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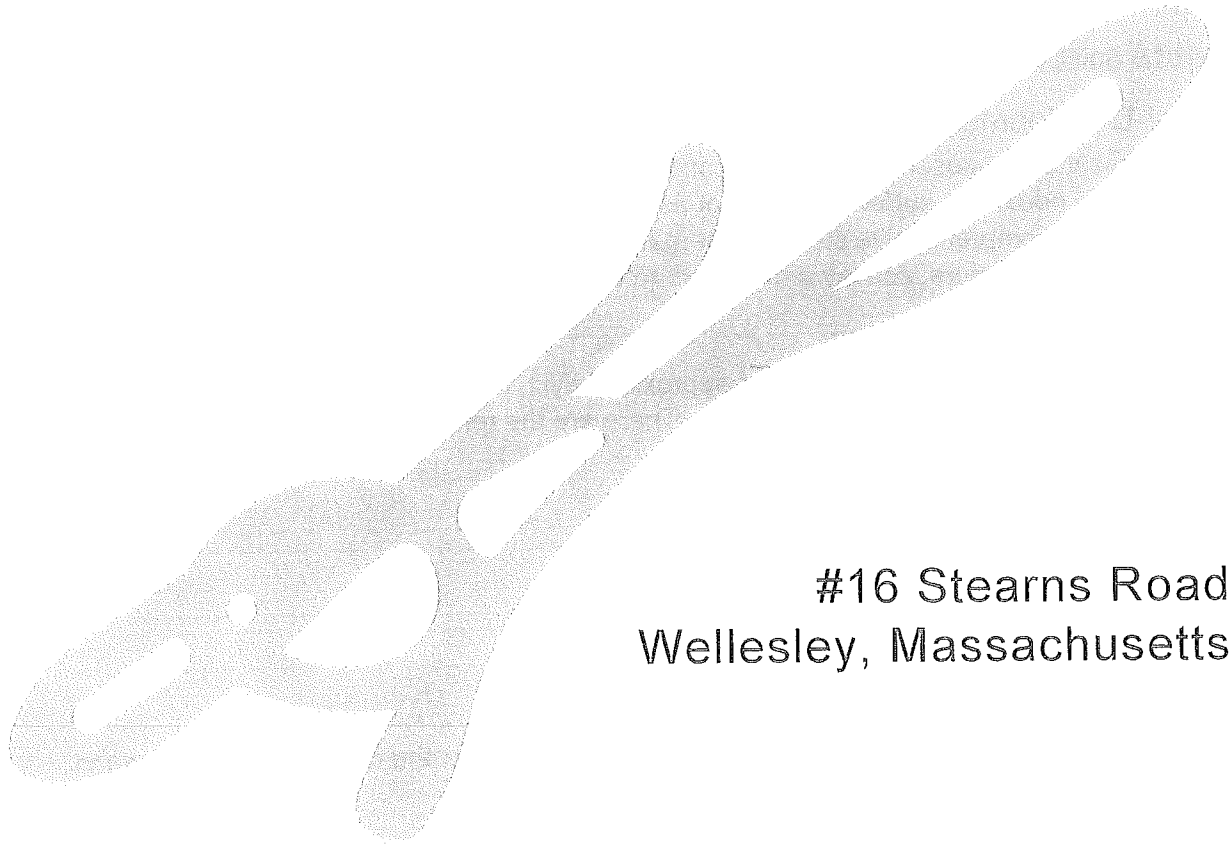
Refer to File No. **WEL-0012**

Storm Water Management Report



#16 Stearns Road
Wellesley, Massachusetts

July 6, 2018

Storm Water Management Report
#16 Stearns Road – Wellesley, MA
July 6, 2018

Introduction

16 Stearns Road, LLC, C/O J. Derenzo Properties (the "Applicant") proposes to develop 24 unit, 3-story condominium building as well as associated parking. In addition to the proposed building and parking, sub-surface chamber systems will be constructed to mitigate the peak rate of stormwater runoff from the site.

Pre-Development Conditions

The existing site is a combination of woods and a prior single family home.

The United States Department of Agriculture Natural Resource Conservation Service (NRCS) Soil Survey mapping indicates Merrimac-Urban Land. According to the NRCS maps the Hydrological Soil Group for the soils is A.

NRCS Soil Survey Mapping and Soil Data accompany this report.

Post-Development Conditions

The Project as proposed includes the construction of a new 24 unit, 3-story condominium building. In addition a surface parking lot as well as parking under the proposed building is being proposed. A comprehensive storm water management plan and drainage system will also be constructed to capture, convey and treat runoff from the increase in imperviousness.

Ground Cover Conditions

The hydrologic study area consists of approximately 1.16 +/- acres in land area. The majority of the existing lot has brush and grass area. There are the remains of the prior house and driveway.

Storm Water Management

Pre-Development Conditions

Drainage System

The existing property has no structured drainage systems for the collection of storm water runoff.

Watersheds

The majority of the existing stormwater runoff is to Stearns Road northwest of the property. (See Existing Watershed Map).

Runoff Calculations

Runoff calculations were performed in accordance with the methodology outlined in the NRCS Soil Conservation Service (SCS) methods as defined in Technical Release 55 (TR-55) and

Technical Release 20 (TR-20) which are the basis for they HydroCAD® hydrologic model. Existing cover conditions and times of concentrations were used to generate runoff hydrographs for each of the sub-catchments in each of the Type III design storms in accordance with Technical Paper 40 (TP-40) as identified in Table 2.

Table 1 - Design Storms

DESIGN STORM (RETURN FREQUENCY)	RAINFALL (INCHES/24-HOURS)
2-year	3.1
10-year	4.6
25-year	5.4
100-year	6.5

Post-Development Conditions

Drainage System

The proposed drainage system consists of a closed stormwater collection system in the parking lot which flows through a Vortsentry treatment unit before being infiltrated using subsurface chambers. The building also discharges to a second set of subsurface chambers for infiltration with a four inch overflow. The Rawls Rate for NRCS Hydrologic Soil Group A of 8.27 inches/hour was used for the infiltration rate.

Watersheds

The general direction of runoff remains unchanged from existing to proposed condition, stormwater will flow to the south.

Runoff Calculations

As in the pre-development condition, runoff calculations were performed in accordance with the methodology outlined in the NRCS Soil Conservation Service (SCS) methods as defined in Technical Release 55 (TR-55) and Technical Release 20 (TR-20) which are the basis for they HydroCAD® hydrologic model. Proposed cover conditions and times of concentrations were used to generate runoff hydrographs for each of the sub-catchments in each of the Type III design storms in accordance with Technical Paper 40 (TP-40) as identified in Table 2.

The developed runoff hydrographs were then flood routed through the proposed sub-surface chambers with infiltration.

Storm Water Management Report
#16 Stearns Road – Wellesley, MA
July 6, 2018

Massachusetts DEP Storm Water Management Standards

The proposed stormwater management system has been designed to comply with the ten (10) standards of the MaDEP Storm Water Management Policy. Each of the standards and the extent of Project compliance are summarized below. Please see the completed MassDEP Storm Water Checklist included with this report.

Standard 1: No New Untreated Discharges

No new storm water conveyances (e.g. outfalls) may discharge untreated storm water directly to or cause erosion in wetlands or waters of the Commonwealth.

There are no stormwater discharges to a wetland untreated. Stormwater quality controls are proposed with the project including: a proprietary treatment device, infiltration chambers.

Standard 2: Peak Rate Attenuation

Storm water management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

Storm water management controls to mitigate peak rates of runoff from the Project were developed for the 2, 10, 25, and 100-year, 24-hour design storm events. As previously stated, runoff calculations were performed in accordance with the methodology outlined in the NRCS Soil Conservation Service (SCS) methods as defined in Technical Release 55 (TR-55) and Technical Release 20 (TR-20) which are the basis for they HydroCAD® hydrologic model. Calculations are provided with this report.

Included with this report is a table which summarizes the peak rate of runoff for each of the studied storms.

Standard 3: Recharge

Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration ... At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the storm water management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Storm Water Handbook.

Included with this report is a table which summarizes volume of runoff for each of the studied storms. As shown the volume of runoff recharge is increased from the existing condition to the proposed condition, therefore the standard is met.

Standard 4: Water Quality

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). The standard is met with pollution prevention plans, storm water best management practices sized to capture the required water quality volume, and pretreatment measures.

The water quality is being achieved with the use of a Proprietary Treatment Device. A TSS worksheet is included with this report.

Sizing of the Proprietary Treatment Device is sized based upon the equivalent Water Quality Flow Rate. Calculations for this are also included.

Standard 5: Land Uses with Higher Potential Pollution Loads

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Storm Water Handbook to eliminate or reduce the discharge of storm water runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and storm water runoff, the proponent shall use the specific structural storm water BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Storm Water Handbook. Storm water discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Standard 5 is not applicable to the Project. The Project is not associated with uses that will subject the site to higher potential pollutant loads as defined in the MaDEP Wetlands and Water Quality regulations.

Land Uses with Higher Potential Pollutant Loads (LUHPPLs) are identified in 310 CMR 22.20B(2) and C(2) a through k and m and in 310 CMR 22.21(2)(a) 1 through 8 and (b) 1 through 6; areas within a site that are the location of activities that are subject to an individual National Pollutant Discharge Elimination System (NPDES) permit or the NPRDE Multi-Sector General Permit; automotive fueling facilities, exterior fleet storage areas, exterior vehicle service and equipment cleaning areas; marinas and boatyards; parking lots with high-intensity use; confined disposal facilities and disposal sites.

Standard 6: Critical Areas

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

The Project is not located within a Critical Area.

Standard 7: Redevelopment Projects

A redevelopment project is required to meet the following Storm Water Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5,

and 6. Existing storm water discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Storm Water Management Standards and improve existing conditions.

Standard 7 is not applicable to the Project. The MaDEP Storm Water Management Handbook definition of a redevelopment project identifies the, *"development, rehabilitation, expansion, and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area."*

Standard 8: Construction Period Pollution Prevention

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

A Construction Period Pollution Prevention and Erosion Control Plan is included with this report. This program details the construction period operation and maintenance for best management practices employed on the project and provides sequencing for pollution prevention measures and erosion and sedimentation controls. Locations of erosion control measures are depicted on the Site Plan set.

Standard 9: Operation and Maintenance Plan

A long-term operation and maintenance plan must be developed and implemented to ensure that storm water management systems function as designed.

A Long Term Operation and Maintenance Plan is included with this report. The Operation and Maintenance program provides details and scheduled for routine and non-routine maintenance to the selected best management practices used in the Project.

Standard 10: Illicit Discharges

All illicit discharges to the storm water management system are prohibited.

Illicit discharges to the storm water management system are discharged that are not entirely comprised of storm water. Discharges to the storm water management system from the following activities or facilities are permissible:

- Firefighting
- Water Main Flushing
- Landscape Irrigation
- Uncontaminated Groundwater
- Potable Water Sources
- Foundation Drains
- Air Conditioning Condensation
- Footing Drains
- Individual Resident Car Washing
- Flows from Riparian Habitats and Wetlands
- Dechlorinated Water from Swimming Pools

- Water Used for Street Sweeping
- Water Used to Clean Residential Buildings (without detergents)

All other illicit discharges to the storm water management system are prohibited.

There are no known illicit discharges anticipated through the completion of this project. Post-construction prevention of illicit discharges is addressed in the Good Housekeeping Practices section of the report.

Conclusion

The Project as proposed has been designed to address both the quality and quantity of storm water runoff from the site improvements. The Project has been designed to meet or exceed each of the ten standards of the MaDEP Storm Water Guidelines.

#16 Stearns Road
Wellesley, MA
Runoff Sumary

South

Storm	Existing Q (C.F.S.)	Proposed Q (C.F.S.)	Change Q (C.F.S.)	Existing Volume (C.F.)	Proposed Volume (C.F)	Change Volume (C.F.)
2 Year	0.00	0.00	0.00	0	0	0
10 Year	0.00	0.00	0.00	10	0	-10
25 Year	0.00	0.00	0.00	35	0	-35
100 Year	0.01	0.00	-0.01	92	0	-92

East

Storm	Existing Q (C.F.S.)	Proposed Q (C.F.S.)	Change Q (C.F.S.)	Existing Volume (C.F.)	Proposed Volume (C.F)	Change Volume (C.F.)
2 Year	0.00	0.00	0.00	0	0	0
10 Year	0.00	0.00	0.00	11	0	-11
25 Year	0.00	0.00	0.00	37	0	-37
100 Year	0.01	0.00	0.00	95	0	-95

To Stearns

Storm	Existing Q (C.F.S.)	Proposed Q (C.F.S.)	Change Q (C.F.S.)	Existing Volume (C.F.)	Proposed Volume (C.F)	Change Volume (C.F.)
2 Year	0.00	0.00	0.00	30	40	10
10 Year	0.05	0.04	-0.01	805	388	-417
25 Year	0.16	0.09	-0.07	1577	690	-887
100 Year	0.42	0.20	-0.22	2968	1212	-1756

Total

Storm	Existing Q (C.F.S.)	Proposed Q (C.F.S.)	Change Q (C.F.S.)	Existing Volume (C.F.)	Proposed Volume (C.F)	Change Volume (C.F.)
2 Year	0.00	0.00	0.00	30	40	10
10 Year	0.05	0.04	-0.01	825	388	-437
25 Year	0.16	0.09	-0.07	1649	690	-959
100 Year	0.44	0.20	-0.24	3155	1212	-1943

#16 Stearns Road
Wellesley, MA
BMP Peak Elevations

BMP 1P rear depression

Storm	Peak Elevation
2 Year	146.51
10 Year	146.65
25 Year	146.79
100 Year	146.96

BMP 2P Rear Building

Storm	Peak Elevation
2 Year	146.35
10 Year	147.09
25 Year	147.53
100 Year	148.28

BMP 3P Parking Lot

Storm	Peak Elevation
2 Year	145.91
10 Year	146.43
25 Year	146.78
100 Year	147.32

BMP 4P Parking at Garage

Storm	Peak Elevation
2 Year	146.10
10 Year	146.70
25 Year	147.05
100 Year	147.58

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Water Quality Flow Calculation Worksheet

Refer to File No. WEL-0012

For First ½-inch of Runoff WQV:

Impervious Surfaces to Vortsentry:

Catchment	Time of Conc. (hours)	Impervious Area (acres)	Impervious Area (sq. mi.)
P1	0.100	0.10	
Σ		0.10	0.000000004

