1999 ANNUAL REPORT

SHEPLEY'S HILL LANDFILL LONG TERM MONITORING & MAINTENANCE **DEVENS, MASSACHUSETTS**

March 2000

PREPARED BY:

DEPARTMENT OF ARMY NEW ENGLAND DISTRICT, CORPS OF ENGINEERS CONCORD, MASSACHUSETTS



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TABLE OF CONTENTS

Sectio	<u>n Title</u>	Page
	EXECUTIVE SUMMARY	1
1.0	INTRODUCTION	
2.0	LANDFILL CAP MAINTENANCE ACTIVITIES	4
3.0	LANDFILL CAP MONITORING ACTIVITIES	5
4.0	LANDFILL GAS MONITORING RESULTS	9
5.0	GROUNDWATER ELEVATIONS	
6.0	GROUNDWATER SAMPLING	13
6.1	Preparation for Sampling	
6.2 6.3	Equipment Decontamination	
7.0	LABORATORY TESTING	16
7.1 7.2	Analyses Results	
8.0	QUALITY CONTROL	
8.1 8.2 8.3 8.3	Field Quality Control Laboratory Quality Control Data Evaluation 1 Data Evaluation for Samples Collected May 1999	
8.3 9.0	.2 Data Evaluation for Samples Collected November 1999	

SHEPLEY'S HILL LANDFILL ANNUAL REPORT

TABLE OF CONTENTS (Cont.)

TABLES

Table 5-1	Monitoring Wells and Elevations	
Table 6-1	Monitoring Well Designation	
Table 7-1	Groundwater Sample Analysis and Procedures	
Table 7-2	Laboratory Results – May 1999	
Table 7-3	Laboratory Results – November 1999	
Table 7-4	Comparison of Historic Arsenic Results	
Table 8-1	Sample Preparation and Analysis Methods	

FIGURES

Figure 3-1	Shepley's Hill Landfill - Findings of Inspection
-	Conducted 1 December 1999
Figure 4-1	Shepley's Hill Landfill - Groundwater Monitoring

APPENDICES

- Appendix A Landfill Maintenance Checklist
- Appendix B Landfill Gas Monitoring Forms
- Appendix C Groundwater Field Analysis Forms
- Appendix D Chain of Custody Forms
- Appendix E Comparison of Arsenic Results
- Appendix F Quality Assurance Reports
- Appendix G Groundwater Analytical Data
- Appendix H References

EXECUTIVE SUMMARY

This annual report has been prepared to document the monitoring and maintenance activities conducted at the Shepley's Hill Landfill in Devens, Massachusetts as required by the Record of Decision (ROD) for areas of contamination 4, 5, and 18 (ABB-ES, Oct 1995). This report was developed by the U.S. Army Corps of Engineers (USCOE), New England District (NAE).

This report documents the results of the fourth year (1999) of the Long Term Monitoring and Maintenance conducted in accordance with the approved Long Term Monitoring and Maintenance Plan (SWEC, May 1996). Activities conducted as part of the Long Term Monitoring and Maintenance Plan include a yearly inspection of the landfill cover, yearly landfill gas vent monitoring, as well as semi-annual groundwater sampling. Post closure monitoring is required for a period of 30 years.

An annual landfill inspection was conducted and observations were made regarding vegetative cover, unwanted vegetation, erosion, settlement, and the condition of previously repaired areas. The cover surface is generally satisfactory with some minor areas of sparse vegetation, settlement and rutting. Intermittent standing water, erosion, overgrown areas and wetlands plants were observed in isolated areas within drainage swales. The access roads on the cap are in good condition. There were no conditions observed which would jeopardize the integrity of the landfill cap. Combustible gas readings were collected from 18 gas vents on the landfill. All of the vents indicated positive readings for methane, carbon dioxide and Percent Lower Explosive Limit. The gas readings are within the parameters of a mature landfill. The vents are functioning properly.

The fourth year of long term groundwater sampling was performed on the 14 compliance point monitoring wells located adjacent to the landfill on the north and east. Samples were collected in accordance with the *EPA's Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* (July 1996). Samples were analyzed for volatile organic compounds, inorganics, and general water quality parameters.

In accordance with the Record of Decision, the effectiveness of the selected Alternative SHL-2 is determined by evaluating groundwater sampling results from two groups of monitoring wells. Wells are designated as either Group 1 or Group 2 wells. Group 1 wells are wells where all chemical of concern concentrations have historically met or been below cleanup levels established in the Record of Decision. Group 2 wells are wells where chemical of concern concentrations have exceeded cleanup levels. In the Long Term Monitoring and Maintenance Plan, all existing wells were designated as Group 2 wells and the three new wells that were installed in 1996 were to be designated after the first round of sampling. During the first five year site review (August 1998) six monitoring wells (SHL-3, SHL-5, SHL-9, SHL-22, SHL-93-10C, and SHL-93-22C) achieved cleanup levels for all chemicals of concern and were reclassified as Group 1 wells. All other wells, including the three new wells, are classified as Group 2 wells. Well designations will be reviewed again during the second five year review.

Of the chemicals of concern established in the Record of Decision, only those chemicals which present carcinogenic risk were considered trigger chemicals in the Long Term Monitoring and Maintenance Plan. The trigger chemicals are arsenic, dichlorobenzenes, and 1,2-dichloroethane. Therefore, the evaluation of effectiveness of Alternative SHL-2 is based on the reduction of carcinogenic risk rather

than reduction of chemical concentrations as a measure of progress toward attainment of cleanup goals. This approach prevents a situation in which failure to attain a concentration reduction goal for a minor contributor to risk (i.e. 1,2-dichloroethane) overshadows the achievement of a 50 percent reduction of concentration of a higher carcinogenic risk (arsenic). Risk reduction was evaluated during the first five year review in August 1998. However, for the annual reports the contaminant concentrations will be referenced against the cleanup levels as a benchmark. It should be noted that the majority of the risk present at Shepley's Hill Landfill is due to arsenic in the groundwater.

Arsenic was the only trigger chemical detected above cleanup levels during the 1999 sampling events. Analytical results from the 1999 groundwater sampling rounds (Tables 7-2 and 7-3) have indicated the presence of arsenic above the cleanup level in wells SHM-96-5B, SHM-96-22B, SHL-11, SHL-20, SHL-19, SHL-4, SHL-9 and SHM-96-5C. The 1999 monitoring year results were compared to previous years data. A comparison of arsenic concentrations during the 1999 period with historical data indicates that there was a general decrease in arsenic concentrations except for wells SHM-96-22B and SHL-11.

The first five-year review to assess the protectiveness of the selected remedial action for Shepley's Hill Landfill was completed in 1998, in accordance with the Record of Decision. The review concluded that reductions of contaminant concentrations and corresponding risk satisfied the evaluation criteria at most, but not all, historical groundwater monitoring wells. However, data from monitoring well SHM-96-5B, at the north end of the landfill, showed arsenic concentrations up to two orders of magnitude greater than historical values in other wells. Therefore, supplemental groundwater investigations were performed by the Army to assess whether arsenic contamination exists beyond the Devens Reserve Forces Training Area boundary, and to characterize its nature and location. In accordance with the *Final Work Plan, Supplemental Groundwater Investigation at Shepley's Hill Landfill, Devens Reserve Forces Training Area, Devens, Massachusetts* (HLA, February 1999) the work included: a hydrogeologic assessment of groundwater recharge potential along the western edge of the landfill, characterization of groundwater flow and quality immediately north of Shepley's Hill Landfill, updating and refining the groundwater model for Shepley's Hill Landfill, and analyzing rock samples for naturally occurring arsenic. This work is complete and a report will follow.

The 1999 landfill inspection identified additional corrective actions required to maintain the landfill cap. These include: regrading and reseeding eroded areas; clearing unwanted vegetation in drainage channels; placement of topsoil and reseeding of depressed areas; remove trees from landfill cap; place stone aprons around gas vents; replacement and regrading catch basins and the repair of the perimeter fence. Corrective actions for landfill cap maintenance will be conducted within the next year. Overall the landfill is in fair condition and is functioning adequately.

The next round of groundwater sampling will be conducted in May 2000.

1.0 INTRODUCTION

This annual report has been prepared to document the monitoring and maintenance procedures conducted at the Shepley's Hill Landfill in Devens, Massachusetts based on the Record of Decision (ROD) (ABB-ES Oct 1995) for Shepley's Hill Landfill Areas of Contamination 4, 5, and 18. This report was developed by the U.S. Army Corps of Engineers (USCOE), New England District (NAE).

The Long Term Monitoring and Maintenance Plan (LTMMP) (SWEC, May 1996) for Shepley's Hill Landfill outlines the landfill closure monitoring and maintenance procedures. These procedures include a semi-annual groundwater sampling program to monitor contaminants, and an annual visual inspection and gas emission monitoring of the landfill cap. This report documents the fourth year of the long term monitoring. The first two years of monitoring were conducted by Stone & Webster Environmental Technology & Services (SWEC). The 1998 and 1999 monitoring were conducted by NAE. Post closure monitoring is required for a period of 30 years.

2.0 LANDFILL CAP MAINTENANCE ACTIVITIES

The Record of Decision for the Shepley's Hill Landfill required monitoring and maintenance of the landfill cap based on observations made during the annual inspections. Based on recommendations made from the 1996 and 1997 inspections, improvements and repairs were performed during 1998 to properly maintain the cap, as previously reported. The only maintenance activities performed during the 1999 year include mowing of the landfill vegetative cover and drainage swales. There were no other cap maintenance improvements or repairs performed during 1999. The recommended maintenance items listed in last years (1998) annual report did not pose an immediate risk in the integrity of the landfill cap and are considered non-critical maintenance procedures. For cost effectiveness purposes, maintenance activities of this non-critical nature will be conducted approximately every two years as warranted. In the event that repairs are identified and to prevent immediate damage to the cap, they will be conducted expeditiously.

3.0 LANDFILL CAP MONITORING ACTIVITIES

The Shepley's Hill Landfill at Devens, Massachusetts was inspected on 1 December 1999, and monitoring activities were performed, on 1 December, and 6 and 7 December 1999, by personnel from the U.S. Army Corps of Engineers, New England District (NAE). Features of the landfill inspected included the cap, the drainage system, the gas vent system, access roads, and the security fence. Observations were made regarding the vegetative cover, vegetation types, erosion, settlement, and general condition of the various features. Appendix A of this report contains the Landfill Maintenance Checklist that summarizes the findings of this inspection. All observations are also presented on Figure 3-1. A narrative of the findings of this inspection follows. Descriptions of observations begin at the northern extremity of the landfill and continue in a counter-clockwise direction.

- In the northern extremity of the landfill cap, between Gas Vent #1 and #2, there is a small low area with ponded water. The area is approximately 15 feet by 15 feet and approximately 3 inches deep. This area should be monitored for further settlement and wetland encroachment. No action is required at this time.
- In the northwest extremity of the landfill cap, between Gas Vent #1 and #3, there is an eroded gully leading to the west drainage swale. It is about 1 to 2 feet wide and 15 feet long. The placement of topsoil and seed in the gully should be sufficient to repair this area.
- In the vicinity of Gas Vent #1, there is an oval-shaped area of erosion, about 5 by 10 feet. The placement of topsoil and seed in the eroded area should be sufficient to repair this area.
- In the existing settled area between Gas Vents #3 and #4, 6 to 12 inches of standing water was observed and wetland species are becoming established. Woody species are just starting to grow on the periphery of this settled area. During a dry period, the settled area should be cleared and mowed to eliminate woody species and to slow the encroachment of wetland species. If the area does not dry out sufficiently to allow mowing, then hand clearing should be performed.
- There is a small soil pile on the east side of the drainage swale. This soil should be spread and seeded in an adjacent low area.
- On the west side between Gas Vent #3 and #6 there is a small area of settlement, about 15 feet by 15 feet, with about 3 inches of standing water. There is no erosion in this settled area, and upland vegetation types are still growing well. This area should be monitored for further settlement and wetland encroachment. No action is required at this time.
- On the west side, to the north and south of Gas Vent #6 there are several small areas of settlement, about 10 feet by 10 feet, with about 3 inches of standing water. There is no erosion in these settled areas, and upland vegetation types are still growing well. These areas should be monitored for further settlement and wetland encroachment. No action is required at this time.

- On the west side, adjacent to Gas Vents #3 and #6, there are woody plants and wetland species growing in the drainage swale. During a dry period, the settled area should be cleared and mowed to eliminate woody species and to slow the encroachment of wetland species. If the area does not dry out sufficiently to allow mowing, then hand clearing should be performed.
- On the west side near Gas Vent #9, a shallow sloped area is undergoing mild erosion. Vegetation is not well established and minor erosion is forming shallow gullies. The placement of topsoil and seed, with a surface treatment of broadcast hay or straw, should be sufficient to repair this area and stop the erosion process.
- In the vicinity of Gas Vent #17, there is an area of settlement, approximately 20 feet by 20 feet and approximately 4 inches deep. There is no erosion in this settled area, and upland vegetation types are still growing well. This area should be monitored for further settlement and wetland encroachment. No action is required at this time.
- In the vicinity of Gas Vent #17, there is an area of woody plant growth, approximately 10 feet by 10 feet. The area should be cleared and reseeded as necessary.
- Catch Basin #2 near the Cooke Street entrance to the site has a broken surface grate. A large piece of the corner of the grate is missing. This surface grate should be replaced.
- Catch Basin #3 near the Cooke Street entrance to the site is not set at grade. Soil excavation in this area has left the rim of the grate about six to eight inches higher than the surrounding ground. This rim of this catch basin should be lowered to the surrounding grade.
- Catch Basin #7 near the southwest corner of the site is substantially overgrown by the adjacent vegetation and will soon be completely overgrown and hidden from view. The catch basin is partially filled with many small pieces of PVC pipe. This catch basin should be cleared of encroaching vegetation and the PVC pipe pieces should be removed.
- The concrete headwall drainage structure at the terminus of the catch basin and underground conduit system on the south side is overgrown with vegetation, including some larger woody species, and is silting in. The grade of the channel bottom is uneven and standing water is present. Wetland species are becoming established as well. The structure and channel immediately downstream should be cleared, accumulated sediment should be removed, and the channel should be regraded as required to properly drain. The channel should then be reseeded or riprap should be placed, depending on water velocities.
- Most of the drainage swale on the south side is being invaded by wetland species. There are also intermittent zones of standing water indicating a lack of proper channel slope and drainage. The south side drainage swale should be cleared of wetland vegetation and regraded as needed to properly drain all areas of standing water. Depending on water velocities, the channel should then be reseeded or riprap should be placed.

- Approximately midway along the south drainage swale, on the outside channel side slope, there is an area about 10 feet by 15 feet that lacks vegetation. It is just beginning to show signs of erosion. This area should be reseeded, with hay or straw placed on the surface, to prevent further erosion.
- In the east side drainage swale, in the vicinity of Gas Vent #13 and continuing downstream to the new rock-lined channel, the drainage swale is overgrown with woody vegetation and wetland species. It appears to be silted in and has a large area of standing water. There is an earth and vegetation obstruction just upstream of the new rock section preventing the drainage of water and turning the channel into a pond. This reach of the drainage swale should be cleared of the obstruction, all vegetation and accumulated silt and sand, and regraded to drain properly. Seeding, or riprap placement, should follow, depending on water velocities.
- The eastern drainage swale has some minor vegetation growth and sand accumulation. The swale should be cleared.
- To the north of the Gas Vent #13 are several small trees. The trees should be removed and the area reseeded as necessary.
- The area in the vicinity of Gas Vent #12 is low and poorly graded. This is a large area, extending toward Gas Vents #14, #15, #16 and the access road. The area is often too wet to mow and is subject to encroachment of woody plants and wetland species. The area is very rutted due to vehicular traffic on the cap. The area should be surveyed, regraded and a drainage swale should be placed to convey water to the existing drainage swale to the east.
- In the vicinity of the new rock channel on the east side, there are large areas with sparse vegetation. The soil in the bare areas is mostly sand and is eroded to a depth of 12 inches in some areas. During the fall of 1998, hydroseeding of some of these barren areas was performed, but very little germination has occurred. The area should be graded to fill in the eroded areas and topsoil should be placed to a depth of 6 inches over the sand to allow grass to grow.
- In the vicinity of Gas Vent # 7 are several small settled areas with standing water. There is no erosion in these settled areas, and upland vegetation types are still growing well. This area should be monitored for further settlement and wetland encroachment. No action is required at this time.
- To the east of Gas Vents # 11 and # 8 is a small stand of trees. These trees should be removed from the cap.
- To the east of Gas Vents # 11 and # 8 on the west bank of the swale is an area that is eroded to a depth of approximately 12 inches. This area should be reseeded, with hay or straw placed on the surface, to prevent further erosion.
- To the east of Gas Vents # 8 and # 5 on the hill above Plow Shop Pond is an area that is eroded to a depth of approximately 6 inches. This area should be reseeded, with hay or straw placed on the surface, to prevent further erosion.

- The access roads on the site are in good condition. Work was performed on these roads in the Fall of 1998 to upgrade the surface. There are no problems on access roads that warrant repair at this time.
- Portions of the perimeter chain-link security fence are in poor condition. Fence sections and gates are missing and unrestricted access to the site is available at several locations. Some evidence of off-road vehicles (ATV's, dirt bikes, etc.) using the cap area was seen. The security fence should be repaired, with all missing fence sections, including gates, replaced or repaired.
- The gas vents are in good condition. All screens and pipes are in functional condition and no repairs are required at this time. Gas Vents #1, 2, 3, 4, 7, 8, have animal burrows adjacent to them. The animals should be removed and the holes repaired. A stone apron should be place around the vents to prevent future burrowing.

A summary of Corrective Action measures to be implemented for the Landfill Cap are included in Section 9.0

4.0 LANDFILL GAS MONITORING RESULTS

The purpose of the landfill gas monitoring program is to establish long-term trends with regard to gas production and venting. A combustible gas survey was performed to determine whether methane, hydrogen sulfide, or volatile organic compounds have accumulated in the subsurface of the landfill site.

The fourth annual landfill gas sampling was conducted on 1 December 1999 and on 6 & 7 December 1999. The weather on 1 December was sunny, with temperatures in the 20's to 30's (°F) and the barometric pressure was 30.1 inches of mercury and falling. The weather on 6 and 7 December 1999 was rainy, with temperatures in the 40s and 50s. The barometric pressure on 7 December was rising. Gas samples were field analyzed for the following parameters using the listed equipment:

Parameter	Equipment
Total Volatile Organic Compounds (VOC)	HNu Photoionization Detector (PID) with a 10.6 eV lamp
Percent Oxygen	Industrial Scientific TMX 412 Combustible Gas Indicator (CGI)
Hydrogen Sulfide (ppm)	CGI
Percent Lower Explosive Limit (LEL)	CGI
Carbon Monoxide (ppm)	CGI
Percent Carbon Dioxide	Landtec Gem-500, GA-90 landfill gas monitor
Percent Methane	Landtec Gem-500, GA-90 landfill gas monitor

The CGI and the Landtec GA-90 were both calibrated in the shop by U.S. Environmental. The PID was calibrated in the field to 248 ppm isobutylene and 0 ppm.

Samples were collected by attaching a rubber Quik cap with a hose clamp to the gas vent pipe. A barbed fitting was placed in a drilled hole in the cap. Tubing was run from the barbed fitting to a MSA LC pump. The pump was operated for approximately 7 to 10 minutes to purge 2 vent pipe volumes and to ensure that the gases collected were representative of the gas collection layer. The gas monitoring equipment was then attached to the MSA pump and turned on. The readings were recorded on the Landfill Gas Monitoring form (Appendix B) after they had stabilized. The locations of the gas vents are shown in Figure 3-1 and 4-1.

In prior years different methods have been used to collect representative gas samples. This has resulted in widely varying results. This year two rounds of sampling were performed using similar methods, again with vastly different results. The dissimilar results can be attributed primarily to

changes in barometric pressure. On 1 December the barometric pressure had been high but was falling as a large storm system was approaching. On 7 December the barometric pressure had been low for several days but was rising due to the approach of a high pressure system.

The results from the 1 December 1999 sampling round can be found on Table 1 in Appendix B. The following is a brief summary of the results. No VOCs were detected in any of the gas vent wells. The oxygen levels ranged from 15.3 % (Vent # 5) to 1.5 % (Vent # 14) using the CGI and 6.8 % (Vent # 5) to 0.3 % (Vent # 9) using the GA-90. The discrepancies in the reading were due to use of a tee fitting between the MSA pump and the gas monitoring equipment. The tee was used to compensate for the different pumping rates between the MSA pump and CGI and GA-90. Initially, too much air was entering through the tee and skewing the oxygen levels on the CGI. It appears the GA-90 numbers for oxygen are more representative of the subsurface conditions. Hydrogen sulfide readings ranged from 3 ppm (Vents # 1 and 17), 2 ppm (Vent # 14) and 0 in all the remaining vents. LEL readings ranged from 2.5 ppm (Vent # 7), 72 % (Vent #10), 1 ppm (Vent # 8 and 9) and 0 in all other vents. Carbon dioxide ranged from 25.7 ppm in (Vent # 18) to 7.6 ppm (Vent # 5). Methane ranged from 32.8 ppm (Vent # 18) to 0.8 ppm (Vent #7). There was a gaseous odor at nearly all the vent wells. Plastic 13 gallon garbage bags were placed over the vent and all inflated within seconds. As noted in Section 3.0 several vents had animal burrows in the vicinity.

The results from the 6 and 7 December 1999 sampling round can be found on Table 2 in Appendix B. The following is a brief summary of the results. No VOCs were detected in any of the gas vent wells. The oxygen levels ranged from 21.0 % (Vent # 5, 7, 11, 16, and 17) to 0.2 % (Vent # 18) using the CGI and 21 % (Vent # 3, 5, 6, 7, and 11) to 0.0 % (Vent # 18) using the GA-90. There was very good correlation between the CGI readings and the GA-90 readings. Hydrogen sulfide were 0 in all the vents. LEL readings ranged from 0 % (Vent # 1, 5, 7, 8, 11, 12, 16, 17) to 100% (Vent #2, 13, 14, and 18). Carbon monoxide ranged from 0.6 ppm (Vent # 2) and 0 in all other vents. Carbon dioxide ranged from 35.8 ppm in (Vent # 18) to 0 ppm (Vent # 3, 5, 6, 7, 8, 10, 11, 12, 16, and 17). Methane ranged from 45.5 ppm (Vent # 18) to 0 ppm (Vent #1, 3, 5, 6, 7, 8, 10, 11, 12, 16, and 17). There was a gaseous odor at Vent # 18 only.

The gas readings are within the parameters of a mature landfill. The vents are functioning properly. The scenario of high atmospheric pressure to low atmospheric pressure results in a venting of landfill gas into the atmosphere. This was the case on 1 December. The scenario of low atmospheric pressure to high atmospheric pressure results in air intrusion into upper potion landfill. This would account for the lower gas readings on 6 and 7 December. The major concern with landfill gas is off-site migration. If the gas vents are functioning properly and are adequately spaced there should be no off-site migration of landfill gases; however, due to the high LEL readings and the proximity of residential housing and commercial development, gas monitoring probes should be installed along the property line where the landfill is adjacent to structures. The probes should be installed in clusters with screens installed at deep, mid-depth and shallow intervals. The deep screen should extend to just above the saturated zone. The top of shallow screen should be installed at approximately 3 to 5 feet below ground surface.

5.0 GROUNDWATER ELEVATIONS

Groundwater elevations were collected from each well during groundwater sampling activities. The depth to groundwater was subtracted from the elevation of the reference point to determine the elevation of the groundwater at each location. Table 5-1 lists the water level elevations for each well for each sampling round. During each sampling event, groundwater elevations were recorded on the first day of sampling for all wells scheduled to be sampled. Locations of monitoring wells are shown in Figure 4-1. Groundwater levels measured during November 1999 were consistently higher than those measured in May 1999, which is most likely due to the relatively dry spring and fairly wet fall (nearly 9 inches of rain fell in September partly attributable to Tropical Storm Floyd). Except for a few anomalies, the mean difference is roughly 0.5 feet. Compared to the year before, May 1999 levels were consistently lower than May 1998 levels and November 1999 levels were mostly higher than November 1998 levels.

In addition to these semi-annual groundwater measurements, regular groundwater measurements of all Shepley's Hill Landfill wells have been conducted by ABB-ES and Harding Lawson Associates (HLA) since 1992. During the first 5-year review (SWEC, August 1998), groundwater elevations were re-evaluated to identify hydraulic gradients and to confirm changes due to the construction of the landfill cap. It was determined that landfill cap has reduced the volume of water beneath the cap resulting in a more northerly groundwater flow (SWEC, 1998). Groundwater flow patterns will be re-evaluated during the next 5 year review.

In light of data collected for the first Five-Year Review performed in accordance with the Record of Decision for the Shepley's Hill Landfill Operable Unit, HLA is performing supplemental groundwater investigations which includes performing a hydrogeologic assessment at Shepley's Hill Landfill to obtain additional data to evaluate the effectiveness of the selected remedial action at minimizing groundwater elevation fluctuations within the capped area. The work is complete and a report will follow. In addition, the data will be used as inputs for refinement of the groundwater model for the landfill. Groundwater elevation data were collected from new piezometers and existing piezometers/monitoring wells at approximately monthly intervals for one year. The data was used to characterize groundwater flow, prepare groundwater elevation isopleths, and as input to the groundwater model. In addition, the Army installed continuous water level monitors in three wells at the landfill. These monitors provided data concerning the response of the groundwater system to precipitation events both within and outside the area of the landfill.

	Groundwater Elevations (Ft NGVD)									
Well Identification	May 10, 1999	November 1, 1999								
SHL-3	217.68	217.85								
SHL-4	217.84	217.92								
SHL-5	213.33	214.85								
SHL-9	213.29	213.71								
SHL-10	217.44	217.59								
SHM-93-10C	218.02	218.12								
SHL-11	217.34	217.39								
SHL-19	217.81	217.96								
SHL-20	217.46	217.44								
SHL-22	213.27	213.71								
SHM-93-22C	213.28	213.71								
SHM-96-22B	213.26	213.68								
SHM-96-5B	213.52	213.96								
SHM-96-5C	213.50	213.94								

TABLE 5-1 Monitoring Wells and Elevations

6.0 GROUNDWATER SAMPLING

Groundwater sampling activities at the landfill are conducted semi-annually. Groundwater sampling activities for the fourth year were conducted in the spring (May 10 - 11, 1999) and in the fall (November 1 - 2, 1999). Wells are designated as either Group 1 or Group 2 wells. Wells which have historically attained cleanup goals are given a Group 1 designation. Wells which have not historically attained cleanup goals are designated as Group 2 wells. Initially, all existing wells were designated as Group 2 wells and the three new wells that were installed in 1996 were to be designated during the first five year site review (SWEC, August 1998). During the first five year site review six wells (SHL-3, SHL-5, SHL-9, SHL-22, SHL-93-10C, and SHL-93-22C) achieved cleanup levels for all COCs and were reclassified as Group 1 wells. All other wells, including the three new wells, were classified as Group 2 wells. These group designations are presented in Table 6-1, located at the end of this section. Well designations will be reviewed again during the second Five-Year review.

6.1 Preparation for Sampling

Wells sampled as part of the long term monitoring program included SHL-3, SHL-4, SHL-5, SHL-9, SHL-10, SHL-11, SHL-19, SHL-20, SHL-22, SHM-93-10C, SHM-93-22C, SHM-96-22B, SHM-96-5B, and SHM-96-5C. Locations of the wells are shown on Figure 4-1. Sampling activities were coordinated with the Devens BRAC office and the contract laboratory prior to commencement of sampling. The contract laboratory was contacted approximately 3 weeks prior to sampling and was requested to prepare and deliver sampling bottles, quality assurance bottles and coolers to New England District approximately 1 week prior to the sampling event. Bottles were checked to insure that they complied with the requirements of the sampling program. Sampling equipment (including the YSI water quality meters and the teflon lined tubing) was reserved for rental/purchase from U.S. Environmental and picked up in the days preceding the sampling event. NAE used their own Grunfos Rediflow II pumps, controllers, Heron water level indicators, HF Scientific DRT-15CE turbidity meters, and portable generator for the sampling. All equipment was inventoried and tested to ensure it was accounted for and functioning. The well logs of each of the wells to be sampled was reviewed by the field team prior to the scheduled event to determine tubing requirements, and brought to the landfill during the sampling event to confirm the screened intervals.

6.2 Sampling

The fourth year of sampling was conducted by USACE, New England District on May 10 - 11, 1999 and November 1 - 2, 1999. Monitoring wells were purged and sampled in accordance with *EPA's Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* (July 1996) using an adjustable rate, low flow submersible pump. Teflon lined tubing was used for sample collection and was disposed after each well was sampled.

Before sampling activities commenced, groundwater elevations were measured at each well location to be sampled. YSI water quality meters and turbidity meters were calibrated at the beginning of each day of use. A calibration check was also performed at the end of each day. During sampling, the generator used to power the pumps was located at an downwind area at least 30 feet away from the well being sampled, to minimize potential contamination from the exhaust. Upon initial opening of each well, initial water levels measurements were collected. The pump intake was lowered to the middle of the screen of each well to be sampled when possible. When the water level was below the top of the screen, the pump was positioned to a depth between the top of the water level and the bottom of the screen.

Once the pumping was initiated, at least one volume greater than the stabilized drawdown volume plus the extraction tubing volume was purged. Water quality parameters, including temperature (temp), specific conductance, pH, oxidation reduction potential (ORP), turbidity, and dissolved oxygen (DO) were collected every 3 to 5 minutes to ensure proper purging of the wells before each well was sampled. The results are listed on Groundwater Field Analysis Forms located in Appendix C. All water quality parameters, except turbidity, were monitored using a flow-thru cell and a Sonde-YSI water meter (YSI 600 XLM or YSI 6820). Turbidity samples were not collected from the flow through cell due to the silt buildup which can occur in the cell. An Y-connector was set up before the flow through cell to take the turbidity readings. Sampling was conducted when required purge volumes were met and water quality parameters became stabilized for three consecutive reading. The tubing was disconnected from the flow-through cell and samples were collected directly from the discharge tubing. Observations made during the sampling activities include:

- To ensure precision of water level measurements, well casings that had faded marks or no marks were remarked.
- None of the pre-preserved sample bottles required pH adjustments after they were filled with the water samples.
- In cases where the water level was lower than the top of the screen, the pumps were lowered to approximately midpoint between the water level and the bottom of the screen. This procedure occurred at several wells during each event.
- During the May 10 sampling, the dissolved oxygen (DO) readings for wells SHL-3, SHL-4, and SHL-11 should be disregarded as they are in error. All three wells were monitored using the same YSI meter that day, which was apparently out of calibration for DO. The recorded dissolved oxygen levels (40 60 ug/L) are approximately 4 to 6 times that of saturation.
- During the May 11 sampling, the pH reading for well SHM-96-22B should be regarded as possibly in error. The pH values during stabilization were as high as 13.45 indicating the possibility of an instrument problem. However, the stabilized pH value was 8.6, which is well within the range of the values this well has registered in the past (pH of 6.5 10).

6.3 Equipment Decontamination

All non-disposable sampling and testing equipment that came in contact with the sampling medium was decontaminated to prevent cross contamination between sampling points. The submersible pump was decontaminated using the following procedure:

- Upon removal of the pump from the well following sample collection, the pump was submersed in a 4-inch PVC riser containing potable water and detergent (Alconox) solution. At least 1 to 2 gallons of the detergent solution was pumped through (started the pump at a low flow rate, as in sampling, and increased to a higher speed).
- The pump was removed and sprayed with potable water to minimize the transfer of soap to the rinser.
- The pump was then submersed in a riser filled with potable water and at least 1 to 2 gallons were pumped through.
- The pump was then submersed in a riser filled with deionized water and at least 1 to 2 gallons were pumped through.
- The submersible pump was sprayed with isopropyl alcohol (reagent grade) using a hand held spray bottle, over a tub. The pump was then submersed in a final deionized water rinse and at least 1 to 2 gallons were pumped through.
- The pump was air dried and wrapped in clean aluminum foil.

Monitoring Well Identification	Well Designation (Based on Final Five Year Review, SWEC, Aug 1998)
SHL-3	Group 1
SHL-4	Group 2
SHL-5	Group 1
SHL-9	Group 1
SHL-10	Group 2
SHM-93-10C	Group 1
SHL-11	Group 2
SHL-19	Group 2
SHL-20	Group 2
SHL-22	Group 1
SHM-93-22C	Group 1
SHM-96-22B	Group 2
SHM-96-5B	Group 2
SHM-96-5C	Group 2

TABLE 6-1 Monitoring Well Designations

7.0 LABORATORY TESTING

Groundwater was sampled in fourteen monitoring well locations using the low-flow method in accordance with the procedures outlined in the approved Long Term Monitoring and Maintenance Plan, Shepley's Hill Landfill (SWEC, May 1996). Samples were sent to Severn Trent Laboratories (formerly Intertek Testing Services Environmental Laboratories) in Colchester, Vermont for analysis. The samples were collected on May 10-11 and November 1-2, 1999. Samples were placed in containers compatible with the intended analysis and properly preserved prior to shipment to the laboratory. Each sealed container was placed in a leakproof plastic bag and placed in a strong thermal ice chest (cooler) filled with bubble wrap packing material, or equivalent, to ensure sample integrity during shipment. Ice was added to cool samples to at least 4^o C. Chains of Custody (COCs) were used to identify and document the samples being shipped (copies are included in Appendix D). Sample custody was initiated by the sampling team upon collection of samples and COC forms were placed in waterproof plastic bags and taped to the inside lid of the cooler. The cooler was sealed with chain-of-custody seals and shipped to the laboratory via overnight delivery.

7.1 Analyses

Water analyses were conducted according to EPA methods 8260B for volatile organics, 6010B for metals, and general inorganics analyses, including chemical oxygen demand by method 410.1, biochemical oxygen demand by method 405.1, hardness by method 130.2, alkalinity by method 310.1, cyanide by SW8946 method 9010A, anions by method 300, and total dissolved solids by method 160.1, and total suspended solids by method 160.2. These analyses were conducted at all wells. Table 7-1 indicates the analysis and procedures used for groundwater samples collected at Shepley's Hill Landfill.

7.2 Results

The approach for evaluating the effectiveness of the remedy is presented in the Record of Decision (ABB-ES, 1995). Of the chemicals of concern identified in the ROD, only those chemicals which present carcinogenic risk were considered trigger chemicals in the Long Term Monitoring and Maintenance Plan (SWEC, May 1996). The trigger chemicals are arsenic, dichlorobenzenes, and 1,2-dichloroethane. Therefore, the evaluation of effectiveness of Alternative SHL-2 is based on the reduction of carcinogenic risk rather than reduction of contamination as a measure of progress toward attainment of cleanup. This approach prevents a situation in which failure to attain a concentration reduction goal for a minor contributor to risk (i.e., 1,2-dichloroethane) overshadows the achievement of a 50 percent reduction of concentration of a higher carcinogenic risk (arsenic). Risk reduction was evaluated during the first five year review in August 1998. However, for the annual reports the contaminant concentrations will be referenced against the cleanup levels as a benchmark. It should be noted that the majority of the risk present at Shepley's Hill landfill is due to arsenic in the groundwater.

Arsenic was the only trigger chemical detected above cleanup levels at the site during the 1999 sampling events. Analytical results for groundwater analyses are presented in the form of a hits only table for chemical contaminants, as presented in Tables 7-2 and 7-3, for the spring and fall rounds,

TABLE 7-1Groundwater Sample Analysis and Procedures

PARAMETERS	METHOD
Valatile Organia Company	
volatile Organic Compounds	USERA 8200
xylenes	USEPA 8260
Acetone	
2-butanone	
2-methyl pentanone	
1,2,-dichlorobenzene	
1,3,-dichlorobenzene	
1,4,-dichlorobenzene	
Inorganics	EPA-SW 6010
Arsenic	
Barium	
Cadmium	
Chromium	
Cyanide (wet chemistry)	
Iron	
Lead	
Manganese	
Mercury	
Selenium	
Silver	
Copper	
Zinc	
General Parameters (measured in Laboratory)	
Total Dissolved Solida	NED METHODS
Total Dissolved Solids	USEPA 160.2
Chloride	USEPA 300
Hardness	
Nitrite-Nitrate as N	SW9056
Sulfate	USEPA 310.1
Alkalinity	000171011
Biochemical Oxygen Demand	
Chemical Oxygen	
General Parameters (measured in the field)	
nH	
Temperature	
Specific Conductance	
Dissolved Oxygen	
Oxygen Reduction Potential	
VOCs (Headspace)	
· · · · · · · · · · · · · · · · · · ·	

USEPA - U.S. Environmental Protection Agency

VOCs - Volatile Organic Compounds

TABLE 7-2 Groundwater Analytical Results - May 10 - 11, 1999 Sampling Event Shepley's Hill Landfill Devens, Massachusetts (SHEET 1 of 1)

	Well No.	SHL-3	SHL-4	SHL-5	SHM-96-5B	SHM-96-5B DUP	SHM-96-5C	SHL-9	SHL-10	SHM-93-10C	SHL-11	SHL-19	SHL-20	SHL-22	SHM-96-22B	SHM-93-22C
PARAMETERS	CLEANUP	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	LEVEL (1)		·····					T								
	ug/L															
VOLATILES (8260)																
Xylenes	10,000 (2)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Acetone	3,000 (4)	<5.0	<5.0	<5.0	4.0 J	4.0 J	3.0 J	15	<5.0	3.2 J	<5.0	<5.0	3.0 J	<5.0	3.5 J	3.3 J
2-Butanone		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Methyl-2-Pentanone	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	2.7 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzene	5 (2)	<5.0	<5.0	<5.0	0.97 J	0.94 J	1.2 J	<5.0	<5.0	<5.0	2.1 J	<5.0	<5.0	<5.0	1.7 J	<5.0
Methyl-t-Butyl Ether	70 (4)	<5.0	<5.0	<5.0	1.6 J	1.7 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	2.0 J	1.6 J	1.2 J
1,1-Dichloroethane	70 (4)	<5.0	<5.0	<5.0	2.6 J	2.6 J	<5.0	<5.0	<5.0	0.97 J	<5.0	<5.0	<5.0	2.2 J	3.2 J	1.7 J
1,2-Dichloroethene (total)	70 (2)	<5.0	<5.0	<5.0	2.7 J	2.7 J	3.2 J	14	<5.0	1.3 J	2.6 J	1.5 J	2.0 J	2.5 J	3.3 J	1.3 J
1,2-Dichloroethane	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1.1 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,3-Dichlorobenzene	600 (2)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,4-Dichlorobenzene	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	2.4 J	<5.0	4.4 J	<5.0	<5.0	<5.0
1,2-Dichlorobenzene	600	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
METALS (6010)																
Arsenic	50	2.7 B	78.2	5.0 B	3,490	3,460	57.0	71.3	2.7 B	10.8 B	431	156 🧎	216	12.2 B	707	42.8
Barium	2,000 (2)	<6.5	88.3	6.6	56.3	55.7	63.9	14.5	<6.5	7.4	116	33	111	12.8	108	76.6
Cadmium	5(2)	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium	100	3.0 B	1.0 B	1.7 B	3.6 B	3.0 B	1.8 B	1.7 B	1.1 B	0.96 B	1.5 B	0.76 B	2.2 B	1.2 B	<0.7	2.0 B
Copper	1,300 (3)	2.8 B	2.2 B	1.7 B	3.9 B	2.1 B	2.0 B	3.6 B	1.4 B	<1.0	2.7 B	1.2 B	1.7 B	1.2 B	5.8 B	1.5 B
Iron	9,100	15.7	16,600	2,590	30,900	30,600	60,900	13,900	<14.9	30.7	84,800	31,100	12,500	558	86,200	606
Lead	15	0.99 B	<0.9	1.1 B	<0.9	<0.9	<0.9	2.3 B	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Manganese	1,715	<1.4	1,100	415	13,400	13,000	6,760	547	<1.4	33.4	2,770	3,690	8,470	862	1,030	610
Mercury (7470A)	2 (2)	0.19 B	0.16 B	0.2 B	0.17 B	<0.14	0.2 B	0.15 B	0.13 B	0.12 B	0.17 B	0.16 B	0.15 B	0.24 B	0.13 B	0.21 B
Nickel	100	2.2	8.2	2.3	16.2	15.4	10.9	1.8	<1.4	1.9	2.6	10.7	14.7	7.5	5.7	<1.4
Selenium	50 (2)	4.3 BJ	<2.7 J	3.3 BJ	<2.7 J	3.1 BJ	<2.7 J	<2.7 J	<2.7 J	<2.7 J	<2.7 J	<2.7 J	3.9 BJ	4.1 BJ	3.3 BJ	<2.7 J
Silver	40 (4)	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9
Zinc	2,000 (4)	11.3 B	18 B	25.8 B	5.5 B	9.8 B	55.9 B	32.3 B	13.6 B	35.7 B	29.4 B	27.7 B	32.6 B	47.4 B	10.3 B	48.1 B
Aluminum	6,870	<10.4	29.4	272	<10.4	<10.4	<10.4	142	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4	<10.4
Sodium	20,000	647 B	12,100	3,070	43,500	42,800	37,100	1,380	1,080 B	7,840	39,300	3,190	47,300	48,200	44,000	22,500
GENERAL CHEMISTRY																
Alkalinity	-	14,000	154,000	34,000	380,000	376,000	396,000	65,000	14,000	192,000	332,000	132,000	418,000	450,000	316,000	266,000
Biochemical Oxygen Demand		<2,000	<2,000	2,000	<2,000	<2,000	<2,000	<2,000	<2,000	<2,000	<2,000	<2,000	<2,000	<2,000	<2,000	<2,000
Chloride		900	18,900	2,300	62,400	61,000	61,000	4,200	1,000	34,900	52,000	4,800	64,100	66,900	58,900	34,000
Chemical Oxygen Demand		<5,000	10,000	32,000	31,000	31,000	42,000	95,000	<5,000	<5,000	35,000	7,000	21,000	17,000	44,000	9,000
Cyanide (Total)	200 (2)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hardness		18,000	132,000	31,000	365,000	364,000	320,000	66,000	18,000	238,000	202,000	97,000	405,000	446,000	245,000	289,000
Nitrate as Nitrogen	10,000 (2)	400	600	300	<200	<200	200	<200	600	<200	<200	<200	<200	<200	<200	<200
Sulfate	500,000 (2)	3,100	6,700	2,600	4,300	4,300	2,000	4,100	3,600	23,400	800 B	18,300	7,700	3,900	4,100	20,700
Total Dissolved Solids		33,000 B	205,000	68,000 B	511,000	528,000	518,000	90,000 B	32,000 B	299,000	404,000	173,000	562,000	569,000	463,000	381,000
Total Suspended Solids		8,100	10,200	168,000	46,800	54,900	43,200	32,700	500	800	55,300	15,700	10,200	2,200	59,300	2,700

Notes:

Shaded areas with bold numbers indicate cleanup level exceedance. -

(1) Cleanup values as developed in the ROD (unless otherwised noted)

(2) No cleanup values were developed so the Maximum Contamination Level (MCLs) were used

(3) No cleanup values were developed so the MMCLs were used

(4) No cleanup values were developed so the MCP GW-1 standard was used

J = Estimated value

 ${\bf B}$ = Analyte is within 5 times of the amount detected in the equipment blank sample

Hardness values for wells SHM-96-5B, SHM-96-5B DUP, and SHL-20 have been revised from what was previously reported in the Spring 1999 Analytical Report due to Quality Assurance Report

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TABLE 7-3 Groundwater Analytical Results - November 1 - 2, 1999 Sampling Event Shepley's Hill Landfill Devens, Massachusetts (SHEET 1 of 1)

	Well No.	SHL-3	SHL-4	SHL-5	SHM-96-5B	SHM-96-5B DUP	SHM-96-5C	SHL-9	SHL-10	SHM-93-10C	SHL-11	SHL-19	SHL-20	SHL-22	SHM-96-22B	SHM-93-22C
PARAMETERS	CLEANUP	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
	LEVEL (1)												1			
	ug/L															
VOLATILES (8260)																
Xylenes	10,000 (2)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Acetone	3,000 (4)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Butanone	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Methyl-2-Pentanone		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzene	5 (2)	<5.0	<5.0	<5.0	0.94 J	0.98 J	0.96 J	<5.0	<5.0	<5.0	2.1 J	<5.0	0.9 J	<5.0	1.7 J	<5.0
Methyl-t-Butyl Ether	70 (4)	<5.0	<5.0	<5.0	1.5 J	1.5 J	2.1 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1.9 J	1.4 J	1.2 J
1,1-Dichloroethane	70 (4)	<5.0	<5.0	<5.0	2.6 J	2.6 J	1.7 J	<5.0	<5.0	0.93 J	<5.0	<5.0	<5.0	2.5 J	2.6 J	1.8 J
1,2-Dichloroethene (total)	70 (2)	<5.0	<5.0	<5.0	3.0 J	3.0 J	2.5 J	<5.0	<5.0	1.0 J	1.8 J	<5.0	1.9 J	2.7 J	3.0 J	1.3 J
1,2-Dichloroethane	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1.1 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,3-Dichlorobenzene	600 (2)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
1,4-Dichlorobenzene	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	1.9 J	<5.0	3.7 J	<5.0	<5.0	<5.0
1,2-Dichlorobenzene	600	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
METALS (6010)				C.E.	0.700					0.7	400	470		7.0	4.440	
Arsenic	000 (0)	<1.9	01.3	0.5	2,100	2,700	44.8	28.5	<1.9	0.7	492	1/0	410	1.3	102	33.2
Barium	2,000 (2)	< 5.6	94.5	11.0	51.6	51.9	51.8	16.2	< 5.6	6.8	121	26.2	716	10.8	123	/5.1
Cadmium	5 (2)	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium	100	<0.9	<0.9	<0.9	4.7	4.5	<0.9	<0.9	1.6	<0.9	<0.9	<0.9	3.2	<0.9	1.0	<0.9
Copper	1,300 (3)	<1.7	<1.7	<1.7	1.8 B	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	<1.7	2.8 B	<1.7
iron	9,100	37.3	5,630	2,200	26,900	27,000	42,100	87,600	229	25.5	75,700	25,600	14,000	400	99,500	479
Lead	15	<1.0	<1.0	1.6 B	<1.0	<1.0	<1.0	<1.0	1.5 B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Manganese	1,715	1.6 B	651	627	13,900	13,300	4,800	578	1.8 B	34.2	2,420	2,960	8,790	684	3,090	528
Mercury (7470A)	2 (2)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	100	<1.7	4.0	2.0	13.5	13.9	2.0	<1.7	<1.7	<1.7	<1.7	5.4	13.7	7.4	7.2	<1.7
Selenium	50 (2)	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4	<2.4
Silver	40 (4)	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9
Zinc	2,000 (4)	2.7 B	5.5 B	6.5 B	7.8 JB	5.8 JB	4.9 B	3.2 8	2.8 B	2.2 B	3.2 B	5.9 B	5.6 B	20.1	9.18	7.7 B
Aluminum	6,870	<14.3	<14.3	267	<14.3	<14.3 45.000	<14.3	54.1	25.7	<14.3	<14.3	<14.3	<14.3	<14.3 F0.000	<14.3	<14.3
Sodium	20,000	648	22,100	3,240	44,800	40,000	38,100	1,380	623	8,020	34,000	3,340	40,200	ວບ,ສບບ	50,100	24,700
GENERAL CHEMISTRY															<u> </u>	
Alkalinity		8.000	166.000	39,000	336.000	344.000	272.000	64.000	12.000	188,000	300.000	84.000	406.000	420.000	348.000	240,000
Biochemical Oxygen Demand		<2 000	<2 000	2,000 B	<2.000	<2.000	<2,000	<2,000	<2.000	<2.000	<2,000	<2.000	<2,000	<2.000	<2.000	2 000 B
Chloride	-	1.100	14.800	1,900	55,500	56,600	52,600	7.200	1.500	30,000	39,300	2,900	56,000	64,800	61,300	42.000
Chemical Oxygen Demand	- 1	14,000	29,000	12,000	20,000 J	28,000 J	42,000	24,000	12,000	26,000	33,000	8,000	36,000	14,000	34,000	18,000
Cyanide (Total)	200 (2)	<5.0	<5.0	<10.0	<10.0	<10.0	<10.0	<10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<10.0	<10.0
Hardness	-	12,000	132,000	50,000	355,000	355,000	245,000	72,000	14,000	222,000	185,000	60,000	380,000	430,000	310,000	270,000
Nitrate as Nitrogen	10,000 (2)	500	200	<200	<200	<200	<200	<200	900	<200	<200	<200	200	<200	<200	<200
Sulfate	500,000 (2)	3,900	7,700	10,000	4,600	4,600	700	7,300	3,200	19,600	1,400	12,500	5,900	4,100	2,600	14,600
Total Dissolved Solids	-	35,000 B	214,000	878,000	542,000	513,000	416,000	119,000	35,000 B	300,000	363,000	118,000	544,000	587,000	604,000	380,000
Total Suspended Solids	-	2,100 B	6,800	7,000	44,600	48,100	52,800	900 B	3,400	1,200 B	62,000	22,000	15,300	1,600 B	117,000	3,100

Notes:

Shaded areas with bold numbers indicate cleanup level exceedance. -

25

(1) Cleanup values as developed in the ROD (unless otherwised noted)

(2) No cleanup values were developed so the Maximum Contamination Level (MCLs) were used

(3) No cleanup values were developed so the MMCLs were used

(4) No cleanup values were developed so the MCP GW-1 standard was used

J = Estimated value

B = Analyte is within 5 times of the amount detected in the equipment blank sample

19

respectively. This table presents only detectable concentrations of chemical contaminants, compared against the applicable cleanup level or MCL if there is no established cleanup level. Results of all wet chemistry analyses are also included in the table. The results of sampling are summarized below.

Results from the spring sampling round are described as follows:

Volatile Organic Compounds (VOCs) were analyzed in the fourteen monitoring wells. None of the wells had detectable concentrations above the established cleanup levels for any of trigger chemicals (or any of the chemicals of concern). The only trigger compounds detected were 1,4-dichlorobenzene (2.4 J μ g/L) in monitoring well SHL-11 and (4.4 J μ g/L) in monitoring well SHL-20 and 1,2-dichloroethane (1.1 J μ g/L) in monitoring well SHM-93-10C. The trigger compound 1,2-dichlorobenze was not detected in any of the wells. Other volatile organic compounds detected at levels below MCLs in groundwater samples include 1,1-dichloroethane (at 3.2 J μ g/L), 1,2-dichloroethene (total) (at 14 J μ g/L), benzene (at 2.1 J μ g/L), Methyl-t-Butyl Ether (at 2 J μ g/L), 4-Methyl-2-Pentanone (at 2.7 J μ g/L), and Acetone (at 15 μ g/L).

Of the identified chemicals of concern for metals, only arsenic was identified as a trigger chemical. Arsenic was detected at concentrations greater than the cleanup level of 50 µg/L in the following monitoring wells: SHL-4 (78.2 ug/L), SHM-96-5C (57.0 ug/L), SHL-9 (71.3 µg/L), SHL-11 (431 μg/L), SHL-19 (156 μg/L), SHL-20 (216 μg/L), SHM-96-22B (707 μg/L), and SHM-96-5B (3,490 μ g/L). A duplicate sample of well SHM-96-5B had a concentration of 3,460 μ g/L. The only other chemicals of concern (non-trigger) detected at concentrations above the cleanup levels were Manganese, Iron and Sodium. Wells SHM-96-5B, SHM-96-5C, SHL-11, SHL-19, and SHL-20 had concentrations of Manganese above the cleanup level of 1,715 µg /L. The maximum value detected for Manganese was 13,400 µg /L at SHM-96-5B. Iron was detected at levels above its cleanup level of 9,100 µg /L at wells SHL-4, SHM-95-5B, SHM-96-5C, SHL-9, SHL-11, SHL-19, SHL-20, and SHM-96-22B, with the maximum detected (86,200 µg /L) at well SHM-96-22B. Sodium was detected at levels above its cleanup level of 20,000 µg /L at wells SHM-95-5B, SHM-96-5C, SHL-11, SHL-20, SHL-22, SHM-96-22B, and SHM-96-22C with the maximum detected (48,200 µg/L) at well SHL-22. It should be noted that the hardness values for wells SHM-96-5B, SHM-96-5B DUP, and SHL-20 have been corrected from what was previously reported in the Spring 1999 Analytical Report based on the Chemical Quality Assurance Report.

Results from the Fall sampling round are described as follows:

Volatile Organic Compounds (VOCs) were analyzed in the fourteen monitoring wells. None of the wells had detectable concentrations above the established cleanup levels for any of trigger chemicals (or any of the chemicals of concern). The only trigger compounds detected were 1,4-dichlorobenzene (1.9 J μ g/L) in monitoring well SHL-11 and (3.7 J μ g/L) in monitoring well SHL-20 and 1,2-dichlorobenze (1.1 J μ g/L) in monitoring well SHL-93-10C. The trigger compound 1,2-dichlorobenze was not detected in any of the wells. Other volatile organic compounds detected in groundwater samples include 1,1-dichlorobenae (at 2.6 J μ g/L), 1,2-dichlorobene (total) (at 3.0 J μ g/L), benzene (at 2.1 J μ g/L), and Methyl-t-Butyl Ether (at 2.1 J μ g/L).

Of the identified chemicals of concern for metals, only arsenic was identified as a trigger chemical. Arsenic was detected at concentrations greater than the cleanup level of 50 µg/L in the following monitoring wells: SHL-4 (61.3 µg /L), SHL-11 (492 µg/L), SHL-19 (176 µg/L), SHL-20 (215 µg/L), SHM-96-22B (1,440 µg/L), and SHM-96-5B (2,700 µg/L). A duplicate sample of well SHM-96-5B also had concentrations of 2,700 µg/L. The only other chemicals of concern detected at concentrations above the cleanup levels were Manganese, Iron and Sodium. Wells SHM-96-5B, SHM-96-5C, SHL-11, SHL-19, SHL-20, and SHM-96-22B had concentrations of Manganese above the cleanup level of 1,715 µg /L. The maximum value detected for Manganese was 13,900 µg /L at SHM-96-5B. Iron was detected at levels above its cleanup level of 9,100 µg /L at wells SHM-95-5B, SHM-96-5C, SHL-9, SHL-11, SHL-19, SHL-20, and SHM-96-22B. with the maximum detected (99,500 µg /L) at well SHM-96-22B. Sodium was detected at levels above its cleanup level of 20,000 µg /L at wells SHL-4, SHM-95-5B, SHM-96-5C, SHL-11, SHL-20, SHL-22, SHM-96-22B, and SHM-96-22C with the maximum detected (50,900 µg /L) at well SHL-22.

Tables 7-2 and 7-3 summarize the monitoring wells that had contaminant concentrations above the cleanup levels during the 1999 monitoring period. These values were compared to previous years data. A comparison of arsenic concentrations detected above the cleanup levels during the 1999 period with historical data is presented in Table 7-4. The comparison indicates the following:

General decrease in arsenic concentrations except for wells SHM-96-22B and SHL-11. Wells SHM-96-5C, SHM-96-5B, SHL-9, and SHL-20 indicated no definitive change over historic values. It should be noted that 8 of the 14 wells were all below the MCL cleanup level for the last round of sampling. The wells below the cleanup levels are wells SHL-3, SHL-5, SHM-96-5C, SHL-9, SHL-10, SHM-93-10C, SHL-22, and SHM-93-22C. Refer to Appendix E for a graphical comparison of arsenic concentrations in monitoring wells for the previous and current sampling periods.

Table 7-4Comparison of Historic Arsenic ResultsShepley's Hill Landfill Groundwater Monitoring

	Arsenic (<i>u</i> g/L)										
Well ID	Aug-91	Dec-91	Mar-93	Jun-93	Nov-96	May-97	Oct-97	May-98	Nov-98	May-99	Nov-99
SHL-3	35	120	6.5	NS	NS	<10 U	< 10 U	< 5 U	< 5.4 U	2.7 B	<1.9 U
SHL-4	260	140	2.54	NS	48.8	73.6 J	180	37.4	89.1	78.2	61.3
SHL-5	23	38	11.4	NS	12	< 10 U	< 10 U	< 5 U	11.5	5.0 B	6.5
SHM-96-5B	NS	NS	NS	NS	1440	3300 J	2040	4300	3080	3490	2700
SHM-96-5C	NS	NS	NS	NS	71	43.2	43.1	49.5	46.8	57.0	44.8
SHL-9	37	67	42.4	NS	46.9	16.1 J	25.2	15	27.2	71.3	28.5
SHL-10	67	120	280	NS	3.4 B	< 10	209	< 5 U	< 5.4 U	2.7 B	<1.9 U
SHM-93-10C	NS	NS	21.3	18.1	12.4	< 10 U	10.5	7.5	10.2	10.8 B	8.7
SHL-11	320	320	340	NS	332	252 J	366	346	376	431	492
SHL-19	340	710	390	NS	138	< 10 U	298	77.5	145	156	176
SHL-20	98	89	330	NS	244	< 10 U	227	238	218	216	215
SHL-22	27	25	32.9	NS	24.8	< 10 U	34.8	10.6	< 5.4 U	12.2 B	7.3
SHM-96-22B	NS	NS	NS	NS	324	318 J	352	365	406	707	1440
SHM-93-22C	NS	NS	68.9	49.8	44.6	40.4	< 10 U	31.6	51.1	42.8	33.2

Notes:

J: Estimated value below the quantitation limit

U: Not detected above the quantitation limit

B: Detected in associated blank

NS: Not sampled

Bold numbers indicate cleanup level exceedances (MCL cleanup level is 50 ug/L)

8.0 QUALITY CONTROL

Quality assurance/quality control (QA/QC) samples were collected to monitor the sample collection, transportation, and analysis procedures.

8.1 Field Quality Control

One set of equipment (rinsate) blank samples was collected from the pump after decontamination had been conducted for each sampling event (May and November) and analyzed for the full suite of analytical parameters. Results of equipment blank samples are discussed below. One field duplicate groundwater sample was collected during each sampling round at well SHM-96-5B and analyzed for the full suite of analytical parameters. Results of duplicate samples are shown on Tables 7-2 and 7-3 and are also discussed below. One trip blank sample was collected per shipped cooler, and submitted for VOC analysis only to evaluate potential cross-contamination of samples during transport. No contaminants were detected in the trip blanks.

8.2 Laboratory Quality Control

One set of QA samples were also collected by the sampling team and sent to the designated QA laboratory (an independent testing laboratory) in the form of duplicates for each sampling round. The QA samples represent approximately 10% of the groundwater samples collected. A QA sample was collected during each sampling round at well SHM-96-5B and analyzed for the full suite of analytical parameters. QA samples were collected, packaged and shipped in the same manner as the other groundwater samples. Appendix F presents the Chemical Quality Assurance Report (CQAR) which provides a statistical comparison of the primary and QA laboratory results for each sampling round. Also presented in Appendix F is the Chemical Data Quality Assessment Report, which provides an overall assessment of results presented in the CQAR's, and their impact on data usability for both sampling rounds.

8.3 Data Evaluation

Fourteen groundwater samples were collected from Shepley's Hill Landfill at Devens, MA during each round of sampling. The samples were analyzed at Severn Trent Laboratories (formerly Intertek Testing Services) in Colchester, VT for Volatile Organic Compounds (VOCs), Target Analyte List (TAL) Metals, Alkalinity, Anions (including Nitrate, Sulfate, and Chloride), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Hardness, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), and Cyanide. The spring samples were collected on May 10-11, 1999, and the fall samples on November 1-2, 1999, (fall) (see Groundwater Analytical Results Tables in Section 7).

The results were evaluated for acceptability in accordance with the laboratory's defined acceptance limits, with standard EPA SW846 guidance and/or with guidelines provided in the draft USACE Methods Compendium document.

All sample coolers were packed with ice packs and ice in the field. Sample shipments were received at the laboratory on May 11 and 12, 1999, for the spring sampling, and November 2 and 3, 1999 for the fall sampling. All samples were appropriately preserved by the procedures shown in Table 8-1. There are no sample shipment or receipt anomalies associated with these samples.

Samples were extracted and analyzed in accordance with the methods and holding time requirements cited in Table 8-1.

8.3.1 Data Evaluation for Samples Collected May 1999

Volatile Organic Compound (VOC) Analysis

Fourteen groundwater samples were analyzed for VOCs using SW846 method 8260B. In addition, the laboratory analyzed: one field duplicate (MW-SHL-DUP-99-01, a duplicate of sample MW-SHL-5B-99-01); two trip blanks (dated 05/10/99 and 05/11/99); and one equipment blank (MW-SHL-EB-99-01, dated 05/11/99).

Laboratory Method Blank, Trip Blank and Equipment Blank Results: Target analytes were undetected at levels above the laboratory's practical quantitation limit (PQL) for method blank, trip blank, and equipment blank samples. All results are acceptable.

<u>Field Duplicate Sample Results</u>: The results of the VOCs for sample MW-SHL-5B-99-01, and its duplicate, sample MW-SHL-DUP-99-01, show less than 20 % relative percent difference for all detected analytes. The field duplicate sample shows acceptable comparative results.

<u>Surrogate Results</u>: All VOC sample surrogate recoveries are within the laboratory's stated acceptance limits. All results are acceptable.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results: One set of matrix spike/matrix spike duplicate (MS/MSD) samples was analyzed for this project. All MS/MSD recoveries and relative percent differences (RPD) are within the laboratory's acceptance limits for VOC analysis, except for 2-Chloroethylvinylether, which showed 0% recovery in both the MS and MSD sample. The laboratory report narrative states that the acid preservative may have degraded this sample. As this analyte is not a site-specific contaminant (and not summarized on the Groundwater Analytical Results Table in section 2), no action was taken. In addition, the analytes, 1,3,5-Trimethylbenzene and 1,2,4-Trimethylbenzene showed slightly low recovery in the MS and/or MSD sample. Since the recoveries are only slightly outside of the acceptance range and the analytes are not a site-specific contaminant (and not summarized on the Groundwater Analytical Results Table in section 2), no action was taken.

Target Analyte List (TAL) Metals Analysis

Fourteen groundwater samples were analyzed for TAL metals using SW846 method 6010B or 7000 series methods. In addition, the laboratory analyzed: one field duplicate (MW-SHL-DUP-99-01, a duplicate of sample MW-SHL-5B-99-01); and one equipment blank (MW-SHL-EB-99-01, dated 05/11/99).

Laboratory Preparation Blank and Equipment Blank Results: Most target analytes were undetected at levels above the instrument detection limit (IDL) for preparation blank and equipment blank samples. The equipment blank sample contained some analytes at levels above the IDL, including Arsenic (2.8 ug/L), Chromium (0.84 ug/L), Copper (7.5 ug/L), Lead (1.6 ug/L), Mercury (0.11 ug/L), Selenium (2.8 ug/L), Zinc (11.8 ug/L), and Sodium (234 ug/L). Sample values which are within five times of the amount detected in the equipment blank are qualified with a B indicating potential blank interference.

<u>Field Duplicate Sample Results</u>: The results of the metals for sample MW-SHL-5B-99-01, and its duplicate, sample MW-SHL-DUP-99-01, show less than 20 % relative percent difference for all analytes detected above the PQL. The field duplicate sample shows acceptable comparative results.

<u>Matrix Spike (MS) and Duplicate Results</u>: One set of matrix spike (MS) and duplicate samples was analyzed for this project. All MS recoveries are within the 75-125 % recovery acceptance limits, except for selenium, which had a recovery of 151%. The post digestion spike recovery was also outside of the 75-125% recovery acceptance limits at 139% recovery. As a result, all sample results are qualified as estimated. For analytes which showed concentrations above the PQL, the duplicate RPDs are within the 20% RPD acceptance limits for metals analysis. All results are acceptable based on RPD criteria.

General Inorganic Analyses

Fourteen groundwater samples were analyzed for general inorganic analyses, including Alkalinity by EPA method 310.1, Anions (including Nitrate, Sulfate, and Chloride) by EPA method 300.0, Biochemical Oxygen Demand (BOD) by EPA method 405.1, Chemical Oxygen Demand (COD) by EPA method 410.1, Total Hardness by EPA method 130.2, Total Dissolved Solids (TDS) by EPA method 160.1, Total Suspended Solids (TSS) by EPA method 160.2, and Cyanide by SW846 method 9010. In addition, the laboratory analyzed: one field duplicate (MW-SHL-DUP-99-01, a duplicate of sample MW-SHL-5B-99-01); and one equipment blank (MW-SHL-EB-01-99-01, dated 05/11/99).

<u>Laboratory Preparation Blank</u> and Equipment Blank Results: All target analytes were undetected at levels above the laboratory's practical quantitation limit (PQL) for preparation blank samples. The equipment blank sample showed detectable levels of sulfate (300 ug/L) and TDS (21,000 ug/L). Sample values which are within five times of the amount detected in the equipment blank are qualified with a B indicating potential blank interference.

<u>Field Duplicate Sample Results</u>: The results of the general inorganic analyses for sample MW-SHL-5B-99-01, and its duplicate, sample MW-SHL-DUP-99-01, showed less than 20 % relative percent difference for all detected analytes. The field duplicate sample shows acceptable comparative results.

<u>Matrix Spike (MS) and Duplicate Results</u>: One set of matrix spike and duplicate samples was analyzed for Cyanide, Hardness, Anions, Alkalinity, and TDS. All MS recoveries and RPDs are within the laboratory's acceptance limits (75-125 % recovery; 20% RPD) for these analyses, except for alkalinity which showed a MS recovery of 73%. Since this recovery is only marginally outside of the acceptance limits, the results were not qualified. All results are acceptable.

Conclusion

Laboratory reports were reviewed for adherence to acceptable laboratory practices. Based on the data evaluation elements reviewed (including holding times, blank sample results, surrogate recoveries, and MS/MSD recoveries), all data may be reported without qualification, except as summarized below:

- <u>Metals Analyses</u>: The matrix spike (MS) recovery for selenium (151%) was outside of the acceptance limits (75-125%). The post digestion spike recovery was also outside of the 75-125% recovery acceptance limits at 139% recovery. As a result, all sample results are qualified as estimated.
- <u>Metals Analyses</u>: The equipment blank sample contained some analytes at levels above the IDL, including Arsenic (2.8 ug/L), Chromium (0.84 ug/L), Copper (7.5 ug/L), Lead (1.6 ug/L), Mercury (0.11 ug/L), Selenium (2.8 ug/L), Zinc (11.8 ug/L), and Sodium (234 ug/L). Sample values which are within five times of the amount detected in the equipment blank are qualified with a B indicating potential blank interference.
- <u>General Inorganic Analyses</u>: The equipment blank sample showed detectable levels of sulfate (300 ug/L) and TDS (21,000 ug/L). Sample values which are within five times of the amount detected in the equipment blank are qualified with a B indicating potential blank interference.

8.3.2 Data Evaluation for Samples Collected November 1999

Volatile Organic Compound (VOC) Analysis

Fourteen groundwater samples were analyzed for VOCs using SW846 method 8260B. In addition, the laboratory analyzed: one field duplicate (MW-DUP-99-02, a duplicate of sample MW-SHM-96-5B-99-02); two trip blanks (dated 11/01/99 and 11/02/99); and one equipment blank (MW-EB-99-02, dated 11/02/99).

Laboratory Method Blank, Trip Blank and Equipment Blank Results: Target analytes were undetected at levels above the laboratory's practical quantitation limit (PQL) for method blank, trip blank, and equipment blank samples. All results are acceptable. <u>Field Duplicate Sample Results</u>: The results of the VOCs for sample MW-96-5B-99-02, and its duplicate, sample MW-DUP-99-02, show less than 20 % relative percent difference for all detected analytes. The field duplicate sample shows acceptable comparative results.

<u>Surrogate Results</u>: All VOC sample surrogate recoveries are within the laboratory's stated acceptance limits. All results are acceptable.

<u>Matrix Spike/Matrix Spike Duplicate (MS/MSD) Results</u>: One set of matrix spike/matrix spike duplicate (MS/MSD) samples was analyzed for this project. Most MS/MSD recoveries and relative percent differences (RPD) are within the laboratory's acceptance limits for VOC analysis. Five out of 84 spiked compounds showed MS and/or MSD recoveries which were slightly outside the acceptance range. These exceedances are not considered to significantly impact the results, as these compounds were not detected in the field samples and are not sitespecific contaminants (i.e., not summarized on the Groundwater Analytical Results Table in section 2), no action was taken. The compound, 2-Chloroethylvinylether, showed 0% recovery in both the MS and MSD sample. Previous laboratory reports have stated that the acid preservative may have degraded this analyte. As this analyte is not a site-specific contaminant (and not summarized on the Groundwater Analytical Results Table in section 2), no action was taken.

Target Analyte List (TAL) Metals Analysis

Fourteen groundwater samples were analyzed for TAL metals using SW846 method 6010B or 7000 series methods. In addition, the laboratory analyzed: one field duplicate (MW-DUP-99-02, a duplicate of sample MW-SHM-96-5B-99-02); and one equipment blank (MW-EB-99-02, dated 11/02/99).

<u>Laboratory Preparation Blank and Equipment Blank Results</u>: Most target analytes were undetected at levels above the instrument detection limit (IDL) for preparation blank and equipment blank samples. The equipment blank sample contained some analytes at levels above the IDL, including Copper (1.7 ug/L), Lead (2.1 ug/L), Manganese (1.4 ug/L), and Zinc (3.2 ug/L). Sample values which are within five times of the amount detected in the equipment blank are qualified with a B indicating potential blank interference.

<u>Field Duplicate Sample Results</u>: The results of the metals for sample MW-SHM-96-5B-99-02, and its duplicate, sample MW-DUP-99-02, show less than 20 % relative percent difference for all analytes detected above the PQL, except for Zinc and Thallium, which showed 29% and 74% RPD, respectively. As a result of the exceedance of RPD criteria for Zinc, both samples are qualified with a J, indicating that they are estimated values. For Thallium, the amount detected in the original (8.3 ug/L) and the field duplicate (18 ug/L) are less than or within two times of the reporting limit (10 ug/L) for this analyte. Higher analytical variability is not uncommon at these low levels. As this analyte is not a site-specific contaminant (and not summarized on the Groundwater Analytical Results Table in section 2), no action was taken. The field duplicate sample shows acceptable comparative results.

<u>Matrix Spike (MS) and Duplicate Results</u>: One set of matrix spike (MS) and duplicate samples was analyzed for this project. All MS recoveries are within the 75-125 % recovery acceptance limits. For analytes which showed concentrations above the PQL, the duplicate RPDs are within the 20% RPD acceptance limits for metals analysis. All results are acceptable based on RPD criteria.

General Inorganic Analyses

Fourteen groundwater samples were analyzed for general inorganic analyses, including Alkalinity by EPA method 310.1, Anions (Nitrate, Phosphate, Sulfate, and Chloride) by EPA method 300.0, Biochemical Oxygen Demand (BOD) by EPA method 405.1, Chemical Oxygen Demand (COD) by EPA method 410.1, Total Hardness by EPA method 130.2, Total Dissolved Solids (TDS) by EPA method 160.1, Total Suspended Solids (TSS) by EPA method 160.2, and Cyanide by SW846 method 9010. In addition, the laboratory analyzed: one field duplicate (MW-DUP-99-02, a duplicate of sample MW-SHM-96-5B-99-02); and one equipment blank (MW-EB-01-99-02, dated 11/02/99).

Laboratory Preparation Blank and Equipment Blank Results: All target analytes were undetected at levels above the laboratory's practical quantitation limit (PQL) for preparation blank samples. The equipment blank sample showed detectable levels of Alkalinity (1,000 ug/L), BOD (3,100 ug/L), TSS (10,000 ug/L), and TDS (600 ug/L). Sample values which are within five times of the amount detected in the equipment blank are qualified with a B indicating potential blank interference.

<u>Field Duplicate Sample Results</u>: The results of the general inorganic analyses for sample MW-SHM-96-5B-99-02, and its duplicate, sample MW-DUP-99-02, showed less than 20 % relative percent difference for all detected analytes, except COD which showed 33% RPD between the original and field duplicate sample result. As a result of the exceedance of RPD criteria for COD, both samples are qualified with a J, indicating that they are estimated values. Other field duplicate samples show acceptable comparative results.

<u>Matrix Spike (MS) and Duplicate Results</u>: One set of matrix spike and duplicate samples was analyzed for Anions. All MS recoveries and RPDs are within the laboratory's acceptance limits (75-125 % recovery; 20% RPD) for the anions, except for phosphate which showed a MS recovery of 40%. As this analyte is not a site-specific contaminant (and not summarized on the Groundwater Analytical Results Table in section 2), no action was taken. All results are acceptable.

Conclusion

Laboratory reports were reviewed for adherence to acceptable laboratory practices. Based on the data evaluation elements reviewed (including holding times, blank sample results, surrogate recoveries, and MS/MSD recoveries), all data may be reported without qualification, except as summarized below:

- <u>Metals Analyses</u>: The equipment blank sample contained some analytes at levels above the IDL, including Copper (1.7 ug/L), Lead (2.1 ug/L), Manganese (1.4 ug/L), and Zinc (3.2 ug/L). Sample values which are within five times of the amount detected in the equipment blank are qualified with a B indicating potential blank interference.
- <u>Metals Analysis</u>: The results of the metals for sample MW-SHM-96-5B-99-02, and its duplicate, sample MW-DUP-99-02, show greater than 20 % relative percent difference for Zinc, which showed 29% RPD between the original and field duplicate sample result. As a result of the exceedance of RPD criteria for Zinc, both samples are qualified with a J, indicating that they are estimated values.
- <u>General Inorganic Analyses</u>: The equipment blank sample showed detectable levels of Alkalinity (1,000 ug/L), BOD (3,100 ug/L), TSS (10,000 ug/L), and TDS (600 ug/L). Sample values which are within five times of the amount detected in the equipment blank are qualified with a B indicating potential blank interference.
- <u>General Inorganic Analyses</u>: The results of the general inorganic analyses for sample MW-SHM-96-5B-99-02, and its duplicate, sample MW-DUP-99-02, show greater than 20 % relative percent difference for COD, which showed 33% RPD between the original and field duplicate sample result. As a result of the exceedance of RPD criteria for COD, both samples are qualified with a J, indicating that they are estimated values.

TABLE 8-1

Sample Preparation and Analysis Methods, Containers, Holding Times, and Preservatives

Parameter	Prepar- action Method ¹	Analysis Method ¹	Sample Container ²	Minimum Volume	Preservative	Holding Time (VTS) ³
VOCs	5030B	8260B	3 X 40 mL vials with Teflon septa screw caps ⁴	40 mL	HCl to pH less than 2 (No Headspace) 4+/- 2°C	14 days
Metals ⁵ Hardness	3010A NA	6010B - Trace ICAP or 7000 series 130.2	1-Liter HDPE	300 mL	HNO3 to pH less than 2	180 days (except Hg) 28 days (Hg) 180 days
Cyanide	NA	9012A	500-mL HDPE	500 mL	NaOH to pH greater than 12, 4+/- 2°C	14 days
Anions ⁶ Alkalinity TDS	NA NA NA	300 310.1 160.1	500-mL HDPE	100 mL 100 mL 100 mL	4+/- 2°C	48 hours for ortho- Phosphate and Nitrate; 28 days for Sulfate and Chloride 14 days 48 hours
COD	NA	410.1	250-mL HDPE	250 mL	H ₂ SO ₄ to pH less than 2, $4+/-2^{\circ}C$	28 days
BOD	NA	405.1	1-Liter HDPE	1000 mL	4+/- 2°℃	48 hours
TSS	NA	160.2	1-Liter HDPE	1000 mL	4+/- 2°C	7 days

1 "Methods for Chemical Analysis of Water and Wastes", Cincinnati, OH, March 1979, EPA 600-4-79-020. "Test Methods for Evaluating Solid Waste, Physical and Chemical Methods", U.S. EPA SW-846, 3rd Edition.

2 Additional sample containers/volume is required for matrix quality control samples.

3 VTS - Verified Time when the Sample was collected.

4 Two vials will be shipped to the laboratory; one will be measured for pH in the field to verify that the sample has been preserved correctly (i.e. pH less than 2)).

5 TAL metals include Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc.

6 Anions include Nitrate, Sulfate, and Chloride.

NA = Not Applicable Hg = Mercury

9.0 CORRECTIVE ACTION

Corrective actions are primarily regrading and reseeding eroded areas and clearing unwanted vegetation in drainage channels. The following areas are the most critical and should be addressed before the next inspection: (1) Clear the earth and vegetation obstruction in the east side drainage swale just upstream of the new riprap section. Drain the area of standing water in the channel upstream of the obstruction and clear, regrade, and reseed or riprap the channel; (2) Clear and mow the existing settled area between Gas Vents #3 and #4 during a dry period. If it does not dry out it should be cleared by hand to eliminate woody and wetland species; (3) Repair the eroded gully between Gas Vents #1 and #3 on the west and between Gas Vents #14 and #12, #11 and #8, and #8 and #5 on the east; (4) Repair and replace the security fence and gates as required to control access to the site; (5) Place topsoil and over the sandy area lacking vegetation on the east side near the new riprap channel, and (6) Remove trees from landfill cap. Along with the corrective actions listed in the report, it is recommended that (1) Regrade the area in the vicinity of Gas Vent # 12 and install a drainage swale, (2) Place stone aprons around gas vents to discourage animals from burrowing, (3) Place settlement plates in low areas to determine the yearly rate of settlement, (4) Repair and regrade around the catch basins on the south side of the landfill, and (5) resurvey the landfill to 1 foot contours to be used to design drainage around Gas Vent #12 and as a planning tool for possible future landfill improvements.

With the exception of the repairs mentioned above, and the other repairs recommended in the report, the landfill is in fair condition and appears to be functioning adequately.




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APPENDIX A

LANDFILL MAINTENANCE CHECKLIST

APPENDIX A Landfill Maintenance Checklist

To be completed in indelible ink.

Inspections are to be performed annually.

DATE: 1 December 1999 INSPECTOR: Ellen Iorio

ORGANIZATION: U.S Army Corps of Engineers, New England District

LANDFILL ATTRIBUTE	OBSERVATIONS	RECOMMENDATIONS	SAT/ UNSAT
Monitoring Wells	1. Inspection performed by groundwater monitoring team	None	
Piezometers	1. Inspection performed by groundwater monitoring team	None	
Cover Surface	 Vegetative cover is generally satisfactory except as noted in the comments that follow. Various species growing; mowed to about 8 inches height. A large area on the southern section was not mowed due to wet conditions. In this area, the vegetation was 18 to 24 inches high. 	1. See specific comments under the sections that follow.	SAT
	 There are several areas where settlement is occurring. Area surrounding gas vent #12 is very wet and rutted due to poor grading. 	 Install settlement plates and monitor. Survey the area to determine best way to promote drainage. Regrade and install a drainage swale. 	SAT UNSAT
	4. There are trees are growing on the cap by gas vent #13 and to the east of gas vents #11 and #8.	4. Remove tres from cap area and reseed as necessary.	UNSAT
Vegetative Growth	1. Approximately midway along the south drainage swale, on the upper part of the outside channel side slope, there is an area about 10 feet by 15 feet which lacks adequate vegetation. It is just beginning to show signs of erosion.	1. This area should be reseeded, with hay or straw placed on the surface, to prevent further erosion.	UNSAT
	2. In the vicinity of the new rock channel on the east side, there are large areas with very sparse or no vegetation. The soil in these bare areas is mostly sand.	2. This area should be regraded where erosion is taking place. The area should have 6 inches of topsoil placed with seed and erosion mat as needed.	UNSAT
Landfill Gas Vent Wells	1. The gas vents are in good condition. All screens and pipes are in functional condition and no repairs are required at this time. Many of the vents had animal burrows adjacent to them. The location of the burrows is noted on the gas vent monitoring result table.	1. All animals should be removed and stone aprons placed around the gas vents	UNSAT

LANDFILL ATTRIBUTE	OBSERVATIONS	RECOMMENDATIONS	SAT/ UNSAT
Drainage Swales	1. Most of the drainage swale on the south side is being invaded by woody species. There are also intermittent zones of standing water indicating a lack of proper channel slope and drainage.	1. The south side drainage swale should be cleared of woody vegetation and regraded as needed to properly drain all areas of standing water. Depending on water velocities, the channel should then be reseeded or riprap should be placed.	UNSAT
	2. In the east side drainage swale, in the vicinity of gas vent #13 and continuing downstream to the new rock-lined channel, the drainage swale is heavily overgrown with woody vegetation and wetland species. It appears to be heavily silted in and has a large area of standing water. There is an earth and vegetation obstruction just upstream of the new rock section preventing the drainage of water and turning the channel into a pond.	2. This reach of the drainage swale should be cleared of the obstruction, all vegetation and accumulated silt and sand, and regraded to drain properly. Seeding, or riprap placement, should follow, depending on water velocities. Survey the swale to determine how to promote proper drainage.	UNSAT
	3. In the drainage swale between gas vent #3 and #4 is being invaded by wetland species.	3. Remove wetland species by mowing or hand clearing.	UNSAT
Culverts	1. The concrete drainage structure at the terminus of the catch basin and underground conduit system on the south side is overgrown with vegetation, including some larger woody species, and is silting in. Standing water is present and wetland species are becoming established as well.	1. The structure and channel immediately downstream should be cleaned out and the channel regraded as required to properly drain.	UNSAT
Catch Basins	1. Catch Basin #2 near the entrance to the site has a broken surface grate.	1. The surface grate should be replaced.	UNSAT
	2. Catch Basin #3 near the entrance to the site is not set at grade. The rim of the basin is about six to eight inches higher than the surrounding ground.	2. The rim of this catch basin should be lowered to meet the surrounding grade.	UNSAT
	3. Catch basin #7 near the southwest corner of the site is substantially overgrown by the adjacent vegetation and will soon be completely overgrown and hidden from view. The catch basin is partially filled with many small pieces of PVC pipe.	3. This catch basin should be cleared of encroaching vegetation and the PVC pipe pieces should be removed.	UNSAT

LANDFILL ATTRIBUTE	OBSERVATIONS	RECOMMENDATIONS	SAT/ UNSAT
Settlement	1. In the settled area between gas vents #3 and #4, 6 to 12 inches of standing water was observed and wetland species are becoming established. No areas of erosion were seen, however. Woody species are just starting to grow on the periphery of this settled area.	1. During a dry period, the settled area should be mowed to eliminate woody species and to slow the encroachment of wetland species.	UNSAT
	2. On the west side between gas vent #3 and #6 there is a small area of settlement, about 15 feet by 15 feet, with about three inches of standing water. There is no erosion in this settled area, and vegetation is still growing well.	2. This area should be monitored for further settlement and wetland encroachment. No action is requird at this time.	SAT
Erosion	1. In the northwest extremity, between gas vent #1 and #3, there is an eroded gully leading to the west drainage swale. It is about one to two feet wide and 15 feet long	1. The placement of topsoil and seed in the gully should be sufficient to repair this area.	UNSAT
	 In the vicinity of gas vent #1, there is an oval-shaped area of erosion, about five feet by ten feet. 	2. The placement of topsoil and seed in the eroded area should be sufficient to repair this area.	UNSAT
	3. On the west side near gas vent #9, a shallow sloped area is undergoing mild erosion. Vegetation is not well established and minor erosion is forming shallow gullies.	3. The placement of topsoil and seed, with a surface treatment of broadcast hay or straw, should be sufficient to repair this area and stop the erosion process.	UNSAT
Access Roads	1. The access roads on the site are in good condition.	1. There are no problems on access roads which warrant repair at this time.	SAT
Security Fencing	1. The perimeter chain-link security fence is in poor condition. Fence sections and gates are missing and unrestricted access to the site is available at many locations. Some evidence of off-road vehicles (ATV's, dirt bikes, etc.) using the turfed cap area was seen.	1. The security fence should be repaired, with all missing fence sections, including gates, replaced or repaired.	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. These locations have been noted in above comments.	1. Wetland encroachment should be eliminated by simple mowing in some areas, and by regrading channels in other areas. The above comments address the actions to take at specific locations.	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; The following areas are the most critical and should be addressed before the next inspection:

(1) Clear the earth and vegetation obstruction in the east side drainage swale just upstream of the new riprap section. Drain the area of standing water in the channel upstream of the obstruction and clear, regrade, and reseed or riprap the channel;

(2) Clear and mow the existing settled area between gas vents #3 and #4 during a dry period. If it does not dry out it should be cleared by hand to eliminate woody and wetland species;

(3) Repair the eroded gully between gas vents #1 and #3 on the west and between gas vents #14 and #12, #11 and #8, and #8 and #5 on the east;

(4) Repair and replace the security fence and gates as required to control access to the site;

- (5) Place topsoil and over the sandy area lacking vegetation on the east side near the new riprap channel, and
- (6) Remove trees from landfill cap.
- Along with the corrective actions listed in the report, the following is recommended:
- (1) Regrade the area in the vicinity of gas vent # 12 and install a drainage swale,
- (2) Place stone aprons around gas vents to discourage animals from burrowing,
- (3) Place settlement plates in noted settlement areas to determine the yearly rate of settlement,
- (4) Repair and regrade around the catch basins on the south side of the landfill,

(5) resurvey the landfill to 1 foot contours to be used to design drainage around gas vent #12 and as a planning tool for possible future landfill improvements.

General Comments: With the exception of the items mentioned in the above paragraph, and the other recommended repairs, the landfill fair condition and appears to be functioning adequately.

APPENDIX B

LANDFILL GAS MONITORING FORMS

APPENDIX B Landfill Gas Monitoring Table 1

Form to be completed in indelible ink

Monitoring is to be performed annually

INSPECTOR: Iorio/Simmer TITLE: Geotechnical/Hydaulics Engineer DATE: 12/1/99

ORGANIZATION: CENAE-EP

WEATHER: $20 - 30^{\circ}$ F, sunny, windy

BARAMETER: 30.1 in Hg TIME: 0800

BARAMETER: 30.0 in Hg TIME: 1330

Vent	VOC	02	H ₂ S	LEL	CO	CO ₂	CH4	Remarks
No.	ppm	%	ppm	%	ppm	%	%	
	PID	CGI/GA-90	CGI	CGI	CGI	GA-90	GA-90	
V-1	0.0	10.8/2.0	3	>100	0	13.4	3.5	Burrows
V-2	0.0	13.3/2.8	0	>100	0	14	7.4	Burrows
V-3	0.0	2.3/0.9	0	>100	0	18.9	14.6	Burrows, Strong odor
V-4	0.0	4.4/1.4	0	>100	0	16.2	9.3	Strong odor
V-5	0.0	15.3/6.8	0	72	2.5	7.6	2.6	
V-6	0.0	2.5/1.4	0	>100	0	16.2	10.8	Slight Odor
V-7	0.0	5.6/3.8	0	54	0	9.1	0.8	Burrows
V-8	0.0	8.9/4.8	0	>100	1	9.6	2.2	Burrows
V-9	0.0	3.6/0.3	0	>100	1	23.2	26.6	
V-10	0.0	12.9/0.5	0	>100	2	17.7	7.0	
V-11	0.0	8.8/3.9	0	>100	0	9.7	7.3	
V-12	0.0	2.4/2.1	0	>100	0	14.5	10.5	
V-13	0.0	2.3/2.3	0	>100	0	14	18.5	
V-14	0.0	1.5/1.7	2	>100	0	22.2	34.1	
V-15	0.0	1.8/2.1	0	>100	0	22.5	23.7	Slight odor
V-16	0.0	2.0/1.8	0	>100	0	19.2	13.0	Slight odor
V-17	0.0	15.2/1.7	3	>100	0	25	26.2	Strong odor
V-18	0.0	1.7/1.7	0	>100	0	25.7	32.8	Slight odor

CALIBATION INFORMATION:

Instrument: PID, 10.6 eV lamp

Results: 0.0/248 ppm isobutylene Calibrated by: Iorio

Instrument: Industrial Scientific TMX 412 CGI

Results: 0.7% Pentane, 50% LEL, 14%/21% O₂ 29ppm H₂S, 50 ppm CO

Calibrated by: US Environmental Co

Instrument: Landtech Gem 500 GA-90

Results: <u>4% O2</u>, <u>14% CO2</u>, <u>14.5% CH4</u>

Calibrated by: US Environmental Co

APPENDIX B Landfill Gas Monitoring Table 2

Form to be completed in indelible ink

Monitoring is to be performed annually

INSPECTOR: Iorio	TITLE: Geotechnical Engineer	DATE: 12/6/99 &12/7/99

ORGANIZATION: CENAE-EP

WEATHER: 40-50° F, rain

BARAMETER: see below

Vent	VOC	02	H ₂ S	LEL	CO	CO ₂	CH4	Rem	arks
No.	ppm	%	ppm	%	ppm	%	%		
	PID	CGI/GA-90	CGI	CGI	CGI	GA-90	GA-90		Date in. Hg
V-1	0.0	19.5/19.7	0	0	0	0.8	0	Burrows	12/7 29.64
V-2	0.0	8.2/7.2	0	>100	0.6	10.9	8.4	Burrows	12/7 29.63
V-3	0.0	20.9/21	0	0.1	0	0	0	Burrows	12/7 29.63
V-4	0.0	17.1/16.2	0	3	0	4.1	2.0	Burrows	12./7 29.63
V-5	0.0	21/21	0	0	0	0	0		12/7 29.63
V-6	0.0	20.8/21	0	0.5	0	0	0		12/7 29.63
V-7	0.0	21/21	0	0	0	0	0	Burrows	12/7 29.62
V-8	0.0	13.4/12.7	0	0	0	6.1	0	Burrows	12/7 29.60
V-9	0.0	20.6/20.2	0	0.5	0	0.6	0.5		12/7 29.60
V-10	0.0	20.9/20.9	0	0.1	0	0.2	0		12/7 29.60
V-11	0.0	21/21	0	0	0	0	0		12/7 29.60
V-12	0.0	20.9/20.6	0	0	0	0.6	0		12/7 29.60
V-13	0.0	14.4/14.7	0	>100	0	4.6	6.6		12/7 29.75
V-14	0.0	18.5/17.0	0	>100	0	5.2	8.0		12/6 29.75
V-15	0.0	20.8/20.2	0	0.4	0	0.7	0.6		12/6 29.65
V-16	0.0	21.0/20.9	0	0	0	0	0		12/6 29.70
V-17	0.0	21.0/20.2	0	0	0	0	0		12/6 29.65
V-18	0.0	0.2/0	0	>100	0	35,8	45.5	Slight odor	12/6 29.65

CALIBATION INFORMATION:

Instrument: PID, 10.6 eV lamp

Results: 0.0/248 ppm isobutylene Calibrated by: Iorio

Instrument: Industrial Scientific TMX 412 CGI

Results: 2.6% Methane, 50% LEL, 14%/21% O₂ 29ppm H₂S, 50 ppm CO Calibrated by: US Environmental Co

Instrument: Landtech Gem 500 GA-90

Results: 4% O2, 14% CO2, 14.5% CH4

Calibrated by: US Environmental Co

APPENDIX C

GROUNDWATER FIELD ANALYSIS FORMS

Groundwater Field Analysis Forms Spring 1999

GWM well #		SHL-3				US A	rmy Corp	os of Eng	ineers			
SCREENED IN	ITERVAL DEPT	H:	25.1-35.1fee	t (top of casir	ng)	Grou	ndwater Sa	mpling Log	Sheet			
H2O LEVEL: F	PRE PUMP INSI	ERTION	30.83 feet (to	op of casing)	- •	Project N	lame: Sheple	ey's Hill Land	fill, Devens	s, MA		
	POST PUM	P INSERTION	30.81 feet			SAMPLE METHOD: EPA LOW STRESS METHOD						
DEPTH SAMPI	LED:	33.0 feet (to	p of casing)			SAMPLE BOTLES: METALS/hardnss 1 - 1L HDPE (ph<2)						
DATE:	05/10/99	TIME:	0845			CYANIDE 1 - 5	500ml HDPE (pl	h>12)		VOC'S 2-40	ml VOA's (ph<2)	
SAMPLED BY:	s.simmer					Anions, Alkalinit	y,TDS 1- 500m	1 HDPE		COD 1 - 1L H	IDPE (ph<2)	
RECORDED B	Ys.simmer					BOD 1 - 1L HD	PE			TSS 1 - 1L HE	DPE	
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS	
24hr	BELOW MP feet	SETTING	mVmin	PURGED	TEMP C	CONDUCTANCE		٣٧	mg/L	NTU's		
855	30.82	122.2	800		12.40	57.0	6.81	166.4	56.3	23.0		
900	31.23	119.8	450		11.40	49.0	6.77	154.5	51.2	12.3		
905	31.22	119.8	375		13.10	45.0	6.58	145.4	50.2	3.5	flow stopped	
910	31.18	170.2	500	1 gallon	14.64	44.0	6.64	139.6	46.1	4.7	pump turned up	
915	31.20	171.3	200		16.19	42.0	6.65	135.4	46.1	4.6	flushed pump	
920	31.23	119.1	400	2 gallon	16.78	45.0	6.65	133.6	45.1	5.7	surge in flow	
925	31.10	122.5	800		12.65	44.0	6.64	131.1	40.0	2.6	pump turned down	
930	31.62	120.2	1000	3gallons	12.29	43.0	6.61	134.6	39.0	1.0		
935	31.63	120.2	800	4 gallons	12.66	43.0	6.65	132.7	38.0	0.9		
940	31.63	120.2	800	5 gallons	12.66	43.0	6.65	133.4	36.9	0.8		
945	31.63	120.2	800	6 gallons	12.77	43.0	6.65	133.7	36.9	0.7		
950	31.63	120.2	800	7 gallons	12.69	43.0	6.66	133.9	35.9	0.6		
955	31.63	120.2	800	8 gallons	12.65	43.0	6.66	134.5	35.9	0.6		
1000	31.63	120.2	800	9 gallons	12.58	43.0	6.66	134.9	35.9	0.4		
							l					
NOTES:	·····				39	6 3%	+0.1 unit	+10 mv	10%	10%)	
SAMPLE TAK	EN AT 1000											

Note: Disregard D.O. readings as they are in error due to technical problems with the instrument

YSI GROUP # 122

TURBIDITY GROUP # 75

Variable flow rate at times (pump screen may be clogged)

GWM well #		SHL-4		••••••••••••••••••••••••••••••••••••••		US A	rmy Cor	os of Eng	gineers		
SCREENED IN	TERVAL DEPT	———————— H:	5.7-15.7 feet			Grour	ndwater Sa	mpling Loa	Sheet		
H2O LEVEL: P	RE PUMP INSI	ERTION	10.87 feet			Project N	ame: Sheple	y's Hill Landfi	ll, Devens,	MA	
	POST PUM	P INSERTION	10.86 feet			SAMPLE METHOD: EPA LOW STRESS METHOD					
DEPTH SAMPL	ED:	13.5 feet				SAMPLE BOTLES: METALS/hardnss 1 - 1L HDPE (ph<2)					
DATE:	05/10/99	TIME:	1115	······································		CYANIDE 1-5	00ml HDPE (pł	า>12)	<u> </u>	VOC'S 2-40	ml VOA's (ph<2)
SAMPLED BY:	S. Simmer	•				Anions, Alkalinit	y,TDS 1- 500m	I HDPE		COD 1 - 1L H	DPE (ph<2)
RECORDED B	Y: S. Simmer					BOD 1 - 1L HD	PE			TSS 1 - 1L HD	PE
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	pH	ORP/Eh	D. O.	TURBIDITY	COMMENTS
24hr	BELOW MP feet	SETTING	mt/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's	
1140	10.92	70.2	900	1 gallon	12.47	509	5.46	-2.1	60.4	830	ery orange color
1145	10.92	70.2	900	2 gallons	11.80	469	5.99	-6.1	56.3	230	
1150	10.93	70.2	950	3 gallons	11.81	430	6.11	-9.1	53.3	118	orange tint
1155	10.93	70.0	950	4 gallons	11.69	403	6.17	-10.1	49.2	52	
1200	10.93	70.0	1000	5 gallons	11.64	396	6.18	-10.5	47.1	25	
1205	10.93	70.0	1000	6 gallons	11.75	390	6.21	-11.5	45.1	20	clear water
1210	10.93	70.0	1000	7 gallons	11.65	386	6.21	-12.3	43.1	10.8	
1215	10.93	70.0	1000	8 gallons	11.51	383	6.21	-13.0	42.0	6.6	
1220	10.93	70.0	1000	9 gallons	11.63	381	6.22	-13.6	41.0	5.2	
1225	10.93	70.0	1000	11 gallons	11.60	379	6.23	-13.9	40.0	5.3	
1230	10.93	69.9	1000	12 gallons	11.57	378	6.22	-13.5	39.0	6.8	
1235	10.93	69.0	1000	13 gallons	11.65	376	6.23	-14.1	39.0	3.7	
1240	10.93	69.0	1000	14 gallons	11.67	378	6.27	-13.5	40.0	3.8]
1245	10.93	69.0	1000	15 gallons	11.65	378	6.24	-13.9	40.0	4.2	
1250	10.93	69.0	1000	16 gallons	11.73	372	6.21	-13.3	40.0	4.3	
1253	10.93	69.0	1000	17 gallons	11.97	373	6.23	-12.1	40.0	4.8	
1256	10.93	69.0	1000	18 gallons	11.95	370	6.25	-11.3	40.0	4.6	
NOTES:					3%	3%	+0.1 unit	+10 mv	10%	10%	
SAMPLE TAKE	EAT 1256										

Note: Disregard D.O. readings as they are in error due to technical problems with the instrument

YSI GROUP # 122

TURBIDITY GROUP # 75

Sun is affecting temp readings

GWM well #		SHL-5				USA	rmy Cor	os of Eng	gineers		
SCREENED IN	ITERVAL DEPT	H:	5.1-15.1 feet	1		Grou	ndwater Sa	Impling Log	Sheet		
H2O LEVEL: F	PRE PUMP INSI	ERTION	4.57 feet			Project N	ame: Shepl	ey's Hill Land	fill, Deven	s, MA	
	POST PUM	P INSERTION	4.50 feet	····		SAMPLE METH	IOD:	EPA LOW SI	RESS MET	HOD	
DEPTH SAMPI	ED:	10 feet				SAMPLE BOTL					
DATE:	05/11/99	TIME:	1230			CYANIDE 1-5	00ml HDPE (p	h>12)		VOC'S 2-40	ml VOA's (ph<2)
SAMPLED BY:	D.Wood		· · · · · · · · · · · · · · · · · · ·			Anions, Alkalinit	y,TDS 1- 500r	nl HDPE		COD 1 - 1L F	IDPE (ph<2)
RECORDED B	YD.Wood					BOD 1 - 1L HD	PE			TSS 1 - 1L HE	PE
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	pН	ORP/Eh	D. O,	TURBIDITY	COMMENTS
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU'8	
1:10	4.68	51.6	350							begin pumping	
1:17	4.82	51.6	350ml							L	·
1:20 4.69 49.0			100ml						ļ	-	
1:26	4.69	49.0	100ml		11.01	83	5.75	72.4	4.00	12.74	
1:30	4.69	49.0	100ml	0.8 gallons	11.50	83	8.84	66.0	3.90	7.20	
1:35	4.69	49.0	100ml		11.89	84	5.80	63.1	3.69	5.40	
1:40	4.69	49.0	100ml		12.15	84	5.79	60.9	3.49	4.36	
1:45	4.69	49.0	100ml		12.24	85	5.78	59.7	3.39	4.56	
1:48	4.69	49.0	100ml	1.1 gallon	12.41	85	5.78	57.8	3.29		
1:51	4.69	49.0	100ml		12.52	85	5.78	57.6	3.29	2.75	
1:54	4.69	49.0	100ml	1.2 gallon	12.61	85	5.75	57.6	3.18	2.25	
2:00											take samples
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L									<u> </u>		
			_ _					ļ			
	L	1	<u> </u>					<u> </u>		1	<u></u>
NUTES: SAMPLE TAK	-N AT 2:00 n m				39	6 3%	+0.1 unit	+10 mV	10%	b 10%	,

GWM well #		SHM-96-5B				US Army Corps of Engineers					
SCREENED IN	ITERVAL DEPT	H:	81.3 - 91.3 f	eet		Grour	ndwater Sa	ampling Log	Sheet		
H2O LEVEL: F	PRE PUMP INSI	ERTION	6.29 feet			Project N	ame: Shep	ley's Hill Land	fill, Devens	s, MA	
	POST PUM	P INSERTION	6.26 feet			SAMPLE METH	OD:	EPA LOW SI	RESS MET	HOD	
DEPTH SAMPL	LED:	85 feet				SAMPLE BOTLES: METALS/hardnss 1 - 1L HDPE (ph<2)					
DATE:	05/11/99	TIME:	2:00			CYANIDE 1-5	00ml HDPE (p	oh>12)		VOC'S 2-40	ml VOA's (ph<2)
SAMPLED BY:	B.waz					Anions, Alkalinit	,TDS 1- 500	ml HDPE		COD 1 - 1LH	IDPE (ph<2)
RECORDED B	B.waz					BOD 1 - 1L HD	E		······································	TSS 1 - 1L HE)PE
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	pН	ORP/Eh	D. O,	TURBIDITY	COMMENTS
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's	
217	6.78	60.6	500	1 gal	10.36	834	5.52	-80.2	2.49	5.4	
221	6.78	60.6	500		10.50	897	6.15	-89.9	1.33	5.5	
225	6.78	60.6	600	2 gal	10.51	909	6.17	-92.2	0.99	2.6	
228	6.78	60.6	600		10.61	913	6.31	-94.4	0.84	2.2	
231	6.78	60.6	600	3 gal	10.63	919	6.33	-96.5	0.69	1.9	
234	6.78	60.6	600		10.64	924	6.44	-97.2	0.69	1.9	
237	6.78	60.6	600	4 gal	10.63	917	6.43	-98.5	0.64	1.8	
240	6.78	60.6	600		10.59	922	6.41	-99.2	0.59	1.8	
243	6.78	60.6	600	5 gal	10.55	924	6.41	-99.7	0.56	1.7	
247	6.78	60.6	600		10.60	923	6.41	-100.5	0.53	1.7	
250	6.78	60.6	600		10.61	923	6.38	-101.1	0.50	1.7	
		·····									
			+						<u> </u>		
	<u> </u>		<u></u>					1			
NOTES: SAMPLE TAKE	EN AT 2:55				3%	5 3%	+0.1 unit	+10 mv	10%	10%	

start pumping @2:12

YSI GROUP # 141

GWM well #		SHM-96-5C				US A	rmy Corp	os of Eng	ineers		
SCREENED IN	TERVAL DEPTI	H:	50.8 - 60.8 fe	eet		Grou	ndwater Sa	mpling Loa	Sheet		
H2O LEVEL: F	PRE PUMP INSE	ERTION	5.77 feet			Project N	lame: Sheple	ey's Hill Land	fill, Devens	s, MA	
	POST PUM	P INSERTION	5.77 feet	· · · · · · · · · · · · · · · · · · ·		SAMPLE METH	IOD:	EPA LOW ST	RESS MET	HOD	
DEPTH SAMPL	ED:	55 feet				SAMPLE BOTLES: METALS/hardnss 1 - 1L HDPE (ph<2)					
DATE:	05/11/99	TIME:	1300	·····		CYANIDE 1-5	500ml HDPE (pl	h>12)		VOC'S 2 - 40	nl VOA's (ph<2)
SAMPLED BY:	B. Waz					Anions Alkalinit	y TDS 1- 500m			COD 1 - 1L H	DPE (ph<2)
RECORDED B	Y: B. Waz					BOD 1 - 1L HD	PE		·····	TSS 1 - 1L HD	PE /
TIME	WATER OPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O,	TURBIDITY	COMMENTS
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's	
110	5.86	61.2	950	1 gal	9.97	828	5.5	-19.9	1.78	4.9	
115	5.86	61.2	950	2 gal	10.24	951	5.64	-55.0	3.03	1.1	
118	5.86	61.2	950	10.32	999	5.66	-58.2	1.75	1.1		
121 5.86 61.2 950 4 ga					10.35	995	5.69	-61.1	1.00	1.0	
124	5.86	61.2	950		10.44	999	5.71	-62.9	0.82	1.2	
128	5.86	61.2	850		10.49	990	5.72	-63.8	0.68	1.1	
131	5,86	57.6	850		10.47	990	5.73	-64.9	0.53	1.2	
134	5.86	57.6	850	6 gal	10.57	988	5.73	-65.7	0.54	1.3	
138	5.86	57.6	800	7 gal	10.60	987	5.71	-66.6	0.52	1.3	
141	5.86	57.6	800		10.55	987	5.72	-66.9	0.51	1.2	
							-				
			1								
NOTES:					3%	3%	+0.1 unit	+10 mv	10%	10%	
SAMPLE TAKE	EN AT 1:45 p.m.										
start pumping	@ 1:08							······································			

GWM well #		SHL-9				US A	rmy Cor	ps of Eng	gineers		
SCREENED IN	TERVAL DEPT	H:	15.0 feet -25	feet		Grour	ndwater Sa	mpling Log	Sheet		
H2O LEVEL: P	RE PUMP INSE	ERTION	9.58 feet			Project N	lame: Shep	ley's Hill Land	lfill, Deven	s, MA	
	POST PUM	P INSERTION	9.58 feet	· · · · · · · · · · · · · · · · · · ·	•	SAMPLE METH	IOD:	EPA LOW ST	RESS MET	HOD	
DEPTH SAMPL	ED:	20 feet				SAMPLE BOTL					
DATE:	05/11/99	TIME:	845			CYANIDE 1-5	00ml HDPE (pl	h>12)		VOC'S 2-40	ml VOA's (ph<2)
SAMPLED BY:	D.Wood			······································		Anions Alkalinit	,TDS 1- 500m	I HDPE		COD 1 - 1L F	IDPE (ph<2)
RECORDED B	D. Wood					BOD 1 - 1L HD	PE		·····	TSS 1 - 1L HE	DPE
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	pH	ORP/Eh	D. O.	TURBIDITY	COMMENTS
24hr	BELOW MP feet	SETTING	mi/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's	
8:58	9.68	69.2	120 ml/min								Turn on pump
9:07	9.68	69.2	140ml/min	····-	9.81	168	6.41	-23.6	4.92		Reddish brown color
9:11	9.68	69.2	140ml/min		10.11	168	6.51	-24.6	4.85	39.7	light red
9:16	9.68	69.5	150ml/min		10.70	168	6.61	-28.1	4.61	24.3	
9:20	9.68	69.2	150ml/min		11.34	168	6.62	-30.3	4.41	20.0	clear
9:25	9.68	69.2	150ml/min		11.78	167	6.61	-30.6	4.20	16.7	
9:31	9.68	69.2	150ml/min	1.2 gal	12.07	167	6.56	-29.8	4.00	12.2	
9:35	9.68	69.2	150ml/min		12.28	167	6.52	-28.7	3.80	10.3	
9:40	9.68	70.0	150ml/min		12.03	166	6.60	-28.1	3.69	10.2	Adjust pump speed
9:43	9.68	70.0	150ml/min		12.43	166	6.58	-27.0	3.69	9.8	
9:47	9.68	70.0	120ml/min	1.8 gal	12.98	166	6.56	-28.8	3.69	9.5	
9:50											Collect samples
l				<u></u>					ļ		
·											
NOTES					20/	20/	+0.1 unit	+10 mv	10%	100/	L
SAMPLE TAKE	N AT 0950				370	3%	τ υ. Ε U ΠΙΙ		10%	10%	1

GWM well #		SHL-10				USA	rmy Cor	ps of Er	ngineers			
SCREENED IN	TERVAL DEPT	H:	17.8 - 41.8 fe	et		Grou	ndwater Sa	ampling Lo	og Sheet			
H2O LEVEL: F	RE PUMP INSE	ERTION	31.32 feet			Project N	lame: Shepl	ey's Hill La	ndfill, Deven	s, MA		
	POST PUM	P INSERTION	31.32 feet			SAMPLE METH	IOD:	EPA LOW	STRESS MET	НОД		
DEPTH SAMPL	ED:	37 feet				SAMPLE BOTLES: METALS/hardnss 1 - 1L HDPE (ph<2)						
DATE:	05/10/99	TIME:	10:20			CYANIDE 1 - 500ml HDPE (ph>12) VOC'S					nl VOA's (ph<2)	
SAMPLED BY:	B. Waz					Anions, Alkalinity, TDS 1- 500ml HDPE				COD 1 - 1L HDPE (ph<2)		
RECORDED B	Y:B. Waz				·····	BOD 1 - 1L HDPE				TSS 1 - 1L HDPE		
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS	
24hi	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's		
1025	31.48	122.5	700		12.01	54	7.10	198.5	10.90	16.4		
1030	31.49	122.5	700	2 gal	13.04	49	7.39	146.7	10.88	6.31		
1034	31.50	122.5	700		13.39	50	7.36	132.3	10.84	2.6		
1037	31.50	122.5	700	3 gal	13.61	50	7.29	125.8	10.85	2.1		
1040	31.50	122.5	600		13.63	50	7.27	123.9	10.83	1.6		
1043	31.50	122.5	650	4 gal	13.79	50	7.21	123.3	10.80	1.6		
1046	31.50	122.5	600		13.83	50	7.20	122.8	10.82	1.2		
1050	31.50	122.5	600	5 gal	13.83	49	7.16	122.8	10.82	0.9		
1053	31.50	122.5	600		13.81	49	7.15	122.7	10.86	0.8		
1056	31.50	122.5	550	6 gal	13.90	49	7.11	123.4	10.84	0.8		
1059	31.50	122.5	550		13.92	49	7.10	124.8	10.82	0.9		
1102	31.50	122.5	550	6.75 gal	13.95	49	7.09	125.2	10.81	0.9		
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	-NI AT 44.05				3%	o 3%	+0.1 unit	+10 mv	10%	o 10%		
SAIVIPLE TAKE	PLE TAKEN AT 11:05											

start pumping 10:20am

YSI GROUP # 141

GWM well #		SHM-93-10	C			US A	rmy Corp	os of Eng	gineers			
SCREENED IN	TERVAL DEPT	H:	45.7-55.7 fe	et		Grou	ndwater Sa	mpling Log	Sheet			
H2O LEVEL: F	PRE PUMP INS	ERTION	30.40 feet			Project N	lame: Sheple	ey's Hill Land	fill, Deven	s, MA		
	POST PUM	IP INSERTION	30.18 feet			SAMPLE METHOD: EPA LOW STRESS METHOD						
DEPTH SAMPI	ED:	50 feet				SAMPLE BOTLES: METALS/hardnss 1 - 1L HDPE (ph<2)						
DATE:	05/10/99	TIME:	9:00			CYANIDE 1 - 500ml HDPE (ph>12) VOC'S 2 - 4					ml VOA's (ph<2)	
SAMPLED BY:	B.waz	-	<u> </u>	<u> </u>		Anions, Alkalini	ty,TDS 1- 500n	nI HDPE		COD 1 - 1L H	DPE (ph<2)	
RECORDED B	'B.waz					BOD 1 - 1L HD	PE			TSS 1 - 1L HE)PE	
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS	
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's		
910	32.02	123.2	500	3 gal	12.70	488	7.24	181.4	0.47	3.7		
915	32.02	123.2	500		12.85	489	7.29	146.5	0.47	2.6		
918	32.02	123.2	500		13.02	491	7.33	114.1	0.43	2.0		
921	32.02	123.2	450	4 gal	13.08	491	7.35	87.4	0.40	1.5		
924	32.03	123.2	500		13.17	492	7.36	59.5	0.37	1.2		
928	32.05	123.2	500		13.24	492	7.38	37.7	0.35	1.0		
932	32.06	123.2	450	5 gal	13.31	492	7.38	21.7	0.34	0.9		
935	32.07	123.2	450		13.30	492	7.39	16.2	0.33	1.0		
938	32.08	123.2	450	6 gal	13.31	493	7.38	7.9	0.32	0.8		
942	32.08	123.2	450		13.40	492	7.39	0.7	0.31	0.7		
945	32.08	123.2	450	7 gal	13.47	492	7.40	-2.4	0.30	0.7		
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					· · · · · · · · · · · · · · · · · · ·							
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NOTES:	<u> </u>	1	<u> </u>	1	3%	3%	+0.1 unit	+10 mv	10%	10%	<u>ı </u>	
SAMPLE TAKE	EN AT 09:50										·····	
start pumping	9:00			·								
start sampling	@ 9:50 a.m.							·····				

GWM well #		SHL-11				US A	rmy Corp	os of Eng	jineers			
SCREENED IN	ITERVAL DEPT	H:	14.8 - 29.8 f	eet		Grou	ndwater Sa	mpling Loa	Sheet			
H2O LEVEL: F	PRE PUMP INS	ERTION	19.0 feet			Project N	lame: Sheple	ey's Hill Land	fill, Deven	s, MA		
	POST PUM	P INSERTION	18.9 feet			SAMPLE METHOD: <u>EPA LOW STRESS METHOD</u>						
DEPTH SAMP	LED:	25 feet		·		SAMPLE BOTL	SAMPLE BOTLES: METALS/hardnss 1 - 1L HDPE (ph<2)					
DATE:	05/10/99	TIME:	1400			CYANIDE 1-5	500ml HDPE (pl	h>12)		VOC'S 2-40	ml VOA's (ph<2)	
SAMPLED BY:	S.Simmer	•				Anions, Alkalinit	y,TDS 1- 500m	I HDPE		- COD 1 - 1L H	DPE (ph<2)	
RECORDED BYS.Simmer						BOD 1 - 1L HD	PE		_	TSS 1 - 1L HD	PE	
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS	
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's		
1415	19.04	95.8	1200	1 gallon	11.57	800	4.72	-3.5	56.3	943	very orange	
1420	19.04	95.8	1200	2 gallons	11.57	835	5.93	-35.8	53.3	45	clearer	
1425	19.04	95.8	1200	3 gallons	11.58	844	6.22	-47.1	50.2	16.5		
1430	19.04	95.8	1200	4gallons/5gallons	11.57	836	6.30	-52.0	48.2	7.0		
1435	1435 19.04 95.8 1200 6 gallon					849	6.34	-55.4	47.1	4.1		
1440	19.04	95.8	1200	7 gallons	11.57	853	6.36	-58.6	45.1	2.4		
1444	19.04	95.8	1200	8 gallons	11.54	857	6.37	-60.2	44.1	1.9		
1447	19.04	95.8	1200	9 gallons	11.56	850	6.38	-61.6	44.1	1.6		
1450	19.04	95.8	1200	10 gallons	11.56	853	6.38	-62.2	44.1	1.3		
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L	<u> </u>	l	1			1			L	<u> </u>		
NOTES:					3%	6 3%	+0.1 unit	+10 mv	10%	5 · 10%	•	
SAMPLE TAK	EN AT 14:50											

Note: Disregard D.O. readings as they are in error due to technical problems with the instrument

YSI GROUP # 122

SCREENED INTERVAL DEPTH: 17.0 - 32.0 feet	Grou	GWM well # SHL-19 US Army Corps of Engineers										
	Groundwater Sampling Log Sheet											
IH20 LEVEL: PRE PUMP INSERTION 23.53 teet	Project N	lame: Shepl	ev's Hill Land	Ifill. Devens	. MA							
POST PUMP INSERTION 23.52 feet	SAMPLE METH	HOD [.]	EPA LOW ST	RESS METH								
DEPTH SAMPLED: 27 feet	SAMPLE BOTI											
DATE: 05/10/99 TIME: 11:30	CYANIDE 1-5	00ml HDPE (pl	1>12)	<u></u>	VOC'S 2-40	ml VOA's (ph<2)						
SAMPLED BY: B. Waz	Anions Alkalinit	, TDS 1- 500m	I HDPE		COD 1 - 11 H	DPE (nh<2)						
RECORDED BY: B. Waz	BOD 1 - 1L HD	PE		· · · · · · · · · · · · · · · · · · ·	TSS 1 - 1L HE	DPE						
TIME WATER DPTH PUMP PURGE RATE CUM. VOLUME H20	SPECIFIC	pH	ORP/Eh	D. O.	TURBIDITY	COMMENTS						
24hr BELOW MP feet SETTING mV/min PURGED TEMP C	CONDUCTANCE		mv	mg/L	NTU's							
1145 23.54 107.1 850 1.5 gal 10.43	334	6.13	-8.1	0.88	85.3	orange color						
1150 23.55 106.7 850 2 gal 11.13	329	6.22	-17.0	0.43	53.5							
1153 23.55 106.6 800 3 gal 11.33	328	6.22	-19.0	0.34	32.0							
1156 23.55 106.7 850 11.31	326	6.22	-19.6	0.31	27.2							
1159 23.55 106.6 850 4 gal 11.25	325	6.23	-20.0	0.27	17.0							
1204 23.55 106.6 850 5 gal 11.32	322	6.21	-19.7	0.24	16.2							
1207 23.55 106.6 850 6 gal 11.33	321	6.20	-19.5	0.23	14.8							
1210 23.55 106.6 850 7 gal 11.27	319	6.18	-19.6	0.21	13.5							
1215 23.55 106.6 850 11.24	316	6.18	-17.4	0.20	12.3							
1218 23.55 106.6 850 8 gal 11.22	315	6.18	-17.3	0.19	10.8							
1220 23.55 106.6 850 9 gal 11.26	314	6.18	-16.6	0.18	10.6							
1223 23.55 106.6 850 11.28	313	6.17	-15.6	0.17	10.2							
1225 sample taken												
	i	······	· · · · · · · · · · · · · · · · · · ·									
		<u></u>										
NOTES: 3%	3%	+0.1 unit	+10 mv	10%	10%							
SAIVIFLE TANEIN AT 1223												
start pumping @1140 MS/MSD Samples also taken at this well												

SCREENED INTERVAL DEPTH: 41.0-51.0 feet Groundwater Sampling Log Sheet H20 LEVEL: PRE PUMP INSERTION 19.38 feet Project Name: Shepley's Hill Landfill, Devens, MA DOST_PLIND INSERTION 10.38 feet CAMPLE METUOD	
H2O LEVEL: PRE PUMP INSERTION 19.38 feet Project Name: Shepley's Hill Landfill, Devens, MA	
DOCT DUMD INCEDION 10.29 foot	
I POST POWPTINSERTION 19.30 TEEL ISAMPLE METHOD: EPA LOW STRESS METHOD	
DEPTH SAMPLED: 45 feet SAMPLE BOTLES: METALS/hardnss 1 - 1L HDPE (ph<2)	3
DATE: 05/10/99 TIME: 2:00 CYANIDE 1 - 500ml HDPE (ph>12) VOC'S 2 - 40ml '	VOA's (ph<2)
SAMPLED BY: B.Waz COD 1 - 1L HDP COD 1 - 1L HDP	E (ph<2)
RECORDED BYB.Waz BOD 1 - 1L HDPE TSS 1 - 1L HDPE TSS 1 - 1L HDPE	
TIME WATER DPTH PUMP PURGE RATE CUM. VOLUME H20 SPECIFIC pH ORP/Eh D. O. TURBIDITY	COMMENTS
24hr BELOW MP feet SETTING mi/min PURGED TEMP C CONDUCTANCE mv mg/L NTU's	
215 19.40 96.6 900 12.16 896 5.78 5.0 1.91 38.8 sli	ght orange tint
219 19.48 96.6 900 1 gal 12.66 928 6.32 -15.8 0.56 24.4	
222 19.48 96.6 900 2 gal 12.73 932 6.38 -20.9 0.41 16.3	
225 19.48 96.6 900 12.80 934 6.40 -24.3 0.36 13.3	
228 19.48 96.6 900 3 gal 12.81 930 6.40 -27.1 0.37 13.8	
231 19.48 96.6 900 4 gal 12.82 929 6.41 -28.6 0.34 8.6	
234 19.48 96.6 900 12.85 925 6.41 -30.2 0.29 6.0	
237 19.48 96.6 900 5 gal 12.86 925 6.41 -30.9 0.27 6.3	
240 19.48 96.6 900 12.89 922 6.41 -32.1 0.26 5.7	
243 19.48 96.6 900 6 gal 12.91 922 6.41 -33.0 0.25 2.9	
246 19.48 96.6 900 7 gal 12.89 930 6.41 -33.5 0.25 2.8	
249 19.48 96.6 900 8 gal 12.91 929 6.41 -33.9 0.24 2.9	
252 19.48 96.6 900 12.91 929 6.42 -34.1 0.24 2.8	
┝────┤────┤────┤───┤───┤───┤───┤───┤───	
NOTES: 3% 3% +0.1 unit +10 mV 10% 10% SAMPLE TAKEN AT 255	
start pumping @213 p m	

GWM well #		SHL-22				US A	rmy Cor	os of Eng	gineers			
SCREENED IN	ITERVAL DEPTI	H:	106.0 - 116.0	D feet		Grou	ndwater Sa	mpling Log	Sheet			
H2O LEVEL: F	PRE PUMP INS	ERTION	7.20 feet			Project N	lame: Sheple	ey's Hill Land	lfill, Deven	s, MA		
	POST PUM	P INSERTION	6.94 feet			SAMPLE METHOD: <u>EPA LOW STRESS METHOD</u>						
DEPTH SAMP	LED:	110 feet				SAMPLE BOTL						
DATE:	05/11/99	TIME:	915			CYANIDE 1-5	500ml HDPE (pl	h>12)		VOC'S 2-40	ml VOA's (ph<2)	
SAMPLED BY:	D.Wood					Anions, Alkalinity, TDS 1- 500ml HDPE C					IDPE (ph<2)	
RECORDED B	D.Wood					BOD 1 - 1L HD	PE			TSS 1 - 1L H)PE	
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS	
24hr	BELOW MP feet	SETTING	m¥min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU'8		
1015	7.52	66.2	350								start pumping	
1019	7.57	66.2	350		9.29	836	5.64	74.3	5.02		clear	
1022	7.54	65.1	175		9.81	647	6.44	-2.9	4.61	2.28		
1027	7.51	65.1	225		9.38	964	6.66	-13.5	4.20			
1030	7.51	65.1	250		9.47	966	6.72	-16.7	4.00	1.65		
1034	7.51	65.1	250	1.6 gal	9.42	970	6.78	-18.2	3.69			
1038	7.51	65.1	250	2.0 gal	9.44	971	6.81	-17.0	3.59	1.29		
1042	7.53	65.1	250		9.54	971	6.82	-16.8	3.59	1.55		
1045	7.53	65.1	250	2.3 gal	9.55	972	6.84	-16.7	3.49	1.52		
1050											take samples	
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NOTES:	EN AT 1050 am				3%	6 3%	+0.1 unit	+10 mv	10%	o 10%	J	

GWM well #		SHM-96-221	В			US A	rmy Cor	ps of Eng	gineers	1	
SCREENED IN	ITERVAL DEPT	H:	62.7 - 92.7 f	eet		Grou	ndwater Sa	mpling Log	Sheet		
H2O LEVEL: F	PRE PUMP INS	ERTION	7.02 feet			Project N	ame: Shepl	ey's Hill Land	fill, Deven	s, MA	
	POST PUM	P INSERTION	7.02 feet			SAMPLE METH	IOD:	EPA LOW ST	RESS MET	HOD	
DEPTH SAMPI	LED:	75 feet				SAMPLE BOTL					
DATE:	05/11/99	TIME:	1100			CYANIDE 1-5)ml VOA's (nh<2)				
SAMPLED BY:	B.waz	•		····		Anions Alkalinit	v.TDS 1- 500r	nl HDPE		COD 1 - 1L	HDPE (ph<2)
RECORDED B	B.waz					BOD 1 - 1L HD	PE			TSS 1 - 1L H	DPE
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's	
1111	7.07'	64.3	700	1 gal	9.48	925	11.40	210.6	2.71	19.8	light orange tint
1116	7.07'	64.3	700	2 gal	9.93	925	13,17	185.0	2.38	23.8	
1119	7.08'	64.3	700		9.95	927	13.15	178.9	2.17	25.7	
1123	7.08'	64.3	700	3 gal	10.01	930	13.35	168.4	1.99	28.0	
1126	7.08'	64.3	700		10.06	929	13.42	162.7	1.90	33.2	
1129	7.08'	64.3	700	4 gal	10.08	924	13.45	160.4	1.72	35.0	?????
1132	7.09'	64.3	700		10.17	870	10.68	-214.9	0.39	42.3	
1135	7.09'	64.4	750		10.19	898	9.10	-227.1	0.43	34.7	
1138	7.09'	64.4	700	5 gal	10.23	10.23 904 8.70 -227.0 0.41 30					
1141	7.09'	64.4	700		10.27	906	8.62	-227.6	0.38	29.7	
1144	7.09'	64.4	700	6 gal	10.29	905	8.63	-228.2	0.36	28.8	
1147	7.09'	64.4	700		10.29	908	8.64	-229.3	0.33	27.7	
							·····				
					· · · · · · · · · · · · · · · · · · ·		<u></u>			<u> </u>	
NOTES:		l			l	3%	+0.1 unit	 +10 mv	10%	<u> </u>	6
SAMPLE TAK	EN AT 11:51										
Start pumping	at 11:08					· · · · · · · · · · · · · · · · · · ·					

GWM well #		SHM-93-220	C			US A	rmy Corp	os of Eng	ineers		
SCREENED IN	TERVAL DEPT	 H:	124 - 134 fee	et	-	Grour	ndwater Sa	mplina Loa	Sheet		
H2O LEVEL: F	RE PUMP INSE		8.30 feet			Project N	ame: Sheple	ev's Hill Landf	ill. Devens.	MA	
	POST PUM	P INSERTION	6.92 feet		-	SAMPLE METH	100.	EPA LOW S	TRESS ME	THOD	
DEPTH SAMPI	ED.	130 feet			-	SAMPLE BOTL	ES: METALS/H	ardnss 1 - 1L H	DPE (ph<2)	<u>- 11 × P.</u>	
DATE:	05/11/99	TIME:	900		-	CYANIDE 1-5	CYANIDE 1 - 500ml HDPE (ph>12) VOC'S 2 - 4				
SAMPLED BY:	B. Waz		····		•	Anions.Alkalinit	.TDS 1- 500m			COD 1 - 1L H	IDPE (ph<2)
RECORDED B	Y: B. Waz					BOD 1 - 1L HD	PE	······································		TSS 1 - 1L HI	DPE
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	pН	ORP/Eh	D. O.	TURBIDITY	COMMENTS
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's	
905	8.70	68.0	450	1 gal	9.74	598	8.04	-85.7	1.23	7.9	strong sulfur ordor
910	9.70	69.2	300		10.04	611	8.39	-118.2	0.99	5.7	
915	10.70	76.0	600	2 gal	10.31	620	- 8.53	-131.8	1.06	8.1	variable flow rates
920	11.62	76.0	300	3 gal	10.48	629	8.57	-139.1	0.65	7.6	33
927	12.92	80.1	350	4 gal	10.37	626	8.56	-145.9	0.71	7.8	stabilizing
931	931 13.40 80.1 300					631	8.58	-149.3	0.60	5.7	water depth
935	13.70	82.3	300		10.02	637	8.49	-149.9	0.51	5.5	
940	14.20	86.5	500	5 gal	9.93	635	8.43	-151.4	0.55	4.4	
945	15.40	86.5	500		10.57	626	8.42	-153.0	0.58	4.0	
949	15.85	86.5	250	6 gal	10.50	631	8.43	-155.5	0.46	4.5	
954	16.20	90.6	450		9.88	634	8.42	-155.3	0.57	4.9	
959	17.20	90.6	300	7 gal	10.55	627	8.46	-156.4	0.52	4.8	
1004	17.35	90.6	250		10.50	630	8.40	-158.1	0.47	4.7	
1008	17.39	90.6	200		10.51	632	8.42	-157.3	0.50	4.5	
1010	17.55	90.6	200	7.5 gal	10.59	630	8.40	-156.8	0.53	4.3	
1013	17.60	90.6			10.63	629	8.39	-156.7	0.55	4.2	
										L	
NOTES		<u> </u>	<u></u>	<u> </u>			+0.1 unit	<u> </u>	100/	4.00/	<u> </u>
NUTES.	N AT 1015					-3%	TU. I UIIIL		10%	10%	^D
Start pumping	a 9.00 am						·····	- 	·····		
otart pumping (u 0.00 am										

Groundwater Field Analysis Forms Fall 1999 ٠

GWM well #		SHL-3				US A	rmy Cor	os of Eng	jineers		
			25.1 - 35.1 ft	top of steel ca	sing sing	Grou Project N	ndwater Sa	Impling Log	Sheet	= MΔ	
	DOST DUM		30.50 feet		Sing	SAMPLE METH					
		31 feet	<u>30.39 leet</u>	* <u></u>		SAMPLE WEIT	TUD. ES: METALS/H	EPA LOW STRI	DDE (ph/2)	<u>}</u>	
	11/01/99		055			CVANIDE 1		10101155 1 - 1に 11 ク)		VOC'S 2 40	nIVOA's (nh<2)
SAMPLED BY	B Waz	· · · · · · · · · · · · · · · · · · ·				Anione Alkalinit	TDS 1-500m				DPE(ph<2)
RECORDED B	Y: B. Waz					BOD 1 - 1L HD	PF			TSS 1 - 11 HD	PE
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	pH	ORP/Eh	D. O.	TURBIDITY	COMMENTS
1025	31.20	119.1	600	1 gal	14.81	46.0	6.95	145.4	10.64	6.5	
1030	31.20	119.1	600		17.09	44.0	6.64	153.0	10.49	3.0	
1035	31.20	119.1	600	2 gal	17.43	43.0	6.60	156.2	10.51	1.9	
1036	31.20	119.1	600		17.50	43.0	6.58	159.0	10.52	1.5	
1040	31.20	119.1	550	3 gal	17.54	42.0	6.55	161.6	10.51	1.5	
1044	31.20	119.1	550		17.64	42.0	6.53	153.6	10.53	1.5	
1048	31.20	119.1	550	4 gai	17.62	42.0	6.53	165,1	10.55	1.0	
1052	31.20	119.1	550		17.61	42.0	6.53	166.4	10.55	1.0	
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NOTES:					3%	3%	+0.1 unit	+10 mv	10%	10%	
SAMPLE TAKE	EN AT 10:55				Saturated Scr	een Volume Rec	quired: 1.6 Gallo	ons (screen not	fully saturate	ed)	

TURBIDITY GROUP # 76 Pump - Grunfos Redi-flow II

GWM well #		SHL-4				US A	rmy Corp	os of Eng	ineers		
SCREENED IN	TERVAL DEPTI		5.7 - 15.7 fee	ət		Grou	ndwater Sa	mplina Loa	Sheet		
H2O LEVEL: F	RE PUMP INSE	ERTION	10.79 feet			Project N	ame: Sheple	ey's Hill Land	fill, Devens	s, MA	
	POST PUM	P INSERTION	10.78 feet			SAMPLE METH	IOD:	EPA LOW STR	ESS METHOD		
DEPTH SAMPI	ED:	15 feet		···· · · · · · ·	•	SAMPLE BOTL					
DATE:	11/01/99	TIME:	1200		•	CYANIDE 1-1	L HDPE (ph>1)	2)	<u></u>	VOC'S 3-40	ml VOA's (ph<2)
SAMPLED BY:	N. McNally					Anions Alkalinit	COD 1 - 1L H	DPE (ph<2)			
RECORDED B	Y: N. McNally					BOD 1 - 1L HDPE TSS					PE
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	pН	ORP/Eh	D. O.	TURBIDITY	COMMENTS
24hr	BELOW MP feet	SETTING	m/min	PURGED	TEMP C	CONDUCTANCE		mν	mg/L	NTU's	
1205	10.81	67.7	200		15.09	397	6.18	20.7	1.03	41.2	cloudy
1210	10.80	67.7	200		16.94	387	6.32	16.1	0.82	44.0	
1215	10.80	70.0	400	1 gal	17.50	371	6.35	17.3	0.70	15.2	
1220	10.80	70.0	400	1.5 gal	16.78	362	6.35	16.8	0.54	9.8	
1225	10.80	71.5	150		17.71	348	6.35	16.2	0.53	10.3	
1230	10.80	80.4	150		18.25	348	6.35	16.4	0.47	18.3	
1235	10.80	94.0	150	2 gal	19.10	350	6.35	15.3	0.42	20.2	
1240	10.80	98.6	200		20.12	349	6.34	13.6	0.45	24.5	
1246	10.80	68.1	300		16.40	346	6.33	3.4	0.33	13.4	
1250	10.80	68.1	400	3 gal	17.47	354	6.33	3.3	0.60	6.8	
1255	10.80	68.1	300		18.24	356	6.34	4.0	0.36	5.7	
1301	10.80	70.3	250	3.5 gal	18.53	347	6.33	3.8	0.34	8.4	
1306	10.80	74.5	250		18.52	351	6.33	2.5	0.41	6.9	
1311	10.81	84.6	300	4 gal	18.63	349	6.33	1.3	0.42	6.6	
1315	10.82	75.2	500		18.76	348	6.33	-0.4	0.45	6.2	
1320	10.82	75.2	300	4.75 gal	17.77	350	6.33	-1.6	0.40	3.3	
1325	10.82	76.0	550	5 gal	17.71	357	6.33	-2.7	0.43	2.8	
1330	10.82	76.0	450		16.15	353	6.33	-3.3	0.39	2.21	
1335	10.82	78.6	400		16.60	354	6.33	-4.2	0.35	2.31	
1340	10.83	74.5			17.13	350	6.33	-1.0	0.33	1.6	
NOTES:					3%	5 100%	+0.1 unit	+10 mv	10%	10%	
SAMPLE TAKE	EN AT 1355				Saturated Scr	een Volume Req	uired: 3.2 galloi	ns			

TURBIDITY GROUP # 75 Pump - Grunfos Redi-flow II

Sheet 1 of 2

GWM well #		SHL-4 (Con	t.)		_	US A	rmy Corp	os of Eng	jineers		
SCREENED IN	TERVAL DEPTI	H:	5.7 - 15.7 fee	et	•	Grou	ndwater Sa	mpling Log	Sheet		
H2O LEVEL: F	RE PUMP INS	ERTION	10.79 feet		•	Project N	ame: Sheple	ey's Hill Land	fill, Devens	s, MA	
	POST PUM	P INSERTION	10.78 feet		•	SAMPLE METH	IOD:	EPA LOW STR.	ESS METHOD)	
DEPTH SAMPI	_ED:	15 feet			•	SAMPLE BOTL	ES: METALS/h	ardnss 1 - 1L F	IDPE (ph<2)	_	
DATE:	11/01/99	TIME:	1200		•	CYANIDE 1 - 1L HDPE (ph>12) VOC					ml VOA's (ph<2)
SAMPLED BY:	N. McNally				-	Anions, Alkalinity, TDS 1- 500ml HDPE					DPE (ph<2)
RECORDED B	Y: N. McNally					BOD 1 - 1L HD	PE			TSS 1 - 1L HD)PE
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS
24hr	BELOW MP feet	SETTING	ml∕min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's	
1345	10.84	71.6	800	8 gal	14.66	347	6.31	-3.3	0.27	1.4	
1350	10.84	70.3	600		15.06	347	6.31	6.7	0.30	1.9	
1355	10.84	70.3	600		15.37	347	6.32	-2.5	0.29	1.1	
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NOTES:					3%	6 100%	+0.1 unit	+10 mv	10%	5 10%)
SAMPLE TAK	EN AT 1355				Saturated Scr	een Volume Req	uired: 3.2 gallo	ns			

TURBIDITY GROUP # 75 Pump - Grunfos Redi-flow II Sheet 2 of 2

GWM well #		SHL-5				US Army Corps of Engineers					
SCREENED IN	TERVAL DEPT	H:	5.1 - 15.1 fe	et		Groundwater Sampling Log Sheet					
H2O LEVEL: F	PRE PUMP INS	ERTION	3.68 feet			Project Name: Shepley's Hill Landfill, Devens, MA					
	POST PUM	P INSERTION	3.65 feet		•	SAMPLE METH	HOD:	EPA LOW STR.	ESS METHOL).	
DEPTH SAMPI	LED:	12 feet				SAMPLE BOTL	ES: METALS/h	ardnss 1 - 1L H	IDPE (ph<2)		
DATE:	11/02/99	TIME:	1335	•	CYANIDE 1-1	L HDPE (ph>1	2)		VOC'S 3-40	ml VOA's (ph<2)	
SAMPLED BY:	B. Waz	•		•	Anions, Alkalinit	y,TDS 1- 500m	I HDPE		COD 1 - 1L H	DPE (ph<2)	
RECORDED B	Y: B. Waz					BOD 1 - 1L HD	PE			TSS 1 - 1L HD)PE
TIME	WATER OPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	pН	ORP/Eh	D. O.	TURBIDITY	COMMENTS
24hr	BELOW MP feet	SETTING	mVmin	PURGED	ТЕМР С	CONDUCTANCE		mv	mg/L	NTU's	
13:47	4.16	50.5	750	1 gal	11.74	92	5.87	96.3	1.04	5.2	Sulfur odor
13:52	4.15	49.6	650	2 gal	12.23	98	5.71	94.1	0.95	3.3	
13:55	4.15	49.3	650		12.49	100	5.70	92.0	0.96	1.6	
13:59	4.13	48.6	500	3 gal	12.60	101	5.69	90.0	0.85	1.6	
2:02	4.10	48.6	500		12.77	101	5.68	88.0	0.83	1.6	
2:05	4.10	48.6	500		12.80	103	5.68	86.3	0.85	1.7	
2:08	4.10	48.6	500	4 gal	12.85	103	5.67	85.0	0.75	2.0	
2:11	4.10	48.6	500		12.91	104	5.67	83.9	0.75	2.0	
2:14	4.10	48.6	500		12.93	104	5.67	82.5	0.73	1.8	
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NOTES:					3%	3%	+0.1 unit	+10 mv	10%	o 10%	
SAMPLE TAKE	<u>-NAI 1415</u>				Saturated Scre	een Volume Req	uired: 3.2 gallo	ons			

TURBIDITY GROUP # 76 Pun

76 Pump - Grunfos Redi-flow II

GWM well #		SHM-96-5B	HM-96-5B US Army Corps of Engineers									
SCREENED IN	ITERVAL DEPTI	H:	81.3 - 91.3 fe	eet		Grou	ndwater Sa	mpling Loa	Sheet			
H2O LEVEL: F	PRE PUMP INSE	ERTION	5.85 feet			Project Name: Shepley's Hill Landfill, Devens, MA						
	POST PUM	P INSERTION	5.60 feet	·		SAMPLE METHOD EPA LOW STRESS METHOD						
DEPTH SAMP	LED:	86 feet				SAMPLE BOTLES: METALS/hardnss 1 - 11 HDPE (ph<2)						
DATE:	11/02/99	TIME:	1115		•	CYANIDE 1-1	L HDPE (ph>1	2)	<u></u>	VOC'S 3 - 40	mI VOA's (ph<2)	
SAMPLED BY:	B. Waz					Anions, Alkalinit	y,TDS 1- 500n		<u> </u>	COD 1 - 1L H	DPE (ph<2)	
RECORDED BY: B. Waz						BOD 1 - 1L HD	PE			TSS 1 - 1L HD	PE	
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	pН	ORP/Eh	D. O.	TURBIDITY	COMMENTS	
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's		
1123	6.35	60.6	900	1 GAL	10.63	685	4.60	-28.7	1.93	1.5		
1127	6.50	59.0	700		10.72	836	6.19	-69.4	1.97	1.3		
1130	6.45	59.0	700	2 GAL	10.97	838	6.44	-74.8	2.43	0.9		
1135	6.45	59.5	750		11.03	836	6.53	-77.7	2.56	0.8		
1138	6.45	59.5	750	3 GAL	11.04	837	6.59	-79.4	2.61	0.9		
1141	6.45	59.5	750	4 GAL	11.04	838	6.61	-80.6	2.47	1.3		
1144	6.45	59.5	750	5 GAL	11.06	838	6.60	-81.7	2.69	1.4		
1148	6.45	59.5	750		11.10	839	6.62	-82.1	2.75	1.2		
1152	6.45	59.5	750	6 GAL	11.08	838	6.62	-82.8	2.77	0.8		
1155	6.47	59.6	750	7 GAL	11.09	838	6.60	-83.4	2.55	0.9		
1159	6.48	59.7	750		11.10	838	6.68	-83.8	2.68	0.8		
1202	6.48	59.6	750	8 GAL	11.12	838	6.65	-84.1	2.74	0.8		
1205	6.48	59.6	750		11.14	838	6.69	-84.5	2.87	0.8		
1208	6.48	59.6	750	9GAL	11.13	837	6.74	-84.7	2.61	0.8		
1211	6.48	59.6	750		11.12	838	6.60	-84.9	2.61	0.6		
1214	6.48	59.6	750	10 GAL	11.11	838	6.70	-85.2	2.75	0.6		
1217	6.48	59.6	750	11 GAL	11.12	838	6.68	-85.4	2.78	0.6		
1220	6.48	59.6	750		11.12	839	6.70	-85.9	2.73	0.5		
1223	6.48	59.6	750	12 GAL	11.12	839	6.69	-86.1	2.76	0.5		
1226	6.48	56.7	500		11.22	839	6.69	-86.0	2.90	0.5		
NOTES:					3%	839%	+0.1 unit	+10 mv	10%	58%	1	
SAMPLE TAKEN AT 1235 Saturated Screen Volume Required: 13 gallons												

QA AND DUPLICATE SAMPLES ALSO TAKEN AT THIS WELL

YSI GROUP #112

TURBIDITY GROUP # 76 Pump -

76 Pump - Grunfos Redi-flow II

Sheet 1 of 2

GWM well #		SHM-96-5B				US A	rmy Cor	ps of Eng	gineers			
SCREENED IN	ITERVAL DEPT	H:	81.3 - 91.3 f	eet		Groundwater Sampling Log Sheet						
H2O LEVEL: F	PRE PUMP INSI	ERTION	5.85 feet			Project Name: Shepley's Hill Landfill, Devens, MA						
POST PUMP INSERTION 5.60 feet						SAMPLE METH	HOD:	EPA LOW STR	ESS METHOL)		
DEPTH SAMP	LED:	86 feet				SAMPLE BOTL	ES: METALS/	hardnss 1 - 1L H	HDPE (ph<2)			
DATE:	11/02/99	TIME:	1115		CYANIDE 1-1	IL HDPE (ph>1	12)		VOC'S 3-40	ml VOA's (ph<2)		
SAMPLED BY:	B. Waz				Anions, Alkalinit	y,TDS 1- 500r	ni HDPE		COD 1 - 1L H	DPE (ph<2)		
RECORDED B	Y: B. Waz					BOD 1 - 1L HD	PE			TSS 1 - 1L HC	PE	
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	pН	ORP/Eh	D. O.	TURBIDITY	COMMENTS	
24hr	BELOW MP feet	SETTING	m∜min	PURGED	TEMP C	CONDUCTANCE		٣٧	mg/L	NTU's		
1229	6.38	56.7	500	13 GAL	11.24	839	6.69	-86.0	3.02	0.5		
1232	6.38	56.7	500		11.30	838	6.65	-85.8	3.10	0.5		
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NOTES:	L	I		L		839%	+0.1 unit	+10 mv	10%	58%	1	
SAMPLE TAK	EN AT 1235				Saturated Scr	een Volume Reg	uired: 13 dallo	ons	, 576	0070		
<u></u>												
	ICATE SAMPLI	ES ALSO TAK	EN AT THIS WE									
YSI GROUP #	112		TURBIDITY G	ROUP # 76	Pump - Grunfe	os Redi-flow II			Sheet 2 of 2	2		

GWM well #		SHM-96-5C				US Army Corps of Engineers						
SCREENED IN	ITERVAL DEPTI	H:	50.8 - 60.8 fe	eet		Groundwater Sampling Log Sheet						
H2O LEVEL: F	PRE PUMP INSI	ERTION	5.32 feet	<u> </u>		Project Name: Shepley's Hill Landfill, Devens, MA						
	POST PUM	P INSERTION	5.31 feet			SAMPLE METHOD: EPA LOW STRESS METHOD						
DEPTH SAMP	LED:	56 feet				SAMPLE BOTLES: METALS/hardnss 1 - 1L HDPE (ph<2)						
DATE:	11/02/99	TIME:	1130		•	CYANIDE 1 - 1	IL HDPE (ph>1	2)		VOC'S 3-40	ml VOA's (ph<2)	
SAMPLED BY:	S. Simmer				•	Anions, Alkalinit	y,TDS 1- 500n	I HDPE		COD 1 - 1L H	IDPE (ph<2)	
RECORDED B	Y: S. Simmer					BOD 1 - 1L HD	PE			TSS 1 - 1L H	DPE	
TIME	WATER OPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS	
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's		
1140	5.34	52.0	200		11.15	253	5.15	119.6	2.76	4.8		
1145	5.33	52.0	200	1 GAL	11.06	491	6.03	0.9	2.08	2.2	incr. pump speed	
1150	5.36	55.0	600		10.95	763	6.37	-35.3	1.64	1.0		
1155	5.38	55.3	600	2 GAL	11.03	776	6.43	-41.6	1.65	0.9		
1200	5.38	55.3	600	3 GAL	11.04	773	6.45	-43.5	1.61	0.8		
1205	5.38	55.3	600	4 GAL	11.05	775	6.46	-46.2	1.62	0.7		
1210	5.38	55.3	600		11.08	769	6.46	-48.6	1.49	0.6		
1215	5.38	55.3	600	5 GAL	11.07	779	6.47	-50.0	1.41	0.7		
1220	5.38	55.3	600	6 GAL	11.08	779	6.46	-51.2	1.43	0.6		
1225	5.38	55.3	600	7 GAL	11.09	777	6.47	-52.4	1.61	0.8		
1230	5.38	55.3	600	8 GAL	11.12	778	6.47	-53.6	1.71	1.0		
1235	5.38	55.3	600	9 GAL	11.14	773	6.48	-54.0	1.87	1.1		
1240	5.38	55.3	600		11.16	764	6.48	-54.7	1.87	0.9		
1245	5.38	55.3	600	10 GAL	11.13	763	6.48	-55.7	2.23	0.5		
1250	5.38	55.3	600	11 GAL	11.14	772	6.47	-56.4	2.04	0.5		
1255	5.38	55.3	600	12 GAL	11.12	775	6.48	-57.9	2.32	0.8		
1300	5.38	54.6	500		11.14	773	6.48	-58.2	2.49	0.7		
1305	5.38	54.6	500	13 GAL	11.16	770	6.48	-59.0	2.11	0.8		
1310	5.38	54.6	500	14 GAL	11.20	768	6.48	-58.9	2.29	0.7		
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NOTES:		······································			39	6 3%	+0.1 unit	+10 mv	10%	5 109	6	
SAMPLE TAK	EN AT 1310				Saturated Scr	een Volume Req	uired: 13 gallo	ns				
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TURBIDITY GROUP # 75 Pump - Grunfos Redi-flow II

GWM well #		SHL-9				US Army Corps of Engineers							
SCREENED IN		H:	15.0 - 25.0	feet		Groundwater Sampling Log Sheet							
H2O LEVEL: P	PRE PUMP INSI	ERTION		9.15 feet		Project Name: Shepley's Hill Landfill, Devens, MA							
	POST PUM	P INSERTION		9.15 feet		SAMPLE METHOD EPA LOW STRESS METHOD							
DEPTH SAMPI	LED:	20 feet				SAMPLE METHOD							
DATE:	ATE: 11/02/99 TIME: 1015						IL HDPE (ph>	12)	<u> </u>	VOC'S 3-40	mI VOA's (ph<2)		
SAMPLED BY: N. McNally						Anions Alkalinit	v.TDS 1- 500r	nl HDPE		COD 1 - 1L H	DPE (ph<2)		
RECORDED B	Y: N. McNally					BOD 1 - 1L HD	PE			TSS 1 - 1L HDPE			
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS		
24hr	BELOW MP feet	SETTING	mVmin	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's			
10:45	9.46	68.5	800		12.29	175	6.84	-59.7	0.38	2.5			
10:50	9.44	68.5	800	1 gal	12.33	175	6.78	-62.2	0.33	1.4			
10:54	9.40	68.1	750	2 gal	12.24	175	6.71	-66.3	0.26	1.1			
10:58	9.39	67.9	700	2.75	12.32	175	6.69	-69.1	0.23	0.6			
11:02	9.40	67.7	700	3.25	12.46	175	6.68	-71.2	0.20	0.8			
11:06	9.40	67.4	600	3.75	12.51	175	6.66	-73.2	0.18	0.4			
11:10	9,40	67.4	600	4.25	12.56	175	6.66	-74.3	0.19	0.4			
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NOTES:					3%	3%	+0.1 unit	+10 mv	10%	10%			
SAMPLE TAKE	EN AT 1113				Saturated Scr	een Volume Req	uired: 3.2 gall	ons					

TURBIDITY GROUP # 75 Pump

75 Pump - Grunfos Redi-flow II

GWM well #		SHL-10		· · · · · · · · · · · · · · · · · · ·		US Army Corps of Engineers						
SCREENED IN	ITERVAL DEPT	H:	17.8 - 41.8 fe	et		Groundwater Sampling Log Sheet						
H2O LEVEL: F	PRE PUMP INSE	ERTION	31.17 feet			Project Name: Shepley's Hill Landfill, Devens, MA						
	POST PUMP I	NSERTION	31.17 feet	·····		SAMPLE METHOD: EPA LOW STRESS METHOD						
DEPTH SAMP	LED:	36 feet	(hit bottom	n at 38 ft)		SAMPLE BOTLES: METALS/hardnss 1 - 1L HDPE (ph<2)						
DATE:	11/01/99	TIME:	913			CYANIDE 1 - 1L HDPE (ph>12) VOC'S 3 - 40ml VOA's (ph<2)						
SAMPLED BY: B. Waz						Anions, Alkalinit	y,TDS 1- 500r	nI HDPE		COD 1 - 1L H	DPE (ph<2)	
RECORDED B	Y:B. Waz					BOD 1 - 1L HD	PE			TSS 1 - 1L HD	PE	
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS	
24hr	BELOW MP feet	SETTING	mVmin	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU'8		
916	31.37	122.5	850	.5 GAL	11.84	60.0	7.19	133.1	11.71	8.2		
921	31.45	122.5	850	1.75 GAL	13.20	60.0	6.92	140.9	11.51	3.2		
925	31.45	122.4	850	3 GAL	13.76	61.0	6.86	144.2	11.44	2.4		
930	31.45	122.5	850	4 GAL	13.77	60.0	6.84	147.7	11.40	2.3		
934	31.45	122.5	850		13.88	60.0	6.83	149.5	11.42	1.6		
937	31.45	122.5	850	5 GAL	13.88	60.0	6.83	151.5	11.38	1.3		
940	31.45	122.5	850		14.01	60.0	6.82	152.2	11.39	1.4		
945	31.45	122.5	850	6 GAL	13.95	59.0	6.81	153.9	11.40	1.5		
948	31.45	122.5	850	7 GAL	14.00	59.0	6.81	155.0	11.39	1.5		
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NOTES:					3%	6 3%	+0.1 unit	+10 mv	10%	6 10%		
SAMPLE TAK	EN AT 950				Saturated Scr	een Volume Req	uired: 3.2 gall	ons (screen	not fully satural	(ed)		

GWM well #		SHM-93-10	C			US Army Corps of Engineers						
SCREENED IN	ITERVAL DEPT	H:	45.7 - 55.7 f	eet		Groundwater Sampling Log Sheet						
H2O LEVEL: F	PRE PUMP INSI	ERTION	30.30 feet			Project Name: Shepley's Hill Landfill, Devens, MA						
	POST PUM	P INSERTION	30 50 feet			SAMPLE METHOD						
DEPTH SAMP	FD [.]	50 feet				SAMPLE METHOD: <u>EFA HOW STRESS METHOD</u>						
	11/01/99	TIME	9:00			CYANIDE 1-1	L HDPF (ph>	12)	<u></u>	VOC'S 3 - 40	mVOA's (ph<2)	
SAMPLED BY:	N McNally					Anions Alkalinit	v TDS 1- 500r	ml HDPE		COD 1 - 11 H	DPF ($ph < 2$)	
RECORDED B	Y: N. McNally					BOD 1 - 1L HD	PE			TSS 1 - 1L HD	PE	
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS	
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's		
916	30.72	121.0	700		12.00	454	7.07	126.0	1.19	2.3		
921	31.22	119.8	450		12.21	451	7.50	113.0	0.56	1.6		
925	31.18	120.2	450	1 gal	13.02	453	7.24	100.4	0.65	1.4		
929	31.20	120.2	450	1.3	13.63	452	7.28	81.7	0.63	1.2		
934	31.40	120.6	450	1.8	13.94	453	7.31	68.2	0.51	0.9		
938	31.40	121.0	500	2.5	14.00	454	7.34	45.2	0.40	0.7		
943	31.40	121.6	300	3 gal	14.03	456	7.36	32.3	0.33	0.8		
948	31.45	120.8	300	3.25	14.04	457	7.37	30.1	0.40	0.7		
953	31.45	120.7	300	3.75	14.12	456	7.38	28.9	0.40	0.7		
959	31.40	120.7	3000	4 gal	14.28	456	7.39	32.2	0.39	0.7		
1003	31.40	120.8	300	4.3	14.42	455	7.39	23.6	0.38	0.6		
1007	31.40	120.8	350	4.5	14.42	456	7.39	24.0	0.38	0.7		
1012	31.40	120.8	350	5 gal	14.48	455	7.40	22.4	0.37	0.5		
1017	31.40	120.8	350		14.48	455	7.40	24.6	0.36	0.5		
1022	31.60	120.8	450	6 gal	13.90	454	7.40	23.5	0.25	0.5		
1028	31.65	120.7	450	6.6	14.28	454	7.40	24.9	0.27	0.5		
1032	31.65	121.8	450	7.5	14.41	455	7.41	17.6	0.27	0.5		
1037	31.70	121.7	400	7.75	14.42	454	7.41	13.7	0.27	0.6		
1042	31.70	121.7	450	8 gal	14.41	454	7.41	14.3	0.26	0.5		
1047	31.70	121.7	440	9 gal	14.45	455	7.41	13.2	0.26	0.5		
NOTES:					3%		+0.1 unit	+10 mv	10%	10%		
SAMPLE TAKE	EN AT 1130				Saturated Scre	en Volume Req	uired: 13 gallo	ons				

TURBIDITY GROUP # 75

Pump - Grunfos Redi-flow II

Sheet 1 of 2
GWM well #		SHM-93-10C	C (Cont.)			US A	rmy Cor	os of Eng	ineers		
SCREENED IN	ITERVAL DEPT	H:	45.7 - 55.7 fe	eet		Grou	ndwater Sa	mpling Log	Sheet		
H2O LEVEL: F	PRE PUMP INSI	ERTION	30.30 feet			Project N	lame: Shepl	ey's Hill Land	fill, Devens	s, MA	
	POST PUM	P INSERTION	30.50 feet			SAMPLE METH	HOD:	EPA LOW STR	ESS METHOD)	
DEPTH SAMPI	LED:	50 feet				SAMPLE BOTL	ES: METALS/h	hardnss 1 - 1L H	IDPE (ph<2)		
DATE:	11/01/99	TIME:	9:00			CYANIDE 1 - 1	IL HDPE (ph>1	2)		VOC'S 3-40r	ml VOA's (ph<2)
SAMPLED BY:	N. McNally					Anions, Alkalinit	y,TDS 1- 500n			COD 1 - 1L H	DPE (ph<2)
RECORDED B	Y: N. McNally		···			BOD 1 - 1L HD	PE			TSS 1 - 1L HD	PE
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS
24hr	BELOW MP feet	SETTING	mVmin	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU'8	
1052	31.70	121.7	400	9.5	14.47	455	7.41	11.4	0.25	0.5	
1057	31.70	121.7	450	10 gal	14.48	455	7.41	13.5	0.25	0.6	
1102	31.75	122.1	500	10.5	454	7.41	10.6	0.24	0.5		
1107	31.75	122.1	500	10.75	14.42	454	7.41	17.5	0.24	0.3	
1111	31.80	122.1	500	11.2	14.42	454	7.42	13.9	0.24	0.3	
1115	31.80	122.1	450	11.7	14.46	454	7.41	10.3	0.23	0.4	
1120	31.80	122.1	400	12.2	14.53	454	7.42	7.6	0.24	0.4	
1125	31.80	122.1	400	12.9	14.52	454	7.42	7.6	0.24	0.4	
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NOTES	<u></u>	L	<u></u>		3%	<u>L</u>	+0.1 unit	1 +10 mv	10%	<u> </u>	L
SAMPLE TAK	EN AT 1130				Saturated Scre	een Volume Rec	uired: 13 gallo	ns			

TURBIDITY GROUP # 75

Sheet 2 of 2

Pump - Grunfos Redi-flow II

GWM well #		SHL-11				US A	rmy Cor	ps of Eng	ineers					
SCREENED IN	ITERVAL DEPT	H:	15 - 30 feet			Grou	ndwater Sa	amplina Loa	Sheet					
H2O LEVEL: F	PRE PUMP INS	ERTION	18.95 feet			Project N	lame: Shepl	ey's Hill Land	fill, Devens	s, MA				
	POST PUM	P INSERTION	19.00 feet			SAMPLE METH	HOD:	EPA LOW STR	ESS METHOD)				
DEPTH SAMP	LED:	25 feet				SAMPLE BOTL	ES: METALS/	nardnss 1 - 1L H	DPE (ph<2)					
DATE:	11/01/99	TIME:	1440			CYANIDE 1 -	1L HDPE (ph>1	2)		VOC'S 3 - 40r	nl VOA's (ph<2)			
SAMPLED BY:	N. McNally					Anions.Alkalinit	v.TDS 1- 500n	-/ nl HDPE		COD 1 - 1L H	DPE $(ph<2)$			
RECORDED B	Y: N. McNally					BOD 1 - 1L HD	PE			TSS 1 - 1L HD	PE			
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O,	TURBIDITY	COMMENTS			
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's				
1452	19.00	94.0	800	0.75 gal	14.91	650	6.07	-47.5	1.40	30	Rusty			
1457	1457 19.00 93.6 800 1.5 gal 15.25 687 6.28 -59.9 0.86 13													
1502	1502 19.00 91.8 550 2 gal 16.36 694 6.33 -65.1 0.74 12													
1500	1500 18.99 91.7 500 2.5 gal 16.85 693 6.34 -69.0 0.65 11													
1510	18.99	91.8	550		17.11	693	6.35	-70.7	0.57	7.9				
1514	18.99	91.7	500	3 gal	17.13	696	6,36	-73.1	0.45	7.3				
1520	18.99	91.8	500	4 gal	17.16	697	6.36	-75.0	0.40	5.6				
1525	18.99	91.7	500		17.14	700	6.36	-79.1	0.33	4.4				
1530	18.98	91.7	450	5 gal	17.32	703	6.37	-80.1	0.31	3.5				
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	I		l		~~~	L	L	<u> </u>	L					
NULES:					3%	3%	+0.1 unit	+10 mv	10%	10%				
SAMPLE TAKE	=N A1 1534				Saturated Scre	en volume Req	uired: 4.8 gallo	ons	<u></u>					

TURBIDITY GROUP # 76 Pump - 0

76 Pump - Grunfos Redi-flow II

GWM well #		SHL-19				US A	rmy Cor	os of Eng	jineers						
SCREENED IN	TERVAL DEPT	H:	17 - 32 feet			Grou	ndwater Sa	Impling Loa	Sheet						
H2O LEVEL: F	RE PUMP INSI	ERTION	23.38 feet			Project N	lame: Shepl	ey's Hill Land	fill, Devens,	, MA					
	POST PUM	P INSERTION	23.38 feet			SAMPLE METH	HOD:	EPA LOW STR.	ESS METHOD						
DEPTH SAMPL	ED:	30 feet	<u>,</u>	······································		SAMPLE BOTL	ES: METALS/	ardnss 1 - 1L H	IDPE (ph<2)	-					
DATE:	11/01/99	TIME:	12:05			CYANIDE 1-1	L HDPE (ph>1	2)		VOC'S 3-40	ml VOA's (ph<2)				
SAMPLED BY:	B. Waz					Anions, Alkalinit	y,TDS 1- 500n			COD 1 - 1LH	IDPE (ph<2)				
RECORDED B	Y: B. Waz					BOD 1 - 1L HD	PE			TSS 1 - 1L H	DPE				
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS				
24hr	BELOW MP feet	SETTING	mVmin	PURGED	TEMP C	CONDUCTANCE		۳v	mg/L	NTU's					
1209	9 23.40 105.9 750 1 GAL 14.53 477 6.23 -23.2 0.92 42 adjust rate to 3 23.40 104.5 600 2 GAL 15.78 155 6.20 -23.1 0.74 45 approx 500m/														
1213	23.40	104.5	600	600 2 GAL 15.78 155 6.20 -23.1 0.74 45 approx.5											
1217	23.40	104.1	500		16.51	403	6.20	-21.1	0.77	48	very turbid				
1221	23.40	104.1	500		16.99	374	6.20	-22.1	0.76	49					
1224	23.40	104.1	500	3 GAL	17.16	354	6.20	-20.9	0.73	47					
1227	23.40	104.1	500	4 GAL	17.31	340	6.19	-20.9	0.72	47					
1230	23.40	104.1	500	4.5 GAL	17.39	330	6.19	-21.3	0.68	45					
1233	23.40	104.1	500		17.44	320	6.19	-20.0	0.67	44					
1237	23.40	104.1	500		17.53	311	6.19	-18.6	0.64	45					
1240	23.40	104.1	500	5.5 GAL	17.58	307	6.19	-17.5	0.65	44					
1243	23.40	104.1	500		17.60	300	6.18	-18.0	0.63	44					
1246	23.40	104.1	500	6.5 GAL	17.62	294	6.17	-16.0	0.62	43					
1249	23.40	104.1	500		17.65	290	6.17	-15.7	0.61	42					
1252	23.40	104.1	500	7.5 GAL	17.72	284	6.17	-15.2	0.61	39					
1255	23.40	104.1	500		17.74	281	6.17	-14.9	0.60	38					
1258	23.40	104.1	500	8.5 GAL	17.72	278	6.17	-13.2	0.60	37					
			<u> </u>					L							
				<u> </u>				1							
NOTES: SAMPLE TAK	EN AT 1300				3% Saturated Scr	o 3% een Volume Rec	+0.1 unit uired: 8 gallon	+10 mv s	10%	6 10%)				

MS/MSD Samples also taken at this well

YSI GROUP # 112

TURBIDITY GROUP # 76

Pump - Grunfos Redi-flow II

GWM well #		SHL-20				USA	rmy Cor	ps of Eng	ineers				
SCREENED IN	ITERVAL DEPTI	H:	41.0 - 51.0 f	eet		Grou	ndwater Sa	ampling Log	Sheet				
H2O LEVEL: F	PRE PUMP INSE	ERTION	19.40 feet			Project N	lame: Shepl	ey's Hill Land	fill, Devens	, MA			
	POST PUM	P INSERTION	19.40 feet	· · · · · · · · · · · · · · · · · · ·		SAMPLE METH	HOD:	EPA LOW STRI	ESS METHOD				
DEPTH SAMPL	LED:	46 feet				SAMPLE BOTL	ES: METALS/	nardnss 1 - 1L H	DPE (ph<2)	-			
DATE:	11/01/99	TIME:	1435			CYANIDE 1-1	IL HDPE (ph>1	2)	<u> (p / _ / / _ / _ / _ / _ / / _ / _ / _ / _ / / _ / / _ / / _ / / _ / / _ / / _ / / _ / / _ / / _ / / _ / / _ / / _ / / _ / / _ / / _ / / _ / / _ / / _ / / / / / _ /</u>	VOC'S 3-40	ml VOA's (ph<2)		
SAMPLED BY:	B. Waz		····			Anions,Alkalinit	y,TDS 1- 500n		·····	COD 1 - 1LH	IDPE (ph<2)		
RECORDED B	Y: B. Waz					BOD 1 - 1L HD	PE			TSS 1 - 1L H	DPE		
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	pН	ORP/Eh	D. O.	TURBIDITY	COMMENTS		
24hr	BELOW MP feet	SETTING	m/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's			
1455	19.45	96.6	700	1 gal	12.41	1098	6.21	4.0	1.78	50.7	Rust Particles		
1500	19.45	96.6 700 12.95 1125 6.29 -6.2 1.52 28.4 Turbid											
1505	19.45	95.5 500 13.24 1126 6.30 -9.5 1.60 33.2 Adj. to 500m											
1508	19.45	95.5 500 2 gal 13.74 1127 6.33 -12.2 1.68 18.5											
1511	19.45	95.5	500		13.85	1127	6.34	-13.2	1.73	14.2			
1514	19.45	95.5	500	3 gal	13.86	1127	6.35	-13.6	1.78	8.6			
1518	19.45	95.5	475		13.89	1126	6.36	-14.5	1.78	6.5			
1521	19.45	95.5	500	4 gal	13.91	1124	6.36	-15.8	1.53	6.4			
1524	19.45	95.5	500		13.90	1124	6.37	-17.1	1.64	6.5			
1527	19.45	95.5	500		13.88	1123	6.37	-17.5	1.77	5.3			
1530	19.45	95.5	500	5 gal	13.79	1125	6.37	-17.9	1.92	3.7			
1533	19.45	95.5	500		13.87	1123	6.38	-18.0	2.01	4.8			
1536	19.45	95.5	500		13.90	1124	6.38	-18.6	1.93	4.7			
1539	19.45	95.5	500	6 gal	13.91	1124	6.38	-18.9	1.94	3.8			
1542	19.45	95.5	500		13.91	1124	6.38	-18.4	1.87	3.5			
1545	19.45	95.5	500		13.91	1124	6.38	-19.3	1.83	4.3			
1548	19.45	95.5	500	7 gal	13.89	1125	6.38	-19.6	1.84	3.7			
1551	19.45	95.5	500		13.80	1128	6.38	-19.3	1.91	3.9.			
1554	1554 19.45 95.5 500 13.79 1129 6.38 -20.1 1.83 3.5												
1557	19.45	95.5	500	8 gal	13.80	1128	6.38	-20.8	1.91	4.2			
NOTES:	·····				3%	3%	+0.1 unit	+10 mv	10%	10%)		
SAMPLE TAKE	EN AT 1615				Saturated Scre	en Volume Req	uired: 13 gallo	ns					

TURBIDITY GROUP # 75

Pump - Grunfos Redi-flow II

Sheet 1 of 2

GWM well #		SHL-20 (Co	nt.)			US A	rmy Cor	ps of Eng	gineers			
SCREENED IN	TERVAL DEPT	H:	41.0 - 51.0 f	eet		Grou	ndwater Sa	ampling Log	Sheet			
H2O LEVEL: F	RE PUMP INSE	ERTION	19.40 feet			Project N	lame: Shepl	ey's Hill Land	fill, Devens	s, MA		
	POST PUM	P INSERTION	19.40 feet			SAMPLE METH	IOD:	EPA LOW STR	ESS METHOD)		
DEPTH SAMPI	_ED:	46 feet				SAMPLE BOTL	ES: METALS/	ardnss 1 - 1L H	IDPE (ph<2)			
DATE:	11/01/99	TIME:	1435			CYANIDE 1-1	L HDPE (ph>1	2)	<u> </u>	VOC'S 3-40	nl VOA's (ph<2)	
SAMPLED BY:	B. Waz					Anions, Alkalinit	y,TDS 1- 500r	nl HDPE		COD 1 - 1L H	DPE (ph<2)	
RECORDED B	Y: B. Waz					BOD 1 - 1L HD	PE			TSS 1 - 1L HD	PE	
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	pН	ORP/Eh	D. O.	TURBIDITY	COMMENTS	
24hr	BELOW MP feet	SETTING	m/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's		
1600	<u>1600 19.45 95.5 500 13.81 1129 6.40 -21.1 1.89 4.4</u>											
1603	19.45	95.5	500		13.78	1130	6.41	-21.2	1.90	3.8		
1606	19.45	95.5	500	9 gal	13.72	1130	6.42	-21.7	1.94	3.6		
1609	19.45	95.5	500		13.71	1131	6.42	-22.0	1.92	3.4		
1612	19.45	95.5	500		13.69	1130	6.42	-22.3	1.94	3.2		
1615	19.45	95.5	500	10 gal	13.67	1130	6.43	-22.5	1.95	3.3		
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L			1			<u> </u>	l	<u>L</u>	1	<u>l</u>	L	
NOTES:					3%	6 3%	+0.1 unit	+10 mv	10%	o 10%		
SAMPLE TAK	EN AT 1615				Saturated Scr	een Volume Req	uired: 13 gallo	ons				

TURBIDITY GROUP # 75 Pump - Grunfos Redi-flow II Sheet 2 of 2

GWM well #		SHL-22				US A	rmy Cor	os of Eng	ineers						
SCREENED IN	TERVAL DEPT	H:	100 - 116 fee	et		Grou	ndwater Sa		Sheet	• NAA					
							arrie. Sriepi	Cy S MILLAND		, IVI/1					
	POST PUM	P INSERTION	6.00 feet			SAMPLE METH		EPA LOW STRI	ESS METHOD						
DEPTH SAMPL	ED:	<u>111 feet</u>				SAMPLE BOTL	.ES: METALS/h	ardnss 1 - 1L H	DPE (ph<2)						
DATE:	11/02/99	TIME:	800			CYANIDE 1-1	L HDPE (ph>1	2)		VOC'S 3-40)ml VOA's (ph<2)				
SAMPLED BY:	B. Waz					Anions, Alkalinit	y,TDS 1- 500n	I HDPE		COD 1 - 1L H	HDPE (ph<2)				
RECORDED B	Y: B. Waz					BOD 1 - 1L HD	PE			TSS 1 - 1L H	DPE				
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS				
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's					
808	7.45	73.4	900	1 gal	10.34 876 5.88 13.9 2.34 2.5 sulfur odor										
812	7.98	70.7	850	2 gal	10.60	893	6.50	-19.1	1.09	2.5					
817	7.98	70.0	800	3 gal	10.80	894	6.66	-21.3	1.19	2.3					
820	7.98	69.2	800	4 gal	10.85	895	6.72	-20.0	1.33	1.5					
824	7.90	69.2	750	5 gal	10.86	896	6.75	-18.8	1.46	1.1	water recharging				
828	7.90	69.2	750	6 gal	10.87	896	6.77	-18.6	1.54	0.6					
831	7.90	69.2	750		10.89	897	6.78	-19.2	1.63	0.6					
835	7.90	69.2	750	7 gal	10.91	897	6.78	-19.6	1.55	0.5					
839	7.90	69.2	750		10.92	896	6.80	-21.1	1.69	0.5					
843	7.90	69.2	750	8 gal	10.94	896	6.80	-21.3	1.69	0.6					
846	7.90	69.2	750	9 gal	10.95	897	6.80	-21.1	1.71	0.5					
849	7.90	69.2	750	10 gal	10.96	896	6.81	-21.4	1.79	0.5					
853	7.90	69.2	750	11 gal	10.97	896	6.81	-21.3	1.78	0.6					
856	7.90	69.2	750		10.98	896	6.81	-22.3	1.74	0.4					
859	7.90	69.2	750	12 gal	11.00	896	6.81	-22.7	1.79	0.5					
902	7.80	67.3	650		11.02	896	6.81	-23.3	1.86	0.5					
905	7.78	67.0	500		10.99 896 6.81 -23.0 1.91 0.3										
908	7.68	67.0	-22.0	1.88	0.4										
					<u> </u>										
NOTES:				L	3%	3%	+0.1 unit	+10 mv	10%	10%	<u> </u>				
SAMPLE TAKE	EN AT 0910		<u></u>		Saturated Scre	een Volume Req	uired: 13 gallo	ns			<u></u>				

TURBIDITY GROUP # 76 Pun

76 Pump - Grunfos Redi-flow II

GWM well #		SHM-96-22E	3			US A	rmy Cor	os of Eng	jineers				
SCREENED IN	ITERVAL DEPT	H:	62.7-92.7 fee	et		Grou	ndwater Sa	amplina Loa	Sheet				
H2O LEVEL: F	PRE PUMP INSI	ERTION	6.60 feet			Project N	lame: Shepl	ey's Hill Land	fill, Devens	s, MA			
	POST PUM	P INSERTION	6.60 feet			SAMPLE METH	HOD:	EPA LOW STR	ESS METHOD)			
DEPTH SAMPI	LED:	75 feet				SAMPLE BOTI	ES: METALS/	nardnss 1 - 1L H	DPE (ph<2)	-			
DATE:	11/02/99	TIME:	815	·····		CYANIDE 1 -	1L HDPE (ph>1	2)	/	VOC'S 3-40	ml VOA's (ph<2)		
SAMPLED BY:	B. Waz		.			Anions, Alkalinit	y,TDS 1- 500n			COD 1 - 1L H	IDPE (ph<2)		
RECORDED B	Y: B. Waz					BOD 1 - 1L HD	PE			TSS 1 - 1L HD	PE		
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	Ð. O.	TURBIDITY	COMMENTS		
929	6.65	6.65 63.2 800 1 GAL 10.29 807 8.28 188.0 2.36 13.0											
933	6.65	63.2	800	2 GAL	10.56	804	9.01	50.0	1.04	22.5			
937	6.65	63.2	800		10.81	867	7.30	-187.4	0.91	10.3			
942	6.65	63.2	700	3 GAL	10.88	879	7.01	-163.1	1.43	6.7			
946	6.65	64.0	800	4 GAL	10.92	878	6.98	-159.4	1.67	6.9			
949	6.65	64.0	800	5 GAL	10.93	879	6.98	-158.2	1.55	6.8			
952	6.65	64.0	800		10.92	879	6.98	-157.6	1.56	6.9			
956	6.65	64.0	800	6 GAL	10.95	879	6.98	-157.4	1.57	6.9			
959	6.65	64.0	800		10.95	880	6.98	-156.7	1.63	7.0			
1002	6.65	64.0	800	7 GAL	10.95	884	6.98	-155.1	1.59	7.4			
1005	6.65	64.0	800		10.97	903	6.98	-147.8	1.72	8.0	numbers changing		
1008	6.65	64.0	800	8 GAL	10.99	987	6.84	-139.5	2.14	5.5			
1011	6.65	64.0	800		10.99	1012	6.80	-137.4	2.24	4.5			
1015	6.65	64.0	800	9 GAL	10.98	1020	6.79	-139.0	2.27	3.9			
1018	6.65	64.0	800		10.97	1021	6.79	-139.3	2.40	3.3			
1021	6.65	61.7	500	10 GAL	10.99	1020	6.78	-138.5	2.83	3.2			
1024	6.65	61.7	500		10.99	1020	6.78	-137.4	2.80	3.0			
1027	6.65	61.7	500	10.75 GAL	11.03	1020	6.78	-136.8	2.92	3.1			
NOTES:					3%	J	1 +0.1 unit	1 +10 mv	<u> </u>	1 <u> </u>	<u></u>		
SAMPLE TAK	EN AT 10:30				Saturated Scre	en Volume Rec	uired: 9.6 gall	ons					

TURBIDITY GROUP # 76 Pump - Grunfos Redi-flow II

GWM well #		SHM-93-220	C			USA	rmy Cor	ps of Eng	ineers			
SCREENED IN	ITERVAL DEPT	H:	124.3 - 134.3	3 feet		Grou	ndwater Sa	ampling Loa	Sheet			
H2O LEVEL: F	PRE PUMP INSI	ERTION	7.85 feet			Project N	lame: Shepl	ey's Hill Land	fill, Devens	s, MA		
	POST PUM	P INSERTION	6.30 feet	· • · · · · · · · · · · · · · · · · · ·		SAMPLE METH	iod:	EPA LOW STRI	SS METHOD			
DEPTH SAMP	LED:	128 feet				SAMPLE BOTL	ES: METALS/	nardnss 1 - 1L H	DPE (ph<2)	_		
DATE:	11/02/99	TIME:	730	· · · · · · · · · · · · · · · · · · ·		CYANIDE 1-1	IL HDPE (ph>1	2)	/	VOC'S 3-40)ml VOA's (ph<2)	
SAMPLED BY:	N. McNally					Anions, Alkalinit	y,TDS 1- 500r	nl HDPE		COD 1 - 1L I	HDPE (ph<2)	
RECORDED B	Y: N. McNally					BOD 1 - 1L HD	PE			TSS 1 - 1L H	DPE	
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS	
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's		
758	6.30	63.1	550		10.87	363	6.77	-468.0	3.71	5.2	strong sulfur odor	
802	7.42	63.2	350		10.72	340	7.25	-103.5	2.87	6.7		
806	7.81	65.5	400	1 gal.	11.06	344	7.40	-122.3	2.17	5.1		
810	8.22	65.5	300		10.91	347	7.45	-125.5	1.97	4.8		
815	8.62	66.5	200	1.25 gal.	11.05	329	7.47	-124.9	2.07	4.8		
821	9.02	66.6	300	1.50 gal.	10.82	588	7.54	-129.6	1.13	5.2		
826	9.65	66.6	200	2 gal.	10.96	575	7.56	-126.7	1.13	5.7		
832	9.81	66.6	125		11.23	543	7.59	-133.5	0.89	5.2		
837	10.02	68. 8	200	2.5	11.55	517	7.61	-130.6	0.94	5.2		
841	10.24	68.8	180		11.25	514	7.62	-121.6	0.98	5.1	drawdown=2.4 gal	
846	11.36	80.7	1100	3.5	10.61	573	7.63	-130.2	0.85	5.2	purge vol=2.4 gal	
852	12.01	80.8	800	4.25	11.52	574	7.65	-142.7	0.38	5.4		
855	13.15	80.8	600	4.5	11.39	575	7.65	-147.3	0.47	5.6		
900	13.85	80.8	300	5	11.30	574	7.65	-150.4	0.47	4.9	drawdown=purge	
905	14.42	93.5	1500	6	11.03	574	7.65	-151.4	0.44	7.0		
910	16.44	93.6	1000	6.75	11.60	573	7.66	-153.6	0.32	4.7		
914	16.67	93.6	750	8	11.50	573	7.66	-156.3	0.35	4.6		
919	18.70	93.6	600	9	11.33	574	7.66	-158.4	0.51	4.4		
924	18.97	93.6	300	9.5	11.35	572	7.66	-159.4	0.47	3.5		
928	19.22	93.6	180		11.42	567	7.67	-158.6	0.55	3.4		
NOTES:	NOTES: 3% +0.1 unit +10 mv 10% 10%											
SAMPLE TAK	EN AT 1106				Saturated Scr	een Volume Req	uired: 13 gallo	ns				
At 0841 - Draw	vdown volume e	qualed purged	volume, therefor	e, little to no rec	charge							

TURBIDITY GROUP # 75 Pum

75 Pump - Grunfos Redi-flow II

Sheet 1 of 2

GWM well #		SHM-93-220	<u> </u>			US A	rmy Corp	os of Eng	ineers							
SCREENED IN	TERVAL DEPT	H:	124.3 - 134.3	3 feet		Groui	ndwater Sa	mpling Log	Sheet							
H2O LEVEL: F	RE PUMP INSI	ERTION	7.85 feet	······		Project N	ame: Sheple	ey's Hill Land	fill, Devens	s, MA						
	POST PUM	P INSERTION	6.30 feet			SAMPLE METH	IOD:	EPA LOW STR	ESS METHOL)						
DEPTH SAMPI	ED:	128 feet				SAMPLE BOTL	ES: METALS/h	ardnss 1 - 1L H	DPE (ph<2)							
DATE:	11/02/99	TIME:	730	,		CYANIDE 1-1	L HDPE (ph>1)	2)	<u>-</u>	VOC'S 3-40	nl VOA's (ph<2)					
SAMPLED BY:	N. McNally	•				Anions, Alkalinit	y,TDS 1- 500m	I HDPE		COD 1 - 1L H	DPE (ph<2)					
RECORDED B	Y: N. McNally					BOD 1 - 1L HD	PE			TSS 1 - 1L HD	PE					
TIME	WATER DPTH	PUMP	PURGE RATE	CUM. VOLUME	H20	SPECIFIC	рН	ORP/Eh	D. O.	TURBIDITY	COMMENTS					
24hr	BELOW MP feet	SETTING	ml/min	PURGED	TEMP C	CONDUCTANCE		mv	mg/L	NTU's						
932	19.31	<u>19.31</u> 93.6 160 10 gal 11.51 464 7.67 -156.3 0.51 2.9														
938	19.32	<u>93.6</u> 100 11.69 467 7.67 -154.4 0.54 2.9														
943	19.21	93.6	100		11.79	11.79 396 7.67 -157.7 0.54 2.8										
948 19.19 93.6 100 11.90 346 7.67 -160.4 0.62 2.6																
952	19.18	94.4	400	10.5	11.00	347	7.68	-159.6	0.50	3.2						
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TURBIDITY GROUP # 75 Pump - Grunfos Redi-flow II

Sheet 2 of 2

APPENDIX D

CHAIN OF CUSTODY FORMS

Severn Trent Laboratories																		_ Arithg		
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Severn Trent Laboratories 55 South Park Drive, Colchester, VT 05446 Tel: (802) 655-1203

CHAIN OF CUSTODY RECORD

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Compared to hear surveys 55 South Park Drive, Colchester, VT 05446 Tel: (802) 655-1203

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APPENDIX E

COMPARISON OF ARSENIC RESULTS

SHEPLEY'S HILL LANDFILL GROUNDWATER MONITORING HISTORIC ARSENIC CONCENTRATION CHARTS



NOTES:

NS: Not Sampled

ND: Not Detected

SHEPLEY'S HILL LANDFILL GROUNDWATER MONITORING HISTORIC ARSENIC CONCENTRATIONS CHARTS



NOTES:

NS: Not Sampled ND: Not Detected

APPENDIX F

QUALITY ASSURANCE REPORTS

Chemical Data Quality Assurance Report 1999

NEW ENGLAND DISTRICT - GEOTECHNICAL & WATER MANAGEMENT BRANCH CHEMICAL DATA QUALITY ASSESSMENT REPORT

Project:	Shepley's Hill Landfill, Long Term Groundwater Monitoring (Samples collected May and November 1999)
Location:	Devens, MA
Reference:	Chemical Quality Assurance Report No. E766-090899, dated 9 September 1999 and No. E766-021100, dated 11 February 2000
Contractor:	New England District, US Army Corps of Engineers, Concord, MA
Prepared By: CDQAR Date:	Marie Wojtas, project chemist, CENAE-EP-GE 29 February 2000

The Chemical Quality Assurance Reports (CQAR) No. E0766-090899 and E0766-021100 for the long term groundwater monitoring project at Shepley's Hill Landfill, Devens, MA were reviewed. The following comments apply to the overall data assessment for two field sampling events which occurred in May and November 1999. The CQARs include comparison of two groundwater samples (one from each sampling event) analyzed for Volatile Organic Compounds (VOCs), Total Metals, Cyanide, Anions, Chemical Oxygen Demand, Biological Oxygen Demand, Alkalinity, Hardness, Total Dissolved Solids, and Total Suspended Solids.

1. <u>Data Useability</u>: The primary laboratory and quality assurance (QA) laboratory data show adequate comparability. The primary laboratory data is useable for the intended purpose. The project objective for this data is for long term groundwater monitoring purposes. The data is compared to the Record of Decision (ROD) and other associated regulatory cleanup goals. The primary contaminant of concern at this site is Arsenic. The QA laboratory data support the primary laboratory data which was used by USACE-NAE to prepare the annual and semi-annual groundwater analytical reports.

2. <u>Data Quality Objectives (DQOs)</u>: DQOs for the project have been satisfied. The following paragraphs summarize the most significant data comparability issues. No immediate corrective action is necessary for these items. Future sampling events will continue to be compared to QA laboratory data to verify the accuracy of the primary laboratory data, as described below.

a. <u>Metals Analysis – Data Discrepancies</u>: There are five minor data discrepancies for Metals (two for chromium; one for lead, thallium, and zinc). In all cases, both laboratories are reporting values which are significantly below the cleanup goal (where one exists). Therefore, these discrepancies are not considered to be significant, but will continue to be monitored for future sampling events.

<u>Corrective Action</u>: The minor data discrepancies noted are not considered to significantly impact the data interpretation, but will continue to be monitored for future sampling events. In particular, chromium will continue to be monitored since it was

determined to be a minor discrepancy in both sets of results.

b. <u>Total Hardness Analysis – Data Discrepancies</u>: There is one major data discrepancy for Total Hardness for the samples collected in May 1999 (CQAR No. E0766-090899). The primary laboratory result was < 2,000 ug/L, while the QA Laboratory result was 415,000 ug/L using EPA method 130.2, a titrimetric method. The primary laboratory results were inconsistent with values reported for Magnesium and Calcium, which are the primary components related to Total Hardness. Therefore, the primary laboratory was requested to calculate Total Hardness results using Standard Methods 2340B, a calculation technique. The primary laboratory revised their results according to the calculation technique, to 365,000 ug/L. The revised results show satisfactory correlation with the QA laboratory results. In addition, two other primary laboratory results from the May 1999 sampling event were revised in the semi-annual groundwater report due to this issue.

<u>Corrective Action</u>: The discrepancy noted for this sample was corrected. No further corrective action is necessary.

c. <u>Total Suspended Solids (TSS) Analysis – Data Discrepancies</u>: There is one major data discrepancy for TSS for the samples collected in November 1999 (CQAR No. E0766-021100). The primary laboratory result is 44,600 ug/L, while the QA laboratory result is 5,000 ug/L. There is no apparent reason for the discrepancy. The primary laboratory results are consistent with the previous (May 1999) round of groundwater results. There is no site cleanup goal for TSS. Therefore, the discrepancy does not significantly impact the interpretation of the results.

<u>Corrective Action</u>: The TSS values will be monitored in the future to determine if the discrepancy continues. If so, further investigation of the methodologies at both laboratories will be initiated.

3. <u>Contract Compliance</u>: The primary and QA laboratories met contractual obligations for this project. Overall, the primary and QA laboratory results compare satisfactorily, and the results obtained from the May and November 1999 sampling events are consistent and reasonable. Both laboratories reported satisfactory supporting quality control data.

Chemical Quality Assurance Report Spring 1999

SHEPLEY'S HILL LANDFILL LONG TERM MONITORING DEVENS, MASSACHUSETTS

CHEMICAL QUALITY ASSURANCE REPORT No. E0776-090899

MAY 11, 1999 SAMPLING EVENT

PREPARED BY THE ENVIRONMENTAL ENGINEERING AND GEOLOGY SECTION ENGINEERING/PLANNING DIVISION

DEPARTMENT OF THE ARMY NEW ENGLAND DISTRICT, CORPS OF ENGINEERS CONCORD, MASSACHUSETTS

SEPTEMBER 8, 1999

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SHEPLEY'S HILL LANDFILL LONG TERM MONITORING DEVENS, MASSACHUSETTS MAY 11, 1999 SAMPLING EVENT

CHEMICAL QUALITY ASSURANCE REPORT No. E0776-090899

TABLE OF CONTENTS

Paragraph	Title	Page
	Executive Summary	1
	Table 1- Data Comparison Summary	2
	Table 2 - Analyses Performed by QA Laboratory	3
1.	QA sample shipping and chain-of-custody deficiencies	4
2.	Data comparison for volatiles by Method 8260	4-5
3.	Data comparison for metals by Method 6010 and 7470	5
4.	Data comparison for cyanide by Method 9010B	5-6
5.	Data comparison for anions by Method 300.0	6
6.	Data comparison for COD and BOD by Method 410.4 and 405.1	6-7
7.	Data comparison for alkalinity by Method 310.1	7
8.	Data comparison for hardness by Method 130.2	7
9.	Data comparison for TDS and TSS by Methods 160.1 and 160.2	8
10.	References	8
	Appendix A - Key to comments on Data Comparison Code	
	Appendix B - Data Comparison Tables	
	Appendix C - Custody Documentation	

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SHEPLEY'S HILL LANDFILL LONG TERM MONITORING DEVENS, MASSACHUSETTS MAY 7, 1999 SAMPLING EVENT

CHEMICAL QUALITY ASSURANCE REPORT No. E0776-090899

Executive Summary

QA samples from one shipment for Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts were analyzed by the QA laboratory, resulting in a total of 92 target analyte determinations. The shipment contained two QA water samples and was received in good condition. The data report from STL (Severn Trent Laboratories), dated 27 May 1999 was used in the comparison. In 28 of these determinations analytes were detected by one or both laboratories. Results from the analysis of QA samples were compared with results from analysis of the corresponding primary samples (Reference 10A). The primary and QA samples agreed overall in 88 (95.7%) of the comparisons. Primary and QA samples agreed quantitatively in 24 out of 28 (85.7%) of the comparisons. Quantitative agreement represents only those determinations where an analyte was detected by at least one laboratory. One major and three minor discrepancies between results from the primary and QA samples were noted. Refer to Table 1 for a QA split sample data comparison summary.

The QA laboratory's QC samples contained all of the necessary information and a complete evaluation was performed. All of the data comparisons for Methods VOA's-8260, TAL Metals-6010, CN, Anions, COD, BOD, Alkalinity, TDS and TSS were in good overall and quantitative agreement. There was only one minor data discrepancy noted for volatiles and two minor data discrepancies noted for metals. All the other quantitative results compared almost identically for all of the target analytes that were reported as hits. There was very little bias to any of the sample results and the data appears to be complete and useable, except for the hardness determination. It appears that the primary laboratory's result for total hardness for sample MW-SHM-96-5B-QA-99-01 is questionable based on a calculation using the separate determinations of calcium and magnesium. The primary laboratory was requested to recalculate total hardness for sample MW-SHM-96-5B-QA-99-01 and reported 365 mg/L, instead of < 2 mg/L by method 130.2. It is strongly recommended that this total hardness calculation be used in the three cases in which major discrepancies in the primary laboratory's total hardness calculation exist. Refer to section 8 for a complete comparison of the primary laboratory's total hardness.

The primary laboratory's data report contained all of the necessary information and a complete evaluation was performed. As stated above, all of the data comparisons for the majority of the analyses were in good overall and quantitative agreement, except for the total hardness determination. The rest of the sample results for all of the analyses were supported by the QC

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data and appear to be complete and useable. The primary laboratory reported the samples in which tentatively identified compounds (TIC's) were detected, but did not specify their possible identification or the number of TIC's detected in each sample. This CQAR is based on the laboratory reporting limits because the detection limits were not provided.

QA analyses were performed by Quanterra Environment, Services, 880 Riverside Parkway, West Sacramento, CA, 95605 and CLS Labs, 3249 Fitzgerald Road, Rancho Cordova, CA, 95742 (see Table 2 for analyses performed by the QA lab). The primary laboratory was Severn Trent Laboratories, 55 South Park Drive, Colchester, VT, 05446.

<u>Table 1</u> <u>Quality Assurance Split Sample</u> Data Comparison Summary

	Overall Agreemen	t (1)	Quantitati Agreemer	ve nt (2)
Test Parameter	Number	Percent	Number	Percent
VOC	62/63	98.4	5/6	83.3
METALS	16/18	88.9	12/14	85.7
CYANIDE	1/1	100	NA	NA
ANIONS	4/4	100	3/3	100
COD	1/1	100	1/1	100
BOD	1/1	100	NA	NA
ALKALINITY	1/1	100	1/1	100
HARDNESS	0/1	0	0/1	0
TDS	1/1	100	1/1	100
TSS	1/1	100	1/1	100
Total	88/92	95.7	24/28	85.7

Project: Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts, May 11, 1999 Sampling Event

NOTES:

(1) Represents the number and percentage agreement of all determinations including analytes not detected by either laboratory.

(2) Represents the number and percentage agreement of only those determinations where an analyte was detected by at least one laboratory.

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TABLE 2

QA ANALYSES PERFORMED

SAMPLE ID	MATRIX	SAMPLE DATE	ANALYSIS
MW-SHM-96-5B-QA-99-01	WATER	5/11/99	VOC,METALS,CN, ANIONS,COD,BOD,ALK, HARDNESS,TDS,TSS
TRIP BLANK	WATER	5/11/99	VOC

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SHEPLEY'S HILL LANDFILL LONG TERM MONITORING DEVENS, MASSACHUSETTS MAY 11, 1999 SAMPLING EVENT

CHEMICAL QUALITY ASSURANCE REPORT No. E0776-090899

QA Findings

1. QA sample shipping and chain-of-custody deficiencies.

One shipment containing two QA water samples was received by Quanterra Environmental Services, West Sacramento, CA, on 12 May 1999. Proper sample handling protocols were followed for this shipment.

A copy of the chain-of-custody form document and cooler receipt form is appended to this report for reference.

2. Data comparison for volatiles (VOC) by Method 8260.

There were 63 volatile determinations. In six of these determinations, target analytes were detected by one or both laboratories. There was overall agreement in 62 (98.4%) of the cases and quantitative agreement in five out of six (83.3%) of the cases. No major and one minor data discrepancy were noted.

The minor discrepancy occurred in sample MW-SHM-96-5B-QA-99-01 in which the QA laboratory reported acetone at < 1.0 ug/L and the primary laboratory reported 4.0 J ug/L. Acetone is a common laboratory contaminant.

The QA laboratory's QC samples were within the acceptance limits for all of the target analytes and a complete evaluation was performed. The method blank and the trip blank were free of contamination above the laboratory's reporting limit for all of the target analytes. All of the samples, LCS/LCSD's, method blank, and trip blank surrogates recoveries were within the laboratory's acceptance limits. All of the LCS/LCSD's target analytes were also within the acceptance limits for accuracy and precision. The QA laboratory only spiked five of the target analytes into the LCS/LCSD. The QA laboratory was not requested to perform MS/MSD's and no evaluation of matrix effects could be determined. All of the samples were analyzed within the required holding times.

The primary laboratory's QC samples contained all the necessary information and a complete evaluation was performed. The method blanks and the trip blanks were free of contamination above the laboratory reporting limit for all of the target analytes. The surrogates

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for both the samples and the laboratory's QC samples were all within the acceptance limits. The primary laboratory reported that the MS/MSD's performed on sample MW-SHL-19-99-01 were within the acceptance limits for all 84 target analytes for precision and seven out of 168 target analytes recoveries were outside the acceptance limits for accuracy. All of the target analytes in the LCS were recovered within the acceptance limits, except in three out of 84 of the cases. All of the samples were analyzed within the required holding times. The primary laboratory was also requested by the USACE project chemist, Marie Wojtas, to report the number of tentatively identified compounds (TIC's) found in each sample and report the findings in the case narrative. The primary laboratory reported that TIC's were detected in the following samples: MW-SHM-93-10C-99-01, MW-SHL-3-99-01, MW-SHL-10-99-01, MW-SHL-19-99-01, MW-SHL-19-99-01, MW-SHL-19-99-01, MW-SHL-10-99-01, MW-SHL-19-99-01, MW-SHL-10-99-01, MW-SHL-10-90-01, MW-SHL-10-90-01, MW-SHL-10-

3. Data comparison for TAL metals by Method 6010 and mercury by Method 7470.

There were 18 metals determinations. In 14 of these determinations, target analytes were detected by one or both laboratories. There was overall agreement in 16 (88.9%) of the cases and quantitative agreement in 12 out of 14 (85.7%) of the cases. No major and two minor data discrepancies were noted.

The first minor data discrepancy occurred in sample MW-SHM-96-5B-QA-99-01 in which the QA laboratory reported chromium at 1.4 B ug/L and the primary laboratory reported 3.6 B ug/L. The second minor discrepancy occurred in sample MW-SHM-96-5B-QA-99-01 in which the QA laboratory reported lead at 1.9 B ug/L and the primary laboratory reported < 0.90 ug/L.

The primary laboratory's QC data report contained all of the necessary QC information and a complete evaluation was performed. The method blanks were free of contamination above the reporting limit for all of the target analytes. The primary laboratory reported that the LCS recoveries were within the acceptance limits for all of the target analytes. The primary laboratory performed a matrix spike and a matrix duplicate on sample SHL-19-99-01. The matrix spike recoveries were all within the acceptance limits of 75-125%, except for selenium at 151%. The RPD's of the matrix duplicate were less than 20%, except for chromium, copper and thallium. All of the spike levels, percent recoveries and QC limits were appropriately indicated on all of the QC reports. All of the samples were analyzed within the required holding times.

The QA laboratory's QC data were within the acceptance limits for all the target analytes and a complete evaluation was performed. The method blanks were free of contamination above the reporting limits. The QA laboratory reported that the LCS/LCSD's were within the acceptance limits for both accuracy and precision. All of the spike levels, percent recoveries and QC limits were appropriately indicated on all of the QC reports. The QA laboratory reported all of the metals were analyzed by Method 6010 Trace-ICP,

except for mercury, which was analyzed by Method 7470-Hg Cold Vapor. All of the samples were analyzed within the required holding times.

4. Data comparison for total cyanide by Method 9010B.

There was one cyanide determination. There was 100% overall agreement in that cyanide was not detected by either laboratory. No major or minor data discrepancies were noted.

The primary laboratory's QC data were within the acceptance limits for cyanide and a complete evaluation was performed. The method blank was free of contamination above the laboratory's reporting limit. The LCS's recovery was within the laboratory's acceptance limits. The matrix spike was recovered within the acceptance limits at 101.0%. The matrix duplicate and the original sample were reported below the laboratory's reporting limit. The sample was analyzed within the required holding time.

All of the QA laboratory's QC data were within acceptance limits and a complete evaluation was performed. The method blank was free of contamination above the laboratory's reporting limit. The LCS/LCSD's were within the acceptance limits for both accuracy and precision. The QA laboratory analyzed the sample by modified Method 9012A, instead of Method 9010B as indicated on the chain of custody. The sample was analyzed within the required holding time.

5. The data comparison for anions by Method 300.0.

There were four anion determinations. In three of these determinations, target analytes were detected by one or both laboratories. There was overall agreement in four (100%) of the cases and quantitative agreement in three out of three (100%) of the cases. No major or minor data discrepancies were noted.

The QA laboratory's QC data were all within the acceptance limits and a complete evaluation was performed. The method blanks were free of contamination above the reporting limit for all of the target analytes. The LCS/LCSD were within the acceptance limits for all of the target analytes for both accuracy and precision and the spiking levels were also indicated. All of the samples were analyzed within the required holding times.

The primary laboratory's QC data were all within the acceptance limits and a complete evaluation was performed. The method blanks were free of contamination above the reporting limit for all of the target analytes. The LCS recoveries were within the acceptance limits. The primary laboratory reported that the matrix spike and the matrix duplicate were within the acceptance limits for both accuracy and precision. All of the samples were analyzed within the required holding times.

6. Data comparison for COD by Method 410.4 and BOD by Method 405.1.

There was one COD and one BOD determination. In both the COD and BOD determinations, there was 100% overall and quantitative agreement. There were no major or minor data discrepancies noted.

The primary laboratory's QC samples were within the acceptance limits for all of the target analytes and a complete evaluation was performed. The method blank was free of contamination for both the COD and BOD results above the laboratory's reporting limit. The LCS recoveries for COD and BOD were both within the laboratory's acceptance limits. The primary laboratory did not report any MS/MSD's results. The samples were analyzed within the required holding times.

The QA laboratory's QC samples were within the acceptance limits for all of the target analytes and a complete evaluation was performed. The method blank was free of contamination above the reporting limit. The LCS/LCSD's were within the acceptance limits for both accuracy and precision. The QA sample was analyzed within the required holding times of 48 hours. The QA laboratory's contracted lab (CLS Labs) performed the BOD analysis.

7. The data comparison for alkalinity by Method 310.1.

There was one alkalinity determination. In this determination, there was 100% overall and 100% quantitative agreement. No major or minor discrepancies were noted.

The QA laboratory's QC samples were within the acceptance limit for alkalinity and a complete evaluation was performed. The method blank was free of contamination above the reporting limit. The QA laboratory reported that the LCS/LCSD's were within the acceptance limits for both accuracy and precision. There were no MS/MSD's performed for alkalinity and no evaluation of matrix effects could be determined. All of the samples were analyzed within the required holding times.

The primary laboratory's QC samples were almost all within the acceptance limit for alkalinity and a complete evaluation was performed. The method blank was free of contamination above the reporting limit. The primary laboratory reported that the LCS's were within the acceptance limits. The primary laboratory reported that the results of the matrix spike analysis performed on sample MW-SHL-19-99-01 were marginally below the laboratory control limits of 75 to 125 percent, at 72.9%. All of the samples were analyzed within the required holding times.

8. Data comparison for total hardness by Method 130.2.

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There was one hardness determination. In this determination, there was 0% overall and 0% quantitative agreement. There was a major discrepancy noted for this determination.

The major discrepancy occurred in sample MW-SHM-96-5B-QA-99-01 in which the QA laboratory reported total hardness at 415 Q mg/L and the primary laboratory reported < 2 mg/L. The "Q", qualifier indicates the reporting limit was elevated due to high analyte levels. Upon further evaluation of the metals data, it was evident that the primary laboratory was in error because they had reported calcium at 118 mg/L. If one were to calculate hardness based on mg equivalent of calcium carbonate/L, using the individual ICAP determinations of calcium and magnesium, the total hardness would be 364.6. The primary laboratory was requested to check their total hardness results against the calculation using the individual determinations of calcium and magnesium. The following table summaries the comparison of the primary laboratory's two methods of calculating total hardness (bold type indicates discrepancies):

Sample ID	Total Hardness by 130.2	Total Hardness by Ca and Mg
MW-SHM-93-10C-99-01	251	238
MW-SHL-3-99-01	18.8	18
MW-SHL-10-99-01	19.4	18
MW-SHL-19-99-01	102	97
MW-SHL-19-99-01MS	ND	125
MW-SHL-19-99-01MSD	ND	97
MW-SHL-19-99-01REP	ND	97
MW-SHL-4-99-01	136	132
MW-SHL-11-99-01	213	202
MW-SHL-20-99-01	405	<2
MW-SHL-9-99-01	67.3	66
MW-SHM-93-22C-99-01	310	289
MW-SHL-22-99-01	477	446
MW-SHM-96-22B-99-01	253	245 .
MW-SHM-96-5C-99-01	333	320
MW-SHL-5-99-01	32.8	31
MW-SHM-96-5B-99-01	365	< 2
MW-DUP-99-01	364	< 2
MW-EB-99-01	0	< 2

The QA laboratory's QC samples were within the acceptance limit for hardness and a complete evaluation was performed. The method blank was free of contamination above the laboratory's reporting limit. The QA laboratory reported that the LCS/LCSD's were within the laboratory's acceptance limits for both accuracy and precision. All of the samples were analyzed within the required holding times.

The primary laboratory's QC samples were within the acceptance limit for total hardness and a complete evaluation was performed. The method blank was free of contamination above the reporting limit. The primary laboratory reported that the LCS was within the laboratory's acceptance limits. The matrix spike and duplicate were within the acceptance limits for accuracy and precision. All of the samples were analyzed within the required holding times.

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9. Data comparison for TDS by Method 160.1 and TSS by Method 160.2.

There was one TDS and one TSS determination. In both the TDS and TSS determinations, there was 100% overall and quantitative agreement. No major or minor data discrepancies were reported.

The primary laboratory's QC samples were within the acceptance limits for all of the target analytes and a complete evaluation was performed. The LCS recoveries for TDS and TSS were both within the laboratory's acceptance limits. The samples were analyzed within the required holding times.

The QA laboratory's QC data were within the acceptance limits for all of the target analytes and a complete evaluation was performed. The method blanks for TDS and TSS were free of contamination above the laboratory's reporting limits. The LCS/LCSD's were within the acceptance limits for both accuracy and precision. All of the samples were analyzed within the required holding times.

10. References.

a. Data Report for Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts, prepared by Severn Trent Laboratories, dated 27 May 1999.

b. EM 200-1-6, Chemical Quality Assurance for Hazardous, Toxic and Radioactive Waste (HTRW) Projects, dated 10 October 1997.

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APPENDIX A KEY TO COMMENTS ON DATA COMPARISON TABLES

0 - Data agrees if any one of the following apply:

- both values are less than respective detection limit (N<MDL)

- N_1 < MDL₁ and N_2 > MDL₂ but < MDL₁*

- both values are above respective detection limit (N>MDL) and difference between two values satisfies conditions below

For all analyses in a water matrix and for metals analysis in soil: <2X difference

For **all** other **soil** analyses: <4X difference

1 - Minor contamination by laboratory contaminant

2 - Not tested by both laboratories

3 - Minor data discrepancy, disagreement not serious, if any one of the following apply:

- N_1 <MDL₁ and N_2 >MDL₂ and the difference between values N_2 * does not exceed the upper limit (described below) defining a minor data discrepancy

- both values are above respective detection limit (N>MDL*) and conditions described below apply to the difference between the two values

For all analyses in a water matrix and for metals analysis in soil: 2X<difference<3X

For **all** other **soil** analyses: 4X<difference<5X

4 - Major data discrepancy, disagreement serious, if any one of the following apply:

- N_1 < MDL₁ and N_2 > MDL₂ and the difference between values N_2 and MDL₁* exceeds the limit (described below) defining a major data discrepancy

- both values are above respective detection limit (N>MDL*) and conditions described below apply to the difference between the two values

For all analyses in a water matrix and for metals analysis in soil: >3X difference For all other soil analyses: >5X difference

MDL = Method Detection Limit N = Analytical result * - not all < values are MDLs. Values which are not MDLs will be noted.

Key to data qualifiers:

B - detected in method blank
DO - Diluted out
J - estimated value, above MDL but below practical quantitation limit
NA - Not analyzed
ND - Not detected
NR - Not reported

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APPENDIX B

DATA COMPARISON TABLES

QA SAMPLE No.: QA FIELD ID: QA ANALYSIS DATE: QA LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD: G9E120181-001 MW-SHM-96-5B-QA-99-01 5/21/99 QUANTERRA 5030B 8260B CONTRACTORS SAMPLE No.: CONTRACTORS FIELD ID: CONTRACTOR'S ANALYSIS DATE: CONTRACTOR'S LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD:

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Page 1 of 2

385167 MW-SHM-96-5B-99-01 5/20/99 STL 5030B 8260B

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 5/11/99 UNITS: ug/L

PARAMETER	QA LAB LRL	RESULTS QA LAB	CONTRACTOR LRL	RESULTS CONTRACTOR	COMPARISON CODE
Dichlorodifluoromethane	< 1.0		< 5.0		0
Chloromethane	< 1.0		< 5.0		0
Vinyl Chloride	< 1.0		< 5.0		0
Bromomethane	< 1.0		< 5.0		0
Chloroethane		2.4		3.1 J	0
Trichlorofluoromethane	< 1.0		< 5.0		0
Acrolein	NR		< 5.0		2
Freon TF	NR		< 5.0		2
1.1-Dichloroethene	< 1.0		< 5.0		0
Acetone	< 1.0			4.0 J	3
Methyl Iodide	NR		< 5.0		2
Carbon Disulfide	NR		< 5.0		2
Allvi Chloride	NR		< 5.0		2
Methylene Chloride	< 1.0		< 5.0		0
Acrylonitrile	NR		< 5.0		2
trans-1.2-Dichloroethene	< 1.0		< 5.0		0
1.2-Dichloroethene (total)	NR			2.7 J	2
Methyl-t-Butyl Ether	NR			1.6 J	2
1.1-Dichloroethane		2.4		2.6 J	0
Vinyl Acetate	NR		< 5.0		2
Chloroprene	NR		< 5.0		2
cis-1_2-Dichloroethene		2.7		2.6 J	0
2-Butanone	< 1.0		< 5.0		0
Projonitrile	NR		< 20		2
Methacrylonitrile	NR		< 5.0		2
Bromochloromethane	< 1.0		< 5.0		0
Tetrahydrofuran	NR		< 50		2
Chloroform	< 1.0		< 5.0		0
1.1.1-Trichloroethane	< 1,0		< 5.0		0
Carbon Tetrachloride	< 1.0		< 5.0		0
Isobutyl Alcohol	NR		< 250		2
Benzene	< 1.0			0.97 J	0
1,2-Dichloroethane	< 1.0		< 5.0		0
Trichloroethene	< 1.0		< 5.0		0
1,2-Dichloropropane	< 1.0		< 5.0		0
Methyl Methacrylate	NR		< 5.0		2
Dibromomethane	< 1.0		< 5.0		0
1,4-Dioxane	< 1.0		< 250		0
Bromodichloromethane	< 1.0		< 5.0		0
2-Chloroethyl Vinyl Ether	NR		< 5.0		2
cic 1.3 Dichloropropene	<10		< 5.0		0

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

Page 1 of 2

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20181-001 CON SHM-96-5B-QA-99-01 CO 99 CONTRAC NTERRA CONTRA B 8	RACTORS SAMPLE No.: DNTRACTORS FIELD ID: TOR'S ANALYSIS DATE: (CTOR'S LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD:	385167 MW-SHM-96-5B-99-01 5/20/99 STL 5030B 8260B
В	ANALYSIS METHOD:	8260B
	20181-001 CONT SHM-96-5B-QA-99-01 CC 99 CONTRAC NTERRA CONTRA B 5	20181-001CONTRACTORS SAMPLE No.:SHM-96-5B-QA-99-01CONTRACTORS FIELD ID:99CONTRACTOR'S ANALYSIS DATE:NTERRACONTRACTOR'S LABORATORY:BEXTRACTION METHOD:BANALYSIS METHOD:

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MATERIAL DESCRIPTION: WATER DATE SAMPLED: 5/11/99 UNITS: ug/L

PARAMETER	OA LAB	RESULTS OA LAB	CONTRACTOR	RESULTS CONTRACTOR	COMPARISC CODE
	LRL	Q	LRL		
4-Methyl-2-pentanone	< 1.0		< 5.0		0
Toluene	< 1.0		< 5.0		0
trans-1,3-Dichloropropene	< 1.0		< 5.0		0
Ethyl Methacrylate	NR		< 5.0		2
1,1,2-Trichloroethane	< 1.0		< 5.0		0
Tetrachloroethene	< 1.0		< 5.0		0
2-Hexanone	NR		< 5.0		2
Dibromochloromethane	< 1.0		< 5.0		0
1,2-Dibromoethane	< 1.0		< 5.0		0
Chlorobenzene	< 1.0		< 5.0		0
1,1,1,2-Tetrachloroethane	< 1.0		< 5.0		0
Ethylbenzene	< 1.0		< 5.0		0
Xylene (total)	< 1.0		< 5.0		0
Styrene	< 1.0		< 5.0		0
Bromoform	< 1.0		< 5.0		0
Isopropylbenzene	< 1.0		< 5.0		0
cis-1,4-Dichloro-2-butene	NR		< 5.0		· 2
1,1,2,2-Tetrachloroethane	< 1.0		< 5.0		0
1,2,3-Trichloropropane	< 1.0		< 5.0		0
trans-1,4-Dichloro-2-butene	< 1.0		< 5.0		0
1,3-Dichlorobenzene	< 1.0		< 5.0		0
1,4-Dichlorobenzene		1.3	< 5.0		0
1,2-Dichlorobenzene	< 1.0		< 5.0		0
1,2-Dibromo-3-Chloropropane	< 1.0		< 5.0		0
1,2,4-Trichlorobenzene	< 1.0		< 5.0		0
Hexachlorobutadiene	< 1.0		< 5.0		0
Naphthalene	< 1.0		< 5.0		0
2,2-Dichloropropane	< 1.0		< 5.0		0
1,1-Dichloropropene	< 1.0		< 5.0		0
1,3-Dichloropropane	< 1.0		< 5.0		0
Bromobenzene	< 1.0		< 5.0		0
n-Propylbenzene	< 1.0		< 5.0		0
2-Chlorotoluene	< 1.0		< 5.0		0
4-Chlorotoluene	< 1.0		< 5.0		0
1,3,5-Trimethylbenzene	< 1.0		< 5.0		0
tert-Butylbenzene	< 1.0		< 5.0		0
1,2,4-Trimethylbenzene	< 1.0		< 5.0		0
sec-Butylbenzene	< 1.0		< 5.0		0
4-Isopropyltoluene	< 1.0		< 5.0		0
n-Butylbenzene	< 1.0		< 5.0		0
1,2,3-Trichlorobenzene	< 1.0		< 5.0		0
SURROGATE RECOVERIES	(%) QA				PRIMARY
4-Bromofluorobenzene (70-130)) 93		Toluene-d8 (88	-110)	96
1,2-Dichloroethane-d4 (70-130) 102		1,2-Dichloroeth	ane-d4 (72-141)	100
Taulana 38 (70 120)	98		Bromofluorobe	nzene (72-122)	112

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

• = Surrogates outside of acceptable limits

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QA SAMPLE No.: QA FIELD ID: QA ANALYSIS DATE: QA LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD: G9E120181-001 MW-SHM-96-5B-QA-99-01 5/20/99 QUANTERRA 3010A 6010B,Hg-7470A

CONTRACTORS SAMPLE No.: CONTRACTORS FIELD ID: CONTRACTOR'S ANALYSIS DATE: CONTRACTOR'S LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD:

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385167 MW-SHM-96-5B-99-01 5/25/99 STL 3010A 6010, Hg-7470

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 5/11/99 UNITS: ug/L

······		······			
		RESULTS		RESULTS	COMPARISON
PARAMETER	QA LAB	QA LAB	CONTRACTOR	CONTRACTOR	CODE
		·······			
Aluminum	· NR		< 10.4		2
Antimony	< 10		< 2.2		0
Arsenic		3200		3490	0
Barium		54		56.3 B	0
Beryllium	< 5.0			4.6 B	0
Cadmium	< 5.0		< 0.30		0
Calciuum	NR			118000	2
Chromium		1.4 B		3.6 B	3
Colbolt		16 B		15.7 B	0
Copper	< 25			3.9 B	0
Iron		29700		30900	0
Lead		1.9 B	< 0.90		3
Manganese		12500		17000	0
Mercury	< 0.20			0.17 B	0
Molybdenum		5.2 B		NR	2
Nickel		17 B		16.2 B	0
Potassium		9820	NR		2
Selenium	< 5.0		< 2.7		0
Silver	< 5.0		< 0.90		0
Thallium		5.8 B		6.2 B	Ő
Vanadium	< 50			1.6 B	0
Zinc		5.3 B		5.5 B	0

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

G9E120181-001 QA SAMPLE No .: CONTRACTORS SAMPLE No.: 385167 QA FIELD ID: MW-SHM-96-5B-QA-99-01 CONTRACTORS FIELD ID: MW-SHM-96-5B-99 5/21/99 QA ANALYSIS DATE: 5/14/99 CONTRACTOR'S ANALYSIS DATE: QA LABORATORY: QUANTERRA CONTRACTOR'S LABORATORY: STL, VT EXTRACTION METHOD: EXTRACTION METHOD: NA NA ANALYSIS METHOD: 9012A ANALYSIS METHOD: 9010

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 5/11/99 UNITS: ug/L

PARAMETER	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISO
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Cyanide (CN)	< 10.0	*****	< 5.0		0

QA SAMPLE No.: QA FIELD ID: QA ANALYSIS DATE: QA LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD:

CONTRACTORS SAMPLE No .: G9E120181-001 385167 MW-SHM-96-5B-QA-99-01 CONTRACTORS FIELD ID: MW-SHM-96-5B-99-01 5/12/99 CONTRACTOR'S ANALYSIS DATE: 5/14/99 QUANTERRA CONTRACTOR'S LABORATORY: STL, VT EXTRACTION METHOD: NA NA 300.0 ANALYSIS METHOD: 300.0

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 5/11/99 UNITS: mg/L

PARAMETER	QA LAB LRL	RESULTS QA LAB	CONTRACTOR LRL	RESULTS CONTRACTOR	COMPARISON CODE
Chloride, CL		6320		62.4	0
Nitrate, as N		0.078	< 0.2		0
Othophosphate, as P	< 0.20		< 0.2		0
Sulfate, SO4		4.3		4.3	0

QA SAMPLE No.; QA FIELD ID: QA ANALYSIS DATE: QA LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD: G9E120181-001 MW-SHM-96-5B-QA-99-01 5/17/99 QUANTERRA NA 310.1 CONTRACTORS SAMPLE No.: CONTRACTORS FIELD ID: CONTRACTOR'S ANALYSIS DATE: CONTRACTOR'S LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD:

385167 MW-SHM-96-5B-99-01 5/13/99 STL, VT NA 310.1

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 5/11/99 UNITS: mg/L

PARAMETER	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Total Alkalinity as CaCO3		383		380	0

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

shl(spring99)inorganics.xls

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G9E120181-001 CONTRACTORS SAMPLE No .: 385167 QA SAMPLE No .: MW-SHM-96-5B-99-01 MW-SHM-96-5B-QA-99-01 CONTRACTORS FIELD ID: QA FIELD ID: QA ANALYSIS DATE: 5/28/99 CONTRACTOR'S ANALYSIS DATE: 5/21/99 STL, VT QA LABORATORY: QUANTERRA CONTRACTOR'S LABORATORY: EXTRACTION METHOD: NA EXTRACTION METHOD: NA 130.2 130.2 ANALYSIS METHOD: ANALYSIS METHOD:

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 5/11/99 UNITS: mg/L

PARAMETER	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Total Hardness as CaCO3		415 Q		<2	4

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

shl(spring99)inorganics.xls

QA SAMPLE No.: QA FIELD ID: QA ANALYSIS DATE: QA LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD: G9E120181-001 MW-SHM-96-5B-QA-99-01 6/1/99 QUANTERRA NA 410.4-COD CONTRACTORS SAMPLE No.: CONTRACTORS FIELD ID: CONTRACTOR'S ANALYSIS DATE: CONTRACTOR'S LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD: 385167 MW-SHM-96-5B-99-01 5/19/99 STL, VT NA 410.1-COD

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 5/11/99 UNITS: mg/L

PARAMETER	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Chemical Oxygen Demand (COD)		22.7		31	0

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shl(spring99)inorganics.xls

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QA SAMPLE No.:	G9E120181-001	CONTRACTORS SAMPLE No.:	385167
QA FIELD ID:	MW-SHM-96-5B-QA-99-01	CONTRACTORS FIELD ID:	MW-SHM-96-5B-99-01
QA ANALYSIS DATE:	5/17/99	CONTRACTOR'S ANALYSIS DATE:	5/12/99
QA LABORATORY:	QUANTERRA	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	405.1	ANALYSIS METHOD:	405.1

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 5/11/99 UNITS: mg/L

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PARAMETER	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Biological Oxygen Demand (5 Day)	< 3.0		< 2.0		0

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

QA SAMPLE No.:	G9E120181-001	¥A-99-01	CONTRACTORS	SAMPLE No.:	385167
QA FIELD ID:	MW-SHM-96-5B-C		CONTRACTO	DRS FIELD ID:	MW-SHM-96-5B-99-01
QA ANALYSIS DATE:	5-13+17-99		CONTRACTOR'S ANA	ALYSIS DATE:	5-12+17-99
QA LABORATORY:	QUANTERRA		CONTRACTOR'S LA	ABORATORY:	STL, VT
EXTRACTION METHOD:	NA		EXTRACTI	ON METHOD:	NA
ANALYSIS METHOD:	160.1 and 160.2		ANALY	SIS METHOD:	160.1 and 160.2
	MATERIAL DESC DATE S	CRIPTION: SAMPLED: UNITS:	WATER 5/11/99 mg/L		
PARAMETER	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Total Dissolved Solids (TDS by 160.1) Total Suspended Solids (TSS by 160.2)		506 39.0		511 46.8	0 0

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

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APPENDIX C

SAMPLE RECEIPT & CUSTODY DOCUMENTATION

1

Severn Trent Laborat 55 South Park Drive, Colches	ories ter, VT 05446 Tel: (802) 655	5-1203				CHAIN OF CUSTOL RECORD
Report to: Company: <u>U.S. Army Curp of Emps</u> Address: <u>696 Virginie Rund</u>	Invoice Company: Address:	to	/ / F	Analysis Requested	2 5 []] []] []	Lab use only Due Date:
Contact: Marie Wostas Phone: 978 318-8175 Fax: 978 318-863 Contract/ Quote #: EØ776 Sampler's Name Steve Simmer of Robert	Contact: Phone: PO/SO #: Sampler's Signature			2603 11.0	70108 mer - 1 14 8 mit - 3 mil	Temp. of coolers when received (C ²): 1 2 3 4 5 Custody Seal N / Y Intact N / Y Screened For Radioactivity
Bring Waz Proj. No. Project Name EØ776 Shepley's Hill Malrix' Date Time & G Malrix' Date Time P b Identifying Marks o	LTM&M I Sample(s)	No /Type of Cont VOA A/G 25 1 Lt. m	ainers ²	Deter 6	Amuel	Lab Sample ID (Lab Use Only)
W 5/11 1455 X mw-SHM-96 W 5/11 Tip Blm	-53-QA-99-01 Ks	3 - 2	24:	3 1 1 1 2 ·		11 id with pulloles 00 5-12-99
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Relinquished by: (Signature) Date: Siling Signature) Date: Relinquished by: (Signature) Date: Relinquished by: (Signature) Date:	Not I e / inguishe Time: Received by: (Signa Sou FED FED Ex Sou A: r Bill # 8/M Time: Received by: (Signa Time: Received by: (Signa	1 Iure) 14804247 Iture)	Date: 5/11/9 Date: 5-12-9 Date:	Time: 17 / \$ 000 Time: 38 / (200) Time:	Remarks) couler QA Sc.mpk: Client's delivery of sam Laboratories terms and	shipped s-Shepley's Hill ples constitutes acceptance of Severn Trent conditions contained in the Price Schedule.
¹ Matrix WW - Wastewater W - Water ² Container VOA - 40 mt vial A/G - Ambri	I	iquid A - Air E - Glass wide mo	l Bag C uth P	C - Charcoal lube	SL · Sludge O · C	Dil STL cannot accept verbal changes. Please Fax written changes to (802) 655-1248

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(802)	855-1248	
(002)	000-12-00	

Chain of Custody Record



UA-4124											R		4			
Buanterra			Project Manager				, , , , , , , , , , , , , , , , , , ,		Date		 Cha	in OI C	Sustody	Numbe	<u></u>	35
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State	Zip Code	<u> </u>	Sile Conlact								 	Anal	ysis			
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Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Contain	ers No	Preservative	Condition	on Receipt	9 <u>8</u> 0						
6E B9E 12018 - 1	5-11-99	1455				Ĩ				X				++		-
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Special Instructions

Possible Hazard Iden	tilication		Sample Disposal			
Non-Hazard	🗖 Flammable 🛛 Skin Irritant	Poison B	Inknown Return To Client	Disposal By Lab	Archive For	Months
Tum Around Time Re	equired	QC Level	Project Specific (Specify)			
Normal	Rush] #. 🗆 #.			
1. Relinquished By	chul foto	Date 5-17-9	Time 1. Received By	2	·	Date Time
2. Relinquished By	E X	512.79	Time 2. Received by	hell	CLS	5/12/95 13:75
3. Relinquished By		Date	Time 3 Received By			Time

Yiji uanterra

LOT RECEIPT CHECKLIST QES West Sacramento	
CLIENT Severn Trent Labs	PM_DB_ LOG # <u>G9F12-9</u>
LOT# (QUANTIMS ID) _ G9E12018 (QUO	DTE # 30186 LOCATION(S) W22C VA
DATE RECEIVED 051299 TIME RECEIVED 0	1930 RL 05729 9
DELIVERED BY	T CLIENT E DHL GO-GETTERS
SHIPPPING CONTAINER(S)	
TEMPERTURE RECORD (IN °C) IR 1 2 1 COC #(S) NIA NIA TEMPERATURE BLANK 3°C	
pH MEASURED YES ANO	
LABELED BY	_dt
LABELS CHECKED BY	
SHORT HOLD TEST NOTIFICATION	
METALS NOTIFIED OF FILTER/PRESERVE VIA VERBAL & EMAIL	
COMPLETE SHIPMENT RECEIVED IN GOOD CONDITION WITH APPROPRIATE TEMPERATURES, CONTAINERS, PRESERVATIVES	
Clouseau TEMPERATURE EXCEEDED (2 °-6 °C	
WET ICE BLUE ICE GEL PACK	
PM NOTIFIED NO COOLING AGENTS USED	
Notes:logzTBcu	/ bubbles

LEAVE NO SPACES BLANK. USE "N/A" IF NOT APPLICABLE. INITIAL AND DATE ALL "N/A" ENTRIES.

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Chemical Quality Assurance Report Fall 1999

SHEPLEY'S HILL LANDFILL LONG TERM MONITORING DEVENS, MASSACHUSETTS

CHEMICAL QUALITY ASSURANCE REPORT No. E0776-021100

NOVEMBER 2, 1999 SAMPLING EVENT

PREPARED BY THE ENVIRONMENTAL ENGINEERING AND GEOLOGY SECTION ENGINEERING/PLANNING DIVISION

DEPARTMENT OF THE ARMY NEW ENGLAND DISTRICT, CORPS OF ENGINEERS CONCORD, MASSACHUSETTS

FERUARY 11, 2000

SHEPLEY'S HILL LANDFILL LONG TERM MONITORING DEVENS, MASSACHUSETTS NOVEMBER 2, 1999 SAMPLING EVENT

CHEMICAL QUALITY ASSURANCE REPORT No. E0776-021100

TABLE OF CONTENTS

Paragraph	Title	Page
	Executive Summary	1-2
	Table 1- Data Comparison Summary	3
	Table 2 - Analyses Performed by QA Laboratory	4
1.	QA sample shipping and chain-of-custody deficiencies	5
2.	Data comparison for volatiles by Method 8260	5-6
3.	Data comparison for metals by Method 6010 and 7470	6-7
4.	Data comparison for cyanide by Method 9010B	7
5.	Data comparison for anions by Method 300.0	7-8
6.	Data comparison for COD and BOD by Method 410.4 and 405.1	8
7.	Data comparison for alkalinity by Method 310.1	8
8.	Data comparison for hardness by Method 130.2	8-9
9.	Data comparison for TDS and TSS by Methods 160.1 and 160.2	9
10.	References	9
	Appendix A - Key to comments on Data Comparison Code	
	Appendix B - Data Comparison Tables	
	Appendix C - Custody Documentation	

SHEPLEY'S HILL LANDFILL LONG TERM MONITORING DEVENS, MASSACHUSETTS NOVEMBER 2, 1999 SAMPLING EVENT

CHEMICAL QUALITY ASSURANCE REPORT No. E0776-021100

Executive Summary

QA samples from one shipment for Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts were analyzed by the QA laboratory, resulting in a total of 76 target analyte determinations. The shipment contained two QA water samples and was received in good condition. The data report from STL (Severn Trent Laboratories), dated 1 December 1999 was used in the comparison. In 25 of these determinations analytes were detected by one or both laboratories. Results from the analysis of QA samples were compared with results from analysis of the corresponding primary samples (Reference 10A). The primary and QA samples agreed overall in 72 (94.7%) of the comparisons. Primary and QA samples agreed quantitatively in 21 out of 25 (84.0%) of the comparisons. Quantitative agreement represents only those determinations where an analyte was detected by at least one laboratory. One major and three minor discrepancies between results from the primary and QA samples were noted. Refer to Table 1 for a QA split sample data comparison summary.

The QA laboratory's QC samples contained all of the necessary information and a complete evaluation was performed. All of the data comparisons for Methods VOA's-8260, TAL Metals-6010, CN, Anions, COD, BOD, Alkalinity, Hardness and TDS were in good overall and quantitative agreement. There were only three minor data discrepancies noted for metals. All the other quantitative results compared almost identically for all of the target analytes that were reported as hits. There was very little bias to any of the sample results and the data appears to be complete and useable, except for the TSS determination. There was one major discrepancy for the TSS result in which the QA laboratory reported 5.0 mg/L and the primary laboratory reported 44.6 mg/L. Based on the evaluation of both laboratory's QC data, no reasonable explanation can be offered for this major discrepancy.

The primary laboratory's data report contained all of the necessary information and a complete evaluation was performed. As stated above, all of the data comparisons for the majority of the analyses were in good overall and quantitative agreement, except for the TSS determination. The rest of the sample results for all of the analyses were supported by the QC data and appear to be complete and useable. The primary laboratory reported the samples in which tentatively identified compounds (TIC's) were detected, but did not specify their possible identification or the number of TIC's detected in each sample. This CQAR is based on the laboratory reporting limits because the detection limits were not provided.

QA analyses were performed by Quanterra Environment, Services, 880 Riverside Parkway, West Sacramento, CA, 95605 and CLS Labs, 3249 Fitzgerald Road, Rancho Cordova, CA, 95742 (see Table 2 for analyses performed by the QA lab). The primary laboratory was Severn Trent Laboratories, 55 South Park Drive, Colchester, VT, 05446.

Table 1Quality Assurance Split SampleData Comparison Summary

Project: Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts, November 2, 1999 Sampling Event

	Overall		Quantitati	ve
Test	Agreement	t (1)	Agreeme	nt (2)
Parameter	Number	Percent	Number	Percent
VOC	47/47	100	7/7	100
METALS	15/18	83.3	8/11	72.7
CYANIDE	1/1	100	NA	NA
ANIONS	4/4	100	2/2	100
COD	1/1	100	1/1	100
BOD	1/1	100	NA	NA
ALKALINITY	1/1	100	1/1	100
HARDNESS	1/1	100	1/1	100
TDS	1/1	100	1/1	100
TSS	0/1	0	0/1	0
Total	72/76	94.7	21/25	84.0

NOTES:

(1) Represents the number and percentage agreement of all determinations including analytes not detected by either laboratory.

(2) Represents the number and percentage agreement of only those determinations where an analyte was detected by at least one laboratory.

TABLE 2

QA ANALYSES PERFORMED

SAMPLE ID	MATRIX	SAMPLE DATE	ANALYSIS
MW-SHM-96-5B-QA-99-02	WATER	11/2/99	VOC,METALS,CN, ANIONS,COD,BOD,ALK, HARDNESS,TDS,TSS
TRIP BLANK	WATER	11/2/99	VOC

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SHEPLEY'S HILL LANDFILL LONG TERM MONITORING DEVENS, MASSACHUSETTS NOVEMBER 2, 1999 SAMPLING EVENT

CHEMICAL QUALITY ASSURANCE REPORT No. E0776-021100

QA Findings

1. QA sample shipping and chain-of-custody deficiencies.

One shipment containing two QA water samples was received by Quanterra Environmental Services, West Sacramento, CA, on 3 November 1999. Proper sample handling protocols were followed for this shipment.

A copy of the chain-of-custody form document and cooler receipt form is appended to this report for reference.

2. Data comparison for volatiles (VOC) by Method 8260.

There were 47 volatile determinations. In seven of these determinations, target analytes were detected by one or both laboratories. There was overall agreement in 47 (100%) of the cases and quantitative agreement in seven out of seven (100%) of the cases. No major or minor data discrepancy were noted.

The QA laboratory's QC samples were within the acceptance limits for all of the target analytes and a complete evaluation was performed. The method blank and the trip blank were free of contamination above the laboratory's reporting limit for all of the target analytes. All of the samples, LCS/LCSD's, method blank, and trip blank surrogates recoveries were within the laboratory's acceptance limits. All of the LCS/LCSD's target analytes were also within the acceptance limits for accuracy and precision. The QA laboratory only spiked five of the target analytes into the LCS/LCSD. The QA laboratory was not requested to perform MS/MSD's and no evaluation of accuracy and precision due to matrix effects could be determined. All of the samples were analyzed within the required holding times. The QA laboratory's reporting limits were approximately five times lower than the primary laboratory.

The primary laboratory's QC samples contained all the necessary information and a complete evaluation was performed. The method blanks and the trip blanks were free of contamination above the laboratory reporting limit for all of the target analytes. The primary laboratory reported 4.8 J ug/L of 2-butanone in the equipment blank. The surrogates for both the samples and the laboratory's QC samples were all within the acceptance limits. The primary laboratory reported that the MS/MSD's performed on sample MW-SHL-19-99-0 were within the acceptance limits for all 84 target analytes for precision and eleven out of 168 target analytes

recoveries were outside the acceptance limits for accuracy. All of the target analytes in the LCS's were recovered within the acceptance limits, except in three out of 84 of the cases, one out of the 84 cases and five out of the 84 cases, for the three respective LCS's analyzed. All of the LCS outages were recovered above the acceptance limits and none of these target analytes were reported in any of the samples. All of the samples were analyzed within the required holding times.

The primary laboratory was also requested by the USACE project chemist, Marie Wojtas, to report the number of tentatively identified compounds (TIC's) found in each sample and report the findings in the case narrative. The primary laboratory reported that TIC's were detected in the following samples: MW-SHM-99-31C, MW-SHM-32X, MW-SHL-22C, MW-SHM-93-22C, MW-SHL-22B, MW-SHM-96-5B, MW-DUP, MW-EB, MW-SHM-96-5C, MW-SHM-93-10C, MW-SHL-11 and MW-SHL-20. The sample MW-SHM-96-5B was also the QA sample. The number of TIC's that were in each sample and their possible identification were not discussed in the case narrative.

3. Data comparison for TAL metals by Method 6010 and mercury by Method 7470.

There were 18 metals determinations. In 11 of these determinations, target analytes were detected by one or both laboratories. There was overall agreement in 15 (83.3%) of the cases and quantitative agreement in eight out of 11 (72.7%) of the cases. No major and three minor data discrepancies were noted.

The first minor data discrepancy occurred in sample MW-SHM-96-5B-QA-99-0 in which the QA laboratory reported chromium at 1.6 B ug/L and the primary laboratory reported 4.7 B ug/L. The second minor discrepancy occurred in sample MW-SHM-96-5B-QA-99-01 in which the QA laboratory reported thallium at 3.7 B ug/L and the primary laboratory reported < 0.90 ug/L.

The primary laboratory's QC data report contained all of the necessary QC information and a complete evaluation was performed. The method blanks were free of contamination above the reporting limit for all of the target analytes. The primary laboratory reported that the LCS recoveries were within the acceptance limits for all of the target analytes. The primary laboratory performed a matrix spike and a matrix duplicate on sample SHL-19-99-01. The matrix spike recoveries were all within the acceptance limits of 75-125%, except for selenium at 151%. The RPD's of the matrix duplicate were less than 20%, except for chromium, copper and thallium. All of the spike levels, percent recoveries and QC limits were appropriately indicated on all of the QC reports. All of the samples were analyzed within the required holding times.

The QA laboratory's QC data were within the acceptance limits for all the target analytes and a complete evaluation was performed. The method blanks were free of contamination above the reporting limits. The QA laboratory reported that the LCS/LCSD's were within the acceptance limits for both accuracy and precision. All of the spike levels, percent recoveries and QC limits were appropriately indicated on all of the QC reports. The QA laboratory reported all of the metals were analyzed by Method 6010 Trace-ICP, except for mercury, which was analyzed by Method 7470-Hg Cold Vapor. All of the samples were analyzed within the required holding times.

4. Data comparison for total cyanide by Method 9010B.

There was one cyanide determination. There was 100% overall agreement in that cyanide was not detected by either laboratory. No major or minor data discrepancies were noted.

The primary laboratory's QC data were within the acceptance limits for cyanide and a complete evaluation was performed. The method blank was free of contamination above the laboratory's reporting limit. The LCS's recovery was not reported. The matrix spike was recovered within the acceptance limits at 99.0%. The matrix duplicate and the original sample were reported below the laboratory's reporting limit. The sample was analyzed within the required holding time.

All of the QA laboratory's QC data were within acceptance limits and a complete evaluation was performed. The method blank was free of contamination above the laboratory's reporting limit. The LCS/LCSD's were within the acceptance limits for both accuracy and precision. The QA laboratory analyzed the sample by modified Method 9012A, instead of Method 9010B as indicated on the chain of custody. The sample was analyzed within the required holding time.

5. The data comparison for anions by Method 300.0.

There were four anion determinations. In two of these determinations, target analytes were detected by one or both laboratories. There was overall agreement in four (100%) of the cases and quantitative agreement in two out of two (100%) of the cases. No major or minor data discrepancies were noted.

The QA laboratory's QC data were all within the acceptance limits and a complete evaluation was performed. The method blanks were free of contamination above the reporting limit for all of the target analytes. The LCS/LCSD were within the acceptance limits for all of the target analytes for both accuracy and precision and the spiking levels were also indicated. The QA laboratory was not requested to perform a MS/MSD on any of the samples and no evaluation of accuracy or precision based on matrix effects could be made. All of the samples were analyzed within the required holding times.

The primary laboratory's QC data were all within the acceptance limits and a complete evaluation was performed. The method blanks were free of contamination above the reporting limit for all of the target analytes. The LCS recoveries were within the acceptance limits. The primary laboratory reported that the matrix spike and the matrix duplicate were within the

laboartory's acceptance limits, except for ortho phosphate which was recovered at 40% in the MS. All of the samples were analyzed within the required holding times.

6. Data comparison for COD by Method 410.4 and BOD by Method 405.1.

There was one COD and one BOD determination. In both the COD and BOD determinations, there was 100% overall and quantitative agreement. There were no major or minor data discrepancies noted.

The primary laboratory's QC samples were within the acceptance limits for all of the target analytes and a complete evaluation was performed. The method blank was free of contamination for both the COD and BOD results above the laboratory's reporting limit. The LCS recoveries for COD and BOD were both within the laboratory's acceptance limits. The primary laboratory did not report any MS/MSD's results. The samples were analyzed within the required holding times.

The QA laboratory's QC samples were within the acceptance limits for all of the target analytes and a complete evaluation was performed. The method blank was free of contamination above the reporting limit. The LCS/LCSD's were within the acceptance limits for both accuracy and precision. The QA sample was analyzed within the required holding times of 48 hours. The QA laboratory's contracted lab (CLS Labs) performed the BOD analysis.

7. The data comparison for alkalinity by Method 310.1.

There was one alkalinity determination. In this determination, there was 100% overall and 100% quantitative agreement. No major or minor discrepancies were noted.

The QA laboratory's QC samples were within the acceptance limit for alkalinity and a complete evaluation was performed. The method blank was free of contamination above the reporting limit. The QA laboratory reported that the LCS/LCSD's were within the acceptance limits for both accuracy and precision. There were no MS/MSD's performed for alkalinity and no evaluation of matrix effects could be determined. All of the samples were analyzed within the required holding times.

The primary laboratory's QC samples were all within the acceptance limit for alkalinity and a complete evaluation was performed. The method blank was free of contamination above the reporting limit. The primary laboratory reported that the LCS's were within the acceptance limits. The primary laboratory did not report a matrix duplicate result. All of the samples were analyzed within the required holding times.

8. Data comparison for total hardness by Method 130.2.

There was one hardness determination. In this determination, there was 100% overall and 100% quantitative agreement. No major or minor discrepancies were noted.

The QA laboratory's QC samples were within the acceptance limit for hardness and a complete evaluation was performed. The method blank was free of contamination above the laboratory's reporting limit. The QA laboratory reported that the LCS/LCSD's were within the laboratory's acceptance limits for both accuracy and precision. All of the samples were analyzed within the required holding times.

The primary laboratory's QC samples were within the acceptance limit for total hardness and a complete evaluation was performed. The method blank was free of contamination above the reporting limit. The primary laboratory reported that the LCS was within the laboratory's acceptance limits. The primary laboratory did not perform a MS/MSD or matrix duplicate sample. All of the samples were analyzed within the required holding times.

9. Data comparison for TDS by Method 160.1 and TSS by Method 160.2.

There was one TDS and one TSS determination. In the TDS determination, there was 100% overall and quantitative agreement. No major or minor data discrepancies were reported. In the TSS determination, there was 0% overall and quantitative agreement. One major data discrepancy was noted.

The major discrepancy was reported in sample MW-SHM-96-5B-QA-99-02 in which the QA laboratory reported TSS at 5.0 mg/L and the primary laboratory reported 44.6 mg/L.

The primary laboratory's QC samples were within the acceptance limits for all of the target analytes and a complete evaluation was performed. The method blanks for TDS and TSS were free of contamination above the laboratory's reporting limits. The LCS recoveries for TDS and TSS were both within the laboratory's acceptance limits. The primary laboratory did not report any MS/MSD sample results. The samples were analyzed within the required holding times.

The QA laboratory's QC data were within the acceptance limits for all of the target analytes and a complete evaluation was performed. The method blanks for TDS and TSS were free of contamination above the laboratory's reporting limits. The LCS/LCSD's were within the acceptance limits for both accuracy and precision. All of the samples were analyzed within the required holding times.

10. References.

a. Data Report for Shepley's Hill Landfill Long Term Monitoring, Devens, Massachusetts, prepared by Severn Trent Laboratories, dated 1 December 1999.

b. EM 200-1-6, Chemical Quality Assurance for Hazardous, Toxic and Radioactive Waste (HTRW) Projects, dated 10 October 1997.

APPENDIX A KEY TO COMMENTS ON DATA COMPARISON TABLES

0 - Data agrees if any one of the following apply:

- both values are less than respective detection limit (N<MDL)

- $N_1 < MDL_1$ and $N_2 > MDL_2$ but $< MDL_1^*$

- both values are above respective detection limit (N>MDL) and difference between two values satisfies conditions below

For all analyses in a water matrix and for metals analysis in soil: <2X difference

For **all** other **soil** analyses: <4X difference

1 - Minor contamination by laboratory contaminant

2 - Not tested by both laboratories

3 - Minor data discrepancy, disagreement not serious, if any one of the following apply:

- N_1 < MDL₁ and N_2 > MDL₂ and the difference between values N_2 * does not exceed the upper limit (described below) defining a minor data discrepancy

- both values are above respective detection limit (N>MDL*) and conditions described below apply to the difference between the two values

For all analyses in a water matrix and for metals analysis in soil: 2X<difference<3X

For **all** other **soil** analyses: 4X<difference<5X

4 - Major data discrepancy, disagreement serious, if any one of the following apply:

- $N_1 < MDL_1$ and $N_2 > MDL_2$ and the difference between values N_2 and MDL_1^* exceeds the limit (described below) defining a major data discrepancy

- both values are above respective detection limit (N>MDL*) and conditions described below apply to the difference between the two values

For all analyses in a water matrix and for metals analysis in soil: >3X difference For all other soil analyses: >5X difference MDL = Method Detection Limit
N = Analytical result
* - not all < values are MDLs. Values which are not MDLs will be noted.

Key to data qualifiers:

B - detected in method blank DO - Diluted out J - estimated value, above MDL but below practical quantitation limit NA - Not analyzed ND - Not detected NR - Not reported

APPENDIX B

DATA COMPARISON TABLES

Page 1 of 2

QA SAMPLE No.: QA FIELD ID: QA ANALYSIS DATE: QA LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD: G9K030197-001 MW-SHM-96-5B-QA-99-02 11/15/99 QUANTERRA 5030B 8260B CONTRACTORS SAMPLE No.: CONTRACTORS FIELD ID: CONTRACTOR'S ANALYSIS DATE: CONTRACTOR'S LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD: 402025 MW-SHM-96-5B-99-02 11/4/99 STL 5030B 8260B

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 11/2/99 UNITS: ug/L

PARAMETER	QA LAB LRL	RESULTS QA LAB	CONTRACTOR LRL	RESULTS CONTRACTOR	COMPARISON CODE
Diablazadi@uazamathana	< 1.0		< 5.0		
Chloromethane	< 1.0		< 5.0		0
Vinyl Chloride	- 1.0	0.62 I	< 5.0		0
Bromomethane	< 1.0	0.02 5	< 5.0		ů 0
Chloroethane	- 1.0	3.0	- 5.0	271	0
Trichlorofluoromethane	< 1.0	5.0	< 5.0	20.7.0	0
Acrolein	NR		< 5.0		2
Freen TF	NR		< 5.0		2
1 1-Dichloroethene	< 1.0		< 5.0		2
Acetone	< 2.0		< 5.0		0
Methyl lodide	NR		< 5.0		2
Carbon Disulfide	NR		< 5.0		2
Allyl Chloride	NR		< 5.0		2
Methylene Chloride	< 1.0		< 5.0		0
Acrylonitrile	NR		< 5.0		2
trans-1.2-Dichloroethene	< 1.0		< 5.0		2
1 2-Dichloroethene (total)	NR			3.0 J	2
Methyl-t-Butyl Ether	NR			1.5 J	- 2
1.1-Dichloroethane		2.4		2.6 J	0
Vinvl Acetate	NR	2	< 5.0		2
Chloropreue	NR		< 5.0		2
cis-1.2-Dichloroethene		2.8		2.9 J	-
2-Butanone	< 2.0	2.0	< 5.0	2	0 0
Projonitrile	NR		< 20		2
Methacrylonitrile	NR		< 5.0		- 2
Bromochloromethane	< 1.0		< 5.0		0
Tetrahydrofuran	NR		< 50		2
Chloroform	< 1.0		< 5.0		0
1.1.1-Trichloroethane	< 1.0		< 5.0		0
Carbon Tetrachloride	< 1.0		< 5.0		0
Isobutyl Alcohol	NR		< 250		2
Benzene		0.86 J		0.94 J	0
1,2-Dichloroethane	< 1.0		< 5.0		0
Trichloroethene	< 1.0		< 5.0		0
1,2-Dichloropropane	< 1.0		< 5.0		0
Methyl Methacrylate	NR		< 5.0		2
Dibromomethane	< 1.0		< 5.0		0
1.4-Dioxane	NR		< 250		2
Bromodichloromethane	< 1.0		< 5.0		0
2-Chloroethyl Vinyl Ether	NR		< 5.0		2
cis-1,3-Dichloropropene	< 1.0		< 5.0		0

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

Page 2 of 2

QA SAMPLE No.: QA FIELD ID: QA ANALYSIS DATE:	G9K030197-001 MW-SHM-96-5B-QA-99-02 11/15/99 OUANTERPA	CONTRACTORS SAMPLE No.: CONTRACTORS FIELD ID: CONTRACTOR'S ANALYSIS DATE:	402025 MW-SHM-96-5B-99-02 5/20/99 STI
EXTRACTION METHOD:	5030B	EXTRACTION METHOD:	5030B
ANALYSIS METHOD:	8260B	ANALYSIS METHOD:	8260B

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 11/2/99 UNITS: ug/L

PARAMETER	QA LAB LRL	RESULTS QA LAB	CONTRACTOR LRL	RESULTS CONTRACTOR	COMPARISO CODE
4-Methyl-2-pentanone	< 2.0		< 5.0		0
Toluene	< 1.0		< 5.0		0
trans-1,3-Dichloropropene	< 1.0		< 5.0		0
Ethyl Methacrylate	NR		< 5.0		2
1,1,2-Trichloroethane	< 1.0		< 5.0		0
Tetrachloroethene	< 1.0		< 5.0		0
2-Hexanone	NR		< 5.0		2
Dibromochloromethane	< 1.0		< 5.0		0
1,2-Dibromoethane	< 2.0		< 5.0		0
Chlorobenzene		0.36 J	< 5.0		0
1,1,1,2-Tetrachloroethane	< 1.0		< 5.0		0
Ethylbenzene	< 1.0		< 5.0		0
Xylene (total)	< 1.0		< 5.0		0
Styrene	< 1.0		< 5.0		0
Bromoform	< 1.0		< 5.0		0
Isopropylbenzene	NR		< 5.0		2
cis-1,4-Dichloro-2-butene	NR		< 5.0		2
1,1.2,2-Tetrachloroethane	NR		< 5.0		2
1.2.3-Trichloropropane	NR		< 5.0		2
trans-1,4-Dichloro-2-butene	NR		< 5.0		2
1,3-Dichlorobenzene	NR		< 5.0		2
1,4-Dichlorobenzene		1.3	< 5.0		0
1,2-Dichlorobenzene		0.16 J	< 5.0		· 0
1,2-Dibromo-3-Chloropropane	< 2.0		< 5.0		0
1,2,4-Trichlorobenzene	< 1.0		< 5.0		0
Hexachlorobutadiene	< 1.0		< 5.0		0
Naphthalene	< 1.0		< 5.0		0
2.2-Dichloropropane	< 1.0		< 5.0		0
1.1-Dichloropropene	< 1.0		< 5.0		0
1,3-Dichloropropane	< 1.0		< 5.0		0
Bromobenzene	NR		< 5.0		2
n-Propylbenzene	NR		< 5.0		2
2-Chiorotoluene	NR		< 5.0		2
4-Chlorotoluene	NR		< 5.0		2
1,3,5-Trimethylbenzene	NR		< 5.0		2
tert-Butylbenzene	NR		< 5.0		2
1,2,4-Trimethylbenzene	NR		< 5.0		2
sec-Butylbenzene	NR		< 5.0		2
4-Isopropyltoluene	NR		< 5.0		2
n-Butylbenzene	NR		< 5.0		2
1,2,3-Trichlorobenzene	< 1.0		< 5.0		0
SURROGATE RECOVERIES	(%) Q	A			PRIMARY
4-Bromofluorobenzene (70-130)) 10)1	Toluene-d8 (88-	110)	98
1,2-Dichloroethane-d4 (70-130) 10	ю	1,2-Dichloroetha	ane-d4 (72-141)	106
			D O - 1	(77 100)	

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

* = Surrogates outside of acceptable limits

QA SAMPLE No.: QA FIELD ID: QA ANALYSIS DATE: QA LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD: G9K030197-001 MW-SHM-96-5B-QA-99-02 11-(10+11)-99 QUANTERRA 3010A 6010B,Hg-7470A CONTRACTORS SAMPLE No.: CONTRACTORS FIELD ID: CONTRACTOR'S ANALYSIS DATE: CONTRACTOR'S LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD: 402025 MW-SHM-96-5B-99-02 11/16/99 STL 3010A 6010, Hg-7470

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 11/2/99 UNITS: ug/L

PARAMETER	QA LAB LRL	RESULTS QA LAB	CONTRACTOR LRL	RESULTS CONTRACTOR	COMPARISO CODE
Aluminum	NR		< 14.3		2
Antimony	< 10		< 2.7		0
Arsenic		2800		2700	0
Barium		51		51.6	0
Beryllium	< 5.0			4.8 B	0
Cadmium	< 5.0		< 0.30		0
Calciuum	NR			118000	2
Chromium		1.6 B		4.7 B	3
Colbolt		15 B		14.4 B	0
Copper	< 25			1.8 B	0
Iron		26100		26900	0
Lead	< 5.0		< 1.0		0
Manganese		13400		17000	0
Mercury	< 0.20	(11-15-99)	< 0.10 (11-	6-99)	0
Molybdenum		2.7 B		NR	2
Nickel		17 B		13.5 B	0
Potassium	NR			9680	2
Selenium	< 5.0		< 2.4		0
Silver	< 5.0		< 1.9		0
Thallium		3.7 B		8.3 B	3
Vanadium	< 50		< 1.5		0
Zinc		3.7 B		7.8 B	3

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

QA SAMPLE No.:	G9K030197-001	CONTRACTORS SAMPLE No.:	402025
QA FIELD ID:	MW-SHM-96-5B-QA-99-02	CONTRACTORS FIELD ID:	MW-SHM-96-5B-99-02
QA ANALYSIS DATE:	11/(10+11)/1999	CONTRACTOR'S ANALYSIS DATE:	11/19/99
QA LABORATORY:	QUANTERRA	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	9012A	ANALYSIS METHOD:	9010

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 11/2/99 UNITS: ug/L

PARAMETER	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Cyanide (CN)	< 10.0		< 10.0		0

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

1-

QA SAMPLE No.: QA FIELD ID: QA ANALYSIS DATE: QA LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD:

G9K030197-001 CONTRACTORS SAMPLE No.: 402025 MW-SHM-96-5B-99-02 MW-SHM-96-5B-QA-99-02 CONTRACTORS FIELD ID: 11/3/99 CONTRACTOR'S ANALYSIS DATE: NR QUANTERRA CONTRACTOR'S LABORATORY: STL, VT EXTRACTION METHOD: NA 300.0 ANALYSIS METHOD: 300.0

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 11/2/99 UNITS: mg/L

NA

PARAMETER	QA LAB LRL	RESULTS QA LAB	CONTRACTOR LRL	RESULTS CONTRACTOR	COMPARISON CODE
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		5440		55 5	0
Chloride, CL		54.4 Q		55.5	0
Chloride, CL Nitrate, as N	< 0.050	54.4 Q	< 0.2	55.5	0
Chloride, CL Nitrate, as N Othophosphate, as P	< 0.050 < 0.20	54.4 Q	< 0.2 < 0.2	55.5	0

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED Q=Elevated reporting limit due to high analyte level.

QA SAMPLE No.:	G9K030197-001	CONTRACTORS SAMPLE No .:	402025
QA FIELD ID:	MW-SHM-96-5B-QA-99-02	CONTRACTORS FIELD ID:	MW-SHM-96-5B-99-02
QA ANALYSIS DATE:	11/10/99	CONTRACTOR'S ANALYSIS DATE:	NR
QA LABORATORY:	QUANTERRA	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	410.4-COD	ANALYSIS METHOD:	410.1-COD

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 11/2/99 UNITS: mg/L

PARAMETER	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Chemical Oxygen Demand (COD)	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	21.5		20	0

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED
QA SAMPLE No.:	G9K030197-001	CONTRACTORS SAMPLE No.:	402025
QA FIELD ID:	MW-SHM-96-5B-QA-99-02	CONTRACTORS FIELD ID:	MW-SHM-96-5B-99-02
QA ANALYSIS DATE:	11/9/99	CONTRACTOR'S ANALYSIS DATE:	NR
QA LABORATORY:	CLS LABS	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	405.1	ANALYSIS METHOD:	405.1

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 11/2/99 UNITS: mg/L

PARAMETER	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Biological Oxygen Demand (5 Day)	< 3.0	ынан талан бай бай түүн үүн үүн үүн үүн байнан	< 2.0		0

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

QA SAMPLE No.: QA FIELD ID: QA ANALYSIS DATE: QA LABORATORY: EXTRACTION METHOD: ANALYSIS METHOD:	G9K030197-00 MW-SHM-96-5 11/8/99 QUANTERRA NA 310.1	1 B-QA-99-02 C	CONTRACTORS CONTRACTOR'S CONTRACTOR'S AN CONTRACTOR'S L EXTRACTI ANALY	SAMPLE No.: DRS FIELD ID: ALYSIS DATE: ABORATORY: ION METHOD: SIS METHOD:	402025 MW-SHM-96-5B-99-02 NR STL, VT NA 310.1
	MATERIAL DA	DESCRIPTION: W TE SAMPLED: 1 UNITS: 1	ATER 1/2/99 ng/L		
PARAMETER	QA LAB LRL	RESULTS QA LAB	CONTRACTOR LRL	RESULTS CONTRACTOR	COMPARISON CODE
Total Alkalinity as CaCC	03	395		336	0

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

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QA SAMPLE No.: G9K030197-001 CONTRACTORS SAMPLE No.: 402025 MW-SHM-96-5B-99-02 QA FIELD ID: MW-SHM-96-5B-QA-99-02 CONTRACTORS FIELD ID: QA ANALYSIS DATE: CONTRACTOR'S ANALYSIS DATE: 11/17/99 NR CONTRACTOR'S LABORATORY: QA LABORATORY: QUANTERRA STL, VT EXTRACTION METHOD: NA EXTRACTION METHOD: NA ANALYSIS METHOD: 130.2 ANALYSIS METHOD: 130.2

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 11/2/99 UNITS: mg/L

PARAMETER	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Total Hardness as CaCO3		360 Q		355	0

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

QA SAMPLE No.:	G9K030197-001	CONTRACTORS SAMPLE No.:	402025
QA FIELD ID:	MW-SHM-96-5B-QA-99-02	CONTRACTORS FIELD ID:	MW-SHM-96-5B-99-02
QA ANALYSIS DATE:	11/9/99	CONTRACTOR'S ANALYSIS DATE:	NR
QA LABORATORY:	QUANTERRA	CONTRACTOR'S LABORATORY:	STL, VT
EXTRACTION METHOD:	NA	EXTRACTION METHOD:	NA
ANALYSIS METHOD:	160.1 and 160.2	ANALYSIS METHOD:	160.1 and 160.2

MATERIAL DESCRIPTION: WATER DATE SAMPLED: 11/2/99 UNITS: mg/L

PARAMETER	QA LAB	RESULTS	CONTRACTOR	RESULTS	COMPARISON
	LRL	QA LAB	LRL	CONTRACTOR	CODE
Total Dissolved Solids (TDS by 160.1) Total Suspended Solids (TSS by 160.2)		502 5.0		542 44.6	0 4

SEE APPENDIX A FOR KEY TO COMMENTS NR=NOT REPORTED

APPENDIX C

SAMPLE RECEIPT & CUSTODY DOCUMENTATION

Chain of Custody Record



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APPENDIX G

GROUNDWATER ANALYTICAL DATA

3.5 inch diskette (not included in all reports)

APPENDIX H

REFERENCES

APPENDIX H

REFERENCES

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