Watershed Study

Millstone Road
Brewster, MA

January 4th, 2021

SUBMITTED TO: Brewster Municipal Affordable Housing Trust

SUBMITTED BY: Bohler

BOHLER

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1.0 INTRODUCTION

This report summarizes the stormwater characteristics of the site and surrounding area and makes recommendations for mitigating permanent and construction period impacts related to the proposed potential affordable housing development (Project) at the Site. This memorandum is based on a variety of available information, including a Site survey, GIS mapping, comments and photographs submitted by abutting property owners and a field visit of the site and adjacent properties.

For the purpose of this memorandum the Project is based on the Concept 2 Plan, Bohler, dated March 10, 2020, but the stormwater design would be similar for any multi-building development on the property. The property survey, watershed mapping and Concept 2 are included in Appendix A – Exhibits. The reader is also directed to the July 9, 2019 Due Diligence Report prepared by Bohler for additional site information, some of which has been included with this memorandum.

This memorandum specifically addresses the following scope:

- **Existing and Proposed Watershed Area Mapping-** This identifies existing and proposed topographical and surface condition information as derived from the survey documents, master plan concepts and available GIS mapping.

- **Existing and Proposed Stormwater Modelling -** Utilizing the topography and surface conditions, an analysis was performed in HydroCAD to quantify the rates of run-off, design points, potential flooding, etc. The analysis includes calculations for the 2-, 10-, 25-, 50- and 100-year storms. This modelling shows design points, related stormwater flow and proposed underground infiltration systems to manage increased run-off from development.

- **Review of Potential Stormwater Impacts to Abutting Properties** – Based on the existing and proposed topography as well as the modelling, an assessment of impacts of abutting properties is provided.

2.0 EXISITNG SITE

2.1 Existing Surface Conditions

The Site, located west of Millstone Road near the intersection with Fern Lane, includes the properties identified as "CAMA ID" 99-1 and 98-12 in the Town of Brewster, Massachusetts. One parcel (ID 99-1) has frontage along the western side of Millstone Road, between 598 and 560 Millstone Road, and is located along the northeastern edge of the second parcel. The second, rear parcel (ID 98-12) is located behind single family residential lots along both Millstone Road and Captains Village Lane, and extends to the west, along the Ocean Edge development and golf

course. The Site also abuts a portion of dedicated conservation land associated with the Captains Village Lane development. The subject properties encompass approximately 16.61 acres.

The Site consists primarily of undeveloped wooded land and is bordered by single family residential lots to the east, south and west. Ocean Edge, a condominium development, borders the Site to the north with a portion of the associated golf course also located to the west.

2.2 Soil Conditions

Based on the United States Department of Agriculture (USDA) Natural Resources Conservation Service's (NRCS) Web Soil Survey, the soils identified across the Site consist of Barnstable-Plymouth-Nantucket complex (Hydrologic Soil Group A) and Plymouth loamy course sand (Hydrologic Soil Group A) which are expected to be very well drained soils. The NRCS Web Soil Survey report has been included in Appendix B for reference. In addition, based on the USDA NRCS Web Soil Survey, the depth to water table and any soil restrictive layer is greater than 6.5 feet.

2.3 Existing Topography

The elevations across the Site range from approximately elevation 82 to 122. Slopes range from generally flat in the far southern extent of the property, up to 10% in the northwest portion of the property. The Existing Conditions Survey, included as in Appendix A, further details the location and existing topography at the Site. Flow arrows have been added to show the above description of the topography.

Also included in Appendix A, is a Watershed Analysis Figure showing a larger area than the Site survey. This figure includes flow arrows, identified low points and design points. The design points correspond to locations where stormwater from the Site is measured in the existing and proposed condition. The Low Points (LP) are locations we evaluated near the site that collect stormwater.

The northern portion of the Site primarily slopes from north to south, towards a low-lying area along the southern property line, near the inner corner of the "L-shaped" property. The southern portion of the Site is primarily sloped from south to north, towards the same low-lying area. This small depression appears to collect and infiltrate runoff in the vicinity and is considered Design Point 1 (DP1). As depicted on the Watershed Figure this design point collects approximately 52 acres. This low-lying area would be the likely location of a future stormwater detention and infiltration system in order to mimic the storage and infiltration that the area provides under existing conditions.

There is a second design point at a low-lying area listed as DP2 on the Watershed Figure. This design point is on an adjacent property and collects stormwater from the project site, Millstone Road and property to the north. There would be a small stormwater detention and infiltration system in order to match existing flows from the Project site to this point to mimic existing conditions.

Adjacent to the site, on the Ocean Edge property to the north and west there are some identified low points. While some low-lying areas are on the golf course and wooded areas, one is on Fletcher Lane collecting runoff from a large part of developed area of Fletcher Lane and Howland Circle. Based on comments submitted by residents this area was reviewed and we agree that it appears to be prone to flooding. Unfortunately, it appears that a low point was built into the road design without a drainage overflow or drainage structures to help convey water from this depression.

We are confident based on the topography along the northern property line as well as typical drainage protocol that the Project if designed properly will not have any negative stormwater impacts on the adjacent condominium development.

3.0 PROPOSED SITE

3.1 Proposed Topography and Stormwater System

The proposed development will consist of a driveway, surface parking and likely multiple buildings across the property. The preferred design was depicted previously in Concept 2. The proposed topography should match the existing to the greatest extent practicable in order to help match stormwater characteristics, minimize grading and preserve as many existing trees as possible. Based on the existing topography and watershed there are two design points to be considered. Design Point 1 (DP1) is located in the northwest corner of the site and DP2 is at the northeast corner of the site.

It is important to note that there is a natural ridge running along the northern property line, which will aid in minimizing stormwater conveyance from the Project travelling to the neighboring properties to the North (Ocean Edge property). This was reviewed in the field and can be seen in the topography depicted in the survey and watershed mapping in appendix A and photos in Appendix C.

Assuming that there is a buffer along the property line, the high point of this ridge should remain intact and prevent stormwater from the development from travelling north to the adjacent condominium development. Near the western most edge of the property, where the ridge offers less relief, a berm, grading and a stormwater collection system of catch basins and manholes should be established to allow no increase in stormwater flow from the development to the northern abutter.

3.2 Proposed Stormwater System

The proposed project will require a new storm drainage system consisting of a series of catch basins, water quality treatment units and an underground infiltration system or surface basin to collect, treat and manage stormwater runoff from the buildings and parking areas. Since the Site is undeveloped and wooded, the development will result in an increase in impervious area

and will require a stormwater management system to retain and infiltrate stormwater in order to match peak rates of runoff compared to that of existing conditions.

We expect that two or more detention and infiltration systems will be designed as part of the project. We have defined two low points that are considered design points for the development. Each system is assumed to be an underground detention/infiltration system for the modelling but could also be open detention ponds.

The proposed development would be a good candidate for the use of a low impact development drainage system, which is suggested under the Massachusetts Stormwater Management Standards. The storm drainage system will need to be further refined as the conceptual planning process moves forward. In addition, during soil testing for the proposed septic system design, Bohler recommends that soil testing be performed in areas identified for stormwater management in order to confirm site soil conditions and depth to groundwater.

We understand there is great concern about adding to flooding issues to the north of the property in the Ocean Edge development. We have reviewed comment letters and provided responses in Appendix E.

4.0 STORMWATER MODELLING

4.1 Methodology

The proposed stormwater management design will provide a decrease in peak stormwater runoff rates from the proposed facility for the 2-, 10-, 25-, 50- and 100-year design storm events utilizing the SCS TR-20 and TR-55 Urban Hydrology for Small Watersheds methods.

The assessment of existing and proposed stormwater flows was performed using HydroCAD©. HydroCAD© input and output data is included in Appendix D. In the modelling DP1 is called POA1 (Point of Analysis 1) and DP2 is called POA2 (Point of Analysis 2).

Times of concentration (Tc) utilized in the preparation of this report were generated utilizing the SCS TR-55 Urban Hydrology for Small Watersheds method. Runoff coefficients for the pre- and post-development conditions were calculated using widely accepted, and often utilized runoff coefficients and have been documented within the hydrology calculations in Appendix D of this report.

Rainfall data for the storm events was obtained from the Northeast Regional Climate Center and the Natural Resources Conservation Service's Extreme Precipitation in New York & New England.

The following rainfall data was used in the calculations:

Table 1 – Rainfall Data

	2-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Rainfall (inches)	**3.23**	**4.69**	**5.60**	**6.29**	**7.0**

Table 2 – Summary of Peak Runoff Rates to Design Point 1 (POA1 in HydroCAD)

Storm Event (years)	2	10	25	50	100
Existing Flow, CFS	9.5	31.8	49.3	63.6	79.3
Proposed Flow, CFS	9.5	31.7	49.1	62.1	78.1
Change, CFS	0.0	-0.1	-0.2	-1.5	-1.2

Table 3 – Summary of Peak Runoff Rates to Design Point 2 (POA2 in HydroCAD)

Storm Event (years)	2	10	25	50	100
Existing Flow, CFS	6.9	13.2	17.3	20.5	23.7
Proposed Flow, CFS	6.7	12.7	16.7	19.8	23.6
Change, CFS	-0.2	-0.5	-0.6	-0.7	-0.1

The proposed stormwater management as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25-, 50- and 100-year design storm events.

5.0 STORMWATER DESIGN RECOMMENDATIONS

The Project should be required to meet the MA DEP Stormwater Standards. Below is a summary of the standards and recommendations for the project.

Standard #1: No New Untreated Discharges

The project should be designed so that proposed impervious paved areas at a minimum shall be collected and passed through the proposed drainage system for treatment prior to discharge. Roof areas, which are clean may be infiltrated directly without treatment.

Standard #2: Peak Rate Attenuation

The proposed stormwater management system should be designed so that post-development peak rates of runoff are below pre-development conditions for the 2-, 10-, 25- and 100-year storm events at all design points.

Standard #3: Recharge

The stormwater runoff from the project should be collected and diverted to infiltration systems to mimic existing drainage pattern at the site.

Standard #4: Water Quality

Water quality treatment should be provided to meet an 80% Total Suspended Solids (TSS) removal.

Standard #5: Land Use with Higher Potential Pollutant Loads

Not Applicable for this project.

Standard #6: Critical Areas

Not Applicable for this project.

Standard #7: Redevelopment

Not Applicable for this project.

Standard #8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

The proposed project should provide construction period erosion and sedimentation controls complying with MA DEP guidance and EPA NPDES guidance. This includes a proposed construction exit, protection for stormwater inlets, protection around temporary material stockpiles and various other techniques as outlined on the erosion and sediment control sheets. Additionally, the project is required to file a Notice of Intent with the US EPA and implement a Stormwater Pollution Prevention Plan (SWPPP) during the construction period. The SWPPP will be prepared prior to the start of construction and will be implemented by the site contractor under the guidance and responsibility of the project's proponent.

Standard #9: Operation and Maintenance Plan (O&M Plan)

An Operation and Maintenance (O&M) Plan for this site should be prepared for the long term operation and maintenance of the proposed site stormwater management system, including initial inspections upon completion of construction, and periodic monitoring of the system components, in accordance with established practices and the manufacturer's recommendations. The O&M Plan should include a list of responsible parties and an estimated budget for inspections and maintenance. The Town may want to require submission of an annual report summarizing the maintenance activities completed.

Standard #10: Prohibition of Illicit Discharges

The proposed stormwater system should only convey allowable non-stormwater discharges (firefighting waters, irrigation, air conditioning condensates, etc.) and should not contain any illicit discharges from prohibited sources.

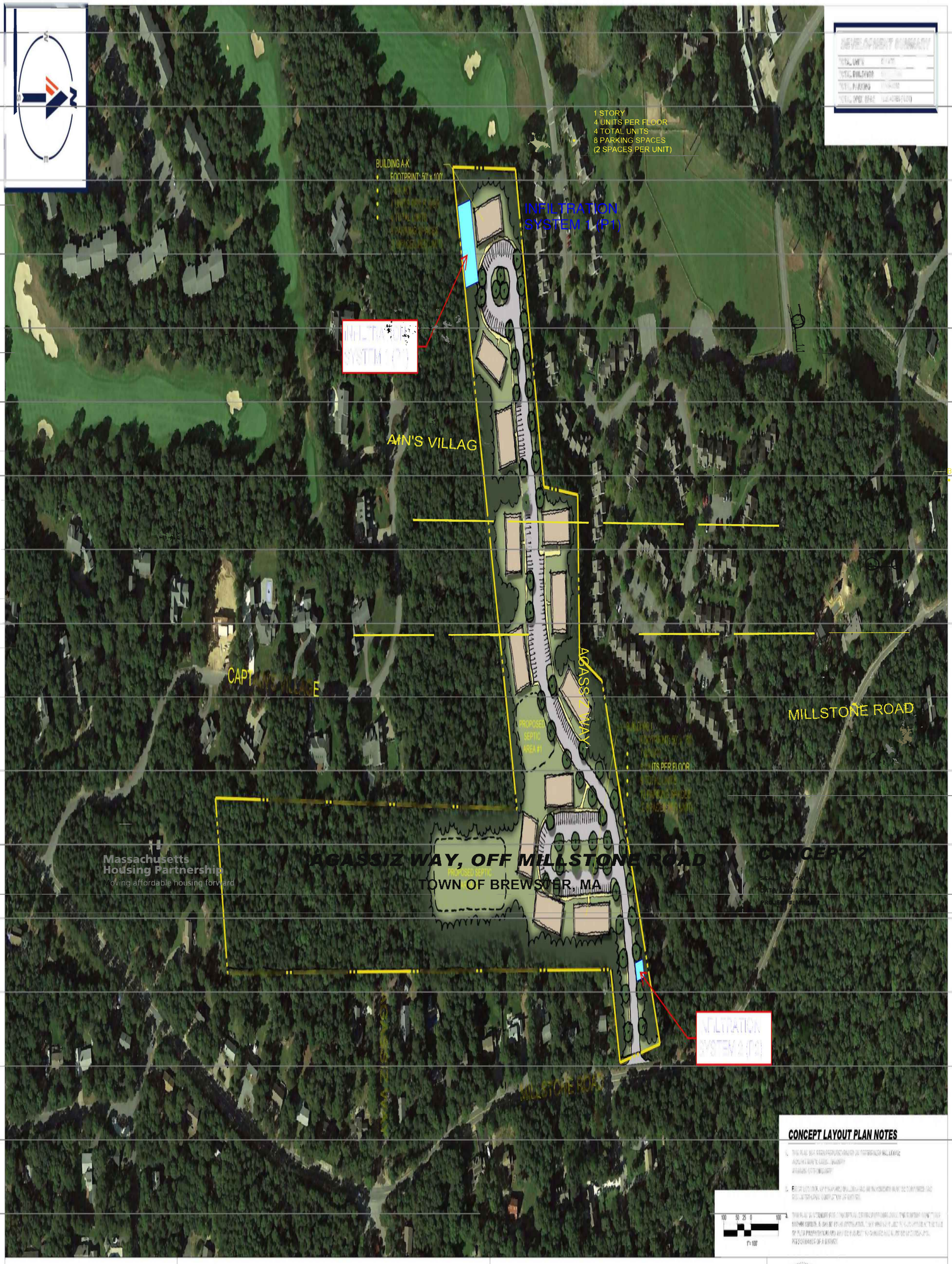
6.0 SUMMARY

The drainage analysis for the site and surrounding area indicate that with typcial stormwater controls and treatment, the proposed Project should not impact surrounding properties.

The existing topography of the site aids in the ability to develop the site because there is a ridge or topographical break along the northern property line.

We recommend that the project be required to complete infiltration testing during the design and permitting process, complete the stormwater design according to the DEP Stormwater Standards and submit a draft SWPPP to the town for review prior to finalizing the design under the EPA NPDES program.

APPENDIX A: EXHIBITS



CONCEPT LAYOUT PLAN NOTES

1.

2.

AGASSIZ WAY, OFF MILLSTONE ROAD
TOWN OF BREWSTER, MA
CONCEPT 2

MJ MRVA

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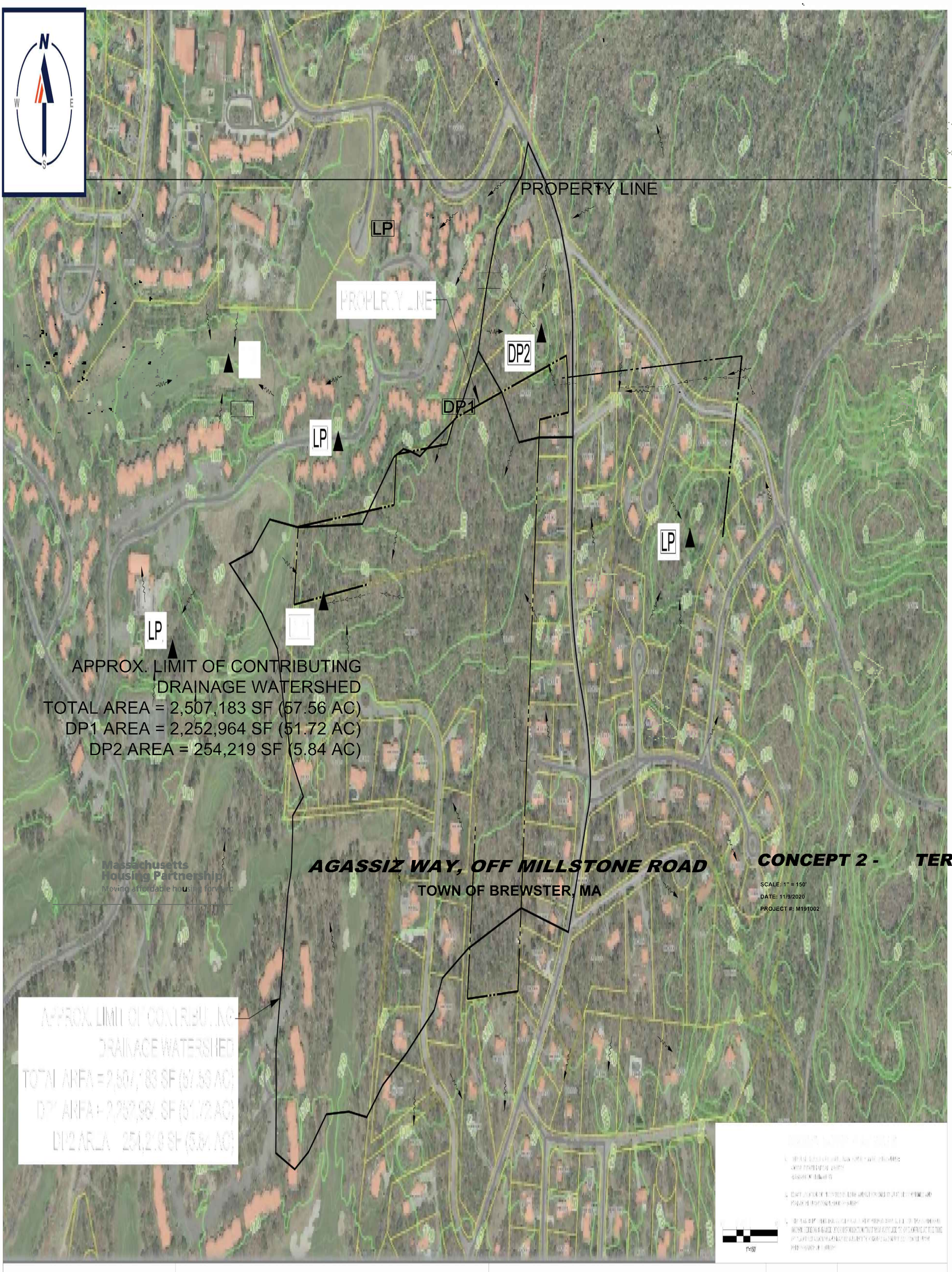
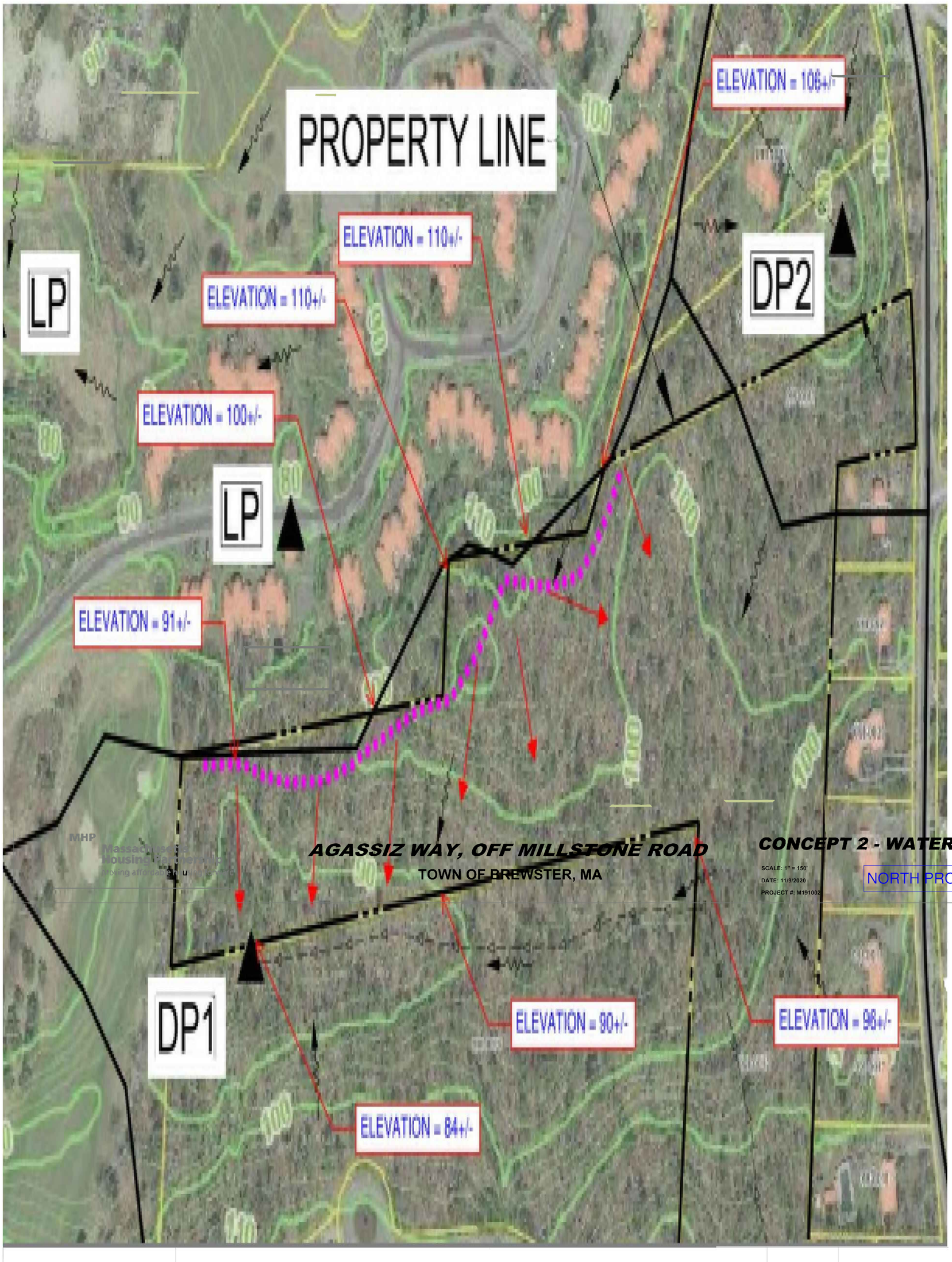

PROPERTY LINE
LP
PROPERTY LINE
DP2
DP1
LP
LP
LP
APPROX. LIMIT OF CONTRIBUTING
DRAINAGE WATERSHED
TOTAL AREA = 2,507,183 SF (57.56 AC)
DP1 AREA = 2,252,964 SF (51.72 AC)
DP2 AREA = 254,219 SF (5.84 AC)
Massachusetts
Housing Partnership
AGASSIZ WAY, OFF MILLSTONE ROAD
TOWN OF BREWSTER, MA
CONCEPT 2 -
SCALE: 1" = 150'
DATE: 11/9/2020
PROJECT #: M191002
BOHLER


PROPERTY LINE
ELEVATION = 106+/-
ELEVATION = 110+/-
ELEVATION = 110+/-
ELEVATION = 100+/-
ELEVATION = 91+/-
LP
LP
DP2
DP1
ELEVATION = 80+/-
ELEVATION = 98+/-
ELEVATION = 84+/-
AGASSIZ WAY, OFF MILLSTONE ROAD
TOWN OF BREWSTER, MA
CONCEPT 2 - WATERS
SCALE: 1" = 150'
DATE: 11/9/2020
PROJECT #: M191002
NORTH PROPE

APPENDIX B: NRCS WEB SOIL SURVEY

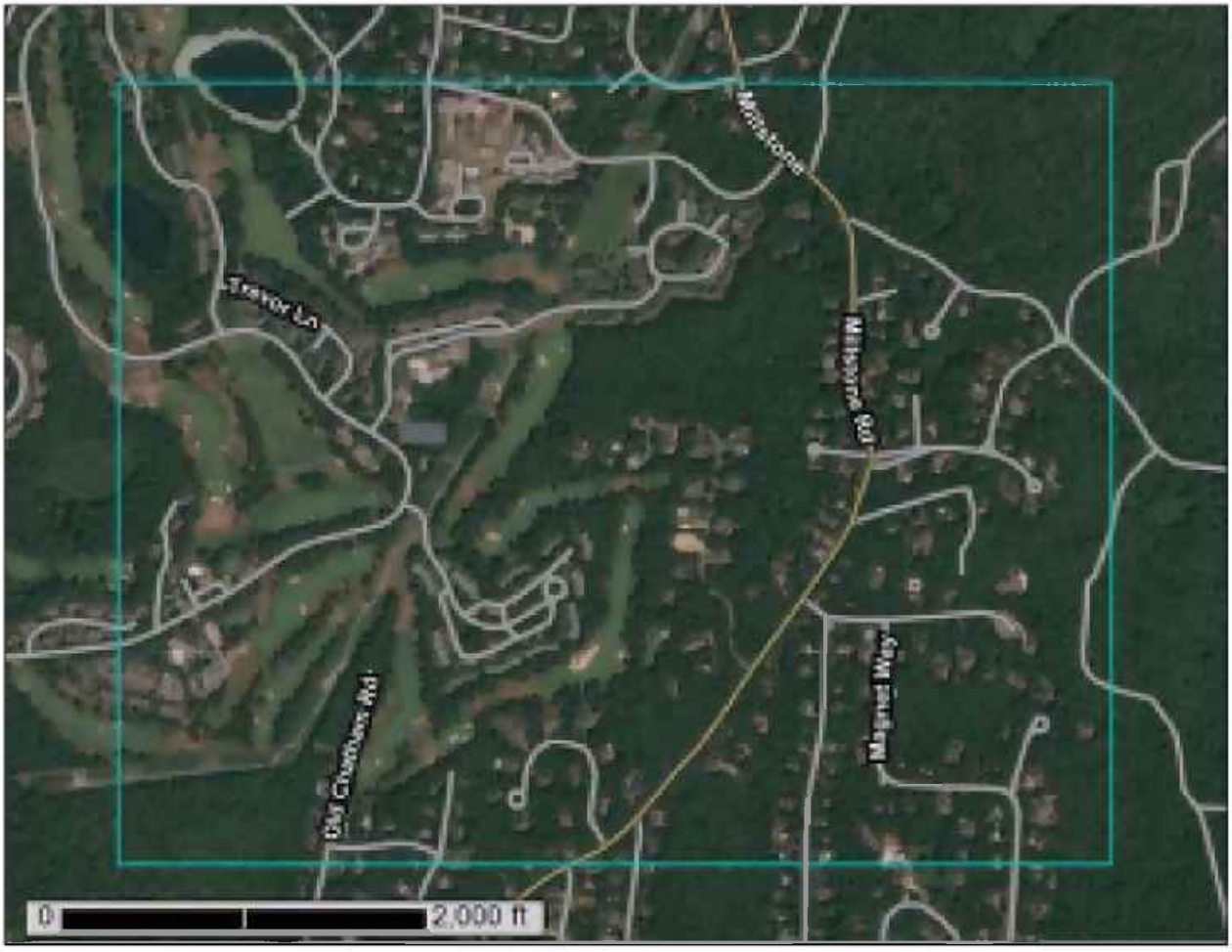
United States Department of Agriculture

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 Barnstable County, Massachusetts



November 9, 2020

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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

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.


1
264B
264B
53A
493D
490C
494C
1
Millstone
494C
493D
493D
435D
494C
493D
54A
493D
435B
435D
Endicott Ln
436B
435C
252A
435B
252C
252D
252C
Map Scale: 1:11,100 if printed on A landscape (11" x 8.5") sheet.
Meters
0 150 300 600 900
Feet
0 500 1000 2000 3000
N
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 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Barnstable County, Massachusetts
Survey Area Data: Version 17, Jun 9, 2020

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

Date(s) aerial images were photographed: Jul 10, 2018—Nov 17, 2018

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
1	Water	5.3	1.0%
53A	Freetown muck, ponded, coastal lowland, 0 to 1 percent slopes	0.0	0.0%
54A	Freetown and Swansea mucks, coastal lowland, 0 to 1 percent slopes	0.7	0.1%
252A	Carver coarse sand, 0 to 3 percent slopes	29.6	5.5%
252C	Carver coarse sand, 8 to 15 percent slopes	1.3	0.2%
252D	Carver coarse sand, 15 to 35 percent slopes	0.3	0.1%
264B	Eastchop loamy fine sand, 3 to 8 percent slopes	6.6	1.2%
435B	Plymouth loamy coarse sand, 3 to 8 percent slopes	87.3	16.2%
435C	Plymouth loamy coarse sand, 8 to 15 percent slopes	25.9	4.8%
435D	Plymouth loamy coarse sand, 15 to 35 percent slopes	36.5	6.8%
436B	Plymouth loamy coarse sand, 3 to 8 percent slopes, very stony	107.2	19.9%
490C	Barnstable-Plymouth-Nantucket complex, rolling	35.2	6.6%
493D	Plymouth-Barnstable-Nantucket complex, hilly, very bouldery	41.2	7.7%
494C	Barnstable-Plymouth-Nantucket complex, rolling, very bouldery	160.6	29.9%
Totals for Area of Interest		**537.8**	**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.

Barnstable County, Massachusetts

1—Water

Map Unit Setting
National map unit symbol: 98s8
Frost-free period: 120 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Typical profile
- 0 to 0 inches: water

53A—Freetown muck, ponded, coastal lowland, 0 to 1 percent slopes

Map Unit Setting
National map unit symbol: 2t2qg
Elevation: 0 to 210 feet
Mean annual precipitation: 40 to 52 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 190 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition
Freetown, ponded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown, Ponded

Setting
Landform: Kettles, depressions, bogs, marshes, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile
Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities
Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 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 low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water capacity: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman, ponded

Percent of map unit: 5 percent
Landform: Depressions on ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea, ponded

Percent of map unit: 5 percent
Landform: Kettles, depressions, bogs, marshes, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

54A—Freetown and Swansea mucks, coastal lowland, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2tyqd
Elevation: 0 to 250 feet
Mean annual precipitation: 40 to 52 inches

Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 190 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Freetown, coastal lowland, and similar soils: 50 percent
Swansea, coastal lowland, and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown, Coastal Lowland

Setting

Landform: Bogs, marshes, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 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 low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water capacity: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Description of Swansea, Coastal Lowland

Setting

Landform: Marshes, swamps, bogs
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

Typical profile

Oa - 0 to 36 inches: muck
Cg - 36 to 79 inches: coarse sand

Properties and qualities

Slope: 0 to 1 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 low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water capacity: Very high (about 17.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Rainberry, coastal lowland

Percent of map unit: 10 percent
Landform: Kettles, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

252A—Carver coarse sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2y07w
Elevation: 0 to 990 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Carver, Coarse Sand

Setting

Landform: Moraines, outwash plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope, crest, tread

Down-slope shape: Convex, linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 3 inches: moderately decomposed plant material
A - 3 to 7 inches: coarse sand
E - 7 to 10 inches: coarse sand
Bw1 - 10 to 15 inches: coarse sand
Bw2 - 15 to 28 inches: coarse sand
BC - 28 to 32 inches: coarse sand
C - 32 to 67 inches: coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Minor Components

Deerfield

Percent of map unit: 10 percent
Landform: Outwash deltas, kame terraces, outwash terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Kame terraces, outwash terraces, eskers, moraines, outwash plains, kames, outwash deltas
Landform position (two-dimensional): Footslope, shoulder, backslope, summit, toeslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Merrimac

Percent of map unit: 3 percent
Landform: Kame terraces, outwash terraces, outwash deltas
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Mashpee

Percent of map unit: 2 percent
Landform: Terraces, depressions, drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

252C—Carver coarse sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2y07z
Elevation: 0 to 250 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Carver, Coarse Sand

Setting

Landform: Moraines, outwash plains
Landform position (two-dimensional): Shoulder, footslope, backslope
Landform position (three-dimensional): Crest, head slope, nose slope, side slope, riser
Down-slope shape: Convex, linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 3 inches: moderately decomposed plant material
A - 3 to 7 inches: coarse sand
E - 7 to 10 inches: coarse sand
Bw1 - 10 to 15 inches: coarse sand
Bw2 - 15 to 28 inches: coarse sand
BC - 28 to 32 inches: coarse sand

C - 32 to 67 inches: coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Minor Components

Deerfield

Percent of map unit: 10 percent
Landform: Outwash deltas, kame terraces, outwash terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Outwash deltas, kame terraces, outwash terraces
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Kames, outwash deltas, kame terraces, outwash terraces, eskers, moraines, outwash plains
Landform position (two-dimensional): Shoulder, backslope, footslope, summit, toeslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

252D—Carver coarse sand, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2y07y
Elevation: 0 to 220 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

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

Description of Carver, Coarse Sand

Setting

Landform: Moraines, outwash plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, riser
Down-slope shape: Convex, linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
Oe - 2 to 3 inches: moderately decomposed plant material
A - 3 to 7 inches: coarse sand
E - 7 to 10 inches: coarse sand
Bw1 - 10 to 15 inches: coarse sand
Bw2 - 15 to 28 inches: coarse sand
BC - 28 to 32 inches: coarse sand
C - 32 to 67 inches: coarse sand

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Minor Components

Deerfield

Percent of map unit: 10 percent
Landform: Kame terraces, outwash terraces, outwash plains, outwash deltas
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Kame terraces, outwash terraces, eskers, moraines, outwash plains, kames, outwash deltas
Landform position (two-dimensional): Footslope, shoulder, backslope, summit, toeslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Merrimac

Percent of map unit: 3 percent
Landform: Outwash deltas, kame terraces, outwash terraces
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Freetown, coastal lowland

Percent of map unit: 2 percent
Landform: Bogs, marshes, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

264B—Eastchop loamy fine sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 98qq
Elevation: 0 to 1,000 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 240 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Eastchop and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Eastchop

Setting

Landform: Outwash plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy glaciofluvial deposits; loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy fine sand
H2 - 6 to 10 inches: loamy fine sand
H3 - 10 to 25 inches: very fine sand
H4 - 25 to 64 inches: very fine sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Minor Components

Hinckley

Percent of map unit: 8 percent
Hydric soil rating: No

Merrimac

Percent of map unit: 7 percent
Hydric soil rating: No

Enfield

Percent of map unit: 5 percent
Hydric soil rating: No

Carver

Percent of map unit: 5 percent

Hydric soil rating: No

435B—Plymouth loamy coarse sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 98rs
Elevation: 0 to 1,000 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Plymouth and similar soils: 70 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plymouth

Setting

Landform: Outwash plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits and/or loose sandy ablation till; loose sandy ablation till and/or loose sandy glaciofluvial deposits; loose sandy ablation till and/or loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 3 inches: loamy coarse sand
H2 - 3 to 29 inches: gravelly loamy coarse sand
H3 - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash

Hydric soil rating: No

Minor Components

Hinckley

Percent of map unit: 8 percent
Hydric soil rating: No

Carver

Percent of map unit: 8 percent
Hydric soil rating: No

Barnstable

Percent of map unit: 6 percent
Hydric soil rating: No

Nantucket

Percent of map unit: 6 percent
Hydric soil rating: No

Merrimac

Percent of map unit: 2 percent
Hydric soil rating: No

435C—Plymouth loamy coarse sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 98rt
Elevation: 0 to 1,000 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Plymouth and similar soils: 65 percent
Minor components: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plymouth

Setting

Landform: Ice-contact slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits and/or loose sandy ablation till; loose sandy ablation till and/or loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 3 inches: loamy coarse sand

H2 - 3 to 29 inches: gravelly loamy coarse sand
H3 - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Minor Components

Carver

Percent of map unit: 15 percent
Hydric soil rating: No

Hinckley

Percent of map unit: 8 percent
Hydric soil rating: No

Barnstable

Percent of map unit: 6 percent
Hydric soil rating: No

Nantucket

Percent of map unit: 6 percent
Hydric soil rating: No

435D—Plymouth loamy coarse sand, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: 98rv
Elevation: 0 to 1,000 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Plymouth and similar soils: 65 percent

Minor components: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plymouth

Setting

Landform: Ice-contact slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits and/or loose sandy ablation till; loose sandy glaciofluvial deposits and/or loose sandy ablation till

Typical profile

H1 - 0 to 3 inches: loamy coarse sand
H2 - 3 to 29 inches: gravelly loamy coarse sand
H3 - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Minor Components

Carver

Percent of map unit: 15 percent
Hydric soil rating: No

Hinckley

Percent of map unit: 10 percent
Hydric soil rating: No

Barnstable

Percent of map unit: 5 percent
Hydric soil rating: No

Nantucket

Percent of map unit: 5 percent
Hydric soil rating: No

436B—Plymouth loamy coarse sand, 3 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 98rw
Elevation: 0 to 1,000 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Plymouth and similar soils: 70 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plymouth

Setting

Landform: Ice-contact slopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits and/or loose sandy ablation till; loose sandy glaciofluvial deposits and/or loose sandy ablation till

Typical profile

H1 - 0 to 3 inches: loamy coarse sand
H2 - 3 to 29 inches: gravelly loamy coarse sand
H3 - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 2.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Minor Components

Carver
Percent of map unit: 10 percent
Hydric soil rating: No

Hinckley
Percent of map unit: 10 percent
Hydric soil rating: No

Nantucket
Percent of map unit: 5 percent
Hydric soil rating: No

Barnstable
Percent of map unit: 5 percent
Hydric soil rating: No

490C—Barnstable-Plymouth-Nantucket complex, rolling

Map Unit Setting
National map unit symbol: 98q1
Elevation: 0 to 1,000 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Barnstable and similar soils: 35 percent
Plymouth and similar soils: 25 percent
Nantucket and similar soils: 15 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Barnstable

Setting
Landform: Moraines
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable loamy ablation till over reworked sandy glaciofluvial deposits; loamy ablation till over reworked sandy outwash

Typical profile
H1 - 0 to 1 inches: sandy loam
H2 - 1 to 23 inches: sandy loam
H3 - 23 to 64 inches: coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F149BY011MA - Well Drained Till Uplands
Hydric soil rating: No

Description of Plymouth

Setting

Landform: Moraines
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits and/or loose sandy ablation till

Typical profile

H1 - 0 to 3 inches: loamy coarse sand
H2 - 3 to 29 inches: gravelly loamy coarse sand
H3 - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Description of Nantucket

Setting

Landform: Moraines

Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable coarse-loamy eolian deposits over dense loamy lodgment till

Typical profile

H1 - 0 to 5 inches: sandy loam
H2 - 5 to 27 inches: sandy loam
H3 - 27 to 64 inches: loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 34 inches to densic material
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 24 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F149BY009MA - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Boxford

Percent of map unit: 9 percent
Hydric soil rating: No

Carver

Percent of map unit: 6 percent
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Hydric soil rating: No

493D—Plymouth-Barnstable-Nantucket complex, hilly, very bouldery

Map Unit Setting

National map unit symbol: 98s3
Elevation: 0 to 1,000 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Plymouth and similar soils: 40 percent
Barnstable and similar soils: 20 percent
Nantucket and similar soils: 15 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plymouth

Setting

Landform: Moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits and/or loose sandy ablation till; loose sandy glaciofluvial deposits and/or loose sandy ablation till

Typical profile

H1 - 0 to 3 inches: loamy coarse sand
H2 - 3 to 29 inches: gravelly loamy coarse sand
H3 - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 2.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Description of Barnstable

Setting

Landform: Moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable loamy ablation till over reworked sandy glaciofluvial deposits; loamy ablation till over reworked sandy outwash

Typical profile

H1 - 0 to 1 inches: sandy loam
H2 - 1 to 23 inches: sandy loam
H3 - 23 to 64 inches: coarse sand

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F149BY011MA - Well Drained Till Uplands
Hydric soil rating: No

Description of Nantucket

Setting

Landform: Moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable coarse-loamy eolian deposits over dense loamy lodgment till

