

Nitsch Engineering

Mystic Water Works at Capen Court

Stormwater Report

Prepared for:

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Nitsch Project #8398

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INTRODUCTION

Nitsch Engineering has prepared this Stormwater Management Report to document compliance with the Massachusetts Stormwater Management Standards associated with the Mystic Water Works located at Capen Court in Somerville, Massachusetts.

This work will include the demolition of existing garage building, paved driveways, parking areas and walkways, renovation of the existing Mystic Water Works building and the construction of a new housing building, parking lot, courtyard, and the stormwater management system to treat and control the stormwater runoff from the associated surface areas.

EXISTING CONDITIONS

Site Description

The site is located Mystic Water works building consists of approximately 1.4± acres and is located at the intersection of Capen Court and Mystic Valley Parkway in Somerville, Massachusetts. The property is bounded by Mystic Valley Parkway to the north and west, commercial properties to the east and senior housing to the south. The existing site includes Capen Court and the adjacent paved parking area along the western portion of the site.

The soil type on the site was determined using the Natural Resources Conservation Services (NRCS) Soil Survey for Middlesex County, Massachusetts. The NRCS has classified the existing subsoil covering the project site consisting of Scio very fine sandy loam with 0 to 3 percent slopes and urban land (land disturbed by construction activity).

The overall terrain generally slopes in a northerly/northwesterly direction from a maximum elevation of 35 along the southern property line to a minimum elevation of 17 along Mystic Valley parkway based on the National Geodetic Vertical Datum (NGVD) of 1929.

The site is listed within Zone X (outside of 100 year flood plain) on Panel 417, Map No. 25017C0417E of the Flood Insurance Rate Map

PROPOSED CONDITIONS

Site Description

The project consists of the redevelopment and conversion of the existing Mystic Water Works located on Mystic Valley Parkway in Somerville into a twenty-five (25) affordable housing unit rental apartment building and the demolition of the existing office and garage outbuilding to be replaced with a newly constructed thirty-five (35) affordable housing unit rental apartment building. All of the sixty (60) one-bedroom units will be designated as low or moderate income units under state guidelines.

The existing Mystic Water Works office and garage outbuilding will be demolished along with the existing paved driveways, paved areas, parking areas, and walkways. The proposed site construction will include new access roadways/driveways, parking areas, courtyard and a stormwater management system to treat and control the stormwater runoff from the site surface areas.

Sediment and Erosion Control Measures

Sediment and erosion control during construction will prevent possible damage to the BVW and the drainage systems. The following guidelines will be adhered to during construction:

1. Keep land disturbance to a minimum. Plan the phases of development so that only the areas actively being developed are exposed. All other areas should have natural vegetation preserved, have good temporary cover, or permanent vegetation established.
2. Stabilize disturbed areas. Permanent structures, temporary or permanent vegetation, and mulch should be employed as quickly as possible after land is disturbed.
3. Protect disturbed areas from stormwater runoff. Install erosion control or stormwater management measures to prevent water from entering and running over disturbed areas, and to prevent erosion damage to downstream facilities.

Install perimeter control practices (siltation fences and/or straw bales). Use practices that isolate the development site from surrounding areas. There will be sediment and erosion controls placed on site. The control will include silt fence with straw bales or watties, and inlet protection for all the catch basins that could receive sediment from work on site.

The contractor will be required to do inspections of all controls regularly to ensure that the controls are working properly. The contractor shall clean and reinstall any control that needs to be cleaned or replaced.

Contractor will clean/flush entire stormwater system prior to final acceptance by the owner.

STORMWATER MANAGEMENT ANALYSIS

Nitsch has performed a stormwater management analysis to compare the pre- and post-development conditions for the Mystic Water Works at Capen Court. The proposed project will reduce the impervious area on site from 42,149 square feet to 40,916 square feet (a reduction of 2.02% compared to the total site area) of the site. As such, the proposed project will result in a decrease in the rate and volume of stormwater run-off.

Nitsch analyzed the hydrology for the drainage areas with the Soil Conservation Service's (SCS) Runoff Curve Number (CN) methodology. The HydroCAD Version 9.10 computer modeling system was used in conjunction with the SCS's methods to determine the peak rates of runoff for the 2-year, 10-year, 25-year, and 100-year 24-hour storm events.

Methodology

Hydrology and Hydraulics

A drainage area, or subcatchment, is an area where the runoff from that area flows to a point, referred to as a design point. The design point is the focus of the runoff analysis. Peak rates of runoff for the existing and proposed conditions are calculated and compared at the design point.

The rate at which the runoff reaches the design point is determined by a number of factors: the slope and flow lengths of the subcatchment area, the soil type of the subcatchment area, and the type of surface cover in the subcatchment area.

The slope of the subcatchment area directly affects the amount and rate of runoff from a subcatchment area. With all other things being equal, a site with steep slopes will produce

more runoff and transport it at a faster rate than a flat site. With a flat site, the rain will have more time to infiltrate the ground before it flows away as runoff. The slope of the site is easily determined by using an existing conditions survey or by a field examination.

The flow length of a subcatchment area is the longest distance that runoff would have to travel to reach the design point. Flow length is an important factor in determining the time of concentration (T_c). The time of concentration is time for runoff to travel from the hydraulically most distant point of the drainage area to a point of interest in that drainage area, in this case, the design point. The time of concentration influences the volume and rate of runoff. A low T_c will result in more runoff with a higher peak rate than a high T_c .

The type of soil on a site also affects the amount and rate of runoff generated. The soil type found on a site determines the amount and rate at which water can be absorbed into the ground. This is important because the more water that infiltrates the soil, the greater the reduction in the volume and rate of runoff. The Soil Conservation Service categorizes soil into one of four hydrologic soils group: Types A, B, C, and D. Type A soils are the most permeable and Type D soils are the least.

The Soil Conservation Service (SCS) Runoff Curve Number (CN) method is the most commonly accepted method for generating peak rates of runoff from areas. CNs are used to calculate the amount of runoff flowing from a subcatchment area using the surface cover and soil type.

The soil type on the site was determined using the SCS's Soil Survey. The Soil Survey contains soil maps that indicate the location and type of the various soils in the area. Descriptions of the soils and their properties (including hydrologic soil group) are also contained in the survey.

The surface cover on a site refers to what is on the surface of a site, whether it is lawn, roof, pavement, brush, woods, etc. Similarly, to the slope and the type of soil, surface cover affects the rate and volume of runoff. Certain types of cover allow for more opportunity for water to be absorbed into the ground. A site covered with impermeable pavement will not allow for any water to be absorbed into the ground, while a site covered by grass will allow some of the water to be absorbed into the ground. Almost all the rain that falls on pavement or other impermeable covers will be converted to runoff. In addition, different vegetative covers have different properties concerning producing runoff.

For each subcatchment area, Nitsch determined drainage flow path lengths, surface cover type, and slopes for sheet and shallow concentrated flow. The information was used to determine the time of concentration (T_c) for each subcatchment area. SCS Runoff Curve Numbers (CNs) were selected by using the cover type and hydrologic soil group of each area. The peak runoff rates for the 2-year, 10-year, and 100-year 24-hour storm events were then determined by inputting the weighted CN, T_c , drainage areas, and drainage information into the HydroCAD storm water modeling system computer program.

HydroCAD Version 9.10

The HydroCAD computer program uses SCS and TR-20 methods to model drainage systems. The SCS Runoff Curve Number method uses CNs to classify the runoff characteristics of an area by the type of soil and the type of ground cover. TR-20 (Technical Release 20) was developed by the Soil Conservation Service to estimate runoff and peak discharges in small watersheds. TR-20 is generally accepted by engineers and reviewing authorities as the standard method for estimating runoff and peak discharges.

HydroCAD Version 9.10 uses up to four types of components to analyze the hydrology of a given site. These components are subcatchments (drainage areas), reaches, basins, and links.

Subcatchments are areas of land that produce surface runoff. The area, weighted CN, and T_c characterize each individual subcatchment area. Reaches are generally uniform streams, channels, or pipes that convey water from one point to another. A basin is any impoundment that fills with water from one or more sources and empties via an outlet structure. Links are used to introduce hydrographs into a project from another source.

Storm Event

Nitsch used Technical Paper 40 by the National Weather Service to estimate the rainfall for the 2-year, 10-year, and 100-year 24-hour storms. The rainfall values used are as follows:

<u>Storm Event</u>	<u>24-hour Rainfall (inches)</u>
2-year	3.1
10-year	4.5
25-year	5.3
100-year	6.5

Closed Drainage System

The existing closed drainage system consists of catch basins, manholes, and one water quality separator unit. The closed drainage system will discharge to the municipal closed drainage system within Mystic Valley Parkway.

Best Management Practices

Best Management Practices (BMPs) include structural and non-structural features used on the site to promote water quality and water quantity mitigation for the developed conditions. BMPs selected for this project include deep sump catch basins with hoods, proprietary water quality units, and subsurface infiltration structures. The Department of Environmental Protection "Massachusetts Stormwater Handbook," Volumes 1, 2, and 3 (January 2008) was used to select structural and non-structural BMPs for the long-term protection of resources at the site.

Hydrologic Analysis

Existing Site Conditions

The site is located Mystic Water works building consists of approximately 1.4± acres and is located at the intersection of Capen Court and Mystic Valley Parkway in Somerville, Massachusetts. The property is bounded by Mystic Valley Parkway to the north and west, commercial properties to the east and senior housing to the south. The existing site includes Capen Court and the adjacent paved parking area along the western portion of the site.

The overall terrain generally slopes in a northerly/northwesterly direction from a maximum elevation of 35 along the southern property line to a minimum elevation of 17 along Mystic Valley parkway based on the National Geodetic Vertical Datum (NGVD) of 1929.

There is a limited drainage system serving the existing site. A majority of the stormwater runoff from the existing building and site surfaces flow on the surface to a closed drainage system within Capen Court. This closed system flows northerly and discharges to the municipal drainage system with Mystic valley Parkway.

The existing drainage areas were compiled from an existing conditions survey prepared by Nitsch Engineering. Additionally, Nitsch Engineering conducted site visits to evaluate the existing onsite drainage patterns and watershed divides from the existing conditions survey. The drainage areas and design points analyzed for this project are shown on the "Pre-Development Drainage Plan (PRE)". The hydrologic calculations for these drainage areas and design points are included in Appendix L. The design points for the analysis are as follows:

- Design Point 1 (3E): The Capen Court closed drainage system located to the north of the project site. Subcatchment Area 1E, 2E, & 4E contributes stormwater runoff to Design Point 1. Subcatchment 1E includes the area associated with the site to the east of Capen Court which include the existing buildings and garage. Subcatchment 2E includes the area associated with the paved parking area to the west of Capen Court. Subcatchment 4E includes the impervious area associated with Capen Court.

Proposed Site Conditions

The project consists of the redevelopment and conversion of the existing Mystic Water Works located on Mystic Valley Parkway in Somerville into a twenty-five (25) affordable housing unit rental apartment building and the demolition of the existing office and garage outbuilding to be replaced with a newly constructed thirty-five (35) affordable housing unit rental apartment building. All of the sixty (60) one-bedroom units will be designated as low or moderate income units under state guidelines.

The existing Mystic Water Works office and garage outbuilding will be demolished along with the existing paved driveways, paved areas, parking areas, fire lane and walkways. The proposed site construction will include new access roadways/driveways, parking areas, courtyard and a stormwater management system to treat and control the stormwater runoff from the site surface areas.

The existing site is not located within the buffer zone of any resource areas, and as such, not subject to Mass DEPs stormwater management regulations. The proposed stormwater management system does however incorporate several Best Management Practices (i.e. stormwater infiltration units, catch basins with sumps and hoods) to reduce the rate of runoff and improve the stormwater quality leaving the site.

To meet these conditions, infiltration Best Management Practices (BMPs) are proposed in the stormwater management plan for the site. These systems include infiltration subsurface structures. Infiltration subsurface structures are underground systems constructed of either perforated pipes or chambers surrounded by stone that capture runoff, and gradually infiltrate it into the ground. These systems are similar to a Title 5 soil absorption system.

Stormwater runoff from the proposed buildings' roof will be directed to the subsurface infiltration structures. Stormwater runoff from the site paved areas will be directed to pretreatment BMPs to remove sediments and other pollutants prior to discharging to subsurface infiltration structures prior to discharging to onsite ground surfaces. Stormwater runoff directed to the subsurface infiltration structures will be pretreated by deep sump catch

basins and proprietary water quality structures prior to discharging to the infiltrations systems.

The same overall area and design points were analyzed for the proposed conditions and are indicated on the "Post-Development Drainage Plan (POST)". The hydrologic calculations for these drainage areas and design points are included in Appendix L. The design points for the analysis are as follows:

- Design Point 1 (3P): The Capen Court closed drainage system located to the north of the project site. Subcatchment Area 1P, 2P, & 4P contributes stormwater runoff to Design Point 1. Subcatchment 1P includes the area associated with the site to the east of Capen Court which include the existing Mystic Water Works building and proposed housing building. Subcatchment 2P includes the area associated with the proposed parking area to the west of Capen Court. Subcatchment 4P includes the impervious area associated with Capen Court.

The change in impervious coverage for the site is provided in Table 1 below.

Table 1: Area Summary Table

Cover	Existing (SF)	Proposed (SF)	Difference (SF)	Impervious Area (%)
Impervious	42,148	40,916	-1,232	-2.01%
Pervious	19,031	20,263	+1,232	+2.01%
Total	61,179	61,179		

Peak Flow Rates

The proposed stormwater management system is expected to reduce the post-development peak rates of runoff to at or below the pre-development rates, with controls. Table 2, "Peak Rates of Runoff," compares the pre- and post-development peak rates of runoff at the design point. Table 2 shows no increase for the 2-, 10-, 25-, and 100-year design storms.

Table 2: Peak Rates of Runoff

	Design Point – 1			
	2-Year	10-year	25-year	100-Year
Existing	4.14 cfs	6.20 cfs	7.37 cfs	9.11 cfs
Proposed	2.56 cfs	4.08 cfs	6.63 cfs	8.25 cfs

Quantity

The proposed stormwater management system is expected to reduce the post-development volumes of runoff to at or below the pre-development volumes, with controls. Table 2, "Volume Quantities," compares the pre- and post-development volumes of runoff at the design point. Table 2 shows no increase for the 2-, 10-, 25-, and 100-year design storms.

Table 2: Volume Quantities

	Design Point – 1			
	2-Year	10-year	25-year	100-Year
Existing	13,242 cf	20,255 cf	24,306 cf	30,405 cf
Proposed	12,415 cf	19,428 cf	23,435 cf	29,403 cf

CONCLUSION

In conclusion, the proposed Mystic Water Works project will result in a decrease in the peak rate of stormwater and volume leaving the site and improve the stormwater quality.

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APPENDIX LIST

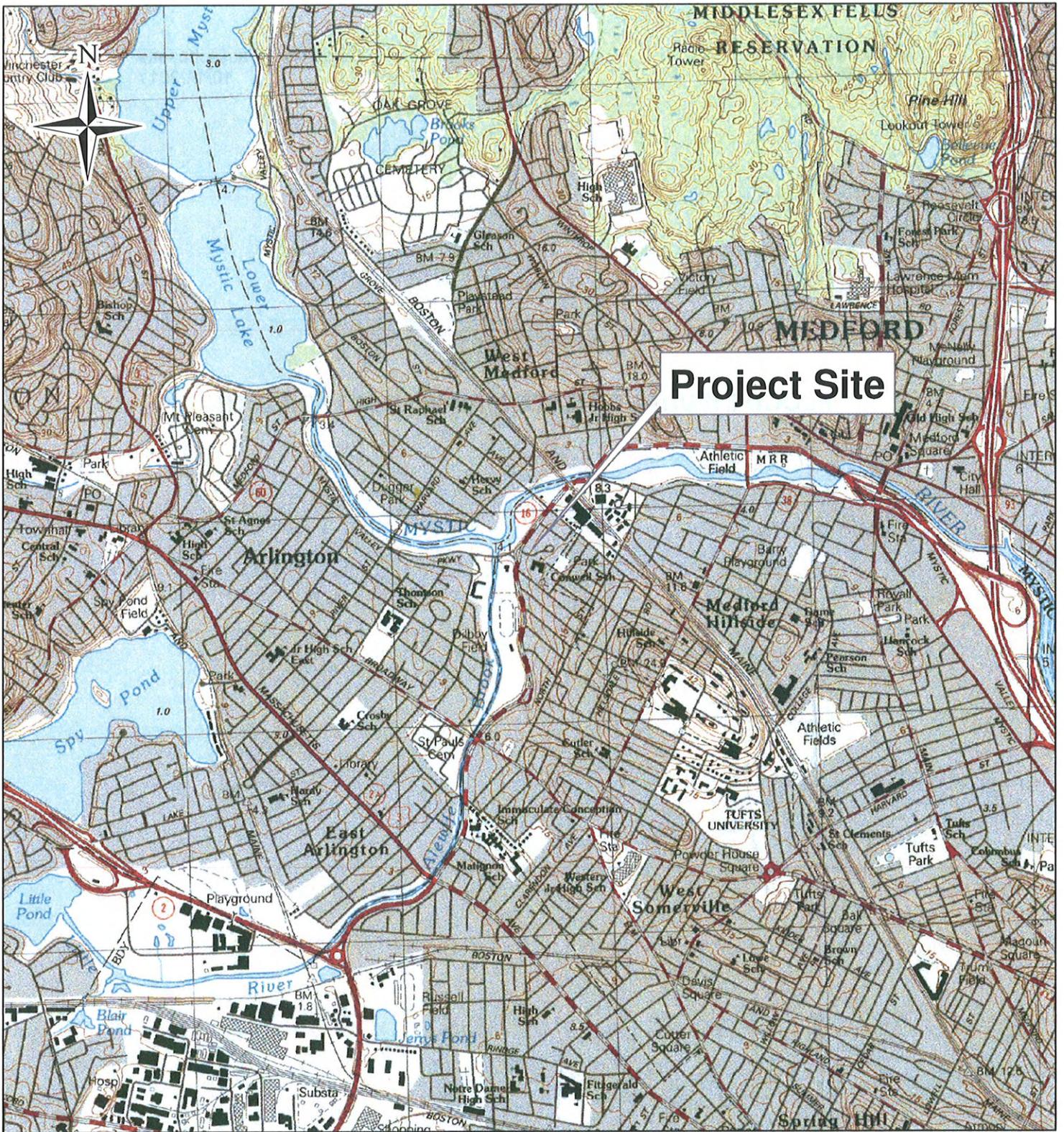
- Appendix A – USGS Map
- Appendix B – FIRM Map for site
- Appendix C – NRCS (SCS) Soil Description and Map
- Appendix D – Pre-Construction Hydrology Report
Post-Construction Hydrology Report
- Appendix E – Pre-Construction Hydrology Plan
Post-Construction Hydrology Plan

Mystic Water Works
Nitsch Project #8398

Somerville, Massachusetts
10/14/2011

APPENDIX A

UNITED STATES GEOLOGICAL SURVEY MAP

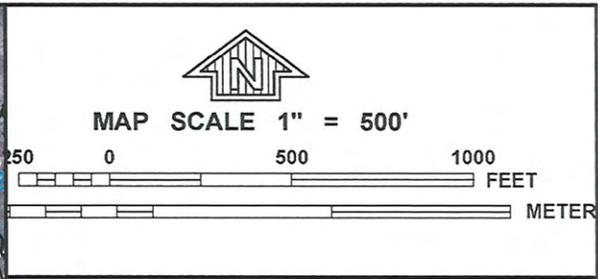
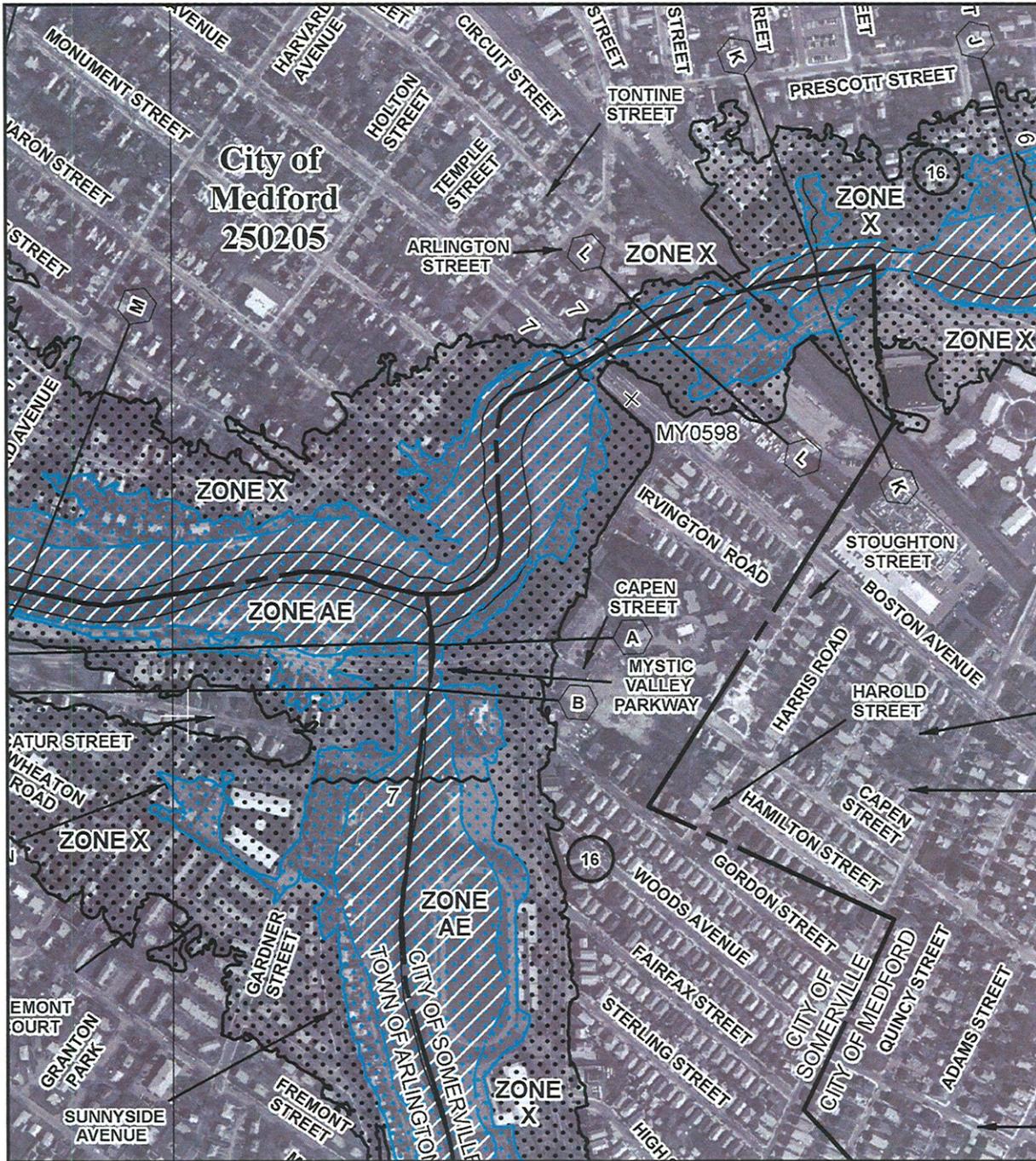


