THOMPSON-LISTON ASSOCIATES, INC.
Professional Engineers Professional Land Surveyors
Erosion Control Specialists
P O Box 570, Boylston MA 01505
info@tlainc.net (508) 869-6151

Drainage Report
4-6 Barrows Road, Worcester, MA
Prepared for CLEB, LLC

July 3, 2024

OBJECTIVE: To infiltrate one inch of runoff from the new impervious surfaces.

METHODOLOGY: The new roof areas include the house and paved driveway. We determined that the gross increase in impervious cover, considering the existing home and garage to be demolished, will be: 5,374 – 1,710 = 3,664 sq. ft. We propose to mitigate the increase in impervious cover by constructing one infiltration BMP on each of the two lots, 4 and 6 Barrows Road, to provide recharge of the runoff from these impervious surfaces. By directing all of the roof runoff to infiltration BMPs, the resulting net impervious area represents a reduction from the present condtions: existing: 1,710 s.f., net proposed impervious area: 1,502 s.f. .

We propose an infiltration system consisting of eight prefabricated high density polyethylene chambers (C-100 as manufactured by Cultec) set in a bed, or envelope of crushed stone on each lot. The dimensions of the crushed stone bed and chambers are shown on the plans.

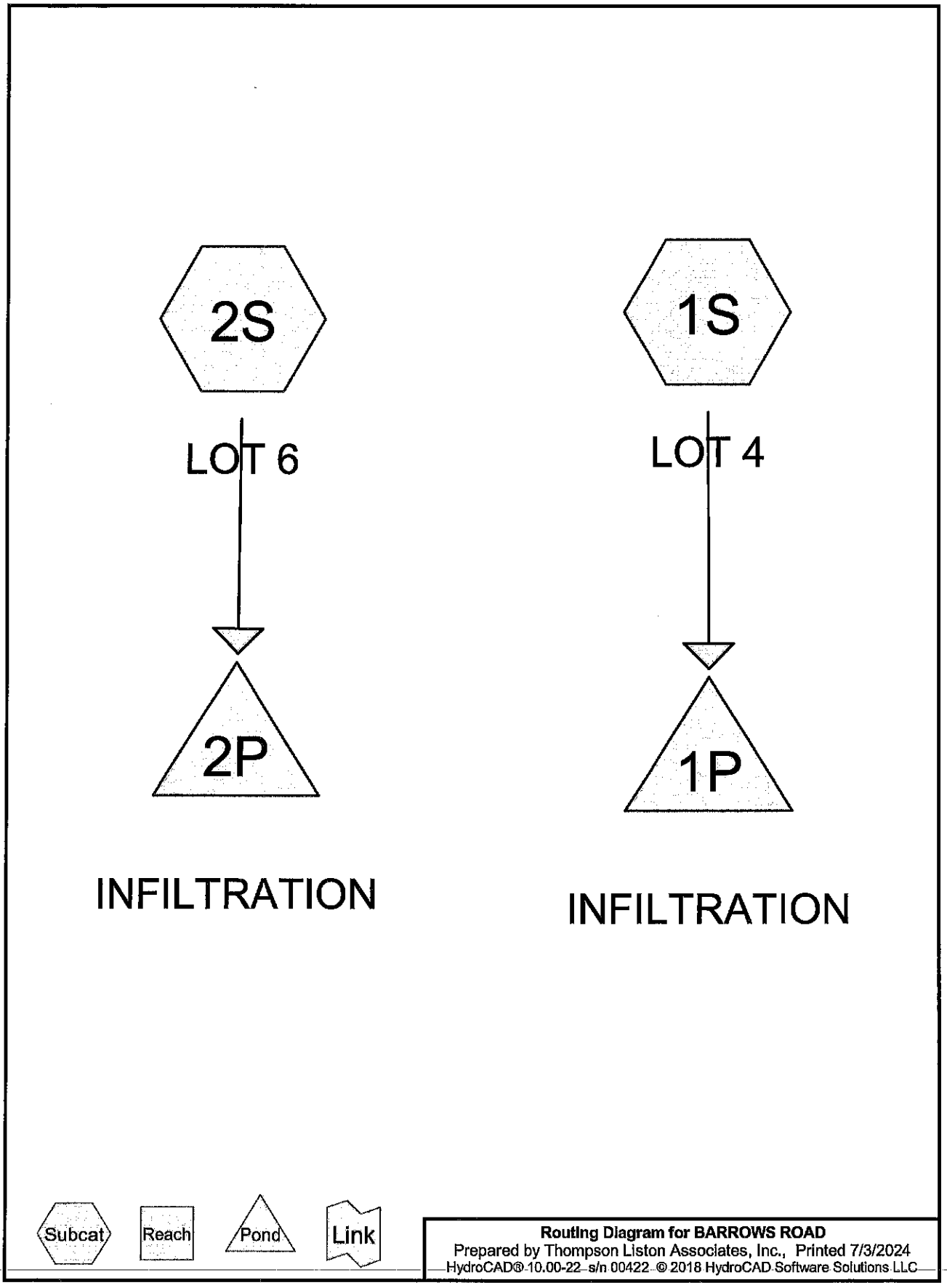
The contributing areas and structures are modeled in the accompanying summary report printout from the HydroCAD^{tm} Stormwater Modeling software. As this system is designed, it is "online" meaning the infiltration BMPs will continue to function throughout the storms and will not be bypassed. If it becomes full however, from larger rainfall, an overflow is provided at the lowest downspout.

SUMMARY: Our calculations show that the infiltration measures are suitably sized for the volume of runoff that will reach them from a minimum of 1" of rainfall, and in fact, will contain up to approximately 4.6 inches of rainfall, the statistical 10-year storm.

Respectfully submitted,

THOMPSON-LISTON ASSOCIATES, INC.

Patrick J. Healy, P.E.
Principal


2S
LOT 6
2P
INFILTRATION
1S
LOT 4
1P
INFILTRATION
Subcat
Reach
Pond
Link
Routing Diagram for BARROWS ROAD
Prepared by Thompson Liston Associates, Inc., Printed 7/3/2024
HydroCAD® 10.00-22 s/n 00422 © 2018 HydroCAD Software Solutions LLC

Summary for Subcatchment 1S: LOT 4

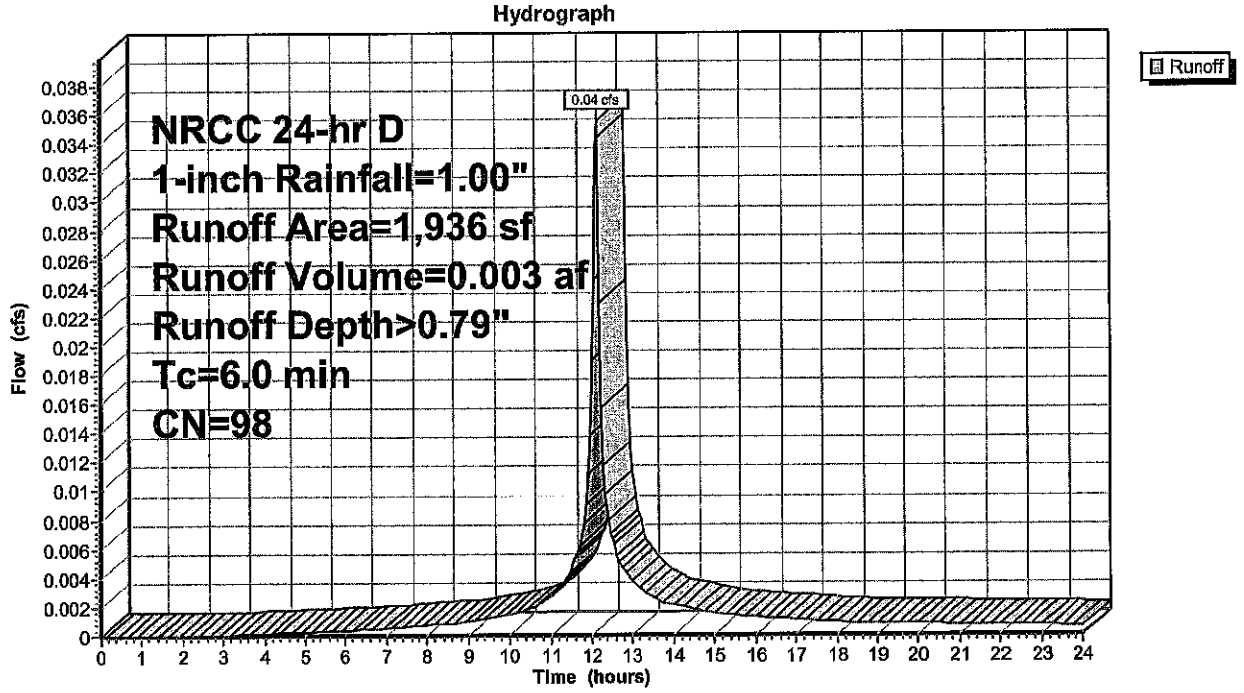
Runoff = 0.04 cfs @ 12.13 hrs, Volume= 0.003 af, Depth> 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-inch Rainfall=1.00"

