Stormwater Management Report

For the Proposed:

Retail Development

Located at:

580 Lake Road
Andover, Connecticut

Prepared for Submission to:

Town of Andover, Connecticut

November 16, 2021
Revised December 10, 2021
Revised January 28, 2022

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BL Project Number: 2101726

Contents

Executive Summary

This report has been prepared in support of a Permit Application by Garrett Homes, LLC to the Town of Andover for the proposed retail development at 580 Lake Road. The subject parcel (Lot 2B) had been previously subdivided from the parcel to the southwest (Lot 2A). The lots are labeled on the Aerial Location Map in Appendix A. The property is located on the northwestern corner of the intersection of Lake Road and Jonathan Trumbull Highway (US Route 6) and is bordered by industrial zoned properties on all sides. The subject parcel contains a total area of approximately 54,034 SF (1.24 acres).

Under the current conditions, the subject parcel is a vacant lot with a grass groundcover. The subject parcel and the surrounding areas discharge to a culvert beneath US Route 6. The other contributing drainage areas to the culvert beneath US Route 6 include a commercial building (Benjamin Franklin Plumbing), a tree farm, residential area, and roadways. Land coverage includes impervious pavement, pervious lawn, and wooded areas.

The existing topography on the subject parcel varies from elevation 292 to about elevation 299 and in general slopes south to north. The subject parcel is at a lower elevation than the surrounding roads. A 18" RCP culvert located at the low point within the Route 6 right-of-way conveys the water under Route 6 to daylight on the northeastern side which ultimately flows into Hop River.

The proposed development on the subject parcel (Lot 2B) includes the construction of a +/- 10,640 SF retail building. The development will include parking, landscaping, a stormwater management system, and additional site and utility improvements typical of commercial-retail development.

The proposed stormwater management system is designed to be in general compliance with the Town of Andover Stormwater Management Standards, 2002 State of Connecticut Guidelines for Soil Erosion and Sediment Control, and the 2004 State of Connecticut Stormwater Quality Manual.

A HydroCAD model, using TR-55 methodology, was developed to evaluate the existing and proposed drainage conditions of the property. The results of the analysis demonstrate that there will not be an increase in peak stormwater runoff rates for the 2-, 10-, 25-, and 100-year storm events.

The proposed stormwater management system has been designed to attenuate the increased flows generated by the proposed development, retain and infiltrate the Water Quality Volume, and provide groundwater recharge. Stormwater quality is being addressed by formulized street sweeping, catch basins with deep sumps and hooded outlets, and hydrodynamic separators. These features will provide the minimum required 80% TSS removal as required in the CT Stormwater Quality Manual.

A design infiltration rate of 2.7in/hr was utilized in this analysis. This infiltration rate was verified by test pits that were performed on Lot 2B (the subject parcel) which obtained a minimum field measured rate of 5.4in/hr in the area of infiltration (TP-6) so a design rate of 2.7in/hr has been utilized.

Existing Site Conditions and Hydrologic Conditions

General Site Information

The site soils identified by the United States Department of Agriculture (USDA) Natural Resources Conservation Services (NRCS) are as follows:

- Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony
  - HSG D
- Sudbury sandy loam, 0 to 5 percent slopes
  - HSG B
- Windsor loamy sand, 3 to 8 percent slopes
  - HSG A
- Hinckley loamy sand, 3 to 15 percent slopes
  - HSG A
- Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes
  - HSG D
- Ninigret fine sandy loam, 0 to 3 percent slopes
  - HSG C

Per the USDA, the NRCS Hydrologic Soil Group ratings for within the project area as noted above. A copy of the USDA NRCS Hydrologic Soil Group Map is included in Appendix A for reference.

Per the FEMA Flood Insurance Rate Map Number 0901610004A for Town of Andover, Connecticut, map revised date: February 3, 1982, the site resides in FEMA Flood Hazard Areas B (medium shading) and C (unshaded). Zone B is defined as areas between the limits of the 100-year flood and 500-year flood or certain areas subject to 100-year flooding with average depths less than one foot or where the contributing drainage area is less than one square mile. Zone C is defined as areas of minimal flooding. Zone C may have ponding and local drainage problems that don't warrant a detailed study or designation as base floodplain. The FEMA Flood insurance rate Map had been based on the NGVD29 vertical datum. To convert the NGVD29 datum to NAVD88 to match the datum on the proposed design plans, all elevations shown on the FEMA Flood insurance rate Map shall be lowered approximately 0.8'. With this elevation correction to the

proper datum, the proposed building finished floor elevation is over 1' above the Base Flood Elevation closest to the subject parcel. A copy of the FEMA Flood insurance rate Map is included in Appendix A for reference.

Existing Hydrologic Conditions

The existing condition drainage area that was analyzed totals 9.22 acres and is approximately 17% impervious. The runoff from the adjacent parcel currently discharges to a grass-lined swale which discharges to a small detention area located on the subject parcel. The small detention area does not have an outlet control structure, it overtops a poorly defined broad-crested grass lined weir to continue on to flow into the existing 18" RCP culvert crossing under Route 6 and ultimately to Hop River. The entrance to the existing 18" RCP culvert was the point of analysis (design point) used in this analysis.

The following is a brief description of the existing drainage areas as shown on the enclosed Existing Drainage Mapping (ED-1) Map, in Appendix E.

Existing Drainage Area 10 (EDA-10): This drainage area consists of the majority of the subject parcel and the offsite area to the west and southwest that flows directly to the existing 18" RCP culvert beneath Route 6 (DP-1), it is 7.49 acres and is approximately 10.9% impervious. EDA-10 consists of primarily of grassed areas, wooded areas, and impervious surface cover from the existing roof areas and roadways.

Existing Drainage Area 20 (EDA-20): This drainage area consists of the majority of the adjacent parcel that has been developed previously, it is 1.73 acres and is approximately 43.0% impervious. Stormwater runoff from this area flows into a grass lined swale which discharges to a small detention area located on the subject parcel. The small detention area does not have an outlet control structure, it overtops a poorly defined broad-crested grass lined weir to continue on to flow into the existing 18" RCP culvert beneath Route 6 (DP-1). EDA-20 consists mainly of developed impervious area and grass, with some wooded areas.

Table 1 – Pre Development (Existing Conditions) Drainage Characteristics.

Drainage Area	Total Area (SF)	Composite Curve Number	Imperviousness Cover (%)	Time of Concentration (Minutes)
EDA-10	326,300	64	10.9%	26.10
EDA-20	75,435	78	43.0%	11.80

Table 2 – Pre-Development Conditions Peak Flows

Analysis Point	Description	Peak Flows (CFS)			
		2-yr	10-yr	25-yr	100-yr
DP-1	Existing 15" Culvert	3.35	9.85	14.52	22.33

Developed Site Conditions and Hydrologic Conditions

The proposed site drainage area totals 9.22 acres and is approximately 26% impervious. The intent of the proposed site drainage is to mimic existing drainage patterns to the maximum extent practical. Due to the location of the proposed parking area (refer to Appendix F), the existing small detention area will need to be infilled, the existing grass lined swale will be modified, and an additional culvert, pipe, and manhole will be installed to connect the swale to the existing 18" RCP culvert beneath Route 6. To mitigate the development of the parcel and the filling of the existing small detention area on site, a subsurface stormwater detention system will be constructed on-site. This additional storage being provided will ensure that the peak flows discharging from the site are maintained or reduced for all storm events while providing infiltration in excess of the water quality volume. The proposed pervious pavement was conservatively assumed to be impervious surface within the hydrologic model to account for winter freeze conditions.

The site stormwater system will provide stormwater detention and water quality improvements through the installation of catch basins with deep sumps and hooded outlets, hydrodynamic separators, subsurface detention system, and a formalized street sweeping program for the impervious surfaces. These measures will treat the stormwater quality flow through structural means to provide water quality treatment in conformance with the State of Connecticut Water Quality Manual. For the hydrologic analysis, the developed site retained the same Design Point as the existing model. The following drainage areas were developed to model the proposed site improvements.

Proposed Drainage Area 101 (PDA-101): This drainage area consists of the offsite area to the west and southwest that flows into the proposed flared end section (FES-1) which will convey flow to the existing 18" RCP culvert beneath Route 6 (DP-1), it is 6.16 acres and is approximately 9.1% impervious. PDA-101 consists of grassed areas, wooded areas, and impervious surface cover from the existing roof areas and roadways. This drainage area has remained unchanged from existing conditions; therefore, it is not subject to any additional water quality treatment measures.

Proposed Drainage Area 102 (PDA-102): This drainage area consists of the portion of the subject parcel and surrounding area from which runoff will be captured in the proposed stormwater

management system and directed into the subsurface stormwater detention system (subsurface stormwater detention system #1), it is 1.15 acres and is approximately 74.1% impervious. Runoff will be treated for total suspended solids through installation of two hydrodynamic separators. From the Subsurface Detention System #1, stormwater will be discharged to the existing 18" RCP culvert beneath Route 6 (DP-1). PDA-102 consists mainly of impervious surface cover along with some grassed areas.

Proposed Drainage Area 103 (PDA-103): This drainage area consists of the building area draining from downspouts along the rear edge of the building, it is 0.22 acres and is entirely impervious. This area includes the majority of the building roof area except for a small area near the building entrance. Stormwater runoff from this area discharges from downspouts and into a roof leader pipe which outlets and flows into the proposed flared end section (FES-1) which will convey flow to the existing 18" RCP culvert beneath Route 6 (DP-1). Stormwater runoff from this area is generated from the building's roof only, as such all runoff is considered clean and therefore is not subject to the water quality regulations for the removal of total suspended solids per the Connecticut Stormwater Quality Manual.

Proposed Drainage Area 201 (PDA-201): This drainage area consists of the majority of the adjacent parcel that has been developed previously, it is 1.69 acres and is approximately 44.2% impervious. Stormwater runoff from this area flows into a grass lined swale, through a culvert along the western edge of the subject parcel, into the proposed flared end section (FES-1) which will convey flow to the existing 18" RCP culvert beneath Route 6 (DP-1). PDA-201 consists mainly of developed impervious area and grass, with some wooded areas. The proposed subsurface detention system (subsurface stormwater detention system #1) has been designed to infiltrate the impounded volume lost due to the infill of the existing detention area, in addition to the water quality volume required for the subject parcel, so there is no loss in groundwater recharge; therefore, this drainage area is not subject to any additional water quality treatment measures.

Table 3 – Post Development Drainage Characteristics.

Drainage Area	Total Area (SF)	Composite Curve Number	Imperviousness Cover (%)	Time of Concentration (Minutes)
PDA-101	268,415	64	9.1%	25.70
PDA-102	50,110	88	74.1%	5.00
PDA-103	9,790	98	100.0%	5.00
PDA-201	73,420	78	44.2%	12.90

Table 4 – Post-Development Conditions Peak Flows

Analysis Point	Description	Peak Flows (CFS)			
		2-yr	10-yr	25-yr	100-yr
DP-1	Existing 15" Culvert	3.27	9.01	13.12	20.23

Table 5 – Existing vs Proposed Peak Rates of Runoff

Peak Flow (cfs)				
	Design Storms			
Analysis Point	**2-yr**	**10-yr**	**25-yr**	**100-yr**
DP-1				
Existing	3.35	9.85	14.52	22.33
Proposed	3.27	9.01	13.12	20.23
Percent Change	-2.39%	-8.53%	-9.64%	-9.40%

Stormwater Management

Hydrologic Modeling of the Entire Site

The hydrologic analysis to determine peak stormwater discharge rates was performed using the HydroCAD stormwater modeling system computer program, version 10.00 developed by HydroCAD Software Solutions, LLC. Hydrographs for each watershed were developed using the SCS Synthetic Unit Hydrograph Method. Rainfall depths and distribution per the NOAA Atlas 14 for Andover, CT were used for the calculation of peak flow rates and are listed in Table 10. The drainage areas, or subcatchments as labeled by the program, are depicted by hexagons on the attached drainage diagrams. Pre-development HydroCAD output can be found in Appendix B and Post-development HydroCAD output can be found in Appendix C.

Table 6 – Rainfall Depths per NOAA Atlas 14
Appendix B - 24 hour Rainfall Data

Return Period	24-hour Rainfall Depth
2-year	3.32”
10-year	5.08”
25-year	6.17”
100-year	7.86”

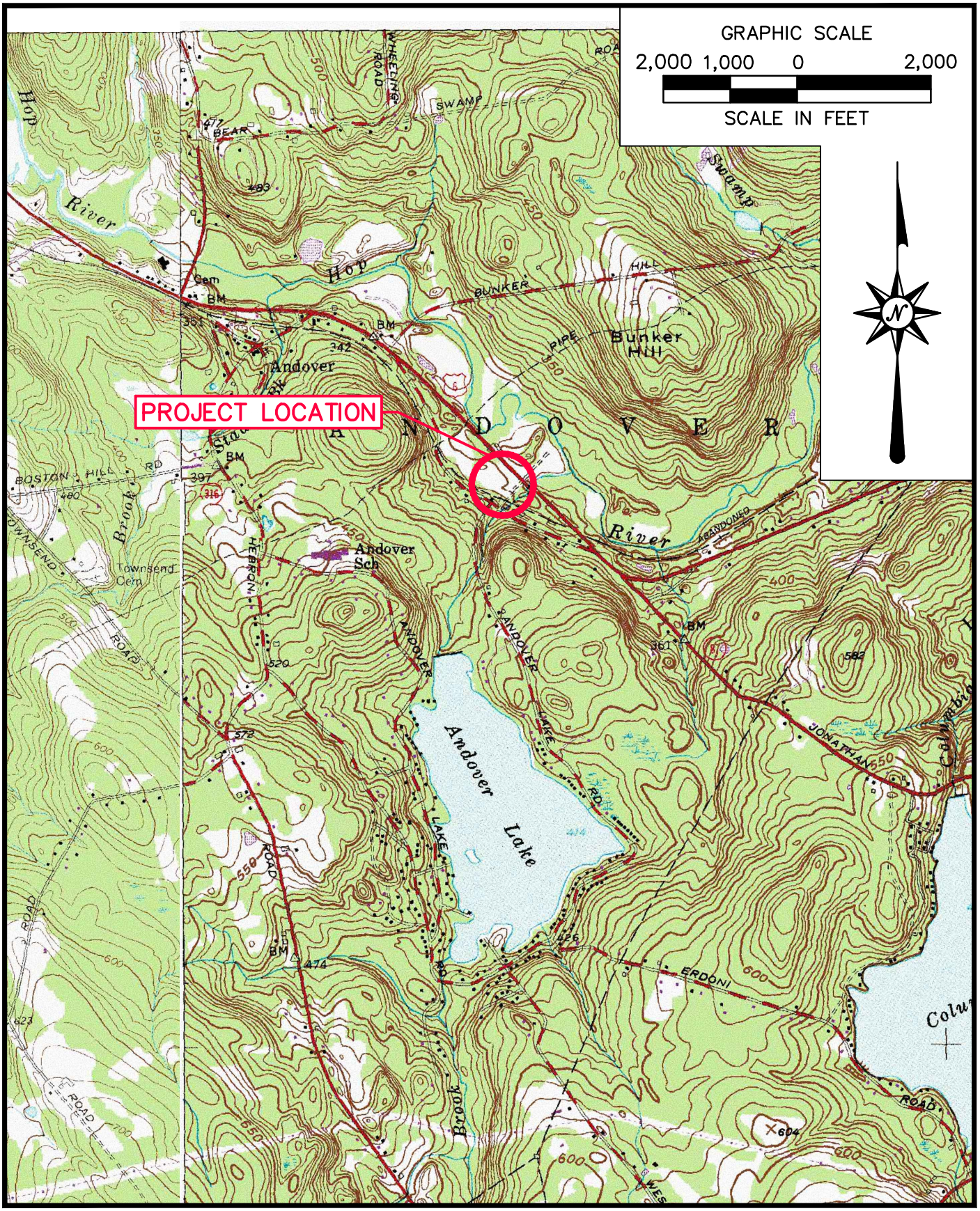
Summary

The post-development peak discharge rates for the total developed site have been decreased for all storm events. All post development stormwater will be discharged offsite to match existing drainage patterns. The proposed subsurface stormwater detention system #1 has been designed to attenuate peak flows, infiltrate the Water Quality Volume, and provide groundwater recharge. Test Pits performed indicate that the level of seasonal high groundwater is beneath the bottom of the subsurface detention system and is not anticipated to impact the function of the proposed system. Stormwater quality is being addressed by formulized street sweeping, catch basins with deep sumps and hooded outlets, and two hydrodynamic separators. These features will provide the minimum required 80% TSS removal as required in the CT Stormwater Manual. The proposed stormwater management system will meet the stormwater quality requirements of the State of Connecticut. There will be no adverse impacts to the state drainage system downstream of the proposed development due to the reduction of peak discharge leaving the site.

APPENDIX A

LOCATION MAPS

Figure 1: USGS Location Map
Figure 2: Aerial Location Map
Figure 3: NRCS Soil Survey Map with Hydrologic Soil Group Data
Figure 4: FEMA Federal Insurance Rate Map
Figure 5: NOAA Atlas 14 Storm Data



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ENGINEERING
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LAND SURVEYING

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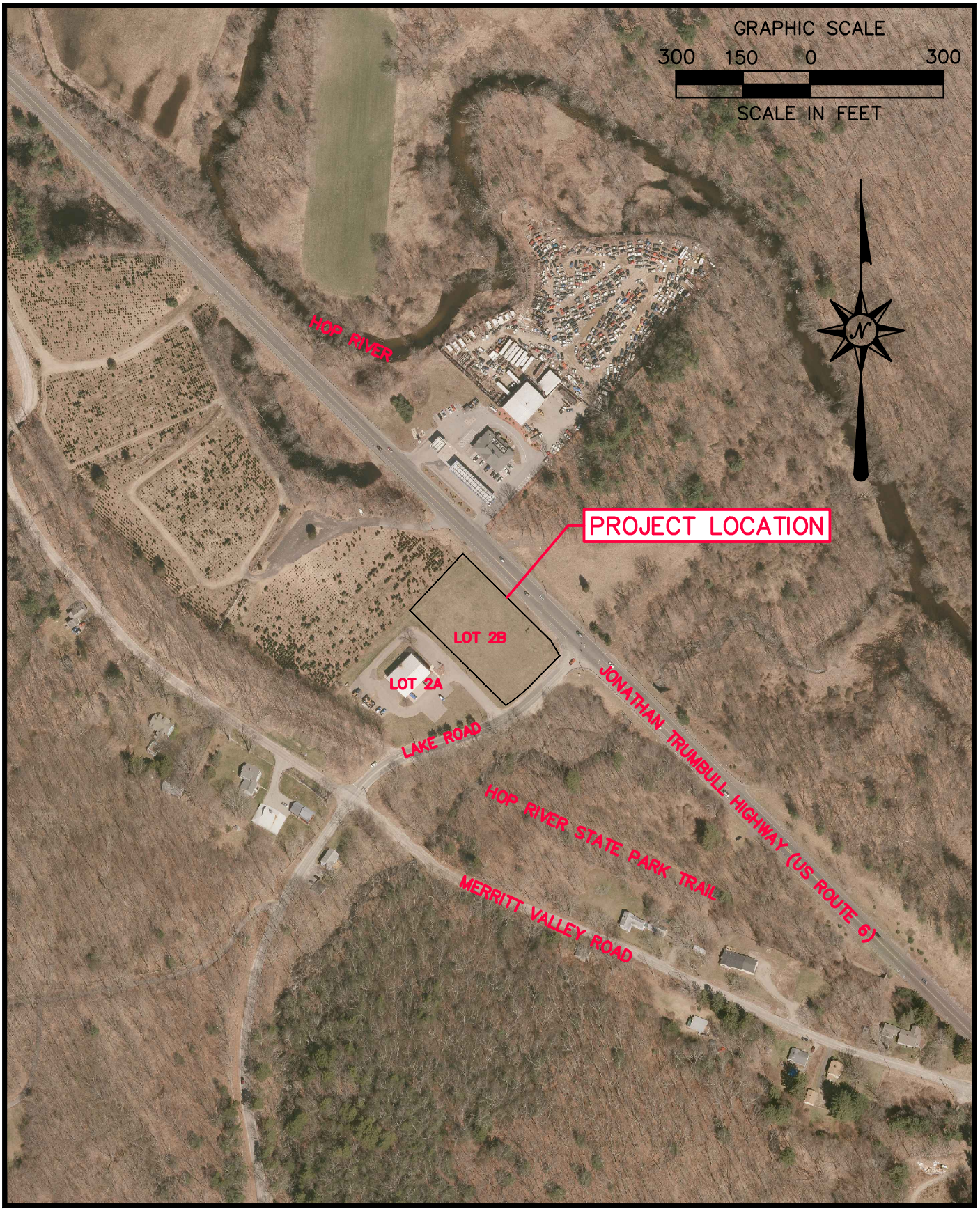
PROPOSED RETAIL DEVELOPMENT

580 LAKE ROAD
ANDOVER, CONNECTICUT

Designed	S.E.L.
Drawn	S.E.L.
Checked	J.A.B.
Scale	1"=2000'
Project No.	2101726
Date	11/16/2021
CAD File	LOC210172601

FIGURE 1

USGS LOCATION MAP



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ARCHITECTURE
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LAND SURVEYING

PROPOSED RETAIL DEVELOPMENT

580 LAKE ROAD
ANDOVER, CONNECTICUT

Designed	S.E.L.
Drawn	S.E.L.
Checked	J.A.B.
Scale	1"=300'
Project No.	2101726
Date	11/16/2021
CAD File	LOC210172601

FIGURE 2

AERIAL LOCATION MAP

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 State of Connecticut

October 29, 2021

Preface

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

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

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

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

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

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

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Contents

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:3,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:12,000.

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: State of Connecticut
Survey Area Data: Version 21, Sep 7, 2021

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

Date(s) aerial images were photographed: Sep 3, 2019—Oct 22, 2019

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
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	2.5	11.3%
23A	Sudbury sandy loam, 0 to 5 percent slopes	4.9	22.6%
36B	Windsor loamy sand, 3 to 8 percent slopes	2.6	11.9%
38C	Hinckley loamy sand, 3 to 15 percent slopes	5.9	27.1%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	0.3	1.4%
75E	Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes	3.8	17.4%
108	Saco silt loam	0.4	1.7%
109	Fluvaquents-Udifluvents complex, frequently flooded	0.1	0.3%
307	Urban land	0.2	1.0%
701A	Ninigret fine sandy loam, 0 to 3 percent slopes	1.2	5.3%
Totals for Area of Interest		**21.8**	**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.

State of Connecticut

3—Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2t2qt
Elevation: 0 to 1,480 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

Ridgebury, extremely stony, and similar soils: 40 percent
Leicester, extremely stony, and similar soils: 35 percent
Whitman, extremely stony, and similar soils: 17 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ridgebury, Extremely Stony

Setting

Landform: Drumlins, ground moraines, hills, drainageways, depressions
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: fine sandy loam
Bw - 6 to 10 inches: sandy loam
Bg - 10 to 19 inches: gravelly sandy loam
Cd - 19 to 66 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Description of Leicester, Extremely Stony

Setting

Landform: Ground moraines, hills, drainageways, depressions
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave
Parent material: Coarse-loamy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 7 inches: fine sandy loam
Bg - 7 to 18 inches: fine sandy loam
BC - 18 to 24 inches: fine sandy loam
C1 - 24 to 39 inches: gravelly fine sandy loam
C2 - 39 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
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: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B/D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Description of Whitman, Extremely Stony

Setting

Landform: Drumlins, ground moraines, hills, drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 1 inches: peat

A - 1 to 10 inches: fine sandy loam
Bg - 10 to 17 inches: gravelly fine sandy loam
Cdg - 17 to 61 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 7 to 38 inches to densic material
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Woodbridge, extremely stony

Percent of map unit: 6 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Swansea

Percent of map unit: 2 percent
Landform: Bogs, swamps
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

23A—Sudbury sandy loam, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 9lkv
Elevation: 0 to 1,200 feet

Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Sudbury

Setting

Landform: Terraces, outwash plains
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Sandy and gravelly glaciofluvial deposits derived from granite and/or schist and/or gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 5 inches: sandy loam
Bw1 - 5 to 17 inches: gravelly sandy loam
Bw2 - 17 to 25 inches: sandy loam
2C - 25 to 60 inches: stratified gravel to sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Agawam

Percent of map unit: 5 percent
Landform: Terraces, outwash plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Terraces, outwash plains, kames

Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Ninigret

Percent of map unit: 5 percent
Landform: Terraces, outwash plains
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Tisbury

Percent of map unit: 3 percent
Landform: Terraces, outwash plains
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Walpole

Percent of map unit: 2 percent
Landform: Drainageways on terraces, depressions on terraces
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

36B—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf
Elevation: 0 to 1,210 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: Farmland of statewide importance

Map Unit Composition

Windsor, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor, Loamy Sand

Setting

Landform: Dunes, outwash plains, deltas, outwash terraces
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 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 99.90 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 supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Hinckley, loamy sand

Percent of map unit: 10 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

38C—Hinckley loamy sand, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svmb
Elevation: 0 to 1,290 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: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 3 to 15 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 99.90 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 supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 5 percent
Landform: Kames, outwash plains, outwash terraces, moraines, eskers
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Agawam

Percent of map unit: 3 percent
Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, toeslope, footslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 2 percent
Landform: Outwash deltas, moraines, outwash plains, kame terraces, outwash terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

73C—Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky

Map Unit Setting

National map unit symbol: 2w698
Elevation: 0 to 1,550 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

Charlton, very stony, and similar soils: 50 percent
Chatfield, very stony, and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton, Very Stony

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 15 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: Low
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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Chatfield, Very Stony

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 2 inches: fine sandy loam
Bw - 2 to 30 inches: gravelly fine sandy loam
2R - 30 to 40 inches: bedrock

Properties and qualities

Slope: 3 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 41 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 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 supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Rock outcrop

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

Sutton, very stony

Percent of map unit: 5 percent
Landform: Ground moraines, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Leicester, very stony

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Hollis, very stony

Percent of map unit: 5 percent
Landform: Hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

75E—Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes

Map Unit Setting

National map unit symbol: 9lqp
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 56 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Hollis and similar soils: 35 percent
Chatfield and similar soils: 30 percent
Rock outcrop: 15 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Landform: Ridges, hills
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy melt-out till derived from granite and/or schist and/or gneiss

Typical profile

Oa - 0 to 1 inches: highly decomposed plant material
A - 1 to 6 inches: gravelly fine sandy loam
Bw1 - 6 to 9 inches: channery fine sandy loam
Bw2 - 9 to 15 inches: gravelly fine sandy loam
2R - 15 to 80 inches: bedrock

Properties and qualities

Slope: 15 to 45 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Chatfield

Setting

Landform: Ridges, hills
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy melt-out till derived from granite and/or schist and/or gneiss

Typical profile

Oa - 0 to 1 inches: highly decomposed plant material
A - 1 to 6 inches: gravelly fine sandy loam
Bw1 - 6 to 15 inches: gravelly fine sandy loam
Bw2 - 15 to 29 inches: gravelly fine sandy loam
2R - 29 to 80 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 45 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to high (0.01 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Properties and qualities

Slope: 15 to 45 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Charlton

Percent of map unit: 7 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Leicester

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Sutton

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Unnamed, red parent material

Percent of map unit: 1 percent
Hydric soil rating: No

Unnamed, sandy subsoil

Percent of map unit: 1 percent
Hydric soil rating: No

Brimfield

Percent of map unit: 1 percent
Landform: Ridges, hills
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

108—Saco silt loam

Map Unit Setting

National map unit symbol: 9ljv
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Saco

Setting

Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-silty alluvium

Typical profile

A - 0 to 12 inches: silt loam
Cg1 - 12 to 32 inches: silt loam
Cg2 - 32 to 48 inches: silt loam
2Cg3 - 48 to 60 inches: stratified very gravelly coarse sand to loamy fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: FrequentNone
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D
Ecological site: F144AY016MA - Very Wet Low Floodplain
Hydric soil rating: Yes

Minor Components

Lim

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

Limerick

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

Winooski

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Rippowam

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Hadley

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Bash

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

109—Fluvaquents-Udifluvents complex, frequently flooded

Map Unit Setting

National map unit symbol: 9ljw
Elevation: 0 to 2,000 feet
Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F

Frost-free period: 120 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Fluvaquents, frequently flooded, and similar soils: 50 percent
Udifluvents, frequently flooded, and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fluvaquents, Frequently Flooded

Setting

Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium

Typical profile

A - 0 to 4 inches: silt loam
Cg1 - 4 to 14 inches: fine sand
Cg2 - 14 to 21 inches: very fine sand
Ab1 - 21 to 38 inches: silt loam
Ab2 - 38 to 45 inches: fine sandy loam
C'g3 - 45 to 55 inches: sand
A'b3 - 55 to 60 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Description of Udifluvents, Frequently Flooded

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 2 inches: fine sandy loam
C - 2 to 4 inches: loamy fine sand
Ap - 4 to 12 inches: fine sandy loam
AC - 12 to 18 inches: fine sandy loam

C1 - 18 to 35 inches: loamy sand
C2 - 35 to 38 inches: very gravelly loamy sand
C3 - 38 to 60 inches: very gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (0.57 to 35.99 in/hr)
Depth to water table: About 72 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Riverwash

Percent of map unit: 5 percent
Landform: Flood plains
Hydric soil rating: Yes

Rippowam

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Saco

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Occum

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Pootatuck

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

307—Urban land

Map Unit Setting

National map unit symbol: 9lmh
Elevation: 0 to 2,000 feet
Mean annual precipitation: 43 to 56 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 120 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile

H - 0 to 6 inches: material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Udorthents, wet substratum

Percent of map unit: 10 percent
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Unnamed, undisturbed soils

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

701A—Ninigret fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2y07d
Elevation: 0 to 1,260 feet

Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Ninigret and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ninigret

Setting

Landform: Kame terraces, outwash plains, moraines, kames, outwash terraces
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, concave
Parent material: Coarse-loamy eolian deposits over sandy and gravelly glaciofluvial deposits derived from gneiss, granite, schist, and/or phyllite

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 16 inches: fine sandy loam
Bw2 - 16 to 26 inches: fine sandy loam
2C - 26 to 65 inches: stratified loamy sand to loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 18 to 38 inches to strongly contrasting textural stratification
Drainage class: Moderately well drained
Runoff class: Very low
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 17 to 39 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: F144AY026CT - Moist Silty Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 5 percent
Landform: Outwash plains, outwash terraces, eskers, kames, moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope, crest, tread
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

Agawam

Percent of map unit: 5 percent
Landform: Kame terraces, outwash plains, outwash terraces, moraines, kames
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope, crest, tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Tisbury

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

Raypol

Percent of map unit: 2 percent
Landform: Drainageways, depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

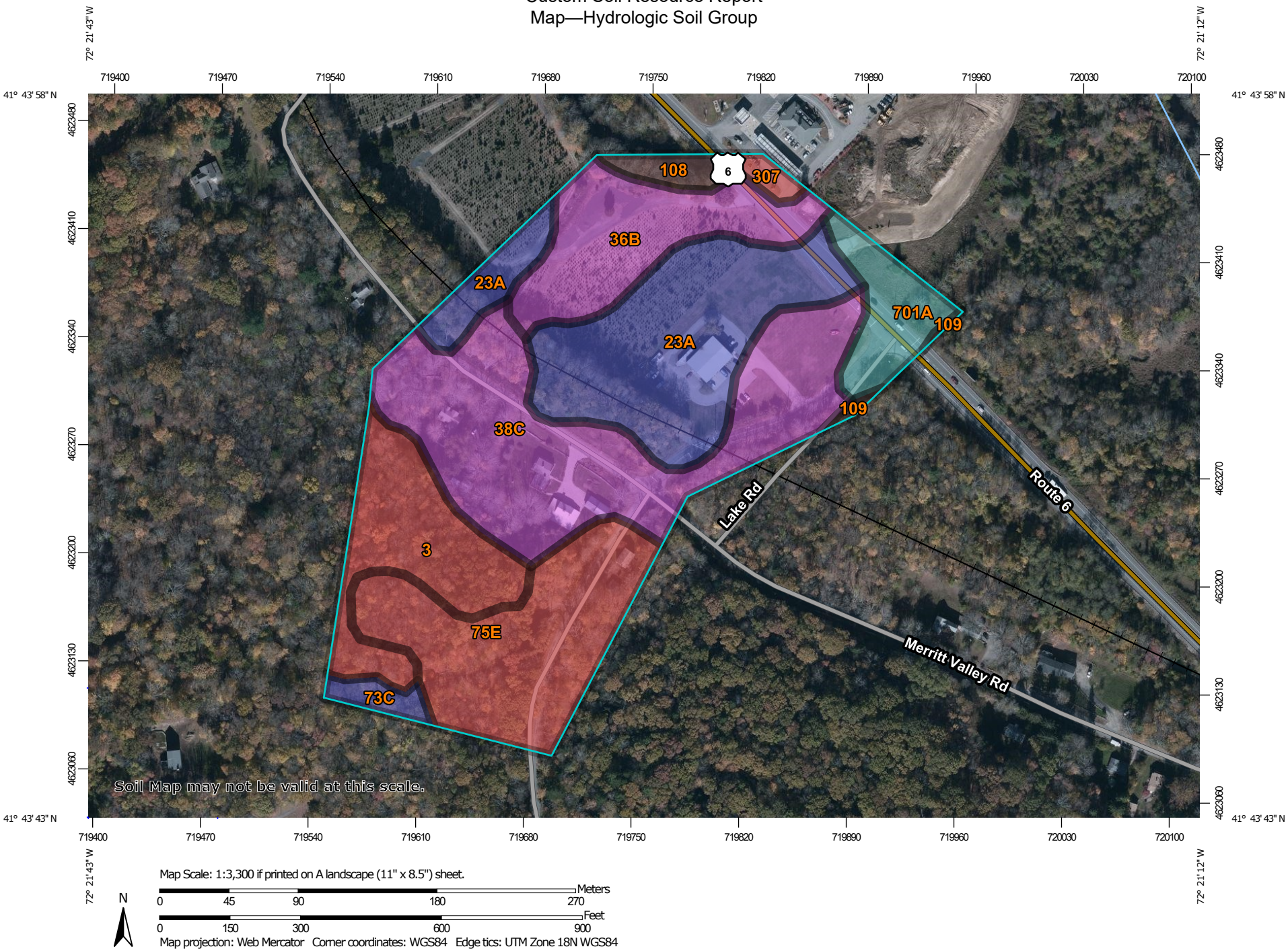
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.



Map Scale: 1:3,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 45 90 180 270

Feet
0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

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 1:12,000.

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: State of Connecticut
Survey Area Data: Version 21, Sep 7, 2021

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

Date(s) aerial images were photographed: Sep 3, 2019—Oct 22, 2019

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	D	2.5	11.3%
23A	Sudbury sandy loam, 0 to 5 percent slopes	B	4.9	22.6%
36B	Windsor loamy sand, 3 to 8 percent slopes	A	2.6	11.9%
38C	Hinckley loamy sand, 3 to 15 percent slopes	A	5.9	27.1%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	B	0.3	1.4%
75E	Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes	D	3.8	17.4%
108	Saco silt loam	B/D	0.4	1.7%
109	Fluvaquents-Udifluvents complex, frequently flooded	B/D	0.1	0.3%
307	Urban land	D	0.2	1.0%
701A	Ninigret fine sandy loam, 0 to 3 percent slopes	C	1.2	5.3%
Totals for Area of Interest			**21.8**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

KEY TO MAP

500-Year Flood Boundary	ZONE B
100-Year Flood Boundary	ZONE A1
Zone Designations*	ZONE A5
100-Year Flood Boundary	ZONE B
500-Year Flood Boundary	ZONE B
Base Flood Elevation Line With Elevation In Feet**	513
Base Flood Elevation in Feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	RM7X
Zone D Boundary	
River Mile	•M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

INITIAL IDENTIFICATION:
APRIL 18, 1975
FLOOD HAZARD BOUNDARY MAP REVISIONS:

FLOOD INSURANCE RATE MAP EFFECTIVE:
FEBRUARY 3, 1982
FLOOD INSURANCE RATE MAP REVISIONS:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.

APPROXIMATE SCALE
400 0 400 FEET

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION IN FT. (NGVD)[1]	DESCRIPTION OF LOCATION
RM 5	350.58	Standard USC&GS disk stamped F9, set in ledge outcrop on south side of US Route 6, located 13.2 feet south of CONRAIL about 2 feet higher than track, 14 rails west of railroad station.
RM 6	339.89	Standard USC&GS and state survey disk stamped 1217X, set in top of granite retaining wall, located on north side of US Route 6 at junction with Hebron Road, 11.5 feet west of southeast corner of retaining wall.
RM 7	324.68	Southeast corner top curb on catch basin at intersection of Connecticut Route 87 and US Route 6.
RM 8	360.50	Standard USC&GS and state survey disk stamped 1788, set in reinforced concrete post 6 inches below ground, located on east side of Connecticut Route 87, 0.35 mile southeast of intersection of US Route 6 and Connecticut Route 87, 70 feet north of Southern New England telephone pole No. 6.

