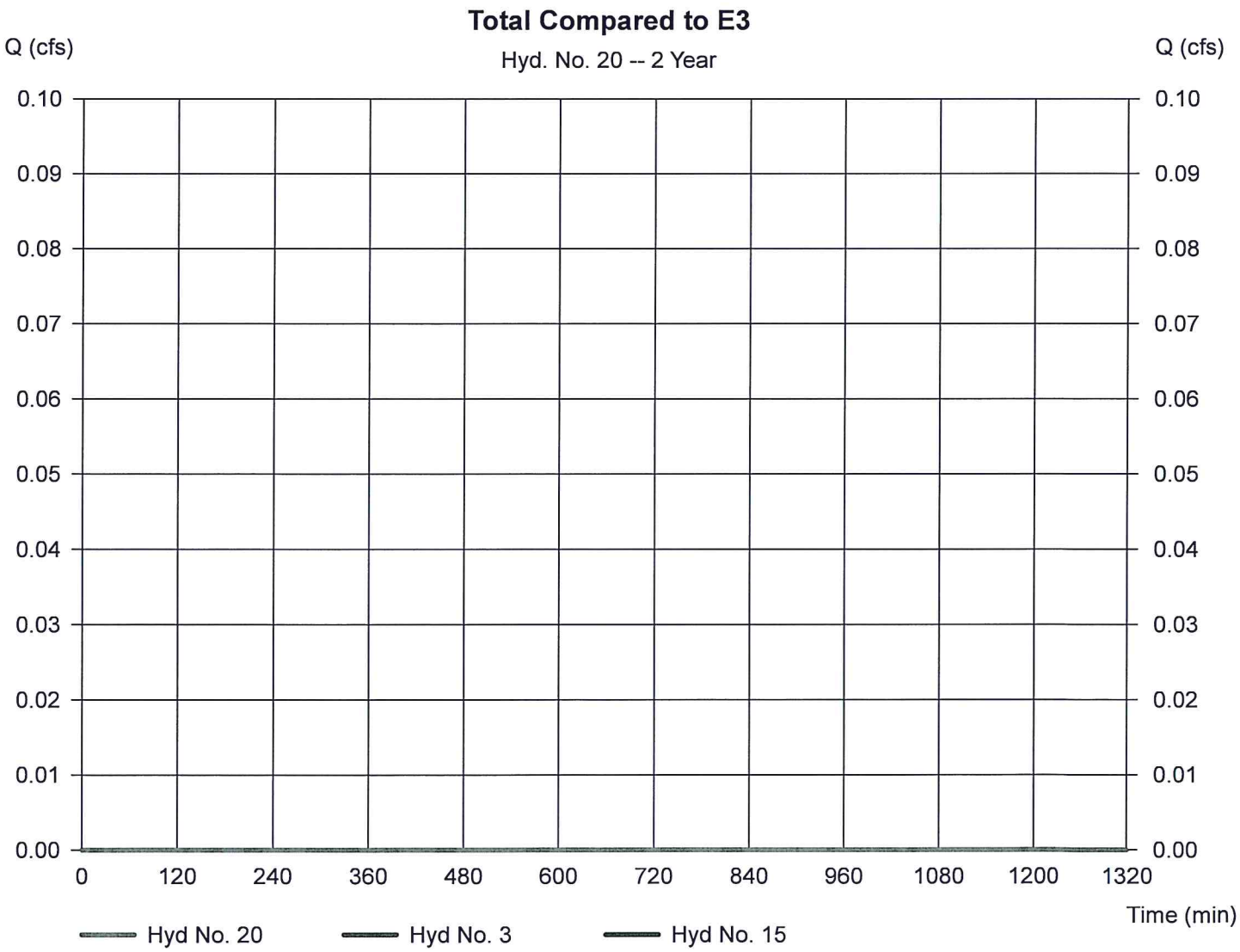
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Nov 3, 2015

Hyd. No. 20

Total Compared to E3

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 3, 15	Contrib. drain. area	= 0.300 ac



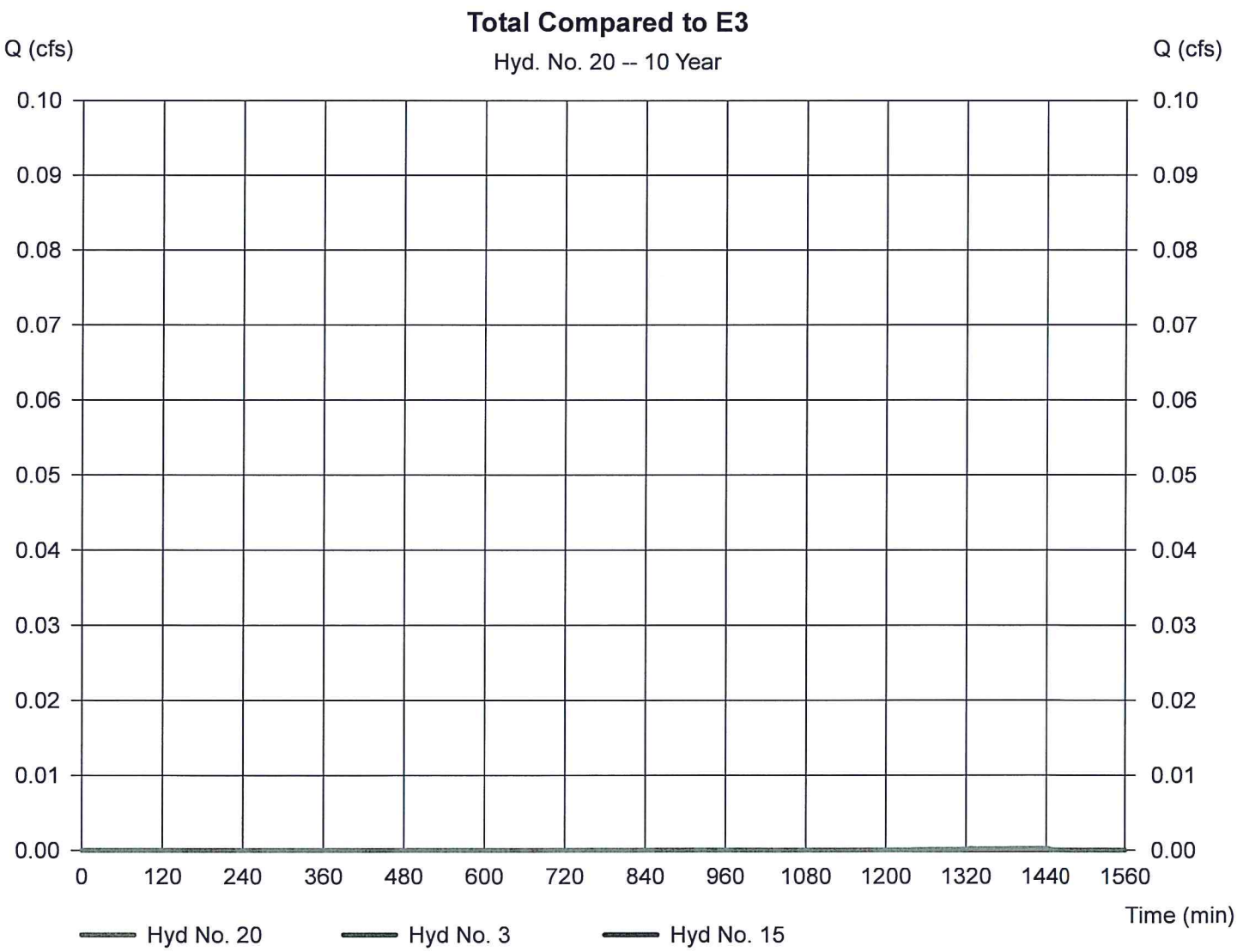
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Nov 3, 2015

