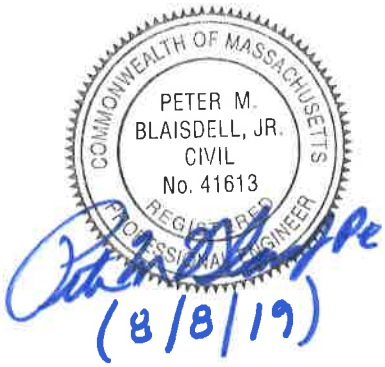
Project No. LYNF-0017

Prepared For:
MCS, LLC
7 Ashley Court
Lynnfield, MA 01940
781-334-4239 (Phone)

Parking Lot Recharge Design
Easterly Portion of Site

"#2 Broadway"
Lynnfield, Massachusetts
August 8, 2019



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Parking Lot Recharge Design
for easterly portion of site

#2 Broadway
Lynnfield, Massachusetts

August 8, 2019

Purpose:

The purpose of this analysis is to design appropriately sized sub-surface recharge area for storm events up to and including the 100-year storm event for the easterly portion of the proposed parking lot adjacent to Broadway (Newburyport Turnpike - Route 1) in order to compensate for the overage in impervious area from the previously approved plan submitted by Hancock Associates, revised through July 14, 2016.

Introduction:

Monastiero Consulting Services, LLC is planning to construct a 68-unit condominium development in a single four (4) story building. The existing site has remnants of a concrete foundation and paved parking areas which are currently overgrown. There are also areas comprised of fill and gravel that were part of former site development. The proposal is to redevelop the site with the construction of the condominium building, paved surface and subsurface parking areas, walkways, landscaping, sewer, water and a new drainage system for treatment of stormwater runoff. Stormwater will be managed through a series of drainage structures and basins that have been designed and approved in accordance with local state and federal regulations. Soil disturbing activities will include: razing existing foundations and parking areas; installing a stabilized construction exit; installing erosion and sediment controls; grading; excavation for the subsurface parking and stormwater treatment structures, utilities, building foundations; construction of parking areas; and preparation for final seeding, mulching, and landscaping.

As mentioned above, the proposed overage in impervious area from the approved plans is approximately 1,332 s.f., In order to be conservative in our design, we have designed the subsurface system to intercept and exfiltrate 2,000 s.f. of impervious area in order to mitigate the post-development runoff rates for the 2, 10- & 100-year storm events.

Existing Condition Soils Analysis:

In order to model the runoff parameters for both the existing and proposed watershed parameters, the parent soils on site were mapped using the Web Soil Survey (WSS) made available on the United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) website. The WSS provides vital soil data and information such as Hydrologic Soil Group (HSG) which is then input into a mathematical model to generate runoff curve numbers.

The user inputs the soil cover type as well as the hydrologic soil group to generate a weighted curve number (CN) and also uses the topography of the land to generate a time of concentration (Tc) from which the stormwater runoff rate as well as volume may be calculated for a certain watershed for comparison.

The WSS the soil in this portion of the project as Map Unit Symbol, 602, Urban land with no Hydrologic Soil Group rating. The area in the westerly portion of the site is listed as Map Symbol 102C, Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes with a Hydrologic Soil Group of "B".

On August 6, 2019, Williams & Sparages excavated and observed a test pit in the location for the proposed parking lot recharge system to confirm the soil texture currently in place. The material observed was comprised of approximately 36" of firm in place, sandy-loam fill over a looser, weak structure sandy-loam fill material down to a depth of 120. There was no groundwater encountered, no redox and no weeping observed in the test pit. Based on these results, we have assumed that the soils in the area of the proposed system will also behave with a hydrologic soil group of "B".

The proposed design of the parking lot recharge system will require the excavation and removal of the existing material within the proposed bed area down to the specified level and replaced with suitable backfill that meets the requirements set forth in the Cultec Specifications.

We have assumed a design infiltration rate through the bottom of the system equaling 1.02 inches per hour as found on Table 2-1 of the Hydrology Handbook for Conservation Commissioners, March 2002 for sandy loams.

Stormwater Modeling Methodology:

The mathematical model used in this analysis was provided using the HydroCAD 10.00-25 Version developed by HydroCAD Software Solutions LLC. HydroCAD is a program that is used to model the hydrology and hydraulics of stormwater runoff and is based largely on programs and techniques developed by the Soil Conservation Service (SCS) now known as the NRCS, specifically TR-20 and TR-55 as well as other hydraulic calculation methods.

HydroCAD allows the user, for a given rainfall event, to generate runoff hydrographs for single or multiple watersheds and is used to determine if a given drainage system is adequate under the desired conditions as well as to predict flooding or other impacts at specified locations such as erosion. In this analysis a 24-hour Type III distribution for using the Rainfall Data for Essex County using the information presented in the Adjusted Technical Paper 40 (TP-40) Design Storms.

Three (3) design storm events were analyzed and the results presented in the tables that follow for the ten (10) year, the twenty-five (25) year and one-hundred (100) year storm events for comparison.

Existing Condition Watershed:

Not Applicable

Proposed Condition Watershed:

The curve number for the pavement area to be captured was selected as 98 and a time of concentration of 6 minutes was assumed for the catchment area. A schematic of the mathematical model as well as the results of the calculations for the 2-year, 10-year, and 100-year, Type III, 24-hour storm events are included in this report.

In order to pre-treat the stormwater runoff from the parking area, we have specified a deep-sump catch basin with "The Eliminator" catch basin trap or approved equal as well as a Sediment & Oil Separator (SOS) before discharging to the Cultec System as shown on the revised plan.

