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Date 21 August 2013

Subject: **Shepley's Hill Landfill Addendum to the Work Plan for LTMMP Update (Final Version)**
Contract Number W912WJ-10-D-0003, Delivery Order 0002

On behalf of the US Army Corps of Engineers (USACE) New England District and the Army BRAC Environmental Office at Devens, Sovereign is pleased to provide the following attachments:

1. CD
2. Addendum to the Work Plan for LTMMP Update (Final Version)

Please contact Bob Simeone or myself if there are questions regarding the attachments.

Sincerely,



Steven Passafaro, PE, LSP
Senior Project Manager

Enclosure: As noted above

FINAL



**ADDENDUM TO THE
WORK PLAN FOR
LONG-TERM MONITORING AND
MAINTENANCE PLAN UPDATE**

SHEPLEY'S HILL LANDFILL

FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MA

AUGUST 2013

**Prepared for:
US Army Corp of Engineers
New England District
Concord, Massachusetts**

**Prepared by:
Sovereign Consulting Inc.
Contract No.: W912WJ-10-D-0003
Delivery Order: 0002**





NOTICE

The United States Department of Defense, Department of Army, funded wholly or in part the preparation of this document and work described herein under Contract No. W912WJ-10-D-0003 and Delivery Order 0002. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Addendum to the Work Plan for Long-Term Monitoring and Maintenance Plan Update

FINAL

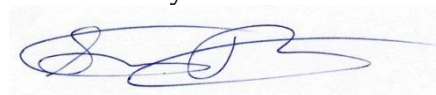
Devens, Massachusetts

August 2013

CERTIFICATION:

I hereby certify that the enclosed Report, shown and marked in this submittal, is that proposed to be incorporated with Contract Number W912WJ-10-D-0003 DO#0002. This Document has been prepared in accordance with USACE Scope of Work and is hereby submitted for Government Approval.

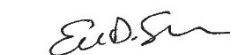
Reviewed By:



8/21/13

Sovereign Project Manager

Date



8/21/13

Sovereign Quality Control Manager

Date

Received By:

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USACE Project Manager

Date

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

As	Arsenic
ATP	Arsenic Treatment Plant
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Contaminant of Concern
COPC	Contaminants of Potential Concern
CQC	Contractor Quality Control
CSM	Conceptual Site Model
cy	Cubic Yard
DERP	Defense Environmental Restoration Program
Devens	Former Fort Devens
DOD	Department of Defense
DPT	Direct Push Technology
DO	Dissolved Oxygen
DQO(s)	Data Quality Objectives
ESD	Explanation of Significant Differences
FS	Feasibility Study
HASP	Health and Safety Plan
IDW	Investigation-Derived Wastes
LTM	Long Term Monitoring
LTMMMP	Long Term Monitoring and Maintenance Plan
LUC	Land Use Control
LUCIP	Land Use Control Implementation Plan
MassDEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAE	New England District
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NIA	North Impact Area
NTCRA	Non-Time Critical Removal Action
NTU	Nephelometric Turbidity Units
ORP	Oxidation-Reduction Potential
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Removal Action Objective
RI	Remedial Investigation
ROD	Record of Decision
SHL	Shepley's Hill Landfill
SOP(s)	Standard Operating Procedure
Sovereign	Sovereign Consulting Inc.
PPE	Personal Protective Equipment
USACE	United States Army Corp of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 INTRODUCTION

Pursuant to the Contract Modification for #W912WJ-10-D-0003 Task Order 0002, Sovereign Consulting Inc., on behalf of the US Army Corps of Engineers New England District (USACE-NAE) and the Army Base Realignment and Closure (BRAC) Environmental Office at Devens, has prepared this addendum to the May 2013 *Work Plan for Long-Term Monitoring and Maintenance Plan Update* to collect additional data for the evaluation of conditions within the North Impact Area (NIA) of the Shepley's Hill Landfill (SHL). The data collection and evaluation activities are being performed in an effort to address USEPA and MassDEP comments from 02 May 2013 and 15 May 2013, respectively.

Refer to **Figure 1** for the Site Locus Plan and **Figure 2** for a plan view of existing conditions in the area of the NIA and the SHL. The data collected through the implementation of this Work Plan will be incorporated into the 2013 SHL Annual Report; no separate data summary report will be prepared for the data collected.

The scope of work presented in this work plan addendum is consistent with the primary project goals from the May 2013 Work Plan. In addition, the following secondary project goals specific to this scope are presented as a supplement to the primary goals:

- Document the behavior of dissolved arsenic in the aquifer as it approaches Nonacoicus Brook;
- Further update the groundwater model and refine the conceptual site model (CSM) for the SHL and the NIA; and,
- Collect data for the installation of permanent monitoring wells to be incorporated into the LTMMP Update and the 2013 SHL Annual Report.

2.0 TECHICAL OBJECTIVES AND DATA COLLECTION

2.1 Scope and Purpose

The purpose of this work plan addendum is to present additional technical scope which will be utilized to document the behavior of dissolved arsenic in the aquifer as it approaches Nonacoicus Brook. The additional data collection suggestions presented to the Army by the USEPA and MassDEP on 15 May 2013 and 02 May 2013, respectively, were considered during the formulation of the scope of work for this addendum. The rationale for this proposed scope of work is provided in **Table 1**. The scope of work will include:

- A. North Impact Area Evaluation: The purpose of the NIA area evaluation is to measure dissolved arsenic and iron concentrations, oxidation-reduction potential (ORP), dissolved oxygen, and other geochemical parameters at select locations in the NIA to document dissolved arsenic concentrations in the aquifer north of the core dissolved arsenic impacted area as groundwater approaches Nonacoicus Brook.. These data will be incorporated into the 2013 Annual Report. Components of this evaluation include the completion of vertical arsenic profiling, permanent monitoring well installation, and monitoring well sampling and analysis, as detailed below:

1. Vertical Groundwater Profiling: Vertical groundwater profiling will be conducted at two select locations in the wetland area north/northeast of SHM-13-03 to profile dissolved arsenic and related geochemical conditions within the northern wetland area of the NIA to document the behavior of dissolved arsenic in the aquifer as it approaches Nonacoicus Brook. The proposed location of each vertical profiling point is detailed on **Figure 3**. Access to these locations is anticipated to require the placement of wood matting to prevent the drill rig from sinking into the wetland and assumes that the work will be completed when the Nonacoicus Brook is below flood stage.
 2. Monitoring Well Installation: Following profiling activities, permanent groundwater monitoring wells will be constructed at both vertical profiling locations. One location will be completed as a shallow/deep couplet well pair (SHM-13-14S/D) to measure vertical gradients, and the other will be completed as a monitoring well screened at the maximum arsenic concentration detected during the profiling (SHM-13-15). The screening intervals will be based upon the groundwater profiling results with the objective of monitoring zones of highest arsenic contamination. In addition, one monitoring well (SHM-13-07) will be installed along the profile transect recently completed in the Spring of 2013 along Old West Main Street per the request of USEPA. Screen depth will be set per previous USEPA correspondence (27 to 37 feet below grade).
 3. Monitoring Well Sampling: Groundwater samples will be collected from the newly installed monitoring wells and select existing monitoring wells and will be submitted for laboratory analysis of dissolved (field filtered) arsenic and geochemical parameters.
- B. Stream Gauging and Piezometer Hydraulics: To provide hydraulic interface elevation data between the groundwater and the brook, a piezometer was installed in Nonacoicus Brook north of SHM-13-03, and three staff gauges were installed at select locations within Nonacoicus Brook. Following installation and development, the piezometer will be sampled as part of monitoring well sampling activities at the newly installed wells detailed above.

Detailed information regarding the scope of services described above is outlined within this work plan.

2.2 Data Quality Objectives

This work plan addendum will address the scope of work as outlined in **Section 2.1** and is consistent with the primary data quality objectives (DQOs) from the May 2013 Work Plan. In addition, the following secondary DQOs specific to this scope are presented as a supplement to the primary DQOs:

1. NIA Evaluation
 - To collect spatial groundwater geochemical data at select locations in the northern wetland area of the NIA to establish permanent monitoring locations; and,

- To document the behavior of dissolved arsenic in the aquifer as it approaches Nonacoicus Brook.

2. Stream Gauging and Piezometer Hydraulics

- To provide hydraulic interface elevation data between the groundwater and the brook; and
- To collect additional hydrologic information for use in the refinement of the groundwater model.

2.3 NIA Evaluation

2.3.1 *Vertical Groundwater Profiling*

The objective of this scope is to advance two (2) groundwater vertical profiling points (SHM-13-14 and SHM-13-15) using direct push technology (DPT) or hollow stem auger (HSA) drilling techniques within the wetland area to the north/northeast of recently installed monitoring well SHM-13-03 as shown on **Figure 3** to profile dissolved arsenic and related geochemical conditions north of arsenic impacted groundwater in the NIA. The rationale for each location is provided in **Table 2**. Access to these locations is anticipated to require the placement of wood matting to prevent the drill rig from sinking into the wetland and assumes that the work will be completed when the Nonacoicus Brook is below flood stage.

Profiling will be completed in a similar fashion as that performed in the May 2013 Work Plan. Representative groundwater samples will be collected upon reaching groundwater surface and at 10-foot intervals thereafter through the aquifer until bedrock or refusal due to drilling conditions are reached. The collected samples will be field filtered using a 0.45- μ m filter and screened using an arsenic field testing kit with a split sample submitted for dissolved arsenic analysis to confirm and obtain accurate information of the actual arsenic concentrations. Due to a minimum 48-hour laboratory turnaround time for arsenic analysis, arsenic test kits will be utilized at these locations to limit drill rig mobilizations within the wetland area and to allow for the installation of a monitoring well at each location following completion of profiling activities. As demonstrated during the 2010 investigation within the NIA and as detailed within the August 2011 Supplemental Groundwater and Landfill Cap Assessment for Long-Term Monitoring and Maintenance Addendum Report (Sovereign, 2011), arsenic test kit data have correlated well with laboratory confirmation samples at SHL and confirmed that the temporary well screen construction depths were situated in zones of maximum arsenic impact.

At each profiling interval, groundwater will be purged for approximately 45 minutes using either a stainless steel bladder pump or a peristaltic/inertial pump, and select monitoring parameters will be recorded using a groundwater chemistry multi-meter with a flow-through cell, which will be properly calibrated at the beginning of each day and post-calibrated at the end of the day. The multi-meter will be used to monitor: dissolved oxygen, pH, temperature, specific conductivity, and ORP. A separate turbidity meter will be used to monitor turbidity. If, however, select intervals exhibit significant parameter variability, the purge time may be increased to up to one hour prior to sample collection.

2.3.2 *Monitoring Well Installation*

Following profiling activities at the two (2) proposed profiling locations, one location will be completed as a shallow/deep couplet well pair (SHM-13-14S/D) to measure vertical gradients, and the other will be completed as a monitoring well screened at the maximum arsenic concentration detected during the profiling (SHM-13-15). To reduce disruption to the wetlands, well installations will be completed using the same drill rig utilized during the profiling immediately following the completion of profiling activities at each location. In addition and due to the close agreement between direct push refusal depth and the depth to bedrock as confirmed with the rotosonic rig in the initial Spring 2013 investigation at the NIA, refusal depth and bedrock confirmation via the collection of a rock cores are not necessary and therefore will not be conducted at these locations.

At these two (2) groundwater profiling locations (SHM-13-14 and SHM-13-15), each well will be completed as a 1" to 2" diameter, schedule 40 PVC permanent groundwater monitoring. Each well will have 10 feet of 10 slot (0.010-inch) screen, and the screening interval will be based upon the arsenic profiling test kit results obtained during groundwater profiling activities with the objective of monitoring zones of highest arsenic contamination.

Based on the completed profiling and as requested in USEPA correspondence, one (1) additional monitoring well (SHM-13-07) will be installed along the profile transect recently completed in the Spring of 2013 along Old West Main Street. Due to the close agreement between direct push refusal depth and the depth to bedrock as confirmed with the rotosonic rig in the Spring 2013 investigation at the NIA, refusal depth and bedrock confirmation via the collection of a rock cores are not necessary and therefore will not be conducted at this location. This well will be completed as a two-inch diameter, schedule 40 PVC groundwater monitoring well installed with a screen depth set per previous USEPA correspondence (27 to 37 feet below grade). The proposed location of this well is detailed on **Figure 3**, and the rationale for this location is provided in **Table 2**.

In order to ensure a proper connection with the aquifer after drilling, each monitoring well will be developed no sooner than 48 hours after installation. The goal of the development effort is to eliminate, to the extent possible, the inflow of suspended particles in the well screen and ensure that during development, turbidity is reduced below 50 NTU. Monitoring well development will be conducted in accordance with the procedures outlined within the October 2001 USEPA Monitor Well Development standard operating procedure (SOP #2044)

2.4 *Stream Gauging and Piezometer Hydraulics*

To provide hydraulic interface elevation data between the groundwater and the brook, Sovereign installed one (1) piezometer (SHP-13-03) in the brook north of SHM-13-03. The piezometer was constructed with a stainless steel drive screen and riser pipe advanced approximately 4 feet below the stream base. Following installation, the piezometer will be developed per the October 2001 EPA *Monitor Well Development SOP* (SOP 2044, Revision 1).

In addition, Sovereign installed three (3) staff gauges (SHSG-13-01G through -03G), of which two (2) were located in the area of SHP-07-03E and SHP-13-03. Each staff gauge was affixed to a

standpipe (in the case of the stream gauges near SHP-07-03E and SHP-13-03, they were affixed to the standpipes for those piezometers) and driven at least 4 feet below the brook stream base. Following installation, a minimum of two (2) water level readings will be collected from the staff gauges during the Summer of 2013 for inclusion within the groundwater model.

2.5 Survey Activities

Following the installation of the proposed wells, stream gauges, and piezometer, the horizontal location and top of casing elevation of each newly installed well, piezometer, and stream gauge will be surveyed horizontally to the Massachusetts State Plan Coordinate System using the World Geodetic System of 1984 and vertically on NAVD 1988 datum. As requested by the USEPA on June 26, 2013, existing wells SHL-12, SHL-17, and SHL-25 will be included in the survey. Following the survey, the location information will be imported into GIS.

2.6 Groundwater Monitoring

2.6.1 Newly Installed Wells and Piezometer

After installation and development, the newly installed couplets/wells (SHM-13-07, SHM-13-14S/D, and SHM-13-15) and the newly installed piezometer (SHP-13-03) will be sampled in accordance with the January 2010 USEPA Region I Low-Stress/Low-Flow groundwater sampling guidance document (SOP #EQASOP-GW 001). Prior to groundwater sampling, the newly installed couplets/wells and piezometer will be gauged to obtain water level information at each location. The groundwater samples will be submitted for laboratory analysis of dissolved (field filtered) arsenic, calcium, sulfate, total alkalinity, magnesium, manganese, sulfide, dissolved iron, sodium, ammonia, nitrate/nitrite, dissolved organic carbon, potassium, and chloride.

At each monitoring well, groundwater will be purged using either a stainless steel bladder pump or a peristaltic/inertial pump, and select monitoring parameters will be recorded using a groundwater chemistry multi-meter with a flow-through cell, which will be properly calibrated at the beginning of each day and post-calibrated at the end of the day. The multi-meter will be used to monitor: dissolved oxygen, pH, temperature, specific conductivity, and ORP. A separate turbidity meter will be used to monitor turbidity.

2.6.2 Additional Monitoring

During the Spring 2013 investigation in the NIA, SHM-13-01 was inaccessible due to high water and flooding from Nonacoicus Brook, and a groundwater sample could not be collected from this well. At the time of sample collection, the level of the brook was higher than the top of the SHM-13-01 standpipe. Consequently, SHM-13-01 will be sampled concurrently with the newly installed wells in accordance with the January 2010 USEPA Region I Low-Stress / Low-Flow groundwater sampling guidance document (SOP #EQASOP-GW 001). The groundwater sample will be submitted for laboratory analysis of dissolved (field filtered) arsenic, calcium, sulfate, total alkalinity, magnesium, manganese, sulfide, dissolved iron, sodium, ammonia, nitrate/nitrite, dissolved organic carbon, potassium, and chloride.

2.7 Quality Assurance / Quality Control Procedures

All sampling equipment must be properly decontaminated prior to sample collection, between sampling locations, and following a sampling event. Decontamination of equipment is necessary to prevent cross-contamination between samples. In addition, rust should be removed from any part of the sampling equipment that may contact the sample. All hand augers, shovels, and equipment which contact the sample will be decontaminated. Decontamination will occur between individual sampling locations, but not within composite sampling locations. USEPA Region 1 Decontamination SOP No. 2000 is used as a guideline for this procedure. Decontamination chemicals (i.e. nitric acid or methanol) will be collected and containerized for off-site disposal.

Specifically, decontamination of equipment used during the scope of work will be conducted as follows:

- All down-hole drilling equipment will be decontaminated prior to initial use and between each borehole. Equipment will be decontaminated at the sample location, or at a pre-designated, controlled location. All equipment will be decontaminated before leaving the site.
- Drilling equipment that will be decontaminated includes drill bits, drill-string tools, drill rods, tremie pipes, clamps, hand tools, steel cable, along with pump drop-lines and pumps. These items will be cleaned, by the subcontractor, using a steam pressure washer.
- Sampling equipment that will be decontaminated will include the water level and water quality meters, pumps and pump equipment, and miscellaneous tools. All items will be cleaned using the method detailed within the Sampling Equipment Decontamination Standard Operating Procedure (SOP).
- Heavily soiled equipment will be washed a second time using an aqueous non-phosphate detergent solution and a portable, high pressure steam cleaner.
- Field duplicates, matrix spikes, matrix spike duplicates and field rinsate blank samples will be collected to provide Quality Control (QC) of sampling efforts.

3.0 SAMPLE CHAIN-OF-CUSTODY, DOCUMENTATION, AND SAMPLE SHIPMENT

The Chain-of-Custody, sample documentation, and sample shipment procedures will be completed in a similar fashion as that performed in the May 2013 Work Plan. Please refer to the May 2013 Work Plan for specific details.

4.0 INVESTIGATION-DERIVED WASTES

Drill cuttings generated during sampling activities will be returned to the ground at the point of collection, consistent with USEPA and Massachusetts Department of Environmental Protection (MassDEP) requirements. Decontamination fluids containing methanol or nitric acid will be

containerized, labeled, sealed with a custody seal, and removed for disposal per applicable hazardous and/or non-hazardous waste generation procedures.

5.0 CONTRACTOR QUALITY CONTROL AND CORRECTIVE ACTION

The contractor quality control and corrective action procedures will be completed in a similar fashion as that performed in the May 2013 Work Plan. Please refer to the May 2013 Work Plan for specific details.

6.0 PROPOSED SCHEDULE

Based on the proposed scope of work outlined in previous sections, implementation is anticipated to follow the approximate schedule dates:

<i>Date</i>	<i>Event</i>
June 2013	Installation of stream gauges and piezometer
August-September 2013	Field Data Collection Activities for the NIA
September 2013	Submission of Draft LTMMP Update
2014	Submission of 2013 Annual Report

A field data collection activity schedule will be provided prior to the implementation of the field work.

7.0 REFERENCES

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USEPA 1994b. Emergency Response Team. *Sampling Equipment Decontamination*, SOP No. 2000, Revision 0. September.

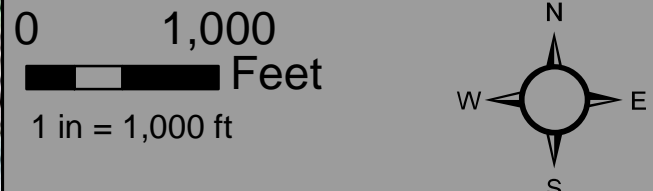


FIGURES



FIGURE 1 SITE LOCUS

FORT DEVENS
AYER, MASSACHUSETTS



Legend

 APPROXIMATE SITE BOUNDARY

NOTES AND SOURCE INFORMATION:
TOPO: 2009 NATIONAL GEOGRAPHIC SOCIETY, i-cubed
IMAGERY:ESRI, i-cubed, USDA FSA, USGS, AEX,
GEO EYE, GETMAPPING, AEROGRIID, IGP

DECEMBER 2010 ROV

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TABLES

Table 1
Technical Objectives and Approach for Proposed Activities
Shepley's Hill Landfill
Devens, Massachusetts

Scope of Work	Hypothesis	Data Gaps	Technical Approach
I Profiling & Well Installation Activities			
A. Proposed - To install additional monitoring wells to address data gaps north/northeast of SHM-13-03 in the northern wetland area of the NIA.	The arsenic impacted area north of the capture zone has been evaluated during previous investigations in 1999, 2001, 2007, 2010, and 2013. The impacted area has stable limits and has been delineated.	Permanent monitoring locations at Nonacoicus Brook in the area north of previously identified arsenic impacted groundwater in the northern wetland area of the NIA.	Install profiling points at proposed locations, dependent upon field conditions and access. Extend to bedrock and collect groundwater samples by intervals. Complete as permanent wells at select locations based on profile results.
B. Eliminated - The installation of profiling points/wells at SHM-10-17 and SHM-10-27.	SHM-10-17 is located between existing well SHM-13-03 and proposed well SHM-13-07, and SHM-10-27 is located between existing well SHM-13-08 and proposed wells SHM-13-14S/D and SHM-13-15. Given the consistency of the plume from 2001 through 2013, a well at these locations would not result in any information different from that collected previously or proposed. Vertical gradients along the southern portion of the wetlands will be monitored by the installation of a couplet well at SHM-13-14S/D.		
II Bedrock Evaluation (Top of Rock)			
A. Eliminated - The collection of additional information to evaluate the top of rock at points SHM-13-07, SHM-13-14, and SHM-13-15.	Due to the close agreement between direct push refusal depth and the depth to bedrock as confirmed with the rotosonic rig in the initial Spring 2013 investigation at the NIA, refusal depth and bedrock confirmation via the collection of a rock cores are not necessary and therefore will not be conducted at these locations.		
III Stream Gauging and Piezometer Hydraulics			
A. Proposed - To install one piezometer in the area of SHM-13-03 and three stream gauges along Nonacoicus Brook.	Hydraulic interface elevation data between the groundwater and the brook will be used in the refinement of the groundwater model and CSM.	Permanent loations for the collection of hydraulic interface elevation data between groundwater and Nonacoicus Brook do not exist north of the arsenic impacted area.	The piezometer will be constructed with a stainless steel drive screen and riser pipe advanced approximately 4 feet below the stream base. Each staff gauge will be affixed to a standpipe and driven at least 4 feet below the brook stream base.
IV Surface Water and Sediment Sampling			
A. Eliminated - The collection of additional surface water/sediment samples from target areas along Nonacoicus Brook.	Significant surface water and sediment sampling has been conducted throughout the study area of Nonacoicus Brook in 2001 and again in 2007. Given the consistency of the groundwater profiling data collected in 2010 and 2013 with the profiling data collected in 2001 and 2007, there is no reason not to believe that the 2001 and 2007 surface water and sediment sampling data are representative of the arsenic conditions in these media at the brook. Should arsenic be found at shallow depths during this profiling work at a concentration that suggest arsenic discharge into the brook, up to two surface water and sediment samples may be collected in the area between SHW-07-04 and SHW-01-05X to supplement the 2001 and 2007 data sets.		

Table 2
Technical Objectives for Proposed Profiling and Monitoring Well Locations
Shepley's Hill Landfill
Devens, Massachusetts

Proposed Location	Objective	Hypothesis	Technical Approach
SHM-13-07	To install a permanent monitoring location at the core of arsenic impacted groundwater along West Main Street.	A permanent monitoring location within the core of arsenic impacted groundwater between the existing LTM wells on Sculley Road and Nonacoicus Brook will provide data to monitor arsenic concentrations.	Install monitoring well at previously profiled location with the screen depth (27 to 37 feet below grade) based on profile results and input from EPA in their correspondence dated 2 May 2013.
SHM-13-14S/D	To establish a shallow and deep pair of permanent monitoring wells located north of SHM-10-27.	Historic profiling data has indicated that arsenic impacted groundwater is located south to southwest of the wetland area. A permanent shallow and deep monitoring location in the southern portion of the wetland will monitor arsenic impacted groundwater across two zones as it enters the wetland area.	Install profiling point, extend to bedrock, and collect groundwater samples by intervals. Complete as permanent wells with the screen depth based on profile results.
SHM-13-15	To establish a permanent monitoring well near Nonacoicus Brook in the northern wetland area of the NIA.	Historic profiling data has indicated that arsenic impacted groundwater is located south to southwest of the wetland area. A permanent monitoring location at Nonacoicus Brook in the wetland will monitor the quality of groundwater as it approaches the brook.	Install profiling point, extend to bedrock, and collect groundwater samples by intervals. Complete as permanent well with the screen depth based on profile results.



APPENDIX A

**Response to 5 August USEPA Comments on the
DRAFT ADDENDUM TO THE WORK PLAN FOR LTMMP UPDATE
SHEPLEY HILL LANDFILL
Former Fort Devens Army Installation
July 2013**

Comment 1 - EPA concurs with the groundwater profiling locations of SHM-13-14 and SHM-13-15. However, although EPA believes collecting profiling data at these locations would provide useful information for the delineation of the plume in the area of the wetland and brook, EPA cautions that these locations may not be ideal locations for long-term monitoring points. EPA is concerned that these locations may encounter long-term issues for access and data reliability, as these areas may be subject to flooding and these areas may be submerged at times of the year when water levels in the brook are high. There are methods to mitigate these concerns, but even with adequate well construction to accommodate these issues, the wells may still have long-term maintenance concerns. EPA does favor the SHM-13-14 location and sees value in a couplet in this area. Possibly, Army can evaluate available data on the flooding levels in this area and move forward with the placement of a well couplet in this area attempting to place the well where it will not be submerged at high-water events and/or employing well construction methods to mitigate these potential issues. Further, EPA's preference for the setting of the deep screen at the SHM-13-14 location would be to await the laboratory arsenic data, as we lose the ability to discriminate arsenic levels in the high range when relying on the arsenic test kit data, but we acknowledge Army's need to limit mobilizations in this area. EPA suggests deferring a well at SHM-13-15 at this point.

Response: Based on both MassDEP requests and the available As data at SHM-13-03 and in consideration of the As data collected at SHM-10-17 and SHM-10-18 in 2010, Army intends to proceed with the installation of the monitoring point at SHM-13-15. Army acknowledges that both locations present logistical challenges in terms of access to complete the profiling and install and maintain the wells. Army intends to construct the wells with full grout seals to the surface and solid pipe risers to elevations above routine flood levels. In order to limit mobilizations and placement of matting to this area for the well installations, Army intends to utilize field test kits to avoid multiple mobilizations to this area. However, Army will attempt to obtain laboratory data in an expedited fashion from the deep screen location at SHM-13-14 by advancing that boring first. The shallow screen at SHM-13-14 and the screen for SHM-13-15 will be set based on the field test kit data, however to avoid two mobilizations of drilling equipment to this area.

Comment 2 - With respect to the permanent wells to be installed at SHM-13-07 and SHM-13-13, EPA concurs with the proposed well at SHM-13-07 consistent with our recommendations in our email of May 2, 2013. However, our recommendation for a well at SHM-13-13 in our May 2, 2013 email was prior to the profiling at this location. EPA was recommending a well at either SHM-13-11 or SHM-13-13 based on the yet to be collected profiling data to bound the plume to the west. However, the profiling data at these locations did not show elevated arsenic and the other geochemical data at these locations do not

indicate plume impacts in this area. Although there is still value in considering this location as a 'sentry' well, there is other well coverage to the northwest of that location. Further, in light of MassDEP's comments, EPA would be amenable to deferring a long-term monitoring well at SHM-13-13.

Response: Army concurs that a new well at location SHM-13-13 is not likely to provide any new data to further our understanding of the nature and extent of As in this area and therefore will omit this location from the workplan. However, Army continues to disagree with MassDEP's comments regarding the necessity of replacement wells at DEP-08-03/SHM-10-17 and DEP-08-03/SHM-10-27 in that consistency of the data from investigations in the NIA conducted in 2001, 2007, 2010, and recently in 2013 all point to the stability of As concentrations in groundwater in the NIA. Therefore, new wells at these locations are simply going to provide similar As concentration data to that collected by Army in 2010. Core impact monitoring wells along West Main Street coupled with SHM-13-03 and the planned wells at SHM-13-14 and SHM-13-15 part of this work plan are expected provide a complete picture of As in this area.

Comment 3 - If Army accepts our comments, possibly the planned well at SHM-13-15 and SHM-13-13 could be 'traded' for 1-2 additional well screens in the area of SHM-10-27 and/or SHM-10-17.

Response: Army does not concur that there are adequate data quality objectives for the installation of wells at location SHM-10-27 or SHM-10-17, per our response to Comment 2, above.

Comment 4 - Clarify whether the SHP-07-01 series peizometers are still viable for the collection of samples.

Response: Based on field reconnaissance in 2013, SHP-07-01D appears present. SHP-07-01DS and SHP-07-01DD were not located. Army has not recently opened SHP-07-01D to assess the viability of sample collection; however, the point appears to be in good condition and is likely able to be sampled. Army notes this location is near to the existing monitoring well SHM-10-01 which was profiled in 2010. Dissolved As concentrations during the 2010 effort from the water table to refusal depth were all less than 1 ug/L. The maximum dissolved As concentration detected in groundwater samples to date from monitoring well SHM-10-01 was 7.87 ug/L from September 2010. Data from SHP-07-01D would be expected to be similar to the data collected from the profile and permanent well at SHM-10-01.

Comment 5 - EPA supports that additional surface water and sediment samples will need to be collected following the evaluation of the data from this supplemental work plan effort to evaluate potential plume impacts to the brook in the area of likely plume discharge.

Response: Army notes that if profiling and sampling data from SHM-13-14 and SHM-13-15 locations do not show elevated As at shallow depths and/or an upward gradient, then

new surface water and sediment samples would not need to be collected and surface water and sediment samples collected from 2001 and 2007 would be consistent with and representative of conditions in these media. Should elevated As be detected in shallow groundwater and or detected in deeper groundwater coupled with a strong upward gradient, Army concurs that additional targeted surface water and sediment samples may be required in this area.

Comment 6 - With respect to the schedule for the Draft LTMMP Update, EPA acknowledges that this supplemental data may not be available for inclusion and consideration in the Draft Report. Other elements, such as the model update, may also not be complete at the time of the Draft LTMMP Update. However, significant additional data from the recent field efforts is available for evaluation and consideration in the planned Draft LTMMP Update. As such, EPA believes it is best to proceed with the preparation of the Draft LTMMP Update document under the current schedule, with the recognition that the document will be updated, as appropriate, as new data becomes available. EPA is willing to discuss the schedule with the Army.

Response: Army concurs.

**Response to 25 July 2013 MassDEP Comments on the
DRAFT ADDENDUM TO THE WORK PLAN FOR LTMMP UPDATE
SHEPLEY HILL LANDFILL
Former Fort Devens Army Installation
July 2013**

Comment 1 - Section 1.0: Please explain how the LTMMP will be updated in September 2013 if the data acquired under the workplan addendum will not be submitted before the 2013 annual report is submitted (~May 2014).

Response: *The LTMMP will be updated based on the work completed as part of this investigation prior to the submittal of the LTMMP; however, portions of the work and/or data will not be back in time for analysis and inclusion into the Draft LTMMP. All of the data collected as part of this effort will be provided in the 2013 Annual Report scheduled for submittal in 2014. Profiling data collected from Spring 2013 efforts have been submitted to the regulators. Spring LTMMP groundwater sampling data will be submitted in August 2013 to the regulators. These new data will be evaluated as part of the LTMMP update; however these data are not expected to significantly change the LTM network to be proposed in the NIA/Nonacoicus Brook area.*

Comment 2 - Sections 1.0 and 2.1: MassDEP assumes "...the behavior of dissolved arsenic in the aquifer as it approaches Nonacoicus Brook..." refers to the groundwater flowpaths by which dissolved arsenic migrates in the region between W. Main Street and Nonacoicus Brook. A reliable determination of these flowpaths is essential for the LTMMP update. In particular, it is essential to determine if the arsenic plume extends to the brook and/or adjacent wetlands.

Response: *Comment noted.*

Comment 3 - Section 2.3.1: To reduce the possibility of inconclusive profile results, MassDEP recommends that hydraulic control points be established in the upland area between West Main Street and Nonacoicus Brook before selecting the wetland profiling locations. Water level measurements from the upland area could then be combined with measurements from planned and existing control points to extend hydraulic control from West Main Street to the immediate vicinity of the wetland and brook. A more reliable extrapolation of vertical and horizontal flow directions beneath the wetland and brook would then be possible. To accomplish this, MassDEP recommends installation of the following upland control points: (1) a plume monitoring well at profile location 10-17 (also can be used to monitor plume core stability) and (2) a plume monitoring well and water table piezometer at profile location 10-27 (can also use well to monitor plume core stability).

Response: *There is approximately 300 feet of distance between SHM-13-03 and SHM-13-07. The location referenced by MassDEP in this comment is approximately 100 feet south of SHM-13-03 and 200 feet north of SHM-13-07. Considering the overall scale of the site and the arsenic impacted area, a well located in between these two points would not add any pertinent hydraulic information to this assessment. Further, the spring 2013 data collected along West Main Street*

mirrors in large part the 2001 profiling effort (see SHX-series data). It is important to note the high degree of consistency between the data collected in 2001, 2007, 2010 and 2013, suggesting a high degree of consistency of arsenic concentration over this 12 year time frame. There exists profiling data from 2010 at the locations SHM-10-17 and SHM-10-27 which can be used to represent the current arsenic concentration in these areas with a high degree of confidence, making the installation of additional monitoring wells unnecessary. Further, the location at SHM-10-27 is only 140 feet from SHM-13-08 and would not result in any additional pertinent hydraulic information. Likewise, the arsenic concentrations documented at this location in 2010 can be used with a high degree of confidence in evaluating the current arsenic concentration at this location.

Comment 4 - Table 1: MassDEP disagrees with the conclusion that installing wells and piezometers at upland profile locations 10-17 and 10-27 "...would not result in any information different from that collected previously or proposed...". As explained in the preceding comment, the lack of monitoring points in this area is a significant data gap.

Response: Army does not concur that there is a sufficient data quality objective for new wells at these locations. Please refer to the response under Comment #3 above.

Comment 5 - Table 1: To ensure that surface water and sediment samples are collected from potential plume discharge areas, surface water and sediment sampling can be deferred until the potential pathways between the plume and the wetland and brook have been assessed. Regarding the results from previous samples, it is not yet known whether any of those samples, which were separated by hundreds of feet in the area of interest, were collected at locations where groundwater from the plume discharges to brook. In addition, none of the samples were collected from the wetland area located immediately downgradient of the core of the plume. Thus, until groundwater flowpaths are determined, the previously collected samples are insufficient to rule out the possibility of unacceptable risk to wetland and brook receptors.

Response: At this time there are no data collected (inclusive of work completed in 2001, 2007, 2010 and 2013) in the NIA area that suggests that the previously collected surface water and sediment samples previously collected are not representative of conditions in these media along the stretch of Nonacoicous Brook in the study area. Nineteen discrete locations were sampled along the reach of the river inclusive of the 2001 and 2007 work. These Samples collected at SHW-01-07X, SHW-07-04 and SHW-01-06X were collected specifically in the study area of this workplan addendum. Further, profiling data collected to date continues to suggest that As impacted groundwater remains at depth, 10's of feet below the brook elevation. Finally, as noted in Army's response to EPA Comment 2, and MassDEP Comment 3, there is a high degree of As consistency in data collected in the NIA over the past 12 years. As such, the previously collected data and previously conducted risk assessments remain valid. Per Army's response to USEPA Comment 5, new surface water and sediment samples will be collected only if the results from SHM-13-14 and SHM-13-15 document elevated concentrations of As at shallow depths suggestive of a local discharge to the brook and/or if As is detected at depth in conjunction with a high vertical gradient suggesting that the As may be reaching the base of the brook. The necessity of additional surface water/sediment samples and their associated data quality objectives can be discussed following collection of the data from SHM-13-14 and SHM-13-15.

**Response to 2 August 2013 PACE Comments on the
DRAFT ADDENDUM TO THE WORK PLAN FOR LTMMP UPDATE
SHEPLEY HILL LANDFILL
Former Fort Devens Army Installation
July 2013**

Comment 1 – The Work Plan Addendum does not provide a discussion of the rationale for the location of the permanent monitoring wells. Because the wells are intended to be used for long-term monitoring of arsenic in the North Impact Area (NIA), the rationale for their location should be documented.

Response: Table 1 of the Work Plan Addendum provides a discussion of the rationale for the location of the wells and the potential data gaps they intend to fill.

Comment 2 – Groundwater monitoring data indicate that the arsenic in the downgradient portions of the NIA is migrating primarily to the north. This appears inconsistent with the prevailing understanding that groundwater flow turns sharply westward in the vicinity of the Brook. The proposed locations of monitoring wells SHM-14S, SHM-14D, and SHM-13-15 appear to be east of the center of mass of the arsenic plume, and therefore these wells may be of limited usefulness as long-term monitoring wells. If groundwater flow turns westward in down-gradient portions of the NIA, these wells could lie outside of the arsenic plume. We therefore recommend that the installation of long-term monitoring wells be deferred until a better understanding of groundwater flow and arsenic transport in the NIA is obtained. We recommend that the focus of the Work Plan be modified to provide additional data on horizontal and vertical groundwater flow in the area between West Main Street and the wetland.

Response: The data collected inclusive of all sampling between 2001 and 2013 document that the impacted groundwater occurs in a north-south band bound to the west by locations with very low As concentrations (SHM-13-11, SHM-13-13, SHZ-01-11X, SHM-13-12, SHM-10-01, SHM-13-02 and SHM-10-26 and SHM-10-10). These eight wells/profile points provide a definitive downgradient edge of impact area in this direction. As Army has noted previously, the presence/absence of arsenic is influenced primarily by oxidation-reduction geochemistry and only secondarily by groundwater flow direction. Therefore, Army cautions against any interpretation of the fate and transport of arsenic at SHL or in the NIA based on a review of groundwater flow as a primary indicator or predictor of the fate of As in the aquifer. The impacted groundwater exists between profile points SHM-10-21 and SHM-10-25, supported by data collected at SHM-13-03. The proposed wells for this workplan addendum are situated in the wetland to the north of this band of impact and were sited primarily at the request of MassDEP upon review of the 2013 profile and sampling results which indicate that the As impacts are trending north.