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December 8, 2014

Mr. John A. Carrigan
Section Chief, Solid Waste Management
Department of Environmental Protection
Northeast Regional Office
205B Lowell Street
Wilmington, Massachusetts 01887

Subject: Semi-Annual Water Quality Monitoring
Haverhill Landfill - October 2014
City of Haverhill, Massachusetts and Aggregate Industries, Inc.

Dear Mr. Carrigan:

On October 6, 2014, CDM Smith Inc. (CDM Smith) personnel performed water quality monitoring at the Haverhill Landfill (the Site) in Haverhill, Massachusetts. The sampling was performed in accordance with the Post-Closure Monitoring Plan (PCM Plan) included in the Final Southern Mound Corrective Action Design (CAD), which was approved by the Massachusetts Department of Environmental Protection (MassDEP) on February 24, 2011.

Water quality samples collected by CDM Smith were analyzed by Absolute Resource Associates of Portsmouth, New Hampshire. CDM Smith has reviewed the laboratory reports and considers these facilities' procedures to be of acceptable quality for periodic monitoring and reporting at the Site.

Approximately 0.05 inches of precipitation was reported within the 48-hour period prior to the monitoring event, and no precipitation was recorded during the monitoring event on October 6.

Groundwater Monitoring

CDM Smith collected groundwater samples from the following monitoring well locations: MW-10M/D, MW-11S, MW-12S, MW-13S/D, MW-14S/D, MW-15SR/M/D, MW-16S, MW-18S/D, MW-19D, and ERT-4. Samples could not be collected from MW-10S, located southwest of the Southern Mound, and MW-17S, located southeast of the Southern Mound, due to an insufficient volume of groundwater present in each well. All well locations are shown on Figure 1. Site Plan and Groundwater Contours - October 2014, included in Appendix A. Samples collected from each monitoring well were analyzed for all the standard parameters included in 310 CMR 19.132 as required in the PCM Plan.

Tidal Conditions

Since the Merrimack River is tidally influenced in the area of the landfill, sampling of monitoring wells adjacent to the Merrimack River and Johnson Creek is performed as close to low tide conditions as

possible. It is expected that monitoring well sampling performed during low tide is more indicative of any contaminant concentrations in groundwater leaving the landfill rather than the background concentrations of contaminants in the river. The wells that are adjacent to the Merrimack River and require sampling at low tide are MW-12S, MW-13S/D, MW-14S/D, and MW-18S/D.

All tidally influenced samples were collected within two hours of low tide during the October 2014 round. The tidal schedule for the day of sampling is shown in Table 1 of Appendix B. In addition to the anticipated low tide schedule, field staff visually confirmed low tide conditions prior to sampling.

Groundwater Levels

The groundwater levels for this sampling round are presented in Table 2 in Appendix B. These levels were collected on October 6, 2014 and are consistent with previous monitoring rounds. Groundwater contours are shown on Figure 1 located in Appendix A. Regional groundwater flow across the landfill site remains in a northeast and eastern direction toward the Merrimack River and Johnson Creek, respectively.

Groundwater Monitoring Analytical Results

In accordance with 310 CMR 19.132, all of the surface water and groundwater results have been compared with both the federal and state Maximum Contaminant Levels (MCLs) and Secondary Maximum Contaminant Levels (SMCLs) for drinking water. As the site is also subject to the requirements of the Massachusetts Contingency Plan (MCP), the groundwater results have also been compared with either the MCP GW-1 or GW-3 Standards, depending on the location of the monitoring well (See Figure 2 in Appendix A).

Sample results of wells located within the designated GW-1 area are presented in Table 3 and Table 4, provided in Appendix B, with comparison to the MCP GW-1 and GW-3 standards (as updated; effective April 25, 2014) as well as the federal and state drinking water standards as required by 310 CMR 19.132. The results from the GW-3 only wells are presented in Table 5 and Table 6, presented in Appendix B, where they are compared to the GW-3 standards (as updated; effective April 25, 2014) and federal and state drinking water standards as required by 310 CMR 19.132.

Surface Water Monitoring

On October 6, 2014, CDM Smith collected surface water samples from the following locations: SW-101, and SW-103 through SW-112. Surface water locations SW-100, located in the wetland swale to the west of the Southern Mound, and SW-102, located in the wetland swale to the west of the Northern Mound, could not be sampled because they were dry. Surface water sampling locations are shown on Figure 1 in Appendix A, except for off-site surface water sampling locations. Specifically, stations SW-103, SW-110, SW-111, and SW-112 are beyond the boundaries of the site plan and are shown on Figure 3, Off-Site Surface Water Sample Locations, also included in Appendix A. Samples

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collected from each surface water sampling location were analyzed for all the standard parameters included in 310 CMR 19.132 as required in the PCM Plan.

Surface Water Monitoring Analytical Results

The analytical results of the surface water sampling are presented in Table 7, provided in Appendix B. As required by 310 CMR 19.132, surface water results were compared to the federal and state drinking water MCLs and SMCLs and to EPA's National Recommended Water Quality Criteria (NRWQC). Hardness is factored into calculating the NRWQC standards for cadmium, chromium, copper, lead, nickel, silver, and zinc. Table 7 in Appendix B presents the hardness-dependent standards calculated for each area (river, creek, confluence, and swale).

In order to achieve reduced reporting limits below the NRWQC, the cadmium, copper, lead and silver analyses for surface water and associated duplicate samples were subcontracted by Absolute Resource Associates to Alpha Analytical of Westborough, Massachusetts. All subcontracted reporting limits were below their respective NRWQC.

Interpretation of Water Quality Monitoring Results

In general, both the groundwater and surface water analytical results obtained during the October 2014 sampling event are consistent when compared to historic data collected during the CSA investigations and subsequent sampling rounds. The following is a summary of specific parameters that have either previously been identified or exceeded one of the comparative regulatory standards discussed above. Data summary tables are included in Appendix B and copies of the laboratory data sheets and the chain of custodies for the samples are included in Appendix C of this letter.

Arsenic

The concentrations of arsenic reported in site-wide samples collected from background wells (MW-10M and MW-10D), the well in the wetland swale to the west of the Southern Mound (MW-11S), wells along the Merrimack River (MW-12S, MW-13S,MW-13D, MW-14S, MW-14D, MW-18S, MW-18D), and wells along Johnson Creek (ERT-4, MW-15SR, MW-15M, MW-15D, MW-16S, and MW-19D) during the October 2014 sampling event are similar to historic results.

Iron and Manganese

Iron and manganese concentrations detected in site-wide groundwater monitoring wells remained consistent or with minor fluctuations when compared to previous sampling rounds with the exception of MW-16S. The concentrations of iron and manganese observed in samples collected from MW-16S during the October 2014 round were elevated when compared to previous rounds. Note that the standards for iron and manganese are SMCLs. SMCLs are established only as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color and odor. This condition will be monitored, but no action is required at this time.

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Sodium
Review of the data for sodium in both groundwater and surface water indicates that its presence is tied to either roadway runoff or salinity in the tidally-influenced Merrimack River and Johnston Creek, depending on the monitoring location. The results of the October 2014 round are similar to those seen in prior spring sampling rounds.

Hardness
Hardness was determined for the surface water monitoring stations, as it factors into the calculations for determining NRWQC for cadmium, chromium, copper, lead, nickel, silver, and zinc. The hardness values analyzed by the laboratory for each surface water station are shown on Table 7 in in addition to the calculated average hardness values for each surface water area (Merrimack River, Johnson Creek, confluence of Merrimack River and Johnson Creek. A value could not be calculated for the swale because it was dry during the October 2014 event. Hardness values for stations within each surface water area were consistent. Concentrations in Johnson Creek may be indicative of the higher calcium concentrations in Johnson Creek, also a component of road salts.

Volatile Organic Compounds (VOCs)
1,4-dioxane was detected at concentrations from 0.31 ug/L to 67 ug/L, exceeding the state and federal MCLs and the MCP GW-1 standards, at locations ERT-4, MW-13D, MW-14S, MW-14D, MW-15M, MW-15D, MW-18D, and MW-19D. Effective April 25, 2014, the MCL and GW-1 standards for 1,4-dioxane were reduced to 0.3 ug/L, which required analysis via method 8260 SIM during the October 2014 round to achieve the required reporting limit. Consequently, these results are first time exceedances, with the exception of MW-13D which has historically been detected above applicable standards. Apart from 1,4-dioxane, VOCs continue to remain below laboratory reporting limits or detected at trace concentrations in all site-wide groundwater monitoring well locations except for ERT-4, where trichloroethene was detected slightly above state and federal MCLs and the MCP-GW-1 standards. CDM Smith notes that the GW-1 standard and MCL were developed based on the active use of the groundwater for a water supply and that the groundwater around the landfill is not utilized for a public water supply.

Conclusions

Results discussed above indicate that groundwater and surface water quality at the Haverhill Landfill is consistent with historic data. In consideration of the above results and conclusions based on prior monitoring results, the following are CDM Smith's recommendations:

- As required by MassDEP's solid waste regulations, CDM Smith submitted a letter/email notifying MassDEP water quality data collected during the October 2014 round exceeded either MCL's or NRWQC's as appropriate. Because the results found during this round are similar to

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those found previously and evaluated as part of the CSA, there is no need to collect any additional samples prior to the next semi-annual round of monitoring or conduct any additional assessment beyond those currently being reviewed by MassDEP.

- Continue to monitor groundwater and surface water concentrations in accordance with the approved PCM Plan. The next water quality next is scheduled for March 2015.

- Continue to explore with MassDEP potential reductions to the monitoring program. CDM Smith notes that the water quality results at the landfill remain consistent and are not providing any new information on environmental conditions around the landfill.

Please do not hesitate to call me at (617) 452-6563 if you have any questions.

