



MILLENNIUM ENGINEERING, INC.

Land Surveyors and Civil Engineers

STORMWATER MANAGEMENT REPORT

FOR THE

PROPOSED SITE IMPROVEMENTS

AT

**29 LAKE ATTITASH ROAD
AMESBURY, MA**

PREPARED FOR:

**FRANK CAVALARO
30 LAKE ATTITASH ROAD
AMESBURY, MA**



DATE: DECMEBER 10, 2025

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29 Lake Attitash Road Amesbury, MA

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I. Introduction

Introduction

The subject parcel is described as Tax Map 59, Lot 47 on the Town of Amesbury, MA Assessor's Map. The project parcel is 0.25 acres in size. Elevations on the site range from 102.00' at the South end of the parcel to 98.00' at the North end of the site. These elevations are based upon 1988 NAV datum.

The proposed site improvements at 29 Lake Attitash road consist of the construction of 1 single-family dwelling. Access to the lot will remain via Lake Attitash road near the existing ground pavement driveway. The proposed stormwater management system for the project incorporates natural drainage patterns and vegetation including grassed conveyance swales and a rain garden. The rain garden will provide stormwater recharge to the groundwater and mitigate peak runoff rates so the post-development runoff rates will be less than or equal to the pre-development rates.

II. Hydrologic Analysis

Existing Site Characteristics

In general, the property is regular in shape and fronts Lake Attitash Road. The property is mostly upland with a bordering vegetated wetland at the northern corner of the lot. There are currently no structures located on-site. See the accompanying plan for a more detailed description of the existing site conditions and topography.

The lot consists of two soil group: Walpole Sandy loam, 31A (Hydrologic Soil Group B/D) and Scarboro mucky fine sandy loam, 6A. 3 soil test probes were performed onsite in November 2025. The test probes indicated sandy loam. See Appendix E for the NRCS soil map.

Proposed Site Features

The Applicant proposes to construct a 1,052 S.F. Single Family Dwelling. Access to the property will be via an Lake Attitash Road. Underground electrical and telecommunications service will also be provided. Sewer and water services are proposed to be connected to the town of Amesbury sewer and water mains located in the Lake Attitash Road Right of Way.

In order to address stormwater management regulations, water quality swales and a rain garden are proposed to treat, store, and infiltrate runoff.

WATERSHED ANALYSIS AND METHODOLOGY

The stormwater runoff management system was analyzed using the storm events of the 2-year, 10-year and 100-year frequency. The analysis was performed using HydroCAD, version 10.00. Using USDA NRCS TR-20 and TR-55 methods of estimating runoff, the program uses the measured characteristics of the site and computes runoff produced by simulated rainfall events. The results are then used to design runoff control structures.

Existing drainage area boundaries were developed using an onsite topographic survey performed by Millennium Engineering, Inc. Proposed site development boundaries were developed from proposed grades and ground cover designed to minimize site storm water management structure requirements.

Hydrologic soil groups and curve numbers were estimated for existing and proposed developed conditions using available NRCS Soil Maps, current vegetation, and terrain.

DRAINAGE ANALYSIS

The purpose of the drainage analysis is two-fold. The first is to analyze and quantify the pre-development runoff flows through the site. The second purpose is to evaluate the impact of the proposed development on drainage patterns and flows, both within and outside the site, and to design a stormwater management system to adequately convey post-development runoff.

The design of the stormwater management system has the following goals:

- 1.) Minimize or eliminate erosion and sedimentation during construction as well as after development.
- 2.) To ensure that post-development flows do not have an adverse effect on downstream drainage structures and landowners.
- 3.) To design a stormwater and treatment system which will carry the surface runoff and satisfy goals one and two.

To determine the hydrological effect of the proposed development on the watershed, the existing conditions must first be analyzed.

WATERSHED DESCRIPTION: EXISTING CONDITIONS

Depending on the soil classification, type of ground cover present and the direction of the flow of runoff, the existing site is divided into watershed areas.

Watershed area E1 consists of all the upland on site consisting of woods, underbrush and a small patch of ground pavement/gravel from the existing driveway. The sub-catchment drains overland to the north towards the bordering vegetated wetland. See the attached plans (Watersheds and HydroCad Data, sheet 1 of 2) for the watershed area boundaries and the pre-development time of concentration flow paths.

WATERSHED ANALYSIS: EXISTING CONDITIONS

The existing conditions were modeled using the tabular hydrograph method with a Type III synthetic storm distribution for the 2, 10 and 100-year storm recurrence intervals. Runoff hydrographs were produced to estimate existing peak discharge.

Flows for the three storm simulations are as follows:

Existing (Pre-development) Peak Runoff Rates (c.f.s.)

Subcatchment	Size	2 Yr	10 Yr	25 Yr	100 Yr
	(Acres)	Storm	Storm	Storm	Storm
E1	0.21	0.09	0.41	0.65	1.17

The pre-development drainage calculations can be found in Appendix A.

WATERSHED DESCRIPTION: POST-DEVELOPMENT CONDITIONS

To determine the post development runoff, new watersheds, runoff curve numbers and times of concentration were generated reflecting the changes in the topography and surface cover. The post-development watersheds are shown on the attached plans (Watersheds and HydroCad Data, sheet 2 of 2).

Watershed area P1A consists of woodland and underbrush surface. The runoff flows over land directly north towards the bordering vegetated wetland. Area P1B consist of the proposed roof, driveway, and lawn areas. The proposed grading directs runoff from these areas toward the rain garden, where the stormwater will be treated and peak runoff rates will be mitigated. The rain garden includes a proposed spillway that, when the system is full, will direct overflow toward Design Point 1 at the bordering vegetated wetland.

WATERSHED ANALYSIS: POST-DEVELOPMENT CONDITIONS

The proposed developed conditions were modeled using the tabular hydrograph method with a Type III synthetic storm distribution for the 2, 10 and 100-year storm recurrence intervals. Runoff hydrographs were produced to estimate the post-development peak discharge.

Flows for the three storm simulations are as follows:

Post-Developed Peak Runoff Rates (c.f.s.)

Subcatchment	Size	2 Yr	10 Yr	25 Yr	100 Yr
	(Acres)	Storm	Storm	Storm	Storm
Total P1	0.21	0.09	0.25	0.40	1.07

The post-development drainage calculations can be found in Appendix B.

SUMMARY TABLE:

Subcatchment	Size	2 Yr	10 Yr	25 Yr	100 Yr
	(Acres)	Storm	Storm	Storm	Storm
Pre-Dev					
Total E1	0.21	0.09	0.41	0.65	1.17
Post-Dev					
Total P1	0.21	0.09	0.25	0.40	1.07

Nitrogen & Phosphorus removal: The proposed rain garden is capable of 30-50% nitrogen removal and 30-90% phosphorus removal.

III. Soils Analysis

SOIL SUITABILITY ASSESSMENT REPORT

COMMONWEALTH OF MASSACHUSETTS

AMESBURY, MASSACHUSETTS

FOR THE DETERMINATION OF GROUNDWATER TABLE ELEVATIONS

SITE INFORMATION

November 19, 2025

Street Address: 29 Lake Attitash Road Town: Amesbury State: Massachusetts Zip Code: 01913 County: Essex
Land Use: Residential Latitude: ~42° 50' 58.40" N Longitude: ~70° 58' 18.14" W Parcel ID: M 59 – Lots 35 & 37

PUBLISHED SOIL DATA AND MAP UNIT DESCRIPTION

Physiographic Division: Appalachian Highlands Physio. Province: New England Physio. Section: Seaboard lowland section
Soil survey area: Essex County, Massachusetts, Northern Part Series name: 31A – Walpole SL, 0-3% slopes
Order: Inceptisol Suborder: Aquepts Family: Sandy, mixed, mesic, Aeric Haplaquepts
Soil moisture regime: Udic Soil temperature regime: Mesic Runoff class: Low
Hydric soil rating: Yes Average depth to water table: 00" – 04" Depth to restrictive feature: > 80"
Frequency of flooding: None Frequency of ponding: None Available water supply (0-60"): Moderate (~6.4")
Drainage Class: Poorly drained Hydrologic Soil Group: B/D Ksat: Moderately low to high (0.14 – 14.17 in/hr)
Ecological site: Moist sandy outwash

WETLAND AREA & USGS WELL MEASUREMENTS

National Wetland Inventory Map: NA Wetlands Conservancy Program: NA Bordering vegetative wetland: > 100'
Current Water Resource Condition (USGS): Well Site # 424841071004101- MA-HLW 23 Haverhill, MA.
Well depth: 15.10' Land surface altitude: 100.00' above NGVD29 Latitude: ~42°48'41.8" N Longitude: ~71°00'41.7" W
Most recent data value: 14.17' on 11/19/25 (depth to water level in feet below land surface) Below Normal

SURFICIAL GEOLOGY

Geologic parent material: Sandy glaciofluvial deposits Geomorphic component: Moist sandy outwash
Slope aspect: Level Landform position (2D): Depression Landform position (3D): Tread
Slope gradient: ~01-03% Down slope shape: Concave Across slope shape: Concave Slope complexity: Simple
Bedrock outcropping in vicinity: None observed Glacial erratics in vicinity: None observed
Bedrock Type: Eliot Formation – Silurian (440 – 420 Ma): Gray to gray green phyllite and calcareous quartzite and quartz-mica schist and well bedded calc-silicates. Very low phyllite and schist content within the till-matrix on-site.

PROBE #25-1

29 Lake Attitash Road, Amesbury, Massachusetts

Date: November 19, 2025 Weather: Clear, 40°-45° F, still and dry.

Landscape: Upland Landform: Outwash plain Position on landscape: Tread

Slope aspect: Level Slope (%): 00 – 03 % Slope complexity: Simple Land Cover: Wooded

Property line: 10⁺ feet Drainage way: 50⁺ feet Drinking water well: 100⁺ feet Abutting septic system: 50⁺ feet

Wetlands: 50⁺ feet Public water supply reservoir: 200⁺ feet Tributary to reservoir: 50⁺ feet

No unsuitable materials present: Disturbed soil: Fill material: Bedrock/ fractured rock:

SOIL PROBE ►25-1

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 13"	A _p	Sandy Loam fine	10YR 3/2 very dark grayish brown	none observed	Friable; weak-grade fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; damp matrix; non-sticky; non-plastic; many fine and medium roots; free of clasts; clear wavy boundary.
13" → 24"	B _w	Sandy Loam fine	10YR 5/4 yellowish brown	18" (c,2,p) 5YR 5/8 10YR 7/1	Friable; weak-grade, fine to medium, sub-angular blocky structure; somewhat cohesive; mixed medium to mostly fine-grained mineral content; damp matrix; non-sticky; non-plastic; free of clasts; no apparent water observed; seasonal high-water table observed at 18"; no bedrock at test hole depth.

Depth to bedrock: > 24"

Seasonal High Groundwater Table: 18"

Apparent water:

#1848

F. Alexander Parker

Massachusetts Soil Evaluator and license number

October 1998

Date of License issuance

PROBE #25-2

29 Lake Attitash Road, Amesbury, Massachusetts

Date: November 19, 2025 Weather: Clear, 40°-45° F, still and dry.

Landscape: Upland Landform: Outwash plain Position on landscape: Tread

Slope aspect: Level Slope (%): 00 – 03 % Slope complexity: Simple Land Cover: Wooded

Property line: 10⁺ feet Drainage way: 50⁺ feet Drinking water well: 100⁺ feet Abutting septic system: 50⁺ feet

Wetlands: 50⁺ feet Public water supply reservoir: 200⁺ feet Tributary to reservoir: 50⁺ feet

No unsuitable materials present: Disturbed soil: Fill material: Bedrock/ fractured rock:

SOIL PROBE ►25-2

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 10"	A _p	Sandy Loam fine	10YR 3/2 very dark grayish brown	none observed	Friable; weak-grade fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; damp matrix; non-sticky; non-plastic; many fine and medium roots; free of clasts; clear wavy boundary.
10" → 28"	B _w	Sandy Loam fine	10YR 5/4 yellowish brown	18" (c,2,p) 5YR 5/8 10YR 7/1	Friable; weak-grade, fine to medium, sub-angular blocky structure; somewhat cohesive; mixed medium to mostly fine-grained mineral content; damp matrix; non-sticky; non-plastic; free of clasts; few fine-to-medium roots; no apparent water observed; seasonal high-water table observed at 18"; no bedrock at test hole depth.

Depth to bedrock: > 28"

Seasonal High Groundwater Table: 18"

Apparent water:

#1848

F. Alexander Parker

Massachusetts Soil Evaluator and license number

October 1998

Date of License issuance

PROBE #25-3

29 Lake Attitash Road, Amesbury, Massachusetts

Date: November 19, 2025 Weather: Clear, 40°-45° F, still and dry.

Landscape: Upland Landform: Outwash plain Position on landscape: Tread

Slope aspect: Level Slope (%): 00 – 03 % Slope complexity: Simple Land Cover: Wooded

Property line: 10⁺ feet Drainage way: 50⁺ feet Drinking water well: 100⁺ feet Abutting septic system: 50⁺ feet

Wetlands: 50⁺ feet Public water supply reservoir: 200⁺ feet Tributary to reservoir: 50⁺ feet

No unsuitable materials present: Disturbed soil: Fill material: Bedrock/ fractured rock:

SOIL PROBE ►25-3

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Color (Munsell)	Redoxomorphic Features/ ESHGWT	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, clasts, stratification, artifacts, restrictive features, etc.
00" → 12"	A	Fine Sandy Loam	10YR 3/2 very dark grayish brown	none observed	Friable; weak-grade fine-to-medium granular structure; somewhat cohesive; fine grained mineral content; damp matrix; non-sticky; non-plastic; many fine and medium roots; free of clasts; clear wavy boundary.
12" → 21"	B _w	Fine Sandy Loam	10YR 5/4 yellowish brown	16" (c,2,p) 5YR 5/8 10YR 7/1	Friable; weak-grade, fine to medium, sub-angular blocky structure; somewhat cohesive; mixed medium to mostly fine-grained mineral content; damp matrix; non-sticky; non-plastic; free of clasts; few fine-to-medium roots; no apparent water observed; seasonal high-water table observed at 16"; no bedrock at test hole depth.

