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:

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revocable Trust of 2021
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I. Introduction

Introduction

The subject property is identified as Tax Map 59, Lot 47 on the Town of Amesbury Assessor's Maps and is located at 29 Lake Attitash Road, Amesbury, Massachusetts. The parcel contains approximately 0.25 acres and generally slopes from south to north, with existing ground elevations ranging from approximately Elev. 102.0 feet at the southern property boundary to Elev. 98.0 feet at the northern property boundary. All elevations referenced herein are based on the North American Vertical Datum of 1988 (NAVD 88).

The proposed project consists of the construction of a single-family residence with associated driveway, utilities, and site improvements. Access to the property will continue to be provided from Lake Attitash Road via the existing driveway location. The proposed stormwater management system has been designed to preserve the site's natural drainage characteristics by utilizing vegetated conveyance swales and a rain garden. The rain garden will promote groundwater recharge, provide water quality treatment, and attenuate stormwater runoff such that post-development peak discharge rates do not exceed existing conditions.

The property is located within the Water Resource Protection District C as defined by the Town of Amesbury Zoning Ordinance. Section XIV I(7)(1) requires that single- and two-family residential developments achieve stormwater recharge through site design that incorporates natural drainage patterns and vegetation to maintain pre-development drainage characteristics and water quality to the greatest extent practicable. The ordinance further requires runoff from rooftops, driveways, and other impervious surfaces to be conveyed through grassed swales, sheet flow over vegetated areas, or other stormwater best management practices capable of providing water quality treatment, including the removal of nitrogen and phosphorus.

Although single-family residential developments are exempt from the Massachusetts Stormwater Standards, the proposed stormwater management system has been designed to comply with the intent of both the Massachusetts Stormwater Handbook and the Town of Amesbury's Water Resource Protection District requirements to the greatest extent practicable.

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	0.79	0.78	1.82	2.74	4.74

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 (Acres)	2 Yr Storm	10 Yr Storm	25 Yr Storm	100 Yr Storm
Pre-Dev					
Total E1	0.79	0.78	1.82	2.74	4.74
Post-Dev					
Total P1	0.21	0.67	1.61	2.44	4.67

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

III. Soils Analysis

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Essex County, Massachusetts, Northern Part

November 24, 2025

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:413 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 5 10 20 30

Feet: 0 20 40 80 120

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 21, Sep 5, 2025

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	0.1	18.9%
31A	Walpole sandy loam, 0 to 3 percent slopes	0.3	81.1%
Totals for Area of Interest		**0.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Essex County, Massachusetts, Northern Part

6A—Scarboro mucky fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svky
Elevation: 0 to 1,320 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Scarboro and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scarboro

Setting

Landform: Drainageways, outwash deltas, depressions, outwash terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy glaciofluvial deposits derived from schist and/or sandy glaciofluvial deposits derived from gneiss and/or sandy glaciofluvial deposits derived from granite

Typical profile

Oe - 0 to 3 inches: mucky peat
A - 3 to 11 inches: mucky fine sandy loam
Cg1 - 11 to 21 inches: sand
Cg2 - 21 to 65 inches: gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: About 0 to 2 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 10 percent
Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Walpole

Percent of map unit: 5 percent
Landform: Outwash plains, depressions, depressions, deltas, outwash terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wareham

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

31A—Walpole sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svkl
Elevation: 0 to 1,350 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Walpole and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Walpole

Setting

Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy glaciofluvial deposits derived from igneous, metamorphic and sedimentary rock

Typical profile

Oe - 0 to 1 inches: mucky peat
A - 1 to 7 inches: sandy loam
Bg - 7 to 21 inches: sandy loam
BC - 21 to 25 inches: gravelly sandy loam
C - 25 to 65 inches: very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 4 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Ecological site: F144AY028MA - Wet Outwash
Hydric soil rating: Yes

Minor Components

Sudbury

Percent of map unit: 10 percent
Landform: Outwash plains
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Scarboro

Percent of map unit: 10 percent
Landform: Depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

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"

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. Stormwater Recharge Calculations

Stormwater Recharge Calculations

Calculations were performed to ensure that the proposed project will comply with the groundwater recharge requirements of the Mass **DEP** Stormwater Management Standards. The required recharge volume was calculated as follows:

The Required Recharge Volume equals a depth of runoff corresponding to the soil type times the impervious areas located on site.

Rv = Fx Impervious area Where:

Rv = Required Recharge Volume, expressed in cubic feet

F = Target Depth Factor associated with each Hydrologic Soil

Group Impervious Area = pavement and rooftop area on site

For the proposed project:

Required Recharge volume, Rv (A soil) = F * total impervious area
= 0.6 in * 1,392 s.f.
= 70 c.f.

Total Required Recharge Volume = 70 c.f.

Total Recharge provided (Rain Garden) = 537 c.f.

V. TSS Removal Calculations

This site has been designed in accordance with section XIV I(7)(1) of the Water Resource Protection District Bylaw:

> *"For lots occupied, or proposed to be occupied, by single or two family residences recharge shall be attained through site design that incorporates natural drainage patterns and vegetation in order to maintain predevelopment stormwater patterns and water quality to the greatest extent possible. Stormwater runoff from rooftops, driveways and other impervious surfaces shall be routed through grassed water quality swales, as sheet flow over lawn areas or to constructed stormwater wetlands, sand filters, organic filters and/or similar systems capable of removing nitrogen and phosphorus from stormwater."*

This project consists of a single-family home and is therefore exempt from the requirements of the Massachusetts Stormwater Standards. However, Millennium Engineering, Inc. (MEI) has designed the site to comply with the applicable stormwater management practices to the maximum extent practicable by incorporating a vegetated rain garden capable of providing TSS removal.

Preliminary treatment, as recommended by the Massachusetts Stormwater Handbook, is difficult to achieve due to the site constraints. To provide pretreatment to the maximum extent practicable, MEI has graded the site to route stormwater runoff over lawn areas prior to discharge to the rain garden. Additionally, roof runoff will discharge to a stone drip edge prior to entering the rain garden, providing an additional opportunity for sediment removal and runoff dispersion.

VI. Water Quality Calculations

Water Quality Calculations

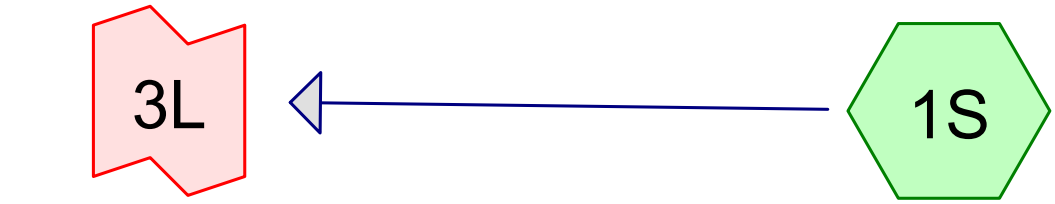
The Massachusetts DEP requires water quality calculations based on 1/2 inch of runoff for the total impervious area associated with the proposed development. The following calculation identifies the water quality volume required.

Total Impervious Area = 345 s.f. (pavement area)
345 s.f. * 1/2" / 12 (to convert to ft) = 15 c.f. of runoff to be treated for water quality.

Volume of the Rain garden below the lowest outlet (emergency overflow)= 537 c.f.

VII. Appendix

a. Existing Conditions HydroCAD Report



Design Point 1
(Wetland)

E1

Subcat Reach Pond Link

Routing Diagram for PRE HCAD
Prepared by Millennium Engineering, Inc, Printed 8/10/2026

Project Notes

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

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.344	65	Brush, Good, HSG C (1S)
0.016	96	Gravel surface, HSG C (1S)
0.102	98	Paved roads HSG C (1S)
0.015	98	Roofs, HSG C (1S)
0.312	70	Woods, Good, HSG C (1S)
0.789	**73**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.789	HSG C	1S
0.000	HSG D	
0.000	Other	
0.789		**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	0.344	0.000	0.000	0.344	Brush, Good	1S
0.000	0.000	0.016	0.000	0.000	0.016	Gravel surface	1S
0.000	0.000	0.102	0.000	0.000	0.102	Paved roads	1S
0.000	0.000	0.015	0.000	0.000	0.015	Roofs	1S
0.000	0.000	0.312	0.000	0.000	0.312	Woods, Good	1S
0.000	**0.000**	**0.789**	**0.000**	**0.000**	**0.789**	**TOTAL AREA**	

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 1S: E1 Runoff Area=34,356 sf 14.85% Impervious Runoff Depth>0.82"
Tc=6.0 min CN=73 Runoff=0.78 cfs 0.054 af

Link 3L: Design Point 1 (Wetland) Inflow=0.78 cfs 0.054 af
Primary=0.78 cfs 0.054 af

Total Runoff Area = 0.789 ac Runoff Volume = 0.054 af Average Runoff Depth = 0.82"
85.15% Pervious = 0.672 ac 14.85% Impervious = 0.117 ac

Summary for Subcatchment 1S: E1

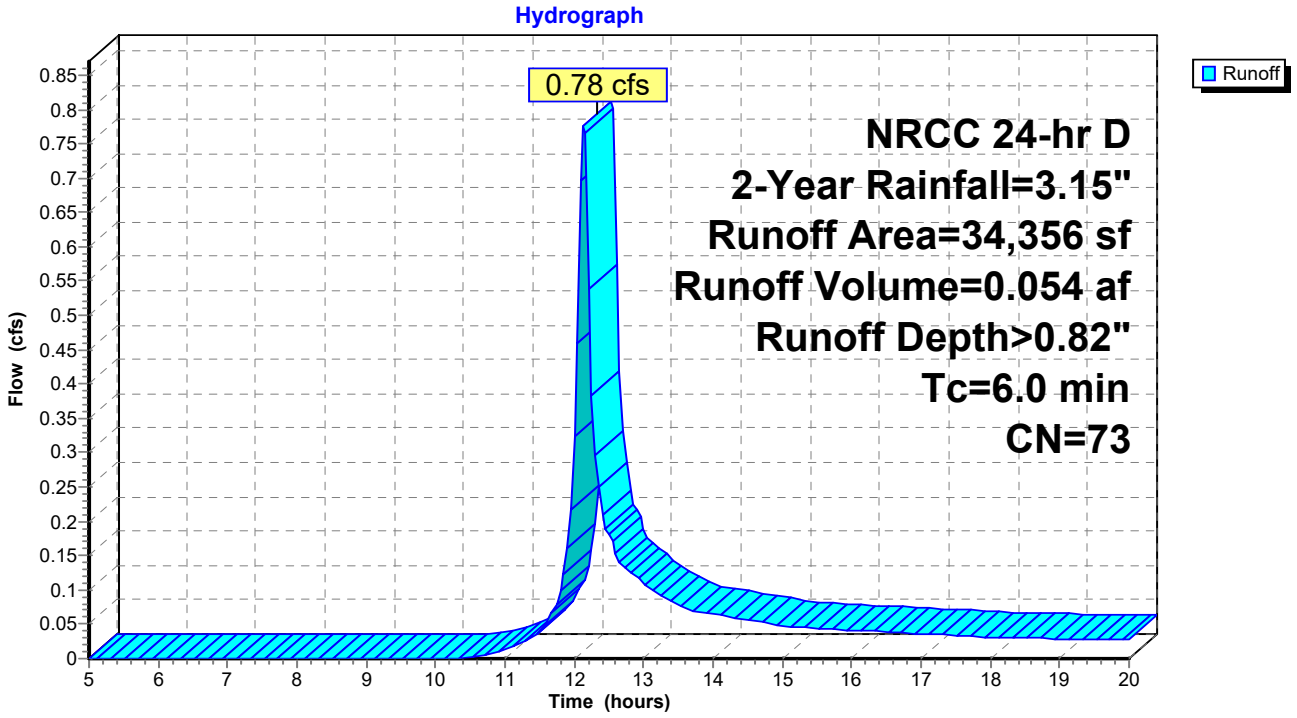
Runoff = 0.78 cfs @ 12.14 hrs, Volume= 0.054 af, Depth> 0.82"
Routed to Link 3L : Design Point 1 (Wetland)

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
	13,594	70	Woods, Good, HSG C
	14,966	65	Brush, Good, HSG C
	640	98	Roofs, HSG C
*	4,462	98	Paved roads HSG C
	34,356	73	Weighted Average
	29,254		85.15% Pervious Area
	5,102		14.85% Impervious Area

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

Subcatchment 1S: E1

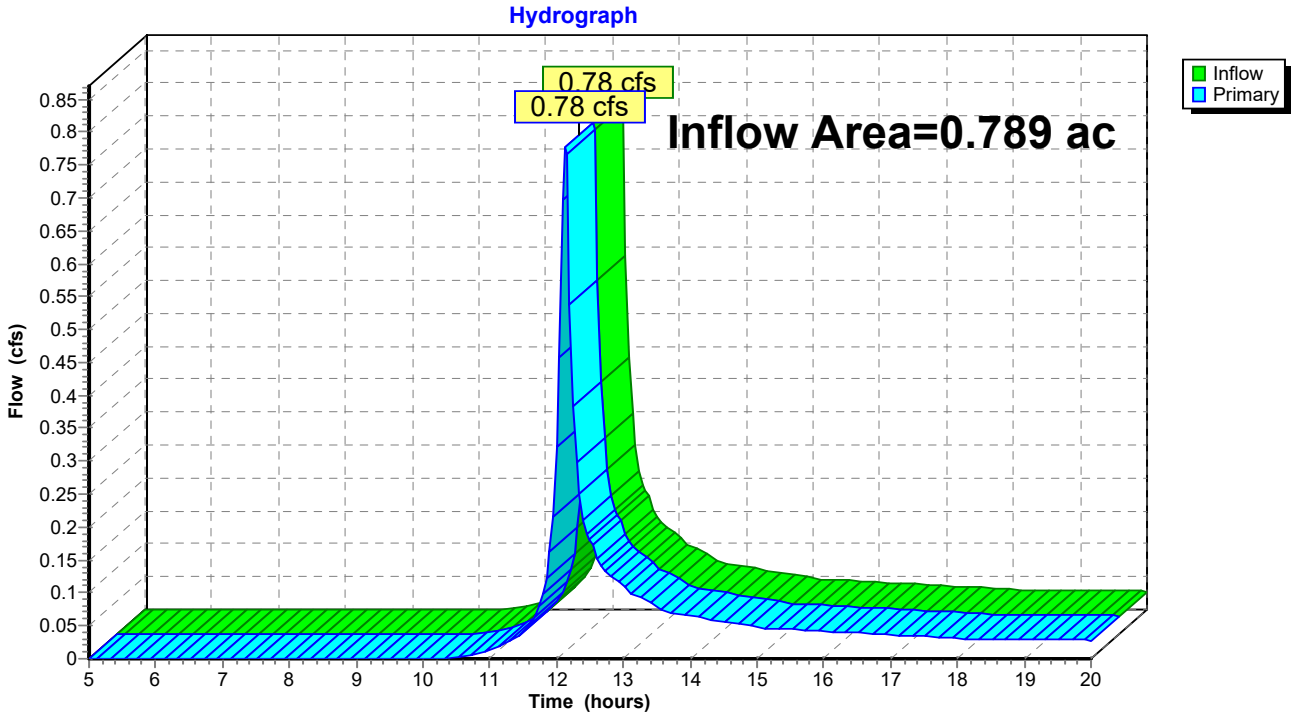


Summary for Link 3L: Design Point 1 (Wetland)

Inflow Area = 0.789 ac, 14.85% Impervious, Inflow Depth > 0.82" for 2-Year event
Inflow = 0.78 cfs @ 12.14 hrs, Volume= 0.054 af
Primary = 0.78 cfs @ 12.14 hrs, Volume= 0.054 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)



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 1S: E1 Runoff Area=34,356 sf 14.85% Impervious Runoff Depth>1.91"
Tc=6.0 min CN=73 Runoff=1.82 cfs 0.125 af

Link 3L: Design Point 1 (Wetland) Inflow=1.82 cfs 0.125 af
Primary=1.82 cfs 0.125 af

Total Runoff Area = 0.789 ac Runoff Volume = 0.125 af Average Runoff Depth = 1.91"
85.15% Pervious = 0.672 ac 14.85% Impervious = 0.117 ac

Summary for Subcatchment 1S: E1

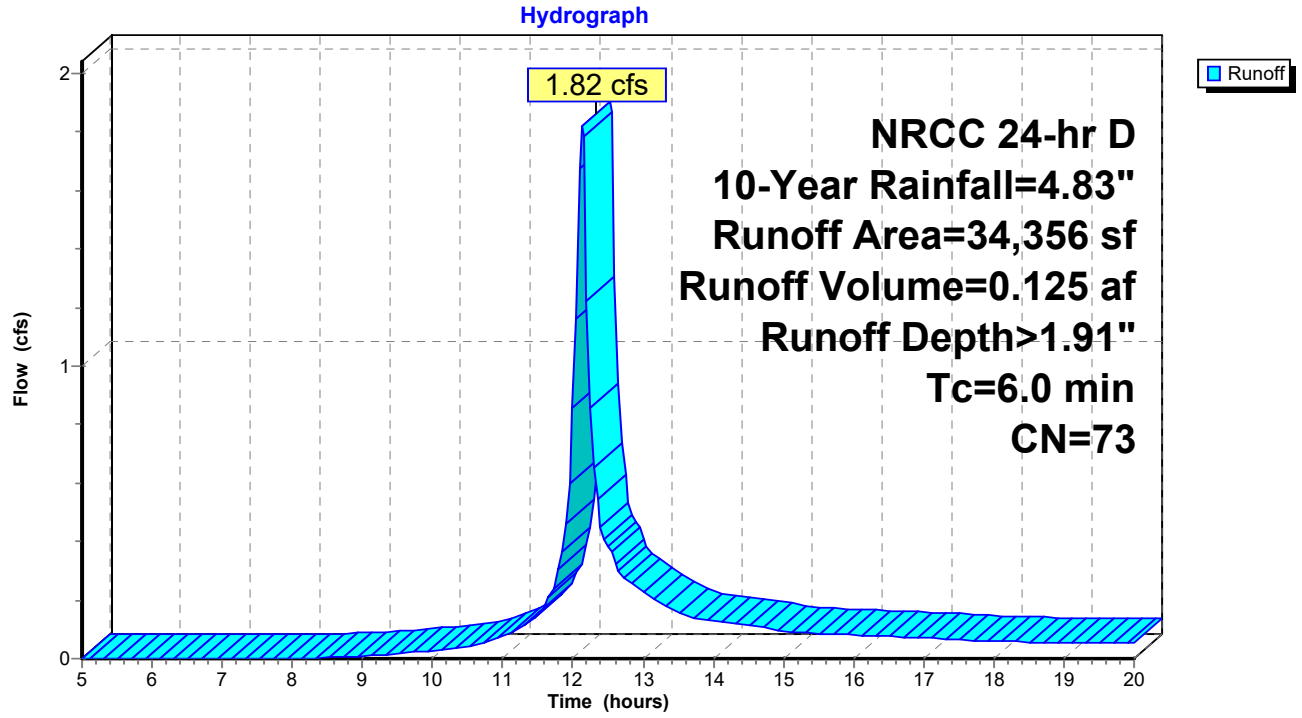
Runoff = 1.82 cfs @ 12.13 hrs, Volume= 0.125 af, Depth> 1.91"
Routed to Link 3L : Design Point 1 (Wetland)