	Area (sf)	CN	Description
*	1,936	98	ROOF
	1,936		100.00% Impervious Area

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

Subcatchment 1S: LOT 4



Summary for Subcatchment 2S: LOT 6

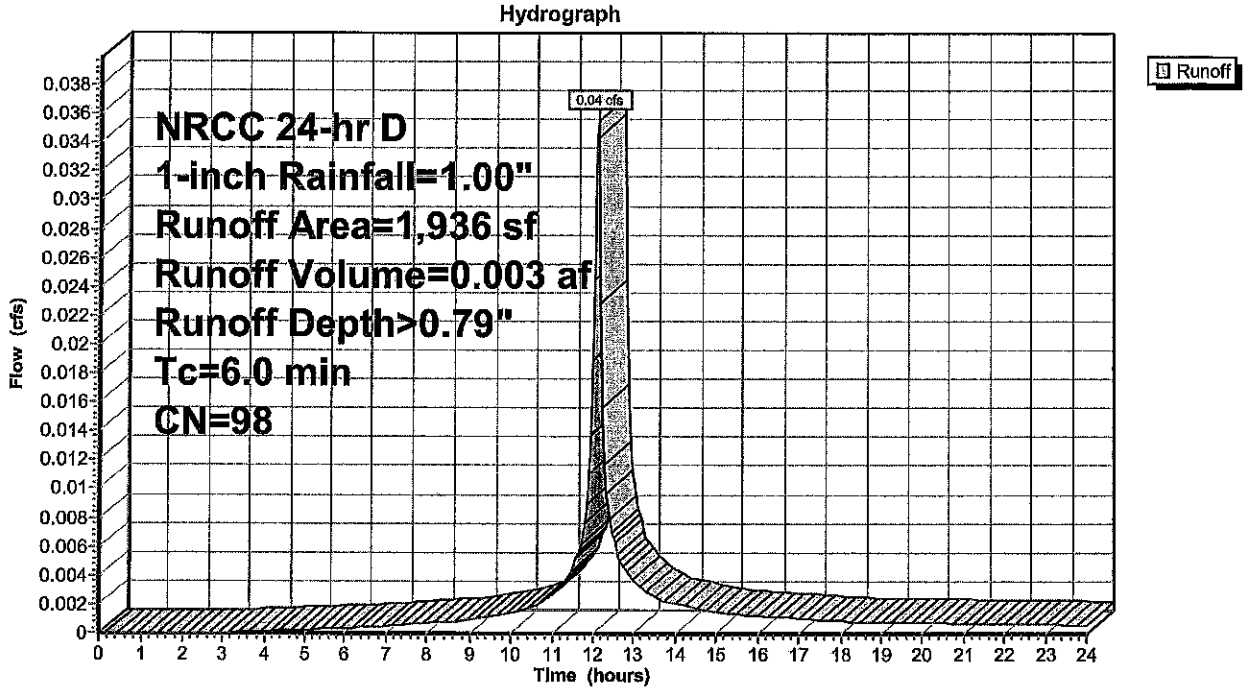
Runoff = 0.04 cfs @ 12.13 hrs, Volume= 0.003 af, Depth> 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 1-inch Rainfall=1.00"

	Area (sf)	CN	Description
*	1,936	98	ROOF
	1,936		100.00% Impervious Area

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

Subcatchment 2S: LOT 6



Summary for Pond 1P: INFILTRATION

Test pit INFIL-1 used

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth > 0.79" for 1-inch event
Inflow = 0.04 cfs @ 12.13 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.05 hrs, Volume= 0.003 af, Atten= 58%, Lag= 0.0 min
Discarded = 0.02 cfs @ 12.05 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 814.13' @ 12.26 hrs Surf.Area= 271 sf Storage= 14 cf

Plug-Flow detention time= 5.9 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 5.1 min (804.0 - 798.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	814.00'	176 cf	**8.33'W x 32.50'L x 2.04'H Field A** 553 cf Overall - 114 cf Embedded = 439 cf x 40.0% Voids
#2A	814.50'	114 cf	**Cultec C-100HD** x 8 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 2 rows
#3	815.00'	1 cf	**4.0" Round Pipe Storage** -Impervious L= 10.0' S= 0.0100 '/'
#4	815.10'	0 cf	**0.33'D x 2.33'H Vertical Cone/Cylinder** -Impervious
		290 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	814.00'	**2.410 in/hr Exfiltration over Horizontal area**
#2	Primary	816.50'	**2.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.02 cfs @ 12.05 hrs HW=814.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=814.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: INFILTRATION - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 2 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

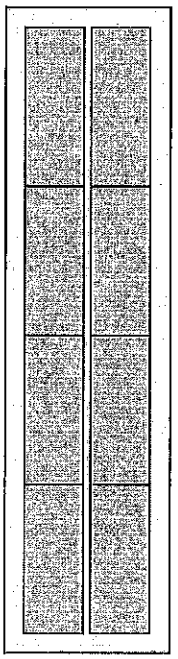
4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +12.0" End Stone x 2 = 32.50' Base Length
2 Rows x 36.0" Wide + 4.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.33' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

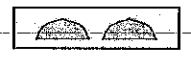
8 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 2 Rows = 113.6 cf Chamber Storage

553.0 cf Field - 113.6 cf Chambers = 439.4 cf Stone x 40.0% Voids = 175.8 cf Stone Storage