Pretreatment: 44% TSS Removal (25% for CB; 25% for SOS)
Total Treatment: 85% TSS Removal (80% for Cultec System w/Pretreatment; 25% SOS)

Conclusion:

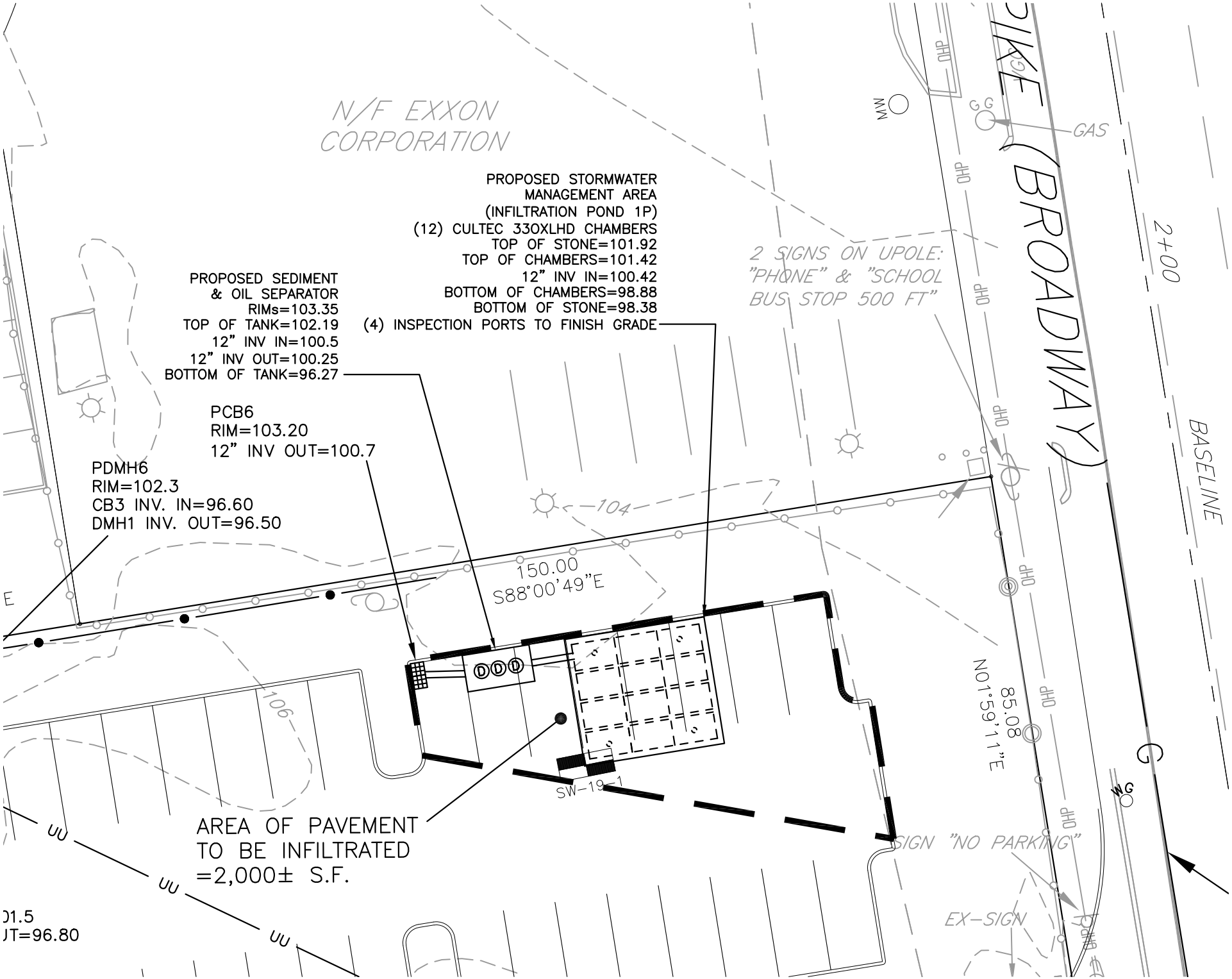
As can be seen by examining the following performance summary table for the parking lot recharge system, the design is effective for mitigating the peak flow rates of runoff from the selected paved area for the 2, 10, & 100-year storm events in accordance with the originally approved drainage analysis for the project.

Proposed Parking Lot Recharge System (HydroCAD 1P)

(12) Cultec Recharger 330XL HD Units
Top of Stone=101.92
Top of Chambers=101.42
12" Invert in=100.42 (From Sediment & Oil Separator)
Bottom of Chambers=98.88
Bottom of Stone=98.38
Install 4 Inspection Ports (IP's) where shown

24-hour Type III Storm Event (YR)	Peak Rate of Runoff In (Qin) cfs.	Peak Rate of Runoff Out (Qout) cfs.			Peak Water Level (W.L.) ft
		*Infiltration (Discarded)		Total Outflow	
2	0.16	0.01		0.01	99.17
10	0.24	0.01		0.01	99.57
100	0.35	0.01		0.01	100.28

* Calculated infiltration rate and peak water levels are based upon a rate of 1.02 inches per hour for NRCS Hydrologic Soil Group "B" as found on Table 2-1 of the Hydrology Handbook of Conservation Commissioners, March 2002 using Rawls, Brakensiek and Saxton, 1982.


N/F EXXON CORPORATION
PROPOSED STORMWATER MANAGEMENT AREA (INFILTRATION POND 1P)
(12) CULTEC 330XLHD CHAMBERS
TOP OF STONE=101.92
TOP OF CHAMBERS=101.42
12" INV IN=100.42
BOTTOM OF CHAMBERS=98.88
BOTTOM OF STONE=98.38
(4) INSPECTION PORTS TO FINISH GRADE
PROPOSED SEDIMENT & OIL SEPARATOR
RIMs=103.35
TOP OF TANK=102.19
12" INV IN=100.5
12" INV OUT=100.25
BOTTOM OF TANK=96.27
PCB6
RIM=103.20
12" INV OUT=100.7
PDMH6
RIM=102.3
CB3 INV. IN=96.60
DMH1 INV. OUT=96.50
2 SIGNS ON UPOLE: "PHONE" & "SCHOOL BUS STOP 500 FT"
GAS
BROADWAY)
2+00
BASELINE
104
106
150.00
S88°00'49"E
85.08
N01°59'11"E
SW-19-1
AREA OF PAVEMENT TO BE INFILTRATED =2,000± S.F.
SIGN "NO PARKING"
EX-SIGN
UU
OHP
WG
G G
01.5
UT=96.80

Easterly Portion of Parking Lot

Infiltration Chambers

Subcat Reach Pond Link

Routing Diagram for Proposed_Subsurface System
Prepared by HP Inc., Printed 8/8/2019
HydroCAD® 10.00-25 s/n 06611 © 2019 HydroCAD Software Solutions LLC