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
	13,594	70	Woods, Good, HSG C
	14,966	65	Brush, Good, HSG C
	640	98	Roofs, HSG C
*	4,462	98	Paved roads HSG C
	34,356	73	Weighted Average
	29,254		85.15% Pervious Area
	5,102		14.85% Impervious Area

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

Subcatchment 1S: E1

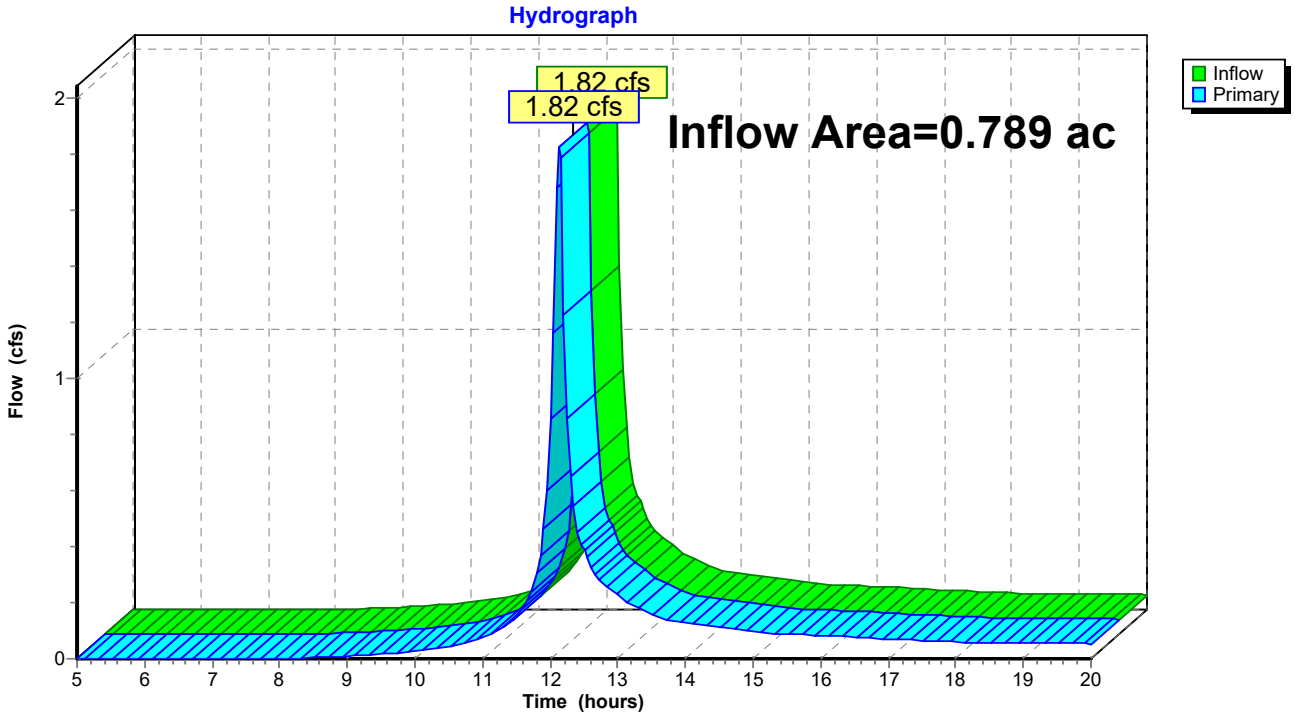


Summary for Link 3L: Design Point 1 (Wetland)

Inflow Area = 0.789 ac, 14.85% Impervious, Inflow Depth > 1.91" for 10-Year event
Inflow = 1.82 cfs @ 12.13 hrs, Volume= 0.125 af
Primary = 1.82 cfs @ 12.13 hrs, Volume= 0.125 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)



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 1S: E1 Runoff Area=34,356 sf 14.85% Impervious Runoff Depth>2.89"
Tc=6.0 min CN=73 Runoff=2.74 cfs 0.190 af

Link 3L: Design Point 1 (Wetland) Inflow=2.74 cfs 0.190 af
Primary=2.74 cfs 0.190 af

Total Runoff Area = 0.789 ac Runoff Volume = 0.190 af Average Runoff Depth = 2.89"
85.15% Pervious = 0.672 ac 14.85% Impervious = 0.117 ac

Summary for Subcatchment 1S: E1

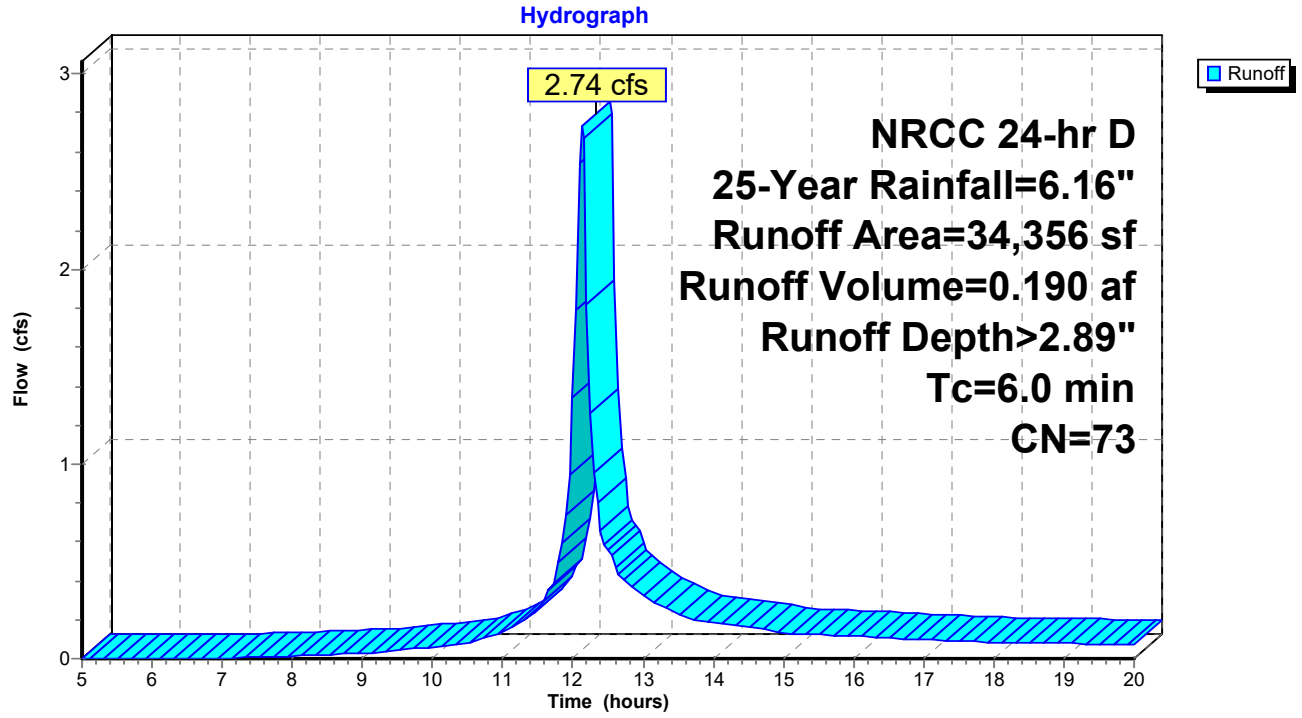
Runoff = 2.74 cfs @ 12.13 hrs, Volume= 0.190 af, Depth> 2.89"
Routed to Link 3L : Design Point 1 (Wetland)

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
	13,594	70	Woods, Good, HSG C
	14,966	65	Brush, Good, HSG C
	640	98	Roofs, HSG C
*	4,462	98	Paved roads HSG C
	34,356	73	Weighted Average
	29,254		85.15% Pervious Area
	5,102		14.85% Impervious Area

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

Subcatchment 1S: E1

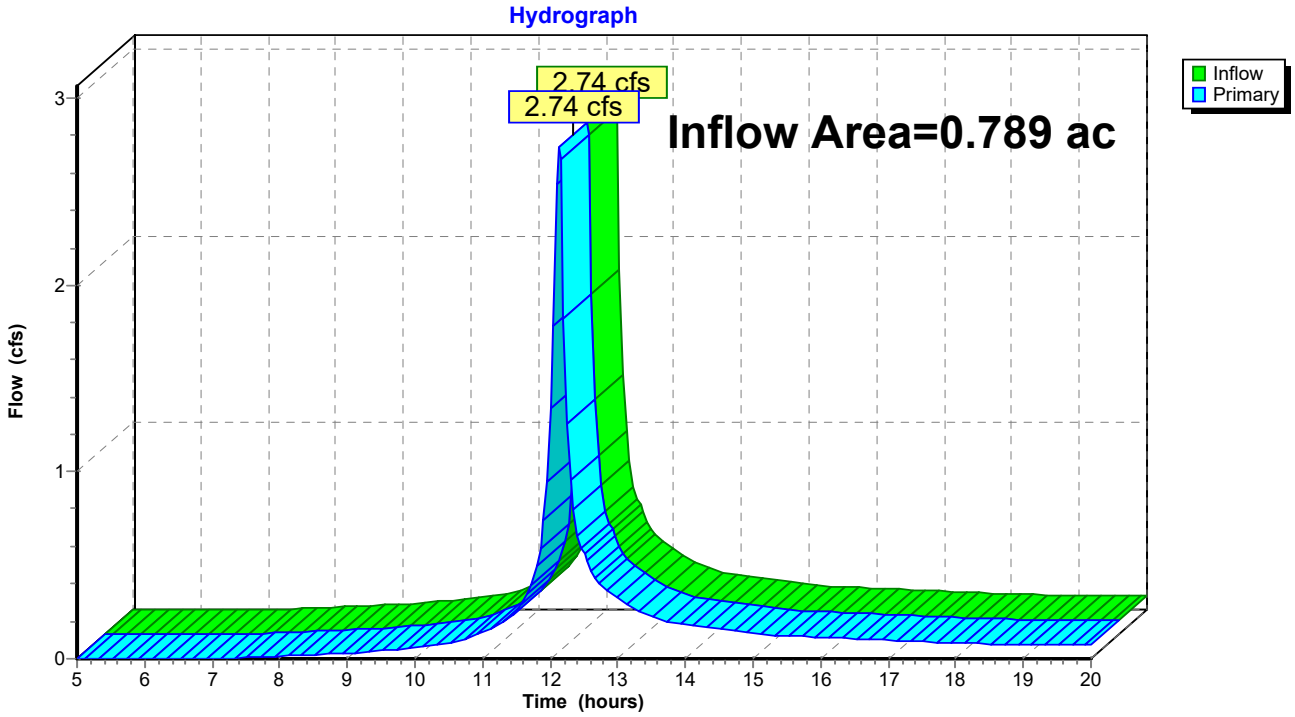


Summary for Link 3L: Design Point 1 (Wetland)

Inflow Area = 0.789 ac, 14.85% Impervious, Inflow Depth > 2.89" for 25-Year event
Inflow = 2.74 cfs @ 12.13 hrs, Volume= 0.190 af
Primary = 2.74 cfs @ 12.13 hrs, Volume= 0.190 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)



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 1S: E1 Runoff Area=34,356 sf 14.85% Impervious Runoff Depth>5.12"
Tc=6.0 min CN=73 Runoff=4.74 cfs 0.337 af

Link 3L: Design Point 1 (Wetland) Inflow=4.74 cfs 0.337 af
Primary=4.74 cfs 0.337 af

Total Runoff Area = 0.789 ac Runoff Volume = 0.337 af Average Runoff Depth = 5.12"
85.15% Pervious = 0.672 ac 14.85% Impervious = 0.117 ac

Summary for Subcatchment 1S: E1

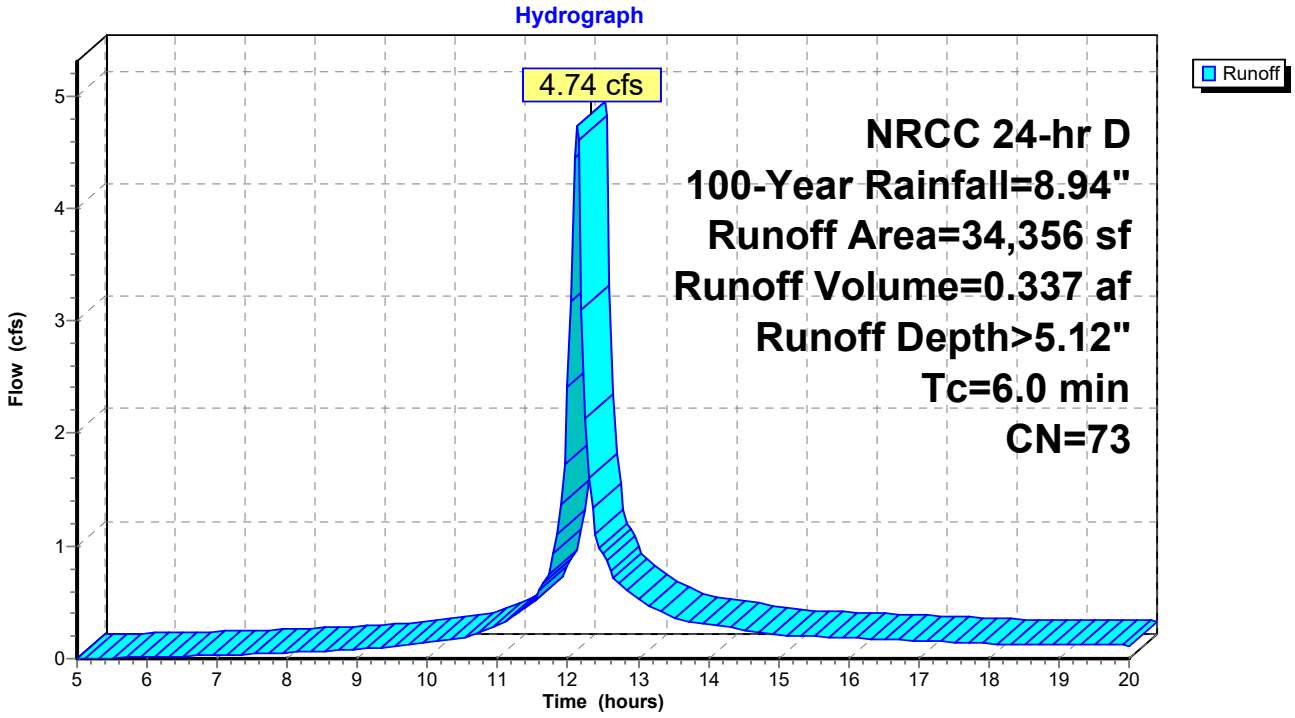
Runoff = 4.74 cfs @ 12.13 hrs, Volume= 0.337 af, Depth> 5.12"
Routed to Link 3L : Design Point 1 (Wetland)

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
	13,594	70	Woods, Good, HSG C
	14,966	65	Brush, Good, HSG C
	640	98	Roofs, HSG C
*	4,462	98	Paved roads HSG C
	34,356	73	Weighted Average
	29,254		85.15% Pervious Area
	5,102		14.85% Impervious Area

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

Subcatchment 1S: E1

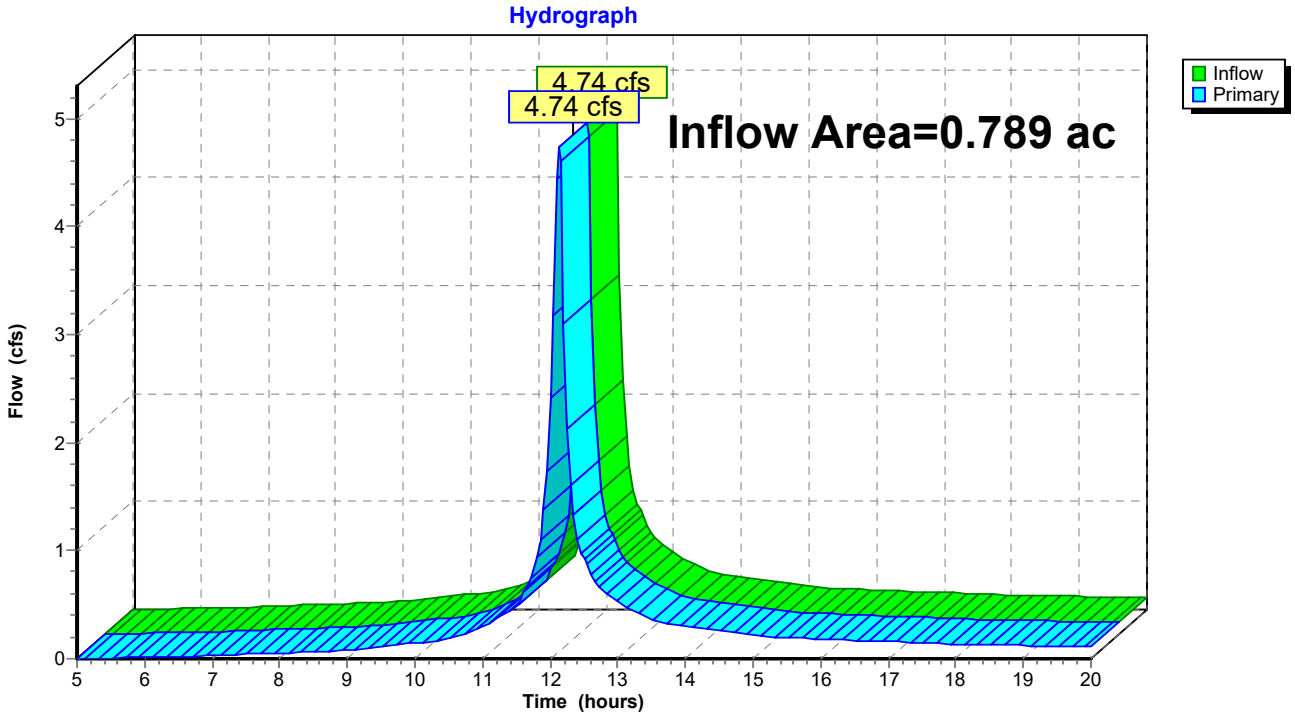


Summary for Link 3L: Design Point 1 (Wetland)