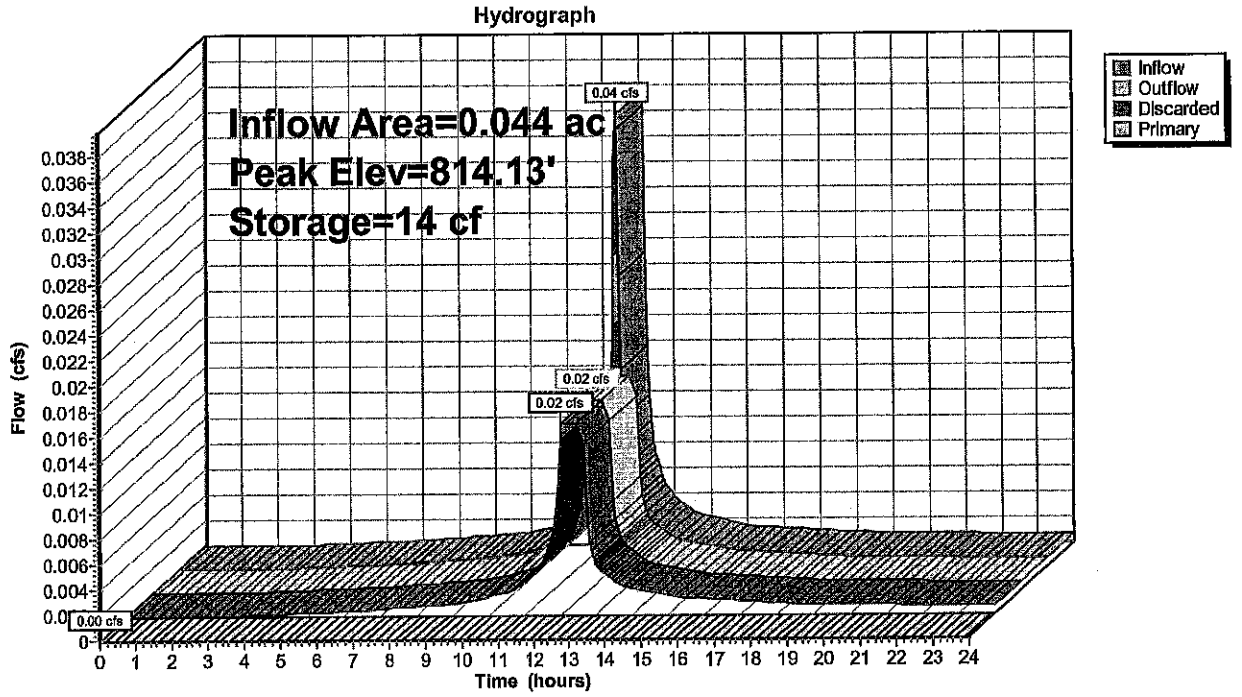
Chamber Storage + Stone Storage = 289.3 cf = 0.007 af
Overall Storage Efficiency = 52.3%
Overall System Size = 32.50' x 8.33' x 2.04'

8 Chambers
20.5 cy Field
16.3 cy Stone





Pond 1P: INFILTRATION



Summary for Pond 2P: INFILTRATION

Test pit INFIL-6 used

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth > 0.79" for 1-inch event
Inflow = 0.04 cfs @ 12.13 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.05 hrs, Volume= 0.003 af, Atten= 58%, Lag= 0.0 min
Discarded = 0.02 cfs @ 12.05 hrs, Volume= 0.003 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 820.63' @ 12.26 hrs Surf.Area= 0.006 ac Storage= 0.000 af

Plug-Flow detention time= 6.5 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 5.6 min (804.5 - 798.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	820.50'	0.004 af	**8.33'W x 32.50'L x 2.04'H Field A** 0.013 af Overall - 0.003 af Embedded = 0.010 af x 40.0% Voids
#2A	821.00'	0.003 af	**Cultec C-100HD** x 8 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 2 rows
#3	821.50'	0.000 af	**4.0" Round Pipe Storage** L= 10.0' S= 0.0100 '/'
		0.007 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	820.50'	**2.410 in/hr Exfiltration over Horizontal area**
#2	Primary	824.30'	**2.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.02 cfs @ 12.05 hrs HW=820.55' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=820.50' (Free Discharge)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: INFILTRATION - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 2 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

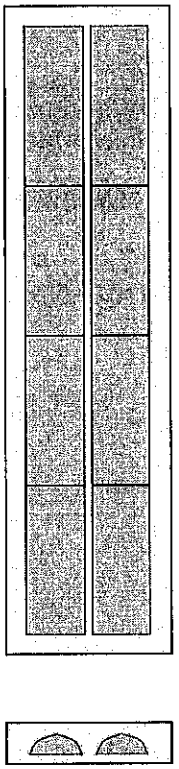
4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +12.0" End Stone x 2 = 32.50' Base Length
2 Rows x 36.0" Wide + 4.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.33' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

8 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 2 Rows = 113.6 cf Chamber Storage

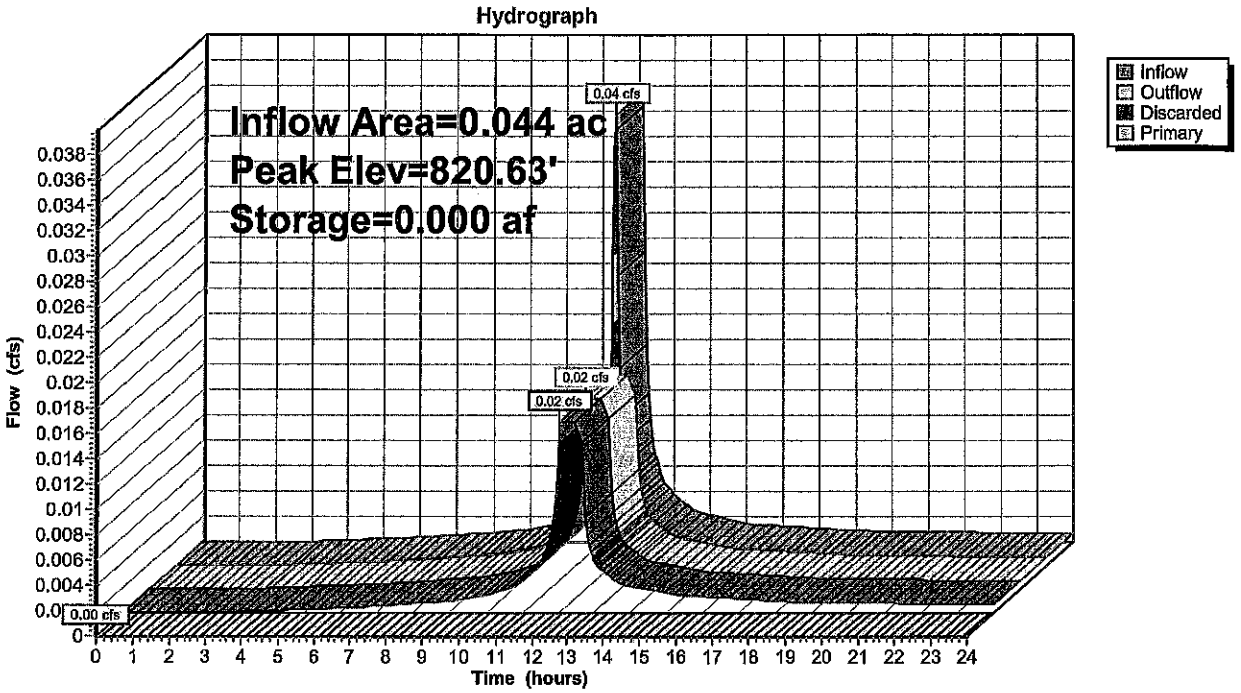
553.0 cf Field - 113.6 cf Chambers = 439.4 cf Stone x 40.0% Voids = 175.8 cf Stone Storage

Chamber Storage + Stone Storage = 289.3 cf = 0.007 af
Overall Storage Efficiency = 52.3%
Overall System Size = 32.50' x 8.33' x 2.04'

