



ALLEN ENGINEERING
& ASSOCIATES, INC.

DRAINAGE ANALYSIS

For A
“Building Addition”
29 Gilmore Drive
In
Sutton, MA 01590



January 5, 2022

Prepared For:

3P Properties, LLC
665 Church Street
Whitinsville, MA 01588

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Building Addition – 29 Gilmore Drive
Sutton, MA

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SUMMARY OF EXISTING DRAINAGE CONDITIONS

Site Description:

The project for which this analysis has been prepared comprises of a small 30,000 square foot area in the rear of the building on 29 Gilmore Drive in Sutton Massachusetts. The property was previously designed and developed as one lot in an industrial subdivision just easterly of Interstate Route 146. The lot currently has a 60,000 square foot building along with its related parking areas, loading docks, access drives, stormwater system and other various utilities. The 30,000 square feet to the west of the building is currently in a flat grassy lawn condition. This area had been earmarked for expansion during the initial planning for the lot.

Allen Engineering & Associates, Inc. has reviewed the Soil Survey for Worcester County prepared by the USDA/NRCS and has found the site to contain several soil types having hydrologic soil group (HSG) designation ranging "A". The "A" soils are sandy and gravel which have very fast infiltration rates. AEA has performed 2 confirmatory test pits and this soil test data is appended to this report in section 4.

Hydrology Background:

Allen Engineering & Associates, Inc. has utilized AutoCAD and HydroCAD software to perform this drainage analysis. Autocad was used to generate the existing and proposed drainage plans that can be found in sections 1 and 2 of this report. These plans were used to define such items as subcatchment areas, Reaches and Ponds. Since this project is simply an addition to the existing building, the following report summarizes the collection and treatment of the stormwater being collected from the proposed roof. HydroCAD was used to calculate the rates and volume of storm water runoff during various storm events. These rates are summarized for the existing and proposed site conditions on page iii.

SUMMARY OF PROPOSED DEVELOPMENT DRAINAGE CONDITIONS

Site Description:

The proposed project (“the Project”) consists of a one story, 30,000 square foot warehouse addition that is designed to match the existing building in terms of its height, roof lines and exterior façade treatment. The footprint of the new addition will be situated to the rear of the existing building where it was envisioned and master planned during the initial site design and permitting for the Site. Upon completion of the Project, the existing and new building will contain 90,000 square feet in aggregate.

The Project will not result in changes to the existing access and circulation, or the esthetics of the site from Gilmore Drive. The building and all associated site work will occur in the rear of the property. Due to the extensive wooded buffer that exists between the Site and Barnett Road, there will be no visual impacts to existing residential dwellings. The nearest residential dwelling is located over 700 feet west of the proposed building.

The project is subject to a Special Permit for the proposed “Warehouse and Distribution” use in the OLI District and Site Plan Approval for an increase in floor space of greater than 25% (50% increase proposed). In each case the Planning Board is designated as the permit granting authority.

Stormwater Management:

The proposed roof infiltration system has been designed to meet the Stormwater Management Standards set by the Massachusetts Department of Environmental Protection (DEP) under the redevelopment category. As detailed in the following standards compliance section the total peak flow rate for the constructed site is less than the existing rates for all storm events examined, and the stormwater runoff is treated to the required level and volume by approved Best Management Practices for Total Suspended Solids removal.

The 30,000 s.f. addition will have its own infiltration system. The system will be comprised of 110 Cultec Recharger 330HD Chambers. The stormwater will be completely recharged for the 2, 10 & 25 year storm events. Only a small discharge will occur in the 100 year storm event.

SUMMARY OF HYDROLOGY

Building Addition, Sutton, MA
Using HydroCAD Software

<u>Job No.:</u>	00303	<u>Calcd By:</u>	M. Allen
<u>Client:</u>	3P Properties, LLC	<u>Date:</u>	1/5/2022
<u>Location:</u>	29 Gilmore Drive, Sutton MA	<u>Revised:</u>	

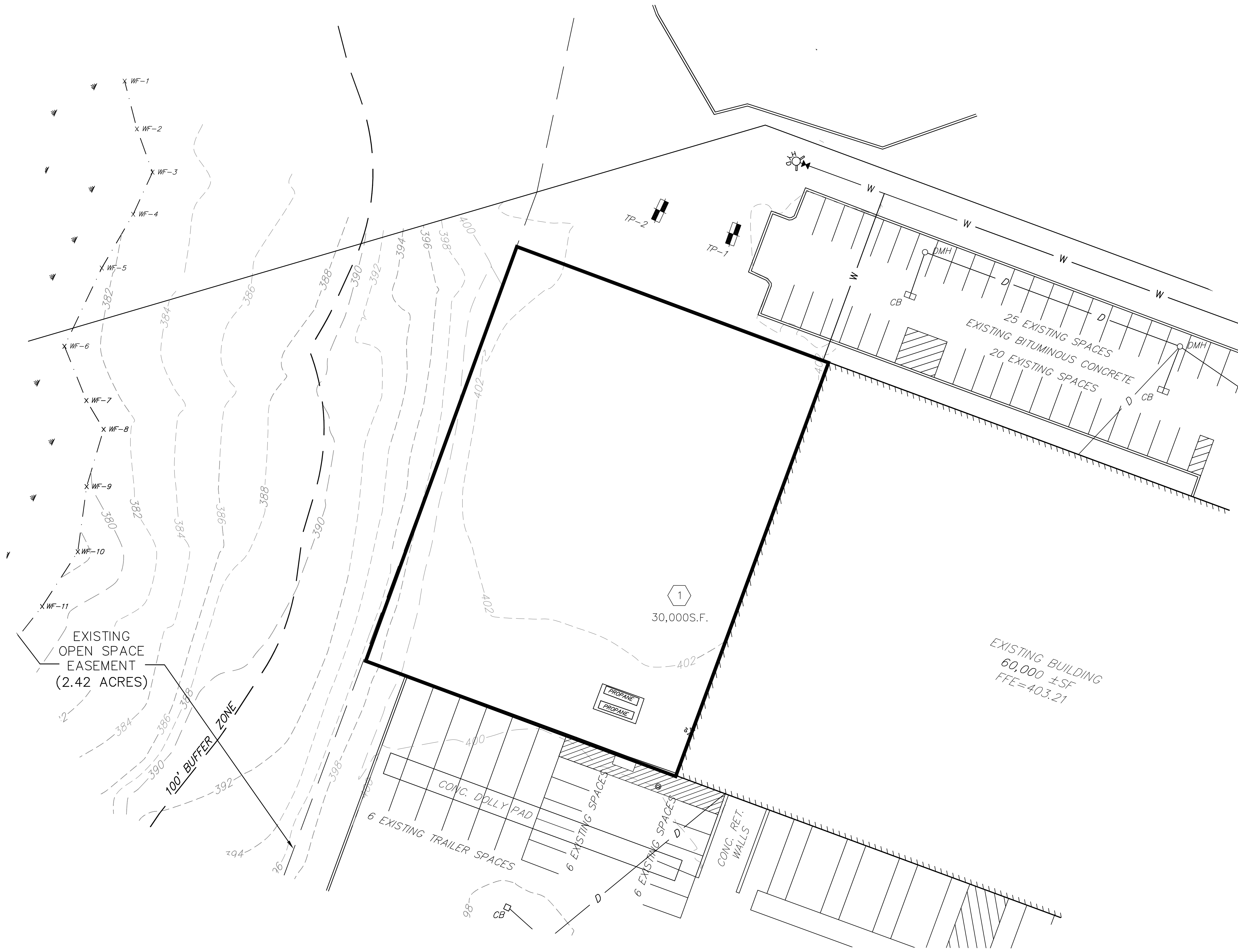
TABLE 1: Summary of Peak Rates of Stormwater Runoff

Evaluation Point	HydroCAD symbols	Existing Conditions Runoff (CFS)				HydroCAD symbols	Proposed Conditions Runoff (CFS)			
		2-Yr	10-Yr	25-Yr	100-Yr		2-Yr	10-Yr	25-Yr	100-Yr
	1S	0.00	0.04	0.16	0.65	1P	0.00	0.00	0.00	0.51

TOTAL	Total	0.00	0.04	0.16	0.65	Total	0.00	0.00	0.00	0.51
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* **NOTE:** Drain Piping is designed to handle the 25-year storm event.

Existing Drainage Calculations



DRAINAGE LEGEND	
	SUBCATCHMENT
	REACH
	POND
	DRAINAGE AREA LIMIT

OWNER & APPLICANT:

3 P Properties, LLC
665 Church Street
Whitinsville, MA 01588

TITLE:

EXISTING DRAINAGE PLAN

For
29 Gilmore Drive
Sutton, MA

SEAL:

1/5/22
PROFESSIONAL ENGINEER

PREPARED BY:

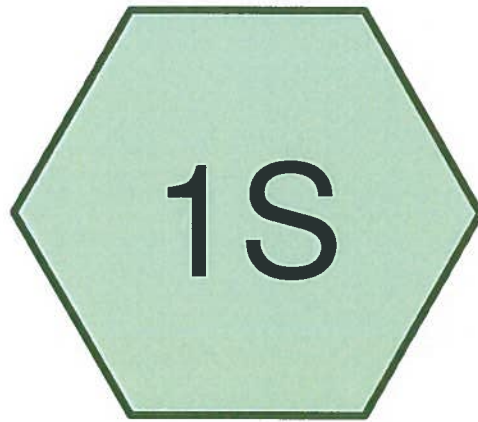
ALLEN ENGINEERING & ASSOCIATES, INC.
Civil Engineers • Surveyors
Land Development Consultants
One Charlesview Road - Suite 2
Hopedale, Ma 01747
(508) 381-3212 • Phone
www.allen-ea.com

SCALE: 1"=40 FEET

DATE: January 5, 2022

REVISIONS			
#	DATE	DESCRIPTION	INIT

JOB NO: 00303 SHEET: 1 of 1



Existing Lawn Area



Routing Diagram for EX-Drainage
Prepared by STS

HydroCAD® 10.10-4b s/n 03871 © 2020 HydroCAD Software Solutions LLC

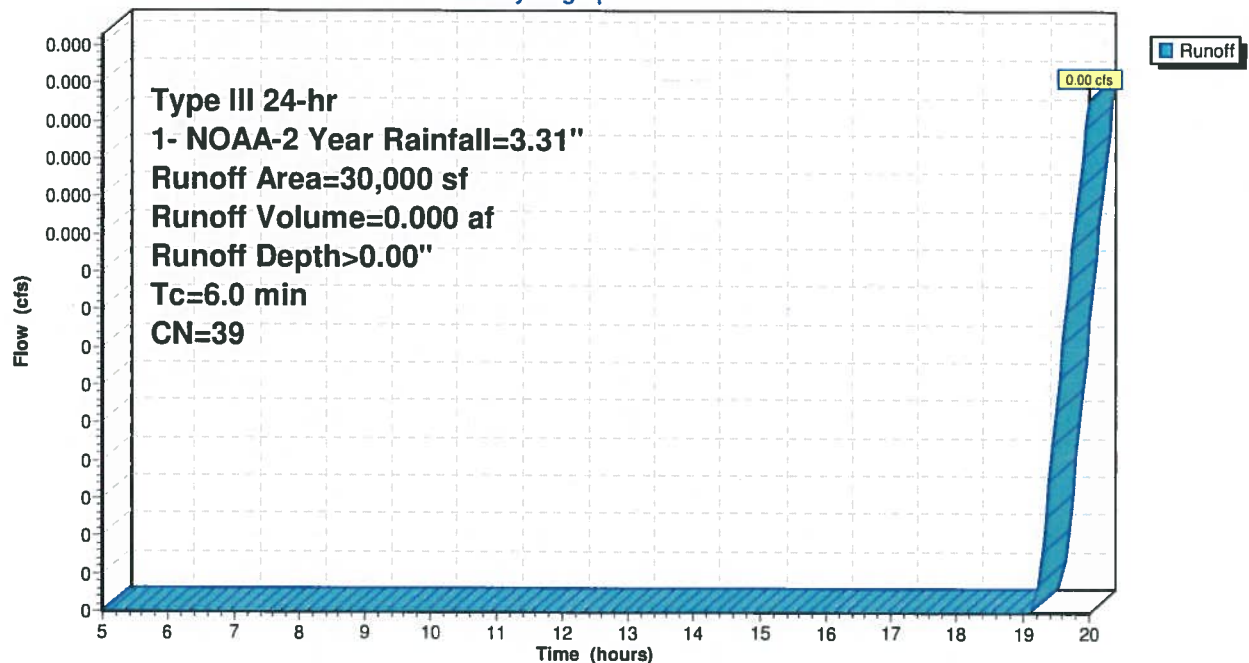
EX-Drainage

Prepared by STS

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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1- NOAA-2 Year	Type III 24-hr		Default	24.00	1	3.31	2
2	2- NOAA-10 Year	Type III 24-hr		Default	24.00	1	5.14	2
3	3- NOAA-25 Year	Type III 24-hr		Default	24.00	1	6.28	2
4	4- NOAA-100 Year	Type III 24-hr		Default	24.00	1	8.13	2



EX-Drainage

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00303 - Existing Condition

Type III 24-hr 2- NOAA-10 Year Rainfall=5.14"

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Summary for Subcatchment 1S: Existing Lawn Area

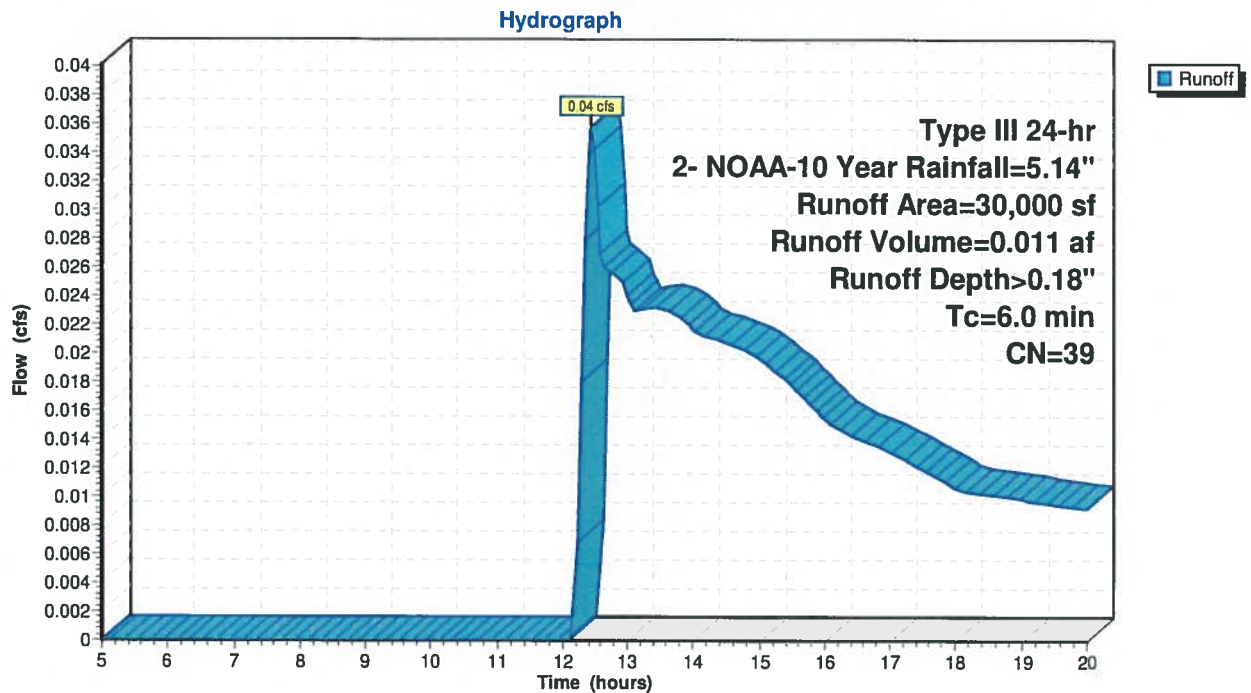
Runoff = 0.04 cfs @ 12.45 hrs, Volume= 0.011 af, Depth> 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2- NOAA-10 Year Rainfall=5.14"

Area (sf)	CN	Description
30,000	39	>75% Grass cover, Good, HSG A
30,000		100.00% Pervious Area

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

Subcatchment 1S: Existing Lawn Area



EX-Drainage

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00303 - Existing Condition

Type III 24-hr 3- NOAA-25 Year Rainfall=6.28"

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Summary for Subcatchment 1S: Existing Lawn Area

