Stormwater Management Report

For the Proposed:

Retail Development

Located at:

25 Falls Road (CT Route 149)
East Haddam, Connecticut

Prepared for Submission to:

Town of East Haddam, Connecticut

February 3, 2021

Prepared for:

Garrett Homes, LLC
59 Field Street
Torrington, CT

Prepared by:

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

BL Project Number: 2001066

Contents

Executive Summary 1
Existing Site Conditions and Hydrologic Conditions 2
Developed Site Conditions and Hydrologic Conditions 3
Stormwater Management 6
Summary 6

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

Appendix B: Pre-development Hydrology (2-, 10-, 25-, and 100-year storms)

Appendix C: Post-development Hydrology (2-, 10-, 25-, and 100-year storms)

Appendix D: Water Quality Calculations
- CTDEEP Water Quality Volume Calculations
- CTDEEP Water Quality Flow Calculations
- Groundwater Recharge Volume Calculations
- Treatment Train Efficiency Worksheet

Appendix E: Drainage Maps
- ED-1 – Existing Drainage Mapping
- PD-1 – Proposed Drainage Mapping
- GD-1 – Grading and Drainage Plan

Appendix F: Stormwater System Operation and Maintenance Manual

Executive Summary

This report has been prepared in support of a Permit Application by Garrett Homes, LLC to the Town of East Haddam for the proposed retail development at 25 Falls Road (CT Route 149). The project parcel is being subdivided from a larger parcel. The resulting property is approximately 1.46 acres in size and is currently developed with three industrial buildings and associated impervious paved parking and drive aisle areas. The property is located on the northern side of Falls Road and east of "The Old Lumberyard" development. The project site shares the driveway connection to Falls Road with The Old Lumber yard development. The parcel is bordered by retail and commercial properties to the north, west, and south and by residential properties to the east.

In general, the existing topography slopes from southeast to northwest across the site from approximately elevation 399' to 389'. Slopes on site vary from approximately 2% along Falls Road and the eastern property bound to approximately 8% in the extreme northwest corner of the parcel. In the existing condition, stormwater from the property sheet flows from southeast to northwest and is captured in existing catch basin structures. Stormwater is then conveyed offsite through a subsurface piping system. In addition to runoff from the project parcel, outflow from the also includes sheet flow runoff from a small area of the residential property bordering the site to the east.

Proposed site improvements will include a 9,100 square foot retail building, paved parking areas and driveways, landscaped areas, pedestrian sidewalks, site utilities and lighting, and stormwater management systems. The proposed stormwater management systems are designed to be in compliance with the 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 directed offsite or into the Falls Road gutter flow. The proposed subsurface stormwater management system has been designed to connect to the existing onsite drainage system while providing water quality improvements.

Stormwater quality is being addressed by a formalized street sweeping program, deep sump and hooded outlet catch basins, and a hydrodynamic separation unit (HDS). These features will provide the minimum required 80% TSS removal as required in the CT Stormwater Quality Manual.

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 Agawam Urban Land Complex and Urban Land. Per the USDA, the NRCS Hydrologic Soil Group ratings for soils within the project area are B and D respectively. 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 09007C0164G for Middlesex County, Connecticut, map revised date: August 28, 2008, the site resides in FEMA Flood Hazard Area X (unshaded). Zone X is defined as "areas determined to be outside the 0.2% annual chance floodplain". A copy of the FEMA Flood insurance rate Map is included in Appendix A for reference.

Existing Hydrologic Conditions

The existing site drainage area that was analyzed totals 2.51 acres and is approximately 56.8% impervious. This area includes a portion of the residential property east of the site from which runoff sheet flows into the existing onsite stormwater management systems (DP-1). The majority of stormwater runoff from the subject property sheet flows untreated into the existing catch basin and piping system that conveys water offsite to the northwest. A small portion of the property sheet flows to the extreme northwest corner of the site and flows offsite down and existing driveway associated with The Old Lumberyard development (DP-2). A small portion of site contributes surface flow to the Falls Road Gutter (DP-3). Below are descriptions of existing drainage areas.

The following is a brief analysis of the existing design points 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 portions of the project parcel and neighboring parcel that drain across the site and into the existing onsite stormwater management system (DP-1). It is 2.18 acres and is approximately 54.3% impervious. EDA-10 consists of the majority portion of the impervious cover associated with the three existing industrial buildings and paved areas, along with lawn areas from on site and the neighboring parcel to the east. Stormwater is conveyed offsite to the northwest through underground piping.

Existing Drainage Area 20 (EDA-20): This drainage area consists of the portion of the project parcel from which stormwater sheet flows offsite to the northwest into an existing driveway (DP-2). It is 0.26 acres and is approximately 66.1% impervious. EDA-20 consists mainly of impervious parking and drive aisle areas with a smaller portion of lawn.

Existing Drainage Area 30 (EDA-30): This drainage area consists of the portion of the project parcel that drains to the south and into the Falls Road gutter (DP-3). It is 0.07 acres and is entirely impervious. EDA-30 consists of impervious paved area associated with the Falls Road right-of-way. Stormwater that flows into the Falls Road gutter is conveyed offsite to the southwest.

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

Drainage Area	Area (square feet)	Composite Curve Number	Impervious Cover (%)	Time of Concentration (minutes)
EDA-10 (Area to Ex Drainage System)	94,975	89	54.3	17.9
EDA-20 (Area Flowing Offsite)	11,285	92	66.1	14.5
EDA-30 (Area to Falls Road Gutter)	3,065	98	100.0	5.0

Table 2 – Pre-Development Conditions Peak Flows

Analysis Point	Peak Flow (cfs)			
	2-yr	10-yr	25-yr	100-yr
Design Point 1 (Existing Drainage System)	3.93	6.67	8.38	10.98
Design Point 2 (Offsite Flow to Northwest)	0.57	0.93	1.15	1.49
Design Point 3 (Falls Road Gutter)	0.28	0.42	0.51	0.65

Developed Site Conditions and Hydrologic Conditions

In the proposed condition, stormwater runoff from newly installed impervious surfaces will be captured in catch basins and conveyed through underground piping, eventually connecting to the existing drainage system which flows offsite to the northwest (DP-1). The northern portion of the project parcel that currently drains offsite by sheet flow into the existing site driveway (DP-2) will continue to drain as it does today and is largely unaffected in terms of surface cover type by proposed construction. The contributing drainage area to the Falls Road Gutter (DP-3) remains unchanged in both size and cover type in the proposed condition. Overall, the site imperviousness has decreased from existing to proposed condition, which effectively decreases the peak flows

directed offsite. The proposed stormwater system will also provide stormwater quality improvements through the implementation of a formalized street sweeping program for the impervious surfaces and the installation of deep sump and hooded outlet catch basins, and a hydrodynamic separator (HDS). The required water quality volume is being detained on site through utilization of an underground stormwater detention system with a conservative exfiltration rate of 0.5 in/hr. 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.

The proposed site drainage area totals 2.51 acres and is approximately 49.5% impervious. The intent of the proposed site drainage is to match existing drainage patterns to the maximum extent practical. For the hydrologic analysis, the developed site retained the same Design Points as the existing model. The following drainage areas were developed to model the proposed site improvements.

Proposed Drainage Area 100 (PDA-100): This drainage area consists of the portions of the project parcel and neighboring parcel that drain across the site from which stormwater will be collected in existing and proposed catch basins. Catch basins collecting water from the proposed development area will flow through the HDS before eventually flowing into the existing onsite stormwater management system (DP-1). It is 1.99 acres and is approximately 39.9% impervious. PDA-100 consists of the majority portion of the impervious cover associated with the proposed paved areas, along with lawn areas from on site and the neighboring parcel to the east. Stormwater is conveyed offsite to the northwest through underground piping.

Proposed Drainage Area 110 (PDA-110): This drainage area consists of the portion of the project parcel that will flow into the underground detention system before eventually flowing into the existing onsite stormwater management system (DP-1). It is 0.21 acres and is 100% impervious. PDA-110 consists of the proposed retail building roof area..

Proposed Drainage Area 200 (PDA-200): This drainage area consists of the portion of the project parcel from which stormwater will continue to sheet flow offsite to the northwest into an existing driveway (DP-2) as it does in existing condition. It is 0.24 acres and is approximately 70.3% impervious. PDA-200 consists mainly of impervious parking and drive aisle areas with a smaller portion of lawn.

Proposed Drainage Area 300 (PDA-300): This drainage area consists of the portion of the project parcel that will continue to drain to the south and into the Falls Road gutter (DP-3). It is 0.07 acres and is entirely impervious. PDA-300 consists of impervious paved area associated with the Falls Road right-of-way. Stormwater that flows into the Falls Road gutter is conveyed offsite to the southwest.

Table 3 – Post-Development Drainage Characteristics.

Drainage Area	Area (square feet)	Composite Curve Number	Impervious Cover (%)	Time of Concentration (minutes)
PDA-100 (Area to Ex Drainage System)	86,765	86	39.9	17.4
PDA-110 (Area to Underground Detention)	9,100	98	100.0	5.0
PDA-200 (Area Flowing Offsite)	10,395	93	70.3	14.5
PDA-300 (Area to Falls Road Gutter)	3,065	98	100.0	5.0

Table 4 – Post-Development Conditions Peak Flows

Analysis Point	Peak Flow (cfs)			
	2-yr	10-yr	25-yr	100-yr
Design Point 1 (Existing Drainage System)	3.72	6.51	8.27	10.94
Design Point 2 (Offsite Flow to Northwest)	0.54	0.87	1.08	1.39
Design Point 3 (Falls Road Gutter)	0.28	0.42	0.51	0.65

Table 5 – Existing vs Proposed Peak Rates of Runoff

	Peak Flow Rate in Cubic Feet per Second (cfs)			
Drainage Area	**2-yr**	**10-yr**	**25-yr**	**100-yr**
Design Point 1				
Existing	3.93	6.67	8.38	10.98
Proposed	3.42	5.75	7.34	9.77
Change	-0.51	-0.92	-1.04	-1.21
Design Point 2				
Existing	0.57	0.93	1.15	1.49
Proposed	0.54	0.87	1.08	1.39
Change	-0.03	-0.06	-0.07	-0.10
Design Point 3				
Existing	0.28	0.42	0.51	0.65
Proposed	0.28	0.42	0.51	0.65
Change	0.00	0.00	0.00	0.00

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 East Haddam, CT were used for the calculation of peak flow rates and are listed in Table 6. 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	3.42”
10-year	5.20”
25-year	6.31”
100-year	8.02”

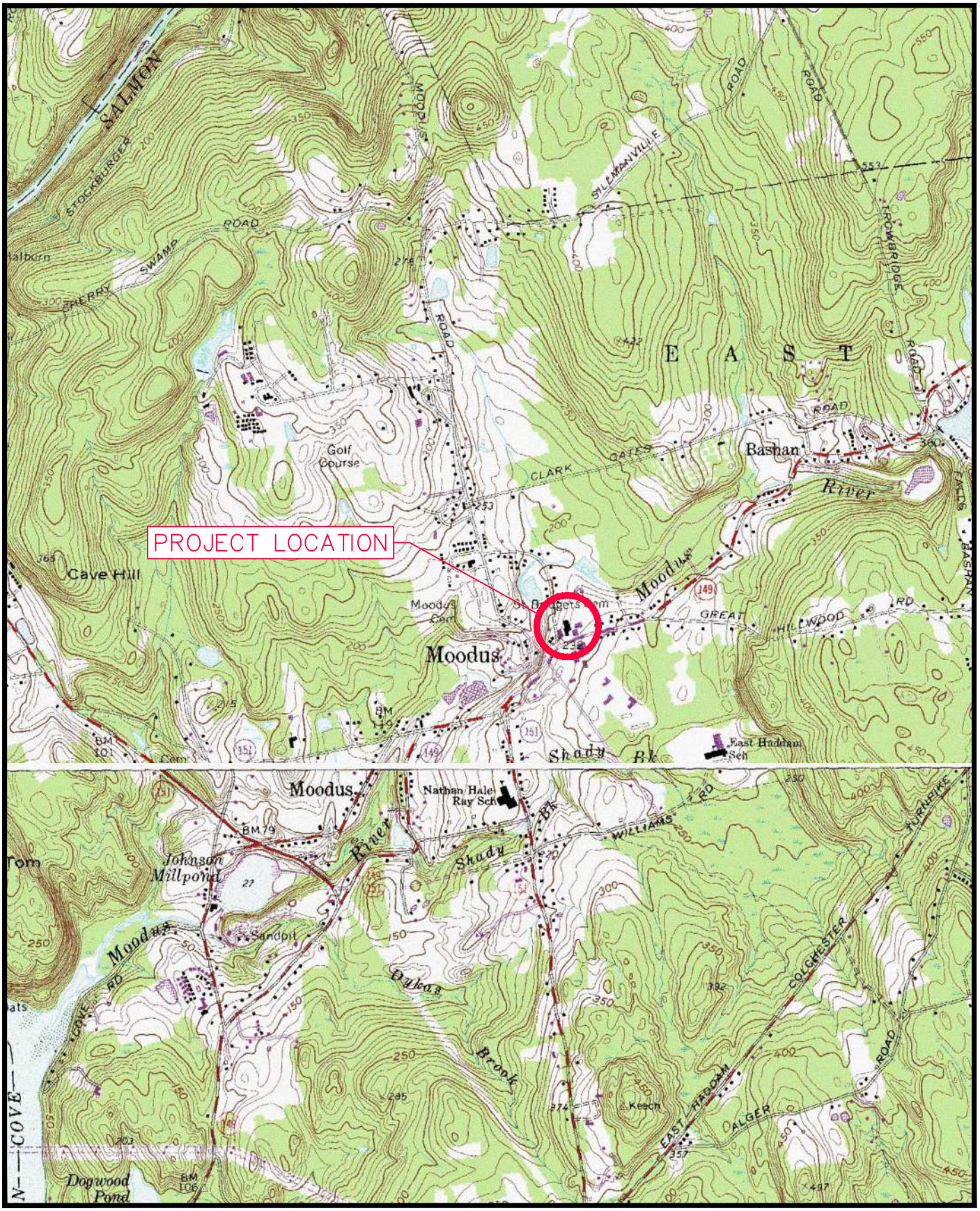
Summary

The post-development peak discharge rates for the total developed site have been decreased for all storm events through reduction of site impervious cover and introduction of a greater area of green space. All post development stormwater will be discharged offsite to match existing drainage patterns. The proposed underground stormwater detention system has been designed to attenuate peak flows for the 2-, 10-, 25-, and 100-year storm events. Stormwater quality is being addressed by a formalized street sweeping program, deep sump and hooded outlet catch basins, and a hydrodynamic separation unit. 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.

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



ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

BL Companies

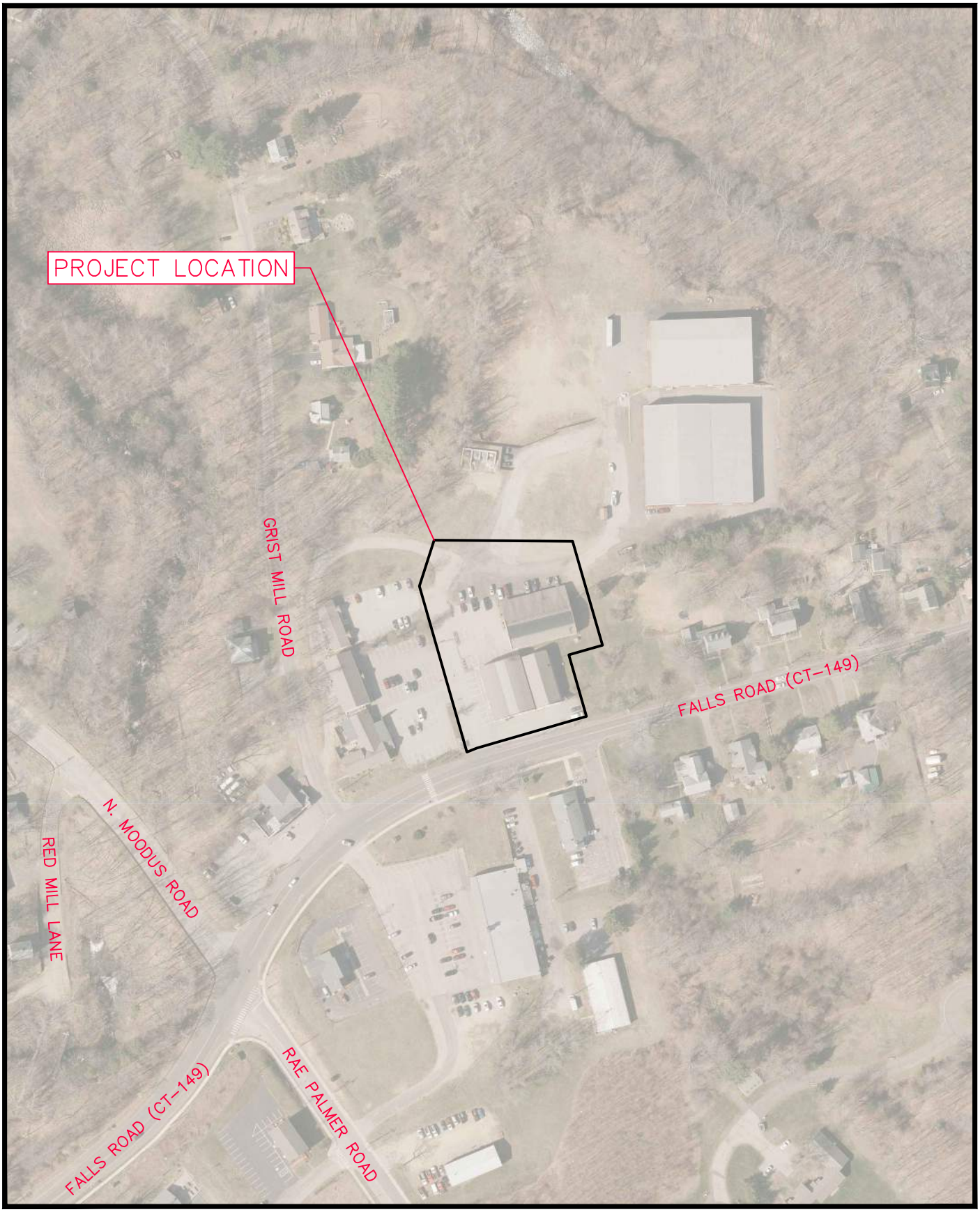
PROPOSED RETAIL DEVELOPMENT

25 FALLS ROAD (CT–149)
EAST HADDAM, CONNECTICUT

Designed	C.J.L.
Drawn	Z.T.Z.
Checked	C.J.L.
Approved	M.J.B.
Scale	1"=2,000'
Project No.	2001066
Date	02/09/2021
CAD File	LOC–2001066–01

FIGURE 1

USGS LOCATION MAP



BL Companies

ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

PROPOSED RETAIL DEVELOPMENT

25 FALLS ROAD (CT-149)
EAST HADDAM, CONNECTICUT

Designed	C.J.L.
Drawn	Z.T.Z.
Checked	C.J.L.
Approved	M.J.B.
Scale	1"=200'
Project No.	2001066
Date	02/09/2021
CAD File	LOC-2001066-01

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



January 15, 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.

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

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface..... 2
Soil Information for All Uses..... 5
Soil Properties and Qualities..... 5
Soil Qualities and Features..... 5
Hydrologic Soil Group..... 5

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.

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:3,840 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

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 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Dec 31, 2009—Oct 30, 2017

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	0.0	0.1%
29B	Agawam fine sandy loam, 3 to 8 percent slopes	B	2.5	4.7%
36A	Windsor loamy sand, 0 to 3 percent slopes	A	6.9	13.2%
36C	Windsor loamy sand, 8 to 15 percent slopes	A	0.8	1.6%
57B	Gloucester gravelly sandy loam, 3 to 8 percent slopes	A	6.4	12.3%
58B	Gloucester gravelly sandy loam, 3 to 8 percent slopes, very stony	A	3.9	7.4%
58C	Gloucester gravelly sandy loam, 8 to 15 percent slopes, very stony	A	0.7	1.4%
73E	Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky	B	0.6	1.1%
102	Pootatuck fine sandy loam	B	6.3	12.0%
103	Rippowam fine sandy loam	B/D	0.5	0.9%
229B	Agawam-Urban land complex, 0 to 8 percent slopes	B	6.2	11.8%
306	Udorthents-Urban land complex	B	0.6	1.2%
307	Urban land	D	15.5	29.6%
W	Water		1.4	2.6%
Totals for Area of Interest			**52.3**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole–foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Connecticut State Plane (FIPSZONE 0600). The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC–3, #9202
1315 East–West Highway
Silver Spring, MD 20910–3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713–3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was provided in digital format by the Connecticut Department of Environmental Protection. This information was derived from digital orthophotos produced at a scale of 1:12,000 from aerial photography flown in 2004 supplemented with aerial photography from 2000.

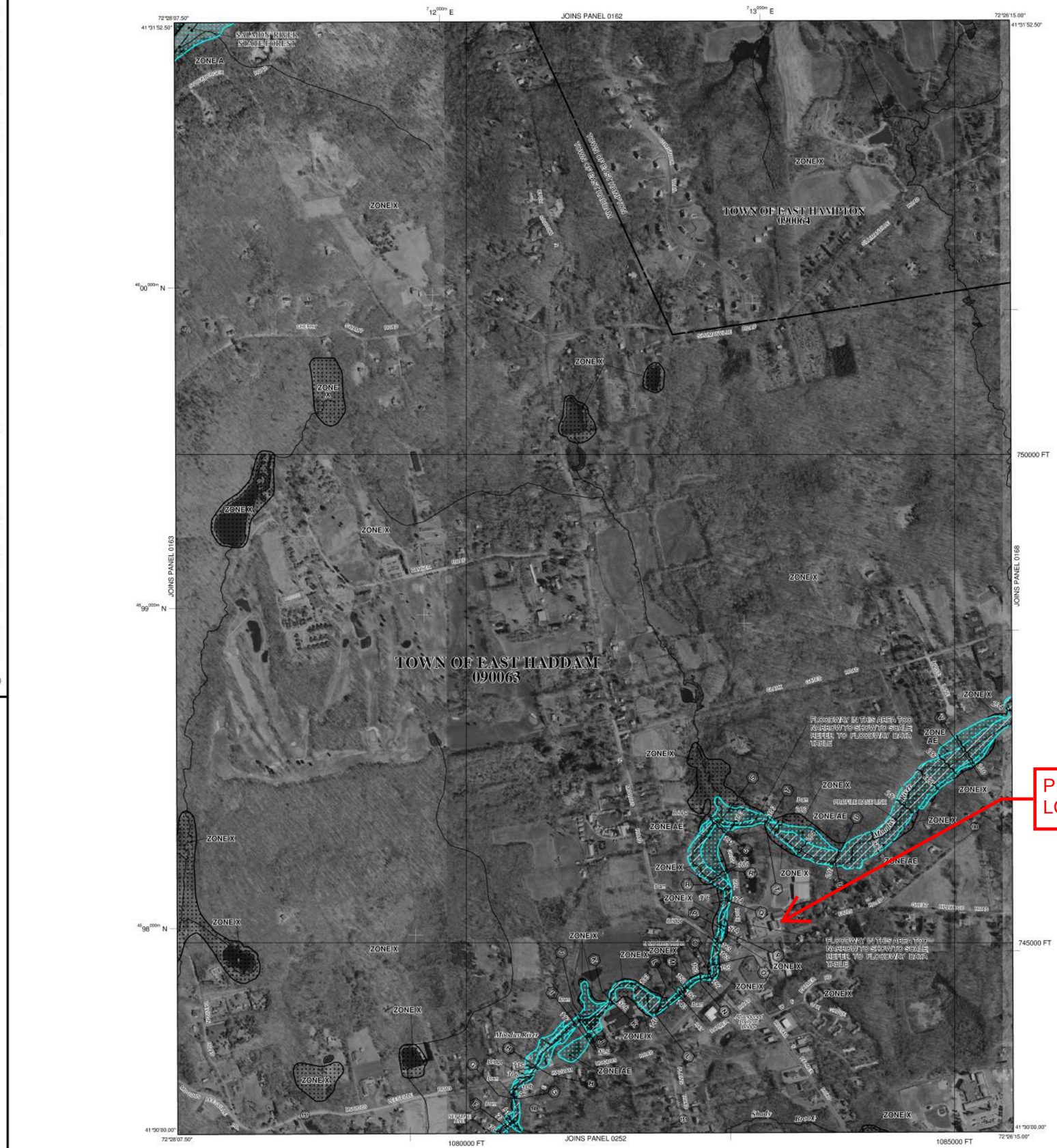
This map reflects more detailed and up–to–date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de–annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1–800–358–9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report,* and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1–800–358–9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1–877–FEMA MAP** (1–877–336–2627) or visit the FEMA website at http://www.fema.gov/.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** No Base Flood Elevations determined.
- **ZONE AE** Base Flood Elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- **ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- **ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A — A — Cross section line
- 23 — 23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275 000m N — 1000-meter Universal Transverse Mercator grid , zone 18
- 6000000 FT — 5000-foot grid : Connecticut State Plane coordinate system, (FIPSZONE 0600), Lambert Conformal Conic
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
August 28, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1–800–638–6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0164G

FIRM
FLOOD INSURANCE RATE MAP
MIDDLESEX COUNTY, CONNECTICUT
(ALL JURISDICTIONS)

PANEL 164 OF 450
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EAST HADDAM, TOWN OF	090063	0164	G
EAST HAMPTON, TOWN OF	090064	0164	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
09007C0164G

EFFECTIVE DATE
AUGUST 28, 2008

Federal Emergency Management Agency

NOAA Atlas 14, Volume 10, Version 3
Location name: Moodus, Connecticut, USA*
Latitude: 41.5071°, Longitude: -72.4452°
Elevation: 231.55 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	**0.334** (0.258-0.418)	**0.403** (0.311-0.506)	**0.516** (0.397-0.650)	**0.610** (0.467-0.773)	**0.740** (0.549-0.974)	**0.837** (0.610-1.13)	**0.939** (0.665-1.30)	**1.05** (0.708-1.49)	**1.22** (0.789-1.78)	**1.35** (0.856-2.01)
10-min	**0.473** (0.365-0.592)	**0.571** (0.440-0.716)	**0.731** (0.563-0.921)	**0.865** (0.662-1.10)	**1.05** (0.777-1.38)	**1.19** (0.863-1.59)	**1.33** (0.942-1.85)	**1.49** (1.00-2.11)	**1.73** (1.12-2.52)	**1.92** (1.21-2.85)
15-min	**0.556** (0.429-0.697)	**0.671** (0.518-0.843)	**0.860** (0.662-1.08)	**1.02** (0.778-1.29)	**1.23** (0.915-1.62)	**1.40** (1.01-1.87)	**1.57** (1.11-2.17)	**1.76** (1.18-2.48)	**2.03** (1.31-2.96)	**2.26** (1.43-3.35)
30-min	**0.763** (0.589-0.956)	**0.921** (0.711-1.16)	**1.18** (0.908-1.49)	**1.39** (1.07-1.76)	**1.69** (1.25-2.23)	**1.91** (1.39-2.57)	**2.15** (1.52-2.98)	**2.41** (1.62-3.41)	**2.78** (1.80-4.06)	**3.09** (1.96-4.59)
60-min	**0.969** (0.749-1.22)	**1.17** (0.903-1.47)	**1.50** (1.15-1.89)	**1.77** (1.36-2.24)	**2.15** (1.59-2.83)	**2.43** (1.77-3.26)	**2.73** (1.93-3.79)	**3.06** (2.06-4.33)	**3.53** (2.29-5.16)	**3.92** (2.48-5.83)
2-hr	**1.29** (1.00-1.60)	**1.54** (1.20-1.92)	**1.96** (1.52-2.45)	**2.31** (1.78-2.90)	**2.78** (2.08-3.64)	**3.14** (2.30-4.19)	**3.52** (2.51-4.86)	**3.95** (2.67-5.54)	**4.59** (2.98-6.64)	**5.13** (3.25-7.55)
3-hr	**1.51** (1.18-1.87)	**1.80** (1.41-2.23)	**2.28** (1.78-2.83)	**2.68** (2.07-3.35)	**3.22** (2.42-4.20)	**3.63** (2.68-4.83)	**4.07** (2.92-5.60)	**4.58** (3.10-6.39)	**5.33** (3.47-7.68)	**5.97** (3.80-8.74)
6-hr	**1.93** (1.53-2.38)	**2.31** (1.82-2.84)	**2.92** (2.30-3.61)	**3.43** (2.68-4.26)	**4.13** (3.13-5.34)	**4.65** (3.45-6.13)	**5.21** (3.76-7.12)	**5.86** (3.99-8.11)	**6.84** (4.47-9.76)	**7.67** (4.89-11.1)
12-hr	**2.41** (1.92-2.94)	**2.89** (2.30-3.53)	**3.67** (2.91-4.50)	**4.32** (3.41-5.32)	**5.21** (3.98-6.68)	**5.87** (4.39-7.69)	**6.58** (4.79-8.93)	**7.42** (5.07-10.2)	**8.67** (5.69-12.3)	**9.73** (6.23-14.0)
24-hr	**2.83** (2.28-3.43)	**3.42** (2.75-4.16)	**4.39** (3.52-5.35)	**5.20** (4.14-6.36)	**6.31** (4.86-8.05)	**7.13** (5.38-9.28)	**8.02** (5.88-10.8)	**9.08** (6.23-12.4)	**10.7** (7.04-15.0)	**12.1** (7.75-17.2)
2-day	**3.16** (2.57-3.80)	**3.87** (3.14-4.66)	**5.03** (4.07-6.08)	**6.00** (4.82-7.28)	**7.33** (5.70-9.29)	**8.30** (6.33-10.8)	**9.37** (6.95-12.6)	**10.7** (7.37-14.4)	**12.8** (8.42-17.7)	**14.5** (9.36-20.5)
3-day	**3.42** (2.80-4.10)	**4.20** (3.43-5.04)	**5.47** (4.45-6.58)	**6.52** (5.27-7.88)	**7.97** (6.23-10.1)	**9.04** (6.92-11.7)	**10.2** (7.60-13.7)	**11.7** (8.06-15.6)	**13.9** (9.22-19.2)	**15.9** (10.3-22.3)
4-day	**3.67** (3.01-4.39)	**4.49** (3.68-5.38)	**5.84** (4.76-7.00)	**6.96** (5.64-8.38)	**8.49** (6.66-10.7)	**9.62** (7.39-12.4)	**10.9** (8.11-14.5)	**12.4** (8.59-16.6)	**14.8** (9.81-20.3)	**16.9** (10.9-23.6)
7-day	**4.38** (3.62-5.20)	**5.29** (4.37-6.29)	**6.79** (5.58-8.10)	**8.04** (6.56-9.62)	**9.75** (7.69-12.2)	**11.0** (8.50-14.0)	**12.4** (9.28-16.4)	**14.1** (9.79-18.7)	**16.7** (11.1-22.7)	**18.9** (12.3-26.2)
10-day	**5.08** (4.22-6.02)	**6.06** (5.02-7.17)	**7.64** (6.32-9.07)	**8.96** (7.35-10.7)	**10.8** (8.53-13.4)	**12.1** (9.37-15.3)	**13.6** (10.2-17.8)	**15.3** (10.7-20.2)	**18.0** (12.0-24.4)	**20.2** (13.1-27.9)
20-day	**7.30** (6.12-8.57)	**8.35** (6.99-9.81)	**10.1** (8.40-11.9)	**11.5** (9.52-13.6)	**13.5** (10.7-16.5)	**14.9** (11.6-18.6)	**16.5** (12.3-21.1)	**18.2** (12.8-23.7)	**20.6** (13.8-27.7)	**22.6** (14.7-30.8)
30-day	**9.16** (7.73-10.7)	**10.3** (8.64-12.0)	**12.0** (10.1-14.1)	**13.5** (11.3-15.9)	**15.6** (12.4-18.9)	**17.1** (13.3-21.1)	**18.7** (13.9-23.6)	**20.3** (14.4-26.4)	**22.5** (15.2-30.1)	**24.2** (15.8-32.9)
45-day	**11.5** (9.75-13.4)	**12.6** (10.7-14.7)	**14.5** (12.2-16.9)	**16.0** (13.4-18.8)	**18.2** (14.6-21.9)	**19.8** (15.5-24.2)	**21.5** (16.0-26.8)	**23.0** (16.3-29.6)	**25.0** (16.9-33.1)	**26.3** (17.2-35.5)
60-day	**13.4** (11.4-15.6)	**14.6** (12.4-17.0)	**16.6** (14.0-19.3)	**18.2** (15.3-21.2)	**20.4** (16.4-24.4)	**22.1** (17.3-26.8)	**23.8** (17.7-29.4)	**25.3** (18.0-32.4)	**27.0** (18.3-35.7)	**28.2** (18.5-37.9)

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

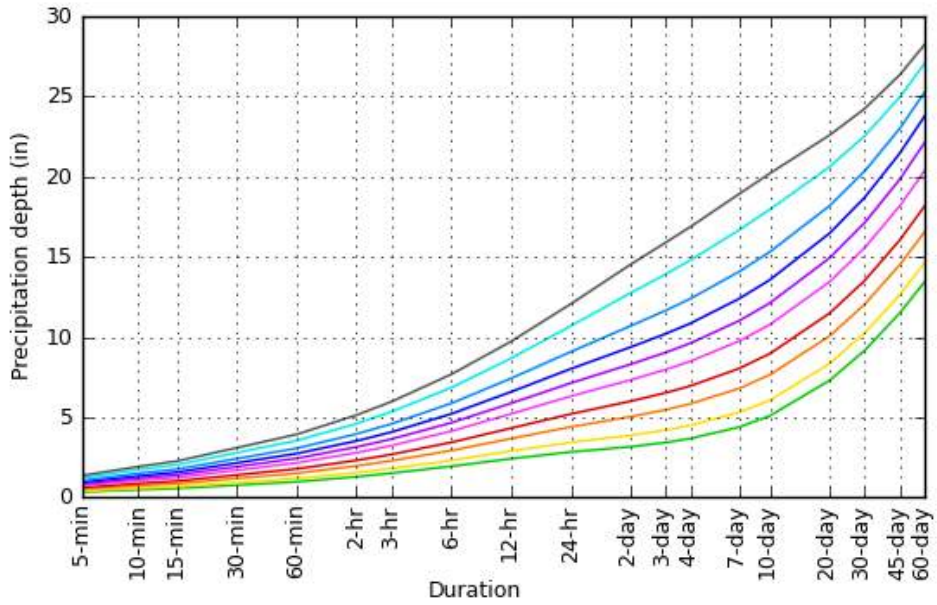
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

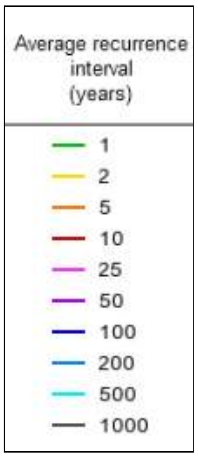
Please refer to NOAA Atlas 14 document for more information.

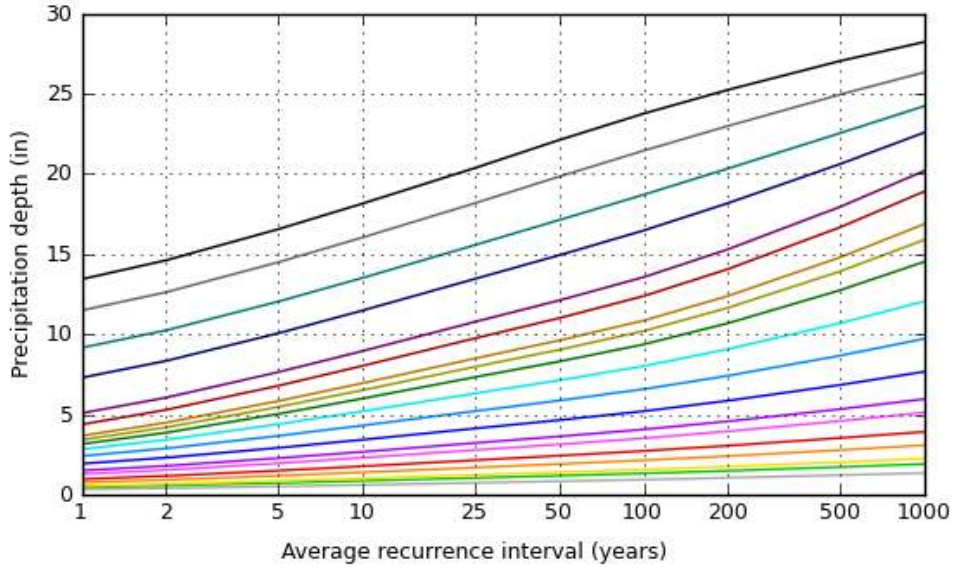
Back to Top

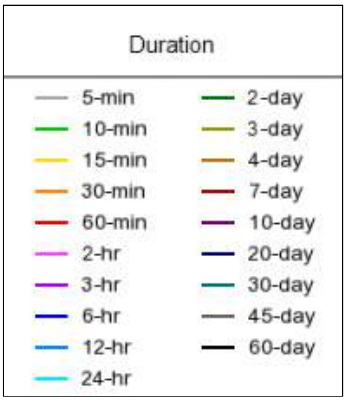
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 41.5071°, Longitude: -72.4452°









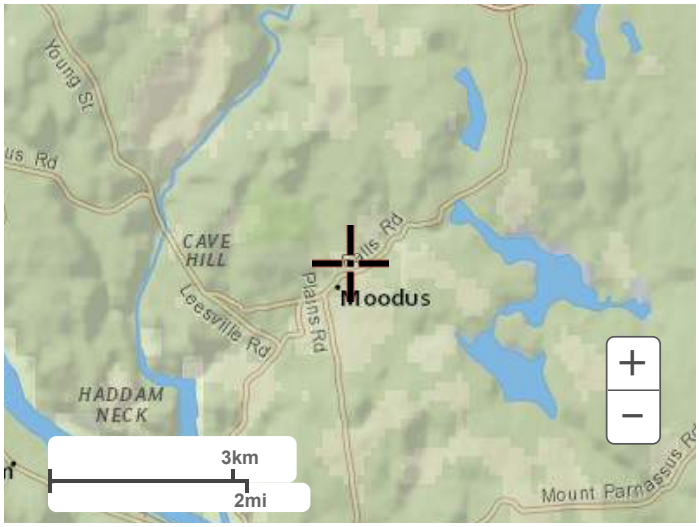
NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Thu Jan 21 15:28:31 2021

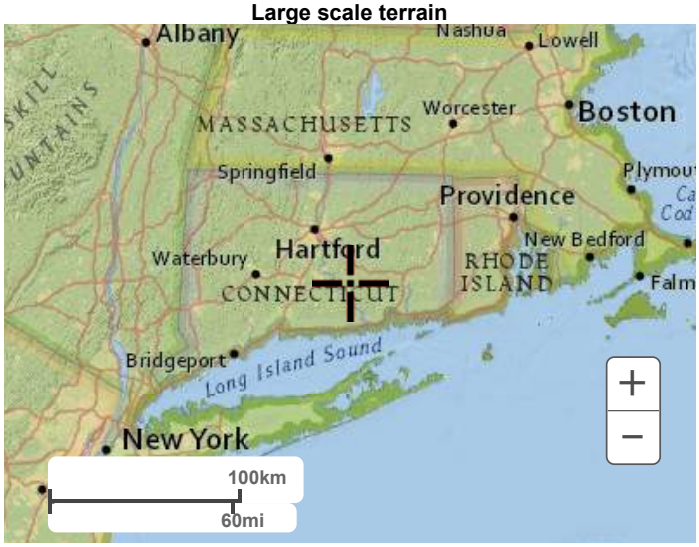
Back to Top

Maps & aerials

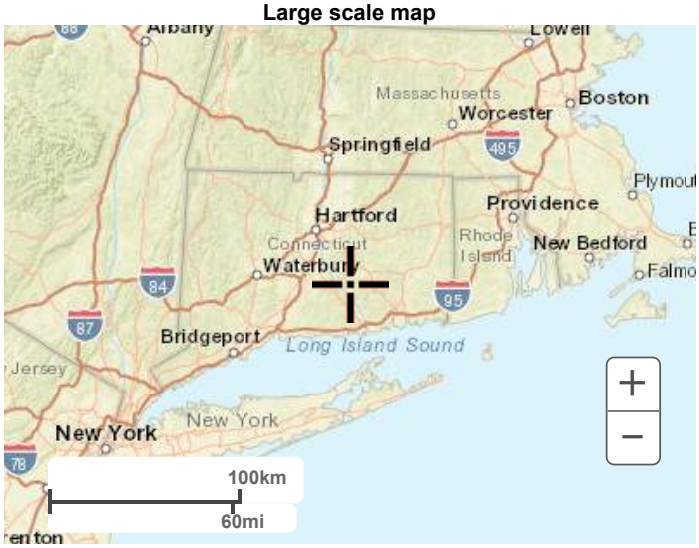
Small scale terrain



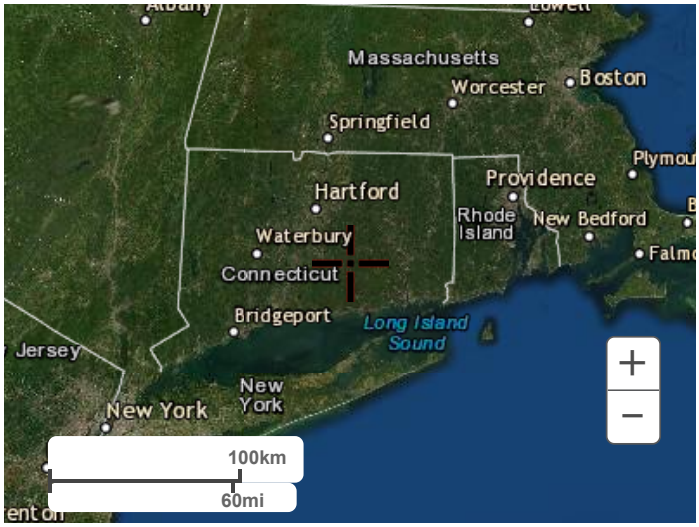
Large scale terrain



Large scale map



Large scale aerial



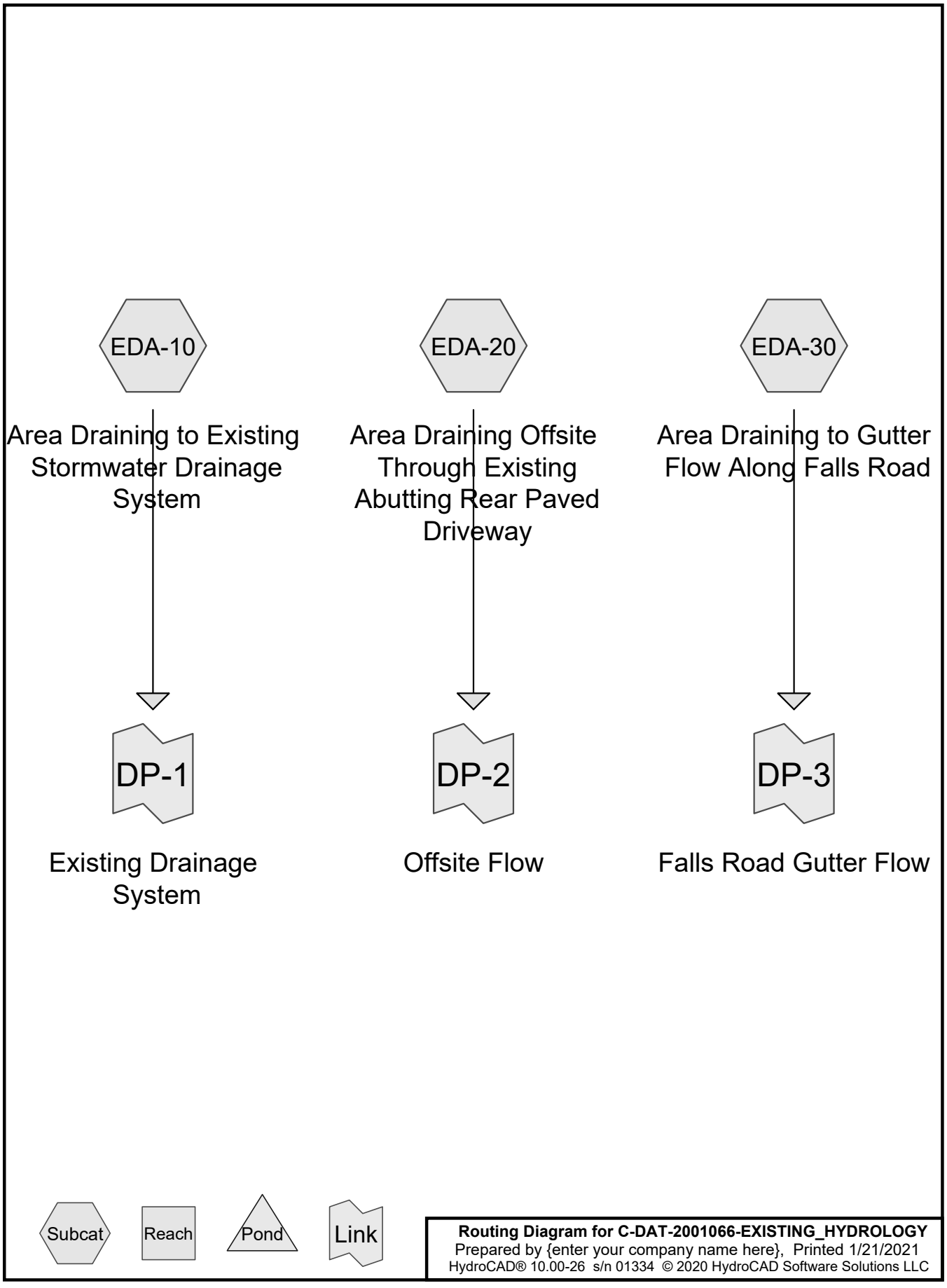
Back to Top

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-2001066-EXISTING_HYDROLOGY
Prepared by {enter your company name here}, Printed 1/21/2021
HydroCAD® 10.00-26 s/n 01334 © 2020 HydroCAD Software Solutions LLC