Depth to bedrock: > 21"

Seasonal High Groundwater Table: 16"

Apparent water:

#1848

F. Alexander Parker

Massachusetts Soil Evaluator and license number

October 1998

Date of License issuance

IV. TSS Removal Calculations

INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: 29 Lake Attitash Road Amesbury, MA

TSS Removal Calculation Worksheet	B	C	D	E	F
	BMP ¹	TSS Removal Rate ¹	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)
	Bioretention Area	0.90	1.00	0.90	0.10
		0.00	0.10	0.00	0.10
		0.00	0.10	0.00	0.10
		0.00	0.10	0.00	0.10
		0.00	0.10	0.00	0.10

Total TSS Removal =

90%

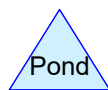
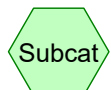
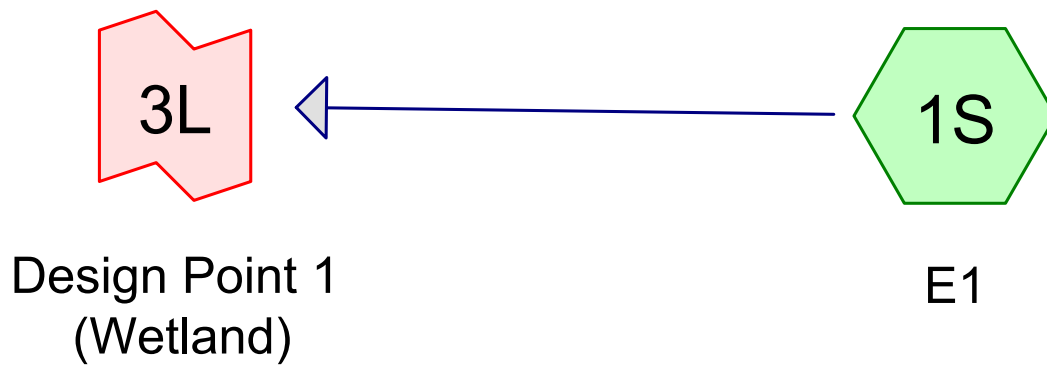
Separate Form Needs to
be Completed for Each
Outlet or BMP Train

Project: 29 Lake Attitash
Prepared By: SRC
Date: 12/4/2025

*Equals remaining load from previous BMP (E)
which enters the BMP

V. Appendix

a. Existing Conditions HydroCAD Report



Routing Diagram for PRE HCAD

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PRE HCAD

Prepared by Millennium Engineering, Inc

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Project Notes

Rainfall events imported from "Atlas-14-Rain.txt" for 440 MA Essex

Rainfall events imported from "Atlas-14-Rain.txt" for 440 MA Essex

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PRE HCAD

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NRCC 24-hr	D	Default	24.00	1	3.15	2
2	10-Year	NRCC 24-hr	D	Default	24.00	1	4.83	2
3	25-Year	NRCC 24-hr	D	Default	24.00	1	6.16	2
4	100-Year	NRCC 24-hr	D	Default	24.00	1	8.94	2

PRE HCAD

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.123	65	Brush, Good, HSG C (1S)
0.016	96	Gravel surface, HSG C (1S)
0.073	70	Woods, Good, HSG C (1S)
0.212	69	TOTAL AREA

PRE HCAD

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.212	HSG C	1S
0.000	HSG D	
0.000	Other	
0.212		TOTAL AREA

PRE HCAD

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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	0.123	0.000	0.000	0.123	Brush, Good	1S
0.000	0.000	0.016	0.000	0.000	0.016	Gravel surface	1S
0.000	0.000	0.073	0.000	0.000	0.073	Woods, Good	1S
0.000	0.000	0.212	0.000	0.000	0.212	TOTAL AREA	

PRE HCAD*NRCC 24-hr D 2-Year Rainfall=3.15"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: E1

Runoff Area=9,214 sf 0.00% Impervious Runoff Depth>0.64"

Tc=6.0 min CN=69 Runoff=0.16 cfs 0.011 af

Link 3L: Design Point 1 (Wetland)

Inflow=0.16 cfs 0.011 af

Primary=0.16 cfs 0.011 af

Total Runoff Area = 0.212 ac Runoff Volume = 0.011 af Average Runoff Depth = 0.64"
100.00% Pervious = 0.212 ac 0.00% Impervious = 0.000 ac

PRE HCAD

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NRCC 24-hr D 2-Year Rainfall=3.15"

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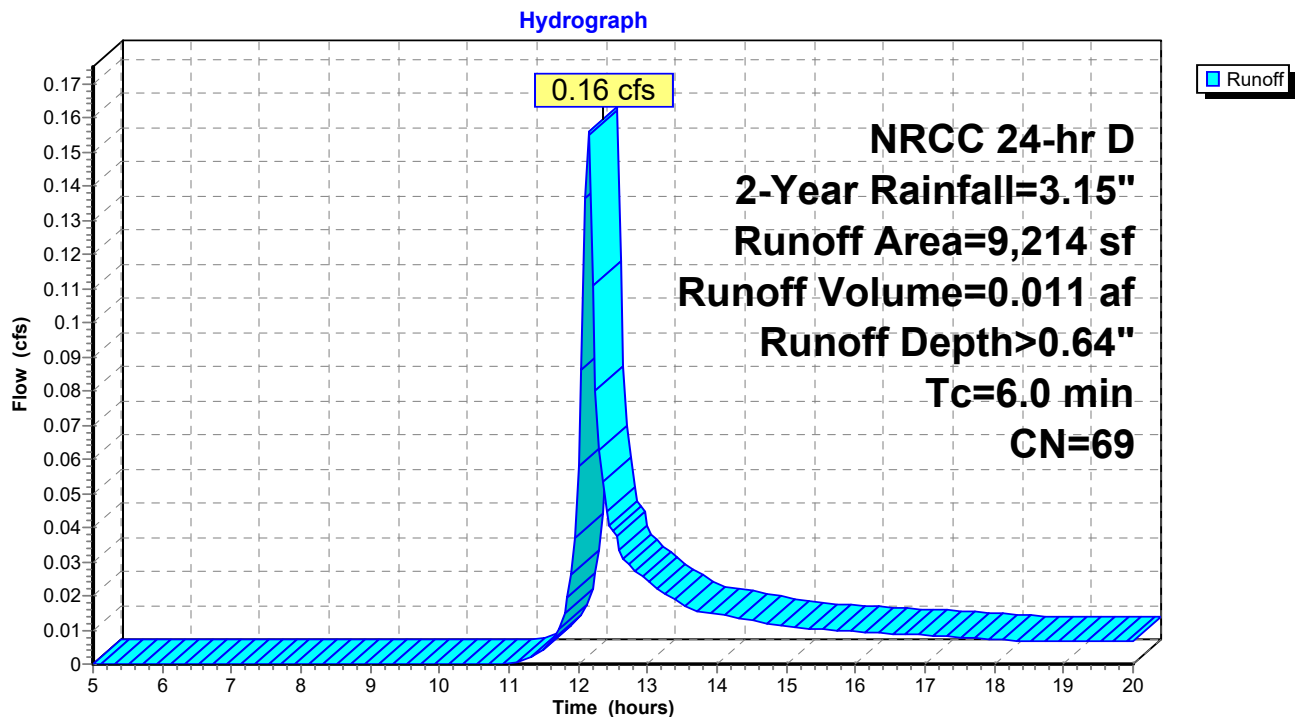
Summary for Subcatchment 1S: E1

Runoff = 0.16 cfs @ 12.14 hrs, Volume= 0.011 af, Depth> 0.64"
Routed to Link 3L : Design Point 1 (Wetland)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
694	96	Gravel surface, HSG C
3,180	70	Woods, Good, HSG C
5,340	65	Brush, Good, HSG C
9,214	69	Weighted Average
9,214		100.00% Pervious Area

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

Subcatchment 1S: E1

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NRCC 24-hr D 2-Year Rainfall=3.15"

Printed 12/5/2025

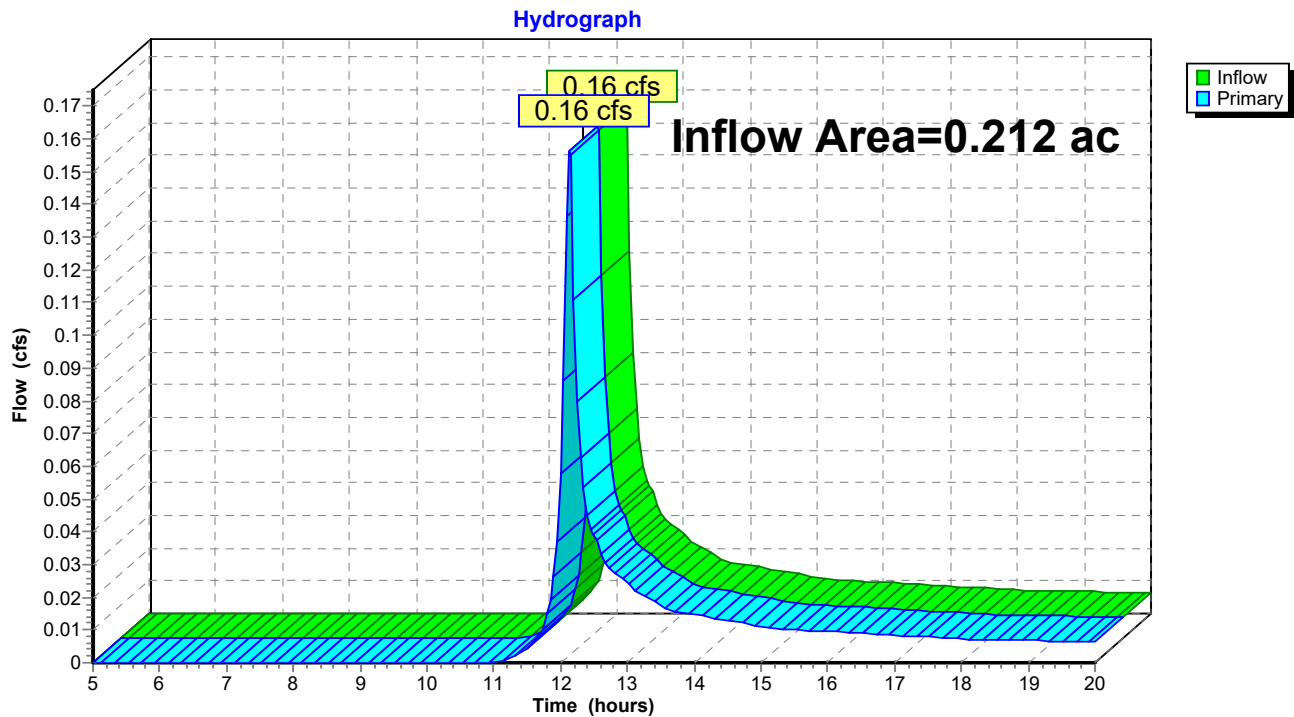
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Summary for Link 3L: Design Point 1 (Wetland)

Inflow Area = 0.212 ac, 0.00% Impervious, Inflow Depth > 0.64" for 2-Year event
Inflow = 0.16 cfs @ 12.14 hrs, Volume= 0.011 af
Primary = 0.16 cfs @ 12.14 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3L: Design Point 1 (Wetland)



PRE HCAD

NRCC 24-hr D 10-Year Rainfall=4.83"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: E1

Runoff Area=9,214 sf 0.00% Impervious Runoff Depth>1.61"

Tc=6.0 min CN=69 Runoff=0.41 cfs 0.028 af

Link 3L: Design Point 1 (Wetland)

Inflow=0.41 cfs 0.028 af

Primary=0.41 cfs 0.028 af

Total Runoff Area = 0.212 ac Runoff Volume = 0.028 af Average Runoff Depth = 1.61"
100.00% Pervious = 0.212 ac 0.00% Impervious = 0.000 ac

PRE HCAD

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NRCC 24-hr D 10-Year Rainfall=4.83"

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Summary for Subcatchment 1S: E1

Runoff = 0.41 cfs @ 12.13 hrs, Volume= 0.028 af, Depth> 1.61"
Routed to Link 3L : Design Point 1 (Wetland)

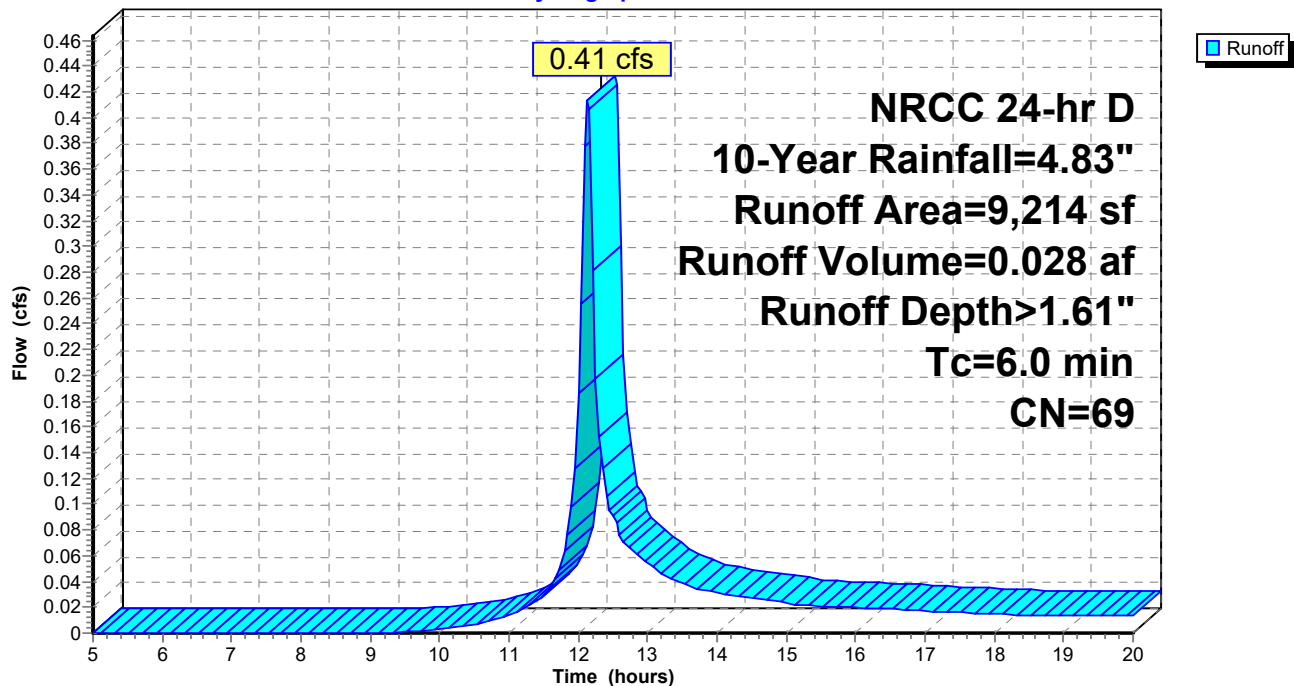
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
694	96	Gravel surface, HSG C
3,180	70	Woods, Good, HSG C
5,340	65	Brush, Good, HSG C
9,214	69	Weighted Average
9,214		100.00% Pervious Area

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

Subcatchment 1S: E1

Hydrograph



PRE HCAD

Prepared by Millennium Engineering, Inc

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NRCC 24-hr D 10-Year Rainfall=4.83"

Printed 12/5/2025

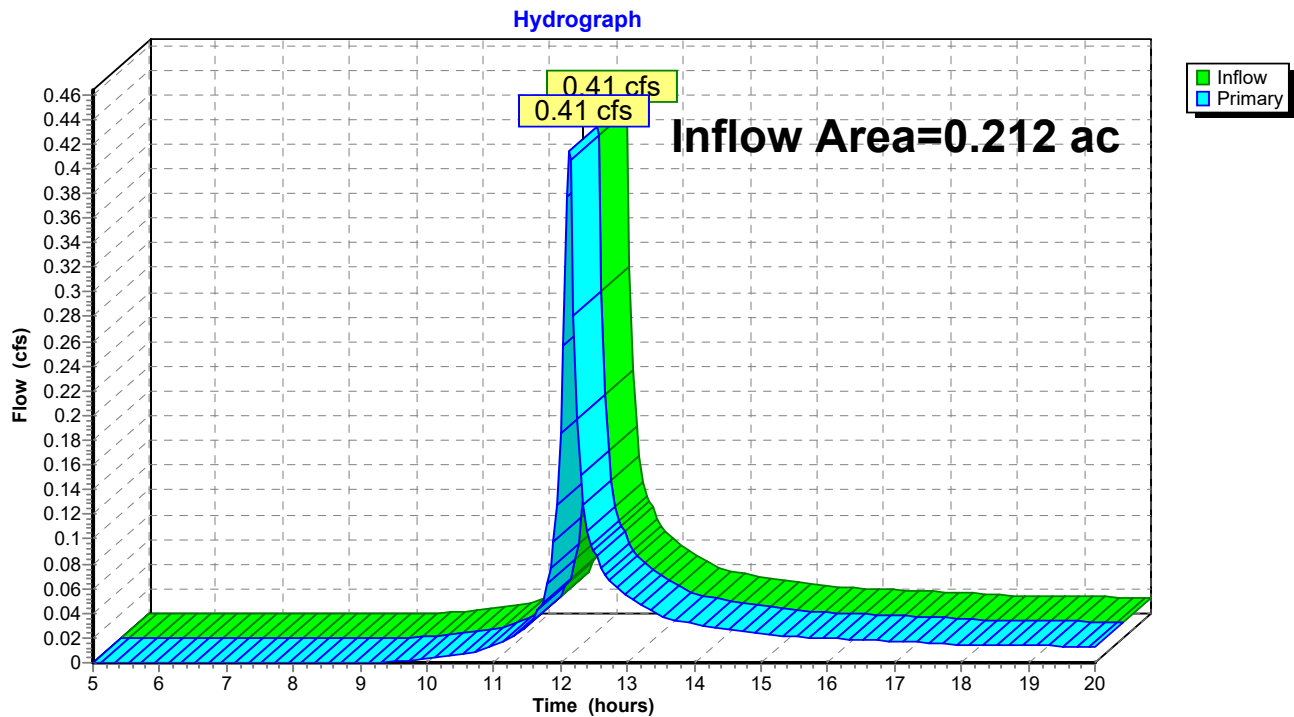
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Summary for Link 3L: Design Point 1 (Wetland)

