	118.85	84	0.19	0.96	4.5	8.84	1.61	0.19	4.5	8.84	1.61	0.00	1.61	4.46	15	0.48	2.26	113.30	112.90	0.013

Project File: New.stm

Number of lines: 4

Date: 3/21/2023

NOTES: Intensity = 42.39 / (Inlet time + 5.10) ^ 0.68 -- Return period = 25 Yrs. ; ** Critical depth

JOB NAME - WEIGHTED 'C' VALUES

SOIL TYPES : (C) Lb1B - Sassafra sandy loam, 2 to 5 percent slopes
 (C) NkrA - Sassafra gravelly sandy loam, 10 to 15 percent slopes

		TYPE 'C' SOILS												
STRUCTURE	TOTAL AREA (acres)	TOTAL WEIGHTED 'C'	IMPERVIOUS		'C' =	IMPERV 'C'	GRASS		'C' =	GRASS 'C'	WOODS		'C' =	WOODS 'C'
			AREA (acres)	%			AREA (acres)	%			AREA (acres)	%		
A3	0.19	0.96	0.18	95%	0.99	0.94		0.01	0.51	0.00	0.01	5%	0.45	0.02
A2.2	0.12	0.99	0.12	100%	0.99	0.99			0.51	0.00		0%	0.45	0.00
TOTALS	0.31	0.97	0.30	97%	0.99	0.96	0.00	0%	0.51	0.00	0.01	3%	0.45	0.01

APPENDIX D: INFILTRATION CALCULATIONS

Annual Groundwater Recharge Analysis (based on GSR-32)

Select Township ↓ **MIDDLESEX CO., METUCHEN BORO**

Average Annual P (in) **48.6**

Climatic Factor **1.55**

Project Name: **100 PROSPECT STREET**

Description: **MEA: 2022.004**

Analysis Date: **03/17/23**

Pre-Developed Conditions					
Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu-ft)
1	0.26	Impervious areas	Lansdowne	0.0	-
2	0.08	Open space	Lansdowne	13.4	3,883
3	0.02	Gravel, dirt	Lansdowne	7.3	527
4	0.1	Open space	Nixon	15.5	5,643
5	0.26	Gravel, dirt	Nixon	10.3	9,708
6	0.04	Woods	Nixon	15.9	2,302
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	0.8			8.0	22,064

Post-Developed Conditions					
Land Segment	Area (acres)	TR-55 Land Cover	Soil	Annual Recharge (in)	Annual Recharge (cu-ft)
1	0.28	Impervious areas	Lansdowne	0.0	-
2	0.08	Open space	Lansdowne	13.4	3,883
3	0.29	Impervious areas	Nixon	0.0	-
4	0.08	Open space	Nixon	15.5	4,514
5	0.03	Woods	Nixon	15.9	1,726
6	0				
7	0				
8	0				
9	0				
10	0				
11	0				
12	0				
13	0				
14	0				
15	0				
Total =	0.8			3.7	10,124

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

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

Annual Recharge Requirements Calculation ↓

% of Pre-Developed Annual Recharge to Preserve =	100%	Total Impervious Area (sq-ft)	3,7	Total Annual Recharge (cu-ft)	10,124
Post-Development Annual Recharge Deficit=	11,940				
Recharge Efficiency Parameters Calculations (area averages)					
RWC= 0.344	(in)	DRWC= 1.42	(in)		
ERWC = 0.77	(in)	EDRWC= 0.32	(in)		

Project Name	100 PROSPECT STREET	Description	MEA: 2022.004	Analysis Date	03/17/23	BMP or LID Type	POROUS PAVEMENT
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Recharge BMP Input Parameters			Root Zone Water capacity Calculated Parameters			Recharge Design Parameters					
Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit	Parameter	Symbol	Value	Unit
BMP Area	ABMP	3375.0	sq.ft	Empty Portion of RWIC under Post-D Natural Recharge	ERWIC	0.50	in	Inches of Runoff to capture	Qdesign	0.05	in
BMP Effective Depth, this is the design variable	dBMP	0.5	in	ERWIC Modified to consider dEXC	EDRWIC	0.00	in	Inches of Rainfall to capture	Pdesign	0.09	in
Upper level of the BMP surface (negative if above ground)	dBMPu	4.0	in	Empty Portion of RWIC under Infil. BMP	RERWIC	0.00	in	Recharge Provided Avg. over Imp. Area		0.3	in
Depth of lower surface of BMP, must be=>dBMPu	dEXC	40.0	in					Runoff Captured Avg. over Imp. Area		0.3	in
Post-development Land Segment Location of BMP	SegBMP	1	unitless								

BMP Calculated Size Parameters			
Parameter	Symbol	Value	Unit
ABMP/Aimp	Aratio	0.01	unitless
BMP Volume	VBMP	151	cu.ft

System Performance Calculated Parameters			
Parameter	Symbol	Value	Unit
Annual BMP Recharge Volume		11,940	cu.ft
Avg BMP Recharge Efficiency		100.0%	% Infiltration Recharged
%Rainfall became Runoff		78.4%	%
%Runoff Infiltrated		0.8%	%
%Runoff Recharged		15.1%	%
%Rainfall Recharged		11.9%	%

OTHER NOTES

Pdesign is accurate only after BMP dimensions are updated to make each volume= deficit volume. The portion of BMP infiltration prior to filling and the area occupied by BMP are ignored in these calculations. Results are sensitive 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" RWIC 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.

Parameters from Annual Recharge Worksheet			
Parameter	Symbol	Value	Unit
Post-D Deficit Recharge (or desired recharge volume)	Vdef	11,940	cu.ft
Post-D Impervious Area (or target Impervious Area)	Aimp	450,000	sq.ft
Root Zone Water Capacity	RWIC	2.24	in
RWIC Modified to consider dEXC	DRWIC	0.00	in
Climatic Factor	C-factor	1.55	no units
Average Annual P	Pavg	48.6	in
Recharge Requirement over Imp. Area	dr	5.8	in

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "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-IIMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration click the "Default Vdef & Aimp" button.

How to solve for different recharge volumes: By default the spreadsheet assigns the values of total deficit recharge volume "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-IIMP to recharge only part of the recharge requirement, set Vdef to your target value and Aimp to impervious area directly connected to your infiltration facility and then solve for ABMP or dBMP. To go back to the default configuration click the "Default Vdef & Aimp" button.

DRAINAGE AREA MAPS