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 Draining to Runoff Area=94,975 sf 46.73% Impervious Runoff Depth>2.27"
Flow Length=413' Tc=17.9 min CN=89 Runoff=3.93 cfs 17,976 cf

Subcatchment EDA-20: Area Draining Runoff Area=11,285 sf 16.53% Impervious Runoff Depth>2.55"
Flow Length=229' Tc=14.5 min CN=92 Runoff=0.57 cfs 2,398 cf

Subcatchment EDA-30: Area Draining to Runoff Area=3,065 sf 100.00% Impervious Runoff Depth>3.18"
Flow Length=198' Slope=0.0200 '/' Tc=5.0 min CN=98 Runoff=0.28 cfs 813 cf

Link DP-1: Existing Drainage System Inflow=3.93 cfs 17,976 cf
Primary=3.93 cfs 17,976 cf

Link DP-2: Offsite Flow Inflow=0.57 cfs 2,398 cf
Primary=0.57 cfs 2,398 cf

Link DP-3: Falls Road Gutter Flow Inflow=0.28 cfs 813 cf
Primary=0.28 cfs 813 cf

Total Runoff Area = 109,325 sf Runoff Volume = 21,187 cf Average Runoff Depth = 2.33"
54.90% Pervious = 60,015 sf 45.10% Impervious = 49,310 sf

Summary for Subcatchment EDA-10: Area Draining to Existing Stormwater Drainage System

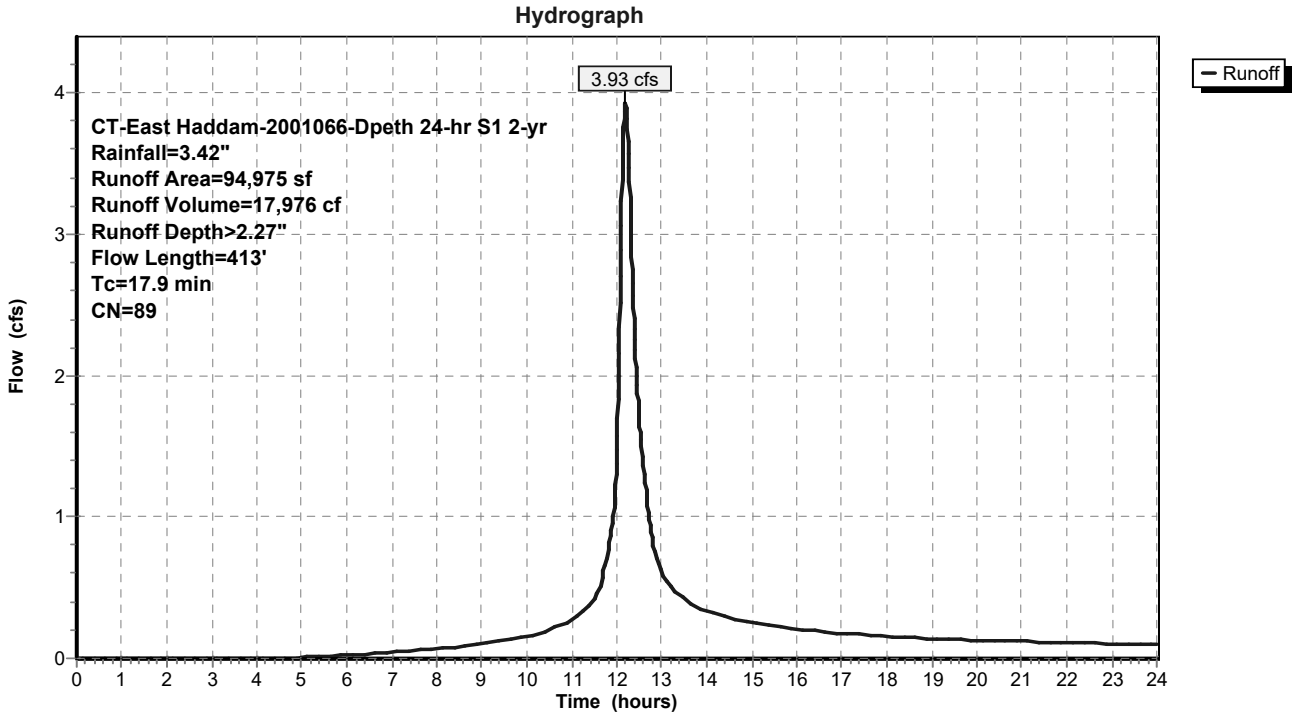
Runoff = 3.93 cfs @ 12.19 hrs, Volume= 17,976 cf, Depth> 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 2-yr Rainfall=3.42"

Area (sf)	CN	Description
6,160	98	Paved parking, HSG B
17,975	69	50-75% Grass cover, Fair, HSG B
38,220	98	Paved parking, HSG D
7,200	96	Gravel surface, HSG D
24,180	84	50-75% Grass cover, Fair, HSG D
1,240	79	Woods, Fair, HSG D
94,975	89	Weighted Average
50,595		53.27% Pervious Area
44,380		46.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	100	0.0150	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
1.1	55	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	223	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	35	0.0050	3.21	2.52	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
17.9	413	Total			

Subcatchment EDA-10: Area Draining to Existing Stormwater Drainage System



Summary for Subcatchment EDA-20: Area Draining Offsite Through Existing Abutting Rear Paved Drive

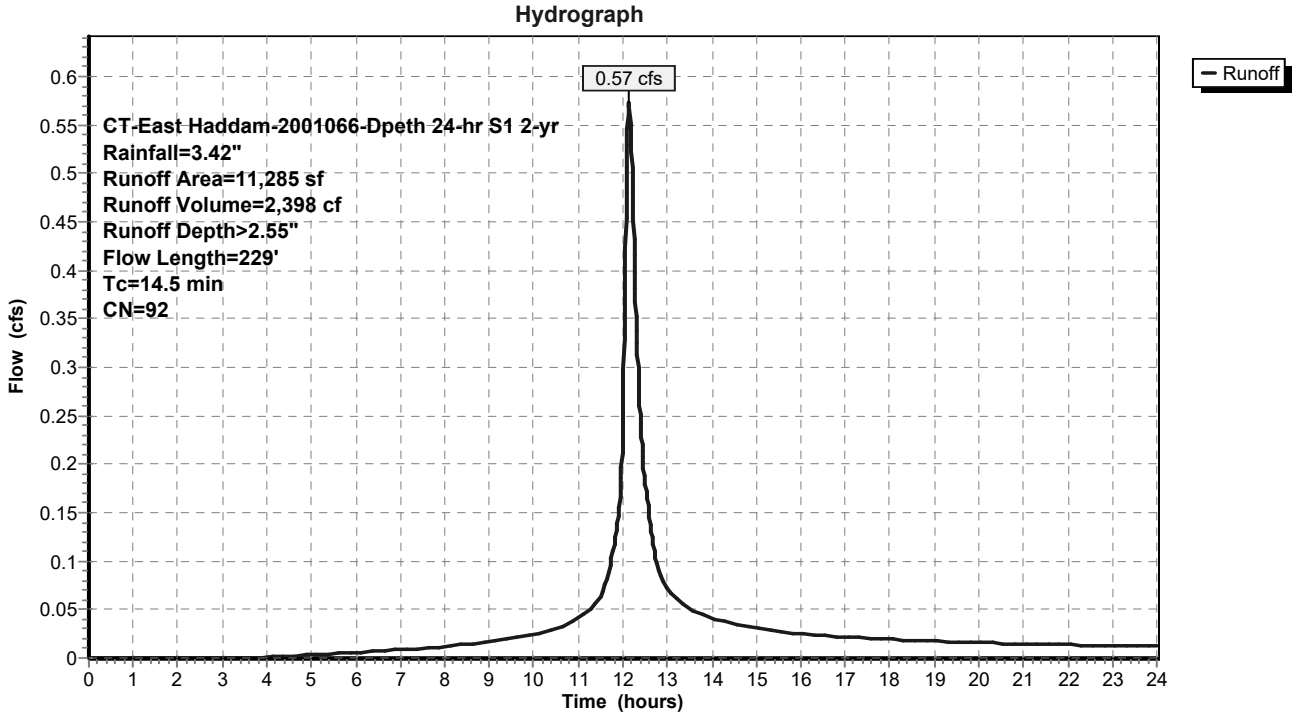
Runoff = 0.57 cfs @ 12.15 hrs, Volume= 2,398 cf, Depth> 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 2-yr Rainfall=3.42"

Area (sf)	CN	Description
1,865	98	Paved parking, HSG D
5,590	96	Gravel surface, HSG D
3,830	84	50-75% Grass cover, Fair, HSG D
11,285	92	Weighted Average
9,420		83.47% Pervious Area
1,865		16.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0200	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
0.3	16	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	113	0.0580	4.89		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.5	229	Total			

Subcatchment EDA-20: Area Draining Offsite Through Existing Abutting Rear Paved Driveway



Summary for Subcatchment EDA-30: Area Draining to Gutter Flow Along Falls Road

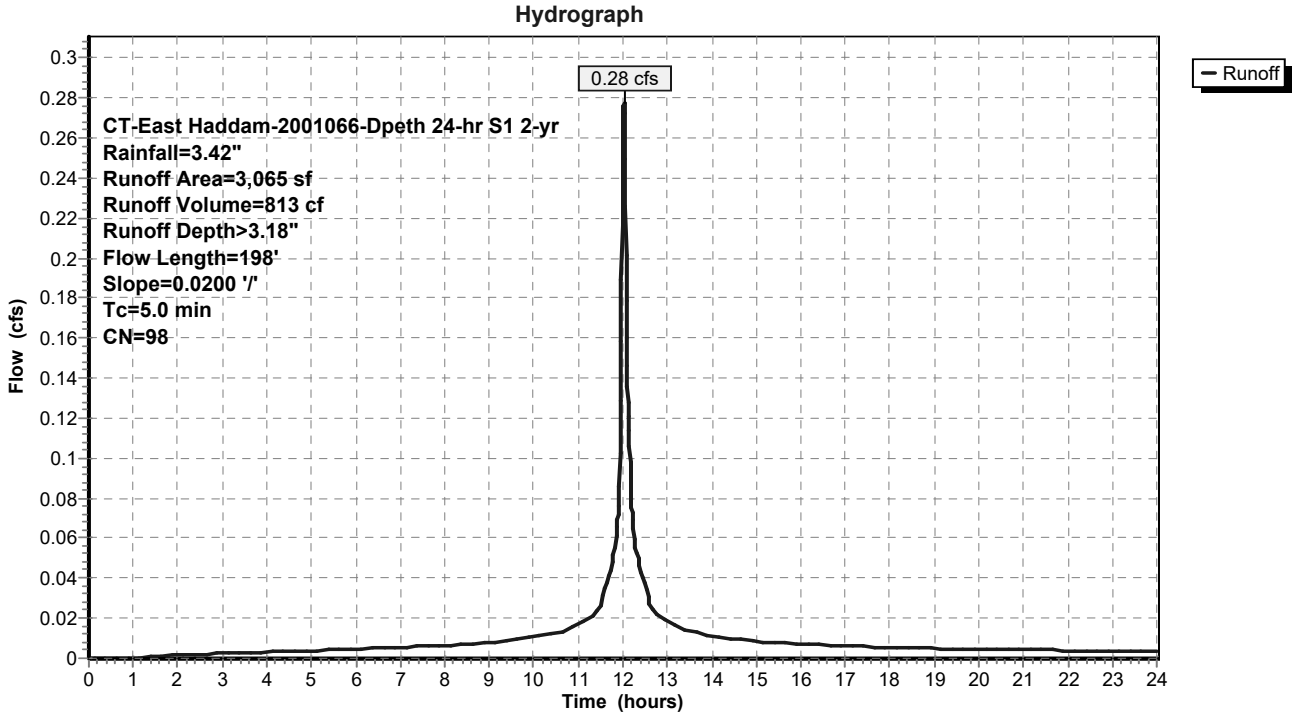
Runoff = 0.28 cfs @ 12.03 hrs, Volume= 813 cf, Depth> 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 2-yr Rainfall=3.42"

Area (sf)	CN	Description
10	98	Paved parking, HSG B
3,055	98	Paved parking, HSG D
3,065	98	Weighted Average
3,065		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.42		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.42"
0.6	98	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	198	Total, Increased to minimum Tc = 5.0 min			

Subcatchment EDA-30: Area Draining to Gutter Flow Along Falls Road

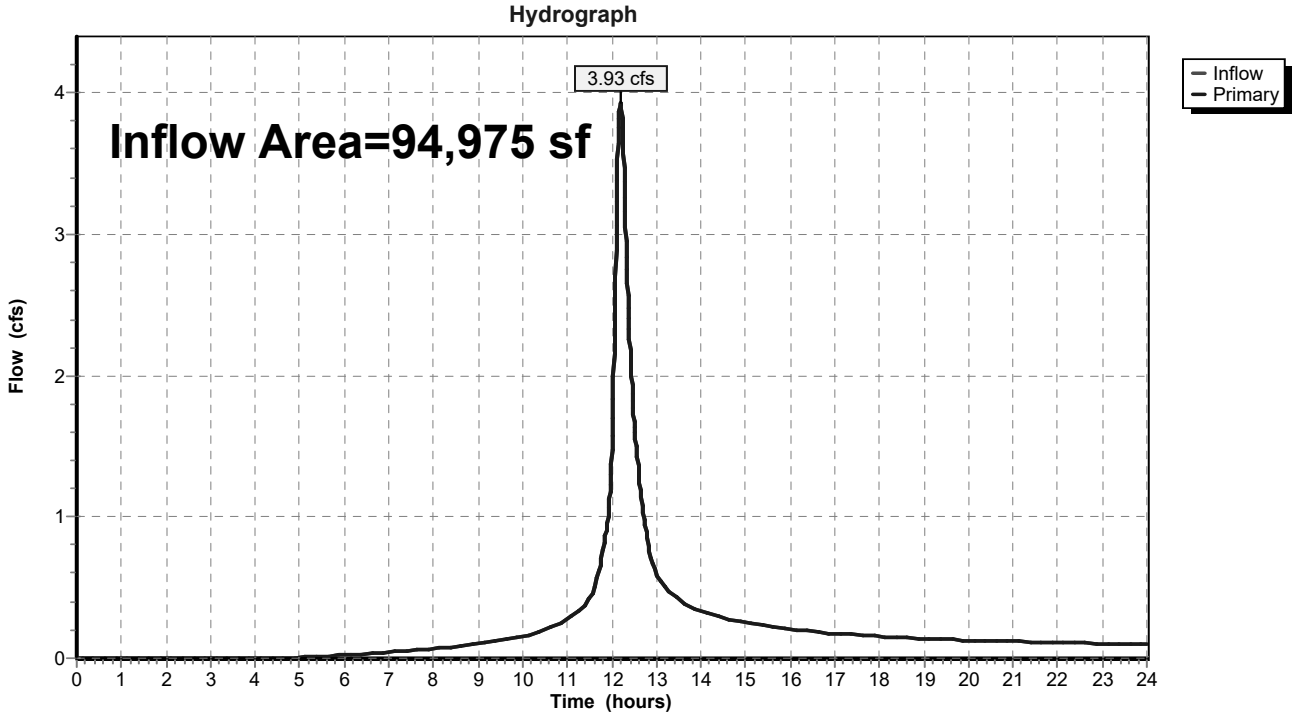


Summary for Link DP-1: Existing Drainage System

Inflow Area = 94,975 sf, 46.73% Impervious, Inflow Depth > 2.27" for 2-yr event
Inflow = 3.93 cfs @ 12.19 hrs, Volume= 17,976 cf
Primary = 3.93 cfs @ 12.19 hrs, Volume= 17,976 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-1: Existing Drainage System

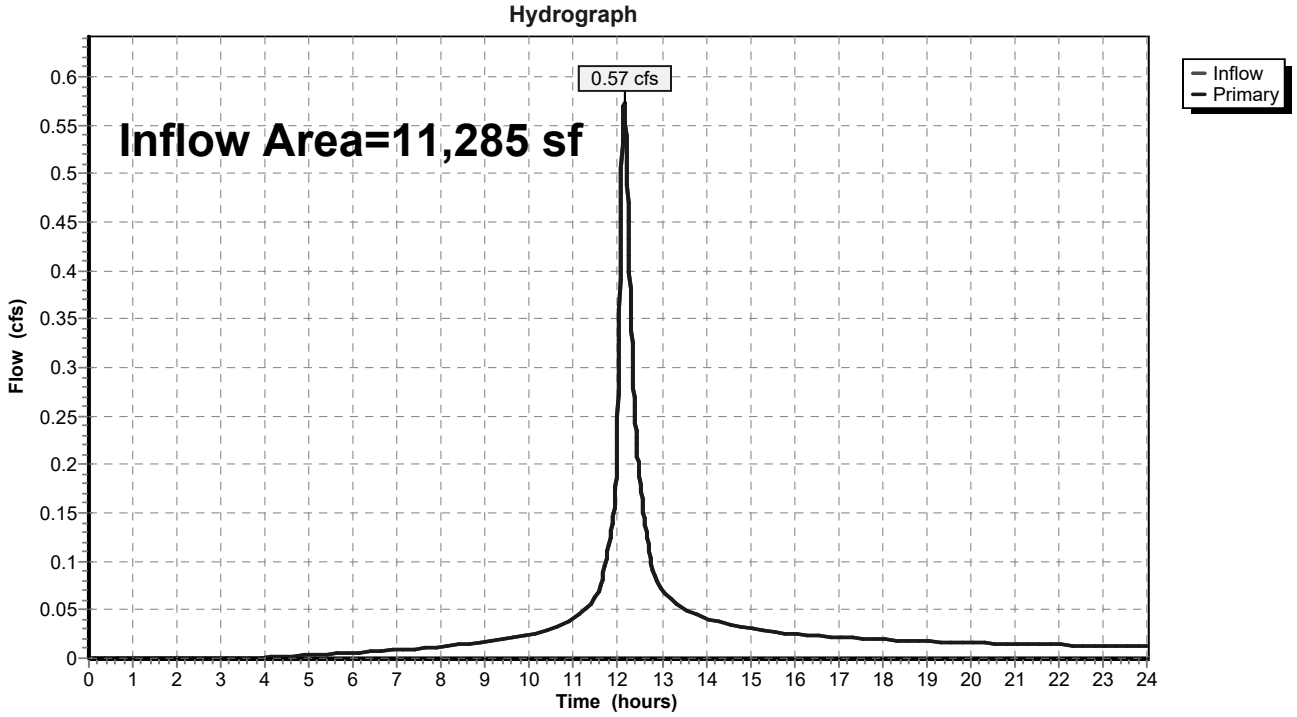


Summary for Link DP-2: Offsite Flow

Inflow Area = 11,285 sf, 16.53% Impervious, Inflow Depth > 2.55" for 2-yr event
Inflow = 0.57 cfs @ 12.15 hrs, Volume= 2,398 cf
Primary = 0.57 cfs @ 12.15 hrs, Volume= 2,398 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-2: Offsite Flow

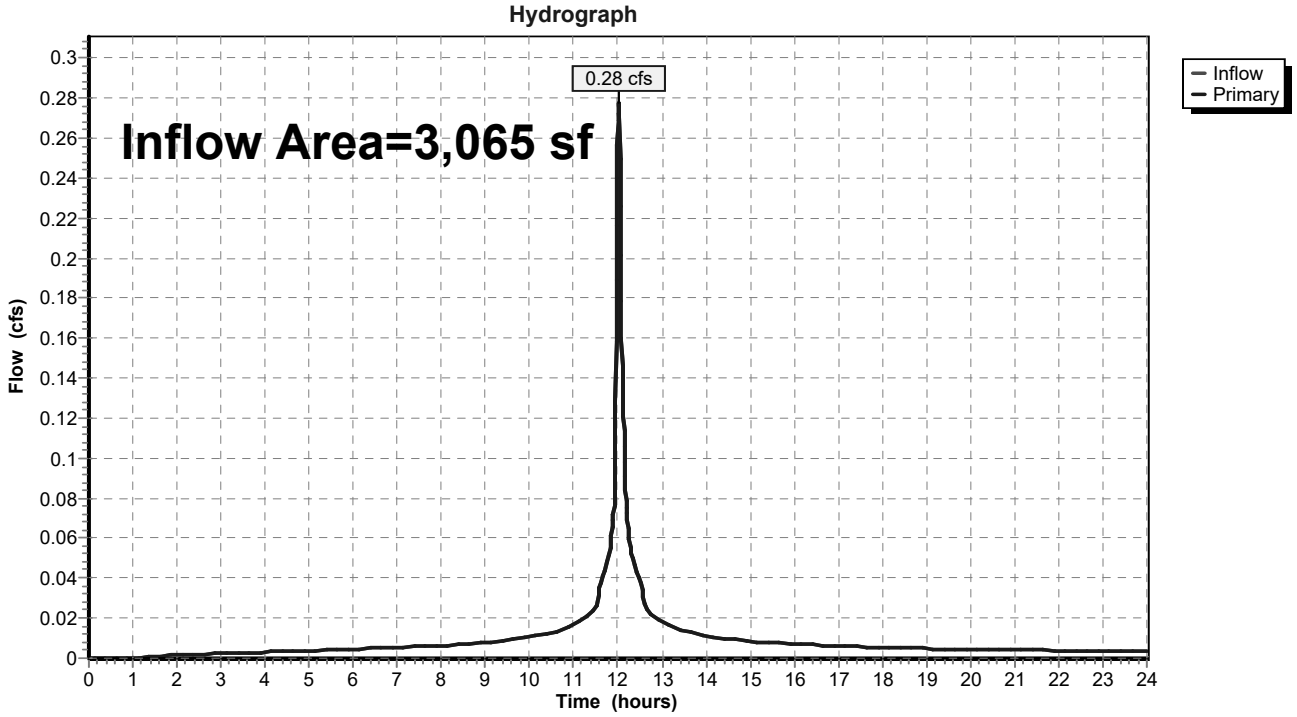


Summary for Link DP-3: Falls Road Gutter Flow

Inflow Area = 3,065 sf,100.00% Impervious, Inflow Depth > 3.18" for 2-yr event
Inflow = 0.28 cfs @ 12.03 hrs, Volume= 813 cf
Primary = 0.28 cfs @ 12.03 hrs, Volume= 813 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-3: Falls Road Gutter Flow



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 Draining to Runoff Area=94,975 sf 46.73% Impervious Runoff Depth>3.94"
Flow Length=413' Tc=17.9 min CN=89 Runoff=6.67 cfs 31,218 cf

Subcatchment EDA-20: Area Draining Runoff Area=11,285 sf 16.53% Impervious Runoff Depth>4.27"
Flow Length=229' Tc=14.5 min CN=92 Runoff=0.93 cfs 4,015 cf

Subcatchment EDA-30: Area Draining to Runoff Area=3,065 sf 100.00% Impervious Runoff Depth>4.96"
Flow Length=198' Slope=0.0200 '/' Tc=5.0 min CN=98 Runoff=0.42 cfs 1,266 cf

Link DP-1: Existing Drainage System Inflow=6.67 cfs 31,218 cf
Primary=6.67 cfs 31,218 cf

Link DP-2: Offsite Flow Inflow=0.93 cfs 4,015 cf
Primary=0.93 cfs 4,015 cf

Link DP-3: Falls Road Gutter Flow Inflow=0.42 cfs 1,266 cf
Primary=0.42 cfs 1,266 cf

Total Runoff Area = 109,325 sf Runoff Volume = 36,499 cf Average Runoff Depth = 4.01"
54.90% Pervious = 60,015 sf 45.10% Impervious = 49,310 sf

Summary for Subcatchment EDA-10: Area Draining to Existing Stormwater Drainage System

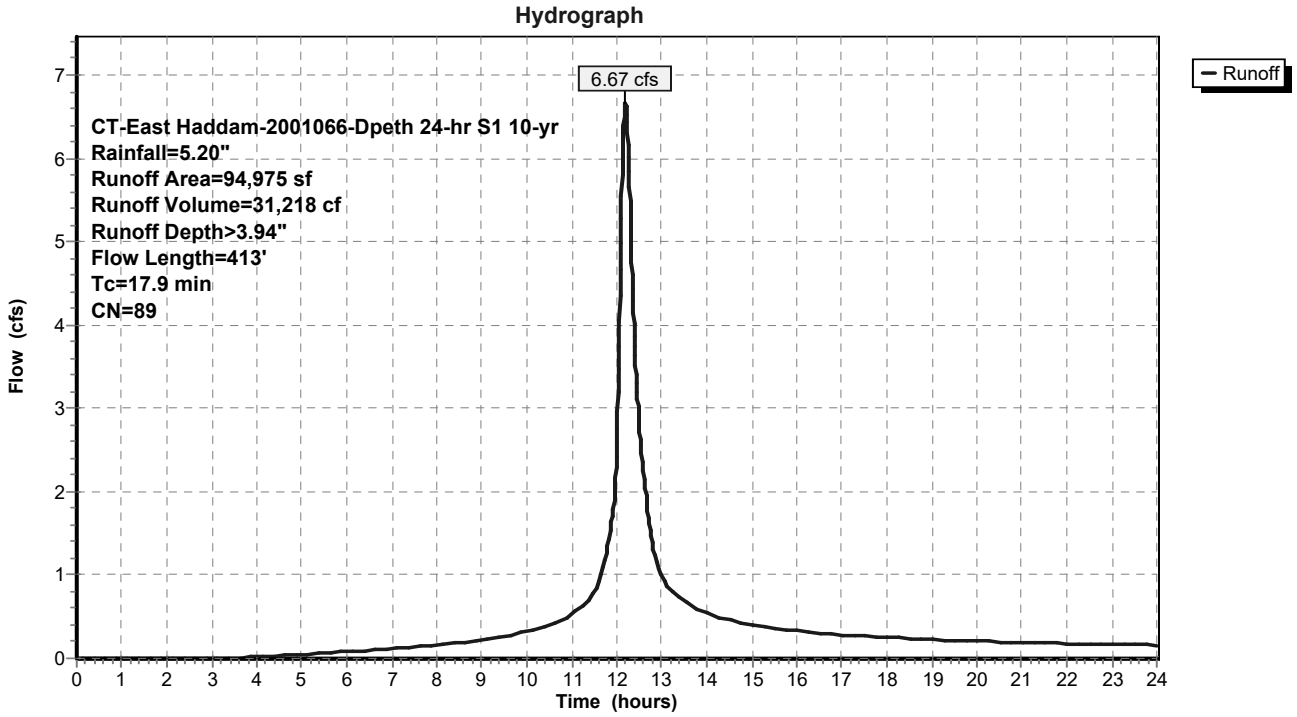
Runoff = 6.67 cfs @ 12.19 hrs, Volume= 31,218 cf, Depth> 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 10-yr Rainfall=5.20"

Area (sf)	CN	Description
6,160	98	Paved parking, HSG B
17,975	69	50-75% Grass cover, Fair, HSG B
38,220	98	Paved parking, HSG D
7,200	96	Gravel surface, HSG D
24,180	84	50-75% Grass cover, Fair, HSG D
1,240	79	Woods, Fair, HSG D
94,975	89	Weighted Average
50,595		53.27% Pervious Area
44,380		46.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	100	0.0150	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
1.1	55	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	223	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	35	0.0050	3.21	2.52	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
17.9	413	Total			

Subcatchment EDA-10: Area Draining to Existing Stormwater Drainage System



Summary for Subcatchment EDA-20: Area Draining Offsite Through Existing Abutting Rear Paved Drive

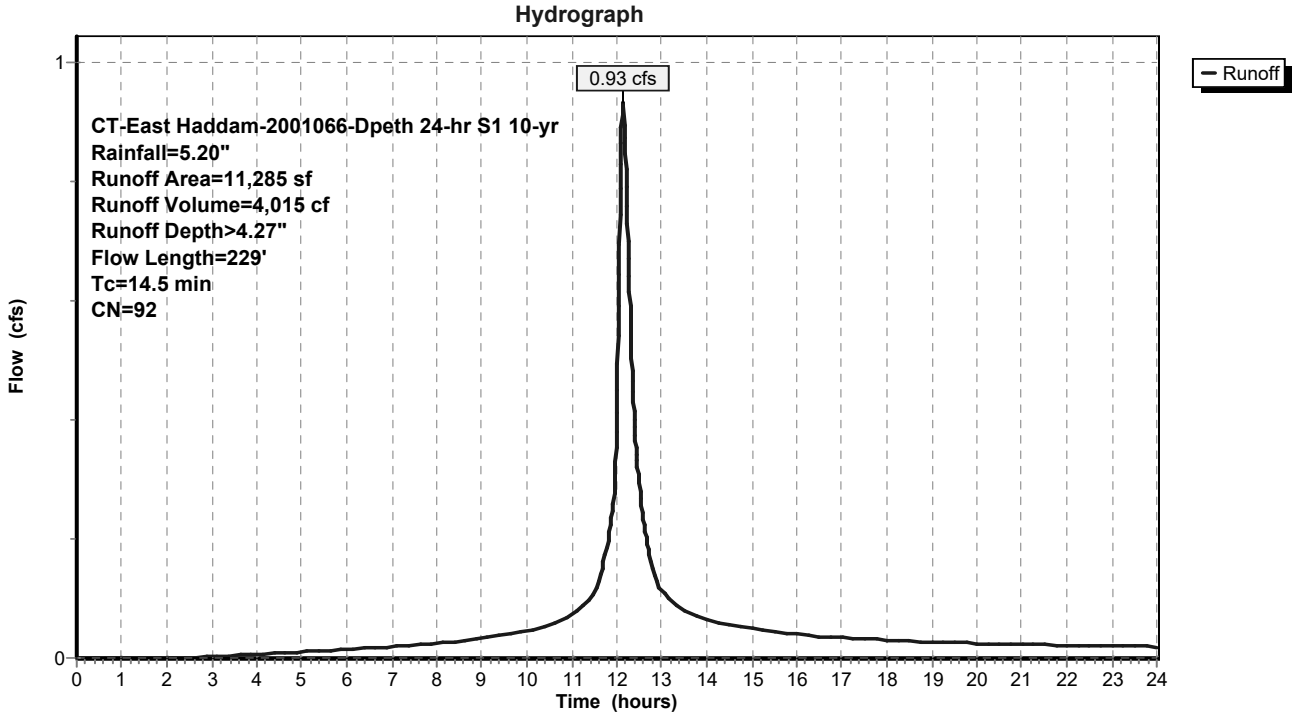
Runoff = 0.93 cfs @ 12.14 hrs, Volume= 4,015 cf, Depth> 4.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 10-yr Rainfall=5.20"

Area (sf)	CN	Description
1,865	98	Paved parking, HSG D
5,590	96	Gravel surface, HSG D
3,830	84	50-75% Grass cover, Fair, HSG D
11,285	92	Weighted Average
9,420		83.47% Pervious Area
1,865		16.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0200	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
0.3	16	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	113	0.0580	4.89		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.5	229	Total			

Subcatchment EDA-20: Area Draining Offsite Through Existing Abutting Rear Paved Driveway



Summary for Subcatchment EDA-30: Area Draining to Gutter Flow Along Falls Road

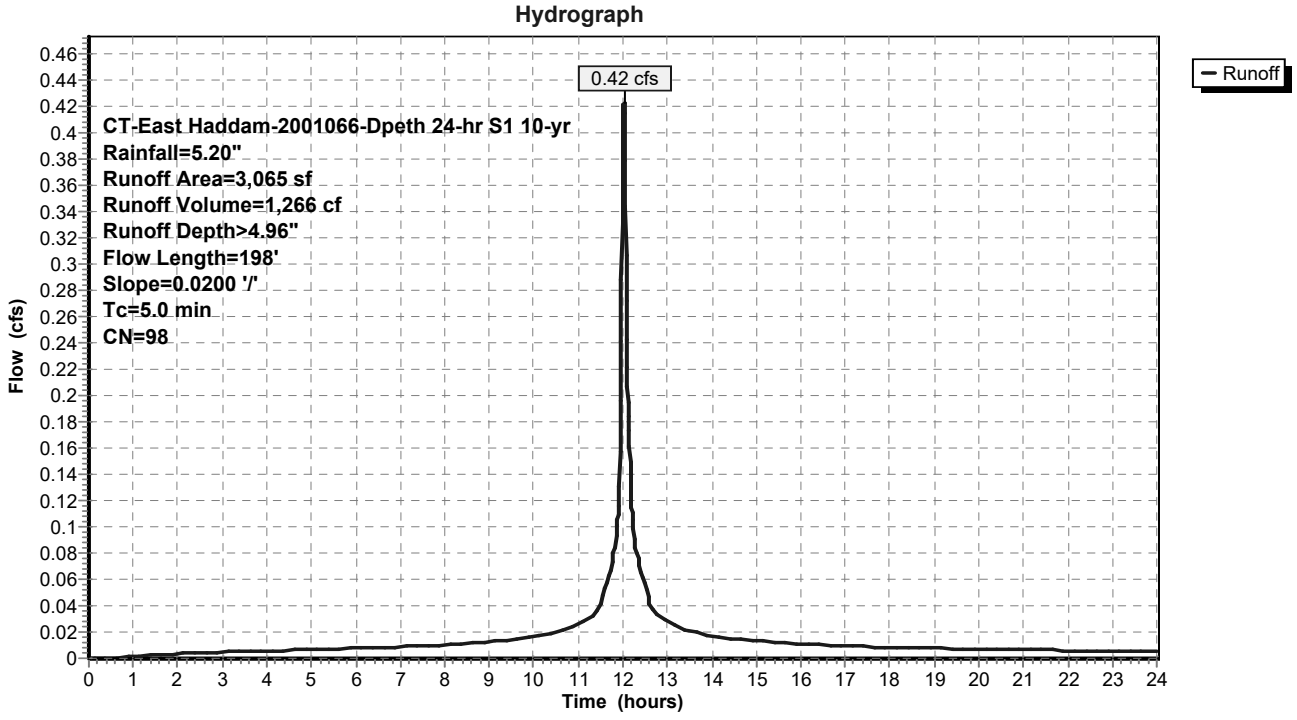
Runoff = 0.42 cfs @ 12.03 hrs, Volume= 1,266 cf, Depth> 4.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 10-yr Rainfall=5.20"

Area (sf)	CN	Description
10	98	Paved parking, HSG B
3,055	98	Paved parking, HSG D
3,065	98	Weighted Average
3,065		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.42		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.42"
0.6	98	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	198	Total, Increased to minimum Tc = 5.0 min			

Subcatchment EDA-30: Area Draining to Gutter Flow Along Falls Road

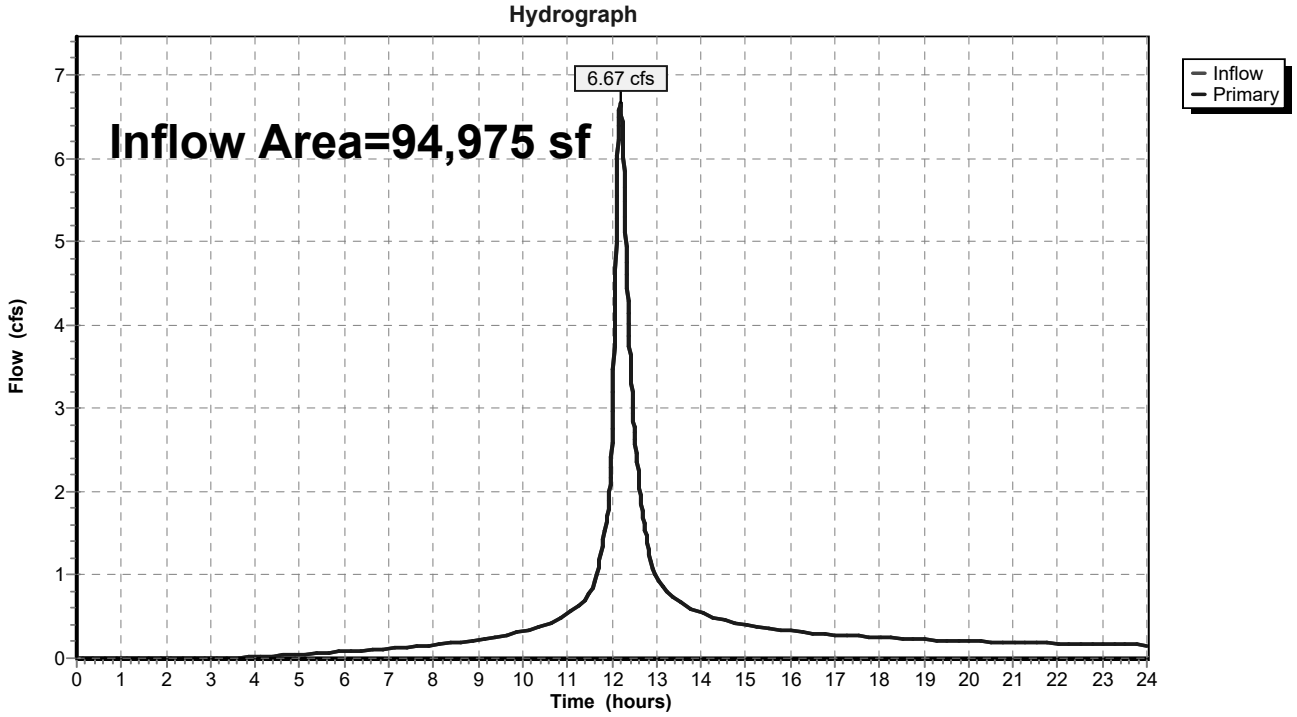


Summary for Link DP-1: Existing Drainage System

Inflow Area = 94,975 sf, 46.73% Impervious, Inflow Depth > 3.94" for 10-yr event
Inflow = 6.67 cfs @ 12.19 hrs, Volume= 31,218 cf
Primary = 6.67 cfs @ 12.19 hrs, Volume= 31,218 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-1: Existing Drainage System

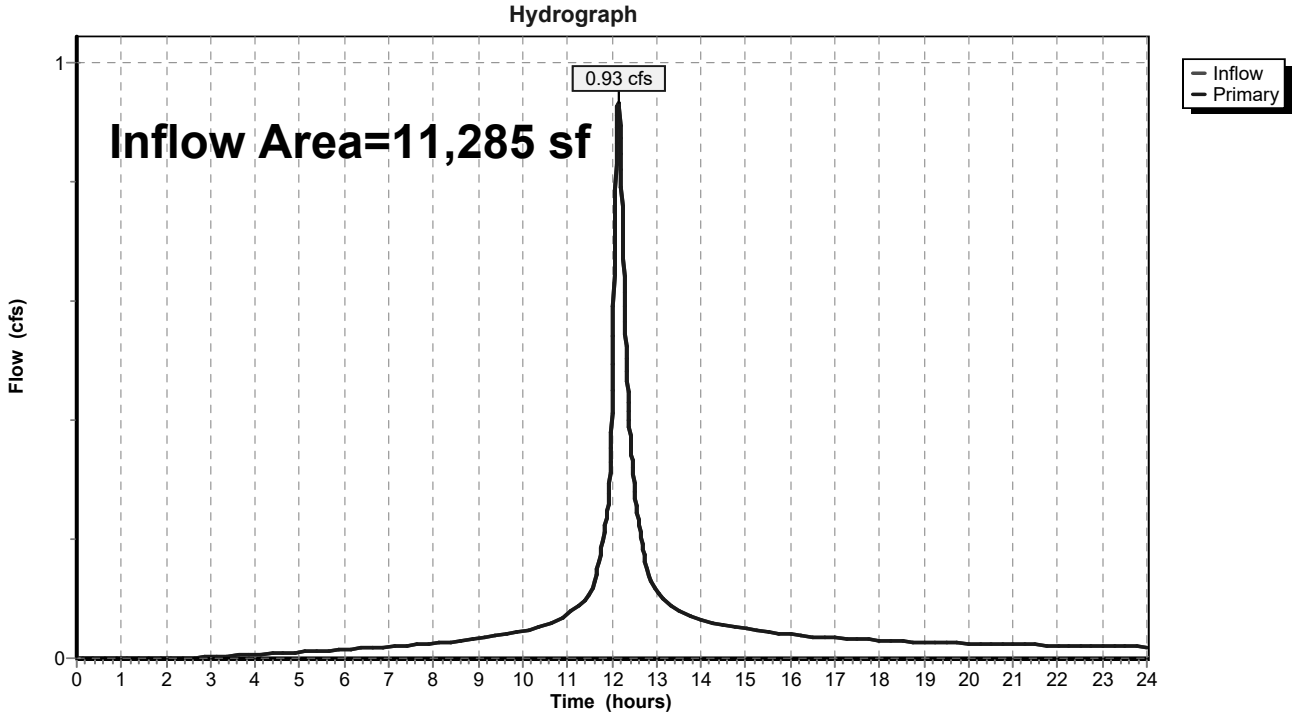


Summary for Link DP-2: Offsite Flow

Inflow Area = 11,285 sf, 16.53% Impervious, Inflow Depth > 4.27" for 10-yr event
Inflow = 0.93 cfs @ 12.14 hrs, Volume= 4,015 cf
Primary = 0.93 cfs @ 12.14 hrs, Volume= 4,015 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-2: Offsite Flow