Inflow Area = 0.212 ac, 0.00% Impervious, Inflow Depth > 1.61" for 10-Year event
Inflow = 0.41 cfs @ 12.13 hrs, Volume= 0.028 af
Primary = 0.41 cfs @ 12.13 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3L: Design Point 1 (Wetland)



PRE HCAD

NRCC 24-hr D 25-Year Rainfall=6.16"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: E1

Runoff Area=9,214 sf 0.00% Impervious Runoff Depth>2.52"

Tc=6.0 min CN=69 Runoff=0.65 cfs 0.044 af

Link 3L: Design Point 1 (Wetland)

Inflow=0.65 cfs 0.044 af

Primary=0.65 cfs 0.044 af

Total Runoff Area = 0.212 ac Runoff Volume = 0.044 af Average Runoff Depth = 2.52"
100.00% Pervious = 0.212 ac 0.00% Impervious = 0.000 ac

PRE HCAD

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NRCC 24-hr D 25-Year Rainfall=6.16"

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Summary for Subcatchment 1S: E1

Runoff = 0.65 cfs @ 12.13 hrs, Volume= 0.044 af, Depth> 2.52"
Routed to Link 3L : Design Point 1 (Wetland)

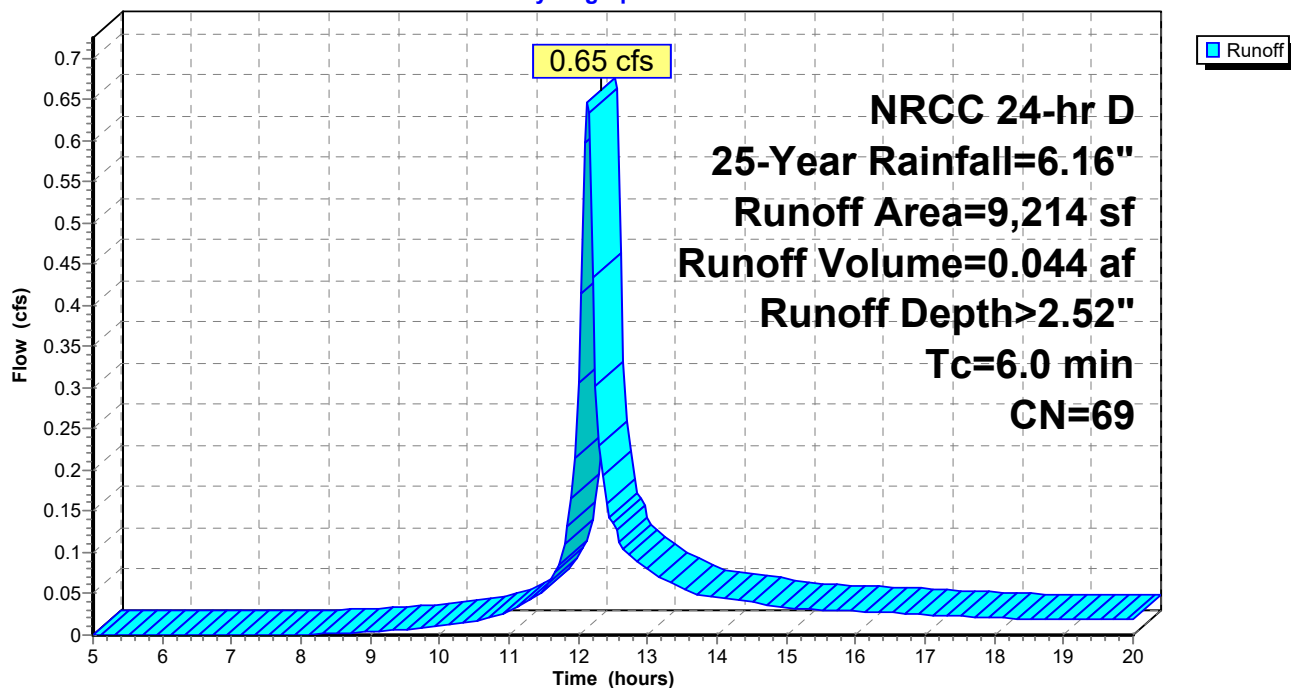
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.16"

Area (sf)	CN	Description
694	96	Gravel surface, HSG C
3,180	70	Woods, Good, HSG C
5,340	65	Brush, Good, HSG C
9,214	69	Weighted Average
9,214		100.00% Pervious Area

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

Subcatchment 1S: E1

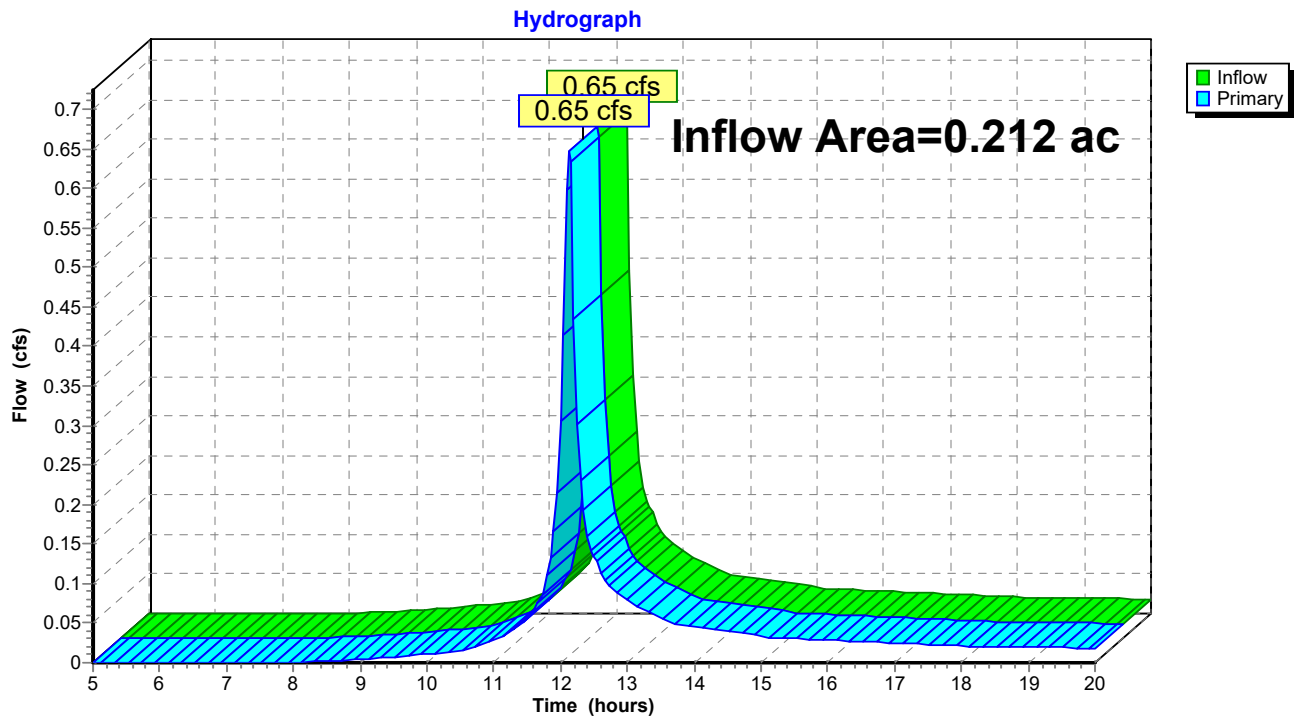
Hydrograph



Summary for Link 3L: Design Point 1 (Wetland)

Inflow Area = 0.212 ac, 0.00% Impervious, Inflow Depth > 2.52" for 25-Year event
Inflow = 0.65 cfs @ 12.13 hrs, Volume= 0.044 af
Primary = 0.65 cfs @ 12.13 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3L: Design Point 1 (Wetland)

PRE HCAD*NRCC 24-hr D 100-Year Rainfall=8.94"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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: E1

Runoff Area=9,214 sf 0.00% Impervious Runoff Depth>4.65"

Tc=6.0 min CN=69 Runoff=1.17 cfs 0.082 af

Link 3L: Design Point 1 (Wetland)

Inflow=1.17 cfs 0.082 af

Primary=1.17 cfs 0.082 af

Total Runoff Area = 0.212 ac Runoff Volume = 0.082 af Average Runoff Depth = 4.65"
100.00% Pervious = 0.212 ac 0.00% Impervious = 0.000 ac

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NRCC 24-hr D 100-Year Rainfall=8.94"

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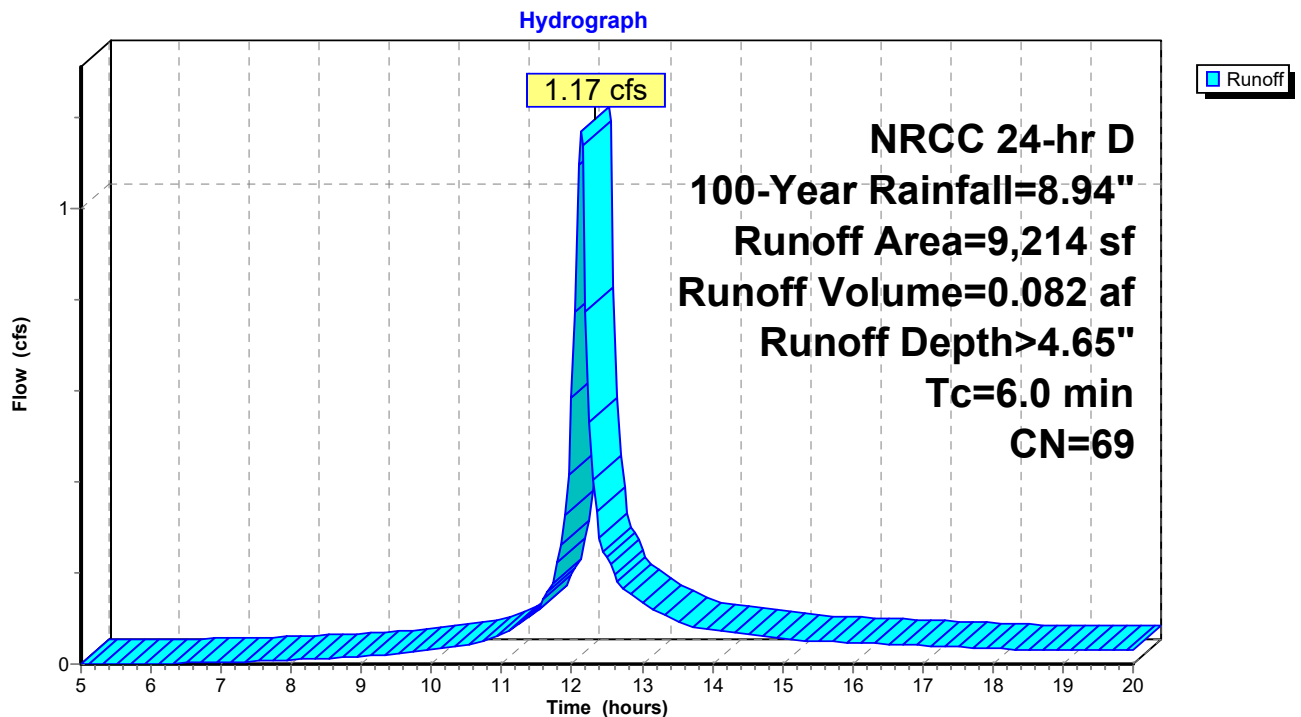
Summary for Subcatchment 1S: E1

Runoff = 1.17 cfs @ 12.13 hrs, Volume= 0.082 af, Depth> 4.65"
Routed to Link 3L : Design Point 1 (Wetland)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
694	96	Gravel surface, HSG C
3,180	70	Woods, Good, HSG C
5,340	65	Brush, Good, HSG C
9,214	69	Weighted Average
9,214		100.00% Pervious Area

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

Subcatchment 1S: E1

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NRCC 24-hr D 100-Year Rainfall=8.94"

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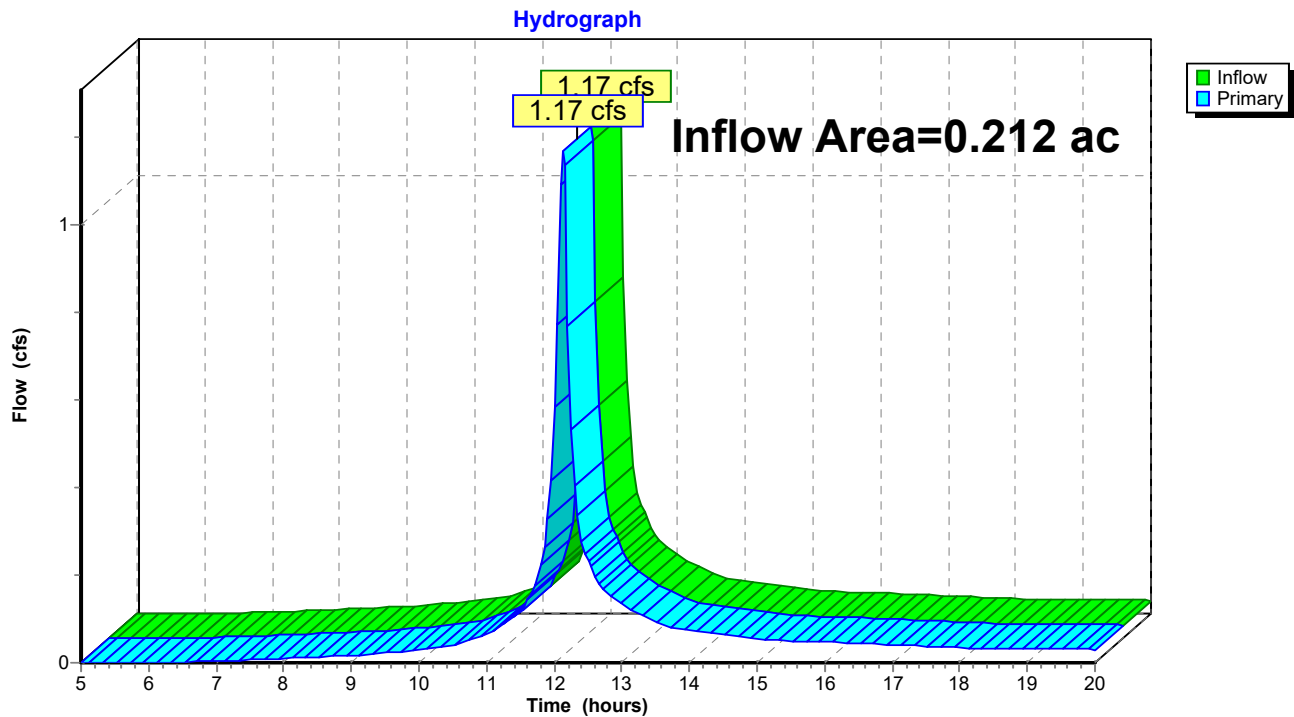
Page 18

Summary for Link 3L: Design Point 1 (Wetland)