Typical profile

H1 - 0 to 5 inches: sandy loam
H2 - 5 to 27 inches: sandy loam

H3 - 27 to 64 inches: loam

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 34 inches to densic material
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 24 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F149BY009MA - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Hinckley

Percent of map unit: 10 percent
Hydric soil rating: No

Carver

Percent of map unit: 10 percent
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Hydric soil rating: No

494C—Barnstable-Plymouth-Nantucket complex, rolling, very bouldery

Map Unit Setting

National map unit symbol: 98q2
Elevation: 0 to 1,000 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Barnstable and similar soils: 35 percent
Plymouth and similar soils: 30 percent

Nantucket and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Barnstable

Setting

Landform: Moraines
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable loamy ablation till over reworked sandy glaciofluvial deposits; loamy ablation till over reworked sandy outwash

Typical profile

H1 - 0 to 1 inches: sandy loam
H2 - 1 to 23 inches: sandy loam
H3 - 23 to 64 inches: coarse sand

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 2.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F149BY011MA - Well Drained Till Uplands
Hydric soil rating: No

Description of Plymouth

Setting

Landform: Moraines
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loose sandy glaciofluvial deposits and/or loose sandy ablation till

Typical profile

H1 - 0 to 3 inches: loamy coarse sand
H2 - 3 to 29 inches: gravelly loamy coarse sand
H3 - 29 to 64 inches: gravelly coarse sand

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F149BY005MA - Dry Outwash
Hydric soil rating: No

Description of Nantucket

Setting

Landform: Moraines
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable coarse-loamy eolian deposits over dense loamy lodgment till

Typical profile

H1 - 0 to 5 inches: sandy loam
H2 - 5 to 27 inches: sandy loam
H3 - 27 to 64 inches: loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 34 inches to densic material
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 24 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F149BY009MA - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Boxford

Percent of map unit: 5 percent

Hydric soil rating: No

Carver

Percent of map unit: 5 percent
Hydric soil rating: No

Merrimac

Percent of map unit: 3 percent
Hydric soil rating: No

Hinckley

Percent of map unit: 2 percent
Hydric soil rating: No

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is

given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause

damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Physical Soil Properties–Barnstable County, Massachusetts														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
1—Water														
Water	>0	—	—	—	—	—	—	—	—					
53A—Freetown muck, ponded, coastal lowland, 0 to 1 percent slopes														
Freetown, ponded	0-2	—	—	—	0.03-0.08-0.16	1.00-10.00-100.00	0.30-0.35-0.60	—	22.0-82.0-93.0			2	8	0
	2-79	—	—	—	0.02-0.12-0.50	1.00-10.00-100.00	0.30-0.32-0.60	—	41.0-87.0-97.0					
54A—Freetown and Swansea mucks, coastal lowland, 0 to 1 percent slopes														
Freetown, coastal lowland	0-2	—	—	—	0.03-0.08-0.16	1.00-10.00-100.00	0.30-0.35-0.60	—	22.0-82.0-93.0			2	8	0
	2-79	—	—	—	0.02-0.12-0.50	1.00-10.00-100.00	0.30-0.32-0.60	—	41.0-87.0-97.0					
Swansea, coastal lowland	0-36	—	—	—	0.23-0.28-0.32	1.00-10.00-100.00	0.30-0.45-0.52	—	55.0-65.0-75.0			1	8	0
	36-79	70-92-100	0-6-26	0-2-10	0.39-1.00-1.60	10.00-100.00-705.00	0.01-0.05-0.16	0.0-0.1-3.2	0.0-0.1-1.0	.02	.02			

Physical Soil Properties–Barnstable County, Massachusetts														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
252A—Carver coarse sand, 0 to 3 percent slopes														
Carver, coarse sand	0-2	0- 0- 0	0- 0- 0	0- 0- 0	0.18-0.20-0.24	10.00-100.00-100.00	0.12-0.34-0.55	—	45.0-80.0-95.0			5	1	180
	2-3	0- 0- 0	0- 0- 0	0- 0- 0	0.18-0.26-0.29	10.00-50.00-100.00	0.12-0.34-0.55	—	45.0-60.0-95.0					
	3-7	70-95- 98	0- 4- 25	0- 1- 6	1.59-1.60-1.60	100.00-402.50-705.00	0.05-0.07-0.13	0.0- 0.0- 0.4	1.0- 2.2- 4.0	.02	.02			
	7-10	70-95- 98	0- 4- 25	0- 1- 6	1.60-1.62-1.62	100.00-402.50-705.00	0.05-0.06-0.12	0.0- 0.0- 0.4	0.3- 0.6- 1.5	.02	.02			
	10-15	70-95- 99	0- 4- 25	0- 1- 6	1.61-1.64-1.65	100.00-402.50-705.00	0.05-0.06-0.12	0.0- 0.0- 0.3	0.3- 0.6- 1.5	.02	.02			
	15-28	70-95- 99	0- 4- 25	0- 1- 6	1.55-1.62-1.68	100.00-402.50-705.00	0.05-0.05-0.11	0.0- 0.0- 0.1	0.1- 0.2- 0.2	.02	.02			
	28-32	70-95- 99	0- 4- 25	0- 1- 6	1.55-1.62-1.68	100.00-402.50-705.00	0.05-0.05-0.11	0.0- 0.0- 0.1	0.1- 0.2- 0.2	.02	.02			
	32-67	85-95-100	0- 4- 15	0- 1- 6	1.58-1.70-1.72	100.00-402.50-705.00	0.05-0.06-0.09	0.0- 0.0- 0.2	0.0- 0.1- 0.5	.02	.02			

Physical Soil Properties–Barnstable County, Massachusetts														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
252C—Carver coarse sand, 8 to 15 percent slopes														
Carver, coarse sand	0-2	0- 0- 0	0- 0- 0	0- 0- 0	0.18-0.20-0.24	10.00-100.00-100.00	0.12-0.34-0.55	—	45.0-80.0-95.0			5	1	180
	2-3	0- 0- 0	0- 0- 0	0- 0- 0	0.18-0.26-0.29	10.00-50.00-100.00	0.12-0.34-0.55	—	45.0-60.0-95.0					
	3-7	70-95- 98	0- 4- 25	0- 1- 6	1.59-1.60-1.60	100.00-402.50-705.00	0.05-0.07-0.13	0.0- 0.0- 0.4	1.0- 2.2- 4.0	.02	.02			
	7-10	70-95- 98	0- 4- 25	0- 1- 6	1.60-1.62-1.62	100.00-402.50-705.00	0.05-0.06-0.12	0.0- 0.0- 0.4	0.3- 0.6- 1.5	.02	.02			
	10-15	70-95- 99	0- 4- 25	0- 1- 6	1.61-1.64-1.65	100.00-402.50-705.00	0.05-0.06-0.12	0.0- 0.0- 0.3	0.3- 0.6- 1.5	.02	.02			
	15-28	70-95- 99	0- 4- 25	0- 1- 6	1.55-1.62-1.68	100.00-402.50-705.00	0.05-0.05-0.11	0.0- 0.0- 0.1	0.1- 0.2- 0.2	.02	.02			
	28-32	70-95- 99	0- 4- 25	0- 1- 6	1.55-1.62-1.68	100.00-402.50-705.00	0.05-0.05-0.11	0.0- 0.0- 0.1	0.1- 0.2- 0.2	.02	.02			
	32-67	85-95-100	0- 4- 15	0- 1- 6	1.58-1.70-1.72	100.00-402.50-705.00	0.05-0.06-0.09	0.0- 0.0- 0.2	0.0- 0.1- 0.5	.02	.02			

Physical Soil Properties–Barnstable County, Massachusetts														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
252D—Carver coarse sand, 15 to 35 percent slopes														
Carver, coarse sand	0-2	0- 0- 0	0- 0- 0	0- 0- 0	0.18-0.20-0.24	10.00-100.00-100.00	0.12-0.34-0.55	—	45.0-80.0-95.0			5	1	180
	2-3	0- 0- 0	0- 0- 0	0- 0- 0	0.18-0.26-0.29	10.00-50.00-100.00	0.12-0.34-0.55	—	45.0-60.0-95.0					
	3-7	70-95- 98	0- 4- 25	0- 1- 6	1.59-1.60-1.60	100.00-402.50-705.00	0.05-0.07-0.13	0.0- 0.0- 0.4	1.0- 2.2- 4.0	.02	.02			
	7-10	70-95- 98	0- 4- 25	0- 1- 6	1.60-1.62-1.62	100.00-402.50-705.00	0.05-0.06-0.12	0.0- 0.0- 0.4	0.3- 0.6- 1.5	.02	.02			
	10-15	70-95- 99	0- 4- 25	0- 1- 6	1.61-1.64-1.65	100.00-402.50-705.00	0.05-0.06-0.12	0.0- 0.0- 0.3	0.3- 0.6- 1.5	.02	.02			
	15-28	70-95- 99	0- 4- 25	0- 1- 6	1.55-1.62-1.68	100.00-402.50-705.00	0.05-0.05-0.11	0.0- 0.0- 0.1	0.1- 0.2- 0.2	.02	.02			
	28-32	70-95- 99	0- 4- 25	0- 1- 6	1.55-1.62-1.68	100.00-402.50-705.00	0.05-0.05-0.11	0.0- 0.0- 0.1	0.1- 0.2- 0.2	.02	.02			
	32-67	85-95-100	0- 4- 15	0- 1- 6	1.58-1.70-1.72	100.00-402.50-705.00	0.05-0.06-0.09	0.0- 0.0- 0.2	0.0- 0.1- 0.5	.02	.02			

Physical Soil Properties–Barnstable County, Massachusetts														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
264B—Eastchop loamy fine sand, 3 to 8 percent slopes														
Eastchop	0-6	-97-	- 1-	1- 3- 4	1.10-1.30-1.50	42.34-91.74-141.14	0.07-0.10-0.12	0.0- 1.5- 2.9	1.0- 1.5-2.0	.05	.05	5	2	134
	6-10	-95-	- 1-	3- 5- 6	1.20-1.30-1.40	42.34-91.74-141.14	0.05-0.08-0.10	0.0- 1.5- 2.9	0.1- 0.5-1.0	.10	.10			
	10-25	-79-	-17-	3- 5- 6	1.30-1.40-1.50	42.34-91.74-141.14	0.05-0.08-0.10	0.0- 1.5- 2.9	0.1- 0.5-1.0	.32	.32			
	25-64	-88-	- 9-	1- 3- 5	1.30-1.45-1.60	42.34-91.74-141.14	0.03-0.07-0.10	0.0- 1.5- 2.9	0.1- 0.5-1.0	.55	.55			
435B—Plymouth loamy coarse sand, 3 to 8 percent slopes														
Plymouth	0-3	-80-	-17-	1- 3- 5	1.10-1.25-1.40	42.34-91.74-141.14	0.04-0.06-0.08	0.0- 1.5- 2.9	2.0- 3.0-4.0	.15	.15	5	2	134
	3-29	-79-	-18-	1- 3- 5	1.25-1.40-1.55	42.34-91.74-141.14	0.03-0.05-0.07	0.0- 1.5- 2.9	0.1- 0.5-1.0	.10	.20			
	29-64	-91-	- 6-	1- 3- 5	1.45-1.55-1.65	141.14-141.14-705.00	0.02-0.03-0.03	0.0- 1.5- 2.9	0.1- 0.5-1.0	.05	.10			

Physical Soil Properties–Barnstable County, Massachusetts														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
435C—Plymouth loamy coarse sand, 8 to 15 percent slopes														
Plymouth	0-3	-80-	-17-	1- 3- 5	1.10-1.25-1.40	42.34-91.74-141.14	0.04-0.06-0.08	0.0- 1.5- 2.9	2.0- 3.0- 4.0	.15	.15	5	2	134
	3-29	-79-	-18-	1- 3- 5	1.25-1.40-1.55	42.34-91.74-141.14	0.03-0.05-0.07	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.10	.20			
	29-64	-91-	- 6-	1- 3- 5	1.45-1.55-1.65	141.14-141.14-705.00	0.02-0.03-0.03	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.05	.10			
435D—Plymouth loamy coarse sand, 15 to 35 percent slopes														
Plymouth	0-3	-80-	-17-	1- 3- 5	1.10-1.25-1.40	42.34-91.74-141.14	0.04-0.06-0.08	0.0- 1.5- 2.9	2.0- 3.0- 4.0	.15	.15	5	2	134
	3-29	-79-	-18-	1- 3- 5	1.25-1.40-1.55	42.34-91.74-141.14	0.03-0.05-0.07	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.10	.20			
	29-64	-91-	- 6-	1- 3- 5	1.45-1.55-1.65	141.14-141.14-705.00	0.02-0.03-0.03	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.05	.10			

Physical Soil Properties–Barnstable County, Massachusetts														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
436B—Plymouth loamy coarse sand, 3 to 8 percent slopes, very stony														
Plymouth	0-3	-80-	-17-	1- 3- 5	1.10-1.25-1.40	42.34-91.74-141.14	0.04-0.07-0.10	0.0- 1.5- 2.9	2.0- 3.0- 5.0	.15	.15	5	2	134
	3-29	-79-	-18-	1- 3- 5	1.25-1.40-1.55	42.34-91.74-141.14	0.03-0.06-0.08	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.10	.20			
	29-64	-91-	- 6-	1- 3- 5	1.45-1.55-1.65	141.14-141.14-705.00	0.02-0.04-0.05	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.05	.10			

Physical Soil Properties–Barnstable County, Massachusetts														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
490C—Barnstable-Plymouth-Nantucket complex, rolling														
Barnstable	0-1	-67-	-30-	2- 4- 6	0.90-1.05-1.20	14.11-28.23-42.34	0.09-0.14-0.18	0.0- 1.5- 2.9	2.0- 3.5- 5.0	.20	.20	5	3	86
	1-23	-67-	-30-	2- 4- 6	1.20-1.35-1.50	14.11-28.23-42.34	0.06-0.09-0.12	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.37	.37			
	23-64	-92-	- 7-	0- 2- 3	1.30-1.45-1.60	42.34-91.74-141.14	0.02-0.05-0.08	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.10	.10			
Plymouth	0-3	-80-	-17-	1- 3- 5	1.10-1.25-1.40	42.34-91.74-141.14	0.04-0.06-0.08	0.0- 1.5- 2.9	2.0- 3.0- 4.0	.15	.15	5	2	134
	3-29	-80-	-17-	1- 3- 5	1.25-1.40-1.55	42.34-91.74-141.14	0.03-0.05-0.07	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.15	.24			
	29-64	-91-	- 6-	1- 3- 5	1.45-1.55-1.65	141.14-141.14-705.00	0.02-0.03-0.03	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.05	.10			
Nantucket	0-5	-66-	-29-	2- 5- 7	1.10-1.15-1.20	4.23-23.29-42.34	0.10-0.17-0.23	0.0- 1.5- 2.9	2.0- 3.5- 5.0	.20	.20	3	3	86
	5-27	-66-	-29-	2- 5- 7	1.20-1.30-1.40	4.23-23.29-42.34	0.08-0.13-0.18	0.0- 1.5- 2.9	0.1- 1.0- 2.0	.32	.32			
	27-64	-63-	-19-	10-18- 25	1.60-1.70-1.80	0.42-2.33-4.23	0.03-0.04-0.05	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.28	.28			

Physical Soil Properties–Barnstable County, Massachusetts														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
493D—Plymouth-Barnstable-Nantucket complex, hilly, very bouldery														
Plymouth	0-3	-80-	-17-	1- 3- 5	1.00-1.15-1.30	42.34-91.74-141.14	0.04-0.07-0.10	0.0- 1.5- 2.9	2.0- 3.0- 5.0	.15	.15	5	2	134
	3-29	-79-	-18-	1- 3- 5	1.25-1.40-1.55	42.34-91.74-141.14	0.03-0.06-0.08	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.10	.20			
	29-64	-91-	- 6-	1- 3- 5	1.45-1.55-1.65	141.14-141.14-705.00	0.02-0.04-0.05	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.05	.10			
Barnstable	0-1	-67-	-30-	2- 4- 6	0.90-1.05-1.20	14.11-28.23-42.34	0.09-0.14-0.18	0.0- 1.5- 2.9	2.0- 3.5- 6.0	.20	.20	5	3	86
	1-23	-67-	-30-	2- 4- 6	1.20-1.35-1.50	14.11-28.23-42.34	0.06-0.09-0.12	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.37	.37			
	23-64	-81-	-17-	0- 2- 3	1.30-1.45-1.60	42.34-91.74-141.14	0.02-0.05-0.08	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.24	.24			
Nantucket	0-5	-66-	-29-	2- 5- 7	1.00-1.10-1.20	4.23-23.29-42.34	0.10-0.14-0.17	0.0- 1.5- 2.9	2.0- 3.5- 6.0	.20	.20	3	3	86
	5-27	-66-	-29-	2- 5- 7	1.20-1.30-1.40	4.23-23.29-42.34	0.08-0.13-0.18	0.0- 1.5- 2.9	1.0- 2.0- 3.0	.32	.32			
	27-64	-63-	-19-	10-18- 25	1.60-1.70-1.80	0.42-2.33-4.23	0.03-0.04-0.05	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.28	.28			

Physical Soil Properties–Barnstable County, Massachusetts														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
494C—Barnstable-Plymouth-Nantucket complex, rolling, very bouldery														
Barnstable	0-1	-67-	-30-	2- 4- 6	0.90-1.05-1.20	14.11-28.23-42.34	0.09-0.14-0.18	0.0- 1.5- 2.9	2.0- 3.5- 6.0	.20	.20	5	3	86
	1-23	-67-	-30-	2- 4- 6	1.20-1.35-1.50	14.11-28.23-42.34	0.06-0.09-0.12	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.37	.37			
	23-64	-92-	- 7-	0- 2- 3	1.30-1.45-1.60	42.34-91.74-141.14	0.02-0.05-0.08	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.10	.10			
Plymouth	0-3	-80-	-17-	1- 3- 5	1.00-1.15-1.30	42.34-91.74-141.14	0.04-0.07-0.10	0.0- 1.5- 2.9	2.0- 3.0- 4.0	.15	.15	5	2	134
	3-29	-80-	-17-	1- 3- 5	1.25-1.40-1.55	42.34-91.74-141.14	0.03-0.06-0.08	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.15	.24			
	29-64	-91-	- 6-	1- 3- 5	1.45-1.55-1.65	141.14-141.14-705.00	0.02-0.04-0.05	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.05	.10			
Nantucket	0-5	-66-	-29-	2- 5- 7	1.00-1.10-1.20	4.23-23.29-42.34	0.10-0.14-0.17	0.0- 1.5- 2.9	2.0- 3.5- 6.0	.20	.20	3	3	86
	5-27	-66-	-29-	2- 5- 7	1.20-1.30-1.40	4.23-23.29-42.34	0.08-0.13-0.18	0.0- 1.5- 2.9	0.1- 1.0- 2.0	.32	.32			
	27-64	-63-	-19-	10-18- 25	1.60-1.70-1.80	0.42-2.33-4.23	0.03-0.04-0.05	0.0- 1.5- 2.9	0.1- 0.5- 1.0	.28	.28			

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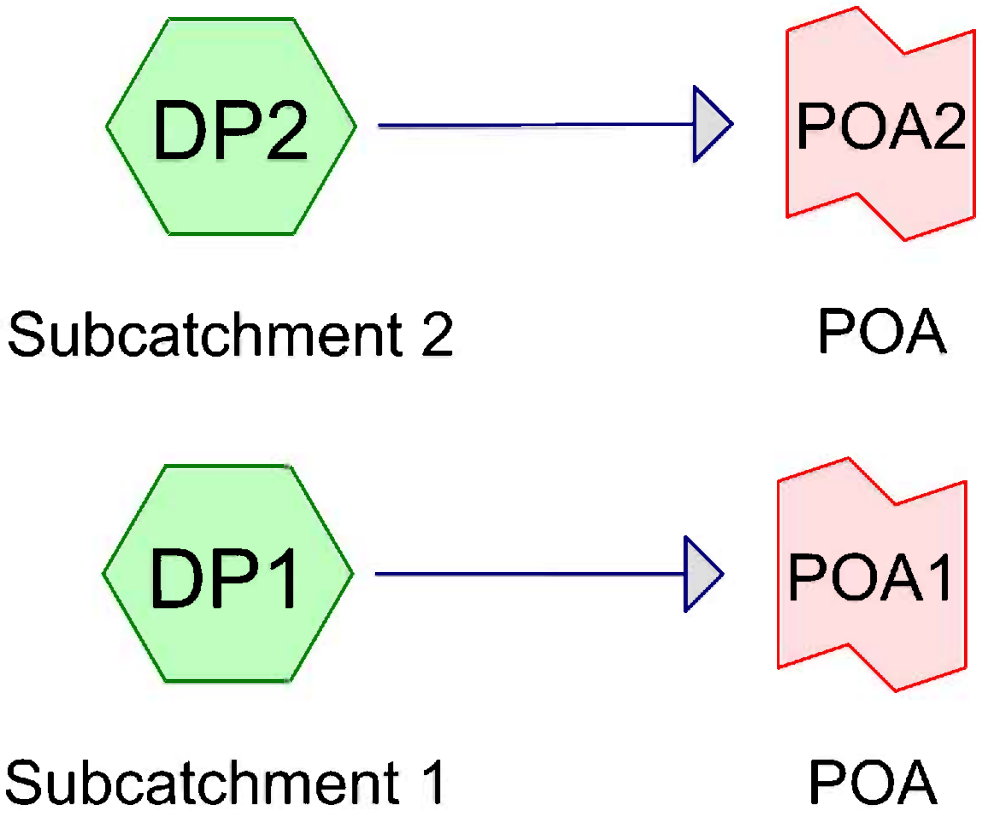
APPENDIX C: SITE PHOTOS

SITE PHOTOS

- *ALONG NORTHERN PROPERTY LINE FROM EAST TO WEST*

APPENDIX D: HYDROLOGIC CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for M191002_Pre
Prepared by {enter your company name here}, Printed 11/9/2020

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
13.594	70	1/2 acre lots, 25% imp, HSG B (DP1)
4.395	80	1/2 acre lots, 25% imp, HSG C (DP2)
2.051	98	Paved roads w/curbs & sewers, HSG B (DP1)
0.217	98	Paved roads w/curbs & sewers, HSG C (DP2)
36.076	55	Woods, Good, HSG B (DP1)
1.224	70	Woods, Good, HSG C (DP2)
57.557	**62**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
51.721	HSG B	DP1
5.836	HSG C	DP2
0.000	HSG D	
0.000	Other	
57.557		**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	13.594	4.395	0.000	0.000	17.989	1/2 acre lots, 25% imp	DP 1, DP 2
0.000	2.051	0.217	0.000	0.000	2.268	Paved roads w/curbs & sewers	DP 1, DP 2
0.000	36.076	1.224	0.000	0.000	37.300	Woods, Good	DP 1, DP 2
0.000	**51.721**	**5.836**	**0.000**	**0.000**	**57.557**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 DP1: Subcatchment 1 Runoff Area=2,252,964 sf 10.54% Impervious Runoff Depth=0.46"
Flow Length=1,435' Tc=39.1 min CN=61 Runoff=9.53 cfs 1.967 af

Subcatchment DP2: Subcatchment 2 Runoff Area=254,219 sf 22.55% Impervious Runoff Depth=1.36"
Flow Length=341' Tc=14.6 min CN=79 Runoff=6.95 cfs 0.661 af

Link POA1: POA Inflow=9.53 cfs 1.967 af
Primary=9.53 cfs 1.967 af

Link POA2: POA Inflow=6.95 cfs 0.661 af
Primary=6.95 cfs 0.661 af

Total Runoff Area = 57.557 ac Runoff Volume = 2.628 af Average Runoff Depth = 0.55"
88.25% Pervious = 50.792 ac 11.75% Impervious = 6.765 ac

Summary for Subcatchment DP1: Subcatchment 1

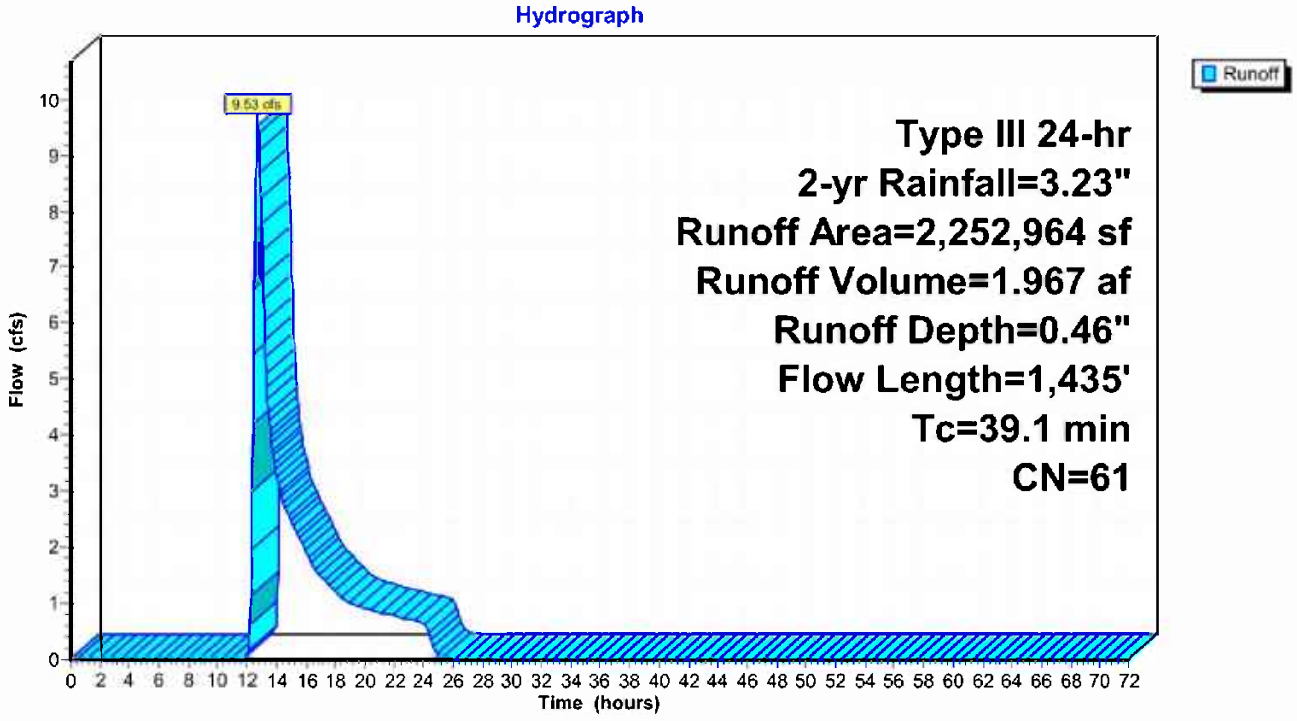
Runoff = 9.53 cfs @ 12.70 hrs, Volume= 1.967 af, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.23"

Area (sf)	CN	Description
592,175	70	1/2 acre lots, 25% imp, HSG B
89,330	98	Paved roads w/curbs & sewers, HSG B
1,571,459	55	Woods, Good, HSG B
2,252,964	61	Weighted Average
2,015,590		89.46% Pervious Area
237,374		10.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
27.9	1,385	0.0274	0.83		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
39.1	1,435	Total			

Subcatchment DP1: Subcatchment 1



Summary for Subcatchment DP2: Subcatchment 2

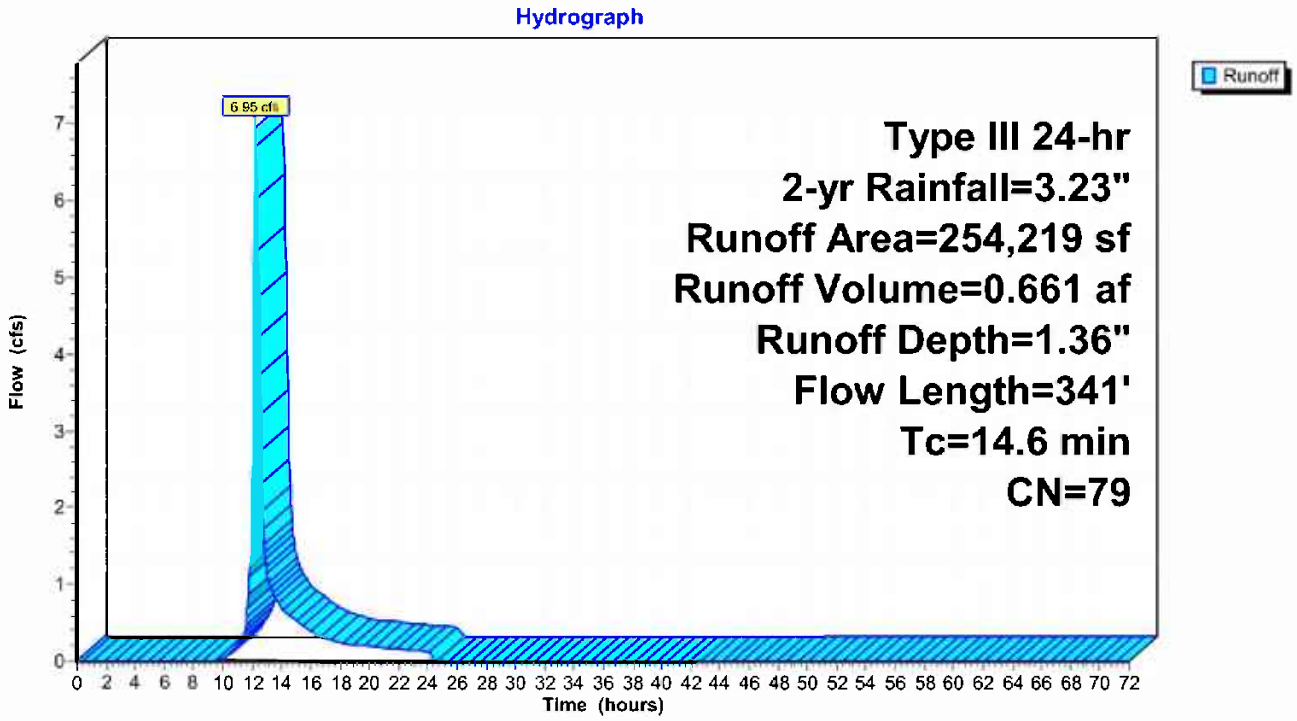
Runoff = 6.95 cfs @ 12.21 hrs, Volume= 0.661 af, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.23"

Area (sf)	CN	Description
191,427	80	1/2 acre lots, 25% imp, HSG C
9,464	98	Paved roads w/curbs & sewers, HSG C
53,328	70	Woods, Good, HSG C
254,219	79	Weighted Average
196,898		77.45% Pervious Area
57,321		22.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
3.4	291	0.0825	1.44		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
14.6	341	Total			

Subcatchment DP2: Subcatchment 2

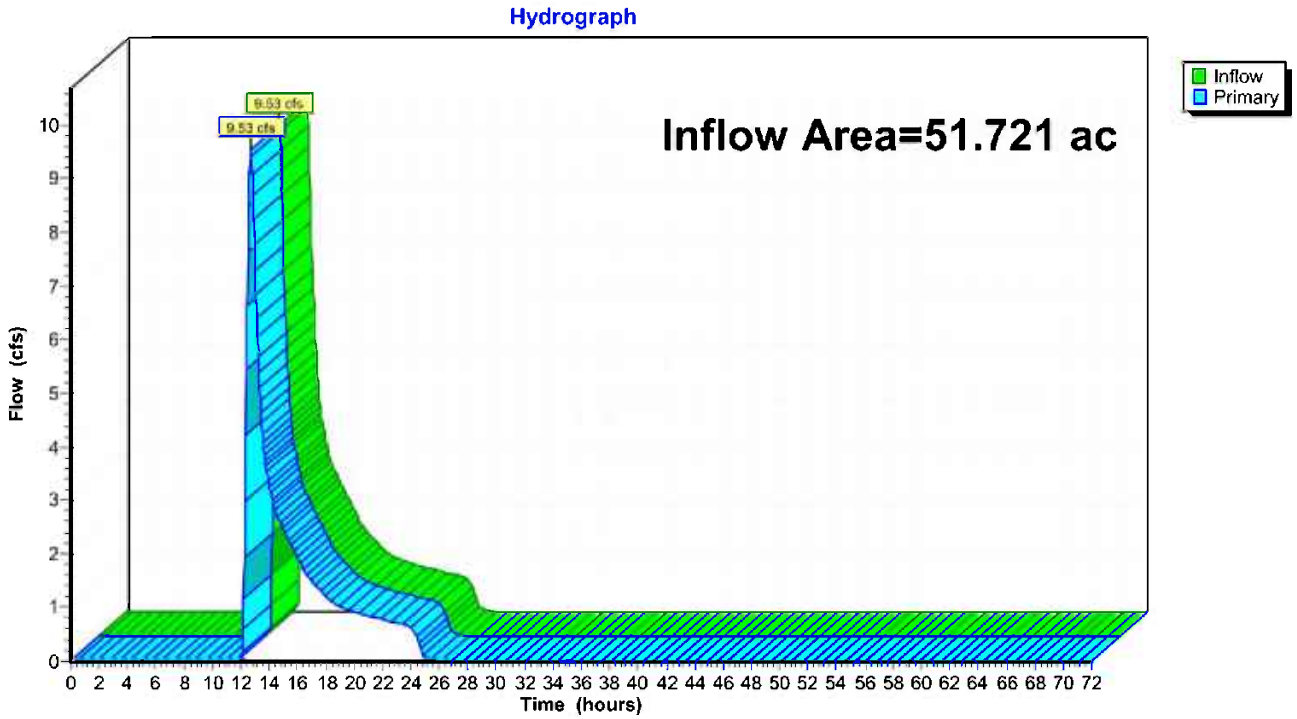


Summary for Link POA1: POA

Inflow Area = 51.721 ac, 10.54% Impervious, Inflow Depth = 0.46" for 2-yr event
Inflow = 9.53 cfs @ 12.70 hrs, Volume= 1.967 af
Primary = 9.53 cfs @ 12.70 hrs, Volume= 1.967 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA1: POA



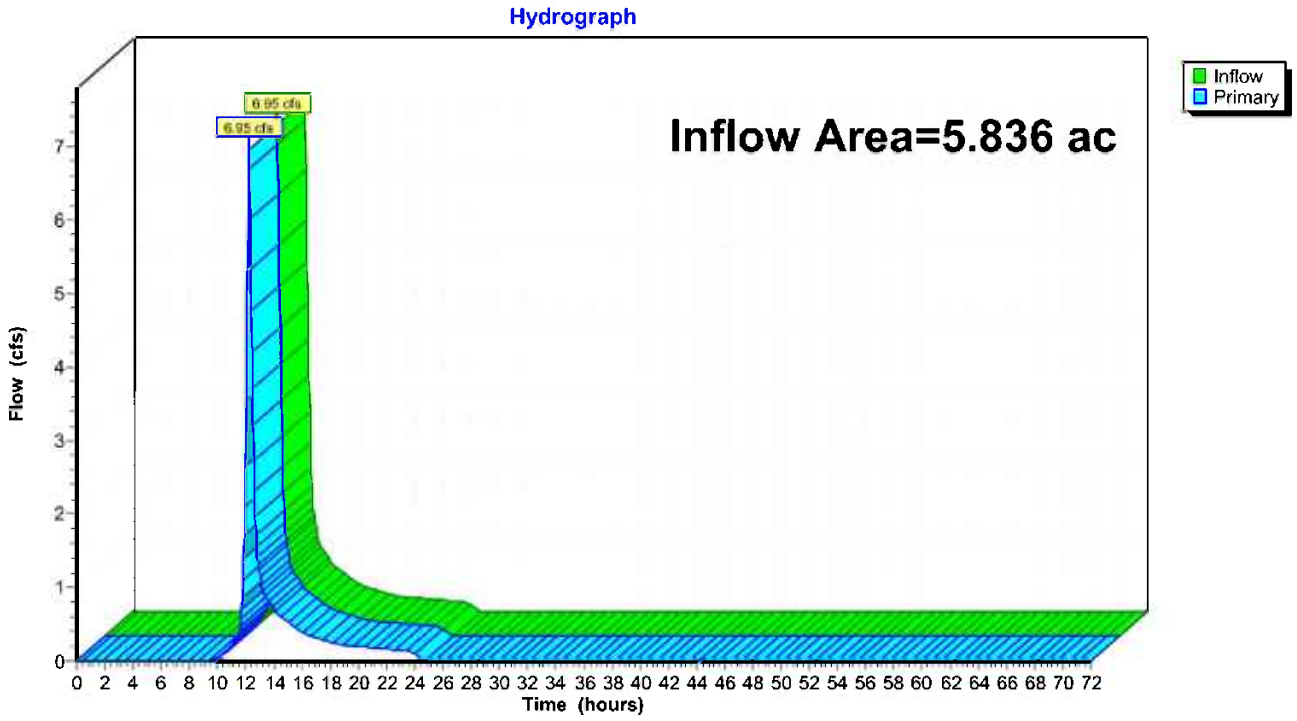
Summary for Link POA2: POA

Inflow Area = 5.836 ac, 22.55% Impervious, Inflow Depth = 1.36" for 2-yr event
Inflow = 6.95 cfs @ 12.21 hrs, Volume= 0.661 af
Primary = 6.95 cfs @ 12.21 hrs, Volume= 0.661 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA2: POA

Hydrograph



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 DP1: Subcatchment 1 Runoff Area=2,252,964 sf 10.54% Impervious Runoff Depth=1.19"
Flow Length=1,435' Tc=39.1 min CN=61 Runoff=31.84 cfs 5.116 af

Subcatchment DP2: Subcatchment 2 Runoff Area=254,219 sf 22.55% Impervious Runoff Depth=2.54"
Flow Length=341' Tc=14.6 min CN=79 Runoff=13.21 cfs 1.234 af

Link POA1: POA Inflow=31.84 cfs 5.116 af
Primary=31.84 cfs 5.116 af

Link POA2: POA Inflow=13.21 cfs 1.234 af
Primary=13.21 cfs 1.234 af

Total Runoff Area = 57.557 ac Runoff Volume = 6.349 af Average Runoff Depth = 1.32"
88.25% Pervious = 50.792 ac 11.75% Impervious = 6.765 ac

Summary for Subcatchment DP1: Subcatchment 1

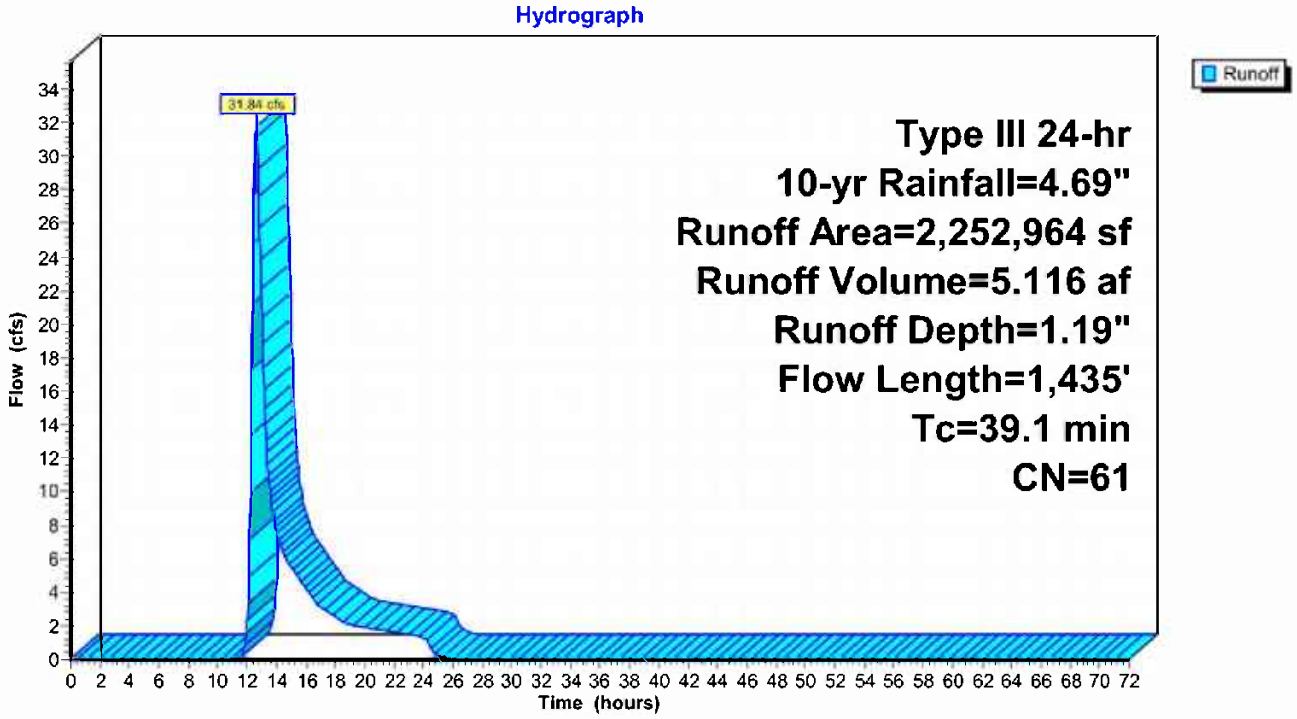
Runoff = 31.84 cfs @ 12.61 hrs, Volume= 5.116 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.69"