8 Chambers
20.5 cy Field
16.3 cy Stone



Pond 2P: INFILTRATION



Summary for Subcatchment 1S: LOT 4

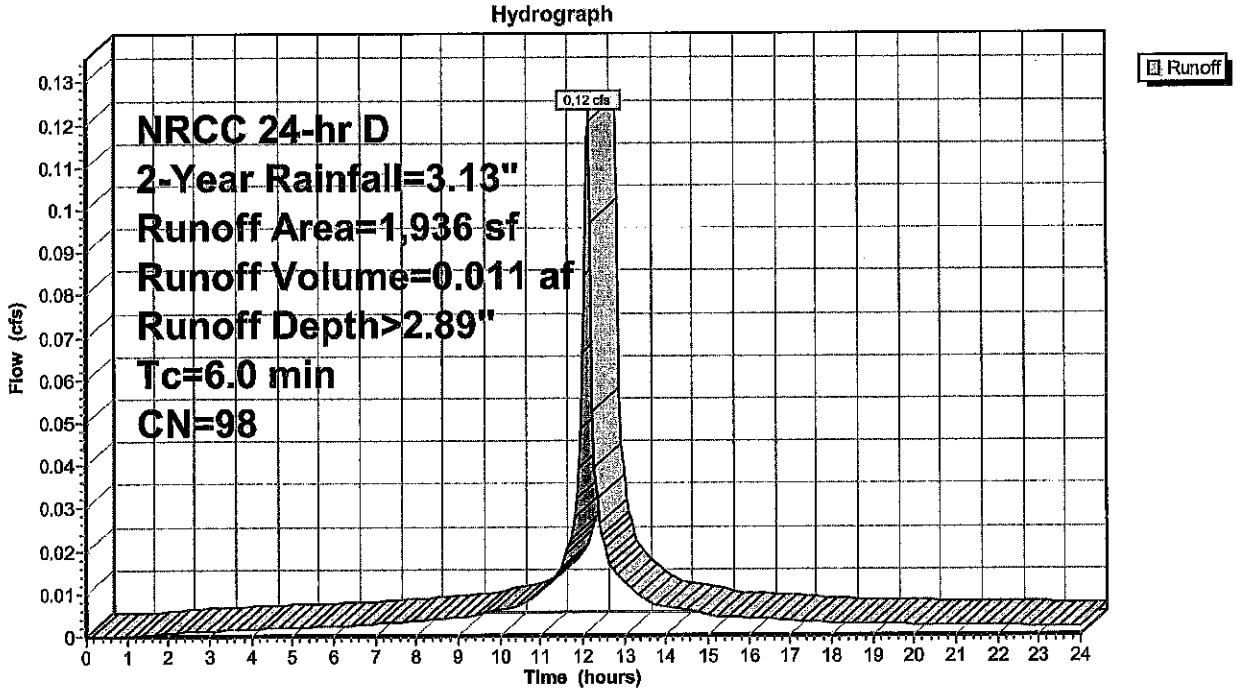
Runoff = 0.12 cfs @ 12.13 hrs, Volume= 0.011 af, Depth> 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

	Area (sf)	CN	Description
*	1,936	98	ROOF
	1,936		100.00% Impervious Area

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

Subcatchment 1S: LOT 4



Summary for Subcatchment 2S: LOT 6

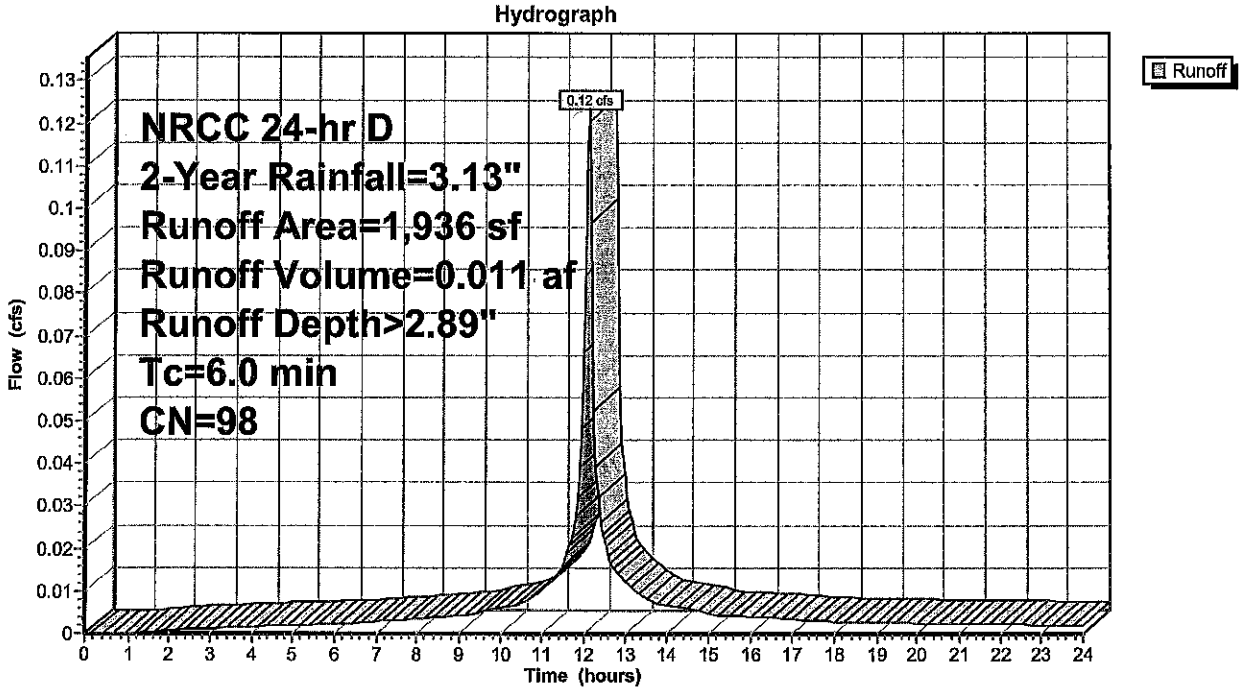
Runoff = 0.12 cfs @ 12.13 hrs, Volume= 0.011 af, Depth> 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 2-Year Rainfall=3.13"

	Area (sf)	CN	Description
*	1,936	98	ROOF
	1,936		100.00% Impervious Area

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

Subcatchment 2S: LOT 6



Summary for Pond 1P: INFILTRATION

Test pit INFIL-1 used

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth > 2.89" for 2-Year event
Inflow = 0.12 cfs @ 12.13 hrs, Volume= 0.011 af
Outflow = 0.02 cfs @ 11.55 hrs, Volume= 0.011 af, Atten= 87%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.55 hrs, Volume= 0.011 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 814.80' @ 12.76 hrs Surf.Area= 271 sf Storage= 114 cf

Plug-Flow detention time= 43.4 min calculated for 0.011 af (100% of inflow)
Center-of-Mass det. time= 42.7 min (803.0 - 760.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	814.00'	176 cf	**8.33'W x 32.50'L x 2.04'H Field A** 553 cf Overall - 114 cf Embedded = 439 cf x 40.0% Voids
#2A	814.50'	114 cf	**Cultec C-100HD** x 8 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 2 rows
#3	815.00'	1 cf	**4.0" Round Pipe Storage** -Impervious L= 10.0' S= 0.0100 '/'
#4	815.10'	0 cf	**0.33'D x 2.33'H Vertical Cone/Cylinder** -Impervious
		290 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	814.00'	**2.410 in/hr Exfiltration over Horizontal area**
#2	Primary	816.50'	**2.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.02 cfs @ 11.55 hrs HW=814.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=814.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: INFILTRATION - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 2 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

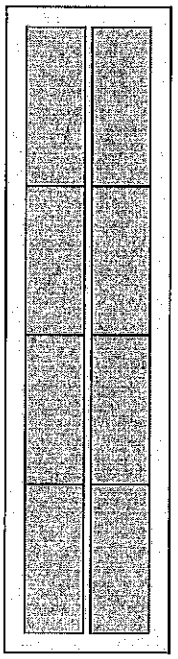
4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +12.0" End Stone x 2 = 32.50' Base Length
2 Rows x 36.0" Wide + 4.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.33' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

8 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 2 Rows = 113.6 cf Chamber Storage