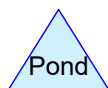
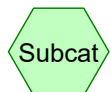
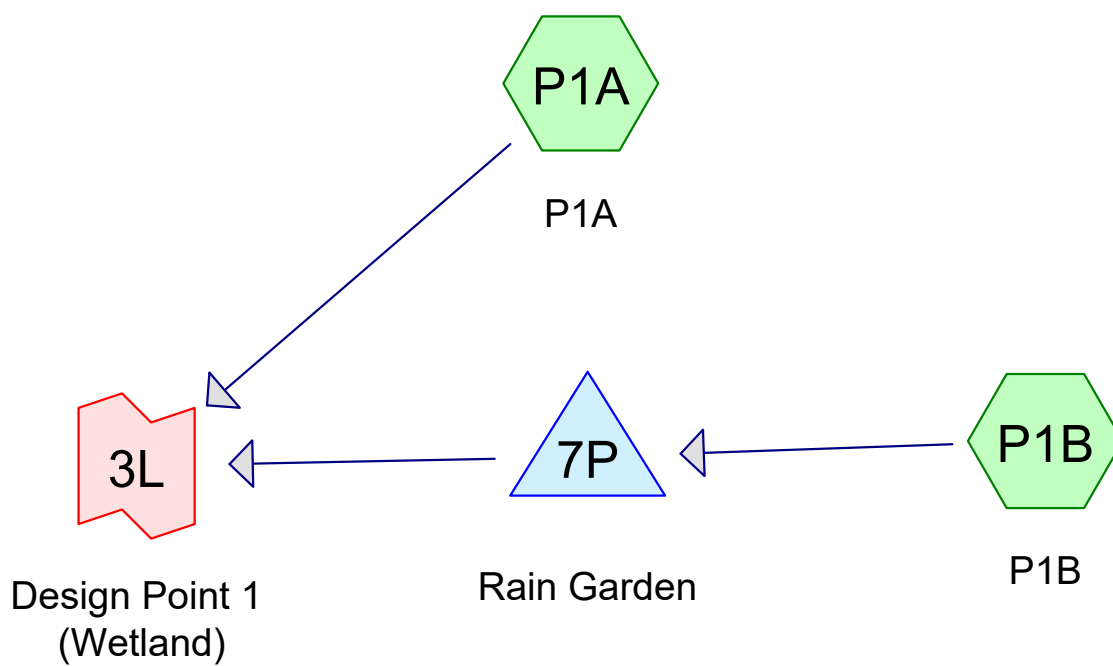
Inflow Area = 0.212 ac, 0.00% Impervious, Inflow Depth > 4.65" for 100-Year event
Inflow = 1.17 cfs @ 12.13 hrs, Volume= 0.082 af
Primary = 1.17 cfs @ 12.13 hrs, Volume= 0.082 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3L: Design Point 1 (Wetland)



b. Proposed Conditions HydroCAD Report



Routing Diagram for POST HCAD

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Page 2

Project Notes

Rainfall events imported from "Atlas-14-Rain.txt" for 440 MA Essex

Rainfall events imported from "Atlas-14-Rain.txt" for 440 MA Essex

Rainfall events imported from "Atlas-14-Rain.txt" for 440 MA Essex

Rainfall events imported from "Atlas-14-Rain.txt" for 440 MA Essex

Rainfall events imported from "Atlas-14-Rain.txt" for 440 MA Essex

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NRCC 24-hr	D	Default	24.00	1	3.15	2
2	10-Year	NRCC 24-hr	D	Default	24.00	1	4.83	2
3	25-Year	NRCC 24-hr	D	Default	24.00	1	6.16	2
4	100-Year	NRCC 24-hr	D	Default	24.00	1	8.94	2

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.042	74	>75% Grass cover, Good, HSG C (P1B)
0.084	65	Brush, Good, HSG C (P1A)
0.004	50	Pervious Pavers (P1B)
0.024	98	Roofs, HSG C (P1B)
0.057	70	Woods, Good, HSG C (P1A)
0.212	72	TOTAL AREA

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.208	HSG C	P1A, P1B
0.000	HSG D	
0.004	Other	P1B
0.212		TOTAL AREA

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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	0.042	0.000	0.000	0.042	>75% Grass cover, Good	P1B
0.000	0.000	0.084	0.000	0.000	0.084	Brush, Good	P1A
0.000	0.000	0.000	0.000	0.004	0.004	Pervious Pavers	P1B
0.000	0.000	0.024	0.000	0.000	0.024	Roofs	P1B
0.000	0.000	0.057	0.000	0.000	0.057	Woods, Good	P1A
0.000	0.000	0.208	0.000	0.004	0.212	TOTAL AREA	

POST HCAD*NRCC 24-hr D 2-Year Rainfall=3.15"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1A: P1A

Runoff Area=6,143 sf 0.00% Impervious Runoff Depth>0.56"
Tc=6.0 min CN=67 Runoff=0.09 cfs 0.007 af

Subcatchment P1B: P1B

Runoff Area=3,077 sf 34.19% Impervious Runoff Depth>1.27"
Tc=6.0 min CN=81 Runoff=0.11 cfs 0.007 af

Pond 7P: Rain Garden

Peak Elev=100.63' Storage=325 cf Inflow=0.11 cfs 0.007 af
Outflow=0.00 cfs 0.000 af

Link 3L: Design Point 1 (Wetland)

Inflow=0.09 cfs 0.007 af
Primary=0.09 cfs 0.007 af

Total Runoff Area = 0.212 ac Runoff Volume = 0.014 af Average Runoff Depth = 0.79"
88.59% Pervious = 0.188 ac 11.41% Impervious = 0.024 ac

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NRCC 24-hr D 2-Year Rainfall=3.15"

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Summary for Subcatchment P1A: P1A

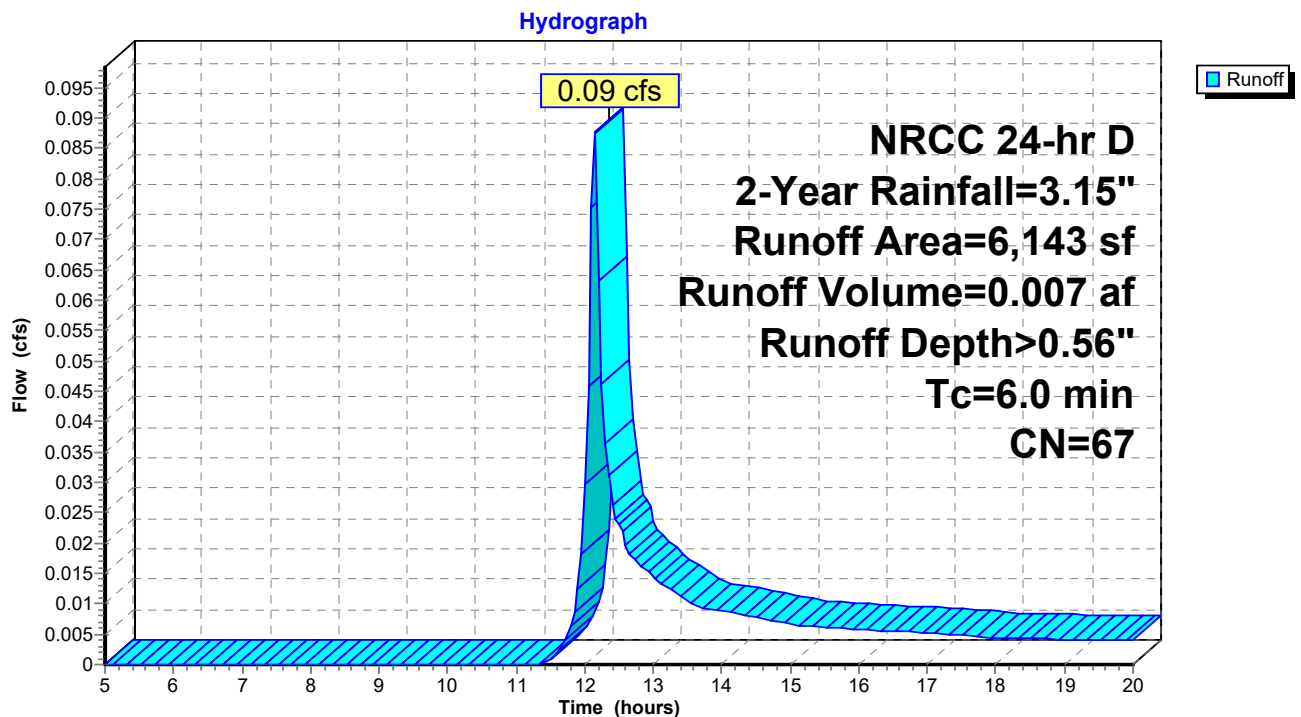
Runoff = 0.09 cfs @ 12.14 hrs, Volume= 0.007 af, Depth> 0.56"
Routed to Link 3L : Design Point 1 (Wetland)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

Area (sf)	CN	Description
2,490	70	Woods, Good, HSG C
3,653	65	Brush, Good, HSG C
6,143	67	Weighted Average
6,143		100.00% Pervious Area

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

Subcatchment P1A: P1A



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NRCC 24-hr D 2-Year Rainfall=3.15"

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Summary for Subcatchment P1B: P1B

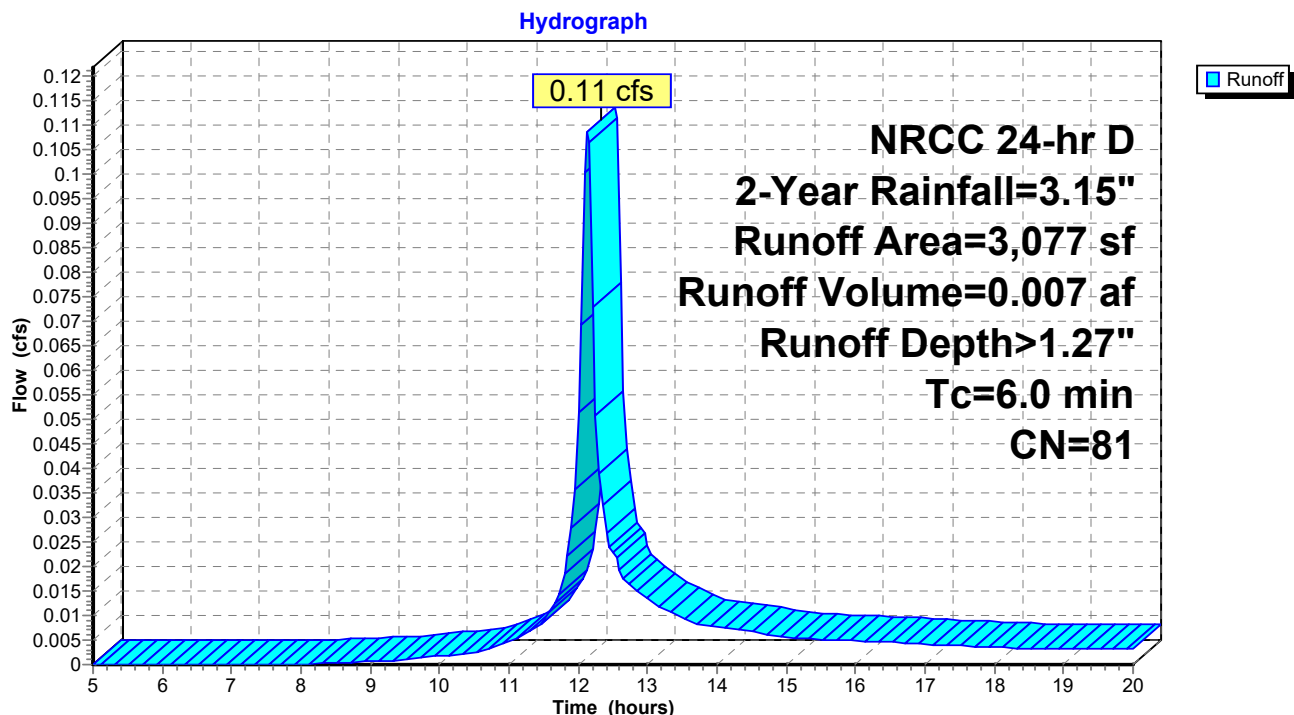
Runoff = 0.11 cfs @ 12.13 hrs, Volume= 0.007 af, Depth> 1.27"
Routed to Pond 7P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.15"

	Area (sf)	CN	Description
*	180	50	Pervious Pavers
	1,052	98	Roofs, HSG C
	1,845	74	>75% Grass cover, Good, HSG C
	3,077	81	Weighted Average
	2,025		65.81% Pervious Area
	1,052		34.19% Impervious Area

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

Subcatchment P1B: P1B



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Summary for Pond 7P: Rain Garden

Inflow Area = 0.071 ac, 34.19% Impervious, Inflow Depth > 1.27" for 2-Year event
 Inflow = 0.11 cfs @ 12.13 hrs, Volume= 0.007 af
 Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
 Routed to Link 3L : Design Point 1 (Wetland)

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 100.63' @ 20.00 hrs Surf.Area= 510 sf Storage= 325 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	99.75'	715 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	207	0	0
100.00	318	66	66
101.00	624	471	537
101.25	804	179	715

Device	Routing	Invert	Outlet Devices
#1	Primary	101.15'	10.0' long x 3.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=99.75' (Free Discharge)

↑1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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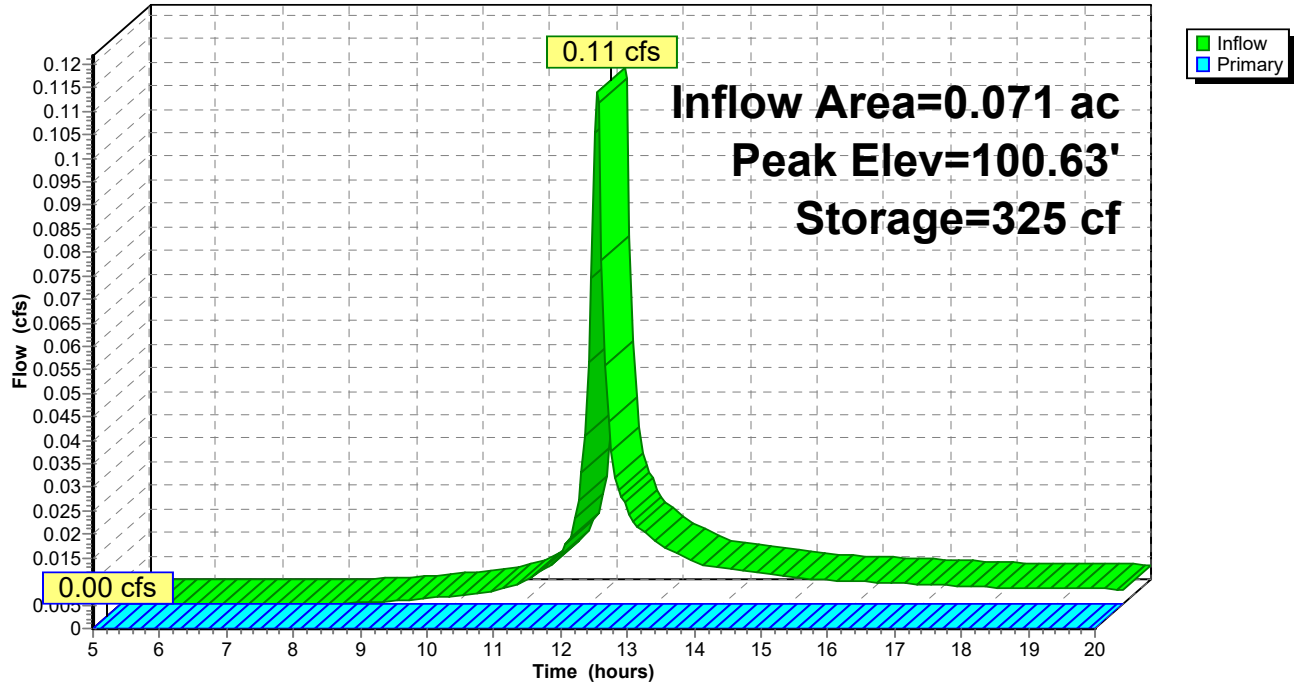
NRCC 24-hr D 2-Year Rainfall=3.15"

