3.1 CSA MONITORING PROGRAM

The CSA monitoring program followed requirements outlined in the MDEP Interim CSA scope of work outlined by MDEP ISA Approval correspondence. One round of sampling was conducted for the Interim CSA study report.

3.1.1 Analytical Parameters

Groundwater and surface water samples were analyzed for the parameters outlined under *Massachusetts Solid Waste Regulations 310 CMR 19.132(1)(h)* including general landfill contaminant indicator parameters, total RCRA 8 metals plus copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn), and volatile organic compounds (VOCs) using EPA Method 8260B. Groundwater samples were also analyzed for pesticides by EPA Method 8081.

Sediment samples were analyzed for percent solids, alkalinity, chemical oxygen demand (COD), chloride, nitrate (NO_3), sulfate (SO_4), cyanide, total RCRA 8 metals plus iron (Fe) and manganese (Mn), and volatile organic compounds (VOCs) using EPA Method 8260.

Lists of analytical parameters are included on the water quality and sediment chemistry tables at the end of this Section.

3.1.2 Monitoring Locations

Monitoring locations where environmental sampling was conducted are those required in MDEP CSA Scope Modification Approval correspondence dated October 27, 2005. Required monitoring stations included 13 groundwater monitoring or test wells, a geothermal heating system well, and 9 surface water (and sediment) stations. Stations are listed in the analytical summary tables at the end of this Section and are shown on the site plans provided in Appendix B.

Test well 11-71 could not be sampled because the well casing was broken below grade and the depth of water in the well precluded sampling using a peristaltic pump. This well is located adjacent to gas monitoring well PGW-4, just west of Pomeroy Pond at the landfill site. Also, groundwater samples were collected from gas monitoring well PGW-6 located just west of the southern portion of the MSW "mound" area of the landfill. Well PGW-6 was installed 10 feet into the groundwater table to provide a downgradient sample from the landfill site.

The geothermal heating system well located at 163 Wildflower Avenue was sampled as required under Condition #6 of the *July 2005 MDEP CSA Scope Approval*. This is a bedrock water well that is used for residential non-contact heating and cooling.

3.2 CSA ANALYTICAL DATA SUMMARY

Laboratory analytical data from groundwater, surface water and sediment samples are provided in Appendix E and summarized in tables provided at the end of this Section. Severn Trent Laboratory (STL) of Westfield, Massachusetts, a state-certified environmental laboratory, collected the samples. All samples were analyzed by STL. Laboratory analytical reports are provided in Appendix E.

Analytical results are reported in mg/L or ug/L. Results reported in mg/L are equivalent to a level of parts per million (ppm). Results reported in ug/L are equivalent to a concentration of part per billion (ppb).

As a basis for comparison, analytical data are compared to Massachusetts Maximum Contaminant Levels (MMCLs), MDEP Office of Research & Standards Guidelines (ORSGs) and Secondary Maximum Contaminant Levels (SMCLs). MMCLs are Massachusetts's drinking water standards. ORSGs are Massachusetts drinking water guidelines established by the MDEP Office of Research & Standards. SMCLs are equivalent to US EPA secondary drinking water guidelines and are not enforceable standards. Surface water quality data are compared to Massachusetts Ambient Water Quality Criteria (AWQC) for fresh water under 310 CMR 40.1516. The AWQC includes both "Acute" and "Chronic" criteria guidelines for some parameters.

Sediment quality is compared to *MDEP Freshwater Sediment Screening Threshold Effects Concentrations* (TECs) and *1993 Ontario Guidelines for the Protection of Aquatic Sediment Quality* in accordance with current MDEP policy. Referenced standards are provided on the analytical summary tables, where available.

3.2.1 Groundwater

Thirteen groundwater samples collected for the CSA study are split into two general groups related to proximity to the landfill and screened aquifer materials. A bedrock well located at 163 Wildflower Drive that is used for a geothermal heating system was also sampled.

3.2.1.1 Landfill & Vicinity Wells

Groundwater monitoring wells and test wells that are located in close proximity to the landfill or downgradient of the landfill are grouped together for the data evaluation. Well #3-80 is screened in the confined aquifer downgradient of the landfill. Well #6-89

is installed in the confining layer at the landfill site. The other wells are screened in the surficial aquifer either at the landfill or downgradient of the site.

Field Analyses (Table 3.1): pH levels were generally less than the SMCL guideline of 6.5-8.5 standard pH units. Specific conductance values varied from 79.8 umhos/cm at well #1-94 to 242.2 umhos/cm at PGW-6 at the landfill site and up to 388.6 umhos/cm downgradient of the site at well #3-68. Dissolved oxygen levels were less than 3.0 mg/L at wells PGW-6, #6-89, #3-68, #3-80 and #1-94. Field turbidity exceeded 1,100 NTU at wells #5-89, #3-68 and #1-03.

General Water Chemistry (Table 3.1): Alkalinity levels exceeded 100 mg/L at wells #3-68 and #3-80, at levels of 174 mg/L and 135 mg/L respectively. COD levels exceeded 100 mg/L at well PGW-6 (120 mg/L). Chloride levels were less than 50 mg/L in all samples, varying in the surficial aquifer wells from 12 mg/L to 45 mg/L, versus a SMCL of 250 mg/L. Nitrate levels were less than 0.05 mg/L in all wells except PGW-6 (0.066 mg/L), #5-89 (0.42 mg/L) and #1-03 (0.29 mg/L), versus a MMCL of 10 mg/L. Sulfate levels were less than 50 mg/L in all wells versus a SMCL of 250 mg/L. The highest sulfate level was detected in samples from well #3-68 at 47 mg/L. Total dissolved solids (TDS) levels varied from 29 mg/L at well #1-94 to 256 mg/L at well #3-68, versus a SMCL of 500 mg/L. Cyanide was not detected in any of the samples.

Total Metals (Table 3.2): Metals concentrations varied but in general were highest in groundwater at wells PGW-6 and #3-68. The metals barium (Ba), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), manganese (Mn) and zinc (Zn) were detected at levels exceeding or equal to 1.0 mg/L in some of the groundwater samples.

Arsenic (As): Not detected.

Barium (Ba): Detected in the groundwater at PGW-6 at a concentration of 9.5 mg/L exceeding the MMCL of 2.0 mg/L. Otherwise, barium (Ba) levels varied from 0.096 mg/L at well #1-94 to 0.800 mg/L at wells #5-89 and #3-80.

Cadmium (Cd): Cadmium (Cd) levels exceeded the MMCL of 0.005 mg/L at wells PGW-6 (0.028 mg/L) and #3-68 (0.013 mg/L). Cadmium (Cd) was detected in the groundwater at levels less than the MMCL at wells #5-89, #6-89, #1-03 and #1-94.

Chromium (Cr): Chromium (Cr) levels exceeded the MMCL of 0.1 mg/L at in the groundwater at wells PGW-6 (1.30 mg/L), #3-68 (6.50 mg/L) and #1-03 (0.120 mg/L). Chromium (Cr) was detected at levels less than the MMCL at wells #5-89, #6-89 and #1-94.

Copper (Cu): Copper (Cu) concentrations in the groundwater exceeded the MMCL of 1.3 mg/L at wells PGW-6 (1.70 mg/L) and #3-68 (5.50 mg/L). Copper (Cu) was detected in the groundwater at levels less than the MMCL at wells #5-89, #6-89, #1-03 and #1-94.

Iron (Fe): Detected in the groundwater at all wells at levels exceeding the SMCL of 0.3 mg/L. Levels exceeded 100 mg/L at wells PGW-6 (2,000 mg/L), #5-89 (110 mg/L), #3-68 (700 mg/L) and #1-03 (130 mg/L). Iron (Fe) levels in the remaining wells exceeded 50 mg/L.

Lead (Pb): Lead (Pb) levels exceeded the MMCL of 0.015 mg/L in the groundwater sampled from all wells except #3-80. Lead (Pb) concentrations exceeded or equaled 0.100 mg/L at wells PGW-6 (0.880 mg/L), #5-89 (0.100 mg/L), #3-68 (1.00 mg/L) and #1-03 (0.100 mg/L).

Manganese (Mn): Detected in the groundwater at all wells at levels exceeding the SMCL of 0.05 mg/L. Levels exceeded 1.0 mg/L at wells PGW-6 (39.0 mg/L), #5-89 (1.60 mg/L), #6-89 (2.60 mg/L), #3-68 (4.50 mg/L), #3-80 (1.30 mg/L) and #1-03 (2.30 mg/L).

Mercury (Hg): Detected in the groundwater at well #3-68 at a concentration of 0.0022 mg/L, just exceeding the MMCL of 0.002 mg/L. Mercury (Hg) was not detected in any of the other groundwater samples.

Selenium (Se): Not detected.

Silver (Ag): Not detected.

Zinc (Zn): Detected in the groundwater at well #3-68 at a concentration of 32.0 mg/L exceeding the SMCL of 5.0 mg/L. Otherwise, zinc (Zn) levels were less than 5.0 in all samples. Zinc (Zn) levels exceeded 1.0 mg/L in the groundwater at wells PGW-6 (3.90 mg/L) and well #1-94 (2.90 mg/L).

Volatile Organic Compounds (VOCs) (Table 3.3): Few VOCs were detected at low concentrations in the groundwater at three of the wells (#6-89, #3-68 and #3-80). No MMCL or ORSG levels were exceeded. Detected compounds are identified below:

Benzene: Detected in the well #3-80 groundwater sample at an estimated concentration of 0.74 ug/L, less than the MMCL of 5.0 ug/L.

Chlorobenzene: Detected in the well #3-68 sample at an estimated concentration of 0.95 ug/L, less than the MMCL of 100 ug/L.

cis-1,2-Dichlorobenzene: Detected in the well #3-80 sample at a concentration of 5.0 ug/L, less than the MMCL of 70 ug/L.

1,2-Dichloroethane: Detected in the well #3-68 sample at an estimated concentration of 0.61 ug/L, less than the MMCL of 5 ug/L.

Toluene: Detected in the well #6-89 groundwater sample at an estimated concentration of 0.69 ug/L, less than the MMCL of 1,000 ug/L.

No VOCs were detected in the groundwater at wells PGW-6, #5-89, #1-03 and #1-94.

Pesticides (Table 3.4): Not detected in the groundwater samples.

3.2.1.2 Bedrock Well (Geothermal Heating System Well)

Water quality analysis of samples collected from a geothermal heating system well at 163 Wildflower Drive used to supply heating or cooling water to a "heat pump" residential heating system were required as part of the Interim CSA study. Samples were collected directly from the non-contact water system. The well is reportedly a bedrock well; cased in the overburden.

Field Analyses (Table 3.1): Samples exhibited a pH of 9.80 standard units that is above the SMCL range of 6.5-8.5 pH standard units. Specific conductance was relatively low at 76.0 umhos/cm. Dissolved oxygen level was 9.17 mg/L. Field turbidity was low at 6.72 NTU.

General Water Chemistry (Table 3.1): Alkalinity was 84.7 mg/L. COD was less than 20 mg/L. Chloride level was very low at 1.3 mg/L. Nitrate level was less than 0.05 mg/L. The sulfate level was 6.8 mg/L. TDS concentration was 96 mg/L. Cyanide was not detected.

Total Metals (Table 3.2): Five metals were detected in the bedrock groundwater sample at concentrations above analytical method detection limits:

Copper (Cu): Copper (Cu) was detected at a concentration of 0.160 mg/L in the groundwater, less than the MMCL of 1.3 mg/L.

Iron (Fe): Detected at a level of 0.530 mg/L, exceeding the SMCL of 0.3 mg/L.

Lead (Pb): The lead (Pb) level equaled the MMCL of 0.015 mg/L in the groundwater sample.

Manganese (Mn): Detected in the groundwater at a concentration of 0.017 mg/L, less than the SMCL of 0.05 mg/L.

Zinc (Zn): Detected in the groundwater at a concentration of 0.150 mg/L, less than the SMCL of 5.0 mg/L.

The metals arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), mercury (Hg), selenium (Se) and silver (Ag) were not detected in the bedrock groundwater sample.

Volatile Organic Compounds (VOCs) (Table 3.3): No VOCs were detected in the bedrock groundwater sample.

Pesticides (Table 3.4): Not detected.

3.2.1.3 Lawrence Swamp Wells

Groundwater monitoring wells and test wells that are located in the Lawrence Swamp Aquifer or cross-gradient (south) of the landfill are grouped together for the data evaluation. Wells #1-83, #2-83 and #3-83 are flowing artesian wells screened in the deep buried confined aquifer that is utilized for public water supply by the Towns of Amherst and Belchertown. The other wells are screened in the surficial aquifer, above the confining layer where it exists. Well #2-03 is upgradient of all these wells; installed at a ground elevation at least 80 feet higher than the others.

Field Analyses (Table 3.1): pH levels were less than the SMCL guideline of 6.5-8.5 standard pH units at wells #2-03, #1-83, #2-85 and #3-85. Specific conductance values varied from 98.6 umhos/cm at #2-83 to 363.0 umhos/cm at upgradient well #2-03. Dissolved oxygen levels were less than 3.0 mg/L at wells #1-83, #2-83, #3-83 and #2-85. Field turbidity exceeded 1,100 NTU at well #2-03.

General Water Chemistry (Table 3.1): Alkalinity levels were less than 100 mg/L at all wells, varying from 10.7 mg/L at well #2-03 to 67.6 mg/L at well #3-83. COD levels exceeded 100 mg/L at well #2-03 (120 mg/L). Chloride levels were less than 50 mg/L in all samples except from #2-03 (88 mg/L), versus a SMCL of 250 mg/L. Nitrate levels were less than 0.05 mg/L except #2-03 (6.9 mg/L), #2-85 (0.41 mg/L) and #3-85 (3.4 mg/L), versus a MMCL of 10 mg/L. Sulfate levels were 20 mg/L or less in all wells versus a SMCL of 250 mg/L. Total dissolved solids (TDS) levels were less than 100 mg/L except at wells #2-03 (220 mg/L) and #3-85 (140 mg/L), versus a SMCL of 500 mg/L. Cyanide was not detected in any of the samples.