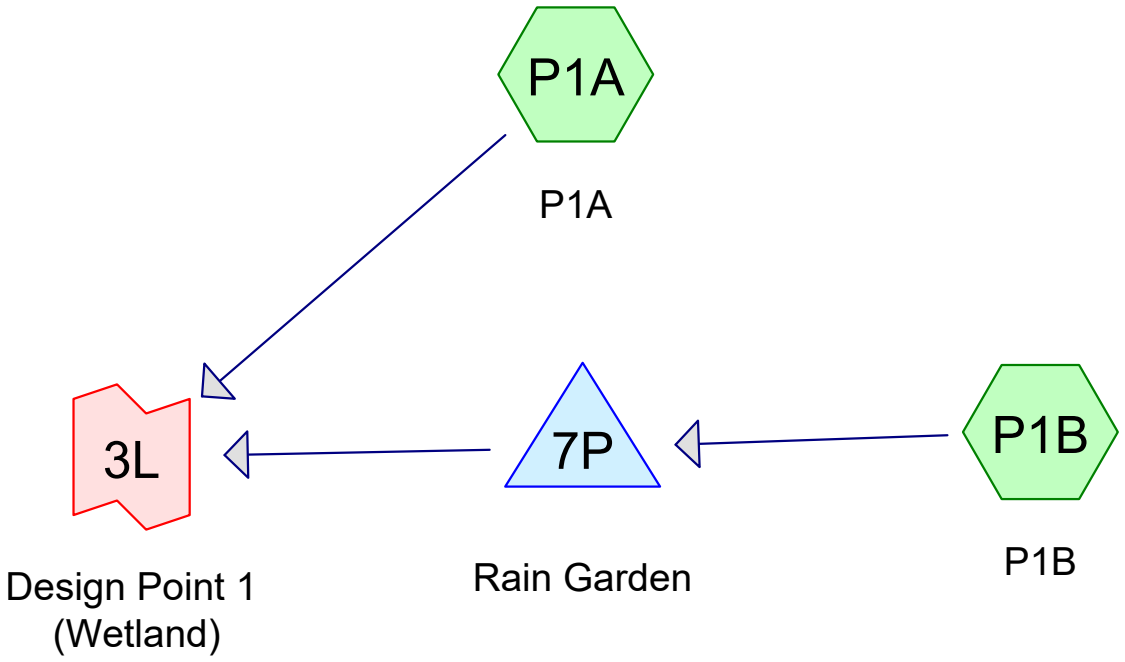
Inflow Area = 0.789 ac, 14.85% Impervious, Inflow Depth > 5.12" for 100-Year event
Inflow = 4.74 cfs @ 12.13 hrs, Volume= 0.337 af
Primary = 4.74 cfs @ 12.13 hrs, Volume= 0.337 af, Atten= 0%, Lag= 0.0 min

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



Subcat Reach Pond Link

Routing Diagram for POST HCAD
Prepared by Millennium Engineering, Inc, Printed 8/10/2026

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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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

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.049	74	>75% Grass cover, Good, HSG C (P1A, P1B)
0.320	65	Brush, Good, HSG C (P1A)
0.098	98	Paved parking, HSG C (P1A)
0.006	74	Pervious Pavers (P1B)
0.024	98	Roofs, HSG C (P1B)
0.296	70	Woods, Good, HSG C (P1A)
0.793	**73**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.787	HSG C	P1A, P1B
0.000	HSG D	
0.006	Other	P1B
0.793		**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	0.049	0.000	0.000	0.049	>75% Grass cover, Good	P1A, P1B
0.000	0.000	0.320	0.000	0.000	0.320	Brush, Good	P1A
0.000	0.000	0.098	0.000	0.000	0.098	Paved parking	P1A
0.000	0.000	0.000	0.000	0.006	0.006	Pervious Pavers	P1B
0.000	0.000	0.024	0.000	0.000	0.024	Roofs	P1B
0.000	0.000	0.296	0.000	0.000	0.296	Woods, Good	P1A
0.000	**0.000**	**0.787**	**0.000**	**0.006**	**0.793**	**TOTAL AREA**	

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=31,593 sf 13.55% Impervious Runoff Depth>0.77"
Tc=6.0 min CN=72 Runoff=0.67 cfs 0.047 af

Subcatchment P1B: P1B Runoff Area=2,955 sf 35.60% Impervious Runoff Depth>1.40"
Tc=6.0 min CN=83 Runoff=0.11 cfs 0.008 af

Pond 7P: Rain Garden Peak Elev=100.38' Storage=210 cf Inflow=0.11 cfs 0.008 af
Discarded=0.00 cfs 0.003 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.003 af

Link 3L: Design Point 1 (Wetland) Inflow=0.67 cfs 0.047 af
Primary=0.67 cfs 0.047 af

Total Runoff Area = 0.793 ac Runoff Volume = 0.055 af Average Runoff Depth = 0.83"
84.56% Pervious = 0.671 ac 15.44% Impervious = 0.122 ac

Summary for Subcatchment P1A: P1A

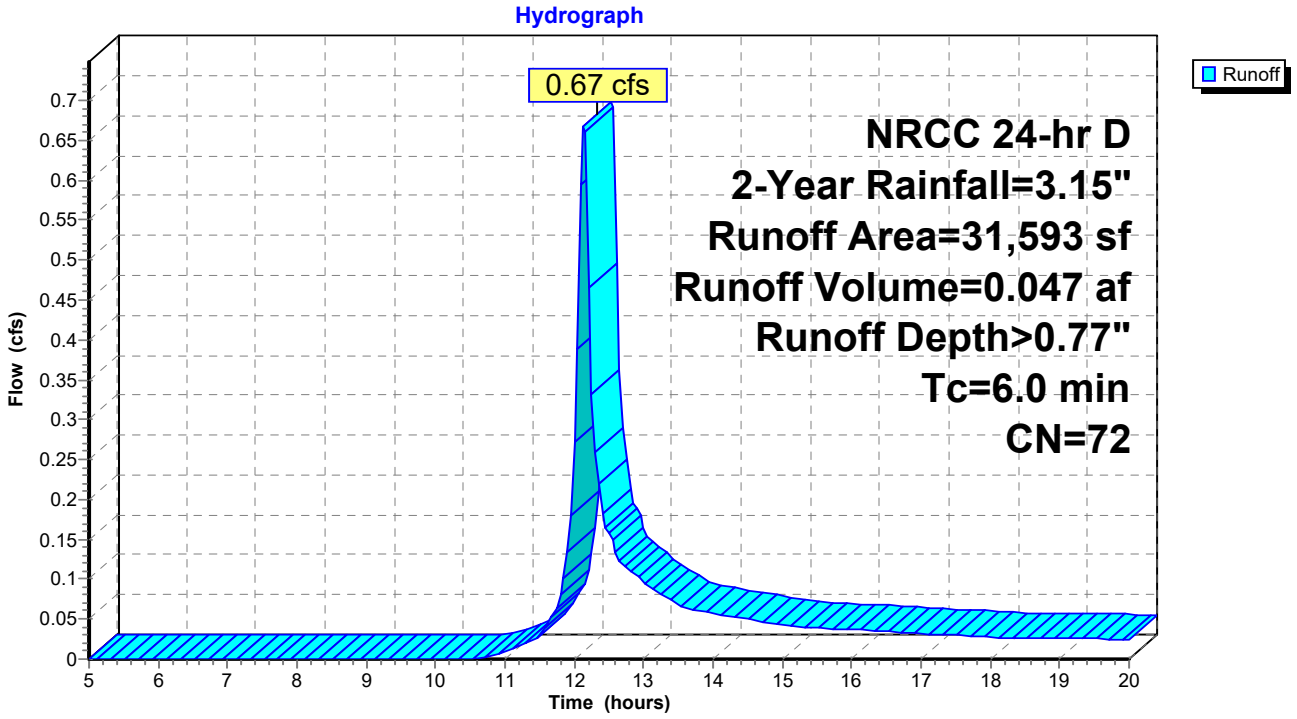
Runoff = 0.67 cfs @ 12.14 hrs, Volume= 0.047 af, Depth> 0.77"
Routed to Link 3L : Design Point 1 (Wetland)

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
12,885	70	Woods, Good, HSG C
13,943	65	Brush, Good, HSG C
4,281	98	Paved parking, HSG C
484	74	>75% Grass cover, Good, HSG C
31,593	72	Weighted Average
27,312		86.45% Pervious Area
4,281		13.55% Impervious Area

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

Subcatchment P1A: P1A



Hydrograph for Subcatchment P1A: P1A

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.26	0.00	0.00
5.25	0.28	0.00	0.00
5.50	0.29	0.00	0.00
5.75	0.31	0.00	0.00
6.00	0.32	0.00	0.00
6.25	0.34	0.00	0.00
6.50	0.36	0.00	0.00
6.75	0.38	0.00	0.00
7.00	0.40	0.00	0.00
7.25	0.42	0.00	0.00
7.50	0.44	0.00	0.00
7.75	0.46	0.00	0.00
8.00	0.48	0.00	0.00
8.25	0.50	0.00	0.00
8.50	0.53	0.00	0.00
8.75	0.55	0.00	0.00
9.00	0.58	0.00	0.00
9.25	0.61	0.00	0.00
9.50	0.64	0.00	0.00
9.75	0.67	0.00	0.00
10.00	0.71	0.00	0.00
10.25	0.75	0.00	0.00
10.50	0.79	0.00	0.00
10.75	0.84	0.00	0.00
11.00	0.89	0.00	0.01
11.25	0.97	0.01	0.02
11.50	1.06	0.02	0.03
11.75	1.19	0.04	0.06
12.00	1.51	0.12	**0.27**
12.25	1.96	0.28	**0.33**
12.50	2.09	0.33	0.16
12.75	2.18	0.37	0.11
13.00	2.26	0.41	0.10
13.25	2.31	0.43	0.08
13.50	2.36	0.46	0.07
13.75	2.40	0.48	0.06
14.00	2.44	0.50	0.06
14.25	2.48	0.52	0.05
14.50	2.51	0.54	0.05
14.75	2.54	0.55	0.05
15.00	2.57	0.57	0.04
15.25	2.60	0.58	0.04
15.50	2.62	0.59	0.04
15.75	2.65	0.61	0.04
16.00	2.67	0.62	0.04
16.25	2.69	0.63	0.04
16.50	2.71	0.64	0.03
16.75	2.73	0.65	0.03
17.00	2.75	0.67	0.03
17.25	2.77	0.68	0.03
17.50	2.79	0.69	0.03
17.75	2.81	0.70	0.03
18.00	2.83	0.71	0.03
18.25	2.84	0.72	0.03
18.50	2.86	0.72	0.03
18.75	2.87	0.73	0.03
19.00	2.89	0.74	0.03
19.25	2.90	0.75	0.03
19.50	2.92	0.76	0.03
19.75	2.93	0.77	0.03
20.00	**2.95**	**0.78**	0.02

Summary for Subcatchment P1B: P1B

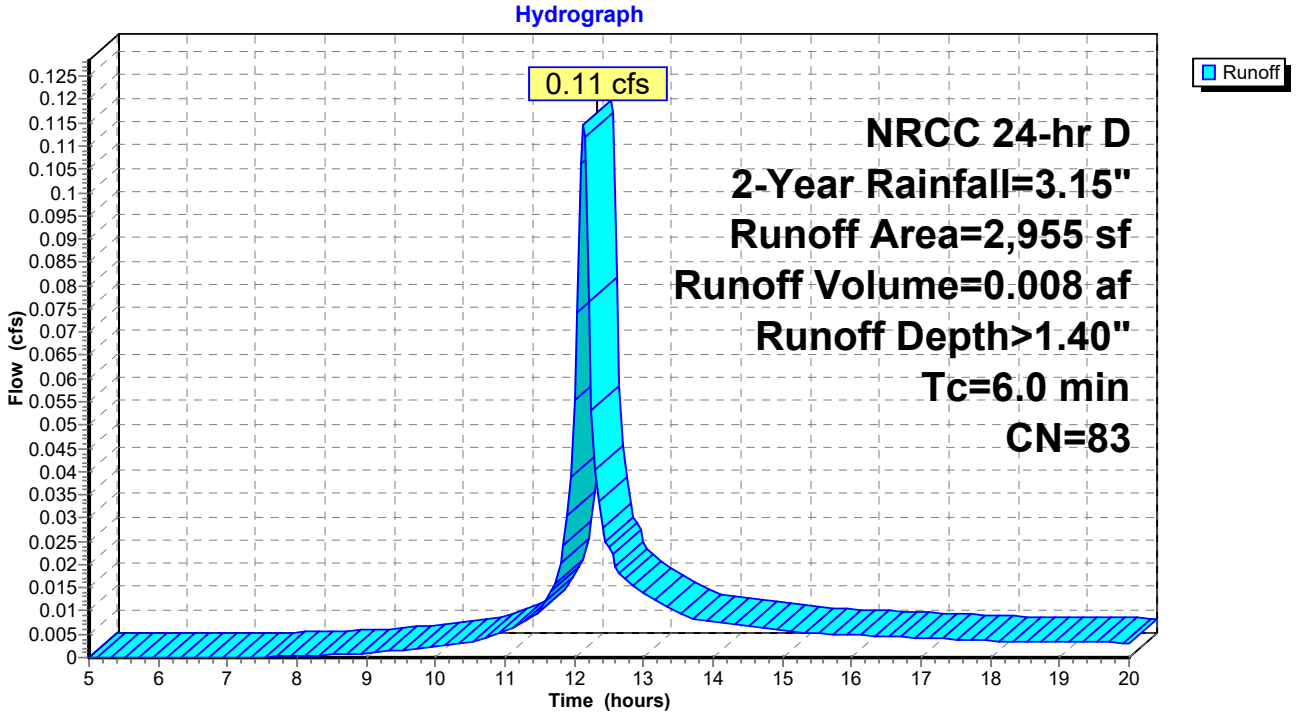
Runoff = 0.11 cfs @ 12.13 hrs, Volume= 0.008 af, Depth> 1.40"
Routed to Pond 7P : Rain Garden

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
*	248	74	Pervious Pavers
	1,052	98	Roofs, HSG C
	1,655	74	>75% Grass cover, Good, HSG C
	2,955	83	Weighted Average
	1,903		64.40% Pervious Area
	1,052		35.60% Impervious Area

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

Subcatchment P1B: P1B



Hydrograph for Subcatchment P1B: P1B

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.26	0.00	0.00
5.25	0.28	0.00	0.00
5.50	0.29	0.00	0.00
5.75	0.31	0.00	0.00
6.00	0.32	0.00	0.00
6.25	0.34	0.00	0.00
6.50	0.36	0.00	0.00
6.75	0.38	0.00	0.00
7.00	0.40	0.00	0.00
7.25	0.42	0.00	0.00
7.50	0.44	0.00	0.00
7.75	0.46	0.00	0.00
8.00	0.48	0.00	0.00
8.25	0.50	0.00	0.00
8.50	0.53	0.01	0.00
8.75	0.55	0.01	0.00
9.00	0.58	0.01	0.00
9.25	0.61	0.02	0.00
9.50	0.64	0.02	0.00
9.75	0.67	0.03	0.00
10.00	0.71	0.04	0.00
10.25	0.75	0.05	0.00
10.50	0.79	0.06	0.00
10.75	0.84	0.07	0.00
11.00	0.89	0.09	0.01
11.25	0.97	0.12	0.01
11.50	1.06	0.15	0.01
11.75	1.19	0.22	0.02
12.00	1.51	0.38	**0.06**
12.25	1.96	0.67	**0.05**
12.50	2.09	0.76	0.02
12.75	2.18	0.82	0.02
13.00	2.26	0.87	0.01
13.25	2.31	0.92	0.01
13.50	2.36	0.95	0.01
13.75	2.40	0.98	0.01
14.00	2.44	1.01	0.01
14.25	2.48	1.04	0.01
14.50	2.51	1.07	0.01
14.75	2.54	1.09	0.01
15.00	2.57	1.11	0.01
15.25	2.60	1.13	0.01
15.50	2.62	1.15	0.01
15.75	2.65	1.17	0.01
16.00	2.67	1.19	0.00
16.25	2.69	1.20	0.00
16.50	2.71	1.22	0.00
16.75	2.73	1.24	0.00
17.00	2.75	1.25	0.00
17.25	2.77	1.27	0.00
17.50	2.79	1.28	0.00
17.75	2.81	1.29	0.00
18.00	2.83	1.31	0.00
18.25	2.84	1.32	0.00
18.50	2.86	1.33	0.00
18.75	2.87	1.34	0.00
19.00	2.89	1.36	0.00
19.25	2.90	1.37	0.00
19.50	2.92	1.38	0.00
19.75	2.93	1.39	0.00
20.00	**2.95**	**1.40**	0.00

Summary for Pond 7P: Rain Garden

Inflow Area = 0.068 ac, 35.60% Impervious, Inflow Depth > 1.40" for 2-Year event
Inflow = 0.11 cfs @ 12.13 hrs, Volume= 0.008 af
Outflow = 0.00 cfs @ 16.23 hrs, Volume= 0.003 af, Atten= 96%, Lag= 246.0 min
Discarded = 0.00 cfs @ 16.23 hrs, Volume= 0.003 af
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= 100.38' @ 16.23 hrs Surf.Area= 435 sf Storage= 210 cf

Plug-Flow detention time= 227.6 min calculated for 0.003 af (43% of inflow)
Center-of-Mass det. time= 124.4 min (928.4 - 804.0)