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Pond 7P: Rain Garden

Hydrograph

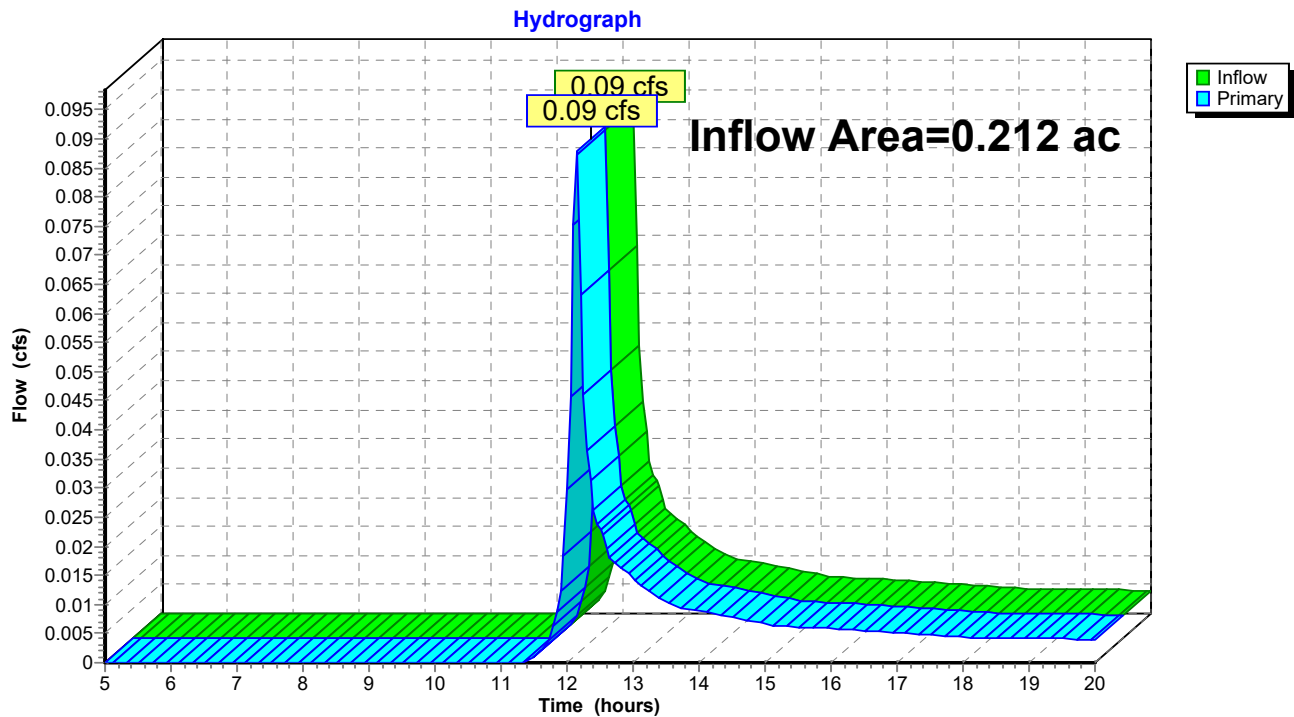


Summary for Link 3L: Design Point 1 (Wetland)

Inflow Area = 0.212 ac, 11.41% Impervious, Inflow Depth > 0.37" for 2-Year event
 Inflow = 0.09 cfs @ 12.14 hrs, Volume= 0.007 af
 Primary = 0.09 cfs @ 12.14 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3L: Design Point 1 (Wetland)



POST HCAD*NRCC 24-hr D 10-Year Rainfall=4.83"*

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1A: P1A

Runoff Area=6,143 sf 0.00% Impervious Runoff Depth>1.47"
Tc=6.0 min CN=67 Runoff=0.25 cfs 0.017 af

Subcatchment P1B: P1B

Runoff Area=3,077 sf 34.19% Impervious Runoff Depth>2.56"
Tc=6.0 min CN=81 Runoff=0.21 cfs 0.015 af

Pond 7P: Rain Garden

Peak Elev=101.15' Storage=640 cf Inflow=0.21 cfs 0.015 af
Outflow=0.01 cfs 0.000 af

Link 3L: Design Point 1 (Wetland)

Inflow=0.25 cfs 0.018 af
Primary=0.25 cfs 0.018 af

Total Runoff Area = 0.212 ac Runoff Volume = 0.032 af Average Runoff Depth = 1.83"
88.59% Pervious = 0.188 ac 11.41% Impervious = 0.024 ac

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NRCC 24-hr D 10-Year Rainfall=4.83"

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Summary for Subcatchment P1A: P1A

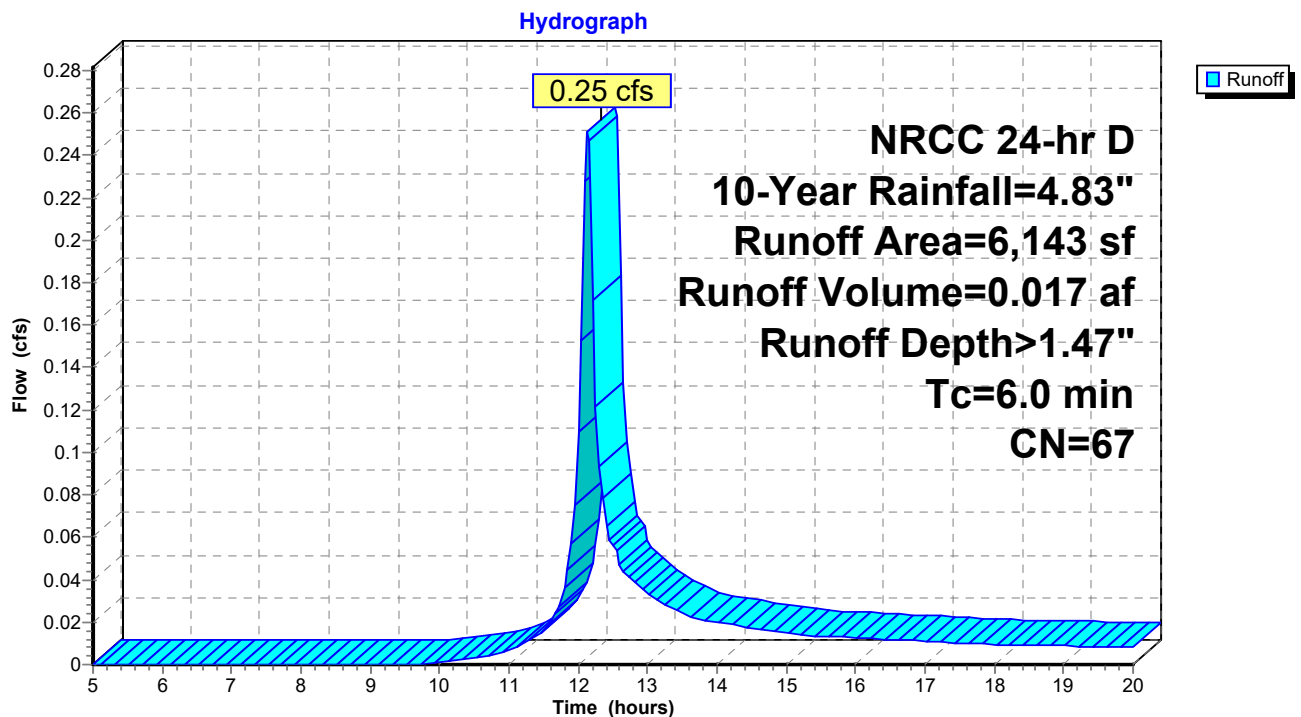
Runoff = 0.25 cfs @ 12.14 hrs, Volume= 0.017 af, Depth> 1.47"
Routed to Link 3L : Design Point 1 (Wetland)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

Area (sf)	CN	Description
2,490	70	Woods, Good, HSG C
3,653	65	Brush, Good, HSG C
6,143	67	Weighted Average
6,143		100.00% Pervious Area

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

Subcatchment P1A: P1A



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NRCC 24-hr D 10-Year Rainfall=4.83"

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Summary for Subcatchment P1B: P1B

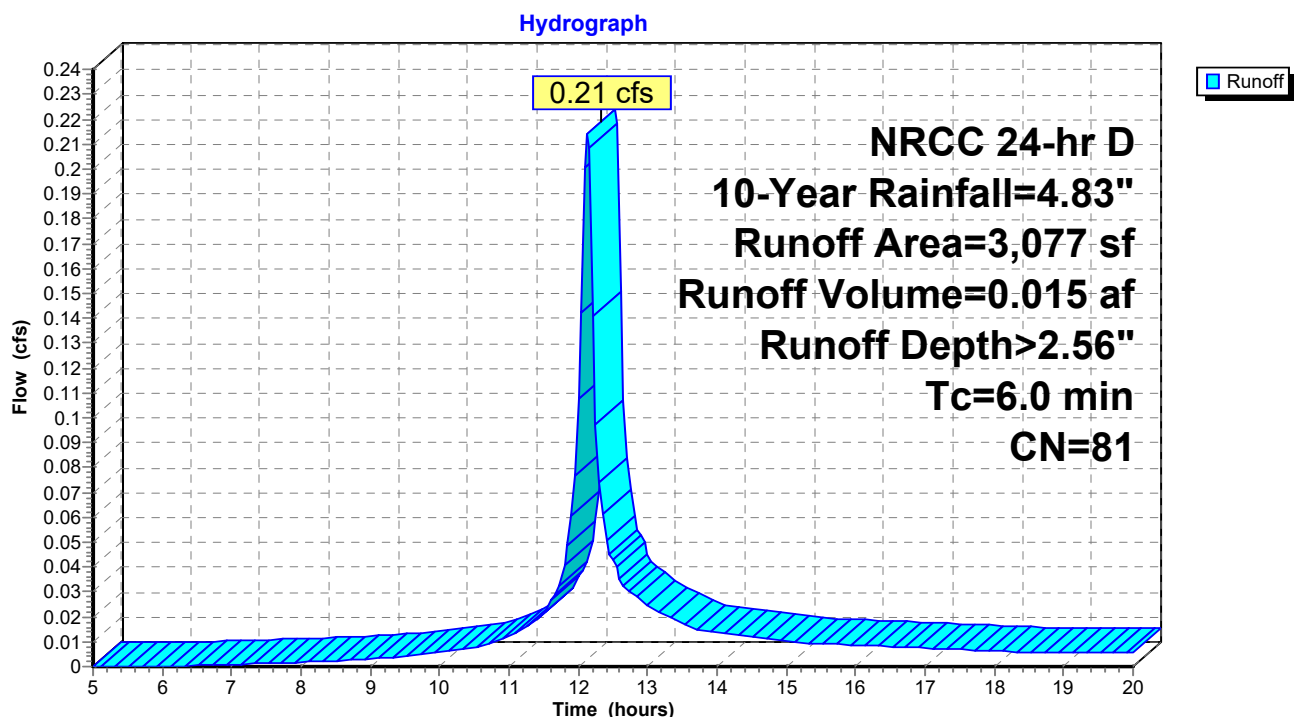
Runoff = 0.21 cfs @ 12.13 hrs, Volume= 0.015 af, Depth> 2.56"
Routed to Pond 7P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.83"

	Area (sf)	CN	Description
*	180	50	Pervious Pavers
	1,052	98	Roofs, HSG C
	1,845	74	>75% Grass cover, Good, HSG C
	3,077	81	Weighted Average
	2,025		65.81% Pervious Area
	1,052		34.19% Impervious Area

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

Subcatchment P1B: P1B



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NRCC 24-hr D 10-Year Rainfall=4.83"

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Summary for Pond 7P: Rain Garden

Inflow Area = 0.071 ac, 34.19% Impervious, Inflow Depth > 2.56" for 10-Year event
 Inflow = 0.21 cfs @ 12.13 hrs, Volume= 0.015 af
 Outflow = 0.01 cfs @ 19.59 hrs, Volume= 0.000 af, Atten= 97%, Lag= 447.8 min
 Primary = 0.01 cfs @ 19.59 hrs, Volume= 0.000 af
 Routed to Link 3L : Design Point 1 (Wetland)

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 101.15' @ 19.59 hrs Surf.Area= 734 sf Storage= 640 cf

Plug-Flow detention time= 690.0 min calculated for 0.000 af (2% of inflow)
 Center-of-Mass det. time= 386.4 min (1,176.9 - 790.5)

Volume	Invert	Avail.Storage	Storage Description
#1	99.75'	715 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	207	0	0
100.00	318	66	66
101.00	624	471	537
101.25	804	179	715

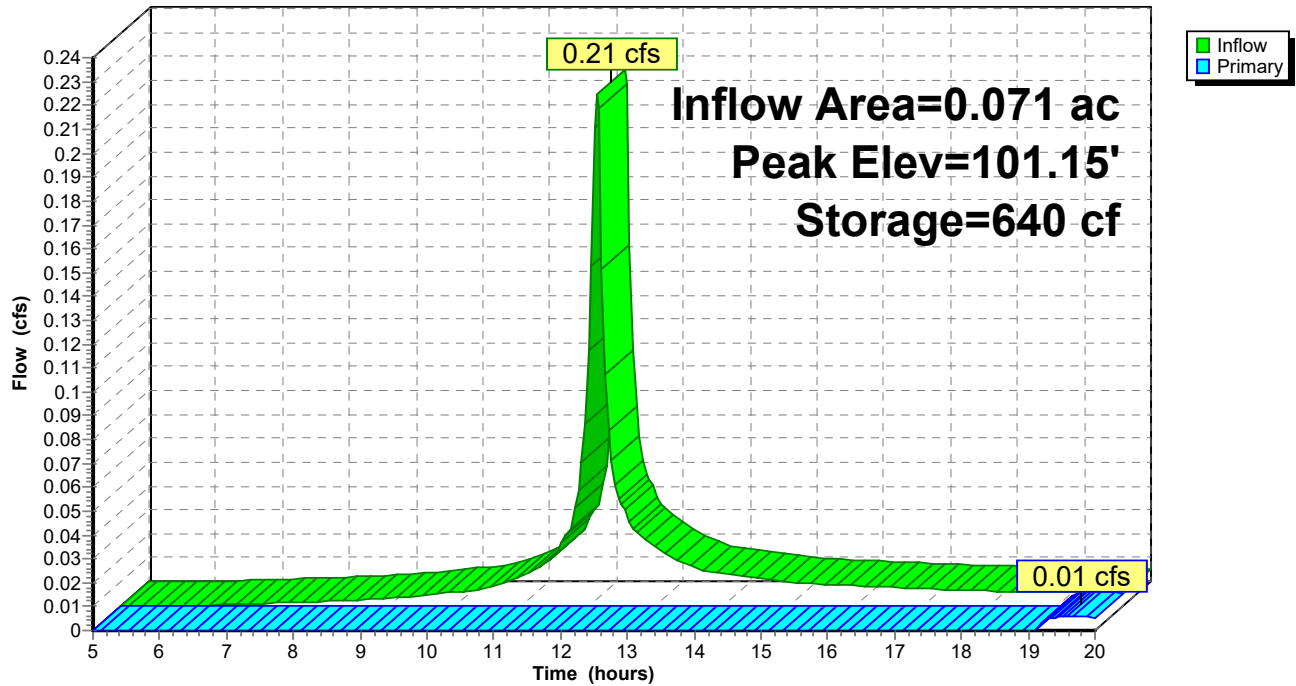
Device	Routing	Invert	Outlet Devices
#1	Primary	101.15'	10.0' long x 3.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 19.59 hrs HW=101.15' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Weir Controls 0.00 cfs @ 0.12 fps)

Pond 7P: Rain Garden

Hydrograph



POST HCAD

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NRCC 24-hr D 10-Year Rainfall=4.83"