Total Metals (Table 3.2): Metals concentrations varied. Iron (Fe), manganese (Mn) and zinc (Zn) were detected at levels exceeding 1.0 mg/L in some of the groundwater samples.

3.2.2.4 Unnamed Kettle Pond

Station SW-7 was established on a small unnamed kettle pond located northwesterly of the Old Amherst Landfill site. The station was sampled as an alternate to a nearby wetland where the MDEP had observed iron staining in the spring of 2005 but was dry during the summer and fall of 2005. The kettle pond is located about 300 feet northeast of the originally proposed wetland sampling station but did not appear impacted by iron staining.

Field Analyses (Table 3.1): The pH level was slightly acidic but within the Massachusetts Class B freshwater range of 6.5-8.3 standard pH units. Temperature was 10.2 degrees C. Specific conductance was 34.4 umhos/cm. The dissolved oxygen level was 8.62 mg/L. Field turbidity was 8.72 NTU.

General Water Chemistry (Table 3.1): Alkalinity was 16 mg/L. COD was 100 mg/L. Chloride level was 1.4 mg/L. Nitrate level was less than 0.05 mg/L. Sulfate level was less than 2 mg/L. TDS level was 52 mg/L. Cyanide was not detected.

Total Metals (Table 3.2): Three metals were detected in the kettle pond sample at concentrations above analytical method detection limits. Iron (Fe) was detected at an elevated level.

> **Barium (Ba):** Barium (Ba) was detected at a trace level of 0.018 mg/L. There is no AWQC or other surface water standard for barium (Ba).
>
> **Iron (Fe):** Detected at a concentration of 4.10 mg/L. There is no AWQC or other surface water standard for iron (Fe).
>
> **Manganese (Mn):** Detected at a concentration of 0.250 mg/L. There is no AWQC or other surface water standard for manganese (Mn).

The metals arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), selenium (Se), silver (Ag) and zinc (Zn) were not detected in the samples collected from SW-7 at the Unnamed Kettle Pond.

Volatile Organic Compounds (VOCs) (Table 3.3): No VOCs were detected.

3.2.2.5 Brickyard Wellfield Spring

Station SW-8 was established at the spring in the wetland located north and immediately adjacent to the abandoned Brickyard Wellfield. The station did not visually appear affected by iron staining.

Field Analyses (Table 3.1): The pH level was slightly acidic but within the Massachusetts Class B freshwater range of 6.5-8.3 standard pH units. Temperature was 9.5 degrees C. Specific conductance was 334.1 umhos/cm. The dissolved oxygen level was 5.47 mg/L. Field turbidity was 3.17 NTU.

General Water Chemistry (Table 3.1): Alkalinity was 150 mg/L. COD was less than 20 mg/L. Chloride level was 28 mg/L. Nitrate level was 0.74 mg/L. Sulfate level was 16 mg/L. TDS level was 220 mg/L. Cyanide was not detected.

Total Metals (Table 3.2): Three metals were detected in the Brickyard Wellfield spring sample at concentrations above analytical method detection limits.

> **Barium (Ba):** Barium (Ba) was detected at a level of 0.230 mg/L. There is no AWQC or other surface water standard for barium (Ba).
>
> **Iron (Fe):** Detected at a concentration of 1.00 mg/L. There is no AWQC or other surface water standard for iron (Fe).
>
> **Manganese (Mn):** Detected at a concentration of 2.70 mg/L. There is no AWQC or other surface water standard for manganese (Mn).

The metals arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), selenium (Se), silver (Ag) and zinc (Zn) were not detected in the samples collected from SW-8 at the Brickyard Wellfield.

Volatile Organic Compounds (VOCs) (Table 3.3): No VOCs were detected.

3.2.2.6 Hop Brook

Upstream (SW-4) and downstream (SW-5) station were monitored on Hop Brook to evaluate potential impacts and water quality changes that may be attributable to the Old Amherst Landfill on Hop Brook. Hop Brook drains the Lawrence Swamp basin and discharges to the Fort River in Amherst. Station SW-4 is the upstream sampling station located at the Station Road stream crossing about 4,000 feet southwest of the site. Station SW-5 is the downstream station located about 3,600 feet west of the Old Amherst Landfill site.

Overall, downstream samples exhibited very slight increases in indicator parameters and the three metals barium (Ba), iron (Fe) and manganese (Mn) when compared to upstream water quality.

Field Analyses (Table 3.1): pH levels were within the Massachusetts Class B freshwater range of 6.5-8.3 standard pH units at each surface water station; decreasing slightly downstream from 7.24 to 6.67 pH units. Temperature increased from 8.2 to

9.8 degrees C. Specific conductance increased slightly at the downstream station from 93.0 to 100.8 umhos/cm. Dissolved oxygen levels increased slightly downstream from 7.86 mg/L to 8.27 mg/L. Field turbidity increased slightly from 5.80 NTU to 6.55 NTU.

General Water Chemistry (Table 3.1): Alkalinity was increased slightly at the downstream station from 14 mg/L to 18 mg/L. COD was 20 mg/L at both upstream and downstream stations. Chloride levels increased slightly from 15 mg/L to 17 mg/L downstream of the site. Nitrate levels increased from 0.087 upstream to 0.16 mg/L downstream. Sulfate levels increased slightly from 9.4 mg/L to 9.9 mg/L downstream. TDS levels increased slightly from 65 mg/L to 77 mg/L downstream. Cyanide was not detected in the samples.

Total Metals (Table 3.2): Three metals were detected in the Hop Brook samples at concentrations above analytical method detection limits:

> **Barium (Ba):** Barium (Ba) levels increased slightly from 0.037 mg/L upstream to 0.045 mg/L downstream. There is no AWQC or other surface water standard for barium (Ba).
>
> **Iron (Fe):** Iron (Fe) levels increased from 0.750 mg/L upstream to 1.00 mg/L downstream. There is no AWQC or other surface water standard for iron (Fe).
>
> **Manganese (Mn):** Manganese (Mn) levels increased from 0.070 mg/L upstream at station SW-4 to 0.110 mg/L downstream at SW-5. There is no AWQC or other surface water standard for manganese (Mn).

The metals arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), selenium (Se), silver (Ag) and zinc (Zn) were not detected in Hop Brook.

Volatile Organic Compounds (VOCs) (Table 3.3): No VOCs were detected in Hop Brook.

3.2.3 Sediments

Sediment samples were collected and analyzed at each of the nine surface water stations established for the Interim CSA study to characterize potential landfill contaminant impacts to sediment at downgradient surface water resources. Sample locations are identical to surface water stations as identified on the site plans in Appendix B.

Sediment samples were analyzed for percent solids, alkalinity, COD, chloride, nitrate (NO_3), sulfate (SO_4), cyanide, total RCRA metals plus copper (Cu), iron (Fe),

manganese (Mn) and zinc (Zn), and VOCs using EPA Method 8260B. Note that detection limits will vary according to percent solids content for individual analyses.

As previously noted, sediment quality is compared to *MDEP Freshwater Sediment Screening Threshold Effects Concentrations* (TECs) and *1993 Ontario Guidelines for the Protection of Aquatic Sediment Quality* in accordance with current MDEP policy. Referenced standards are provided on the analytical summary tables, where available.

3.2.3.1 Pomeroy Pond - Sediment

Sediment sample SED-3 was collected at the SW-3 surface water station on Pomeroy Pond adjacent to the landfill.

General Chemistry (Table 3.5): Percent solids were 51%. Alkalinity was 87 mg/kg. COD was 430 mg/kg. Chloride level was less than 37 mg/kg. Nitrate level was less than 9.2 mg/kg. Sulfate level was less than 73 mg/kg. Cyanide was not detected.

Total Metals (Table 3.6): Seven metals were detected in the Pomeroy Pond sediment sample at concentrations above analytical method detection limits:

Barium (Ba): Barium (Ba) was detected at a concentration of 80 mg/kg. There is no sediment standard or guideline for barium (Ba).

Chromium (Cr): Detected at a level of 9.5 mg/kg, less than the MDEP TEC guideline of 43.4 mg/kg.

Iron (Fe): Detected at a level of 12,000 mg/kg, less than the Ontario Aquatic Sediment guideline of 20,000 mg/kg for low level effects.

Lead (Pb): Detected at a level of 23 mg/kg, less than the MDEP TEC guideline of 35.8 mg/kg.

Manganese (Mn): Detected at a level of 140 mg/kg, less than the Ontario Aquatic Sediment guideline of 460 mg/kg for low level effects.

Mercury (Hg): Detected at a level of 0.096 mg/kg, less than the MDEP TEC guideline of 0.18 mg/kg.

Zinc (Zn): Detected at a level of 52 mg/kg, less than the MDEP TEC guideline of 121 mg/kg.

The metals arsenic (As), cadmium (Cd), copper (Cu), Selenium (Se) and silver (Ag) were not detected.

Volatile Organic Compounds (VOCs) (Table 3.7): No target VOCs were detected. Non-target VOCs detected in the samples included hexanal at 11.4 ug/kg and pentanal at 2.3 ug/kg. Similar to the soil VOC data, these compounds may be artifacts of the preservation method.

3.2.3.2 Gull Pond & Tributaries - Sediments

Sediment sample SED-2 was collected at the Gull Pond SW-2 surface water station. Sediment samples SED-1 and SED-9 were collected at tributary locations SW-1 and SW-9, respectively. Station SED-1 is located on a drainage channel that visibly exhibits iron staining.

General Chemistry (Table 3.5): Percent solids were lowest at tributary station SED-1 at 42%, versus a range of 77-78% at the other tributary and Gull Pond stations. Alkalinity was highest at station SED-1 (250 mg/kg) and lower at SED-9 (37 mg/kg) and SED-2 (11 mg/kg). COD, chloride and nitrate levels were less than reporting limits at each station. The sulfate level at SED-1 was 140 mg/kg and was less than reporting limits at the other two stations. Cyanide was not detected in the samples.

Total Metals (Table 3.6): Nine metals were detected in the Gull Pond and tributary sediment samples at concentrations above analytical method detection limits:

Arsenic (As): Detected in the SED-1 sample at a concentration of 28 mg/kg, exceeding the MDEP TEC guideline of 9.79 mg/kg for sediment. Arsenic (As) was not detected in the SED-9 and SED-2 samples.

Barium (Ba): Barium (Ba) levels were highest at station SED-1 (430 mg/kg) and lower at stations SED-9 (57 mg/kg) and station SW-2 (60 mg/kg). There is no sediment standard or guideline for barium (Ba).

Chromium (Cr): Detected at levels of 20 mg/kg (SED-1), 11 mg/kg (SED-9) and 9.0 mg/kg (SED-2), all less than the MDEP TEC guideline of 43.4 mg/kg.

Iron (Fe): Iron (Fe) levels varied from 99,000 mg/kg at SED-1, 13,000 mg/kg at SED-9 and to 9,400 mg/kg at SED-2. The iron (Fe) concentration at SED-1 exceeded the Ontario Aquatic Sediment guideline of 40,000 mg/kg for severe level effects.

Lead (Pb): Detected at levels of 16 mg/kg (SED-1), 9.6 mg/kg (SED-9) and 4.3 mg/kg (SED-2), all less than the MDEP TEC guideline of 35.8 mg/kg.

Manganese (Mn): Manganese (Mn) levels varied from 610 mg/kg at SED-1, 240 mg/kg at SED-9 and to 110 mg/kg at SED-2. The manganese (Mn)

concentration at SED-1 exceeded the Ontario Aquatic Sediment guideline of 460 mg/kg for low level effects.

Mercury (Hg): Detected at a level of 0.098 mg/kg at SED-1, less than the MDEP TEC guideline of 0.18 mg/kg. Not detected at the other two stations.

Zinc (Zn): Detected at levels of 230 mg/kg at SED-1, 22 mg/kg at SED-9 and to 27 mg/kg at SED-2. The SED-1 sample exceeded the MDEP TEC guideline of 121 mg/kg.

The metals cadmium (Cd), selenium (Se) and silver (Ag) were not detected in the samples.

Volatile Organic Compounds (VOCs) (Table 3.7): No VOCs were detected at either the SED-1 tributary station or SED-2 on Gull Pond. A single non-target VOC, hexanal, was detected at the SED-9 station.

Hexanal: Detected at a concentration of 2.1 ug/kg in the SED-9 sample.

3.2.3.3 KC Train Seepage Area - Sediment

SED-6 is located at the SW-6 station downgradient and west of the landfill at a seepage area in a forested wetland along the "KC Trail". The wetland is the source of small brooks via seepage and spring flow. Sediments within the area appear iron stained.

General Chemistry (Table 3.5): Percent solids was 29%. Alkalinity was 330 mg/kg. COD was 1,200 mg/kg. Chloride level was 88 mg/kg. Nitrate and sulfate levels were below method detection limits. Cyanide was not detected.

Total Metals (Table 3.6): Five metals were detected in the SED-6 sample at concentrations above analytical method detection limits:

Arsenic (As): Detected in the SED-6 sample at a concentration of 53 mg/kg, exceeding the MDEP TEC guideline of 9.79 mg/kg for sediment.

Barium (Ba): Detected in the SED-6 sample at a concentration of 800 mg/kg. There is no sediment standard or guideline for barium (Ba).

Iron (Fe): Iron (Fe) was detected at a concentration of 350,000 mg/kg, exceeding the Ontario Aquatic Sediment guideline of 40,000 mg/kg for severe level effects.

Manganese (Mn): Manganese (Mn) was detected at a concentration of 7,800 mg/kg, exceeding the Ontario Aquatic Sediment guideline of 1,100 mg/kg for severe level effects.

Mercury (Hg): Detected at a level of 0.12 mg/kg, less than the MDEP TEC guideline of 0.18 mg/kg.

The metals cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), selenium (Se), silver (Ag) and zinc (Zn) were not detected at analytical method detection limits.

Volatile Organic Compounds (VOCs) (Table 3.7): A trace level of one VOC was detected in the SED-6 sediment sample. Otherwise, no VOCs were detected.

