

<p><b>STORMWATER MANAGEMENT</b></p> <p><b>REPORT</b></p> <p>for</p> <p><b>312 Bayberry Lane</b></p> <p>Westport, CT</p> <p>June 17, 2020</p>	
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***Narrative:***

The owner of 312 Bayberry Lane, Westport, CT proposes to construct a proposed driveway expansion of an existing driveway on an existing developed property. Improvements are limited to the areas related to the construction of the above-listed structures and lawn areas as shown on the site plans prepared by LANDTECH.

The property is 2.54± acres in size, it is located to the west of the Bayberry Lane. There are wetlands located on the property and the site drains to the Aspetuck River located to the east of the property.

The NRCS soils map indicates the upland soils in the vicinity of the proposed improvements to be Agawam fine sandy loam, and Charlton-Chatfield complex, which are well-drained soils in Hydrologic Soil Group B. Deep test results confirm the hydrologic rating of this area. Based on field observation, a conservative infiltration rate of 2"/hour (observed infiltration rate of 1" in 20 min.) was utilized in the design of the proposed drainage system. It is assumed that the underlying soils will allow the detained storm water to infiltrate within 72 hours, per CT DEEP guidance (requires a 0.39"/hour infiltration rate).

For the purposes of modeling the pre and post development conditions we have analyzed one (1) drainage area in the pre-development conditions and two (2) subareas in the post-development conditions. Existing drainage area 1 currently discharges via sheet flow to the east into the Aspetuck River and includes the entire site including the existing residence, driveway, and pool all of which are to remain. The existing residence and driveway are routed to a previously constructed underground detention system via a system of roof leaders, catch basin and collection piping. All existing impervious areas are to remain and have been modeled as impervious area in both the existing and proposed conditions.

In the proposed conditions, subarea 1A which includes the proposed driveway expansion will discharge via a system of catch basins and collection piping into a proposed detention system. The proposed underground detention system will overflow to a proposed catch basin located in the proposed driveway expansion. Subarea 1B which includes the remainder of the site including the existing residence, driveway, and pool will discharge towards the Aspetuck River via sheet flow as it does in existing conditions. The existing catch basin located in the existing driveway to be reconstructed shall be relocated so there will be no increase in impervious area discharging to the existing underground detention system.

The proposed drainage system is only intended to capture runoff from the proposed driveway expansion. The proposed underground detention system is sized based on the required water quality volume and runoff control for the 25-year storm event for the site.

In addition to the proposed driveway expansion the owner proposes to reroute the existing footing drains to a second proposed underground detention system. The existing footing drains currently discharge to an existing crushed stone drain located in the rear of the residence. This underground detention system has been sized so the entire footing drain flow infiltrates.

Table 1 summarizes the required and proposed water quality volumes (WQv) and runoff control for the 25-year storm event.

<b>TABLE 1 – WQv &amp; 25 YEAR STORM</b>		
	PRE-DEV/ REQUIRED	POST DEV W/ CULTECS
PEAK RATE STORMWATER RUNOFF FROM SITE (cfs)	6.61	6.50
WATER QUALITY (cf)	134.49	588.80

It is our professional opinion that upon construction of the proposed improvements, stormwater discharge from the site will comply with the applicable rules and regulations of the Town of Westport.

***Exhibits:***

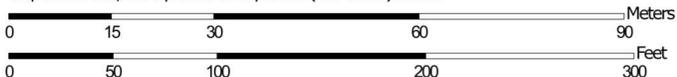
- NRCS Soils Report
- Watershed Maps
- Water Quality Volume Calculations
- Stormwater Runoff Computations

# NRCS Soils Report

Hydrologic Soil Group—State of Connecticut



Map Scale: 1:1,100 if printed on A portrait (8.5" x 11") sheet.



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



## MAP LEGEND

<b>Area of Interest (AOI)</b>	 C
 Area of Interest (AOI)	 C/D
<b>Soils</b>	 D
<b>Soil Rating Polygons</b>	 Not rated or not available
 A	<b>Water Features</b>
 A/D	 Streams and Canals
 B	<b>Transportation</b>
 B/D	 Rails
 C	 Interstate Highways
 C/D	 US Routes
 D	 Major Roads
 Not rated or not available	 Local Roads
<b>Soil Rating Lines</b>	<b>Background</b>
 A	 Aerial Photography
 A/D	
 B	
 B/D	
 C	
 C/D	
 D	
 Not rated or not available	
<b>Soil Rating Points</b>	
 A	
 A/D	
 B	
 B/D	

## 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 19, Sep 13, 2019

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 5, 2016

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.