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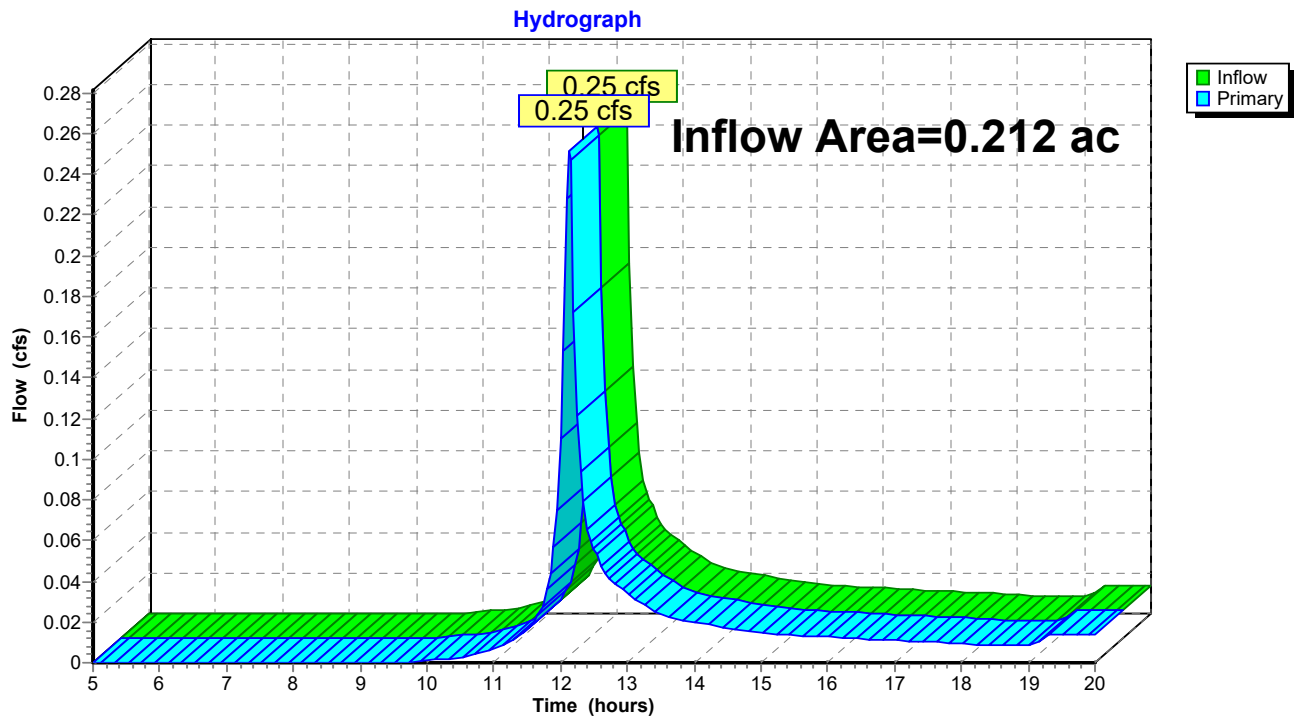
Page 18

Summary for Link 3L: Design Point 1 (Wetland)

Inflow Area = 0.212 ac, 11.41% Impervious, Inflow Depth > 1.00" for 10-Year event
Inflow = 0.25 cfs @ 12.14 hrs, Volume= 0.018 af
Primary = 0.25 cfs @ 12.14 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3L: Design Point 1 (Wetland)



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NRCC 24-hr D 25-Year Rainfall=6.16"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1A: P1A

Runoff Area=6,143 sf 0.00% Impervious Runoff Depth>2.35"
Tc=6.0 min CN=67 Runoff=0.40 cfs 0.028 af

Subcatchment P1B: P1B

Runoff Area=3,077 sf 34.19% Impervious Runoff Depth>3.66"
Tc=6.0 min CN=81 Runoff=0.30 cfs 0.022 af

Pond 7P: Rain Garden

Peak Elev=101.16' Storage=646 cf Inflow=0.30 cfs 0.022 af
Outflow=0.03 cfs 0.007 af

Link 3L: Design Point 1 (Wetland)

Inflow=0.40 cfs 0.034 af
Primary=0.40 cfs 0.034 af

Total Runoff Area = 0.212 ac Runoff Volume = 0.049 af Average Runoff Depth = 2.79"
88.59% Pervious = 0.188 ac 11.41% Impervious = 0.024 ac

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NRCC 24-hr D 25-Year Rainfall=6.16"

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Summary for Subcatchment P1A: P1A

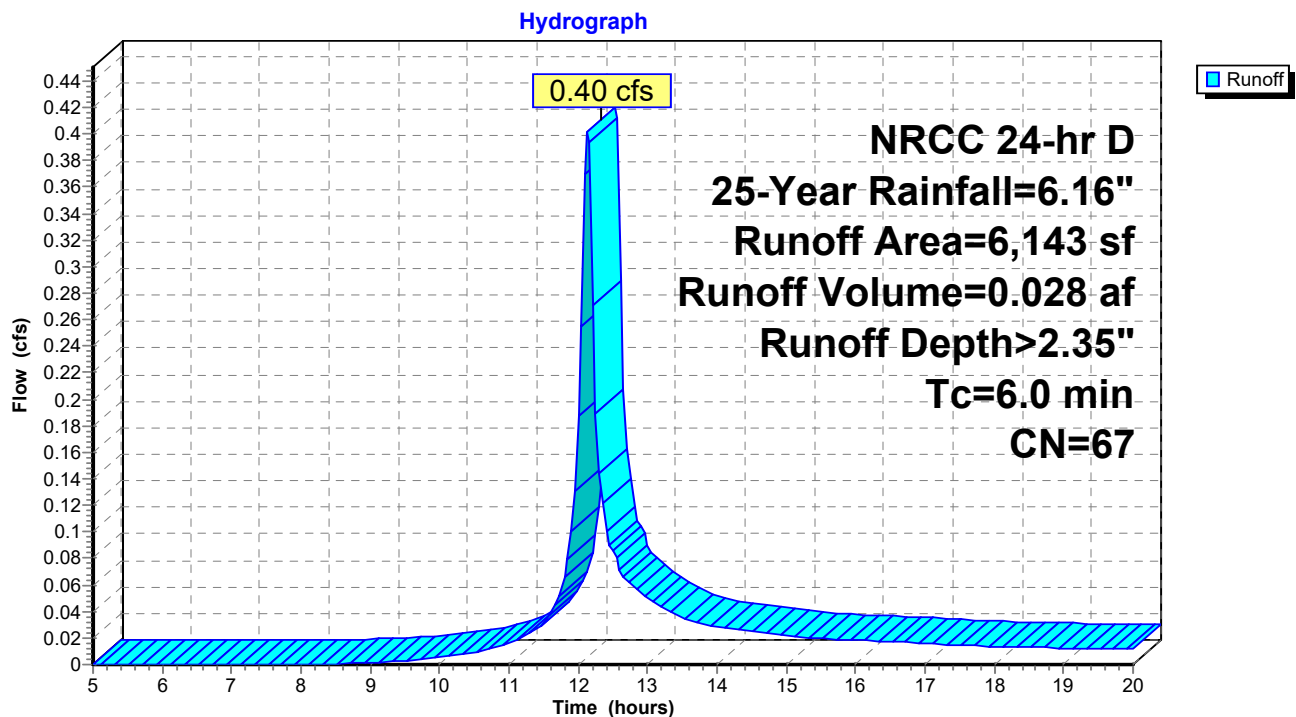
Runoff = 0.40 cfs @ 12.13 hrs, Volume= 0.028 af, Depth> 2.35"
Routed to Link 3L : Design Point 1 (Wetland)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.16"

Area (sf)	CN	Description
2,490	70	Woods, Good, HSG C
3,653	65	Brush, Good, HSG C
6,143	67	Weighted Average
6,143		100.00% Pervious Area

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

Subcatchment P1A: P1A



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NRCC 24-hr D 25-Year Rainfall=6.16"

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Summary for Subcatchment P1B: P1B

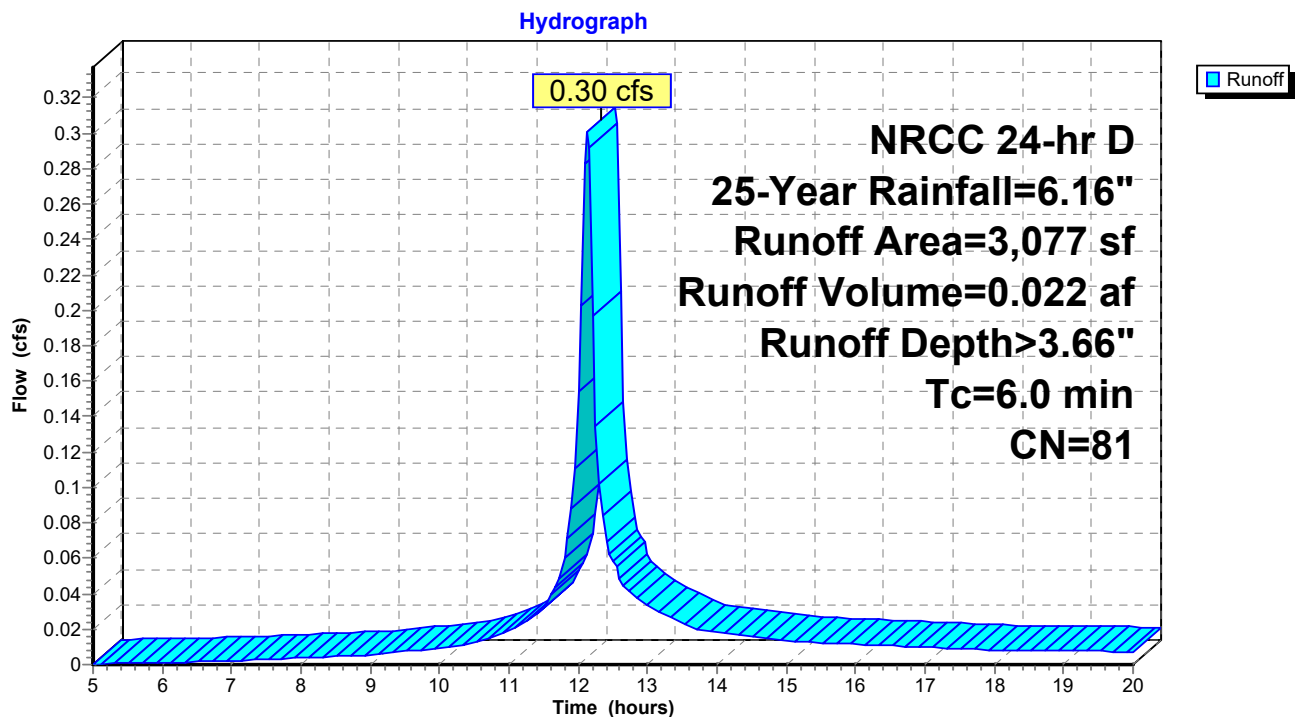
Runoff = 0.30 cfs @ 12.13 hrs, Volume= 0.022 af, Depth> 3.66"
Routed to Pond 7P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 25-Year Rainfall=6.16"

	Area (sf)	CN	Description
*	180	50	Pervious Pavers
	1,052	98	Roofs, HSG C
	1,845	74	>75% Grass cover, Good, HSG C
	3,077	81	Weighted Average
	2,025		65.81% Pervious Area
	1,052		34.19% Impervious Area

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

Subcatchment P1B: P1B



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Summary for Pond 7P: Rain Garden

Inflow Area = 0.071 ac, 34.19% Impervious, Inflow Depth > 3.66" for 25-Year event
 Inflow = 0.30 cfs @ 12.13 hrs, Volume= 0.022 af
 Outflow = 0.03 cfs @ 13.38 hrs, Volume= 0.007 af, Atten= 92%, Lag= 75.0 min
 Primary = 0.03 cfs @ 13.38 hrs, Volume= 0.007 af
 Routed to Link 3L : Design Point 1 (Wetland)

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 101.16' @ 13.38 hrs Surf.Area= 739 sf Storage= 646 cf

Plug-Flow detention time= 300.4 min calculated for 0.007 af (32% of inflow)
 Center-of-Mass det. time= 173.0 min (952.8 - 779.8)

Volume	Invert	Avail.Storage	Storage Description
#1	99.75'	715 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	207	0	0
100.00	318	66	66
101.00	624	471	537
101.25	804	179	715

Device	Routing	Invert	Outlet Devices
#1	Primary	101.15'	10.0' long x 3.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.03 cfs @ 13.38 hrs HW=101.16' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Weir Controls 0.03 cfs @ 0.25 fps)

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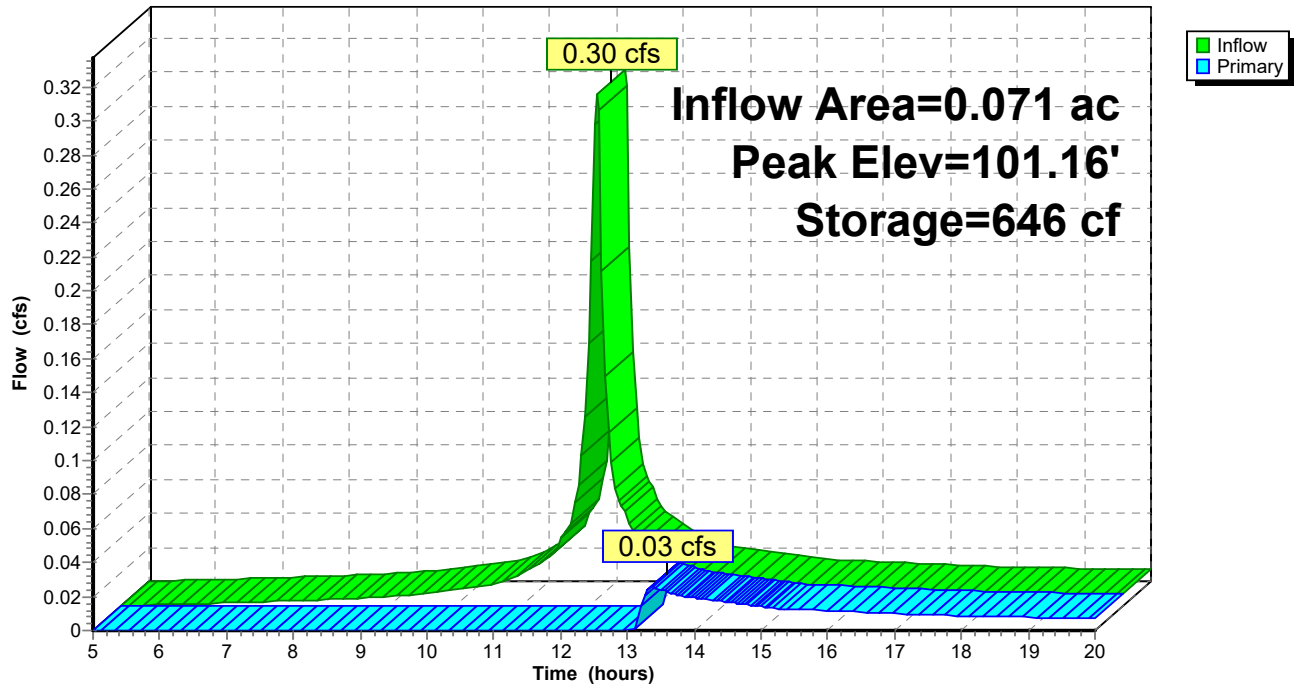
NRCC 24-hr D 25-Year Rainfall=6.16"

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Pond 7P: Rain Garden

Hydrograph



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NRCC 24-hr D 25-Year Rainfall=6.16"