1,4-Dichlorobenzene: Detected at a concentration of 3.7 ug/kg. No sediment standard exists for this compound.

3.2.3.4 Unnamed Kettle Pond - Sediment

SED-7 was collected at the SW-7 station on a small unnamed kettle pond located northwesterly of the Old Amherst Landfill site.

General Chemistry (Table 3.5): Percent solids was 37%. Alkalinity was 160 mg/kg. COD was 1,300 mg/kg. Chloride, nitrate and sulfate levels were below method detection limits. Cyanide was not detected.

Total Metals (Table 3.6): Six metals were detected at concentrations above analytical method detection limits:

Barium (Ba): Detected at a concentration of 78 mg/kg. There is no sediment standard or guideline for barium (Ba).

Iron (Fe): Iron (Fe) was detected at a concentration of 8,800 mg/kg, less than the Ontario Aquatic Sediment guideline of 20,000 mg/kg for low level effects.

Lead (Pb): Detected at a level of 24 mg/kg, less than the MDEP TEC guideline of 35.8 mg/kg.

Manganese (Mn): Detected at a concentration of 250 mg/kg, less than the Ontario Aquatic Sediment guideline of 460 mg/kg for low level effects.

Mercury (Hg): Detected at a level of 0.18 mg/kg, equivalent to the MDEP TEC guideline of 0.18 mg/kg.

Zinc (Zn): Detected at a level of 140 mg/kg, exceeding the MDEP TEC guideline of 121 mg/kg.

The metals arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), selenium (Se) and silver (Ag) were not detected at analytical method detection limits.

Volatile Organic Compounds (VOCs) (Table 3.7): A trace level of one VOC was detected in the SED-6 sediment sample. Additionally, two non-target compounds were detected.

Toluene: Detected at a concentration of 5.7 ug/kg.

Dimethyl ether: Non-target compound detected at a concentration of 4.8 ug/kg.

Hexanal: Non-target compound detected at a concentration of 5.6 ug/kg.

3.2.3.5 Brickyard Wellfield Spring - Sediment

SED-8 was collected at the SW-8 surface water station that was established at the spring in the wetland located north and immediately adjacent to the abandoned Brickyard Wellfield. The spring did not visually appear affected by iron staining at the time of site selection.

General Chemistry (Table 3.5): Percent solids was 24%. Alkalinity was 230 mg/kg. COD was 1,400 mg/kg. Chloride, nitrate and sulfate levels were below method detection limits. Cyanide was not detected.

Total Metals (Table 3.6): Six metals were detected in the Brickyard Wellfield spring sediment sample at concentrations above analytical method detection limits.

Barium (Ba): Detected at a concentration of 110 mg/kg. There is no sediment standard or guideline for barium (Ba).

Copper (Cu): Detected at a level of 370 mg/kg, exceeding the MDEP TEC guideline of 31.6 mg/kg.

Iron (Fe): Iron (Fe) was detected at a concentration of 21,000 mg/kg, exceeding the Ontario Aquatic Sediment guideline of 20,000 mg/kg for low level effects.

Lead (Pb): Detected at a level of 47 mg/kg, exceeding the MDEP TEC guideline of 35.8 mg/kg.

Manganese (Mn): Detected at a concentration of 220 mg/kg, less than the Ontario Aquatic Sediment guideline of 460 mg/kg for low level effects.

Zinc (Zn): Detected at a level of 120 mg/kg, less than the MDEP TEC guideline of 121 mg/kg.

The metals arsenic (As), cadmium (Cd), chromium (Cr), mercury (Hg), selenium (Se) and silver (Ag) were not detected at analytical method detection limits.

Volatile Organic Compounds (VOCs) (Table 3.7): A trace level of one VOC was detected in the SED-8 sediment sample. Otherwise, no VOCs were detected.

Chlorobenzene: Detected at a concentration of 3.0 ug/kg. No sediment standard exists for this compound.

3.2.3.6 Hop Brook - Sediments

Upstream (SED4) and downstream (SED-5) stations were monitored on Hop Brook at the corresponding surface water stations.

General Chemistry (Table 3.5): Percent solids varied from 35% at the upstream station to 53% at the downstream station. Alkalinity in the sediment varied from 21 mg/kg upstream to 19 mg/kg downstream. COD varied from 1,300 upstream to 690 mg/kg downstream. Chloride levels in the sediment were 46 mg/kg upstream less than 38 mg/kg downstream along Hop Brook. Nitrate was not detected. Sulfate levels in the sediment were 110 mg/kg at the SED-4 upstream station to less than 75 mg/kg at downstream station SED-5 on Hop Brook. Cyanide was not detected.

Total Metals (Table 3.6): Eight metals were detected in the Hop Brook samples at concentrations above analytical method detection limits:

Barium (Ba): Detected at concentrations varying from 110 mg/kg upstream to 240 mg/kg downstream on Hop Brook. There is no sediment standard or guideline for barium (Ba).

Chromium (Cr): Detected at levels varying from 9.7 mg/kg upstream at SED-4 to 25 mg/kg downstream at SED-5 in the Hop Brook sediment, all less than the MDEP TEC guideline of 43.4 mg/kg.

Copper (Cu): Detected at a levels of 23 mg/kg in the downstream sediment sample versus a level of less than 18 mg/kg in the upstream sample. The MDEP TEC guideline for copper (Cu) is 31.6 mg/kg.

Iron (Fe): Detected at concentrations varying from 14,000 at the upstream SED-4 station to 29,000 mg/kg at the downstream SED-5 station. The downstream sediment sample exceeded the Ontario Aquatic Sediment guideline for iron (Fe) of 20,000 mg/kg for low level effects.

Lead (Pb): Detected at levels of 23 mg/kg upstream at SED-4 and 37 mg/kg downstream at SED-5. The downstream Hop Brook sample at SED-5 exceeded the MDEP TEC guideline for lead (Pb) of 35.8 mg/kg.

Manganese (Mn): Detected at a concentration of 270 mg/kg upstream at SED-4 and at 840 mg/kg downstream at SED-5. The downstream sample concentration exceeded the Ontario Aquatic Sediment guideline of 460 mg/kg for low level effects.

Mercury (Hg): Detected at a level of 0.15 mg/kg in the downstream SED-5 sample, less than the MDEP TEC guideline of 0.18 mg/kg. Not detected in the SED-4 sample.

Zinc (Zn): Detected at a level of 120 mg/kg in the downstream SED-5 sample, less than the MDEP TEC guideline of 121. Not detected in the SED-4 sample.

The metals arsenic (As), cadmium (Cd), , selenium (Se) and silver (Ag) were not detected in the Hop Brook samples at analytical method detection limits.

Volatile Organic Compounds (VOCs) (Table 3.7): A trace level of one target VOC was detected in the SED-4 sediment sample. Additionally, a non-target compound was detected in the SED-4 sample. No VOCs were detected in the SED-5 sample.

Toluene: Detected at a concentration of 3.5 ug/kg.

Hexanal: Non-target compound detected at a concentration of 2.5 ug/kg.

3.3 IDENTIFICATION OF "CONTAMINANTS OF CONCERN (COCS)"

Landfill contaminants and concentrations in various media are identified to evaluate potential impact to receptors as one of the primary objectives of the CSA study. Landfill "contaminants of concern" or COCs for groundwater, surface water and sediment that may impact on-site or off-site receptors are identified following the review of laboratory analytical data provided in the previous Section. Where compounds or analytes have been detected at concentrations below applicable water or sediment quality criteria guidelines, these compounds are screened out from further evaluation.

3.3.1 Groundwater

3.3.1.1 Landfill & Vicinity Wells

Field Analyses: COCs are an acidic pH. Other potential landfill groundwater quality impacts are low dissolved oxygen, moderately elevated specific conductance and high turbidity.

General Water Chemistry: No COCs are identified that exceeded MMCL or SMCL levels. Other potential landfill groundwater quality impacts are slightly to moderately elevated levels of alkalinity, COD, chloride, sulfate and TDS.

Total Metals: COCs are barium (Ba), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg) and zinc (Zn).

Volatile Organic Compounds (VOCs): No COCs are identified.

Pesticides: No COCs are identified.

3.3.1.2 Bedrock Well (Geothermal Heating System Well)

Field Analyses: COCs are an alkaline pH.

General Water Chemistry: No COCs are identified that exceeded MMCL or SMCL levels.

Total Metals: COCs are iron (Fe) and lead (Pb).

Volatile Organic Compounds (VOCs): No COCs are identified.

3.3.1.3 Lawrence Swamp Wells

Field Analyses: COCs are an acidic to alkaline pH in various wells.

General Water Chemistry: No COCs are identified that exceeded MMCL or SMCL levels.

Total Metals: COCs are iron (Fe), lead (Pb), manganese (Mn), and zinc (Zn).

Volatile Organic Compounds (VOCs): No COCs are identified.

Pesticides: No COCs are identified.

3.3.2 Surface Water

Field Analyses: COCs are limited to a low dissolved oxygen level in surface water.

General Water Chemistry: No COCs are identified.

Total Metals: COCs are limited to lead (Pb). Other potential landfill surface water quality impacts are moderately elevated to elevated levels of barium (Ba), iron (Fe) and manganese (Mn).

Volatile Organic Compounds (VOCs): No COCs are identified.

3.3.3 Sediments

General Chemistry: No COCs are identified. Other potential landfill sediment quality impacts are moderately elevated to elevated levels of alkalinity, COD and chloride.

Total Metals: COCs include arsenic (As), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg) and zinc (Zn). Other potential landfill sediment quality impacts are moderately elevated levels of barium (Ba).

Volatile Organic Compounds (VOCs): No COCs are identified.

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Table 3.1
General Water Chemistry Analyses
Old Amherst Landfill CSA Study

Sampling Station	Date	General Landfill Contaminant Indicator Parameters											
		Field pH (Std units)	Field Temp. (C)	Field Spec. Cond. (umhos)	Field D.O. (mg/L)	Field Turbidity (NTU)	Alkalinity (mg/L)	COD (mg/L)	Chloride (mg/L)	NO3 (mg/L)	SO4 (mg/L)	TDS (mg/L)	Cyanide (mg/L)
MA Drinking Water Standards MMCLs or SMCLs		6.5-8.5*							250*	10	250*	500*	0.2
MA AWQC - 310 CMR 40.1516(1)													
Fresh Water - Acute Criteria													0.022
Fresh Water - Chronic Criteria													0.0052
MA Class B - Inland Fresh Water		6.5 - 8.3	28.3		5.0								
Landfill & Vicinity - Water Supply Test Wells & Groundwater Monitoring Wells													
Well PGW-6	11-Nov-05	6.86	10.1	242.2	1.85	584	87.7	120	31	0.066	14	157	<0.010
Well #5-89	10-Nov-05	5.94	7.7	144.6	8.19	>1100	17.6	42	41	0.42	<2	122	<0.010
Well 6-89	10-Nov-05	6.03	8.5	181.2	2.26	399	18.7	36	45	<0.05	<2	124	<0.010
Well #3-68	10-Nov-05	6.21	9.4	388.6	2.29	>1100	174	68	30	<0.05	47	256	<0.010
Well #3-80	10-Nov-05	6.53	10.1	358.2	1.48	117	135	<20	34	<0.05	3.7	196	<0.010
Well #1-03	10-Nov-05	6.13	13.1	146.8	5.23	>1100	20.3	34	33	0.29	6.6	104	<0.010
Well #1-94	18-Nov-05	8.60	8.3	79.8	2.08	xxx	25	27	12	<0.05	<2	29	<0.010
Geothermal Well 163 Wildflower Ave.	10-Nov-05	9.80	10.1	76.00	9.17	6.72	84.7	<20	1.3	<0.05	6.8	96	<0.010
Lawrence Swamp Monitoring Stations - Water Supply Test Wells & Groundwater Monitoring Wells													
Well #2-03	10-Nov-05	5.47	11.5	363.0	6.86	>1100	10.7	130	88	6.9	17	220	<0.010
Well #1-83	11-Nov-05	9.82	9.4	79.10	1.95	2.22	51.4	<20	5.9	<0.05	2.9	73	<0.010
Well #2-83	10-Nov-05	7.18	7.9	98.6	1.77	61.6	45.6	46	7.5	<0.05	19	72	<0.010
Well #3-83	10-Nov-05	7.87	9.2	121.6	1.16	6.49	67.6	65	15	<0.05	5.3	84	<0.010
Well #2-85	10-Nov-05	6.20	9.0	131.5	1.57	471	22.5	42	21	0.41	20	98	<0.010
Well #3-85	10-Nov-05	6.16	9.1	182.2	6.87	247	26.6	24	34	3.4	11	140	<0.010

Table 3.1
General Water Chemistry Analyses
Old Amherst Landfill CSA Study

Sampling Station	Date	General Landfill Contaminant Indicator Parameters											
		Field pH (Std units)	Field Temp. (C)	Field Spec. Cond. (umhos)	Field D.O. (mg/L)	Field Turbidity (NTU)	Alkalinity (mg/L)	COD (mg/L)	Chloride (mg/L)	NO3 (mg/L)	SO4 (mg/L)	TDS (mg/L)	Cyanide (mg/L)
MA Drinking Water Standards MMCLs or SMCLs		6.5-8.5*							250*	10	250*	500*	0.2
MA AWQC - 310 CMR 40.1516(1)													
Fresh Water - Acute Criteria													0.022
Fresh Water - Chronic Criteria													0.0052
MA Class B - Inland Fresh Water		6.5 - 8.3	28.3		5.0								
Pomeroy Pond - Adjacent to Landfill													
SW-3	8-Nov-05	6.68	9.2	162.7	6.30	5.25	12	32	41	0.062	11	110	<0.010
Gull Pond - Downgradient of Landfill													
Inlet SW-1	8-Nov-05	6.68	10.6	510	5.62	8.84	190	<20	49	0.31	14	230	<0.010
Inlet SW-9	8-Nov-05	6.59	9.5	262.7	8.96	4.96	41	<20	7.5	1.5	12	210	<0.010
Pond SW-2	8-Nov-05	6.68	9.7	225.5	7.31	9.12	56	<20	53	1.5	11	170	<0.010
Trail - Seepage Area in Downgradient Wetland													
SW-6	8-Nov-05	6.58	9.5	528	1.72	518	200	62	89	<0.05	16	240	<0.010
Kettle Pond - Downgradient of Landfill													
SW-7	8-Nov-05	6.78	10.2	34.4	8.62	8.72	16	100	1.4	<0.05	<2	52	<0.010
Brickyard Wellfield - Spring in Adjacent Wetland													
SW-8	8-Nov-05	6.62	9.5	334.1	5.47	3.17	150	<20	28	0.74	16	220	<0.010
Hop Brook - Downgradient Receiving Stream													
Upstream SW-4	8-Nov-05	7.24	8.2	93.0	7.86	5.80	14	20	15	0.087	9.4	65	<0.010
Downstream SW-5	8-Nov-05	6.67	9.8	100.8	8.27	6.55	18	20	17	0.16	9.9	77	<0.010