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
29B	Agawam fine sandy loam, 3 to 8 percent slopes	B	0.1	2.4%
73C	Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky	B	2.3	97.6%
<b>Totals for Area of Interest</b>			<b>2.3</b>	<b>100.0%</b>

### Description

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.

## Rating Options

*Aggregation Method: Dominant Condition*

*Component Percent Cutoff: None Specified*

*Tie-break Rule: Higher*

# Watershed Maps





# Water Quality Volume Calculations

Project: 312 Bayberry Lane  
Westport, CT

By: SM  
Checked: RP

Date:  
Revised:

**1. Water Quality Volume**

**a. Compute volumetric runoff coefficient, R**  $R = 0.05 + 0.009(I)$

**Proposed**

Total Drainage Area, <i>A</i>	0.039	acres
Total Impervious Area	0.039	acres
Percentage of Impervious Area, <i>I</i>	100.0%	
Runoff Coefficient, <i>R</i>	0.950	

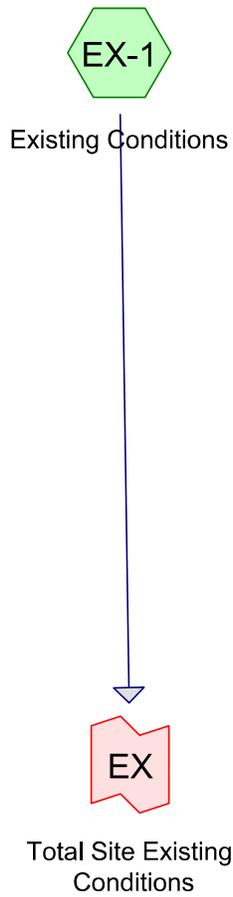
**b. Compute water quality volume, WQV**  $WQV = [(1")(R)(A)]/12$

Total Project Area, <i>A</i>	0.039	acres	
Runoff Coefficient, <i>R</i>	0.950		
Water Quality Volume, <i>WQV</i>	0.003	acre-foot	
<b>Water Quality Volume, <i>WQV</i></b>	<b>134.49</b>	<b>cf</b>	<b><i>Required</i></b>
<b>WQV in CULTEC 330 XLHD</b>	<b>588.80</b>	<b>cf</b>	<b><i>Provided</i></b>

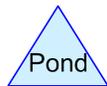
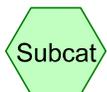
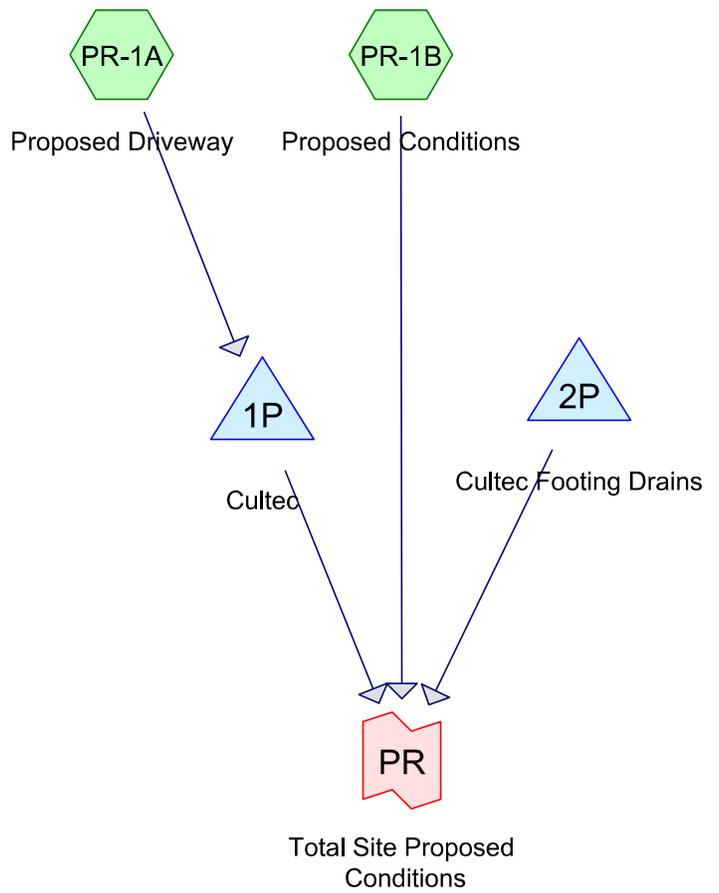
***Water Quality Volume provided > required***