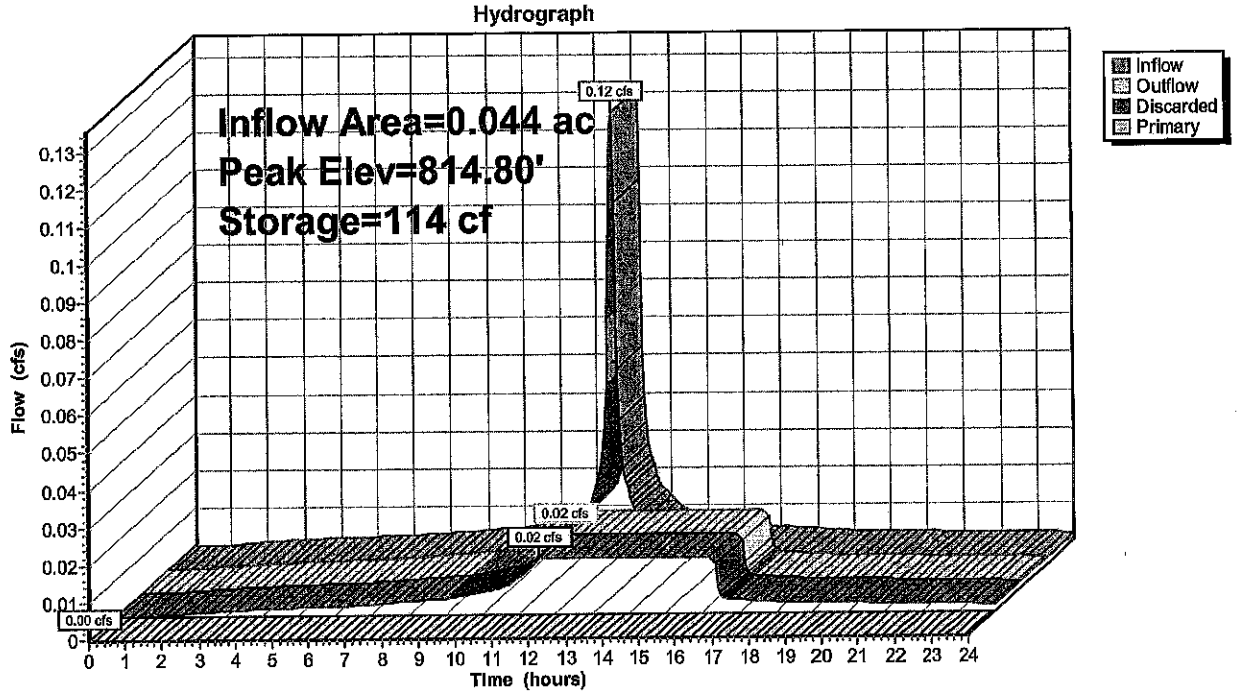
553.0 cf Field - 113.6 cf Chambers = 439.4 cf Stone x 40.0% Voids = 175.8 cf Stone Storage

Chamber Storage + Stone Storage = 289.3 cf = 0.007 af
Overall Storage Efficiency = 52.3%
Overall System Size = 32.50' x 8.33' x 2.04'

8 Chambers
20.5 cy Field
16.3 cy Stone



Pond 1P: INFILTRATION



Summary for Pond 2P: INFILTRATION

Test pit INFIL-6 used

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth > 2.89" for 2-Year event
Inflow = 0.12 cfs @ 12.13 hrs, Volume= 0.011 af
Outflow = 0.02 cfs @ 11.55 hrs, Volume= 0.011 af, Atten= 87%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.55 hrs, Volume= 0.011 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 821.30' @ 12.76 hrs Surf.Area= 0.006 ac Storage= 0.003 af

Plug-Flow detention time= 44.1 min calculated for 0.011 af (100% of inflow)
Center-of-Mass det. time= 43.2 min (803.5 - 760.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	820.50'	0.004 af	**8.33'W x 32.50'L x 2.04'H Field A** 0.013 af Overall - 0.003 af Embedded = 0.010 af x 40.0% Voids
#2A	821.00'	0.003 af	**Cultec C-100HD** x 8 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 2 rows
#3	821.50'	0.000 af	**4.0" Round Pipe Storage** L= 10.0' S= 0.0100 '/'
		0.007 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	820.50'	**2.410 in/hr Exfiltration over Horizontal area**
#2	Primary	824.30'	**2.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.02 cfs @ 11.55 hrs HW=820.54' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=820.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: INFILTRATION - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 2 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +12.0" End Stone x 2 = 32.50' Base Length
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6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

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553.0 cf Field - 113.6 cf Chambers = 439.4 cf Stone x 40.0% Voids = 175.8 cf Stone Storage

Chamber Storage + Stone Storage = 289.3 cf = 0.007 af
Overall Storage Efficiency = 52.3%
Overall System Size = 32.50' x 8.33' x 2.04'

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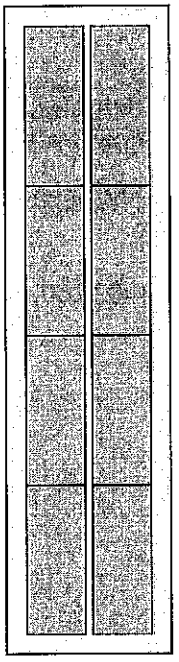
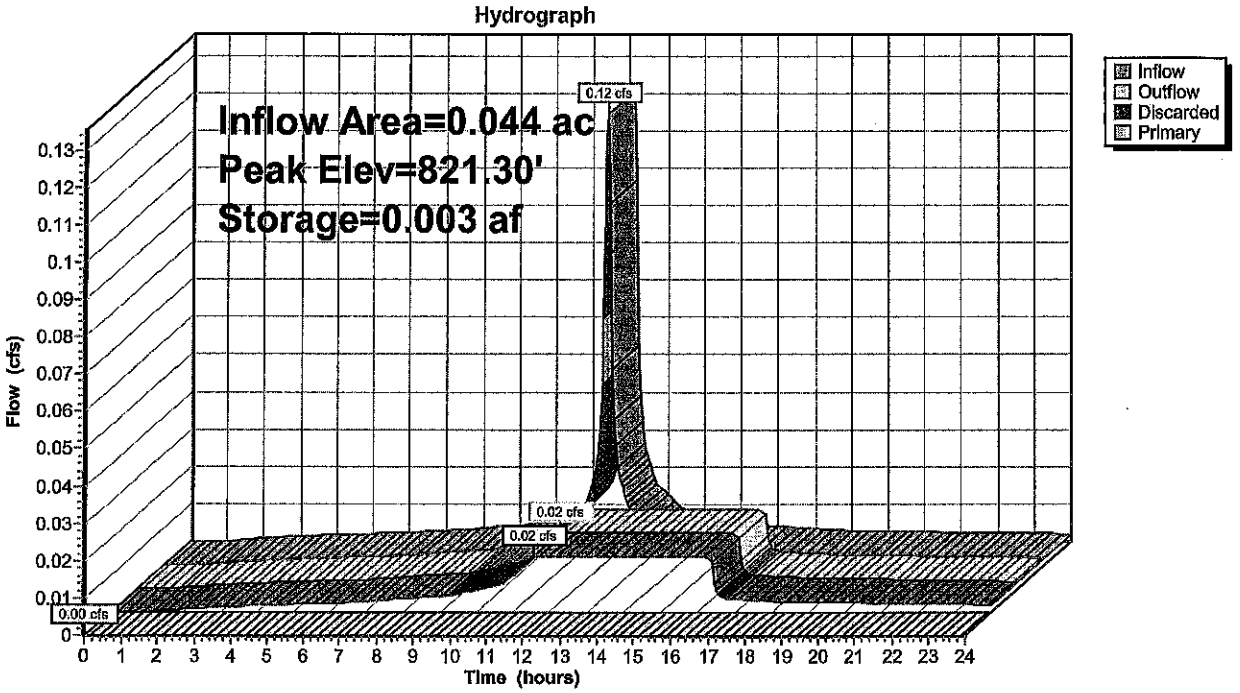
16.3 cy Stone