Area (sf)	CN	Description
592,175	70	1/2 acre lots, 25% imp, HSG B
89,330	98	Paved roads w/curbs & sewers, HSG B
1,571,459	55	Woods, Good, HSG B
2,252,964	61	Weighted Average
2,015,590		89.46% Pervious Area
237,374		10.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
27.9	1,385	0.0274	0.83		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
39.1	1,435	Total			

Subcatchment DP1: Subcatchment 1



Summary for Subcatchment DP2: Subcatchment 2

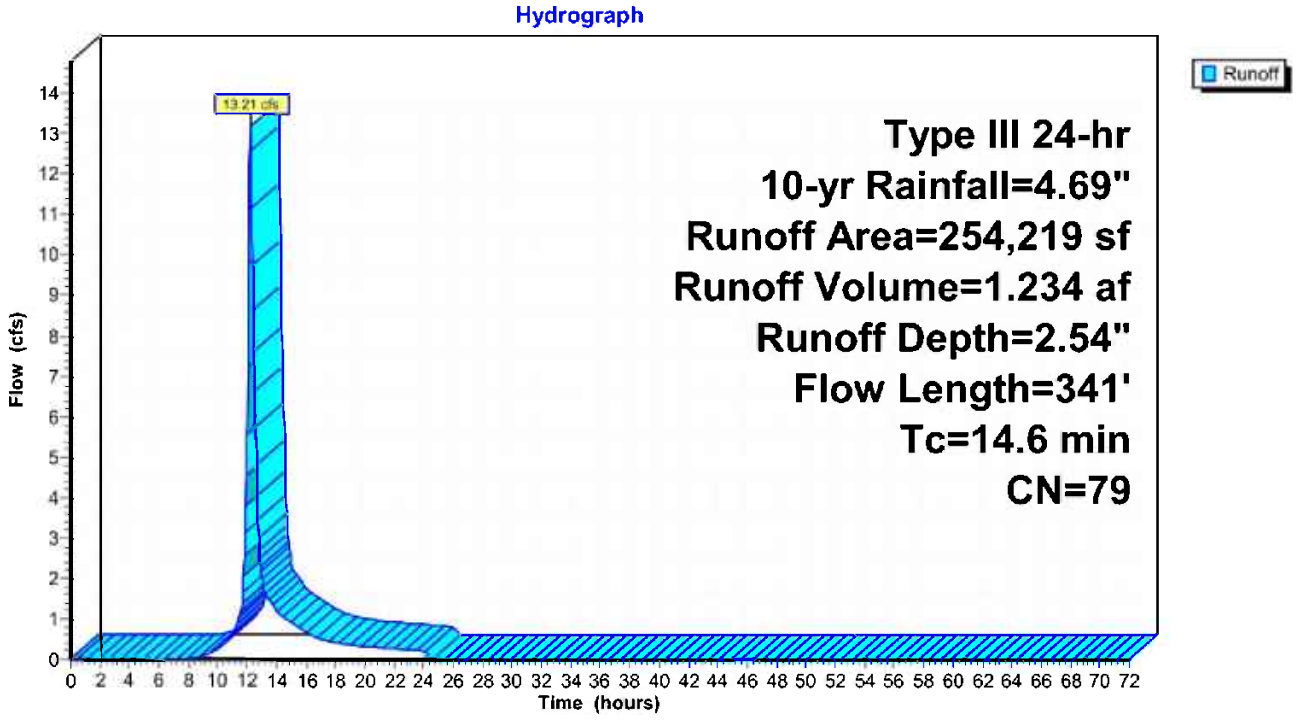
Runoff = 13.21 cfs @ 12.21 hrs, Volume= 1.234 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.69"

Area (sf)	CN	Description
191,427	80	1/2 acre lots, 25% imp, HSG C
9,464	98	Paved roads w/curbs & sewers, HSG C
53,328	70	Woods, Good, HSG C
254,219	79	Weighted Average
196,898		77.45% Pervious Area
57,321		22.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
3.4	291	0.0825	1.44		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
14.6	341	Total			

Subcatchment DP2: Subcatchment 2

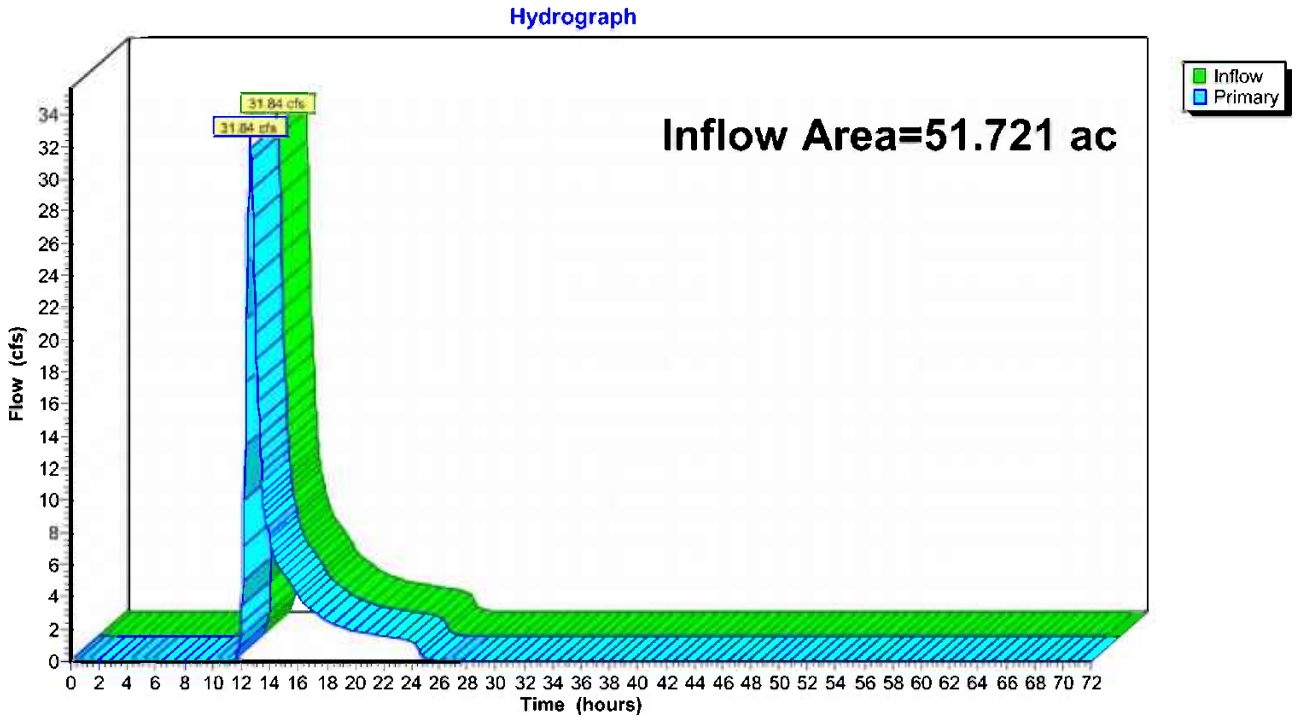


Summary for Link POA1: POA

Inflow Area = 51.721 ac, 10.54% Impervious, Inflow Depth = 1.19" for 10-yr event
Inflow = 31.84 cfs @ 12.61 hrs, Volume= 5.116 af
Primary = 31.84 cfs @ 12.61 hrs, Volume= 5.116 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA1: POA

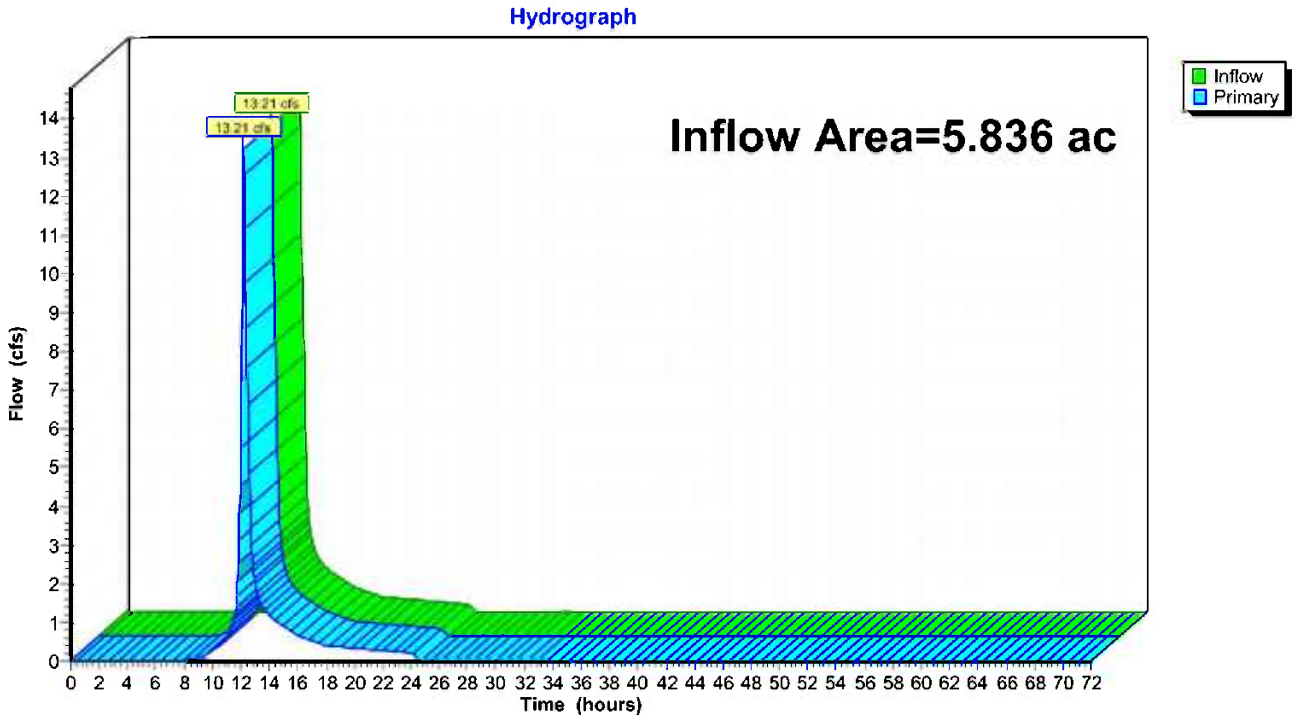


Summary for Link POA2: POA

Inflow Area = 5.836 ac, 22.55% Impervious, Inflow Depth = 2.54" for 10-yr event
Inflow = 13.21 cfs @ 12.21 hrs, Volume= 1.234 af
Primary = 13.21 cfs @ 12.21 hrs, Volume= 1.234 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA2: POA



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 DP1: Subcatchment 1 Runoff Area=2,252,964 sf 10.54% Impervious Runoff Depth=1.74"
Flow Length=1,435' Tc=39.1 min CN=61 Runoff=49.26 cfs 7.512 af

Subcatchment DP2: Subcatchment 2 Runoff Area=254,219 sf 22.55% Impervious Runoff Depth=3.32"
Flow Length=341' Tc=14.6 min CN=79 Runoff=17.31 cfs 1.617 af

Link POA1: POA Inflow=49.26 cfs 7.512 af
Primary=49.26 cfs 7.512 af

Link POA2: POA Inflow=17.31 cfs 1.617 af
Primary=17.31 cfs 1.617 af

Total Runoff Area = 57.557 ac Runoff Volume = 9.129 af Average Runoff Depth = 1.90"
88.25% Pervious = 50.792 ac 11.75% Impervious = 6.765 ac

Summary for Subcatchment DP1: Subcatchment 1

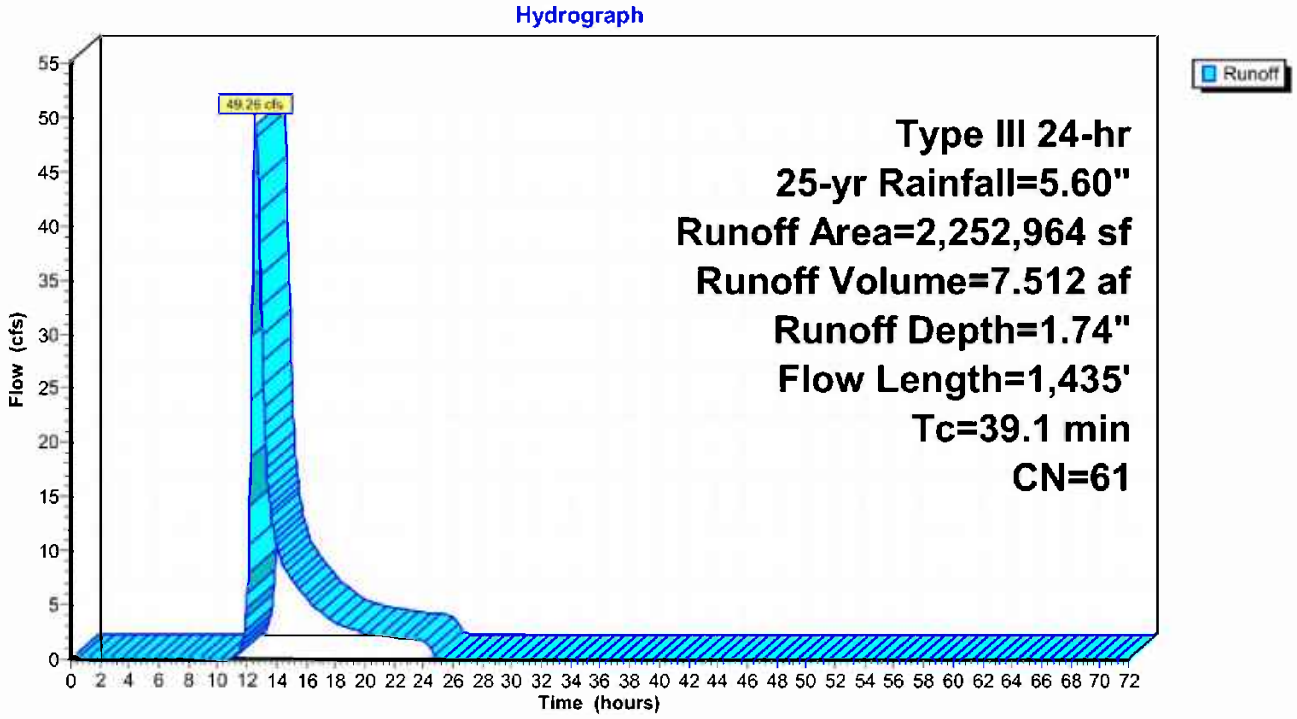
Runoff = 49.26 cfs @ 12.59 hrs, Volume= 7.512 af, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.60"

Area (sf)	CN	Description
592,175	70	1/2 acre lots, 25% imp, HSG B
89,330	98	Paved roads w/curbs & sewers, HSG B
1,571,459	55	Woods, Good, HSG B
2,252,964	61	Weighted Average
2,015,590		89.46% Pervious Area
237,374		10.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
27.9	1,385	0.0274	0.83		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
39.1	1,435	Total			

Subcatchment DP1: Subcatchment 1



Summary for Subcatchment DP2: Subcatchment 2

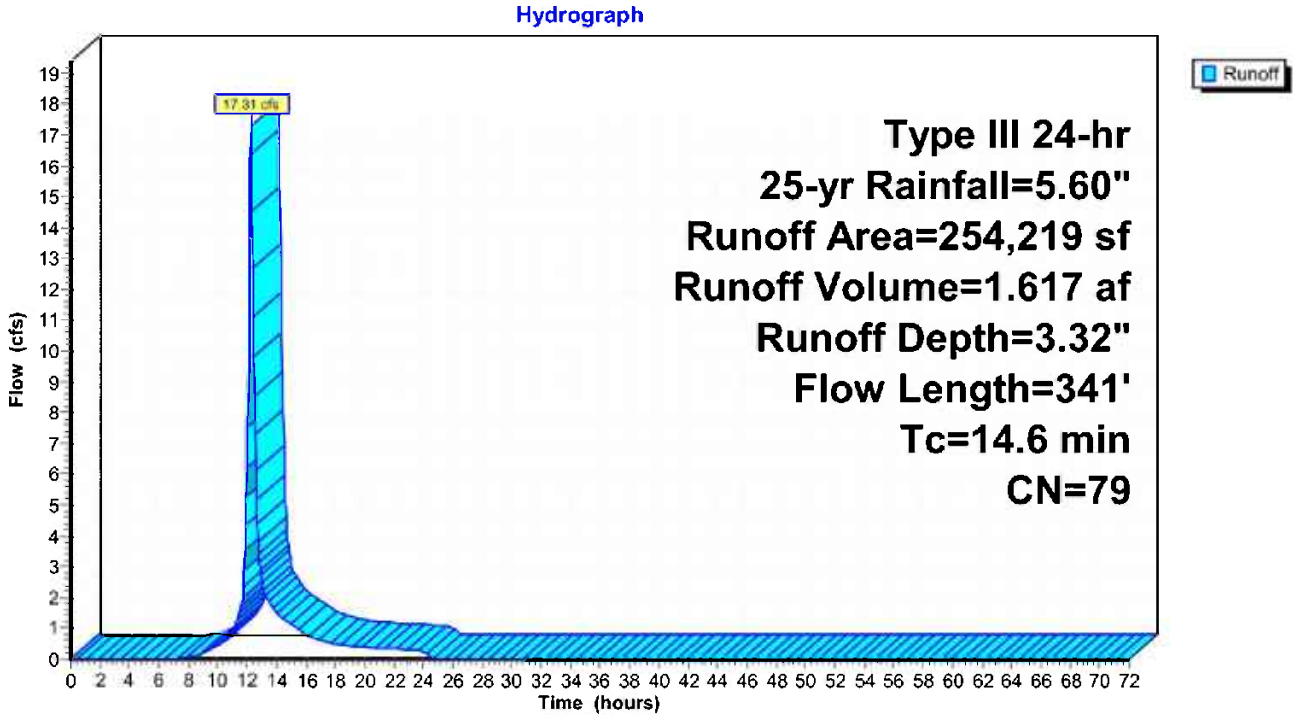
Runoff = 17.31 cfs @ 12.20 hrs, Volume= 1.617 af, Depth= 3.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.60"

Area (sf)	CN	Description
191,427	80	1/2 acre lots, 25% imp, HSG C
9,464	98	Paved roads w/curbs & sewers, HSG C
53,328	70	Woods, Good, HSG C
254,219	79	Weighted Average
196,898		77.45% Pervious Area
57,321		22.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
3.4	291	0.0825	1.44		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
14.6	341	Total			

Subcatchment DP2: Subcatchment 2

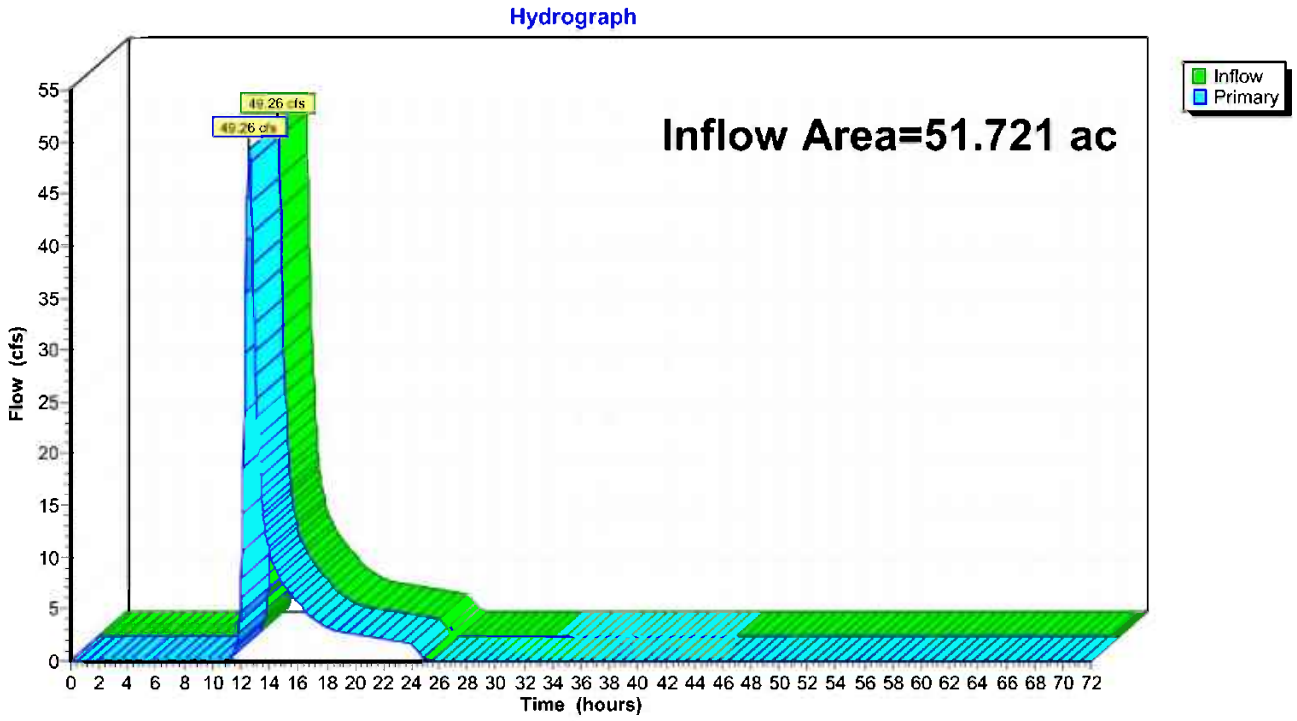


Summary for Link POA1: POA

Inflow Area = 51.721 ac, 10.54% Impervious, Inflow Depth = 1.74" for 25-yr event
Inflow = 49.26 cfs @ 12.59 hrs, Volume= 7.512 af
Primary = 49.26 cfs @ 12.59 hrs, Volume= 7.512 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA1: POA

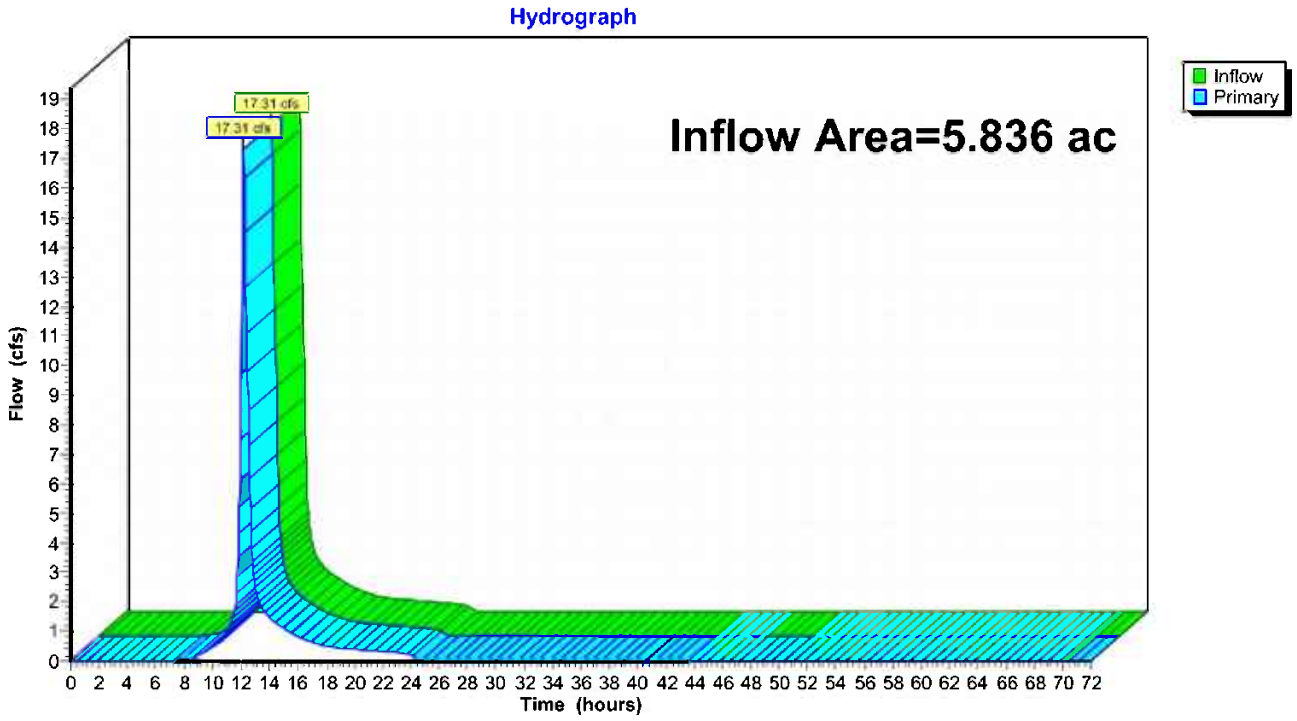


Summary for Link POA2: POA

Inflow Area = 5.836 ac, 22.55% Impervious, Inflow Depth = 3.32" for 25-yr event
Inflow = 17.31 cfs @ 12.20 hrs, Volume= 1.617 af
Primary = 17.31 cfs @ 12.20 hrs, Volume= 1.617 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA2: POA



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 DP1: Subcatchment 1 Runoff Area=2,252,964 sf 10.54% Impervious Runoff Depth=2.20"
Flow Length=1,435' Tc=39.1 min CN=61 Runoff=63.65 cfs 9.491 af

Subcatchment DP2: Subcatchment 2 Runoff Area=254,219 sf 22.55% Impervious Runoff Depth=3.94"
Flow Length=341' Tc=14.6 min CN=79 Runoff=20.47 cfs 1.916 af

Link POA1: POA Inflow=63.65 cfs 9.491 af
Primary=63.65 cfs 9.491 af

Link POA2: POA Inflow=20.47 cfs 1.916 af
Primary=20.47 cfs 1.916 af

Total Runoff Area = 57.557 ac Runoff Volume = 11.407 af Average Runoff Depth = 2.38"
88.25% Pervious = 50.792 ac 11.75% Impervious = 6.765 ac

Summary for Subcatchment DP1: Subcatchment 1

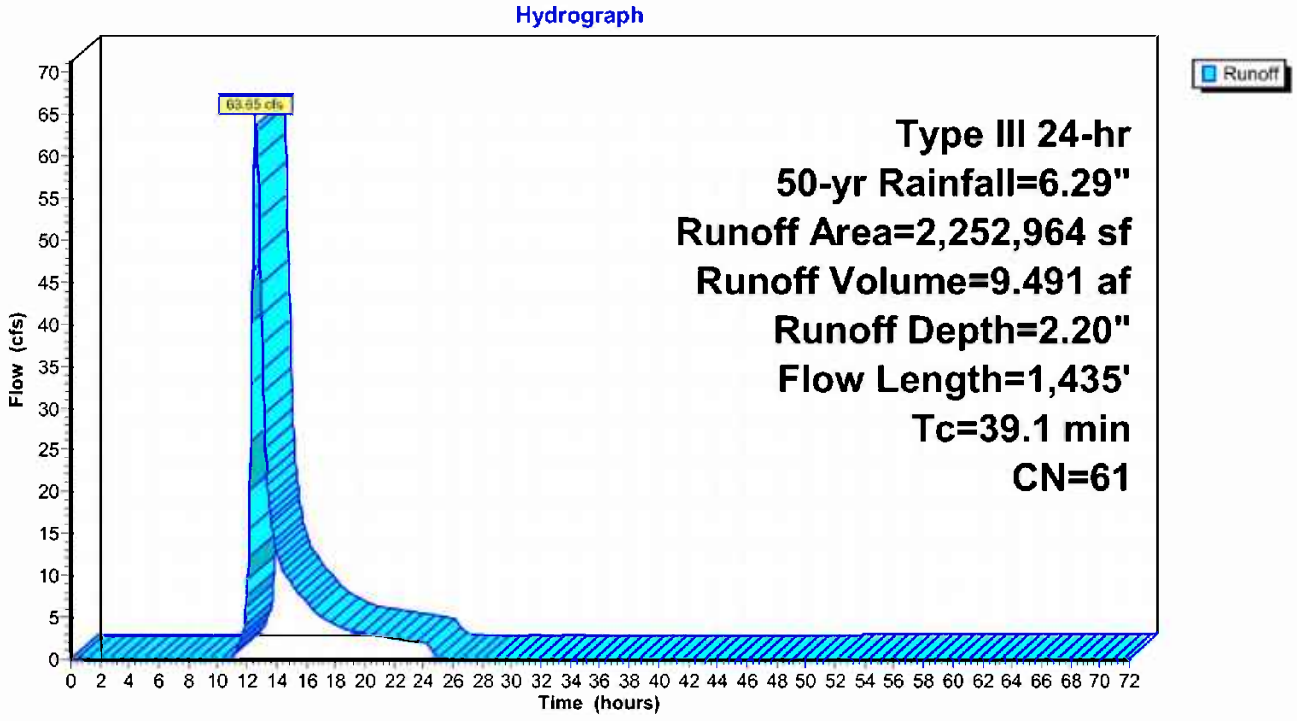
Runoff = 63.65 cfs @ 12.58 hrs, Volume= 9.491 af, Depth= 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-yr Rainfall=6.29"

Area (sf)	CN	Description
592,175	70	1/2 acre lots, 25% imp, HSG B
89,330	98	Paved roads w/curbs & sewers, HSG B
1,571,459	55	Woods, Good, HSG B
2,252,964	61	Weighted Average
2,015,590		89.46% Pervious Area
237,374		10.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
27.9	1,385	0.0274	0.83		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
39.1	1,435	Total			

Subcatchment DP1: Subcatchment 1



Summary for Subcatchment DP2: Subcatchment 2

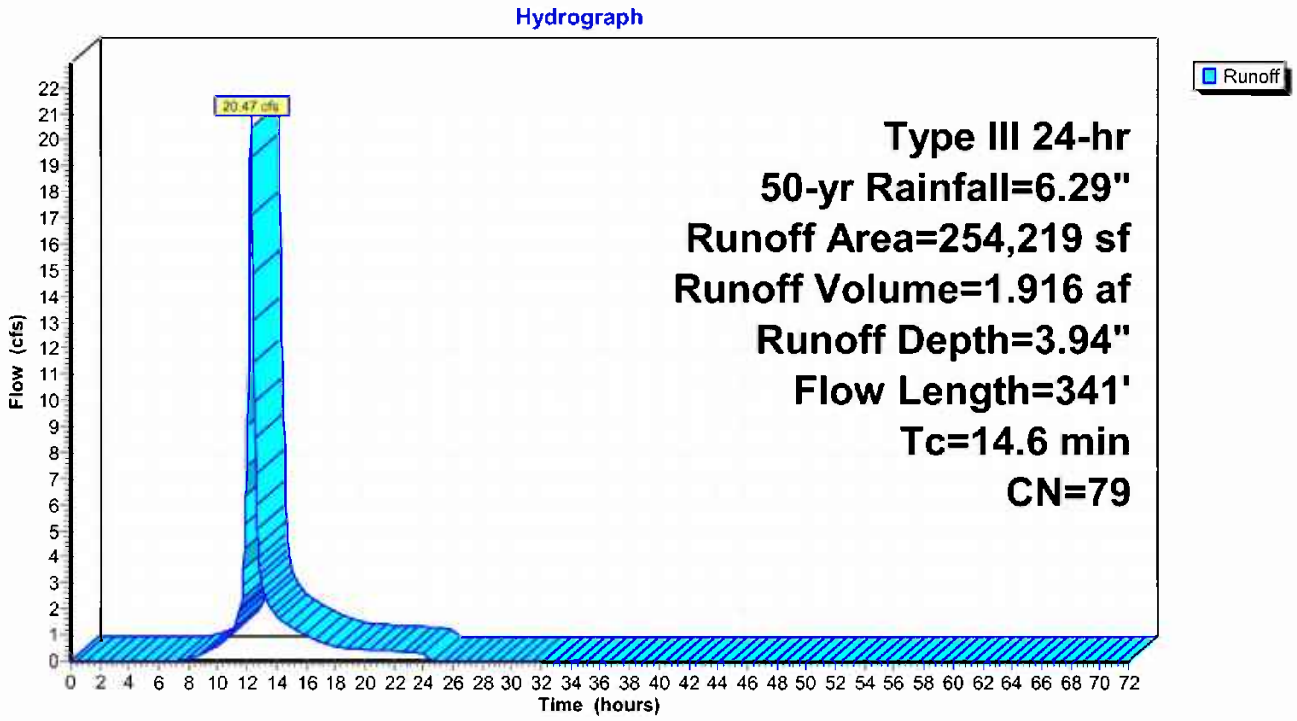
Runoff = 20.47 cfs @ 12.20 hrs, Volume= 1.916 af, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-yr Rainfall=6.29"

Area (sf)	CN	Description
191,427	80	1/2 acre lots, 25% imp, HSG C
9,464	98	Paved roads w/curbs & sewers, HSG C
53,328	70	Woods, Good, HSG C
254,219	79	Weighted Average
196,898		77.45% Pervious Area
57,321		22.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
3.4	291	0.0825	1.44		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
14.6	341	Total			

Subcatchment DP2: Subcatchment 2

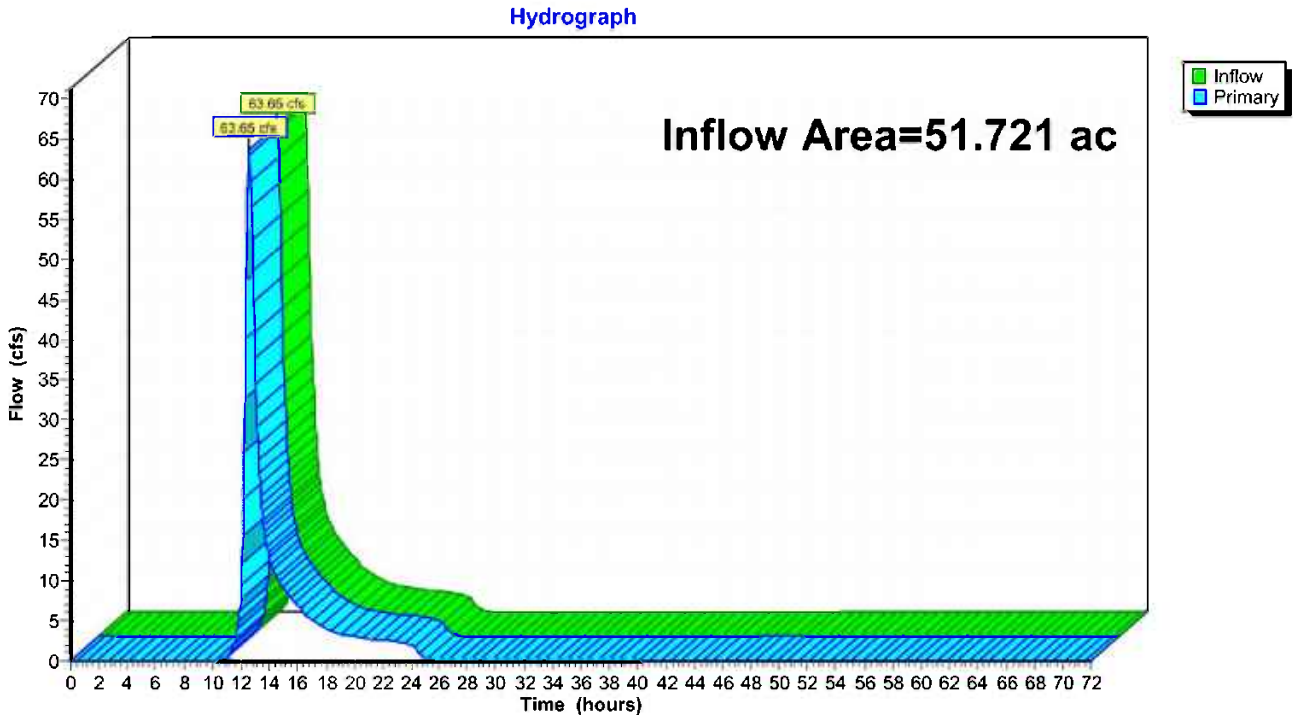


Summary for Link POA1: POA

Inflow Area = 51.721 ac, 10.54% Impervious, Inflow Depth = 2.20" for 50-yr event
Inflow = 63.65 cfs @ 12.58 hrs, Volume= 9.491 af
Primary = 63.65 cfs @ 12.58 hrs, Volume= 9.491 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA1: POA

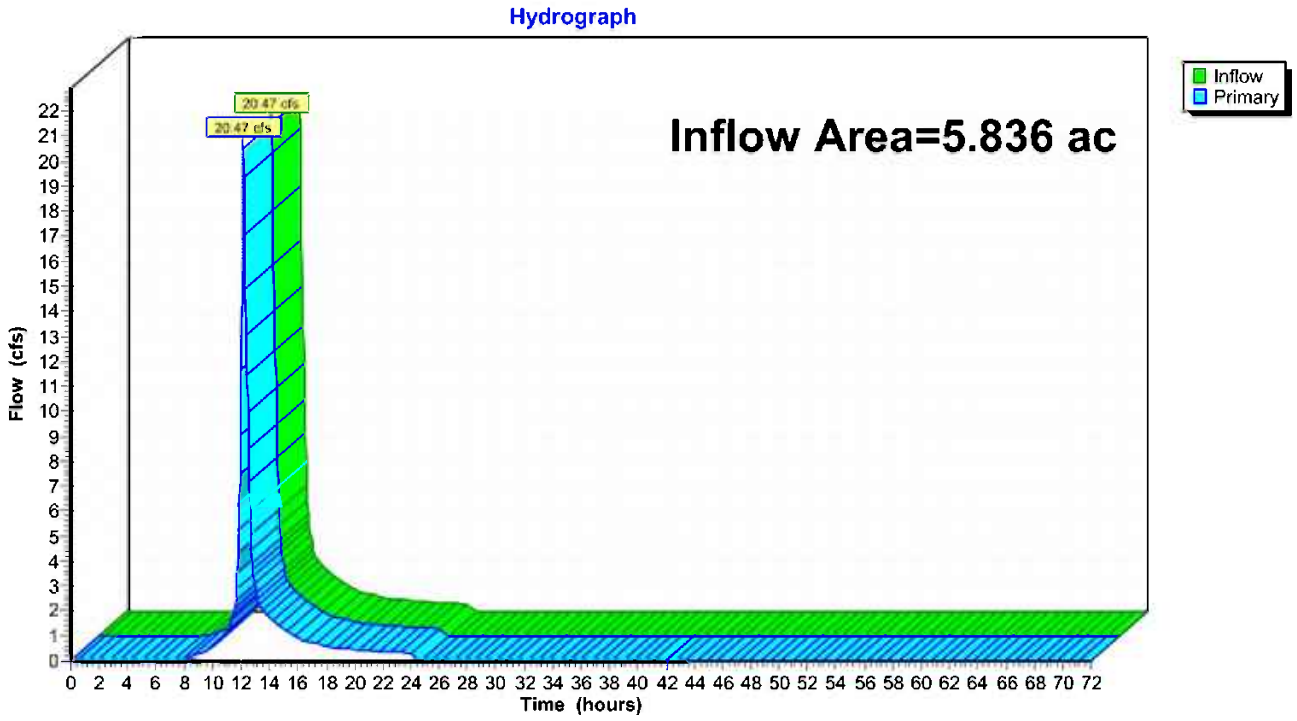


Summary for Link POA2: POA

Inflow Area = 5.836 ac, 22.55% Impervious, Inflow Depth = 3.94" for 50-yr event
Inflow = 20.47 cfs @ 12.20 hrs, Volume= 1.916 af
Primary = 20.47 cfs @ 12.20 hrs, Volume= 1.916 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA2: POA



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 DP1: Subcatchment 1 Runoff Area=2,252,964 sf 10.54% Impervious Runoff Depth=2.70"
Flow Length=1,435' Tc=39.1 min CN=61 Runoff=79.34 cfs 11.646 af

Subcatchment DP2: Subcatchment 2 Runoff Area=254,219 sf 22.55% Impervious Runoff Depth=4.58"
Flow Length=341' Tc=14.6 min CN=79 Runoff=23.75 cfs 2.230 af

Link POA1: POA Inflow=79.34 cfs 11.646 af
Primary=79.34 cfs 11.646 af

Link POA2: POA Inflow=23.75 cfs 2.230 af
Primary=23.75 cfs 2.230 af

Total Runoff Area = 57.557 ac Runoff Volume = 13.875 af Average Runoff Depth = 2.89"
88.25% Pervious = 50.792 ac 11.75% Impervious = 6.765 ac