Hyd. No. 20

Total Compared to E3

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 1326 min
Time interval	= 2 min	Hyd. volume	= 2 cuft
Inflow hyds.	= 3, 15	Contrib. drain. area	= 0.300 ac



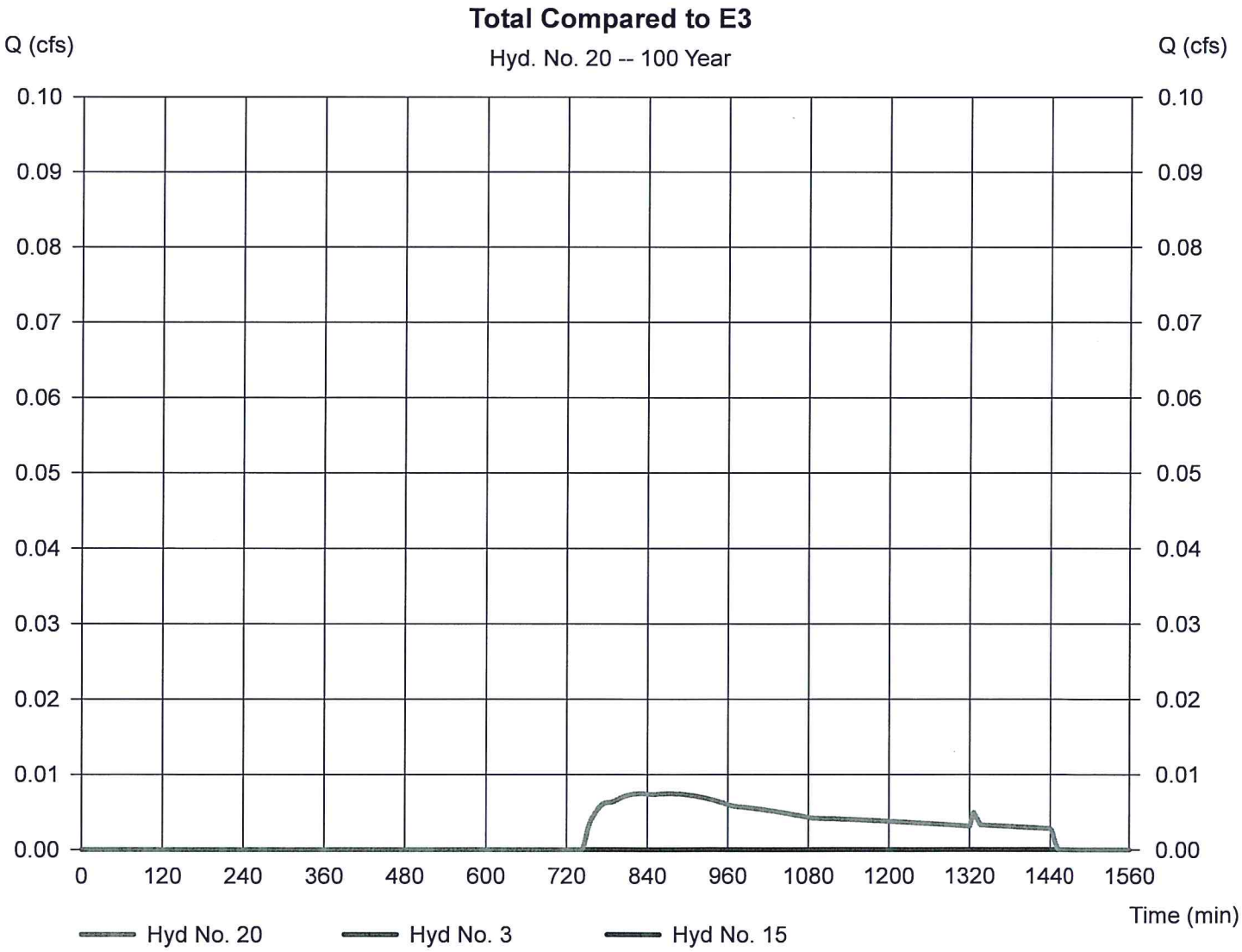
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Tuesday, Nov 3, 2015

Hyd. No. 20

Total Compared to E3

Hydrograph type	= Combine	Peak discharge	= 0.007 cfs
Storm frequency	= 100 yrs	Time to peak	= 830 min
Time interval	= 2 min	Hyd. volume	= 201 cuft
Inflow hyds.	= 3, 15	Contrib. drain. area	= 0.300 ac



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Nov 3, 2015

Pond No. 1 - Infiltration Area 1

Pond Data

UG Chambers - Invert elev. = 153.50 ft, Rise x Span = 2.50 x 4.25 ft, Barrel Len = 57.00 ft, No. Barrels = 4, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 153.00 ft, Width = 4.88 ft, Height = 3.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	153.00	n/a	0	0
0.35	153.35	n/a	156	156
0.70	153.70	n/a	272	428
1.05	154.05	n/a	357	785
1.40	154.40	n/a	350	1,135
1.75	154.75	n/a	339	1,474
2.10	155.10	n/a	323	1,797
2.45	155.45	n/a	299	2,096
2.80	155.80	n/a	262	2,358
3.15	156.15	n/a	186	2,544
3.50	156.50	n/a	156	2,700