149 Capen Street/485 Mystic Valley Parkway
USGS Map
Somerville, MA



APPENDIX B

FLOOD INSURANCE RATE MAP (F.I.R.M.) FOR SITE



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0417E

FIRM

FLOOD INSURANCE RATE MAP

MIDDLESEX COUNTY,
MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 417 OF 656
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ARLINGTON TOWN OF	250177	0417	E
MEDFORD, CITY OF	250205	0417	E
SOMERVILLE, CITY OF	250214	0417	E
WINCHESTER, TOWN OF	250228	0417	E

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
25017C0417E

EFFECTIVE DATE
JUNE 4, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

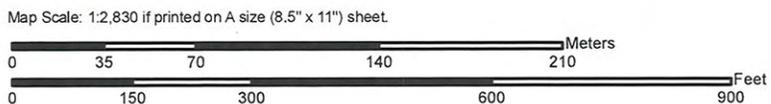
Mystic Water Works
Nitsch Project #8398

Somerville, Massachusetts
10/14/2011

APPENDIX C

NRCS (SCS) SOIL DESCRIPTION AND MAP

(Mystic Water Works - Somerville)



Soil Map—Middlesex County, Massachusetts
(Mystic Water Works - Somerville)

MAP LEGEND

	Area of Interest (AOI)		Very Stony Spot
	Soil Map Units		Wet Spot
Special Point Features			Other
	Blowout	Special Line Features	
	Borrow Pit		Gully
	Clay Spot		Short Steep Slope
	Closed Depression		Other
	Gravel Pit	Political Features	
	Gravelly Spot		Cities
	Landfill	Water Features	
	Lava Flow		Streams and Canals
	Marsh or swamp	Transportation	
	Mine or Quarry		Rails
	Miscellaneous Water		Interstate Highways
	Perennial Water		US Routes
	Rock Outcrop		Major Roads
	Saline Spot		Local Roads
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		
	Spoil Area		
	Stony Spot		

MAP INFORMATION

Map Scale: 1:2,830 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: UTM Zone 19N NAD83

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 12, Feb 26, 2010

Date(s) aerial images were photographed: 7/10/2003

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

Map Unit Legend

Middlesex County, Massachusetts (MA017)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	2.1	6.4%
223A	Scio very fine sandy loam, 0 to 3 percent slopes	5.7	17.7%
602	Urban land	8.3	25.9%
621B	Scio-Urban land complex, 0 to 8 percent slopes	4.0	12.6%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.3	1.0%
627C	Newport-Urban land complex, 3 to 15 percent slopes	0.0	0.1%
629C	Canton-Charlton-Urban land complex, 3 to 15 percent slopes	7.3	22.8%
654	Udorthents, loamy	3.1	9.8%
655	Udorthents, wet substratum	1.2	3.8%
Totals for Area of Interest		32.2	100.0%

Map Unit Description

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

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

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

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

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

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

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

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

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

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

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

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Middlesex County, Massachusetts

223A—Scio very fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

Elevation: 0 to 2,100 feet

Mean annual precipitation: 45 to 54 inches

Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 145 to 240 days

Map Unit Composition

Scio and similar soils: 80 percent

Minor components: 20 percent

Description of Scio

Setting

Landform: Terraces, depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy and/or silty glaciofluvial deposits

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water capacity: High (about 11.4 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 8 inches: Very fine sandy loam
8 to 35 inches: Very fine sandy loam
35 to 65 inches: Silt loam

Minor Components

Haven

Percent of map unit: 10 percent
Landform: Terraces, plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex

Sudbury

Percent of map unit: 5 percent
Landform: Terraces, plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Concave

Tisbury

Percent of map unit: 5 percent
Landform: Plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave

Across-slope shape: Concave

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 12, Feb 26, 2010

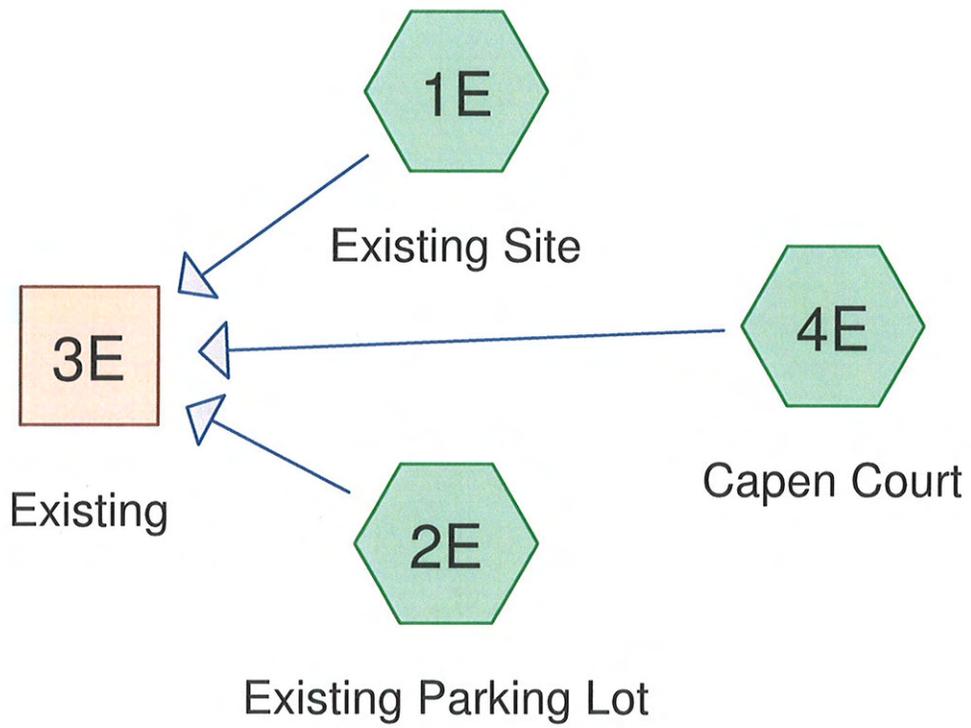
Mystic Water Works
Nitsch Project #8398

Somerville, Massachusetts
10/14/2011

APPENDIX D

PRE-CONSTRUCTION HYDROLOGY REPORT

POST-CONSTRUCTION HYDROLOGY REPORT



Pre v Post (2011-0831)

Prepared by Nitsch Engineering

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.437	89	<50% Grass cover, Poor, HSG D (1E, 2E)
0.099	98	Paved parking, HSG A (4E)
0.868	98	Paved roads w/curbs & sewers, HSG D (1E, 2E)
1.404		TOTAL AREA

Pre v Post (2011-0831)

Prepared by Nitsch Engineering

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Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.099	HSG A	4E
0.000	HSG B	
0.000	HSG C	
1.305	HSG D	1E, 2E
0.000	Other	
1.404		TOTAL AREA

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Type III 24-hr 2-yr Rainfall=3.10"

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Time span=0.00-25.00 hrs, dt=0.02 hrs, 1251 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1E: Existing Site

Runoff Area=49,675 sf 62.58% Impervious Runoff Depth=2.55"
Tc=5.0 min CN=95 Runoff=3.33 cfs 0.242 af

Subcatchment 2E: Existing Parking Lot

Runoff Area=7,174 sf 93.84% Impervious Runoff Depth=2.76"
Tc=5.0 min CN=97 Runoff=0.50 cfs 0.038 af

Subcatchment 4E: Capen Court

Runoff Area=4,331 sf 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.31 cfs 0.024 af

Reach 3E: Existing

Inflow=4.14 cfs 0.304 af
Outflow=4.14 cfs 0.304 af

Total Runoff Area = 1.404 ac Runoff Volume = 0.304 af Average Runoff Depth = 2.59"
31.11% Pervious = 0.437 ac 68.89% Impervious = 0.968 ac

Summary for Subcatchment 1E: Existing Site

Runoff = 3.33 cfs @ 12.07 hrs, Volume= 0.242 af, Depth= 2.55"

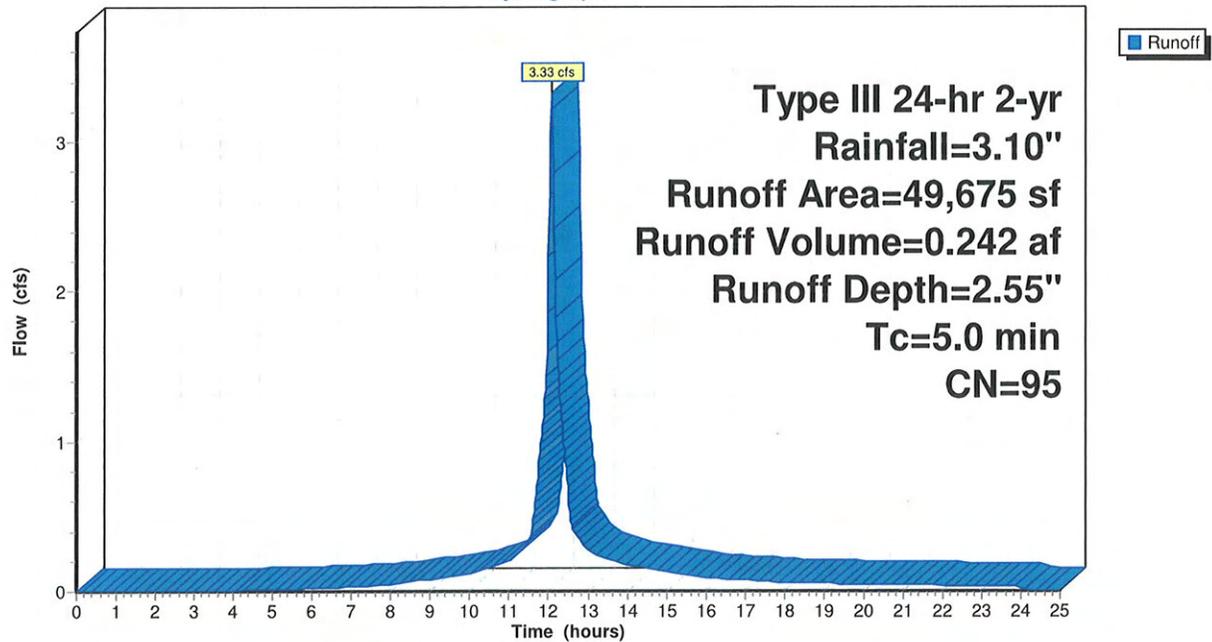
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
 Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
31,086	98	Paved roads w/curbs & sewers, HSG D
18,589	89	<50% Grass cover, Poor, HSG D
49,675	95	Weighted Average
18,589		37.42% Pervious Area
31,086		62.58% Impervious Area

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

Subcatchment 1E: Existing Site

Hydrograph



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Type III 24-hr 2-yr Rainfall=3.10"

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Summary for Subcatchment 2E: Existing Parking Lot

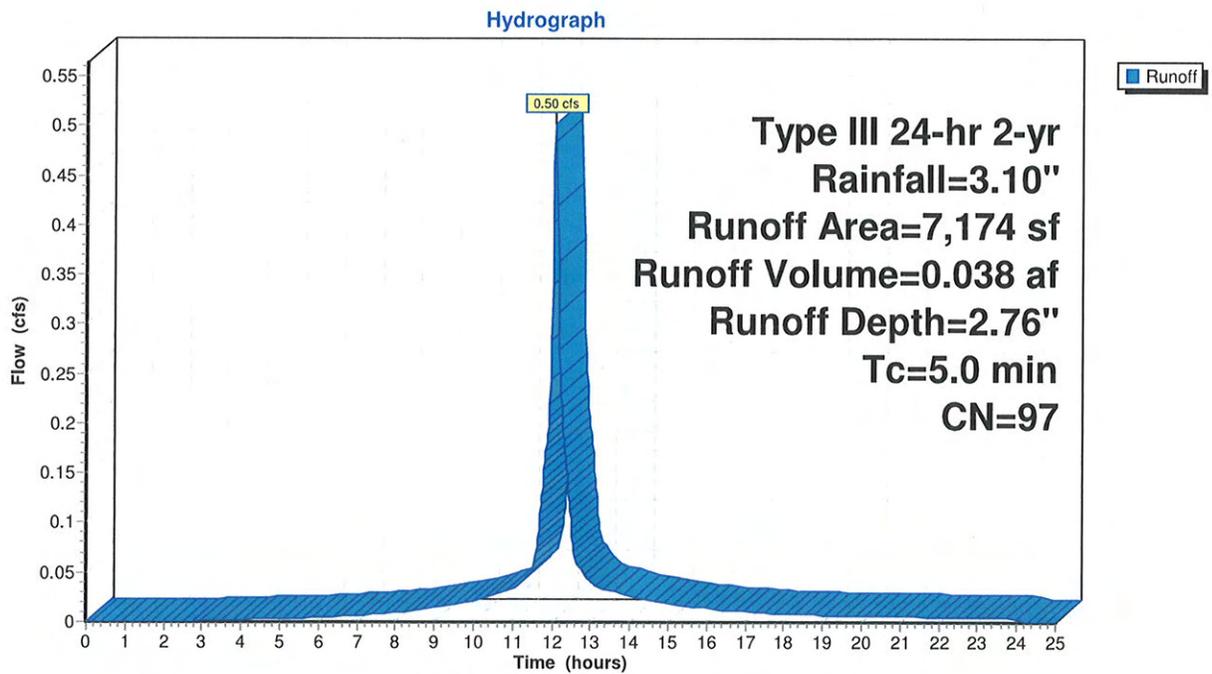
Runoff = 0.50 cfs @ 12.07 hrs, Volume= 0.038 af, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
6,732	98	Paved roads w/curbs & sewers, HSG D
442	89	<50% Grass cover, Poor, HSG D
7,174	97	Weighted Average
442		6.16% Pervious Area
6,732		93.84% Impervious Area

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

Subcatchment 2E: Existing Parking Lot



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Type III 24-hr 2-yr Rainfall=3.10"

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Summary for Subcatchment 4E: Capen Court

Runoff = 0.31 cfs @ 12.07 hrs, Volume= 0.024 af, Depth= 2.87"

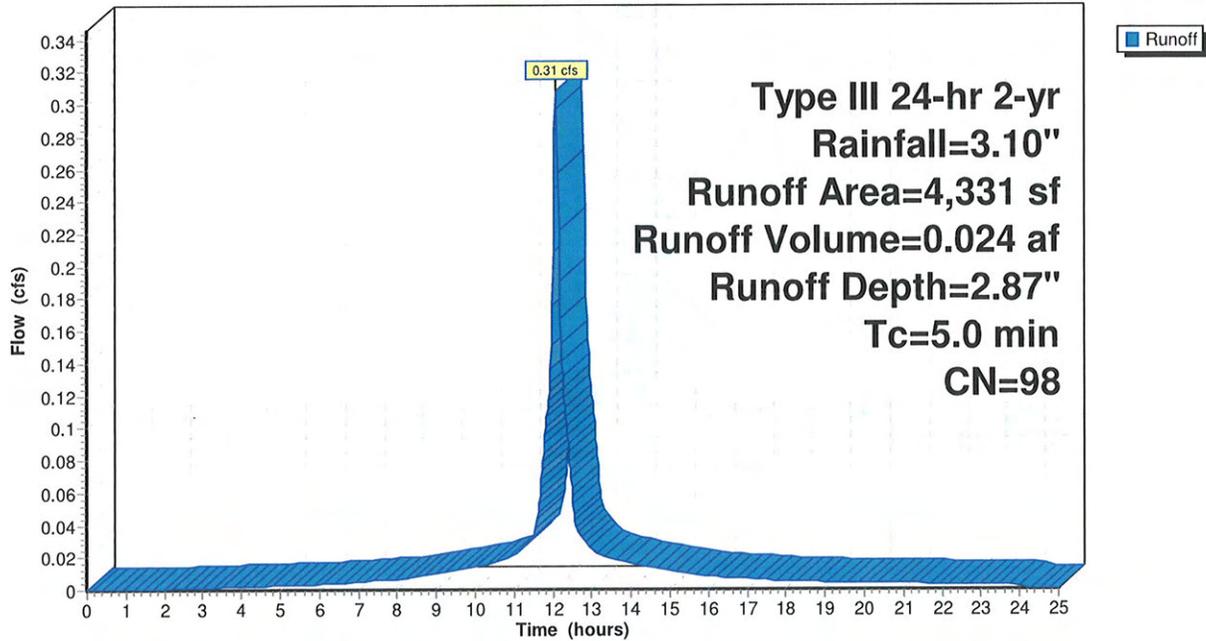
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
4,331	98	Paved parking, HSG A
4,331		100.00% Impervious Area

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

Subcatchment 4E: Capen Court

Hydrograph



Summary for Reach 3E: Existing

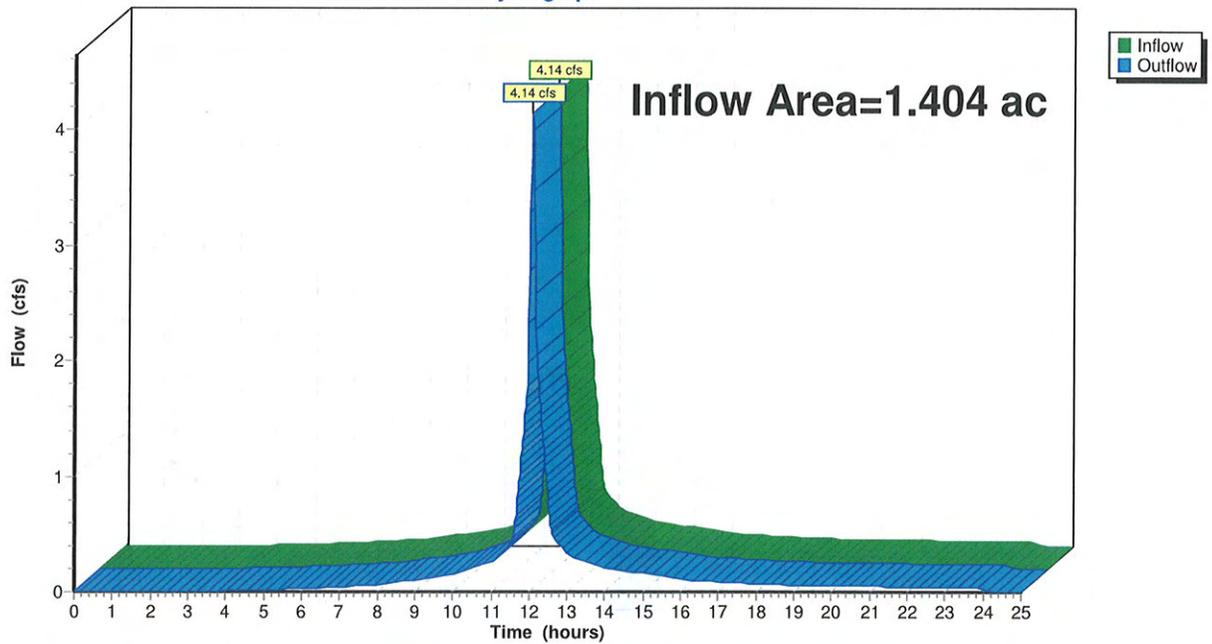
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.404 ac, 68.89% Impervious, Inflow Depth = 2.59" for 2-yr event
Inflow = 4.14 cfs @ 12.07 hrs, Volume= 0.304 af
Outflow = 4.14 cfs @ 12.07 hrs, Volume= 0.304 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs

Reach 3E: Existing

Hydrograph



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Type III 24-hr 10-yr Rainfall=4.50"

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Time span=0.00-25.00 hrs, dt=0.02 hrs, 1251 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1E: Existing Site

Runoff Area=49,675 sf 62.58% Impervious Runoff Depth=3.92"
Tc=5.0 min CN=95 Runoff=5.01 cfs 0.373 af

Subcatchment 2E: Existing Parking Lot

Runoff Area=7,174 sf 93.84% Impervious Runoff Depth=4.15"
Tc=5.0 min CN=97 Runoff=0.74 cfs 0.057 af

Subcatchment 4E: Capen Court

Runoff Area=4,331 sf 100.00% Impervious Runoff Depth=4.26"
Tc=5.0 min CN=98 Runoff=0.45 cfs 0.035 af

Reach 3E: Existing

Inflow=6.20 cfs 0.465 af
Outflow=6.20 cfs 0.465 af

Total Runoff Area = 1.404 ac Runoff Volume = 0.465 af Average Runoff Depth = 3.98"
31.11% Pervious = 0.437 ac 68.89% Impervious = 0.968 ac

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Type III 24-hr 10-yr Rainfall=4.50"

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Summary for Subcatchment 1E: Existing Site

Runoff = 5.01 cfs @ 12.07 hrs, Volume= 0.373 af, Depth= 3.92"

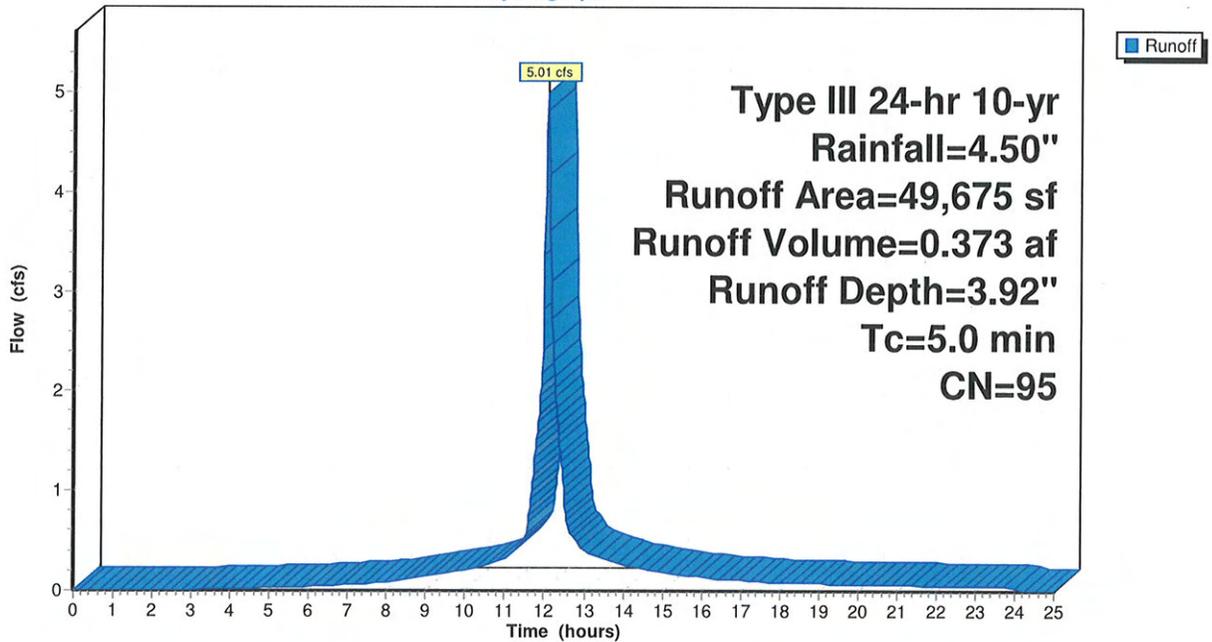
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
31,086	98	Paved roads w/curbs & sewers, HSG D
18,589	89	<50% Grass cover, Poor, HSG D
49,675	95	Weighted Average
18,589		37.42% Pervious Area
31,086		62.58% Impervious Area

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

Subcatchment 1E: Existing Site

Hydrograph



Summary for Subcatchment 2E: Existing Parking Lot

Runoff = 0.74 cfs @ 12.07 hrs, Volume= 0.057 af, Depth= 4.15"

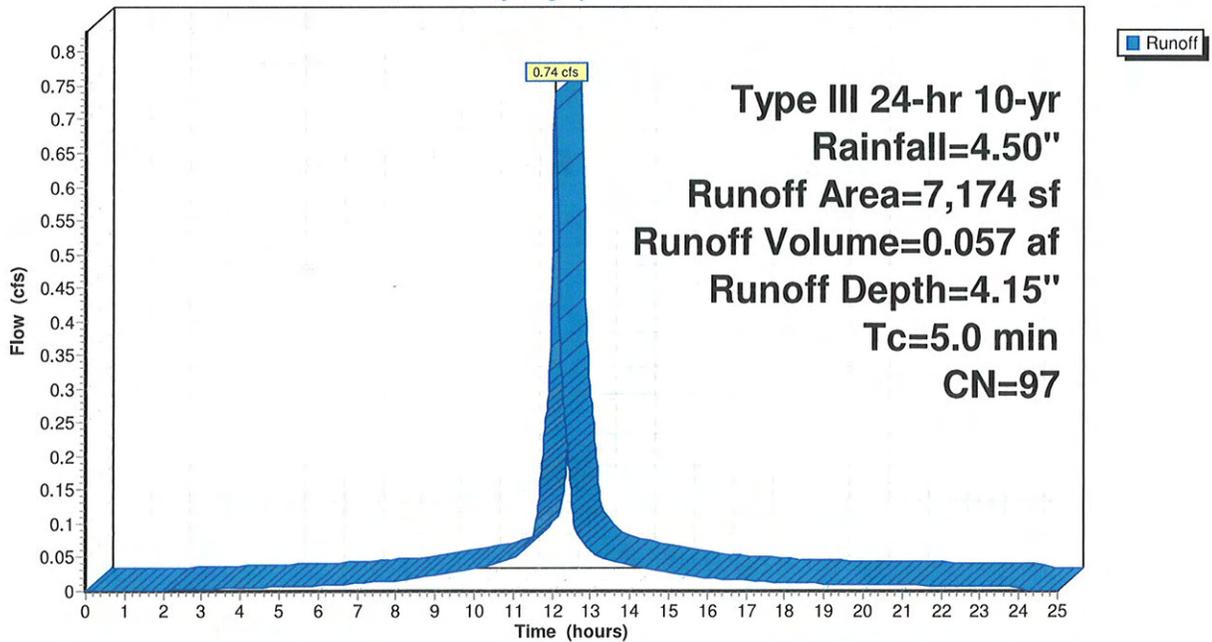
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
 Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
6,732	98	Paved roads w/curbs & sewers, HSG D
442	89	<50% Grass cover, Poor, HSG D
7,174	97	Weighted Average
442		6.16% Pervious Area
6,732		93.84% Impervious Area

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

Subcatchment 2E: Existing Parking Lot

Hydrograph



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Type III 24-hr 10-yr Rainfall=4.50"

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Summary for Subcatchment 4E: Capen Court

Runoff = 0.45 cfs @ 12.07 hrs, Volume= 0.035 af, Depth= 4.26"

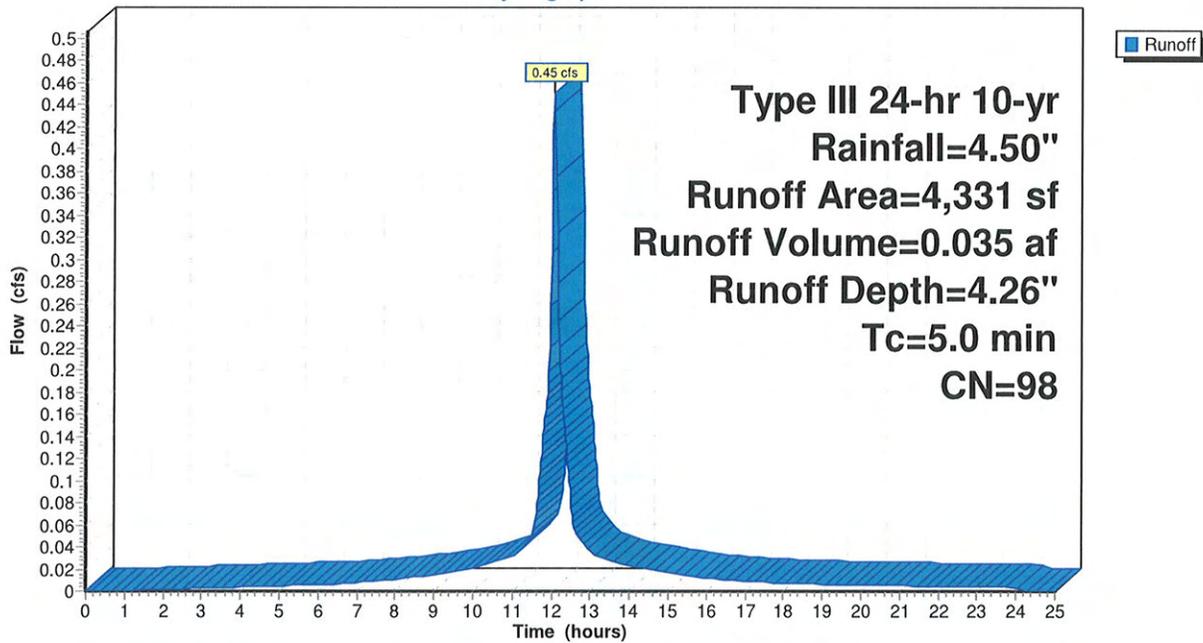
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
4,331	98	Paved parking, HSG A
4,331		100.00% Impervious Area

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

Subcatchment 4E: Capen Court

Hydrograph

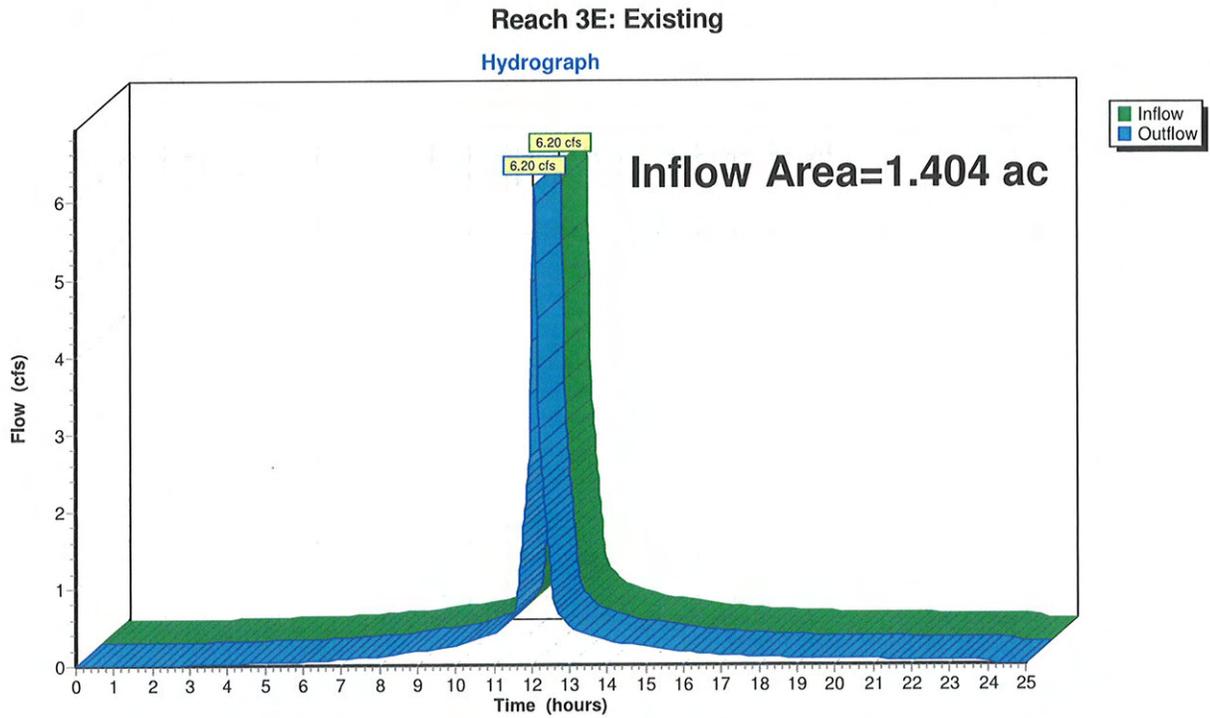


Summary for Reach 3E: Existing

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.404 ac, 68.89% Impervious, Inflow Depth = 3.98" for 10-yr event
Inflow = 6.20 cfs @ 12.07 hrs, Volume= 0.465 af
Outflow = 6.20 cfs @ 12.07 hrs, Volume= 0.465 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs



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Type III 24-hr 25-yr Rainfall=5.30"

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Time span=0.00-25.00 hrs, dt=0.02 hrs, 1251 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1E: Existing Site

Runoff Area=49,675 sf 62.58% Impervious Runoff Depth=4.72"
Tc=5.0 min CN=95 Runoff=5.96 cfs 0.448 af

Subcatchment 2E: Existing Parking Lot

Runoff Area=7,174 sf 93.84% Impervious Runoff Depth=4.95"
Tc=5.0 min CN=97 Runoff=0.88 cfs 0.068 af

Subcatchment 4E: Capen Court

Runoff Area=4,331 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=98 Runoff=0.53 cfs 0.042 af

Reach 3E: Existing

Inflow=7.37 cfs 0.558 af
Outflow=7.37 cfs 0.558 af

Total Runoff Area = 1.404 ac Runoff Volume = 0.558 af Average Runoff Depth = 4.77"
31.11% Pervious = 0.437 ac 68.89% Impervious = 0.968 ac

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Type III 24-hr 25-yr Rainfall=5.30"

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Summary for Subcatchment 1E: Existing Site

Runoff = 5.96 cfs @ 12.07 hrs, Volume= 0.448 af, Depth= 4.72"

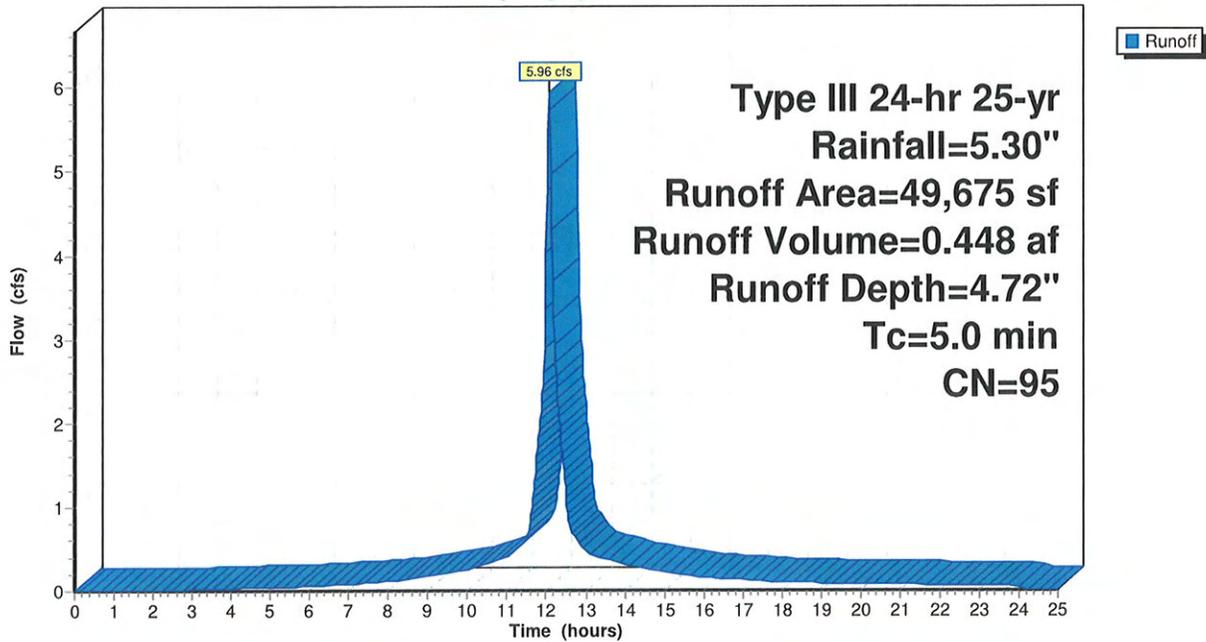
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
31,086	98	Paved roads w/curbs & sewers, HSG D
18,589	89	<50% Grass cover, Poor, HSG D
49,675	95	Weighted Average
18,589		37.42% Pervious Area
31,086		62.58% Impervious Area

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

Subcatchment 1E: Existing Site

Hydrograph



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Type III 24-hr 25-yr Rainfall=5.30"

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Summary for Subcatchment 2E: Existing Parking Lot

Runoff = 0.88 cfs @ 12.07 hrs, Volume= 0.068 af, Depth= 4.95"

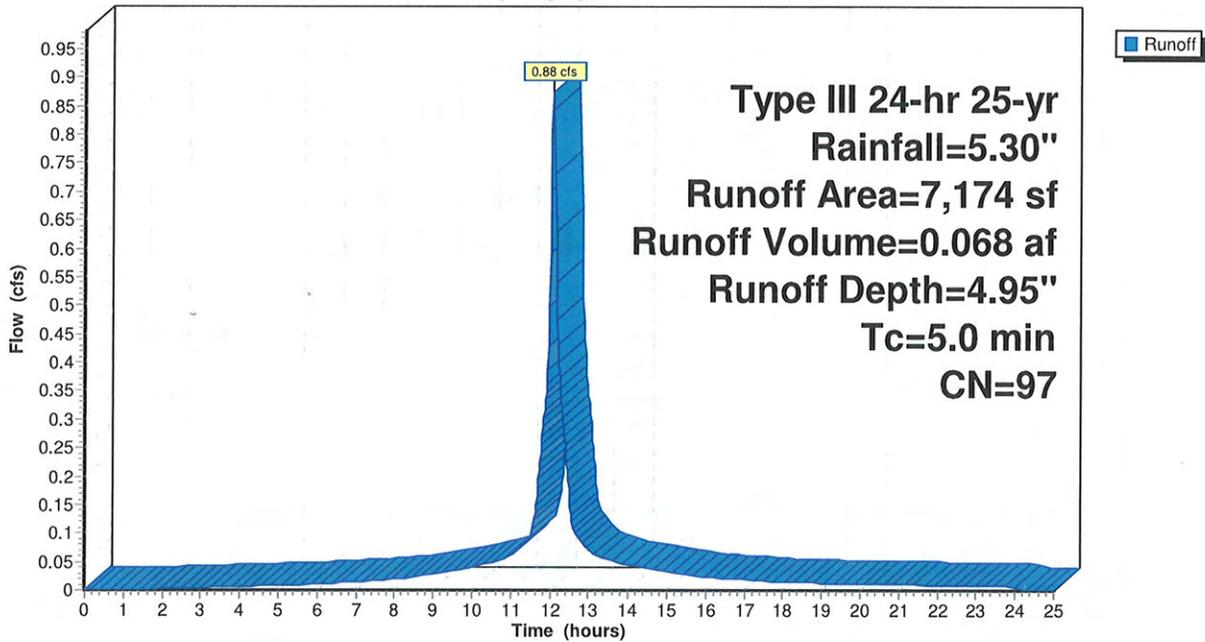
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
6,732	98	Paved roads w/curbs & sewers, HSG D
442	89	<50% Grass cover, Poor, HSG D
7,174	97	Weighted Average
442		6.16% Pervious Area
6,732		93.84% Impervious Area

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

Subcatchment 2E: Existing Parking Lot

Hydrograph



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Type III 24-hr 25-yr Rainfall=5.30"

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Summary for Subcatchment 4E: Capen Court

Runoff = 0.53 cfs @ 12.07 hrs, Volume= 0.042 af, Depth= 5.06"