Summary for Subcatchment DP1: Subcatchment 1

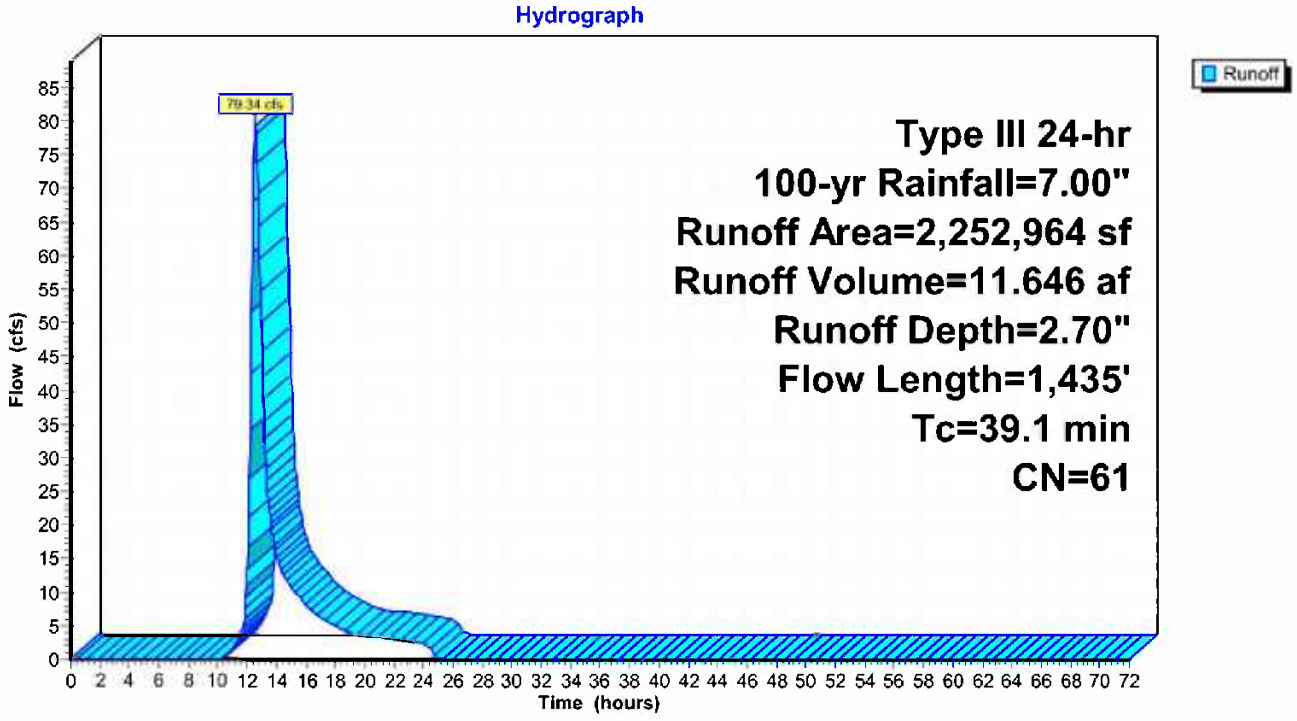
Runoff = 79.34 cfs @ 12.57 hrs, Volume= 11.646 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
592,175	70	1/2 acre lots, 25% imp, HSG B
89,330	98	Paved roads w/curbs & sewers, HSG B
1,571,459	55	Woods, Good, HSG B
2,252,964	61	Weighted Average
2,015,590		89.46% Pervious Area
237,374		10.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
27.9	1,385	0.0274	0.83		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
39.1	1,435	Total			

Subcatchment DP1: Subcatchment 1



Summary for Subcatchment DP2: Subcatchment 2

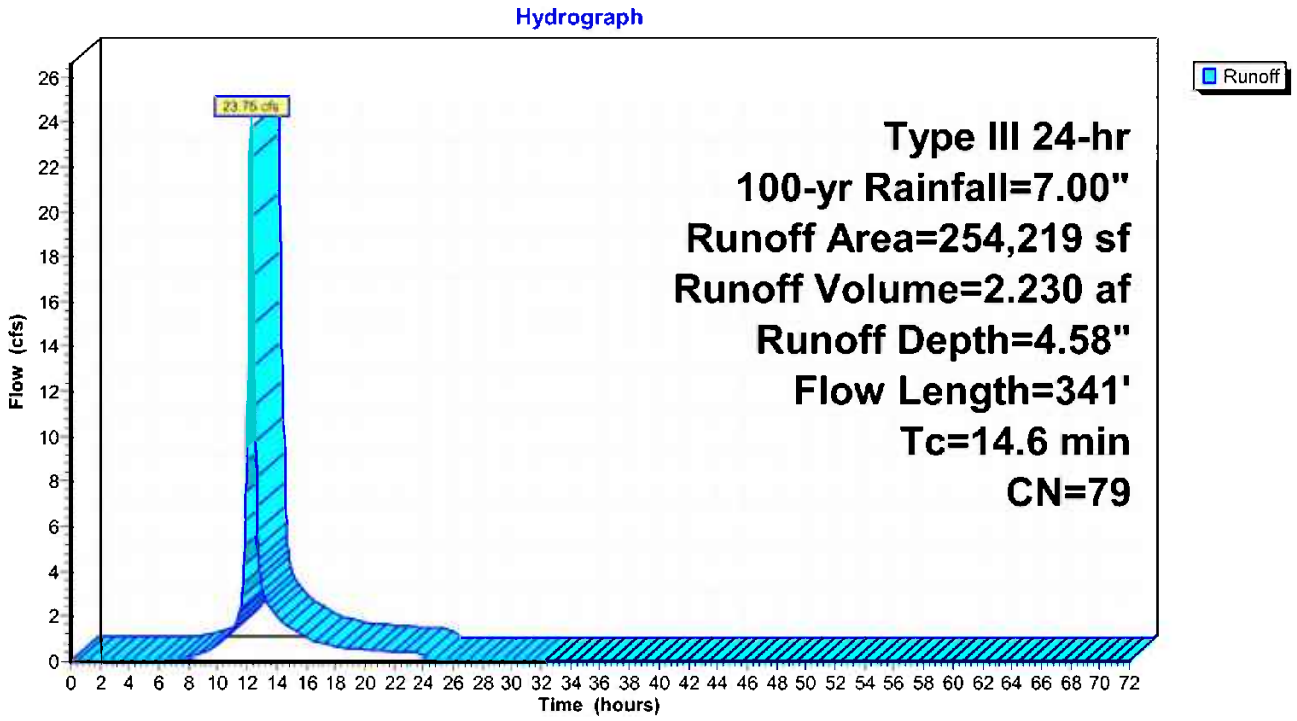
Runoff = 23.75 cfs @ 12.20 hrs, Volume= 2.230 af, Depth= 4.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
191,427	80	1/2 acre lots, 25% imp, HSG C
9,464	98	Paved roads w/curbs & sewers, HSG C
53,328	70	Woods, Good, HSG C
254,219	79	Weighted Average
196,898		77.45% Pervious Area
57,321		22.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
3.4	291	0.0825	1.44		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
14.6	341	Total			

Subcatchment DP2: Subcatchment 2

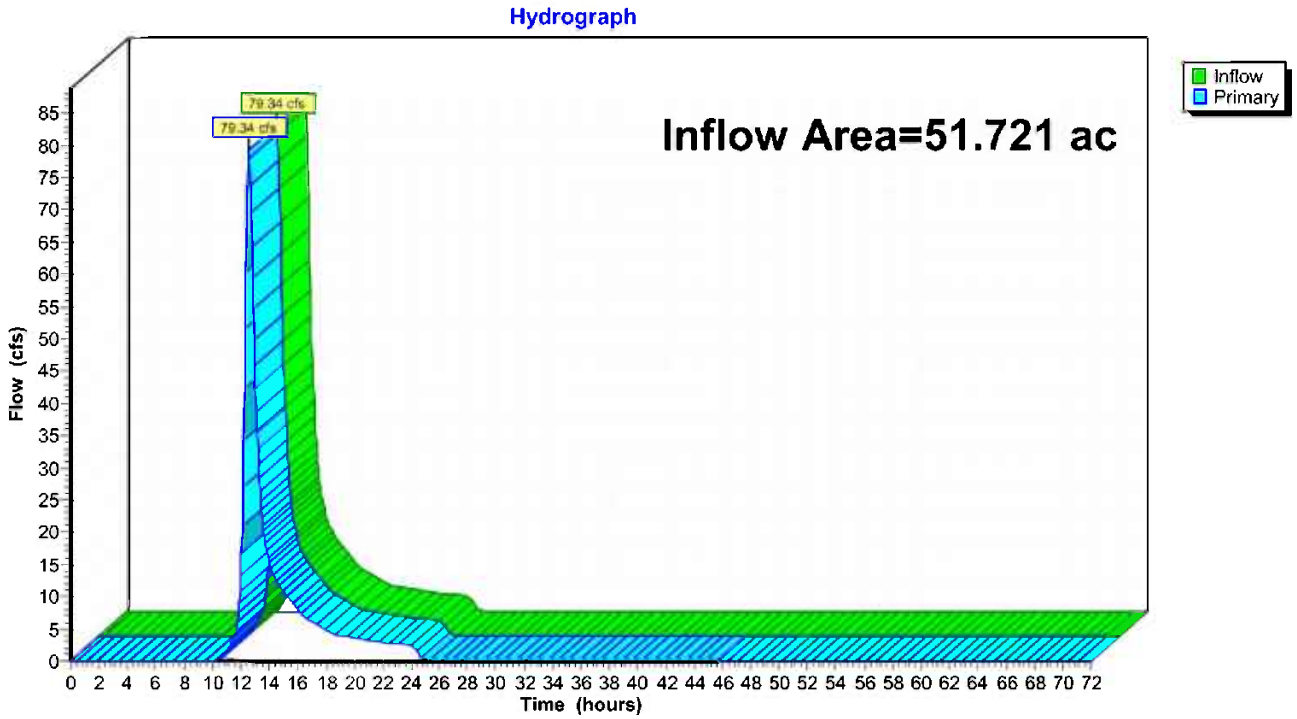


Summary for Link POA1: POA

Inflow Area = 51.721 ac, 10.54% Impervious, Inflow Depth = 2.70" for 100-yr event
Inflow = 79.34 cfs @ 12.57 hrs, Volume= 11.646 af
Primary = 79.34 cfs @ 12.57 hrs, Volume= 11.646 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA1: POA

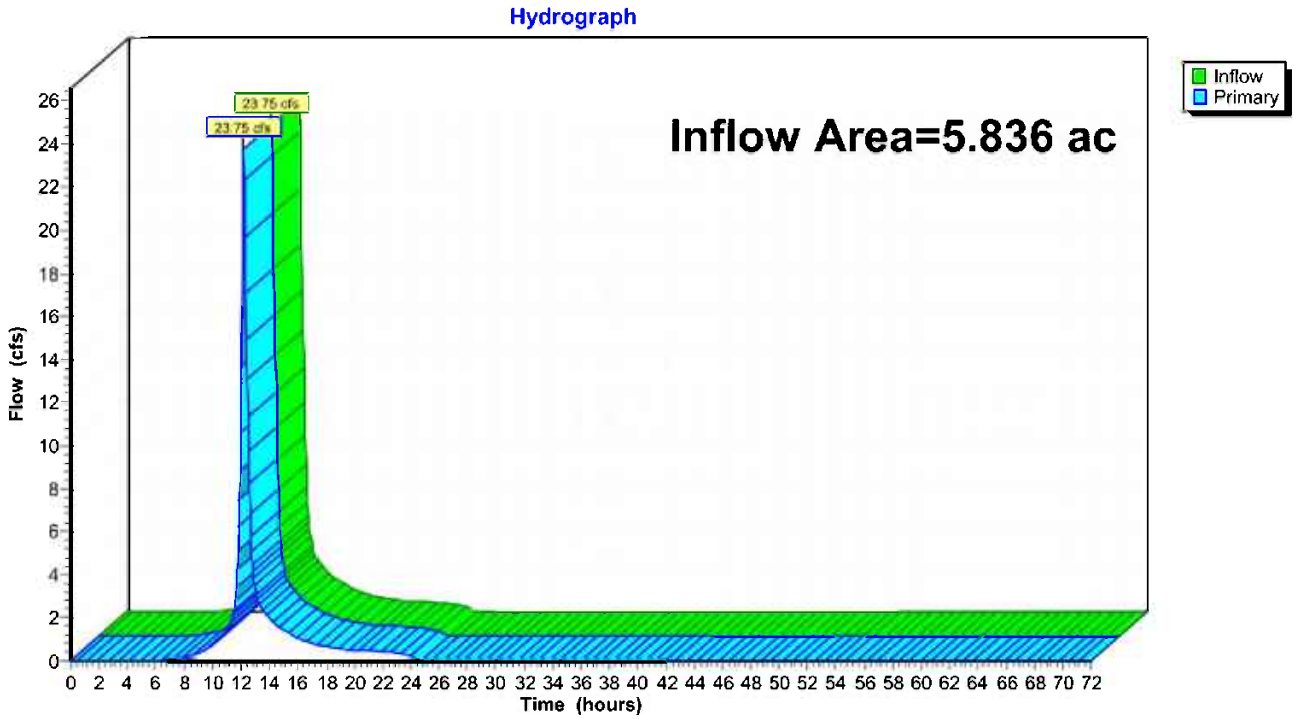


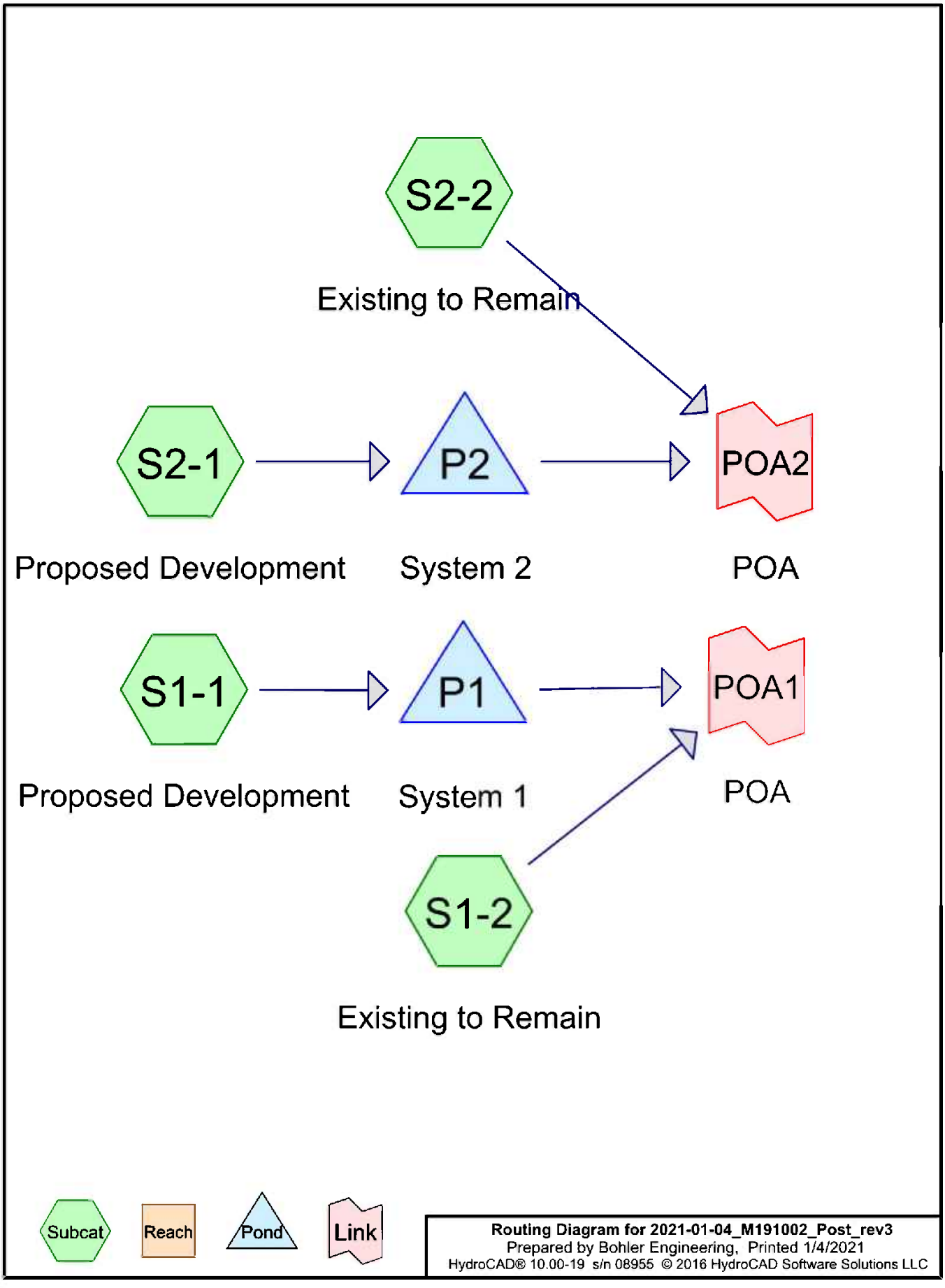
Summary for Link POA2: POA

Inflow Area = 5.836 ac, 22.55% Impervious, Inflow Depth = 4.58" for 100-yr event
Inflow = 23.75 cfs @ 12.20 hrs, Volume= 2.230 af
Primary = 23.75 cfs @ 12.20 hrs, Volume= 2.230 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA2: POA




S2-2
Existing to Remain
S2-1
P2
POA2
Proposed Development
System 2
POA
S1-1
P1
POA1
Proposed Development
System 1
POA
S1-2
Existing to Remain
Subcat
Reach
Pond
Link
Routing Diagram for 2021-01-04_M191002_Post_rev3
Prepared by Bohler Engineering, Printed 1/4/2021
HydroCAD® 10.00-19 s/n 08955 © 2016 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
13.594	70	1/2 acre lots, 25% imp, HSG B (S1-2)
4.395	80	1/2 acre lots, 25% imp, HSG C (S2-2)
0.496	83	1/4 acre lots, 38% imp, HSG C (S2-1)
4.304	61	>75% Grass cover, Good, HSG B (S1-1)
4.082	98	Paved roads w/curbs & sewers, HSG B (S1-1, S1-2)
0.453	98	Paved roads w/curbs & sewers, HSG C (S2-1, S2-2)
1.395	98	Roofs, HSG B (S1-1)
28.346	55	Woods, Good, HSG B (S1-2)
0.492	70	Woods, Good, HSG C (S2-2)
57.557	**66**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
51.721	HSG B	S1-1, S1-2
5.836	HSG C	S2-1, S2-2
0.000	HSG D	
0.000	Other	
57.557		**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	13.594	4.395	0.000	0.000	17.989	1/2 acre lots, 25% imp	S1-2, S2-2
0.000	0.000	0.496	0.000	0.000	0.496	1/4 acre lots, 38% imp	S2-1
0.000	4.304	0.000	0.000	0.000	4.304	>75% Grass cover, Good	S1-1
0.000	4.082	0.453	0.000	0.000	4.535	Paved roads w/curbs & sewers	S1-1, S1-2, S2-1, S2-2
0.000	1.395	0.000	0.000	0.000	1.395	Roofs	S1-1
0.000	28.346	0.492	0.000	0.000	28.838	Woods, Good	S1-2, S2-2
0.000	**51.721**	**5.836**	**0.000**	**0.000**	**57.557**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 S1-1: Proposed Runoff Area=336,721 sf 44.32% Impervious Runoff Depth=1.23"
Tc=6.0 min CN=77 Runoff=10.70 cfs 0.794 af

Subcatchment S1-2: Existing to Remain Runoff Area=1,916,243 sf 12.39% Impervious Runoff Depth=0.49"
Flow Length=1,435' Tc=39.1 min CN=62 Runoff=9.16 cfs 1.810 af

Subcatchment S2-1: Proposed Runoff Area=31,888 sf 57.99% Impervious Runoff Depth=2.02"
Tc=6.0 min CN=88 Runoff=1.69 cfs 0.123 af

Subcatchment S2-2: Existing to Remain Runoff Area=222,331 sf 25.78% Impervious Runoff Depth=1.43"
Flow Length=341' Tc=14.6 min CN=80 Runoff=6.41 cfs 0.606 af

Pond P1: System 1 Peak Elev=1.93' Storage=8,333 cf Inflow=10.70 cfs 0.794 af
Discarded=2.21 cfs 0.778 af Primary=0.40 cfs 0.017 af Outflow=2.61 cfs 0.794 af

Pond P2: System 2 Peak Elev=2.42' Storage=1,445 cf Inflow=1.69 cfs 0.123 af
Discarded=0.17 cfs 0.099 af Primary=0.37 cfs 0.025 af Outflow=0.54 cfs 0.123 af

Link POA1: POA Inflow=9.50 cfs 1.827 af
Primary=9.50 cfs 1.827 af

Link POA2: POA Inflow=6.71 cfs 0.631 af
Primary=6.71 cfs 0.631 af

Total Runoff Area = 57.557 ac Runoff Volume = 3.335 af Average Runoff Depth = 0.70"
81.56% Pervious = 46.942 ac 18.44% Impervious = 10.615 ac

Summary for Subcatchment S1-1: Proposed Development

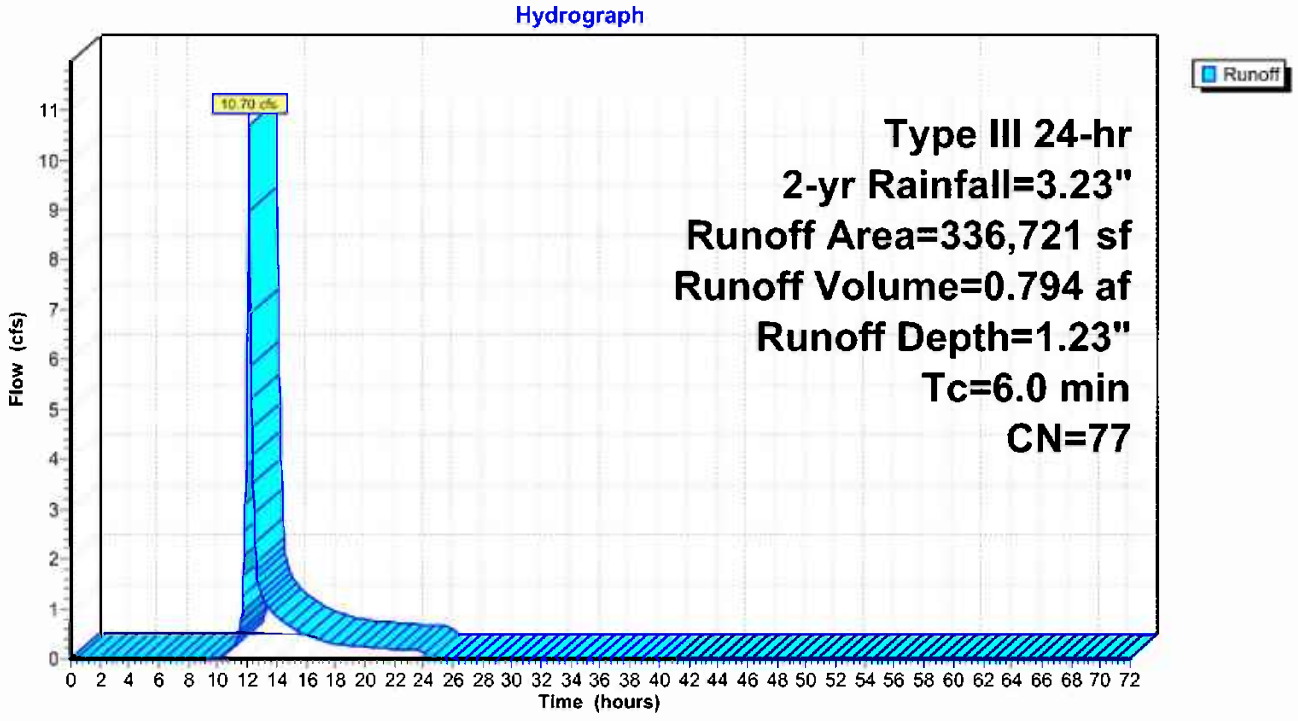
Runoff = 10.70 cfs @ 12.10 hrs, Volume= 0.794 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.23"

Area (sf)	CN	Description
88,475	98	Paved roads w/curbs & sewers, HSG B
187,496	61	>75% Grass cover, Good, HSG B
60,750	98	Roofs, HSG B
336,721	77	Weighted Average
187,496		55.68% Pervious Area
149,225		44.32% Impervious Area

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

Subcatchment S1-1: Proposed Development



Summary for Subcatchment S1-2: Existing to Remain

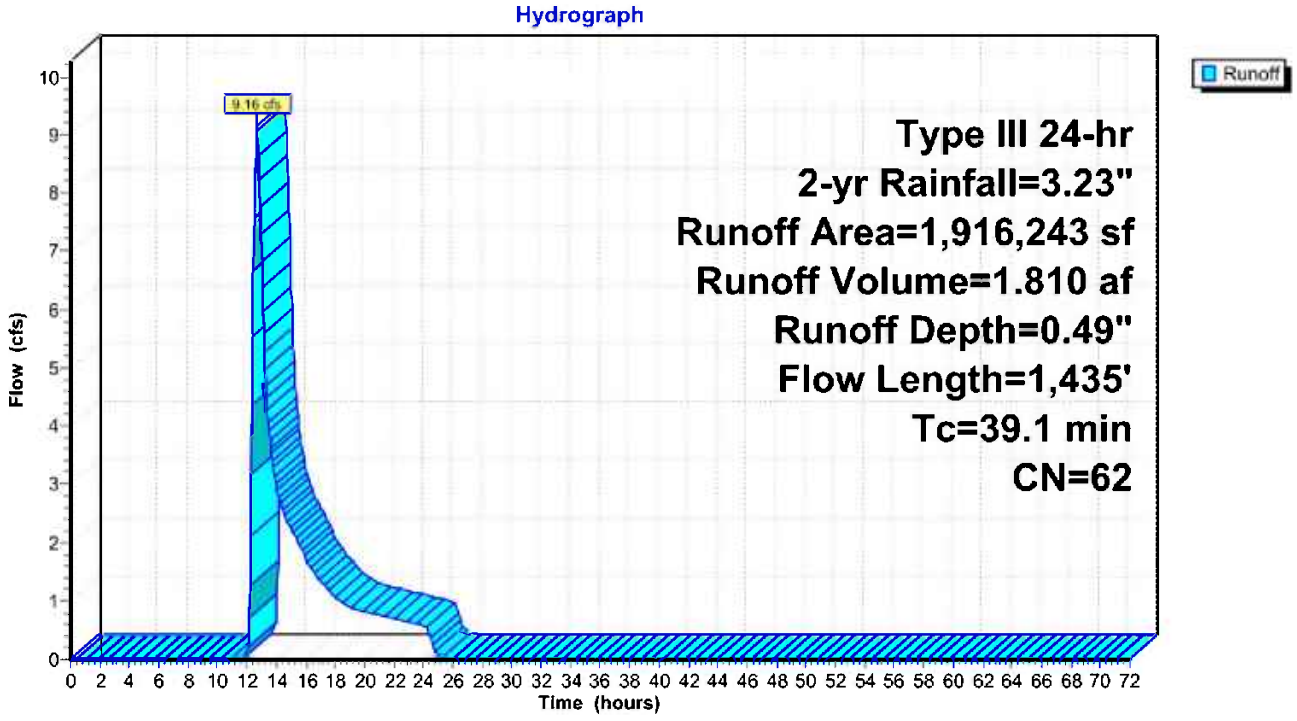
Runoff = 9.16 cfs @ 12.68 hrs, Volume= 1.810 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.23"

Area (sf)	CN	Description
592,175	70	1/2 acre lots, 25% imp, HSG B
89,330	98	Paved roads w/curbs & sewers, HSG B
1,234,738	55	Woods, Good, HSG B
1,916,243	62	Weighted Average
1,678,869		87.61% Pervious Area
237,374		12.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
27.9	1,385	0.0274	0.83		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
39.1	1,435	Total			

Subcatchment S1-2: Existing to Remain



Summary for Subcatchment S2-1: Proposed Development

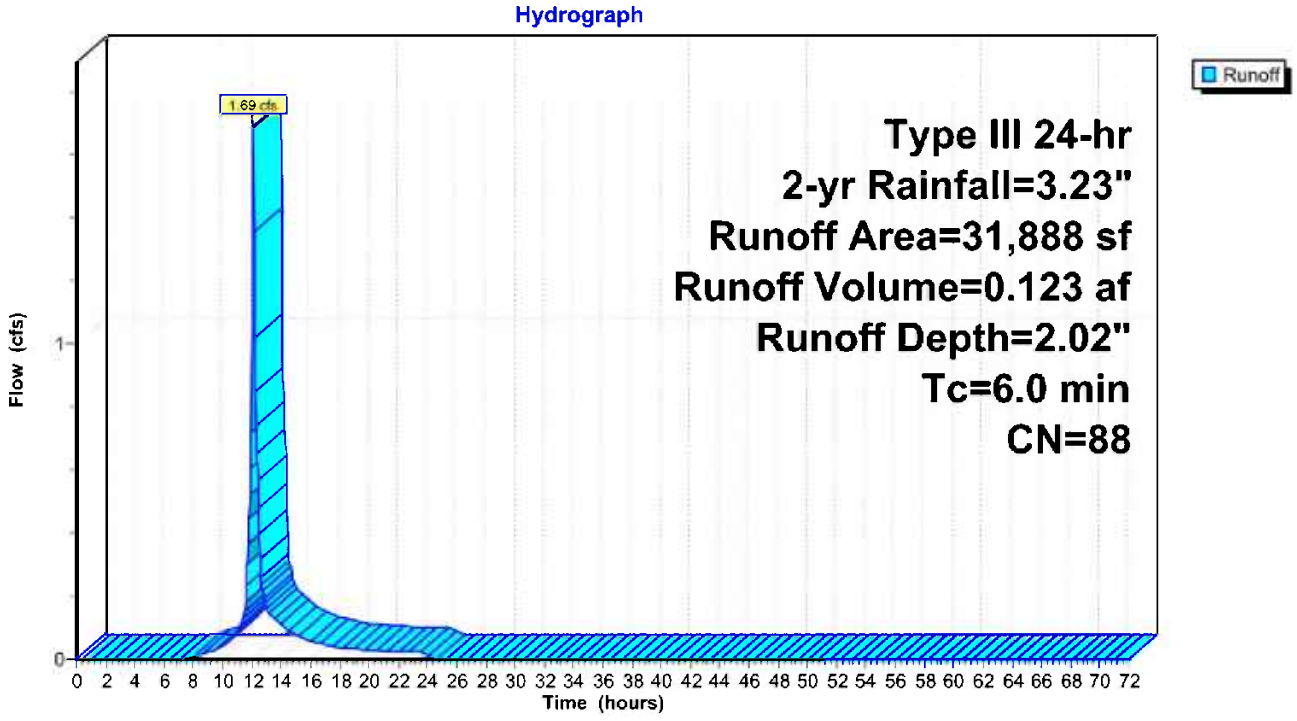
Runoff = 1.69 cfs @ 12.09 hrs, Volume= 0.123 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.23"

Area (sf)	CN	Description
10,280	98	Paved roads w/curbs & sewers, HSG C
21,608	83	1/4 acre lots, 38% imp, HSG C
31,888	88	Weighted Average
13,397		42.01% Pervious Area
18,491		57.99% Impervious Area

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

Subcatchment S2-1: Proposed Development



Summary for Subcatchment S2-2: Existing to Remain

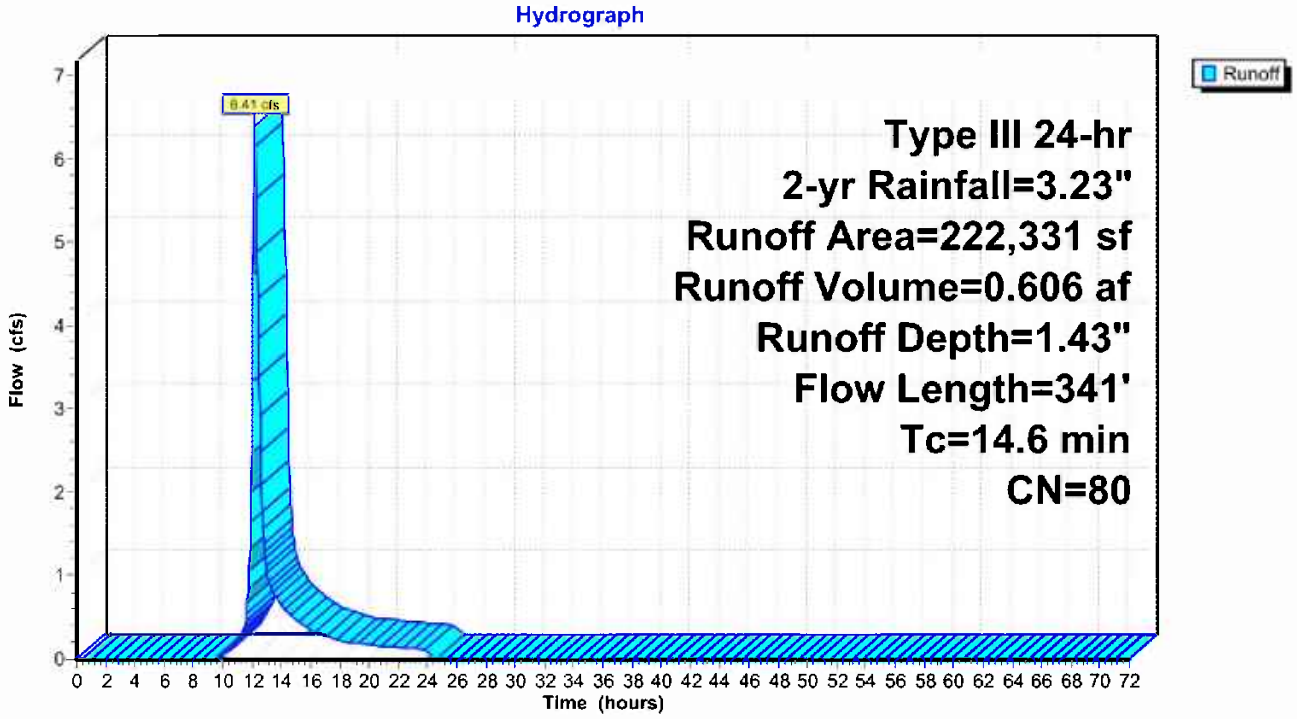
Runoff = 6.41 cfs @ 12.21 hrs, Volume= 0.606 af, Depth= 1.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.23"

Area (sf)	CN	Description
191,427	80	1/2 acre lots, 25% imp, HSG C
9,464	98	Paved roads w/curbs & sewers, HSG C
21,440	70	Woods, Good, HSG C
222,331	80	Weighted Average
165,010		74.22% Pervious Area
57,321		25.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
3.4	291	0.0825	1.44		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
14.6	341	Total			

Subcatchment S2-2: Existing to Remain



Summary for Pond P1: System 1

Inflow Area = 7.730 ac, 44.32% Impervious, Inflow Depth = 1.23" for 2-yr event
Inflow = 10.70 cfs @ 12.10 hrs, Volume= 0.794 af
Outflow = 2.61 cfs @ 12.53 hrs, Volume= 0.794 af, Atten= 76%, Lag= 25.8 min
Discarded = 2.21 cfs @ 11.85 hrs, Volume= 0.778 af
Primary = 0.40 cfs @ 12.53 hrs, Volume= 0.017 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 1.93' @ 12.53 hrs Surf.Area= 6,355 sf Storage= 8,333 cf

Plug-Flow detention time= 22.2 min calculated for 0.794 af (100% of inflow)
Center-of-Mass det. time= 22.2 min (874.0 - 851.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	10,167 cf	**46.67'W x 135.92'L x 6.75'H Field A** 42,814 cf Overall - 17,395 cf Embedded = 25,418 cf x 40.0% Voids
#2A	0.75'	17,395 cf	**ADS_StormTech MC-4500 +Cap** x 160 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 5 Rows of 32 Chambers Cap Storage= +35.7 cf x 2 x 5 rows = 357.0 cf
#3	0.00'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		27,688 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**15.000 in/hr Exfiltration over Surface area**
#2	Primary	1.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	2.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	4.20'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	7.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=2.21 cfs @ 11.85 hrs HW=0.10' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 2.21 cfs)

Primary OutFlow Max=0.40 cfs @ 12.53 hrs HW=1.93' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.40 cfs @ 2.23 fps)
├**3=Orifice/Grate** (Controls 0.00 cfs)
├**4=Orifice/Grate** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P1: System 1 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 5 rows = 357.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

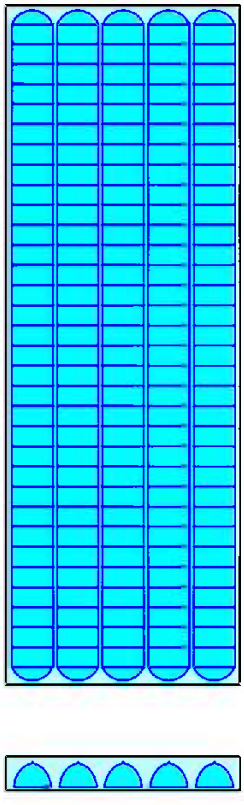
32 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 133.92' Row Length +12.0" End Stone x 2 = 135.92' Base Length
5 Rows x 100.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 46.67' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

160 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 5 Rows = 17,395.5 cf Chamber Storage

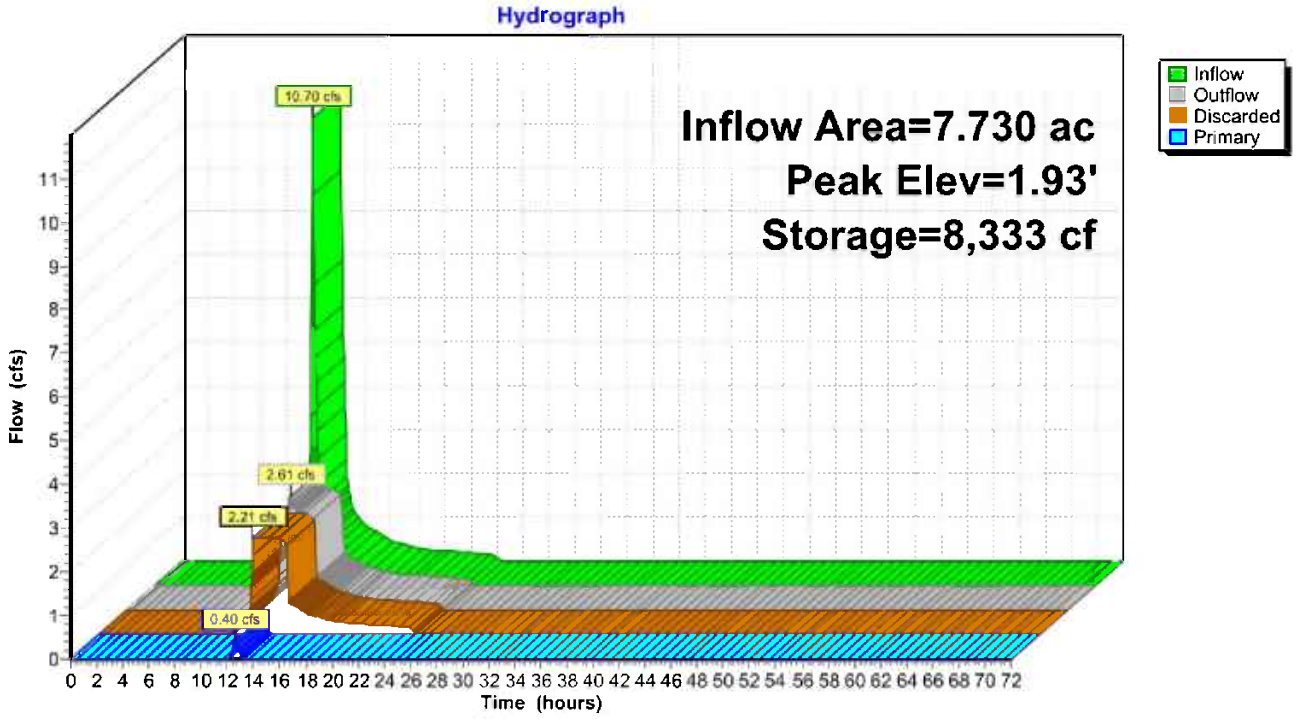
42,813.8 cf Field - 17,395.5 cf Chambers = 25,418.3 cf Stone x 40.0% Voids = 10,167.3 cf Stone Storage

Chamber Storage + Stone Storage = 27,562.8 cf = 0.633 af
Overall Storage Efficiency = 64.4%
Overall System Size = 135.92' x 46.67' x 6.75'

160 Chambers
1,585.7 cy Field
941.4 cy Stone



Pond P1: System 1



Summary for Pond P2: System 2

Inflow Area = 0.732 ac, 57.99% Impervious, Inflow Depth = 2.02" for 2-yr event
Inflow = 1.69 cfs @ 12.09 hrs, Volume= 0.123 af
Outflow = 0.54 cfs @ 12.42 hrs, Volume= 0.123 af, Atten= 68%, Lag= 19.6 min
Discarded = 0.17 cfs @ 11.65 hrs, Volume= 0.099 af
Primary = 0.37 cfs @ 12.42 hrs, Volume= 0.025 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 2.42' @ 12.42 hrs Surf.Area= 891 sf Storage= 1,445 cf