Time of Concentration:

Longest Catchment Tc: 0.10

q_u from Figure 2, attached: 752 csm/in

Water Quality Flow (WQF):

$$Q_{1.0} = (q_u)(A)(WQV)$$

Where:

$Q_{0.5}$ = peak flow rate associated with the first ½-inch of runoff;

q_u = the unit peak discharge, in cubic feet per second per square mile per inch;

A = impervious surface in drainage area, in square miles;

WQV = water quality volume, in inches (0.5 inches)

$$Q_{0.5} = \left(752\frac{csm}{in}\right)(0.000000004\ sq.\ mi.)(0.5")$$

$$Q_{0.5} = 0.0000014\ cfs$$

Proprietary Separator Selection:

The VortSentry HS48 will provide a presumptive removal rate of 80% for water quality flows through 0.55 cfs. See Massachusetts sizing table below:

VortSentry HS Model	Swirl Chamber Diameter (ft)	Typical Depth Below Invert (ft)	Treatment Capacity (cfs)[1]	Max. Inlet/Outlet Pipe Diameter (in)	Maximum Sediment Storage Capacity (CF)
VortSentry HS36*	3	5.6	0.55	18	39
w/ 1' added sump	3	6.6	0.55	18	47
w/ 2' added sump	3	7.6	0.55	18	54
w/ 3' added sump	3	8.6	0.55	18	61
w/ 4' added sump	3	9.6	0.55	18	68
w/ 5' added sump	3	10.6	0.55	18	75
VortSentry HS48**	4	6.8	1.2	24	85
w/ 1' added sump	4	7.8	1.2	24	97
w/ 2' added sump	4	8.8	1.2	24	110
w/ 3' added sump	4	9.8	1.2	24	123
w/ 4' added sump	4	10.8	1.2	24	135
VortSentry HS60***	5	8.0	2.2	30	156
w/ 1' added sump	5	9.0	2.2	30	176
w/ 2' added sump	5	10.0	2.2	30	196
w/ 3' added sump	5	11.0	2.2	30	215

*maintenance recommended when sediment reaches a height of 3'-7" below water surface elevation in sump.
**maintenance recommended when sediment reaches a height of 4'-9" below water surface elevation in sump.
***maintenance recommended when sediment reaches a height of 6.0' below water surface elevation in sump.
1. Design Flow Rate is based on 80% removal of particle size distribution with an average particle size of 240 micron. This flow also represents the maximum flow prior to which bypass occurs.

Notes:
- Systems can be sized based on a water quality flow (e.g. 1 inch storm) or on a net annual basis depending on the local regulatory requirement.
- When sizing based on a water quality storm, the required flow to be treated should be equal or less than the listed water quality flow for the selected system. Systems sized based on a water quality storm are generally more conservatively sized.
- Additional particle size distributions are available for sizing purposes upon request.
- Depth below invert is measured to the inside bottom of the system. This depth can be adjusted to meet specific storage or maintenance requirements.
- Contact our support staff for the most cost effective sizing for your area.

Water Quality Flow Calculation
16 Stearns Road – Wellesley, MA
July 6, 2018

The StormCeptor STC 450i will provide a presumptive removal rate of 77% for water quality flows through 0.40 cfs. See Massachusetts sizing table below:

Massachusetts – Water Quality (Q) Flow Rate

Stormceptor STC Model	Inside Diameter	Typical Depth Below Inlet Pipe Invert [1]	Water Quality Flow Rate Q [2]	Peak Conveyance Flow Rate [3]	Hydrocarbon Capacity [4]	Maximum Sediment Capacity [4]
	(ft)	(in)	(cfs)	(cfs)	(Gallons)	(ft³)
STC 450i	4	68	0.40	5.5	86	46
STC 900	6	63	0.89	22	251	89
STC 2400	8	104	1.58	22	840	205
STC 4800	10	140	2.47	22	909	543
STC 7200	12	148	3.56	22	1,059	839
STC 11000	2 x 10	142	4.94	48	2,792	1,086
STC 16000	2 x 12	148	7.12	48	3,055	1,677

[1] Depth Below Pipe Inlet Invert to the Bottom of Base Slab, and Maximum Sediment Capacity can vary to accommodate specific site designs and pollutant loads. Depths can vary to accommodate special designs or site conditions. Contact your local representative for assistance.
[2] Water Quality Flow Rate (Q) is based on 80% annual average TSS removal of the ORI 10 particle size distribution.
[3] Peak Conveyance Flow Rate is based upon 10 ft velocity of 3 feet per second and outlet pipe diameters of 18-inch, 36-inch, and 54-inch diameters.
[4] Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

Figure 2: For First ½-inch of Runoff, Table of qu values for Ia/P Curve = 0.0.058, listed by tc, for Type III Storm Distribution

Tc (Hours)	qu (csm/in)
0.01	821
0.03	821
0.05	813
0.067	794
0.083	773
0.1	752
0.116	733
0.133	713
0.15	694
0.167	677
0.183	662
0.2	646
0.217	632
0.233	619
0.25	606
0.3	572
0.333	552
0.35	542
0.4	516
0.416	508
0.5	472
0.583	443
0.6	437
0.667	417
0.7	408
0.8	383
0.9	361
1	342
1.1	325
1.2	311
1.3	297
1.4	285
1.5	274
1.6	264
1.7	254
1.8	246
1.9	238
2	230
2.1	223
2.2	217
2.3	211
2.4	205
2.5	200
2.6	194
2.7	190
2.8	185
2.9	181
3	176
3.1	173
3.2	169
3.3	165
3.4	162
3.5	158
3.6	155
3.7	152
3.8	149
3.9	147
4	144
4.1	141
4.2	139
4.3	136
4.4	134
4.5	132
4.6	130
4.7	128
4.8	126
4.9	124
5	122
5.1	120
5.2	118
5.3	116
5.4	115
5.5	113
5.6	112
5.7	110
5.8	109
5.9	107
6	106
6.1	104
6.2	103
6.3	102
6.4	100
6.5	99
6.6	98
6.7	97
6.8	96
6.9	94
7	93
7.1	92
7.2	91
7.3	90
7.4	89
7.5	88
7.6	87
7.7	86
7.8	85
7.9	84
8	84
8.1	83
8.2	82
8.3	81
8.4	80
8.5	79
8.6	79
8.7	78
8.8	77
8.9	76
9	76
9.1	75
9.2	74
9.3	74
9.4	73
9.5	72
9.6	72
9.7	71
9.8	70
9.9	70
10	69

Version 1, Automated: Mar. 4, 2008

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: #16 Stearns Road, Wellesley, MA

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Street Sweeping - 10%	0.10	1.00	0.10	0.90
Proprietary Treatment Practice	0.77	0.90	0.69	0.21
Subsurface Infiltration Structure	0.80	0.21	0.17	0.04
	0.00	0.04	0.00	0.04
	0.00	0.04	0.00	0.04

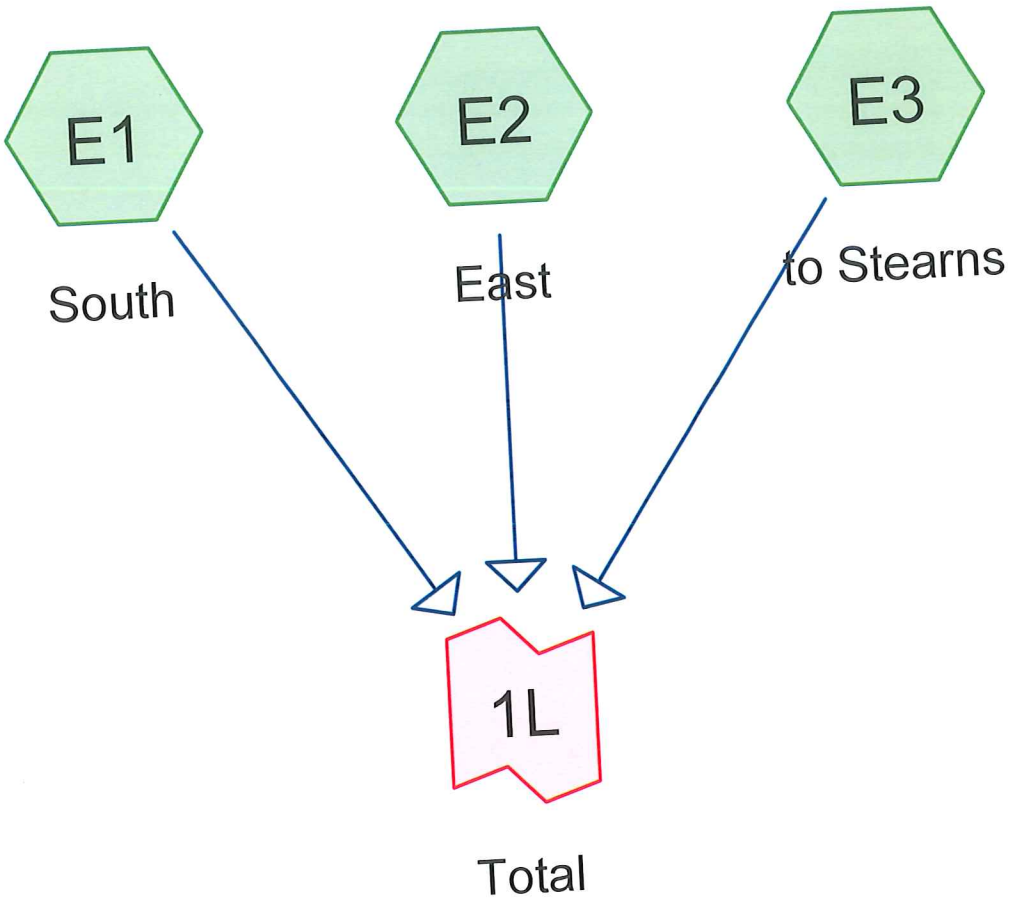
Total TSS Removal = 96%

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

Project: WEL-0012
Prepared By: WRB
Date: 6-Jul-18

*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



Subcat Reach Pond Link

Routing Diagram for EX-16stearns
Prepared by Microsoft, Printed 7/6/2018

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
10,042	39	>75% Grass cover, Good, HSG A (E3)
36,750	35	Brush, Fair, HSG A (E1, E2, E3)
2,166	98	Paved parking, HSG A (E3)
1,930	98	Roofs, HSG A (E3)
50,888	**41**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
50,888	HSG A	E1, E2, E3
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
50,888		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
10,042	0	0	0	0	10,042	>75% Grass cover, Good
36,750	0	0	0	0	36,750	Brush, Fair
2,166	0	0	0	0	2,166	Paved parking
1,930	0	0	0	0	1,930	Roofs
50,888	**0**	**0**	**0**	**0**	**50,888**	**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: South Runoff Area=3,030 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=35 Runoff=0.00 cfs 0 cf

Subcatchment E2: East Runoff Area=3,131 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=35 Runoff=0.00 cfs 0 cf

Subcatchment E3: to Stearns Runoff Area=44,727 sf 9.16% Impervious Runoff Depth=0.01"
Flow Length=368' Tc=14.2 min CN=42 Runoff=0.00 cfs 30 cf

Link 1L: Total Inflow=0.00 cfs 30 cf
Primary=0.00 cfs 30 cf

Total Runoff Area = 50,888 sf Runoff Volume = 30 cf Average Runoff Depth = 0.01"
91.95% Pervious = 46,792 sf 8.05% Impervious = 4,096 sf

Summary for Subcatchment E1: South

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (sf)	CN	Description
3,030	35	Brush, Fair, HSG A
3,030		100.00% Pervious Area

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

Summary for Subcatchment E2: East

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (sf)	CN	Description
3,131	35	Brush, Fair, HSG A
3,131		100.00% Pervious Area

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

Summary for Subcatchment E3: to Stearns

Runoff = 0.00 cfs @ 22.51 hrs, Volume= 30 cf, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (sf)	CN	Description
30,589	35	Brush, Fair, HSG A
10,042	39	>75% Grass cover, Good, HSG A
2,166	98	Paved parking, HSG A
1,930	98	Roofs, HSG A
44,727	42	Weighted Average
40,631		90.84% Pervious Area
4,096		9.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.2200	0.17		**Sheet Flow, sheet** Woods: Light underbrush n= 0.400 P2= 3.10"
0.2	40	0.3500	2.96		**Shallow Concentrated Flow, shallow** Woodland Kv= 5.0 fps
7.3	220	0.0100	0.50		**Shallow Concentrated Flow, depression** Woodland Kv= 5.0 fps
1.9	58	0.0100	0.50		**Shallow Concentrated Flow, shallow** Woodland Kv= 5.0 fps
14.2	368	Total			

Summary for Link 1L: Total

Inflow Area = 50,888 sf, 8.05% Impervious, Inflow Depth = 0.01" for 2 Year event
Inflow = 0.00 cfs @ 22.51 hrs, Volume= 30 cf
Primary = 0.00 cfs @ 22.51 hrs, Volume= 30 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: South Runoff Area=3,030 sf 0.00% Impervious Runoff Depth=0.04"
Tc=6.0 min CN=35 Runoff=0.00 cfs 10 cf

Subcatchment E2: East Runoff Area=3,131 sf 0.00% Impervious Runoff Depth=0.04"
Tc=6.0 min CN=35 Runoff=0.00 cfs 11 cf

Subcatchment E3: to Stearns Runoff Area=44,727 sf 9.16% Impervious Runoff Depth=0.22"
Flow Length=368' Tc=14.2 min CN=42 Runoff=0.05 cfs 805 cf

Link 1L: Total Inflow=0.05 cfs 825 cf
Primary=0.05 cfs 825 cf

Total Runoff Area = 50,888 sf Runoff Volume = 825 cf Average Runoff Depth = 0.19"
91.95% Pervious = 46,792 sf 8.05% Impervious = 4,096 sf

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: South Runoff Area=3,030 sf 0.00% Impervious Runoff Depth=0.14"
Tc=6.0 min CN=35 Runoff=0.00 cfs 35 cf

Subcatchment E2: East Runoff Area=3,131 sf 0.00% Impervious Runoff Depth=0.14"
Tc=6.0 min CN=35 Runoff=0.00 cfs 37 cf

Subcatchment E3: to Stearns Runoff Area=44,727 sf 9.16% Impervious Runoff Depth=0.42"
Flow Length=368' Tc=14.2 min CN=42 Runoff=0.16 cfs 1,577 cf