Summary for Subcatchment 1S: Easterly Portion of Parking Lot

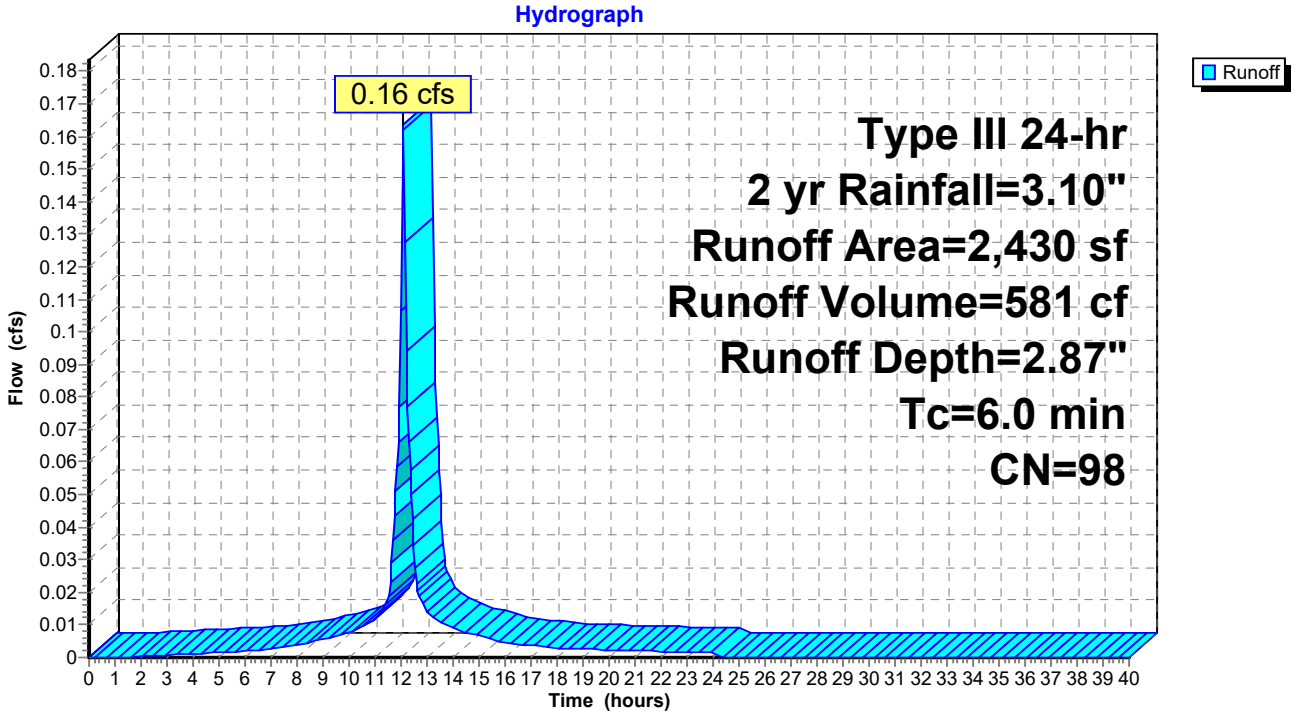
Runoff = 0.16 cfs @ 12.09 hrs, Volume= 581 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=3.10"

Area (sf)	CN	Description
2,430	98	Paved parking, HSG B
2,430		100.00% Impervious Area

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

Subcatchment 1S: Easterly Portion of Parking Lot



Summary for Pond 1P: Infiltration Chambers

Inflow Area = 2,430 sf,100.00% Impervious, Inflow Depth = 2.87" for 2 yr event
Inflow = 0.16 cfs @ 12.09 hrs, Volume= 581 cf
Outflow = 0.01 cfs @ 11.55 hrs, Volume= 581 cf, Atten= 93%, Lag= 0.0 min
Discarded = 0.01 cfs @ 11.55 hrs, Volume= 581 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 99.17' @ 13.24 hrs Surf.Area= 510 sf Storage= 224 cf

Plug-Flow detention time= 139.8 min calculated for 581 cf (100% of inflow)
Center-of-Mass det. time= 139.8 min (896.9 - 757.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	98.38'	455 cf	**20.83'W x 24.50'L x 3.54'H Field A** 1,808 cf Overall - 671 cf Embedded = 1,137 cf x 40.0% Voids
#2A	98.88'	671 cf	**Cultec R-330XLHD** x 12 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 4 rows
		1,125 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	98.38'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 11.55 hrs HW=98.42' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Pond 1P: Infiltration 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 4 rows

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

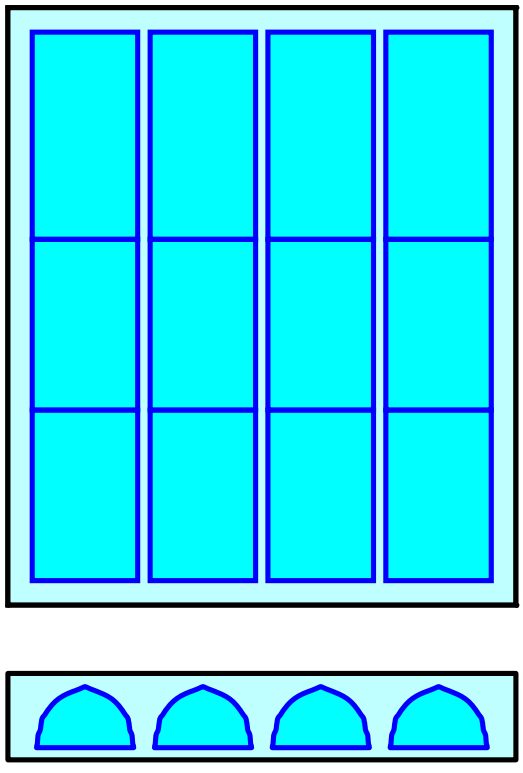
3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length
4 Rows x 52.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.83' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

12 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 4 Rows = 670.6 cf Chamber Storage