* SMCL - Secondary Maximum Contaminant Level

Table 3.2 - Metals Analyses
Old Amherst Landfill CSA Study

Location	Date	As (mg/L)	Ba (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Mn (mg/L)	Hg (mg/L)	Se (mg/L)	Ag (mg/L)	Zn (mg/L)
MA Drinking Water Standards MMCLs & SMCLs		0.05	2	0.005	0.1	1.3	0.3*	0.015	0.05*	0.002	0.05	0.10*	5*
MA AWQC - 310 CMR 40.1516(1) Fresh Water - Acute Criteria		0.850		0.0039	1.7	0.018		0.083		0.0024	0.020	0.00092	0.120
Fresh Water - Chronic Criteria				0.0011	0.21	0.012		0.0032		0.000012	0.005	0.00012	0.110
GROUNDWATER MONITORING STATIONS (TOTAL METALS)													
Landfill & Vicinity - Water Supply Test Wells & Groundwater Monitoring Wells													
Well PGW-6	11-Nov-05	<0.200	9.50	0.028	1.30	1.70	2000	0.880	39.0	<0.0002	<0.100	<0.050	3.90
Well #5-89	10-Nov-05	<0.010	0.800	0.0015	0.060	0.110	110	0.100	1.60	<0.0002	<0.010	<0.005	0.190
Well #6-89	10-Nov-05	<0.010	0.360	0.0021	0.062	0.059	57.0	0.067	2.60	<0.0002	<0.010	<0.005	0.140
Well #3-68	10-Nov-05	<0.010	0.620	0.013	6.50	5.50	700	1.00	4.50	0.0022	<0.050	<0.025	32.0
Well #3-80	10-Nov-05	<0.010	0.800	<0.001	<0.005	<0.010	52.0	0.0063	1.30	<0.0002	<0.010	<0.005	0.450
Well #1-03	10-Nov-05	<0.050	0.670	0.0021	0.120	0.160	130	0.100	2.30	<0.0002	<0.010	<0.005	0.320
Well #1-94	10-Nov-05	<0.010	0.096	0.0025	0.013	0.014	95.0	0.033	0.890	<0.0002	<0.020	<0.005	2.90
Geothermal Well 163 Wildflower Ave.	10-Nov-05	<0.010	<0.010	<0.001	<0.005	0.160	0.530	0.015	0.017	<0.0002	<0.010	<0.005	0.150
Lawrence Swamp Monitoring Stations - Water Supply Test Wells & Groundwater Monitoring Wells													
Well #2-03	10-Nov-05	<0.010	0.640	0.0012	0.069	0.098	88.0	0.088	1.70	<0.0002	<0.010	<0.005	0.190
Well #1-83	11-Nov-05	<0.010	0.052	<0.001	<0.005	<0.010	<0.100	<0.001	<0.010	<0.0002	<0.010	<0.005	<0.050
Well #2-83	10-Nov-05	<0.010	0.087	<0.001	<0.005	<0.010	74.0	<0.005	0.230	<0.0002	<0.010	<0.005	6.80
Well #3-83	10-Nov-05	<0.010	0.440	<0.020	<0.100	<0.200	2100	0.0048	3.20	<0.0002	<0.200	<0.100	19.0
Well #2-85	10-Nov-05	<0.010	0.160	0.0018	0.035	0.076	140	0.110	1.50	<0.0002	<0.010	<0.005	1.10
Well #3-85	10-Nov-05	<0.010	0.290	0.0012	0.030	0.026	110	0.017	0.790	<0.0002	<0.010	<0.005	0.083

Table 3.2 - Metals Analyses
Old Amherst Landfill CSA Study

Location	Date	As (mg/L)	Ba (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Mn (mg/L)	Hg (mg/L)	Se (mg/L)	Ag (mg/L)	Zn (mg/L)
MA Drinking Water Standards MMCLs & SMCLs		0.05	2	0.005	0.1	1.3	0.3*	0.015	0.05*	0.002	0.05	0.10*	5*
MA AWQC - 310 CMR 40.1516(1)													
Fresh Water - Acute Criteria		0.850		0.0039	1.7	0.018		0.083		0.0024	0.020	0.00092	0.120
Fresh Water - Chronic Criteria				0.0011	0.21	0.012		0.0032		0.000012	0.005	0.00012	0.110
SURFACE WATER MONITORING STATIONS (TOTAL METALS)													
Pomeroy Pond - Adjacent to Landfill													
SW-3	8-Nov-05	<0.010	0.044	<0.0025	<0.005	<0.010	0.260	<0.001	0.047	<0.0002	<0.020	<0.005	<0.050
Gull Pond - Downgradient of Landfill													
Inlet SW-1	8-Nov-05	<0.010	0.590	<0.0025	<0.005	<0.010	14.0	<0.001	1.50	<0.0002	<0.020	<0.005	<0.050
Inlet SW-9	8-Nov-05	<0.010	0.180	<0.0025	<0.005	<0.010	0.100	<0.001	0.150	<0.0002	<0.020	<0.005	<0.050
Pond SW-2	8-Nov-05	<0.010	0.180	<0.0025	<0.005	<0.010	1.10	<0.001	0.170	<0.0002	<0.020	<0.005	<0.050
Trail - Seepage Area in Downgradient Wetland													
SW-6	8-Nov-05	0.015	0.660	<0.0025	<0.005	<0.010	150	0.0034	6.00	<0.0002	<0.020	<0.005	<0.050
Kettle Pond - Downgradient of Landfill													
SW-7	8-Nov-05	<0.010	0.018	<0.0025	<0.005	<0.010	4.10	<0.001	0.250	<0.0002	<0.020	<0.005	<0.050
Brickyard Wellfield - Spring in Downgradient Wetland													
SW-8	8-Nov-05	<0.010	0.230	<0.0025	<0.005	<0.010	1.00	<0.005	2.70	<0.0002	<0.020	<0.005	<0.050
Hop Brook - Downgradient Receiving Stream													
Upstream SW-4	8-Nov-05	<0.010	0.037	<0.0025	<0.005	<0.010	0.750	<0.005	0.070	<0.0002	<0.020	<0.005	<0.050
Downstream SW-5	8-Jan-05	<0.010	0.045	<0.0025	<0.005	<0.010	1.00	<0.001	0.110	<0.0002	<0.020	<0.005	<0.050

* SMCL - US EPA Secondary Maximum Contaminant Level

Table 3.3 - VOC Analyses
Old Amherst Landfill CSA Study

EPA METHOD 8260 Compound	Standards MMCL / ORSG (ug/L)	Surface Water Standards AWQC: Acute / Chronic (ug/L)	Well PGW-6	Well #5-89	Well #6-89	Well #3-68
			11/11/05	11/10/05	11/10/05	11/10/05
Acetone	6,300 ORSG		U	U	U	U
Bromobenzene			U	U	U	U
Benzene	5 MMCL	5300 / xxxx	U	U	U	U
Bromochloromethane			U	U	U	U
Bromodichloromethane			U	U	U	U
Bromoform			U	U	U	U
Bromomethane	10 ORSG		U	U	U	U
2-Butanone (MEK)	4,000 ORSG		U	U	U	U
Carbon tetrachloride	5 MMCL		U	U	U	U
Chlorobenzene	100 MMCL	35,200 / xxxx	U	U	U	0.95 J
Chlorodibromomethane			U	U	U	U
Chloroethane			U	U	U	U
Chloroform	5 ORSG		U	U	U	U
Chloromethane		28,900 / 1,240	U	U	U	U
2-Chlorotoluene			U	U	U	U
4-Chlorotoluene			U	U	U	U
cis-1,2-Dichloroethene	70 MMCL		U	U	U	U
Dibromomethane			U	U	U	U
1,2-Dibromo-3-chloropropane			U	U	U	U
Dichlorodifluoromethane			U	U	U	U
1,2-Dichlorobenzene	600 MMCL		U	U	U	U
1,3-Dichlorobenzene		1120 / 763	U	U	U	U
1,4-Dichlorobenzene	5 MMCL	1,120 / 763	U	U	U	U
1,1-Dichloroethane	70 ORSG	1,120 / 763	U	U	U	U
1,2-Dichloroethane	5 MMCL		U	U	U	0.61 J
1,1-Dichloroethene	7 MMCL	118,000 / 20,000	U	U	U	U
1,2-Dichloropropane	5 MMCL	11,600 /xxxx	U	U	U	U
1,3-Dichloropropane	0.4 ORSG	23,000 / 5,700	U	U	U	U
2,2-Dichloropropane		23,000 / 5,700	U	U	U	U
1,1-Dichloropropene		23,000 / 5,700	U	U	U	U
cis-1,3-Dichloropropene		6,060 / 244	U	U	U	U
trans-1,3-Dichloropropene		6,060 / 244	U	U	U	U
Ethylbenzene	700 MMCL	6,060 / 244	U	U	U	U
Ethylene Dibromide	0.02 MMCL	32,000 / xxxx	U	U	U	U
Fluorotrichloromethane			U	U	U	U
2-Hexanone			U	U	U	U
Hexachlorobutadiene			U	U	U	U
Isopropylbenzene			U	U	U	U
4-Methyl-2-pentanone	350 ORSG		U	U	U	U
Methylene chloride	5 MMCL		U	U	U	U
Methyl-tert-butyl ether	70 ORSG		U	U	U	U
n-Butylbenzene			U	U	U	U
n-Propylbenzene			U	U	U	U
Naphthalene			U	U	U	U
m&p-Xylene	10000 Total MMCL		U	U	U	U
p-Isopropyltoluene			U	U	U	U
o-Xylene	10000 Total MMCL		U	U	U	U
sec-Butylbenzene			U	U	U	U
Styrene	100 MMCL		U	U	U	U
Tert-Butylbenzene			U	U	U	U
Tetrachloroethene	5 MMCL	5,280 / 840	U	U	U	U
1,1,1,2-Tetrachloroethane		9,320 / 2,400	U	U	U	U
1,1,2,2-Tetrachloroethane		9,320 / 2,400	U	U	U	U
Toluene	1000 MMCL	17,500 / xxxx	U	U	0.69 J	U
trans-1,2-Dichloroethene	100 MMCL		U	U	U	U
1,2,3-Trichlorobenzene			U	U	U	U
1,2,4-Trichlorobenzene	70 MMCL		U	U	U	U
1,1,1-Trichloroethane	200 MMCL	18,000 / xxxx	U	U	U	U
1,1,2-Trichloroethane	5 MMCL	18,000 / 9,400	U	U	U	U
Trichloroethene	5 MMCL	45,000 / 21,900	U	U	U	U
1,2,3-Trichloropropane			U	U	U	U
1,2,4-Trimethylbenzene			U	U	U	U
1,3,5-Trimethylbenzene			U	U	U	U
Vinyl Chloride	2 MMCL		U	U	U	U
Total Quantified Target VOCs			0.0	0.0	0.0	0.0
Identified Non-Target Compounds			0	0	0	0

MMCL = Massachusetts Maximum Contaminant Level

ORSG = Office of Research & Standards Guidelines

AWQC = Massachusetts Ambient Water Quality Criteria for fresh water under 310 CMR 40.1516

U or ND = Not detected.

Table 3.3 - VOC Analyses
Old Amherst Landfill CSA Study

EPA METHOD 8260 Compound	Standards MMCL / ORSG (ug/L)	Surface Water Standards AWQC: Acute / Chronic (ug/L)	Well #3-80 11/10/05	Well #1-03 11/10/05	Well #1-94 11/18/05	Geothermal Well 163 Wildflower Ave. 11/10/05
Acetone	6,300 ORSG		U	U	U	U
Bromobenzene			U	U	U	U
Benzene	5 MMCL	5300 / xxxx	0.74 J	U	U	U
Bromochloromethane			U	U	U	U
Bromodichloromethane			U	U	U	U
Bromoform			U	U	U	U
Bromomethane	10 ORSG		U	U	U	U
2-Butanone (MEK)	4,000 ORSG		U	U	U	U
Carbon tetrachloride	5 MMCL		U	U	U	U
Chlorobenzene	100 MMCL	35,200 / xxxx	U	U	U	U
Chlorodibromomethane			U	U	U	U
Chloroethane			U	U	U	U
Chloroform	5 ORSG		U	U	U	U
Chloromethane		28,900 / 1,240	U	U	U	U
2-Chlorotoluene			U	U	U	U
4-Chlorotoluene			U	U	U	U
cis-1,2-Dichloroethene	70 MMCL		5.0	U	U	U
Dibromomethane			U	U	U	U
1,2-Dibromo-3-chloropropane			U	U	U	U
Dichlorodifluoromethane			U	U	U	U
1,2-Dichlorobenzene	600 MMCL		U	U	U	U
1,3-Dichlorobenzene		1120 / 763	U	U	U	U
1,4-Dichlorobenzene	5 MMCL	1,120 / 763	U	U	U	U
1,1-Dichloroethane	70 ORSG	1,120 / 763	U	U	U	U
1,2-Dichloroethane	5 MMCL		U	U	U	U
1,1-Dichloroethene	7 MMCL	118,000 / 20,000	U	U	U	U
1,2-Dichloropropane	5 MMCL	11,600 /xxxx	U	U	U	U
1,3-Dichloropropane	0.4 ORSG	23,000 / 5,700	U	U	U	U
2,2-Dichloropropane		23,000 / 5,700	U	U	U	U
1,1-Dichloropropene		23,000 / 5,700	U	U	U	U
cis-1,3-Dichloropropene		6,060 / 244	U	U	U	U
trans-1,3-Dichloropropene		6,060 / 244	U	U	U	U
Ethylbenzene	700 MMCL	6,060 / 244	U	U	U	U
Ethylene Dibromide	0.02 MMCL	32,000 / xxxx	U	U	U	U
Fluorotrichloromethane			U	U	U	U
2-Hexanone			U	U	U	U
Hexachlorobutadiene			U	U	U	U
Isopropylbenzene			U	U	U	U
4-Methyl-2-pentanone	350 ORSG		U	U	U	U
Methylene chloride	5 MMCL		U	U	U	U
Methyl-tert-butyl ether	70 ORSG		U	U	U	U
n-Butylbenzene			U	U	U	U
n-Propylbenzene			U	U	U	U
Naphthalene			U	U	U	U
m&p-Xylene	10000 Total MMCL		U	U	U	U
p-Isopropyltoluene			U	U	U	U
o-Xylene	10000 Total MMCL		U	U	U	U
sec-Butylbenzene			U	U	U	U
Styrene	100 MMCL		U	U	U	U
Tert-Butylbenzene			U	U	U	U
Tetrachloroethene	5 MMCL	5,280 / 840	U	U	U	U
1,1,1,2-Tetrachloroethane		9,320 / 2,400	U	U	U	U
1,1,2,2-Tetrachloroethane		9,320 / 2,400	U	U	U	U
Toluene	1000 MMCL	17,500 / xxxx	U	U	U	U
trans-1,2-Dichloroethene	100 MMCL		U	U	U	U
1,2,3-Trichlorobenzene			U	U	U	U
1,2,4-Trichlorobenzene	70 MMCL		U	U	U	U
1,1,1-Trichloroethane	200 MMCL	18,000 / xxxx	U	U	U	U
1,1,2-Trichloroethane	5 MMCL	18,000 / 9,400	U	U	U	U
Trichloroethene	5 MMCL	45,000 / 21,900	U	U	U	U
1,2,3-Trichloropropane			U	U	U	U
1,2,4-Trimethylbenzene			U	U	U	U
1,3,5-Trimethylbenzene			U	U	U	U
Vinyl Chloride	2 MMCL		U	U	U	U
Total Quantified Target VOCs			5.0	0.0	0.0	0.0
Identified Non-Target Compounds			0	0	0	0

MMCL = Massachusetts Maximum Contaminant Level

ORSG = Office of Research & Standards Guidelines

AWQC = Massachusetts Ambient Water Quality Criteria for fresh water under 310 CMR 40.

U or ND = Not detected.

Table 3.3 - VOC Analyses
Old Amherst Landfill CSA Study

Tighe & Bond, Inc.

EPA METHOD 8260 Compound	Standards MMCL / ORSG (ug/L)	Surface Water Standards AWQC: Acute / Chronic (ug/L)	Well #2-03 11/10/05	Well #1-83 11/11/05	Well #2-83 11/10/05	Well #3-83 11/10/05
Acetone	6,300 ORSG		U	U	U	U
Bromobenzene			U	U	U	U
Benzene	5 MMCL	5300 / xxxx	U	U	U	U
Bromochloromethane			U	U	U	U
Bromodichloromethane			U	U	U	U
Bromoform			U	U	U	U
Bromomethane	10 ORSG		U	U	U	U
2-Butanone (MEK)	4,000 ORSG		U	U	U	U
Carbon tetrachloride	5 MMCL		U	U	U	U
Chlorobenzene	100 MMCL	35,200 / xxxx	U	U	U	U
Chlorodibromomethane			U	U	U	U
Chloroethane			U	U	U	U
Chloroform	5 ORSG		U	U	U	U
Chloromethane		28,900 / 1,240	U	U	U	U
2-Chlorotoluene			U	U	U	U
4-Chlorotoluene			U	U	U	U
cis-1,2-Dichloroethene	70 MMCL		U	U	U	U
Dibromomethane			U	U	U	U
1,2-Dibromo-3-chloropropane			U	U	U	U
Dichlorodifluoromethane			U	U	U	U
1,2-Dichlorobenzene	600 MMCL		U	U	U	U
1,3-Dichlorobenzene		1120 / 763	U	U	U	U
1,4-Dichlorobenzene	5 MMCL	1,120 / 763	U	U	U	U
1,1-Dichloroethane	70 ORSG	1,120 / 763	U	U	U	U
1,2-Dichloroethane	5 MMCL		U	U	U	U
1,1-Dichloroethene	7 MMCL	118,000 / 20,000	U	U	U	U
1,2-Dichloropropane	5 MMCL	11,600 /xxxx	U	U	U	U
1,3-Dichloropropane	0.4 ORSG	23,000 / 5,700	U	U	U	U
2,2-Dichloropropane		23,000 / 5,700	U	U	U	U
1,1-Dichloropropene		23,000 / 5,700	U	U	U	U
cis-1,3-Dichloropropene		6,060 / 244	U	U	U	U
trans-1,3-Dichloropropene		6,060 / 244	U	U	U	U
Ethylbenzene	700 MMCL	6,060 / 244	U	U	U	U
Ethylene Dibromide	0.02 MMCL	32,000 / xxxx	U	U	U	U
Fluorotrichloromethane			U	U	U	U
2-Hexanone			U	U	U	U
Hexachlorobutadiene			U	U	U	U
Isopropylbenzene			U	U	U	U
4-Methyl-2-pentanone	350 ORSG		U	U	U	U
Methylene chloride	5 MMCL		U	U	U	U
Methyl-tert-butyl ether	70 ORSG		U	U	U	U
n-Butylbenzene			U	U	U	U
n-Propylbenzene			U	U	U	U
Naphthalene			U	U	U	U
m&p-Xylene	10000 Total MMCL		U	U	U	U
p-Isopropyltoluene			U	U	U	U
o-Xylene	10000 Total MMCL		U	U	U	U
sec-Butylbenzene			U	U	U	U
Styrene	100 MMCL		U	U	U	U
Tert-Butylbenzene			U	U	U	U
Tetrachloroethene	5 MMCL	5,280 / 840	U	U	U	U
1,1,1,2-Tetrachloroethane		9,320 / 2,400	U	U	U	U
1,1,2,2-Tetrachloroethane		9,320 / 2,400	U	U	U	U
Toluene	1000 MMCL	17,500 / xxxx	U	U	U	U
trans-1,2-Dichloroethene	100 MMCL		U	U	U	U
1,2,3-Trichlorobenzene			U	U	U	U
1,2,4-Trichlorobenzene	70 MMCL		U	U	U	U
1,1,1-Trichloroethane	200 MMCL	18,000 / xxxx	U	U	U	U
1,1,2-Trichloroethane	5 MMCL	18,000 / 9,400	U	U	U	U
Trichloroethene	5 MMCL	45,000 / 21,900	U	U	U	U
1,2,3-Trichloropropane			U	U	U	U
1,2,4-Trimethylbenzene			U	U	U	U
1,3,5-Trimethylbenzene			U	U	U	U
Vinyl Chloride	2 MMCL		U	U	U	U
Total Quantified Target VOCs			0.0	0.0	0.0	0.0
Identified Non-Target Compounds			0	0	0	0

MMCL = Massachusetts Maximum Contaminant Level

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AWQC = Massachusetts Ambient Water Quality Criteria for fresh water under 310 CMR 40.

U or ND = Not detected.

Table 3.3 - VOC Analyses
Old Amherst Landfill CSA Study

EPA METHOD 8260 Compound	Standards MMCL / ORSG (ug/L)	Surface Water Standards AWQC: Acute / Chronic (ug/L)	Well #2-85		Well #3-85		SW-1		SW-2	
			11/10/05		11/10/05		11/08/05		11/08/05	
Acetone	6,300 ORSG		U		U		U		U	
Bromobenzene			U		U		U		U	
Benzene	5 MMCL	5300 / xxxx	U		U		U		U	
Bromochloromethane			U		U		U		U	
Bromodichloromethane			U		U		U		U	
Bromoform			U		U		U		U	
Bromomethane	10 ORSG		U		U		U		U	
2-Butanone (MEK)	4,000 ORSG		U		U		U		U	
Carbon tetrachloride	5 MMCL		U		U		U		U	
Chlorobenzene	100 MMCL	35,200 / xxxx	U		U		U		U	
Chlorodibromomethane			U		U		U		U	
Chloroethane			U		U		U		U	
Chloroform	5 ORSG		U		U		U		U	
Chloromethane		28,900 / 1,240	U		U		U		U	
2-Chlorotoluene			U		U		U		U	
4-Chlorotoluene			U		U		U		U	
cis-1,2-Dichloroethene	70 MMCL		U		U		U		U	
Dibromomethane			U		U		U		U	
1,2-Dibromo-3-chloropropane			U		U		U		U	
Dichlorodifluoromethane			U		U		U		U	
1,2-Dichlorobenzene	600 MMCL		U		U		U		U	
1,3-Dichlorobenzene		1120 / 763	U		U		U		U	
1,4-Dichlorobenzene	5 MMCL	1,120 / 763	U		U		U		U	
1,1-Dichloroethane	70 ORSG	1,120 / 763	U		U		U		U	
1,2-Dichloroethane	5 MMCL		U		U		U		U	
1,1-Dichloroethene	7 MMCL	118,000 / 20,000	U		U		U		U	
1,2-Dichloropropane	5 MMCL	11,600 /xxxx	U		U		U		U	
1,3-Dichloropropane	0.4 ORSG	23,000 / 5,700	U		U		U		U	
2,2-Dichloropropane		23,000 / 5,700	U		U		U		U	
1,1-Dichloropropene		23,000 / 5,700	U		U		U		U	
cis-1,3-Dichloropropene		6,060 / 244	U		U		U		U	
trans-1,3-Dichloropropene		6,060 / 244	U		U		U		U	
Ethylbenzene	700 MMCL	6,060 / 244	U		U		U		U	
Ethylene Dibromide	0.02 MMCL	32,000 / xxxx	U		U		U		U	
Fluorotrichloromethane			U		U		U		U	
2-Hexanone			U		U		U		U	
Hexachlorobutadiene			U		U		U		U	
Isopropylbenzene			U		U		U		U	
4-Methyl-2-pentanone	350 ORSG		U		U		U		U	
Methylene chloride	5 MMCL		U		U		U		U	
Methyl-tert-butyl ether	70 ORSG		U		U		U		U	
n-Butylbenzene			U		U		U		U	
n-Propylbenzene			U		U		U		U	
Naphthalene			U		U		U		U	
m&p-Xylene	10000 Total MMCL		U		U		U		U	
p-Isopropyltoluene			U		U		U		U	
o-Xylene	10000 Total MMCL		U		U		U		U	
sec-Butylbenzene			U		U		U		U	
Styrene	100 MMCL		U		U		U		U	
Tert-Butylbenzene			U		U		U		U	
Tetrachloroethene	5 MMCL	5,280 / 840	U		U		U		U	
1,1,1,2-Tetrachloroethane		9,320 / 2,400	U		U		U		U	
1,1,2,2-Tetrachloroethane		9,320 / 2,400	U		U		U		U	
Toluene	1000 MMCL	17,500 / xxxx	U		U		U		U	
trans-1,2-Dichloroethene	100 MMCL		U		U		U		U	
1,2,3-Trichlorobenzene			U		U		U		U	
1,2,4-Trichlorobenzene	70 MMCL		U		U		U		U	
1,1,1-Trichloroethane	200 MMCL	18,000 / xxxx	U		U		U		U	
1,1,2-Trichloroethane	5 MMCL	18,000 / 9,400	U		U		U		U	
Trichloroethene	5 MMCL	45,000 / 21,900	U		U		U		U	
1,2,3-Trichloropropane			U		U		U		U	
1,2,4-Trimethylbenzene			U		U		U		U	
1,3,5-Trimethylbenzene			U		U		U		U	
Vinyl Chloride	2 MMCL		U		U		U		U	
Total Quantified Target VOCs			0.0		0.0		0.0		0.0	
Identified Non-Target Compounds			0		0		0		0	

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ORSG = Office of Research & Standards Guidelines

AWQC = Massachusetts Ambient Water Quality Criteria for fresh water under 310 CMR 40.

U or ND = Not detected.

Table 3.3 - VOC Analyses
Old Amherst Landfill CSA Study

EPA METHOD 8260 Compound	Standards MMCL / ORSG (ug/L)	Surface Water Standards AWQC: Acute / Chronic (ug/L)	SW-3	SW-4	SW-5	SW-6
			11/08/05	11/08/05	11/08/05	11/08/05
Acetone	6,300 ORSG		U	U	U	U
Bromobenzene			U	U	U	U
Benzene	5 MMCL	5300 / xxxx	U	U	U	U
Bromochloromethane			U	U	U	U
Bromodichloromethane			U	U	U	U
Bromoform			U	U	U	U
Bromomethane	10 ORSG		U	U	U	U
2-Butanone (MEK)	4,000 ORSG		U	U	U	U
Carbon tetrachloride	5 MMCL		U	U	U	U
Chlorobenzene	100 MMCL	35,200 / xxxx	U	U	U	1.3
Chlorodibromomethane			U	U	U	U
Chloroethane			U	U	U	U
Chloroform	5 ORSG		U	U	U	U
Chloromethane		28,900 / 1,240	U	U	U	U
2-Chlorotoluene			U	U	U	U
4-Chlorotoluene			U	U	U	U
cis-1,2-Dichloroethene	70 MMCL		U	U	U	U
Dibromomethane			U	U	U	U
1,2-Dibromo-3-chloropropane			U	U	U	U
Dichlorodifluoromethane			U	U	U	U
1,2-Dichlorobenzene	600 MMCL		U	U	U	U
1,3-Dichlorobenzene		1120 / 763	U	U	U	U
1,4-Dichlorobenzene	5 MMCL	1,120 / 763	U	U	U	U
1,1-Dichloroethane	70 ORSG	1,120 / 763	U	U	U	U
1,2-Dichloroethane	5 MMCL		U	U	U	U
1,1-Dichloroethene	7 MMCL	118,000 / 20,000	U	U	U	U
1,2-Dichloropropane	5 MMCL	11,600 /xxxx	U	U	U	U
1,3-Dichloropropane	0.4 ORSG	23,000 / 5,700	U	U	U	U
2,2-Dichloropropane		23,000 / 5,700	U	U	U	U
1,1-Dichloropropene		23,000 / 5,700	U	U	U	U
cis-1,3-Dichloropropene		6,060 / 244	U	U	U	U
trans-1,3-Dichloropropene		6,060 / 244	U	U	U	U
Ethylbenzene	700 MMCL	6,060 / 244	U	U	U	U
Ethylene Dibromide	0.02 MMCL	32,000 / xxxx	U	U	U	U
Fluorotrichloromethane			U	U	U	U
2-Hexanone			U	U	U	U
Hexachlorobutadiene			U	U	U	U
Isopropylbenzene			U	U	U	U
4-Methyl-2-pentanone	350 ORSG		U	U	U	U
Methylene chloride	5 MMCL		U	U	U	U
Methyl-tert-butyl ether	70 ORSG		U	U	U	U
n-Butylbenzene			U	U	U	U
n-Propylbenzene			U	U	U	U
Naphthalene			U	U	U	U
m&p-Xylene	10000 Total MMCL		U	U	U	U
p-Isopropyltoluene			U	U	U	U
o-Xylene	10000 Total MMCL		U	U	U	U
sec-Butylbenzene			U	U	U	U
Styrene	100 MMCL		U	U	U	U
Tert-Butylbenzene			U	U	U	U
Tetrachloroethene	5 MMCL	5,280 / 840	U	U	U	U
1,1,1,2-Tetrachloroethane		9,320 / 2,400	U	U	U	U
1,1,2,2-Tetrachloroethane		9,320 / 2,400	U	U	U	U
Toluene	1000 MMCL	17,500 / xxxx	U	U	U	U
trans-1,2-Dichloroethene	100 MMCL		U	U	U	U
1,2,3-Trichlorobenzene			U	U	U	U
1,2,4-Trichlorobenzene	70 MMCL		U	U	U	U
1,1,1-Trichloroethane	200 MMCL	18,000 / xxxx	U	U	U	U
1,1,2-Trichloroethane	5 MMCL	18,000 / 9,400	U	U	U	U
Trichloroethene	5 MMCL	45,000 / 21,900	U	U	U	U
1,2,3-Trichloropropane			U	U	U	U
1,2,4-Trimethylbenzene			U	U	U	U
1,3,5-Trimethylbenzene			U	U	U	U
Vinyl Chloride	2 MMCL		U	U	U	U
Total Quantified Target VOCs			0.0	0.0	0.0	1.3
Identified Non-Target Compounds			0	0	0	0

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ORSG = Office of Research & Standards Guidelines

AWQC = Massachusetts Ambient Water Quality Criteria for fresh water under 310 CMR 40.

U or ND = Not detected.

Table 3.3 - VOC Analyses
Old Amherst Landfill CSA Study

EPA METHOD 8260 Compound	Standards MMCL / ORSG (ug/L)	Surface Water Standards AWQC: Acute / Chronic (ug/L)	SW-7	SW-8	SW-9
			11/08/05	11/08/05	11/08/05
Acetone	6,300 ORSG		U	U	U
Bromobenzene			U	U	U
Benzene	5 MMCL	5300 / xxxx	U	U	U
Bromochloromethane			U	U	U
Bromodichloromethane			U	U	U
Bromoform			U	U	U
Bromomethane	10 ORSG		U	U	U
2-Butanone (MEK)	4,000 ORSG		U	U	U
Carbon tetrachloride	5 MMCL		U	U	U
Chlorobenzene	100 MMCL	35,200 / xxxx	U	U	U
Chlorodibromomethane			U	U	U
Chloroethane			U	U	U
Chloroform	5 ORSG		U	U	U
Chloromethane		28,900 / 1,240	U	U	U
2-Chlorotoluene			U	U	U
4-Chlorotoluene			U	U	U
cis-1,2-Dichloroethene	70 MMCL		U	U	U
Dibromomethane			U	U	U
1,2-Dibromo-3-chloropropane			U	U	U
Dichlorodifluoromethane			U	U	U
1,2-Dichlorobenzene	600 MMCL		U	U	U
1,3-Dichlorobenzene		1120 / 763	U	U	U
1,4-Dichlorobenzene	5 MMCL	1,120 / 763	U	U	U
1,1-Dichloroethane	70 ORSG	1,120 / 763	U	U	U
1,2-Dichloroethane	5 MMCL		U	U	U
1,1-Dichloroethene	7 MMCL	118,000 / 20,000	U	U	U
1,2-Dichloropropane	5 MMCL	11,600 /xxxx	U	U	U
1,3-Dichloropropane	0.4 ORSG	23,000 / 5,700	U	U	U
2,2-Dichloropropane		23,000 / 5,700	U	U	U
1,1-Dichloropropene		23,000 / 5,700	U	U	U
cis-1,3-Dichloropropene		6,060 / 244	U	U	U
trans-1,3-Dichloropropene		6,060 / 244	U	U	U
Ethylbenzene	700 MMCL	6,060 / 244	U	U	U
Ethylene Dibromide	0.02 MMCL	32,000 / xxxx	U	U	U
Fluorotrichloromethane			U	U	U
2-Hexanone			U	U	U
Hexachlorobutadiene			U	U	U
Isopropylbenzene			U	U	U
4-Methyl-2-pentanone	350 ORSG		U	U	U
Methylene chloride	5 MMCL		U	U	U
Methyl-tert-butyl ether	70 ORSG		U	U	U
n-Butylbenzene			U	U	U
n-Propylbenzene			U	U	U
Naphthalene			U	U	U
m&p-Xylene	10000 Total MMCL		U	U	U
p-Isopropyltoluene			U	U	U
o-Xylene	10000 Total MMCL		U	U	U
sec-Butylbenzene			U	U	U
Styrene	100 MMCL		U	U	U
Tert-Butylbenzene			U	U	U
Tetrachloroethene	5 MMCL	5,280 / 840	U	U	U
1,1,1,2-Tetrachloroethane		9,320 / 2,400	U	U	U
1,1,2,2-Tetrachloroethane		9,320 / 2,400	U	U	U
Toluene	1000 MMCL	17,500 / xxxx	U	U	U
trans-1,2-Dichloroethene	100 MMCL		U	U	U
1,2,3-Trichlorobenzene			U	U	U
1,2,4-Trichlorobenzene	70 MMCL		U	U	U
1,1,1-Trichloroethane	200 MMCL	18,000 / xxxx	U	U	U
1,1,2-Trichloroethane	5 MMCL	18,000 / 9,400	U	U	U
Trichloroethene	5 MMCL	45,000 / 21,900	U	U	U
1,2,3-Trichloropropane			U	U	U
1,2,4-Trimethylbenzene			U	U	U
1,3,5-Trimethylbenzene			U	U	U
Vinyl Chloride	2 MMCL		U	U	U
Total Quantified Target VOCs			0.0	0.0	0.0
Identified Non-Target Compounds			0	0	0

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ORSG = Office of Research & Standards Guidelines

AWQC = Massachusetts Ambient Water Quality Criteria for fresh water under 310 CMR 40.

U or ND = Not detected.

Table 3.4 - Pesticide Analyses
Old Amherst Landfill CSA Study

EPA Method SW846 8081A Pesticides	Standards MMCL / ORSG (ug/L)	Well #1-03		Well #2-03		Well #2-83		Well #2-85	
		11/10/05		11/10/05		11/10/05		11/10/05	
alpha-BHC		U <0.10		U <0.10		U <0.10		U <0.10	
beta-BHC		U <0.10		U <0.10		U <0.10		U <0.10	
delta-BHC		U <0.10		U <0.10		U <0.10		U <0.10	
gamma-BHC (Lindane)		U <0.10		U <0.10		U <0.10		U <0.10	
Heptachlor	0.4 MMCL	U <0.10		U <0.10		U <0.10		U <0.10	
Aldrin		U <0.10		U <0.10		U <0.10		U <0.10	
Heptachlor epoxide	0.2 MMCL	U <0.10		U <0.10		U <0.10		U <0.10	
Endosulfan I		U <0.10		U <0.10		U <0.10		U <0.10	
Dieldrin		U <0.10		U <0.10		U <0.10		U <0.10	
4,4'-DDE		U <0.10		U <0.10		U <0.10		U <0.10	
Endrin		U <0.10		U <0.10		U <0.10		U <0.10	
Endosulfan II		U <0.10		U <0.10		U <0.10		U <0.10	
4,4'-DDD		U <0.10		U <0.10		U <0.10		U <0.10	
Endosulfan sulfate		U <0.10		U <0.10		U <0.10		U <0.10	
4,4'-DDT		U <0.10		U <0.10		U <0.10		U <0.10	
Methoxychlor	40 MMCL	U <0.10		U <0.10		U <0.10		U <0.10	
Toxaphene	3 MMCL	U <5.0		U <5.0		U <5.0		U <5.0	
Endrin aldehyde	2 MMCL	U <0.10		U <0.10		U <0.10		U <0.10	
Chlordane, total	2 MMCL	U <0.50		U <0.50		U <0.50		U <0.50	
Total Quantified Target Pesticides		0.0		0.0		0.0		0.0	

MMCL = Massachusetts Maximum Contaminant Level

ORSG = Office of Research & Standards Guidelines

AWQC = Massachusetts Ambient Water Quality Criteria

U or ND = Not detected.

Table 3.4 - Pesticide Analyses
Old Amherst Landfill CSA Study

Tighe & Bond, Inc.

EPA Method SW846 8081A Pesticides	Standards MMCL / ORSG (ug/L)	Well #3-68		Well #3-80		Well #3-83		Well #3-85	
		11/10/05		11/10/05		11/10/05		11/10/05	
alpha-BHC		U <0.10		U <0.10		U <0.10		U <0.10	
beta-BHC		U <0.10		U <0.10		U <0.10		U <0.10	
delta-BHC		U <0.10		U <0.10		U <0.10		U <0.10	
gamma-BHC (Lindane)		U <0.10		U <0.10		U <0.10		U <0.10	
Heptachlor	0.4 MMCL	U <0.10		U <0.10		U <0.10		U <0.10	
Aldrin		U <0.10		U <0.10		U <0.10		U <0.10	
Heptachlor epoxide	0.2 MMCL	U <0.10		U <0.10		U <0.10		U <0.10	
Endosulfan I		U <0.10		U <0.10		U <0.10		U <0.10	
Dieldrin		U <0.10		U <0.10		U <0.10		U <0.10	
4,4'-DDE		U <0.10		U <0.10		U <0.10		U <0.10	
Endrin		U <0.10		U <0.10		U <0.10		U <0.10	
Endosulfan II		U <0.10		U <0.10		U <0.10		U <0.10	
4,4'-DDD		U <0.10		U <0.10		U <0.10		U <0.10	
Endosulfan sulfate		U <0.10		U <0.10		U <0.10		U <0.10	
4,4'-DDT		U <0.10		U <0.10		U <0.10		U <0.10	
Methoxychlor	40 MMCL	U <0.10		U <0.10		U <0.10		U <0.10	
Toxaphene	3 MMCL	U <5.0		U <5.0		U <5.0		U <5.0	
Endrin aldehyde	2 MMCL	U <0.10		U <0.10		U <0.10		U <0.10	
Chlordane, total	2 MMCL	U <0.50		U <0.50		U <0.50		U <0.50	
Total Quantified Target Pesticides		0.0		0.0		0.0		0.0	

MMCL = Massachusetts Maximum Contaminant Level

ORSG = Office of Research & Standards Guidelines

AWQC = Massachusetts Ambient Water Quality Criteria

U or ND = Not detected.

Table 3.4 - Pesticide Analyses
Old Amherst Landfill CSA Study

Tighe & Bond, Inc.

EPA Method SW846 8081A Pesticides	Standards MMCL / ORSG (ug/L)	Well #5-89		Well #6-89		Well #1-83		Well #1-94	
		11/10/05		11/10/05		11/11/05		11/18/05	
alpha-BHC		U	<0.10	U	<0.10	U	<0.10	U	<0.10
beta-BHC		U	<0.10	U	<0.10	U	<0.10	U	<0.10
delta-BHC		U	<0.10	U	<0.10	U	<0.10	U	<0.10
gamma-BHC (Lindane)		U	<0.10	U	<0.10	U	<0.10	U	<0.10
Heptachlor	0.4 MMCL	U	<0.10	U	<0.10	U	<0.10	U	<0.10
Aldrin		U	<0.10	U	<0.10	U	<0.10	U	<0.10
Heptachlor epoxide	0.2 MMCL	U	<0.10	U	<0.10	U	<0.10	U	<0.10
Endosulfan I		U	<0.10	U	<0.10	U	<0.10	U	<0.10
Dieldrin		U	<0.10	U	<0.10	U	<0.10	U	<0.10
4,4'-DDE		U	<0.10	U	<0.10	U	<0.10	U	<0.10
Endrin		U	<0.10	U	<0.10	U	<0.10	U	<0.10
Endosulfan II		U	<0.10	U	<0.10	U	<0.10	U	<0.10
4,4'-DDD		U	<0.10	U	<0.10	U	<0.10	U	<0.10
Endosulfan sulfate		U	<0.10	U	<0.10	U	<0.10	U	<0.10
4,4'-DDT		U	<0.10	U	<0.10	U	<0.10	U	<0.10
Methoxychlor	40 MMCL	U	<0.10	U	<0.10	U	<0.10	U	<0.10
Toxaphene	3 MMCL	U	<5.0	U	<5.0	U	<5.0	U	<5.0
Endrin aldehyde	2 MMCL	U	<0.10	U	<0.10	U	<0.10	U	<0.10
Chlordane, total	2 MMCL	U	<0.50	U	<0.50	U	<0.50		xxx
Total Quantified Target Pesticides			0.0		0.0		0.0		0.0

MMCL = Massachusetts Maximum Contaminant Level

ORSG = Office of Research & Standards Guidelines

AWQC = Massachusetts Ambient Water Quality Criteria

U or ND = Not detected.

Table 3.5
General Sediment Chemistry Analyses
Old Amherst Landfill CSA Study

Sampling Station	Date	General Landfill Contaminant Indicator Parameters											
		Field pH (Std units)	Field Temp. (C)	Field Spec. Cond. (umhos)	Field D.O. (mg/L)	% Solids	Alkalinity (mg/kg)	COD (mg/kg)	Chloride (mg/kg)	NO3 (mg/kg)	SO4 (mg/kg)	TDS (mg/kg)	Cyanide (mg/kg)
SEDIMENT MONITORING STATIONS (Same as Surface Water Stations)													
Pomeroy Pond - Adjacent to Landfill													
SED-3 (SW-3)	8-Nov-05	xxx	xxx	xxx	xxx	51%	87	430	<37	<9.2	<73	xxx	<21
Gull Pond - Downgradient of Landfill													
SED-1 (Inlet SW-1)	8-Nov-05	xxx	xxx	xxx	xxx	42%	250	<480	<48	<12	140	xxx	<32
SED-9 (Inlet SW-9)	8-Nov-05	xxx	xxx	xxx	xxx	77%	37	<260	<180	<44	<350	xxx	<17
SED-2 (Pond SW-2)	8-Nov-05	xxx	xxx	xxx	xxx	78%	11	<260	<22	<5.5	<44	xxx	<26
Trail - Seepage Area in Downgradient Wetland													
SED-6 (SW-6)	8-Nov-05	xxx	xxx	xxx	xxx	29%	330	1200	88	<18	<140	xxx	<19
Kettle Pond - Downgradient of Landfill													
SED-7 (SW-7)	8-Nov-05	xxx	xxx	xxx	xxx	37%	160	1300	<150	<37	<300	xxx	<22
Brickyard Wellfield - Spring in Adjacent Wetland													
SED-8 (SW-8)	8-Nov-05	xxx	xxx	xxx	xxx	24%	230	1400	<150	<37	<290	xxx	<23
Hop Brook - Downgradient Receiving Stream													
SED 4 (Upstream SW-4)	8-Nov-05	xxx	xxx	xxx	xxx	35%	21	1300	46	<12	110	xxx	<22
SED-5 (Downstream SW-5)	8-Nov-05	xxx	xxx	xxx	xxx	53%	19	690	<38	<9.4	<75	xxx	<21

Table 3.6 - Sediment Metals Analyses
Old Amherst Landfill CSA Study

Location	Date	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Pb (mg/kg)	Mn (mg/kg)	Hg (mg/kg)	Se (mg/kg)	Ag (mg/kg)	Zn (mg/kg)
MDEP Sediment Screening Criteria MCP - Stage 1 Risk Assessment		**9.79**		**0.99**	**43.4**	**31.6**		**35.8**		**0.18**			**121**
MDEP Sediment Guideline Reference: Ontario Guidelines for Aquatic Sediment Quality (Sept, 1993)													
Lowest Effect Level		6.0		0.6	26	16	20,000	31	460	0.2			120
Severe Effect Level		33		10	110	110	40,000	250	1,100	2.0			820
MDEP Sediment Reuse Standards		40		80	1000			2000		10			
SEDIMENT MONITORING STATIONS (Same as Surface Water)													
Pomeroy Pond - Adjacent to Landfill													
SED-3 (SW-3)	8-Nov-05	<9.9	80	<2.0	9.5	<9.9	12000	23	140	0.096	<15	<4.9	52
Gull Pond - Downgradient of Landfill													
SED-1 (Inlet SW-1)	8-Nov-05	**28**	430	<2.8	20	23	99000	16	610	0.098	<21	<6.9	**230**
SED-9 (Inlet SW-9)	8-Nov-05	<7.0	57	<1.4	11	11	13000	9.6	240	<0.047	<11	<3.5	22
SED-2 (Pond SW-2)	8-Nov-05	<7.5	60	<1.5	9.0	<7.5	9400	4.3	110	<0.047	<11	<3.8	27
Trail - Seepage Area in Downgradient Wetland													
SED-6 (SW-6)	8-Nov-05	**53**	800	<8.0	<20	<40	350000	<20	7800	0.12	<20	<20	<99
Kettle Pond - Downgradient of Landfill													
SED-7 (SW-7)	8-Nov-05	<16	78	<3.2	<8.0	<24	8800	24	250	**0.18**	<24	<8.0	**140**

Table 3.6 - Sediment Metals Analyses
Old Amherst Landfill CSA Study

Location	Date	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Pb (mg/kg)	Mn (mg/kg)	Hg (mg/kg)	Se (mg/kg)	Ag (mg/kg)	Zn (mg/kg)
MDEP Sediment Screening Criteria MCP - Stage 1 Risk Assessment		**9.79**		**0.99**	**43.4**	**31.6**		**35.8**		**0.18**			**121**
MDEP Sediment Guideline Reference: Ontario Guidelines for Aquatic Sediment Quality (Sept, 1993)													
Lowest Effect Level		6.0		0.6	26	16	20,000	31	460	0.2			120
Severe Effect Level		33		10	110	110	40,000	250	1,100	2.0			820
MDEP Sediment Reuse Standards		40		80	1000			2000		10			
Brickyard Wellfield - Spring in Downgradient Wetland													
SED-8 (SW-8)	8-Nov-05	<25	110	<4.9	<12	**370**	21000	**47**	220	<0.16	<37	<12	120
Hop Brook - Downgradient Receiving Stream													
SED-4 (Upstream SW-4)	8-Nov-05	<18	110	<3.7	9.7	<18	14000	23	270	<0.14	<27	<9.1	<46
SED-5 (Downstream SW-5)	8-Nov-05	<12	240	<2.3	25	23	29000	**37**	840	0.15	<18	<5.9	120

Table 3.7 - Sediment VOC Data Summary
Old Amherst Landfill CSA Study

EPA METHOD 8260 Compound	MCP Method 1 Cleanup Standards (µg/kg)	SED-1 (SW-1) Gull Pond Inlet 11/08/05	SED-2 (SW-2) Gull Pond 11/08/05	SED-3 (SW-3) Pomeroy Pond 11/08/05
Acetone	3,000	U	U	U
Bromobenzene		U	U	U
Benzene	10,000	U	U	U
Bromochloromethane		U	U	U
Bromodichloromethane	100	U	U	U
Bromoform	100	U	U	U
Bromomethane	10,000	U	U	U
2-Butanone	300	U	U	U
Carbon tetrachloride	1,000	U	U	U
Chlorobenzene	8,000	U	U	U
Dibromochloromethane		U	U	U
Chloroethane		U	U	U
Chloroform	100	U	U	U
Chloromethane		U	U	U
2-Chlorotoluene		U	U	U
4-Chlorotoluene		U	U	U
cis-1,2-Dichloroethene	2,000	U	U	U
trans-1,2-Dichloroethene	4,000	U	U	U
Dibromomethane		U	U	U
1,2-Dibromo-3-chloropropane		U	U	U
1,2-Dichlorobenzene	100,000	U	U	U
1,3-Dichlorobenzene	100,000	U	U	U
1,4-Dichlorobenzene	2,000	U	U	U
1,1-Dichloroethane	3,000	U	U	U
1,2-Dichloroethane	50	U	U	U
1,1-Dichloroethene	700	U	U	U
1,2-Dichloropropane	100	U	U	U
1,3-Dichloropropane	10	U	U	U
2,2-Dichloropropane		U	U	U
1,1-Dichloropropene		U	U	U
cis-1,3-Dichloropropene		U	U	U
trans-1,3-Dichloropropene		U	U	U
Ethylbenzene	80,000	U	U	U
Ethylene Dibromide	5.0	U	U	U
Trichlorofluoromethane		U	U	U
2-Hexanone		U	U	U
Hexachlorobutadiene	3,000	U	U	U
Isopropylbenzene		U	U	U
4-Methyl-2-pentanone	500	U	U	U
Methylene chloride	100	U	U	U
Methyl-tert-Butyl ether	300	U	U	U
n-Butylbenzene		U	U	U
n-Propylbenzene		U	U	U
Naphthalene	4,000	U	U	U
m&p-Xylene	500,000	U	U	U
p-Isopropyltoluene		U	U	U
o-Xylene	500,000	U	U	U
sec-Butylbenzene		U	U	U
Styrene	2,000	U	U	U
Tert-Butylbenzene		U	U	U
Tetrachloroethene	500	U	U	U
1,1,1,2-Tetrachloroethane	400	U	U	U
1,1,2,2-Tetrachloroethane	20	U	U	U
Toluene	90,000	U	U	U
1,2,3-Trichlorobenzene		U	U	U
1,2,4-Trichlorobenzene	100,000	U	U	U
1,1,1-Trichloroethane	30,000	U	U	U
1,1,2-Trichloroethane	300	U	U	U
Trichloroethene	400	U	U	U
1,2,3-Trichloropropane		U	U	U
1,2,4-Trimethylbenzene		U	U	U
1,3,5-Trimethylbenzene		U	U	U
Vinyl Chloride	300	U	U	U
Total Quantified Target VOCs		0	0	0
Identified Non-Target Compounds		0	0	
Dimethyl ether				U
Hexanal				11.4
Pentanal				2.3

U = Not Detected
NA = Not Analyzed

Table 3.7 - Sediment VOC Data Summary
Old Amherst Landfill CSA Study

Tighe & Bond, Inc.

EPA METHOD 8260 Compound	MCP Method 1 Cleanup Standards (µg/kg)	SED-4 (SW-4) Upstream - Hop Brook 11/08/05		SED-5 (SW-5) Downstream - Hop Brook 11/08/05		SED-6 (SW-6) Trail - Wetland Seepage Area 11/08/05	
Acetone	3,000	U		U		U	
Bromobenzene		U		U		U	
Benzene	10,000	U		U		U	
Bromochloromethane		U		U		U	
Bromodichloromethane	100	U		U		U	
Bromoform	100	U		U		U	
Bromomethane	10,000	U		U		U	
2-Butanone	300	U		U		U	
Carbon tetrachloride	1,000	U		U		U	
Chlorobenzene	8,000	U		U		U	
Dibromochloromethane		U		U		U	
Chloroethane		U		U		U	
Chloroform	100	U		U		U	
Chloromethane		U		U		U	
2-Chlorotoluene		U		U		U	
4-Chlorotoluene		U		U		U	
cis-1,2-Dichloroethene	2,000	U		U		U	
trans-1,2-Dichloroethene	4,000	U		U		U	
Dibromomethane		U		U		U	
1,2-Dibromo-3-chloropropane		U		U		U	
1,2-Dichlorobenzene	100,000	U		U		U	
1,3-Dichlorobenzene	100,000	U		U		U	
1,4-Dichlorobenzene	2,000	U		U		3.7	
1,1-Dichloroethane	3,000	U		U		U	
1,2-Dichloroethane	50	U		U		U	
1,1-Dichloroethene	700	U		U		U	
1,2-Dichloropropane	100	U		U		U	
1,3-Dichloropropane	10	U		U		U	
2,2-Dichloropropane		U		U		U	
1,1-Dichloropropene		U		U		U	
cis-1,3-Dichloropropene		U		U		U	
trans-1,3-Dichloropropene		U		U		U	
Ethylbenzene	80,000	U		U		U	
Ethylene Dibromide	5.0	U		U		U	
Trichlorofluoromethane		U		U		U	
2-Hexanone		U		U		U	
Hexachlorobutadiene	3,000	U		U		U	
Isopropylbenzene		U		U		U	
4-Methyl-2-pentanone	500	U		U		U	
Methylene chloride	100	U		U		U	
Methyl-tert-Butyl ether	300	U		U		U	
n-Butylbenzene		U		U		U	
n-Propylbenzene		U		U		U	
Naphthalene	4,000	U		U		U	
m&p-Xylene	500,000	U		U		U	
p-Isopropyltoluene		U		U		U	
o-Xylene	500,000	U		U		U	
sec-Butylbenzene		U		U		U	
Styrene	2,000	U		U		U	
Tert-Butylbenzene		U		U		U	
Tetrachloroethene	500	U		U		U	
1,1,1,2-Tetrachloroethane	400	U		U		U	
1,1,2,2-Tetrachloroethane	20	U		U		U	
Toluene	90,000	3.5		U		U	
1,2,3-Trichlorobenzene		U		U		U	
1,2,4-Trichlorobenzene	100,000	U		U		U	
1,1,1-Trichloroethane	30,000	U		U		U	
1,1,2-Trichloroethane	300	U		U		U	
Trichloroethene	400	U		U		U	
1,2,3-Trichloropropane		U		U		U	
1,2,4-Trimethylbenzene		U		U		U	
1,3,5-Trimethylbenzene		U		U		U	
Vinyl Chloride	300	U		U		U	
Total Quantified Target VOCs		3.5		0		3.7	
Identified Non-Target Compounds				0		0	
Dimethyl ether		U					
Hexanal		2.5					
Pentanal		U					

U = Not Detected
NA = Not Analyzed

Table 3.7 - Sediment VOC Data Summary
Old Amherst Landfill CSA Study

Tighe & Bond, Inc.

EPA METHOD 8260 Compound	MCP Method 1 Cleanup Standards (µg/kg)	SED-7 (SW-7) Kettle Pond - Downgradient 11/08/05		SED-8 (SW-8) Brickyard Wellfield - Spring 11/08/05		SED-9 (SW-9) Gull Pond Inlet 11/08/05	
Acetone	3,000	U		U		U	
Bromobenzene		U		U		U	
Benzene	10,000	U		U		U	
Bromochloromethane		U		U		U	
Bromodichloromethane	100	U		U		U	
Bromoform	100	U		U		U	
Bromomethane	10,000	U		U		U	
2-Butanone	300	U		U		U	
Carbon tetrachloride	1,000	U		U		U	
Chlorobenzene	8,000	U		3.0		U	
Dibromochloromethane		U		U		U	
Chloroethane		U		U		U	
Chloroform	100	U		U		U	
Chloromethane		U		U		U	
2-Chlorotoluene		U		U		U	
4-Chlorotoluene		U		U		U	
cis-1,2-Dichloroethene	2,000	U		U		U	
trans-1,2-Dichloroethene	4,000	U		U		U	
Dibromomethane		U		U		U	
1,2-Dibromo-3-chloropropane		U		U		U	
1,2-Dichlorobenzene	100,000	U		U		U	
1,3-Dichlorobenzene	100,000	U		U		U	
1,4-Dichlorobenzene	2,000	U		U		U	
1,1-Dichloroethane	3,000	U		U		U	
1,2-Dichloroethane	50	U		U		U	
1,1-Dichloroethene	700	U		U		U	
1,2-Dichloropropane	100	U		U		U	
1,3-Dichloropropane	10	U		U		U	
2,2-Dichloropropane		U		U		U	
1,1-Dichloropropene		U		U		U	
cis-1,3-Dichloropropene		U		U		U	
trans-1,3-Dichloropropene		U		U		U	
Ethylbenzene	80,000	U		U		U	
Ethylene Dibromide	5.0	U		U		U	
Trichlorofluoromethane		U		U		U	
2-Hexanone		U		U		U	
Hexachlorobutadiene	3,000	U		U		U	
Isopropylbenzene		U		U		U	
4-Methyl-2-pentanone	500	U		U		U	
Methylene chloride	100	U		U		U	
Methyl-tert-Butyl ether	300	U		U		U	
n-Butylbenzene		U		U		U	
n-Propylbenzene		U		U		U	
Naphthalene	4,000	U		U		U	
m&p-Xylene	500,000	U		U		U	
p-Isopropyltoluene		U		U		U	
o-Xylene	500,000	U		U		U	
sec-Butylbenzene		U		U		U	
Styrene	2,000	U		U		U	
Tert-Butylbenzene		U		U		U	
Tetrachloroethene	500	U		U		U	
1,1,1,2-Tetrachloroethane	400	U		U		U	
1,1,2,2-Tetrachloroethane	20	U		U		U	
Toluene	90,000	5.7		U		U	
1,2,3-Trichlorobenzene		U		U		U	
1,2,4-Trichlorobenzene	100,000	U		U		U	
1,1,1-Trichloroethane	30,000	U		U		U	
1,1,2-Trichloroethane	300	U		U		U	
Trichloroethene	400	U		U		U	
1,2,3-Trichloropropane		U		U		U	
1,2,4-Trimethylbenzene		U		U		U	
1,3,5-Trimethylbenzene		U		U		U	
Vinyl Chloride	300	U		U		U	
Total Quantified Target VOCs		5.7		3		0	
Identified Non-Target Compounds				0			
Dimethyl ether		4.8				U	
Hexanal		5.6				2.1	
Pentanal		U				U	

U = Not Detected
NA = Not Analyzed

4.1 SUMMARY FINDINGS

The Interim CSA study of the Old Amherst Landfill focused on the collection and analysis of groundwater samples from existing monitoring and test wells, evaluation of groundwater contour data, collection of surface water samples and sediment samples from potential downgradient surface water receptors (some visually affected by iron staining), evaluation of subsurface migration at the perimeter of the landfill site, ambient air monitoring at the site, and characterization of landfill cover. One of the primary goals of the Interim CSA study is to provide recommendations for additional well installation and assessment to complete the CSA study. Study findings include:

- Seven gas monitoring wells (PGW-1 through PGW-7) were installed on the perimeter of the landfill site to check the presence of subsurface landfill gas emissions.
    - The wells were installed to a depth of 50 feet or a minimum of 5-feet into the groundwater table, with the exception of PGW-6 installed to a depth of 88 feet for groundwater sampling purposes.
    - The wells were screened and sand packed through the vadose zone to a depth of 5 feet below grade.
    - Overall, soils encountered were fine to medium sands overlying very fine sand and silt at depth.
- Subsurface landfill gas monitoring of the new perimeter gas monitoring wells and existing soil gas points indicated that landfill gases were not detected in the subsurface off Town property.
- A 100-foot grid was established across the site to facilitate ambient air monitoring and the evaluation of existing soil cover. A total of 209 grid stations were established across the 40-acre site.
- An ambient air survey conducted across the surface of the landfill at a height of 5 feet did not detect any landfill gas impacts to the "breathing zone".
- A "test hole" evaluation was conducted across the landfill at a spacing of one shallow boring per acre to evaluate the depth of cover, characterize the barrier layer soils, check shallow soil gas in each boring above the barrier layer soils, check the hydraulic conductivity of the barrier layer at select locations, and collect and analyze topsoil samples for chemical analyses.

- The landfill cover characterization indicated that the soil cover across the landfill is fairly consistent, varying from 7 to 15 inches of topsoil overlying 5 to 12 inches of barrier layer soils.

- Soil gas monitoring of the test holes prior to penetrating the barrier layer did not detect any landfill gases.

- Hydraulic conductivity of the barrier layer varied from $3.4x10^{-4}$ cm/s to $2.7x10^{-6}$ cm/s. Sample integrity may have been compromised by heavy rainfall that caused seepage of water into the test holes, possible intermixing soil of the barrier layer with overlying soils.

- Analysis of cover soils for metals and volatile organic compounds (VOCs) indicated that all metals concentrations were less than MDEP MCP RC S-1 guidance levels for playground, recreational and drinking water areas. No target VOC analytes were detected. Three non-target VOCs were detected at trace levels in various samples; these may be due to the sample preservation method.

- All new gas monitoring wells and any existing test or monitoring wells that required elevation control were surveyed by the Town Engineering Department. Surveyed well elevations were used to calculate groundwater elevations.

- Groundwater elevations measured in November 2005 were used to construct the site Groundwater Contour Plan provided in Appendix B. The groundwater elevation data was supplemented with spot elevations of surface waters and wetlands to better define groundwater flow paths downgradient of the site.

    - The November 2005 groundwater contours indicate an overall westerly flow from the landfill site, towards Hop Brook and associated wetlands.

    - Site groundwater elevation data indicates a very steep hydraulic gradient along the western edge of Pomeroy Pond, flattening to the west across and downgradient of the landfill site.

    - Groundwater flow from the landfill is not projected to impact the area to the south of well #1-03, approximately 1,000 feet southwest of the site waste disposal limits.

- The environmental monitoring program for the Interim CSA study was conducted in November 2005. The program included collection and analysis of 13 groundwater samples, and 9 surface water samples and 9 sediment samples. Analytical parameters included all general water chemistry, metals and VOC analyses required

under Massachusetts Solid Waste Regulation 310 CMR 19.132(1)(h) with the addition of pesticide analyses for the groundwater samples. Total metals were analyzed at all sampling stations. Potential "Contaminants of Concern or COCs" were identified by comparison to applicable standards as summarized below:

- Groundwater COCs included an acidic to alkaline pH outside of the range of 6.5-8.5 standard pH units, and the metals barium (Ba), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg) and zinc (Zn). No VOCs were identified as COCs in the groundwater.

- Other potential landfill groundwater quality impacts include slightly to moderately elevated levels of alkalinity, COD, chloride, sulfate and TDS, and trace concentrations of VOCs at levels less than 10 ug/L (< 10 ppb).

- Surface water COCs included a dissolved oxygen content of less than 5 mg/L, and the metal lead (Pb). No VOCs were identified as COCs in the surface water.

- Other potential landfill surface water quality impacts are moderately elevated to elevated levels of barium (Ba), iron (Fe) and manganese (Mn), and trace concentrations of VOCs at levels less than 10 ug/L (< 10 ppb).

- Sediment COCs include the metals arsenic (As), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg) and zinc (Zn). No VOCs were identified as COCs in the sediment samples.

- Other potential landfill sediment quality impacts are moderately elevated to elevated levels of alkalinity, COD and chloride, and moderately elevated levels of the metal barium (Ba).

4.2 RECOMMENDED "PHASE 2" CSA WORK

Condition #14 of the *July 6, 2005 Initial Site Assessment (ISA) Permit Approval* required a second phase of CSA activities, based on the initial CSA study phase presented herein as the Interim CSA Report. Based on this data and the information presented in the ISA Report, the following is recommended for the "Phase 2" CSA scope of work:

4.2.1 Additional Groundwater Monitoring Wells

Eight additional groundwater monitoring wells are recommended for the second phase of the CSA study. The new monitoring wells are proposed at five locations, one

upgradient, 3 downgradient and the fifth at existing Lawrence Swamp Aquifer monitoring well #1-03. Well locations are described as follows:

Proposed Upgradient Well #1-06: Shallow upgradient well that is screened in the upper 10 feet of saturated soils. The well is located along Old Belchertown Road to the east of the MSW disposal area and the C&D disposal area at the Old Amherst Landfill as an upgradient well to characterize background groundwater quality conditions.

Proposed Downgradient Well Cluster #2-06 and #3-06: Shallow and confined aquifer wells installed adjacent to Gull Pond near the SW-1 surface water station.

Proposed Downgradient Well Cluster #4-06 and #5-06: Shallow and confined aquifer wells installed east of the SW-7 surface water station along Wildflower Drive, roughly 200 feet south of the intersection with Pine Grove Road. An alternate location is along Hop Brook Drive to the west of the SW-7 station, although this location is close to test well #3-68 at the Brickyard Wellfield. Test Well #3-68 was sampled for the Interim CSA study.

Proposed Downgradient Well Cluster #6-06 and #7-06: Shallow and confined aquifer wells installed along Woodlot Road, roughly 250 feet south of the intersection with Old Farm Road. An alternate location is at the intersection of Hop Brook Drive and Old Farm Road.

Proposed Downgradient Well #8-06: Confined aquifer well installed adjacent to shallow monitoring well #1-03 located along the sewer pump station access road that intersects Woodlot Road. Well #1-03 is used by the Town to monitor for changes in water quality that may affect the Lawrence Swamp Aquifer. A confined aquifer well at this location would strengthen the monitoring well network designed to protect the aquifer from contamination due to either the Old Amherst Landfill or residential development in Amherst Woods.

Most of the groundwater monitoring wells are proposed as "well clusters" consisting of a shallow well screened in the upper surficial aquifer and a deeper well installed in the underlying confined aquifer, where it exists downgradient of the landfill in the Lawrence Swamp basin. Surficial wells will be used to characterize potential landfill impact while deeper "confined aquifer" wells will enable monitoring of the confined aquifer at these locations for potential landfill water quality impacts.

4.2.2 Second CSA Monitoring Round

A second round of CSA monitoring is proposed as follows:

4.2.2.1 Analytical Parameters

Analytical parameters recommended for the second CSA monitoring round include all listed water quality parameters under Massachusetts Solid Waste Regulations 310 CMR 19.132(1)(h), plus field turbidity.

Also, it is recommended that all monitoring wells or test wells to be sampled for the second round of CSA analyses be redeveloped to clear screen zones of accumulated sediments or metal scale.

4.2.2.2 Groundwater Monitoring

Groundwater sample collection and water quality analyses are recommended for the following eight recommended CSA monitoring wells and the 14 other wells previously sampled for the CSA study:

Eight Proposed Monitoring Wells:

- shallow well #1-06
- well cluster #2-06 and #3-06
- well cluster #4-06 and #5-06
- well cluster #6-06 and #7-06
- confined aquifer well #8-06

Fourteen Existing Monitoring and Test Wells:

- gas monitoring well PGW-6
- non-potable bedrock well at 163 Wildflower Drive
- shallow well #1-03
- shallow well #2-03
- well cluster #5-89 and #6-89
- brickyard wellfield shallow well 3-68
- confined aquifer well #3-80
- well #1-94

- confined aquifer well #1-83
- confined aquifer well #2-83
- confined aquifer well 3-83
- shallow well #2-85
- shallow well #3-85

4.2.2.3 Surface Water Monitoring Stations

Surface water sample collection and water quality analyses are recommended for the existing nine CSA sampling stations:

- SW-1 Gull Pond tributary
- SW-2 Gull Pond
- SW-3 Pomeroy Pond
- SW-4 Hop Brook upstream
- SW-5 Hop Brook downstream
- SW-6 KC Trail seepage area
- SW-7 Unnamed Kettle Pond
- SW-8 Brickyard Wellfield spring
- SW-9 Gull Pond tributary

4.2.2.4 Sediment

No additional sediment samples are recommended.

4.2.2.5 Soil Gas Assessment

A second round of soil gas analyses using the seven new perimeter gas monitoring wells and existing soil gas monitoring points. Monitoring parameters are percent lower explosion limit (LEL) for methane, percent oxygen and hydrogen sulfide gas (ppm level).

4.2.3 LAC Items: Pages C-26 through C-29

The MDEP Landfill Technical Guidance Manual (LAC manual) outlines under pages C-26 through C-29 the specific CSA Report submittal requirements. In addition to updating the information submitted for the Interim CSA Report and the ISA Report, the following will be provided:

- Interpretation of geologic stratigraphy including two geologic cross sections
- Calculation of the landfill mass water balance
- Determination of hydraulic conductivity for the eight new CSA monitoring wells
- Identification of contaminant migration pathways
- Conduct a baseline qualitative risk assessment

- Recommendations for the scope of work for a Corrective Action Alternatives Analysis (CAAA), if needed

4.2.4 Landfill Post-Closure Maintenance & Monitoring

The "Phase 2" CSA Report will include recommendations for long-term landfill post-closure maintenance and environmental monitoring following the requirements of the Massachusetts Solid Waste Regulations 310 CMR 19.000.

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