Culvert / Orifice Structures

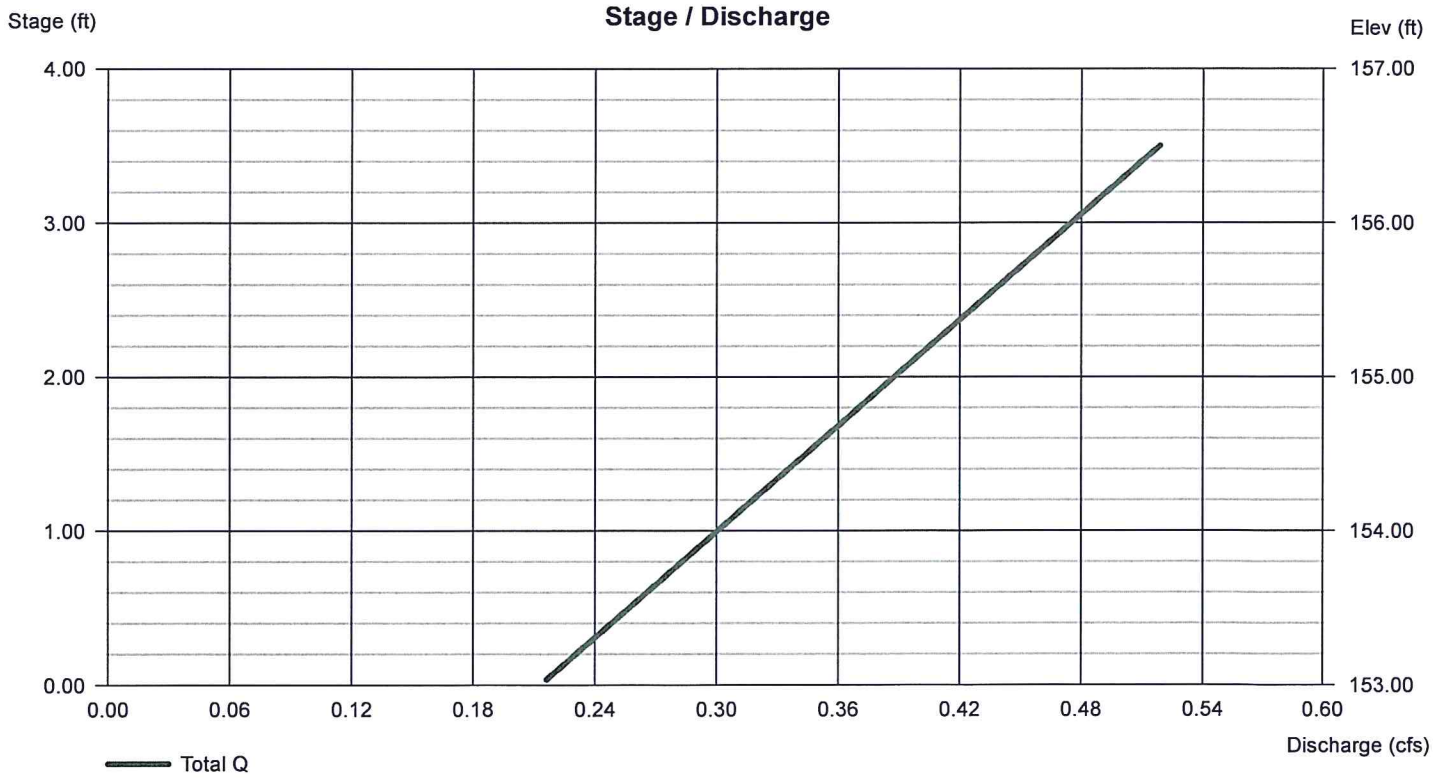
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 8.270 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Nov 3, 2015

Pond No. 2 - Roof Infiltration

Pond Data

UG Chambers - Invert elev. = 153.50 ft, Rise x Span = 2.50 x 4.25 ft, Barrel Len = 37.50 ft, No. Barrels = 1, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 153.00 ft, Width = 6.25 ft, Height = 3.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	153.00	n/a	0	0
0.35	153.35	n/a	33	33
0.70	153.70	n/a	52	85
1.05	154.05	n/a	66	151
1.40	154.40	n/a	65	215
1.75	154.75	n/a	63	278
2.10	155.10	n/a	60	339
2.45	155.45	n/a	56	395
2.80	155.80	n/a	50	445
3.15	156.15	n/a	38	483
3.50	156.50	n/a	33	516

Culvert / Orifice Structures

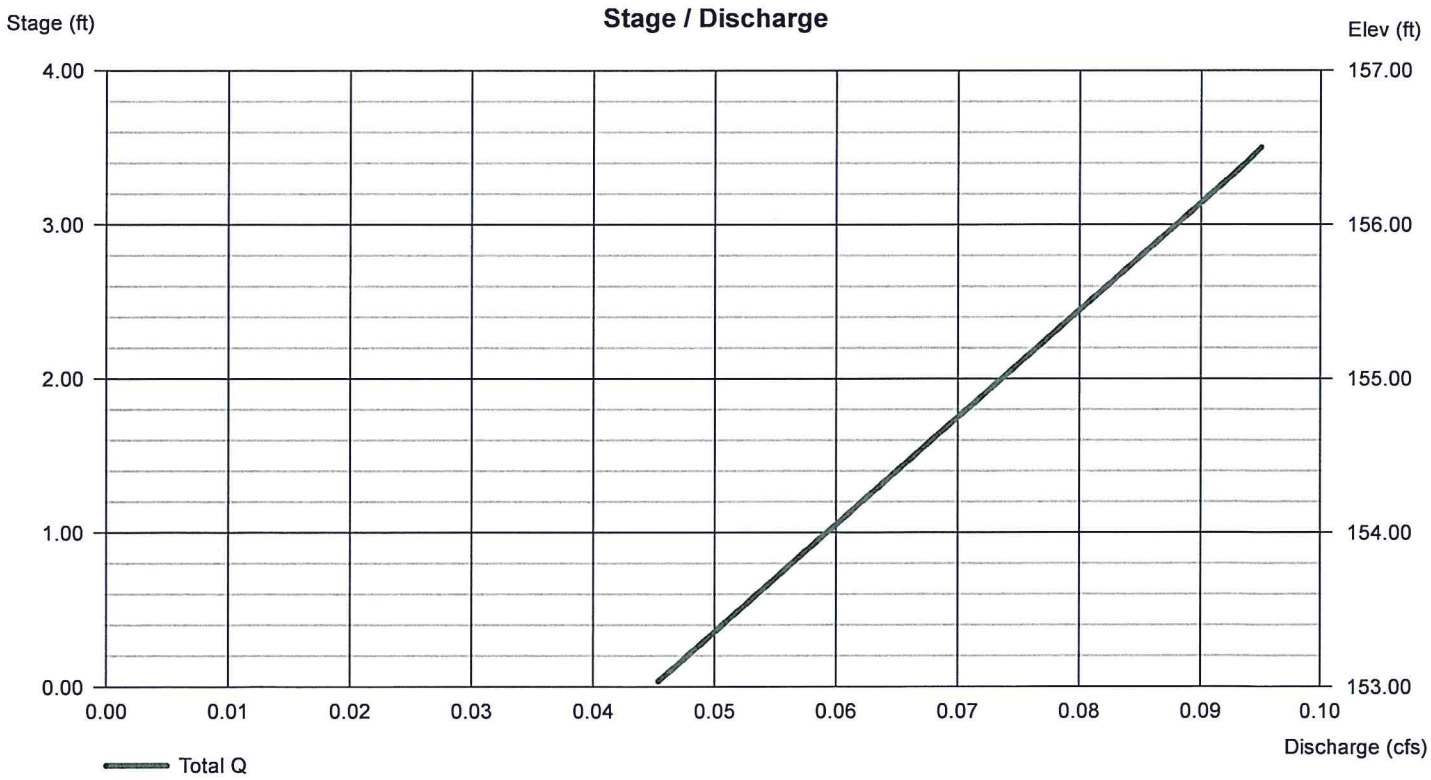
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 8.270 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Nov 3, 2015

Pond No. 3 - Infiltration Area 2

Pond Data

UG Chambers - Invert elev. = 158.50 ft, Rise x Span = 2.50 x 4.25 ft, Barrel Len = 28.48 ft, No. Barrels = 5, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 158.00 ft, Width = 4.88 ft, Height = 3.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	158.00	n/a	0	0
0.35	158.35	n/a	97	97
0.70	158.70	n/a	170	267
1.05	159.05	n/a	223	490
1.40	159.40	n/a	219	709
1.75	159.75	n/a	212	921
2.10	160.10	n/a	202	1,122
2.45	160.45	n/a	187	1,309
2.80	160.80	n/a	164	1,472
3.15	161.15	n/a	116	1,589
3.50	161.50	n/a	97	1,686