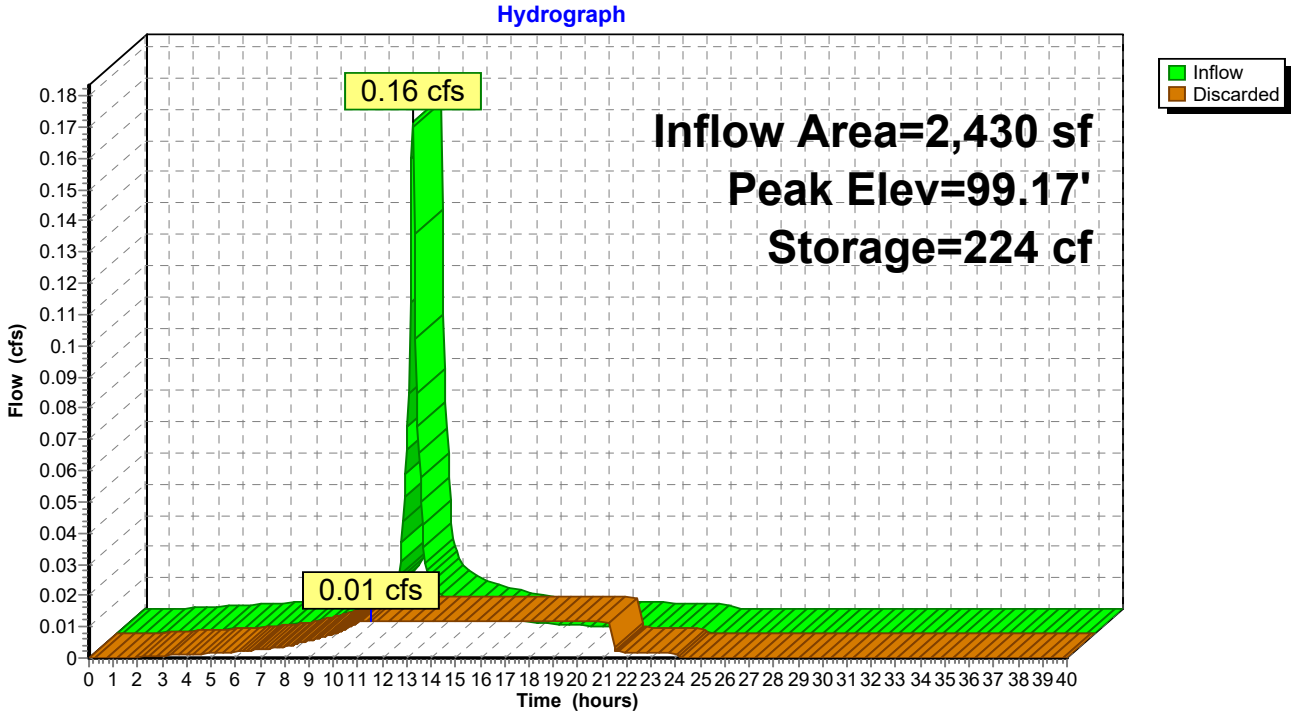
1,807.7 cf Field - 670.6 cf Chambers = 1,137.1 cf Stone x 40.0% Voids = 454.9 cf Stone Storage

Chamber Storage + Stone Storage = 1,125.4 cf = 0.026 af
Overall Storage Efficiency = 62.3%
Overall System Size = 24.50' x 20.83' x 3.54'

12 Chambers
67.0 cy Field
42.1 cy Stone



Pond 1P: Infiltration Chambers



Summary for Subcatchment 1S: Easterly Portion of Parking Lot

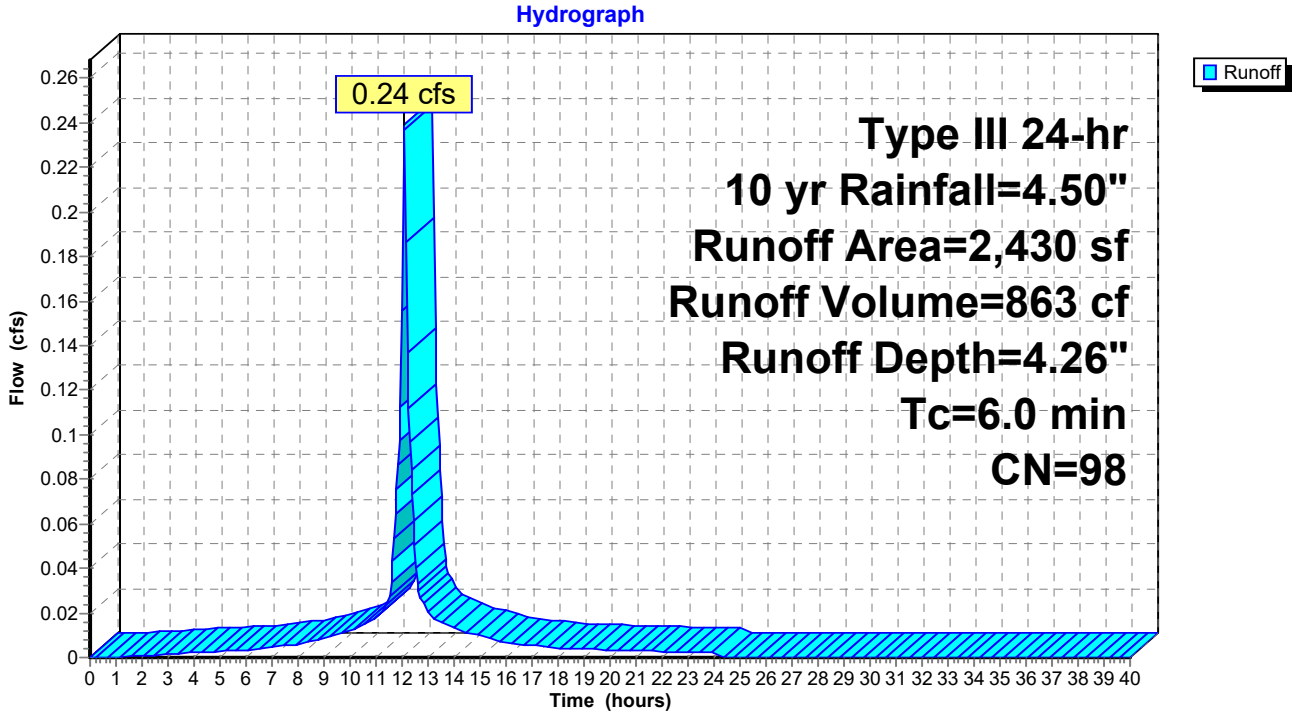
Runoff = 0.24 cfs @ 12.09 hrs, Volume= 863 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=4.50"

Area (sf)	CN	Description
2,430	98	Paved parking, HSG B
2,430		100.00% Impervious Area

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

Subcatchment 1S: Easterly Portion of Parking Lot



Summary for Pond 1P: Infiltration Chambers

Inflow Area = 2,430 sf,100.00% Impervious, Inflow Depth = 4.26" for 10 yr event
Inflow = 0.24 cfs @ 12.09 hrs, Volume= 863 cf
Outflow = 0.01 cfs @ 10.85 hrs, Volume= 863 cf, Atten= 95%, Lag= 0.0 min
Discarded = 0.01 cfs @ 10.85 hrs, Volume= 863 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 99.57' @ 14.20 hrs Surf.Area= 510 sf Storage= 389 cf