[1]National Geodetic Vertical Datum of 1929

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

TOWN OF
ANDOVER,
CONNECTICUT
TOLLAND COUNTY

PANEL 4 OF 10
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
090161 0004 A

EFFECTIVE DATE:
FEBRUARY 3, 1982

Federal Emergency Management Agency

NOAA Atlas 14, Volume 10, Version 3
Location name: Andover, Connecticut, USA*
Latitude: 41.7315°, Longitude: -72.3572°
Elevation: 302.3 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.328** (0.251-0.427)	**0.398** (0.304-0.518)	**0.512** (0.390-0.668)	**0.606** (0.460-0.795)	**0.736** (0.543-1.01)	**0.834** (0.603-1.16)	**0.937** (0.661-1.35)	**1.05** (0.706-1.55)	**1.22** (0.791-1.85)	**1.36** (0.862-2.10)
10-min	**0.465** (0.356-0.604)	**0.564** (0.431-0.733)	**0.725** (0.553-0.946)	**0.859** (0.651-1.13)	**1.04** (0.769-1.43)	**1.18** (0.854-1.65)	**1.33** (0.936-1.91)	**1.49** (1.00-2.19)	**1.73** (1.12-2.62)	**1.93** (1.22-2.97)
15-min	**0.547** (0.419-0.711)	**0.663** (0.507-0.863)	**0.853** (0.650-1.11)	**1.01** (0.766-1.33)	**1.23** (0.904-1.68)	**1.39** (1.01-1.94)	**1.56** (1.10-2.25)	**1.76** (1.18-2.57)	**2.04** (1.32-3.08)	**2.27** (1.44-3.50)
30-min	**0.748** (0.572-0.972)	**0.906** (0.693-1.18)	**1.17** (0.888-1.52)	**1.38** (1.05-1.81)	**1.68** (1.23-2.29)	**1.90** (1.37-2.64)	**2.13** (1.50-3.07)	**2.40** (1.61-3.51)	**2.78** (1.80-4.21)	**3.10** (1.96-4.77)
60-min	**0.948** (0.726-1.23)	**1.15** (0.878-1.50)	**1.48** (1.13-1.93)	**1.75** (1.33-2.29)	**2.12** (1.56-2.90)	**2.40** (1.74-3.35)	**2.70** (1.91-3.89)	**3.04** (2.03-4.45)	**3.52** (2.28-5.33)	**3.92** (2.48-6.04)
2-hr	**1.23** (0.944-1.59)	**1.48** (1.14-1.92)	**1.89** (1.45-2.46)	**2.23** (1.70-2.92)	**2.71** (2.01-3.69)	**3.06** (2.23-4.25)	**3.43** (2.45-4.96)	**3.88** (2.61-5.66)	**4.57** (2.96-6.87)	**5.15** (3.27-7.88)
3-hr	**1.42** (1.10-1.84)	**1.71** (1.32-2.21)	**2.19** (1.68-2.83)	**2.58** (1.97-3.35)	**3.12** (2.32-4.24)	**3.52** (2.58-4.88)	**3.95** (2.83-5.70)	**4.48** (3.02-6.51)	**5.29** (3.44-7.93)	**5.99** (3.81-9.13)
6-hr	**1.83** (1.42-2.34)	**2.19** (1.70-2.82)	**2.80** (2.16-3.60)	**3.29** (2.53-4.26)	**3.98** (2.98-5.38)	**4.49** (3.30-6.19)	**5.04** (3.63-7.23)	**5.71** (3.86-8.24)	**6.76** (4.40-10.0)	**7.65** (4.88-11.6)
12-hr	**2.30** (1.79-2.94)	**2.77** (2.16-3.54)	**3.54** (2.75-4.53)	**4.17** (3.22-5.37)	**5.05** (3.79-6.78)	**5.69** (4.20-7.80)	**6.39** (4.61-9.09)	**7.24** (4.91-10.4)	**8.51** (5.57-12.6)	**9.61** (6.15-14.4)
24-hr	**2.73** (2.14-3.47)	**3.32** (2.60-4.22)	**4.28** (3.34-5.46)	**5.08** (3.94-6.50)	**6.17** (4.66-8.25)	**6.98** (5.18-9.53)	**7.86** (5.70-11.1)	**8.93** (6.08-12.7)	**10.5** (6.92-15.5)	**11.9** (7.66-17.8)
2-day	**3.07** (2.42-3.87)	**3.78** (2.97-4.78)	**4.95** (3.88-6.27)	**5.91** (4.61-7.53)	**7.25** (5.51-9.66)	**8.23** (6.15-11.2)	**9.30** (6.81-13.2)	**10.6** (7.27-15.1)	**12.8** (8.39-18.6)	**14.6** (9.40-21.6)
3-day	**3.32** (2.63-4.19)	**4.11** (3.24-5.18)	**5.39** (4.24-6.81)	**6.45** (5.05-8.20)	**7.92** (6.04-10.5)	**8.99** (6.74-12.2)	**10.2** (7.47-14.4)	**11.7** (7.98-16.5)	**14.0** (9.24-20.4)	**16.1** (10.4-23.7)
4-day	**3.56** (2.82-4.48)	**4.40** (3.48-5.53)	**5.76** (4.54-7.27)	**6.90** (5.41-8.74)	**8.46** (6.46-11.2)	**9.60** (7.21-13.0)	**10.9** (7.99-15.3)	**12.5** (8.53-17.5)	**15.0** (9.88-21.7)	**17.2** (11.1-25.2)
7-day	**4.22** (3.36-5.29)	**5.17** (4.11-6.47)	**6.71** (5.31-8.43)	**7.98** (6.29-10.1)	**9.74** (7.47-12.8)	**11.0** (8.31-14.9)	**12.5** (9.18-17.4)	**14.2** (9.78-19.9)	**17.0** (11.3-24.5)	**19.4** (12.6-28.4)
10-day	**4.89** (3.90-6.10)	**5.89** (4.69-7.36)	**7.53** (5.98-9.43)	**8.89** (7.02-11.2)	**10.8** (8.26-14.1)	**12.1** (9.15-16.2)	**13.6** (10.0-18.9)	**15.5** (10.7-21.6)	**18.3** (12.2-26.3)	**20.8** (13.5-30.3)
20-day	**6.98** (5.60-8.67)	**8.06** (6.46-10.0)	**9.82** (7.84-12.2)	**11.3** (8.95-14.1)	**13.3** (10.2-17.2)	**14.8** (11.1-19.5)	**16.4** (12.0-22.3)	**18.2** (12.6-25.1)	**20.8** (13.9-29.5)	**23.0** (14.9-33.1)
30-day	**8.76** (7.05-10.8)	**9.86** (7.93-12.2)	**11.7** (9.35-14.5)	**13.2** (10.5-16.4)	**15.2** (11.7-19.6)	**16.8** (12.7-22.0)	**18.4** (13.4-24.7)	**20.1** (14.0-27.7)	**22.4** (15.0-31.7)	**24.3** (15.8-34.9)
45-day	**11.0** (8.86-13.5)	**12.1** (9.76-15.0)	**14.0** (11.2-17.3)	**15.5** (12.4-19.3)	**17.6** (13.6-22.5)	**19.3** (14.5-25.0)	**20.9** (15.2-27.7)	**22.5** (15.7-30.7)	**24.5** (16.4-34.4)	**25.9** (16.9-37.1)
60-day	**12.8** (10.4-15.8)	**14.0** (11.3-17.3)	**15.9** (12.8-19.6)	**17.5** (14.0-21.7)	**19.7** (15.2-25.0)	**21.4** (16.1-27.5)	**23.0** (16.7-30.3)	**24.5** (17.1-33.3)	**26.3** (17.7-36.8)	**27.4** (17.9-39.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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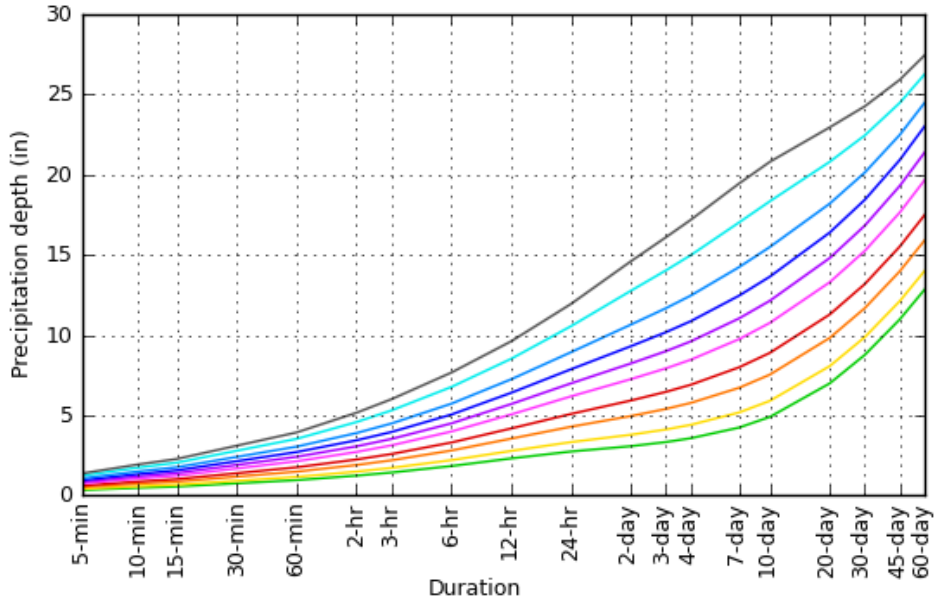
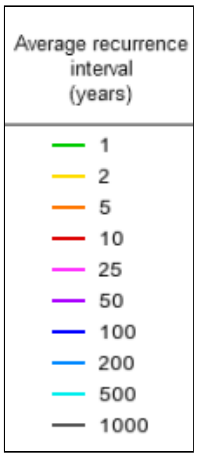
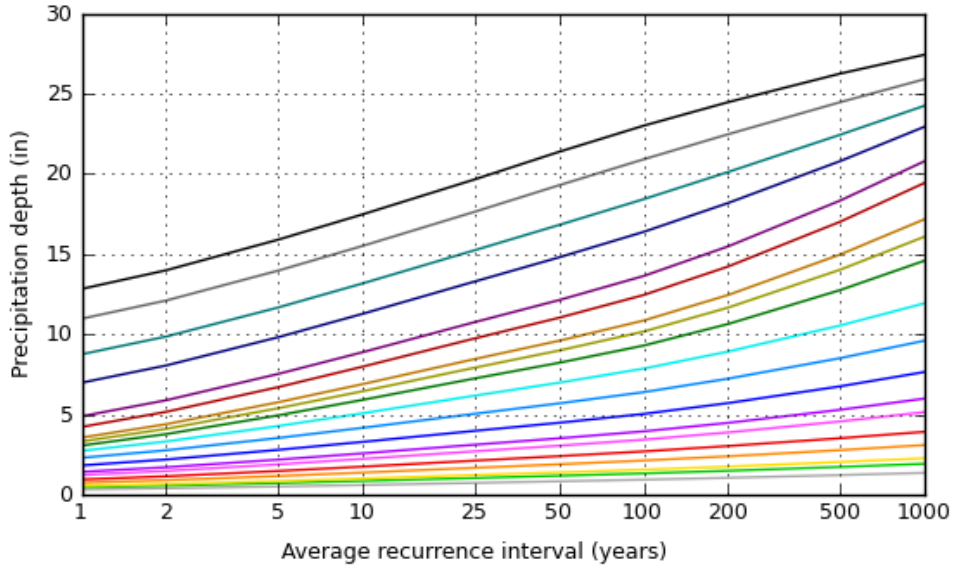
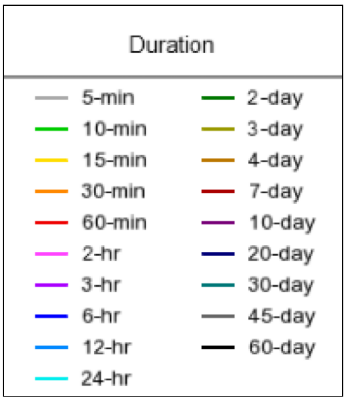
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 41.7315°, Longitude: -72.3572°









NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Fri Oct 29 19:00:51 2021

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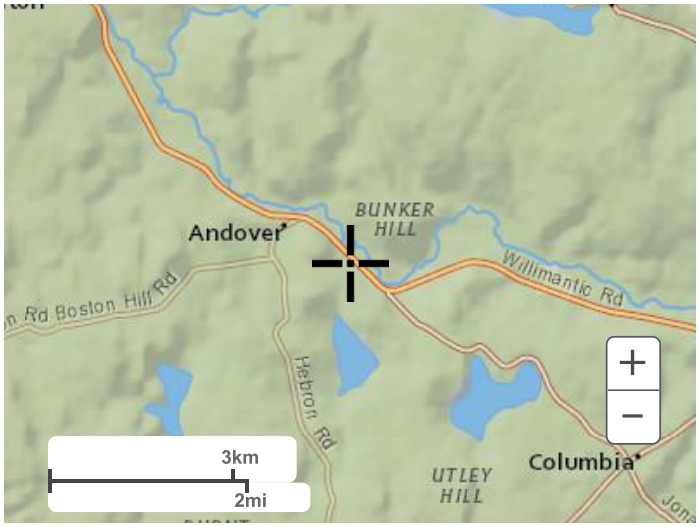
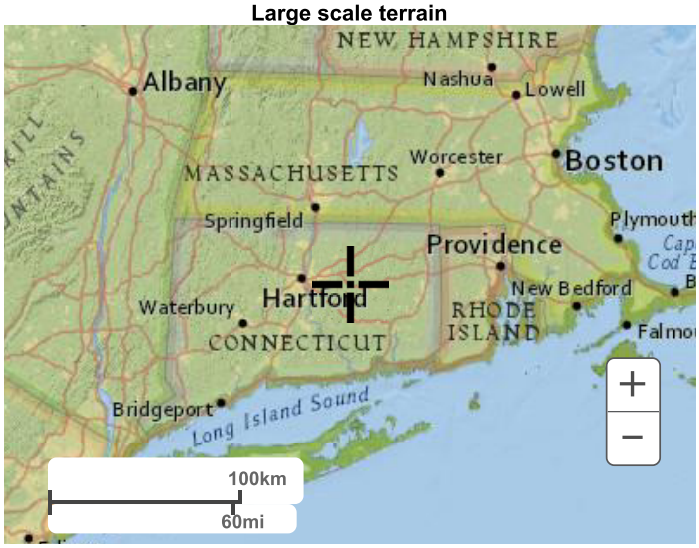
Maps & aerials

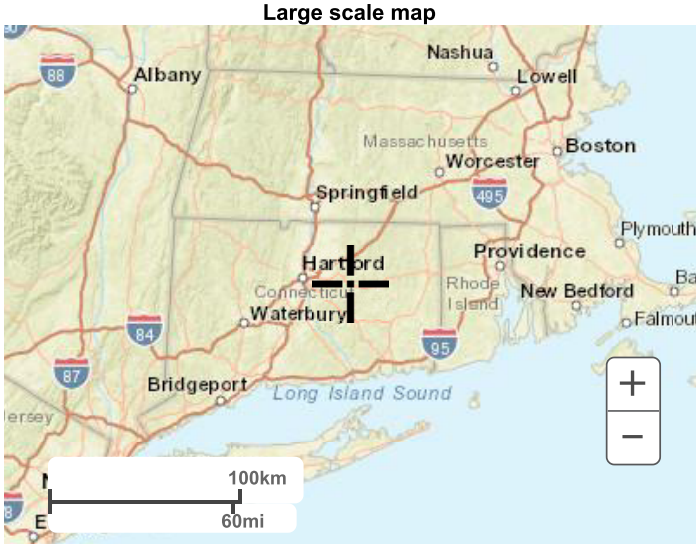
Small scale terrain



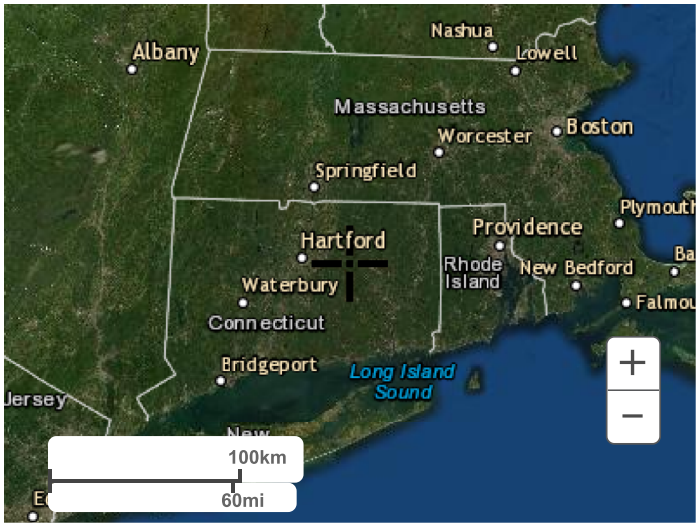
Large scale terrain



Large scale map



Large scale aerial



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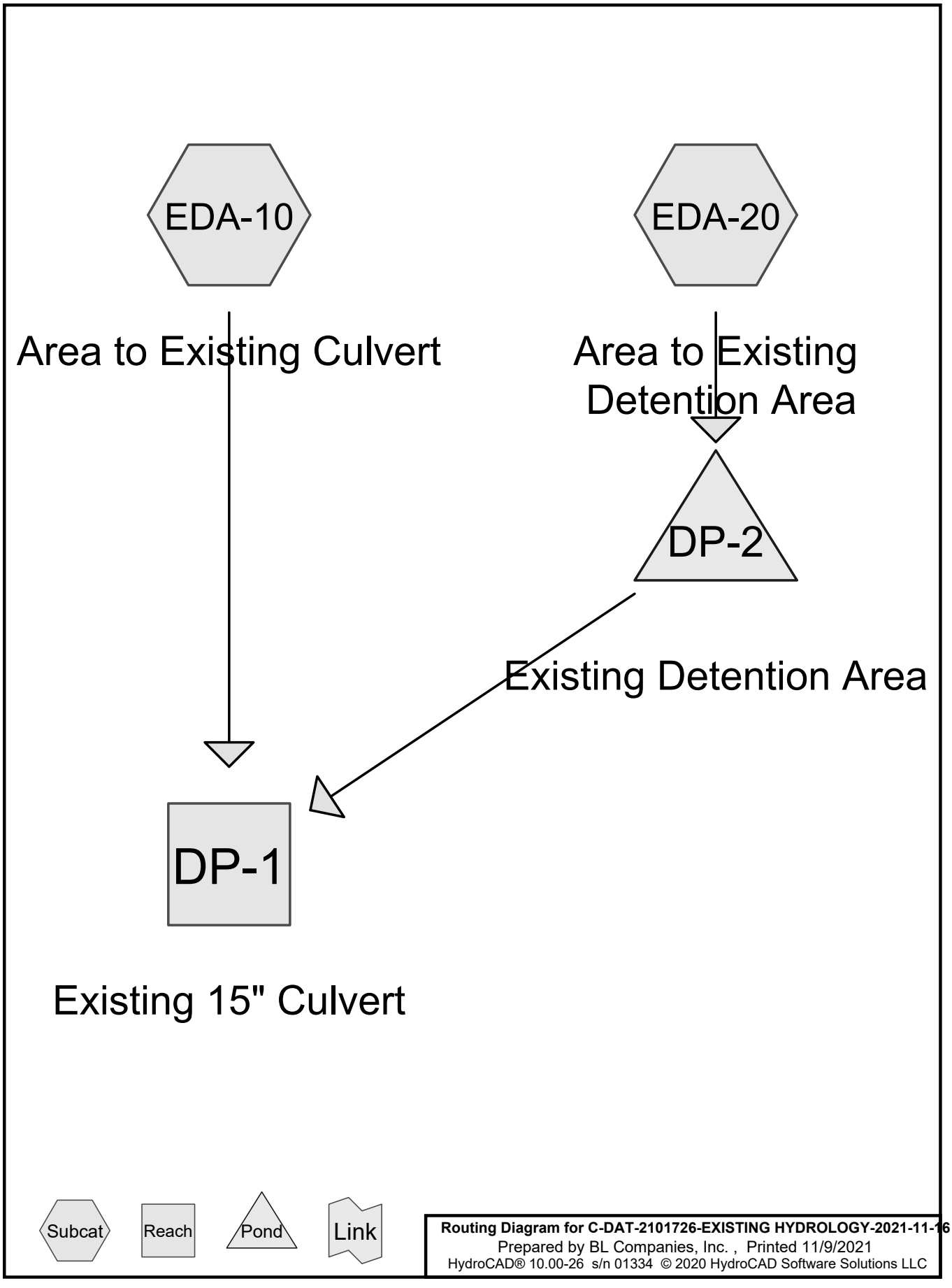
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

APPENDIX B

PRE-DEVELOPMENT HYDROLOGY



Routing Diagram for C-DAT-2101726-EXISTING HYDROLOGY-2021-11-16
Prepared by BL Companies, Inc. , Printed 11/9/2021

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 EDA-10: Area to Existing Runoff Area=326,300 sf 10.89% Impervious Runoff Depth=0.62"
Flow Length=1,373' Tc=26.1 min CN=64 Runoff=2.21 cfs 0.385 af

Subcatchment EDA-20: Area to Existing Runoff Area=75,435 sf 43.02% Impervious Runoff Depth=1.36"
Flow Length=219' Tc=11.8 min CN=78 Runoff=2.27 cfs 0.197 af

Reach DP-1: Existing 15" Culvert Inflow=3.35 cfs 0.476 af
Outflow=3.35 cfs 0.476 af

Pond DP-2: Existing Detention Area Peak Elev=292.76' Storage=934 cf Inflow=2.27 cfs 0.197 af
Discarded=0.10 cfs 0.105 af Primary=2.15 cfs 0.092 af Outflow=2.24 cfs 0.197 af

Total Runoff Area = 9.223 ac Runoff Volume = 0.581 af Average Runoff Depth = 0.76"
83.08% Pervious = 7.662 ac 16.92% Impervious = 1.561 ac

Summary for Subcatchment EDA-10: Area to Existing Culvert

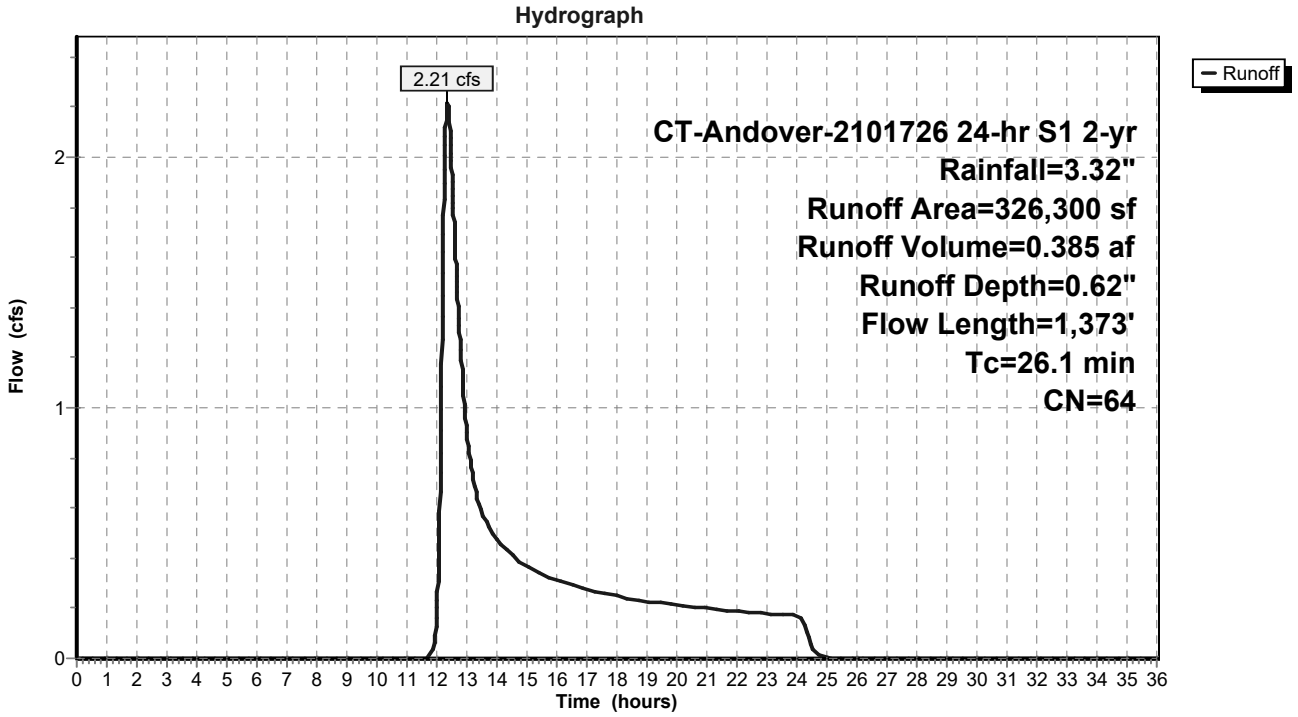
Runoff = 2.21 cfs @ 12.36 hrs, Volume= 0.385 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 2-yr Rainfall=3.32"

Area (sf)	CN	Description
113,745	49	50-75% Grass cover, Fair, HSG A
77,460	69	50-75% Grass cover, Fair, HSG B
3,180	79	50-75% Grass cover, Fair, HSG C
1,600	84	50-75% Grass cover, Fair, HSG D
17,760	36	Woods, Fair, HSG A
35,505	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
41,515	79	Woods, Fair, HSG D
26,885	98	Paved parking, HSG A
4,070	98	Paved parking, HSG B
4,580	98	Paved parking, HSG C
0	98	Paved parking, HSG D
326,300	64	Weighted Average
290,765		89.11% Pervious Area
35,535		10.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.6	300	0.1533	1.96		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	66	0.0077	1.32		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.6	160	0.0437	4.24		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	35	0.0214	2.19		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.9	125	0.2149	2.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.3	587	0.0106	1.54		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
26.1	1,373	Total			

Subcatchment EDA-10: Area to Existing Culvert



Summary for Subcatchment EDA-20: Area to Existing Detention Area

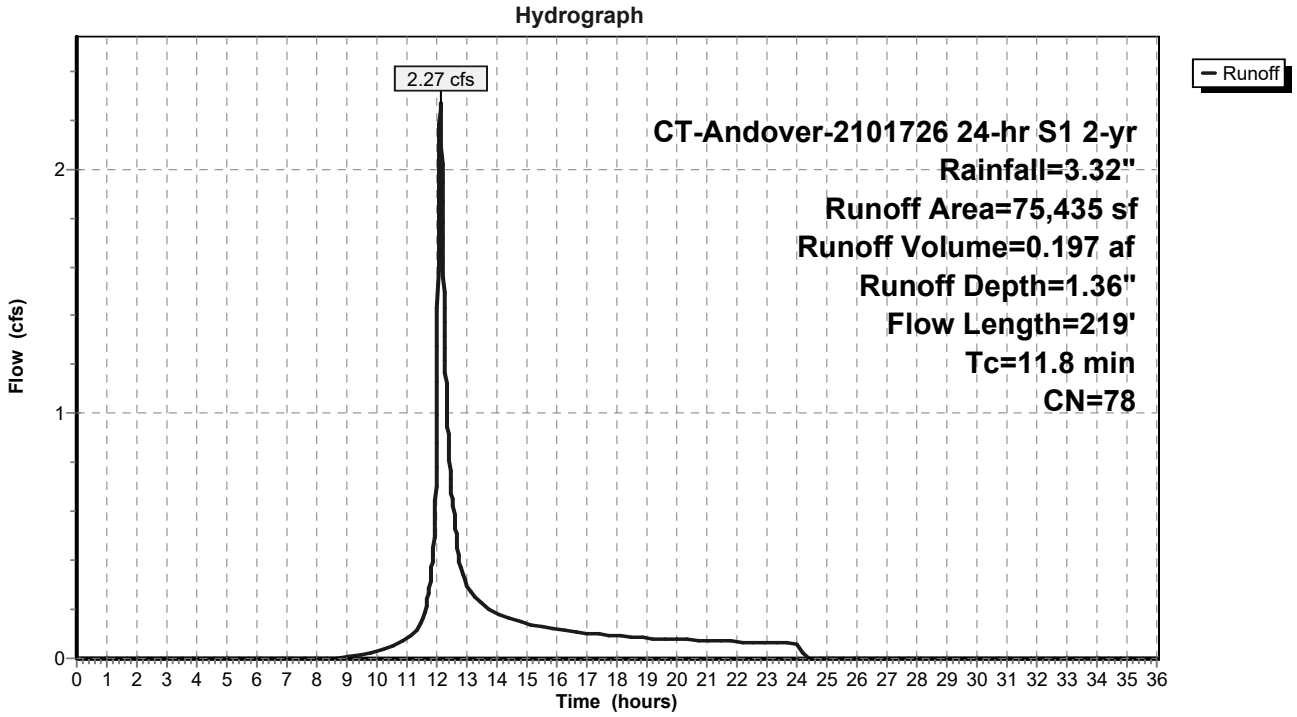
Runoff = 2.27 cfs @ 12.12 hrs, Volume= 0.197 af, Depth= 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 2-yr Rainfall=3.32"

Area (sf)	CN	Description
10,175	49	50-75% Grass cover, Fair, HSG A
29,050	69	50-75% Grass cover, Fair, HSG B
0	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
3,755	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
7,735	98	Paved parking, HSG A
24,720	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
75,435	78	Weighted Average
42,980		56.98% Pervious Area
32,455		43.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	100	0.0150	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.32"
1.0	119	0.0180	2.01		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.8	219	Total			

Subcatchment EDA-20: Area to Existing Detention Area

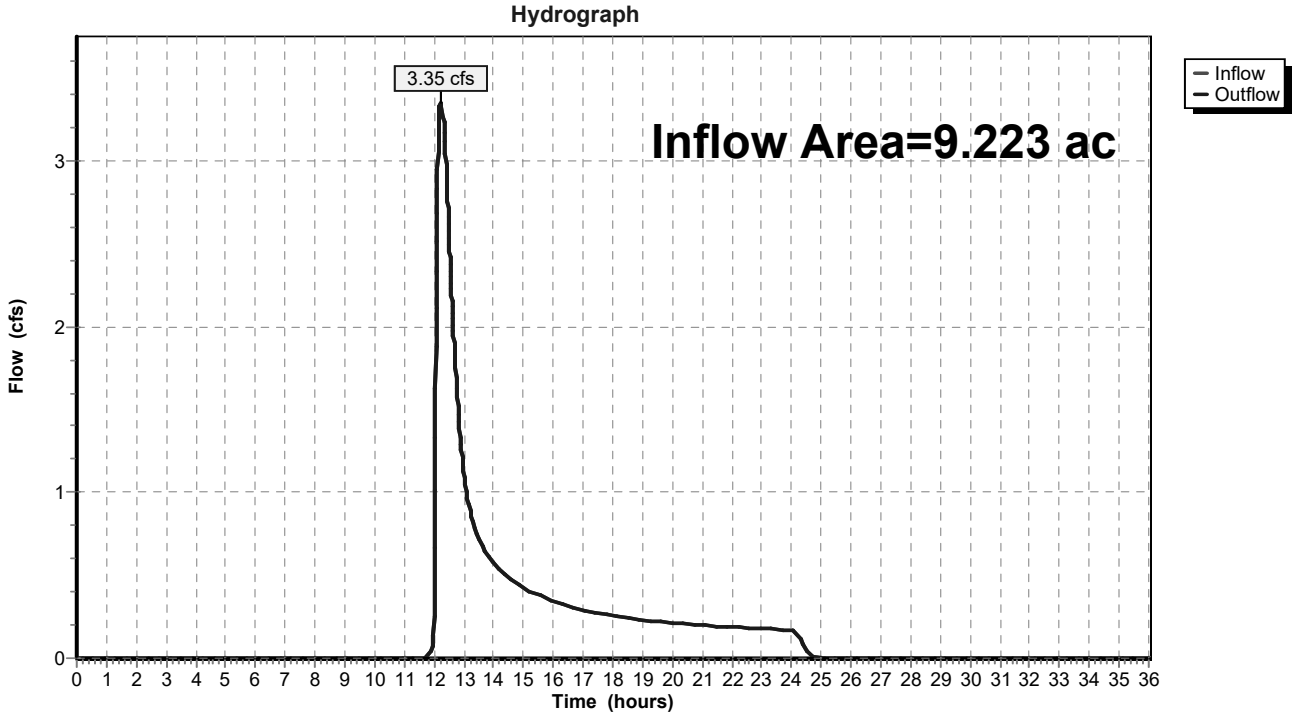


Summary for Reach DP-1: Existing 15" Culvert

Inflow Area = 9.223 ac, 16.92% Impervious, Inflow Depth = 0.62" for 2-yr event
Inflow = 3.35 cfs @ 12.21 hrs, Volume= 0.476 af
Outflow = 3.35 cfs @ 12.21 hrs, Volume= 0.476 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-1: Existing 15" Culvert



Summary for Pond DP-2: Existing Detention Area

Inflow Area = 1.732 ac, 43.02% Impervious, Inflow Depth = 1.36" for 2-yr event
Inflow = 2.27 cfs @ 12.12 hrs, Volume= 0.197 af
Outflow = 2.24 cfs @ 12.13 hrs, Volume= 0.197 af, Atten= 1%, Lag= 1.0 min
Discarded = 0.10 cfs @ 12.13 hrs, Volume= 0.105 af
Primary = 2.15 cfs @ 12.13 hrs, Volume= 0.092 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 292.76' @ 12.13 hrs Surf.Area= 1,539 sf Storage= 934 cf

Plug-Flow detention time= 72.5 min calculated for 0.196 af (100% of inflow)
Center-of-Mass det. time= 72.6 min (952.6 - 880.0)

Volume	Invert	Avail.Storage	Storage Description
#1	291.36'	2,185 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

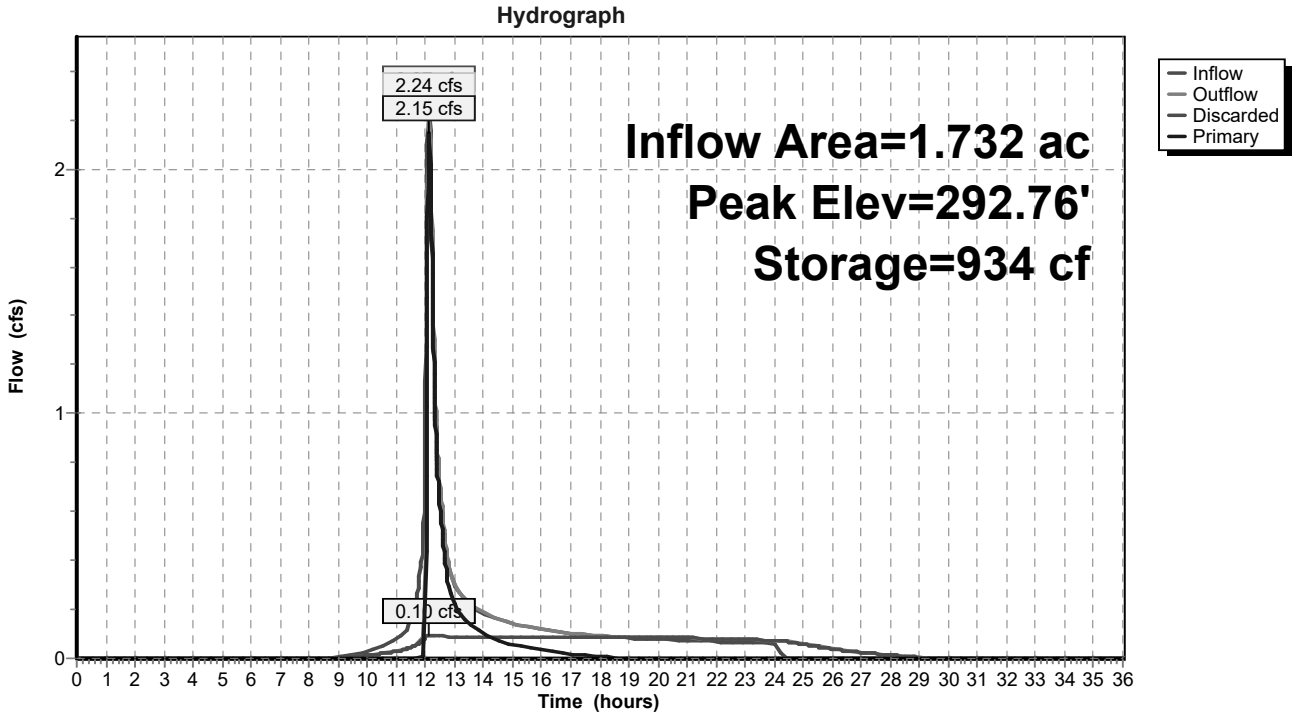
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
291.36	0	0	0
292.00	499	160	160
293.00	1,868	1,184	1,343
293.36	2,807	842	2,185

Device	Routing	Invert	Outlet Devices
#1	Discarded	291.36'	**2.700 in/hr Exfiltration over Surface area**
#2	Primary	292.65'	**25.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.10 cfs @ 12.13 hrs HW=292.76' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=2.15 cfs @ 12.13 hrs HW=292.76' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 2.15 cfs @ 0.78 fps)