Culvert / Orifice Structures

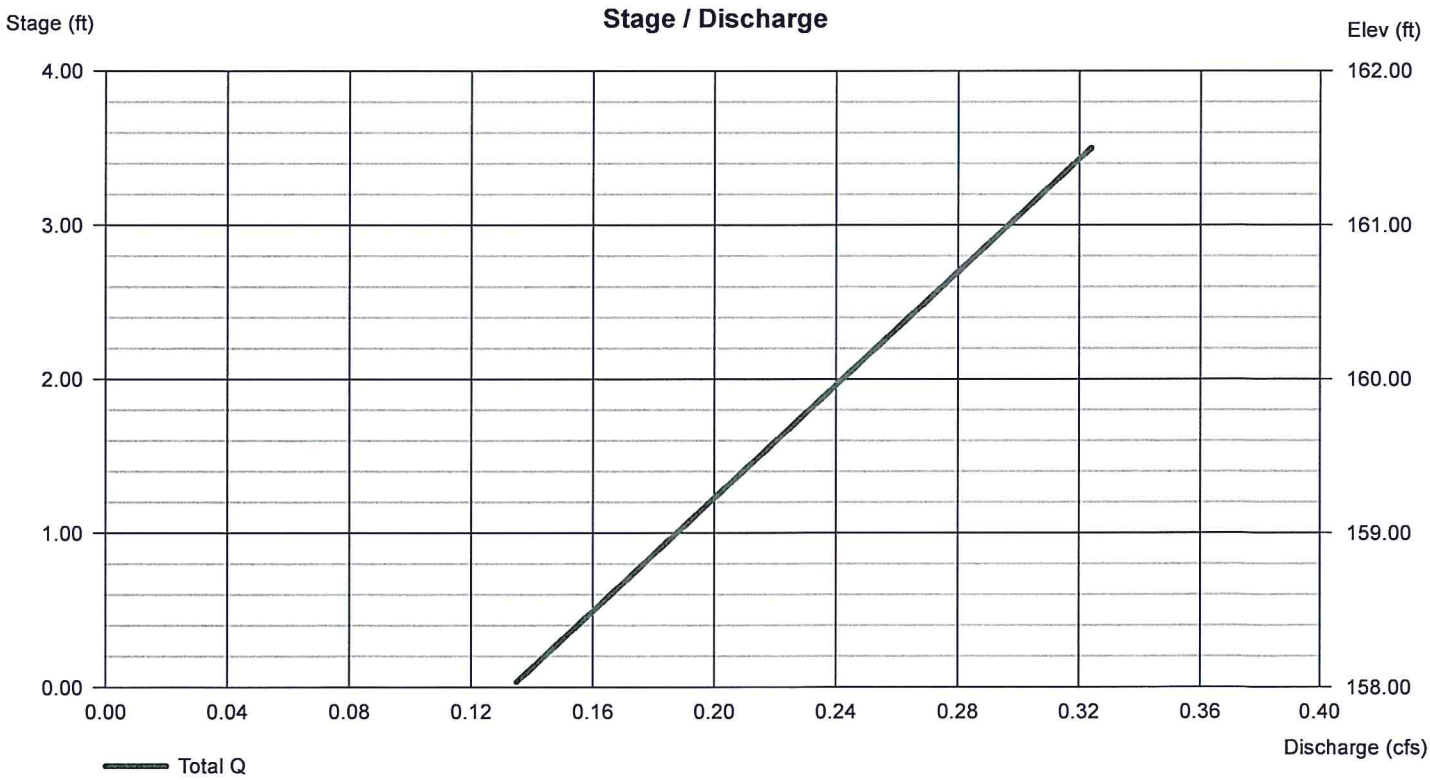
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 8.270 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Nov 3, 2015

Pond No. 4 - Dwelling Roof Drywell

Pond Data

UG Chambers - Invert elev. = 161.50 ft, Rise x Span = 2.50 x 4.25 ft, Barrel Len = 49.84 ft, No. Barrels = 1, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 161.00 ft, Width = 6.25 ft, Height = 3.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	161.00	n/a	0	0
0.35	161.35	n/a	44	44
0.70	161.70	n/a	69	113
1.05	162.05	n/a	88	200
1.40	162.40	n/a	86	286
1.75	162.75	n/a	84	370
2.10	163.10	n/a	80	450
2.45	163.45	n/a	75	525
2.80	163.80	n/a	67	592
3.15	164.15	n/a	50	642
3.50	164.50	n/a	44	686

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 8.270 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Water Quality Volume Calculations

Project: 267 Great Road
Location: Acton, MA
Prepared For: Benjamin Ewing (Stamski & McNary, Inc.)

CONTECH® ENGINEERED SOLUTIONS

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1.0" of runoff.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	Impv. (acres)	A (miles^2)	t_c (min)	t_c (hr)	WQV (in)
DMH-2	0.19	0.0002969	5.0	0.083	1.00
DMH-3	0.24	0.0003750	5.0	0.083	1.00

Procedure:

Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Structure Name	qu (csm/in.)
DMH-2	795.00
DMH-3	795.00

1. Compute Q Rate using the following equation:

$$Q_1 = (qu)\ (A)\ (WQV)$$

where:

Q_1 = flow fate associated with first 1.0" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1.0" in this case)

Structure Name	Q_1 (cfs)
DMH-2	0.24
DMH-3	0.30

Project: 267 Great Road (phase 2)
Location: Acton, MA
Prepared For: James Melvin (Stamski & McNary, Inc.)

CONTECH ENGINEERED SOLUTIONS

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1.0" of runoff.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	Impv. (acres)	A ($miles^2$)	t_c (min)	t_c (hr)	WQV (in)
CDS	0.20	0.0003164	5.0	0.083	1.00

Procedure:

Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Structure Name	qu (csm/in.)
CDS	795.00

1. Compute Q Rate using the following equation:

$$Q_1 = (qu)\ (A)\ (WQV)$$

where:

Q_1 = flow fate associated with first 1.0" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1.0" in this case)

Structure Name	Q_1 (cfs)
CDS	0.25

Groundwater Recharge Calculations

Recharge Volume Calculations

Job: SM-4860A

Calculated by: JTM
Date: 9/18/2015

P4

Soils: Hinchley Loamy Sand
Hydrologic Group: A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious area: 0.38 acres
16,457 s.f.

Required Recharge Volume (Rv)

$$Rv = 16{,}457 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{823 \text{ c.f.}}$$

Simple Dynamic Method
A=Rv / (D+KT)
Rv=A(D+kT)

D (depth of infiltration facility):	0.5	ft
K (saturated hydraulic conductivity):	8.27	inches/hour
	0.6891667	feet/hour
T (time):	2	hours
A=	1,150	s.f.
Voids=	0.40	
Volume of Chambers=	1,469	
Rv=	3,284	c.f. > 823 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 0.36 Hours
0.36 < 72 hours O.K.

P5

Soils: Hinckley Loamy Sand
Hydrologic Group: A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious area: 0.20 acres
8,820 s.f.

Required Recharge Volume (Rv)

Rv = 8,820 s.f. x $\frac{0.6}{12}$ = **441 c.f.**

Simple Dynamic Method

A=Rv / (D+KT)

Rv=A(D+kT)

D (depth of infiltration facility):	0.5	ft
K (saturated hydraulic conductivity):	8.27	inches/hour
	0.6891667	feet/hour
T (time):	2	hours
A=	715	s.f.
Voids=	0.40	
Volume of Chambers=	918	
Rv=	2,047	c.f. > 441 c.f.