Link 1L: Total Inflow=0.16 cfs 1,649 cf
Primary=0.16 cfs 1,649 cf

Total Runoff Area = 50,888 sf Runoff Volume = 1,649 cf Average Runoff Depth = 0.39"
91.95% Pervious = 46,792 sf 8.05% Impervious = 4,096 sf

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

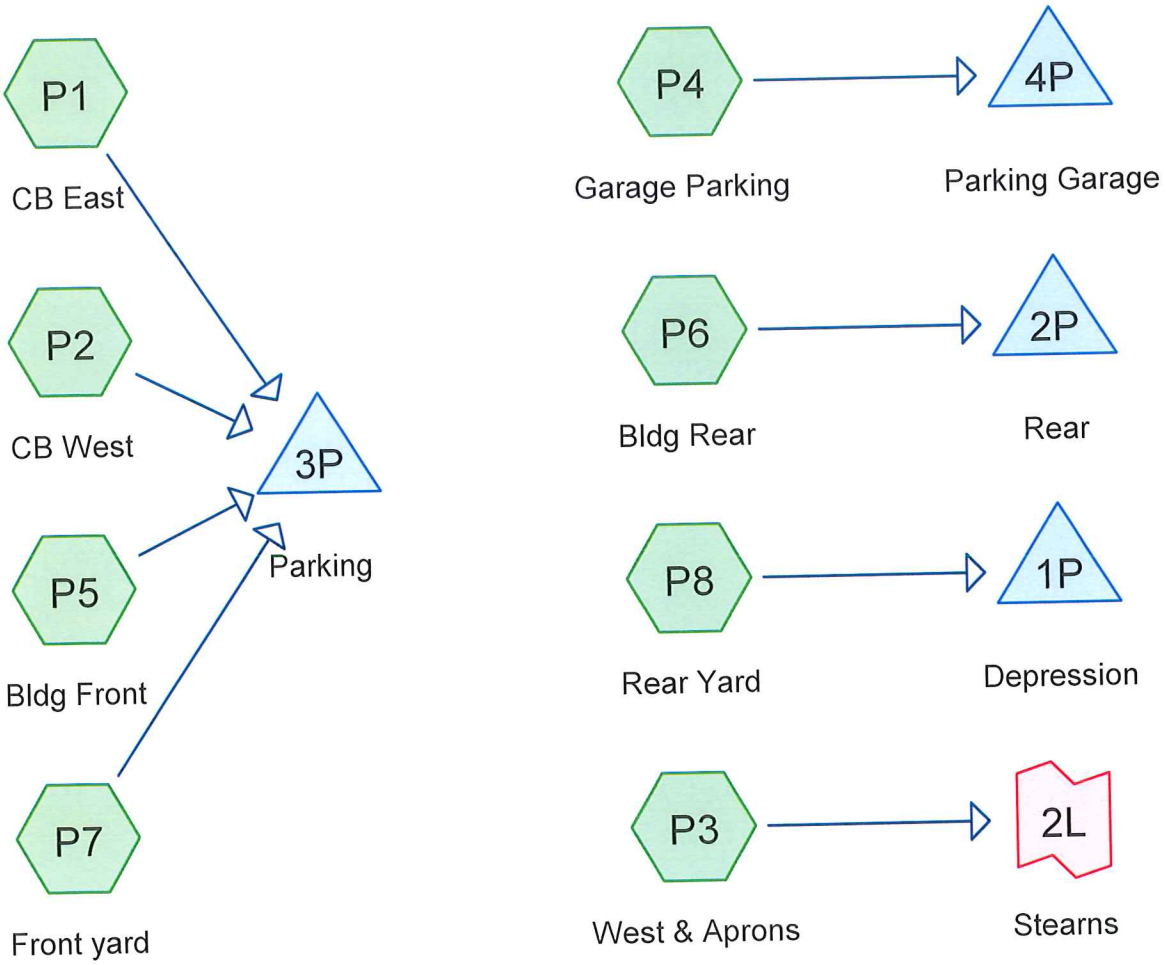
Subcatchment E1: South Runoff Area=3,030 sf 0.00% Impervious Runoff Depth=0.36"
Tc=6.0 min CN=35 Runoff=0.01 cfs 92 cf

Subcatchment E2: East Runoff Area=3,131 sf 0.00% Impervious Runoff Depth=0.36"
Tc=6.0 min CN=35 Runoff=0.01 cfs 95 cf

Subcatchment E3: to Stearns Runoff Area=44,727 sf 9.16% Impervious Runoff Depth=0.80"
Flow Length=368' Tc=14.2 min CN=42 Runoff=0.42 cfs 2,968 cf

Link 1L: Total Inflow=0.44 cfs 3,155 cf
Primary=0.44 cfs 3,155 cf

Total Runoff Area = 50,888 sf Runoff Volume = 3,155 cf Average Runoff Depth = 0.74"
91.95% Pervious = 46,792 sf 8.05% Impervious = 4,096 sf



Subcat Reach Pond Link

Routing Diagram for PR-16stearns
Prepared by Microsoft, Printed 7/6/2018
HydroCAD® 10.00-21 s/n 03206 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
19,858	39	>75% Grass cover, Good, HSG A (P1, P2, P3, P4, P7, P8)
4,375	35	Brush, Fair, HSG A (P3)
9,693	98	Paved parking, HSG A (P1, P2, P3, P4)
741	98	Paved parking, HSG A (walk) (P8)
559	98	Paved parking, HSG A (wall) (P1, P3)
14,820	98	Roofs, HSG A (P5, P6)
844	98	Roofs, HSG A (porch) (P1, P3, P8)
50,890	**70**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
50,890	HSG A	P1, P2, P3, P4, P5, P6, P7, P8
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
50,890		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
19,858	0	0	0	0	19,858	>75% Grass cover, Good
4,375	0	0	0	0	4,375	Brush, Fair
10,993	0	0	0	0	10,993	Paved parking
15,664	0	0	0	0	15,664	Roofs
50,890	**0**	**0**	**0**	**0**	**50,890**	**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: CB East Runoff Area=8,671 sf 49.86% Impervious Runoff Depth=0.68"
Tc=6.0 min CN=68 Runoff=0.13 cfs 491 cf

Subcatchment P2: CB West Runoff Area=2,318 sf 87.58% Impervious Runoff Depth=2.16"
Tc=6.0 min CN=91 Runoff=0.13 cfs 418 cf

Subcatchment P3: West & Aprons Runoff Area=14,392 sf 12.79% Impervious Runoff Depth=0.03"
Flow Length=360' Tc=15.3 min CN=45 Runoff=0.00 cfs 40 cf

Subcatchment P4: Garage Parking Runoff Area=2,853 sf 92.99% Impervious Runoff Depth=2.45"
Tc=6.0 min CN=94 Runoff=0.18 cfs 582 cf

Subcatchment P5: Bldg Front Runoff Area=7,410 sf 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=0.50 cfs 1,771 cf

Subcatchment P6: Bldg Rear Runoff Area=7,410 sf 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=0.50 cfs 1,771 cf

Subcatchment P7: Front yard Runoff Area=1,933 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=39 Runoff=0.00 cfs 0 cf

Subcatchment P8: Rear Yard Runoff Area=5,903 sf 16.77% Impervious Runoff Depth=0.09"
Tc=6.0 min CN=49 Runoff=0.00 cfs 45 cf

Pond 1P: Depression Peak Elev=146.51' Storage=0 cf Inflow=0.00 cfs 45 cf
Outflow=0.00 cfs 45 cf

Pond 2P: Rear Peak Elev=146.35' Storage=352 cf Inflow=0.50 cfs 1,771 cf
Outflow=0.12 cfs 1,771 cf

Pond 3P: Parking Peak Elev=145.91' Storage=320 cf Inflow=0.76 cfs 2,680 cf
Outflow=0.29 cfs 2,680 cf

Pond 4P: Parking Garage Peak Elev=146.10' Storage=100 cf Inflow=0.18 cfs 582 cf
Outflow=0.05 cfs 582 cf

Link 2L: Stearns Inflow=0.00 cfs 40 cf
Primary=0.00 cfs 40 cf

Total Runoff Area = 50,890 sf Runoff Volume = 5,117 cf Average Runoff Depth = 1.21"
47.62% Pervious = 24,233 sf 52.38% Impervious = 26,657 sf

Summary for Subcatchment P1: CB East

Runoff = 0.13 cfs @ 12.11 hrs, Volume= 491 cf, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

	Area (sf)	CN	Description
	3,598	98	Paved parking, HSG A
*	310	98	Paved parking, HSG A (wall)
*	415	98	Roofs, HSG A (porch)
	4,348	39	>75% Grass cover, Good, HSG A
	8,671	68	Weighted Average
	4,348		50.14% Pervious Area
	4,323		49.86% Impervious Area

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

Summary for Subcatchment P2: CB West

Runoff = 0.13 cfs @ 12.09 hrs, Volume= 418 cf, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (sf)	CN	Description
288	39	>75% Grass cover, Good, HSG A
2,030	98	Paved parking, HSG A
2,318	91	Weighted Average
288		12.42% Pervious Area
2,030		87.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, direct calc <2

Summary for Subcatchment P3: West & Aprons

Runoff = 0.00 cfs @ 15.76 hrs, Volume= 40 cf, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

	Area (sf)	CN	Description
*	180	98	Roofs, HSG A (porch)
	1,412	98	Paved parking, HSG A
*	249	98	Paved parking, HSG A (wall)
	8,176	39	>75% Grass cover, Good, HSG A
	4,375	35	Brush, Fair, HSG A
	14,392	45	Weighted Average
	12,551		87.21% Pervious Area
	1,841		12.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		**Sheet Flow, sheet** Grass: Short n= 0.150 P2= 3.10"
10.4	310	0.0050	0.49		**Shallow Concentrated Flow, shallow** Short Grass Pasture Kv= 7.0 fps
15.3	360	Total			

Summary for Subcatchment P4: Garage Parking

Runoff = 0.18 cfs @ 12.09 hrs, Volume= 582 cf, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (sf)	CN	Description
2,653	98	Paved parking, HSG A
200	39	>75% Grass cover, Good, HSG A
2,853	94	Weighted Average
200		7.01% Pervious Area
2,653		92.99% Impervious Area

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

Summary for Subcatchment P5: Bldg Front

Runoff = 0.50 cfs @ 12.09 hrs, Volume= 1,771 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (sf)	CN	Description
7,410	98	Roofs, HSG A
7,410		100.00% Impervious Area

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

Summary for Subcatchment P6: Bldg Rear

Runoff = 0.50 cfs @ 12.09 hrs, Volume= 1,771 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (sf)	CN	Description
7,410	98	Roofs, HSG A
7,410		100.00% Impervious Area

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

Summary for Subcatchment P7: Front yard

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

Area (sf)	CN	Description
1,933	39	>75% Grass cover, Good, HSG A
1,933		100.00% Pervious Area

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

Summary for Subcatchment P8: Rear Yard

Runoff = 0.00 cfs @ 13.80 hrs, Volume= 45 cf, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

	Area (sf)	CN	Description
*	249	98	Roofs, HSG A (porch)
*	741	98	Paved parking, HSG A (walk)
	4,913	39	>75% Grass cover, Good, HSG A
	5,903	49	Weighted Average
	4,913		83.23% Pervious Area
	990		16.77% Impervious Area

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

Summary for Pond 1P: Depression

Inflow Area = 5,903 sf, 16.77% Impervious, Inflow Depth = 0.09" for 2 Year event
Inflow = 0.00 cfs @ 13.80 hrs, Volume= 45 cf
Outflow = 0.00 cfs @ 14.68 hrs, Volume= 45 cf, Atten= 1%, Lag= 53.1 min
Discarded = 0.00 cfs @ 14.68 hrs, Volume= 45 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 146.51' @ 14.68 hrs Surf.Area= 12 sf Storage= 0 cf

Plug-Flow detention time= 15.0 min calculated for 45 cf (100% of inflow)
Center-of-Mass det. time= 14.8 min (1,052.7 - 1,038.0)

Volume	Invert	Avail.Storage	Storage Description
#1	146.50'	54,967 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
146.50	4	0	0
147.00	444	112	112
148.00	1,681	1,063	1,175
180.00	1,681	53,792	54,967

Device	Routing	Invert	Outlet Devices
#1	Discarded	146.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 14.68 hrs HW=146.51' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Summary for Pond 2P: Rear

Inflow Area = 7,410 sf,100.00% Impervious, Inflow Depth = 2.87" for 2 Year event
Inflow = 0.50 cfs @ 12.09 hrs, Volume= 1,771 cf
Outflow = 0.12 cfs @ 11.75 hrs, Volume= 1,771 cf, Atten= 75%, Lag= 0.0 min
Discarded = 0.12 cfs @ 11.75 hrs, Volume= 1,771 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 146.35' @ 12.46 hrs Surf.Area= 643 sf Storage= 352 cf

Plug-Flow detention time= 13.7 min calculated for 1,769 cf (100% of inflow)
Center-of-Mass det. time= 13.7 min (770.8 - 757.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	145.40'	614 cf	**6.33'W x 101.50'L x 3.54'H Field A** 2,277 cf Overall - 741 cf Embedded = 1,535 cf x 40.0% Voids
#2A	145.90'	741 cf	**Cultec R-330XLHD** x 14 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 1 rows
		1,356 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	145.40'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.12 cfs @ 11.75 hrs HW=145.44' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

Summary for Pond 3P: Parking

Inflow Area = 20,332 sf, 67.69% Impervious, Inflow Depth = 1.58" for 2 Year event
Inflow = 0.76 cfs @ 12.09 hrs, Volume= 2,680 cf
Outflow = 0.29 cfs @ 11.95 hrs, Volume= 2,680 cf, Atten= 61%, Lag= 0.0 min
Discarded = 0.29 cfs @ 11.95 hrs, Volume= 2,680 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 145.91' @ 12.35 hrs Surf.Area= 1,531 sf Storage= 320 cf

Plug-Flow detention time= 5.1 min calculated for 2,677 cf (100% of inflow)
Center-of-Mass det. time= 5.1 min (793.0 - 787.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	145.40'	1,317 cf	**20.83'W x 73.50'L x 3.54'H Field A** 5,423 cf Overall - 2,131 cf Embedded = 3,292 cf x 40.0% Voids
#2A	145.90'	2,131 cf	**Cultec R-330XLHD** x 40 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 4 rows
		3,448 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	145.40'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.29 cfs @ 11.95 hrs HW=145.44' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.29 cfs)