Pond DP-2: Existing Detention Area



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 EDA-10: Area to Existing Runoff Area=326,300 sf 10.89% Impervious Runoff Depth=1.63"
Flow Length=1,373' Tc=26.1 min CN=64 Runoff=7.39 cfs 1.019 af

Subcatchment EDA-20: Area to Existing Runoff Area=75,435 sf 43.02% Impervious Runoff Depth=2.78"
Flow Length=219' Tc=11.8 min CN=78 Runoff=4.75 cfs 0.401 af

Reach DP-1: Existing 15" Culvert Inflow=9.85 cfs 1.295 af
Outflow=9.85 cfs 1.295 af

Pond DP-2: Existing Detention Area Peak Elev=292.83' Storage=1,049 cf Inflow=4.75 cfs 0.401 af
Discarded=0.10 cfs 0.125 af Primary=4.61 cfs 0.276 af Outflow=4.71 cfs 0.401 af

Total Runoff Area = 9.223 ac Runoff Volume = 1.420 af Average Runoff Depth = 1.85"
83.08% Pervious = 7.662 ac 16.92% Impervious = 1.561 ac

Summary for Subcatchment EDA-10: Area to Existing Culvert

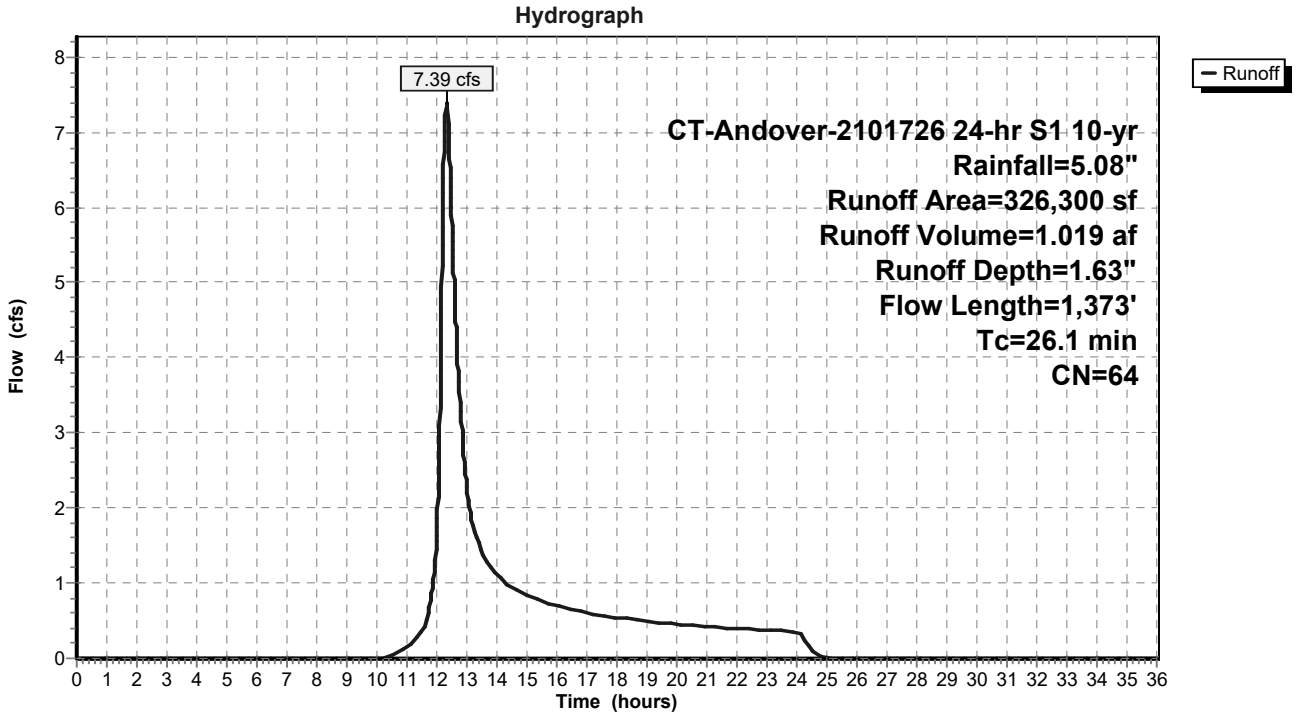
Runoff = 7.39 cfs @ 12.33 hrs, Volume= 1.019 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 10-yr Rainfall=5.08"

Area (sf)	CN	Description
113,745	49	50-75% Grass cover, Fair, HSG A
77,460	69	50-75% Grass cover, Fair, HSG B
3,180	79	50-75% Grass cover, Fair, HSG C
1,600	84	50-75% Grass cover, Fair, HSG D
17,760	36	Woods, Fair, HSG A
35,505	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
41,515	79	Woods, Fair, HSG D
26,885	98	Paved parking, HSG A
4,070	98	Paved parking, HSG B
4,580	98	Paved parking, HSG C
0	98	Paved parking, HSG D
326,300	64	Weighted Average
290,765		89.11% Pervious Area
35,535		10.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.6	300	0.1533	1.96		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	66	0.0077	1.32		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.6	160	0.0437	4.24		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	35	0.0214	2.19		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.9	125	0.2149	2.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.3	587	0.0106	1.54		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
26.1	1,373	Total			

Subcatchment EDA-10: Area to Existing Culvert



Summary for Subcatchment EDA-20: Area to Existing Detention Area

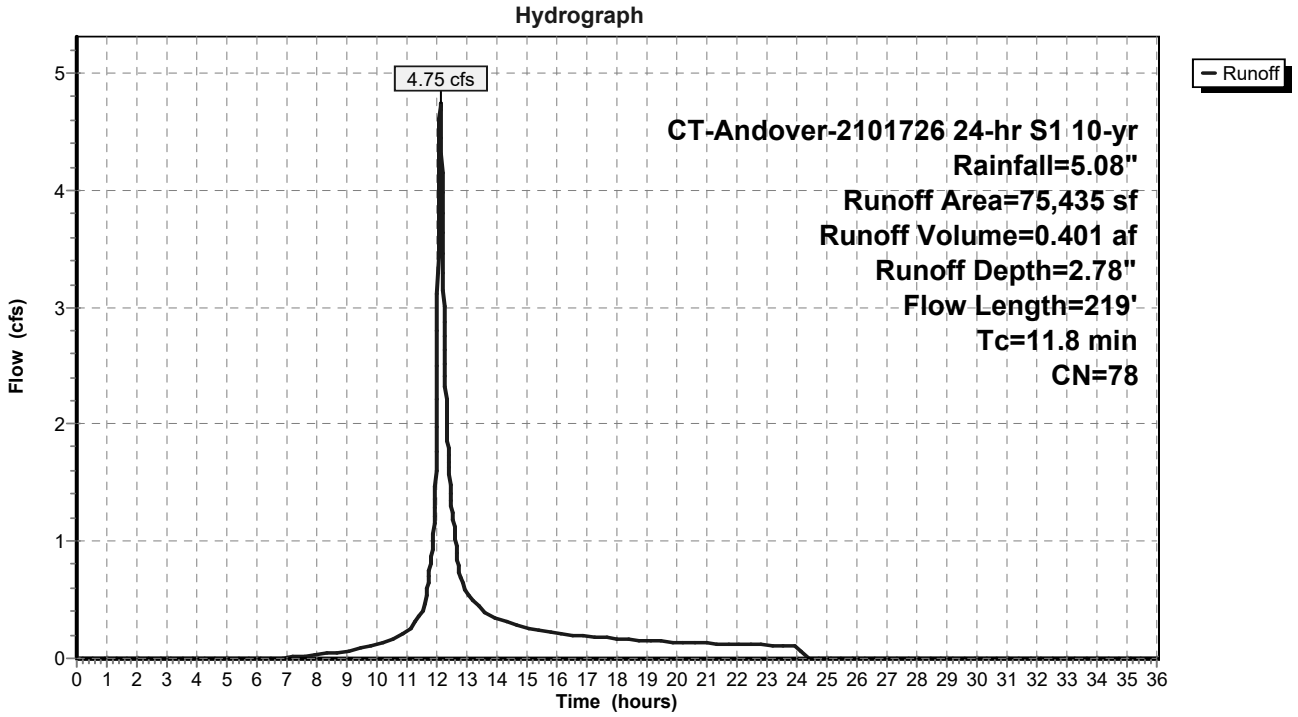
Runoff = 4.75 cfs @ 12.11 hrs, Volume= 0.401 af, Depth= 2.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 10-yr Rainfall=5.08"

Area (sf)	CN	Description
10,175	49	50-75% Grass cover, Fair, HSG A
29,050	69	50-75% Grass cover, Fair, HSG B
0	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
3,755	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
7,735	98	Paved parking, HSG A
24,720	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
75,435	78	Weighted Average
42,980		56.98% Pervious Area
32,455		43.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	100	0.0150	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.32"
1.0	119	0.0180	2.01		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.8	219	Total			

Subcatchment EDA-20: Area to Existing Detention Area

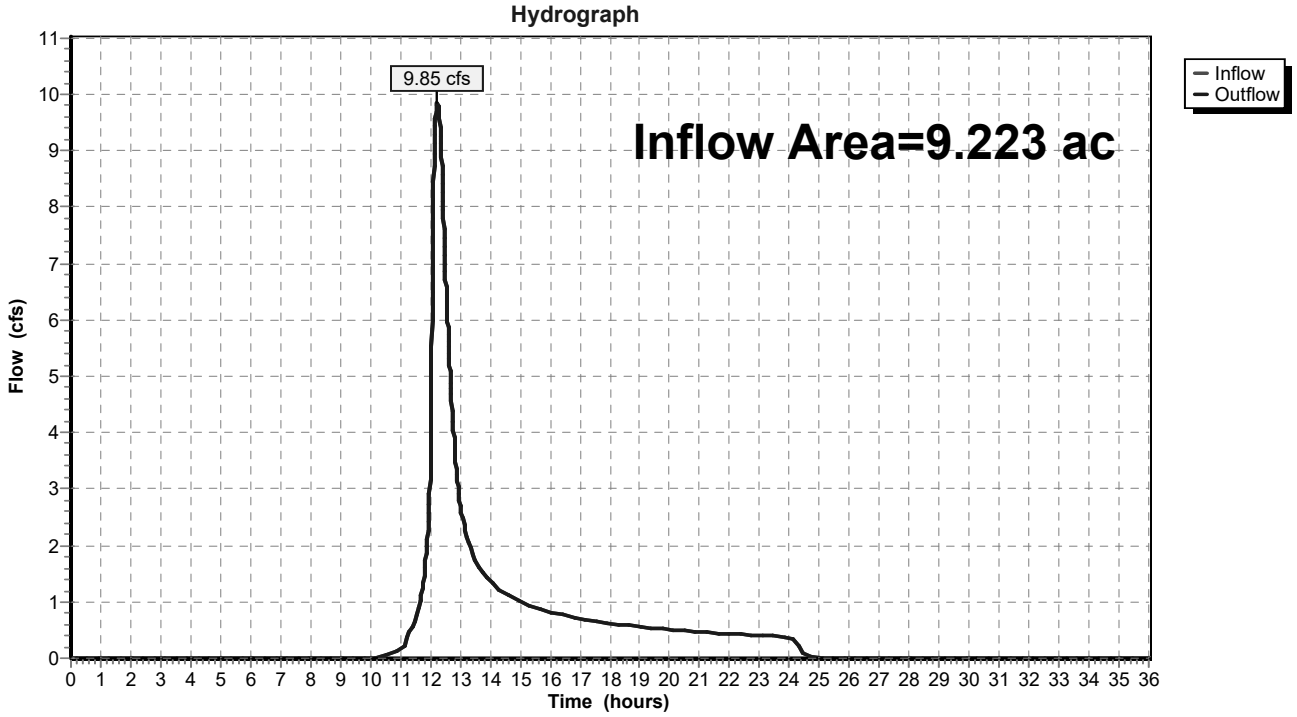


Summary for Reach DP-1: Existing 15" Culvert

Inflow Area = 9.223 ac, 16.92% Impervious, Inflow Depth = 1.68" for 10-yr event
Inflow = 9.85 cfs @ 12.24 hrs, Volume= 1.295 af
Outflow = 9.85 cfs @ 12.24 hrs, Volume= 1.295 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-1: Existing 15" Culvert



Summary for Pond DP-2: Existing Detention Area

Inflow Area = 1.732 ac, 43.02% Impervious, Inflow Depth = 2.78" for 10-yr event
Inflow = 4.75 cfs @ 12.11 hrs, Volume= 0.401 af
Outflow = 4.71 cfs @ 12.13 hrs, Volume= 0.401 af, Atten= 1%, Lag= 0.8 min
Discarded = 0.10 cfs @ 12.13 hrs, Volume= 0.125 af
Primary = 4.61 cfs @ 12.13 hrs, Volume= 0.276 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 292.83' @ 12.13 hrs Surf.Area= 1,638 sf Storage= 1,049 cf

Plug-Flow detention time= 43.5 min calculated for 0.401 af (100% of inflow)
Center-of-Mass det. time= 43.6 min (897.4 - 853.8)

Volume	Invert	Avail.Storage	Storage Description
#1	291.36'	2,185 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

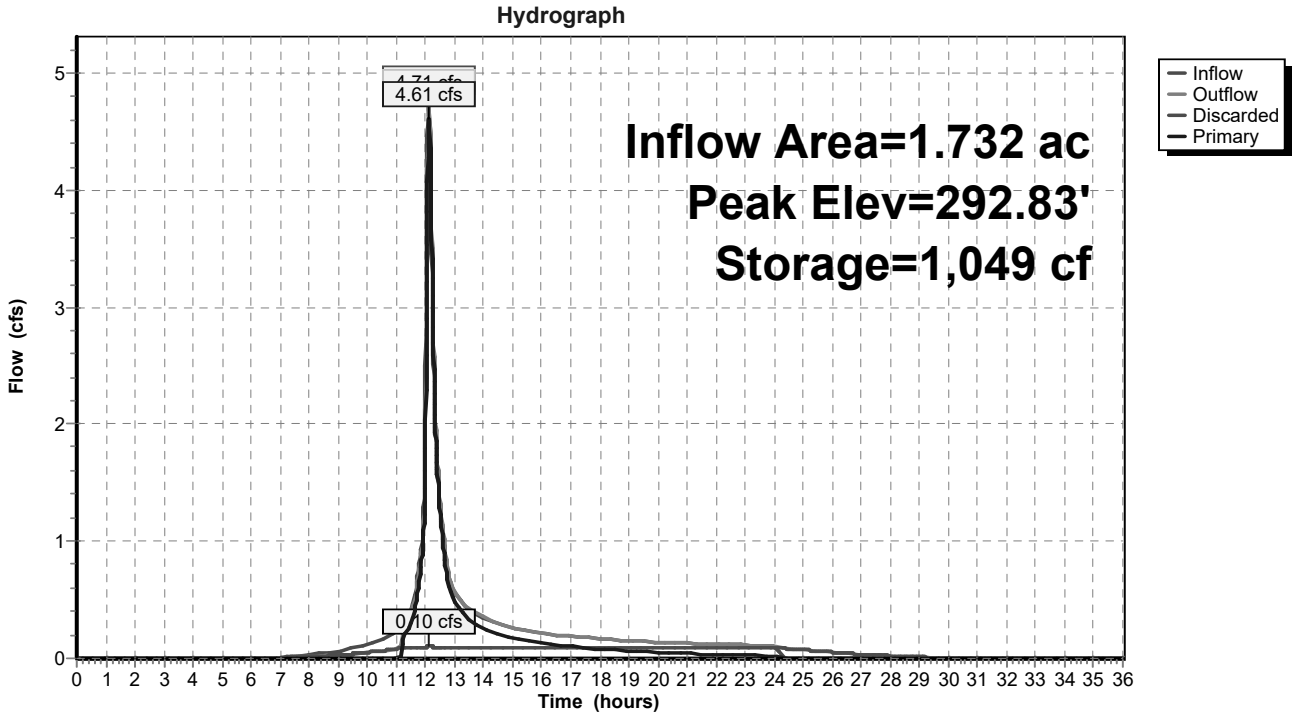
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
291.36	0	0	0
292.00	499	160	160
293.00	1,868	1,184	1,343
293.36	2,807	842	2,185

Device	Routing	Invert	Outlet Devices
#1	Discarded	291.36'	**2.700 in/hr Exfiltration over Surface area**
#2	Primary	292.65'	**25.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.10 cfs @ 12.13 hrs HW=292.83' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=4.60 cfs @ 12.13 hrs HW=292.83' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 4.60 cfs @ 1.01 fps)

Pond DP-2: Existing Detention Area



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 EDA-10: Area to Existing Runoff Area=326,300 sf 10.89% Impervious Runoff Depth=2.39"
Flow Length=1,373' Tc=26.1 min CN=64 Runoff=11.20 cfs 1.489 af

Subcatchment EDA-20: Area to Existing Runoff Area=75,435 sf 43.02% Impervious Runoff Depth=3.73"
Flow Length=219' Tc=11.8 min CN=78 Runoff=6.37 cfs 0.538 af

Reach DP-1: Existing 15" Culvert Inflow=14.52 cfs 1.894 af
Outflow=14.52 cfs 1.894 af

Pond DP-2: Existing Detention Area Peak Elev=292.87' Storage=1,115 cf Inflow=6.37 cfs 0.538 af
Discarded=0.11 cfs 0.133 af Primary=6.23 cfs 0.405 af Outflow=6.33 cfs 0.538 af

Total Runoff Area = 9.223 ac Runoff Volume = 2.027 af Average Runoff Depth = 2.64"
83.08% Pervious = 7.662 ac 16.92% Impervious = 1.561 ac

Summary for Subcatchment EDA-10: Area to Existing Culvert

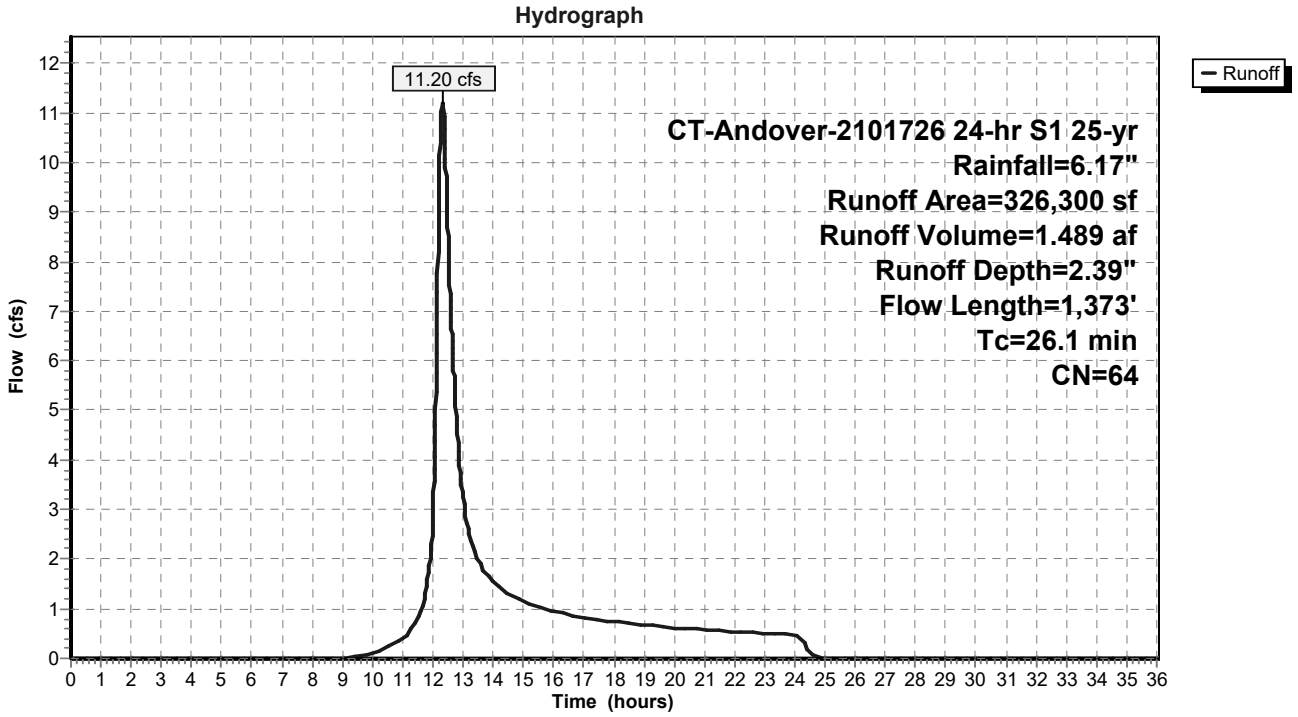
Runoff = 11.20 cfs @ 12.32 hrs, Volume= 1.489 af, Depth= 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 25-yr Rainfall=6.17"

Area (sf)	CN	Description
113,745	49	50-75% Grass cover, Fair, HSG A
77,460	69	50-75% Grass cover, Fair, HSG B
3,180	79	50-75% Grass cover, Fair, HSG C
1,600	84	50-75% Grass cover, Fair, HSG D
17,760	36	Woods, Fair, HSG A
35,505	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
41,515	79	Woods, Fair, HSG D
26,885	98	Paved parking, HSG A
4,070	98	Paved parking, HSG B
4,580	98	Paved parking, HSG C
0	98	Paved parking, HSG D
326,300	64	Weighted Average
290,765		89.11% Pervious Area
35,535		10.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.6	300	0.1533	1.96		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	66	0.0077	1.32		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.6	160	0.0437	4.24		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	35	0.0214	2.19		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.9	125	0.2149	2.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.3	587	0.0106	1.54		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
26.1	1,373	Total			

Subcatchment EDA-10: Area to Existing Culvert



Summary for Subcatchment EDA-20: Area to Existing Detention Area

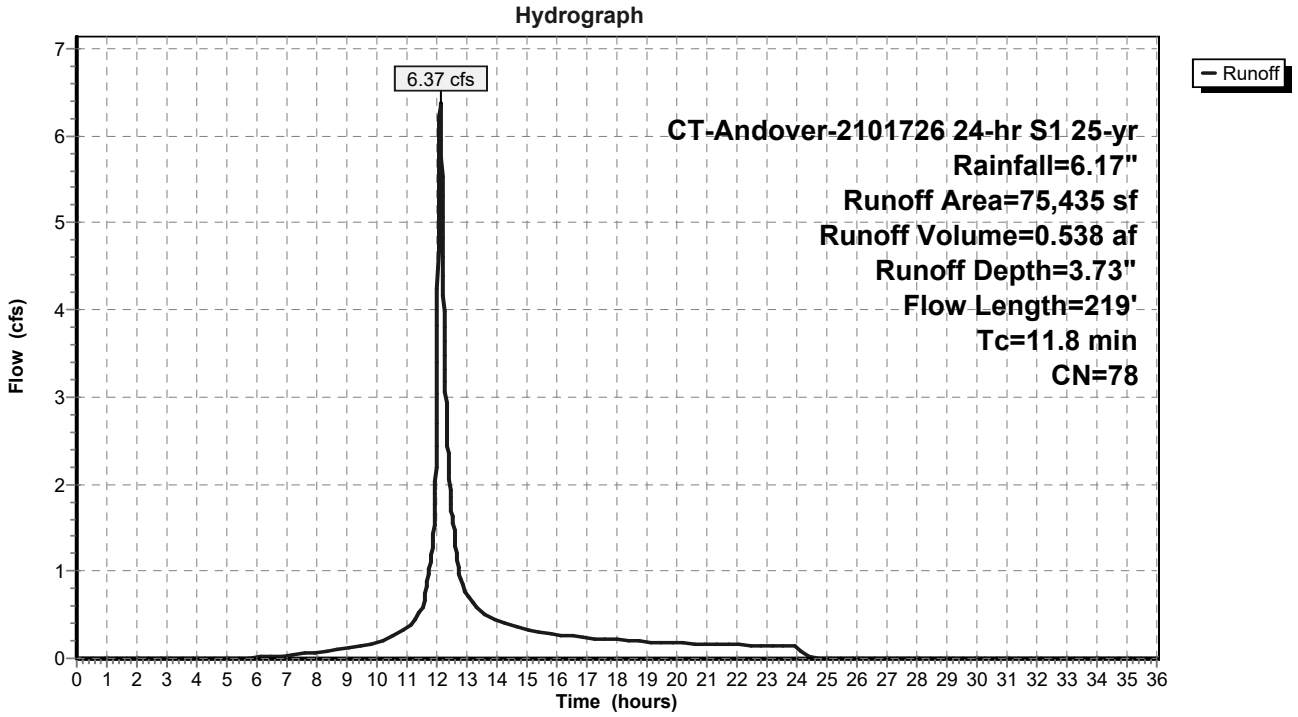
Runoff = 6.37 cfs @ 12.11 hrs, Volume= 0.538 af, Depth= 3.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 25-yr Rainfall=6.17"

Area (sf)	CN	Description
10,175	49	50-75% Grass cover, Fair, HSG A
29,050	69	50-75% Grass cover, Fair, HSG B
0	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
3,755	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
7,735	98	Paved parking, HSG A
24,720	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
75,435	78	Weighted Average
42,980		56.98% Pervious Area
32,455		43.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	100	0.0150	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.32"
1.0	119	0.0180	2.01		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.8	219	Total			

Subcatchment EDA-20: Area to Existing Detention Area

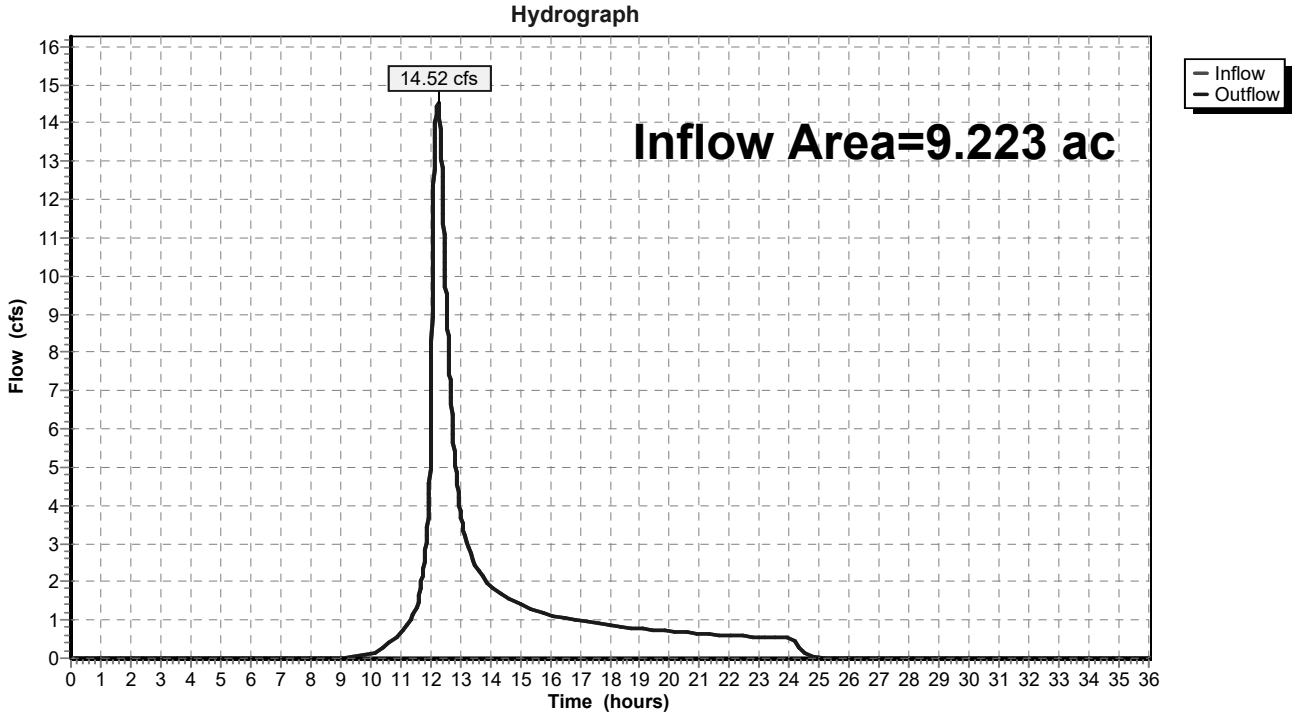


Summary for Reach DP-1: Existing 15" Culvert

Inflow Area = 9.223 ac, 16.92% Impervious, Inflow Depth = 2.46" for 25-yr event
Inflow = 14.52 cfs @ 12.26 hrs, Volume= 1.894 af
Outflow = 14.52 cfs @ 12.26 hrs, Volume= 1.894 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-1: Existing 15" Culvert



Summary for Pond DP-2: Existing Detention Area

Inflow Area = 1.732 ac, 43.02% Impervious, Inflow Depth = 3.73" for 25-yr event
Inflow = 6.37 cfs @ 12.11 hrs, Volume= 0.538 af
Outflow = 6.33 cfs @ 12.12 hrs, Volume= 0.538 af, Atten= 1%, Lag= 0.7 min
Discarded = 0.11 cfs @ 12.12 hrs, Volume= 0.133 af
Primary = 6.23 cfs @ 12.12 hrs, Volume= 0.405 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 292.87' @ 12.12 hrs Surf.Area= 1,692 sf Storage= 1,115 cf

Plug-Flow detention time= 34.7 min calculated for 0.538 af (100% of inflow)
Center-of-Mass det. time= 34.8 min (877.8 - 843.0)

Volume	Invert	Avail.Storage	Storage Description
#1	291.36'	2,185 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

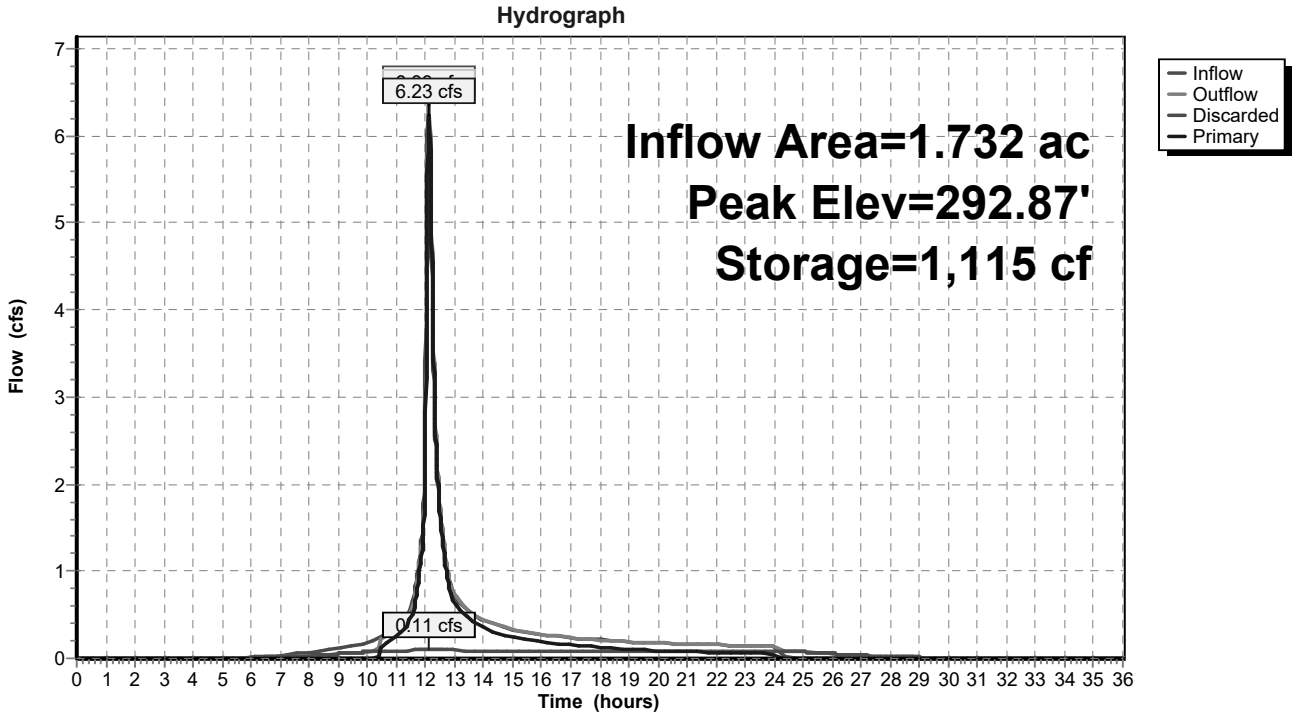
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
291.36	0	0	0
292.00	499	160	160
293.00	1,868	1,184	1,343
293.36	2,807	842	2,185

Device	Routing	Invert	Outlet Devices
#1	Discarded	291.36'	**2.700 in/hr Exfiltration over Surface area**
#2	Primary	292.65'	**25.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.11 cfs @ 12.12 hrs HW=292.87' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=6.22 cfs @ 12.12 hrs HW=292.87' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 6.22 cfs @ 1.12 fps)

Pond DP-2: Existing Detention Area



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 EDA-10: Area to Existing Runoff Area=326,300 sf 10.89% Impervious Runoff Depth=3.67"
Flow Length=1,373' Tc=26.1 min CN=64 Runoff=17.66 cfs 2.291 af

Subcatchment EDA-20: Area to Existing Runoff Area=75,435 sf 43.02% Impervious Runoff Depth=5.26"
Flow Length=219' Tc=11.8 min CN=78 Runoff=8.95 cfs 0.759 af

Reach DP-1: Existing 15" Culvert Inflow=22.33 cfs 2.907 af
Outflow=22.33 cfs 2.907 af

Pond DP-2: Existing Detention Area Peak Elev=292.93' Storage=1,209 cf Inflow=8.95 cfs 0.759 af
Discarded=0.11 cfs 0.144 af Primary=8.79 cfs 0.616 af Outflow=8.90 cfs 0.759 af

Total Runoff Area = 9.223 ac Runoff Volume = 3.050 af Average Runoff Depth = 3.97"
83.08% Pervious = 7.662 ac 16.92% Impervious = 1.561 ac

Summary for Subcatchment EDA-10: Area to Existing Culvert

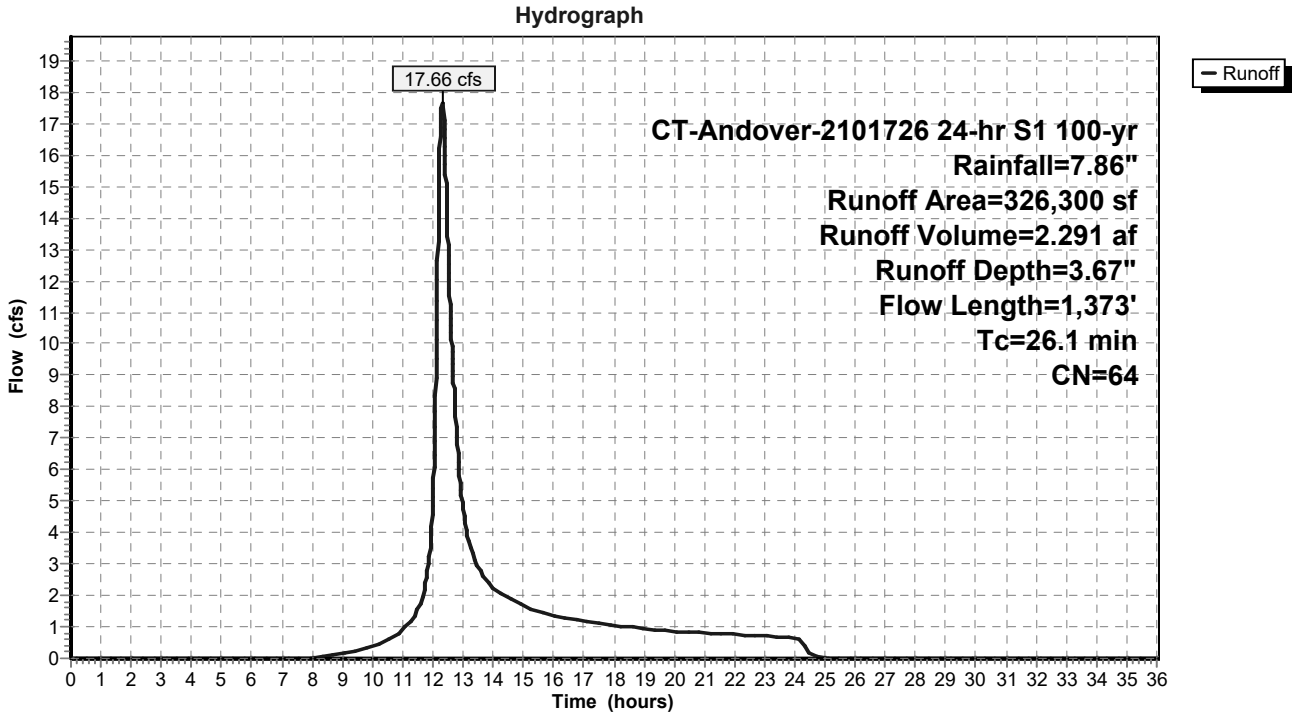
Runoff = 17.66 cfs @ 12.32 hrs, Volume= 2.291 af, Depth= 3.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 100-yr Rainfall=7.86"