Pond 2P: INFILTRATION



Summary for Subcatchment 1S: LOT 4

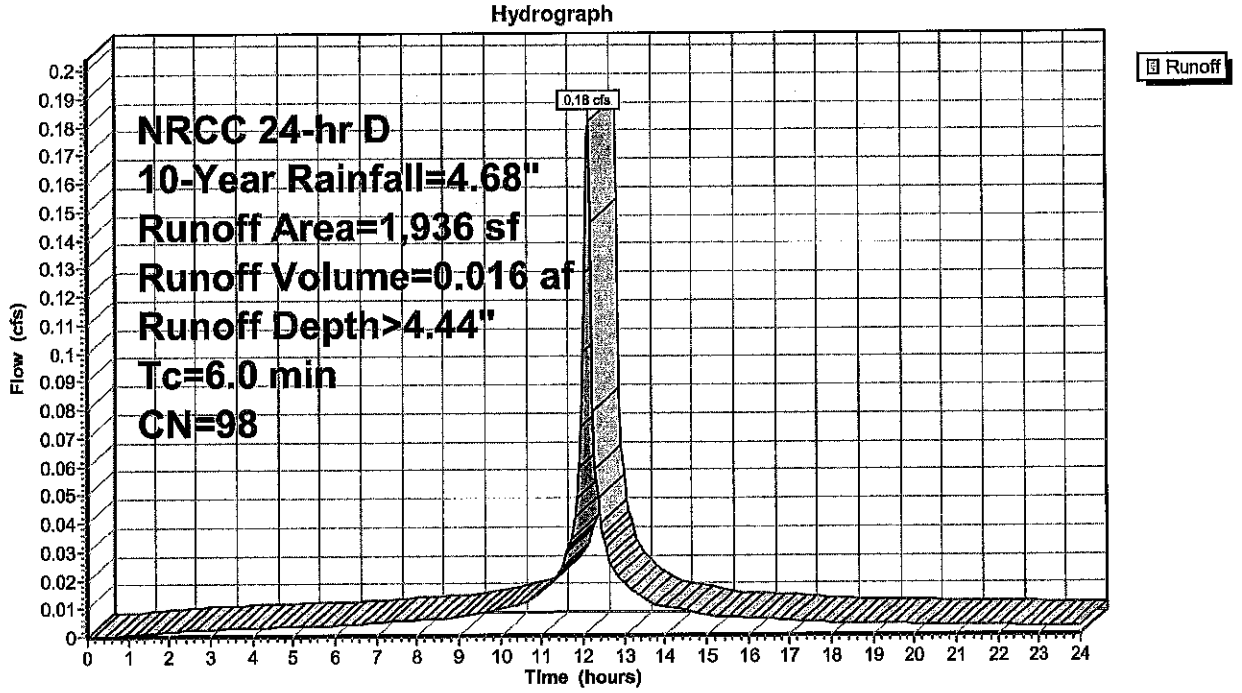
Runoff = 0.18 cfs @ 12.13 hrs, Volume= 0.016 af, Depth> 4.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
NRCC 24-hr D 10-Year Rainfall=4.68"

	Area (sf)	CN	Description
*	1,936	98	ROOF
	1,936		100.00% Impervious Area

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

Subcatchment 1S: LOT 4



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Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
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	Area (sf)	CN	Description
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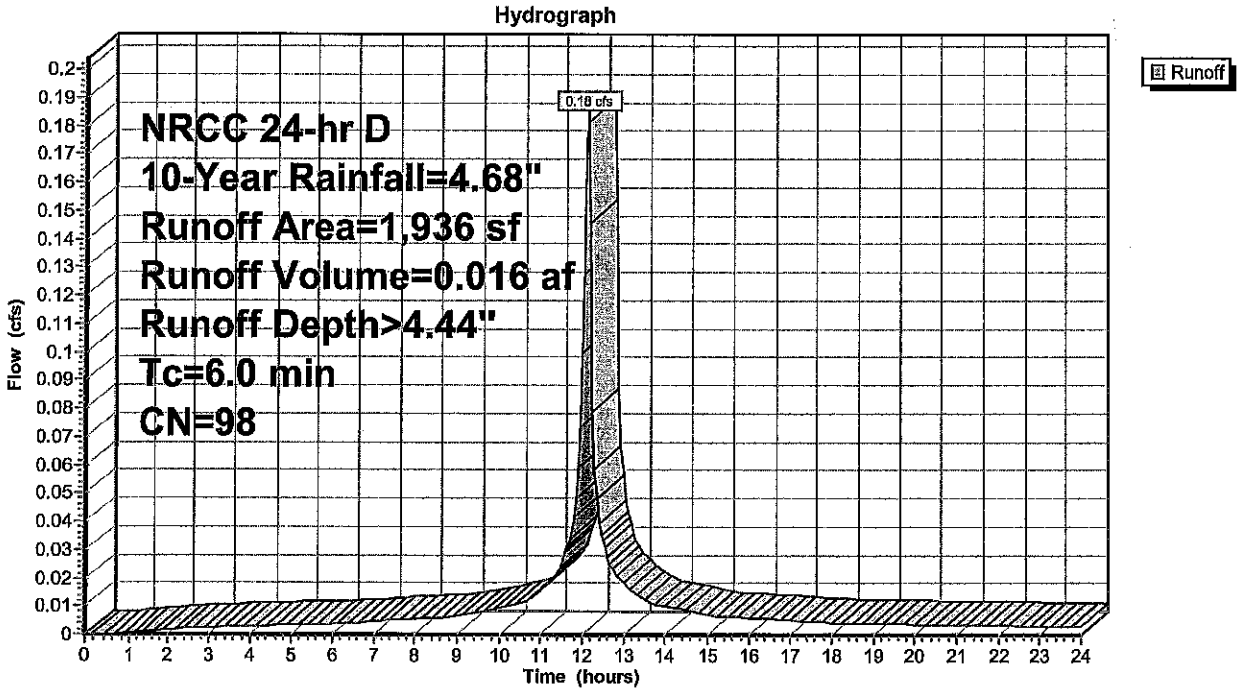
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2S: LOT 6



Summary for Pond 1P: INFILTRATION

Test pit INFIL-1 used

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth > 4.44" for 10-Year event
Inflow = 0.18 cfs @ 12.13 hrs, Volume= 0.016 af
Outflow = 0.02 cfs @ 11.05 hrs, Volume= 0.016 af, Atten= 92%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.05 hrs, Volume= 0.016 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 815.40' @ 13.27 hrs Surf.Area= 271 sf Storage= 219 cf

Plug-Flow detention time= 96.4 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 95.5 min (846.6 - 751.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	814.00'	176 cf	**8.33'W x 32.50'L x 2.04'H Field A** 553 cf Overall - 114 cf Embedded = 439 cf x 40.0% Voids
#2A	814.50'	114 cf	**Cultec C-100HD** x 8 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 2 rows
#3	815.00'	1 cf	**4.0" Round Pipe Storage** -Impervious L= 10.0' S= 0.0100 '/'
#4	815.10'	0 cf	**0.33'D x 2.33'H Vertical Cone/Cylinder** -Impervious
		290 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	814.00'	**2.410 in/hr Exfiltration over Horizontal area**
#2	Primary	816.50'	**2.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.02 cfs @ 11.05 hrs HW=814.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=814.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: INFILTRATION - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 2 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

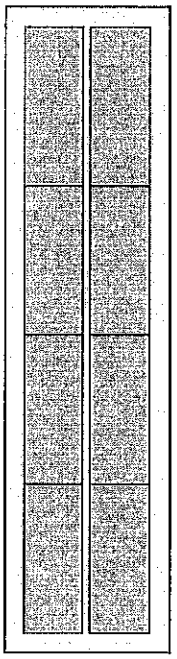
4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +12.0" End Stone x 2 = 32.50' Base Length
2 Rows x 36.0" Wide + 4.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.33' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

8 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 2 Rows = 113.6 cf Chamber Storage