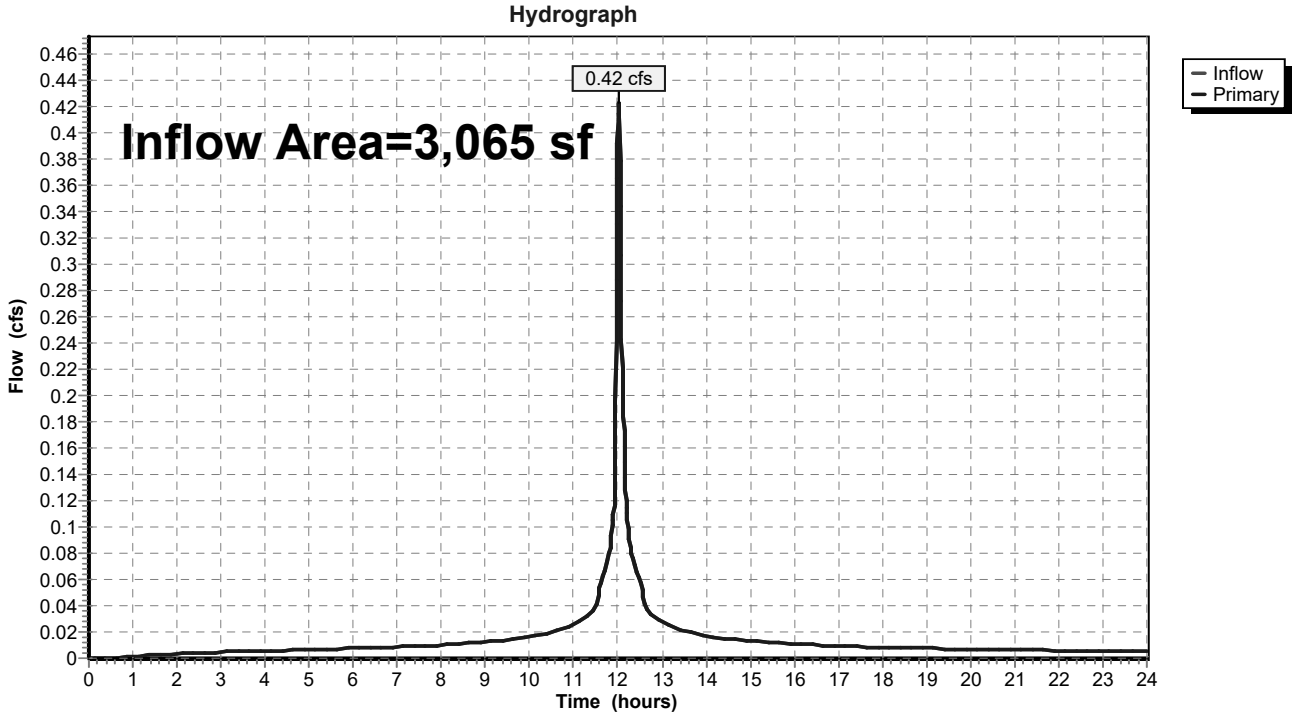


Summary for Link DP-3: Falls Road Gutter Flow

Inflow Area = 3,065 sf,100.00% Impervious, Inflow Depth > 4.96" for 10-yr event
Inflow = 0.42 cfs @ 12.03 hrs, Volume= 1,266 cf
Primary = 0.42 cfs @ 12.03 hrs, Volume= 1,266 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-3: Falls Road Gutter Flow



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 Draining to Runoff Area=94,975 sf 46.73% Impervious Runoff Depth>5.01"
Flow Length=413' Tc=17.9 min CN=89 Runoff=8.38 cfs 39,671 cf

Subcatchment EDA-20: Area Draining Runoff Area=11,285 sf 16.53% Impervious Runoff Depth>5.36"
Flow Length=229' Tc=14.5 min CN=92 Runoff=1.15 cfs 5,036 cf

Subcatchment EDA-30: Area Draining to Runoff Area=3,065 sf 100.00% Impervious Runoff Depth>6.07"
Flow Length=198' Slope=0.0200 '/' Tc=5.0 min CN=98 Runoff=0.51 cfs 1,549 cf

Link DP-1: Existing Drainage System Inflow=8.38 cfs 39,671 cf
Primary=8.38 cfs 39,671 cf

Link DP-2: Offsite Flow Inflow=1.15 cfs 5,036 cf
Primary=1.15 cfs 5,036 cf

Link DP-3: Falls Road Gutter Flow Inflow=0.51 cfs 1,549 cf
Primary=0.51 cfs 1,549 cf

Total Runoff Area = 109,325 sf Runoff Volume = 46,257 cf Average Runoff Depth = 5.08"
54.90% Pervious = 60,015 sf 45.10% Impervious = 49,310 sf

Summary for Subcatchment EDA-10: Area Draining to Existing Stormwater Drainage System

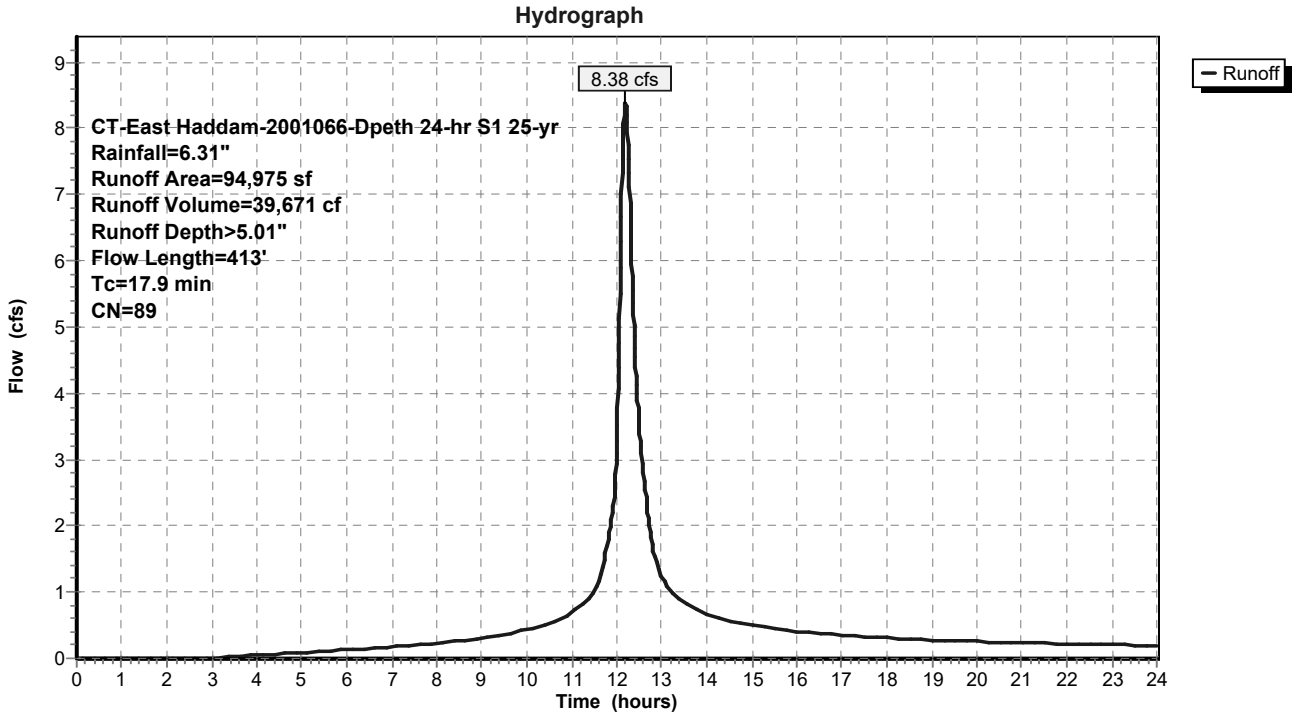
Runoff = 8.38 cfs @ 12.19 hrs, Volume= 39,671 cf, Depth> 5.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 25-yr Rainfall=6.31"

Area (sf)	CN	Description
6,160	98	Paved parking, HSG B
17,975	69	50-75% Grass cover, Fair, HSG B
38,220	98	Paved parking, HSG D
7,200	96	Gravel surface, HSG D
24,180	84	50-75% Grass cover, Fair, HSG D
1,240	79	Woods, Fair, HSG D
94,975	89	Weighted Average
50,595		53.27% Pervious Area
44,380		46.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	100	0.0150	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
1.1	55	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	223	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	35	0.0050	3.21	2.52	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
17.9	413	Total			

Subcatchment EDA-10: Area Draining to Existing Stormwater Drainage System



Summary for Subcatchment EDA-20: Area Draining Offsite Through Existing Abutting Rear Paved Drive

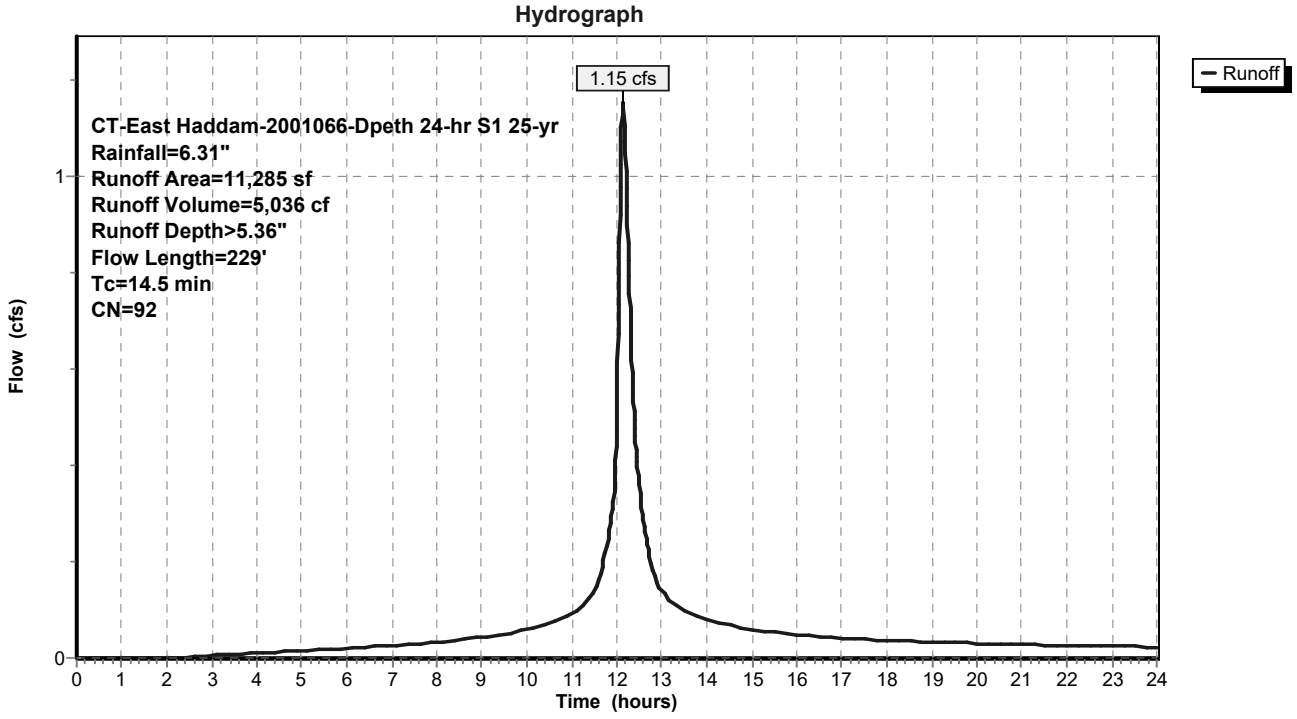
Runoff = 1.15 cfs @ 12.14 hrs, Volume= 5,036 cf, Depth> 5.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 25-yr Rainfall=6.31"

Area (sf)	CN	Description
1,865	98	Paved parking, HSG D
5,590	96	Gravel surface, HSG D
3,830	84	50-75% Grass cover, Fair, HSG D
11,285	92	Weighted Average
9,420		83.47% Pervious Area
1,865		16.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0200	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
0.3	16	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	113	0.0580	4.89		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.5	229	Total			

Subcatchment EDA-20: Area Draining Offsite Through Existing Abutting Rear Paved Driveway



Summary for Subcatchment EDA-30: Area Draining to Gutter Flow Along Falls Road

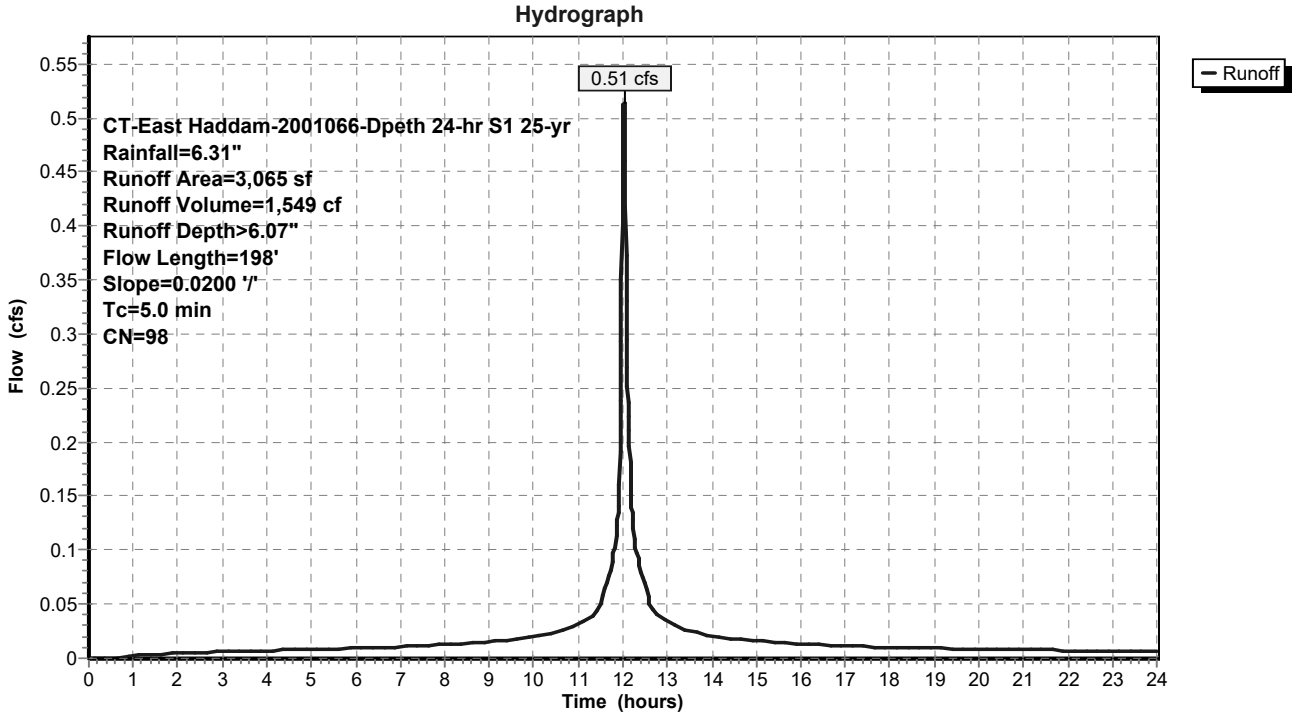
Runoff = 0.51 cfs @ 12.03 hrs, Volume= 1,549 cf, Depth> 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 25-yr Rainfall=6.31"

Area (sf)	CN	Description
10	98	Paved parking, HSG B
3,055	98	Paved parking, HSG D
3,065	98	Weighted Average
3,065		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.42		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.42"
0.6	98	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	198	Total, Increased to minimum Tc = 5.0 min			

Subcatchment EDA-30: Area Draining to Gutter Flow Along Falls Road

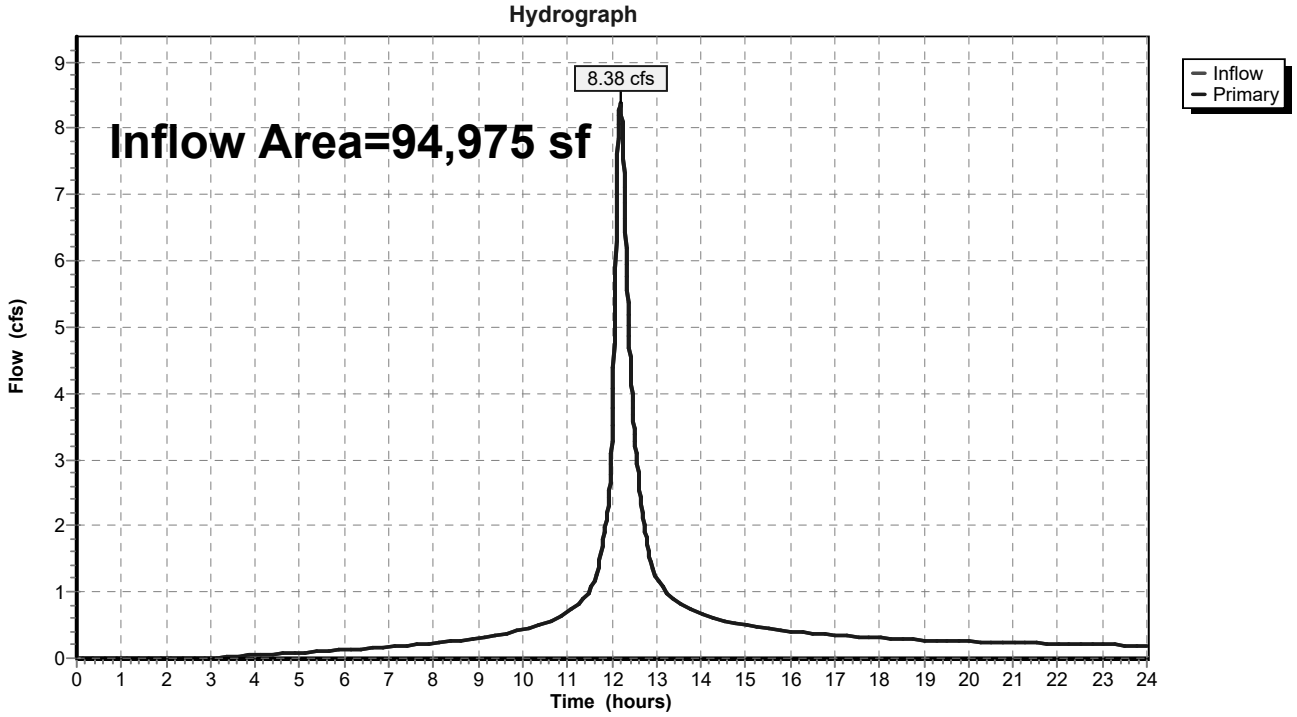


Summary for Link DP-1: Existing Drainage System

Inflow Area = 94,975 sf, 46.73% Impervious, Inflow Depth > 5.01" for 25-yr event
Inflow = 8.38 cfs @ 12.19 hrs, Volume= 39,671 cf
Primary = 8.38 cfs @ 12.19 hrs, Volume= 39,671 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-1: Existing Drainage System

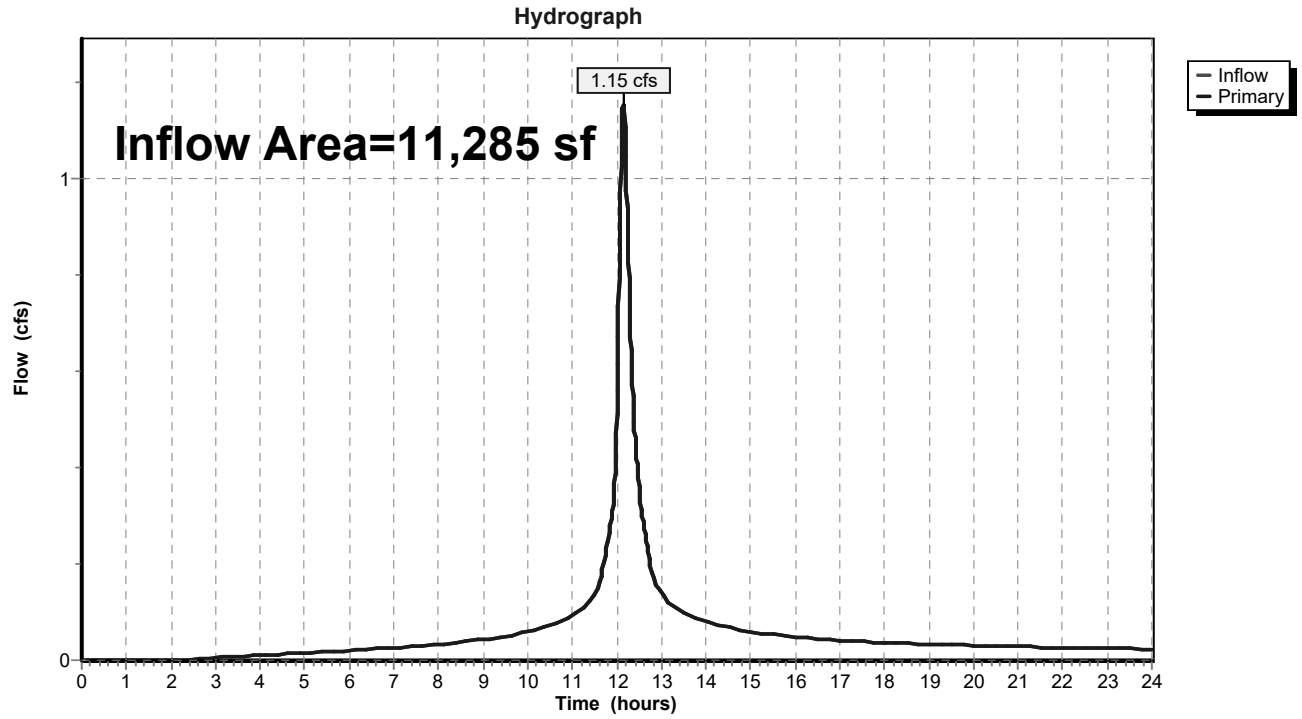


Summary for Link DP-2: Offsite Flow

Inflow Area = 11,285 sf, 16.53% Impervious, Inflow Depth > 5.36" for 25-yr event
Inflow = 1.15 cfs @ 12.14 hrs, Volume= 5,036 cf
Primary = 1.15 cfs @ 12.14 hrs, Volume= 5,036 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-2: Offsite Flow

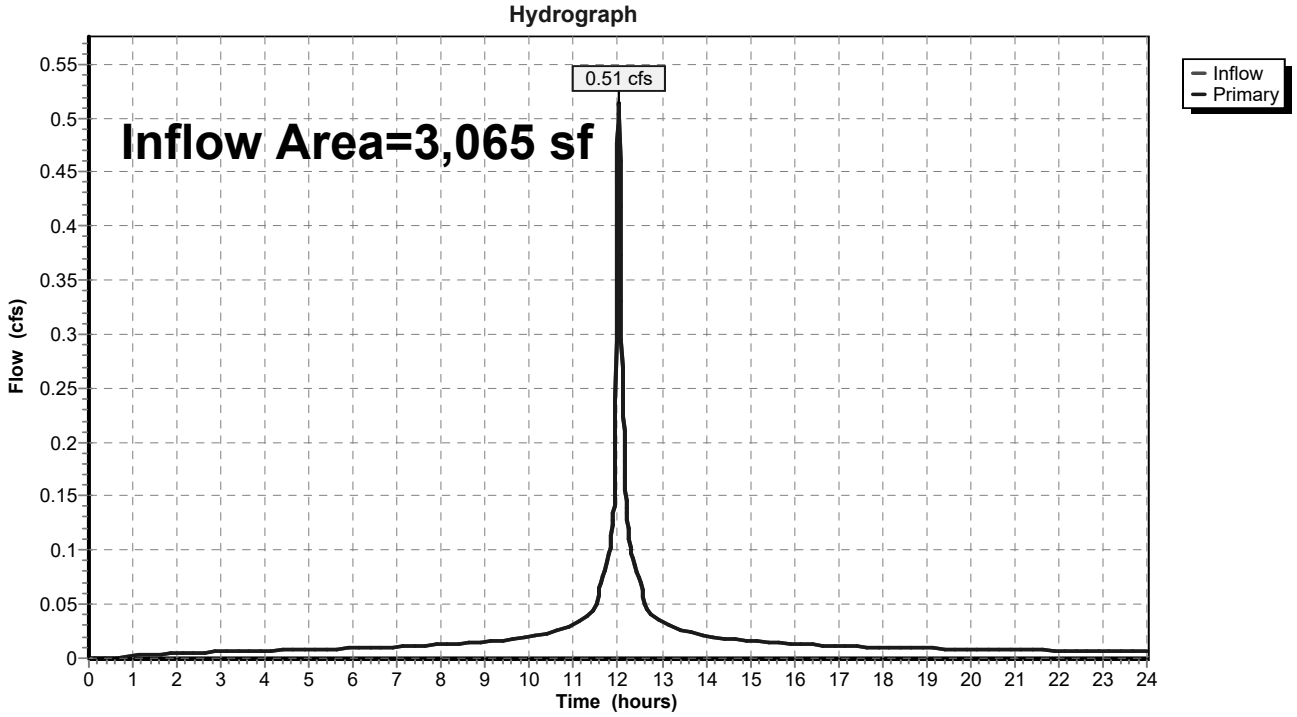


Summary for Link DP-3: Falls Road Gutter Flow

Inflow Area = 3,065 sf,100.00% Impervious, Inflow Depth > 6.07" for 25-yr event
Inflow = 0.51 cfs @ 12.03 hrs, Volume= 1,549 cf
Primary = 0.51 cfs @ 12.03 hrs, Volume= 1,549 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-3: Falls Road Gutter Flow



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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 Draining to Runoff Area=94,975 sf 46.73% Impervious Runoff Depth>6.68"
Flow Length=413' Tc=17.9 min CN=89 Runoff=10.98 cfs 52,838 cf

Subcatchment EDA-20: Area Draining Runoff Area=11,285 sf 16.53% Impervious Runoff Depth>7.04"
Flow Length=229' Tc=14.5 min CN=92 Runoff=1.49 cfs 6,619 cf

Subcatchment EDA-30: Area Draining to Runoff Area=3,065 sf 100.00% Impervious Runoff Depth>7.77"
Flow Length=198' Slope=0.0200 '/' Tc=5.0 min CN=98 Runoff=0.65 cfs 1,985 cf

Link DP-1: Existing Drainage System Inflow=10.98 cfs 52,838 cf
Primary=10.98 cfs 52,838 cf

Link DP-2: Offsite Flow Inflow=1.49 cfs 6,619 cf
Primary=1.49 cfs 6,619 cf

Link DP-3: Falls Road Gutter Flow Inflow=0.65 cfs 1,985 cf
Primary=0.65 cfs 1,985 cf

Total Runoff Area = 109,325 sf Runoff Volume = 61,442 cf Average Runoff Depth = 6.74"
54.90% Pervious = 60,015 sf 45.10% Impervious = 49,310 sf

Summary for Subcatchment EDA-10: Area Draining to Existing Stormwater Drainage System

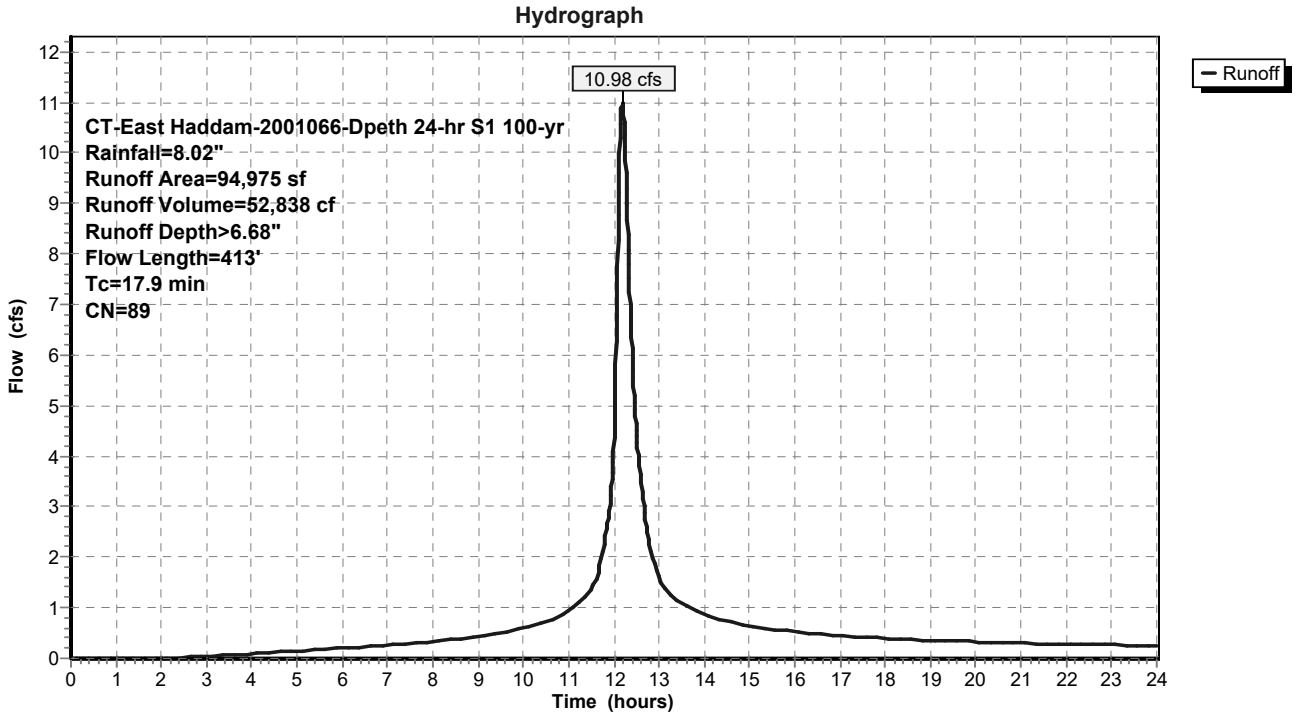
Runoff = 10.98 cfs @ 12.19 hrs, Volume= 52,838 cf, Depth> 6.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 100-yr Rainfall=8.02"

Area (sf)	CN	Description
6,160	98	Paved parking, HSG B
17,975	69	50-75% Grass cover, Fair, HSG B
38,220	98	Paved parking, HSG D
7,200	96	Gravel surface, HSG D
24,180	84	50-75% Grass cover, Fair, HSG D
1,240	79	Woods, Fair, HSG D
94,975	89	Weighted Average
50,595		53.27% Pervious Area
44,380		46.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	100	0.0150	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
1.1	55	0.0150	0.86		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.1	223	0.0300	3.52		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	35	0.0050	3.21	2.52	**Pipe Channel, RCP_Round 12"** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
17.9	413	Total			

Subcatchment EDA-10: Area Draining to Existing Stormwater Drainage System



Summary for Subcatchment EDA-20: Area Draining Offsite Through Existing Abutting Rear Paved Drive

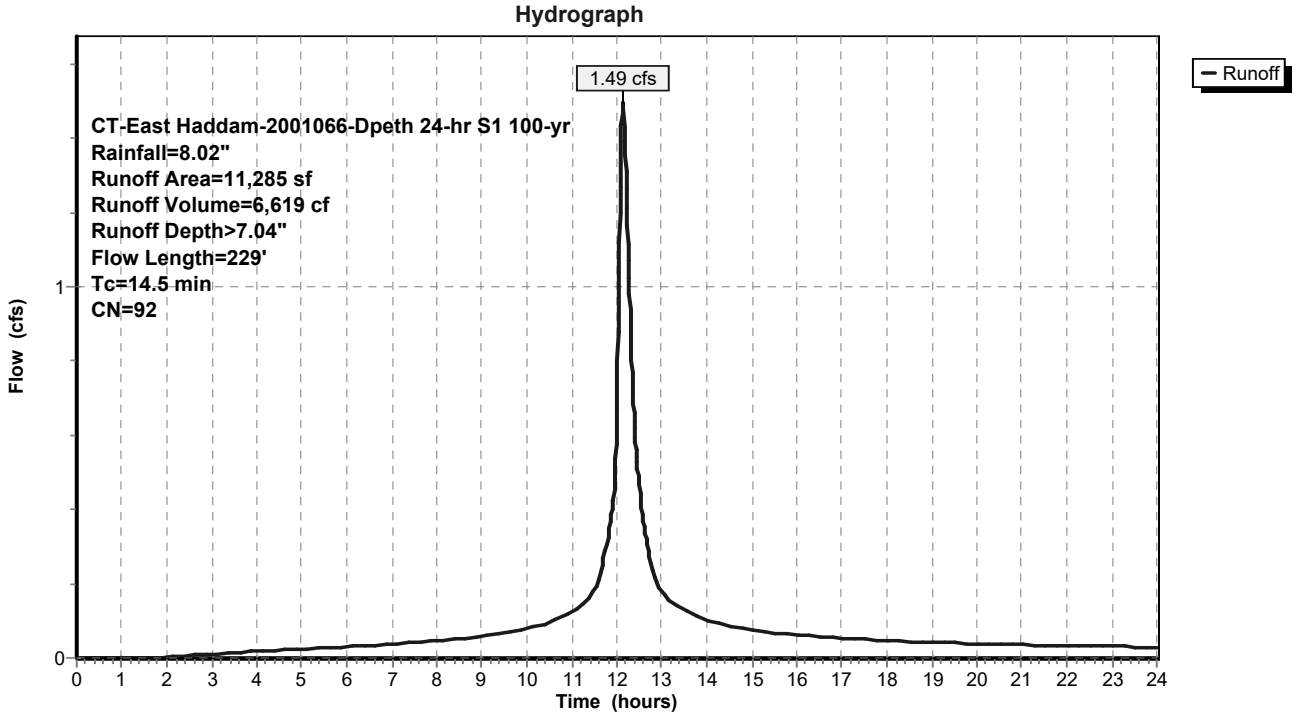
Runoff = 1.49 cfs @ 12.14 hrs, Volume= 6,619 cf, Depth> 7.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 100-yr Rainfall=8.02"

Area (sf)	CN	Description
1,865	98	Paved parking, HSG D
5,590	96	Gravel surface, HSG D
3,830	84	50-75% Grass cover, Fair, HSG D
11,285	92	Weighted Average
9,420		83.47% Pervious Area
1,865		16.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0200	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
0.3	16	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	113	0.0580	4.89		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.5	229	Total			

Subcatchment EDA-20: Area Draining Offsite Through Existing Abutting Rear Paved Driveway



Summary for Subcatchment EDA-30: Area Draining to Gutter Flow Along Falls Road

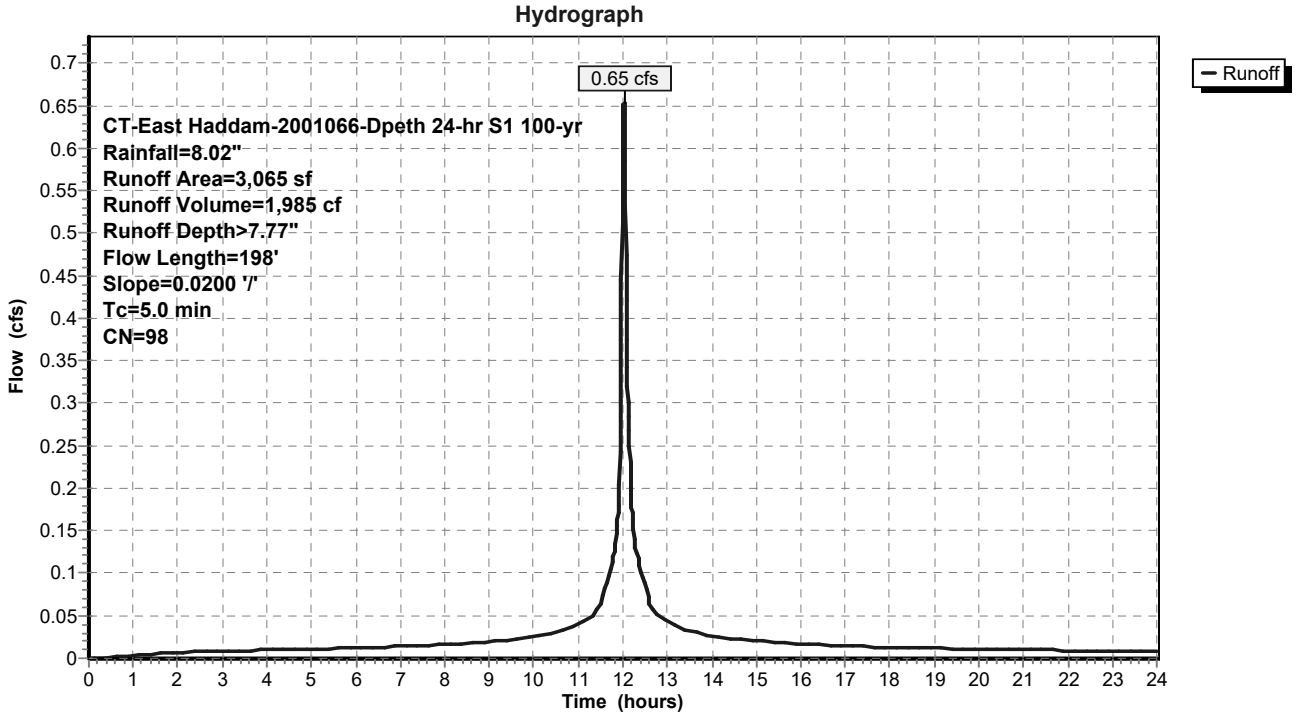
Runoff = 0.65 cfs @ 12.03 hrs, Volume= 1,985 cf, Depth> 7.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 100-yr Rainfall=8.02"

Area (sf)	CN	Description
10	98	Paved parking, HSG B
3,055	98	Paved parking, HSG D
3,065	98	Weighted Average
3,065		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.42		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.42"
0.6	98	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	198	Total, Increased to minimum Tc = 5.0 min			

Subcatchment EDA-30: Area Draining to Gutter Flow Along Falls Road

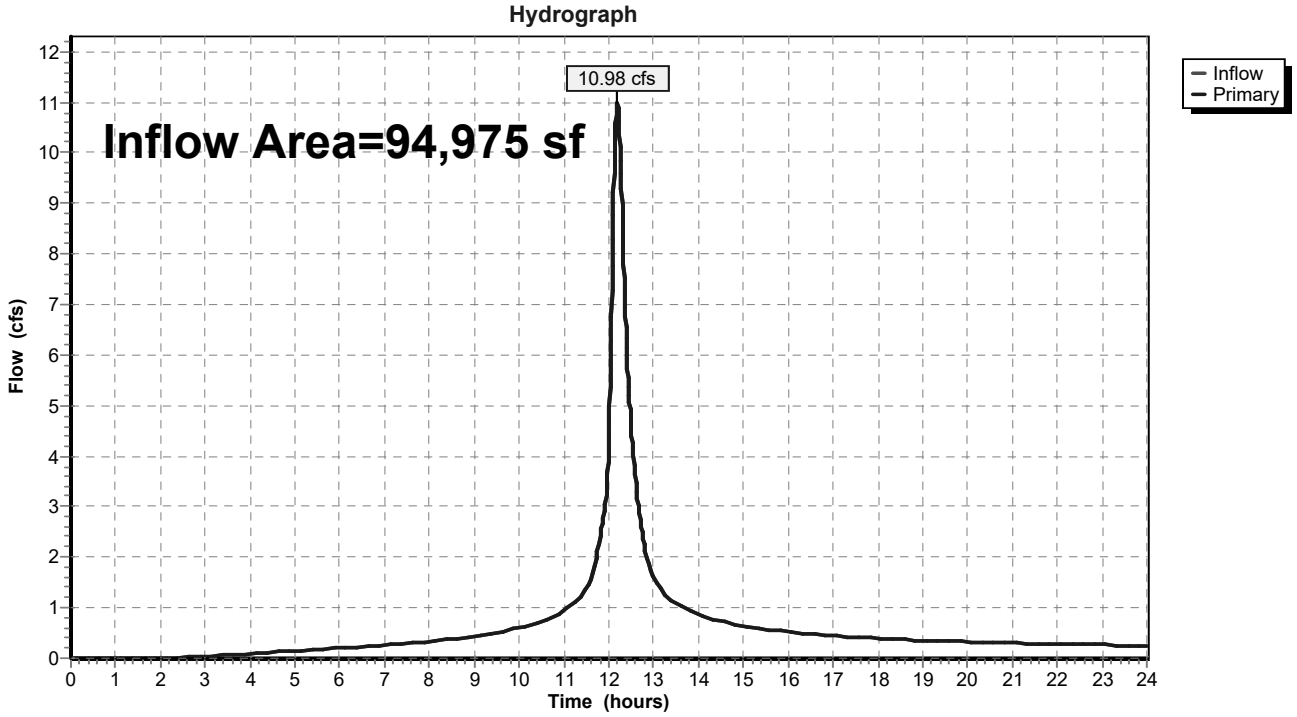


Summary for Link DP-1: Existing Drainage System

Inflow Area = 94,975 sf, 46.73% Impervious, Inflow Depth > 6.68" for 100-yr event
Inflow = 10.98 cfs @ 12.19 hrs, Volume= 52,838 cf
Primary = 10.98 cfs @ 12.19 hrs, Volume= 52,838 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-1: Existing Drainage System