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

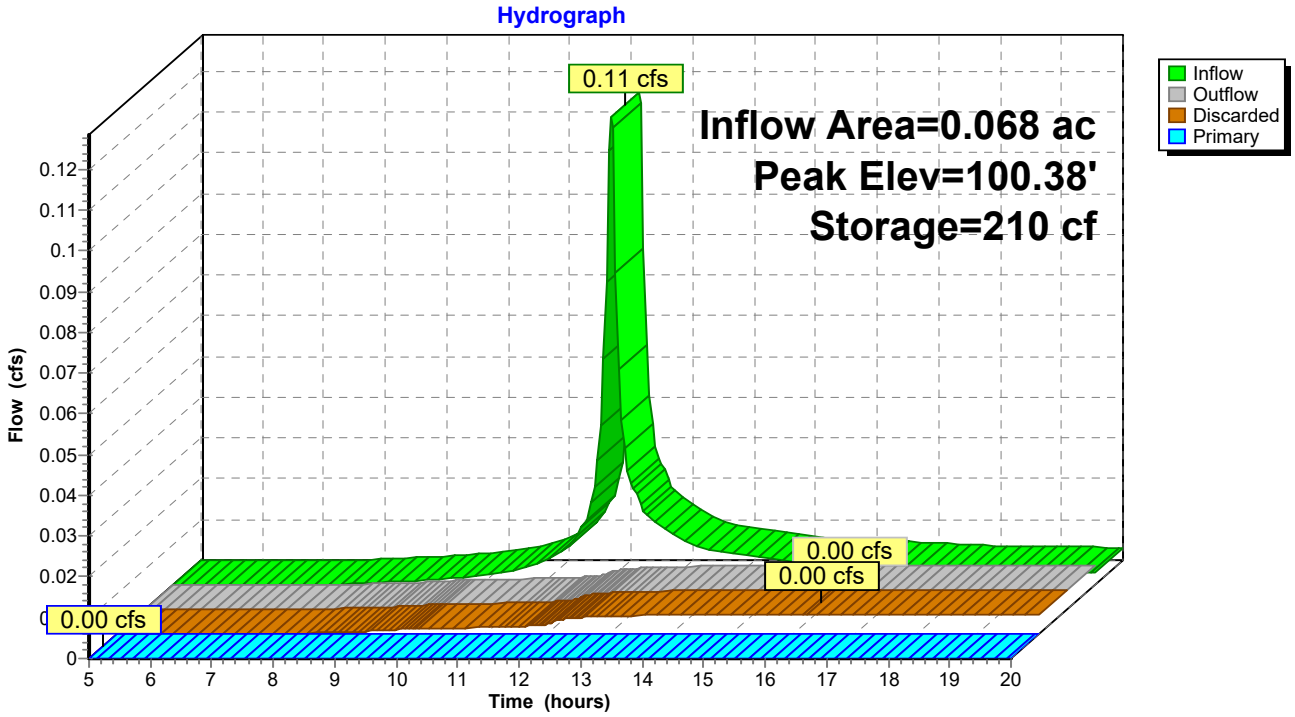
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	207	0	0
100.00	318	66	66
101.00	624	471	537
101.25	804	179	715

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**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
#2	Discarded	99.75'	**0.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 99.16'

Discarded OutFlow Max=0.00 cfs @ 16.23 hrs HW=100.38' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=99.75' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 7P: Rain Garden



Hydrograph for Pond 7P: Rain Garden

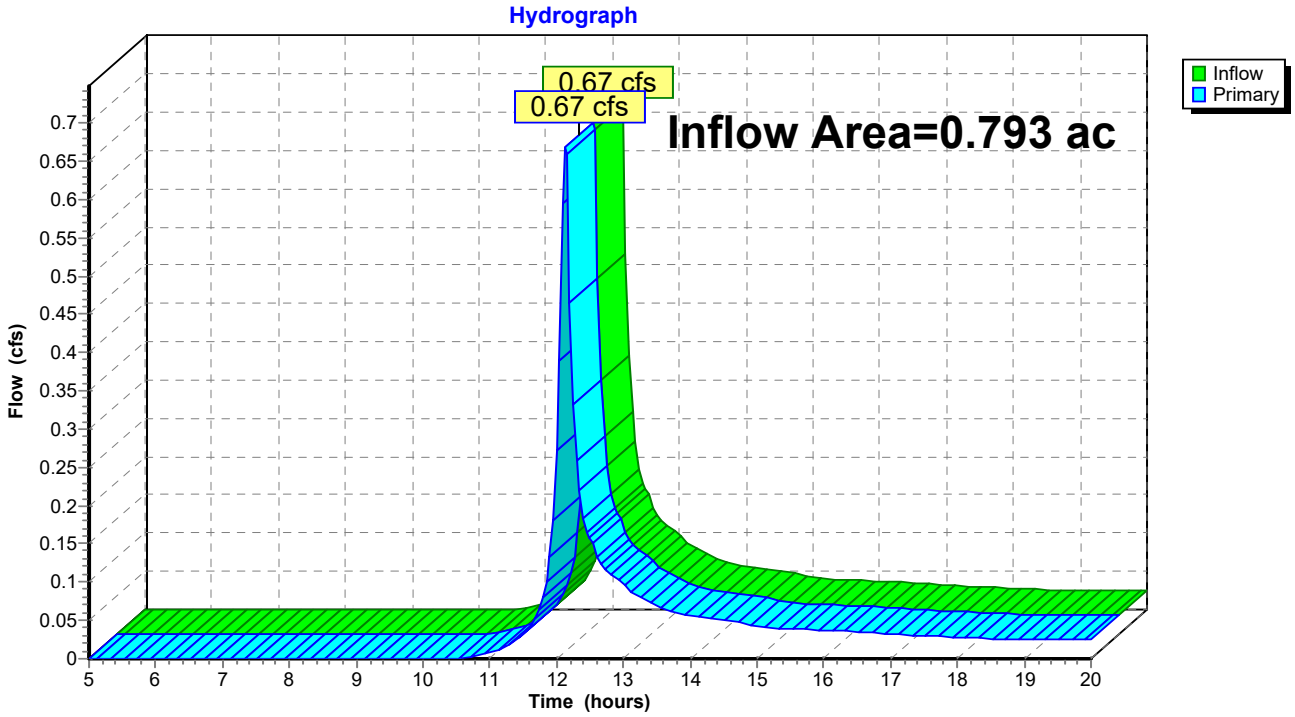
Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
5.00	0.00	0	99.75	0.00	0.00	**0.00**
5.50	0.00	0	99.75	0.00	0.00	0.00
6.00	0.00	0	99.75	0.00	0.00	0.00
6.50	0.00	0	99.75	0.00	0.00	0.00
7.00	0.00	0	99.75	0.00	0.00	0.00
7.50	0.00	0	99.75	0.00	0.00	0.00
8.00	0.00	0	99.75	0.00	0.00	0.00
8.50	0.00	1	99.75	0.00	0.00	0.00
9.00	0.00	1	99.76	0.00	0.00	0.00
9.50	0.00	2	99.76	0.00	0.00	0.00
10.00	0.00	3	99.77	0.00	0.00	0.00
10.50	0.00	6	99.78	0.00	0.00	0.00
11.00	0.01	11	99.80	0.00	0.00	0.00
11.50	0.01	22	99.84	0.00	0.00	0.00
12.00	**0.06**	57	99.97	0.00	0.00	0.00
12.50	**0.02**	156	100.25	0.00	0.00	0.00
13.00	0.01	180	100.31	0.00	0.00	0.00
13.50	0.01	193	100.34	0.00	0.00	0.00
14.00	0.01	200	100.36	0.00	0.00	0.00
14.50	0.01	205	100.37	0.00	0.00	0.00
15.00	0.01	208	100.38	0.00	0.00	0.00
15.50	0.01	209	100.38	0.00	0.00	0.00
16.00	0.00	**210**	**100.38**	**0.00**	**0.00**	0.00
16.50	0.00	**210**	**100.38**	**0.00**	**0.00**	0.00
17.00	0.00	209	100.38	0.00	0.00	0.00
17.50	0.00	208	100.38	0.00	0.00	0.00
18.00	0.00	206	100.37	0.00	0.00	0.00
18.50	0.00	204	100.37	0.00	0.00	0.00
19.00	0.00	202	100.36	0.00	0.00	0.00
19.50	0.00	199	100.36	0.00	0.00	0.00
20.00	0.00	197	100.35	0.00	0.00	0.00

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

Inflow Area = 0.793 ac, 15.44% Impervious, Inflow Depth > 0.71" for 2-Year event
Inflow = 0.67 cfs @ 12.14 hrs, Volume= 0.047 af
Primary = 0.67 cfs @ 12.14 hrs, Volume= 0.047 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)



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

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
5.00	0.00	**0.00**	0.00
5.25	0.00	0.00	0.00
5.50	0.00	0.00	0.00
5.75	0.00	0.00	0.00
6.00	0.00	0.00	0.00
6.25	0.00	0.00	0.00
6.50	0.00	0.00	0.00
6.75	0.00	0.00	0.00
7.00	0.00	0.00	0.00
7.25	0.00	0.00	0.00
7.50	0.00	0.00	0.00
7.75	0.00	0.00	0.00
8.00	0.00	0.00	0.00
8.25	0.00	0.00	0.00
8.50	0.00	0.00	0.00
8.75	0.00	0.00	0.00
9.00	0.00	0.00	0.00
9.25	0.00	0.00	0.00
9.50	0.00	0.00	0.00
9.75	0.00	0.00	0.00
10.00	0.00	0.00	0.00
10.25	0.00	0.00	0.00
10.50	0.00	0.00	0.00
10.75	0.00	0.00	0.00
11.00	0.01	0.00	0.01
11.25	0.02	0.00	0.02
11.50	0.03	0.00	0.03
11.75	0.06	0.00	0.06
12.00	**0.27**	0.00	**0.27**
12.25	**0.33**	0.00	**0.33**
12.50	0.16	0.00	0.16
12.75	0.11	0.00	0.11
13.00	0.10	0.00	0.10
13.25	0.08	0.00	0.08
13.50	0.07	0.00	0.07
13.75	0.06	0.00	0.06
14.00	0.06	0.00	0.06
14.25	0.05	0.00	0.05
14.50	0.05	0.00	0.05
14.75	0.05	0.00	0.05
15.00	0.04	0.00	0.04
15.25	0.04	0.00	0.04
15.50	0.04	0.00	0.04
15.75	0.04	0.00	0.04
16.00	0.04	0.00	0.04
16.25	0.04	0.00	0.04
16.50	0.03	0.00	0.03
16.75	0.03	0.00	0.03
17.00	0.03	0.00	0.03
17.25	0.03	0.00	0.03
17.50	0.03	0.00	0.03
17.75	0.03	0.00	0.03
18.00	0.03	0.00	0.03
18.25	0.03	0.00	0.03
18.50	0.03	0.00	0.03
18.75	0.03	0.00	0.03
19.00	0.03	0.00	0.03
19.25	0.03	0.00	0.03
19.50	0.03	0.00	0.03
19.75	0.03	0.00	0.03
20.00	0.02	0.00	0.02

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=31,593 sf 13.55% Impervious Runoff Depth>1.83"
Tc=6.0 min CN=72 Runoff=1.61 cfs 0.111 af

Subcatchment P1B: P1B Runoff Area=2,955 sf 35.60% Impervious Runoff Depth>2.74"
Tc=6.0 min CN=83 Runoff=0.22 cfs 0.015 af

Pond 7P: Rain Garden Peak Elev=100.85' Storage=445 cf Inflow=0.22 cfs 0.015 af
Discarded=0.01 cfs 0.006 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.006 af

Link 3L: Design Point 1 (Wetland) Inflow=1.61 cfs 0.111 af
Primary=1.61 cfs 0.111 af

Total Runoff Area = 0.793 ac Runoff Volume = 0.126 af Average Runoff Depth = 1.91"
84.56% Pervious = 0.671 ac 15.44% Impervious = 0.122 ac

Summary for Subcatchment P1A: P1A

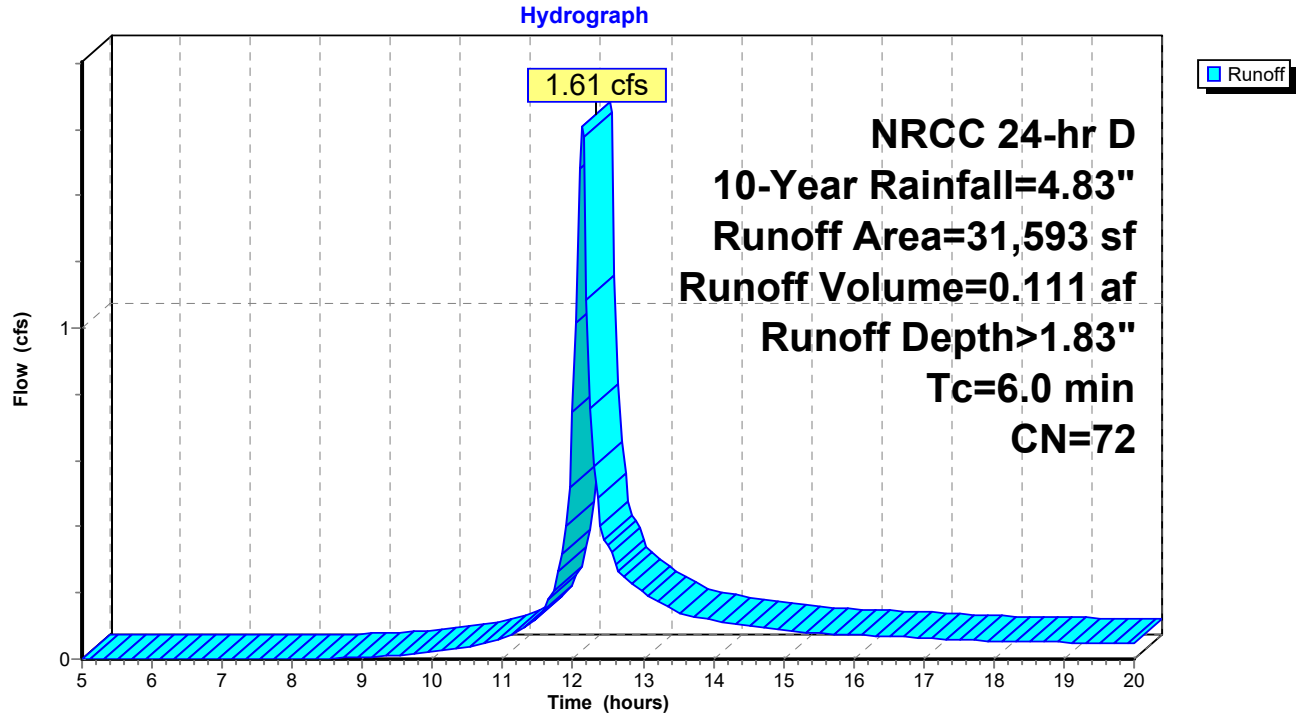
Runoff = 1.61 cfs @ 12.13 hrs, Volume= 0.111 af, Depth> 1.83"
Routed to Link 3L : Design Point 1 (Wetland)

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
12,885	70	Woods, Good, HSG C
13,943	65	Brush, Good, HSG C
4,281	98	Paved parking, HSG C
484	74	>75% Grass cover, Good, HSG C
31,593	72	Weighted Average
27,312		86.45% Pervious Area
4,281		13.55% Impervious Area

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

Subcatchment P1A: P1A



Hydrograph for Subcatchment P1A: P1A

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.40	0.00	0.00
5.25	0.43	0.00	0.00
5.50	0.45	0.00	0.00
5.75	0.47	0.00	0.00
6.00	0.50	0.00	0.00
6.25	0.52	0.00	0.00
6.50	0.55	0.00	0.00
6.75	0.58	0.00	0.00
7.00	0.61	0.00	0.00
7.25	0.64	0.00	0.00
7.50	0.67	0.00	0.00
7.75	0.70	0.00	0.00
8.00	0.74	0.00	0.00
8.25	0.77	0.00	0.00
8.50	0.81	0.00	0.00
8.75	0.85	0.00	0.00
9.00	0.89	0.00	0.01
9.25	0.93	0.01	0.01
9.50	0.98	0.01	0.01
9.75	1.03	0.02	0.02
10.00	1.08	0.02	0.02
10.25	1.14	0.03	0.03
10.50	1.21	0.04	0.03
10.75	1.28	0.06	0.05
11.00	1.37	0.08	0.06
11.25	1.48	0.11	0.09
11.50	1.62	0.15	0.12
11.75	1.83	0.22	0.22
12.00	2.31	0.43	**0.75**
12.25	3.00	0.81	**0.76**
12.50	3.21	0.94	0.34
12.75	3.35	1.02	0.24
13.00	3.46	1.09	0.20
13.25	3.55	1.15	0.17
13.50	3.62	1.20	0.14
13.75	3.69	1.25	0.12
14.00	3.75	1.29	0.12
14.25	3.80	1.32	0.11
14.50	3.85	1.36	0.10
14.75	3.90	1.39	0.09
15.00	3.94	1.42	0.09
15.25	3.98	1.45	0.08
15.50	4.02	1.47	0.08
15.75	4.06	1.50	0.08
16.00	4.09	1.53	0.07
16.25	4.13	1.55	0.07
16.50	4.16	1.57	0.07
16.75	4.19	1.60	0.07
17.00	4.22	1.62	0.06
17.25	4.25	1.64	0.06
17.50	4.28	1.66	0.06
17.75	4.31	1.68	0.06
18.00	4.33	1.70	0.05
18.25	4.36	1.72	0.05
18.50	4.38	1.73	0.05
18.75	4.40	1.75	0.05
19.00	4.43	1.77	0.05
19.25	4.45	1.78	0.05
19.50	4.47	1.80	0.05
19.75	4.50	1.82	0.05
20.00	**4.52**	**1.83**	0.05

Summary for Subcatchment P1B: P1B

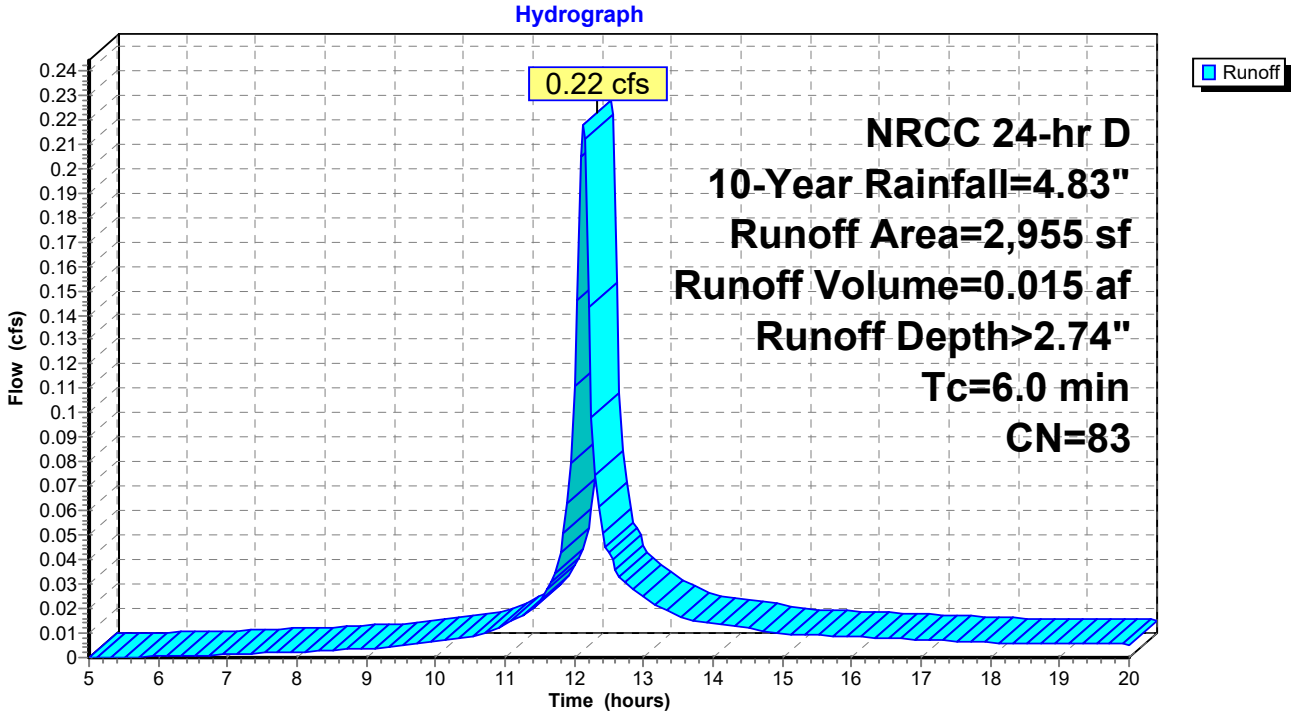
Runoff = 0.22 cfs @ 12.13 hrs, Volume= 0.015 af, Depth> 2.74"
Routed to Pond 7P : Rain Garden