# Stormwater Runoff Computations

Existing Conditions



Proposed Conditions



### 312 Bayberry Lane - Drainage

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#### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.630	61	>75% Grass cover, Good, HSG B (EX-1, PR-1B)
0.001	98	Existing AC Units To Remain (EX-1, PR-1B)
0.148	98	Existing Driveway To Be Reconstructed (EX-1, PR-1B)
0.001	98	Existing Generator To Remain (EX-1, PR-1B)
0.032	98	Existing Patio To Remain (EX-1, PR-1B)
0.032	98	Existing Pool To Remain (EX-1, PR-1B)
0.016	98	Existing Porches To Remain (EX-1, PR-1B)
0.156	98	Existing Residence to Remain (EX-1, PR-1B)
0.016	98	Existing Walks/Stairs To Remain (EX-1, PR-1B)
0.039	98	Pr. Driveway (PR-1A)
<b>5.071</b>	<b>64</b>	<b>TOTAL AREA</b>

# 312 Bayberry Lane - Drainage

Type III 24-hr 25yr Storm Rainfall=6.40"

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## Summary for Subcatchment EX-1: Existing Conditions

Runoff = 6.61 cfs @ 12.13 hrs, Volume= 0.539 af, Depth= 2.55"

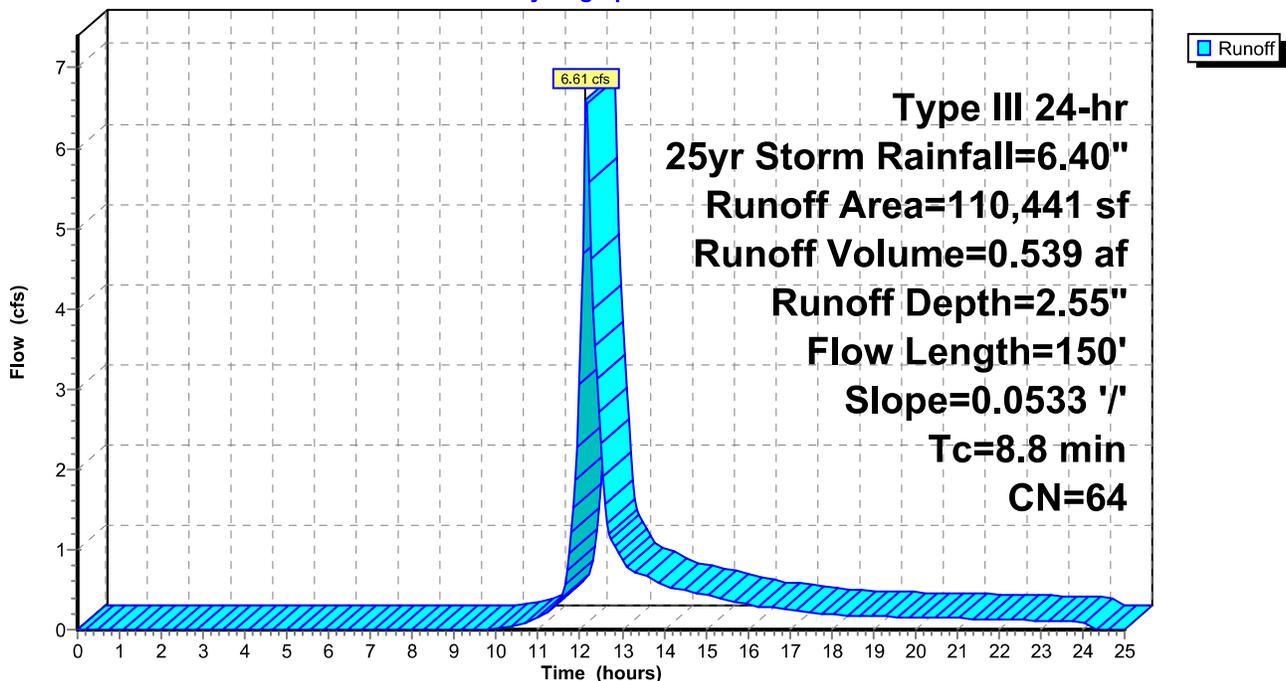
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25yr Storm Rainfall=6.40"

Area (sf)	CN	Description
* 3,400	98	Existing Residence to Remain
* 3,225	98	Existing Driveway To Be Reconstructed
* 703	98	Existing Pool To Remain
* 689	98	Existing Patio To Remain
* 351	98	Existing Porches To Remain
* 346	98	Existing Walks/Stairs To Remain
* 18	98	Existing AC Units To Remain
* 13	98	Existing Generator To Remain
101,696	61	>75% Grass cover, Good, HSG B
110,441	64	Weighted Average
101,696		92.08% Pervious Area
8,745		7.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	150	0.0533	0.29		<b>Sheet Flow, Sheet Flow</b> Grass: Short n= 0.150 P2= 3.50"