Plug-Flow detention time= 34.8 min calculated for 0.123 af (100% of inflow)
Center-of-Mass det. time= 34.8 min (849.5 - 814.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	1,554 cf	**28.50'W x 31.27'L x 6.75'H Field A** 6,015 cf Overall - 2,131 cf Embedded = 3,884 cf x 40.0% Voids
#2A	0.75'	2,131 cf	**ADS_StormTech MC-4500 +Cap** x 18 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 3 Rows of 6 Chambers Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf
		3,685 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**8.300 in/hr Exfiltration over Surface area**
#2	Primary	1.50'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	3.40'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	5.80'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	6.70'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.17 cfs @ 11.65 hrs HW=0.09' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.36 cfs @ 12.42 hrs HW=2.42' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.36 cfs @ 4.18 fps)
├**3=Orifice/Grate** (Controls 0.00 cfs)
├**4=Orifice/Grate** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond P2: System 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

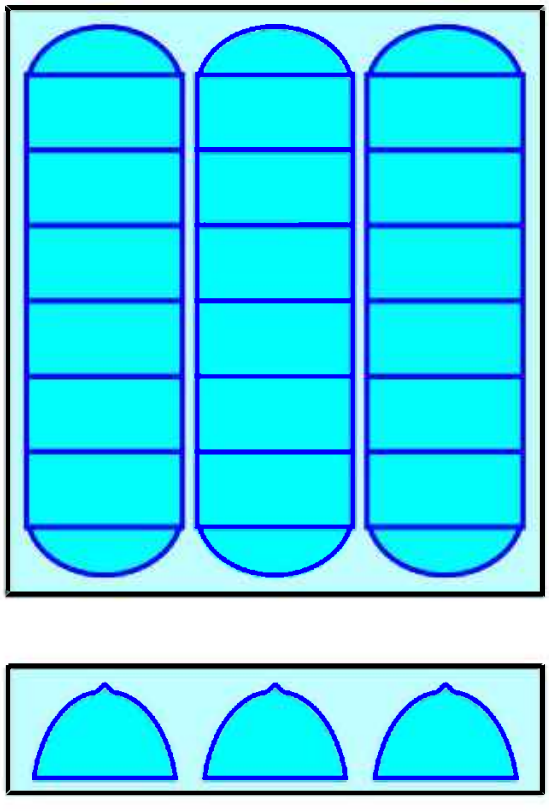
6 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 29.27' Row Length +12.0" End Stone x 2 = 31.27' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

18 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 3 Rows = 2,131.0 cf Chamber Storage

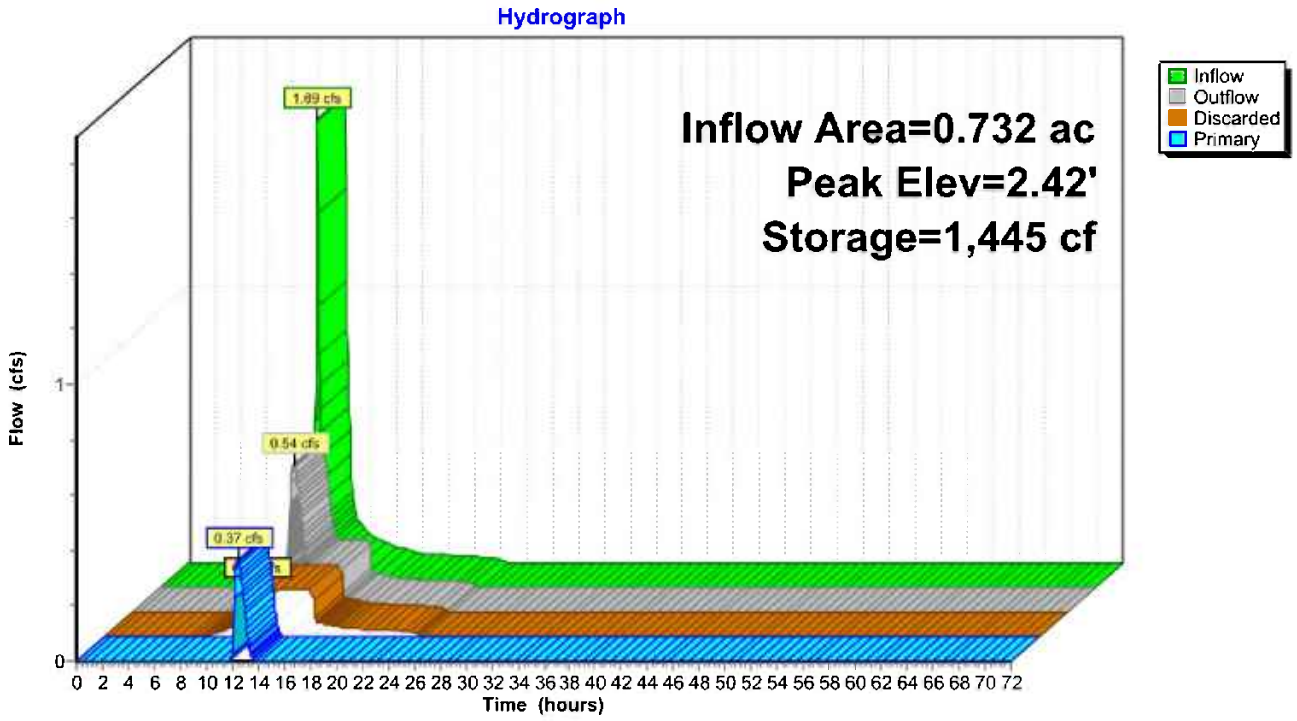
6,014.9 cf Field - 2,131.0 cf Chambers = 3,883.9 cf Stone x 40.0% Voids = 1,553.6 cf Stone Storage

Chamber Storage + Stone Storage = 3,684.6 cf = 0.085 af
Overall Storage Efficiency = 61.3%
Overall System Size = 31.27' x 28.50' x 6.75'

18 Chambers
222.8 cy Field
143.8 cy Stone



Pond P2: System 2

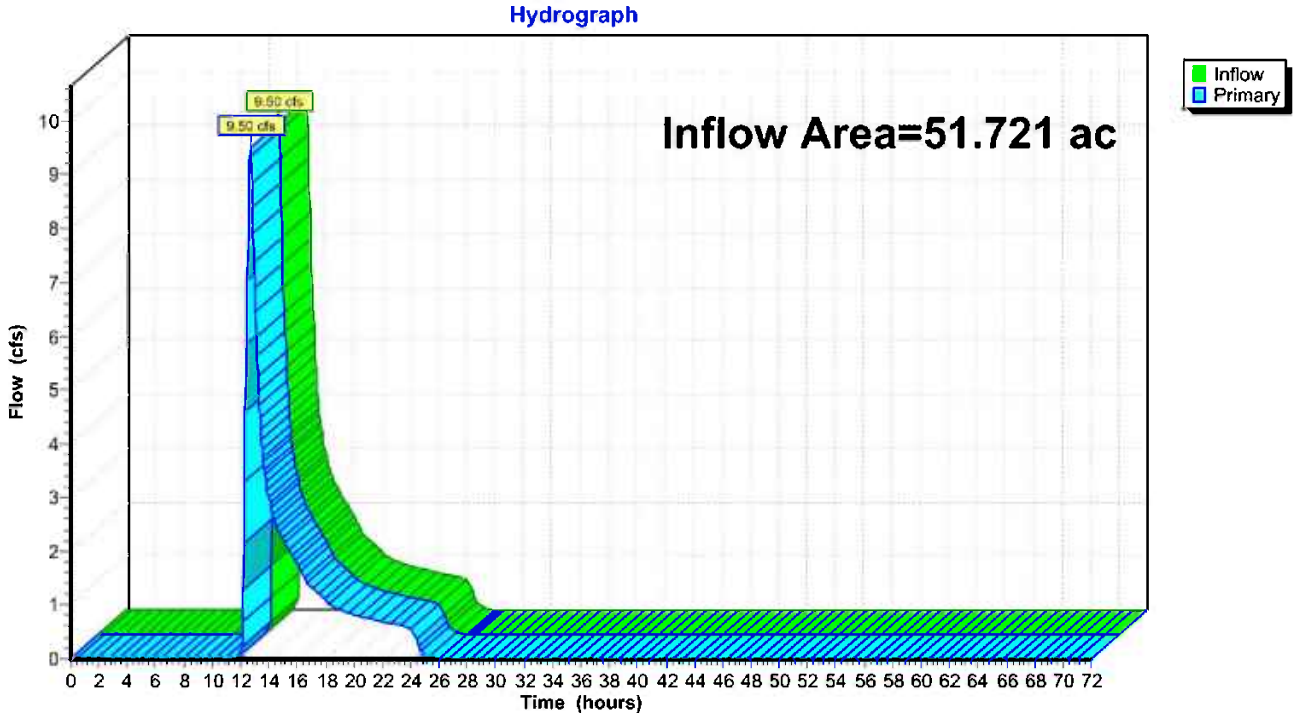


Summary for Link POA1: POA

Inflow Area = 51.721 ac, 17.16% Impervious, Inflow Depth = 0.42" for 2-yr event
Inflow = 9.50 cfs @ 12.67 hrs, Volume= 1.827 af
Primary = 9.50 cfs @ 12.67 hrs, Volume= 1.827 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA1: POA

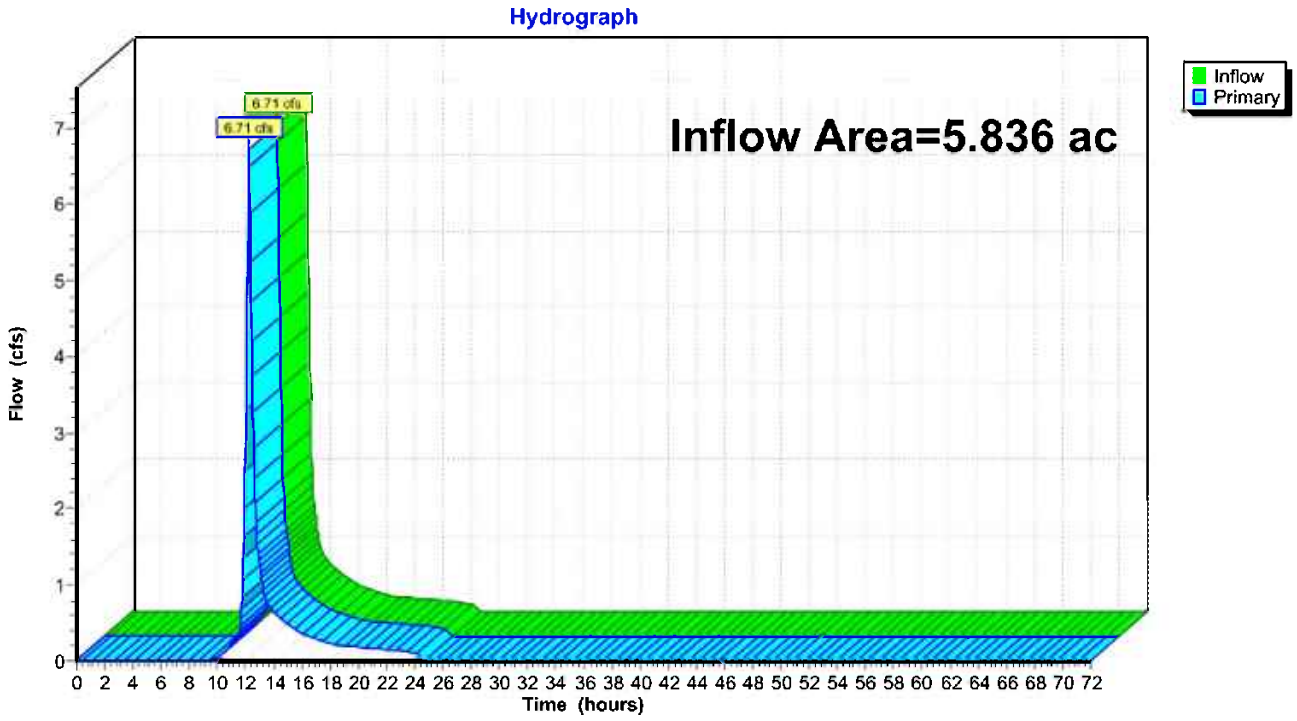


Summary for Link POA2: POA

Inflow Area = 5.836 ac, 29.82% Impervious, Inflow Depth = 1.30" for 2-yr event
Inflow = 6.71 cfs @ 12.21 hrs, Volume= 0.631 af
Primary = 6.71 cfs @ 12.21 hrs, Volume= 0.631 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA2: POA



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 S1-1: Proposed Runoff Area=336,721 sf 44.32% Impervious Runoff Depth=2.37"
Tc=6.0 min CN=77 Runoff=21.00 cfs 1.524 af

Subcatchment S1-2: Existing to Remain Runoff Area=1,916,243 sf 12.39% Impervious Runoff Depth=1.25"
Flow Length=1,435' Tc=39.1 min CN=62 Runoff=28.98 cfs 4.586 af

Subcatchment S2-1: Proposed Runoff Area=31,888 sf 57.99% Impervious Runoff Depth=3.38"
Tc=6.0 min CN=88 Runoff=2.78 cfs 0.206 af

Subcatchment S2-2: Existing to Remain Runoff Area=222,331 sf 25.78% Impervious Runoff Depth=2.62"
Flow Length=341' Tc=14.6 min CN=80 Runoff=11.95 cfs 1.116 af

Pond P1: System 1 Peak Elev=4.12' Storage=19,231 cf Inflow=21.00 cfs 1.524 af
Discarded=2.21 cfs 1.205 af Primary=2.75 cfs 0.319 af Outflow=4.96 cfs 1.524 af

Pond P2: System 2 Peak Elev=3.91' Storage=2,412 cf Inflow=2.78 cfs 0.206 af
Discarded=0.17 cfs 0.134 af Primary=0.88 cfs 0.072 af Outflow=1.05 cfs 0.206 af

Link POA1: POA Inflow=31.69 cfs 4.905 af
Primary=31.69 cfs 4.905 af

Link POA2: POA Inflow=12.70 cfs 1.188 af
Primary=12.70 cfs 1.188 af

Total Runoff Area = 57.557 ac Runoff Volume = 7.432 af Average Runoff Depth = 1.55"
81.56% Pervious = 46.942 ac 18.44% Impervious = 10.615 ac

Summary for Subcatchment S1-1: Proposed Development

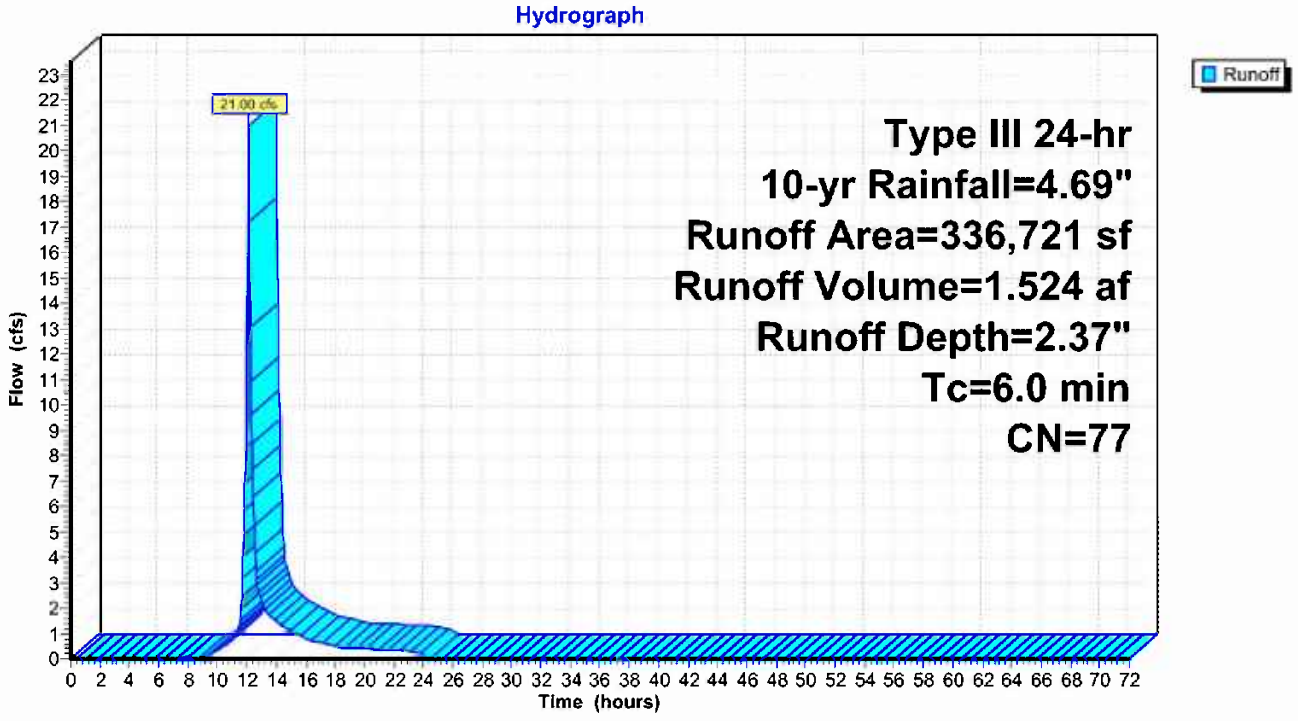
Runoff = 21.00 cfs @ 12.09 hrs, Volume= 1.524 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.69"

Area (sf)	CN	Description
88,475	98	Paved roads w/curbs & sewers, HSG B
187,496	61	>75% Grass cover, Good, HSG B
60,750	98	Roofs, HSG B
336,721	77	Weighted Average
187,496		55.68% Pervious Area
149,225		44.32% Impervious Area

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

Subcatchment S1-1: Proposed Development



Summary for Subcatchment S1-2: Existing to Remain

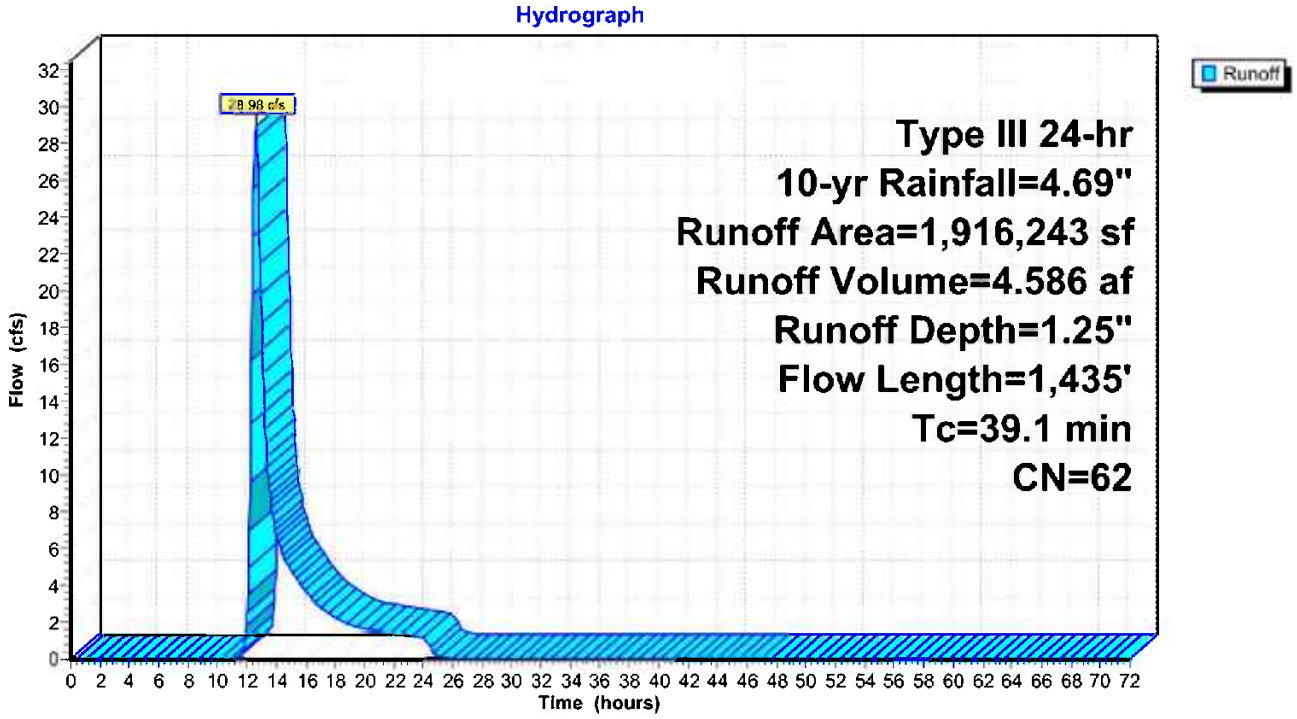
Runoff = 28.98 cfs @ 12.61 hrs, Volume= 4.586 af, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.69"

Area (sf)	CN	Description
592,175	70	1/2 acre lots, 25% imp, HSG B
89,330	98	Paved roads w/curbs & sewers, HSG B
1,234,738	55	Woods, Good, HSG B
1,916,243	62	Weighted Average
1,678,869		87.61% Pervious Area
237,374		12.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
27.9	1,385	0.0274	0.83		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
39.1	1,435	Total			

Subcatchment S1-2: Existing to Remain



Summary for Subcatchment S2-1: Proposed Development

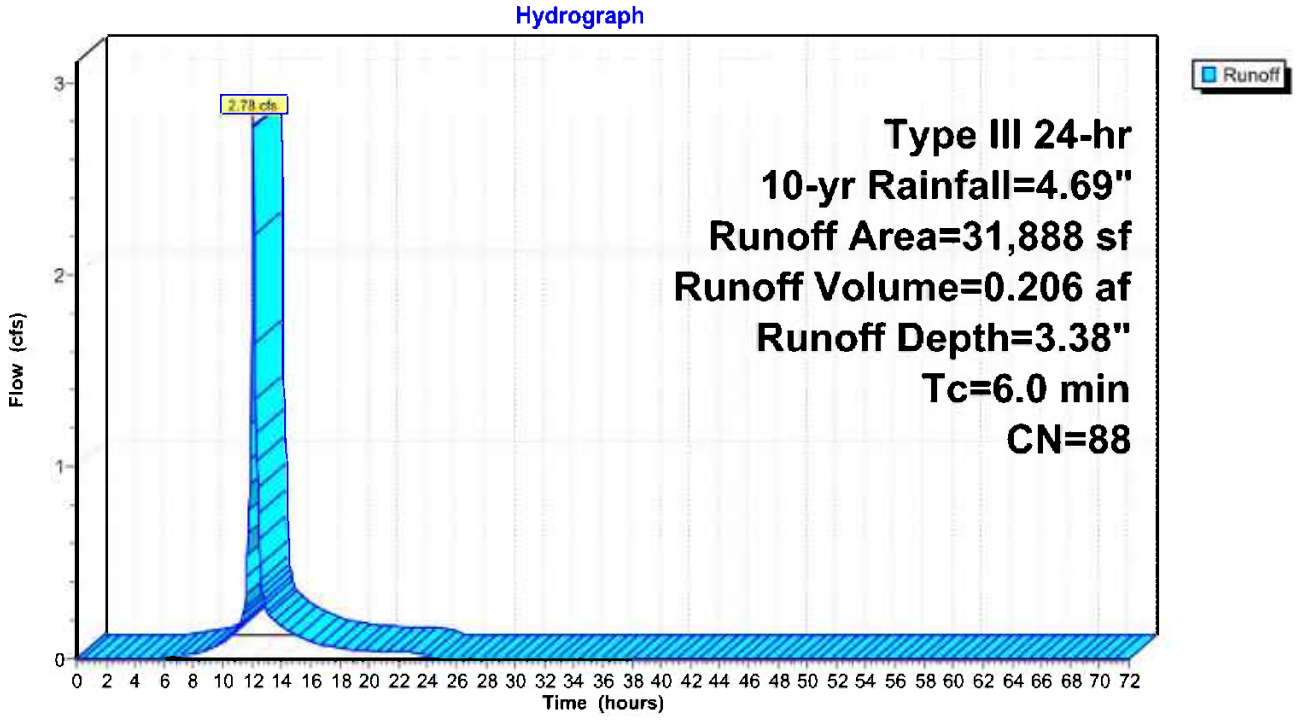
Runoff = 2.78 cfs @ 12.09 hrs, Volume= 0.206 af, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.69"

Area (sf)	CN	Description
10,280	98	Paved roads w/curbs & sewers, HSG C
21,608	83	1/4 acre lots, 38% imp, HSG C
31,888	88	Weighted Average
13,397		42.01% Pervious Area
18,491		57.99% Impervious Area

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

Subcatchment S2-1: Proposed Development



Summary for Subcatchment S2-2: Existing to Remain

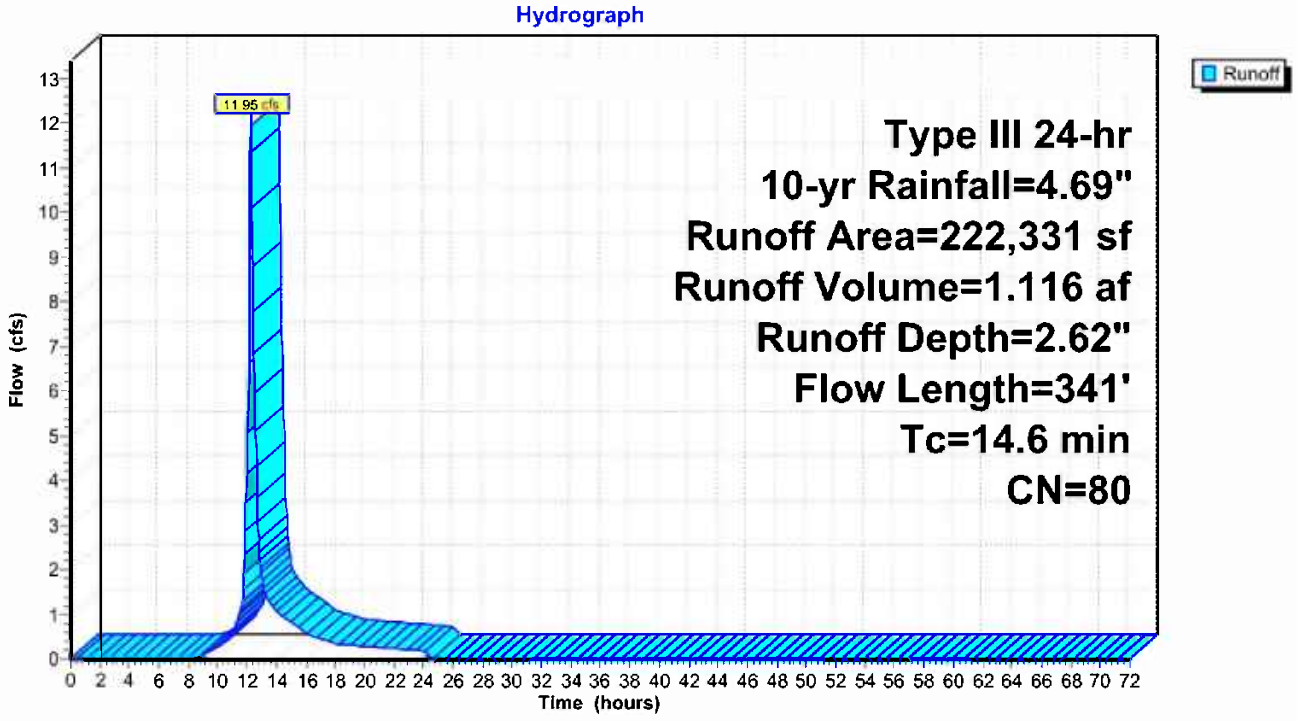
Runoff = 11.95 cfs @ 12.20 hrs, Volume= 1.116 af, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.69"

Area (sf)	CN	Description
191,427	80	1/2 acre lots, 25% imp, HSG C
9,464	98	Paved roads w/curbs & sewers, HSG C
21,440	70	Woods, Good, HSG C
222,331	80	Weighted Average
165,010		74.22% Pervious Area
57,321		25.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
3.4	291	0.0825	1.44		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
14.6	341	Total			

Subcatchment S2-2: Existing to Remain



Summary for Pond P1: System 1

Inflow Area = 7.730 ac, 44.32% Impervious, Inflow Depth = 2.37" for 10-yr event
Inflow = 21.00 cfs @ 12.09 hrs, Volume= 1.524 af
Outflow = 4.96 cfs @ 12.51 hrs, Volume= 1.524 af, Atten= 76%, Lag= 25.2 min
Discarded = 2.21 cfs @ 11.70 hrs, Volume= 1.205 af
Primary = 2.75 cfs @ 12.51 hrs, Volume= 0.319 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 4.12' @ 12.51 hrs Surf.Area= 6,355 sf Storage= 19,231 cf

Plug-Flow detention time= 36.0 min calculated for 1.523 af (100% of inflow)
Center-of-Mass det. time= 36.0 min (868.7 - 832.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	10,167 cf	**46.67'W x 135.92'L x 6.75'H Field A** 42,814 cf Overall - 17,395 cf Embedded = 25,418 cf x 40.0% Voids
#2A	0.75'	17,395 cf	**ADS_StormTech MC-4500 +Cap** x 160 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 5 Rows of 32 Chambers Cap Storage= +35.7 cf x 2 x 5 rows = 357.0 cf
#3	0.00'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		27,688 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**15.000 in/hr Exfiltration over Surface area**
#2	Primary	1.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	2.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	4.20'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	7.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=2.21 cfs @ 11.70 hrs HW=0.14' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 2.21 cfs)

Primary OutFlow Max=2.75 cfs @ 12.51 hrs HW=4.12' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 1.46 cfs @ 7.41 fps)
├**3=Orifice/Grate** (Orifice Controls 1.29 cfs @ 6.58 fps)
├**4=Orifice/Grate** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P1: System 1 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 5 rows = 357.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

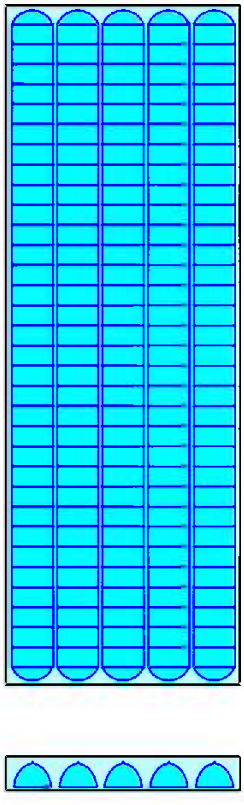
32 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 133.92' Row Length +12.0" End Stone x 2 = 135.92' Base Length
5 Rows x 100.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 46.67' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

160 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 5 Rows = 17,395.5 cf Chamber Storage

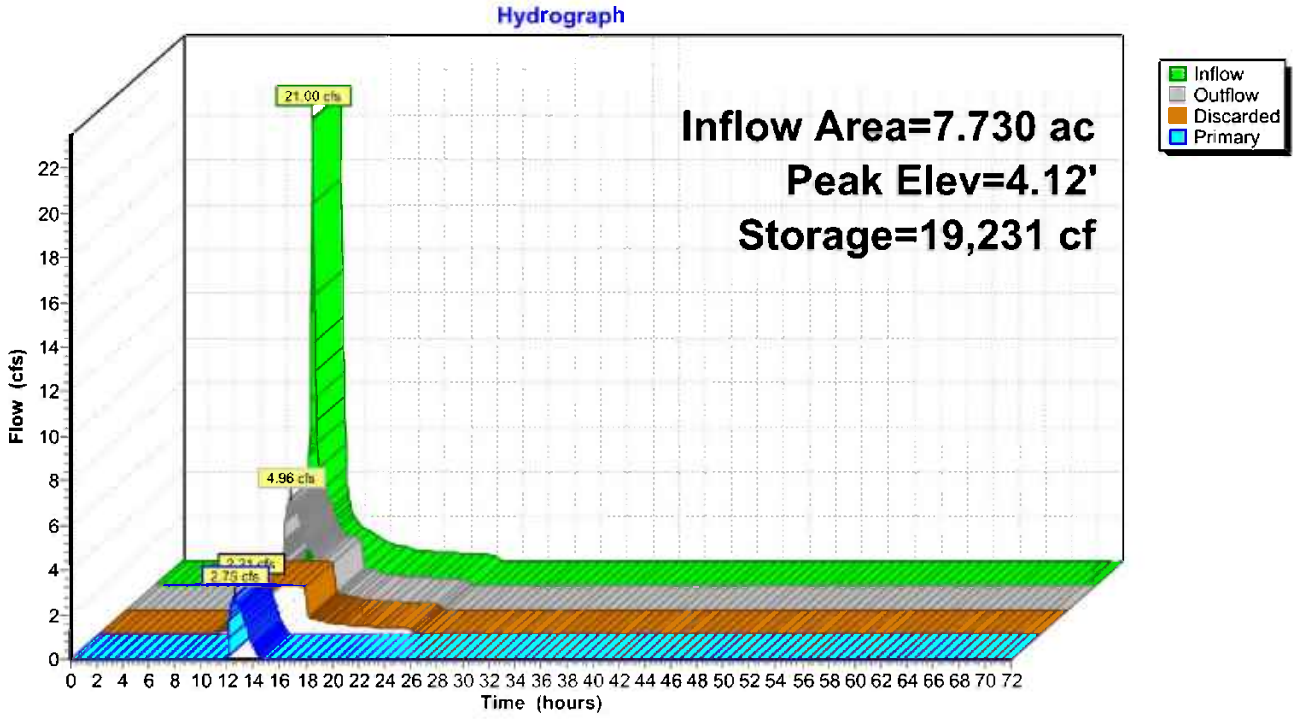
42,813.8 cf Field - 17,395.5 cf Chambers = 25,418.3 cf Stone x 40.0% Voids = 10,167.3 cf Stone Storage

Chamber Storage + Stone Storage = 27,562.8 cf = 0.633 af
Overall Storage Efficiency = 64.4%
Overall System Size = 135.92' x 46.67' x 6.75'

160 Chambers
1,585.7 cy Field
941.4 cy Stone



Pond P1: System 1



Summary for Pond P2: System 2

Inflow Area = 0.732 ac, 57.99% Impervious, Inflow Depth = 3.38" for 10-yr event
Inflow = 2.78 cfs @ 12.09 hrs, Volume= 0.206 af
Outflow = 1.05 cfs @ 12.35 hrs, Volume= 0.206 af, Atten= 62%, Lag= 15.4 min
Discarded = 0.17 cfs @ 11.20 hrs, Volume= 0.134 af
Primary = 0.88 cfs @ 12.35 hrs, Volume= 0.072 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 3.91' @ 12.35 hrs Surf.Area= 891 sf Storage= 2,412 cf

Plug-Flow detention time= 36.3 min calculated for 0.206 af (100% of inflow)
Center-of-Mass det. time= 36.3 min (836.5 - 800.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	1,554 cf	**28.50'W x 31.27'L x 6.75'H Field A** 6,015 cf Overall - 2,131 cf Embedded = 3,884 cf x 40.0% Voids
#2A	0.75'	2,131 cf	**ADS_StormTech MC-4500 +Cap** x 18 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 3 Rows of 6 Chambers Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf
		3,685 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**8.300 in/hr Exfiltration over Surface area**
#2	Primary	1.50'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	3.40'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	5.80'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	6.70'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.17 cfs @ 11.20 hrs HW=0.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.88 cfs @ 12.35 hrs HW=3.91' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.63 cfs @ 7.22 fps)
├**3=Orifice/Grate** (Orifice Controls 0.25 cfs @ 2.83 fps)
├**4=Orifice/Grate** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond P2: System 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

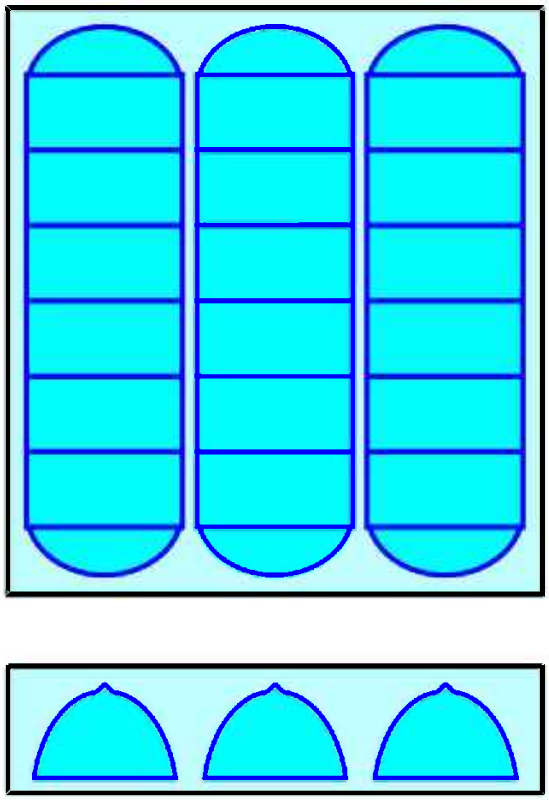
6 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 29.27' Row Length +12.0" End Stone x 2 = 31.27' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

18 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 3 Rows = 2,131.0 cf Chamber Storage

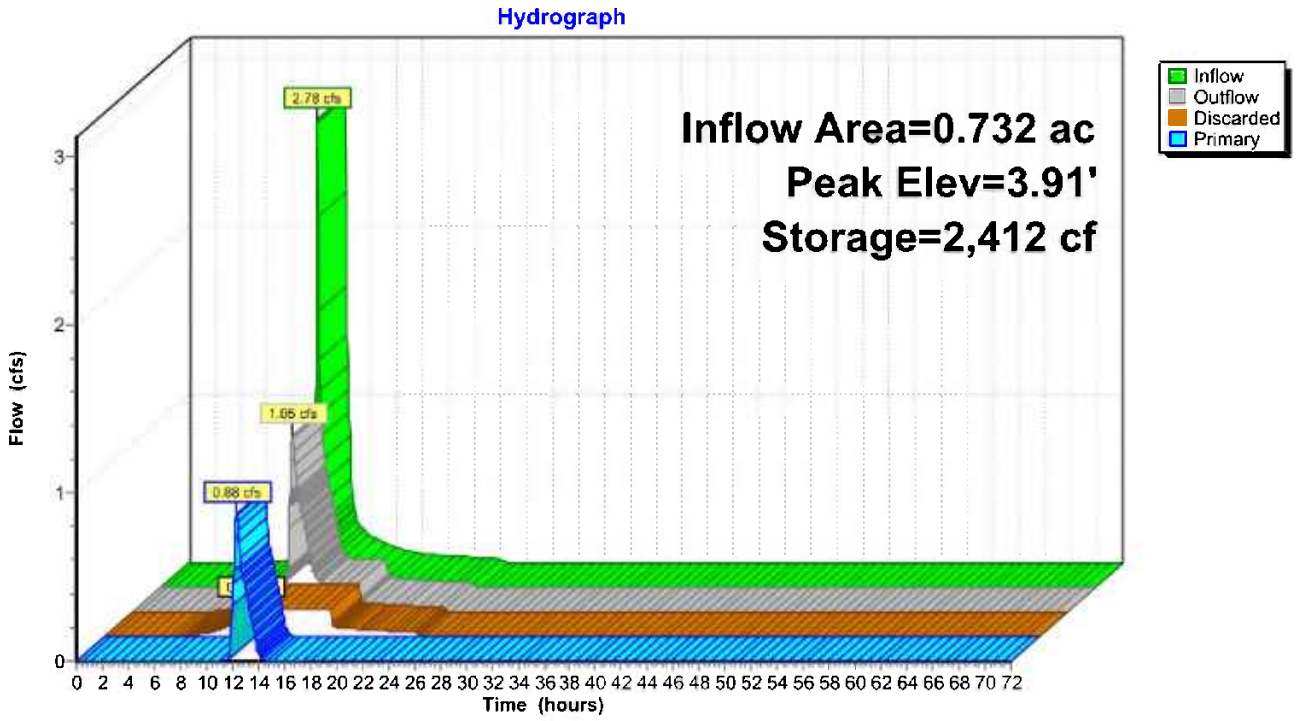
6,014.9 cf Field - 2,131.0 cf Chambers = 3,883.9 cf Stone x 40.0% Voids = 1,553.6 cf Stone Storage

Chamber Storage + Stone Storage = 3,684.6 cf = 0.085 af
Overall Storage Efficiency = 61.3%
Overall System Size = 31.27' x 28.50' x 6.75'