Area (sf)	CN	Description
113,745	49	50-75% Grass cover, Fair, HSG A
77,460	69	50-75% Grass cover, Fair, HSG B
3,180	79	50-75% Grass cover, Fair, HSG C
1,600	84	50-75% Grass cover, Fair, HSG D
17,760	36	Woods, Fair, HSG A
35,505	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
41,515	79	Woods, Fair, HSG D
26,885	98	Paved parking, HSG A
4,070	98	Paved parking, HSG B
4,580	98	Paved parking, HSG C
0	98	Paved parking, HSG D
326,300	64	Weighted Average
290,765		89.11% Pervious Area
35,535		10.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.6	300	0.1533	1.96		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	66	0.0077	1.32		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.6	160	0.0437	4.24		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	35	0.0214	2.19		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.9	125	0.2149	2.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.3	587	0.0106	1.54		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
26.1	1,373	Total			

Subcatchment EDA-10: Area to Existing Culvert



Summary for Subcatchment EDA-20: Area to Existing Detention Area

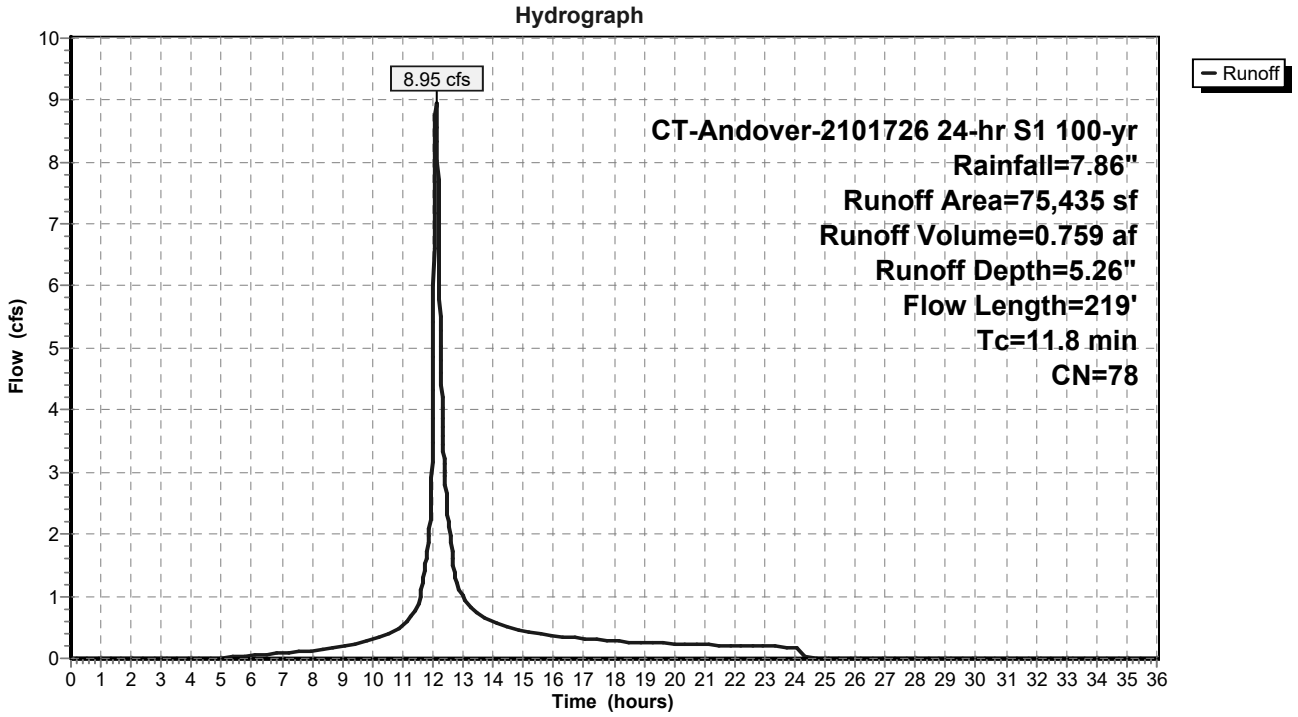
Runoff = 8.95 cfs @ 12.11 hrs, Volume= 0.759 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 100-yr Rainfall=7.86"

Area (sf)	CN	Description
10,175	49	50-75% Grass cover, Fair, HSG A
29,050	69	50-75% Grass cover, Fair, HSG B
0	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
3,755	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
7,735	98	Paved parking, HSG A
24,720	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
75,435	78	Weighted Average
42,980		56.98% Pervious Area
32,455		43.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	100	0.0150	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.32"
1.0	119	0.0180	2.01		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
11.8	219	Total			

Subcatchment EDA-20: Area to Existing Detention Area

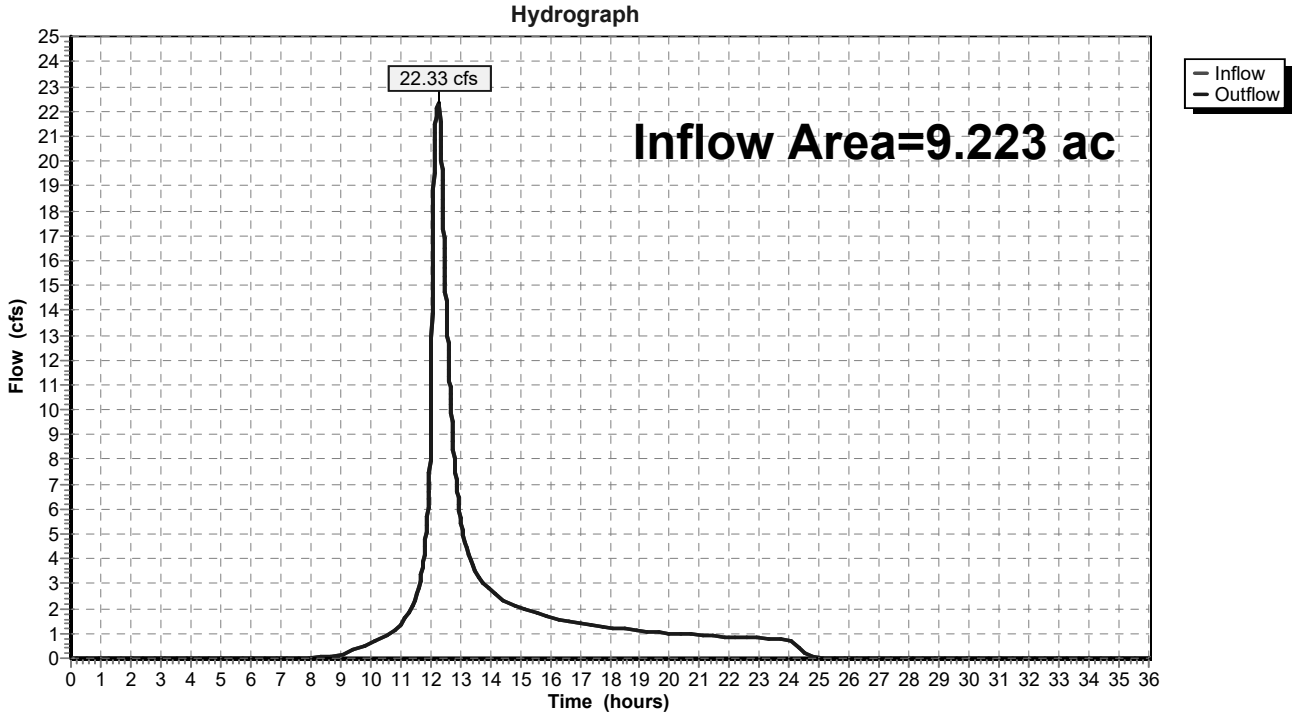


Summary for Reach DP-1: Existing 15" Culvert

Inflow Area = 9.223 ac, 16.92% Impervious, Inflow Depth = 3.78" for 100-yr event
Inflow = 22.33 cfs @ 12.26 hrs, Volume= 2.907 af
Outflow = 22.33 cfs @ 12.26 hrs, Volume= 2.907 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-1: Existing 15" Culvert



Summary for Pond DP-2: Existing Detention Area

Inflow Area = 1.732 ac, 43.02% Impervious, Inflow Depth = 5.26" for 100-yr event
Inflow = 8.95 cfs @ 12.11 hrs, Volume= 0.759 af
Outflow = 8.90 cfs @ 12.12 hrs, Volume= 0.759 af, Atten= 0%, Lag= 0.6 min
Discarded = 0.11 cfs @ 12.12 hrs, Volume= 0.144 af
Primary = 8.79 cfs @ 12.12 hrs, Volume= 0.616 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 292.93' @ 12.12 hrs Surf.Area= 1,767 sf Storage= 1,209 cf

Plug-Flow detention time= 26.8 min calculated for 0.759 af (100% of inflow)
Center-of-Mass det. time= 26.9 min (857.1 - 830.2)

Volume	Invert	Avail.Storage	Storage Description
#1	291.36'	2,185 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

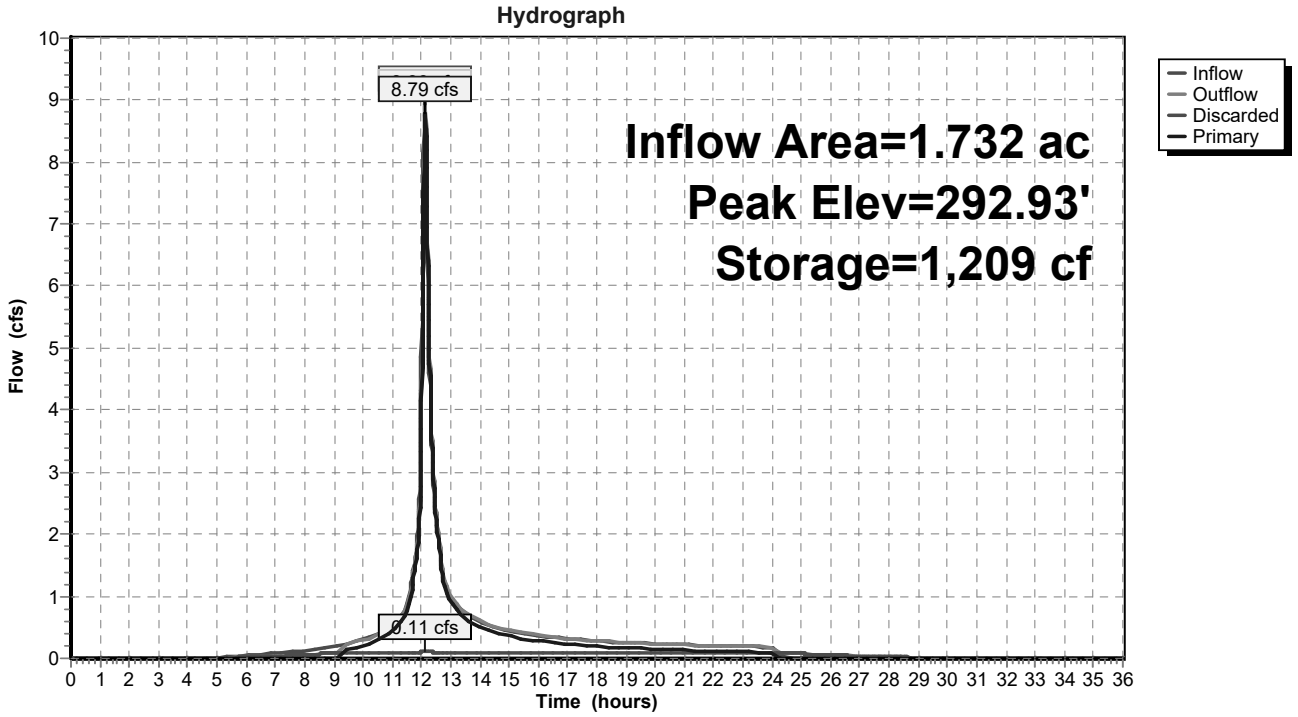
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
291.36	0	0	0
292.00	499	160	160
293.00	1,868	1,184	1,343
293.36	2,807	842	2,185

Device	Routing	Invert	Outlet Devices
#1	Discarded	291.36'	**2.700 in/hr Exfiltration over Surface area**
#2	Primary	292.65'	**25.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.11 cfs @ 12.12 hrs HW=292.93' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

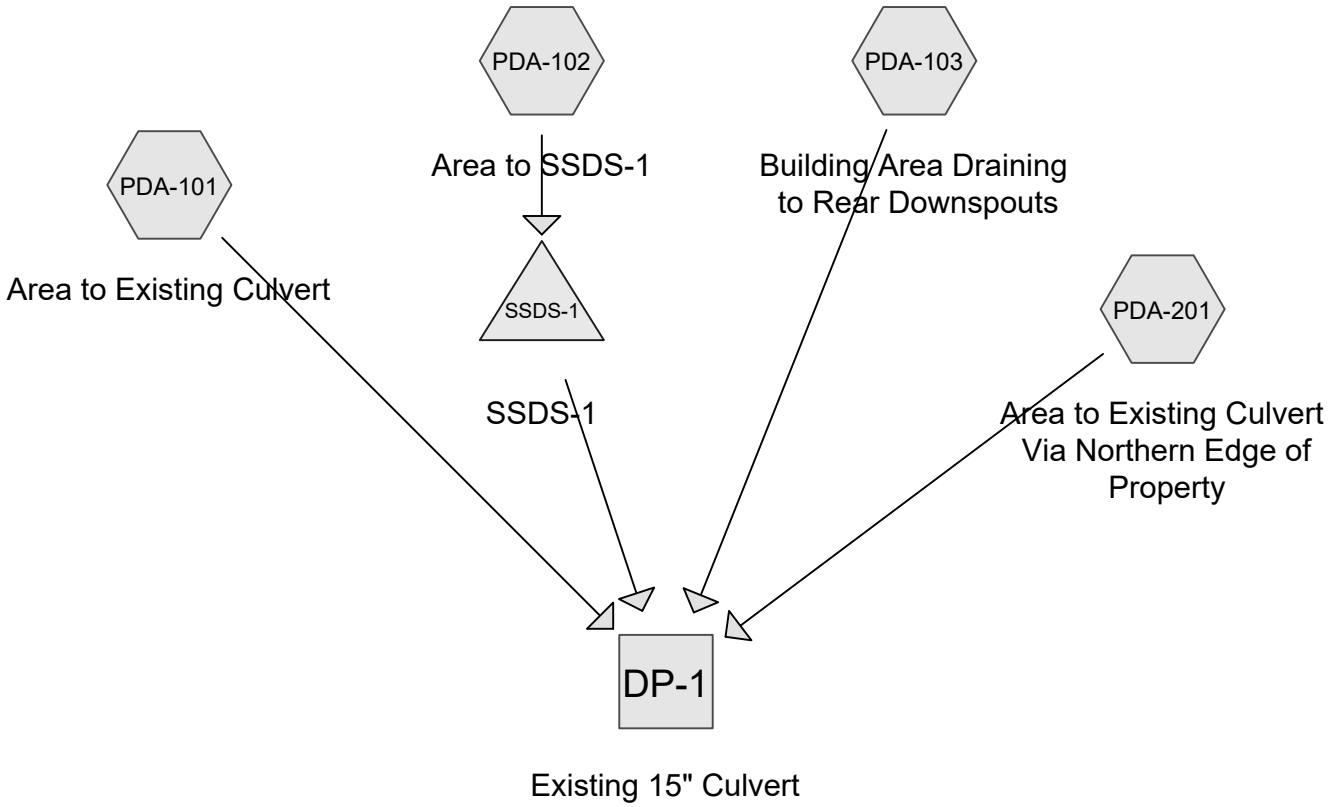
Primary OutFlow Max=8.78 cfs @ 12.12 hrs HW=292.93' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 8.78 cfs @ 1.27 fps)

Pond DP-2: Existing Detention Area



APPENDIX C

POST-DEVELOPMENT HYDROLOGY



Subcat Reach Pond Link

Routing Diagram for C-DAT-2101726-PROPOSED HYDROLOGY-2022-01-28

Prepared by BL Companies, Inc. , Printed 1/25/2022

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 PDA-101: Area to Existing Runoff Area=268,415 sf 9.08% Impervious Runoff Depth=0.62"
Flow Length=1,381' Tc=25.7 min CN=64 Runoff=1.84 cfs 0.316 af

Subcatchment PDA-102: Area to SSDS-1 Runoff Area=50,110 sf 74.13% Impervious Runoff Depth=2.11"
Tc=5.0 min CN=88 Runoff=3.39 cfs 0.202 af

Subcatchment PDA-103: Building Area Runoff Area=9,790 sf 100.00% Impervious Runoff Depth=3.09"
Flow Length=314' Tc=5.0 min CN=98 Runoff=0.87 cfs 0.058 af

Subcatchment PDA-201: Area to Existing Runoff Area=73,420 sf 44.21% Impervious Runoff Depth=1.30"
Flow Length=383' Tc=12.9 min CN=77 Runoff=2.00 cfs 0.182 af

Reach DP-1: Existing 15" Culvert Inflow=3.27 cfs 0.557 af
Outflow=3.27 cfs 0.557 af

Pond SSDS-1: SSDS-1 Peak Elev=289.22' Storage=3,027 cf Inflow=3.39 cfs 0.202 af
Discarded=0.21 cfs 0.202 af Primary=0.00 cfs 0.000 af Outflow=0.21 cfs 0.202 af

Total Runoff Area = 9.223 ac Runoff Volume = 0.758 af Average Runoff Depth = 0.99"
74.17% Pervious = 6.840 ac 25.83% Impervious = 2.382 ac

Summary for Subcatchment PDA-101: Area to Existing Culvert

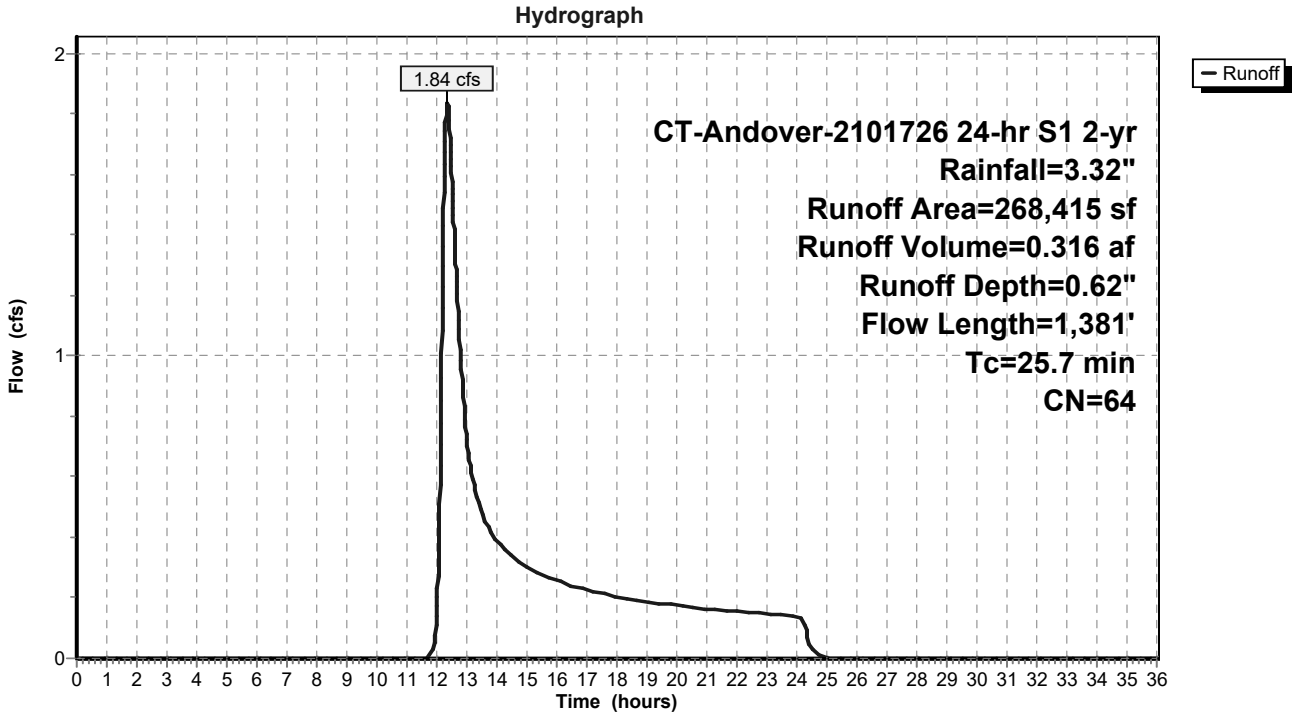
Runoff = 1.84 cfs @ 12.36 hrs, Volume= 0.316 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 2-yr Rainfall=3.32"

Area (sf)	CN	Description
83,295	49	50-75% Grass cover, Fair, HSG A
64,370	69	50-75% Grass cover, Fair, HSG B
0	79	50-75% Grass cover, Fair, HSG C
1,600	84	50-75% Grass cover, Fair, HSG D
17,760	36	Woods, Fair, HSG A
35,505	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
41,515	79	Woods, Fair, HSG D
22,095	98	Paved parking, HSG A
2,275	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
268,415	64	Weighted Average
244,045		90.92% Pervious Area
24,370		9.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.6	300	0.1533	1.96		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	66	0.0077	1.32		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.6	160	0.0437	4.24		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	35	0.0214	2.19		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.9	125	0.2149	2.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.7	532	0.0107	1.55		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.2	63	0.0100	5.70	7.00	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
25.7	1,381	Total			

Subcatchment PDA-101: Area to Existing Culvert



Summary for Subcatchment PDA-102: Area to SSDS-1

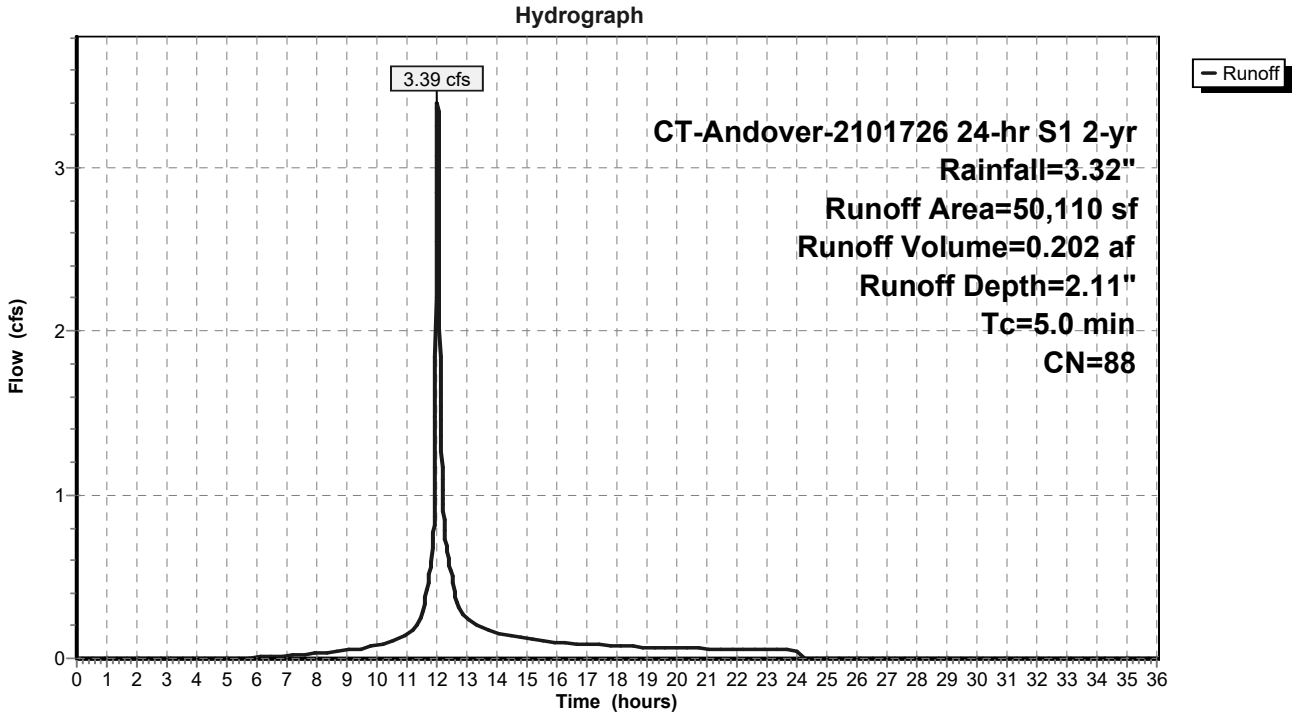
Runoff = 3.39 cfs @ 12.03 hrs, Volume= 0.202 af, Depth= 2.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 2-yr Rainfall=3.32"

Area (sf)	CN	Description
7,340	49	50-75% Grass cover, Fair, HSG A
2,860	69	50-75% Grass cover, Fair, HSG B
2,765	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
0	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
18,990	98	Paved parking, HSG A
13,160	98	Paved parking, HSG B
4,995	98	Paved parking, HSG C
0	98	Paved parking, HSG D
50,110	88	Weighted Average
12,965		25.87% Pervious Area
37,145		74.13% Impervious Area

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

Subcatchment PDA-102: Area to SSDS-1



Summary for Subcatchment PDA-103: Building Area Draining to Rear Downspouts

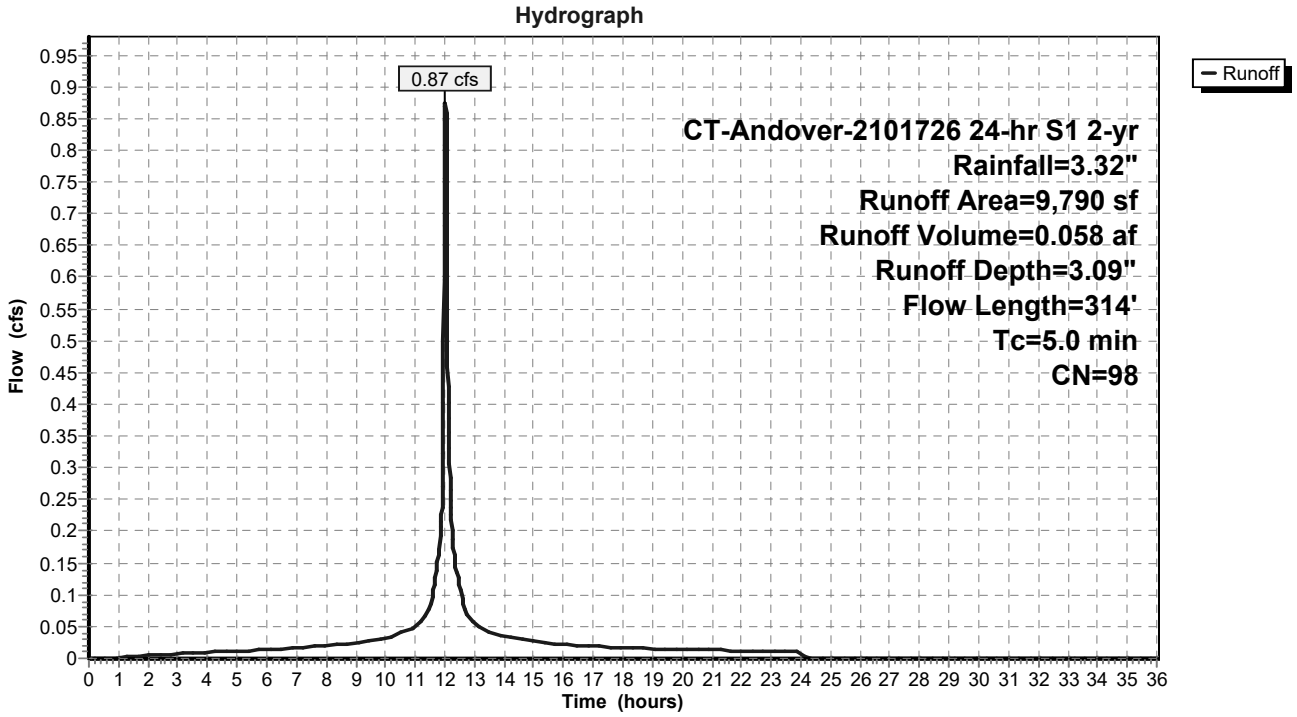
Runoff = 0.87 cfs @ 12.03 hrs, Volume= 0.058 af, Depth= 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 2-yr Rainfall=3.32"

Area (sf)	CN	Description
0	49	50-75% Grass cover, Fair, HSG A
0	69	50-75% Grass cover, Fair, HSG B
0	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
0	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
5,150	98	Paved parking, HSG A
4,640	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
9,790	98	Weighted Average
9,790		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	204	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.1	18	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.1	92	0.0089	1.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
2.3	314	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PDA-103: Building Area Draining to Rear Downspouts



Summary for Subcatchment PDA-201: Area to Existing Culvert Via Northern Edge of Property

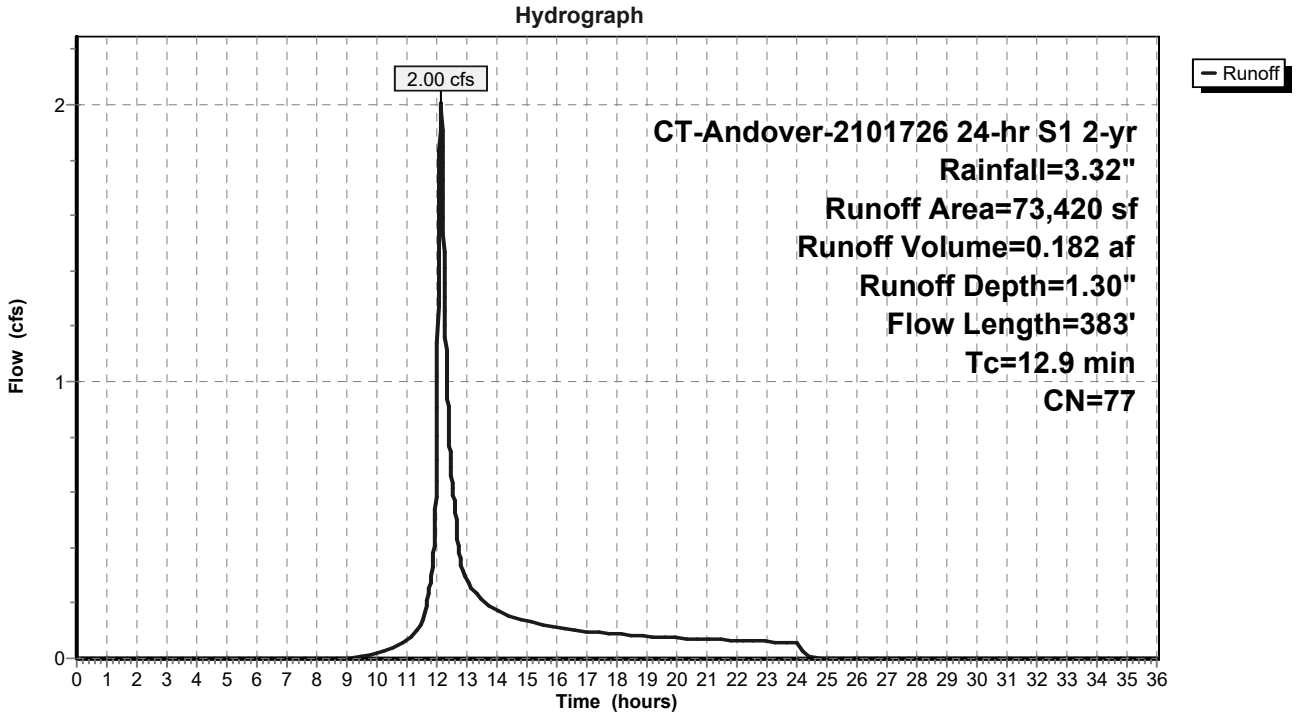
Runoff = 2.00 cfs @ 12.13 hrs, Volume= 0.182 af, Depth= 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 2-yr Rainfall=3.32"

Area (sf)	CN	Description
10,930	49	50-75% Grass cover, Fair, HSG A
19,275	69	50-75% Grass cover, Fair, HSG B
3,000	39	>75% Grass cover, Good, HSG A
4,000	61	>75% Grass cover, Good, HSG B
0	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
3,755	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
7,740	98	Paved parking, HSG A
24,720	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
73,420	77	Weighted Average
40,960		55.79% Pervious Area
32,460		44.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	100	0.0150	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.32"
0.4	75	0.0370	2.89		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	54	0.0054	3.33	2.62	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.1	91	0.0089	1.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	63	0.0050	4.03	4.95	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
12.9	383	Total			

Subcatchment PDA-201: Area to Existing Culvert Via Northern Edge of Property

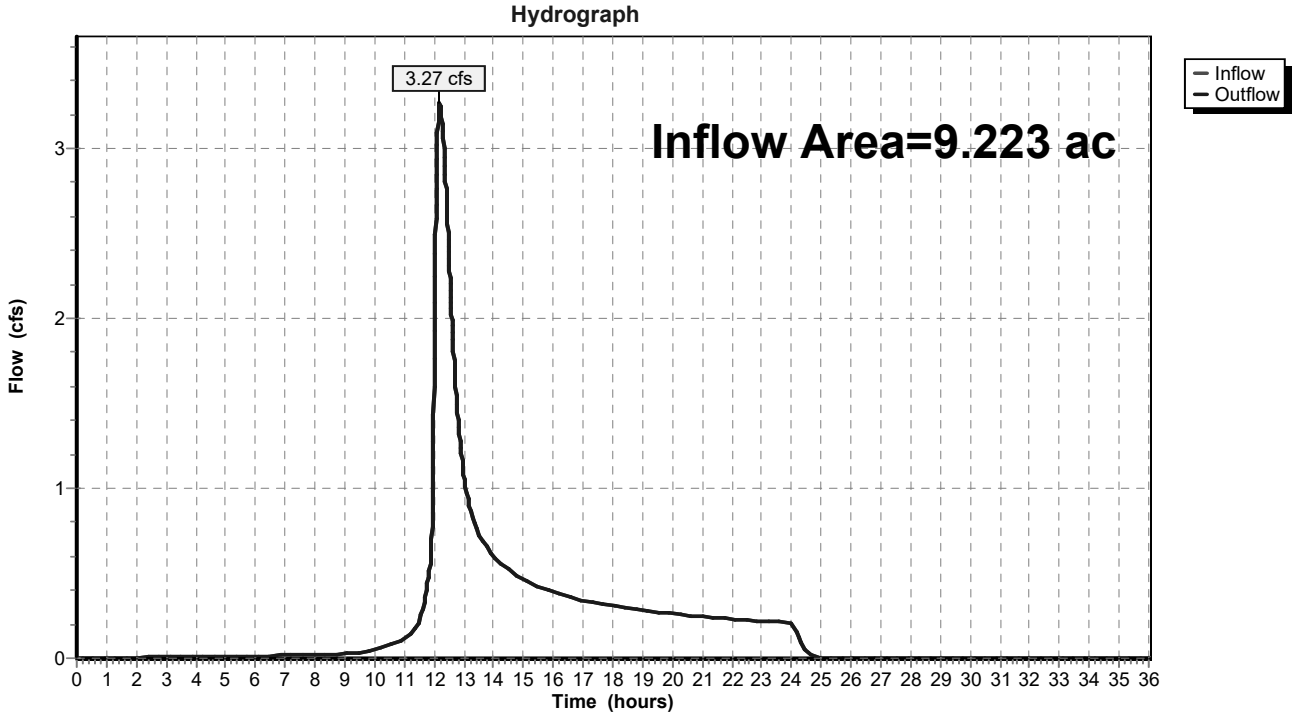


Summary for Reach DP-1: Existing 15" Culvert

Inflow Area = 9.223 ac, 25.83% Impervious, Inflow Depth = 0.72" for 2-yr event
Inflow = 3.27 cfs @ 12.18 hrs, Volume= 0.557 af
Outflow = 3.27 cfs @ 12.18 hrs, Volume= 0.557 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-1: Existing 15" Culvert



Summary for Pond SSDS-1: SSDS-1

Inflow Area = 1.150 ac, 74.13% Impervious, Inflow Depth = 2.11" for 2-yr event
Inflow = 3.39 cfs @ 12.03 hrs, Volume= 0.202 af
Outflow = 0.21 cfs @ 11.46 hrs, Volume= 0.202 af, Atten= 94%, Lag= 0.0 min
Discarded = 0.21 cfs @ 11.46 hrs, Volume= 0.202 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 289.22' @ 13.24 hrs Surf.Area= 3,411 sf Storage= 3,027 cf

Plug-Flow detention time= 113.6 min calculated for 0.202 af (100% of inflow)
Center-of-Mass det. time= 113.6 min (944.1 - 830.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	287.58'	2,444 cf	**41.60'W x 82.00'L x 5.00'H Field A** 17,056 cf Overall - 10,947 cf Embedded = 6,109 cf x 40.0% Voids
#2A	288.58'	8,421 cf	**Concrete Galley 4x8x4** x 90 Inside #1 Inside= 42.0"W x 43.0"H => 12.47 sf x 7.50'L = 93.6 cf Outside= 52.8"W x 48.0"H => 15.20 sf x 8.00'L = 121.6 cf 90 Chambers in 9 Rows
		10,864 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	291.58'	**12.0" Round Culvert** L= 21.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 291.58' / 291.30' S= 0.0133 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	287.58'	**2.700 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.21 cfs @ 11.46 hrs HW=287.63' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.21 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=287.58' (Free Discharge)
↑—**1=Culvert** (Controls 0.00 cfs)