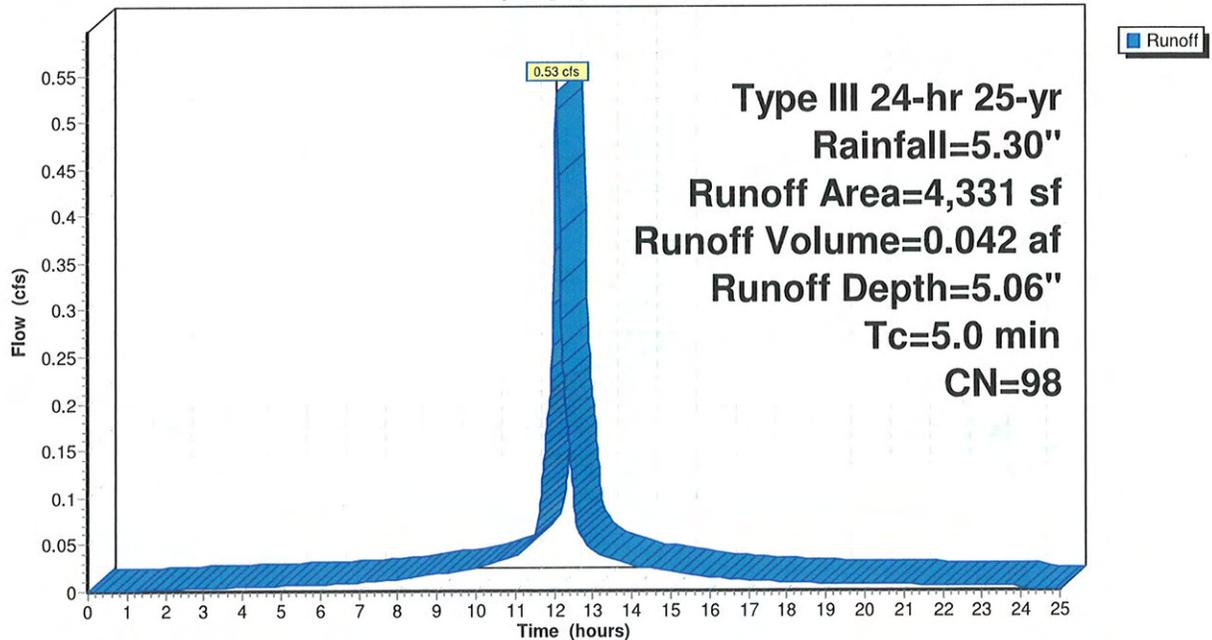
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
4,331	98	Paved parking, HSG A
4,331		100.00% Impervious Area

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

Subcatchment 4E: Capen Court

Hydrograph

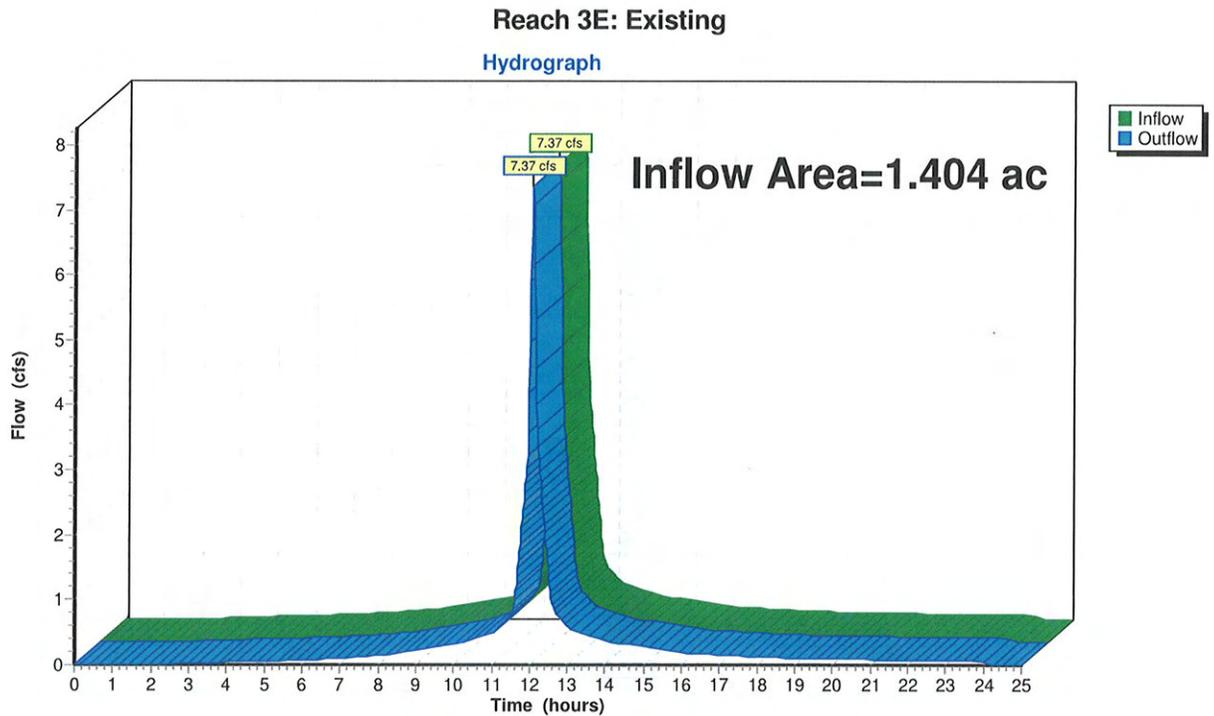


Summary for Reach 3E: Existing

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.404 ac, 68.89% Impervious, Inflow Depth = 4.77" for 25-yr event
Inflow = 7.37 cfs @ 12.07 hrs, Volume= 0.558 af
Outflow = 7.37 cfs @ 12.07 hrs, Volume= 0.558 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs



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Type III 24-hr 100-yr Rainfall=6.50"

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Time span=0.00-25.00 hrs, dt=0.02 hrs, 1251 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1E: Existing Site

Runoff Area=49,675 sf 62.58% Impervious Runoff Depth=5.91"
Tc=5.0 min CN=95 Runoff=7.37 cfs 0.561 af

Subcatchment 2E: Existing Parking Lot

Runoff Area=7,174 sf 93.84% Impervious Runoff Depth=6.14"
Tc=5.0 min CN=97 Runoff=1.08 cfs 0.084 af

Subcatchment 4E: Capen Court

Runoff Area=4,331 sf 100.00% Impervious Runoff Depth=6.26"
Tc=5.0 min CN=98 Runoff=0.65 cfs 0.052 af

Reach 3E: Existing

Inflow=9.11 cfs 0.698 af
Outflow=9.11 cfs 0.698 af

Total Runoff Area = 1.404 ac Runoff Volume = 0.698 af Average Runoff Depth = 5.96"
31.11% Pervious = 0.437 ac 68.89% Impervious = 0.968 ac

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Type III 24-hr 100-yr Rainfall=6.50"

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Summary for Subcatchment 1E: Existing Site

Runoff = 7.37 cfs @ 12.07 hrs, Volume= 0.561 af, Depth= 5.91"

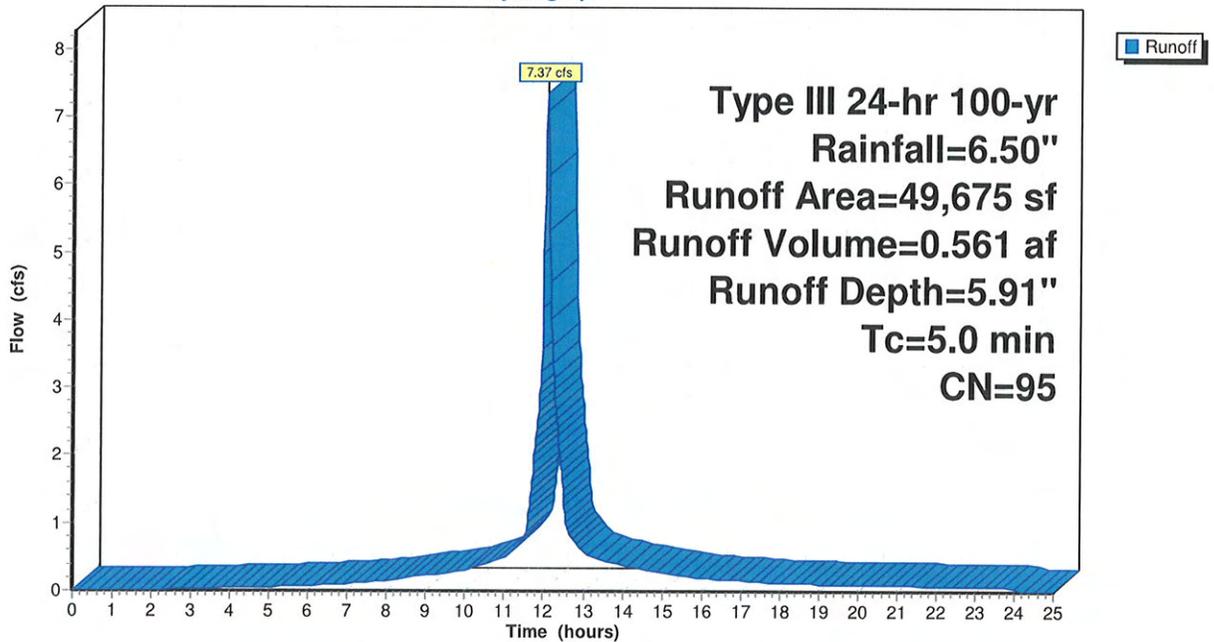
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
31,086	98	Paved roads w/curbs & sewers, HSG D
18,589	89	<50% Grass cover, Poor, HSG D
49,675	95	Weighted Average
18,589		37.42% Pervious Area
31,086		62.58% Impervious Area

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

Subcatchment 1E: Existing Site

Hydrograph



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Type III 24-hr 100-yr Rainfall=6.50"

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Summary for Subcatchment 2E: Existing Parking Lot

Runoff = 1.08 cfs @ 12.07 hrs, Volume= 0.084 af, Depth= 6.14"

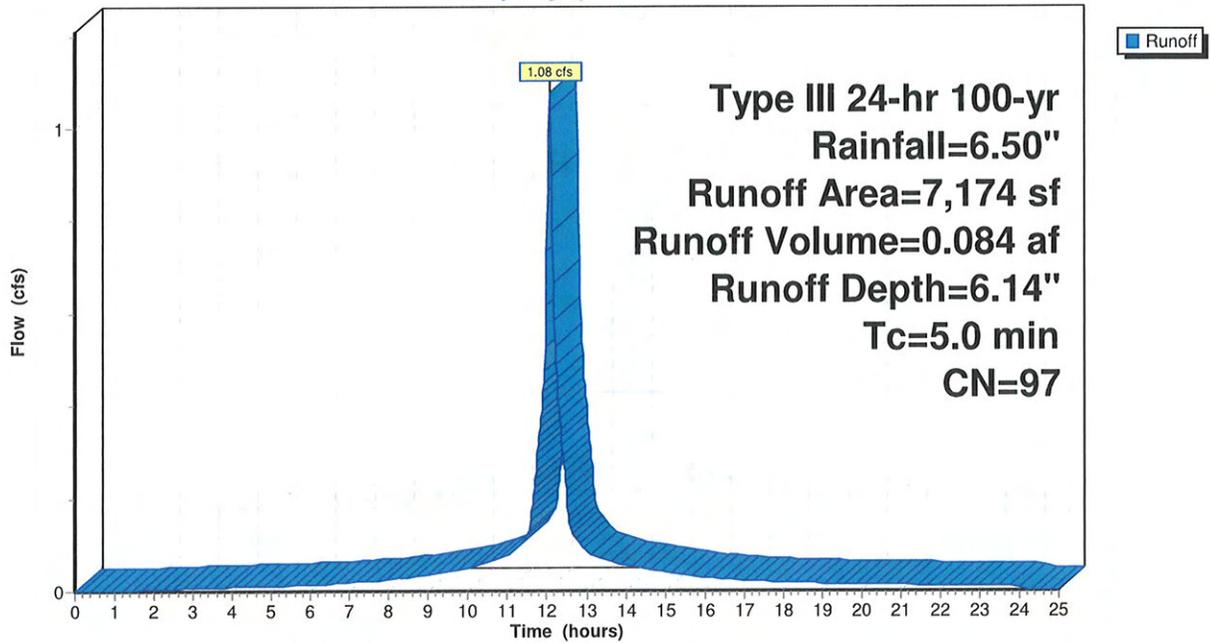
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
6,732	98	Paved roads w/curbs & sewers, HSG D
442	89	<50% Grass cover, Poor, HSG D
7,174	97	Weighted Average
442		6.16% Pervious Area
6,732		93.84% Impervious Area

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

Subcatchment 2E: Existing Parking Lot

Hydrograph



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Type III 24-hr 100-yr Rainfall=6.50"

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Summary for Subcatchment 4E: Capen Court

Runoff = 0.65 cfs @ 12.07 hrs, Volume= 0.052 af, Depth= 6.26"

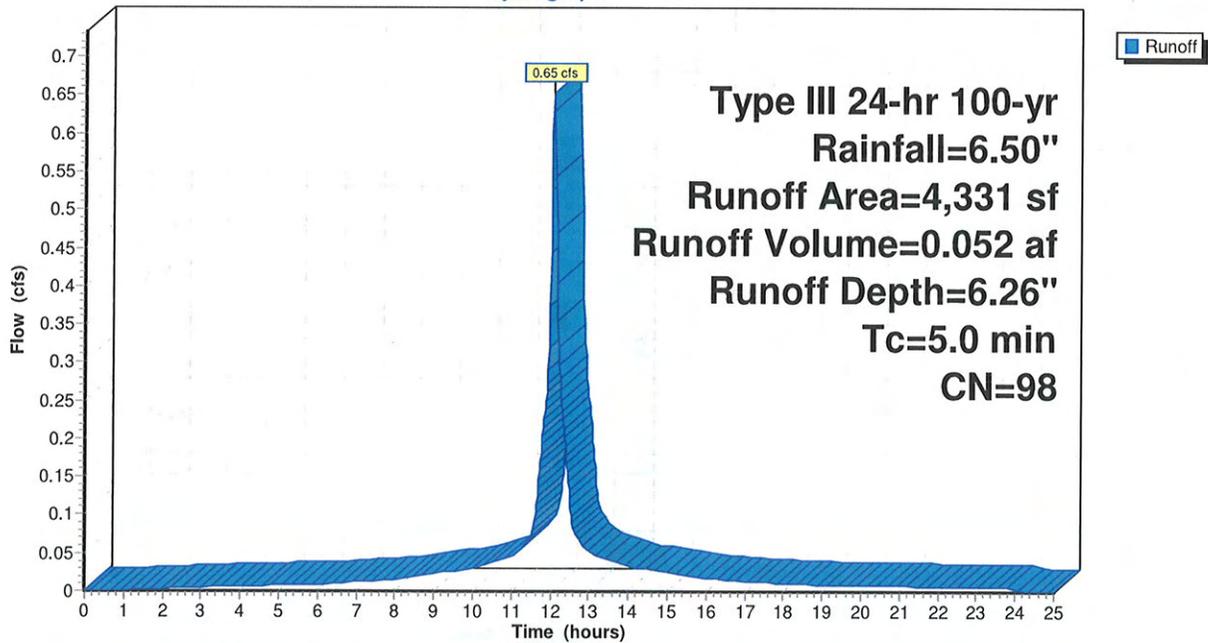
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
4,331	98	Paved parking, HSG A
4,331		100.00% Impervious Area

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

Subcatchment 4E: Capen Court

Hydrograph



Summary for Reach 3E: Existing

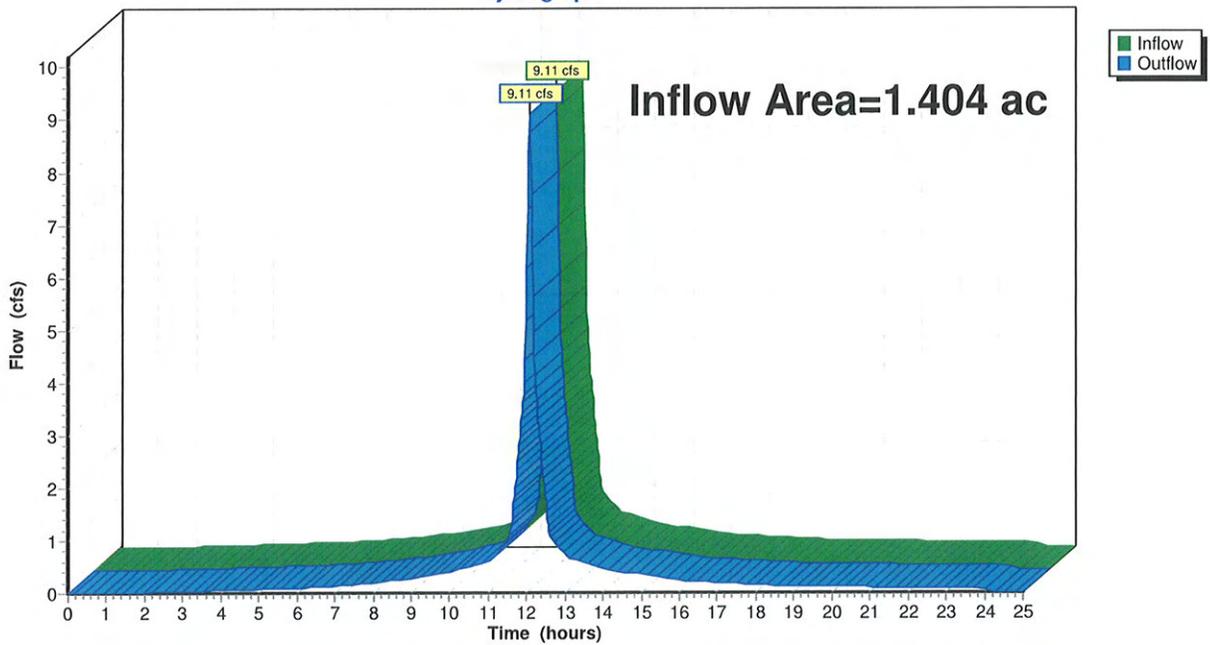
[40] Hint: Not Described (Outflow=Inflow)

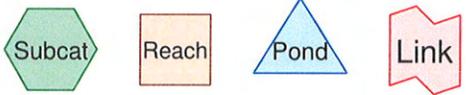
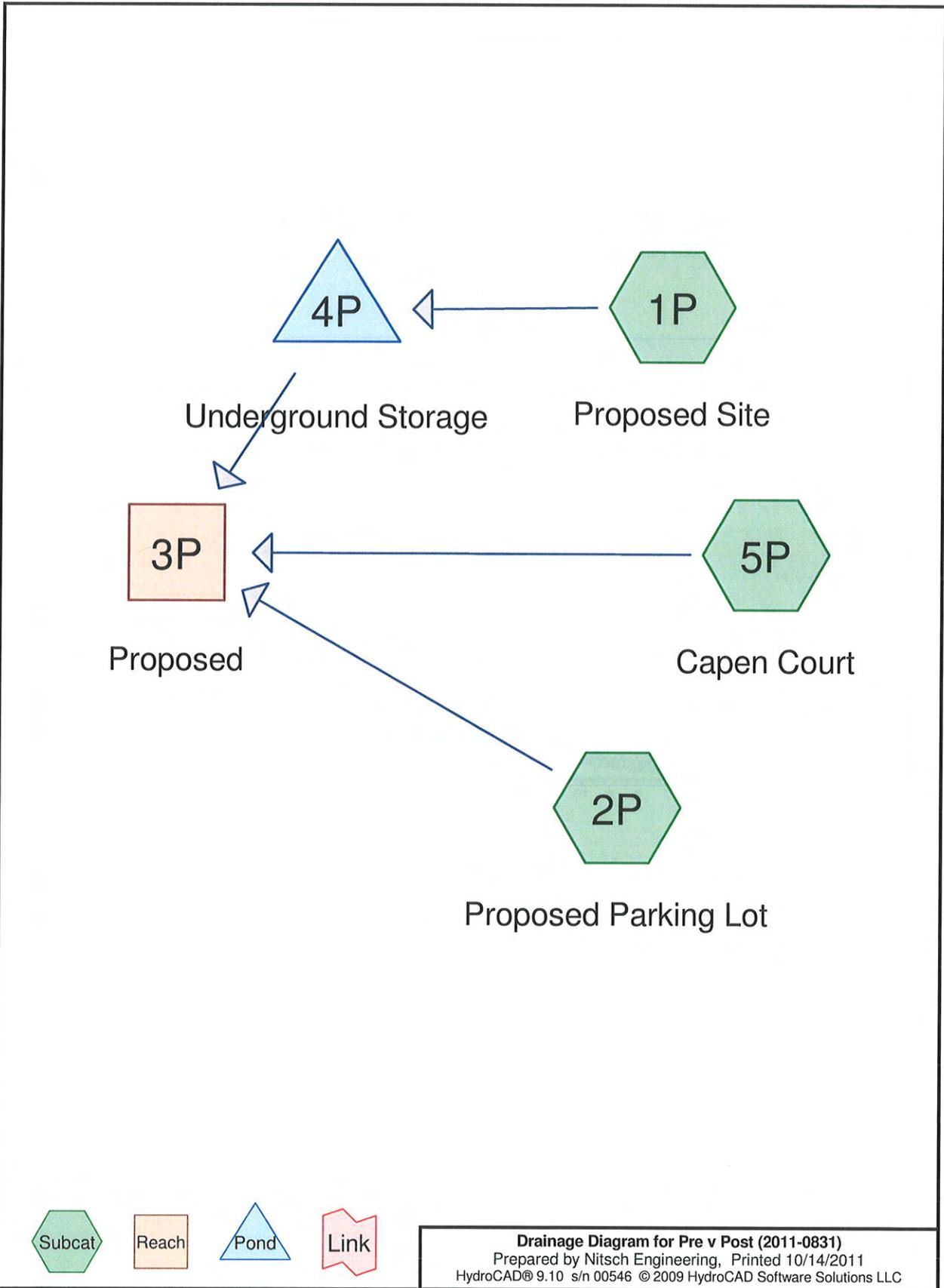
Inflow Area = 1.404 ac, 68.89% Impervious, Inflow Depth = 5.96" for 100-yr event
Inflow = 9.11 cfs @ 12.07 hrs, Volume= 0.698 af
Outflow = 9.11 cfs @ 12.07 hrs, Volume= 0.698 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs

Reach 3E: Existing

Hydrograph





Drainage Diagram for Pre v Post (2011-0831)
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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.465	89	<50% Grass cover, Poor, HSG D (1P, 2P)
0.099	98	Paved parking, HSG A (5P)
0.812	98	Paved roads w/curbs & sewers, HSG D (1P, 2P)
0.028	98	Pavers (1P)
1.404		TOTAL AREA

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Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.099	HSG A	5P
0.000	HSG B	
0.000	HSG C	
1.277	HSG D	1P, 2P
0.028	Other	1P
1.404		TOTAL AREA

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Type III 24-hr 2-yr Rainfall=3.10"

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Time span=0.00-25.00 hrs, dt=0.02 hrs, 1251 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1P: Proposed Site

Runoff Area=49,675 sf 64.31% Impervious Runoff Depth=2.55"
Tc=5.0 min CN=95 Runoff=3.33 cfs 0.242 af

Subcatchment 2P: Proposed Parking Lot

Runoff Area=7,173 sf 64.65% Impervious Runoff Depth=2.55"
Tc=5.0 min CN=95 Runoff=0.48 cfs 0.035 af

Subcatchment 5P: Capen Court

Runoff Area=4,331 sf 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.31 cfs 0.024 af

Reach 3P: Proposed

Inflow=2.56 cfs 0.285 af
Outflow=2.56 cfs 0.285 af

Pond 4P: Underground Storage

Peak Elev=13.50' Storage=0.043 af Inflow=3.33 cfs 0.242 af
Discarded=0.00 cfs 0.005 af Primary=1.96 cfs 0.226 af Outflow=1.96 cfs 0.231 af

Total Runoff Area = 1.404 ac Runoff Volume = 0.301 af Average Runoff Depth = 2.57"
33.12% Pervious = 0.465 ac 66.88% Impervious = 0.939 ac

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Type III 24-hr 2-yr Rainfall=3.10"

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Summary for Subcatchment 1P: Proposed Site

Runoff = 3.33 cfs @ 12.07 hrs, Volume= 0.242 af, Depth= 2.55"

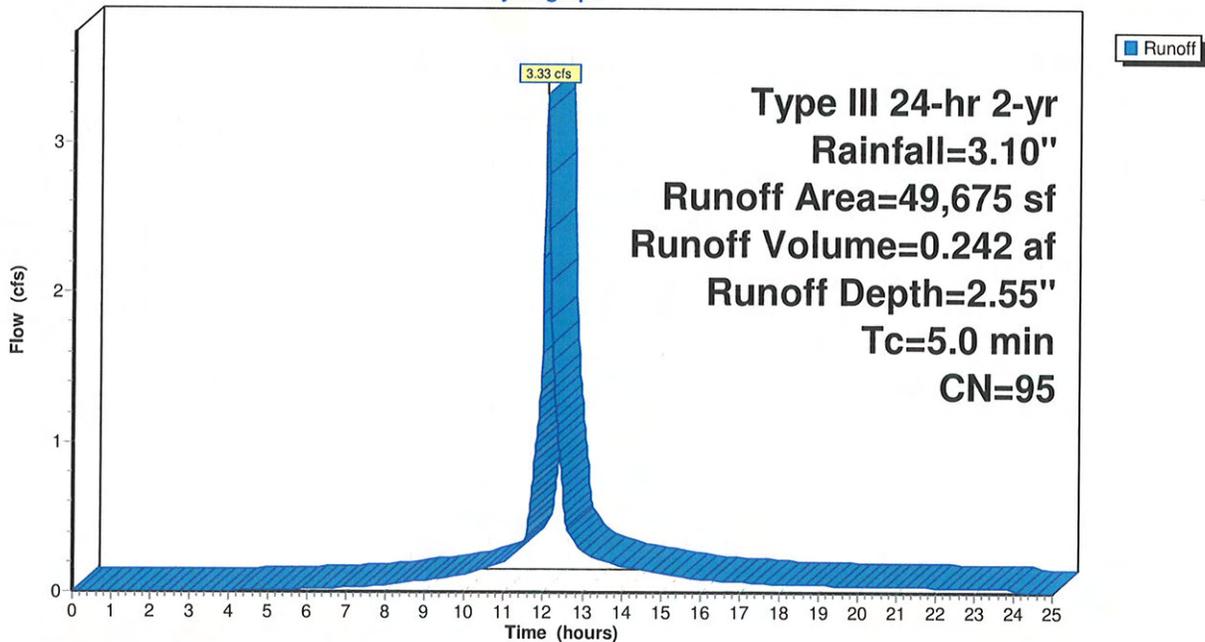
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
30,724	98	Paved roads w/curbs & sewers, HSG D
17,727	89	<50% Grass cover, Poor, HSG D
* 1,224	98	Pavers
49,675	95	Weighted Average
17,727		35.69% Pervious Area
31,948		64.31% Impervious Area

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

Subcatchment 1P: Proposed Site

Hydrograph



Pre v Post (2011-0831)

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Type III 24-hr 2-yr Rainfall=3.10"

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Summary for Subcatchment 2P: Proposed Parking Lot

Runoff = 0.48 cfs @ 12.07 hrs, Volume= 0.035 af, Depth= 2.55"

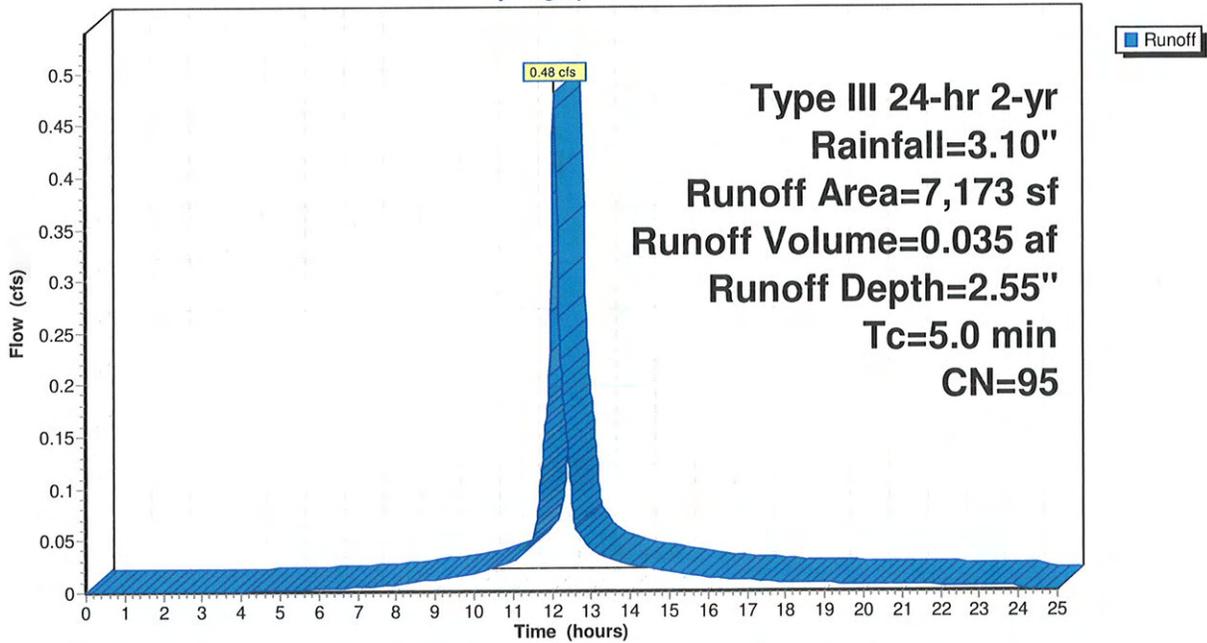
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
4,637	98	Paved roads w/curbs & sewers, HSG D
2,536	89	<50% Grass cover, Poor, HSG D
7,173	95	Weighted Average
2,536		35.35% Pervious Area
4,637		64.65% Impervious Area

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

Subcatchment 2P: Proposed Parking Lot

Hydrograph



Summary for Subcatchment 5P: Capen Court

Runoff = 0.31 cfs @ 12.07 hrs, Volume= 0.024 af, Depth= 2.87"

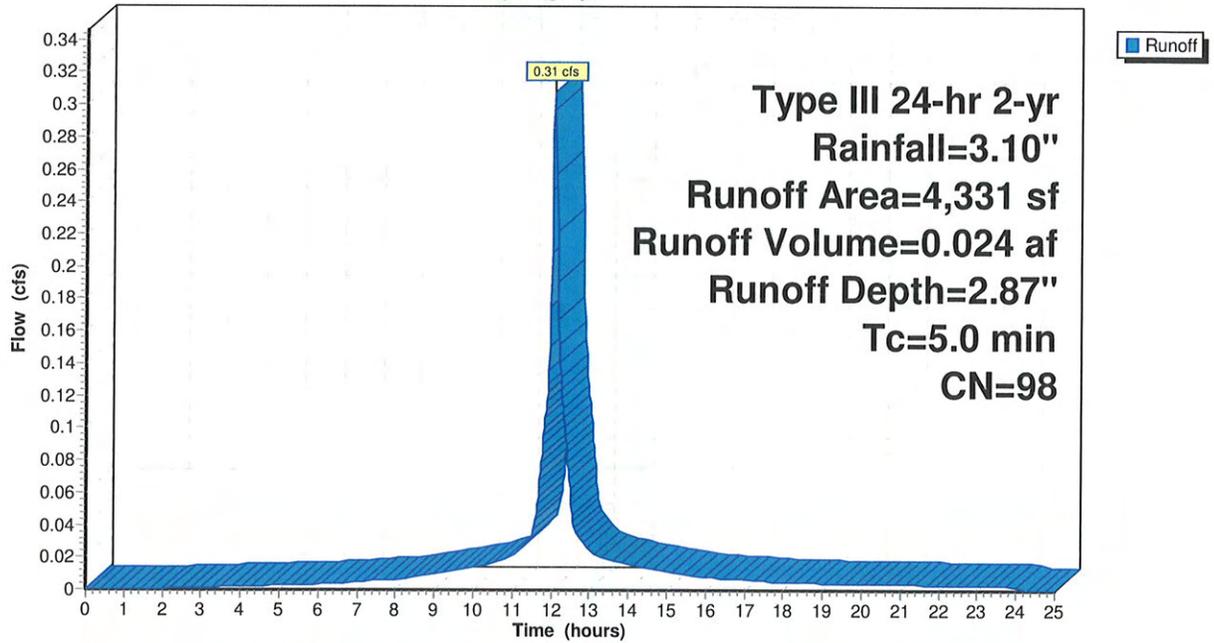
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
4,331	98	Paved parking, HSG A
4,331		100.00% Impervious Area

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

Subcatchment 5P: Capen Court

Hydrograph



Summary for Reach 3P: Proposed

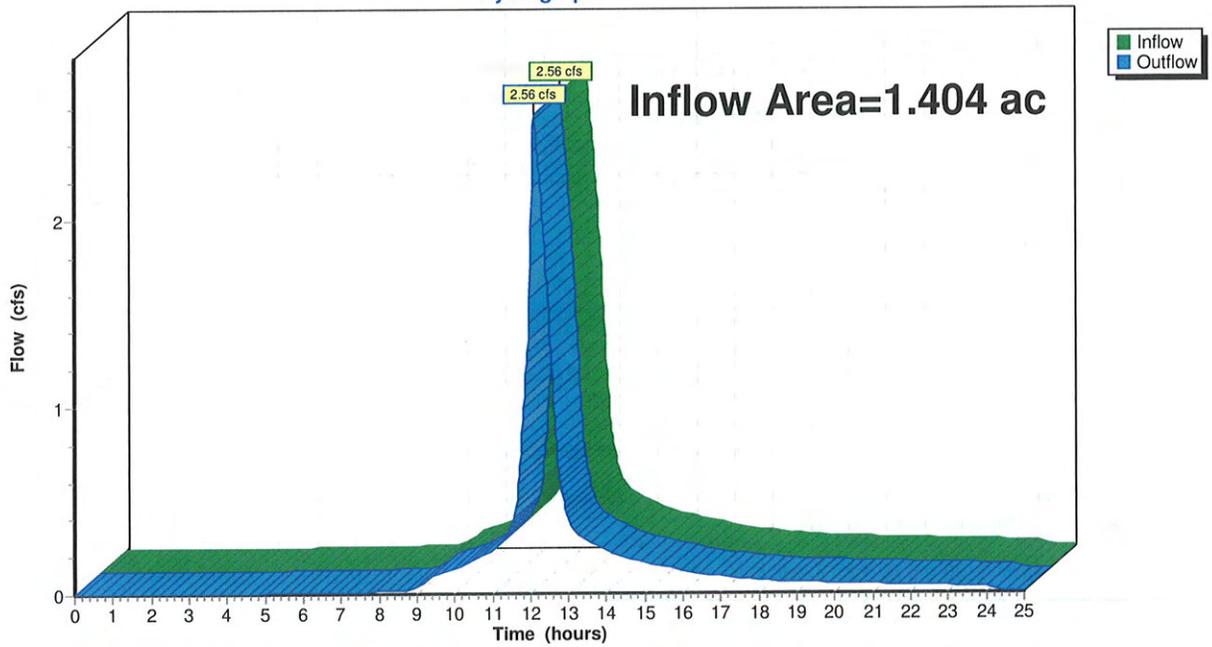
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.404 ac, 66.88% Impervious, Inflow Depth > 2.43" for 2-yr event
Inflow = 2.56 cfs @ 12.11 hrs, Volume= 0.285 af
Outflow = 2.56 cfs @ 12.11 hrs, Volume= 0.285 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs

Reach 3P: Proposed

Hydrograph



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Type III 24-hr 2-yr Rainfall=3.10"

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Summary for Pond 4P: Underground Storage

Inflow Area = 1.140 ac, 64.31% Impervious, Inflow Depth = 2.55" for 2-yr event
 Inflow = 3.33 cfs @ 12.07 hrs, Volume= 0.242 af
 Outflow = 1.96 cfs @ 12.17 hrs, Volume= 0.231 af, Atten= 41%, Lag= 5.9 min
 Discarded = 0.00 cfs @ 5.00 hrs, Volume= 0.005 af
 Primary = 1.96 cfs @ 12.17 hrs, Volume= 0.226 af

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs / 2
 Peak Elev= 13.50' @ 12.17 hrs Surf.Area= 0.034 ac Storage= 0.043 af

Plug-Flow detention time= 55.7 min calculated for 0.231 af (96% of inflow)
 Center-of-Mass det. time= 30.3 min (811.3 - 781.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	11.50'	0.023 af	25.25'W x 58.96'L x 3.50'H Field A 0.120 af Overall - 0.042 af Embedded = 0.077 af x 30.0% Voids
#2A	12.00'	0.042 af	StormTech SC-740 x 40 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
		0.065 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	12.00'	18.0" Vert. Orifice/Grate C= 0.600
#2	Device 1	12.18'	6.0" Vert. Orifice/Grate X 2.00 C= 0.600
#3	Device 1	14.50'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.50 Width (feet) 3.00 3.00 3.00
#4	Discarded	11.50'	0.090 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=11.56' (Free Discharge)
 ↳4=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=1.96 cfs @ 12.17 hrs HW=13.50' (Free Discharge)
 ↳1=Orifice/Grate (Passes 1.96 cfs of 7.37 cfs potential flow)
 ↳2=Orifice/Grate (Orifice Controls 1.96 cfs @ 4.98 fps)
 ↳3=Custom Weir/Orifice (Controls 0.00 cfs)

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Type III 24-hr 2-yr Rainfall=3.10"

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Pond 4P: Underground Storage - Chamber Wizard Field A

Chamber Model = StormTech SC-740

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C

8 Chambers/Row x 7.12' Long = 56.96' + 12.0" End Stone x 2 = 58.96' Base Length

5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

40 Chambers x 45.9 cf = 1,837.6 cf Chamber Storage

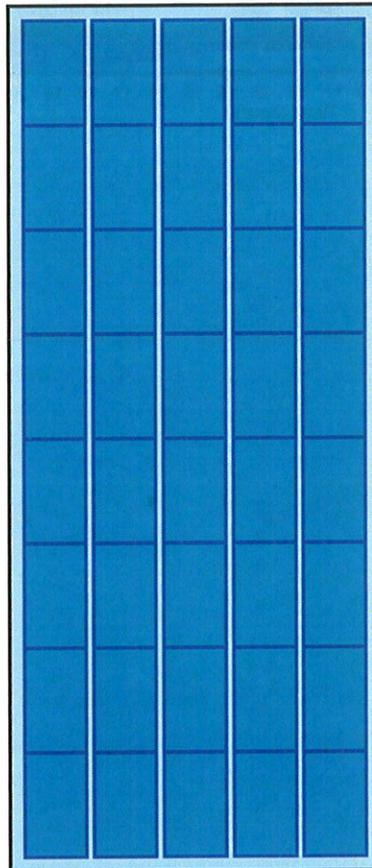
5,210.6 cf Field - 1,837.6 cf Chambers = 3,373.0 cf Stone x 30.0% Voids = 1,011.9 cf Stone Storage

Stone + Chamber Storage = 2,849.5 cf = 0.065 af

40 Chambers

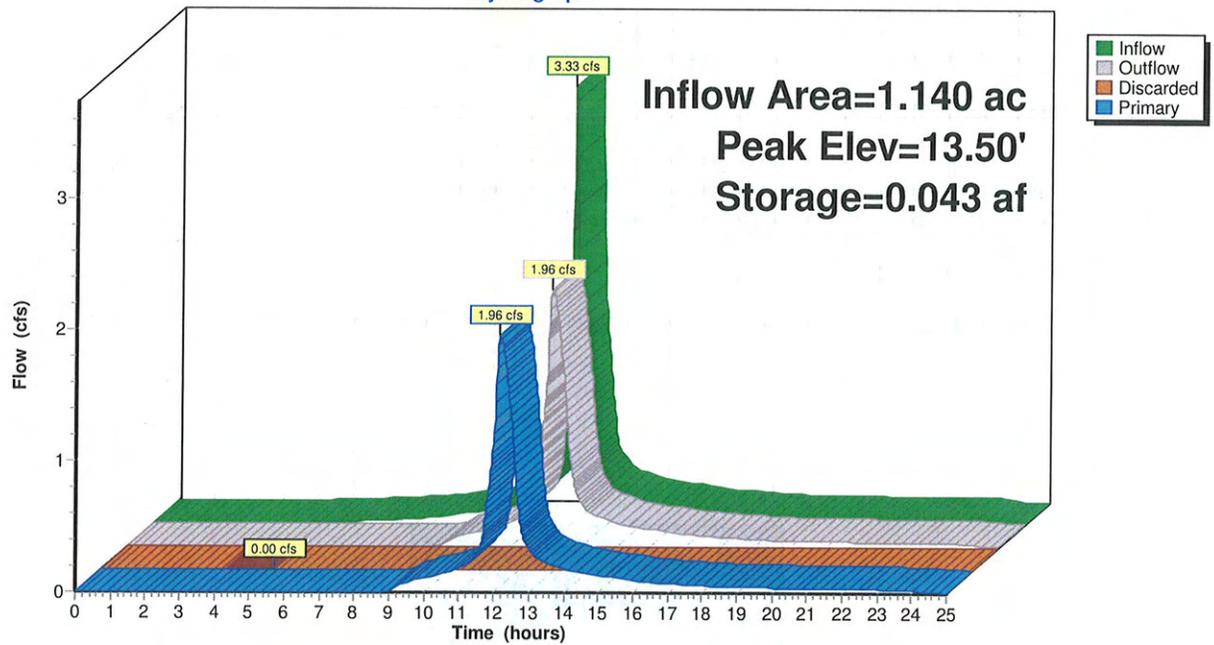
193.0 cy Field

124.9 cy Stone



Pond 4P: Underground Storage

Hydrograph



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Type III 24-hr 10-yr Rainfall=4.50"

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Time span=0.00-25.00 hrs, dt=0.02 hrs, 1251 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1P: Proposed Site

Runoff Area=49,675 sf 64.31% Impervious Runoff Depth=3.92"
Tc=5.0 min CN=95 Runoff=5.01 cfs 0.373 af

Subcatchment 2P: Proposed Parking Lot

Runoff Area=7,173 sf 64.65% Impervious Runoff Depth=3.92"
Tc=5.0 min CN=95 Runoff=0.72 cfs 0.054 af

Subcatchment 5P: Capen Court

Runoff Area=4,331 sf 100.00% Impervious Runoff Depth=4.26"
Tc=5.0 min CN=98 Runoff=0.45 cfs 0.035 af

Reach 3P: Proposed

Inflow=4.08 cfs 0.446 af
Outflow=4.08 cfs 0.446 af

Pond 4P: Underground Storage

Peak Elev=14.63' Storage=0.062 af Inflow=5.01 cfs 0.373 af
Discarded=0.00 cfs 0.006 af Primary=3.29 cfs 0.357 af Outflow=3.29 cfs 0.362 af