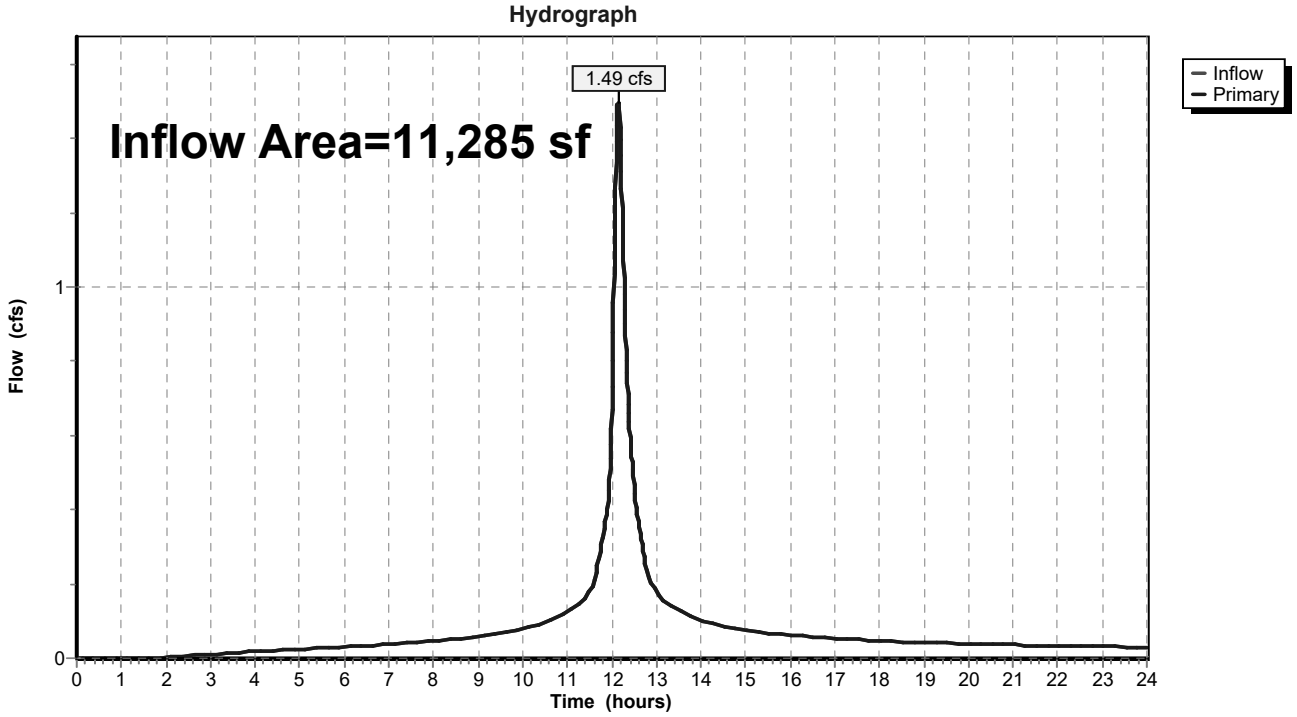


Summary for Link DP-2: Offsite Flow

Inflow Area = 11,285 sf, 16.53% Impervious, Inflow Depth > 7.04" for 100-yr event
Inflow = 1.49 cfs @ 12.14 hrs, Volume= 6,619 cf
Primary = 1.49 cfs @ 12.14 hrs, Volume= 6,619 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-2: Offsite Flow

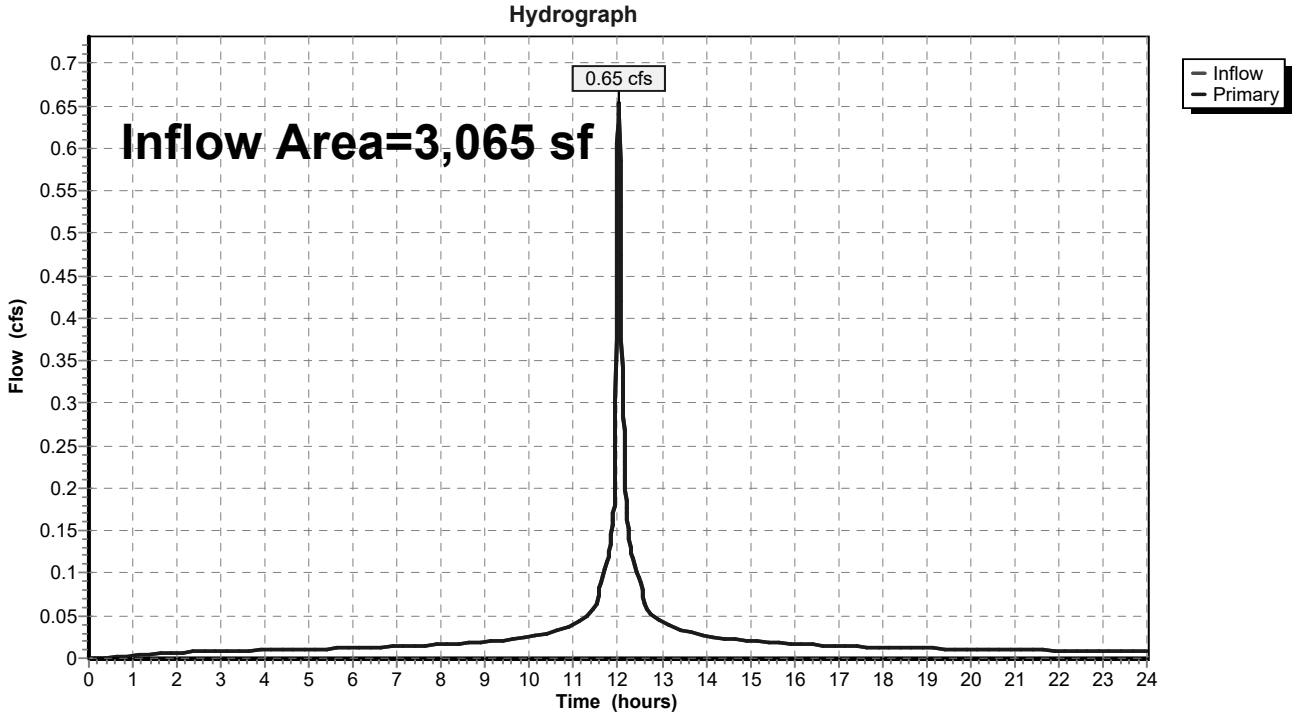


Summary for Link DP-3: Falls Road Gutter Flow

Inflow Area = 3,065 sf,100.00% Impervious, Inflow Depth > 7.77" for 100-yr event
Inflow = 0.65 cfs @ 12.03 hrs, Volume= 1,985 cf
Primary = 0.65 cfs @ 12.03 hrs, Volume= 1,985 cf, Atten= 0%, Lag= 0.0 min

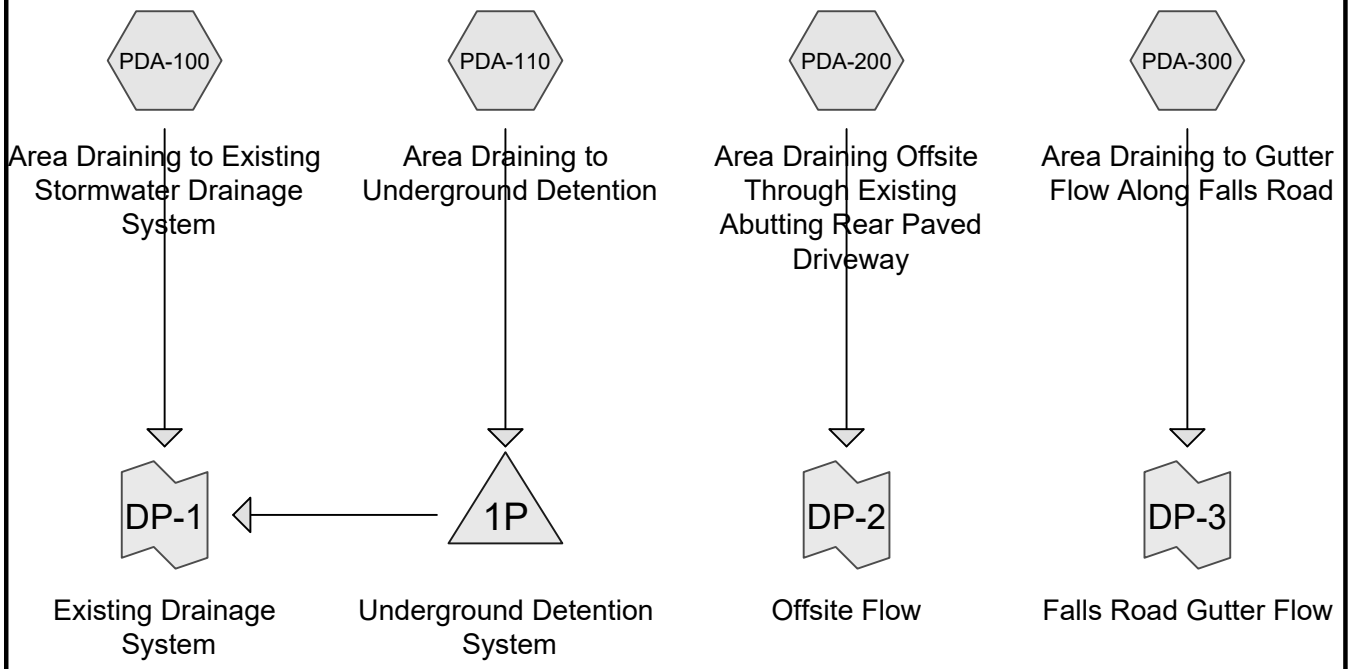
Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-3: Falls Road Gutter Flow



APPENDIX C

POST-DEVELOPMENT HYDROLOGY



Subcat Reach Pond Link

Routing Diagram for C-DAT-2001066-PROPOSED_HYDROLOGY
Prepared by {enter your company name here}, Printed 2/2/2021
HydroCAD® 10.00-25 s/n 01334 © 2019 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
17,975	69	50-75% Grass cover, Fair, HSG B (PDA-100)
36,015	84	50-75% Grass cover, Fair, HSG D (PDA-100, PDA-200)
7,955	96	Gravel surface, HSG D (PDA-100, PDA-200)
6,170	98	Paved parking, HSG B (PDA-100, PDA-300)
39,970	98	Paved parking, HSG D (PDA-100, PDA-110, PDA-200, PDA-300)
1,240	79	Woods, Fair, HSG D (PDA-100)
109,325	**88**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
24,145	HSG B	PDA-100, PDA-300
0	HSG C	
85,180	HSG D	PDA-100, PDA-110, PDA-200, PDA-300
0	Other	
109,325		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Su Nu
0	17,975	0	36,015	0	53,990	50-75% Grass cover, Fair	
0	0	0	7,955	0	7,955	Gravel surface	
0	6,170	0	39,970	0	46,140	Paved parking	
0	0	0	1,240	0	1,240	Woods, Fair	
0	**24,145**	**0**	**85,180**	**0**	**109,325**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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-100: Area Draining to Runoff Area=86,765 sf 36.39% Impervious Runoff Depth>2.02"
Flow Length=545' Tc=17.4 min CN=86 Runoff=3.24 cfs 14,580 cf

Subcatchment PDA-110: Area Draining to Runoff Area=9,100 sf 100.00% Impervious Runoff Depth>3.18"
Tc=5.0 min CN=98 Runoff=0.82 cfs 2,414 cf

Subcatchment PDA-200: Area Draining Runoff Area=10,395 sf 23.14% Impervious Runoff Depth>2.65"
Flow Length=229' Tc=14.5 min CN=93 Runoff=0.54 cfs 2,293 cf

Subcatchment PDA-300: Area Draining to Runoff Area=3,065 sf 100.00% Impervious Runoff Depth>3.18"
Flow Length=198' Slope=0.0200 '/' Tc=5.0 min CN=98 Runoff=0.28 cfs 813 cf

Pond 1P: Underground Detention System Peak Elev=388.96' Storage=1,791 cf Inflow=0.82 cfs 2,414 cf
Discarded=0.01 cfs 623 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 623 cf

Link DP-1: Existing Drainage System Inflow=3.24 cfs 14,580 cf
Primary=3.24 cfs 14,580 cf

Link DP-2: Offsite Flow Inflow=0.54 cfs 2,293 cf
Primary=0.54 cfs 2,293 cf

Link DP-3: Falls Road Gutter Flow Inflow=0.28 cfs 813 cf
Primary=0.28 cfs 813 cf

Total Runoff Area = 109,325 sf Runoff Volume = 20,100 cf Average Runoff Depth = 2.21"
57.80% Pervious = 63,185 sf 42.20% Impervious = 46,140 sf

Summary for Subcatchment PDA-100: Area Draining to Existing Stormwater Drainage System

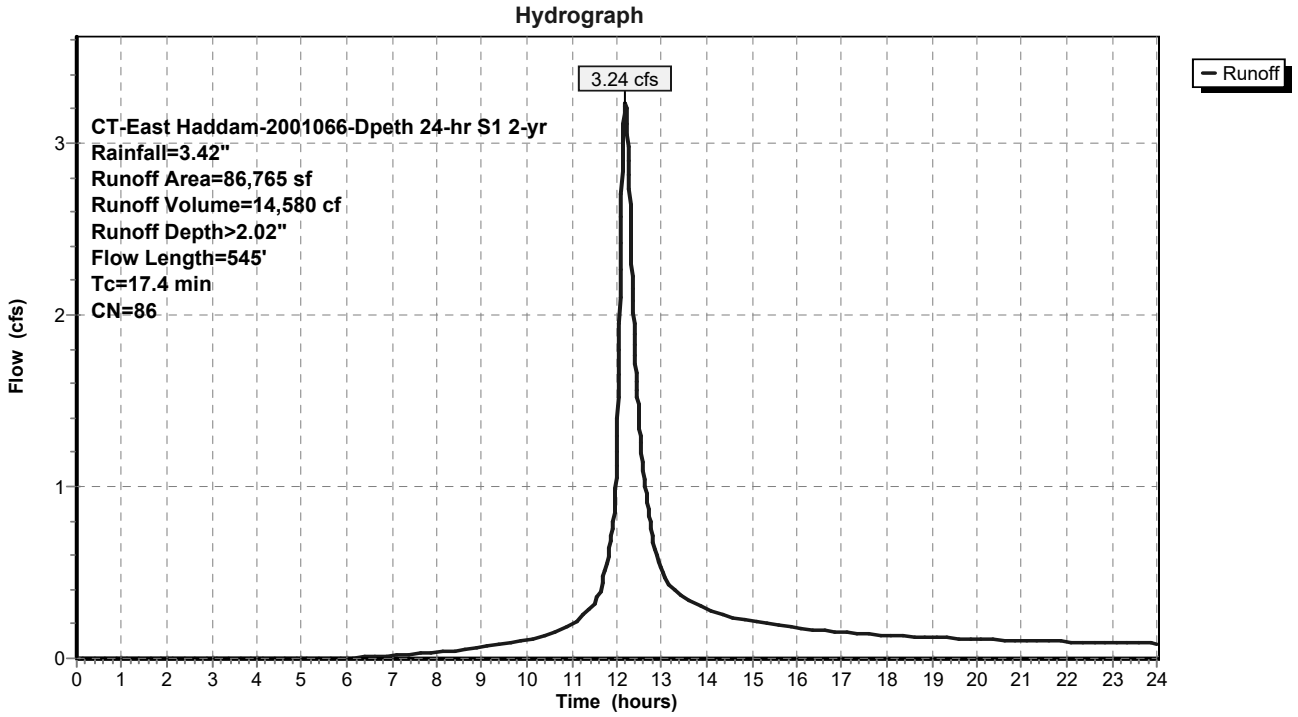
Runoff = 3.24 cfs @ 12.19 hrs, Volume= 14,580 cf, Depth> 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 2-yr Rainfall=3.42"

Area (sf)	CN	Description
6,160	98	Paved parking, HSG B
17,975	69	50-75% Grass cover, Fair, HSG B
25,410	98	Paved parking, HSG D
3,055	96	Gravel surface, HSG D
32,925	84	50-75% Grass cover, Fair, HSG D
1,240	79	Woods, Fair, HSG D
86,765	86	Weighted Average
55,195		63.61% Pervious Area
31,570		36.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	100	0.0150	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
0.4	40	0.0500	1.57		**Shallow Concentrated Flow, short hill to loading area** Short Grass Pasture Kv= 7.0 fps
0.3	55	0.0300	3.52		**Shallow Concentrated Flow, across loading area to curb gutter f** Paved Kv= 20.3 fps
0.3	62	0.0250	3.21		**Shallow Concentrated Flow, gutter flow along curb** Paved Kv= 20.3 fps
0.1	27	0.0400	4.06		**Shallow Concentrated Flow, gutter flow into CB** Paved Kv= 20.3 fps
0.3	87	0.0050	4.17	3.28	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.1	16	0.0050	4.84	5.94	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
0.0	21	0.1050	19.11	15.01	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.1	71	0.0370	11.34	8.91	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.1	40	0.0500	13.19	10.36	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.2	26	0.0010	1.86	1.46	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
17.4	545	Total			

Subcatchment PDA-100: Area Draining to Existing Stormwater Drainage System



Summary for Subcatchment PDA-110: Area Draining to Underground Detention

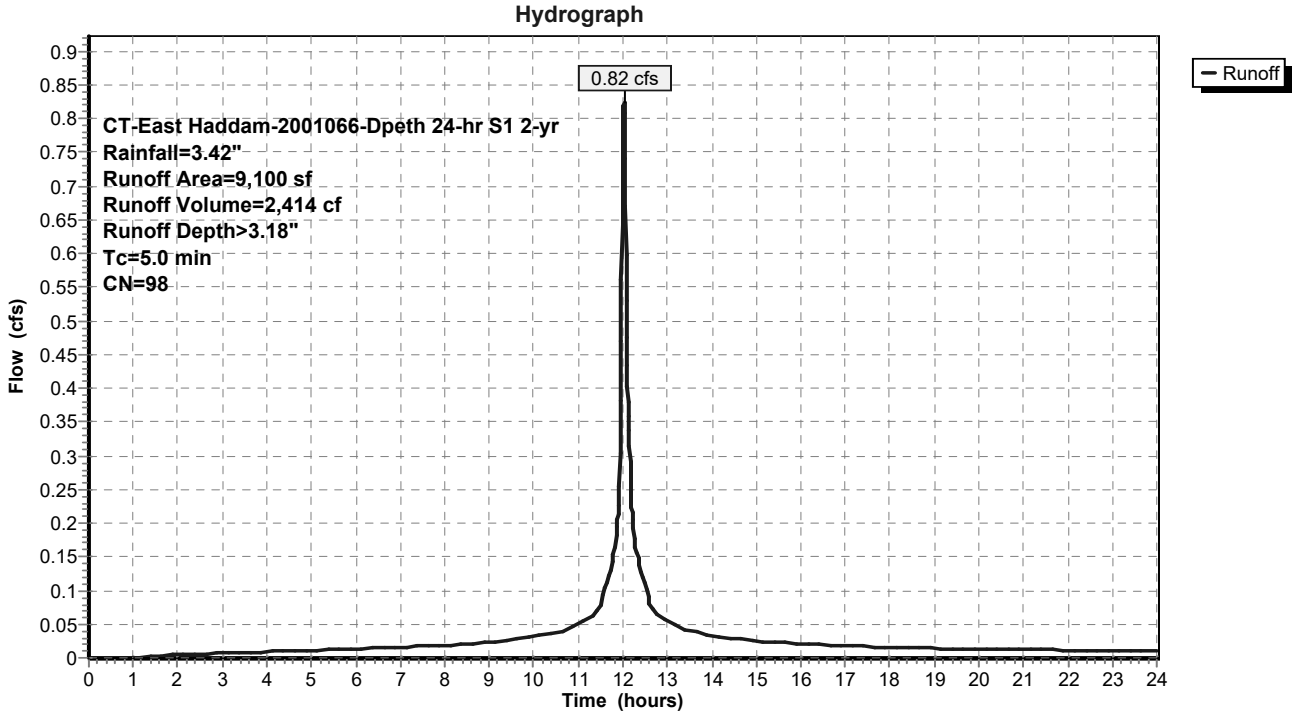
Runoff = 0.82 cfs @ 12.03 hrs, Volume= 2,414 cf, Depth> 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 2-yr Rainfall=3.42"

Area (sf)	CN	Description
0	98	Paved parking, HSG B
0	69	50-75% Grass cover, Fair, HSG B
9,100	98	Paved parking, HSG D
0	96	Gravel surface, HSG D
0	84	50-75% Grass cover, Fair, HSG D
0	79	Woods, Fair, HSG D
9,100	98	Weighted Average
9,100		100.00% Impervious Area

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

Subcatchment PDA-110: Area Draining to Underground Detention



Summary for Subcatchment PDA-200: Area Draining Offsite Through Existing Abutting Rear Paved Drive

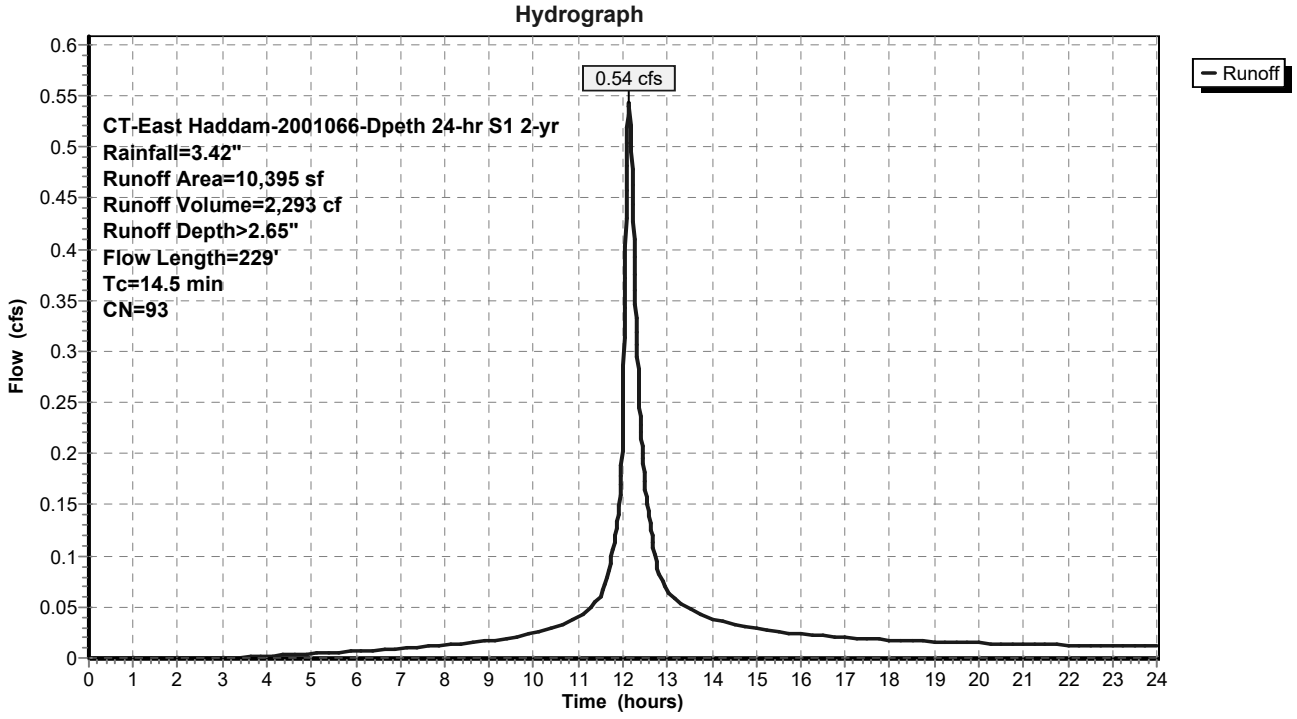
Runoff = 0.54 cfs @ 12.14 hrs, Volume= 2,293 cf, Depth> 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 2-yr Rainfall=3.42"

Area (sf)	CN	Description
2,405	98	Paved parking, HSG D
4,900	96	Gravel surface, HSG D
3,090	84	50-75% Grass cover, Fair, HSG D
10,395	93	Weighted Average
7,990		76.86% Pervious Area
2,405		23.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0200	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
0.3	16	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	113	0.0580	4.89		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.5	229	Total			

Subcatchment PDA-200: Area Draining Offsite Through Existing Abutting Rear Paved Driveway



Summary for Subcatchment PDA-300: Area Draining to Gutter Flow Along Falls Road

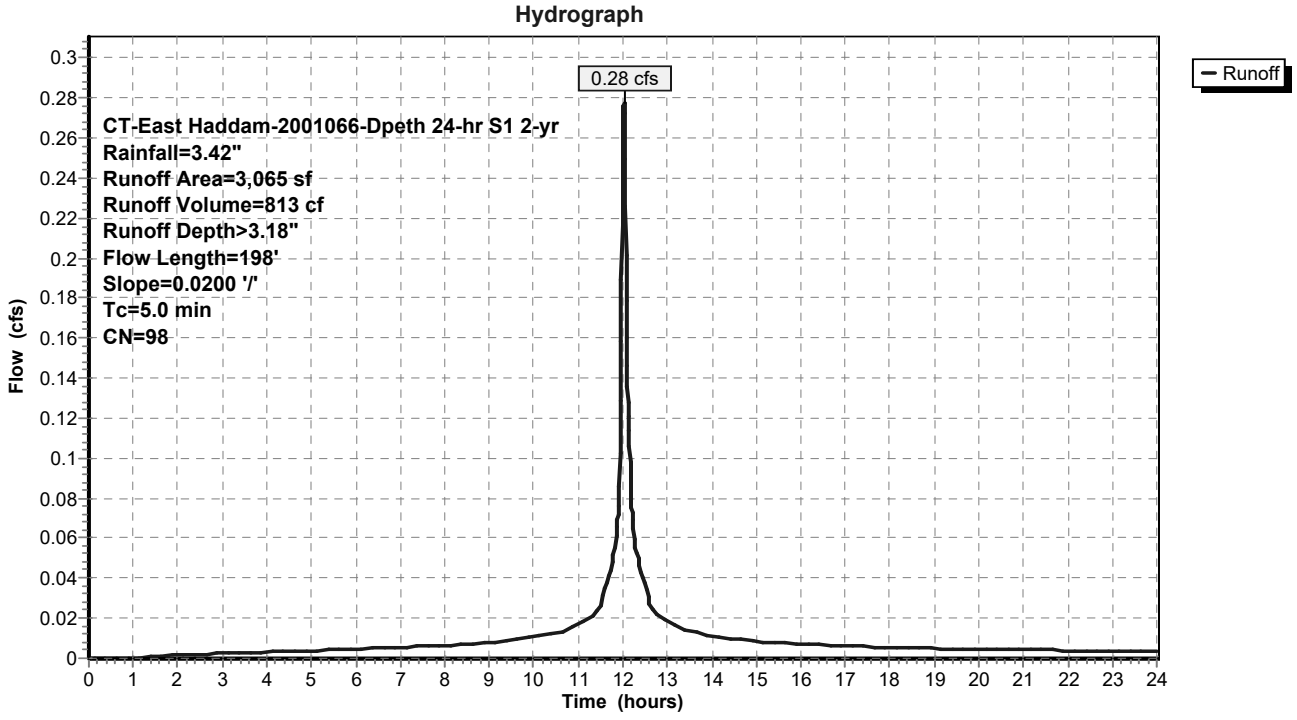
Runoff = 0.28 cfs @ 12.03 hrs, Volume= 813 cf, Depth> 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 2-yr Rainfall=3.42"

Area (sf)	CN	Description
10	98	Paved parking, HSG B
3,055	98	Paved parking, HSG D
3,065	98	Weighted Average
3,065		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.42		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.42"
0.6	98	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	198	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PDA-300: Area Draining to Gutter Flow Along Falls Road



Summary for Pond 1P: Underground Detention System

Inflow Area = 9,100 sf,100.00% Impervious, Inflow Depth > 3.18" for 2-yr event
Inflow = 0.82 cfs @ 12.03 hrs, Volume= 2,414 cf
Outflow = 0.01 cfs @ 4.09 hrs, Volume= 623 cf, Atten= 99%, Lag= 0.0 min
Discarded = 0.01 cfs @ 4.09 hrs, Volume= 623 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 388.96' @ 24.00 hrs Surf.Area= 697 sf Storage= 1,791 cf

Plug-Flow detention time= 310.5 min calculated for 623 cf (26% of inflow)
Center-of-Mass det. time= 39.9 min (795.8 - 755.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	385.25'	1,216 cf	**10.33'W x 67.49'L x 6.75'H Field A** 4,708 cf Overall - 1,669 cf Embedded = 3,039 cf x 40.0% Voids
#2A	386.00'	1,669 cf	**ADS_StormTech MC-4500 +Cap** x 15 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf
		2,884 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	389.37'	**8.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 389.37' / 389.32' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Discarded	385.25'	**0.500 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 4.09 hrs HW=385.32' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=385.25' (Free Discharge)
↑—**1=Culvert** (Controls 0.00 cfs)

Pond 1P: Underground Detention System - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf

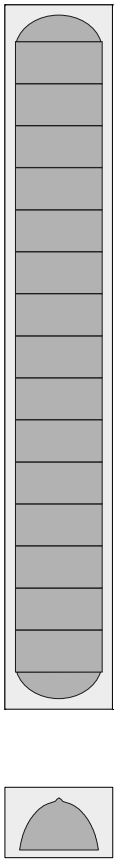
15 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 65.49' Row Length +12.0" End Stone x 2 = 67.49' Base Length
1 Rows x 100.0" Wide + 12.0" Side Stone x 2 = 10.33' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

15 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 1 Rows = 1,668.8 cf Chamber Storage

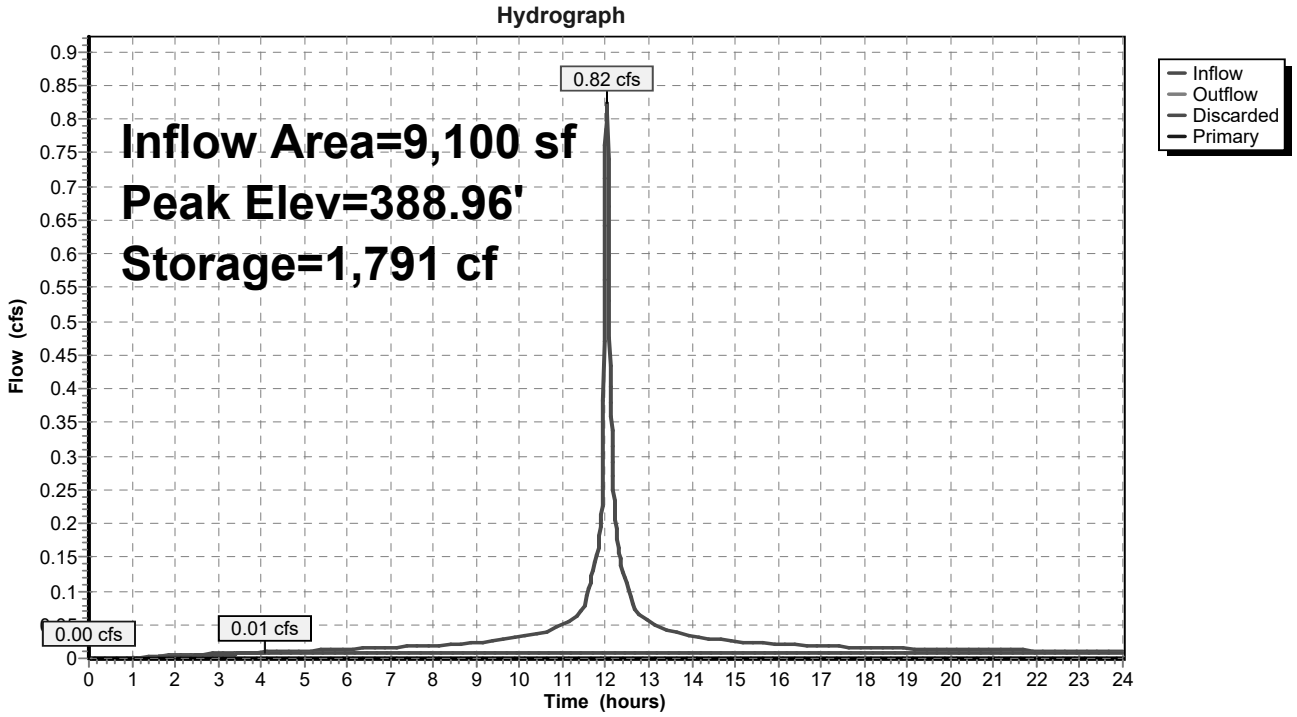
4,707.5 cf Field - 1,668.8 cf Chambers = 3,038.8 cf Stone x 40.0% Voids = 1,215.5 cf Stone Storage

Chamber Storage + Stone Storage = 2,884.3 cf = 0.066 af
Overall Storage Efficiency = 61.3%
Overall System Size = 67.49' x 10.33' x 6.75'

15 Chambers
174.4 cy Field
112.5 cy Stone



Pond 1P: Underground Detention System

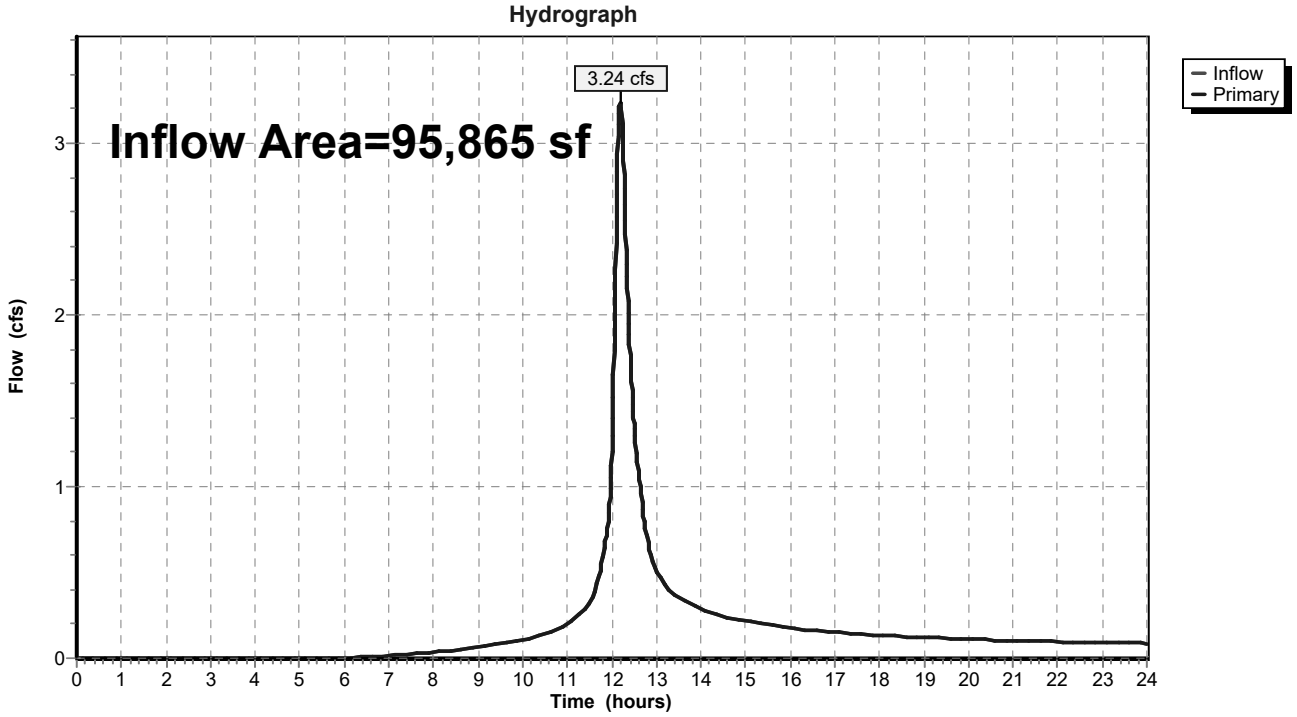


Summary for Link DP-1: Existing Drainage System

Inflow Area = 95,865 sf, 42.42% Impervious, Inflow Depth > 1.83" for 2-yr event
Inflow = 3.24 cfs @ 12.19 hrs, Volume= 14,580 cf
Primary = 3.24 cfs @ 12.19 hrs, Volume= 14,580 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-1: Existing Drainage System

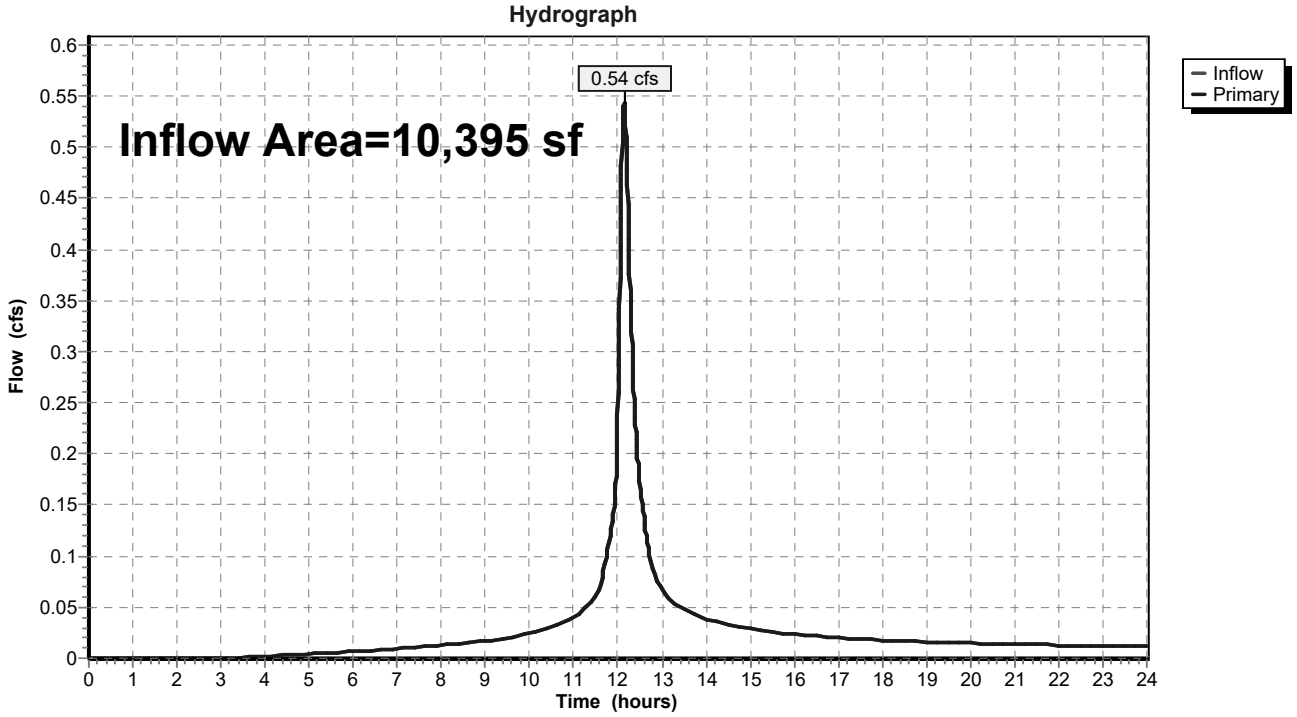


Summary for Link DP-2: Offsite Flow

Inflow Area = 10,395 sf, 23.14% Impervious, Inflow Depth > 2.65" for 2-yr event
Inflow = 0.54 cfs @ 12.14 hrs, Volume= 2,293 cf
Primary = 0.54 cfs @ 12.14 hrs, Volume= 2,293 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-2: Offsite Flow

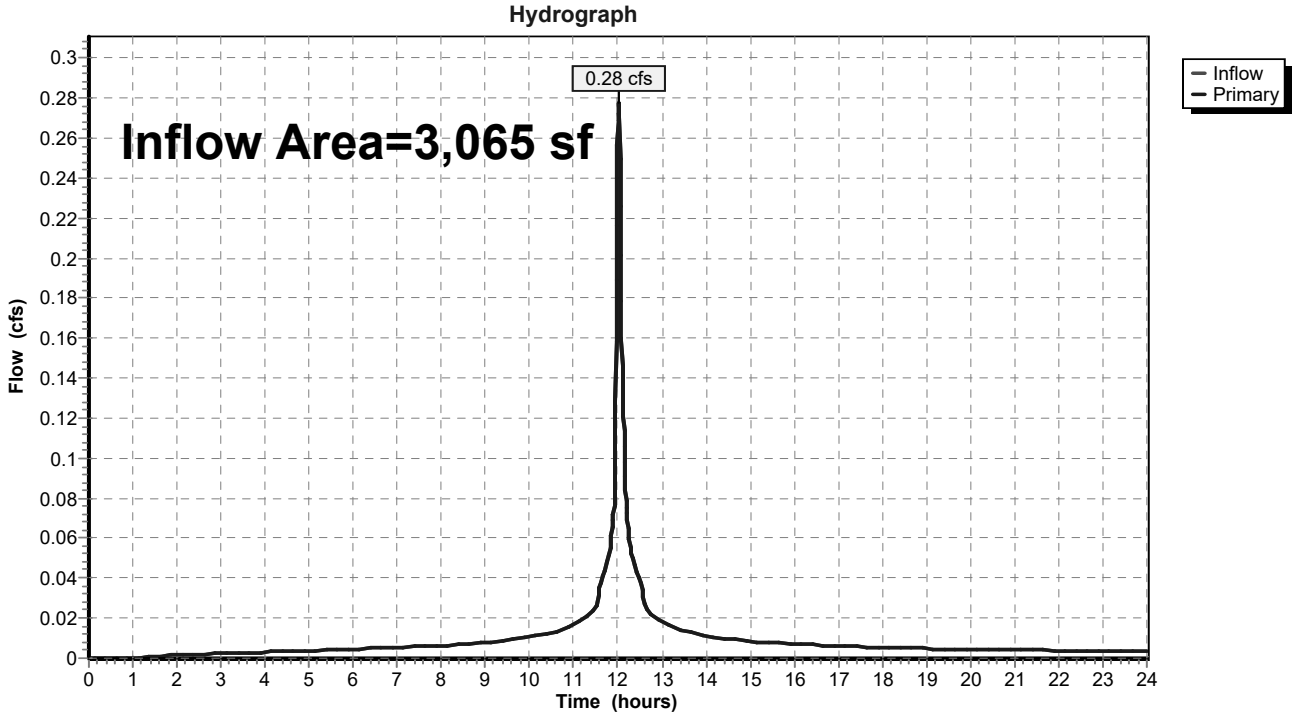


Summary for Link DP-3: Falls Road Gutter Flow

Inflow Area = 3,065 sf,100.00% Impervious, Inflow Depth > 3.18" for 2-yr event
Inflow = 0.28 cfs @ 12.03 hrs, Volume= 813 cf
Primary = 0.28 cfs @ 12.03 hrs, Volume= 813 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-3: Falls Road Gutter Flow



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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-100: Area Draining to Runoff Area=86,765 sf 36.39% Impervious Runoff Depth>3.64"
Flow Length=545' Tc=17.4 min CN=86 Runoff=5.75 cfs 26,288 cf

Subcatchment PDA-110: Area Draining to Runoff Area=9,100 sf 100.00% Impervious Runoff Depth>4.96"
Tc=5.0 min CN=98 Runoff=1.26 cfs 3,759 cf