18 Chambers
222.8 cy Field
143.8 cy Stone



Pond P2: System 2

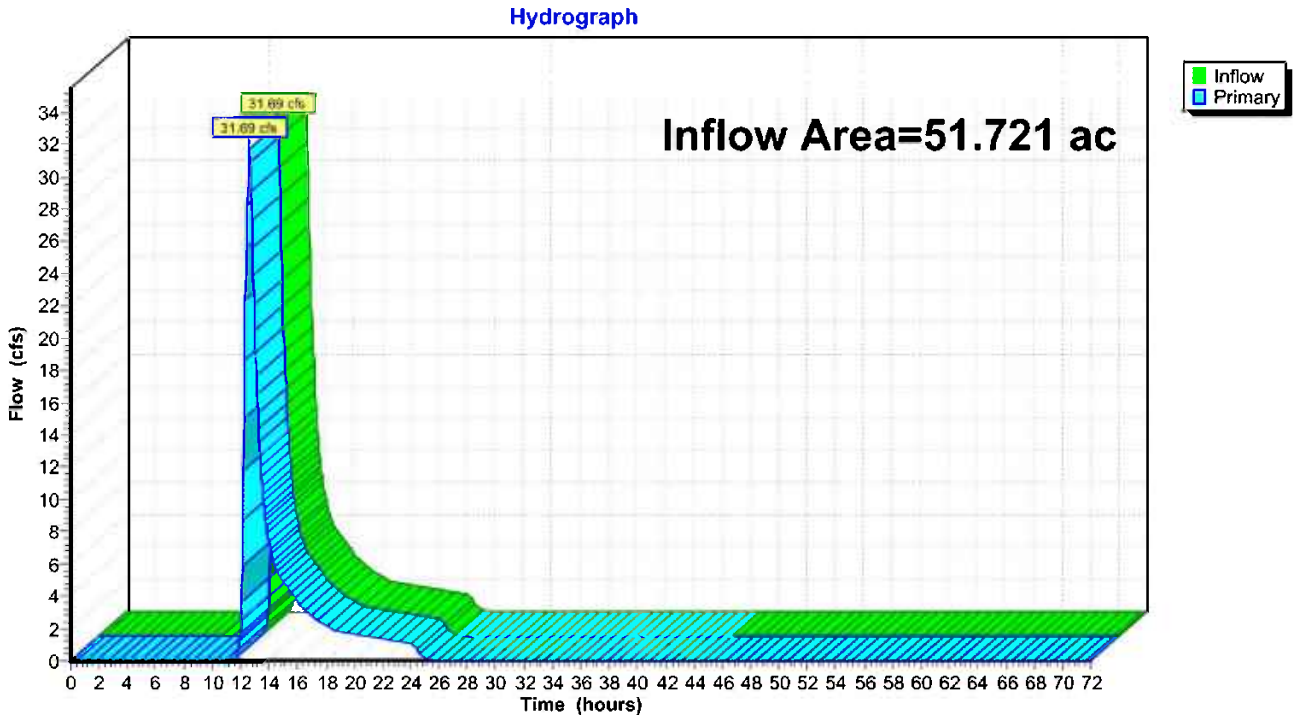


Summary for Link POA1: POA

Inflow Area = 51.721 ac, 17.16% Impervious, Inflow Depth = 1.14" for 10-yr event
Inflow = 31.69 cfs @ 12.60 hrs, Volume= 4.905 af
Primary = 31.69 cfs @ 12.60 hrs, Volume= 4.905 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA1: POA

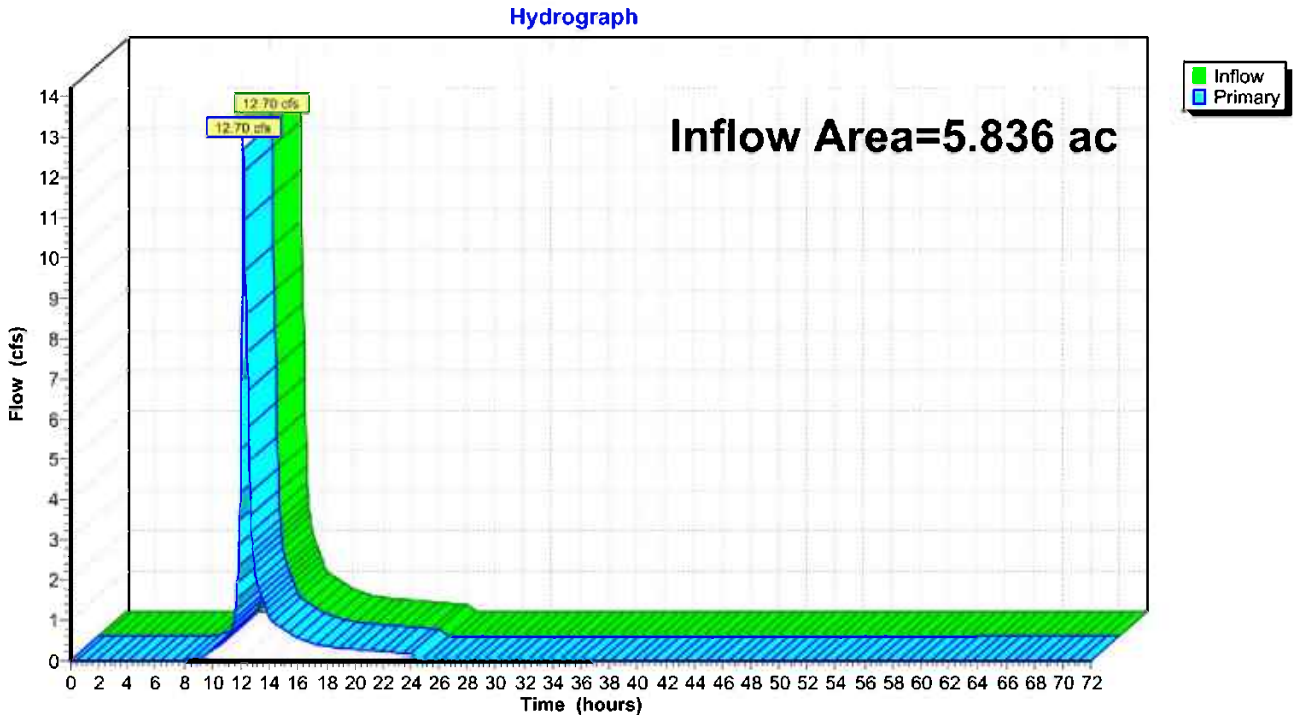


Summary for Link POA2: POA

Inflow Area = 5.836 ac, 29.82% Impervious, Inflow Depth = 2.44" for 10-yr event
Inflow = 12.70 cfs @ 12.21 hrs, Volume= 1.188 af
Primary = 12.70 cfs @ 12.21 hrs, Volume= 1.188 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA2: POA



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 S1-1: Proposed Runoff Area=336,721 sf 44.32% Impervious Runoff Depth=3.13"
Tc=6.0 min CN=77 Runoff=27.83 cfs 2.018 af

Subcatchment S1-2: Existing to Remain Runoff Area=1,916,243 sf 12.39% Impervious Runoff Depth=1.82"
Flow Length=1,435' Tc=39.1 min CN=62 Runoff=44.19 cfs 6.678 af

Subcatchment S2-1: Proposed Runoff Area=31,888 sf 57.99% Impervious Runoff Depth=4.24"
Tc=6.0 min CN=88 Runoff=3.45 cfs 0.259 af

Subcatchment S2-2: Existing to Remain Runoff Area=222,331 sf 25.78% Impervious Runoff Depth=3.42"
Flow Length=341' Tc=14.6 min CN=80 Runoff=15.57 cfs 1.456 af

Pond P1: System 1 Peak Elev=6.15' Storage=26,126 cf Inflow=27.83 cfs 2.018 af
Discarded=2.21 cfs 1.423 af Primary=5.09 cfs 0.594 af Outflow=7.29 cfs 2.018 af

Pond P2: System 2 Peak Elev=4.86' Storage=2,948 cf Inflow=3.45 cfs 0.259 af
Discarded=0.17 cfs 0.153 af Primary=1.23 cfs 0.106 af Outflow=1.40 cfs 0.259 af

Link POA1: POA Inflow=49.12 cfs 7.273 af
Primary=49.12 cfs 7.273 af

Link POA2: POA Inflow=16.73 cfs 1.561 af
Primary=16.73 cfs 1.561 af

Total Runoff Area = 57.557 ac Runoff Volume = 10.410 af Average Runoff Depth = 2.17"
81.56% Pervious = 46.942 ac 18.44% Impervious = 10.615 ac

Summary for Subcatchment S1-1: Proposed Development

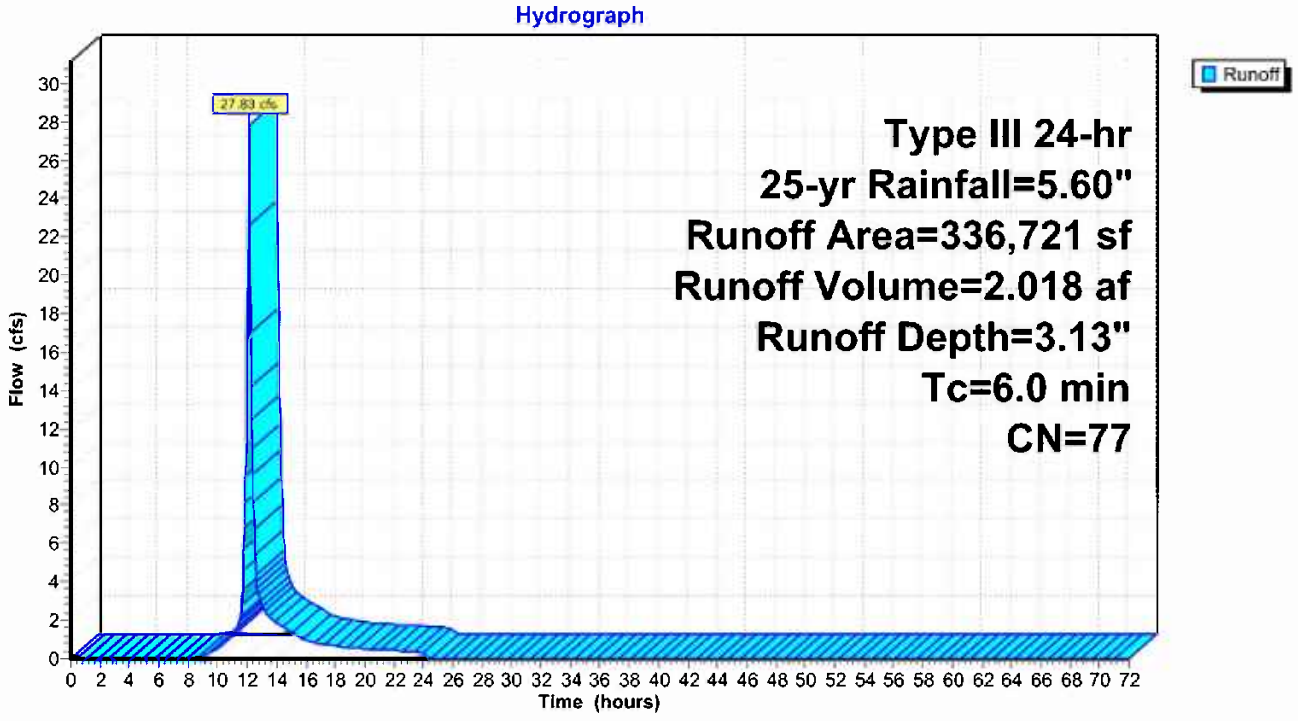
Runoff = 27.83 cfs @ 12.09 hrs, Volume= 2.018 af, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.60"

Area (sf)	CN	Description
88,475	98	Paved roads w/curbs & sewers, HSG B
187,496	61	>75% Grass cover, Good, HSG B
60,750	98	Roofs, HSG B
336,721	77	Weighted Average
187,496		55.68% Pervious Area
149,225		44.32% Impervious Area

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

Subcatchment S1-1: Proposed Development



Summary for Subcatchment S1-2: Existing to Remain

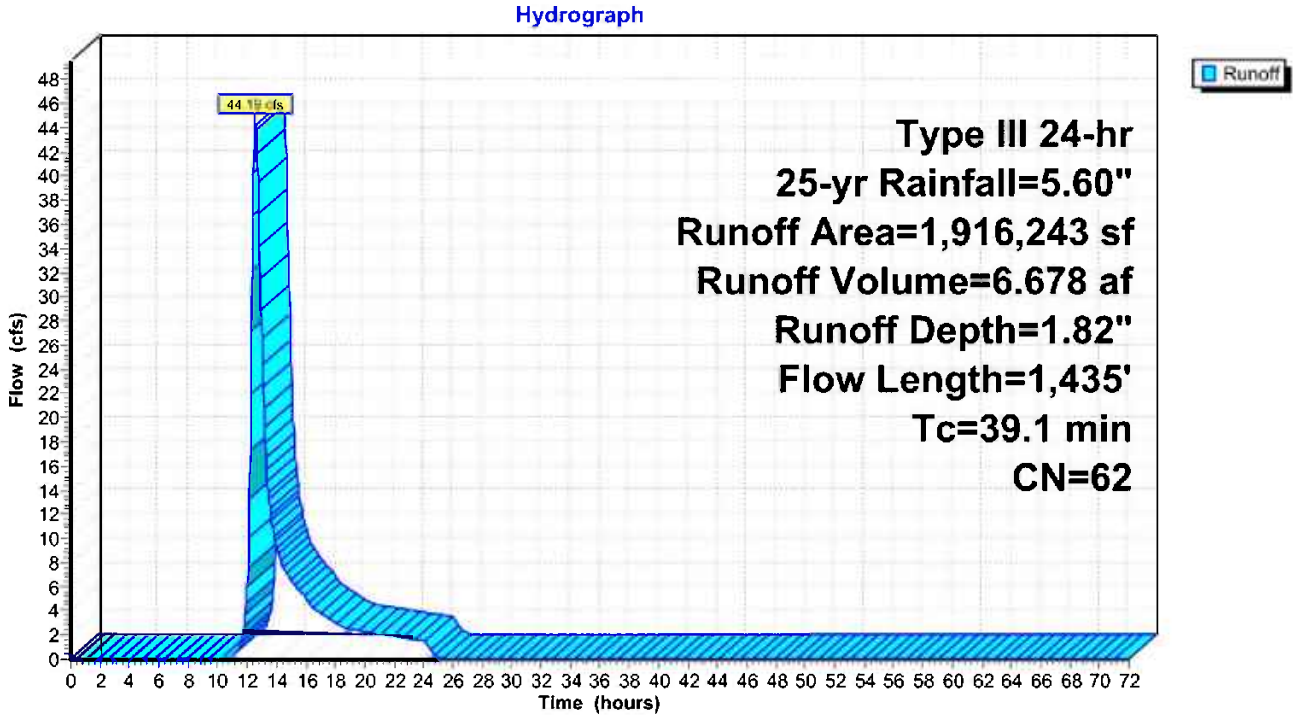
Runoff = 44.19 cfs @ 12.58 hrs, Volume= 6.678 af, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.60"

Area (sf)	CN	Description
592,175	70	1/2 acre lots, 25% imp, HSG B
89,330	98	Paved roads w/curbs & sewers, HSG B
1,234,738	55	Woods, Good, HSG B
1,916,243	62	Weighted Average
1,678,869		87.61% Pervious Area
237,374		12.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
27.9	1,385	0.0274	0.83		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
39.1	1,435	Total			

Subcatchment S1-2: Existing to Remain



Summary for Subcatchment S2-1: Proposed Development

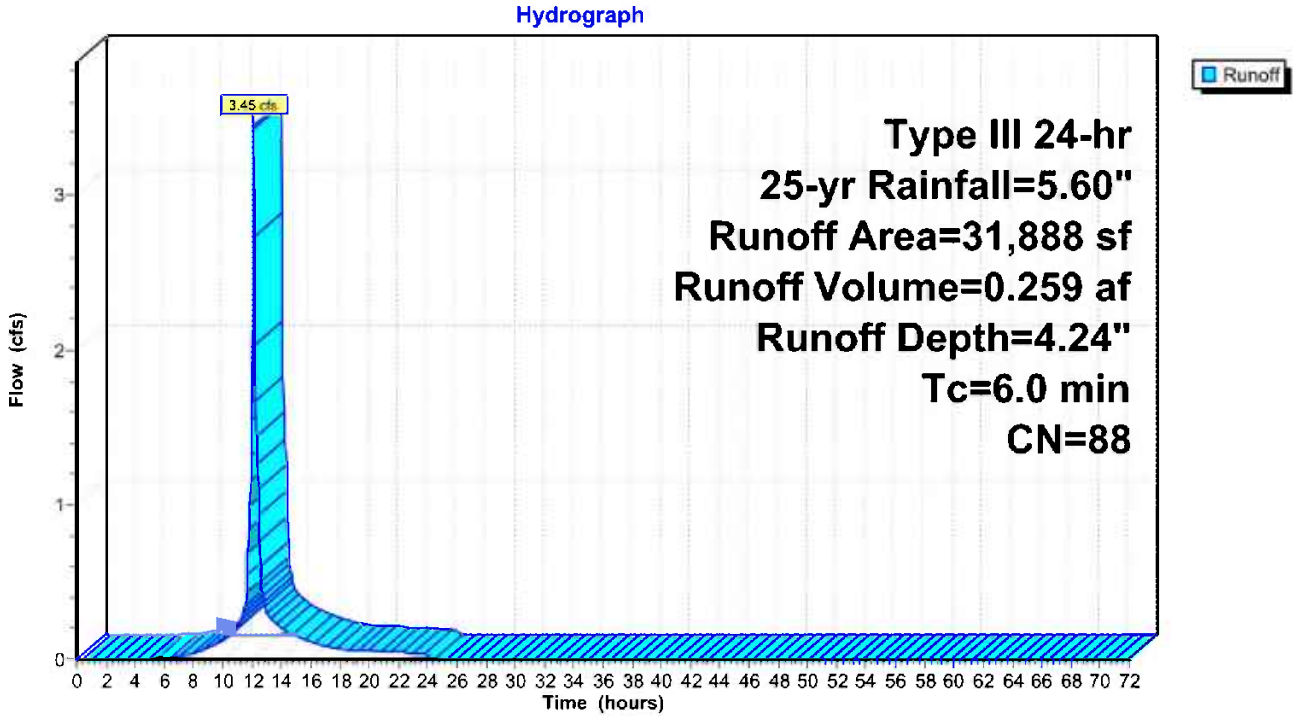
Runoff = 3.45 cfs @ 12.09 hrs, Volume= 0.259 af, Depth= 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.60"

Area (sf)	CN	Description
10,280	98	Paved roads w/curbs & sewers, HSG C
21,608	83	1/4 acre lots, 38% imp, HSG C
31,888	88	Weighted Average
13,397		42.01% Pervious Area
18,491		57.99% Impervious Area

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

Subcatchment S2-1: Proposed Development



Summary for Subcatchment S2-2: Existing to Remain

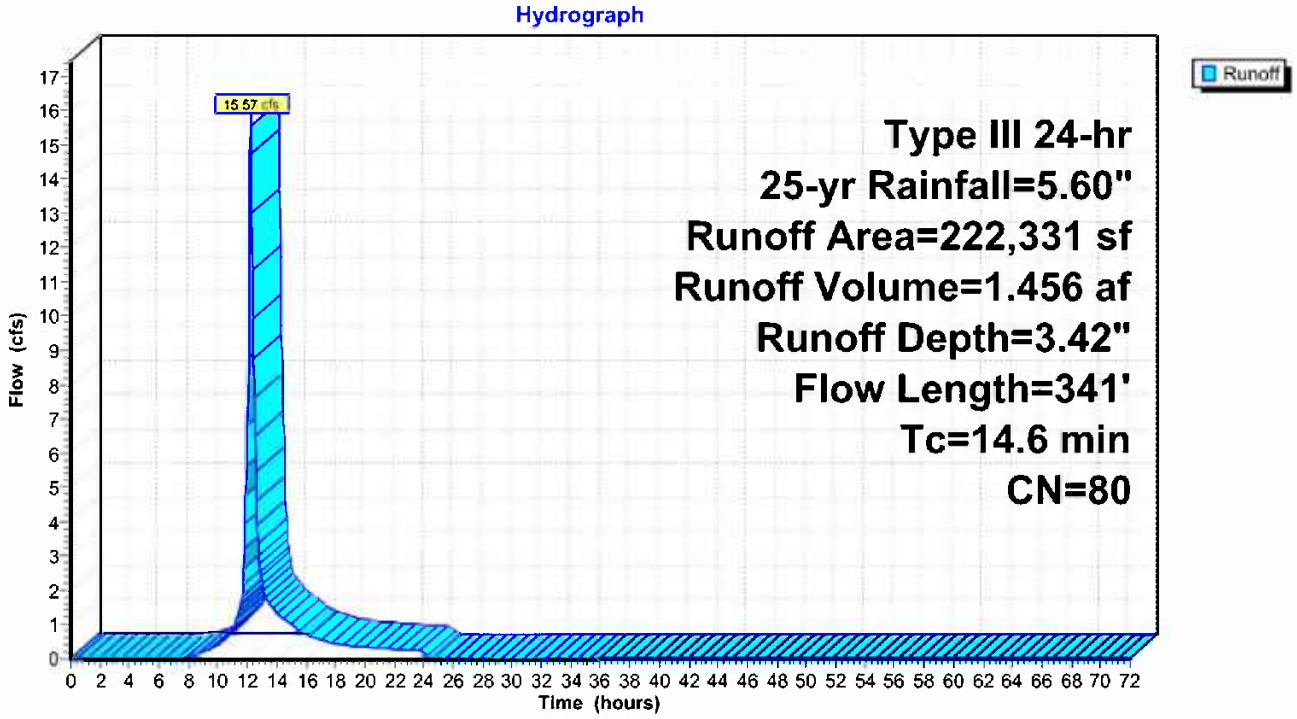
Runoff = 15.57 cfs @ 12.20 hrs, Volume= 1.456 af, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.60"

Area (sf)	CN	Description
191,427	80	1/2 acre lots, 25% imp, HSG C
9,464	98	Paved roads w/curbs & sewers, HSG C
21,440	70	Woods, Good, HSG C
222,331	80	Weighted Average
165,010		74.22% Pervious Area
57,321		25.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
3.4	291	0.0825	1.44		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
14.6	341	Total			

Subcatchment S2-2: Existing to Remain



Summary for Pond P1: System 1

Inflow Area = 7.730 ac, 44.32% Impervious, Inflow Depth = 3.13" for 25-yr event
Inflow = 27.83 cfs @ 12.09 hrs, Volume= 2.018 af
Outflow = 7.29 cfs @ 12.48 hrs, Volume= 2.018 af, Atten= 74%, Lag= 23.3 min
Discarded = 2.21 cfs @ 11.60 hrs, Volume= 1.423 af
Primary = 5.09 cfs @ 12.48 hrs, Volume= 0.594 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 6.15' @ 12.48 hrs Surf.Area= 6,355 sf Storage= 26,126 cf

Plug-Flow detention time= 39.7 min calculated for 2.016 af (100% of inflow)
Center-of-Mass det. time= 39.7 min (864.3 - 824.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	10,167 cf	**46.67'W x 135.92'L x 6.75'H Field A** 42,814 cf Overall - 17,395 cf Embedded = 25,418 cf x 40.0% Voids
#2A	0.75'	17,395 cf	**ADS_StormTech MC-4500 +Cap** x 160 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 5 Rows of 32 Chambers Cap Storage= +35.7 cf x 2 x 5 rows = 357.0 cf
#3	0.00'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		27,688 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**15.000 in/hr Exfiltration over Surface area**
#2	Primary	1.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	2.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	4.20'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	7.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=2.21 cfs @ 11.60 hrs HW=0.12' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 2.21 cfs)

Primary OutFlow Max=5.08 cfs @ 12.48 hrs HW=6.14' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 1.98 cfs @ 10.09 fps)
├**3=Orifice/Grate** (Orifice Controls 1.87 cfs @ 9.50 fps)
├**4=Orifice/Grate** (Orifice Controls 1.23 cfs @ 6.26 fps)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond P1: System 1 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 5 rows = 357.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

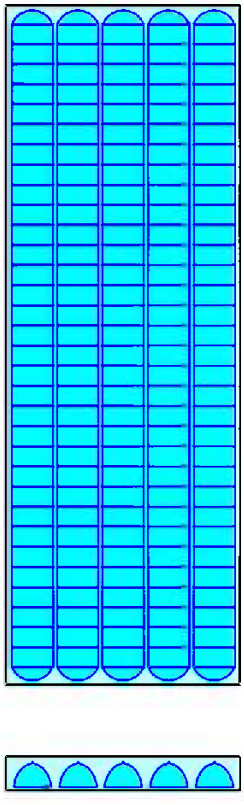
32 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 133.92' Row Length +12.0" End Stone x 2 = 135.92' Base Length
5 Rows x 100.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 46.67' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

160 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 5 Rows = 17,395.5 cf Chamber Storage

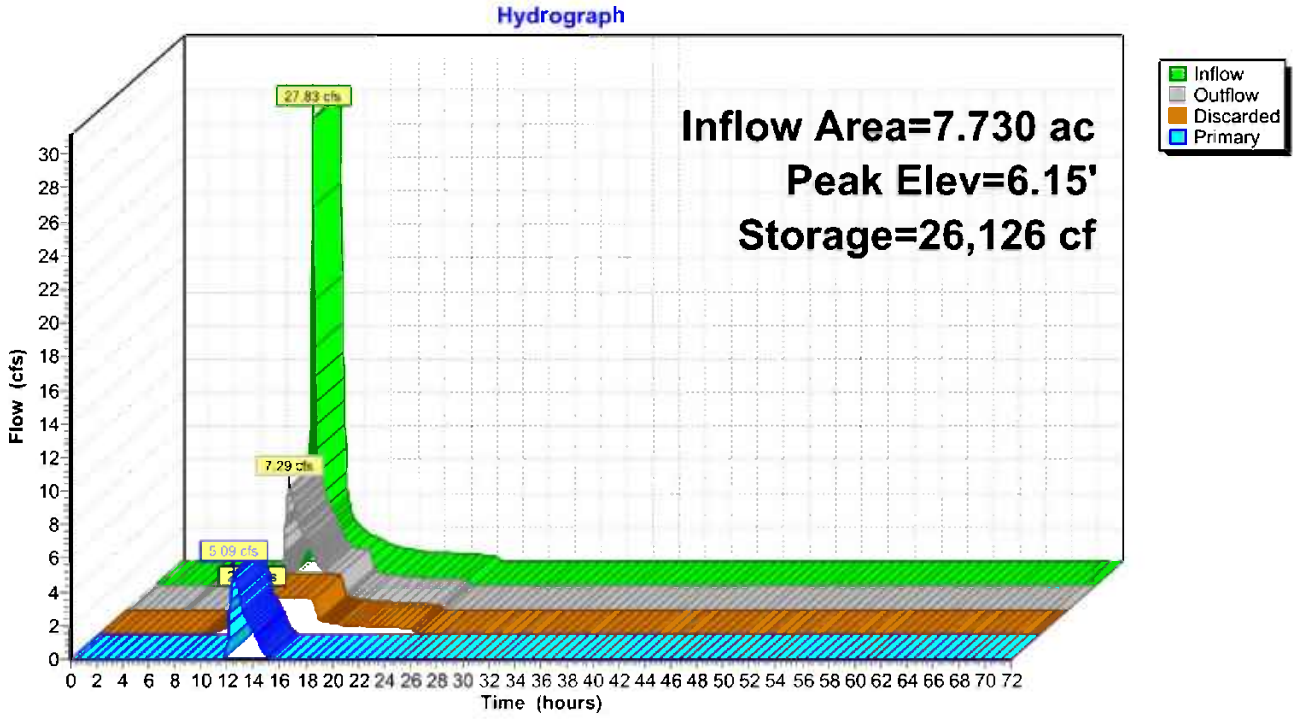
42,813.8 cf Field - 17,395.5 cf Chambers = 25,418.3 cf Stone x 40.0% Voids = 10,167.3 cf Stone Storage

Chamber Storage + Stone Storage = 27,562.8 cf = 0.633 af
Overall Storage Efficiency = 64.4%
Overall System Size = 135.92' x 46.67' x 6.75'

160 Chambers
1,585.7 cy Field
941.4 cy Stone



Pond P1: System 1



Summary for Pond P2: System 2

Inflow Area = 0.732 ac, 57.99% Impervious, Inflow Depth = 4.24" for 25-yr event
Inflow = 3.45 cfs @ 12.09 hrs, Volume= 0.259 af
Outflow = 1.40 cfs @ 12.31 hrs, Volume= 0.259 af, Atten= 59%, Lag= 13.6 min
Discarded = 0.17 cfs @ 10.75 hrs, Volume= 0.153 af
Primary = 1.23 cfs @ 12.31 hrs, Volume= 0.106 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 4.86' @ 12.31 hrs Surf.Area= 891 sf Storage= 2,948 cf

Plug-Flow detention time= 35.9 min calculated for 0.259 af (100% of inflow)
Center-of-Mass det. time= 35.9 min (829.7 - 793.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	1,554 cf	**28.50'W x 31.27'L x 6.75'H Field A** 6,015 cf Overall - 2,131 cf Embedded = 3,884 cf x 40.0% Voids
#2A	0.75'	2,131 cf	**ADS_StormTech MC-4500 +Cap** x 18 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 3 Rows of 6 Chambers Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf
		3,685 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**8.300 in/hr Exfiltration over Surface area**
#2	Primary	1.50'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	3.40'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	5.80'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	6.70'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.17 cfs @ 10.75 hrs HW=0.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=1.23 cfs @ 12.31 hrs HW=4.85' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.75 cfs @ 8.60 fps)
├**3=Orifice/Grate** (Orifice Controls 0.48 cfs @ 5.47 fps)
├**4=Orifice/Grate** (Controls 0.00 cfs)
└**5=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond P2: System 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

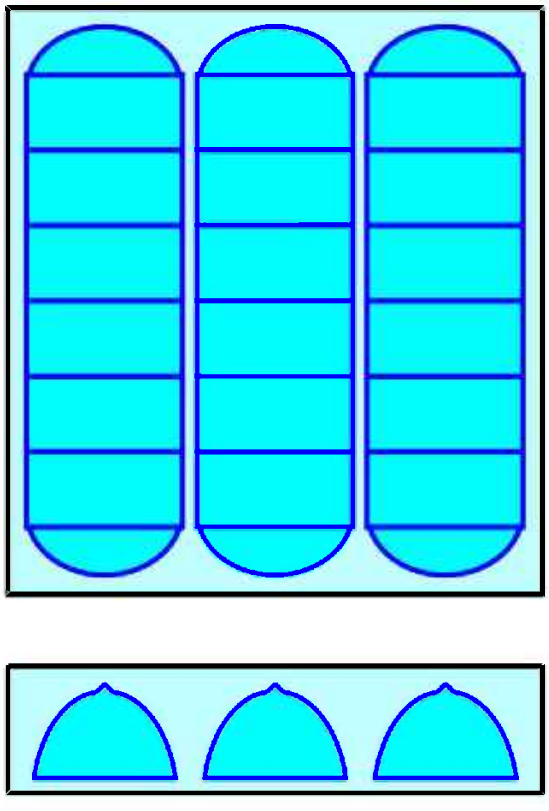
6 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 29.27' Row Length +12.0" End Stone x 2 = 31.27' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

18 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 3 Rows = 2,131.0 cf Chamber Storage

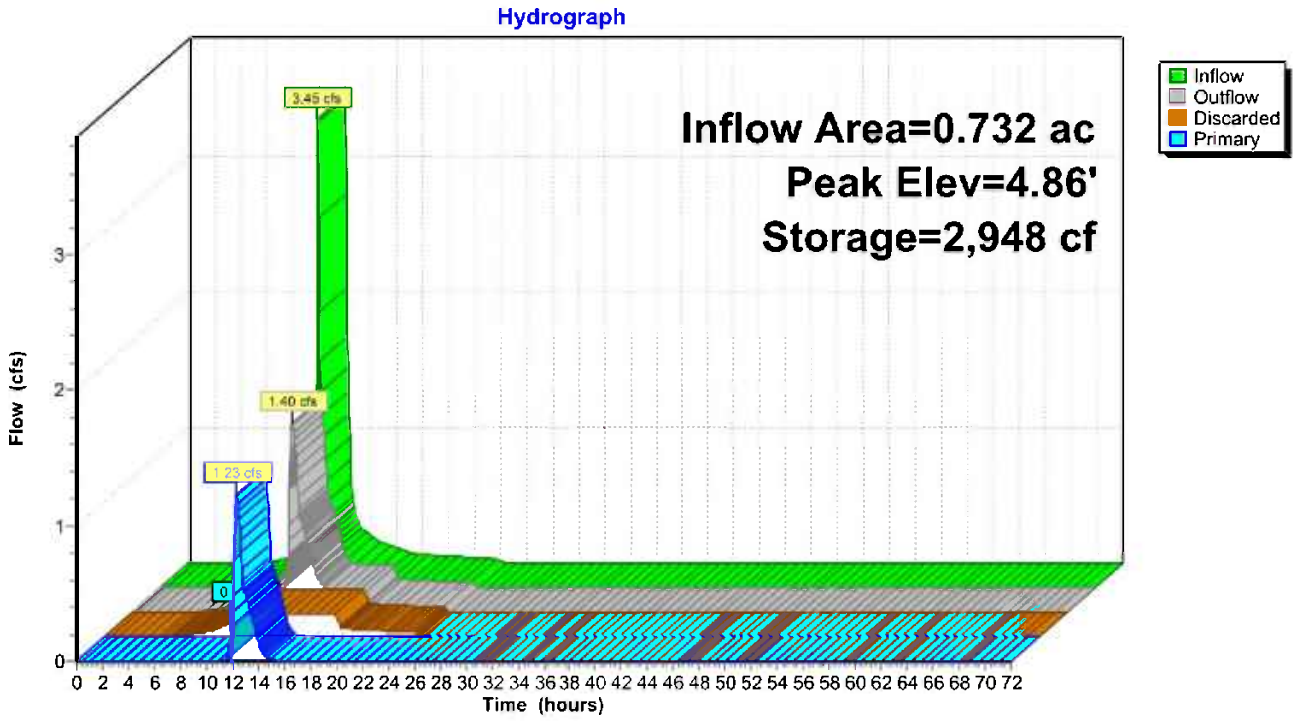
6,014.9 cf Field - 2,131.0 cf Chambers = 3,883.9 cf Stone x 40.0% Voids = 1,553.6 cf Stone Storage

Chamber Storage + Stone Storage = 3,684.6 cf = 0.085 af
Overall Storage Efficiency = 61.3%
Overall System Size = 31.27' x 28.50' x 6.75'

18 Chambers
222.8 cy Field
143.8 cy Stone



Pond P2: System 2

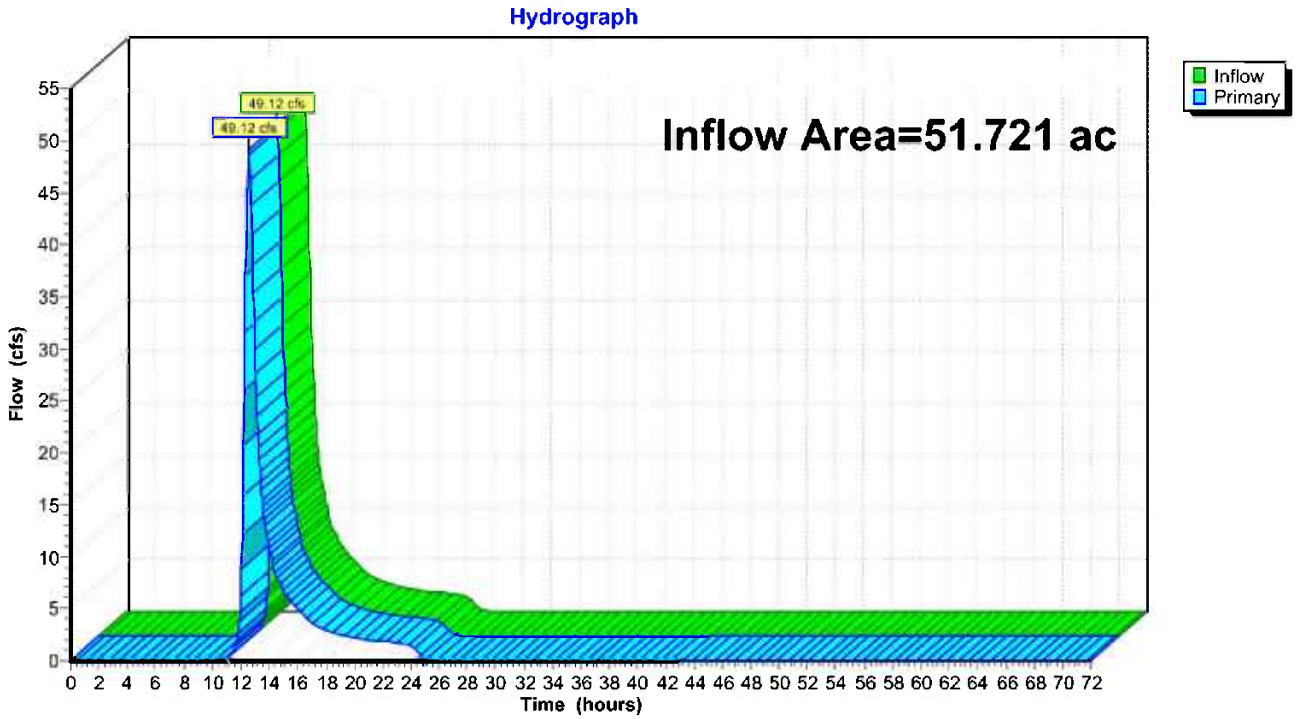


Summary for Link POA1: POA

Inflow Area = 51.721 ac, 17.16% Impervious, Inflow Depth = 1.69" for 25-yr event
Inflow = 49.12 cfs @ 12.58 hrs, Volume= 7.273 af
Primary = 49.12 cfs @ 12.58 hrs, Volume= 7.273 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA1: POA

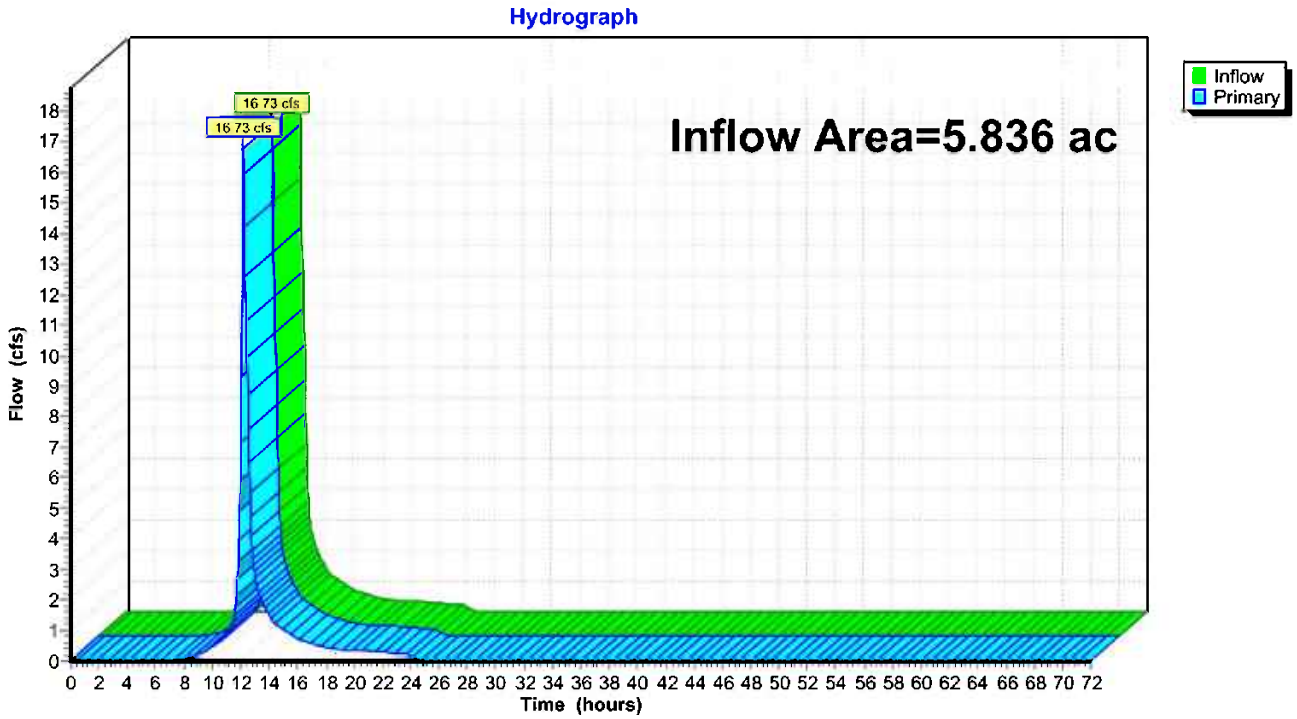


Summary for Link POA2: POA

Inflow Area = 5.836 ac, 29.82% Impervious, Inflow Depth = 3.21" for 25-yr event
Inflow = 16.73 cfs @ 12.20 hrs, Volume= 1.561 af
Primary = 16.73 cfs @ 12.20 hrs, Volume= 1.561 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA2: POA