72 Hour Drawdown

Rv/(K x Bottom Area)= 0.31 Hours

0.31 < 72 hours O.K.

Roof Drywell(Office)

Soils: Hinckley Loamy Sand

Hydrologic Group: A

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.08 acres

3,605 s.f.

Required Recharge Volume (Rv)

Rv = 3,605 s.f. x $\frac{0.6}{12}$ = **180 c.f.**

Simple Dynamic Method

A=Rv / (D+KT)

Rv=A(D+kT)

D (depth of infiltration facility):	0.5	ft
K (saturated hydraulic conductivity):	8.27	inches/hour
	0.6891667	feet/hour
T (time):	2	hours
A=	197	s.f.
Voids=	0.40	
Volume of Chambers=	230	
Rv=	541	c.f. > 180 c.f.

72 Hour Drawdown

Rv/(K x Bottom Area)= 0.48 Hours

0.48 < 72 hours O.K.

Roof Drywell(Dwelling)

Soils: Hinckley Loamy Sand

Hydrologic Group: A

Required Recharge Volume

0.6 inches of runoff x impervious area

Impervious area: 0.09 acres

4,068 s.f.

Required Recharge Volume (Rv)

$$Rv = 4{,}068 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{203 \text{ c.f.}}$$

Simple Dynamic Method

A=Rv / (D+KT)

Rv=A(D+kT)

D (depth of infiltration facility):	0.5	ft
K (saturated hydraulic conductivity):	8.27	inches/hour
	0.6891667	feet/hour
T (time):	2	hours
A=	324	s.f.
Voids=	0.40	
Volume of Chambers=	321	
Rv=	832	c.f. > 203 c.f.

72 Hour Drawdown

Rv/(K x Bottom Area)= 0.35 Hours

0.35 < 72 hours O.K.

TSS Removal Calculations

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: Pretreatment for Subsurface Inf. Area 2

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catch Basin W/ Hood	25%	1.00	0.25	0.75
CDS 2015-4	89.0%	0..75	0.67	0.08

Total TSS Removal = 92%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 4860A
Prepared By: JTM
Date: 10/30/15

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: Pretreatment for Subsurface Inf. Area 1

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catch Basin W/ Hood	25%	1.00	0.25	0.75
CDS 2015-4	92.9%	0..75	0.70	0.05

Total TSS Removal = 95%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 4860A
Prepared By: JTM
Date: 10/30/15

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: Subsirface Infiltration Area 1

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
CDS 2015-4	92.9%	1.00	0.93	0.07
Stormtech subsurface Structure	80%	0.07	0.06	0.01

Total TSS Removal = 99%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 4860A
Prepared By: JTM
Date: 10/30/2015

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: Subsirface Infiltration Area 2

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
CDS 2015-4	89.0%	1.00	0.89	0.11
Stormtech subsurface Structure	80%	0.11	0.9	0.02

Total TSS Removal = 98%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 4860A
Prepared By: JTM
Date: 10/30/2015

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

CDS ESTIMATED NET ANNUAL TSS REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

CONTECH ENGINEERED SOLUTIONS

267 GREAT ROAD
ACTON, MA
for SYSTEM: DMH-2

Area	0.19	acres	CDS Model	
Weighted C	0.90		2015-4	
Tc	5	minutes	CDS Treatment Capacity	
			1.4	cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Removal Efficiency (%)	Incremental Removal (%)
0.02	10.2%	10.2%	0.00	0.00	100.0	10.2
0.04	9.6%	19.8%	0.01	0.01	100.0	9.6
0.06	9.4%	29.3%	0.01	0.01	100.0	9.4
0.08	7.7%	37.0%	0.01	0.01	100.0	7.7
0.10	8.6%	45.6%	0.02	0.02	100.0	8.6
0.12	6.3%	51.9%	0.02	0.02	100.0	6.3
0.14	4.7%	56.5%	0.02	0.02	100.0	4.7
0.16	4.6%	61.2%	0.03	0.03	100.0	4.6
0.18	3.5%	64.7%	0.03	0.03	100.0	3.5
0.20	4.3%	69.1%	0.03	0.03	100.0	4.3
0.25	8.0%	77.1%	0.04	0.04	99.9	8.0
0.30	5.6%	82.7%	0.05	0.05	99.6	5.6
0.35	4.4%	87.0%	0.06	0.06	99.3	4.3
0.40	2.5%	89.5%	0.07	0.07	99.1	2.5
0.45	2.5%	92.1%	0.08	0.08	98.8	2.5
0.50	1.4%	93.5%	0.09	0.09	98.5	1.4
0.75	5.0%	98.5%	0.13	0.13	97.0	4.9
1.00	1.0%	99.5%	0.17	0.17	95.6	1.0
1.50	0.0%	99.5%	0.26	0.26	92.7	0.0
2.00	0.0%	99.5%	0.34	0.34	89.8	0.0
3.00	0.5%	100.0%	0.51	0.51	84.0	0.4
						99.6

Removal Efficiency Adjustment[2] =	6.5%
Predicted % Annual Rainfall Treated =	93.5%
Predicted Net Annual Load Removal Efficiency =	**93.1%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CDS ESTIMATED NET ANNUAL TSS REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

CONTECH ENGINEERED SOLUTIONS

267 GREAT ROAD
ACTON, MA
for SYSTEM: DMH-3

Area	0.24	acres	CDS Model	
Weighted C	0.90		2015-4	
Tc	5	minutes	CDS Treatment Capacity	
			1.4	cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Removal Efficiency (%)	Incremental Removal (%)
0.02	10.2%	10.2%	0.00	0.00	100.0	10.2
0.04	9.6%	19.8%	0.01	0.01	100.0	9.6
0.06	9.4%	29.3%	0.01	0.01	100.0	9.4
0.08	7.7%	37.0%	0.02	0.02	100.0	7.7
0.10	8.6%	45.6%	0.02	0.02	100.0	8.6
0.12	6.3%	51.9%	0.03	0.03	100.0	6.3
0.14	4.7%	56.5%	0.03	0.03	100.0	4.7
0.16	4.6%	61.2%	0.03	0.03	100.0	4.6
0.18	3.5%	64.7%	0.04	0.04	100.0	3.5
0.20	4.3%	69.1%	0.04	0.04	99.9	4.3
0.25	8.0%	77.1%	0.05	0.05	99.5	8.0
0.30	5.6%	82.7%	0.06	0.06	99.2	5.5
0.35	4.4%	87.0%	0.08	0.08	98.8	4.3
0.40	2.5%	89.5%	0.09	0.09	98.4	2.5
0.45	2.5%	92.1%	0.10	0.10	98.1	2.5
0.50	1.4%	93.5%	0.11	0.11	97.7	1.3
0.75	5.0%	98.5%	0.16	0.16	95.9	4.8
1.00	1.0%	99.5%	0.22	0.22	94.0	1.0
1.50	0.0%	99.5%	0.32	0.32	90.4	0.0
2.00	0.0%	99.5%	0.43	0.43	86.7	0.0
3.00	0.5%	100.0%	0.65	0.65	79.4	0.4
						99.4
					Removal Efficiency Adjustment[2] =	6.5%
					Predicted % Annual Rainfall Treated =	93.5%
					Predicted Net Annual Load Removal Efficiency =	**92.9%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CDS ESTIMATED NET ANNUAL TSS REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