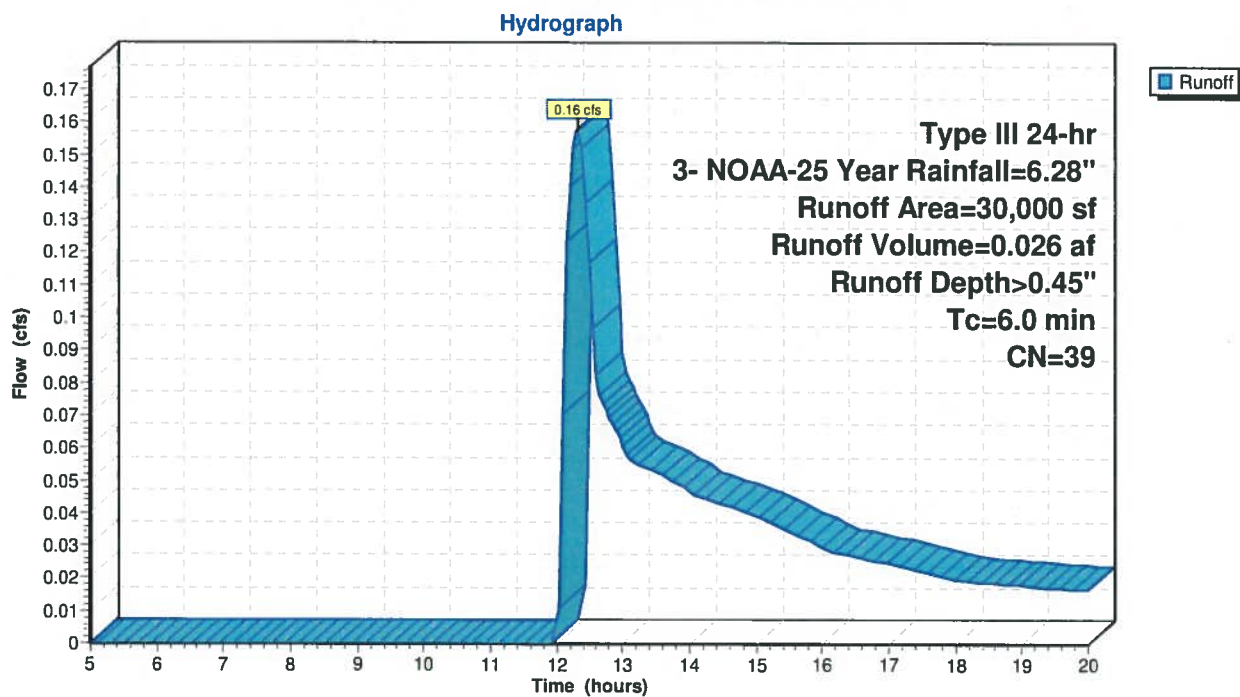
Runoff = 0.16 cfs @ 12.32 hrs, Volume= 0.026 af, Depth> 0.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 3- NOAA-25 Year Rainfall=6.28"

Area (sf)	CN	Description
30,000	39	>75% Grass cover, Good, HSG A
30,000		100.00% Pervious Area

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

Subcatchment 1S: Existing Lawn Area



EX-Drainage

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00303 - Existing Condition

Type III 24-hr 4- NOAA-100 Year Rainfall=8.13"

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Summary for Subcatchment 1S: Existing Lawn Area

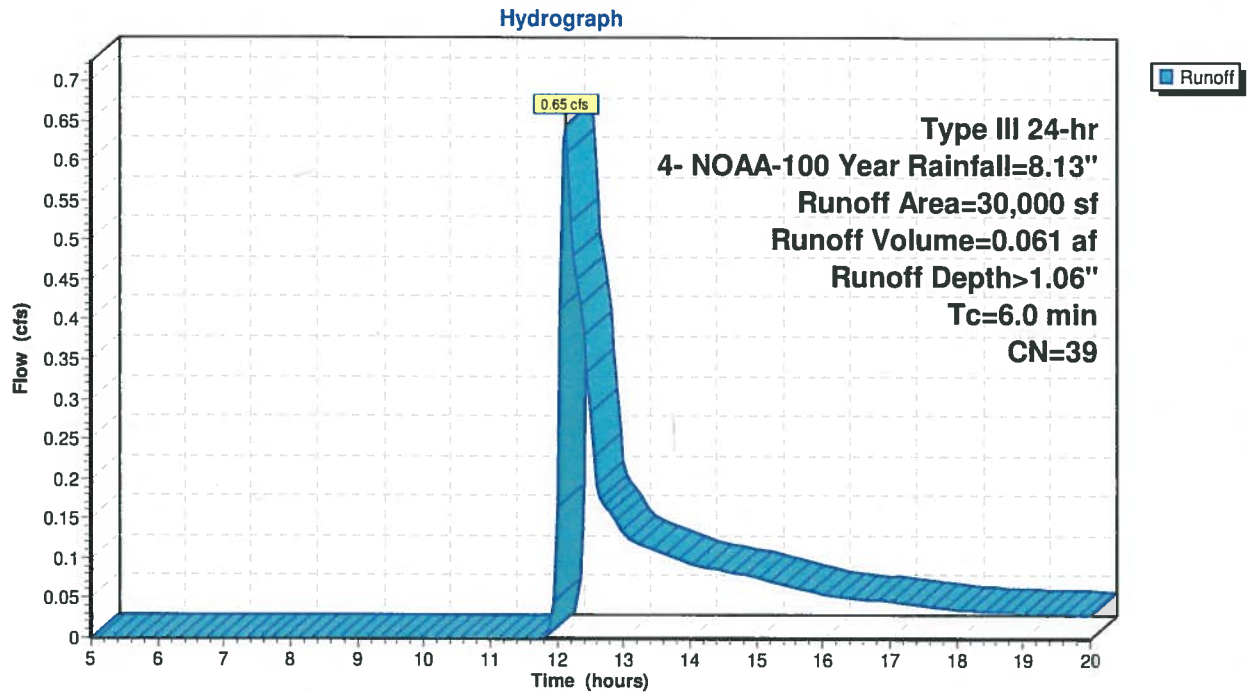
Runoff = 0.65 cfs @ 12.12 hrs, Volume= 0.061 af, Depth> 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 4- NOAA-100 Year Rainfall=8.13"

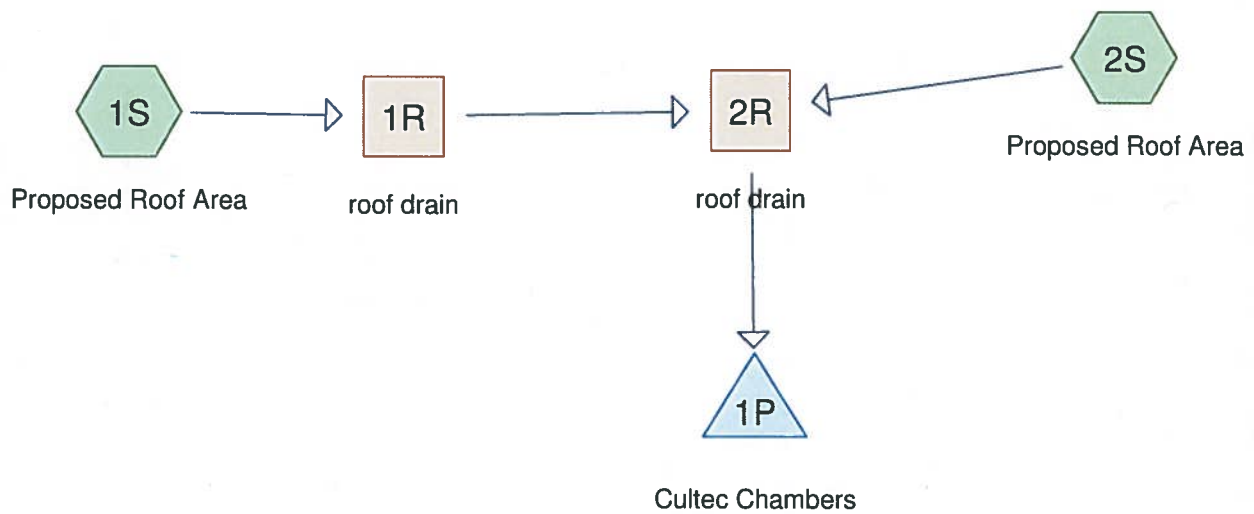
Area (sf)	CN	Description
30,000	39	>75% Grass cover, Good, HSG A
30,000		100.00% Pervious Area

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

Subcatchment 1S: Existing Lawn Area



Post Development Drainage Calculations



Subcat



Reach



Pond



Link

Routing Diagram for PR-Drainage
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PR-Drainage

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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1- NOAA-2 Year	Type III 24-hr		Default	24.00	1	3.31	2
2	2- NOAA-10 Year	Type III 24-hr		Default	24.00	1	5.14	2
3	3- NOAA-25 Year	Type III 24-hr		Default	24.00	1	6.28	2
4	4- NOAA-100 Year	Type III 24-hr		Default	24.00	1	8.13	2

PR-Drainage

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Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	1R	396.00	394.50	300.0	0.0050	0.013	0.0	12.0	0.0
2	2R	394.50	393.50	120.0	0.0083	0.013	0.0	15.0	0.0

PR-Drainage

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00303 - Proposed Condition

Type III 24-hr 1- NOAA-2 Year Rainfall=3.31"

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Summary for Subcatchment 1S: Proposed Roof Area

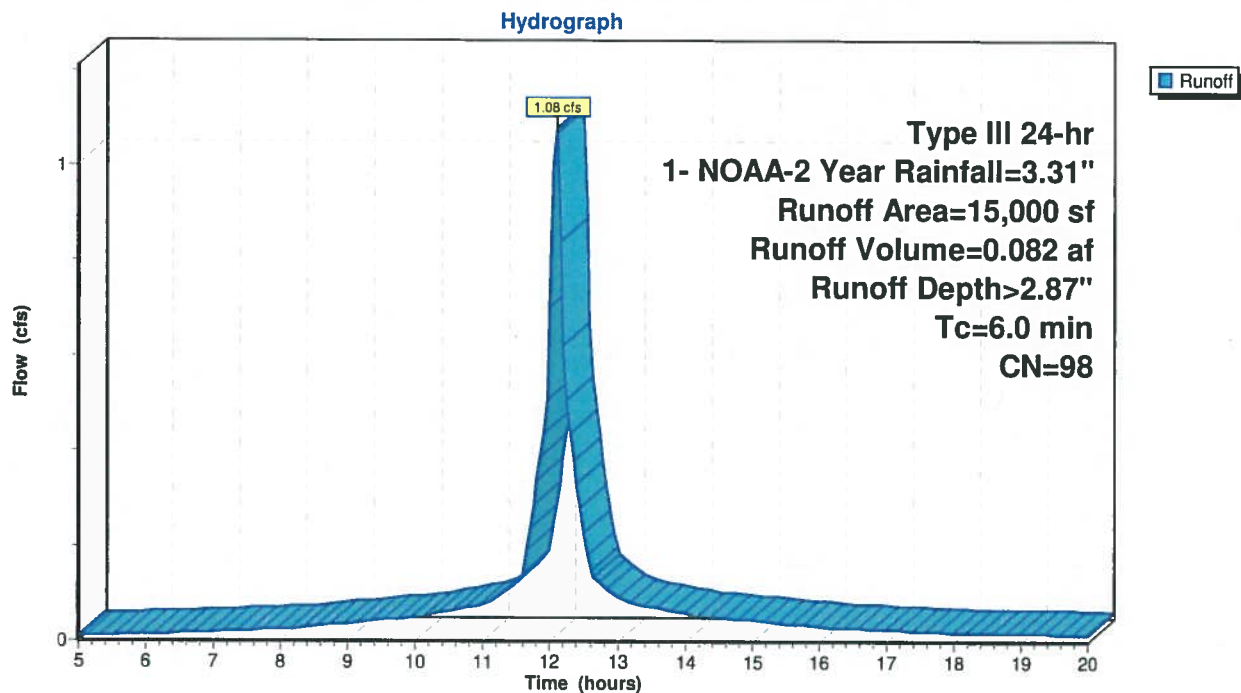
Runoff = 1.08 cfs @ 12.09 hrs, Volume= 0.082 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1- NOAA-2 Year Rainfall=3.31"

Area (sf)	CN	Description
15,000	98	Roofs, HSG A
15,000		100.00% Impervious Area

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

Subcatchment 1S: Proposed Roof Area



PR-Drainage

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00303 - Proposed Condition

Type III 24-hr 1- NOAA-2 Year Rainfall=3.31"

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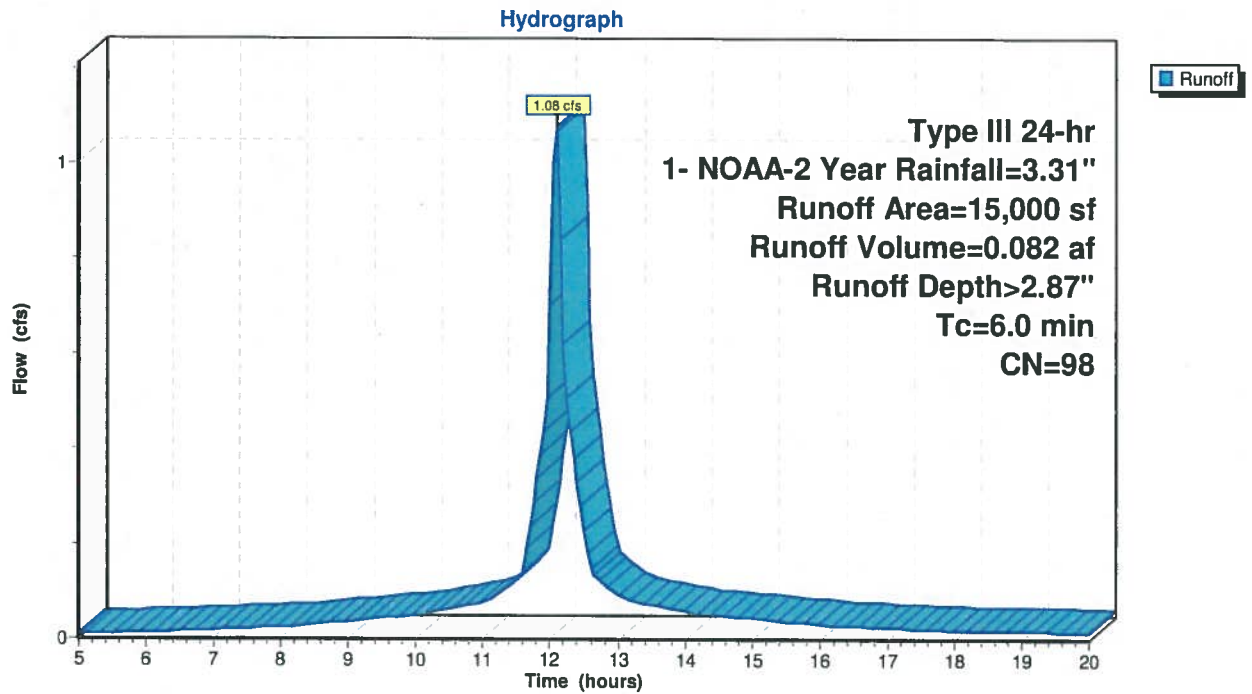
Summary for Subcatchment 2S: Proposed Roof Area

Runoff = 1.08 cfs @ 12.09 hrs, Volume= 0.082 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1- NOAA-2 Year Rainfall=3.31"

Area (sf)	CN	Description
15,000	98	Roofs, HSG A
15,000		100.00% Impervious Area

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

Subcatchment 2S: Proposed Roof Area

PR-Drainage

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00303 - Proposed Condition

Type III 24-hr 1- NOAA-2 Year Rainfall=3.31"

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Summary for Reach 1R: roof drain

Inflow Area = 0.344 ac, 100.00% Impervious, Inflow Depth > 2.87" for 1- NOAA-2 Year event
Inflow = 1.08 cfs @ 12.09 hrs, Volume= 0.082 af
Outflow = 1.01 cfs @ 12.14 hrs, Volume= 0.082 af, Atten= 6%, Lag= 3.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Max. Velocity= 3.06 fps, Min. Travel Time= 1.6 min

Avg. Velocity = 1.20 fps, Avg. Travel Time= 4.2 min

Peak Storage= 103 cf @ 12.11 hrs

Average Depth at Peak Storage= 0.45', Surface Width= 1.00'

Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.52 cfs

12.0" Round Pipe

n= 0.013 Corrugated PE, smooth interior

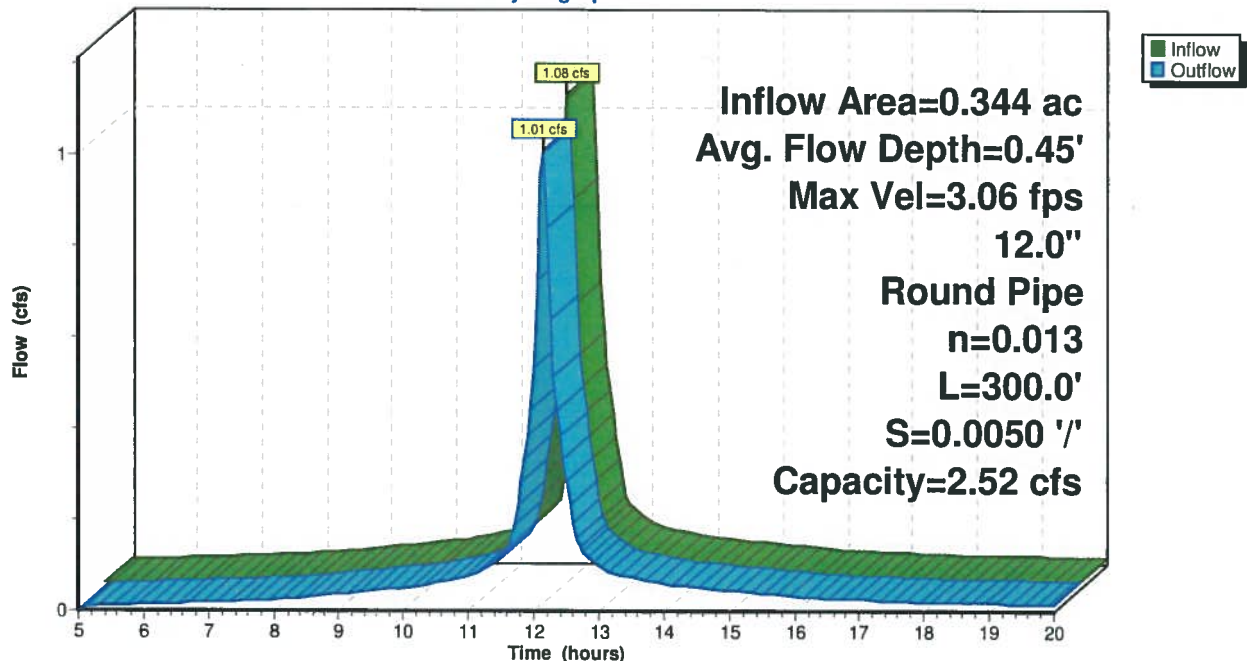
Length= 300.0' Slope= 0.0050 '/'

Inlet Invert= 396.00', Outlet Invert= 394.50'



Reach 1R: roof drain

Hydrograph



PR-Drainage

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00303 - Proposed Condition

Type III 24-hr 1- NOAA-2 Year Rainfall=3.31"

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Summary for Reach 2R: roof drain

Inflow Area = 0.689 ac, 100.00% Impervious, Inflow Depth > 2.87" for 1- NOAA-2 Year event
Inflow = 2.03 cfs @ 12.11 hrs, Volume= 0.165 af
Outflow = 1.99 cfs @ 12.12 hrs, Volume= 0.165 af, Atten= 2%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Max. Velocity= 4.35 fps, Min. Travel Time= 0.5 min

Avg. Velocity = 1.72 fps, Avg. Travel Time= 1.2 min

Peak Storage= 56 cf @ 12.11 hrs

Average Depth at Peak Storage= 0.51', Surface Width= 1.23'

Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.90 cfs

15.0" Round Pipe

n= 0.013 Corrugated PE, smooth interior

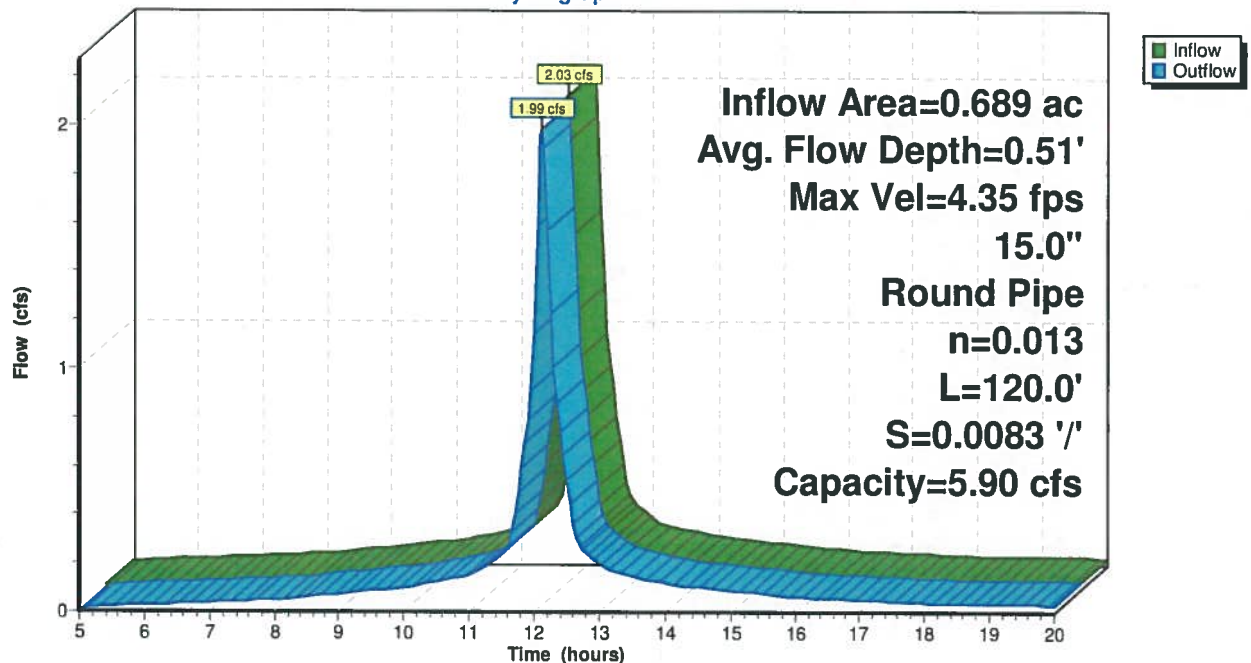
Length= 120.0' Slope= 0.0083 '/'

Inlet Invert= 394.50', Outlet Invert= 393.50'



Reach 2R: roof drain

Hydrograph



PR-Drainage

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00303 - Proposed Condition

Type III 24-hr 1- NOAA-2 Year Rainfall=3.31"

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Summary for Pond 1P: Cultec Chambers

Inflow Area = 0.689 ac, 100.00% Impervious, Inflow Depth > 2.87" for 1- NOAA-2 Year event
 Inflow = 1.99 cfs @ 12.12 hrs, Volume= 0.165 af
 Outflow = 0.24 cfs @ 11.60 hrs, Volume= 0.165 af, Atten= 88%, Lag= 0.0 min
 Discarded = 0.24 cfs @ 11.60 hrs, Volume= 0.165 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 392.66' @ 12.81 hrs Surf.Area= 0.098 ac Storage= 0.058 af

Plug-Flow detention time= 74.7 min calculated for 0.165 af (100% of inflow)
 Center-of-Mass det. time= 74.2 min (815.6 - 741.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	391.70'	0.085 af	56.67'W x 75.50'L x 3.54'H Field A 0.348 af Overall - 0.135 af Embedded = 0.213 af x 40.0% Voids
#2A	392.20'	0.135 af	Cultec R-330XLHD x 110 Inside #1 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 11 rows
		0.220 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	391.70'	2.410 in/hr Exfiltration over Surface area
#2	Primary	394.20'	6.0" Vert. Orifice/Grate X 4.00 C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.24 cfs @ 11.60 hrs HW=391.74' (Free Discharge)
 ↳ **1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=391.70' (Free Discharge)
 ↳ **2=Orifice/Grate** (Controls 0.00 cfs)

PR-Drainage

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00303 - Proposed Condition

Type III 24-hr 1- NOAA-2 Year Rainfall=3.31"

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Pond 1P: Cultec Chambers - 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 11 rows

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

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +24.0" End Stone x 2 = 75.50' Base Length

11 Rows x 52.0" Wide + 6.0" Spacing x 10 + 24.0" Side Stone x 2 = 56.67' Base Width

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

110 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 11 Rows = 5,860.2 cf Chamber Storage

15,152.4 cf Field - 5,860.2 cf Chambers = 9,292.2 cf Stone x 40.0% Voids = 3,716.9 cf Stone Storage

Chamber Storage + Stone Storage = 9,577.1 cf = 0.220 af

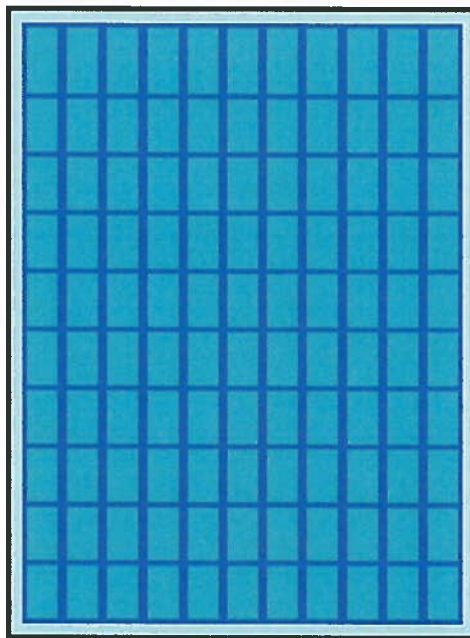
Overall Storage Efficiency = 63.2%

Overall System Size = 75.50' x 56.67' x 3.54'

110 Chambers

561.2 cy Field

344.2 cy Stone



PR-Drainage

Prepared by STS

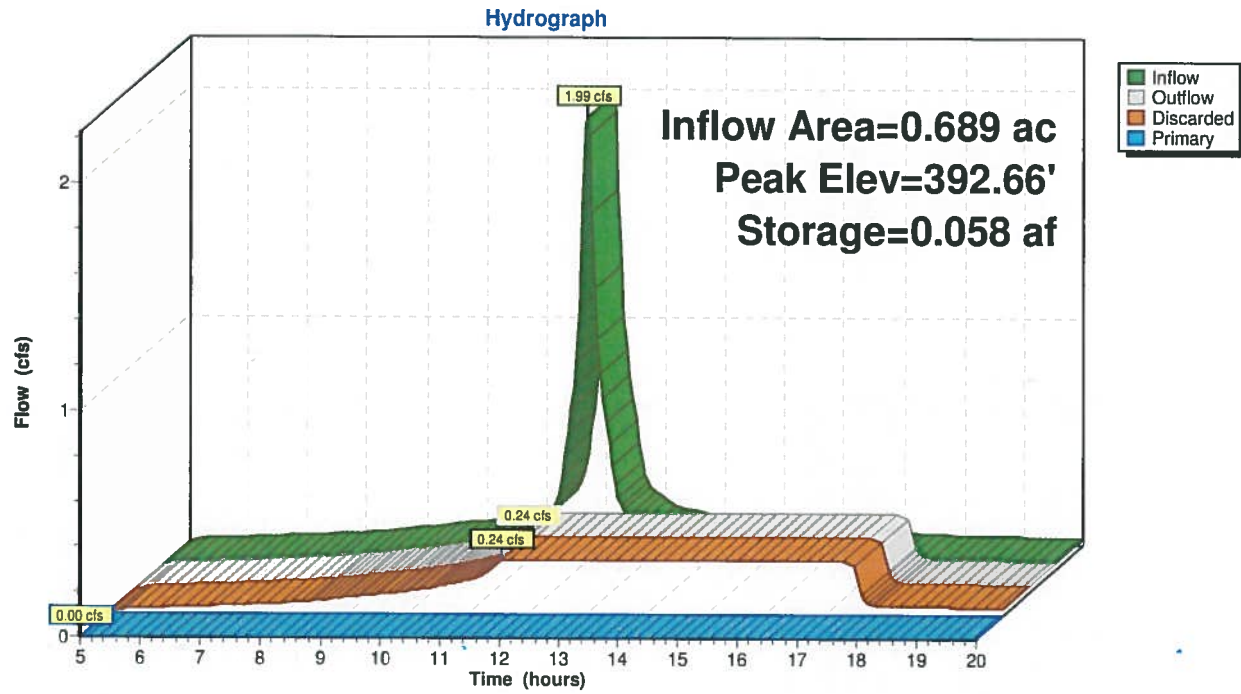
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00303 - Proposed Condition

Type III 24-hr 1- NOAA-2 Year Rainfall=3.31"

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Pond 1P: Cultec Chambers



PR-Drainage

Prepared by STS

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00303 - Proposed Condition

Type III 24-hr 2- NOAA-10 Year Rainfall=5.14"

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Summary for Subcatchment 1S: Proposed Roof Area

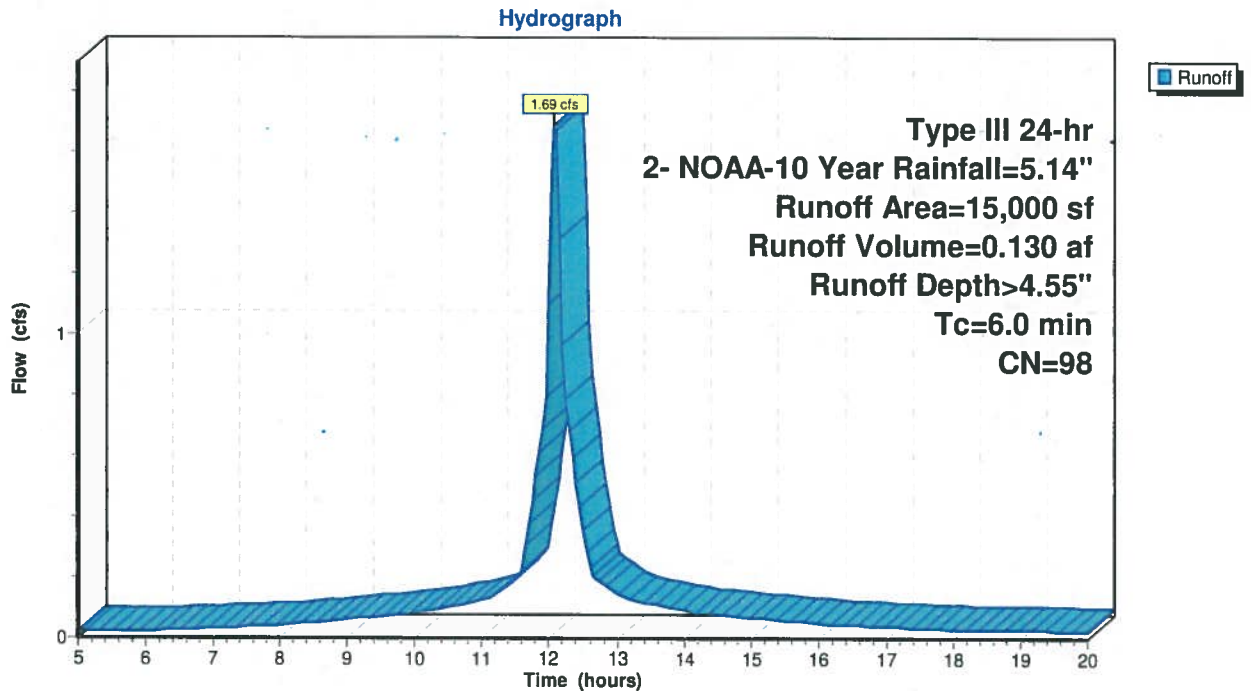
Runoff = 1.69 cfs @ 12.09 hrs, Volume= 0.130 af, Depth> 4.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2- NOAA-10 Year Rainfall=5.14"

Area (sf)	CN	Description
15,000	98	Roofs, HSG A
15,000		100.00% Impervious Area

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

Subcatchment 1S: Proposed Roof Area



PR-Drainage

Prepared by STS

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00303 - Proposed Condition

Type III 24-hr 2- NOAA-10 Year Rainfall=5.14"

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Summary for Subcatchment 2S: Proposed Roof Area