Summary for Pond 4P: Parking Garage

Inflow Area = 2,853 sf, 92.99% Impervious, Inflow Depth = 2.45" for 2 Year event
Inflow = 0.18 cfs @ 12.09 hrs, Volume= 582 cf
Outflow = 0.05 cfs @ 11.85 hrs, Volume= 582 cf, Atten= 70%, Lag= 0.0 min
Discarded = 0.05 cfs @ 11.85 hrs, Volume= 582 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 146.10' @ 12.41 hrs Surf.Area= 280 sf Storage= 100 cf

Plug-Flow detention time= 9.1 min calculated for 581 cf (100% of inflow)
Center-of-Mass det. time= 9.1 min (797.3 - 788.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	145.40'	258 cf	**16.00'W x 17.50'L x 3.54'H Field A** 992 cf Overall - 346 cf Embedded = 645 cf x 40.0% Voids
#2A	145.90'	346 cf	**Cultec R-330XLHD** x 6 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		605 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	145.40'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.05 cfs @ 11.85 hrs HW=145.44' (Free Discharge)
↑1=Exfiltration (Exfiltration Controls 0.05 cfs)

Summary for Link 2L: Stearns

Inflow Area = 14,392 sf, 12.79% Impervious, Inflow Depth = 0.03" for 2 Year event
Inflow = 0.00 cfs @ 15.76 hrs, Volume= 40 cf
Primary = 0.00 cfs @ 15.76 hrs, Volume= 40 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: CB East Runoff Area=8,671 sf 49.86% Impervious Runoff Depth=1.60"
Tc=6.0 min CN=68 Runoff=0.35 cfs 1,156 cf

Subcatchment P2: CB West Runoff Area=2,318 sf 87.58% Impervious Runoff Depth=3.59"
Tc=6.0 min CN=91 Runoff=0.21 cfs 694 cf

Subcatchment P3: West & Aprons Runoff Area=14,392 sf 12.79% Impervious Runoff Depth=0.32"
Flow Length=360' Tc=15.3 min CN=45 Runoff=0.04 cfs 388 cf

Subcatchment P4: Garage Parking Runoff Area=2,853 sf 92.99% Impervious Runoff Depth=3.91"
Tc=6.0 min CN=94 Runoff=0.27 cfs 930 cf

Subcatchment P5: Bldg Front Runoff Area=7,410 sf 100.00% Impervious Runoff Depth=4.36"
Tc=6.0 min CN=98 Runoff=0.75 cfs 2,695 cf

Subcatchment P6: Bldg Rear Runoff Area=7,410 sf 100.00% Impervious Runoff Depth=4.36"
Tc=6.0 min CN=98 Runoff=0.75 cfs 2,695 cf

Subcatchment P7: Front yard Runoff Area=1,933 sf 0.00% Impervious Runoff Depth=0.13"
Tc=6.0 min CN=39 Runoff=0.00 cfs 20 cf

Subcatchment P8: Rear Yard Runoff Area=5,903 sf 16.77% Impervious Runoff Depth=0.49"
Tc=6.0 min CN=49 Runoff=0.04 cfs 241 cf

Pond 1P: Depression Peak Elev=146.65' Storage=10 cf Inflow=0.04 cfs 241 cf
Outflow=0.02 cfs 241 cf

Pond 2P: Rear Peak Elev=147.09' Storage=703 cf Inflow=0.75 cfs 2,695 cf
Outflow=0.12 cfs 2,695 cf

Pond 3P: Parking Peak Elev=146.43' Storage=988 cf Inflow=1.31 cfs 4,566 cf
Outflow=0.29 cfs 4,566 cf

Pond 4P: Parking Garage Peak Elev=146.70' Storage=231 cf Inflow=0.27 cfs 930 cf
Outflow=0.05 cfs 930 cf

Link 2L: Stearns Inflow=0.04 cfs 388 cf
Primary=0.04 cfs 388 cf

Total Runoff Area = 50,890 sf Runoff Volume = 8,820 cf Average Runoff Depth = 2.08"
47.62% Pervious = 24,233 sf 52.38% Impervious = 26,657 sf

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: CB East Runoff Area=8,671 sf 49.86% Impervious Runoff Depth=2.17"
Tc=6.0 min CN=68 Runoff=0.49 cfs 1,568 cf

Subcatchment P2: CB West Runoff Area=2,318 sf 87.58% Impervious Runoff Depth=4.37"
Tc=6.0 min CN=91 Runoff=0.25 cfs 844 cf

Subcatchment P3: West & Aprons Runoff Area=14,392 sf 12.79% Impervious Runoff Depth=0.58"
Flow Length=360' Tc=15.3 min CN=45 Runoff=0.09 cfs 690 cf

Subcatchment P4: Garage Parking Runoff Area=2,853 sf 92.99% Impervious Runoff Depth=4.70"
Tc=6.0 min CN=94 Runoff=0.33 cfs 1,118 cf

Subcatchment P5: Bldg Front Runoff Area=7,410 sf 100.00% Impervious Runoff Depth=5.16"
Tc=6.0 min CN=98 Runoff=0.88 cfs 3,188 cf

Subcatchment P6: Bldg Rear Runoff Area=7,410 sf 100.00% Impervious Runoff Depth=5.16"
Tc=6.0 min CN=98 Runoff=0.88 cfs 3,188 cf

Subcatchment P7: Front yard Runoff Area=1,933 sf 0.00% Impervious Runoff Depth=0.29"
Tc=6.0 min CN=39 Runoff=0.00 cfs 46 cf

Subcatchment P8: Rear Yard Runoff Area=5,903 sf 16.77% Impervious Runoff Depth=0.80"
Tc=6.0 min CN=49 Runoff=0.08 cfs 395 cf

Pond 1P: Depression Peak Elev=146.79' Storage=38 cf Inflow=0.08 cfs 395 cf
Outflow=0.05 cfs 395 cf

Pond 2P: Rear Peak Elev=147.53' Storage=901 cf Inflow=0.88 cfs 3,188 cf
Outflow=0.12 cfs 3,188 cf

Pond 3P: Parking Peak Elev=146.78' Storage=1,424 cf Inflow=1.62 cfs 5,646 cf
Outflow=0.29 cfs 5,646 cf

Pond 4P: Parking Garage Peak Elev=147.05' Storage=306 cf Inflow=0.33 cfs 1,118 cf
Outflow=0.05 cfs 1,118 cf

Link 2L: Stearns Inflow=0.09 cfs 690 cf
Primary=0.09 cfs 690 cf

Total Runoff Area = 50,890 sf Runoff Volume = 11,037 cf Average Runoff Depth = 2.60"
47.62% Pervious = 24,233 sf 52.38% Impervious = 26,657 sf

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: CB East Runoff Area=8,671 sf 49.86% Impervious Runoff Depth=3.01"
Tc=6.0 min CN=68 Runoff=0.69 cfs 2,175 cf

Subcatchment P2: CB West Runoff Area=2,318 sf 87.58% Impervious Runoff Depth=5.45"
Tc=6.0 min CN=91 Runoff=0.31 cfs 1,052 cf

Subcatchment P3: West & Aprons Runoff Area=14,392 sf 12.79% Impervious Runoff Depth=1.01"
Flow Length=360' Tc=15.3 min CN=45 Runoff=0.20 cfs 1,212 cf

Subcatchment P4: Garage Parking Runoff Area=2,853 sf 92.99% Impervious Runoff Depth=5.79"
Tc=6.0 min CN=94 Runoff=0.40 cfs 1,377 cf

Subcatchment P5: Bldg Front Runoff Area=7,410 sf 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=1.06 cfs 3,866 cf

Subcatchment P6: Bldg Rear Runoff Area=7,410 sf 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=1.06 cfs 3,866 cf

Subcatchment P7: Front yard Runoff Area=1,933 sf 0.00% Impervious Runoff Depth=0.60"
Tc=6.0 min CN=39 Runoff=0.01 cfs 96 cf

Subcatchment P8: Rear Yard Runoff Area=5,903 sf 16.77% Impervious Runoff Depth=1.32"
Tc=6.0 min CN=49 Runoff=0.17 cfs 648 cf

Pond 1P: Depression Peak Elev=146.96' Storage=95 cf Inflow=0.17 cfs 648 cf
Outflow=0.08 cfs 648 cf

Pond 2P: Rear Peak Elev=148.28' Storage=1,183 cf Inflow=1.06 cfs 3,866 cf
Outflow=0.12 cfs 3,866 cf

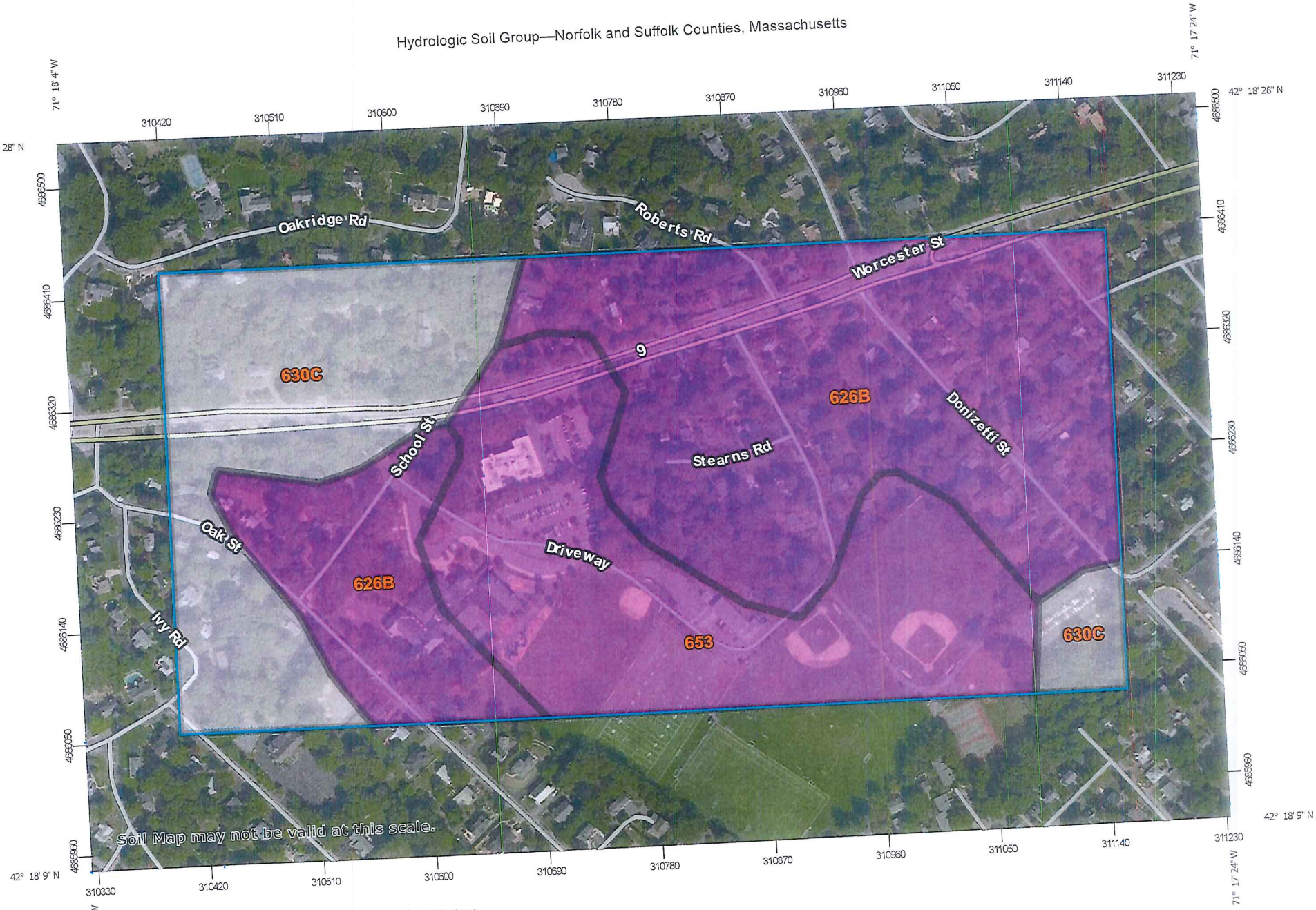
Pond 3P: Parking Peak Elev=147.32' Storage=2,081 cf Inflow=2.06 cfs 7,190 cf
Outflow=0.29 cfs 7,190 cf

Pond 4P: Parking Garage Peak Elev=147.58' Storage=413 cf Inflow=0.40 cfs 1,377 cf
Outflow=0.05 cfs 1,377 cf

Link 2L: Stearns Inflow=0.20 cfs 1,212 cf
Primary=0.20 cfs 1,212 cf

Total Runoff Area = 50,890 sf Runoff Volume = 14,293 cf Average Runoff Depth = 3.37"
47.62% Pervious = 24,233 sf 52.38% Impervious = 26,657 sf

Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts



Map Scale: 1:4,150 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 200, 400, 800, 1200

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

Natural Resources Conservation Service

Web Soil Survey
National Cooperative Soil Survey

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 13, Oct 6, 2017

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

Date(s) aerial images were photographed: Sep 12, 2014—Sep 28, 2014

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	34.1	48.7%
630C	Charlton-Hollis-Urban land complex, 3 to 15 percent slopes		16.4	23.4%
653	Udorthents, sandy	A	19.5	27.9%
Totals for Area of Interest			70.0	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Norfolk and Suffolk Counties, Massachusetts

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: vkvw
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 50 percent
Urban land: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable coarse-loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 19 inches: fine sandy loam
H2 - 19 to 23 inches: gravelly loamy sand
H3 - 23 to 60 inches: stratified sand to very gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 18 to 30 inches to strongly contrasting textural stratification
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Windsor

Percent of map unit: 10 percent

Hinckley

Percent of map unit: 7 percent

Sudbury

Percent of map unit: 3 percent

Data Source Information

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 10, Sep 19, 2014


626B
653
Stumm Rd
Pomeroy Rd
0
100 ft

USDA United States Department of Agriculture
Natural Resources Conservation Service

Web Soil Survey

Contact Us | Subscribe | Archived Soil Surveys | Soil Survey Status | Glossary | Preferences | Link | Logout | Help

A A A

Area of Interest (AOI) | Soil Map | Soil Data Explorer | Download Soils Data | Shopping Cart (Free)

Search

Area of Interest

Open All | Close All

AOI Properties

Clear AOI

AOI Information

Name

Map Unit Symbols
- Use Soil Survey Area Map Unit Symbols
- Use National Map Unit Symbols