CONTECH ENGINEERED SOLUTIONS

267 GREAT ROAD (PHASE 2)
ACTON, MA
for SYSTEM: CDS

Area	0.2	acres	CDS Model	
Weighted C	0.90		2015-4	
Tc	6	minutes	CDS Treatment Capacity	
			1.4	cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Removal Efficiency (%)	Incremental Removal (%)
0.02	10.2%	10.2%	0.00	0.00	97.0	9.9
0.04	9.6%	19.8%	0.01	0.01	96.9	9.3
0.06	9.4%	29.3%	0.01	0.01	96.7	9.1
0.08	7.7%	37.0%	0.01	0.01	96.5	7.5
0.10	8.6%	45.6%	0.02	0.02	96.3	8.3
0.12	6.3%	51.9%	0.02	0.02	96.2	6.1
0.14	4.7%	56.5%	0.03	0.03	96.0	4.5
0.16	4.6%	61.2%	0.03	0.03	95.8	4.4
0.18	3.5%	64.7%	0.03	0.03	95.6	3.4
0.20	4.3%	69.1%	0.04	0.04	95.5	4.1
0.25	8.0%	77.1%	0.05	0.05	95.0	7.6
0.30	5.6%	82.7%	0.05	0.05	94.6	5.3
0.35	4.4%	87.0%	0.06	0.06	94.2	4.1
0.40	2.5%	89.5%	0.07	0.07	93.7	2.4
0.45	2.5%	92.1%	0.08	0.08	93.3	2.4
0.50	1.4%	93.5%	0.09	0.09	92.8	1.3
0.75	5.0%	98.5%	0.14	0.14	90.6	4.6
1.00	1.0%	99.5%	0.18	0.18	88.5	0.9
1.50	0.0%	99.5%	0.27	0.27	84.1	0.0
2.00	0.0%	99.5%	0.36	0.36	79.7	0.0
3.00	0.5%	100.0%	0.54	0.54	70.9	0.3
						95.4

Removal Efficiency Adjustment[2] =	6.5%
Predicted % Annual Rainfall Treated =	93.5%
Predicted Net Annual Load Removal Efficiency =	**89.0%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Storm Sewer Design

DESIGN STORM: 100 YEAR
DATE: 9/17/2015
DONE BY: JTM
FILE: 4860A RATIONAL METHOD.wb3

STORM SEWER DESIGN

(ADS N-12)"n"= 0.010 4"-10"
(ADS N-12)"n"= 0.012 12"-36"
(ADS N-12)"n"= 0.013 42"-60"
(Cast Iron)"n"= 0.011
(RCP)"n"=0.013

PROJECT: SM-4860A
LOCATION: Acton, MA

FROM	TO	LENGTH (FT)	TRIBUTARY AREA INCR. (ACRES)	TRIBUTARY AREA TOTAL (ACRES)	TIME OF FLOW TO UPPER END (MIN)	TIME OF FLOW TIME IN SECTION (MIN)	RUNOFF COEFF. "C"	RAINFALL INTENSITY (IN/HR)	"Q" TOTAL RUNOFF (CFS)	SLOPE of PIPE (FT/FT)	DIAM (IN)	MANN. "n"	CAPACITY FULL (CFS)	VELOCITY FULL (FPS)	DESIGN FLOW VELOCITY (FPS)	DESIGN FLOW VELOCITY HEAD (FT)	DESIGN FLOW DEPTH OF FLOW (FT)	DESIGN FLOW TOTAL ENERGY HEAD (FT)	MANHOLE INVERT DROP (FT)	FALL IN PIPE (FT)	DRAIN INV. ELEVATION UPPER END	DRAIN INV. ELEVATION LOWER END	GROUND SURFACE UPPER END	GROUND SURFACE LOWER END	
CB-1	DMH-2	50		0.099	10	0.19	0.75	7.6	0.57	0.019	12	0.012	5.37	6.84	4.39	0.30	0.22	0.51		0.97	155.4	154.43	159.4	160.4	CB-1
CB-3	DMH-4	8		0.04	10	0.05	0.90	7.6	0.24	0.012	12	0.012	4.31	5.49	2.89	0.13	0.16	0.28		0.10	156.59	156.49	160.3	160.5	CB-3
CB-4	DMH-4	16		0.12	10	0.09	0.43	7.6	0.38	0.010	15	0.012	6.99	5.70	3.00	0.14	0.19	0.33		0.16	156.65	156.49	160.4	160.5	CB-4
DMH-4	DI-1	77		0.152	10	0.37	0.54	7.6	0.62	0.010	15	0.012	6.99	5.70	3.50	0.19	0.25	0.44		0.77	156.39	155.62	160.5	158.8	DMH-4
DI-1	DMH-1	22		0.50	10	0.08	0.32	7.6	1.22	0.010	12	0.012	3.85	4.91	4.34	0.29	0.39	0.68		0.22	155.52	155.3	158.3	159.6	DI-1
DMH-1	DMH-2	77		0.502	10	0.30	0.32	7.6	1.22	0.010	12	0.012	3.85	4.91	4.34	0.29	0.39	0.68		0.77	155.2	154.43	159.6	160.4	DMH-1
DMH-2	INF	53		0.601	10	0.17	0.29	7.6	1.33	0.016	12	0.012	4.82	6.14	5.21	0.42	0.36	0.78		0.83	154.33	153.5	160.4	160.1	DMH-2
CB-2	DMH-3	6		0.398	10	0.01	0.64	7.6	1.94	0.083	12	0.012	11.12	14.17	10.58	1.74	0.28	2.02		0.50	154.3	153.8	159.3	159.4	CB-2
DMH-3	INF	8		0.398	10	0.02	0.64	7.6	1.94	0.025	12	0.012	6.09	7.76	6.87	0.73	0.39	1.12		0.20	153.7	153.5	159.4	159.5	DMH-3
CB-5	DMH-5	10		0.63	10	0.03	0.42	7.6	2.01	0.010	12	0.012	3.85	4.91	4.95	0.38	0.51	0.89		0.10	158.8	158.7	162.5	162.8	CB-5
DMH-5	INF	6		0.63	10	0.02	0.42	7.6	2.01	0.017	12	0.012	4.97	6.34	5.98	0.56	0.44	1.00		0.10	158.6	158.5	162.8	162.9	DMH-5

CB - CATCH BASIN
DI - DROP INLET
DMH- DRAIN MANHOLE
INF - INFILTRATION AREA

Project: 267 Great Road By JTM Date 9/17/2015

Location: Acton, MA Checked Date

Rational Method

Q = peak flow rate, (cfs) i = rainfall intensity inches/hour

C = runoff coefficient, A = area (ac)
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

CB-1

Surface Cover	A (ac)	C	Product A x C
impervious	0.08	0.9	0.0702
lands/grass	0.02	0.2	0.0042
woods	0.00	0.15	0
sum =	0.10	sum =	0.0744

C = **0.75** = total product / total area

DI-1

Surface Cover	A (ac)	C	Product A x C
impervious	0.01	0.9	0.0117
lands/grass	0.34	0.2	0.0674
woods	0	0.15	0
sum =	0.35	sum =	0.0791