Subcatchment PDA-200: Area Draining Runoff Area=10,395 sf 23.14% Impervious Runoff Depth>4.38"
Flow Length=229' Tc=14.5 min CN=93 Runoff=0.87 cfs 3,793 cf

Subcatchment PDA-300: Area Draining to Runoff Area=3,065 sf 100.00% Impervious Runoff Depth>4.96"
Flow Length=198' Slope=0.0200 '/' Tc=5.0 min CN=98 Runoff=0.42 cfs 1,266 cf

Pond 1P: Underground Detention System Peak Elev=389.60' Storage=2,091 cf Inflow=1.26 cfs 3,759 cf
Discarded=0.01 cfs 652 cf Primary=0.12 cfs 1,095 cf Outflow=0.13 cfs 1,748 cf

Link DP-1: Existing Drainage System Inflow=5.75 cfs 27,383 cf
Primary=5.75 cfs 27,383 cf

Link DP-2: Offsite Flow Inflow=0.87 cfs 3,793 cf
Primary=0.87 cfs 3,793 cf

Link DP-3: Falls Road Gutter Flow Inflow=0.42 cfs 1,266 cf
Primary=0.42 cfs 1,266 cf

Total Runoff Area = 109,325 sf Runoff Volume = 35,107 cf Average Runoff Depth = 3.85"
57.80% Pervious = 63,185 sf 42.20% Impervious = 46,140 sf

Summary for Subcatchment PDA-100: Area Draining to Existing Stormwater Drainage System

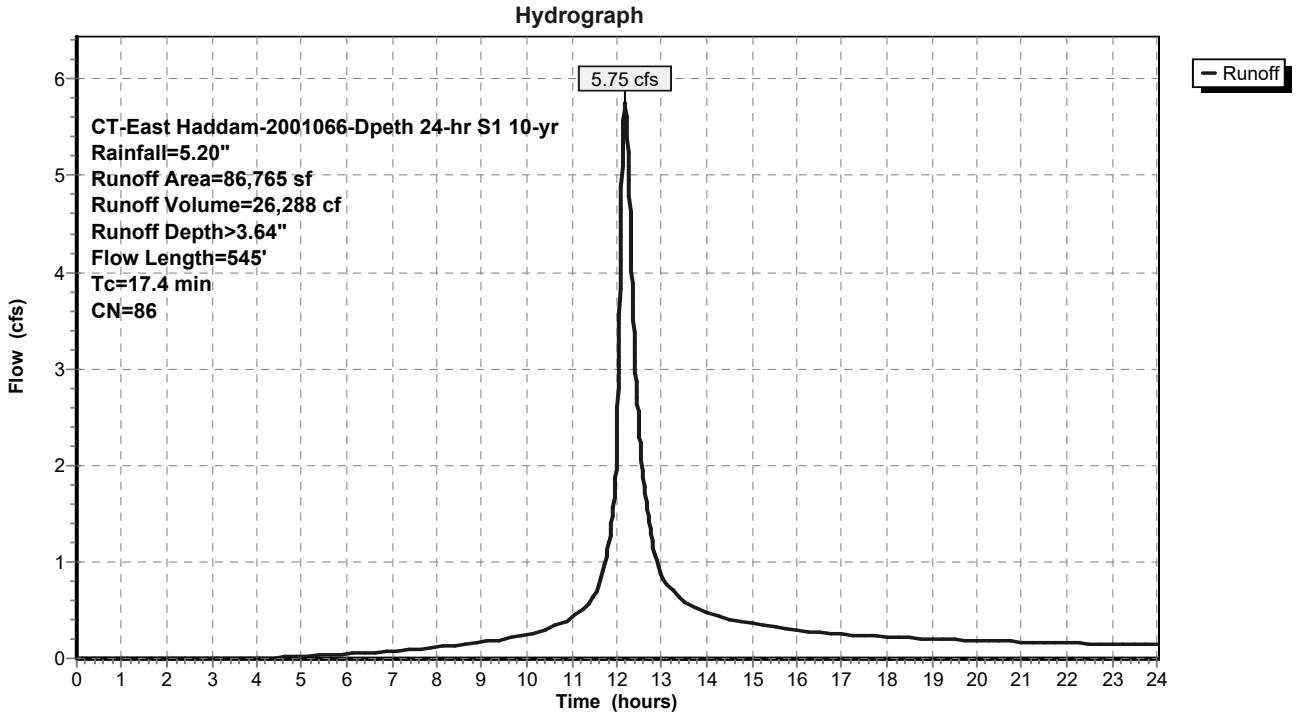
Runoff = 5.75 cfs @ 12.19 hrs, Volume= 26,288 cf, Depth> 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 10-yr Rainfall=5.20"

Area (sf)	CN	Description
6,160	98	Paved parking, HSG B
17,975	69	50-75% Grass cover, Fair, HSG B
25,410	98	Paved parking, HSG D
3,055	96	Gravel surface, HSG D
32,925	84	50-75% Grass cover, Fair, HSG D
1,240	79	Woods, Fair, HSG D
86,765	86	Weighted Average
55,195		63.61% Pervious Area
31,570		36.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	100	0.0150	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
0.4	40	0.0500	1.57		**Shallow Concentrated Flow, short hill to loading area** Short Grass Pasture Kv= 7.0 fps
0.3	55	0.0300	3.52		**Shallow Concentrated Flow, across loading area to curb gutter f** Paved Kv= 20.3 fps
0.3	62	0.0250	3.21		**Shallow Concentrated Flow, gutter flow along curb** Paved Kv= 20.3 fps
0.1	27	0.0400	4.06		**Shallow Concentrated Flow, gutter flow into CB** Paved Kv= 20.3 fps
0.3	87	0.0050	4.17	3.28	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.1	16	0.0050	4.84	5.94	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
0.0	21	0.1050	19.11	15.01	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.1	71	0.0370	11.34	8.91	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.1	40	0.0500	13.19	10.36	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.2	26	0.0010	1.86	1.46	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
17.4	545	Total			

Subcatchment PDA-100: Area Draining to Existing Stormwater Drainage System



Summary for Subcatchment PDA-110: Area Draining to Underground Detention

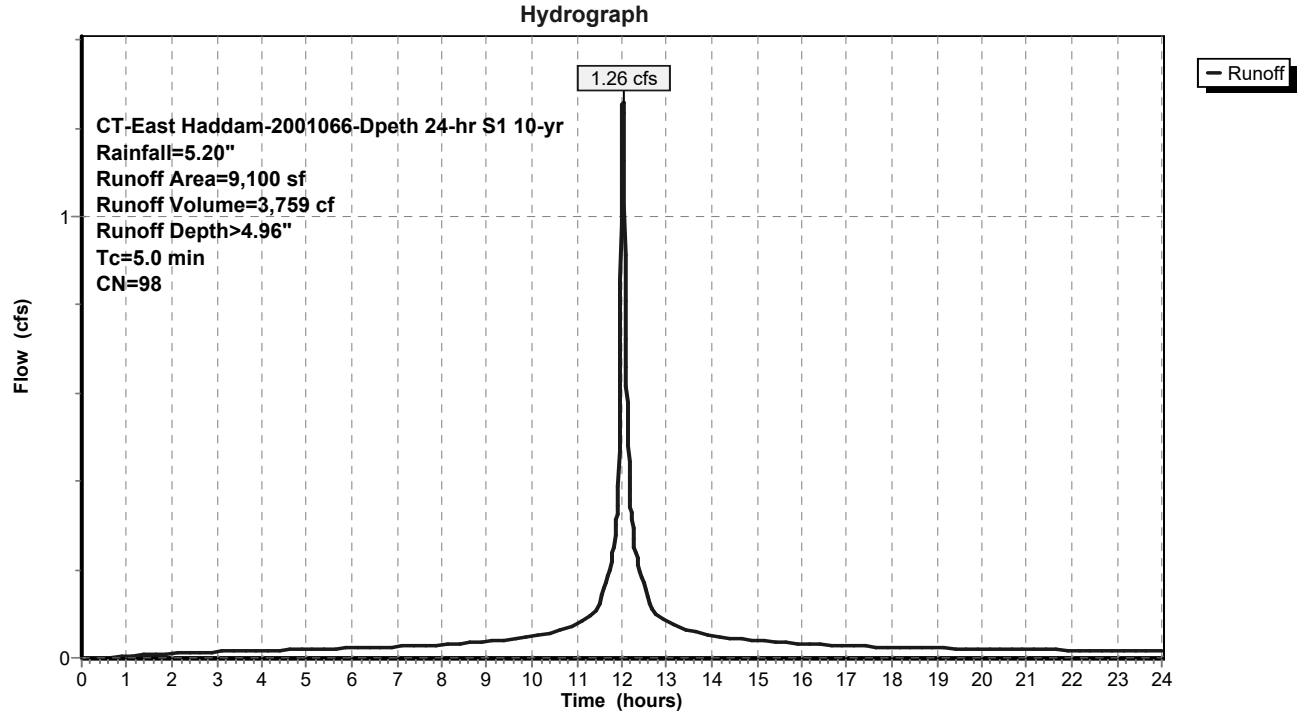
Runoff = 1.26 cfs @ 12.03 hrs, Volume= 3,759 cf, Depth> 4.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 10-yr Rainfall=5.20"

Area (sf)	CN	Description
0	98	Paved parking, HSG B
0	69	50-75% Grass cover, Fair, HSG B
9,100	98	Paved parking, HSG D
0	96	Gravel surface, HSG D
0	84	50-75% Grass cover, Fair, HSG D
0	79	Woods, Fair, HSG D
9,100	98	Weighted Average
9,100		100.00% Impervious Area

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

Subcatchment PDA-110: Area Draining to Underground Detention



Summary for Subcatchment PDA-200: Area Draining Offsite Through Existing Abutting Rear Paved Drive

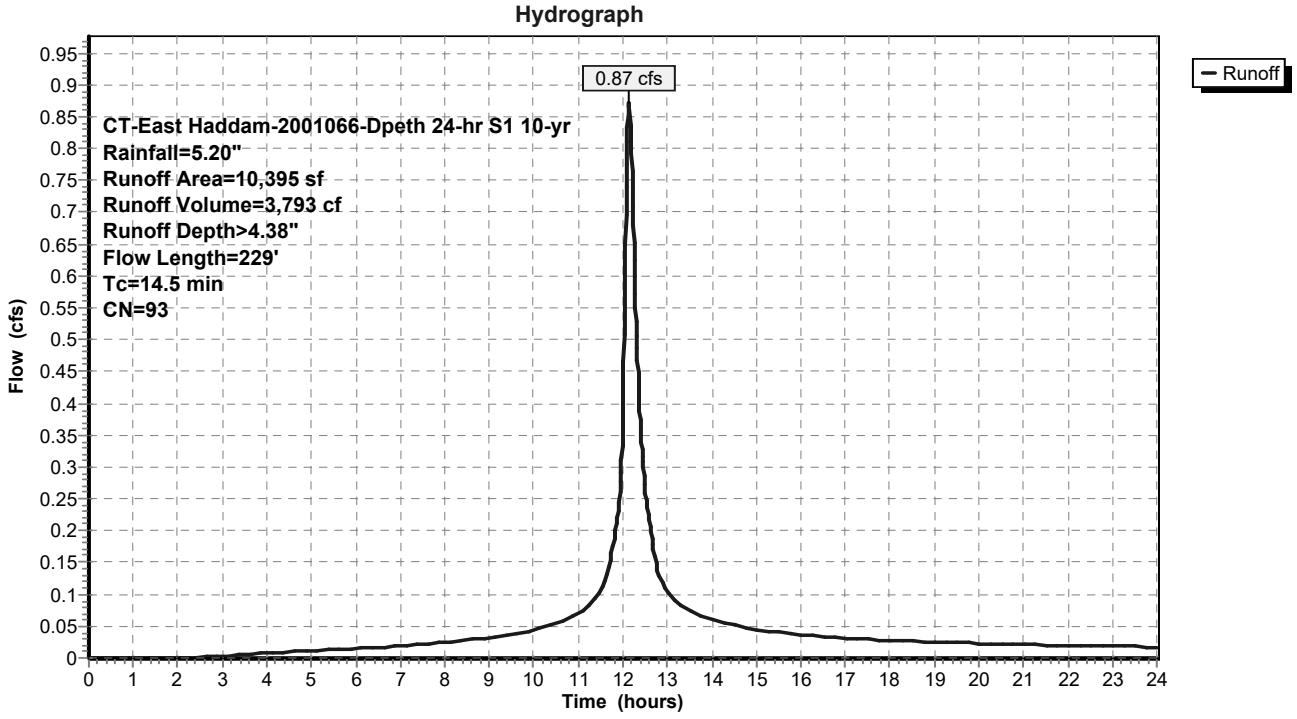
Runoff = 0.87 cfs @ 12.14 hrs, Volume= 3,793 cf, Depth> 4.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 10-yr Rainfall=5.20"

Area (sf)	CN	Description
2,405	98	Paved parking, HSG D
4,900	96	Gravel surface, HSG D
3,090	84	50-75% Grass cover, Fair, HSG D
10,395	93	Weighted Average
7,990		76.86% Pervious Area
2,405		23.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0200	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
0.3	16	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	113	0.0580	4.89		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.5	229	Total			

Subcatchment PDA-200: Area Draining Offsite Through Existing Abutting Rear Paved Driveway



Summary for Subcatchment PDA-300: Area Draining to Gutter Flow Along Falls Road

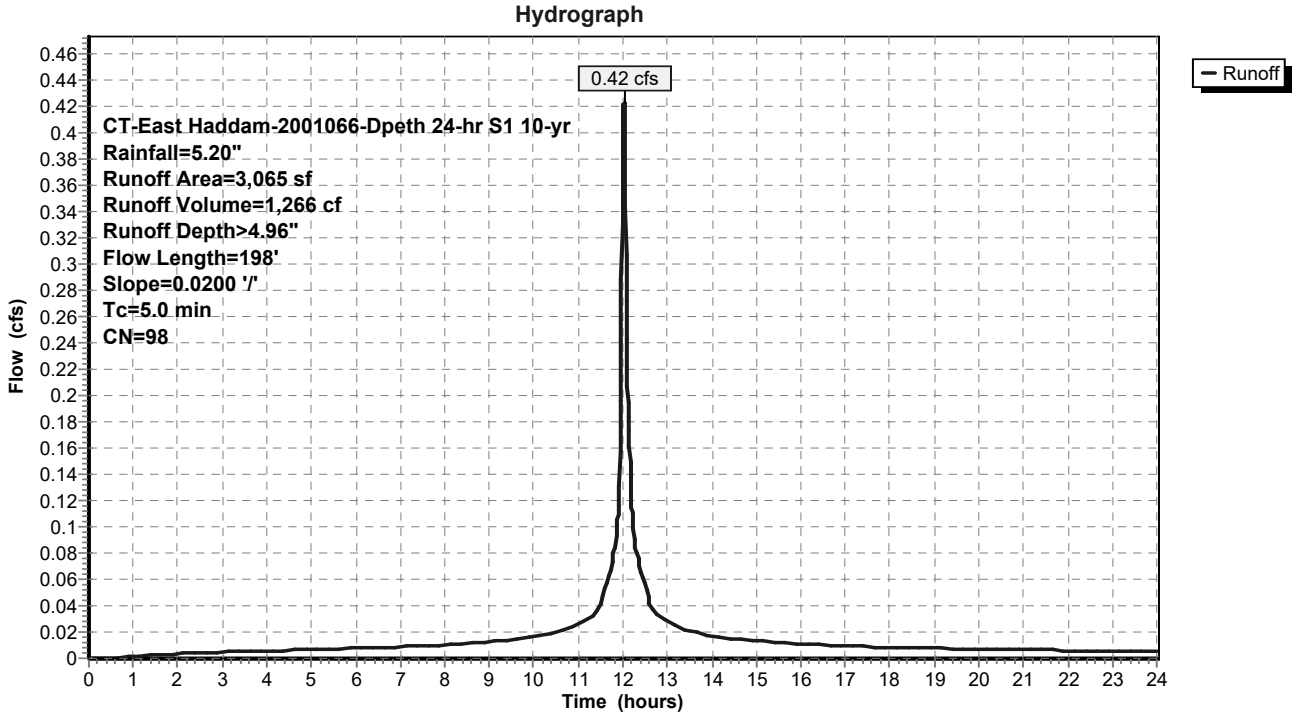
Runoff = 0.42 cfs @ 12.03 hrs, Volume= 1,266 cf, Depth> 4.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 10-yr Rainfall=5.20"

Area (sf)	CN	Description
10	98	Paved parking, HSG B
3,055	98	Paved parking, HSG D
3,065	98	Weighted Average
3,065		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.42		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.42"
0.6	98	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	198	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PDA-300: Area Draining to Gutter Flow Along Falls Road



Summary for Pond 1P: Underground Detention System

Inflow Area = 9,100 sf,100.00% Impervious, Inflow Depth > 4.96" for 10-yr event
Inflow = 1.26 cfs @ 12.03 hrs, Volume= 3,759 cf
Outflow = 0.13 cfs @ 12.59 hrs, Volume= 1,748 cf, Atten= 90%, Lag= 33.8 min
Discarded = 0.01 cfs @ 2.31 hrs, Volume= 652 cf
Primary = 0.12 cfs @ 12.59 hrs, Volume= 1,095 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 389.60' @ 12.59 hrs Surf.Area= 697 sf Storage= 2,091 cf

Plug-Flow detention time= 309.0 min calculated for 1,748 cf (46% of inflow)
Center-of-Mass det. time= 131.4 min (878.3 - 746.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	385.25'	1,216 cf	**10.33'W x 67.49'L x 6.75'H Field A** 4,708 cf Overall - 1,669 cf Embedded = 3,039 cf x 40.0% Voids
#2A	386.00'	1,669 cf	**ADS_StormTech MC-4500 +Cap** x 15 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf
		2,884 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	389.37'	**8.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 389.37' / 389.32' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Discarded	385.25'	**0.500 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 2.31 hrs HW=385.32' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.12 cfs @ 12.59 hrs HW=389.60' (Free Discharge)
1=Culvert (Barrel Controls 0.12 cfs @ 1.66 fps)

Pond 1P: Underground Detention System - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf

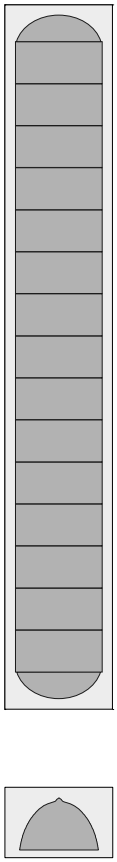
15 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 65.49' Row Length +12.0" End Stone x 2 = 67.49' Base Length
1 Rows x 100.0" Wide + 12.0" Side Stone x 2 = 10.33' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

15 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 1 Rows = 1,668.8 cf Chamber Storage

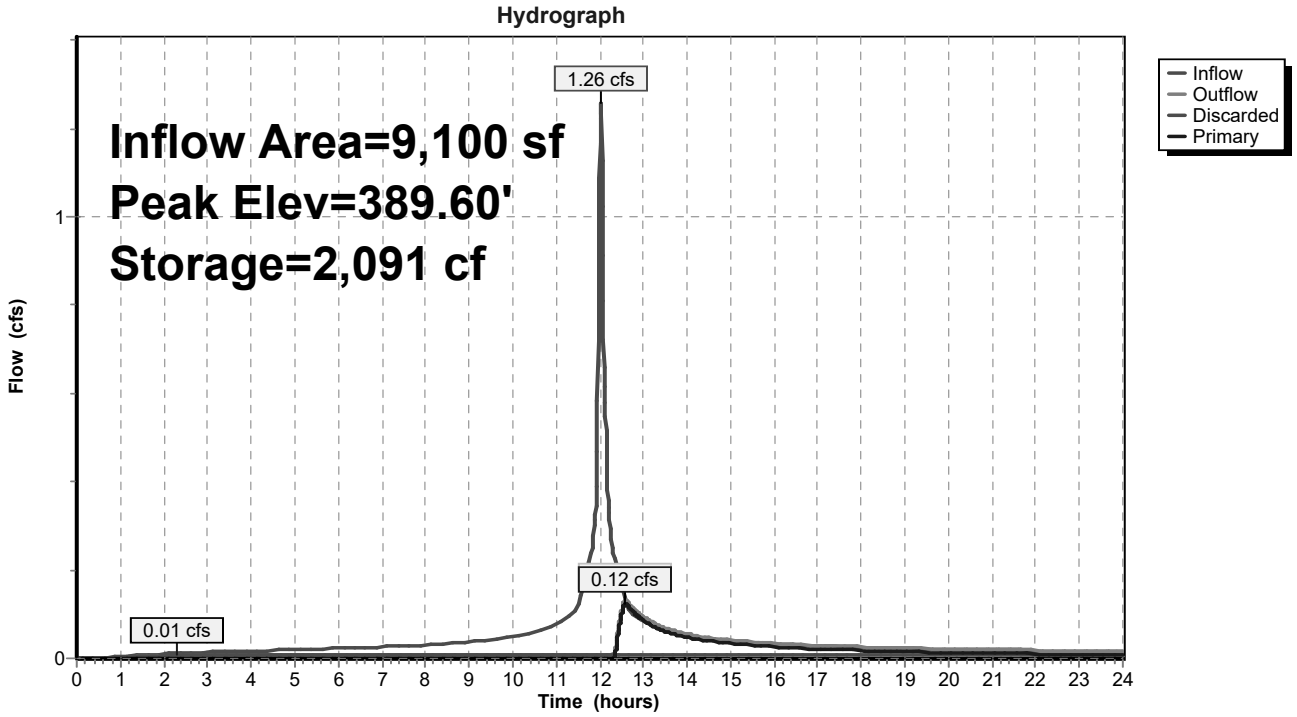
4,707.5 cf Field - 1,668.8 cf Chambers = 3,038.8 cf Stone x 40.0% Voids = 1,215.5 cf Stone Storage

Chamber Storage + Stone Storage = 2,884.3 cf = 0.066 af
Overall Storage Efficiency = 61.3%
Overall System Size = 67.49' x 10.33' x 6.75'

15 Chambers
174.4 cy Field
112.5 cy Stone



Pond 1P: Underground Detention System

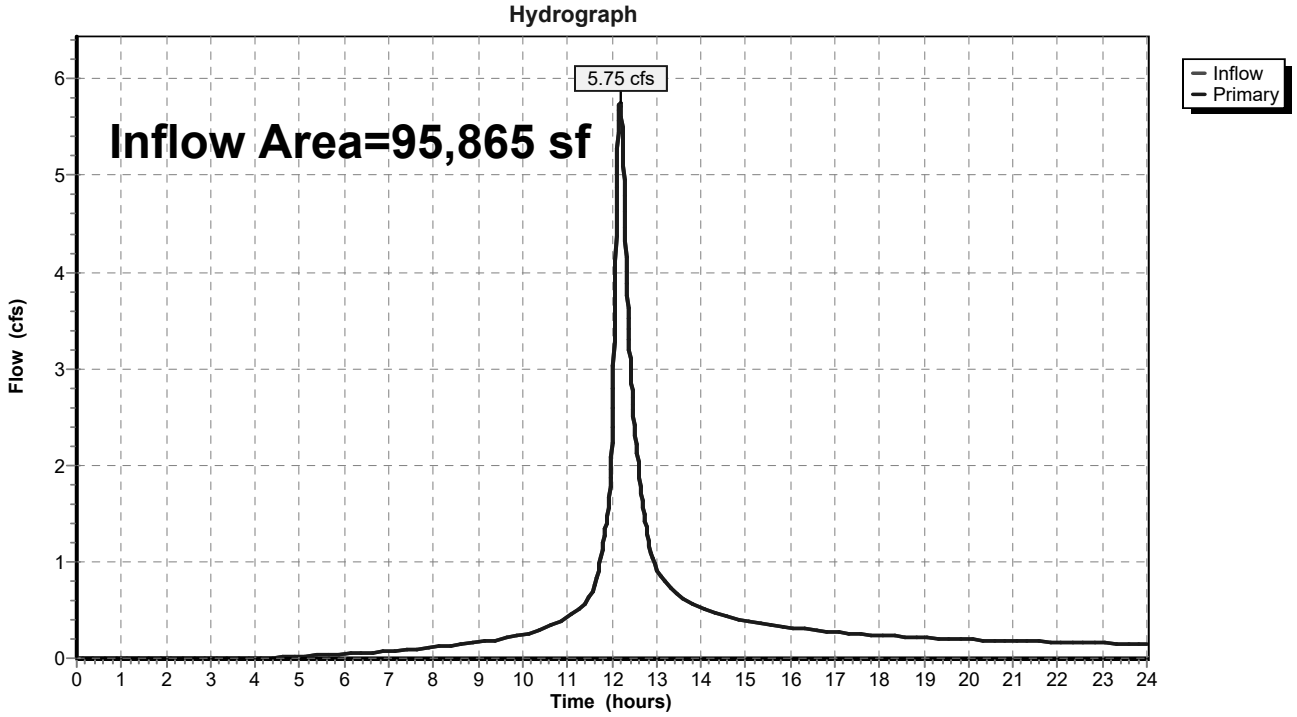


Summary for Link DP-1: Existing Drainage System

Inflow Area = 95,865 sf, 42.42% Impervious, Inflow Depth > 3.43" for 10-yr event
Inflow = 5.75 cfs @ 12.19 hrs, Volume= 27,383 cf
Primary = 5.75 cfs @ 12.19 hrs, Volume= 27,383 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-1: Existing Drainage System

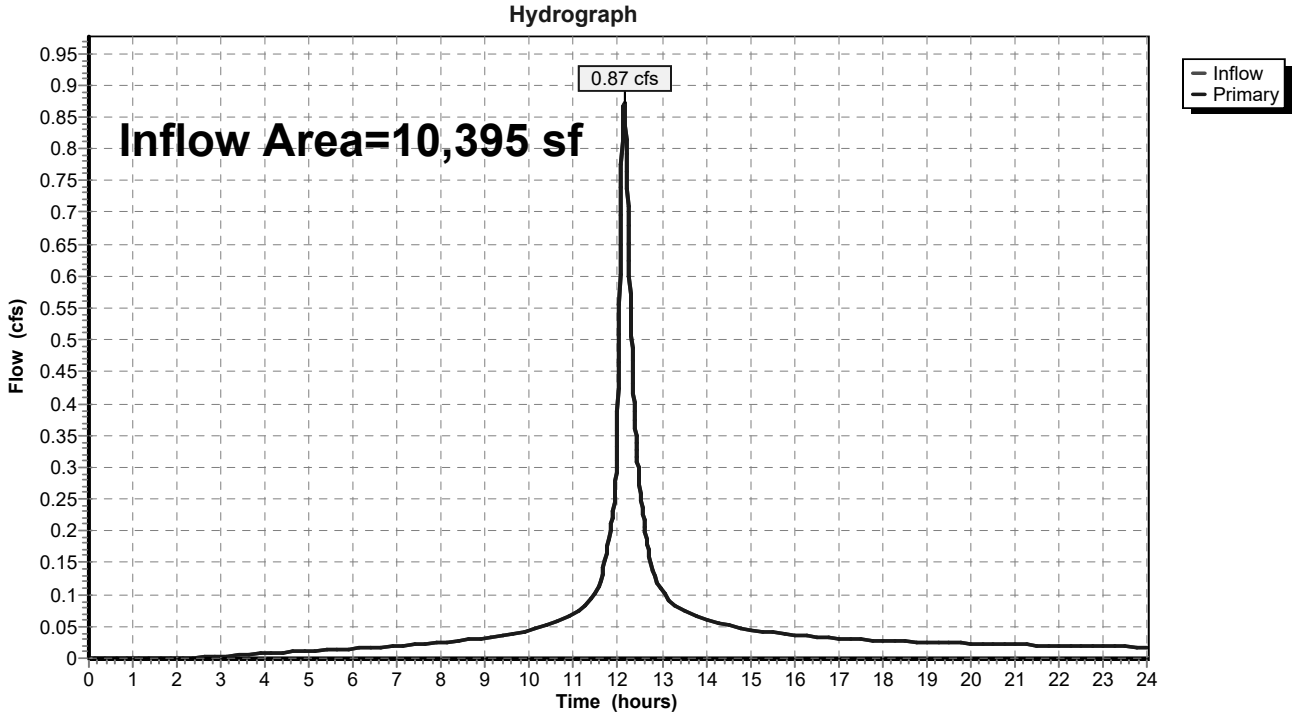


Summary for Link DP-2: Offsite Flow

Inflow Area = 10,395 sf, 23.14% Impervious, Inflow Depth > 4.38" for 10-yr event
Inflow = 0.87 cfs @ 12.14 hrs, Volume= 3,793 cf
Primary = 0.87 cfs @ 12.14 hrs, Volume= 3,793 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-2: Offsite Flow

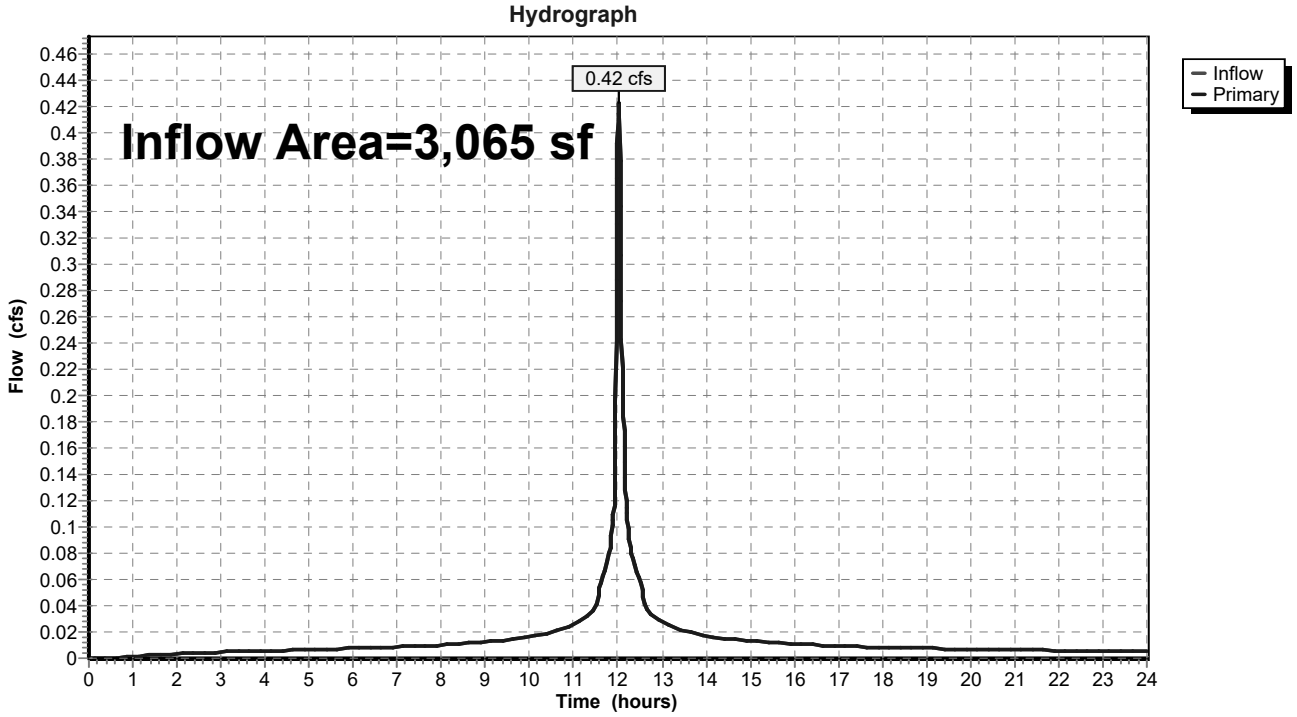


Summary for Link DP-3: Falls Road Gutter Flow

Inflow Area = 3,065 sf,100.00% Impervious, Inflow Depth > 4.96" for 10-yr event
Inflow = 0.42 cfs @ 12.03 hrs, Volume= 1,266 cf
Primary = 0.42 cfs @ 12.03 hrs, Volume= 1,266 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-3: Falls Road Gutter Flow



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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-100: Area Draining to Runoff Area=86,765 sf 36.39% Impervious Runoff Depth>4.68"
Flow Length=545' Tc=17.4 min CN=86 Runoff=7.34 cfs 33,853 cf

Subcatchment PDA-110: Area Draining to Runoff Area=9,100 sf 100.00% Impervious Runoff Depth>6.07"
Tc=5.0 min CN=98 Runoff=1.53 cfs 4,599 cf

Subcatchment PDA-200: Area Draining Runoff Area=10,395 sf 23.14% Impervious Runoff Depth>5.47"
Flow Length=229' Tc=14.5 min CN=93 Runoff=1.08 cfs 4,738 cf

Subcatchment PDA-300: Area Draining to Runoff Area=3,065 sf 100.00% Impervious Runoff Depth>6.07"
Flow Length=198' Slope=0.0200 '/' Tc=5.0 min CN=98 Runoff=0.51 cfs 1,549 cf

Pond 1P: Underground Detention System Peak Elev=389.86' Storage=2,202 cf Inflow=1.53 cfs 4,599 cf
Discarded=0.01 cfs 661 cf Primary=0.46 cfs 1,922 cf Outflow=0.47 cfs 2,583 cf

Link DP-1: Existing Drainage System Inflow=7.81 cfs 35,775 cf
Primary=7.81 cfs 35,775 cf

Link DP-2: Offsite Flow Inflow=1.08 cfs 4,738 cf
Primary=1.08 cfs 4,738 cf

Link DP-3: Falls Road Gutter Flow Inflow=0.51 cfs 1,549 cf
Primary=0.51 cfs 1,549 cf

Total Runoff Area = 109,325 sf Runoff Volume = 44,739 cf Average Runoff Depth = 4.91"
57.80% Pervious = 63,185 sf 42.20% Impervious = 46,140 sf

Summary for Subcatchment PDA-100: Area Draining to Existing Stormwater Drainage System

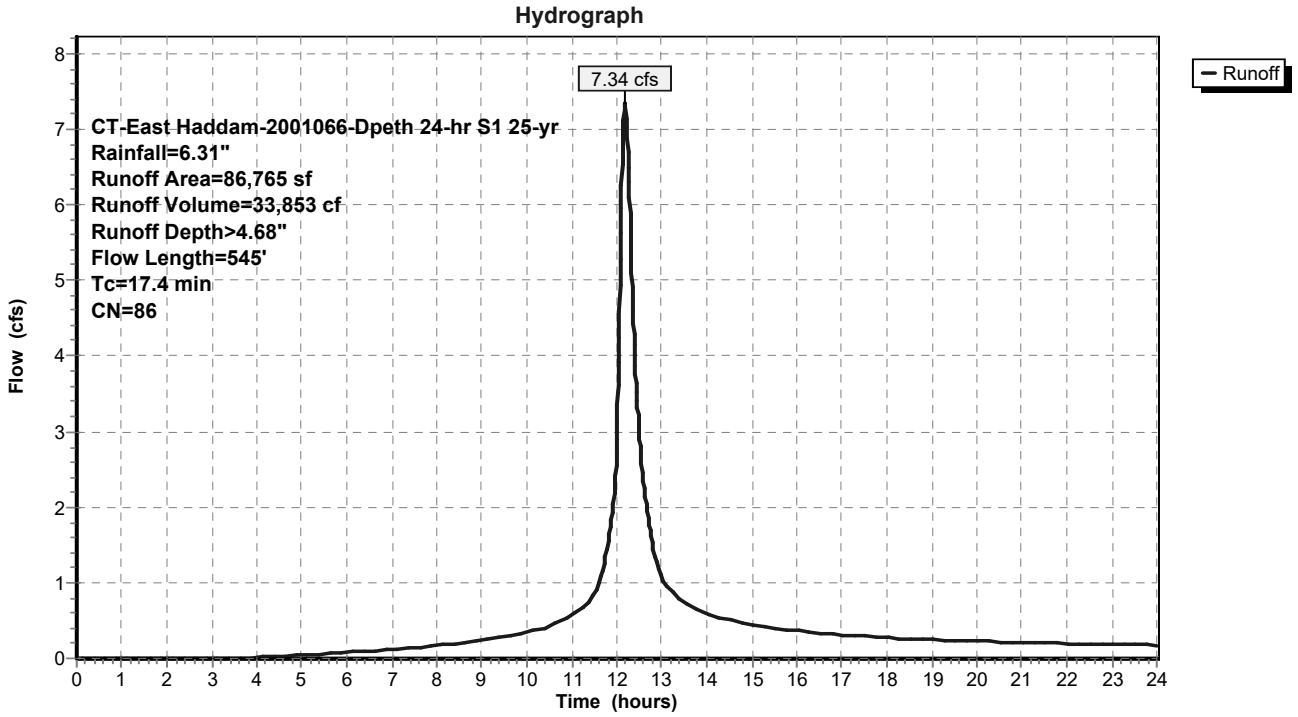
Runoff = 7.34 cfs @ 12.18 hrs, Volume= 33,853 cf, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 25-yr Rainfall=6.31"

Area (sf)	CN	Description
6,160	98	Paved parking, HSG B
17,975	69	50-75% Grass cover, Fair, HSG B
25,410	98	Paved parking, HSG D
3,055	96	Gravel surface, HSG D
32,925	84	50-75% Grass cover, Fair, HSG D
1,240	79	Woods, Fair, HSG D
86,765	86	Weighted Average
55,195		63.61% Pervious Area
31,570		36.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	100	0.0150	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
0.4	40	0.0500	1.57		**Shallow Concentrated Flow, short hill to loading area** Short Grass Pasture Kv= 7.0 fps
0.3	55	0.0300	3.52		**Shallow Concentrated Flow, across loading area to curb gutter f** Paved Kv= 20.3 fps
0.3	62	0.0250	3.21		**Shallow Concentrated Flow, gutter flow along curb** Paved Kv= 20.3 fps
0.1	27	0.0400	4.06		**Shallow Concentrated Flow, gutter flow into CB** Paved Kv= 20.3 fps
0.3	87	0.0050	4.17	3.28	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.1	16	0.0050	4.84	5.94	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
0.0	21	0.1050	19.11	15.01	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.1	71	0.0370	11.34	8.91	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.1	40	0.0500	13.19	10.36	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.2	26	0.0010	1.86	1.46	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
17.4	545	Total			

Subcatchment PDA-100: Area Draining to Existing Stormwater Drainage System



Summary for Subcatchment PDA-110: Area Draining to Underground Detention

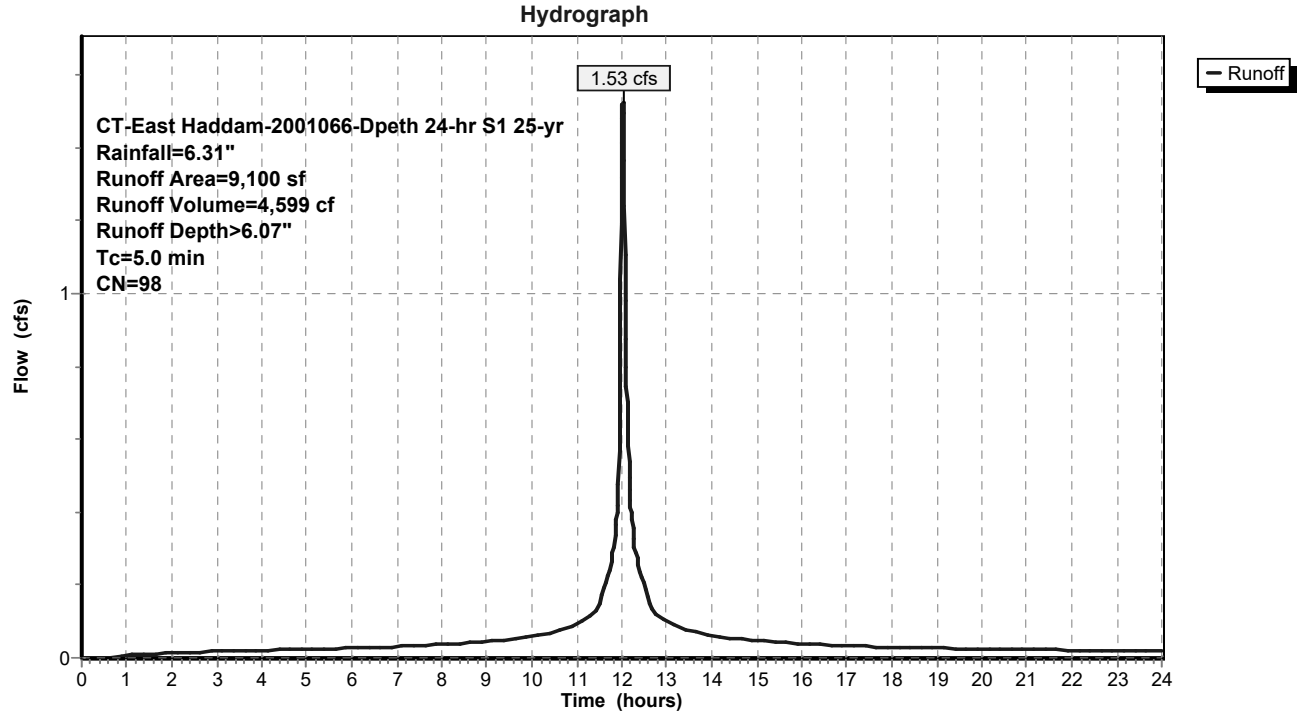
Runoff = 1.53 cfs @ 12.03 hrs, Volume= 4,599 cf, Depth> 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 25-yr Rainfall=6.31"

Area (sf)	CN	Description
0	98	Paved parking, HSG B
0	69	50-75% Grass cover, Fair, HSG B
9,100	98	Paved parking, HSG D
0	96	Gravel surface, HSG D
0	84	50-75% Grass cover, Fair, HSG D
0	79	Woods, Fair, HSG D
9,100	98	Weighted Average
9,100		100.00% Impervious Area

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

Subcatchment PDA-110: Area Draining to Underground Detention



Summary for Subcatchment PDA-200: Area Draining Offsite Through Existing Abutting Rear Paved Drive