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
*	248	74	Pervious Pavers
	1,052	98	Roofs, HSG C
	1,655	74	>75% Grass cover, Good, HSG C
	2,955	83	Weighted Average
	1,903		64.40% Pervious Area
	1,052		35.60% Impervious Area

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

Subcatchment P1B: P1B



Hydrograph for Subcatchment P1B: P1B

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.40	0.00	0.00
5.25	0.43	0.00	0.00
5.50	0.45	0.00	0.00
5.75	0.47	0.00	0.00
6.00	0.50	0.00	0.00
6.25	0.52	0.01	0.00
6.50	0.55	0.01	0.00
6.75	0.58	0.01	0.00
7.00	0.61	0.02	0.00
7.25	0.64	0.02	0.00
7.50	0.67	0.03	0.00
7.75	0.70	0.04	0.00
8.00	0.74	0.04	0.00
8.25	0.77	0.05	0.00
8.50	0.81	0.07	0.00
8.75	0.85	0.08	0.00
9.00	0.89	0.09	0.00
9.25	0.93	0.11	0.00
9.50	0.98	0.12	0.00
9.75	1.03	0.14	0.01
10.00	1.08	0.17	0.01
10.25	1.14	0.19	0.01
10.50	1.21	0.22	0.01
10.75	1.28	0.26	0.01
11.00	1.37	0.31	0.01
11.25	1.48	0.37	0.02
11.50	1.62	0.45	0.02
11.75	1.83	0.58	0.04
12.00	2.31	0.92	**0.11**
12.25	3.00	1.45	**0.10**
12.50	3.21	1.62	0.04
12.75	3.35	1.73	0.03
13.00	3.46	1.82	0.02
13.25	3.55	1.90	0.02
13.50	3.62	1.96	0.02
13.75	3.69	2.02	0.01
14.00	3.75	2.07	0.01
14.25	3.80	2.12	0.01
14.50	3.85	2.16	0.01
14.75	3.90	2.20	0.01
15.00	3.94	2.24	0.01
15.25	3.98	2.27	0.01
15.50	4.02	2.30	0.01
15.75	4.06	2.34	0.01
16.00	4.09	2.37	0.01
16.25	4.13	2.40	0.01
16.50	4.16	2.43	0.01
16.75	4.19	2.45	0.01
17.00	4.22	2.48	0.01
17.25	4.25	2.51	0.01
17.50	4.28	2.53	0.01
17.75	4.31	2.55	0.01
18.00	4.33	2.58	0.01
18.25	4.36	2.60	0.01
18.50	4.38	2.62	0.01
18.75	4.40	2.64	0.01
19.00	4.43	2.66	0.01
19.25	4.45	2.68	0.01
19.50	4.47	2.70	0.01
19.75	4.50	2.72	0.01
20.00	**4.52**	**2.74**	0.01

Summary for Pond 7P: Rain Garden

Inflow Area = 0.068 ac, 35.60% Impervious, Inflow Depth > 2.74" for 10-Year event
Inflow = 0.22 cfs @ 12.13 hrs, Volume= 0.015 af
Outflow = 0.01 cfs @ 16.75 hrs, Volume= 0.006 af, Atten= 97%, Lag= 277.2 min
Discarded = 0.01 cfs @ 16.75 hrs, Volume= 0.006 af
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= 100.85' @ 16.75 hrs Surf.Area= 577 sf Storage= 445 cf

Plug-Flow detention time= 244.8 min calculated for 0.006 af (36% of inflow)
Center-of-Mass det. time= 128.5 min (912.9 - 784.4)

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

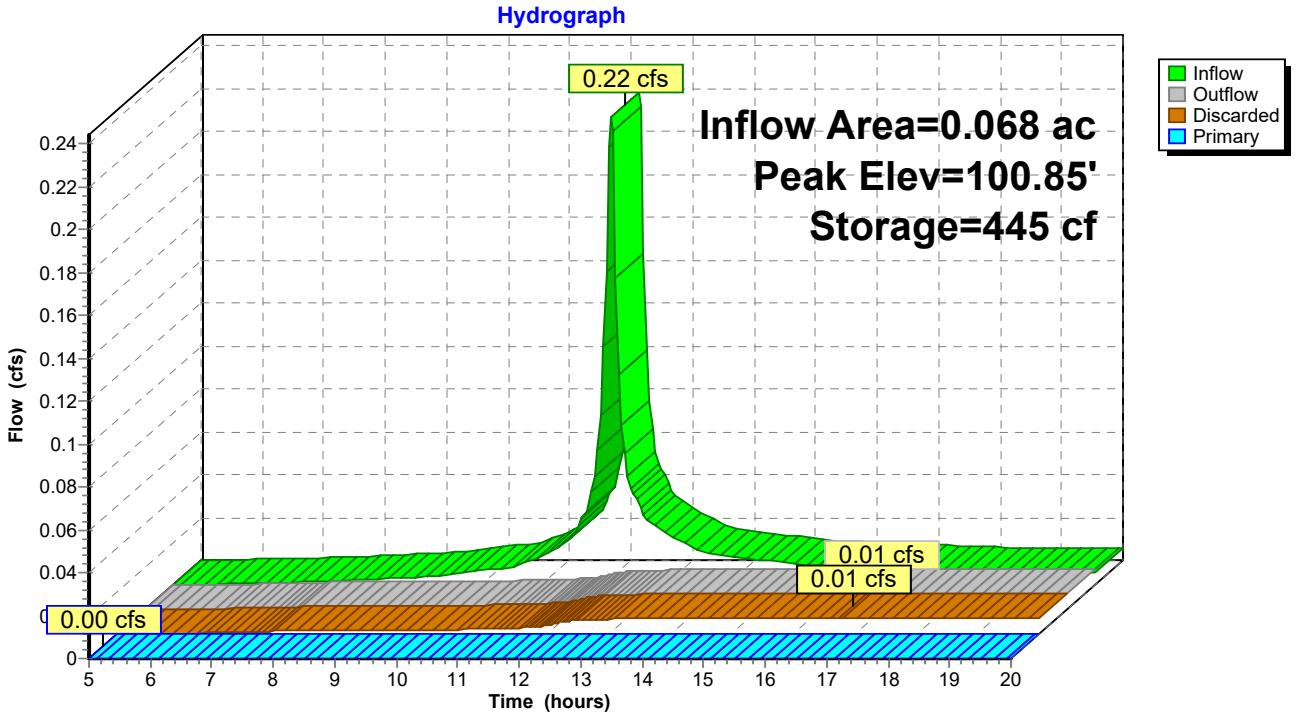
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	207	0	0
100.00	318	66	66
101.00	624	471	537
101.25	804	179	715

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**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
#2	Discarded	99.75'	**0.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 99.16'

Discarded OutFlow Max=0.01 cfs @ 16.75 hrs HW=100.85' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=99.75' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 7P: Rain Garden



Hydrograph for Pond 7P: Rain Garden

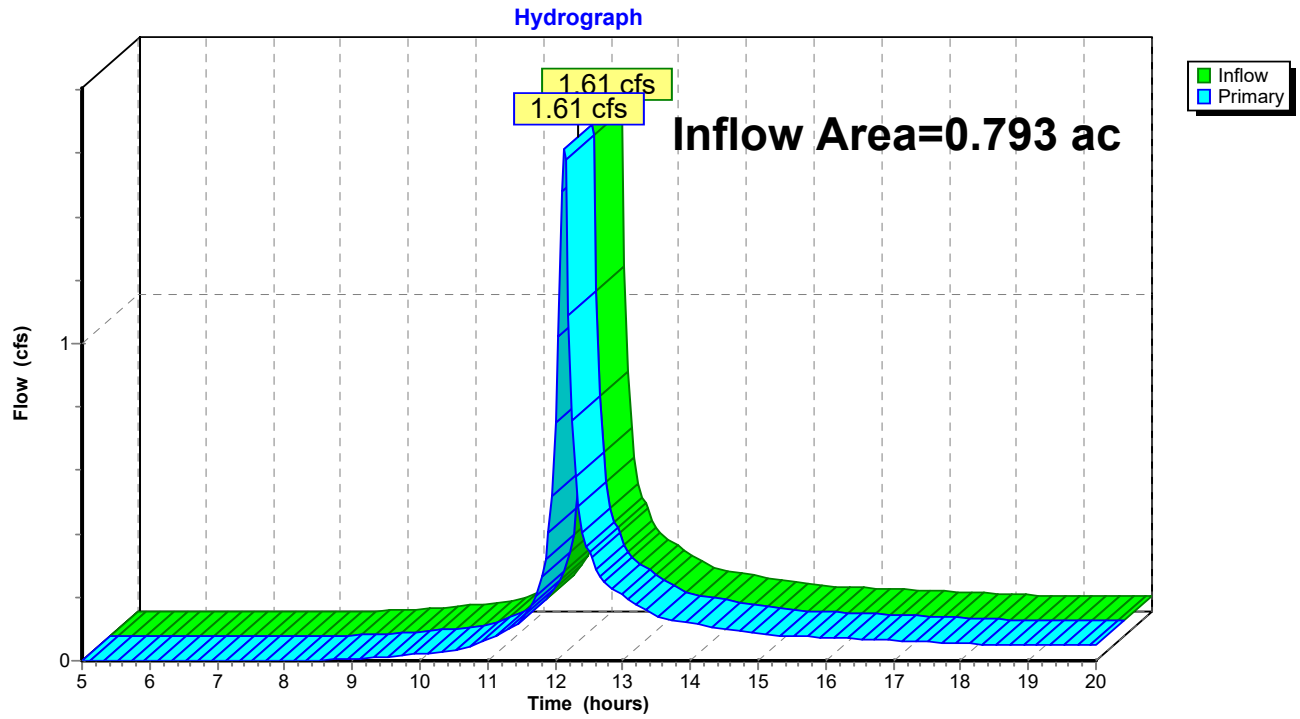
Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
5.00	0.00	0	99.75	0.00	0.00	**0.00**
5.50	0.00	0	99.75	0.00	0.00	0.00
6.00	0.00	0	99.75	0.00	0.00	0.00
6.50	0.00	1	99.76	0.00	0.00	0.00
7.00	0.00	2	99.76	0.00	0.00	0.00
7.50	0.00	3	99.76	0.00	0.00	0.00
8.00	0.00	4	99.77	0.00	0.00	0.00
8.50	0.00	6	99.78	0.00	0.00	0.00
9.00	0.00	10	99.79	0.00	0.00	0.00
9.50	0.00	14	99.81	0.00	0.00	0.00
10.00	0.01	22	99.84	0.00	0.00	0.00
10.50	0.01	31	99.88	0.00	0.00	0.00
11.00	0.01	47	99.94	0.00	0.00	0.00
11.50	0.02	74	100.03	0.00	0.00	0.00
12.00	**0.11**	150	100.24	0.00	0.00	0.00
12.50	**0.04**	340	100.66	0.01	0.01	0.00
13.00	0.02	384	100.74	0.01	0.01	0.00
13.50	0.02	408	100.78	0.01	0.01	0.00
14.00	0.01	422	100.81	0.01	0.01	0.00
14.50	0.01	432	100.83	0.01	0.01	0.00
15.00	0.01	438	100.84	0.01	0.01	0.00
15.50	0.01	442	100.84	0.01	0.01	0.00
16.00	0.01	444	100.85	0.01	0.01	0.00
16.50	0.01	**445**	**100.85**	**0.01**	**0.01**	0.00
17.00	0.01	**445**	**100.85**	**0.01**	**0.01**	0.00
17.50	0.01	444	100.85	0.01	0.01	0.00
18.00	0.01	442	100.84	0.01	0.01	0.00
18.50	0.01	439	100.84	0.01	0.01	0.00
19.00	0.01	436	100.83	0.01	0.01	0.00
19.50	0.01	432	100.83	0.01	0.01	0.00
20.00	0.01	429	100.82	0.01	0.01	0.00

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

Inflow Area = 0.793 ac, 15.44% Impervious, Inflow Depth > 1.67" for 10-Year event
Inflow = 1.61 cfs @ 12.13 hrs, Volume= 0.111 af
Primary = 1.61 cfs @ 12.13 hrs, Volume= 0.111 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)



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

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
5.00	0.00	**0.00**	0.00
5.25	0.00	0.00	0.00
5.50	0.00	0.00	0.00
5.75	0.00	0.00	0.00
6.00	0.00	0.00	0.00
6.25	0.00	0.00	0.00
6.50	0.00	0.00	0.00
6.75	0.00	0.00	0.00
7.00	0.00	0.00	0.00
7.25	0.00	0.00	0.00
7.50	0.00	0.00	0.00
7.75	0.00	0.00	0.00
8.00	0.00	0.00	0.00
8.25	0.00	0.00	0.00
8.50	0.00	0.00	0.00
8.75	0.00	0.00	0.00
9.00	0.01	0.00	0.01
9.25	0.01	0.00	0.01
9.50	0.01	0.00	0.01
9.75	0.02	0.00	0.02
10.00	0.02	0.00	0.02
10.25	0.03	0.00	0.03
10.50	0.03	0.00	0.03
10.75	0.05	0.00	0.05
11.00	0.06	0.00	0.06
11.25	0.09	0.00	0.09
11.50	0.12	0.00	0.12
11.75	0.22	0.00	0.22
12.00	**0.75**	0.00	**0.75**
12.25	**0.76**	0.00	**0.76**
12.50	0.34	0.00	0.34
12.75	0.24	0.00	0.24
13.00	0.20	0.00	0.20
13.25	0.17	0.00	0.17
13.50	0.14	0.00	0.14
13.75	0.12	0.00	0.12
14.00	0.12	0.00	0.12
14.25	0.11	0.00	0.11
14.50	0.10	0.00	0.10
14.75	0.09	0.00	0.09
15.00	0.09	0.00	0.09
15.25	0.08	0.00	0.08
15.50	0.08	0.00	0.08
15.75	0.08	0.00	0.08
16.00	0.07	0.00	0.07
16.25	0.07	0.00	0.07
16.50	0.07	0.00	0.07
16.75	0.07	0.00	0.07
17.00	0.06	0.00	0.06
17.25	0.06	0.00	0.06
17.50	0.06	0.00	0.06
17.75	0.06	0.00	0.06
18.00	0.05	0.00	0.05
18.25	0.05	0.00	0.05
18.50	0.05	0.00	0.05
18.75	0.05	0.00	0.05
19.00	0.05	0.00	0.05
19.25	0.05	0.00	0.05
19.50	0.05	0.00	0.05
19.75	0.05	0.00	0.05
20.00	0.05	0.00	0.05

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=31,593 sf 13.55% Impervious Runoff Depth>2.79"
Tc=6.0 min CN=72 Runoff=2.44 cfs 0.169 af

Subcatchment P1B: P1B Runoff Area=2,955 sf 35.60% Impervious Runoff Depth>3.86"
Tc=6.0 min CN=83 Runoff=0.30 cfs 0.022 af

Pond 7P: Rain Garden Peak Elev=101.01' Storage=543 cf Inflow=0.30 cfs 0.022 af
Discarded=0.01 cfs 0.007 af Primary=0.03 cfs 0.003 af Outflow=0.04 cfs 0.010 af

Link 3L: Design Point 1 (Wetland) Inflow=2.44 cfs 0.172 af
Primary=2.44 cfs 0.172 af

Total Runoff Area = 0.793 ac Runoff Volume = 0.191 af Average Runoff Depth = 2.89"
84.56% Pervious = 0.671 ac 15.44% Impervious = 0.122 ac

Summary for Subcatchment P1A: P1A

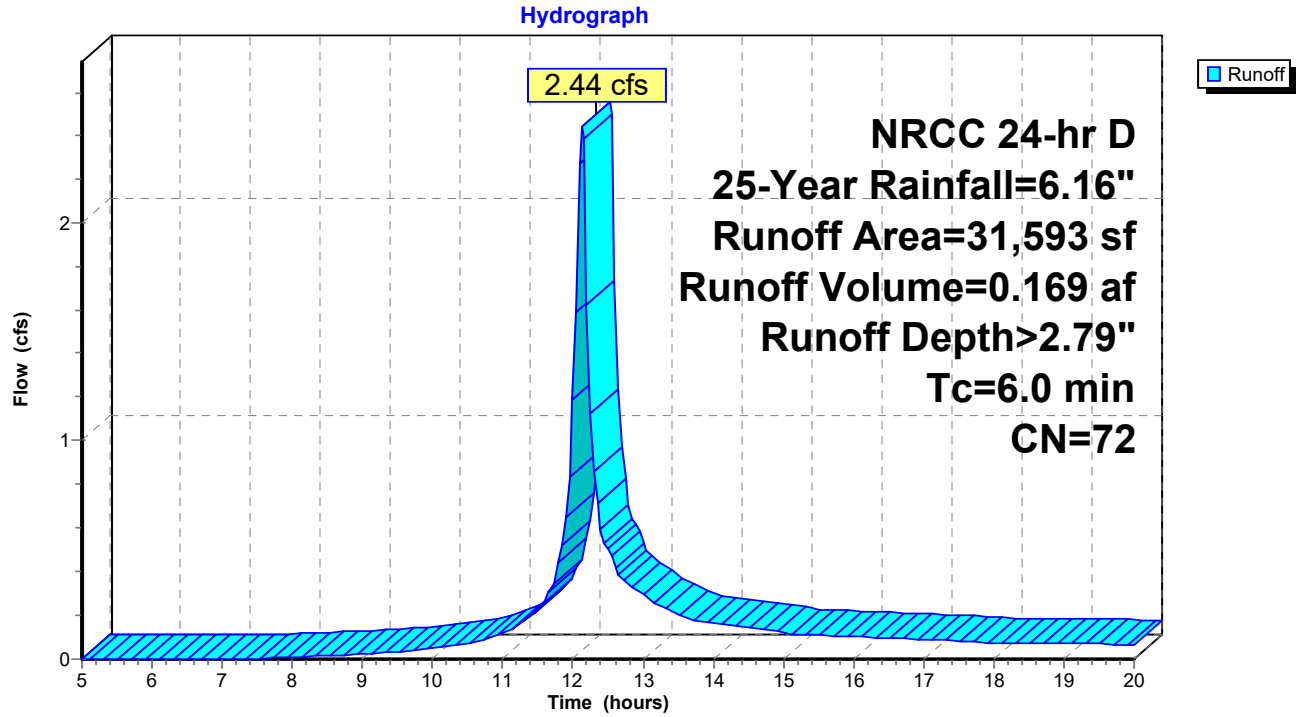
Runoff = 2.44 cfs @ 12.13 hrs, Volume= 0.169 af, Depth> 2.79"
Routed to Link 3L : Design Point 1 (Wetland)