Area (acres) 19.2

Soil Data Available from Web Soil Survey

Norfolk and Suffolk Counties, Massachusetts (MA616)

Data Availability Tabular and Spatial, complete

Tabular Data Version 7, Sep 19, 2014

Spatial Data Version 4, Dec 17, 2013

Clear AOI

Import AOI

Export AOI

Quick Navigation

Address

View

Address 680 Worcester Street, Wellesley, Ma

Show location marker

View

State and County

Soil Survey Area

Latitude and Longitude

PLSS (Section, Township, Range)

Bureau of Land Management

Department of Defense

Forest Service

National Park Service

Hydrologic Unit

Area of Interest Interactive Map

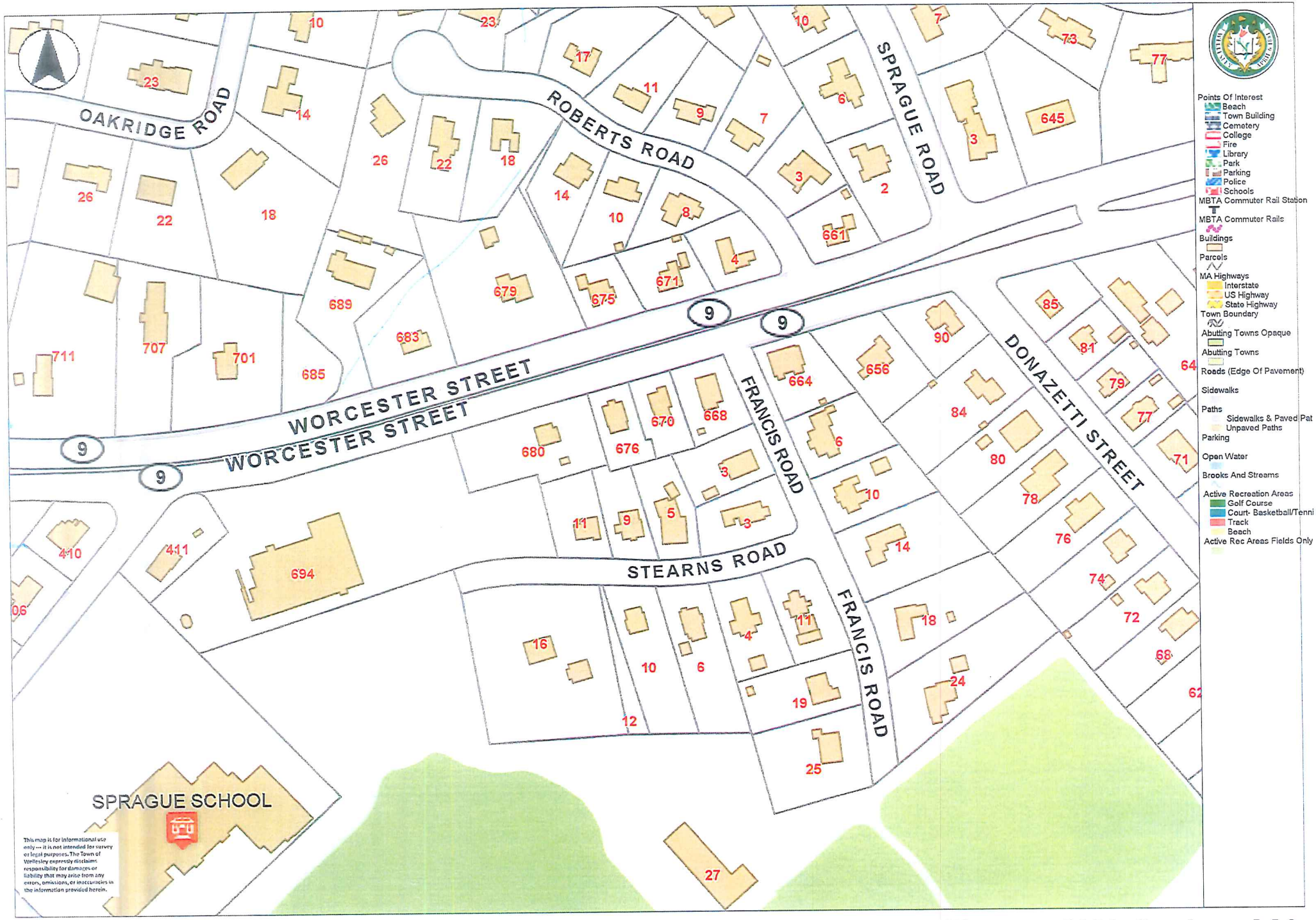
View Extent Contiguous U.S.

Scale (not to scale)

Soil Data Available

Name	Area Symbol	Data Availability	Version
Norfolk and Suffolk Counties, Massachusetts	MA616	Tabular and Spatial, complete	Survey Area: Version 10, Sep 19, 2014 Tabular: Version 7, Sep 19, 2014 Spatial: Version 4, Dec 17, 2013

FOIA | Accessibility Statement | Privacy Policy | Non-Discrimination Statement | Information Quality | USA.gov | White House



Printed on 08/10/2015 at 06:43 AM

Town of Wellesley, MA

Hayes Engineering, Inc.
Land Planners
Environmental Engineers
603 Salem Street
Wakefield, MA 01880
T: (781) 246-2800
F: (781) 246-7596
Nantucket: (508) 228-7909
www.hayeseng.com

Commonwealth of Massachusetts
City/Town of WELLESLEY

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

A. Facility Information

12 STEARNS ROAD LLC C/O JAY J. DERENZO
Owner Name

43 CHARLES STREET
Street Address

NEEDHAM
City

MA
State

02494
Zip Code

Map/Lot #

B. Site Information

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

2. Soil Survey Available? ☐ Yes ☐ No If yes: Source Soil Map Unit

Soil Name

Soil Limitations

Landform

Geologic/Parent Material

3. Surficial Geological Report Available? ☐ Yes ☐ No If yes: Year Published/Source Publication Scale Map Unit

4. Flood Rate Insurance Map

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

If Yes, continue to #5.

5. Within a velocity zone? ☐ Yes ☐ No

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

7. Current Water Resource Conditions (USGS): Month/Year Range: ☐ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of WELLESLEY
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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

Dec 6, 2017
Date

Gordon Rogerson
Typed or Printed Name of Soil Evaluator / License # 2074

June 30, 2019
Expiration Date of License

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.

Commonwealth of Massachusetts
City/Town of WELLESLEY
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: SWA-1 | 12-6-17 (Date) | _____ (Time) | Cldy 50° (Weather)

1. Location STEARNS RD
   Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: /
2. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)
   _____ Vegetation _____ Landform _____ Position on Landscape (SU, SH, BS, FS,
3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet
   Property Line _____ feet Drinking Water Well _____ feet Other _____ feet
4. Parent Material: Till 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: 75 Depth Weeping from Pit _____ Depth Standing Water in Hole
   Estimated Depth to High Groundwater: 45 inches _____ elevation

Commonwealth of Massachusetts
City/Town of WELLESLEY
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12	A	10YR 3/2				fsl	0	0%	gr	mfr	
12-22	Bw	10YR 4/6				fsl	0	0%	m	mfr	
22-36	C1	2.5Y 6/4				sl	0	0%	m	mfr	
36-60	C2	10YR 4/4	45	10YR 6/8		gr ls	20	0%	m	mfi	
60-77	C	weathered	Rock								
	R										

Additional Notes:

Commonwealth of Massachusetts
City/Town of WELLESLEY
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: SWA-2 | 12-6-17 (Date) | _____ (Time) | cldy 50° (Weather)

1. Location STEARNS ROAD
   Ground Elevation at Surface of Hole: _____ feet | Latitude/Longitude: _____ /
2. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) | _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) | _____ Slope (%)
   _____ Vegetation | _____ Landform | _____ Position on Landscape (SU, SH, BS, FS,
3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Wetlands _____ feet
   Property Line _____ feet | Drinking Water Well _____ feet | Other _____ feet
4. Parent Material: TILL | 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: NO Depth Weeping from Pit | NO Depth Standing Water in Hole
   Estimated Depth to High Groundwater: 42 inches | _____ elevation

Commonwealth of Massachusetts
City/Town of WELLESLEY
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: SWA-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-11	A	10YR3/2				fsl	0	0%	gr	mfr	
11-24	Bw	10YR4/6				fsl	0	0%	m	mfr	
24-42	C	10YR4/4				grls	15	20%	m	mfi	
	R										

Additional Notes:

Commonwealth of Massachusetts
City/Town of WELLESLEY
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: SWA3 | 12-6-17 (Date) | ____ (Time) | Cldy 50° (Weather)

1. Location STEARNS RD
   Ground Elevation at Surface of Hole: ____ feet | Latitude/Longitude: /
2. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) | Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ | Slope (%) ____
   Vegetation ____ | Landform ____ | Position on Landscape (SU, SH, BS, FS, ____
3. Distances from: Open Water Body ____ feet | Drainage Way ____ feet | Wetlands ____ feet
   Property Line ____ feet | Drinking Water Well ____ feet | Other ____ feet
4. Parent Material: Till | 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: ND (Depth Weeping from Pit) | ND (Depth Standing Water in Hole)
   Estimated Depth to High Groundwater: 60 inches | ____ elevation

Commonwealth of Massachusetts
City/Town of WELLESLEY
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: SWA-3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-57	FILL - TILE - Conc. Slabs Bldgs					fsl	<				
57-66	Ab	10YR 3/2	60			fsl	0		gr	m-fr	
66-76	C	2.5Y 7/3				vyfsl	0	0/0	m	m-fr	

Additional Notes:

Commonwealth of Massachusetts
City/Town of WELLESLEY

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

C. On-Site Review (continued)

Deep Observation Hole Number: SWA-4 | 12-6-17 (Date) | _____ (Time) | Cldy 50 (Weather)

1. Location STEARNS ROAD
   Ground Elevation at Surface of Hole: _____ feet
   Latitude/Longitude: /

2. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.)
   Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%) _____
   Vegetation _____ Landform _____ Position on Landscape (SU, SH, BS, FS, _____

3. Distances from:
   Open Water Body _____ feet
   Drainage Way _____ feet
   Wetlands _____ feet
   Property Line _____ feet
   Drinking Water Well _____ feet
   Other _____ feet

4. Parent Material: TILL
   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: 70 Depth Weeping from Pit; 70 Depth Standing Water in Hole
   Estimated Depth to High Groundwater: 45 inches _____ elevation

Commonwealth of Massachusetts
City/Town of WELLESLEY
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: SWA-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-32	Fill										
32-39	Bw	10YR 3/3				fsl	0	0%	gr	mfr	
39-45	Bwb	10YR 5/6	45	10YR 6/8 5Y 7/2		fsl	0	0%	m	mfr	
45-72	C	2.5Y 6/4				sl	0	0%	m	mfr	
	R										

Additional Notes:

Commonwealth of Massachusetts
City/Town of WELLESLEY
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # 1	Obs. Hole # 2	Obs. Hole # 3	Obs. Hole # 4
☐ Depth observed standing water in observation hole	75 inches	— inches	— inches	70 inches
☐ Depth weeping from side of observation hole	75 inches	— inches	— inches	70 inches
☐ Depth to soil redoximorphic features (mottles)	45 inches	42 inches	60 inches	45 inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	inches	inches	inches	inches

Index Well Number _____ Reading Date _____

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

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

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

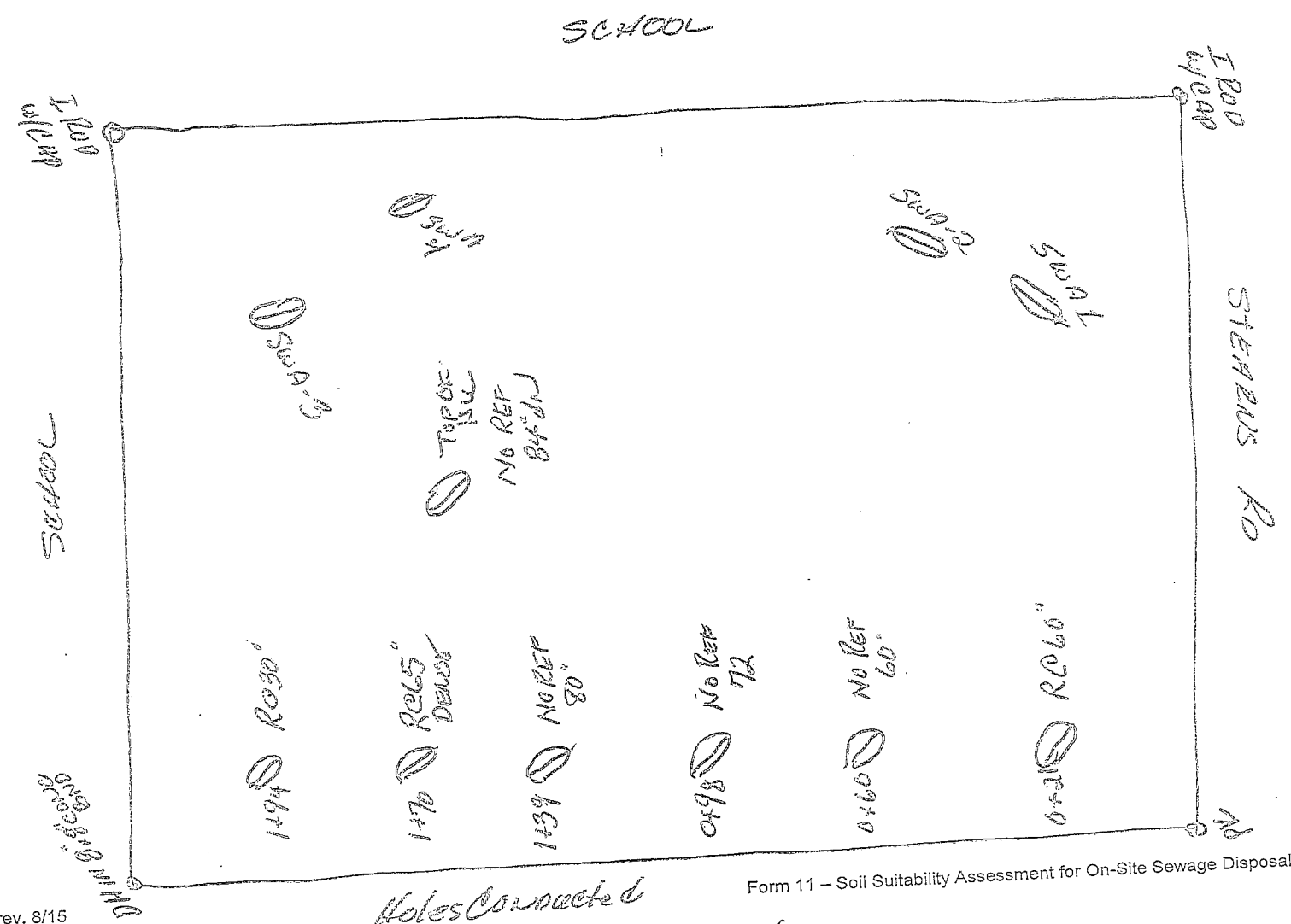
E. Depth of Pervious Material

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

Commonwealth of Massachusetts
City/Town of WELLESLEY
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

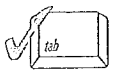
Use this sheet for field diagrams:

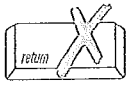


Commonwealth of Massachusetts
City/Town of
Percolation Test
Form 12

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 #

City/Town | State | Zip Code

Contact Person (if different from Owner) | Telephone Number

B. Test Results

	Date	Time	Date	Time
Observation Hole #				
Depth of Perc				
Start Pre-Soak				
End Pre-Soak				
Time at 12"				
Time at 9"				
Time at 6"				
Time (9"-6")				
Rate (Min./Inch)				
	Test Passed: ☐ Test Failed: ☐		Test Passed: ☐ Test Failed: ☐	

Test Performed By:

Board of Health Witness

Comments:

TOWN OF WELLESLEY MASSACHUSETTS
WETLANDS PROTECTION COMMITTEE
525 WASHINGTON STREET, WELLESLEY, MASSACHUSETTS 02482-5992

Pam Helinek, Wetlands Administrator
Email: phellinek@wellesleywpc.org
Telephone: (781) 431-1019 x2292
Cell: (781) 467-6366

Via Certified Mail

December 15, 2015

Elizabeth Wallis
Hayes Engineering, Inc
603 Salem Street
Wakefield, MA 01880

Re: Negative Determination of Applicability – 680 and 694 Worcester Street, Wellesley

Dear Ms. Wallis:

The Wellesley Wetlands Protection Committee has voted to issue a ***Negative Determination of Applicability*** for the area at the above referenced addresses. The Committee has determined that there are no jurisdictional Resource Areas or Buffer Zones on these parcels.

If you have any questions, please feel free to contact our office.

For the Committee,

Pam Helinek
Wetlands Administrator, Town of Wellesley

Cc: MassDEP Northeast Regional Office, 205B Lowell Street, Wilmington, MA 01887
Building
File

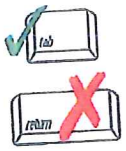
Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

A. General Information

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



From:

Wellesley Wetlands Protection Committee
Conservation Commission

To: Applicant

Hayes Engineering Inc
Name 603 Salem Street
Mailing Address
Wakefield | MA | 01880
City/Town | State | Zip Code

Property Owner (if different from applicant):

Name
Mailing Address
City/Town | State | Zip Code

1. Title and Date (or Revised Date if applicable) of Final Plans and Other Documents:

Title: Resource Area Determination, #680 Worcester Street, Wellesley, MA — Date: 11/10/2015
Title: Web Soil Survey Soil Report for #680 Worcester Street — Date: 11/12/2015
Title — Date

2. Date Request Filed:

11/10/2015

B. Determination

Pursuant to the authority of M.G.L. c. 131, § 40, the Conservation Commission considered your Request for Determination of Applicability, with its supporting documentation, and made the following Determination.

Project Description (if applicable):

The applicant requests the Wetlands Protection Committee to determine that the Isolated Wetland shown on the accompanying plan is not an area subject to protection under either the Massachusetts Wetlands Protection Act or the Town of Wellesley Wetlands Protection Bylaw. The Committee is further requested to determine that no other Resource Areas or Buffer Zones are present on the subject property.

Project Location:

680 and 694 Worcester Street — Wellesley
Street Address

121, 135 — 18, 73
Assessors Map/Plat Number | Parcel/Lot Number

B. Determination (cont.)

☐ 6. The following area and/or work, if any, is subject to a municipal ordinance or bylaw but not subject to the Massachusetts Wetlands Protection Act:

☐ 7. If a Notice of Intent is filed for the work in the Riverfront Area described on referenced plan(s) and document(s), which includes all or part of the work described in the Request, the applicant must consider the following alternatives. (Refer to the wetland regulations at 10.58(4)c. for more information about the scope of alternatives requirements):

- ☐ Alternatives limited to the lot on which the project is located.
- ☐ Alternatives limited to the lot on which the project is located, the subdivided lots, and any adjacent lots formerly or presently owned by the same owner.
- ☐ Alternatives limited to the original parcel on which the project is located, the subdivided parcels, any adjacent parcels, and any other land which can reasonably be obtained within the municipality.
- ☐ Alternatives extend to any sites which can reasonably be obtained within the appropriate region of the state.

Negative Determination

Note: No further action under the Wetlands Protection Act is required by the applicant. However, if the Department is requested to issue a Superseding Determination of Applicability, work may not proceed on this project unless the Department fails to act on such request within 35 days of the date the request is post-marked for certified mail or hand delivered to the Department. Work may then proceed at the owner's risk only upon notice to the Department and to the Conservation Commission. Requirements for requests for Superseding Determinations are listed at the end of this document.

☒ 1. The area described in the Request is not an area subject to protection under the Act or the Buffer Zone.

☐ 2. The work described in the Request is within an area subject to protection under the Act, but will not remove, fill, dredge, or alter that area. Therefore, said work does not require the filing of a Notice of Intent.

☐ 3. The work described in the Request is within the Buffer Zone, as defined in the regulations, but will not alter an Area subject to protection under the Act. Therefore, said work does not require the filing of a Notice of Intent, subject to the following conditions (if any).
See attached Exhibit A.

☐ 4. The work described in the Request is not within an Area subject to protection under the Act (including the Buffer Zone). Therefore, said work does not require the filing of a Notice of Intent, unless and until said work alters an Area subject to protection under the Act.

WPA Form 2 – Determination of Applicability

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

B. Determination (cont.)

☐ 5. The area described in the Request is subject to protection under the Act. Since the work described therein meets the requirements for the following exemption, as specified in the Act and the regulations, no Notice of Intent is required:

Exempt Activity (site applicable statuatory/regulatory provisions)

☒ 6. The area and/or work described in the Request is not subject to review and approval by:

Wellesley
Name of Municipality

Pursuant to a municipal wetlands ordinance or bylaw,

Town of Wellesley Wetlands Protection Bylaw — Name

Article 44 — Ordinance or Bylaw Citation

C. Authorization

This Determination is issued to the applicant and delivered as follows:

☐ by hand delivery on — Date

☒ by certified mail, return receipt requested on 12/16/2015 — Date

This Determination is valid for **three years** from the date of issuance (except Determinations for Vegetation Management Plans which are valid for the duration of the Plan). This Determination does not relieve the applicant from complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.

This Determination must be signed by a majority of the Conservation Commission. A copy must be sent to the appropriate DEP Regional Office (see http://www.mass.gov/eea/agencies/massdep/about/contacts/find-the-massdep-regional-office-for-your-city-or-town.html) and the property owner (if different from the applicant).

Signatures:

Robert Collins

J. Stanley Waugh

Carl Sciple

Richard Howell

Neal Glick

12/10/2015
Date

Project File: WEL-0012
16 Stearns Road
Wellesley, Massachusetts 02482

OPERATION AND MAINTENANCE PLAN AND LONG-TERM POLLUTION PREVENTION PLAN

16 Stearns Road

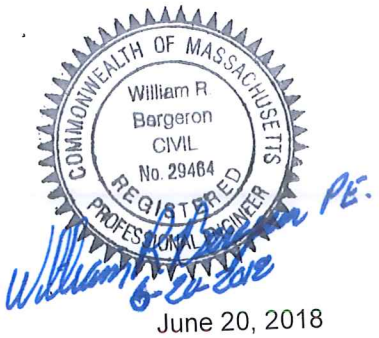
Wellesley, Massachusetts

Date: June 20, 2018

Hayes Engineering, Inc.

Hayes Engineering, Inc.
603 Salem Street
Wakefield, MA 01880
Tel: (781) 246-2800
Fax :(781) 246-7596

OPERATION AND MAINTENANCE PLAN
16 STEARNS ROAD
WELLESLEY, MASSACHUSETTS



June 20, 2018

GENERAL

The management plan incorporates a combination of three or more of the following chain of structural Best Management Practices to improve the water quality of the stormwater runoff from the proposed roadway.

1. Deep Sump Catch Basin with hood
2. Proprietary Particle Separator
3. Parking Lot Sweeping

These stormwater management facilities have unique characteristics, uses, planning considerations and maintenance requirements. The maintenance requirements, as suggested by the DEP in "Volume 2 Chapter 2: Structural BMP Specifications for the Massachusetts Stormwater Handbook", and the suggested schedules, are summarized in the following sections. It is suggested that the following guidelines be adhered to for a one-year cycle following completion of the project, then adjusted, as necessary, based on the results of the required inspections, unless otherwise stated.

Deep Sump Catch Basin

- Deep Sump Catch Basins should be inspected and cleaned a minimum of four (4) times per year and at the end of foliage and snow removal seasons for the first two years of operation. If the results of these cleanings reveal that less frequent cleaning is needed then the frequency may be adjusted but catch basins will be inspected and cleaned at least once annually.

- Sediment must be removed whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.

- All sediments and hydrocarbons should be properly handled and disposed, in accordance with local, state and federal guidelines and regulations.

Stormwater Management Areas (Subsurface Detention Chambers)

Chamber maintenance is not generally required. However, Subsurface systems are prone to failure due to clogging. Regulating the sediment and petroleum product input to the proposed system is the priority maintenance activity. Sediments and any oil spillage should be trapped and removed before they reach the chambers. Catch basin and proprietary particle separator pre-treatment devices which flow into the infiltration system shall be regularly cleaned according to the maintenance schedules provided herein to prevent fine sediments and debris from entering and clogging the subsurface system.

To assist with the function of the infiltration chambers the first row in the system is an Isolator Row.

Isolator Row Inspection and Maintenance

- Inspect the Isolator Row after the site is stabilized and twice annually for the first year thereafter.
- Inspection should be adjusted after the first year as needed but at a minimum annually.
- Maintenance is required if sediment exceeds three inches throughout the length of the Isolator Row.
- Clean the Isolator Row with a JetVac system with a rear facing nozzle.
- The nozzle should be fed down the length of the Isolator Row and retrieved while the manhole used to access the system is vacuumed.
- Repeat the process until the backflush is clean.

In addition, Hayes Engineering, Inc. recommends the following to ensure that the chambers function well into the future.

- The Contractor shall verify that the required crushed stone and geotechnical fabric materials are clean and free of sediments and petroleum residue prior to, during and after the chamber system installation.

- Inspections of the chamber system shall be made by a registered professional engineer after every major storm for the first few months after construction to verify that proper function has been achieved. During these initial inspections, water levels in the chambers should be measured and recorded in a permanent log over several days to check the drainage duration and verify that sediments are not accumulating. If ponded water is present after 24 hours or an accumulation of sediment or debris is noted within the chambers, the Homeowners Association (or designated property manager) and engineer shall determine the cause for this condition and devise an action plan to improve system functionality. Any required maintenance or major repair will be documented in the permanent log book and be completed within seven business days, with a report of such to the Towns Engineer.

- Once the chamber system has been verified to perform as designed, interior chamber conditions shall be inspected at least annually. Post construction inspections (to be conducted through inspection ports) shall consist of documenting interior chamber and bed conditions, measured water depth, and presence of sediment. If inspection indicates that the system is clogged (ponding water present after 24 hours or sediment accumulations present), replacement or major repair actions may be required as determined by a professional engineer. In this case, the Homeowners Association (or designated property manager) and engineer shall determine the cause for this condition and devise an action plan. Any required maintenance or major repair will be documented in the permanent log book and be completed within seven business days, with a report of such to the Town Engineer.

- The inspection and maintenance responsibility for the subsurface system shall belong to the Homeowners Association (or designated property manager).

VortSentry HS Water Quality Chamber

Regulating the input to the proposed water quality system is the priority maintenance activity. Sediments and any oil spillage should be trapped and removed before they reach the chambers.

- VortSentry HS chamber maintenance shall be performed on a regular basis as recommended by the manufacturer (described in the attached excerpt from the VortSentry HS Guide Operation, Design, Performance and Maintenance Brochure obtained from the website summarized below.

- Sediment removal is recommended annually, but is likely to vary widely based on site conditions and loadings. Typical maintenance cleaning can be done with a vacuum truck. Inspection for each of the VortSentry HS units will include a quantification of the sediment load and oil and grease volumes. This is easily made from the surface with a tube dipstick with ball valve inserted through the cleanout pipe or other access port. Depths of sediment indicating maintenance are presented in the following table for the various models. Inspection of the internal structure should be part of the routine inspection plan. The units are designed to accept 15% of their capacity in solids annually based on maximum drainage area loading. Removal of sediment, oils, and grease from the system will depend on rates of accumulation. All sediment and oil waste materials shall be disposed of in accordance with all Federal, State, and Local regulations.

REQUIRED MAINTENANCE *

Model	Sediment Depth (in.)
VortSentry HS	24"

Parking Lot Sweeping

In order to minimize the TSS load to the deep sump catch basins and those BMPs downstream it is planned to sweep the pavement areas four (4) times per year or more frequently if conditions require. Based upon actual experience and documentation a revised schedule may be submitted but all pavement areas will be swept at least once annually.

Removal of Siltation Controls

All siltation controls, including, but not limited to, hay bales and silt fence, shall be removed, with the approval of the Town Engineer, as soon as practical after paving, re-vegetation and total stabilization of the site. Unvegetated areas remaining in the area of the siltation controls shall be loamed and seeded with the appropriate groundcover to ensure re-vegetation as rapidly as possible after the removal of the siltation controls. In the case of all proposed stormwater management facilities, during construction of the proposed

stormwater management system the developer shall be the owner and party responsible for maintenance.

Owner and Maintenance Responsibilities

Once the development is complete, the Homeowners Association will assume the responsibility of on-going maintenance, as well as the long-term pollution prevention plan, unless other legally-binding agreements are established with another entity.