Total Runoff Area = 1.404 ac Runoff Volume = 0.462 af Average Runoff Depth = 3.95"
33.12% Pervious = 0.465 ac 66.88% Impervious = 0.939 ac

Summary for Subcatchment 1P: Proposed Site

Runoff = 5.01 cfs @ 12.07 hrs, Volume= 0.373 af, Depth= 3.92"

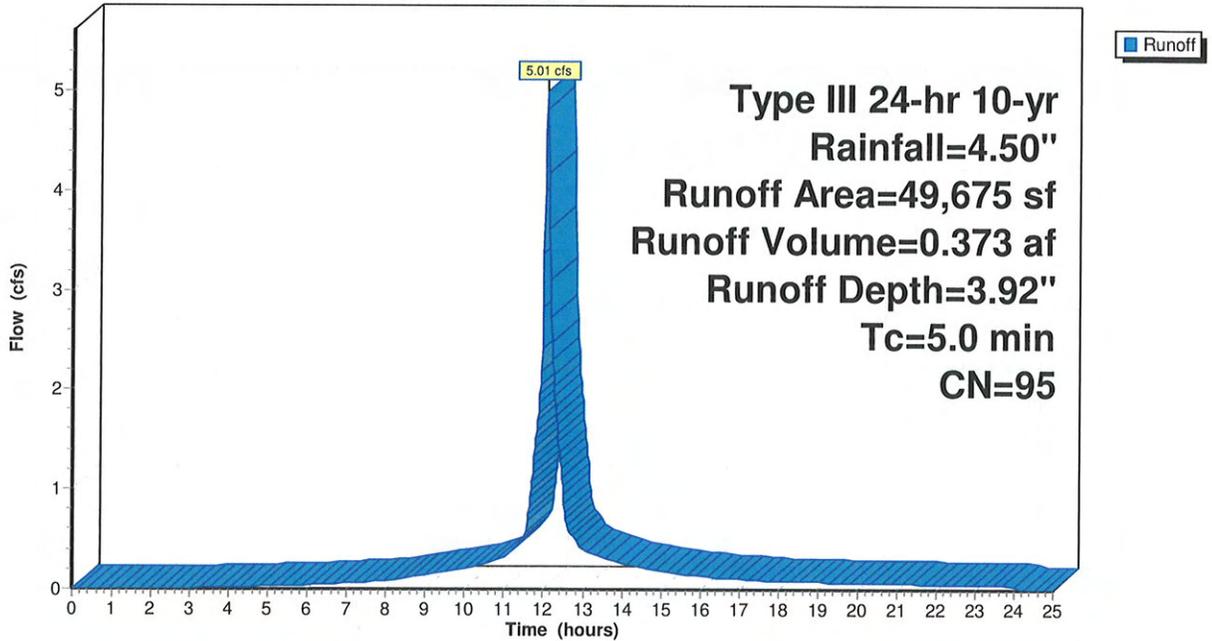
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
 Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
30,724	98	Paved roads w/curbs & sewers, HSG D
17,727	89	<50% Grass cover, Poor, HSG D
* 1,224	98	Pavers
49,675	95	Weighted Average
17,727		35.69% Pervious Area
31,948		64.31% Impervious Area

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

Subcatchment 1P: Proposed Site

Hydrograph



Pre v Post (2011-0831)

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Type III 24-hr 10-yr Rainfall=4.50"

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Summary for Subcatchment 2P: Proposed Parking Lot

Runoff = 0.72 cfs @ 12.07 hrs, Volume= 0.054 af, Depth= 3.92"

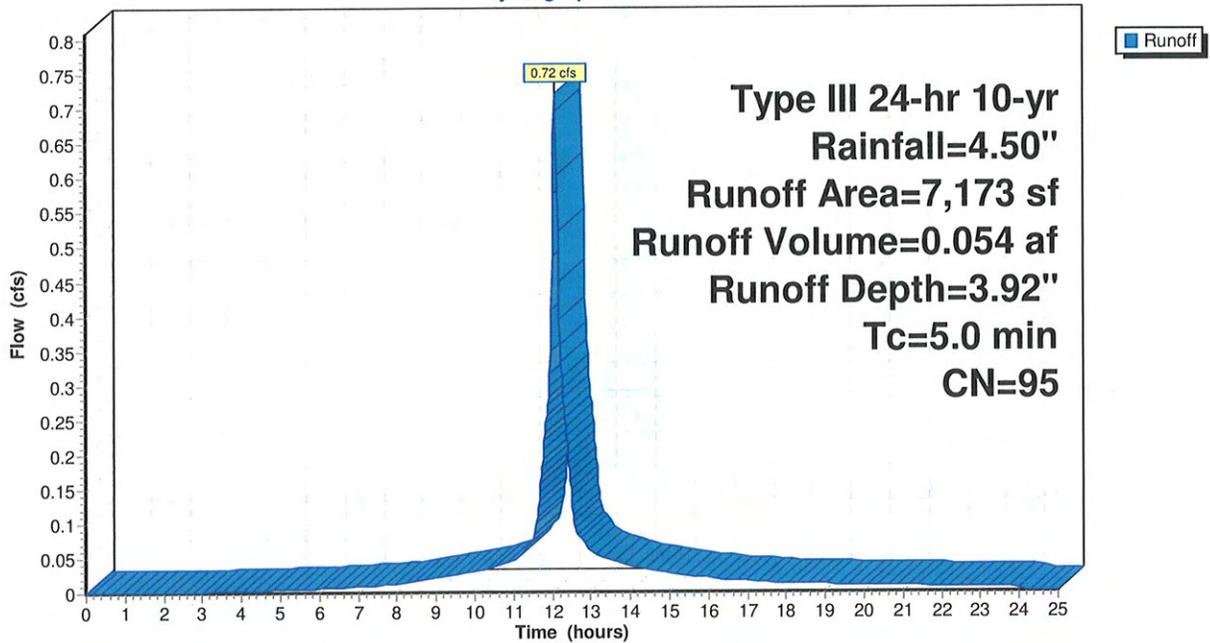
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
4,637	98	Paved roads w/curbs & sewers, HSG D
2,536	89	<50% Grass cover, Poor, HSG D
7,173	95	Weighted Average
2,536		35.35% Pervious Area
4,637		64.65% Impervious Area

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

Subcatchment 2P: Proposed Parking Lot

Hydrograph



Summary for Subcatchment 5P: Capen Court

Runoff = 0.45 cfs @ 12.07 hrs, Volume= 0.035 af, Depth= 4.26"

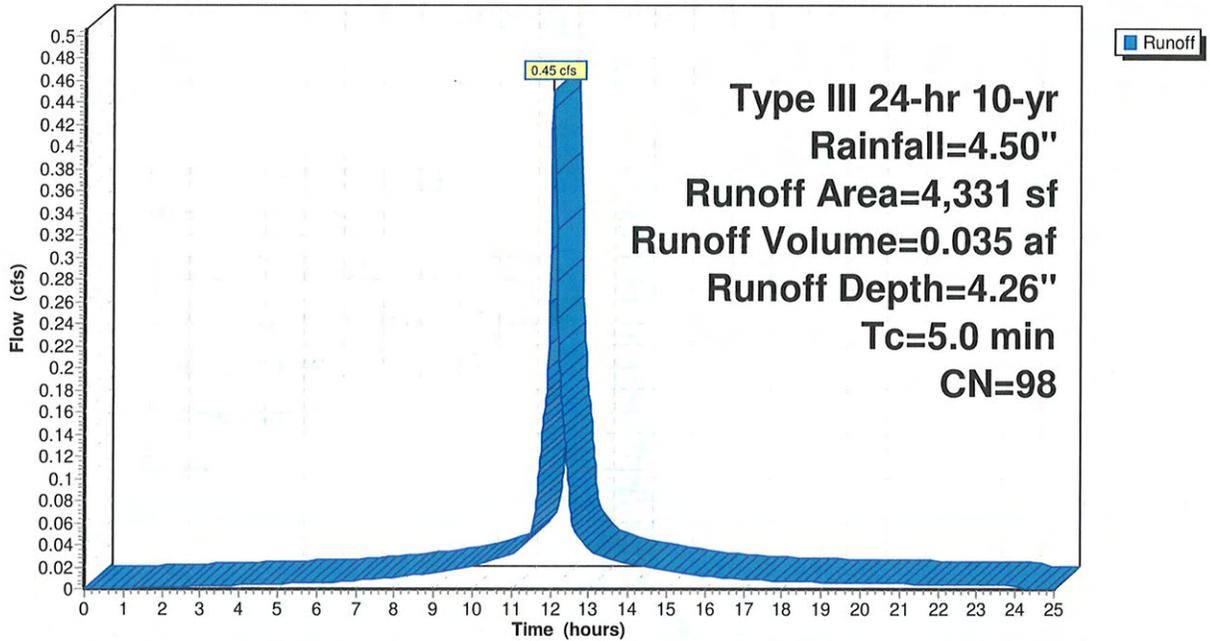
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
 Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
4,331	98	Paved parking, HSG A
4,331		100.00% Impervious Area

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

Subcatchment 5P: Capen Court

Hydrograph



Summary for Reach 3P: Proposed

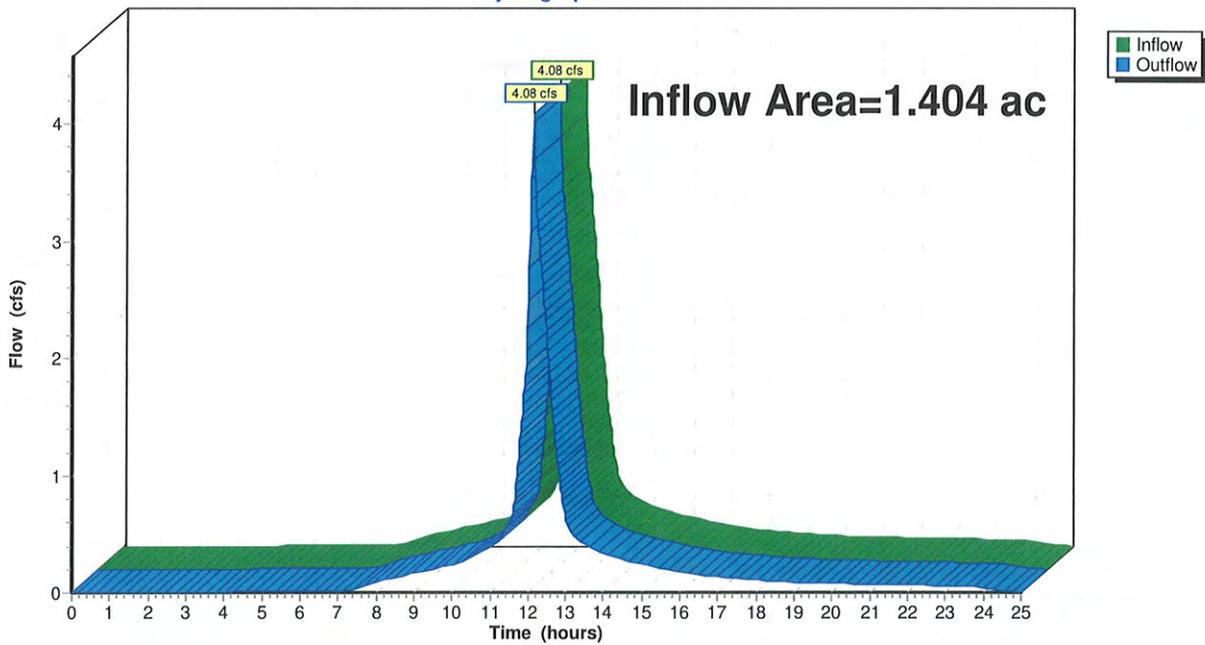
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.404 ac, 66.88% Impervious, Inflow Depth > 3.81" for 10-yr event
Inflow = 4.08 cfs @ 12.15 hrs, Volume= 0.446 af
Outflow = 4.08 cfs @ 12.15 hrs, Volume= 0.446 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs

Reach 3P: Proposed

Hydrograph



Summary for Pond 4P: Underground Storage

Inflow Area = 1.140 ac, 64.31% Impervious, Inflow Depth = 3.92" for 10-yr event
 Inflow = 5.01 cfs @ 12.07 hrs, Volume= 0.373 af
 Outflow = 3.29 cfs @ 12.16 hrs, Volume= 0.362 af, Atten= 34%, Lag= 5.1 min
 Discarded = 0.00 cfs @ 3.68 hrs, Volume= 0.006 af
 Primary = 3.29 cfs @ 12.16 hrs, Volume= 0.357 af

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs / 2
 Peak Elev= 14.63' @ 12.16 hrs Surf.Area= 0.034 ac Storage= 0.062 af

Plug-Flow detention time= 44.0 min calculated for 0.362 af (97% of inflow)
 Center-of-Mass det. time= 26.4 min (796.5 - 770.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	11.50'	0.023 af	25.25'W x 58.96'L x 3.50'H Field A 0.120 af Overall - 0.042 af Embedded = 0.077 af x 30.0% Voids
#2A	12.00'	0.042 af	StormTech SC-740 x 40 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
		0.065 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	12.00'	18.0" Vert. Orifice/Grate C= 0.600
#2	Device 1	12.18'	6.0" Vert. Orifice/Grate X 2.00 C= 0.600
#3	Device 1	14.50'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.50 Width (feet) 3.00 3.00 3.00
#4	Discarded	11.50'	0.090 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.00 cfs @ 3.68 hrs HW=11.56' (Free Discharge)
 ↑4=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=3.26 cfs @ 12.16 hrs HW=14.63' (Free Discharge)
 ↑1=Orifice/Grate (Passes 3.26 cfs of 11.66 cfs potential flow)
 ↑2=Orifice/Grate (Orifice Controls 2.80 cfs @ 7.14 fps)
 ↑3=Custom Weir/Orifice (Weir Controls 0.45 cfs @ 1.18 fps)

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Type III 24-hr 10-yr Rainfall=4.50"

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Pond 4P: Underground Storage - Chamber Wizard Field A

Chamber Model = StormTech SC-740

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C

8 Chambers/Row x 7.12' Long = 56.96' + 12.0" End Stone x 2 = 58.96' Base Length

5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

40 Chambers x 45.9 cf = 1,837.6 cf Chamber Storage

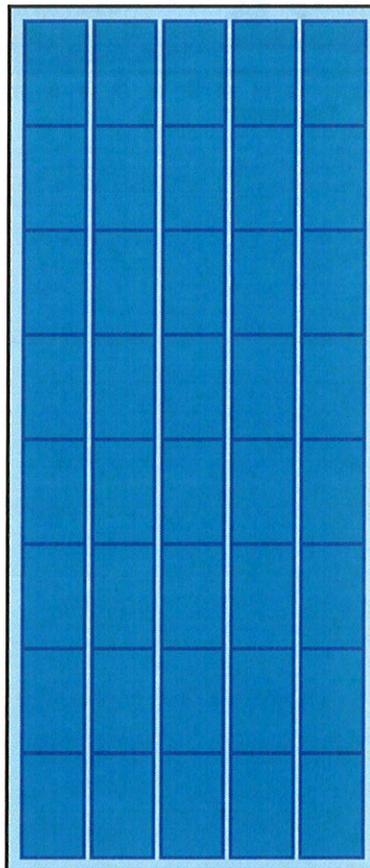
5,210.6 cf Field - 1,837.6 cf Chambers = 3,373.0 cf Stone x 30.0% Voids = 1,011.9 cf Stone Storage

Stone + Chamber Storage = 2,849.5 cf = 0.065 af

40 Chambers

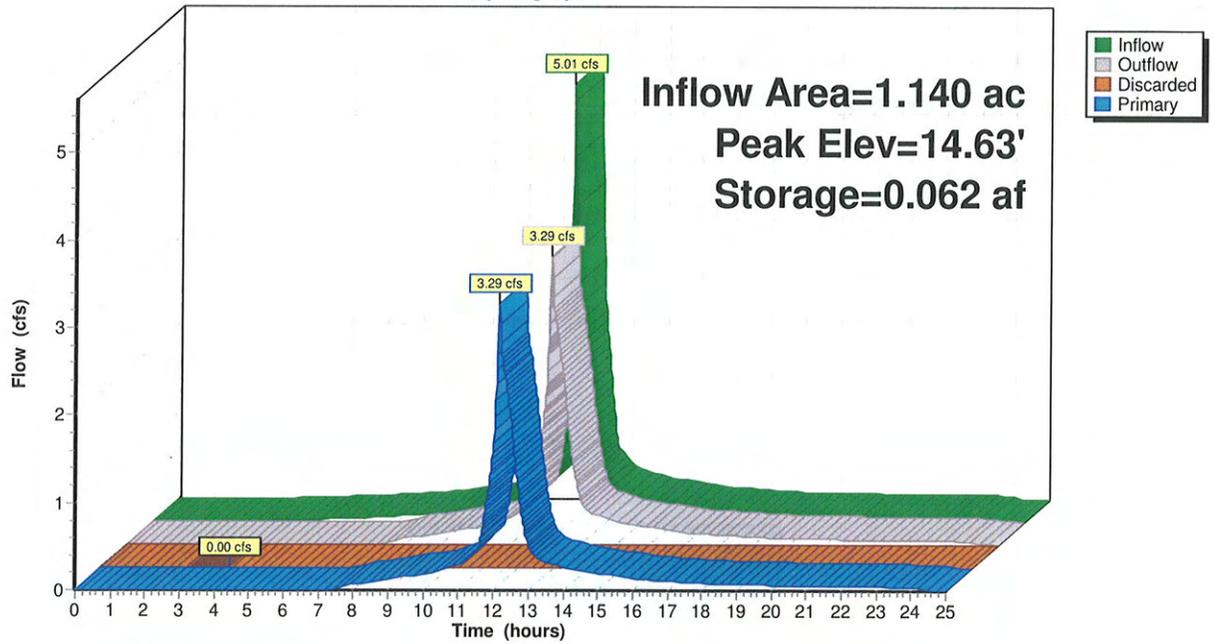
193.0 cy Field

124.9 cy Stone



Pond 4P: Underground Storage

Hydrograph



Pre v Post (2011-0831)

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Type III 24-hr 25-yr Rainfall=5.30"

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Time span=0.00-25.00 hrs, dt=0.02 hrs, 1251 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1P: Proposed Site

Runoff Area=49,675 sf 64.31% Impervious Runoff Depth=4.72"
Tc=5.0 min CN=95 Runoff=5.96 cfs 0.448 af

Subcatchment 2P: Proposed Parking Lot

Runoff Area=7,173 sf 64.65% Impervious Runoff Depth=4.72"
Tc=5.0 min CN=95 Runoff=0.86 cfs 0.065 af

Subcatchment 5P: Capen Court

Runoff Area=4,331 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=98 Runoff=0.53 cfs 0.042 af

Reach 3P: Proposed

Inflow=6.63 cfs 0.538 af
Outflow=6.63 cfs 0.538 af

Pond 4P: Underground Storage

Peak Elev=14.88' Storage=0.064 af Inflow=5.96 cfs 0.448 af
Discarded=0.00 cfs 0.006 af Primary=5.25 cfs 0.432 af Outflow=5.26 cfs 0.437 af

Total Runoff Area = 1.404 ac Runoff Volume = 0.555 af Average Runoff Depth = 4.74"
33.12% Pervious = 0.465 ac 66.88% Impervious = 0.939 ac

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Type III 24-hr 25-yr Rainfall=5.30"

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Summary for Subcatchment 1P: Proposed Site

Runoff = 5.96 cfs @ 12.07 hrs, Volume= 0.448 af, Depth= 4.72"

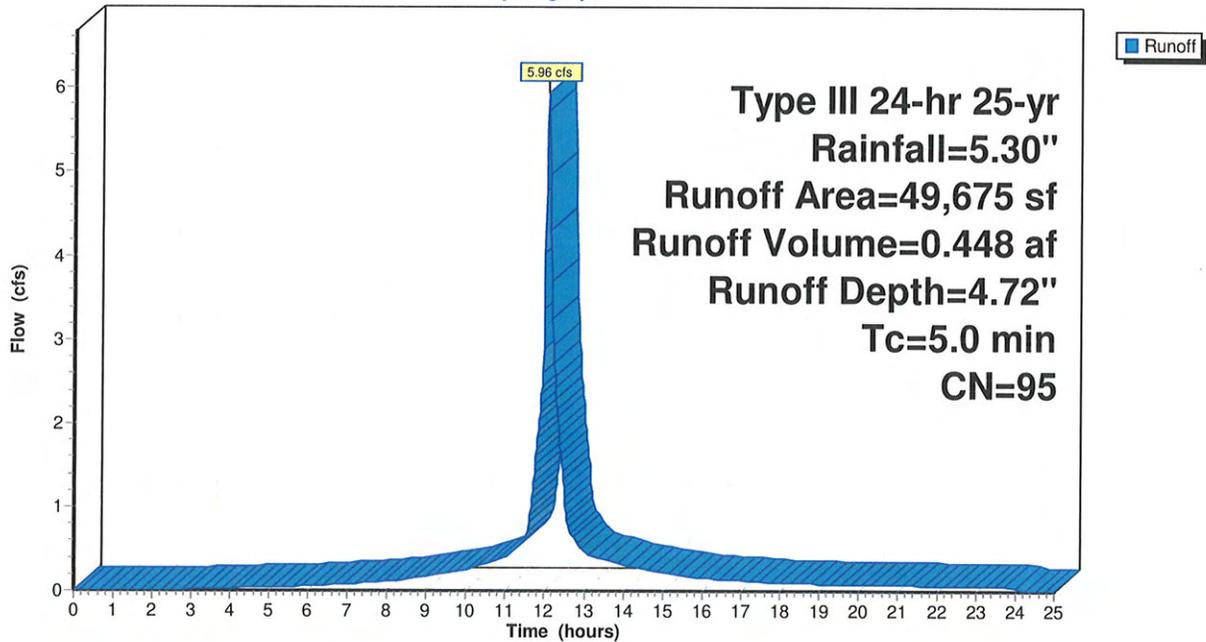
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
30,724	98	Paved roads w/curbs & sewers, HSG D
17,727	89	<50% Grass cover, Poor, HSG D
* 1,224	98	Pavers
49,675	95	Weighted Average
17,727		35.69% Pervious Area
31,948		64.31% Impervious Area

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

Subcatchment 1P: Proposed Site

Hydrograph



Summary for Subcatchment 2P: Proposed Parking Lot

Runoff = 0.86 cfs @ 12.07 hrs, Volume= 0.065 af, Depth= 4.72"

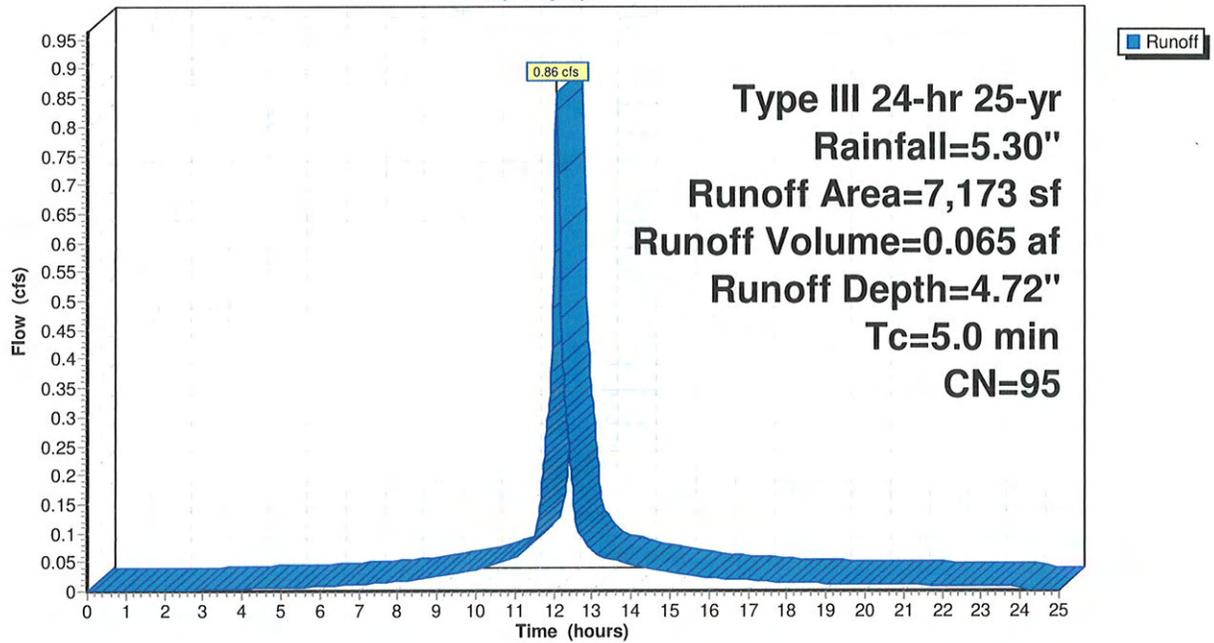
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
4,637	98	Paved roads w/curbs & sewers, HSG D
2,536	89	<50% Grass cover, Poor, HSG D
7,173	95	Weighted Average
2,536		35.35% Pervious Area
4,637		64.65% Impervious Area

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

Subcatchment 2P: Proposed Parking Lot

Hydrograph



Summary for Subcatchment 5P: Capen Court

Runoff = 0.53 cfs @ 12.07 hrs, Volume= 0.042 af, Depth= 5.06"

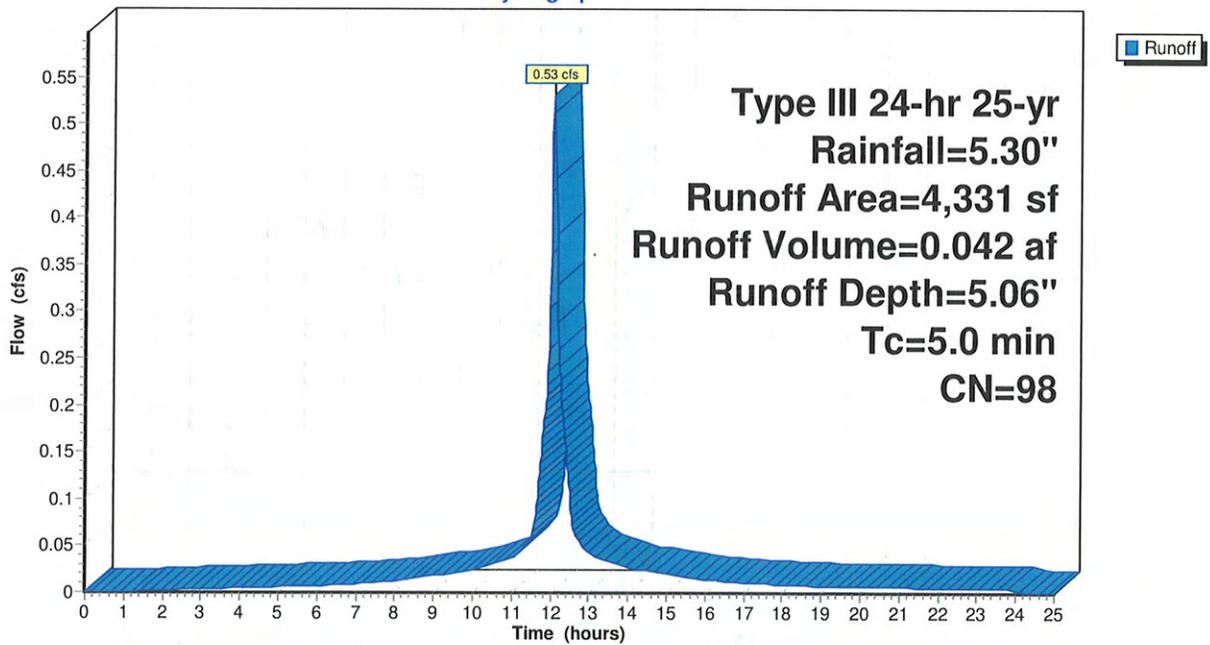
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
 Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
4,331	98	Paved parking, HSG A
4,331		100.00% Impervious Area

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

Subcatchment 5P: Capen Court

Hydrograph



Summary for Reach 3P: Proposed

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.404 ac, 66.88% Impervious, Inflow Depth > 4.60" for 25-yr event

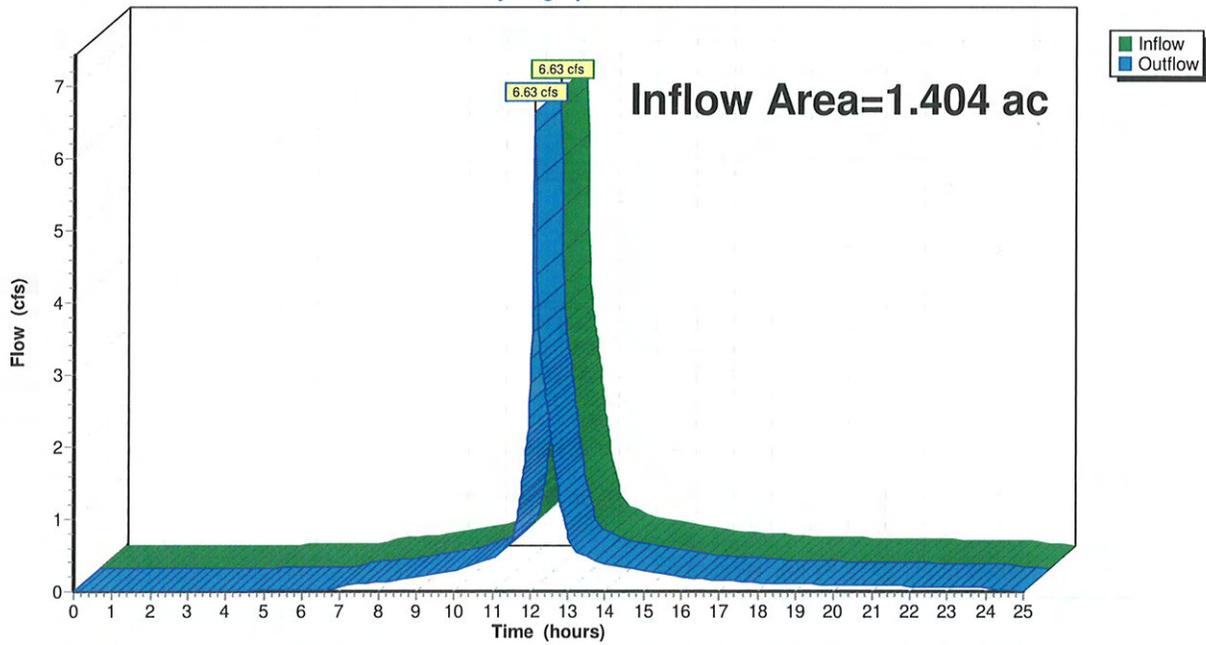
Inflow = 6.63 cfs @ 12.11 hrs, Volume= 0.538 af

Outflow = 6.63 cfs @ 12.11 hrs, Volume= 0.538 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs

Reach 3P: Proposed

Hydrograph



Summary for Pond 4P: Underground Storage

Inflow Area = 1.140 ac, 64.31% Impervious, Inflow Depth = 4.72" for 25-yr event
 Inflow = 5.96 cfs @ 12.07 hrs, Volume= 0.448 af
 Outflow = 5.26 cfs @ 12.11 hrs, Volume= 0.437 af, Atten= 12%, Lag= 2.4 min
 Discarded = 0.00 cfs @ 3.20 hrs, Volume= 0.006 af
 Primary = 5.25 cfs @ 12.11 hrs, Volume= 0.432 af

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs / 2
 Peak Elev= 14.88' @ 12.11 hrs Surf.Area= 0.034 ac Storage= 0.064 af

Plug-Flow detention time= 39.4 min calculated for 0.437 af (98% of inflow)
 Center-of-Mass det. time= 24.4 min (790.2 - 765.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	11.50'	0.023 af	25.25'W x 58.96'L x 3.50'H Field A 0.120 af Overall - 0.042 af Embedded = 0.077 af x 30.0% Voids
#2A	12.00'	0.042 af	StormTech SC-740 x 40 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
		0.065 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	12.00'	18.0" Vert. Orifice/Grate C= 0.600
#2	Device 1	12.18'	6.0" Vert. Orifice/Grate X 2.00 C= 0.600
#3	Device 1	14.50'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.50 Width (feet) 3.00 3.00 3.00
#4	Discarded	11.50'	0.090 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.00 cfs @ 3.20 hrs HW=11.56' (Free Discharge)
 ↳4=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=5.18 cfs @ 12.11 hrs HW=14.87' (Free Discharge)
 ↳1=Orifice/Grate (Passes 5.18 cfs of 12.39 cfs potential flow)
 ↳2=Orifice/Grate (Orifice Controls 2.95 cfs @ 7.52 fps)
 ↳3=Custom Weir/Orifice (Weir Controls 2.23 cfs @ 2.00 fps)

Pre v Post (2011-0831)

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Type III 24-hr 25-yr Rainfall=5.30"

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Pond 4P: Underground Storage - Chamber Wizard Field A

Chamber Model = StormTech SC-740

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C

8 Chambers/Row x 7.12' Long = 56.96' + 12.0" End Stone x 2 = 58.96' Base Length

5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

40 Chambers x 45.9 cf = 1,837.6 cf Chamber Storage

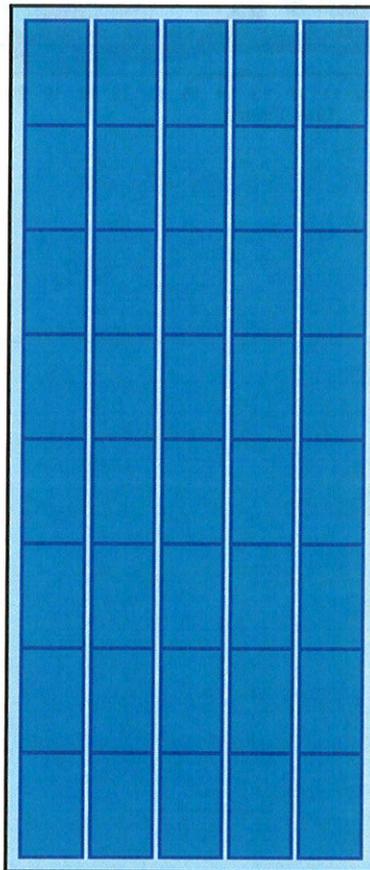
5,210.6 cf Field - 1,837.6 cf Chambers = 3,373.0 cf Stone x 30.0% Voids = 1,011.9 cf Stone Storage

Stone + Chamber Storage = 2,849.5 cf = 0.065 af

40 Chambers

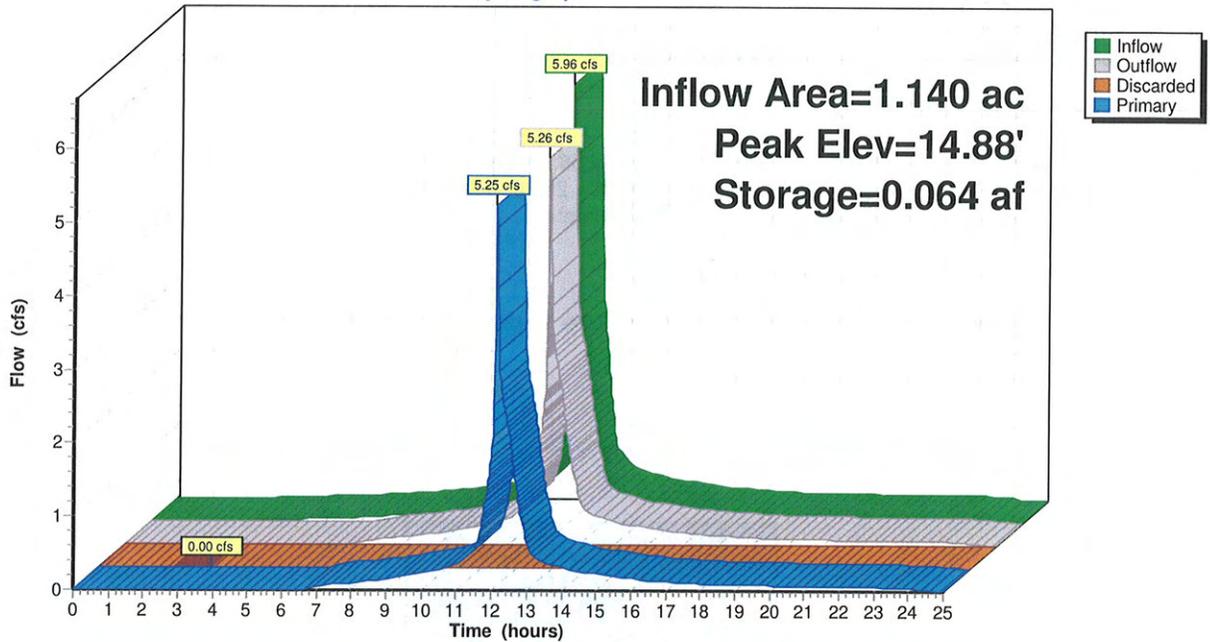
193.0 cy Field

124.9 cy Stone



Pond 4P: Underground Storage

Hydrograph



Pre v Post (2011-0831)

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Type III 24-hr 100-yr Rainfall=6.50"

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Time span=0.00-25.00 hrs, dt=0.02 hrs, 1251 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1P: Proposed Site

Runoff Area=49,675 sf 64.31% Impervious Runoff Depth=5.91"
Tc=5.0 min CN=95 Runoff=7.37 cfs 0.561 af

Subcatchment 2P: Proposed Parking Lot

Runoff Area=7,173 sf 64.65% Impervious Runoff Depth=5.91"
Tc=5.0 min CN=95 Runoff=1.06 cfs 0.081 af

Subcatchment 5P: Capen Court

Runoff Area=4,331 sf 100.00% Impervious Runoff Depth=6.26"
Tc=5.0 min CN=98 Runoff=0.65 cfs 0.052 af

Reach 3P: Proposed

Inflow=8.25 cfs 0.675 af
Outflow=8.25 cfs 0.675 af

Pond 4P: Underground Storage

Peak Elev=15.00' Storage=0.065 af Inflow=7.37 cfs 0.561 af
Discarded=0.00 cfs 0.006 af Primary=6.53 cfs 0.542 af Outflow=6.54 cfs 0.548 af

Total Runoff Area = 1.404 ac Runoff Volume = 0.694 af Average Runoff Depth = 5.93"
33.12% Pervious = 0.465 ac 66.88% Impervious = 0.939 ac

Pre v Post (2011-0831)

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Type III 24-hr 100-yr Rainfall=6.50"

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Summary for Subcatchment 1P: Proposed Site

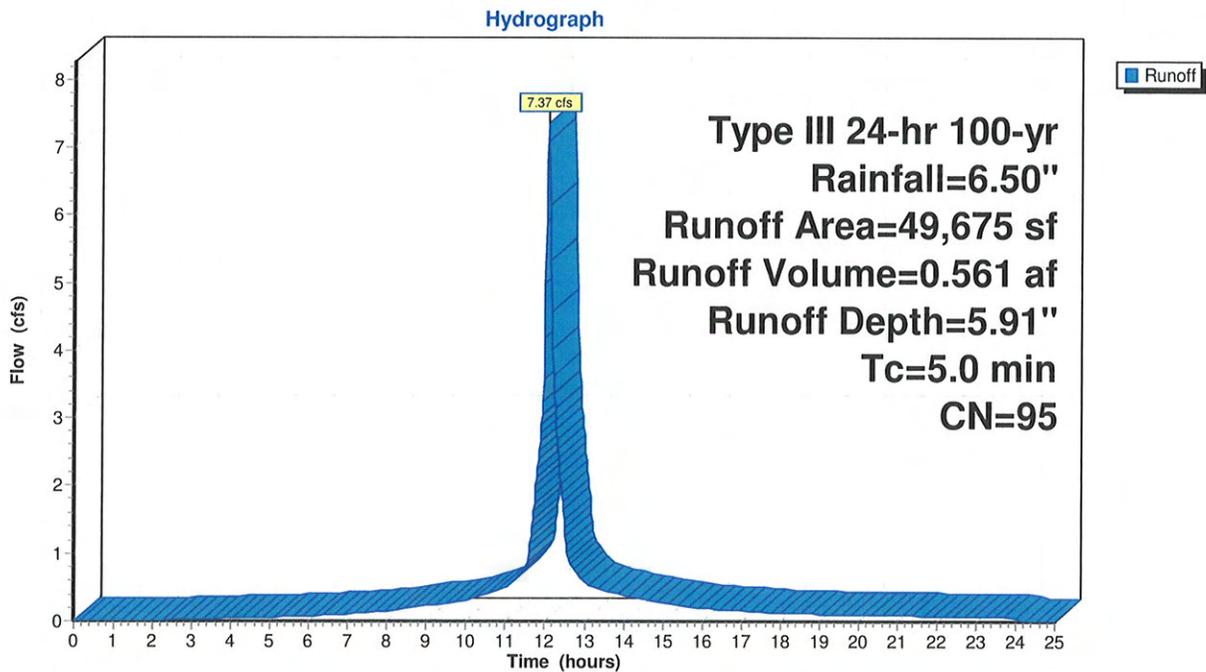
Runoff = 7.37 cfs @ 12.07 hrs, Volume= 0.561 af, Depth= 5.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
30,724	98	Paved roads w/curbs & sewers, HSG D
17,727	89	<50% Grass cover, Poor, HSG D
* 1,224	98	Pavers
49,675	95	Weighted Average
17,727		35.69% Pervious Area
31,948		64.31% Impervious Area

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

Subcatchment 1P: Proposed Site



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Type III 24-hr 100-yr Rainfall=6.50"

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Summary for Subcatchment 2P: Proposed Parking Lot

Runoff = 1.06 cfs @ 12.07 hrs, Volume= 0.081 af, Depth= 5.91"

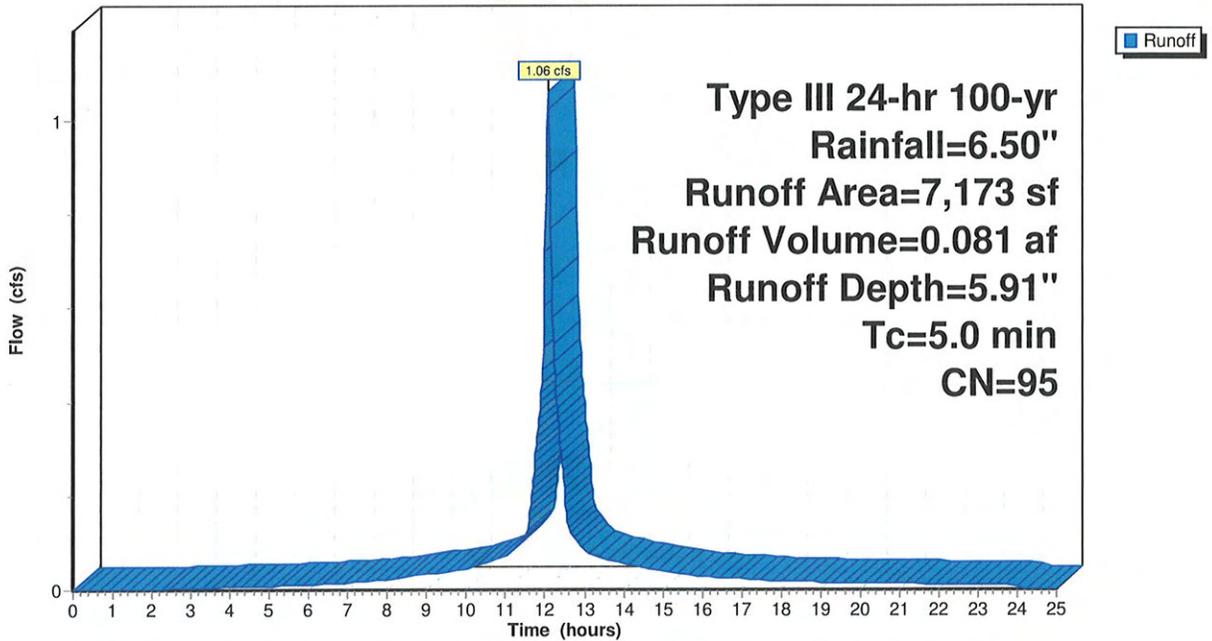
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
4,637	98	Paved roads w/curbs & sewers, HSG D
2,536	89	<50% Grass cover, Poor, HSG D
7,173	95	Weighted Average
2,536		35.35% Pervious Area
4,637		64.65% Impervious Area

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

Subcatchment 2P: Proposed Parking Lot

Hydrograph



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Type III 24-hr 100-yr Rainfall=6.50"

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Summary for Subcatchment 5P: Capen Court

Runoff = 0.65 cfs @ 12.07 hrs, Volume= 0.052 af, Depth= 6.26"

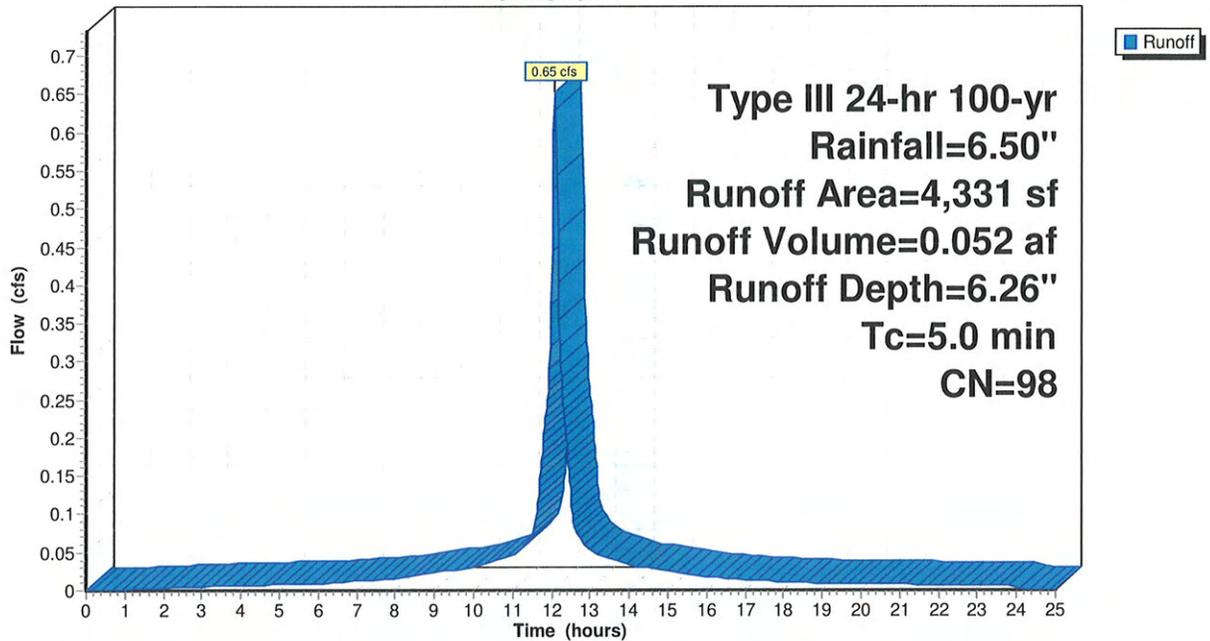
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-yr Rainfall=6.50"

Area (sf)	CN	Description
4,331	98	Paved parking, HSG A
4,331		100.00% Impervious Area

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

Subcatchment 5P: Capen Court

Hydrograph



Summary for Reach 3P: Proposed

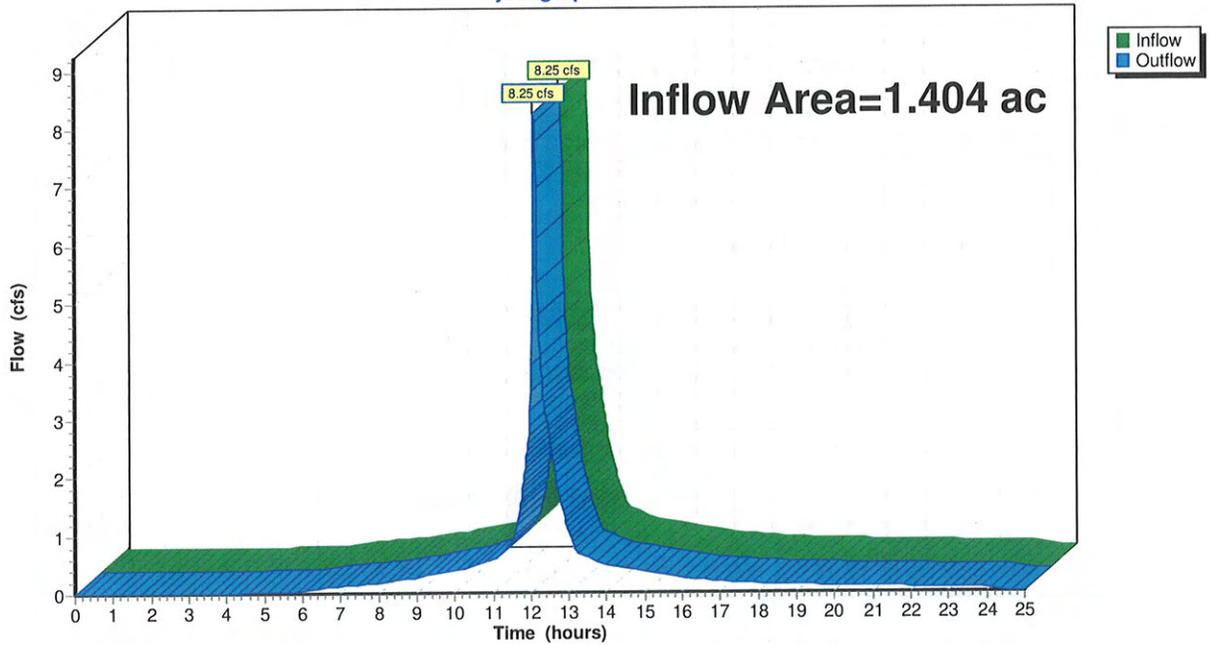
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.404 ac, 66.88% Impervious, Inflow Depth > 5.77" for 100-yr event
Inflow = 8.25 cfs @ 12.07 hrs, Volume= 0.675 af
Outflow = 8.25 cfs @ 12.07 hrs, Volume= 0.675 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs

Reach 3P: Proposed

Hydrograph



Summary for Pond 4P: Underground Storage

Inflow Area = 1.140 ac, 64.31% Impervious, Inflow Depth = 5.91" for 100-yr event
 Inflow = 7.37 cfs @ 12.07 hrs, Volume= 0.561 af
 Outflow = 6.54 cfs @ 12.07 hrs, Volume= 0.548 af, Atten= 11%, Lag= 0.1 min
 Discarded = 0.00 cfs @ 2.66 hrs, Volume= 0.006 af
 Primary = 6.53 cfs @ 12.07 hrs, Volume= 0.542 af

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.02 hrs / 2
 Peak Elev= 15.00' @ 12.07 hrs Surf.Area= 0.034 ac Storage= 0.065 af

Plug-Flow detention time= 37.2 min calculated for 0.548 af (98% of inflow)
 Center-of-Mass det. time= 22.3 min (783.0 - 760.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	11.50'	0.023 af	25.25'W x 58.96'L x 3.50'H Field A 0.120 af Overall - 0.042 af Embedded = 0.077 af x 30.0% Voids
#2A	12.00'	0.042 af	StormTech SC-740 x 40 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
		0.065 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	12.00'	18.0" Vert. Orifice/Grate C= 0.600
#2	Device 1	12.18'	6.0" Vert. Orifice/Grate X 2.00 C= 0.600
#3	Device 1	14.50'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 1.00 2.50 Width (feet) 3.00 3.00 3.00
#4	Discarded	11.50'	0.090 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.00 cfs @ 2.66 hrs HW=11.56' (Free Discharge)
 ↳4=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=6.52 cfs @ 12.07 hrs HW=15.00' (Free Discharge)
 ↳1=Orifice/Grate (Passes 6.52 cfs of 12.77 cfs potential flow)
 ↳2=Orifice/Grate (Orifice Controls 3.03 cfs @ 7.72 fps)
 ↳3=Custom Weir/Orifice (Weir Controls 3.48 cfs @ 2.32 fps)

Pre v Post (2011-0831)

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Type III 24-hr 100-yr Rainfall=6.50"

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Pond 4P: Underground Storage - Chamber Wizard Field A

Chamber Model = StormTech SC-740

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C

8 Chambers/Row x 7.12' Long = 56.96' + 12.0" End Stone x 2 = 58.96' Base Length

5 Rows x 51.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.25' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

40 Chambers x 45.9 cf = 1,837.6 cf Chamber Storage

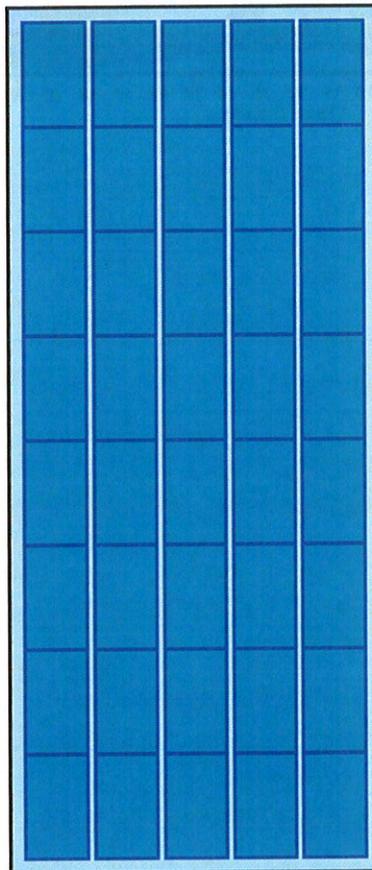
5,210.6 cf Field - 1,837.6 cf Chambers = 3,373.0 cf Stone x 30.0% Voids = 1,011.9 cf Stone Storage

Stone + Chamber Storage = 2,849.5 cf = 0.065 af

40 Chambers

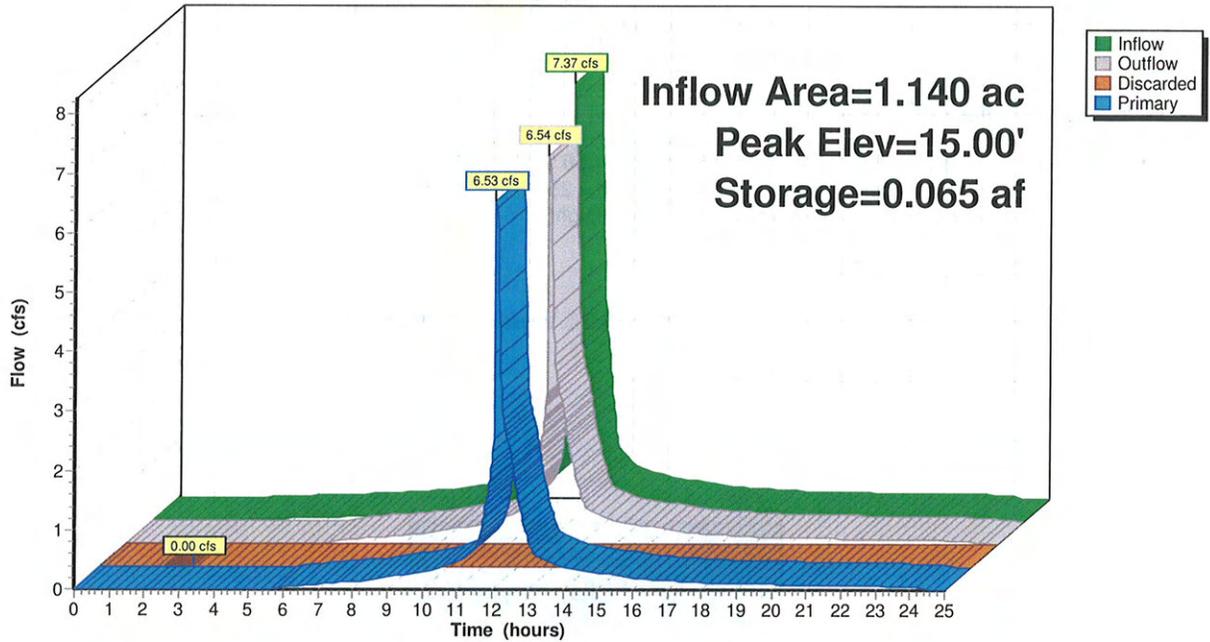
193.0 cy Field

124.9 cy Stone



Pond 4P: Underground Storage

Hydrograph



Mystic Water Works
Nitsch Project #8398

Somerville, Massachusetts
10/14/2011

APPENDIX E

PRE-CONSTRUCTION HYDROLOGY PLAN

POST-CONSTRUCTION HYDROLOGY PLAN

MERIDIAN OF
PLAN 498 OF 1992

**DiMella
Shaffer**
Architecture | Interior Design | Planning

281 Summer Street
Boston, MA 022
Tel: 617.426.5004
Fax: 617.426.0046

- Client: Somerville Housing Authority Tel: 617-625-1125
- MEP/FP Engineer: R.W. Sullivan Engineering Tel: 617-523-8227 Fax: 617-523-8016
- Structural Engineer: L.A. Fuess Partners Tel: 617-948-5700 Fax: 617-948-5710
- Civil Engineer: Nitsch Engineering Tel: 617-338-0063 Fax: 617-338-6472
- Landscape Consultant: Copley Wolf Design Group Tel: 617-854-9000 Fax: 617-854-9002
- Code Consultant: R.W. Sullivan Engineering Tel: 617-523-8227 Fax: 617-523-8016
- Cost Estimator: VJ Associates Tel: 781-444-8200 Fax: 781-444-8242
- Historical Consultant: MacRosie Historic Advisors Tel: 617-499-4009 Fax: 617-499-4019

Project Status

Issue Description Date

Scale: 1"=20'

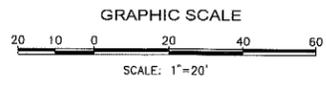
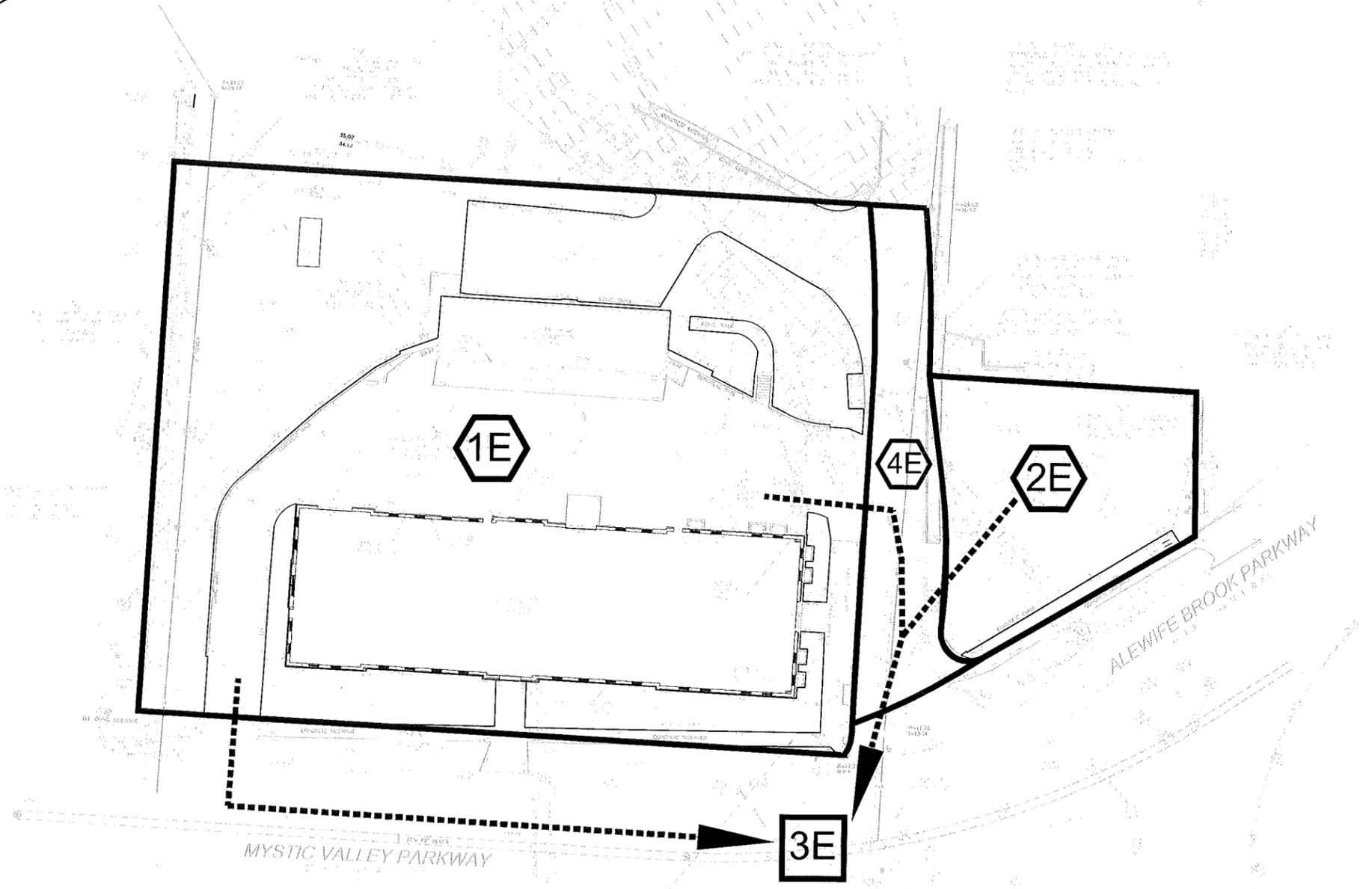
Drawn By: OMW Checked By: AD Reviewed By:

Project No. 2010080.00

**Mystic Water
Works at Capen
Court**

Capen St.
Somerville, MA 02144

**PRE-CONSTRUCTION
HYDROLOGY PLAN**



PRE

MERIDIAN OF
PLAN 498 OF 1932



281 Summer Street
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- Client: Somerville Housing Authority Tel: 617-625-1125
- MEP/FP Engineer: R.W. Sullivan Engineering Tel: 617-523-8227 Fax: 617-523-8016
- Structural Engineer: L.A. Fuess Partners Tel: 617-948-5700 Fax: 617-948-5710
- Civil Engineer: Nitsch Engineering Tel: 617-338-0063 Fax: 617-338-6472
- Landscape Consultant: Copley Wolf Design Group Tel: 617-654-9000 Fax: 617-654-9002
- Code Consultant: R.W. Sullivan Engineering Tel: 617-523-8227 Fax: 617-523-8016
- Cost Estimator: VJ Associates Tel: 781-444-8200 Fax: 781-444-8242
- Historical Consultant: MacRostie Historic Advisors Tel: 617-499-4009 Fax: 617-499-4019

Project Status

Issue Description Date

Scale: 1"=20'

Drawn By: OMW Checked By: AD Reviewed By:

Project No. 2010080.00

Mystic Water Works at Capen Court

Capen St.
Somerville, MA 02144

POST-CONSTRUCTION HYDROLOGY PLAN