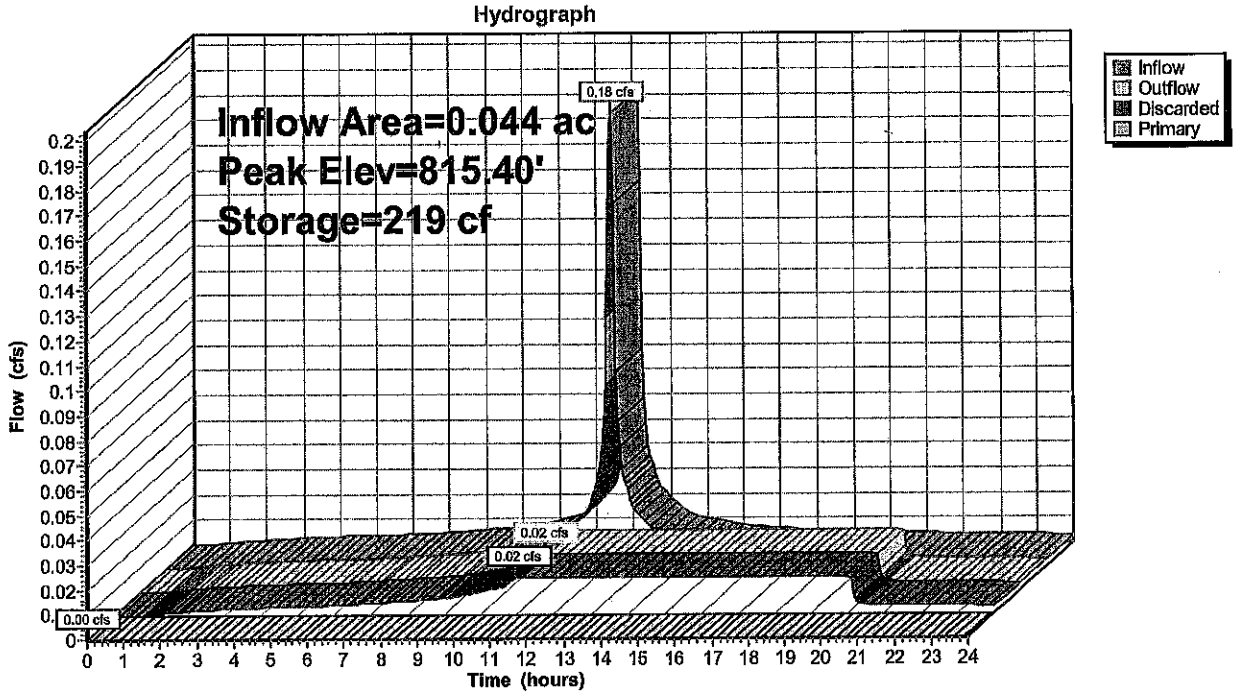
553.0 cf Field - 113.6 cf Chambers = 439.4 cf Stone x 40.0% Voids = 175.8 cf Stone Storage

Chamber Storage + Stone Storage = 289.3 cf = 0.007 af
Overall Storage Efficiency = 52.3%
Overall System Size = 32.50' x 8.33' x 2.04'

8 Chambers
20.5 cy Field
16.3 cy Stone



Pond 1P: INFILTRATION



Summary for Pond 2P: INFILTRATION

Test pit INFIL-6 used

Inflow Area = 0.044 ac,100.00% Impervious, Inflow Depth > 4.44" for 10-Year event
Inflow = 0.18 cfs @ 12.13 hrs, Volume= 0.016 af
Outflow = 0.02 cfs @ 12.50 hrs, Volume= 0.016 af, Atten= 92%, Lag= 22.4 min
Discarded = 0.02 cfs @ 12.50 hrs, Volume= 0.016 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 821.90' @ 13.25 hrs Surf.Area= 0.006 ac Storage= 0.005 af

Plug-Flow detention time= 95.7 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 94.9 min (845.9 - 751.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	820.50'	0.004 af	**8.33'W x 32.50'L x 2.04'H Field A** 0.013 af Overall - 0.003 af Embedded = 0.010 af x 40.0% Voids
#2A	821.00'	0.003 af	**Cultec C-100HD** x 8 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 2 rows
#3	821.50'	0.000 af	**4.0" Round Pipe Storage** L= 10.0' S= 0.0100 '/'
		0.007 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	820.50'	**2.410 in/hr Exfiltration over Horizontal area**
#2	Primary	824.30'	**2.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.02 cfs @ 12.50 hrs HW=821.78' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=820.50' (Free Discharge)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 2P: INFILTRATION - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 2 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

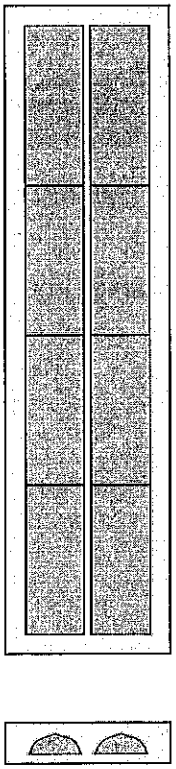
4 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 30.50' Row Length +12.0" End Stone x 2 = 32.50' Base Length
2 Rows x 36.0" Wide + 4.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.33' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

8 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 2 Rows = 113.6 cf Chamber Storage

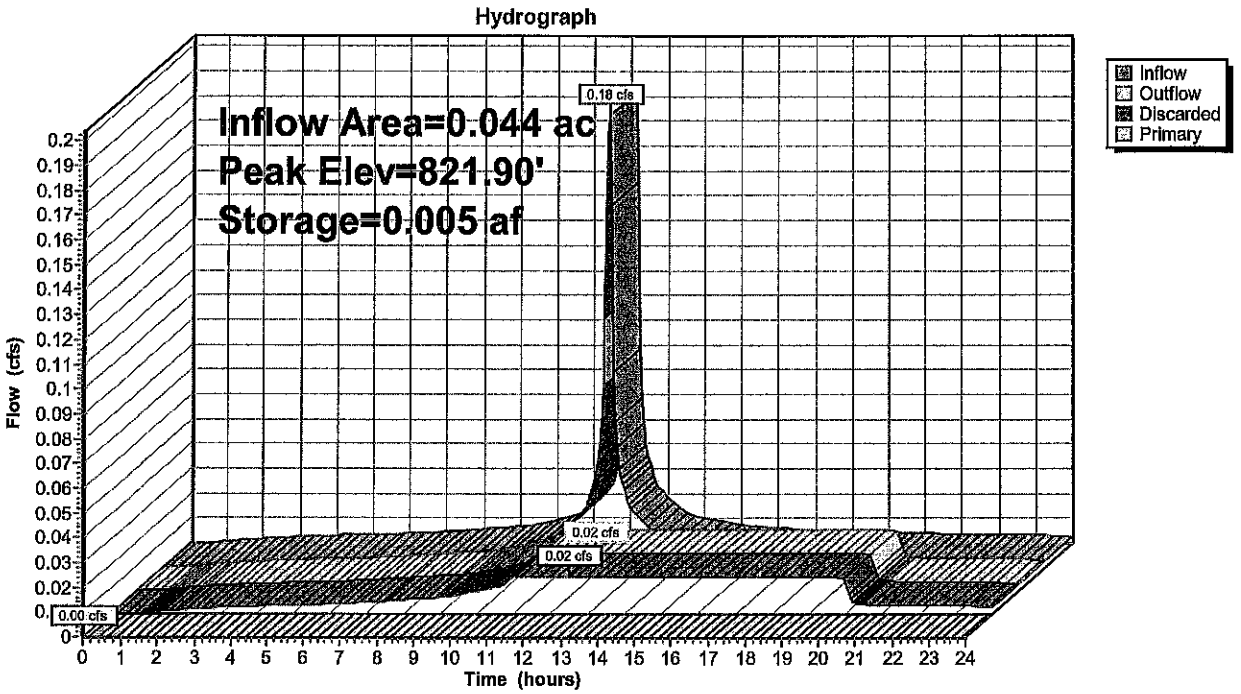
553.0 cf Field - 113.6 cf Chambers = 439.4 cf Stone x 40.0% Voids = 175.8 cf Stone Storage

Chamber Storage + Stone Storage = 289.3 cf = 0.007 af
Overall Storage Efficiency = 52.3%
Overall System Size = 32.50' x 8.33' x 2.04'

8 Chambers
20.5 cy Field
16.3 cy Stone



Pond 2P: INFILTRATION



Commonwealth of Massachusetts
City/Town of Worcester

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Cleb, LLC
Owner Name

4 Barrows Rd
Street Address

Map/Lot #

Worcester
City

MA
State

01609
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey USDA WSS (Source) 307C (Soil Map Unit) Paxton Fine Sandy Loam (Soil Series)

Ground Moraines, Hills, Drumlines
Landform

None
Soil Limitations

Coarse-Loamy Lodgment till Derived From Gneiss, Granite, and/or Schist
Soil Parent material

3. Surficial Geological Report 2018/MassGIS (Year Published/Source) Thin Till (Map Unit)

Non sort, Non Strat matrix of sand, some silt, little clay and scattered pebbles, cobbles and boulders. Predominatly till from last Glaciation
Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No If yes, MassGIS Wetland Data Layer:
Wetland Type

7. Current Water Resource Conditions (USGS): 06/13/2024 (Month/Day/ Year) Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed:
(Zone II, IWPA, Zone A, EEA Data Portal, etc.)