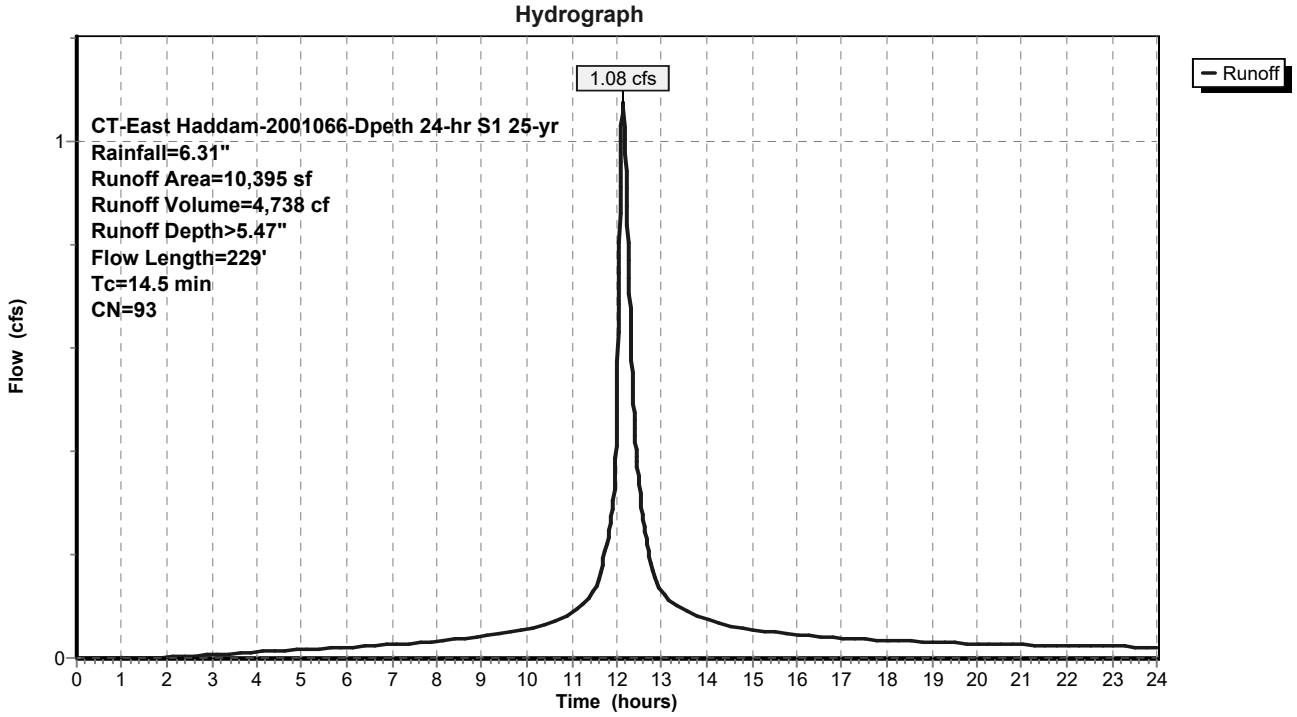
Runoff = 1.08 cfs @ 12.14 hrs, Volume= 4,738 cf, Depth> 5.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 25-yr Rainfall=6.31"

Area (sf)	CN	Description
2,405	98	Paved parking, HSG D
4,900	96	Gravel surface, HSG D
3,090	84	50-75% Grass cover, Fair, HSG D
10,395	93	Weighted Average
7,990		76.86% Pervious Area
2,405		23.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0200	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
0.3	16	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	113	0.0580	4.89		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.5	229	Total			

Subcatchment PDA-200: Area Draining Offsite Through Existing Abutting Rear Paved Driveway



Summary for Subcatchment PDA-300: Area Draining to Gutter Flow Along Falls Road

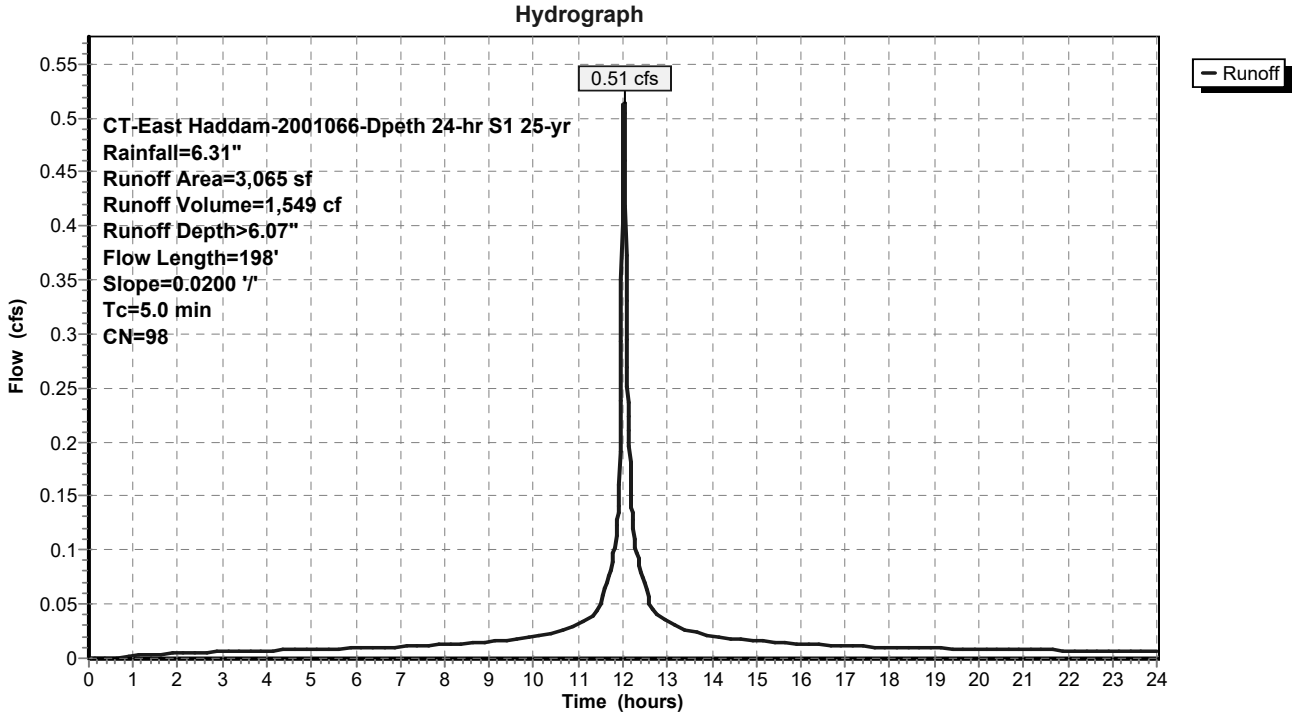
Runoff = 0.51 cfs @ 12.03 hrs, Volume= 1,549 cf, Depth> 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 25-yr Rainfall=6.31"

Area (sf)	CN	Description
10	98	Paved parking, HSG B
3,055	98	Paved parking, HSG D
3,065	98	Weighted Average
3,065		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.42		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.42"
0.6	98	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	198	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PDA-300: Area Draining to Gutter Flow Along Falls Road



Summary for Pond 1P: Underground Detention System

Inflow Area = 9,100 sf,100.00% Impervious, Inflow Depth > 6.07" for 25-yr event
Inflow = 1.53 cfs @ 12.03 hrs, Volume= 4,599 cf
Outflow = 0.47 cfs @ 12.18 hrs, Volume= 2,583 cf, Atten= 69%, Lag= 9.2 min
Discarded = 0.01 cfs @ 1.82 hrs, Volume= 661 cf
Primary = 0.46 cfs @ 12.18 hrs, Volume= 1,922 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 389.86' @ 12.18 hrs Surf.Area= 697 sf Storage= 2,202 cf

Plug-Flow detention time= 267.1 min calculated for 2,582 cf (56% of inflow)
Center-of-Mass det. time= 115.2 min (858.6 - 743.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	385.25'	1,216 cf	**10.33'W x 67.49'L x 6.75'H Field A** 4,708 cf Overall - 1,669 cf Embedded = 3,039 cf x 40.0% Voids
#2A	386.00'	1,669 cf	**ADS_StormTech MC-4500 +Cap** x 15 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf
		2,884 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	389.37'	**8.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 389.37' / 389.32' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Discarded	385.25'	**0.500 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 1.82 hrs HW=385.32' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.46 cfs @ 12.18 hrs HW=389.86' (Free Discharge)
1=Culvert (Barrel Controls 0.46 cfs @ 2.35 fps)

Pond 1P: Underground Detention System - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf

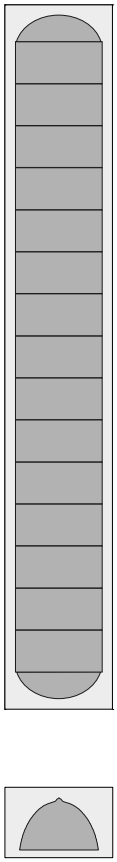
15 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 65.49' Row Length +12.0" End Stone x 2 = 67.49' Base Length
1 Rows x 100.0" Wide + 12.0" Side Stone x 2 = 10.33' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

15 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 1 Rows = 1,668.8 cf Chamber Storage

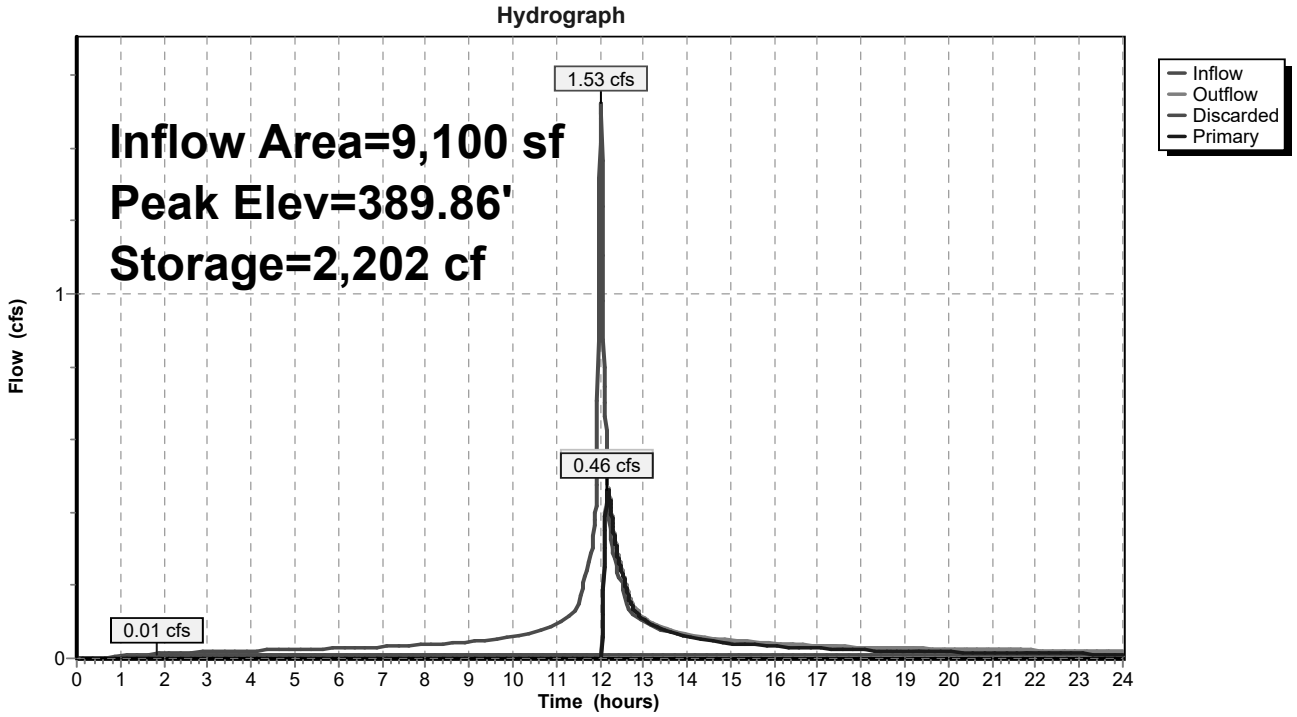
4,707.5 cf Field - 1,668.8 cf Chambers = 3,038.8 cf Stone x 40.0% Voids = 1,215.5 cf Stone Storage

Chamber Storage + Stone Storage = 2,884.3 cf = 0.066 af
Overall Storage Efficiency = 61.3%
Overall System Size = 67.49' x 10.33' x 6.75'

15 Chambers
174.4 cy Field
112.5 cy Stone



Pond 1P: Underground Detention System

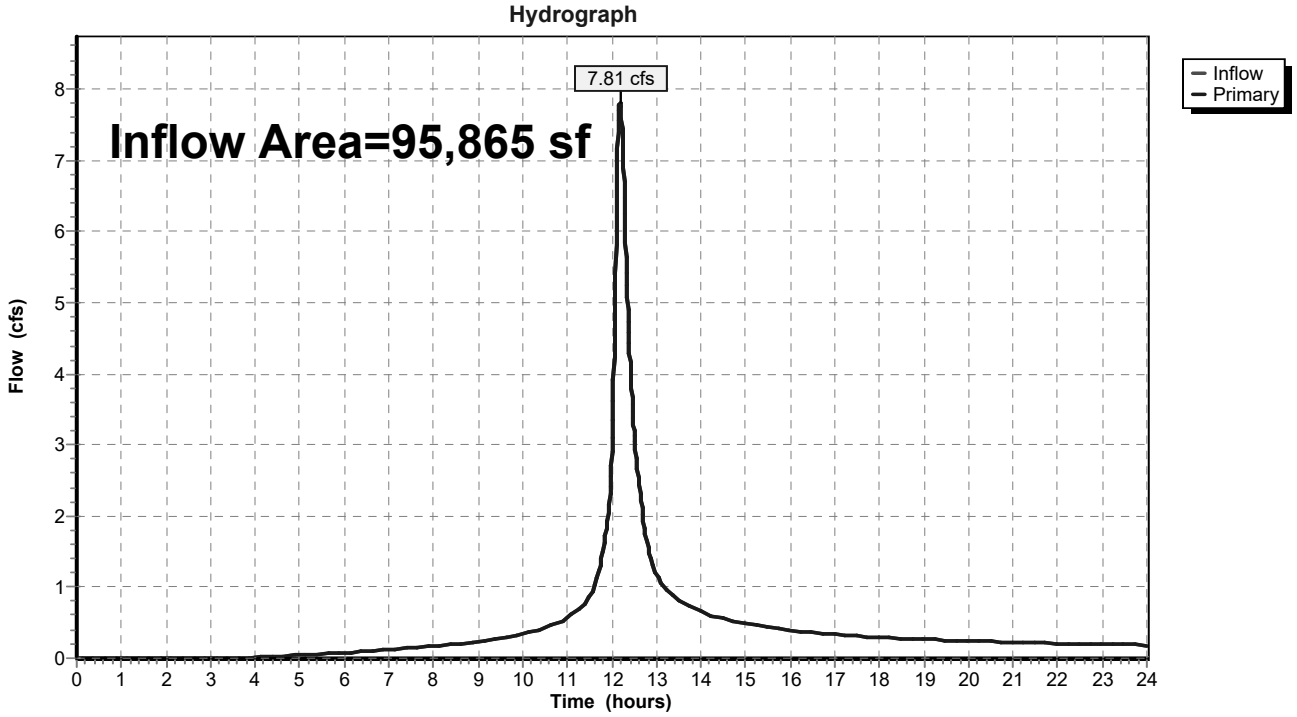


Summary for Link DP-1: Existing Drainage System

Inflow Area = 95,865 sf, 42.42% Impervious, Inflow Depth > 4.48" for 25-yr event
Inflow = 7.81 cfs @ 12.18 hrs, Volume= 35,775 cf
Primary = 7.81 cfs @ 12.18 hrs, Volume= 35,775 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-1: Existing Drainage System

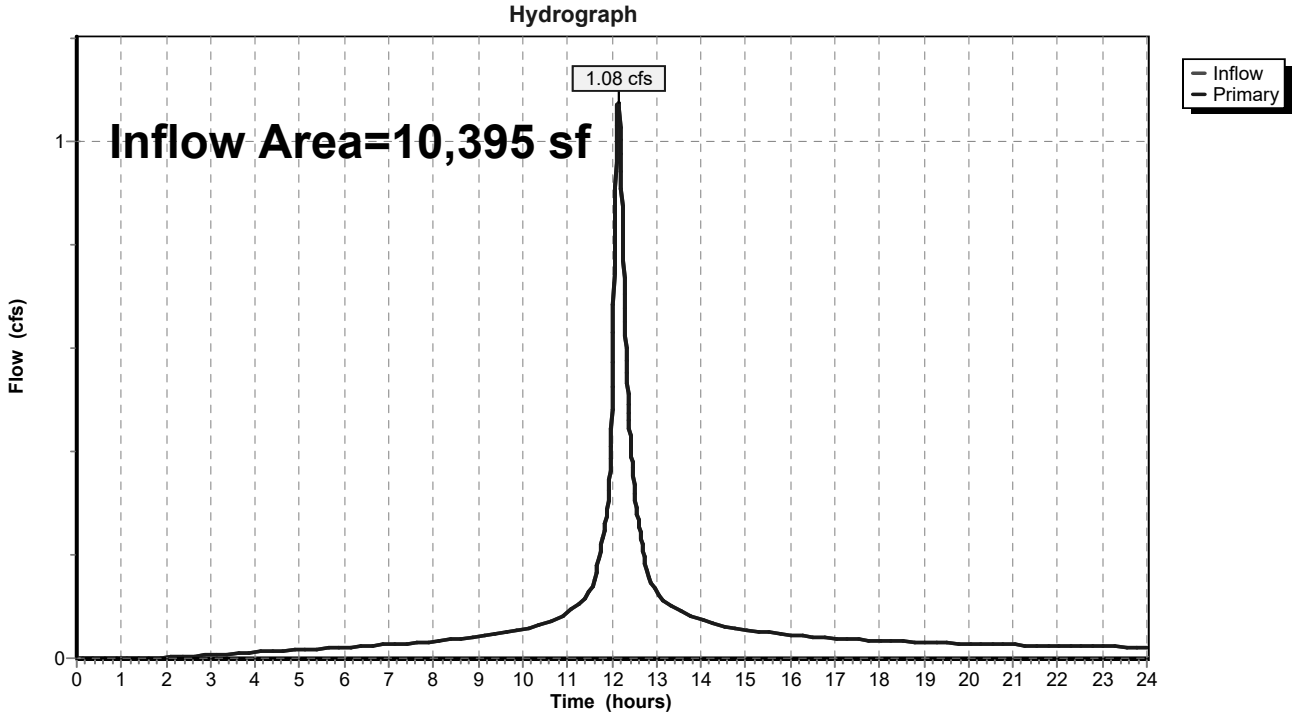


Summary for Link DP-2: Offsite Flow

Inflow Area = 10,395 sf, 23.14% Impervious, Inflow Depth > 5.47" for 25-yr event
Inflow = 1.08 cfs @ 12.14 hrs, Volume= 4,738 cf
Primary = 1.08 cfs @ 12.14 hrs, Volume= 4,738 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-2: Offsite Flow

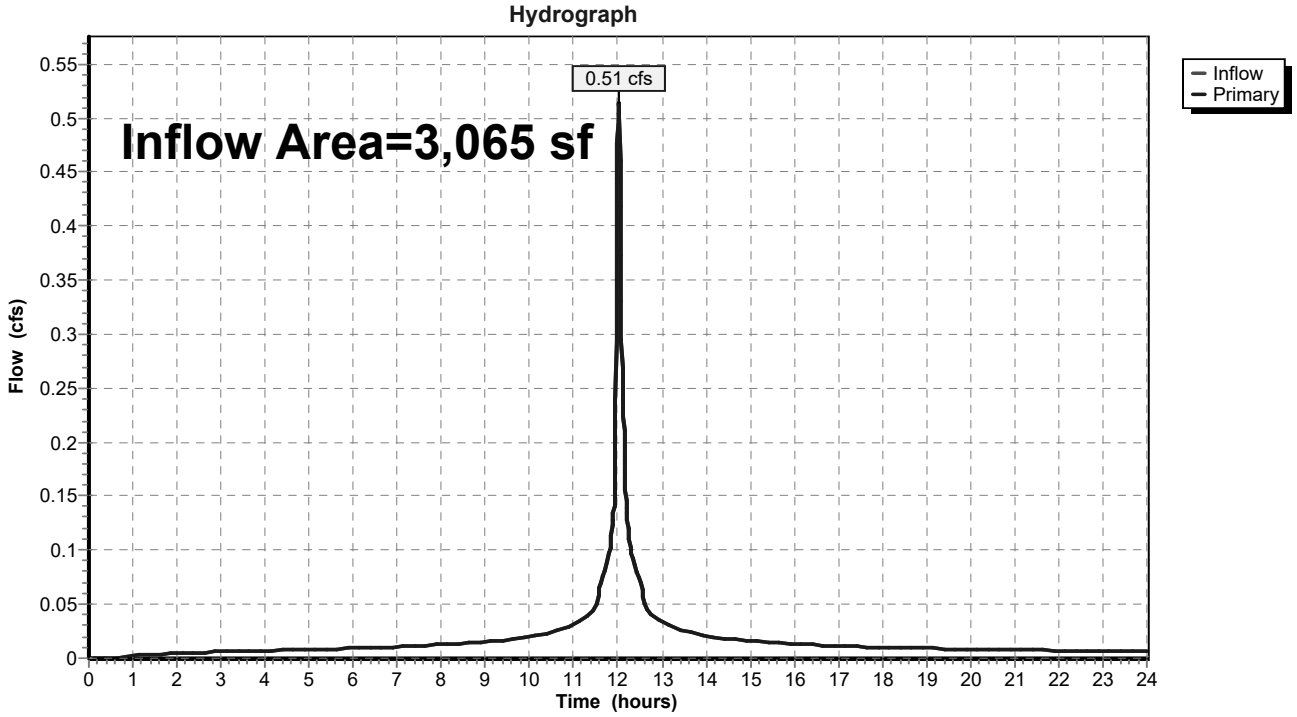


Summary for Link DP-3: Falls Road Gutter Flow

Inflow Area = 3,065 sf,100.00% Impervious, Inflow Depth > 6.07" for 25-yr event
Inflow = 0.51 cfs @ 12.03 hrs, Volume= 1,549 cf
Primary = 0.51 cfs @ 12.03 hrs, Volume= 1,549 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-3: Falls Road Gutter Flow



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 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-100: Area Draining to Runoff Area=86,765 sf 36.39% Impervious Runoff Depth>6.32"
Flow Length=545' Tc=17.4 min CN=86 Runoff=9.77 cfs 45,708 cf

Subcatchment PDA-110: Area Draining to Runoff Area=9,100 sf 100.00% Impervious Runoff Depth>7.77"
Tc=5.0 min CN=98 Runoff=1.94 cfs 5,894 cf

Subcatchment PDA-200: Area Draining Runoff Area=10,395 sf 23.14% Impervious Runoff Depth>7.16"
Flow Length=229' Tc=14.5 min CN=93 Runoff=1.39 cfs 6,200 cf

Subcatchment PDA-300: Area Draining to Runoff Area=3,065 sf 100.00% Impervious Runoff Depth>7.77"
Flow Length=198' Slope=0.0200 '/' Tc=5.0 min CN=98 Runoff=0.65 cfs 1,985 cf

Pond 1P: Underground Detention System Peak Elev=390.43' Storage=2,429 cf Inflow=1.94 cfs 5,894 cf
Discarded=0.01 cfs 669 cf Primary=1.31 cfs 3,203 cf Outflow=1.31 cfs 3,872 cf

Link DP-1: Existing Drainage System Inflow=10.72 cfs 48,911 cf
Primary=10.72 cfs 48,911 cf

Link DP-2: Offsite Flow Inflow=1.39 cfs 6,200 cf
Primary=1.39 cfs 6,200 cf

Link DP-3: Falls Road Gutter Flow Inflow=0.65 cfs 1,985 cf
Primary=0.65 cfs 1,985 cf

Total Runoff Area = 109,325 sf Runoff Volume = 59,787 cf Average Runoff Depth = 6.56"
57.80% Pervious = 63,185 sf 42.20% Impervious = 46,140 sf

Summary for Subcatchment PDA-100: Area Draining to Existing Stormwater Drainage System

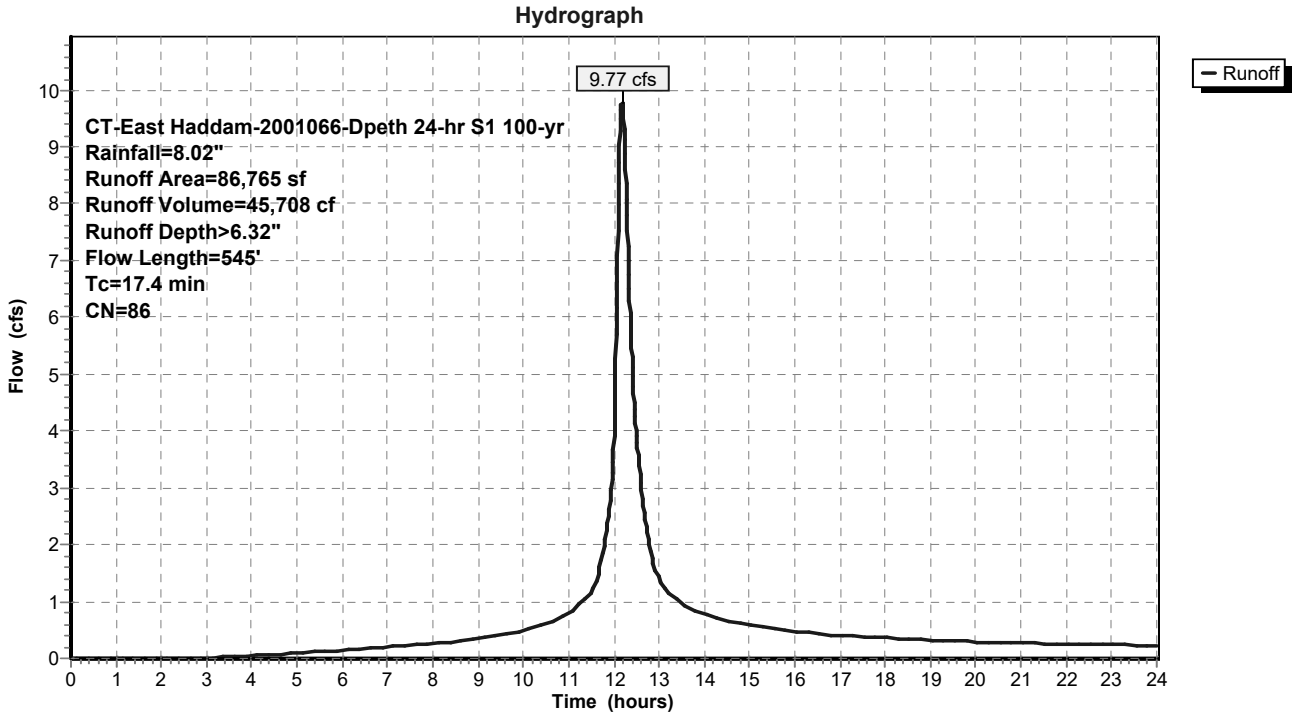
Runoff = 9.77 cfs @ 12.18 hrs, Volume= 45,708 cf, Depth> 6.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 100-yr Rainfall=8.02"

Area (sf)	CN	Description
6,160	98	Paved parking, HSG B
17,975	69	50-75% Grass cover, Fair, HSG B
25,410	98	Paved parking, HSG D
3,055	96	Gravel surface, HSG D
32,925	84	50-75% Grass cover, Fair, HSG D
1,240	79	Woods, Fair, HSG D
86,765	86	Weighted Average
55,195		63.61% Pervious Area
31,570		36.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.5	100	0.0150	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
0.4	40	0.0500	1.57		**Shallow Concentrated Flow, short hill to loading area** Short Grass Pasture Kv= 7.0 fps
0.3	55	0.0300	3.52		**Shallow Concentrated Flow, across loading area to curb gutter f** Paved Kv= 20.3 fps
0.3	62	0.0250	3.21		**Shallow Concentrated Flow, gutter flow along curb** Paved Kv= 20.3 fps
0.1	27	0.0400	4.06		**Shallow Concentrated Flow, gutter flow into CB** Paved Kv= 20.3 fps
0.3	87	0.0050	4.17	3.28	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.1	16	0.0050	4.84	5.94	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.010 PVC, smooth interior
0.0	21	0.1050	19.11	15.01	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.1	71	0.0370	11.34	8.91	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.1	40	0.0500	13.19	10.36	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
0.2	26	0.0010	1.86	1.46	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior
17.4	545	Total			

Subcatchment PDA-100: Area Draining to Existing Stormwater Drainage System



Summary for Subcatchment PDA-110: Area Draining to Underground Detention

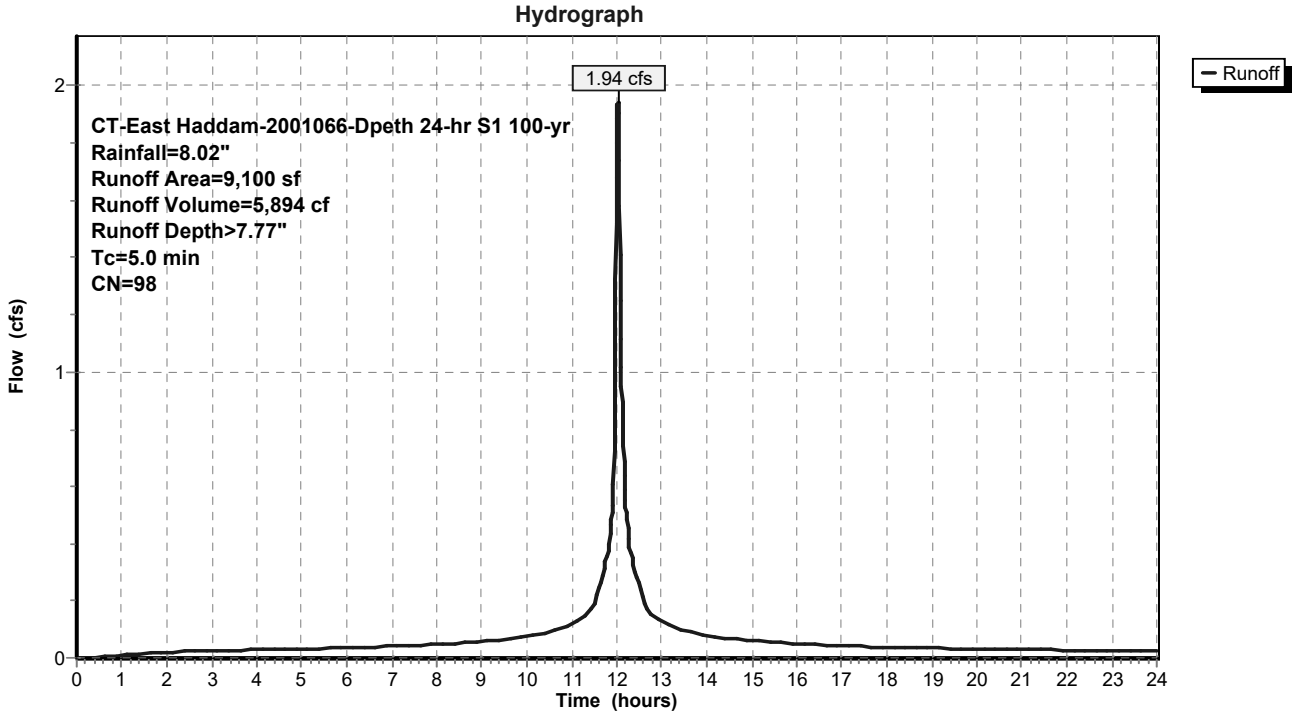
Runoff = 1.94 cfs @ 12.03 hrs, Volume= 5,894 cf, Depth> 7.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 100-yr Rainfall=8.02"

Area (sf)	CN	Description
0	98	Paved parking, HSG B
0	69	50-75% Grass cover, Fair, HSG B
9,100	98	Paved parking, HSG D
0	96	Gravel surface, HSG D
0	84	50-75% Grass cover, Fair, HSG D
0	79	Woods, Fair, HSG D
9,100	98	Weighted Average
9,100		100.00% Impervious Area

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

Subcatchment PDA-110: Area Draining to Underground Detention



Summary for Subcatchment PDA-200: Area Draining Offsite Through Existing Abutting Rear Paved Drive

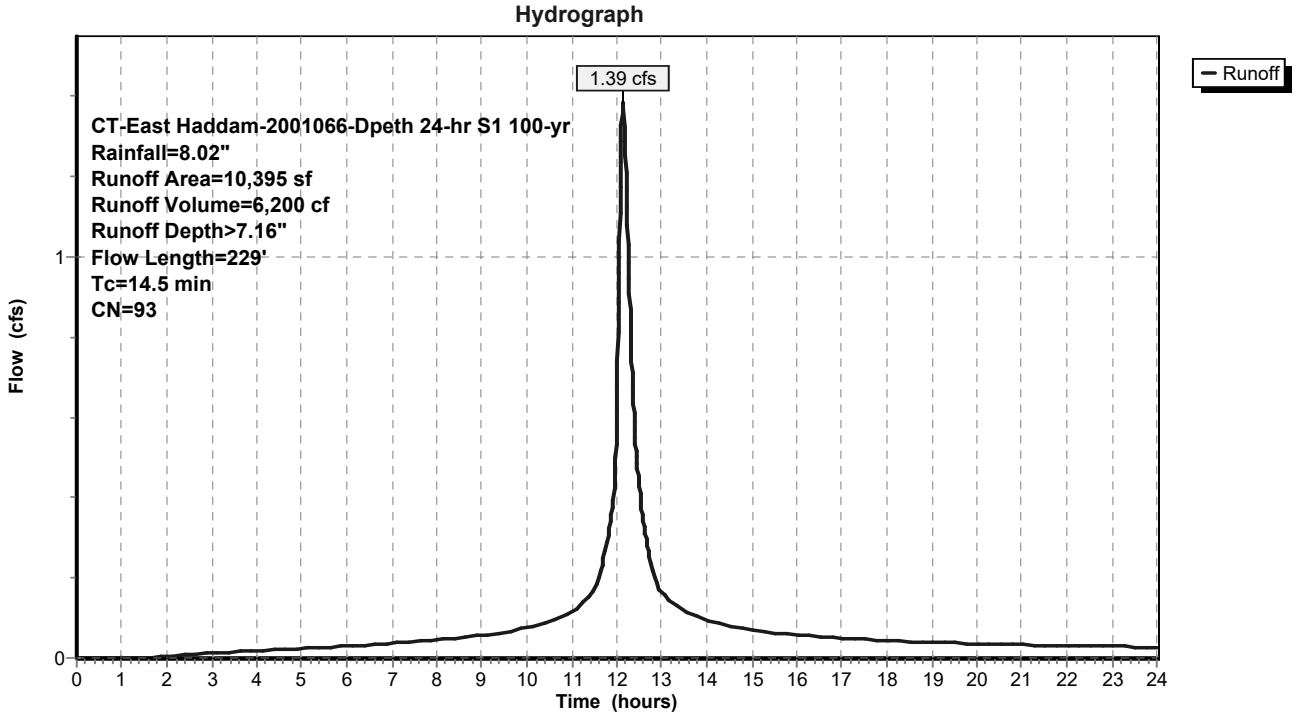
Runoff = 1.39 cfs @ 12.14 hrs, Volume= 6,200 cf, Depth> 7.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 100-yr Rainfall=8.02"

Area (sf)	CN	Description
2,405	98	Paved parking, HSG D
4,900	96	Gravel surface, HSG D
3,090	84	50-75% Grass cover, Fair, HSG D
10,395	93	Weighted Average
7,990		76.86% Pervious Area
2,405		23.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0200	0.12		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.42"
0.3	16	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	113	0.0580	4.89		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
14.5	229	Total			

Subcatchment PDA-200: Area Draining Offsite Through Existing Abutting Rear Paved Driveway



Summary for Subcatchment PDA-300: Area Draining to Gutter Flow Along Falls Road

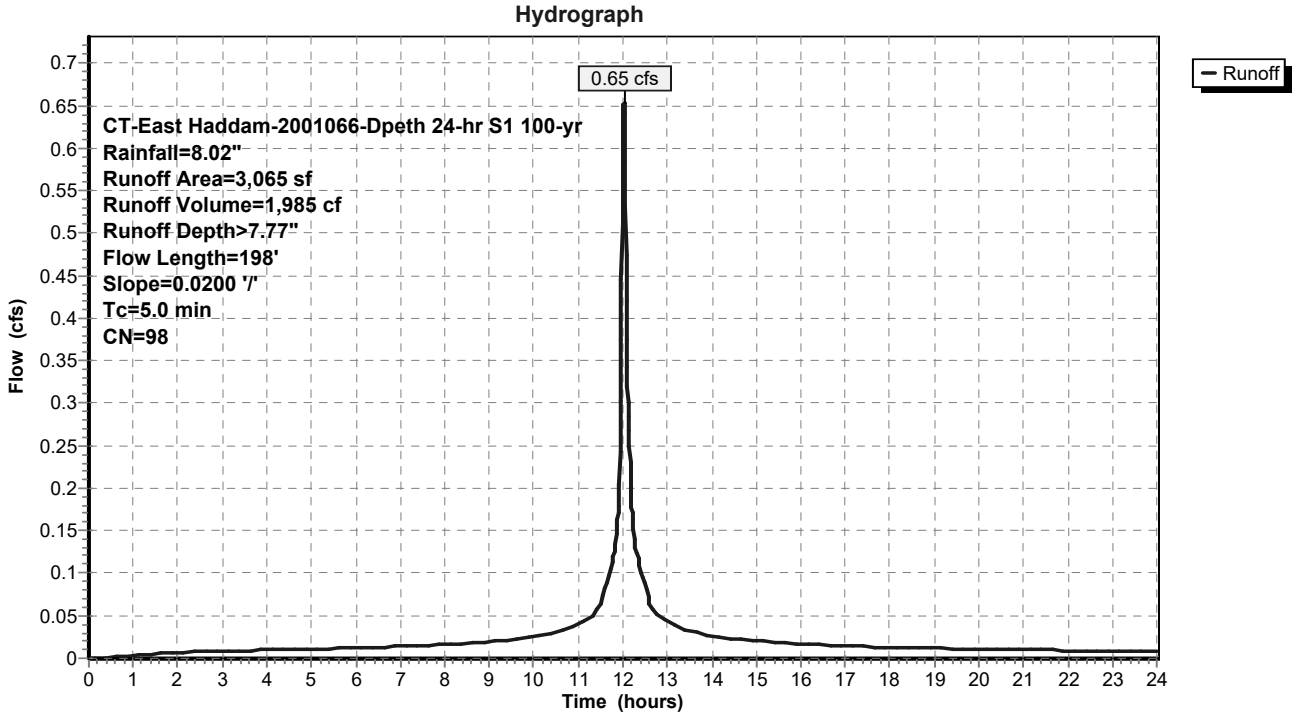
Runoff = 0.65 cfs @ 12.03 hrs, Volume= 1,985 cf, Depth> 7.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
CT-East Haddam-2001066-Dpeth 24-hr S1 100-yr Rainfall=8.02"

Area (sf)	CN	Description
10	98	Paved parking, HSG B
3,055	98	Paved parking, HSG D
3,065	98	Weighted Average
3,065		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.42		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.42"
0.6	98	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.8	198	Total, Increased to minimum Tc = 5.0 min			

Subcatchment PDA-300: Area Draining to Gutter Flow Along Falls Road



Summary for Pond 1P: Underground Detention System

Inflow Area = 9,100 sf,100.00% Impervious, Inflow Depth > 7.77" for 100-yr event
Inflow = 1.94 cfs @ 12.03 hrs, Volume= 5,894 cf
Outflow = 1.31 cfs @ 12.08 hrs, Volume= 3,872 cf, Atten= 32%, Lag= 3.1 min
Discarded = 0.01 cfs @ 1.38 hrs, Volume= 669 cf
Primary = 1.31 cfs @ 12.08 hrs, Volume= 3,203 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 390.43' @ 12.08 hrs Surf.Area= 697 sf Storage= 2,429 cf

Plug-Flow detention time= 235.8 min calculated for 3,872 cf (66% of inflow)
Center-of-Mass det. time= 104.0 min (843.8 - 739.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	385.25'	1,216 cf	**10.33'W x 67.49'L x 6.75'H Field A** 4,708 cf Overall - 1,669 cf Embedded = 3,039 cf x 40.0% Voids
#2A	386.00'	1,669 cf	**ADS_StormTech MC-4500 +Cap** x 15 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf
		2,884 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	389.37'	**8.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 389.37' / 389.32' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#2	Discarded	385.25'	**0.500 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 1.38 hrs HW=385.32' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=1.30 cfs @ 12.08 hrs HW=390.43' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 1.30 cfs @ 3.73 fps)

Pond 1P: Underground Detention System - Chamber Wizard Field A

Chamber Model = ADS_StormTechMC-4500 +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.02'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf

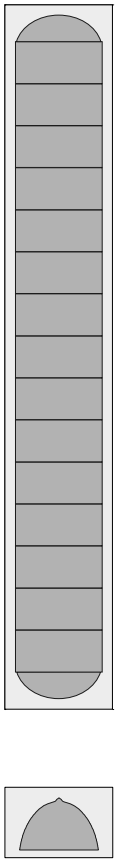
15 Chambers/Row x 4.02' Long +2.56' Cap Length x 2 = 65.49' Row Length +12.0" End Stone x 2 = 67.49' Base Length
1 Rows x 100.0" Wide + 12.0" Side Stone x 2 = 10.33' Base Width
9.0" Base + 60.0" Chamber Height + 12.0" Cover = 6.75' Field Height

15 Chambers x 106.5 cf + 35.7 cf Cap Volume x 2 x 1 Rows = 1,668.8 cf Chamber Storage

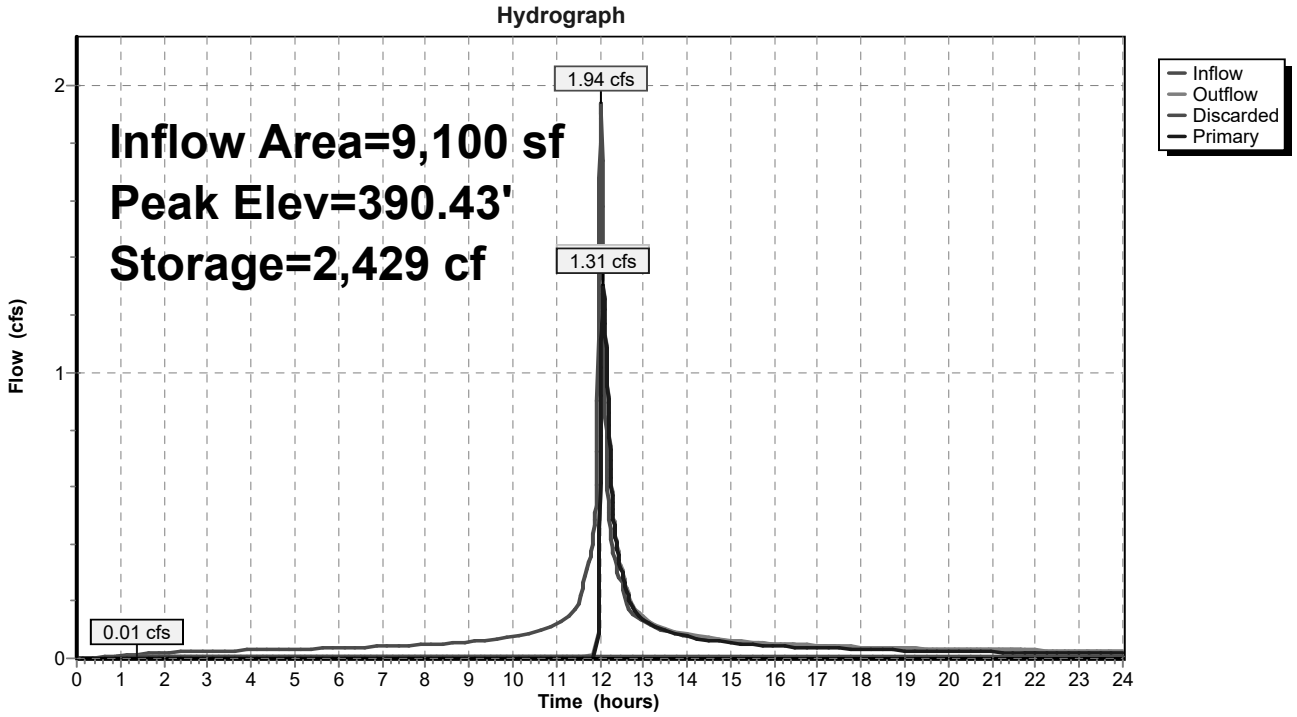
4,707.5 cf Field - 1,668.8 cf Chambers = 3,038.8 cf Stone x 40.0% Voids = 1,215.5 cf Stone Storage

Chamber Storage + Stone Storage = 2,884.3 cf = 0.066 af
Overall Storage Efficiency = 61.3%
Overall System Size = 67.49' x 10.33' x 6.75'

15 Chambers
174.4 cy Field
112.5 cy Stone



Pond 1P: Underground Detention System

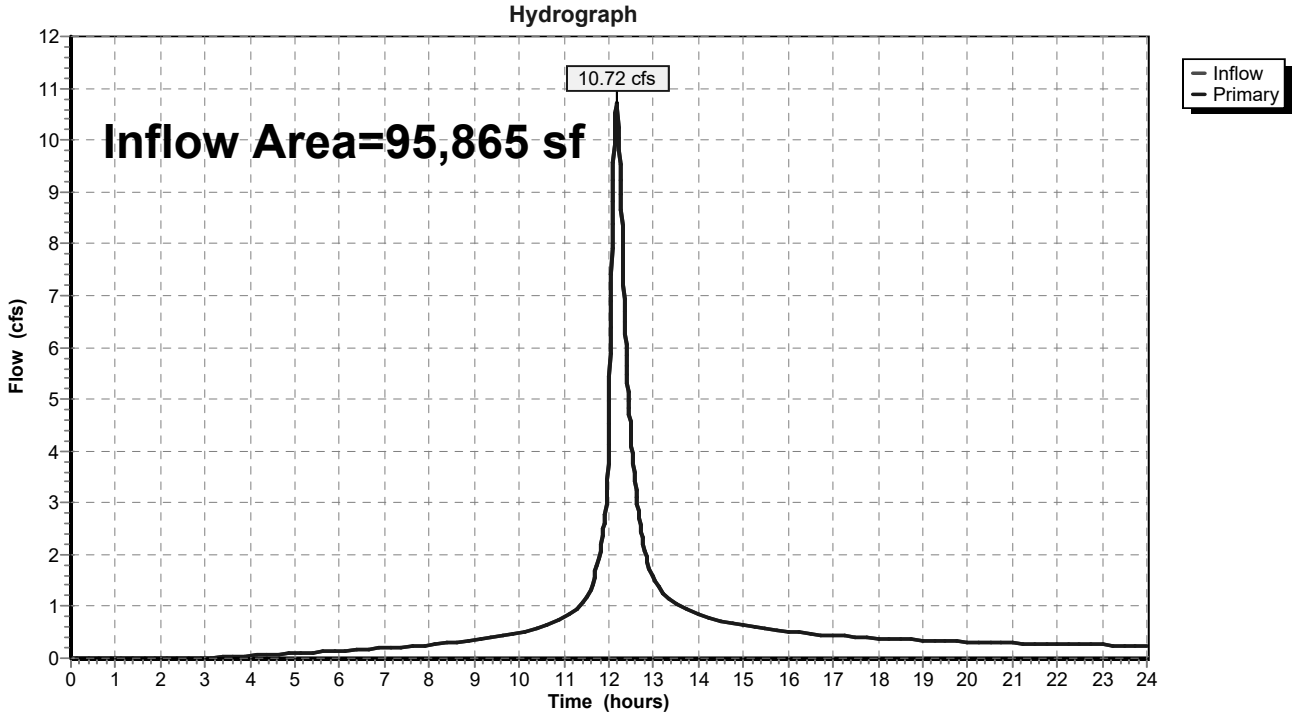


Summary for Link DP-1: Existing Drainage System

Inflow Area = 95,865 sf, 42.42% Impervious, Inflow Depth > 6.12" for 100-yr event
Inflow = 10.72 cfs @ 12.18 hrs, Volume= 48,911 cf
Primary = 10.72 cfs @ 12.18 hrs, Volume= 48,911 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-1: Existing Drainage System

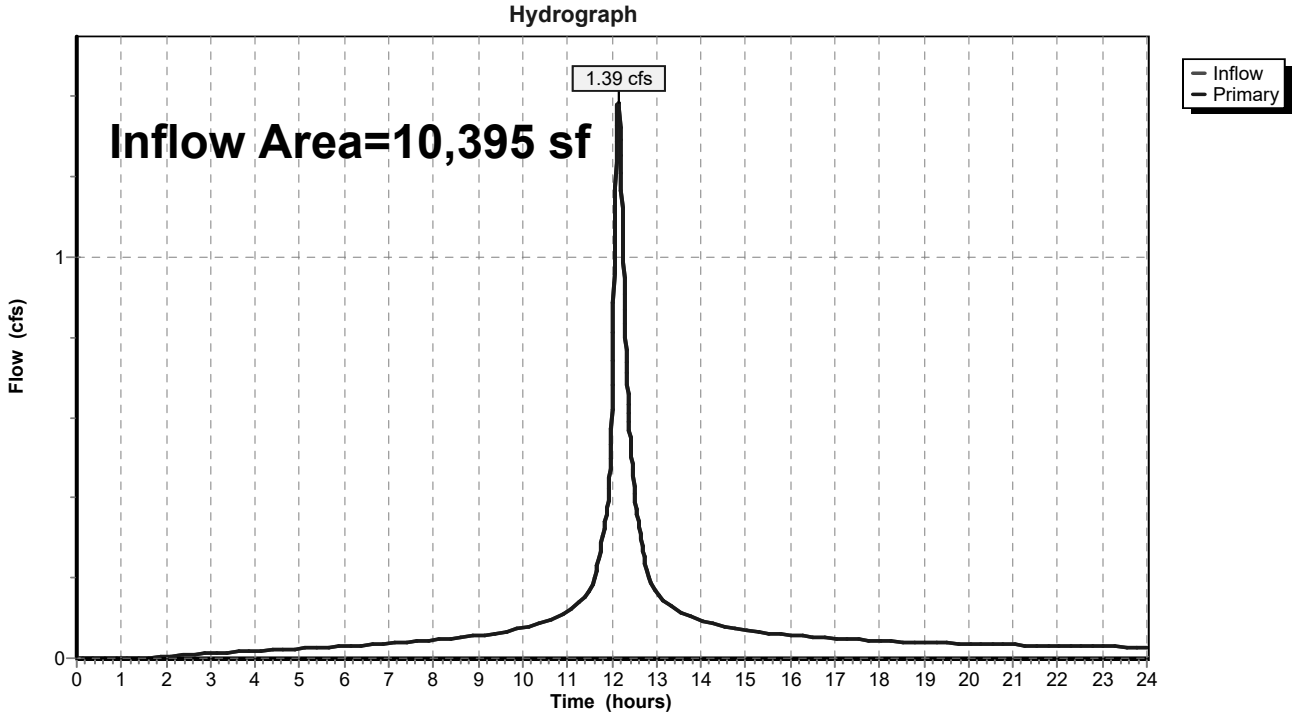


Summary for Link DP-2: Offsite Flow

Inflow Area = 10,395 sf, 23.14% Impervious, Inflow Depth > 7.16" for 100-yr event
Inflow = 1.39 cfs @ 12.14 hrs, Volume= 6,200 cf
Primary = 1.39 cfs @ 12.14 hrs, Volume= 6,200 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-2: Offsite Flow

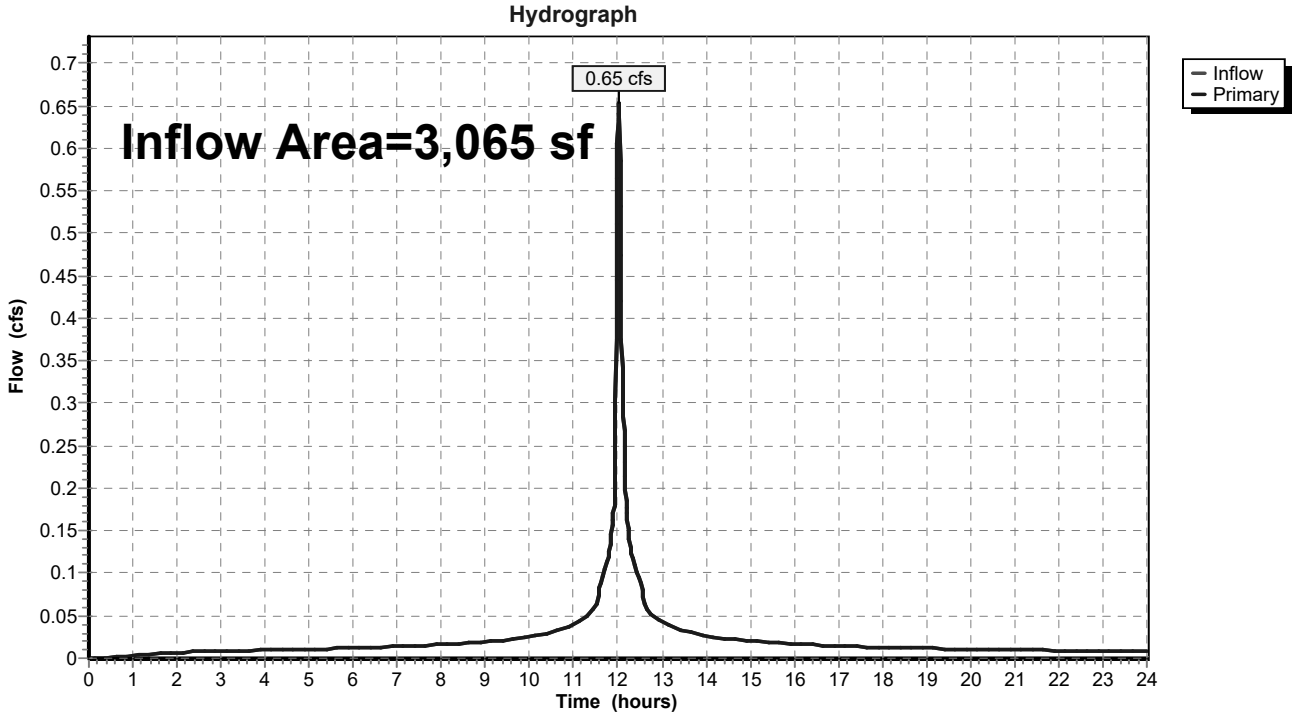


Summary for Link DP-3: Falls Road Gutter Flow

Inflow Area = 3,065 sf,100.00% Impervious, Inflow Depth > 7.77" for 100-yr event
Inflow = 0.65 cfs @ 12.03 hrs, Volume= 1,985 cf
Primary = 0.65 cfs @ 12.03 hrs, Volume= 1,985 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP-3: Falls Road Gutter Flow



APPENDIX D

WATER QUALITY CALCULATIONS

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

Water Quality Calculations

Determine Water Quality Volume

From CT 2004 Stormwater Quality Manual, Section 7.4.1:

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

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

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

Area		Total Area		Impervious Area		Impervious Cover	Volumetric Runoff Coefficient	Water Quality Volume (WQV)		Water Quality Volume Required *	Water Quality Volume Provided
ID		ac	ft^2	ac	ft^2	%	R	acre-feet	ft^3	ft^3	ft^3
Area to Underground Stormwater Detention System		1.456	63,422	0.839	36,540	57.62	0.569	0.069	3,006	1,503	1,985

Note: The provided Water Quality Volume for the Underground detention System was derived from the Stage Volume tables in HydroCAD as the volume below the first orifice elevation.

* Total impervious cover on site has been reduced and is over 40% impevious in the existing condition. Due to this, the project can be calssified as a redevelopment and the required water quality volume has been calcuated as half of the total WQV calcuated for the site.

Water Quality Calculations

Determine Water Quality Flow

From CT 2004 Stormwater Quality Manual:

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

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

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

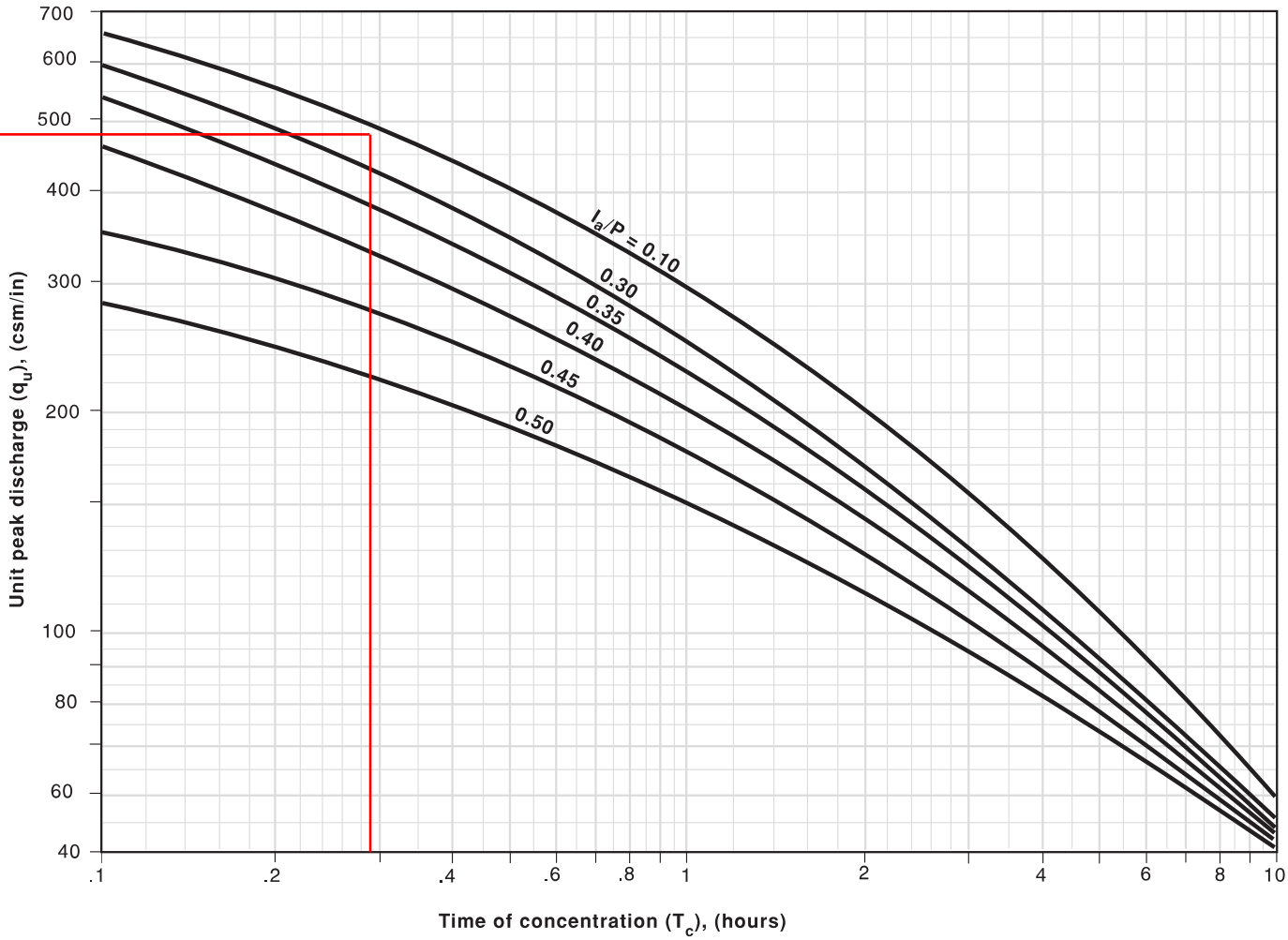
CN = Runoff Curve Number
P = design preciptation, inches, (1" for water quality storm)
Q = runoff depth (in watershed inches)
T_c = time of concentration
I_a = Initial abstraction, inches, from Table 4-1, Chapter 4, TR-55
q_u = unit peak discharge,
WQF = water quality flow (cfs)

Structure		Total Area			Imp Area		Imp Cover	R	WQV	Q	P	CN	T_c		I_a	I_a/P	q_u *	WQF
		ft^2	ac	mi^2	ft^2	ac	%	-	acre-feet	in	in	-	mins	hours	in	-	$cfs/mi^2/in$	cfs
HDS-1	PDA-100	95,860	2.201	0.003	43,725	1.004	45.61	0.461	0.084	0.46	1.00	93	17.4	0.29	0.151	0.151	480	0.66

* 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.

Exhibit 4-III Unit peal discharge (q_u) for NRCS (SCS) type III rainfall distribution

HDS-1
480



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)

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	
	A	B	C	D	A	B	C	D	A	B	C	D	(ac-ft)	(cu ft)
1.456	0.000	0.000	0.000	1.456	0.000	0.786	0.000	1.007	0.00	0.00	0.00	0.69	0.000	0

Table from 2004 Connecticut Stormwater Quality Manual

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

More Conservative Groundwater Recharge Amounts used in Calculations

NRCS Hydrologic Soil	Groundwater Recharge
A	0.60
B	0.40
C	0.25
D	0.00

Note: Due to all soils contained within the site property line being classified as hydrologic soil group D, groundwater recharge is not required on site per the 2004 CT Stormwater Quality Manual.

Best Management Practice (BMP) Treatment Train Efficiency Worksheet

Prepared for:
Proposed Retail Development
25 Falls Road
East Haddam, Connecticut

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

Date prepared:
January 21, 2021

Overall Site Treatment Train Efficiency to Underground Stormwater Detention System

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 Basin	secondary (conventional)	25
E3	Hydrodynamic Separator**	Primary	80

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

* 80% required per CT DEEP
** Manufacturer Claims 80% TSS Removal
*** Schueler 1996 & EPA 1993

BMP	*Type pf Treatment*	*TSS Removal Rate*	*Starting TSS Load*	*Amount Removed*	*Remaining Load*
Impervious Surface Sweeping***	secondary (conventional)	0.10	1	0.10	0.9
Deep Sump and Hooded Catch Basin	secondary (conventional)	0.25	0.9	0.23	0.68
Hydrodynamic Separator**	Primary	0.8	0.68	0.54	0.14

Overall Treatment Train Efficiency (% **87**

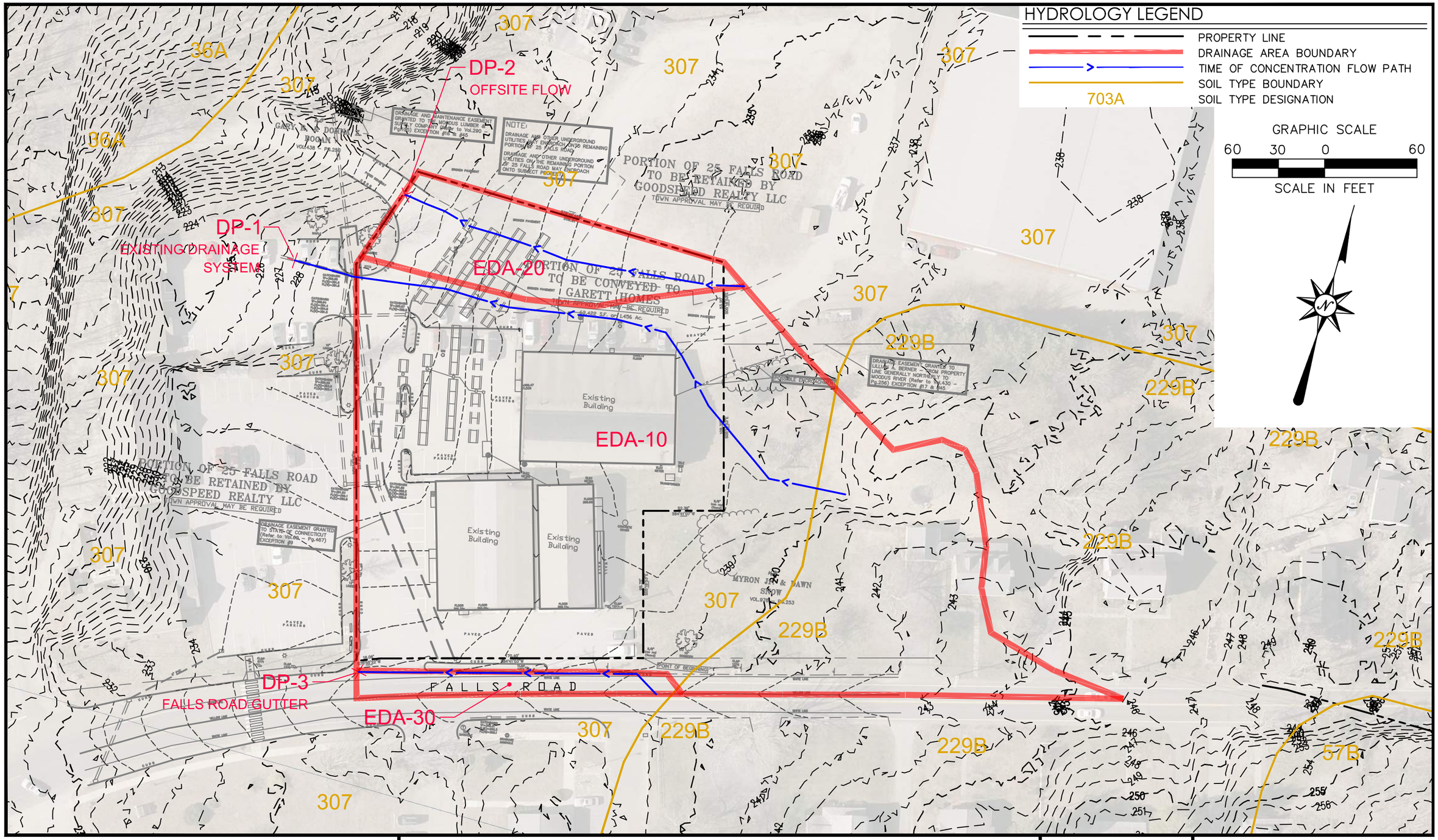
TSS Removal Rates (adapted from Schueler, 1996, & EPA, 1993)

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

DRAINAGE MAPS

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



ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

BL Companies

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

EXISTING DRAINAGE MAPPING

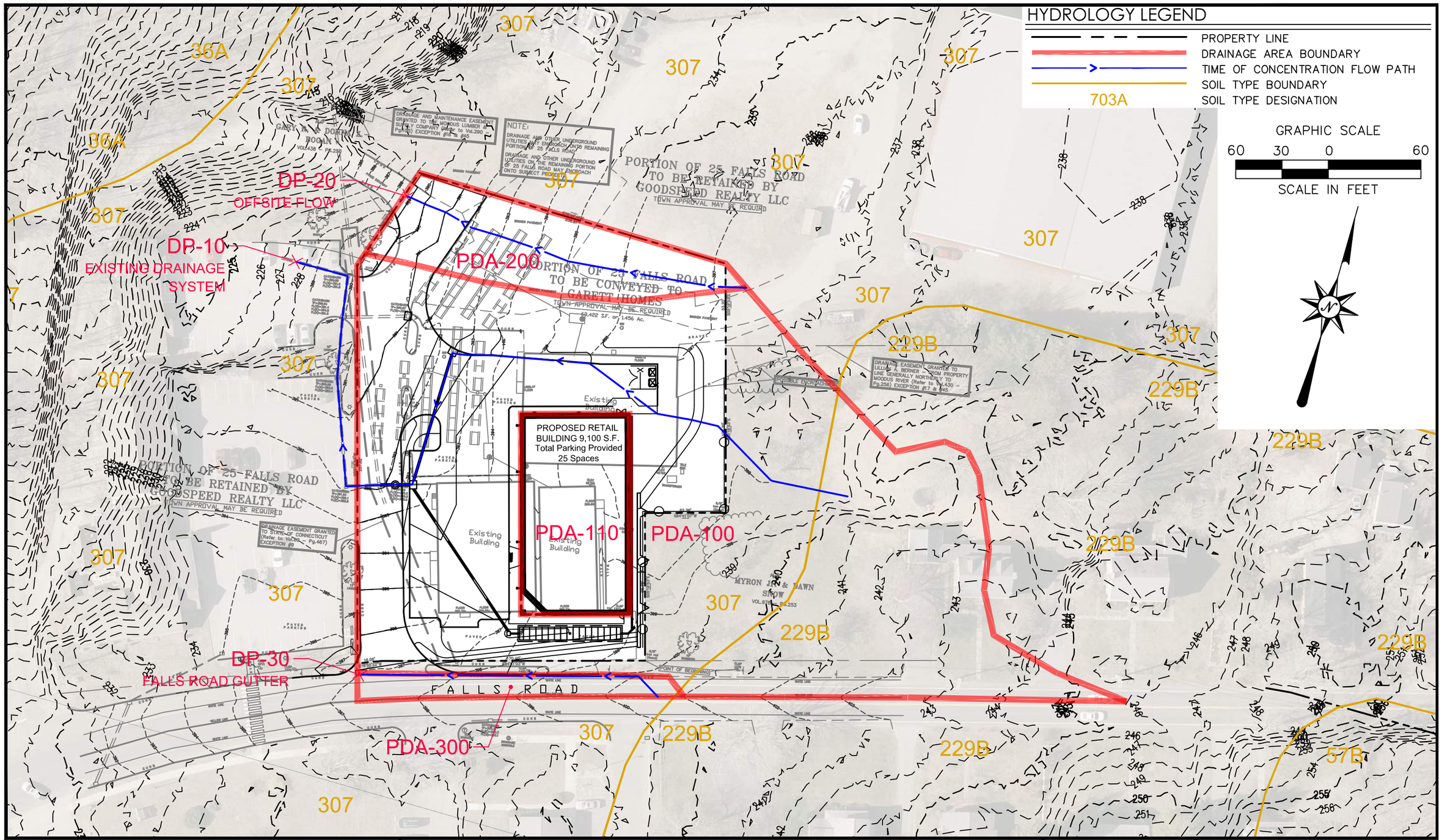
PROPOSED RETAIL DEVELOPMENT
25 FALLS ROAD
EAST HADDAM, CONNECTICUT

Designed	C.J.L.
Drawn	Z.T.Z.
Reviewed	M.J.B.
Scale	1"=60'
Project No.	2001420
Date	02/09/2021
CAD File	ED-2001066-01.dwg

ED-1

©2021 BL COMPANIES, INC. THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF BL COMPANIES.

XREF (s): ; XZ200106601 ; BD200106601



ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

BL Companies

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

PROPOSED DRAINAGE MAPPING

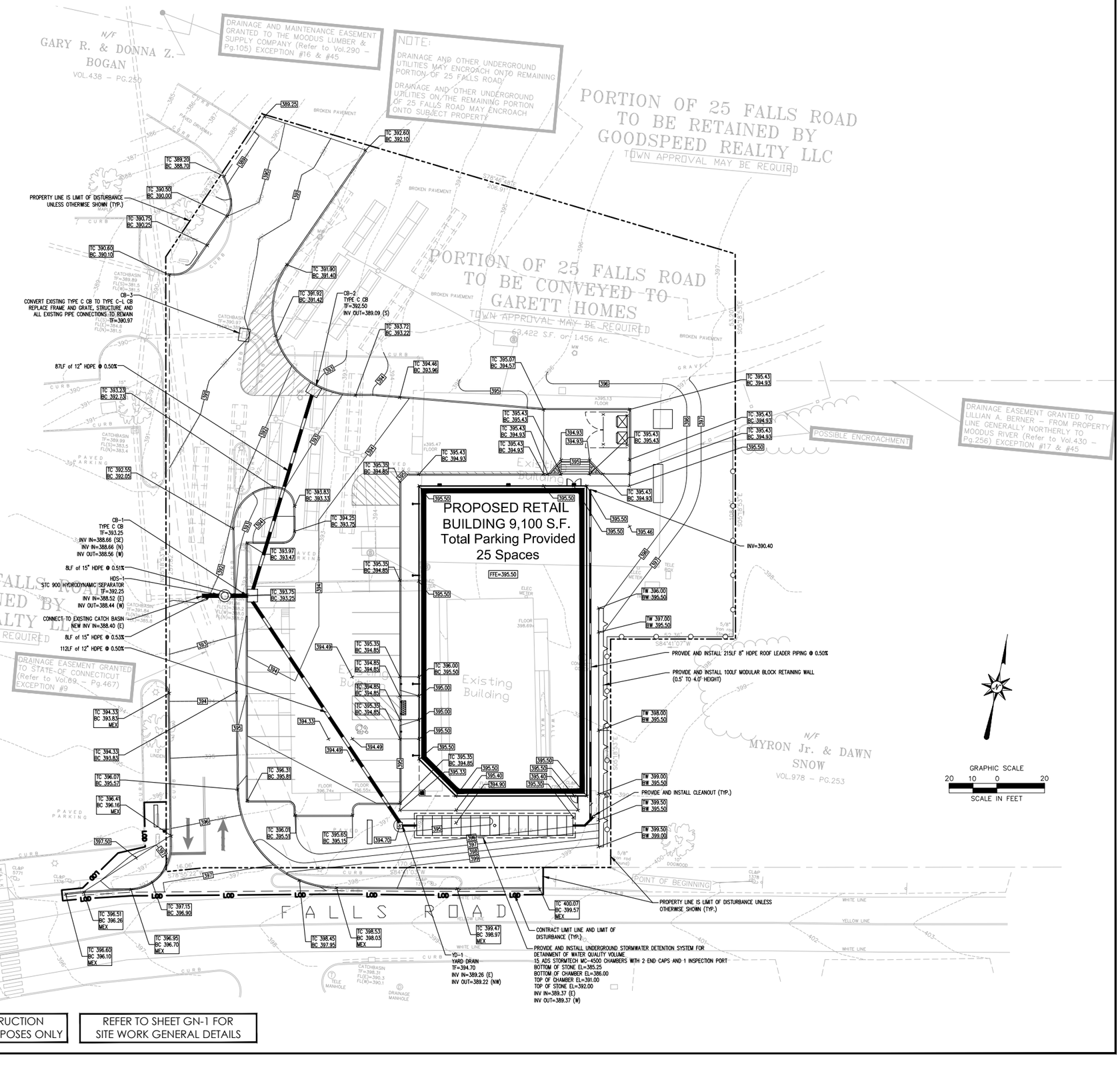
PROPOSED RETAIL DEVELOPMENT
25 FALLS ROAD
EAST HADDAM, CONNECTICUT

Designed	C.J.L.
Drawn	Z.T.Z.
Reviewed	M.J.B.
Scale	1"=60'
Project No.	2001420
Date	02/09/2021
CAD File	PD-2001066-01.dwg

PD-1

©2021 BL COMPANIES, INC. THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF BL COMPANIES.

XREF (s): ; XZ200106601 ; BD200106601 ; XC200106601 ; XC200106602



GRADING AND DRAINAGE LEGEND

- PROPERTY LINE
- LOD — LIMIT OF DISTURBANCE AND SITE WORK CONTRACT LIMIT LINE
- SAWCUT LINE
- 394 — PROPOSED CONTOUR LINE (1' INTERVAL)
- EXISTING CONTOUR LINE (1' INTERVAL)
- 394.00 — PROPOSED SPOT GRADE

SPOT GRADE ABBREVIATIONS

BC	BOTTOM OF CURB
TC	TOP OF CURB
BL	BOTTOM OF LIP
TL	TOP OF LIP
BW	BOTTOM OF WALL
TW	TOP OF WALL
MEX	MEET EXISTING CONDITION

- PROVIDE AND INSTALL STORM PIPE
- PROVIDE AND INSTALL CATCH BASIN (TYPE C OR TYPE C–L)
- PROVIDE AND INSTALL DRAINAGE MANHOLE OR HYDRODYNAMIC SEPARATOR
- PROVIDE AND INSTALL MODULAR BLOCK RETAINING WALL

NOT FOR CONSTRUCTION FOR PERMITTING PURPOSES ONLY

REFER TO SHEET GN-1 FOR SITE WORK GENERAL DETAILS

© 2021 BL COMPANIES, INC. THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF BL COMPANIES.

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

PROPOSED RETAIL DEVELOPMENT

25 FALLS ROAD
EAST HADDAM, CT 06438

REVISIONS

No.	Date	Desc.

Designed	C.J.L.
Drawn	Z.T.Z.
Reviewed	M.J.B.
Scale	1" = 20'
Project No.	2001066
Date	2/3/2021
CAD File:	GD-2001066-01

Title

GRADING AND DRAINAGE PLAN

Sheet No.

GD-1

6 OF 23

2202101 C:\REVIEW\X_CIVIL\SOX1020\09\DWG\GD-2001066-01.DWG,GD-2001066-01

Xref's: BL-24X36.XREF , XC2001066R1 , XC2001066R2

APPENDIX F

STORMWATER SYSTEM
OPERATION AND MAINTENANCE MANUAL

Appendix F:

Stormwater System
Operations and Maintenance Plan

For the Proposed:

Retail Development

Located at:

25 Falls Road (CT Route 149)
East Haddam, Connecticut

Prepared for Submission to:

Town of East Haddam, Connecticut

February 9, 2021

Prepared for:

Garrett Homes, LLC
59 Field Street
Torrington, CT

Prepared by:

Architecture
Engineering
Environmental
Land Surveying
BL Companies

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

BL Project Number: 2001066

Table of Contents

GENERAL OVERVIEW **2**

Purpose & Goals 2
Responsible Parties 2
List of Permits & Special Conditions 3
Maintenance Logs and Checklists 3
Forms 3
Employee Training 3
Spill Control 3

STORM WATER MANAGEMENT **4**

System Components 4
Catch Basins and Manholes 4
Hydrodynamic Separators (or approved equal) 4
Subsurface Stormwater Management Systems (Underground Detention Systems) 5

SITE MAINTENANCE **5**

Parking Lots 5
Landscaping 5
Outdoor Storage 6
Deicing and Snow Removal & Storage 6

General Overview

This Operations and Maintenance Plan has been prepared in support of a Permit Application by Garrett Homes, LLC to the Town of East Haddam for the proposed retail development at 25 Falls Road (CT Route 149). The project parcel is being subdivided from a larger parcel. The resulting property is approximately 1.46 acres in size and is currently developed with three industrial buildings and associated impervious paved parking and drive aisle areas. The property is located on the northern side of Falls Road and east of "The Old Lumberyard" development. The project site shares the driveway connection to Falls Road with The Old Lumber yard development. The parcel is bordered by retail and commercial properties to the north, west, and south and by residential properties to the east. In general, the existing topography slopes from southeast to northwest across the site from approximately elevation 399' to 389'. Slopes on site vary from approximately 2% along Falls Road and the eastern property bound to approximately 8% in the extreme northwest corner of the parcel. In the existing condition, stormwater from the property sheet flows from southeast to northwest and is captured in existing catch basin structures. Stormwater is then conveyed offsite through a subsurface piping system. In addition to runoff from the project parcel, outflow from the also includes sheet flow runoff from a small area of the residential property bordering the site to the east. Proposed site improvements will include a 9,100 square foot retail building, paved parking areas and driveways, landscaped areas, pedestrian sidewalks, site utilities and lighting, and stormwater management systems. The proposed stormwater management systems are designed to be in compliance with the 2004 State of Connecticut Stormwater Quality Manual.

The following Operations and Maintenance Plan was prepared specifically for this proposed development in the Town of East Haddam, 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 East Haddam – Site Plan Permit, Building Permit
- State of Connecticut Department of Transportation – Encroachment Permit
- Farmington Valley Health Department – Septic System 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.

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 for trash accumulation as well as overall condition. 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 Management Systems (Underground Detention Systems)

The underground detention systems 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 underground 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 buildings.

Deicing and Snow Removal & Storage

The use of clean sand may be used to aid traction in conjunction with salt and/or chemicals for deicing, snow melting and other related winter weather management. 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 East Hartford 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 HDS Inspection		
* Underground Detention System Inspection		
FEBRUARY:		
* Catch Basin and HDS Inspection		
MARCH:		
* Catch Basin and HDS Inspection		
APRIL:		
* Catch Basin and HDS Inspection		
* Underground Detention System Inspection		
Sweeping of Paved Surfaces		
Shrub Fertilization		
Lawn Liming (if necessary)		
JUNE:		
Sweeping of Paved Surfaces		
SEPTEMBER:		
* Catch Basin and HDS Inspection		
* Underground Detention System Inspection		
Sweeping of Paved Surfaces		
Tree and Lawn Fertilization		
DECEMBER:		
* Catch Basin and HDS Inspection		
* Underground Detention System Inspection		
Sweeping of Paved Surfaces		

*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 HDS Inspection			
* Underground Detention System Inspection			
Sweeping of Paved Surfaces			
Shrub Fertilization			
Lawn Liming (if necessary)			
JUNE:			
Sweeping of Paved Surfaces			
SEPTEMBER:			
* Catch Basin and HDS Inspection			
* Underground Detention System Inspection			
Sweeping of Paved Surfaces			
Tree and Lawn Fertilization			
DECEMBER:			
* Catch Basin and HDS Inspection			
Sweeping of Paved Surfaces			

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

CATCH BASIN / HYDRODYNAMIC SEPARATOR 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

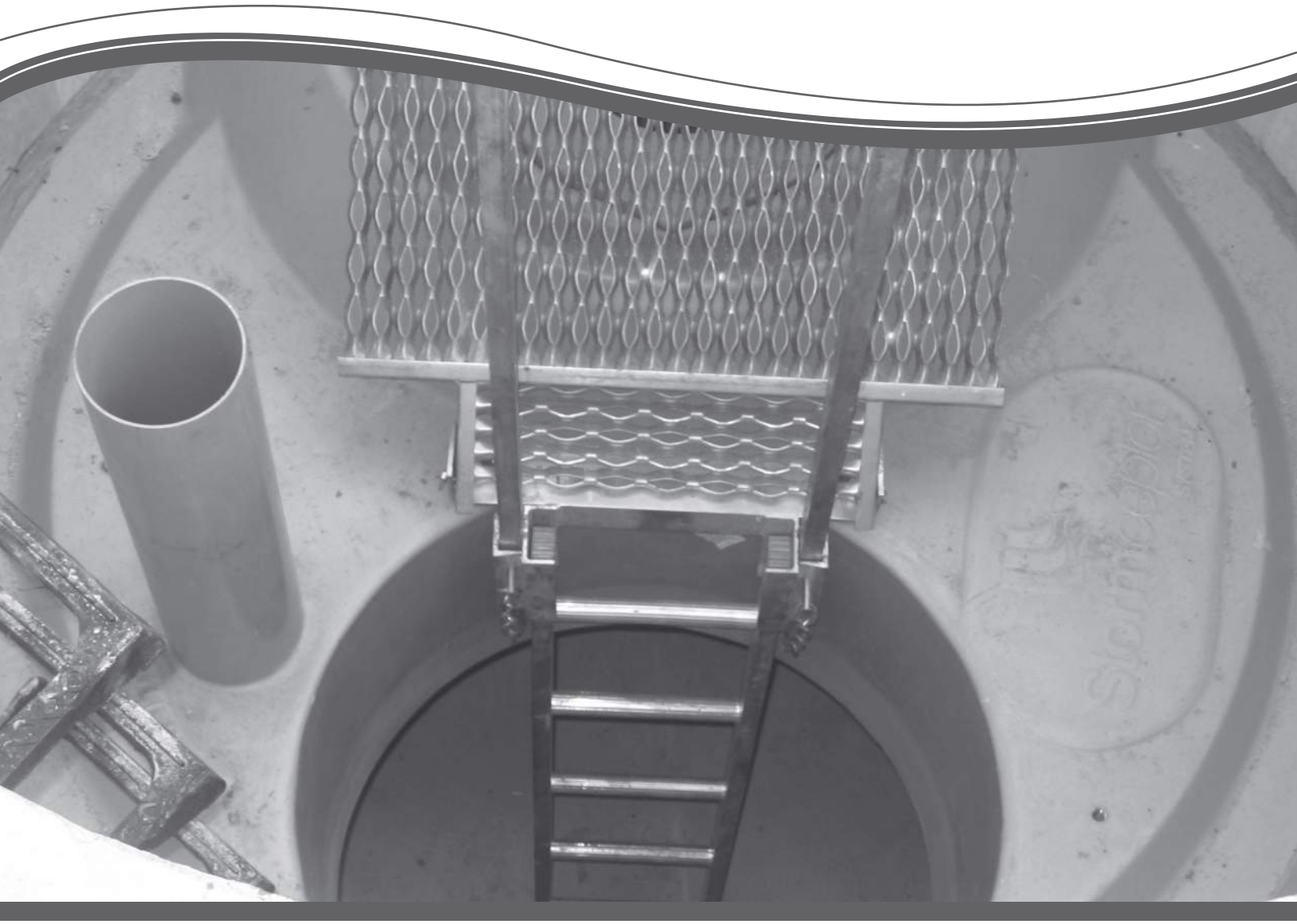
- Secure traffic and pedestrian traffic with cones, barrels, etc.
- Clean surface area around each catch basin.
- Remove grates and set aside
- Clean grates, remove litter and debris that may be trapped within the grate
- Visually inspect condition of outlet hood and remove trash and debris from hood 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 STORMWATER DETENTION SYSTEM AND BASIN 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		
	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

Stormceptor® STC
Operation and Maintenance Guide



Stormceptor® STC

Stormceptor Design Notes

- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.

Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences			
Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000
Single inlet pipe	3 in. (75 mm)	1 in. (25 mm)	3 in. (75 mm)
Multiple inlet pipes	3 in. (75 mm)	3 in. (75 mm)	Only one inlet pipe.