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
12,885	70	Woods, Good, HSG C
13,943	65	Brush, Good, HSG C
4,281	98	Paved parking, HSG C
484	74	>75% Grass cover, Good, HSG C
31,593	72	Weighted Average
27,312		86.45% Pervious Area
4,281		13.55% Impervious Area

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

Subcatchment P1A: P1A



Hydrograph for Subcatchment P1A: P1A

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.51	0.00	0.00
5.25	0.54	0.00	0.00
5.50	0.57	0.00	0.00
5.75	0.60	0.00	0.00
6.00	0.63	0.00	0.00
6.25	0.67	0.00	0.00
6.50	0.70	0.00	0.00
6.75	0.74	0.00	0.00
7.00	0.77	0.00	0.00
7.25	0.81	0.00	0.00
7.50	0.85	0.00	0.00
7.75	0.90	0.00	0.01
8.00	0.94	0.01	0.01
8.25	0.98	0.01	0.01
8.50	1.03	0.02	0.02
8.75	1.08	0.02	0.02
9.00	1.13	0.03	0.02
9.25	1.19	0.04	0.03
9.50	1.25	0.05	0.03
9.75	1.31	0.06	0.04
10.00	1.38	0.08	0.05
10.25	1.46	0.10	0.06
10.50	1.54	0.12	0.07
10.75	1.64	0.15	0.09
11.00	1.75	0.19	0.12
11.25	1.89	0.25	0.16
11.50	2.06	0.32	0.22
11.75	2.33	0.44	0.36
12.00	2.95	0.78	**1.18**
12.25	3.83	1.34	**1.13**
12.50	4.10	1.53	0.50
12.75	4.27	1.65	0.35
13.00	4.41	1.75	0.29
13.25	4.52	1.84	0.24
13.50	4.62	1.91	0.20
13.75	4.70	1.97	0.18
14.00	4.78	2.03	0.17
14.25	4.85	2.08	0.16
14.50	4.91	2.13	0.14
14.75	4.97	2.18	0.13
15.00	5.03	2.22	0.12
15.25	5.08	2.26	0.11
15.50	5.13	2.30	0.11
15.75	5.18	2.33	0.11
16.00	5.22	2.37	0.10
16.25	5.26	2.40	0.10
16.50	5.31	2.44	0.10
16.75	5.35	2.47	0.09
17.00	5.39	2.50	0.09
17.25	5.42	2.53	0.09
17.50	5.46	2.56	0.08
17.75	5.49	2.58	0.08
18.00	5.53	2.61	0.07
18.25	5.56	2.63	0.07
18.50	5.59	2.66	0.07
18.75	5.62	2.68	0.07
19.00	5.65	2.71	0.07
19.25	5.68	2.73	0.07
19.50	5.71	2.75	0.07
19.75	5.73	2.78	0.07
20.00	**5.76**	**2.80**	0.07

Summary for Subcatchment P1B: P1B

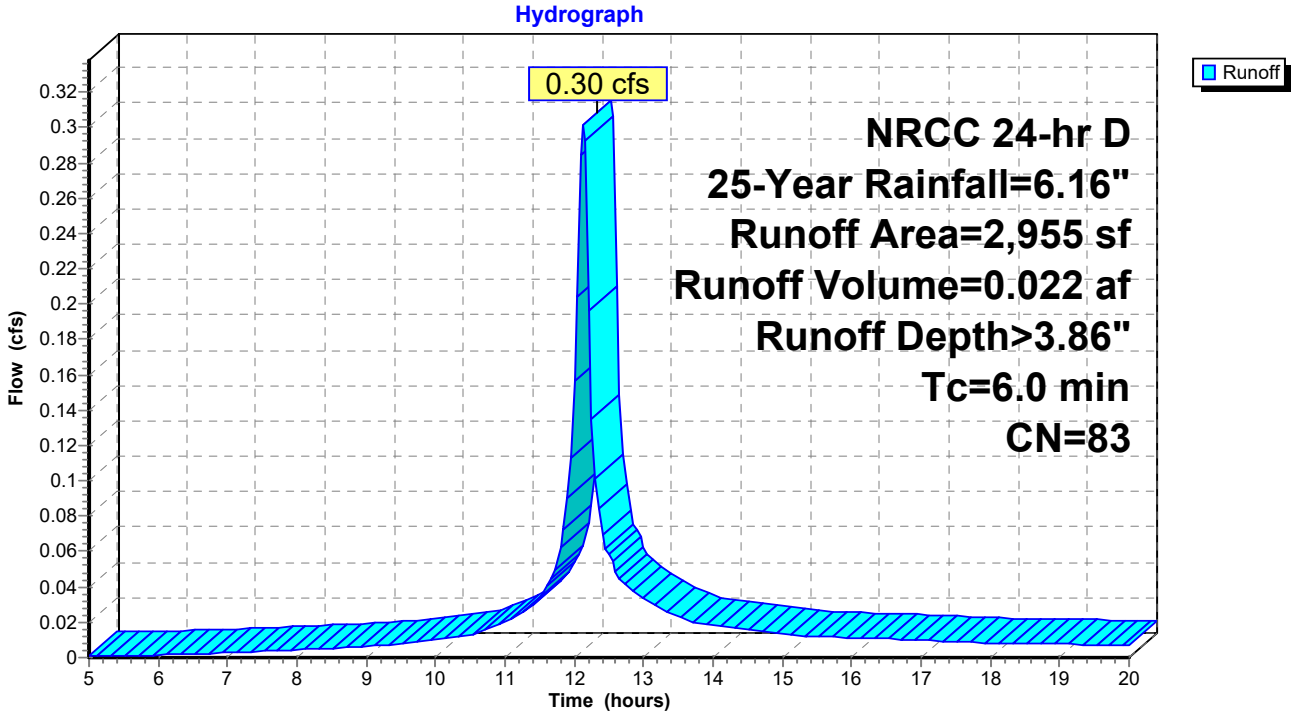
Runoff = 0.30 cfs @ 12.13 hrs, Volume= 0.022 af, Depth> 3.86"
Routed to Pond 7P : Rain Garden

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
*	248	74	Pervious Pavers
	1,052	98	Roofs, HSG C
	1,655	74	>75% Grass cover, Good, HSG C
	2,955	83	Weighted Average
	1,903		64.40% Pervious Area
	1,052		35.60% Impervious Area

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

Subcatchment P1B: P1B



Hydrograph for Subcatchment P1B: P1B

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.51	0.00	0.00
5.25	0.54	0.01	0.00
5.50	0.57	0.01	0.00
5.75	0.60	0.02	0.00
6.00	0.63	0.02	0.00
6.25	0.67	0.03	0.00
6.50	0.70	0.04	0.00
6.75	0.74	0.04	0.00
7.00	0.77	0.05	0.00
7.25	0.81	0.07	0.00
7.50	0.85	0.08	0.00
7.75	0.90	0.09	0.00
8.00	0.94	0.11	0.00
8.25	0.98	0.13	0.00
8.50	1.03	0.14	0.01
8.75	1.08	0.17	0.01
9.00	1.13	0.19	0.01
9.25	1.19	0.21	0.01
9.50	1.25	0.24	0.01
9.75	1.31	0.28	0.01
10.00	1.38	0.31	0.01
10.25	1.46	0.35	0.01
10.50	1.54	0.40	0.01
10.75	1.64	0.46	0.02
11.00	1.75	0.53	0.02
11.25	1.89	0.62	0.03
11.50	2.06	0.74	0.03
11.75	2.33	0.93	0.05
12.00	2.95	1.41	**0.16**
12.25	3.83	2.14	**0.13**
12.50	4.10	2.37	0.06
12.75	4.27	2.52	0.04
13.00	4.41	2.65	0.03
13.25	4.52	2.75	0.03
13.50	4.62	2.83	0.02
13.75	4.70	2.91	0.02
14.00	4.78	2.97	0.02
14.25	4.85	3.04	0.02
14.50	4.91	3.10	0.02
14.75	4.97	3.15	0.01
15.00	5.03	3.20	0.01
15.25	5.08	3.25	0.01
15.50	5.13	3.29	0.01
15.75	5.18	3.33	0.01
16.00	5.22	3.37	0.01
16.25	5.26	3.41	0.01
16.50	5.31	3.45	0.01
16.75	5.35	3.49	0.01
17.00	5.39	3.53	0.01
17.25	5.42	3.56	0.01
17.50	5.46	3.59	0.01
17.75	5.49	3.62	0.01
18.00	5.53	3.65	0.01
18.25	5.56	3.68	0.01
18.50	5.59	3.71	0.01
18.75	5.62	3.74	0.01
19.00	5.65	3.77	0.01
19.25	5.68	3.79	0.01
19.50	5.71	3.82	0.01
19.75	5.73	3.85	0.01
20.00	**5.76**	**3.87**	0.01

Summary for Pond 7P: Rain Garden

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.068 ac, 35.60% Impervious, Inflow Depth > 3.86" for 25-Year event
Inflow = 0.30 cfs @ 12.13 hrs, Volume= 0.022 af
Outflow = 0.04 cfs @ 12.92 hrs, Volume= 0.010 af, Atten= 88%, Lag= 47.5 min
Discarded = 0.01 cfs @ 12.92 hrs, Volume= 0.007 af
Primary = 0.03 cfs @ 12.92 hrs, Volume= 0.003 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= 101.01' @ 12.92 hrs Surf.Area= 632 sf Storage= 543 cf

Plug-Flow detention time= 214.1 min calculated for 0.010 af (44% of inflow)
Center-of-Mass det. time= 105.7 min (880.1 - 774.4)

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

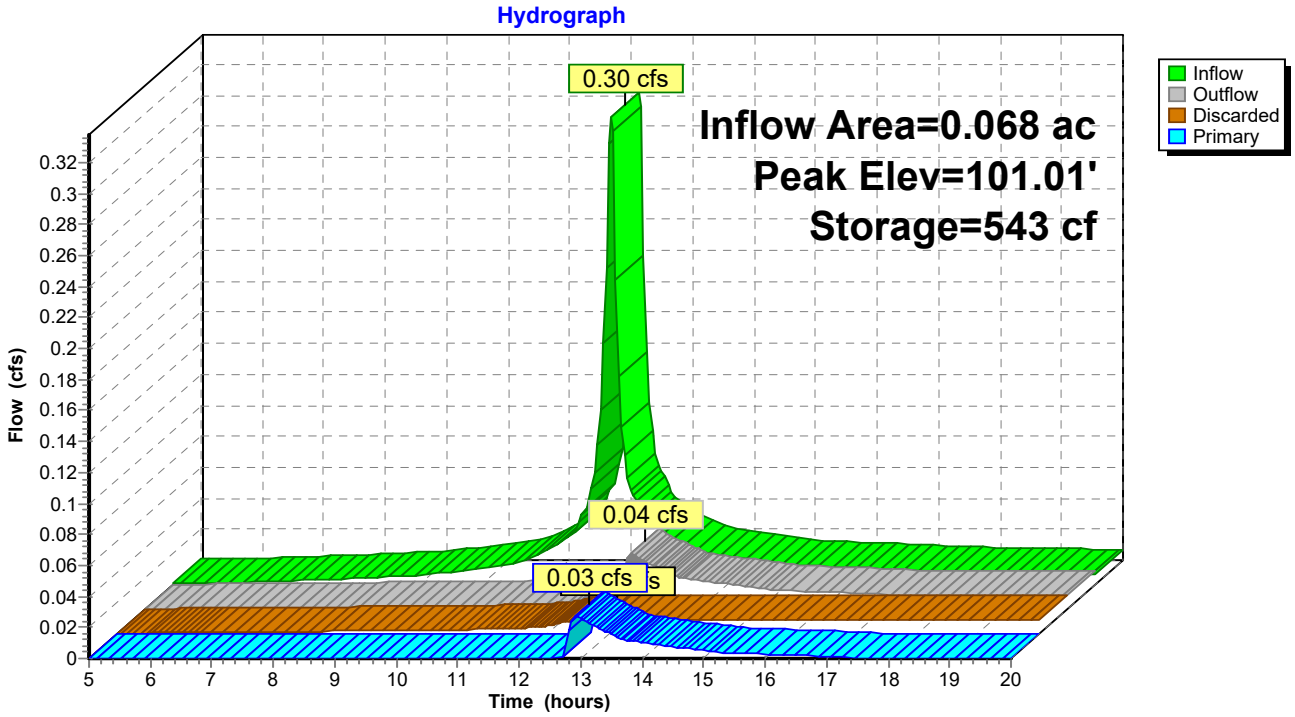
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	207	0	0
100.00	318	66	66
101.00	624	471	537
101.25	804	179	715

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**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
#2	Discarded	99.75'	**0.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 99.16'

Discarded OutFlow Max=0.01 cfs @ 12.92 hrs HW=101.01' (Free Discharge)
2=Exfiltration (Controls 0.01 cfs)

Primary OutFlow Max=0.03 cfs @ 12.92 hrs HW=101.01' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.03 cfs @ 0.25 fps)

Pond 7P: Rain Garden



Hydrograph for Pond 7P: Rain Garden

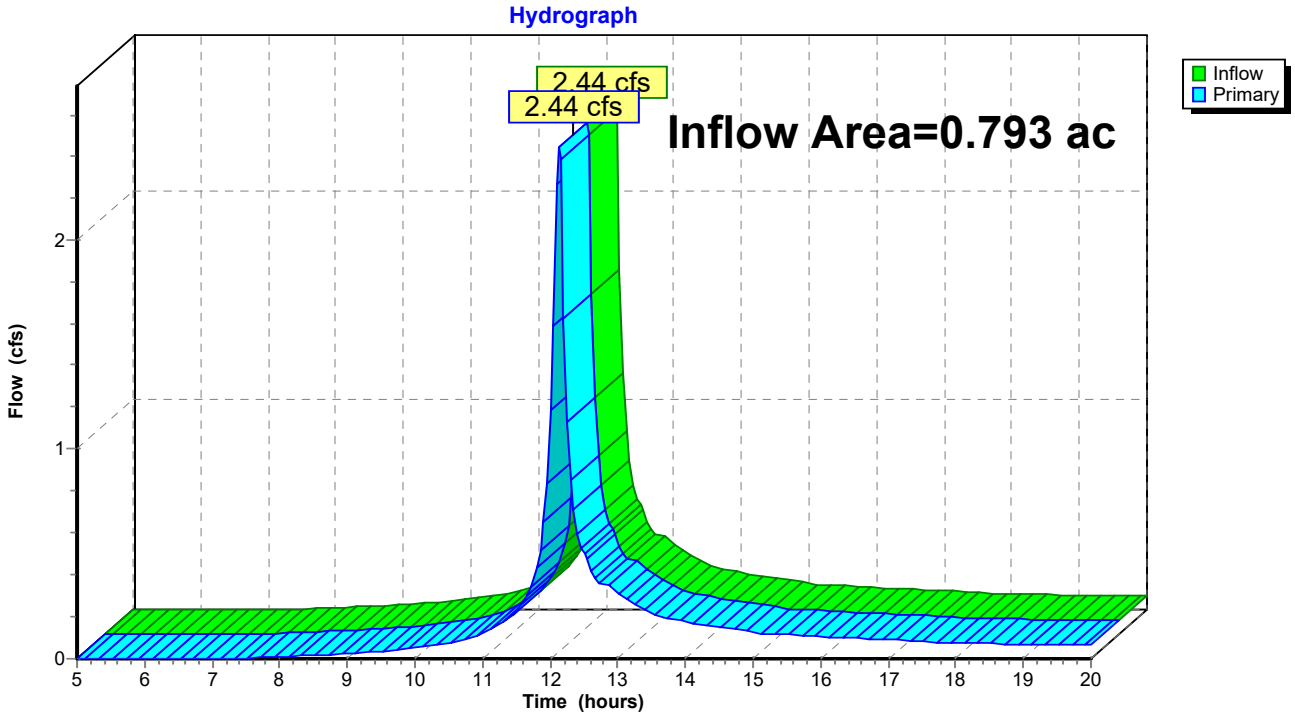
Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
5.00	0.00	0	99.75	0.00	0.00	0.00
5.50	0.00	1	99.76	0.00	0.00	0.00
6.00	0.00	2	99.76	0.00	0.00	0.00
6.50	0.00	3	99.77	0.00	0.00	0.00
7.00	0.00	5	99.77	0.00	0.00	0.00
7.50	0.00	8	99.79	0.00	0.00	0.00
8.00	0.00	13	99.81	0.00	0.00	0.00
8.50	0.01	18	99.83	0.00	0.00	0.00
9.00	0.01	25	99.86	0.00	0.00	0.00
9.50	0.01	34	99.89	0.00	0.00	0.00
10.00	0.01	47	99.94	0.00	0.00	0.00
10.50	0.01	64	99.99	0.00	0.00	0.00
11.00	0.02	88	100.07	0.00	0.00	0.00
11.50	0.03	129	100.18	0.00	0.00	0.00
12.00	**0.16**	239	100.45	0.01	0.01	0.00
12.50	**0.06**	**502**	**100.94**	**0.01**	**0.01**	**0.00**
13.00	0.03	**543**	**101.01**	**0.03**	**0.01**	**0.03**
13.50	0.02	541	101.01	0.02	0.01	0.02
14.00	0.02	539	101.00	0.02	0.01	0.01
14.50	0.02	539	101.00	0.02	0.01	0.01
15.00	0.01	538	101.00	0.01	0.01	0.01
15.50	0.01	538	101.00	0.01	0.01	0.00
16.00	0.01	537	101.00	0.01	0.01	0.00
16.50	0.01	537	101.00	0.01	0.01	0.00
17.00	0.01	537	101.00	0.01	0.01	0.00
17.50	0.01	537	101.00	0.01	0.01	0.00
18.00	0.01	536	101.00	0.01	0.01	0.00
18.50	0.01	535	101.00	0.01	0.01	0.00
19.00	0.01	533	100.99	0.01	0.01	0.00
19.50	0.01	531	100.99	0.01	0.01	0.00
20.00	0.01	529	100.99	0.01	0.01	0.00