Pond SSDS-1: SSDS-1 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x8x4 (Concrete Galley, UCPI 4x8x4 Galley or equivalent)
Inside= 42.0"W x 43.0"H => 12.47 sf x 7.50'L = 93.6 cf
Outside= 52.8"W x 48.0"H => 15.20 sf x 8.00'L = 121.6 cf

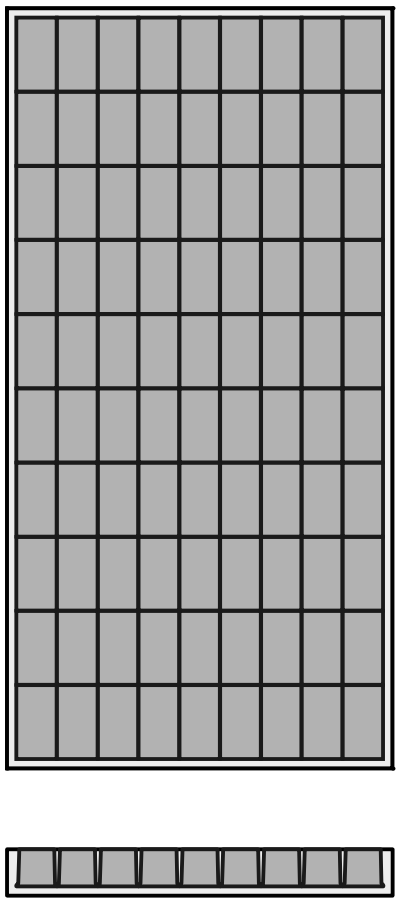
10 Chambers/Row x 8.00' Long = 80.00' Row Length +12.0" End Stone x 2 = 82.00' Base Length
9 Rows x 52.8" Wide + 12.0" Side Stone x 2 = 41.60' Base Width
12.0" Base + 48.0" Chamber Height = 5.00' Field Height

90 Chambers x 93.6 cf = 8,420.6 cf Chamber Storage
90 Chambers x 121.6 cf = 10,947.2 cf Displacement

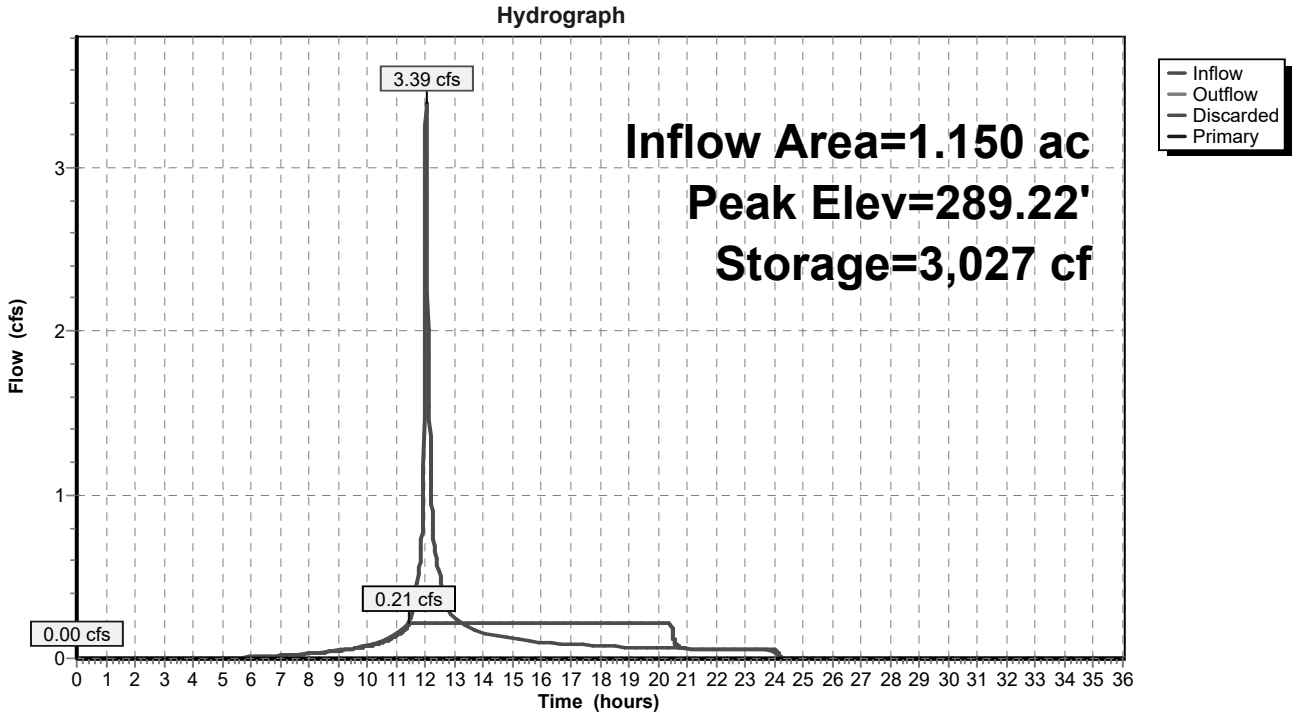
17,056.0 cf Field - 10,947.2 cf Chambers = 6,108.8 cf Stone x 40.0% Voids = 2,443.5 cf Stone Storage

Chamber Storage + Stone Storage = 10,864.1 cf = 0.249 af
Overall Storage Efficiency = 63.7%
Overall System Size = 82.00' x 41.60' x 5.00'

90 Chambers
631.7 cy Field
226.3 cy Stone



Pond SSDS-1: SSDS-1



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 PDA-101: Area to Existing Runoff Area=268,415 sf 9.08% Impervious Runoff Depth=1.63"
Flow Length=1,381' Tc=25.7 min CN=64 Runoff=6.12 cfs 0.838 af

Subcatchment PDA-102: Area to SSDS-1 Runoff Area=50,110 sf 74.13% Impervious Runoff Depth=3.74"
Tc=5.0 min CN=88 Runoff=5.90 cfs 0.359 af

Subcatchment PDA-103: Building Area Runoff Area=9,790 sf 100.00% Impervious Runoff Depth=4.84"
Flow Length=314' Tc=5.0 min CN=98 Runoff=1.34 cfs 0.091 af

Subcatchment PDA-201: Area to Existing Runoff Area=73,420 sf 44.21% Impervious Runoff Depth=2.69"
Flow Length=383' Tc=12.9 min CN=77 Runoff=4.28 cfs 0.378 af

Reach DP-1: Existing 15" Culvert Inflow=9.01 cfs 1.307 af
Outflow=9.01 cfs 1.307 af

Pond SSDS-1: SSDS-1 Peak Elev=290.64' Storage=6,776 cf Inflow=5.90 cfs 0.359 af
Discarded=0.21 cfs 0.359 af Primary=0.00 cfs 0.000 af Outflow=0.21 cfs 0.359 af

Total Runoff Area = 9.223 ac Runoff Volume = 1.666 af Average Runoff Depth = 2.17"
74.17% Pervious = 6.840 ac 25.83% Impervious = 2.382 ac

Summary for Subcatchment PDA-101: Area to Existing Culvert

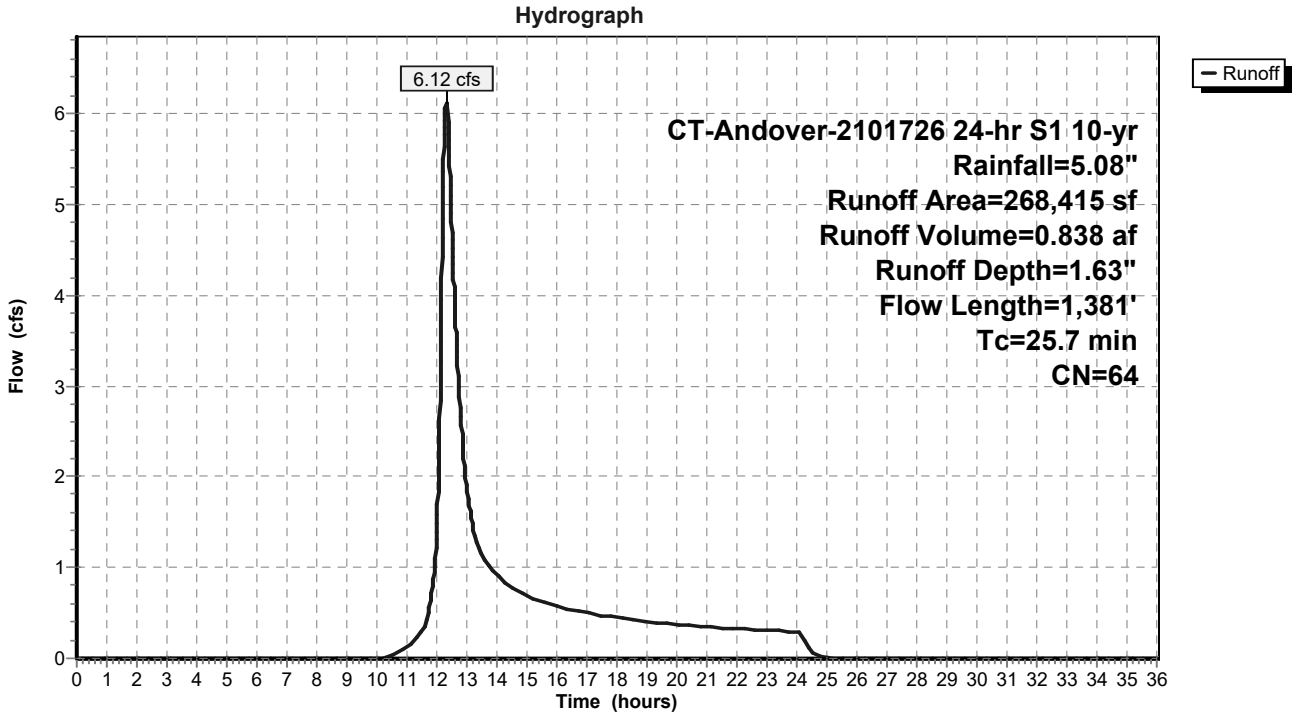
Runoff = 6.12 cfs @ 12.31 hrs, Volume= 0.838 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 10-yr Rainfall=5.08"

Area (sf)	CN	Description
83,295	49	50-75% Grass cover, Fair, HSG A
64,370	69	50-75% Grass cover, Fair, HSG B
0	79	50-75% Grass cover, Fair, HSG C
1,600	84	50-75% Grass cover, Fair, HSG D
17,760	36	Woods, Fair, HSG A
35,505	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
41,515	79	Woods, Fair, HSG D
22,095	98	Paved parking, HSG A
2,275	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
268,415	64	Weighted Average
244,045		90.92% Pervious Area
24,370		9.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.6	300	0.1533	1.96		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	66	0.0077	1.32		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.6	160	0.0437	4.24		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	35	0.0214	2.19		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.9	125	0.2149	2.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.7	532	0.0107	1.55		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.2	63	0.0100	5.70	7.00	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
25.7	1,381	Total			

Subcatchment PDA-101: Area to Existing Culvert



Summary for Subcatchment PDA-102: Area to SSDS-1

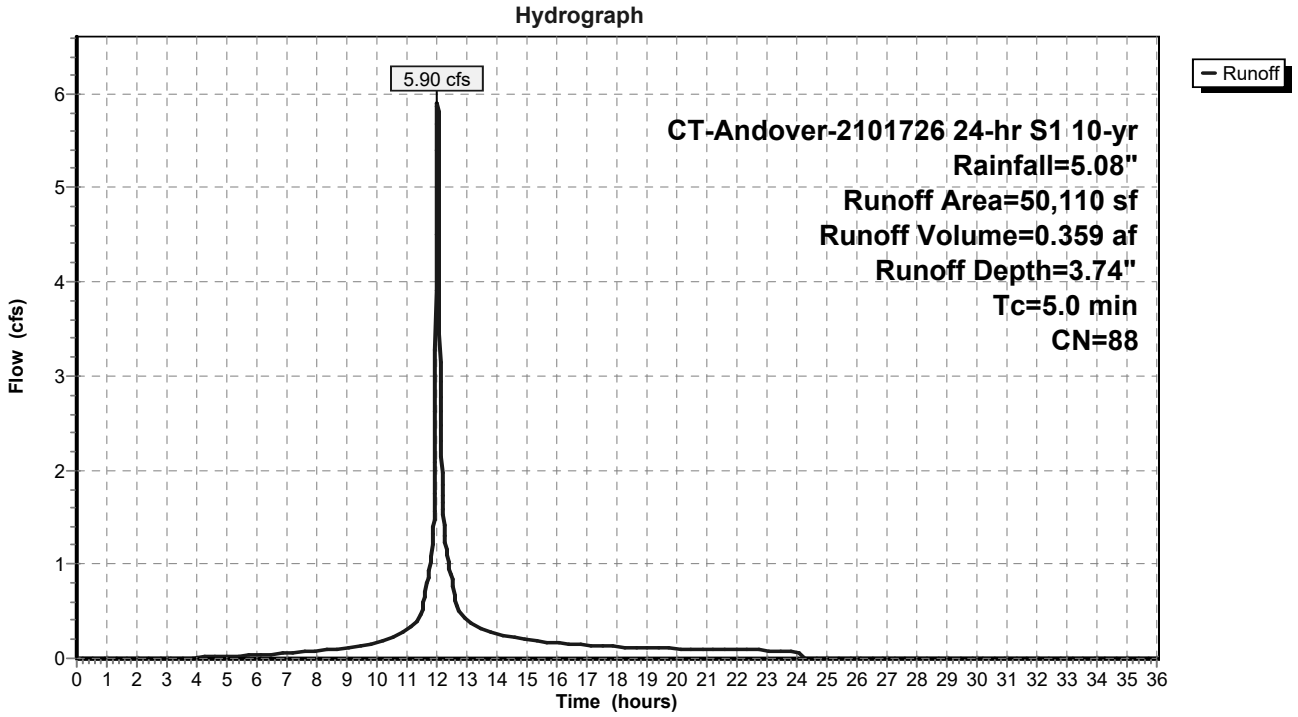
Runoff = 5.90 cfs @ 12.03 hrs, Volume= 0.359 af, Depth= 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 10-yr Rainfall=5.08"

Area (sf)	CN	Description
7,340	49	50-75% Grass cover, Fair, HSG A
2,860	69	50-75% Grass cover, Fair, HSG B
2,765	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
0	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
18,990	98	Paved parking, HSG A
13,160	98	Paved parking, HSG B
4,995	98	Paved parking, HSG C
0	98	Paved parking, HSG D
50,110	88	Weighted Average
12,965		25.87% Pervious Area
37,145		74.13% Impervious Area

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

Subcatchment PDA-102: Area to SSDS-1



Summary for Subcatchment PDA-103: Building Area Draining to Rear Downspouts

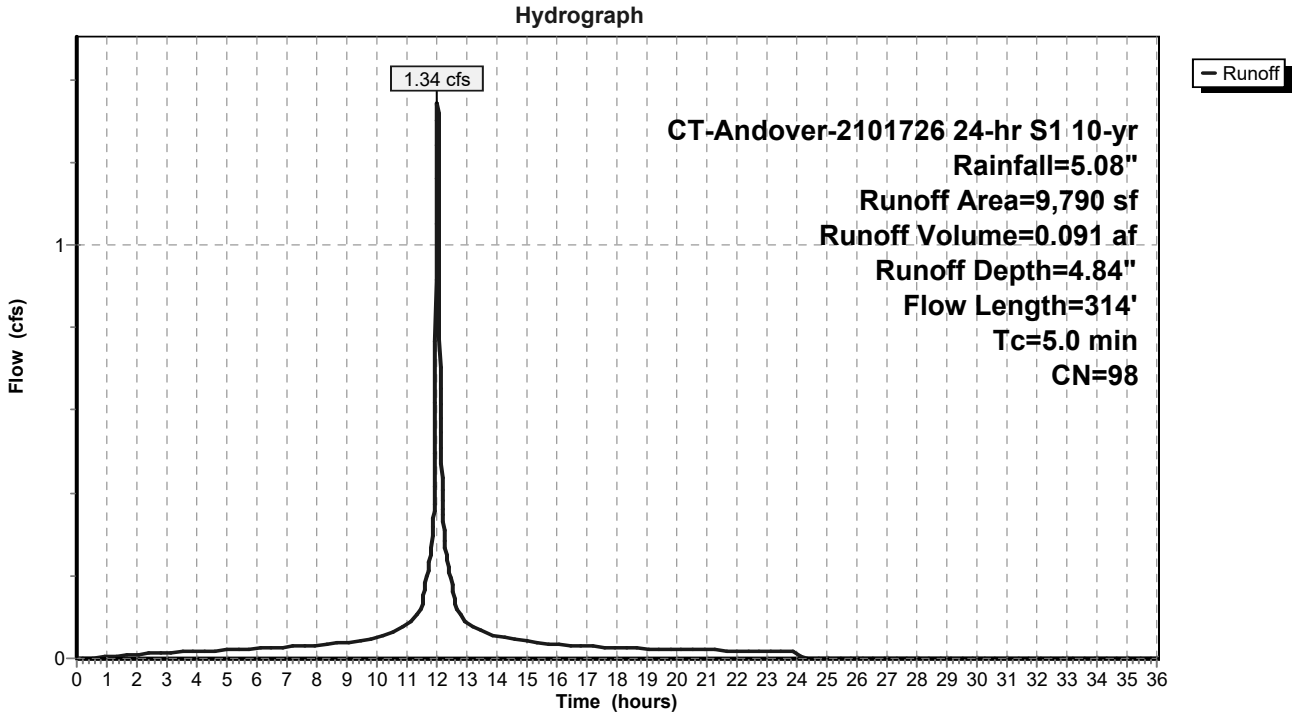
Runoff = 1.34 cfs @ 12.03 hrs, Volume= 0.091 af, Depth= 4.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 10-yr Rainfall=5.08"

Area (sf)	CN	Description
0	49	50-75% Grass cover, Fair, HSG A
0	69	50-75% Grass cover, Fair, HSG B
0	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
0	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
5,150	98	Paved parking, HSG A
4,640	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
9,790	98	Weighted Average
9,790		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	204	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.1	18	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.1	92	0.0089	1.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
2.3	314	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PDA-103: Building Area Draining to Rear Downspouts



Summary for Subcatchment PDA-201: Area to Existing Culvert Via Northern Edge of Property

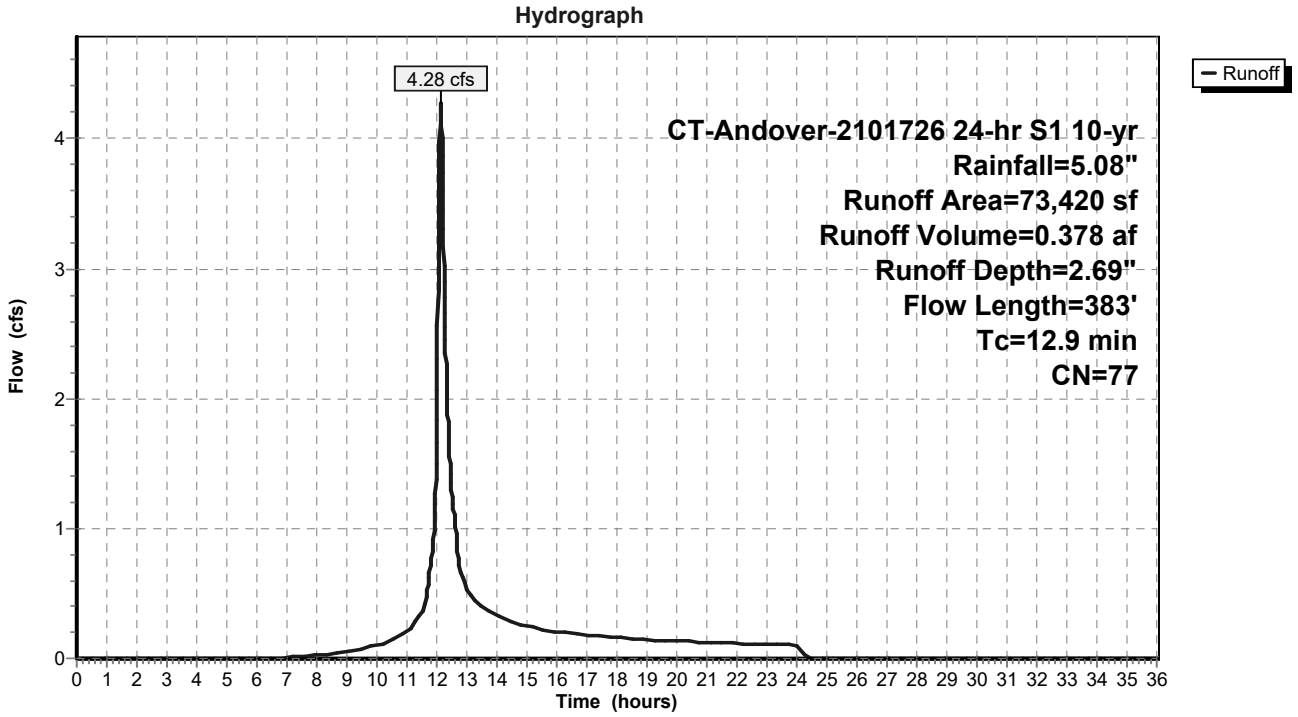
Runoff = 4.28 cfs @ 12.13 hrs, Volume= 0.378 af, Depth= 2.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 10-yr Rainfall=5.08"

Area (sf)	CN	Description
10,930	49	50-75% Grass cover, Fair, HSG A
19,275	69	50-75% Grass cover, Fair, HSG B
3,000	39	>75% Grass cover, Good, HSG A
4,000	61	>75% Grass cover, Good, HSG B
0	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
3,755	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
7,740	98	Paved parking, HSG A
24,720	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
73,420	77	Weighted Average
40,960		55.79% Pervious Area
32,460		44.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	100	0.0150	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.32"
0.4	75	0.0370	2.89		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	54	0.0054	3.33	2.62	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.1	91	0.0089	1.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	63	0.0050	4.03	4.95	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
12.9	383	Total			

Subcatchment PDA-201: Area to Existing Culvert Via Northern Edge of Property

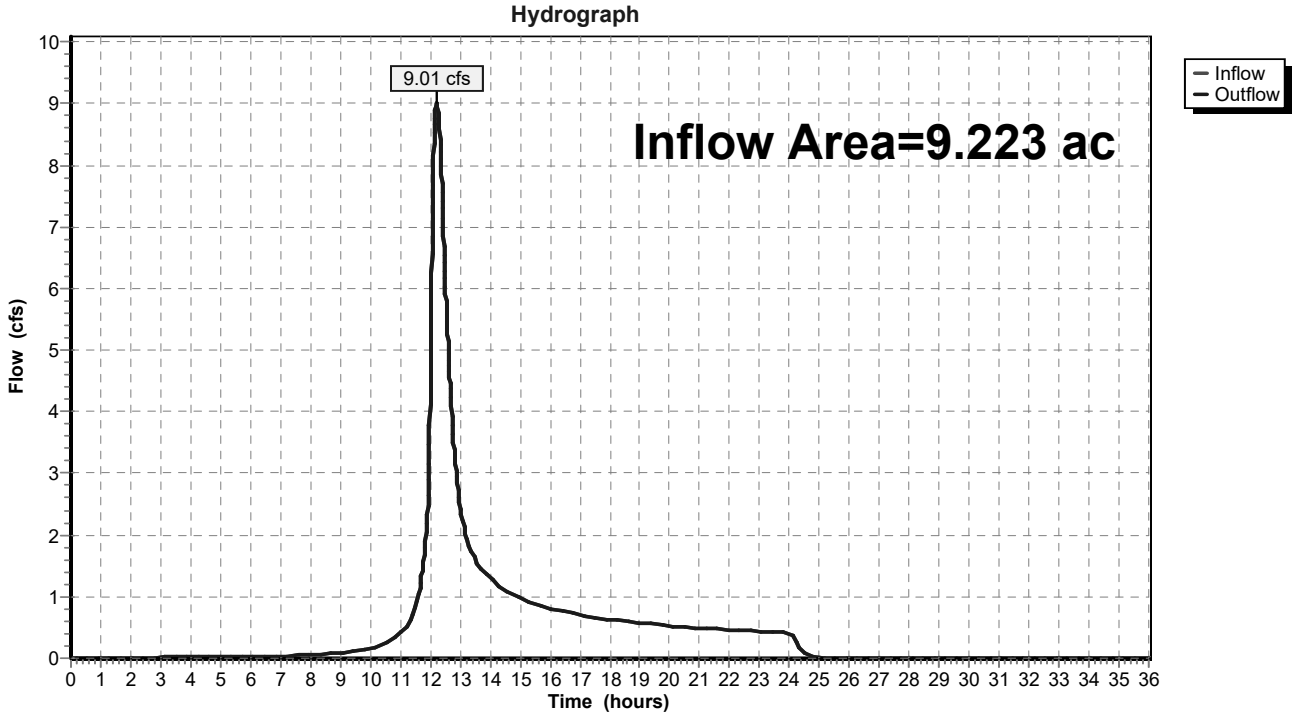


Summary for Reach DP-1: Existing 15" Culvert

Inflow Area = 9.223 ac, 25.83% Impervious, Inflow Depth = 1.70" for 10-yr event
Inflow = 9.01 cfs @ 12.22 hrs, Volume= 1.307 af
Outflow = 9.01 cfs @ 12.22 hrs, Volume= 1.307 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-1: Existing 15" Culvert



Summary for Pond SSDS-1: SSDS-1

Inflow Area = 1.150 ac, 74.13% Impervious, Inflow Depth = 3.74" for 10-yr event
Inflow = 5.90 cfs @ 12.03 hrs, Volume= 0.359 af
Outflow = 0.21 cfs @ 10.59 hrs, Volume= 0.359 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.21 cfs @ 10.59 hrs, Volume= 0.359 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 290.64' @ 14.63 hrs Surf.Area= 3,411 sf Storage= 6,776 cf

Plug-Flow detention time= 296.1 min calculated for 0.359 af (100% of inflow)
Center-of-Mass det. time= 296.1 min (1,105.7 - 809.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	287.58'	2,444 cf	**41.60'W x 82.00'L x 5.00'H Field A** 17,056 cf Overall - 10,947 cf Embedded = 6,109 cf x 40.0% Voids
#2A	288.58'	8,421 cf	**Concrete Galley 4x8x4** x 90 Inside #1 Inside= 42.0"W x 43.0"H => 12.47 sf x 7.50'L = 93.6 cf Outside= 52.8"W x 48.0"H => 15.20 sf x 8.00'L = 121.6 cf 90 Chambers in 9 Rows
		10,864 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	291.58'	**12.0" Round Culvert** L= 21.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 291.58' / 291.30' S= 0.0133 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	287.58'	**2.700 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.21 cfs @ 10.59 hrs HW=287.63' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.21 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=287.58' (Free Discharge)
↑—**1=Culvert** (Controls 0.00 cfs)

Pond SSDS-1: SSDS-1 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x8x4 (Concrete Galley, UCPI 4x8x4 Galley or equivalent)
Inside= 42.0"W x 43.0"H => 12.47 sf x 7.50'L = 93.6 cf
Outside= 52.8"W x 48.0"H => 15.20 sf x 8.00'L = 121.6 cf

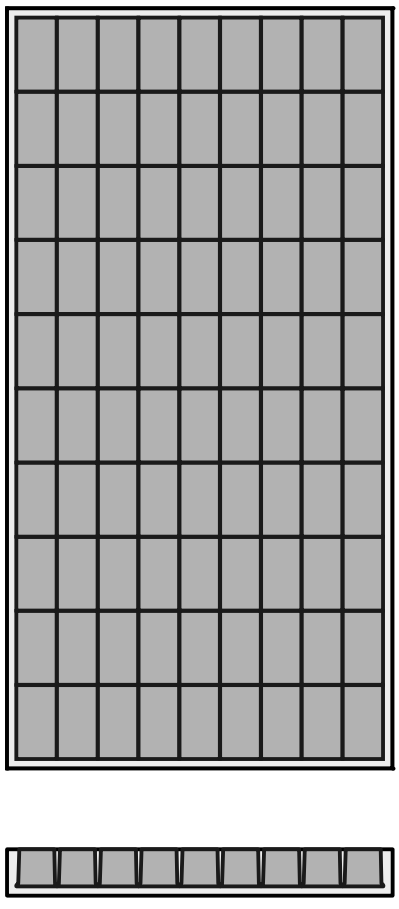
10 Chambers/Row x 8.00' Long = 80.00' Row Length +12.0" End Stone x 2 = 82.00' Base Length
9 Rows x 52.8" Wide + 12.0" Side Stone x 2 = 41.60' Base Width
12.0" Base + 48.0" Chamber Height = 5.00' Field Height

90 Chambers x 93.6 cf = 8,420.6 cf Chamber Storage
90 Chambers x 121.6 cf = 10,947.2 cf Displacement

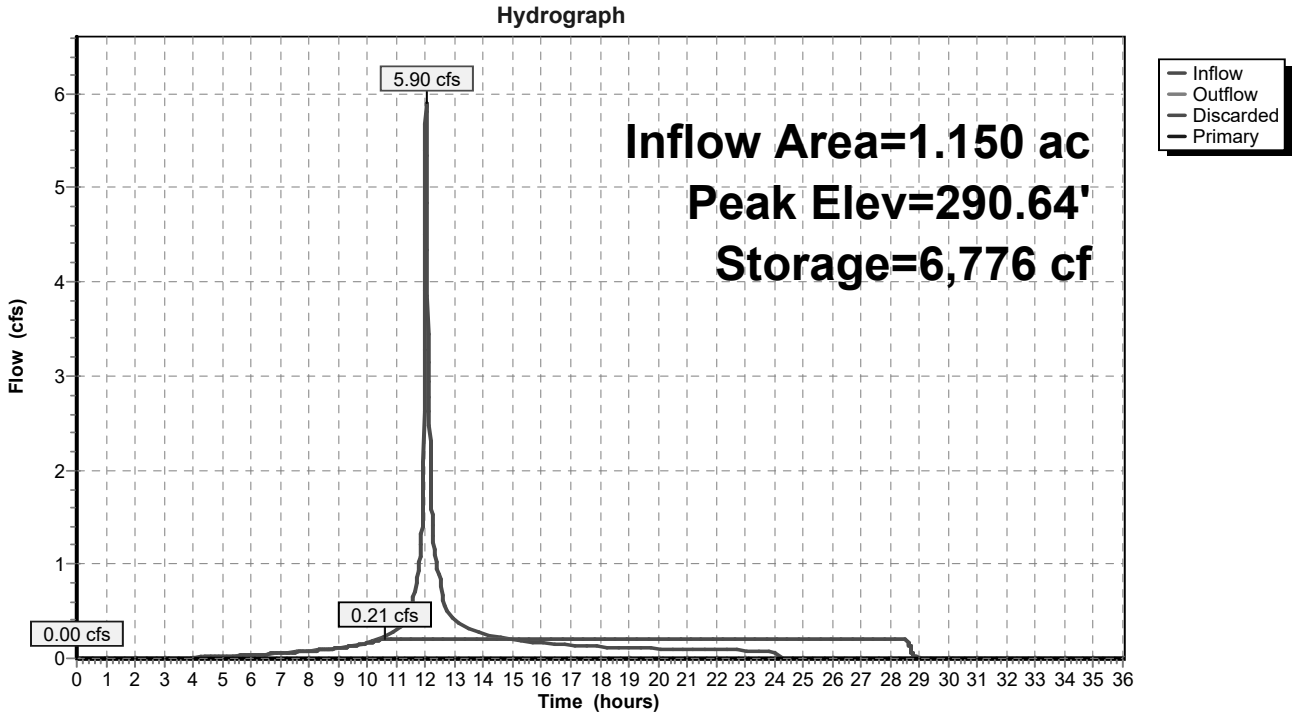
17,056.0 cf Field - 10,947.2 cf Chambers = 6,108.8 cf Stone x 40.0% Voids = 2,443.5 cf Stone Storage

Chamber Storage + Stone Storage = 10,864.1 cf = 0.249 af
Overall Storage Efficiency = 63.7%
Overall System Size = 82.00' x 41.60' x 5.00'

90 Chambers
631.7 cy Field
226.3 cy Stone



Pond SSDS-1: SSDS-1



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 PDA-101: Area to Existing Runoff Area=268,415 sf 9.08% Impervious Runoff Depth=2.39"
Flow Length=1,381' Tc=25.7 min CN=64 Runoff=9.29 cfs 1.225 af

Subcatchment PDA-102: Area to SSDS-1 Runoff Area=50,110 sf 74.13% Impervious Runoff Depth=4.79"
Tc=5.0 min CN=88 Runoff=7.46 cfs 0.459 af

Subcatchment PDA-103: Building Area Runoff Area=9,790 sf 100.00% Impervious Runoff Depth=5.93"
Flow Length=314' Tc=5.0 min CN=98 Runoff=1.63 cfs 0.111 af

Subcatchment PDA-201: Area to Existing Runoff Area=73,420 sf 44.21% Impervious Runoff Depth=3.63"
Flow Length=383' Tc=12.9 min CN=77 Runoff=5.78 cfs 0.510 af

Reach DP-1: Existing 15" Culvert Inflow=13.12 cfs 1.850 af
Outflow=13.12 cfs 1.850 af

Pond SSDS-1: SSDS-1 Peak Elev=291.66' Storage=9,439 cf Inflow=7.46 cfs 0.459 af
Discarded=0.21 cfs 0.455 af Primary=0.03 cfs 0.004 af Outflow=0.24 cfs 0.459 af

Total Runoff Area = 9.223 ac Runoff Volume = 2.305 af Average Runoff Depth = 3.00"
74.17% Pervious = 6.840 ac 25.83% Impervious = 2.382 ac

Summary for Subcatchment PDA-101: Area to Existing Culvert

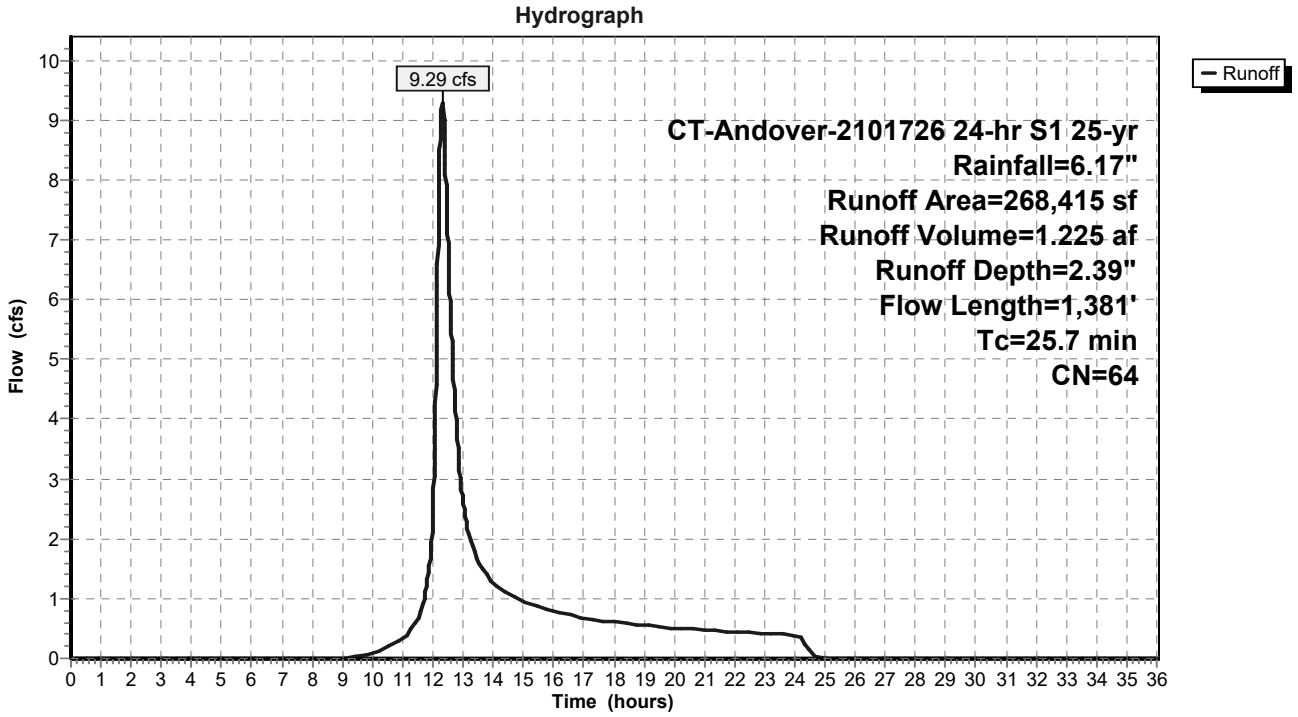
Runoff = 9.29 cfs @ 12.31 hrs, Volume= 1.225 af, Depth= 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 25-yr Rainfall=6.17"