C = **0.23** = total product / total area

DMH-4	**0.15**	0.54	0.0815
sum=	**0.50**	sum=	0.1606

C = **0.32** = total product / total area

DMH-1

Surface Cover	A (ac)	C	Product A x C
DI-1	0.50	0.32	0.1606
			0.000
sum =	0.502	sum =	0.1606

C = **0.32** = total product / total area

Project: 267 Great Road By JTM Date 9/17/2015

Location: Acton, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs) i = rainfall intensity inches/hour

C = runoff coefficient, A = area (ac)
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

CB-3

Surface Cover	A (ac)	C	Product A x C
impervious	0.04	0.9	0.0315
lands/grass	0.00	0.2	0
woods	0.00	0.15	0
sum =	0.04	sum =	0.0315

C = **0.90** = total product / total area

CB-4

Surface Cover	A (ac)	C	Product A x C
impervious	0.04	0.9	0.0342
lands/grass	0.08	0.2	0.0158
woods	0	0.15	0
sum =	0.12	sum =	0.05

C = **0.43** = total product / total area

DMH-4

Surface Cover	A (ac)	C	Product A x C
CB-3	0.04	0.90	0.0315
CB-4	0.12	0.43	0.05
sum =	0.152	sum =	0.0815

C = **0.54** = total product / total area

Project: 267 Great Road By JTM Date 9/17/2015

Location: Acton, MA Checked Date

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

DMH-2

Surface Cover	A (ac)	C	Product A x C
DMH-1	0.502	0.32	0.1606
CB-1	0.10	0.15	0.015
sum =	0.60	sum =	0.17545

C = **0.29** = total product / total area

CB-2

Surface Cover	A (ac)	C	Product A x C
impervious	0.25	0.9	0.2259
lands/grass	0.15	0.2	0.0294
woods	0	0.15	0
sum =	0.40	sum =	0.2553

C = **0.64** = total product / total area

DMH-3

Surface Cover	A (ac)	C	Product A x C
CB-2	0.398	0.64	0.2553
sum =	0.40	sum =	0.2553

C = **0.64** = total product / total area

Project: 267 Great Road By JTM Date 9/17/2015

Location: Acton, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-5

Surface Cover	A (ac)	C	Product A x C
impervious	0.20	0.9	0.18
lands/grass	0.41	0.2	0.082
woods	0.02	0.15	0.003
sum =	0.63	sum =	0.265

C = **0.42** = total product / total area

DMH-5

Surface Cover	A (ac)	C	Product A x C
CB-5	0.63	0.42	0.265
sum =	0.63	sum =	0.265

C = **0.42** = total product / total area

Inlet Grate Capacity Calculations

Job: SM-4860A
Project: 267 Great Road

Calculated by: JTM
Date: 9/17/2015

LeBARON FOUNDRY, INC. LF246 inlet grate pass area A = 225 sq. in.
1.56 sq. ft.

Q = (C*A* SQRT(2*g*h))*f

C = orifice coefficient
C = 0.6 square edges
A = inlet area
A = 1.56 sq. ft.
g = gravitational constant
g = 32.2 ft/sec^2
h = head on inlet
h = 0.33 ft. (low points)
0.17 ft. (on slope)
f = clogging factor
f = 0.66

Single Grate
Q (MAX)= 2.85 cfs (LP) low points LF246
Q (MAX)= 2.04 cfs (OS) on slope LF246
Double Grate
Q (MAX)= 5.70 cfs (LP) low points LF246
Q (MAX)= 4.09 cfs (OS) on slope LF246

	TRIBUTARY AREA (AC)	TIME OF CONC.	100 YR INTENSITY	C	Q=CiA Q100	POSITION	Q (MAX)	single grate	double grate
CB1	0.10	10	7.6	0.75	0.57	LP	2.85	yes	
CB2	0.40	10	7.6	0.64	1.95	LP	2.85	yes	
CB3	0.04	10	7.6	0.9	0.27	OS	2.04	yes	
CB4	0.12	10	7.6	0.43	0.39	OS	2.04	yes	
CB5	0.63	10	7.6	0.42	2.01	LP	2.85	yes	

Soil Evaluation

Commonwealth of Massachusetts
City/Town of Acton

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

A. Facility Information

John A.C. Kimball, Jr.
Owner Name

267 Great Road
Street Address

E5-13
Map/Lot #

Acton
City

MA
State

01720
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Published Soil Survey Available? ☒ Yes ☐ No If yes: nesoil.com (Year Published) 1:25,000 (Publication Scale) 626B / 253B (Soil Map Unit)

   Merrimac-Urban land complex / Hinkley loamy sand
   Soil Name

   Soil Limitations

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: MassGIS (Year Published) Publication Scale Map Unit

   Sand and Gravel
   Geologic Material

   Landform

4. Flood Rate Insurance Map

   Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☐ Yes ☒ No

   Within the 500-year flood boundary? ☐ Yes ☒ No Within a velocity zone? ☐ Yes ☒ No

5. Wetland Area: National Wetland Inventory Map — Map Unit: On-Site Delineation; Name:

   Wetlands Conservancy Program Map — Map Unit: ; Name:

6. Current Water Resource Conditions (USGS): March 2012 (Month/Year) Range: ☐ Above Normal ☒ Normal ☐ Below Normal

7. Other references reviewed:

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 8:15 (Time) CLEAR (Weather)

1. Deep Observation Hole Logs

Deep Hole Number TP-1 Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: YARD (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 0-5% (Slope (%))

GRASS (Vegetation) _____ (Landform) _____ (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area 200 feet

Property Line 215 feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☒ No ☐

If Yes: Depth Weeping from Pit 96" Depth Standing Water in Hole 96"

Estimated Depth to High Groundwater: 72" (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

267 GREAT TRAIL
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12"	A	10YR 2/2	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
12"-30"	B	10YR 5/6	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
30"-11'	C	2.5Y 6/4	72"	7.5YR 6/8	5%	SAND	—	—	SG	LOOSE	

Additional Notes _____

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 3:30 (Time) CLEAR (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: YARD (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 0-5% (Slope (%))

Vegetation GARDEN Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area 100 feet

Property Line 710 feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☒ No ☐

If Yes: Depth Weeping from Pit 103" Depth Standing Water in Hole 103"

Estimated Depth to High Groundwater: 78" (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

267 GREAT ROAD
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-2

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-16"	A	10YR 2/2	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
16"-30"	B	10YR 5/6	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
30"-11'	C	2.5Y 6/4	78"	7.5YR 6/2	5%	SAND	—	—	SG	LOOSE	

Additional Notes _____

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 8:45 (Time) SUNNY (Weather)

1. Deep Observation Hole Logs

Deep Hole Number TP-3 Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: YARD (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 0-5% (Slope (%))

GARDEN (Vegetation) _____ (Landform) _____ (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

Property Line >10 feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☒ No ☐

If Yes: Depth Weeping from Pit 77" Depth Standing Water in Hole 84"

Estimated Depth to High Groundwater: 72" (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

267 GREAT ROAD
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-3

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles) Depth	Color	Percent	Soil Texture (USDA)	Coarse Fragments % by Volume Gravel	Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
0-12"	A	10YR 2/2	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
12"-28"	B	10YR 5/6	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
28"-10'	C	2.5Y 6/4	72"	7.5YR 4/4	5%	SAND	5%	—	S.G	LOOSE	

Additional Notes GRAVEL STARTS @ 9'

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 9:00 (Time) CLEAR (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: YARD (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 0-5% (Slope (%))