Plug-Flow detention time= 264.2 min calculated for 862 cf (100% of inflow)
Center-of-Mass det. time= 264.1 min (1,013.9 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	98.38'	455 cf	**20.83'W x 24.50'L x 3.54'H Field A** 1,808 cf Overall - 671 cf Embedded = 1,137 cf x 40.0% Voids
#2A	98.88'	671 cf	**Cultec R-330XLHD** x 12 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 4 rows
		1,125 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	98.38'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 10.85 hrs HW=98.42' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Pond 1P: Infiltration 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 4 rows

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

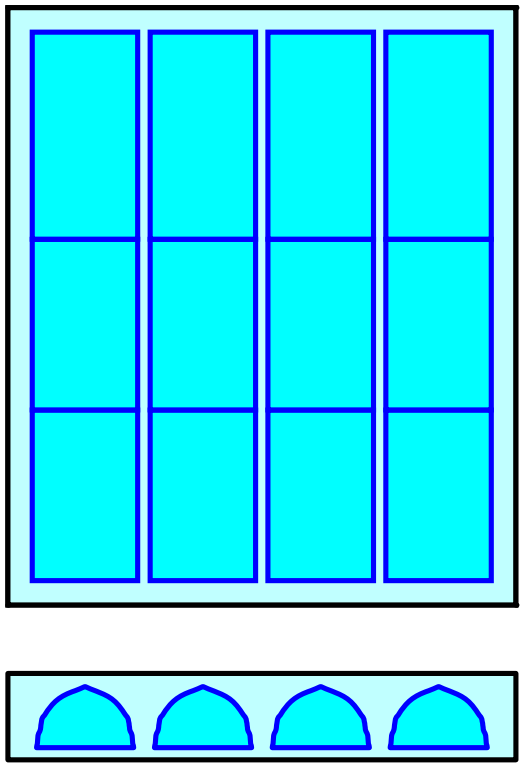
3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length
4 Rows x 52.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.83' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

12 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 4 Rows = 670.6 cf Chamber Storage

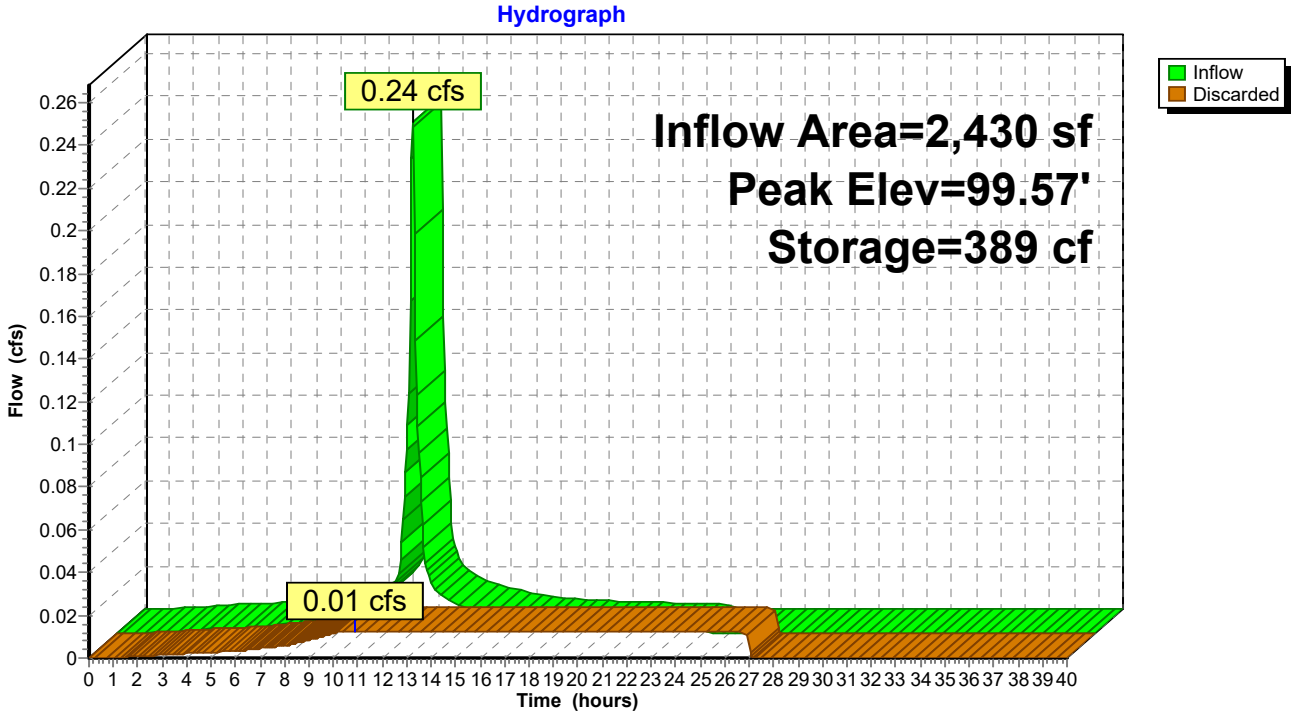
1,807.7 cf Field - 670.6 cf Chambers = 1,137.1 cf Stone x 40.0% Voids = 454.9 cf Stone Storage

Chamber Storage + Stone Storage = 1,125.4 cf = 0.026 af
Overall Storage Efficiency = 62.3%
Overall System Size = 24.50' x 20.83' x 3.54'

12 Chambers
67.0 cy Field
42.1 cy Stone



Pond 1P: Infiltration Chambers



Summary for Subcatchment 1S: Easterly Portion of Parking Lot

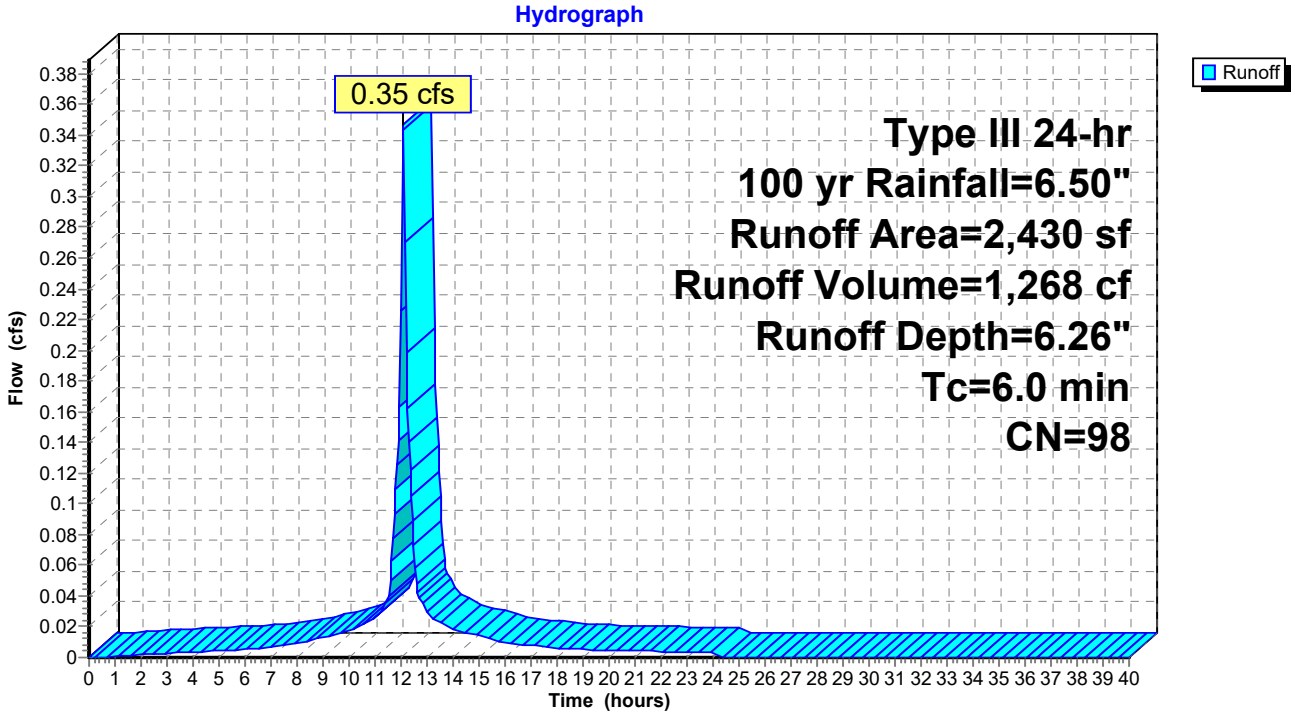
Runoff = 0.35 cfs @ 12.09 hrs, Volume= 1,268 cf, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.50"

Area (sf)	CN	Description
2,430	98	Paved parking, HSG B
2,430		100.00% Impervious Area

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

Subcatchment 1S: Easterly Portion of Parking Lot



Summary for Pond 1P: Infiltration Chambers

Inflow Area = 2,430 sf,100.00% Impervious, Inflow Depth = 6.26" for 100 yr event
Inflow = 0.35 cfs @ 12.09 hrs, Volume= 1,268 cf
Outflow = 0.01 cfs @ 9.65 hrs, Volume= 1,268 cf, Atten= 97%, Lag= 0.0 min
Discarded = 0.01 cfs @ 9.65 hrs, Volume= 1,268 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Peak Elev= 100.28' @ 15.48 hrs Surf.Area= 510 sf Storage= 670 cf

Plug-Flow detention time= 467.6 min calculated for 1,268 cf (100% of inflow)
Center-of-Mass det. time= 467.6 min (1,211.6 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	98.38'	455 cf	**20.83'W x 24.50'L x 3.54'H Field A** 1,808 cf Overall - 671 cf Embedded = 1,137 cf x 40.0% Voids
#2A	98.88'	671 cf	**Cultec R-330XLHD** x 12 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 4 rows
		1,125 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	98.38'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 9.65 hrs HW=98.42' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Pond 1P: Infiltration 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 4 rows

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

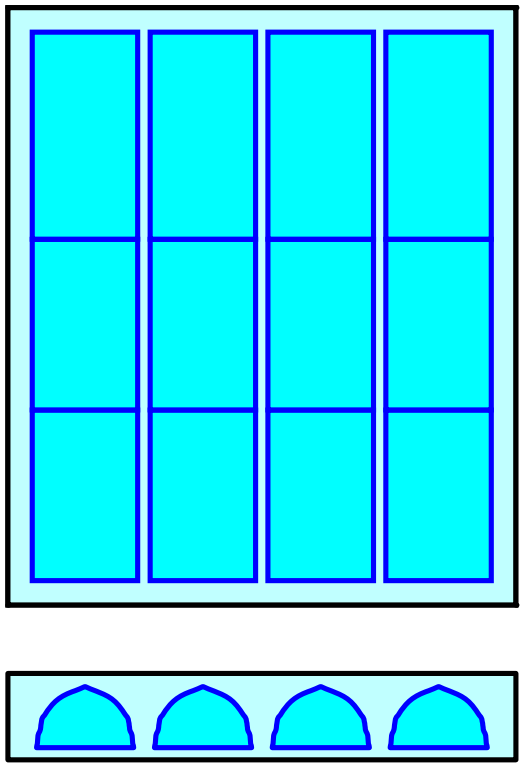
3 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 22.50' Row Length +12.0" End Stone x 2 = 24.50' Base Length
4 Rows x 52.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.83' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

12 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 4 Rows = 670.6 cf Chamber Storage

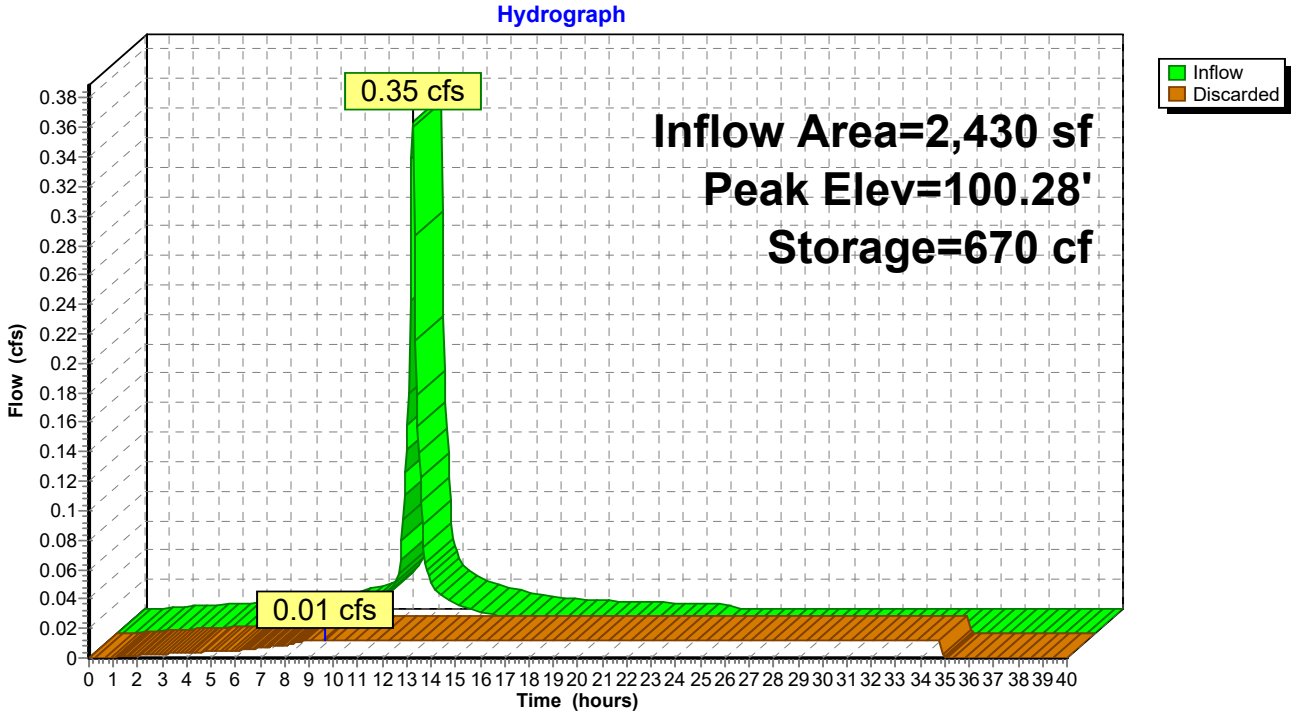
1,807.7 cf Field - 670.6 cf Chambers = 1,137.1 cf Stone x 40.0% Voids = 454.9 cf Stone Storage

Chamber Storage + Stone Storage = 1,125.4 cf = 0.026 af
Overall Storage Efficiency = 62.3%
Overall System Size = 24.50' x 20.83' x 3.54'

12 Chambers
67.0 cy Field
42.1 cy Stone



Pond 1P: Infiltration Chambers



Address: 2 Broadway Date: 8/6/19 Sunny, 85°

Soil Evaluator: T. Ackerly

Excavation Operator: _____ BOH Witness: N.A.

Land Use: Woods, Lawn, Pavement, Meadow / Residential, Commercial, Industrial

Slope: None, Slight, Moderate, Steep

Vegetation: Grass, Coniferous/Deciduous Trees, Wetland

Landform: Drumlin, Till Ridge, Ground Moraine, Moraine, Esker, Kame, Lake, Outwash Plain, Kettle, Flood Plain

Position on Landscape: Top, Middle, Bottom

SW-19-1

	Depth	Horizon	Texture	Color				Mottles	Fragments	Structure	Consist.
TP:	0	O a e i	Sand-F,M,C,V.C.								
	1	M	L. Sand								
	36	Fill (htm)	S. Loam-F., V.F.	N.A				N.A	10% Stones	—	firm
		u	Loam								
	36	A p	Sand-F,M,C,V.C.	2.5		1	1	Depth:	%	Str.less,W,M,S	Loose
		E	L. Sand	5	Y	2	2	_____	Grav:	Granular	V.Friable
	1	B w g h s	S. Loam-F., V.F.	7.5		3	3	Conc:	Cobb: 15	Blocky	Friable
		C 1 d g r	Loam			4	4	_____	Stone:	Platey	Firm
	120	R	Class III:_____	10	YR	5	5	Depl:	Bdlr: 20	Prismatic	V.Firm
		Fill (htm)	Class IV:_____	GL		6	6	_____		S.Ang.blocky	Ext.Firm
						7	7	ESHGW:		Columnar	
						8	8	_____		Sat/Damp	
						1	1	Depth:	%	Str.less,W,M,S	Loose
		A p	Sand-F,M,C,V.C.	2.5		2	2	_____	Grav:	Granular	V.Friable
		E	L. Sand	5	Y	3	3	Conc:	Cobb:	Blocky	Friable
		B w g h s	S. Loam- F., V.F.	7.5		4	4	_____	Stone:	Platey	Firm
		C 1 d g r	Loam			5	5	Depl:	Bdlr:	Prismatic	V.Firm
		R	Class III:_____	10	YR	6	6	_____		S.Ang.blocky	Ext.Firm
		Fill (htm)	Class IV:_____	GL		7	7	ESHGW:		Columnar	
						8	8	_____		Sat/Damp	
Weep						1	1	Depth:	%	Str.less,W,M,S	Loose
Y/N		A p	Sand-F,M,C,V.C.	2.5		2	2	_____	Grav:	Granular	V.Friable
		E	L. Sand	5	Y	3	3	Conc:	Cobb:	Blocky	Friable
		B w g h s	S. Loam- F., V.F.	7.5		4	4	_____	Stone:	Platey	Firm
		C 1 d g r	Loam			5	5	Depl:	Bdlr:	Prismatic	V.Firm
		R	Class III:_____	10	YR	6	6	_____		S.Ang.blocky	Ext.Firm
		Fill (htm)	Class IV:_____	GL		7	7	ESHGW:		Columnar	
						8	8	_____		Sat/Damp	
						1	1	Depth:	%	Str.less,W,M,S	Loose
		A p	Sand-F,M,C,V.C.	2.5		2	2	_____	Grav:	Granular	V.Friable
		E	L. Sand	5	Y	3	3	Conc:	Cobb:	Blocky	Friable
		B w g h s	S. Loam- F., V.F.	7.5		4	4	_____	Stone:	Platey	Firm
		C 1 d g r	Loam			5	5	Depl:	Bdlr:	Prismatic	V.Firm
Stand		R	Class III:_____	10	YR	6	6	_____		S.Ang.blocky	Ext.Firm
H20		Fill (htm)	Class IV:_____	GL		7	7	ESHGW:		Columnar	
						8	8	_____		Sat/Damp	
Y/N						1	1	Depth:	%	Str.less,W,M,S	Loose
		A p	Sand-F,M,C,V.C.	2.5		2	2	_____	Grav:	Granular	V.Friable
		E	L. Sand	5	Y	3	3	Conc:	Cobb:	Blocky	Friable
		B w g h s	S. Loam- F., V.F.	7.5		4	4	_____	Stone:	Platey	Firm
		C 1 d g r	Loam			5	5	Depl:	Bdlr:	Prismatic	V.Firm
		R	Class III:_____	10	YR	6	6	_____		S.Ang.blocky	Ext.Firm
		Fill (htm)	Class IV:_____	GL		7	7	ESHGW:		Columnar	
						8	8	_____		Sat/Damp	