Very truly yours,

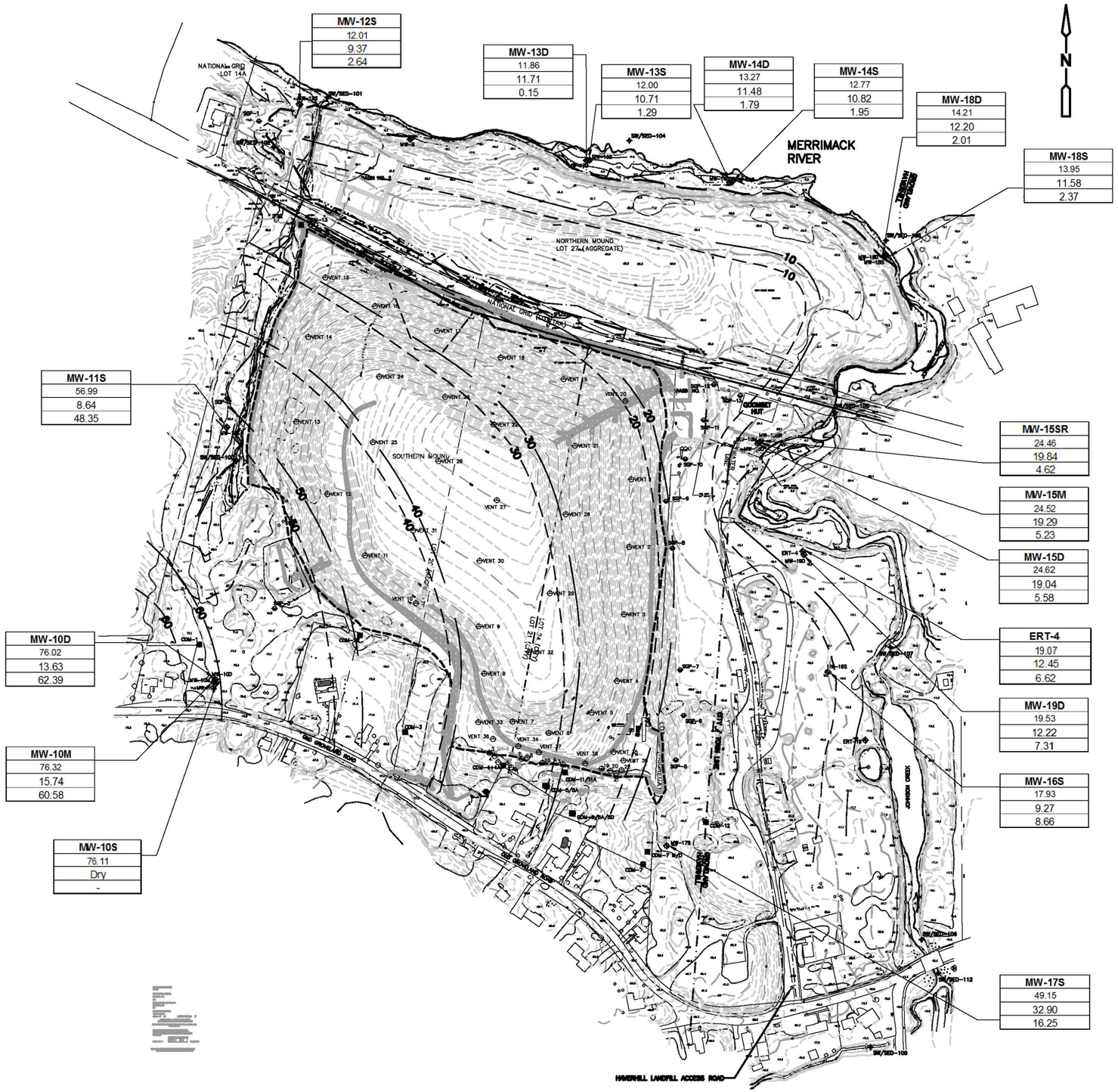
Nathan Jones, P.E.
CDM Smith Inc.

Enclosures

cc: Janet Waldron - MassDEP, Boston
John Morey - MassDEP, Boston
Derrick Golden - EPA Region I
Robert Ward - Haverhill Water/Wastewater Division
Joel Nickel - Aggregate Industries
Dennis Lydon - Aggregate Industries
Michael Leon, Esq. - Nutter, McClennen & Fish, LLP
Gary Gill - Austern, Esq. - Nutter, McClennen & Fish, LLP
Bruce Haskell - Langdon Environmental
Haverhill Information Repository
File: CSA/4.4.5f.xxxviv

Appendix A

Figures



LEGEND

- EDGE OF WASTE (APPROX.)
- PROPERTY LINE
- BORDERING VEGETATED WETLAND LINE
- INLAND BANK LINE
- NON-JURISDICTIONAL/ISOLATED WETLAND LINE
- LIMIT OF 100-FOOT BUFFER ZONE
- LIMIT OF 200-FOOT RIVERFRONT AREA
- LIMIT OF 100 YEAR FLOODPLAIN
- LIMIT OF TOWN OF GROVELAND 100-FOOT BUFFER ZONE TO LAND SUBJECT TO FLOODING
- 10' CONTOUR - PRIOR TO GRADING AND SHAPING PROJECTS
- 2' CONTOUR - PRIOR TO GRADING AND SHAPING PROJECTS
- SPOT ELEVATION - PRIOR TO GRADING AND SHAPING PROJECT
- TREE LINE
- WATER SERVICE
- CITY OF HAVERHILL/ TOWN OF GROVELAND BOUNDARY
- LOT LINE
- FENCE
- DRAINAGE PIPE
- STONE BOUND
- UTILITY POLE
- OVERBURDEN GROUNDWATER CONTOUR (FT-MSL)
- BEDROCK GROUNDWATER CONTOUR (FT-MSL)
- CDM-1 LANDFILL GAS MONITORING WELL
- SW/SED-109 FORMER LANDFILL GAS MONITORING WELL SURFACE WATER/SEDIMENT SAMPLING LOCATION
- MW-19D GROUNDWATER MONITORING WELL LOCATION
- VENT 22 LANDFILL GAS VENT LOCATION
- SGP-2 LANDFILL SOIL GAS PROBE LOCATION

Monitoring Well Number	MW-10M
Elevation to Top of PVC Casing (ft. NGVD)	76.32
Depth to Water (ft.)	15.74
GW Elevation (ft. NGVD)	60.58

NOTES

1. TOPOGRAPHIC PLAN PREPARED BY EASTERN TOPOGRAPHICS FOR THE CITY OF HAVERHILL AND REFLECTS EXISTING GROUND CONDITIONS ON APRIL 13, 1992.
2. PROPERTY SURVEY AND FIELD SURVEY CONDUCTED BY RICHARD F. KAMINSKI & ASSOCIATES, INC., LAWRENCE, MASSACHUSETTS. PROPERTY LINE PLAN PREPARED ON NOVEMBER 16, 1992. SEVERAL OF THE PROPERTY LINES WERE DEVELOPED FROM AN UNDATED CITY ASSESSOR'S MAP AND THE PROPERTY LINES ARE APPROXIMATE.
3. ELEVATION DATUM IS BASED ON THE MEAN SEA LEVEL DATUM (MSL).
4. EDGE OF WASTE ALONG MERRIMACK RIVER BASED ON PREVIOUS INVESTIGATIONS AND SITE VISITS.
5. GROUNDWATER ELEVATIONS AT EACH WELL MEASURED ON OCTOBER 6 2014.
6. GROUNDWATER CONTOURS SHOWN REFLECT SITE CONDITIONS BASED ON PREVIOUS DATA. GROUNDWATER ELEVATIONS COLLECTED IN OCTOBER 2014 ARE CONSISTENT.
7. MW-15SR REPLACED MW-15S IN NOVEMBER 2004, AND WAS SUBSEQUENTLY SURVEYED BY RICHARD F. KAMINSKI & ASSOCIATES, INC. DURING THE FALL OF 2005. THIS PLAN REFLECTS THE UPDATED TOP OF PVC ELEVATION. WELLS MW-18S/D, MW-19D, ERT-4, ERT-19 AND MW-9 WERE SURVEYED IN MARCH/APRIL 2008.

1" = 340'

170 0 340

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: M. BOGOSH
DRAWN BY: M. BOGOSH
SHEET CHK'D BY: S. GRYSZKIEWICZ
CROSS CHK'D BY: N. JONES
APPROVED BY: A. MILLER
DATE: NOVEMBER 2014

CDM Smith

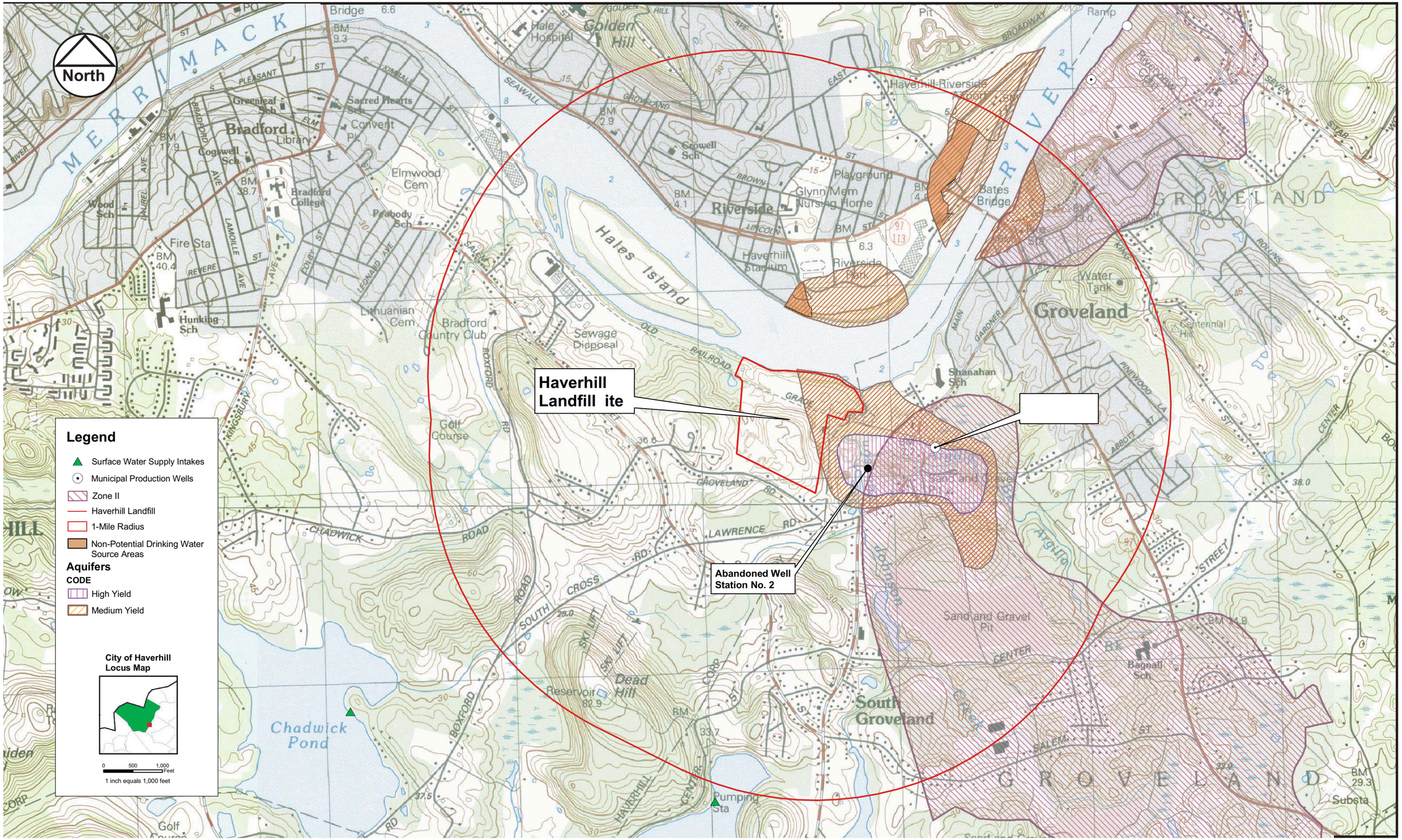
CITY OF HAVERHILL
HAVERHILL, MASSACHUSETTS