O&M / LPPP
16 Stearns Road
Wellesley, MA 02482
June 20, 2018

INSPECTION AND MAINTENANCE REPORT FORM
680 Worcester Street
Wellesley, Massachusetts

TO BE COMPLETED FOR REQUIRED INSPECTIONS AND MAINTENANCE
AT THE FREQUENCY SPECIFIED IN THE OPERATION AND MAINTENANCE PLAN

Inspector: _____ Date: _____

Inspector's Title: _____

Days Since Last Rainfall: _____ Amount of Last Rainfall: _____

	BMP	BMP Installed at Grade? (circle one)		BMP Maintenance Required or performed? (circle one)		Corrective Action Needed And Notes
1	Catch Basin inlets And gas traps	Yes	No	Yes	No	
2	CONTECH Vortsentry HS	Yes	No	Yes	No	
3	Isolator Row	Yes	No	Yes	No	
4	Subsurface Detention	Yes	No	Yes	No	
5		Yes	No	Yes	No	
6		Yes	No	Yes	No	
7		Yes	No	Yes	No	

Additional Comments:

_____

_____

_____

LONG TERM POLLUTION PREVENTION PLAN
680 Worcester Street
Wellesley, Massachusetts

- Good housekeeping practices: Prevent or reduce pollutant runoff from the project development through the use of street sweeping, erosion control and catch basin cleaning. It should be noted that we are not seeking credit for TSS removal with street sweeping for this project.

- Provisions for storing materials and waste products inside or under cover: All materials stored on site should be stored in a neat and orderly fashion in their appropriate containers and, if possible, under a roof or other secure enclosure. Waste products should be placed in secure receptacles until they are emptied by a licensed solid waste management company in Massachusetts.

- Vehicle washing controls: The project is comprised of single family house lots; therefore, the responsibility lies with the individual homeowners. The homeowners can prevent soap, scum and oily grit from entering the proposed drainage system by washing vehicles on the grass areas instead of the driveway or street.

- Requirements for routine inspections and maintenance of stormwater BMPs: Follow the guidelines outlined above.

- Spill prevention and response plans:

  Prevention: All materials stored on site should be stored in a neat and orderly fashion in their appropriate containers and, if possible, under a roof or other secure enclosure. Products should be kept in their original containers with the original manufacturer's label. Products should not be mixed with one another unless recommended by the manufacturer. If possible, all of the product should be used up before disposing of the container. The Manufacturer's recommendations for proper use and disposal should be followed.

  Response: Manufacturer's recommended methods for cleanup should be followed. Spills should be cleaned up immediately after discovery. The spill area shall be kept well ventilated and personnel shall wear appropriate protective clothing to prevent injury from contact with a hazardous substance. Spills of toxic or hazardous material shall be reported to the appropriate State and/or local authority in accordance with local and/or State regulations.

- Provisions for maintenance of lawns, gardens, and other landscaped areas: The project is comprised of single family house lots, therefore, these activities should be left up the individual homeowners to schedule and perform.

- Requirements for storage and use of fertilizers, herbicides, and pesticides (Should any questions arise about these materials the Order of Conditions for this project should be consulted if applicable):

Fertilizers: Fertilizers shall be applied in the minimum amounts recommended by the manufacturer. Once applied, fertilizers shall be worked into the soil to limit exposure to stormwater. Storage shall be stored under a roof or other secure enclosure. The contents of any partially used bags of fertilizers shall be transferred to a sealable plastic bag or bin to avoid spills.

Herbicides and Pesticides: Store herbicides and pesticides in original containers that are closed and labeled, in a secure area out of reach of children and pets. Avoid storing in damp areas where containers may become moist or rusty. Herbicides and Pesticides should not be stored near food. Follow the label instructions strictly about where and how much to apply. Do not put herbicides and pesticides in the trash or down the drain. Use rubber gloves when handling and use an appropriate cartridge mask if using products extensively.

- Pet waste management provisions: The project is comprised of single family house lots, therefore, the responsibility lies with the individual homeowners who own pets to perform the clean up and disposal of their pet waste.

- Provisions for operation and management of septic systems: The project is comprised of single family house lots; therefore, the septic systems are privately owned and the responsibility for these activities lies with the individual homeowners to schedule and perform.

- Provisions for solid waste management: Waste products should be placed in secure receptacles until they are emptied by a licensed solid waste management company in Massachusetts.

- Snow disposal and plowing plans relative to Wetland Resource Areas: Snow disposal should be in accordance with the Bureau of Resource Protection Snow Disposal Guidelines, Guideline No. BRPG01-01 effective December 21, 2015, a copy of which is attached.

- Winter Road Salt and/or Sand Use and Storage restrictions:

  Road Salt: Use and storage should be in accordance with the Bureau of Resource Protection Drinking Water Program Guidelines on Deicing Chemical (Road Salt) Storage, Guideline No. DWSG97-1 effective December 19, 1997, a copy of which is attached.

  Sand: Whenever possible, use of environmentally friendly alternatives, i.e. calcium chloride and sand instead of salt for melting ice should be considered.

- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan: The responsibility lies with the Homeowners Association.

O&M / LPPP
16 Stearns Road
Wellesley, MA 02482
June 20, 2018

Effective Date: March 8, 2001

Guideline No. BRPG01-01

Applicability: Applies to all federal, state, regional and local agencies, as well as to private businesses.

Supersedes: BRP Snow Disposal Guideline BRPG97-1 issued 12/19/97, and all previous snow disposal guidance

Approved by: Glenn Haas, Assistant Commissioner for Resource Protection

PURPOSE: To provide guidelines to all government agencies and private businesses regarding snow disposal site selection, site preparation and maintenance, and emergency snow disposal options that are acceptable to the Department of Environmental Protection, Bureau of Resource Protection.

APPLICABILITY: These Guidelines are issued by the Bureau of Resource Protection on behalf of all Bureau Programs (including Drinking Water Supply, Wetlands and Waterways, Wastewater Management, and Watershed Planning and Permitting). They apply to public agencies and private businesses disposing of snow in the Commonwealth of Massachusetts.

INTRODUCTION

Finding a place to dispose of collected snow poses a challenge to municipalities and businesses as they clear roads, parking lots, bridges, and sidewalks. While we are all aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into waterbodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that communities can take to minimize the impacts of snow disposal on public health and the environment. These steps will help communities avoid the costs of a contaminated water supply, degraded waterbodies, and flooding. Everything we do on the land has the potential to impact our water resources. Given the authority of local government over the use of the land, municipal officials and staff have a critically important role to play in protecting our water resources.

The purpose of these guidelines is to help municipalities and businesses select, prepare, and maintain appropriate snow disposal sites before the snow begins to accumulate through the winter.

RECOMMENDED GUIDELINES

These snow disposal guidelines address: (1) site selection; (2) site preparation and maintenance; and (3) emergency snow disposal.

1. SITE SELECTION

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas away from water resources and wells. At these locations, the snow meltwater can filter in to the soil, leaving behind sand and debris which can be removed in the springtime. The following areas should be avoided:

- Avoid dumping of snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.

- Do not dump snow within a Zone II or Interim Wellhead Protection Area (IWPA) of a public water supply well or within 75 feet of a private well, where road salt may contaminate water supplies.

- Avoid dumping snow on MassDEP-designated high and medium-yield aquifers where it may contaminate groundwater (see the next page for information on ordering maps from MassGIS showing the locations of aquifers, Zone II's, and IWPAs in your community).

- Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater, and in gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.

- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage swales or ditches. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Site Selection Procedures

1. It is important that the municipal Department of Public Works or Highway Department, Conservation Commission, and Board of Health work together to select appropriate snow disposal sites. The following steps should be taken:

2. Estimate how much snow disposal capacity is needed for the season so that an adequate number of disposal sites can be selected and prepared.

3. Identify sites that could potentially be used for snow disposal such as municipal open space (e.g., parking lots or parks).

4. Sites located in upland locations that are not likely to impact sensitive environmental resources should be selected first.

5. If more storage space is still needed, prioritize the sites with the least environmental impact (using the site selection criteria, and local or MassGIS maps as a guide).

MassGIS Maps of Open Space and Water Resources

If local maps do not show the information you need to select appropriate snow disposal sites, you may order maps from MassGIS (Massachusetts Geographic Information System) which show publicly owned open spaces and approximate locations of sensitive environmental resources (locations should be field-verified where possible). Different coverages or map themes depicting sensitive environmental resources are available from MassGIS on the map you order. At a minimum, you should order the Priority Resources Map. The Priority Resources Map includes aquifers, public water supplies, MassDEP-approved Zone II's, Interim Wellhead Protection Areas, Wetlands, Open Space, Areas of Critical Environmental Concern, NHESP Wetlands Habitats, MassDEP Permitted Solid Waste facilities, Surface Water Protection areas (Zone A's) and base map features. The cost of this map is $25.00. Other coverages or map themes you may consider, depending on the location of your city or town, include Outstanding Resource Waters and MassDEP Eelgrass Resources. These are available at $25.00 each, with each map theme being depicted on a separate map. Maps should be ordered from MassGIS. Maps may also be ordered by fax at 617-626-1249 (order form available from the MassGIS web site) or mail. For further information, contact MassGIS at 617-626-1189.

2. SITE PREPARATION AND MAINTENANCE

In addition to carefully selecting disposal sites before the winter begins, it is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- A silt fence or equivalent barrier should be placed securely on the downgradient side of the snow disposal site.
- To filter pollutants out of the meltwater, a 50-foot vegetative buffer strip should be maintained during the growth season between the disposal site and adjacent waterbodies.
- Debris should be cleared from the site prior to using the site for snow disposal.
- Debris should be cleared from the site and properly disposed of at the end of the snow season and no later than May 15.

3. EMERGENCY SNOW DISPOSAL

As mentioned earlier, it is important to estimate the amount of snow disposal capacity you will need so that an adequate number of upland disposal sites can be selected and prepared.

If despite your planning, upland disposal sites have been exhausted, snow may be disposed of near waterbodies. A vegetated buffer of at least 50 feet should still be maintained between the site and the waterbody in these situations. Furthermore, it is essential that the other guidelines for preparing and maintaining snow disposal sites be followed to minimize the threat to adjacent waterbodies.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, disposal of snow that is not obviously contaminated with road salt, sand, and other pollutants may be allowed in certain waterbodies under certain conditions. In these dire situations, notify your Conservation Commission and the appropriate MassDEP Regional Service Center before disposing of snow in a waterbody.

Use the following guidelines in these emergency situations:

- Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
- Do not dispose of snow in saltmarshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, Zone IIs or IWPAs of public water supply wells, Outstanding Resource Waters, or Areas of Critical Environmental Concern.
- Do not dispose of snow where trucks may cause shoreline damage or erosion.
- Consult with the municipal Conservation Commission to ensure that snow disposal in open water complies with local ordinances and bylaws.

FOR MORE INFORMATION

If you need more information, contact one of MassDEP's Regional Service Centers:

Northeast Regional Office, Wilmington, 978-694-3200
Southeast Regional Office, Lakeville, 508-946-2714
Central Regional Office, Worcester, 508-792-7683
Western Regional Office, Springfield, 413-755-2214

or

Call Thomas Maguire of DEP's Bureau of Resource Protection in Boston at 617-292-5602.

O&M / LPPP
16 Stearns Road
Wellesley, MA 02482
June 20, 2018

Effective Date: December 19, 1997

Guideline No. DWSG97-1

Applicability: Applies to all parties storing road salt or other chemical deicing agents.

Supersedes: Fact Sheet: DEICING CHEMICAL (ROAD SALT) STORAGE (January 1996)

Approved by: Arleen O'Donnell, Asst. Commissioner for Resource Protection

PURPOSE: To summarize salt storage prohibition standards around drinking water supplies and current salt storage practices.

APPLICABILITY: These guidelines are issued on behalf of the Bureau of Resource Protection's Drinking Water Program. They apply to all parties storing road salt or other chemical deicing agents.

I. The Road Salt Problem:
Historically, there have been incidents in Massachusetts where improperly stored road salt has polluted public and private drinking water supplies. Recognizing the problem, state and local governments have taken steps in recent years to remediate impacted water supplies and to protect water supplies from future contamination. As a result of properly designing storage sheds, new incidents are uncommon. These guidelines summarize salt storage prohibition standards around drinking water supplies and current salt storage practices.

II. Salt Pile Restrictions in Water Supply Protection Areas:
Uncovered storage of salt is forbidden by Massachusetts General Law Chapter 85, section 7A in areas that would threaten water supplies. The Drinking Water Regulations, 310 CMR 22.21(2)(b), also restrict deicing chemical storage within wellhead protection areas (Zone I and Zone II) for public water supply wells, as follows: "storage of sodium chloride, chemically treated abrasives or other chemicals used for the removal of ice and snow on roads [are prohibited], unless such storage is within a structure designed to prevent the generation and escape of contaminated runoff or leachate." For drinking water reservoirs, 310 CMR 22.20C prohibits, through local bylaw, uncovered or uncontained storage of road or parking lot de-icing and sanding materials within Zone A at new reservoirs and at those reservoirs increasing their withdrawals under MGL Chapter 21G, the Water Management Act.

For people on a low-sodium diet, 20 mg/L of sodium in drinking water is consistent with the bottled water regulations' meaning of "sodium free." At 20 mg/L, sodium contributes 10% or less to the sodium level in people on a sodium-restricted diet. For more information contact: Catherine Sarafinas at 617-556-1070 or catherine.sarafinas@state.ma.us, or Suzanne Robert at 617-292-5620 or suzanne.robert@state.ma.us.

III. Salt Storage Best Management Practices (BMP):

Components of an "environment-friendly" roadway deicing salt storage facility include:

- the right site = a flat site;
- adequate space for salt piles;
- storage on a pad (impervious/paved area);
- storage under a roof; and
- runoff collection/containment.

For more information, see The Salt Storage Handbook, 6th ed. Virginia: Salt Institute, 2006 (phone 703-549-4648 orhttp://www.saltinstitute.org/publication/safe-and-sustainable-snowfighting/).

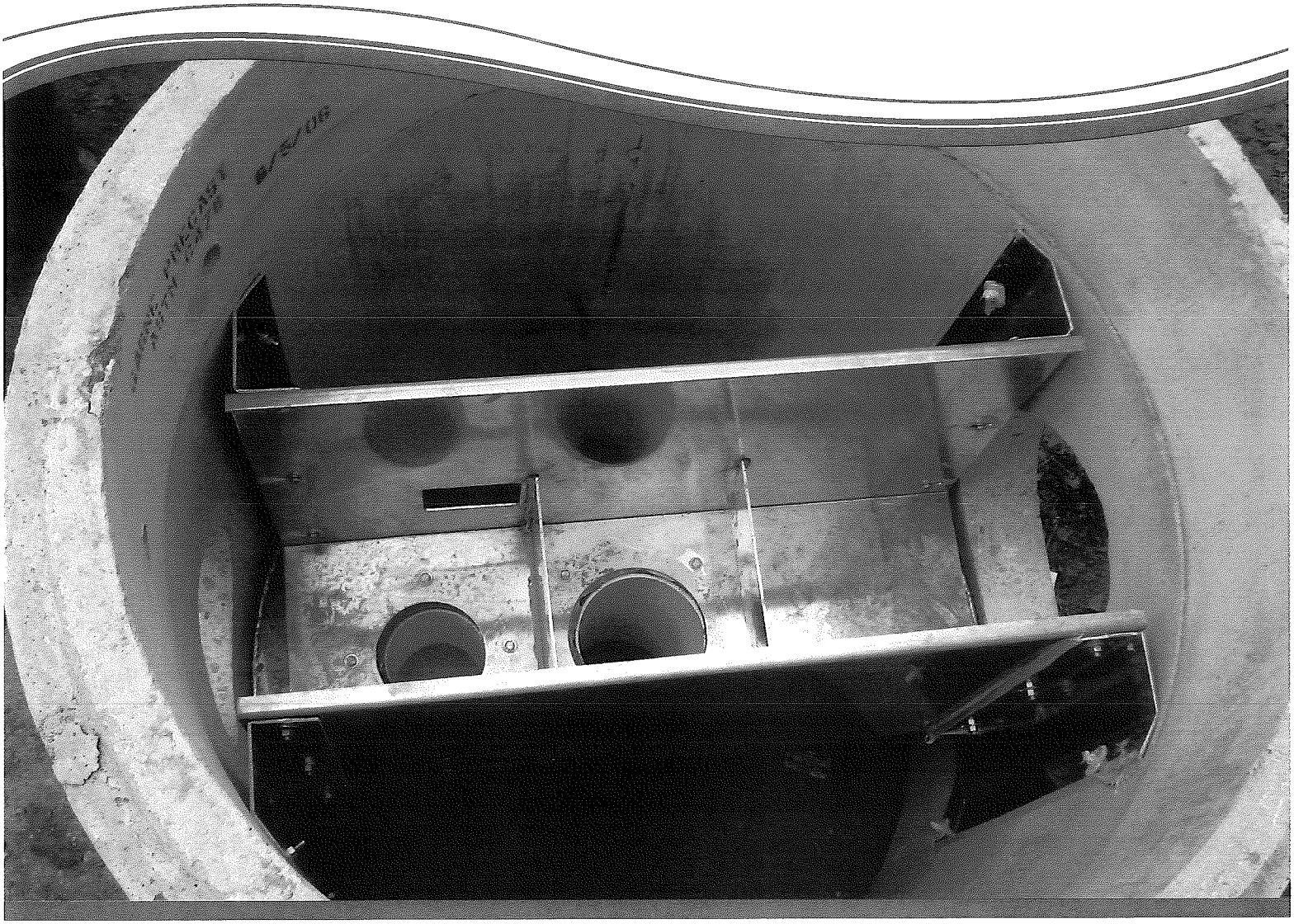
IV. Salt Storage Practices of the Massachusetts Highway Department:

The Massachusetts Highway Department (MHD) has 216 permanent salt storage sheds at 109 locations in the state. On leased land and state land under arteries and ramps, where the MHD cannot build sheds, salt piles are stored under impermeable material. This accounts for an additional 15 sites. The MHD also administers a program to assist municipalities with the construction of salt storage sheds. Of 351 communities, 201 municipalities have used state funds for salt storage facilities.

For more information about MHD's salt storage facilities, contact Paul Brown at the Massachusetts Highway Department, 10 Park Plaza, Boston, MA 02116 (phone 617-973-7792).

URBANGREEN®

VortSentry® HS Guide Operation, Design, Performance and Maintenance



CONTECH®
ENGINEERED SOLUTIONS

VortSentry® HS

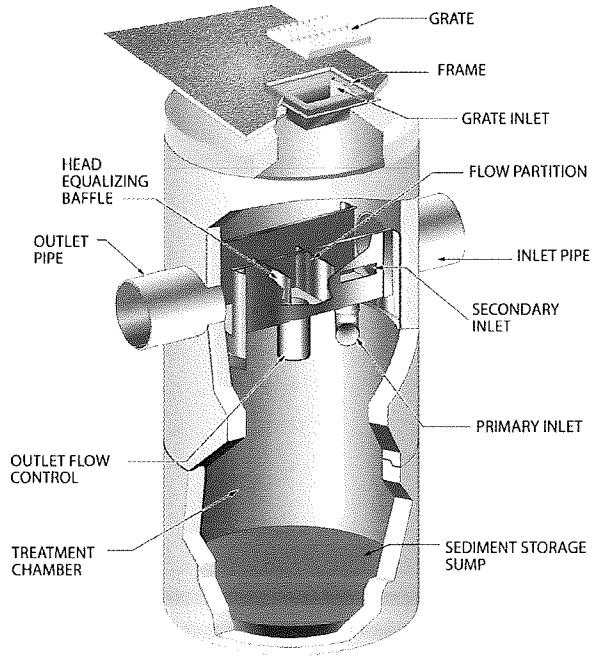
The VortSentry HS is a compact, below grade stormwater treatment system that employs helical flow technology to enhance gravitational separation of floating and settling pollutants from stormwater flows. With the ability to accept a wide range of pipe sizes, the VortSentry HS can treat and convey flows from small to large sites. A unique internal bypass design means higher flows can be diverted without the use of external bypass structures. The VortSentry HS is also available in a grate inlet configuration, which is ideal for retrofit installations.

Operation Overview

Low, frequently occurring storm flows are directed into the treatment chamber through the primary inlet. The tangentially oriented downward pipe induces a swirling motion in the treatment chamber that increases capture and containment abilities. Moderate storm flows are directed into the treatment chamber through the secondary inlet, which allows for capture of floating trash and debris. The secondary inlet also provides for treatment of higher flows without significantly increasing the velocity or turbulence in the treatment chamber. This allows for a more quiescent separation environment. Settleable solids and floating pollutants are captured and contained in the treatment chamber.

Flow exits the treatment chamber through the outlet flow control, which manages the amount of flow that is treated and helps maintain the helical flow patterns developed within the treatment chamber.

Flows exceeding the system's rated treatment flow are diverted away from the treatment chamber by the flow partition. Internal diversion of high flows eliminates the need for external bypass structures. During bypass, the head equalizing baffle applies head on the outlet flow control to limit the flow through the treatment chamber. This helps prevent re-suspension of previously captured pollutants.



Design Basics

There are two primary methods of sizing a VortSentry HS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow for a defined particle size. The summation process of the Rational Rainfall Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically, VortSentry HS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a particle gradation with an average particle size (d_{50}) of 240-microns (μm).

Water Quality Flow Rate Method

In many cases, regulations require that a specific flow rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval (i.e. the six-month storm) or a water quality depth (i.e. 1/2-inch of rainfall).

The VortSentry HS is designed to treat all flows up to the WQQ. Due to its internal bypass weir configuration, flow rates in the treatment chamber only increase minimally once the WQQ is surpassed. At influent rates higher than the WQQ, the flow partition will allow most flow exceeding the treatment flow rate to bypass the treatment chamber. This allows removal efficiency to remain relatively constant in the treatment chamber and reduces the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the VortSentry HS will remove a specific gradation of sediment at a specific removal efficiency. Therefore they are variable based on the gradation and removal efficiency specified by the design engineer and the unit size is scaled according to the project goal.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. The Rational Rainfall Method is a sizing program Contech uses to estimate a net annual sediment load reduction for a particular VortSentry HS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics. For more information on the Rational Rainfall Method, see *Vortechs Technical Bulletin 4: Modeling Long Term Load Reduction: The Rational Rainfall Method*, available at **www.ContechES.com/stormwater**

Treatment Flow Rate

The outlet flow control is sized to allow the WQQ to pass entirely through the treatment chamber at a water surface elevation equal to the crest of the flow partition. The head equalizing baffle applies head on the outlet flow control to limit the flow through the treatment chamber when bypass occurs, thus helping to prevent re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The VortSentry HS is available in three standard configurations: inline (with inlet and outlet pipes at 180° to each other), grated inlet, and a combination of grate and pipe inlets. All three configurations are available in 36-inch (900-mm) through 96-inch (2400-mm) diameter manholes.

The configuration of the system is determined by the suffix of the model name:

- A model name without a suffix denotes a standard pipe inlet (Example HS48).
- A "G" at the end of the model designation denotes a grate inlet (Example HS48G).
- A "GP" at the end of the model designation denotes a combination of grate and pipe inlets (Example HS48GP).

Performance

Full-Scale Laboratory Test Results

Laboratory testing of the VortSentry HS was conducted using F-55 Silica, a commercially available sand product with an average particle size of 240-μm (Table 1). This material was metered into a model HS48 VortSentry HS at an average concentration of between 250-mg/L and 300-mg/L at flow rates ranging from 0.50-cfs to 1.5-cfs (14-L/s to 56-L/s).

US Standard Sieve Size	Particle Size Micron (μm)	Cumulative Passing %
30	600	99.7%
40	425	95.7%
50	300	74.7%
70	212	33.7%
100	150	6.7%
140	106	0.7%

Table 1 : US Silica F-55 Particle Size Distribution

Removal efficiencies at each flow rate were calculated based on net sediment loads passing the influent and effluent sampling points. Results are illustrated in Figure 1.

Assuming that sediment in the inlet chamber is ideally mixed, removal rates through the system will decay according to the percentage of flow bypassed. This effect has been observed in the laboratory where the test system is designed to produce a

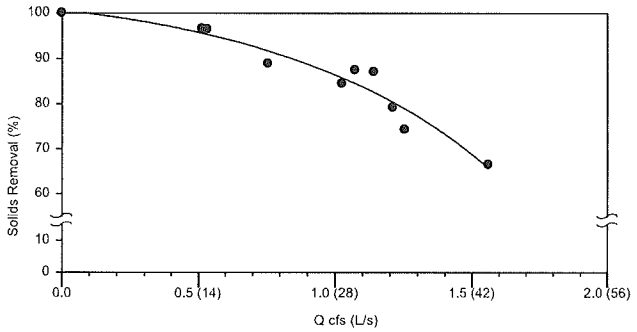


Figure 1: VortSentry HS Removal Efficiencies for 240-μm Particle Gradation

thoroughly mixed inlet stream. All VortSentry HS models have the same aspect ratio regardless of system diameter (i.e. an increase in diameter results in a corresponding increase in depth). Operating rates are expressed volumetrically.

Removal efficiency at each operating rate is calculated according to the average of volumetric and Froude scaling methods and is described by Equation 1.

Equation 1: $$\left(\frac{\text{Diameter Prototype}}{\text{Diameter Model}}\right)^{2.75} = \left(\frac{\text{Flow Rate Prototype}}{\text{Flow Rate Model}}\right)$$

Equation 1 and actual laboratory test results were used to determine the flow rate which would be required for the various VortSentry HS models to remove 80% of solids.

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Maintenance

The VortSentry HS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit, i.e., unstable soils or heavy winter sanding will cause the treatment chamber to fill more quickly, but regular sweeping will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant deposition and transport may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall) however more frequent inspections may be necessary in equipment washdown areas and in climates where winter sanding operations may lead to rapid accumulations of a large volume of sediment. It is useful and often required as part of a permit to keep a record of each inspection. A simple inspection and maintenance log form for doing so is available for download at **www.ContechES.com/stormwater**

The VortSentry HS should be cleaned when the sediment has accumulated to a depth of two feet in the treatment chamber. This determination can be made by taking two measurements with a stadia rod or similar measuring device; one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the distance given in Table 2, the VortSentry HS should be maintained to ensure effective treatment.

Cleaning

Cleaning of the VortSentry HS should be done during dry weather conditions when no flow is entering the system. Cleanout of the VortSentry HS with a vacuum truck is generally the most effective and convenient method of excavating pollutants from the system. Simply remove the manhole cover and insert the vacuum hose into the sump. All pollutants can be removed from this one access point from the surface with no requirements for Confined Space Entry.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use adsorbent pads, which solidify the oils. These are usually much easier to remove from the unit individually, and less expensive to dispose than the oil/water emulsion that may be

created by vacuuming the oily layer. Floating trash can be netted out if you wish to separate it from the other pollutants.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure proper safety precautions. If anyone physically enters the unit, Confined Space Entry procedures need to be followed.

Disposal of all material removed from the VortSentry HS should be done is accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

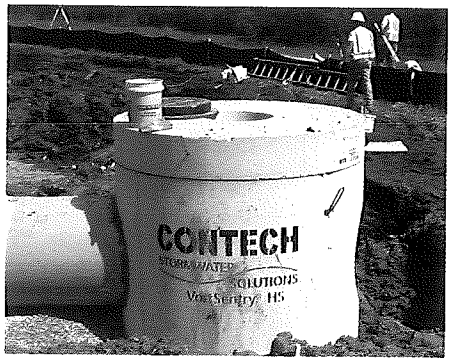
VortSentry HS Model	Diameter		Distance Between Water Surface and Top of Storage Sump		Sediment Storage		Oil Spill Storage	
	in.	m	ft.	m	yd^3	m^3	gal.	liter
HS36	36	0.9	3.6	1.1	0.5	0.4	83	314
HS48	48	1.2	4.7	1.4	0.9	0.7	158	598
HS60	60	1.5	6.0	1.8	1.5	1.1	258	978
HS72	72	1.8	7.1	2.2	2.1	1.6	372	1409
HS84	84	2.1	8.4	2.6	2.9	2.2	649	2458
HS96	96	2.4	9.5	2.9	3.7	2.8	845	3199

Table 2: VortSentry HS Maintenance Indicators and Sediment Storage Capacities.

Note: To avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile. Finer, silty particles at the top of the pile may be more difficult to feel with the measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.

Logon to **www.ContechES.com/stormwater** to download the VortSentry HS Inspection and Maintenance Log.

For assistance with maintaining your VortSentry HS, contact us regarding the Contech Maintenance compliance certification program.



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Support

- Drawings and specifications are available at contechstormwater.com.
- Site-specific design support is available from our engineers.