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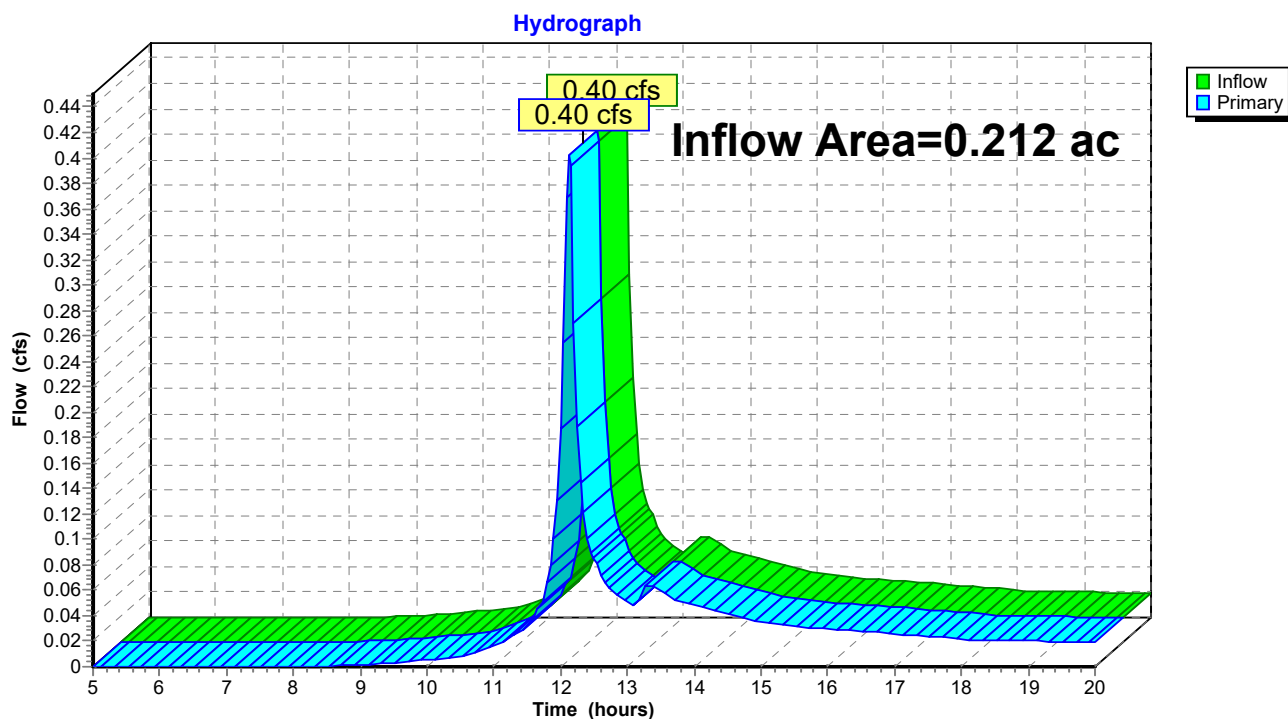
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Summary for Link 3L: Design Point 1 (Wetland)

Inflow Area = 0.212 ac, 11.41% Impervious, Inflow Depth > 1.95" for 25-Year event
Inflow = 0.40 cfs @ 12.13 hrs, Volume= 0.034 af
Primary = 0.40 cfs @ 12.13 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3L: Design Point 1 (Wetland)



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NRCC 24-hr D 100-Year Rainfall=8.94"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1A: P1A

Runoff Area=6,143 sf 0.00% Impervious Runoff Depth>4.42"
Tc=6.0 min CN=67 Runoff=0.74 cfs 0.052 af

Subcatchment P1B: P1B

Runoff Area=3,077 sf 34.19% Impervious Runoff Depth>6.05"
Tc=6.0 min CN=81 Runoff=0.48 cfs 0.036 af

Pond 7P: Rain Garden

Peak Elev=101.21' Storage=687 cf Inflow=0.48 cfs 0.036 af
Outflow=0.40 cfs 0.021 af

Link 3L: Design Point 1 (Wetland)

Inflow=1.07 cfs 0.073 af
Primary=1.07 cfs 0.073 af

Total Runoff Area = 0.212 ac Runoff Volume = 0.088 af Average Runoff Depth = 4.96"
88.59% Pervious = 0.188 ac 11.41% Impervious = 0.024 ac

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Summary for Subcatchment P1A: P1A

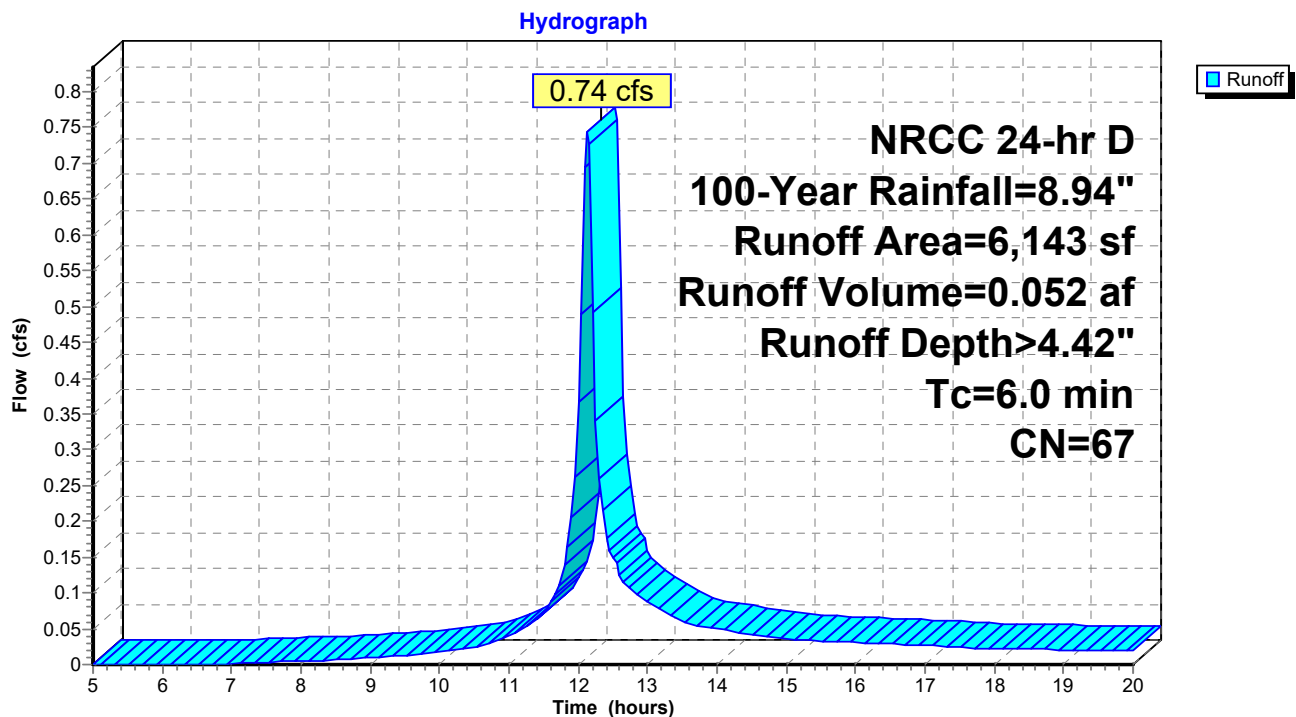
Runoff = 0.74 cfs @ 12.13 hrs, Volume= 0.052 af, Depth> 4.42"
Routed to Link 3L : Design Point 1 (Wetland)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
2,490	70	Woods, Good, HSG C
3,653	65	Brush, Good, HSG C
6,143	67	Weighted Average
6,143		100.00% Pervious Area

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

Subcatchment P1A: P1A



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Summary for Subcatchment P1B: P1B

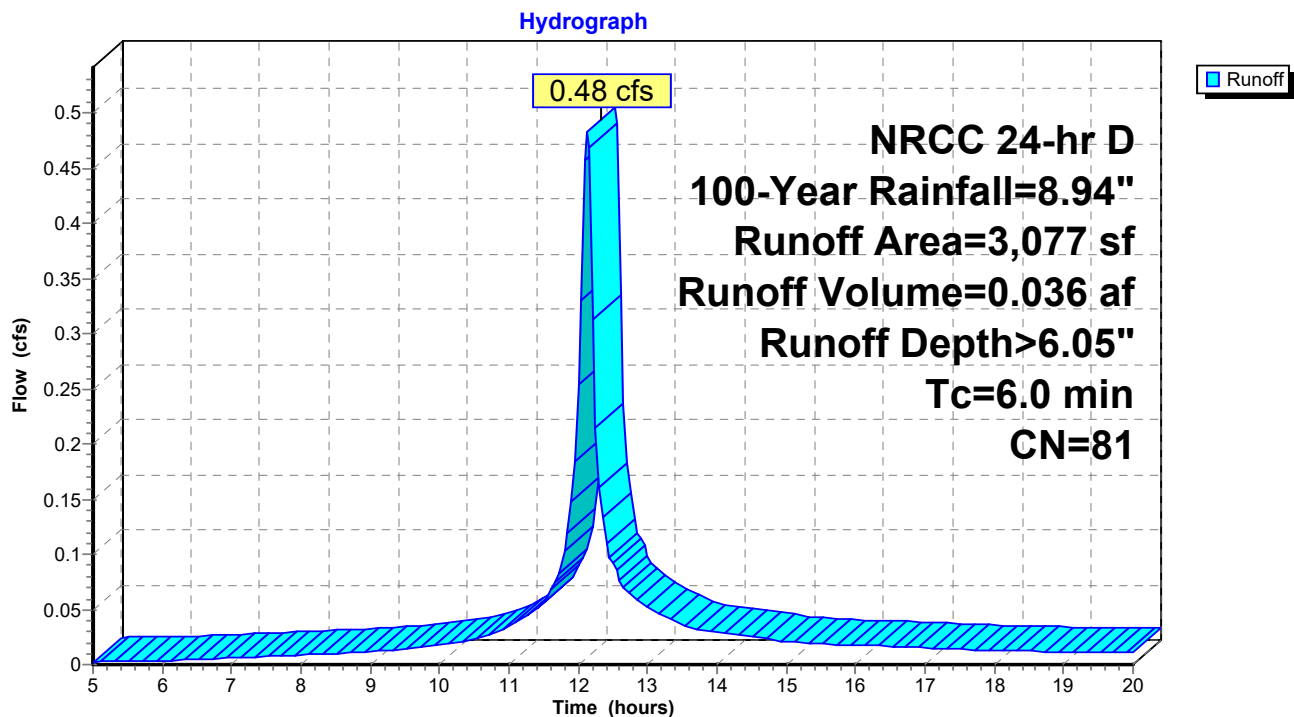
Runoff = 0.48 cfs @ 12.13 hrs, Volume= 0.036 af, Depth> 6.05"
Routed to Pond 7P : Rain Garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
*	180	50	Pervious Pavers
	1,052	98	Roofs, HSG C
	1,845	74	>75% Grass cover, Good, HSG C
	3,077	81	Weighted Average
	2,025		65.81% Pervious Area
	1,052		34.19% Impervious Area

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

Subcatchment P1B: P1B



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Summary for Pond 7P: Rain Garden

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.071 ac, 34.19% Impervious, Inflow Depth > 6.05" for 100-Year event
 Inflow = 0.48 cfs @ 12.13 hrs, Volume= 0.036 af
 Outflow = 0.40 cfs @ 12.19 hrs, Volume= 0.021 af, Atten= 18%, Lag= 3.7 min
 Primary = 0.40 cfs @ 12.19 hrs, Volume= 0.021 af
 Routed to Link 3L : Design Point 1 (Wetland)

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 101.21' @ 12.19 hrs Surf.Area= 778 sf Storage= 687 cf

Plug-Flow detention time= 176.0 min calculated for 0.021 af (59% of inflow)
 Center-of-Mass det. time= 84.1 min (850.3 - 766.2)

Volume	Invert	Avail.Storage	Storage Description
#1	99.75'	715 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	207	0	0
100.00	318	66	66
101.00	624	471	537
101.25	804	179	715

Device	Routing	Invert	Outlet Devices
#1	Primary	101.15'	10.0' long x 3.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.38 cfs @ 12.19 hrs HW=101.21' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Weir Controls 0.38 cfs @ 0.61 fps)

POST HCAD

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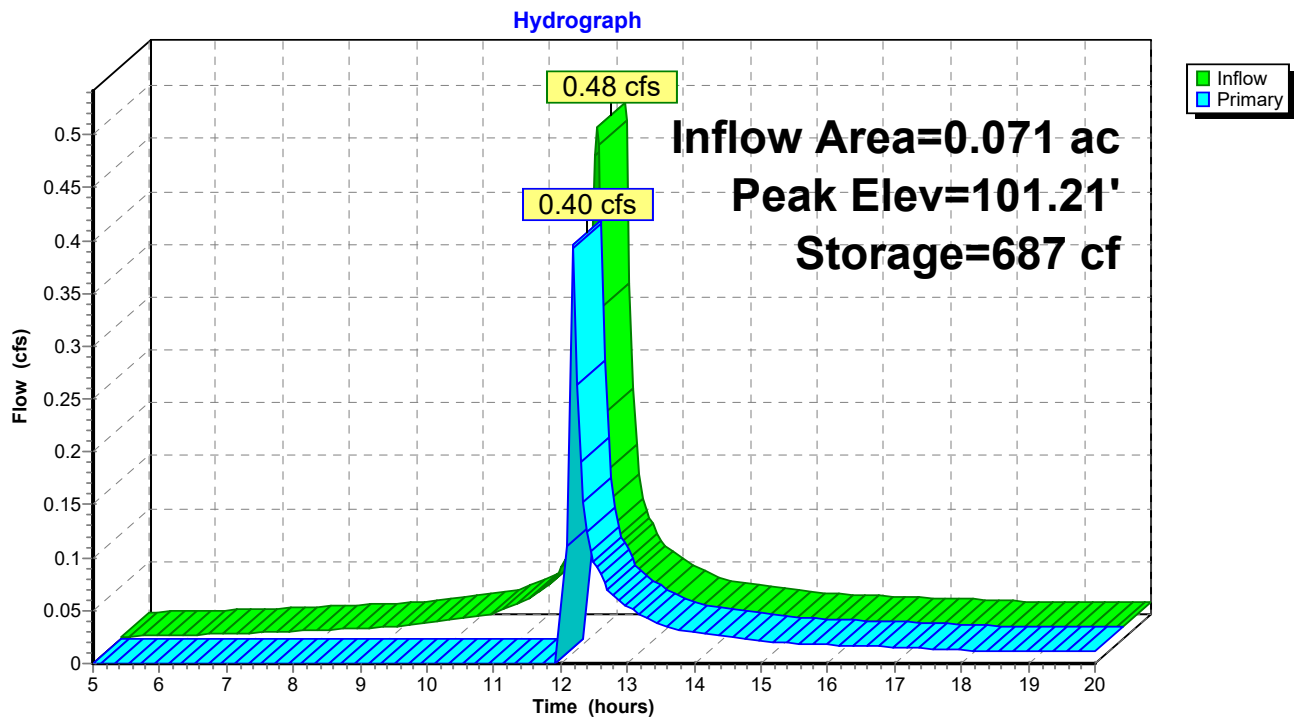
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NRCC 24-hr D 100-Year Rainfall=8.94"

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Pond 7P: Rain Garden

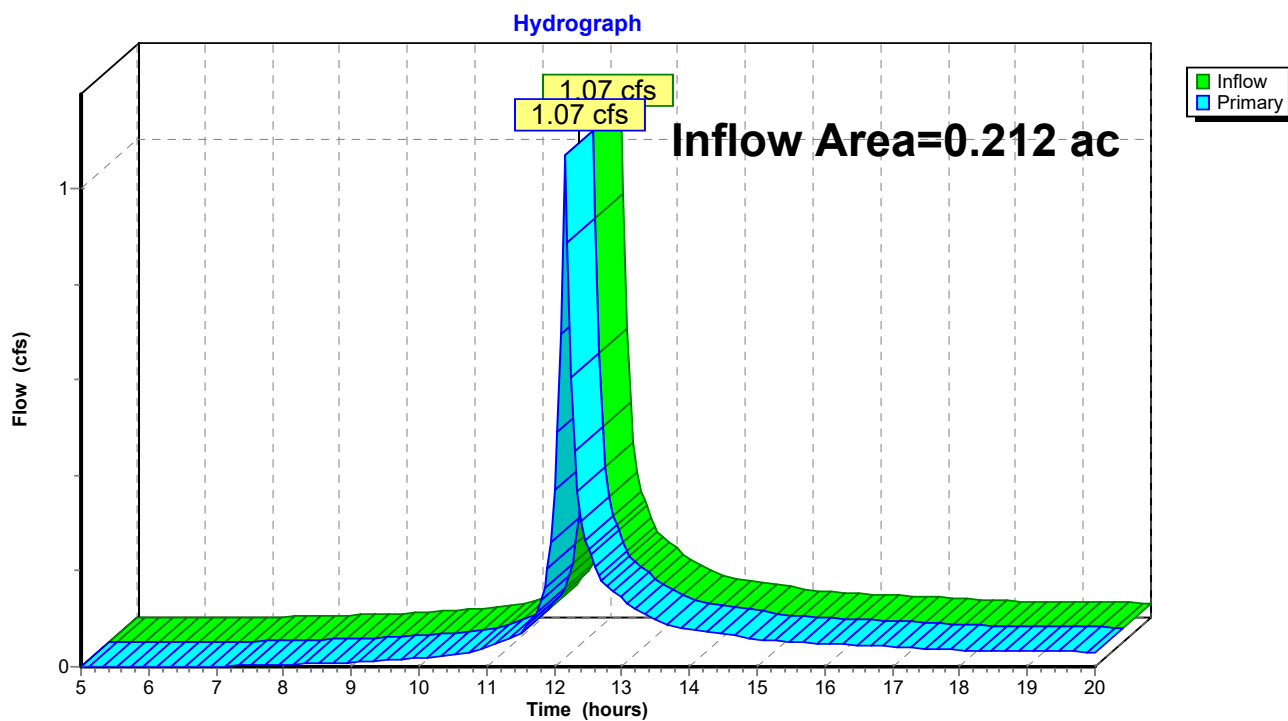


Summary for Link 3L: Design Point 1 (Wetland)