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 S1-1: Proposed Runoff Area=336,721 sf 44.32% Impervious Runoff Depth=3.73"
Tc=6.0 min CN=77 Runoff=33.12 cfs 2.405 af

Subcatchment S1-2: Existing to Remain Runoff Area=1,916,243 sf 12.39% Impervious Runoff Depth=2.29"
Flow Length=1,435' Tc=39.1 min CN=62 Runoff=56.74 cfs 8.399 af

Subcatchment S2-1: Proposed Runoff Area=31,888 sf 57.99% Impervious Runoff Depth=4.91"
Tc=6.0 min CN=88 Runoff=3.96 cfs 0.299 af

Subcatchment S2-2: Existing to Remain Runoff Area=222,331 sf 25.78% Impervious Runoff Depth=4.04"
Flow Length=341' Tc=14.6 min CN=80 Runoff=18.34 cfs 1.720 af

Pond P1: System 1 Peak Elev=7.73' Storage=27,660 cf Inflow=33.12 cfs 2.405 af
Discarded=2.21 cfs 1.568 af Primary=14.10 cfs 0.837 af Outflow=16.31 cfs 2.405 af

Pond P2: System 2 Peak Elev=5.89' Storage=3,378 cf Inflow=3.96 cfs 0.299 af
Discarded=0.17 cfs 0.166 af Primary=1.53 cfs 0.134 af Outflow=1.70 cfs 0.299 af

Link POA1: POA Inflow=62.07 cfs 9.236 af
Primary=62.07 cfs 9.236 af

Link POA2: POA Inflow=19.79 cfs 1.854 af
Primary=19.79 cfs 1.854 af

Total Runoff Area = 57.557 ac Runoff Volume = 12.824 af Average Runoff Depth = 2.67"
81.56% Pervious = 46.942 ac 18.44% Impervious = 10.615 ac

Summary for Subcatchment S1-1: Proposed Development

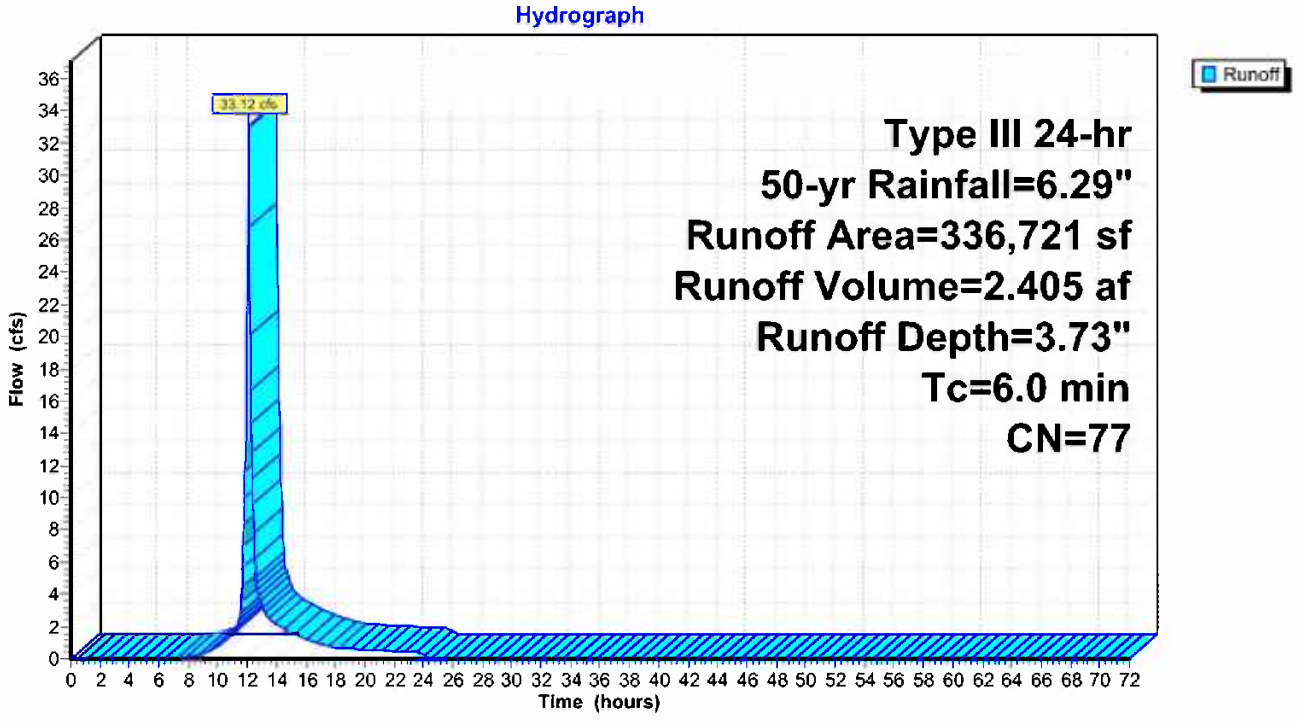
Runoff = 33.12 cfs @ 12.09 hrs, Volume= 2.405 af, Depth= 3.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-yr Rainfall=6.29"

Area (sf)	CN	Description
88,475	98	Paved roads w/curbs & sewers, HSG B
187,496	61	>75% Grass cover, Good, HSG B
60,750	98	Roofs, HSG B
336,721	77	Weighted Average
187,496		55.68% Pervious Area
149,225		44.32% Impervious Area

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

Subcatchment S1-1: Proposed Development



Summary for Subcatchment S1-2: Existing to Remain

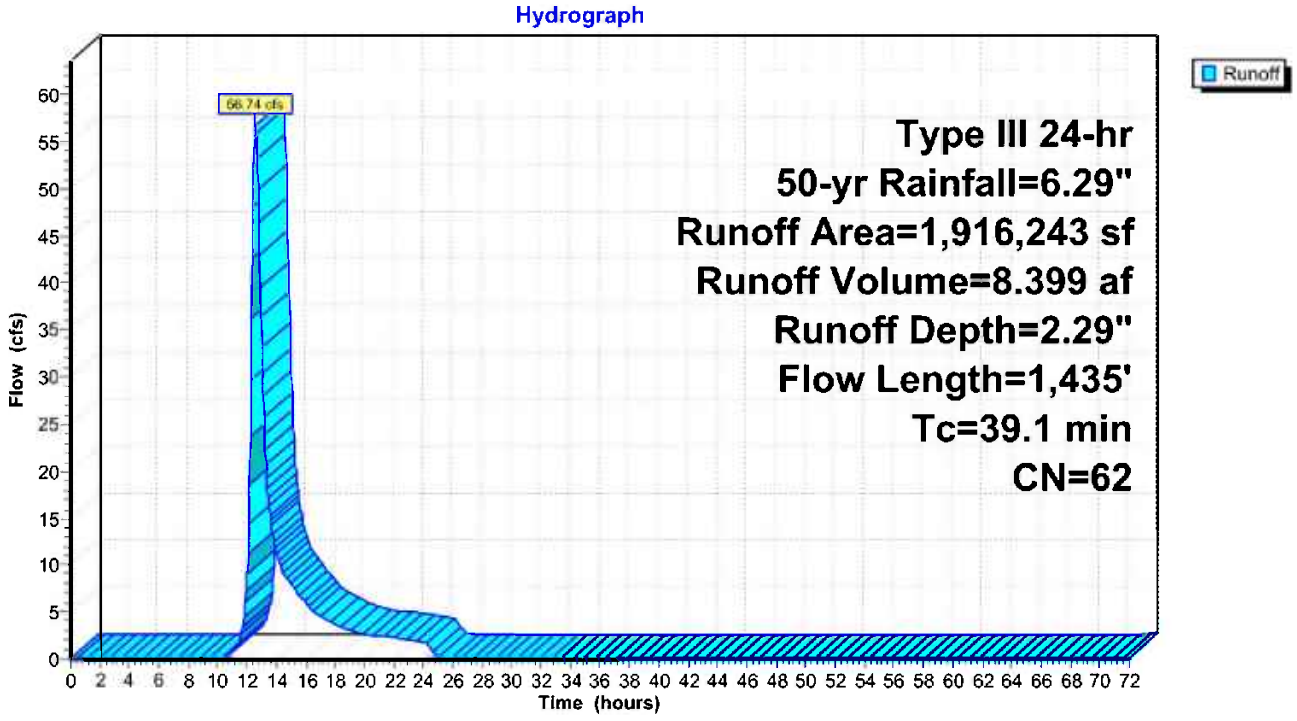
Runoff = 56.74 cfs @ 12.57 hrs, Volume= 8.399 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-yr Rainfall=6.29"

Area (sf)	CN	Description
592,175	70	1/2 acre lots, 25% imp, HSG B
89,330	98	Paved roads w/curbs & sewers, HSG B
1,234,738	55	Woods, Good, HSG B
1,916,243	62	Weighted Average
1,678,869		87.61% Pervious Area
237,374		12.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
27.9	1,385	0.0274	0.83		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
39.1	1,435	Total			

Subcatchment S1-2: Existing to Remain



Summary for Subcatchment S2-1: Proposed Development

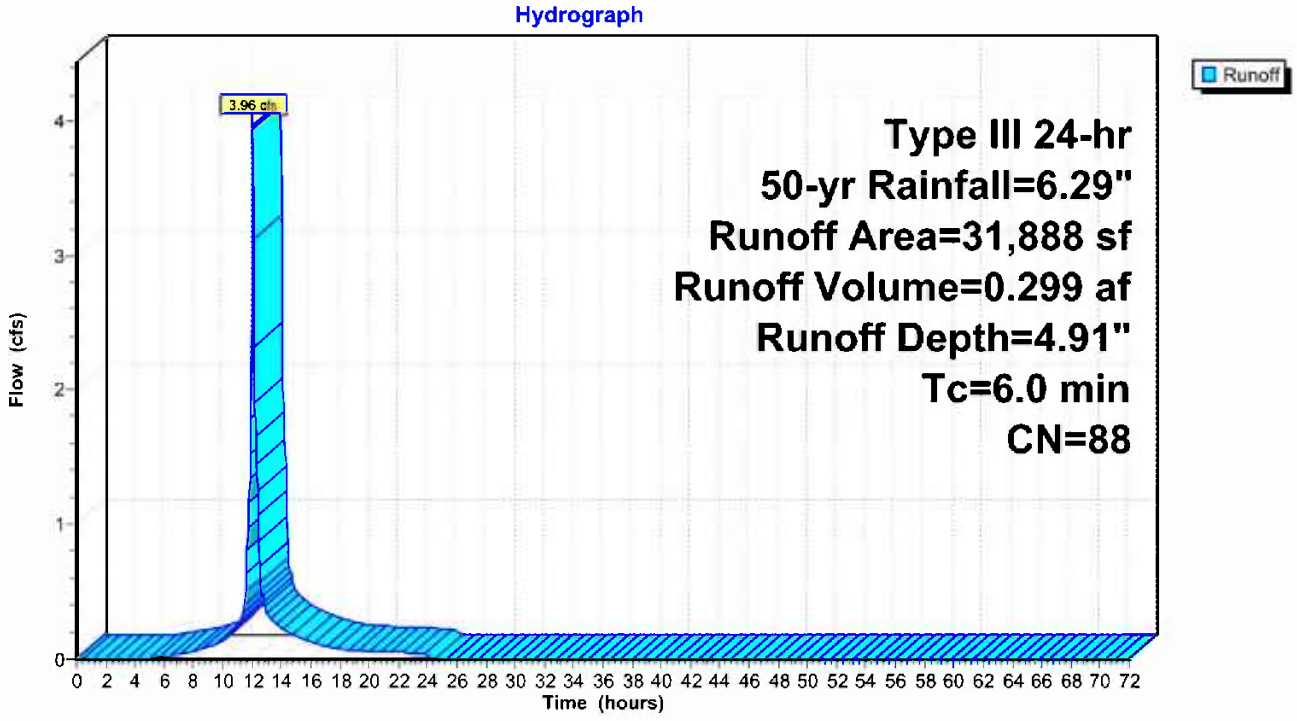
Runoff = 3.96 cfs @ 12.09 hrs, Volume= 0.299 af, Depth= 4.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-yr Rainfall=6.29"

Area (sf)	CN	Description
10,280	98	Paved roads w/curbs & sewers, HSG C
21,608	83	1/4 acre lots, 38% imp, HSG C
31,888	88	Weighted Average
13,397		42.01% Pervious Area
18,491		57.99% Impervious Area

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

Subcatchment S2-1: Proposed Development



Summary for Subcatchment S2-2: Existing to Remain

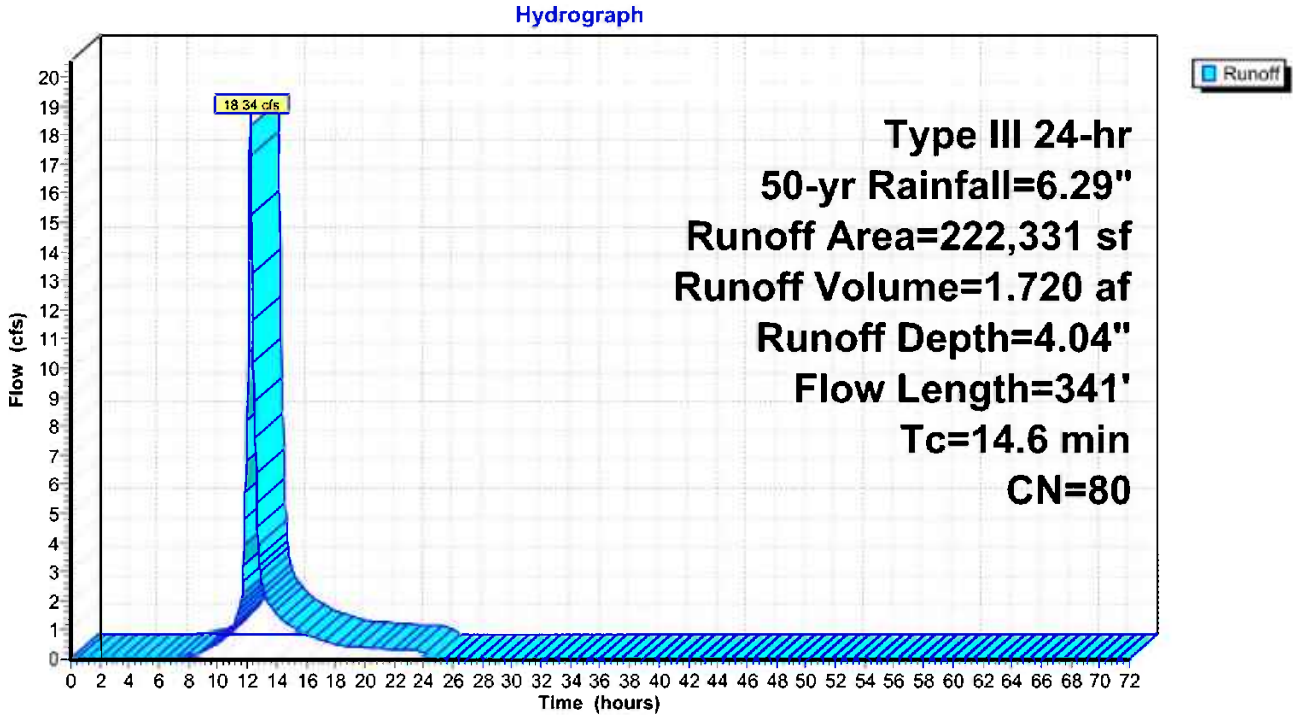
Runoff = 18.34 cfs @ 12.20 hrs, Volume= 1.720 af, Depth= 4.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50-yr Rainfall=6.29"

Area (sf)	CN	Description
191,427	80	1/2 acre lots, 25% imp, HSG C
9,464	98	Paved roads w/curbs & sewers, HSG C
21,440	70	Woods, Good, HSG C
222,331	80	Weighted Average
165,010		74.22% Pervious Area
57,321		25.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
3.4	291	0.0825	1.44		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
14.6	341	Total			

Subcatchment S2-2: Existing to Remain



Summary for Pond P1: System 1

Inflow Area = 7.730 ac, 44.32% Impervious, Inflow Depth = 3.73" for 50-yr event
Inflow = 33.12 cfs @ 12.09 hrs, Volume= 2.405 af
Outflow = 16.31 cfs @ 12.28 hrs, Volume= 2.405 af, Atten= 51%, Lag= 11.4 min
Discarded = 2.21 cfs @ 11.40 hrs, Volume= 1.568 af
Primary = 14.10 cfs @ 12.28 hrs, Volume= 0.837 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 7.73' @ 12.28 hrs Surf.Area= 6,355 sf Storage= 27,660 cf

Plug-Flow detention time= 38.5 min calculated for 2.405 af (100% of inflow)
Center-of-Mass det. time= 38.5 min (858.0 - 819.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	10,167 cf	**46.67'W x 135.92'L x 6.75'H Field A** 42,814 cf Overall - 17,395 cf Embedded = 25,418 cf x 40.0% Voids
#2A	0.75'	17,395 cf	**ADS_StormTech MC-4500 +Cap** x 160 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 5 Rows of 32 Chambers Cap Storage= +35.7 cf x 2 x 5 rows = 357.0 cf
#3	0.00'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		27,688 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**15.000 in/hr Exfiltration over Surface area**
#2	Primary	1.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	2.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	4.20'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	7.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=2.21 cfs @ 11.40 hrs HW=0.11' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 2.21 cfs)

Primary OutFlow Max=13.49 cfs @ 12.28 hrs HW=7.69' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 2.30 cfs @ 11.73 fps)
├**3=Orifice/Grate** (Orifice Controls 2.21 cfs @ 11.23 fps)
├**4=Orifice/Grate** (Orifice Controls 1.70 cfs @ 8.67 fps)
└**5=Broad-Crested Rectangular Weir** (Weir Controls 7.28 cfs @ 2.64 fps)

Pond P1: System 1 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 5 rows = 357.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

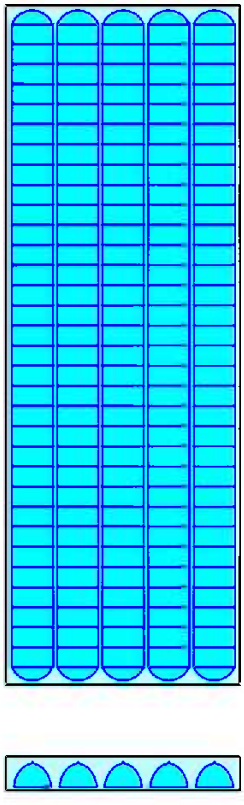
32 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 133.92' Row Length +12.0" End Stone x 2 = 135.92' Base Length
5 Rows x 100.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 46.67' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

160 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 5 Rows = 17,395.5 cf Chamber Storage

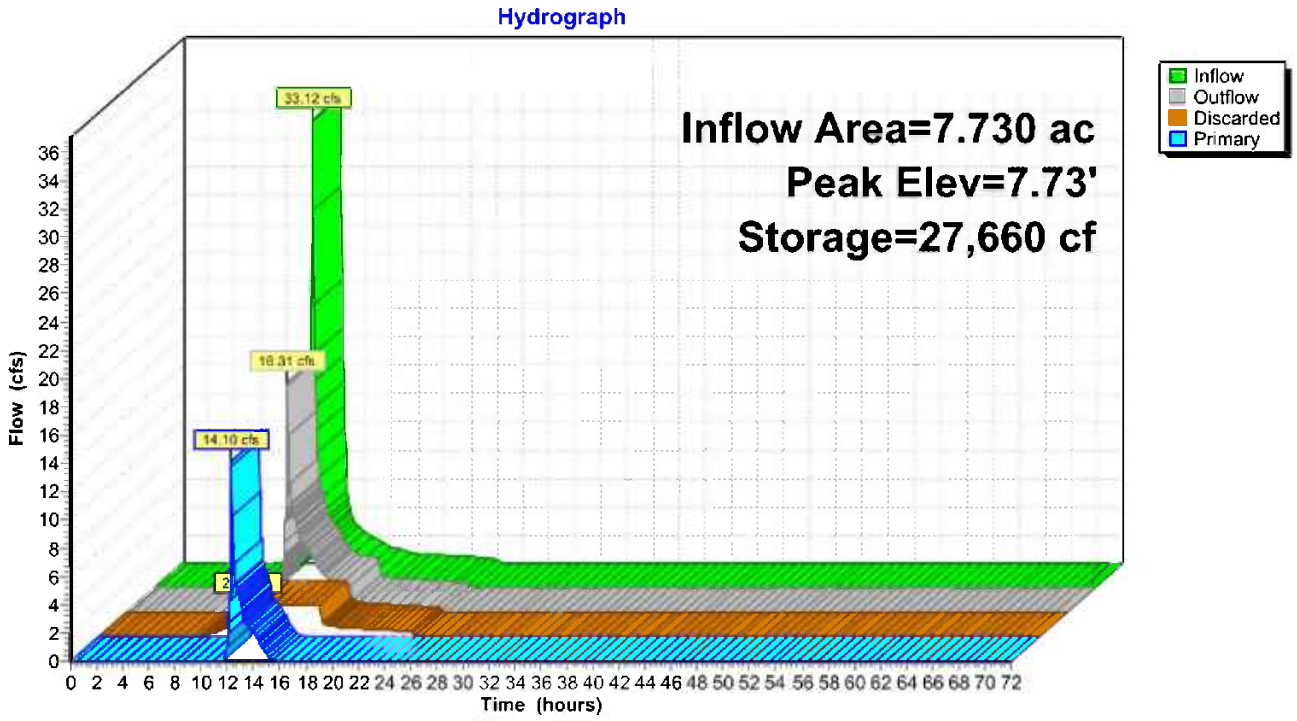
42,813.8 cf Field - 17,395.5 cf Chambers = 25,418.3 cf Stone x 40.0% Voids = 10,167.3 cf Stone Storage

Chamber Storage + Stone Storage = 27,562.8 cf = 0.633 af
Overall Storage Efficiency = 64.4%
Overall System Size = 135.92' x 46.67' x 6.75'

160 Chambers
1,585.7 cy Field
941.4 cy Stone



Pond P1: System 1



Summary for Pond P2: System 2

Inflow Area = 0.732 ac, 57.99% Impervious, Inflow Depth = 4.91" for 50-yr event
Inflow = 3.96 cfs @ 12.09 hrs, Volume= 0.299 af
Outflow = 1.70 cfs @ 12.30 hrs, Volume= 0.299 af, Atten= 57%, Lag= 12.4 min
Discarded = 0.17 cfs @ 10.40 hrs, Volume= 0.166 af
Primary = 1.53 cfs @ 12.30 hrs, Volume= 0.134 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 5.89' @ 12.29 hrs Surf.Area= 891 sf Storage= 3,378 cf

Plug-Flow detention time= 35.8 min calculated for 0.299 af (100% of inflow)
Center-of-Mass det. time= 35.8 min (825.7 - 789.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	1,554 cf	**28.50'W x 31.27'L x 6.75'H Field A** 6,015 cf Overall - 2,131 cf Embedded = 3,884 cf x 40.0% Voids
#2A	0.75'	2,131 cf	**ADS_StormTech MC-4500 +Cap** x 18 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 3 Rows of 6 Chambers Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf
		3,685 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**8.300 in/hr Exfiltration over Surface area**
#2	Primary	1.50'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	3.40'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	5.80'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	6.70'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.17 cfs @ 10.40 hrs HW=0.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=1.53 cfs @ 12.30 hrs HW=5.89' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.86 cfs @ 9.89 fps)
├**3=Orifice/Grate** (Orifice Controls 0.64 cfs @ 7.33 fps)
├**4=Orifice/Grate** (Orifice Controls 0.02 cfs @ 1.00 fps)
└**5=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond P2: System 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

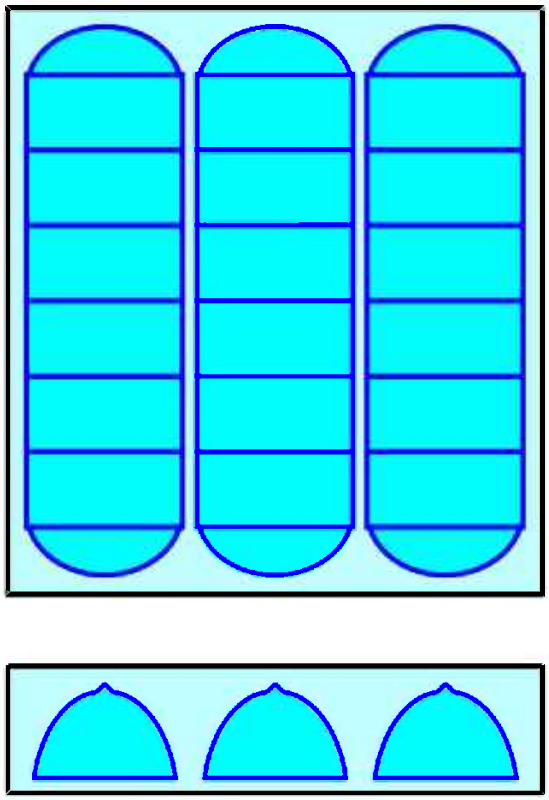
6 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 29.27' Row Length +12.0" End Stone x 2 = 31.27' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

18 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 3 Rows = 2,131.0 cf Chamber Storage

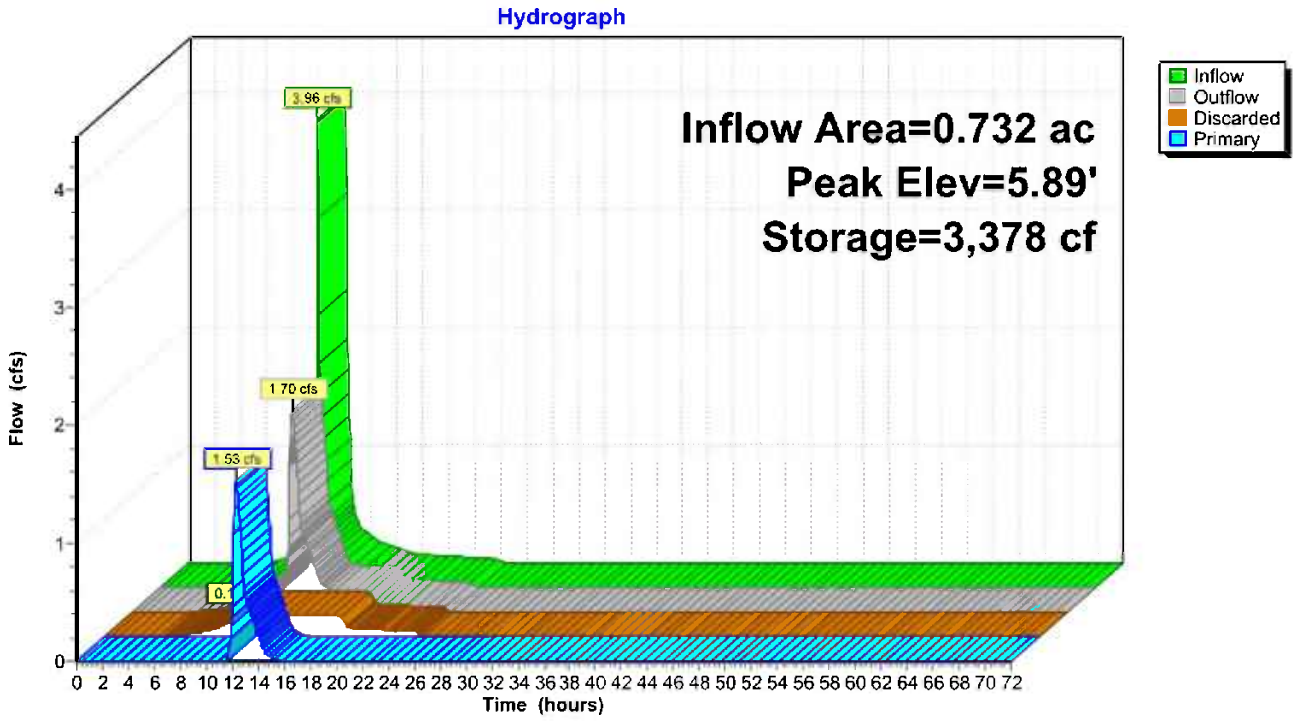
6,014.9 cf Field - 2,131.0 cf Chambers = 3,883.9 cf Stone x 40.0% Voids = 1,553.6 cf Stone Storage

Chamber Storage + Stone Storage = 3,684.6 cf = 0.085 af
Overall Storage Efficiency = 61.3%
Overall System Size = 31.27' x 28.50' x 6.75'

18 Chambers
222.8 cy Field
143.8 cy Stone



Pond P2: System 2

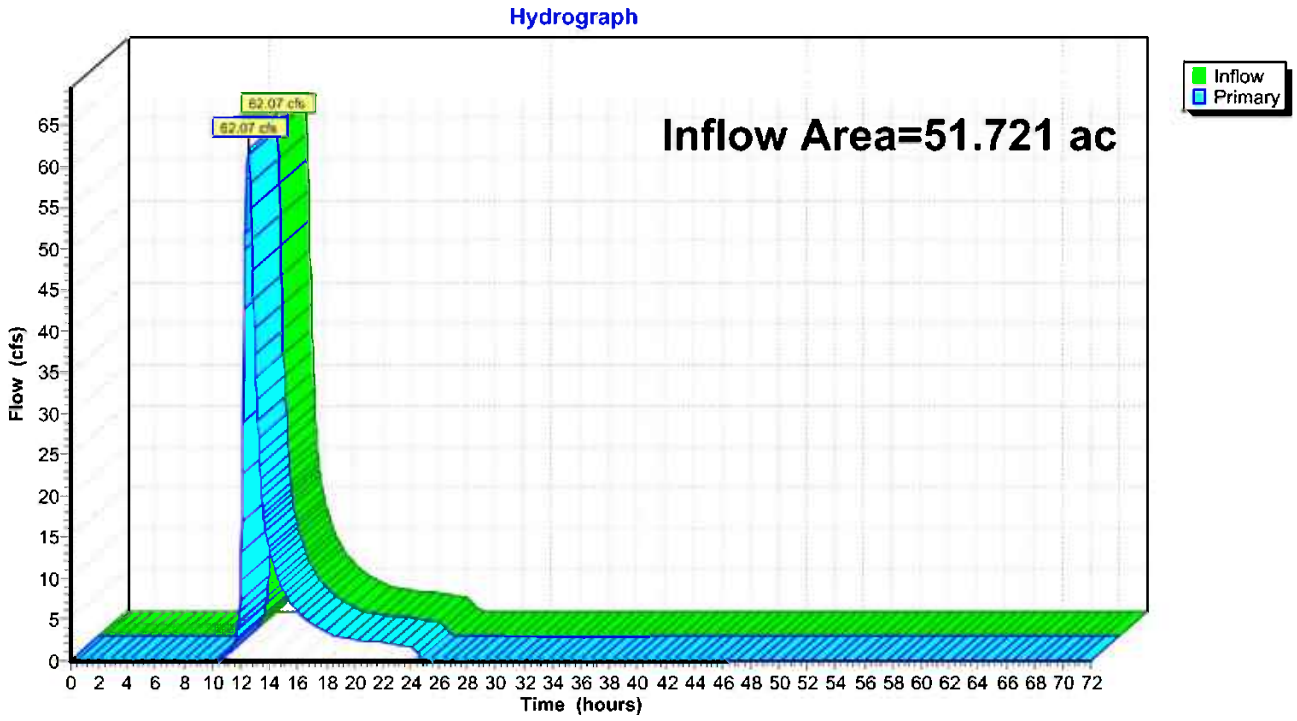


Summary for Link POA1: POA

Inflow Area = 51.721 ac, 17.16% Impervious, Inflow Depth = 2.14" for 50-yr event
Inflow = 62.07 cfs @ 12.53 hrs, Volume= 9.236 af
Primary = 62.07 cfs @ 12.53 hrs, Volume= 9.236 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA1: POA

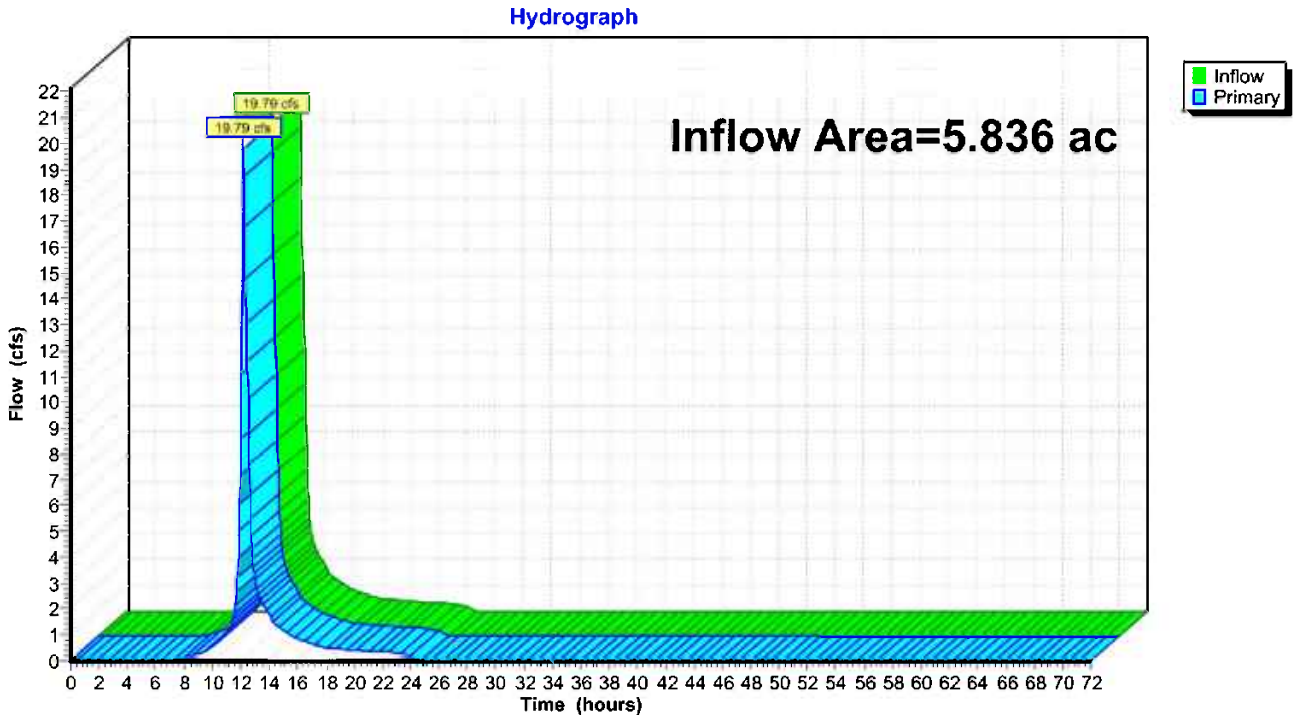


Summary for Link POA2: POA

Inflow Area = 5.836 ac, 29.82% Impervious, Inflow Depth = 3.81" for 50-yr event
Inflow = 19.79 cfs @ 12.20 hrs, Volume= 1.854 af
Primary = 19.79 cfs @ 12.20 hrs, Volume= 1.854 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA2: POA



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 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 S1-1: Proposed Runoff Area=336,721 sf 44.32% Impervious Runoff Depth=4.37"
Tc=6.0 min CN=77 Runoff=38.61 cfs 2.812 af

Subcatchment S1-2: Existing to Remain Runoff Area=1,916,243 sf 12.39% Impervious Runoff Depth=2.80"
Flow Length=1,435' Tc=39.1 min CN=62 Runoff=70.29 cfs 10.268 af

Subcatchment S2-1: Proposed Runoff Area=31,888 sf 57.99% Impervious Runoff Depth=5.59"
Tc=6.0 min CN=88 Runoff=4.49 cfs 0.341 af

Subcatchment S2-2: Existing to Remain Runoff Area=222,331 sf 25.78% Impervious Runoff Depth=4.69"
Flow Length=341' Tc=14.6 min CN=80 Runoff=21.22 cfs 1.997 af

Pond P1: System 1 Peak Elev=8.75' Storage=27,673 cf Inflow=38.61 cfs 2.812 af
Discarded=2.21 cfs 1.708 af Primary=36.45 cfs 1.105 af Outflow=38.65 cfs 2.812 af

Pond P2: System 2 Peak Elev=6.60' Storage=3,630 cf Inflow=4.49 cfs 0.341 af
Discarded=0.17 cfs 0.178 af Primary=2.38 cfs 0.164 af Outflow=2.55 cfs 0.341 af

Link POA1: POA Inflow=78.06 cfs 11.373 af
Primary=78.06 cfs 11.373 af

Link POA2: POA Inflow=23.56 cfs 2.160 af
Primary=23.56 cfs 2.160 af

Total Runoff Area = 57.557 ac Runoff Volume = 15.419 af Average Runoff Depth = 3.21"
81.56% Pervious = 46.942 ac 18.44% Impervious = 10.615 ac

Summary for Subcatchment S1-1: Proposed Development

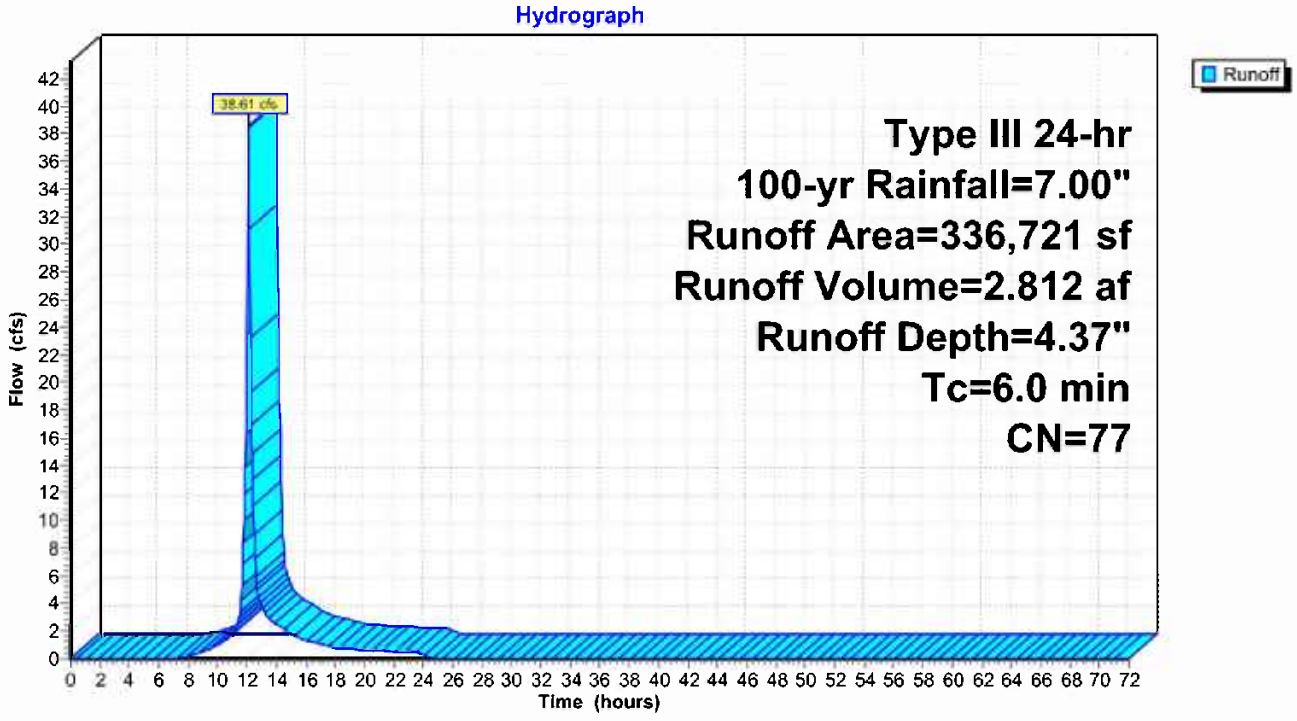
Runoff = 38.61 cfs @ 12.09 hrs, Volume= 2.812 af, Depth= 4.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
88,475	98	Paved roads w/curbs & sewers, HSG B
187,496	61	>75% Grass cover, Good, HSG B
60,750	98	Roofs, HSG B
336,721	77	Weighted Average
187,496		55.68% Pervious Area
149,225		44.32% Impervious Area