Area (sf)	CN	Description
83,295	49	50-75% Grass cover, Fair, HSG A
64,370	69	50-75% Grass cover, Fair, HSG B
0	79	50-75% Grass cover, Fair, HSG C
1,600	84	50-75% Grass cover, Fair, HSG D
17,760	36	Woods, Fair, HSG A
35,505	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
41,515	79	Woods, Fair, HSG D
22,095	98	Paved parking, HSG A
2,275	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
268,415	64	Weighted Average
244,045		90.92% Pervious Area
24,370		9.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.6	300	0.1533	1.96		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	66	0.0077	1.32		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.6	160	0.0437	4.24		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	35	0.0214	2.19		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.9	125	0.2149	2.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.7	532	0.0107	1.55		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.2	63	0.0100	5.70	7.00	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
25.7	1,381	Total			

Subcatchment PDA-101: Area to Existing Culvert



Summary for Subcatchment PDA-102: Area to SSDS-1

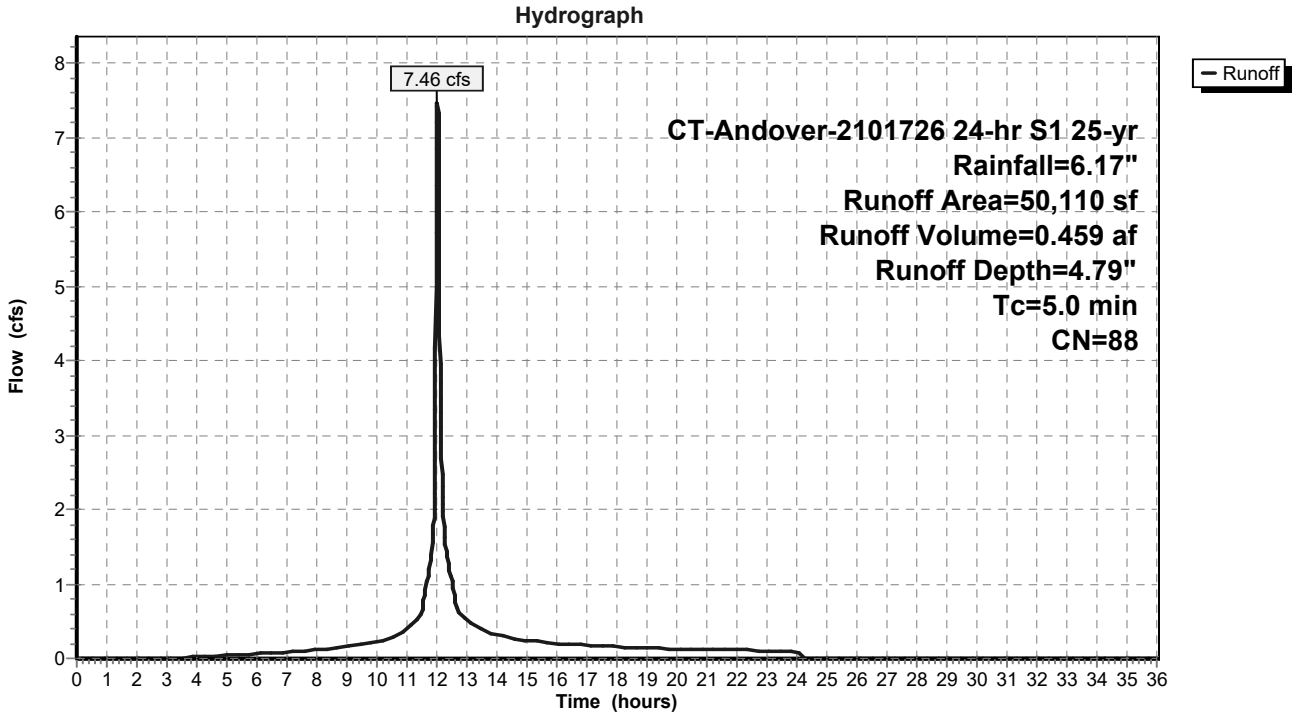
Runoff = 7.46 cfs @ 12.03 hrs, Volume= 0.459 af, Depth= 4.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 25-yr Rainfall=6.17"

Area (sf)	CN	Description
7,340	49	50-75% Grass cover, Fair, HSG A
2,860	69	50-75% Grass cover, Fair, HSG B
2,765	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
0	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
18,990	98	Paved parking, HSG A
13,160	98	Paved parking, HSG B
4,995	98	Paved parking, HSG C
0	98	Paved parking, HSG D
50,110	88	Weighted Average
12,965		25.87% Pervious Area
37,145		74.13% Impervious Area

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

Subcatchment PDA-102: Area to SSDS-1



Summary for Subcatchment PDA-103: Building Area Draining to Rear Downspouts

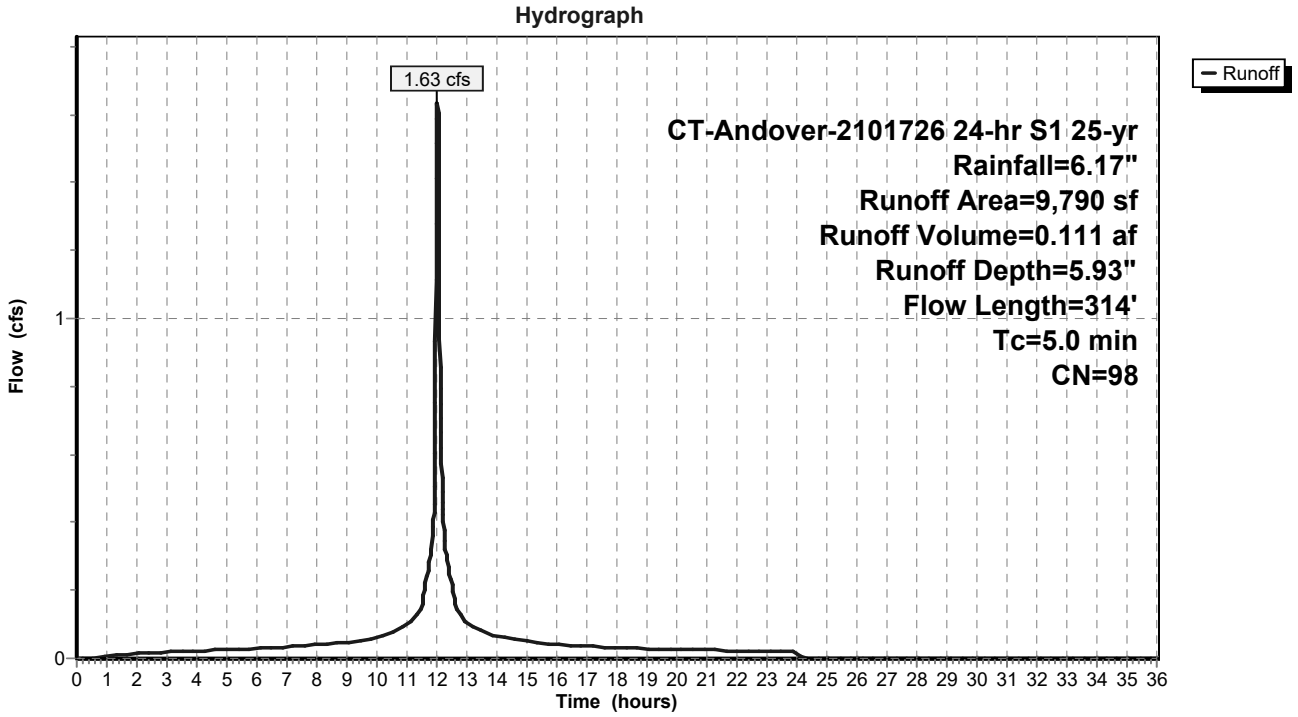
Runoff = 1.63 cfs @ 12.03 hrs, Volume= 0.111 af, Depth= 5.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 25-yr Rainfall=6.17"

Area (sf)	CN	Description
0	49	50-75% Grass cover, Fair, HSG A
0	69	50-75% Grass cover, Fair, HSG B
0	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
0	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
5,150	98	Paved parking, HSG A
4,640	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
9,790	98	Weighted Average
9,790		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	204	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.1	18	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.1	92	0.0089	1.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
2.3	314	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PDA-103: Building Area Draining to Rear Downspouts



Summary for Subcatchment PDA-201: Area to Existing Culvert Via Northern Edge of Property

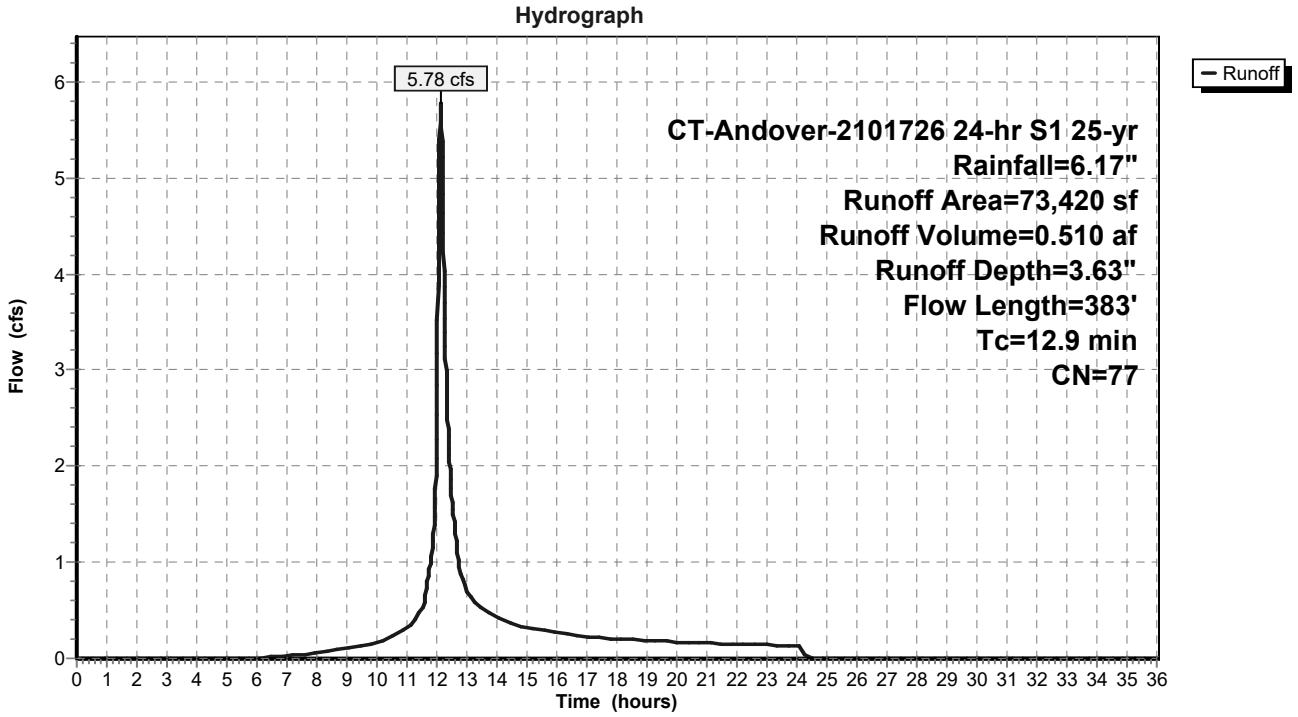
Runoff = 5.78 cfs @ 12.13 hrs, Volume= 0.510 af, Depth= 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 25-yr Rainfall=6.17"

Area (sf)	CN	Description
10,930	49	50-75% Grass cover, Fair, HSG A
19,275	69	50-75% Grass cover, Fair, HSG B
3,000	39	>75% Grass cover, Good, HSG A
4,000	61	>75% Grass cover, Good, HSG B
0	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
3,755	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
7,740	98	Paved parking, HSG A
24,720	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
73,420	77	Weighted Average
40,960		55.79% Pervious Area
32,460		44.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	100	0.0150	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.32"
0.4	75	0.0370	2.89		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	54	0.0054	3.33	2.62	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.1	91	0.0089	1.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	63	0.0050	4.03	4.95	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
12.9	383	Total			

Subcatchment PDA-201: Area to Existing Culvert Via Northern Edge of Property

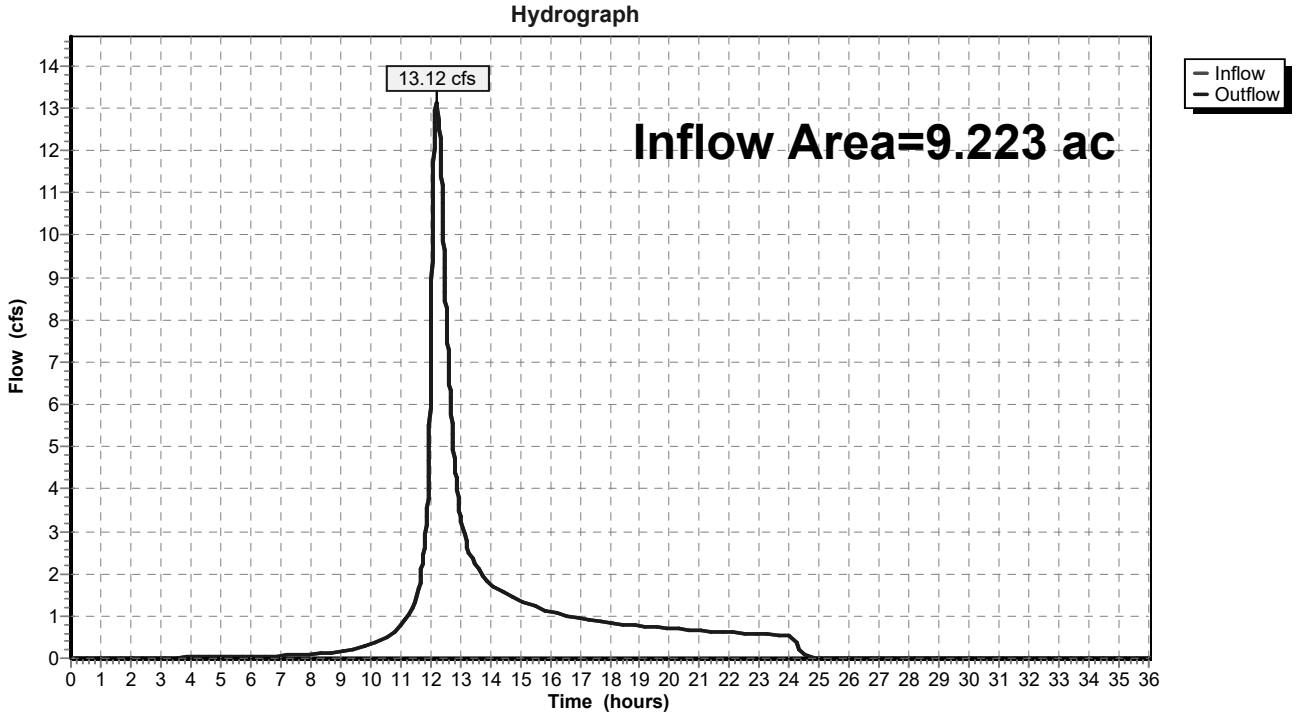


Summary for Reach DP-1: Existing 15" Culvert

Inflow Area = 9.223 ac, 25.83% Impervious, Inflow Depth = 2.41" for 25-yr event
Inflow = 13.12 cfs @ 12.22 hrs, Volume= 1.850 af
Outflow = 13.12 cfs @ 12.22 hrs, Volume= 1.850 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-1: Existing 15" Culvert



Summary for Pond SSDS-1: SSDS-1

Inflow Area = 1.150 ac, 74.13% Impervious, Inflow Depth = 4.79" for 25-yr event
Inflow = 7.46 cfs @ 12.03 hrs, Volume= 0.459 af
Outflow = 0.24 cfs @ 14.97 hrs, Volume= 0.459 af, Atten= 97%, Lag= 176.8 min
Discarded = 0.21 cfs @ 9.96 hrs, Volume= 0.455 af
Primary = 0.03 cfs @ 14.97 hrs, Volume= 0.004 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 291.66' @ 14.97 hrs Surf.Area= 3,411 sf Storage= 9,439 cf

Plug-Flow detention time= 409.9 min calculated for 0.459 af (100% of inflow)
Center-of-Mass det. time= 409.9 min (1,210.9 - 800.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	287.58'	2,444 cf	**41.60'W x 82.00'L x 5.00'H Field A** 17,056 cf Overall - 10,947 cf Embedded = 6,109 cf x 40.0% Voids
#2A	288.58'	8,421 cf	**Concrete Galley 4x8x4** x 90 Inside #1 Inside= 42.0"W x 43.0"H => 12.47 sf x 7.50'L = 93.6 cf Outside= 52.8"W x 48.0"H => 15.20 sf x 8.00'L = 121.6 cf 90 Chambers in 9 Rows
		10,864 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	291.58'	**12.0" Round Culvert** L= 21.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 291.58' / 291.30' S= 0.0133 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	287.58'	**2.700 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.21 cfs @ 9.96 hrs HW=287.63' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.21 cfs)

Primary OutFlow Max=0.03 cfs @ 14.97 hrs HW=291.66' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.03 cfs @ 1.43 fps)

Pond SSDS-1: SSDS-1 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x8x4 (Concrete Galley, UCPI 4x8x4 Galley or equivalent)
Inside= 42.0"W x 43.0"H => 12.47 sf x 7.50'L = 93.6 cf
Outside= 52.8"W x 48.0"H => 15.20 sf x 8.00'L = 121.6 cf

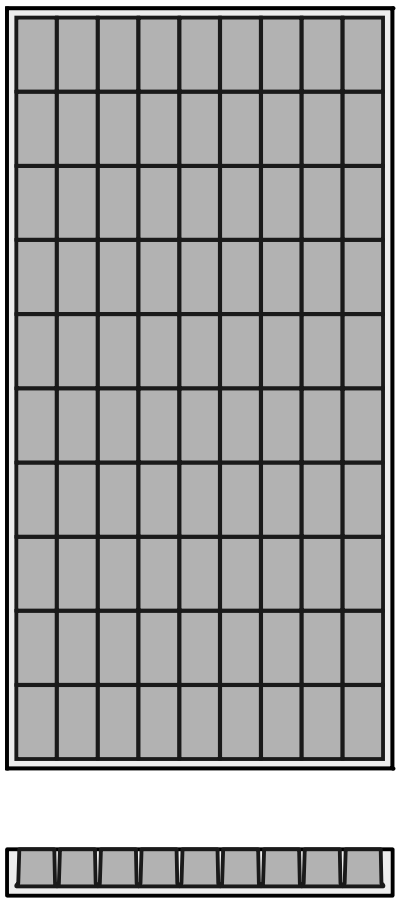
10 Chambers/Row x 8.00' Long = 80.00' Row Length +12.0" End Stone x 2 = 82.00' Base Length
9 Rows x 52.8" Wide + 12.0" Side Stone x 2 = 41.60' Base Width
12.0" Base + 48.0" Chamber Height = 5.00' Field Height

90 Chambers x 93.6 cf = 8,420.6 cf Chamber Storage
90 Chambers x 121.6 cf = 10,947.2 cf Displacement

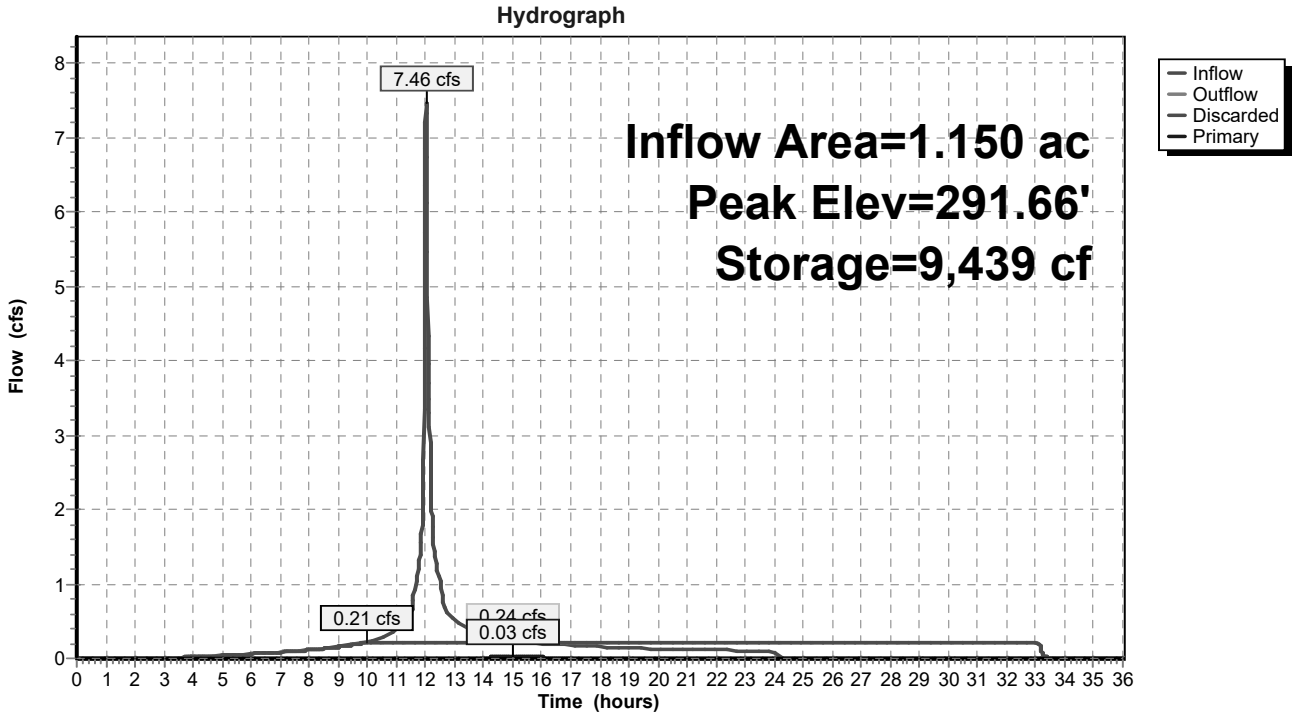
17,056.0 cf Field - 10,947.2 cf Chambers = 6,108.8 cf Stone x 40.0% Voids = 2,443.5 cf Stone Storage

Chamber Storage + Stone Storage = 10,864.1 cf = 0.249 af
Overall Storage Efficiency = 63.7%
Overall System Size = 82.00' x 41.60' x 5.00'

90 Chambers
631.7 cy Field
226.3 cy Stone



Pond SSDS-1: SSDS-1



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 PDA-101: Area to Existing Runoff Area=268,415 sf 9.08% Impervious Runoff Depth=3.67"
Flow Length=1,381' Tc=25.7 min CN=64 Runoff=14.65 cfs 1.884 af

Subcatchment PDA-102: Area to SSDS-1 Runoff Area=50,110 sf 74.13% Impervious Runoff Depth=6.43"
Tc=5.0 min CN=88 Runoff=9.86 cfs 0.617 af

Subcatchment PDA-103: Building Area Runoff Area=9,790 sf 100.00% Impervious Runoff Depth=7.62"
Flow Length=314' Tc=5.0 min CN=98 Runoff=2.08 cfs 0.143 af

Subcatchment PDA-201: Area to Existing Runoff Area=73,420 sf 44.21% Impervious Runoff Depth=5.15"
Flow Length=383' Tc=12.9 min CN=77 Runoff=8.17 cfs 0.723 af

Reach DP-1: Existing 15" Culvert Inflow=20.23 cfs 2.866 af
Outflow=20.23 cfs 2.866 af

Pond SSDS-1: SSDS-1 Peak Elev=292.11' Storage=10,612 cf Inflow=9.86 cfs 0.617 af
Discarded=0.21 cfs 0.501 af Primary=0.99 cfs 0.116 af Outflow=1.20 cfs 0.617 af

Total Runoff Area = 9.223 ac Runoff Volume = 3.367 af Average Runoff Depth = 4.38"
74.17% Pervious = 6.840 ac 25.83% Impervious = 2.382 ac

Summary for Subcatchment PDA-101: Area to Existing Culvert

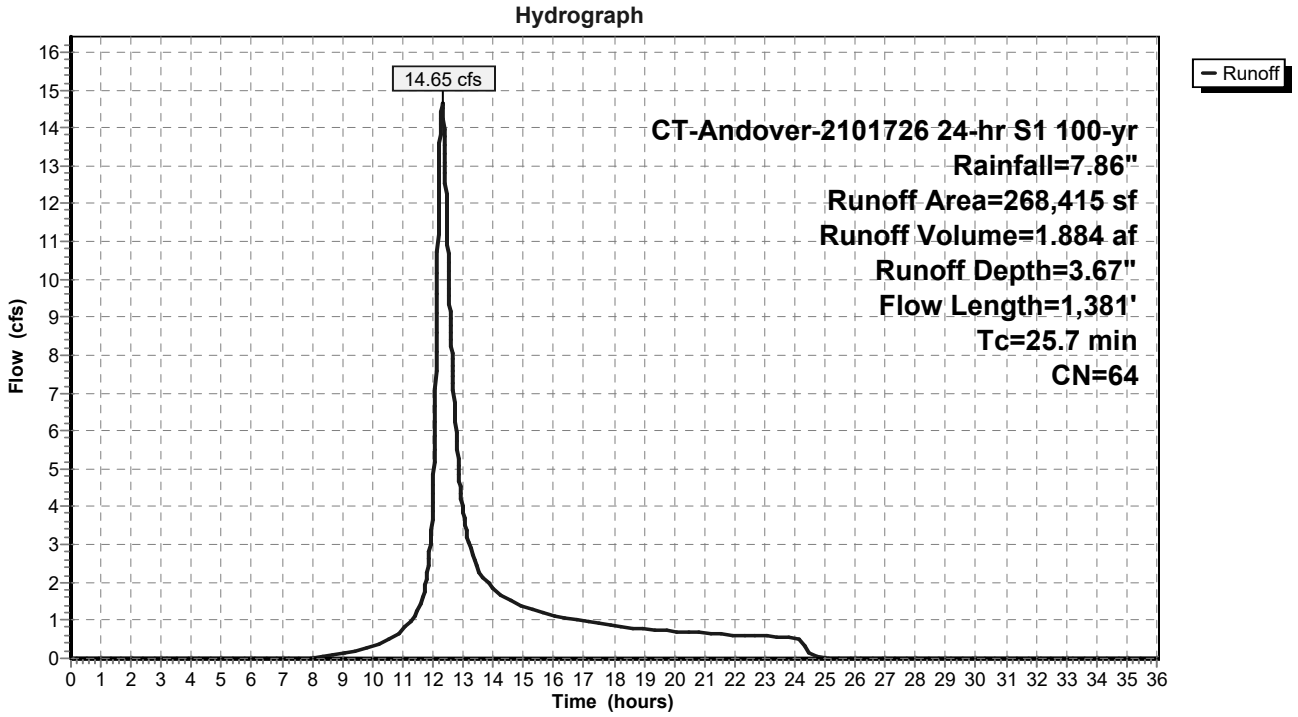
Runoff = 14.65 cfs @ 12.31 hrs, Volume= 1.884 af, Depth= 3.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 100-yr Rainfall=7.86"

Area (sf)	CN	Description
83,295	49	50-75% Grass cover, Fair, HSG A
64,370	69	50-75% Grass cover, Fair, HSG B
0	79	50-75% Grass cover, Fair, HSG C
1,600	84	50-75% Grass cover, Fair, HSG D
17,760	36	Woods, Fair, HSG A
35,505	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
41,515	79	Woods, Fair, HSG D
22,095	98	Paved parking, HSG A
2,275	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
268,415	64	Weighted Average
244,045		90.92% Pervious Area
24,370		9.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.6	100	0.0500	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.32"
2.6	300	0.1533	1.96		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.8	66	0.0077	1.32		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.6	160	0.0437	4.24		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	35	0.0214	2.19		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.9	125	0.2149	2.32		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.7	532	0.0107	1.55		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.2	63	0.0100	5.70	7.00	**Pipe Channel, RCP_Round 15"** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
25.7	1,381	Total			

Subcatchment PDA-101: Area to Existing Culvert



Summary for Subcatchment PDA-102: Area to SSDS-1

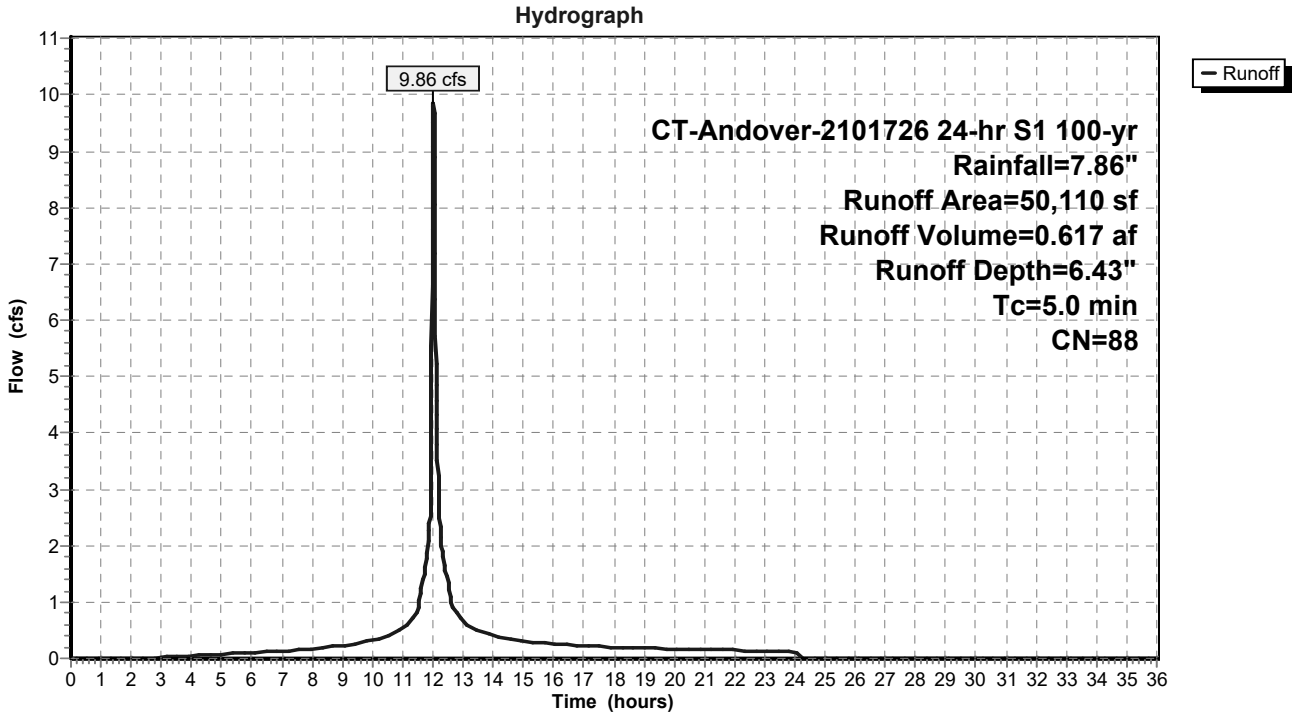
Runoff = 9.86 cfs @ 12.03 hrs, Volume= 0.617 af, Depth= 6.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 100-yr Rainfall=7.86"

Area (sf)	CN	Description
7,340	49	50-75% Grass cover, Fair, HSG A
2,860	69	50-75% Grass cover, Fair, HSG B
2,765	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
0	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
18,990	98	Paved parking, HSG A
13,160	98	Paved parking, HSG B
4,995	98	Paved parking, HSG C
0	98	Paved parking, HSG D
50,110	88	Weighted Average
12,965		25.87% Pervious Area
37,145		74.13% Impervious Area

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

Subcatchment PDA-102: Area to SSDS-1



Summary for Subcatchment PDA-103: Building Area Draining to Rear Downspouts

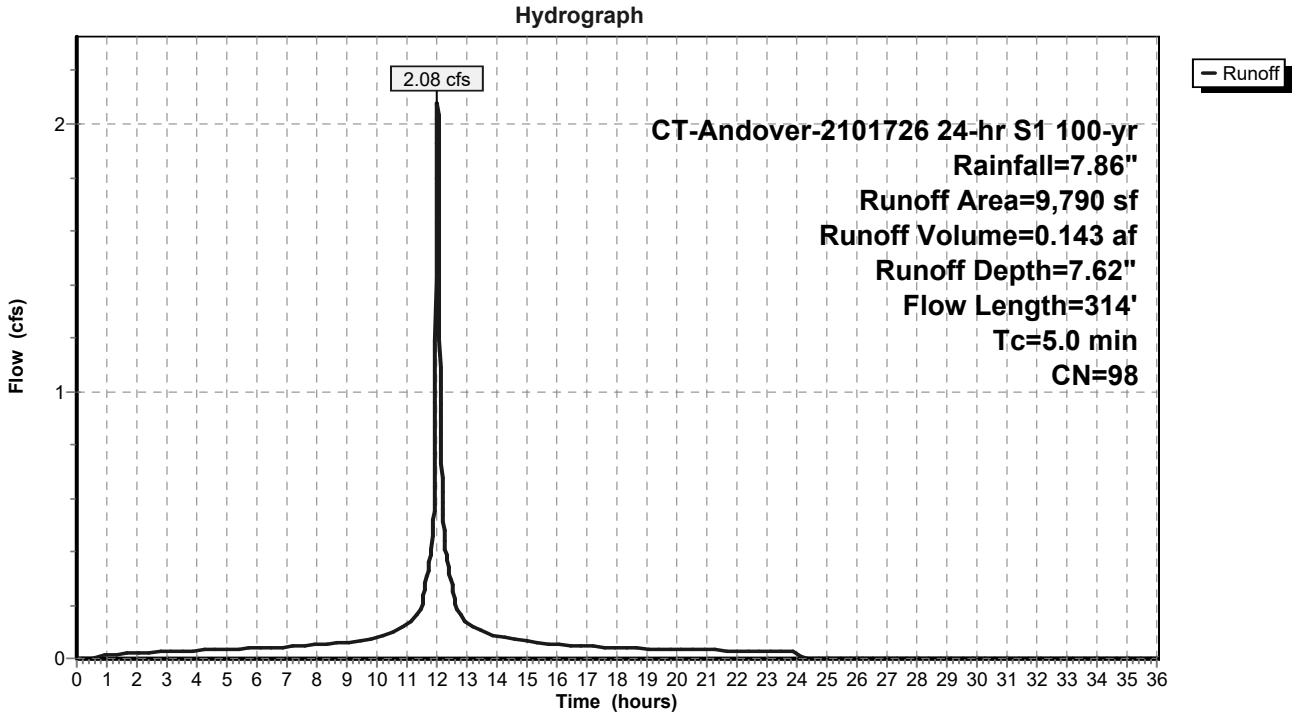
Runoff = 2.08 cfs @ 12.03 hrs, Volume= 0.143 af, Depth= 7.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 100-yr Rainfall=7.86"

Area (sf)	CN	Description
0	49	50-75% Grass cover, Fair, HSG A
0	69	50-75% Grass cover, Fair, HSG B
0	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
0	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
5,150	98	Paved parking, HSG A
4,640	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
9,790	98	Weighted Average
9,790		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	204	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.1	18	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.1	92	0.0089	1.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
2.3	314	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PDA-103: Building Area Draining to Rear Downspouts



Summary for Subcatchment PDA-201: Area to Existing Culvert Via Northern Edge of Property

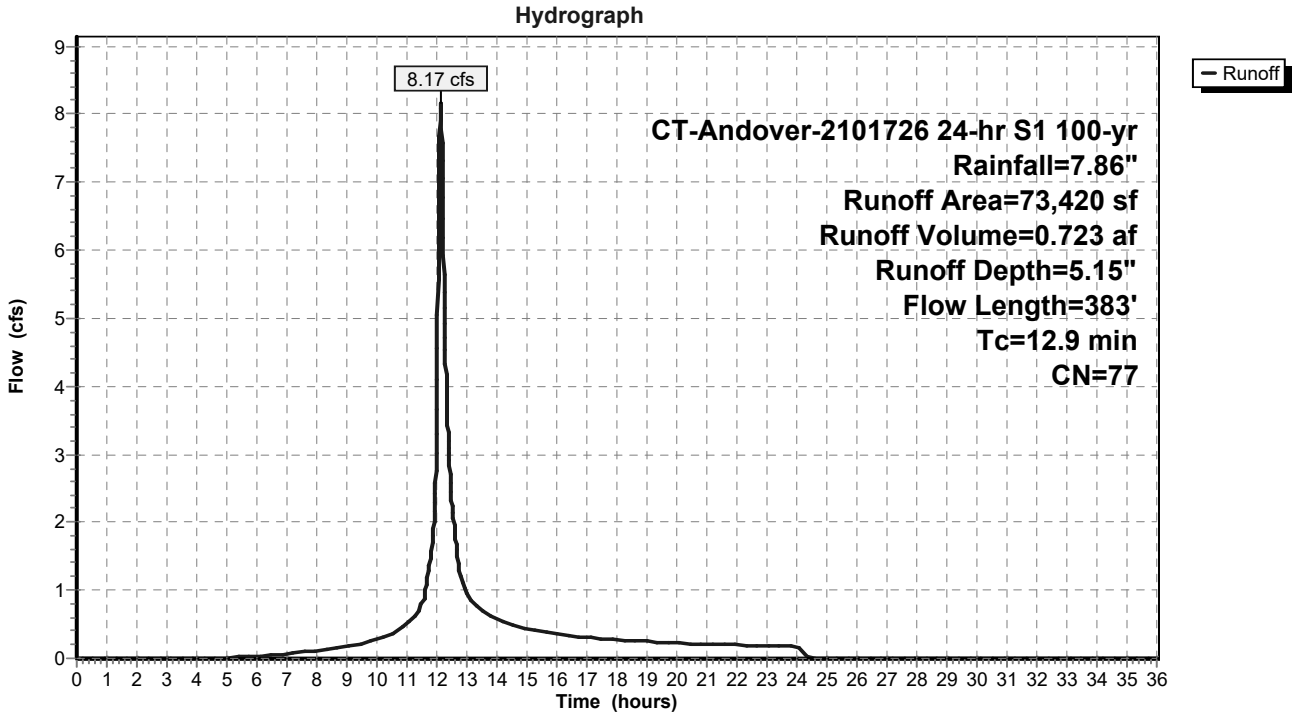
Runoff = 8.17 cfs @ 12.13 hrs, Volume= 0.723 af, Depth= 5.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
CT-Andover-2101726 24-hr S1 100-yr Rainfall=7.86"

Area (sf)	CN	Description
10,930	49	50-75% Grass cover, Fair, HSG A
19,275	69	50-75% Grass cover, Fair, HSG B
3,000	39	>75% Grass cover, Good, HSG A
4,000	61	>75% Grass cover, Good, HSG B
0	79	50-75% Grass cover, Fair, HSG C
0	84	50-75% Grass cover, Fair, HSG D
0	36	Woods, Fair, HSG A
3,755	60	Woods, Fair, HSG B
0	73	Woods, Fair, HSG C
0	79	Woods, Fair, HSG D
7,740	98	Paved parking, HSG A
24,720	98	Paved parking, HSG B
0	98	Paved parking, HSG C
0	98	Paved parking, HSG D
73,420	77	Weighted Average
40,960		55.79% Pervious Area
32,460		44.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	100	0.0150	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.32"
0.4	75	0.0370	2.89		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	54	0.0054	3.33	2.62	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
1.1	91	0.0089	1.42		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.3	63	0.0050	4.03	4.95	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012 Concrete pipe, finished
12.9	383	Total			

Subcatchment PDA-201: Area to Existing Culvert Via Northern Edge of Property

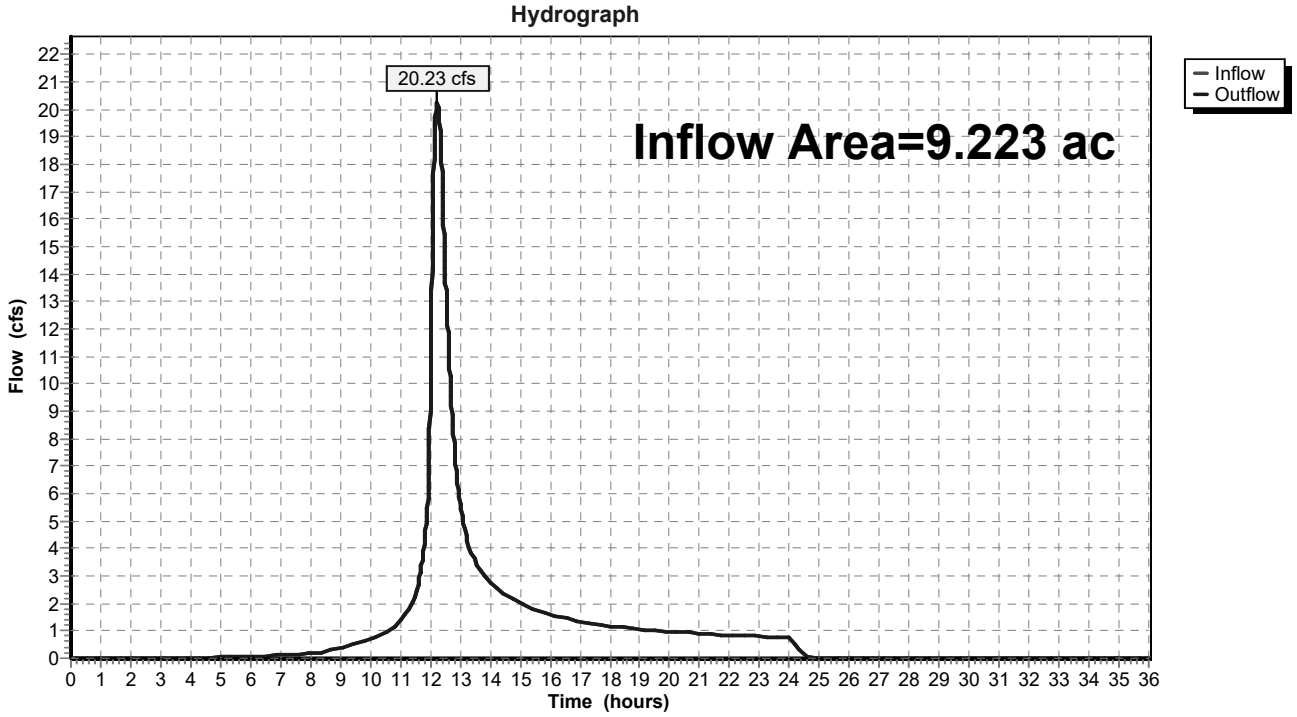


Summary for Reach DP-1: Existing 15" Culvert

Inflow Area = 9.223 ac, 25.83% Impervious, Inflow Depth = 3.73" for 100-yr event
Inflow = 20.23 cfs @ 12.25 hrs, Volume= 2.866 af
Outflow = 20.23 cfs @ 12.25 hrs, Volume= 2.866 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-1: Existing 15" Culvert



Summary for Pond SSDS-1: SSDS-1

Inflow Area = 1.150 ac, 74.13% Impervious, Inflow Depth = 6.43" for 100-yr event
Inflow = 9.86 cfs @ 12.03 hrs, Volume= 0.617 af
Outflow = 1.20 cfs @ 12.55 hrs, Volume= 0.617 af, Atten= 88%, Lag= 31.7 min
Discarded = 0.21 cfs @ 8.91 hrs, Volume= 0.501 af
Primary = 0.99 cfs @ 12.55 hrs, Volume= 0.116 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 292.11' @ 12.55 hrs Surf.Area= 3,411 sf Storage= 10,612 cf

Plug-Flow detention time= 351.3 min calculated for 0.617 af (100% of inflow)
Center-of-Mass det. time= 351.2 min (1,142.1 - 790.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	287.58'	2,444 cf	**41.60'W x 82.00'L x 5.00'H Field A** 17,056 cf Overall - 10,947 cf Embedded = 6,109 cf x 40.0% Voids
#2A	288.58'	8,421 cf	**Concrete Galley 4x8x4** x 90 Inside #1 Inside= 42.0"W x 43.0"H => 12.47 sf x 7.50'L = 93.6 cf Outside= 52.8"W x 48.0"H => 15.20 sf x 8.00'L = 121.6 cf 90 Chambers in 9 Rows
		10,864 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	291.58'	**12.0" Round Culvert** L= 21.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 291.58' / 291.30' S= 0.0133 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	287.58'	**2.700 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.21 cfs @ 8.91 hrs HW=287.63' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.21 cfs)

Primary OutFlow Max=0.99 cfs @ 12.55 hrs HW=292.11' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.99 cfs @ 3.39 fps)

Pond SSDS-1: SSDS-1 - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x8x4 (Concrete Galley, UCPI 4x8x4 Galley or equivalent)
Inside= 42.0"W x 43.0"H => 12.47 sf x 7.50'L = 93.6 cf
Outside= 52.8"W x 48.0"H => 15.20 sf x 8.00'L = 121.6 cf

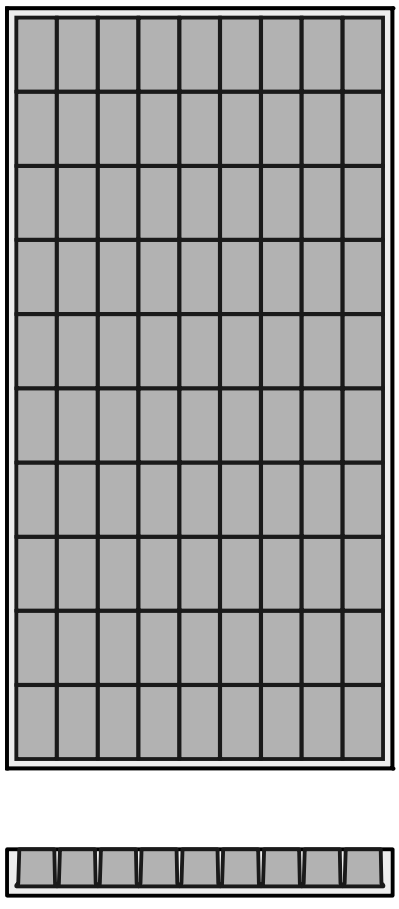
10 Chambers/Row x 8.00' Long = 80.00' Row Length +12.0" End Stone x 2 = 82.00' Base Length
9 Rows x 52.8" Wide + 12.0" Side Stone x 2 = 41.60' Base Width
12.0" Base + 48.0" Chamber Height = 5.00' Field Height

90 Chambers x 93.6 cf = 8,420.6 cf Chamber Storage
90 Chambers x 121.6 cf = 10,947.2 cf Displacement

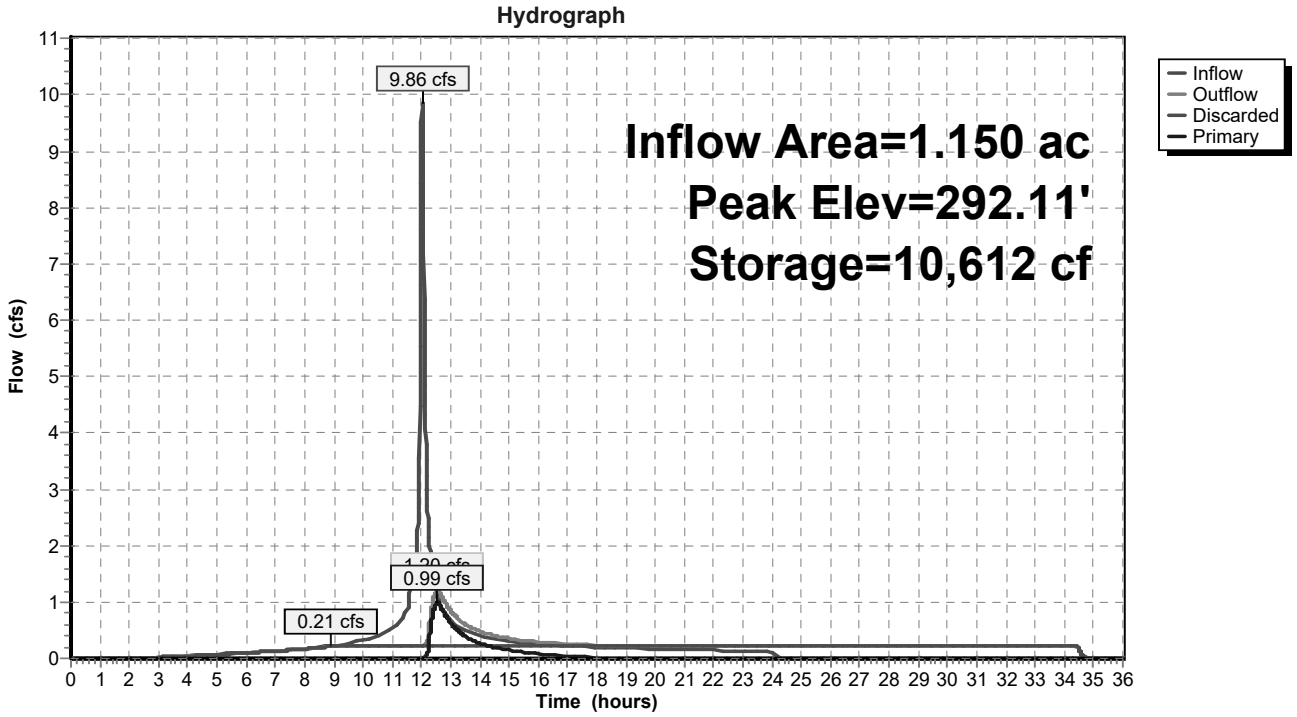
17,056.0 cf Field - 10,947.2 cf Chambers = 6,108.8 cf Stone x 40.0% Voids = 2,443.5 cf Stone Storage

Chamber Storage + Stone Storage = 10,864.1 cf = 0.249 af
Overall Storage Efficiency = 63.7%
Overall System Size = 82.00' x 41.60' x 5.00'

90 Chambers
631.7 cy Field
226.3 cy Stone



Pond SSDS-1: SSDS-1



APPENDIX D

WATER QUALITY CALCULATIONS

CTDEEP Water Quality Volume Calculations
Groundwater Recharge Calculations
CTDEEP Water Quality Flow Calculation
Treatment Train Efficiency Worksheet

Water Quality Calculations

Determine Water Quality Volume

From CT 2004 Stormwater Quality Manual:

$$WQV = \frac{(1")(R)(A)}{12}$$

$$R = 0.05 + 0.009(I)$$

WQV = water quality volume (ac-ft)
R = volumetric runoff coefficient
I = percent impervious cover
A = site area in acres
WQv = Calculated Water Quality Volume

Area		Total Area		Impervious Area		Impervious Cover	Volumetric Runoff Coefficient	Water Quality Volume (WQV)		Proposed Water Quality Volume (WQV)	
ID		ac	ft^2	ac	ft^2	%	R	acre-feet	ft^3	acre-feet	ft^3
Area to SSDS-1	PDA 102	1.150	50,110	0.853	37,145	74.17	0.718	0.069	3,006	0.212	9,233

*The Proposed Water Quality Volume (WQV) is calculated at the available storage depth below the lowest orifice

Water Quality Calculations- CT General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities

Determine Water Quality Volume

From CT 2004 Stormwater Quality Manual:

$$WQV = \frac{(1")(R)(A)}{12}$$

$$R = 0.05 + 0.009(I)$$

WQV = water quality volume (ac-ft)
R = volumetric runoff coefficient
I = percent impervious cover
A = site area in acres
WQv = Calculated Water Quality Volume

Area		Total Area		Impervious Area		Impervious Cover	Volumetric Runoff Coefficient	Water Quality Volume (WQV)		Proposed Water Quality Volume (WQV)	
ID		ac	ft^2	ac	ft^2	%	R	acre-feet	ft^3	acre-feet	ft^3
Entire Site		1.240	54,034	0.781	34,006	62.98	0.617	0.064	2,788	0.212	9,233

*The Proposed Water Quality Volume (WQV) is calculated at the available ponding depth below the lowest orifice

Groundwater Recharge Volume Calculations

Groundwater Recharge Volume

From CT 2004 Stormwater Quality Manual:

$$GVR = \frac{(D)(A)(I)}{12}$$

GRV Groundwater Recharge Volume (ac-ft)
D = Depth of Runoff to be Recharged (table 7-4)
A = site area in acres
I = impervious cover (decimal)
Qv = Calculated Water Quality Volume

a 1.37 4366

	A											I			
	Total Site Area (AC)	Site Area by NRCS Hydrologic Soil Group				Impervious Cover by NRCS Hydrologic Soil Group				Site Imperviousness (Decimel) by NRCS Hydrologic Soil Group				GRV Required (ac-ft)	Potential Recharge Pond Volumes Proposed (ac-ft)
		A	B	C	D	A	B	C	D	A	B	C	D		
	1.24	0.62	0.58	0.04	0.00	0.43	0.35	0.00	0.00	0.35	0.28	0.00	0.00	0.011	0.212

Table 7-4
Groundwater Recharge Depth

NRCS Hydrologic Soil Group	Average Annual Recharge	Groundwater Recharge Depth (D)
A	18 inches/year	0.4 inches
B	12 inches/year	0.25 inches
C	6 inches/year	0.10 inches
D	3 inches/year	0 inches (waived)

Source: MADEP, 1997.
NRCS – Natural Resources Conservation Service

Water Quality Calculations

Determine Water Quality Flow

From CT 2004 Stormwater Quality Manual:

$$CN = \frac{1000}{\left[10 + 5P + 10Q - 10\left(Q^2 + 1.25QP\right)^{\frac{1}{2}}\right]}$$

$$Q = \frac{[WQV\,(acre-feet) \times [12(inches/foot)]]}{DrainageArea(acres)}$$

$$WQF = (q_u)(A)(Q)$$

CN = Runoff Curve Number
P = design preciptation, inches, (1" for water quality storm)
Q = runoff depth (in watershed inches)
T_c = time of concentration
I_a = Initial abstraction, inches, from Table 4-1, Chapter 4, TR-55
q_u = unit peak discharge,
WQF = water quality flow (cfs)

Structure	Area	Total Area			Imp Area		Imp Cover	R	WQV	Q	P	CN	T_c		I_a	I_a/P	q_u *	WQF
ID	ID	ft^2	ac	mi^2	ft^2	ac	%	-	acre-feet	in	in	-	mins	hours	in	-	$cfs/mi^2/in$	cfs
CB(HDS)-2	PDA-102	46,065	1.058	0.0017	32,748	0.752	71.08	0.690	0.061	0.69	1.00	97	5.0	0.08	0.062	0.062	660	0.75
CB(HDS)-3	PDA-102	4,388	0.101	0.0002	4,388	0.101	100.00	0.950	0.008	0.95	1.00	100	5.0	0.08	0.041	0.041	660	0.1

* From Exhibit 4-III: Unit peak discharge (q_u) for SCS type III rainfall distribution, Urban Hydrology for Small Watersheds (TR-55), USDS< SCS, June 1986.

TABLE 2 - PERFORMANCE MATRIX FOR CTDOT QUALIFIED HYDRODYNAMIC SEPARATORS

Max WQF (cfs)	Product Model									
	Barracuda	***Cascade***	***CDS***	***Concentrator***	***Downstream Defender***	***DVS***	***First Defense***	***HydroStorm***	***SciClone***	***Xcelerator***
0.1	Barracuda S3(3)	CS-3(3)	CDS-3(3)	AS-2(2.5)	4ft(4)	DVS-36(3)	3ft(3)	HS3(3)	SC-3(3)	XC-2(2.5)
0.2	Barracuda S3(3)	CS-3(3)	CDS-3(3)	AS-2(2.5)	4ft(4)	DVS-36(3)	3ft(3)	HS3(3)	SC-3(3)	XC-2(2.5)
0.3	Barracuda S3(3)	CS-3(3)	CDS-3(3)	AS-2(2.5)	4ft(4)	DVS-36(3)	3ft(3)	HS3(3)	SC-3(3)	XC-2(2.5)
0.4	Barracuda S3(3)	CS-3(3)	CDS-3(3)	AS-3(3.5)	4ft(4)	DVS-36(3)	3ft(3)	HS3(3)	SC-4(4)	XC-2(2.5)
0.5	Barracuda S3(3)	CS-3(3)	CDS-3(3)	AS-3(3.5)	4ft(4)	DVS-36(3)	3ft(3)	HS3(3)	SC-4(4)	XC-2(2.5)
0.6	Barracuda S3(3)	CS-3(3)	CDS-4(4)	AS-3(3.5)	4ft(4)	DVS-48(4)	3ft(3)	HS4(4)	SC-4(4)	XC-3(3.5)
0.7	Barracuda S3(3)	CS-3(3)	CDS-4(4)	AS-3(3.5)	4ft(4)	DVS-48(4)	3ft(3)	HS4(4)	SC-4(4)	XC-3(3.5)
0.8	Barracuda S4(4)	CS-3(3)	CDS-4(4)	AS-4(4.5)	4ft(4)	DVS-48(4)	3ft(3)	HS4(4)	SC-5(5)	XC-3(3.5)
0.9	Barracuda S4(4)	CS-3(3)	CDS-4(4)	AS-4(4.5)	4ft(4)	DVS-48(4)	4ft(4)	HS5(5)	SC-5(5)	XC-3(3.5)
1.0	Barracuda S4(4)	CS-3(3)	CDS-5(5)	AS-4(4.5)	4ft(4)	DVS-48(4)	4ft(4)	HS5(5)	SC-5(5)	XC-3(3.5)
1.1	Barracuda S4(4)	CS-4(4)	CDS-5(5)	AS-4(4.5)	4ft(4)	DVS-60(5)	4ft(4)	HS5(5)	SC-6(6)	XC-3(3.5)
1.2	Barracuda S4(4)	CS-4(4)	CDS-5(5)	AS-5(5)	6ft(6)	DVS-60(5)	4ft(4)	HS5(5)	SC-6(6)	XC-4(4.5)
1.3	Barracuda S5(5)	CS-4(4)	CDS-5(5)	AS-5(5)	6ft(6)	DVS-60(5)	4ft(4)	HS5(5)	SC-6(6)	XC-4(4.5)
1.4	Barracuda S5(5)	CS-4(4)	CDS-5(5)	AS-5(5)	6ft(6)	DVS-60(5)	4ft(4)	HS6(6)	SC-6(6)	XC-4(4.5)
1.5	Barracuda S5(5)	CS-4(4)	CDS-5(5)	AS-6(6)	6ft(6)	DVS-60(5)	4ft(4)	HS6(6)	SC-6(6)	XC-4(4.5)
1.6	Barracuda S5(5)	CS-4(4)	CDS-6(6)	AS-6(6)	6ft(6)	DVS-72(6)	5ft(5)	HS6(6)	SC-7(7)	XC-4(4.5)
1.7	Barracuda S5(5)	CS-4(4)	CDS-6(6)	AS-6(6)	6ft(6)	DVS-72(6)	5ft(5)	HS6(6)	SC-7(7)	XC-4(4.5)
1.8	Barracuda S5(5)	CS-4(4)	CDS-6(6)	AS-6(6)	6ft(6)	DVS-72(6)	5ft(5)	HS6(6)	SC-7(7)	XC-4(4.5)

Best Management Practice (BMP) Treatment Train Efficiency Worksheet

Prepared for:
Proposed Retail Development
580 Lake Road
Andover, Connecticut

Prepared by:
BL Companies
100 Constitution Plaza, 10th Floor
Hartford Connecticut

Date prepared:
November 16, 2021

Overall Site Treatment Train Efficiency

Et=[1-(1-E1)(1-E2)(1-E3)(1-E4)(1-E?)]*100

BMP	BMP Description	Type pf Treatment	Efficiency Rate %
E1	Impervious Surface Sweeping***	Secondary (conventional)	10
E2	Deep Sump and Hooded Catch Basins***	Secondary (conventional)	25
E3	Hydrodynamic Separator**	Secondary	80

Overall Treatment Train Efficiency (Et)= **87 % Total Suspended Solids (TSS) Remova**

* 80% require per CT DEP
** Manufacturers claim 80% TSS removal
*** Schueler 1996 & EPA 1993
**** New Jersey Stormwater Best Management Practices Manua

BMP	*Type pf Treatment*	*TSS Removal Rate*	*Starting TSS Load*	*Amount Removed*	*Remaining Load*
Impervious Surface Sweeping***	Secondary (conventional)	0.10	1.00	0.10	0.90
Deep Sump and Hooded Catch Basins***	Secondary (conventional)	0.25	0.90	0.23	0.68
Hydrodynamic Separator**	Secondary	0.8	0.68	0.54	0.14
Overall Treatment Train Efficiency (%					**87**

TSS Removal Rates (adapted from Schueler, 1996, & EPA, 1993)

BMP List	Design Rate	Range of Average TSS Removal Rates	Brief Design Requirements
Extended Detention Pond	70%	60-80%	Sediment forebay
Wet Pond (a)	70%	60-80%	Sediment forebay
Constructed Wetland (b)	80%	65-80%	Designed to infiltrate or retain
Water Quality Swale	70%	60-80%	Designed to infiltrate or retain
Infiltration Trench	80%	75-80%	Pretreatment critical
Infiltration Basin	80%	75-80% (predicted)	Pretreatment critical
Dry Well	80%	80% (predicted)	Rooftop runoff
			(uncontaminated only)
Sand Filter (c)	80%	80%	Pretreatment
Organic Filter (d)	80%	80%+	Pretreatment
Water Quality Inlet	25%	15-35% w/ cleanout	Off-line only; 0.1" minimum Water Quality Volume (WQV) storage
Sediment Trap (Forebay)	25%	25% w/ cleanout	Storm flows for 2-year event must not cause erosion; 0.1" minimum WQV storage
Drainage Channel	25%	25%	Check dams; non-erosive for 2-yr.
Deep Sump and Hooded Catch Basin	25%	25% w/ cleanout	Deep sump general rule = 4 x pipe diameter or 4.0' for pipes 18" or less
Street Sweeping	10%	10%	Discretionary non-structural credit, must be part of approved plan

APPENDIX E

SUBSURFACE SOIL INVESTIGATION LOGS

Test Pit Logs

Falling Head Permeability Test Logs

TP-1
BL Project #2101726
October 13, 2021

580 Lake Road, Andover, CT

TEST PIT FIELD LOG

PERSONNEL PRESENT	EXCAVATION EQUIPMENT					
Sarah LeClerc - BL Companies	Contractor	Suhoski			Ground Surface Elevation	292.10
	Operator				Datum	NAVD 88
	Make		Model	CAT	Temperature	55-70
	Bucket Capacity		Reach		Weather	Foggy/Partly Cloudy

Depth	SOIL DESCRIPTION	Excav. Effort	Cobble and Boulder Data	Remark No.
0"-17"	Topsoil	E		
17"-30"	Orange/Brown Fine Sandy Loam	E		
30"-59"	Brown Sand and Medium/Course Gravel and Cobbles	E	and cobbles	
59"-129"	Brown Medium Sand, Stratified	E	trace cobbles	2
	Bottom of Test Pit at 129"			

REMARKS:

1. Mottling was not observed.
2. Ground water was obseved at 104"
3. Bedrock was not observed.

TEST PIT PLAN

North

LEGEND

COBBLES AND BOULDERS

Size Range Classification	Letter Designation
3" - 12"	Cobble (C)
12" - 24	Small (S)
24" - 36"	Medium (M)
36" and Larger	Large (L)

PROPORTIONS USED (QUANTITATIVE TERMS)

TRACE (TR)	0-10%
LITTLE (LI)	10-20%
SOME (SO)	20-35%
AND	35-50%

QUALITATIVE TERMS

OCCASIONAL
FEW
FREQUENT
NUMEROUS

EXCAVATION EFFORT

E - Easy
M - Moderate
D - Difficult

▼ Observed Depth to Groundwater

355 Research Parkway Meriden, CT 06450 Tel.(203) 630-1406 Fax (203) 630-2615
Architecture § Engineering § Planning § Landscape Architecture § Land Surveying § Environmental Sciences

TP-2
BL Project #2101726
October 13, 2021

580 Lake Road, Andover, CT

TEST PIT FIELD LOG

PERSONNEL PRESENT	EXCAVATION EQUIPMENT					
Sarah LeClerc - BL Companies	Contractor	Suhoski			Ground Surface Elevation	292.50
	Operator				Datum	NAVD 88
	Make		Model	CAT	Temperature	55-70
	Bucket Capacity		Reach		Weather	Foggy/Partly Cloudy

Depth	SOIL DESCRIPTION	Excav. Effort	Cobble and Boulder Data	Remark No.
0"-16"	Topsoil	E		
16"-33"	Orange/Brown Fine Sandy Loam	E		
33"-66"	Brown Sand and Medium/Course Gravel and Cobbles	E	and cobbles	
66"-156"	Brown Medium Sand, Stratified	E	trace cobbles	2
	Bottom of Test Pit at 156"			

REMARKS:

1. Mottling was not observed.
2. Ground water was obseved at 109"
3. Bedrock was not observed.

TEST PIT PLAN

North

LEGEND

COBBLES AND BOULDERS

Size Range Classification	Letter Designation
3" - 12"	Cobble (C)
12" - 24	Small (S)
24" - 36"	Medium (M)
36" and Larger	Large (L)

PROPORTIONS USED (QUANTITATIVE TERMS)

TRACE (TR)	0-10%
LITTLE (LI)	10-20%
SOME (SO)	20-35%
AND	35-50%

QUALITATIVE TERMS

OCCASIONAL
FEW
FREQUENT
NUMEROUS

EXCAVATION EFFORT

E - Easy
M - Moderate
D - Difficult

▼ Observed Depth to Groundwater

355 Research Parkway Meriden, CT 06450 Tel.(203) 630-1406 Fax (203) 630-2615
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TP-3
BL Project #2101726
October 13, 2021

580 Lake Road, Andover, CT

TEST PIT FIELD LOG

PERSONNEL PRESENT	EXCAVATION EQUIPMENT				
Sarah LeClerc - BL Companies	Contractor	Suhoski		Ground Surface Elevation	294.50
	Operator			Datum	NAVD 88
	Make		Model CAT	Temperature	55-70
	Bucket Capacity		Reach	Weather	Foggy/Partly Cloudy

Depth	SOIL DESCRIPTION	Excav. Effort	Cobble and Boulder Data	Remark No.
0"-12"	Topsoil	E		
12"-26"	Orange/Brown Fine Sandy Loam	E		
26"-74"	Brown Sand and Cobbles and Small Boulders	E	d cobbles/boulders	
74"-153"	Brown Medium Sand, Stratified	E	trace cobbles	2
	Bottom of Test Pit at 153"			

REMARKS:

1. Mottling was not observed.
2. Ground water was obseved at 121"
3. Bedrock was not observed.

TEST PIT PLAN

North

LEGEND

COBBLES AND BOULDERS

Size Range Classification	Letter Designation
3" - 12"	Cobble (C)
12" - 24	Small (S)
24" - 36"	Medium (M)
36" and Larger	Large (L)

PROPORTIONS USED (QUANTITATIVE TERMS)

TRACE (TR)	0-10%
LITTLE (LI)	10-20%
SOME (SO)	20-35%
AND	35-50%

QUALITATIVE TERMS

OCCASIONAL
FEW
FREQUENT
NUMEROUS

EXCAVATION EFFORT

E - Easy
M - Moderate
D - Difficult

▼ Observed Depth to Groundwater

355 Research Parkway Meriden, CT 06450 Tel.(203) 630-1406 Fax (203) 630-2615
Architecture § Engineering § Planning § Landscape Architecture § Land Surveying § Environmental Sciences

TP-4
BL Project #2101726
October 13, 2021

580 Lake Road, Andover, CT

TEST PIT FIELD LOG

PERSONNEL PRESENT	EXCAVATION EQUIPMENT					
Sarah LeClerc - BL Companies	Contractor	Suhoski			Ground Surface Elevation	296.20
	Operator				Datum	NAVD 88
	Make		Model	CAT	Temperature	55-70
	Bucket Capacity		Reach		Weather	Foggy/Partly Cloudy

Depth	SOIL DESCRIPTION	Excav. Effort	Cobble and Boulder Data	Remark No.
0"-13"	Topsoil	E		
13"-28"	Orange/Brown Fine Sandy Loam	E		
28"-80"	Brown Sand and Medium/Course Gravel and Cobbles	E	d cobbles/boulders	
80"-101"	Orange/Brown Fine Sandy Loam	E	trace cobbles	2
101"-153"	Brown Medium Sand, Stratified	E	trace cobbles	2
	Bottom of Test Pit at 153"			

REMARKS:

1. Mottling was not observed.
2. Ground water was obseved at 127"
3. Bedrock was not observed.
4. Soil sample was taken at 43".

TEST PIT PLAN

North

LEGEND

COBBLES AND BOULDERS

Size Range Classification	Letter Designation
3" - 12"	Cobble (C)
12" - 24	Small (S)
24" - 36"	Medium (M)
36" and Larger	Large (L)

PROPORTIONS USED (QUANTITATIVE TERMS)

TRACE (TR)	0-10%
LITTLE (LI)	10-20%
SOME (SO)	20-35%
AND	35-50%

QUALITATIVE TERMS

OCCASIONAL
FEW
FREQUENT
NUMEROUS

EXCAVATION EFFORT

E - Easy
M - Moderate
D - Difficult

▼ Observed Depth to Groundwater

355 Research Parkway Meriden, CT 06450 Tel.(203) 630-1406 Fax (203) 630-2615
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TP-5
BL Project #2101726
October 13, 2021

580 Lake Road, Andover, CT

TEST PIT FIELD LOG

PERSONNEL PRESENT	EXCAVATION EQUIPMENT				
Sarah LeClerc - BL Companies	Contractor	Suhoski		Ground Surface Elevation	293.95
	Operator			Datum	NAVD 88
	Make		Model CAT	Temperature	55-70
	Bucket Capacity		Reach	Weather	Foggy/Partly Cloudy

Depth	SOIL DESCRIPTION	Excav. Effort	Cobble and Boulder Data	Remark No.
0"-20"	Topsoil	E		
20"-41"	Orange/Brown Fine Sandy Loam	E		
41"-76"	Brown Sand and Medium/Course Gravel and Cobbles	E	and cobbles	
76"-130"	Red/Brown Fine Sandy Loam	E	trace cobbles	2
	Bottom of Test Pit at 130"			

REMARKS:

1. Mottling was not observed.
2. Ground water was obseved at 120"
3. Bedrock was not observed.
4. Soil sample was taken at 60".

TEST PIT PLAN

North

LEGEND

COBBLES AND BOULDERS

Size Range Classification	Letter Designation
3" - 12"	Cobble (C)
12" - 24	Small (S)
24" - 36"	Medium (M)
36" and Larger	Large (L)

PROPORTIONS USED (QUANTITATIVE TERMS)

TRACE (TR)	0-10%
LITTLE (LI)	10-20%
SOME (SO)	20-35%
AND	35-50%

QUALITATIVE TERMS

OCCASIONAL
FEW
FREQUENT
NUMEROUS

EXCAVATION EFFORT

E - Easy
M - Moderate
D - Difficult

▼ Observed Depth to Groundwater

355 Research Parkway Meriden, CT 06450 Tel.(203) 630-1406 Fax (203) 630-2615
Architecture § Engineering § Planning § Landscape Architecture § Land Surveying § Environmental Sciences

TP-6
BL Project #2101726
October 13, 2021

580 Lake Road, Andover, CT

TEST PIT FIELD LOG

PERSONNEL PRESENT	EXCAVATION EQUIPMENT					
Sarah LeClerc - BL Companies	Contractor	Suhoski			Ground Surface Elevation	293.30
	Operator				Datum	NAVD 88
	Make		Model	CAT	Temperature	55-70
	Bucket Capacity		Reach		Weather	Foggy/Partly Cloudy

Depth	SOIL DESCRIPTION	Excav. Effort	Cobble and Boulder Data	Remark No.
0"-20"	Topsoil	E		
20"-31"	Orange/Brown Fine Sandy Loam	E		
31"-83"	Brown Sand and Medium/Course Gravel and Cobbles	E	and cobbles	
83"-110"	Red/Brown Fine Sandy Loam	E	trace cobbles	2
	Bottom of Test Pit at 110"			

REMARKS:

1. Mottling was not observed.
2. Ground water was obseved at 101"
3. Bedrock was not observed.
4. Soil sample was taken at 53".

TEST PIT PLAN

North

LEGEND

COBBLES AND BOULDERS

Size Range Classification	Letter Designation
3" - 12"	Cobble (C)
12" - 24	Small (S)
24" - 36"	Medium (M)
36" and Larger	Large (L)

PROPORTIONS USED (QUANTITATIVE TERMS)

TRACE (TR)	0-10%
LITTLE (LI)	10-20%
SOME (SO)	20-35%
AND	35-50%

QUALITATIVE TERMS

OCCASIONAL
FEW
FREQUENT
NUMEROUS

EXCAVATION EFFORT

E - Easy
M - Moderate
D - Difficult

▼ Observed Depth to Groundwater

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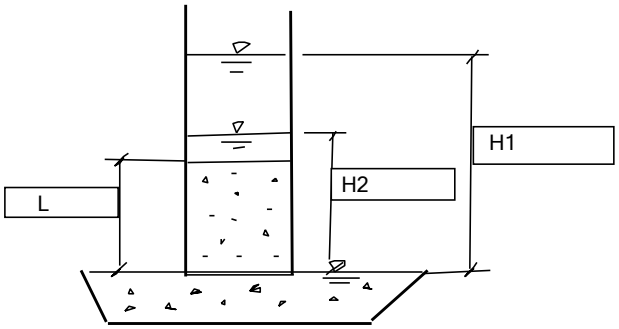
FALLING HEAD
PERMEABILITY TEST

PROJECT: Proposed Development **PROJECT #2101726** **BY:** SEL
DATE: 1 10/13/2021

TEST PIT # **4**

SAMPLE TP-4 **SAMPLE LENGTH:** **5.75** **in.**
SAMPLE DEPTH: **43** **in**

presoak start: 1:34pm
presoak finish: 2:04pm



$$K = \frac{(H1 - H2) \times L}{t \times (H1 + H2)/2}$$

Time (min.)	H1 (in.)	H2 (in.)	H1 - H2 (in)	H1 + H2/2 (in)	K (in/min.)	K (ft./day)
0.000	8.750					
2.000	8.750	8.630	0.120	8.690	0.040	4.764
4.000	8.750	8.270	0.480	8.510	0.081	9.730
6.000	8.750	8.030	0.720	8.390	0.082	9.869
8.000	8.750	7.730	1.020	8.240	0.089	10.677
10.000	8.750	7.550	1.200	8.150	0.085	10.160
					Average=	**9.040** ft/day
					or	4.52 in/hr

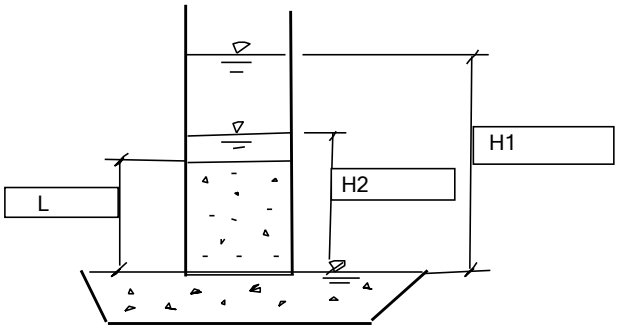
FALLING HEAD
PERMEABILITY TEST

PROJECT: Proposed Development **PROJECT #2101726** **BY:** SEL
DATE: 1 10/13/2021

TEST PIT # **5**

SAMPLE TP-5 **SAMPLE LENGTH:** **5.75** **in.**
SAMPLE DEPTH: **60** **in**

presoak start: 1:34pm
presoak finish: 2:04pm



$$K = \frac{(H1 - H2) \times L}{t \times (H1 + H2)/2}$$

Time (min.)	H1 (in.)	H2 (in.)	H1 - H2 (in)	H1 + H2/2 (in)	K (in/min.)	K (ft./day)
0.000	8.750					
1.000	8.750	8.510	0.240	8.630	0.160	19.189
2.000	8.750	8.150	0.600	8.450	0.204	24.497
3.000	8.750	8.030	0.720	8.390	0.164	19.738
4.000	8.750	7.790	0.960	8.270	0.167	20.024
5.000	8.750	7.550	1.200	8.150	0.169	20.319
6.000	8.750	7.310	1.440	8.030	0.172	20.623
7.000	8.750	7.190	1.560	7.970	0.161	19.294
8.000	8.750	7.070	1.680	7.910	0.153	18.319
9.000	8.750	6.830	1.920	7.790	0.157	18.896
10.000	8.750	6.710	2.040	7.730	0.152	18.210
					Average=	**19.911** ft/day
					or	9.96 in/hr

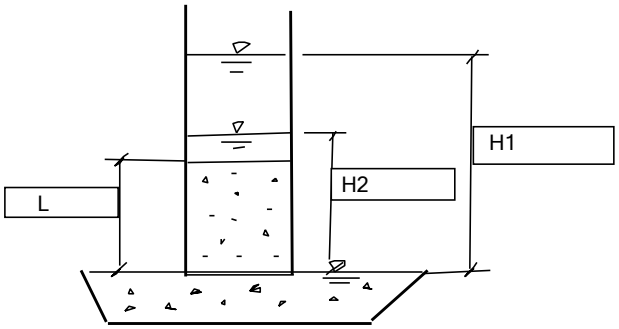
FALLING HEAD
PERMEABILITY TEST

PROJECT: Proposed Development **PROJECT #2101726** **BY:** SEL
DATE: 1 10/13/2021

TEST PIT # **6**

SAMPLE TP-6 **SAMPLE LENGTH:** **5.75** **in.**
SAMPLE DEPTH: **53** **in**

presoak start: 1:34pm
presoak finish: 2:04pm



$$K = \frac{(H1 - H2) \times L}{t \times (H1 + H2)/2}$$

Time (min.)	H1 (in.)	H2 (in.)	H1 - H2 (in)	H1 + H2/2 (in)	K (in/min.)	K (ft./day)
0.000	8.750					
2.000	8.750	8.510	0.240	8.630	0.080	9.594
4.000	8.750	8.270	0.480	8.510	0.081	9.730
6.000	8.750	7.910	0.840	8.330	0.097	11.597
8.000	8.750	7.670	1.080	8.210	0.095	11.346
10.000	8.750	7.370	1.380	8.060	0.098	11.814
					Average=	**10.816** ft/day
					or	5.41 in/hr

APPENDIX F

DRAINAGE MAPS

ED-1 – Existing Drainage Mapping
PD-1 – Proposed Drainage Mapping
GD-1 – Grading and Drainage Plan

EXISTING HYDROLOGY INFORMATION

DRAINAGE AREA	TOTAL AREA (S.F.)	IMPERVIOUS AREA (S.F.)	PERVIOUS AREA (S.F.)	PERCENT IMPERVIOUS (%)	CN	TIME OF CONCETRATIONS (MIN.)
EDA-10	326,300	35,535	290,765	10.9%	64	26.1
EDA-20	75,435	32,455	42,980	43.0%	78	11.8

HYDROLOGY LEGEND

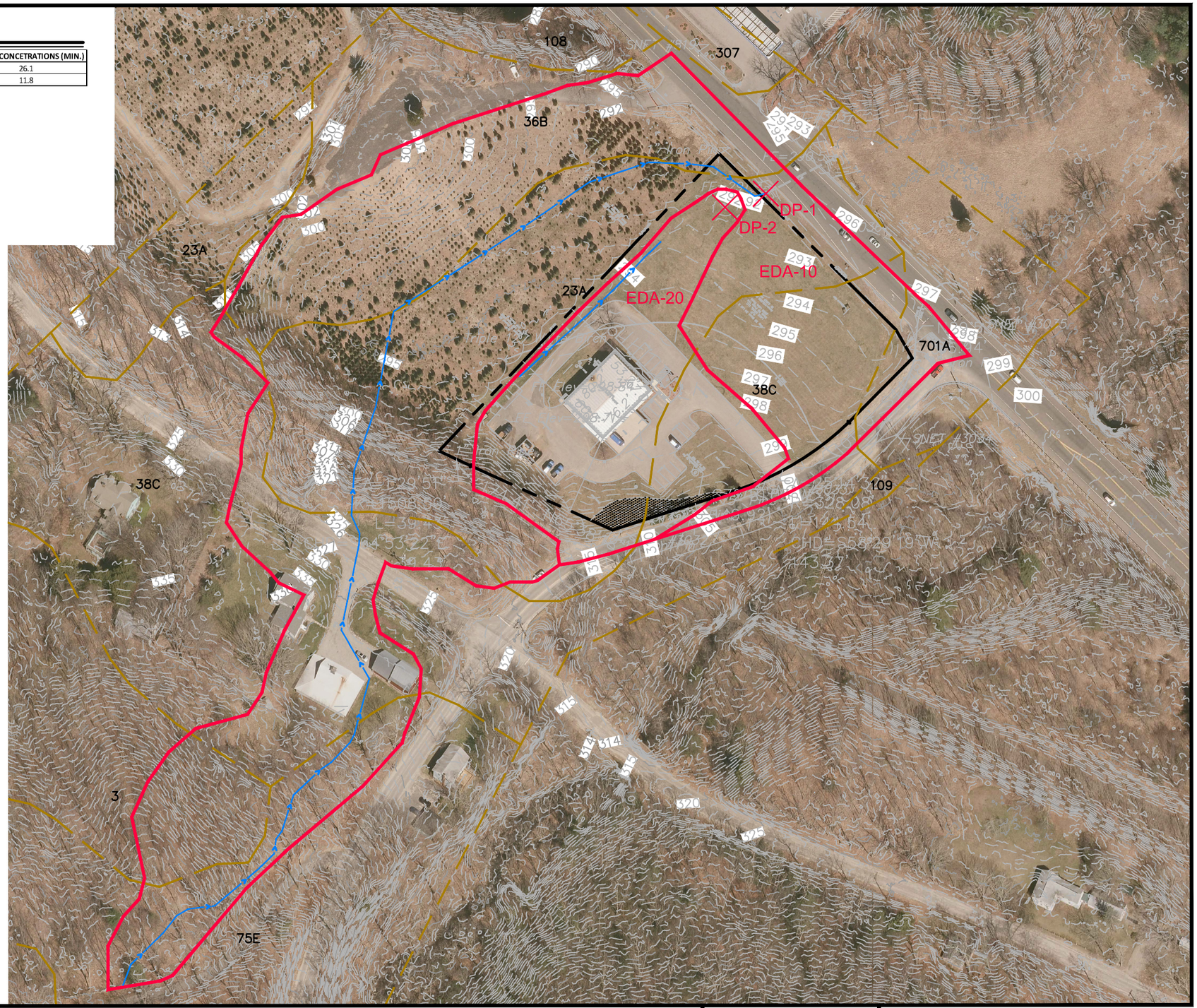
PROPERTY LINE

DRAINAGE AREA BOUNDARY

TIME OF CONCENTRATION FLOW PATH

SOIL TYPE BOUNDARY

306 SOIL TYPE DESIGNATION



GRAPHIC SCALE

120 60 0 120

SCALE IN FEET

BL Companies

ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

100 Constitution Plaza, 10th Floor
Hartford, CT 06103
(860) 249-2200
(860) 249-2400 Fax

EXISTING DRAINAGE MAPPING

PROPOSED RETAIL DEVELOPMENT
580 LAKE ROAD
ANDOVER, CONNECTICUT

Designed	S.E.L.
Drawn	S.E.L.
Reviewed	J.A.B.
Scale	1"=120'
Project No.	2101726
Date	11/16/2021
CAD File	ED210172601

ED-1

PROPOSED HYDROLOGY INFORMATION

DRAINAGE AREA	TOTAL AREA (S.F.)	IMPERVIOUS AREA (S.F.)	PERVIOUS AREA (S.F.)	PERCENT IMPERVIOUS (%)	CN	TIME OF CONCETRATIONS (MIN.)
PDA-101	268,415	24,370	244,045	9.1%	64	25.7
PDA-102	50,110	37,145	12,965	74.1%	88	5.0
PDA-103	9,790	9,790	0	100.0%	98	5.0
PDA-201	73,420	32,460	40,960	44.2%	78	12.9

HYDROLOGY LEGEND

PROPERTY LINE

DRAINAGE AREA BOUNDARY

TIME OF CONCENTRATION FLOW PATH

SOIL TYPE BOUNDARY

306 SOIL TYPE DESIGNATION

GRAPHIC SCALE

120 60 0 120

SCALE IN FEET

BL Companies

ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

100 Constitution Plaza, 10th Floor
Hartford, CT 06103
(860) 249-2200
(860) 249-2400 Fax

PROPOSED DRAINAGE MAPPING

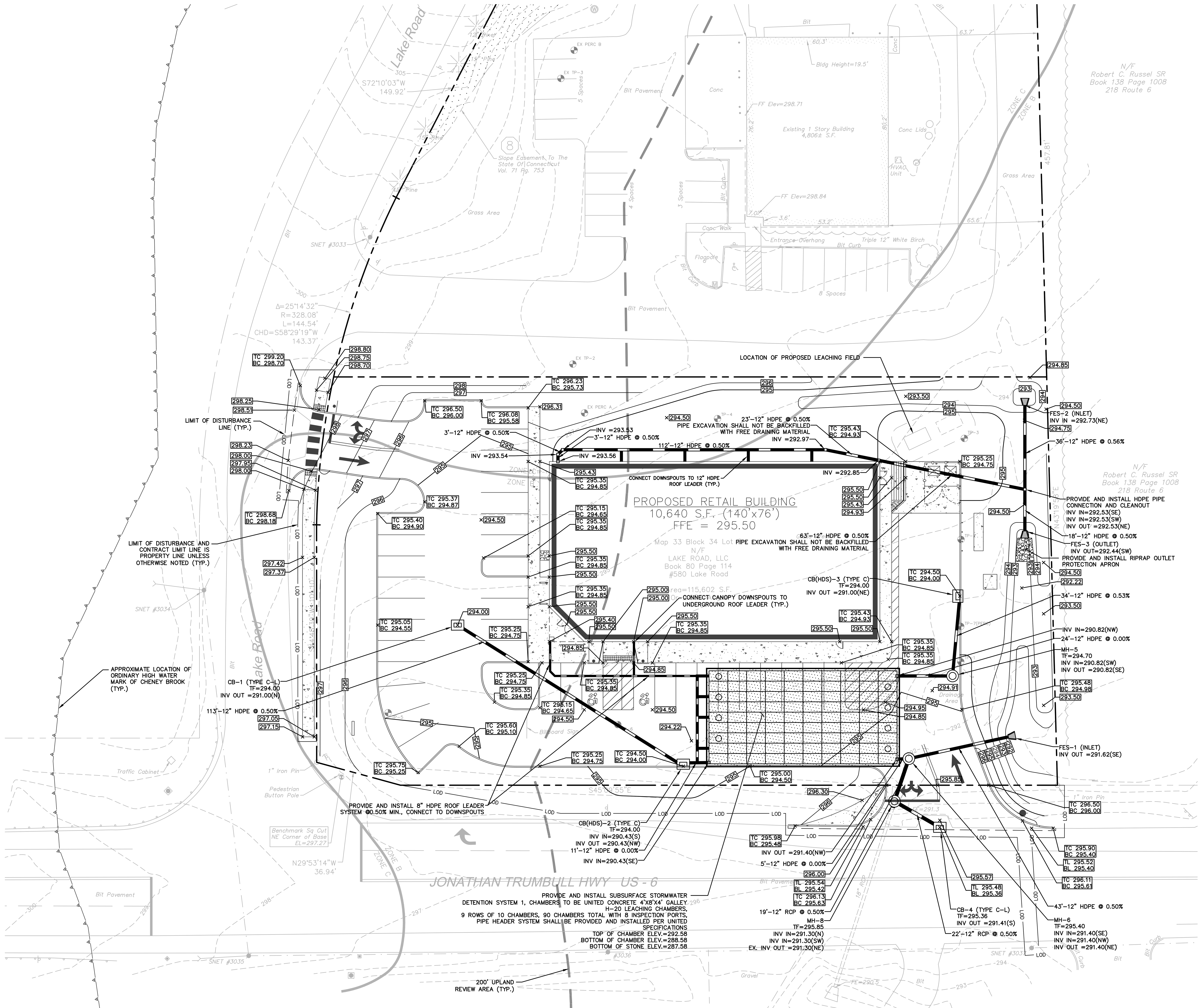
PROPOSED RETAIL DEVELOPMENT
580 LAKE ROAD
ANDOVER, CONNECTICUT

Designed	S.E.L.
Drawn	S.E.L.
Reviewed	J.A.B.
Scale	1"=120'
Project No.	2101726
Date	01/28/2022
CAD File	PD210172601

PD-1

FOR PERMITTING PURPOSES ONLY
NOT RELEASED FOR CONSTRUCTION

REFER TO SHEET GN-1 FOR
SITE WORK GENERAL NOTES



GRADING AND DRAINAGE LEGEND

	PROPERTY LINE
LOD	LIMIT OF DISTURBANCE AND SITEWORK CONTRACK LIMIT LINE
	SAWCUT LINE
	STORM LINE
	MANHOLE
	CATCH BASIN
	YARD DRAIN
100	PROPOSED CONTOUR LINE
×100.00 ×TC 100.50 BC 100.00	PROPOSED SPOT GRADE

SPOT GRADE ABBREVIATIONS

BC	BOTTOM OF CURB
TC	TOP OF CURB
MEX	MEET EXISTING CONDITION

NOTE:
ALL CATCH BASINS SHALL HAVE HOODED OUTLETS AND A MIN. 4' SUMP

GRAPHIC SCALE
20 10 0 20
SCALE IN FEET

BL Companies
Architecture
Engineering
Environmental
Land Surveying
100 Constitution Plaza, 10th Floor
Hartford, CT 06103
(860) 249-2200
(860) 249-2400 Fax

PROPOSED RETAIL DEVELOPMENT
580 LAKE ROAD
ANDOVER, TOLLAND COUNTY, CONNECTICUT

REVISIONS

No.	Date	Desc.
1.	12/10/2021	REVISED PER HEALTH DISTRICT COMMENTS
2.	01/10/2022	REVISED PER HEALTH DISTRICT COMMENTS
3.	01/28/2022	REVISED PER CTDOT COMMENTS

Designed	S.E.L.
Drawn	Z.T.Z.
Reviewed	J.A.B.
Scale	1"=20'
Project No.	2101726
Date	11/18/2021
CAD File:	GD210172601

Title
GRADING AND DRAINAGE PLAN

Sheet No.
GD-1

Xref (s): : BD210172601 : XC210172601 : XY210172601 : XC210172602 : XC210172604

APPENDIX G

STORMWATER SYSTEM
OPERATION AND MAINTENANCE MANUAL

Appendix G:

Stormwater System
Operations and Maintenance Plan

For the Proposed:

Retail Development

Located at:

580 Lake Road
Andover, Connecticut

Prepared for Submission to:
Town of Andover, Connecticut

November 16, 2021

Prepared for:
Garrett Homes, LLC
59 Field Street
Torrington, Connecticut

Prepared by:

Architecture
Engineering
Environmental
Land Surveying
Companies

BL Companies
100 Constitution Plaza, 10th Floor
Hartford, Connecticut 06103
Phone: (860) 249-2200
Fax: (860) 249-2400

BL Project Number: 2101726

Table of Contents

General Overview

This plan has been prepared in support of a Permit Application by Garrett Homes, LLC to the Town of Andover for the proposed retail development at 580 Lake Road. The subject parcel (Lot 2B) had been previously subdivided from the parcel to the southwest (Lot 2A). The lots are labeled on the Aerial Location Map in Appendix A. The property is located on the northwestern corner of the intersection of Lake Road and Jonathan Trumbull Highway (US Route 6) and is bordered by industrial zoned properties on all sides. The subject parcel contains a total area of approximately 54,034 SF (1.24 acres).

Under the current conditions, the subject parcel is a vacant lot with a grass groundcover. The subject parcel and the surrounding areas discharge to a culvert beneath US Route 6. The other contributing drainage areas to the culvert beneath US Route 6 include a commercial building (Benjamin Franklin Plumbing), a tree farm, residential area, and roadways. Land coverage includes impervious pavement, pervious lawn, and wooded areas.

The existing topography on the subject parcel varies from elevation 292 to about elevation 299 and in general slopes south to north. The subject parcel is at a lower elevation than the surrounding roads. A 15" RCP culvert located at the low point within the Route 6 right-of-way conveys the water under Route 6 to daylight on the northeastern side which ultimately flows into Hop River.

The proposed development on the subject parcel (Lot 2B) includes the construction of a +/- 10,640 SF retail building. The development will include parking, landscaping, a stormwater management system, and additional site and utility improvements typical of commercial-retail development.

The following Operations and Maintenance Plan was prepared specifically for this proposed development in the Town of Andover, Connecticut. The Plan was developed to satisfy the requirements of the Connecticut Department of Energy and Environmental Protection's 2002 Connecticut Guidelines for Soil Erosion and Sediment Control.

Purpose & Goals

The purpose of this Manual is to ensure that the stormwater management components are operated in accordance with all approvals and permits. The primary goal is to inform all the property managers about how the system operates and what maintenance items are necessary to protect downstream wetlands and watercourses. The secondary goal is to provide a practical, efficient means of maintenance planning and record keeping to verify permit compliance.

Responsible Parties

The Property Owner will be responsible for implementing the Plan on the property.

Maintenance inspections shall be performed by a qualified professional.

Some utilities located on the site will be owned and maintained by various utility companies in accordance with their standards. The property owner may maintain the service connections.

List of Permits & Special Conditions

The project will receive several permits, which may contain special conditions that require compliance by the property owner and maintenance contractors. This permit may include the following:

- Town of Andover Permits –Inland Wetlands and Watercourses Permit, Site Plan, Building Permit
- State of Connecticut – Encroachment Permit

Maintenance Logs and Checklists

The property owner will keep a record of all maintenance procedures performed, date of inspection/ cleanings, etc. Copies of inspection reports and maintenance records shall be kept on-site. Yearly inspection reports of the stormwater management system shall be submitted to the Town.

Forms

The following forms will be developed for annual maintenance. Copies of the forms will be kept on-site as part of the Storm Water Management Plan.

- Annual Checklist
- Quarterly Checklist
- Monthly Checklist

Employee Training

The property owner will have an employee-training program, with annual up-dates, to ensure that the qualified employees charged with maintaining the buildings and grounds do so in accordance with the approved permit conditions. All employees that have maintenance duties will be adequately informed of their responsibilities.

Spill Control

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and clean-up:

- Manufacturer's recommended methods for spill clean-up will be clearly posted and site personnel will be made aware of the procedures and the location of the information and clean-up supplies.

- Materials and equipment necessary for spill clean-up will be kept in the material storage area on-site. Equipment and materials will include but not be limited to: absorbent booms or mats, brooms, dust pans, mops, rags, gloves, goggles, sand, and plastic and metal trash containers specifically for this purpose.
- All spills will be cleaned immediately after discovery.
- The spill area will be kept well-ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with hazardous substance.
- Spills of toxic or hazardous material, regardless of size, will be reported to the appropriate State or local government agency.
- If a spill occurs, this plan will be adjusted to include measures to prevent this type of spill from reoccurring and how to clean the spill if there is another one. A description of the spill, the cause, and the remediation measures will also be included.

A spill report shall be prepared by the property owner following each occurrence. The spill report shall present a description of the release, including quantity and type of material, date of spill, circumstances leading to the release, location of spill, response actions and personnel, documentation of notifications and corrective measures implemented to prevent reoccurrence.

The property owner shall identify an appropriately qualified and trained site employee involved with day-to-day site operations to be the spill prevention and clean-up coordinator. The name(s) of responsible spill personnel shall be posted on-site. Each employee shall be instructed that all spills are to be reported to the spill prevention and clean-up coordinator.

Storm Water Management

System Components

The storm water management system has several components that are shown on the Grading and Drainage Plan (GD-1), that performs various functions in treating storm water runoff:

Catch Basins and Manholes

The property owner is responsible for cleaning the catch basins and manholes on the property. A Connecticut Licensed hauler shall clean the sumps and dispose of removed sand legally. The road sand may be reused for winter sanding, but may not be stored on-site. As part of the hauling contract, the hauler shall notify the property owner in writing where the material is being disposed.

Each catch basin shall be inspected every four months, with one inspection occurring during the month of April. Any debris occurring within one foot from the bottom of each sump shall be removed by Vacuum "Vactor" type of maintenance equipment.

During the inspection of each of the catch basin sumps, the hoods (where provided) on each of the outlet pipes shall also be observed. In the event that a hood is damaged or off the hanger, it shall be reset or repaired.

Hydrodynamic Separators (or approved equal)

The hydrodynamic separator manholes will be cleaned periodically during construction, and at the end of construction once the landscaped areas are fully stabilized.

For the first year of operation following construction, inspect each manhole once each month for the months of January, February, March and April, and once every four months thereafter. A graduated measuring device (stadia rod) shall be inserted into each grit chamber and measurements of any accumulations shall be recorded. Any debris, which has accumulated to within one foot of the water surface inside the grit chamber portion of each tank, shall be removed by vacuum "Vactor" type of equipment.

After the first year of operation, each manhole shall be inspected at a minimum, three times yearly with one inspection occurring in the month of April in the same manner as described above for the first season of operation. Any accumulations found to be occurring within one foot of the water surface shall be removed from the manhole and properly disposed off-site. Also, any floating material discovered during inspections shall be removed from the tank.

A detailed maintenance logbook shall be kept for each manhole. Information is to include, but not be limited to, the date of inspection, record of grit depth, condition of baffles, observation of any floatable, and date of cleaning performed.

Subsurface Stormwater Detention System

The underground detention system shall be inspected every six months in the months of April and October. Each of the inspection ports provided shall be opened and visually checked from the surface. Observation of grit inside of the detention system shall be noted and any deposits found to be 2 inches or more, as measured from the invert of pipe, shall be cleaned and removed. The subsurface detention system qualifies as a Confined Space under OSHA regulations, and any maintenance involving entry into the pipes should comply with OSHA Confined Space Entry Regulations.

Site Maintenance

Parking Lots

Parking lots and sidewalks shall be swept as necessary by the property owner, or at least once per year, to clean sediment, trash, and other debris. The property owner will sweep parking lots on the property in the spring to remove winter accumulations of road sand.

Landscaping

The management company retained by the property owner will maintain landscaped areas. Normally the landscaping maintenance will consist of pruning, mulching, planting, mowing lawns, raking leaves, etc. Use of fertilizers and pesticides will be controlled and limited to minimal amounts necessary for healthy landscape maintenance.

The lawn areas, once established, will be maintained at a typical height of 3 ½". This will allow the grass to be maintained with minimal impact from weeds and/or pests. The low-

maintenance areas will be maintained as a meadow or allowed to revert back to natural conditions. Topsoil, brush, leaves, clippings, woodchips, mulch, equipment, and other material shall be stored off site.

Outdoor Storage

There will be no outdoor storage of hazardous chemicals, de-icing agents, fertilizer, pesticides, or herbicides anywhere around the building or on site.

Deicing and Snow Removal & Storage

The use of clean sand may be used to aid traction in conjunction with chemicals for deicing, snow melting and other related winter weather management. Sodium chloride should not be used as a deicing agent on the impervious surfaces due to potential effects to groundwater quality. Only calcium chloride or calcium magnesium may be used onsite as deicing chemicals. Snow shall be shoveled and plowed from sidewalk and parking areas as soon as practical during and after winter storms. Sand accumulation shall be removed from the site at the end of the winter season or appropriate time when seasonal snow has melted. Alternative deicing methods must be submitted prior to use onsite for review to the Town of Andover for approval.

MAINTENANCE SCHEDULE

During the First Year of Operation:		
Task:	Completion Date:	Manager's Initials:
JANUARY:		
Employee Training Program with Spill Program		
*Catch Basin and Hydrodynamic Separator Inspection		
FEBRUARY:		
*Hydrodynamic Separator Inspection		
MARCH:		
*Hydrodynamic Separator Inspection		
APRIL:		
*Catch Basin and Hydrodynamic Separator Inspection		
*Subsurface Stormwater Detention		
Sweeping of Paved Surfaces		
Shrub Fertilization		
Lawn Liming (if necessary)		
AUGUST:		
*Catch Basin and Hydrodynamic Separator Inspection		
OCTOBER:		
*Subsurface Stormwater Detention		
Tree and Lawn Fertilization		
Sweeping of Paved Surfaces		
DECEMBER:		
*Catch Basin and Hydrodynamic Separator Inspection		

*NOTE: Use appropriate worksheet found in this plan to conduct the inspection.

After the First Year of Operation:			
FOR YEAR_____			
Task:		Completion Date:	Manager's Initials:
JANUARY:			
Employee Training Program with Spill Program			
APRIL:			
*Catch Basin and Hydrodynamic Separator Inspection			
*Subsurface Stormwater Detention			
Sweeping of Paved Surfaces			
Shrub Fertilization			
Lawn Liming (if necessary)			
AUGUST:			
*Catch Basin and Hydrodynamic Separator Inspection			
OCTOBER:			
*Subsurface Stormwater Detention			
Tree and Lawn Fertilization			
Sweeping of Paved Surfaces			
DECEMBER:			
*Catch Basin and Hydrodynamic Separator Inspection			

*NOTE: Use appropriate worksheet found in this plan to conduct the inspection.

CATCH BASIN / CATCH BASIN INSERT INSPECTION LOG

Name of Inspector:

Date:

Catch Basin ID	Condition (circle one)		Debris above 1’ within sump? (If yes then catch basin is to be cleaned)		Date of Catch Basin/Cleaning (if debris is greater than 1’)		Condition of Hood (if applicable, remove trash/debris if necessary)	Comments:
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							

On-site Procedures for Inspection and Maintenance of Catch Basin Inserts

• Secure traffic and pedestrian traffic with cones, barrels, etc.

• Clean surface area around each catch basin.

• Remove grates and set aside

• Clean grates, remove litter and debris that may be trapped within the grate

• Visually inspect condition of outlet hood and remove trash and debris from hood if necessary.

• Remove by vactor hose the debris that has been trapped in the trough area. Dispose of in accordance with local, state and federal regulatory agency requirements. Most debris that is captured in the trough or sump area will fall into the non-hazardous waste category.

• Visually inspect and check the condition of the trough area.

• Replace grate and lockdown as needed.

• Un-secure traffic control area.

• Complete service report and submit to facility owner.

SUBSURFACE STROWMATER DETENTION SYSTEM INSPECTION LOG

Name of Inspector:

Date:

Basin ID	Overall condition of Inlet Pipe (circle one)			Condition of Facility (circle one)			Debris and Sediment Removed from Basin?[1]		Inlets and Outlets are Clear and Functioning?		Date of Cleaning Performed	Comments
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		
	Excellent	Fair	Poor	Excellent	Fair	Poor	Yes	No	Yes	No		

1 – Sediment deposits shall be removed from the subsurface detention basin when the deposited material reaches a height of 2” measured from the top of the stone bedding.

CONTECH®
ENGINEERED SOLUTIONS

CDS Guide
Operation, Design, Performance and Maintenance

CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

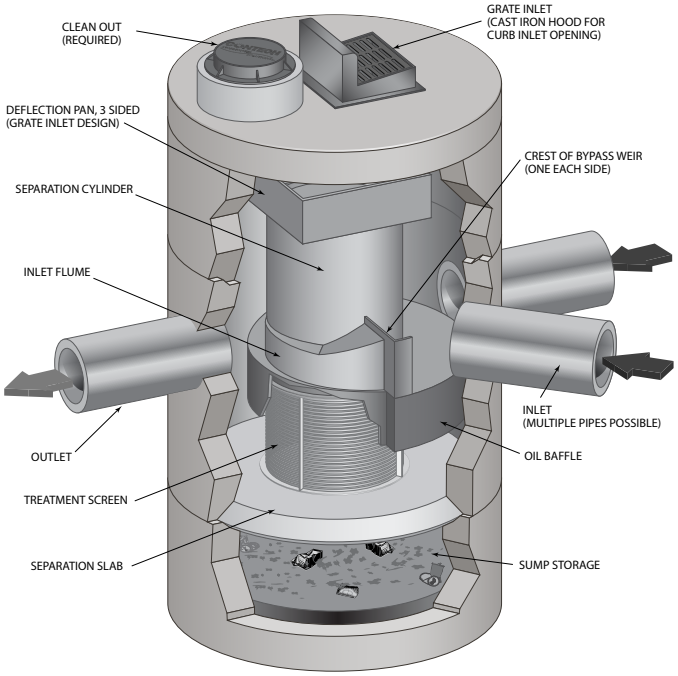
Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the and Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns (μm) or 50 microns (μm).

Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are

determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation (d50 = 20 to 30 μm) covering a wide size range (Coefficient of Uniformity, C averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d50 (d50 for NJDEP is approximately 50 μm) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d50) of 106 microns. The PSDs for the test material are shown in Figure 1.

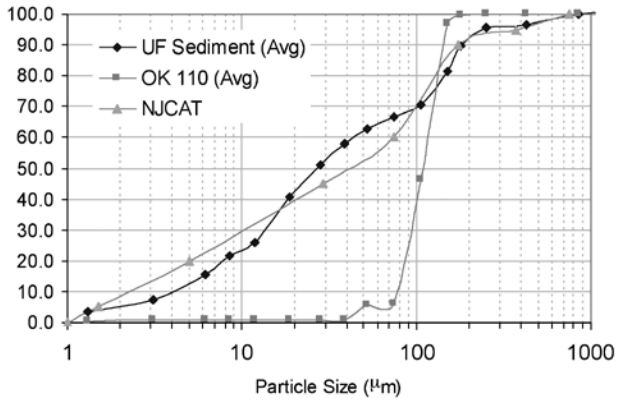


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect

to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

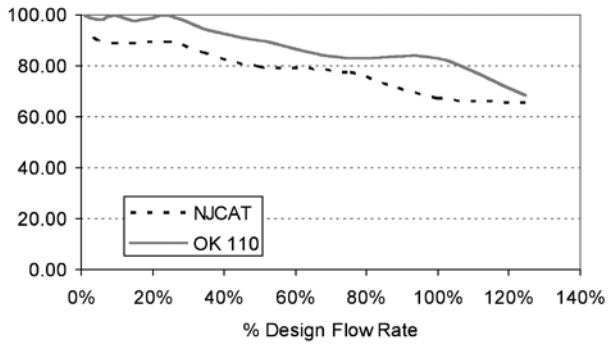


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution (d50 = 125 μm).

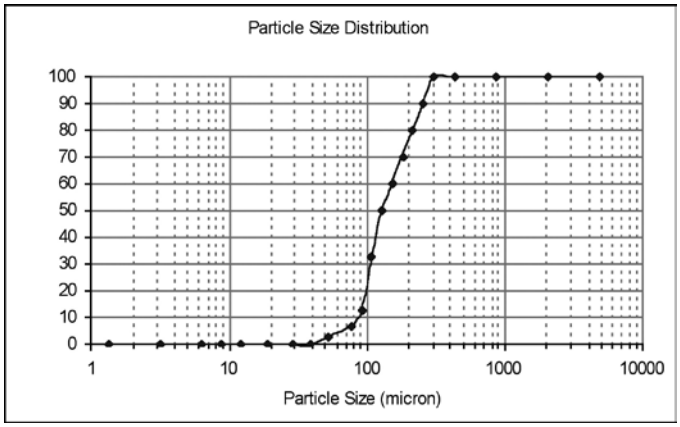


Figure 3. WASDOE PSD

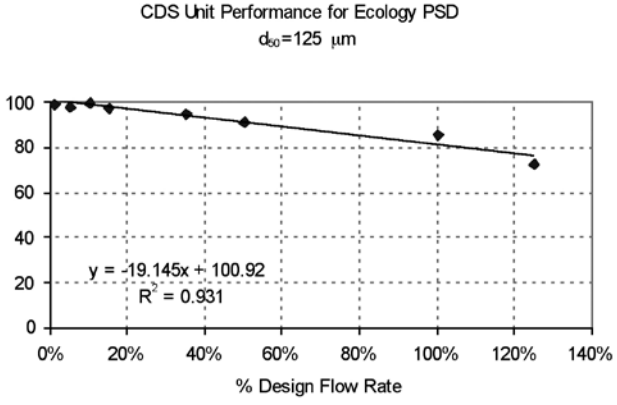


Figure 4. Modeled performance for WASDOE PSD.

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified

during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

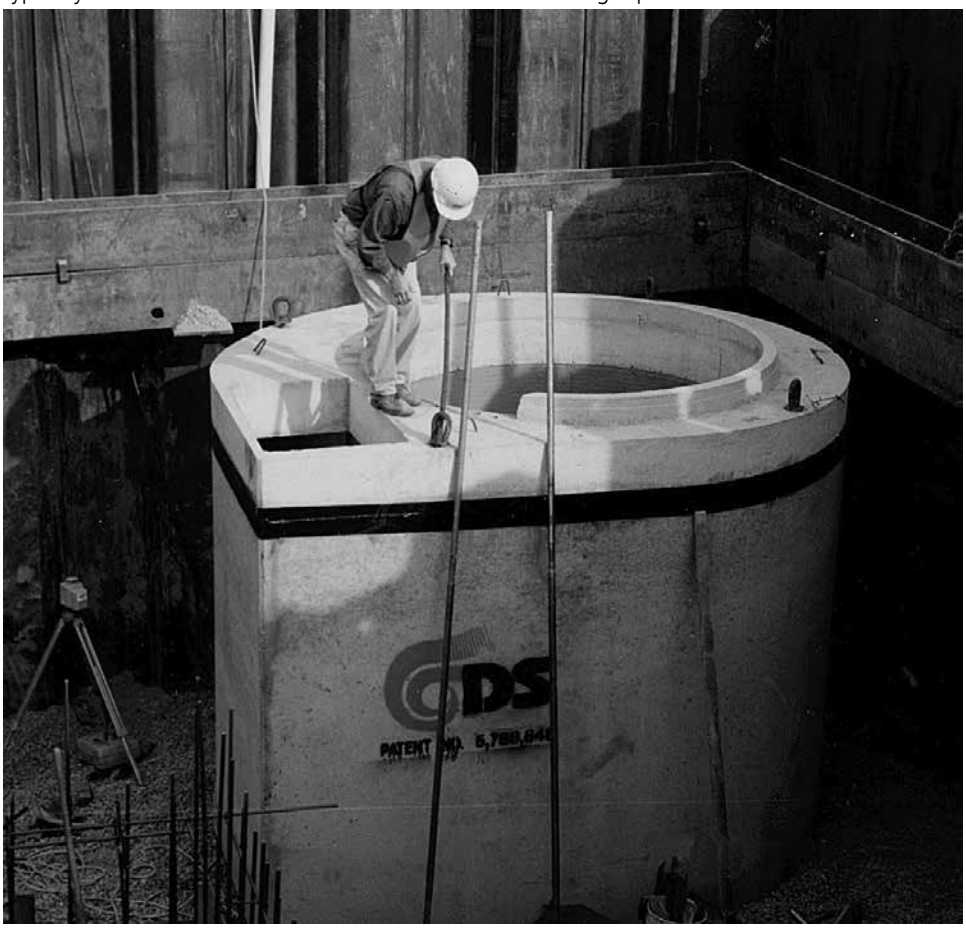
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile**.

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

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