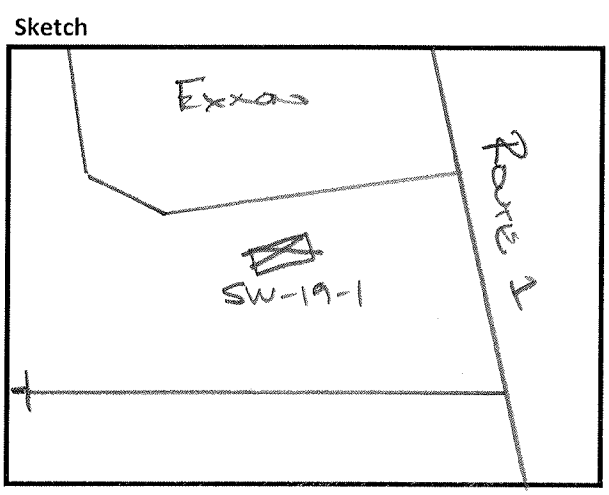
Gravel: 2mm to 3 inches Stones: 10 inches to 2 feet

Cobbles: 3 inches to 10 inches Boulders: > 2 feet

Perc Test

Hole# _____	Hole# _____
Shelf	Shelf
Bottom	Bottom
Start 15 Minute Presoak	Start 15 Minute Presoak
End 15 Minute Presoak (12")	End 15 Minute Presoak (12")
Time at 9"_____	Time at 9"_____
Time at 6"_____	Time at 6"_____
Time 9"-6" ____	Time 9"-6" ____
Rate:	Rate:

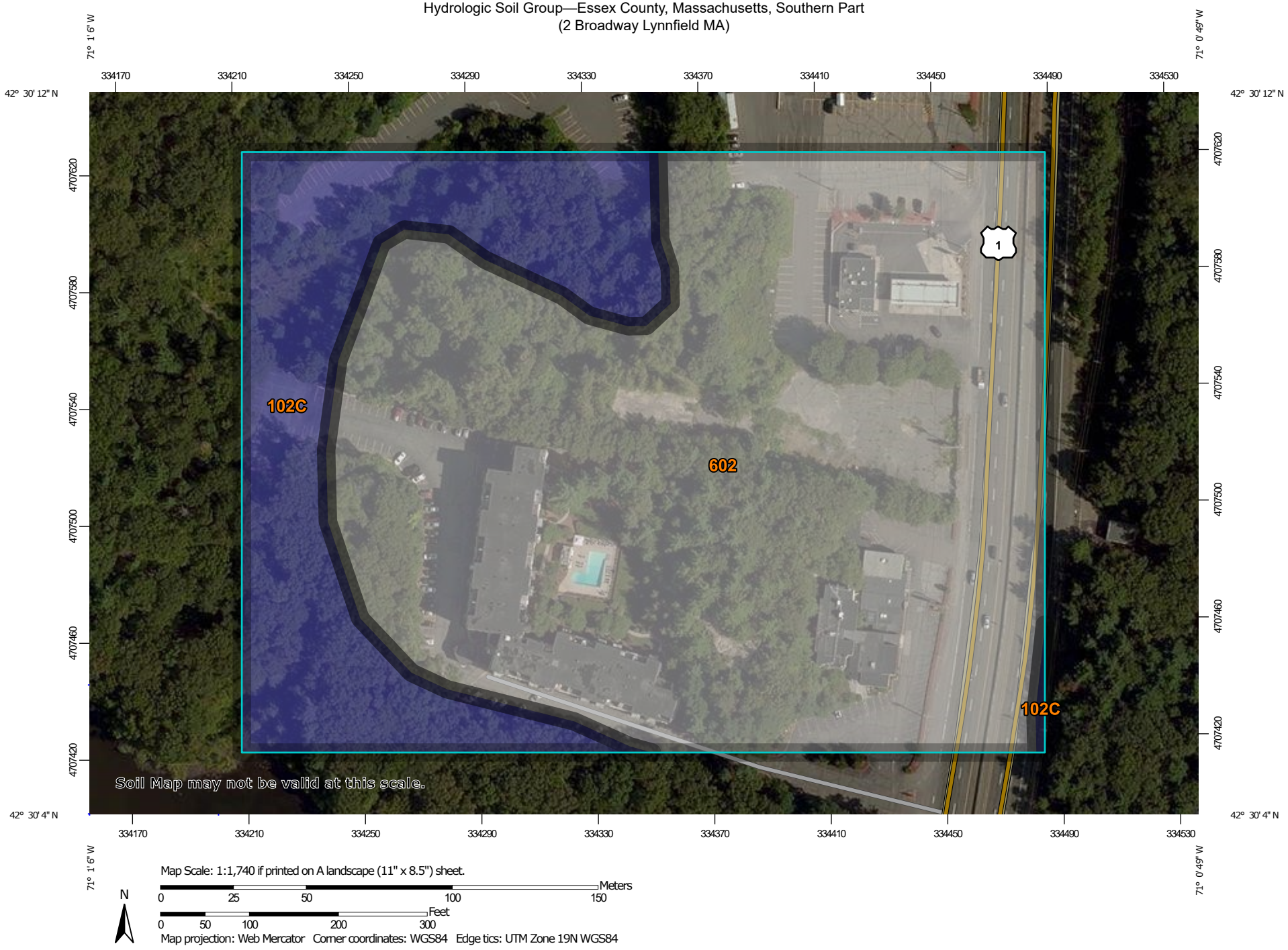
Sketch



Other notes:

For Stormwater Design only

Hydrologic Soil Group—Essex County, Massachusetts, Southern Part
(2 Broadway Lynnfield MA)



Map Scale: 1:1,740 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Essex County, Massachusetts, Southern Part
Survey Area Data: Version 15, Sep 7, 2018

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

Date(s) aerial images were photographed: Aug 10, 2014—Aug 25, 2014

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
102C	Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes	B	3.4	24.4%
602	Urban land		10.6	75.6%
Totals for Area of Interest			**14.1**	**100.0%**

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