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

Inflow Area = 0.793 ac, 15.44% Impervious, Inflow Depth > 2.60" for 25-Year event
Inflow = 2.44 cfs @ 12.13 hrs, Volume= 0.172 af
Primary = 2.44 cfs @ 12.13 hrs, Volume= 0.172 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)



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

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
5.00	0.00	**0.00**	0.00
5.25	0.00	0.00	0.00
5.50	0.00	0.00	0.00
5.75	0.00	0.00	0.00
6.00	0.00	0.00	0.00
6.25	0.00	0.00	0.00
6.50	0.00	0.00	0.00
6.75	0.00	0.00	0.00
7.00	0.00	0.00	0.00
7.25	0.00	0.00	0.00
7.50	0.00	0.00	0.00
7.75	0.01	0.00	0.01
8.00	0.01	0.00	0.01
8.25	0.01	0.00	0.01
8.50	0.02	0.00	0.02
8.75	0.02	0.00	0.02
9.00	0.02	0.00	0.02
9.25	0.03	0.00	0.03
9.50	0.03	0.00	0.03
9.75	0.04	0.00	0.04
10.00	0.05	0.00	0.05
10.25	0.06	0.00	0.06
10.50	0.07	0.00	0.07
10.75	0.09	0.00	0.09
11.00	0.12	0.00	0.12
11.25	0.16	0.00	0.16
11.50	0.22	0.00	0.22
11.75	0.36	0.00	0.36
12.00	**1.18**	0.00	**1.18**
12.25	**1.13**	0.00	**1.13**
12.50	0.50	0.00	0.50
12.75	0.36	0.00	0.36
13.00	0.32	0.00	0.32
13.25	0.26	0.00	0.26
13.50	0.22	0.00	0.22
13.75	0.19	0.00	0.19
14.00	0.18	0.00	0.18
14.25	0.16	0.00	0.16
14.50	0.15	0.00	0.15
14.75	0.14	0.00	0.14
15.00	0.13	0.00	0.13
15.25	0.12	0.00	0.12
15.50	0.11	0.00	0.11
15.75	0.11	0.00	0.11
16.00	0.11	0.00	0.11
16.25	0.10	0.00	0.10
16.50	0.10	0.00	0.10
16.75	0.09	0.00	0.09
17.00	0.09	0.00	0.09
17.25	0.09	0.00	0.09
17.50	0.08	0.00	0.08
17.75	0.08	0.00	0.08
18.00	0.07	0.00	0.07
18.25	0.07	0.00	0.07
18.50	0.07	0.00	0.07
18.75	0.07	0.00	0.07
19.00	0.07	0.00	0.07
19.25	0.07	0.00	0.07
19.50	0.07	0.00	0.07
19.75	0.07	0.00	0.07
20.00	0.07	0.00	0.07

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=31,593 sf 13.55% Impervious Runoff Depth>5.01"
Tc=6.0 min CN=72 Runoff=4.27 cfs 0.303 af

Subcatchment P1B: P1B Runoff Area=2,955 sf 35.60% Impervious Runoff Depth>6.27"
Tc=6.0 min CN=83 Runoff=0.48 cfs 0.035 af

Pond 7P: Rain Garden Peak Elev=101.07' Storage=584 cf Inflow=0.48 cfs 0.035 af
Discarded=0.01 cfs 0.007 af Primary=0.48 cfs 0.016 af Outflow=0.49 cfs 0.023 af

Link 3L: Design Point 1 (Wetland) Inflow=4.67 cfs 0.318 af
Primary=4.67 cfs 0.318 af

Total Runoff Area = 0.793 ac Runoff Volume = 0.338 af Average Runoff Depth = 5.11"
84.56% Pervious = 0.671 ac 15.44% Impervious = 0.122 ac

Summary for Subcatchment P1A: P1A

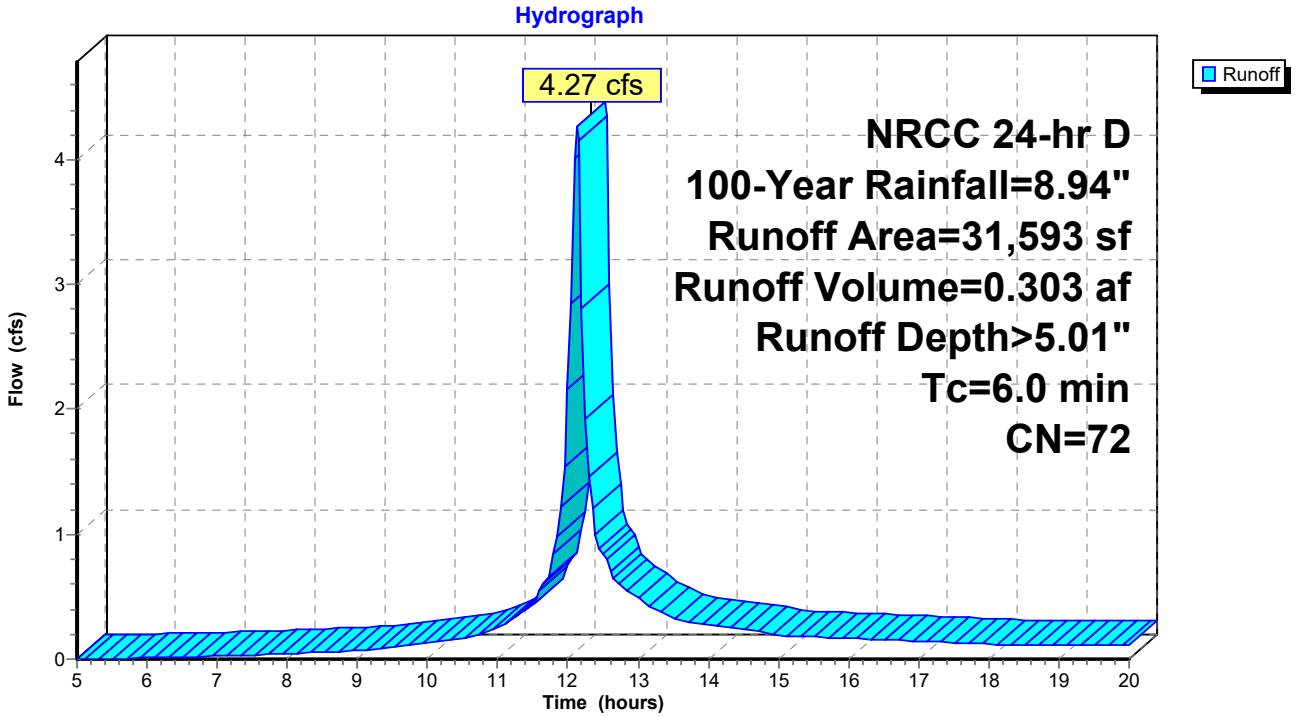
Runoff = 4.27 cfs @ 12.13 hrs, Volume= 0.303 af, Depth> 5.01"
Routed to Link 3L : Design Point 1 (Wetland)

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
12,885	70	Woods, Good, HSG C
13,943	65	Brush, Good, HSG C
4,281	98	Paved parking, HSG C
484	74	>75% Grass cover, Good, HSG C
31,593	72	Weighted Average
27,312		86.45% Pervious Area
4,281		13.55% Impervious Area

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

Subcatchment P1A: P1A



Hydrograph for Subcatchment P1A: P1A

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.74	0.00	0.00
5.25	0.79	0.00	0.00
5.50	0.83	0.00	0.00
5.75	0.88	0.00	0.01
6.00	0.92	0.01	0.01
6.25	0.97	0.01	0.01
6.50	1.02	0.01	0.02
6.75	1.07	0.02	0.02
7.00	1.12	0.03	0.02
7.25	1.18	0.04	0.03
7.50	1.24	0.05	0.03
7.75	1.30	0.06	0.04
8.00	1.36	0.08	0.04
8.25	1.43	0.09	0.05
8.50	1.50	0.11	0.06
8.75	1.57	0.13	0.06
9.00	1.64	0.16	0.07
9.25	1.72	0.18	0.08
9.50	1.81	0.22	0.09
9.75	1.90	0.25	0.11
10.00	2.00	0.29	0.13
10.25	2.12	0.34	0.14
10.50	2.23	0.40	0.16
10.75	2.37	0.46	0.20
11.00	2.54	0.55	0.26
11.25	2.75	0.66	0.34
11.50	2.99	0.81	0.43
11.75	3.38	1.04	0.70
12.00	4.28	1.66	**2.17**
12.25	5.56	2.64	**1.93**
12.50	5.95	2.95	0.84
12.75	6.19	3.15	0.59
13.00	6.40	3.32	0.48
13.25	6.57	3.46	0.40
13.50	6.71	3.58	0.33
13.75	6.82	3.68	0.29
14.00	6.94	3.77	0.27
14.25	7.04	3.86	0.25
14.50	7.13	3.94	0.23
14.75	7.22	4.02	0.22
15.00	7.30	4.09	0.20
15.25	7.37	4.15	0.18
15.50	7.44	4.21	0.18
15.75	7.51	4.27	0.17
16.00	7.58	4.33	0.17
16.25	7.64	4.38	0.16
16.50	7.70	4.43	0.16
16.75	7.76	4.48	0.15
17.00	7.82	4.53	0.14
17.25	7.87	4.58	0.14
17.50	7.92	4.63	0.13
17.75	7.97	4.67	0.13
18.00	8.02	4.71	0.12
18.25	8.06	4.75	0.12
18.50	8.11	4.79	0.11
18.75	8.15	4.83	0.11
19.00	8.20	4.87	0.11
19.25	8.24	4.90	0.11
19.50	8.28	4.94	0.11
19.75	8.32	4.98	0.11
20.00	**8.36**	**5.02**	0.11

Summary for Subcatchment P1B: P1B

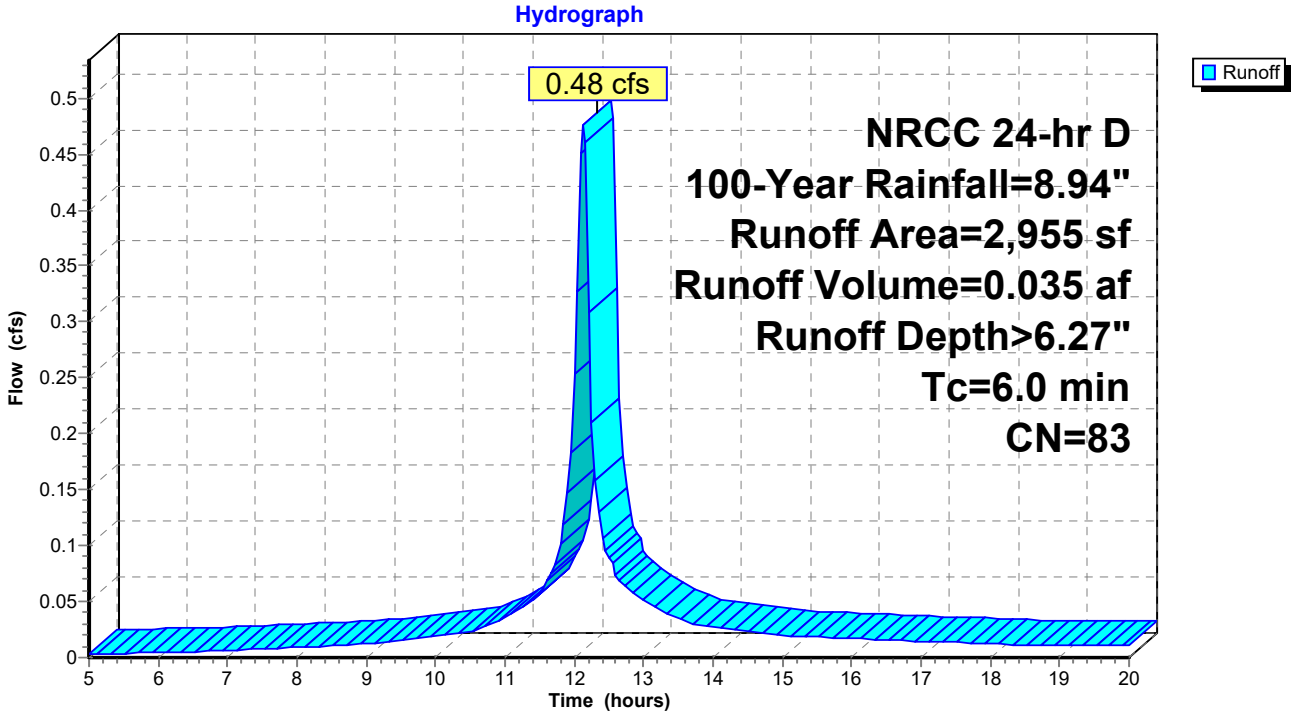
Runoff = 0.48 cfs @ 12.13 hrs, Volume= 0.035 af, Depth> 6.27"
Routed to Pond 7P : Rain Garden

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 100-Year Rainfall=8.94"

	Area (sf)	CN	Description
*	248	74	Pervious Pavers
	1,052	98	Roofs, HSG C
	1,655	74	>75% Grass cover, Good, HSG C
	2,955	83	Weighted Average
	1,903		64.40% Pervious Area
	1,052		35.60% Impervious Area

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

Subcatchment P1B: P1B



Hydrograph for Subcatchment P1B: P1B

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
5.00	0.74	0.05	0.00
5.25	0.79	0.06	0.00
5.50	0.83	0.07	0.00
5.75	0.88	0.09	0.00
6.00	0.92	0.10	0.00
6.25	0.97	0.12	0.00
6.50	1.02	0.14	0.01
6.75	1.07	0.16	0.01
7.00	1.12	0.18	0.01
7.25	1.18	0.21	0.01
7.50	1.24	0.24	0.01
7.75	1.30	0.27	0.01
8.00	1.36	0.30	0.01
8.25	1.43	0.34	0.01
8.50	1.50	0.38	0.01
8.75	1.57	0.42	0.01
9.00	1.64	0.46	0.01
9.25	1.72	0.51	0.01
9.50	1.81	0.57	0.02
9.75	1.90	0.63	0.02
10.00	2.00	0.70	0.02
10.25	2.12	0.77	0.02
10.50	2.23	0.86	0.02
10.75	2.37	0.96	0.03
11.00	2.54	1.09	0.04
11.25	2.75	1.25	0.04
11.50	2.99	1.44	0.06
11.75	3.38	1.76	0.09
12.00	4.28	2.53	**0.25**
12.25	5.56	3.69	**0.21**
12.50	5.95	4.04	0.09
12.75	6.19	4.27	0.06
13.00	6.40	4.46	0.05
13.25	6.57	4.62	0.04
13.50	6.71	4.75	0.03
13.75	6.82	4.86	0.03
14.00	6.94	4.97	0.03
14.25	7.04	5.06	0.03
14.50	7.13	5.15	0.02
14.75	7.22	5.24	0.02
15.00	7.30	5.31	0.02
15.25	7.37	5.38	0.02
15.50	7.44	5.45	0.02
15.75	7.51	5.51	0.02
16.00	7.58	5.57	0.02
16.25	7.64	5.63	0.02
16.50	7.70	5.69	0.02
16.75	7.76	5.75	0.02
17.00	7.82	5.80	0.01
17.25	7.87	5.85	0.01
17.50	7.92	5.90	0.01
17.75	7.97	5.95	0.01
18.00	8.02	6.00	0.01
18.25	8.06	6.04	0.01
18.50	8.11	6.08	0.01
18.75	8.15	6.12	0.01
19.00	8.20	6.17	0.01
19.25	8.24	6.21	0.01
19.50	8.28	6.25	0.01
19.75	8.32	6.29	0.01
20.00	**8.36**	**6.33**	0.01

Summary for Pond 7P: Rain Garden

[82] Warning: Early inflow requires earlier time span
[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 0.068 ac, 35.60% Impervious, Inflow Depth > 6.27" for 100-Year event
Inflow = 0.48 cfs @ 12.13 hrs, Volume= 0.035 af
Outflow = 0.49 cfs @ 12.16 hrs, Volume= 0.023 af, Atten= 0%, Lag= 2.2 min
Discarded = 0.01 cfs @ 12.16 hrs, Volume= 0.007 af
Primary = 0.48 cfs @ 12.16 hrs, Volume= 0.016 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= 101.07' @ 12.16 hrs Surf.Area= 677 sf Storage= 584 cf

Plug-Flow detention time= 145.0 min calculated for 0.023 af (65% of inflow)
Center-of-Mass det. time= 61.8 min (823.9 - 762.1)

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

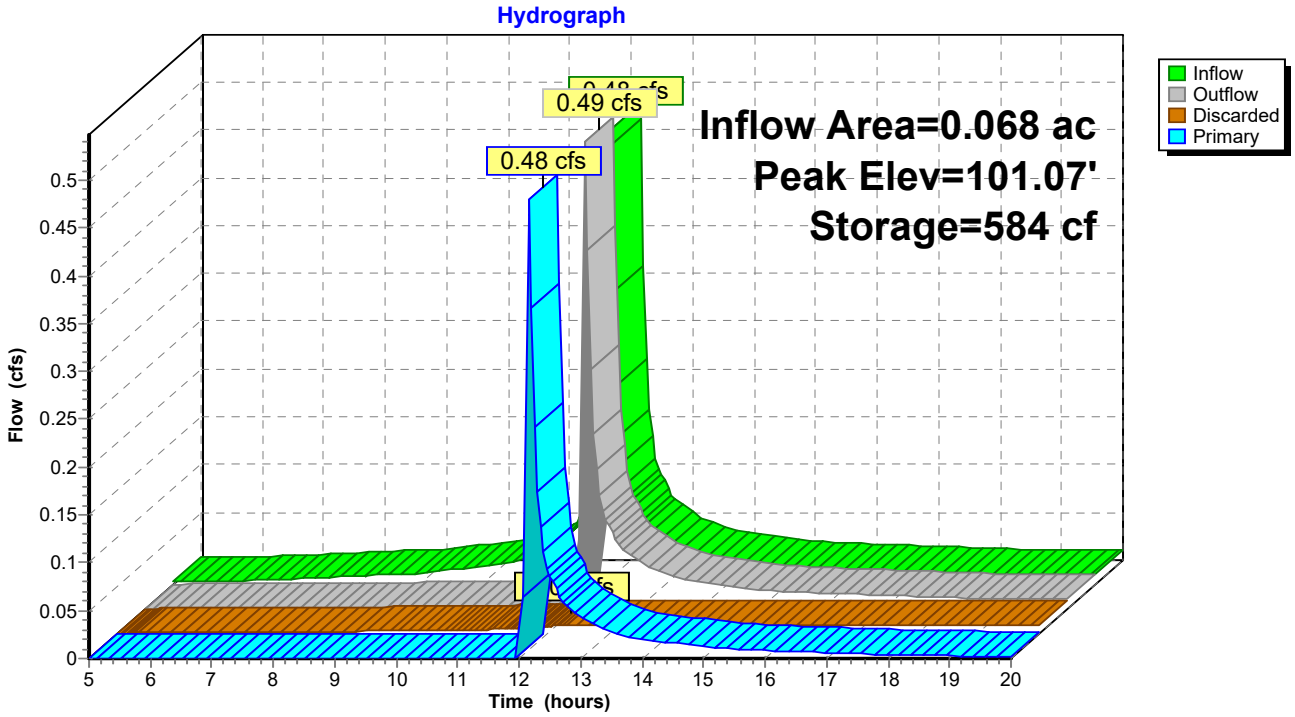
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
99.75	207	0	0
100.00	318	66	66
101.00	624	471	537
101.25	804	179	715