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

Subcatchment S1-1: Proposed Development



Summary for Subcatchment S1-2: Existing to Remain

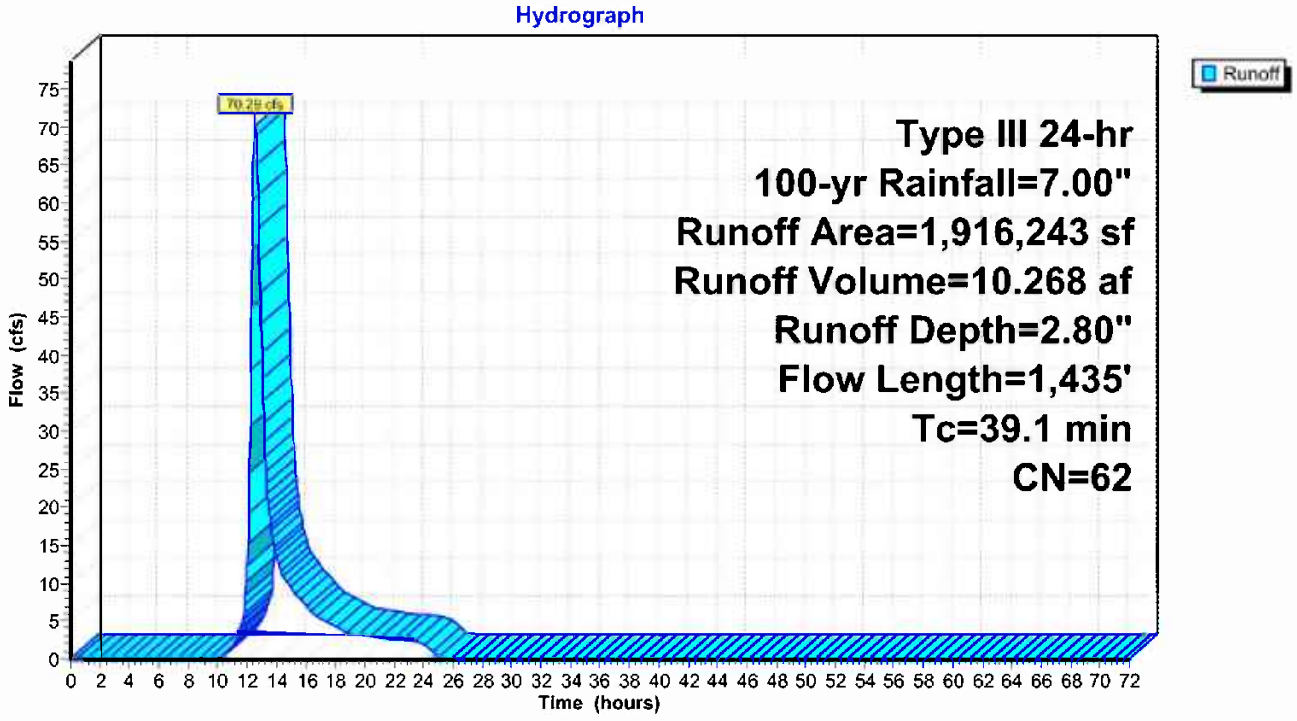
Runoff = 70.29 cfs @ 12.57 hrs, Volume= 10.268 af, Depth= 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
592,175	70	1/2 acre lots, 25% imp, HSG B
89,330	98	Paved roads w/curbs & sewers, HSG B
1,234,738	55	Woods, Good, HSG B
1,916,243	62	Weighted Average
1,678,869		87.61% Pervious Area
237,374		12.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
27.9	1,385	0.0274	0.83		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
39.1	1,435	Total			

Subcatchment S1-2: Existing to Remain



Summary for Subcatchment S2-1: Proposed Development

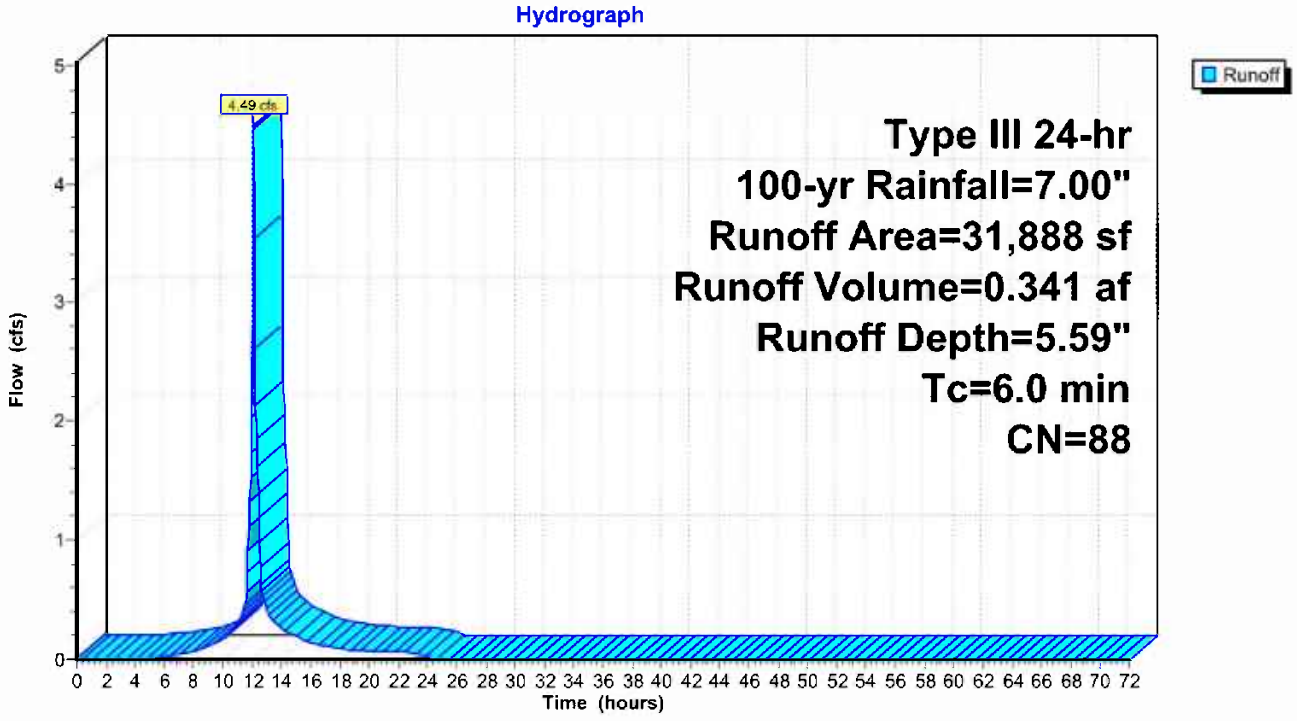
Runoff = 4.49 cfs @ 12.09 hrs, Volume= 0.341 af, Depth= 5.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
10,280	98	Paved roads w/curbs & sewers, HSG C
21,608	83	1/4 acre lots, 38% imp, HSG C
31,888	88	Weighted Average
13,397		42.01% Pervious Area
18,491		57.99% Impervious Area

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

Subcatchment S2-1: Proposed Development



Summary for Subcatchment S2-2: Existing to Remain

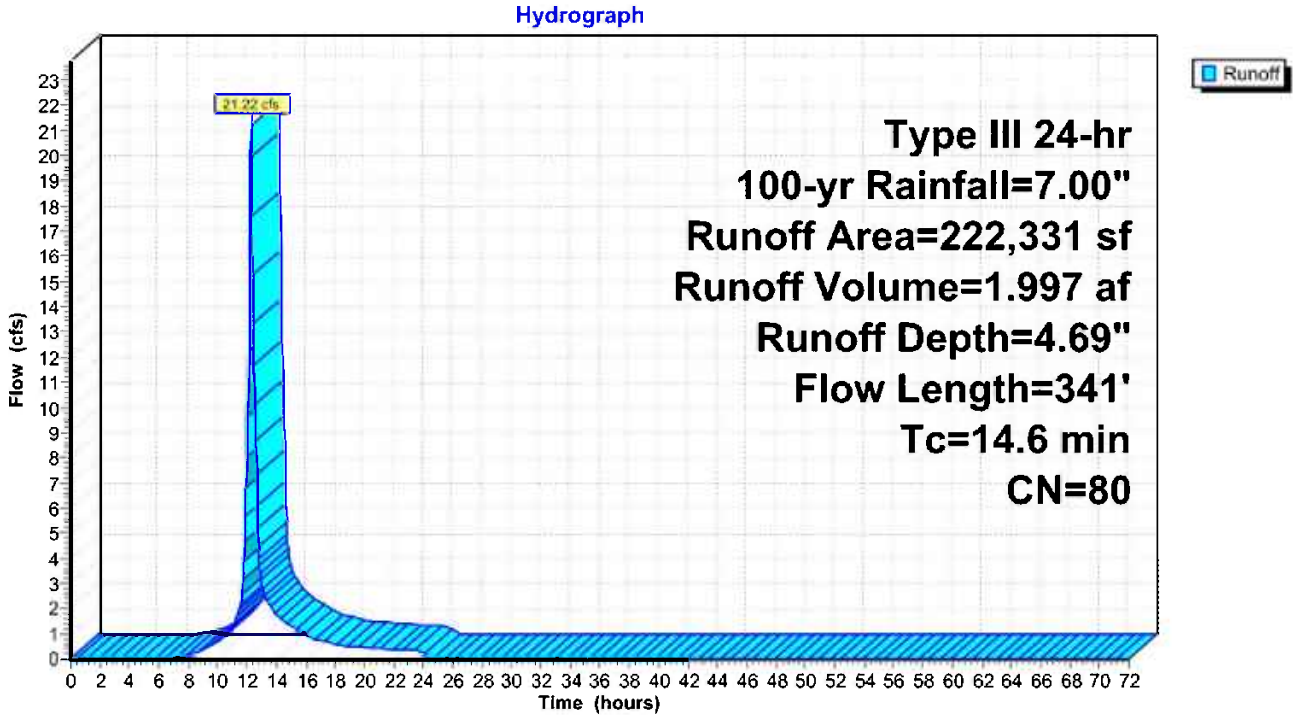
Runoff = 21.22 cfs @ 12.20 hrs, Volume= 1.997 af, Depth= 4.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=7.00"

Area (sf)	CN	Description
191,427	80	1/2 acre lots, 25% imp, HSG C
9,464	98	Paved roads w/curbs & sewers, HSG C
21,440	70	Woods, Good, HSG C
222,331	80	Weighted Average
165,010		74.22% Pervious Area
57,321		25.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	50	0.1000	0.07		**Sheet Flow, A** Woods: Dense underbrush n= 0.800 P2= 3.23"
3.4	291	0.0825	1.44		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
14.6	341	Total			

Subcatchment S2-2: Existing to Remain



Summary for Pond P1: System 1

[88] Warning: Qout>Qin may require smaller dt or Finer Routing
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

Inflow Area =	7.730 ac,	44.32% Impervious,	Inflow Depth =	4.37"	for 100-yr event
Inflow =	38.61 cfs @	12.09 hrs,	Volume=	2.812 af	
Outflow =	38.65 cfs @	12.20 hrs,	Volume=	2.812 af,	Atten= 0%, Lag= 6.3 min
Discarded =	2.21 cfs @	11.25 hrs,	Volume=	1.708 af	
Primary =	36.45 cfs @	12.20 hrs,	Volume=	1.105 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 8.75' @ 12.19 hrs Surf.Area= 6,355 sf Storage= 27,673 cf

Plug-Flow detention time= 36.4 min calculated for 2.810 af (100% of inflow)
Center-of-Mass det. time= 36.4 min (851.5 - 815.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	10,167 cf	**46.67'W x 135.92'L x 6.75'H Field A** 42,814 cf Overall - 17,395 cf Embedded = 25,418 cf x 40.0% Voids
#2A	0.75'	17,395 cf	**ADS_StormTech MC-4500 +Cap** x 160 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 5 Rows of 32 Chambers Cap Storage= +35.7 cf x 2 x 5 rows = 357.0 cf
#3	0.00'	126 cf	**4.00'D x 10.00'H Vertical Cone/Cylinder**
		27,688 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**15.000 in/hr Exfiltration over Surface area**
#2	Primary	1.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	2.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	4.20'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	7.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=2.21 cfs @ 11.25 hrs HW=0.11' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 2.21 cfs)

Primary OutFlow Max=34.32 cfs @ 12.20 hrs HW=8.63' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 2.48 cfs @ 12.63 fps)
├**3=Orifice/Grate** (Orifice Controls 2.39 cfs @ 12.16 fps)
├**4=Orifice/Grate** (Orifice Controls 1.93 cfs @ 9.84 fps)
└**5=Broad-Crested Rectangular Weir** (Weir Controls 27.53 cfs @ 4.23 fps)

Pond P1: System 1 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 5 rows = 357.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

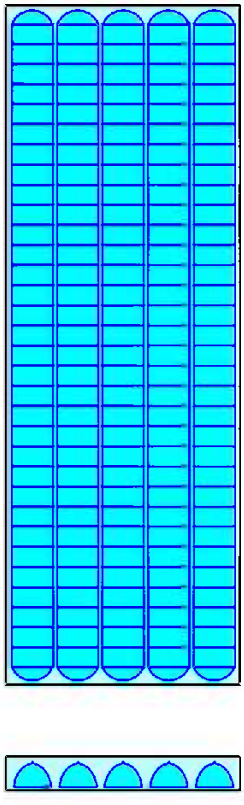
32 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 133.92' Row Length +12.0" End Stone x 2 = 135.92' Base Length
5 Rows x 100.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 46.67' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

160 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 5 Rows = 17,395.5 cf Chamber Storage

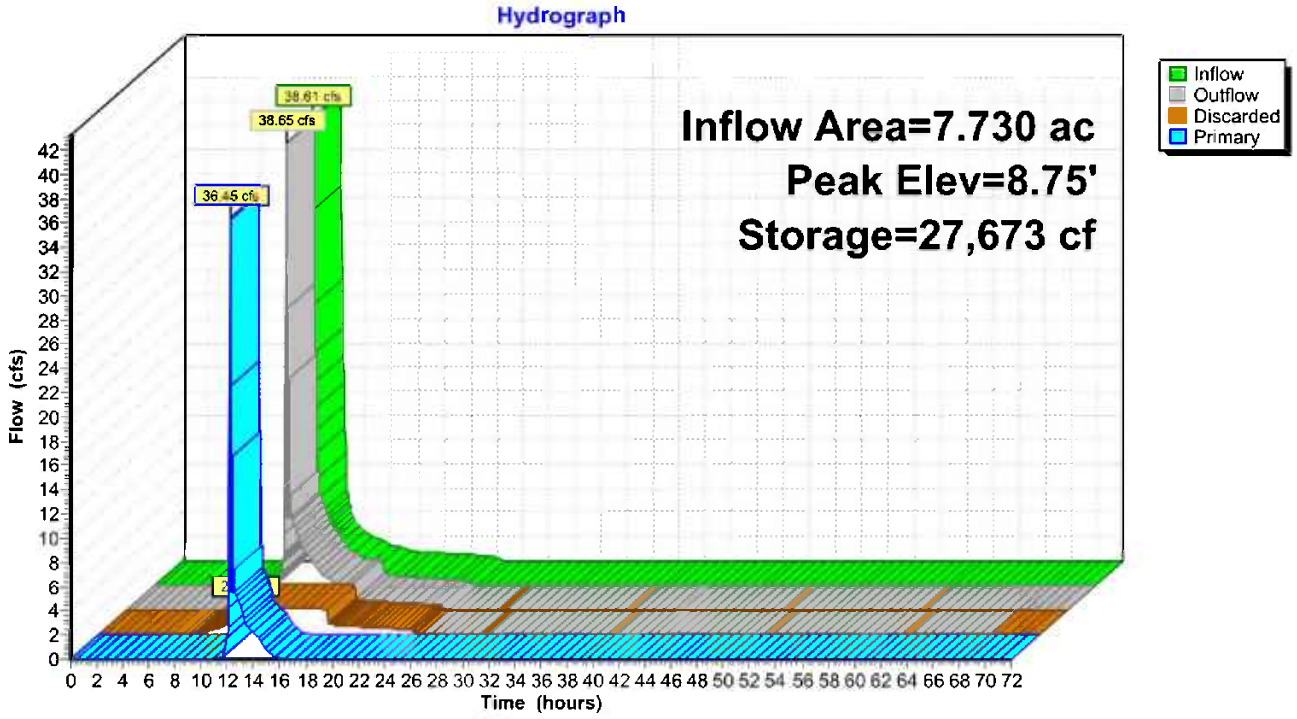
42,813.8 cf Field - 17,395.5 cf Chambers = 25,418.3 cf Stone x 40.0% Voids = 10,167.3 cf Stone Storage

Chamber Storage + Stone Storage = 27,562.8 cf = 0.633 af
Overall Storage Efficiency = 64.4%
Overall System Size = 135.92' x 46.67' x 6.75'

160 Chambers
1,585.7 cy Field
941.4 cy Stone



Pond P1: System 1



Summary for Pond P2: System 2

Inflow Area = 0.732 ac, 57.99% Impervious, Inflow Depth = 5.59" for 100-yr event
Inflow = 4.49 cfs @ 12.09 hrs, Volume= 0.341 af
Outflow = 2.55 cfs @ 12.22 hrs, Volume= 0.341 af, Atten= 43%, Lag= 7.9 min
Discarded = 0.17 cfs @ 10.15 hrs, Volume= 0.178 af
Primary = 2.38 cfs @ 12.22 hrs, Volume= 0.164 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 6.60' @ 12.22 hrs Surf.Area= 891 sf Storage= 3,630 cf

Plug-Flow detention time= 35.0 min calculated for 0.341 af (100% of inflow)
Center-of-Mass det. time= 35.0 min (821.3 - 786.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	1,554 cf	**28.50'W x 31.27'L x 6.75'H Field A** 6,015 cf Overall - 2,131 cf Embedded = 3,884 cf x 40.0% Voids
#2A	0.75'	2,131 cf	**ADS_StormTech MC-4500 +Cap** x 18 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 3 Rows of 6 Chambers Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf
		3,685 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**8.300 in/hr Exfiltration over Surface area**
#2	Primary	1.50'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Primary	3.40'	**4.0" Vert. Orifice/Grate** C= 0.600
#4	Primary	5.80'	**6.0" Vert. Orifice/Grate** C= 0.600
#5	Primary	6.70'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.17 cfs @ 10.15 hrs HW=0.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=2.32 cfs @ 12.22 hrs HW=6.54' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.93 cfs @ 10.63 fps)
├**3=Orifice/Grate** (Orifice Controls 0.72 cfs @ 8.31 fps)
├**4=Orifice/Grate** (Orifice Controls 0.66 cfs @ 3.38 fps)
└**5=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Pond P2: System 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech®MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 3 rows = 214.2 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

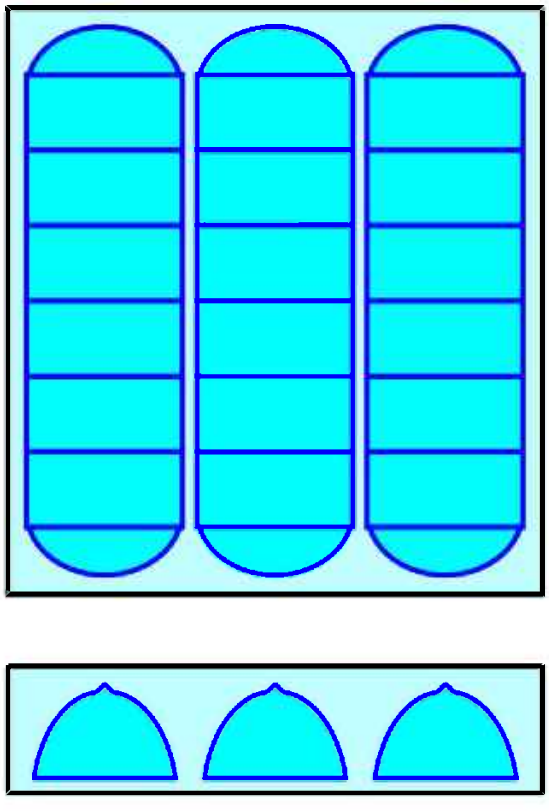
6 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 29.27' Row Length +12.0" End Stone x 2 = 31.27' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

18 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 3 Rows = 2,131.0 cf Chamber Storage

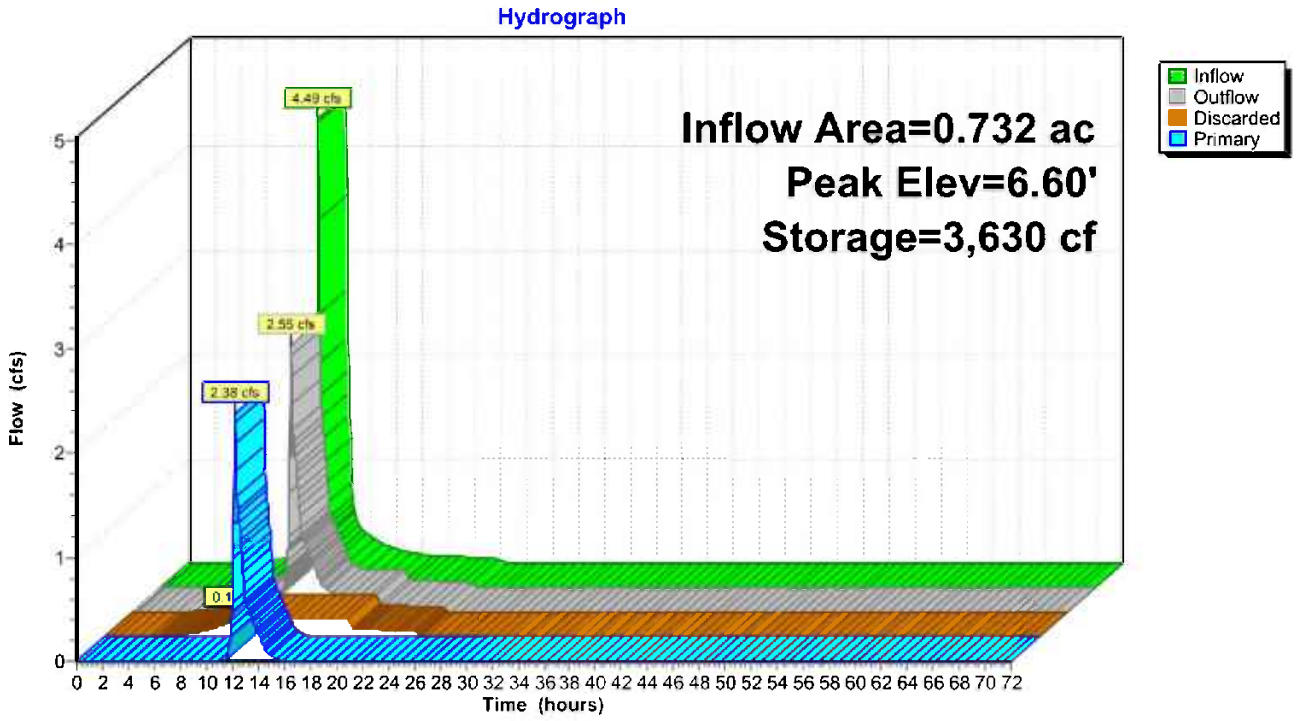
6,014.9 cf Field - 2,131.0 cf Chambers = 3,883.9 cf Stone x 40.0% Voids = 1,553.6 cf Stone Storage

Chamber Storage + Stone Storage = 3,684.6 cf = 0.085 af
Overall Storage Efficiency = 61.3%
Overall System Size = 31.27' x 28.50' x 6.75'

18 Chambers
222.8 cy Field
143.8 cy Stone



Pond P2: System 2

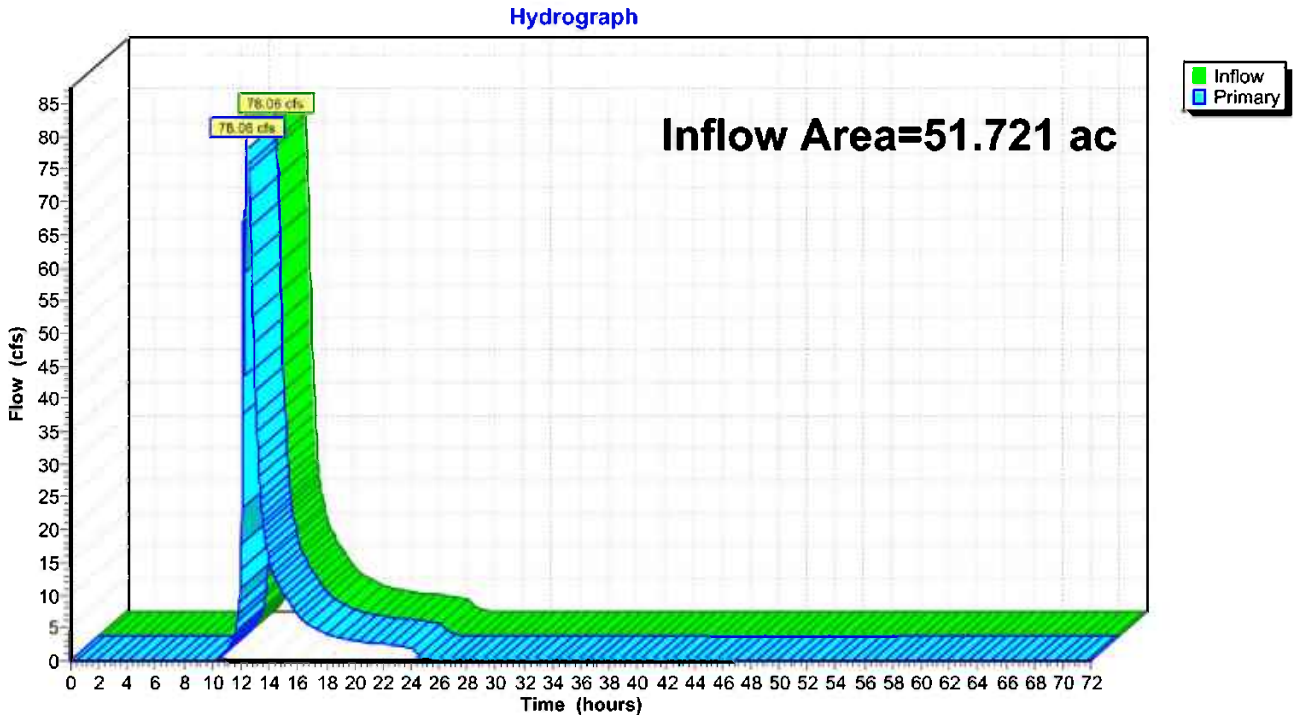


Summary for Link POA1: POA

Inflow Area = 51.721 ac, 17.16% Impervious, Inflow Depth = 2.64" for 100-yr event
Inflow = 78.06 cfs @ 12.41 hrs, Volume= 11.373 af
Primary = 78.06 cfs @ 12.41 hrs, Volume= 11.373 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA1: POA

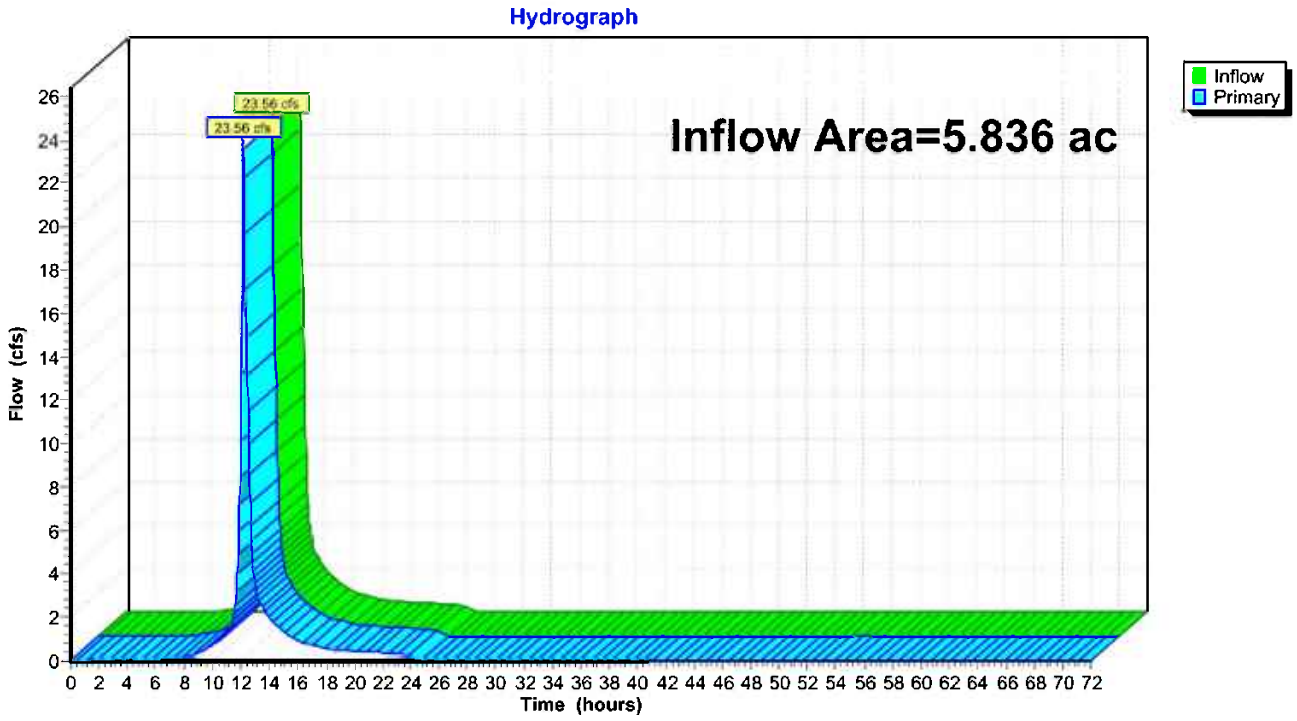


Summary for Link POA2: POA

Inflow Area = 5.836 ac, 29.82% Impervious, Inflow Depth = 4.44" for 100-yr event
Inflow = 23.56 cfs @ 12.20 hrs, Volume= 2.160 af
Primary = 23.56 cfs @ 12.20 hrs, Volume= 2.160 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link POA2: POA



APPENDIX E: PUBLIC COMMENT LETTERS AND RESPONSES

Comment Letter #1

Jill Scalise

From:
Sent: Thursday, November 12, 2020 2:11 PM
To: Jill Scalise; I
Subject: Millstone Meeting

Hi Jill,

I might not be able to make the meeting tonight on such short notice. Is there a way I can send in some comments. I am concerned that the initial topography map that has been created shows 94 to 84 (10 ft drop) in elevation on the property but that does not take into account the additional 40-50 ft drop in elevation from the edge of the plat of the property to our backyards or 100 ft drop down all the way to blueberry pond down below us. In addition, digging two 10 ft deep holes on the property will only tell the engineers how the water perks not how it will flow down hill or the volume of water the roads and impervious cover can create based of 2 inch of rainfall. Can you please include this concern that could have devastating effects for the 60 Home owners abutting the Millstone Project.

Thank You,

Sent from my iPhone

We reviewed the topography on the Project site and abutting properties, including property to the north. The ridge that runs along the north property line is favorable in that the development's stormwater will flow south and west.

Groundwater generally follows the surface topography and we do not feel that the proposed development will cause an increase in stormwater runoff to the north if it is designed properly.

The watershed mapping included in the study shows how the water flows.

Comment Letter #2

Jill Scalise

From:
Sent: Thursday, November 12, 2020 4:58 PM
To: Jill Scalise
Subject: Re: Millstone Meeting

Hi Jill,

I read the contract and scope of services from the Engineering company in regards to watersheds. My concern is that the study may be limited to the plat of land and not the 50 ft drop in elevation the the land it shuts.

Regards,

Sent from my iPhone

> On Nov 12, 2020, at 3:06 PM, Jill Scalise <jscalise@brewster-ma.gov> wrote:
>

We reviewed the topography on the Project site and abutting properties, including property to the north.

The watershed mapping included in the study shows how the water flows and localized low points on the project site and abutting properties.

Comment Letter #3

Jill Scalise

From:
Sent: Wednesday, September 2, 2020 12:23 PM
To: housingmeeting
Cc:

Subject: Millstone Project
Attachments: IMG_2152.jpeg; IMG_2150.jpeg

Follow Up Flag: Follow up
Flag Status: Completed

I appreciate the opportunity to pose this question for Bohler Engineering. *From a hydrological perspective, and considering the adjacent topography, what, in their professional opinion, is the best location for the contemplated structures on the Millstone property?*

I ask this because Fletcher Lane is the low point in a trough formed by hills on three sides. The area currently proposed for the bulk of the development is on the slope of the highest and steepest hill. On August 9, 2018, a sudden (but certainly not unusual) downpour flooded the street. The storm sewer system was overwhelmed and the road became impassable. The 75+ homes on Howland Circle were effectively isolated. Water streamed down the hill, gouging gulleys in several places on the hillside. I have attached pictures of the situation.

Combined, the seven structures and 21 homes at the base of the hill on Fletcher Lane alone have an assessed value in excess of $5.1 million. Many additional homes near the base of the hill on Howland Circle will no doubt be subject to similar issues from this development as well.

If it is not possible to get to my question at the September 3 meeting, I would appreciate a written response at your earliest convenience.

Thank you.

We reviewed the topography on the Project site and abutting properties, including property to the north. The ridge that runs along the north property line is favorable in that the development's stormwater will flow south and west.

It would be favorable to locate and grade the proposed project to maintain this ridgeline as much as possible to limit runoff from leaving the Site. Where natrual topography cannot be used to direct runoff the future Project design should include adequate collection systems to minimize impacts to abutting properties.

Based on a review of the topography and a site walk, the issue on Fletcher Lane appears to be due to an inadequate drainage design or possibly a maintenance issue if the system is sized properly.

We do not feel that the proposed development will cause an increase in stormwater runoff to the north if it is designed properly. The majority of the stormwater from the Project will flow to the southwest.

Comment Letter #4

Jill Scalise

From:
Sent: Wednesday, September 2, 2020 4:38 PM
To: housingmeeting
Subject: Affordable housing concerns

Date: September 1, 2020

To: Jill Scalise, Town of Brewster Housing Coordinator

From:

We fully support and understand the need for affordable housing in Brewster.

The Millstone development came as a surprise to most homeowners in Howland I and Howland II villages in Ocean Edge. We together represent by far the largest percentage/number of individuals that will be most directly and negatively impacted in terms of quiet enjoyment and otherwise.

From a homeowner's perspective we most strongly object to the placement and the number of buildings - for reasons perhaps not discussed during the planning meetings and LEGO activities, when influence on outcomes was highest and representation by Howland Village homeowners was lowest, if any at all.

We hope that the following concerns are considered, particularly before the RFP process commences:

- Significant loss of protection from severe flooding during storms which we all know are increasing in number and intensity. In the storm from two summers ago, the rain came so fast, and at such a volume that the only place for the runoff to go was into our front yard and down the hill rendering Fletcher Lane useless for a good portion of the day. As a result, the fire road had to be opened so that owners could safely exit the property. With the removal of trees, shrubs and ground cover from this heavily treed parcel of land, particularly in the area of high elevation sitting high above many homes on Fletcher and Howland Circle, the results could be catastrophic should we experience another massive storm and or tornado. Trees, shrubs, and ground cover removed and replaced by large sections of asphalt and concrete would result in rainwater, soil, mulch, and fertilizer run-off, flowing unimpeded and unchecked through the newly created streets and parking lots and on downhill (along with always inevitable litter picked up along the way) to homes, streets, and landscaping in our villages. Our community would be forced to bear the total ongoing cost of cleanup, repairs and replacement individually and as a homeowner's association.

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- Noise disturbance, especially at night, from potentially 360 (90 bedrooms x average mix of 1, 2 or more children and adults), their visitors, loud vehicles, and pets. A man made buffer, along with a natural buffer should be installed to decrease the anticipated noise pollution.

- Nighttime light pollution from the buildings and streetlights, particularly from the higher elevations would be a major new disturbance.

- Close proximity from the new street to the abutting condos and open spaces affords new access to our homes, especially when vacated for long periods in winter, inviting new potential for trespass and crime.

- The negative effect on our home values due to close proximity of new buildings to the once peaceful property line.

We strongly advocate for:

- 50' buffer at minimum.

- No buildings, or at most only one story on the high ground.

- More equitable density allocations - buildings arranged and flowing more equally to the South and East regardless of higher infrastructure costs.

- High barrier fencing & natural fencing along the perimeter.

- The further subdividing of the property must not occur, as discussed during an earlier committee meeting. The main concern being overcrowding and the need for additional septic systems.

- Buildings should not exceed the current 30' height restrictions. The concept of buildings higher than this was raised during an earlier committee meeting.

- Strict occupancy and vehicle rules and regulations enforced through regular inspections by management.

- Equitable number of units to be designated for singles as well as seniors

- All relevant documents should be made readily available to the public, including total budget for the project; anticipated budget breakdown for annual management, supervision and maintenance; tenant selection process; rental lease sample, details on how the three-year tenancy limits are expected to work; rules and regulations for tenants.

- We would like to see more long-term housing plans. In particular, with this being a first-time ever affordable housing project of its kind for Brewster, and one that we will be living beside long into the future. How does this compare to other towns? How has affordable housing impacted those neighborhoods?

- We would also request a timeline for this project. How long can we expect the building to last and disrupt the peace and quiet of the area? What will be the impact to the abutters from heavy equipment? What will be done to prevent construction runoff onto Howland and Fletcher Lanes once the land is stripped?

Comment Letter #4

- Finally, we are concerned about approximately $500,000+ anticipated revenue shortfall to the town this year due to COVID, with the possibility of another shortfall next year. With the pandemic already placing additional stress on the town's existing resources and infrastructure, will funds still be available to complete this project, as well as the new multimillion school building, in the same time frame (which with the discovery of Nauset High not being safe for use during the Covid safety protocol inspection, only increases that cost more)?

Thank you for your time and consideration.

We reviewed the topography on the Project site and abutting properties, including property to the north. The ridge that runs along the north property line is favorable in that the development's stormwater will flow south and west.

Based on a review of the topography and a site walk, the issue on Fletcher Lane appears to be due to an inadequate drainage design or possibly a maintenance issue if the system is sized properly.

We do not feel that the proposed development will cause an increase in stormwater runoff to the north if it is designed properly. The majority of the stormwater from the Project will flow to the southwest.

The Project, being over one acre is required to prepare and file a Stormwater Pollution Prevention Plan (SWPPP) under the EPA NPDES program. We have recommended that this plan be submitted in draft form to the town for review prior to finalizing and registering with the EPA.

Comment Letter #5

Jill Scalise

From:
Sent: Tuesday, September 1, 2020 12:41 PM
To: Jill Scalise
Subject:

Dear Ms. Scalise,

I am a homeowner in the Howland I village at Ocean Edge. I understand there will be a meeting to discuss the development of the Millstone Project this Thursday. I am addressing my concerns and questions to you as suggested by our management team.

I am an original owner, purchasing our unit in 1987. I have been following the information that has been dispersed to our ownership with great interest and concern. My unit backs up directly to the parcel that is currently under discussion for placement of some of the units.

I fully understand the need to provide affordable housing for the community. I am not an engineer, but after studying the drawings of the parcel, it appears to me there are options for placement of the units. I am sure this is not intentional, but other developed areas that border this parcel are left intact with absolutely no negative impact to their landscape, irrigation, sight lines, or noise pollution.

We chose this unit specifically because it provided a lovely private backyard space. This privacy would be greatly impacted if the chosen development site is used for any of the housing. I am very unclear as to how much privacy we would actually still have. It seems possible that we would sit in our backyard or look out our sliding door and be able to interact with the neighbors in a totally different development. There would be no buffer to prevent light or noise pollution. It appears the buffer could be only 50 feet which would ruin the beauty of the woods that are a beautiful backdrop to our homes.

More importantly, I am extraordinarily concerned by the impact this will have on a current drainage situation that exists and has since I've lived here. In a strong rain storm or melting snow storm, the entire area behind my home floods and runs down to my patio and quite honestly comes within an inch of my sliding door opening. Through the years, we have all tried to arrive at a solution but it seems that it is more or less a topography and wetland issue which can't totally be resolved.

If the parcel behind my home is developed, I cannot even imagine the negative impact it would have on my property. We are on a downslope from the parcel you are considering and without the landscape to hold some of this water back and draw it into the ground, I will be flooded. My unit will substantially decrease in value and worst, I may have an indoor flooding issue. This is TOTALLY UNACCEPTABLE and I am asking that you consider placement of the units where the impact to the current homeowners would not be this potentially serious. Once the wooded area is disturbed, the impact to the entire backend of this space will be significantly impacted. I believe there is an engineering study addressing this issue, but it would be beneficial if those making the decision could consult with the management here and share ideas on how to resolve the problem before the decisions are finalized. We know what happens here in a rainstorm, the engineers have not had the opportunity to see the impact.

It seems much of this was decided and discussed without an opportunity for our ownership to attend and speak directly and interactively with your committee. Many of us are part time residents but nonetheless we pay full time real estate taxes and should be included in the decision process. I'm sure it would be possible to locate the development where the

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~~impact would not be as potentially harmful to the ecosystem behind our homes and our brick and mortar property as~~ well.

~~I urge you to consider our collective and my personal plea to consider other spaces to place the units within your parcel. I believe our voice should be respected and considered.~~

We reviewed the topography on the Project site and abutting properties, including property to the north. The ridge that runs along the north property line is favorable in that the development's stormwater will flow south and west.

The issue on Fletcher Lane appears to be due to an inadequate drainage design.

We do not feel that the proposed development will cause an increase in stormwater runoff to the north if it is designed properly. The majority of the stormwater from the Project will flow to the southwest.