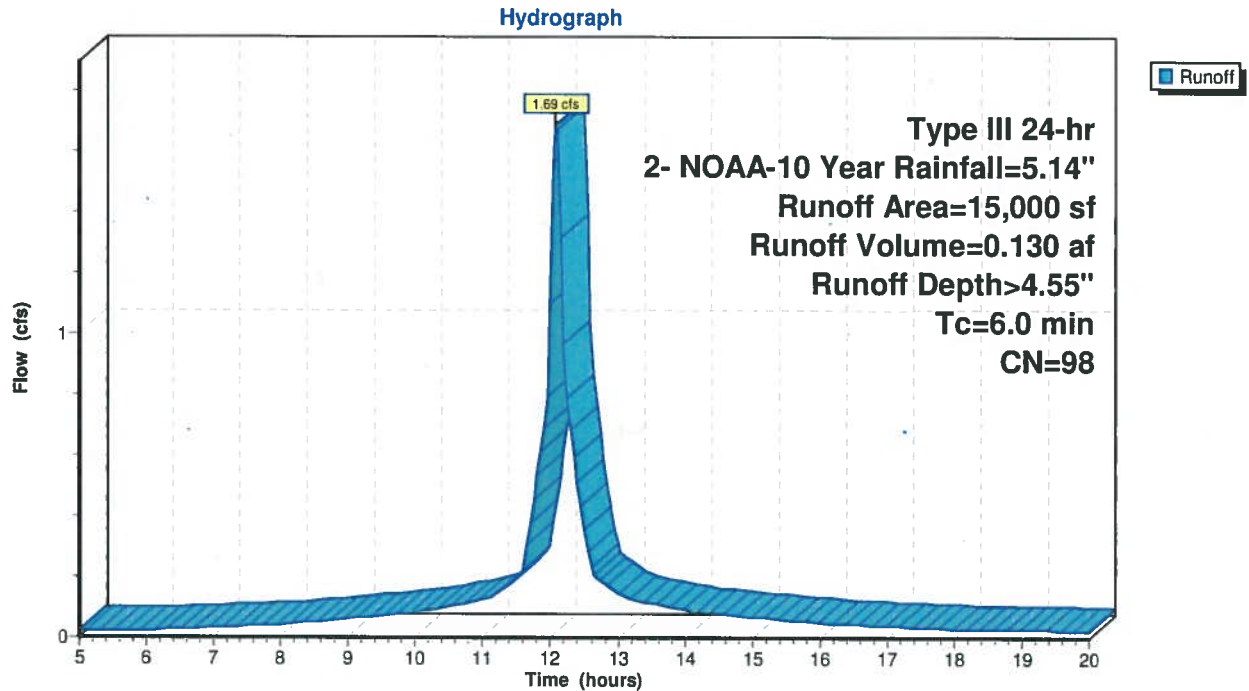
Runoff = 1.69 cfs @ 12.09 hrs, Volume= 0.130 af, Depth> 4.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
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Area (sf)	CN	Description
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15,000		100.00% Impervious Area

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

Subcatchment 2S: Proposed Roof Area



PR-Drainage

Prepared by STS

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00303 - Proposed Condition

Type III 24-hr 2- NOAA-10 Year Rainfall=5.14"

Page 20

Summary for Reach 1R: roof drain

Inflow Area = 0.344 ac, 100.00% Impervious, Inflow Depth > 4.55" for 2- NOAA-10 Year event
Inflow = 1.69 cfs @ 12.09 hrs, Volume= 0.130 af
Outflow = 1.58 cfs @ 12.13 hrs, Volume= 0.130 af, Atten= 6%, Lag= 2.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Max. Velocity= 3.42 fps, Min. Travel Time= 1.5 min

Avg. Velocity = 1.38 fps, Avg. Travel Time= 3.6 min

Peak Storage= 145 cf @ 12.11 hrs

Average Depth at Peak Storage= 0.59' , Surface Width= 0.98'

Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.52 cfs

12.0" Round Pipe

n= 0.013 Corrugated PE, smooth interior

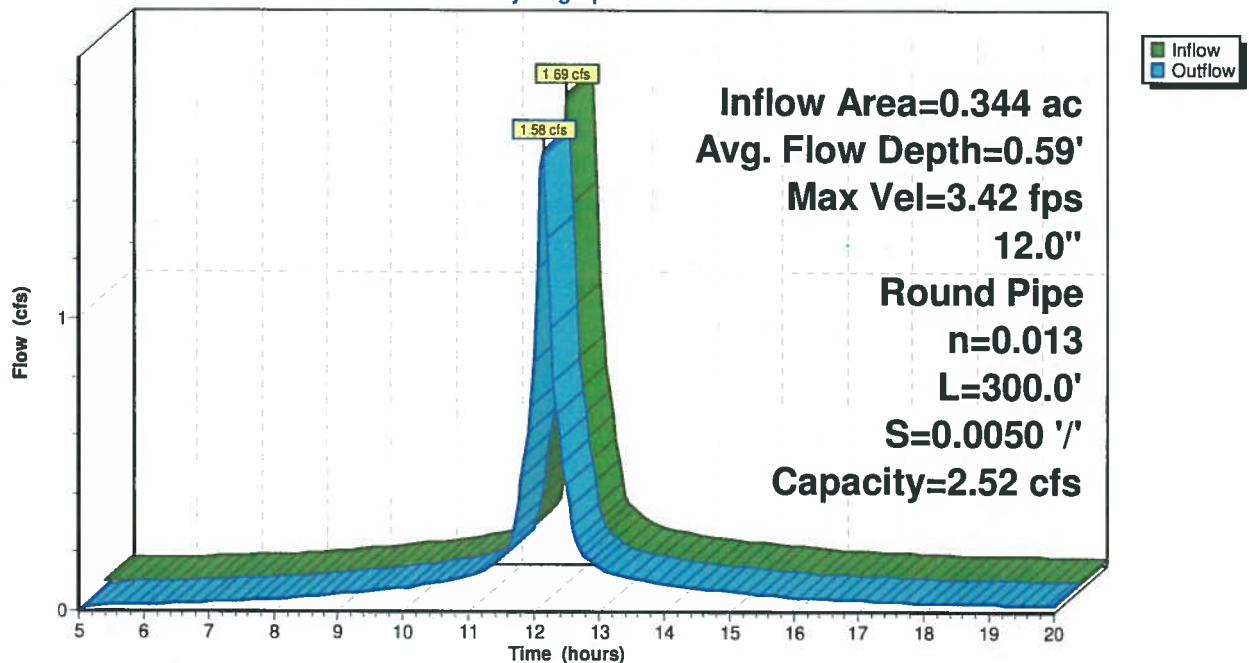
Length= 300.0' Slope= 0.0050 '/'

Inlet Invert= 396.00', Outlet Invert= 394.50'



Reach 1R: roof drain

Hydrograph



PR-Drainage

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00303 - Proposed Condition

Type III 24-hr 2- NOAA-10 Year Rainfall=5.14"

Page 21

Summary for Reach 2R: roof drain

Inflow Area = 0.689 ac, 100.00% Impervious, Inflow Depth > 4.54" for 2- NOAA-10 Year event
Inflow = 3.20 cfs @ 12.10 hrs, Volume= 0.261 af
Outflow = 3.14 cfs @ 12.12 hrs, Volume= 0.261 af, Atten= 2%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Max. Velocity= 4.90 fps, Min. Travel Time= 0.4 min

Avg. Velocity = 1.98 fps, Avg. Travel Time= 1.0 min

Peak Storage= 78 cf @ 12.11 hrs

Average Depth at Peak Storage= 0.66' , Surface Width= 1.25'

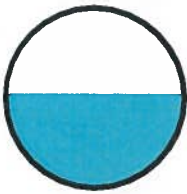
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.90 cfs

15.0" Round Pipe

n= 0.013 Corrugated PE, smooth interior

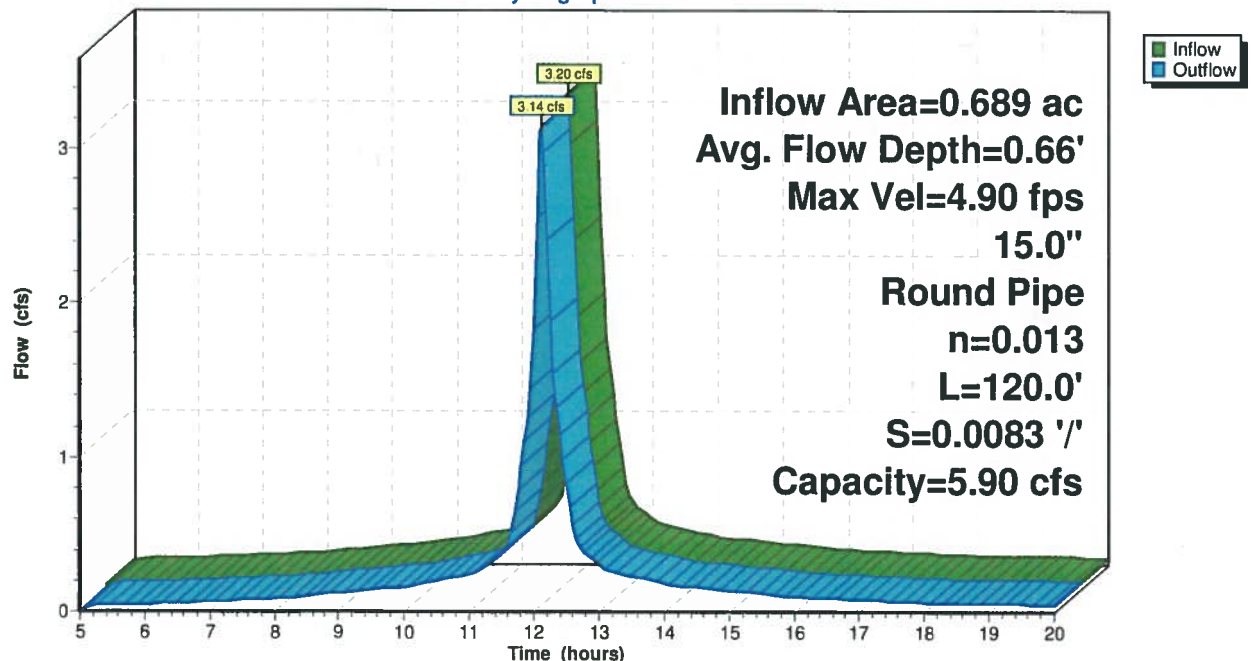
Length= 120.0' Slope= 0.0083 '/'

Inlet Invert= 394.50', Outlet Invert= 393.50'



Reach 2R: roof drain

Hydrograph



PR-Drainage

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Type III 24-hr 2- NOAA-10 Year Rainfall=5.14"

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Summary for Pond 1P: Cultec Chambers

Inflow Area = 0.689 ac, 100.00% Impervious, Inflow Depth > 4.54" for 2- NOAA-10 Year event
 Inflow = 3.14 cfs @ 12.12 hrs, Volume= 0.261 af
 Outflow = 0.24 cfs @ 11.05 hrs, Volume= 0.227 af, Atten= 92%, Lag= 0.0 min
 Discarded = 0.24 cfs @ 11.05 hrs, Volume= 0.227 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 393.31' @ 13.39 hrs Surf.Area= 0.098 ac Storage= 0.109 af

Plug-Flow detention time= 148.1 min calculated for 0.227 af (87% of inflow)
 Center-of-Mass det. time= 107.4 min (845.2 - 737.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	391.70'	0.085 af	56.67'W x 75.50'L x 3.54'H Field A 0.348 af Overall - 0.135 af Embedded = 0.213 af x 40.0% Voids
#2A	392.20'	0.135 af	Cultec R-330XLHD x 110 Inside #1 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 11 rows
		0.220 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	391.70'	2.410 in/hr Exfiltration over Surface area
#2	Primary	394.20'	6.0" Vert. Orifice/Grate X 4.00 C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.24 cfs @ 11.05 hrs HW=391.74' (Free Discharge)
 ↳ **1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=391.70' (Free Discharge)
 ↳ **2=Orifice/Grate** (Controls 0.00 cfs)

PR-Drainage

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Type III 24-hr 2- NOAA-10 Year Rainfall=5.14"

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Pond 1P: Cultec Chambers - 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 11 rows

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

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +24.0" End Stone x 2 = 75.50' Base Length

11 Rows x 52.0" Wide + 6.0" Spacing x 10 + 24.0" Side Stone x 2 = 56.67' Base Width

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

110 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 11 Rows = 5,860.2 cf Chamber Storage

15,152.4 cf Field - 5,860.2 cf Chambers = 9,292.2 cf Stone x 40.0% Voids = 3,716.9 cf Stone Storage

Chamber Storage + Stone Storage = 9,577.1 cf = 0.220 af

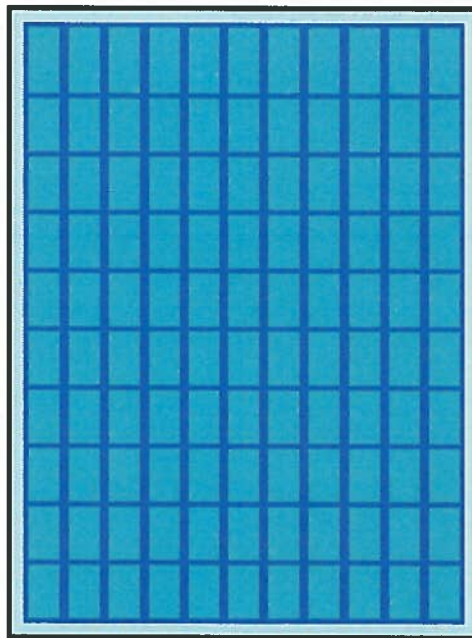
Overall Storage Efficiency = 63.2%

Overall System Size = 75.50' x 56.67' x 3.54'

110 Chambers

561.2 cy Field

344.2 cy Stone



PR-Drainage

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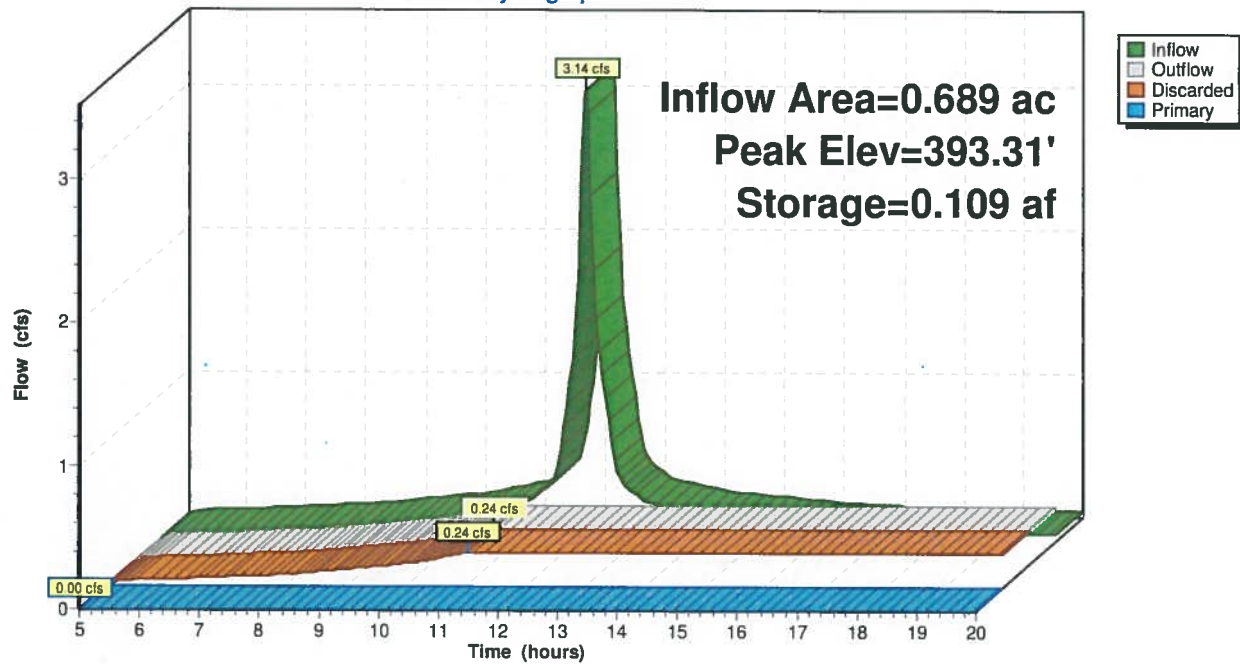
00303 - Proposed Condition

Type III 24-hr 2- NOAA-10 Year Rainfall=5.14"

Page 24

Pond 1P: Cultec Chambers

Hydrograph



PR-Drainage

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00303 - Proposed Condition

Type III 24-hr 3- NOAA-25 Year Rainfall=6.28"

Page 25

Summary for Subcatchment 1S: Proposed Roof Area

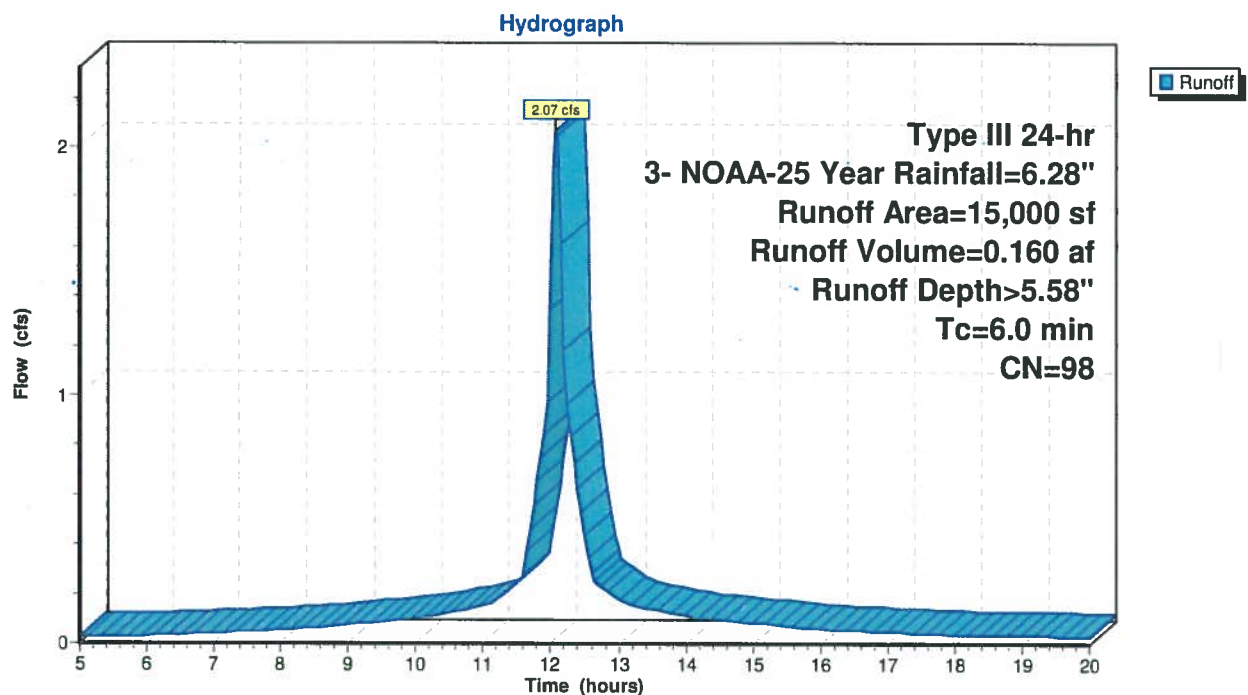
Runoff = 2.07 cfs @ 12.09 hrs, Volume= 0.160 af, Depth> 5.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 3- NOAA-25 Year Rainfall=6.28"

Area (sf)	CN	Description
15,000	98	Roofs, HSG A
15,000		100.00% Impervious Area

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

Subcatchment 1S: Proposed Roof Area



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Type III 24-hr 3- NOAA-25 Year Rainfall=6.28"

Page 26

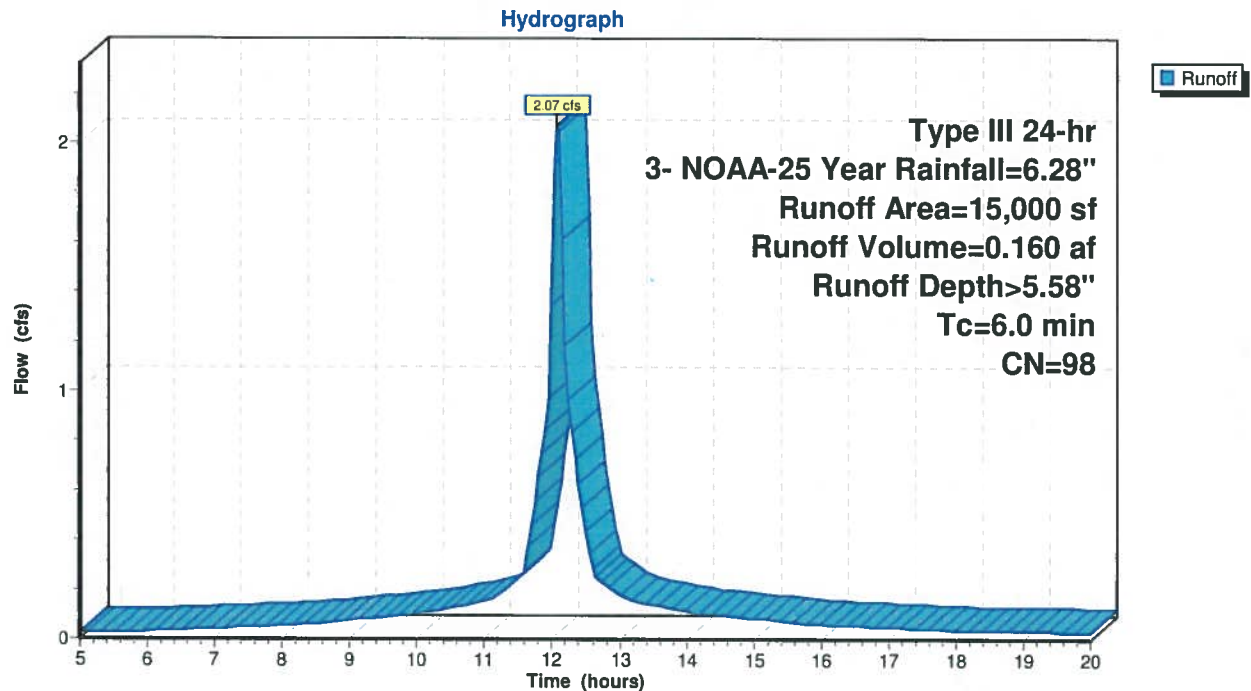
Summary for Subcatchment 2S: Proposed Roof Area

Runoff = 2.07 cfs @ 12.09 hrs, Volume= 0.160 af, Depth> 5.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 3- NOAA-25 Year Rainfall=6.28"

Area (sf)	CN	Description
15,000	98	Roofs, HSG A
15,000		100.00% Impervious Area

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

Subcatchment 2S: Proposed Roof Area

PR-Drainage

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Type III 24-hr 3- NOAA-25 Year Rainfall=6.28"

Page 27

Summary for Reach 1R: roof drain

Inflow Area = 0.344 ac, 100.00% Impervious, Inflow Depth > 5.58" for 3- NOAA-25 Year event
Inflow = 2.07 cfs @ 12.09 hrs, Volume= 0.160 af
Outflow = 1.94 cfs @ 12.13 hrs, Volume= 0.160 af, Atten= 6%, Lag= 2.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Max. Velocity= 3.57 fps, Min. Travel Time= 1.4 min

Avg. Velocity = 1.47 fps, Avg. Travel Time= 3.4 min

Peak Storage= 171 cf @ 12.11 hrs

Average Depth at Peak Storage= 0.68' , Surface Width= 0.93'

Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.52 cfs

12.0" Round Pipe

n= 0.013 Corrugated PE, smooth interior

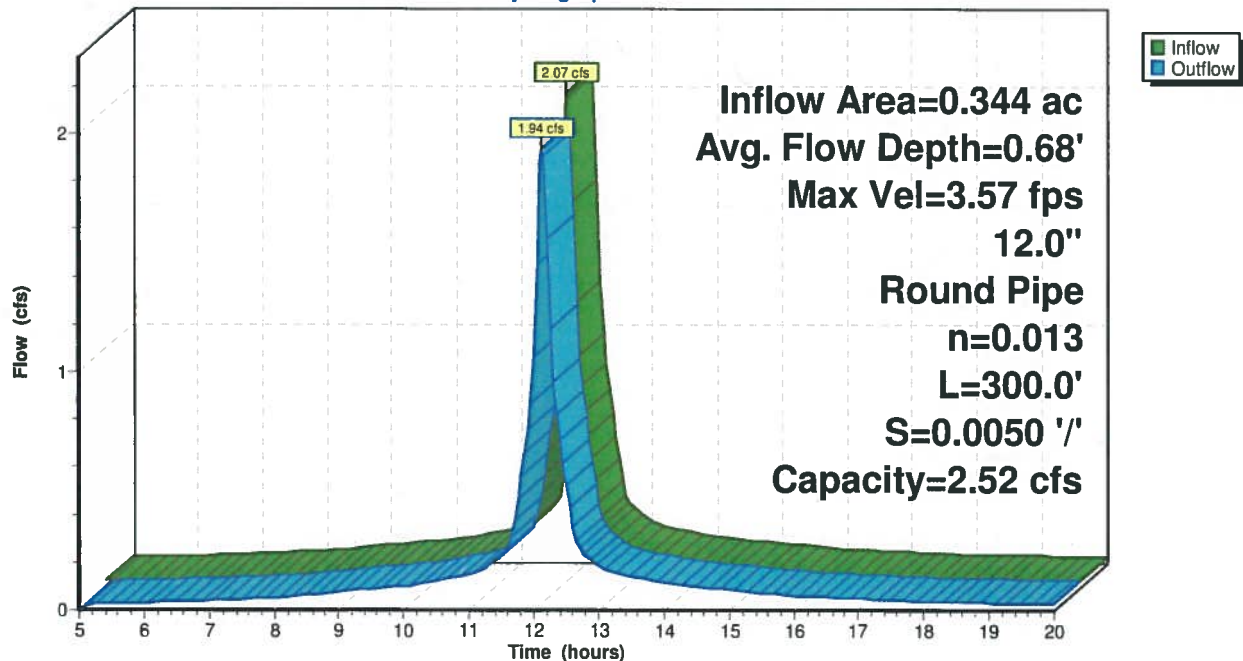
Length= 300.0' Slope= 0.0050 '/'

Inlet Invert= 396.00', Outlet Invert= 394.50'



Reach 1R: roof drain

Hydrograph



PR-Drainage

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Type III 24-hr 3- NOAA-25 Year Rainfall=6.28"

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Summary for Reach 2R: roof drain

Inflow Area = 0.689 ac, 100.00% Impervious, Inflow Depth > 5.58" for 3- NOAA-25 Year event
Inflow = 3.92 cfs @ 12.10 hrs, Volume= 0.320 af
Outflow = 3.86 cfs @ 12.11 hrs, Volume= 0.320 af, Atten= 2%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Max. Velocity= 5.14 fps, Min. Travel Time= 0.4 min

Avg. Velocity= 2.11 fps, Avg. Travel Time= 0.9 min

Peak Storage= 91 cf @ 12.11 hrs

Average Depth at Peak Storage= 0.74' , Surface Width= 1.23'

Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.90 cfs

15.0" Round Pipe

n= 0.013 Corrugated PE, smooth interior

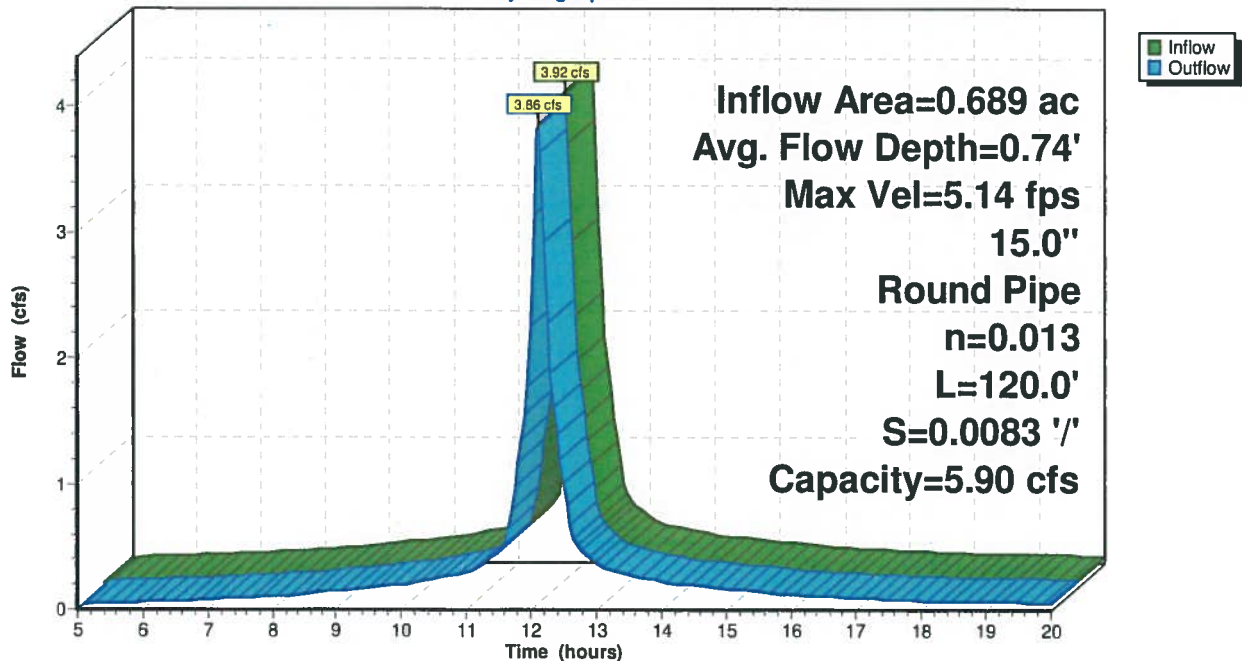
Length= 120.0' Slope= 0.0083 '/'

Inlet Invert= 394.50', Outlet Invert= 393.50'



Reach 2R: roof drain

Hydrograph



PR-Drainage

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Type III 24-hr 3- NOAA-25 Year Rainfall=6.28"

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Summary for Pond 1P: Cultec Chambers

Inflow Area = 0.689 ac, 100.00% Impervious, Inflow Depth > 5.58" for 3- NOAA-25 Year event
 Inflow = 3.86 cfs @ 12.11 hrs, Volume= 0.320 af
 Outflow = 0.24 cfs @ 10.50 hrs, Volume= 0.238 af, Atten= 94%, Lag= 0.0 min
 Discarded = 0.24 cfs @ 10.50 hrs, Volume= 0.238 af
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 393.81' @ 13.90 hrs Surf.Area= 0.098 ac Storage= 0.146 af

Plug-Flow detention time= 155.1 min calculated for 0.238 af (74% of inflow)
 Center-of-Mass det. time= 93.3 min (830.0 - 736.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	391.70'	0.085 af	56.67'W x 75.50'L x 3.54'H Field A 0.348 af Overall - 0.135 af Embedded = 0.213 af x 40.0% Voids
#2A	392.20'	0.135 af	Cultec R-330XLHD x 110 Inside #1 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 11 rows
		0.220 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	391.70'	2.410 in/hr Exfiltration over Surface area
#2	Primary	394.20'	6.0" Vert. Orifice/Grate X 4.00 C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.24 cfs @ 10.50 hrs HW=391.74' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=391.70' (Free Discharge)
 ↑ **2=Orifice/Grate** (Controls 0.00 cfs)

PR-Drainage

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Type III 24-hr 3- NOAA-25 Year Rainfall=6.28"

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Pond 1P: Cultec Chambers - 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 11 rows

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

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +24.0" End Stone x 2 = 75.50' Base Length

11 Rows x 52.0" Wide + 6.0" Spacing x 10 + 24.0" Side Stone x 2 = 56.67' Base Width

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

110 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 11 Rows = 5,860.2 cf Chamber Storage

15,152.4 cf Field - 5,860.2 cf Chambers = 9,292.2 cf Stone x 40.0% Voids = 3,716.9 cf Stone Storage

Chamber Storage + Stone Storage = 9,577.1 cf = 0.220 af

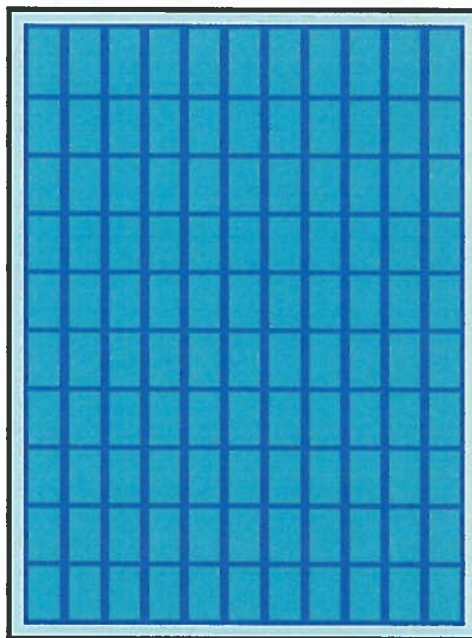
Overall Storage Efficiency = 63.2%

Overall System Size = 75.50' x 56.67' x 3.54'

110 Chambers

561.2 cy Field

344.2 cy Stone



PR-Drainage

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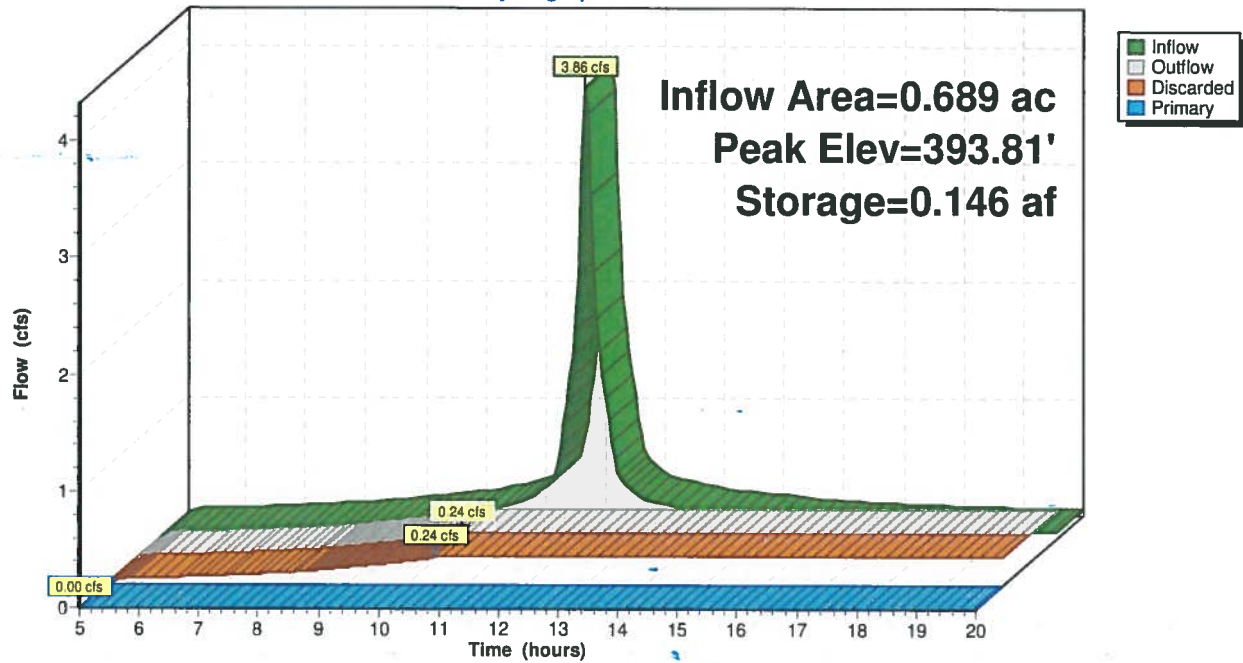
00303 - Proposed Condition

Type III 24-hr 3- NOAA-25 Year Rainfall=6.28"

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Pond 1P: Cultec Chambers

Hydrograph



PR-Drainage

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Type III 24-hr 4- NOAA-100 Year Rainfall=8.13"

Page 32

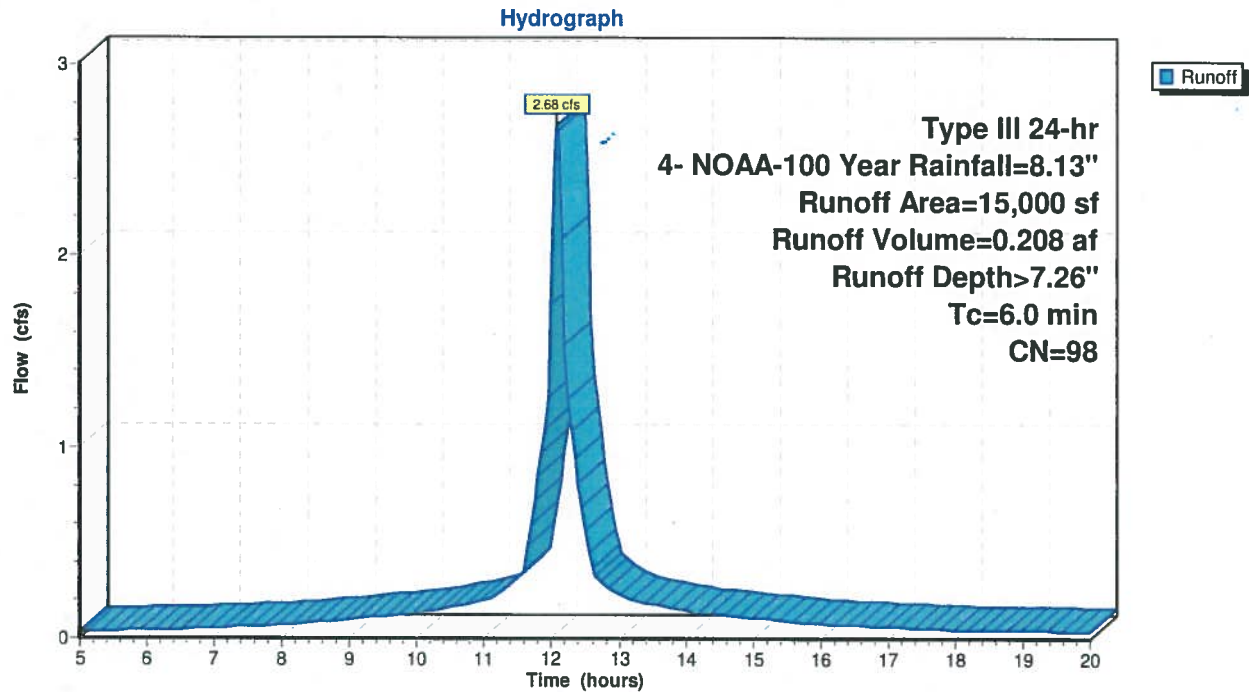
Summary for Subcatchment 1S: Proposed Roof Area

Runoff = 2.68 cfs @ 12.09 hrs, Volume= 0.208 af, Depth> 7.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 4- NOAA-100 Year Rainfall=8.13"

Area (sf)	CN	Description
15,000	98	Roofs, HSG A
15,000		100.00% Impervious Area

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

Subcatchment 1S: Proposed Roof Area

PR-Drainage

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Type III 24-hr 4- NOAA-100 Year Rainfall=8.13"

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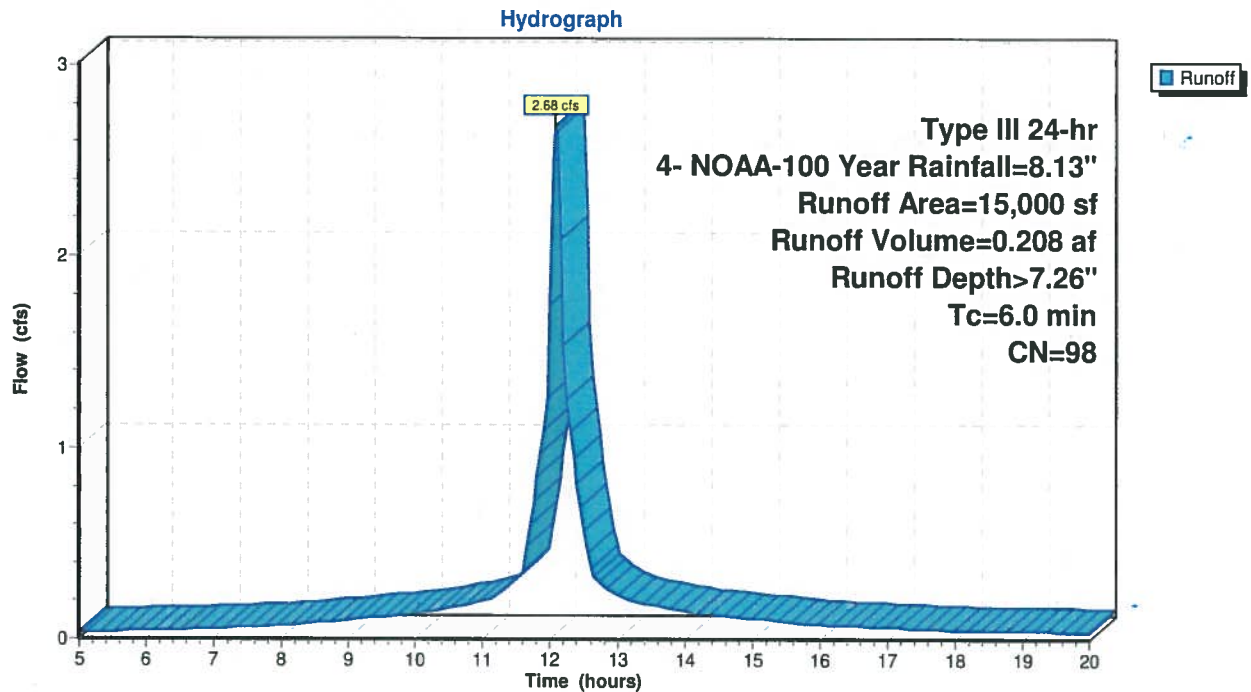
Summary for Subcatchment 2S: Proposed Roof Area

Runoff = 2.68 cfs @ 12.09 hrs, Volume= 0.208 af, Depth> 7.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 4- NOAA-100 Year Rainfall=8.13"

Area (sf)	CN	Description
15,000	98	Roofs, HSG A
15,000		100.00% Impervious Area

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

Subcatchment 2S: Proposed Roof Area

PR-Drainage

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Type III 24-hr 4- NOAA-100 Year Rainfall=8.13"

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Summary for Reach 1R: roof drain

Inflow Area = 0.344 ac, 100.00% Impervious, Inflow Depth > 7.26" for 4- NOAA-100 Year event
Inflow = 2.68 cfs @ 12.09 hrs, Volume= 0.208 af
Outflow = 2.51 cfs @ 12.13 hrs, Volume= 0.208 af, Atten= 7%, Lag= 2.7 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Max. Velocity= 3.65 fps, Min. Travel Time= 1.4 min

Avg. Velocity = 1.59 fps, Avg. Travel Time= 3.1 min

Peak Storage= 214 cf @ 12.11 hrs

Average Depth at Peak Storage= 0.85' , Surface Width= 0.71'

Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.52 cfs

12.0" Round Pipe

n= 0.013 Corrugated PE, smooth interior

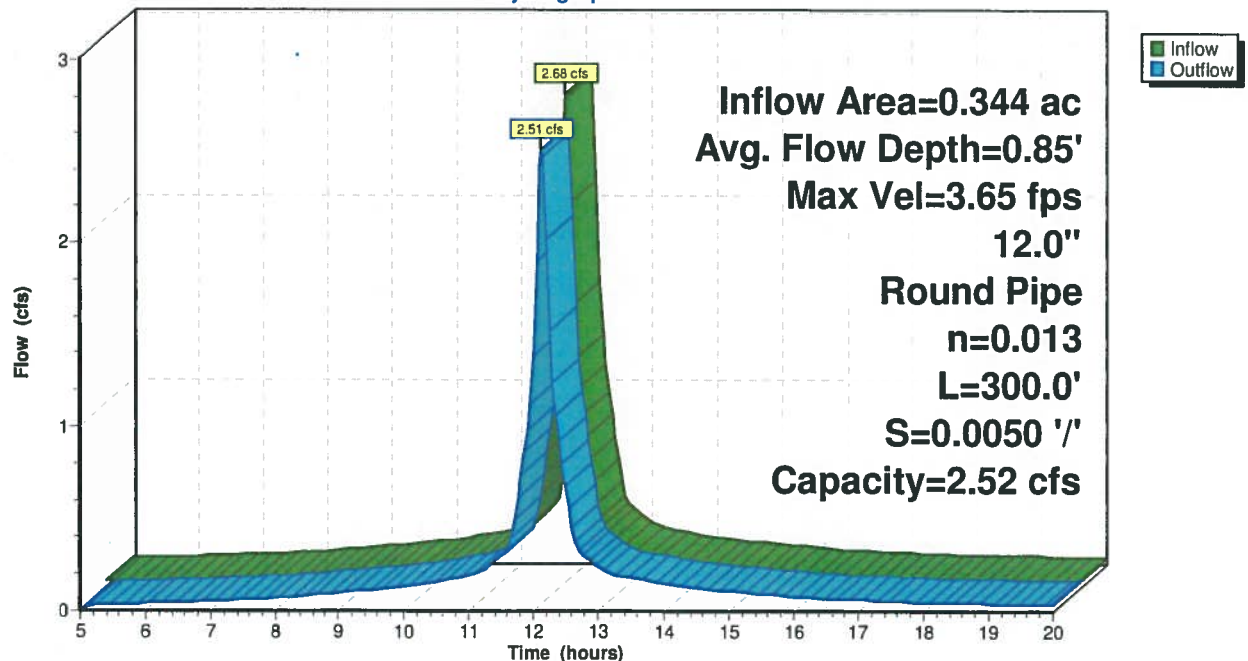
Length= 300.0' Slope= 0.0050 '/'

Inlet Invert= 396.00', Outlet Invert= 394.50'



Reach 1R: roof drain

Hydrograph



PR-Drainage

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Type III 24-hr 4- NOAA-100 Year Rainfall=8.13"

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Summary for Reach 2R: roof drain

Inflow Area = 0.689 ac, 100.00% Impervious, Inflow Depth > 7.26" for 4- NOAA-100 Year event
Inflow = 5.08 cfs @ 12.10 hrs, Volume= 0.416 af
Outflow = 4.99 cfs @ 12.11 hrs, Volume= 0.416 af, Atten= 2%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Max. Velocity= 5.40 fps, Min. Travel Time= 0.4 min

Avg. Velocity = 2.28 fps, Avg. Travel Time= 0.9 min

Peak Storage= 113 cf @ 12.11 hrs

Average Depth at Peak Storage= 0.89' , Surface Width= 1.13'

Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.90 cfs

15.0" Round Pipe

n= 0.013 Corrugated PE, smooth interior

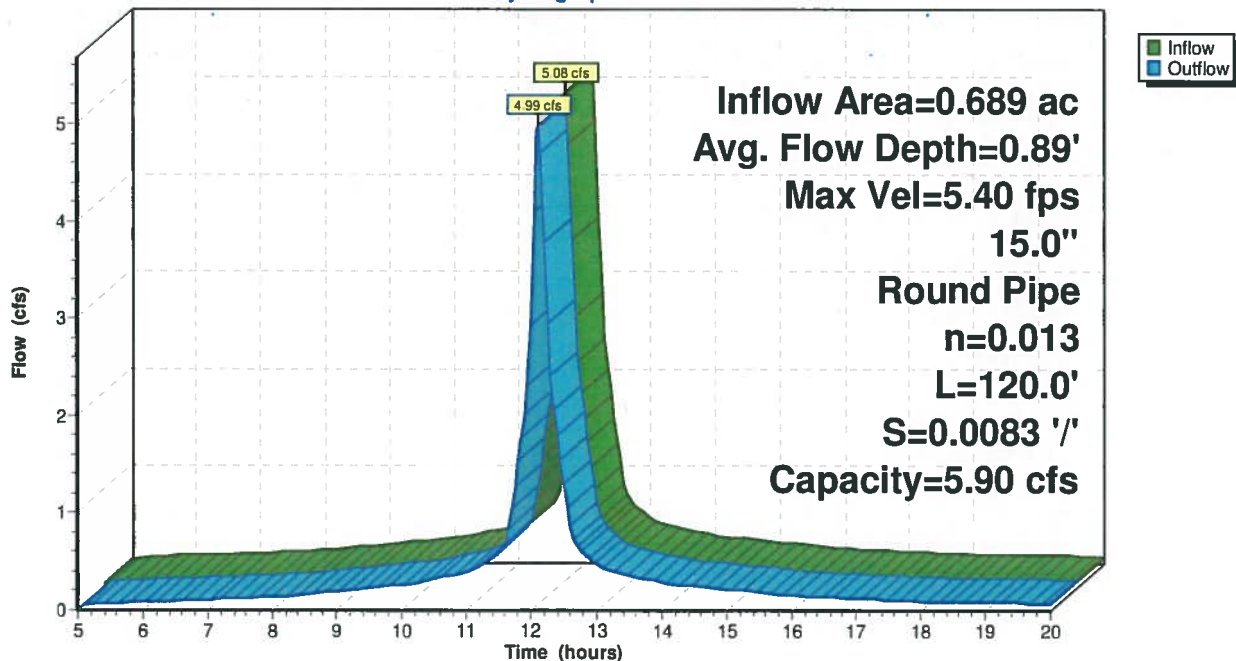
Length= 120.0' Slope= 0.0083 '/'

Inlet Invert= 394.50', Outlet Invert= 393.50'



Reach 2R: roof drain

Hydrograph



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Type III 24-hr 4- NOAA-100 Year Rainfall=8.13"

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Summary for Pond 1P: Cultec Chambers

Inflow Area = 0.689 ac, 100.00% Impervious, Inflow Depth > 7.25" for 4- NOAA-100 Year event
 Inflow = 4.99 cfs @ 12.11 hrs, Volume= 0.416 af
 Outflow = 0.75 cfs @ 12.65 hrs, Volume= 0.291 af, Atten= 85%, Lag= 32.2 min
 Discarded = 0.24 cfs @ 9.70 hrs, Volume= 0.253 af
 Primary = 0.51 cfs @ 12.65 hrs, Volume= 0.039 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 394.42' @ 12.65 hrs Surf.Area= 0.098 ac Storage= 0.185 af

Plug-Flow detention time= 141.4 min calculated for 0.291 af (70% of inflow)
 Center-of-Mass det. time= 72.8 min (808.4 - 735.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	391.70'	0.085 af	56.67'W x 75.50'L x 3.54'H Field A 0.348 af Overall - 0.135 af Embedded = 0.213 af x 40.0% Voids
#2A	392.20'	0.135 af	Cultec R-330XLHD x 110 Inside #1 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 11 rows
		0.220 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	391.70'	2.410 in/hr Exfiltration over Surface area
#2	Primary	394.20'	6.0" Vert. Orifice/Grate X 4.00 C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.24 cfs @ 9.70 hrs HW=391.74' (Free Discharge)
 ↳ **1=Exfiltration** (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=0.51 cfs @ 12.65 hrs HW=394.42' (Free Discharge)
 ↳ **2=Orifice/Grate** (Orifice Controls 0.51 cfs @ 1.58 fps)

PR-Drainage

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Type III 24-hr 4- NOAA-100 Year Rainfall=8.13"

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Pond 1P: Cultec Chambers - 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 11 rows

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

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +24.0" End Stone x 2 = 75.50' Base Length

11 Rows x 52.0" Wide + 6.0" Spacing x 10 + 24.0" Side Stone x 2 = 56.67' Base Width

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

110 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 11 Rows = 5,860.2 cf Chamber Storage

15,152.4 cf Field - 5,860.2 cf Chambers = 9,292.2 cf Stone x 40.0% Voids = 3,716.9 cf Stone Storage

Chamber Storage + Stone Storage = 9,577.1 cf = 0.220 af

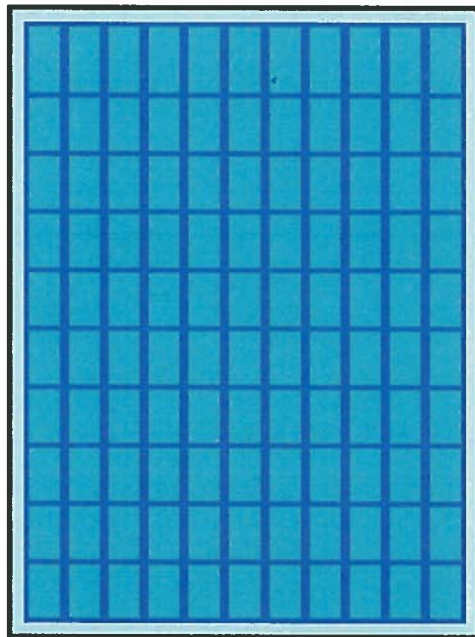
Overall Storage Efficiency = 63.2%

Overall System Size = 75.50' x 56.67' x 3.54'

110 Chambers

561.2 cy Field

344.2 cy Stone



PR-Drainage

Prepared by STS

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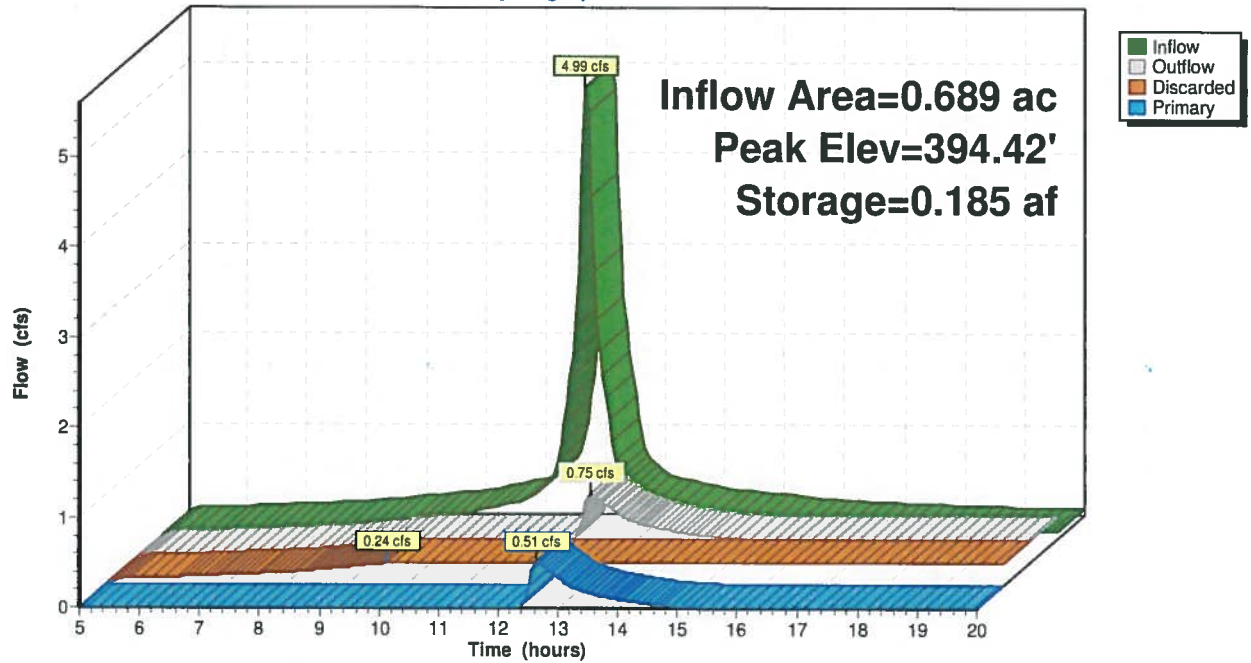
00303 - Proposed Condition

Type III 24-hr 4- NOAA-100 Year Rainfall=8.13"

Page 38

Pond 1P: Cultec Chambers

Hydrograph



Stormwater Management

STORMWATER MANAGEMENT COMPLIANCE

Standard #1 No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

- No new conveyances will discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. The new stormwater discharges are treated and provided with hardened outfalls to avoid surface erosion.

Standard #2 Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

- See Table-Section 1, Page 1 - Summary of Peak Rates of Stormwater Runoff
Post-development peak discharge rates do not exceed existing peak discharge rates.
Calculations do not include reduction in flows by dynamic exfiltration from infiltration devices.

Standard #3 Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

- Impervious area = proposed roof addition
Flow to Infiltration Basin 1 (25-Yr Storm)
Impervious area HSG-A (0.60") = 30,000 sf = Req'd. recharge = 1,500 cf

Basin 1 Volume = 10,367 cf

Standard #4 Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:

- a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
 - b. Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and
 - c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.
- **The only runoff is from the new roof. This is not subject to TSS removal.**

Standard #5 For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

- Locus site does not meet the criteria to be designated as a "LUHPPL

Standard #6 Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

- Stormwater does not discharge within the Zone II or Interim Wellhead Protection Area of a public water supply or to any other critical area.

Standard #7 A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

- The site is designed to meet redevelopment standards.

Standard #8 A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

- The plan set includes notes and details to avoid sediment migration and construction period erosion.

Standard #9 A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

- **Long-term operation and maintenance plan**

The proposed stormwater management system and the Best Management Practices (BMP's) are to be constructed in accordance with the approved site design plans. During the construction process the general site contractor and property owner shall be designated as the owners of the BMP's and will be responsible for their operation and maintenance. Once the BMP's are constructed they are to be protected from sedimentation until the site is stabilized and vegetated. Inspections should be performed routinely and after every major storm event. Any accumulated sediments and debris are to be removed and any eroded areas are to be re-graded and re-vegetated.

Post-Development Phase Ownership:

After the completion of the site construction, the entire drainage system will be the responsibility of the property owner – 3P Properties, LLC

Emergency Fuel Spill Response:

In the event of a fuel spill the responsible party shall call 9-1-1. They shall follow local and state removal procedures for the contaminant. The responsible contractor shall also call the Sutton Board of Health at (508) 865-8724 and the Mass DEP at (508) 792-7650. Any contaminated soil must be completely removed from the property and be delivered to a certified land fill.

Operation & Maintenance:

The following are the minimum maintenance criteria for the proposed BMP's. Responsible parties should however review the Mass DEP Stormwater Handbook for further explanation.

Cultec Stormwater System

The Cultec System includes all of the plastic chambers and the PVC pipe that feeds the system from the last manhole. This system is equipped with manholes at the beginning and end of the system. The system should be inspected at least twice per year to ensure that it is operating as intended. Inspections should be conducted during the spring and fall seasons. The Cultec System shall be cleaned out if a minimum of six inches

Of material has accumulated as viewed and measured through the manholes. Inspections shall also include verifying adequate soil cover is maintained over and around the system. This area shall be free of permanent structures.

Standard #10

Illicit Discharge Compliance Statement

Owner: 3P Properties, LLC
Address: 665 Church Street, Whitinsville, MA 01588
Tel. (508) 889-7035

Responsibility

Owners are responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the USEPA NPDES Construction General Permit and responsible for identifying and eliminating illicit discharges (as defined by the USEPA).

Engineer's Compliance Statement:

To the best of my knowledge, the submitted plans, computations and specifications meet the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist on the site. All documents and attachments were prepared under my direction and qualified personnel properly gathered and evaluated the information submitted, to the best of my knowledge.

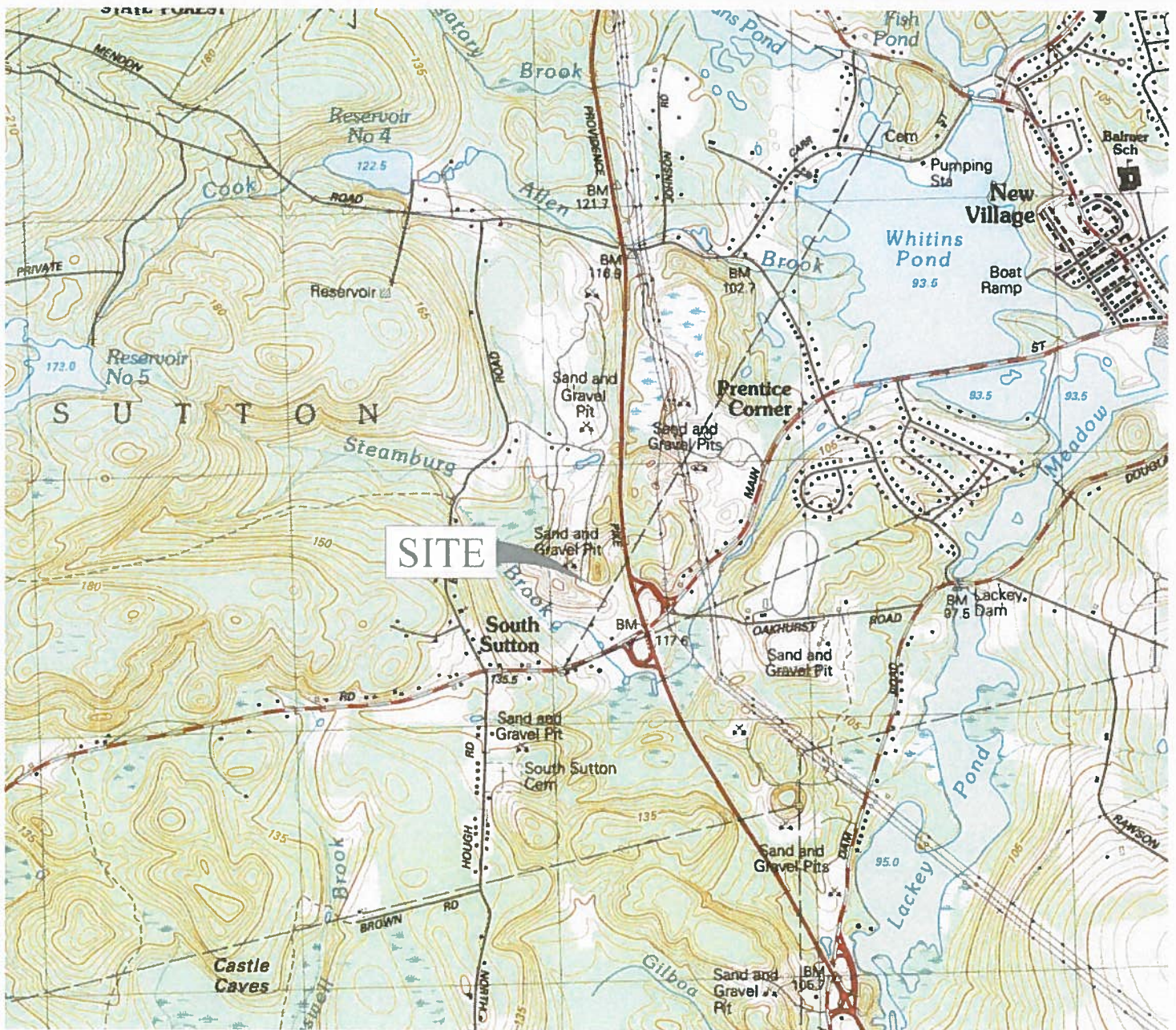
Included with this statement are site plans, drawn to scale, that identify the location of systems for conveying stormwater on the site and show that these systems do not allow the entry of any illicit discharges into the stormwater management system. The plans also show any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater systems.

For a redevelopment project (if applicable), all actions taken to identify and remove illicit discharges, including without limitation, visual screening, dye or smoke testing, and the removal of any sources of illicit discharges to the stormwater management system are documented and included with this statement.

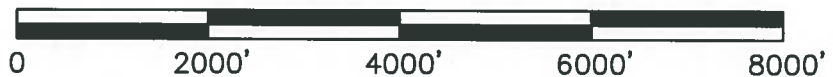

Professional Engineer

11/5/22
Date

Supplemental Information



SCALE: 1" = 2000'



PORTION OF U.S.G.S. GEODETIC MAP

SITE: 29 Gilmore Drive
Sutton, MA 01590

PREPARED BY: **ALLEN ENGINEERING
& ASSOCIATES, INC.**



Civil Engineers • Surveyors
Land Development Consultants

One Charlesview Road - Suite 2
Hopedale, Ma 01747
(508) 381-3212 • Phone
www.allen-ea.com

DATE: 1/5/2022

JOB NO: 00303

Location Address or Lot No.: 29 Gilmore Drive
Sutton, Massachusetts

On-site Review

Deep Hole Number: TP 1 Date: 12/3/2021 Time: 9:00 am Weather: Sunny 45°F

Location (identify on site plan):

Land Use: Industrial Lot, Slope 1-3%

Vegetation: Grass

Landform: Ground Moraine

Position on landscape: (sketch on the back):

Distances from:

Open Water Body: ≥ 100 feet

Drainage Way: ≥ 100 feet

Possible Wet Area: ≥ 100 feet

Property Line: > 30 feet

Drinking Water Well: ≥ 100 feet

Other:

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, & Gravel)
0-20"	Fill	-	-		
20"-100"	C	Sand			

MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic): glacial outwash

Depth to Bedrock: None Found

Depth to Groundwater: Standing Water in the Hole: None Found Weeping from Pit Face: None Found

Estimated Seasonal High Groundwater: 100" bottom of hole

DEP APPROVED FORM – 12/07/95

Location Address or Lot No.: 29 Gilmore Drive
Sutton, Massachusetts

On-site Review

Deep Hole Number: TP 2 Date: 12/3/2021 Time: 9:00 am Weather: Sunny 45°F

Location (identify on site plan):

Land Use: Industrial Lot, Slope 1-3%

Vegetation: Grass

Landform: Ground Moraine

Position on landscape: (sketch on the back):

Distances from:

Open Water Body: ≥ 100 feet

Drainage Way: ≥ 100 feet

Possible Wet Area: ≥ 100 feet

Property Line: > 30 feet

Drinking Water Well: ≥ 100 feet

Other:

DEEP OBSERVATION HOLE LOG*

Depth from Surface (Inches)	Soil Horizon	Soil Texture (USDA)	Soil Color (Munsell)	Soil Mottling	Other (Structure, Stones, Boulders, Consistency, & Gravel)
0-13"	Fill	-	-		
13"-102"	C	Sand			

MINIMUM OF 2 HOLES REQUIRED AT EVERY PROPOSED DISPOSAL AREA

Parent Material (geologic): glacial outwash

Depth to Bedrock: None Found

Depth to Groundwater: Standing Water in the Hole: None Found

Weeping from Pit Face: None Found

Estimated Seasonal High Groundwater: 102" bottom of hole

DEP APPROVED FORM – 12/07/95

NOAA Atlas 14, Volume 10, Version 3

NORTHBRIDGE 2

Station ID: 19-5524

Location name: Whitinsville, Massachusetts, USA*

Latitude: 42.115°, Longitude: -71.6758°

Elevation:

Elevation (station metadata): 315 ft**

* source: ESRI Maps

** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerals](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.336 (0.266-0.417)	0.400 (0.316-0.498)	0.505 (0.398-0.631)	0.593 (0.464-0.745)	0.713 (0.536-0.936)	0.804 (0.594-1.08)	0.898 (0.641-1.25)	1.00 (0.678-1.43)	1.15 (0.744-1.70)	1.26 (0.797-1.91)
10-min	0.476 (0.376-0.591)	0.567 (0.448-0.705)	0.716 (0.564-0.894)	0.840 (0.657-1.06)	1.01 (0.763-1.33)	1.14 (0.841-1.53)	1.27 (0.909-1.77)	1.42 (0.960-2.03)	1.62 (1.05-2.41)	1.79 (1.13-2.71)
15-min	0.559 (0.443-0.695)	0.667 (0.527-0.830)	0.843 (0.664-1.05)	0.988 (0.773-1.24)	1.19 (0.897-1.56)	1.34 (0.989-1.80)	1.50 (1.07-2.09)	1.67 (1.13-2.39)	1.91 (1.24-2.84)	2.10 (1.33-3.19)
30-min	0.770 (0.609-0.957)	0.918 (0.726-1.14)	1.16 (0.914-1.45)	1.36 (1.07-1.71)	1.64 (1.24-2.15)	1.85 (1.36-2.48)	2.06 (1.47-2.87)	2.30 (1.56-3.29)	2.63 (1.71-3.91)	2.89 (1.83-4.39)
60-min	0.981 (0.776-1.22)	1.17 (0.925-1.46)	1.48 (1.17-1.85)	1.74 (1.36-2.18)	2.09 (1.58-2.74)	2.35 (1.74-3.16)	2.63 (1.88-3.66)	2.93 (1.98-4.20)	3.35 (2.18-4.98)	3.69 (2.33-5.60)
2-hr	1.27 (1.01-1.57)	1.50 (1.20-1.86)	1.89 (1.50-2.35)	2.21 (1.74-2.76)	2.65 (2.02-3.47)	2.98 (2.22-3.99)	3.33 (2.40-4.63)	3.73 (2.53-5.31)	4.30 (2.80-6.35)	4.76 (3.03-7.19)
3-hr	1.46 (1.17-1.80)	1.74 (1.39-2.14)	2.18 (1.74-2.70)	2.55 (2.02-3.17)	3.06 (2.34-3.99)	3.44 (2.57-4.59)	3.85 (2.79-5.35)	4.32 (2.94-6.12)	5.00 (3.27-7.37)	5.58 (3.55-8.39)
6-hr	1.85 (1.49-2.26)	2.21 (1.77-2.70)	2.79 (2.24-3.43)	3.28 (2.61-4.05)	3.95 (3.04-5.12)	4.44 (3.35-5.91)	4.98 (3.64-6.91)	5.62 (3.84-7.92)	6.58 (4.31-9.62)	7.40 (4.72-11.0)
12-hr	2.29 (1.85-2.78)	2.76 (2.24-3.36)	3.54 (2.86-4.33)	4.19 (3.36-5.14)	5.08 (3.93-6.56)	5.74 (4.35-7.60)	6.45 (4.75-8.93)	7.32 (5.02-10.3)	8.65 (5.68-12.6)	9.80 (6.27-14.5)
24-hr	2.70 (2.21-3.26)	3.31 (2.70-4.00)	4.31 (3.50-5.23)	5.14 (4.14-6.27)	6.28 (4.89-8.07)	7.12 (5.43-9.39)	8.04 (5.96-11.1)	9.17 (6.31-12.8)	10.9 (7.20-15.8)	12.5 (8.00-18.4)
2-day	3.07 (2.53-3.68)	3.81 (3.12-4.57)	5.01 (4.09-6.03)	6.00 (4.87-7.27)	7.37 (5.79-9.43)	8.38 (6.44-11.0)	9.48 (7.09-13.0)	10.9 (7.51-15.1)	13.1 (8.63-18.7)	15.0 (9.64-21.9)
3-day	3.36 (2.77-4.01)	4.15 (3.42-4.97)	5.45 (4.47-6.54)	6.53 (5.32-7.88)	8.01 (6.30-10.2)	9.09 (7.01-11.9)	10.3 (7.71-14.1)	11.8 (8.16-16.3)	14.1 (9.36-20.2)	16.2 (10.4-23.6)
4-day	3.63 (3.00-4.32)	4.46 (3.68-5.31)	5.82 (4.78-6.96)	6.94 (5.67-8.35)	8.49 (6.70-10.8)	9.63 (7.44-12.5)	10.9 (8.16-14.8)	12.4 (8.62-17.1)	14.9 (9.85-21.2)	17.0 (11.0-24.7)
7-day	4.36 (3.63-5.16)	5.26 (4.37-6.24)	6.73 (5.56-8.01)	7.95 (6.53-9.51)	9.62 (7.62-12.1)	10.9 (8.41-14.0)	12.2 (9.15-16.4)	13.8 (9.63-18.9)	16.3 (10.8-23.1)	18.4 (11.9-26.6)
10-day	5.06 (4.22-5.97)	5.99 (4.99-7.08)	7.52 (6.24-8.91)	8.78 (7.24-10.5)	10.5 (8.35-13.2)	11.8 (9.15-15.1)	13.2 (9.88-17.6)	14.8 (10.4-20.2)	17.3 (11.5-24.3)	19.3 (12.5-27.8)
20-day	7.13 (6.00-8.36)	8.11 (6.81-9.52)	9.71 (8.11-11.4)	11.0 (9.16-13.1)	12.9 (10.2-15.9)	14.2 (11.0-18.0)	15.7 (11.7-20.5)	17.2 (12.1-23.2)	19.3 (13.0-27.0)	21.0 (13.7-30.0)
30-day	8.87 (7.48-10.4)	9.87 (8.32-11.5)	11.5 (9.65-13.5)	12.9 (10.7-15.2)	14.7 (11.8-18.0)	16.2 (12.5-20.2)	17.6 (13.1-22.7)	19.0 (13.4-25.5)	20.9 (14.1-29.1)	22.3 (14.5-31.8)
45-day	11.0 (9.36-12.8)	12.1 (10.2-14.1)	13.8 (11.6-16.1)	15.2 (12.7-17.8)	17.1 (13.7-20.8)	18.6 (14.4-23.0)	20.0 (14.9-25.6)	21.4 (15.1-28.5)	23.0 (15.5-31.8)	24.1 (15.7-34.2)
60-day	12.9 (10.9-14.9)	13.9 (11.8-16.2)	15.7 (13.2-18.3)	17.1 (14.3-20.1)	19.1 (15.3-23.1)	20.7 (16.1-25.5)	22.1 (16.4-28.1)	23.4 (16.6-31.1)	24.9 (16.8-34.3)	25.8 (16.9-36.5)

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

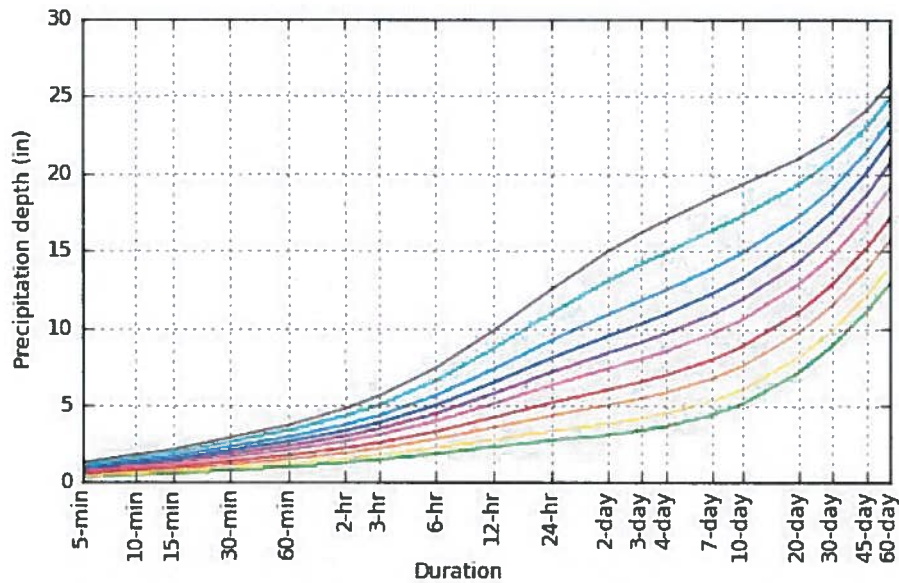
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

Please refer to NOAA Atlas 14 document for more information.

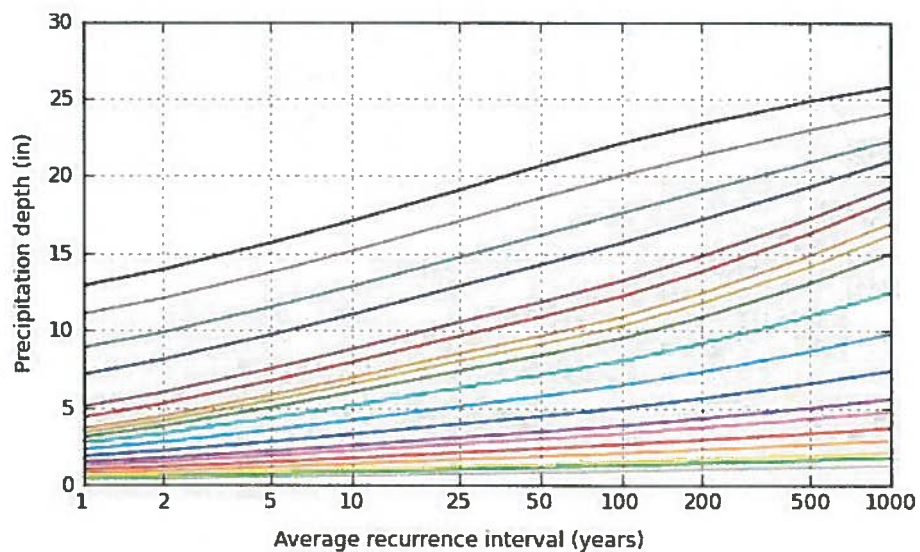
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PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 42.1150°, Longitude: -71.6758°



Average recurrence interval (years)
1
2
5
10
25
50
100
200
500
1000



Duration	
5-min	2-day
10-min	3-day
15-min	4-day
30-min	7-day
60-min	10-day
2-hr	20-day
3-hr	30-day
6-hr	45-day
12-hr	60-day
24-hr	



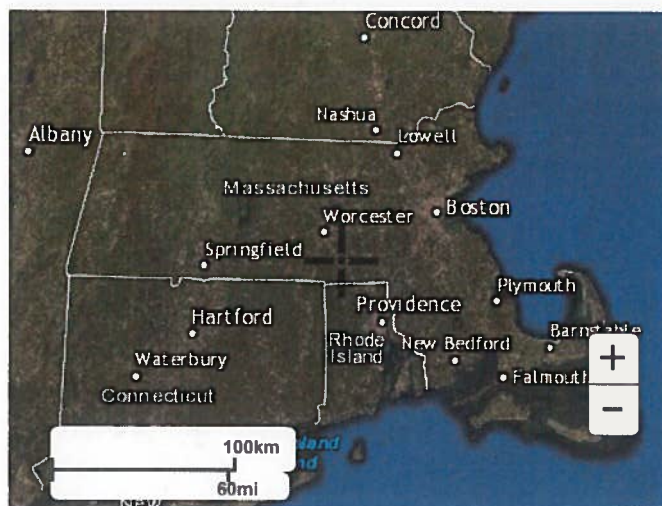
Large scale terrain



Large scale map



Large scale aerial

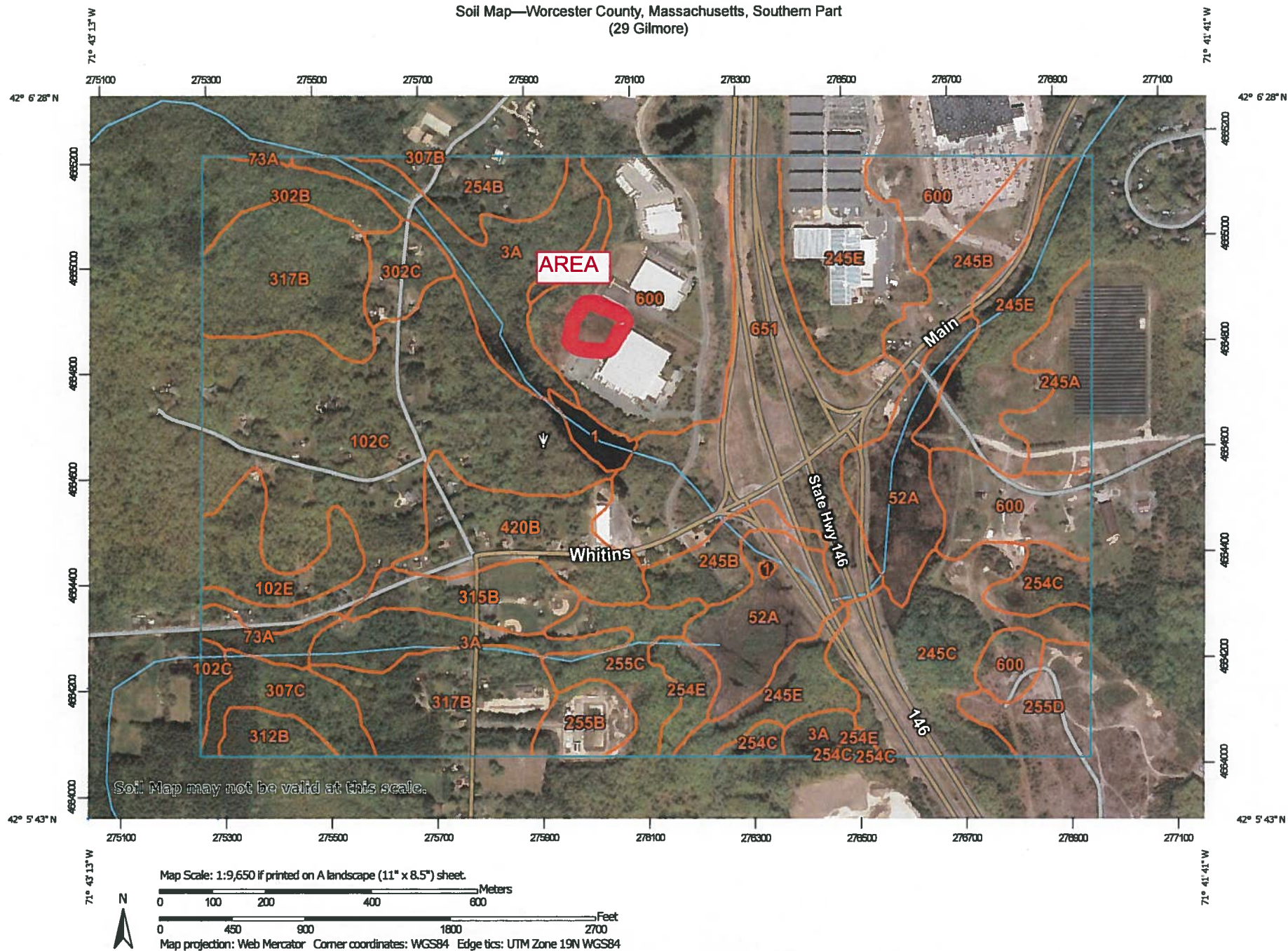


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1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)

Soil Map—Worcester County, Massachusetts, Southern Part
(29 Gilmore)












































Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

1/3/2022
Page 1 of 4

MAP LEGEND

	Area of Interest (AOI)		Soil Area
	Soils		Stony Spot
	Soil Map Unit Polygons		Very Stony Spot
	Soil Map Unit Lines		Wet Spot
	Soil Map Unit Points		Other
	Special Point Features		Special Line Features
	Blowout		Water Features
	Borrow Pit		Streams and Canals
	Clay Spot		Transportation
	Closed Depression		Rails
	Gravel Pit		Interstate Highways
	Gravelly Spot		US Routes
	Landfill		Major Roads
	Lava Flow		Local Roads
	Marsh or swamp		Background
	Mine or Quarry		Aerial Photography
	Miscellaneous Water		
	Perennial Water		
	Rock Outcrop		
	Saline Spot		
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Worcester County, Massachusetts, Southern Part

Survey Area Data: Version 14, Sep 3, 2021

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

Date(s) aerial images were photographed: May 18, 2019—Jul 9, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	2.6	0.5%
3A	Scarboro and Walpole soils, 0 to 3 percent slopes	29.1	6.1%
52A	Freetown muck, 0 to 1 percent slopes	26.3	5.5%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	3.9	0.8%
102C	Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes	63.7	13.4%
102E	Chatfield-Hollis-Rock outcrop complex, 15 to 35 percent slopes	9.6	2.0%
245A	Hinckley loamy sand, 0 to 3 percent slopes	9.9	2.1%
245B	Hinckley loamy sand, 3 to 8 percent slopes	18.0	3.8%
245C	Hinckley loamy sand, 8 to 15 percent slopes	25.5	5.4%
245E	Hinckley loamy sand, 15 to 35 percent slopes	46.7	9.8%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	8.7	1.8%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	6.0	1.3%
254E	Merrimac fine sandy loam 15 to 35 percent slopes	4.8	1.0%
255B	Windsor loamy sand, 3 to 8 percent slopes	5.3	1.1%
255C	Windsor loamy sand, 8 to 15 percent slopes	10.1	2.1%
255D	Windsor loamy sand, 15 to 25 percent slopes	8.2	1.7%
302B	Montauk fine sandy loam, 0 to 8 percent slopes, extremely stony	8.3	1.7%
302C	Montauk fine sandy loam, 8 to 15 percent slopes, extremely stony	5.4	1.1%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	0.0	0.0%
307C	Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony	8.0	1.7%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	3.7	0.8%
315B	Scituate fine sandy loam, 3 to 8 percent slopes	9.1	1.9%
317B	Scituate fine sandy loam, 3 to 8 percent slopes, extremely stony	35.8	7.5%
420B	Canton fine sandy loam, 3 to 8 percent slopes	16.7	3.5%
600	Pits, gravel	62.0	13.0%
651	Udorthents, smoothed	47.9	10.1%
Totals for Area of Interest		475.4	100.0%