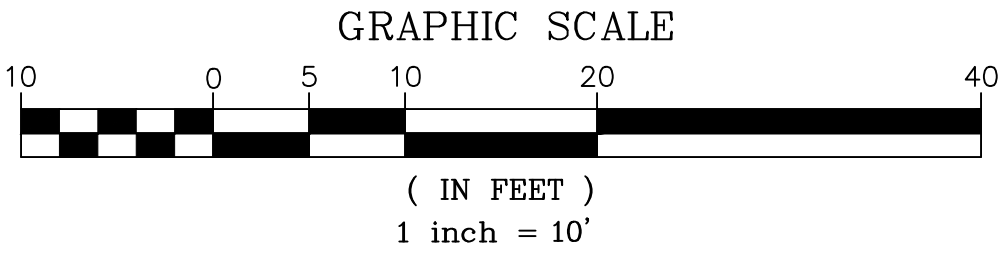
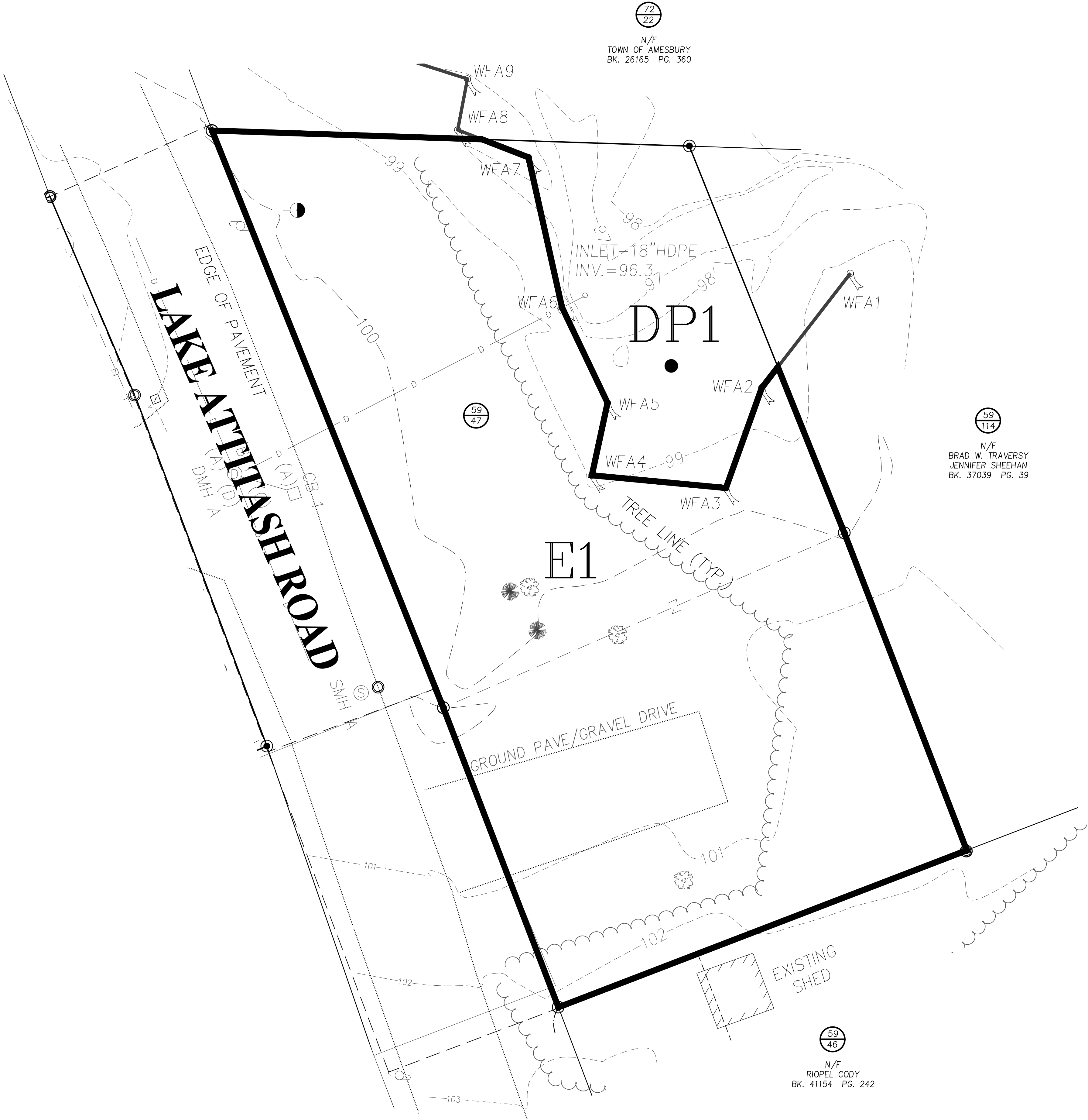
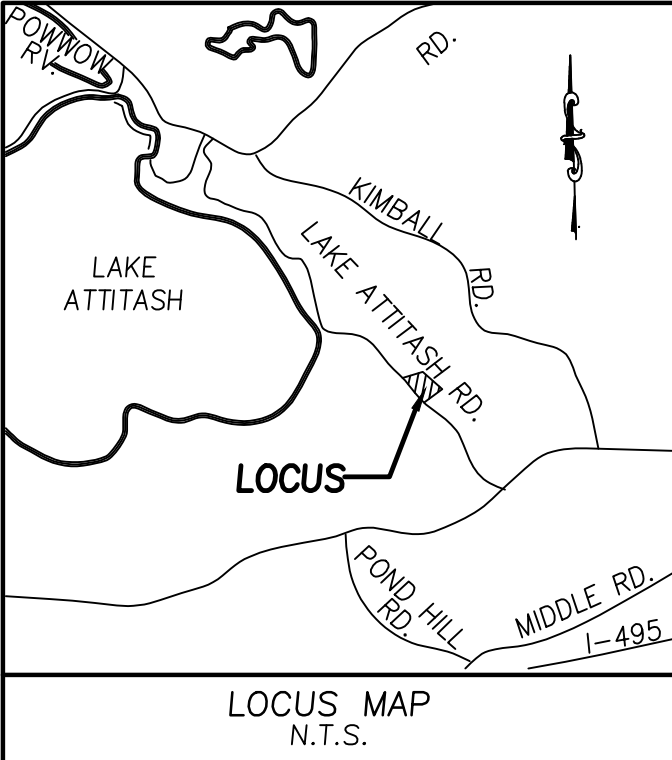
Inflow Area = 0.212 ac, 11.41% Impervious, Inflow Depth > 4.13" for 100-Year event
 Inflow = 1.07 cfs @ 12.16 hrs, Volume= 0.073 af
 Primary = 1.07 cfs @ 12.16 hrs, Volume= 0.073 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3L: Design Point 1 (Wetland)

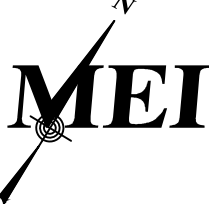


c. Watershed Maps



PREPARED FOR
FRANK CAVALLARO
30 LAKE ATTITASH ROAD,
AMESBURY, MA

NO.	DATE	DESCRIPTION	BY		



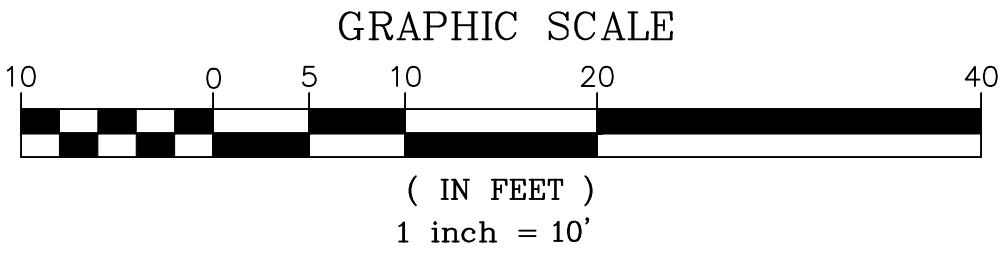
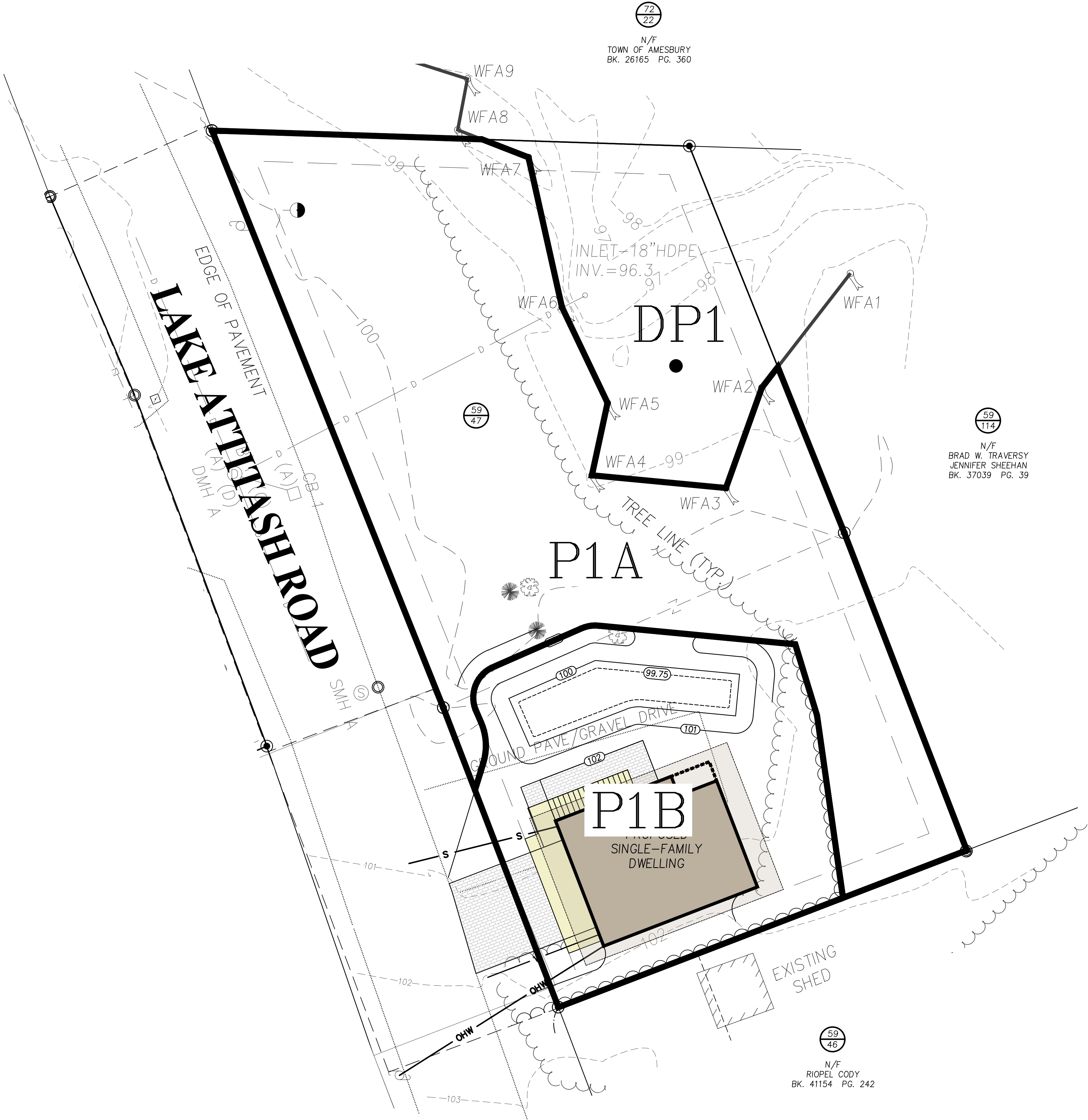
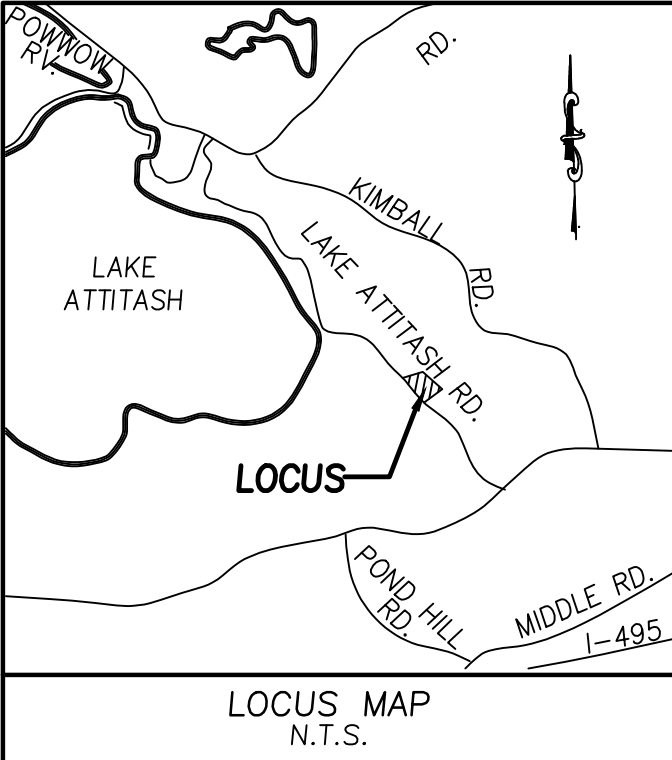
MILLENNIUM ENGINEERING, INC.
ENGINEERING AND LAND SURVEYING
62 ELM ST. SALISBURY, MA 01952 (978) 463-8980
13 HAMPTON RD. EXETER, NH 03833 (603) 778-0528

SCALE: 1" = 20'	CALC. BY: S.R.C.	PROJECT: M203812
DATE: NOV. 24, 2025	CHKD. BY: J.T.M.	

SITE PLAN
IN
AMESBURY, MA
AT
29 LAKE ATTITASH ROAD

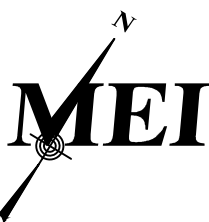
**PRE -
DEVELOPMENT
WATERSHED
MAP**

SHEET: 1 OF 2



PREPARED FOR
FRANK CAVALLARO
30 LAKE ATTITASH ROAD,
AMESBURY, MA

NO.	DATE	DESCRIPTION	BY



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SCALE: 1" = 20'	CALC. BY: S.R.C.	PROJECT: M203812
DATE: NOV. 24, 2025	CHKD. BY: J.T.M.	

SITE PLAN
IN
AMESBURY, MA
AT
29 LAKE ATTITASH ROAD

**POST -
DEVELOPMENT
WATERSHED
MAP**

SHEET: 2 OF 2