Maximum inlet and outlet pipe diameters:

Inlet/Outlet Configuration	Inlet Unit STC 450i	In-Line Unit STC 900 to STC 7200	Series* STC 11000 to STC 16000
Straight Through	24 inch (600 mm)	42 inch (1050 mm)	60 inch (1500 mm)
Bend (90 degrees)	18 inch (450 mm)	33 inch (825 mm)	33 inch (825 mm)

- The inlet and in-line Stormceptor units can accommodate turns to a maximum of 90 degrees.
- Minimum distance from top of grade to crown is 2 feet (0.6 m)
- Submerged conditions. A unit is submerged when the standing water elevation at the proposed location of the Stormceptor unit is greater than the outlet invert elevation during zero flow conditions. In these cases, please contact your local Stormceptor representative and provide the following information:
- Top of grade elevation
- Stormceptor inlet and outlet pipe diameters and invert elevations
- Standing water elevation
- Stormceptor head loss, K = 1.3 (for submerged condition, K = 4)

Stormceptor® STC

OPERATION AND MAINTENANCE GUIDE
Table of Content

1. About Stormceptor 4
2. Stormceptor Design Overview 4
3. Key Operation Features 6
4. Stormceptor Product Line 7
5. Sizing the Stormceptor System 10
6. Spill Controls 12
7. Stormceptor Options 14
8. Comparing Technologies 17
9. Testing 18
10. Installation 18
11. Stormceptor Construction Sequence 18
12. Maintenance 19

1. About Stormceptor

The Stormceptor® STC (Standard Treatment Cell) was developed by Imbrium™ Systems to address the growing need to remove and isolate pollution from the storm drain system before it enters the environment. The Stormceptor STC targets hydrocarbons and total suspended solids (TSS) in stormwater runoff. It improves water quality by removing contaminants through the gravitational settling of fine sediments and floatation of hydrocarbons while preventing the re-suspension or scour of previously captured pollutants.

The development of the Stormceptor STC revolutionized stormwater treatment, and created an entirely new category of environmental technology. Protecting thousands of waterways around the world, the Stormceptor System has set the standard for effective stormwater treatment.

1.1. Patent Information

The Stormceptor technology is protected by the following patents:

- Australia Patent No. 693,164 • 693,164 • 707,133 • 729,096 • 779401
- Austrian Patent No. 289647
- Canadian Patent No 2,009,208 •2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending)
- China Patent No 1168439
- Denmark DK 711879
- German DE 69534021
- Indonesian Patent No 16688
- Japan Patent No 9-11476 (Pending)
- Korea 10-2000-0026101 (Pending)
- Malaysia Patent No PI9701737 (Pending)
- New Zealand Patent No 314646
- United States Patent No 4,985,148 • 5,498,331 • 5,725,760 • 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690
- Stormceptor OSR Patent Pending • Stormceptor LCS Patent Pending

2. Stormceptor Design Overview

2.1. Design Philosophy

The patented Stormceptor System has been designed to focus on the environmental objective of providing long-term pollution control. The unique and innovative Stormceptor design allows for continuous positive treatment of runoff during all rainfall events, while ensuring that all captured pollutants are retained within the system, even during intense storm events.

An integral part of the Stormceptor design is PCSWMM for Stormceptor - sizing software developed in conjunction with Computational Hydraulics Inc. (CHI) and internationally acclaimed expert, Dr. Bill James. Using local historical rainfall data and continuous simulation modeling, this software allows a Stormceptor unit to be designed for each individual site and the corresponding water quality objectives.

By using PCSWMM for Stormceptor, the Stormceptor System can be designed to remove a wide range of particles (typically from 20 to 2,000 microns), and can also be customized to remove a specific particle size distribution (PSD). The specified PSD should accurately reflect what is in the stormwater runoff to ensure the device is achieving the desired water quality objective. Since stormwater runoff contains small particles (less than 75 microns), it is important to design a treatment system to remove smaller particles in addition to coarse particles.

2.2. Benefits

The Stormceptor System removes free oil and suspended solids from stormwater, preventing spills and non-point source pollution from entering downstream lakes and rivers. The key benefits, capabilities and applications of the Stormceptor System are as follows:

- Provides continuous positive treatment during all rainfall events
- Can be designed to remove over 80% of the annual sediment load
- Removes a wide range of particles
- Can be designed to remove a specific particle size distribution (PSD)
- Captures free oil from stormwater
- Prevents scouring or re-suspension of trapped pollutants
- Pre-treatment to reduce maintenance costs for downstream treatment measures (ponds, swales, detention basins, filters)
- Groundwater recharge protection
- Spills capture and mitigation
- Simple to design and specify
- Designed to your local watershed conditions
- Small footprint to allow for easy retrofit installations
- Easy to maintain (vacuum truck)
- Multiple inlets can connect to a single unit
- Suitable as a bend structure
- Pre-engineered for traffic loading (minimum AASHTO HS-20)
- Minimal elevation drop between inlet and outlet pipes
- Small head loss
- Additional protection provided by an 18" (457 mm) fiberglass skirt below the top of the insert, for the containment of hydrocarbons in the event of a spill.

2.3. Environmental Benefit

Freshwater resources are vital to the health and welfare of their surrounding communities. There is increasing public awareness, government regulations and corporate commitment to reducing the pollution entering our waterways. A major source of this pollution originates from stormwater runoff from urban areas. Rainfall runoff carries oils, sediment and other contaminants from roads and parking lots discharging directly into our streams, lakes and coastal waterways.

The Stormceptor System is designed to isolate contaminants from getting into the natural environment. The Stormceptor technology provides protection for the environment from spills that occur at service stations and vehicle accident sites, while also removing contaminated sediment in runoff that washes from roads and parking lots.

3. Key Operation Features

3.1. Scour Prevention

A key feature of the Stormceptor System is its patented scour prevention technology. This innovation ensures pollutants are captured and retained during all rainfall events, even extreme storms. The Stormceptor System provides continuous positive treatment for all rainfall events, including intense storms. Stormceptor slows incoming runoff, controlling and reducing velocities in the lower chamber to create a non-turbulent environment that promotes free oils and floatable debris to rise and sediment to settle.

The patented scour prevention technology, the fiberglass insert, regulates flows into the lower chamber through a combination of a weir and orifice while diverting high energy flows away through the upper chamber to prevent scouring. Laboratory testing demonstrated no scouring when tested up to 125% of the unit's operating rate, with the unit loaded to 100% sediment capacity (NJDEP, 2005). Second, the depth of the lower chamber ensures the sediment storage zone is adequately separated from the path of flow in the lower chamber to prevent scouring.

3.2. Operational Hydraulic Loading Rate

Designers and regulators need to evaluate the treatment capacity and performance of manufactured stormwater treatment systems. A commonly used parameter is the "operational hydraulic loading rate" which originated as a design methodology for wastewater treatment devices.

Operational hydraulic loading rate may be calculated by dividing the flow rate into a device by its settling area. This represents the critical settling velocity that is the prime determinant to quantify the influent particle size and density captured by the device. PCSWMM for Stormceptor uses a similar parameter that is calculated by dividing the hydraulic detention time in the device by the fall distance of the sediment.

$$v_{SC} = \frac{H}{6_H} = \frac{Q}{A_S}$$

Where:

v_{SC} = critical settling velocity, ft/s (m/s)

H = tank depth, ft (m)

$Ø_H$ = hydraulic detention time, ft/s (m/s)

Q = volumetric flow rate, ft3/s (m3/s)

A_S = surface area, ft^2 (m^2)

(Tchobanoglous, G. and Schroeder, E.D. 1987. Water Quality. Addison Wesley.)

Unlike designing typical wastewater devices, stormwater systems are designed for highly variable flow rates including intense peak flows. PCSWMM for Stormceptor incorporates all of the flows into its calculations, ensuring that the operational hydraulic loading rate is considered not only for one flow rate, but for all flows including extreme events.

3.3. Double Wall Containment

The Stormceptor System was conceived as a pollution identifier to assist with identifying illicit discharges. The fiberglass insert has a continuous skirt that lines the concrete barrel wall for a depth of 18 inches (457 mm) that provides double wall containment for hydrocarbons storage. This protective barrier ensures that toxic floatables do not migrate through the concrete wall into the surrounding soils.

4. Stormceptor Product Line

4.1. Stormceptor Models

A summary of Stormceptor models and capacities are listed in Table 1.

Table 1. Stormceptor Models

Stormceptor Model	Total Storage Volume U.S. Gal (L)	Hydrocarbon Storage Capacity U.S. Gal (L)	Maximum Sediment Capacity ft^3 (L)
STC 450i	470 (1,780)	86 (330)	46 (1,302)
STC 900	952 (3,600)	251 (950)	89 (2,520)
STC 1200	1,234 (4,670)	251 (950)	127 (3,596)
STC 1800	1,833 (6,940)	251 (950)	207 (5,861)
STC 2400	2,462 (9,320)	840 (3,180)	205 (5,805)
STC 3600	3,715 (1,406)	840 (3,180)	373 (10,562)
STC 4800	5,059 (1,950)	909 (3,440)	543 (15,376)
STC 6000	6,136 (23,230)	909 (3,440)	687 (19,453)
STC 7200	7,420 (28,090)	1,059 (4,010)	839 (23,757)
STC 11000	11,194 (42,370)	2,797 (10, 590)	1,086 (30,752)
STC 13000	13,348 (50,530)	2,797 (10, 590)	1,374 (38,907)
STC 16000	15,918 (60,260)	3,055 (11, 560)	1,677 (47,487)

NOTE: Storage volumes may vary slightly from region to region. For detailed information, contact your local Stormceptor representative.

4.2. Inline Stormceptor

The Inline Stormceptor, Figure 1, is the standard design for most stormwater treatment applications. The patented Stormceptor design allows the Inline unit to maintain continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate. The Inline Stormceptor is composed of a precast concrete tank with a fiberglass insert situated at the invert of the storm sewer pipe, creating an upper chamber above the insert and a lower chamber below the insert.

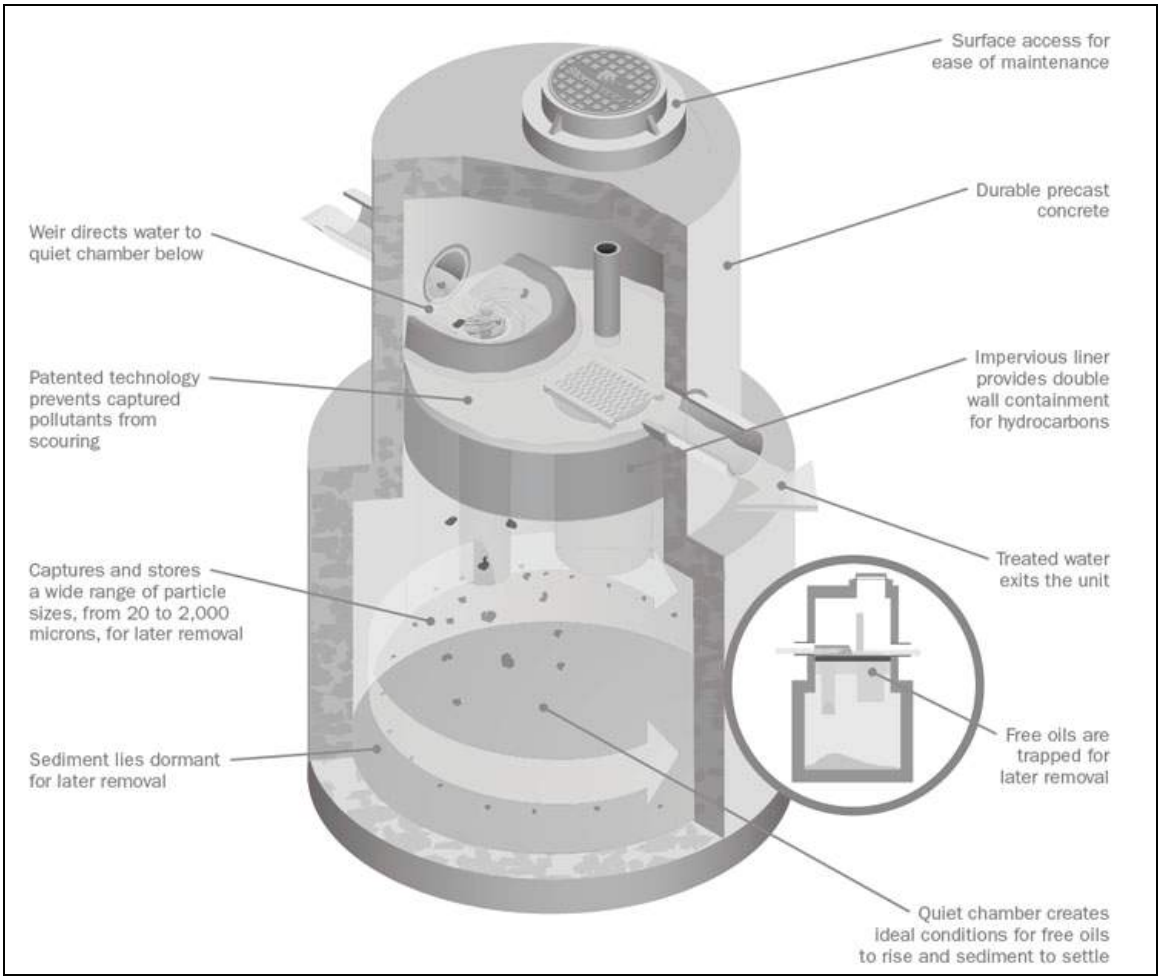


Figure 1. Inline Stormceptor

Operation

As water flows into the Stormceptor unit, it is slowed and directed to the lower chamber by a weir and drop tee. The stormwater enters the lower chamber, a non-turbulent environment, allowing free oils to rise and sediment to settle. The oil is captured underneath the fiberglass insert and shielded from exposure to the concrete walls by a fiberglass skirt. After the pollutants separate, treated water continues up a riser pipe, and exits the lower chamber on the downstream side of the weir before leaving the unit. During high flow events, the Stormceptor System's patented scour prevention technology ensures continuous pollutant removal and prevents re-suspension of previously captured pollutants.

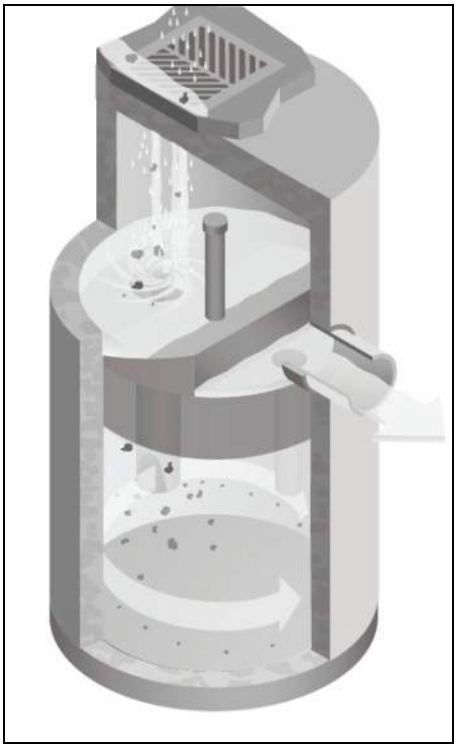


Figure 2. Inlet Stormceptor

4.3. Inlet Stormceptor

The Inlet Stormceptor System, Figure 2, was designed to provide protection for parking lots, loading bays, gas stations and other spill-prone areas. The Inlet Stormceptor is designed to remove sediment from stormwater introduced through a grated inlet, a storm sewer pipe, or both.

The Inlet Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

4.4. Series Stormceptor

Designed to treat larger drainage areas, the Series Stormceptor System, Figure 3, consists of two adjacent Stormceptor models that function in parallel. This design eliminates the need for additional structures and piping to reduce installation costs.

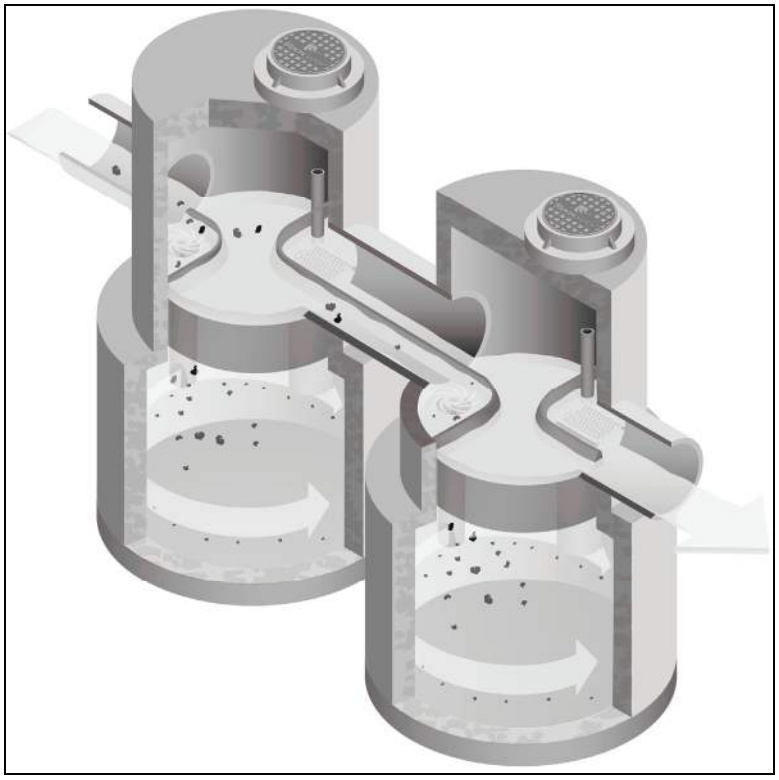


Figure 3. Series System

The Series Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

5. Sizing the Stormceptor System

The Stormceptor System is a versatile product that can be used for many different aspects of water quality improvement. While addressing these needs, there are conditions that the designer needs to be aware of in order to size the Stormceptor model to meet the demands of each individual site in an efficient and cost-effective manner.

PCSWMM for Stormceptor is the support tool used for identifying the appropriate Stormceptor model. In order to size a unit, it is recommended the user follow the seven design steps in the program. The steps are as follows:

STEP 1 – Project Details

The first step prior to sizing the Stormceptor System is to clearly identify the water quality objective for the development. It is recommended that a level of annual sediment (TSS) removal be identified and defined by a particle size distribution.

STEP 2 – Site Details

Identify the site development by the drainage area and the level of imperviousness. It is recommended that imperviousness be calculated based on the actual area of imperviousness based on paved surfaces, sidewalks and rooftops.

STEP 3 – Upstream Attenuation

The Stormceptor System is designed as a water quality device and is sometimes used in conjunction with onsite water quantity control devices such as ponds or underground detention systems. When possible, a greater benefit is typically achieved when installing a Stormceptor unit upstream of a detention facility. By placing the Stormceptor unit upstream of a detention structure, a benefit of less maintenance of the detention facility is realized.

STEP 4 – Particle Size Distribution

It is critical that the PSD be defined as part of the water quality objective. PSD is critical for the design of treatment system for a unit process of gravity settling and governs the size of a treatment system. A range of particle sizes has been provided and it is recommended that clays and silt-sized particles be considered in addition to sand and gravel-sized particles. Options and sample PSDs are provided in PCSWMM for Stormceptor. The default particle size distribution is the Fine Distribution, Table 2, option.

Table 2. Fine Distribution

Particle Size	Distribution	Specific Gravity
20	20%	1.3
60	20%	1.8
150	20%	2.2
400	20%	2.65
2000	20%	2.65

If the objective is the long-term removal of 80% of the total suspended solids on a given site, the PSD should be representative of the expected sediment on the site. For example, a system designed to remove 80% of coarse particles (greater than 75 microns) would provide relatively poor removal efficiency of finer particles that may be naturally prevalent in runoff from the site.

Since the small particle fraction contributes a disproportionately large amount of the total available particle surface area for pollutant adsorption, a system designed primarily for coarse particle capture will compromise water quality objectives.

STEP 5 – Rainfall Records

Local historical rainfall has been acquired from the U.S. National Oceanic and Atmospheric Administration, Environment Canada and regulatory agencies across North America. The rainfall data provided with PCSMM for Stormceptor provides an accurate estimation of small storm hydrology by modeling actual historical storm events including duration, intensities and peaks.

STEP 6 – Summary

At this point, the program may be executed to predict the level of TSS removal from the site. Once the simulation has completed, a table shall be generated identifying the TSS removal of each Stormceptor unit.

STEP 7 – Sizing Summary

Performance estimates of all Stormceptor units for the given site parameters will be displayed in a tabular format. The unit that meets the water quality objective, identified in Step 1, will be highlighted.

5.1. PCSWMM for Stormceptor

The Stormceptor System has been developed in conjunction with PCSWMM for Stormceptor as a technological solution to achieve water quality goals. Together, these two innovations model, simulate, predict and calculate the water quality objectives desired by a design engineer for TSS removal.

PCSWMM for Stormceptor is a proprietary sizing program which uses site specific inputs to a computer model to simulate sediment accumulation, hydrology and long-term total suspended solids removal. The model has been calibrated to field monitoring results from Stormceptor units that have been monitored in North America. The sizing methodology can be described by three processes:

1. Determination of real time hydrology
2. Buildup and wash off of TSS from impervious land areas
3. TSS transport through the Stormceptor (settling and discharge). The use of a calibrated model is the preferred method for sizing stormwater quality structures for the following reasons:
    - » The hydrology of the local area is properly and accurately incorporated in the sizing (distribution of flows, flow rate ranges and peaks, back-to-back storms, inter-event times)
    - » The distribution of TSS with the hydrology is properly and accurately considered in the sizing
    - » Particle size distribution is properly considered in the sizing
    - » The sizing can be optimized for TSS removal
    - » The cost benefit of alternate TSS removal criteria can be easily assessed
    - » The program assesses the performance of all Stormceptor models. Sizing may be selected based on a specific water quality outcome or based on the Maximum Extent Practicable

For more information regarding PCSWMM for Stormceptor, contact your local Stormceptor representative, or visit www.imbriumsystems.com to download a free copy of the program.

5.2. Sediment Loading Characteristics

The way in which sediment is transferred to stormwater can have a considerable effect on which type of system is implemented. On typical impervious surfaces (e.g. parking lots) sediment will build over time and wash off with the next rainfall. When rainfall patterns are examined, a short intense storm will have a higher concentration of sediment than a long slow drizzle. Together with rainfall data representing the site's typical rainfall patterns, sediment loading characteristics play a part in the correct sizing of a stormwater quality device.

Typical Sites

For standard site design of the Stormceptor System, PCSWMM for Stormceptor is utilized to accurately assess the unit's performance. As an integral part of the product's design, the program can be used to meet local requirements for total suspended solid removal. Typical installations of manufactured stormwater treatment devices would occur on areas such as paved parking lots or paved roads. These are considered "stable" surfaces which have non – erodible surfaces.

Unstable Sites

While standard sites consist of stable concrete or asphalt surfaces, sites such as gravel parking lots, or maintenance yards with stockpiles of sediment would be classified as "unstable". These types of sites do not exhibit first flush characteristics, are highly erodible and exhibit atypical sediment loading characteristics and must therefore be sized more carefully. Contact your local Stormceptor representative for assistance in selecting a proper unit sized for such unstable sites.

6. Spill Controls

When considering the removal of total petroleum hydrocarbons (TPH) from a storm sewer system there are two functions of the system: oil removal, and spill capture.

'Oil Removal' describes the capture of the minute volumes of free oil mobilized from impervious surfaces. In this instance relatively low concentrations, volumes and flow rates are considered. While the Stormceptor unit will still provide an appreciable oil removal function during higher flow events and/or with higher TPH concentrations, desired effluent limits may be exceeded under these conditions.

'Spill Capture' describes a manner of TPH removal more appropriate to recovery of a relatively high volume of a single phase deleterious liquid that is introduced to the storm sewer system over a relatively short duration. The two design criteria involved when considering this manner of introduction are overall volume and the specific gravity of the material. A standard Stormceptor unit will be able to capture and retain a maximum spill volume and a minimum specific gravity.

For spill characteristics that fall outside these limits, unit modifications are required. Contact your local Stormceptor Representative for more information.

One of the key features of the Stormceptor technology is its ability to capture and retain spills. While the standard Stormceptor System provides excellent protection for spill control, there are additional options to enhance spill protection if desired.

6.1. Oil Level Alarm

The oil level alarm is an electronic monitoring system designed to trigger a visual and audible alarm when a pre-set level of oil is reached within the lower chamber. As a standard, the oil

level alarm is designed to trigger at approximately 85% of the unit's available depth level for oil capture. The feature acts as a safeguard against spills caused by exceeding the oil storage capacity of the separator and eliminates the need for manual oil level inspection.

The oil level alarm installed on the Stormceptor insert is illustrated in Figure 4.

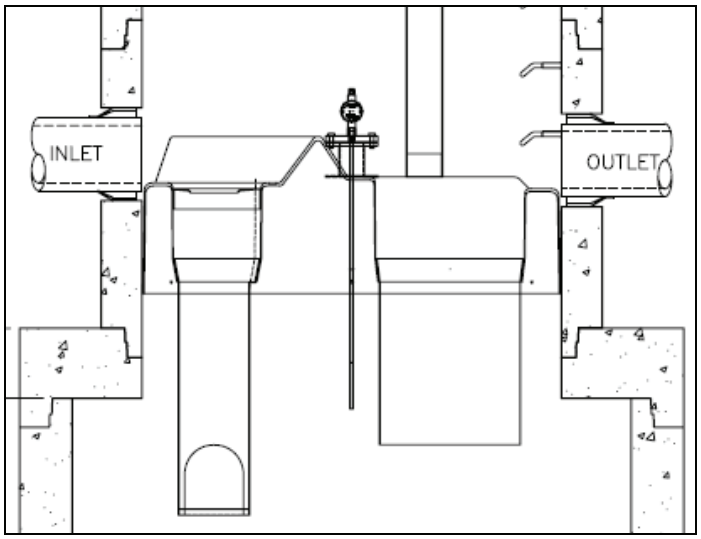


Figure 4. Oil level alarm

6.2. Increased Volume Storage Capacity

The Stormceptor unit may be modified to store a greater spill volume than is typically available. Under such a scenario, instead of installing a larger than required unit, modifications can be made to the recommended Stormceptor model to accommodate larger volumes. Contact your local Stormceptor representative for additional information and assistance for modifications.

7. Stormceptor Options

The Stormceptor System allows flexibility to incorporate to existing and new storm drainage infrastructure. The following section identifies considerations that should be reviewed when installing the system into a drainage network. For conditions that fall outside of the recommendations in this section, please contact your local Stormceptor representative for further guidance.

7.1. Installation Depth Minimum Cover

The minimum distance from the top of grade to the crown of the inlet pipe is 24 inches (600 mm). For situations that have a lower minimum distance, contact your local Stormceptor representative.

7.2. Maximum Inlet and Outlet Pipe Diameters

Maximum inlet and outlet pipe diameters are illustrated in Figure 5. Contact your local Stormceptor representative for larger pipe diameters

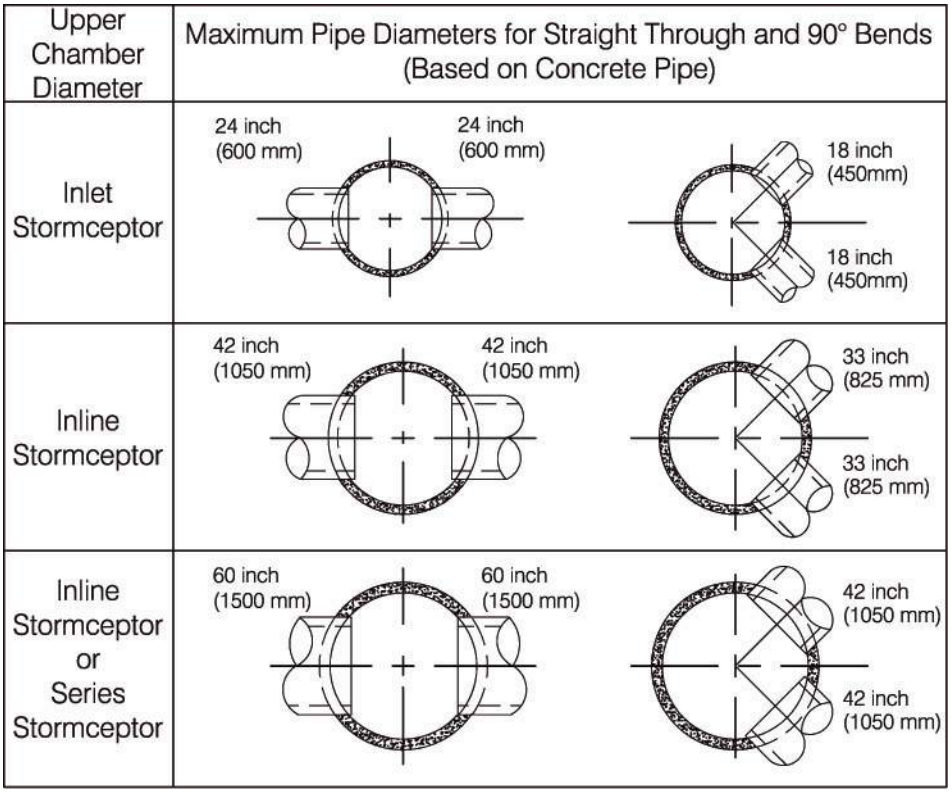


Figure 5. Maximum pipe diameters for straight through and bend applications

*The bend should only be incorporated into the second structure (downstream structure) of the Series Stormceptor System

7.3. Bends

The Stormceptor System can be used to change horizontal alignment in the storm drain network up to a maximum of 90 degrees. Figure 6 illustrates the typical bend situations of the Stormceptor System. Bends should only be applied to the second structure (downstream structure) of the Series Stormceptor System.

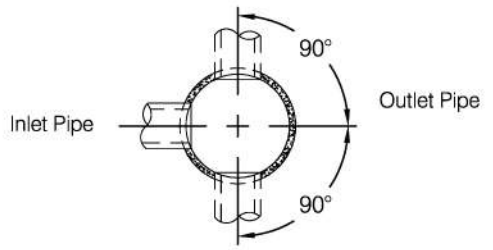
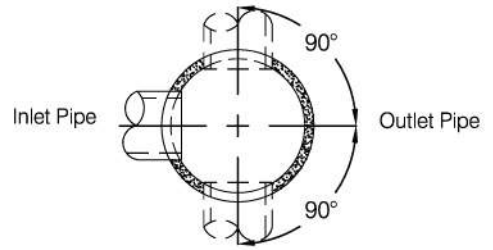
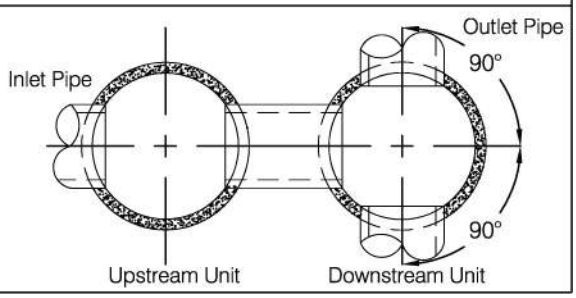
Stormceptor System	Maximum Bend Configurations
Inlet Stormceptor	
Inline Stormceptor	
Series Stormceptor	

Figure 6. Maximum bend angles

7.4. Multiple Inlet Pipes

The Inlet and Inline Stormceptor System can accommodate two or more inlet pipes. The maximum number of inlet pipes that can be accommodated into a Stormceptor unit is a function of the number, alignment and diameter of the pipes and its effects on the structural integrity of the precast concrete. When multiple inlet pipes are used for new developments, each inlet pipe shall have an invert elevation 3 inches (75 mm) higher than the outlet pipe invert elevation.

7.5. Inlet/Outlet Pipe Invert Elevations

Recommended inlet and outlet pipe invert differences are listed in Table 3.

Table 3. Recommended Drops Between Inlet and Outlet Pipe Inverts

Number of Inlet Pipes	Inlet System	In-Line System	Series System
1	3 inches (75 mm)	1 inch (25 mm)	3 inches (75 mm)
>1	3 inches (75 mm)	3 inches (75 mm)	Not Applicable

7.6. Shallow Stormceptor

In cases where there may be restrictions to the depth of burial of storm sewer systems. In this situation, for selected Stormceptor models, the lower chamber components may be increased in diameter to reduce the overall depth of excavation required.

7.7. Customized Live Load

The Stormceptor system is typically designed for local highway truck loading (AASHTO HS- 20). When the project requires live loads greater than HS-20, the Stormceptor System may be customized structurally for a pre-specified live load. Contact your local Stormceptor representative for customized loading conditions.

7.8. Pre-treatment

The Stormceptor System may be sized to remove sediment and for spills control in conjunction with other stormwater BMPs to meet the water quality objective. For pretreatment applications, the Stormceptor System should be the first unit in a treatment train. The benefits of pre-treatment include the extension of the operational life (extension of maintenance frequency) of large stormwater management facilities, prevention of spills and lower total life- cycle maintenance cost.

7.9. Head loss

The head loss through the Stormceptor System is similar to a 60 degree bend at a manhole. The K value for calculating minor losses is approximately 1.3 (minor loss = k*1.3v2/2g).

However, when a Submerged modification is applied to a Stormceptor unit, the corresponding K value is 4.

7.10. Submerged

The Submerged modification, Figure 7, allows the Stormceptor System to operate in submerged or partially submerged storm sewers. This configuration can be installed on all models of the Stormceptor System by modifying the fiberglass insert. A customized weir height and a secondary drop tee are added.

Submerged instances are defined as standing water in the storm drain system during zero flow conditions. In these instances, the following information is necessary for the proper design and application of submerged modifications:

- Stormceptor top of grade elevation
- Stormceptor outlet pipe invert elevation
- Standing water elevation

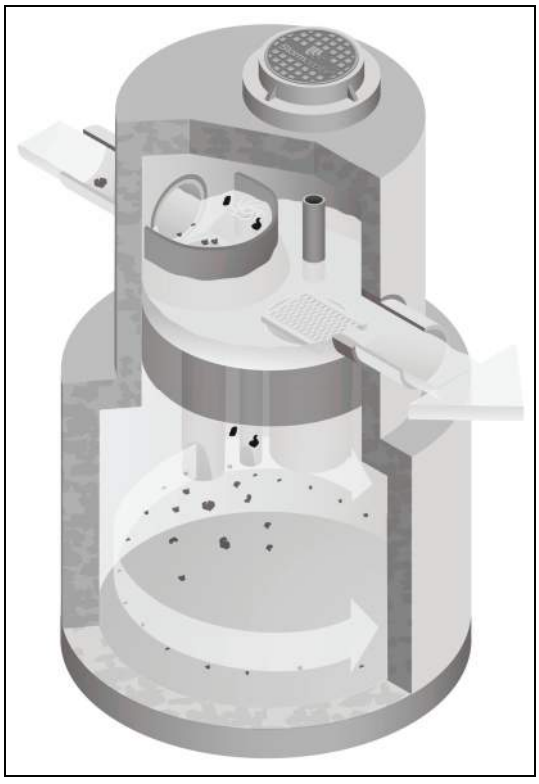


Figure 7. Submerged Stormceptor

8. Comparing Technologies

Designers have many choices available to achieve water quality goals in the treatment of stormwater runoff. Since many alternatives are available for use in stormwater quality treatment it is important to consider how to make an appropriate comparison between "approved alternatives". The following is a guide to assist with the accurate comparison of differing technologies and performance claims.

8.1. Particle Size Distribution (PSD)

The most sensitive parameter to the design of a stormwater quality device is the selection of the design particle size. While it is recommended that the actual particle size distribution (PSD) for sites be measured prior to sizing, alternative values for particle size should be selected to represent what is likely to occur naturally on the site. A reasonable estimate of a particle size distribution likely to be found on parking lots or other impervious surfaces should consist of a wide range of particles such as 20 microns to 2,000 microns (Ontario MOE, 1994).

There is no absolute right particle size distribution or specific gravity and the user is cautioned to review the site location, characteristics, material handling practices and regulatory requirements when selecting a particle size distribution. When comparing technologies, designs using different PSDs will result in incomparable TSS removal efficiencies. The PSD of the TSS removed needs to be standard between two products to allow for an accurate comparison.

8.2. Scour Prevention

In order to accurately predict the performance of a manufactured treatment device, there must be confidence that it will perform under all conditions. Since rainfall patterns cannot be predicted, stormwater quality devices placed in storm sewer systems must be able to withstand extreme events, and ensure that all pollutants previously captured are retained in the system.

In order to have confidence in a system's performance under extreme conditions, independent validation of scour prevention is essential when examining different technologies. Lack of independent verification of scour prevention should make a designer wary of accepting any product's performance claims.

8.3. Hydraulics

Full scale laboratory testing has been used to confirm the hydraulics of the Stormceptor System. Results of lab testing have been used to physically design the Stormceptor System and the sewer pipes entering and leaving the unit. Key benefits of Stormceptor are:

- Low head loss (typical k value of 1.3)
- Minimal inlet/outlet invert elevation drop across the structure
- Use as a bend structure
- Accommodates multiple inlets

The adaptability of the treatment device to the storm sewer design infrastructure can affect the overall performance and cost of the site.

8.4. Hydrology

Stormwater quality treatment technologies need to perform under varying climatic conditions. These can vary from long low intensity rainfall to short duration, high intensity storms. Since a treatment device is expected to perform under all these conditions, it makes sense that any system's design should accommodate those conditions as well.

Long-term continuous simulation evaluates the performance of a technology under the varying conditions expected in the climate of the subject site. Single, peak event design does not provide this information and is not equivalent to long-term simulation. Designers should request long-term simulation performance to ensure the technology can meet the long-term water quality objective.

9. Testing

The Stormceptor System has been the most widely monitored stormwater treatment technology in the world. Performance verification and monitoring programs are completed to the strictest standards and integrity. Since its introduction in 1990, numerous independent field tests and studies detailing the effectiveness of the Stormceptor System have been completed.

- Coventry University, UK – 97% removal of oil, 83% removal of sand and 73% removal of peat
- National Water Research Institute, Canada, - scaled testing for the development of the Stormceptor System identifying both TSS removal and scour prevention.
- New Jersey TARP Program – full scale testing of an STC 900 demonstrating 75% TSS removal of particles from 1 to 1000 microns. Scour testing completed demonstrated that the system does not scour. The New Jersey Department of Environmental Protection was followed.
- City of Indianapolis – full scale testing of an STC 900 demonstrating over 80% TSS removal of particles from 50 microns to 300 microns at 130% of the unit's operating rate. Scour testing completed demonstrated that the system does not scour.
- Westwood Massachusetts (1997), demonstrated >80% TSS removal
- Como Park (1997), demonstrated 76% TSS removal
- Ontario MOE SWAMP Program – 57% removal of 1 to 25 micron particles
- Laval Quebec – 50% removal of 1 to 25 micron particles

10. Installation

The installation of the concrete Stormceptor should conform in general to state highway, or local specifications for the installation of manholes. Selected sections of a general specification that are applicable are summarized in the following sections.

10.1. Excavation

Excavation for the installation of the Stormceptor should conform to state highway, or local specifications. Topsoil removed during the excavation for the Stormceptor should be stockpiled in designated areas and should not be mixed with subsoil or other materials.

Topsoil stockpiles and the general site preparation for the installation of the Stormceptor should conform to state highway or local specifications.

The Stormceptor should not be installed on frozen ground. Excavation should extend a minimum of 12 inches (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

In areas with a high water table, continuous dewatering may be required to ensure that the excavation is stable and free of water.

10.2. Backfilling

Backfill material should conform to state highway or local specifications. Backfill material should be placed in uniform layers not exceeding 12 inches (300mm) in depth and compacted to state highway or local specifications.

11. Stormceptor Construction Sequence

The concrete Stormceptor is installed in sections in the following sequence:

1. Aggregate base
2. Base slab
3. Lower chamber sections
4. Upper chamber section with fiberglass insert
5. Connect inlet and outlet pipes
6. Assembly of fiberglass insert components (drop tee, riser pipe, oil cleanout port and orifice plate
7. Remainder of upper chamber
8. Frame and access cover

The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

Adjustment of the Stormceptor can be performed by lifting the upper sections free of the excavated area, re-leveling the base and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the Stormceptor has been constructed, any lift holes must be plugged with mortar.

12. Maintenance

12.1. Health and Safety

The Stormceptor System has been designed considering safety first. It is recommended that confined space entry protocols be followed if entry to the unit is required. In addition, the fiberglass insert has the following health and safety features:

- Designed to withstand the weight of personnel
- A safety grate is located over the 24 inch (600 mm) riser pipe opening
- Ladder rungs can be provided for entry into the unit, if required

12.2. Maintenance Procedures

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The vacuum service industry is a well- established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances.

The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the guideline values provided in the Table 4.

Table 4. Sediment Depths Indicating Required Servicing*

Particle Size	Specific Gravity
Model	Sediment Depth inches (mm)
450i	8 (200)
900	8 (200)
1200	10 (250)
1800	15 (381)
2400	12 (300)
3600	17 (430)
4800	15 (380)
6000	18 (460)
7200	15 (381)
11000	17 (380)
13000	20 (500)
16000	17 (380)
* based on 15% of the Stormceptor unit's total storage	

Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years).

Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 24 inches (600 mm) opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

1. Check for oil through the oil cleanout port
2. Remove any oil separately using a small portable pump
3. Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank
4. Remove the sludge from the bottom of the unit using the vacuum truck
5. Re-fill Stormceptor with water where required by the local jurisdiction

12.3. Submerged Stormceptor

Careful attention should be paid to maintenance of the Submerged Stormceptor System. In cases where the storm drain system is submerged, there is a requirement to plug both the inlet and outlet pipes to economically clean out the unit.

12.4. Hydrocarbon Spills

The Stormceptor is often installed in areas where the potential for spills is great. The Stormceptor System should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

12.5. Disposal

Requirements for the disposal of material from the Stormceptor System are similar to that of any other stormwater Best Management Practice (BMP) where permitted. Disposal options for the sediment may range from disposal in a sanitary trunk sewer upstream of a sewage treatment plant, to disposal in a sanitary landfill site. Petroleum waste products collected in the Stormceptor (free oil/chemical/fuel spills) should be removed by a licensed waste management company.

12.6. Oil Sheens

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a rainbow or sheen can be seen at very small oil concentrations (<10 mg/L). Stormceptor will remove over 98% of all free oil spills from storm sewer systems for dry weather or frequently occurring runoff events.

The appearance of a sheen at the outlet with high influent oil concentrations does not mean the unit is not working to this level of removal. In addition, if the influent oil is emulsified the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified conditions.



SUPPORT

Drawings and specifications are available at www.ContechES.com.

Site-specific design support is available from our engineers.

©2020 Contech Engineered Solutions LLC, a QUIKRETE Company

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122

NOTHING IN THIS CATALOG SHOULD BE CONSTRUED AS A WARRANTY. APPLICATIONS SUGGESTED HEREIN ARE DESCRIBED ONLY TO HELP READERS MAKE THEIR OWN EVALUATIONS AND DECISIONS, AND ARE NEITHER GUARANTEES NOR WARRANTIES OF SUITABILITY FOR ANY APPLICATION. CONTECH MAKES NO WARRANTY WHATSOEVER, EXPRESS OR IMPLIED, RELATED TO THE APPLICATIONS, MATERIALS, COATINGS, OR PRODUCTS DISCUSSED HEREIN. ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND ALL IMPLIED WARRANTIES OF FITNESS FOR ANY PARTICULAR PURPOSE ARE DISCLAIMED BY CONTECH. SEE CONTECH'S CONDITIONS OF SALE (AVAILABLE AT WWW.CONTECHES.COM/COS) FOR MORE INFORMATION.

CONTECH ENGINEERED SOLUTIONS
800-925-5240
www.ContechES.com