## Subcatchment EX-1: Existing Conditions

Hydrograph



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Type III 24-hr 25yr Storm Rainfall=6.40"

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## Summary for Subcatchment PR-1A: Proposed Driveway

Runoff = 0.27 cfs @ 12.05 hrs, Volume= 0.020 af, Depth= 6.16"

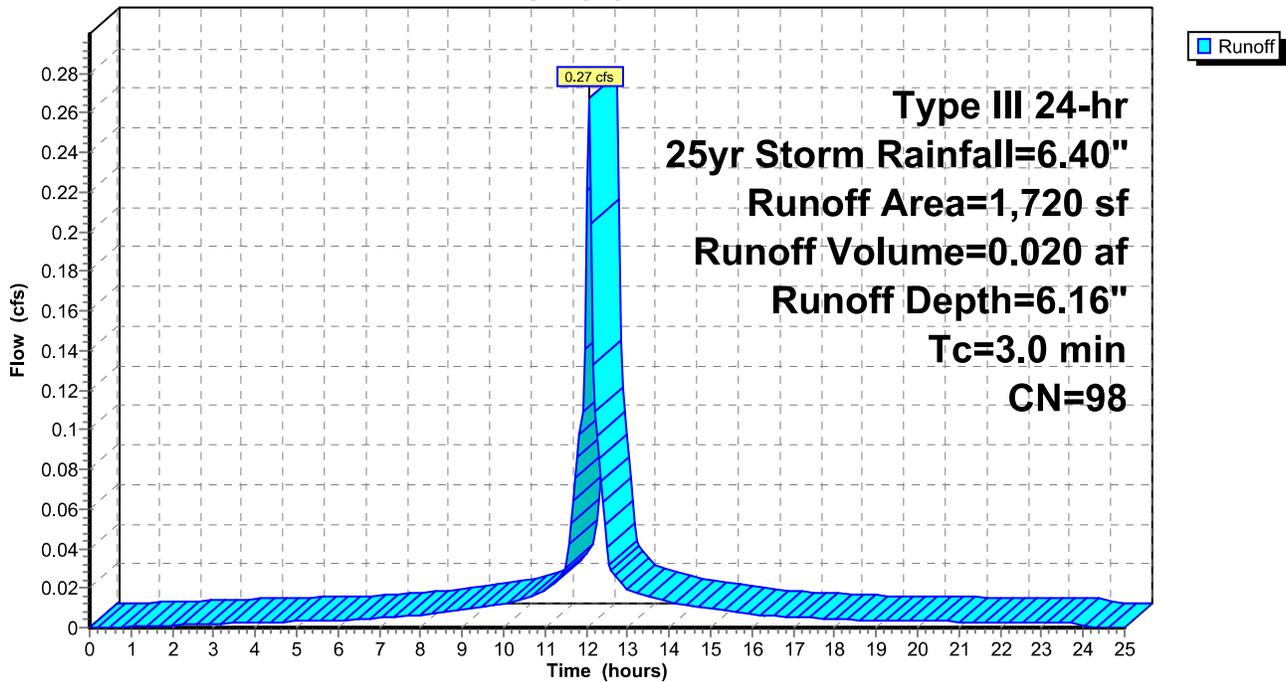
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25yr Storm Rainfall=6.40"

Area (sf)	CN	Description
* 1,720	98	Pr. Driveway
1,720		100.00% Impervious Area

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

## Subcatchment PR-1A: Proposed Driveway

Hydrograph



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## Summary for Subcatchment PR-1B: Proposed Conditions

Runoff = 6.50 cfs @ 12.13 hrs, Volume= 0.531 af, Depth= 2.55"