Commonwealth of Massachusetts
City/Town of Worcester

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: INFL- 1 (Hole #) | 06/13/2024 (Date) | 8:00am (Time) | Sunny (Weather) | 42.30380 (Latitude) | -71.84550 (Longitude)

1. Land Use: Lawn (e.g., woodland, agricultural field, vacant lot, etc.) | Grass, Decro Plants (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-5% (Slope (%))

Description of Location: Abandoned Lawn next to building

2. Soil Parent Material: Coarse-Loamy Lodgment till | Hill (Landform) | Flat portion on slope of Hill (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body 400 feet | Drainage Way 600 feet | Wetlands 800 feet | Property Line 50 feet | Drinking Water Well N/A feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0"-12"	Fill				Cnc : Dpl:						
12"-24"	Ab	FSL	10YR 2/2		Cnc : Dpl:				Gran	Fri	
24"-36	Bb	FSL	10YR 3/6		Cnc : Dpl:				Gran	Fri	
36"-100"	C	LS	2.5Y 7/3	72"	Cnc : Dpl:		15%	10%	SubAng	Comp	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Worcester

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: INFL-2 (Hole #) | 06/13/2024 (Date) | 8:30am (Time) | Sunny (Weather) | 42.30385 (Latitude) | -71.84552 (Longitude)

1. Land Use: Lawn (e.g., woodland, agricultural field, vacant lot, etc.) | Grass Deco Plants (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-5% (Slope (%))

Description of Location: Abandoned Lawn next to building

2. Soil Parent Material: Coarse-Loamy Lodgment till | Hill (Landform) | Flat portion on slope of Hil (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body 400 feet | Drainage Way 600 feet | Wetlands 800 feet | Property Line 50 feet | Drinking Water Well N/A feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0"-8"					Cnc : Dpl:						
8"-13"	Ab	FSL	10YR 2/2		Cnc : Dpl:				Gran	Fri	
13'-30"	Bb	FSL	10YR 3/6		Cnc : Dpl:				Gran	Fri	
30"-100"	C	LS	2.5Y 7/3	72"	Cnc : Dpl:		15%	10%	SubAng	Comp	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Worcester

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

		Obs. Hole #Infl-1	Obs. Hole #Infl-2
☒	Depth to soil redoximorphic features	72 inches	72 inches
☐	Depth to observed standing water in observation hole	_____ inches	_____ inches
☐	Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: 60 inches Lower boundary: 61 inches

c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of Worcester

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: INFL- 3 (Hole #) | 06/13/2024 (Date) | 9:00am (Time) | Sunny (Weather) | 42.30393 (Latitude) | -71.84557 (Longitude)

1. Land Use: Lawn (e.g., woodland, agricultural field, vacant lot, etc.) | Grass, Decro Plants (Vegetation) | None (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-5% (Slope (%))

Description of Location: Abandoned Lawn next to building

2. Soil Parent Material: Coarse-Loamy Lodgment till | Hill (Landform) | Flat portion on slope of Hill (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body 400 feet | Drainage Way 600 feet | Wetlands 800 feet | Property Line 50 feet | Drinking Water Well N/A feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0"-4"	Fill				Cnc : Dpl:						
4"-7"	Ab	FSL	10YR 2/2		Cnc : Dpl:				Gran	Fri	
7"-32	Bb	FSL	10YR 3/6		Cnc : Dpl:				Gran	Fri	
32"-100"	C	LS	2.5Y 7/3	72"	Cnc : Dpl:		15%	15%	SubAng	Comp	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Worcester

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: INFL-4 (Hole #) | 06/13/2024 (Date) | 9:30am (Time) | Sunny (Weather) | 42.30363 (Latitude) | -71.84608 (Longitude)

1. Land Use: Cleared Lot (e.g., woodland, agricultural field, vacant lot, etc.) | >1 yr trees, weeds (Vegetation) | Few cobbles (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-5% (Slope (%))

   Description of Location: Cleared Lot next to building

2. Soil Parent Material: Coarse-Loamy Lodgment till | Hill (Landform) | Flat portion on slope of Hil (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body 400 feet | Drainage Way 600 feet | Wetlands 800 feet | Property Line 50 feet | Drinking Water Well N/A feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0"-10"	A	FSL	10YR 2/2		Cnc : Dpl:				Gran	Fri	
10"-34"	B	FSL	10YR 3/6		Cnc : Dpl:				Gran	Fri	
34"-70"	C1	SL	2.5Y 7/3		Cnc : Dpl:				SubAng	Comp	
70"-100"	C2	LS	2.5Y 7/3	72"	Cnc : Dpl:		15%	15%	SubAng	Comp	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Worcester

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole #Infl-3	Obs. Hole #Infl-4
☒ Depth to soil redoximorphic features	72 inches	72 inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: 55 inches Lower boundary: 58 inches

c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of Worcester

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: INFL- 5 (Hole #) | 06/13/2024 (Date) | 10:00am (Time) | Sunny (Weather) | 42.30356 (Latitude) | -71.84596 (Longitude)

1. Land Use: Cleared Lot (e.g., woodland, agricultural field, vacant lot, etc.) | >1 yr trees, weeds (Vegetation) | Few Cobbles (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-5% (Slope (%))

Description of Location: Cleared Lot next to building

2. Soil Parent Material: Coarse-Loamy Lodgment till | Hill (Landform) | Flat portion on slope of Hill (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body 400 feet | Drainage Way 600 feet | Wetlands 800 feet | Property Line 50 feet | Drinking Water Well N/A feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0"-10"	A	FSl	10YR 2/2		Cnc : Dpl:				Gran	Fri	
10"-28"	B	FSL	10YR 3/6		Cnc : Dpl:				Gran	Fri	
28"-72"	C	LS	2.5Y 7/3	72"	Cnc : Dpl:		15%	10%	SubAng	Comp	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Worcester

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: INFL-6 (Hole #) | 06/13/2024 (Date) | 10:30am (Time) | Sunny (Weather) | 42.30350 (Latitude) | -71.84600 (Longitude)

1. Land Use: Cleared Lot (e.g., woodland, agricultural field, vacant lot, etc.) | >1 yr trees, weeds (Vegetation) | Few cobbles (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-5% (Slope (%))

   Description of Location: Cleared Lot next to building

2. Soil Parent Material: Coarse-Loamy Lodgment till | Hill (Landform) | Flat portion on slope of Hil (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body 400 feet | Drainage Way 600 feet | Wetlands 800 feet | Property Line 50 feet | Drinking Water Well N/A feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0"-10"	A	FSL	10YR 2/2		Cnc : Dpl:				Gran	Fri	
10"-34"	B	FSL	10YR 3/6		Cnc : Dpl:				Gran	Fri	
34"-70"	C1	SL	2.5Y 7/3		Cnc : Dpl:				SubAng	Comp	
70"-100"	C2	LS	2.5Y 7/3	72"	Cnc : Dpl:		15%	15%	SubAng	Comp	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Worcester

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):	Obs. Hole #Infl-5	Obs. Hole #Infl-6
☒ Depth to soil redoximorphic features	72 inches	72 inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: 58 inches Lower boundary: 58 inches

c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of Worcester

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator	Date
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams: