FINAL
REMOVAL ACTION WORK PLAN
FORMER PISTOL RANGE AND LHAAP-04
FORMER PILOT WASTEWATER TREATMENT PLANT, GROUP 4
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Shaw®

ON THE LINE

AUGUST 2009

Shaw® Shaw Environmental, Inc.

Date: August 3, 2009

*Project No.:*117591

TRANSMITTAL LETTER:

To: Mr. Aaron Williams

Address: US Army Corps of Engineers - Tulsa
CESWT-PP-M
1645 South 101st East Ave
Tulsa, Oklahoma 74128

Re: Final Removal Action Work Plan Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas, August 2009

Contract No. W912QR-04-D-0027/DS02

For: Review ____ As Requested ____ Approval ____ Corrections ____ Submittal ____ Other X ____

Item No:	*No. of Copies*	*Date:*	*Document Title*
1	2	August 2009	**Final Removal Action Work Plan Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4** Longhorn Army Ammunition Plant, Karnack, Texas

Aaron – Enclosed please find two copies of Shaw's final version of the above-named document.

The document has been distributed according to the list below. Please call if any questions or comments.

Sincerely:

Praveen Srivastav
Project Manager

CC: Distribution List:
J. Lambert/S. Fiehler – USACE, Tulsa (sent to A. Williams for distribution)
M. Mechenes – AEC
R. Zeiler – BRAC-LHAAP
S. Tzhone – EPA Region 6 (2)
F. Duke – TCEQ, Austin (2)
D. Vodak – TCEQ, Tyler
P. Bruckwicki –U.S. Fish and Wildlife Service

3010 Briarpark Drive, Suite 400, Houston, Texas 77042 Phone: (713) 996-4522/Fax: (713) 996-4436

DEPARTMENT OF THE ARMY
LONGHORN ARMY AMMUNITION PLANT
POST OFFICE BOX 220
RATCLIFF, AR 72951

August 3, 2009

DAIM-ODB-LO

Mr. Stephen Tzhone
US Environmental Protection Agency
Superfund Division (6SF-AT)
1445 Ross Avenue
Dallas, TX 75202-2733

Re: Final Removal Action Work Plan Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas, August 2009

Dear Mr. Tzhone,

The above-referenced document is being transmitted to you for your review. The document has been prepared by Shaw Environmental, Inc. (Shaw) on behalf of the Army as part of Shaw's performance based contract for the facility.

The point of contact for this action is the undersigned. I ask that Praveen Srivastav, Shaw's Project Manager, be copied on any communications related to the project. I may be contacted at 479-635-0110, or by email at rose.zeiler@us.army.mil.

Sincerely,

Rose M. Zeiler, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
F. Duke, TCEQ, Austin, TX
D. Vodak, TCEQ, Tyler, TX
P. Bruckwicki, Caddo Lake NWR, TX
J. Lambert/S. Fiehler, USACE, Tulsa District, OK
A. Williams, USACE, Tulsa District, OK
M. Mechenes, USAEC, MD
P. Srivastav, Shaw – Houston, TX (for project files)

DEPARTMENT OF THE ARMY
LONGHORN ARMY AMMUNITION PLANT
POST OFFICE BOX 220
RATCLIFF, AR 72951

August 3, 2009

DAIM-ODB-LO

Ms. Fay Duke
Texas Commission on Environmental Quality
TCEQ Environmental Cleanup Section I, Team 2, MC-136
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Final Removal Action Work Plan Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas, August 2009
SUP 126

Dear Ms. Duke,

The above-referenced document is being transmitted to you for your review. The document has been prepared by Shaw Environmental, Inc. (Shaw) on behalf of the Army as part of Shaw's performance based contract for the facility.

The point of contact for this action is the undersigned. I ask that Praveen Srivastav, Shaw's Project Manager be copied on any communications related to the project. I may be contacted at 479-635-0110, or by email at rose.zeiler@us.army.mil.

Sincerely,

Rose M. Zeiler, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
S. Tzhone, USEPA Region 6, Dallas, TX
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M. Mechenes, USAEC, MD
A. Williams, USACE, Tulsa District, OK
P. Srivastav, Shaw, Houston, TX (for project files)

Comments on Draft Final Removal Action Work Plan (published May 2009)
Former Pistol Range and LHAAP-04 Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

July 2009

Reviewer: Stephen Tzhone, USEPA Region 6, 214-665-8409
Respondents: Praveen Srivastav, Susan Watson, Shaw Environmental, Inc.

1. Respondent Concurs (C), Does Not Concur (D), Takes Exception (E), or Delete (X).
2. Commenter Agrees (A) with response, or Does not Agree (D) with response.

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Revised Response	A or D[2]
1			EPA did not see any information on the preferred route for truck traffic or emergency medical information, such as where to take injured personnel, hospital location, etc. Would that be presented elsewhere (i.e., the Installation-wide Plan)?	C	The emergency medical information (contacts, route to hospital, etc.) is included in Appendix A of the Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas, Dated January 2006 and Amended October 2008.	A
2		Section 1.1.1	Section 1.1.1 is an introduction to the Former Pistol Range. The soil discusses soil contamination at the site, but never actually mentions that the contaminant of concern is lead (even though since the site was a pistol site, lead would be the obvious contaminant of concern). Suggest adding lead as the COC in this section just in case a person not familiar with this site reads this document.	C	Lead will be added to the second sentence of the second paragraph of Section 1.1.1 as follows: " . . . where the soil was contaminated with lead at levels . . . "	A
3		Section 1.1.2 3rd paragraph	Section 1.1.2, 3rd paragraph, states that based on previous studies no impact to the groundwater was determined from groundwater investigations, which is somewhat correct since there are no wells actually in the area of known soil contamination. Several of the previous soil boreholes sampled at this site appear to be in the groundwater table indicating that soil to groundwater contamination probably has occurred at this location. What is the depth to water at this site?	C	Depth to groundwater in November 2007 was approximately 8 feet bgs.	A
4			Soil borehole 04SB13 has a 2,870 value for perchlorate at a depth of 23.5-24.5 which would be a soil sample collected from within the water table, so the groundwater is already contaminated with perchlorate at this site. This location is slightly upgradient of the main excavation area and isn't a candidate for soil removal due to soil concentration below removal standards. Soil samples from 04SB08 and 04SB07 have detections of perchlorate at deeper depths that were collected within the water table. Perchlorate is in the water table at this site even though the wells outside the area don't have any detection. There could be a several source areas based on the data.	C	The GWP-Ind is exceeded at only one location, i.e. 04SB08 at 9-10 feet bgs, which may be at the top of the saturated zone. The soil samples from 04SB07, 04SB08, and 04SB13 collected at depths greater than 19 feet bgs are likely to be in the saturated zone, but had perchlorate concentrations below the GWP-Ind. It is possible that the groundwater at these locations also has some perchlorate, but the concentrations in the groundwater may or may not be above the GW-Ind. The new well to be installed will provide definitive data. USEPA's comment regarding multiple sources is noted. Irrespective of the number of sources, the RAWP calls for removal of all soil exceeding GWP-Ind.	A

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Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Revised Response	A or D[2]
5			Does 04SB07 have a typo for the deepest soil sample (21.5 to 21.5)?	C	Depth should be 19 to 20 feet bgs for deepest sample at 04SB07. Figure 1-4 will be revised.	A
6		Figure 2-2	Additional mercury samples are being proposed to the north in the concrete pad area which is a good idea and the current work plan describes the rationale and how it will be accomplished in great detail. SB-13 had a hit of 400 for mercury, but there are no previous soil borehole holes to the southwest or west that would show the outer extent of this contamination. Recommend collecting at least two more DPT samples for mercury to the west and southwest of SB-13.	D	The additional samples collected beneath the concrete pad detected mercury at very low estimated concentrations (<40 ug/kg) as indicated on the revised Figure 2-2. The sample collected just to the north of SB-13, 04SLAB01, had an estimated concentration 0.0384 mg/kg at 3 to 3.5 feet bgs. This sample is north/northwest of SB-13. The area directly to the west of SB-13 is also covered by concrete. Since the concentrations under the slab were all below the cleanup level of 0.15 mg/kg, and the area to the west of SB-13 is covered by concrete, it is unlikely that there are high mercury concentrations in the soil directly to the west of SB-13. The soil up to the edge of the slab will be excavated to 4 feet bgs. Shaw will split the confirmation wall sample along the wall as follows: One confirmation wall sample will be from the southwest excavation corner to the edge of the slab near 04SLAB01, and one confirmation wall sample will be from near 04SLAB01 to the corner near SB-9. The first sample should be representative of the soil to the west of SB-13, and if it indicates mercury concentrations are above 0.15 mg/kg, the concrete will be removed and the area will be excavated.	A
			In addition, 04SB02 had some relatively large hits of perchlorate. There are no soil samples collected for perchlorate to the south of this location to show that there isn't any other further contaminated soil. The DPT samples that are being collected to the west of this location near the electric pole will help delineate to the west, but not to the south. Suggest adding one more DPT south of this location just outside the site boundary line.	D	Confirmation samples of the excavation floor and walls will determine if additional contaminated soil remains to the south.	A

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Reviewer: Stephen Tzhone, USEPA Region 6, 214-665-8409
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7			After the preliminary soil sampling following the current work plan it is assumed that the known soil contamination would be delineated and a new map or soil removal would be provided. Please add a similar statement to the text.	C	The premobilization DPT sampling at LHAAP-04 was conducted. Attached is a revised Figure 2-2 which shows the results of the DPT samples. Also attached is a revised Figure 2-4 which indicates the initial concrete slab removal and excavation to an initial depth of 5 feet below top of slab. The word "optional" will be removed Section 2.7.	A
8			The work plan includes details on QA/QC of soil removed and so forth, but there doesn't seem to be a plan to collect QA/QC for samples collected during the preliminary work or during the work. Please provide details on QA/QC on soil samples and sample frequency.	C	Per Section 7.3.2, Appendix C, Chemical Data Acquisition, of the Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas, dated January 2006 and Amended October 2008, QC Replicate Samples will be collected for every 10 or less field samples. If requested, Shaw can collect a QA replicate sample for EPA.	A
9			There are only five wells in the general vicinity of the area of concern with no wells actually located within the contaminated area. The groundwater flow direction(s) were determined from 2007 mass water level data which takes into account water levels from outside the current map shown (good use of the data). The density of wells in this area is pretty limited, but groundwater levels that have been collected in this area in the past have shown a similar pattern with a hydrologic high at this site. Based on the current groundwater elevation map and past soil samples, there is the potential to have two plumes originating from this site, one to the southeast and one to the northeast. The plan to install a new well near 04SB11 is a good idea to help determine the groundwater flow direction and if there is a perchlorate plume originating from this area. Please provide rationale on this current proposed well location.	C/D	Based on the contaminated area and groundwater gradient from November/December 2007 (EE/CA), any plume would likely be to the southwest. Any groundwater contamination from the location of the highest soil concentration (STEP-04 SS06) is likely to be captured in 04WW01, which has been clean. In Section 2.11, after the second sentence of the first paragraph, the following will be added: "The placement of the well will be finalized following receipt of confirmation sample results. Well placement recommendation will be submitted for regulatory approval prior to well installation."	A
			Are there any plans to determine the nature and extent of potential groundwater contamination at LHAAP-04? Additional wells on the southwest (04SS03 area) and even the northeast of the pad (04SB01 area) would help define if the perchlorate contamination in the groundwater.	C	The new well will be used to monitor the groundwater to evaluate the effectiveness of the removal of the soil-to-groundwater pathway. If the new well has contamination that continues after source removal, a new course of action will be discussed at that time.	A

Comments on Draft Final Removal Action Work Plan (published May 2009)
Former Pistol Range and LHAAP-04 Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

July 2009

Reviewer: Fay Duke, TCEQ, 512-239-2443
Respondents: Praveen Srivastav, Susan Watson, Shaw Environmental, Inc.

1. Respondent Concurs (C), Does Not Concur (D), Takes Exception (E), or Delete (X).
2. Commenter Agrees (A) with response, or Does not Agree (D) with response.

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
1		Section 2.5	It states that excavated soil will be stockpiled and covered with plastic sheeting or placed in covered roll-off containers pending the result of waste characterization samples. Additionally, it states in Section 2.8.2 that temporary soil stockpile will be placed on the concrete pad if the soil under the concrete is clean or be placed near the road. Please note that all temporary stockpile area must be constructed to prevent cross contamination and have measures to control surface water run on and run off.	C	Measures will be taken to prevent cross-contamination and to control surface run on and run off as described in Section 3.8 of the Installation-Wide Work Plan, i.e., temporary berms will be constructed and the staging area will be underlain with two layers of 6-mil polyethylene.	A
2		Section 2.10	It states that excavated area would be backfilled with cleaned fill from an approved off-site source. Please clarify the criteria being used to approve the fill and whether soil sampling is planned for the fill materials.	C	The fourth sentence of Section 2.10 will be deleted and the following text will be added as an additional paragraph: "Clean fill will be obtained from an off-site borrow source. Existing documentation from the borrow source will be reviewed to evaluate if it is clean compared to background, SAI-Ind and GWP-Ind values. If necessary, Shaw will collect representative samples from the borrow source for environmental testing."	A
3		Section 2.11	It states that after the complete of site restoration, a monitoring well will be installed near 04SB11. What is the rational for the well installation at this location? We believe that if only one well is installed to evaluate whether the groundwater has been impacted by the soil contamination found at this site, the well should be located near/down gradient of the location with highest concentrations and with the deepest soil contamination. We believe the well should be installed near/downgradient of 04SB08.	C	Please see response to EPA Comment #9.	A It is my understanding from the responses that location of the additional well is deferred until the completion of the soil excavation.

Comments on Draft Final Removal Action Work Plan (published May 2009)
Former Pistol Range and LHAAP-04 Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

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4		Section 2.5 and Section 2.12	It states the boundaries of the completed soil excavations will be surveyed. Please note that if confirmation cannot be achieve to indicate that all contaminated soil above cleanup levels were removed, the depth of excavation should be surveyed so that it can be recorded in the deed.	C	Excavation depth measurements will be collected along the walls from ground surface to depth of the excavation or to groundwater interface. Only the boundaries and surface elevation will be surveyed. Survey data and excavation dimensions (including depth) will be included in the Closure Report. Later surveying for recordation purposes will be limited to the site boundaries since the entire site (both LHAAP-04 and Pistol Range) is restricted to nonresidential use.	A If contaminated soil above the MSCs for direct contact are left in place and not excavated, the deed recordation must include the information of the depth at which the contamination remained.
5		Air Monitoring (Appendix A)	It states that real-time aerosol monitors will be placed in the work area and at the downwind site perimeter. It also states that the location maybe adjusted to compensate for changes of wind direction. Please clarify the method of determining the wind direction.	C	The wind direction will be determined by visual observation of wind sock.	A

00076111

FILE PATH: T:\GIS\Longhorn\MXD\Site04PRILHAAP04_DPTLocs_Revised.mxd

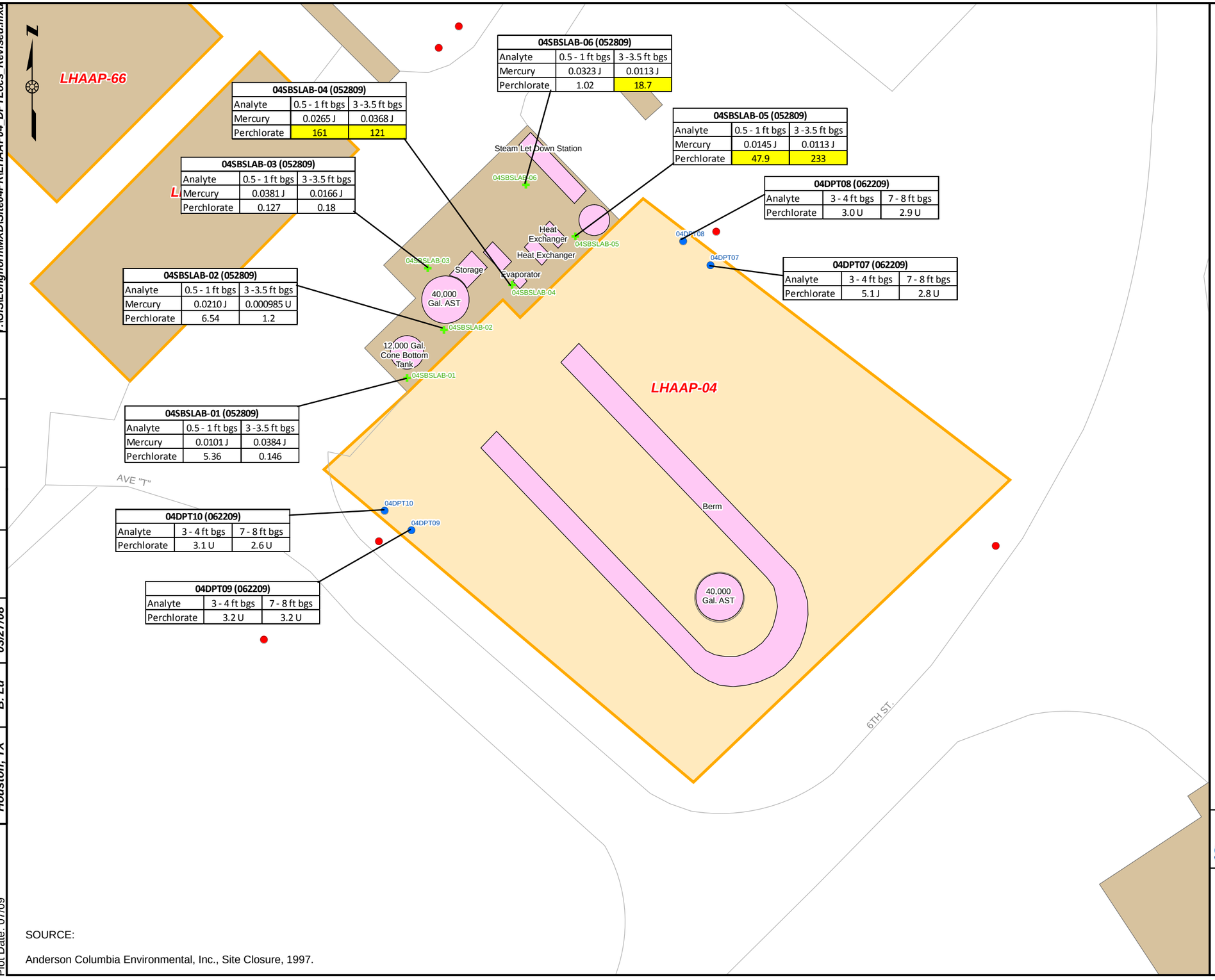
APPROVED BY

CHECKED BY

DRAWN BY: B. Lu 03/27/08

OFFICE: Houston, TX

Plot Date: 07/09



04SBSLAB-06 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0323 J	0.0113 J
Perchlorate	1.02	18.7

04SBSLAB-04 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0265 J	0.0368 J
Perchlorate	161	121

04SBSLAB-05 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0145 J	0.0113 J
Perchlorate	47.9	233

04SBSLAB-03 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0381 J	0.0166 J
Perchlorate	0.127	0.18

04DPT08 (062209)		
Analyte	3 - 4 ft bgs	7 - 8 ft bgs
Perchlorate	3.0 U	2.9 U

04SBSLAB-02 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0210 J	0.000985 U
Perchlorate	6.54	1.2

04DPT07 (062209)		
Analyte	3 - 4 ft bgs	7 - 8 ft bgs
Perchlorate	5.1 J	2.8 U

04SBSLAB-01 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0101 J	0.0384 J
Perchlorate	5.36	0.146

04DPT10 (062209)		
Analyte	3 - 4 ft bgs	7 - 8 ft bgs
Perchlorate	3.1 U	2.6 U

04DPT09 (062209)		
Analyte	3 - 4 ft bgs	7 - 8 ft bgs
Perchlorate	3.2 U	3.2 U

LEGEND

- Live Electric Pole
- DPT Sample Location - Near Electric Pole
- DPT Sample Location - Through Concrete Slab
- Road
- Former Operation Structure (Raised Pad)
- Concrete Slab
- Site

AST -- Aboveground Storage Tank

NOTES:

1. Results in milligrams per kilogram.
2. Yellow highlighted sample results are above the proposed cleanup level.

0 15 30 60 Feet

SOURCE:

Anderson Columbia Environmental, Inc., Site Closure, 1997.

U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 2-2 (REVISED)

PRE-MOBILIZATION SAMPLE RESULTS LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00076112

LOCATION	EAST	NORTH
A	3306023.7	6959119.1
B	3306001.4	6959098.2
C	3305977.2	6959123.5
D	3305915.7	6959064.8
E	3305891.5	6959090.1
F	3305942.2	6959138.5
G	3305947.5	6959132.9
H	3305980.5	6959164.7
I	3305950.2	6959115.5
J	3305905.5	6959075.4
K	3305895.2	6959086.2
L	3305939.9	6959126.1
M	3305988.1	6959144.4
N	3305973.6	6959130.6
O	3305959.8	6959145.2
P	3305974.4	6959158.9

Concrete to be removed. Initial excavation depth of 5' below top of concrete.

An approximate 20' x 20' area will be excavated to 10' bgs initially.

Approximately 5' from the edge of the slab, a 15' x 60' area will be excavated to 7' bgs initially.

LHAAP-04

AVE "T"

6TH ST.

Steam Let Down Station

Heat Exchanger

Heat Exchanger

Storage

Evaporator

40,000 Gal. AST

12,000 Gal. Cone Bottom Tank

SUMP122

Berm

40,000 Gal. AST

Tank-NE

Tank-SE

Tank-NW

Tank-MID

Tank-SW

Pipe-2'

Pipe-25'

Pipe-50'

Pipe-75'

Pipe-97'

LH-S122-01

LH-S122-02

04SB01 04SB02 04SB03 04SB04 04SB05 04SB06 04SB07 04SB08 04SB09 04SB10 04SB11 04SB12 04SB13

04DPT07 04DPT08 04DPT09 04DPT10

04SBSLAB-01 04SBSLAB-02 04SBSLAB-03 04SBSLAB-04 04SBSLAB-05 04SBSLAB-06

SB-1 SB-2 SB-3 SB-4 SB-5 SB-6 SB-7 SB-8 SB-9 SB-10 SB-11 SB-12 SB-13

STEP-04SS01 STEP-04SS02 STEP-04SS03 STEP-04SS04 STEP-04SS05 STEP-04SS06 STEP-04SS07 STEP-04SS08 STEP-04SS09 STEP-04SS10 STEP-04SS11 STEP-04SS12 STEP-04SS13 STEP-04SS14 STEP-04SS15

LEGEND

- DPT Sample Location - Near Electric Pole
- DPT Sample Location - Through Concrete Slab
- Electrical Line Pole
- Pole Only
- Hydrant
- 4' Depth Composite Sample (floor grab location)
- 5' Depth Composite Sample (floor grab location)
- 7' Depth Composite Sample (floor grab location)
- 10' Depth Composite Sample (floor grab location)
- Sump
- Soil Boring Associated with Sump122
- 2007 Soil Sampling Location (Shaw, 2007)
- 2006 Soil Sampling Location (Shaw, 2006)
- 2002 Surface Soil Sample (STEP, 2003)
- 2000 Soil Boring (Jacobs, 2002b)
- 1997 Soil Boring (ACE, 1997)
- Road
- Excavation Area Deepter than 5' bgs
- Former Location of Operational Structure
- Approximate Location of Pilot Study Plot
- Initial Excavation of 4 Feet
- Initial Area of Excavation Deeper than 4 Feet
- 4' bgs Initially
- Concrete Slab
- Site

NOTE:

A confirmation sample will be collected from the floor for approximately every 750 square feet and from each overexcavated area.

bgs - below ground surface

Samples will be analyzed for perchlorate.

0 15 30 60 Feet

U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 2-4 (REVISED)

INITIAL EXCAVATION AREAS
LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 03/28/08	S. Watson 07/13/09	P. Srivastav 07/14/09	T:\GIS\Longhorn\MXD\Site04PRI\LHAAP04_Excavations_REV.mxd

Plot Date: 07/09

FINAL

REMOVAL ACTION WORK PLAN
FORMER PISTOL RANGE AND LHAAP-04, FORMER PILOT WASTEWATER TREATMENT PLANT, GROUP 4
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared for

U.S. Army Corps of Engineers
Tulsa District
1645 South 101st Avenue
Tulsa, Oklahoma

Prepared by

Shaw Environmental, Inc.
3010 Briarpark, Suite 400
Houston, Texas 77042

Contract No. W912QR-04-D-0027, Task Order No. DS02
Shaw Project No. 117591

August 2009

Table of Contents

List of Tables

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List of Appendices

Acronyms and Abbreviations

ARAR	applicable or relevant and appropriate requirements
ASTM	ASTM International (formerly American Society for Testing and Materials)
bgs	below ground surface
CDAP	Chemical Data Acquisition Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CQCP	Contractor Quality Control Plan
DPT	Direct Push Technology
EE/CA	Engineering Evaluation/Cost Analysis
GPR	ground penetrating radar
GPS	Global Positioning System
GWP-Ind	soil MSC for industrial use based on groundwater protection
GWTP	groundwater treatment plant
HASP	Health and Safety Plan
HDPE	high-density polyethylene
LHAAP	Longhorn Army Ammunition Plant
LHAAP-04	Former Pilot Wastewater Treatment Plant
MARC	Multiple Award Remediation Contract
mg/kg	milligrams per kilogram
MSC	medium-specific concentration
PVC	polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RAO	removal action objective
SAI-Ind	soil MSC for industrial use based on inhalation, ingestion, and dermal contact
Shaw	Shaw Environmental, Inc.
SOP	Standard Operating Procedure
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TCLP	toxicity characteristic leaching procedure
TO	Task Order
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
XRF	x-ray fluorescence

1.0 Introduction

Shaw Environmental, Inc. (Shaw) has been contracted by the U.S. Army Corps of Engineers (USACE) Tulsa District to complete the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response at multiple sites at the former Longhorn Army Ammunition Plant (LHAAP) near Karnack, Texas. This Work Plan for the Former Pistol Range and the Former Pilot Wastewater Treatment Plant (LHAAP-04) is a part of the response. This work is being performed under the Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D-0027, Task Order (TO) DS02, with oversight by the USACE, Tulsa District.

1.1 Background

LHAAP is located in central-east Texas in the northeastern corner of Harrison County, approximately 14 miles northeast of Marshall, Texas (see **Figure 1-1**). The facility occupies approximately 8,416 acres between State Highway 43 in Karnack, Texas, and the western shore of Caddo Lake. Caddo Lake is a large freshwater lake that bounds LHAAP to the north and east. The eastern fence of LHAAP is 3.5 miles from the Texas-Louisiana state border.

1.1.1 Former Pistol Range

The former Pistol Range is located in the southeastern portion of LHAAP (**Figure 1-2**). The approximately 0.4 acre site lies within a rectangular clearing at the end of Robert Avenue, south of Avenue Q. The site is the eastern portion of a rectangular field and is approximately 110 feet north to south by 150 feet east to west (approximately 0.4 acres). The target area was a wooded slope adjacent to the east end of the clearing. The area was used as a small arms firing range by base security personnel from the 1950s until 2004 for small arms qualification and recertification.

Preliminary field investigations were conducted at the Pistol Range in 1995, with subsequent site investigations in 2006 (soil sampling for site characterization) and 2007 (groundwater sampling and vertical delineation of soil contamination). The investigations showed that there had been no impact to groundwater, but identified areas at the former Pistol Range where the soil was contaminated with lead at levels that exceed the Texas Commission on Environmental Quality (TCEQ) soils medium-specific concentration (MSC) for industrial use based on inhalation, ingestion, and dermal contact (SAI-Ind). There have been no previous removal actions at the former Pistol Range (Shaw, 2009a).

1.1.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

LHAAP-04 occupies approximately 1/2 acre in the central portion of LHAAP at the northwest corner of 6th and 60th Streets adjacent to the former fire station (**Figure 1-2**). In 1984, the Former Pilot Wastewater Treatment Plant began operation. Wastewater from sumps throughout LHAAP was trucked to the plant for treatment. After the wastewater settled, it was transferred to one of two storage tanks, and then pumped through a heat exchanger to an evaporation tower. Solids were shipped off site for disposal. Sludge from the settling tanks was blown down and drummed weekly, then burned at Burning Ground No. 3 (LHAAP-18/24) (Plexus Scientific Corporation, 2005).

The demolition and disposal of the Former Pilot Wastewater Treatment Facility and its associated hazardous waste was completed in the summer of 1997 as part of the Resource Conservation and Recovery Act (RCRA) closure of the plant.

Various sampling events were conducted at LHAAP-04 from 1993 through 2008 to assess the contamination from the operations at LHAAP-04 (Shaw, 2009b) and its impact to the soil and/or groundwater. No impact to the groundwater was determined from the groundwater investigations. Following RCRA closure of LHAAP-04, soil sampling was conducted (Anderson Columbia Environmental, 1997), and LHAAP-04 was approved for closure according to the Risk Reduction Rule Standard 2 in 1998 with the stipulation that the remaining soil contamination be addressed under the CERCLA (Shaw, 2009b). The soil sampling results after 1998 delineated the perchlorate contamination in the soil at concentrations that are above the TCEQ soil MSC for industrial use based on groundwater protection (GWP-Ind) (TCEQ, 2006). Within the perchlorate contaminated soil area is an isolated area of mercury contamination that is above the SAI-Ind. There have been no removal actions undertaken at LHAAP-04; however, a pilot study was conducted in 2000 and 2001. During the study, three different carbon sources were mixed into the top 12 inches of soil. The applications resulted in reductions in perchlorate concentrations in surface soil but results varied in deeper soil.

1.2 Remedial Action Objectives

The removal action alternatives that will be implemented at the former Pistol Range and LHAAP-04 were developed in accordance with the CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Contingency Plan (40 Code of Federal Regulations [CFR] Part 300). The actions were developed based on the assumption that land use at both sites will be industrial (e.g., wildlife refuge). Both removal actions assume that land use notification will be recorded at the Harrison County courthouse to indicate that the property is suitable for nonresidential use. It is also assumed that these removal actions will be the final actions at both sites.

1.2.1 Former Pistol Range

A removal action at the former Pistol Range must protect human health and meet applicable or relevant and appropriate requirements (ARARs). As noted in the Engineering Evaluation/Cost Analysis (EE/CA) (Shaw, 2009a), ecological risk is not an issue at the former Pistol Range. Therefore, any proposed removal action need not specifically address ecological risk except as it forms the basis of certain ARARs. The threat that must be addressed at the former Pistol Range is soil contamination that could adversely affect human health via ingestion, inhalation, and direct contact (Shaw, 2009a).

The removal action objective (RAO) for the former Pistol Range, consistent with the reasonably anticipated future use as a wildlife refuge, can be described as follows:

- Minimize the potential for human contact with soil containing lead at concentrations that could adversely affect future maintenance workers

This objective was the basis for formulating and evaluating removal alternatives and selecting a removal action. The U.S. Army will implement the following response at the former Pistol Range:

- Excavate soil contaminated with lead exceeding industrial use levels and dispose of the soil off site at an approved landfill.

1.2.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

Portions of LHAAP-04 contain soil with concentrations of perchlorate that are a potential source of groundwater and surface water contamination. Additionally, there is a localized area of mercury contamination that exceeds levels protective of future maintenance workers. The implementation of the removal action derived from the EE/CA (Shaw, 2009b) is expected to considerably improve the environmental conditions and reduce the potential human health threat.

The RAOs for LHAAP-04 include:

- Protection of human health and the environment by eliminating the threat for potential releases of perchlorate from contaminated soil to groundwater.
- Protection of human health and the environment by eliminating the threat for potential releases of perchlorate and mercury from contaminated soil to surface water.
- Protection of human health by eliminating the potential for exposure to mercury contaminated surface soils for a future maintenance worker.

These objectives were used as the basis for formulating and evaluating removal alternatives and selecting a removal action. The U.S. Army will implement the following at LHAAP-04:

- Excavate soil contaminated with perchlorate exceeding levels with the potential to cross-contaminate groundwater and dispose that soil offsite at an approved landfill.
- Excavate soil contaminated with mercury exceeding industrial use levels and dispose of that soil off site at an approved landfill.

1.3 Cleanup Levels

Both sites involve the removal of soil exceeding their respective cleanup levels, and the subsequent transport of these soils to an appropriately licensed off-site facility for disposal. Once confirmation sampling results meet the proposed cleanup levels, the excavation area will be backfilled with clean soil and reseeded.

The tables below present the cleanup levels for each site.

Table 1-1
Former Pistol Range
Proposed Cleanup Levels

Chemical	Concentration (mg/kg)	Basis[a]
Lead	1,000	SAI-Ind

Notes and Abbreviations:

[a] *Texas Commission on Environmental Quality, Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs) dated March 31, 2006*

mg/kg *milligrams per kilogram*

SAI-Ind *Soil MSC for industrial use based on inhalation, ingestion, and dermal contact*

Table 1-2
LHAAP-04, Former Pilot Wastewater Treatment Plant
Proposed Cleanup Levels

Chemical	Concentration (mg/kg)	Basis[a]
Perchlorate	7.2	GWP-Ind
Mercury[b]	0.15	SAI-Ind

Notes and Abbreviations:

[a] *Texas Commission on Environmental Quality, Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs) dated March 31, 2006*

[b] *Mercury cleanup level is limited to the excavation wall adjacent to the concrete pad.*

mg/kg *milligrams per kilogram*
GWP-Ind *Soil MSC for industrial use based on groundwater protection*
SAI-Ind *Soil MSC for industrial use based on inhalation, ingestion, and dermal contact*

1.4 Areas of Contamination

Based on available sampling data, the soil at the former Pistol Range has been identified as a medium of concern due to the presence of lead concentrations exceeding the TCEQ SAI-Ind value of 1,000 milligrams per kilogram (mg/kg). Lead concentrations exceeding the TCEQ SAI-Ind value were detected in the 0-0.5 foot interval at locations N50,E25; N50,0; and N75,0 and the 0.5-1.0 feet interval at N50,E25. Based on the sampling results, the area of lead contaminated soil exceeding the TCEQ SAI-Ind is estimated to be less than 2,500 ft^2. This area is illustrated on **Figure 1-3** as the region bounded by the 1,000 mg/kg concentration contour. The depth of lead contaminated soil at the former Pistol Range varies from 0.5 foot to 1.0 foot over the contaminated area. Therefore, the volume of soil at the former Pistol Range that exceeds the SAI-Ind is estimated to be 150 cubic yards (in-place) (Shaw, 2009a).

The scope of the proposed action for the contaminated soil at LHAAP-04 site addresses an area of approximately 4,100 square feet (estimated volume of approximately 840 cubic yards) as shown on **Figure 1-4** (Shaw, 2009b). The mercury contaminated soil is along the concrete pad and is encompassed within the larger perchlorate contaminated soil area. The depth of contaminated soil at LHAAP-04 begins at ground surface with the excavation boundaries shown on **Figure 1-4**. However, there are areas within that boundary with greater depths. The deepest excavation is anticipated to be 10 feet below ground surface (bgs) in an area of approximately 400 square feet near 04SB08.

00076122

Plot Date: 04/08	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
	Houston, TX	B. Lu	07/24/07	J. Patin	07/24/07	P. Srivastav	04/10/08	T:\GIS\Longhorn\MXD\LHAAP04\EECA\LHAAPLoc.mxd

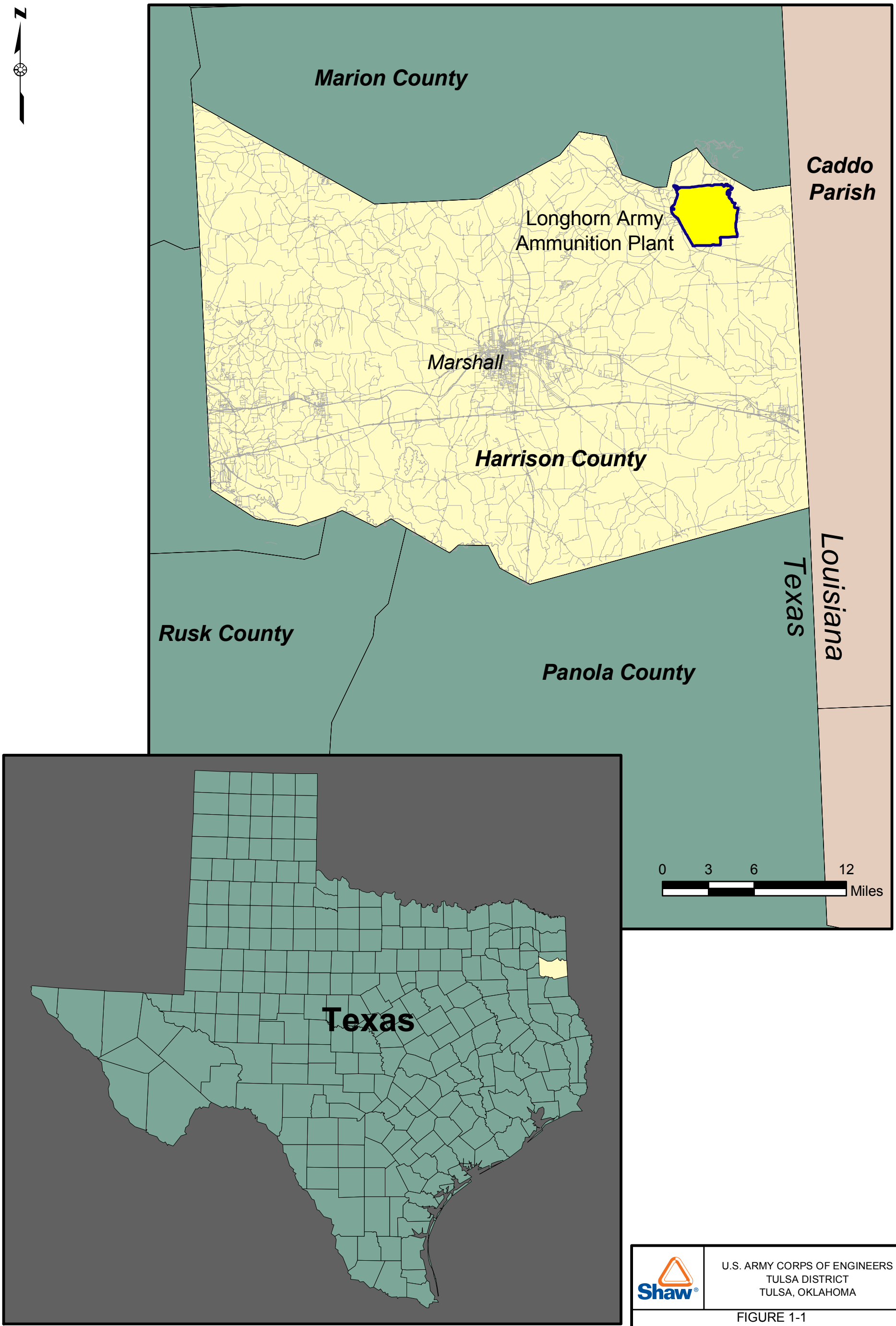

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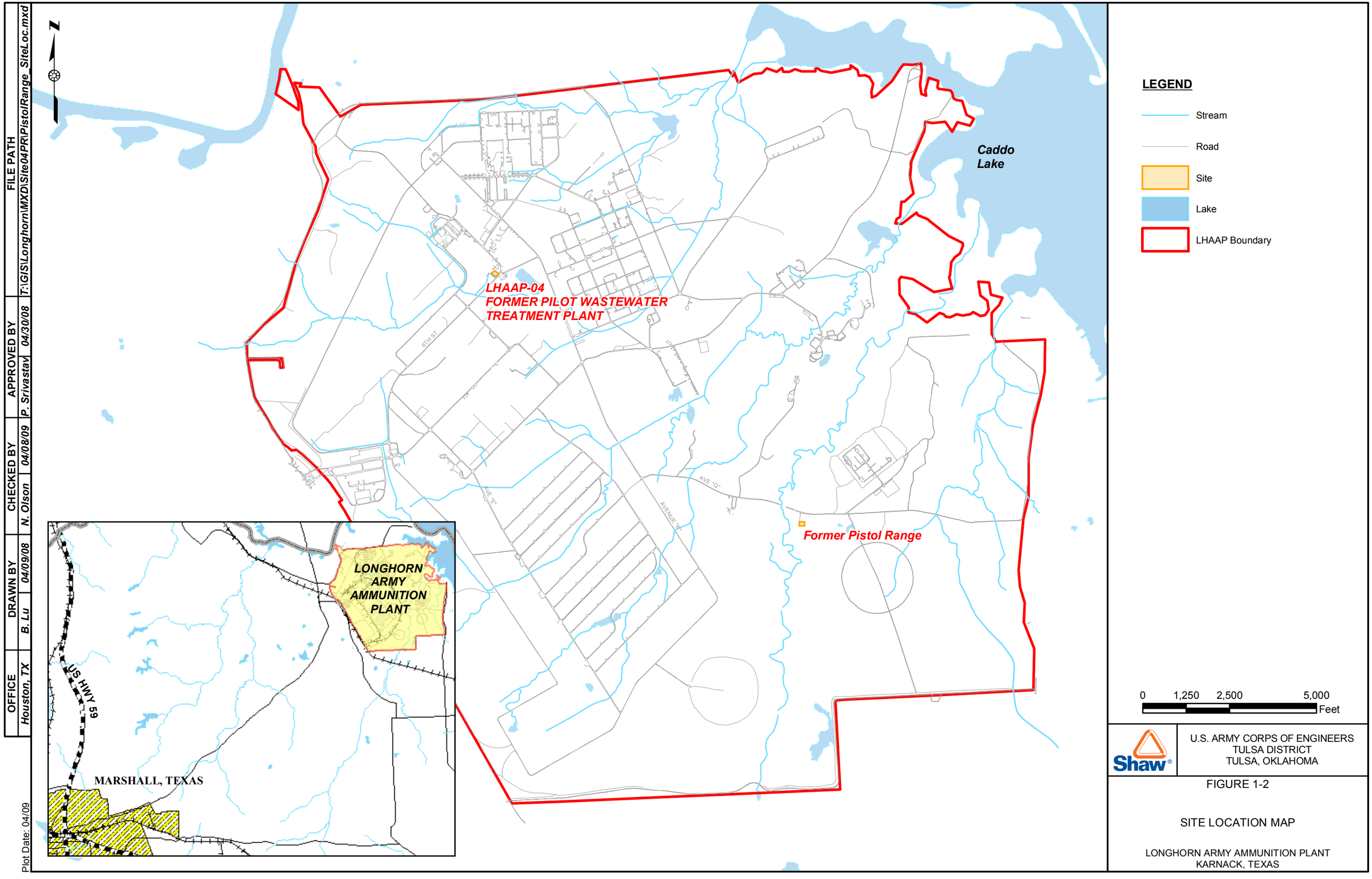
FIGURE 1-1
LOCATION OF LONGHORN ARMY AMMUNITION PLANT, HARRISON COUNTY, TEXAS

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00076123



FILE PATH	T:\GIS\Longhorn\MXD\Site04PRIPistolRange_SiteLoc.mxd
APPROVED BY	P. Srivastav 04/30/08
CHECKED BY	N. Olson 04/08/09
DRAWN BY	B. Lu 04/09/08
OFFICE	Houston, TX

Plot Date: 04/09

U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 1-2

SITE LOCATION MAP

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

FILE PATH		T:\GIS\Longhorn\MXD\Site04PRIPistolRange_XRF_Data.mxd
APPROVED BY	P. Srivastav	05/19/09
CHECKED BY	N. Olson	04/08/09
DRAWN BY	GWT	1/09/07
OFFICE	Houston, TX	

Plot Date: 04/09

Harrison Bayou

Robert Ave

Pistol Range

West Ditch <LOD

Central Ditch <LOD

East Ditch <LOD

S100 W175 <LOD
S50 W125 26.1
0 W75 <LOD
N25 W50 <LOD
N50 W25 33.1
N75 0 1000
N100 W25 <LOD
N75 W25 <LOD
N100 0 <LOD
S100 W150 <LOD
S50 W100 <LOD
0 W50 31.4
N25 W25 40.4
N50 0 1120
N75 E25 LOWER 750.8
N75 E25 UPPER 52.4
S125 W150 <LOD
S75 W100 15.5
S25 W50 16.6
0 W25 18.1
N25 0 33.1
N50 E25 3977.6
S125 W125 <LOD
S75 W75 <LOD
S25 W25 12.8
0 0 <LOD
N25 E25 55.7
N50 E50 LOWER 559.2
N50 E50 UPPER 117.9
S150 W125 <LOD
S100 W75 <LOD
S50 W25 <LOD
S25 0 <LOD
0 E25 <LOD
N25 E50 27.5
N25 E75 LOWER 527.2
N25 E75 UPPER 14.8
S150 W100 <LOD
S100 W50 24.2
S50 0 <LOD
S25 E25 <LOD
0 E50 15.3
S125 W50 <LOD
S75 0 <LOD
S50 E25 <LOD
S25 E50 21.3
0 E75 24.5
0 E100 <LOD

1,000
2,000
3,000
100

LEGEND

- XRF Sediment Sample Location
- XRF Sample Location
- Area of Removal Boundary
- Lead Concentration Contour
- Stream
- Road
- Approximate Firing Line Location
- 25-foot Grid
- Target Embankment
- Pistol Range

NOTES:

1. LOD is level of detection.
2. Lead concentrations are in milligrams per kilogram.
3. 1,000 contour is boundary of area of removal.

0 20 40 80 Feet

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FIGURE 1-3

AREA OF CONTAMINATION
FORMER PISTOL RANGE

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00076125

FILE PATH: T:\GIS\Longhorn\MXD\Site04PR\LHAAP04_PercHg.mxd
APPROVED BY: P. Srivastav 03/03/09
CHECKED BY: S. Watson 03/03/09
DRAWN BY: B. Lu 03/28/08
OFFICE: Houston, TX

LHAAP-66

LHAAP-60

LHAAP-04

Former Pilot Wastewater Treatment Plant

Former Tank

FORMER SUMP122

6TH ST.

04SB03	04SB03	
24.5 (0-0.5)	<45 (0-0.5)	
516 (1-3)	<45 (1-3)	
76.7 (3-5)	<43.6 (3-5)	

STEP-04SS12: <11.1 (0-0.5); 97.1 (1-2)

STEP-04SS15: <12.1 (0-0.5); <10.8 (1-2)

STEP-04SS09: <11.6 (0-0.5); 14.6 J (1-2); 289 (4-5)

STEP-04SS11: 139 J (0-0.5); <11.8 (1-2)

SB-2: <100 (0-1)

SB-1: <100 (0-1)

SB-3: <100 (0-1)

SB-4: <100 (0-1)

SB-5: <100 (0-1)

SB-9: <100 (0-1)

SB-10: <100 (0-1)

Pipe-2': <100 (approx. 8)

SB-11: 89,000 (0-1)

SB-6: <100 (0-1)

04SB01
36,200 (0-0.5)
144,000 (1-2)

04SB10
<5 (0-0.5)
36.8 (3-4)

SB-12: 300 (0-1)

SB-13: 400 (0-1)

STEP-04SS06: 163,000 (0-0.5); 160,000 (1-2)

SB-7: <100 (0-1)

SB-8: <100 (0-1)

STEP-04SS08: <45.8 (0-0.5); 171 (1-2)

STEP-04SS10: <12.2 (0-0.5); 14 J (1-2)

LH-S122-02: <100 (0.5-1); <100 (4-4.5); <100 (5.4-5.9)

04SB05	04SB05
1,220 (0-0.5)	<44 (0-0.5)
76,400 (1-3)	<47 (1-3)
49,900 (3-5)	<45 (3-5)

04SB08	
9/15/2006	10/22/2007
27,100 (0-0.5)	1,680 (0-0.5)
95,500 (3-4)	4,750 (4-5)
355 (19.5-19.5)	25,600 (9-10)

04SB13
1,620 (0-0.5)
1,840 (3-4)
2,870 (23.5-24.5)

LH-S122-01: <100 (0.5-1.2); <100 (4-4.5)

STEP-04SS05: 2,210 (0-0.5); 9,340 (1-2)

Pipe-25': <100 (approx. 8)

04SB11: <4.98 (0-0.5); <5 (3-4)

04SB04	04SB04
<5.9 (0-0.5)	55.9 (0-0.5)
92.8 (1-3)	<44 (1-3)
1,440 (3-5)	<47 (3-5)

STEP-04SS03: 61.4 J (0-0.5); 866 (1-2); 10,000 (4-5)

04SB07
3,830 (0-0.5)
5,160 (3-4)
134 (19-20)

Pipe-50': <100 (approx. 8)

STEP-04SS07: 29.3 J (0-0.5); 46 (1-2)

04SB12
63.1 (0-0.5)
2,330 (3-4)

Pipe-75': <100 (approx. 8)

04SB02
45,400 (0-0.5)
33,600 (1-2)

Tank-NE: <100 (0-1)

Pipe-97': <100 (approx. 8)

04SB09
<5 (0-0.5)
18.4 (3-4)

STEP-04SS02: <10.4 (0-0.5); <8.66 (1-2)

Tank-NW: <100 (0-1)

Tank-SE: <100 (0-1)

Tank-MID: <100 (0-1)

STEP-04SS04: 122 (0-0.5); 124 (1-2)

Tank-SW: <100 (0-1)

04SB06	04SB06
<5.9 (0-0.5)	<44 (0-0.5)
<5.8 (1-3)	<44 (1-3)
23.3 (3-5)	<47 (3-5)

STEP-04SS13: <11.9 (0-0.5); <11.7 (1-2)

STEP-04SS01: 53 (0-0.5); 24.5 J (1-2)

STEP-04SS14: <12.3 (0-0.5); <12.4 (1-2)

PILOT STUDY FINAL PERCHLORATE CONCENTRATIONS

	9'	9'	
0-12" / 12-24" / 24-36"	BDL / 46,200 / 121,100	4,100 / 80,100 / 109,400	15'
0-12" / 12-24" / 24-36"	BDL / 9,100 / 10,100	BDL / BDL / 500	15'
0-12" / 12-24" / 24-36"	2,200 / 18,100 / 16,100	BDL / BDL / BDL	15'
0-12" / 12-24" / 24-36"	600 / 15,000 / 9,300		18'
	18'		

Perchlorate concentrations in micrograms/kilogram

BDL -- Below detection limits

LEGEND

- Former Sump Location
- Soil Boring Associated to Sump122
- 2007 Soil Sampling Location (Shaw, 2007)
- 2006 Soil Sampling Location (Shaw, 2006)
- 2002 Surface Soil Sample (STEP, 2003)
- 2000 Soil Boring (Jacobs, 2002b)
- 1997 Soil Boring (ACE, 1997)
- Road
- Approximate Location of Pilot Study Plot
- Boundary of Proposed Excavation Area
- Building or Concrete Slab
- Site
- 04SB09 / <10 (0-0.5) / 18.4 (3-4) — Perchlorate Sampling Results
- SB-1 / <100 (0-1) — Mercury Sampling Results
- Concentrations Exceeding Medium-Specific Concentration (See Notes 4 & 5)

NOTES:
1. Concentrations reported in micrograms per kilogram (µg/kg).
2. Depth intervals are in feet below ground surface.
3. Pilot study plot information is from "Pilot Scale In-Situ Bioremediation of Perchlorate-Contaminated Soils at the Longhorn Army Ammunition Plant" by V. Nzengung, K. C. Das, and J. R. Kastner of University of Georgia, 2001.
4. 150 µg/kg Mercury soil medium-specific concentration for industrial use based on inhalation, ingestion, and dermal.
5. 7,200 µg/kg Perchlorate soil medium-specific concentration for industrial use based on groundwater protection.
6. Northeast end of excavation was moved approximately 7-feet southwest of the boundary presented in the EE/CA (Shaw 2009b) based on additional field measurements and photographs of PLANTECO pilot study plot.

0 15 30 60 Feet

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FIGURE 1-4

AREAS OF CONTAMINATION
LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Plot Date: 03/09

References:

Jacobs Engineering Group, Inc., 2002b, Final Remedial Investigation Report Addendum for the Group 4 Sites Remedial Investigation Report: Sites 04, 08, 67, and Hydrocarbon Study, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN, Feburary.
Solutions to Environmental Problems, Inc. (STEP), 2005, Draft Final Project Report, Plant-Wide Perchlorate Investigation, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN, April.
Anderson Columbia Environmental, (ACE), 1997, Closure Report, Pilot Wastewater Treatment Plant, Longhorn Army Ammunition Plant, Karnack, TX, EPA Identification TX 6213820 5B3, Solid Waste Registration No. 30990, September.
Shaw, 2008, Final Data Evaluation Report, Chemical Concentrations in Soil Associated with LHAAP-35/36 Sumps, Longhorn Army Ammunition Plant, Karnack, Texas, Houston, Texas, January.

2.0 Field Activities

This section describes the field activities planned at the former Pistol Range and LHAAP-04. Typically, general activities apply to both sites. Site-specific activities are described in associated subsections. The field activities to be conducted under this Work Plan are outlined below:

- Pre-mobilization activities
- Preliminary activities/mobilization
- Site clearing
- Plug and abandon well at former Pistol Range
- Soil excavation
- Confirmation soil sampling
- Optional concrete removal, LHAAP-04
- Waste management
- Decontamination
- Site restoration
- Installation of monitoring well, LHAAP-04
- Demobilization
- Reporting
- Schedule

The field activities will be conducted in accordance with the Site-Specific Supplement to Health and Safety Plan (HASP) in **Appendix A**. The work will be routinely inspected in accordance with the Contractor Quality Control Plan (CQCP) in **Appendix B**. Additional information regarding these tasks can be found in Appendix C, Chemical Data Acquisition Plan (CDAP), and Appendix D, Field Procedures of the Final Installation-Wide Work Plan (Shaw, 2006).

2.1 Pre-mobilization Activities

A pre-construction meeting will be held for the U.S. Army, U.S. Environmental Protection Agency (USEPA), LHAAP, and Shaw prior to the initiation of field activities.

Prior to mobilization, Shaw will secure any applicable permits and notifications. These may include federal, state and local requirements. Shaw will also secure utility clearance for water, sewer, gas, electric, and communication. A ground penetrating radar (GPR) was used to locate any underground utilities. The GPR unit was aided by an approved instrument that induced current upon any underground utility lines (except fiber optic lines), thus allowing the utility line to be located using a signal receiver. Once all lines were identified, pin flags and marking tape were used to mark the utilities (**Figure 2-1**).

Shaw will inspect LHAAP-04 to identify overhead electrical lines that may restrict removal activities and electrical poles within or near the excavation at LHAAP-04 that have the potential to become unstable as soil is removed. As necessary, Shaw will either shut down power, reroute power, remove poles, and/or ensure that the poles are guy-wired for stability. If power must be shut down, the power outage will be coordinated with groundwater treatment plant (GWTP) and fire station operations.

At the former Pistol Range, pre-mobilization activities will consist of sampling at location N75,E25-lower due to an x-ray fluorescence (XRF) lead result of 750.8 mg/kg. As discussed in the EE/CA for the former Pistol Range (Shaw, 2009a), XRF results at the former Pistol Range tended to underestimate laboratory analytical results. Therefore, a sample from N75, E25-lower will be submitted to an analytical laboratory for lead analysis. The analytical result will be compared to the cleanup level (presented in **Table 1-1**). If the result exceeds the cleanup level or the pre-mobilization sample is not collected, the boundary of the excavation will be expanded to include this location.

Shaw advanced six soil borings at LHAAP-04 for the purpose of collecting soil samples beneath the concrete slab along the north-western side of the site. Before those borings were advanced, utilities such as water, gas, and sewer were located. Historic site maps and drawings were consulted to ensure sampling locations are not in close proximity to buried lines. The concrete slab was penetrated in six locations near the tank pad/foundations. The locations are shown on **Figure 2-2**. The concrete slab is approximately 4 inches thick where the penetrations were done. The tank pads are approximately 8 inches thick. Soil samples were collected from immediately below the pad and at approximately 3 feet bgs with a Direct Push Technology (DPT) probe. The soil samples were analyzed for perchlorate and mercury. The soil sample results were compared to cleanup levels (**Section 1.3**). The levels were exceeded in the soil beneath the slab at three locations, and the slab in that area will be removed and handled as discussed in **Section 2.7**, Concrete Removal.

Additional pre-mobilization soil samples collected at LHAAP-04 were to determine how close the excavation is likely to approach the nearby electrical poles. Samples were collected at four locations as shown on **Figure 2-2**. At each location, two soil samples were collected: 3-4 feet bgs and 7-8 feet bgs. Based on these results, the active line power poles will not be in the excavation.

2.2 Preliminary Activities/Mobilization

Shaw anticipates mobilizing the following personnel:

- Site supervisor
- Quality control/safety manager

- Two equipment operators
- One laborer/sample technician

Those personnel will utilize the following major equipment:

- Tracked excavator
- Water truck
- Three pickup trucks
- Roll-off boxes
- Dozer

Attachments for the excavator will also be mobilized as necessary if the concrete slab at LHAAP-04 must be removed.

2.3 Site Setup

A Global Positioning System (GPS) will be used to delineate and mark the excavation areas per **Figure 2-3** and **Figure 2-4**. The potential areas of excavation will then be marked with survey stakes, pin flags, paint, or other appropriate marking.

The areas to initially be excavated will be established prior to mobilization of the excavation personnel. The existing XRF sample results and the result of the premobilization sample at N75,E25-lower will be used to identify the initial limits of excavation at the former Pistol Range.

Once the excavation areas have been delineated, removal of shrubs and other vegetative cover within the excavation areas would commence. Clearing of the vegetation will largely be conducted using a tractor mounted bush hog and other conventional equipment. At the former Pistol Range, large numbers of bullets or casings have not been observed during investigations. Such "source" material may be hidden by vegetation, and could bias any confirmation sampling. Therefore, small vegetation and vegetation debris will be removed from the area to be excavated and a surrounding zone of approximately 25 feet. The area will be sprayed with a defoliant to destroy any hazardous vegetation (e.g., poison ivy), and then will be cleared using brush mowers and/or weed eaters. Larger shrubs will be left in place where practical; no trees over 4-inch diameter will be removed. The area will be raked by mechanical equipment and/or by hand to remove vegetative debris and allow visual observation of the ground surface. Unless it contains soil, the vegetative debris will be stockpiled on site and allowed to decay naturally. If portions of the vegetative debris contain soil, that material will be disposed with the soil from the excavation.

Site set-up for both excavations will include setting up a decontamination station. The equipment decontamination station would be constructed with non-permeable material such as

high-density polyethylene (HDPE) for containment purposes. This decontamination station will be bermed to ensure containment of any decontamination liquids. Since the only water needs are for decontamination, water would be trucked to the site and, if necessary, stored in a portable tank.

2.4 Well Abandonment

Prior to excavation activities, one monitoring well (PRWW01) must be plugged and abandoned. Monitoring well abandonment will be in accordance with Shaw Standard Operating Procedure (SOP) EI-GSO40 and the requirements described in Task 2 of the CQCP (**Appendix B**). A state of Texas licensed driller will be contracted to perform the abandonment. A truck mounted drill rig will be used to pull the monitoring well casing from the ground. Once the casing is removed, bentonite grout will be pumped into the cavity to seal the borehole and prevent formation of a conduit from the ground surface to the subsurface. If the well casing and screen cannot be entirely pulled from the ground, the well will be grouted in place. The concrete pad and four bollards will be removed from the ground and disposed of by the contracted drilling company as municipal waste.

2.5 Soil Excavation

Initial excavation limits will be established as described in **Section 2.3**. Excavated soils will be stockpiled on and covered with plastic sheeting or placed in covered roll-off containers pending the results of waste characterization samples. Vertical excavation will stop if groundwater or bedrock is encountered.

Excavation and soil handling activities will be performed utilizing standard health and safety practices to minimize airborne particle generation and exposure pathways that might place workers at risk. Air monitoring will be conducted in work areas to determine if airborne emissions exceed acceptable levels. Modified Level D personal protective equipment and decontamination equipment is proposed (**Appendix A**).

Excavation of both sites will be performed using a 12–14 ton excavator or equivalent. Additionally, a water truck will be on site during excavation activities for decontamination and dust suppression.

The Site Superintendent and QC Manager will mark the corners of the completed excavation at each site for subsequent surveying (see **Section 2.12**). They will also measure and document the depths of excavation, including any depth variations across the excavation.

In the event of rainfall, storm water runoff from surrounding areas will be diverted, as feasible, away from the excavation. After the rainfall event, any storm water in the excavation will be pumped to a tank, allowed to settle, and then conveyed to the GWTP.

2.5.1 Former Pistol Range

The quantity of lead-contaminated soils requiring excavation is estimated to be approximately 150 cubic yards, or 225 tons. Excavation will proceed until confirmatory analysis has determined that all lead contamination above the TCEQ SAI-Ind value of 1,000 mg/kg has been removed. The project team will first inspect the cleared area for evidence of bullet pockets or other range debris (e.g., casings). Such isolated locations will be excavated until no further debris or bullet fragments are observed. Then the project team will proceed to excavate the pre-designated limits of excavation (**Figure 2-3**). Because XRF results tended to slightly underestimate the laboratory results for soil lead concentrations (Shaw, 2009a), certain sample locations (e.g., N75, E25-lower, which had an XRF lead result of 750.8 mg/kg) may be included by expanding the excavation.

Excavated material will be segregated in separate stockpiles or roll-off containers based on the suspected level of contamination. One composite sample will be collected for each approximate 100 tons of excavated material and submitted to an off-site laboratory for toxicity characteristic leaching procedure (TCLP) metals analysis to confirm whether or not the soil is classified as a hazardous waste. That sampling will be performed in accordance with the requirements described in Task 4 of the CQCP (**Appendix B**). Based on waste classification, the soil will be loaded and transported by truck to the appropriate permitted disposal facility.

2.5.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

Total volume of contaminated soils to be excavated at LHAAP-04 is estimated to be 840 cubic yards, or 1,260 tons. Based on the soil sampling data, an area for an initial 4-foot-deep excavation has been proposed. Three areas where perchlorate concentrations are greater than 7,200 micrograms per kilogram below the 4-foot-depth, will be excavated by a 2-foot-depth beyond the sampled depth. These depths vary from 5 feet to 10 feet. These areas are shown on **Figure 2-4**. After the initial excavation, the wall adjacent to the concrete pad will be tested for both mercury and perchlorate. The other walls and floor will be tested for perchlorate only. Soil will be excavated until the confirmation sample results (from the excavation floor and side walls) indicate soil concentrations below the cleanup levels identified in **Table 1-2** or when groundwater is encountered.

To the extent practical, the excavator will be used to excavate the contaminated soils and directly place the soils into roll-off boxes or dump trucks that would take the soils to a permitted landfill. However, on-site stockpiling may be required depending on soil volumes and logistics.

During excavation, some abandoned water lines, an abandoned sewer line, and lines to a tank may be encountered. These lines will be investigated before removal to ensure that they are not active and truly are abandoned. If it is determined that the lines are not active, they will be

removed or be abandoned in place. Inactive lines that are cut by the excavation will be plugged with grout.

Five electric power poles are in close proximity to the proposed excavation at LHAAP-04 (see **Figure 2-1**):

Pole #1: one abandoned pole 2 feet beyond the northeast end of the excavation
Pole #2: one live pole 17 feet beyond the northeast end of the excavation
Pole #3: one abandoned pole 34 feet beyond the northeast end of the excavation
Pole #4: one live pole 9 feet beyond the southwest end of the proposed excavation
Pole #5: one abandoned pole 8 feet beyond the southwest end of the proposed excavation

Because it is so close to the proposed excavation, Pole #1 will be removed using the excavator.

If excavation to 4 feet bgs occurs no closer than 4 feet to a pole, the pole should not need to be abandoned. A licensed engineer will review poles for stability if:

- Excavation takes place within 4 feet of a pole.
- Excavation at 4 feet from a pole is greater than 4 feet bgs.
- A pole shows visual evidence of shifting.

If considered potentially unstable, the power poles will be braced or removed. Power lines will be rerouted as necessary if poles are removed.

2.6 Confirmation Soil Sampling

2.6.1 Former Pistol Range

In adherence to Task 4 of the CQCP (**Appendix B**), confirmation sampling will be conducted concurrently with excavation activities to document that the remaining soils meet established cleanup levels. Excavation will continue until the TCEQ SAI-Ind value of 1,000 mg/kg has been met. It is estimated that ten samples (five on the floor, four from the sides [one for every 50 feet of perimeter], and one field duplicate) will be collected during excavation activities and sent to an off-site laboratory for lead analysis.

2.6.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

Confirmation sampling will be conducted concurrently with excavation and will document that the remaining soils meet established cleanup levels. After the initial excavation, the wall adjacent to the concrete pad will be tested for both mercury and perchlorate. The other walls and floor will be tested for perchlorate only. Excavation would continue until concentrations in the soil are less than the cleanup levels identified in **Table 1-2**. A 5-point composite soil sample will be collected from approximately every 750 square feet of the excavation floor area and of each

wall. If contaminants are detected in the composite samples above their cleanup levels, the area will be excavated an additional foot. This would continue until confirmation samples demonstrate the contaminants remaining in the soil are below their cleanup level or until groundwater is encountered.

In the event that groundwater is encountered and a floor sample cannot be collected, a linear 5-point composite sample will be collected from each excavation sidewall. The individual grab samples will be collected from the sidewalls just above the groundwater interface. If the linear 5-point composite sidewall sample is above the cleanup level, then additional excavation of the sidewall will be conducted to the groundwater interface depth. Thus, vadose zone soil that is identified as exceeding the cleanup levels would be removed.

Additional details for sampling and analysis are found in the Final Installation-Wide Work Plan, Appendix C, CDAP (Shaw, 2006).

2.7 Concrete Removal at LHAAP-04

The pre-mobilization soil sample results beneath the concrete slab at LHAAP-04 exceeded the cleanup levels. The slab will be removed, and the soil beneath the slab will be excavated as shown on **Figure 2-4**. The concrete will be broken using an excavator with a hammer attachment. The concrete will be staged separately from soil and crushed to below 6-inch size using a crusher attachment on the excavator. The concrete will be tested for perchlorate and mercury. If the perchlorate and mercury levels are below cleanup standards, the concrete will be used as a portion of the backfill for the completed excavation. If the perchlorate or mercury exceed cleanup standards, the concrete will be disposed off site at an approved landfill.

2.8 Waste Management

This section specifies methods and procedures to be implemented by Shaw to verify that waste generated during site activities are handled, transported, stored, and disposed in compliance with applicable federal, state, and local rules and regulations. Waste management activities will be conducted in accordance with the requirements presented in Task 6 of the CQCP (**Appendix B**).

Description of Wastes. Excavation activities at both the former Pistol Range and LHAAP-04 are expected to generate the following waste streams:

Waste Type	Estimated Quantity
Lead Contaminated Soil	225 tons
Perchlorate and Mercury Contaminated Soil	2,000 tons
Decontamination Water and Drill Cuttings	330 gallons [(6) 55-gallon drums]
Miscellaneous Wastes (PPE, paper towels, rags, etc.)	---

Waste Characterization. Waste characterization samples will be collected and analyzed to ensure that the waste materials are not hazardous. For the contaminated soil, a waste characterization sample will be collected for every 100 cubic yards from either the stockpile or the roll-off containers as required by the disposal facility. Sample analysis will be conducted by an off-site laboratory. For waste liquids, composite samples will be collected from the 55-gallon drums of waste water generated. The results will be used to classify and code wastes in accordance with the requirements of 30 Texas Administrative Code (TAC) 335, Subchapter R. Additional details for disposal sampling are found in the Final Installation-Wide Work Plan, Appendix C, CDAP and Appendix D, Field Procedures (Shaw, 2006).

Decontamination liquids will be stored in a portable tank for subsequent disposal. One waste characterization sample will be collected in accordance with Shaw SOP EI-FS115 and submitted to an off-site laboratory for total RCRA method analysis. Following waste characterization analysis, the liquid will be disposed at an off-site hazardous waste facility if found to be hazardous, or at the GWTP at LHAAP-18/24 if determined to be non-hazardous.

Waste Accumulation. The contaminated soil will be staged on site in either lined roll-off containers or stockpiled. The roll-off containers and/or the stockpiled soil will be covered in the event of rainfall. The non-hazardous decontamination water and drill cuttings will be stored in 55-gallon drums until disposal at the LHAAP GWTP. The miscellaneous wastes will be placed in plastic bags until disposal.

Waste Disposal. Each waste type generated during the field activities would require a different disposal method. These include:

Waste Type	Disposal Method
Soil and Concrete: RCRA Non-Hazardous	RCRA Subtitle D Landfill
Soil: RCRA Hazardous	RCRA Subtitle C Landfill
Decontamination Water-Non-Hazardous Waste	LHAAP Groundwater Treatment Plant (GWTP)
Miscellaneous Wastes	Municipal Solid Waste

Disposal Facility Selection. Shaw would select the final disposal facility for the waste based on several factors:

- TSDF capacity to accommodate incoming waste;
- Solicitation of bids using applicable Federal Acquisition Regulations;

- Verification of permits and insurance (at time of award); and,
- The disposal facility must meet the permit compliance requirements.

Selection of the off-site disposal facility will follow the acceptability criteria in accordance with USEPA's Offsite Rule (40 CFR 300.440).

Waste Transportation and Disposal. It is assumed that all materials generated will be transported and disposed of as non-hazardous waste and sent to an off-site permitted disposal facility.

Any wastes or contaminated media classified as hazardous and transferred off-site or transported in commerce along public rights-of-way must meet U.S. Department of Transportation requirements for hazardous materials as well as the specific requirements for the type of waste (e.g., RCRA, solid waste). These include packaging, labeling, marking, manifesting, and placarding requirements for the specific waste type. In addition, all wastes sent off site must also meet the Texas waste acceptance criteria for disposal facilities (30 TAC 451, Subchapter B).

2.8.1 Former Pistol Range

Excavated contaminated soil may be consolidated on site in a staging area before being sent off site for disposal.

2.8.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

If the soil under the concrete pad is clean, the roll-offs and/or temporary soil stockpile will be placed on it for easy access using the excavator. If the soil beneath the concrete pad is contaminated, the roll-offs and/or temporary soil stockpile will be placed near the road to allow easy access and direct loading of trucks using the excavator.

2.9 Decontamination of Equipment and Personnel

A permanent decontamination station is located at the on-site GWTP at LHAAP-18/24 and can accommodate large equipment. As noted in **Section 2.3**, temporary decontamination pads will be constructed at an approved on-site location as needed to decontaminate equipment and prevent cross-contamination between sites. The decontamination pad will be approximately 15 feet in length and width, bermed, and covered with HDPE sheeting. Wash water will be contained and transported to the GWTP for disposal when necessary. Equipment used for the excavation and handling of contaminated soil will be inspected for contamination prior to leaving the site. Contaminated soil that adheres to the equipment will be removed by mechanical means. If contamination is still visibly present after mechanical cleaning, equipment will be rinsed with decontamination liquids. Further information on decontamination procedures are found in the Final Installation-Wide Work Plan, Appendix D, Field Procedures (Shaw, 2006).

Personnel shall be decontaminated as indicated in the Site-Specific Supplement to HASP (see **Appendix A**).

2.10 Site Restoration

Once the excavation has been completed, Shaw will restore the site and demobilize. As needed, backfill operations would proceed after excavation activities are complete. The areas would be backfilled with a clean fill and would have approximately 6 inches of topsoil applied. The area will be graded, if necessary, to match the original topography and to ensure positive drainage and reseeded per applicable USACE requirements.

Clean fill will be obtained from an off-site borrow source. Existing documentation from the borrow source will be reviewed to evaluate if it is clean compared to background, SAI-Ind, and GWP-Ind values. If necessary, Shaw will collect representative samples from the borrow source for environmental testing.

2.11 Installation of Monitoring Well at LHAAP-04

After site restoration activities are complete, a shallow zone monitoring well, 04WW04, will be installed in/or adjacent to the soil excavation area at LHAAP-04. The monitoring well will be installed near 04SB11 sample location or just north of it. The placement of the well will be finalized following receipt of confirmation sample results. Well placement recommendation will be submitted for regulatory approval prior to well installation. Following development, groundwater samples will be collected from the monitoring well to evaluate the effectiveness of the removal of the soil-to-groundwater pathway. Well installation and groundwater sampling will be performed in accordance with the requirements presented in Tasks 8 and 9 of the CQCP (**Appendix B**).

The monitoring well will be drilled and installed using a hollow-stem auger or mud rotary drill rig depending upon site conditions. Fill material will not be sampled, but samples of native soil will be collected continuously using a split barrel core sampler advanced ahead of the drill bit. The soil samples will be described according to ASTM D2488-00, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), and logged on USACE Engineering Form 1836 (Drilling Log) or equivalent. The monitoring well will be constructed with flush-joint threaded, schedule 40, polyvinyl chloride (PVC). The monitoring well will be installed in the annulus of the hollow-stem auger. The PVC well screen for each well will be 0.01-inch slotted and 10 feet in length.

Additional details for well installation, well development and sampling are found in the Final Installation-Wide Work Plan, Appendix C, CDAP and Appendix D, Field Procedures (Shaw, 2006).

2.12 Surveying

A State of Texas-licensed professional land surveyor will survey the boundaries of the completed soil excavations and the location and elevation of the newly installed monitoring well at LHAAP-04. If after excavation it is determined that soils above the SAI-Ind for lead (Pistol Range) or SAI-Ind for mercury (LHAAP-04) are remaining and cannot feasibly be excavated, the locations above the SAI-Ind will be staked and surveyed for elevation and northing/easting readings. The horizontal coordinates (northing and easting) will be surveyed to the nearest 0.1 foot and will be based on the North American Datum of 1983. The vertical elevations of the top of well (top-of-casing) at LHAAP-04 will be surveyed to nearest 0.01 feet. The ground surface elevation at the LHAAP-04 well location will be surveyed to the nearest 0.1 feet. To ensure compatibility with pre-existing well elevations, the top-of-casing for the nearest existing well will be surveyed. If discrepancies are noted, the USACE will be consulted for resolution. Surveying will be in accordance with the requirements described in Task 10 of the CQCP (**Appendix B**).

2.13 Restoration

The excavated areas will be regraded to blend with the surrounding topography. Clean fill soil will be imported as necessary to match the surrounding grade and ensure positive drainage. The soil will be placed using the excavator and, if needed, a dozer. Compaction will be incidental to placement.

At restored areas of the former Pistol Range, erosion control matting will be applied to the slope, and flat areas will be seeded and mulched.

At LHAAP-04, the restored surface will be seeded and mulched. Shaw will confer with the Army regarding the acceptability of the grass seed for the sites prior to application.

2.14 Demobilization

Upon completion of site restoration operations, Shaw will remove temporary facilities, perform final equipment decontamination, and demobilize personnel.

2.15 Reporting

After the removal action has been completed and the final inspection approved by the Army, a Closure Report will be prepared. Compilation of the information for the report will occur throughout the duration of the removal actions. The report should include site drawings, sample data, copies of all manifests, and a narrative of the removal actions. The completed Draft Closure Report will be submitted to the Army for review and comment. Following this, a Draft Final Closure Report will be submitted to the regulatory agencies for review and comment. When regulatory agency comments have been resolved, the Final Closure Report will be issued.

2.16 Schedule

The estimated length of time for construction activities including site setup, clearing and grubbing, excavation, disposal, confirmatory sampling, waste characterization and site restoration is approximately 4½ weeks. **Table 2-1** shows the anticipated duration for each of the major site activities.

Table 2-1
Durations for Major Site Activities

Activities	Duration
Mobilization/Site Setup	1 Day
Excavation:	
Former Pistol Range	2 Days
LHAAP-04	8 Days
Confirmation Sampling and Analysis (each site)	3 Days
Backfill	5 Days
Site Restoration	2 Days
Monitoring Well at LHAAP-04	1 Day
Exceptions:	
Concrete breakup and overexcavation	5 Days +
Resample	3 Days
Estimated Duration	28 Days to 40 Days

Note:
Does not include pre-mobilization activities or rerouting of utilities.

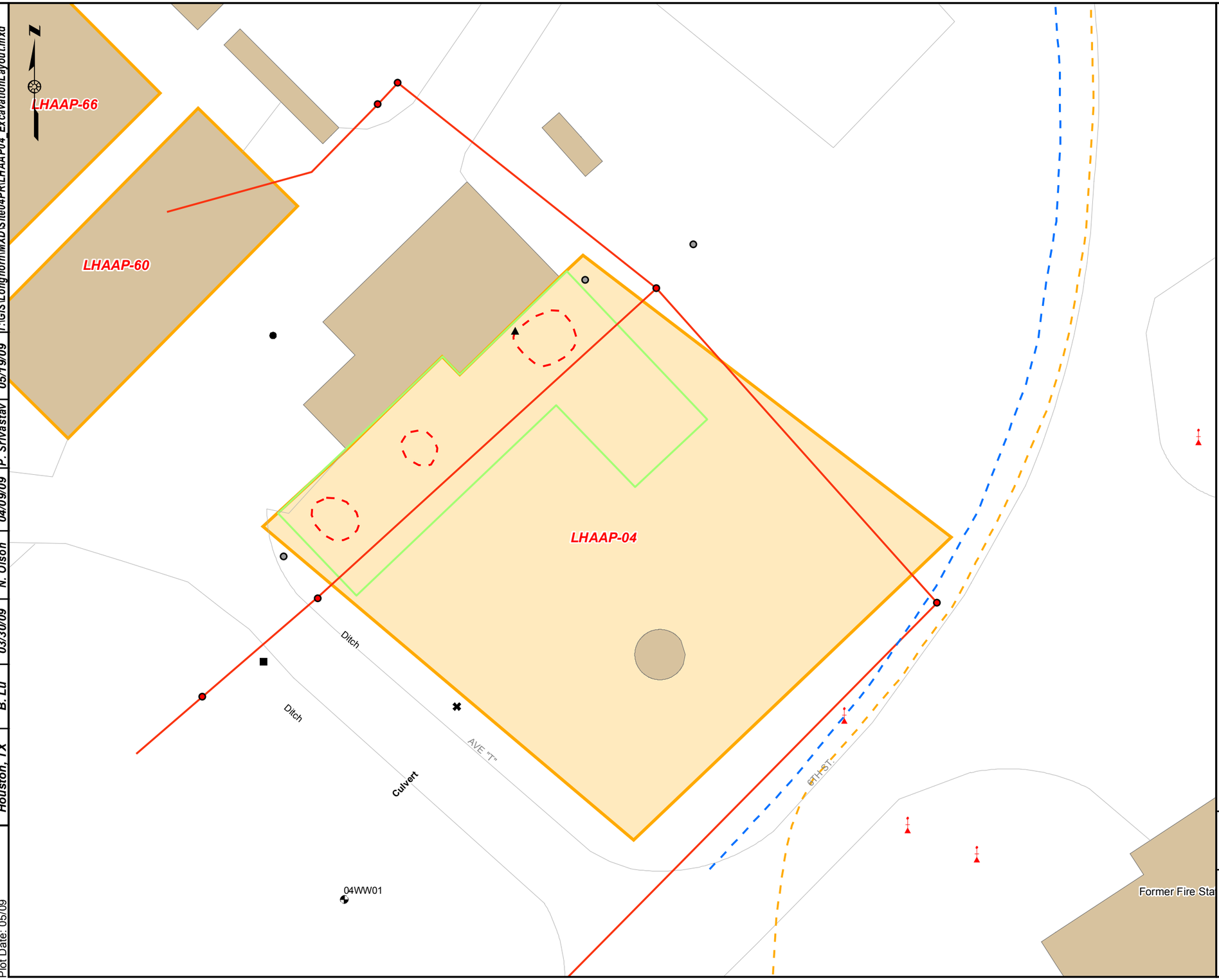
Currently, a former power plant adjacent to LHAAP-04 is being demolished. Due to the associated movement of trucks and material through May 2009, Shaw's mobilization to LHAAP-04 is anticipated to begin in June 2009.

00076138

OFFICE	DRAWN BY	CHECKED BY
Houston, TX	B. Lu 03/30/09	N. Olson 04/09/09

APPROVED BY	FILE PATH
P. Srivastav 05/19/09	T:\GIS\Longhorn\MXD\Site04PRI\LHAAP04_ExcavationLayout.mxd

Plot Date: 05/09



LEGEND

- Electrical Line Pole
- Pole Only
- Hydrant
- Abandoned Eye Wash and Shower
- Hose Bib
- Sanitary Sewer Cleanout
- Water Valve
- Shallow Monitoring Well
- Located communications line 3 ft below ground surface
- Located water line 3 ft below ground surface
- Electrical Line
- Road
- Initial Excavation of 4 Feet
- Initial Area of Excavation Deeper than 4 Feet
- Concrete Slab
- Site

Note:

Northeast end of excavation was moved approximately 7-feet southwest of the boundary presented in the EE/CA (Shaw 2009b) based on additional field measurements and photographs of PLANTECO pilot study plot.

0 15 30 60 Feet

Shaw®

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TULSA, OKLAHOMA

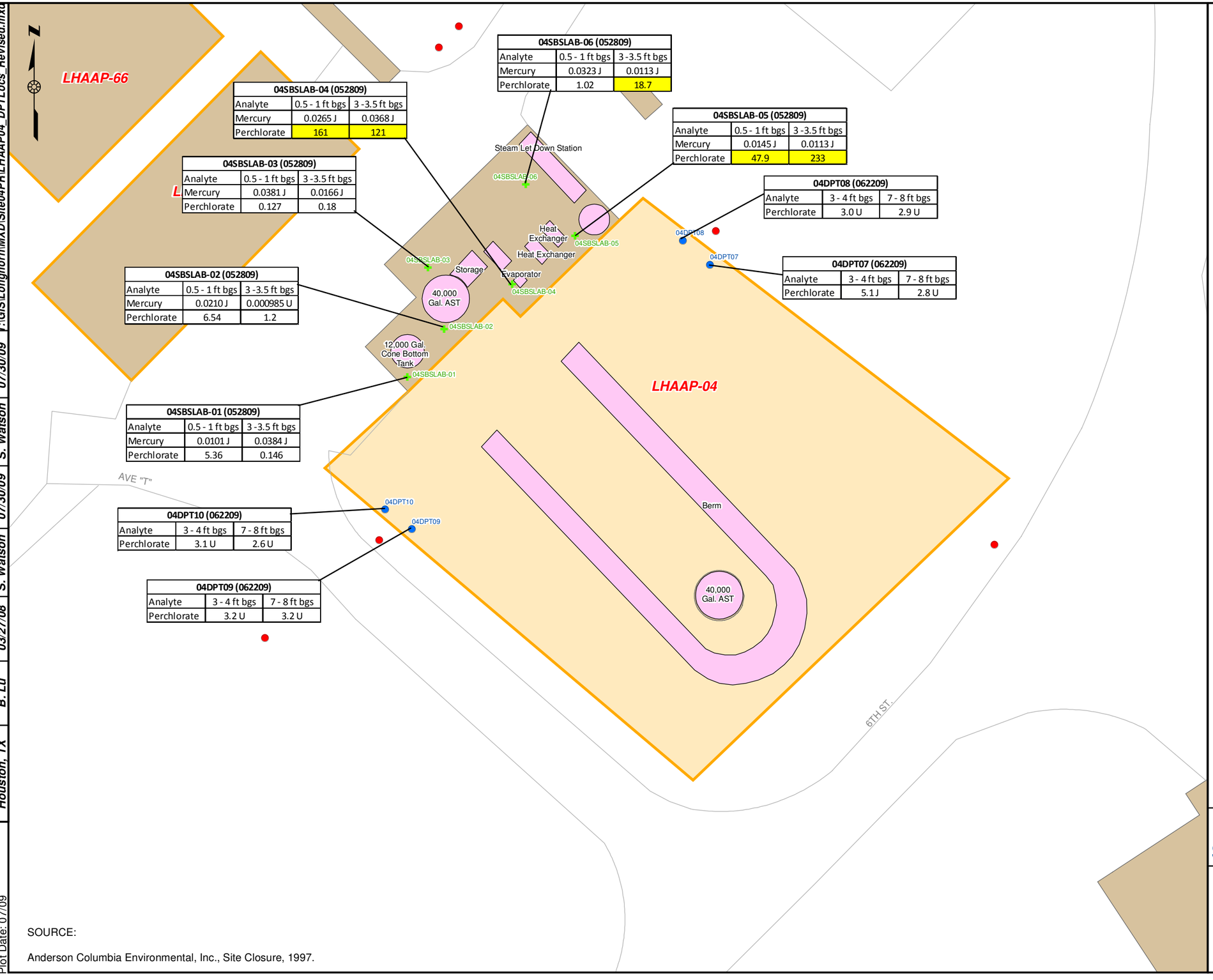
FIGURE 2-1

LOCATION OF UTILITIES
LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

FILE PATH	APPROVED BY	CHECKED BY	DRAWN BY	OFFICE
T:\GIS\Longhorn\MXD\Site04PR\LHAAP04_DPTLocs_Revised.mxd	S. Watson 07/30/09	S. Watson 07/30/09	B. Lu 03/27/08	Houston, TX

Plot Date: 07/09



LEGEND

- Live Electric Pole
- DPT Sample Location - Near Electric Pole
- DPT Sample Location - Through Concrete Slab
- Road
- Former Operation Structure (Raised Pad)
- Concrete Slab
- Site

AST -- Aboveground Storage Tank

NOTES:

1. Results in milligrams per kilogram.
2. Yellow highlighted sample results are above the proposed cleanup level.

0 15 30 60 Feet

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TULSA, OKLAHOMA

FIGURE 2-2

PRE-MOBILIZATION SAMPLE RESULTS
LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

SOURCE:

Anderson Columbia Environmental, Inc., Site Closure, 1997.

00076140

LOCATION	EAST	NORTH
A	3314847.9	6951929.7
B	3314857.5	6951929.7
C	3314871.2	6951904.3
D	3314890.4	6951893.8
E	3314890.4	6951880.5
F	3314870.8	6951866.3
G	3314848.7	6951866.3
H	3314832.9	6951882.6
I	3314832.9	6951899.7
J	3314837.5	6951904.7

LEGEND

- XRF Sediment Sample Location
- XRF Sample Location
- Lead Concentration Contour
- Stream
- Road
- Approximate Firing Line Location
- Excavation Area
- 25-foot Grid
- Target Embankment
- Pistol Range

NOTES:

1. LOD is level of detection.
2. Lead concentrations are in milligrams per kilogram.
3. 1,000 contour is boundary of area of removal.

0 20 40 80 Feet

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TULSA, OKLAHOMA

FIGURE 2-3

INITIAL EXCAVATION AREA
FORMER PISTOL RANGE

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

FILE PATH	T:\GIS\Longhorn\MXD\Site04PRIPistolRange_InitialExcavations.mxd
APPROVED BY	P. Srivastav 03/03/09
CHECKED BY	N. Olson 04/09/09
DRAWN BY	GWT 1/09/07
OFFICE	Houston, TX

Plot Date: 05/09

00076141

LOCATION	EAST	NORTH
A	3306023.7	6959119.1
B	3306001.4	6959098.2
C	3305977.2	6959123.5
D	3305915.7	6959064.8
E	3305891.5	6959090.1
F	3305942.2	6959138.5
G	3305947.5	6959132.9
H	3305980.5	6959164.7
I	3305950.2	6959115.5
J	3305905.5	6959075.4
K	3305895.2	6959086.2
L	3305939.9	6959126.1
M	3305988.1	6959144.4
N	3305973.6	6959130.6
O	3305959.8	6959145.2
P	3305974.4	6959158.9

Concrete to be removed. Initial excavation depth of 5' below top of concrete.

An approximate 20' x 20' area will be excavated to 10' bgs initially.

Approximately 5' from the edge of the slab, a 15' x 60' area will be excavated to 7' bgs initially.

LHAAP-04

40,000 Gal. AST

12,000 Gal. Cone Bottom Tank

Heat Exchanger

Evaporator

Storage

Steam Let Down Station

Berm

Pipe-2'

Pipe-25'

Pipe-50'

Pipe-75'

Pipe-97'

Tank-NE

Tank-SE

Tank-NW

Tank-MID

Tank-SW

SUMP122

LH: S122-01

LH: S122-02

04SBSLAB-01

04SBSLAB-02

04SBSLAB-03

04SBSLAB-04

04SBSLAB-05

04SBSLAB-06

SB-1

SB-2

SB-3

SB-4

SB-5

SB-6

SB-7

SB-8

SB-9

SB-10

SB-11

SB-12

SB-13

04SB01

04SB02

04SB03

04SB04

04SB05

04SB06

04SB07

04SB08

04SB09

04SB10

04SB11

04SB12

04SB13

04DPT07

04DPT08

04DPT09

04DPT10

STEP-04SS01

STEP-04SS02

STEP-04SS03

STEP-04SS04

STEP-04SS05

STEP-04SS06

STEP-04SS07

STEP-04SS08

STEP-04SS09

STEP-04SS10

STEP-04SS11

STEP-04SS12

STEP-04SS13

STEP-04SS14

STEP-04SS15

AVE "T"

6TH ST.

N

LEGEND

- DPT Sample Location - Near Electric Pole
- DPT Sample Location - Through Concrete Slab
- Electrical Line Pole
- Pole Only
- Hydrant
- 4' Depth Composite Sample (floor grab location)
- 5' Depth Composite Sample (floor grab location)
- 7' Depth Composite Sample (floor grab location)
- 10' Depth Composite Sample (floor grab location)
- Sump
- Soil Boring Associated with Sump122
- 2007 Soil Sampling Location (Shaw, 2007)
- 2006 Soil Sampling Location (Shaw, 2006)
- 2002 Surface Soil Sample (STEP, 2003)
- 2000 Soil Boring (Jacobs, 2002b)
- 1997 Soil Boring (ACE, 1997)
- Road
- Excavation Area Deepter than 5' bgs
- Former Location of Operational Structure
- Approximate Location of Pilot Study Plot
- Initial Excavation of 4 Feet
- Initial Area of Excavation Deeper than 4 Feet
- 4' bgs Initially
- Concrete Slab
- Site

NOTE:

A confirmation sample will be collected from the floor for approximately every 750 square feet and from each overexcavated area.

bgs - below ground surface

Samples will be analyzed for perchlorate.

0 15 30 60 Feet

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TULSA, OKLAHOMA

FIGURE 2-4

INITIAL EXCAVATION AREAS
LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 03/28/08	S. Watson 07/03/09	P. Srivastav 07/30/09	T:\GIS\LonghornMXD\Site04PR\LHAAP04_Excavations_REV.mxd

Plot Date: 07/09

3.0 Health and Safety

The HASP (the latest revision of Appendix A of the Installation-Wide Work Plan [Shaw, 2006]) incorporates health and safety policies and safe operating procedures for individual project site activities. These procedures allow work activities to be carried out in a controlled, effective manner, consistent with Shaw policies.

Information specific to the removal action activities at the former Pistol Range and LHAAP-04 is provided in **Appendix A**. This information includes PPE levels, air monitoring requirements, and activity hazard analyses. These items supplement the HASP; they do not replace it. This information is not addressed by the site-wide HASP because the hazards are unique to the proposed work.

Prior to initiating work at the facility for any site, workers will have signed the HASP in the designated area to indicate they have read and understood the document. Also, daily safety meetings will be held with all field crew members prior to starting work each day in order to review the day's scope of work, any site conditions expected, and any hazards that need to be addressed or acknowledged.

3.1 Work near Overhead Electric Lines

Because of its potential importance at LHAAP-04, this section emphasizes that Shaw will adhere to safety procedure HS308, Underground/Overhead Utility Contact Prevention (Shaw E & I, 2006) for clearance of equipment prior to commencement of activities in proximity to power lines. **Table 3-1** (USACE, 2008) identifies the minimum clearance from energized overhead electric lines.

Table 3-1
Minimum Clearance from Energized Overhead Electric Lines

Voltage (nominal, kV, alternating current)	Minimum Rated Clearance
Up to 50	10 ft (3 m)
51 – 200	15 ft (4.6 m)
201 – 350	20 ft (6 m)
351 – 500	25 ft (7.6 m)
501 – 650	30 ft (9.1 m)
651 – 800	35 ft (10.7 m)
801 – 950	40 ft (12.2 m)
951 – 1100	45 ft (13.7 m)
Clearance values calculated using: (Initial kV-50kV) x (4 in/10 kV) x (1 ft/12 in) = increased distance (ft) over 10 ft. Add this value to 10 ft to yield minimum rated clearance	

Notes and Abbreviations:

All dimensions are distances from live part to employee. Source: USACE, 2008

ft feet kV kilovolts
in inches m meters

4.0 Quality Assurance/Quality Control

The CQCP provides information on quality assurance/quality control (QA/QC) procedures for this project. The CQCP identifies personnel, procedures, controls, instructions, tests, verifications, documents, and forms to be used and the types of records to be maintained. The CQCP addresses quality control requirements specific to each major feature of work, including special steps that apply to the former Pistol Range and LHAAP-04. The CQCP is provided in **Appendix B**.

The USACE Three-Phase QC process will be used to enforce QA/QC requirements and include preparatory inspections, initial inspections, and follow-up inspections. The three-phases of inspections will target each definable feature of work during the execution of project activities.

5.0 References

Anderson Columbia Environmental, 1997, *Closure Report, Pilot Wastewater Treatment Plant, Longhorn Army Ammunition Plant, Karnack, Texas, EPA Identification No. TX6213820583, Solid Waste Registration No. 30990,* September.

Plexus Scientific Corporation, 2005, *Environmental Site Assessment, Phase I and II Report, Final, Production Areas, Longhorn Army Ammunition Plan, Karnack, Texas*, February.

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Appendix A

Site-Specific Supplement to Health and Safety Plan

APPENDIX A
SITE-SPECIFIC SUPPLEMENT TO HEALTH AND SAFETY PLAN

FINAL
REMOVAL ACTION WORK PLAN
FORMER PISTOL RANGE AND LHAAP-04,
FORMER PILOT WASTEWATER TREATMENT PLANT, GROUP 4
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared for

U.S. Army Corps of Engineers
Tulsa District
1645 South 101st Avenue
Tulsa, Oklahoma

Prepared by

Shaw Environmental, Inc.
3010 Briarpark Drive, Suite 400
Houston, Texas 77042

Contract Number W912QR-04-D-0027
Task Order No. DS02

August 2009

PPE Levels

LHAAP-04 Concrete Coring

Level D – Modified PPE:

- Hard hat meeting ANSI Z89.1 specifications.
- Safety glasses with side shields meeting ANSI Z87.1 specifications.
- Safety-toed work boots meeting ANSI Z41 specifications.
- Nitrile surgical gloves (inner or double layer).
- Hearing protection (if necessary or required).
- High visibility vests (ground personnel when working near heavy equipment or vehicular traffic).
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary).

LHAAP-04 Direct Push Soil Sampling

Level D – Modified PPE:

- Hard hat meeting ANSI Z89.1 specifications.
- Safety glasses with side shields meeting ANSI Z87.1 specifications.
- Safety-toed work boots meeting ANSI Z41 specifications.
- Nitrile surgical gloves (inner or double layer).
- Hearing protection (if necessary or required).
- High visibility vests (ground personnel when working near heavy equipment or vehicular traffic).
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary).

LHAAP-04 Soil Excavation, Soil Handling, Concrete Demolition, Soil or Concrete Load-out, and Monitoring Well Installation

Level D – Modified PPE:

- Hard hat meeting ANSI Z89.1 specifications.
- Safety glasses with side shields meeting ANSI Z87.1 specifications.
- Safety-toed work boots meeting ANSI Z41 specifications.
- Nitrile surgical gloves (inner or double layer).

- Disposable Tyvek® coveralls with hoods, elastic wrists, and ankles.
- Chemical resistant boot covers and/or outer boots (polyvinyl chloride [PVC]/latex/neoprene when there is potential for shoe/boot contact with contaminated soil or water).
- Hearing protection (if necessary or required).
- High visibility vests (ground personnel when working near heavy equipment or vehicular traffic).
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary).

Former Pistol Range Excavation, Soil Handling, or Load-out

Level D – Modified PPE:

- Hard hat meeting ANSI Z89.1 specifications.
- Safety glasses with side shields meeting ANSI Z87.1 specifications.
- Safety-toed work boots meeting ANSI Z41 specifications.
- Nitrile surgical gloves (inner or double layer).
- Disposable Tyvek® coveralls with hoods, elastic wrists, and ankles.
- Chemical resistant boot covers and/or outer boots (polyvinyl chloride [PVC]/latex/neoprene when there is potential for shoe/boot contact with contaminated soil or water).
- Hearing protection (if necessary or required).
- High visibility vests (ground personnel when working near heavy equipment or vehicular traffic).
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary).

Air Monitoring

LHAAP-04 and Former Pistol Range

Real-Time Aerosol Monitor

Real-time aerosol monitors (MIE pDR-1000 or equivalent) shall be used to monitor dust emissions during contaminated soil excavation, soil removal, soil handling, soil loading, concrete boring, concrete demolition, and other dust generating activities. The real-time aerosol monitors will be placed in the work area (near areas where ground personnel are working) and at the downwind site perimeter. The selected placement of these instruments may need to be adjusted throughout the workday to compensate for changes of wind direction.

Real-Time Aerosol Monitoring Action Levels

The real-time aerosol monitors will be set to alarm when the instantaneous aerosol concentration reaches 1.0 mg/m^3. The alarm will be used to indicate that additional dust control is necessary.

The real-time aerosol monitors are capable of collecting and integrating the aerosol concentrations throughout the workday into a TWA. Aerosol monitors shall be visually checked on an hourly basis during dust generating activities to verify that the TWA remains below 1.0 mg/m^3. Aerosol monitors registering time-weighted average aerosol concentrations at or above 2.0 mg/m^3 require that workers upgrade to Level C PPE and indicate that additional dust control measures are necessary. Failure to control workday time-weighted average dust concentrations to below 4.0 mg/m^3 shall necessitate ceasing dust generating activities and contacting the PM and HSM for implementing alternate work practices.

The full work-shift time-integrated concentrations will be evaluated at the conclusion of each workday to verify aerosol concentrations are maintained below action levels.

Personal Air Sampling (Time-Integrated)

Time-integrated air sampling may be performed at the discretion of the HSM, if air-monitoring action levels are exceeded.

Medical Surveillance

LHAAP-04 and Former Pistol Range

There are no special medical surveillance requirements in addition to the requirements of 29 CFR 1910.120(f), which are already in place.

Activity Hazard Analysis (AHA)

Activity: Concrete Coring Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Arrival of new personnel at site.	New personnel.	All personnel shall attend the site orientation training.
	Failure to plan.	Complete JSA for task, as specified in Shaw HS 045, Job Safety Analysis.
Unload equipment.	Heavy lifting, strains, and sprains.	No individual shall lift any object that weighs over 60 pounds.
		Use proper lifting techniques.
		Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.
Concrete coring.	Intrusive activities.	Follow procedure for Intrusive Activities Permit in Health and Safety Plan (HASP) and follow Shaw HS 308, Underground/Overhead Utility Contact Prevention.
		Underground utilities shall be located and marked prior to commencing coring activity.
	Contaminated concrete or soil.	Wear PPE as specified in the HASP.
		Perform air monitoring as specified in the HASP.
		Notify the Site Safety and Health Officer (SSHO) if odors are detected.
		Perform decontamination as specified in the HASP.
	Use of hand tools.	Inspect hand tools daily and before each use.
		Tools, which are damaged, shall be removed from service.
		Personnel shall work in a manner and pace to reduce strains and overexertion.
		Follow the cutting tool procedures, which are specified in the HASP.

Activity Hazard Analysis (AHA)

Activity: Concrete Coring Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Concrete coring (continued).	Noise.	Personnel working in vicinity of equipment shall wear hearing protection to reduce exposures to below the OSHA limits.
	Use of coring machine.	All components of the machine that has a direct bearing on the safety of the operation shall be inspected at the beginning of each shift and when possible, observed during operation. All guards for moving machinery shall be in place. The machine shall not be used if it is not in a safe operating condition. A copy of the coring machine manual shall be available at the job site and reviewed/followed by coring personnel. Personnel shall be aware of pinch-point hazards and work in a manner to prevent injuries. Hands shall be kept out of areas that may present a pinching hazard and personnel shall not position themselves between equipment. The operator shall verbally alert employees and visually ensure employees are clear from dangerous parts of equipment prior to starting or engaging equipment. Coring equipment shall be equipped with a guard and an emergency shutdown device. All crew members shall know the location and operation of the kill switch.
	Tip over of coring machine.	The coring machine shall be positioned in a level fashion with stands and outriggers set.
	Moving/operating parts and equipment.	The coring tool shall be maintained or cleaned only when the machine is shut-off. Crew members shall not wear loose clothing or jewelry.

Activity Hazard Analysis (AHA)

Activity: Concrete Coring Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Concrete coring (continued).	Open borings.	The coring-holes shall be covered, secured, and flagged when work is not in progress.
	Fire.	Smoking is permitted in designated areas only.
		A 20-B:C fire extinguisher shall be available in each work and fueling area.
		Do not start gasoline-powered equipment in fueling area (at least 10 feet away).
		Store gasoline in safety cans with flash arresters and spring-loaded vents.
	Slips, trips, and falls.	Keep work areas clear and maintain housekeeping.
		Do not jump from elevated surfaces.
		Use caution when walking on rocky, slippery, or uneven terrain
	Hand injuries.	Items to be handled shall be inspected for sharp edges or protrusions prior to being handled.
		Wear leather gloves when handling sharp materials.
		Be aware of and avoid pinch point hazards.
		Use cutting tool procedures in HASP.
		Wear PPE and tape joints to keep insects away from the skin.
		Use 3M Ultrathon (N,N-diethyl-m-toluamide) and Repel Permanone (permethrins) to repel chiggers, mosquitoes, and ticks.
		Check limbs/body for insects/insect bites before showering.
		Notify SSHO of flu-like symptoms.

Activity Hazard Analysis (AHA)

Activity: Concrete Coring Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Concrete coring (continued).	Heat stress and cold stress. Severe weather.	Follow procedures outlined in the HASP. The SSHO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. The SSHO will identify a suitable tornado shelter at each work location. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or tornado shelters as appropriate). When clouds with dark bases and wind speeds pick up, anticipate thunderstorms and the potential for tornadoes. Those who have been struck by lightning did not seek cover in a timely fashion. Follow the procedures in the HASP.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
PPE First aid kit Leather gloves Concrete Coring Machine Insect repellant Repel Permanone Fire extinguishers Air monitoring instruments Hearing protection	Site inspections (daily) Intrusive activities permit Coring machine (prior to each use) Verify tornado shelter available Monitor approaching storms Fire extinguishers (weekly) Hand tools (before each use) Extension cords (before each use)	HAZWOPER Site orientation Hazard Communication Review equipment operator's manual Hearing conservation Biological hazard identification and control Emergency procedures Tornado shelter locations Lightning Safety Procedures Fire extinguisher use

Activity Hazard Analysis (AHA)

Activity: Subsurface Soil Sampling Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Arrival of new personnel at site.	New personnel.	All personnel shall attend the site orientation training.
	Failure to plan.	Complete JSA for task, as specified in Shaw HS 045, Job Safety Analysis.
Unload equipment.	Heavy lifting, strains, and sprains.	No individual shall lift any object that weighs over 60 pounds.
		Use proper lifting techniques.
		Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.
Direct-pushing and subsurface soil sampling.	Intrusive activities.	Follow procedure for Intrusive Activities Permit in Health and Safety Plan (HASP) and follow Shaw HS 308, Underground/Overhead Utility Contact Prevention.
		Underground utilities shall be located and marked prior to commencing direct push activity.
Competent Person Drilling Oversight:	Contaminated water or soil.	Wear PPE as specified in the HASP.
		Perform air monitoring as specified in the HASP.
		Notify the Site Safety and Health Officer (SSHO) if odors are detected.
		Perform decontamination as specified in the HASP.
	Use of hand tools.	Inspect hand tools daily and before each use.
		Tools, which are damaged, shall be removed from service.
		Personnel shall work in a manner and pace to reduce strains and overexertion.
		Follow the cutting tool procedures, which are specified in the HASP.

Activity Hazard Analysis (AHA)

Activity: Subsurface Soil Sampling Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Direct-pushing and subsurface soil sampling (continued).	Use of direct-push equipment.	Inspect direct-push equipment prior to use and daily thereafter - particular attention shall be given to hydraulic lines and fittings. Verify all personnel are instructed in emergency shut-down procedures. All crewmembers, including geologists, shall know the location and operation of the kill switch. Personnel shall be cautious of moving equipment, such as the hydraulic cylinder and rams. Be aware of pinch-point hazards and work in a manner to prevent injuries. Direct push crewmembers shall not wear loose clothing or jewelry. The operator shall verbally alert employees and visually verify employees are clear from dangerous parts of equipment prior to starting or engaging equipment. Be aware of and avoid hot surfaces from heat generated from engine. Review operator's manual and Geoprobe Systems safety information: http://www.geoprobe.com/service/safety.htm
	Noise.	Personnel working in vicinity of equipment shall wear hearing protection while equipment is in the hammering mode to reduce exposures to below the OSHA limits. Noise dosimetry shall be performed on personnel when operating the direct-push rig in the hammering mode. Double hearing protection may be necessary if in direct-push is in hammering mode.
	Use of methanol (if necessary).	Properly label all containers and review MSDS. Use PPE including nitrile gloves and chemical splash goggles.

Activity Hazard Analysis (AHA)

Activity: Subsurface Soil Sampling Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Direct-pushing and subsurface soil sampling (continued).	Use of methanol (continued).	A portable eyewash station shall be readily available in the area where methanol is being used. Personnel who sustain contact with methanol shall immediately wash the affected area with soap and water (eyes should be irrigated for 15 minutes with potable water) and seek immediate medical attention
	Fire.	Smoking is permitted in designated areas only. A 20-B:C fire extinguisher shall be available in each work and fueling area. Do not start gasoline-powered equipment in fueling area (at least 10 feet away). Store gasoline in safety cans with flash arresters and spring-loaded vents.
	Slips, trips, and falls.	Keep work areas clear and maintain housekeeping. Do not jump from elevated surfaces. Use caution when walking on rocky, slippery, or uneven terrain
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Wear leather gloves when handling sharp materials. Be aware of and avoid pinch point hazards. Use cutting tool procedures in HASP.

Activity Hazard Analysis (AHA)

Activity: Subsurface Soil Sampling Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Direct-pushing and subsurface soil sampling (continued).	Insect/animal bites/West Nile Virus.	Review injury potential with workers. Wear PPE and tape joints to keep insects away from the skin. Use 3M Ultrathon (N,N-diethyl-m-toluamide) and Repel Permanone (permethrins) to repel chiggers, mosquitoes, and ticks. Check limbs/body for insects/insect bites before showering. Notify SSHO of flu-like symptoms.
	Contact dermatitis and poison ivy.	Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Identify and review poisonous plants with workers. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where work raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to easily contract poison ivy.
	Heat stress and cold stress.	Follow procedures outlined in the HASP.

Activity Hazard Analysis (AHA)

Activity: Subsurface Soil Sampling Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Direct-pushing and subsurface soil sampling (continued).	Severe weather.	The SSHO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. The SSHO will identify a suitable tornado shelter at each work location. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or tornado shelters as appropriate). When clouds with dark bases and wind speeds pick up, anticipate thunderstorms and the potential for tornadoes. Those who have been struck by lightning did not seek cover in a timely fashion. Follow the procedures in the HASP.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
PPE First aid kit Leather gloves Insect repellant Repel Permanone Fire extinguishers Eyewash station Air monitoring instruments Hearing protection Noise dosimeter	Site inspections (daily) Intrusive activities permit Direct-push equipment (before use and daily) Survey areas for poisonous plants, insects, and animals Check body for ticks Verify tornado shelter available Monitor approaching storms Fire extinguishers (weekly) Eyewash station (daily) Hand tools (before each use) Extension cords (before each use)	HAZWOPER Competent Person Drilling Oversight Site orientation Hazard Communication Review equipment operator's manual Review Geoprobe Systems safety information Hearing conservation Biological hazard identification and control Emergency procedures Tornado shelter locations Lightning Safety Procedures Fire extinguisher use

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Excavation at LHAAP-04. Excavation Competent Person:	New personnel. Failure to properly plan daily activities. Site contaminants. Underground and overhead utilities. Fire.	All personnel shall attend the site orientation training, which shall include Lead Awareness Training. Complete JSA for task, as specified in Shaw HS 045, Job Safety Analysis. Wear PPE as specified in the HASP. Set up work zones and decontamination facilities. Perform air sampling as specified in the HASP. Wash hands and face before eating, drinking, smoking, or chewing. Locate and mark underground utilities prior to commencing activity (follow Shaw HS 308). Identify overhead utilities in work areas and travel routes. Verify voltages in overhead electric lines; the minimum distances from electrical lines must be observed (EM 385-1-1 Table 11-1). Contact utility company to de-energize overhead electric line in LHAAP-04 work area during excavation activities. Verify overhead line has been de-energized, visibly grounded, tested, and locked-out/tagged-out. Remain aware of overhead power lines and maintain safe clearances – use spotters when excavating near line. Adjust size of equipment to maintain clearance from overhead line. Place signs or decals in equipment and dump trucks to maintain at least 10-feet clearance from de-energized line. Post overhead hazard warning signs on ground at excavation area. All electrical, gas, and telephone utilities are to be hand dug within three feet of utility markings. Smoke only in designated areas. Provide 20-B:C fire extinguishers in work area.

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Excavation at LHAAP-04 (continued).	Noise.	Wear hearing protection when in noisy areas or when operating power tools to reduce noise exposures to below the OSHA limits. Perform noise monitoring on equipment operators and ground personnel working in the vicinity of noisy equipment.
	Use of mechanical / heavy equipment.	Only qualified personnel shall be permitted to operate equipment. Inspect equipment daily after the initial USACE inspection. Deficiencies in equipment shall be noted on the inspection form. Equipment found to be unsafe shall not be used. All equipment shall be operated at safe speeds and in a safe manner. Wear safety belts and hearing protection. Shut down all equipment with energies dissipated prior to performing maintenance activities – lock out/tag out procedures may apply. Do not wear loose clothing, and stay clear of moving parts. All mobile equipment shall have backing alarms. Ground personnel, working near heavy equipment, shall wear high visibility conspicuity vests. Ground personnel shall not position themselves between equipment and stationary objects. Personnel are only permitted to approach equipment after a signal from the operator. Personnel shall verify that all mechanical guards are in place and functioning properly.

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Excavation at LHAAP-04 (continued).	Excavation.	The competent person shall inspect the excavation to determine soil classification and specify proper sloping. Inspect excavations (when personnel entry is required) daily, any time conditions change. Store excavated material at least 2 feet from the edge of the excavation; prevent excessive loading of the excavation face. Provide sufficient stairs, ladders, or ramps when workers enter excavations over four feet. Treat trenches over four feet deep as confined spaces. Slope, bench, or shore excavations over five feet deep, if worker entry is required. Provide at least two means of exit for personnel working in excavations.
	Dust.	Control dust by frequent wetting of soils and concrete.
	Hand injuries.	Items to be handled shall be inspected for sharp edges and protrusions prior to being handled. Wear leather gloves. Be aware of and avoid pinch point hazards.
	Electrical.	Ground fault circuit interrupters shall be used on all portable electrical equipment, power tools, and extension cords. Only hard or extra-hard usage extension cords shall be used. Extension cords, power tools, and lighting equipment shall be inspected before each use, protected from damage, and kept out of wet areas.
	Use of hand tools.	Select the proper tool – do not improvise. Check the condition of tools before starting (do not use damaged tools). Be aware of who and what is around you when using hand tools. Check your position, footing, and grip before tool use.

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Excavation at LHAAP-04 (continued).	Struck-by abandoned utility poles.	Excavator used to remove abandoned utility poles shall be equipped with Falling Object Guarding System (FOGS) and front windshield guard. Keep all ground personnel twice the horizontal distance of pole height from pole when removing or felling poles. Size poles to manageable lengths prior to moving, handling, and loading. Use grapple or thumb to handle or maneuver poles.
	Heavy lifting, strains, and sprains.	No individual shall lift any object that weighs over 60 pounds. Use proper lifting techniques. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.
	Dump truck operations.	Re-evaluate overhead hazards prior to allowing dump trucks onto the project site. Barricade areas with overhead hazards with caution tape to prevent dump bed from contact. In areas where it is not feasible to use barricades, then spotters and overhead hazard warning signs shall be provided: however, the minimum distances from electrical lines must be observed (EM 385-1-1 Table 11-1). Wear seat belts while trucks are in motion at the project site. Assist trucks when backing is necessary.
	Slips, trips, and falls.	Work areas clear shall be kept organized during work activities. Personnel shall not jump from equipment or elevated surfaces. Use caution when walking on rough terrain or overgrown areas or slippery surfaces.

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Excavation at LHAAP-04 (continued).	Use of Bentonite or Portland cement to abandon pipes.	Read and follow MSDS for each operational hazardous chemical used. Personnel shall handle dry materials in a manner to limit dust generation. Avoid inhalation of dust or wear respiratory protection. Avoid physical contact with grout, cement, or concrete. Safety glasses and glove use is required when contact with grout, cement, or concrete is possible/probable. Personnel who sustain skin contact shall immediately wash the affected area with soap and water (eyes should be irrigated for 15 minutes with potable water) and report the incident to the Site Supervisor. Avoid allowing Bentonite to accumulate in work area as Bentonite can be extremely slippery – use caution when walking/working on slippery surfaces.
	Severe weather.	The Site Superintendent will monitor weather conditions each day in order to plan and prepare for hazardous conditions. The Site Superintendent will identify a suitable tornado shelter at each work location. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or storm shelters as appropriate). When clouds with dark bases and wind speeds pick up, anticipate thunderstorms and the potential for tornadoes. Those who have been struck by lightning did not seek cover in a timely fashion. Follow the procedures in HASP.

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Excavation at LHAAP-04 (continued).	Irritating and toxic plants/insects.	Review injury potential with workers. Observe work areas at a distance to determine if wasps/bees are active or nesting. Wear PPE and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-Diethyl-m-toluamide (DEET), e.g., 3M Ultrathon or equivalent and clothing insecticide preparations containing 0.5 percent permethrins (Repel Permanone) to prevent insect bites. Check limbs/body for insects/insect bites before showering. Notify SSHO of flu-like symptoms. Identify and review poisonous plants with workers. Identify workers who are known to contract poison ivy. Inspect work areas for poisonous plants. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Avoid unnecessary clearing of plant/vegetation areas. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Note: There are pre-exposure and post-exposure poison ivy preparations that should be on hand in case poison ivy is encountered.
	Heat stress and cold stress.	Follow heat stress and cold stress procedures in HASP.

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
PPE, as specified in the HASP Air monitoring instruments Leather gloves Fire extinguishers Hearing protection First aid kit AM/FM radio	Site inspections (daily) Heavy equipment (USACE form prior to use) Heavy equipment (daily) Tools (before each use) Dump trucks (daily) Fire extinguishers (weekly) Underground utilities location (prior to intrusive activities) Overhead hazards (prior to entering work areas) Excavations (daily) Identify pinch point hazards Hand tools (before use)	Site orientation HAZWOPER Hazard communication Lifting/back safety Qualified operators Fire extinguisher use Lockout/tagout procedures Excavation Competent Person Emergency procedures Lightning Safety Procedures

Appendix B

Contractor Quality Control Plan

APPENDIX B
CONTRACTOR QUALITY CONTROL PLAN

FINAL
REMOVAL ACTION WORK PLAN
FORMER PISTOL RANGE AND LHAAP-04,
FORMER PILOT WASTEWATER TREATMENT PLANT, GROUP 4
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared for

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Contract Number W912QR-04-D-0027
Task Order No. DS02

August 2009

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Acronyms and Abbreviations

CDAP	Chemical Data Acquisition Plan
CQC	contractor quality control
CQCP	Contractor Quality Control Plan
CQCSM	Contractor Quality Control System Manager
DPT	Direct Push Technology
GPS	Global Positioning System
HASP	Health and Safety Plan
LHAAP	Longhorn Army Ammunition Plant
MARC	Multiple Award Remediation Contract
OSHA	Occupational Safety and Health Administration
PPE	personal protection equipment
QAR	quality assurance representative
QC	quality control
Shaw	Shaw Environmental, Inc.
SSO	Site Safety Officer
TO	task order
USACE	U.S. Army Corps of Engineers

1.0 Introduction

The U.S. Army Corps of Engineers (USACE), Tulsa District, contracted Shaw Environmental, Inc. (Shaw), under the Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D0027, Task Order (TO) No. DS02, to perform closure of multiple environmental sites at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas. TO DS02 is being administered by the Tulsa District of USACE.

LHAAP is located in central-east Texas, in Harrison County, between State Highway 43 at Karnack, Texas, and Caddo Lake. Figure 1-1 of the Work Plan shows the location of LHAAP and surrounding communities.

The objective of this TO is to perform investigations, collect data, perform remediation activities at multiple sites on an expedited basis to achieve site closures and bring as many sites as possible into the long-term management/long-term operation stage as early as possible. This Contractor Quality Control Plan (CQCP) documents quality control (QC) requirements that will be implemented during investigation and remediation of the former Pistol Range and LHAAP-04.

2.0 Contractor Quality Control Plan Purpose and Scope

2.1 Contractor Quality Control Plan Purpose

This CQCP establishes procedures that enable common project field activities to be completed successfully and documents QC requirements for services provided by Shaw and its subcontractors during project activities at the former Pistol Range and LHAAP-04. This plan describes requirements for organizing, planning, performing, reviewing, documenting, and reporting activities that may affect the quality of the work. This CQCP applies the specific requirements of Shaw's Contractor Quality Control (CQC) System to this project by establishing controls for:

- QC staff organization and authority
- Workmanship
- Construction activities for major definable features of work
- Records
- Inspections and tests
- Documentation
- Audits
- Subcontractor performance

This plan references standard field procedures, policies, regulations, and practices required to implement the work. A controlled copy of applicable Field Procedures from Appendix D (Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Shaw, 2006) will be available as a reference document.

2.2 Contractor Quality Control Plan Scope

This CQCP is applicable to the work proposed at the former Pistol Range and LHAAP-04, including the major definable features of site work (or major project tasks) identified below:

Task 1 – Mobilization and Site Setup
Task 2 – Monitoring Well Abandonment
Task 3 – Soil Excavation and Disposal
Task 4 – Soil Sampling
Task 5 – Direct Push Technology (DPT) Sampling
Task 6 – Investigation-Derived Waste Management
Task 7 – Concrete Removal
Task 8 – Monitoring Well/Compliance Well Installation
Task 9 – Groundwater Sampling
Task 10 – Surveying
Task 11 – Site Restoration and Demobilization

2.3 Acceptance of Contractor Quality Control Plan

Work within the scope of this plan will not be started prior to providing this CQCP to USACE, unless otherwise permitted by USACE. Any proposed changes to this CQCP will require notification to USACE in writing. Proposed changes are subject to the approval of USACE.

3.0 Organization and Responsibilities

3.1 Personnel and Structure

The Contractor Quality Control System Manager (CQCSM) coordinates implementation of this CQCP with the Site Superintendent, Remediation Manager, and the Project Manager.

3.2 Duties and Responsibilities

The duties and responsibilities of personnel with regard to the CQC program are briefly outlined below. Duties and responsibilities of health and safety personnel are presented in Appendix A, Health and Safety Plan (HASP) (Shaw, 2006).

Project Manager: The Project Manager is responsible for all activities on the project, and directs and monitors the Site Superintendent in planning, coordinating, and controlling the work. The Project Manager has overall responsibility for establishing the CQCP and for its implementation, and he has the authority to access the required resources throughout Shaw to ensure compliance with the contract requirements.

Remediation Manager: The Remediation Manager will direct investigation and remediation activities and will be responsible for the overall preparation of submittals related to investigation and remediation activities. This individual will direct the technical staff during daily operations. He/she will coordinate and supervise human health/ecological risk assessment activities, feasibility studies, and decision documents and will ensure that regulatory requirements are met and will support the Project Manager with regulatory interaction. Other responsibilities include overseeing drilling, geologic interpretation, and required modeling.

Project Hydrogeologist: The Project Hydrogeologist reports to the Remediation Manager and is responsible for site investigation technical assurance. This individual will oversee the site investigation activities. The project hydrogeologist has the following duties and authorities:

- Plan and oversee site drilling and monitoring well installation
- Select the well screening intervals
- Perform and/or oversee the purging and sampling of newly installed monitoring wells and existing monitoring wells
- Perform and/or oversee the preservation, packaging, and shipping of samples to an off-site, fixed laboratory for environmental analyses
- Ensure documentation accuracy, completeness, and consistency among field team members

- Stop work that deviates from the contract documents or is otherwise nonconforming or unsafe.

CQCSM: The CQCSM is responsible for the overall management of the project CQC program during field activities. Depending on the extent of on-going field work, the CQCSM may perform dual roles of CQC management and site safety management. When serving as CQCSM/Site Safety Officer (SSO), this individual receives administrative and day-to-day direction from the Remediation Manager. This individual is responsible to the Shaw Program QC Manager for direction on matters that may affect the QC requirements for the project and to the Shaw Program Health and Safety Manager for safety-related matters. The CQCSM/SSO is assigned the following duties:

- Monitor and verify that the work is performed in accordance with the contract requirements
- Review and verify the disposition of discrepancy and corrective action reports
- Perform QC inspections and surveillance, and report daily on project QC
- Monitor project submittals in accordance with submittal register requirements
- Submit QC reports to the USACE Field Representative/Quality Assurance Representative (QAR) on a daily basis, unless other arrangements are agreed to by the USACE

The CQCSM has the authority to reject materials and workmanship that do not comply with project requirements, and to stop nonconforming work activities (see **Figure 3-1**). This individual will also verify conformance with the HASP.

Site Superintendent: The Site Superintendent is responsible to the Remediation Manager and the Project Manager for day-to-day supervision of the on-site remedial activities. The Site Superintendent's involvement in QC includes communicating the necessity of quality workmanship in all remedial activities to the on-site project staff.

Program QC Manager: The Program QC Manager is responsible to review, monitor, and report the conformance to QC requirements set forth in the CQCP. He may also advise the CQCSM on QC methods and practices. He will maintain a record of his quality monitoring activities and will inform the CQCSM of his monitoring activities. He shall also be responsible for performing periodic internal audits, and reporting his findings to the CQCSM.

Subcontractors: Shaw assumes overall responsibility for conformance to the quality requirements for the subcontracted items and services. Subcontractors are responsible to the Project Manager and Remediation Manager for completing the portion of work assigned to them,

and to the CQCSM for CQCP activities. They shall verify that their construction and materials comply with the requirements of the contract plans and specifications. Subcontractors include organizations supplying quality-related items or services to the project.

3.3 Qualification of Personnel

Shaw personnel assigned to the project are qualified to perform the tasks to which they are assigned. The Project Manager and the Remediation Manager will appraise the qualification of professional and/or technical personnel assigned to the project. The appraisal will include the comparison of the requirements of the job assignment with the relevant experience and training of the prospective assignee.

Shaw Environmental, Inc.
3010 Briarpark, Suite 400
Houston, Texas 77042

To:	William Squire
From:	John W. Patin, QC Manager
Date:	August, 2009
Subject:	Contractor Quality Control System Manager, Letter of Authority U.S. Army Corps of Engineers, Tulsa District MARC Contract No. W912QR-04-D0027, Task Order No. DS02

This letter describes the responsibilities and authority delegated to you in your capacity as the Contractor Quality Control System Manager for Site Closure of Multiple Sites at Longhorn Army Ammunition Plant, Karnack, Texas.

In this position, you are responsible for the implementation and enforcement of the CQCP and site specific addenda. You will use the plan to verify that the quality of materials, workmanship, operations, and safety monitoring conforms to the Work Plan, its appendices, and addenda.

Your responsibilities include identifying and reporting quality problems, rejecting nonconforming materials, initiating corrective actions, and requesting solutions for nonconforming activities. You have the authority to control or stop project activities until satisfactory disposition and implementation of corrective actions are achieved. Detailed responsibilities and guidelines are given in the Work Plan, its appendices, and addenda.

Figure 3-1
Letter of Authority

4.0 Contractor Quality Control Systems

4.1 Control Measures

The CQCP provides measures to verify and document that the work performed complies with the requirements specified in the contract documents. These measures include:

- CQC inspections
- Document control
- Submittals
- Completion inspection
- Records

Procedures for implementing the above measures are included throughout the CQCP. The CQCP may be supplemented by additional guidelines or instructions for implementing the work and/or verifying compliance with the contract requirements.

4.2 Quality Control Monitoring

The project CQC program is monitored to verify that the program is in compliance with the CQCP. Monitoring activities are performed by the Shaw Program QC Manager, or his representative, and include the review of daily QC reporting and instructions, or directions given to the CQCSM on QC matters. If required, an assessment of the project's CQC system is performed. If performed, the assessment includes the following items:

- Subcontractor performance
- Field operation and records
- CQC and health and safety inspections, testing, and records
- Document control
- Training records

4.3 Quality Control Testing

As applicable, the CQCSM monitors the equipment/materials testing firm and/or analytical laboratory activities to verify the following:

- Execution of required tests
- Location of tests
- Timely and accurate reporting of test results
- Correct frequency of tests
- Completeness of documentation

5.0 Inspection Plan

QC inspections include inspection of equipment, materials, testing procedures, documentation/submittals, and workmanship before, during, and after each definable feature of work. QC inspections are performed by the CQCSM in accordance with the Three-Phase Contractor Quality Control System. The CQCSM gives the USACE QAR advance notification (at least 24 hours) of formal inspections.

Definable features of site work (or major work tasks) for which QC inspections will be performed are addressed below.

Definable Features of Site Work:

Task 1 – Mobilization and Site Setup
Task 2 – Monitoring Well Abandonment
Task 3 – Soil Excavation and Disposal
Task 4 – Soil Sampling
Task 5 – DPT Sampling
Task 6 – Investigation-Derived Waste Management
Task 7 – Concrete Removal
Task 8 – Monitoring Well/Compliance Well Installation
Task 9 – Groundwater Sampling
Task 10 – Surveying
Task 11 – Site Restoration and Demobilization

Other site remediation activities that constitute definable features of site work will be defined within site-specific addenda to the work plan. Those addenda will also identify related QC inspection requirements.

5.1 Task 1 – Mobilization and Site Setup

Following approval of the Work Plan, Shaw will mobilize the necessary personnel and equipment to prepare the site for investigation activities. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Site personnel have the necessary Occupational Safety and Health Administration (OSHA) training and medical surveillance statements/certifications
- Heavy equipment (e.g., drilling rig) has undergone safety and preventive maintenance checks, and is suitable for the task for which it will be used.
- Measuring and test equipment has undergone calibration and/or calibration checks to assure accuracy and precision.

- The project team understands the investigation/remediation requirements.
- Site personnel have received a HASP by the SSO and have acknowledged this review by signing the HASP acknowledgment form.
- Installed government property plan (when applicable) is reviewed and implemented for the equipment to be installed on site.
- Work zones and decontamination facilities are established in accordance with the HASP.
- Material storage areas are kept orderly.
- Site security measures are adequately maintained to prevent unauthorized access.
- Work zones are clearly demarcated using temporary barricading or fencing as required.

Once the site is mobilized and set up, field activities will commence.

5.2 Task 2 – Monitoring Well Abandonment

Shaw will abandon monitoring wells that were installed during any investigation and remediation activities as needed. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Preparatory meetings are held with work crews to discuss the regulatory requirements for well abandonment.
- Personnel associated with this task have applicable OSHA training and medical surveillance certifications.
- Worker protection is adequate for the associated task hazards.
- Abandonment activities will employ a well driller licensed in the state of Texas.
- Well abandonment materials and equipment are suitable and approved for use prior to starting the work.
- Well locations and top of casing elevations are verified and recorded in a logbook prior to abandonment.
- Required agency permits and/or notifications are completed prior to starting abandonment activities.
- Waste generated during abandonment activities is handled and disposed according to the waste management plan.
- Quantity and depth measurements are made and recorded accurately the amount of grout used, depth below ground surface of the top of the grout once the grout

has settled and hardened, and the amount of cover soil placed and compacted above the top of the grout to re-establish a level ground surface.

- A multi-purpose completion report and/or well abandonment log is accurately completed for each abandoned well and submitted to the State of Texas. Copies are maintained in the project file until submitted to the USACE with the final report.

5.3 Task 3 – Soil Excavation and Disposal

Soil samples will also be collected from excavations for confirmation sampling. Contaminated soils will be excavated, removed and disposed off site. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Underground utilities are marked and digging permits are obtained prior to excavation activities.
- Preparatory meetings are held with work crews to discuss the scope of work for excavation and removal of contaminated soil.
- Personnel associated with this task have applicable OSHA training and medical surveillance certifications.
- Worker protection is adequate for the associated task hazards.
- The excavations boundaries are marked in the field for each location and the proposed depths of excavations are confirmed prior to excavation activity.
- Field documentation is legible, accurate, and complete.
- Confirmation samples are screened using properly calibrated field instruments and selected samples are sent to off-site laboratory for confirmation analysis.
- Following confirmation sampling, the excavated areas are backfilled, compacted and tested the degree of compaction.
- The contaminated soils are staged at a designated place pending waste characterization and subsequent disposal.
- The excavation boundaries are surveyed by a surveyor licensed in the State of Texas.

Shaw will restore the sites to their original grade and condition as necessary.

5.3.1 Field Screening

The soil and groundwater samples will be screened in the field for confirmation and will be sent to a laboratory for confirmation analyses. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Sampling personnel have reviewed the Chemical Data Acquisition Plan (CDAP) and understand the scope of work.
- The CQCSM/SSO has briefed sampling personnel on task hazards and the appropriate personal protective equipment (PPE) level before sampling screening begins.
- A sampling equipment checklist is developed for this task and is reviewed with sampling personnel before sampling begins.
- Field screening instrumentation is calibrated before the start of the work and at the end of the sampling day.
- Calibrated equipment will be uniquely identified by using either the manufacturer's serial number or other means.

Calibration records traceable to the equipment will be readily available for reference. In addition, the results of calibrations and records of repairs will be recorded in a logbook.

5.4 Task 4 – Soil Sampling

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Sampling personnel have reviewed the CDAP (Shaw, 2006), Work Plan, and any related documents regarding the scope of work.
- The CQCSM/SSO has briefed sampling personnel on task hazards and the appropriate PPE level before sampling begins.
- A sampling equipment checklist is developed for this task and is reviewed with sampling personnel before sampling begins.
- The specified sampling equipment and materials are used for sample collection.
- Sampling equipment decontamination procedures are performed according to the CDAP.
- Sampling documentation procedures in the CDAP are followed and field documentation is legible, accurate, and complete.
- Quality assurance and QC samples are collected at prescribed frequencies in accordance with CDAP protocols and procedures.
- Sample labels, custody seals, and chain-of-custody forms contain pertinent sampling and analytical information before samples are packaged and shipped off site for laboratory analysis.
- Sampling and analytical records are maintained in the project file (in secured area).

- All field instruments are calibrated at the start of the testing day.

5.5 Task 5 – DPT Sampling

Shaw will penetrate the concrete slab and collect soil samples beneath the slab using DPT. Shaw will also collect soil samples using DPT near specific electric poles. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Sampling personnel have reviewed the CDAP (Shaw, 2006), Work Plan, and any related documents regarding the scope of work.
- The CQCSM/SSO has briefed sampling personnel on task hazards and the appropriate PPE level before sampling begins.
- A sampling equipment checklist is developed for this task and is reviewed with sampling personnel before sampling begins.
- The specified sampling equipment and materials are used for sample collection.
- Sampling equipment decontamination procedures are performed according to the CDAP.
- Sampling documentation procedures in the CDAP are followed and field documentation is legible, accurate, and complete.
- Quality assurance and QC samples are collected at prescribed frequencies in accordance with CDAP protocols and procedures.
- Sample labels, custody seals, and chain-of-custody forms contain pertinent sampling and analytical information before samples are packaged and shipped off site for laboratory analysis.
- Sampling and analytical records are maintained in the project file (in secured area).
- All field instruments are calibrated at the start of the testing day.

5.6 Task 6 – Investigation-Derived Waste Management

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Waste generated during the project activities will be segregated by type (e.g., soil cuttings, PPE, well development and purging liquids, trash/debris) and stored in approved 55-gallon drums or other containers.
- Waste containers are labeled with a waterproof marker according to the Work Plan, indicating the content, accumulation date, waste code(s) (if known) and pertinent analytical information.

- Waste handling activities are documented in the field logbook and a tracking log is prepared that indicates waste type, point of waste generation (i.e., well number) container size and type, accumulation date, storage location, disposal destination, transporter name, shipping paper/manifest number, and transportation and disposal dates.
- Waste containers are leak proof and stored in a secure storage area.
- Waste storage area is clearly demarcated using barricade tape and/or temporary barricade fencing, as required.
- Waste container and storage area inspections are performed on a weekly basis (at a minimum) and documented in the field logbook and/or in a standard inspection form.

5.7 Task 7 – Concrete Removal

If the concrete slab is contaminated, it will be excavated, removed and disposed off site. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Underground utilities are marked and digging permits are obtained prior to excavation activities
- Preparatory meetings are held with work crews to discuss the scope of work for excavation and removal of contaminated soil.
- Personnel associated with this task have applicable OSHA training and medical surveillance certifications.
- Worker protection is adequate for the associated task hazards.
- The excavations boundaries are marked in the field for each location and the proposed depths of excavations are confirmed prior to excavation activity.
- Field documentation is legible, accurate, and complete.
- The excavated areas are backfilled, compacted and tested the degree of compaction.
- The contaminated broken-up concrete slab pieces are staged at a designated place pending waste characterization and subsequent disposal.
- The excavation boundaries are surveyed by a surveyor licensed in the State of Texas.

Shaw will restore the sites to their original grade and condition as necessary.

5.8 Task 8 – Monitoring Well/Compliance Well Installation

Groundwater monitoring well construction materials and specifications are provided in Appendix D (Shaw, 2006). The specifications conform to the following:

- Engineering and Design – *Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites*, EM 1110-1-4000 (USACE, 1998)
- Technical Requirements – *Locations and Standards of Completion for Wells*, Texas Administrative Code Title 16, Part 4, Chapter 76, Section 76.1000 (State of Texas, 2001)
- Monitor-Well Construction Specifications, Texas Administrative Code Title 30, Part 1, Chapter 330, Subchapter I, Section 330.242 (State of Texas, 1993)

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Drilling locations are marked/staked in the field and verified against those in the approved drawings prior to well drilling.
- Underground utilities that transect the sites are located and marked, and their depths are known, so as to avoid damaging them during drilling activities.
- Digging permits (when applicable) are obtained prior to the start of work.
- Qualified drilling firms are procured to perform this task.
- The driller is licensed by the Texas Department of Licensing and Regulation and maintains a current license, in good standing.
- Personnel associated with this task have applicable OSHA training and medical surveillance certifications.
- The CQCSM/SSO has briefed personnel on task-specific hazards and the appropriate PPE to be worn and performed a job safety analysis for well drilling and installation.
- Drilling personnel have reviewed the HASP and signed the acknowledgement form.
- Task crews undergo preparatory briefing to verify their understanding of the scope of work and health and safety issues.
- Drilling team leader (i.e., Shaw Hydrogeologist) instructs the drilling crew of the depth of the well and its construction, and documents those instructions in the field notes.
- Drilling team leader documents the suitability of the construction materials.

- Construction materials meet specifications, are contaminant-free, and shipped/ received in good order.
- Well construction details are properly logged on forms and in the site logbook.
- Incomplete construction is protected from surface-water infiltration.
- Completed construction conforms to work plan requirements, specifications and drawings for well installation and surface completion.
- Generated soil cuttings, decontamination fluids, and contaminated PPE are handled and disposed of in accordance with the waste disposal requirements described in Section 3.7 of the Installation-Wide Work Plan and Attachment 10 of Appendix D, and state and federal regulations.
- Adjacent ground surfaces are protected from spillage during drilling operations.
- Well filter pack, bentonite, and grout volumes are calculated and documented in the field log book.
- Bentonite seal and grout is allowed to hydrate/cure sufficiently prior to beginning well development.
- Monitoring well development equipment, methods, and stabilization measurements are performed in accordance with the CDAP (Shaw, 2006).
- Well development fluids are handled, characterized, and disposed of in accordance with the requirements addressed in section 2.8 of the Work Plan, and state and federal regulations. Field screening requirements are listed in **Section 5.3.1** of this CQCP. Additional information on field screening procedures is found in Appendix D, Attachment 1 (Shaw, 2006).
- Disturbance of property surrounding drilling site is minimized.

Ground water sampling will commence following monitoring well installation and development.

5.9 Task 9 – Groundwater Sampling

Following the installation of groundwater monitoring wells, Shaw will collect groundwater samples for laboratory analyses. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Sampling personnel have reviewed the CDAP and Work Plan and understand the scope of work.
- The CQCSM/SSO has briefed sampling personnel on task hazards and the appropriate PPE level before sampling begins.

- A sampling equipment checklist is developed for this task and is reviewed with sampling personnel before sampling begins.
- Well depth and depth-to-water measurements are performed consistently from a common location at top-of-well casing (e.g., notch in top of casing or northern lip of casing).
- Well water volume is calculated accurately using well measurements.
- Well is purged of the required quantity of well water and water quality is stabilized as defined by the CDAP prior to sample collection.
- Purged water is contained in drums and managed in accordance with Work Plan waste handling requirements. Field screening procedures is found in Appendix D, Attachment 1.
- The specified sampling equipment and materials are used for sample collection.
- The sampling team leader (i.e., Shaw Hydrogeologist) has instructed samplers on the sampling procedures and protocols and has assigned specific duties and responsibilities to each team member.
- Sampling equipment decontamination procedures are performed according to the CDAP.
- Sampling documentation procedures in the CDAP are followed and field documentation is legible, accurate, and complete.
- Quality assurance and QC samples are collected at prescribed frequencies in accordance with CDAP protocols and procedures.
- Sample labels, custody seals, and chain-of-custody forms contain pertinent sampling and analytical information before samples are packaged and shipped off site for laboratory analysis.
- Sampling and analytical records are maintained in the project file (in secured area).
- All field instruments are calibrated at the start of the testing day.

5.10 Task 10 – Surveying

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- A qualified land surveyor licensed by the State of Texas is employed to perform well surveying.
- Survey datum (vertical and horizontal) used is consistent with the work plan requirements and/or historical datum.

- Survey team undergoes preparatory meeting to verify their understanding of the scope of work.
- Surveying equipment is operative and properly calibrated.
- Instrument calibration is performed per manufacturer instructions.
- Survey points are clearly marked or labeled (e.g., notch in the top of casing and/or brass surveying marker embedded in surface pad).
- Field documentation is legible, accurate, and complete.
- Worker protection is adequate for the associated task hazards.

For identifying locations of soil samples and limits of excavation, a Global Positioning System (GPS) may be used in lieu of land surveying. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Survey team undergoes preparatory meeting to verify their understanding of the scope of work.
- Surveying equipment is operative and properly calibrated.
- Instrument calibration is performed per manufacturer instructions.
- Survey points are clearly marked or labeled
- Field documentation is legible, accurate, and complete.
- Worker protection is adequate for the associated task hazards.

5.11 Task 11 – Site Restoration and Demobilization

Shaw will restore the site and demobilize once response complete is attained. Using the Three-Phase CQC System, the CQCSM will affirm the following:

- Equipment installed for the purposes of this project, and not intended to be operated after this project is demobilized.
- Information for remaining equipment or installed materials has been submitted to LHAAP and USACE.

5.12 Other Site Remediation Tasks

Shaw will perform various site remedial activities to include optimizing the existing on site groundwater treatment plant, soil/groundwater flushing, and instituting bioremedial solutions where applicable. Using the Three-Phase CQC system, the CQCSM will monitor these tasks as

appropriate. Specific QC requirements for these tasks will be identified in site-specific addenda to the work plan.

6.0 Document Control

6.1 Documentation

The CQCSM maintains current records of QC activities and tests performed, including those of suppliers and subcontractors. The records will be maintained as evidence that required control measures and tests have been performed, and indicate the results of the activities. Photographic documentation is also maintained for this project in accordance with **Section 6.4** of this plan.

6.2 Daily CQC Report

A Daily CQC Report is completed and maintained by the CQCSM using a standard form. The form is provided in **Attachment 1**. As applicable, standard forms used to document safety, technical, and operations aspects of daily field activities will be attached to the Daily CQC Report.

6.3 Daily Weather Conditions/Lost Time Report

A Daily Weather Conditions/Lost Time Report is prepared daily by the CQCSM. A report form is provided at the end of this section. Lost time will be logged into the report in increments of 25% (in other words, 0%, 25%, 50%, 75% or 100%). The amount of lost time incurred will be agreed upon and initialed by the CQCSM and the Corps of Engineers' QAR or Technical Manager overseeing the project work. Upon completion of the report for the specified period of time, one copy of the report should be submitted to the QAR/Technical Manager once each month during fieldwork and an extra copy should be maintained by the CQCSM for future reference.

6.4 Photographs

The CQCSM will photograph the project activities. Photographs will be taken on a regular basis during the course of the project to document the work, events, and equipment used. The frequency and number of pictures taken will depend upon the activities occurring and the amount of documentation needed. The Project Manager or Remediation manager will use judgment to determine the frequency and number of pictures taken; however, a sufficient quantity of pictures will be taken to effectively document the TO.

Pictures will be taken using 35mm film or digital medium (using a digital camera or video camera). Photos will be documented on a project log (see standard form in **Attachment 1**), which includes the photo number, date, time, description of the task depicted, and the view direction (e.g., facing northwest). A copy of the photo log, pictures, slides/videos, and digital media will be maintained in Project Files.

6.5 Review of Vendor Submittals

Vendors and subcontractors are required to expeditiously submit items such as drawings, test data, and specifications to Shaw for review to enable timely submittals to USACE. Shaw technical and CQC personnel review each submittal for compliance with contract documents. If acceptable, the item is stamped or indicated as such, and forwarded to USACE for review and acceptance.

If unacceptable, errors or deficiencies are identified and returned to the vendor or subcontractor for correction. The corrected document is resubmitted to Shaw for review until it meets contract requirements.

6.6 Government Property Accounting and Control

If applicable, Shaw will acquire, manage, and dispose of government property. At the completion of the project, all real property (removed and/or installed) will be listed on a Property Inventory Sheet.

6.7 Submittals

The Project Manager, Remediation Manager, the Program Controls Engineer, and the CQCSM are responsible for project submittals. A submittal register prepared for this project is given in **Figure 6-1**.

SUBMITTAL REGISTER																								DACA56-94-D-0020 TO No. 0109
TITLE AND LOCATION: **Longhorn Army Ammunition Plant – Former Pistol Range and LHAAP-04**														CONTRACTOR: Shaw Environmental Inc.										
				TYPE OF SUBMITTAL									CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVT. ACTION		
TRANSMITTAL NO	ITEM NO	SPEC PARA NO	DESCRIPTION OF ITEM SUBMITTED	DATA	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFO ONLY	GOVT. APPROVED	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MAT'L NEEDED BY	CODE	DATE	SUBMIT TO GOVT	CODE	DATE	REMARKS
a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	
			Work Plan (and Appendices)		X	X	X							X		Per Project Schedule								
			Site Personnel OSHA Medical & Training Certificates							X		X	X			Prior to start of work								
			CQC and Safety Reports						X				X			Daily								
			Well Construction Methods/Specifications	X	X								X			Per Work Plan								
			Transporter ID, Insurance Cert							X			X			Prior to subcontract award								
			Manifests/Shipping Papers									X	X			Prior to shipment								
			Disposal Facility ID	X									X			Prior to subcontract award								
			Environmental Inspection Sheets									X	X			Per Work Plan								
			Groundwater Sampling Results	X					X				X			Upon data evaluation								
			Survey Drawings (As-built)		X									X		Upon completion								
			Well Construction Completion Forms									X		X		To State of Texas within 30 days of construction completion								
			Well Abandonment Forms									X		X		To the State of Texas within 30 days of construction completion								
			Drilling Logs & Groundwater Sampling Forms									X				With Daily QC Reports								

Figure 6-1
Submittal Register

7.0 Subcontractor Quality Control

Subcontractors for this project are responsible for compliance with the QC requirements of their respective subcontract. Subcontractors include organizations supplying quality related items or services to the project. Shaw assumes overall responsibility for conformance to the quality requirements for the subcontracted items and services.

Subcontract documents should include the requirements for personnel qualifications, technical performance levels, QC procedures, acceptability criteria, and documentation. The CQCSM, or his designee, reviews the subcontract procurement documents to verify that the QC requirements are communicated to the subcontractor.

Each subcontractor is required to identify an adequately qualified individual within the organization to perform QC duties. The qualifications of this individual are submitted to the CQCSM for review and approval. The CQCSM coordinates the QC functions with the designated subcontractor QC representative. The Project Manager, or his authorized designee, assists the CQCSM in managing subcontractor QC.

The CQCSM is responsible for the performance of inspections, surveillance, document reviews, audits, and other QC functions to verify compliance with the subcontract requirements. These activities are documented on inspection reports, checklists, audit reports, field logs, or other forms appropriate to the function performed.

For field operations, the CQCSM performs QC inspections before, during, and after the subcontractor activities, to the extent required, to verify that the subcontractor is in compliance with the QC requirements of the contract and the applicable subcontract documents.

Audits of subcontractor activities are conducted by the CQCSM as necessary to verify compliance with the CQCP. Objective evidence of conformance to the subcontract documents is reviewed during the audits.

8.0 References

Shaw Environmental and Infrastructure, Inc. (Shaw E & I), 2005, *Standard Operating Procedures: Technical, ShawNet and Intranet for the Shaw Group, Inc.*, Baton Rouge, Louisiana (February 2006).

Shaw Environmental, Inc. (Shaw), 2006, *Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas*, Houston, Texas, January.

State of Texas, 2001, Administrative Code Title 16, Part 4, Chapter 76, Section 76.1000, *Technical Requirements – Locations and Standards of Completion for Wells*, Austin, Texas.

State of Texas, 1993, Texas Administrative Code Title 30, Part 1, Chapter 330, Subchapter I, Section 330.242, *Monitor-Well Construction Specifications*, Austin, Texas.

U.S. Army Corps of Engineers, 1998, *Engineering and Design – Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites*, EM 1110-1-4000.

Attachment 1

Field Forms

- Preparatory Inspection Check List
- Initial/Follow-Up Inspection Form
- Final Inspection Form(s)
- Daily Contractor Quality Control Report
- Daily Weather Conditions/Lost Time Report
- Photo Log Form
- Corrective Action Report

PREPARATORY INSPECTION CHECKLIST

Shaw Environmental, Inc.
3010 Briarpark Drive
Houston, Texas 77042

Project Name:_____
Project Location_____
Project No.:_____

Plan or Specification Title/Section:_____ **Drawing Nos.:**_____

A. Personnel present *(use back of form to list additional personnel)*

Name	Position	Company

B. Submittals involved: *(use back of form to list additional submittals)*

Number and Type	Description	Indicate Contractor of Government Approval

C. Are all materials on hand and in accordance with approvals: ☐ Yes ☐ No
List all deficiencies:

D. Test required: (list/reference all quality control tests with their required frequencies):

E. Accident prevention preplanning (list all health and safety items discussed):

CQCSM: _____

INITIAL/FOLLOW-UP INSPECTION FORM

Shaw Environmental, Inc.
3010 Briarpark Drive
Houston, Texas 77042

Project Name:_____
Project Location_____
Project No.:_____

(check one)

INITIAL PHASE CHECK LIST ☐ OR
FOLLOW-UP PHASE CHECK LIST ☐

Plan or Specification Section:_____ Drawing Nos.:_____

A. Personnel present:

Name	Position	Company

B. Materials are in strict conformance with contract specifications: ☐ Yes ☐ No
If no, explain:

C. Work being performed is in strict conformance with contract specifications: ☐ Yes ☐ No
If no, explain:

D. Workmanship is acceptable: ☐ Yes ☐ No
If improvement is needed, explain:

CQCSM: _____

FINAL INSPECTION FORM

Shaw Environmental, Inc.
3010 Briarpark Drive
Houston, Texas 77042

Project Name:_____
Project Location_____
Shaw Project No.:_____

FINAL INSPECTION FORM

Plan or Specification Title/Section:_____Drawing Nos.:_____

Inspected Work (list feature(s) of work inspected):

1. 6.
2. 7.
3. 8.
4. 9.
5. 10.

Performance Specification by Contract Delivery Order Reference	Status of Inspection

On behalf of Shaw, I certify that the work inspected is complete and meets the performance specifications cited above and that all material and equipment used and work performed was completed in accordance with approved plans and work instructions and meets contract delivery order requirements.

CQCSM _____ Date_____/_____/_____

Site Manager_____ **Date_____/_____/_____**

DAILY CONTRACTOR QUALITY CONTROL REPORT

Shaw Environmental, Inc.
3010 Briarpark Drive
Houston, Texas 77042

Project Name:_____
Project Location:_____
Shaw Report No.:_____

WEATHER: ( ) Clear ( ) P. Cloudy ( ) Cloudy
Wind_____
Temperature: High_____ Low_____
Precipitation: Today_____ Previous Period (i.e., weekend)_____
Site Conditions:_____
Lost Time Due to Inclement Weather: _____%

PRIME CONTRACTOR/SUBCONTRACTORS AND AREAS OF RESPONSIBILITY/LABOR COUNT:
(Include number, trade, hours, employer, location, and description of work.)
a.

b.

c.

d.

e.

f.

WORK PERFORMED: (Include location and description of work performed including equipment used. Refer to work performed by prime and/or subcontractors as previously designated by letter above. Attached subcontractor daily activity reports when applicable):

MATERIALS AND/OR EQUIPMENT DELIVERED: (Include a description of materials and/or equipment, quantity, date/hours used, date of safety check, and supplier)

RESULTS OF SURVEILLANCE: (Include satisfactory work completed or deficiencies with action to be taken.)
a. Preparatory Inspection: (Attach Minutes)

b. Initial Inspection: (Attach Minutes)

c. Follow-up Inspection: (List results of inspection compared to specification requirements.)

d. Safety Inspection: (Include safety violations and corrective actions taken.)

OFF-SITE SURVEILLANCE ACTIVITIES: (Include action taken.)

QC TESTS PERFORMED AND RESULTS: (As required by plans and/or specifications.)

VERBAL INSTRUCTIONS RECEIVED OR GIVEN: (List any instructions received from government personnel or given by Shaw on construction deficiencies identified, required retesting, etc., and the corresponding action to be taken.)

CHANGED CONDITIONS/DELAYS/CONFLICTS ENCOUNTERED: (List any conflicts with the delivery order [i.e., Scope of Work and/or drawings], delays to the project attributable to site, and weather conditions, etc.)

SUBMITTALS REVIEWED: (Include submittal number, specification reference, and name of submitter.)

MEETINGS: (List the meetings, i.e., Health and Safety, Site Operations, Cost/Schedule, etc.)

VISITORS:

REMARKS: (Any additional information pertinent to the project not defined by the previous entries.)

CONTRACTOR'S VERIFICATION: The above report is complete and correct. All material and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications except as noted above.

Shaw CQCSM (or designee)

_____/_____/_____
Date

DAILY WEATHER CONDITIONS/LOST TIME REPORT

DAILY WEATHER CONDITIONS/LOST TIME REPORT FOR WEEK/MONTH OF_____

Contract No.:_____ Delivery Order No.:_____ Project:_____

Contractor:_____

DAY	DATE	W/C. L/T	% LOST	ACTIVITY DELAYED	REMARKS	CONCUR	
						CQCR	QAR
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
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16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Weather Conditions (W/C): R - Precipitation, C - Extreme Temperature, M - Muddy Site Conditions W - Extreme Winds
Other Lost Time Conditions (L/T): D - Demobilized, S - Standby

Representative of the Contractor_____

Representative of the Government_____

PHOTO LOG FORM

PROJECT PHOTO LOG				
Project Name:_____ **Project Location:_____** **Project No.:_____**				
Photo No.	**Date**	**Time**	**Task and Description**	**View Direction**

CORRECTIVE ACTION REPORT

Shaw Environmental, Inc.
3010 Briarpark Drive
Houston, Texas 77042

Project Name:_____
Project Location:_____
Report No.:_____

DESCRIPTION OF PROBLEM:_____

PERSONNEL RESPONSIBLE FOR INVESTIGATIVE PROCESS:_____

RECOMMENDED CORRECTIVE ACTIONS:_____

PERSONNEL RESPONSIBLE FOR IMPLEMENTATION OF CORRECTIVE ACTIONS:_____

RESULTING ACTIONS AND EFFECTIVENESS OF THOSE ACTIONS:_____

PERSONNEL RESPONSIBLE FOR MONITORING EFFECTIVENESS OF CORRECTIVE ACTIONS:_____

FINAL DISPOSITION APPROVED BY:

Name:_____ Title:_____

Date:_____

Name:_____ Title:_____

Date:_____

COPIES TO: