2008 Annual Report
Shepley's Hill Landfill
Devens, Massachusetts

Agency for the
Army BRAC ENVIRONMENTAL
Box 100, Devens, Massachusetts

Contract Number
W91ZLK-05-D-0009
Task Order - 0006

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September 2009

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Subject:
FINAL 2008 Annual Report –
Shepley's Hill Landfill and Treatment Plant, Long-Term Monitoring and O&M Services
Contract Number W91ZLK-05-D-009, Task Order 0006

On behalf of the US Army BRAC Environmental Office at Devens, ECC is pleased to provide the *FINAL 2008 Annual Report – Shepley's Hill Landfill and Treatment Plant, Long-Term Monitoring and O&M Services.* This 2008 Annual Report discusses the operation and maintenance (O&M) of the existing groundwater extraction, treatment and discharge system, groundwater monitoring, and landfill monitoring and maintenance for the year 2008.

Sincerely,

Fred Santos, PG
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2008 Annual Report
Shepley's Hill Landfill

Devens, Massachusetts

September 2009

Prepared for:

Army Contracting Agency

for

Department of the Army
BRAC ENVIRONMENTAL

30 Quebec Street, Box 100
Devens, Massachusetts

Contract Number W91ZLK-05-D-0009 Task Order - 0006

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2008 Annual Report

Shepley's Hill Landfill and Treatment Plant
Long-Term Monitoring and O&M Services
Former Fort Devens, Massachusetts

September 2009

I hereby certify that the enclosed Annual Report, shown and marked in this submittal, is that proposed to be incorporated with Contract Number W91ZLK-05-D-0009 Task Order -0006. This Annual Report complies with the Performance Work Statement and is being submitted for Government approval.

Reviewed and Approved by:

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Project Manager — Date

Accepted by:

Contracting Officer's Representative — Date 9/18/09

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

AMEC	AMEC Earth & Environmental Inc.
AOC	Area of Concern
AR	Annual Report
ATP	Arsenic Treatment Plant
BEC	Base Environmental Coordinator
BCT	BRAC Cleanup Team
bgs	Below Ground Surface
BRAC	Base Re-alignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfd	Cubic Feet per Day
CFR	Code of Federal Regulations
CIP	Clean-in-place
CMR	Code of Massachusetts Regulations
COC	Contaminant of Concern
COR	Contracting Officer's Representative
cy	cubic yard
ECC	Environmental Chemical Corporation
EPA	U.S. Environmental Protection Agency
FBRO	Filtered bottom roll-off
FS	Feasibility Study
FYR	Five Year Review
gal	gallon
gpm	gallons per minute
GWTP	Groundwater Treatment Plant
LEL	Lower explosive limit
LGP	Landfill gas probes
LTM	Long-Term Monitoring
LTMMP	Long Term Monitoring and Maintenance Plan
MassDEP	Massachusetts Department of Environmental Protection

MCL	Maximum concentration limit
MG	Million gallons
msl	Mean sea level
O&M	Operations and Maintenance
OPS	Operating Properly and Successfully
ORP	Oxidation reduction potential
ORD	U. S. Environmental Protection Agency, Office of Research and Development
PID	Photoionization detector
POTW	Publicly-Owned Treatment Works
PMP	Project Management Plan
ppb	parts per billion
ppm	parts per million
PVC	Polyvinyl chloride
RI	Remedial Investigation
ROD	Record of Decision
SHL	Shepley's Hill Landfill
SPC	Specific conductivity
SWET	Stone & Webster Environmental Technology & Services
USACE-NAE	U. S. Army Corps of Engineers, New England District
USEPA	U. S. Environmental Protection Agency
µg/L	Micrograms per liter
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

The Annual Report (AR) documents the long-term monitoring, inspection, and operations and maintenance activities conducted in 2008 at Shepley's Hill Landfill (SHL) at Former Fort Devens, Massachusetts. The Army has prepared this report in accordance with the final approved Revised Long Term Monitoring and Maintenance Plan (LTMMP) (CH2MHill, 2007b). The LTMMP provides the basis for monitoring of groundwater, landfill gas sampling, and landfill inspections that have been conducted since the mid 1990's, and now includes monitoring of the arsenic groundwater extraction, treatment, and POTW discharge system (Contingency Remedy) that has been in full time operation since March, 2006.

In addition, this 2008 AR includes a follow-up to the initial performance assessment for the Contingency Remedy that was included in the 2007 AR (ECC, 2008a). As described in the Record of Decision for Shepley's Hill Landfill (USAEC, 1995), the remedial response objectives are to:

- Protect potential residential receptors from exposure to contaminated groundwater migrating from the landfill having chemicals in excess of MCLs, and
- Prevent contaminated groundwater from contributing to the contamination of Plow Shop Pond sediments in excess of human health and ecological risk-based concentrations.

A full evaluation of off-site risks is presently being performed as part of the *Supplemental Groundwater Investigation and Landfill Cap Assessment* (AMEC, 2008). In addition, a separate RI/FS is being conducted for Area of Contamination (AOC) 72 (Plow Shop Pond), for which a work plan is currently in review. Therefore, the performance assessment included in this report is focused on extraction system hydraulics and demonstration of containment of contaminated groundwater in excess of MCLs, while the determination that the overall remedy (inclusive of the landfill cap, Contingency Remedy, and any future actions to mitigate unacceptable risks at AOC 72) is achieving the objectives above will necessarily be made in the future.

Landfill Maintenance and Monitoring

The overall condition of the landfill appears satisfactory with the exception of several settled areas where pooling of water has been observed, and damaged or non-existent fencing in a few locations. Elevated levels of methane and percent lower explosive limit (LEL) were observed in five landfill gas probes (LGPs) (LGP-05-5X, LGP-05-9X, LGP-05-10X, LGP-05-13X, and LGP-

05-14X) on the southern end of the landfill during low barometric pressure conditions. These same LGPs were re-sampled during high pressure conditions and results were consistent with historic data. To enhance the perimeter landfill gas monitoring program quarterly sampling has been recommended and additional gas wells have been proposed to better characterize vadose zone conditions. Landfill gas vent results were generally consistent with historical results and indicate proper landfill gas venting.

Arsenic Treatment Plant Operations, Maintenance and Monitoring

During 2008 the Contingency Remedy groundwater extraction and treatment system was operated at full capacity. Accounting for recycling of filter back wash (sidestream flow), the average extraction rate during operation was 46 gpm for 2008. The system was on-line approximately 81% of the available time during the year. A significant portion of the downtime for 2008 was related to the approved drawdown assessment conducted in February-March, microfilter strainer basket replacement, and air compressor repairs. During routine operations, the largest contributor to downtime is the frequent need for filtered bottom roll-off (FBRO) pumpouts and clean-in-place maintenance on the microfiltration system. Based on total discharge to the POTW, the net average extraction rate for 2008 was 34 gpm.

The arsenic treatment plant (ATP) was extremely effective at removing arsenic from the groundwater. Average influent arsenic concentrations were just under 3,000 micrograms per liter (µg/L) based on periodic sampling. Effluent arsenic concentrations have been consistently low, averaging 1.55 µg/L during the year, well below the target goal of 10 µg/L. Through 31 December 2008, approximately 1,031 pounds of arsenic, 633 pounds of manganese, and 22,355 pounds of iron have been removed from groundwater.

Groundwater Monitoring

In general, arsenic concentrations in the LTMMP wells remain relatively stable or are decreasing, compared to historic levels. Only three wells, SHL-11, SHM-05-41C, and SHM-05-40X, had concentrations greater than historical averages. It should be noted that based on a comparison of filtered and unfiltered sampling results at SHL-19 total arsenic values are related to high turbidity and do not reflect dissolved concentrations. The majority of geochemical data collected to date do not indicate significant changes in redox conditions and arsenic concentrations. However, it should be noted that arsenic concentrations have been trending

downward in near-field monitoring wells SHM-93-22B and SHM-96-5B since system start-up in Spring 2006 with the most significant declines to date in the latest sampling round.

System Performance Metrics and Assessment

Consistent with EPA guidance including *A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems* (USEPA, 2008), a multiple lines of evidence approach was taken with respect to the performance assessment. Four individual assessment components were identified as part of a hydraulic capture zone analysis: gradient vector analysis, capture zone width calculation, comparison to model results, and a drawdown assessment. Two assessment components were identified as part of geochemical monitoring: an advective travel time analysis and a discussion of changes in relevant geochemical conditions. With respect to the hydraulic capture zone analysis, while no single component conclusively demonstrates capture effectiveness, all four indicate some degree of correspondence to the expected aquifer response to pumping. With respect to the geochemical monitoring, the data are encouraging but presently inconclusive. This too is consistent with expectations in that, based on estimated groundwater velocities, it will take many years to 'flush' currently impacted groundwater from areas outside the capture zone. Further, it will likely require additional time for new equilibrium redox conditions (presumably oxidizing) to be established, which in turn are expected to result in declines in arsenic concentration.

Given that a number of monitoring wells upgradient (i.e. SHL-15) or cross-gradient (i.e. SHM-93-10D) from the landfill, and well outside the influence of the groundwater extraction system, exhibit arsenic concentrations in excess of the MCL, the expectation that the Contingency Remedy can achieve the ROD objectives is potentially unrealistic. In particular, both EPA-ORD studies and groundwater flow modeling efforts to date have indicated that the Contingency Remedy does not preclude or significantly reduce groundwater discharge to Red Cove. Therefore, the discharge of shallow arsenic-impacted groundwater to Red Cove, evident in SHL-11 and SHP_01-38A, is expected to persist. Whether this condition poses a risk is to-be-determined via the proposed RI/FS activities for AOC 72, however, these arsenic concentrations are an order of magnitude lower than those in the area north of the extraction wells. Thus, the Contingency Remedy, as presently configured, can be interpreted to contain the majority of arsenic mass being mobilized by landfill-induced reducing conditions and, therefore, the system is considered to be operating as designed.

Recommendations

It is recommended that settled areas where pooling and minor rutting damage has been observed should be repaired (filled, graded & seeded). This work has been initiated and will be completed in 2009. Small trees near the margin of the landfill should be removed and the gas vents painted. The frequency of the perimeter landfill gas monitoring should be increased to quarterly in 2009. Finally, a number of upgrades to the Shepley's Hill ATP process and components, including addition of a bag filter, a contact tank, a larger chlorine dioxide feed pump, and a larger hot water tank, will be implemented to increase treatment capacity and reduce plant downtime.

Future groundwater monitoring should be conducted consistent with the revised LTMMP; however, optimization of the monitoring program is recommended to reduce the numbers of wells and parameters which presently provide nominal performance monitoring value.

1.0 INTRODUCTION

This Annual Report (AR) was prepared by ECC for the U. S. Army to meet the required reporting for the Shepley's Hill Landfill, located at the Former Fort Devens, Massachusetts (Figure 1-1). This AR discusses the operation and maintenance (O&M) of the existing groundwater extraction, treatment and discharge system, groundwater monitoring, and landfill monitoring and maintenance for 2008. These activities were conducted as part of monitoring under the *Revised Long Term Maintenance and Monitoring Plan* (LTMMP) (CH2M HILL, 2007b). In addition, this report includes a revised system performance assessment incorporating results from a revised version of the site groundwater model.

1.1 Background

Shepley's Hill Landfill encompasses approximately 84 acres in the northeast corner of the main post of the former Fort Devens (Figure 1-1). The landfill is bordered to the east and northeast by Plow Shop Pond, to the north by Nonacoicus Brook (which drains the pond), to the west by Shepley's Hill, to the south by recent commercial development, and to the southeast by land formerly containing a railroad roundhouse.

The landfill was reportedly operating by the early 1940s, and evidence from test pits within the landfill suggests earlier usage, possibly as early as the mid-nineteenth century. The landfill contains a variety of waste materials, including incinerator ash, demolition debris, asbestos, sanitary wastes, spent shell casings, glass, and other wastes. Based on boring logs, the maximum depth of the refuse occurs in the central portion of the landfill and is estimated to be about 40 feet below ground surface (bgs). The volume of the landfill has been estimated at over 1.3×10^6 cubic yards (cy) (USAEC, 1995).

The landfill was closed in five phases between 1987 and 1992-93 in accordance with Massachusetts regulations 310 CMR 19.000. The Massachusetts Department of Environmental Protection (MassDEP) approved the closure plan in 1985. The closure consisted of installing a 30-mil and 40-mil polyvinyl chloride (PVC) membrane cap, covered with soil and vegetation and incorporating gas vents. The closure also included installation of wells to monitor groundwater quality around the landfill, and construction of drainage swales to control surface water runoff. MassDEP issued a Landfill Capping Compliance Letter approving the closure in February 1996.

Subsequent to closure, remedial investigations (RIs) evaluated soil, sediment, surface water, and groundwater conditions at and in the immediate vicinity of the landfill. The results confirmed the presence of various contaminants, particularly certain inorganics and volatile organic compounds (VOCs), in groundwater, sediments and surface water at or adjacent to Shepley's Hill Landfill. A Feasibility Study (FS) and Record of Decision (ROD), for Shepley's Hill Landfill Operable Unit, Area of Contamination 4, 5 and 18 (USAEC, 1995) resulted in a remedy that required long term monitoring and maintenance of the existing landfill cap and groundwater monitoring. Table 1-1 lists the relevant COCs and their target cleanup levels. The ROD included a contingency provision, which required that a pump and treat system be installed if groundwater contaminant concentrations (primarily arsenic) did not meet risk-based performance standards over time. Due to continued elevated contaminant concentrations, the Army installed and started operating a groundwater extraction and treatment system (the Contingency Remedy) in 2006 to address groundwater contamination emanating from the northern portion of the landfill. Initially the system was operated at an extraction rate of 25 gpm. In July 2007 the extraction rate was increased from 25 gpm to the full design rate of 50 gpm.

1.2 5-Year Review Status

Stone & Webster Environmental Technology & Services (SWET) conducted the first two years of landfill post-closure monitoring in 1996 and 1997. These first two years of monitoring were included in the first Five Year Review (FYR), Shepley's Hill Landfill, Long Term Monitoring (SWET, 1998) after the final capping of the landfill in 1993. The USACE, New England District conducted the monitoring between 1998 and 2005. In 2000, a comprehensive review for all Devens sites was performed and included in the *Five Year Review Report for Devens Reserve Forces Training Area, Devens, MA* (HLA, 2000) which included monitoring conducted for Shepley's Hill Landfill Operable Unit in 1996 through 1999. A second comprehensive FYR was completed in 2005 (Nobis, 2005) and included monitoring conducted from 1999 through 2004. In this review the Army and EPA deferred the protectiveness statement for the Shepley's Hill Landfill Operable Unit pending completion of Landfill Cap Maintenance and the CSA\CAAA (now referred to as the Supplemental Groundwater and Landfill Cap Assessment for Long-Term Monitoring and Maintenance). The first phase of Landfill Cap Maintenance was conducted in the fall of 2008 and will be completed in 2009. The Draft Supplemental Groundwater and Landfill Cap Assessment for Long-Term Monitoring and Maintenance report was submitted in

December 2008. The next FYR will be completed in 2010 and consequently will be the first to include discussion of the Contingency Remedy.

1.3 Regulatory Context

In accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120(h)(3), federal agencies are required to demonstrate that remedies are "operating properly and successfully" (OPS) prior to deed transfer of federally-owned property (USEPA, 1996a). CERCLA Section 120(h)(3) provides for transfer of property upon which remedial actions have taken place through the issuance of the CERCLA covenant to the property deed that warrants that *(I) all remedial action necessary to protect human health and the environment with respect to any such substance remaining on the property has been taken before the date of such transfer and (II) any additional remedial action found to be necessary after the date of such transfer shall be conducted by the United States (CERCLA 120(h)(3)(A)(ii)).*

Section 120(h)(3)(B), Covenant Requirements, of CERCLA goes on to state:
for the purposes of subparagraph (A)(ii)(I) and (C)(iii), all remedial action described in such subparagraph has been taken if the construction and installation of an approved remedial design has been completed, and the remedy has been demonstrated to the Administrator to be operating properly and successfully. The carrying out of long-term pumping and treating, or operation and maintenance, after the remedy has been demonstrated to the Administrator to be operating properly and successfully does not preclude the transfer of the property.

A remedial action or system is considered to be operating "properly" if it is operating as designed. A remedial system is operating successfully if "its operation will achieve the cleanup levels or performance goals delineated in the decision document (USEPA, 1996a)." As described in the Record of Decision for Shepley's Hill landfill (USAEC, 1995), the remedial response objectives are to:

- Protect potential residential receptors from exposure to contaminated groundwater migrating from the landfill having chemicals in excess of MCLs, and
- Prevent contaminated groundwater from contributing to the contamination of Plow Shop Pond sediments in excess of human health and ecological risk-based concentrations.

The *Supplemental Groundwater Investigation and Landfill Cap Assessment* (AMEC, 2009) was initiated by the Army in 2005 to assess the adequacy of the landfill cap and the overall remedy at mitigating risks. The initial phase of this effort is focused on the area north of the landfill beyond the capture zone of the groundwater treatment system and the potential impacts associated with elevated arsenic concentrations in groundwater. Subsequently, the Red Cove area of Plow Shop Pond is to be addressed as part of the RI/FS for Area of Contamination (AOC) 72. In addition, USEPA's Office of Research and Development (ORD), has been conducting independent detailed investigations of the physical and geochemical processes related to arsenic accumulation in Red Cove.

The working hypothesis in these assessments is that the distribution of arsenic in groundwater is closely related to reducing conditions, which persist to the north of the landfill footprint to beyond W. Main St. and in groundwaters converging on Red Cove. With implementation of the Contingency Remedy, the source of reduced groundwater emanating from the landfill is presumably being contained; however, groundwater geochemistry and specifically redox conditions downgradient may not adjust to new equilibrium conditions within a reasonable timeframe necessary to achieve the MCL for Arsenic. Therefore, the performance assessment included as Section 5 is focused on extraction system hydraulics and demonstration of containment, while the determination that the overall remedy is "operating properly and successfully" will be addressed in the future, based on the *Supplemental Groundwater Investigation and Landfill Cap Assessment* (AMEC, 2009) and the subsequent AOC 72 reporting.

1.4 Objectives

2008 was the second year of monitoring under the revised LTMMP (CH2M HILL, 2007b) and the first complete year of operation of the Contingency Remedy at the target design rate of 50 gpm. The objectives of this Annual Report are as follows:

- Summarize landfill maintenance activities.
- Document landfill cap inspection to identify areas requiring future maintenance.
- Present landfill gas measurements at 18 gas vents and 13 permanent landfill perimeter gas monitoring wells to establish long-term trends with regard to gas production and venting.

- Summarize operations, maintenance, sampling, and reporting associated with the arsenic treatment plant (ATP) and provide recommendations for any modifications.
- Present results from LTMMP wells for groundwater elevations, laboratory geochemical analyses including COC concentrations, and field parameters to compare to cleanup levels established in the ROD.
- Advance the initial assessment system hydraulic performance presented in the 2007 AR, based on additional data collected in 2008 and the revised numerical model of groundwater flow developed as part of the *Supplemental Groundwater Investigation and Landfill Cap Assessment* (AMEC, 2009).

1.5 Report Organization

Section 2 of this report documents the routine landfill maintenance and inspection activities, and also includes the results of gas monitoring in both gas vents and perimeter soil gas wells. Section 3 of this report presents the ATP operations, maintenance, and monitoring. Section 4 summarizes the LTMMP groundwater monitoring resulting including synoptic water levels, arsenic concentrations and other water quality data. Section 5 presents the updated system performance assessment at the design rate of 50 gpm. Finally, Section 6 presents conclusions and recommendations for future system operations, monitoring, and assessments.

2.0 LANDFILL MAINTENANCE AND MONITORING

From March to November 2008, ECC conducted gas vent and soil gas probe sampling and in December 2008, performed a walk-over inspection of the landfill. This annual sampling and inspection is conducted to detect and correct problems such as erosion, settlement, or movement of soil on the cap, and to evaluate the effectiveness of the cap vent system. A summary of landfill cap maintenance, findings of the inspection and sampling are presented in the following sections. The landfill inspection checklist and supporting figures are presented in Appendix A.

2.1 Maintenance

In September and October of 2008 the landfill cap was mowed to an approximate height of 4 inches. The mowing event lasted approximately three weeks and included all areas within the landfill boundary with the exception of the extreme southeastern portion of the landfill (see Figure A-1). This area is primarily covered with loess, sandy soil that doesn't support good vegetative growth. A large area directly north of this area (adjacent to the landfill boundary) is being used for the staging of soil from nearby construction activities. In December 2008, filling of depressions on the landfill in accordance with past AR recommendations was initiated however work was stopped due to weather and will be completed in 2009. In addition, several areas within the drainage swales surrounding the landfill were cleared of minor vegetation/shrub/tree growth.

2.2 Inspection

The Shepley's Hill Landfill was inspected on 29 December 2008. Features of the landfill that were inspected included the cap, drainage system, gas vent system, access roads, monitoring wells, piezometers, and security fence. Observations were made regarding the vegetative cover, vegetation types, erosion, settlement, and general conditions. The overall condition of the landfill appears satisfactory with the exception of several subsidence areas where ponding of water is frequently observed. A summary of the findings are presented in the following text and detailed inspection findings are presented in the Landfill Inspection Report in Appendix A.

Monitoring Wells: Inspection of the wells revealed no damage to the protective casings or caps, and the wells are in good condition.

Piezometers: Inspection of the piezometers revealed no damage to the protective casings or caps, and the piezometers are in good condition.

Cover Surface: No large (greater than 100 square feet) bare spots were observed, and there was no evidence of surface disruption caused by frost heaves.

Vegetative Growth: Overall, the vegetative cover appears to be in good condition. In a few locations, small trees have begun to grow near the margins of the landfill and should be removed.

Landfill Gas Vents: No damage to gas vents was observed, and no gas being vented could be visually detected. The non-galvanized vents are exhibiting rust and should be re-painted.

Drainage Swales: All drainage swales appeared to be in good condition. Several swales were without rip rap protection but did not exhibit any erosion. Substantial vegetative growth was observed in many places which should be removed.

Culverts: Culverts all appeared to be in good operating condition without the need for repair or clean-out.

Catch Basins: Catch basins were all in good operating condition without the need for clean-out, and there appears to be proper grading around the rims with the exception of Catch Basin #3 near the entrance to the site. The rim of this catch basin should be lowered to meet the surrounding grade. Catch Basin #2 has a broken grate but otherwise is functioning properly.

Settlement: There are many areas across the landfill where settlement has caused depressions to exist. These depressions have been observed after rainfall to hold water which indicates that the integrity of the cap is sound. However, these depressions should be filled and graded to conform to the slope of the surrounding landfill surface, a task that was initiated in December 2008 and will be completed in 2009.

Erosion: No erosion was noted anywhere over the landfill surface.

Access Roads: At the time of the inspection all access roads were in good condition. Minor erosion/rutting exists on the access road over the north end of the landfill; the roadway is in very

good condition from the soil staging area at the east center of the landfill south all the way to Cook Street.

Security Fencing. The fencing surrounding the site is in places non-existent, and along the western boundary where the fence runs over Shepley's Hill several tree falls have destroyed the fence. Along the eastern boundary there is a new railroad spur line that breaches the fence, and the fence is non-existent along much of the southern boundary. In general, there is open public access to the landfill from the western and southern portions of the site, though all access roads to the landfill are gated and locked.

Wetlands Encroachment: Wetland encroachment is taking place at several locations, but is not happening on a wide scale and individual areas of encroachment are all small. Wetland encroachment should be controlled by simple mowing in some areas, and by clearing channels in other areas.

Photographs taken during the landfill inspection are included in Appendix A.

2.2.1 Recommendations

The work to repair settled areas where ponding and minor rutting damage has been observed should be completed in 2009 (filled, graded & seeded). In addition, the small trees near the margin of the landfill should be removed and the gas vents painted.

2.3 Landfill Gas Monitoring

On 29 and 30 September 2008, annual sampling of all the gas vents and landfill gas probes (LGP) (adjacent to the cap) was completed (See Figure A-1 for locations). The method used for landfill gas sampling is the procedure described in the MADEP Landfill Technical Guidance Manual. The equipment that is typically used consists of a LandTech Gem 2000+ for reading carbon monoxide, carbon dioxide, hydrogen sulfide, oxygen, methane and LEL; and a Mini-Rae PID for total volatile organic compounds. The sampling device is connected directly to the sampling port at the top of the probe/vent to read initial levels of gas concentrations. After the initial readings the probes are purged of two (2) well volumes as suggested in the MADEP Landfill Technical Guidance Manual. After the probe is purged the gas sampling equipment is connected directly to the sampling port and the gas concentrations are read again. Sampling included the following parameters:

- Total Volatile Organic Compounds (ppm)
- Percent oxygen
- Hydrogen sulfide concentration (ppm)
- Percent lower explosive limit (LEL)
- Carbon monoxide concentration (ppm)
- Percent carbon dioxide
- Percent methane

Results of the annual Landfill Gas Monitoring, including supplemental sampling of selected LGPs, are presented in Appendix B and are discussed in the following sections.

2.3.1 Perimeter Gas Monitoring

Results from the September 2008 LGP sampling indicated the presence of elevated levels of methane and percent lower explosive limit (LEL) in five LGPs (LGP-05-5X, LGP-05-9X, LGP-05-10X, LGP-05-13X and LGP-05-14X) on the southern end of the landfill that were inconsistent with the majority of historical data from previous sampling events (though similar elevated readings were observed in three LGPs in 2007). The elevated levels of methane/LEL were not found upon resampling two weeks later. Three subsequent sampling events in October and November found that methane/LEL is elevated in these probes during periods of low atmospheric pressure weather conditions and return to low/ND levels immediately after atmospheric pressure had increased to normal levels. Results of this sampling effort are summarized in a Technical Memorandum to Robert Simeone from Fred Santos and Willard Murray dated 12 November 2008 (Appendix B). This memo concludes that the elevated %LEL and methane gas levels are transient events and only persist for a short time while low barometric pressure resides over the landfill; furthermore the distance that landfill gas migrates away from the landfill during these low pressure events is less than 10 feet from the LGPs based on manual probing of shallow soil on 7 November 2008.

To further evaluate the potential for landfill gas migration, quarterly LGP sampling has been recommended in the Supplemental Landfill Gas Monitoring Well work plan (ECC, 2008b). In addition, a review of the existing LGP network indicates that existing LGPs are shallow and do not monitor the full thickness of the unsaturated zone. Therefore, installation of additional gas

wells in both the southern and northern boundary areas has also been recommended. Future sampling frequencies will be re-assessed in subsequent ARs.

2.3.2 Landfill Gas Vent Results

Several vents in the southern section of the landfill exhibited high levels of methane (>10%), carbon dioxide (>15%) and LEL (>100%). However, no vents showed presence of any VOCs or hydrogen sulfide. Oxygen levels ranged from 1.5% (GV-14) to 21.9% (GV-1, GV-4 and GV-11), with the lowest O_2 levels principally observed in vents exhibiting high levels of methane and %LEL. Landfill gas vent results were fairly consistent with historical results and indicate proper landfill gas venting.

3.0 ARSENIC TREATMENT PLANT OPERATIONS, MAINTENANCE AND MONITORING

The Shepley's Hill Arsenic Treatment Plant (ATP) treated and discharged approximately 18.0 million gallons of groundwater from 1 January through 31 December, 2008, bringing the cumulative discharge total to approximately 37.9 million gallons since system startup.

The operations, maintenance and monitoring history for the ATP for the period from 1 January 2008 through 31 December 2008 is presented in the following sections.

3.1 Operations

The following sections describe the ATP operations and system efficiency for the reporting period.

3.1.1 System Description

The ATP consists of the following major components:

- Two extraction wells
- Chlorine dioxide generator and dosing system
- Ferric chloride dosing system (currently not in use)
- Microfiltration skid
- Solids removal and dewatering system

Groundwater is pumped into the ATP via two extraction wells, each with the capacity to pump up to 50 gpm. The extraction wells are located at the northern border of the landfill cap and can be operated independently or in tandem to a maximum total influent flow of 50 gpm.

Groundwater from the extraction wells enters the ATP through a manifold where the flow is combined into a single influent waste stream. ATP influent is dosed with chlorine dioxide to oxidize inorganics (primarily iron, arsenic, and manganese). The oxidized inorganics quickly form precipitates which can be filtered out of the waste stream by the microfiltration system. Filtrate from the microfiltration system is pumped into an effluent sump which then pumps the treated water into the Devens Publicly Owned Treatment Works (POTW) collection system.

It is noted that the ATP also has a ferric chloride dosing system. The original design requires that the ATP influent contain approximately 40 parts per million (ppm) of iron to effectively precipitate and coagulate arsenic. However, current influent characteristics show iron concentrations well above the necessary level, therefore the ferric chloride system is not currently in use. Influent iron concentrations are monitored quarterly to ensure sufficient iron is present in the influent. If necessary the ferric chloride system can be activated.

The microfiltration system is periodically backwashed to clear the filtered precipitates from the filter membranes. Backwash solution is pumped into the solids removal system where the precipitates are allowed to settle in an inclined plate clarifier (IPC), the settled solids (sludge) is then conditioned with polymer and pumped into a filtered bottom roll-off (FBRO) for further dewatering. Supernatant from the IPC and leachate from the FBRO are periodically pumped back into the influent manifold.

Historical monthly treatment totals are shown in Table 3-2.

3.1.2 System Efficiency

During 2008 the treatment plant was operational approximately 81% of the available time. A significant part of the downtime was due to routine plant maintenance, primarily emptying sludge from the filter bottom roll-off (FBRO) and performing clean-in-place (CIP) maintenance on the micro-filtration skid. In addition to routine shutdowns, three specific events also contributed to plant downtime. The plant was off-line for approximately 140 hours for the approved Drawdown Assessment completed in February 2008, 260 hours to conduct air compressor maintenance, and 164 hours for the replacement and upgrade of the micro-filter strainer basket. The plant was also shutdown on three different occasions (70 hours total) at the request of the Massachusetts Development as they completed repairs and upgrades to their POTW collection system. A summary of on-line hours, flow totals, and operating status for each month is shown in Table 3-1.

The ATP system continues to generate a significant amount of sludge, requiring the FBRO to be emptied after treating approximately 900,000 gallons of groundwater, which is approximately every 15 days of continuous operations. The FBRO pumpout process requires the ATP be shutdown the day prior to the pumpout to allow excess leachate to drain from the FBRO. A subcontracted vendor uses a vactor truck to vacuum the dewatered sludge from the roll-off.

The sludge is transported to a secure landfill for off-site disposal. Once the FBRO pumpout is completed, the ATP is restarted. The typical downtime from an FBRO pumpout is approximately 24-36 hours.

The primary cause of the high sludge generation is the high concentration of inorganics (primarily iron) in the influent. Influent concentrations have decreased slightly since startup of the ATP, however the combined inorganic concentrations (iron, arsenic, and manganese) remains high at approximately 68 parts per million (ppm). Influent inorganic loading is discussed in more detail in Section 3.3.1. The FBRO pumpout history is shown in Table 3-3.

The ATP microfiltration system continues to require frequent clean-in-place (CIP) maintenance. CIPs are necessary when the microfiltration membranes become fouled and require increase pressure to pump the waste water through the system. CIPs are required approximately every two weeks and are typically scheduled in conjunction with the FBRO pumpouts in order to minimize downtime. However, several factors influence how effective the CIP procedures are and how often they are necessary.

Since startup, several different CIP processes have been tested and refined to determine the most effective approach. Current CIPs consist of closed-loop flow through the membrane modules with a solution of sulfuric and citric acid, combined with periodic air sparging of the filter modules. The solution is recirculated for approximately 8 hours, and then allowed to soak overnight. The microfiltration system is then drained and rinsed, and the process is repeated with a solution of caustic soda and sodium hypochlorite. This solution is recirculated for approximately 4 hours (no over night soak). The process is greatly influenced by how fouled the membranes were prior to the CIP, the amount of time the solutions are allowed to soak and by the temperature of the solution.

Effective CIPs typically result in the system being able to run approximately 15 days before another CIP is required. Approximately every other month an extended (prolonged soak) or double CIP (acid solution recirculation/soak repeated after caustic solution recirculation) is required to regain full recovery.

The CIP process continues to be evaluated and refined to improve the process and minimize downtime.

3.2 Maintenance

This section details several system maintenance highlights encountered or implemented during the year.

3.2.1 Air Compressor Repair and Oil Upgrade

In June 2008 the air compressor began repeatedly overheating. The service vendor discovered that the food grade oil (recommended by the microfilter vendor) was deteriorating faster than expected and was causing the compressor to overheat. In addition, it was discovered that when the compressor was idle for extended periods, the food grade oil would "varnish". This condition eventually resulted in significant damage to several of the air compressor components. In October 2008 the air compressor failed again, which required the GWTP to be shutdown for several days to replace the temperature switch, thermovalve, and screw element on the compressor. At this time, the air compressor vendor agreed that upgrading the oil from food grade to synthetic oil would have no negative impacts on the microfilter. The compressor system is equipped with dual air reservoirs and redundant filters that will prevent any oil particles from entering the supplied air and contaminating the microfilter membranes. The air compressor has run without incident since the oil was upgraded.

3.2.2 Microfilter Strainer Housing Replacement and Bypass

In July 2008 the original microfilter strainer housing began leaking due to corrosion from repeated exposure to the harsh CIP conditions. Temporary repairs were made and replacement housing was ordered. The housing was replaced on 25 July 2008. On 5 August 2008, during a CIP procedure, the replacement housing ruptured due to severe corrosion. The original (repaired) housing was re-installed to allow the system to stay on-line. The housing vendor inspected the failed replacement housing and determined that portions of the housing were not properly coated at the factory, thus a new replacement housing was ordered. The vendor also recommended that a bypass line be installed so the housing would no longer be exposed to the harsh CIP conditions. (Note: The strainer housing is only in use when the microfilter is treating water; during CIP process the strainer is not used but is still exposed to the CIP solution). On 20 August 2008 the bypass line was completed. The bypass line allows the strainer housing to be isolated from the harsh solution during CIPs, as a result no further corrosion issues are expected. The new strainer housing was received and installed on 10 October 2008.

3.2.3 Chlorine Dioxide Control Valve and Actuator

On 20 March 2008 the chlorine dioxide feed valve actuator was replaced with an upgraded model. The original chlorine dioxide feed valve model had been discontinued and the replacement model was not compatible with the original model actuator. The feed valve typically needs replacement every 6 months, when the original model valve was no longer available, the actuator needed to be replaced.

The chlorine dioxide system is operating at maximum capacity. The original chlorine dioxide feed pump was sized properly for the original application. The pump could easily deliver >2 gpm at a designed head of approximately 15 feet. In September 2005, during plant startup it was necessary to install an eductor on the influent pipe which created additional head pressure. This did not negatively affect the plant when operating at 25 gpm as the pump was not required to operate at full capacity. However, when the plant flow was increased to 50 gpm the head on the influent pipe was increased to more than 40 feet. At this pressure the chlorine dioxide feed pump struggles to maintain the necessary flow when the microfilter is operating at 53 gpm. On 27 October 2008 an upgraded chlorine dioxide control valve, which has a larger flow control orifice and therefore slightly reduced head pressure, was installed. The upgraded valve allows sufficient chlorine dioxide flow when the microfilter is operating at 53 gpm.

3.2.4 Repair and Re-Piping of Effluent Pump P-511

On 6 February 2008 the impeller and mechanical seal were replaced on Effluent Pump (P-511). In addition, the pump was re-piped and the check valve re-located to the bottom of the suction pipe. The original piping design had the check valve located on the discharge side of the pump. This condition resulted in the pump losing prime each time the pump shut off. The pump would re-prime when it turned on, but the re-priming caused undue strain and wear on the impeller and seal, ultimately causing the seal to leak and the pump to lose capacity. The pump has operated with out incident (and retains prime when off) since the changes were implement. (Note: The alternate Effluent Pump, P-512, has the check valve located properly at the bottom of the suction pipe. The re-piping on P-512 was performed shortly after startup by CH2M Hill when the pump would not self-prime. At that time P-511 would self-prime so the piping was not changed.)

3.2.5 Wellfield Maintenance

During the period of performance for this report no well field maintenance was performed or required. Both extraction wells continue to operate at designed flow with no problems observed.

3.3 Monitoring

The following sections detail the ATP sampling for arsenic and other contaminants of concern.

3.3.1 Influent Inorganic Sampling

Influent inorganic loading characteristics are assessed quarterly. Influent inorganic sampling is not required by either the discharge permit or by the LTMMP, but is periodically monitored to gauge system loading and to ensure that a sufficient iron concentration is maintained to promote iron and arsenic precipitant coagulation. (Note: As previously discussed, CH2M Hill Technical Memorandums during startup recommend a minimum iron concentration of 40 ppm. Influent iron concentration remains well above this level; however the ATP has the ability to add ferric chloride to the influent if necessary).

The total inorganic loading (iron, arsenic, and manganese) has slightly declined since system start-up, but remains high, averaging 68.56 ppm for 2008. Individual average concentrations for iron, arsenic and manganese were 63.63, 3.00, and 1.94 ppm respectively. Influent loading concentrations of iron, arsenic and manganese are shown in Table 3-4 and graphically illustrated in Figure 3-1.

3.3.2 Effluent Arsenic Monitoring

In accordance with the ATP's discharge permit, monthly effluent arsenic samples were collected each month throughout the year. Monthly sampling results are shown in Table 3-5.

Overall the plant has been extremely effective at removing arsenic from the groundwater. Effluent arsenic concentrations have been consistently low, averaging 4 ppb during the year, well below the permit level of 150 ppb. Through 31 December 2008 the ATP has removed approximately 1,031 pounds of arsenic from the treated groundwater.

3.3.3 Other Sampling Results

The discharge permit required quarterly sampling was conducted on 6 March 2008, 17 June 2008, 10 September 2008, and 2 December 2008. The required annual sampling was conducted concurrent with the 10 September 2008 event. All sampled parameters were within discharge limits. Quarterly and Annual sampling results are shown in Tables 3-6 and 3-7, respectively.

As required by the LTMMP, annual methane and volatile organic compounds (VOC) sampling of the plant influent was conducted. Results from methane sampling conducted on 10 September 2008 indicated a methane concentration of 14.5 ppm in EW-01 and 10.4 ppm in EW-04. Results from VOC sampling conducted on 2 October 2008 are presented in Table 3-8. Detections of low concentrations of VOCs were consistent with previous years sampling results.

3.3.4 Discharge Permit Modification

No discharge permit modifications were made during 2008. The current permit, issued by Massachusetts Development, expires on 28 June 2010.

3.4 Evaluation of Treatment Plant Capacity

The plant was operated at 50 gpm for 2-3 days in January 2006 for chlorine dioxide dosage and residual testing. From startup through July 2007, the plant discharge permit was limited to 25 gpm. In July 2007 the discharge permit was increased to 50 gpm and in August 2007 the plant flow was increased to maximum filtration capacity. As a result of operating the plant at the higher flow rate, several limitations were discovered that prohibit the plant from operating consistently and efficiently at an average flow of 50 gpm. The specific limitations and conclusions are described below.

3.4.1 Chlorine Dioxide Feed Pump

The original chlorine dioxide feed pump was sized properly for the original application. The pump could easily deliver >2 gpm at a designed head of approximately 15 feet. During startup, it was necessary to install an eductor on the influent pipe, which created an additional 20 feet of head. This didn't negatively affect the plant when operating at 25 gpm, as the pump was not required to pump a full capacity. However, when the plant flow was increased to 50 gpm the head on the influent pipe was increase to >40 feet. The pump struggles to maintain the

necessary chlorine dioxide dosing when the microfilter is operating at 53 gpm. Any increase in flow or chlorine dioxide dosing rate will require the pump to be upgraded.

3.4.2 CIP Frequency

During startup, it was determined that the CIP frequency would likely be approximately once a month at a flowrate of 25 gpm. At an increased flow rate the CIP frequency has increased to approximately once every 2-3 weeks, which results in considerably more plant downtime.

3.4.3 Lack of Sufficient Hot Water for CIPs

The recommended CIP process requires approximately 120 gallons of water at 90° F. The original water tank has a capacity of 6 gallons, which is not adequate for the application. The lack of sufficient temperature can be compensated for by extending the soaking time of the CIP solution. At the recommended temperature the anticipated (according to the microfiltration vendor) CIP time is approximately 8-10 hours. Currently, the approximate CIP time is about 30 hours. An adequate hot water source could drastically reduce the shutdown time necessary to complete CIPs.

3.4.4 FBRO Pumpout

During startup it was determined that the FBRO pumpout would need to occur approximately every 4-5 weeks at a flow rate of 25 gpm, which is roughly about 1.2 MG of treated groundwater. At an increased flow rate, not only does the plant generate more sludge, but the FBRO rolloff fills at a faster rate as a result of the increase pumping rate into the FBRO and the reduced time for drainage. At the increased flow rate, the FBRO needs to be pumped out approximately every 15 days or 0.95 MG of treated water. This results in more shutdown time for the ATP.

3.4.5 Increased Sidestream Volume

During startup, the plant microfilter was operated at approximately 28 gpm and was backwashed approximately every 42 minutes. This resulted in approximately 39,000 gallons of treated water with 2,100 gallons of sidestream flow, about 5%.

At a flow rate of 52 gpm, the higher pressure and reduced retention time result in the microfilter fouling at a higher rate, which requires more frequent and higher volume backwashes.

Operating at 52 gpm, the microfilter is backwashed every 12 minutes. This results in approximately 67,000 gallons of treated water with 7500 gallons of sidestream flow, about 11%.

In summary, at the increased flow rate the treatment plant is much less efficient. Sidestream volume is recycled into the plant influent and is retreated, effectively reducing the capacity of the plant.

3.5 Recommendations

Recommendations for improvements to increase the average ATP flow rate to approximately 50 gpm are described below.

3.5.1 Upgrade Chlorine Dioxide Feed Pump

As previously stated, the current chlorine dioxide pump is undersized for the current application and is operating at peak capacity. Upgrading the pump would allow more of a margin for proper chlorine dioxide dosing at the current and proper dosing at a higher rate of flow.

3.5.2 Increase System Retention Time

Currently the system has virtually no retention time (less than a minute) prior to the oxidized groundwater contacting the microfilter membranes. Grab samples have shown that even a short retention time of 5 minutes enhances the oxidation process, creates a better precipitant and reduces colodial solids. According to the microfiltration vendor, colodial solids quickly foul the membranes, resulting in more frequent backwashing. Adding a small (330 gal.) contact tank & mixer would decrease the fouling load, which would result in less backwashing (sidestream) and less CIPs (downtime). Installation of this contact tank is recommended and scheduled to be completed in March 2009.

3.5.3 Direct Discharge of Sidestream Volume

At the current maximum flowrate, the plant generates approximately 7,600 gallons per day of sidestream water (backwash), which is pumped back into the plant influent (reducing pumped volume from the wells). It may be possible to use bag filters to remove any residual solids from the Inclined Plate Clarifier (IPC) supernatant and direct discharge this volume directly into the plant effluent. Previous sampling data showed the filtered IPC supernatant (10 micron filter) contained approximately 350 ppb of As, if discharged with the existing plant effluent the

resulting effluent concentration would be around 40 ppb, which is below the discharge permit level of 120 ppb but exceeds an action level of 30 ppb that would trigger weekly sampling.

Recent improvements to the IPC have resulted in a better quality supernatant. Using a 5 micron (or even a 1 micron) bag filter would reduce the arsenic concentration in the sidestream water. Reducing the sidestream water arsenic concentration to around 100 ppb (or less) would result in an effluent concentration of approximately 12 ppb, which is well below the discharge permit level of 120 ppb. Installation of this bag filter is recommended and scheduled to be completed in March 2009.

3.5.4 Sufficient Hot Water Heater

A properly sized hot water tank, capable of providing sufficient volume and temperature of CIP solution would increase the effectiveness of CIPs, decrease the amount of time necessary to perform CIPs, and thereby increase total plant throughput. Installation of a larger hot water tank is recommended and scheduled to be completed in March 2009.

3.5.5 Evaluate Alternative Filtration Options

In response to the MCL for arsenic being lowered to 10 ppb for drinking water, several vendors have recently developed new technologies for achieving this level in drinking water supplies. The application at the Shepley's Hill ATP presents some unique challenges (extremely high inorganic loading), which limit the effectiveness and practicality of these technologies. However, as viable alternative treatment options become available, ECC will evaluate and recommend promising methods for potential bench and/or pilot scale testing.

4.0 GROUNDWATER MONITORING

Groundwater monitoring activities were conducted in accordance with the LTMMP (CH2M Hill, 2007b) for the period of 1 January 2008 through 31 December 2008. The details and results of these sampling events are presented in the following sections. Field forms for water levels and groundwater sampling are provided in Appendix C and analytical data validation reports are provided in Appendix D.

4.1 Groundwater Elevations

Groundwater level measurements at Shepley's Hill Landfill wells were collected as part of site-wide monitoring events on 16 April and 30 September 2008. Table 4-1 provides the relevant characteristics of the LTMMP monitoring well network including the geological unit(s) the well is screened in and screen depths or elevations. Figure 4-1 displays the locations of these wells, color coded by sampling frequency. Groundwater elevations for both sampling rounds are listed in Table 4-2. Groundwater elevations measured in April were on average one half foot higher than those in October. Contour maps of watertable elevation on 16 April and 30 September are presented in Figures 4-2 and 4-3. While precipitation was generally above average for much of 2008, as reflected in the increasing water levels (in 54 of 70 wells), the geometry of the watertable surface in both spring and fall is similar to that observed in previous years.

4.2 Geochemical Results

LTMMP monitoring wells were purged and sampled in accordance with EPA's guidance for low stress purging and sampling (U.S. EPA, 1996b & 2002). Samples for the Spring (April) and Fall (October) events were analyzed for inorganics and general water quality parameters.

4.2.1 Laboratory

Table 4-3 provides a summary of laboratory analytical and field parameter data collected from the April and October 2008 sampling events. The laboratory analytes include arsenic, iron, manganese, and a suite of cations including calcium, magnesium, potassium, and sodium. In addition, other general chemistry parameters include turbidity, alkalinity, chloride, nitrogen (as nitrate), and sulfate. Values that exceed the cleanup levels established in the ROD are highlighted in Table 4-3.

In-situ geochemical water quality measurements collected in conjunction with the "quarterly snapshot" sampling are presented in Table 4-4. Quarterly snapshots supplement in-situ field parameters collected as part of semi-annual sampling events to provide additional data to assess trends in the nearfield area. Parameters include pH, specific conductivity (SPC), dissolved oxygen, temperature, and oxidation reduction potential (ORP). A summary of historical arsenic results at selected LTMMP wells is presented in Table 4-5. Arsenic (the primary COC) trends are discussed in Section 4.2.1.1, while ORP results (the primary indicator of redox conditions controlling arsenic mobility) are summarized in Section 4.2.2.

These data are being used to evaluate geochemical conditions as they change with operation of the Contingency Remedy, primarily downgradient of the wellfield. However, data were collected in other areas to provide a baseline of upgradient conditions. In general, nearfield and downgradient wells, in close proximity to the extraction wells, have not yet shown significant increases in ORP since the Contingency Remedy pumping rate was increased to the full 50 gpm design rate. However there have been notable systematic decreases in arsenic concentrations in some downgradient wells, as discussed below. Though conditions appear to be improving, additional data needs to be collected to determine if trends persist over time.

4.2.1.1 Arsenic Results

Arsenic was detected above its cleanup level in 28 of 38 monitoring wells sampled at the site during the 2008 sampling events, down from 31 wells in 2007. Figure 4-4 presents arsenic results for the 2007 and 2008 semi-annual sampling events. Historic arsenic data through 2008 for selected monitoring wells are provided in Table 4-5 and also plotted in chart form for selected wells in Appendix E. In general, arsenic concentrations in some wells have been relatively stable or decreasing, compared to historic levels. Only the following wells in 2008 were reported to have concentrations greater than historical averages: SHL-11, SHM-05-41C, and SHM-05-40X. As the latter two wells are in the downgradient area, well outside the extraction well capture zone, these results indicate the leading edge of the plume is still advancing.

The 2007 AR (ECC, 2008a) suggested the elevated arsenic concentration (885.1 µg/L) at SHL-19 observed in October 2007 was related to turbidity and recommended both filtered and unfiltered samples be collected during the October 2008 sampling round. Based on comparison

of the results for filtered (28 µg /L) and unfiltered (173.6 µg /L) samples, it is concluded that dissolved arsenic concentrations are considerably lower than previously thought at this location.

Arsenic concentrations at SHM-93-22B have continued to display a downward trend since the Spring 2006 sampling round. Overall, arsenic levels at nearby well SHL-96-5B also appear to be on a downward trend since its historical maximum of 5,110 µg/L in May 2000. This general pattern is interpreted to be related to the operation of the extraction wells; however, observations over a longer period will be necessary to confirm and better define these trends.

During the 2008 spring sampling event, SHM-05-41B and SHM-93-22B had the highest concentrations of arsenic at the site (2,349 and 1,721 µg/L respectively). Notably SHM-05-41B and SHM-93-22B are screened at similar depths in the sand/till unit located just above bedrock. During the 2008 fall sampling event, well SHM-05-40X had the highest concentration of arsenic, 4,920 µg/L, which is also the historical maximum for that well but similar to prior levels. During both sampling rounds in 2008, arsenic levels at SHL-8S and SHL-8D were below 1 µg/L. This is noteworthy because during the October 2007 sampling round, both wells had first time detections in excess of 10 µg/L. It is suspected that both detections were anomalies, however further observations will be necessary to validate this assumption.

4.2.1.2 Other COCs Results

The other COCs detected at concentrations above cleanup levels were iron, manganese, and sodium (Table 4-3). Wells that had concentrations of manganese above the cleanup level of 1,715 µg/L were: N-5 P-1, SHL-11, SHL-19, SHL-22, SHM-05-39A, SHM-05-39B, SHM-05-41B, SHM-05-41C, SHM-05-42B, SHM-93-22B, SHM-96-5B, SHM-96-5C, SHM-99-31C, SHM-99-32X, AND SHM-99-29X. The maximum value detected for manganese was 10,800 µg/L at SHM-96-5B in October 2008. Wells that had concentrations of sodium above the cleanup level of 20,000 µg/L were: SHL-13, SHL-20, SHL-22, SHM-05-39B, SHM-05-41C, SHM05-42B, SHM-93-22B, SHM-96-5B, SHM-96-5C, SHM-99-32X, and SHM-01-36X. The maximum value detected for sodium was 83,000 µg/L at SHM-05-39B in October 2008. Concentrations of iron above the cleanup level of 9,100 µg/L were detected at 19 wells with a maximum value of 100,000 µg/L at SHM-05-41B in April 2008. Filtered and unfiltered samples were collected at well SHL-19, both of which exceeded the standards for iron and manganese.

Similar to arsenic, trends iron and manganese concentrations are evident that may or may not be related to changes to the flow system resulting from Contingency Remedy operation. Wells in which both parameters appear to be decreasing include: SHL-20, SHL-4, SHL-5, SHM-05-39B, SHM-05-41A, SHM-93-22C, SHM-96-5C, SHM-99-31B, and SHM-99-31C. Of these wells, SHL-20, SHM-05-39B, SHM-05-41A, SHM-93-22C, SHM-96-5C, and SHM-99-31B have also exhibited arsenic declines in the most recent samples. Wells in which iron or manganese appear to be increasing include: SHL-13, SHL-15, SHL-22, SHM-05-40X, SHM-05-42B, and SHM-93-10D. Of these wells, SHL-15 and SHM-05-40X have also exhibited arsenic increases in the most recent samples.

4.2.2 Field Parameters

In-situ geochemical water quality measurements collected in 2008 are presented in Tables 4-3 and 4-4. While this sampling is conducted quarterly, the fourth round for 2007 was actually collected in January 2008. Therefore, the fourth quarter 2007 and first quarter 2008 rounds were combined, and the results are presented in this report. Future monitoring will adhere to the Jan-Apr-Jul-Oct schedule now established.

ORP is a particularly significant field parameter at Shepley's Hill Landfill. Since arsenic and iron are mobilized by reducing conditions, be they landfill-induced or due to natural conditions (i.e. peat deposits), higher concentrations are expected in locations where ORP values are negative. Arsenic concentrations and field ORP measurements from 2008 are listed in Table 4-3. As previously noted, the majority of samples with arsenic above 10 ug/L also have negative ORP values. One notable exception is SHL-15 which is upgradient of the landfill and considered a background well, yet presently has arsenic concentration of 75 ug/L. Other exceptions to this trend may reflect transition areas or seasonal influences.

Downgradient area wells that have negative ORP values include SHM-99-32X, SHM-99-31B, SHM-99-31C, SHM-05-39A, SHM-05-39B, SHM-05-40X, SHM-05-41B, SHM-05-41C, and SHM-05-42B. Nearfield area wells with negative ORP values include SHL-9, SHL-22, SHM-93-22B, SHM-93-22C, SHM-96-5B, and SHM-96-5C. Pond area wells with observed negative ORP values include SHP-01-38A, SHP-01-36X, and SHP-01-37X. Five upgradient area wells had negative ORP values: N-5 P-1, N-5 P-2, SHL-11, SHM-93-10C, and SHM-93-10D.

4.3 Proposed Monitoring Program Optimization

As part of the technical analysis for 2008 an evaluation of historical analytical results and the function each individual well serves in that program was performed. The objective of this evaluation was to categorize each well in terms of purpose and usefulness with respect to analytical monitoring and thereby optimize the program without compromising the data quality objectives. Based on this evaluation it is recommended that select monitoring wells be considered for omission from the LTMMP program moving forward if they meet the following criteria:

- Are not located downgradient of the landfill
- Have a consistent history of Arsenic concentrations at background levels
- Are providing little value in terms of bounding the plume

Eight wells which appear to meet these criteria include: SHL-21, SHL-23, SHP-01-36X, SHP-01-37X, SHL-10, SHM-93-10C, and SHM-93-10D.

- SHL-21 is located in an area potentially downgradient of the landfill but is screened at the watertable, is therefore unlikely to be influenced by the landfill, and has never exhibited an Arsenic concentration in excess of the MCL.
- SHL-23 is located in an area where water from Shepley's Hill is inferred to be recharging groundwater near the landfill toe, is therefore uninfluenced by the landfill, and has never exhibited an Arsenic concentration in excess of the MCL.
- SHP-01-36X is a watertable well located in an area near the 'hinge' between areas where Plow Shop Pond is inferred to be gaining or losing water with respect to groundwater, is therefore uninfluenced by the landfill, and has consistently exhibited Arsenic concentrations in excess of the MCL but similar to the background conditions observed at SHL-15 and elsewhere.
- Similarly, SHP-01-37X is located adjacent Plow Shop Pond and exhibits a water level very close to pond level, is therefore uninfluenced by the landfill, and has consistently exhibited an Arsenic concentration in excess of the MCL but similar to background.
- SHL-10, SHM-93-10C, and SHM-93-10D are water table and bedrock wells, respectively (though reported to be completed in bedrock the screened interval for SHM-93-10D is unknown). These wells are interpreted to be cross-gradient and therefore uninfluenced by the landfill, and have periodically exhibited Arsenic concentrations in excess of the MCL but similar to background.

It is recommended that these monitoring wells be removed from the LTMMP starting in 2009.

In addition, based on review of the results of field parameter sampling for 2007 and 2008, it is evident that rapid changes in ORP or other indicator parameters are not occurring and, therefore, sampling at a quarterly frequency does not provide much useful information. Therefore, it is recommended that sampling for field parameters should be conducted a maximum of twice a year, in conjunction with routine analytical sampling.

5.0 SYSTEM PERFORMANCE METRICS AND ASSESSMENT

In the 2007 AR (ECC, 2008a), a revised set of performance metrics were established and an initial system performance assessment was performed focused on system hydraulics and demonstration of containment of groundwater in excess of MCLs. Consistent with EPA guidance including *A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems* (USEPA, 2008), a multiple lines of evidence approach was taken with respect to the performance assessment. The assessment components include the following:

- Hydraulic Capture Zone Analysis
  - Gradient Vector Analysis
  - Capture Zone Width Calculation
  - Drawdown Assessment
  - Comparison to Numerical Model Results
- Geochemical Monitoring
  - Advective Travel Time Analysis
  - Geochemical Assessment

For 2008, individual components of the assessment have been updated only where new data is available. For example, because hydraulic gradients are largely unchanged since 2007, there is no need to update Capture Zone Width Calculation. Similarly, no new data are available on aquifer drawdown relative to that presented in the 2007 AR and, thus, the drawdown assessment was not updated, though the data was used to support modeling efforts as discussed below in Section 5.1.3.

As part of the *Supplemental Groundwater Investigation and Landfill Cap Assessment* (AMEC, 2009) the numerical model of groundwater flow used in extraction system design was revised and recalibrated to more accurately represent as-built conditions, with the extraction well screens completed only in the lower portion of the aquifer. In response to concerns raised over mass balance in this initial model update, further refinements have been recently completed. Consequently, the Comparison to Numerical Model Results and Advective Travel Time Analysis components of the assessment have been updated using the latest model.

In previous ARs quantitative assessment of Arsenic concentration declines was deferred based on the fact that the system had been operating at less than the full design rate of 50 gpm. Since July 2007 the system has been operating at full capacity and notably, declining Arsenic levels in nearfield wells, initially identified in the 2007 AR, persist. However, because arsenic declines have not been accompanied by changes in redox conditions a quantitative geochemical model-based extrapolation of Arsenic concentrations cannot yet be performed. Thus, this assessment component remains largely a qualitative description of current geochemical conditions and apparent trends.

Table 5-1 provides a description of each assessment component, its data requirements, and a brief summary of the results. Additional details are provided in the following sections. The OPS determination for the overall remedy will be addressed in the future after Agency review of the *Supplemental Groundwater Investigation and Landfill Cap Assessment* (AMEC, 2009) and completion of the subsequent AOC 72 reporting.

5.1 Hydraulic Capture Assessment

The hydraulic capture assessment is comprised of four lines of evidence to support the evaluation. These components are presented in the following sections.

5.1.1 Gradient Vector Analysis

Horizontal hydraulic gradient vectors were computed for selected well triplets (3 adjacent wells with similar screened intervals) using data from three separate synoptic water level surveys, conducted on 15 October 2007, 16 April 2008, and 30 September 2008, under 50 gpm operating conditions. Figure 5-1 plots all three sets of vectors for comparison. Results are largely consistent with the previous analysis with two exceptions. The triplet comprised of SHL-5, SHM-05-42A and SHL-8S displays a markedly different flow direction for both events in 2008 relative to October 2007. This appears to be primarily a function of the anomalously low water level recorded at SHL-5 for October 2007, which is several feet below its historic mean value (unlike its near neighbors). In addition, the triplet comprised of N-1,P-3; SHP-05-43 and SHP-01-36X shows a significantly different flow direction for the April 2008 round. While this may reflect an actual reversal of flow direction related to the inferred "hingeline" between where the pond gains and loses groundwater, it is noteworthy that these water levels differ by less than 0.1 feet, so the gradient is essentially negligible.

As expected, gradient vectors in the nearfield area remain directed toward the extraction wells while those farfield exhibit an equal or greater apparent variation due to seasonal changes in watertable elevation. Vectors along the western edge of plow Shop Pond confirm (as previously interpreted) that there is hydraulic gradient toward the pond in the Red Cove area and away from the pond closer to the dam. As will be shown in Sections 5.1.4 and 5.2.1 below, calculated gradient vectors are also generally consistent with model predicted patterns of flow both inside and outside the capture zone.

5.1.2 Capture Zone Width Calculation

Calculation of capture zone width was performed based on the basic water balance equation for an idealized aquifer:

$$Q = W\ B\ K\ I$$

where: Q = flow rate (vol/time)
W = capture zone width (length)
B = saturated thickness (length)
K = hydraulic conductivity (length/time)
I = hydraulic gradient (dimensionless)

assuming: 1) homogenous, isotropic aquifer
2) constant saturated thickness
3) no recharge

Input parameter values are as follows:

1. Cumulative extraction rate of EW-01 and EW-04 is 50 gpm (9625 cubic feet per day).
2. Saturated thickness at the extraction well area is a maximum of 94 feet with an average of 90 feet. The impacted portion in which the wells are screened is approximately 50 feet.
3. Hydraulic conductivity of the overburden/waste deposits is estimated at 45 ft/day at the extraction wells and 35 ft/day upgradient within the landfill (Harding ESE, 2002; CH2M HILL, 2006).
4. Hydraulic gradient across the extraction well area (based on 2007 and 2008 synoptic water levels from N5, P1 to SHM-93-22C) ranges from 0.0054 to 0.0072 ft/ft with an average of 0.0063 ft/ft.

Using the average hydraulic conductivity (40 ft/day) and gradient (0.0063 ft/ft), the calculated capture zone width is 763 feet based on the estimated saturated thickness of 50 feet. This saturated thickness value is considered representative of the impacted portion of the aquifer, across which the extraction wells are screened, as well as the full saturated thickness within the landfill proper just upgradient. For the full saturated thickness at the extraction wells (90 feet), the calculated capture zone width is 424 feet. Further upgradient, the overburden aquifer continues to thin as the bedrock surface rises and calculated capture zone width would increase proportionally.

Given the simplicity of this analytical solution approach, results are inversely proportional to both the hydraulic conductivity and saturated thickness parameters. Therefore, it is acknowledged that uncertainty in these values directly corresponds to uncertainty in the predicted capture zone width. Despite this limitation, based on an interpreted width of the impacted portion of the aquifer at the extraction wells of less than 444 feet (approximate distance from SHM-96-5B to SHL-23) the calculated capture zone width is considered sufficient to achieve full containment of the northward migrating plume lobe. It is noted that there is some uncertainty as to how far east of SHM-96-5B impacted groundwater persists, however data from SHL-8D, screened at a similar depth, and SHL-21, screened at the watertable, suggests the northern lobe is not contiguous with the elevated arsenic concentrations at SHL-11.

5.1.3 Drawdown Assessment

The 2007 AR (ECC, 2008a) included the results of an extraction system hydraulic drawdown assessment (performed February-March 2008) to calculate drawdown in the aquifer under ambient (non-pumping) and stressed (pumping) conditions. Based on comparison of observed drawdowns to contours of predicted drawdown developed using the existing (CH2MHill's 'run412') groundwater model, it was concluded that the model overpredicts the magnitude in the nearfield area due to the fact that: 1) some wells have shallow screens while the extraction wells are screened only in the deep portion of the aquifer whereas the overburden aquifer is represented in the model as a single integrated layer, and 2) the model does not presently account for vertical anisotropy in hydraulic conductivity of the aquifer which likely limits propagation of pumping stresses vertically in the field. Consequently, to improve correspondence with field observations and thereby the accuracy of model predictions, these data, along with synoptic water levels from 2/20/08, were used in recalibration of the existing numerical model of groundwater flow. The development of this initial 3-layer model (SHL004)

was documented in the *Supplemental Groundwater Investigation and Landfill Cap Assessment* (SGILCA) (AMEC, 2009).

5.1.4 Comparison to Numerical Model Results

In the 2007 AR, the then current groundwater flow model of operating conditions (referred to as 'run412' in various CH2M HILL reports) was utilized to delineate the extraction well capture zone and map flow patterns and advective travel time relationships in the downgradient area. As discussed above, in early 2008 the 'run412' model was revised and recalibrated as part of the SGILCA. Significant model revisions include: 1) subdivision of the single model layer representing overburden into separate shallow and deep layers (the 'deep overburden' layer corresponding to the portion of the aquifer in which the extraction wells are completed) and 2) introduction of vertical anisotropy within the overburden ranging from 3:1 in the shallow portion to 10:1 in the deep portion.

Subsequent to the SGILCA, the 3-layer model has been further revised to resolve the mass balance issues acknowledged in that report and recalibrated. In addition, average water levels recorded since system operation began in Fall 2005 were calculated for comparison to the current calibration targets from Feb 2008 (Table 5-2). It was noted that synoptic water levels from Feb 2008 were higher than average, potentially due to active recharge from snowmelt before and during the survey. Thus, these water levels are not considered representative of long-term average conditions which the steady–state model simulates. Consequently, this latest model (SHL005) has been recalibrated to average water levels along with drawdown from the Feb 2008 shutdown test (Figures 5-2 through 5-4). A comparison of mass balance between the original 2-layer and most current 3-layer (SHL005) model is provided in Table 5-3. Changes to input parameters relative to the SHL004 (and SHL002) model variant include: 1) increase in bedrock hydraulic conductivity by a factor of 2 from 0.65 ft/day to 1.2 ft/day, 2) increase in hydraulic conductivity within the landfill and the overburden immediately downgradient to 50 ft/day (previous values ranged from 35 to 45 ft/day), 3) adjustment of vertical anisotropy to 10:1 throughout the overburden saturated thickness, and 4) utilization of the more stable PCG2 numerical solver.

Figure 5-5 shows the model predicted watertable elevation contours and capture zones as defined by backward particle tracking from the extraction well pair utilizing the SHL005 model. Three capture zones are depicted: the 50 gpm design rate, the average rate achieved for 2008

of 34 gpm (based on total discharge to the POTW), and 41.7 gpm, the average rate presently being achieved since system upgrades in May 2009. In addition, reverse particle tracks from monitoring well screens in which Arsenic exceeds the MCL have been developed using the ambient conditions model variant. The endpoints of these flowpaths indicate the source areas for this water (under current recharge conditions with the cap in place). This map indicates: 1) the predicted capture zone for the system as operated in 2008 effectively contains groundwater passing through the western half of the landfill footprint, and 2) the source areas for captured water correspond to the predicted source areas for arsenic impacted water downgradient. Therefore, the extraction system as currently being operated is considered sufficient to fully contain impacted groundwater migrating northward from the toe of the landfill, though this conclusion is subject to the uncertainty in the eastward extent of impacts cited above in Section 5.1.2.

Figure 5-6 depicts this same capture zone particle tracks from a cross-sectional perspective. Though partially obscured by particle tracks coming down from the elevated watertable under Shepley's Hill, this figure indicates the capture zone extends vertically upward well into the shallow overburden layer (layer 1) to an elevation of approximately 207 ft ngvd in the vicinity of the extraction wells and systematically higher as the aquifer thins and rises to the south.

Though modeling results are never unique, collectively, the correspondence to observed water levels, drawdowns, gradients and the prevailing conceptual hydrogeologic model suggest the revised model is a reasonable representation of the groundwater flow system under pumping conditions.

5.2 Geochemical Monitoring Assessment

Recent and historical trends in aquifer geochemistry and specifically arsenic are discussed in Section 4.2. Notably, since the Contingency Remedy has been in operation, arsenic concentrations in selected nearfield wells (SHM-96-5B and SHM-93-22B) have systematically declined. These apparent trends are discussed below in the context of site-wide flow patterns and travel times and also in terms of changes to prevailing geochemical conditions (redox) as they relate to expected time-to-cleanup.

5.2.1 Advective Travel Time Analysis

The existing groundwater flow model may be used to calculate travel time relationships throughout the flowfield. Figure 5-7 illustrates model-predicted travel times using time markers (arrows spaced at 2 year intervals) along forward particle paths initiated from a line south of the extraction wells. This map shows that groundwater in the downgradient area travels horizontally at an average velocity of less than 1 ft/day. For example, groundwater presently in the vicinity of SHL-21 will require approximately 4 years to reach SHP-99-31A along Molumco Road. As a consequence of this relatively slow advective transport velocity and the fact that redox conditions will likely take some time to fully equilibrate to flow system changes, rapid changes in ORP values and arsenic concentrations in downgradient wells are not expected.

5.2.2 Geochemical Assessment

As discussed in Section 4, based on available monitoring data, elevated metals concentrations and negative redox potential persist approximately 1500 feet downgradient of the landfill toe. Maximum arsenic concentrations in this plume lobe are at ppm levels, however, impacted groundwater primarily occurs in the lower half of the overburden aquifer and its vertical position as it extends downgradient, is controlled by the elevation of the bedrock-overburden contact. Impacted groundwater also exists outside the landfill footprint in the vicinity of Red Cove. Maximum arsenic concentrations are below 1 ppm and this plume lobe is generally found in the shallow portion of the overburden aquifer.

Notable declines in arsenic concentration within the toe plume were observed during the October 2007 sampling at SHM-96-5B and SHM-93-22B, the two impacted monitoring locations nearest the extraction wells, and these declines have generally persisted through 2008. These data are of interest as they potentially reflect the beginning of mitigation of arsenic impacts in the downgradient aquifer. Consequently, an initial evaluation of methods for quantifying and projecting these apparent trends was undertaken. Methods considered ranged from simple empirical curve fitting approaches to sophisticated geochemical modeling techniques. This evaluation concluded that, due to the complexities of redox chemistry and Fe-As relationships, empirical methods will tend to yield overly optimistic projections of the time to cleanup and only methods which consider overall geochemical conditions should be considered.

However, as presented in Section 4.2, overall geochemical conditions have not changed in these particular wells, as exhibited by field parameters, specifically redox potential, and other metals concentrations such as iron and manganese. These observations suggest the geochemical system is still in the process of equilibrating to the comparatively rapid changes in flow system dynamics that have resulted from operation of the extraction wells. Further, geochemical model-based studies of natural attenuation rates after capping at other arsenic impacted landfills suggest that, due to carbon adsorbed on the aquifer matrix which continues to consume oxygen, several 100s of aquifer pore volumes would need to be flushed with oxygenated water to reduce arsenic concentrations by 2 orders of magnitude (USGS, 2004). Consequently, based on approximately 4 years of groundwater travel time between the landfill toe and Molumco Rd., this portion of the aquifer would require ~1000 years to reach the target cleanup level. Thus, recent arsenic declines, however encouraging, are potentially ephemeral. Until overall geochemical conditions exhibit consistent and prevailing changes, specifically increases in redox potential and declines in both iron and arsenic, extrapolation of observed arsenic concentration trends by any method is not considered practical at this time.

5.3 Performance Assessment Summary

Consistent with EPA guidance including *A Systematic Approach for Evaluating of Capture Zones at Pump and Treat Systems* (USEPA, 2008), a multiple lines of evidence approach was taken with respect to the performance assessment. The individual assessment components, their data requirements, and a brief summary of the results are provided in Table 5-3. With respect to the hydraulic capture zone analysis, while no single component conclusively demonstrates capture effectiveness, all four indicate some degree of correspondence to the expected aquifer response to pumping. With respect to the geochemical monitoring, the data may reflect the beginning of mitigation of arsenic impacts in the downgradient aquifer, yet, based on estimated groundwater velocities, it will take many years to 'flush' currently impacted groundwater from areas outside the capture zone and then additional time for new equilibrium redox conditions (presumably oxidizing) to be established, which in turn are expected to result in declines in arsenic concentration.

Given that a number of monitoring wells upgradient (i.e. SHL-15) or cross-gradient (i.e. SHM-93-10D) from the landfill, and well outside the influence of the groundwater extraction system,

exhibit arsenic concentrations in excess of the MCL, the expectation that the Contingency Remedy can achieve the ROD objectives is potentially unrealistic. In particular, both EPA-ORD studies and groundwater flow modeling efforts to date have indicated that the Contingency Remedy does not preclude or significantly reduce groundwater discharge to Red Cove. Therefore, the discharge of shallow arsenic-impacted groundwater to Red Cove, evident in SHL-11 and SHP-01-38A, is expected to persist. Whether this condition poses a risk is to-be-determined via the proposed RI/FS activities for AOC 72, however, these arsenic concentrations are an order of magnitude lower than those in the northward migrating plume. Thus, the Contingency Remedy, as presently configured, can be interpreted to contain the majority of arsenic mass within the landfill footprint being mobilized by landfill-induced reducing conditions and, therefore, the system is considered to be operating as designed.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Conclusions and recommendations resulting from the long-term monitoring and O&M services conducted at Shepley's Hill Landfill during 2008 are summarized in the following sections.

6.1 Conclusions

- The landfill cap was mowed to an approximate height of 4" in the fall of 2008 and areas within northern drainage swales were cleared of vegetation.
- The overall condition of the landfill appears satisfactory with the exception of several settled areas where pooling of water is frequently observed and, damaged or non-existent fencing.
- Elevated levels of methane and percent lower explosive limit (LEL) were observed in five LGPs (LGP-05-5X, LGP-05-9X, LGP-05-10X, LGP-05-13X, and LGP-05-14X) on the southern end of the landfill during low barometric pressure conditions. These same LGPs were re-sampled during high pressure conditions and the results were consistent with historic data.
- Landfill gas vent results were consistent with historical results and indicate proper landfill gas venting.
- The Contingency Remedy groundwater extraction and treatment system was operated at a rate of 46 gpm, accounting for sidestream recirculation.
- The ATP was on-line approximately 81% of the available time during the year. However, a significant part of the downtime for 2008 was related to the drawdown assessment conducted in February-March, microfilter strainer basket replacement, and air compressor repairs. During routine operations by far the largest contributor of downtime is the frequent need for filtered bottom roll-off (FBRO) pumpouts and clean-in-place maintenance on the microfiltration system. Based on total discharge to the POTW, the net average extraction rate for the year is 34 gpm.
- Several maintenance activities were completed, including microfilter strainer housing replacement, chlorine dioxide actuator replacement and effluent pump repair to maintain the ATP in good working condition.
- The ATP was extremely effective at removing arsenic from the groundwater. Average influent arsenic concentrations remain high at approximately 3,000 µg/L. Effluent arsenic concentrations have been consistently low, averaging 4 µg/L during the year.

well below the target goal of 10 µg/L. Through 31 December 2008 the ATP has removed approximately 1,031 pounds of arsenic from the treated groundwater.

- While 2008 water levels were generally higher than in 2007, the geometry of the watertable surface in both spring and fall is similar to that observed in previous years.
- In general, arsenic concentrations in the LTMMP wells remain relatively stable or decreasing, compared to historic levels. Only the following wells in 2007 were reported to have concentrations greater than historical averages: SHL-11, SHM-05-41C, and SHM-05-40X.
- Geochemical data collected to date have not displayed significant changes in redox chemistry related to the operation of the system, however systematic reductions in arsenic concentrations are apparent in two wells immediately downgradient of the capture zone.
- The hydraulic capture zone assessment indicates that the extraction wellfield is containing the majority of arsenic mass migrating northward from the landfill toe and, therefore, is operating as designed.

6.2 Recommendations

All recommendations made in the 2007 AR were completed in 2008 with the exception of the surface repairs and landfill gas monitoring assessment, which were completed in the first half of 2009. As discussed above, projection of Arsenic trends is deferred until monitoring data indicates consistent changes to related geochemical parameters such as dissolved iron, ORP, and DO are observed. Recommendations for 2009 are as follows:

- The settled areas where pooling and minor rutting damage has been observed should be repaired (filled, graded & seeded). In addition, the small trees near the margin of the landfill should be removed and the gas vents painted.
- The landfill perimeter gas monitoring network should be augmented with additional gas wells completed in the vadose zone in both the southern and northern boundary areas.
- The frequency of the perimeter landfill gas monitoring should be increased to quarterly in 2009.
- The current chlorine dioxide pump should be upgraded to allow for proper chlorine dioxide dosing at the higher rate of flow.
- A small (330 gal.) contact tank & mixer should be added to increase retention time and thereby create a better precipitant and reduce colloidal solids to decrease the fouling

load on the microfilter, which would result in less backwashing (sidestream) and less CIPs (downtime).

- Use bag filters to remove residual solids from the Inclined Plate Clarifier (IPC) supernatant and direct discharge this volume directly into the plant effluent and thereby eliminate the recycling of this 'sidestream' water which presently limits plant capacity.
- Increase the size of the hot water tank to provide sufficient volume & temperature of CIP solution to increase the effectiveness of CIPs, and decrease the amount of time necessary to perform CIPs.
- In order to address the bias of Arsenic concentrations due to turbidity, filtered samples should be collected from SHL-19 going forward.
- The groundwater monitoring program should be optimized to winnow monitoring locations and frequencies which provide minimal value. Wells SHL-21, SHL-23, SHP-01-36X, SHP-01-37X, SHL-10, SHM-93-10C, and SHM-93-10D should be removed from the LTMMP starting in 2009. Sampling for field parameters should be conducted twice a year in conjunction with analytical sampling.

7.0 REFERENCES

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Table 1-1
Contaminants of Concern (COC) Cleanup Level
Shepley's Hill Landfill
Devens, Massachusetts

COC	Cleanup Level (µg/L)	Selection Basis
Arsenic	10	MCL[1]
Chromium	100	MCL
1,2-Dichlorobenzene	600	MCL
1,4-Dichlorobenzene	5	MCL
1,2-Dichloroethane	5	MCL
Lead	15	Action Level
Manganese	1715	Background[2]
Nickel	100	MCL
Sodium	20000	Health Advisory
Aluminum	6870	Background
Iron	9100	Background

Notes:

1) Revised from ROD clean-up level of 50 µg/L

2) Revised ROD clean-up level based on background evaluation

MCL = Maximum Contaminant Level

Table 3-1
Operations Summary - January 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
01/01/2008	23.5	62,900	System shutdown at 2330 for FBRO and CIP.
01/02/2008	8.75	22,900	FBRO & CIP completed, system restarted at 1515.
01/03/2008	21.75	55,200	System SCADA alarm at 2145, T-2 tank low, system remotely shutdown by operator.
01/04/2008	16.25	41,100	System restarted at 0745.
01/05/2008	24	60,300	Operating.
01/06/2008	24	60,000	Operating.
01/07/2008	24	59,700	Operating.
01/08/2008	24	58,900	Received 1500 gallons sodium hypochlorite.
01/09/2008	23.75	58,600	Changed chlorine cylinder.
01/10/2008	11	29,300	**Completed monthly sampling, effluent As at 3.0 ppb.** System shutdown at 1100 for CIP.
01/11/2008	12	29,700	CIP completed, system restarted at 1200.
01/12/2008	24	60,200	Operating.
01/13/2008	24	60,200	Operating.
01/14/2008	24	61,200	Operating.
01/15/2008	23.75	62,200	Changed chlorine cylinder.
01/16/2008	24	61,700	Operating.
01/17/2008	24	64,100	Operating.
01/18/2008	8.5	24,400	System shutdown at 0830 for FBRO pumpout and CIP.
01/19/2008	0	0	System shutdown.
01/20/2008	0	0	System shutdown.
01/21/2008	12.5	33,000	FBRO & CIP completed, system restarted at 1145.
01/22/2008	24	61,300	Operating.
01/23/2008	24	60,200	Operating.
01/24/2008	24	61,100	Changed chlorine cylinder.
01/25/2008	24	62,600	Operating.
01/26/2008	24	61,400	Operating.
01/27/2008	24	62,600	Operating.
01/28/2008	24	62,500	Operating.
01/29/2008	24	63,400	Operating.
01/30/2008	24	64,400	SCADA call at 2000, low air pressure. Operator responded and reset alarm, no downtime.
01/31/2008	24	64,000	Operating.
Total	**617.75**	**1,589,100**	
Total Available Hours	**744**		
Percent On-Line	**83**		

Table 3-1
Operations Summary - March 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
03/01/2008	24	63,400	Operating.
03/02/2008	24	63,300	Operating.
03/03/2008	21.5	57,800	SCADA call at 0455, system shutdown due to faulty CLO2 valve. Operator restarted plant at 0730.
03/04/2008	24	63,600	Operating.
03/05/2008	24	62,000	Completed Integrity Test on microfilter skid.
03/06/2008	24	61,600	Changed chlorine cylinder. Completed monthly and quarterly effluent sampling, effluent arsenic at 1.1 ppb.
03/07/2008	24	61,000	Operating.
03/08/2008	24	60,800	Operating.
03/09/2008	3	8,500	SCADA call at 0225, system shutdown due to faulty CLO2 valve. Valve replaced. System remained off-line for CIP and FBRO pumpout.
03/10/2008	8	22,400	CIP and FBRO pumpout completed, system restarted at 1500.
03/11/2008	14	17,000	SCADA call at 1350, system shutdown, CLO2 actuator failure, replacement ordered.
03/12/2008	10	24,900	System restarted at 1410, CLO2 actuator replacement pending, replacement ordered.
03/13/2008	24	57,800	Operating.
03/14/2008	24	58,600	Operating.
03/15/2008	24	58,300	Operating.
03/16/2008	24	58,500	Changed chlorine cylinder.
03/17/2008	24	58,300	Operating.
03/18/2008	24	58,200	Operating.
03/19/2008	22.5	55,000	SCADA call at 2230, system shutdown due to CLO2 actuator failure.
03/20/2008	14.25	35,500	System restarted at 0800. System shutdown at 1015, actuator replaced, system restarted at 1200.
03/21/2008	24	58,600	Operating.
03/22/2008	24	57,700	Operating.
03/23/2008	24	58,700	Operating.
03/24/2008	24	59,300	Operating.
03/25/2008	24	61,800	Changed chlorine cylinder.
03/26/2008	24	62,400	Operating.
03/27/2008	8	23,300	System shutdown at 0800 for CIP and FBRO pumpout.
03/28/2008	10.5	26,900	CIP and FBRO pumpout completed, system restarted at 1330.
03/29/2008	24	60,400	Operating.
03/30/2008	24	60,500	Operating.
03/31/2008	24	60,500	Changed chlorine cylinder.
Total	**639.75**	**1,596,600**	
Total Available Hours	**744**		
Percent On-Line	**86**		

Table 3-1
Operations Summary - May 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
05/01/2008	10.5	29,000	System shutdown at 1030 for CIP and FBRO pumpout.
05/02/2008	14.5	37,700	CIP and FBRO pumpout completed, system restarted at 0930.
05/03/2008	24	60,600	Operating.
05/04/2008	24	61,500	Operating.
05/05/2008	24	60,900	Operating.
05/06/2008	15.5	39,200	System shutdown at 0630 per request of MassDevelopment POTW. System restarted at 1500.
05/07/2008	18	45,400	SCADA callout, system shutdown at 0130, momentary power failure. System restarted at 0730. Changed chlorine cylinder.
05/08/2008	24	60,600	Operating.
05/09/2008	24	61,300	Operating.
05/10/2008	24	61,000	Operating.
05/11/2008	24	60,200	Operating.
05/12/2008	24	60,900	Operating.
05/13/2008	24	61,400	Operating.
05/14/2008	24	60,200	Changed chlorine cylinder.
05/15/2008	24	61,200	**Completed monthly samping, effluent As at 1.0 ppb.**
05/16/2008	24	61,300	Operating.
05/17/2008	12	30,800	SCADA callout, system shutdown at 1200, T-2 hi-hi. System left off for CIP and FBRO pumpout. Performed Integrity Test on Micro filter. Started CIP.
05/18/2008	0	0	System shutdown, CIP ongoing
05/19/2008	14	35,700	FBRO pumpout and CIP completed. System restarted at 1000.
05/20/2008	24	60,400	Operating.
05/21/2008	24	59,800	Operating.
05/22/2008	24	60,700	Operating.
05/23/2008	24	60,600	Installed anti-siphon on sludge line to FBRO.
05/24/2008	24	60,400	Operating.
05/25/2008	24	59,800	Operating.
05/26/2008	24	60,500	Operating.
05/27/2008	9	22,900	System shutdown at 0900 at the request of Mass Development, pump station problem. Started a CIP.
05/28/2008	15	37,000	Completed CIP. Changed chlorine cylinder.
05/29/2008	24	61,000	Operating.
05/30/2008	24	61,300	Operating.
05/31/2008	23.75	63,000	SCADA alarm 2109, high T-2 leve. System remotely shutdown by operator at 2350.
Total	**636.25**	**1,616,300**	
Total Available Hours	**744**		
Percent On-Line	**86**		

Table 3-1
Operations Summary - January 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
01/01/2008	23.5	62,900	System shutdown at 2330 for FBRO and CIP.
01/02/2008	8.75	22,900	FBRO & CIP completed, system restarted at 1515.
01/03/2008	21.75	55,200	System SCADA alarm at 2145, T-2 tank low, system remotely shutdown by operator.
01/04/2008	16.25	41,100	System restarted at 0745
01/05/2008	24	60,300	Operating.
01/06/2008	24	60,000	Operating.
01/07/2008	24	59,700	Operating.
01/08/2008	24	58,900	Received 1500 gallons sodium hypochlorite.
01/09/2008	23.75	58,600	Changed chlorine cylinder.
01/10/2008	11	29,300	**Completed monthly sampling, effluent As at 3.0 ppb.** System shutdown at 1100 for CIP.
01/11/2008	12	29,700	CIP completed, system restarted at 1200.
01/12/2008	24	60,200	Operating.
01/13/2008	24	60,200	Operating.
01/14/2008	24	61,200	Operating.
01/15/2008	23.75	62,200	Changed chlorine cylinder.
01/16/2008	24	61,700	Operating.
01/17/2008	24	64,100	Operating.
01/18/2008	8.5	24,400	System shutdown at 0830 for FBRO pumpout and CIP.
01/19/2008	0	0	System shutdown.
01/20/2008	0	0	System shutdown.
01/21/2008	12.5	33,000	FBRO & CIP completed, system restarted at 1145.
01/22/2008	24	61,300	Operating.
01/23/2008	24	60,200	Operating.
01/24/2008	24	61,100	Changed chlorine cylinder.
01/25/2008	24	62,600	Operating.
01/26/2008	24	61,400	Operating.
01/27/2008	24	62,600	Operating.
01/28/2008	24	62,500	Operating.
01/29/2008	24	63,400	Operating.
01/30/2008	24	64,400	SCADA call at 2000, low air pressure. Operator responded and reset alarm, no downtime.
01/31/2008	24	64,000	Operating.
Total	**617.75**	**1,589,100**	
Total Available Hours	**744**		
Percent On-Line	**83**		

Table 3-1
Operations Summary - February 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
02/01/2008	24	64,400	Operating.
02/02/2008	24	64,400	Operating.
02/03/2008	24	64,300	Operating.
02/04/2008	24	64,300	Changed chlorine cylinder.
02/05/2008	7.25	20,800	System shutdown at 0715 for FBRO pumpout and CIP.
02/06/2008	14.25	37,500	FBRO pumpout and CIP completed, system restarted at 0945. Completed re-piping of P-511 effluent pump.
02/07/2008	24	64,200	Operating.
02/08/2008	24	64,100	Operating.
02/09/2008	24	64,000	Operating.
02/10/2008	24	63,800	Operating.
02/11/2008	24	63,700	Changed chlorine cylinder.
02/12/2008	24	64,100	Operating.
02/13/2008	24	63,900	**Completed monthly sampling, effluent As at 1.0 ppb.**
02/14/2008	24	64,300	Operating.
02/15/2008	24	63,600	Operating.
02/16/2008	24	63,600	Operating.
02/17/2008	24	64,200	Operating.
02/18/2008	24	63,300	Operating.
02/19/2008	24	64,600	Changed chlorine cylinder.
02/20/2008	12	33,500	System shutdown at 1200 for FBRO, CIP, and Drawdown Assessment.
02/21/2008	0	0	System shutdown.
02/22/2008	0	1,800	System shutdown. FBRO pumpout completed, started CIP.
02/23/2008	0	0	System shutdown.
02/24/2008	0	0	System shutdown.
02/25/2008	0	0	CIP completed. Air compressor maintenance completed.
02/26/2008	17	45,200	System restarted at 0710. Drawdown Assessment ongoing.
02/27/2008	24	63,500	Changed chlorine cylinder.
02/28/2008	24	63,400	Operating.
02/29/2008	24	63,600	Operating.
Total	**530.5**	**1,418,100**	
Total Available Hours	**696**		
Percent On-Line	**76**		

Table 3-1
Operations Summary - March 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
03/01/2008	24	63,400	Operating.
03/02/2008	24	63,300	Operating.
03/03/2008	21.5	57,800	SCADA call at 0455, system shutdown due to faulty CLO2 valve. Operator restarted plant at 0730.
03/04/2008	24	63,600	Operating.
03/05/2008	24	62,000	Completed Integrity Test on microfilter skid.
03/06/2008	24	61,600	Changed chlorine cylinder. Completed monthly and quarterly effluent sampling, effluent arsenic at 1.1 ppb.
03/07/2008	24	61,000	Operating.
03/08/2008	24	60,800	Operating.
03/09/2008	3	8,500	SCADA call at 0225, system shutdown due to faulty CLO2 valve. Valve replaced. System remained off-line for CIP and FBRO pumpout.
03/10/2008	8	22,400	CIP and FBRO pumpout completed, system restarted at 1500.
03/11/2008	14	17,000	SCADA call at 1350, system shutdown, CLO2 actuator failure, replacement ordered.
03/12/2008	10	24,900	System restarted at 1410, CLO2 actuator replacement pending, replacement ordered.
03/13/2008	24	57,800	Operating.
03/14/2008	24	58,600	Operating.
03/15/2008	24	58,300	Operating.
03/16/2008	24	58,500	Changed chlorine cylinder.
03/17/2008	24	58,300	Operating.
03/18/2008	24	58,200	Operating.
03/19/2008	22.5	55,000	SCADA call at 2230, system shutdown due to CLO2 actuator failure.
03/20/2008	14.25	35,500	System restarted at 0800. System shutdown at 1015, actuator replaced, system restarted at 1200.
03/21/2008	24	58,600	Operating.
03/22/2008	24	57,700	Operating.
03/23/2008	24	58,700	Operating.
03/24/2008	24	59,300	Operating.
03/25/2008	24	61,800	Changed chlorine cylinder.
03/26/2008	24	62,400	Operating.
03/27/2008	8	23,300	System shutdown at 0800 for CIP and FBRO pumpout.
03/28/2008	10.5	26,900	CIP and FBRO pumpout completed, system restarted at 1330.
03/29/2008	24	60,400	Operating.
03/30/2008	24	60,500	Operating.
03/31/2008	24	60,500	Changed chlorine cylinder.
Total	**639.75**	**1,596,600**	
Total Available Hours	**744**		
Percent On-Line	**86**		

Table 3-1
Operations Summary - April 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
04/01/2008	24	61,100	Operating.
04/02/2008	24	61,200	Operating.
04/03/2008	10.75	28,100	System shutdown at 1045 for CIP.
04/04/2008	12	30,700	CIP completed, system back on at 1200.
04/05/2008	24	60,500	Operating.
04/06/2008	24	58,300	Operating.
04/07/2008	24	60,500	Annual fire alarm and sprinkler system inspection completed. Received 1500 gallon sodium chlorite delivery.
04/08/2008	24	63,600	Operating.
04/09/2008	24	60,200	Annual fire extinguisher inspection completed.
04/10/2008	24	60,500	Changed chlorine cylinder. **Completed monthly sampling, effluent As at 1.0 ppb.**
04/11/2008	24	60,600	Operating.
04/12/2008	24	60,900	Operating.
04/13/2008	9	23,800	System shutdown at 0900 for CIP and FBRO pumpout.
04/14/2008	14	34,800	CIP and FBRO pumpout completed. System restarted at 1000.
04/15/2008	24	60,600	Operating.
04/16/2008	24	60,800	Changed chlorine cylinder.
04/17/2008	24	60,700	Operating.
04/18/2008	24	61,500	Operating.
04/19/2008	24	60,700	Operating.
04/20/2008	10	25,400	SCADA alarm at 1000, chlorine dioxide system trouble.
04/21/2008	16	40,500	System restarted at 0800, chlorine dioxide feed valve replaced with used spare.
04/22/2008	13.25	34,200	System shutdown at 1315 by operator, chlorine dioxide valve leaking, new replacement valve ordered.
04/23/2008	12.25	31,100	Chlorine dioxide feed valve replaced, system restarted at 1215. Changed chlorine cylinder.
04/24/2008	24	62,000	Operating.
04/25/2008	24	62,900	Operating.
04/26/2008	24	61,700	Operating.
04/27/2008	24	62,600	Operating.
04/28/2008	24	62,100	Operating.
04/29/2008	19.67	51,800	SCADA alarm at 0507, momentary power failure. System restarted at 0926.
04/30/2008	24	63,100	Operating.
Total	**620.92**	**1,586,500**	
Total Available Hours	**720**		
Percent On-Line	**86**		

Table 3-1
Operations Summary - May 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
05/01/2008	10.5	29,000	System shutdown at 1030 for CIP and FBRO pumpout.
05/02/2008	14.5	37,700	CIP and FBRO pumpout completed, system restarted at 0930.
05/03/2008	24	60,600	Operating.
05/04/2008	24	61,500	Operating.
05/05/2008	24	60,900	Operating.
05/06/2008	15.5	39,200	System shutdown at 0630 per request of MassDevelopment POTW. System restarted at 1500.
05/07/2008	18	45,400	SCADA callout, system shutdown at 0130, momentary power failure. System restarted at 0730. Changed chlorine cylinder.
05/08/2008	24	60,600	Operating.
05/09/2008	24	61,300	Operating.
05/10/2008	24	61,000	Operating.
05/11/2008	24	60,200	Operating.
05/12/2008	24	60,900	Operating.
05/13/2008	24	61,400	Operating.
05/14/2008	24	60,200	Changed chlorine cylinder.
05/15/2008	24	61,200	**Completed monthly samping, effluent As at 1.0 ppb.**
05/16/2008	24	61,300	Operating.
05/17/2008	12	30,800	SCADA callout, system shutdown at 1200, T-2 hi-hi. System left off for CIP and FBRO pumpout. Performed Integrity Test on Micro filter. Started CIP.
05/18/2008	0	0	System shutdown, CIP ongoing.
05/19/2008	14	35,700	FBRO pumpout and CIP completed. System restarted at 1000.
05/20/2008	24	60,400	Operating.
05/21/2008	24	59,800	Operating.
05/22/2008	24	60,700	Operating.
05/23/2008	24	60,600	Installed anti-siphon on sludge line to FBRO.
05/24/2008	24	60,400	Operating.
05/25/2008	24	59,800	Operating.
05/26/2008	24	60,500	Operating.
05/27/2008	9	22,900	System shutdown at 0900 at the request of Mass Development, pump station problem. Started a CIP.
05/28/2008	15	37,000	Completed CIP. Changed chlorine cylinder.
05/29/2008	24	61,000	Operating.
05/30/2008	24	61,300	Operating.
05/31/2008	23.75	63,000	SCADA alarm 2109, high T-2 leve. System remotely shutdown by operator at 2350.
Total	**636.25**	**1,616,300**	
Total Available Hours	**744**		
Percent On-Line	**86**		

Table 3-1
Operations Summary - June 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
06/01/2008	0.75	1,200	System restarted at 0845. SCADA alarm at 0930, effluent sump high-high, system left shutdown.
06/02/2008	10.5	27,000	Air compressor failure. Atlas Copco on-site for service, system restarted at 1330.
06/03/2008	24	62,800	Operating.
06/04/2008	24	61,600	Changed chlorine cylinder.
06/05/2008	22	57,300	SCADA callout at 2151, CLO2 trouble, automatic system shutdown
06/06/2008	15.5	14,800	CLO2 alarm reset, system restarted at 0830. System shutdown at 1415 at the request of Mass Development, problem with pump station. Mass Development requested the system remain down for the weekend.
06/07/2008	0	1,000	Started CIP
06/08/2008	0	0	System off-line.
06/09/2008	12	28,800	FBRO pumout completed. CIP completed. System restarted at 1200.
06/10/2008	24	60,800	Operating.
06/11/2008	24	61,200	Operating.
06/12/2008	24	60,600	Changed chlorine cylinder.
06/13/2008	24	61,300	Operating.
06/14/2008	24	61,200	Operating.
06/15/2008	24	60,300	Operating.
06/16/2008	24	61,200	Operating.
06/17/2008	24	60,800	Completed quarterly effluent sampling. **Effluent As at 1 ppb.**
06/18/2008	24	61,700	Operating.
06/19/2008	24	60,600	Operating.
06/20/2008	23.25	59,300	AYD on-site to test 3 backflow devices, 1 failed. SCADA callout at 2315, system shutdown due to power failure.
06/21/2008	16	41,100	VFDs reset by operator, system restarted at 0800.
06/22/2008	24	60,500	Operating.
06/23/2008	24	60,700	Operating.
06/24/2008	9	23,800	System shutdown at 0900 for CIP and FBRO pumpout.
06/25/2008	10.5	25,800	CIP and FBRO pumpout completed. System restarted at 1330. Changed chlorine cylinder.
06/26/2008	18	45,400	SCADA callout at 0130, system shutdown for high thickener level. System restarted at 0730.
06/27/2008	24	60,600	Operating.
06/28/2008	24	61,100	Operating.
06/29/2008	24	61,100	Operating.
06/30/2008	24	60,800	Completed repairs to backflow device.
Total	**569.5**	**1,424,400**	
Total Available Hours	**720**		
Percent On-Line	**79**		

Table 3-1
Operations Summary - July 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
07/01/2008	24	61,500	Changed chlorine cylinder.
07/02/2008	24	60,900	Operating.
07/03/2008	24	60,900	Operating.
07/04/2008	24	61,100	Operating.
07/05/2008	24	60,800	Operating.
07/06/2008	24	60,900	Operating.
07/07/2008	24	61,300	Operating.
07/08/2008	24	61,800	**Completed monthly sampling, effluent As at 1.25 ppb.**
07/09/2008	24	62,500	Changed chlorine cylinder.
07/10/2008	12.75	34,300	System shutdown at 1245 for FBRO pumpout and CIP.
07/11/2008	8.75	22,700	FBRO and CIP completed. System restarted at 1515
07/12/2008	24	62,000	Operating.
07/13/2008	24	62,300	Operating.
07/14/2008	20	51,500	Completed temporary leak repair to MF strainer. Plugged leaking membrane strands on modules #1 & #6.
07/15/2008	24	62,500	Changed chlorine cylinder.
07/16/2008	24	62,100	Operating.
07/17/2008	24	62,200	Operating.
07/18/2008	24	62,400	Operating.
07/19/2008	18.5	55,100	SCADA alarm at 1815, MF low air alarm. System remotely shutdown at 1830.
07/20/2008	0	200	System remains shutdown pending air compressor maintenance.
07/21/2008	0	0	System shutdown
07/22/2008	0	0	System shutdown.
07/23/2008	12	30,400	Air compressor repairs completed, system restarted at 1200.
07/24/2008	24	62,500	Operating.
07/25/2008	17.5	45,200	System shutdown at 0715 per request of Mass Development. Installed replacement strainer housing on MF skid. Tightened connections on modules 4 & 6. System restarted at 1345.
07/26/2008	24	62,100	Operating.
07/27/2008	24	61,800	Operating.
07/28/2008	24	62,700	Operating.
07/29/2008	24	61,400	Changed chlorine cylinder.
07/30/2008	24	59,900	Operating.
07/31/2008	24	57,000	Operating.
Total	**617.5**	**1,591,800**	
Total Available Hours	**744**		
Percent On-Line	**83**		

Table 3-1
Operations Summary - August 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
08/01/2008	12.75	28,600	System shutdown at 1245 for CIP and FBRO pumpout.
08/02/2008	0	0	System shutdown.
08/03/2008	0	0	System shutdown.
08/04/2008	10.5	26,100	CIP and FBRO pumpout completed. Major corrosion damage to strainer housing, replace with old housing. System back on-line at 1330.
08/05/2008	24	60,900	Changed chlorine cylinder.
08/06/2008	24	60,700	**Completed monthly sampling, effluent As at 1.0 ppb.**
08/07/2008	23	58,400	SCADA alarm at 1630, system shutdown due to power failure from electrical storm. On-call operator responded and restarted system at 1720.
08/08/2008	24	60,800	Operating.
08/09/2008	14	35,800	System shutdown at 1400 pending installation of strainer by-pass line on MF.
08/10/2008	0	0	System shutdown.
08/11/2008	0	0	System shutdown.
08/12/2008	0	0	System shutdown.
08/13/2008	0	0	System shutdown.
08/14/2008	0	0	System shutdown.
08/15/2008	0	0	System shutdown.
08/16/2008	13.5	33,100	System restarted at 1030.
08/17/2008	24	60,600	Operating.
08/18/2008	24	60,600	Operating.
08/19/2008	24	60,200	Operating.
08/20/2008	9.5	24,300	System shutdown at 0930. Installed strainer by-pass line on MF skid. Started CIP.
08/21/2008	10	25,400	Completed CIP. System restarted at 1400.
08/22/2008	24	60,000	Changed chlorine cylinder.
08/23/2008	24	60,200	Operating.
08/24/2008	24	60,800	Operating.
08/25/2008	22	55,500	SCADA alarm at 2150, system shutdown due to CLO2 trouble alarm.
08/26/2008	16.5	41,600	System restarted at 0730.
08/27/2008	24	61,300	Operating.
08/28/2008	8	21,700	System shutdown at 0800 for FBRO pumpout and CIP.
08/29/2008	10	24,400	FBRO pumpout & CIP completed. System back on at 1400.
08/30/2008	24	60,100	Operating.
08/31/2008	24	60,400	Operating.
Total	**437.75**	**1,101,700**	
Total Available Hours	**744**		
Percent On-Line	**59**		

Table 3-1
Operations Summary - September 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
09/01/2008	24	60,300	Operating.
09/02/2008	24	60,200	Operating.
09/03/2008	24	60,200	Operating.
09/04/2008	24	60,000	Operating.
09/05/2008	24	61,300	Operating.
09/06/2008	24	60,100	Operating.
09/07/2008	24	60,900	Operating.
09/08/2008	24	60,000	Changed chlorine cylinder.
09/09/2008	24	61,100	Operating.
09/10/2008	22.5	57,200	Completed monthly, quarterly and annual sampling. SCADA alarm at 2230, low air, system shutdown remotely by on-call operator. **Completed monthly sampling, effluent As at 5.3 ppb.**
09/11/2008	2.5	5,100	Replaced MF air solenoid. System restarted at 1500. SCADA alarm at 1730, low air, system shutdown remotely by on-call operator.
09/12/2008	16	38,700	Replaced faulty MF I/O card, system restarted at 0800.
09/13/2008	24	60,800	Operating.
09/14/2008	24	61,600	Operating.
09/15/2008	6	16,700	System shutdown at 0600 for CIP and FBRO pumpout. FBRO pumpout completed.
09/16/2008	9.5	23,500	CIP completed. System restarted at 1430.
09/17/2008	24	60,800	Operating.
09/18/2008	24	60,400	Operating.
09/19/2008	24	60,700	Changed chlorine cylinder.
09/20/2008	24	59,700	Operating.
09/21/2008	24	60,600	Operating.
09/22/2008	24	60,600	Operating.
09/23/2008	24	60,600	Operating.
09/24/2008	24	59,900	Operating.
09/25/2008	24	60,400	Changed chlorine cylinder.
09/26/2008	24	60,100	Operating.
09/27/2008	24	60,700	Operating.
09/28/2008	24	60,200	Operating.
09/29/2008	24	60,300	Operating.
09/30/2008	24	60,100	Operating.
Total	**656.5**	**1,652,800**	
Total Available Hours	**720**		
Percent On-Line	**91**		

Table 3-1
Operations Summary - October 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
10/01/2008	24	61,200	Operating.
10/02/2008	13.3	34,100	Changed chlorine cylinder. System shutdown at 1318 for CIP and FBRO pumpout.
10/03/2008	1.25	2,500	CIP and FBRO pumpout completed. System restarted at 1315. System shutdown on low pressure, air compressor high temp. Reset air compressor but it tripped again. System shutdown pending maintenance.
10/04/2008	0	0	System shutdown.
10/05/2008	0	0	System shutdown.
10/06/2008	0	0	Discovered faulty temp switch on compressor, replacement ordered.
10/07/2008	0	0	Temp switch replaced, discovered faulty thermovalve on compressor, replacement ordered.
10/08/2008	14.5	36,400	Thermovalve replaced. System restartred at 0924.
10/09/2008	5	13,000	SCADA alarm at 0412, MF low air pressure. Air element bad on air compressor, replacement ordered.
10/10/2008	12.5	30,600	Air compressor element replaced. Replacment MF strainer housing installed. System restarted at 1130.
10/11/2008	24	60,000	Operating.
10/12/2008	24	60,100	Operating.
10/13/2008	24	59,800	Operating.
10/14/2008	24	60,000	Changed chlorine cylinder. **Completed monthly sampling, effluent As at 1.1 ppb.**
10/15/2008	24	59,900	Operating.
10/16/2008	7.5	20,100	System shutdown at 0730 for CIP.
10/17/2008	7.5	18,500	CIP completed, system restarted at 1630.
10/18/2008	24	60,300	Operating.
10/19/2008	24	60,200	Operating.
10/20/2008	24	59,800	Operating.
10/21/2008	24	59,700	Operating.
10/22/2008	24	60,000	Operating.
10/23/2008	24	60,600	Operating.
10/24/2008	18.75	47,600	System shutdown remotely at 1845 to allow FBRO to drain.
10/25/2008	15	37,500	System restarted at 0900.
10/26/2008	8.5	24,500	System shutdown at 0830 for CIP and FBRO pumpout.
10/27/2008	10	25,300	CIP and FBRO pumpout completed. Replaced CLO2 control valve. Changed chlorine cyliner. System restarted at 1400.
10/28/2008	24	59,300	Operating.
10/29/2008	18.75	47,800	System shutdown at 0245, CLO2 trouble. System restarted at 0730. System shutdown at 1115, CLO2 trouble. Adjusted CLO2 limit switches, system restarted at 1145.
10/30/2008	24	60,700	Operating.
10/31/2008	24	59,400	Operating.
Total	**492.55**	**1,238,900**	
Total Available Hours	744		
Percent On-Line	66		

Table 3-1
Operations Summary - November 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
11/01/2008	24	61,500	Operating.
11/02/2008	24	61,700	Operating.
11/03/2008	24	61,300	Operating.
11/04/2008	24	63,800	**Changed chlorine cylinder. Completed monthly effluent sampling, As at 1.0 ppb.**
11/05/2008	24	61,100	Operating.
11/06/2008	24	61,500	Operating.
11/07/2008	24	61,800	Changed chlorine cylinder.
11/08/2008	24	61,700	Operating.
11/09/2008	6.25	18,100	System shutdown at 0615 for FBRO pumpout.
11/10/2008	14.75	38,600	FBRO pumpout completed, system restarted at 0915.
11/11/2008	24	61,600	Operating.
11/12/2008	24	60,200	Operating.
11/13/2008	24	57,500	Conducted plant tours for Devens charter school.
11/14/2008	24	57,700	Operating.
11/15/2008	24	57,800	Operating.
11/16/2008	24	57,700	Operating.
11/17/2008	24	57,400	Operating.
11/18/2008	24	57,600	Operating.
11/19/2008	24	57,400	Changed chlorine cylinder.
11/20/2008	24	57,500	Operating.
11/21/2008	23.5	55,800	Adjusted limit switches on CLO2 control valve.
11/22/2008	24	57,400	Operating.
11/23/2008	24	57,400	Operating.
11/24/2008	24	57,700	Operating.
11/25/2008	10	24,300	Changed chlorine cylinder. System shutdown at 1000 for CIP and FBRO pumpout.
11/26/2008	9.5	23,200	Completed CIP and FBRO pumpout. Adjusted limit switches on CLO2 control valve.
11/27/2008	24	60,100	Operating.
11/28/2008	24	60,200	Operating.
11/29/2008	24	59,400	Operating.
11/30/2008	24	60,500	Operating.
Total	**664**	**1,649,500**	
Total Available Hours	**720**		
Percent On-Line	**92**		

Table 3-1
Operations Summary - December 2008
Shepley's Hill Landfill
Devens, Massachusetts

Date	Hours On-Line	Gallons Discharged	Status
12/01/2008	24	60,400	Operating.
12/02/2008	24	59,100	Completed monthly & quarterly effluent sampling.
12/03/2008	24	60,200	Changed chlorine cylinder.
12/04/2008	24	60,500	Operating.
12/05/2008	24	60,200	Operating.
12/06/2008	24	59,000	Operating.
12/07/2008	24	60,200	Operating.
12/08/2008	24	60,300	Operating.
12/09/2008	24	60,000	Operating.
12/10/2008	24	59,500	Operating.
12/11/2008	14.5	36,700	Changed chlorine cylinder. System shutdown at 1430 for for FBRO pumpout.
12/12/2008	0	0	FBRO pumpout completed. Power loss at 0930 due to severe ice storm, system remained shutdown.
12/13/2008	14	34,500	System restarted at 1000.
12/14/2008	24	60,200	Operating.
12/15/2008	24	60,000	Operating.
12/16/2008	24	60,000	Operating.
12/17/2008	24	59,600	Operating.
12/18/2008	24	59,500	Operating.
12/19/2008	24	59,900	Changed chlorine cylinder.
12/20/2008	24	60,000	Operating.
12/21/2008	24	60,300	Operating.
12/22/2008	9.25	24,500	System shutdown for CIP and to allow FBRO to drain.
12/23/2008	8	24,800	CIP completed, system restarted at 1500.
12/24/2008	24	58,600	Operating.
12/25/2008	16	39,200	System shutdown at 1600 to allow FBRO to drain.
12/26/2008	15.5	37,100	System restarted at 0830.
12/27/2008	11.5	28,200	System shutdown at 1130 to allow FBRO to drain.
12/28/2008	13	31,500	System restarted at 0900. System remotely shutdown at 2200 to allow FBRO to drain.
12/29/2008	13.25	32,200	FBRO pumpout completed. System restarted at 1045. Installed air sparge line from compressor to IPC.
12/30/2008	22	53,100	SCADA alarm at 2200, system shutdown for high recycle level alarm.
12/31/2008	17	42,100	System restarted at 0700.
Total	**510**	**1,521,400**	
Total Available Hours	**744**		
Percent On-Line	**82**		

Table 3-2
Monthly Discharge Totals
Arsenic Treatment Plant
Shepley's Hill Landfill
Deven's Massachusetts

Month	Discharge Flow (gallons)	Month	Discharge Flow (gallons)
startup 8&9/2005	213,900	Jul-08	1,591,800
Mar-06	555,800	Aug-08	1,101,700
Apr-06	833,600	Sep-08	1,652,800
May-06	941,700	Oct-08	1,238,900
Jun-06	979,000	Nov-08	1,649,500
Jul-06	646,600	Dec-08	1,521,400
Aug-06	327,200		
Sep-06	453,500		
Oct-06	597,500		
Nov-06	562,500		
Dec-06	606,800		
Jan-07	739,600		
Feb-07	0		
Mar-07	672,400		
Apr-07	854,000		
May-07	974,700		
Jun-07	942,200		
Jul-07	970,500		
Aug-07	1,563,400		
Sep-07	1,809,100		
Oct-07	1,616,000		
Nov-07	1,436,200		
Dec-07	1,629,200		
Jan-08	1,589,100		
Feb-08	1,418,100		
Mar-08	1,596,600		
Apr-08	1,586,500		
May-08	1,616,300		
Jun-08	1,424,400		
		Cumulative Total	**37,912,500**

Table 3-3
Filter Bottom Rolloff Pumpout History
Arsenic Treatment Plant
Shepley's Hill Landfill
Devens, Massachusetts

FBRO Number	Total Volume Treated	Volume Treated per FBRO	Date Emptied
1	850,000	850,000	3/29/06
2	1,817,000	967,000	5/5/06
3	2,860,400	1,043,400	6/8/06
4	3,987,800	1,127,400	7/21/06
5	5,326,400	1,338,600	10/23/06
6	6,321,500	995,100	12/5/06
7	7,295,600	974,100	1/22/07
8	8,327,100	1,031,500	4/6/07
9	9,243,800	916,700	5/4/07
	9,116,100	**Changed to Effluent Totalizer**	
10	10,110,500	994,400	6/4/07
11	10,957,600	847,100	7/2/07
12	11,937,100	979,500	8/1/07
13	12,845,700	908,600	8/20/07
14	13,861,100	1,015,400	9/7/07
15	14,758,100	897,000	9/21/07
16	15,671,100	913,000	10/8/07
17	16,575,600	904,500	10/26/07
18	17,582,300	1,006,700	11/12/07
19	18,530,500	948,200	12/5/07
20	19,413,700	883,200	12/21/07
21	20,055,100	641,400	1/2/08
22	20,923,600	868,500	1/21/07
23	21,858,300	934,700	2/6/08
24	22,762,700	904,400	2/22/08
25	23,500,200	737,500	3/10/06
26	24,386,500	886,300	3/28/08
27	25,284,800	898,300	4/14/08
28	26,210,300	925,500	5/2/08
29	27,094,500	884,200	5/19/08
30	28,023,400	928,900	06/09/2008
31	28,907,300	883,900	06/25/2008
32	29,807,900	900,600	07/11/2008
33	30,835,300	1,027,400	08/04/3008
34	31,764,200	928,900	08/29/2008
35	32,693,300	929,100	09/15/2008
36	33,656,400	963,100	10/02/2008
37	34,547,500	891,100	10/24/2008
38	35,311,500	764,000	11/10/2008
39	36,186,100	874,600	11/26/2008
40	37,085,600	899,500	12/12/2008
41	37,812,700	727,100	12/29/2008

Table 3-4
As/Fe/Mn Influent Concentrations
Arsenic Treatment Plant
Shepley's Hill Landfill
Devens, Massachusetts

	Flow	EW-01			EW-04			Average			
Date	(gpm)	As	Fe	Mn	As	Fe	Mn	As	Fe	Mn	Total
12/06/2006	40	2.8	92	2.5	5.0	72	1.8	3.9	82.0	2.1	88.0
12/06/2006	50	2.8	90	2.5	5.2	72	1.7	4.0	81.0	2.1	87.1
12/07/2006	25	2.6	87	2.4	4.9	70	1.7	3.8	78.5	2.1	84.4
08/07/2007	55	2.4	88	2.5	4.1	67	1.7	3.2	77.5	2.1	82.8
09/11/2007	55	2.6	80	2.3	4.0	54	1.5	3.3	67.0	1.9	72.2
12/27/2007	51	2.5	77	2.3	3.9	56	1.7	3.2	66.5	2.0	71.6
03/06/2008	52	2.4	74	2.2	3.7	50	1.6	3.1	62.0	1.9	67.0
06/17/2008	52	2.4	75	2.2	3.6	50	1.6	3.0	62.5	1.9	67.4
09/10/2008	52	2.2	78	2.2	3.6	54	1.8	2.9	66.0	2.0	70.9
12/02/2008	52	2.3	78	2.3	3.6	50	1.7	3.0	64.0	2.0	69.0

Note: All concentrations in mg/L.

Table 3-5
Monthly Effluent Sampling Results
Arsenic Treatment Plant
Shepley's Hill Landfill
Devens, Massachusetts

Date	Effluent Arsenic Concentration (ppb)	Date	Effluent Arsenic Concentration (ppb)
08/29/2005	1.5	07/08/2008	1.25
08/30/2005	1.2	08/06/2008	1
08/31/2005	17.1	09/10/2008	5.3
09/01/2005	1	10/14/2008	1.1
09/02/2005	1	11/04/2008	1
09/06/2005	1	12/02/2008	0.67
09/08/2005	0.9		
09/09/2005	3		
03/10/2006	0.9		
03/15/2006	2		
03/23/2006	1		
04/07/2006	2		
04/14/2006	1.3		
04/20/2006	9		
04/27/2006	2		
05/22/2006	2		
06/27/2006	0.0005(1)		
07/12/2006	2		
08/31/2006	13		
09/28/2006	28		
10/16/2006	4		
11/14/2006	2		
12/26/2006	34		
01/05/2007	19		
01/16/2007	2		
01/23/2007	4		
01/30/2007	1		
03/22/2007	2		
04/11/2007	0.0005(1)		
05/16/2007	1.2		
06/13/2007	1.3		
07/12/2007	1.4		
08/07/2007	1.5		
09/11/2007	1.3		
10/10/2007	1.2		
11/06/2007	1.3		
12/27/2007	1.2		
01/10/2008	3		
02/13/2008	1		
03/06/2008	1.1		
04/10/2008	1		
05/15/2008	1		
06/17/2008	1		

Notes:
Table includes all daily/weekly (when required) Arsenic sampling results
(1) Reporting Limit for Non-detect

Table 3-6
Quarterly Effluent Sampling Results
Arsenic Treatment Plant
Shepley's Hill Landfill
Devens, Massachusetts

Sample Date	09/02/2006	03/15/2006	06/27/2006	09/02/2006	12/26/2006	03/22/2007	06/13/2007	09/11/2007	12/27/2007	03/06/2008	06/17/2008	09/10/2008	12/02/2008
Analyte													
BOD	NA	ND	ND										
Solids, Total Suspended	ND	ND	ND										
Cyanide, Total	ND	ND	0.007	ND	ND	ND	ND						
Chloride	54	44	50	100	50	68	56	60	67	80	60	58	62
pH	6.7	5.8	6.5										
Nitrogen, Nitrate	ND	ND	ND	ND	ND	ND	0.18	0.32	0.21	0.36	0.26	0.16	0.3
Sulfate	ND	ND	ND	2.6	160	78	2.2	2.7	3.3	3	3.1	2.8	3.2
Oil & Grease, Hem-Grav	ND	ND	ND										
Metals													
Aluminum, Total	ND	ND	ND	ND	ND	ND	ND						
Antimony, Total	ND	ND	ND	ND	ND	ND	ND						
Arsenic, Total	0.001	0.002	ND	0.028	0.034	0.002	0.0013	0.0013	0.0012	0.0011	0.00094	0.0053	0.00087
Barium, Total	ND	0.02	0.03	0.02	0.015	0.029	0.023	0.023	0.023	0.023	0.022	0.024	0.022
Beryllium, Total	ND	ND	ND	ND	ND	ND	ND						
Cadmium, Total	ND	ND	ND	ND	ND	ND	ND						
Chromium, Total	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper, Total	ND	ND	ND	ND	0.026	0.017	0.015	0.0049	0.0076 J	0.015	0.13	0.0096J	0.011
Lead, Total	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium, Total	ND	8.5	8.8	9.1	8.4	8.1	7.5	7.1	7.6	6.9	6.9	7.1	6.8
Manganese, Total	ND	0.87	2.1	0.26	0.876	0.709	0.001	0.0026	0.0011 J	0.0008 J	ND	0.0026J	ND
Mercury, Total	ND	ND	ND	ND	ND	ND	ND	ND	0.00002 J	0.00002 J	0.00005J	ND	ND
Nickel, Total	ND	ND	ND	ND	ND	0.010	0.005						
Selenium, Total	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver, Total	ND	ND	ND	ND	ND	ND	ND	ND	0.0009 J	ND	ND	ND	ND
Thallium, Total	ND	ND	ND	ND	ND	ND	ND						
Zinc, Total	ND	ND	ND	ND	ND	0.007	0.005						
VOCs													
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND						

Notes:
All units in mg/L except pH (standard pH units)
NA = Not analyzed
ND = Non-detect at laboratory detection limit
Shaded areas indicate sampling parameter no longer required
All detection limits are below discharge limits
J = Value is greater than Reporting Limit but less than MDL

Table 3-7
Annual Effluent Sampling Results
Arsenic Treatment Plant
Shepley's Hill Landfill
Devens, Massachusetts

Analyte		Analyte		Analyte	
VOCs	Conc.	Semi-Volatiles	Conc.	Pest. & PCBs	Conc.
1,1,1-TRICHLOROETHANE	ND	1,2,4-TRICHLOROBENZENE	ND	4,4-DDD	ND
1,1,2,2-TETRACHLOROETHANE	ND	1,2-BENZPHENANTHRACENE	ND	4,4-DDE	ND
1,1,2-TRICHLOROETHANE	ND	1,2-DICHLOROBENZENE	ND	4,4-DDT	ND
1,1-DICHLOROETHANE	0.49 J	1,4-DICHLOROBENZENE	ND	ALDRIN	ND
1,1-DICHLOROETHYLENE	ND	2,2-OXYBIS(1-CHLOROPROPAI	ND	ALPHA-BHC	ND
1,2-DICHLOROBENZENE	ND	2,4,6-TRICHLOROPHENOL	ND	AROCLOR 1221	ND
1,2-DICHLOROETHANE	ND	2,4-DICHLOROPHENOL	ND	AROCLOR 1254	ND
1,2-DICHLOROPROPANE	ND	2,4-DIMETHYLPHENOL	ND	AROCLOR 1260	ND
1,4-DICHLOROBENZENE	0.89 J	2,4-DINITROPHENOL	ND	AROCLOR-1016	ND
2-CHLOROETHYL VINYL ETHER	ND	2,4-DINITROTOLUENE	ND	AROCLOR-1232	ND
ACROLEIN	ND	2,6-DINITROTOLUENE	ND	AROCLOR-1242	ND
ACRYLONITRILE	ND	2-CHLORONAPHTHALENE	ND	AROCLOR-1248	ND
BENZENE	0.91 J	2-CHLOROPHENOL	ND	BETA-BHC	ND
BROMODICHLOROMETHANE	ND	2-METHYLPHENOL	ND	CAMPHECHLOR	ND
BROMOMETHANE	ND	2-NITROPHENOL	ND	CHLORDANE	ND
CARBON TETRACHLORIDE	ND	3,3'-DICHLOROBENZIDINE	ND	CIS-CHLORDANE	ND
CHLOROBENZENE	0.71 J	3,5,5-TRIMETHYL-2-CYCLOHEX	ND	DELTA-BHC	ND
CHLORODIBROMOMETHANE	ND	3-METHYLPHENOL/4-METHYLF	ND	DIELDRIN	ND
CHLOROETHANE	0.82 J	4,6-DINITRO-2-METHYLPHENO	ND	ENDOSULFAN I	ND
CHLOROFORM	0.92 J	4-BROMOPHENYL PHENYL ETI	ND	ENDOSULFAN II	ND
CHLOROMETHANE	ND	4-CHLORO-3-METHYLPHENOL	ND	ENDOSULFAN SULFAT	ND
CIS-1,3-DICHLOROPROPENE	ND	4-CHLOROPHENYL PHENYL ET	ND	ENDRIN	ND
DICHLOROMETHANE	ND	4-NITROPHENOL	ND	ENDRIN ALDEHYDE	ND
ETHYLBENZENE	ND	ACENAPHTHENE	ND	GAMMA-BHC (LINDANE	ND
M-DICHLOROBENZENE	ND	ACENAPHTHYLENE	ND	GAMMA-CHLORDANE	ND
METHYLBENZENE	ND	ANTHRACENE	ND	HEPTACHLOR	ND
TETRACHLOROETHENE	ND	AZOBENZENE	ND	HEPTACHLOR EPOXID	ND
TRANS-1,2-DICHLOROETHENE	ND	BENZIDINE	ND		
TRANS-1,3-DICHLOROPROPENE	ND	BENZO(A)ANTHRACENE	ND	**TPHs (total)**	1430 J
TRIBOMOMETHANE	ND	BENZO(A)PYRENE	ND		
TRICHLOROETHYLENE	ND	BENZO(B)FLUORANTHENE	ND		
VINYL CHLORIDE	ND	BENZO(G,H,I)PERYLENE	ND		
		BENZO(K)FLUORANTHENE	ND		
General	Conc.	BENZYL BUTYL PHTHALATE	ND		
CHLORIDE	58000	BIS(2-CHLORDETHOXY)METHA	ND		
SULFATE	2600	BIS(2-CHLOROETHYL)ETHER	ND		
NITRATE (AS N)	160	BIS(2-ETHYLHEXYL)PHTHALAT	ND		
		DIBENZ(A,H)ANTHRACENE	ND		
Metals	Conc.	DIETHYL PHTHALATE	ND		
BARIUM	24	DIMETHYL PHTHALATE	ND		
CADMIUM	ND	DI-N-BUTYLPHTHALATE	ND		
CHROMIUM	ND	DI-N-OCTYLPHTHALATE	ND		
COPPER	9.6 J	FLUORANTHENE	ND		
IRON	ND	FLUORENE	ND		
LEAD	ND	HEXACHLORO-1,3-BUTADIENE	ND		
MAGNESIUM	7100	HEXACHLOROBENZENE	ND		
MANGANESE	2.6 J	HEXACHLOROCYCLOPENTADI	ND		
SELENIUM	ND	HEXACHLOROETHANE	ND		
SILVER	ND	INDENO(1,2,3-CD)PYRENE	ND		
ARSENIC	5.3	M-DICHLOROBENZENE	ND		
MERCURY	ND	METHANAMINE, N-METHYL-N-I	ND		
		NAPHTHALENE	ND		
		NITROBENZENE	ND		
		N-NITROSODI-N-PROPYLAMINI	ND		
		N-NITROSODIPHENYLAMINE	ND		
		PENTACHLOROPHENOL	ND		
		PHENANTHRENE	ND		
		PHENOL	ND		
		PYRENE	ND		

Notes:
J = Value is below the reported detection limit but greater than the method detection limit, the value is estimated
ND = Non-detect at laboratory detection limit. All detection limits are below discharge limits
All units in ug/l

Table 3-5
Influent VOC Concentrations
Arsenic Treament Plant
Shepley's Hill Landfill, Devens, Massachusetts

EW-01		EW-04	
Analyte	**Result**	**Analyte**	**Result**
Methylene chloride	ND	Methylene chloride	ND
1,1-Dichloroethane	0.91	1,1-Dichloroethane	ND
Chloroform	ND	Chloroform	ND
Carbon tetrachloride	ND	Carbon tetrachloride	ND
1,2-Dichloropropane	ND	1,2-Dichloropropane	ND
Dibromochloromethane	ND	Dibromochloromethane	ND
1,1,2-Trichloroethane	ND	1,1,2-Trichloroethane	ND
Tetrachloroethene	ND	Tetrachloroethene	ND
Chlorobenzene	1.1	Chlorobenzene	0.76
Trichlorofluoromethane	ND	Trichlorofluoromethane	ND
1,2-Dichloroethane	ND	1,2-Dichloroethane	ND
1,1,1-Trichloroethane	ND	1,1,1-Trichloroethane	ND
Bromodichloromethane	ND	Bromodichloromethane	ND
trans-1,3-Dichloropropene	ND	trans-1,3-Dichloropropene	ND
cis-1,3-Dichloropropene	ND	cis-1,3-Dichloropropene	ND
1,1-Dichloropropene	ND	1,1-Dichloropropene	ND
Bromoform	ND	Bromoform	ND
1,1,2,2-Tetrachloroethane	ND	1,1,2,2-Tetrachloroethane	ND
Benzene	1.5	Benzene	0.86
Toluene	ND	Toluene	ND
Ethylbenzene	ND	Ethylbenzene	ND
Chloromethane	ND	Chloromethane	ND
Bromomethane	ND	Bromomethane	ND
Vinyl chloride	0.4J	Vinyl chloride	ND
Chloroethane	ND	Chloroethane	ND
1,1-Dichloroethene	ND	1,1-Dichloroethene	ND
trans-1,2-Dichloroethene	ND	trans-1,2-Dichloroethene	ND
Trichloroethene	ND	Trichloroethene	ND
1,2-Dichlorobenzene	0.2J	1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND	1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	1.4J	1,4-Dichlorobenzene	0.57J
Methyl tert butyl ether	ND	Methyl tert butyl ether	ND
p/m-Xylene	ND	p/m-Xylene	ND
o-Xylene	ND	o-Xylene	ND
cis-1,2-Dichloroethene	1.7	cis-1,2-Dichloroethene	0.74
Dibromomethane	ND	Dibromomethane	ND
1,2,3-Trichloropropane	ND	1,2,3-Trichloropropane	ND
Styrene	ND	Styrene	ND
Dichlorodifluoromethane	ND	Dichlorodifluoromethane	ND
Acetone	ND	Acetone	ND
Carbon disulfide	ND	Carbon disulfide	ND
2-Butanone	ND	2-Butanone	ND
4-Methyl-2-pentanone	ND	4-Methyl-2-pentanone	ND
2-Hexanone	ND	2-Hexanone	ND
Bromochloromethane	ND	Bromochloromethane	ND
Tetrahydrofuran	ND	Tetrahydrofuran	ND
2,2-Dichloropropane	ND	2,2-Dichloropropane	ND
1,2-Dibromoethane	ND	1,2-Dibromoethane	ND
1,3-Dichloropropane	ND	1,3-Dichloropropane	ND
1,1,1,2-Tetrachloroethane	ND	1,1,1,2-Tetrachloroethane	ND
Bromobenzene	ND	Bromobenzene	ND
n-Butylbenzene	ND	n-Butylbenzene	ND
sec-Butylbenzene	ND	sec-Butylbenzene	ND
tert-Butylbenzene	ND	tert-Butylbenzene	ND
o-Chlorotoluene	ND	o-Chlorotoluene	ND
p-Chlorotoluene	ND	p-Chlorotoluene	ND
1,2-Dibromo-3-chloropropane	ND	1,2-Dibromo-3-chloropropane	ND
Hexachlorobutadiene	ND	Hexachlorobutadiene	ND
Isopropylbenzene	ND	Isopropylbenzene	ND
p-Isopropyltoluene	ND	p-Isopropyltoluene	ND
Naphthalene	ND	Naphthalene	ND
n-Propylbenzene	ND	n-Propylbenzene	ND
1,2,3-Trichlorobenzene	ND	1,2,3-Trichlorobenzene	ND
1,2,4-Trichlorobenzene	ND	1,2,4-Trichlorobenzene	ND
1,3,5-Trimethylbenzene	ND	1,3,5-Trimethylbenzene	ND
1,2,4-Trimethylbenzene	ND	1,2,4-Trimethylbenzene	ND
Ethyl ether	17	Ethyl ether	7.5
Isopropyl Ether	ND	Isopropyl Ether	ND
Ethyl-Tert Butyl-Ether	ND	Ethyl-Tert Butyl-Ether	ND
Tertiary Amyl Methyl Ether	ND	Tertiary Amyl Methyl Ether	ND
1,4-Dioxane	ND	1,4-Dioxane	ND
Total EW-01	**22.21**	**Total EW-04**	**9.86**

Notes:
J = Value is below the reportable detection limit but greater than the method detection limit; the value is estimated.
ND = Non-detect at laboratory detection limit. All detection limits are below discharge limits.
All units in ug/l

Table 4-1
Long Term Monitoring Network
Shepley's Hill Landfill
Devens, Massachusetts

Well ID	Surface (ft msl)	Screen Interval (ft bgs)	Screen Elevation (ft msl)	Interval Description	Chemistry: Only Field Parameters	Chemistry: Fall	Chemistry: Spring	Hydraulics: Fall/Spring
DOWNGRADIENT - MOLUMCO ROAD								
SHM-05-40X	224.6	32.0 - 34.0	192.6 - 190.6	Mid-Depth Overburden/Till	–	X	–	X
SHM-05-39A	222.9	37.0 - 39.0	185.9 - 183.9	Mid-Depth Overburden	–	X	–	X
SHM-05-39B	222.9	66.0 - 68.0	156.9 - 154.9	Deep Overburden	–	X	–	X
SHP-99-31A	213.5	4.0 - 14.0	209.5 - 199.5	Shallow Overburden/WT	–	X	–	X
SHP-99-31B	213.5	55.0 - 65.0	158.5 - 148.5	Mid-Depth Overburden	–	X	–	X
SHP-99-31C	213.5	68.0 - 78.0	145.5 - 135.5	Deep Overburden	–	X	–	X
SHX-99-32X	220.1	72.0 - 82.0	148.1 - 138.1	Deep Overburden	–	X	–	X
SHP-05-48A,B	–	–	–	Water Table	–	–	–	X
SHP-05-49A,B	–	–	–	Water Table	–	–	–	X
SHP-99-34A	223.6	12.5 - 17.5	211.1 - 206.1	Shallow Overburden/WT	–	–	–	X
SHP-99-34B	223.6	74.5 - 79.5	149.1 - 144.1	Deep Overburden	–	–	–	X
DOWNGRADIENT - WOODS								
SHM-05-41A	223.8	42.0 - 44.0	181.8 - 179.8	Shallow Overburden	–	X	X	X
SHM-05-41B	223.6	62.0 - 64.0	161.6 - 159.6	Mid-Depth Overburden	–	X	X	X
SHM-05-41C	224	88.0 - 93.0	136.0 - 131.0	Deep Overburden/Till	–	X	X	X
SHM-05-42A	214.5	40.0 - 42.0	174.5 - 172.5	Shallow Overburden	–	X	X	X
SHM-05-42B	214.5	70.0 - 72.0	144.5 - 142.5	Mid-Depth Overburden	–	X	X	X
NEARFIELD AREA								
SHL-23	240.4	23.0 - 33.0	217.4 - 207.4	Shallow Overburden/WT	X	X	X	X
SHL-9	222.9	15.0 - 25.0	207.9 - 197.9	Shallow Overburden/WT	X	X	X	X
SHL-22	219.6	105.0 - 115.0	114.6 - 104.6	Deep Overburden	X	X	X	X
SHM-93-22B	219.9	82.3 - 92.3	137.6 - 127.6	Mid-Depth Overburden	X	X	X	X
SHM-93-22C	217.9	124.3 - 134.3	93.6 - 83.6	Bedrock	X	X	X	X
SHL-5	216.4	3.0 - 13.0	213.4 - 203.4	Shallow Overburden/WT	X	X	X	X
SHM-96-5B	218.5	80.0 - 90.0	138.5 - 128.5	Base of Sand/Till	X	X	X	X
SHM-96-5C	218.7	50.0 - 60.0	168.7 - 158.7	Mid-Depth Overburden	X	X	X	X
SHL-8S	220.1	52.0 - 54.0	168.1 - 166.1	Mid-Depth Overburden	X	X	X	X
SHL-8D*	220.1	68.0 - 70.0	152.1 - 150.1	Deep Overburden	X	X	X	X
SHL-21	257.8	42.0 - 52.0	215.8 - 205.8	Shallow Overburden/WT	X	X	X	X
SHP-05-45A	227.3	20.0 - 25.0	207.3 - 202.3	Shallow Overburden	–	–	–	X
SHP-05-45B	227.7	65.0 - 75.0	162.7 - 152.7	Mid-Depth Overburden	–	–	–	X
SHP-05-46A	227.3	20.0 - 25.0	207.3 - 202.3	Shallow Overburden	–	–	–	X
SHP-05-46B	227.1	65.0 - 75.0	162.1 - 152.1	Mid-Depth Overburden	–	–	–	X
SHP-05-43	259.4	50.5 - 60.5	208.9 - 198.9	Shallow Overburden	–	–	–	X
SHP-05-44	256.4	51.0 - 61.0	205.4 - 195.4	Mid-Depth Overburden	–	–	–	X
POND AREA								
SHL-13	220.1	5.0 - 20.0	215.1 - 200.1	Shallow Overburden/WT	–	X	–	X
SHP-01-36A	221.1	3.0 - 8.0	218.1 - 213.1	Shallow Overburden/WT	–	X	–	X
SHP-01-37X	219.5	1.0 - 6.0	218.5 - 213.5	Shallow Overburden/WT	–	X	–	X
SHP-01-38A	219.8	1.5 - 6.5	218.3 - 213.3	Shallow Overburden/WT	–	X	–	X
PSP-01	–	–	–	Pond Stage	–	–	–	X
SHP-05-47A,B	–	–	–	Water Table	–	–	–	X
N1-P1	228.8			Deep Overburden	–	–	–	X
N1-P2	228.8			Mid-Depth Overburden	–	–	–	X
N1-P3	228.8			Shallow Overburden/WT	–	–	–	X
N2-P1	221.6			Deep Overburden	–	–	–	X
N2-P2	221.6			Mid-Depth Overburden	–	–	–	X
SHP-01-38B	219.9	18.0 - 23.0	201.9 - 196.9	Deep Overburden	–	–	–	X
N3-P1*	219.8	33.0 - 35.0	186.8 - 184.8	Bedrock	–	–	–	X
N3-P2*	219.8	4.0 - 9.0	215.8 - 210.8	Water Table	–	–	–	X
UPGRADIENT AREA								
SHL-15	260.1			Shallow Overburden/WT	–	X	–	X
N5-P1*	241.7	144.0 - 149.0	97.7 - 92.7	Bedrock	–	X	–	X
N5-P2*	241.7	20.0 - 25.0	221.7 - 216.7	Shallow Overburden/WT	–	X	–	X
SHP-95-29X	242.5	19.0 - 29.0	223.5 - 213.5	Shallow Overburden/WT	–	X	–	X
SHL-20	235.4	39.0 - 49.0	196.4 - 186.4	Deep Overburden/Till	–	X	–	X
SHL-11	235	12.0 - 27.0	223.0 - 208.0	Shallow Overburden/WT	–	X	–	X
SHL-4	226.4	3.0 - 13.0	223.4 - 213.4	Shallow Overburden/WT	–	X	–	X
SHL-19	239.5	20.0 - 30.0	219.5 - 209.5	Shallow Overburden/WT	–	X	–	X
SHL-10	249.1	24.0 - 39.0	225.1 - 210.1	Shallow Overburden/WT	–	X	–	X
SHM-93-10C	247.1	44.0 - 54.0	202.7 - 192.7	Bedrock	–	X	–	X
SHM-93-10D	246.5			Bedrock	–	X	–	X
SHL-3	247.4	24.0 - 34.0	223.4 - 213.4	Shallow Overburden/WT	–	–	–	X
SHP-95-25X	257.5	30.0 - 40.0	227.5 - 217.5	Shallow Overburden/WT	–	–	–	X
SHL-18	256.5			Shallow Overburden/WT	–	–	–	X
SHM-93-18B	236.2	78.5 - 88.5	157.7 - 147.7	Deep Overburden/Till	–	–	–	X
SHP-95-27X	236.3			Shallow Overburden/WT	–	–	–	X
N6-P1*	257.1	84.0 - 88.0	173.1 - 169.1	Bedrock	–	–	–	X
N7-P1*	254.4	86.0 - 89.0	168.4 - 165.4	Bedrock	–	–	–	X
N7-P2*	254.4	29.0 - 35.0	225.4 - 219.4	Shallow Overburden/WT	–	–	–	X
SHL-2A*	237.6	110.0 - 120.0	127.6 - 117.6	Deep Overburden	–	–	–	X
EW-01 pilot				Overburden	–	–	–	X
EW-04 pilot				Overburden	–	–	–	X

Notes:
ft bgs = feet below ground level
ft msl = feet mean sea level
* Installation [illegible] values derived from Supplemental Groundwater Investigation (Harding ESE, 2003)
[illegible]

Table 4-2
Site-Wide Groundwater Elevation Surveys
Shepley's Hill Landfill
Devens, Massachusetts

Well ID	Reference Elevation[1,2] (ft msl)	04/16/2008 DTW (TOC) (ft)	04/16/2008 Elevation (ft msl)	09/30/2008 DTW (TOC) (ft)	09/30/2008 Elevation (ft msl)
N-1, P-1	231	14.32	216.78	14.31	216.69
N-1, P-2	231	13.81	217.19	14.07	216.93
N-1, P-3	231.2	13.66	217.54	13.79	217.41
N-2, P-1	223.1	5.25	217.85	5.35	217.75
N-2, P-2	223	5.52	217.48	5.52	217.48
N-3, P-1	221.8	4.41	217.39	4.51	217.29
N-3, P-2	221.5	4.21	217.29	4.19	217.31
N-5, P-1	243.7	22	221.7	23.37	220.33
N-5, P-2	243.7	22.47	221.23	23.6	220.1
N-6, P-1	259.9	35.4	224.5	36.69	223.21
N-7, P-1	256.6	28.71	227.89	29.5	227.1
N-7, P-2	257.1	28.75	228.35	29.55	227.55
PSP-01	216.1	1.52	217.62	1.65	217.75
SHL-10	248.8	30.45	218.35	30.67	218.13
SHL-11	236.5	18.16	218.34	18.4	218.1
SHL-13	221.8	6.09	215.71	6.49	215.31
SHL-15	260.9	16.07	244.83	18.15	242.75
SHL-18	238.6	18.45	220.15	18.31	220.29
SHL-19	241.5	22.45	219.05	22.39	219.11
SHL-20	237	18.52	218.48	18.8	218.2
SHL-21	260	44.01	215.99	45.11	214.89
SHL-22	220.6	5.92	214.68	6.7	213.9
SHL-23	242.3	25.59	216.71	27.7	214.6
SHL-24	239.8	14.29	225.51	14.08	225.72
SHL-3	247.8	29.82	218.78	29.98	217.82
SHL-4	226.1	10.04	218.06	10.03	218.07
SHL-5	218.6	2.63	215.97	2.2	216.4
SHL-8D	221.8	6.51	215.29	7.07	214.73
SHL-8S	222	6.64	215.36	7.2	214.8
SHL-9	223	8.11	214.89	8.99	214.01
SHM-05-39A	222.6	10.31	212.29	10.99	211.61
SHM-05-39B	222.6	11.1	211.5	11.9	210.7
SHM-05-40C	224.4	12.92	211.48	13.82	210.58
SHM-05-41A	223.5	9.09	214.41	10.03	213.47
SHM-05-41B	223.3	8.91	214.39	9.86	213.44

Well ID	Reference Elevation[1,2] (ft msl)	04/16/2008 DTW (TOC) (ft)	04/16/2008 Elevation (ft msl)	09/30/2008 DTW (TOC) (ft)	09/30/2008 Elevation (ft msl)
SHM-05-41C	223.6	9.2	214.4	10.06	213.54
SHM-05-42A	217.6	3.52	214.28	4.18	213.62
SHM-05-42B	217.8	3.49	214.31	4.21	213.59
SHM-93-10C	248.6	28.81	219.79	29.85	218.75
SHM-93-10D	248.9	29.93	218.97	28.81	220.09
SHM-93-18B	238.5	18.1	220.2	17.99	220.31
SHM-93-22C	221.7	6.94	214.76	7.78	213.92
SHM-96-22B	220.4	5.77	214.63	6.58	213.82
SHM-96-5B	220	4.99	215.01	5.71	214.29
SHM-96-5C	219.4	4.42	214.98	5.12	214.28
SHM-99-31A	215.4	1.94	213.46	1.58	213.82
SHM-99-31B	215.4	1.84	213.56	3.39	212.01
SHM-99-31C	215.8	3.11	212.69	3.71	212.09
SHM-99-32X	222.3	NS	NS	9.27	213.03
SHP-01-36X	225.1	7.51	217.59	7.54	217.56
SHP-01-37X	223.7	6.26	217.44	6.27	217.43
SHP-01-38A	221.6	3.85	217.95	3.8	218
SHP-01-38B	222	3.78	218.22	3.87	218.13
SHP-05-43	261.7	44.08	217.62	44.9	216.8
SHP-05-44	259.1	41.41	217.69	41.9	217.2
SHP-05-45A	229.5	14.57	214.93	15.43	214.07
SHP-05-45B	230.1	15.1	215	15.2	214.9
SHP-05-46A	229.3	13.3	216	14.28	215.02
SHP-05-46B	228.7	13.99	214.71	14.9	213.8
SHP-05-47A	218.5	4.32	214.18	4.35	214.15
SHP-05-47B	216.3	2.25	214.05	2.02	214.28
SHP-05-48A	217	3.47	213.53	3.5	213.5
SHP-05-48B	218.4	4.88	213.52	4.61	213.79
SHP-05-49A	217.8	5.43	212.37	4.21	213.59
SHP-05-49B	216.2	4.92	211.28	5.29	210.91
SHP-99-27X	238.5	13.98	224.52	13.25	225.25
SHP-99-29X	244.41	21.28	223.13	23.35	221.06
SHP-99-34A	225.7	12.43	213.27	12.13	213.57
SHP-99-34B	225.6	12.28	213.32	12.66	212.94
SHP-99-35X	259.2	35.66	223.54	39.6	219.6

Notes: 1. All ground surface and reference elevations based on field survey performed by Meridian Associates, Inc. between July and August 2005 except SHL-10 which is based on groundwater monitoring well completion log by CurTest, Inc.

2. Elevations based upon project system reported to be National Geodetic Vertical Datum of 1929 (NGVD29)

MSL = Mean Sea Level

DTW = Depth to Water

TOC = Top of Casing

NS = Not Sampled

Table 4-2
Site-Wide Groundwater Elevation Surveys
Shepley's Hill Landfill
Devens, Massachusetts

Well ID	Reference Elevation[1,2] (ft msl)	04/16/2008 DTW (TOC) (ft)	04/16/2008 Elevation (ft msl)	09/30/2008 DTW (TOC) (ft)	09/30/2008 Elevation (ft msl)
N-1, P-1	231	14.22	216.78	14.31	216.69
N-1, P-2	231	13.81	217.19	14.07	216.93
N-1, P-3	231.2	13.66	217.54	13.79	217.41
N-2, P-1	223.1	5.25	217.85	5.35	217.75
N-2, P-2	223	5.52	217.48	5.52	217.48
N-3, P-1	221.8	4.41	217.39	4.51	217.29
N-3, P-2	221.5	4.21	217.29	4.19	217.31
N-5, P-1	243.7	22	221.7	23.37	220.33
N-5, P-2	243.7	22.47	221.23	23.6	220.1
N-6, P-1	259.9	35.4	224.5	36.69	223.21
N-7, P-1	256.6	28.71	227.89	29.5	227.1
N-7, P-2	257.1	28.75	228.35	29.55	227.55
PSP-01	216.1	1.52	217.62	1.65	217.75
SHL-10	248.8	30.45	218.35	30.67	218.13
SHL-11	236.5	18.16	218.34	18.4	218.1
SHL-13	221.8	6.09	215.71	6.49	215.31
SHL-15	260.9	16.07	244.83	18.15	242.75
SHL-18	238.6	18.45	220.15	18.31	220.29
SHL-19	241.5	22.45	219.05	22.39	219.11
SHL-20	237	18.52	218.48	18.8	218.2
SHL-21	260	44.01	215.99	45.11	214.89
SHL-22	220.6	5.92	214.68	6.7	213.9
SHL-23	242.3	25.59	216.71	27.7	214.6
SHL-24	239.8	14.29	225.51	14.08	225.72
SHL-3	247.8	29.82	218.78	29.98	217.82
SHL-4	228.1	10.04	218.06	10.03	218.07
SHL-5	218.6	2.63	215.97	2.2	216.4
SHL-8D	221.8	6.51	215.29	7.07	214.73
SHL-8S	222	6.64	215.36	7.2	214.8
SHL-9	223	8.11	214.89	8.99	214.01
SHM-05-39A	222.6	10.31	212.29	10.99	211.61
SHM-05-39B	222.6	11.1	211.5	11.9	210.7
SHM-05-40X	224.4	12.92	211.48	13.82	210.58
SHM-05-41A	223.5	9.09	214.41	10.03	213.47
SHM-05-41B	223.3	8.91	214.39	9.86	213.44
SHM-05-41C	223.6	9.2	214.4	10.06	213.54
SHM-05-42A	217.8	3.52	214.28	4.18	213.62
SHM-05-42B	217.8	3.49	214.31	4.21	213.59
SHM-93-10C	248.6	28.81	219.79	29.85	218.75
SHM-93-10D	248.9	29.93	218.97	28.81	220.09
SHM-93-18B	238.3	18.1	220.2	17.99	220.31
SHM-93-22C	221.7	6.94	214.76	7.78	213.92
SHM-96-22B	220.4	5.77	214.63	6.58	213.82
SHM-96-5B	220	4.99	215.01	5.71	214.29
SHM-96-5C	219.4	4.42	214.98	5.12	214.28
SHM-99-31A	215.4	1.94	213.46	1.58	213.82
SHM-99-31B	215.4	1.84	213.56	3.39	212.01
SHM-99-31C	215.8	3.11	212.69	3.71	212.09
SHM-99-32X	222.3	NS	NS	9.27	213.03
SHP-01-36X	225.1	7.51	217.59	7.54	217.56
SHP-01-37X	223.7	6.26	217.44	6.27	217.43
SHP-01-38A	221.8	3.85	217.95	3.8	218
SHP-01-38B	222	3.78	218.22	3.87	218.13
SHP-05-43	261.7	44.08	217.62	44.9	216.8
SHP-05-44	259.1	41.41	217.69	41.9	217.2
SHP-05-45A	229.5	14.57	214.93	15.43	214.07
SHP-05-45B	230.1	15.1	215	15.2	214.9
SHP-05-46A	229.3	13.3	216	14.28	215.02
SHP-05-46B	228.7	13.99	214.71	14.9	213.8
SHP-05-47A	218.5	4.32	214.18	4.35	214.15
SHP-05-47B	216.3	2.25	214.05	2.02	214.28
SHP-05-48A	217	3.47	213.53	3.5	213.5
SHP-05-48B	218.4	4.88	213.52	4.61	213.79
SHP-05-49A	217.8	5.43	212.37	4.21	213.59
SHP-05-49B	216.2	4.92	211.28	5.29	210.91
SHP-95-27X	238.5	13.98	224.52	13.25	225.25
SHP-99-29X	244.41	21.28	223.13	23.35	221.06
SHP-99-34A	225.7	12.43	213.27	12.13	213.57
SHP-99-34B	225.6	12.28	213.32	12.66	212.94
SHP-99-35X	259.2	35.66	223.54	39.6	219.6

Notes: 1. All ground surface and reference elevations based on field survey performed by Meridan Associates, Inc. between July and August 2005 except SHL-10, which is based on groundwater monitoring well completion log by ConTest, Inc.

2. Elevations based upon project system, reported to be National Geodetic Vertical Datum of 1929 (NGVD29)

MSL = Mean Sea Level

DTW = Depth to Water

TOC = Top of Casing

NS = Not Sampled

Table 4-3
Groundwater Analytical Results
Shepley's Hill Landfill
Devens, Massachusetts

Analytical Parameter	Units	MCL or ROD Standard	Sample ID															
			SHL-8S Apr-2008	SHL-8S Oct-2008	SHL-9 Apr-2008	SHL-9 Oct-2008	SHM-05-39A Oct-2008	SHM-05-39B Oct-2008	SHM-05-40X Oct-2008	SHM-05-41A Apr-2008	SHM-05-41A Oct-2008	SHM-05-41B Apr-2008	SHM-05-41B Oct-2008	SHM-05-41C Apr-2008	SHM-05-41C Oct-2008	SHM-05-42A Apr-2008	SHM-05-42A Oct-2008	SHM-05-42B Apr-2008
ALKALINITY, TOTAL (AS CACO3)	ug/l		18000	16000	61000	72000	220000	320000	280000	31000	28000	330000	240000	340000	340000	15000	16400	470000
CHLORIDE	ug/l		7000	7400	1600	6100	19000	90000	16000	6700	2100	21000	13000	100000	33000	1300	1200	45000
NITRATE (AS N)	ug/l		150	100 UJ	57 J	100 U	130 J	180	48 J	61 J	65 J	250 J	1000 UJ	94 J	56 J	110	89 J	1000 U
SULFATE	ug/l		1100	1700	7400	7400	3200	3700	2400	91000	7600	1000 U	2900	1800	390 J	7000	6700	2800
TURBIDITY	NTU		0.2 U	0.2 U	3.4	3	140	54	380	1.2	2.6	280	210	170	280	5.2	1.6	280
Dissolved Metals by SW6010/SW6020																		
ARSENIC	ug/l	10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CALCIUM METAL	ug/l		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
IRON	ug/l	9100	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MAGNESIUM	ug/l		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MANGANESE	ug/l	1715	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
POTASSIUM	ug/l		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
SODIUM	ug/l	20000	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Metals by SW6010/SW6020																		
ARSENIC	ug/l	10	0.5 U	1 UJ	14.6	40.7	275.6	241.2	4920	26.9	18.7	2348	1910	662.2	789.3	2.5	1 U	266.2
CALCIUM METAL	ug/l		4300	4300	22000	24000	37000	91000	49000	8800	7000	48000	31000	95000	99000	5500	5400	75000
IRON	ug/l	9100	50 U	50 U	3500	51000	60000	4000	65000	3500	1900	100000	68000	16300	19000	590	80	73000
MAGNESIUM	ug/l		770	790	1600	1700	4800	13000	7400	1700	1400	6600	4400	13000	13000	1100	1100	12000
MANGANESE	ug/l	1715	12	14	426	452	1750	5320	1420	396	224	1780	1330	2960	3100	30	7.6 J	2530
POTASSIUM	ug/l		1200 J	2500 U	1800 J	2500	10000	7400	8000	2100 J	2400 J	15000	12000	6700	3400	1600 J	1800 J	20000
SODIUM	ug/l	20000	5200	5800	2000	3200	11000	63000	19000	4400	3400	16000	15000	75000	35000	2000 U	1300 J	36000
Field Readings	**Units**	**MCL or ROD Standard**	**SHL-8S Apr-2008**	**SHL-8S Oct-2008**	**SHL-9 Apr-2008**	**SHL-9 Oct-2008**	**SHM-05-39A Oct-2008**	**SHM-05-39B Oct-2008**	**SHM-05-40X Oct-2008**	**SHM-05-41A Apr-2008**	**SHM-05-41A Oct-2008**	**SHM-05-41B Apr-2008**	**SHM-05-41B Oct-2008**	**SHM-05-41C Apr-2008**	**SHM-05-41C Oct-2008**	**SHM-05-42A Apr-2008**	**SHM-05-42A Oct-2008**	**SHM-05-42B Apr-2008**
DO	mg/l	n/a	2.03	1.07	0.27	1.1	0.2	6.25	0.22	0.55	0.27	0.36	0.12	0.16	0.12	5.36	3.65	0.2
ORP	Millivolts	n/a	158	234.5	-12	-46	-76.1	-70.9	-104.2	35	10.8	-76	-89	-110	-149.5	230	179.6	-59
pH	pH Units	n/a	5.11	5.67	6.48	6.43	6.38	6.86	6.58	6.33	6.73	6.36	5.52	6.9	7.42	5.02	6.1	5.78
SPC	mS/cm	n/a	0.227	0.04	0.159	0.205	0.492	0.879	0.549	0.116	0.052	0.787	0.367	0.886	0.491	0.211	0.033	1.112
Temp	DEG C	n/a	8.85	10.4	7.28	8.85	7.58	9.82	7.91	9.76	10.47	9.77	11.49	9.6	10.81	9.77	10.13	10.06
TURBIDITY	NTU	n/a	NS	0.63	NS	NS	1.19	7.81	14.3	NS	1.96	NS	2.56	NS	4.7	NS	0.64	NS

Notes: J = Estimated Detect
U = Not detected at indicated reporting limit
NS = Not Sampled
Highlighted values exceed MCL or ROD standard

Table 4-3
Groundwater Analytical Results
Shepley's Hill Landfill
Devens, Massachusetts

Analytical Parameter	Units	MCL or ROD Standard	Sample ID														
			SHM-85-42B Oct-2008	SHM-93-18C Oct-2008	SHM-93-18D Oct-2008	SHM-93-22C Apr-2008	SHM-93-22C Oct-2008	SHM-96-22B Apr-2008	SHM-96-22B Oct-2008	SHM-96-5B Apr-2008	SHM-96-5B Oct-2008	SHM-96-5C Apr-2008	SHM-96-5C Oct-2008	SHM-99-31A Oct-2008	SHM-99-31B Oct-2008	SHM-99-31C Oct-2008	SHM-99-32X Oct-2008
ALKALINITY, TOTAL (AS CACO3)	ug/l		350000	170000	61000	180000	110000	320000	320000	330000	320000	330000	310000	47000	140000	360000	360000
CHLORIDE	ug/l		33000	24000	26000	25000	13000	29000	18000	22000	19000	28000	21000	16000	9200	32000	37000
NITRATE (AS N)	ug/l		110 J	100 UJ	100 UJ	78 J	290	100 U	1000 UJ	100 U	100 U	500 U	100 UJ	100 U	500 U	40 J	500 U
SULFATE	ug/l		4600	19000	18000	9100	8600	3400	3400	4100	4800	620 J	1700	4300	3800	1800	5600
TURBIDITY	NTU		270	0.8	130	3.9	4.2	400	260	90	12	67	31	0.87	6.2	310	300
Dissolved Metals by SW6010/SW6020																	
ARSENIC	ug/l	10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CALCIUM METAL	ug/l		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
IRON	ug/l	9100	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MAGNESIUM	ug/l		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MANGANESE	ug/l	1715	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
POTASSIUM	ug/l		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
SODIUM	ug/l	20000	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Metals by SW6010/SW6020																	
ARSENIC	ug/l	10	356	16.1	23.4	29.4	17.7	1721	1374	1587	747.8	54.7	51.8	18.2	70.5	280.3	203.8
CALCIUM METAL	ug/l		64000	72000	82000	58000	36000	70000	71000	73000	82000	66000	65000	13000	30000	85800	92000
IRON	ug/l	9100	66000	50	17000	1000	640	72000	54000	18000	5300	25000	21000	8400	19000	36600	37000
MAGNESIUM	ug/l		10000	4100	660	6400	5000	12000	11000	12000	13000	8600	8500	880	3200	13000	14000
MANGANESE	ug/l	1715	2410	40	140	335	150	2310	4520	9240	10800	5450	3960	495	690	3880	4200
POTASSIUM	ug/l		15000	4800	5900	4700	4380	14000	9500	10000	8500	14000	11000	2500 U	4600	10000	7000
SODIUM	ug/l	20000	29000	8400	7700	13000	10000	27000	24000	22000	26000	27000	26000	11000	11000	33800	35000
Field Readings	**Units**	**MCL or ROD Standard**	**SHM-85-42B Oct-2008**	**SHM-93-18C Oct-2008**	**SHM-93-18D Oct-2008**	**SHM-93-22C Apr-2008**	**SHM-93-22C Oct-2008**	**SHM-96-22B Apr-2008**	**SHM-96-22B Oct-2008**	**SHM-96-5B Apr-2008**	**SHM-96-5B Oct-2008**	**SHM-96-5C Apr-2008**	**SHM-96-5C Oct-2008**	**SHM-99-31A Oct-2008**	**SHM-99-31B Oct-2008**	**SHM-99-31C Oct-2008**	**SHM-99-32X Oct-2008**
DO	mg/l	n/a	0.13	0.77	0.12	0.35	0.31	0.1	0.21	0.2	0.58	0.12	1.5	0.15	0.9	0.12	0.24
ORP	Millivolts	n/a	-79	-12	-15.7	-142	-86.6	-96	-82.5	-11	6	-21	-57.7	28	-41.2	-90.8	-76.8
pH	pH Units	n/a	6.67	7.27	11.35	7.53	7.87	6.84	6.47	5.82	6.21	5.24	6.21	5.8	6.48	6.59	6.44
SPC	ms/cm	n/a	0.53	0.411	0.312	0.443	0.256	0.859	0.722	0.762	0.709	0.86	0.705	0.159	0.212	0.529	0.713
Temp	DEG C	n/a	10.31	8.87	8.99	8.44	7.75	7.01	7.41	9.78	9.64	9.49	7.51	10.87	10.91	10.79	6.98
TURBIDITY	NTU	n/a	6.35	2.82	82.7	NS	5.18	NS	13	NS	1.02	NS	2.13	1.27	0.96	1.55	8.35

Notes: J = Estimated Detect
U = Not detected at indicated reporting limit
NS = Not Sampled
Highlighted values exceed MCL or ROD standard

Table 4-3
Groundwater Analytical Results
Shepley's Hill Landfill
Devens, Massachusetts

Analaytical Parameter	Units	MCL or ROD Standard	Sample ID			
			SHP-01-36X Oct-2008	SHP-01-37X Oct-2008	SHP-01-38A Oct-2008	SHP-99-29X Oct-2008
ALKALINITY, TOTAL (AS CACO3)	ug/l		38000	38000	140000 J	100000
CHLORIDE	ug/l		39000	25000	28000	2900
NITRATE (AS N)	ug/l		100 U	100 U	500 UJ	1000 UJ
SULFATE	ug/l		1000 U	3400	16000	5900
TURBIDITY	NTU		0.2 U	0.2 U	33	9.9
			Dissolved Metals by SW6010/SW6020			
ARSENIC	ug/l	10	NS	NS	NS	NS
CALCIUM METAL	ug/l		NS	NS	NS	NS
IRON	ug/l	9100	NS	NS	NS	NS
MAGNESIUM	ug/l		NS	NS	NS	NS
MANGANESE	ug/l	1715	NS	NS	NS	NS
POTASSIUM	ug/l		NS	NS	NS	NS
SODIUM	ug/l	20000	NS	NS	NS	NS
			Total Metals by SW6010/SW6020			
ARSENIC	ug/l	10	27.9	38.1	602.4	2106
CALCIUM METAL	ug/l		9600	7300	28000	9000
IRON	ug/l	9100	5000	6800	26000	40000
MAGNESIUM	ug/l		1800	1400	4300	890
MANGANESE	ug/l	1715	119	310	664	5370
POTASSIUM	ug/l		1800 J	1300 J	9200	2500 U
SODIUM	ug/l	20000	23000	19000	16000	2300
Field Readings	**Units**	**MCL or ROD Standard**	**SHP-01-36X Oct-2008**	**SHP-01-37X Oct-2008**	**SHP-01-38A Oct-2008**	**SHP-99-29X Oct-2008**
DO	mg/l	n/a	0.16	0.12	0.15	0.22
ORP	Millivolts	n/a	-38.7	-54.2	-60.9	14.6
pH	pH Units	n/a	6.37	6.51	6.3	5.3
SPC	ms/cm	n/a	0.219	0.175	0.418	0.226
Temp	DEG C	n/a	17.37	15.59	12.96	11.77
TURBIDITY	NTU	n/a	0.31	0.09	0.04	4.4

Notes: J = Estimated Detect
U = Not detected at indicated reporting limit
NS = Not Sampled
Highlighted values exceed MCL or ROD standard

Table 4-4
In-Situ Water Quality Monitoring Results
Shepley's Hill Landfill
Devens, Massachusetts

Well	Event	Date	DO (mg/l)	ORP (Millivolts)	pH (pH Units)	SPC (ms/cm)	Temp (DEG C)	TURBIDITY (NTU)
SHL-21	Winter 2008	01/10/2008	10.16	176	6	0.048	12.61	NS
SHL-21	Spring 2008	04/18/2008	9.67	241	5.98	0.225	12.48	NS
SHL-21	Summer 2008	07/16/2008	9.99	252	5.22	0.061	13.64	0.39
SHL-21	Fall 2008	10/06/2008	8.78	127	6.02	0.066	9.78	0.91
SHL-22	Winter 2008	01/09/2008	0.68	-51	6.7	0.508	9.23	NS
SHL-22	Spring 2008	04/21/2008	0.21	2	6.89	0.767	7.98	NS
SHL-22	Summer 2008	07/15/2008	8.51	52.6	6.31	0.776	10.18	0.33
SHL-22	Fall 2008	10/01/2008	0.15	-21	6.5	0.736	7.41	0
SHL-23	Winter 2008	01/09/2008	10.01	160	5.55	0.033	12.96	NS
SHL-23	Spring 2008	04/21/2008	14.36	248	5.25	0.032	10.84	1.42
SHL-23	Summer 2008	07/15/2008	12.63	276	4.9	0.036	11.08	8.19
SHL-23	Fall 2008	10/06/2008	12.11	184	5.94	0.041	8.2	0.51
SHL-5	Winter 2008	01/08/2008	0.67	60	5.42	0.079	4.72	NS
SHL-5	Spring 2008	04/17/2008	0.11	73	3.26	0.251	5.08	NS
SHL-5	Summer 2008	07/15/2008	0.11	3	5.5	0.108	12.84	1.52
SHL-5	Fall 2008	10/01/2008	0.11	17.7	5.57	0.095	11.48	1.85
SHL-8D	Winter 2008	01/08/2008	5.86	215	6.41	0.112	9.07	NS
SHL-8D	Spring 2008	04/17/2008	1.57	233	5.86	0.313	9.64	NS
SHL-8D	Summer 2008	07/15/2008	1.09	121	6.08	0.163	10.82	0.18
SHL-8D	Fall 2008	10/01/2008	1.53	225.6	5.81	0.084	10.87	0.21
SHL-8S	Winter 2008	01/08/2008	1.29	101	6.39	0.062	9.43	NS
SHL-8S	Spring 2008	04/17/2008	2.03	158	6.11	0.227	8.85	NS
SHL-8S	Summer 2008	07/15/2008	1.32	149	6.03	0.073	10.68	0.51
SHL-8S	Fall 2008	10/01/2008	1.07	234.5	5.67	0.04	10.4	0.63
SHL-9	Winter 2008	01/09/2008	0.1	-58	6.63	0.114	9.19	NS
SHL-9	Spring 2008	04/21/2008	0.27	-12	6.48	0.159	7.28	NS
SHL-9	Summer 2008	07/15/2008	0.21	-15	6.19	0.214	8.8	1.46
SHL-9	Fall 2008	10/01/2008	1.1	-46	6.43	0.205	8.85	NS
SHM-93-22C	Winter 2008	01/09/2008	0.28	-117	7.53	0.623	8.87	NS
SHM-93-22C	Spring 2008	04/21/2008	0.35	-142	7.53	0.443	8.44	NS
SHM-93-22C	Summer 2008	07/15/2008	0.2	-87.7	7.55	0.231	11.99	NS
SHM-93-22C	Fall 2008	10/02/2008	0.31	-96.6	7.87	0.256	7.75	5.16
SHM-96-22B	Winter 2008	01/09/2008	0.18	-84	6.66	0.726	9.4	NS
SHM-96-22B	Spring 2008	04/21/2008	0.1	-96	6.64	0.659	7.01	NS
SHM-96-22B	Summer 2008	07/15/2008	0.38	-67.7	6.19	819	9.86	9.54
SHM-96-22B	Fall 2008	10/01/2008	0.21	-82.5	6.47	0.722	7.41	13
SHM-96-5B	Winter 2008	01/08/2008	0.17	-2	5.99	0.655	9.6	NS
SHM-96-5B	Spring 2008	04/17/2008	0.2	-11	5.52	0.792	9.79	NS
SHM-96-5B	Summer 2008	07/15/2008	0.35	10	6.08	0.691	11.36	0.81
SHM-96-5B	Fall 2008	10/01/2008	0.58	6	6.21	0.709	9.64	1.02
SHM-96-5C	Winter 2008	01/08/2008	0.26	-63	6.1	0.735	9.65	NS
SHM-96-5C	Spring 2008	04/17/2008	0.12	-21	5.24	0.86	9.49	NS
SHM-96-5C	Summer 2008	07/15/2008	0.17	-45	6.29	0.705	10.53	3.2
SHM-96-5C	Fall 2008	10/01/2008	1.5	-57.7	6.21	0.705	7.51	2.13

Notes: All parameters measured after stabilization using low-flow purging
NS = Not Sampled

Table 4-5
Summary of Historical Arsenic Concentrations
Shepley's Hill Landfill
Devens, Massachusetts

Well ID	MW-1	MW-2	PSW-01	SHL-10	SHL-11	SHL-12	SHL-13	SHL-16	SHL-19	SHL-20	SHL-21	SHL-22	SHL-23	SHL-24	SHL-3	SHL-30	SHL-35	SHL-3	SHM-05-36A	SHM-05-38B	SHM-05-39A	SHM-05-41A	SHM-05-41B	SHM-05-42A	SHM-05-42B
Type of Dissolved	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(D)	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(T)	(T)							
Sample Date	Units																								
08/07/1991	ug/L				67.0	320				340	99		27		33.9	260	23.0				37.0						
12/01/1991	ug/L				130	320				710	89		25		100	140	35.0				67.0						
05/01/1992	ug/L				280	340				380	330		32.9		6.5	2.64	11.4				40.4						
08/31/1992	ug/L				NS	NS				NS	NS		NS		NS	NS	NS				NS						
11/01/1995	ug/L				3.4 B	332				138	244		24.8		NS	48.4	13.0				46.0						
05/01/1997	ug/L				10 U	252 U				10 U	10 U		10 U		10 U	73.0 J	10 U				16.1 J						
10/01/1996	ug/L				200	340				208	227		34.9		10 U	156	10 U				29.2						
05/01/1998	ug/L				5 U	340				77.3	218		10.8		5 U	51.4	5 U				18.0						
11/01/1998	ug/L				3.4 U	376				145	218		5.4 U		5.4 U	89.1	11.2				27.2						
05/01/1999	ug/L				2.7 B	451				158	216		12.2 B		2.7 B	72.2	5.0 B				71.3						
11/01/1999	ug/L				1.9 U	492				176	215		7.1		1.9 U	67.3	6.5				23.5						
05/01/2000	ug/L				2.5 U	484				41.4	210		14.5		2.5 U	1.98	2.5 U				15.0						
11/01/2000	ug/L				4.2 U	523				154	172		45		17.4	91.5	13.5				31.4						
05/01/2001	ug/L				4.1 U	487				120	166		47.0		4.1 U	58.8	13.8				18.1						
10/01/2001	ug/L				1.5 U	571				183	166		44.2		1.5 U	66.0	14.8				28.1						
05/02/2002	ug/L				4.0 B	469				86.9	154		60.8 B		2.8 B	47.8 B	11.8 B				144						
10/02/2002	ug/L				3.2 U	648				164	175		77.1		3.2 U	86.1	3.2 U				29						
05/01/2003	ug/L				4.7 U	486				36.3	197		101		4.7 U	25.6	7.3				13.4						
11/01/2003	ug/L				4.1 U	639				83.0	184		76.4		4.1 U	13.4	4.7 B				30.5						
05/01/2004	ug/L				2.6 U	502				75	138		66.1		2.6 U	27.2	7.4 B				19.5						
11/01/2004	ug/L				5.8 U	617				121	168		65.4		5.8 U	15.5	6.8 B				32.2						
05/01/2005	ug/L				4.5 U	524				26.3	168		NS		4.5 U	10.1	7.0 B				NS						
11/01/2005	ug/L				5 U	567				158	186		154		NS	5 U	5 U				18.0						
04/10/2006	ug/L			5 U			5 U						171						5 U		21						
04/11/2006	ug/L																	5 U				285	580	3,610	58	2,420		
04/13/2006	ug/L	4940	37					18																			626	
04/04/2006	ug/L											5 U		5 U													5 U	266
08/01/2006	ug/L									1,790					5 U													
08/08/2006	ug/L	5910	45	5	5 U	700	5 U	16		1,790	346				5 U	5 U	6											
08/08/2006	ug/L																	5 U		5 U				3,420	52	2,720	614	
08/09/2006	ug/L												167								21						5 U	241
09/12/2006	ug/L													5 U								288						
09/13/2006	ug/L																						634					
09/20/2006	ug/L																							3,510	41	2,730	840	
09/21/2006	ug/L			10			5 U						109					5 U		5 U	46	270					5 U	276
09/25/2006	ug/L	4580	32					44				5 U		5 U									415					
12/01/2006	ug/L			6 U	5 U		5 U								5 U													266
12/05/2006	ug/L																											
12/06/2006	ug/L					868				142	361		115		5 U	5 U	8				51	248		4,070	39	2,380	696	5 U	
12/07/2006	ug/L																											
12/12/2006	ug/L	1,630	30					83				5 U		5 U				5 U		5 U			412					
12/13/2006	ug/L																											
04/10/2007	ug/L												98	3 U							26				30	1990	627	3 U	249
04/11/2007	ug/L											3 U						3 U		3 U								
05/09/2007	ug/L																6.2											
10/15/2007	ug/L				0.59 J	866.5		42		865.1	356.2	0.81 J	55.1			7.5					34.1							
10/15/2007	ug/L													0.71 J								391.5	309.4		24.9	2591	684.5	1.01 J	304.8
10/16/2007	ug/L	4650	29.1				1.8										16.3	11.9	23.5					3445					
04/13/2008	ug/L																4.1	0.5 U	0.5 U								2.5	256.2
04/15/2008	ug/L											1.1		0.19 J														
04/21/2008	ug/L												106.2								14.6				28.9	2542	682.5		
10/01/2008	ug/L						3.3						81					4.8	0.24	0.71	40.7					1810			
10/02/2008	ug/L																					2756	241.2	4020	19.7		799.9	1.2	256
10/03/2008	ug/L	1749	25.5		0.81	663.5		75	28	173.8	7.9					2.3												
10/09/2008	ug/L											1.3		0.35														

Table 4-5
Summary of Historical Arsenic Concentrations
Shepley's Hill Landfill
Devens, Massachusetts

Well ID / Field ID (Shown)		SHM-93-10C (T)	SHM-93-18C (T)	SHM-93-22C (T)	SHM-96-22B (T)	SHM-96-5B (T)	SHM-96-5C (T)	SHM-99-31A (T)	SHM-99-31B (T)	SHM-99-31C (T)	SHM-99-32X (T)	SHP-01-36X (T)	SHP-01-37X (T)	SHP-01-38X (T)	SHP-99-29X (T)
Sample Date	Units														
08/01/1991	ug/L	NS		NS	NS	NS	NS								
12/01/1991	ug/L	NS		NS	NS	NS	NS								
03/01/1993	ug/L	21.3		68.3	NS	NS	NS								
06/01/1993	ug/L	16.1		46.8	NS	NS	NS								
11/01/1996	ug/L	13.4		44.6	324	1,440	71								
05/01/1997	ug/L	10 U		40.4	316 J	3,300 J	43.2								
11/01/1997	ug/L	10.6		10 U	352	2,040	43.1								
05/01/1998	ug/L	7.5		31.6	365	4,380	49.5								
11/01/1998	ug/L	10.0		51.1	406	3,080	40.8								
05/01/1999	ug/L	10.6 B		43.9	707	3,480	57								
11/01/1999	ug/L	8.7		33.2	1,440	2,700	44.9								4200
05/01/2000	ug/L	5.9 J		34.4	1,360	5,110	52.2								
11/01/2000	ug/L	8.8		47.9	1,180	2,580	40.7								
05/01/2001	ug/L	6.8		19.7	1,540	3,860	80.5								
10/01/2001	ug/L	10.1		31.8	1,670	1,850	41.3								3800
05/02/2002	ug/L	11.0 B		30.5 B	2,040	3,800	60.4 B								
10/02/2002	ug/L	7.1		30.1	169	1,970	41.3								
05/01/2003	ug/L	9.8		21.0	2,070	3,520	55.1								
11/01/2003	ug/L	5.2 U		29.3	2,500	3,080	48.3								
05/01/2004	ug/L	7.2 B		27.8	1,690	3,050	47.1								
11/01/2004	ug/L	10.6 B		34.8	2,360	2,110	49.5								
06/01/2005	ug/L	6.1 B		15.9	NS	NS	NS								
10/01/2005	ug/L	11.0		23.0	3,320	4,190	43								
04/10/2006	ug/L				3290	2110	47								
04/11/2006	ug/L							9	56	270	168				
04/13/2006	ug/L											24	41	550	
04/14/2006	ug/L		14												
06/01/2006	ug/L					2,780	51								
06/02/2006	ug/L	12		17											
06/08/2006	ug/L					2760	51				186				
06/09/2006	ug/L				3,440							22	49	496	
06/12/2006	ug/L							12	53	273					
06/13/2006	ug/L		22												
09/20/2006	ug/L					1570	37	23	74	306	202				
09/21/2006	ug/L				3110							30	48	881	
09/25/2006	ug/L		14												
12/01/2006	ug/L		12			2,980	24					19	46		
12/05/2006	ug/L					2880	24								
12/06/2006	ug/L	10		73	3,100										
12/07/2006	ug/L							16	72	301	178				
12/12/2006	ug/L														
12/13/2006	ug/L													623	
04/10/2007	ug/L			76	2600										
04/11/2007	ug/L					2030	47								
05/29/2007	ug/L														
10/16/2007	ug/L	9.8		72.5	1078							16.7	28.6	781.4	
10/17/2007	ug/L					750	81.1	22.7	85.5	292.1	268.2				
10/18/2007	ug/L		10.3												2860
04/17/2008	ug/L					1587	54.7								
04/18/2008	ug/L														
04/21/2008	ug/L			20.4	1721										
10/01/2008	ug/L				1374	747.6	51.8								
10/02/2008	ug/L			17.7				16.2	79.5	268.3	203.3				
10/03/2008	ug/L	10.1	23.4												
10/06/2008	ug/L											27.4	35.1	603.4	2106

Table 5-1
Summary of Revised System Performance Assessment Metrics and Results
Shepley's Hill Landfill
Devens, Massachusetts

Performance Assessment Component	Method	Description	Data Utilized	Results	Interpretation	Conclusion
Hydraulic Capture Zone Analysis	Gradient Vector Analysis	Compute horizontal hydraulic gradient vectors between groups of wells in nearfield hydraulic monitoring network under 50 gpm pumping conditions for comparison to non-pumping baseline conditions.	Water level data from Fall 2007, April 2008, and September 2008.	Map comparing computed vectors under pumping conditions from the 10/15/07, 2/20/08 and 2/25/08 synoptic events.	Horizontal flow patterns are influenced by pumping primarily in the nearfield area.	operating as designed
	Capture Zone Width Calculation	Compute theoretical capture zone width using basic flow budget and conservative assumptions regarding hydraulic conductivity and saturated thickness.	Observed hydraulic gradients for 2007, aquifer properties as specified in existing model, saturated thickness from SGI cross-sections and extraction well boring logs.	Calculated capture zone width is 763 feet at the extraction wells, based on the saturated thickness of 50 feet.	Calculated capture zone width is adequate to contain the estimated 444 foot width of impacted aquifer.	operating as designed
	Comparison to Numerical Model Results	Compare results of above analyses to particle track simulations using the revised (2009) 3-d numerical model of the aquifer flowfield.	Numerical simulation results for 34, 42, and 50 gpm pumping rates (AMEC's "SHL005" 3-layer model)	Comparison maps series with predicted flow patterns and capture zone.	Capture zone at 2008 average extraction rate (34 gpm) is narrower and shifted west relative to design rate of 50 gpm. Effectivelly containing As >1000ppb in deep groundwater.	operating as designed
	50 gpm Drawdown Assessment	Compare nearfield water levels under 50 gpm pumping and non-pumping conditions at next system shutdown to determine observed drawdown.	Two synoptic rounds just prior to and after a system restart at 50 gpm. (Completed 3/3/08)	Comparison map with observed vs. predicted drawdowns based on the February 2008 System	Distribution and magnitude of observed drawdown generally consistent with predicted.	operating as designed
Geochemical Monitoring	Advective Travel Time Analysis	Develop particle track-based travel times to predict when unimpacted groundwater from plume flanks should arrive at downgradient impacted wells.	Numerical simulation results for 50 gpm design pumping rate.	Map plotting predicted 2 year travel time markers.	Advective velocities in downgradient groundwater generally 1 ft/day and therefore changes in geochemical conditions are expected to take several years to be fully realized.	operating as designed
	Geochemical Assessment	Evaluate As concentrations and ORP data since System Startup for changes relative to historical conditions.	Historic As, Fe and ORP data from Spring 2006 through 2008.	Despite notable declines in As concentrations overall geochemistry has not changed significantly.	Simple best-fit empirical extrapolations are considered unrealistic. Development of geochemical model-based projections is recommended when data on As, Fe, and ORP suggest overall geochemistry is changing.	Inconclusive

Table 5-2
Groundwater Elevations 2005-2008
Shepley's Hill Landfill
Devens, Massachusetts

Well ID	08/24/2005	04/10/2006	06/05/2006	09/18/2006	12/15/2006	04/09/2007	10/15/2007	02/20/2008	02/25/2008	03/04/2008	04/16/2008	09/30/2008	Mean	Min	Max	Range	Corrected Mean
N-1, P-1	216.1	216.3	217.0	216.3	216.5	216.3	216.9	217.6	217.1	217.3	216.8	216.7	216.7	216.1	217.6	1.5	216.7
N-1, P-2	216.2	216.5	217.4	216.4	216.9	216.4	217.3	217.7	217.4	217.3	217.2	216.9	217.0	216.2	217.7	1.5	217.0
N-1, P-3	216.7	216.9	216.0	216.9	217.3	215.6	218.1	216.2	217.8	217.8	217.5	217.4	217.2	215.6	218.2	2.4	217.2
N-2, P-1	217.2	217.4	218.0	217.1	217.4	217.2	218.4	218.4	218.0	218.1	217.9	217.8	217.7	217.1	218.4	1.3	217.7
N-2, P-2	216.9	217.1	217.7	217.2	217.5	216.9	218.1	218.1	217.7	217.8	217.5	217.5	217.5	216.9	218.1	1.3	217.5
N-3, P-1	217.0	216.8	217.0	217.1	216.9	216.7	217.6	218.3	217.6	217.9	217.4	217.3	217.3	216.7	218.3	1.7	217.3
N-3, P-2	216.7	216.9	313.6	216.8	217.1	213.3	218.0	218.0	217.6	217.8	217.3	217.3	216.7	213.3	218.0	4.7	216.7
N-5, P-1	220.2	221.3	221.8	220.4	220.6	220.0	219.5	220.4	220.6	220.6	221.7	220.3	220.6	219.5	221.8	2.3	220.6
N-5, P-2	220.4					223.7	219.3	219.5	219.6	220.0	221.2	220.1	220.5	219.3	223.7	4.4	220.5
N-6, P-1	223.4	224.3	224.6	223.7	223.9	223.0	222.3	222.7	223.0	223.1	224.5	223.2	223.4	222.3	224.6	2.3	223.4
N-7, P-1	226.3	227.2	228.0	226.7	226.7	226.0	225.1	226.3	226.5	226.7	227.9	227.1	226.7	225.1	228.0	2.9	226.7
N-7, P-2	226.7	227.7	227.4	227.2	227.1	226.4	225.4	226.6	227.0	227.1	228.4	227.6	227.0	225.4	228.4	2.9	227.0
PSP-01	217.0	217.2	217.6	217.0	216.6	217.4	218.4	218.3	217.9	217.9	217.6	217.8	217.5	216.6	218.4	1.8	217.5
SHL-10	218.8	219.0	220.4	218.9	219.8	218.0	218.3	219.3	218.9	219.5	218.4	218.1	218.9	218.0	220.4	2.4	218.9
SHL-11	217.5	217.9	218.5	217.7	218.0	217.9	218.3	218.7	218.4	218.3	218.3	218.1	218.1	217.5	218.7	1.2	218.1
SHL-13	214.2	214.8	216.1	214.5	215.4	215.2	215.0	216.3	216.0	215.8	215.7	215.3	215.4	214.2	216.3	2.1	215.4
SHL-15	242.0	243.8	344.9	241.5	243.5	244.0	240.3	245.6	245.4	245.1	244.6	242.8	243.6	240.3	245.6	5.3	243.6
SHL-18	219.0	219.2	220.9	219.1	220.2	219.8	219.5	221.0	220.7	220.4	220.2	220.3	220.0	219.0	221.0	2.0	220.0
SHL-19	218.1	218.6	220.1	218.2	218.9	219.0	218.7	220.0	219.6	219.2	219.1	219.1	219.0	218.1	220.1	2.0	219.0
SHL-20	217.7	218.1	218.7	217.8	218.1	218.1	218.3	218.6	218.5	218.4	218.6	218.2	218.3	217.7	218.8	1.1	218.3
SHL-21	214.2	215.0	216.3	214.3	215.5	214.9	210.9	216.0	216.1	215.8	216.0	214.9	215.0	210.9	216.3	5.4	215.4
SHL-22	213.2	213.8	215.5	213.5	214.5	214.6	212.3	215.2	215.5	214.6	214.7	213.9	214.3	212.3	215.5	3.2	214.3
SHL-23	214.1	215.0	217.2	214.1	216.0	215.9	212.6	216.7	217.3	216.7	216.7	214.6	215.6	212.6	217.3	4.7	215.6
SHL-24	224.1		226.3	224.5	224.7	224.3	223.7	225.7	225.4	225.3	225.5	225.7	225.0	223.7	226.3	2.6	225.0
SHL-3	217.8	218.8	219.2	217.9	219.1	219.2	219.4	218.9	218.6	218.3	218.8	217.8	218.6	217.8	219.4	1.6	218.6
SHL-4	217.3	217.7	218.6	217.4	217.8	217.9	218.1	218.6	218.2	218.2	218.1	218.1	218.0	217.3	218.6	1.3	218.0
SHL-5	213.3	215.5	216.7	213.7	215.9	216.4	212.8	217.0	216.4	216.4	216.0	216.4	215.5	212.8	217.0	4.2	215.8
SHL-8D	213.8	214.4	215.8	213.9	214.9	214.6	213.8	215.8	215.7	215.3	215.3	214.7	214.8	213.8	215.8	2.0	214.8
SHL-8S	213.8	214.5	215.8	214.3	215.1	214.5	213.9	215.8	215.7	215.4	215.4	214.8	214.9	213.8	215.8	2.0	214.9
SHL-9	213.2	213.9	315.6	213.4	214.6	215.0	212.2	215.9	215.7	214.9	214.9	214.0	214.5	212.2	215.9	3.7	214.5
SHM-05-39A	210.7	211.4	212.7	211.1	213.1	212.1	210.6	212.9	212.8		212.3	211.6	211.8	210.6	212.9	2.3	211.8
SHM-05-39B	209.9	210.8	211.8	210.4	207.0	211.2	209.9	212.1	212.0		211.5	210.7	210.6	207.0	212.1	5.1	210.8
SHM-05-40X	209.9	210.4	211.9	210.3	211.2	211.2	209.7	212.1	212.1	211.6	211.5	210.6	211.0	209.7	212.1	2.4	211.0
SHM-05-41A	212.8	213.4	215.1	213.0	214.2	214.3	212.0	215.0	215.2	214.4	214.4	213.5	213.9	212.0	215.2	3.2	213.9
SHM-05-41B	212.8	213.4	215.1	213.0	214.2	214.3	211.9	214.9	215.1	214.3	214.4	213.4	213.9	211.9	215.1	3.2	213.9
SHM-05-41C	212.9	213.5	215.1	213.1	214.3	214.3	212.0	215.0	215.2	214.6	214.4	213.5	214.0	212.0	215.2	3.2	214.0
SHM-05-42A	212.6	213.5	215.0	213.0	214.2	214.3	212.2				214.3	213.6	213.7	212.2	215.0	2.8	213.7
SHM-05-42B	212.9	213.5	215.1	213.1	214.2	214.4	212.2				214.3	213.6	213.7	212.2	215.1	2.9	213.7
SHM-93-10C	218.7	218.9	220.2	218.6	219.7	219.4	219.3	220.5	220.2	220.0	219.8	218.8	219.5	218.7	220.5	1.8	219.5
SHM-93-10D	218.3	218.6	219.7	218.4	219.3	218.7	218.8	220.0	219.9	219.6	219.0	220.1	219.2	218.3	220.1	1.8	219.2
SHM-93-18B	219.0	219.2	220.9	219.1	220.2	219.6	219.5	221.0	220.7	220.4	220.2	220.3	220.0	219.0	221.0	2.0	220.0
SHM-93-22C	214.3	213.8	215.5	213.4	214.6	214.7	212.3	215.6	215.5	214.8	214.8	213.9	214.3	212.3	215.6	3.3	214.3
SHM-96-22B	213.2	213.7	215.4	213.4	214.5	214.5	212.4	214.3	214.2	213.5	214.6	213.8	214.0	212.4	215.4	3.1	214.0
SHM-96-5B	216.8	214.2	215.8	213.7	214.9	214.9	212.9	215.6	215.8	215.0	215.0	214.3	214.9	212.9	216.6	3.7	214.9
SHM-96-5C	213.4	214.2	215.7	213.7	214.8	214.9	212.8	215.5	215.7	214.9	215.0	214.3	214.6	212.8	215.7	2.9	214.6
SHM-99-31A	211.0	212.9	214.3	211.7	213.5	213.6	211.5		213.7	213.6	213.5	213.8	213.0	211.0	214.3	3.3	213.0
SHM-99-31B	211.1	211.8	213.0	211.5	212.4	212.4	211.0		213.0	212.8	213.6	212.0	212.2	211.0	213.6	2.6	212.2
SHM-99-31C	211.2	211.9	213.2	211.6	212.6	212.6	211.1		213.2	212.8	212.7	212.1	212.3	211.1	213.2	2.1	212.3
SHM-99-32X	212.1	212.7	214.2	212.5	213.4	213.5	212.0	185.3	185.4	185.5		213.0	205.4	185.3	214.2	28.9	212.9
SHP-01-36X	217.9		217.8		216.9	217.0	219.0	218.2		217.8	217.6	217.6	217.8	216.9	219.0	2.1	217.8
SHP-01-37X	216.8	217.0	217.7	217.0	217.2	216.9	215.1	218.1	217.7	217.7	217.4	217.4	217.2	215.1	218.1	3.0	217.2
SHP-01-38A	217.4	217.7	218.3	217.6	217.8	217.4	216.3	218.5	218.2	218.3	218.0	218.0	218.0	217.4	218.5	1.1	218.0
SHP-01-38B	217.5	217.9	218.5	217.7	217.9	217.6	218.4	218.6	218.3	218.4	218.2	218.1	218.1	217.5	218.6	1.1	218.1
SHP-05-43	216.3	216.8	217.5	216.4	217.1	209.4	216.7	217.7	217.8	217.6	217.6	216.8	216.5	209.4	217.8	8.4	217.1
SHP-05-44	216.6	217.0	217.3	216.8	217.2	206.5	218.0	218.0	217.8	217.7	217.7	217.2	216.5	206.5	218.0	11.5	217.4
SHP-05-45A	213.8	214.3	216.0	214.0	214.9	214.7	212.3	215.5	216.2	214.8	214.9	214.1	214.5	212.3	216.2	3.8	214.6
SHP-05-45B	213.8	214.3	215.9	214.0	215.0	214.6	212.2	215.3	216.1	214.8	215.0	214.9	214.7	212.2	216.1	3.9	214.7
SHP-05-46A	214.0	214.6	216.2	214.2	215.3	214.9	213.4	216.3	217.0	215.8	216.0	215.0	215.2	213.4	217.0	3.6	216.2
SHP-05-46B	214.1	214.6	216.3	214.3	215.2	214.9	212.1	215.1	215.7	214.6	214.7	213.8	214.6	212.1	216.3	4.2	214.6
SHP-05-47A	212.5	213.1		212.8	213.8	212.9	213.0		214.2	214.2	214.2	214.2	213.5	212.5	214.2	1.7	213.5
SHP-05-47B	212.4	213.1		212.7	213.6	213.7	213.2			214.2	214.1	214.3	213.5	212.4	214.3	1.9	213.5
SHP-05-48A		213.5	214.4	212.8		213.6					213.5	213.5	213.5	212.8	214.4	1.6	213.5
SHP-05-48B		213.4	214.4	212.9	213.6	213.5					213.5	213.8	213.6	212.9	214.4	1.5	213.6
SHP-05-49A	211.9	213.4	212.8	212.0	212.5		213.3		214.0	213.9	212.4	213.6	213.0	211.9	214.0	2.1	213.0
SHP-05-49B	211.8		213.1	211.5	212.0			211.6	210.8	210.8	211.3	210.9	211.5	210.8	213.1	2.3	211.5
SHP-95-27X	205.5	209.0	205.5	222.5	224.9	205.5	221.8	224.7	224.4	224.0	224.5	225.3	218.1	205.5	225.3	19.8	
SHP-99-29X							219.9				223.1	221.1	221.3	219.9	223.1	3.3	221.3
SHP-99-33A	210.9	212.0	213.5	211.4	212.5								212.1	210.9	213.5	2.6	212.1
SHP-99-33B	211.3	211.8	213.0	211.5	212.4								212.0	211.3	213.0	1.7	212.0
SHP-99-34A	212.1		214.2		213.1	213.0	212.4	214.2	213.4	213.4	213.3	213.6	213.3	212.1	214.2	2.1	213.3
SHP-99-34B	212.3	212.3	213.6	212.7	213.2	213.2	211.8	213.3	214.0	213.8	213.3	212.9	213.0	211.8	214.0	2.2	213.0
SHP-99-35X	222.8	223.4	223.6	222.9	222.4	222.4	222.0	222.2	222.3	222.4	223.5	219.6	222.5	219.6	223.6	4.0	222.5

Note: corrected mean calculated by omitting anomalous values highlighted in yellow

Table 5-3
Groundwater Model
Mass Balance Comparison

	SHL002 (2 layer)		SHL005 (revised 3 layer)		SHL005amb (ambient conditions)	
Component	**Inflow**	**Outflow**	**Inflow**	**Outflow**	**Inflow**	**Outflow**
Recharge	556	0	556	0	556	0
ET	0	0	0	0	0	0
Constant Head	167	102	151	93	150	94
River	306	814	296	794	282	821
Lake	0	0	0	0	0	0
Drain	0	11	0	12	0	20
GHB	0	0	0	0	0	0
Well	16	120	16	120	16	70
Stream	0	0	0	0	0	0
Storage	0	0	0	0	0	0
TOTAL	1045	1047	1019	1019	1005	1005
DIFFERENCE (%)	-0.22		0.0007		0.0008	

note: all units gallons per minute

Figures

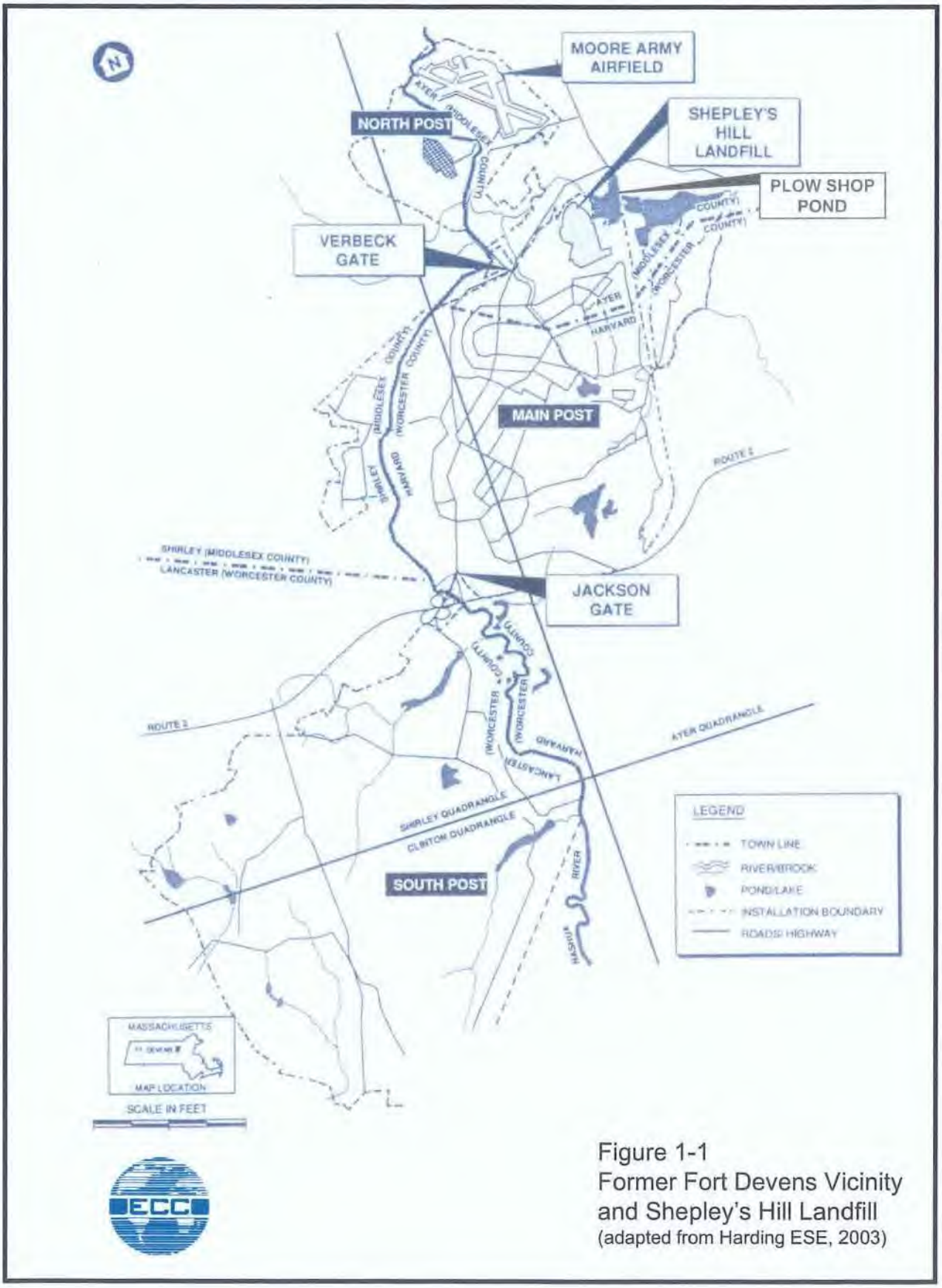


Figure 1-1
Former Fort Devens Vicinity
and Shepley's Hill Landfill
(adapted from Harding ESE, 2003)

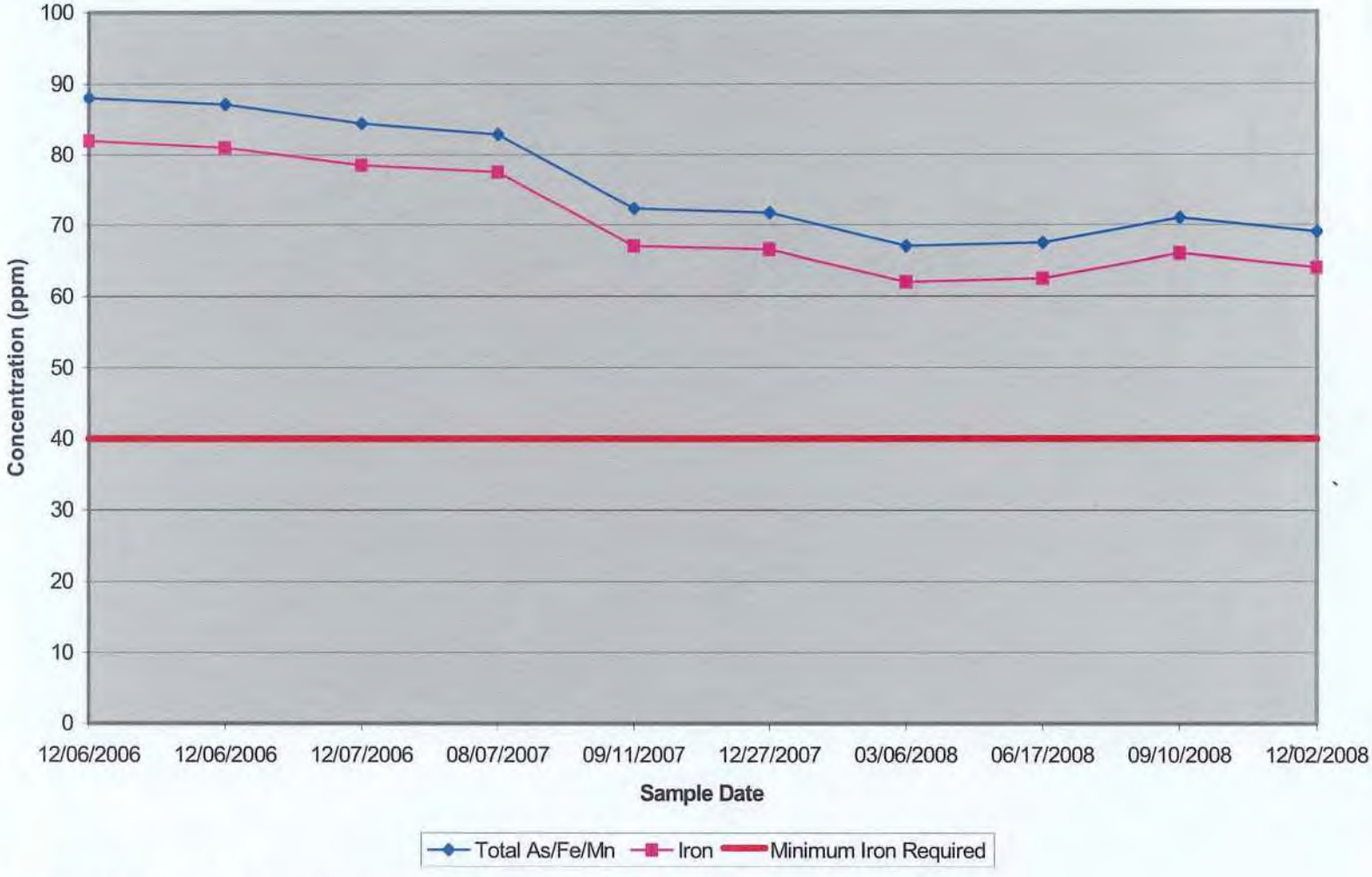


Figure 3-1. Iron and Total As\Fe\Mn Influent Concentrations

LTMMP Well Network and Sampling Frequency

FIGURE 4-1

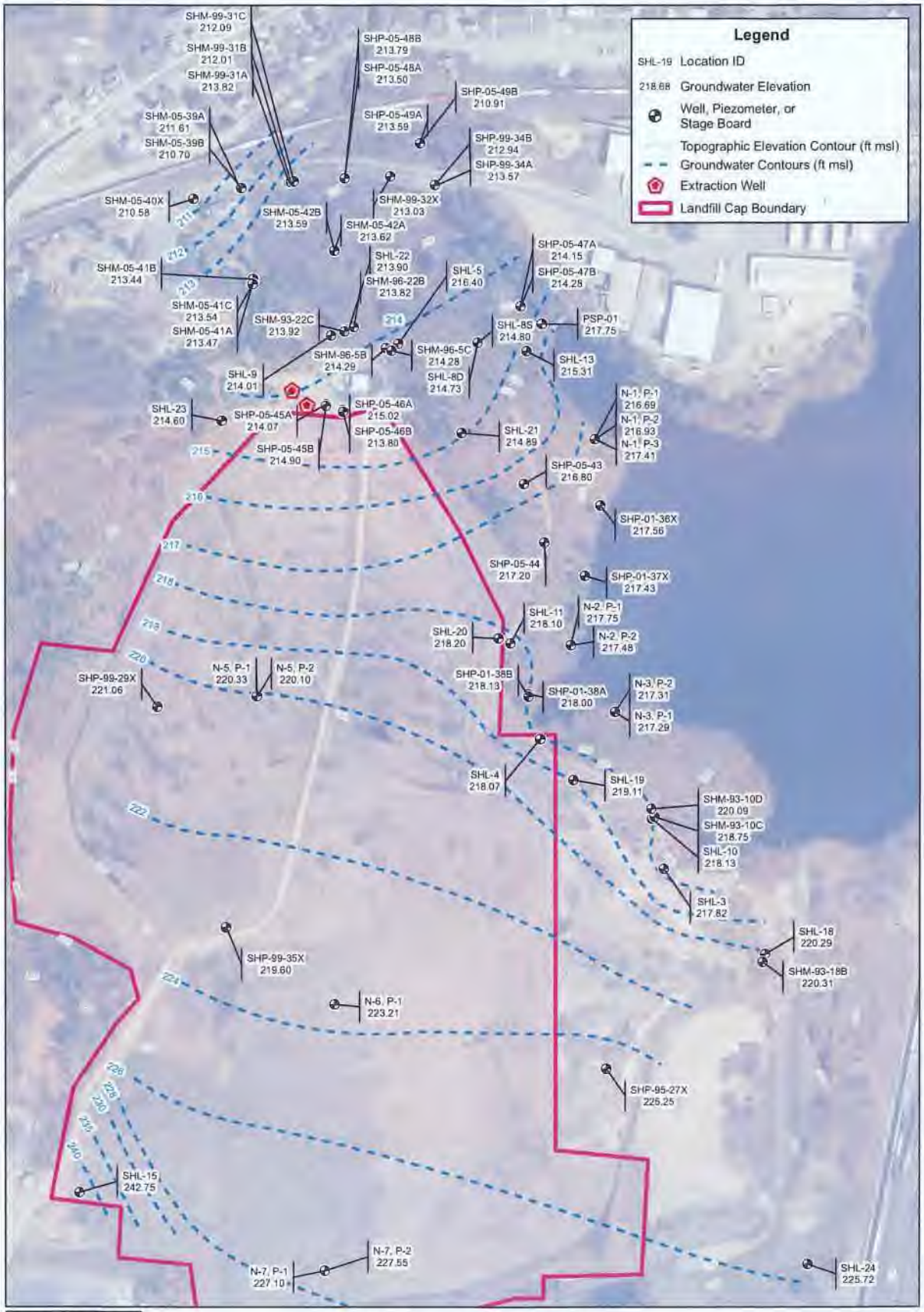
2008 Annual Report

Shepley's Hill Landfill
Ayer, Massachusetts

0 300
Feet

H:\ShepleyLandfill\Task24\MXD\Figure4-1.mxd H:\ShepleyLandfill\Task24\Export\Figure4-1.pdf January 29, 2009 DWN: DJK CHKD: KMP

H:\Shepley Landfill\Task24\MXD\Figure4-2_rev1.mxd H:\Shepley Landfill\Task24\Export\Figure4-2_rev1.pdf May 21, 2008 DWN: DJK APC: CHKD: JWN



Groundwater Elevations
September 30, 2008

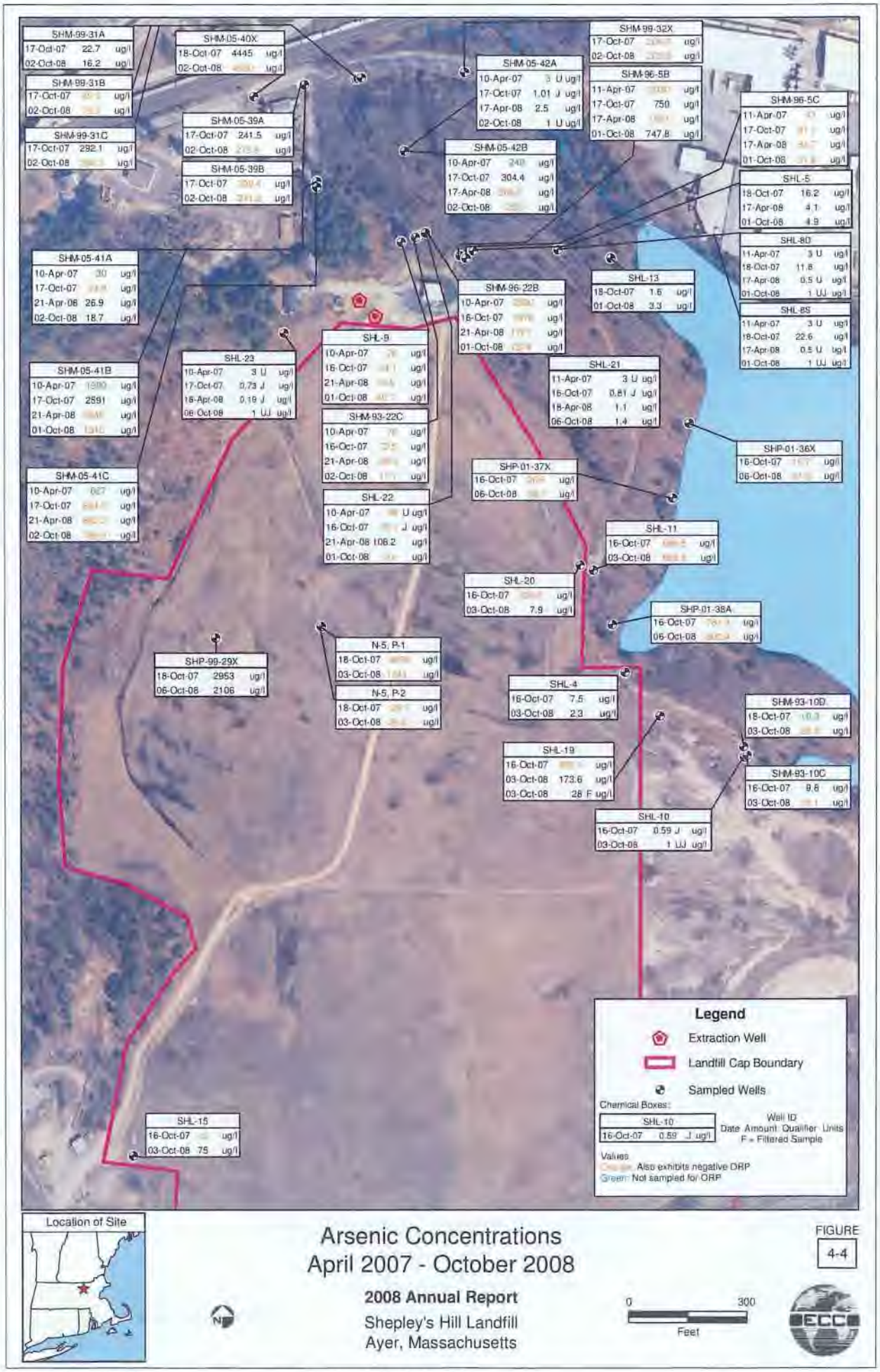
2008 Annual Report

Shepley's Hill Landfill
Ayer, Massachusetts

FIGURE
4-3

0 300
Feet

H:\Shepley Landfill\Task24\MXD\Figure4-3_nov1.mxd H:\Shepley Landfill\Task24\Export\Figure4-3_nov1.pdf May 21, 2009 DWN: DJH APC CHKD: AKN


SHM-99-31A
17-Oct-07 22.7 ug/l
02-Oct-08 16.2 ug/l
SHM-99-31B
17-Oct-07 ug/l
02-Oct-08 ug/l
SHM-99-31C
17-Oct-07 292.1 ug/l
02-Oct-08 ug/l
SHM-05-40X
18-Oct-07 4445 ug/l
02-Oct-08 ug/l
SHM-05-39A
17-Oct-07 241.5 ug/l
02-Oct-08 ug/l
SHM-05-39B
17-Oct-07 ug/l
02-Oct-08 ug/l
SHM-05-41A
10-Apr-07 30 ug/l
17-Oct-07 ug/l
21-Apr-08 26.9 ug/l
02-Oct-08 18.7 ug/l
SHM-05-41B
10-Apr-07 ug/l
17-Oct-07 2891 ug/l
21-Apr-08 ug/l
01-Oct-08 ug/l
SHM-05-41C
10-Apr-07 627 ug/l
17-Oct-07 ug/l
21-Apr-08 ug/l
02-Oct-08 ug/l
SHM-05-42A
10-Apr-07 3 U ug/l
17-Oct-07 1.01 J ug/l
17-Apr-08 2.5 ug/l
02-Oct-08 1 U ug/l
SHM-05-42B
10-Apr-07 ug/l
17-Oct-07 304.4 ug/l
17-Apr-08 ug/l
02-Oct-08 ug/l
SHM-99-32X
17-Oct-07 ug/l
02-Oct-08 ug/l
SHM-96-5B
11-Apr-07 ug/l
17-Oct-07 750 ug/l
17-Apr-08 ug/l
01-Oct-08 747.8 ug/l
SHM-96-5C
11-Apr-07 ug/l
17-Oct-07 ug/l
17-Apr-08 ug/l
01-Oct-08 ug/l
SHM-96-22B
10-Apr-07 ug/l
16-Oct-07 ug/l
21-Apr-08 ug/l
01-Oct-08 ug/l
SHL-5
18-Oct-07 16.2 ug/l
17-Apr-08 4.1 ug/l
01-Oct-08 4.9 ug/l
SHL-8D
11-Apr-07 3 U ug/l
18-Oct-07 11.8 ug/l
17-Apr-08 0.5 U ug/l
01-Oct-08 1 UJ ug/l
SHL-8S
11-Apr-07 3 U ug/l
18-Oct-07 22.6 ug/l
17-Apr-08 0.5 U ug/l
01-Oct-08 1 UJ ug/l
SHL-13
18-Oct-07 1.6 ug/l
01-Oct-08 3.3 ug/l
SHL-9
10-Apr-07 ug/l
16-Oct-07 ug/l
21-Apr-08 ug/l
01-Oct-08 ug/l
SHL-23
10-Apr-07 3 U ug/l
17-Oct-07 0.73 J ug/l
16-Apr-08 0.19 J ug/l
06-Oct-08 1 UJ ug/l
SHM-93-22C
10-Apr-07 ug/l
16-Oct-07 ug/l
21-Apr-08 ug/l
02-Oct-08 ug/l
SHL-21
11-Apr-07 3 U ug/l
16-Oct-07 0.81 J ug/l
18-Apr-08 1.1 ug/l
06-Oct-08 1.4 ug/l
SHP-01-36X
16-Oct-07 ug/l
06-Oct-08 ug/l
SHP-01-37X
16-Oct-07 ug/l
06-Oct-08 ug/l
SHL-22
10-Apr-07 U ug/l
16-Oct-07 J ug/l
21-Apr-08 108.2 ug/l
01-Oct-08 ug/l
SHL-11
16-Oct-07 ug/l
03-Oct-08 ug/l
SHL-20
16-Oct-07 ug/l
03-Oct-08 7.9 ug/l
SHP-01-38A
16-Oct-07 ug/l
06-Oct-08 ug/l
SHP-99-29X
18-Oct-07 2953 ug/l
06-Oct-08 2106 ug/l
N-5, P-1
18-Oct-07 ug/l
03-Oct-08 ug/l
N-5, P-2
18-Oct-07 ug/l
03-Oct-08 ug/l
SHL-4
16-Oct-07 7.5 ug/l
03-Oct-08 2.3 ug/l
SHM-93-10D
18-Oct-07 ug/l
03-Oct-08 ug/l
SHL-19
16-Oct-07 ug/l
03-Oct-08 173.6 ug/l
03-Oct-08 28 F ug/l
SHM-93-10C
16-Oct-07 9.8 ug/l
03-Oct-08 ug/l
SHL-10
16-Oct-07 0.59 J ug/l
03-Oct-08 1 UJ ug/l
SHL-15
16-Oct-07 ug/l
03-Oct-08 75 ug/l
Legend
Extraction Well
Landfill Cap Boundary
Sampled Wells
Chemical Boxes:
SHL-10
16-Oct-07 0.59 J ug/l
Well ID
Date Amount Qualifier Units
F = Filtered Sample
Values
Also exhibits negative ORP
Not sampled for ORP
Location of Site
Arsenic Concentrations
April 2007 - October 2008
2008 Annual Report
Shepley's Hill Landfill
Ayer, Massachusetts
FIGURE
4-4
0
300
Feet
ECC

Gradient Vector Magnitude (%)					
Date	Area 1	Area 2	Area 3	Area 4	Area 5
October 15, 2007	0.572	1.324	0.3	0.62	0.075
April 16, 2008	0.618	1.292	0.518	0.022	0.307
September 30, 2008	0.618	1.145	1.011	0.205	0.222

Horizontal Hydraulic Gradient Vectors: October 15, 2007, April 16, 2008, and September 30, 2008

2008 Annual Report

Shepley's Hill Landfill
Ayer, Massachusetts

FIGURE 5-1

0 200 Feet

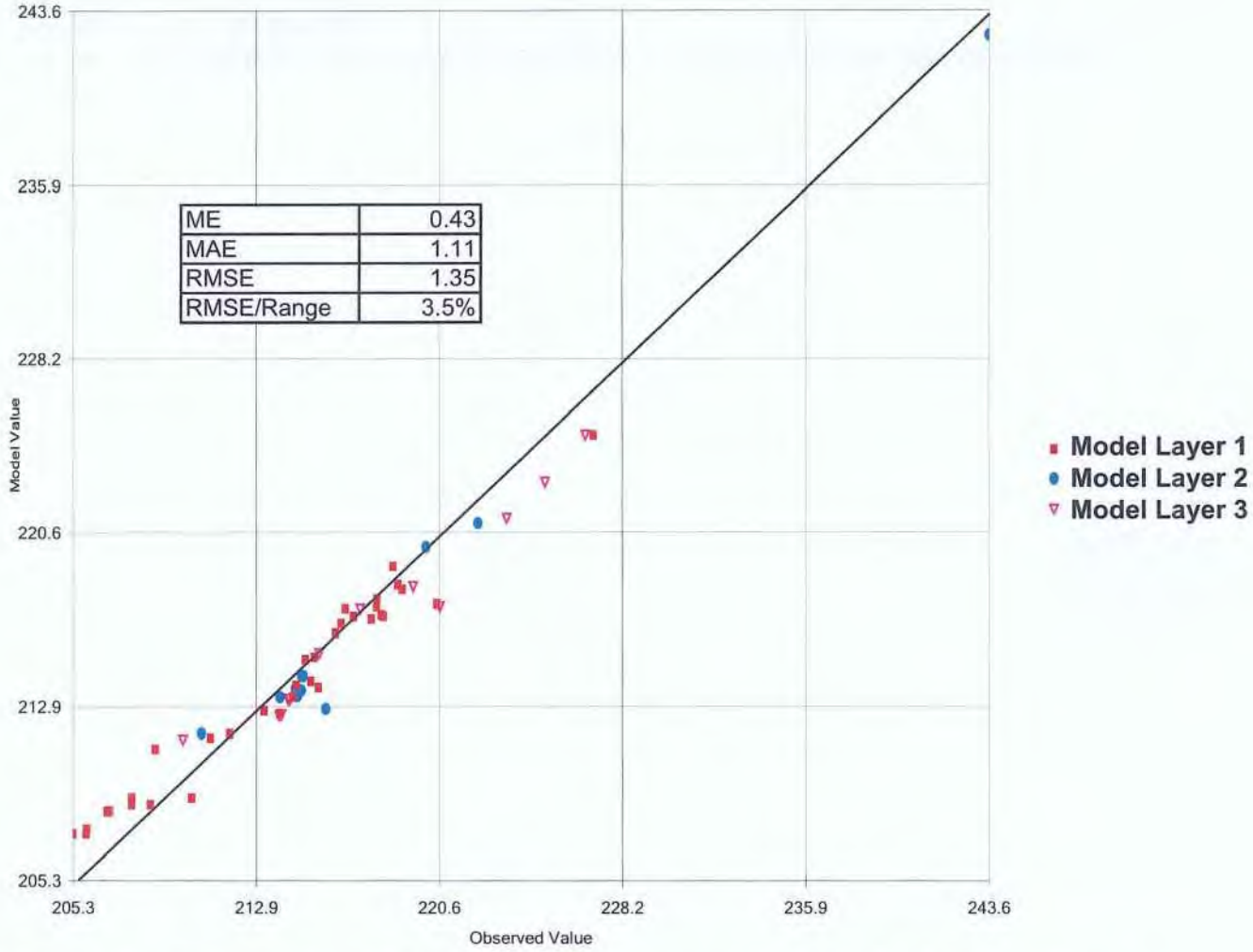


Figure 5-2. Correlation Between Long Term Average and Predicted Groundwater Elevations: SHL005 Model (calibrated)

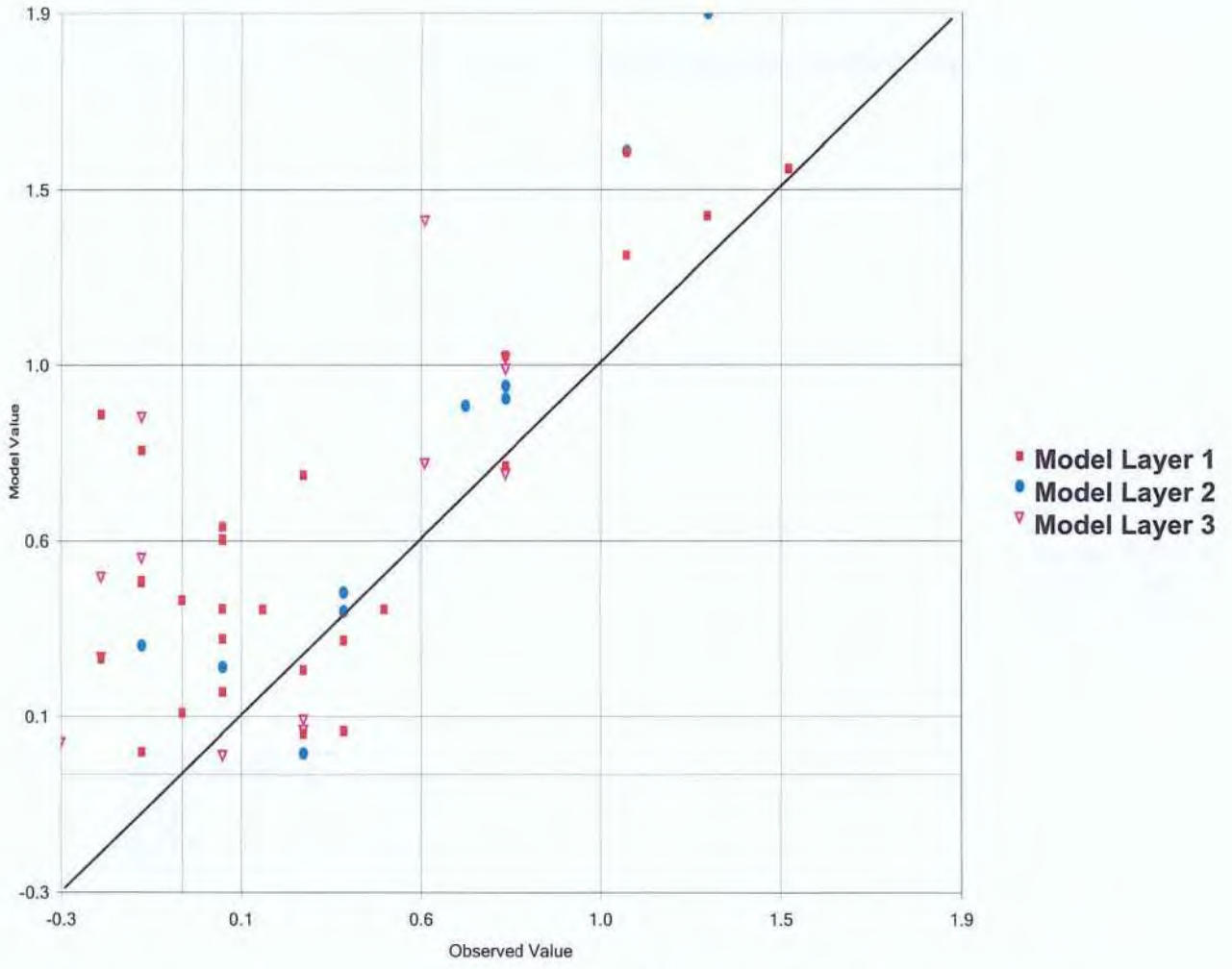


Figure 5-3. Correlation Between Observed (2/25 to 3/3/08) and Predicted Aquifer Drawdown: SHL005 Model (calibrated)

SITE LOCATION

Comparison of Revised Model Prediction to Drawdown Observed During February 2008 System Shutdown

2008 Annual Report

Shepley's Hill Landfill
Ayer, Massachusetts

Notes & Sources: Aerial Imagery: 1:5,000 Color Digital Ortho Images: Mass GIS, 2005
Observed drawdowns are based on water levels collected on 2/25 and 3/4/08 under shutdown and 50 gpm operating conditions, respectively.

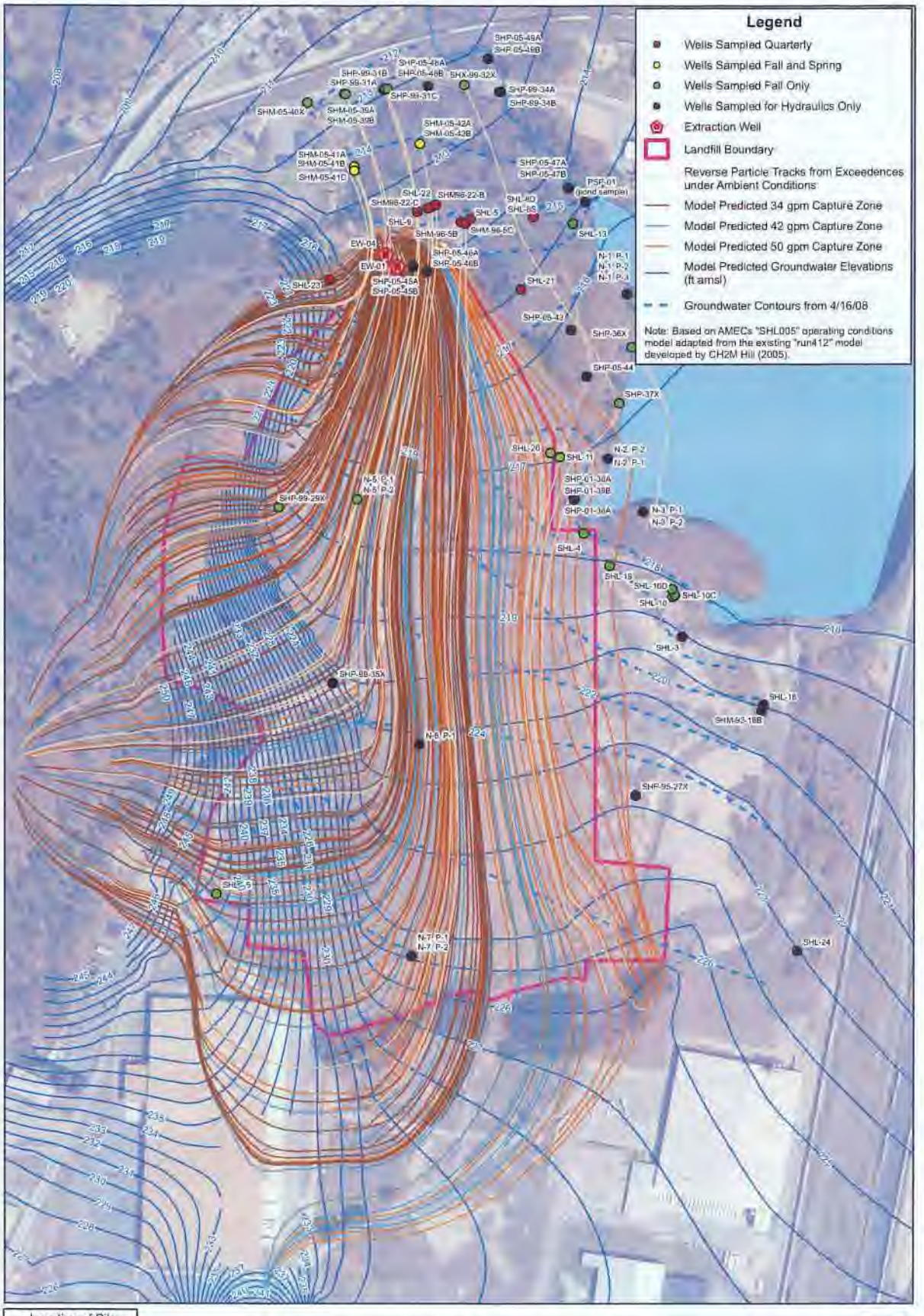
LEGEND

- Observed Drawdown (ft)
- Extraction Well
- Model Predicted Drawdown at 50 gpm (ft)
- Landfill Boundary

0 300
Feet

FIGURE 5-4

H:\ShepleyLandfill\Task28\MXD\Figure5-3.mxd H:\ShepleyLandfill\Task28\Export\Figure5-3.pdf August 12, 2008 DWN: DJK APC: CHKD: CA


Legend
Wells Sampled Quarterly
Wells Sampled Fall and Spring
Wells Sampled Fall Only
Wells Sampled for Hydraulics Only
Extraction Well
Landfill Boundary
Reverse Particle Tracks from Exceedences under Ambient Conditions
Model Predicted 34 gpm Capture Zone
Model Predicted 42 gpm Capture Zone
Model Predicted 50 gpm Capture Zone
Model Predicted Groundwater Elevations (ft amsl)
Groundwater Contours from 4/16/08
Note: Based on AMEC's "SHL005" operating conditions model adapted from the existing "run412" model developed by CH2M Hill (2005).
SHP-05-49A
SHP-05-49B
SHP-05-48A
SHP-05-48B
SHX-99-32X
SHP-99-31B
SHP-99-31A
SHP-99-31C
SHP-99-34A
SHP-99-34B
SHM-05-40X
SHM-05-39A
SHM-05-39B
SHM-05-42A
SHM-05-42B
SHM-05-41A
SHM-05-41B
SHM-05-41C
SHP-05-47A
SHP-05-47B
PSP-01 (pond sample)
SHL-22
SHM96-22-B
SHM96-22-C
SHL-8D
SHL-8S
SHL-5
SHM-96-5C
SHL-9
SHM-96-5B
SHL-13
EW-04
EW-01
SHP-05-46A
SHP-05-46B
SHL-23
SHP-05-45A
SHP-05-45B
SHL-21
N-1 P-1
N-1 P-2
N-1 P-3
SHP-05-43
SHP-36X
SHP-05-44
SHP-37X
SHL-20
SHL-11
N-2 P-2
N-2 P-1
SHP-01-34A
SHP-01-34B
SHP-01-34A
N-3 P-1
N-3 P-2
N-5 P-1
N-5 P-2
SHP-99-29X
SHL-4
SHL-18
SHL-16D
SHL-10C
SHL-10
SHL-3
SHP-99-35X
SHL-16
SHM-93-16B
N-6 P-1
SHP-95-27X
SHL-5
N-7 P-1
N-7 P-2
SHL-24
Location of Site
Model Predicted Capture Zones
2008 Annual Report
Shepley's Hill Landfill
Ayer, Massachusetts
0
300
Feet
FIGURE
5-5
ECC

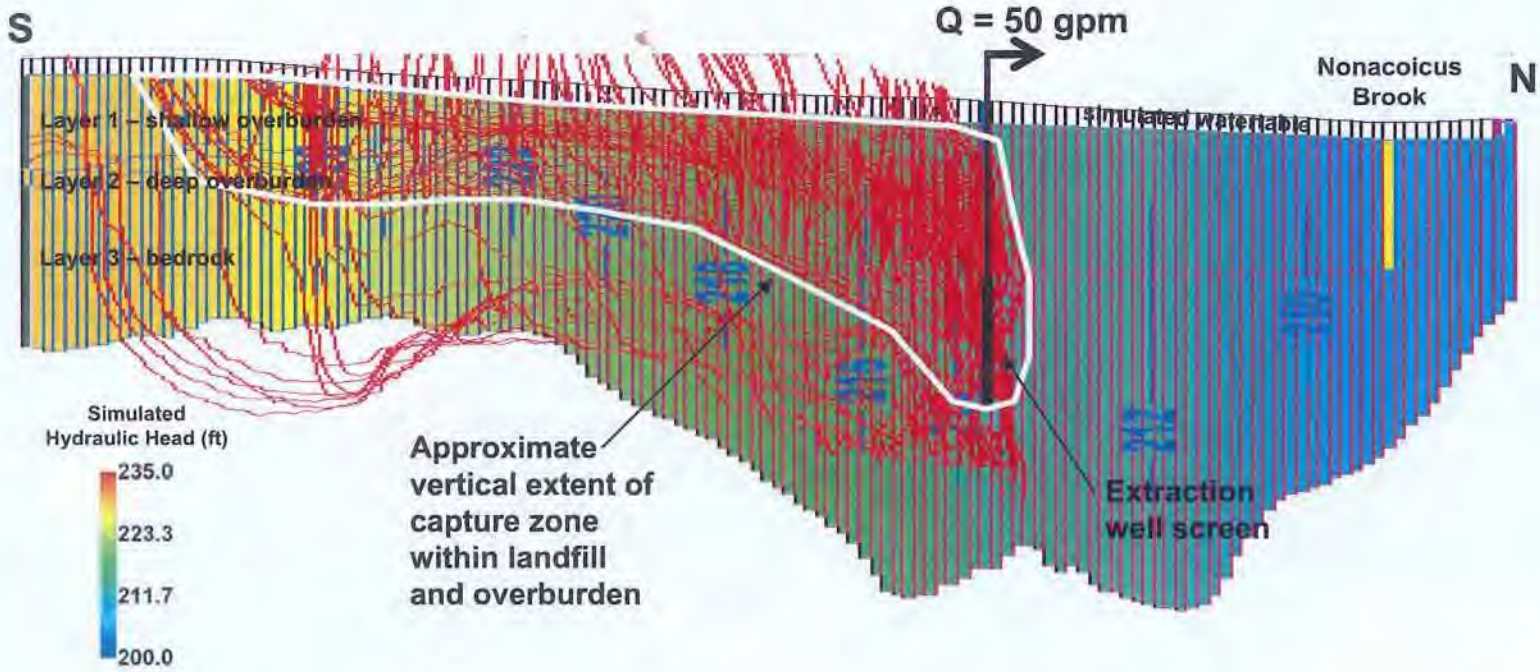
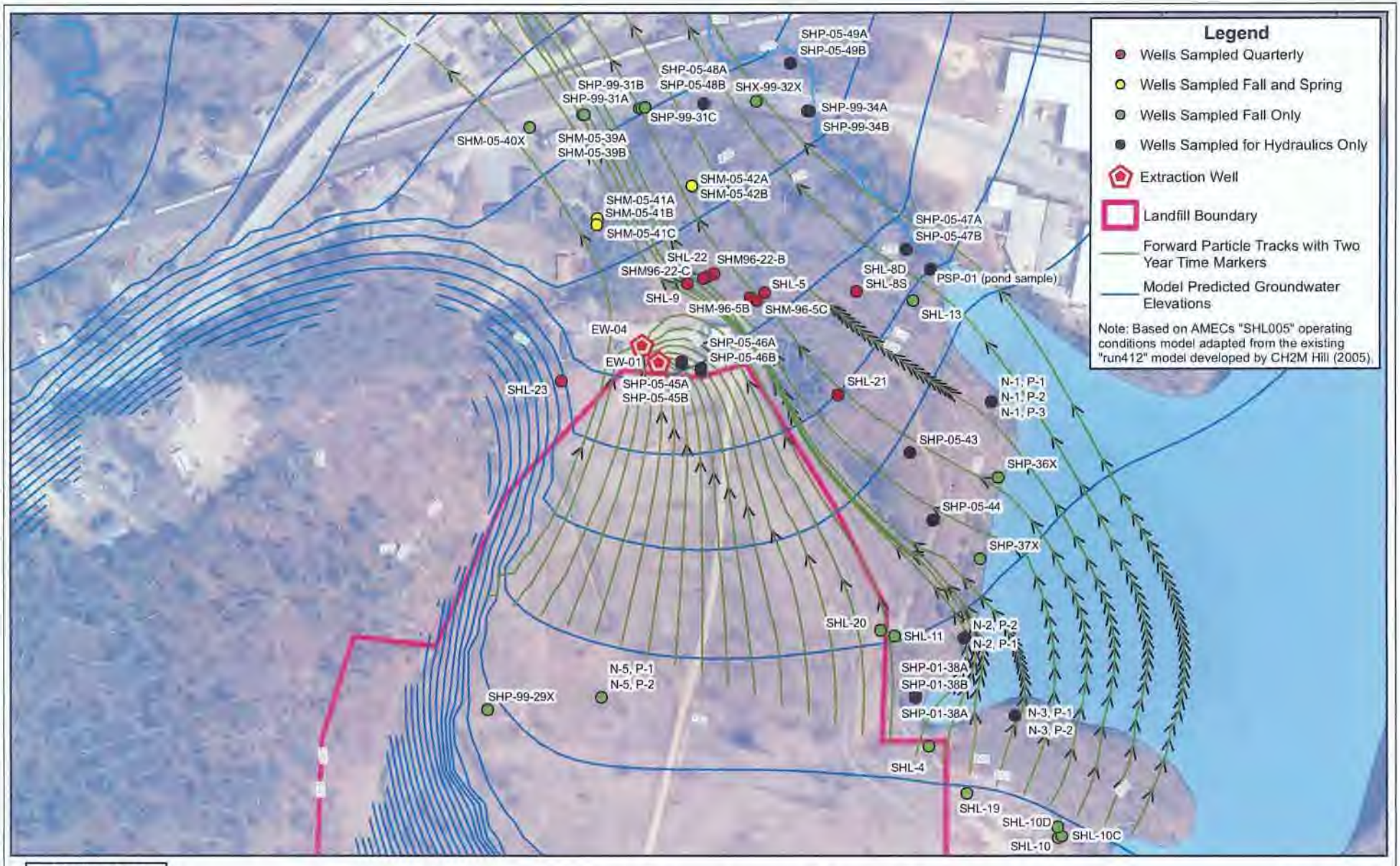


Figure 5-6 N-S Cross-section through Extraction Wellfield with Projected Capture Zone Particle Tracks



Model Predicted Groundwater Travel Times

2008 Annual Report

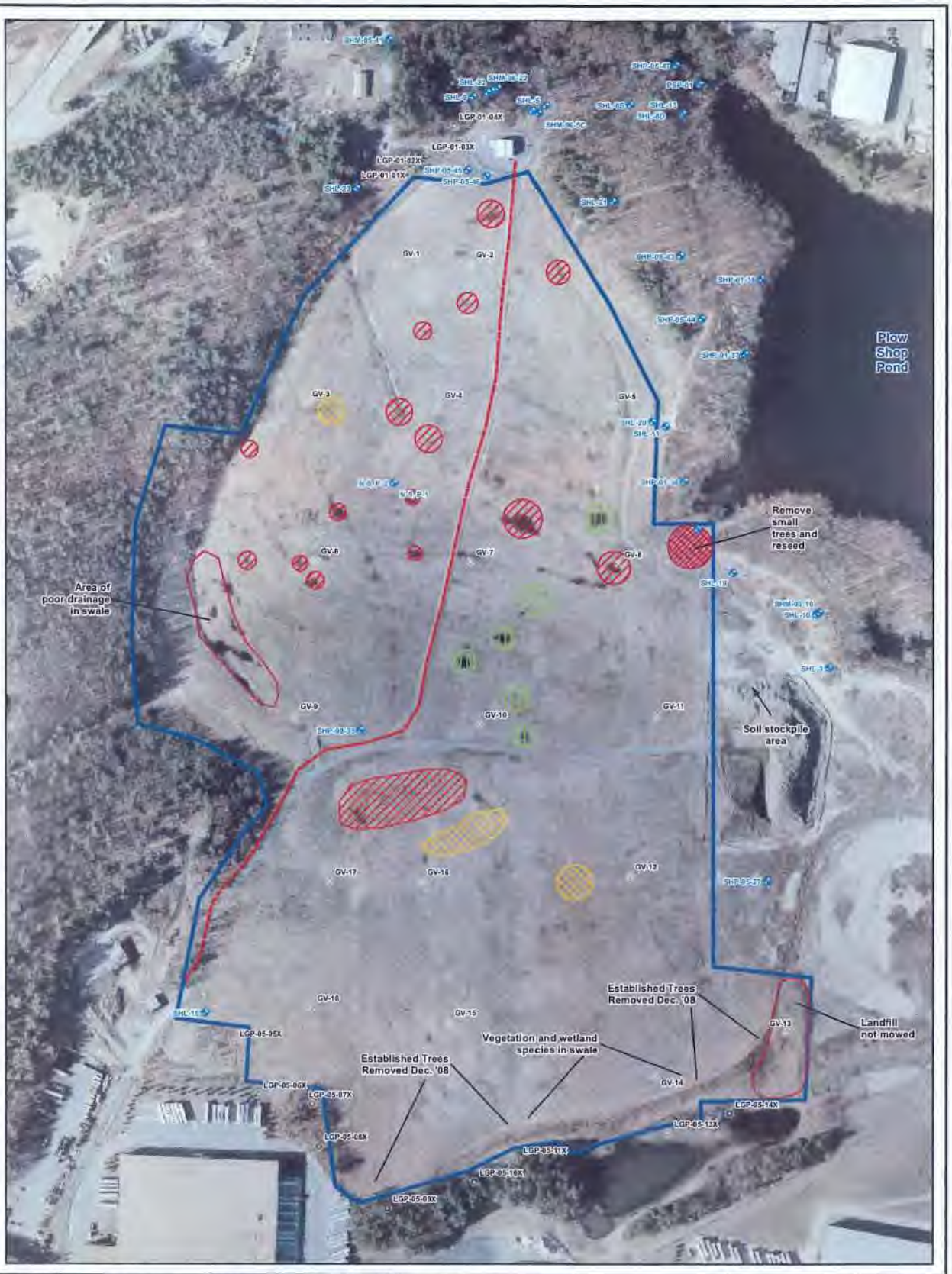
Shepley's Hill Landfill
Ayer, Massachusetts

FIGURE
5-7

H:\ShepleyLandfill\ \XD\Figure5-4.mxd H:\ShepleyLandfill\Task28\Export\Figure5-4.pdf August 6, 2009 DWN: APC CHKD: AKN

Appendix A

Landfill Inspection Report



Contract No.	W91ZLK-05-D-0009
Description	Fort Devens, MA
Coordinate system	NAD 1983, State Plane, Massachusetts Mainland in meters
Sources	

Date	16-JAN-2009	Rev.	Date	App. By
DB	J. Kim			
CB	W. Murray			
AB				

Area of Detail

Legend

- Monitoring Well
- Gas Vent
- Gas Probe
- Utility Berm
- Sparce Vegetation
- Standing Water
- Vehicle Damage
- Depressions Filled in December '08
- Other Finding of Inspection
- Landfill Boundary

Figure A-1

Findings of Inspection December 29, 2008

Shepley Hill Landfill
Devens RFTA
Devens, MA

ECC GIS Server:
C:\Other\GIS\FtDevens\MapDocuments\
FtDevens_FigA-1_113017.mxd

0 100 200 400 Feet

Landfill Maintenance Checklist
Shepley's Hill Landfill Devens, Massachusetts

Date: December 29, 2008
Inspectors: Fred Santos/Dave Reault /Willard Murray, Ph.D., P.E.

LANDFILL ATTRIBUTE	OBSERVATIONS	RECOMMENDATIONS	SAT/UNSAT
Cover Surface	1. The vegetation covering the majority of the landfill is adequate; a small area on the east edge has sparse vegetation due to a lack of topsoil but no significant erosion was observed in this area; mowed to about four inches height in September 2008.	1. See specific comments under the sections that follow.	SAT
	2. The areas noted in the 2007 report where settlement has occurred were being filled and graded to conform to the slope of the surrounding landfill surface during this inspection. As reported in the *Draft* Supplemental Groundwater and Landfill Cap Assessment for Long-Term Monitoring and Maintenance (AMEC, 2008): "Depressions due to subsidence create standing water and additional hydraulic pressure on the geomembrane, and repairs to eliminate these were underway as of December 2008."	2. Monitor after completion of current repairs.	SAT
	3. No tree or shrub growth was observed on the landfill surface, but was observed in riprap drainage areas along the southern perimeter and in northern swale – the small tree growth was removed in December.	3. Monitor for tree growth in future. Remove shrub/sapling growth as necessary.	SAT
	4. A utility berm was constructed through the middle of the landfill in 2004. It provides utility service to the pumping station at the northeastern corner of the landfill. An access path was built over the utility berm in the fall of 2006 in the middle of the landfill, near GV-9. No adverse effects from this construction were observed.	4. Continue observation of effects on drainage patterns in the vicinity of the utility berm during future inspections.	SAT

Landfill Maintenance Checklist
Shepley's Hill Landfill Devens, Massachusetts

LANDFILL ATTRIBUTE	OBSERVATIONS	RECOMMENDATIONS	SAT/UNSAT
Vegetative Growth	1. The previously reported sparse/eroded vegetation in the vicinity of gas vents 8, 11, and 12 appears to have been naturally revegetated and no erosion features are apparent. The area near SHL-4 has sparse vegetation cover, but no significant erosion.	1. Continuing observation of this area to detect any erosion or development of sparse vegetation cover should conducted annually. The area around SHL-4 should be revegetated.	SAT UNSAT
Landfill Gas Vents and Monitoring Wells	1. The gas vents are in good condition. All screens and pipes are in functional condition. All of the non-galvanized vents are showing signs of rusting and corrosion. These include all gas vents except for GV-12 through GV-15. 2. Monitoring wells and piezometers are all in good condition with no damage observed. All monitoring wells and piezometers have been equipped with keyed-alike padlocks with keys issued to necessary personnel.	1. Touch-up work on the non-galvanized vents should be conducted including scraping, cleaning and painting. 2. None	SAT SAT
Drainage Swales	1. Some of the drainage swale on the south side is exhibiting growth of vegetation/wetland species. 2. In the south-east side drainage swale, in the vicinity of GV-13 and continuing downstream to the rip rap lined channel, the drainage swale appears to have accumulations of silt in some areas. 3. Vegetation growing in rip rap lined channel located in the northern side (under Sculley Road access road).	1. The swale should be cleared of vegetation, accumulated sediment, and debris. 2. The swale will be surveyed after snow melt in 2009 to determine the amount of silt removal needed to maintain a continuous slope of the channel bottom. 3. The swale should be cleared of vegetation.	UNSAT UNSAT UNSAT

Landfill Maintenance Checklist
Shepley's Hill Landfill Devens, Massachusetts

LANDFILL ATTRIBUTE	OBSERVATIONS	RECOMMENDATIONS	SAT/UNSAT
Culverts	1. The concrete drainage structure at the terminus of the catch basin and underground conduit system south of the landfill is overgrown with vegetation and is silting in. Standing water is present and wetland species are becoming established as well.	1. This catch basin and drainage system were constructed specifically for runoff from the commercial buildings and parking lots south of the landfill, and are therefore not the responsibility of the Army.	SAT
Catch Basins	1. Catch Basin #2 near the entrance to the site has a broken surface grate. 2. Catch Basin #3 near the entrance to the site is not set to grade. The rim of the basin is about six to eight inches higher than the surrounding ground.	1. The surface grate should be replaced, however this is outside the landfill boundary and does not affect landfill cap integrity. 2. The rim of this catch basin should be lowered to meet the surrounding grade, however this is outside the landfill boundary and does not affect landfill cap integrity.	SAT SAT
Settlement	1. Repairs to eliminate depressions caused by settlement were underway as of December 2008.	1. An inspection of these areas should be conducted in 2009 to verify satisfactory repair.	SAT
Erosion	1. No substantial erosion observed.	1. None	SAT
Access Roads	1. The access roads on the landfill road are generally in good condition.	1. None	SAT
Security/Fencing	1. Perimeter fencing is damage and non-existent along much of the western boundary of the landfill (wooded area along Shepley's Hill). However, no roads have open access to the landfill. Existing fence gates across roads that access the landfill are secured with chains and padlocks.	1. None	SAT

Landfill Maintenance Checklist
Shepley's Hill Landfill Devens, Massachusetts

LANDFILL ATTRIBUTE	OBSERVATIONS	RECOMMENDATIONS	SAT/UNSAT
Wetland Encroachment	1. Wetland encroachment is taking place at several locations, but is not happening on a wide scale. Overall, the areas of encroachment are small.	1. Wetland encroachment should be controlled by simple mowing in some areas, and by clearing channels in other areas.	UNSAT
Immediate Action Required: The following problem areas, from among those mentioned in the comments above, are the most critical and should be addressed before the next inspection: 1. Wetland encroachment should be stopped by mowing and clearing as needed. 2. Vegetation in rip rap lined channels and southern swale should be removed.			
NOTES: SAT = satisfactory UNSAT = unsatisfactory			

Depression Repair Looking North (see Treatment Plant at north end)

Depression Repair Looking Northeast (see Treatment Plant at north end)

Tree Removal Southeast Drainage Swale (looking east)

Tree Removal Southern Drainage Swale (looking west)

Southern Drainage Swale (looking east)

Southern Drainage Swale (looking west)

Western Swale (looking north)

Northwestern Swale (looking northeast to treatment plant)

Depression Repair – Landfill Center

Depression Repair – Landfill Center

Depression Repair – Landfill Center East (looking toward Plow Shop Pond)

Depression Repair – Landfill Center East (looking southwest)

Landfill Center Depressions (after snowfall)

Appendix B

Landfill Gas Results

Project: Shapley's Hill Landfill

Gas Monitoring Data

VENT	DATE	AP	T (°F)	VOC ppm PID	O_2 % GEM 500	H_2S ppm ISTMX	% LEL ISTMX	CO ppm ISTMX	CO_2 % GEM 500	CH_4 % GEM 500
GV-1 (PH1)	11/19/1996	30.5	32	0.0	21.4	0.0	0.0	0.0	0.0	0.0
	10/29/1997	29.9	45	1.0	17.5	0.0	4.0	5.0	1.7	0.2
	10/26/1998	30.2	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	2.0	3.0	100.0	0.0	13.4	3.5
	12/07/1999	29.6	45	0.0	19.7	0.0	0.0	0.0	0.8	0.0
	10/30/2000	29.7	45	0.0	8.3	0.0	0.0	0.0	9.5	1.0
	12/05/2001	29.9	65	0.0	20.8	0.0	0.0	0.0	0.0	0.0
	11/05/2002	29.9	50	0.0	18.3	0.0	0.0	0.0	1.2	0.0
	11/17/2003	30.1	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	11/16/2004	30.0	45	0.0	16.9	0.0	0.0	0.0	3.1	0.0
	11/08/2005	29.9	55	0.0	5.6	0.0	32.0	0.0	10.8	1.7
	12/14/2006	30.0	55.0	0.0	6.5	0.0	95.0	4.0	10.9	1.9
	10/23/2007	29.5	74	0.0	14.5	0.0	0.0	0.0	4.7	0.0
	09/30/2008	29.6	61	0.7	21.9	0.0	0.0	0.0	0.0	0.0
GV-2 (PH1)	11/19/1996	30.5	32	0.0	21.5	0.0	0.0	0.0	0.0	0.0
	10/29/1997	29.9	45	0.0	20.1	0.0	0.0	2.0	0.2	0.0
	10/26/1998	30.2	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	2.8	0.0	100.0	0.0	14.0	7.4
	12/07/1999	29.6	45	0.0	7.2	0.0	100.0	0.6	10.9	8.4
	10/30/2000	29.7	45	0.0	21.0	0.0	0.0	0.0	2.6	1.3
	12/05/2001	29.9	65	0.0	15.2	0.0	93.0	0.0	4.7	2.4
	11/05/2002	29.9	50	0.0	18.1	0.0	75.0	0.0	1.3	1.4
	11/17/2003	30.1	45	0.0	20.8	0.0	75.0	0.0	0.0	0.0
	11/16/2004	30.0	45	0.0	2.9	0.0	100.0	0.0	15.4	11.0
	11/08/2005	29.9	55	0.0	5.2	0.0	100.0	0.0	12.8	8.6
	12/14/2006	30.0	55.0	0.0	5.2	0.0	100.0	6.0	15.6	11.5
	10/23/2007	29.5	74	0.0	11.2	0.0	60.0	13.0	6.4	3.0
	09/30/2008	29.6	61	0.7	21.9	0.0	0.0	0.0	0.0	0.0
GV-3 (PH1)	11/19/1996	30.5	32	0.0	21.3	0.0	0.0	0.0	0.0	0.0
	10/29/1997	29.9	45	1.0	14.3	0.0	20.0	1.0	3.8	0.9
	10/26/1998	30.2	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	0.9	0.0	100.0	0.0	16.9	14.6
	12/07/1999	29.6	45	0.0	21.0	0.0	0.1	0.0	0.0	0.0
	10/30/2000	29.7	45	0.0	11.5	0.0	7.0	0.0	7.9	5.8
	12/05/2001	29.9	65	0.0	10.3	0.0	100.0	0.0	8.3	6.3
	11/05/2002	29.9	50	0.0	10.7	0.0	100.0	0.0	5.7	3.4
	11/17/2003	30.1	45	0.0	20.6	0.0	0.0	0.0	0.0	0.0
	11/16/2004	30.0	45	0.0	8.9	0.0	100.0	0.0	10.3	7.6
	11/08/2005	29.9	55	0.0	2.8	0.0	100.0	0.0	15.1	9.0
	12/14/2006	30.0	55.0	0.0	6.5	0.0	100.0	6.0	18.9	10.9
	10/23/2007	29.5	74	0.0	8.2	0.0	94.0	0.0	8.3	4.7
	09/30/2008	29.6	61	0.0	21.7	0.0	0.0	0.0	0.0	0.0

Project: Shepley's Hill Landfill

Gas Monitoring Data

VENT	DATE	AP	T (°F)	VOC ppm PID	O_2 % GEM 500	H_2S ppm ISTMX	% LEL ISTMX	CO ppm ISTMX	CO_2 % GEM 500	CH_4 % GEM 500
GV-4(PH1)	11/19/1996	30.5	32	0.0	21.3	0.0	2.0	0.0	0.0	0.0
	10/29/1997	29.9	45	0.0	12.3	0.0	50.0	3.0	5.3	2.4
	10/26/1998	30.2	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	1.4	0.0	100.0	0.0	16.2	9.3
	12/07/1999	29.6	45	0.0	16.2	0.0	3.0	0.0	4.1	2.0
	10/30/2000	29.7	45	0.0	17.4	0.0	0.0	0.0	1.7	0.5
	12/05/2001	29.9	65	0.0	14.5	0.0	61.0	0.0	4.4	1.3
	11/05/2002	29.9	50	0.0	14.1	0.0	100.0	0.0	4.0	0.9
	11/17/2003	30.1	45	0.0	20.7	0.0	0.0	0.0	0.0	0.0
	11/16/2004	30.0	45	0.0	8.0	0.0	100.0	0.0	9.5	3.0
	11/08/2005	29.9	55	0.0	6.4	0.0	50.0	0.0	10.6	4.3
	12/14/2006	30.0	55.0	0.0	10.0	0.0	52.0	2.0	8.8	1.2
	10/23/2007	29.5	74	0.0	14.9	0.0	39.0	8.0	4.8	1.9
	09/30/2008	29.6	61	0.0	21.9	0.0	0.0	0.0	0.0	0.0
GV-5 (PH1)	11/19/1996	30.5	32	0.0	21.4	0.0	0.0	0.0	0.0	0.0
	10/29/1997	29.9	45	0.2	19.2	0.0	0.0	1.0	0.7	0.0
	10/26/1998	30.2	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	6.8	0.0	72.0	2.5	7.6	2.6
	12/07/1999	29.6	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	10/30/2000	29.7	45	0.0	16.3	0.0	0.0	0.0	2.4	0.0
	12/05/2001	29.9	65	0.0	15.3	0.0	5.0	0.0	3.6	0.1
	11/05/2002	29.9	50	0.0	18.8	0.0	0.0	0.0	0.8	0.0
	11/17/2003	30.1	45	0.0	20.8	0.0	0.0	0.0	0.0	0.0
	11/16/2004	30.0	45	0.0	11.7	0.0	33.0	0.0	7.0	0.7
	11/08/2005	29.9	55	0.0	10.4	0.0	11.0	0.0	7.7	1.4
	12/14/2006	30.0	55.0	0.6	17.9	0.0	2.0	2.0	6.3	2.0
	10/23/2007	29.5	74	0.0	16.2	0.0	0.0	4.0	1.8	0.0
	09/30/2008	29.6	61	0.3	21.6	0.0	0.0	0.0	0.0	0.0
GV-6 (PH1)	11/19/1996	30.5	32	0.0	21.4	0.0	0.0	0.0	0.0	0.0
	10/29/1997	29.9	45	0.0	17.2	0.0	8.0	1.0	1.7	0.4
	10/26/1998	30.2	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	1.4	0.0	100.0	0.0	16.2	10.8
	12/07/1999	29.6	45	0.0	21.0	0.0	0.5	0.0	0.0	0.0
	10/30/2000	29.7	45	0.4	11.6	0.0	4.0	0.0	7.2	3.1
	12/05/2001	29.9	65	0.0	14.8	0.0	37.0	0.0	3.9	0.7
	11/05/2002	29.9	50	0.0	15.4	0.0	100.0	0.0	3.4	2.8
	11/17/2003	30.1	45	0.0	20.4	0.0	1.0	0.0	0.0	0.0
	11/16/2004	30.0	45	0.0	11.6	0.0	78.0	0.0	6.6	2.2
	11/08/2005	29.9	55	0.0	0.4	0.0	100.0	0.0	18.9	12.5
	12/14/2006	30.0	55.0	0.0	1.3	0.0	100.0	8.0	21.2	14.4
	10/23/2007	29.5	74	0.0	15.3	0.0	53.0	0.0	3.9	2.7
	09/30/2008	29.6	61	0.0	21.8	0.0	0.0	0.0	0.0	0.0

Project: Shepley's Hill Landfill

Gas Monitoring Data

VENT	DATE	AP	T (°F)	VOC ppm PID	O_2 % GEM 500	H_2S ppm ISTMX	% LEL ISTMX	CO ppm ISTMX	CO_2 % GEM 500	CH_4 % GEM 500
GV-7(PH1)	11/19/1996	30.5	32	0.0	21.4	0.0	0.0	0.0	0.0	0.0
	10/29/1997	29.9	45	0.0	20.3	0.0	0.0	1.0	0.1	0.0
	10/26/1998	30.2	45	0.0	21.1	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	3.8	0.0	54.0	0.0	9.1	0.8
	12/07/1999	29.6	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	10/30/2000	29.7	45	0.0	18.1	0.0	0.0	0.0	1.0	0.0
	12/05/2001	29.9	65	0.0	16.4	0.0	31.0	0.0	2.4	0.7
	11/05/2002	29.9	50	0.0	18.0	0.0	16.0	0.0	0.8	0.2
	11/17/2003	30.1	45	0.0	20.4	0.0	1.0	0.0	0.0	0.0
	11/16/2004	30.0	45	0.0	7.9	0.0	19.0	0.0	8.2	1.3
	11/08/2005	29.9	55	0.0	2.1	0.0	14.0	0.0	12.2	4.4
	12/14/2006	30.0	55.0	0.0	1.1	0.0	100.0	8.0	17.1	6.0
	10/23/2007	29.5	74	0.0	19.6	0.0	0.0	6.0	0.7	0.0
	09/30/2008	29.6	61	0.0	21.8	0.0	0.0	0.0	0.0	0.0
GV-8 (PH1)	11/19/1996	30.5	32	0.0	21.2	0.0	2.0	0.0	0.1	0.1
	10/29/1997	29.9	45	0.0	18.7	0.0	4.0	1.0	1.0	0.2
	10/26/1998	30.2	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	4.8	0.0	100.0	1.0	9.6	2.2
	12/07/1999	29.6	45	0.0	12.7	0.0	0.0	0.0	6.1	0.0
	10/30/2000	29.7	45	0.0	19.3	0.0	0.0	0.0	0.1	0.0
	12/05/2001	29.9	65	0.0	14.8	0.0	50.0	0.0	4.2	1.3
	11/05/2002	29.9	50	0.0	16.1	0.0	40.0	0.0	2.4	0.6
	11/17/2003	30.1	45	0.0	19.7	0.0	0.0	0.0	0.2	0.0
	11/16/2004	30.0	45	0.0	7.5	0.0	31.0	0.0	9.6	0.9
	11/08/2005	29.9	55	0.0	8.3	0.0	25.0	0.0	8.9	4.2
	12/14/2006	30.0	55.0	0.0	16.3	0.0	23.0	3.0	11.6	1.2
	10/23/2007	29.5	74	0.0	16.9	0.0	0.0	6.0	2.1	0.0
	09/30/2008	29.6	61	0.0	21.8	0.0	0.0	0.0	0.0	0.0
GV-9 (PH1)	11/19/1996	30.5	32	0.0	21.2	0.0	1.0	0.0	0.0	0.1
	10/29/1997	29.9	45	0.0	19.7	0.0	6.0	1.0	0.4	0.3
	10/26/1998	30.2	45	0.0	21.1	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	0.3	0.0	100.0	1.0	23.2	26.6
	12/07/1999	29.6	45	0.0	20.2	0.0	0.5	0.0	0.6	0.5
	10/30/2000	29.7	45	0.0	19.0	0.0	0.0	0.0	0.2	0.0
	12/05/2001	29.9	65	0.0	6.7	0.0	100.0	0.0	10.2	9.2
	11/05/2002	29.9	50	0.0	7.2	0.0	100.0	0.0	14.7	19.8
	11/17/2003	30.1	45	0.0	11.5	0.0	100.0	1.0	9.9	15.0
	11/16/2004	30.0	45	0.0	4.1	0.0	100.0	0.0	18.6	23.9
	11/08/2005	29.9	55	0.0	0.0	0.0	100.0	0.0	21.8	26.4
	12/14/2006	30.0	55.0	0.0	6.5	0.0	100.0	6.0	23.6	32.0
	10/23/2007	29.5	74	0.0	5.8	0.0	100.0	15.0	15.7	21.7
	09/30/2008	29.6	61	0.0	21.8	0.0	0.0	0.0	0.0	0.0

Project: Shepley's Hill Landfill

Gas Monitoring Data

VENT	DATE	AP	T (°F)	VOC ppm PID	O_2 % GEM 500	H_2S ppm ISTMX	% LEL ISTMX	CO ppm ISTMX	CO_2 % GEM 500	CH_4 % GEM 500
GV-10 (PH1)	11/19/1996	30.5	32	0.0	21.2	0.0	0.0	0.0	0.0	0.0
	10/29/1997	29.9	45	0.2	19.5	0.0	0.0	1.0	0.2	0.0
	10/26/1998	30.2	45	0.0	21.1	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	0.5	0.0	100.0	2.0	17.7	7.0
	12/07/1999	29.6	45	0.0	20.9	0.0	0.1	0.0	0.2	0.0
	10/30/2000	29.7	45	0.0	19.1	0.0	0.0	0.0	0.2	0.0
	12/05/2001	29.9	65	0.0	13.8	0.0	55.0	0.0	4.1	1.4
	11/05/2002	29.9	50	0.0	17.8	0.0	9.0	0.0	0.6	0.0
	11/17/2003	30.1	45	0.4	20.3	0.0	2.0	0.0	0.0	0.0
	11/16/2004	30.0	45	0.0	0.3	0.0	100.0	4.0	17.6	6.5
	11/08/2005	29.9	55	0.0	0.6	0.0	100.0	0.0	14.8	10.3
	12/14/2006	30.0	55.0	0.0	8.5	0.0	100.0	7.0	17.9	9.6
	10/23/2007	29.5	74	0.0	19.8	0.0	0.0	6.0	0.5	0.0
	09/30/2008	29.6	61	0.0	21.8	0.0	0.0	0.0	0.0	0.0
GV-11(PH1)	11/19/1996	30.5	32	0.0	21.3	0.0	0.0	0.0	0.0	0.0
	10/29/1997	29.9	45	0.0	20.1	0.0	0.0	1.0	0.1	0.0
	10/26/1998	30.2	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	3.9	0.0	100.0	0.0	9.7	7.3
	12/07/1999	29.6	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	10/30/2000	29.7	45	0.0	19.3	0.0	0.0	0.0	0.1	0.0
	12/05/2001	29.9	65	0.0	14.7	0.0	69.0	0.0	3.4	2.5
	11/05/2002	29.9	50	0.0	16.3	0.0	62.0	0.0	1.5	1.0
	11/17/2003	30.1	45	0.0	19.0	0.0	5.0	0.0	0.5	0.0
	11/16/2004	30.0	45	0.0	8.4	0.0	100.0	0.0	7.4	4.2
	11/08/2005	29.9	55	0.0	10.1	0.0	12.0	0.0	6.4	2.2
	12/14/2006	30.0	55.0	0.0	10.7	0.0	100.0	6.0	7.2	3.3
	10/23/2007	29.5	74	0.0	12.5	0.0	60.0	16.0	3.8	3.1
	09/30/2008	29.6	61	0.0	21.9	0.0	0.0	0.0	0.0	0.0
GV-12(PH2)	11/19/1996	30.5	32	0.0	21.2	0.0	0.0	0.0	0.0	0.0
	10/29/1997	29.9	45	0.0	20.5	0.0	0.0	1.0	0.0	0.0
	10/26/1998	30.2	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	2.1	0.0	100.0	0.0	14.5	10.5
	12/07/1999	29.6	45	0.0	20.6	0.0	0.0	0.0	0.6	0.0
	10/30/2000	29.7	45	0.0	4.9	0.0	20.0	0.0	8.2	2.7
	12/05/2001	29.9	65	0.0	1.2	0.0	100.0	4.0	13.6	8.0
	11/05/2002	29.9	50	0.0	20.5	0.0	0.0	0.0	0.0	0.0
	11/17/2003	30.1	45	0.0	19.8	0.0	0.0	0.0	0.0	0.0
	11/16/2004	30.0	45	0.0	20.6	0.0	46.0	0.0	0.8	0.5
	11/08/2005	29.9	55	0.0	2.8	0.0	100.0	0.0	9.4	6.4
	12/14/2006	30.0	55.0	0.2	21.0	0.0	0.0	0.0	0.1	0.0
	10/23/2007	29.5	74	0.0	20.2	0.0	0.0	6.0	0.5	0.0
	09/30/2008	29.6	61	0.0	13.1	0.0	0.0	0.0	4.3	0.0

Project: Shepley's Hill Landfill

Gas Monitoring Data

VENT	DATE	AP	T (°F)	VOC ppm PID	O_2 % GEM 500	H_2S ppm ISTMX	% LEL ISTMX	CO ppm ISTMX	CO_2 % GEM 500	CH_4 % GEM 500
GV-13 (PH2)	11/19/1996	30.5	32	0.0	21.2	0.0	0.0	0.0	0.0	0.0
	10/29/1997	29.9	45	0.0	17.9	0.0	66.0	1.0	2.0	1.6
	10/26/1998	30.2	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	2.3	0.0	100.0	0.0	14.0	18.5
	12/07/1999	29.6	45	0.0	14.7	0.0	100.0	0.0	4.6	6.6
	11/01/2000	29.8	55	0.0	0.1	0.0	100.0	0.0	14.5	19.1
	12/05/2001	29.9	65	0.0	4.3	0.0	100.0	1.0	10.1	11.3
	11/05/2002	29.9	50	0.0	9.3	0.0	100.0	0.0	6.3	4.9
	11/17/2003	30.1	45	0.0	19.2	0.0	2.0	0.0	0.3	0.0
	11/16/2004	30.0	45	0.0	21.2	0.0	75.0	0.0	0.1	0.2
	11/08/2005	29.9	55	0.0	20.2	0.0	25.0	0.0	0.5	0.5
	12/14/2006	30.0	55.0	0.2	20.1	0.0	0.0	0.0	0.2	0.0
	10/23/2007	29.5	74	0.0	0.2	0.0	100.0	0.0	13.1	14.7
	09/30/2008	29.6	61	0.0	5.2	0.0	>100	0.0	1.0	13.9
GV-14 (PH2)	11/19/1996	30.5	32	0.0	21.2	0.0	0.0	0.0	0.0	0.0
	10/29/1997	29.9	45	0.0	20.4	0.0	0.0	1.0	0.0	0.0
	10/26/1998	30.2	45	0.0	21.2	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	1.7	2.0	100.0	0.0	22.2	34.1
	12/06/1999	29.7	45	0.0	17.0	0.0	100.0	0.0	5.2	8.0
	11/01/2000	29.8	55	0.0	0.0	0.0	100.0	0.0	26.6	41.0
	12/05/2001	29.9	65	0.0	1.6	0.0	100.0	2.0	22.2	33.1
	11/05/2002	29.9	50	0.0	2.2	0.0	100.0	0.0	15.7	18.6
	11/17/2003	30.1	45	0.0	5.8	0.0	57.0	0.0	7.8	3.8
	11/16/2004	30.0	45	0.0	4.4	0.0	100.0	13.0	19.9	33.5
	11/08/2005	29.9	55	0.0	20.7	0.0	6.0	0.0	0.2	0.3
	12/14/2006	30.0	55.0	0.1	21.0	0.0	13.0	0.0	0.4	0.1
	10/23/2007	29.5	74	0.0	0.2	0.0	100.0	8.0	23.1	33.6
	09/30/2008	29.6	61	0.0	1.5	0.0	>100	0.0	20.0	26.8
GV-15 (PH3)	11/19/1996	30.5	32	0.0	20.1	0.0	11.0	0.0	0.6	0.4
	10/29/1997	29.9	45	0.0	13.4	0.0	46.0	1.0	4.2	2.2
	10/26/1998	30.2	45	0.0	21.6	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	2.1	0.0	100.0	0.0	22.5	23.7
	12/06/1999	29.7	45	0.0	20.2	0.0	0.4	0.0	0.7	0.6
	11/01/2000	29.8	55	0.0	0.1	0.0	100.0	0.0	26.6	27.7
	12/05/2001	29.9	65	0.0	0.3	0.0	100.0	0.0	22.9	23.4
	11/05/2002	29.9	50	0.0	4.2	0.0	100.0	0.0	12.2	10.6
	11/17/2003	30.1	45	0.0	8.2	0.0	74.0	0.0	7.4	5.1
	11/16/2004	30.0	45	0.0	0.0	0.0	100.0	11.0	26.1	32.4
	11/08/2005	29.9	55	0.0	20.9	0.0	0.0	0.0	0.0	0.0
	12/14/2006	30.0	55.0	0.2	21.0	0.0	4.0	0.0	0.4	0.1
	10/23/2007	29.5	74	0.0	0.1	0.0	100.0	12.0	27.4	24.9
	09/30/2008	29.6	61	0.0	3.9	0.0	>100	0.0	15.1	11.3

Project: Shepley's Hill Landfill

Gas Monitoring Data

VENT	DATE	AP	T (°F)	VOC ppm PID	O_2 % GEM 500	H_2S ppm ISTMX	% LEL ISTMX	CO ppm ISTMX	CO_2 % GEM 500	CH_4 % GEM 500
GV-16 (PH3)	11/19/1996	30.5	32	0.0	21.1	0.0	1.0	0.0	0.0	0.0
	10/29/1997	29.9	45	0.2	18.0	0.0	2.0	1.0	1.0	0.0
	10/26/1998	30.2	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	1.8	0.0	100.0	0.0	19.2	13.0
	12/06/1999	29.7	45	0.0	20.9	0.0	0.0	0.0	0.0	0.0
	11/01/2000	29.8	55	30.0	0.5	0.0	65.0	0.0	21.8	14.8
	12/05/2001	29.9	65	0.0	0.4	0.0	65.0	1.0	19.7	12.5
	11/05/2002	29.9	50	0.0	20.7	0.0	0.0	0.0	0.0	0.0
	11/17/2003	30.1	45	0.0	15.0	0.0	29.0	0.0	2.3	1.0
	11/16/2004	30.0	45	0.0	0.1	0.0	100.0	10.0	24.6	22.6
	11/08/2005	29.9	55	0.0	0.0	0.0	100.0	2.0	23.7	20.7
	12/14/2006	30.0	55.0	0.0	20.1	0.0	1.0	0.0	1.1	0.2
	10/23/2007	29.5	74	0.0	0.1	1.0	100.0	11.0	25.3	15.1
	09/30/2008	29.6	61	0.0	3.8	0.0	96.0	0.0	16.7	4.8
GV-17 (PH4A)	11/19/1996	30.5	32	0.0	21.0	0.0	2.0	0.0	0.2	0.1
	10/29/1997	29.9	45	0.0	16.1	0.0	8.0	1.0	2.5	0.5
	10/26/1998	30.2	45	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	1.7	3.0	100.0	0.0	25.0	26.2
	12/06/1999	29.7	45	0.0	20.2	0.0	0.0	0.0	0.0	0.0
	11/01/2000	29.8	55	40.0	0.1	0.0	100.0	0.0	29.2	32.0
	12/05/2001	29.9	65	0.0	2.2	0.0	100.0	3.0	19.6	17.1
	11/05/2002	29.9	50	0.0	14.9	0.0	17.0	0.0	3.0	0.5
	11/17/2003	30.1	45	0.4	14.8	0.0	7.0	0.0	2.1	0.4
	11/16/2004	30.0	45	0.0	0.0	0.0	100.0	10.0	27.6	37.6
	11/08/2005	29.9	55	0.0	0.0	0.0	100.0	3.0	27.0	32.7
	12/14/2006	30.0	55.0	0.0	9.2	0.0	100.0	5.0	16.5	17.4
	10/23/2007	29.5	74	0.0	16.2	0.0	100.0	0.0	15.2	22.1
	09/30/2008	29.6	61	0.0	21.0	0.0	26.0	0.0	1.0	1.3
GV-16 (PH4B)	11/19/1996	30.5	32	0.0	21.2	0.0	2.0	0.0	0.1	0.2
	10/29/1997	29.9	45	0.0	18.6	0.0	50.0	0.0	2.4	2.7
	10/26/1998	30.2	45	0.0	21.1	0.0	0.0	0.0	0.0	0.0
	12/01/1999	30.0	25	0.0	1.7	0.0	100.0	0.0	25.7	32.6
	12/06/1999	29.7	45	0.0	0.0	0.0	100.0	0.0	35.8	45.5
	11/01/2000	29.8	55	0.0	0.2	0.0	100.0	0.0	30.0	39.5
	12/05/2001	29.9	65	0.0	3.7	0.0	100.0	0.0	21.7	29.1
	11/05/2002	29.9	50	0.0	3.2	0.0	100.0	0.0	19.0	23.5
	11/17/2003	30.1	45	0.0	19.5	0.0	2.0	0.0	0.4	0.3
	11/16/2004	30.0	45	0.0	21.2	0.0	0.0	0.0	0.0	0.0
	11/08/2005	29.9	55	0.0	21.0	0.0	0.0	0.0	0.0	0.0
	12/14/2006	30.0	55.0	0.0	21.0	0.0	0.0	0.0	0.2	0.0
	10/23/2007	29.5	74	0.0	0.1	0.0	100.0	7.0	28.6	37.1
	09/30/2008	29.6	61	0.0	18.2	0.0	24.0	1.0	1.7	1.1

Project: Shepley's Hill Landfill

Gas Monitoring Data

VENT	DATE	AP	T (°F)	VOC ppm PID	O_2 % GEM 500	H_2S ppm ISTMX	% LEL ISTMX	CO ppm ISTMX	CO_2 % GEM 500	CH_4 % GEM 500
LGP-01-01X	12/05/2001	29.9	65.0	0.0	20.9	0.0	0.0	0.0	0.0	0.0
	11/05/2002	29.9	50.0	0.0	20.2	0.0	0.0	0.0	0.2	0.0
	11/17/2003	30.1	45.0	0.8	20.0	0.0	0.0	0.0	0.3	0.0
	11/16/2004	30.0	45.0	0.0	20.6	0.0	0.0	0.0	0.4	0.0
	11/08/2005	29.9	55.0	0.0	20.3	0.0	0.0	0.0	0.7	0.0
	12/11/2006	30.4	35.0	0.0	20.9	0.0	0.0	0.0	0.0	0.0
	10/23/2007	29.5	74	0.0	20.4	0.0	0.0	0.0	0.7	0.0
	03/18/2008	30.4	50.0	0.0	20.9	0.0	0.0	0.0	0.1	0.0
	09/29/2008	29.7	70	0	19.2	0	0	5	1.4	0
LGP-01-02X	12/05/2001	29.9	65.0	0.0	20.3	0.0	0.0	0.0	0.8	0.0
	11/05/2002	29.9	50.0	0.0	19.3	0.0	0.0	0.0	1.4	0.0
	11/17/2003	30.1	45.0	0.9	18.8	0.0	0.0	0.0	1.7	0.0
	11/16/2004	30.0	45.0	0.0	20.0	0.0	0.0	0.0	1.7	0.0
	11/08/2005	29.9	55.0	0.0	19.2	0.0	0.0	0.0	2.2	0.0
	12/11/2006	30.4	35.0	0.0	20.4	0.0	0.0	1.0	1.2	0.0
	10/23/2007	29.5	74	0.0	19.7	0.0	0.0	0.0	1.5	0.0
	03/18/2008	30.4	50.0	0.0	20.2	0.0	0.0	0.0	0.6	0.0
	09/29/2008	29.7	70	0.0	17.6	0.0	0.0	0.0	2.9	0.0
LGP-01-03X	12/05/2001	29.9	65.0	0.0	20.7	0.0	0.0	0.0	0.3	0.0
	11/05/2002	29.9	50.0	0.0	20.2	0.0	0.0	0.0	0.6	0.0
	11/17/2003	30.1	45.0	0.9	19.6	0.0	0.0	0.0	0.8	0.0
	11/16/2004	30.0	45.0	0.0	21.3	0.0	0.0	0.0	0.0	0.0
	11/08/2005	29.9	55.0	0.0	19.5	0.0	0.0	0.0	1.7	0.0
	12/11/2006	30.4	35.0	0.0	20.6	0.0	0.0	0.0	1.7	0.0
	10/23/2007	29.5	74	0.0	19.5	0.0	0.0	0.0	1.4	0.0
	03/18/2008	30.4	50.0	0.0	20.5	0.0	0.0	0.0	0.4	0.0
	09/29/2008	29.7	70	0.0	18.7	0.0	0.0	2.0	1.5	0.0
LGP-01-04X	12/05/2001	29.9	65.0	0.0	20.8	0.0	0.0	0.0	0.1	0.0
	11/05/2002	29.9	50.0	0.0	20.2	0.0	0.0	0.0	0.2	0.0
	11/17/2003	30.1	45.0	0.9	19.9	0.0	0.0	0.0	0.4	0.0
	11/16/2004	30.0	45.0	0.0	21.3	0.0	0.0	0.0	0.0	0.0
	11/08/2005	29.9	55.0	0.0	20.3	0.0	0.0	0.0	0.6	0.0
	12/11/2006	30.4	35.0	1.5	20.6	0.0	0.0	0.0	0.5	0.0
	10/23/2007	29.5	74	0.0	20.2	0.0	0.0	0.0	0.6	0.0
	03/18/2008	30.4	50.0	0.0	20.4	0.0	0.0	0.0	0.1	0.1
	09/29/2008	29.7	70	0.0	19.6	0.0	0.0	3.0	0.8	0.0
LGP-05-05X	12/11/2006	30.4	35.0	0.0	20.3	0.0	0.0	0.0	1.5	0.0
	10/23/2007	29.5	74	0.0	14.8	0.0	0.0	0.0	6.3	0.0
	03/18/2008	30.4	50.0	0.0	21.0	0.0	1.0	0.0	0.5	0.1
	09/29/2008	29.7	70	0.0	0.0	0.0	>100	0.0	37.7	35.7
	10/12/2008	30.4	75		17.8		0.0		3.0	0.0
	10/16/2008	29.7	65		20.9		0.0		2.6	0.0
	11/05/2008	30.2	65		3.0		0.0		15.2	0.0
	11/07/2008	29.9	65		0.6		>100		24.8	15.8

Project: Shepley's Hill Landfill

Gas Monitoring Data

VENT	DATE	AP	T (°F)	VOC ppm PID	O_2 % GEM 500	H_2S ppm ISTMX	% LEL ISTMX	CO ppm ISTMX	CO_2 % GEM 500	CH_4 % GEM 500
LGP-05-06X	12/11/2006	30.4	35.0	0.0	18.2	0.0	0.0	1.0	2.8	0.0
	10/23/2007	29.5	74	0.0	15.4	0.0	0.0	0.0	5.3	0.0
	03/18/2008	30.4	50.0	17.2	0.0	0.0	0.0	0.0	1.2	0.0
	09/29/2008	29.7	70	0.0	2.6	0.0	0.0	9.0	7.6	0.0
LGP-05-07X	12/11/2006	30.4	35.0	0.3	17.3	0.0	0.0	1.0	4.1	0.0
	10/23/2007	29.5	74	0.0	16.6	0.0	0.0	0.0	6.3	0.0
	03/18/2008	30.4	50.0	17.8	0.0	0.0	0.0	0.0	2.1	0.0
	09/29/2008	29.7	70	0.0	20.1	0.0	0.0	0.0	0.1	0.0
LGP-05-08X	12/11/2006	30.4	35.0	0.0	10.4	0.0	0.0	4.0	12.3	0.0
	10/23/2007	29.5	74	0.0	5.3	0.0	0.0	0.0	16.0	0.0
	03/18/2008	30.4	50.0	0.0	15.7	1.0	0.0	0.0	6.7	0.0
	09/29/2008	29.7	70	0.0	4.2	0.0	10.0	0.0	7.4	0.6
LGP-05-09X	12/11/2006	30.4	35.0	0.1	11.0	0.0	1.0	4.0	8.8	0.0
	10/23/2007	29.5	74	0.0	13.5	0.0	0.0	0.0	8.8	0.0
	03/18/2008	30.4	50.0	0.0	15.6	0.0	1.0	0.0	4.8	0.1
	09/29/2008	29.7	70	0.0	0.0	0.0	>100	0.0	18.1	18.9
	10/12/2008	30.4	75		14.4		0.0		6.7	0.0
	10/16/2008	29.7	65		8.4		>100		10.6	8.6
	11/05/2008	30.2	65		6.4		0.0		10.3	0.0
	11/07/2008	29.9	65		0.1		>100		13.6	6.7
LGP-05-10X	12/11/2006	30.4	35.0	0.3	12.6	0.0	2.0	4.0	10.4	0.0
	10/23/2007	29.5	74	0.0	0.1	1.0	>100	0.0	22.5	5.8
	03/18/2008	30.4	50.0	0.0	18.1	0.0	1.0	0.0	5.5	0.1
	09/29/2008	29.7	70	0.0	0.0	0.0	>100	0.0	19.9	10.1
	10/12/2008	30.4	75		14.2		0.0		7.2	0.0
	10/16/2008	29.7	65		5.8		>100		16.7	14.7
	11/05/2008	30.2	65		2.2		0.0		13.2	0.0
	11/07/2008	29.9	65		0.6		>100		18.8	10.3
LGP-05-11X	12/11/2006	30.4	35.0	2.2	6.9	0.0	2.0	3.0	15.0	0.0
	10/23/2007	29.5	74	0.0	5.3	0.0	>100	0.0	17.7	5.9
	03/18/2008	30.4	50.0	0.0	20.9	0.0	0.0	0.0	1.2	0.0
	09/29/2008	29.7	70	0.0	1.0	0.0	0.0	6.0	7.1	0.0
LGP-05-13X	12/11/2006	30.4	35.0	0.2	18.5	0.0	0.0	0.0	3.2	0.0
	10/23/2007	29.5	74	0.0	2.9	0.0	88.0	0.0	14.5	4.4
	03/18/2008	30.4	50.0	0.0	18.9	0.0	1.0	0.0	2.9	0.1
	09/29/2008	29.7	70	0.0	1.5	0.0	35.0	0.0	13.8	1.7
	10/12/2008	30.4	75		17.5		0.0		3.5	0.0
	10/16/2008	29.7	65		20.6		0.0		0.0	0.0
	11/05/2008	30.2	65		6.0		0.0		9.6	0.0
	11/07/2008	29.9	65		0.6		39.0		13.0	1.9

Project: Shepley's Hill Landfill

Gas Monitoring Data

VENT	DATE	AP	T (^{0}F)	VOC ppm PID	O_2 % GEM 500	H_2S ppm ISTMX	% LEL ISTMX	CO ppm ISTMX	CO_2 % GEM 500	CH_4 % GEM 500
LGP-05-14X	12/11/2006	30.4	35.0	0.4	8.9	0.0	0.0	3.0	5.1	0.0
	10/23/2007	29.5	74	0.0	19.5	0.0	37.0	8.0	5.3	0.1
	03/18/2008	30.4	50.0	0.0	13.7	0.0	1.0	0.0	1.3	0.1
	09/29/2008	29.7	70	0.0	16.2	0.0	23.0	0.0	2.1	1.1
	10/12/2008	30.4	75		9.2		25.0		5.6	1.2
	10/16/2008	29.7	65		11.6		>100		5.0	7.1
	11/05/2008	30.2	65		7.4		18.0		7.3	0.1
	11/07/2008	29.9	65		3.4		>100		9.0	5.1

Typical Landfill Gases

Component	Percent by Volume
NMOCs	0.01 to 0.6
O_2	0.1 to 1.0
Sulfides	0 to 1.0
CO	0 to 0.2
CO_2	40 to 60
CH_4	45 to 60

SHEPLEY'S HILL LANDFILL GAS

TECHNICAL MEMORANDUM

TO:	ROBERT SIMEONE
FROM:	FRED SANTOS, WILLARD MURRAY
SUBJECT:	DEVENS SHEPLEY'S HILL LANDFILL GAS EVALUATION OF THE SOUTHERN PERIMETER
DATE:	11/12/08
CC:	FILE (CORRESPONDENCE LOG# 5404.006.COR.011), PAUL HUNT

Purpose:

Review recent landfill gas probe measurements related to high and /low barometric pressure and determine extent of potential gas migration.

Summary Results of Recent Sampling Data at Landfill Gas Probes:

ECC has reviewed both the results of recent sampling of landfill gas probes on the southern end of the Shepley's Hill Landfill and the April 2008 Draft report entitled "Gas Trend Report, Shepley's Hill Landfill, Ayer, Massachusetts, by the US Army Corps of Engineers, New England District. This review has revealed the following:

1. On 9/29/08 gas results along the southern edge of the landfill at LGP-5, LGP-9 and LGP-10 showed >100% LEL and LGP-13 showed 35% LEL; weather was cloudy and temperature was in the 70s and barometric pressure was 29.6 inches of mercury.
2. On 10/12/08 gas results along the southern edge of the landfill at these same LGPs showed 0 % LEL; weather was clear with temperature in the 70s and barometric pressure was 30.1 inches of mercury.
3. On 10/16/08 gas results along the southern edge of the landfill at LGP-9, LGP-10 and LGP-14 showed >100% LEL; weather was cloudy with temperature in the 60s and barometric pressure was 29.8 inches of mercury. Storm drains and manholes near the southern perimeter of the landfill and Cook Street were checked for landfill gas during this sampling episode. Gas results showed zero methane and LEL in the manhole/storm drains.
4. On 11/5/08 gas results along the southern edge of the landfill were once again at 0% LEL except for a reading of 18% LEL at LGP-14; weather was overcast with temperature in the 60s but the barometric pressure was high at 30.1 inches of mercury.
5. On 11/7/08 gas results along the southern edge of the landfill at LGP-5, LGP-9, LGP-10 and LGP-14 showed >100% LEL and LGP-13 showed 39% LEL; weather was overcast with slight rain and barometric pressure at 29.9 inches of mercury; on this sampling episode drive probes were placed at distances of 10 to

25 feet out from the above LGPs to see if migration has occurred to greater distances from the landfill edge; at locations adjacent to LGP-5, LGP-9 and LGP-10 for sample depths of 3 ft and 6 ft the %LEL was zero, furthermore, at locations

LGP-13 and LGP-14 at sample depth of 3 ft the %LEL was zero and water was encountered at a depth of 5 to 6 ft.

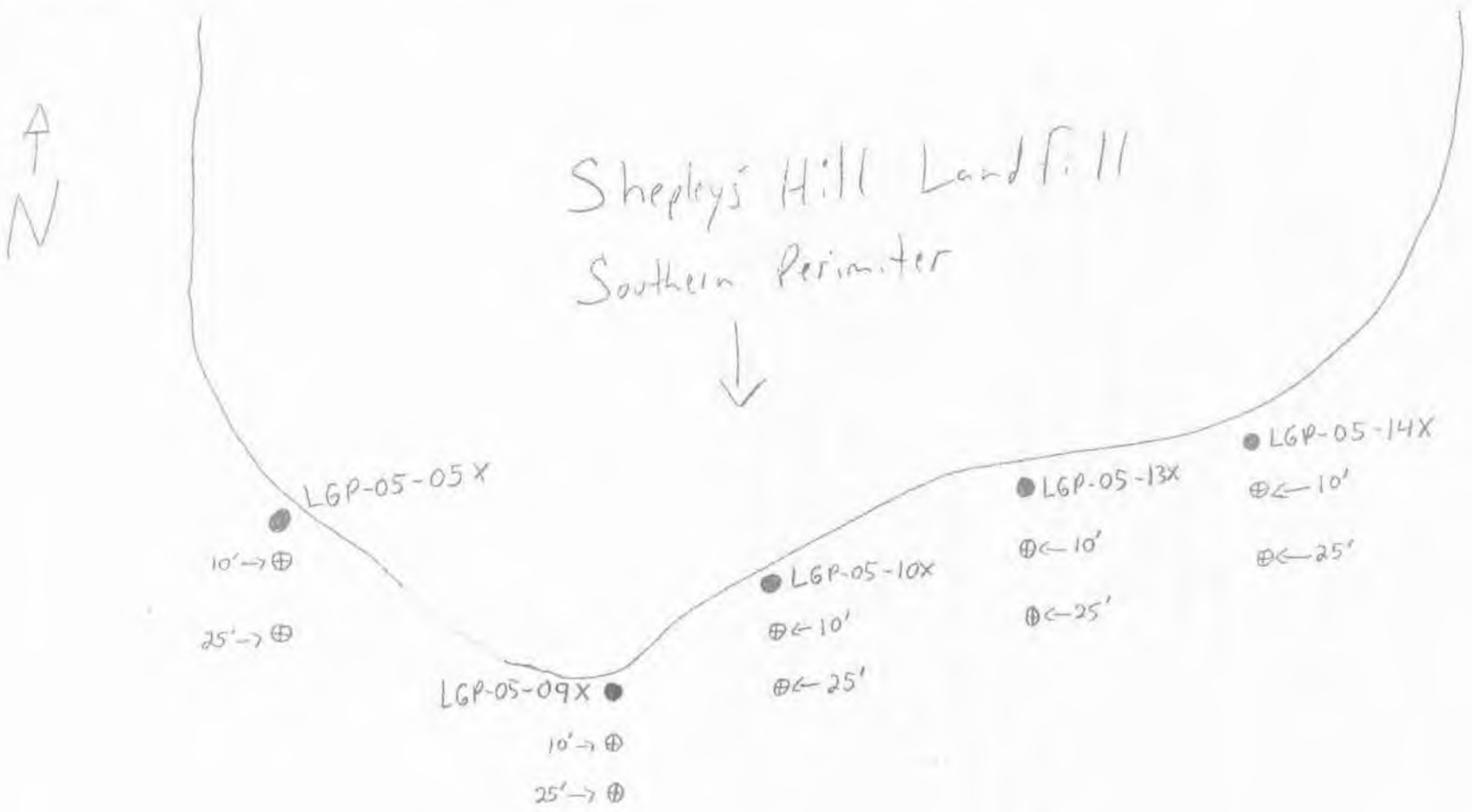
6. Prior to the September 2008 detection of excessive %LEL readings, the LGPs have detected little or no methane gas since installation at the northern or southern perimeter of the landfill, as reported in the April 2008 Gas Trend Report by the US Army Corps of Engineers.

It can clearly be seen that when the weather is clear and/or barometric pressure is high, there is no significant landfill gas migration outside the landfill cap. However, when the weather is cloudy and overcast and barometric pressure is relatively low, landfill gas tends to migrate laterally outside the landfill cap along the southern end of the landfill in the vicinity of LGP-5, LGP-9, LGP-10, LGP-13 and LGP-14. The distance migrated is small, less than 10 to 25 feet from the edge of the landfill cap during these periods of low barometric pressure. When high barometric pressure returns the landfill gas is apparently pushed back beneath the landfill cap.

Conclusions Regarding Landfill Gas Migration:

The observed high %LEL gas levels measured recently in landfill gas probes along the southern edge of the Shepley's Hill Landfill cap are transient events and only persist for a short time while a low barometric pressure system resides over the landfill. Furthermore, during this time of low pressure the distance gas migrates away from the edge of the landfill is very small, less than 10 to 25 feet. When the inclement weather and its associated low pressure are replaced by clear weather and relatively high atmospheric pressure, the landfill gas probes show that %LEL values return to zero or to very low values.

ECC Drive Probe Sampling Event of Temporary Gas Probes 07 November 2008



⊕ Manual Drive Probe Sampling Locations (Probe was driven 10 feet and 25 feet away from the LGPs)

Not to Scale

Appendix C

Field Data Sheets

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: ~~Site 3&7~~ Devens
Location: ~~New London, CT~~ Devens Hwy, MA
Well ID: SHL-8D

Date: 1/8/08
Sampler: DR/DC
PID Reading: 0

Start Time: 0940 End Time: 1025
Well Construction:
Depth to water: 7.82
Well Depth: 68.62
Water Column:
Total Volume Removed (L) 28 L

Field Testing Equipment

Make	Model	Serial #
Geopump	2	001118

Time	volume removed (liters)	Flow Rate (ml/min)	Depth To Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm (0.112 ✓)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	color	Salinity
1000	~~4~~ 8	400	8.05	9.03	6.47	~~2.28~~	6.05	222	0.40		
1005	~~6~~ 12			9.05	6.45	0.112	5.94	220	0.85		
1010	~~8~~ 16	400	8.05	9.03	6.44	0.112	5.97	216	0.45		
1015	~~10~~ 20		8.05	9.05	6.42	0.112	5.90	216	0.58		
1020	~~22~~ 24	400	8.06	9.06	6.41	0.112	5.87	215	0.70		
1025	~~24~~ 28		8.05	9.07	6.41	0.112	5.86	215	0.51		

Acceptance Criteria: < 0.3 ft | 10% | ± 0.2 | 10% | 10% | ±10mv | <10

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments

Signature

1/8/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-96-5C

Date: 1/8/08
Sampler: Reid Cone
PID Reading: 0.0

Start Time: 1040 End Time: 1145
Well Construction: 4" PVC
Depth to water: 5.92'
Well Depth: 79.49'
Water Column: 73.57'
Total Volume Removed (L) 32.5

Field Testing Equipment

Make	Model	Serial #
YSI	650 MDS	00L1207 AA
YSI	600XL	04J1600 AC
Lamotte	Turbidimeter	5885-2305
Geopump	Peristaltic	7021

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1100	10	500	5.98	9.52	6.13	0807	0.38	-82	2
1105	2.5	500	5.98	9.55	6.16	0.811	0.30	-83	7
1110	2.5	500	5.98	9.60	6.17	0.810	0.29	-83	6
1115	2.5	500	5.98	9.64	6.18	0810	0.28	-84	4
1120	2.5	500	5.98	9.61	6.17	0.807	0.27	-83	3
1125	2.5	500	5.98	9.63	6.16	0.774	0.27	-76	2
1130	2.5	500	5.98	9.59	6.12	0.746	0.27	-68	1
1135	2.5	500	5.98	9.62	6.11	0.740	0.27	-66	1
1140	2.5	500	5.98	9.64	6.10	0.737	0.26	-64	1
1145	2.5	500	5.98	9.65	6.10	0.735	0.26	-63	0
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
	NO Sample collected				

Comments

Signature

1/8/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-85

Date: 1/8/08
Sampler: David Comeau
PID Reading: 0.0

Start Time: 0940 End Time: 1035
Well Construction: 2" PVC
Depth to water: 7.78'
Well Depth: 55.88'
Water Column: 48.10'
Total Volume Removed (L) 30.25

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	00L1207 AA
YSI	600XL	04J1600 AC
Lamotte	Turbidimeter	5885-2305
Geopump	Peristaltic	7021

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
0955	8.25	550	10.34	9.39	6.76	0.061	1.18	139	1
1005	5.5	550	10.42	9.40	6.64	0.061	1.24	108	1
1010	2.75	550	10.43	9.43	6.58	0.062	1.24	101	1
1015	2.75	550	10.45	9.43	6.53	0.062	1.25	99	0
1020	2.75	550	10.46	9.42	6.47	0.062	1.28	99	0
1025	2.75	550	10.46	9.44	6.42	0.062	1.28	101	0
1030	2.75	550	10.47	9.44	6.41	0.062	1.28	102	0
1035	2.75	550	10.48	9.43	6.39	0.062	1.29	101	0
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
	No Sample collected				

Comments:

Signature

1/8/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-5

Date: 1/9/08
Sampler: David Campo
PID Reading: 0.0

Start Time: 1149 End Time: 1235
Well Construction: 2" PVC
Depth to water: 3.36'
Well Depth: 13.43'
Water Column: 10.07'
Total Volume Removed (L) 18.4

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	00L1207AA
YSI	600XL	04J1600AC
Lamotte	Turbidimeter	5885-2305
Geopump	Peristaltic	2021

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1205	6.4	400	3.78	4.66	6.40	0.075	0.76	69	120
1215	4.0	400	3.79	4.69	5.42	0.077	0.69	65	1
1220	2.0	400	3.80	4.72	5.40	0.077	0.67	63	1
1225	2.0	400	3.90	4.72	5.41	0.078	0.66	62	1
1230	2.0	400	3.81	4.69	5.42	0.079	0.66	61	1
1235	2.0	400	3.81	4.72	5.42	0.079	0.67	60	1

Acceptance Criteria: < 0.3 ft 3% ± 0.1 3% 10% ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyse:
	NO Samples Collected				

Comments

Signature

1/9/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-96-5B

Date: 1/8/08
Sampler: DR/DC
PID Reading: NA

Start Time: 1040 **End Time:**
Well Construction: 5" PVC
Depth to water: 6.51
Well Depth: 89.40
Water Column:
Total Volume Removed (L)

Field Testing Equipment

Make	Model	Serial #

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	~~color~~ Turbidity
1050	[illegible]	450	6.92	9.35	6.43	0.654	0.79	20.	2.6
1100	4.5	450	6.92	9.58	6.44	0.654	0.37	-2	0.7
1115		450	6.92	9.56	6.36	0.656	0.22	-8	0.5
1120	9	450	6.92	9.55	6.35	0.656	0.21	-9	
1125				9.58	6.31	0.655	0.19	-9	
1130	13.5	450	6.92	9.61	6.24	0.653	0.19	-8	0.9
1135				9.63	6.20	0.657	0.18	-8	0.6
1140	18	450	6.92	9.64	6.13	0.655	0.18	-6	0.6
1145				9.69	6.09	0.657	0.17	-3	
1150	22.5	450	6.92	9.57	5.98	0.656	0.18	0	0.8
1155	27	450	6.92	9.60	5.99	0.655	0.17	-2	0.7

Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
	SHM-96-5B-010808	vials	2	HCL	Methane/Ethane

Comments

[signature]
Signature

1/8/08
Date

[initials]

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-23

Date: 1/9/08
Sampler: David Corrow
PID Reading: 0.0

Start Time: 1125 **End Time:** 1220
Well Construction: 4" PVC
Depth to water: 28.43'
Well Depth: 35.33'
Water Column: 6.90'
Total Volume Removed (L) 12.1

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03J0955AH
YSI	600XL	01F0657AD
Lamotte	Turbidimeter	2912-5101
Grundfos	Controller	9823

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color Turbidity
1145	4.4	220	28.57	12.03	5.75	0.035	10.20	149	0
1150	1.1	220	28.57	12.33	5.79	0.035	10.18	152	0
1155	1.1	220	28.58	12.42	5.65	0.034	10.17	160	0
1200	1.1	220	28.58	12.63	5.61	0.034	10.14	167	0
1205	1.1	220	28.58	12.75	5.60	0.033	10.12	171	0
210	1.1	220	28.59	12.93	5.57	0.033	10.08	176	0
1215	1.1	220	28.59	13.01	5.56	0.033	10.06	177	0
1220	1.1	220	28.59	12.99	5.55	0.033	10.01	190	0
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
	12 Samples Collected				

Comments

Signature

1/9/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-93-22C
Start Time: 0940 End Time: 1045
Well Construction: 5" pvc
Depth to water: 8.29
Well Depth: 134.3
Water Column: 126.01
Total Volume Removed (L) 32.5

Date: 1/9/08
Sampler: David Comeau
PID Reading: 0.0

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03J0955 AH
YSI	600XL	01F0857 AD
Lamotte	Turbidimeter	2912-5101
Grundfos	Controller	9823

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1020	20.0	500	24.21	9.42	7.52	0.623	7.35	-140	7
1025	2.5	500	25.10	9.44	7.54	0.621	0.46	-121	2
1030	2.5	500	25.34	9.07	7.53	0.623	0.31	-112	1
1035	2.5	500	25.51	9.01	7.55	0.623	0.29	-122	1
1040	2.5	500	25.64	8.98	7.54	0.623	0.30	-120	1
1045	2.5	500	25.73	8.87	7.53	0.623	0.24	-117	0
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mV	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
	No sample collected				

Comments

Signature

1/9/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHC-22

Date: 9 JAN 08
Sampler: Geoff Collins
PID Reading: 0

Start Time: 0857 End Time: 1007
Well Construction: SA" PVC
Depth to water: 7.41
Well Depth: 7100
Water Column: 107.59
Total Volume Removed (L) 21

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03J0955AH
YSI	6000XL	01F0657
LaMotte	TOTO	5885-2305

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
0957	18	300	7.91	9.33	6.71	0.508	0.75	-55.4	0.3
1002	19.5	" "	7.91	9.23	6.70	0.508	0.68	-52.2	0
1007	21	" "	7.91	9.23	6.70	0.508	0.68	-51.1	0

Acceptance Criteria: < 0.3 ft 3% ± 0.1 3% 10% ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments

Signature

9 JAN 08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-9

Date: 9 JAN 08
Sampler: GRIFFIN/KOS
PID Reading: 0

Start Time: 1010 End Time: 1110
Well Construction: 2" PVC
Depth to water: 9.71
Well Depth: 26.11
Water Column: 1.69
Total Volume Removed (L) 17.5

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03J0955AH
YSI	600XL	01F0657
LaMotte	2020	5995-2305

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1045	10.5	300	10.02	9.31	6.95	0.154	0.98	-78.4	10
1050	11.5	" "	10.02	9.28	6.71	0.151	0.21	-62.3	09
1055	13	" "	10.02	9.26	6.64	0.145	0.14	-59.3	06
1100	14.5	" "	10.02	9.20	6.64	0.144	0.11	-58.8	0
1105	16	" "	10.02	9.19	6.63	0.144	0.11	-57.6	0
1110	17.5	" "	10.02	9.19	6.63	0.144	0.10	-57.8	0
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments

Signature

9 JAN 2008
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-05-39A

Date: 1/9/08
Sampler: David Cambell
PID Reading: 0.0

Start Time: 1405 **End Time:** 1525
Well Construction: 2" PVC
Depth to water: 11.70'
Well Depth: 38.62'
Water Column: 26.92'
Total Volume Removed (L) 44.0

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03J0955AH
YSI	600XL	01F0657AD
Lamotte	Turbidimeter	2912-5101
Geopump	Peristaltic	1118

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color Turbidity
1505	33.0	550	11.70	10.19	6.50	0.513	0.56	-71	0
1510	2.75	550	11.70	10.16	6.46	0.510	0.18	-72	0
1515	2.75	550	11.70	10.13	6.45	0.511	0.10	-76	0
1520	2.75	550	11.70	10.12	6.45	0.512	0.10	-77	0
1525	2.75	550	11.70	10.11	6.44	0.512	0.11	-76	0

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1525	SHM-05-39A-010908	40ml vial	2	HCl	MTBE/Ethers

Comments

Signature

1/9/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-05-42B

Date: 1/9/08
Sampler: Geoff Cokinos
PID Reading: 0

Start Time: 1410 End Time: 1510
Well Construction: 1" PVC
Depth to water: 4.61
Well Depth: 76.30
Water Column: 71.69
Total Volume Removed (L) 16.5

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	06D2528AC
YSI	600XL	04J/6000 AB "AF
LaMotte	2020	5885-2305

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1415	1.5	300	*	9.20	6.42	0.346	0.48	-76.7	5
1420	3	" "		9.19	6.40	0.357	0.46	-75.8	3.6
1425	4.5	" "		9.19	6.39	0.376	0.46	-76.1	2.8
1430	6	" "		9.20	6.38	0.399	0.46	-74.8	2.6
1435	7.5	" "		9.26	6.34	0.590	0.50	-78.5	2.4
1440	9	" "		9.31	6.35	0.633	0.29	-80.6	2.1
1445	10.5	" "		9.34	6.35	0.650	0.29	-81.6	1.6
1450	12	" "		9.35	6.35	0.655	0.29	-82.5	1
1455	13.5	" "		9.39	6.36	0.666	0.29	-83.3	0
1500	15	" "		9.39	6.36	0.667	0.29	-84.2	0
1505	16.5	" "		9.38	6.36	0.667	0.29	-84.2	0
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 618 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1510	SHM-05-42B-010908	40ml Vial	2	HCl	Methane/Ethane

Comments
* Unable to collect depth to water while low flowing well due to pve diameter when sample tubing is placed inside casing

Signature

9 JAN 2008
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-05-39B

Date: 1/9/09
Sampler: Dave Cannon
PID Reading: 0.0

Start Time: 1330 **End Time:** 1500
Well Construction: 2" PVC
Depth to water: 11.31'
Well Depth: 67.10'
Water Column: 55.79'
Total Volume Removed (L) 36.0

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03J0955 AH
YSI	600XL	01F0657 AD
Lamotte	Turbidimeter	2912-5101
Grundfos	Controller	9823

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color Turbidity
1350	8.0	400	15.90	10.12	6.64	0.849	0.21	-98	85
1400	4.0	400	20.37	11.51	6.78	0.849	0.96	-95	21
1410	4.0	400	24.26	11.15	6.85	0.849	0.23	-96	50
1420	4.0	400	27.26	11.74	6.90	0.845	0.18	-84	19
1430	4.0	400	29.25	11.83	6.92	0.844	0.18	-83	10
440	4.0	400	29.10	11.68	6.92	0.846	0.16	-79	5
1450	4.0	400	29.99	11.96	6.92	0845	0.14	-77	0
1455	2.0	400	30.33	12.18	6.91	0.842	0.15	-78	0
1500	2.0	400	30.87	12.20	6.92	0.840	0.14	-77	0

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1500	SHM-05-39B-010908	40ml vol	2	HCl	EPH/VPH/ Extras

Comments

Signature

1/9/09
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-05-41B

Date: 1/9/08
Sampler: Geoff Cakouros
PID Reading: 0

Start Time: 1305 End Time: 1410
Well Construction: 2" PVC
Depth to water: 10.44
Well Depth: 61.30
Water Column: 50.86
Total Volume Removed (L) 15

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	06D7528AG
YSI	600XL	04J16000AF
LaMotte	2020	5885-0305

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1325	5	250	10.51	10.67	6.18	0.626	0.61	-92.0	2.7
1330	6.25	" "	10.51	10.54	6.19	0.624	0.34	-91.1	1
1335	7.5	" "	10.51	10.53	6.20	0.624	0.21	-93.2	0
1340	8.75	" "	10.51	10.40	6.20	0.621	0.21	-92.4	0
1345	10	" "	10.51	10.30	6.21	0.618	0.20	-92.9	0
1350	11.25	" "	10.51	10.29	6.21	0.618	0.20	-92.7	0
1355	12.5	" "	10.51	10.21	6.22	0.614	0.20	-92.7	0
1400	13.75	" "	10.51	10.21	6.22	0.614	0.20	-91.8	0
1405	15	" "	10.51	10.20	6.21	0.614	0.20	-92.1	0
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1410	SHM-05-41B-~~09~~05010908	40ml Vial	2	HCl	MTBE/EtOH
" "	SHM-05-41B-010908 MS/MSD	" "	" "	" "	" "
0000	DUP-010908	" "	" "	" "	" "

Comments

Signature

9 Jan 2008
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-05-41A

Date: 1/9/08
Sampler: Geoff Collins
PID Reading: 0

Start Time: 1145 End Time: 1300
Well Construction: 2" PVC
Depth to water: 10.65
Well Depth: 40.51
Water Column: 29.86
Total Volume Removed (L) 21

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	06D2528AG
YSI	600XL	04J16000AF
LaMotte	2020	5885-2305

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1245	18	300	10.81	10.25	6.26	0.061	0.20	-10.2	0
1250	19.5	" "	10.81	10.26	6.26	0.064	0.21	-10.3	0
1255	21	" "	10.81	10.26	6.26	0.066	0.21	-8.1	0

Acceptance Criteria: < 0.3 ft 3% ± 0.1 3% 10% ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1300	SHM-05-41A-010908	40 ML VIAL	2	HCl	Methane/Ethane

Comments

Signature

9 JAN 2008
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-05-41C

Date: 1/9/08
Sampler: Geoff Coleman
PID Reading: 0

Start Time: 1140 End Time: 1240
Well Construction: 2" PVC
Depth to water: 10.73
Well Depth: 87.31
Water Column: 76.58
Total Volume Removed (L) 11

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	06D2578AG
YSI	600XL	04F/6000AE
LaMotte	7070	5885-2305

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1200	4	200	10.85	9.99	6.89	0.569	0.12	-159.5	16
1205	5	" "	10.85	10.07	6.90	0.565	0.11	-159.1	10
1210	6	" "	10.85	10.13	6.91	0.560	0.10	-158.2	7
1215	7	" "	10.85	10.23	6.92	0.558	0.19	-157.1	6
1220	8	" "	10.85	10.29	6.93	0.561	0.19	-156.4	4.5
1225	9	" "	10.85	10.27	6.93	0.561	0.19	-155.1	2
1230	10	" "	~~10.76~~ 10.85	10.76	6.93	0.561	0.19	-155.1	2
1240	11	" "	10.85	10.26	6.93	0.561	0.19	-155.3	2

Acceptance Criteria: < 0.3 ft 3% ± 0.1 3% 10% ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1240	SHM-05-41C-01090	40ml vial	2	HCl	Methane/Ethane

Comments

Signature

9 JAN 08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-96-22B

Date: 1/9/08
Sampler: David Cameron
PID Reading: 0.0ppm

Start Time: 0855 **End Time:** 0955
Well Construction: 4" PVC
Depth to water: 7.26'
Well Depth: 92.10'
Water Column: 84.84'
Total Volume Removed (L) 34.20

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03J0955 AH
YSI	600XL	01F0657 AD
Lamotte	Turbidimeter	2912-5101
Geopump	Peristaltic	1118

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color Turbidity
0920	14.25	570	7.26	9.43	6.65	0.727	0.24	-88	22
0930	5.7	570	7.26	9.42	6.65	0.729	0.24	-87	6
0935	2.85	570	7.26	9.40	6.65	0.729	0.20	-87	6
0940	2.85	570	7.26	9.35	6.65	0.728	0.18	-82	5
0945	2.85	570	7.26	9.35	6.66	0.728	0.20	-81	5
1950	2.85	570	7.26	9.34	6.65	0.727	0.19	-82	4
0955	2.85	570	7.26	9.40	6.66	0.729	0.18	-84	4
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
0955	SHM-96-22B-010908	40ml vial	2	HCl	Methane/Ethane

Comments

Signature

1/9/08
Date

Environmental Chemical Corporation
Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-99-31C

Date: 10 Jan 08
Sampler: Geoff Gokinos
PID Reading: 0

Start Time: 0950 End Time: 1040
Well Construction: 2" pvc
Depth to water: 1.85
Well Depth: 15.65
Water Column: 13.8
Total Volume Removed (L): 13.5

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03J0955AH
YSI	600XL	01F0657AD
LaMotte	2020	5885-2305

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1015	7.5	300	2.20	8.11	5.48	0.078	0.14	14.31	12
1020	9	" "	" "	7.34	5.48	0.078	0.14	15.27	9.8
1025	10.5	" "	" "	7.24	5.49	0.076	0.14	15.45	3
1030	12	" "	" "	7.24	5.48	0.076	0.14	15.48	2.6
1035	13.5	" "	" "	7.24	5.48	0.076	0.14	15.50	2.5
Acceptance Criteria:			< 0.3 ft	3%	±0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1040	SHM-99-31C-011008	40ml vial	2	HCl	Methane/Ethane

Comments

Signature

10 JAN 08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-99-32X

Date: 10 JAN 2008
Sampler: GARY PERKINS
PID Reading: 0

Start Time: 1010 End Time: 1125
Well Construction: 2" PVC
Depth to water: 9.50
Well Depth: 84.00
Water Column: 74.50
Total Volume Removed (L) 22

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03J0955AH
YSI	600XL	01F0657AD
LaMotte	2020	5885-2305

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1100	15	300	9.54	9.57	6.56	0.531	0.75	-88.7	0
1105	17.5	" "	9.54	9.50	6.56	0.532	0.23	-88.4	0
1110	18	" "	9.54	9.63	6.57	0.536	0.20	-92.8	0
1115	20.5	" "	9.56	9.63	6.57	0.533	0.14	-93.4	0
1120	22	" "	9.56	9.64	6.58	0.529	0.19	-93.9	0
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1125	SHM-99-32X-011008	40ml vial	2	HCl	Acetylene/Ethene

Comments

Signature: [signature]

Date: 10 JAN 2008

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-99-31A

Date: 10 JAN 08
Sampler: Geoff Cokalas
PID Reading: 0

Start Time: 0845 End Time: 0850
Well Construction: 2" PVC
Depth to water: 4.07
Well Depth: 78.15
Water Column: 74.08
Total Volume Removed (L) 18

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03J0955AH
YSI	600XL	01F0657AD
LaMotte	2020	5885-2305

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
0900	4.5	300	4.20	9.14	6.68	0.560	0.45	-112.4	20
0905	6	" "	4.20	9.14	6.67	0.558	0.36	-112.1	20.1
0910	7.5	" "	4.20	9.06	6.67	0.555	0.31	-110.0	19.9
0915	9	" "	4.20	8.99	6.67	0.548	0.28	-108.7	19.9
0920	10.5	" "	4.20	9.05	6.67	0.542	0.20	-100.2	12.2
0925	12	" "	4.20	9.09	6.67	0.539	0.18	-93.4	11.5
0930	13.5	" "	4.20	9.12	6.67	0.539	0.18	-92.5	10
0935	15	" "	4.20	9.11	6.67	0.537	0.18	-85.2	6
0940	16.5	" "	4.20	9.10	6.67	0.536	0.18	-83.5	5.2
0945	18	" "	4.20	9.10	6.67	0.536	0.18	-84.8	5

Acceptance Criteria: <0.3 ft 3% ±0.1 3% 10% ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
0950	SHM-99-31A-011008	40ml vial	2	HCl	Methane/Ethane

Comments

Signature

10 JAN 08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-99-3IB

Date: 10 JAN 08
Sampler: Groff Cokinos
PID Reading: 0

Start Time: 0850 End Time: 1005
Well Construction: 2" PVC
Depth to water: 3.75
Well Depth: 61.35
Water Column: 57.60
Total Volume Removed (L) 21

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03509558H
YSI	600XL	01F0657AD
Hanna	7020	5885-2305

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
0950	18	300	4.10	9.10	6.34	0.313	0.18	-41.3	0
0955	19.5	" "	4.10	9.11	6.34	0.312	0.18	-42.5	0
~~0100~~ 1000	21	" "	4.10	9.11	6.34	0.312	0.18	-42.3	0
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1005	SHM-99-3IB-01008	40ML VOA	2	HCl	Methane/Ethane

Comments

Signature

10 Jan 08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-21

Date: 1/10/08
Sampler: David Gordon
PID Reading: 0.0

Start Time: 0911 End Time: 0955
Well Construction: 4" PVC
Depth to water: 45.32'
Well Depth: 54.70'
Water Column: 9.33'
Total Volume Removed (L) 22.0

Field Testing Equipment

Make	Model	Serial #
YSI	650 MDS	06D1538AG
YSI	600XL	04J1600AF
Lamotte	Turbidimeter	2912-5101
Grundfos	Controller	9823

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
0930	9.5	500	45.42	11.60	6.07	0.054	11.51	153	3
0935	2.5	500	45.42	12.30	6.06	0.052	9.49	158	3
0940	2.5	500	45.42	12.59	6.03	0.051	10.16	164	3
0945	2.5	500	45.42	12.63	6.02	0.050	10.19	170	3
0950	2.5	500	45.42	12.61	6.01	0.050	10.18	173	3
0955	2.5	500	45.42	12.61	6.00	0.049	10.16	176	2
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
	NO Samples Collected				

Comments

Signature

1/10/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: EW-1

Date: 1-10-08
Sampler: DR
PID Reading: —

Start Time: _____ **End Time:** _____
Well Construction: _____
Depth to water: _____
Well Depth: _____
Water Column: _____
Total Volume Removed (L) _____

Field Testing Equipment

Make	Model	Serial #

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
0840	—	—	—	10.83	6.23	0.760	3.97	-88	3.2

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
	Methanol/ethanol				

Comments

_____
_____
_____

DR
Signature

1/10/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: EW-2

Date: 1/10/08
Sampler: DR
PID Reading: —

Start Time: _____ End Time: _____
Well Construction: _____
Depth to water: _____
Well Depth: _____
Water Column: _____
Total Volume Removed (L) _____

Field Testing Equipment

Make	Model	Serial #

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
0830	—	—	—	10.29	6.28	0.530	4.21	-88	3.1

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
	Methane/Ethane				

Comments

_____
_____
_____

_____ Signature

1/10/08 Date

INSTRUMENT CALIBRATION LOG

Project/Site Name Fort Devens **Date** 1/8/08 **Weather** 50, Partly Cloudy

Calibrated By David Gomeau **Instrument** 650 MDS / 600XL **Serial Number** 00L1207 AA / 04J1600 AC

Parameters	Pre-calibration Reading	Post-calibration Reading	Temperature °C	Comments
Conductivity	1.413	1.467	13.98	
pH (7)	7.00	6.82	14.33	
pH (4)	3.95	4.31	14.36	
pH (10)	9.94	9.82	15.45	
ORP	240	236.7	14.32	
Dissolved Oxygen	100%	98.4	14.04	
Barometric Pressure	760			

INSTRUMENT CALIBRATION LOG

Project/Site Name Devens **Date** 1/9/08 **Weather** 50°, overcast, Rain

Calibrated By David Comeau **Instrument** 650MDS 600XL **Serial Number** 03J0955 AH 01F0657 AD

Parameters	Pre-calibration Reading	Post-calibration Reading	Temperature °C	Comments
Conductivity	1.413	1.415	15.85	
pH (7)	7.00	7.00	16.24	
pH (4)	4.00	3.99	16.75	
pH (10)	9.98	9.99	16.51	
ORP	240	240.6	16.59	
Dissolved Oxygen	100	100	16.70	
Barometric Pressure	760	760		

INSTRUMENT CALIBRATION LOG

Project/Site Name Devens **Date** 1/9/08 **Weather** 50's Overcast, Rain

Calibrated By Geoff Gekas **Instrument** 650 MDS 600 x1 **Serial Number** 03509554H 01FCE57AD

Parameters	Pre-calibration Reading	Post-calibration Reading	Temperature °C	Comments
Conductivity	1.413	1.411	15.88	
pH (7)	7.00	7.02	15.91	
pH (4)	4.00	4.00	16.02	
pH (10)	10.00	9.99	16.01	
ORP	240	240.3	15.99	
Dissolved Oxygen	100	99	15.81	
Barometric Pressure	760	760		

INSTRUMENT CALIBRATION LOG

Project/Site Name Deuces **Date** 10 JAN 08 **Weather** 50's partly cloudy

Calibrated By Geoff Cokinos **Instrument** 650MDS / 600XL **Serial Number** 06D2528AG / 04J16000AF

Parameters	Pre-calibration Reading	Post-calibration Reading	Temperature °C	Comments
Conductivity	1.413	1.411	13.53	
pH (7)	7.00	7.05	13.76	
pH (4)	4.00	4.17	13.41	
pH (10)	10.00	10.26	13.57	
ORP	240	239.8	13.36	
Dissolved Oxygen	100	102%	13.45	
Barometric Pressure	758			

INSTRUMENT CALIBRATION LOG

Project/Site Name Devens **Date** 10 JAN 08 **Weather** 40's partly cloudy

Calibrated By Geoff Cokinos **Instrument** 650 MDS / 600XL **Serial Number** 03J0955AH / 01F0657AD

Parameters	Pre-calibration Reading	Post-calibration Reading	Temperature °C	Comments
Conductivity	1.413	1.411	13.52	
pH (7)	7.00	7.09	13.70	
pH (4)	4.00	3.98	13.21	
pH (10)	10.00	9.99	13.46	
ORP	240	238.6	13.30	
Dissolved Oxygen	100	100.2	13.07	
Barometric Pressure	760	760		

INSTRUMENT CALIBRATION LOG

Project/Site Name Fort Devens **Calibrated By** David Comeau

Instrument/Serial Number	Pre-cal 1.0 (NTU)	Pre-cal 10 (NTU)	Post-cal 1.0 (NTU)	Post-cal 10 (NTU)	Date
Lamotte Turbidimeter 5885-2305	1.05	10	0.95	9.8	1/7/08
Lamotte Turbidimeter 2912-5105	1.06	10	0.95	10.3	1/8/08
Lamotte Turbidimeter 5885-2305	1.00	10	0.98	10.1	1/9/08
Lamotte Turbidimeter 2912-5105	0.95	10	1.00	10.08	1/9/08
Lamotte Turbidimeter 2912-5105	1.00	10	1.27	11.0	1/10/08
Lamotte Turbidimeter 5885-2305	1.00	10	1.11	11.1	1/10/08
Lamotte Turbidimeter					
Lamotte Turbidimeter					
Lamotte Turbidimeter					
Lamotte Turbidimeter					
Lamotte Turbidimeter					
Lamotte Turbidimeter					

INSTRUMENT CALIBRATION LOG

Project/Site Name Devens **Date** 1/8/08 **Weather** clear, 40's

Calibrated By Dave Renn **Instrument** YSI 650 MDS 600XL **Serial Number** 03J0955 AH 01F0657AD

Parameters	Pre-calibration Reading	Post-calibration Reading	Temperature °C	Comments
Conductivity	1.413	1.425	15.05	
pH (7)	7.00	7.11	15.25	
pH (4)	3.99	4.04	15.21	
pH (10)	9.97	9.86	15.31	
ORP	240.3	239.3	14.82	
Dissolved Oxygen	101.1 %	103.2%	14.10	
Barometric Pressure	760.0			

Shepley Hill Water Levels

Date: 4/16/2008

Project Site: Shepley Hill Landfill

Water Level Meter: Solinst #35560

Field Crew: Dave Reault, Bill Bearce

Weather: Clear, 50s; Baro press @ 0745 = 30.27"

Note	Well	Time	DTW	Well	Time	DTW	Note
	SHL-15	1347	16.07	SHM-96-5B *✓	0905	11.97	Cap/tubing gone
No lock	N7-P1 *✓	1343	28.71	SHM-96-5C *✓	0900	4.42	
	N7-P2	1342	28.75	SHL-8S *✓	0916	6.64	
	SHP-99-35X	1354	35.66	SHL-8D	0916	6.51	
No lock	N6-P1 *✓	1352	35.40	SHL-13	0916	6.09	
No lock	SHP-95-27X *✓	1337	13.98	PSP-01	0915	1.50	
No lock	SHL-24 *✓	1332	14.29	SHP-05-47A	1144	4.52	
No lock	SHM-93-18B *✓	1328	18.10	SHP-05-47B	1144	2.25	
	SHL-18	1329	18.45	SHM-93-22B	0903	5.77	
No lock	SHL-3 *✓	1325	*TOC 29.82	[illegible]	0900	6.94	
	SHL-10D	1322	29.93	SHL-22 *✓	0901	5.92	
	[illegible]	1320	28.81	SHL-9 *✓	0859	8.11	
	[illegible]	1317	30.45	[illegible]	0848	25.59	
No lock	SHL-19 *✓	1315	22.45	SHM-05-41A	0945	9.09	
No lock	SHL-4 *✓	1312	10.04	SHM-05-41B	0944	8.91	
	SHL-11	13.09	18.16	SHM-05-41C	0946	9.20	
No lock	SHL-20 *✓	1310	18.52	SHM-05-42A *✓	0942	3.52	
	SHP-01-36A	1300	3.85	SHM-05-42B	0942	3.49	
	SHP-01-36B	1301	3.78	SHM-05-39A	0953	10.31	
No lock	N3-P1 *	1305	4.41	[illegible]	0953	11.10	
	N3-P2 *	1306	4.21	SHM-05-40X	0957	12.92	
	N2-P1	1255	5.25	SHP-99-31A	1008	1.94	
	N2-P2	1256	5.52	SHP-99-31B	1008	1.84	
	SHP-36X	1245	7.51	SHP-99-31C	1008	3.11	
	SHP-37X	1250	6.26	SHP-05-48A	1010	3.47	
	N1-P1	1238	14.22	SHP-05-48B	1010	4.88	
	N1-P2	1237	13.81	SHP-99-32X *✓	1013	8.66	
	N1-P3	1236	13.66	SHP-99-34A *✓	1016	12.43	
	[illegible]	1227	44.01	SHP-99-34B	1016	12.28	
	SHP-05-43	1230	44.08	SHP-05-49A	1028	5.43	
	SHP-05-44	1233	41.41	SHP-05-49B	1028	4.92	
	N5-P1	1401	22.00	SHP-05-45A	0851	14.57	
	N5-P2	1402	22.47	SHP-05-45B	0851	15.10	
No lock	SHP-99-29X *	1358	21.28	SHP-05-46A	0854	13.30	
	SHL-5	0908	2.63	SHP-05-46B *✓	0854	13.99	

Yellow = Peristaltic
Red = Grundfos
Bold = Spring only
Bold outline = Quarterly Snapshot

* - No padlock

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-05-41C-

Date: 4/21/08
Sampler: DR/WB
PID Reading: 0

Start Time: 1245 **End Time:** 1330
Well Construction:
Depth to water: 9.40
Well Depth:
Water Column:
Total Volume Removed (L) 22.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	
YSI	650 MDS	
Geopump	Geotech	07032

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
1315	15	500	9.55	9.69	6.86	0.985	0.24	-80	6.06
1320			9.56	9.67	6.89	1.002	0.18	-107	6.27
1325	20	500	9.56	9.60	6.91	0.983	0.18	-109	6.00
1330	22.5		9.56	9.60	6.90	0.986	0.18	-110	5.09

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1330	SHM-05-41C-042108		3		

Comments

D/Reau
Signature

4/21/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-05-41A

Date: 4/21/08
Sampler: DR/WB
PID Reading: 0

Start Time: 1210 **End Time:** 1305
Well Construction:
Depth to water: 9.29
Well Depth: 9.29
Water Column:
Total Volume Removed (L) 26.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	
YSI	650 MDS	
Geopump geotech		11141

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
1250	20	500	9.35	9.37	6.42	0.120	0.90	23	2.58
1255			9.34	9.44	6.38	0.118	0.64	32	1.64
1300	25	500	9.35	9.66	6.35	0.118	0.55	32	1.33
1305	27.5	500	9.35	9.76	6.33	0.116	0.55	35	1.02
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1305	SHM-96-41A-042108		3		

Comments

DR
Signature

4/21/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-9C-22B

Date: 4/21/09
Sampler: DR
PID Reading: 2

Start Time: 0845 **End Time:** 0935
Well Construction:
Depth to water: 5.88'
Well Depth: 5.88' DR
Water Column:
Total Volume Removed (L) 25

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	
YSI	650MDS	
~~Cont~~ Geopump Geotech		07032

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	~~color~~ Turb
0855	5	500	5.92	6.65	6.65	0.862	0.13	-84	9.43
0905	10	500	5.95	6.71	6.66	0.878	0.09	-87	1.82 DR
0915	15	500	5.94	6.83	6.65	0.868	0.09	-90	2.00
0925	20	500	5.95	6.94	6.64	0.862	0.06	-86	1.72
0930			5.95	6.98	6.64	0.860	0.07	-94	1.80
35	25	500	5.94	7.01	6.64	0.859	0.10	-96	1.78

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
0935	SHM-9C-22B-042108				

Comments

D. Reault
Signature

4/21/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-22

Date: 4/21/08
Sampler: DR
PID Reading: 0

Start Time: 0900 **End Time:** 1005
Well Construction:
Depth to water: 6.09
Well Depth:
Water Column:
Total Volume Removed (L) 30.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	
YSI	650 MDS	
Geopump Geotech		11141

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Color Turb
0945	22.5	500	6.72	7.72	6.71	0.768	0.20	-22	0.07
0950	25	500	6.75	7.77	6.70	0.767	0.12	-11	0.06
0955			6.76	7.83	6.70	0.767	0.22	-7	
1000	30	500	6.76	7.88	6.70	0.789	0.21	-4	0.41
1005	32.5	500	6.76	7.98	6.69	0.767	0.21	2	0.63

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1005	SHL-22-042108		3		

Comments

D Reault
Signature

4/21/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-96-22C
Start Time: 0955 **End Time:** 1105
Well Construction:
Depth to water: 6.84
Well Depth:
Water Column:
Total Volume Removed (L) 18

Date: 4/21/08
Sampler: DR
PID Reading: 0

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	
YSI	650 MDS	
Grundfos	Redi-Flow 2	

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
1025	20	300	22.38	9.18	7.36	0.465	1.79	-112	2.64
1030			22.91	8.32	7.47	0.445	0.57	-126	
1035	23	300	23.31	8.15	7.49	0.439	0.40	-127	2.22
1040			23.76	8.01	7.51	0.439	0.35	-124	
1045	26	250	24.18	8.11	7.52	0.441	0.33	-132	1.82
50	27.5	250	24.67	8.13	7.52	0.442	0.25	-140	
1055	28.5	200	24.91	8.28	7.53	0.443	0.31	-140	1.76
1100	29.5	200	25.16	8.31	7.53	0.444	0.34	-141	
1105	30.5	200	25.39	8.44	7.53	0.443	0.35	-142	1.83
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1105	SHM-96-22C-042108				

Comments

Level dropped quickly at start, had to make several adjustments on pump controller

D. Reault (signature)
Signature

4/21/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-9

Date: 4/21/08
Sampler: DR
PID Reading: 0

Start Time: 1015 **End Time:** 1130
Well Construction:
Depth to water: 8.29
Well Depth:
Water Column:
Total Volume Removed (L) ~~37.5~~ DR 37.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	
YSI	650 MDS	
Geopump Geotech	07032	

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
1120	32.5	500	8.98	7.13	6.53	0.159	0.32	-12	
1125	35	500	8.98	7.24	6.50	0.159	0.29	-13	1.52
1130	37.5	500	8.98	7.28	6.48	0.159	0.27	-12	1.25
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1130	SHL-9-042108		3		

Comments

D Reault
Signature

4/21/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-05-41B
Start Time: 1155 **End Time:** 1240
Well Construction:
Depth to water: 9.13
Well Depth: ~~213~~ ØR
Water Column:
Total Volume Removed (L) 22.5

Date: 4/21/08
Sampler: DR/WB
PID Reading: ø

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	
YSI	650 MDS	
Geopump Geotech		07032

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	~~color~~ NTU
1210		500	9.15	9.35	6.36	0.793	0.54	-71	22.8
1215	10	500	9.15	9.40	6.37	0.796	0.42	-69	43.7
1220			9.14	9.35	6.37	0.792	0.51	-73	29.2
1225	15	500	9.14	9.35	6.37	0.791	0.38	-76	12.7
1230			9.15	9.57	6.37	0.789	0.38	-77	7.79
35	20	500	9.14	9.78	6.37	0.787	0.37	-76	8.03
1240	22.5	500	9.14	9.77	6.36	0.787	0.38	-76	5.37

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv | 10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1240	SHM-05-41B-042108		3		

Comments

[signature] Signature

4/21/08 Date

1-303-887-8345

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-23
Start Time: 0945 **End Time:** 1030
Well Construction:
Depth to water: 25.74
Well Depth: 35.30
Water Column:
Total Volume Removed (L) 22.5

Date: 4/18/08
Sampler: DR
PID Reading: N/A

Field Testing Equipment

Make	Model	Serial #
YSI	600XL-B-M	
YSI	650MDS	
Grundfos	Redi Flow	

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	~~color~~ Turb
0955	5	500	25.85	10.59	4.50	0.213	12.54	340	
1000				10.70	4.26	0.211	12.51	380	1.46
1005	10	500	25.87	10.74	4.13	0.209	12.46	406	
1010		500	25.88	10.64	4.17	0.210	12.48	427	1.05
1015	15	500	25.87	10.65	3.91	0.211	12.45	460	0.45
1020			25.87	10.71	3.51	0.207	12.38	493	
1025									
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1030	SHL-23-041808		3		

Comments

D M Reen
Signature

4/18/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID:

Date: 4/15/08
Sampler: DR
PID Reading: N/A

Start Time: 0835 **End Time:** 0910
Well Construction: SHL-21
Depth to water: 44.09
Well Depth: 54.70
Water Column:
Total Volume Removed (L) 22.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL-B-M	
YSI	650 MDS	
Grundfos	Redi-Flo	

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	~~color~~ Turbidity
0835	5	500	44.20	11.98	6.89	0.222	10.33	221	0.97
0840				12.08	6.66	0.223	10.35	224	
0845	10	500	44.21	12.29	6.46	0.223	10.22	226	0.98
0850			44.20	12.37	6.28	0.225	10.10	232	
0855	15	500	44.21	12.46	6.17	0.224	10.00	234	0.47
0900			44.20	12.37	6.10	0.225	9.57	235	
0905	20	500	44.20	12.42	5.99	0.225	9.70	239	
0910	22.5	500	44.21	12.46	5.98	0.225	9.67	241	0.57
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
0910	SHL-21-041808		3		
	DUP-041808		3		

Comments Collected field duplicate sample from this well

D. Rambo
Signature

4/15/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-23
Start Time: 1355 **End Time:**
Well Construction:
Depth to water: 25.91
Well Depth:
Water Column:
Total Volume Removed (L)

Date: 4/21/08
Sampler: JR
PID Reading: 0

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	
YSI	650 MDS	
Friedrichs Peristaltic Pump		

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1405	4.5	450	26.05	10.53	5.97	0.038	8.49	182	1.50
1410			26.05	10.74	5.55	0.034	15.30	215	
1415	9	450	26.04	10.80	5.39	0.033	15.46	228	1.32
1420			26.05	10.74	5.30	0.032	15.02	239	
1425	13.5	450	26.05	10.85	5.20	0.034	14.57	244	1.67
1430	16	450	26.04	10.84	5.25	0.032	14.36	248	1.42

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
	NONE				

Comments No sampling - quarterly snapshot readings only

J. Reuter
Signature

4/21/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-5
Start Time: ~~0850~~ 0950 **End Time:** 1100
Well Construction:
Depth to water: 2.69'
Well Depth: 13.35'
Water Column:
Total Volume Removed (L) 35

Date: 4/17/08
Sampler: DR
PID Reading: N/A

Field Testing Equipment

Make	Model	Serial #
YSI	600XL-B-M	01R0643
YSI	650 MDS	07B0644AH
Geopump	Geotech	07032

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
1020	15	500	3.22	5.26	5.78	0.263	1.14	46	0.37
1030	20		3.23	4.92	4.63	0.253	0.14	35	
1035			3.23	4.94	4.41	0.251	0.13	38	0.41
1040	25	500	3.23	4.93	4.32	0.250	0.12	40	
1045			3.23	5.01	4.18	0.250	0.11	44	0.39
1050	30	500	3.23	5.05	3.97	0.250	0.11	51	
1055		500	3.22	5.09	3.43	0.251	0.11	68	
1100	35	500	3.23	5.08	3.26	0.251	0.11	73	0.47

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1100	SHL-5-041708		3		

Comments

DM Reault
Signature

4/17/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SMW-96-B5C

Date: 4/17/08
Sampler: DR
PID Reading: N/A

Start Time: 1030 **End Time:** 1200
Well Construction:
Depth to water: 4.46
Well Depth: 77.25
Water Column:
Total Volume Removed (L) 40.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL-B-M	01K0643
YSI	650 MDS	02B0644 AH
Geopump	Geotech	11141

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
1130	27	450	4.51	9.74	6.86	0.882	0.99	-50	
1135			4.51	9.50	5.93	0.875	0.32	-47	0.46
1140	31.5	450	4.52	9.45	5.53	0.869	0.20	-40	
1145			4.52	9.42	5.21	0.869	0.16	-28	0.57
1150	36	450	4.52	9.49	5.16	0.862	0.12	-22	
1155			4.51	9.46	5.29	0.862	0.11	-23	0.43
1200	40.5	450	4.52	9.48	5.24	0.860	0.12	-21	0.41

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1200	SMW-96-5C-041708				

Comments

Signature

4/17/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-96-5B

Date: 4/17/08
Sampler: DR1WB
PID Reading: NA

Start Time: 1205 **End Time:** 1250
Well Construction:
Depth to water: 4.92
Well Depth: 92'
Water Column:
Total Volume Removed (L) 18

Field Testing Equipment

Make	Model	Serial #
YSI	600XL-B-M	01K0643
YSI	650 MDS	02B0644AH
Geopump Geotech		07032

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
1215	4	400	~~4.87~~ 5.37	9.73	5.07	0.799	0.41	-1	
1220			5.40	9.72	5.29	0.798	0.31	-6	
1225	8	400	5.37	9.77	5.45	0.795	0.28	-10	2.43
1230	10	400	5.38	9.74	5.53	0.795	0.26	-12	
1235	12	400	5.39	9.65	5.51	0.794	0.22	-10	1.24
1245	16	400	5.39	9.75	5.55	0.793	0.21	-12	0.82
1250	18	400	5.38	9.78	5.52	0.792	0.20	-11	0.71

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1250	SHM-96-5B-041708		3		

Comments

DR Rewalt
Signature

4/17/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHMW-42A

Date: 4/17/08
Sampler: DR + WR3
PID Reading: NA

Start Time: 1325 **End Time:** 1405
Well Construction:
Depth to water: 3.58
Well Depth: 44.50'
Water Column:
Total Volume Removed (L) 20

Field Testing Equipment

Make	Model	Serial #
Grundfos	GEO TECH	07032
YSI	600XL-B-M	01K0643
YSI	650 MDS	02D0644AH

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color TRB
1335	5	500	4.02	9.64	5.80	.225	4.85	130	7.77
1340			4.04	9.66	5.34	0.218	5.02	167	6.57
1345	10	500	4.04	9.65	5.13	0.214	5.15	188	5.71
1350			4.05	9.85	5.10	0.212	5.24	203	4.65
1355	15	500	4.04	9.74	5.09	0.212	5.31	214	3.24
1400	17.5	500	4.04	9.81	5.03	0.211	5.36	228	4.06
1405	20	500	4.05	9.77	5.02	0.211	5.36	230	
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1405	SHM-05-42A				

Comments

Signature

4/17/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-05-42B

Date: 4/17/08
Sampler: DR & WB
PID Reading: NA

Start Time: 1325 **End Time:** 1425
Well Construction:
Depth to water: 3.55
Well Depth: 73.60
Water Column:
Total Volume Removed (L) 30

Field Testing Equipment

Make	Model	Serial #
Geo pump	GEOTECH	11141
YSI	600XL-B-M	98J0643
YSI	650 MDS	02B0644AH

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color TRB
1410	12.5	500	3.94	10.10	5.49	1.114	0.24	-51	1.09
1415	25		3.95	10.08	5.58	1.114	0.21	-53	0.84
1420	27.5	500	3.94	10.07	5.72	1.113	0.21	-56	0.99
1425	30	500	3.95	10.06	5.78	1.112	0.20	-59	1.02
1430									

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1425	SHM-05-42B-041708		3		

Comments

D Reault
Signature

4/17/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-8D

Date: 4/17/08
Sampler: DR
PID Reading: N/A

Start Time: 0905 **End Time:** 1010
Well Construction:
Depth to water: 6.52'
Well Depth: 68.45'
Water Column:
Total Volume Removed (L) 26

Field Testing Equipment

Make	Model	Serial #
YSI	600XL-B-M	01K0643
YSI	650 MDS	02B0644 AH
Geopump	Geotech	11141

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	~~color~~ Turb
~~0940~~ 0945	14	400	6.89	9.44	5.94	0.312	1.56	173	0.08
~~0950~~ 0950	18		6.88	9.72	5.82	0.312	1.53	193	
~~0955~~ 0955	20	400	6.89	9.60	5.68	0.314	1.55	210	
1000	22	400	6.90	9.59	5.61	0.314	1.57	223	0
1005	24	400	6.89	9.65	5.63	0.314	1.57	230	
1010	26	400	6.89	9.64	5.66	0.313	1.57	233	
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1010	SHL-8D-041708	Plastic	1	None	AK
"	"	"	1	~~None~~ HNO_3	Metals
"	"	"	1	None	Turb, Cl, NO_3, SO_4

Comments

D. Ream
Signature

4/17/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-85

Date: 4/17/08
Sampler: DR
PID Reading: N/A

Start Time: 0835 **End Time:** 0935
Well Construction:
Depth to water: 6.66'
Well Depth: 55.80'
Water Column:
Total Volume Removed (L) 24

Field Testing Equipment

Make	Model	Serial #
YSI	600XL-B-M	01K0643
YSI	650 MDS	02B0644 AH
Geopump geotech		07032

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	eeler-Turb
0845	4	400		8.68	8.17	0.233	7.44	235	0.76
0850	6	400	8.75	8.44	7.34	0.229	5.88	243	
0900	10		8.90	8.50	6.88	0.228	3.71	206	
0905	12	400	8.92	8.54	6.60	0.228	2.83	187	1.42
0910	14		8.92	8.61	6.44	0.228	2.35	173	
0915	16	400	8.92	8.63	6.35	0.228	2.52	167	0.91
0920	18		8.92	8.73	6.26	0.227	2.02	157	
0925	20	400	8.93	8.78	6.18	0.227	2.12	155	
0930	22			8.79	6.14	0.227	2.07	157	0.41
0935	24	400	8.92	8.85	6.11	0.227	2.03	158	0.50

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv | 10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

A 045-858 823

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
0935	SHL-85-041708	Plastic	3	None/None/HNO3	

Comments

D Rearick
Signature

4/17/08
Date

INSTRUMENT CALIBRATION LOG

Project/Site Name Fort Devens, Ayer, Ma. **Date** 4/21/08 **Weather** Cloudy, 50's

Calibrated By [signature] **Instrument** YSI 600XL / YSI 650 MDS **Serial Number** 02A 1047 AB / 01A1 431 AA

Parameters	Pre-calibration Reading	Post-calibration Reading	Temperature °C	Comments
Conductivity	1.413	1.426	15.41	
pH (7)	7.00	6.94	15.60	
pH (4)	3.99	3.94	15.45	
pH (10)	9.96	9.89	16.29	
ORP	239.1	239.7	15.81	
Dissolved Oxygen	99.4%	104.1 %	15.66	
Barometric Pressure	30.38 @ 0800			

INSTRUMENT CALIBRATION LOG

Project/Site Name Devens Date 4/17/08 Weather clear, 50's

Calibrated By Dave Reath Instrument YSI 600XL-B-M / YSI 650 MDS Serial Number 01K043 / 02B0644 APH

Parameters	Pre-calibration Reading	Post-calibration Reading	Temperature °C	Comments
Conductivity	1.293	1.414/1.417	15.83	
pH (7)	7.16	7.00 / 7.08	15.79	
pH (4)	4.06	3.99 / 4.16	15.75	
pH (10)	9.75	9.97/9.98	15.43	
ORP	246	240/238	15.83	
Dissolved Oxygen	95.8%	100.0%/99.7%	16.11	
Barometric Pressure	30.22 @ 0745			

1.293
1.367

Pine Environmental Services, Inc

155-E New Boston St., Woburn, MA 01801
800-519-PINE(Toll-Free)
781-932-9698(Phone)
781-932-9729(Fax)
pine-ma@pine-environmental.com

Certificate of YSI 600 XL Calibration

YSI 600 XL Serial Number 01K0643AD was calibrated to the manufacturer's specifications with NIST standards.

Model: 600 XL
Pine No: 5314
Serial No: 01K0643AD

lot Number: YSI_600XL/XLM/556

Calibration Standard	Instrument Output	Allowable Range	% Difference
Dissolve Oxygen-Span1: 100%	100%	95-105 %	0%
Conductivity-Span1: 1.413ms/cm	1.413ms/cm	1.34-1.48 ms/cm	0%
Dissolve Oxygen-Zero1: 0mg/L	0.01mg/L	0-0 mg/L	0.01%
PH-Span1: 4PH	4PH	3.8-4.2 PH	0%
PH-Zero1: 7PH	7PH	6.65-7.35 PH	0%
Redox: 240mv	240mv	228-252 mv	0%

Environmental Conditions of Test Area:

Temperature Degree F: 70 %Relative Humidity 29

Calibrated By: Elig Demorais **Date:** 4/11/2008 10:20:00 AM

All instruments are calibrated by Pine Environmental Services, Inc. according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services, Inc. of any defect within 24 hours of receipt of equipment
Please call 800-519-PINE for Technical Assistance

See attached packing list

Pine Environmental Services, Inc
155-E New Boston St., Woburn, MA 01801
800-519-PINE(Toll-Free)
781-932-9698(Phone)
781-932-9729(Fax)
pine-ma@pine-environmental.com

YSI 600 XL Packing List

Pine No: 5314 **Serial No:** 01K0643AD

Standard Items	Prepared	QC Check	Received by Customer	Received by Pine
650 MDS Display	✓	✓		
Manual	✓	✓		
Quick reference card	✓	✓		
Field cable (100')	✓	✓		
Stand (base, claw, and rod)	✓	✓		
Probe guard w/ weight	✓	✓		
Storage/ calibration cup w/ sponge	✓	✓		
Flow through cell	✓	✓		
2 of each barb size (1/4, 3/8, and 1/2)	✓	✓		
DO probe reconditioning kit	✓	✓		
C alkaline batteries (4)	✓	✓		
6-series communications cable	✓	✓		
YSI Ecowatch software	✓	✓		
Calibration kit (pH, conductivity, and ORP)	✓	✓		
NIST traceable calibration sheet	✓	✓		

Prepared By: RD
QC By: CC
Date: 4/11/2008

This packing list is to ensure that every item needed to operate the unit was sent and received. Upon receiving a shipment, please fill out the "Received by customer" column. Call Pine within 24 hrs. of receiving the equipment if any pieces are missing, damaged, or malfunctioning. Thank you for choosing Pine Environmental Services, Inc.

For Technical Support call 800-519-PINE

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-8D

Date: 7/15/08
Sampler: DR
PID Reading: N/A

Start Time: 0920 End Time: 1020
Well Construction: 2" PVC
Depth to water: 8.08
Well Depth: 68.70
Water Column:
Total Volume Removed (L) 30

Field Testing Equipment

Make	Model	Serial #
YSI	600 XL	01A0019AA
650 MDS Display		04J15158AC
LA Motte	2020	

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color Turb
0945	12.5	500	8.46	10.82	6.31	0.167	0.96	62	0.33
0950	15	500	8.48	10.86	6.24	0.167	0.95	66	0.26
0955	17.5	500	8.48	10.78	6.19	0.166	0.97	67	0.13
1000	20	500	8.48	10.80	6.16	0.165	1.01	91	0.04
1005	22.5	500	8.48	10.80	6.12	0.165	1.03	106	0.06
1010	25	500	8.48	10.85	6.11	0.164	1.05	114	0.22
1015	27.5	500	8.48	10.78	6.08	0.163	1.08	119	0.21
1020	30	500	8.48	10.82	6.08	0.163	1.09	121	0.18
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments: No sampling, parameters only

Signature

7/15/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-85

Date: 7/15/08
Sampler: DR
PID Reading: N/A

Start Time: 0940 End Time: 1040
Well Construction: 2" PVC
Depth to water: 8.31
Well Depth: 58.90
Water Column:
Total Volume Removed (L) 30

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01A0019 AA
650 MDS Display		04J1515 8AC
LaMotte	2020	

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	~~color~~ Turb
1025	22.5	500	10.50	10.57	6.09	0.077	1.45	135	1.17
1030	25	500	10.51	10.65	6.04	0.073	1.33	144	0.92
1035	27.5	500	10.51	10.62	6.04	0.073	1.33	147	0.57
1040	30	500	10.51	10.68	6.03	0.073	1.32	149	0.51
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments: No sampling, parameters only

D Reuter
Signature

7/15/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-96-5C
Start Time: 1050 **End Time:** 1135
Well Construction: 4" PVC
Depth to water: 6.31
Well Depth: 79.50
Water Column:
Total Volume Removed (L) 22.5

Date: 7/15/08
Sampler: DR
PID Reading: N/A

Field Testing Equipment

Make	Model	Serial #
YSI	600 XL	01A0UR AA
650	MDS Display	04J15159 AC
La Motte 2020		

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
1100	5	500	6.42	10.48	6.21	0.754	0.19	-55	19.7
1105	7.5	500	6.42	10.54	6.25	0.716	0.16	-48	6.18
1110	10	500	6.42	10.41	6.26	0.708	0.19	-46	4.38
1115	12.5	500	6.42	10.44	6.27	0.705	0.18	-45	3.05
1120	15	500	6.42	10.50	6.28	0.705	0.17	-45	2.76
1125	17.5	500	6.44	10.46	6.29	0.705	0.17	-45	2.80
1130	20	500	6.43	10.56	6.28	0.704	0.17	-45	2.08
1135	22.5	500	6.43	10.53	6.29	0.705	0.17	-45	3.20
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments No sampling, parameters only

[signature]
Signature

7/15/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-96-5B

Date: 7/15/08
Sampler: DR
PID Reading: N/A

Start Time: 1100 **End Time:** 1205
Well Construction: 4" PVC
Depth to water: 6.92
Well Depth: 88.4
Water Column:
Total Volume Removed (L) 32.5

Field Testing Equipment

Make	Model	Serial #
YSI	600 XL	01A0019AA
650 MDS Display		04515158AC
LaMotte	2020	

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
1145	22.5	500	7.35	11.48	6.28	2.692	0.21	-20	0.85
1150	25	500	7.34	11.35	6.09	0.695	0.30	0	1.23
1155	27.5	500	7.35	11.22	6.04	2.694	0.34	9	0.96
1200	30	500	7.35	11.27	6.06	0.692	0.32	10	0.67
1205	32.5	500	7.34	11.35	6.08	0.691	0.35	10	0.81
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments No sampling, parameters only.

DR
Signature

7/15/08
Date

Environmental Chemical Corporation
Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-5
Start Time: 1145 **End Time:** 1225
Well Construction: 2" PVC
Depth to water: 5.45
Well Depth: 13.82
Water Column:
Total Volume Removed (L) 20

Date: 7/15/08
Sampler: DR
PID Reading: N/A

Field Testing Equipment

Make	Model	Serial #
YSI	600 XL	01A 0019 AA
650 MDS Display		04J15158AC
LaMotte 2020		

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
1210	12.5	500	5.95	12.89	5.73	0.122	0.13	7	2.24
1215	15	500	5.97	12.89	5.62	0.111	0.12	9	
1220	17.5	500	5.95	12.83	5.60	0.109	0.11	5	1.92
1225	20	500	5.95	12.84	5.60	0.108	0.11	3	1.52
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments No sampling, parameters only.

DRenault
Signature

7/15/08
Date

[illegible]

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-22

Date: 7/15/09
Sampler: DR
PID Reading: N/A

Start Time: 1245 **End Time:** 1350
Well Construction: 4" PVC
Depth to water: 8.02
Well Depth: 110.7
Water Column:
Total Volume Removed (L) 30

Field Testing Equipment

Make	Model	Serial #
YSI	600 XL	01A0019AA
650 MDS	Display	04J15158AC
LaMotte	2020	

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
1300	7.5	500	8.68	10.30	5.97	0.775	0.63	37	0.20
1310	10	500	8.67	10.19	6.11	0.776	0.60	35.7	0.22
1315	12.5	500	8.68	10.26	6.19	0.775	0.50	33.3	0.25
1320	15	500	8.69	10.19	6.25	0.776	0.47	32.1	0.58
1325	17.5	500	8.69	10.08	6.28	0.776	0.55	24.5	0.59
1330	20	500	8.68	10.06	6.30	0.776	0.54	24.7	0.28
1335	22.5	500	8.68	10.06	6.31	0.777	0.51	36.3	0.30
1340	25	500	8.67	10.09	6.32	0.778	0.51	44.7	0.42
1345	27.5	500	8.67	10.10	6.31	0.777	0.55	49.7	0.32
1350	30	500	8.67	10.18	6.31	0.776	8.78	52.8	0.35
Acceptance Criteria:			< 0.3 ft	3%	±0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments No sampling, parameters only

DR Beaudet
Signature

7/15/09
Date

7.78
92.3
1.70

Environmental Chemical Corporation
Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-96-22B
Start Time: 1250 **End Time:** 1415
Well Construction:
Depth to water: 7.78
Well Depth: 92.32
Water Column:
Total Volume Removed (L) 34.5

Date: 7/15/08
Sampler: DR
PID Reading: NA

Field Testing Equipment

Make	Model	Serial #
YSI	600 XL	01A0019AH
650	MDS Display	04J5158AC
LaMotte 2020		

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
13:55	24.5	500	7.80	10.08	6.21	.813	.89	-52.9	6.71
14:00	27	500	7.80	10.01	6.21	.820	.39	-63.8	6.80
14:05	29.5	500	7.79	10.01	6.20	.820	.38	-66.7	9.48
14:10	32	500	7.79	9.83	6.19	.821	.39	-67.2	8.51
14:15	34.5	500	7.79	9.86	6.19	.819	.38	-67.7	9.54
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments
No sampling, parameters only

DJ Reault — Signature
7/15/08 — Date

13.5   5/00

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHM-96-22C

Date: 7/15/08
Sampler: DR
PID Reading: N/A

Start Time: 1330 **End Time:** 1445
Well Construction:
Depth to water: 9.01
Well Depth: 13.68
Water Column:
Total Volume Removed (L) 40

Field Testing Equipment

Make	Model	Serial #
YSI	600 XL	01A0019AA
YSI	MDS Display	04J1515BAC
LaMotte	2020	

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	color
1415	30	~500	32.75	10.96	7.12	.243	.23	-113	6.89
1420	32.5		33.45	11.29	7.32	.234	.31	-106	6.20
1425	35		33.85	11.41	7.44	.231	.13	-91.6	4.84
1430	36.5	300	34.34	11.46	7.51	.233	.14	-80.1	4.48
1435	38	275	34.72	11.64	7.53	.233	0.15	-80.6	5.21
1440	38.5	275	35.00	11.73	7.54	0.231	0.17	-80.9	4.83
1445	40	250	35.30	11.99	7.55	0231	0.20	-87.7	
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments No sampling parameters only. Well sampled w/ Grundfos - water level too low for peristaltic.

D J Reuter
Signature

7/15/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-9

Date: 7/15/08
Sampler: DR
PID Reading: N/A

Start Time: 1505 **End Time:** 1510
Well Construction: 2" PVC
Depth to water: 10.19
Well Depth: 26.19
Water Column:
Total Volume Removed (L) 32.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01A0019AA
GeoTech	MDS Display	04J1515 8Ac
LaMotte	2020	

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	~~color~~ Turb
1505	25	500	10.82	8.81	6.40	.215	0.39	-24	1.32
1500	27.5	500	10.82	8.92	6.26	.214	0.24	-17	1.53
1505	30	500	10.82	8.85	6.21	.214	0.22	-15	1.43
1510	32.5	500	10.82	8.80	6.19	0.214	0.21	-15	1.46

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments No sampling, parameters only. TA

DR
Signature

7/15/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-23
Start Time: 0900 **End Time:** 0935
Well Construction: 4" PVC
Depth to water: 28.82
Well Depth: 35.27
Water Column:
Total Volume Removed (L) 21

Date: 7/16/08
Sampler: DR
PID Reading: N/A

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01A0019 AA
650	MDS Display	04J15158AC
LaMotte	2020	

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	~~color~~ Turb
0915	9	600	29.07	10.82	6.19	.039	12.81	241	5.49
0920	12	600	29.06	11.00	5.28	.037	12.86	264	7.62
0925	15	600	29.07	10.91	5.01	.037	12.87	270	8.87
0930	18	600	29.06	11.04	4.91	.037	12.86	273	8.81
0935	21	600	29.08	11.08	4.90	.036	12.83	276	8.19
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments

No sampling, parameters only. Well sampled w/ grundfos

[signature]
Signature

7/16/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Fort Devens
Location: Ayer, MA
Well ID: SHL-21

Date: 7/16/08
Sampler: DR
PID Reading: N/A

Start Time: 1005 **End Time:** 1050
Well Construction:
Depth to water: 45.91
Well Depth: 54.80
Water Column:
Total Volume Removed (L) 22.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01A0019 AA
650	MDS Display	04J15158 AC
LaMotte	2020	

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	~~color~~ Turb
1020	7.5	500	46.00	12.98	5.37	.064	8.90	219	1.16
1025	10	500	46.01	12.80	5.28	.066	9.32	230	0.67
1030	12.5	500	46.00	13.33	5.26	.065	9.33	236	0.56
1035	15	500	46.00	13.34	5.27	.063	9.75	240	0.65
1040	17.5	500	46.00	13.46	5.22	.061	9.89	247	0.58
1045	20	500	46.01	13.65	5.22	.061	9.93	250	0.62
1050	22.5	500	46.00	13.64	5.22	.061	9.79	252	0.39
Acceptance Criteria:			< 0.3 ft	3%	±0.1	3%	10%	±10mv	10%

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses

Comments No sampling, parameters only Well purged w/ Grundfos.

D. Reault
Signature

7/16/08
Date

Pine Environmental Services, Inc

1 Industrial Way, Suite 3, Portland, ME 04103
888-779-PINE(Toll-Free)
207-797-4100(Phone)
207-797-5174(Fax)
pine-me@pine-environmental.com

YSI 600 XL Packing List

Pine No: 1678 **Serial No:** 01A0019AA

Standard Items	Prepared QC Check	Received by Customer	Received by Pine
650 MDS Display	✓	✓	
Manual	✓	✓	
Quick reference card	✓	✓	
Field cable	✓	✓	
Stand (base, claw, and rod)	✓	✓	
Probe guard w/ weight	✓	✓	
Storage/ calibration cup w/ sponge	✓	✓	
Flow through cell	✓	✓	
2 of each barb size (1/4, 3/8, and 1/2)	✓	✓	
DO probe reconditioning kit	✓	✓	
C alkaline batteries (4)	✓	✓	
6-series communications cable	✓	✓	
YSI Ecowatch software	✓	✓	
Calibration kit (pH, conductivity, and ORP)	✓	✓	
NIST traceable calibration sheet	✓	✓	

Prepared By: JM
QC By: [illegible]
Date: 7/9/2008

This packing list is to ensure that every item needed to operate the unit was sent and received. Upon receiving a shipment, please fill out the "Received by customer" column. Call Pine within 24 hrs. of receiving the equipment if any pieces are missing, damaged, or malfunctioning. Thank you for choosing Pine Environmental Services, Inc.

For Technical Support call 888-779-PINE

Pine Environmental Services, Inc

1 Industrial Way, Suite 3, Portland, ME 04103
888-779-PINE(Toll-Free)
207-797-4100(Phone)
207-797-5174(Fax)
pine-me@pine-environmental.com

Certificate of YSI 600 XL Calibration

YSI 600 XL Serial Number 01A0019AA was calibrated to the manufacturer's specifications with NIST standards.

Model: 600 XL
Pine No: 1678
Serial No: 01A0019AA

lot Number: Sodium Sulphite

Calibration Standard	Instrument Output	Allowable Range	% Difference
Dissolve Oxygen-Zero1: 0%	0%	0-0 %	0%

lot Number:100% Saturated Air

Calibration Standard	Instrument Output	Allowable Range	% Difference
Dissolve Oxygen-Span1: 100%	100%	95-105 %	0%

lot Number:g686 (ORP 240mV)

Calibration Standard	Instrument Output	Allowable Range	% Difference
Redox: 240mv	240mv	228-252 mv	0%

lot Number:2509185 (Cond 1.413)

Calibration Standard	Instrument Output	Allowable Range	% Difference
Conductivity-Span1: 1.413ms/cm	1.413ms/cm	1.34-1.48 ms/cm	0%

lot Number:2409220.(PH 7)

Calibration Standard	Instrument Output	Allowable Range	% Difference
PH-Zero1: 7PH	7PH	6.65-7.35 PH	0%

lot Number:2407088 (PH4)

Calibration Standard	Instrument Output	Allowable Range	% Difference
PH-Span1: 4PH	4PH	3.8-4.2 PH	0%

Environmental Conditions of Test Area:

Temperature Degree F: %Relative Humidity

Calibrated By: Charles Hollien **Date:** 7/9/2008 2:48:00 PM

All instruments are calibrated by Pine Environmental Services, Inc. according to the manufacturer's specifications, but it is the customer's responsibility to calibrate and maintain this unit in accordance with the manufacturer's specifications and/or the customer's own specific needs.

Notify Pine Environmental Services, Inc. of any defect within 24 hours of receipt of equipment
Please call 888-779-PINE for Technical Assistance

See attached packing list

INSTRUMENT CALIBRATION LOG

Project/Site Name Fort Devens, Ayer, Ma. **Date** 7/15/08 **Weather** Cloudy, 70's

Calibrated By D.R **Instrument** 6 YSI 650 MDS / YSI 600XL **Serial Number** 04J1515 8AC / 01A0019AA

Parameters	Pre-calibration Reading	Post-calibration Reading	Temperature °C	Comments
Conductivity	1.413	1.393	25.69	
pH (7)	7.03	6.83	25.51	
pH (4)	3.99	4.05	25.69	
pH (10)	~~10.01~~ 9.92	9.79	20.34	
ORP	238	236	25.54	
Dissolved Oxygen	99.6%	104.3%	22.20	
Barometric Pressure	756.9			
LaMotte 2020 Turbidity	0.96/1.00	10.33/10.00		

INSTRUMENT CALIBRATION LOG

Project/Site Name Fort Devens, Ayer, Ma. **Date** 7/16/08 **Weather** Clear, 80's

Calibrated By DR **Instrument** YSI 650 MDS / YSI 600 XL **Serial Number** 04315158AC / 01A0019 JAM

Parameters	Pre-calibration Reading	Post-calibration Reading	Temperature °C	Comments
Conductivity	1.414	1.431	19.98	
pH (7)	7.00	6.88	19.57	
pH (4)	3.99	3.90	19.53	
pH (10)	9.91	9.89	19.60	
ORP	240	235	19.87	
Dissolved Oxygen	100 %	102.4 %	23.67	
Barometric Pressure	760.2	760.1		
LaMotte 2020 Turbidity	.95 @ 1.00 9.97 @ 10.00	0.96 @ 1.00 9.97 @ 10.00		

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF

Location: Ayer, MA

Well ID: ~~SHM-05-41~~ SHM-05-41-B

Date: ~~8/14/08~~ 10/1/08

Sampler: M. Ke

PID Reading: N/A

Start Time: 1300 End Time: 1355

Well Construction: 2" PVC

Depth to water: 9.76'

Well Depth: 63.88'

Water Column: 54.12'

Total Volume Removed (L) 27.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0643AF
YSI	650MDS	02E0534AM
Lamotte	2020	1680-0900
Geotech	Geopump	H0600 3023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1310	5	500 ml	9.79	11.23	5.69	.373	.22	-99	4.00
1320	10	"	9.79	11.31	5.47	.374	.21	-98	5.18
1330	15	"	9.79	11.42	5.34	.371	0.14	-92	4.32
1340	20	"	9.79	11.34	5.37	.370	0.12	-89	15.4
1345	22.5	"	9.79	11.45	5.46	.369	0.14	-89	5.62
1350	25.0	"	9.79	11.50	5.52	.368	0.13	89	2.21
1355	27.5	"	9.79	11.49	5.52	.367	0.12	89	2.56

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1355	SHM-05-41-B 1001200's	250 ml Plastic	1	None	All
1355	SHM-05-41-B 1001200s	250 ml Plastic	1	HNO3	Metals
1355	SHM-05-41-B 1001200s	500 ml Plastic	1	None	Total Cl, Nitr, SO4

Comments Dup taken

Signature

10-1-08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM-96-5B

Date: 10/1/02
Sampler: T.B, K.E
PID Reading: 0

Start Time: 8:40 **End Time:** 9:25
Well Construction: 4" PVC
Depth to water: 5.61
Well Depth: 19.75
Water Column: 14.14
Total Volume Removed (L) 6.75

Field Testing Equipment

Make	Model	Serial #
YSI	650 MDS	02K598AB
YSI	600 XLR	04J1599AD
LaMotte	2020	5303-3504

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
8:55	0.75	~~150~~ 125	5.74	9.86	6.53	0.744	0.98	44.1	3.05
9:00	1.5	150	~~5.75~~	9.77	6.35	0.729	0.98	18.1	2.10
9:05	2.25	150	5.76	9.67	6.27	0.721	0.75	12.3	2.12
9:10	3.00	150	5.76	9.63	6.23	0.710	0.70	7.4	~~0.96~~
9:15	3.75	150	5.76	9.65	6.21	0.710	0.68	6.1	1.86
9:20	4.50	150	5.76	9.64	6.21	0.709	0.58	6.0	1.02

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
9:25	SHM-96-5B	1001 2001			
~~9:25~~					
~~9:25~~					

Comments

Clear and odorless

Signature

10/1/02
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHLBS 10012008

Date: 10/1/08
Sampler: Michael Piccolo
PID Reading: 0

Start Time: 955 **End Time:** 10:55
Well Construction: 2" PVC
Depth to water: 7.14'
Well Depth: 55.86'
Water Column:
Total Volume Removed (L) 17.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0643AF
YSI	650MDS	02E0534AM
Lamotte	2020	1680-0900
Geotech	Geopump	H0600 3023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1000	2.0	200	7.14'	10.74	5.78	0.041	1.11	141.6	3.03
1010	4.0	300	7.14'	10.44	5.71	0.040	1.07	178.2	2.54
1020	7.0	300	7.14'	10.43	5.69	0.040	1.06	181.7	1.09
1030	10.0	300	7.14'	10.42	5.68	0.041	1.06	199.5	0.44
1040	13.0	300	7.14'	10.40	5.67	0.041	1.07	223.6	0.68
1045	14.5	300	7.14'	10.34	5.67	0.040	1.06	233.2	0.59
1050	16.0	300	7.14'	10.38	5.67	0.041	1.06	233.6	0.62
1055	17.5	300	7.14	10.40	5.67	0.040	1.07	234.5	0.63
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 816 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1055	SHLBS 10012008	250 mL plastic	1	None	Alk
1055	SHLBS 10012008	250 mL plastic	1	HNO3	Metals
1055	SHLBS 10012008	500 mL Plastic	1	None	Turb, Cl, NO3, SO4

Comments ORP readings seemed high. calibration check after sampling read 242.3 for the 240.0 [redacted] solution. Re-calibrated to 240.0 anyway

Signature

10/1/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHL 13 10012008

Date: 10/1/08
Sampler: Michael Reed
PID Reading: 0

Start Time: 845 **End Time:** 930
Well Construction: 2" PVC.
Depth to water: 6.41
Well Depth: 21.56
Water Column: 15.15
Total Volume Removed (L) 9.0

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0643AF
YSI	650 MDS	02E0534 AM
Lamotte	2020	1680-0900
Geotech	Geopump	H0600 3023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
850	1.0	200	6.41	14.08	5.57	0.115	0.31	41.0	4.04
900	3.0	200	6.41	14.25	5.49	0.147	0.31	46.6	2.60
910	5.0	200	6.41	14.23	5.45	0.147	0.24	47.0	1.07
920	7.0	200	6.41	14.25	5.45	0.147	0.21	48.0	0.75
925	8.0	200	6.41	14.24	5.46	0.147	0.20	47.8	0.55
930	9.0	200	6.41	14.24	5.45	0.147	0.20	48.1	0.61
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
930	SHLS1001 2008	250 mL plastic	1	None	AA
930	SHLS1001 2008	250 mL plastic	1	HNO3	Metals
930	SHLS1001 2008	500 mL plastic	1	None	Turb, Cl, Alky, SO4

Comments

Signature

10-1-08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Date: 10-1-08
Location: Ayer, MA
Sampler: Michael Rocco
Well ID: SHL8D 10012008
PID Reading: 0

Start Time: 1120 **End Time:** 1220
Well Construction: 2" PVC
Depth to water: 7.00'
Well Depth: 68.82'
Water Column: 61.82'
Total Volume Removed (L) 18.0

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0643AF
YSI	650 MDS	02E0524AM
Lamotte	2020	1680-0900
Geotech	Geopump	H0600 3023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1125	1.5	300	7.00'	10.90	5.90	0.077	0.84	12.7	1.72
1135	4.5	300	7.00'	10.73	5.81	0.081	1.64	95.0	0.98
1145	7.5	300	7.00'	10.72	5.81	0.083	1.56	160.6	0.52
1155	10.5	300	7.00'	10.80	5.82	0.083	1.54	186.4	0.46
1205	13.5	300	7.00	10.79	5.81	0.084	1.54	210.8	0.31
1210	~~15.0~~ 16.5	300	7.00	10.85	5.82	0.084	1.53	218.7	0.45
1215	16.5	300	7.00	10.92	5.81	0.084	1.53	223.2	0.32
1220	18.0	300	7.00	10.87	5.81	0.084	1.53	225.6	0.21

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1220	SHL8D 10012008	250 mL Plastic	1	None	Alk
1220	SHL8D 10012008	250 mL Plastic	1	HNO3	Metals
1220	SHL8D 10012008	250 mL Plastic	1	None	Turb, Cl, NO3, SO4

Comments

Signature

10-1-08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: ~~SHM-96-5~~ SHL-5

Date: 10/1/08
Sampler: TS/ME
PID Reading: 0

Start Time: 10:40 **End Time:** 11:25
Well Construction: 2" PVC
Depth to water: 1.99
Well Depth: ~~14.95~~ 13.70
Water Column: 11.71
Total Volume Removed (L) 16

Field Testing Equipment

Make	Model	Serial #
YSI	650 MDS	02K0598AB
YSI	600 XLR	04G1599AD
Lamotte	2020	5303-3504

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
10:55	2 6	400	1.99	11.46	5.70	0.101	0.14	36.7	0.45
11:00	8	400	1.99	11.47	5.65	0.100	0.14	30.9	0.09
11:05	10	400	1.99	11.46	5.60	0.100	0.12	26.6	0.08
11:10	12	400	1.99	11.46	5.58	0.099	0.14	21.4	0.08
11:15	14	400	1.99	11.46	5.56	0.099	0.11	21.3	0.22
11:20	16	400	1.99	11.48	5.57	0.098	0.11	17.7	1.65
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
11:25	SHL-5-1001~~08~~2008				

Comments

Clear and Odorless

[signature]
Signature

10/1/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM-96-5C

Date: 10/1/08
Sampler: TD/NE
PID Reading: 0

Start Time: 0945 **End Time:** 1035
Well Construction: 4" PVC
Depth to water: 5.05
Well Depth: 79.7
Water Column: 74.65
Total Volume Removed (L) 25.0

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	02K05818AB
YSI	600XLM	04J15999AB
Lamotte	2020	5303-3504

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1000	10.0	500	5.07	7.63	6.22	0.721	2.1	-48.4	5.37
1005	12.5		5.07	7.47	6.20	0.713	1.8	-49.6	5.55
1010	15.0		5.07	7.49	6.20	0.710	1.6	-50.5	6.25
1015	17.5		5.07	7.49	6.20	0.709	1.6	-53.2	5.81
1020	20.0		5.07	7.49	6.20	0.707	1.5	-55.0	4.13
1025	22.5		5.07	7.55	6.20	0.705	1.5	-56.7	3.41
1030	25.0	↓	5.07	7.51	6.20	0.705	1.5	-57.7	2.13

Acceptance Criteria: <0.3 ft 3% ± 0.1 3% 10% ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1035	SHM-96-5C-10012008				

Comments

Clear + odorless

Signature

10/1/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM-93-22B

Date: 10/1/08
Sampler: TB/NE
PID Reading: 0

Start Time: 12:55 End Time: 13:40
Well Construction: 4" PVC
Depth to water: 6.45
Well Depth: 92.50
Water Column: 86.05
Total Volume Removed (L) 12.0

Field Testing Equipment

Make	Model	Serial #
YSI	650 MDS	02K0598AB
YSI	600XLR	04J1599AD
Lamotte	2020	5303-3604

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
13:10	4.5	300	6.45	7.5	6.66	0.727	1.42	-86.7	39
13:15	6.0	300	6.50	7.46	6.53	0.721	0.32	-90.5	31
13:20	7.5	300	6.50	7.44	6.5	0.721	0.23	-88.6	22
13:25	9.0	300	6.50	7.38	6.48	0.721	0.22	-87.2	19
13:30	10.5	300	6.50	7.46	6.48	0.721	0.22	-84.9	16
13:35	12.0	300	6.50	7.41	6.47	0.722	0.21	-82.5	13
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
13:40	SHM-93-22B-10012008				

Comments

Colorless & Odorless

Signature: [signature]

Date: 10/1/08

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill
Location: Ayer, MA
Well ID: SHL-22

Date: 10/16/08
Sampler: [illegible]
PID Reading: 0

Start Time: 11:55 **End Time:** 1245
Well Construction: 4" PVC
Depth to water: 110.5
Well Depth: 6.62
Water Column: 103.88
Total Volume Removed (L) 15.75

Field Testing Equipment

Make	Model	Serial #
YSI	650 MDS	02K0598 MS
YSI	600XLM	04J1599AD
Lamotte	2020	5303-3504

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
12:10	5.25	350	7.14	7.23	6.38	0.737	0.27	-6.1	0.0
12:15	7.00	↓	7.14	7.30	6.44	0.737	0.23	-12.3	0.0
12:20	8.75		7.15	7.29	6.44	0.735	0.21	-13.6	0.0
1225	10.50		7.15	7.27	6.46	0.735	0.20	-15.8	0.0
1230	12.25		7.15	7.36	6.48	0.736	0.19	-18.8	0.0
1235	14.00		↓	7.37	6.49	0.736	0.17	-20.7	0.0
1240	15.75	↓	↓	7.41	6.50	0.736	0.15	-21.0	0.0

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1245	SHL-22-10012008				

Comments

Calibrated turb. meter twice and still read 0 for all times
Sample clear + odorless

Signature

10/16/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHL-9

Date: 10/1/08
Sampler: TD/NG
PID Reading: 0

Start Time: 1400 **End Time:** 1445
Well Construction: 2"
Depth to water: 8.85
Well Depth: 25.54
Water Column: 16.69
Total Volume Removed (L)

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	07K0598AB
YSI	600XLR	04J15795AD
Lamotte	2020	3503-3504

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1415	6.0	400	9.10	8.81	6.51	0.202	2.4	-37.0	0.0
1420	8.0	400	9.10	8.73	6.46	0.200	2.0	-38.6	↓
1425	10.0	400	9.10	8.74	6.45	0.202	1.6	-41.8	↓
1430	12.0	400	9.10	8.82	6.44	0.203	1.4	-43.6	4.11
1435	14.0	↓	↓	8.71	6.43	0.204	1.2	-44.2	2.81
1440	16.0	↓	↓	8.85	6.43	0.205	1.1	-46.0	1.65

Acceptance Criteria: < 0.3 ft; 3%; ± 0.1; 3%; 10%; ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1445	SHL-9-10012008				

Comments

Turb meter out of cal - won't recal. Switched to and calib'd Lamotte meter (SN 1680-0900).
Sample clear + odorless

Signature

10/1/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM 9931B 10032005

Date: 10/2/05
Sampler: M. Rivera, M. Edwards
PID Reading: 0

Start Time: 14:10 End Time: 14:55
Well Construction: 2" PVC
Depth to water: 3.31
Well Depth: 61.45
Water Column: 58.14
Total Volume Removed (L) 22.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0443AE
YSI	650MDS	02E0534AM
LaMotte	2020	1680-0900
Geotech	Geopump	H06003023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
14:15	2.5	500	3.31	11.01	6.60	0.079	4.1	2.7	10.33
14:25	7.5	500	3.31	10.95	6.52	0.183	1.3	-38.1	0.45
14:35	12.5	500	3.31	10.96	6.52	0.198	1.0	-41.6	0.23
14:45	17.5	500	3.31	10.95	6.49	0.207	0.9	-41.6	0.06
14:50	20.0	500	3.31	10.90	6.47	0.210	0.9	-41.4	0.22
14:55	22.5	500	3.31	10.91	6.48	0.212	0.9	-41.2	0.46

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
14:55	SHM 9931B 10032005	250ml plastic	1	None	AIK
14:55	SHM9931B 10032005	250ml plastic	1	HNO_3	Metal
14:55	SHM9931B 10032005	500ml plastic	1	None	Total Cl, NO_3, SO_4

Comments

Signature

10/2/05
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM 9931C 10022008

Date: 10/2/08
Sampler: N. Edwards, M. Rivera
PID Reading: 0

Start Time: 13:15 End Time: 14:00
Well Construction: 2" PVC
Depth to water: 3.60
Well Depth: 80.05
Water Column: 76.45
Total Volume Removed (L) 22.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0643AF
YSI	650 MDS	02E0534AF
LaMotte	2020	1680-0900
Geotech	Geopump	K06003023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
13:20	2.5	500	3.60	11.25	6.57	0.495	0.98	-53.3	28.3
13:30	7.5	500	3.60	10.93	6.39	0.542	0.21	-84.0	17.0
13:40	12.5	500	3.60	10.92	6.53	0.536	0.15	-89.1	5.24
13:50	17.5	500	3.60	10.79	6.59	0.531	0.13	-90.6	2.57
13:55	20.0	500	3.60	10.83	6.60	0.531	0.12	-90.7	2.04
14:00	22.5	500	3.60	10.79	6.59	0.529	0.12	-90.8	1.55
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
14:00	SHM 9931C 10022008	250ml plastic	1	None	ALK
14:00	SHM9931C 10022008	250ml plastic	1	HNO_3	Metals
14:00	SHM9931C 10022008	500ml plastic	1	None	Turbidity, Cl, NO_3, SO_4

Comments

Nick Edwards
Signature

10/2/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM-99-32K
Date: 10/2/08
Sampler: Tyler Barrett
PID Reading: 0

Start Time: 1430 End Time: 1455
Well Construction: 2" PVC
Depth to water: 9.11
Well Depth: 83.9
Water Column: 74.79
Total Volume Removed (L) 12.0

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03K0558AC
YSI	600 XLR	08J100559AD
LaMotte	2020	1680-0900

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1435	6.0	400	9.15	7.06	6.32	0.713	0.29	-73.7	
1440	8.0	↓	↓	7.01	6.39	0.713	0.25	-74.2	
1445	10.0	↓	↓	7.04	6.42	0.713	0.24	-75.1	
1450	12.0	↓	↓	6.98	6.44	0.713	0.24	-76.8	8.35
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1455	SHM-99-32K100208				

Comments

purged for 15 min @ 400 ml/min before starting monitoring
sample clear & odorless

Signature

10/2/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM-99-31A

Date: 10/2
Sampler: TG + Brian T
PID Reading: 0

Start Time: 1350 **End Time:** 1410
Well Construction: 2" PVC
Depth to water: 1.61
Well Depth: 15.65
Water Column: 14.04
Total Volume Removed (L) 14.0

Field Testing Equipment

Make	Model	Serial #
YSI	650 MDS	05K0558AO
YSI	600 XLM	04J1599AD
Lamotte	2020	1680-0500

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1345	6.0	400	1.76	10.68	5.89	0.159	0.46	32.8	
1350	8.0		1.76	10.65	5.86	0.159	0.36	32.3	
1355	10.0		1.76	10.64	5.83	0.159	0.19	30.7	
1400	12.0		1.76	10.67	5.81	0.161	0.16	29.1	
1405	14.0	↓	1.76	10.67	5.80	0.159	0.15	28.0	1.37

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1410	SHM-99-31A 100305				

Comments

Purged 15 min @ 400 mL/min before start of monitoring
Sample clear colorless

Signature

10/2/05
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM-05-40X
Start Time: 1245 **End Time:** 1320
Well Construction: 2" PVC
Depth to water: 13.71
Well Depth: 33.53
Water Column: 19.82
Total Volume Removed (L) 12.0

Date: 10/2/08
Sampler: Tyler Bassett
PID Reading: 0

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03K0558AN
YSI	600XLR	04J1579AD
LaMotte	2020	1680-0502

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1300	6.0	400	13.76	7.61	6.57	0.557	0.48	-103.0	
1305	8.0	↓	13.76	7.43	6.56	0.551	0.25	-100.8	
1310	10.0		13.76	7.65	6.57	0.549	0.23	-100.9	
1315	12.0	↓	13.76	7.91	6.58	0.549	0.22	-104.2	14.3
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1320	SHM-05-40X 100208				

Comments

Purged 15 min @ 400 ml/min before start of monitoring
Sample ~~clear~~ + colorless
slightly silty

Signature

10/2/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM-05-39A

Date: 10/2/08
Sampler: Tyler Brandt
PID Reading: 0

Start Time: 1145 **End Time:** 1240
Well Construction: 2" PVC
Depth to water: 10.88
Well Depth: 38.58
Water Column: 27.7
Total Volume Removed (L) 24.0

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03K0558AB
YSI	600XLM	04J1559AD
Lamotte	2020	1680-0900

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1215	15.0	500	11.05	7.84	6.70	0.515	1.81	-70.6	
1220	17.5	500	11.05	7.65	6.53	0.494	0.47	-72.9	
1225	20.0	500	11.10	7.76	6.45	0.490	0.26	-76.5	
1230	22.0	400	11.10	7.65	6.39	0.491	0.22	-77.3	
1235	24.0	400	11.10	7.58	6.38	0.493	0.30	-76.1	1.19

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1240	SHM-05-39A 100308				

Comments

Purged for ~30 min @ 500 ml/min before start of monitoring
Sample clear colorless

Signature

10/2/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM-05-39B
Date: 10/2/08
Sampler: [illegible]
PID Reading: 0

Start Time: 1050 End Time: 1215
Well Construction: 2" PVC
Depth to water: 13.5
Well Depth: 67.05
Water Column: 53.55
Total Volume Removed (L): 19.0

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	[illegible] AG
YSI	600XLR	04515335 AD
LaMotte	2020	1680-0900

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1110	4.0	200	17.42	8.68	7.01	0.983	0.52	-2.3	
1115	4.75	150	17.74	9.39	6.93	0.975	0.53	-5.2	
1120	5.50	150	18.45	9.65	6.96	0.983	0.44	-9.5	
1125	7.0	300	19.32	9.38	6.87	0.963	0.30	-32.7	
1130	8.5	300	21.5	9.40	6.85	0.933	0.26	-51.4	
1135	10.0	300	21.77	9.46	6.85	0.918	0.34	-53.1	
1140	11.5	300	22.53	9.46	6.85	0.915	0.25	-59.5	
1145	12.5	200	23.51	9.55	6.83	0.895	0.21	-59.5	
1150	13.5	200	24.43	9.35	6.85	0.906	0.22	-62.6	
1155	16.0	500	25.55	9.22	6.86	0.888	0.48	-60.2	
1200	17.0	200	26.30	9.31	6.86	0.895	0.31	-63.6	
1205	18.0	200	26.75	9.60	6.84	0.903	0.25	-65.4	
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1215	SHM-05-39B 100208				

Comments

Purged for about 20 min before beginning monitoring (~4 liters)

[signature] Signature   10/2/08 Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM-05-39B

Date: 10/2/08
Sampler: Tyler Bennett
PID Reading: 0

Start Time: 1050 End Time: 1215
Well Construction: page 1
Depth to water:
Well Depth:
Water Column:
Total Volume Removed (L)

Field Testing Equipment

Make	Model	Serial #
page 1		

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1210	1960	200	26.78	9.88	6.86	0.879	0.25	-78.3	7.81
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1215	SHM-05-39B 100208				

Comments: Sample clear to slightly

Signature

10/2/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM-99-22C

Date: 10/2/08
Sampler: Tyler Barrett
PID Reading: 0

Start Time: 0745 **End Time:** 1015
Well Construction: 4" PVC
Depth to water: 7.64
Well Depth: >100.'
Water Column: ?
Total Volume Removed (L) 50.25

Field Testing Equipment

Make	Model	Serial #
YSI	650 MDS	02K0578AB
YSI	600 XLR	04J1555AD
Lamotte	2020	1680-0410

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
0810	35.0	600	25.07	7.53	7.80	0.249	0.23	77.4	
0815	37.0	400	25.75	7.33	7.77	0.246	0.19	32.8	
0820	35.00	400	26.3	7.34	7.77	0.244	0.17	1.0	
*0925	40.5	300	28.27	11.63	7.86	0.1005	10.71	57.0	
0935	43.5	300	29.35	7.02	7.58	0.277	0.47	-83.1	
0940	44.5	200	29.75	7.35	7.73	0.266	0.55	-88.7	
0945	45.5	200	29.97	7.53	7.80	0.262	0.59	-89.1	
0950	46.25	150	30.32	7.62	7.83	0.259	0.48	-94.2	
0955	47.25	200	30.52	7.65	7.85	0.256	0.46	-93.6	
1000	48.25	200	30.70	7.58	7.86	0.255	0.37	-94.9	
1005	49.25	200	30.87	7.64	7.86	0.256	0.34	-97.2	
1010	50.25	200	30.97	7.75	7.87	0.256	0.31	-96.6	5.16
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1015	SHM-99-22C 100208				

Comments
- Sample clear & odorless
- Purged ~35 liters for 25 min before reducing flow rate to begin monitoring. Generator ran out of gas so we stopped purging for ~1 hr. Well did not recharge [illegible] so we could purge ~0580
- *YSI screen froze @0925 (hence high readings); hard reboot corrected issue.

Signature: [signature]

Date: 10/2/08

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM05 42A 10022008

Date: 10-2-08
Sampler: Michael Ricci'o
PID Reading: 0

Start Time: 1150 End Time: 1250
Well Construction: 1" PVC
Depth to water: 4.50'
Well Depth: 44.34'
Water Column: 39.84'
Total Volume Removed (L) 30.0

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0643AF
YSI	650 MDS	02E0534AM
Lamotte	2020	1680-0900
Geotech	Geopump	H06003023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1155	2.5	500	4.50	10.33	6.70	.043	3.57	0.6	31.0
1205	7.5	500	4.50	10.20	6.34	.033	3.63	59.5	14.6
1215	12.5	500	4.50	10.15	6.22	.032	3.67	92.7	2.76
1225	17.5	500	4.50	10.11	6.18	.033	3.67	119.5	1.80
1235	22.5	500	4.50	10.14	6.13	033	3.67	151.2	0.97
1240	25.0	500	4.50	10.12	6.11	.033	3.65	167.4	0.85
1245	27.5	500	4.50	10.13	6.10	.033	3.65	171.0	0.92
1250	30.0	500	4.50	10.15	6.10	.033	3.65	179.6	0.64
Acceptance Criteria:			± 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1250	SHM05 42A 10022008	250 mL plastic	1	None	Alk
1250	SHM05 42A 10022008	250 mL plastic	1	HNO3	Metals
1250	SHM05 42A 10022008	500mL plastic	1	None	Turb, Cl, NO3, SO4

Comments

Signature

10-2-08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM0542B 10022008
Start Time: 1055 End Time: 1150
Well Construction: 1" PVC
Depth to water: 4.07'
Well Depth: 73.62'
Water Column: 69.53'
Total Volume Removed (L) 27.5

Date: 10-2-08
Sampler: Michelloccio / Nicole Edwards
PID Reading: 0

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0643 AF
YSI	650MDS	02E0534 AM
Lamotte	2020	1680-0900
Geotech	Geopump	H06003023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1100	2.5	500	4.07	10.37	6.71	.510	.53	-70.8	15.2
1110	7.5	500	4.07	10.34	6.70	.526	.33	-73.9	13.8
1120	12.5	500	4.07	10.34	6.70	.529	.23	-75.7	6.64
1130	17.5	500	4.07	10.30	6.70	.530	.15	-77.1	5.95
1135	20.0	500	4.07	10.31	6.68	.531	.14	-77.8	5.63
1140	22.5	500	4.07	10.30	6.66	.531	.13	-78.5	6.52
1145	25.0	500	4.07	10.30	6.67	.531	.13	-78.9	6.34
1150	27.5	500	4.07	10.31	6.67	.530	.13	-77.0	6.35
Acceptance Criteria:			≤ 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1150	SHM0542B10022008	250 ml plastic	1	None	Alk
1150	SHM0542B10022008	250 ml plastic	1	HNO_3	Metals
1150	SHM0542B10022008	500 ml plastic	1	None	Turb, Cl, NO_3, SO_4

Comments

[signature]
Signature

10-2-08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM 05-41A 10022008

Date: 10/2/08
Sampler: Nicole Edwards / Mike K.
PID Reading: 0

Start Time: 745 **End Time:** 835
Well Construction: 2" PVC
Depth to water: 9.91'
Well Depth: 40.61'
Water Column: 29.70
Total Volume Removed (L) 20

Field Testing Equipment

Make	Model	Serial #
YSI	6000XL	01K0643AF
YSI	650MDS	02E0539AH
Lamotte	2020	1680-0900
Geotech	Geopump	406003023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
750	2	400	9.91	10.47	6.66	.066	1.57	116.7	10.99
800	6	400	9.91	10.46	6.70	.054	0.38	45.2	6.05
810	10	400	9.91	10.43	6.73	.053	0.29	17.3	2.12
820	14	400	9.91	10.43	6.74	.052	0.30	11.8	1.67
825	16	400	9.91	10.53	6.75	.053	0.28	11.9	1.19
830	18	400	9.91	10.44	6.74	.052	0.25	11.6	1.58
835	20	400	9.91	10.47	6.73	.052	0.27	10.8	1.96

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
835	SHM 05 41A 10022008	250 mL plastic	3	NaOH	Al/K
835	SHM 05 41A 10022008	250 mL plastic	3	HNO_3	Metals
835	SHM 05 41A 10022008	500 mL plastic	3	None	Turb, Cl, NO_3, SO_4

Comments MS/MSD taken

Signature

10/2/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHM 0541C 10022008
Start Time: 850 End Time: 940
Well Construction: 2" PVC
Depth to water: 9.85
Well Depth: 85.61
Water Column: 75.76
Total Volume Removed (L) 20

Date: 10/2/08
Sampler: Michael Ricco / Nicole Edmunds
PID Reading: 0

Field Testing Equipment

Make	Model	Serial #
YSI	6000XL	02E0643AF
YSI	650 MDS	02E0534AM
Lamotte	2020	1610-0900
Geotech	Geopump	HOBO0023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
900	4	400	9.85	10.81	7.35	.528	0.29	-133.2	76.0
910	8	400	9.85	10.82	7.43	.492	0.15	-140.5	22.3
920	12	400	9.85	10.81	7.43	.490	0.14	-146.7	9.72
930	16	400	9.85	10.82	7.44	.491	0.13	-148.7	7.62
935	18	400	9.85	10.80	7.44	.491	0.12	-149.3	5.30
940	20	400	9.85	10.81	7.45	.491	0.12	-141.5	4.20

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
940	SHM 05 41C 10022008	250 mL plastic	1	None	Alk
940	SHM 05 41C 10022008	250 mL plastic	1	HNO3	Metals
940	SHM 05 41C 10022008	500mL Plastic	1	None	Turb, Cl, NO2, SO4

Comments

Signature

10-2-08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF

Location: Ayer, MA

Well ID: SHL-11

Date: 10/3/08

Sampler: Tyler Bennett

PID Reading: 0

Start Time: 1255 **End Time:** 1340

Well Construction: 2" PVC

Depth to water: 18.40

Well Depth: 29.70

Water Column: 11.30

Total Volume Removed (L) 12.0

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	02K0548AB
YSI	600XLR	04J1559AD
LaMotte	2020	2496-1501

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1310	4.5	300	18.45	8.64	7.03	0.450	0.36	-74.5	43.4
1315	6.0	300	18.45	8.57	6.83	0.455	0.33	-75.0	29.8
1320	7.5	300	18.45	8.55	6.71	0.456	0.32	-74.4	24.0
1325	9.0	300	18.45	8.57	6.62	0.455	0.32	-73.8	19.8
1330	10.5	300	18.45	8.59	6.56	0.454	0.32	-73.6	17.5
1335	12.0	300	18.45	8.72	6.50	0.451	0.34	-72.1	19.2
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1340	SHL-11100308				

Comments

Purged 15 min @ 300 ml/min before monitoring began

Sample slightly silty & odorless

[signature]
Signature

10/3/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHP-93-100
Start Time: 1135 **End Time:**
Well Construction: 4" Metal
Depth to water: 29.60
Well Depth:
Water Column:
Total Volume Removed (L) 18.75

Date: 10/3/08
Sampler: Tyler Bennett
PID Reading: 0

Field Testing Equipment

Make	Model	Serial #
YSI	650 MDS	02K0538AB
YSI	600XLM	04J1559AD
Lamotte	2020	2496-1501

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1150	7.5	400	32.20	7.75	10.65	0.278	0.78	1.1	39.7
1155	9.5	400	32.88	8.63	11.00	0.309	0.21	-3.8	49.3
1200	11.5	400	33.19	8.64	11.13	0.310	0.32	-6.6	49.9
1205	13.25	350	33.63	8.43	11.25	0.311	0.18	-9.7	63.0
1210	14.0	150	34.15	8.74	11.28	0.311	0.21	-11.1	74.3
1215	15.5	300	34.54	8.53	11.32	0.313	0.18	-13.9	79.5
1220	17.0	300	35.21	8.83	11.33	0.313	0.11	-14.2	86.8
1225	18.75	250	35.73	8.99	11.35	0.312	0.12	-15.7	82.7

Acceptance Criteria: < 0.3 ft 3% ± 0.1 3% 10% ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1230	SHP-93-100 100308				

Comments

Purged 15 min @ 500 ml/min before monitoring began
Sample slightly silty + odorless

Signature

10/3/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHm-93 DC

Date: 10/3/08
Sampler: Tyler Barrett
PID Reading: 0

Start Time: 1015 **End Time:** 1120
Well Construction: 4" PVC
Depth to water: 28.73
Well Depth: 56.50
Water Column: 27.77
Total Volume Removed (L) 24.0

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	08K0558 AB
YSI	6000LS	04J1599SAD
Lamotte	2020	2496-1501

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1035	8.0	400	30.40	8.13°	7.01	0.413	1.65	62.2	7.39
1040	10.0	400	30.50	8.40	7.08	0.414	1.43	45.6	6.55
1045	12.0	400	30.54	8.44	7.14	0.413	1.22	26.6	5.02
1050	14.0	400	30.62	8.53	7.19	0.413	1.17	10.7	4.24
1055	16.0	400	30.62	8.93	7.23	0.412	1.24	0.4	3.91
1100	18.0	400	30.62	8.46	7.24	0.414	1.07	-5.0	4.1
1105	20.0	400	30.74	8.69	7.25	0.411	0.93	-8.5	3.36
1110	22.0	400	30.77	8.84	7.26	0.411	0.86	-11.2	3.0
1115	24.0	400	30.81	8.67	7.27	0.411	0.77	-12.0	2.67
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1120	SHm-93-10C 100308				

Comments

Purged for 20 min (6 vol) before monitoring began. Sample clear + odorless

Signature

10/3/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF

Location: Ayer, MA

Well ID: SHL-10

Date: 10/3/08

Sampler: Tyler Barrett

PID Reading: 0

Start Time: 0830 **End Time:** 0945

Well Construction: 2" PVC

Depth to water: 30.62

Well Depth: 38.65

Water Column: 8.03

Total Volume Removed (L) 28.0

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	02K0598AB
YSI	600XLR	04J1599AD
Lamotte	2020	~~[illegible]~~ (TD) 2456-2501

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
0845	6.0	400	30.71	9.26	7.42	0.070	11.59	149.3	
0850	8.0	400	30.71	9.15	7.24	0.069	11.56	144.4	
0855	10.0	400	30.71	9.23	7.12	0.069	11.46	142.9	
0900	12.0	400	30.71	9.33	7.00	0.069	11.45	140.4	
0905	14.0	400	30.71	9.30	6.93	0.068	11.46	138.7	
0910	16.0	400	30.71	9.37	6.87	0.068	11.41	135.3	
0915	18.0	400	30.71	9.56	6.83	0.069	11.29	129.7	
0920	20.0	400	30.71	9.71	6.79	0.069	11.31	115.1	
0925	22.0	400	30.71	9.83	6.74	0.068	11.33	112.3	
0930	24.0	400	30.71	9.82	6.73	0.069	11.31	103.7	
0935	26.0	400	30.71	9.78	6.71	0.068	11.85	93.7	
0940	28.0	400	30.71	9.57	6.69	0.068	11.33	95.1	3.09
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
~~[illegible]~~ 0945	SHL-10100308				

Comments

Purged for 15 min @ 400 ml/min before monitoring began
Sample clear + odorless

[signature]
Signature

10/3/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHL15 100308

Date: 10-3-08
Sampler: Michael Rocco
PID Reading: 0

Start Time: 815 **End Time:** 900
Well Construction: 4" PVC
Depth to water: 18.04
Well Depth: 26.34
Water Column: 8.30
Total Volume Removed (L) 22.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0643AF
YSI	650MDS	02E0534A14
Lamotte	2020	1680-0900
Eurotech	Geopump	M0600 3023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
830	7.5	500	18.04	12.43	5.89	.141	.45	42.0	5.43
840	12.5	500	18.04	12.88	5.75	.140	.34	42.2	1.10
850	17.5	500	18.04	12.41	5.69	.140	.15	42.0	1.30
855	20.0	500	18.04	12.90	5.69	.139	.14	40.9	1.00
900	22.5	500	18.04	12.90	5.69	.140	.13	41.3	1.40

Acceptance Criteria:	< 0.3 ft	3%	± 0.1	3%	10%	±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
900	SHL15 100308	250 mL plastic	1	None	Alk
900	SHL15 100308	250 ml plastic	1	HNO_3	NH3
900	SHL15 100308	500 ml plastic	1	None	Turb, Cl, NO_3, SO_4

Comments Purged for 15 min. before recording data

Signature

10-3-08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHL19 100308

Date: 10-30 08
Sampler: Michael/Rocco
PID Reading: 0

Start Time: 1215 **End Time:** 1250
Well Construction: 4" PVC
Depth to water: 22.36
Well Depth: 32.34
Water Column: 9.98
Total Volume Removed (L) 17.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0643AF
YSI	650 MDS	02E0534AM
Lamotte	2020	1680-0900
Geotech	Geopump	H06003023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1235	10.0	500	22.36	12.94	6.08	.149	0.29	4.4	68.9
1240	12.5	500	22.36	13.00	6.05	.149	0.28	4.8	60.8
1245	15.0	500	22.36	13.04	6.04	.149	0.29	5.1	59.4
1250	17.5	500	22.36	13.04	6.05	.149	0.28	5.3	60.5

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mV

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1250	SHL19 100308	250 mL plastic	1	None	AIK
1250	SHL19 100308	250 mL plastic	1	HNO_3	Metals
1250	SHL19 100308	500 mL plastic	1	None	TotCl, SO_4, Alk
1250	SHL19 100308F	~~250 mL~~ 500 ml	1	None	Dissolved Metals
		(AA) Plastic			

Comments Purged for 20 min then took readings

Signature

10-30 08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHL 20100308

Date: 10-3-08
Sampler: Michael Rocco
PID Reading: 0

Start Time: 1310 **End Time:** 1355
Well Construction: 4" PVC
Depth to water: 18.72
Well Depth: 50.47
Water Column: 31.75
Total Volume Removed (L) 22.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01R0643AF
YSI	650MDS	02E0534AM
Lamotte	2020	1680-0900
Geotech	Geopump	H08FC3023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1325	7.5	500	18.72	12.01	6.64	.295	0.66	14.4	17.1
1335	12.5	500	18.72	11.95	6.61	.299	0.30	30.8	14.7
1345	17.5	500	18.72	12.06	6.51	.300	0.21	63.6	14.7
1350	20.0	500	18.72	12.10	6.48	.300	0.20	83.4	13.3
1355	22.5	500	18.72	12.18	6.44	.301	0.19	90.1	13.2
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1355	SHL 20 100308	250 mL plastic	1	None	AR
1355	SHL 20 100308	250 ml plastic	1	HNO3	Metals
1355	SHL 20 100308	500 ml plastic	1	None	Turb, Cl, NO_3, SO_4

Comments Purged for 15 min before recording data

Signature

10-3-08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHL4100308

Date: 10-3-08
Sampler: Michael Ricci
PID Reading: 0

Start Time: 1115 End Time: 1155
Well Construction: 2" PVC
Depth to water: 10.09
Well Depth: 15.54
Water Column: 5.45
Total Volume Removed (L) 20.0

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0643AF
YSI	650MDS	02E0534AM
Lamotte	2020	1680-0900
~~Hydrolab~~	Geopump	H08003023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1130	7.5	500	10.09	12.40	5.68	.069	.91	264.9	5.72
1140	12.5	500	10.09	11.84	5.66	.058	.88	276.9	2.34
1145	15.0	500	10.09	11.86	5.73	.054	.90	277.8	1.08
1150	17.5	500	10.09	11.85	5.72	.054	.87	280.8	1.17
1155	20.0	500	10.09	11.80	5.71	.053	.91	201.3	1.04

Acceptance Criteria: < 0.3 ft 3% ± 0.1 3% 10% ±10mV

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1155	SHL4100308	250 mL plastic	1	None	Alk
1155	SHL4100308	250 mL plastic	1	HNO3	Metals
1155	SHL4100308	500 mL plastic	1	None	Turb, Cl, NO3, SO4

Comments: Purged for 15 min. before taking data

Signature

10-3-08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF

Location: Ayer, MA

Well ID: N5-P1

Date: 10/3/08

Sampler: [illegible]

PID Reading: 0

Start Time: 1410 End Time: 1455

Well Construction: 1.5" PVC

Depth to water: 23.70

Well Depth: 32.65

Water Column: 8.95

Total Volume Removed (L) 13.0

Field Testing Equipment

Make	Model	Serial #
YSI	650MDS	03K0558AB
YSI	600XLR	04J1555AD
LaMotte	2020	2496-1501

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1425	4.25	250	*	7.82	6.07	0.999	0.58	-57.0	3.0
1430	6.0	↓		7.75	6.06	0.997	0.45	-55.5	0.90
1435	7.75			7.70	6.05	0.994	0.40	-57.5	0.87
1440	9.50			7.67	6.05	0.994	0.39	-57.8	0.83
1445	11.25			7.65	6.05	0.993	0.34	-55.5	0.0
1450	13.0	↓	23.75	7.66	6.04	0.993	0.34	-53.4	0.0
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1455	N5-P1 100308				

Comments

Purged for 15 min @ 250 ml/min before monitoring began

* Waterlevel probe would not fit with tubing in well

[signature] Signature

10/3/08 Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: N5 P2 100308
Start Time: 1230 **End Time:** 1315
Well Construction: 1" PVC
Depth to water: 23.28
Well Depth: 100.92
Water Column: 77.64
Total Volume Removed (L) 8.00

Date: 10-3-05
Sampler: Nadine/Riccio
PID Reading: 0

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0645AF
YSI	650MDS	02E0534AM
Lamotte	2020	1680-0900
Geotech	Grapnump	H06003023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1445	3.25	250	23.28	12.73	6.73	.425	1.32	-63.2	5.92
1455	5.75	250	"	11.87	6.64	.414	.37	-64.9	6.32
1505	6.50	250	"	11.61	6.65	.446	.43	-63.4	6.88
1510	7.25	250	"	11.62	6.66	.453	.32	-64.2	6.54
1515	8.00	250	"	11.62	6.65	.460	.32	-64.3	6.01

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
~~1315~~	~~N5 P2 100308~~	250 ml plastic	1	None	Alk
~~1315~~ 1515	N5 P2 100308	250 ml plastic	1	HNO3	Metals
~~1315~~ 1515	N5 P2 100308	500 ml plastic	1	None	Turb, Cl, NO3, SO4

Comments Water meter could not fit with tubing. took water level reading after samples were collected

Signature

10-3-05
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHL-23
Start Time: 0905 **End Time:**
Well Construction: 4" PVC
Depth to water: 27.14'
Well Depth: 53.42
Water Column:
Total Volume Removed (L) 37.5 L

Date: 10/6/08
Sampler: DR
PID Reading: N/A

Field Testing Equipment

Make	Model	Serial #
LaMotte	2020 Turbidity	2496-1501
YSI	650 MDS	02K0598 AB
Grundfos		
Solonist	WLI	47560

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
0920	7.5	500	27.25	7.49	8.70	0.041	15.69	—	—
1000	27.5	500	27.28	7.91	8.50	0.047	12.26	173	0.36
1005	30	500	27.28	8.06	7.22	0.042	12.23	175	0.51
1010	32.5	500	27.27	8.07	6.48	0.041	12.19	180	0.34
1015	35	500	27.28	8.05	6.04	0.041	12.16	183	0.54
1020	37.5	500	27.28	8.20	5.94	0.041	12.11	184	0.51
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mV	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1020	SHL-23-100608		3		
1020	DUP-02-100608		3		

Comments Had to replaced DO membrane & recal after 1st reading well was left purging.

DR
Signature

10/6/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHL-21

Date: 10/6/08
Sampler: DR
PID Reading: N/A

Start Time: 1040 **End Time:**
Well Construction:
Depth to water: 44.90
Well Depth: 54.91
Water Column:
Total Volume Removed (L)

Field Testing Equipment

Make	Model	Serial #
Lamotte	2020	2496-1501
YSI	650 MDS	02L0598 AB
GrundFos		
Solonist	U-1	47560

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1050	5	500	44.96	7.97	5.93	0.068	10.07	154	0.17
1100	10	500	44.97	8.84	6.00	0.068	9.04	145	0.07
1125	22.5	500	44.97	9.69	6.02	0.066	8.76	126	0.78
1130	25	500	44.97	9.63	6.02	0.066	8.82	127	0.61
1135	27.5	500	44.97	9.78	6.02	0.066	8.78	127	0.91

Acceptance Criteria: < 0.3 ft | 3% | ± 0.1 | 3% | 10% | ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1135	SHL-21-100608				

Comments

Signature

10/6/08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHP-0136x

Date: 10-6-08
Sampler: EG/MR
PID Reading: 0

Start Time: 0955 **End Time:** 1045
Well Construction: 1" steel
Depth to water: 7.77
Well Depth: 12.7
Water Column: 5.07
Total Volume Removed (L) 20.0

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01K0143AF
YSI	650MDS	02E053 AM
Lamotte	2020	1550-0902
Geopump	-	H06003023

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1025	15.0	500	7.77	17.27	6.46	.221	0.36	-34.6	3.22
1030	17.5	500	7.77	17.40	6.40	.219	0.21	-38.9	0.75
1035	20.5	500	—	17.37	6.37	.219	0.16	-38.7	0.31
Acceptance Criteria:		< 0.3 ft		3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1040	SHP-0136x-100608	500mL Poly	1	None	Turbidity, Cl, NO3, SO4
1040	SHP-0136x-100608	250mL Poly	1	None	Alkalinity
1040	SHP-0136x-100608	250mL Poly	1	HNO3	Metals

Comments
* Purged for 30 min prior to taking readings
* Well will not fit water level and tubing

Signature: [signature]

Date: 10-6-08

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHP-01372

Date: 10-6-08
Sampler: EW MR
PID Reading: 0

Start Time: 0910 **End Time:** 1015
Well Construction: 1" PVC
Depth to water: 6.52
Well Depth: 10.99
Water Column: 4.47
Total Volume Removed (L) 27.5

Field Testing Equipment

Make	Model	Serial #
YSI	600XL	01101143AF
YSI	650MDS	02E0534AM
Geopump	—	H0600 3023
Lamotte	2020	1680-0906

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
0955	22.5	500	6.52	15.48	6.65	0.176	0.72	-67.3	0.8
1000	2.5	500	—	15.60	6.55	.175	0.15	-56	0.19
1005	2.5	500	—	15.59	6.51	.175	0.12	-54.2	0.09
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mV	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
1010	SHP-01372 100608	250mL Poly	1	HNO_3	metals
1010	SHP-01372 100608	250mL Poly	1	None	Alkalinity
1010	SHP-01372-100608	500mL Poly	1	None	Turbidity, Cl, NO_3, SO

Comments
* Purged for 45 minutes before taking readings
* Well too skinny to fit water level in well with tubing

[signature]

Signature

10-6-08

Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHPO138A

Date: 10/6/08
Sampler: E.L./M.R.
PID Reading: 0

Start Time: 0900 **End Time:** 0950
Well Construction: 1" PVC
Depth to water: 4.00
Well Depth: 8.16
Water Column: 4.30
Total Volume Removed (L) 22.5

Field Testing Equipment

Make	Model	Serial #
YSI	100XL	01K0643AF
YSI	600QS	02E0534AM
GeoPUMP		07330
Lamotte	2020	1120-0140

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
0915	7.5	500	4.00	12.91	6.34	.416	0.22	-56.7	0.45
0920	2.5	500	—	12.92	6.34	.416	0.20	-58.2	0.17
0925	2.5	500	—	12.94	6.33	.416	0.18	-58.6	0.16
0930	2.5	500	—	12.94	6.32	.417	0.17	-59.4	0.09
0935	2.5	500	—	12.96	6.32	.417	0.16	-59.9	0.07
0940	2.5	500	—	12.98	6.31	.418	0.15	-60.3	0.06
0945	2.5	500	—	12.96	6.30	.418	0.15	-60.9	0.04
Acceptance Criteria:			< 0.3 ft	3%	± 0.1	3%	10%	±10mv	

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
0945	SHPO138A100608	250 Poly	5	None	Alkalinity
0945	SHPO138A100608	250 Poly	3	HNO3	MetalS
0945	SHPO138A100608	500ML Poly	3	None	Turbidity, Cl, NO3, SO4

Comments
* Purged for 15 min Prior to Taking Readings
* - Water Level meter does not fit with Tubing
* MS/MSD Taken

Signature

10-1-08
Date

Environmental Chemical Corporation

Low Flow/Low Stress Groundwater Sampling Log

Project: Shepley's Hill LF
Location: Ayer, MA
Well ID: SHP-9929X

Date: 10-6-08
Sampler: EG / MR
PID Reading: 0

Start Time: 1130 End Time:
Well Construction: 2" PVC
Depth to water: 24.46
Well Depth: 30.73
Water Column: 6.27
Total Volume Removed (L) 20.0

Field Testing Equipment

Make	Model	Serial #
YSI	600X	01K0643 AF
YSI	650MDS	02E0534 AM
GeoPump		HH003023
LaMotte	2020	1680 0700

Time	Volume Removed (liters)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (celsius)	pH (STD)	SPC mS/cm	DO (mg/L)	ORP (mV)	Turbidity
1140	5.0	500	24.46	11.6	5.48	.293	0.61	5.1	403
1145	2.5	500	24.46	11.68	5.39	.267	0.37	3.0	23.0
1200	7.5	500	24.46	11.70	5.3	.226	0.24	13.9	8.8
1205	2.5	500	24.46	11.72	5.28	.227	0.21	14.5	6.8
1210	2.5	500	24.46	11.83	5.30	.225	0.21	14.3	4.1
1215	2.5	500	24.46	11.77	5.30	.226	0.22	14.6	4.4

Acceptance Criteria: < 0.3 ft 3% ± 0.1 3% 10% ±10mv

2" screen volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# of Bottles	Preservative	Analyses
	SHP-9929X-100608	500ML Poly	1	NONE	Turbidity, Cl, NO3, SO4
	SHP-9929X-100608	250ML Poly	1	NONE	Alkalinity
	SHP-9929X-100608	250ML Poly	1	HNO3	METALS

Comments

Signature

10-6-08
Date

Appendix D

Analytical Data Validation Reports

February 3, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

INTRODUCTION

This data validation report covers fourteen primary water samples, one field duplicate and two equipment blanks collected on January 8, January 9, and January 10, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on January 10, 2008 and assigned sample delivery group (SDG) number L0800400, upon receipt. Alpha analyzed the samples for dissolved gases (methane and ethane) by gas chromatography. The associated field sample identification (ID) and Alpha sample ID are presented in Table 2.

AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3. The level of data validation specified in Table 1 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality. Any limitations on the data are listed below. Definitions of data qualifiers added during validation and summaries of specific qualifiers added to each affected sample as a result of the data validation findings are presented in Table 4 attached to this report.

Table 1. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 01/10/08 at temperature of 2°C	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0800400

Table 2. Field Sample List

Lab Sample Number	Field ID	Comments
L0800400-01	SHM-96-5B-010808	
L0800400-02	SHM-96-22B-010908	
L0800400-03	SHM-05-41C-010908	
L0800400-04	SHM-05-41A-010908	
L0800400-05	SHM-05-41B-010908	MS/MSD
L0800400-06	SHM-05-39B-010908	
L0800400-07	SHM-05-42B-010908	
L0800400-08	SHM-05-39A-010908	
L0800400-08	EW-2-011008	
L0800400-09	DUP-010908	Field duplicate of SHM-05-41B-010908

February 3, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Lab Sample Number	Field ID	Comments
L0800400-10	EW-1-011008	
L0800400-11	SHM-99-31A-011008	
L0800400-12	SHM-99-31B-011008	
L0800400-13	SHM-99-31C-011008	
L0800400-14	SHM-99-32X-011008	
L0800400-15	EQP-011008	Equipment blank
L0800400-16	EQG-011008	Equipment blank

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 4. Dissolved Gases (Methane and Ethane) by Gas Chromatography

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data, and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C 3) No sample preservation required. 4) Sample delivery documentation.	Coolers temperature upon arrival at Alpha was 2°C. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous unpreserved sample 7 days and aqueous preserved 14 days. 2) If analysis HT exceeded flag all detected results "J" and nondetected results "UJ" 3) If HT grossly exceeded (≥ 3x HT) flag all detected results "J" and nondetected results "R"	Samples were analyzed within holding time.		
Initial Calibration	1) Minimum of 5 standards. 2) Compounds with RSDs ≤ 15% or "r" ≥ 0.99, values flag detected results "J" and nondetected results "UJ" 3) ICV recovery 80% to 120%.	Initial calibration met established criteria. Calibration was performed on 11/21/2007.		
Continuing Calibration Verification (CCV)	1) No qualification if recovery between 80 – 120%. a) %R >120 or 130% flag detected results "J" b) %R <80 or 70% flag detected results "J" and nondetected results "UJ"	CCV recovery was within acceptance limits.		

February 3, 2008 Dissolved Gases (Methane and Ethane) by Gas Chromatography
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Trip, Field, Rinsate, etc.)	1) Every 20 samples prior to running samples and after calibration standards: 2) Matrix and preservative specific; 3) Target analytes must be < RL 2) Apply TB, FB, RB results to samples with same collection date.	Methane was detected in the method blank WG308658-2 at a concentration of 0.16 ug/L. Methane, at 0.66 ug/L, was detected in EQG-011008 and EQP-011008, respectively.	Methane concentrations in all associated samples were more than 5 times the method blank and/or equipment blanks concentrations. Data usability is not adversely affected by the blanks detections.	None
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recoveries	1) 70-130% recovery; ≤25%RPD a) %R<70% flag detected results "J" and nondetected results "UJ" b) %R>130% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" 2) Qualify all associated samples.	LCS/LCSD recoveries and the RPD were within acceptance criteria.		
Laboratory /Field Duplicate	1) RPD > 25%	Sample SHM-99-31A-011008 was analyzed in duplicate by the laboratory. Sample DUP-010908 was the collected as a field duplicate of sample SHM-05-41B-010908. The RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 70-130%. 2) If background concentration is greater than 4x the spike concentration qualification is not required 3) RPD>30% flag detected results "J"	Sample SHM-05-41B-010908 was used as sample source for MS/MSD. The recoveries and RPD were within acceptance criteria.		

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Qualify detected results with concentrations greater than the highest ICAL standard concentration "J" 2) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Ethane from samples SHM-05-39A-010908, SHM-05-41C-010908, and SHM-05-31B-011008 was detected and reported between the MDL and the RL. Samples SHM-05-42B-010908 and SHM-99-31C-011008 were analyzed at a 4-fold dilution and samples DUP-010908, EW-1-011008, EW-2-011008, SHM-05-39A-010908, SHM-05-41B-010908, and SHM-99-31B-011008 were analyzed at a 10-fold dilution, in order to quantify the methane within the calibration range of the instrument. The laboratory reported both sets of results (initial and dilution) on the data tables.	AMEC J qualified the ethane results from the samples SHM-05-39A-010908, SHM-05-41C-010908, and SHM-05-31B-011008 on the data tables, with a TR (trace level) reason code. AMEC R qualified and rejected the initial methane results from the affected samples, with a Z (not applicable) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Melanie Roshu
Environmental Chemist

REVIEWED BY:

Denise Ladebauche
Environmental Chemist

TABLE 4
Data Validation Qualifiers
Fort Devens, Shepley's Hill Landfill
DVR_SDG_L0800400

Sample ID	Sample Date	EPA Analytical Method	Lab Sample ID	Analyte	Result	Units	Validation Qualifiers	Reason Code
EW-1-011008	1/10/2008		L0800400-11	METHANE	>1026	ug/l	R	Z
EW-2-011008	1/10/2008		L0800400-09	METHANE	>1026	ug/l	R	Z
SHM-05-39A-010908	1/9/2008		L0800400-08	METHANE	>1026	ug/l	R	Z
SHM-05-39A-010908	1/9/2008		L0800400-08	ETHANE	0.478	ug/l	J	TR
SHM-05-41B-010908	1/9/2008		L0800400-05	METHANE	>1026	ug/l	R	Z
SHM-05-41C-010908	1/9/2008		L0800400-03	ETHANE	0.339	ug/l	J	TR
SHM-05-42B-010908	1/9/2008		L0800400-07	METHANE	>1026	ug/l	R	Z
SHM-99-31B-011008	1/10/2008		L0800400-13	METHANE	>1026	ug/l	R	Z
SHM-99-31B-011008	1/10/2008		L0800400-13	ETHANE	0.4	ug/l	J	TR
SHM-99-31C-011008	1/10/2008		L0800400-14	METHANE	>1026	ug/l	R	Z
DUP-010908	1/9/2008		L0800400-10	METHANE	>1026	ug/l	R	Z

Validation Qualifiers:

R — The R qualifier indicates that a result has been rejected due to serious QC problems. It is not possible to definitively determine whether the analyte is present or absent in the sample.

U — The U qualifier indicates that the analyte must be considered to be nondetected at the concentration listed. U qualifiers added during data quality review are typically a result of detections of target analytes in field, trip, or laboratory blanks.

J — The J qualifier indicates that the associated result is quantitatively uncertain. J qualifiers added during validation may indicate a concentration between the method detection limit (MDL) and the method reporting limit (MRL) or a data limitation related to a QC element that exceeds required acceptance limits.

UJ — The UJ qualifier indicates reporting limit is estimated. UJ qualifiers added during validation may indicate either a high or low bias related to a QC element that exceeds required acceptance limits.

Reason Code:

TR — Trace level detect
Z — Result not applicable. Alternate result into the data table

January 28, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

INTRODUCTION

This data validation report covers one water sample collected on January 10, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The sample was dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on January 10, 2008 and assigned sample delivery group (SDG) number L0800407 upon receipt. Alpha analyzed the sample for total arsenic using USEPA Method 6020A. The associated field sample identification (ID) and Alpha sample ID is presented in Table 1.

The level of data validation specified in Table 2 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Arsenic was detected and reported at 3.0 µg/L concentration.

Table 1. Field Sample List

Lab Sample Number	Field ID	Comments
L0800407-01	EFP-011008	

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 01/10/2008 at a temperature of 2°C	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0800407

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Arsenic by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 2°C. The sample was transported to the laboratory, directly from the sampling site. Sample was preserved with HNO3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg – 28 days to analysis	The sample was analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ"	The tune standard met established criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) r^2≥0.995, quadratic calibration (at least 6 points, not forced through zero).	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		

January 28, 2008 Arsenic by USEPA Method 6020A

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards, analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020) : J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Calibration Range/ Results	1) Results >Upper calibration range J qualify detects. 2) Results <Method reporting limit, >method detection limit; J qualify detects (estimated).	Arsenic was detected and reported within the calibration range.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration; flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	Arsenic was not detected in the associated method blank.		
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample, U qualify detects. 4) Sample results >5x blank level, no action required.	Arsenic was not detected in the CCBs at concentrations greater than the method-detection limit. Arsenic was detected in the ICB at 0.0001 mg/L.	The detected sample concentration, at 0.0030 mg/L, was more than 5 times the concentration detected in the ICB. Data usability is not affected by the ICB detection.	None
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results <5x the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check.	1) No qualification required if recovery between 80-120%. a) %R< 80% flag detected results "J" and nondetected results "UJ". b) %R >120% flag detected results "J". c) %R<10% flag detected results "J" and nondetected results "R".	ICS-A/ICS-AB recoveries were within acceptance limits.		

January 28, 2008 Arsenic by USEPA Method 6020A
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a)%R<30% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" and nondetected results "UJ"	IS recoveries were within the acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits at 99% and 102%.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND: J- detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No laboratory duplicate was associated with this sample.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 40% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND; J- detections, UJ qualify non detects. 2) ± MRL for results ≤ 5x the MRL	No field duplicate was associated with this SDG.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	No MS/MSD was associated with this SDG.		

January 28, 2008 **Arsenic by USEPA Method 6020A**

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-150% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects. b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	PDS recovery was within acceptance limits at 104%.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50-times MDL 3) %D>10% flag detected results "J"	The %D for the SD performed on sample EFF-011008 could not be evaluated due to sample concentration less than 50 times the MDL.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration a) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Arsenic was reported as detected and the required reporting limit of 0.003 mg/L was met.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Melanie Roshu
Environmental Chemist

REVIEWED BY:

Denise Ladebauche
Environmental Chemist

March 11, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

INTRODUCTION

This data validation report covers one water sample collected on February 13, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The sample was dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on February 14, 2008 and assigned sample delivery group (SDG) number L0802104 upon receipt. Alpha analyzed the sample for total arsenic using USEPA Method 6020A. The associated field sample identification (ID) and Alpha sample ID is presented in Table 1.

The level of data validation specified in Table 2 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Arsenic was detected and reported at 3.0 µg/L concentration.

Table 1. Field Sample List

Lab Sample Number	Field ID	Comments
L0802104-01	EFF-021308	3 ppb detection limit

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 02/14/2008 at a temperature of 2°C	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0802104

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Arsenic by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 2°C Sample was preserved with HNO3 to pH<2 The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg – 28 days to analysis	The sample was analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ"	The tune standard met established criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) $r^2 \geq 0.995$, quadratic calibration (at least 6 points, not forced through zero).	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		

March 11, 2008 **Arsenic by USEPA Method 6020A**
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards, analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020) : J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Calibration Range/ Results	1) Results >Upper calibration range J qualify detects. 2) Results <Method reporting limit, >method detection limit; J qualify detects (estimated).	Arsenic was detected and reported within the calibration range.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration; flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	Arsenic was not detected in the associated method blank.		
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample: J) qualify detects 4) Sample results >5X blank level, no action required.	Arsenic was not detected in the ICB or CCBs at concentrations greater than the method-detection limit.		
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results ≤5x the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ"	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120% a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a)%R<30% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" and nondetected results "UJ"	IS recoveries were within the acceptance limits.		

March 11, 2008 **Arsenic by USEPA Method 6020A**
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits at 98% and 96% respectively.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND: J- detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No laboratory duplicate was associated with this sample.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 40% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND: J- detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No field duplicate was associated with this SDG.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	No MS/MSD was associated with this SDG.		
Post Digestion Spike (PDS)	1) Acceptance limits are 75-150% (EPA Method 6000/7000). 2) Quality results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS was performed on sample EFF-021308. The recovery was within acceptance limits at 102%.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50-times MDL 3) %D>10% flag detected results "J"	The %D for the SD performed on sample EFF-021308 could not be evaluated due to sample concentration less than 50 times the MDL.		

March 11, 2008 **Arsenic by USEPA Method 6020A**
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Arsenic was reported as detected and the required reporting limit of 0.003 mg/L was met.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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REVIEWED BY:

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March 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Anions by USEPA Methods 300.0/353.2

INTRODUCTION

This data validation report covers three primary water samples collected on March 6, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on March 6, 2008 and assigned sample delivery group (SDG) number L0803144, upon receipt. Alpha analyzed the samples for total metals using USEPA 6000/7000 methods; chloride and sulfate using USEPA Method 300.0; and, nitrate using USEPA Method 353.2. The associated field sample identification (ID) and Alpha sample IDs are presented in Table 2.

AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3 and Table 4. The level of data validation specified in Table 1 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality. Any limitations on the data are listed below.

Table 1. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 03/06/08 at a temperature of 8°C	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0803144

Table 2. Field Sample List

Lab Sample Number	Field ID	Comments
L0803144-01	EFF-030608	Metals, Anions
L0803144-02	EW01-030608	Analyzed only for As, Fe, Mn
L0803144-03	EW02-030608	Analyzed only for As, Fe, Mn

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Metals by USEPA Methods 6010B, 6020A, and USEPA Method 7470A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 8°C. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory sample receipt and log in checklist indicates that samples integrity was maintained during transport.	Samples were not affected by the temperature outside of acceptance limits, in consideration of the short time from sample collection to delivery to the laboratory.	None
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg – 28 days to analysis.	Samples were analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU qualify detected results "J" and nondetected results "UJ"	ICP-MS Tune met acceptance criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero).	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICVs met acceptance criteria.		

March 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020); J qualify detects; no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020); J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data.	All CCV recoveries were within acceptance limits.		
Calibration Range/ Results	1) Results >Upper calibration range J qualify detects. 2) Results <Method reporting limit, >method detection limit; J qualify detects (estimated).	Manganese (0.0008 mg/L) and mercury (0.00002 mg/L) from sample EFF-030608 were reported below the method reporting limit.	These analytes were J qualified on the data tables, with a TR (trace level) reason code.	Estimation
Blanks (Method, Field, Equipment Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration; flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	No analytes were detected in the preparation blank associated with these samples.		
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample, U qualify detects. 4) Sample results >5x blank level, no action required.	Silver was detected in the ICB (0.00078 mg/L) and CCB (0.00119 mg/L) associated with sample EFF-030608.	Silver was not detected in sample EFF-030608; therefore data usability is not affected.	None
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results ≤5x the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a) %R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits, except for calcium at 79% in the ICS-A.	AMEC J qualified the detected calcium result from sample EFF-030608, with an I (Instrument performance) reason code.	Low

March 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a)%R<30% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" and nondetected results "UJ"	All internal standards %R were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptable limits.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND; J-detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No laboratory duplicate was associated with this SDG.		
Field Duplicate RPD	1) RPD >20% waters (>30% soils) 2) For detected results more than 5 times their PQLs flag "J" 3) Differences in concentrations > the MRL for analytes with concentrations less than 5 times their PQLs, flag "J"	No field duplicate was associated with this SDG.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	No MS/MSD was associated with this SDG.		

March 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-150% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects. b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	Sample EFF-030608 was used as source for the PDS. The recoveries were within acceptance limits, except for calcium at 70%.	AMEC J qualified the calcium result from sample EFF-030608, with a P (PDS recovery) reason code.	Low
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50-times MDL 3) %D>10% flag detected results "J"	The laboratory performed serial dilution analyses on sample EFF-030608. The %Ds were less than 10% for sample concentrations more than 50 times the MDL.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the MDL, but below the RL should be considered estimated and be flagged "J"	Manganese (0.0011 mg/L) and mercury (0.00002 mg/L) were detected below the RL of 0.01 mg/L and 0.0002 mg/L, respectively, in sample EFF-030608.	AMEC J qualified the manganese and mercury results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 4. Nitrate by USEPA 353.2, and Chloride and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C 3) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 8°C. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.	The sample was not affected by the temperature outside of acceptance limits, in consideration of the	None

March 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
			short time from sample collection to delivery to the laboratory.	
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 353.2)	The sample was analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) $r \geq 0.99$ for chloride, sulfate and nitrate, linear calibration Analytes with low $r < 0.99$ flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met. Chloride and sulfate calibration was performed on 01/16/2008. Nitrate calibration was performed on 03/06/2008.		
ICV/CCV	1) No qualification if recovery between 90-110% (chloride, sulfate and nitrate) and 85-115% (cyanide). a) %R >110% (chloride, sulfate and nitrate) and 115% (cyanide) flag detected results "J" b) %R <90% (chloride, sulfate and nitrate) and 85% (cyanide) flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <5x contaminant concentration and between MDL and MRL, raise result to MRL and flag "U" 2) If sample result is <5x contaminant concentration and ≥ MRL flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	No nitrate, chloride, or sulfate were detected in the associated method blanks.		
ICBs/CCBs	1) Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 80-120% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) 20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ" 2) ± MRL for results ≤ 5x the MRL. Difference >MRL, flag detected results "J" and nondetected results "UJ"	Sample EFF-030608 was analyzed in duplicate for chloride, sulfate, and nitrate. The RPDs were within acceptance criteria.		

March 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	1) RPD ≤ 20% for aqueous samples (≤ 30% soil samples) for analytes with concentrations more than 5 times their PQLs, and concentrations within one MRL for analytes with concentrations less than 5 times their PQLs	No field duplicate was collected with this SDG.		
MS/MSD	1) No qualification required if recovery between 75-125% 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 75% flag detected results "J" and nondetected results "UJ" %R > 125% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample (Qualify results for samples collected at same location but differing depths as well)	Sample EFF-030608 was used as the source sample for MS/MSD for chloride and sulfate. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LDR "J" 2) The reported RL should not be below the lowest ICAL standard concentration. 3) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Sulfate and nitrate were reported as detected above the method reporting limits. Chloride was reported at an elevated reporting limit, due to dilution needed to bring the concentration of the sample within the calibration range.	No qualification is required	None
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.
Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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REVIEWED BY:

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May 5, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

INTRODUCTION

This data validation report covers one water sample collected on April 10, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The sample was dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on April 10, 2008 and assigned sample delivery group (SDG) number L0805053 upon receipt.. Alpha analyzed the sample for total arsenic using USEPA Method 6020A. The associated field sample identification (ID) and Alpha sample ID is presented in Table 1.

The level of data validation specified in Table 2 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Arsenic was detected and reported at 1.0 µg/L concentration.

Table 1. Field Sample List

Lab Sample Number	Field ID	Comments
L0805053-01	EFF-041008	3 ppb detection limit

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 04/10/2008 at a temperature of 4°C.	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0805053

Region 1 Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Arsenic by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 4°C. Sample was preserved with HNO3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg – 28 days to analysis	The sample was analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ"	The tune standard met established criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero).	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		

May 5, 2008 **Arsenic by USEPA Method 6020A**

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020), J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020) , J qualify detects, UJ qualify non detects. c) CCV outside 65-135%, reject data.	All CCV recoveries were within acceptance limits.		
Calibration Range/ Results	1) Results >Upper calibration range J qualify detects. 2) Results <Method reporting limit, >method detection limit; J qualify detects (estimated).	Arsenic was detected and reported within the calibration range.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration, flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	Arsenic was not detected in the associated method blank.		
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whicheyer is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample, U quality detects. 4) Sample results >5x blank level, no action required.	Arsenic was not detected in the CCBs at concentrations greater than the method-detection limit. Arsenic was detected in the ICB at 0.1 µg/L.	The concentration detected in the sample was more than 5 times the ICB concentration; therefore, data usability is not adversely affected.	
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, quality detected results ≤5x the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		
Interelement checks: ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a)%R<30% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" and nondetected results "UJ"	IS recoveries were within the acceptance limits.		

May 5, 2008 Arsenic by USEPA Method 6020A

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits at 93% and 98%, respectively.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND: J-detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No laboratory duplicate was associated with this sample.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 40% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND: J-detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No field duplicate was associated with this SDG.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	No MS/MSD was associated with this SDG.		
Post Digestion Spike (PDS)	1) Acceptance limits are 75-150% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS was performed on sample EFF-041008. The recovery was within acceptance limits at 108%.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50-times MDL 3) %D>10% flag detected results "J"	The %D for the SD performed on sample EFF-041008 could not be evaluated due to sample concentration less than 50 times the MDL.		

May 5, 2008 **Arsenic by USEPA Method 6020A**
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Arsenic was reported as detected and the required reporting limit of 0.003 mg/L was met.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

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May 12, 2008 Metals by USEPA Methods 6010/6020
Region I Data Review Worksheet Other Inorganics by USEPA 2130B/2320B/300.0/9251/4500NO3-F
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

INTRODUCTION

This data validation report covers sixteen primary water samples, one field duplicate, and two field QC (equipment blank) samples collected on April 17, April 18, and April 21, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on April 17, April 18, and April 21, 2008 and assigned sample delivery group (SDG) numbers L0805420, L0805511, and L0805609, upon receipt. Alpha analyzed the samples for total metals using USEPA 6010/6020 methods, turbidity using Standard Method 2130B, total alkalinity using Standard Method 2320B, chloride using USEPA Method 9251, sulfate using USEPA Method 300.0, and nitrate-nitrogen using Standard Method 4500NO3-F. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA and Standard Methods outlined in Table 3, Table 4 and Table 5. The level of data validation specified in Table 2 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and USEPA Region I Tier II Guidance. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality. Any limitations on the data are listed below. Definitions of data qualifiers and summaries of specific qualifiers added to each affected sample as a result of the data validation findings are presented in Table 6 attached to this report.

Table 1. Field Sample List

Lab Sample Number	Field ID	Comments
L0805420-01	SHM-05-42B-041708	
L0805420-02	SHM-05-42A-041708	
L0805420-03	SHM-96-5B-041708	
L0805420-04	SHM-96-5C-041708	
L0805420-05	SHL-59-041708	
L0805420-06	SHL-8D-041708	
L0805420-07	SHL-8S-041708	
L0805609-01	SHM-96-22B-042108	MS/MSD was analyzed by laboratory on this sample
L0805609-02	SHL-22-042108	MS/MSD was indicated by the COC on this sample
L0805609-03	SHM-96-22C-042108	
L0805609-04	SHL-9-042108	
L0805609-05	SHM-05-41B-042108	
L0805609-06	SHM-05-41A-042108	
L0805609-07	SHM-05-41C-042108	
L0805511-01	SHL-21-041808	

May 12, 2008 — **Metals by USEPA Methods 6010/6020**
Region I Data Review Worksheet — **Other Inorganics by USEPA 2130B/2320B/300.0/9251/4500NO3-F**
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Lab Sample Number	Field ID	Comments
L0805511-02	DHL-23-041808	
L0805511-03	EQBLANK-P-041808	Field QC
L0805511-04	EQBLANK-G-041808	Field QC
L0805511-05	DUP-041808	Field Duplicate of SHL-21-041808

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	Three sample coolers were received on 4/17/08, 4/18/08, and 4/21/08 at temperatures of 6, 9, and 6°C.	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0805420 L0805511 L0805609

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Metals by USEPA 6010B/6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package		
COC	1) Sample custody documentation. 2) Temperature 4 ±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Coolers temperatures upon arrival at Alpha were 6, 9, and 6°C. Samples were received by the laboratory the same day they were collected. Not enough time had passed for the samples to reach the specified EPA temperature. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.	No qualification required	
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	Samples were analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ"	ICP-MS tune solution met the required limit.		

May 12, 2008 — **Metals by USEPA Methods 6010/6020**
Region I Data Review Worksheet — **Other Inorganics by USEPA 2130B/2320B/300.0/9251/4500NO3-F**
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Initial Calibration	1) Correct calibration standards. At least 5 standards points not forced through zero are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero).	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICVs met acceptance criteria		
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020), J qualify detects, no qualification is necessary for non detects b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020), J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Calibration Range/ Results	1) Results >Upper calibration range J quality detects. 2) Results <Method reporting limit, >method detection limit; J qualify detects (estimated).	Manganese, potassium, iron, sodium, calcium, and arsenic in some samples from these SDGs were detected at concentrations below the method reporting limit. Alpha J qualified the results less than the method reporting limit and AMEC concurs with these qualifications.	AMEC J qualified detections below the reporting limit with a TR (Trace level detected), reason code.	Estimation
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration; flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	Metals were not detected in the method blank at concentrations greater than the MDL. Calcium was detected at 0.044 mg/L in the equipment blank EQBLANK-G-041808.	The calcium concentrations detected in the associated samples were more than 5 times the equipment blank concentration. No qualification is warranted.	

May 12, 2008 — **Metals by USEPA Methods 6010/6020**
Region I Data Review Worksheet — **Other Inorganics by USEPA 2130B/2320B/300.0/9251/4500NO3-F**
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample, U quality detects 4) Sample results >5x blank level, no action required.	Arsenic and iron were detected in multiple CCBs in the sequence associated with SDGs L0805420 and L0805511. All other metals were not detected in the ICB/CCBs associated with these samples.	AMEC U qualified the detected arsenic result from sample SHL-8D-041708, the detected arsenic and iron results from sample SHL-8S-041708, and the iron results from samples SHL-21-041808 and SHL-23-041808 with a B (contaminant detected) reason code, because the sample concentrations were less than 5 times the concentration detected in the CCBs.	
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results ≤5x the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120% a) %R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits, except as described below. Arsenic was detected at 0.00052 mg/L in the ICS-A associated with SDG L0805420. Similar concentrations were observed in samples SHL-8D-041708 and SHL-8S-041708. Sodium was detected at 0.0763 mg/L in the ICS-A associated with SDG L0805511. A similar concentration was observed in sample SHL-23-041808.	AMEC J qualified the sodium result from sample SHL-23-041808, with a M reason code (method QC criteria not met), because of suboptimal interelement correction. The arsenic results from these samples were previously U qualified; therefore, no more qualification is required.	High

May 12, 2008 — **Metals by USEPA Methods 6010/6020**
Region I Data Review Worksheet — **Other Inorganics by USEPA 2130B/2320B/300.0/9251/4500NO3-F**
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a) %R<30% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" and nondetected results "UJ"	The IS % RIs were within acceptable limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptable limits.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND: J-detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	The laboratory duplicates were not associated with any sample from these SDGs.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 40% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND: J-detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	Sample DUP-041808 was the field duplicate of sample SHL-21-041808. All % RPDs were within acceptance criteria.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	Sample SHM-96-22B-042108 was used as the source for the MS/MSD. The recoveries were acceptable for all analytes, except arsenic (186%/135%) and iron (0%/0%).	The arsenic and iron background concentrations at 1.721 mg/L and 72 mg/L, respectively, were more than 4 times the spike concentrations of 0.12 mg/L and 1 mg/L, respectively. No qualification is required.	
Post Digestion Spike (PDS)	1) Acceptance limits are 75-150% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	Samples SHM-05-42B-041708, SHL-21-041808 and SHM-96-22B-042108 were used as the source for the PDSs. The recoveries were acceptable for all analytes.		

May 12, 2008 — **Metals by USEPA Methods 6010/6020**
Region I Data Review Worksheet — **Other Inorganics by USEPA 2130B/2320B/300.0/9251/4500NO3-F**
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50-times IDL 3) %D>10% flag detected results "J"	The laboratory performed serial dilution analysis on samples SHM-05-42B-041708, SHL-21-041808, and SHM-96-22B-042108. The % Ds were within acceptance limits, except for potassium (15%), magnesium (11%), arsenic (27%), and potassium (14%).	Potassium, magnesium and arsenic concentrations were <50 times the MDL, therefore no qualification is required.	
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the IDL but below the RL should be considered estimated and be flagged "J"	The laboratory J qualified detected results with concentrations between the RL and MDL and AMEC concurs with these qualifications.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	The laboratory did not use sample SHL-22-042108 as the source sample for the MS/MSD, as indicated by the COC. Instead, they used sample SHM-96-22B-042108 as the source sample for the MS/MSD.	No qualification required.	

Table 4. Turbidity by USEPA 2130B and Total Alkalinity by USEPA 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file: a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were 6, 9, and 6°C. Samples were received by the laboratory the same day they were collected. Not enough time had passed for the samples to reach the specified EPA temperature. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.	No qualification required.	
Holding Times (HT)	1) 14 days, preservation not required (Alkalinity) (EPA Method 2320B) 2) 48 hours, preservation not required (Turbidity)(EPA Method 2130B)	Samples were analyzed as per EPA Method requirements.		

May 12, 2008 — **Metals by USEPA Methods 6010/6020**
Region I Data Review Worksheet — **Other Inorganics by USEPA 2130B/2320B/300.0/9251/4500NO3-F**
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Initial Calibration	1) r ≥ 0.99 for alkalinity linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	1) No qualification if recovery between 90-110% (alkalinity). a) %R >110% (alkalinity) flag detected results "J" b) %R <90% (alkalinity) flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <5x contaminant concentration and between MDL and MRL, raise result to MRL and flag "U" 2) If sample result is <5x contaminant concentration and ≥ MRL flag "U" 3) Sample result ≥5x contaminant concentration, no qualification required.	SDG L0805420 Turbidity was detected in the method blank WG318570-3 at 0.16 NTU. Total alkalinity was detected in the method blank WG318706-4 at 0.6 mg/L. The alkalinity concentrations in the associated samples were more than 5 times the MB concentration, therefore, no alkalinity results were qualified. SDG L0805511 Turbidity was detected in the method blank WG318721-3 at 0.16 NTU, and in the equipment blanks EQBLANK-P-041808 and EQBLANK-G-041808 at 0.09 NTU and 0.1 NTU, respectively. Total alkalinity was detected in the method blank WG319084-4 at 0.6 mg/L and in the equipment blanks EQBLANK-P-041808 and EQBLANK-G-041808 at 1.1 mg/L and 1.1 mg/L, respectively. SDG L0805609 Turbidity was detected in the method blank WG318911-3 at 0.16 NTU. Total alkalinity was detected in the method blank WG319603-4 at 0.7 mg/L.	AMEC U qualified the detected turbidity results from samples SHL-5-041708, SHL-8D-041708, SHL-8S-041708, DUP-041808, and SHL-21-041808, EQBLANK-P-041808, EQBLANK-G-041808; and the detected total alkalinity results from samples SHL-23-041808, EQBLANK-P-041808, EQBLANK-G-041808 because the sample concentrations were less than 5x the MB and/or EB concentrations. A B (contamination detected) reason code was applied.	High
ICBs/CCBs	1) Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		

May 12, 2008 — **Metals by USEPA Methods 6010/6020**
Region 1 Data Review Worksheet — **Other Inorganics by USEPA 2130B/2320B/300.0/9251/4500NO3-F**
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
LCS	1) No qualification if recovery between 80-120% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) 20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ" 2) ± MRL for results ≤ 5x the MRL. Difference >MRL, flag detected results "J" and nondetected results "UJ"	SDG L0805420 Sample SHL-5-041708 was analyzed in duplicate for turbidity and sample SHM-05-42A-041708 was analyzed in duplicate for total alkalinity. The RPDs were within the specified limit. SDG L0805511 Sample DUP-041808 was analyzed in duplicate for turbidity, and sample SHL-23-041808 was analyzed in duplicate for total alkalinity. The RPDs were within the specified limit. SDG L0805609 Sample SHM-96-22B-042108 was analyzed in duplicate for turbidity and total alkalinity. The RPDs were within the specified limit.		
Field Duplicates	1) RPD ≤ 20% for aqueous samples (≤ 30% soil samples) for analytes with concentrations more than 5 times their PQLs, and concentrations within one MRL for analytes with concentrations less than 5 times their PQLs	Sample DUP-041808 was the field duplicate of sample SHL-21-041808. Field duplicate RPDs were within method specified criteria.		
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required. %R< 75% flag detected results "J" and nondetected results "UJ" %R > 125% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	No MS/MSD was associated with samples from SDGs L0805420, L0805511, or L0805609 for these methods.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. 3) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Turbidity and total alkalinity were detected in all associated samples at a concentration above the method reporting limits. Some RLs were elevated due to samples being analyzed at a 10-fold or 5-fold dilution in order to eliminate interferences.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Chloride by USEPA 9251, Nitrate by USEPA 4500NO3-F, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were 6, 9 and 6°C. Samples were received by the laboratory the same day that they were collected. Not enough time passed for samples to reach the specified EPA temperature. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.	No qualification required.	
Holding Times (HT)	1) 14 days if the samples preserved to pH>12 (EPA Method 9014). 2) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 9251 and 300.0) 3) 48 hours, preservation not required (Nitrate-N)(EPA Method 4500NO3-F)	The samples were analyzed and preserved per EPA Method requirements.		
Initial Calibration	1) r ≥ 0.995 for Cyanide and r ≥ 0.99 for chloride, sulfate and nitrate, linear calibration. Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias.	Initial calibration criteria were met.		

May 12, 2008 — **Metals by USEPA Methods 6010/6020**
Region I Data Review Worksheet — **Other Inorganics by USEPA 2130B/2320B/300.0/9251/4500NO3-F**
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
ICV/CCV	1) No qualification if recovery between 90-110% (chloride, sulfate and nitrate) and 85-115% (cyanide). a) %R >110% (chloride, sulfate and nitrate) and 115% (cyanide) flag detected results "J" b) %R <90% (chloride, sulfate and nitrate) and 85% (cyanide) flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <5x contaminant concentration and between MDL and MRL, raise result to MRL and flag "U" 2) If sample result is <5x contaminant concentration and ≥ MRL flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	No chloride, sulfate and/or nitrate were detected in the method and/or equipment blanks associated with the samples from these SDGs.		
ICBs/CCBs	1) Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 80-120% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) 20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ" 2) ± MRL for results ≤ 5x the MRL. Difference >MRL, flag detected results "J" and nondetected results "UJ"	SDG L0805420 Sample SHL-8D-041708 was analyzed in duplicate for nitrate. The RPD was within the method specified limit. SDG L0805511 Sample DUP-041808 was analyzed in duplicate for chloride and sulfate and sample SHL-23-041808 was analyzed in duplicate for nitrate. The RPDs were within the method specified limit. SDG L0805609 Sample SHM-96-22B-042108 was analyzed in duplicate for nitrate. The RPD was within the method specified limit.		
Field Duplicates	1) RPD ≤ 20% for aqueous samples (≤ 30% soil samples) for analytes with concentrations more than 5 times their PQLs, and concentrations within one MRL for analytes with concentrations less than 5 times their PQLs.	Sample DUP-041808 was the field duplicate of sample SHL-21-041808. The RPDs were within method specified limits.		

May 12, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6010/6020
Other Inorganics by USEPA 2130B/2320B/300.0/9251/4500NO3-F

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required. %R< 75% flag detected results "J" and nondetected results "UJ" %R > 125% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	No MS/MSD was associated with samples from SDGs L0805420 and L0805511 for these methods. Sample SHM-96-22B-042108 was used as the source sample for the MS/MSD. The chloride recoveries at 25% were outside acceptance limits. The sample background concentration was more than 4 times the spike concentration.	No qualification required.	
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. 3) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Nitrate, chloride, and sulfate were detected at concentrations below and above the method reporting limits. Some RLs were elevated due to samples being analyzed at a 10-fold or 5-fold dilution in order to eliminate interferences.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors - field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Melanie Roshu
Environmental Chemist

REVIEWED BY:

Denise Ladebauche
Environmental Chemist

TABLE 6
Data Validation Qualifiers
Fort Devens, Shepley's Hill Landfill
DVR_SDGs_L0805420_L0805511_L0805609

Sample ID	Sample Date	EPA Analytical Method	Lab Sample ID	Analyte	Result	Units	Validation Qualifiers	Reason Code
SHL-8D-041708	4/17/2008	SW6010	L0805420-06	MANGANESE	0.0019	mg/l	J	TR
SHL-8D-041708	4/17/2008	SW6010	L0805420-06	POTASSIUM	0.84	mg/l	J	TR
SHL-8D-041708	4/17/2008	SW6020	L0805420-06	ARSENIC	0.00038	mg/l	U	B, M
SHL-8S-041708	4/17/2008	2130B	L0805420-07	TURBIDITY	0.34	NTU	U	B
SHL-8S-041708	4/17/2008	SW6010	L0805420-07	IRON	0.021	mg/l	U	B
SHL-8S-041708	4/17/2008	SW6010	L0805420-07	POTASSIUM	1.2	mg/l	J	TR
SHL-8S-041708	4/17/2008	SW6020	L0805420-07	ARSENIC	0.00042	mg/l	U	B, M
SHM-05-42A-041708	4/17/2008	SW6010	L0805420-02	POTASSIUM	1.6	mg/l	J	TR
SHM-96-5C-041708	4/17/2008	E300	L0805420-04	SULFATE	0.62	mg/l	J	TR
SHL-5-041708	4/17/2008	2130B	L0805420-05	TURBIDITY	0.74	NTU	U	B
SHL-5-041708	4/17/2008	E353.2	L0805420-05	NITRATE (AS N)	0.056	mg/l	J	TR
SHL-5-041708	4/17/2008	SW6010	L0805420-05	POTASSIUM	1.3	mg/l	J	TR
SHL-5-041708	4/17/2008	SW6010	L0805420-05	SODIUM	0.93	mg/l	J	TR
SHL-8D-041708	4/17/2008	2130B	L0805420-06	TURBIDITY	0.09	NTU	U	B
DUP-041808	4/18/2008	2130B	L0805511-05	TURBIDITY	0.29	NTU	U	B
DUP-041808	4/18/2008	SW6010	L0805511-05	MANGANESE	0.0011	mg/l	J	TR
DUP-041808	4/18/2008	SW6010	L0805511-05	POTASSIUM	0.82	mg/l	J	TR
DUP-041808	4/18/2008	SW6010	L0805511-05	SODIUM	1.6	mg/l	J	TR
EQBLANK-G-041808	4/18/2008	2130B	L0805511-04	TURBIDITY	0.1	NTU	U	B
EQBLANK-G-041808	4/18/2008	A2320	L0805511-04	ALKALINITY, TOTAL	1.1	mg/L	U	B
EQBLANK-G-041808	4/18/2008	E300	L0805511-04	CHLORIDE	0.072	mg/l	J	TR
EQBLANK-G-041808	4/18/2008	SW6010	L0805511-04	CALCIUM METAL	0.044	mg/l	J	TR
EQBLANK-P-041808	4/18/2008	2130B	L0805511-03	TURBIDITY	0.09	NTU	U	B
EQBLANK-P-041808	4/18/2008	A2320	L0805511-03	ALKALINITY, TOTAL	1.1	mg/L	U	B
SHL-21-041808	4/18/2008	2130B	L0805511-01	TURBIDITY	0.43	NTU	U	B
SHL-21-041808	4/18/2008	SW6010	L0805511-01	IRON	0.019	mg/l	U	B
SHL-21-041808	4/18/2008	SW6010	L0805511-01	MANGANESE	0.0013	mg/l	J	TR
SHL-21-041808	4/18/2008	SW6010	L0805511-01	POTASSIUM	0.82	mg/l	J	TR
SHL-21-041808	4/18/2008	SW6010	L0805511-01	SODIUM	1.3	mg/l	J	TR
SHL-23-041808	4/18/2008	A2320	L0805511-02	ALKALINITY, TOTAL	3.2	mg/L	U	B
SHL-23-041808	4/18/2008	SW6010	L0805511-02	IRON	0.023	mg/l	U	B
SHL-23-041808	4/18/2008	SW6010	L0805511-02	POTASSIUM	0.64	mg/l	J	TR
SHL-23-041808	4/18/2008	SW6010	L0805511-02	SODIUM	0.59	mg/l	J	TR, M

TABLE 6
Data Validation Qualifiers
Fort Devens, Shepley's Hill Landfill
DVR_SDGs_L0805420_L0805511_L0805609

Sample ID	Sample Date	EPA Analytical Method	Lab Sample ID	Analyte	Result	Units	Validation Qualifiers	Reason Code
SHL-23-041808	4/18/2008	SW6020	L0805511-02	ARSENIC	0.00019	mg/l	J	TR
SHL-22-042108	4/21/2008	E353.2	L0805609-02	NITRATE (AS N)	0.055	mg/l	J	TR
SHL-9-042108	4/21/2008	E353.2	L0805609-04	NITRATE (AS N)	0.057	mg/l	J	TR
SHL-9-042108	4/21/2008	SW6010	L0805609-04	POTASSIUM	1.8	mg/l	J	TR
SHM-05-41A-042108	4/21/2008	E353.2	L0805609-06	NITRATE (AS N)	0.061	mg/l	J	TR
SHM-05-41A-042108	4/21/2008	SW6010	L0805609-06	POTASSIUM	2.1	mg/l	J	TR
SHM-05-41B-042108	4/21/2008	E353.2	L0805609-05	NITRATE (AS N)	0.25	mg/l	J	TR
SHM-05-41C-042108	4/21/2008	E353.2	L0805609-07	NITRATE (AS N)	0.094	mg/l	J	TR
SHM-96-22C-042108	4/21/2008	E353.2	L0805609-03	NITRATE (AS N)	0.078	mg/l	J	TR

Validation Qualifiers:

R — The R qualifier indicates that a result has been rejected due to serious QC problems. It is not possible to definitively determine whether the analyte is present or absent in the sample.

U — The U qualifier indicates that the analyte must be considered to be nondetected at the concentration listed. U qualifiers added during data quality review are typically a result of detections of target analytes in field, trip, or laboratory blanks.

J — The J qualifier indicates that the associated result is quantitatively uncertain. J qualifiers added during validation may indicate a concentration between the method detection limit (MDL) and the method reporting limit (MRL) or a data limitation related to a QC element that exceeds required acceptance limits.

UJ — The UJ qualifier indicates reporting limit is estimated. UJ qualifiers added during validation may indicate either a high or low bias related to a QC element that exceeds required acceptance limits.

Reason Code:

B — Contaminant detected in preparation (method) or calibration blank
TR — Trace level detect
M — Method QC criteria not met

June 9, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

INTRODUCTION

This data validation report covers one water sample collected on May 15, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The sample was dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on May 15, 2008 and assigned sample delivery group (SDG) number L0807096 upon receipt. Alpha analyzed the sample for total arsenic using USEPA Method 6020A. The associated field sample identification (ID) and Alpha sample ID is presented in Table 1.

The level of data validation specified in Table 2 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Arsenic was detected and reported at 1.0 µg/L concentration.

Table 1. Field Sample List

Lab Sample Number	Field ID	Comments
L0807096-01	EFF-051508	3 ppb detection limit

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 05/15/2008 at a temperature of 6°C	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0807096

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Arsenic by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 6°C. Sample was preserved with HNO3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2. 2) Hg - 28 days to analysis.	The sample was analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ".	The tune standard met established criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero).	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020). 3) 75-89% recovery, J quality detects and UJ quality nondetects. 4) 111-125% recovery, J quality detects. 5) 80-120% recovery (EPA 7470). 6) RSD <5% for the replicate.	ICV met acceptance criteria.		

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards: analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020) , J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Calibration Range/ Results	1) Results >Upper calibration range J qualify detects. 2) Results <Method reporting limit, >method detection limit: J qualify detects (estimated).	Arsenic was detected and reported within the calibration range.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration; flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	Arsenic was not detected in the associated method blank.		
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample, U qualify detects. 4) Sample results >5x blank level, no action required.	Arsenic was not detected in the ICB or CCBs at concentrations greater than the method-detection limit.		
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results <5x the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a)%R<30% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" and nondetected results "UJ"	IS recoveries were within the acceptance limits.		

June 9, 2008 **Arsenic by USEPA Method 6020A**

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits at 97% and 101%, respectively.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND; J- detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No laboratory duplicate was associated with this sample.		
Field Duplicate RPD	1) RPD ≤ 30% (waters), ≤ 40% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND; J- detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No field duplicate was associated with this SDG.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	No MS/MSD was associated with this SDG.		
Post Digestion Spike (PDS)	1) Acceptance limits are 75-150% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS was performed on sample EFF-051508. The recovery was within acceptance limits at 110%.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50-times MDL 3) %D>10% flag detected results "J"	The %D for the SD performed on sample EFF-051508 was within acceptance limits at 5%.		

June 9, 2008 **Arsenic by USEPA Method 6020A**
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Arsenic was reported as detected and the required reporting limit of 0.003 mg/L was met.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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Environmental Chemist

REVIEWED BY:

Denise Ladebauche
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July 7, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Anions by USEPA Methods 300.0/353.2

INTRODUCTION

This data validation report covers three primary water samples collected on June 17, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on June 17, 2008 and assigned sample delivery group (SDG) number L0808901, upon receipt. Alpha analyzed the samples for total metals using USEPA 6000/7000 methods; chloride and sulfate using USEPA Method 300.0; and, nitrate using USEPA Method 353.2. The associated field sample identification (ID) and Alpha sample IDs are presented in Table 2.

AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3 and Table 4. The level of data validation specified in Table 1 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality. Any limitations on the data are listed below.

Table 1. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 06/17/08 at a temperature of 2°C	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0808901

Table 2. Field Sample List

Lab Sample Number	Field ID	Comments
L0808901-01	EFF-061708	Metals, Anions
L0808901-02	EW01-061708	Analyzed only for As, Fe, Mn
L0808901-03	EW02-061708	Analyzed only for As, Fe, Mn

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Metals by USEPA Methods 6010B, 6020A, and USEPA Method 7470A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 2°C. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory sample receipt and log in checklist indicates that samples integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	Samples were analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ"	ICP-MS Tune met acceptance criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero).	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICVs met acceptance criteria.		

July 7, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020): J qualify detects, UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration: flag "U" 3) Sample result ≥5x contaminant concentration: no qualification required.	No analytes were detected in the preparation blank associated with these samples.		
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater 2) Evaluate absolute values down to the MDL. 3) Sample results ≤ 5x blank sample, U qualify detects 4) Sample results >5x blank level, no action required	Copper was detected in the ICB (0.00117 mg/L) and manganese (0.00059 mg/L) and silver (0.00115 mg/L) were detected in the CCB associated with sample EFF-061708.	Manganese and silver were not detected in sample EFF-061708; the copper concentration in the sample was more than 4 times the ICB concentration; therefore data usability is not affected.	None
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results ≤5x the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ"	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		

July 7, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a) %R<30% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" and nondetected results "UJ"	All internal standard %Rs were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptable limits.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit, J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND; J-detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No laboratory duplicate was associated with this SDG		
Field Duplicate RPD	1) RPD >20% waters (>30% soils) 2) For detected results more than 5 times their PQLs flag "J" 3) Differences in concentrations > the MRL for analytes with concentrations less than 5 times their PQLs flag "J"	No field duplicate was associated with this SDG.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	No MS/MSD was associated with this SDG.		
Post Digestion Spike (PDS)	1) Acceptance limits are 75-150% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	Sample EFF-061708 was used as the source for the PDS. The recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50-times MDL 3) %D>10% flag detected results "J"	The laboratory performed serial dilution analyses on sample EFF-061708. The %Ds were less than 10% for sample concentrations greater than 50 times the MDL.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Iron (0.042 mg/L), arsenic (0.00094 mg/L), and mercury (0.00005 mg/L) from sample EFF-061708 were reported below the method reporting limit.	AMEC J qualified the iron, arsenic, and mercury results from sample EFF-061708 with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 4. Nitrate by USEPA 353.2, and Chloride and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C 3) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 2°C. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 353.2)	The sample was analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) r ≥ 0.99 for chloride, sulfate and nitrate linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias.	Initial calibration criteria were met. Chloride and sulfate calibration was performed on 05/09/2008. Nitrate calibration was performed on 06/17/2008.		

July 7, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
ICV/CCV	1) No qualification if recovery between 90-110% (chloride, sulfate and nitrate) and 85-115% (cyanide). a) %R >110% (chloride, sulfate and nitrate) and 115% (cyanide) flag detected results "J" b) %R <90% (chloride, sulfate and nitrate) and 85% (cyanide) flag detected results "J" and nondetected results "UJ"	ICVs and CCVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <5x contaminant concentration and between MDL and MRL, raise result to MRL and flag "U" 2) If sample result is <5x contaminant concentration and ≥ MRL flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	No nitrate, chloride, or sulfate were detected in the associated method blanks		
ICBs/CCBs	1) Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 80-120% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) 20% ≤RPD. RPD >20% flag detected results "J" and nondetected results "UJ" 2) ± MRL for results ≤ 5x the MRL. Difference >MRL, flag detected results "J" and nondetected results "UJ"	Sample EFF-061708 was analyzed in duplicate for chloride, sulfate, and nitrate. The RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 20% for aqueous samples (≤ 30% soil samples) for analytes with concentrations more than 5 times their PQLs, and concentrations within one MRL for analytes with concentrations less than 5 times their PQLs	No field duplicate was collected with this SDG.		
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required. %R< 75% flag detected results "J" and nondetected results "UJ" %R < 125% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	Sample EFF-061708 was used as the source sample for MS/MSD for chloride and sulfate. The recoveries were within acceptance criteria.		

July 7, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LDR "J" 2) The reported RL should not be below the lowest ICAL standard concentration. 3) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Sulfate and nitrate were reported as detected above the method reporting limits. Chloride was reported at an elevated reporting limit, due to dilution needed to bring the concentration of the sample within the calibration range.	No qualification is required.	None
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.
Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Melanie Roshu
Environmental Chemist

REVIEWED BY:

Denise Ladebauche
Environmental Chemist

August 5, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

INTRODUCTION

This data validation report covers one water sample collected on July 8, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The sample was dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on July 8, 2008 and assigned sample delivery group (SDG) number L0810030 upon receipt. Alpha analyzed the sample for total arsenic using USEPA Method 6020A. The associated field sample identification (ID) and Alpha sample ID is presented in Table 1.

The level of data validation specified in Table 2 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Arsenic was detected and reported at a concentration of 1.25 µg/L.

Table 1. Field Sample List

Lab Sample Number	Field ID	Comments
L0810030-01	EFF-070808	3 ppb detection limit

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 07/08/2008 at a temperature of 10°C.	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0810030

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Arsenic by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 10°C. The sample was received at the laboratory above the required temperature range. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.	The sample was received at the laboratory directly from the site and did not have sufficient time to chill. The sample integrity was not affected by the elevated cooler temperature. No qualification warranted.	None
Holding Time	1) Aqueous sample 180 days if preserved to pH<2. 2) Hg - 28 days to analysis	The sample was analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ"	The tune standard met established criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero),.	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		

August 5, 2008 **Arsenic by USEPA Method 6020A**

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020); J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020) ; J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Calibration Range/ Results	1) Results >Upper calibration range J qualify detects. 2) Results <Method reporting limit, >method detection limit, J qualify detects (estimated).	Arsenic was detected and reported in sample EFP-070808 at 0.00125 mg/L, below the reporting limit of 2 ug/L.	AMEC concurs with the laboratory and J qualified the detected arsenic result with a TR (trace level detected) reason code.	Estimated
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration; flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	Arsenic was not detected in the associated method blank.		
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample, U quality detects. 4) Sample results >5x blank level, no action required.	Arsenic was not detected in the ICB or CCBs at concentrations greater than the method-detection limit.		
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results ≤5× the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check.	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		

August 5, 2008 Arsenic by USEPA Method 6020A
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a)%R<30% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" and nondetected results "UJ"	IS recoveries were within the acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits at 93% and 89%, respectively.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND; J- detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL.	No laboratory duplicate was associated with this sample.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 40% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND; J- detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL.	No field duplicate was associated with this SDG.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	No MS/MSD was associated with this SDG.		

August 5, 2008 **Arsenic by USEPA Method 6020A**

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-150% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS was performed on sample EFF-070808. The recovery was within acceptance limits at 104%.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50-times MDL 3) %D>10% flag detected results "J"	The %D for the SD performed on sample EFF-070808 was within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Arsenic was reported as detected and the required reporting limit of 0.003 mg/L was met.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Melanie Roshu
Environmental Chemist

REVIEWED BY:

Denise Ladebauche
Environmental Chemist

August 29, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

INTRODUCTION

This data validation report covers one water sample collected on August 6, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The sample was dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on August 6, 2008 and assigned sample delivery group (SDG) number L0811539 upon receipt. Alpha analyzed the sample for total arsenic using USEPA Method 6020A. The associated field sample identification (ID) and Alpha sample ID is presented in Table 1.

The level of data validation specified in Table 2 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Arsenic was detected and reported at a concentration of 1.0 µg/L.

Table 1. Field Sample List

Lab Sample Number	Field ID	Comments
L0811539-01	EFF-080608	3 ppb detection limit

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 08/06/2008 at a temperature of 8°C.	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0811539

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Arsenic by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 8°C. The sample was received at the laboratory above the required temperature range. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.	The sample was received at the laboratory directly from the site and did not have sufficient time to chill. The sample integrity was not affected by the elevated cooler temperature. No qualification warranted.	None
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The sample was analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ"	The tune standard met established criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration: $r \geq 0.995$ (EPA Method 6010/6020/7470). 2) $r^2 \geq 0.995$ quadratic calibration (at least 6 points, not forced through zero).	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470). 6) RSD <3% for the replicate.	ICV met acceptance criteria.		

August 29, 2008 Arsenic by USEPA Method 6020A

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020) : J qualify detects; UJ qualify non detects. c) CCV outside 65-135% , reject data	All CCV recoveries were within acceptance limits.		
Calibration Range/ Results	1) Results >Upper calibration range J qualify detects. 2) Results <Method reporting limit, >method detection limit: J qualify detects (estimated).	Arsenic was detected and reported in sample EFF-080608 at 0.0010 mg/L, above the reporting limit of 0.0005 mg/L.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration; flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	Arsenic was not detected in the associated method blank.		
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample, U qualify detects 4) Sample results ≥5x blank level, no action required.	Arsenic was not detected in the ICB or CCBs at concentrations greater than the method-detection limit.		
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results ≤5x the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a) %R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		

August 29, 2008 **Arsenic by USEPA Method 6020A**
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard a)%R<30% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" and nondetected results "UJ"	IS recoveries were within the acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits at 100%.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND; J- detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No laboratory duplicate was associated with this sample.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 40% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND; J- detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No field duplicate was associated with this SDG.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	No MS/MSD was associated with this SDG.		

August 29, 2008 **Arsenic by USEPA Method 6020A**
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-150% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects. b) Recoveries <75% flag detected results "J" and nondetected results "UJ". c) Recoveries >125% flag detected results "J"	The PDS was performed on sample EFF-080608. The recovery was within acceptance limits at 95%.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series). 2) ≤10% for analytes with concentration >50-times MDL. 3) %D>10% flag detected results "J"	The %D for the SD performed on sample EFF-080608 was within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J". 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J".	Arsenic was reported as detected and the required reporting limit of 0.003 mg/L was met.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

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REVIEWED BY:

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October 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Semivolatile Organic Compounds by USEPA 625
Volatile Organic Compounds by USEPA Method 624
Total Petroleum Hydrocarbons by USEPA Method 1664A
Anions by USEPA Methods 300.0/353.2
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) by EPA Method 608
Dissolved Gases (Methane, and Ethane) by Gas Chromatography (RSK175)

INTRODUCTION

This data validation report covers three primary water samples collected on September 10, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on September 10, 2008 and assigned sample delivery group (SDG) number L0813388, upon receipt. Alpha analyzed the samples for total metals using USEPA 6000/7000 methods, dissolved methane and ethane using RSK175, semivolatile organic compounds using USEPA Method 625, volatile organic compounds using USEPA method 624, total petroleum hydrocarbons using USEPA method 1664A, chloride and sulfate using USEPA Method 300.0, nitrate using USEPA Method 353.2 and organochlorine pesticides and PCBs using EPA Method 608. The associated field sample identification (ID) and Alpha sample IDs are presented in Table 2.

AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3, Table 4, Table 5, Table 6, Table 7 and Table 8. The level of data validation specified in Table 1 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality. Any limitations on the data and detected results are listed below.

Table 1. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 09/10/08 at a temperature of 4.1°C	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0813388

Table 2. Field Sample List

Lab Sample Number	Field ID	Comments
L0813388-01	EW1-091008	Analyzed only for As, Fe, Mn, dissolved methane and ethane
L0813388-02	EW2-091008	Analyzed only for As, Fe, Mn, dissolved methane and ethane
L0813388-03	EFF-091008	Metals, 624, 625, TPH, Anions, 608

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Metals by USEPA Methods 6010B, 6020A, and USEPA Method 7470A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 4.1°C. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory sample receipt and log in checklist indicates that samples integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	Samples were analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ"	ICP-MS Tune met acceptance criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration. r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero).	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICVs met acceptance criteria.		

October 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Semivolatile Organic Compounds by USEPA 625
Volatile Organic Compounds by USEPA Method 624
Total Petroleum Hydrocarbons by USEPA Method 1664A
Anions by USEPA Methods 300.0/353.2
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) by EPA Method 608
Dissolved Gases (Methane, and Ethane) by Gas Chromatography (RSK175)

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards: analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020) a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects; no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020) : J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Calibration Range/ Results	1) Results >Upper calibration range J qualify detects. 2) Results <Method reporting limit, >method detection limit: J qualify detects (estimated)	Manganese (0.0026 mg/L) and copper (0.0096 mg/L) from sample EFF-091008 were reported below the method reporting limit.	These analytes were J qualified on the data tables, with a TR (trace level) reason code.	Estimation
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration: flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	Arsenic at 0.0001 mg/L was detected in method blank WG335948. The detected arsenic concentrations in the associated samples were more than 5 times the blank concentration. Data usability was not affected. No analytes were detected in the preparation blanks associated with these samples.		
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample, U qualify detects 4) Sample results >5x blank level, no action required	Arsenic at different concentrations was detected in the CCBs associated with all samples. The detected arsenic concentrations in all samples were more than 5 times the blank concentrations. Data usability was not affected. Barium (0.00133 mg/L), manganese (0.00058 mg/L), and silver (0.00103 mg/L) were detected in the ICB associated with sample EFF-091008. The detected barium and manganese concentrations were more than 5 times the blank concentrations and silver was not reported as detect in sample EFF-091008. Data usability was not affected.		

October 26, 2008
Region I Data Review Worksheet
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USEPA Region I Tier II Guidance

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Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results ≤5× the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ"	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a)%R<30% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" and nondetected results "UJ"	All internal standards %R were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptable limits.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result = MRL and other ND: J-detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No laboratory duplicate was associated with this SDG.		
Field Duplicate RPD	1) RPD >20% waters (>30% soils) 2) For detected results more than 5 times their PQLs flag "J" 3) Differences in concentrations ± the MRL for analytes with concentrations less than 5 times their PQLs flag "J"	No field duplicate was associated with this SDG.		

October 26, 2008
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USEPA Region I Tier II Guidance

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Dissolved Gases (Methane, and Ethane) by Gas Chromatography (RSK175)

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	No MS/MSD was associated with this SDG.		
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	Sample EFF-091008 was used as the source for the PDS. The recoveries were within acceptance limits, except for total selenium at 126%.	AMEC UJ qualified the total selenium result from sample EFF-091008 with a P (PDS not within control limits) reason code.	Estimation
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) <10% for analytes with concentration >50-times IDL 3) %D>10% flag detected results "J"	The laboratory performed serial dilution analyses on samples EFF-091008 and EW1-091008. The %Ds were less than 10%.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Manganese (0.0026 mg/L) and copper (0.0096 mg/L) were detected below the RL of 0.01 mg/L in sample EFF-091008.	AMEC J qualified the manganese and copper results from sample EFF-091008 with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 4. Semivolatile Organic Compounds by USEPA Method 625

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data, and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C 3) No sample preservation required. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 4.1°C. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 7 days to extraction, soil 14 days to extraction. Extracts – analyzed within 40 days of extraction. 2) If extraction or analysis HT exceeded flag all detected results "J" and nondetected results "UJ" 3) If HT grossly exceeded (≥ 3x HT) flag all detected results "J" and nondetected results "R"	Sample was extracted and analyzed within holding time.		
GC/MS instrument performance check (DFTPP)	1) Samples analyzed beyond tune time flag all detected results "J" and nondetected results "UJ"	DFTPP tune met acceptance criteria.		
Initial Calibration	1) Compounds with RSDs ≤15% or r or r^2≥ 0.99 values flag detected results "J" and nondetected results "UJ" 2) Compounds with very low RRFs (<0.01) flag detected results "J" and nondetected results "R"	Initial calibration met established criteria.		
Continuing Calibration Verification (CCV)	1) No qualification if recovery between 80-120%. a) %R >120% flag detected results "J" b) %R <80% flag detected results "J" and nondetected results "UJ"	CCV recoveries were within acceptance limits.		

October 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Semivolatile Organic Compounds by USEPA 625
Volatile Organic Compounds by USEPA Method 624
Total Petroleum Hydrocarbons by USEPA Method 1664A
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Dissolved Gases (Methane, and Ethane) by Gas Chromatography (RSK175)

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate; etc.)	1) Should be < MRL for the analyte a) If sample result is <5x contaminant concentration and between MDL and MRL, raise result to MRL and flag "U" b) If sample result is <5x contaminant concentration and ≥ MRL flag, "U" c) Sample results ≥5x contaminant concentration no qualification required. d) If gross contamination exists flag detected results "R" 2) Apply FB, EB, RB results to samples with same collection date.	Analytes were not detected in the method blank WG336096-1.		
Surrogates	1) 30-130% recovery for base-neutral compounds and 15-110% recovery for acid compounds for samples. 2) 40-140% for method blanks, matrix spikes and LCS.	Surrogate phenol-D6 was recovered at 19% in sample EFF-091008. The other two surrogate compounds from the same fraction met established criteria; therefore data usability is not affected.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recoveries	1) 40-140% recovery for base-neutral compounds and 30-130% for acid compounds; ≤20%RPD a) %R<40% or 30% flag detected results "J" and nondetected results "UJ" b) %R>140% or 130% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	Phenol (28%) was outside of the acceptance criteria, in the LCS associated with sample EFF-091008.	AMEC UJ qualified the associated analyte from sample EFF-091008, with an L (LCS % recovery was not within control limits) reason code.	Low
MS/MSD	1) No qualification required if recovery between 40-140% for base-neutral compounds and 30-130% for acid compounds. a) %R<40% or 30% flag detected results "J" and nondetected results "UJ" b) %R<140% or 130% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" 2) If background concentration is greater than 4x the spike concentration qualification is not required. 3) RPD>20% waters (>30% soils) flag detected results "J"	No MS/MSD was associated with this SDG.		
Field Duplicates	1) RPD ≤ 20% for aqueous samples (≤ 30% soil samples) for analytes with concentrations more than 5 times their PQLs; and concentrations within one MRL for analytes with concentrations less than 5 times their PQLs.	No field duplicate was collected with this SDG.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Internal Standards	1) 50%-200% of area counts in associated CCAL standard. 2) ±30 seconds of RT in associated CCAL standard.	Internal standards were within acceptance criteria.		
Compound Quantitation	1) Qualify detected results with concentrations greater than the highest ICAL standard concentration "J" 2) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	SVOC compounds were reported as not detected at the method-detection limit for sample EFF-091008.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Volatile Organic Compounds by USEPA Method 624

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data, and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C 3) No sample preservation required. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 4.1°C. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous unpreserved sample 7 days and aqueous preserved 14 days. 2) If analysis HT exceeded flag all detected results "J" and nondetected results "UJ" 3) If HT grossly exceeded (≥ 3x HT) flag all detected results "J" and nondetected results "R"	Sample was extracted and analyzed within holding time.		
GC/MS tunes with BFB	1) Every 12 hours. 2) Samples analyzed beyond tune time flag all detected results "J" and nondetected results "UJ"	BFB tune met acceptance criteria.		

October 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Semivolatile Organic Compounds by USEPA 625
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Anions by USEPA Methods 300.0/353.2
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) by EPA Method 608
Dissolved Gases (Methane, and Ethane) by Gas Chromatography (RSK175)

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Initial Calibration	1) Minimum of 5 standards. 2) Compounds with RSDs ≤ 15% or "r" ≥ 0.99, except CCCs which must be ≤ 30%RSD or "r" ≥ 0.99, values flag detected results "J" and nondetected results "UJ" 2) Compounds with very low RRFs (<0.01) flag detected results "J" and nondetected results "R	Initial calibration met established criteria.		
Continuing Calibration Verification (CCV)	1) No qualification if recovery between 80 – 120% for CCCs and 70%-130% for other analytes. a) %R >120 or 130% flag detected results "J" b) %R <80 or 70% flag detected results "J" and nondetected results "UJ"	CCV recovery was within acceptance limits.		
Blanks (Method, Trip, Field, Rinsate, etc.)	1) Every 20 samples prior to running samples and after calibration standards. 2) Matrix and preservative specific. 3) Target analytes must be < RL except for common laboratory contaminants (e.g. acetone, methylene chloride, MEK which must be <5x the RL) 2) Apply TB, FB, RB results to samples with same collection date.	VOCs were not detected in the method blank WG336340-8.		
Surrogates	1) 70-130% recovery for samples. 2) 80-120% for method blanks, matrix spikes and LCS.	All surrogate recoveries met established criteria.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recoveries	1) 70-130% recovery; ≤25%RPD a) %R<70% flag detected results "J" and nondetected results "UJ" b) %R>130% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" 2) Qualify all associated samples.	LCS/LCSD recoveries and RPD were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 70-130%. 2) If background concentration is greater than 4x the spike concentration qualification is not required 3) RPD>30% flag detected results "J"	No MS/MSD was associated with this SDG.		
Internal Standards (IS)	1) 50%-200% of area counts in associated CCAL standard. 2) ±30 seconds of RT in associated CCAL standard.	Internal standards were within acceptance criteria.		

October 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Semivolatile Organic Compounds by USEPA 625
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Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) by EPA Method 608
Dissolved Gases (Methane, and Ethane) by Gas Chromatography (RSK175)

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Qualify detected results with concentrations greater than the highest ICAL standard concentration "J" 2) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	1,4-Dichlorobenzene, 1,1-dichloromethane, chloroform, chlorobenzene, benzene, and chloroethane from sample EFF-091008 were detected and reported between the MDL and the RL.	AMEC J qualified these analytes from the sample EFF-091008 on the data tables, with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Total Petroleum Hydrocarbons by USEPA Method 1664A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file: a. Sample data package including case narrative, QC data, and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation 2) Temperature 4±2°C 3) Aqueous samples preserved at the time of collection to pH<2 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 4.1°C. The sample was preserved to pH<2 at the laboratory. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.	AMEC J qualified the TPH result from sample EFF-091008, because the pH adjustment was done more than 4 hours after time of collection. Therefore an M (Method QC criteria not met) reason code was applied.	Estimation
Holding Time	1) Aqueous and solid samples must be analyzed within 28 days from sample collection. 2) If extraction or analysis HT exceeded flag all detected results "J" and nondetected results "UJ" 3) If HT grossly exceeded (> 3x HT) flag all detected results "J" and nondetected results "R"	Sample was extracted and analyzed within holding time.		

October 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Semivolatile Organic Compounds by USEPA 625
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Dissolved Gases (Methane, and Ethane) by Gas Chromatography (RSK175)

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Should be < MRL for the analyte. a) If sample result is <5x contaminant concentration and between MDL and MRL, raise result to MRL and flag "U" b) If sample result is <5x contaminant concentration and ≥ MRL flag, "U" c) Sample results ≥5x contaminant concentration no qualification required. d) If gross contamination exists flag detected results "R" 2) Apply FB, EB, RB results to samples with same collection date.	TPH was not detected in the method blank.		
Laboratory Control Sample Recoveries	1) 64-132% recovery: a) %R<64% flag detected results "J" and nondetected results "UJ" b) %R>132% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" 2) Qualify all associated samples.	LCS recovery was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 64-132%. a) %R<64% flag detected results "J" and nondetected results "UJ" b) %R<132% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" 2) If background concentration is greater than 4x the spike concentration qualification is not required 3) RPD>50 flag detected results "J"	An MS was performed on a sample from a different SDG and is not applicable to this sample.		
Compound Quantitation	1) Qualify detected results with concentrations greater than the highest ICAL standard concentration "J" 2) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	TPH from sample EFF-091008 was detected and reported between the MDL and the RL.	AMEC J qualified the TPH from the sample EFF-091008 on the data tables with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Nitrate by USEPA 353.2, and Chloride and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C 3) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 4.1°C. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 353.2)	The sample was analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) $r \geq 0.99$ for chloride, sulfate and nitrate, linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	1) No qualification if recovery between 90-110% (chloride, sulfate and nitrate) and 85-115% (cyanide). a) %R >110% (chloride, sulfate and nitrate) and 115% (cyanide) flag detected results "J" b) %R <90% (chloride, sulfate and nitrate) and 85% (cyanide) flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <5x contaminant concentration and between MDL and MRL, raise result to MRL and flag "U" 2) If sample result is <5x contaminant concentration and ≥ MRL flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	No nitrate, chloride, or sulfate was detected in the associated method blanks.		
ICBs/CCBs	1) Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		

October 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Semivolatile Organic Compounds by USEPA 625
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Dissolved Gases (Methane, and Ethane) by Gas Chromatography (RSK175)

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
LCS	1) No qualification if recovery between 80-120% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) 20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ" 2) ± MRL for results ≤ 5x the MRL. Difference >MRL, flag detected results "J" and nondetected results "UJ"	Sample EFF-091008 was analyzed in duplicate for chloride, sulfate, and nitrate. The RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 20% for aqueous samples (≤ 30% soil samples) for analytes with concentrations more than 5 times their PQLs, and concentrations within one MRL for analytes with concentrations less than 5 times their PQLs	No field duplicate was collected with this SDG.		
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 75% flag detected results "J" and nondetected results "UJ" %R > 125% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	Sample EFF-091008 was used as the source sample for MS for chloride, sulfate and nitrate. All recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LDR "J" 2) The reported RL should not be below the lowest ICAL standard concentration. 3) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Chloride, sulfate, and nitrate were reported as detected above the method reporting limits.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Organochlorine Pesticides and Polychlorinated Biphenyls by USEPA Method 608

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data, and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) No sample preservation required. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 4.1°C. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 7 days to extraction; soil 14 days to extraction. Extracts – analyzed within 40 days of extraction. 2) If extraction or analysis HT exceeded flag all detected results "J" and nondetected results "UJ" 3) If HT grossly exceeded (≥ 3x HT) flag all detected results "J" and nondetected results "R"	Sample was extracted and analyzed within holding time.		
Endrin/DDT Breakdown	1) Before samples are analyzed. 2) % Breakdown must be ≤ 15 and must be evaluated using peak areas.	Endrin and DDT breakdown met the acceptance criteria.		
Initial Calibration	1) Compounds with RSDs ≤20% or r or r^2 ≥ 0.99 values; flag detected results "J" and nondetected results use professional judgment. 2) Curves must be verified by an independent ICV before analysis.	Initial calibration met established criteria.		
Continuing Calibration Verification (CCV)	1) Prior to samples, every 12 hours or every 20 samples, whichever is more frequent, and at the end of the analytical sequence. 2) No qualification if recovery between 85 – 115%. a) %R >115% flag detected results "J" b) %R <85% flag detected results "J" and nondetected results "UJ"	CCVs were analyzed as required and the recoveries met established criteria.		

October 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Semivolatile Organic Compounds by USEPA 625
Volatile Organic Compounds by USEPA Method 624
Total Petroleum Hydrocarbons by USEPA Method 1664A
Anions by USEPA Methods 300.0/353.2
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) by EPA Method 608
Dissolved Gases (Methane, and Ethane) by Gas Chromatography (RSK175)

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Should be < MRL for the analyte a) If sample result is <5x contaminant concentration and between MDL and MRL, raise result to MRL and flag "U" b) If sample result is <5x contaminant concentration and ≥ MRL flag, "U" c) Sample results ≥5x contaminant concentration no qualification required. d) If gross contamination exists flag detected results "R" 2) Apply FB, EB, RB results to samples with same collection date.	Analytes were not detected in the method blank WG336144-1.		
Surrogates	1) Minimum of 2 2) 30-150% recovery for both surrogates on both columns	Surrogate recoveries were within established criteria.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recoveries	1) 40-140% recovery ≤20%RPD for waters and ≤30% for solids a) %R<40% flag detected results "J" and nondetected results "UJ" b) %R>140% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	Delta-BHC (29%/33%), beta-BHC (38%), heptachlor (39%), and aldrin (32%/32%) were outside of the acceptance criteria, in the LCS and/or LCSD associated with sample EFF-091008.	AMEC UJ qualified the associated analytes from sample EFF-091008, with an L (LCS % recovery was not within control limits) reason code.	Low
MS/MSD	1) No qualification required if recovery between 40-140% for PCBs and 30-150% for pesticides. a) %R<40% or 30% flag detected results "J" and nondetected results "UJ" b) %R<140% or 150% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" 2) If background concentration is greater than 4x the spike concentration qualification is not required. 3) RPD>30% for congeners, single-component pesticides (>50% aroclors, multi-component analytes) flag detected results "J"	MS/MSD was not performed on sample from this SDG.		
Internal Standards (Congeners only)	1) Minimum of 1. 2) 50%-200% of area counts in associated CCAL standard. 3) ±30 seconds of RT in associated CCAL standard.	Internal standards were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Identification and Quantitation	1) Qualify detected results with concentrations greater than the highest ICAL standard concentration "J" 2) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J" 3) Secondary column analysis: RPD <40% for positive results. "J" qualify results that exceed 40%.	Pesticide / PCB compounds were reported as not detected at the method-detection limit for sample LTF-091008.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 9. Dissolved Gases (Methane and Ethane) by Gas Chromatography (RSK175)

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data, and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C 3) Preservation with HCl or H_2SO_4 to pH <2. 4) Sample delivery documentation.	Coolers temperature upon arrival at Alpha was 4.1°C. Samples were preserved with HCl to pH<2. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous preserved 14 days. 2) If analysis HT exceeded flag all detected results "J" and nondetected results "UJ" 3) If HT grossly exceeded (≥ 3x HT) flag all detected results "J" and nondetected results "R"	Samples were analyzed within holding time.		
Initial Calibration	1) Minimum of 4 standards. 2) Compounds with RSDs ≤ 15% or "r" ≥ 0.99, values flag detected results "J" and nondetected results "UJ" 3) ICV recovery 80% to 120%.	Initial calibration met established criteria.		

October 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Semivolatile Organic Compounds by USEPA 625
Volatile Organic Compounds by USEPA Method 624
Total Petroleum Hydrocarbons by USEPA Method 1664A
Anions by USEPA Methods 300.0/353.2
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) by EPA Method 608
Dissolved Gases (Methane, and Ethane) by Gas Chromatography (RSK175)

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) No qualification if recovery between 80—120%. a) %R > 120 or 130% flag detected results "J" b) %R <80 or 70% flag detected results "J" and nondetected results "UJ"	CCV recovery was within acceptance limits.		
Blanks (Method, Trip, Field, Rinsate, etc.)	1) Every 20 samples prior to running samples and after calibration standards: 2) Matrix and preservative specific: 3) Target analytes must be < RL 2) Apply TB, FB, RB results to samples with same collection date.	Methane and ethane were not detected in method blank WG336139-2.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recoveries	1) 70-130% recovery; ≤25%RPD a) %R<70% flag detected results "J" and nondetected results "UJ" b) %R>130% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" 2) Qualify all associated samples.	LCS/LCSD recoveries and the RPD were within acceptance criteria.		
Laboratory /Field Duplicate	1) RPD > 25%	Sample EW1-091008 was analyzed in duplicate by the laboratory. The RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 70-130%. 2) If background concentration is greater than 4x the spike concentration qualification is not required. 3) RPD>30% flag detected results "J"	The MS/MSD source sample was not associated with sample from this SDG.		
Compound Quantitation	1) Qualify detected results with concentrations greater than the highest ICAL standard concentration "J" 2) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Ethane from samples EW2-091008 was detected and reported between the MDL and the RL. Samples EW1-091008 and EW2-091008 were analyzed at a 40-fold dilution, in order to quantify the methane within the calibration range of the instrument. The laboratory reported both sets of results (initial and dilution) on the data tables.	AMEC J qualified the ethane results from the sample EW2-091008 on the data tables, with a TR (trace level) reason code. AMEC R qualified and rejected the initial methane results from the affected samples, with a Z (not applicable) reason code.	Estimation

October 26, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6000/7000
Semivolatile Organic Compounds by USEPA 625
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Anions by USEPA Methods 300.0/353.2
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) by EPA Method 608
Dissolved Gases (Methane, and Ethane) by Gas Chromatography (RSK175)

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

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November 14, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6020A/6010B
Volatile Organic Compounds by USEPA Method 8260B
Other Inorganics by USEPA 2130B/2320B/300.0/353.2

INTRODUCTION

This data validation report covers forty one primary water samples, two field duplicates and two equipment blanks collected between October 1, 2008 and October 6, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) between October 1, 2008 and October 6, 2008 and assigned sample delivery groups (SDGs) numbers L0814614, L0814662, L0814699, and L0814732 upon receipt. Alpha analyzed the samples for total or dissolved metals using USEPA 6020A/6010B methods, volatile organic compounds using USEPA method 8260B, turbidity using Standard method 2130B, total alkalinity using Standard Method 2320B, chloride and sulfate using USEPA Method 300.0, and nitrate using USEPA Method 353.2. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 2.

AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3, Table 4, Table 5, and Table 6. The level of data validation specified in Table 1 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality. Any limitations on the data are listed below. Definitions of data qualifiers added during validation and summaries of specific qualifiers added to each affected sample as a result of the data validation findings are presented in Table 7 attached to this report.

Table 1. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	Two sample coolers were received on 10/01/08 at temperatures of 2.6 and 3.2°C. Two sample coolers were received on 10/02/08 at temperature of 3.0°C. One sample cooler was received on 10/03/08 at temperature of 2.4°C. One sample cooler was received on 10/06/08 at temperature of 2.0°C.	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0814614 L0814662 L0814699 L0814732

Table 2. Field Sample List

Lab Sample Number	Field ID	Comments
L0814614-01	SHL-8D-10012008	Metals, Other inorganics
L0814614-02	SHM-05-41B10012008	Metals, Other inorganics
L0814614-03	DUP01	Field Duplicate of SHM-05-41B10012008
L0814614-04	SHL-13-10012008	Metals, Other inorganics
L0814614-05	SHL-8S-10012008	Metals, Other inorganics
L0814614-06	SHM-96-5B10012008	Metals, Other inorganics
L0814614-07	SHL-5-10012008	Metals, Other inorganics
L0814614-08	SHM-96-5C10012008	Metals, Other inorganics
L0814614-09	SHM-93-22B10012008	Metals, Other inorganics
L0814614-10	SHL-22-10012008	Metals, Other inorganics
L0814614-11	SHL-910012008	Metals, Other inorganics
L0814662-01	SHM9931B10022008	Metals, Other inorganics
L0814662-02	SHM9931C10022008	Metals, Other inorganics
L0814662-03	SHM9932X10022008	Metals, Other inorganics
L0814662-04	SHM9931A10022008	Metals, Other inorganics
L0814662-05	SHM0540X10022008	Metals, Other inorganics
L0814662-06	SHM0539A10022008	Metals, Other inorganics
L0814662-07	SHM0539B10022008	Metals, Other inorganics
L0814662-08	SHM9322C10022008	Metals, Other inorganics
L0814662-09	SHM0542A10022008	Metals, Other inorganics
L0814662-10	SHM0542B10022008	Metals, Other inorganics
L0814662-11	SHM0541A10022008	Metals, Other inorganics
L0814662-12	SHM0541C10022008	Metals, Other inorganics
L0814662-13	EW01-100208	8260B
L0814662-14	EW02-100208	8260B
L0814669-01	SHL-11-100308	Metals, Other inorganics
L0814699-02	SHP-93-10D100308	Metals, Other inorganics
L0814699-03	SHM-93-10C100308	Metals, Other inorganics
L0814699-04	SHL-10-100308	Metals, Other inorganics
L0814699-05	SHL-15-100308	Metals, Other inorganics
L0814699-06	SHL-19-100308	Metals, Other inorganics
L0814699-07	SHL-19-100308 F	Dissolved Metals
L0814699-08	SHL-20-100308	Metals, Other inorganics
L0814699-09	SHL-4-100308	Metals, Other inorganics
L0814699-10	N5P1-100308	Metals, Other inorganics
L0814699-11	N5P2-100308	Metals, Other inorganics
L0814732-01	DUP02100608	Potassium; Field duplicate of SHL21100608
L0814732-03	SHP0137X100608	Nitrate only
L0814732-04	SHP0136X100608	Nitrate & Sulfate
L0814732-05	SHL21100608	Metals
L0814732-06	SHL23100608	Potassium
L0814732-07	SHP0129X100608	Potassium
L0814732-08	EQD-100608	Metals, Other inorganics; Equipment Blank
L0814732-09	EQG-100608	Metals, Other inorganics; Equipment Blank

November 14, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6020A/6010B
Volatile Organic Compounds by USEPA Method 8260B
Other Inorganics by USEPA 2130B/2320B/300.0/353.2

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Metals by USEPA Methods 6010B and 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2, except sample SHL-19-100308 that was received above the appropriate pH. The laboratory added the additional HNO3. The Chain of Custody is intact. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.	No qualification required, since the cooler temperature was within acceptance limits and pH adjusted within hours of collection.	
Holding Time	1) Aqueous sample 180 days if preserved to pH<2	Samples were analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ"	ICP-MS Tune met acceptance criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470) 2) $r^2 \geq 0.995$, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICVs met acceptance criteria.		

November 14, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6020A/6010B
Volatile Organic Compounds by USEPA Method 8260B
Other Inorganics by USEPA 2130B/2320B/300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020): a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020) : J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration; flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	No analytes were detected in the preparation blanks associated with these samples, except for total arsenic at 0.00037 mg/L in MB associated with SDG L0814662; total and dissolved arsenic at 0.00026 and 0.00061 mg/L, respectively, in MB associated with SDG L0814699; total arsenic at 0.000013 mg/L in MB associated with SDG L0814732. Total arsenic at 0.0021 mg/L and 0.00069 mg/L was detected in the equipment blanks EQD-100608 and EQG-100608, respectively. The samples affected by these detections are: DUP02100608, SHL21100608, and SHL23100608, SHM0542A10022008, and SHL-10-100308. Calcium at 0.058 mg/L was detected in equipment blank EQG-100608.	AMEC U qualified the detected arsenic results from the affected samples, because the samples concentrations were less than 5x the EB or MB concentration. A B (contamination detected) reason code was applied. Calcium concentrations in the associated samples were more than 5 times the equipment blank concentration. No qualification is required.	High
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample, U qualify detects. 4) Sample results ≥5x blank level, no action required.	Arsenic was detected in the CCBs associated with SDGs L0814614, L0814662 and L0814732. Samples that were affected by these detections are SHL-8D-10012008 and SHL-8S-10012008, EQD-100608, and EQG-100608.	AMEC U qualified the detected arsenic results from the associated samples, because the sample concentrations were less than 5x the CCB concentrations. A B (contamination detected) reason code was applied.	High
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results ≤5x the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		

November 14, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6020A/6010B
Volatile Organic Compounds by USEPA Method 8260B
Other Inorganics by USEPA 2130B/2320B/300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a)%R<30% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" and nondetected results "UJ"	All internal standard %Rs were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptable limits.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit, J quality detects, UJ quality non detects. b) If one result > MRL and other ND: J- detections, UJ quality non detects 2) ± MRL for results ≤ 5x the MRL	Sample SHL-19-100308 F was analyzed in duplicate by the laboratory. The RPDs were within acceptance limits.		
Field Duplicate RPD	1) RPD >20% waters (>30% soils) 2) For detected results more than 5 times their PQLs flag "J" 3) Differences in concentrations > the MRL for analytes with concentrations less than 5 times their PQLs, flag "J"	Sample DUP01 was collected as a field duplicate for sample SHM-05-41B10012008. The RPDs were within acceptance limits. No field duplicate was associated with SDGs L0814662 or L0814699. Sample DUP02100608 was collected as a field duplicate for sample SHL21100608. The RPDs were within acceptance limits, except for calcium at 91%.	AMEC J qualified the detected calcium results from samples DUP02100608 and SHL21100608, with an E (poor agreement) reason code.	High

November 14, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6020A/6010B
Volatile Organic Compounds by USEPA Method 8260B
Other Inorganics by USEPA 2130B/2320B/300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	Samples SHM0541A10022008, SHL-11-19-100308 F, and SHP0138A100608 were used as the source sample for MS/MSDs. The recoveries and RPDs were within acceptance limits, except for arsenic (132%) and iron (200%) in the MS associated with sample SHP0138A100608. The background concentrations for these analytes were more than 4 times the spike concentration.	No qualification required.	
Post Digestion Spike (PDS)	1) Acceptance limits are 75-150% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	Samples SHL-8D-10012008, SHM0541A10022008, SHL-11-100308, and SHP0138A100608 were used as the source for the PDS. The recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series). 2) ≤10% for analytes with concentration >50-times IDL. 3) %D>10% flag detected results "J"	The laboratory performed serial dilution analyses on samples SHL-8D-10012008, SHM0541A10022008, SHL-11-100308, and SHP0138A100608. The %Ds were within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Arsenic from samples SHL-8D-10012008, SHL-8S-10012008, SHL-10-100308, DUP02100608, EQG-100608, and SHL23100608, manganese from sample SHM-05-42A, potassium from samples SHM-05-41A, SHL-8S-10012008, SHM-05-42A, SHL-4-100308, SHP0136X100608, and SHP0137X100608, sodium from samples SHM-05-42A, SHL-8S-10012008, SHL-15-100308, SHL-4-100308, DUP02100608, and SHL23100608, calcium from sample EQG-100608 were reported below the method reporting limit.	These analytes were J qualified on the data tables, with a TR (trace level) reason code.	Estimation

November 14, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6020A/6010B
Volatile Organic Compounds by USEPA Method 8260B
Other Inorganics by USEPA 2130B/2320B/300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 4. Volatile Organic Compounds by USEPA Method 8260B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data, and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C 3) Sample preserved with HCl 4) Sample delivery documentation.	Coolers temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous unpreserved sample 7 days and aqueous preserved 14 days. 2) If analysis HT exceeded flag all detected results "J" and nondetected results "UJ" 3) If HT grossly exceeded (≥ 3x HT) flag all detected results "J" and nondetected results "R"	Samples were analyzed within holding time.		
GC/MS tunes with BFB	1) Every 12 hours. 2) Samples analyzed beyond tune time flag all detected results "J" and nondetected results "UJ"	BFB tune met acceptance criteria.		
Initial Calibration	1) Minimum of 5 standards. 2) Compounds with RSDs ≤ 15% or "r" ≥ 0.99, except CCCs which must be ≤ 30%RSD or "r" ≥ 0.99, values flag detected results "J" and nondetected results "UJ" 2) Compounds with very low RRFs (<0.01) flag detected results "J" and nondetected results "R"	Initial calibration met established criteria. Calibration was performed on 10/07/2008.		
Continuing Calibration Verification (CCV)	1) No qualification if recovery between 80 – 120% for CCCs and 70%-130% for other analytes. a) %R >120 or 130% flag detected results "J" b) %R <80 or 70% flag detected results "J" and nondetected results "UJ"	CCV recovery was within acceptance limits.		

November 14, 2008
Region 1 Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6020A/6010B
Volatile Organic Compounds by USEPA Method 8260B
Other Inorganics by USEPA 2130B/2320B/300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Trip, Field, Rinsate, etc.)	1) Every 20 samples prior to running samples and after calibration standards; 2) Matrix and preservative specific; 3) Target analytes must be < RL except for common laboratory contaminants (e.g. acetone, methylene chloride, MEK which must be <5x the RL) 2) Apply TB, FB, RB results to samples with same collection date.	VOCs were not detected in the method blank WG339343-3.		
Surrogates	1) 70-130% recovery for samples. 2) 80-120% for method blanks, matrix spikes and LCS.	All surrogate recoveries met established criteria.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recoveries	1) 70-130% recovery; ≤25% RPD a) %R<70% flag detected results "J" and nondetected results "UJ" b) %R>130% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" 2) Qualify all associated samples.	LCS/LCSD recoveries and RPD were within acceptance criteria, except for acetone which recovered at 147% and 133%, respectively.	Acetone was reported as not detected in associated samples, therefore no qualification is required.	High
MS/MSD	1) No qualification required if recovery between 70-130%. 2) If background concentration is greater than 4x the spike concentration qualification is not required. 3) RPD>30% flag detected results "J"	No MS/MSD was associated with this SDG.		
Internal Standards (IS)	1) 50%-200% of area counts in associated CCAL standard. 2) ±30 seconds of RT in associated CCAL standard.	Internal standards were within acceptance criteria.		
Compound Quantitation	1) Quality detected results with concentrations greater than the highest ICAL standard concentration "J" 2) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	1,4-Dichlorobenzene, vinyl chloride, and 1,2-dichlorobenzene from sample EW01-100208 and 1,4-dichlorobenzene from sample EW02-100208 were detected and reported between the MDL and the RL.	AMEC J qualified these analytes from the samples EW01-100208 and EW02-100208 on the data tables, with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Turbidity by Standard Method 2130B and Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 14 days, preservation not required (Alkalinity) (EPA Method 2320B) 2) 48 hours, preservation not required (Turbidity)(EPA Method 2130B)	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	1) r ≥ 0.99 for alkalinity linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	1) No qualification if recovery between 90-110% (alkalinity) a) %R >110% (alkalinity) flag detected results "J" b) %R <90% (alkalinity) flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits		

November 14, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6020A/6010B
Volatile Organic Compounds by USEPA Method 8260B
Other Inorganics by USEPA 2130B/2320B/300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <5x contaminant concentration and between MDL and MRL, raise result to MRL and flag "U" 2) If sample result is <5x contaminant concentration and ≥ MRL flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	Alkalinity was not detected in the associated method blanks. Turbidity was detected in the method blanks WG338547-2 and WG338717-2 at 0.12 NTU, WG338902-2 at 0.12 NTU, WG338919-2 at 0.08 NTU, and the equipment blanks (EQG-100608 and EQD-100608) at 0.15 NTU and 0.14 NTU, respectively. The concentrations in the associated samples were more than 5 times the MB and EB concentrations, except for what was qualified by AMEC.	AMEC U qualified the detected turbidity result from samples SHL-13-10012008, SHL-5-10012008, SHL-8D-10012008, SHL-8S-10012008, SHP0136X100608, SHP0137X100608, SHL-10-100308, SHL-4-100308, EQG-100608, and EQD-100608 because the sample concentrations were less than 5x the MB concentration. A B (contamination detected) reason code was applied.	High
ICBs/CCBs	1) Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 80-120% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCSs recoveries were within acceptance criteria.		
Lab Duplicate	1) 20% ≤RPD; RPD >20% flag detected results "J" and nondetected results "UJ" 2) ± MRL for results ≤ 5x the MRL. Difference >MRL, flag detected results "J" and nondetected results "UJ"	Samples SHL-22-10012008, SHM0541A10022008, N5P1-100308, and SHP0138A100608 were analyzed in duplicate for turbidity and samples SHL-8S-10012008, SHM0541A10022008 SHL-4-100308, and SHP0138A100608 were analyzed in duplicate for total alkalinity. The RPDs were within the specified limit.		

November 14, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6020A/6010B
Volatile Organic Compounds by USEPA Method 8260B
Other Inorganics by USEPA 2130B/2320B/300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	1) RPD ≤ 20% for aqueous samples (≤ 50% soil samples) for analytes with concentrations more than 5 times their PQLs, and concentrations within one MRL for analytes with concentrations less than 5 times their PQLs.	Sample DUP01 was collected as a field duplicate for sample SHM-05-41B10012008. The RPDs were within acceptance limits. No field duplicate was associated with SDGs L0814662 or L0814699. Sample DUP02100608 was collected as the field duplicate for sample SHL21100608. The RPDs for turbidity (50%) and alkalinity (138%) were high.	AMEC J qualified the detected turbidity and alkalinity results from sample SHL21100608 and it's duplicate with an E (poor agreement between duplicates) reason code.	High
MS/MSD	1) No qualification required if recovery between 75-125% 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 75% flag detected results "J" and nondetected results "UJ" %R > 125% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	Sample SHP0138A100608 was used as the source sample for MS for alkalinity. The recovery was low at 64%.	AMEC J qualified the detected alkalinity result from the associated sample with Q (MS/MSD recovery) reason code.	Low
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. 3) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above or below the method reporting limit of 2.0 mg/L. Turbidity from samples EQD-100608, EQG-100608, and SHL-SD-10012008 was detected and reported between the MDL and the RL.	AMEC J qualified the turbidity results from these samples on the data tables, with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Nitrate by USEPA 353.2, and Chloride and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

November 14, 2008
Region 1 Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region 1 Tier II Guidance

Metals by USEPA Methods 6020A/6010B
Volatile Organic Compounds by USEPA Method 8260B
Other Inorganics by USEPA 2130B/2320B/300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature 4±2°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 353.2)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) r ≥ 0.99 for chloride, sulfate and nitrate, linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias.	Initial calibration criteria were met.		
ICV/CCV	1) No qualification if recovery between 90-110% (chloride, sulfate and nitrate) and 85-115% (cyanide). a) %R >110% (chloride, sulfate and nitrate) and 115% (cyanide) flag detected results "J" b) %R <90% (chloride, sulfate and nitrate) and 85% (cyanide) flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <5x contaminant concentration and between MDL and MRL raise result to MRL and flag "U" 2) If sample result is <5x contaminant concentration and ≥ MRL flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	No chloride or sulfate was detected in the associated method blanks. Nitrate was detected in the method blank WG338521-2 at 0.051 mg/L, in MB WG338690-2 at 0.028 mg/L, and in MB WG339053-2 at 0.042 mg/L. The samples affected by these blank detections are SHL-5-10012008, SHL-8S-10012008, SHM-05-41B10012008, SHM-93-22B10012008, SHM-96-5C10012008, NSP2-100308, N5P1-100308, SHL-15-100308, SHL-4-100308, SHM-93-10C100308, SHP-93-10D100308, EQD-100608, EQG-100608, SHL21100608, SHP0129X100608, and SHP0138A100608.	AMEC U qualified the detected nitrate results from the affected samples because the sample concentrations were less than 5x the MB concentration. A B (contamination detected) reason code was applied.	High
ICBs/CCBs	1) Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		

November 14, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6020A/6010B
Volatile Organic Compounds by USEPA Method 8260B
Other Inorganics by USEPA 2130B/2320B/300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
LCS	1) No qualification if recovery between 80-120% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) 20% ≤RPD. RPD >20% flag detected results "J" and nondetected results "UJ" 2) ± MRL for results ≤ 5x the MRL. Difference >MRL, flag detected results "J" and nondetected results "UJ"	Sample SHL-8D-10012008, SHM0541A10022008, and SHP0138A100608 were analyzed in duplicate for chloride and sulfate. sample SHM-96-5B-101707 was analyzed in duplicate for sulfate and samples SHL-22-10012008, SHM0541A10022008, SHL-15-100308, SHP0138A100608 were analyzed in duplicate for nitrate. The RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 20% for aqueous samples (≤ 30% soil samples) for analytes with concentrations more than 5 times their PQLs, and concentrations within one MRL for analytes with concentrations less than 5 times their PQLs	Sample DUP01 was collected as a field duplicate for sample SHM-05-41B10012008. The chloride and sulfate RPDs were within acceptance limits. The nitrate RPD was high at 125%. No field duplicate was associated with SDGs L0814662 or L0814699. Sample DUP02100608 was collected as the field duplicate for sample SHL21100608. The chloride and sulfate RPDs were within acceptance limits. The nitrate RPD was high at 120%.	No qualification is required because the nitrate concentrations in the samples were less than 5 times their PQL.	None
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 75% flag detected results "J" and nondetected results "UJ" %R > 125% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	Sample SHP0138A100608 was used as the source sample for the MS for sulfate, chloride and nitrate. The recoveries were within acceptance criteria.		

November 14, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6020A/6010B
Volatile Organic Compounds by USEPA Method 8260B
Other Inorganics by USEPA 2130B/2320B/300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LDR "J" 2) The reported RL should not be below the lowest ICAL standard concentration 3) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Nitrate from samples DUP01, EQD-100608, EQG-100608, N5P1-100308, N5P2-100308, SHL-11-100308, SHL-15-100308, SHL21100608, SHL-5-10012008, SHL-8S-10012008, SHM0539A10022008, SHM0540X10022008, SHM0541A10022008, SHM-05-41B10012008, SHM0541C10022008, SHM0542A10022008, SHM0542B10022008, SHM-93-10C100308, SHM-93-22B10012008, SHM-96-5C10012008, SHM9931C10022008, SHP0129X100608, SHP0138A100608, and SHP-93-10D100308, chloride from sample EQG-100608, and sulfate from samples EQD-100608, SHL-11-100308, and SHM0541C10022008, were detected and reported between the MDL and the RL.	AMEC J qualified the detected nitrate, chloride and sulfate results from affected samples on the data tables, with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

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TABLE 7
Data Validation Qualifiers
Fort Devens, Shepley's Hill Landfill
DVR_SDGs_L0814614_L0814662_L0814699_L0814732

Sample ID	Sample Date	EPA Analytical Method	Lab Sample ID	Analyte	Result	Units	Validation Qualifiers	Reason Code
DUP01	10/1/2008	E353.2	L0814614-03	NITRATE (AS N)	0.52	mg/l	J	TR
DUP02100608	10/6/2008	SW6010	L0814732-01	CALCIUM METAL	2.6	mg/l	J	E
DUP02100608	10/6/2008	A2320	L0814732-01	ALKALINITY, TOTAL (AS CACO3)	3.5	mg/L	J	E
DUP02100608	10/6/2008	SW6020	L0814732-01	ARSENIC	0.0002	mg/l	UJ	TR; B
DUP02100608	10/6/2008	SW6010	L0814732-01	SODIUM	1.4	mg/l	J	TR
DUP02100608	10/6/2008	2130B	L0814732-01	TURBIDITY	1.5	NTU	J	E
EQD-100608	10/6/2008	SW6020	L0814732-08	ARSENIC	0.0021	mg/l	U	B
EQD-100608	10/6/2008	2130B	L0814732-08	TURBIDITY	0.14	NTU	UJ	TR, B
EQD-100608	10/6/2008	E300	L0814732-08	SULFATE SULFATE	0.32	mg/l	J	TR
EQD-100608	10/6/2008	E353.2	L0814732-08	NITRATE (AS N)	0.05	mg/l	UJ	TR, B
EQG-100608	10/6/2008	E300	L0814732-09	CHLORIDE	0.068	mg/l	J	TR
EQG-100608	10/6/2008	E353.2	L0814732-09	NITRATE (AS N)	0.054	mg/l	UJ	TR, B
EQG-100608	10/6/2008	SW6010	L0814732-09	CALCIUM METAL	0.058	mg/l	J	TR
EQG-100608	10/6/2008	SW6020	L0814732-09	ARSENIC	0.00069	mg/l	UJ	TR, B
EQG-100608	10/6/2008	2130B	L0814732-09	TURBIDITY	0.15	NTU	UJ	TR, B
EW01-100208	10/2/2008	SW8260	L0814662-13	1,4-DICHLOROBENZENE	1.4	ug/l	J	TR
EW01-100208	10/2/2008	SW8260	L0814662-13	VINYL CHLORIDE	0.4	ug/l	J	TR
EW01-100208	10/2/2008	SW8260	L0814662-13	1,2-DICHLOROBENZENE	0.2	ug/l	J	TR
EW02-100208	10/2/2008	SW8260	L0814662-14	1,4-DICHLOROBENZENE	0.57	ug/l	J	TR
N5P2-100308	03-Oct-08	E353.2	L0814699-10	NITRATE (AS N)	0.12	mg/l	UJ	TR
N5P1-100308	03-Oct-08	E353.2	L0814699-11	NITRATE (AS N)	0.055	mg/l	UJ	TR
SHL-10-100308	10/3/2008	2130B	L0814699-04	TURBIDITY	0.53	NTU	U	B
SHL-10-100308	10/3/2008	SW6020	L0814699-04	ARSENIC	0.00091	mg/l	UJ	TR, B
SHL-11-100308	10/3/2008	E353.2	L0814699-01	NITRATE (AS N)	0.2	mg/l	J	TR
SHL-11-100308	10/3/2008	E300	L0814699-01	SULFATE SULFATE	0.54	mg/l	J	TR
SHL-13-10012008	10/1/2008	2130B	L0814614-04	TURBIDITY	0.23	NTU	U	B
SHL-15-100308	10/3/2008	SW6010	L0814699-05	SODIUM	1.6	mg/l	J	TR
SHL-15-100308	10/3/2008	E353.2	L0814699-05	NITRATE (AS N)	0.019	mg/l	UJ	TR
SHL21100608	10/6/2008	SW6010	L0814732-05	CALCIUM METAL	6.9	mg/l	J	E
SHL21100608	10/6/2008	E353.2	L0814732-05	NITRATE (AS N)	0.093	mg/l	UJ	TR, B
SHL21100608	10/6/2008	SW6020	L0814732-05	ARSENIC	0.0014	mg/l	U	B
SHL21100608	10/6/2008	2130B	L0814732-05	TURBIDITY	2.5	NTU	J	E

TABLE 7
Data Validation Qualifiers
Fort Devens, Shepley's Hill Landfill
DVR_SDGs_L0814614_L0814662_L0814699_L0814732

Sample ID	Sample Date	EPA Analytical Method	Lab Sample ID	Analyte	Result	Units	Validation Qualifiers	Reason Code
SHL21100608	10/6/2008	A2320	L0814732-05	ALKALINITY, TOTAL (AS CACO3)	19	mg/L	J	E
SHL21100608	10/6/2008	SW6010	L0814732-06	SODIUM	1.4	mg/l	J	TR
SHL21100608	10/6/2008	SW6020	L0814732-06	ARSENIC	0.00026	mg/l	UJ	TR, B
SHL-4-100308	10/3/2008	2130B	L0814699-09	TURBIDITY	0.57	NTU	U	B
SHL-4-100308	10/3/2008	E353.2	L0814699-09	NITRATE (AS N)	0.14	mg/l	U	B
SHL-4-100308	10/3/2008	SW6010	L0814699-09	POTASSIUM	1.9	mg/l	J	TR
SHL-4-100308	10/3/2008	SW6010	L0814699-09	SODIUM	1.3	mg/l	J	TR
SHL-5-10012008	10/1/2008	2130B	L0814614-07	TURBIDITY	0.60	NTU	U	B
SHL-5-10012008	10/1/2008	SW6010	L0814614-07	POTASSIUM	1.6	mg/l	J	TR
SHL-5-10012008	10/1/2008	SW6010	L0814614-07	SODIUM	1.3	mg/l	J	TR
SHL-5-10012008	10/1/2008	E353.2	L0814614-07	NITRATE (AS N)	0.067	mg/l	UJ	TR, B
SHL-8D-10012008	10/1/2008	E353.2	L0814614-01	NITRATE (AS N)	0.15	mg/l	U	B
SHL-8D-10012008	10/1/2008	2130B	L0814614-01	TURBIDITY	0.09	NTU	U	B
SHL-8D-10012008	10/1/2008	SW6020	L0814614-01	ARSENIC	0.00024	mg/l	UJ	TR, B
SHL-8S-10012008	10/1/2008	E353.2	L0814614-05	NITRATE (AS N)	0.098	mg/l	UJ	TR, B
SHL-8S-10012008	10/1/2008	2130B	L0814614-05	TURBIDITY	0.23	NTU	U	B
SHL-8S-10012008	10/1/2008	SW6020	L0814614-05	ARSENIC	0.00073	mg/l	UJ	TR, B
SHM0539A10022008	10/2/2008	E353.2	L0814662-06	NITRATE (AS N)	0.13	mg/l	J	TR
SHM0540X10022008	10/2/2008	E353.2	L0814662-05	NITRATE (AS N)	0.048	mg/l	J	TR
SHM0541A10022008	10/2/2008	SW6010	L0814662-11	POTASSIUM	2.4	mg/l	J	TR
SHM0541A10022008	10/2/2008	E353.2	L0814662-11	NITRATE (AS N)	0.065	mg/l	J	TR
SHM-05-41B10012008	10/1/2008	E353.2	L0814614-02	NITRATE (AS N)	0.12	mg/l	UJ	TR, B
SHM0541C10022008	10/2/2008	E353.2	L0814662-12	NITRATE (AS N)	0.056	mg/l	J	TR
SHM0541C10022008	10/2/2008	E300	L0814662-12	SULFATE SULFATE	0.39	mg/l	J	TR
SHM0542A10022008	10/2/2008	SW6010	L0814662-09	POTASSIUM	1.8	mg/l	J	TR
SHM0542A10022008	10/2/2008	SW6010	L0814662-09	SODIUM	1.3	mg/l	J	TR
SHM0542A10022008	10/2/2008	SW6010	L0814662-09	MANGANESE	0.0076	mg/l	J	TR
SHM0542A10022008	10/2/2008	E353.2	L0814662-09	NITRATE (AS N)	0.099	mg/l	J	TR
SHM0542A10022008	10/2/2008	SW6020	L0814662-09	ARSENIC	0.0013	mg/l	U	B
SHM0542B10022008	10/2/2008	E353.2	L0814662-10	NITRATE (AS N)	0.11	mg/l	J	TR
SHM-93-10C100308	10/3/2008	E353.2	L0814699-03	NITRATE (AS N)	0.056	mg/l	UJ	TR
SHM-93-22B10012008	10/1/2008	E353.2	L0814614-09	NITRATE (AS N)	0.15	mg/l	UJ	TR, B

TABLE 7
Data Validation Qualifiers
Fort Devens, Shepley's Hill Landfill
DVR_SDGs_L0814614_L0814662_L0814699_L0814732

Sample ID	Sample Date	EPA Analytical Method	Lab Sample ID	Analyte	Result	Units	Validation Qualifiers	Reason Code
SHM-96-5C10012008	10/1/2008	E353.2	L0814614-08	NITRATE (AS N)	0.053	mg/l	UJ	TR, B
SHM9931C10022008	10/2/2008	E353.2	L0814662-02	NITRATE (AS N)	0.04	mg/l	J	TR
SHP0129X100608	10/6/2008	E353.2	L0814732-07	NITRATE (AS N)	0.15	mg/l	UJ	TR, B
SHP0136X100608	10/6/2008	2130B	L0814732-04	TURBIDITY	0.47	NTU	U	B
SHP0136X100608	10/6/2008	SW6010	L0814732-04	POTASSIUM	1.8	mg/l	J	TR
SHP0137X100608	10/6/2008	SW6010	L0814732-03	POTASSIUM	1.3	mg/l	J	TR
SHP0137X100608	10/6/2008	2130B	L0814732-03	TURBIDITY	0.36	NTU	U	B
SHP0139A100608	10/6/2008	E353.2	L0814732-02	NITRATE (AS N)	0.14	mg/l	UJ	TR, B
SHP0139A100608	10/6/2008	A2320	L0814732-02	ALKALINITY, TOTAL (AS CACO3)	140	mg/L	J	Q
SHP-93-10D100308	10/3/2008	E353.2	L0814699-02	NITRATE (AS N)	0.066	mg/l	UJ	TR

Validation Qualifiers:

R — The R qualifier indicates that a result has been rejected due to serious QC problems. It is not possible to definitively determine whether the analyte is present or absent in the sample.

U — The U qualifier indicates that the analyte must be considered to be nondetected at the concentration listed. U qualifiers added during data quality review are typically a result of detections of target analytes in field, trip, or laboratory blanks.

J — The J qualifier indicates that the associated result is quantitatively uncertain. J qualifiers added during validation may indicate a concentration between the method detection limit (MDL) and the method reporting limit (MRL) or a data limitation related to a QC element that exceeds required acceptance limits.

UJ — The UJ qualifier indicates reporting limit is estimated. UJ qualifiers added during validation may indicate either a high or low bias related to a QC element that exceeds required acceptance limits.

Reason Code:

B — Contaminent detected in preparation (method) or calibration blank
E — Duplicates (field or laboratory) showed poor agreement
TR — Trace level detect
Q — MS/MSD recovery or relative procent difference was not within acceptance limits.

November 6, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

INTRODUCTION

This data validation report covers one water sample collected on October 14, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The sample was dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on October 14, 2008 and assigned sample delivery group (SDG) number L0815140 upon receipt. Alpha analyzed the sample for total arsenic using USEPA Method 6020A. The associated field sample identification (ID) and Alpha sample ID is presented in Table 1.

The level of data validation specified in Table 2 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Arsenic was detected and reported at a concentration of 1.1 µg/L.

Table 1. Field Sample List

Lab Sample Number	Field ID	Comments
L0815140-01	EFF-101408	3 ppb detection limit

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 10/14/2008 at a temperature of 4°C.	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0815140

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Arsenic by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 4°C. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The sample was analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ"	The tune standard met established criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero).	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		

November 6, 2008 **Arsenic by USEPA Method 6020A**

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards: analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020); J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020) ; J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Calibration Range/ Results	1) Results > Upper calibration range J qualify detects. 2) Results <Method reporting limit, >method detection limit; J qualify detects (estimated).	Arsenic was detected and reported in sample EFF-101408 at 0.0011 mg/L, above the reporting limit of 0.0005 mg/L.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration; flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	Arsenic at 0.00012 mg/L was detected in the associated method blank. Sample concentration was more than 5 times the MB concentration.	No qualification required.	None
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample, U qualify detects. 4) Sample results >5x blank level, no action required.	Arsenic was detected in the ICB (0.00018 mg/L) and CCBs (0.00014 mg/L and 0.00011 mg/L) at concentrations greater than the method-detection limit. The sample concentration was more than 5 times the concentration detected in ICB and CCBs.	No qualification required.	None
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results ≤5× the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		

November 6, 2008 **Arsenic by USEPA Method 6020A**

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a) %R<30% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" and nondetected results "UJ"	IS recoveries were within the acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits at 97% and 93%, respectively.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND: J-detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No laboratory duplicate was associated with this sample.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 40% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND: J-detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No field duplicate was associated with this SDG.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	No MS/MSD was associated with this SDG.		

November 6, 2008 Arsenic by USEPA Method 6020A
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-150% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required. a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS was performed on sample EFF-101408. The recovery was within acceptance limits at 108%.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50-times MDL 3) %D>10% flag detected results "J"	The %D for the SD performed on sample EFF-101408 was within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Arsenic was reported as detected and the required reporting limit of 0.003 mg/L was met.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Melanie Roshu
Environmental Chemist

REVIEWED BY:

Denise Ladebauche
Environmental Chemist

November 20, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

INTRODUCTION

This data validation report covers one water sample collected on November 4, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The sample was dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on November 4, 2008 and assigned sample delivery group (SDG) number L0816302 upon receipt. Alpha analyzed the sample for total arsenic using USEPA Method 6020A. The associated field sample identification (ID) and Alpha sample ID is presented in Table 1.

The level of data validation specified in Table 2 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Arsenic was detected and reported at a concentration of 1.0 µg/L.

Table 1. Field Sample List

Lab Sample Number	Field ID	Comments
L0816302-01	EFF-110408	3 ppb detection limit

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 11/04/2008 at a temperature of 3°C.	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0816302

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Arsenic by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 3°C. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The sample was analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ".	The tune standard met established criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero).	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		

November 20, 2008 **Arsenic by USEPA Method 6020A**

Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020) ; J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Calibration Range/ Results	1) Results >Upper calibration range J qualify detects. 2) Results<Method reporting limit, >method detection limit; J qualify detects (estimated).	Arsenic was detected and reported in sample EFF-110408 at 0.0010 mg/L, above the reporting limit of 0.0005 mg/L.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration; flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	Arsenic was not detected in the associated method blank.		
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample, U qualify detects 4) Sample results >5x blank level, no action required.	Arsenic was not detected in the ICB and/or CCBs at concentrations greater than the method-detection limit.		
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results ≤5× the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		

November 20, 2008 **Arsenic by USEPA Method 6020A**
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a)%R<30% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" and nondetected results "UJ"	IS recoveries were within the acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits at 100% and 92%, respectively.		
Laboratory Duplicate RPD	1) RPD ≤ 20% a) If exceeds RPD limit; J qualify detects, UJ qualify non detects b) If one result > MRL and other ND; J-detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No laboratory duplicate was associated with this sample.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 40% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND; J-detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No field duplicate was associated with this SDG.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	No MS/MSD was associated with this SDG.		

November 20, 2008 Arsenic by USEPA Method 6020A
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-150% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS was performed on sample EFF-110408. The recovery was within acceptance limits at 110%.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration ≥50-times MDL 3) %D>10% flag detected results "J"	The %D for the SD performed on sample EFF-110408 was within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Arsenic was reported as detected and the required reporting limit of 0.003 mg/L was met.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Melanie Roshu
Environmental Chemist

REVIEWED BY:

Denise Ladebauche
Environmental Chemist

December 29, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6010B, 6020A, and 7470A
Anions by USEPA Methods 300.0/353.2

INTRODUCTION

This data validation report covers three primary water samples collected on December 2, 2008 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by ECC at Alpha Woods Hole Laboratory in Westborough, MA (Alpha) on December 2, 2008 and assigned sample delivery group (SDG) number L0817660, upon receipt. Alpha analyzed the samples for total metals using USEPA 6010B, 6020A, and 7470A methods, chloride and sulfates using USEPA Method 300.0, and nitrate using USEPA Method 353.2. The associated field sample identification (ID) and Alpha sample IDs are presented in Table 2.

AMEC reviewed the laboratory's analytical data package to assess for adherence to acceptable laboratory practices and the data validation requirements as specified in MADEP Massachusetts Contingency Plan Compendium of Analytical Methods and applicable USEPA Methods outlined in Table 3 and Table 4. The level of data validation specified in Table 1 was performed with reference to the Fort Devens Quality Assurance Project Plan (QAPP) and EPA Region I Tier II Guidance. For Tier II data review, data quality objectives are assessed by review of the CLP summary forms, with no review of the associated raw data.

EXECUTIVE SUMMARY

All data is generally usable and of good quality. Any limitations on the data and detected results are listed below.

Table 1. Sample Status

Data Validation Level	Matrix	Preservation	Temperature Sample Receipt	Laboratory	SDG Number
Tier II	Aqueous	As required by method	One sample cooler was received on 12/2/08 at a temperature of 3°C	Alpha Woods Hole Laboratory, 8 Walkup Drive, Westborough, MA 01581	L0817660

Table 2. Field Sample List

Lab Sample Number	Field ID	Comments
L0817660-01	EFF-120208	Metals, Anions.
L0817660-02	EW01-120208	Analyzed only for As, Fe, Mn
L0817660-03	EW02-120208	Analyzed only for As, Fe, Mn

December 29, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Metals by USEPA Methods 6010B, 6020A, and USEPA Method 7470A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 3°C. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	Samples were analyzed within holding time.		
ICP-MS Tune	1) Tuning solution analyzed at least four times. RSD ≤ 5% for each component. 2) Mass calibration not within 0.1 AMU, qualify detected results "J" and nondetected results "UJ"	ICP-MS Tune met acceptance criteria.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration. r≥0.995 (EPA Method 6010/6020/7470) 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero).	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICVs met acceptance criteria.		

December 29, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6010B, 6020A, and 7470A
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020); J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020) ; J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the MDL. 2) If sample result is <5x contaminant concentration; flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	No analytes were detected in the preparation blanks associated with these samples.		
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the MDL. 3) Sample results < 5x blank sample, U qualify detects. 4) Sample results >5x blank level, no action required.	No analytes were detected in the ICB/CCBs associated with these samples.		
Negative blanks	1) If the blank has a negative result with an absolute value >MDL, qualify detected results ≤5× the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		

December 29, 2008
Region I Data Review Worksheet
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Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6010B, 6020A, and 7470A
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Internal Standards (IS)	1) Intensity of IS must be 30-120% of intensity of IS in the initial calibration standard. a)%R<30% flag detected results "J" and nondetected results "UJ" b) %R >130% flag detected results "J" and nondetected results "UJ"	All internal standards %R were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptable limits.		
Laboratory Duplicate RPD	1) RPD ≤20% a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > MRL and other ND; J-detections, UJ qualify non detects 2) ± MRL for results ≤ 5x the MRL	No laboratory duplicate was associated with this SDG.		
Field Duplicate RPD	1) RPD >20% waters (>30% soils) 2) For detected results more than 5 times their PQLs flag "J" 3) Differences in concentrations > the MRL for analytes with concentrations less than 5 times their PQLs, flag "J"	No field duplicate was associated with this SDG.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	No MS/MSD was associated with this SDG.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125% (EPA Method 6000/7000). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and undetected results "UJ" c) Recoveries >125% flag detected results "J"	Sample EFF-120208 was used as the source for the PDS. The recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50-times IDL 3) %D>10% flag detected results "J"	The laboratory performed serial dilution analyses on samples EFF-120208 and EW1-120208. The %Ds were less than 10%.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported MRL should not be below the lowest ICAL standard concentration. a) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Arsenic (0.00087 mg/L) was detected below the RL of 0.001 mg/L in sample EFF-120208.	AMEC J qualified the arsenic result from sample EFF-120208 with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 4. Nitrate by USEPA 353.2, and Chloride and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C 3) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 3°C. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		

December 29, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6010B, 6020A, and 7470A
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 353.2)	The sample was analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) r ≥ 0.99 for chloride, sulfate and nitrate, linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	1) No qualification if recovery between 90-110% (chloride, sulfate and nitrate) and 85-115% (cyanide). a) %R >110% (chloride, sulfate and nitrate) and 115% (cyanide) flag detected results "J" b) %R <90% (chloride, sulfate and nitrate) and 85% (cyanide) flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <5x contaminant concentration and between MDL and MRL, raise result to MRL and flag "U" 2) If sample result is <5x contaminant concentration and ≥ MRL flag "U" 3) Sample result ≥5x contaminant concentration; no qualification required.	Sulfate (0.12 mg/L) and nitrate (0.053 mg/L) were detected in the method blanks associated with sample EFF-120208. The detected sulfate and nitrate concentrations in sample EFF-120208 were more that 5 times the blank concentrations. Data usability is not affected. No chloride was detected in the associated method blank.		
ICBs/CCBs	1) Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 80-120% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) 20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ" 2) ± MRL for results ≤ 5x the MRL. Difference >MRL, flag detected results "J" and nondetected results "UJ"	Sample EFF-120208 was analyzed in duplicate for nitrate. The RPDs were within acceptance criteria.		

December 29, 2008
Region I Data Review Worksheet
Project: SHL, Fort Devens
Review Criteria: Fort Devens QAPP and MADEP MCP
USEPA Region I Tier II Guidance

Metals by USEPA Methods 6010B, 6020A, and 7470A
Anions by USEPA Methods 300.0/353.2

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	1) RPD ≤ 20% for aqueous samples (≤ 30% soil samples) for analytes with concentrations more than 5 times their PQLs, and concentrations within one MRL for analytes with concentrations less than 5 times their PQLs	No field duplicate was collected with this SDG.		
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 75% flag detected results "J" and nondetected results "UJ" %R< 125% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	Sample EFE-120208 was used as the source sample for MS for nitrate. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LDR "J" 2) The reported RL should not be below the lowest ICAL standard concentration. 3) Positive results reported above the MDL but below the RL should be considered estimated and be flagged "J"	Chloride, sulfate, and nitrate were reported as detected above the method reporting limits.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.
Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

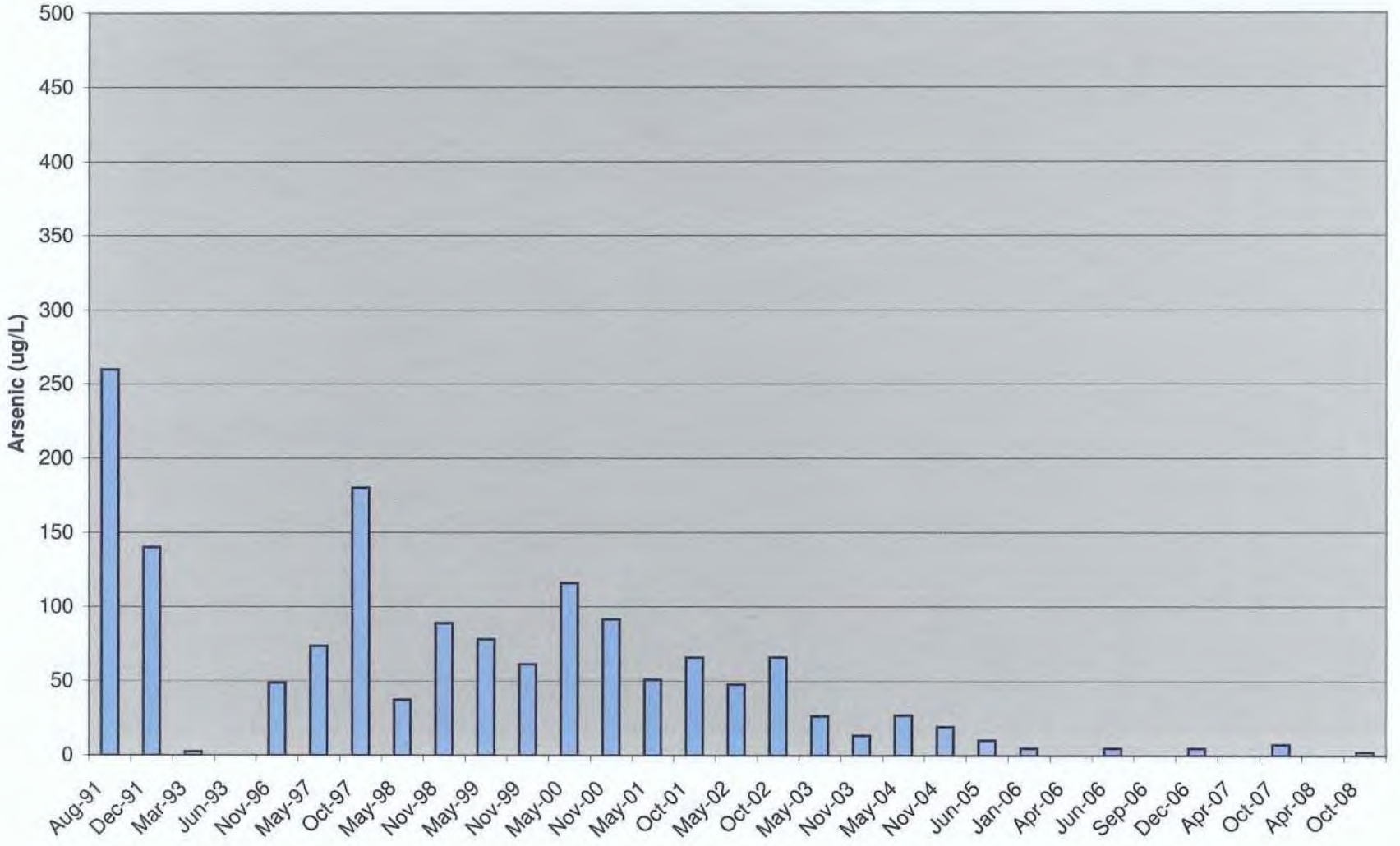
Melanie Roshu
Environmental Chemist

REVIEWED BY:

Denise Ladebauche
Environmental Chemist

Appendix E

Arsenic Trends


SHL-4
Arsenic (ug/L)
500
450
400
350
300
250
200
150
100
50
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Oct-01
May-02
Oct-02
May-03
Nov-03
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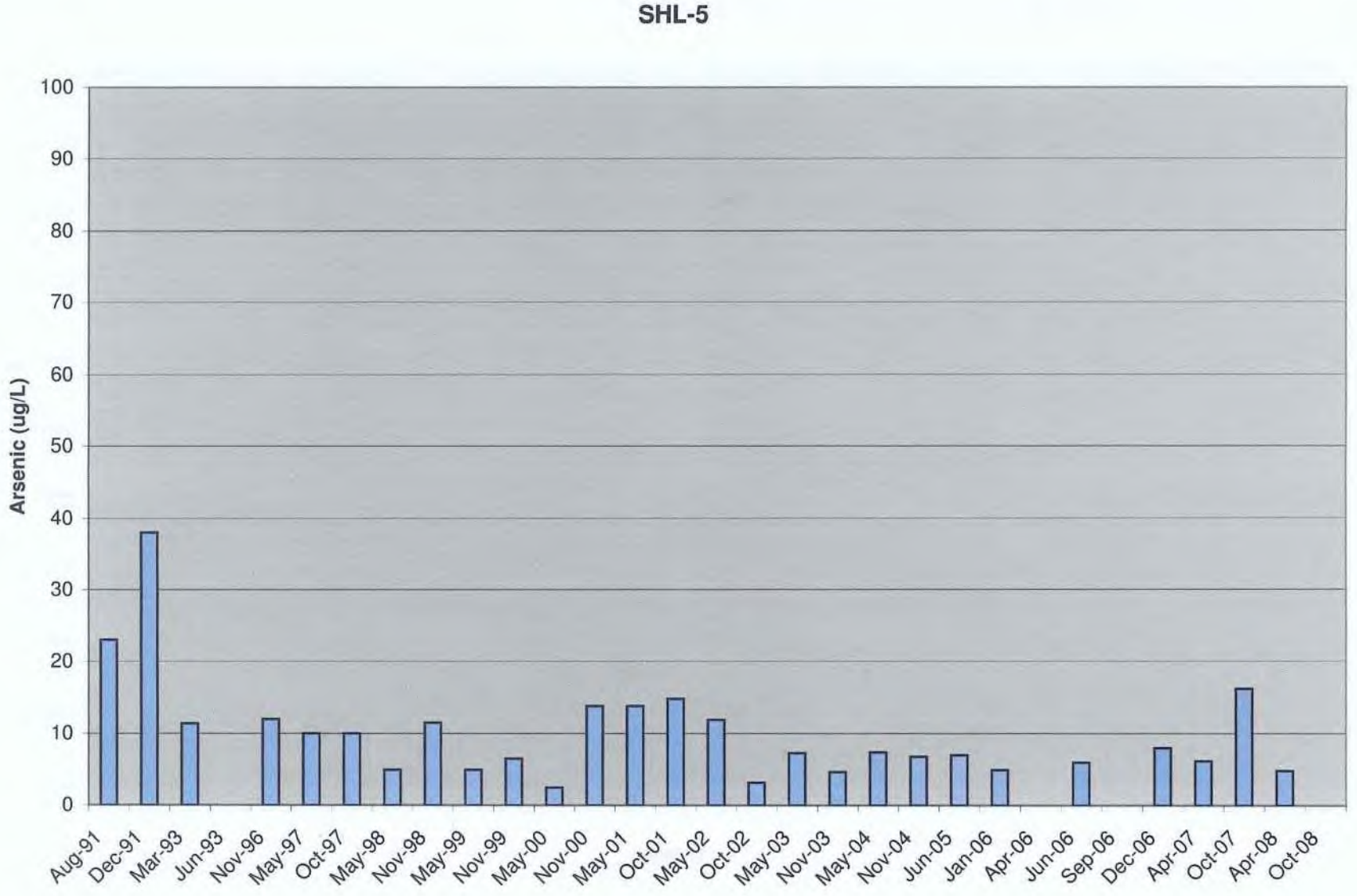
Dec-06
Apr-07
Oct-07
Apr-08
Oct-08


SHL-5
Arsenic (ug/L)
100
90
80
70
60
50
40
30
20
10
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Oct-01
May-02
Oct-02
May-03
Nov-03
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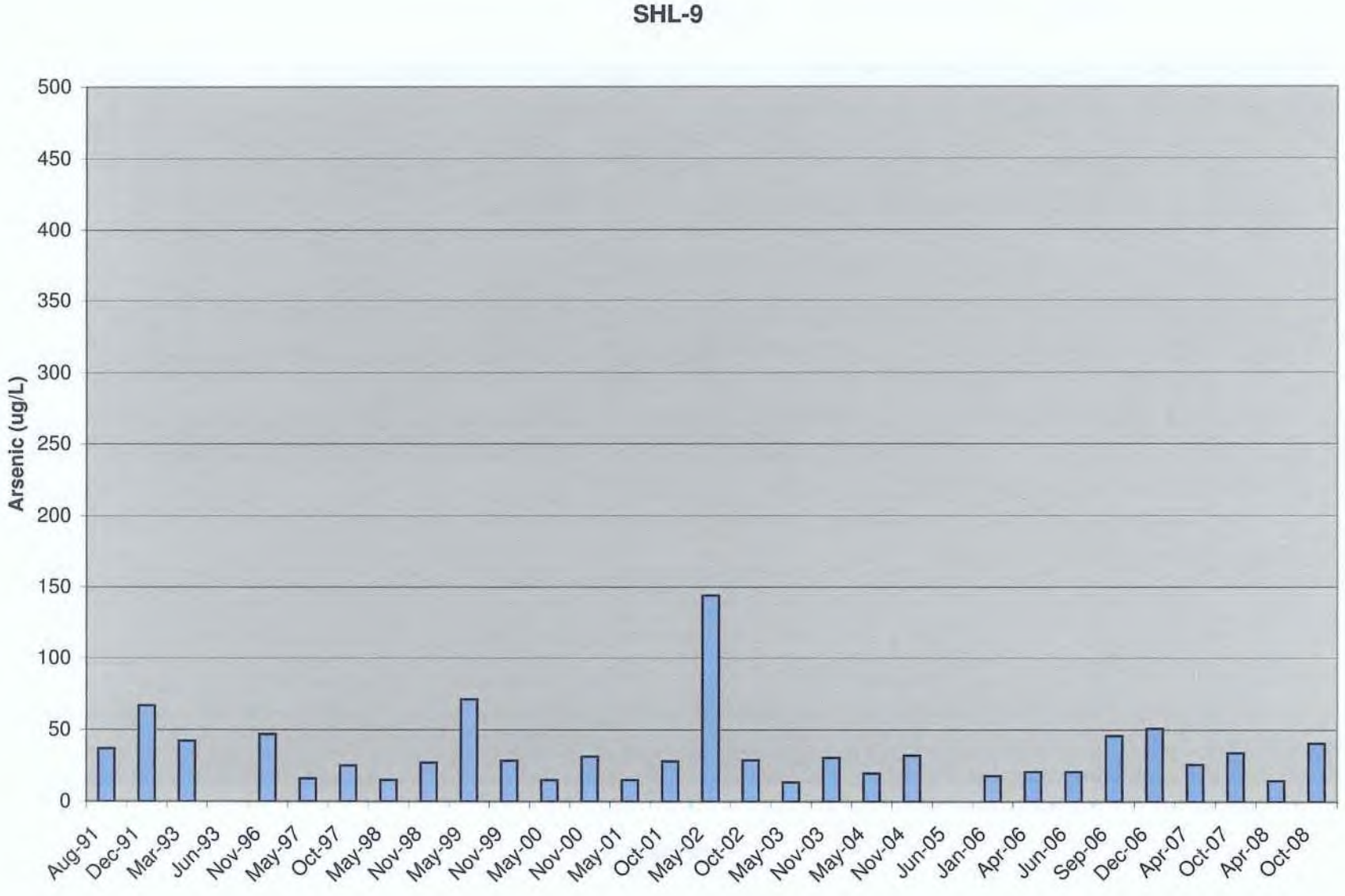
Sep-06
Dec-06
Apr-07
Oct-07
Apr-08
Oct-08


SHL-9
Arsenic (ug/L)
500
450
400
350
300
250
200
150
100
50
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Oct-01
May-02
Oct-02
May-03
Nov-03
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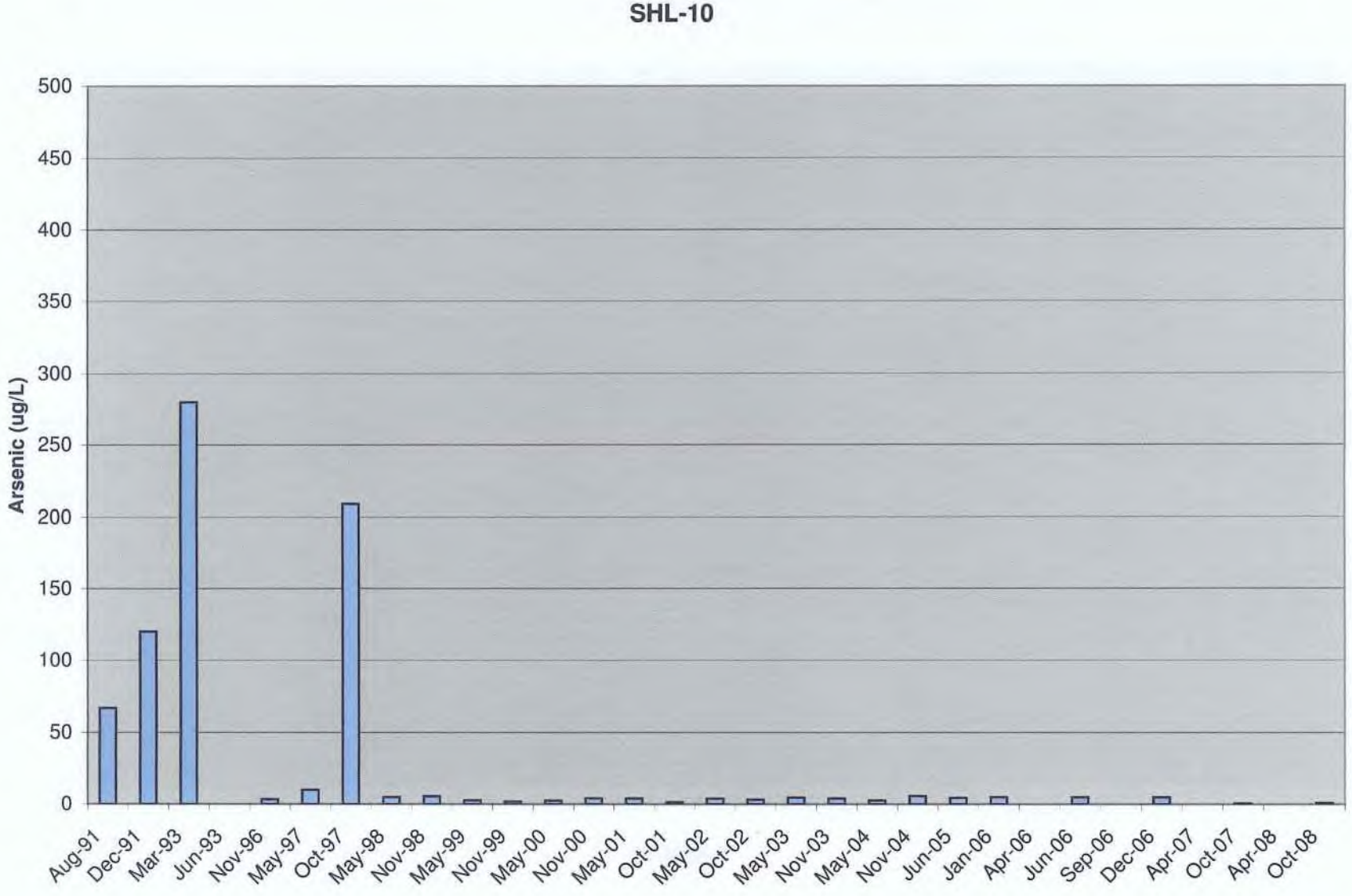
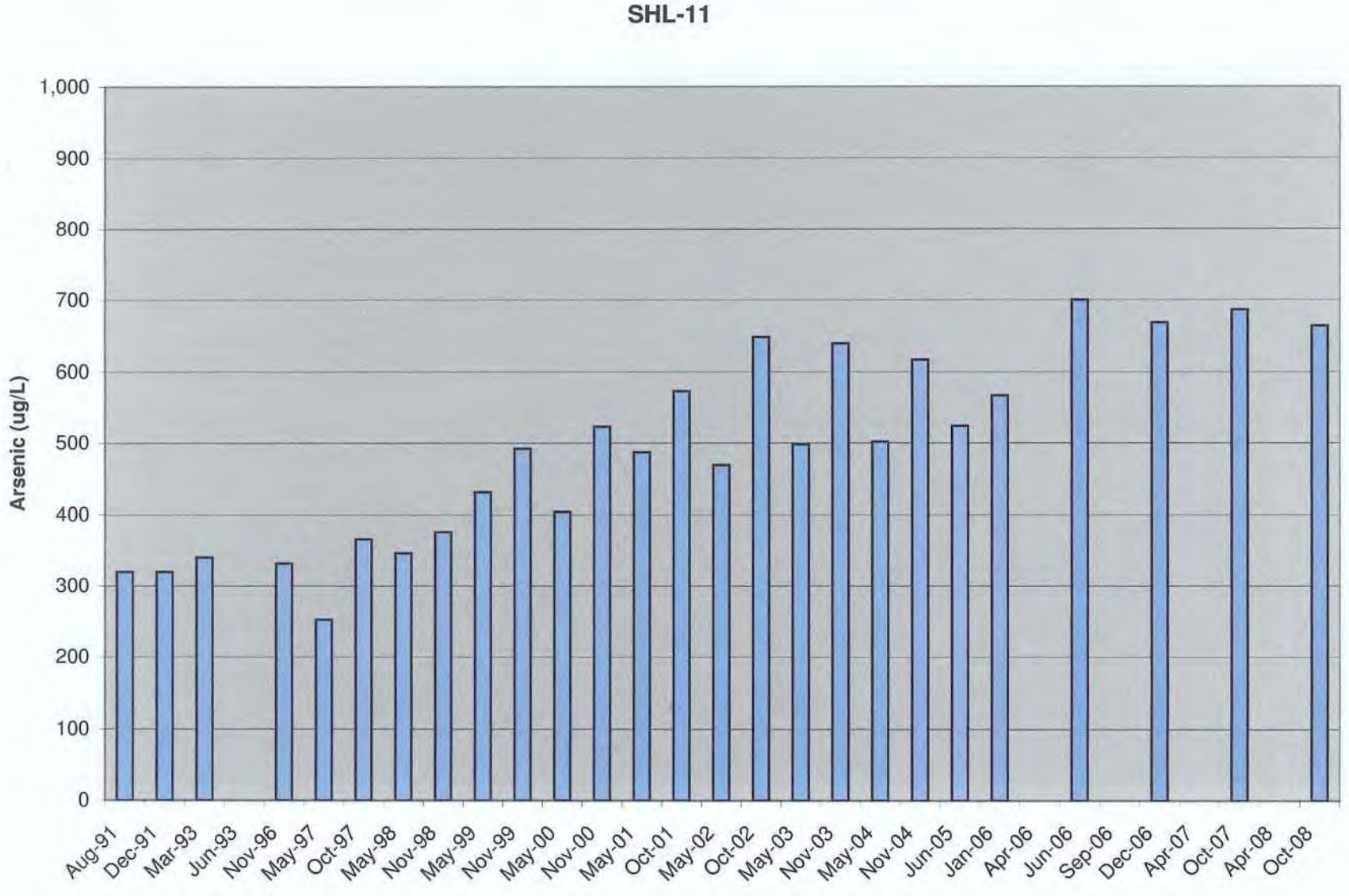
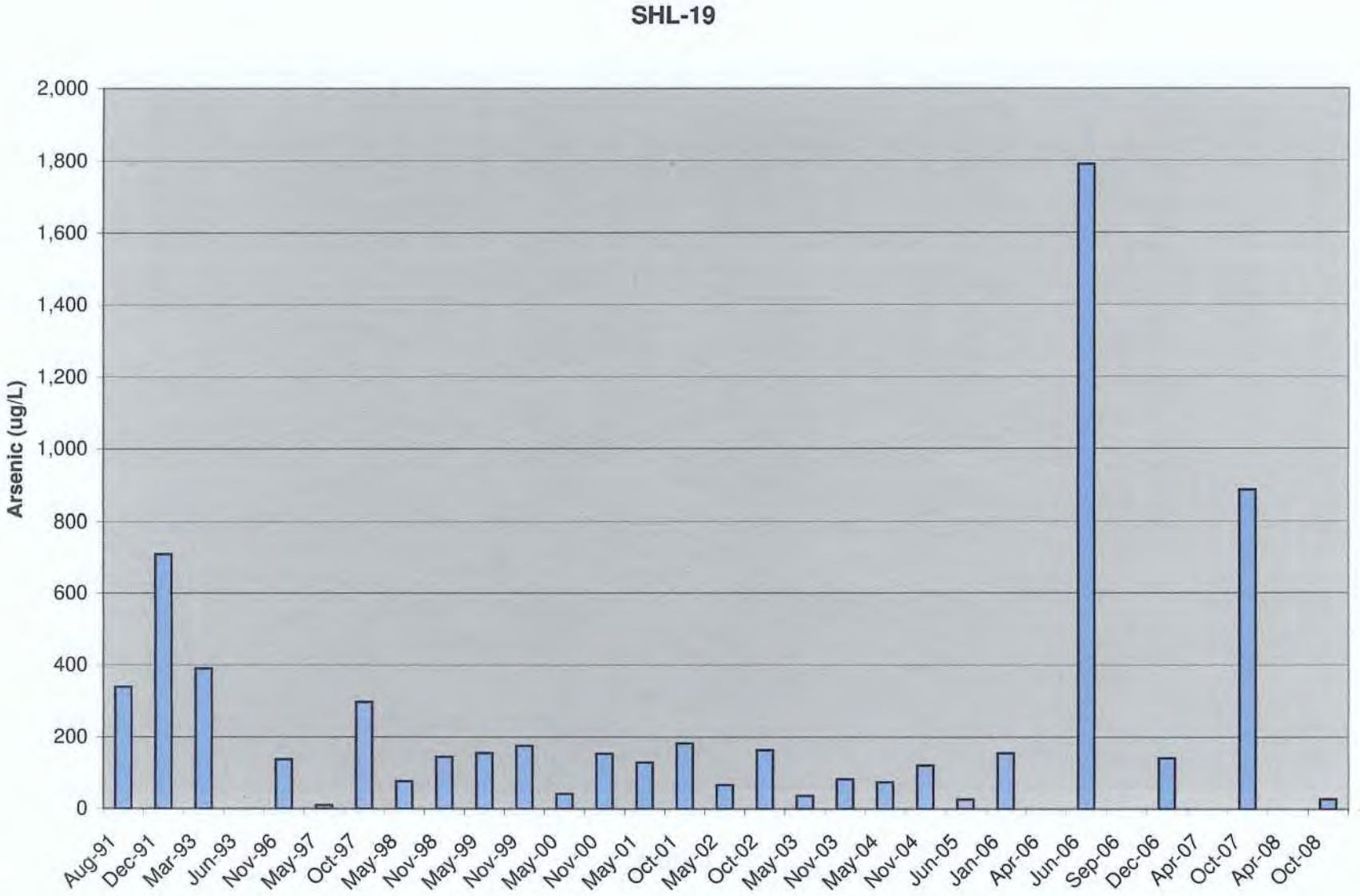
Sep-06
Dec-06
Apr-07
Oct-07
Apr-08
Oct-08


SHL-10
Arsenic (ug/L)
500
450
400
350
300
250
200
150
100
50
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Oct-01
May-02
Oct-02
May-03
Nov-03
May-04
Nov-04
Jun-05
Jan-06
Apr-06
Jun-06
Sep-06
Dec-06
Apr-07
Oct-07
Apr-08
Oct-08


SHL-11
Arsenic (ug/L)
1,000
900
800
700
600
500
400
300
200
100
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Oct-01
May-02
Oct-02
May-03
Nov-03
May-04
Nov-04
Jun-05
Jan-06
Apr-06
Jun-06
Sep-06
Dec-06
Apr-07
Oct-07
Apr-08
Oct-08


SHL-19
Arsenic (ug/L)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Oct-01
May-02
Oct-02
May-03
Nov-03
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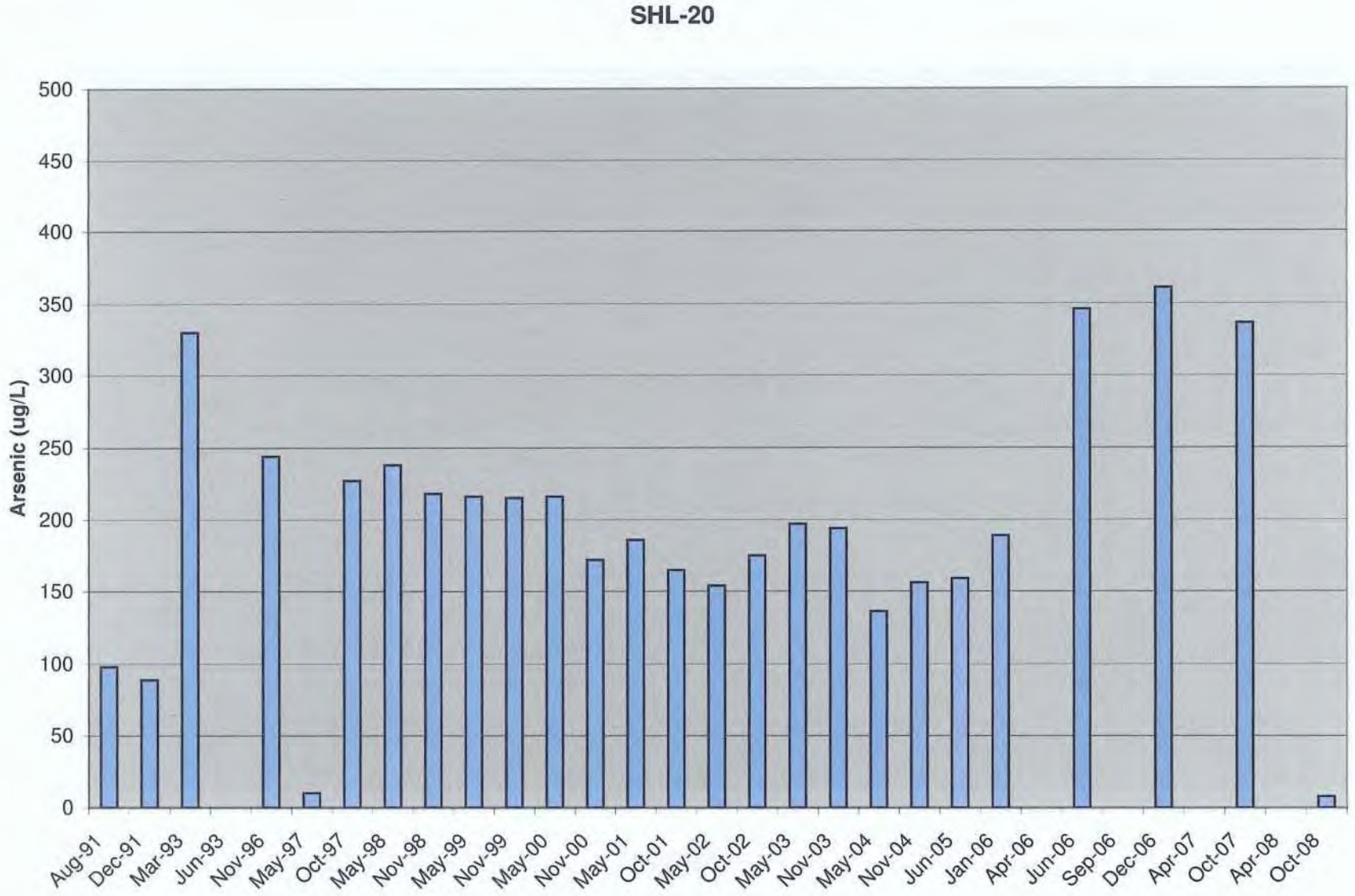
Sep-06
Dec-06
Apr-07
Oct-07
Apr-08
Oct-08


SHL-20
Arsenic (ug/L)
500
450
400
350
300
250
200
150
100
50
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Oct-01
May-02
Oct-02
May-03
Nov-03
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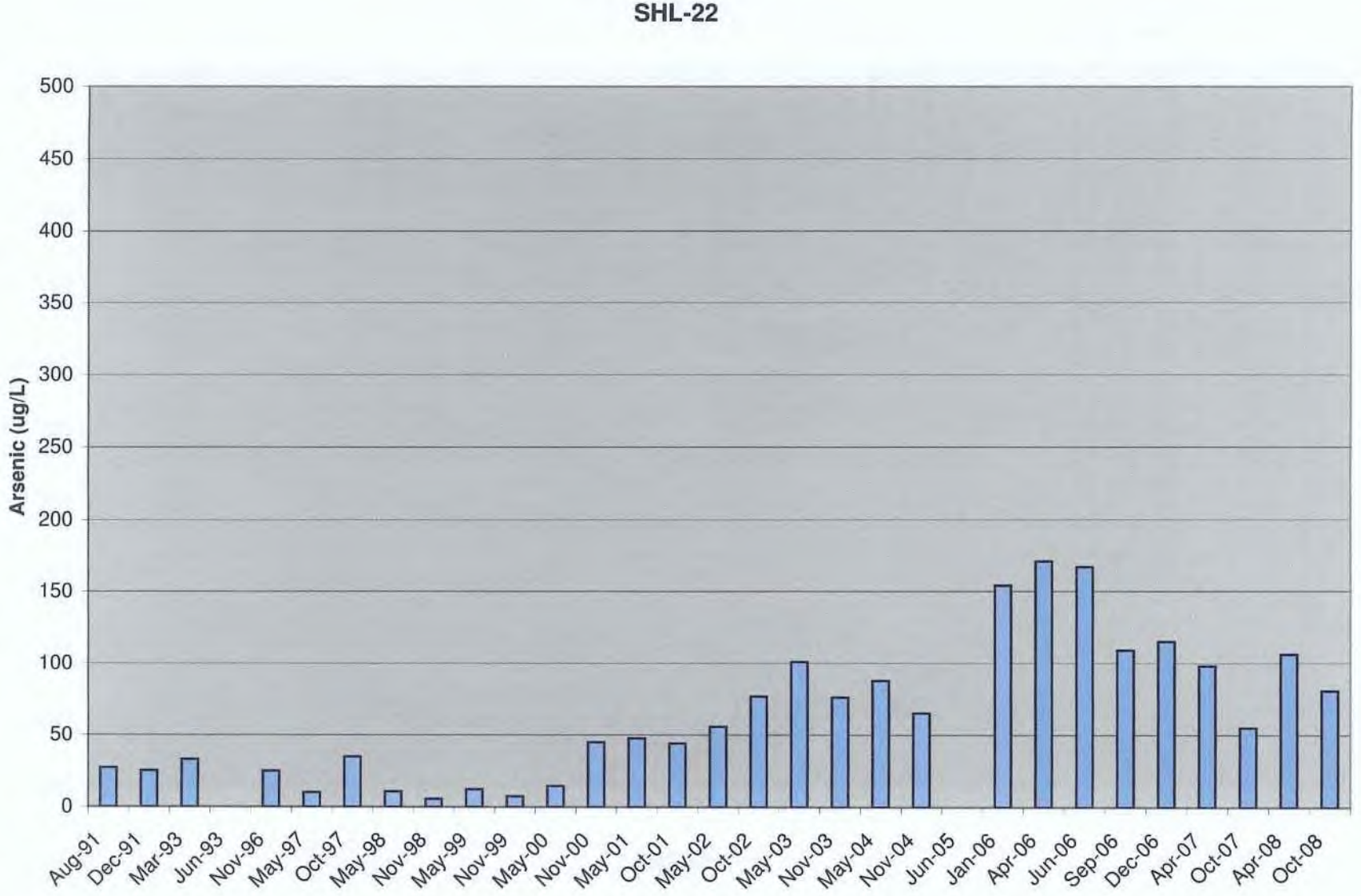
Apr-08
Oct-08


SHL-22
Arsenic (ug/L)
500
450
400
350
300
250
200
150
100
50
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Oct-01
May-02
Oct-02
May-03
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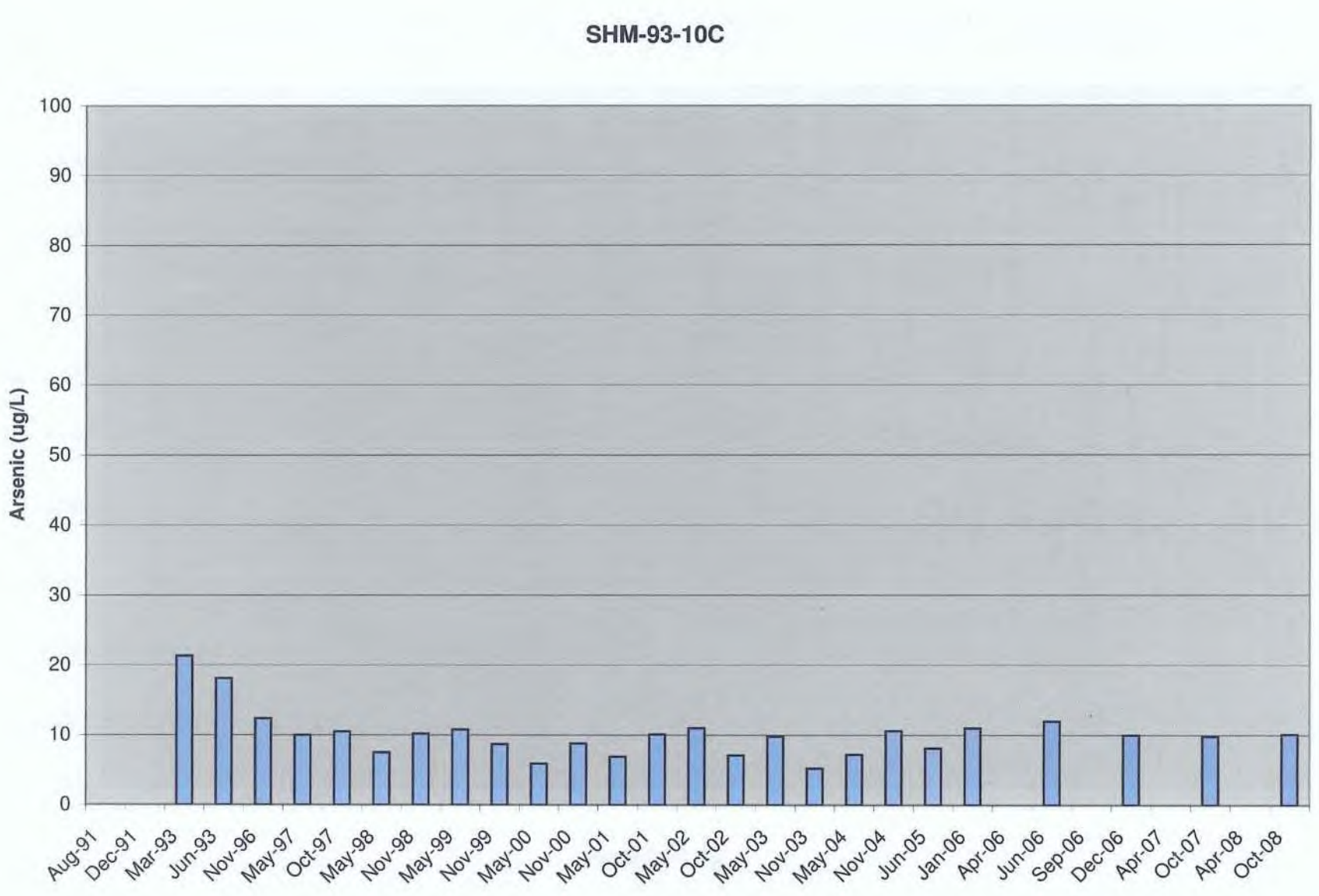
SHM-93-10C
Arsenic (ug/L)
100
90
80
70
60
50
40
30
20
10
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Oct-01
May-02
Oct-02
May-03
Nov-03
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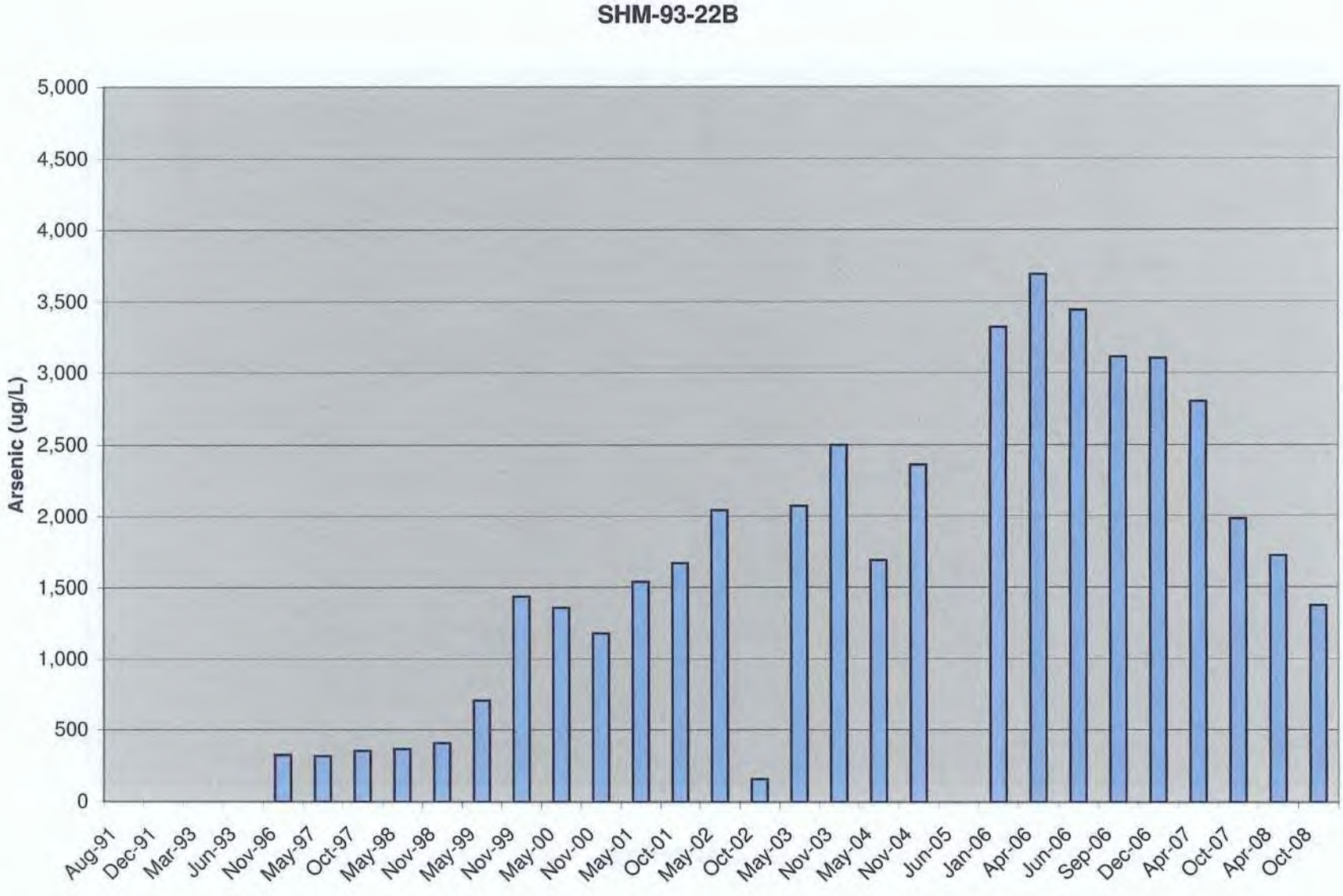
Oct-08


SHM-93-22B
Arsenic (ug/L)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Oct-01
May-02
Oct-02
May-03
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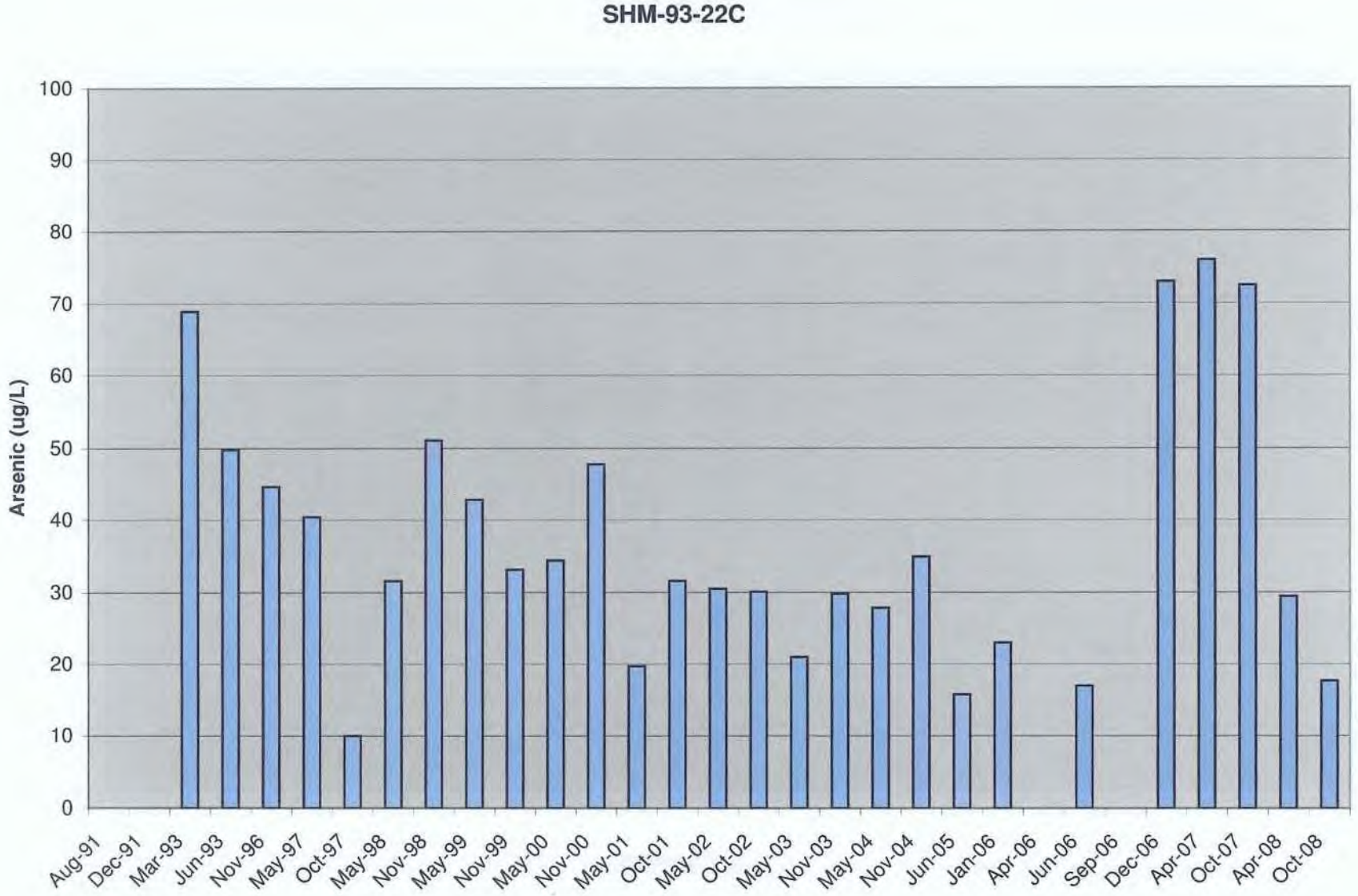
SHM-93-22C
Arsenic (ug/L)
100
90
80
70
60
50
40
30
20
10
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
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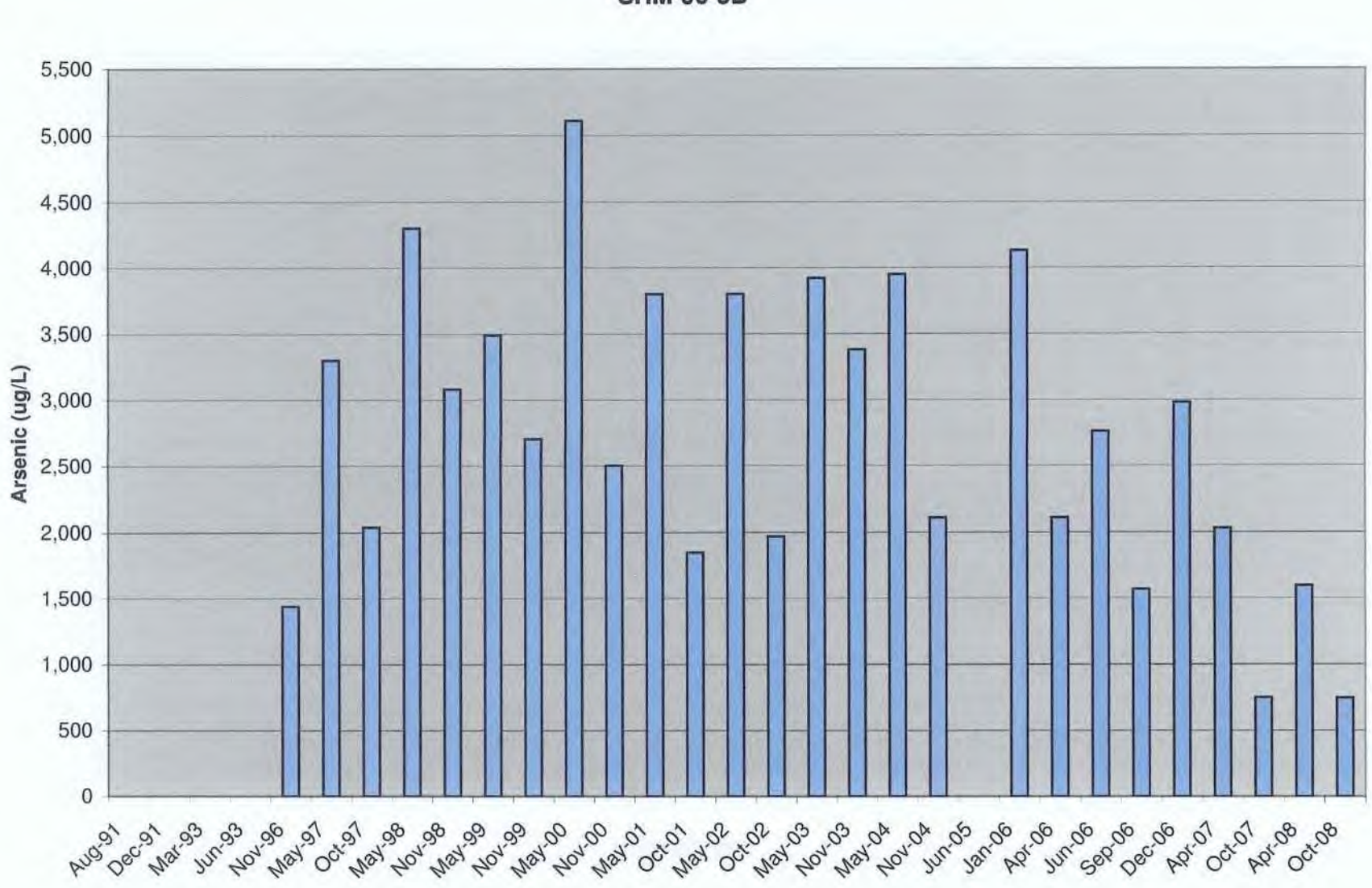
SHM-96-5B
Arsenic (ug/L)
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Oct-01
May-02
Oct-02
May-03
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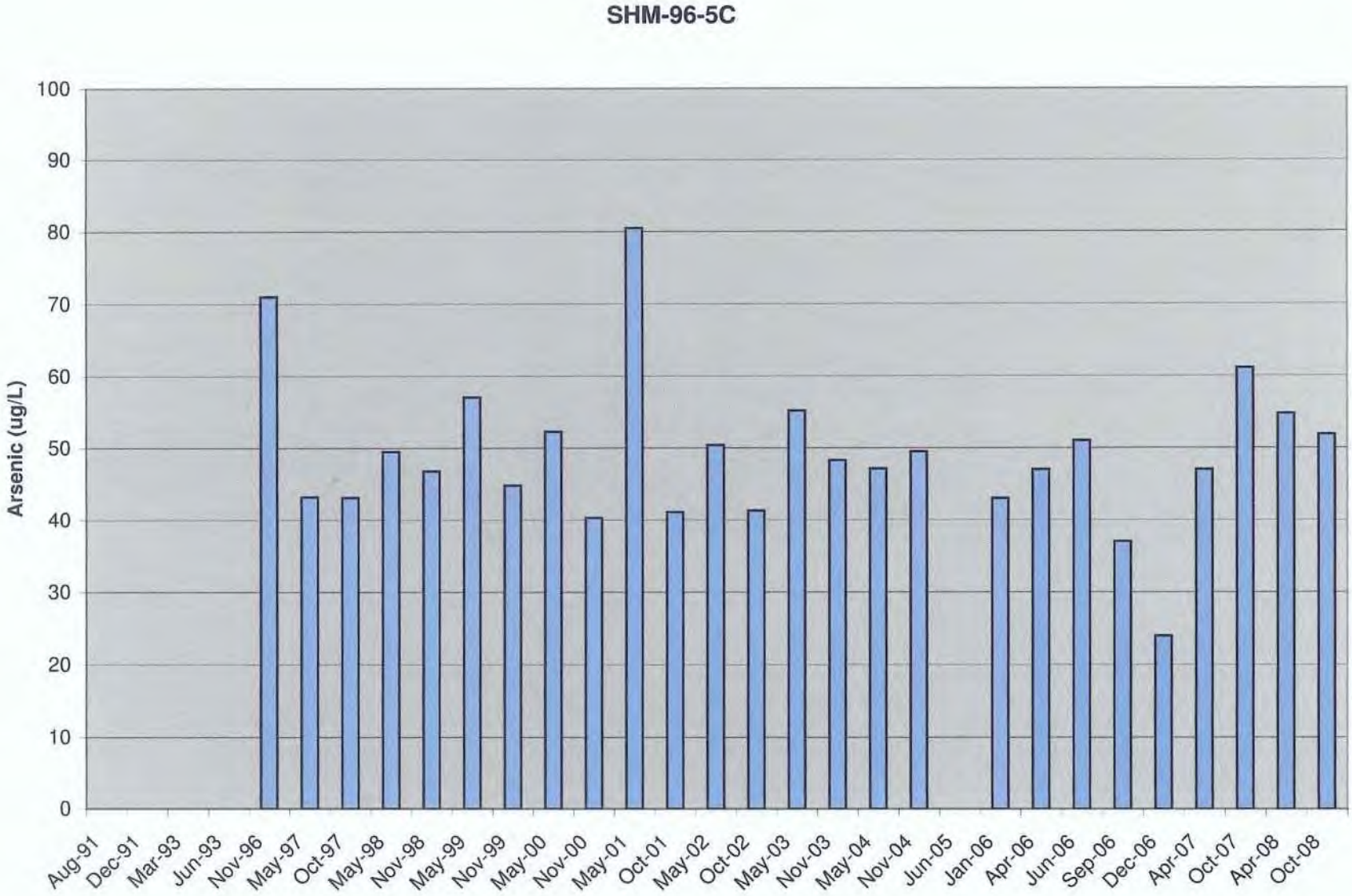

SHM-96-5C
Arsenic (ug/L)
100
90
80
70
60
50
40
30
20
10
0
Aug-91
Dec-91
Mar-93
Jun-93
Nov-96
May-97
Oct-97
May-98
Nov-98
May-99
Nov-99
May-00
Nov-00
May-01
Oct-01
May-02
Oct-02
May-03
Nov-03
May-04
Nov-04
Jun-05
Jan-06
Apr-06
Jun-06
Sep-06
Dec-06
Apr-07
Oct-07
Apr-08
Oct-08

Appendix F

Agency Comments and Army Responses

Draft
Responses to EPA Comments on
2008 Annual Report
Shepley's Hill Landfill and Treatment Plant
Long Term Monitoring and O&M Services
Former Fort Devens, Massachusetts
August 2009

General Comments:

1. The hydraulic capture zone analysis has been discussed at previous BCT meetings and in other document comment-response exchanges. The discussion of the numerical model results does not include any of the qualifications that were developed in revision of the *Supplemental Groundwater Investigation and Landfill Cap Assessment* (AMEC, 2008). Please expand Section 5.0 of the Annual Report to acknowledge the computational issues encountered (i.e., convergence and water-balance problems), and the attendant uncertainties in the model results. Please see related Specific Comments.

Response: Section 5 will be updated to document a revised version of the site groundwater flow model in which the computational issues identified in the SGILCA have been resolved. This model will be used to update all related figures and interpretations in the report.

2. Throughout the document, the statement is made that the Contingency Remedy is operating as designed. EPA does not concur that there is adequate support for this statement. Our concerns primarily relate to the uncertainties with the model, as noted above. As stated in EPA's comment letter on the Draft 2007 Annual Report, the BCT must identify appropriate remedy evaluation criteria to assess the effectiveness of the groundwater treatment system and establish metrics so that the performance of the remedy under full operating conditions can be measured. EPA believes that a reliable model is critical to this evaluation. With the next Five-Year Review scheduled for 2010, it is important the BCT make this a priority.

Response: Comment noted. The Army believes the revised model and assessment will address the subject component of the performance metrics. The Army suggests the most appropriate remedy evaluation criteria is capture of groundwater flowpaths interpreted to account for Arsenic detections within the landfill and north of the landfill toe, as suggested in Specific Comment No. 7.

3. EPA understands the desire to optimize resources supporting the long-term monitoring program by eliminating certain wells that do not contribute significantly to evaluating either arsenic plume behavior or the performance of the extraction system. Nevertheless, the wells that are identified in this report as candidates for elimination from the LTMMP may provide important insight into the long-term adjustment of the flow field to the extraction system, including changes in redox conditions that are not yet evident. EPA does not concur with the recommendation and suggests a BCT discussion on this issue.

Response: Please see response to Specific Comment No. 5.

Specific Comments:

1. Page 3-1, Sec. 3.1.1, System Description. This section provides a thorough description of the treatment plant operation; however, no mention is made of the fate of methane dissolved in the influent groundwater. Please explain where and how the influent is allowed to outgas.

Response: The treatment plant is not designed to treat for dissolved methane. Upgrades to the original plant design completed by CH2M Hill in February 2006 addressed the safety factors resulting from dissolved methane. Upgrades included sealing and venting process tanks to the outside of the treatment plant, installing methane and oxygen sensors near potential methane release areas, and upgrading electrical conduit/wiring in the extraction wells and effluent sump to explosion proof. It is assumed that any dissolved methane that is released into the headspace of treatment system tanks is vented to the outside of the building. Any methane that volatizes into the headspace of treatment tanks is off-gassed to the exterior of the plant. Any remaining methane that is not volatized within the treatment system remains dissolved in the plant effluent.

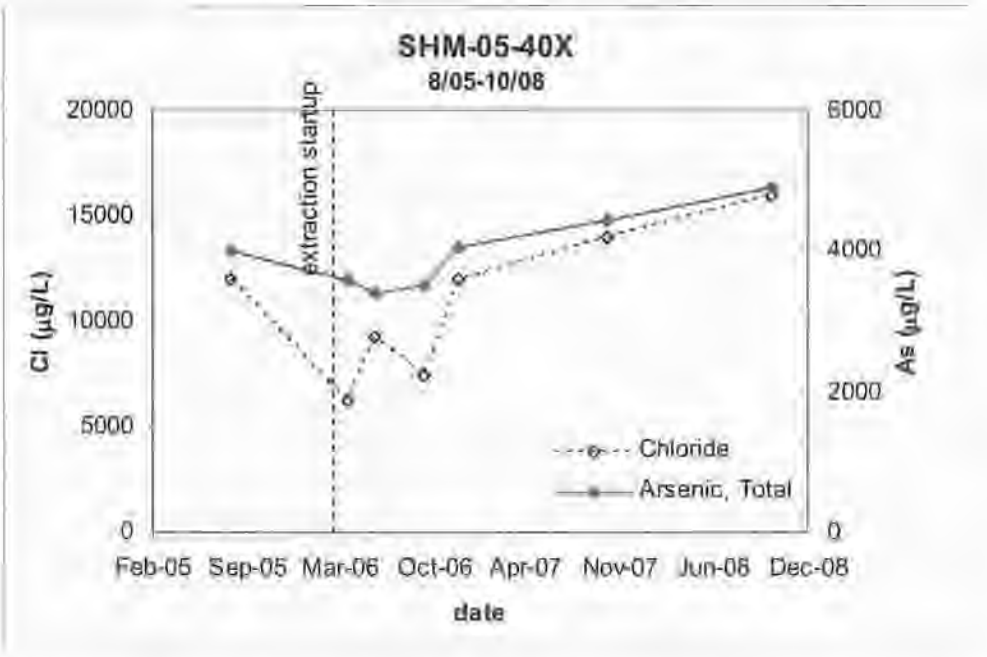
2. Page 3-6, Sec. 3.3.1, Influent Inorganic Sampling. It is apparent from the inorganic loading data that total concentrations (iron, manganese, and arsenic) have declined slightly since start-up of the extraction system. Because most of the total is accounted for by the iron concentrations, it is difficult to evaluate changes in arsenic levels from the plot of the inorganic data (Fig. 3-1), which shows only the total (Fe + As + Mn) and Fe. Please consider adding As and Mn to this plot in future reports. It is interesting to note that arsenic in EW-04 has decreased by approximately 1.4 mg/L since system start-up (from an initial maximum of ~5 mg/L to 3.6 mg/L in the Dec. 2008 sampling), but the most recent value is still about 50% higher than the levels seen in EW-01 (between 2.3 and 2.6 mg/L). The latter have remained relatively constant since system start-up.

Response: The intent of Figure 3-1 was to track the total inorganic loading on the plant to predict sludge generation and also to insure that influent iron concentrations are sufficient to maintain the necessary iron to arsenic ratio for complete arsenic removal. Initial bench-scale testing conducted by CH2M Hill determined that a minimum of 40 mg/l of iron in the influent was necessary for complete coagulation and removal of the influent arsenic. The plant design includes a ferric chloride injection system to enhance arsenic removal if influent concentrations of iron are not sufficient, however this has not been necessary due to consistently high influent iron concentrations. The influent As and Mn concentrations will be added to Figure 3-1 in future reports.

3. Page 4-2, Sec. 4.2.1.1, Arsenic Results. The first paragraph in this section notes that SHL-11, SHM-05-41C, and SHM-05-40X reported As concentrations in the 2008 sampling events that were greater than historical averages. Since SHM-05-41C and SHM-05-40X are outside the capture zone, this observation is interpreted as an indication that "...the leading edge of the plume is still advancing." If this scenario is accurate, why do locations intermediate between the toe of the landfill and SHM-05-40X – e.g., SHL-9 – not show increasing arsenic? Please elaborate.

Response: SHL-9 is a shallow\watertable well and does not sample the impacted zone at the base of the overburden aquifer. While the screen interval for SHM-05-40X is at a similar elevation to SHL-9, bedrock is considerably shallower and, consequently, the elevation of the plume is shallower as it rides along this surface. Therefore, the plume is interpreted to be below the screen interval at SHL-9 and this well provides no information on the leading edge of the plume or trailing edge assuming it has been cut off from the source by the extraction system. Consequently, the statement is considered accurate.

4. Page 4-3, Sec. 4.2.1.1, Arsenic Results. The last paragraph in this section states that the highest arsenic concentration observed in the 2008 fall sampling event was found in SHM-05-40X, and that this concentration (4920 ug/L) was a historical maximum for this monitoring well but "...similar to prior levels." EPA notes that arsenic concentrations in this well have risen steadily, and increased by 1500 ug/L, since June 2006:



The apparent systematic increase in arsenic is accompanied by rising levels of chloride, which suggests a shift in the flow field: SHM-05-40X may now be on a different flow line due to the startup of the extraction system, and is intercepting groundwater of a different composition. It is premature to speculate on the cause of the increasing arsenic at this location at this time, but results from future sampling rounds may explain these observations.

Response: Comment noted. It is acknowledged that SHM-05-40X exhibits increases over the last four consecutive samples. However the individual increments of change are considered modest compared to the overall ppm level concentration. Given travel time relationships and distance from the extraction wells it is unlikely that a trend could manifest itself at this well so soon after startup. Continued assessment of this and other area wells will provide indication of water quality changes as a result of extraction stress.

5. Page 4-5, Sec. 4.3, Proposed Monitoring Program Optimization. The rationale for optimizing the monitoring program by reducing the number of wells in the LTMMP is understood. However, the criteria for selecting wells for omission from the monitoring program appear to focus on whether or not the wells provide information about high-arsenic, landfill-impacted groundwater. EPA believes that the selected wells nevertheless contribute valuable data for evaluating the continuing evolution of the flow field across and downgradient from the landfill. It is noted throughout the 2008 Annual Report that rapid changes in ORP, arsenic, and other indicators of geochemical conditions within the SHL groundwater system are not expected. The text states (p. 5-7) that "…the geochemical system is still in the process of equilibrating to the comparatively rapid changes in flow system dynamics that have resulted from operation of the extraction wells." In support of observing the geochemical equilibration of the system, as well as potentially providing ground-truth data for the hydraulic-capture modeling, EPA believes that these wells need to be retained for the following reasons:

Well ID	Location	Reason for Retaining
SHL-21, SHL-23	east and west, respectively, of the toe of the landfill	These wells lie on flow lines that may shift, over time, with continued operation of the extraction system.
SHL-13	East of the toe of the landfill, adjacent to the Plow Shop Pond dam outlet	This well intercepts pond water as it recharges the overburden; there is a redox gradient between SHL-13 and the high-arsenic zone at SHM-96-5B, so SHL-13 should be monitored at least annually as an end-member of this gradient.
SHP-01-36X and -37X	On western edge of Plow Shop Pond, north of Red Cove	These wells intercept pond water but provide information about the position of the hinge line and also serve as points of reference for any changes in direction of flow lines along the eastern edge of SHL
SHL-10, 10C	East of SHL, southeast of Red Cove	These wells are the closest to the Pond in this area and serve as monitoring points for changes to both overburden and bedrock water.

EPA has not found documentation of the screened interval for SHM-93-10D. Also, the high pH recorded historically for this well (> 11 for the last three sampling events) may indicate well-construction problems. EPA would concur with dropping this well from the LTMMP, if the Army proposed this revision to the approved LTMMP.

Response: Based on the 2008 drawdown evaluation, the hydraulic stress exerted by the system is nearly instantaneous and it is extremely unlikely that there will be more then very minor fluctuations in the orientation of flow paths at/near the system. Further, analytical sampling of SHP-01-36X and -37X provides no information on the location of the hinge line nor is this

information considered critical to evaluation of system performance. Consequently, with the exception of SHL-13, the Army contends the remaining 7 wells have historically exhibited very consistent analytical results, provide no useful information on either landfill conditions or system performance, and should be dropped from the LTMMP or, at a minimum, be sampled less frequently.

6. Page 5-4, Sec. 5.1.2, Capture Zone Width Calculation. Please note that the capture zone width calculated from the idealized, analytical model (given by the expression shown on p. 5-3) applies only far upgradient. Therefore, the comparison of the "width of the impacted portion of the aquifer *at the extraction wells*" to this calculated width is inappropriate. The same analytical solution for the capture zone due to a single, fully-penetrating well in a uniform aquifer of constant thickness shows that the capture zone width abreast of the well (i.e., roughly in the vicinity of the line cited from SHM-96-5B to SHL-23) is only half the far-field width. The appropriate comparison, then, is between the estimated impacted width of 444 ft and *half* the calculated far-field width (382 ft for the 50-ft thickness; 212 ft for the 90-ft thickness). Although this comparison is significantly less favorable, it is acknowledged that this calculation is inevitably very crude, given the more three-dimensional character of the system (i.e., variable saturated thickness, two extraction wells separated by a finite distance, extraction screens that do not cross the full saturated thickness, etc.).

Response: The calculation in question is a straightforward expression balancing interpreted groundwater velocity against the extraction rate. It assumes a homogenous, isotropic, uniformly thick aquifer and results in a cross-sectional area of capture which can be related to a capture width by assuming a saturated thickness. This value does apply some distance upgradient from the extraction site, beyond the area of converging flow to the well. At present it is unclear how far the ppm-concentration Arsenic plume detected at wells 22B and 5B extends to the east and whether it is continuous with or separate from detections along the eastern perimeter. Until this can be resolved the Army suggests this calculated capture zone width is not a meaningful system performance metric and should be omitted from future performance assessments. Further, the Army recommends an appropriate metric for defining "successful capture" is capture of those flowpaths leading to downgradient detections as discussed further in response to Comment 7 below.

7. Page 5-5, Sec. 5.1.4, Comparison to Numerical Model Results. The text states that the model-predicted capture zone "... is still considered sufficient to fully contain impacted groundwater migrating northward from the toe of the landfill ... ." This statement seems to be taking the position that the upgradient coverage of the landfill footprint is less critical than is the capture cross-section in the highest-arsenic zone at the north end of the landfill. This is a reasonable position with respect to arresting advective transport of arsenic to the north. A key monitoring location in defining the high-As zone is SHM-96-22B, which historically has exhibited some of the highest concentrations in the system. It is difficult to tell from the graphics supplied (e.g., Fig. 5-2 and Fig. 5-4) whether or not the model indicates that groundwater that passed through SHM-96-22B prior to initiation of the extraction is now captured. The same remarks apply to SHM-96-5B. Both of these wells lie well outside the predicted capture zone. For future presentations of the model results, it is suggested that the model be run for ambient conditions (i.e., no extraction), and that particle backtracks be

mapped from key, "hotspot" wells. Then one can overlay the computed capture zone under pumping conditions to see if that encompasses the flowlines previously leading to the "hotspot" wells. This may support the claim regarding "full[] contain[ment] [of] impacted groundwater."

Response: The recommended particle track exercise has been performed using the updated model discussed in General Comment 1 as shown in revised Figure 5-2 (attached). Reverse particle tracks were used to define the source areas for water arriving at downgradient detections under ambient conditions for comparison to the source areas for water captured by the extraction system. Results indicate the computed capture zone for both the design rate and the average operational rate achieved in 2008 are sufficient to capture those flowpaths leading to detections at SHM-96-22B and SHM-96-5B and, therefore, the conclusion the system is containing the highest arsenic zone is well supported.

8. Page 5-5, Sec. 5.1.4, Comparison to Numerical Model Results. The discussion of the numerical model does not include any of the qualifications that were developed in revision of the *Supplemental Groundwater Investigation and Landfill Cap Assessment* (AMEC, 2008). Please expand this section of the Annual Report to acknowledge the computational issues encountered (i.e., convergence and water-balance problems), and the attendant uncertainties in the model results.

Response: See response to General Comment 1.

9. Page 6-2, Sec. 6.2, Recommendations. Include a section reporting on the Recommendations from the 2007 Annual Report and detailing the steps taken to address those Recommendations and the status of that effort. If Recommendations included in this Draft 2008 Annual Report are items that were also noted last year, include a justification for why they were not addressed.

Response: The requested section will be added.

Draft
Responses to MassDEP Comments on
2008 Annual Report
Shepley's Hill Landfill and Treatment Plant
Long Term Monitoring and O&M Services
Former Fort Devens, Massachusetts
August 2009

Comments:

1. Section 2.3: MassDEP may agree that high levels of methane detection at the landfill gas probes are not perpetual, but periodic detection of methane with concentrations exceeding 25% of Lower Explosive Limit at the property boundary may warrant further assessment and corrective actions.

Response: Comment noted. In 2009, the Army enhanced the landfill perimeter gas monitoring network by installing 13 additional gas wells completed in the vadose zone in the southern and northern boundary areas. The frequency of the perimeter landfill gas monitoring has been increased to quarterly in 2009. Quarterly perimeter gas monitoring events are initiated during a low barometric pressure system and discontinued when a high barometric system arrives over the landfill in order to assess the relationship between gas concentrations and barometric pressure. Assessment of the perimeter landfill gas in the southern and northern boundary areas is ongoing.

2. Section 3.3.3: High concentrations of methane (14.5 ppm and 10.4 ppm) in the plant influents were not encountered during the earlier investigations and are of concern. MassDEP believes additional methane plume delineation beyond north toe of the landfill should be conducted and would recommend, at minimum, additional methane sampling at the P&T influents, together with monitoring wells SHM-05-41B and SHM-05-40X. These two wells are located down gradient of those pumping wells and have recorded relatively high arsenic concentrations. In addition monitoring well SHM-05-40X was screened relatively shallow and located close enough to the neighborhood at Scully Road.

Response: The dissolved methane concentration of 14,500 ug/l detected in the influent to the treatment system from extraction well EW-01 in September 2008 was slightly higher than the previous maximum of 12,100 ug/l. Safety measures are in place at the treatment plant to address dissolved methane. Consequently, an increase in sampling frequency of treatment plant influent does not provide significant value. Previous sampling for methane in downgradient wells indicated methane is not present at the watertable and therefore there is no potential for off gassing to soil.

3. Section 4.2.1.1: Because of the higher than historical arsenic concentrations at monitoring wells SHM-05-41C and SHM-05-40X, downgradient of the pumping wells, it was concluded that "the leading edge of the plume is still advancing". This conclusion seems contradictory to the statement under Section 5.3 of Performance Assessment Summary, which concluded that "the Contingency Remedy...can be interpreted to contain the majority of arsenic mass being mobilized by landfill-induced reducing conditions..." It is MassDEP's understanding that the containment provided by the extraction system is centered on the north plume, and should significantly cut-off the plume. Please explain.

Response: The statement referring to the leading edge addresses the portion of the plume already well downgradient and outside the capture zone for the extraction wells. The text will be modified to read "..contain the majority of arsenic mass *within the landfill footprint* being mobilized..".

4. Section 4.2.1.1: The decreasing trend of arsenic concentrations at SHM-96-22B and SHM-96-5B seems encouraging, but the increasing trend of arsenic concentrations noted at SHL-11 and SHM-05-40X are puzzling. A detailed delineation of arsenic contamination is needed to monitor and evaluate the performance of the pump-and-treat system.

Response: The Army disagrees the increasing trend at SHL-11 is a cause for concern as the levels in this well have ranged from 300 to 600 ppb for over 18 years. However, as discussed in Section 4, the trend at SHM-05-40X indicates the leading edge of the plume downgradient from the capture zone is still advancing. The Army believes that adequate delineation of Arsenic contamination is achieved with the existing LTMMP monitoring well array. However, it is acknowledged that the continuity between the northern trending plume lobe and detection in the vicinity of Red Cove is a data gap with respect to performance assessment. Please see also response to Comment No. 8.

5. Table 4-5, Summary of Historical Arsenic Concentrations, Section 4.2.1.1: Monitoring well SHP-99-29X at least was sampled around 1999 when it was first installed. Please add the results to the table.

Response: The subject results will be added to the table.

6. Section 4.3: The proposal to omit eight monitoring wells from the long-term sampling program is premature because it is based on unconfirmed assumptions and could result in the loss of significant data concerning the changing groundwater chemistry resulting from the operation of the extraction system. The primary assumption of concern is the extent of the contaminant plume. In particular, the assumption that arsenic in samples collected from wells SHP-01-36X, SHP-01-37X, SHL-10, SHM-93-10C, and SHM-93-10D is attributable to background conditions and not influenced by the landfill has not been established by a sound delineation of the contaminant plume. Further, available information indicates that samples from these fives wells are influenced by the landfill; the noted low concentrations of arsenic reported in samples collected from nearby wells SHL-13, SHL-21, and SHL-23 suggest that background concentrations are below those reported in the samples from the five wells. Consequently, a more robust and complete delineation of the contaminant plume should be developed before the scope of the sampling program is reduced. Recommendations to accomplish this follow in Comment 11.

Response: The Army maintains the requested wells, with the exception of SHL-13, should be dropped from the LTMMP, or at a minimum be sampled less frequently, on the basis that they provide no useful data on landfill conditions or system performance. Further, due to their relatively shallow screen positions, SHL-21 and SHL-23 likely sample recent recharge and therefore do not necessarily reflect background conditions. The Army disagrees with the statement that "a more robust and complete delineation" is needed. Please see also response to EPA Comment No. 5.

7. Section 5.1.1: The performance evaluation should include an assessment of the vertical extent of capture. Consequently, in addition to analyzing horizontal gradients, the report should include an analysis of vertical gradients.

Response: Figure 5-3 (now renumbered to 5-6) provides a view of the vertical extent of capture. As has been discussed in response to previous comments on this topic, vertical gradients are negligible in the majority of nested wells across the site confirming that horizontal flow dominates in the overburden aquifer.

8. Section 5.1.2: As acknowledged here, there is substantial uncertainty in the capture zone width calculation due to the unrealistic simplifying assumptions. In addition, the equation used to calculate the capture zone width differs from that presented in the cited guidance (*A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems*) and the results from the calculation disagree significantly with the results from the revised numerical groundwater model (Section 5.1.4). Consequently, the capture zone width calculation does not appear to be a reliable measure of actual site conditions.

Response: The calculation in question is a straightforward expression balancing interpreted groundwater velocity against the extraction rate. It assumes a homogenous, isotropic, uniformly thick aquifer and results in a cross-sectional area of capture which can be related to a capture width by assuming a saturated thickness. This value does apply some distance upgradient from

the extraction site, beyond the area of converging flow to the well. At present it is unclear how far the ppm-concentration Arsenic plume detected at wells 22B and 5B extends to the east and whether it is continuous with or separate from detections along the eastern perimeter. Until this can be resolved the Army suggests this calculated capture zone width is not a meaningful system performance metric and suggests the most appropriate remedy evaluation criteria is capture of groundwater flowpaths interpreted to account for Arsenic detections within the landfill and north of the landfill toe.

9. Section 5.1.4: As discussed recently in connection with the on-going review of the *Supplemental Groundwater Investigation and Landfill Cap Assessment* report, a significant mass-balance error has been identified in the revised groundwater model, casting doubt on the statement suggesting that the revised model is a reasonable representation of site conditions. Consequently, the numerical model analysis cannot be considered a reliable representation of actual site conditions until this uncertainty is addressed.

Response: The report will be modified to include documentation of a revised version of the groundwater model in which computational issues have been resolved.

10. Section 5.3: While there is significant uncertainty associated with each of the lines of evidence used to assess the performance of the extraction system, it is clear that the extraction system is not providing sufficient containment to achieve the ROD objectives. Consequently, additional action is required to enhance the performance of the extraction system or develop and implement a remedial alternative that will achieve the ROD objectives. Similar conclusions were presented in USEPA's May 14, 2009 letter concerning the draft *Supplemental Groundwater Investigation and Landfill Cap Assessment* report, along with a list of additional work items that were specified to implement a remedy that satisfies the ROD requirements. MassDEP endorses these work items as an appropriate path forward.

Response: The Army disagrees with this statement and suggests the system has not been operating long enough to draw such a conclusion. As discussed in Section 5.2.2, there is presently insufficient data on geochemical changes in the aquifer to conclude ROD objectives cannot be achieved with continued operation. At this time the Army suggests the most appropriate remedy evaluation criteria is capture of groundwater flowpaths interpreted to account for Arsenic detections within the landfill and north of the landfill toe. Please see also response to EPA Comment No. 7.

11. For future reference, many of the uncertainties associated with the lines of evidence used to evaluate the extraction system appear to be attributable to an inadequate site conceptual model. In particular, the horizontal and vertical extents of contamination have not been delineated in sufficient detail to support a performance assessment. As described in the cited USEPA guidance (*A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems*), adequate delineation of contamination is an essential part of the first step in the evaluation process, and a necessary input for the subsequent five steps. Further, as noted in the guidance, an adequate delineation of contamination is critical where the spatial distribution of contamination is complex, as is the case at the Shepley's Hill Landfill site, where an extended contaminant source region is present, multiple plume lobes impacting different portions of the overburden aquifer appear to have formed, and bedrock may influence both the flow and chemistry of the impacted groundwater. The lack of a defined target capture zone and lack of an interpreted actual capture zone in the report, and the absence of a spatial delineation of the various "lobes", "fronts", "leading edges", and "hinge lines" mentioned in the report are indicative of the underlying problem.

    While additional monitoring wells may be needed to plug data gaps, it appears that much of the problem can be addressed with a more detailed evaluation of existing data, rather than a substantial field investigation. As a preliminary step, MassDEP recommends that the magnitude and distribution of pre-extraction contamination be delineated by plotting arsenic concentration contours and ORP measurement contours in: (1) map view at three or more depth intervals spanning the vertical extent of the impacted region, and (2) cross-section views (including geologic stratigraphy) constructed along the axes of the plume lobes and transverse to the plume axes at several locations, including a transect that includes the extraction wells. In addition, preparation of a map of bedrock topography is recommended to investigate the influence of bedrock on the distribution of contamination.

Response: Comment noted. Supplemental cross-sections as wells as a map of bedrock topography in the downgradient area as interpreted\simulated, were included in the Supplemental Assessment Report (AMEC, 2009). However, the Army disagrees that the Conceptual Site Model is inadequate and that available data is not sufficient to support performance assessment. Additional interpretive maps and sections will be considered for future Annual Reports.

Draft
Responses to PACE Comments on
2008 Annual Report
Shepley's Hill Landfill and Treatment Plant
Long Term Monitoring and O&M Services
Former Fort Devens, Massachusetts
August 2009

Comments:

1. The report provides a revised capture zone for the groundwater extraction system that is smaller than previously estimated. ECR is concerned that the revised capture zone may still be significantly over-estimated because it assumes a steady-state extraction rate of 50 gallons per minute (gpm). The report states that the actual groundwater withdrawal rate when the system is pumping is 46 gpm due to recirculation of water skimmed from the rolloffs. More importantly, when system downtime is accounted for, the actual average flow rate of the system is approximately 34 gpm, which is nearly one-third lower than the 50 gpm utilized to estimate the extent of the capture zone. ECR recommends that the capture zone be re-calculated using the average annual flow rate of 34 gpm, and that the discussion of the capture zone be revised as necessary.

Response: The report will be revised to depict the predicted capture zone at both the design rate and average operational rate for 2008, and also for 2009 to date, based on the most recent model variant.

2. Currently, the report concludes that "the capture zone width is considered sufficient to achieve full containment of the northward migrating plume lobe." This finding may need to be revised if the understanding of the capture zone changes significantly based on the above comments.

Response: As shown in revised Figure 5-2 (attached) the model predicted capture zone at the average operational extraction rate of 34 is sufficient to encompass the ambient flowpaths which lead to the highest detections immediately downgradient at SHM-96-22B and SHM-96-5B. As such this finding is supported. See also response to EPA Specific Comment No. 7.

3. The groundwater contours and backward particle tracks shown in Figure 5-2 appear to contradict the report's "full containment" conclusion by suggesting the existence of northerly-trending flowpaths to the east of the extraction wells. Please reconcile the report's conclusion with the data presented in Figure 5-2. The use of forward tracking of particles outside the delineated capture zone may be useful in accomplishing this objective.

Response: See response to Comment 2.

4. The report concludes that the pump-and-treat system is "operating as designed." ECR believes that this conclusion currently cannot be supported with the available data and the above-mentioned issues associated with the capture zone estimate.

Response: See response to Comment 2.

5. On page 4-2 of the report, the statement is made that "In general, arsenic concentrations in these wells have been relatively stable or decreasing, compared to historic levels." While it is true that arsenic results at many wells are stable and a few have decreased, this statement is considered misleading given the overall rise in arsenic concentrations since placement of the cap, and the fact that arsenic results at some wells continue to increase.

Response: The text will be modified to read "..in *some* wells..".

6. A more thorough description of the landfill gas sampling method in the beginning of Section 2.3 would be helpful in evaluating the data collected. Were the samples collected from ambient air at the mouth of the probe or vent, or from within the probe or vent itself? What criteria was used for selecting the volume of gas to be purged?

Response: The following text will be added to the section: "The method used for landfill gas sampling is the procedure described in the MADEP Landfill Technical Guidance Manual. The equipment that is typically used consists of a LandTech Gem 2000+ for reading carbon monoxide, carbon dioxide, hydrogen sulfide, oxygen, methane and LEL; and a Mini-Rae PID for total volatile organic compounds. The sampling device is connected directly to the sampling port at the top of the probe/vent to read initial levels of gas concentrations. After the initial readings the probes are purged of two (2) well volumes as suggested in the MADEP Landfill Technical Guidance Manual. After the probe is purged the gas sampling equipment is connected directly to the sampling port and the gas concentrations are read again."

7. ECR suspects that the word "educator" on pages 3-5 and 3-7 should be replaced with "eductor."

Response: The text will be revised accordingly.

8. ECR agrees that LTMP wells that have always shown arsenic results below the Maximum Contaminant Level (MCL) should be deleted from the monitoring program, and agrees that ORP measurements should be reduced from quarterly to semi-annually. However, wells that have exhibited arsenic results above the MCL should, in our opinion, continue to be sampled at least annually to provide data on the status and progress of the cleanup.

Response: Comment noted. Specific reductions in the LTMMP will be discussed with the BCT and documented in an LTMMP amendment.

9. Figure 5-1 represents hydraulic gradient vectors using arrows of approximately equal length, providing information on the direction of the vector but not its magnitude. To provide a more complete picture of the flow field, the magnitude of the vectors should be indicated by a written value and/or by appropriately varying the length of the arrows.

Response: Gradient values will be added to the figure.

10. On page 5-7, an approximate time of 1,000 years is projected to meet the arsenic MCL. Because this estimate is likely to be quoted and may be utilized in future decision-making, complete documentation of how this estimate was arrived at should be provided as an appendix to the report.

Response: The estimate of ~1000 years is based on the USGS fact sheet cited which states several hundred (assume ~250) pore volumes would need to be flushed in order to lower concentrations by 2 orders of magnitude. Therefore, because it requires 4 years to flush one pore volume in the impacted zone between the landfill toe and Molumco Rd, it will potentially require 1000 years (250 pore volumes x 4 years per pore volume) in order to lower concentrations by 2 orders of magnitude (e.g. from 1000 to 10 ug/L).

11. Based on a comparison of results from filtered and unfiltered samples from well SHL-19, the report concludes that filtered results are more representative of dissolved concentrations, and that future samples should be filtered prior to analysis. ECR is concerned that filtering through a 0.45 micron filter may underestimate the true concentration of mobile arsenic. It is noted that the turbidity measured at SHL-19 in 2008 was not excessive relative to other wells, and that the well was purged at 500 millimeters per minute (ml/min) for 35 minutes while other wells were purged for longer periods at rates as low as 150 ml/min. ECR recommends that unfiltered samples be collected from SHL-19 using a lower flow rate and a longer purge time (e.g., up to one hour). If this approach yields an appreciable decrease in turbidity, then these results should be used for comparison to cleanup goals.

Response: The turbidity of SHL-19 was measured at 60 NTUs in Fall 2008, 3 times higher than the next highest value and an order of magnitude higher than the majority of monitoring wells. During the next sampling event a slower purge rate will be tested to see if turbidity can be reduced, however, filtered and non-filtered samples will continue to be collected.

12. The 2007 Annual Report recommended the construction of a fence around portions of the landfill where access was not restricted. It is our understanding that this recommendation was not implemented. The Draft 2008 report does not recommend that fencing be installed. PACE and ECR believe that it is important to control access to the landfill, and we encourage the Army to reconsider the recommendation to construct a fence.

Response: Although there is access for the public to enter the landfill property on foot in different areas of the site, all access roads to the landfill are secured with chains and padlocks. No vehicles have open access to the landfill. A security fence also surrounds the arsenic treatment system. The Army believes that: 1) due to the exposed bedrock conditions particularly at the north end of Shepley's Hill, it is infeasible to construct a secure fence encompassing such a large area around the landfill property, and 2) controlling pedestrian access is unnecessary as there is little risk of property damage (critical areas are secure) and Health risks do not exist for trespassers.