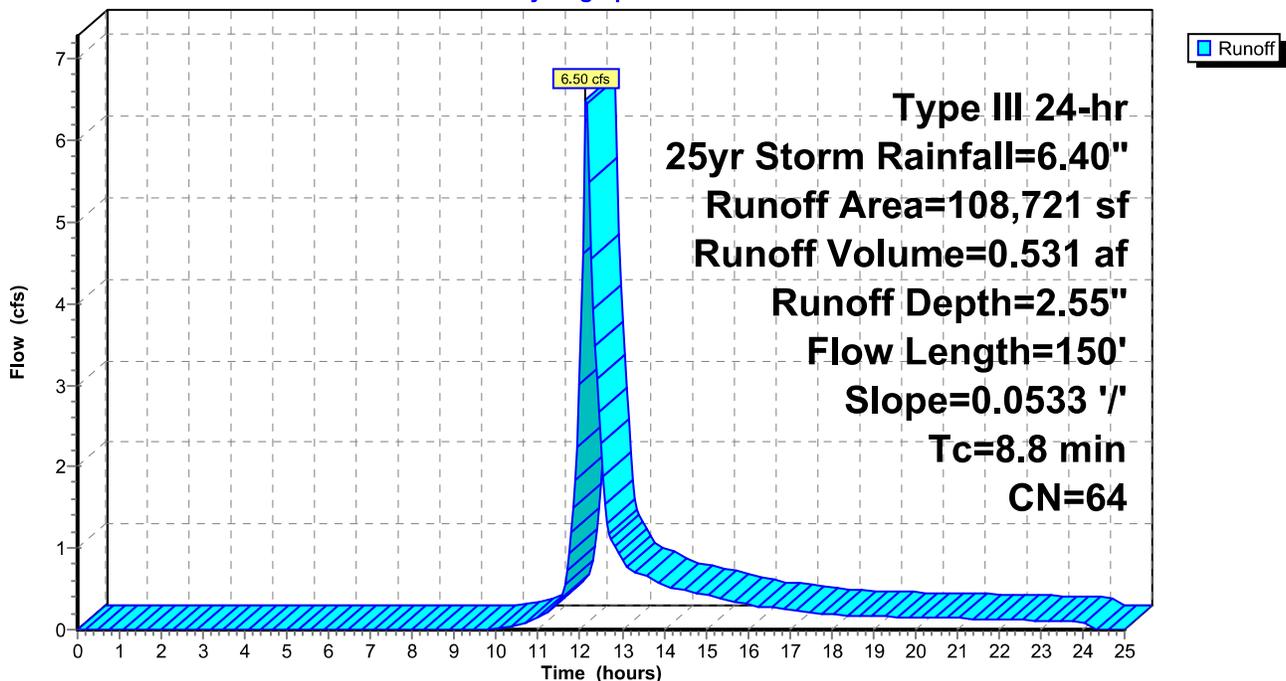
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25yr Storm Rainfall=6.40"

Area (sf)	CN	Description
* 3,400	98	Existing Residence to Remain
* 3,225	98	Existing Driveway To Be Reconstructed
* 703	98	Existing Pool To Remain
* 689	98	Existing Patio To Remain
* 351	98	Existing Porches To Remain
* 346	98	Existing Walks/Stairs To Remain
* 18	98	Existing AC Units To Remain
* 13	98	Existing Generator To Remain
99,976	61	>75% Grass cover, Good, HSG B
108,721	64	Weighted Average
99,976		91.96% Pervious Area
8,745		8.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	150	0.0533	0.29		<b>Sheet Flow, Sheet Flow</b> Grass: Short n= 0.150 P2= 3.50"

## Subcatchment PR-1B: Proposed Conditions

Hydrograph



### 312 Bayberry Lane - Drainage

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### Summary for Pond 1P: Cultec

Inflow Area = 0.039 ac, 100.00% Impervious, Inflow Depth = 6.16" for 25yr Storm event  
 Inflow = 0.27 cfs @ 12.05 hrs, Volume= 0.020 af  
 Outflow = 0.01 cfs @ 10.25 hrs, Volume= 0.019 af, Atten= 95%, Lag= 0.0 min  
 Discarded = 0.01 cfs @ 10.25 hrs, Volume= 0.019 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs  
 Peak Elev= 99.27' @ 14.02 hrs Surf.Area= 0.006 ac Storage= 0.009 af

Plug-Flow detention time= 245.6 min calculated for 0.019 af (93% of inflow)  
 Center-of-Mass det. time= 206.7 min ( 948.1 - 741.4 )

Volume	Invert	Avail.Storage	Storage Description
#1A	97.15'	0.006 af	<b>11.17'W x 24.50'L x 3.54'H Field A</b> 0.022 af Overall - 0.008 af Embedded = 0.015 af x 40.0% Voids
#2A	97.65'	0.008 af	<b>Cultec R-330XLHD x 6 Inside #1</b> Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		0.014 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	97.15'	<b>2.000 in/hr Exfiltration over Surface area</b>
#2	Primary	101.00'	<b>6.0" Vert. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.01 cfs @ 10.25 hrs HW=97.19' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.01 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=97.15' (Free Discharge)  
 ↑2=Orifice/Grate ( Controls 0.00 cfs)

**312 Bayberry Lane - Drainage**

Type III 24-hr 25yr Storm Rainfall=6.40"

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**Pond 1P: Cultec - Chamber Wizard Field A**

**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length

2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.17' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

6 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 335.3 cf Chamber Storage

968.9 cf Field - 335.3 cf Chambers = 633.6 cf Stone x 40.0% Voids = 253.5 cf Stone Storage

Chamber Storage + Stone Storage = 588.8 cf = 0.014 af

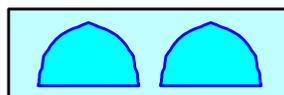
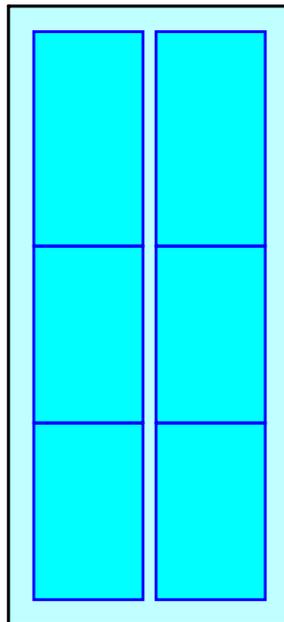
Overall Storage Efficiency = 60.8%

Overall System Size = 24.50' x 11.17' x 3.54'

6 Chambers

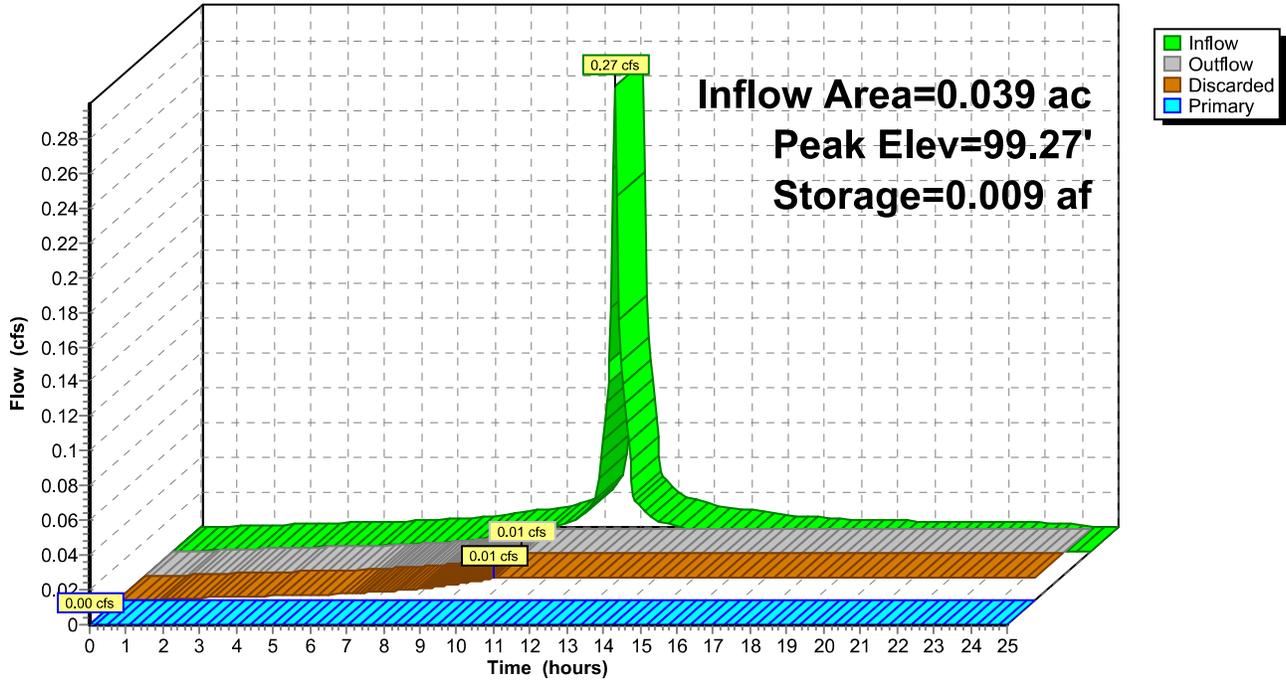
35.9 cy Field

23.5 cy Stone



Pond 1P: Cultec

Hydrograph



### 312 Bayberry Lane - Drainage

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### Summary for Pond 2P: Cultec Footing Drains

Inflow = 0.05 cfs @ 0.00 hrs, Volume= 0.104 af, Incl. 0.05 cfs Base Flow  
Outflow = 0.03 cfs @ 13.05 hrs, Volume= 0.067 af, Atten= 30%, Lag= 783.0 min  
Discarded = 0.03 cfs @ 0.10 hrs, Volume= 0.063 af  
Primary = 0.00 cfs @ 13.05 hrs, Volume= 0.004 af

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs / 2  
Peak Elev= 94.10' @ 13.05 hrs Surf.Area= 659 sf Storage= 917 cf

Plug-Flow detention time= 289.6 min calculated for 0.067 af (65% of inflow)  
Center-of-Mass det. time= 26.7 min ( 776.7 - 750.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	91.05'	504 cf	<b>12.08'W x 54.50'L x 2.54'H Field A</b> 1,674 cf Overall - 413 cf Embedded = 1,261 cf x 40.0% Voids
#2A	91.55'	413 cf	<b>Cultec R-150XLHD x 15 Inside #1</b> Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap Row Length Adjustment= +0.75' x 2.65 sf x 3 rows
		917 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	91.05'	<b>2.000 in/hr Exfiltration over Surface area</b>
#2	Primary	94.10'	<b>6.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads

**Discarded OutFlow** Max=0.03 cfs @ 0.10 hrs HW=91.09' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

**Primary OutFlow** Max=0.00 cfs @ 13.05 hrs HW=94.10' (Free Discharge)

↑**2=Orifice/Grate** (Weir Controls 0.00 cfs @ 0.23 fps)

**312 Bayberry Lane - Drainage**

Type III 24-hr 25yr Storm Rainfall=6.40"

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**Pond 2P: Cultec Footing Drains - Chamber Wizard Field A**

**Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)**

Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf

Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap

Row Length Adjustment= +0.75' x 2.65 sf x 3 rows

33.0" Wide + 8.0" Spacing = 41.0" C-C Row Spacing

5 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 52.00' Row Length +15.0" End Stone x 2 = 54.50' Base Length

3 Rows x 33.0" Wide + 8.0" Spacing x 2 + 15.0" Side Stone x 2 = 12.08' Base Width

6.0" Stone Base + 18.5" Chamber Height + 6.0" Stone Cover = 2.54' Field Height

15 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 3 Rows = 413.2 cf Chamber Storage

1,673.8 cf Field - 413.2 cf Chambers = 1,260.5 cf Stone x 40.0% Voids = 504.2 cf Stone Storage

Chamber Storage + Stone Storage = 917.5 cf = 0.021 af

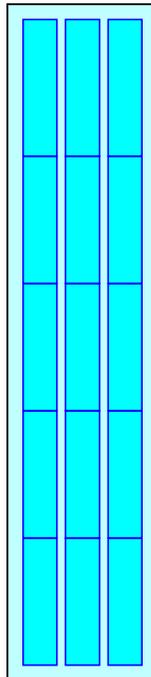
Overall Storage Efficiency = 54.8%

Overall System Size = 54.50' x 12.08' x 2.54'

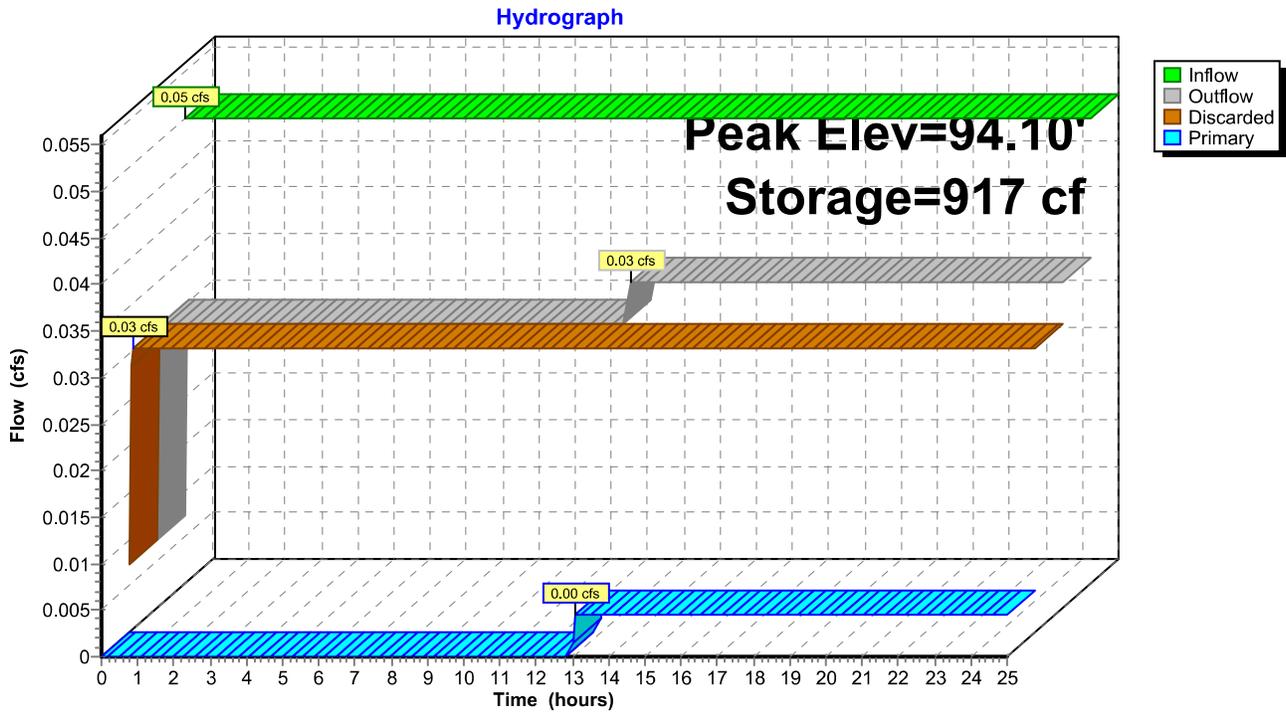
15 Chambers

62.0 cy Field

46.7 cy Stone



### Pond 2P: Cultec Footing Drains



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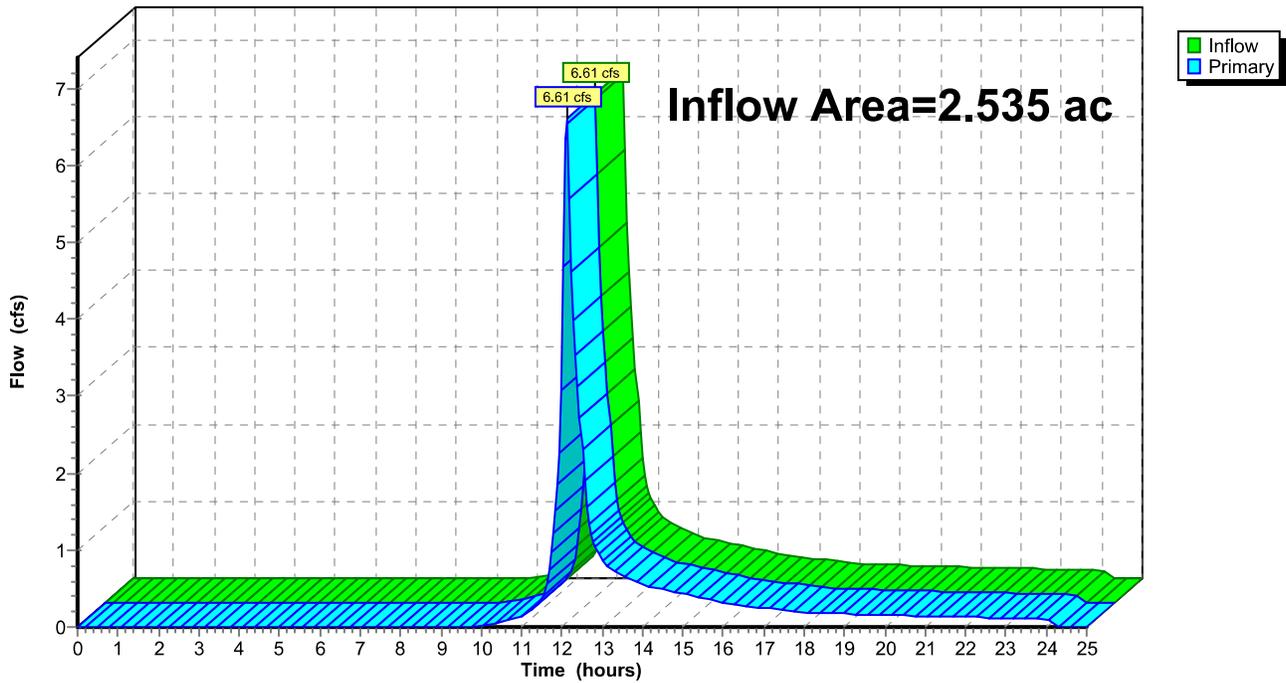
## Summary for Link EX: Total Site Existing Conditions

Inflow Area = 2.535 ac, 7.92% Impervious, Inflow Depth = 2.55" for 25yr Storm event  
Inflow = 6.61 cfs @ 12.13 hrs, Volume= 0.539 af  
Primary = 6.61 cfs @ 12.13 hrs, Volume= 0.539 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs

## Link EX: Total Site Existing Conditions

Hydrograph



# 312 Bayberry Lane - Drainage

Type III 24-hr 25yr Storm Rainfall=6.40"

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## Summary for Link PR: Total Site Proposed Conditions

Inflow Area = 2.535 ac, 9.48% Impervious, Inflow Depth > 2.53" for 25yr Storm event  
Inflow = 6.50 cfs @ 12.13 hrs, Volume= 0.535 af  
Primary = 6.50 cfs @ 12.13 hrs, Volume= 0.535 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-25.00 hrs, dt= 0.05 hrs

## Link PR: Total Site Proposed Conditions