Device	Routing	Invert	Outlet Devices
#1	Primary	101.00'	**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
#2	Discarded	99.75'	**0.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 99.16'

Discarded OutFlow Max=0.01 cfs @ 12.16 hrs HW=101.07' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.43 cfs @ 12.16 hrs HW=101.07' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.43 cfs @ 0.64 fps)

Pond 7P: Rain Garden



Hydrograph for Pond 7P: Rain Garden

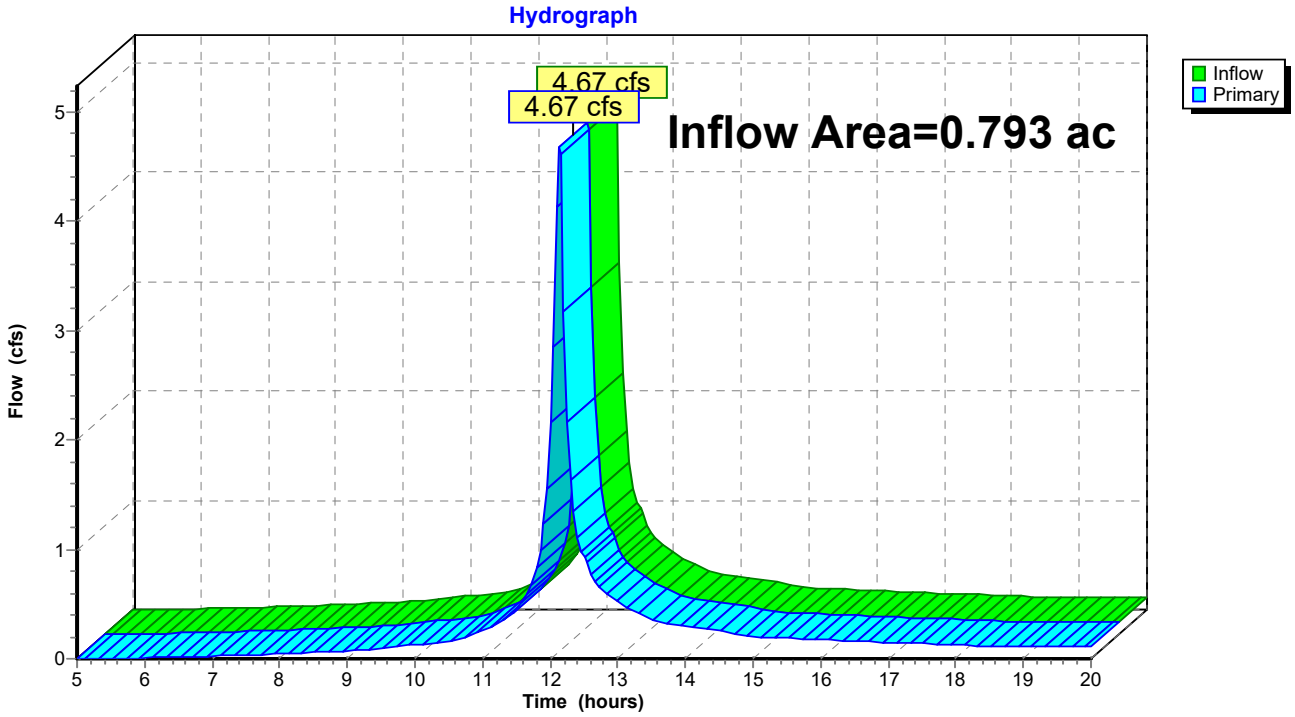
Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
5.00	0.00	0	99.75	0.00	0.00	0.00
5.50	0.00	4	99.77	0.00	0.00	0.00
6.00	0.00	9	99.79	0.00	0.00	0.00
6.50	0.01	15	99.82	0.00	0.00	0.00
7.00	0.01	23	99.85	0.00	0.00	0.00
7.50	0.01	32	99.89	0.00	0.00	0.00
8.00	0.01	44	99.93	0.00	0.00	0.00
8.50	0.01	57	99.97	0.00	0.00	0.00
9.00	0.01	73	100.02	0.00	0.00	0.00
9.50	0.02	92	100.08	0.00	0.00	0.00
10.00	0.02	118	100.15	0.00	0.00	0.00
10.50	0.02	149	100.24	0.00	0.00	0.00
11.00	0.04	193	100.34	0.00	0.00	0.00
11.50	0.06	265	100.51	0.01	0.01	0.00
12.00	**0.25**	**448**	**100.85**	**0.01**	**0.01**	**0.00**
12.50	**0.09**	**551**	**101.02**	**0.09**	**0.01**	**0.09**
13.00	0.05	546	101.01	0.05	0.01	0.04
13.50	0.03	543	101.01	0.04	0.01	0.03
14.00	0.03	542	101.01	0.03	0.01	0.02
14.50	0.02	541	101.01	0.02	0.01	0.02
15.00	0.02	540	101.01	0.02	0.01	0.01
15.50	0.02	539	101.00	0.02	0.01	0.01
16.00	0.02	539	101.00	0.02	0.01	0.01
16.50	0.02	539	101.00	0.02	0.01	0.01
17.00	0.01	538	101.00	0.01	0.01	0.01
17.50	0.01	538	101.00	0.01	0.01	0.01
18.00	0.01	538	101.00	0.01	0.01	0.00
18.50	0.01	537	101.00	0.01	0.01	0.00
19.00	0.01	537	101.00	0.01	0.01	0.00
19.50	0.01	537	101.00	0.01	0.01	0.00
20.00	0.01	537	101.00	0.01	0.01	0.00

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

Inflow Area = 0.793 ac, 15.44% Impervious, Inflow Depth > 4.82" for 100-Year event
Inflow = 4.67 cfs @ 12.14 hrs, Volume= 0.318 af
Primary = 4.67 cfs @ 12.14 hrs, Volume= 0.318 af, Atten= 0%, Lag= 0.0 min

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

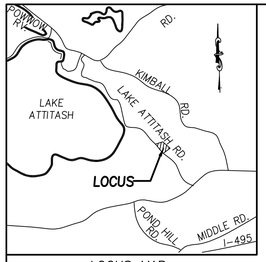
Link 3L: Design Point 1 (Wetland)



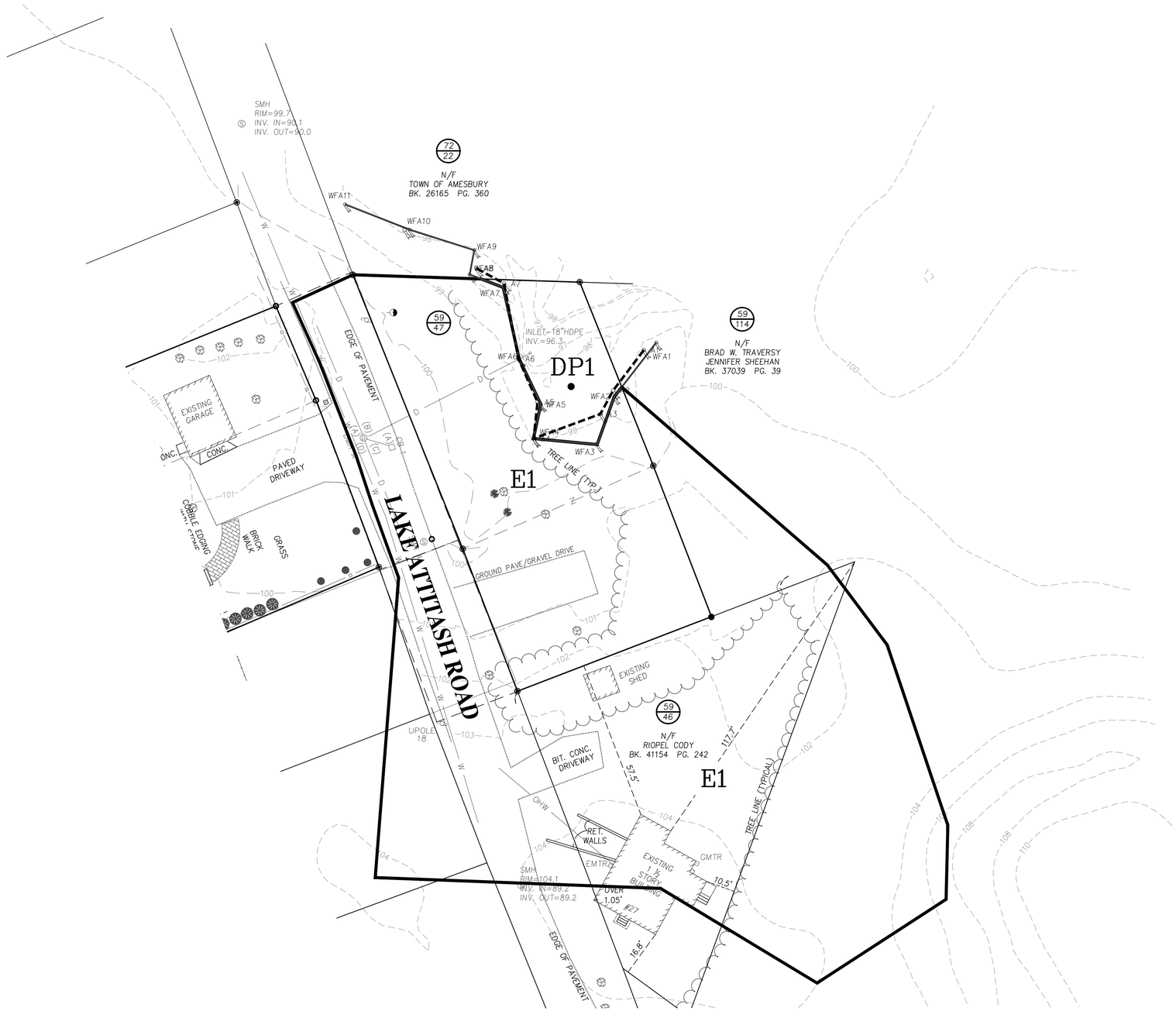
Hydrograph for Link 3L: Design Point 1 (Wetland)

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
5.00	0.00	**0.00**	0.00
5.25	0.00	0.00	0.00
5.50	0.00	0.00	0.00
5.75	0.01	0.00	0.01
6.00	0.01	0.00	0.01
6.25	0.01	0.00	0.01
6.50	0.02	0.00	0.02
6.75	0.02	0.00	0.02
7.00	0.02	0.00	0.02
7.25	0.03	0.00	0.03
7.50	0.03	0.00	0.03
7.75	0.04	0.00	0.04
8.00	0.04	0.00	0.04
8.25	0.05	0.00	0.05
8.50	0.06	0.00	0.06
8.75	0.06	0.00	0.06
9.00	0.07	0.00	0.07
9.25	0.08	0.00	0.08
9.50	0.09	0.00	0.09
9.75	0.11	0.00	0.11
10.00	0.13	0.00	0.13
10.25	0.14	0.00	0.14
10.50	0.16	0.00	0.16
10.75	0.20	0.00	0.20
11.00	0.26	0.00	0.26
11.25	0.34	0.00	0.34
11.50	0.43	0.00	0.43
11.75	0.70	0.00	0.70
12.00	**2.17**	0.00	**2.17**
12.25	**2.17**	0.00	**2.17**
12.50	0.93	0.00	0.93
12.75	0.65	0.00	0.65
13.00	0.53	0.00	0.53
13.25	0.43	0.00	0.43
13.50	0.36	0.00	0.36
13.75	0.31	0.00	0.31
14.00	0.29	0.00	0.29
14.25	0.27	0.00	0.27
14.50	0.25	0.00	0.25
14.75	0.23	0.00	0.23
15.00	0.21	0.00	0.21
15.25	0.19	0.00	0.19
15.50	0.19	0.00	0.19
15.75	0.18	0.00	0.18
16.00	0.18	0.00	0.18
16.25	0.17	0.00	0.17
16.50	0.16	0.00	0.16
16.75	0.16	0.00	0.16
17.00	0.15	0.00	0.15
17.25	0.14	0.00	0.14
17.50	0.14	0.00	0.14
17.75	0.13	0.00	0.13
18.00	0.12	0.00	0.12
18.25	0.12	0.00	0.12
18.50	0.12	0.00	0.12
18.75	0.12	0.00	0.12
19.00	0.11	0.00	0.11
19.25	0.11	0.00	0.11
19.50	0.11	0.00	0.11
19.75	0.11	0.00	0.11
20.00	0.11	0.00	0.11

c. Watershed Maps



LOCUS MAP
N.T.S.



GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 inch = 20'

PREPARED FOR

FRANK CAVALLARO
30 LAKE ATTITASH ROAD,
AMESBURY, MA

NO.	DATE	DESCRIPTION	BY
1	8/10/26	RESPONSE TO PEER REVIEW	S.R.C.

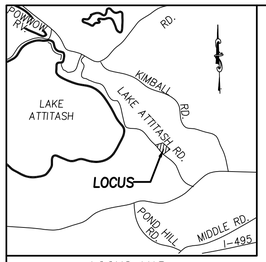
MILLENNIUM ENGINEERING, INC.
ENGINEERING AND LAND SURVEYING
62 ELM ST. SALISBURY, MA 01952 (978) 463-8980
13 HAMPTON RD. EXETER, NH 03833 (603) 778-0528

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

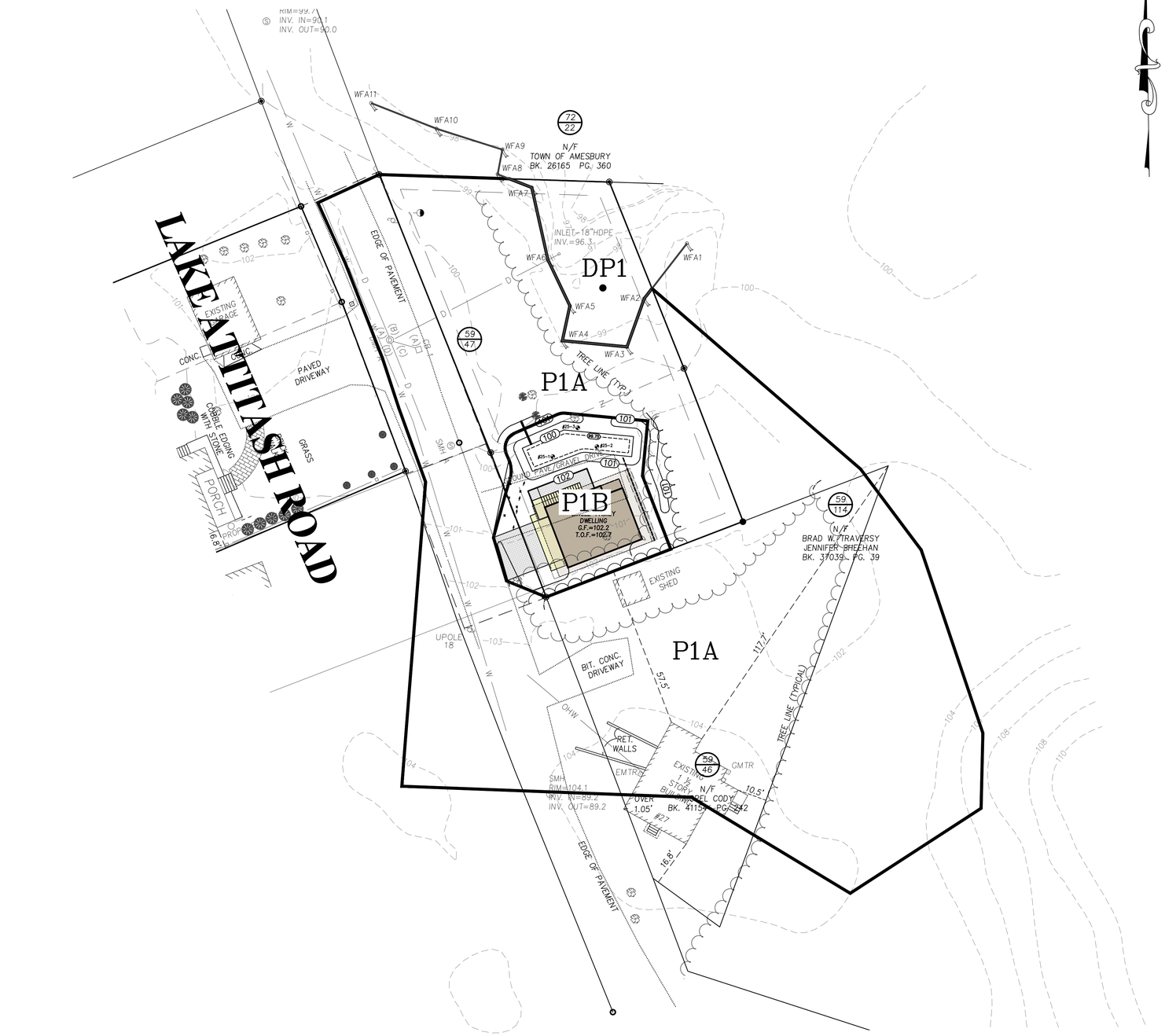
SITE PLAN
IN
AMESBURY, MA
AT
29 LAKE ATTITASH ROAD

PRE - DEVELOPMENT WATERSHED MAP

SHEET: 1 OF 2



LOCUS MAP
N.T.S.



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SITE PLAN
IN
AMESBURY, MA
AT
29 LAKE ATTITASH ROAD

POST - DEVELOPMENT WATERSHED MAP

SHEET: 2 OF 2