INTERIM MONITORING PROGRAM

SITE PLAN AND GROUNDWATER CONTOURS OCTOBER 2014

PROJECT NO. 0522/37609/46134
FILE NAME: CSTPL009

1


North
Legend
Surface Water Supply Intakes
Municipal Production Wells
Zone II
Haverhill Landfill
1-Mile Radius
Non-Potential Drinking Water Source Areas
Aquifers
CODE
High Yield
Medium Yield
City of Haverhill Locus Map
0 500 1,000 Feet
1 inch equals 1,000 feet
Haverhill Landfill ite
Abandoned Well Station No. 2
MERRIMACK RIVER
Hales Island
Chadwick Pond
Bradford
Riverside
Groveland
South Groveland
Golden Hill
Dead Hill
Haverhill Riverside Airport
Bates Bridge
Sand and Gravel Pit
Golf Course
Sewage Disposal
Pumping Sta
Reservoir
Water Tank
Substa

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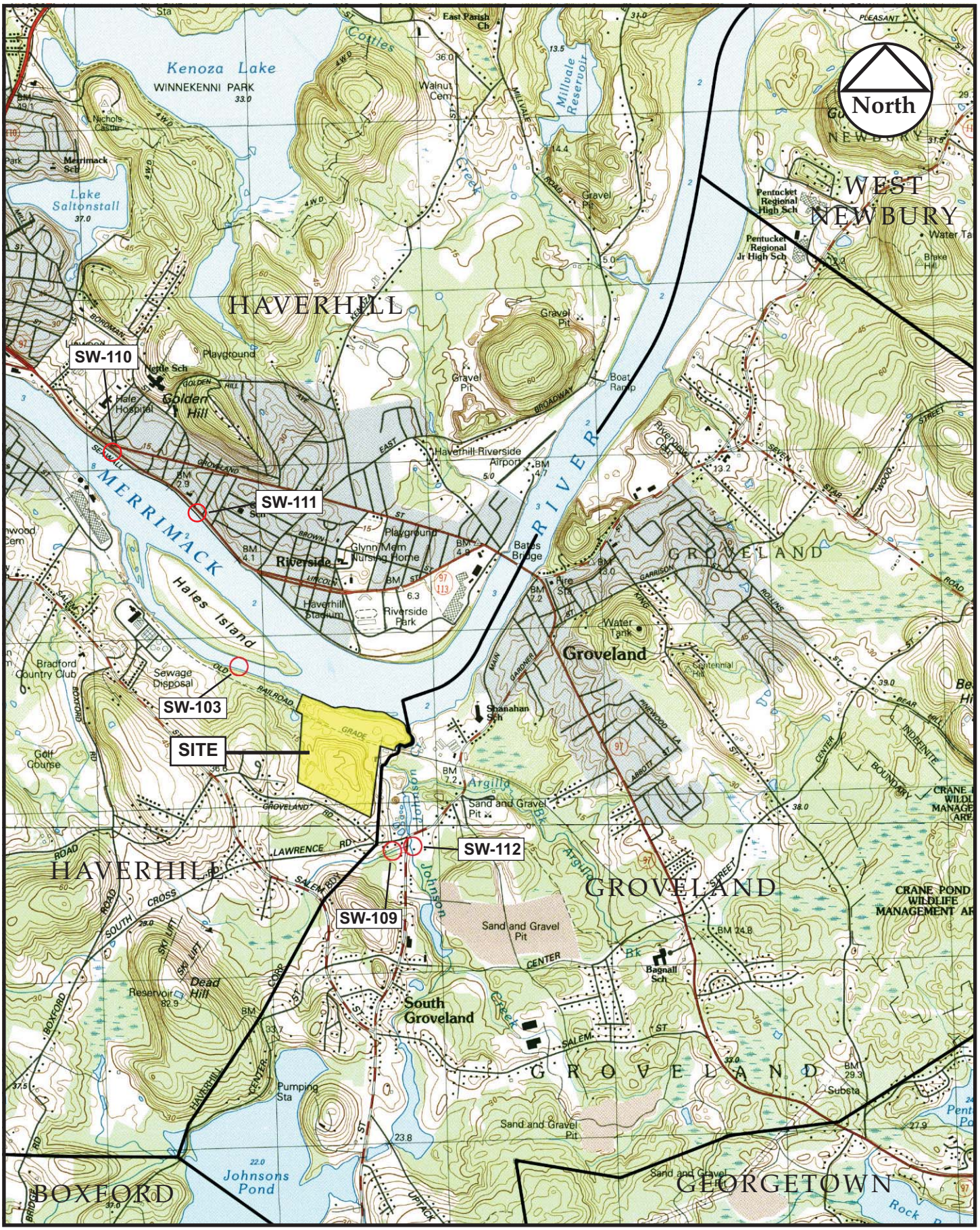

0 2000 4000
Scale in Feet

○ = Off-Site Surface Water Sample Location

Haverhill Municipal Landfill Project
Haverhill, Massachusetts

CDM Smith

Figure 3
Off-Site Surface Water Sample Locations

Appendix B

Tables

Table 1
Tidal Schedule for the Merrimack River at Haverhill, Massachusetts (Riverside)
Interim Monitoring - October 2014
Haverhill Landfill, Haverhill, Massachusetts
42°45'53"N, 71°03'39"W

Date	Time (EDT)	Height (feet)	High or Low Tide
10/6/2014	**6:36**	-0.3	Low
10/6/2014	**11:37**	5.9	High
10/6/2014	**19:00**	-0.3	Low

Source: www.tides4fishing.com/us/massachusetts/riverside-haverhill

Table 2
Summary of Groundwater Elevations
Interim Monitoring - October 6, 2014
Haverhill Landfill, Haverhill, Massachusetts

Monitoring Well Number	Elevation to Top of PVC Casing [1] (ft. NGVD)	Depth to Water [2] (ft.)	Groundwater Elevation (ft. NGVD)
ERT-4	19.07	12.45	6.62
MW-10S	76.11	Dry	-
MW-10M	76.32	15.74	60.58
MW-10D	76.02	13.63	62.39
MW-11S	56.99	8.64	48.35
MW-12S	12.01	9.37	2.64
MW-13S	12.00	10.71	1.29
MW-13D	11.86	11.71	0.15
MW-14S	12.77	10.82	1.95
MW-14D	13.27	11.48	1.79
MW-15SR	24.46	19.84	4.62
MW-15M	24.52	19.29	5.23
MW-15D	24.62	19.04	5.58
MW-16S	17.93	9.27	8.66
MW-17S	49.15	32.90	16.25
MW-18S	13.95	11.58	2.37
MW-18D	14.21	12.20	2.01
MW-19D	19.53	12.22	7.31

Notes

(1) Elevation as surveyed by Kaminski & Associates Inc. during fall 2005, with the exception of wells MW-18S/D and MW-19D,which were surveyed by ASEC Corporation on 03/24/08, and well ERT-4 which was surveyed by ASEC Corporation on 04/07/08.
(2) Depth to water measured from top of PVC casing

Table 3
Groundwater Sampling Results for GW-1 Wells
Metals, Conventional and Field Parameters
October 2014
Haverhill Landfill, Haverhill, Massachusetts

				SAMPLING DATE	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014
				RES LABORATORY SAMPLING NUMBER	31162-016	31162-005	31162-006	31162-007	31162-008	31162-009	31162-010	31162-011	31162-017
				CDM SAMPLING NUMBER	**ERT-4***	**MW-13S***	**MW-13D***	**MW-14S***	**MW-14D***	**MW-15SR***	**MW-15M***	**MW-15D***	**MW-15D***
METALS	***MA and EPA DRINKING WATER STANDARDS[11,12,15]***	***MCP GW-1 STANDARDS[13]***	***MCP GW-3 STANDARDS[13]***	***UNITS***									DUP-3
Aluminum	50 - 200 (2,4,21)	NL	NL	ug/L	-	-	-	-	-	-	-	-	-
Antimony	6 (1,3)	6	8,000	ug/L	-	-	-	-	-	-	-	-	-
Arsenic	10 (1,3)	10	900	ug/L	460	25	240	<8	8	8	290	<8	8
Barium	2,000 (1,3)	2,000	50,000	ug/L	230	80	300	60	<50	60	250	<50	<50
Beryllium	4 (1,3)	4	200 (19)	ug/L	-	-	-		-	-	-	-	-
Cadmium	5 (1,3)	5	4	ug/L	<4	<4	<4	<4	<4	<4	<4	<4	<4
Calcium	NL	NL	NL	ug/L	57,000	37,000	140,000	24,000	26,000	69,000	130,000	17,000	17,000
Chromium (total)	100 (1,3)	100	300	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cobalt	NL	NL	NL	ug/L	-	-	-		-	-	-	-	-
Copper	1,000 (2,4)	NL	NL	ug/L	<50	<50	50	<50	<50	<50	<50	<50	<50
Iron	300 (2,4)	NL	NL	ug/L	49,000	990	16,000	660	150	<50	37,000	200	210
Lead	15 (1,3,10)	15	10	ug/L	**12**	<8	<8	<8	<8	<8	10	<8	<8
Magnesium	NL	NL	NL	ug/L	-	-	-		-	-	-	-	-
Manganese	50 (2,4)	NL	NL	ug/L	100	180	2,600	110	140	<30	1,100	190	190
Mercury	2 (1,3)	2	20	ug/L	<0.2	<0.2	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	100 (2)	100	200	ug/L	-	-	-	-	-	-	-	-	-
Potassium	NL	NL	NL	ug/L	-	-	-	-	-	-	-	-	-
Selenium	50 (1,3)	50	100	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50
Silver	100 (2,4)	100	7	ug/L	<7	<7	<7	<7	<7	<7	<7	<7	<7
Sodium	20,000 (2)	NL	NL	ug/L	50,000	21,000	110,000	31,000	49,000	27,000	46,000	47,000	48,000
Vanadium	NL	30	4,000	ug/L	-	-	-	-	-	-	-	-	-
Zinc	5,000 (2,4)	5,000	900	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50
CONVENTIONAL PARAMETERS													
Total Dissolved Solids (Residue, Filterable)	500 (2,4)	NL	NL	mg/L	560	220	900	200	270	360	750	230	-
Sulfate	250 (2,4)	NL	NL	mg/L	21	4.8	25	13	13	48	45	13	-
Chloride	250 (2,4)	NL	NL	mg/L	78	40	160	55	78	28	92	18	-
Alkalinity, Total (as CaCO3)	NL	NL	NL	mg/L	520	92	600	39	71	170	480	140	-
Nitrogen, (N) (18)	10 (1,3)	NL	NL	mg/L	1.0	0.2	1.1	0.8	< 0.1	1.2	1.0	0.1	-
Chemical Oxygen Demand	NL	NL	NL	mg/L	<25	< 25	57	42	33	< 25	54	< 25	-
Hardness (CaCO3)	NL	NL	NL	mg/L	-	100	460	66	87	-	-	-	-
FIELD PARAMETERS													
pH	6.5-8.5 (2,4)	NL	NL		6.81	6.12	6.61	5.67	7.77	6.03	6.16	7.76	-
Specific Conductivity	NL	NL	NL	umhos	1,184	247	1,266	275	355	384	1,120	305	-
Temperature	NL	NL	NL	degrees C	13.2	14.46	12.50	14.87	12.45	11.06	10.68	10.83	-
Dissolved Oxygen	NL	NL	NL	mg/L	0.20	0.66	0.20	0.99	0.24	2.64	0.41	0.34	-
INORGANIC PARAMETERS													
Cyanide (total)	200 (1,3,9)	200 (20)	30 (20)	ug/L	<20	<20	<20	<20	<20	<20	<20	<20	<20
Thallium	2 (1,3)	2	3,000	ug/L	-	-	-	-	-	-	-	-	-

Notes:
(1) Massachusetts Drinking Water Standard (MCL)
(2) Massachusetts Drinking Water Secondary Standard or Guideline (SMCL)
(3) EPA Primary Drinking Water Standard (MCL)
(4) EPA Secondary Drinking Water Standard (SMCL)
(5) This criteria is dependent on hardness in the water. Values shown in the tables are based on an average hardness at the site of 33 mg/L for samples near Merrimack River,
71 mg/L for samples near Johnson Creek, and 33 mg/L for the confluence of Merrimack River and Johnson Creek (SW-105). A value could not be measured for the swale because it was dry.
(6) When the concentration of dissolved organic carbon is elevated, copper is substatially less toxic and use of Water-Effect Ratios might be appropriate.
(7) This value is for total recoverable selenium, but there is a formula to change it to dissolved Se
(8) No Criterion Continuous Concentration (CCC) was available so Criterion Maximum Concentration (CMC) was used
(9) Cyanide expressed as free, or physiologically available cyanide.
(10) Action Level
(11) Massachusetts State Drinking Water Standards; dated 2011
(12) Environmental Protection Agency Drinking Water Regulations; as posted on www.epa.gov as of May 2009.
(13) MCP GW-1 and GW-3 Standards (Method 1); version February 14, 2008
(14) NRWQC - National Recommended Water Quality Criteria; version dated 2009
(15) The lower of Massachusetts and EPA MCL or SMCL is listed.
(16) Standard listed is for Chromium III. No standard is established for Total Chromium.
(17) Species Dependent Criteria
(18) Nitrogen analyzed sometimes as Nitrate (N) and sometimes as Nitrate+Nitrite (N).
(19) Supplemental MCP Amendment, Effective February 2008
(20) Cyanide expressed as Physiologically Available Cyanide (PAC). In the absence of measured PAC, the standard is applicable to Total Cyanide.
(21) A range is specified for the aluminum secondary standard. Guidance relating to this standard provided by EPA, and adopted by Massachusetts, indicates that 50 ug/L is the optimal value for the secondary standard,
but that the range is provided because certain systems may have difficulty meeting this criteria. For the purposes of these tables, any aluminum concentration above 50 ug/L is considered an exceedance, and is highlighted.
NL = No Limit.

"-" Indicates that the sample was not analyzed for that consitutent.
Grey shading indicates an exceedence of EPA or MA drinking water standards.
Bold outlining indicates an exceedence of MCP GW-1 standards.
Bolded text indicates an exceedence of MCP GW-3 standards.
< : Not Detected above laboratory reporting limit
* Indicates a well to which MCP GW-1 standards apply.
MA and EPA drinking water standards, and MCP GW-3 standards apply to all wells.

Table 3
Groundwater Sampling Results for GW-1 Wells
Metals, Conventional and Field Parameters
October 2014
Haverhill Landfill, Haverhill, Massachusetts

				SAMPLING DATE	10/6/2014	10/6/2014	10/6/2014	10/6/2014
				RES LABORATORY SAMPLING NUMBER	31162-012	31162-013	31162-014	31162-015
				CDM SAMPLING NUMBER	**MW-16S***	**MW-18S***	**MW-18D***	**MW-19D***
METALS	***MA and EPA DRINKING WATER STANDARDS[11,12,15]***	***MCP GW-1 STANDARDS[13]***	***MCP GW-3 STANDARDS[13]***	***UNITS***				
Aluminum	50 - 200 (2,4,21)	NL	NL	ug/L	-	-	-	-
Antimony	6 (1,3)	6	8,000	ug/L	-	-	-	-
Arsenic	10 (1,3)	10	900	ug/L	<8	20	<8	<8
Barium	2,000 (1,3)	2,000	50,000	ug/L	60	<50	<50	<50
Beryllium	4 (1,3)	4	200 (19)	ug/L	-	-	-	-
Cadmium	5 (1,3)	5	4	ug/L	<4	<4	<4	<4
Calcium	NL	NL	NL	ug/L	46,000	22,000	31,000	45,000
Chromium (total)	100 (1,3)	100	300	ug/L	<50	<50	<50	<50
Cobalt	NL	NL	NL	ug/L	-	-	-	-
Copper	1,000 (2,4)	NL	NL	ug/L	<50	<50	<50	<50
Iron	300 (2,4)	NL	NL	ug/L	1,500	7,200	<50	140
Lead	15 (1,3,10)	15	10	ug/L	<8	<8	<8	<8
Magnesium	NL	NL	NL	ug/L	-	-	-	-
Manganese	50 (2,4)	NL	NL	ug/L	7,200	150	210	260
Mercury	2 (1,3)	2	20	ug/L	<0.2	<0.2	<0.2	<0.2
Nickel	100 (2)	100	200	ug/L	-	-	-	-
Potassium	NL	NL	NL	ug/L	-		-	
Selenium	50 (1,3)	50	100	ug/L	<50	<50	<50	<50
Silver	100 (2,4)	100	7	ug/L	<7	<7	<7	<7
Sodium	20,000 (2)	NL	NL	ug/L	14,000	23,000	11,000	18,000
Vanadium	NL	30	4,000	ug/L	-	-	-	-
Zinc	5,000 (2,4)	5,000	900	ug/L	<50	<50	<50	<50
CONVENTIONAL PARAMETERS								
Total Dissolved Solids (Residue, Filterable)	500 (2,4)	NL	NL	mg/L	250	180	180	340
Sulfate	250 (2,4)	NL	NL	mg/L	1.0	8.8	13	7.1
Chloride	250 (2,4)	NL	NL	mg/L	11	38	20	75
Alkalinity, Total (as CaCO3)	NL	NL	NL	mg/L	180	54	76	97
Nitrogen, (N) (18)	10 (1,3)	NL	NL	mg/L	0.2	0.2	0.1	<0.1
Chemical Oxygen Demand	NL	NL	NL	mg/L	< 25	< 25	48	< 25
Hardness (CaCO3)	NL	NL	NL	mg/L	-	62	96	-
FIELD PARAMETERS								
pH	6.5-8.5 (2,4)	NL	NL		6.66	5.73	6.19	7.81
Specific Conductivity	NL	NL	NL	umhos	333	224	186	376
Temperature	NL	NL	NL	degrees C	13.74	13.1	12.29	13.87
Dissolved Oxygen	NL	NL	NL	mg/L	0.25	0.59	0.25	0.27
INORGANIC PARAMETERS								
Cyanide (total)	200 (1,3,9)	200 (20)	30 (20)	ug/L	<20	<20	<20	<20
Thallium	2 (1,3)	2	3,000	ug/L	-	-	-	-

Notes:
(1) Massachusetts Drinking Water Standard (MCL)
(2) Massachusetts Drinking Water Secondary Standard or Guideline (SMCL)
(3) EPA Primary Drinking Water Standard (MCL)
(4) EPA Secondary Drinking Water Standard (SMCL)
(5) This criteria is dependent on hardness in the water. Values shown in the tables are based on an average hardness at the site of 33 mg/L for samples nea
71 mg/L for samples near Johnson Creek, and 33 mg/L for the confluence of Merrimack River and Johnson Creek (SW-105). A value could not be measured
(6) When the concentration of dissolved organic carbon is elevated, copper is substatially less toxic and use of Water-Effect Ratios might be appropriate.
(7) This value is for total recoverable selenium, but there is a formula to change it to dissolved Se
(8) No Criterion Continuous Concentration (CCC) was available so Criterion Maximum Concentration (CMC) was used
(9) Cyanide expressed as free, or physiologically available cyanide.
(10) Action Level
(11) Massachusetts State Drinking Water Standards; dated 2011
(12) Environmental Protection Agency Drinking Water Regulations; as posted on www.epa.gov as of May 2009.
(13) MCP GW-1 and GW-3 Standards (Method 1); version February 14, 2008
(14) NRWQC - National Recommended Water Quality Criteria; version dated 2009
(15) The lower of Massachusetts and EPA MCL or SMCL is listed.
(16) Standard listed is for Chromium III. No standard is established for Total Chromium.
(17) Species Dependent Criteria
(18) Nitrogen analyzed sometimes as Nitrate (N) and sometimes as Nitrate+Nitrite (N).
(19) Supplemental MCP Amendment, Effective February 2008
(20) Cyanide expressed as Physiologically Available Cyanide (PAC). In the absence of measured PAC, the standard is applicable to Total Cyanide.
(21) A range is specified for the aluminum secondary standard. Guidance relating to this standard provided by EPA, and adopted by Massachusetts, indicates

NL = No Limit.

"-" Indicates that the sample was not analyzed for that consitutent.
Grey shading indicates an exceedence of EPA or MA drinking water standards.
Bold outlining indicates an exceedence of MCL GW-1 standards.
Bolded text indicates an exceedence of MCP GW-3 standards.
< : Not Detected above laboratory reporting limit
* Indicates a well to which MCP GW-1 standards apply.
MA and EPA drinking water standards, and MCP GW-3 standards apply to all wells.

Table 4
Groundwater Sampling Results for GW-1 Wells
Volatile Organic Compounds (VOCs)
October 2014
Haverhill Landfill, Haverhill, Massachusetts

				SAMPLING DATE	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014
				ANALYSIS DATE	10/9/2014	10/8/2014	10/9/2014	10/9/2014	10/9/2014	10/8/2014	10/9/2014
				LABORATORY SAMPLING NUMBER	31162-016	31162-005	31162-006	31162-007	31162-008	31162-009	31162-010
				CDM SAMPLING NUMBER	**ERT-4***	**MW-13S***	**MW-13D***	**MW-14S***	**MW-14D***	**MW-15SR***	**MW-15M***
VOCs	***MA and EPA DRINKING WATER STANDARDS [7,9,11]***	***MCP GW-1 STANDARDS[9]***	***MCP GW-3 STANDARDS[9]***	***UNITS***							
1,1,1,2-Tetrachloroethane	NL	5	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,1,1-Trichloroethane	200 (1,3)	200	20,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,1,2,2-Tetrachloroethane	NL	2	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,1,2-Trichloroethane	5 (1,3)	5	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,1-Dichloroethane	70 (2)	70	20,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,1-Dichloroethene	7 (1,3)	7	30,000	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1-Dichloropropene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,2,3-Trichlorobenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,2,3-Trichloropropane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,2,4-Trichlorobenzene	70 (1,3)	70	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,2,4-Trimethylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,2-Dibromo-3-chloropropane	0.2 (1,3)	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,2-Dibromoethane	0.02 (1)	0.02	50,000.00	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,2-Dichlorobenzene	600 (1,3)	600	2,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,2-Dichloroethane	5 (1,3)	5	20,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,2-Dichloropropane	5 (1,3)	5	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,3,5-Trimethylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,3-Dichlorobenzene	NL	100	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,3-Dichloropropane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,4-Dichlorobenzene	5 (1)	5	8,000	ug/L	< 2	< 2	2	< 2	< 2	< 2	< 2
1,4-Dioxane	0.3 (2)	0.3	50,000	ug/L	3.5	< 0.3	67	0.39	4.9	< 0.3	5.0
2,2-Dichloropropane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
2-Butanone	4000 (2)	4,000	50,000	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10
2-Chloroethyl Vinyl Ether	NL	NL	NL	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5
2-Chlorotoluene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
2-Hexanone	NL	NL	NL	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10
4-Chlorotoluene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
4-Isopropyltoluene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
4-Methyl-2-pentanone	350 (2)	350	50,000	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Acetone	6300 (2)	6,300	50,000	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Acrolein	NL	NL	NL	ug/L	NS	NS	NS	NS	NS	NS	NS
Benzene	5 (1,3)	5	10,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Bromobenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Bromochloromethane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Bromodichloromethane	NL	3	50,000	ug/L	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Bromoform	NL	4	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Bromomethane	10 (2)	10	800	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Carbon disulfide	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Carbon tetrachloride	5 (1,3)	5	5,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Chlorobenzene	100 (1,3)	100	1,000	ug/L	4	< 2	9	< 2	< 2	< 2	3
Chloroethane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Chloroform	70 (2)	70	20,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Chloromethane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
cis-1,2-Dichloroethene	70 (1,3)	70	50,000	ug/L	20	< 2	< 2	< 2	< 2	< 2	18
cis-1,3-Dichloropropene	NL	(5)	(5)	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Dibromochloromethane	NL	2	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Dibromomethane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Dichlorodifluoromethane	1400 (2)	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2

Table 4
Groundwater Sampling Results for GW-1 Wells
Volatile Organic Compounds (VOCs)
October 2014
Haverhill Landfill, Haverhill, Massachusetts

				SAMPLING DATE	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014
				ANALYSIS DATE	10/9/2014	10/8/2014	10/9/2014	10/9/2014	10/9/2014	10/8/2014	10/9/2014
				LABORATORY SAMPLING NUMBER	31162-016	31162-005	31162-006	31162-007	31162-008	31162-009	31162-010
				CDM SAMPLING NUMBER	**ERT-4***	**MW-13S***	**MW-13D***	**MW-14S***	**MW-14D***	**MW-15SR***	**MW-15M***
VOCs	***MA and EPA DRINKING WATER STANDARDS [7,9,11]***	***MCP GW-1 STANDARDS[9]***	***MCP GW-3 STANDARDS[9]***	***UNITS***							
Diethyl ether	NL	NL	NL	ug/L	2	< 2	10	< 2	4	< 2	3
Diisopropyl ether	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ethylbenzene	700 (1,3)	700	5,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Ethyl tertiary butyl ether	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Hexachlorobutadiene	NL	1	3,000	ug/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Isopropylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
m,p-Xylene	10000 (1,3,6)	10,000 (1,3,6)	5,000 (6)	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Methyl tert-butyl ether	70 (2)	70	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Methylene chloride	5 (1,3)	5	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Naphthalene	140 (2)	140	20,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
n-Butylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
n-Propylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
o-Xylene	10000 (1,3,6)	10,000 (6)	5,000 (6)	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
sec-Butylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Styrene	100 (1,3)	100	6,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
t-Butanol (TBA)	120 (2)	NL	NL	ug/L	< 30	< 30	36	< 30	< 30	< 30	< 30
tert-Butylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Tertiary Amyl Methyl Ether	90 (2)	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Tetrachloroethene	5 (1,3)	5	30,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Tetrahydrofuran	600 (2)	NL	NL	ug/L	5	< 2	< 2	< 2	< 2	< 2	4
Toluene	1000 (1,3)	1,000	40,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
trans-1,2-Dichloroethene	100 (1,3)	100	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
trans-1,3-Dichloropropene	NL	(5)	(5)	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Trichloroethene	5 (1,3)	5	5,000	ug/L	6	< 2	< 2	< 2	< 2	< 2	< 2
Trichlorofluoromethane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Vinyl acetate	NL	NL	NL	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Vinyl chloride	2 (1,3)	2	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	2

Notes:
(1) Massachusetts Drinking Water Standard (MCL)
(2) Massachusetts Drinking Water Secondary Standard (SMCL) or Guideline.
(3) EPA Primary Drinking Water Standard (MCL)
(4) EPA Secondary Drinking Water Standard (SMCL)
(5) MA MCL for 1,3-Dichloropropene is 0.4 ug/L, MCP GW-3 standard is 200 ug/L and GW-1 standard is 0.4 ug/L.
(6) Listed standard is for total xylenes, no individual isomer standards exist.
(7) Massachusetts State Drinking Water Standards; dated 2011.
(8) Environmental Protection Agency Drinking Water Regulations; as posted on www.epa.gov as of May 2009.
(9) MCP GW-1 and GW-3 Standards (Method 1); version February 14, 2008.
(10) NRWQC - National Recommended Water Quality Criteria; version dated 2009
(11) The lower of Massachusetts and EPA MCL is listed.
NL: no limit

Since a particular stereoisomer is not specified, a comparison can not be made to the standard.

"-" Indicates that the sample was not analyzed for that consitutent.
Grey shading indicates an exceedence of EPA or MA drinking water standards.
Bold outlining indicates an exceedence of MCP GW-1 standards.
Bolded text indicates an exceedence of MCP GW-3 standards.
< : Not Detected above laboratory reporting limit
* Indicates a well to which MCP GW-1 standards apply.
MA and EPA drinking water standards, and MCP GW-3 standards apply to all wells.

Table 4
Groundwater Sampling Results for GW-1 Wells
Volatile Organic Compounds (VOCs)
October 2014
Haverhill Landfill, Haverhill, Massachusetts

				SAMPLING DATE	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014
				ANALYSIS DATE	10/8/2014	10/9/2014	10/8/2014	10/8/2014	10/8/2014	10/9/2014
				LABORATORY SAMPLING NUMBER	31162-011	31162-017	31162-012	31162-013	31162-014	31162-015
				CDM SAMPLING NUMBER	**MW-15D***	**MW-15D***	**MW-16S***	**MW-18S***	**MW-18D***	**MW-19D***
VOCs	***MA and EPA DRINKING WATER STANDARDS [7,9,11]***	***MCP GW-1 STANDARDS[9]***	***MCP GW-3 STANDARDS[9]***	***UNITS***		Duplicate-3				
1,1,1,2-Tetrachloroethane	NL	5	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,1,1-Trichloroethane	200 (1,3)	200	20,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,1,2,2-Tetrachloroethane	NL	2	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,1,2-Trichloroethane	5 (1,3)	5	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,1-Dichloroethane	70 (2)	70	20,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,1-Dichloroethene	7 (1,3)	7	30,000	ug/L	< 1	< 1	< 1	< 1	< 1	< 1
1,1-Dichloropropene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,2,3-Trichlorobenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,2,3-Trichloropropane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,2,4-Trichlorobenzene	70 (1,3)	70	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,2,4-Trimethylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,2-Dibromo-3-chloropropane	0.2 (1,3)	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,2-Dibromoethane	0.02 (1)	0.02	50,000.00	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,2-Dichlorobenzene	600 (1,3)	600	2,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,2-Dichloroethane	5 (1,3)	5	20,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,2-Dichloropropane	5 (1,3)	5	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,3,5-Trimethylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,3-Dichlorobenzene	NL	100	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,3-Dichloropropane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,4-Dichlorobenzene	5 (1)	5	8,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
1,4-Dioxane	0.3 (2)	0.3	50,000	ug/L	1.7	1.6	< 0.3	< 0.3	0.31	14
2,2-Dichloropropane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
2-Butanone	4000 (2)	4,000	50,000	ug/L	< 10	< 10	< 10	< 10	< 10	< 10
2-Chloroethyl Vinyl Ether	NL	NL	NL	ug/L	< 5	< 5	< 5	< 5	< 5	< 5
2-Chlorotoluene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
2-Hexanone	NL	NL	NL	ug/L	< 10	< 10	< 10	< 10	< 10	< 10
4-Chlorotoluene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
4-Isopropyltoluene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
4-Methyl-2-pentanone	350 (2)	350	50,000	ug/L	< 10	< 10	< 10	< 10	< 10	< 10
Acetone	6300 (2)	6,300	50,000	ug/L	< 10	< 10	< 10	< 10	< 10	< 10
Acrolein	NL	NL	NL	ug/L	NS	NS	NS	NS	NS	NS
Benzene	5 (1,3)	5	10,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Bromobenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Bromochloromethane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Bromodichloromethane	NL	3	50,000	ug/L	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Bromoform	NL	4	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Bromomethane	10 (2)	10	800	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Carbon disulfide	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Carbon tetrachloride	5 (1,3)	5	5,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Chlorobenzene	100 (1,3)	100	1,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Chloroethane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Chloroform	70 (2)	70	20,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Chloromethane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
cis-1,2-Dichloroethene	70 (1,3)	70	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
cis-1,3-Dichloropropene	NL	(5)	(5)	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Dibromochloromethane	NL	2	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Dibromomethane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Dichlorodifluoromethane	1400 (2)	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2

Table 4
Groundwater Sampling Results for GW-1 Wells
Volatile Organic Compounds (VOCs)
October 2014
Haverhill Landfill, Haverhill, Massachusetts

				SAMPLING DATE	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014
				ANALYSIS DATE	10/8/2014	10/9/2014	10/8/2014	10/8/2014	10/8/2014	10/9/2014
				LABORATORY SAMPLING NUMBER	31162-011	31162-017	31162-012	31162-013	31162-014	31162-015
				CDM SAMPLING NUMBER	**MW-15D***	**MW-15D***	**MW-16S***	**MW-18S***	**MW-18D***	**MW-19D***
VOCs	***MA and EPA DRINKING WATER STANDARDS [7,9,11]***	***MCP GW-1 STANDARDS[9]***	***MCP GW-3 STANDARDS[9]***	***UNITS***		Duplicate-3				
Diethyl ether	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	7
Diisopropyl ether	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Ethylbenzene	700 (1,3)	700	5,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Ethyl tertiary butyl ether	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Hexachlorobutadiene	NL	1	3,000	ug/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Isopropylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
m,p-Xylene	10000 (1,3,6)	10,000 (1,3,6)	5,000 (6)	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Methyl tert-butyl ether	70 (2)	70	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Methylene chloride	5 (1,3)	5	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Naphthalene	140 (2)	140	20,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
n-Butylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
n-Propylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
o-Xylene	10000 (1,3,6)	10,000 (6)	5,000 (6)	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
sec-Butylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Styrene	100 (1,3)	100	6,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
t-Butanol (TBA)	120 (2)	NL	NL	ug/L	< 30	< 30	< 30	< 30	< 30	< 30
tert-Butylbenzene	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Tertiary Amyl Methyl Ether	90 (2)	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Tetrachloroethene	5 (1,3)	5	30,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Tetrahydrofuran	600 (2)	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	3
Toluene	1000 (1,3)	1,000	40,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
trans-1,2-Dichloroethene	100 (1,3)	100	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
trans-1,3-Dichloropropene	NL	(5)	(5)	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Trichloroethene	5 (1,3)	5	5,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Trichlorofluoromethane	NL	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2	< 2
Vinyl acetate	NL	NL	NL	ug/L	< 10	< 10	< 10	< 10	< 10	< 10
Vinyl chloride	2 (1,3)	2	50,000	ug/L	< 2	< 2	< 2	< 2	< 2	< 2

Notes:
(1) Massachusetts Drinking Water Standard (MCL)
(2) Massachusetts Drinking Water Secondary Standard (SMCL) or Guideline.
(3) EPA Primary Drinking Water Standard (MCL)
(4) EPA Secondary Drinking Water Standard (SMCL)
(5) MA MCL for 1,3-Dichloropropene is 0.4 ug/L, MCP GW-3 standard is 200 ug/L and GW-1 standard is 0.4 ug/L.
(6) Standard for isomer(s) is not specified, a response or cleanup may be made to the standard.
(7) Massachusetts State Drinking Water Standards; dated 2011.
(8) Environmental Protection Agency Drinking Water Regulations; as posted on www.epa.gov as of May 2009.
(9) MCP GW-1 and GW-3 Standards (Method 1); version February 14, 2008.
(10) NRWQC - National Recommended Water Quality Criteria; version dated 2009
(11) The lower of Massachusetts and EPA MCL is listed.
NL: no limit

"-" Indicates that the sample was not analyzed for that consitutent.
Grey shading indicates an exceedence of EPA or MA drinking water standards.
Bold outlining indicates an exceedence of MCL GW-1 standards.
Bolded text indicates an exceedence of MCP GW-3 standards.
< : Not Detected above laboratory reporting limit
* Indicates a well to which MCP GW-1 standards apply.
MA and EPA drinking water standards, and MCP GW-3 standards apply to all wells.

Table 5
Groundwater Sampling Results for GW-3 Wells
Metals, Conventional and Field Parameters
October 2014
Haverhill Landfill, Haverhill, Massachusetts

			SAMPLING DATE	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014
			RES LABORATORY SAMPLING NUMBER	31162-001	31162-002	31162-020	31162-003	31162-004
			CDM SAMPLING NUMBER	**MW-10M**	**MW-10D**	**MW-10D***	**MW-11S**	**MW-12S**
METALS	***MA and EPA DRINKING WATER STANDARDS[11,12,15]***	***MCP GW-3 STANDARDS[13]***	***UNITS***			DUP-4		
Aluminum	50 - 200 (2,4,21)	NL	ug/L	-	-	-	-	-
Antimony	6 (1,3)	8,000	ug/L	-	-	-	-	-
Arsenic	10 (1,3)	900	ug/L	36	24	22	<8	<8
Barium	2,000 (1,3)	50,000	ug/L	<50	<50	<50	<50	<50
Beryllium	4 (1,3)	200 (19)	ug/L	-	-	-	-	-
Cadmium	5 (1,3)	4	ug/L	<4	<4	<4	<4	<4
Calcium	NL	NL	ug/L	31,000	27,000	27,000	25,000	29,000
Chromium (total)	100 (1,3)	300	ug/L	<50	<50	<50	<50	<50
Cobalt	NL	NL	ug/L	-	-	-	-	-
Copper	1,000 (2,4)	NL	ug/L	<50	<50	<50	<50	<50
Iron	300 (2,4)	NL	ug/L	50	140	140	100	<50
Lead	15 (1,3,10)	10	ug/L	<8	<8	<8	<8	<8
Magnesium	NL	NL	ug/L	-	-	-	-	-
Manganese	50 (2,4)	NL	ug/L	90	90	90	120	70
Mercury	2 (1,3)	20	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	100 (2)	200	ug/L	-	-	-	-	-
Potassium	NL	NL	ug/L	-	-	-	-	-
Selenium	50 (1,3)	100	ug/L	<50	<50	<50	<50	<50
Silver	100 (2,4)	7	ug/L	<7	<7	<7	<7	<7
Sodium	20,000 (2)	NL	ug/L	10,000	11,000	11,000	7,300	13,000
Vanadium	NL	4,000	ug/L	-	-	-	-	-
Zinc	5,000 (2,4)	900	ug/L	<50	<50	<50	<50	<50
CONVENTIONAL PARAMETERS								
Total Dissolved Solids (Residue, Filterable)	500 (2,4)	NL	mg/L	180	140	-	150	140
Sulfate	250 (2,4)	NL	mg/L	38	31	-	23	28
Chloride	250 (2,4)	NL	mg/L	18	12	-	7.4	15
Alkalinity, Total (as CaCO3)	NL	NL	mg/L	62	67	-	82	63
Nitrogen, (N) (18)	10 (1,3)	NL	mg/L	<0.1	<0.1	-	<0.1	2.2
Chemical Oxygen Demand	NL	NL	mg/L	33	< 25	-	54	42
Hardness (CaCO3)	NL	NL	mg/L	-	-	-	-	91
FIELD PARAMETERS								
pH	6.5-8.5 (2,4)	NL		7.48	7.49	-	6.81	6.01
Specific Conductivity	NL	NL	umhos	224	212	-	195	219
Temperature	NL	NL	degrees C	11.18	14.28	-	14.31	12.07
Dissolved Oxygen	NL	NL	mg/L	0.24	0.17	-	0.45	0.49
INORGANIC PARAMETERS								
Cyanide (total)	200 (1,3,9)	30 (20)	ug/L	<20	<20	<20	<20	<20
Thallium	2 (1,3)	3,000	ug/L	-	-	-	-	-

Notes:
(1) Massachusetts Drinking Water Standard (MCL)
(2) Massachusetts Drinking Water Secondary Standard or Guideline (SMCL)
(3) EPA Primary Drinking Water Standard (MCL)
(4) EPA Secondary Drinking Water Standard (SMCL)
(5) This criteria is dependent on hardness in the water. Values shown in the tables are based on an average hardness at the site of 33 mg/L for samples ne
71 mg/L for samples near Johnson Creek, and 33 mg/L for the confluence of Merrimack River and Johnson Creek (SW-105). A value could not be measured for the swale because it was dry.
(6) When the concentration of dissolved organic carbon is elevated, copper is substatially less toxic and use of Water-Effect Ratios might be appropriate.
(7) This value is for total recoverable selenium, but there is a formula to change it to dissolved Se
(8) No Criterion Continuous Concentration (CCC) was available so Criterion Maximum Concentration (CMC) was used
(9) Cyanide expressed as free, or physiologically available cyanide.
(10) Action Level
(11) Massachusetts State Drinking Water Standards; dated 2011
(12) Environmental Protection Agency Drinking Water Regulations; as posted on www.epa.gov as of May 2009.
(13) MCP GW-1 and GW-3 Standards (Method 1); version February 14, 2008
(14) NRWQC - National Recommended Water Quality Criteria; version dated 2009
(15) The lower of Massachusetts and EPA MCL or SMCL is listed.
(16) Standard listed is for Chromium III. No standard is established for Total Chromium.
(17) Species Dependent Criteria
(18) Nitrogen analyzed sometimes as Nitrate (N) and sometimes as Nitrate+Nitrite (N).
(19) Supplemental MCP Amendment, Effective February 2008
(20) Cyanide expressed as Physiologically Available Cyanide (PAC). In the absence of measured PAC, the standard is applicable to Total Cyanide.
(21) A range is specified for the aluminum secondary standard. Guidance relating to this standard provided by EPA, and adopted by Massachusetts, indicates that 50 ug/L is the optimal value for the secondary standard, but that the range is provided because certain systems may have difficulty meeting this criteria. For the purposes of these tables, any aluminum concentration above 50 ug/L is considered an exceedance, and is highlighted.
NL = No Limit.

Grey shading indicates and exceedence of drinking water standards.
Bolded text indicates an exceedence of MCP GW-3 standards.
< : Not Detected above laboratory reporting limit
* : Indicates a well to which MCP GW-1 standards apply.

Table 6
Groundwater Sampling Results for GW-3 Wells
Volatile Organic Compounds (VOCs)
October 2014
Haverhill Landfill, Haverhill, Massachusetts

			SAMPLING DATE	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014
			ANALYSIS DATE	10/8/2014	10/8/2014	10/9/2014	10/9/2014	10/8/2014
			LABORATORY SAMPLING NUMBER	31162-001	31162-002	31662-020	31162-003	31162-004
			CDM SAMPLING NUMBER	**MW-10M**	**MW-10D**	**MW-10D**	**MW-11S**	**MW-12S**
VOCs	***MA and EPA DRINKING WATER STANDARDS [7,9,11]***	***MCP GW-3 STANDARDS[9]***	***UNITS***			Duplicate-4		
1,1,1,2-Tetrachloroethane	NL	50,000	ug/L	< 2	< 2	< 2	< 2	< 2
1,1,1-Trichloroethane	200 (1,3)	20,000	ug/L	< 2	< 2	< 2	< 2	< 2
1,1,2,2-Tetrachloroethane	NL	50,000	ug/L	< 2	< 2	< 2	< 2	< 2
1,1,2-Trichloroethane	5 (1,3)	50,000	ug/L	< 2	< 2	< 2	< 2	< 2
1,1-Dichloroethane	70 (2)	20,000	ug/L	< 2	< 2	< 2	< 2	< 2
1,1-Dichloroethene	7 (1,3)	30,000	ug/L	< 1	< 1	< 1	< 1	< 1
1,1-Dichloropropene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
1,2,3-Trichlorobenzene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
1,2,3-Trichloropropane	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
1,2,4-Trichlorobenzene	70 (1,3)	50,000	ug/L	< 2	< 2	< 2	< 2	< 2
1,2,4-Trimethylbenzene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
1,2-Dibromo-3-chloropropane	0.2 (1,3)	NL	ug/L	< 2	< 2	< 2	< 2	< 2
1,2-Dibromoethane	0.02 (1)	50,000.00	ug/L	< 2	< 2	< 2	< 2	< 2
1,2-Dichlorobenzene	600 (1,3)	2,000	ug/L	< 2	< 2	< 2	< 2	< 2
1,2-Dichloroethane	5 (1,3)	20,000	ug/L	< 2	< 2	< 2	< 2	< 2
1,2-Dichloropropane	5 (1,3)	50,000	ug/L	< 2	< 2	< 2	< 2	< 2
1,3,5-Trimethylbenzene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
1,3-Dichlorobenzene	NL	50,000	ug/L	< 2	< 2	< 2	< 2	< 2
1,3-Dichloropropane	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
1,4-Dichlorobenzene	5 (1)	8,000	ug/L	< 2	< 2	< 2	< 2	< 2
1,4-Dioxane	0.3 (2)	50,000	ug/L	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
2,2-Dichloropropane	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
2-Butanone	4000 (2)	50,000	ug/L	< 10	< 10	< 10	< 10	< 10
2-Chloroethyl Vinyl Ether	NL	NL	ug/L	< 5	< 5	< 5	< 5	< 5
2-Chlorotoluene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
2-Hexanone	NL	NL	ug/L	< 10	< 10	< 10	< 10	< 10
4-Chlorotoluene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
4-Isopropyltoluene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
4-Methyl-2-pentanone	350 (2)	50,000	ug/L	< 10	< 10	< 10	< 10	< 10
Acetone	6300 (2)	50,000	ug/L	< 10	< 10	< 10	< 10	< 10
Acrolein	NL	NL	ug/L	NS	NS	NS	NS	NS
Benzene	5 (1,3)	10,000	ug/L	< 2	< 2	< 2	< 2	< 2
Bromobenzene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Bromochloromethane	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Bromodichloromethane	NL	50,000	ug/L	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Bromoform	NL	50,000	ug/L	< 2	< 2	< 2	< 2	< 2
Bromomethane	10 (2)	800	ug/L	< 2	< 2	< 2	< 2	< 2
Carbon disulfide	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Carbon tetrachloride	5 (1,3)	5,000	ug/L	< 2	< 2	< 2	< 2	< 2
Chlorobenzene	100 (1,3)	1,000	ug/L	< 2	< 2	< 2	< 2	< 2
Chloroethane	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Chloroform	70 (2)	20,000	ug/L	< 2	< 2	< 2	< 2	< 2
Chloromethane	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
cis-1,2-Dichloroethene	70 (1,3)	50,000	ug/L	< 2	< 2	< 2	< 2	< 2
cis-1,3-Dichloropropene	NL	(5)	ug/L	< 2	< 2	< 2	< 2	< 2

Table 6
Groundwater Sampling Results for GW-3 Wells
Volatile Organic Compounds (VOCs)
October 2014
Haverhill Landfill, Haverhill, Massachusetts

			SAMPLING DATE	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014
			ANALYSIS DATE	10/8/2014	10/8/2014	10/9/2014	10/9/2014	10/8/2014
			LABORATORY SAMPLING NUMBER	31162-001	31162-002	31662-020	31162-003	31162-004
			CDM SAMPLING NUMBER	**MW-10M**	**MW-10D**	**MW-10D**	**MW-11S**	**MW-12S**
VOCs	***MA and EPA DRINKING WATER STANDARDS [7,9,11]***	***MCP GW-3 STANDARDS[9]***	***UNITS***			Duplicate-4		
Dibromochloromethane	NL	50,000	ug/L	< 2	< 2	< 2	< 2	< 2
Dibromomethane	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Dichlorodifluoromethane	1400 (2)	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Diethyl ether	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Diisopropyl ether	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Ethylbenzene	700 (1,3)	5,000	ug/L	< 2	< 2	< 2	< 2	< 2
Ethyl tertiary butyl ether	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Hexachlorobutadiene	NL	3,000	ug/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Isopropylbenzene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
m,p-Xylene	10000 (1,3,6)	5,000 (6)	ug/L	< 2	< 2	< 2	< 2	< 2
Methyl tert-butyl ether	70 (2)	50,000	ug/L	< 2	< 2	< 2	< 2	< 2
Methylene chloride	5 (1,3)	50,000	ug/L	< 2	< 2	< 2	< 2	< 2
Naphthalene	140 (2)	20,000	ug/L	< 2	< 2	< 2	< 2	< 2
n-Butylbenzene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
n-Propylbenzene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
o-Xylene	10000 (1,3,6)	5,000 (6)	ug/L	< 2	< 2	< 2	< 2	< 2
sec-Butylbenzene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Styrene	100 (1,3)	6,000	ug/L	< 2	< 2	< 2	< 2	< 2
t-Butanol (TBA)	120 (2)	NL	ug/L	< 30	< 30	< 30	< 30	< 30
tert-Butylbenzene	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Tertiary Amyl Methyl Ether	90 (2)	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Tetrachloroethene	5 (1,3)	30,000	ug/L	< 2	< 2	< 2	< 2	< 2
Tetrahydrofuran	600 (2)	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Toluene	1000 (1,3)	40,000	ug/L	< 2	< 2	< 2	< 2	< 2
trans-1,2-Dichloroethene	100 (1,3)	50,000	ug/L	< 2	< 2	< 2	< 2	< 2
trans-1,3-Dichloropropene	NL	(5)	ug/L	< 2	< 2	< 2	< 2	< 2
Trichloroethene	5 (1,3)	5,000	ug/L	< 2	< 2	< 2	< 2	< 2
Trichlorofluoromethane	NL	NL	ug/L	< 2	< 2	< 2	< 2	< 2
Vinyl acetate	NL	NL	ug/L	< 10	< 10	< 10	< 10	< 10
Vinyl chloride	2 (1,3)	50,000	ug/L	< 2	< 2	< 2	< 2	< 2

Notes:
(1) Massachusetts Drinking Water Standard (MCL)
(2) Massachusetts Drinking Water Secondary Standard (SMCL) or Guideline.
(3) EPA Primary Drinking Water Standard (MCL)
(4) EPA Secondary Drinking Water Standard (SMCL)
(5) MA MCL for 1,3-Dichloropropene is 0.4 ug/L, MCP GW-3 standard is 200 ug/L and GW-1 standard is 0.4 ug/L.
(6) Listed standard is for total xylenes, no individual isomer standards exist.
Since a particular stereoisomer is not specified, a comparison can not be made to the standard.
(7) Massachusetts State Drinking Water Standards; dated 2011.
(8) Environmental Protection Agency Drinking Water Regulations; as posted on www.epa.gov as of May 2009.
(9) MCP GW-1 and GW-3 Standards (Method 1); version February 14, 2008.
(10) NRWQC - National Recommended Water Quality Criteria; version dated 2009
(11) The lower of Massachusetts and EPA MCL is listed.
NL: no limit
NS: Not Sampled
MW-10S was not sampled because it was dry.

Table 7
Surface Water Sampling Results
Metals, Conventional and Field Parameters
October 2014
Haverhill Landfill, Haverhill, Massachusetts

							SAMPLING DATE	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014	10/6/2014
							RES LABORATORY SAMPLING NUMBER	31163-001	31163-002	31163-012	31163-003	31163-004	31163-005	31163-006	31163-007	31163-008	31163-013	31163-009	31163-010	31163-011
							CDM SAMPLING NUMBER	**SW-101[a]**	**SW-103[a]**	**SW-103[a]**	**SW-104[a]**	**SW-105[d]**	**SW-106[b]**	**SW-107[b]**	**SW-108[b]**	**SW-109[b]**	**SW-109[b]**	**SW-110[a]**	**SW-111[a]**	**SW-112[b]**
METALS	***MA and EPA DRINKING WATER STANDARDS [11,12,15]***		***NRWQC [14]***					***UNITS***			DUP-1						DUP-2			
			Merrimack River	***Johnson Creek***	***Swale***	***Confluence (SW-105)***	***Notes***													
Aluminum	50 - 200	(2,4,21)	NL	NL	NL	NL		ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Antimony	6	(1,3)	NL	NL	NL	NL		ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	10	(1,3)	150	150	150	150		ug/L	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8	<8
Barium	2,000	(1,3)	NL	NL	NL	NL		ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Beryllium	4	(1,3)	NL	NL	NL	NL		ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	5	(1,3)	0.11	0.19	0.21	0.11	(5)	ug/L	<0.11	<0.11	0.2	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
Calcium	NL		NL	NL	NL	NL		ug/L	10,000	9,500	9,100	9,100	9,200	20,000	20,000	20,000	21,000	20,000	9,400	9,000	21,000
Chromium (total)	100	(1,3)	30	56	60	30	(5,16)	ug/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cobalt	NL		NL	NL	NL	NL		ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	1,000	(2,4)	3.5	7	7	3.5	(5,6)	ug/L	1.81	1.15	1.13	1.68	1.48	<1.0	<1.0	1.04	<1.0	<1.0	1.8	2.02	<1.0
Iron	300	(2,4)	1,000	1,000	1,000	1,000		ug/L	70	100	70	60	60	130	190	180	70	<50	70	60	50
Lead	15	(1,3,10)	0.74	1.7	1.9	0.74	(5)	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Magnesium	NL		NL	NL	NL	NL		ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	50	(2,4)	NL	NL	NL	NL		ug/L	<30	30	30	<30	<30	**110**	**70**	**80**	<30	<30	<30	<30	<30
Mercury	2	(1,3)	0.77	0.77	0.77	0.77		ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	100	(2)	20	39	42	20	(5)	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Potassium	NL		NL	NL	NL	NL		ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	50	(1,3)	5	5	5	5	(7)	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Silver	100	(2,4)	0.48	1.79	2.05	0.48	(5,8)	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Sodium	20,000	(2)	NL	NL	NL	NL		ug/L	**36,000**	**35,000**	**35,000**	**34,000**	**34,000**	**40,000**	**36,000**	**37,000**	**43,000**	**42,000**	**35,000**	**34,000**	**43,000**
Vanadium	NL		NL	NL	NL	NL		ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	5,000	(2,4)	46	89	95	46	(5)	ug/L	<40	<40	<40	50	40	60	50	40	<40	<40	<40	<40	<40
CONVENTIONAL PARAMETERS																					
Total Dissolved Solids (Residue, Filterable)	500	(2,4)	NL	NL	NL	NL		mg/L	180	190	-	170	170	250	220	220	250	-	150	180	250
Sulfate	250	(2,4)	NL	NL	NL	NL		mg/L	9.4	9.3	-	9.4	9.4	14	14	13	17	-	9.2	9.0	17
Chloride	250	(2,4)	230	230	230	230		mg/L	58	58	-	58	58	76	68	68	78	-	60	58	79
Alkalinity, Total (as CaCO3)	NL		20	20	20	20		mg/L	20	20	-	20	21	47	44	48	49	-	20	20	46
Nitrogen, (N) (18)	10	(1,3)	NL	NL	NL	NL		mg/L	1.4	1.4	-	1.4	1.4	0.9	0.6	0.4	0.8	-	1.4	1.4	1.0
Chemical Oxygen Demand	NL		NL	NL	NL	NL		mg/L	< 25	51	-	45	< 25	< 25	< 25	85	100	-	< 25	76	45
Hardness (CaCO3)	NL		NL	NL	NL	NL		mg/L	35	34	-	33	33	69	69	71	72	-	32	32	75
FIELD PARAMETERS																					
pH	6.5-8.5	(2,4)	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0			6.53	**6.49**	-	6.56	6.63	6.60	6.66	6.66	6.83	-	6.72	6.79	6.72
Specific Conductivity	NL		NL	NL	NL	NL		umhos	270	243	-	269	270	375	353	354	392	-	277	272	372
Temperature	NL						(17)	degrees C	15.25	15.09	-	15.94	15.62	12.08	14.0	11.75	11.53	-	17.95	18.7	11.63
Dissolved Oxygen	NL						(17)	mg/L	6.28	5.18	-	5.35	4.19	5.1	5.27	5.1	9.75	-	6.63	7.08	9.51
INORGANIC PARAMETERS																					
Cyanide (total)	200	(1,3,9)	5.2	5.2	5.2	5.2	(9)	ug/L	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Thallium	2	(1,3)	NL	NL	NL	NL		ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
(1) Massachusetts Drinking Water Standard (MCL)
(2) Massachusetts Drinking Water Secondary Standard or Guideline (SMCL)
(3) EPA Primary Drinking Water Standard (MCL)
(4) EPA Secondary Drinking Water Standard (SMCL)
(5) This criteria is dependent on hardness in the water. Values shown in the tables are based on an average hardness at the site of 33 mg/L for samples near Merrimack River, 71 mg/L for samples near Johnson Creek, and 33 mg/L for the confluence of Merrimack River and Johnson Creek (SW-105). A value could not be measured for the swale because i
(6) When the concentration of dissolved organic carbon is elevated, copper is substatially less toxic and use of Water-Effect Ratios might be appropriate.
(7) This value is for total recoverable selenium, but there is a formula to change it to dissolved Se
(8) No Criterion Continuous Concentration (CCC) was available so Criterion Maximum Concentration (CMC) was used
(9) Cyanide expressed as free, or physiologically available cyanide.
(10) Action Level
(11) Massachusetts State Drinking Water Standards; dated 2011
(12) Environmental Protection Agency Drinking Water Regulations; as posted on www.epa.gov as of May 2009.
(13) MCP GW-1 and GW-3 Standards (Method 1); version February 14, 2008
(14) NRWQC - National Recommended Water Quality Criteria; version dated 2009
(15) The lower of Massachusetts and EPA MCL or SMCL is listed.
(16) Standard listed is for Chromium III. No standard is established for Total Chromium.
(17) Species Dependent Criteria
(18) Nitrogen analyzed sometimes as Nitrate (N) and sometimes as Nitrate+Nitrite (N).
(19) Supplemental MCP Amendment, Effective February 2008
(20) Cyanide expressed as Physiologically Available Cyanide (PAC). In the absence of measured PAC, the standard is applicable to Total Cyanide.
(21) A range is specified for the aluminum secondary standard. Guidance relating to this standard provided by EPA, and adopted by Massachusetts, indicates that 50 ug/L is the optimal value for the secondary standard, but that the range is provided because certain systems may have difficulty meeting this criteria. For the purposes of these tables, any aluminum concentration above 50 ug/L is considered an exceedance, and is highlighted.
NL = No Limit.

"-" Indicates that the sample was not analyzed for that consitutent.
Bolded text indicates an exceedence of EPA or MA drinking water standards.
Grey shading indicates an exceedence of NRWQC.
SW-102 was not sampled because this location was dry.
Data qualifiers:
J: Estimated

a: Sample location is near the Merrimack River; Merrimack River criteria apply.
b: Sample location is near Johnson Creek; Johnson Creek criteria apply.
c: Sample location is near the swale; swale criteria apply.
d: Sample location is at the confluence of the Merrimack River and Johnson Creek; confluence criteria apply.