GRASS/SHRUBS (Vegetation) _____ (Landform) _____ (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area 7100 feet

Property Line 710 feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: 84" (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

267 GREAT ROAD
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-14"	A		—	—	—	LOAMY SAND	—	—	M	F	
14"-32"	B		—	—	—	LOAMY SAND	—	—	M	F	
32"-10'	C		84"	7.5YR 6/4 7.5YR 6/4	5%	SAND	10%	5%	SG	LOOSE	

Additional Notes TIGHT STONES @ 10'

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 9:15 (Time) CLEAR (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: YARD (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 5-10% (Slope (%))

GRASS / TREES (Vegetation) _____ (Landform) ON-SLOPE (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

Property Line >100' feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water In Hole —

Estimated Depth to High Groundwater: 108" (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

267 GREAT ROAD
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-5

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12"	A	10YR 2/2	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
12"-30"	B	10YR 5/6	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
30"-10'	C	2.5Y 6/4	108"	7.5YR 6/2	5%	COARSE SAND	100%	2%	SG	LOOSE	

Additional Notes: CAVING IN @ 8'

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 9:30 (Time) CLEAR (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: YARD (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 2-10% (Slope (%))

GRASS (Vegetation) _____ (Landform) _____ (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area 100+/- feet

Property Line 510 feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water In Hole —

Estimated Depth to High Groundwater: > 10' (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

267 GREAT ROAD
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-6

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12"	A	10YR 2/2	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
12"-30"	B	10YR 5/6	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
30"-10'	C	2.5Y 6/4	—	—	—	COARSE SAND	10%	2%	SG	LOOSE	

Additional Notes: CAVING IN @ 8'

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 10:00 (Time) CLEAR (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) — Surface Stones — 2-10% Slope (%)

PINES Vegetation — Landform — FOOTSLOPE Position on landscape (attach sheet)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area 200 feet

Property Line 210 feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: 210' Inches _____ elevation

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

267 GREAT ROAD
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-7

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-11"	A	10YR 2/2	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
11"-26"	B	10YR 5/6	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
26"-10'	C	2.5Y 4/4	—	—	—	COARSE SAND	10%	—	SG	LOOSE	

Additional Notes: CAVING IN @ 8'

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 10:15 (Time) CLEAR (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 2-10% (Slope (%))

PINES (Vegetation) _____ (Landform) SITUATION (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

Property Line >10 feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: >10' (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

267 GREAT ROAD
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-8

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-11"	A	10YR 2/2	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
11-22"	B	10YR 5/6	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
22"-10'	C	2.5Y 6/4	—	—	—	COARSE SAND	15%	—	SG	LOOSE	

Additional Notes: CAVING IN @ 3'

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 10:20 (Time) CLEAR (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) — ON SLOPE (Slope (%))

PINES (Vegetation) — (Landform) — (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

Property Line >10 feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: >10' (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

267 GRANT ROAD
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-9

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10"	A	10YR 2/2	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
10"-30"	B	10YR 5/6	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
30"-72"	C	2.5Y 6/4	—	—	—	COARSE SAND	10%	—	SG	LOOSE	

Additional Notes _____

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 10:45 (Time) CLEAR (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: WOODLAND (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 5-10% (Slope (%))

PINES (Vegetation) (Landform) ON SLOPE (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

Property Line >10' feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: >10' (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
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267 GREAT ROAD
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-10

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6"	A	10YR 2/2	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
6"-14"	B	10YR 5/6	—	—	—	LOAMY SAND	—	—	MASSIVE	LOOSE	
14"-10'	C	2.5Y 6/4	—	—	—	COARSE SAND	10%	—	SG	LOOSE	

Additional Notes: CAVING IN @ 8'

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 11:00 (Time) CLEAR (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: WOODLAND. (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 2-5% (Slope (%))

PINES (Vegetation) _____ (Landform) _____ (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area 200 feet

Property Line 210 feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: 70" (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

267 GREAT ROAD
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-11

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12"	A	10YR 2/2	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
12"-20"	B	10YR 5/6	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
20"-60"	C	2.5Y 6/4	—	—	—	COARSE SAND	10%	—	SG	LOOSE	

Additional Notes _____

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 11:30 (Time) CLEAR (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: YARD (e.g. woodland, agricultural field, vacant lot, etc.) — (Surface Stones) 0-10% (Slope (%))

GRASS / SHRUBS (Vegetation) _____ (Landform) ON-SLOPE (Position on landscape (attach sheet))

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area 200 feet

Property Line 710 feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: 710' (Inches) _____ (elevation)

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

267 GREAT ROAD
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-12

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6"	A	10YR 2/2	—	—	—	LOAMY SAND	—	—	MASSIVE	FRIABLE	
6"-11"	B	10YR 5/6	—	—	—	LOAMY SAND	—	—	SG	LOOSE	
11"-80"	C	2.5Y 6/4	—	—	—	COARSE SAND	10%	—	SG	LOOSE	

Additional Notes _____

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Site Address or Map/Lot Number

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

Deep Observation Hole A: 3/27/12 (Date) 11:45 (Time) CLEAR (Weather)

1. Deep Observation Hole Logs

Deep Hole Number _____ Ground Elevation at Surface of Hole _____

Location (Identify on Plan) _____

2. Land Use: YARD (e.g. woodland, agricultural field, vacant lot, etc.) — Surface Stones — 0-5% Slope (%)

GRASS Vegetation _____ Landform _____ Position on landscape (attach sheet) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Possible Wet Area >100 feet

Property Line >10 feet Drinking Water Well — feet Other _____

4. Parent Material: OUTWASH Unsuitable Materials Present: Yes ☐ No ☒

If Yes: Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock ☐

5. Groundwater Observed: Yes ☐ No ☒

If Yes: Depth Weeping from Pit — Depth Standing Water in Hole —

Estimated Depth to High Groundwater: >10' inches _____ elevation

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Wastewater Permitting Program
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

267 GREAT ROAD
Site Address or Map/Lot Number

Deep Observation Hole A: Deep Hole Number: TP-13

Depth (In.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6"	A	10YR 2/2	—	—	—		—	—	MASSIVE	FRIABLE	
6"-10"	B	10YR 5/6	—	—	—	LOAMY SAND	—	—	SG	LOOSE	
10"-12	C	2.5Y 6/4	—	—	—	COARSE SAND	10%	—	SG	LOOSE	

Additional Notes _____

Commonwealth of Massachusetts
City/Town of
Percolation Test
Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A. Site Information

Owner Name

Street Address or Lot #: 267 GREAT ROAD

City/Town: ACTON | State: MA | Zip Code: 01720

Contact Person (if different from Owner) | Telephone Number

B. Test Results

	Date: 3/27/12 Time:	Date: 3/27/12 Time:
Observation Hole #	PT-A	PT-P
Depth of Perc	52"	54"
Start Pre-Soak		
End Pre-Soak	UTS	UTS
Time at 12"		
Time at 9"		
Time at 6"		
Time (9"-6")		
Rate (Min./Inch)	<2 MPI	<2 MPI
Test Passed:	☒	☒
Test Failed:	☐	☐

Test Performed By: STAMSKI AND McNARY, INC (BENJAMIN FWINE)

Witnessed By: ACTON BOARD OF HEALTH (JUSTIN SNAIR)

Comments: